MCUXpresso SDK Documentation

Release 26.09.00

NXP
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This documentation contains information specific to the mc56f81000evk board.

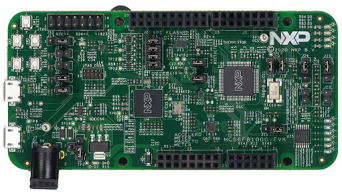
Chapter 1

MC56F81000-EVK

1.1 Overview

The MC56F81000-EVK is an ultra-low-cost development platform for digital signal controller MC56F81xxx MCU.

- The kit is form-factor compatible with the Arduino™ R3 pin layout and features ROM bootloader supporting SCI and LPIIC.
- The MC56F81000-EVK features onboard debugger(multilink) circuit enabling debugging and programming with CodeWarrior.
- Peripherals enable rapid prototyping, including a 6-axis digital accelerometer and magnetometer to create full eCompass capabilities, 6 buffered LEDs including PWM signals, 4 user LEDs, 4 user push_buttons for direct interaction, two OPAMP external feedback circuits, an SPI interfaced Flash memory and a USB to UART bridge circuit.



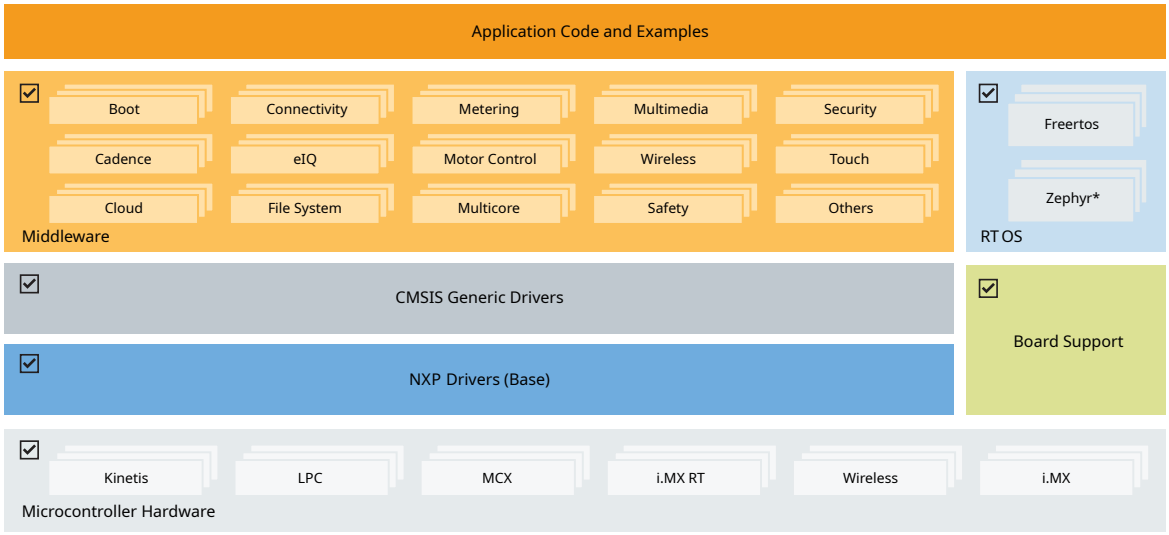
MCU device and part on board is shown below:

- Device: MC56F81768
- PartNumber: MC56F81768LVLH

1.2 SDK Introduction

1.2.1 MCUXpresso Software Development Kit (SDK)

The MCUXpresso SDK is a comprehensive software enablement package designed to simplify and accelerate application development with Arm® Cortex®-M based devices from NXP, including its general purpose, crossover and wireless-enabled MCUs. It includes production-grade software with integrated enabling software technologies (stacks and middleware), reference examples, and more.



*Zephyr RTOS leverages base SDK components via NXP Zepher HAL

Features

Comprehensive Driver Library

- Flexible peripheral drivers for rapid development
- Optimized for performance and code size

RTOS Integration

- FreeRTOS support with optimized configurations
- Real-time application frameworks
- Task management and scheduling examples

Middleware Components

- Connectivity stacks (USB, Ethernet, wireless, communication protocols)
- AI inference engines and neural network libraries
- Audio processing and voice recognition libraries
- Security frameworks and cryptographic libraries
- Graphics and user interface components
- Motor control and real-time control libraries
- File systems and storage solutions
- Partner middleware can be added using CMake and west manifests

Extensive Examples

- Basic peripheral use cases to full technology demonstrations
- Board-specific reference implementations

- Out-of-box Demo Applications
- Middleware component examples and integrations

Distribution Formats

MCUXpresso SDK is available in two main formats:

GitHub Repository SDK Git-based distribution hosted on GitHub for modular development, continuous updates, and collaborative workflows. The SDK uses multiple repositories managed by the Zephyr west tool to provide flexible, component-based development. See Getting Started for setup instructions.

SDK Package Downloadable packages from SDK Builder for offline development. Starting with release 25.12.00, two package versions are available:

- **Classic SDK Package**: Traditional board-specific packages with pre-configured IDE projects for MCUXpresso IDE, IAR, Keil, and other toolchains.
- **Repository-Layout SDK Package**: Board-specific packages that maintain the same structure and build system as the GitHub Repository SDK, providing offline access to the repository-based development experience. Available when selecting the ARMGCC toolchain.

Note: From version 25.12.00 onward, selecting ARMGCC downloads the Repository-Layout version; all other toolchains remain in the Classic version.

Delivery and Release

NXP integrates Coverity® Static Analysis and Black Duck Software Composition Analysis into the SDK development process to deliver secure, high-quality software.

- **Annual releases (June)** for popular products, with Long Term Support (LTS) on GitHub — back-ported security (SVE/PSIRT) and severe bug fixes for two years.
- **Quarterly releases** for NPI and recent products.
- SBOMs provided for all GitHub SDK repositories.

Release	Release Name	Maintenance
LTS	26.06.00-LTS	2 years until June 2028
Quarterly	26.09.00	None, rebase to mainline
LTS	27.06.00-LTS	2 years until June 2029

Supported platforms are listed at mcuxpresso.nxp.com/sdk-versions.

Toolchain Support

All driver examples and most application examples are provided for the following toolchains:

Toolchain	GitHub	Archive/Zip	Generated (west)	Getting Started
MCUXpresso IDE	✓	✓ eclipse	✓	Link
MCUXpresso for VS Code	✓	✓ CMake	N.A.	*Link*
IAR Embedded Workbench	✓	✓ EWARM	✓ EWARM	Link
Keil™ MDK-Arm	✓	✓ uVision	✓ uVision	Link
CLI GNU toolchain	✓	✓ CMake	N.A.	*Link*

Archive/Zip packages can be downloaded from SDK Builder or imported directly in VS Code and MCUXpresso IDE using the Import Wizard.

IAR and Keil projects can be generated from the GitHub SDK CMake examples using a west build command.

Repository Architecture

The SDK uses a multi-repository structure on GitHub managed by the Zephyr West Tool, enabling:

- **Modular Organization**: Drivers, RTOS, middleware, and examples in separate repositories
- **Customizable Manifests**: Targeted setups for specific requirements
- **Selective Downloads**: Include only needed components
- **Independent Updates**: Component-level version control
- **Scalable Integration**: Easy addition of new repository components

Support and Resources

Community Support

- Open GitHub issues and discussions for questions and contributions
- MCUXpresso SDK Community Forum
- MCUXpresso Software and Tools Forum

Documentation

- Comprehensive guides and API documentation online

Technical Support

- NXP Support for commercial development assistance

SDK Product Page

- MCUXpresso SDK on NXP.com

Trainings

- MCUXpresso Training Hub
- MCUXpresso SDK Curriculum

1.3 Getting Started with MCUXpresso SDK Package

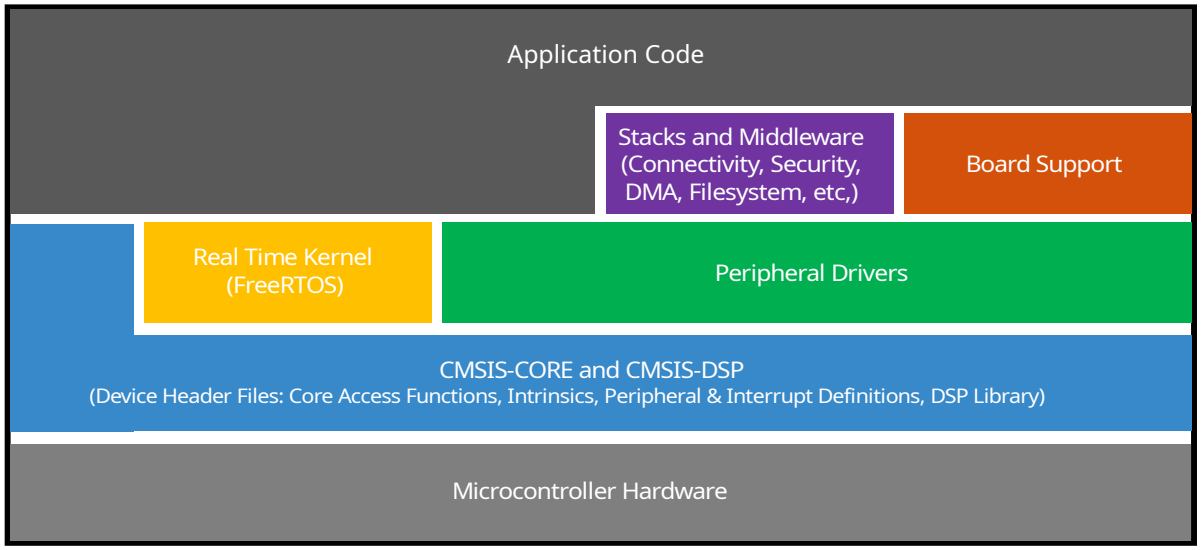
1.3.1 Getting Started with Package

Overview

The NXP MCUXpresso software and tools offer comprehensive development solutions designed to optimize, ease, and help accelerate embedded system development of applications based on general purpose, crossover, and Bluetooth-enabled MCUs from NXP. The MCUXpresso SDK includes a flexible set of peripheral drivers designed to speed up and simplify development of embedded applications. Along with the peripheral drivers, the MCUXpresso SDK provides an extensive and rich set of example applications covering everything from basic peripheral use case examples to full demo applications. The MCUXpresso SDK contains optional RTOS integrations such as FreeRTOS and Azure RTOS, and various other middleware to support rapid development.

For supported toolchain versions, see *MCUXpresso SDK Release Notes* (document MCUXSDKRN).

For more details about MCUXpresso SDK, see MCUXpresso Software Development Kit (SDK).



Build and run SDK example on codewarrior

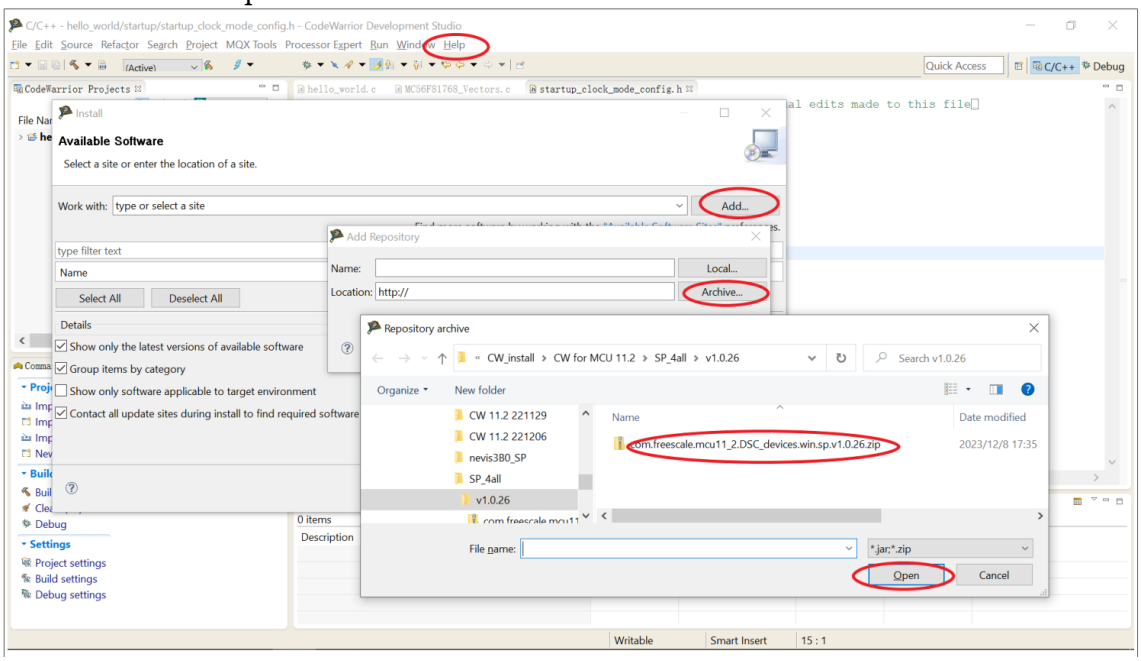
Install CodeWarrior Take below codewarrior specific combination as example

- CodeWarrior Development Studio v11.2 + CodeWarrior for DSC v11.2 SP1 (Service Pack 1)

Steps to install CodeWarrior

- Download the following packages from CodeWarrior for 56800 Digital Signal Controller v11.2, and ensure to keep them in the same folder.
  - CodeWarrior for DSC v11.2: CW_MCU_v11.2_b221206.exe.
  - DSC support package: com.freescale.mcu11_2.dsc.updatesite.zip.
  - DSC device ServicePack1: com.freescale.mcu11_2.DSC_devices.win.sp.v1.0.26.zip.
- Install CodeWarrior for DSC v11.2.
- Install ServicePack1 within CodeWarrior from the menu. Click the **Help** menu -> select **Install new software -> Add -> Archive** -> select the down-

loaded SP1 -> open -> check **MCU v11.2 DSC Service Packs** -> click **Next**.

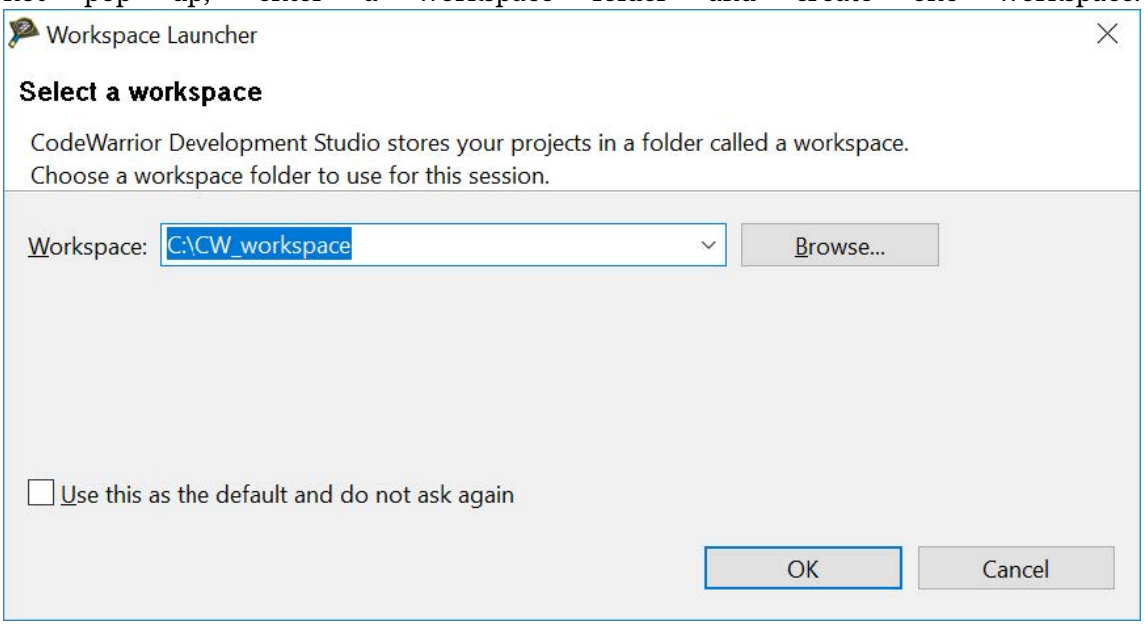


NOTE

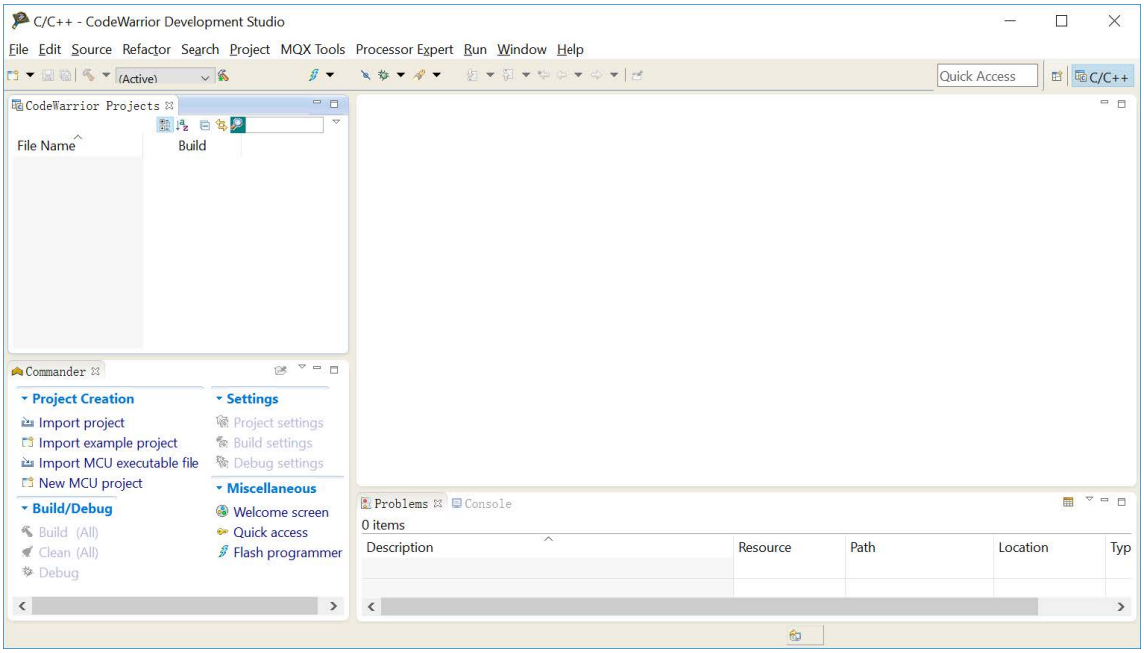
- CodeWarrior for DSC only support Windows.
- Check the corresponding board release note for specific requirement of codewarrior and service pack version.

Build an example application To build the hello_world example application, perform the following example steps:

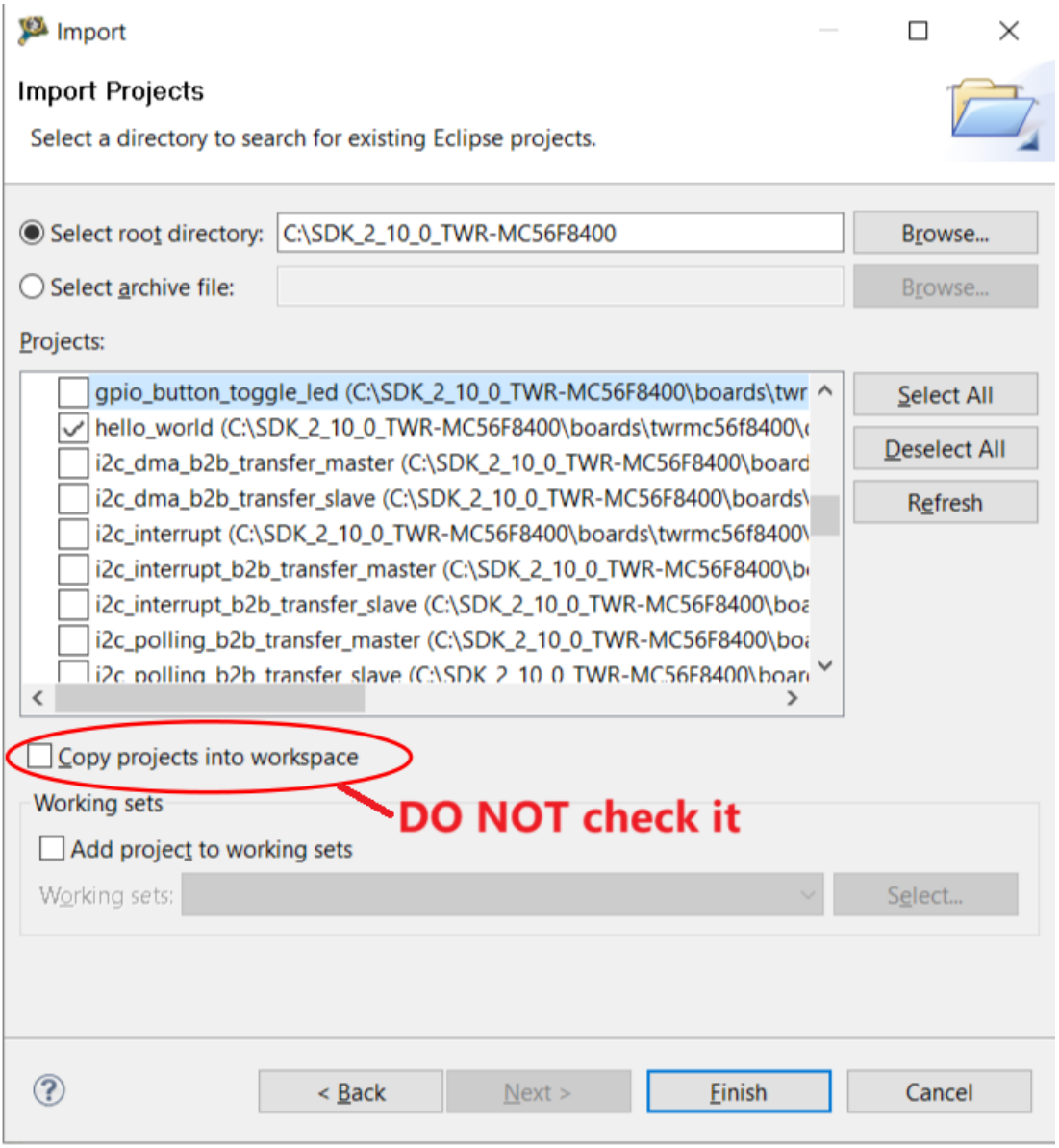
1. Launch CodeWarrior and in the workspace launcher, choose a workspace which holds the projects to use. If the dialogue box does not pop up, enter a workspace folder and create one workspace.



Then the CodeWarrior Development Studio workspace with empty projects appears.



2. Import the project into the workspace. Click **Import project** in the **Commander** pane. A form pops up. Click **Browse** to the SDK install directory. Take TWR-MC56F8400 SDK as an example, all available demo projects are shown. Select the hello_world project in the list and click **Finish**.



NOTE

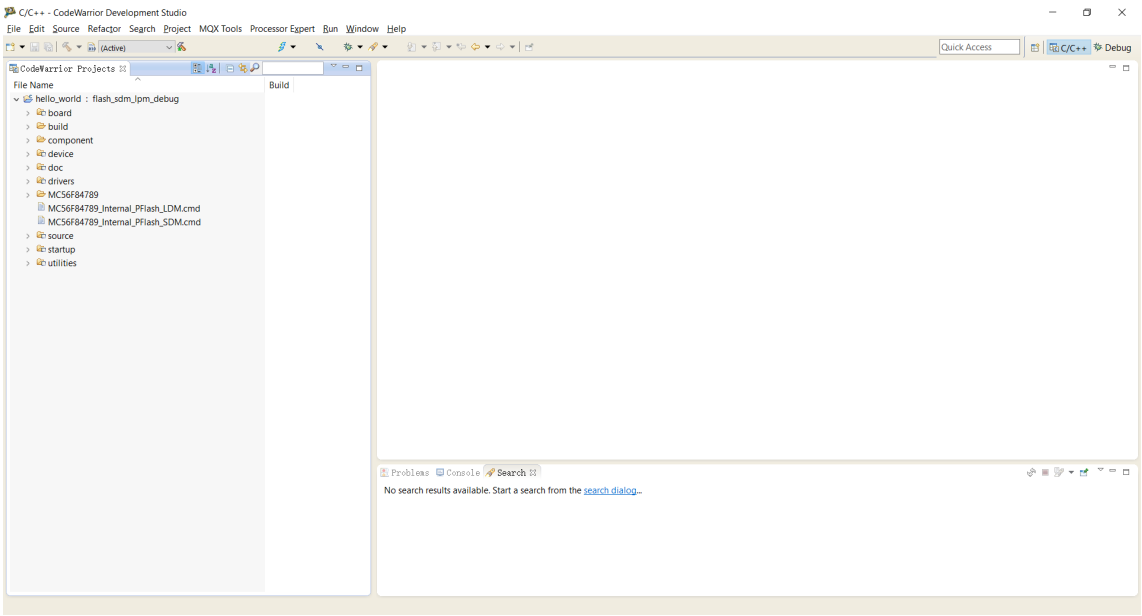
- If you already know the project location, navigate to the folder when clicking **Browse**, and only one project can be seen. To locate most example application workspace files, use the following path

```
<install_dir>/boards/<board_name>/<example_type>/<application_name>/codewarrior
```

Take TWR-MC56F8400 SDK as an example, the hello_world workspace is located in

```
<install_dir>/boards/twrmc56f8400/demo_apps/hello_world/codewarrior
```

3. Select the desired build target from the drop-down menu. For this example, select **hello_world – flash_sdm_lpm_debug**



4. To build the demo application, click **Build (All)** in the **Commander** pane.
5. The build completes without errors.

Board debugger setup Board debugger info:

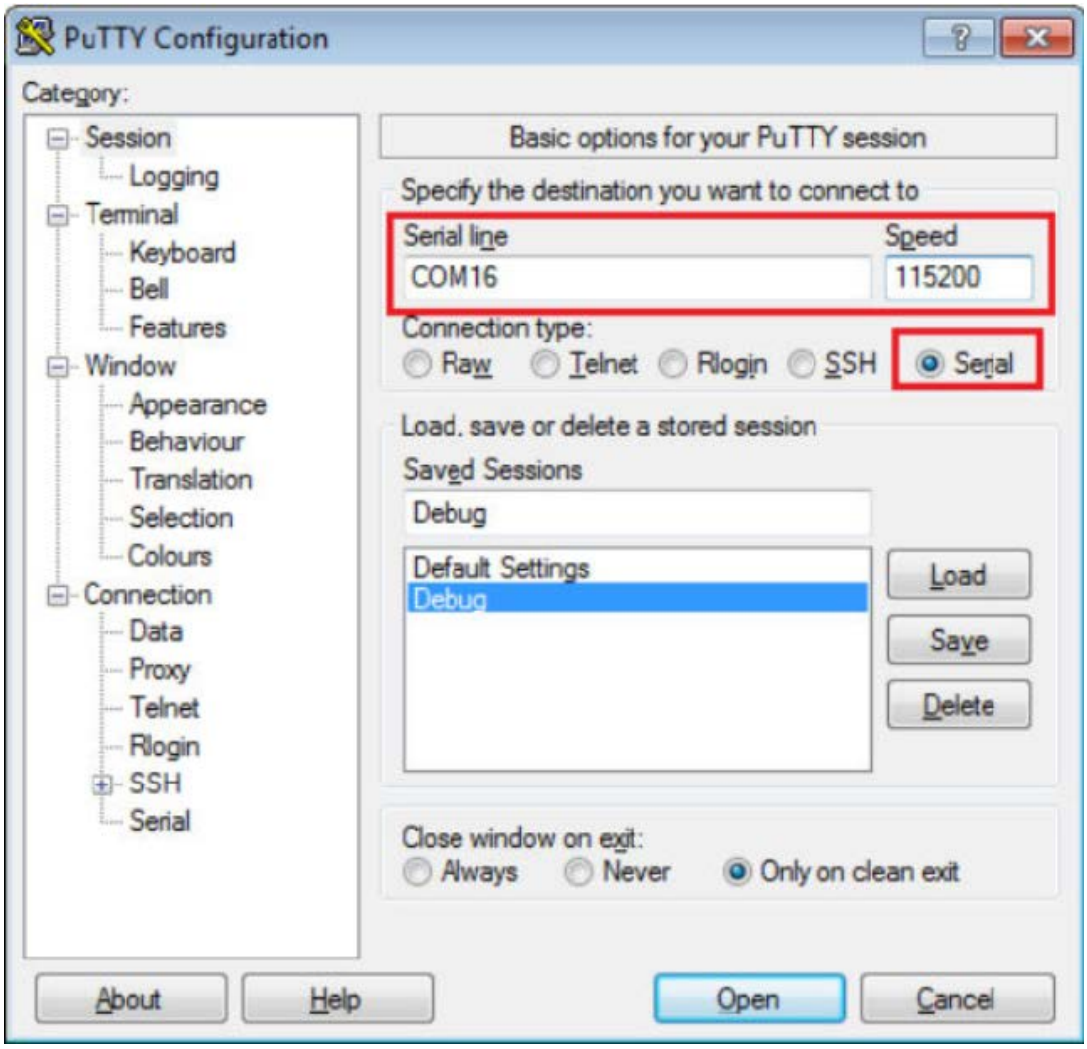
- Default debugger is multilink.
- Onboard debugger USB port is J12, which set the debugger port.
- Onboard USB UART bridge USB port is J26, which set the COM port.

To download and run the application, perform the following steps:

- Connect USB cable between the host PC and the debugger USB port.
- Connect USB cable between the host PC and the USB UART bridge USB port.
- Install the debugger driver as PC hint if it is the first time you run it on the PC. The debugger driver are provided by CodeWarrior by default.
- Install the USB UART bridge driver as PC hint if it is the first time you run it on the PC. The USB to UART bridge (CP2102) driver may be found on SILICON LAB.

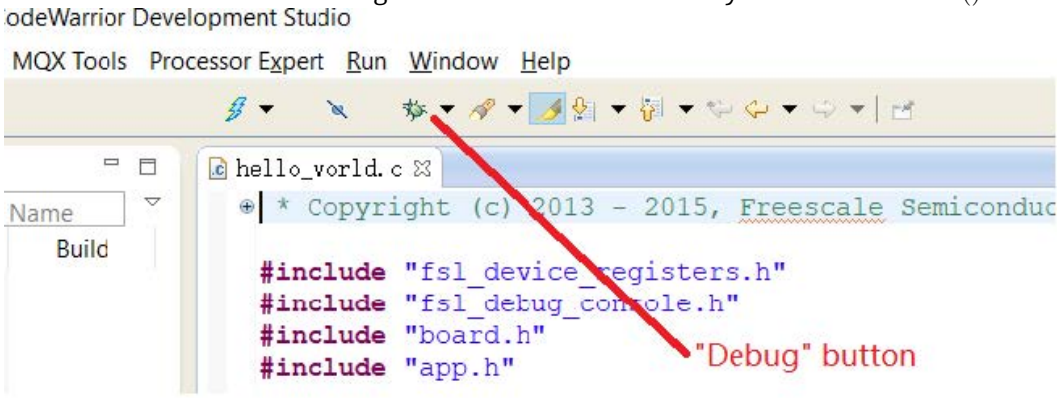
Run an example application To download and run the application, perform the following steps:

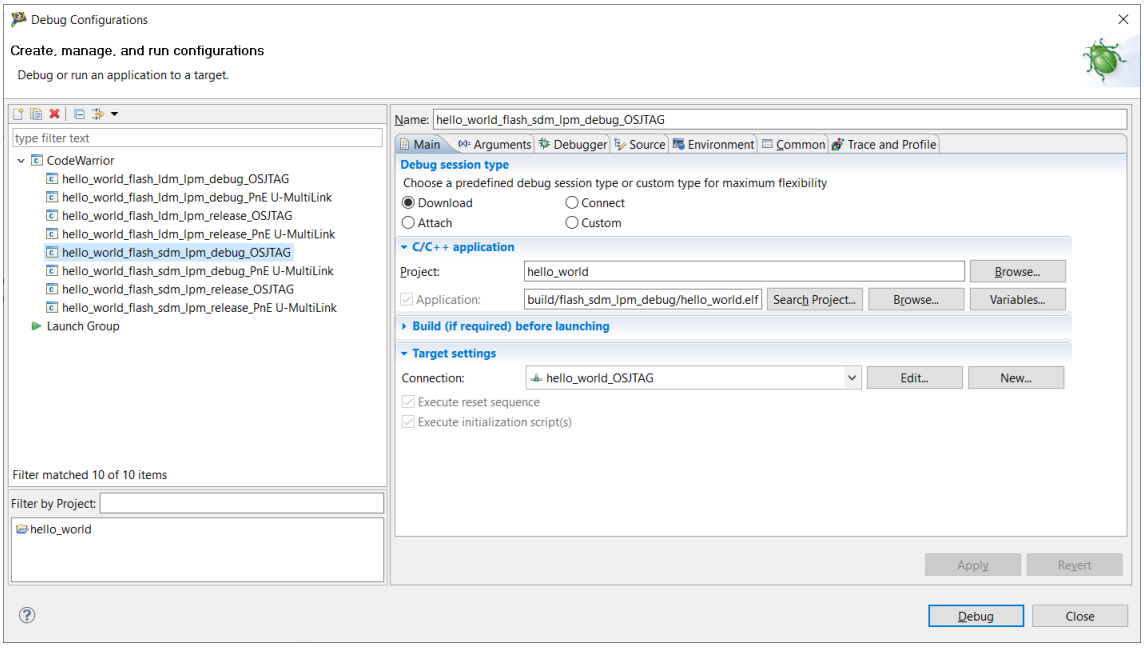
1. Open the terminal application on the PC, such as PuTTY or TeraTerm, and connect to the debug COM port (see *How to determine COM port*). Configure the terminal with these settings:
   - 115200, defined by BOARD_DEBUG_UART_BAUDRATE in the *board.h* file
   - No parity
   - 8 data bits



- 1 stop bit

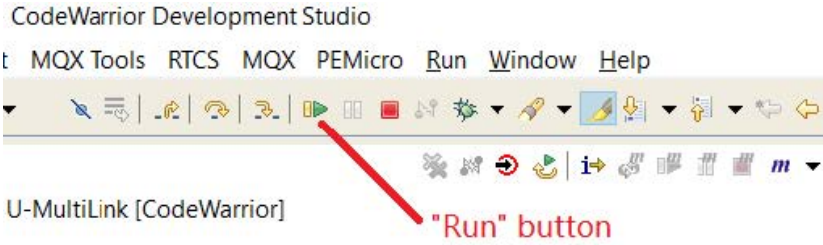
2. For this example(TWR-MC56F8400 hello_world), click **Debug** in the **Commander** pane, and select the hello_world_flash_sdm_lpm_debug_OSJTAG launch configuration. Then the application is downloaded onto target board and automatically runs to the main() function.



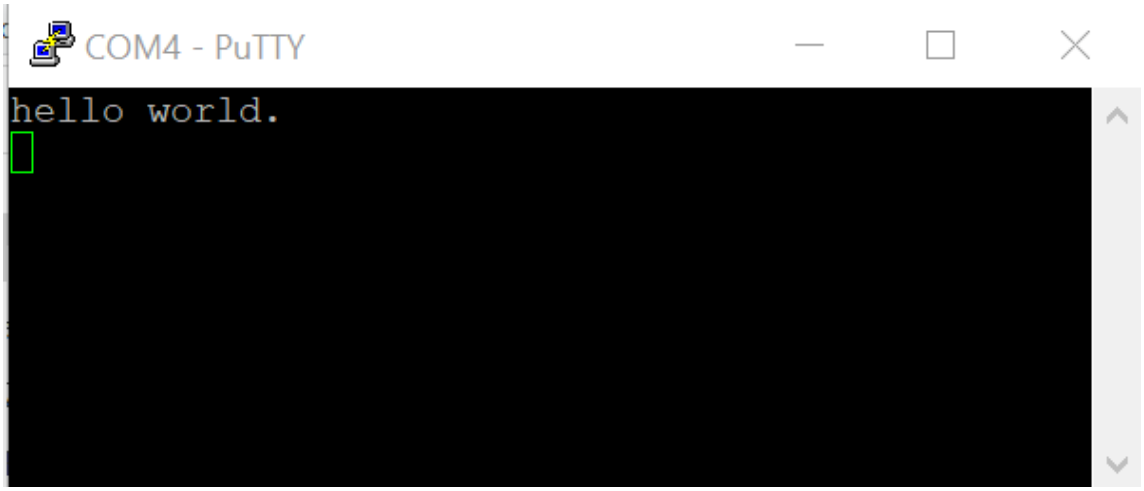


Note:

- Generally there are four build configurations for DSC SDK examples: flash_sdm_lpm_debug, flash_sdm_lpm_release, flash_ldm_lpm_debug, and flash_ldm_lpm_release.
  - *_debug: uses optimization level 1
  - *_release: uses optimization level 4
  - sdm: small data memory model
  - ldm: large data memory model
  - lpm: large program memory model
- Select corresponding launch configuration based on build target and debugger type.
- Some examples may require specific hardware settings, check each demo readme document, which includes detail instructions for HW and SW settings.



3. To run the code, click **Run** on the toolbar.
4. The hello_world application is now running and a banner is displayed on the terminal.



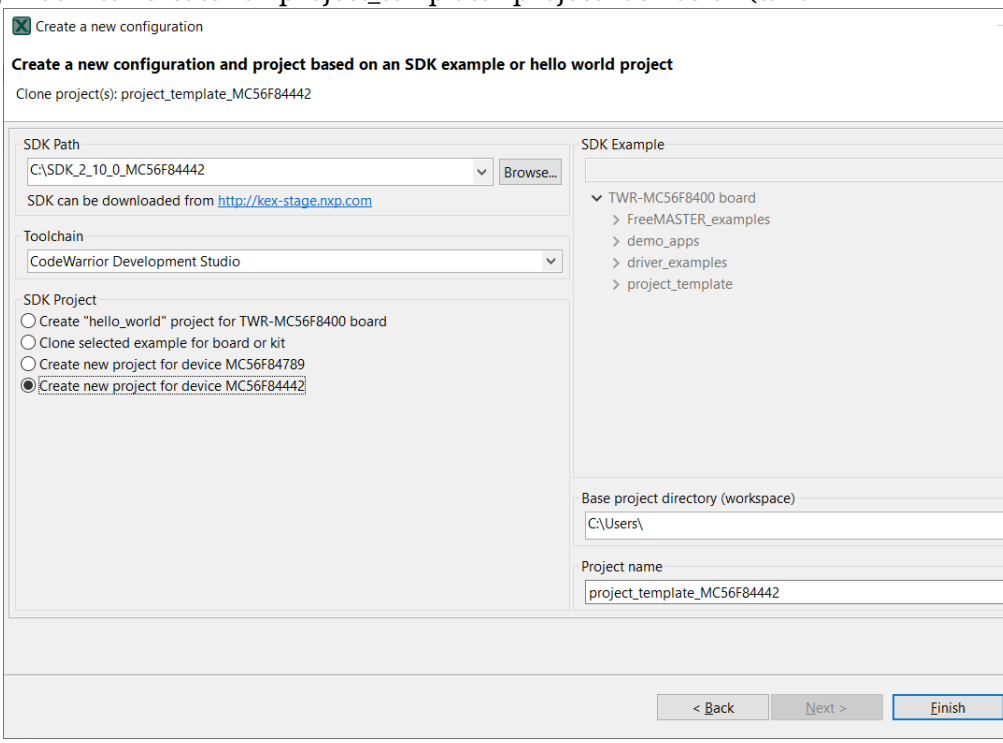
Project template for a specific DSC part

For device with specific part number, the easiest way to set up customer own project based on MCUXpresso DSC SDK peripheral driver, is the project_template. MCUXpresso Config Tool is used to generate the project_template.

The project_template provides basic MCUXpresso DSC SDK software framework, including startup, linker file, device header file, debug setting, peripheral driver, FreeMASTER, and so on.

Steps to generate the project_template for specific derivative part number by MCUXpresso Config Tool

1. Download the specific device SDK package and unzip it. note: The project template requires FreeMASTER, middleware FreeMASTER selection is a must when downloading DSC SDK from nxp website
2. Use MCUXpresso Config Tool to create a project_template project as below(take MC56F84442 as example).



3. Import the generated template_project into CodeWarrior IDE and start the development.

NOTE

- The default created project template by Config Tool is project_template_{part_number}. User could modify the default name in **Project name** textbox.
- All peripheral drivers files are included in the generated project_template project. They are same as the peripheral drivers within SDK package. If some drivers are not used or required, users may delete them in CodeWarrior, or delete them directly under folder *${project_path}/drivers*.

How to determine COM port

This section describes the steps necessary to determine the debug COM port number of your NXP hardware development platform. All NXP boards ship with a factory programmed, onboard debug interface, whether it is based on MCU-Link or the legacy OpenSDA, LPC-Link2, P&E Micro OSJTAG interface. To determine what your specific board ships with, see Default debug interfaces.

1. **Linux**: The serial port can be determined by running the following command after the USB Serial is connected to the host:

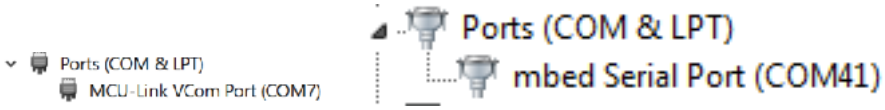
```
$ dmesg | grep "ttyUSB"
  [503175.307873] usb 3-12: cp210x converter now attached to ttyUSB0
  [503175.309372] usb 3-12: cp210x converter now attached to ttyUSB1
```

   There are two ports, one is for core0 debug console and the other is for core1.

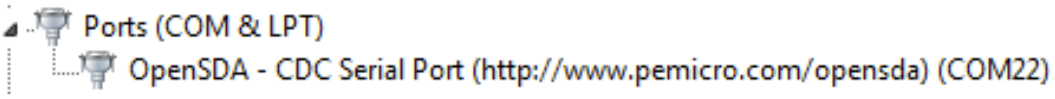
2. **Windows**: To determine the COM port open Device Manager in the Windows operating system. Click the **Start** menu and type **Device Manager** in the search bar.

   In the Device Manager, expand the **Ports (COM & LPT)** section to view the available ports. The COM port names are different for all the NXP boards.

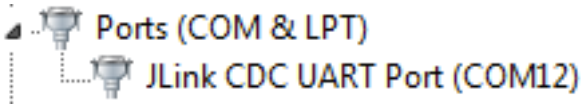
   1. **CMSIS-DAP/mbed/DAPLink** interface:



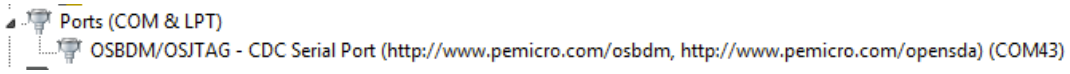
   2. **P&E Micro**:



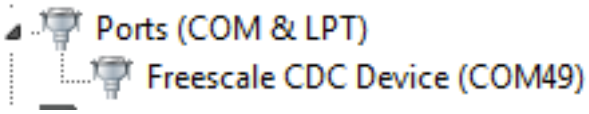
   3. **J-Link**:



   4. **P&E Micro OSJTAG**:



   5. **MRB-KW01**:



1.4 Getting Started with MCUXpresso SDK GitHub

1.4.1 Getting Started with MCUXpresso SDK Repository

Welcome to the **GitHub Repository SDK Guide**. This documentation provides instructions for setting up and working with the MCUXpresso SDK distributed in a **multi-repository model**. The SDK is distributed across multiple GitHub repositories and managed using the **Zephyr West** tool, enabling modular development and streamlined workflows.

Overview

The GitHub Repository SDK approach offers:

- **Modular Structure**: Multiple repositories for flexibility and scalability.
- **Zephyr West Integration**: Simplified repository management and synchronization.
- **Cross-Platform Support**: Designed for MCUXpresso SDK development environments.

Benefits of the Multi-Repository Approach

- **Scalability**: Easily add or update components without impacting the entire SDK.
- **Collaboration**: Enables distributed development across teams and repositories.
- **Version Control**: Independent versioning for components ensures better stability.
- **Automation**: Zephyr West simplifies dependency handling and repository synchronization.

Setup and Configuration

Follow these steps to prepare your development environment:

Development Tools Installation This guide explains how to install the essential tools for development with the MCUXpresso SDK.

Quick Start: Automated Installation (Recommended)

The **MCUXpresso Installer** is the fastest way to get started. It automatically installs all the basic tools you need.

1. **Download the MCUXpresso Installer** from: MCUXpresso Installer
2. **Run the installer** and select **"MCUXpresso SDK Developer"** from the menu
3. **Click Install** and let it handle everything automatically

Manual Installation

If you prefer to install tools manually or need specific versions, follow these steps:

Essential Tools

Git - Version Control

What it does: Manages code versions and downloads SDK repositories from GitHub.

Installation:

- Visit git-scm.com
- Download for your operating system
- Run installer with default settings
- **Important**: Make sure "Add Git to PATH" is selected during installation

Setup:

```
git config --global user.name "Your Name"
git config --global user.email "youremail@example.com"
```

Python - Scripting Environment

What it does: Runs build scripts and SDK tools.

Installation:

- Install Python **3.10 or newer** from python.org
- **Important**: Check "Add Python to PATH" during installation

West - SDK Management Tool

What it does: Manages SDK repositories and provides build commands. The west tool is developed by the Zephyr project for managing multiple repositories.

Installation:

```
pip install -U west
```

Minimum version: 1.2.0 or newer

Build System Tools

CMake - Build Configuration

What it does: Configures how your projects are built.

Recommended version: 3.30.0 or newer

Installation:

- **Windows**: Download .msi installer from cmake.org/download
- **Linux**: Use package manager or download from cmake.org
- **macOS**: Use Homebrew (brew install cmake) or download from cmake.org

Ninja - Fast Build System

What it does: Compiles your code quickly.

Minimum version: 1.12.1 or newer

Installation:

- **Windows**: Usually included, or download from ninja-build.org
- **Linux**: sudo apt install ninja-build or download binary
- **macOS**: brew install ninja or download binary

Ruby - IDE Project Generation (Optional)

What it does: Generates project files for IDEs like IAR and Keil.

When needed: Only if you want to use traditional IDEs instead of VS Code.

Installation: Follow the Ruby environment setup guide

Compiler Toolchains

Choose and install the compiler toolchain you want to use:

Toolchain	Best For	Download Link	Environment Variable
Arm GCC (Recommended)	Most users, free	Arm GNU Toolchain	ARMGCC_DIR
IAR EWARM	Professional development	IAR Systems	IAR_DIR
Keil MDK	Arm ecosystem	Arm Developer	MDK_DIR
Arm Compiler	Advanced optimization	Arm Developer	ARMCLANG_DIR
Code Warrior	DSC platforms	NXP CodeWarrior	CW_DIR
Xtensa	DSP core	Tensilica Tools	XCC_DIR

Setting Up Environment Variables

After toolchain installation, set an environment variable so the build system locates it:

Windows:

```
# Example for ARM GCC installed in C:\armgcc
setx ARMGCC_DIR "C:\armgcc"
```

Linux/macOS:

```
# Add to ~/.bashrc or ~/.zshrc
export ARMGCC_DIR="/usr"  # or your installation path
```

Verify Your Installation

After installation, verify everything works by opening a terminal/command prompt and running these commands:

```
# Check each tool - you should see version numbers
git --version
python --version
west --version
cmake --version
ninja --version
arm-none-eabi-gcc --version  # (if using ARM GCC)
```

Troubleshooting Installation Issues

"Command not found" errors:

- The tool isn't in your system PATH
- **Solution**: Add the installation directory to your PATH environment variable

Python/pip issues:

- Try using `python3` and `pip3` instead of `python` and `pip`

- On Windows, run the Command Prompt as an Administrator

Slow downloads:

- Add timeout option: pip install -U west --default-timeout=1000
- Use alternative mirror: pip install -U west -i https://pypi.tuna.tsinghua.edu.cn/simple

GitHub Repository Setup This guide explains how to initialize your MCUXpresso SDK workspace from GitHub repositories using the west tool. The GitHub Repository SDK uses multiple repositories hosted on GitHub to provide modular, flexible development.

Prerequisites

Verify the requirements:

System Requirements:

- Python 3.8 or later
- Git 2.25 or later
- CMake 3.20 or later
- Build tools for your target platform

Verification Commands:

```
python --version    # Should show 3.8+
git --version       # Should show 2.25+
cmake --version     # Should show 3.20+
west --version      # Should show west tool installation
```

Workspace Initialization

The GitHub Repository SDK uses the Zephyr west tool to manage multiple repositories containing different SDK components.

Step 1: Initialize Workspace

Create and initialize your SDK workspace from GitHub:

Get the latest SDK from main branch:

```
west init -m https://github.com/nxp-mcuxpresso/mcuxsdk-manifests.git mcuxpresso-sdk
```

Get SDK at specific revision:

```
west init -m https://github.com/nxp-mcuxpresso/mcuxsdk-manifests.git mcuxpresso-sdk --mr {revision}
```

Note: Replace {revision} *with the desired release tag, such as* v25.09.00

Step 2: Choose Your Repository Update Strategy

Navigate to the SDK workspace:

```
cd mcuxpresso-sdk
```

The west tool manages multiple GitHub repositories containing different SDK components. You have two options for downloading:

Option A: Download All Repositories (Complete SDK)

Download all SDK repositories for comprehensive development:

```
west update
```

This command downloads all the repositories defined in the manifest from GitHub. Initial download takes several minutes and requires ~7 GB of disk space.

Best for:

- Exploring the complete SDK
- Multi-board development projects
- Comprehensive middleware evaluation

Option B: Targeted Repository Download (Recommended)

Download only repositories needed for your specific board or device to save time and disk space:

```
# For specific board development
west update_board --set board your_board_name

# For specific device family development
west update_board --set device your_device_name

# List available repositories before downloading
west update_board --set board your_board_name --list-repo
```

Best for:

- Single board development
- Faster setup and reduced disk usage
- Focused development workflows

Examples:

```
# Update only repositories for FRDM-MCXW23 board
west update_board --set board frdmmcxw23

# Update only repositories for MCXW23 device family
west update_board --set device mcxw23
```

Step 3: Verify Installation

Confirm successful setup:

```
# Verify workspace structure
ls -la
# Should show: manifests/ and mcuxsdk/ directories

# Test build system
west list_project -p examples/demo_apps/hello_world
# Should display available build configurations
```

Advanced Repository Management

The west extension command `update_board` provides advanced repository management capabilities for optimized workspace setup with GitHub repositories.

Board-Specific Setup

Update only repositories required for a specific board:

```
# Update only repositories for specific board, e.g., frdmmcxw23
west update_board --set board frdmmcxw23

# List available repositories for the board before updating
west update_board --set board frdmmcxw23 --list-repo
```

Device-Specific Setup

Update only repositories required for a specific device family:

```
# Update only repositories for specific device, e.g., MCXW235
west update_board --set device mcxw23

# List available repositories for the device family
west update_board --set device mcxw23 --list-repo
```

Custom Configuration

For advanced users who want to create custom repository combinations:

```
# Use custom configuration file
west update_board --set custom path/to/custom-config.yml

# Generate custom configuration template
cp manifests/boards/custom.yml.template my-custom-config.yml
```

Benefits of Targeted Setup

Reduced Download Size

- Download only components needed for your target board or device
- Significantly faster initial setup for focused development
- Typical reduction from 7 GB to 2GB

Optimized Workspace

- Cleaner workspace with relevant components only
- Reduced disk space usage
- Faster repository operations

Flexible Development

- Switch between different board configurations easily
- Maintain separate workspaces for different projects
- Include optional components as needed

Repository Information

Before setting up your workspace, you can explore what repositories are available:

```
# Display repository information in console
west update_board --set board frdmmcxw23 --list-repo

# Export repository information to YAML file for reference
west update_board --set board frdmmcxw23 --list-repo -o board-repos.yml
```

This command lists all the available repositories with descriptions and outlines the included components in the workspace.

Package Generation (Optional)

The update_board command can also generate ZIP packages for offline distribution:

```
# Generate board-specific SDK package
west update_board --set board frdmmcxw23 -o frdmmcxw23-sdk.zip
```

Note: Package generation is primarily intended for creating custom SDK distributions. For regular development, use the workspace update commands without the -o option.

Workspace Management

Updating Your Workspace

Keep your SDK current with latest updates from GitHub:

For Complete SDK Workspace:

```
# Update manifest repository
cd manifests
git pull

# Update all component repositories
cd ..
west update
```

For Targeted Workspace:

```
# Update manifest repository
cd manifests
git pull

# Update board-specific repositories
cd ..
west update_board --set board your_board_name
```

Workspace Status

Check workspace synchronization status:

```
# Show status of all repositories
west status

# Show detailed information about repositories
west list
```

Troubleshooting

Network Issues:

- Use west update --keep-descendants for partial failures
- Configure Git credentials for private repositories
- Check firewall settings for Git protocol access

Permission Issues:

- Ensure write permissions in workspace directory
- Run commands without sudo/administrator privileges

- Verify Git SSH key configuration for authenticated access

Disk Space:

- Full SDK workspace requires approximately 7-8 GB
- Targeted workspace typically requires 1-2 GB
- Use board-specific setup to reduce workspace size

Repository Management Issues:

- Verify board/device names match available configurations
- Check that custom YAML files follow the correct template format
- Use `--list-repo` to verify available repositories before setup

Next Steps

With your workspace initialized:

1. Review *Workspace Structure* to understand the layout
2. Build your first project with *First Build Guide*
3. Explore *Development Workflows MCUXPresso VSCode* or *Development Workflows Command Line* for the details on project setup and execution

For advanced repository management, see the west tool documentation.

Prebuilt Binary Blobs Some SDK components ship with prebuilt binary files (`.a`, `.lib`, `.bin`, etc.) that are **not included in the git repository itself**. Instead they are fetched on demand from a dedicated blob repository using the `west blobs` command.

This keeps the main SDK checkout small and fast while still making the binaries available immediately when you need them.

When do you need to fetch blobs?

You typically need blobs when:

- You are building an example that links against a prebuilt library (e.g. a machine learning inference engine, a wireless stack library, or a graphics middleware).
- After a fresh `west init` + `west update`, the build fails with a linker error about a missing `.a` or `.lib` file.
- You run `west blobs check` and see `MISSING` entries.

Quick start

Run these commands from your SDK workspace root (the directory that contains `manifests/` and `mcuxsdk/`):

```
# 1. See what blobs are available and whether they are already present
west blobs check

# 2. Fetch any missing blobs
west blobs fetch

# 3. Confirm everything is present
west blobs check
```

A green result looks like:

```
mcu-sdk-examples: 1078/1078 entries: OK
```

Fetch blobs for a specific project only

If you only need blobs for one component, pass the west project name:

```
west blobs fetch mcu-sdk-examples
```

Use `west blobs list` to see available project names and their blob files:

```
west blobs list
```

License

By fetching blobs you accept the license terms bundled with each blob set. The applicable license file is located alongside `mcux_blobs.yml` in the relevant SDK subdirectory (for example `mcuxsdk/examples/LICENSE`).

Some blob sets require explicit license acceptance. If a blob has `click-through: True`, `west blobs fetch` will prompt you to confirm before downloading.

Keeping blobs up to date

After running `west update` (which updates the SDK source), re-run:

```
west blobs fetch
```

Blobs that are already present and whose sha256 matches are skipped automatically; only new or changed blobs are downloaded.

Troubleshooting

Build error: cannot find `-lsomething` or missing `.a` / `.bin`

```
west blobs fetch      # fetch all missing blobs
west blobs check      # verify
```

Re-fetch a corrupted or incomplete blob

```
# Remove locally cached blobs for one project and re-download
west blobs clean mcu-sdk-examples
west blobs fetch mcu-sdk-examples
```

Network / proxy issues

`west blobs fetch` downloads files over HTTPS. If your network requires a proxy, set the standard environment variables before running the command:

```
export HTTPS_PROXY=http://your-proxy:port
west blobs fetch
```

Checking without downloading

```
west blobs check      # shows OK or MISSING per entry; does not download
west blobs list       # lists all declared blobs; does not download
```

Next steps

- *Building Your First Project* — build and run an SDK example
- *Exploring the SDK* — workspace layout and example organization

Explore SDK Structure and Content

Learn about the organization of the SDK and its components:

SDK Architecture Overview The MCUXpresso SDK uses a modular architecture where software components are distributed across multiple repositories hosted on GitHub and managed through the west tool. This approach provides flexibility, maintainability, and enables selective component inclusion.

Repository Organization

Based on the manifest structure, the SDK consists of four main repository categories:

Manifest Repository

The manifest repo (mcuxsdk-manifests) contains the west.yml manifest file that tracks all other repositories in the SDK.

Base Repositories

Recorded in submanifests/base.yml and loaded in the root west.yml manifest file. These are the foundational repositories that build the SDK:

- **Devices**: MCU-specific support packages
- **Examples**: Demonstration applications and code samples
- **Boards**: Board support packages

Middleware Repositories

Recorded in the submanifests/middleware subdirectory, categorized according to functionality:

- **Connectivity**: Networking stacks, USB, and communication protocols
- **Security**: Cryptographic libraries and secure boot components
- **Wireless**: Bluetooth, IEEE 802.15.4, and other wireless protocols
- **Graphics**: Display drivers and UI frameworks
- **Audio**: Audio processing and voice recognition libraries
- **Machine Learning**: AI inference engines and neural network libraries

- **Safety**: IEC60730B safety libraries
- **Motor Control**: Motor control and real-time control libraries

Internal Repositories

Recorded in submanifests/internal.yml and grouped into the "bifrost" group. These are only visible to NXP internal developers and hosted on NXP internal git servers.

Repository Hosting

Public repositories are hosted on GitHub under these organizations:

- nxp-mcuxpresso
- NXP
- nxp-zephyr

Internal repositories are hosted on NXP's private Git infrastructure.

Benefits of This Architecture

Selective Integration: Projects include only required components, reducing memory footprint and build complexity.

Independent Versioning: Each component maintains its own release cycle and version control.

Community Collaboration: Public repositories accept community contributions through standard Git workflows.

Scalable Maintenance: Component owners can update their repositories without affecting the entire SDK.

Workspace Management

The west tool manages repository synchronization, version tracking, and workspace updates. All repositories are checked out under the mcuxsdk/ directory with their designated paths defined in the manifest files.

Workspace Structure After you initialize your SDK workspace, it creates a specific directory structure that organizes all SDK components. This structure is identical for both GitHub Repository SDK and Repository-Layout SDK Package.

Top-Level Organization

```
your-sdk-workspace/
  manifests/        # West manifest repository
  mcuxsdk/          # Main SDK content
```

The mcuxsdk/ directory serves as your primary working directory and contains all the SDK components.

SDK Component Layout

Based on the actual SDK structure, the main directories include:

Directory	Contents	Purpose
arch/	Architecture-specific files	ARM CMSIS, build configurations
cmake	Build system modules	CMake configuration and build rules
compo	Software components	Reusable software libraries and utilities
devices	Device support packages	MCU-specific headers, startup code, linker scripts
drivers	Peripheral drivers	Hardware abstraction layer for MCU peripherals
examp	Sample applications	Demonstration code and reference implementations
middle	Optional software stacks	Networking, graphics, security, and other libraries
rtos/	Operating system support	FreeRTOS integration
scripts	Build and utility scripts	West extensions and development tools
svd	Svd files for devices, this is optional because of large size. Customers run `west manifest config group.filter +optional` and `west update mcux-soc-svd` to get this folder.	

Example Organization

Examples follow a two-tier structure separating common code from board-specific implementations:

Common Example Files

```
examples/demo_apps/hello_world/
  CMakeLists.txt       # Build configuration
  example.yml          # Example metadata
  hello_world.c        # Application source code
  Kconfig              # Configuration options
  readme.md            # General documentation
```

Board-Specific Files

```
examples/_boards/your_board/demo_apps/hello_world/
  app.h                    # Board specific application header
  example_board_readme.md  # Board specific documentation
  hardware_init.c          # Board specific hardware initialization
  pin_mux.c                # Pin multiplexing configuration
  pin_mux.h                # Pin multiplexing header definitions
  hello_world.bin          # Pre-built binary for quick testing
  hello_world.mex          # MCUXpresso Config Tools project file
  prj.conf                 # Board specific Kconfig configuration
  reconfig.cmake           # Board specific cmake configuration overrides
```

Device Support Structure

Device support is organized hierarchically by MCU family:

```
devices/
  MCX/                  # MCU portfolio
    MCXW/               # MCU family
      MCXW235/          # Specific device
        MCXW235.h           # Device register definitions
        drivers/            # Device-specific drivers
        gcc/                # GNU toolchain files
        iar/                # IAR toolchain files
        mcuxpresso/         # MCUXpresso IDE files
        startup_MCXW235.c # Startup and vector table
        system_MCXW235.c  # System initialization
```

Middleware Organization

Middleware components are categorized by functionality and maintained in separate repositories. Based on the manifest files, common middleware categories include:

- **Connectivity**: USB, TCP/IP, industrial protocols
- **Security**: Cryptographic libraries, secure boot
- **Wireless**: Bluetooth, IEEE 802.15.4, Wi-Fi
- **Graphics**: Display drivers, UI frameworks
- **Audio**: Processing libraries, voice recognition
- **Machine Learning**: Inference engines, neural networks
- **Safety**: IEC60730B safety libraries
- **Motor Control**: Motor control and real-time control libraries

Documentation Structure

SDK documentation is distributed across multiple locations:

- docs/ - Core SDK documentation and build infrastructure
- Component repositories - API documentation and integration guides
- Board directories - Hardware-specific setup instructions

For complete documentation, refer to the online documentation.

Understanding Example Structure

Each example has **two README files**:

1. General README: examples/demo_apps/hello_world/readme.md

- What the example does
- General functionality description
- Common usage information

2. Board-Specific README: examples/_boards/{board_name}/demo_apps/hello_world/example_board_readme.md

- Board-specific setup instructions
- Hardware connections required

- Board-specific behavior notes

Tip: Always check both readme files - start with the general one, then read the board-specific one for detailed setup.

Development Workflows

Get started with building and running projects:

Building Your First Project This guide explains how to build and run your first SDK example project using the west build system. This applies to both GitHub Repository SDK and Repository-Layout SDK Package.

Prerequisites

- GitHub Repository SDK workspace initialized OR Repository-Layout SDK Package extracted
- Development board connected via USB
- Build tools installed per *Installation Guide*

Understanding Board Support

Before building, check whether your board is single-core or multicore, and which core IDs it supports:

```
west boards -b your_board
```

This prints the resolved device and, for multicore boards, the list of valid `core_ids` you'll need for the build command below. For a single-core board, no core ID is needed.

If you want to see every supported build configuration (toolchain/config combination) for a specific example instead, use:

```
west list_project -p examples/demo_apps/hello_world
```

This shows all supported build configurations. You can filter by toolchain:

```
west list_project -p examples/demo_apps/hello_world -t armgcc
```

`west list_project` is the most complete way to discover build commands across all boards and targets, but `west boards -b your_board` is the quicker way to look up just the board/core information you need once you already know which example you want to build.

Basic Build Process

Simple Build

Build the hello_world example with default settings:

```
west build -b your_board examples/demo_apps/hello_world
```

The default toolchain is armgcc, and the build system will select the first debug target as default if no config is specified.

Specifying Configuration

```
# Release build
west build -b your_board examples/demo_apps/hello_world --config release

# Debug build (default)
west build -b your_board examples/demo_apps/hello_world --config debug
```

Alternative Toolchains

```
# IAR toolchain
west build -b your_board examples/demo_apps/hello_world --toolchain iar

# Other toolchains as supported by the example
```

Multicore Applications

For multicore devices, `west boards -b your_board` (above) tells you which core IDs are valid. Specify the core either with `-Dcore_id=`:

```
west build -b evkbmimxrt1170 examples/demo_apps/hello_world --toolchain iar -Dcore_id=cm7 --config␣
↪flexspi_nor_debug
```

or more concisely by appending `@<core_id>` to the board name:

```
west build -b evkbmimxrt1170@cm7 examples/demo_apps/hello_world --toolchain iar --config flexspi_nor_
↪debug
```

Single-core boards don't need a core ID at all.

For multicore projects using sysbuild:

```
west build -b evkbmimxrt1170 --sysbuild ./examples/multicore_examples/hello_world/primary -Dcore_
↪id=cm7 --config flexspi_nor_debug --toolchain=armgcc -p always
```

Flash an Application

Flash the built application to your board:

```
west flash -r linkserver
```

Debug

Start a debug session:

```
west debug -r linkserver
```

Common Build Options

Clean Build

Force a complete rebuild:

```
west build -b your_board examples/demo_apps/hello_world -p always
```

Dry Run

See the commands that get executed without running them:

```
west build -b your_board examples/demo_apps/hello_world --dry-run
```

Device Variants

For boards supporting multiple device variants:

```
west build -b your_board examples/demo_apps/hello_world --device DEVICE_PART_NUMBER --config␣
↪release
```

Project Configuration

CMake Configuration Only

Run configuration without building:

```
west build -b your_board examples/demo_apps/hello_world -Dcore_id=cm7 --cmake-only -p
```

Interactive Configuration

Launch the configuration GUI:

```
west build -t guiconfig
```

Troubleshooting

Build Failures

Use pristine builds to resolve dependency issues:

```
west build -b your_board examples/demo_apps/hello_world -p always
```

Getting Help

View the help information for west build:

```
west build -h
```

Check Supported Configurations

To see available configuration options and board targets for an example, refer to the below command:

```
west list_project -p examples/demo_apps/hello_world
```

Next Steps

- Explore other examples in the SDK
- Learn about *Command Line Development* for advanced options
- Try *VS Code Development* for integrated development
- Refer *Workspace Structure* to understand the SDK layout

MCUXpresso for VS Code Development This guide covers using MCUXpresso for VS Code extension to build, debug, and develop SDK applications with an integrated development environment.

Prerequisites

- SDK workspace initialized (GitHub Repository SDK or Repository-Layout SDK Package)
- Development tools installed per *Installation Guide*
- Visual Studio Code installed
- MCUXpresso for VS Code extension installed

Extension Installation

Install MCUXpresso for VS Code

The MCUXpresso for VS Code extension provides integrated development capabilities for MCUXpresso SDK projects. Refer to the MCUXpresso for VS Code documentation for detailed installation and setup instructions.

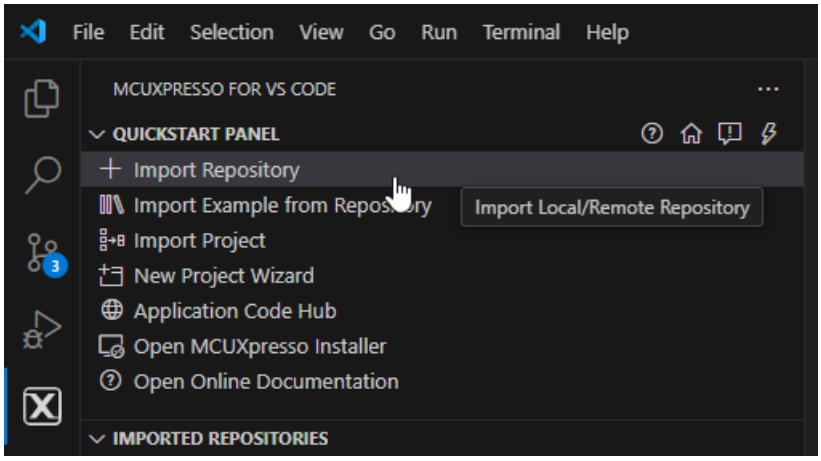
SDK Import and Setup

Import Methods

The SDK can be imported in several ways. The MCUXpresso for VS Code extension supports both GitHub Repository SDK and Repository-Layout SDK Package distributions.

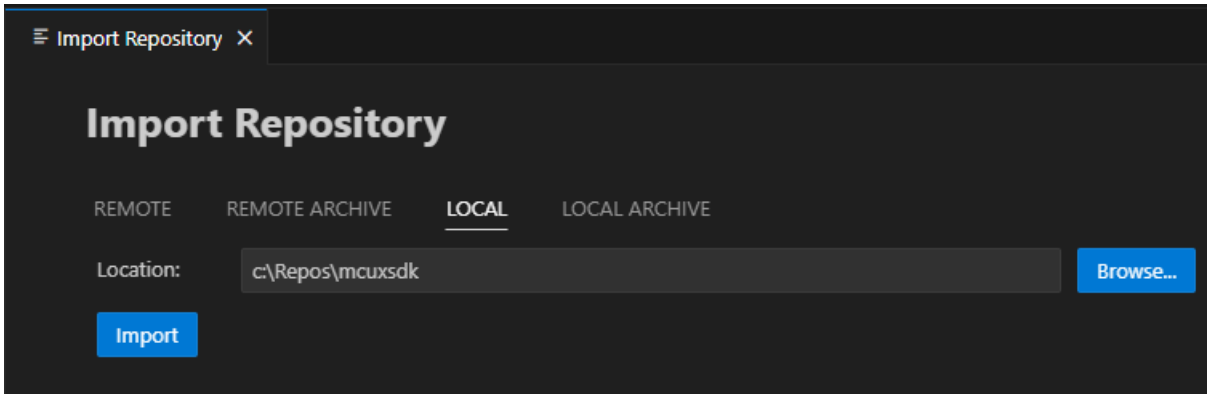
Import GitHub Repository SDK

Click **Import Repository** from the **QUICKSTART PANEL**

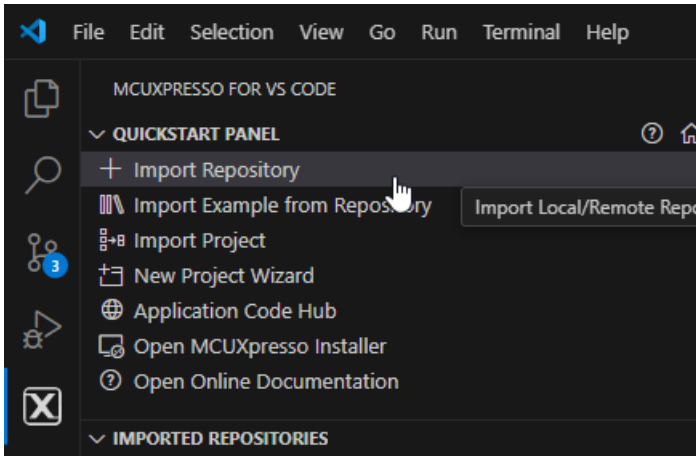


Note: You can import the SDK in several ways. Refer to the MCUXpresso for VS Code documentation for details.

Select **Local** if you've already obtained the SDK according to *setting up the repo*. Select your location and click **Import**.

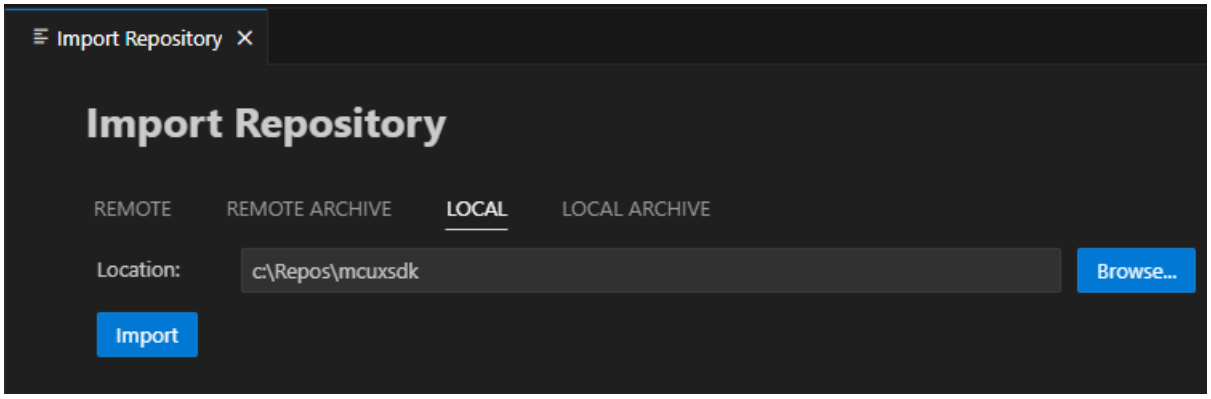


Import Repository-Layout SDK Package

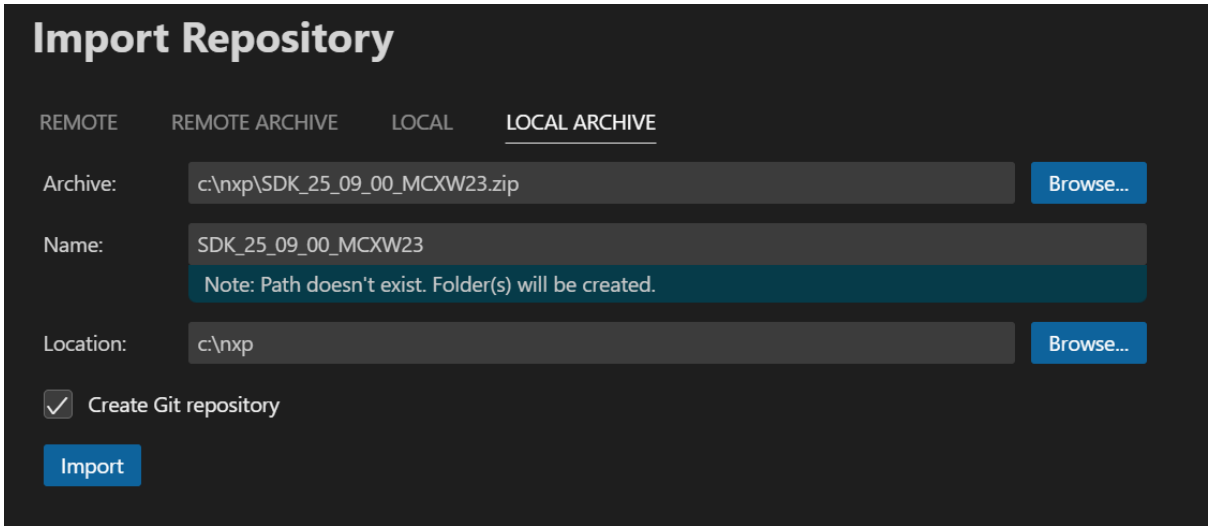


Click **Import Repository** from the **QUICKSTART PANEL**

Select **Local** if you've already unzipped the Repository-Layout SDK Package. Select your location and click **Import**.



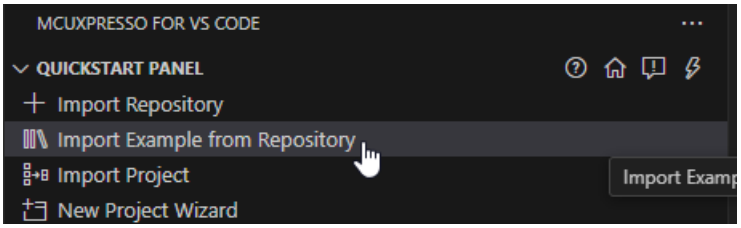
Else if the SDK is ZIP archive, select **Local Archive**, browse to the downloaded SDK ZIP file, fill the link of expect location, then click **Import**.



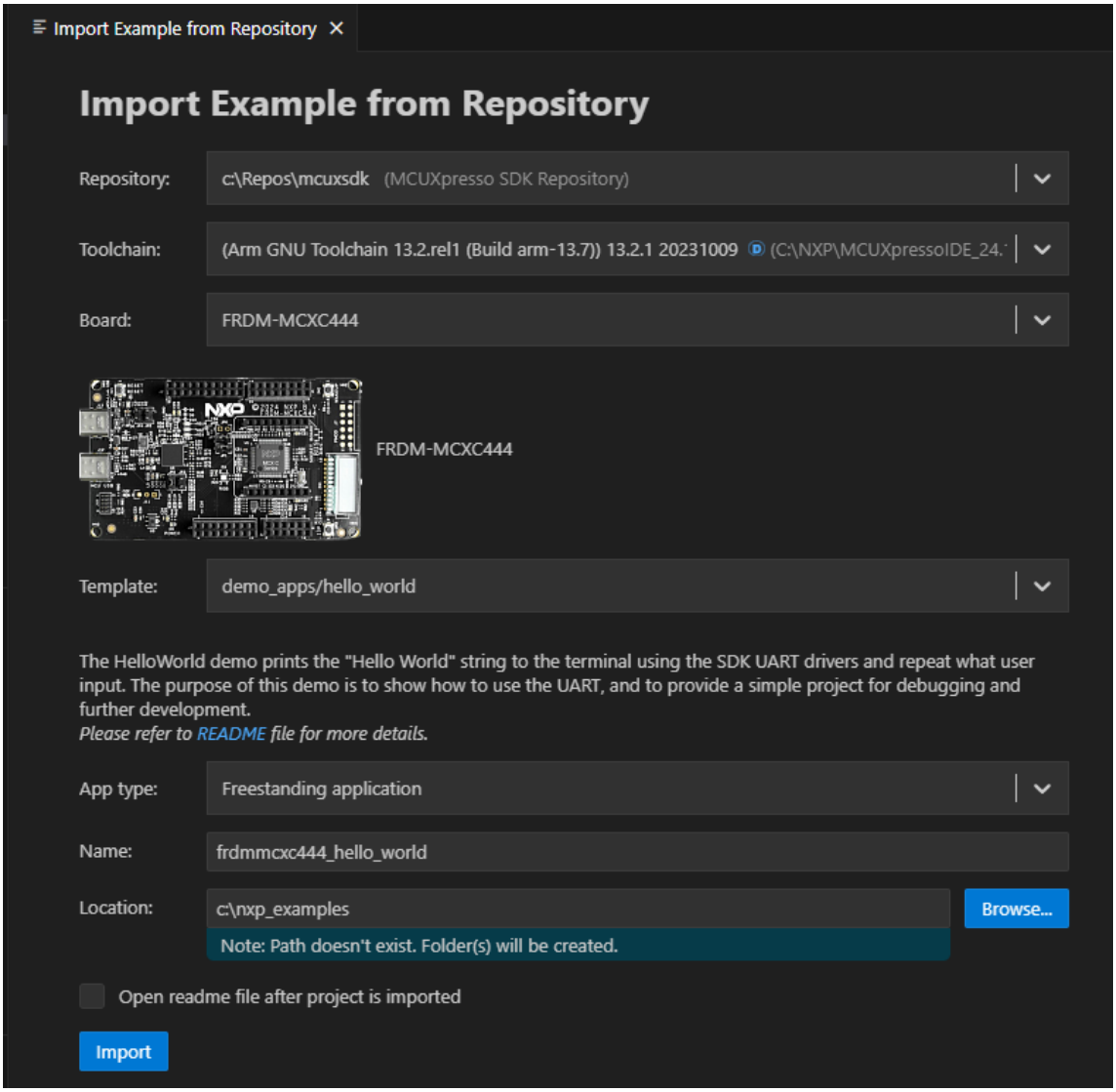
Building Example Applications

Import Example Project

1. Click **Import Example from Repository** from the **QUICKSTART PANEL**



2. Configure project settings:
   - **MCUXpresso SDK**: Select your imported SDK
   - **Arm GNU Toolchain**: Choose toolchain
   - **Board**: Select your target development board
   - **Template**: Choose example category
   - **Application**: Select specific example (e.g., hello_world)
   - **App type**: Choose between Repository applications or Freestanding applications
3. Click **Import**



Application Types

Repository Applications:

- Located inside the MCUXpresso SDK
- Integrated with SDK workspace

Freestanding Applications:

- Imported to user-defined location
- Independent of SDK location

Trust Confirmation

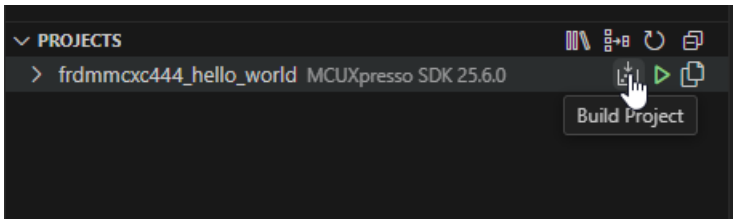
VS Code will prompt you to confirm if the imported files are trusted. Click **Yes** to proceed.

Building Projects

Build Process

1. Navigate to **PROJECTS** view
2. Find your project

3. Click the **Build Project** icon

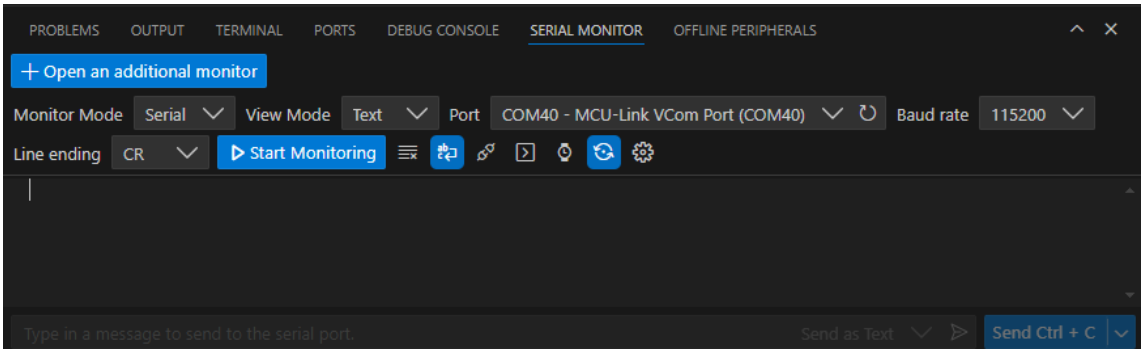


The integrated terminal will display build output at the bottom of the VS Code window.

Running and Debugging

Serial Monitor Setup

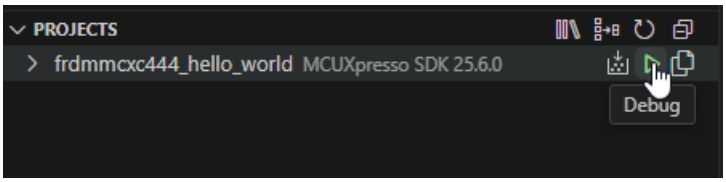
1. Open **Serial Monitor** from VS Code's integrated terminal



2. Configure serial settings:
   - **VCom Port**: Select port for your device
   - **Baud Rate**: Set to 115200

Debug Session

1. Navigate to **PROJECTS** view
2. Click the play button to initiate a debug session



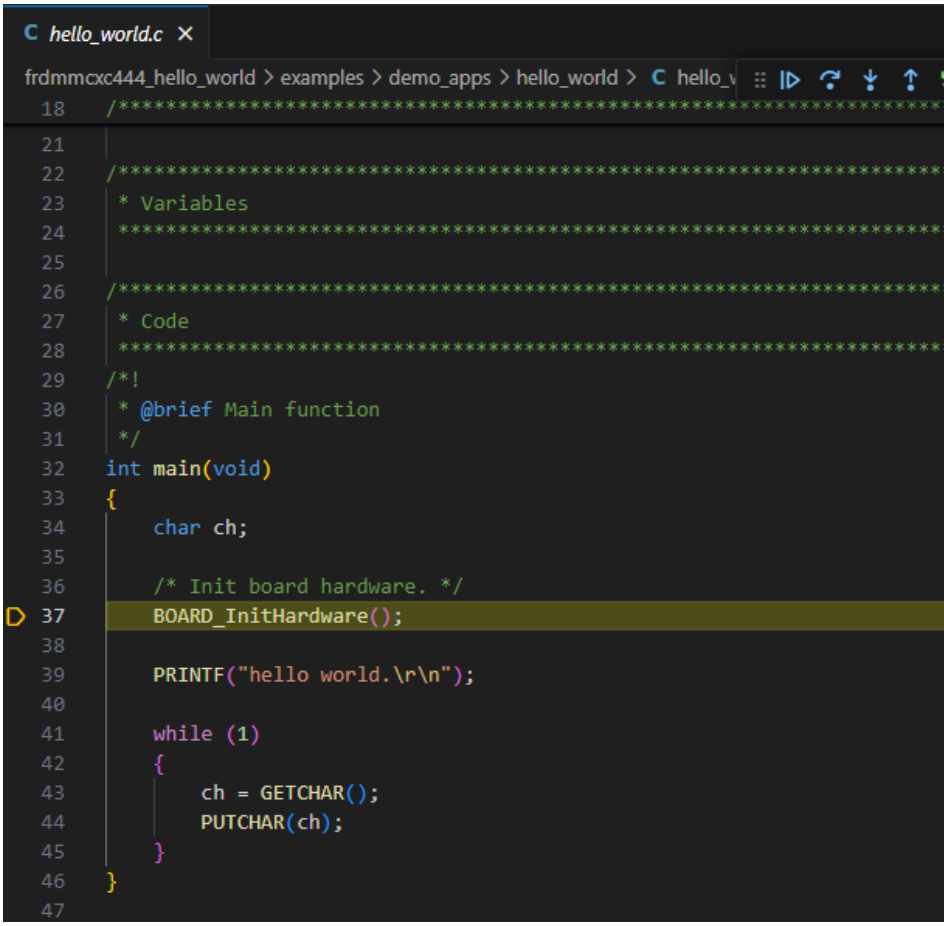
The debug session will begin with debug controls initially at the top of the interface.

Debug Controls

Use the debug controls to manage execution:

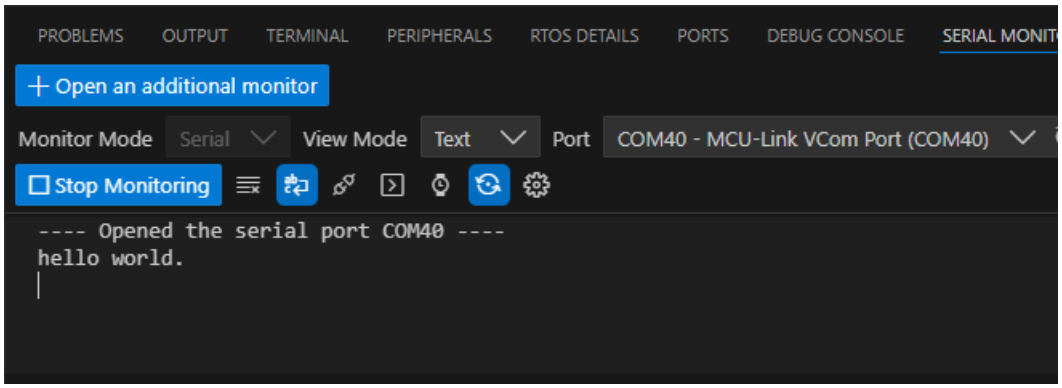
- **Continue**: Resume code execution
- **Step controls**: Navigate through code

- **Stop**: Terminate debug session



Monitor Output

Observe application output in the **Serial Monitor** to verify correct operation.



Debug Probe Support

For comprehensive information on debug probe support and configuration, refer to the MCUXpresso for VS Code Debug documentation.

Project Configuration

Workspace Management

The extension integrates with the MCUXpresso SDK workspace structure, providing access to:

- Example applications

- Board configurations
- Middleware components
- Build system integration

Multi-Project Support

The PROJECTS view allows management of multiple imported projects within the same workspace.

Troubleshooting

Import Issues

SDK not detected:

- Verify SDK workspace is properly initialized
- Ensure all required repositories are updated
- Check SDK manifest files are present

Project import failures:

- Confirm board support exists for selected example
- Verify toolchain installation
- Check example compatibility with selected board

Build Problems

Build failures:

- Check integrated terminal for error messages
- Verify all dependencies are installed
- Ensure toolchain is properly configured

Debug Issues

Debug session fails:

- Verify board connection via USB
- Check debug probe drivers are installed
- Confirm build completed successfully

Serial monitor problems:

- Verify correct VCom port selection
- Check baud rate configuration (115200)
- Ensure board drivers are installed

Integration with Command Line

MCUXpresso for VS Code integrates with the underlying west build system, allowing seamless integration with command line workflows described in *Command Line Development*.

Advanced Features

Project Types

The extension supports both repository-based and freestanding project types, providing flexibility in project organization and SDK integration.

Build System Integration

The extension leverages the MCUXpresso SDK build system, providing access to all build configurations and options available through command line tools.

Next Steps

- Explore additional examples in the SDK
- Review *Command Line Development* for advanced build options
- Refer to the MCUXpresso for VS Code documentation for detailed documentation
- Learn about *SDK Architecture* for better understanding of the development environment

Command Line Development This guide covers developing with the MCUXpresso SDK using command line tools and the west build system. This workflow applies to both GitHub Repository SDK and Repository-Layout SDK Package distributions.

Prerequisites

- GitHub Repository SDK workspace initialized OR Repository-Layout SDK Package extracted
- Development tools installed per *Installation Guide*
- Target board connected via USB

Understanding Board Support

Use the west extension to discover available examples for your board:

```
west list_project -p examples/demo_apps/hello_world
```

This shows all supported build configurations. You can filter by toolchain:

```
west list_project -p examples/demo_apps/hello_world -t armgcc
```

Basic Build Commands

Standard Build Process

Build with default settings (armgcc toolchain, first debug config):

```
west build -b your_board examples/demo_apps/hello_world
```

Specifying Build Configuration

```
# Release build
west build -b your_board examples/demo_apps/hello_world --config release

# Debug build with specific toolchain
west build -b your_board examples/demo_apps/hello_world --toolchain iar --config debug
```

Multicore Applications

For multicore devices, specify the core ID:

```
west build -b evkbmimxrt1170 examples/demo_apps/hello_world --toolchain iar -Dcore_id=cm7 --config␣
↪flexspi_nor_debug
```

For multicore projects using sysbuild:

```
west build -b evkbmimxrt1170 --sysbuild ./examples/multicore_examples/hello_world/primary -Dcore_
↪id=cm7 --config flexspi_nor_debug --toolchain=armgcc -p always
```

Shield Support

For boards with shields:

```
west build -b mimxrt700evk --shield a8974 examples/issdk_examples/sensors/fxls8974cf/fxls8974cf_poll -
↪Dcore_id=cm33_core0
```

Advanced Build Options

Clean Builds

Force a complete rebuild:

```
west build -b your_board examples/demo_apps/hello_world -p always
```

Dry Run

See what commands would be executed:

```
west build -b your_board examples/demo_apps/hello_world --dry-run
```

Device Variants

For boards supporting multiple device variants:

```
west build -b your_board examples/demo_apps/hello_world --device MK22F12810 --config release
```

Project Configuration

CMake Configuration Only

Run configuration without building:

```
west build -b evkbmimxrt1170 examples/demo_apps/hello_world -Dcore_id=cm7 --cmake-only -p
```

Interactive Configuration

Launch the configuration GUI:

```
west build -t guiconfig
```

Flashing and Debugging

Flash Application

Flash the built application to your board:

```
west flash -r linkserver
```

Debug Session

Start a debugging session:

```
west debug -r linkserver
```

IDE Project Generation

To use a traditional IDE instead of the command line or VS Code, generate an IDE project from the CMake build with `-t guiproject`:

- Run a demo using IAR
- Run a demo using MDK

Both guides cover the Ruby dependency required for IDE project generation.

Troubleshooting

Build Failures

Use pristine builds to resolve dependency issues:

```
west build -b your_board examples/demo_apps/hello_world -p always
```

Toolchain Issues

Verify environment variables are set correctly:

```
# Check ARM GCC
echo $ARMGCC_DIR
arm-none-eabi-gcc --version

# Check IAR (if using)
echo $IAR_DIR
```

Getting Help

Display help information:

```
west build -h
west flash -h
west debug -h
```

Check Supported Configurations

If unsure about supported options for an example:

```
west list_project -p examples/demo_apps/hello_world
```

Best Practices

Project Organization

- Keep custom projects outside the SDK tree
- Use version control for your application code
- Document any SDK modifications

Build Efficiency

- Use `-p always` for clean builds when troubleshooting
- Leverage `--dry-run` to understand build processes
- Use specific configs and toolchains to reduce build time

Development Workflow

1. Start with existing examples closest to your requirements
2. Copy and modify rather than building from scratch
3. Test with hello_world before moving to complex examples
4. Use configuration tools for pin muxing and clock setup

Next Steps

- Explore *VS Code Development* for integrated development experience
- Review *Workspace Structure* to understand SDK organization
- Refer build system documentation for advanced configurations

Using MCUXpresso Config Tools MCUXpresso Config tools provide a user-friendly way to configure hardware initialization of your projects. This guide explains the basic workflow with the MCUXpresso SDK west build system and the Config Tools.

Prerequisites

- GitHub Repository SDK workspace initialized OR Repository-Layout SDK Package extracted
- MCUXpresso Config Tools standalone installed (version 25.09 or above)
- MCUXpresso SDK Project that can be successfully built

Board Files

MCUXpresso Config Tools generate source files for the board. These files include pin_mux.c/h and clock_config.c/h. The files contain initialization code functions that reflect the hardware configuration in the Config Tools. Within the SDK codebase, these files are specific for the board and either shared by multiple example projects or specific for one example. Open or import the configuration from the SDK project in the Config Tools and customize the settings to match the custom board or specific project use case and regenerate the code. See *User Guide for MCUXpresso Config Tools (Desktop)* (document GSMCUXCTUG) for details.

Note: When opening the configuration for SDK example projects, the board files may be shared across multiple examples. To ensure a separate copy of the board configuration files exists, create a freestanding project with copied board files.

Visual Studio Code

To open the configuration in Visual Studio Code, use the context menu for the project to access Config Tools. See MCUXpresso Extension Documentation for details.
Otherwise, use the manual workflow described in detail in the following section.

Manual Workflow

Use the following steps:

1. Before using Config Tools, run the west command to get the project information for Config Tools from the SDK project files, for example:

```
west cfg_project_info -b lpcxpresso55s69 ...mcuxsdk/examples/demo_apps/hello_world/ -Dcore_
↪id=cm33_core0
```

This results in the creation of the project information json file that is searched by the config tools when the configuration is created. The parameters of the command should match the build parameters that will be used for the project.

2. Launch the MCUXpresso Config Tools and in the **Start development** wizard, select **Create a new configuration based on the existing IDE/Toolchain project**. Select the created "cfg_tools" subfolder as a project folder (for example: ...mcuxsdk/examples/demo_apps/hello_world/cfg_tools/).

Updating the SDK West project

Note: Updating project is supported with Config Tools V25.12 or newer only.

Changes in the Config tools generated source code modules may require adjustments to the toolchain project to ensure a successful build. These changes may mean, for example, adding the newly generated files, adding include paths, required drivers, or other SDK components. This section describes how to manually resolve the changes needed in the project within the toolchain projects based on the SDK project managed by the West tool.

After the configuration in the Config Tools is finished, write updated files to the disk using the 'Update Code' command. The written files include a json file with the required changes for the toolchain project.

To resolve the changes in the project in the terminal, launch the west command that updates the project. For example:

```
west cfg_resolve -b lpcxpresso55s69 ...mcuxsdk/examples/demo_apps/hello_world/ -Dcore_id=cm33_core0
```

This command updates the appropriate cmake and kconfig files to address the changes. After this, the application can be built.

Note: The cfg_resolve command supports additional arguments. Launch the *west cfg_resolve -h* command to get the list and description.

1.5 Release Notes

1.5.1 MCUXpresso SDK Release Notes

Development tools

The MCUXpresso SDK was tested with following development tools. Same versions or above are recommended.

- CodeWarrior Development Studio v11.2 with CodeWarrior for DSC v11.2 SP1 (Service Pack 1)

Supported development systems

This release supports board and devices listed in following table. The board and devices in bold were tested in this release.

Development boards	MCU devices
MC56F81000-EVK	MC56F81643LVLC, MC56F81646LVLF, MC56F81648LVLH, MC56F81663LVLC, MC56F81666LVLF, MC56F81668LVLH, MC56F81743LVLC, MC56F81746LMLF, MC56F81746LVLF, MC56F81748LMLH, MC56F81748LVLH, MC56F81763LVLC, MC56F81766AMLFA, MC56F81766LMLF, MC56F81766LVLF, MC56F81768AMLHA, MC56F81768LMLH, **MC56F81768LVLH**

Release contents

Table 1 provides an overview of the MCUXpresso DSC SDK release package contents and locations.

Deliverable	Location
Boards	<install_dir>/boards
Demo applications	<install_dir>/boards/<board_name>/demo_apps
Driver examples	<install_dir>/boards/<board_name>/driver_examples
Documentation	<install_dir>/docs
Driver, SoC header files, extension header files and feature header files	<install_dir>/devices/<device_name>
Peripheral Drivers	<install_dir>/devices/<device_name>/drivers
Utilities such as debug console	<install_dir>/devices/<device_name>/utilities
Middleware	<install_dir>/middleware

MCUXpresso SDK release package

The MCUXpresso SDK release package content is aligned with the silicon subfamily it supports. This includes the boards, CMSIS, devices, middleware, and RTOS support.

Device support The device folder contains the whole software enablement available for the specific System-on-Chip (SoC) subfamily. This folder includes clock-specific implementation, device register header files, device register feature header files, and the system configuration source files. Included with the standard SoC support are folders containing peripheral drivers, toolchain support, and a standard debug console. The device-specific header files provide a direct access to the microcontroller peripheral registers. The device header file provides an overall SoC memory mapped register definition. The folder also includes the feature header file for each peripheral on the microcontroller. The toolchain folder contains the startup code and linker files for each supported toolchain. The startup code efficiently transfers the code execution to the main() function.

Board support The boards folder provides the board-specific demo applications, driver examples, and middleware examples.

Demo application and other examples The demo applications demonstrate the usage of the peripheral drivers to achieve a system level solution. Each demo application contains a readme file that describes the operation of the demo and required setup steps. The driver examples demonstrate the capabilities of the peripheral drivers. Each example implements a common use case to help demonstrate the driver functionality.

Middleware

Motor Control Software (ACIM, BLDC, PMSM) Motor control examples.

FreeMASTER FreeMASTER communication driver for 32-bit platforms.

Known Issues

This section lists the known issues, limitations, and/or workarounds.

PRINTF issue for program address space When project is compiled with SDM, print the address in program address space malfunction.

- Failed example when SDM
  - PRINTF("%p", main); Root cause: in SDM, %p is treated as 16-bit value, however main in program address space is still considered as 32-bit.
- Workaround(compliant with SDM and LDM)
  - PRINTF("0x%lx", (uint32_t)main);

1.6 ChangeLog

1.6.1 MCUXpresso SDK Changelog

Board Support Files

board [25.06.00]

- Initial version

clock_config [25.06.00]

- Initial version

pin_mux [25.06.00]

- Initial version

CADC

[2.2.0]

- New Features
- Supported platforms which don't have ANA4 expansion MUX.

[2.1.0]

- Improvements
- Added some APIs to support some devices that equipped expansion mux.

[2.0.1]

- Bug Fixes
- Fixed the bug that channel mode set to wrong value.
- Fixed the bug that independent parallel mode set to wrong value.
- Fixed violations of the MISRA C-2012 rules.

[2.0.0]

- Initial version.

CLOCK

[2.2.0]

- Update to support silicon revision 1

[2.1.0]

- Accumulated bug fix
- MISRA warning fix

[2.0.0]

- Initial version.

CMP

[2.0.1]

- Improvements
- Supported MC56F82xxxx and MC56F84xxxx.
  - Bug Fixes
- Fixed violations of the MISRA C-2012 rules.

[2.0.0]

- Initial version.

COMMON

[2.6.7]

- Improvements
  - EnableIRQ/DisableIRQ: Use IRQSTEER_GetInstIdxByIRQ() to determine IRQSTEER instance index instead of simple division. Supports multiple IRQSTEER instances with different interrupt counts.

[2.6.6]

- Improvements
  - Support Cortex M55.

[2.6.5]

- Bug Fixes
  - Fixed the issue that the function SDK_DelayAtLeastUs may underflow and cause a long delay when the input parameter is small and the system clock is low.

[2.6.4]

- New Features
  - Add macros to tag deprecated features and experimental features.

[2.6.3]

- New Features
  - Added bit mask inversion macros to avoid type promotion.
  - Added register operation macros.
- Improvements
  - Make function MSDK_EnableCpuCycleCounter compatible with CMSIS-5 and CMSIS-6.
- Bug Fixes
  - Fixed build issue of CMSIS PACK BSP example caused by CMSIS 6.1 issue.

[2.6.2]

- Bug Fixes
  - Fixed violations of MISRA C-2012 rule for implicit conversions in boolean contexts

[2.6.1]

- Improvements
  - Support Cortex M23.

[2.6.0]

- Bug Fixes
  - Fix CERT-C violations.

[2.5.0]

- New Features
  - Added new APIs InitCriticalSectionMeasurementContext, DisableGlobalIRQEx and EnableGlobalIRQEx so that user can measure the execution time of the protected sections.

[2.4.3]

- Improvements
  - Enable irqs that mount under irqsteer interrupt extender.

[2.4.2]

- Improvements
  - Add the macros to convert peripheral address to secure address or non-secure address.

[2.4.1]

- Improvements
  - Improve for the macro redefinition error when integrated with zephyr.

[2.4.0]

- New Features
  - Added EnableIRQWithPriority, IRQ_SetPriority, and IRQ_ClearPendingIRQ for ARM.
  - Added MSDK_EnableCpuCycleCounter, MSDK_GetCpuCycleCount for ARM.

[2.3.3]

- New Features
  - Added NETC into status group.

[2.3.2]

- Improvements
  - Make driver aarch64 compatible

[2.3.1]

- Bug Fixes
  - Fixed MAKE_VERSION overflow on 16-bit platforms.

[2.3.0]

- Improvements
  - Split the driver to common part and CPU architecture related part.

[2.2.10]

- Bug Fixes
  - Fixed the ATOMIC macros build error in cpp files.

[2.2.9]

- Bug Fixes
  - Fixed MISRA C-2012 issue, 5.6, 5.8, 8.4, 8.5, 8.6, 10.1, 10.4, 17.7, 21.3.
  - Fixed SDK_Malloc issue that not allocate memory with required size.

[2.2.8]

- Improvements
  - Included stddef.h header file for MDK tool chain.
- New Features:
  - Added atomic modification macros.

[2.2.7]

- Other Change
  - Added MECC status group definition.

[2.2.6]

- Other Change
  - Added more status group definition.
- Bug Fixes
  - Undef __VECTOR_TABLE to avoid duplicate definition in cmsis_clang.h

[2.2.5]

- Bug Fixes
  - Fixed MISRA C-2012 rule-15.5.

[2.2.4]

- Bug Fixes
  - Fixed MISRA C-2012 rule-10.4.

[2.2.3]

- New Features
  - Provided better accuracy of SDK_DelayAtLeastUs with DWT, use macro SDK_DELAY_USE_DWT to enable this feature.
  - Modified the Cortex-M7 delay count divisor based on latest tests on RT series boards, this setting lets result be closer to actual delay time.

[2.2.2]

- New Features
  - Added include RTE_Components.h for CMSIS pack RTE.

[2.2.1]

- Bug Fixes
  - Fixed violation of MISRA C-2012 Rule 3.1, 10.1, 10.3, 10.4, 11.6, 11.9.

[2.2.0]

- New Features
  - Moved SDK_DelayAtLeastUs function from clock driver to common driver.

[2.1.4]

- New Features
  - Added OTFAD into status group.

[2.1.3]

- Bug Fixes
  - MISRA C-2012 issue fixed.
    - Fixed the rule: rule-10.3.

[2.1.2]

- Improvements
  - Add SUPPRESS_FALL_THROUGH_WARNING() macro for the usage of suppressing fallthrough warning.

[2.1.1]

- Bug Fixes
  - Deleted and optimized repeated macro.

[2.1.0]

- New Features
  - Added IRQ operation for XCC toolchain.
  - Added group IDs for newly supported drivers.

[2.0.2]

- Bug Fixes
  - MISRA C-2012 issue fixed.
    - Fixed the rule: rule-10.4.

[2.0.1]

- Improvements
  - Removed the implementation of LPC8XX Enable/DisableDeepSleepIRQ() function.
  - Added new feature macro switch "FSL_FEATURE_HAS_NO_NONCACHEABLE_SECTION" for specific SoCs which have no noncacheable sections, that helps avoid an unnecessary complex in link file and the startup file.
  - Updated the align(x) to **attribute**(aligned(x)) to support MDK v6 armclang compiler.

[2.0.0]

- Initial version.

COP

[2.2.3]

- Bug Fixes
  - Fixed violations of MISRA C-2012 rule 10.3.

[2.2.2]

- Bug Fixes
- Added configuration of CWP bits in COP_Init, fixed write protection bEnableWriteProtect cannot be configured as part of cop_config_t.

[2.2.1]

- Bug Fixes
- Fixed violations of the MISRA C-2012 rules.

[2.2.0]

- Improvements
- Updated cop_config_t member naming.
- Deleted COP_Disable API, added COP_Enable to enable/disable COP.

[2.1.0]

- Improvements
- API interface changes:
  - Renamed "COP_EnableInterrupts/COP_DisableInterrupts" to "COP_EnableInterrupt/COP_DisableInterrupt" and remove unnecessary parameter.
  - New Features
- Added APIs to enable/disable the COP COP Loss of Reference counter.

[2.0.0]

- Initial version.

CRC

[2.0.1]

- Bug Fixes
- Fixed violations of the MISRA C-2012 rules.

[2.0.0]

- Initial version.

DAC

[2.0.1]

- Improvements
- Supported MC56F82xxx and MC56F84xxx.
  - Bug Fixes
- Fixed violations of the MISRA C-2012 rules.

[2.0.0]

- Initial version.

DMAMUX

[2.0.0]

- Initial version.

EDMA

[2.0.4]

- New Features
  - Added common IRQ handler entry EDMA_DriverIRQHandler.

[2.0.3]

- Fixed the MISRA-2012 violations.
- Fixed rule 10.3.

[2.0.2]

- Fixed the MISRA-2012 violations.
- Fixed rule 5.8, 9.2, 10.3, 10.4, 11.6.

[2.0.1]

- Code modification for SDM compliance

[2.0.0]

- Initial version.

EVTG

[2.0.1]

- Bug Fixes
  - Fixed mismatched parentheses in EVTG_Init() FORCE_BYPASS write that broke the CodeWarrior DSC build when force-bypass flip-flop is enabled.

[2.0.0]

- Initial version.

EWM

[2.0.2]

- Bug Fixes
- Fixed violations of MISRA C-2012 rule 10.3.

[2.0.1]

- Bug Fixes
- Fixed violations of the MISRA C-2012 rules.

[2.0.0]

- Initial version.

FLASH

[3.0.0]

- Initial version — Basic FTFx IP command support

GPIO

[2.0.1]

- Bug Fixes
- Fixed violations of the MISRA C-2012 rules.

[2.0.0]

- Initial version.

INTC

[2.0.2]

- Improvements
  - Support SOC with different vector base address (VBA) shift.

[2.0.1]

- Improvements
- Added doxygen comments.

[2.0.0]

- Initial version.

LPI2C

[2.0.3]

- New Feature
  - Added common IRQ handler entry LPI2C_DriverIRQHandler.

[2.0.2]

- Bug Fixes
- Fixed bug in eDMA transfer for SoCs whose rx and tx have different eDMA requests.

[2.0.1]

- Bug Fixes
- Fixed the MISRA-2012 violations.

[2.0.0]

- Initial version.

MCM

[2.1.0]

- Improvements
  - Supported MC56F85xxx.

[2.0.1]

- Improvements
- Supported MC56F82xxx and MC56F84xxx.

[2.0.0]

- Initial version.

OPAMP

[2.0.0]

- Initial version.

PIT

[2.3.3]

- Bug Fixes
- Fixed CERT INT31-C violations in the CTRL register accesses: complements of 16-bit register masks are now explicitly cast to uint16_t before the read-modify-write, and the bool bEnableNegativeEdge field is normalized to 1U/0U before the PIT_CTRL_PRESET_POLARITY() write.

[2.3.2]

- Improvements
- Guarded slave mode support (pit_config_t.bEnableSlaveMode, PIT_EnableSlaveMode(), and the CTRL SLAVE bitfield write) behind FSL_FEATURE_PIT_CTRL_HAS_SLAVE so devices whose PIT CTRL has no SLAVE bit build correctly.

[2.3.1]

- Bug Fixes
- Fixed violations of MISRA C-2012 rule 10.3.

[2.3.0]

- Improvements
- Filtered Preset input to reset PIT counter.
- Support SYNC_OUT output stretch and toggle mode.
- Added PIT_SetPresetFiltConfig() to set FILT register configurations.
- Added PIT_SetSyncOutConfig() to set SYNC register configurations.

[2.2.1]

- Bug Fixes
- Fixed violations of the MISRA C-2012 rules.

[2.2.0]

- Improvements
- Updated pit_config_t member naming.
- Removed some APIs for prescaler and clock source selection.

[2.1.0]

- Improvements
- Updated PIT clock source and PIT prescaler with more meaningful comments.
- Updated PIT_SetTimerPeriod() and PIT_GetCurrentTimerCount() with 16-bit parameter.
- Deleted mask parameter for PIT_ClearStatusFlags/PIT_EnableInterrupts/PIT_DisableInterrupts.
- Added PIT_SetTimerClockSource() API to configure clock source.
- Added PIT_EnableSlaveMode() API to configure slave mode.

[2.0.1]

- New Features
- Added PIT_SetTimerPrescaler() API to configure clock prescaler value.

[2.0.0]

- Initial version.

PMC

[2.1.0]

- Improvements
- Added PMC_SetVrefTrim() and PMC_SetVcapTrim() APIs to support MC56F80xxx.

[2.0.0]

- Initial version.

eFlexPWM

[2.2.1]

- Bug Fixes
  - Fixed PWM_SetupFaultProtectionConfig() using wrong macro PWM_FCTRL_FSAFE instead of PWM_FCTRL_FIE for the fault interrupt enable field.
  - Fixed PWM_SetupFaultProtectionConfig() using PWM_FFILT_GSTR for both FILT_CNT and FILT_PER fields instead of PWM_FFILT_FILT_CNT and PWM_FFILT_FILT_PER.
  - Fixed PWM_SetupOutputConfig() not programming TCTRL[OUT_TRIG_EN] bits from bVal0TriggerEnable ~ bVal5TriggerEnable; previous code overwrote TCTRL multiple times and lost the OUT_TRIG_EN value.
  - Fixed PWM_SetupOutputConfig() not updating MASK register on devices without MASK[UPDATE_MASK] bitfield.
  - Fixed PWM_SetupSMConfig() passing the address of eStrBusClock (&psConfig->eStrBusClock) instead of its value to PWM_MCTRL2_STRETCH_CNT_PRSC(), and using |= which preserved stale prescaler bits; corrected to RMW.
  - Fixed PWM_SetupDeadtimeConfig() leaving CTRL[SPLIT] set when switching away from kPWM_IndependentWithSplitDoubleSwitchPwm mode.

[2.2.0]

- New Features
- Supported capture PWM input filter.
- Supported different PWM deadtime count register width.
  - Bug Fixes
- Fixed wrong pwm_sm_pwm_out_t enum order issue.

[2.1.1]

- Bug Fixes
- Fixed build error when soc not support Capture A/B features.

[2.1.0]

- Improvements
- Supported MC56F80xxx.

[2.0.2]

- Bug Fixes
- Fixed clear status flags API doesn't work issue.

[2.0.1]

- Improvements
- Supported MC56F82xxx and MC56F84xxx .
  - Bug Fixes
- Fixed violations of the MISRA C-2012 rules.

[2.0.0]

- Initial version.

QDC

[2.1.0]

- New Features
- Supported input filter prescaler.
- Supported the feature that the position counter to be initialized by Index Event Edge Mark.

[2.0.1]

- Improvements
- Supported MC56F84xxx.

[2.0.0]

- Initial version.

QSCI

[2.0.5]

- New Feature
  - Added common IRQ handler entry QSCI_DriverIRQHandler.

[2.0.4]

- Bug Fixes
- Fixed DMA transfer blocking issue by enabling tx idle interrupt after DMA transmission finishes, and invoke completion callback after tx idle interrupt occurs.

[2.0.3]

- Bug Fixes
- Fixed violations of the MISRA C-2012 rules.

[2.0.2]

- Improvements
- Supported QSCI which has 13-bit integer and 3-bit fractional baud rate selection.

[2.0.1]

- Bug Fixes
- Fixed bug that when starting the non-blocking receive, the rx idle interrupt is not enabled, and when receiving is done the rx idle interrupt is not disabled.

[2.0.0]

- Initial version.

QTMR

[2.0.1]

- Improvements
- Supported to get TMR capture register address.
  - Bug Fixes
- Fixed violations of the MISRA C-2012 rules.

[2.0.0]

- Initial version.

Queued SPI

[2.1.2]

- New Feature
  - Added common IRQ handler entry QSPI_DriverIRQHandler.

[2.1.1]

- Bug Fixes
- Fixed wrong baudrate calculation method.

[2.1.0]

- Bug Fixes
- Fixed wrong definitions of interrupt enable/disable masks.
- Fixed wrong usage of QSPI_DisableInterrupts.
- Fixed wrong type casts.
- Fixed bug for master blocking transfer of rx FIFO overflow.

[2.0.0]

- Initial version.

SIM

[2.2.0]

- Use dedicated SIM driver for MC56F81xxx

[2.1.0]

- Improvements
- Updated support for MC56F82xxx and MC56F84xxx.
  - Bug Fixes
- Fixed violations of the MISRA C-2012 rules.

[2.0.0]

- Initial version.

DSC_XBARA

[2.0.2]

- Improvements
  - Updated XBARA_SELx_SELn_MASK macro to use SOC register bit field macros (XBARA_SEL0_SEL0_MASK / XBARA_SEL0_SEL1_MASK) instead of hardcoded values.

[2.0.1]

- Bug Fixes
- Fixed violations of the MISRA C-2012 rules.

[2.0.0]

- Initial version.

Chapter 2

MC56F81768

2.1 CADC: 12-bit Cyclic Analog-to-Digital Converter Driver

void CADC_Init(ADC_Type *base, const *cadc_config_t* *psConfig)

Initializes the CADC module, such as scan mode, DMA trigger source, interrupt mask and so on.

This function is to make the initialization for using CADC module. The operations are:

- Enable the clock for CADC.
- Set power up delay and Idle work mode.
- Set DMA trigger source.
- Enable the interrupts(Including High/Low limit interrupt, zero crossing interrupt interrupt, end of scan interrupt and each sample slot's scan interrupt).
- Set scan mode.
- Set disabled sample slot for the scan.
- Set scan control options.
- Set selected channels' mode.
- Set gain for each channel.
- Config conterA and converterB.

Note: The high limit value, low limit value, offset value and zerocrossing mode of each sample slot will not be configured in this function, to set those options, the APIs in "Sample Slot Control Interfaces" function group can be used.

Parameters

- base – CADC peripheral base address.
- psConfig – Pointer to configuration structure. See *cadc_config_t*.

void CADC_GetDefaultConfig(*cadc_config_t* *psConfig)

Gets an available pre-defined options(such as scan mode, DMA trigger source, interrupt mask and so on) for module's configuration.

This function initializes the module's configuration structure with an available settings. The default value are:

```
psConfig->eDMATriggerSource = kCADC_DMATrigSrcEndofScan;
psConfig->eIdleWorkMode = kCADC_IdleKeepNormal;
psConfig-s>u16PowerUpDelay = 26U;
psConfig->u32EnabledInterruptMask = 0U;
psConfig->eScanMode = kCADC_ScanModeTriggeredParallelSimultaneous;
psConfig->uDisabledSampleSlot.u32SampleDisVal = 0xFF0F0UL;
psConfig->uScanControl.u32ScanCtrlVal         = 0x0UL;
psConfig->eChannelGain[x] = kCADC_SignalGainX1;
psConfig->sampleSlotScanInterruptEnableMask = kCADC_NonSampleSlotMask;
For the default setting of converter, please see CADC_GetConverterDefaultConfig().
```

Parameters

- psConfig – Pointer to configuration structure. See *cadc_config_t*.

void CADC_Deinit(ADC_Type *base)

De-initializes the CADC module, including power down both converter and disable the clock(Optional).

This function is to make the de-initialization for using CADC module. The operations are:

- Power down both converter.
- Disable the clock for CADC.

Parameters

- base – CADC peripheral base address.

static inline void CADC_SetScanMode(ADC_Type *base, *cadc_scan_mode_t* eScanMode)

Sets the scan mode(such as Sequential scan mode, Simultaneous parallel scan mode, Independent parallel scan

mode) of dual converters.

Parameters

- base – CADC peripheral base address.
- eScanMode – Dual converters' scan mode, please see *cadc_scan_mode_t* for details.

static inline void CADC_SetScanControl(ADC_Type *base, *cadc_scan_control_t* uScanControl)

The function provides the ability to pause and await new sync in the conversion sequence.

Parameters

- base – CADC peripheral base address.
- uScanControl – The scan control value, please refer to *cadc_scan_control_t* for details.

void CADC_SetChannelMode(ADC_Type *base, *cadc_channel_mode_t* eChannelMode)

Sets mode for the specific channel(Each channel can be set as single-end, fully differential and unipolar differential(Optional) mode).

Parameters

- base – CADC peripheral base address.
- eChannelMode – The channel mode to be set, please refer to *cadc_channel_mode_t* for details.

void CADC_SetChannelGain(ADC_Type *base, *cadc_channel_number_t* eChannelNumber, *cadc_channel_gain_t* eChannelGain)

Sets the gain(Supports X1, X2, X4) of selected channel.

Parameters

- base – CADC peripheral base address.
- eChannelNumber – The number of channel, please refer to *cadc_channel_number_t*.
- eChannelGain – The gain amplification, please refer to *cadc_channel_gain_t* for details.

void CADC_GetSampleSlotDefaultConfig(*cadc_sample_slot_config_t* *psConfig)

Gets sample slot default configuration including zero crossing mode, high limit value, low limit value and offset value.

```
psConfig->eZeroCrossingMode = kCADC_ZeroCrossingDisabled;
psConfig->u16HighLimitValue  = 0x7FF8U;
psConfig->u16LowLimitValue   = 0x0U;
psConfig->u16OffsetValue     = 0x0U;
```

Parameters

- psConfig – Pointer to configuration structure. See *cadc_sample_slot_config_t*.

void CADC_SetSampleSlotConfig(ADC_Type *base, *cadc_sample_slot_index_t* eSampleIndex, const *cadc_sample_slot_config_t* *psConfig)

Configures the options(including zero crossing mode, high limit value, low limit value and offset value) for sample slot.

Note: This function can be used to set high limit value, low limit value, offset value and zerocrossing mode of the sample slot.

Parameters

- base – CADC peripheral base address.
- eSampleIndex – Index of sample slot in conversion sequence. Please refer to *cadc_sample_slot_index_t*.
- psConfig – Pointer to configuration structure. See *cadc_sample_slot_config_t*.

void CADC_SetSampleSlotZeroCrossingMode(ADC_Type *base, *cadc_sample_slot_index_t* eSampleIndex, *cadc_sample_slot_zero_crossing_mode_t* eZeroCrossingMode)

Sets zero-crossing mode for the selected sample slot.

Parameters

- base – CADC peripheral base address.
- eSampleIndex – The index of sample slot. Please refer to *cadc_sample_slot_index_t* for details.
- eZeroCrossingMode – Zero crossing mode, please refer to *cadc_sample_slot_zero_crossing_mode_t* for details.

void CADC_RouteChannelToSampleSlot(ADC_Type *base, *cadc_sample_slot_index_t* eSampleIndex, *cadc_channel_number_t* eChannelNumber)

Routes the channel to the sample slot.

Parameters

- base – CADC peripheral base address.
- eSampleIndex – The index of sample slot, please refer to *cadc_sample_slot_index_t* for details.
- eChannelNumber – Sample channel number, please refer to *cadc_channel_number_t* for details.

static inline void CADC_SetSampleSlotLowLimitValue(ADC_Type *base, *cadc_sample_slot_index_t* eSampleIndex, uint16_t u16LowLimitValue)

Sets the low limit value(-32768 ~ 32767 with lower three bits of fixed value 0) for the specific sample slot.

Parameters

- base – CADC peripheral base address.
- eSampleIndex – The index of sample slot. Please refer to *cadc_sample_slot_index_t* for details.
- u16LowLimitValue – Low limit value(-32768 ~ 32767 with lower three bits of fixed value 0). Original value formation as hardware register, with 3-bits left shifted.

static inline void CADC_SetSampleSlotHighLimitValue(ADC_Type *base, *cadc_sample_slot_index_t* eSampleIndex, uint16_t u16HighLimitValue)

Sets the high limit value(-32768 ~ 32767 with lower three bits of fixed value 0) for the specific sample slot.

Parameters

- base – CADC peripheral base address.
- eSampleIndex – The index of sample slot. Please refer to *cadc_sample_slot_index_t* for details.
- u16HighLimitValue – High limit value(-32768 ~ 32767 with lower three bits of fixed value 0). Original value formation as hardware register, with 3-bits left shifted.

static inline void CADC_SetSampleSlotOffsetValue(ADC_Type *base, *cadc_sample_slot_index_t* eSampleIndex, uint16_t u16OffsetValue)

Sets the offset value(-32768 ~ 32767 with lower three bits of fixed value 0) for the specific sample slot.

Parameters

- base – CADC peripheral base address.
- eSampleIndex – The index of sample slot. Please refer to *cadc_sample_slot_index_t* for details.
- u16OffsetValue – Offset value(-32768 ~ 32767 with lower three bits of fixed value 0). Original value formation as hardware register, with 3-bits left shifted.

static inline uint16_t CADC_GetSampleSlotResultValue(ADC_Type *base, *cadc_sample_slot_index_t* eSampleIndex)

Gets the sample result value.

This function is to get the sample result value. The returned value keeps it original formation just like in hardware result register. It includes the sign bit as the MSB and 3-bit left shifted value.

Parameters

- base – CADC peripheral base address.
- eSampleIndex – Index of sample slot. For the counts of sample slots, please refer to *cadc_sample_slot_index_t* for details.

Returns

Sample's conversion value.

void CADC_GetConverterDefaultConfig(*cadc_converter_config_t* *psConfig)

Gets available pre-defined settings(such as clock divisor, reference voltage source, and so on) for each converter's configuration.

This function initializes each converter's configuration structure with an available settings. The default value are:

```
psConfig->u16ClockDivisor = 4U;(ADC clock = Peripheral clock / 5)
psConfig->eSpeedMode = kCADC_SpeedMode0; (Chip specific)
psConfig->eHighReferenceVoltageSource = kCADC_ReferenceVoltageVrefPad;
psConfig->eLowReferenceVoltageSource = kCADC_ReferenceVoltageVrefPad;
psConfig->u16SampleWindowCount = 0U; (Chip specific)
psConfig->bEnableDMA          = false;
psConfig->bPowerUp    = false;
psConfig->bScanInitBySync  = true;
```

Parameters

- psConfig – Pointer to configuration structure. See *cadc_converter_config_t*.

void CADC_SetConverterConfig(ADC_Type *base, *cadc_converter_id_t* eConverterId, const *cadc_converter_config_t* *psConfig)

Configures the options(such as clock divisor, reference voltage source, and so on) for the converter.

This function can be used to configure the converter The operations are:

- Set clock divisor;
- Set reference voltage source
- Enable/Disable DMA
- Power-up/power-down converter

Parameters

- base – CADC peripheral base address.
- eConverterId – The converter Id. See *cadc_converter_id_t*.
- psConfig – Pointer to configuration structure. See *cadc_converter_config_t*.

static inline void CADC_EnableConverter(ADC_Type *base, *cadc_converter_id_t* eConverterId, bool bEnable)

Changes the converter to stop mode or normal mode.

The conversion should only be launched after the converter is in normal mode. When in stop mode, the current scan is stopped and no further scans can start. All the software trigger and hardware trigger are ignored.

Parameters

- base – CADC peripheral base address.
- eConverterId – The converter Id. See *cadc_converter_id_t*.
- bEnable – Used to change the operation mode.
  - **true** Changed to normal mode.
  - **false** Changed to stop mode

static inline void CADC_EnableConverterSyncInput(ADC_Type *base, *cadc_converter_id_t* eConverterId, bool bEnable)

Enables/Disables the external sync input pulse to initiate a scan.

Note: When in "Once" scan mode, this gate would be off automatically after an available sync is received. User needs to enable the input again manually if another sync signal is wanted.

Parameters

- base – CADC peripheral base address.
- eConverterId – The converter Id. See *cadc_converter_id_t*.
- bEnable – Enable the feature or not.
  - **true** Used a SYNC input pulse or START command to initiate a scan.
  - **false** Only use the START command to initiate a scan.

static inline void CADC_DoSoftwareTriggerConverter(ADC_Type *base, *cadc_converter_id_t* eConverterId)

Uses software trigger to start a conversion sequence.

This function is to do the software trigger to the converter. The software trigger can used to start a conversion sequence.

Parameters

- base – CADC peripheral base address.
- eConverterId – The ID of the converter to be started. See *cadc_converter_id_t*.

static inline void CADC_SetConverterClockDivisor(ADC_Type *base, *cadc_converter_id_t* eConverterId, uint16_t u16ClockDivisor)

Sets clock divisor(Range from 0 to 63) for converterA and conveter B.

Parameters

- base – CADC peripheral base address.
- eConverterId – The converter Id. See *cadc_converter_id_t*.
- u16ClockDivisor – Converter's clock divisor for the clock source.Available setting range is 0-63.
  - When the clockDivisor is 0, the divisor is 2.
  - For all other clockDivisor values, the divisor is 1 more than the decimal value of clockDivisor: clockDivisor + 1

void CADC_SetConverterReferenceVoltageSource(ADC_Type *base, *cadc_converter_id_t* eConverterId, *cadc_reference_voltage_source_t* eHighReferenceVoltage, *cadc_reference_voltage_source_t* eLowReferenceVoltage)

Sets converter's reference voltage source(Including high reference voltage source and low reference voltage

source).

Parameters

- base – CADC peripheral base address.
- eConverterId – The converter Id. See *cadc_converter_id_t*.
- eHighReferenceVoltage – High voltage reference source, please refer to *cadc_reference_voltage_source_t*.
- eLowReferenceVoltage – Low voltage reference source, please refer to *cadc_reference_voltage_source_t*.

void CADC_EnableConverterPower(ADC_Type *base, *cadc_converter_id_t* eConverterId, bool bEnable)

Powers up/down the specific converter.

This function is to enable the power for the converter. The converter should be powered up before the conversion. Once this API is called to power up the converter, the converter would be powered on after a few moment (so-called power up delay, the function *CADC_SetPowerUpDelay()* can be used to set the power up delay), so that the power would be stable.

Parameters

- base – CADC peripheral base address.
- eConverterId – The converter to be powered. See *cadc_converter_id_t*.
- bEnable – Powers up/down the converter.
  - **true** Power up the specific converter.
  - **false** Power down the specific converter.

static inline void CADC_EnableConverterDMA(ADC_Type *base, *cadc_converter_id_t* eConverterId, bool bEnable)

Enables/Disables the converter's DMA feature.

Parameters

- base – CADC peripheral base address.
- eConverterId – The converter id. See *cadc_converter_id_t*.
- bEnable – Enables/Disables the DMA.
  - **true** Enable the converter's DMA.
  - **false** Disable the converter's DMA.

void CADC_SetConverterMuxAuxConfig(ADC_Type *base, *cadc_converter_id_t* eConverterId, const *cadc_exp_mux_aux_config_t* *psMuxAuxConfig)

Configures selected converter's expansion mux and aux settings.

Parameters

- base – ADC peripheral base address.

- eConverterId – The converter id, see *cadc_converter_id_t*.
- psMuxAuxConfig – Pointer to *cadc_exp_mux_aux_config_t* structure.

static inline void CADC_ResetConverterExpMuxScan(ADC_Type *base, *cadc_converter_id_t* eConverterId)

Resets selected converter's expansion mux scan.

Parameters

- base – ADC peripheral base address.
- eConverterId – The converter id, see *cadc_converter_id_t*.

static inline void CADC_SetConverterExpansionMuxOperateMode(ADC_Type *base, *cadc_converter_id_t* eConverterId, *cadc_expansion_mux_operate_mode_t* eOperateMode)

Sets selected converter's expansion mux operate mode.

Parameters

- base – ADC peripheral base address.
- eConverterId – The converter id, see *cadc_converter_id_t*.
- eOperateMode – Used to set expansion mux operate mode.

static inline void CADC_SetConverterAuxiliaryControl(ADC_Type *base, *cadc_converter_id_t* eConverterId, uint16_t u16AuxControl)

Sets selected converter's auxiliary control set.

Parameters

- base – ADC peripheral base address.
- eConverterId – The converter id, see *cadc_converter_id_t*.
- u16AuxControl – The mask of auxiliary control, should be the OR'ed value of *cadc_auxiliary_control_t*.

static inline void CADC_SetConverterMuxChannels(ADC_Type *base, *cadc_converter_id_t* eConverterId, uint32_t u32MuxChannelMask)

Sets selected converter's mux channels.

Parameters

- base – ADC peripheral base address.
- eConverterId – The converter id, see *cadc_converter_id_t*.
- u32MuxChannelMask – The mask of mux selection of all mux solts, should be the OR'ed value of *cadc_expansion_mux_selection_t*.

static inline void CADC_SetExpansionMuxAuxDisabledSlot(ADC_Type *base, *cadc_converter_id_t* eConverterId, *cadc_expansion_disabled_mux_slot_t* eDisabledMuxSlot)

Set selected converter's mux and aux disabled slot.

Parameters

- base – ADC peripheral base address.
- eConverterId – The converter id, see *cadc_converter_id_t*.

- eDisabledMuxSlot – The mux slot to disabled, please refer to *cadc_expansion_disabled_mux_slot_t*.

static inline void CADC_SetPowerUpDelay(ADC_Type *base, uint16_t u16PowerUpDelay)

Sets power up delay(The number of ADC clocks to power up the converters before allowing a scan to start).

Parameters

- base – CADC peripheral base address.
- u16PowerUpDelay – The number of ADC clocks to power up an ADC converter. Ranges from 0 to 63.

static inline void CADC_EnableAutoPowerDownMode(ADC_Type *base, bool bEnable)

Enables/Disables auto-powerdown converters when the module is not in use for a scan.

Parameters

- base – CADC peripheral base address.
- bEnable – Enable/Disable auto-powerdown mode.
  - **true** Enable auto-powerdown mode, so when the module is not in use, it will auto-powerdown.
  - **false** Disable auto-powerdown mode, so when the module is not in use, the power will still on.

static inline void CADC_SetDMATriggerSource(ADC_Type *base, *cadc_dma_trigger_source_t* eDMATriggerSource)

Sets DMA trigger source(available selections are “End of scan” and “Sample Ready”).

Parameters

- base – CADC peripheral base address.
- eDMATriggerSource – DMA trigger source. Please refer to *cadc_dma_trigger_source_t* for details.

static inline void CADC_EnableInterrupts(ADC_Type *base, uint32_t u32Mask)

Enables the interrupts(such as high/low limit interrupts, end of scan interrupts, and so on).

Parameters

- base – CADC peripheral base address.
- u32Mask – Mask value for converters interrupt events. Should be the OR’ed value of *_cadc_interrupt_enable*.

static inline void CADC_DisableInterrupts(ADC_Type *base, uint32_t u32Mask)

Disables the interrupts(such as high/low limit interrupts, end of scan interrupts, and so on).

Parameters

- base – CADC peripheral base address.
- u32Mask – Mask value for converts interrupt events. Should be the OR’ed value of *_cadc_interrupt_enable*.

static inline uint16_t CADC_GetMiscStatusFlags(ADC_Type *base)

Gets Miscellaneous status flags, such as end of scan status flag, high/low limit interrupt flags and so on.

Note: This API will return the current status of the ADC module, including high limit interrupt status, low limit status flag, zero crossing interrupt status, End of scan interrupt status, conversion in progress status. But some status flags are not included in this function. To get sample slot ready status flag,

please invoking *CADC_GetSampleSlotReadyStatusFlags()*, to get sample slot limit violations status please invoking *CADC_ClearSampleSlotLowLimitStatusFlags()* and *CADC_GetSampleSlotHighLimitStatusFlags()*, to get zerocrossing status please invoking *CADC_GetSampleSlotZeroCrossingStatusFlags()*. To get converters' power status please invoke CADC_GetPowerStatusFlag().

Parameters

- base – CADC peripheral base address.

Returns

Mask value for the event flags. See *_cadc_misc_status_flags*.

static inline void CADC_ClearMiscStatusFlags(ADC_Type *base, uint16_t u16Flags)

Clears Miscellaneous status flags(Only for "end of scan" status flags).

Note: Only kCADC_ConverterAEndOfScanFlag and kCADC_ConverterBEndOfScanFlag can be cleared. And sample slot related status flags can not be cleared in this function. To clear the status flags of limit violations, please invoking *CADC_ClearSampleSlotLowLimitStatusFlags()* and *CADC_ClearSampleSlotHighLimitStatusFlags()*, to clear the status flags of zero crossing mode, please invoking *CADC_ClearSampleSlotZeroCrossingStatusFlags()*.

Parameters

- base – CADC peripheral base address.
- u16Flags – Mask value for the event flags to be cleared. See *_cadc_misc_status_flags*. Only the enumeration *kCADC_ConverterAEndOfScanFlag* and *kCADC_ConverterBEndOfScanFlag* are useful.

static inline uint32_t CADC_GetSampleSlotReadyStatusFlags(ADC_Type *base)

Gets sample slots ready status flag, those status flags are cleared by reading the corresponding sample slots' result.

Parameters

- base – CADC peripheral base address.

static inline uint32_t CADC_GetSampleSlotLowLimitStatusFlags(ADC_Type *base)

Gets sample slot low limit status flags(Each bit represents one sample slot).

Parameters

- base – CADC peripheral base address.

Returns

The value of all sample slots' low limit status. Each bit represents one sample slot.

static inline void CADC_ClearSampleSlotLowLimitStatusFlags(ADC_Type *base, uint32_t u32SampleMask)

Clears sample slot's low limit status flags(Each bit represents one sample slot).

Parameters

- base – CADC peripheral base address.
- u32SampleMask – Mask value of sample slots. This parameter should be the OR'ed value of *cadc_sample_slot_mask_t*.

static inline uint32_t CADC_GetSampleSlotHighLimitStatusFlags(ADC_Type *base)

Gets sample slot high limit status flags(Each bit represents one sample slot).

Parameters

- base – CADC peripheral base address.

Returns

The value of all sample slots' high limit status. Each bit represents each sample slot.

static inline void CADC_ClearSampleSlotHighLimitStatusFlags(ADC_Type *base, uint32_t u32SampleMask)

Clears sample slot's high limit status flags(Each bit represents one sample slot).

Parameters

- base – CADC peripheral base address.
- u32SampleMask – Mask value of sample slots. This parameter should be the OR'ed value of *cadc_sample_slot_mask_t*.

static inline uint32_t CADC_GetSampleSlotZeroCrossingStatusFlags(ADC_Type *base)

Gets sample slot zero crossing status flags(Each bit represents one sample slot).

Parameters

- base – CADC peripheral base address.

Returns

The value of all sample slots' zero crossing status. Each bit represents each sample slot.

static inline void CADC_ClearSampleSlotZeroCrossingStatusFlags(ADC_Type *base, uint32_t u32SampleMask)

Clears sample slot's zero crossing status flags(Each bit represents one sample slot).

Parameters

- base – CADC peripheral base address.
- u32SampleMask – Mask value of sample slots. This parameter should be the OR'ed value of *cadc_sample_slot_mask_t*.

static inline uint16_t CADC_GetPowerStatusFlags(ADC_Type *base)

Gets converters power status(Those power status can not be cleared).

Parameters

- base – CADC peripheral base address.

Returns

The mask value of the converters' power status flag, see *_cadc_converter_power_status_flags*.

static inline uint16_t CADC_GetConverterExpMuxChannelScanCompStatusFlags(ADC_Type *base)

Gets converter's expansion mux channel scan complete status flags.

Parameters

- base – CADC peripheral base address.

Returns

uint16_t The mask value of converters' expansion mux channel scan status flags, see *_cadc_expansion_mux_status_flags*.

static inline void CADC_ClearConverterExpMuxChannelScanCompStatusFlags(ADC_Type *base, uint16_t u16FlagMask)

Clears converter's expansion mux channel scan complete status flags.

Parameters

- base – CADC peripheral base address.
- u16FlagMask – The mask value of *_cadc_expansion_mux_status_flags*.

FSL_CADC_DRIVER_VERSION

CADC driver version.

enum _cadc_misc_status_flags

CADC miscellaneous status flags used to tell peripheral's miscellaneous status, such as zerocrossing, end of scan flags.

Values:

enumerator kCADC_ZeroCrossingInterruptFlag

Zero crossing encountered. IRQ pending if enabled Zero Crossing Interrupt.

enumerator kCADC_HighLimitInterruptFlag

High limit exceeded flag. IRQ pending if enabled high limit interrupt.

enumerator kCADC_LowLimitInterruptFlag

Low limit exceeded flag. IRQ pending if enabled low limit interrupt.

enumerator kCADC_ConverterAInProgressFlag

Conversion in progress, converter A.

enumerator kCADC_ConverterBInProgressFlag

Conversion in progress, converter B.

enumerator kCADC_ConverterAEndOfScanFlag

End of scan, converter A.

enumerator kCADC_ConverterBEndOfScanFlag

End of scan, converter B.

enumerator kCADC_StatusAllFlags

enum _cadc_converter_power_status_flags

The enumeration of converter power status.

Values:

enumerator kCADC_ConverterAPowerDownFlag

The converterA is powered down.

enumerator kCADC_ConverterBPowerDownFlag

The converterB is powered down.

enum _cadc_expansion_mux_status_flags

The enumeration of expansion mux channel scan complete interrupt request status flag.

Values:

enumerator kCADC_ANA4ExpMuxAuxScanCompInterruptFlag

ANA4 Expansion MUX Channel Scan Complete Interrupt flag.

enumerator kCADC_ANB4ExpMuxAuxScanCompInterruptFlag

ANB4 Expansion MUX Channel Scan Complete Interrupt flag.

enum _cadc_interrupt_enable

CADC Interrupts enumeration.

Values:

enumerator kCADC_Sample0ScanInterruptEnable

If sample0 is converted, generate the scan interrupt.

enumerator kCADC_Sample1ScanInterruptEnable

If sample1 is converted, generate the scan interrupt.

enumerator kCADC_Sample2ScanInterruptEnable

If sample2 is converted, generate the scan interrupt.

enumerator kCADC_Sample3ScanInterruptEnable

If sample3 is converted, generate the scan interrupt.

enumerator kCADC_Sample4ScanInterruptEnable

If sample4 is converted, generate the scan interrupt.

enumerator kCADC_Sample5ScanInterruptEnable

If sample5 is converted, generate the scan interrupt.

enumerator kCADC_Sample6ScanInterruptEnable

If sample6 is converted, generate the scan interrupt.

enumerator kCADC_Sample7ScanInterruptEnable

If sample7 is converted, generate the scan interrupt.

enumerator kCADC_Sample8ScanInterruptEnable

If sample8 is converted, generate the scan interrupt.

enumerator kCADC_Sample9ScanInterruptEnable

If sample9 is converted, generate the scan interrupt.

enumerator kCADC_Sample10ScanInterruptEnable

If sample10 is converted, generate the scan interrupt.

enumerator kCADC_Sample11ScanInterruptEnable

If sample11 is converted, generate the scan interrupt.

enumerator kCADC_Sample12ScanInterruptEnable

If sample12 is converted, generate the scan interrupt.

enumerator kCADC_Sample13ScanInterruptEnable

If sample13 is converted, generate the scan interrupt.

enumerator kCADC_Sample14ScanInterruptEnable

If sample14 is converted, generate the scan interrupt.

enumerator kCADC_Sample15ScanInterruptEnable

If sample15 is converted, generate the scan interrupt.

enumerator kCADC_ANA4ExpMuxScanCompleteInterruptEnable

If ANA4 expansion MUX channel scan complete, generate the interrupt.

enumerator kCADC_ANB4ExpMuxScanCompleteInterruptEnable

If ANB4 expansion MUX channel scan complete, generate the interrupt.

enumerator kCADC_HighLimitInterruptEnable

If the result value is greater than the high limit value, generate high limit interrupt.

enumerator kCADC_LowLimitInterruptEnable

If the result value is less than the low limit value, generate low limit interrupt.

enumerator kCADC_ZeroCrossingInterruptEnable

If the current value has a sign change from the previous result in the selected zero crossing mode, generate the zero crossing mode

enumerator kCADC_ConversionCompleteInterrupt0Enable

Upon the completion of the scan, generate the end of scan interrupt, when the scan mode is selected as sequential mode or simultaneous parallel mode. For looping scan mode, the interrupt will trigger after the completion of each iteration of loop.

enumerator kCADC_ConversionCompleteInterrupt1Enable

When the scan mode is independent parallel mode, up the completion of the converter scan, generate te end of scan interrupt. For looping scan mode, the interrupt will trigger after the completion of each iteration of loop.

enumerator kCADC_ALLInterruptEnable

enum _cadc_converter_id

CADC Converter identifier.

Values:

enumerator kCADC_ConverterA

Converter A.

enumerator kCADC_ConverterB
Converter B.

enum _cadc_idle_work_mode
The enumeration of work mode when the module is not used.
Values:

enumerator kCADC_IdleKeepNormal
Keep normal.

enumerator kCADC_IdleAutoPowerDown
Fall into power down mode automatically.

enum _cadc_dma_trigger_source
The enumeration of DMA trigger source.
Values:

enumerator kCADC_DMATrigSrcEndofScan
DMA trigger source is end of scan interrupt.

enumerator kCADC_DMATrigSrcSampleReady
DMA trigger source is RDY bits.

enum _cadc_scan_mode
The enumeration of dual converter's scan mode.
Values:

enumerator kCADC_ScanModeOnceSequential
Once (single) sequential.

enumerator kCADC_ScanModeOnceParallelIndependent
Once parallel independently.

enumerator kCADC_ScanModeLoopSequential
Loop sequential.

enumerator kCADC_ScanModeLoopParallelIndependent
Loop parallel independently.

enumerator kCADC_ScanModeTriggeredSequential
Triggered sequential.

enumerator kCADC_ScanModeTriggeredParallelIndependent
Triggered parallel independently.

enumerator kCADC_ScanModeOnceParallelSimultaneous
Once parallel simultaneously.

enumerator kCADC_ScanModeLoopParallelSimultaneous
Loop parallel simultaneously.

enumerator kCADC_ScanModeTriggeredParallelSimultaneous
Triggered parallel simultaneously.

enum _cadc_reference_voltage_source
The enumeration of converter's reference voltage source.
Values:

enumerator kCADC_ReferenceVoltageVrefPad
VREF pin.

enumerator kCADC_ReferenceVoltageChannelPad
ANx2 or ANx3 pin.

enum _cadc_channel_gain
The enumeration of sample slot connected channel gain.
Values:

enumerator kCADC_SignalGainX1
Gain x1.

enumerator kCADC_SignalGainX2
Gain x2.

enumerator kCADC_SignalGainX4
Gain x4.

enum _cadc_channel_mode
The enumeration of all channels' channel mode.
Values:

enumerator kCADC_ANA0_1_SingleEnd
ANA0 and ANA1 both configured as single ended inputs.

enumerator kCADC_ANA0_1_FullyDifferential
ANA0 configured as fully differential positive input, ANA1 configured as fully differential negative input.

enumerator kCADC_ANA0_1_UnipolarDifferential
ANA0 configured as unipolar differential positive input, ANA1 configured as unipolar differential negative input.

enumerator kCADC_ANA2_3_SingleEnd
ANA2 and ANA3 both configured as single ended inputs.

enumerator kCADC_ANA2_3_FullyDifferential

ANA2 configured as fully differential positive input, ANA3 configured as fully differential negative input.

enumerator kCADC_ANA2_3_UnipolarDifferential

ANA2 configured as unipolar differential positive input, ANA3 configured as unipolar differential negative input.

enumerator kCADC_ANB0_1_SingleEnd

ANB0 and ANB1 both configured as single ended inputs.

enumerator kCADC_ANB0_1_FullyDifferential

ANB0 configured as fully differential positive input, ANB1 configured as fully differential negative input.

enumerator kCADC_ANB0_1_UnipolarDifferential

ANB0 configured as unipolar differential positive input, ANB1 configured as unipolar differential negative input.

enumerator kCADC_ANB2_3_SingleEnd

ANB2 and ANB3 both configured as single ended inputs.

enumerator kCADC_ANB2_3_FullyDifferential

ANB2 configured as fully differential positive input, ANB3 configured as fully differential negative input.

enumerator kCADC_ANB2_3_UnipolarDifferential

ANB2 configured as unipolar differential positive input, ANB3 configured as unipolar differential negative input.

enumerator kCADC_ANA4_5_SingleEnd

ANA4 and ANA5 both configured as single ended inputs.

enumerator kCADC_ANA4_5_FullyDifferential

ANA4 configured as fully differential positive input, ANA5 configured as fully differential negative input.

enumerator kCADC_ANA4_5_UnipolarDifferential

ANA4 configured as unipolar differential positive input, ANA5 configured as unipolar differential negative input.

enumerator kCADC_ANA6_7_SingleEnd

ANA6 and ANA7 both configured as single ended inputs.

enumerator kCADC_ANA6_7_FullyDifferential

ANA6 configured as fully differential positive input, ANA7 configured as fully differential negative input.

enumerator kCADC_ANA6_7_UnipolarDifferential

ANA6 configured as unipolar differential positive input, ANA7 configured as unipolar differential negative input.

enumerator kCADC_ANB4_5_SingleEnd

ANB4 and ANB5 both configured as single ended inputs.

enumerator kCADC_ANB4_5_FullyDifferential

ANB4 configured as fully differential positive input, ANB5 configured as fully differential negative input.

enumerator kCADC_ANB4_5_UnipolarDifferential

ANB4 configured as unipolar differential positive input, ANB5 configured as unipolar differential negative input.

enumerator kCADC_ANB6_7_SingleEnd

ANB6 and ANB7 both configured as single ended inputs.

enumerator kCADC_ANB6_7_FullyDifferential

ANB6 configured as fully differential positive input, ANB7 configured as fully differential negative input.

enumerator kCADC_ANB6_7_UnipolarDifferential

ANB6 configured as unipolar differential positive input, ANB7 configured as unipolar differential negative input.

enum _cadc_channel_number

The enumerator of all channels that can be routed to the specific sample slot.

Values:

enumerator kCADC_SingleEndANA0_DiffANA0pANA1n

Single Endned ANA0 Signal Or Differential ANA0+, ANA1- signal.

enumerator kCADC_SingleEndANA1_DiffANA0pANA1n

Single Endned ANA1 Signal Or Differential ANA0+, ANA1- signal.

enumerator kCADC_SingleEndANA2_DiffANA2pANA3n

Single Endned ANA2 Signal Or Differential ANA2+, ANA3- signal.

enumerator kCADC_SingleEndANA3_DiffANA2pANA3n

Single Endned ANA3 Signal Or Differential ANA2+, ANA3- signal.

enumerator kCADC_SingleEndANA4_DiffANA4pANA5n

Single Endned ANA4 Signal Or Differential ANA4+, ANA5- signal.

enumerator kCADC_SingleEndANA5_DiffANA4pANA5n

Single Endned ANA5 Signal Or Differential ANA4+, ANA5- signal.

enumerator kCADC_SingleEndANA6_DiffANA6pANA7n

Single Endned ANA6 Signal Or Differential ANA6+, ANA7- signal.

enumerator kCADC_SingleEndANA7_DiffANA6pANA7n

Single Endned ANA7 Signal Or Differential ANA6+, ANA7- signal.

enumerator kCADC_SingleEndANB0_DiffANB0pANB1n
Single Endned ANB0 Signal Or Differential ANB0+, ANB1- signal.

enumerator kCADC_SingleEndANB1_DiffANB0pANB1n
Single Endned ANB1 Signal Or Differential ANB0+, ANB1- signal.

enumerator kCADC_SingleEndANB2_DiffANB2pANB3n
Single Endned ANB2 Signal Or Differential ANB2+, ANB3- signal.

enumerator kCADC_SingleEndANB3_DiffANB2pANB3n
Single Endned ANB3 Signal Or Differential ANB2+, ANB3- signal.

enumerator kCADC_SingleEndANB4_DiffANB4pANB5n
Single Endned ANB4 Signal Or Differential ANB4+, ANB5- signal.

enumerator kCADC_SingleEndANB5_DiffANB4pANB5n
Single Endned ANB5 Signal Or Differential ANB4+, ANB5- signal.

enumerator kCADC_SingleEndANB6_DiffANB6pANB7n
Single Endned ANB6 Signal Or Differential ANB6+, ANB7- signal.

enumerator kCADC_SingleEndANB7_DiffANB6pANB7n
Single Endned ANB7 Signal Or Differential ANB6+, ANB7- signal.

enum _cadc_sample_slot_mask
The enumeration of sample slot mask.
Values:

enumerator kCADC_NonSampleSlotMask

enumerator kCADC_SampleSlot0Mask
The mask of sample slot0.

enumerator kCADC_SampleSlot1Mask
The mask of sample slot1.

enumerator kCADC_SampleSlot2Mask
The mask of sample slot2.

enumerator kCADC_SampleSlot3Mask
The mask of sample slot3.

enumerator kCADC_SampleSlot4Mask
The mask of sample slot4.

enumerator kCADC_SampleSlot5Mask
The mask of sample slot5.

enumerator kCADC_SampleSlot6Mask
The mask of sample slot6.

enumerator kCADC_SampleSlot7Mask
The mask of sample slot7.

enumerator kCADC_SampleSlot8Mask
The mask of sample slot8.

enumerator kCADC_SampleSlot9Mask
The mask of sample slot9.

enumerator kCADC_SampleSlot10Mask
The mask of sample slot10.

enumerator kCADC_SampleSlot11Mask
The mask of sample slot11.

enumerator kCADC_SampleSlot12Mask
The mask of sample slot12.

enumerator kCADC_SampleSlot13Mask
The mask of sample slot13.

enumerator kCADC_SampleSlot14Mask
The mask of sample slot14.

enumerator kCADC_SampleSlot15Mask
The mask of sample slot15.

enumerator kCADC_AllSampleSlotsMask
The mask of all sample slots.

enum _cadc_sample_slot_index
The enumeration of sample slot index.
Values:

enumerator kCADC_SampleSlot0Index
The index of sample slot0.

enumerator kCADC_SampleSlot1Index
The index of sample slot1.

enumerator kCADC_SampleSlot2Index
The index of sample slot2.

enumerator kCADC_SampleSlot3Index
The index of sample slot3.

enumerator kCADC_SampleSlot4Index
The index of sample slot4.

enumerator kCADC_SampleSlot5Index
The index of sample slot5.

enumerator kCADC_SampleSlot6Index
The index of sample slot6.

enumerator kCADC_SampleSlot7Index
The index of sample slot7.

enumerator kCADC_SampleSlot8Index
The index of sample slot8.

enumerator kCADC_SampleSlot9Index
The index of sample slot9.

enumerator kCADC_SampleSlot10Index
The index of sample slot10.

enumerator kCADC_SampleSlot11Index
The index of sample slot11.

enumerator kCADC_SampleSlot12Index
The index of sample slot12.

enumerator kCADC_SampleSlot13Index
The index of sample slot13.

enumerator kCADC_SampleSlot14Index
The index of sample slot14.

enumerator kCADC_SampleSlot15Index
The index of sample slot15.

enum _cadc_sample_slot_sequential_mode_disabled
The enumeration for the sample slot to be disabled in sequential mode.
Values:

enumerator kCADC_Sample0Disabled
Disable Sample slot0, the scan will stop at sample slot0 in sequential scan mode

enumerator kCADC_Sample1Disabled
Disable Sample slot1, the scan will stop at sample slot1 in sequential scan mode

enumerator kCADC_Sample2Disabled
Disable Sample slot2, the scan will stop at sample slot2 in sequential scan mode

enumerator kCADC_Sample3Disabled
Disable Sample slot3, the scan will stop at sample slot3 in sequential scan mode

enumerator kCADC_Sample4Disabled
Disable Sample slot4, the scan will stop at sample slot4 in sequential scan mode

enumerator kCADC_Sample5Disabled
Disable Sample slot5, the scan will stop at sample slot5 in sequential scan mode

enumerator kCADC_Sample6Disabled
Disable Sample slot6, the scan will stop at sample slot6 in sequential scan mode

enumerator kCADC_Sample7Disabled
Disable Sample slot7, the scan will stop at sample slot7 in sequential scan mode

enumerator kCADC_Sample8Disabled
Disable Sample slot8, the scan will stop at sample slot8 in sequential scan mode

enumerator kCADC_Sample9Disabled
Disable Sample slot9, the scan will stop at sample slot9 in sequential scan mode

enumerator kCADC_Sample10Disabled
Disable Sample slot10, the scan will stop at sample slot10 in sequential scan mode

enumerator kCADC_Sample11Disabled
Disable Sample slot11, the scan will stop at sample slot11 in sequential scan mode

enumerator kCADC_Sample12Disabled
Disable Sample slot12, the scan will stop at sample slot12 in sequential scan mode

enumerator kCADC_Sample13Disabled
Disable Sample slot13, the scan will stop at sample slot13 in sequential scan mode

enumerator kCADC_Sample14Disabled
Disable Sample slot14, the scan will stop at sample slot14 in sequential scan mode

enumerator kCADC_Sample15Disabled
Disable Sample slot15, the scan will stop at sample slot15 in sequential scan mode

enum __cadc_sample_slot_simultParallel_mode_disabled
The enumeration for the sample slot to be disabled in simultaneous parallel mode.
Values:

enumerator kCADC_Sample0_8Disabled
Disable Sample slot0 and Sample Slot 8, in the simultaneous parallel mode the converter A and converter B will stop at Sample slot0 and Sample slot 8.

enumerator kCADC_Sample1_9Disabled

Disable Sample slot1 and Sample Slot 9, in the simultaneous parallel mode the converter A and converter B will stop at Sample slot1 and Sample slot 9.

enumerator kCADC_Sample2_10Disabled

Disable Sample slot2 and Sample Slot 10, in the simultaneous parallel mode the converter A and converter B will stop at Sample slot2 and Sample slot 10.

enumerator kCADC_Sample3_11Disabled

Disable Sample slot3 and Sample Slot 11, in the simultaneous parallel mode the converter A and converter B will stop at Sample slot3 and Sample slot 11.

enumerator kCADC_Sample4_12Disabled

Disable Sample slot4 and Sample Slot 12, in the simultaneous parallel mode the converter A and converter B will stop at Sample slot4 and Sample slot 12.

enumerator kCADC_Sample5_13Disabled

Disable Sample slot5 and Sample Slot 13, in the simultaneous parallel mode the converter A and converter B will stop at Sample slot5 and Sample slot 13.

enumerator kCADC_Sample6_14Disabled

Disable Sample slot6 and Sample Slot 14, in the simultaneous parallel mode the converter A and converter B will stop at Sample slot7 and Sample slot 14.

enumerator kCADC_Sample7_15Disabled

Disable Sample slot7 and Sample Slot 15, in the simultaneous parallel mode the converter A and converter B will stop at Sample slot7 and Sample slot 15.

enum _cadc_sample_slot_independentParallel_mode_convA_disabled

The enumeration for the sample slot to be disabled for the converter A in independent parallel mode.

Values:

enumerator kCADC_ConvASample0Disabled

Disable Sample slot0, the scan will stop at sample slot0 in sequential scan mode

enumerator kCADC_ConvASample1Disabled

Disable Sample slot1, the scan will stop at sample slot1 in sequential scan mode

enumerator kCADC_ConvASample2Disabled

Disable Sample slot2, the scan will stop at sample slot2 in sequential scan mode

enumerator kCADC_ConvASample3Disabled

Disable Sample slot3, the scan will stop at sample slot3 in sequential scan mode

enumerator kCADC_ConvASample4Disabled

Disable Sample slot4, the scan will stop at sample slot4 in sequential scan mode

enumerator kCADC_ConvASample5Disabled

Disable Sample slot5, the scan will stop at sample slot5 in sequential scan mode

enumerator kCADC_ConvASample6Disabled

Disable Sample slot6, the scan will stop at sample slot6 in sequential scan mode

enumerator kCADC_ConvASample7Disabled

Disable Sample slot7, the scan will stop at sample slot7 in sequential scan mode

enumerator kCADC_ConvASampleReserved

Reserved

enum _cadc_sample_slot_indParallel_mode_convB_disabled

The enumeration for the sample slot to be disabled for the converter B in independent parallel mode.

Values:

enumerator kCADC_ConvBSample8Disabled

Disable Sample slot8, the scan will stop at sample slot8 in sequential scan mode

enumerator kCADC_ConvBSample9Disabled

Disable Sample slot9, the scan will stop at sample slot9 in sequential scan mode

enumerator kCADC_ConvBSample10Disabled

Disable Sample slot10, the scan will stop at sample slot10 in sequential scan mode

enumerator kCADC_ConvBSample11Disabled

Disable Sample slot11, the scan will stop at sample slot11 in sequential scan mode

enumerator kCADC_ConvBSample12Disabled

Disable Sample slot12, the scan will stop at sample slot12 in sequential scan mode

enumerator kCADC_ConvBSample13Disabled

Disable Sample slot13, the scan will stop at sample slot13 in sequential scan mode

enumerator kCADC_ConvBSample14Disabled

Disable Sample slot14, the scan will stop at sample slot14 in sequential scan mode

enumerator kCADC_ConvBSample15Disabled

Disable Sample slot15, the scan will stop at sample slot15 in sequential scan mode

enumerator kCADC_ConvBSampleReserved

Reserved

enum _cadc_sample_slot_zero_crossing_mode

The enumeration for the sample slot's zero crossing event.

Values:

enumerator kCADC_ZeroCrossingDisabled

Zero Crossing disabled.

enumerator kCADC_ZeroCrossingForPtoNSign
Zero Crossing enabled for positive to negative sign change.

enumerator kCADC_ZeroCrossingForNtoPSign
Zero Crossing enabled for negative to positive sign change.

enumerator kCADC_ZeroCrossingForAnySignChanged
Zero Crossing enabled for any sign change.

enum _cadc_expansion_mux_operate_mode
The enumeration for expansion multiplexer.
Values:

enumerator kCADC_ExpMuxManualMode
MUX channel feeding to ANA4/ANB4 is selected as MUXSEL0.

enumerator kCADC_ExpMuxScanMode0
The sample completion of ANA4/ANB4 enableds subsequent selected channel.

enumerator kCADC_ExpMuxScanMode1
The sample completion of ANA7/ANB7 enableds subsequent selected channel.

enumerator kCADC_ExpMuxScanMode2
The sample completion of ANA4/ANB4 or ANA7/ANB7 enableds subsequent selected channel.

enum _cadc_auxiliary_control
The enumeration of conveter's auxiliary control.
Values:

enumerator kCADC_AuxSel0_Config0
Auxiliary select 0 controls AUX_SEL0 = 0, AUX_SEL1 = 0.

enumerator kCADC_AuxSel0_Config1
Auxiliary select 0 controls AUX_SEL0 = 1, AUX_SEL1 = 0.

enumerator kCADC_AuxSel0_Config2
Auxiliary select 0 controls AUX_SEL0 = 0, AUX_SEL1 = 1.

enumerator kCADC_AuxSel0_Config3
Auxiliary select 0 controls AUX_SEL0 = 1, AUX_SEL1 = 1.

enumerator kCADC_AuxSel1_Config0
Auxiliary select 1 controls AUX_SEL0 = 0, AUX_SEL1 = 0.

enumerator kCADC_AuxSel1_Config1
Auxiliary select 1 controls AUX_SEL0 = 1, AUX_SEL1 = 0.

enumerator kCADC_AuxSel1_Config2
Auxiliary select 1 controls AUX_SEL0 = 0, AUX_SEL1 = 1.

enumerator kCADC_AuxSel1_Config3
Auxiliary select 1 controls AUX_SEL0 = 1, AUX_SEL1 = 1.

enumerator kCADC_AuxSel2_Config0
Auxiliary select 2 controls AUX_SEL0 = 0, AUX_SEL1 = 0.

enumerator kCADC_AuxSel2_Config1
Auxiliary select 2 controls AUX_SEL0 = 1, AUX_SEL1 = 0.

enumerator kCADC_AuxSel2_Config2
Auxiliary select 2 controls AUX_SEL0 = 0, AUX_SEL1 = 1.

enumerator kCADC_AuxSel2_Config3
Auxiliary select 2 controls AUX_SEL0 = 1, AUX_SEL1 = 1.

enumerator kCADC_AuxSel3_Config0
Auxiliary select 3 controls AUX_SEL0 = 0, AUX_SEL1 = 0.

enumerator kCADC_AuxSel3_Config1
Auxiliary select 3 controls AUX_SEL0 = 1, AUX_SEL1 = 0.

enumerator kCADC_AuxSel3_Config2
Auxiliary select 3 controls AUX_SEL0 = 0, AUX_SEL1 = 1.

enumerator kCADC_AuxSel3_Config3
Auxiliary select 3 controls AUX_SEL0 = 1, AUX_SEL1 = 1.

enumerator kCADC_AuxSel4_Config0
Auxiliary select 4 controls AUX_SEL0 = 0, AUX_SEL1 = 0.

enumerator kCADC_AuxSel4_Config1
Auxiliary select 4 controls AUX_SEL0 = 1, AUX_SEL1 = 0.

enumerator kCADC_AuxSel4_Config2
Auxiliary select 4 controls AUX_SEL0 = 0, AUX_SEL1 = 1.

enumerator kCADC_AuxSel4_Config3
Auxiliary select 4 controls AUX_SEL0 = 1, AUX_SEL1 = 1.

enumerator kCADC_AuxSel5_Config0
Auxiliary select 5 controls AUX_SEL0 = 0, AUX_SEL1 = 0.

enumerator kCADC_AuxSel5_Config1
Auxiliary select 5 controls AUX_SEL0 = 1, AUX_SEL1 = 0.

enumerator kCADC_AuxSel5_Config2
Auxiliary select 5 controls AUX_SEL0 = 0, AUX_SEL1 = 1.

enumerator kCADC_AuxSel5_Config3
Auxiliary select 5 controls AUX_SEL0 = 1, AUX_SEL1 = 1.

enumerator kCADC_AuxSel6_Config0
Auxiliary select 6 controls AUX_SEL0 = 0, AUX_SEL1 = 0.

enumerator kCADC_AuxSel6_Config1
Auxiliary select 6 controls AUX_SEL0 = 1, AUX_SEL1 = 0.

enumerator kCADC_AuxSel6_Config2
Auxiliary select 6 controls AUX_SEL0 = 0, AUX_SEL1 = 1.

enumerator kCADC_AuxSel6_Config3
Auxiliary select 6 controls AUX_SEL0 = 1, AUX_SEL1 = 1.

enumerator kCADC_AuxSel7_Config0
Auxiliary select 7 controls AUX_SEL0 = 0, AUX_SEL1 = 0.

enumerator kCADC_AuxSel7_Config1
Auxiliary select 7 controls AUX_SEL0 = 1, AUX_SEL1 = 0.

enumerator kCADC_AuxSel7_Config2
Auxiliary select 7 controls AUX_SEL0 = 0, AUX_SEL1 = 1.

enumerator kCADC_AuxSel7_Config3
Auxiliary select 7 controls AUX_SEL0 = 1, AUX_SEL1 = 1.

enum _cadc_expansion_disabled_mux_slot
The enumeration for the expansion mux slot to be disabled.
Values:

enumerator kCADC_ExpaMuxNoDisable
Expansion mux scan not disabled.

enumerator kCADC_ExpMux0Disable
Expansion mux slot 0.

enumerator kCADC_ExpMux1Disable
Expansion mux slot 1.

enumerator kCADC_ExpMux2Disable
Expansion mux slot 2.

enumerator kCADC_ExpMux3Disable
Expansion mux slot 3.

enumerator kCADC_ExpMux4Disable
Expansion mux slot 4.

enumerator kCADC_ExpMux5Disable
Expansion mux slot 5.

enumerator kCADC_ExpMux6Disable
Expansion mux slot 6.

enumerator kCADC_ExpMux7Disable
Expansion mux slot 7.

enum _cadc_expansion_mux_selection
The enumeration of expanssion mux selection.
Values:

enumerator kCADC_MuxSel0_Channel0
MUX's channel 0 for MUXSEL0.

enumerator kCADC_MuxSel0_Channel1
MUX's channel 1 for MUXSEL0.

enumerator kCADC_MuxSel0_Channel2
MUX's channel 2 for MUXSEL0.

enumerator kCADC_MuxSel0_Channel3
MUX's channel 3 for MUXSEL0.

enumerator kCADC_MuxSel0_Channel4
MUX's channel 4 for MUXSEL0.

enumerator kCADC_MuxSel0_Channel5
MUX's channel 5 for MUXSEL0.

enumerator kCADC_MuxSel0_Channel6
MUX's channel 6 for MUXSEL0.

enumerator kCADC_MuxSel0_Channel7
MUX's channel 7 for MUXSEL0.

enumerator kCADC_MuxSel1_Channel0
MUX's channel 0 for MUXSEL1.

enumerator kCADC_MuxSel1_Channel1
MUX's channel 1 for MUXSEL1.

enumerator kCADC_MuxSel1_Channel2
MUX's channel 2 for MUXSEL1.

enumerator kCADC_MuxSel1_Channel3
MUX's channel 3 for MUXSEL1.

enumerator kCADC_MuxSel1_Channel4
MUX's channel 4 for MUXSEL1.

enumerator kCADC_MuxSel1_Channel5
MUX's channel 5 for MUXSEL1.

enumerator kCADC_MuxSel1_Channel6
MUX's channel 6 for MUXSEL1.

enumerator kCADC_MuxSel1_Channel7
MUX's channel 7 for MUXSEL1.

enumerator kCADC_MuxSel2_Channel0
MUX's channel 0 for MUXSEL2.

enumerator kCADC_MuxSel2_Channel1
MUX's channel 1 for MUXSEL2.

enumerator kCADC_MuxSel2_Channel2
MUX's channel 2 for MUXSEL2.

enumerator kCADC_MuxSel2_Channel3
MUX's channel 3 for MUXSEL2.

enumerator kCADC_MuxSel2_Channel4
MUX's channel 4 for MUXSEL2.

enumerator kCADC_MuxSel2_Channel5
MUX's channel 5 for MUXSEL2.

enumerator kCADC_MuxSel2_Channel6
MUX's channel 6 for MUXSEL2.

enumerator kCADC_MuxSel2_Channel7
MUX's channel 7 for MUXSEL2.

enumerator kCADC_MuxSel3_Channel0
MUX's channel 0 for MUXSEL3.

enumerator kCADC_MuxSel3_Channel1
MUX's channel 1 for MUXSEL3.

enumerator kCADC_MuxSel3_Channel2
MUX's channel 2 for MUXSEL3.

enumerator kCADC_MuxSel3_Channel3
MUX's channel 3 for MUXSEL3.

enumerator kCADC_MuxSel3_Channel4
MUX's channel 4 for MUXSEL3.

enumerator kCADC_MuxSel3_Channel5
MUX's channel 5 for MUXSEL3.

enumerator kCADC_MuxSel3_Channel6
MUX's channel 6 for MUXSEL3.

enumerator kCADC_MuxSel3_Channel7
MUX's channel 7 for MUXSEL3.

enumerator kCADC_MuxSel4_Channel0
MUX's channel 0 for MUXSEL4.

enumerator kCADC_MuxSel4_Channel1
MUX's channel 1 for MUXSEL4.

enumerator kCADC_MuxSel4_Channel2
MUX's channel 2 for MUXSEL4.

enumerator kCADC_MuxSel4_Channel3
MUX's channel 3 for MUXSEL4.

enumerator kCADC_MuxSel4_Channel4
MUX's channel 4 for MUXSEL4.

enumerator kCADC_MuxSel4_Channel5
MUX's channel 5 for MUXSEL4.

enumerator kCADC_MuxSel4_Channel6
MUX's channel 6 for MUXSEL4.

enumerator kCADC_MuxSel4_Channel7
MUX's channel 7 for MUXSEL4.

enumerator kCADC_MuxSel5_Channel0
MUX's channel 0 for MUXSEL5.

enumerator kCADC_MuxSel5_Channel1
MUX's channel 1 for MUXSEL5.

enumerator kCADC_MuxSel5_Channel2
MUX's channel 2 for MUXSEL5.

enumerator kCADC_MuxSel5_Channel3
MUX's channel 3 for MUXSEL5.

enumerator kCADC_MuxSel5_Channel4
MUX's channel 4 for MUXSEL5.

enumerator kCADC_MuxSel5_Channel5
MUX's channel 5 for MUXSEL5.

enumerator kCADC_MuxSel5_Channel6
MUX's channel 6 for MUXSEL5.

enumerator kCADC_MuxSel5_Channel7
MUX's channel 7 for MUXSEL5.

enumerator kCADC_MuxSel6_Channel0
MUX's channel 0 for MUXSEL6.

enumerator kCADC_MuxSel6_Channel1
MUX's channel 1 for MUXSEL6.

enumerator kCADC_MuxSel6_Channel2
MUX's channel 2 for MUXSEL6.

enumerator kCADC_MuxSel6_Channel3
MUX's channel 3 for MUXSEL6.

enumerator kCADC_MuxSel6_Channel4
MUX's channel 4 for MUXSEL6.

enumerator kCADC_MuxSel6_Channel5
MUX's channel 5 for MUXSEL6.

enumerator kCADC_MuxSel6_Channel6
MUX's channel 6 for MUXSEL6.

enumerator kCADC_MuxSel6_Channel7
MUX's channel 7 for MUXSEL6.

enumerator kCADC_MuxSel7_Channel0
MUX's channel 0 for MUXSEL7.

enumerator kCADC_MuxSel7_Channel1
MUX's channel 1 for MUXSEL7.

enumerator kCADC_MuxSel7_Channel2
MUX's channel 2 for MUXSEL7.

enumerator kCADC_MuxSel7_Channel3
MUX's channel 3 for MUXSEL7.

enumerator kCADC_MuxSel7_Channel4
MUX's channel 4 for MUXSEL7.

enumerator kCADC_MuxSel7_Channel5
MUX's channel 5 for MUXSEL7.

enumerator kCADC_MuxSel7_Channel6
MUX's channel 6 for MUXSEL7.

enumerator kCADC_MuxSel7_Channel7
MUX's channel 7 for MUXSEL7.

typedef enum *_cadc_converter_id* cadc_converter_id_t
CADC Converter identifier.

typedef enum *_cadc_idle_work_mode* cadc_idle_work_mode_t
The enumeration of work mode when the module is not used.

typedef enum *_cadc_dma_trigger_source* cadc_dma_trigger_source_t
The enumeration of DMA trigger source.

typedef enum *_cadc_scan_mode* cadc_scan_mode_t
The enumeration of dual converter's scan mode.

typedef enum *_cadc_reference_voltage_source* cadc_reference_voltage_source_t
The enumeration of converter's reference voltage source.

typedef enum *_cadc_channel_gain* cadc_channel_gain_t
The enumeration of sample slot connected channel gain.

typedef enum *_cadc_channel_mode* cadc_channel_mode_t
The enumeration of all channels' channel mode.

typedef enum *_cadc_channel_number* cadc_channel_number_t
The enumerator of all channels that can be routed to the specific sample slot.

typedef enum *_cadc_sample_slot_mask* cadc_sample_slot_mask_t
The enumeration of sample slot mask.

typedef enum *_cadc_sample_slot_index* cadc_sample_slot_index_t
The enumeration of sample slot index.

typedef enum *_cadc_sample_slot_sequential_mode_disabled*
cadc_sample_slot_sequential_mode_disabled_t
The enumeration for the sample slot to be disabled in sequential mode.

typedef enum *_cadc_sample_slot_simultParallel_mode_disabled*
cadc_sample_slot_simultParallel_mode_disabled_t

The enumeration for the sample slot to be disabled in simultaneous parallel mode.

typedef enum *_cadc_sample_slot_independentParallel_mode_convA_disabled*
cadc_sample_slot_independentParallel_mode_convA_disabled_t

The enumeration for the sample slot to be disabled for the converter A in independent parallel mode.

typedef enum *_cadc_sample_slot_indParallel_mode_convB_disabled*
cadc_sample_slot_independentParallel_mode_convB_disabled_t

The enumeration for the sample slot to be disabled for the converter B in independent parallel mode.

typedef enum *_cadc_sample_slot_zero_crossing_mode* cadc_sample_slot_zero_crossing_mode_t

The enumeration for the sample slot's zero crossing event.

typedef enum *_cadc_expansion_mux_operate_mode* cadc_expansion_mux_operate_mode_t

The enumeration for expansion multiplexer.

typedef struct *_cadc_sample_slot_independentParallel_mode_disabled*
cadc_sample_slot_independentParallel_mode_disabled_t

The structure of the disabled sample slots in independent parallel mode.

typedef union *_cadc_sample_slot_disabled* cadc_sample_slot_disabled_t

The union of disabled sample slot for each scan mode.

typedef struct *_cadc_sample_config* cadc_sample_slot_config_t

The structure for configuring the sample slot.

typedef struct *_cadc_scan_ctrl_sequential_mode* cadc_scan_ctrl_seq_mode_t

Cadc scan control for sequential scan mode.

Note: Each member of this structure represent one bit of the word. Asserted the structure's member means delay sample until a new sync input occurs. Cleared the structure's member means perform sample immediately after the completion of the current sample.

---

typedef struct *_cadc_scan_ctrl_simultParallel_mode* cadc_scan_ctrl_simultParallel_mode_t

Cadc scan control for simultaneous parallel scan mode.

Note: Each member of this structure represent one bit of the word. Asserted the structure's member means delay sample until a new sync input occurs. Cleared the structure's member means perform sample immediately after the completion of the current sample.

---

typedef struct *_cadc_scan_ctrl_independent_parallel_mode_converterA*
cadc_scan_ctrl_independent_parallel_mode_converterA_t

The scan ctrl struture for converterA in independent scan mode.

typedef struct *_cadc_scan_ctrl_independent_parallel_mode_converterB*
cadc_scan_ctrl_independent_parallel_mode_converterB_t

The scan ctrl struture for converterB in independent scan mode.

typedef union *_cadc_scan_ctrl_independent_parallel_mode*
cadc_scan_ctrl_independent_parallel_mode_t

The union for converters in independent parallel mode.

typedef union *_cadc_scan_control* cadc_scan_control_t

The union of the scan control for each scan mode.

typedef enum *_cadc_auxiliary_control* cadc_auxiliary_control_t

The enumeration of conveter's auxiliary control.

typedef enum *_cadc_expansion_disabled_mux_slot* cadc_expansion_disabled_mux_slot_t

The enumeration for the expansion mux slot to be disabled.

typedef enum *_cadc_expansion_mux_selection* cadc_expansion_mux_selection_t

The enumeration of expanssion mux selection.

typedef struct *_cadc_exp_mux_aux_config* cadc_exp_mux_aux_config_t

The structure for configuring Cyclic ADC's expansion setting.

typedef struct *_cadc_converter_config* cadc_converter_config_t

The structure for configuring each converter.

typedef struct *_cadc_config* cadc_config_t

The structure for configuring the Cyclic ADC's setting.

CADC_SAMPLE_SLOTS_COUNT

Macro for CADC sample slot count.

struct __cadc_sample_slot_independentParallel_mode_disabled

#include <fsl_cadc.h> The structure of the disabled sample slots in independent parallel mode.

Public Members

cadc_sample_slot_independentParallel_mode_convA_disabled_t eConverterA

The sample slot to be disabled for the converter A, when the scan mode is set as independent parallel mode.

cadc_sample_slot_independentParallel_mode_convB_disabled_t eConverterB

The sample slot to be disabled for the converter B, when the scan mode is set as independent parallel mode.

union __cadc_sample_slot_disabled

#include <fsl_cadc.h> The union of disabled sample slot for each scan mode.

Public Members

uint32_t u32SampleDisVal

The 32 bits width of disabled sample slot value. This member used to get the disabled sample slot which sets in different scan modes in word type. This member is not recommended to be used to set the disabled sample slot. This member is designed to be used in driver level only, the application should not use this member.

cadc_sample_slot_sequential_mode_disabled_t eSequentialModeDisSample

If the scan mode is selected as sequential mode, the application must use this member to set the disabled sample slot. This member is used to set disabled sample slot when the scan mode is selected as sequential mode. The scan will stop at the first disabled sample slot in that mode. So for the application, this member should be set as one sample slot index that the scan will stop.

cadc_sample_slot_simultParallel_mode_disabled_t eSimultParallelModeDisSample

In simultaneous parallel scan mode, the application must use this member to set the disabled sample slot. In that scan mode, the scan will stop when either converter encounters a disabled sample.

cadc_sample_slot_independentParallel_mode_disabled_t sIndependentParallelModeDisSample

In independent parallel scan mode, the application must use this member to set the disabled sample slot. In that scan mode, the converter will stop scan when it encounters a disabled sample slot. In this mode, the disabled sample slot for converterA and converterB may different.

struct __cadc_sample_config

#include <fsl_cadc.h> The structure for configuring the sample slot.

Public Members

cadc_sample_slot_zero_crossing_mode_t eZeroCrossingMode

Zero crossing mode.

uint16_t u16HighLimitValue

High limit value. Original value formation as hardware register, with 3-bits left shifted.

uint16_t u16LowLimitValue

Low limit value. Original value formation as hardware register, with 3-bits left shifted.

uint16_t u16OffsetValue

Offset value. Original value formation as hardware register, with 3-bits left shifted.

struct __cadc_scan_ctrl_sequential_mode

#include <fsl_cadc.h> Cadc scan control for sequential scan mode.

Note: Each member of this structure represent one bit of the word. Asserted the structure's member means delay sample until a new sync input occurs. Cleared the structure's member means perform sample immediately after the completion of the current sample.

Public Members

uint32_t bitSample0
Control whether delay sample0 until a new sync input occurs.

uint32_t bitSample1
Control whether delay sample1 until a new sync input occurs.

uint32_t bitSample2
Control whether delay sample2 until a new sync input occurs.

uint32_t bitSample3
Control whether delay sample3 until a new sync input occurs.

uint32_t bitSample4
Control whether delay sample4 until a new sync input occurs.

uint32_t bitSample5
Control whether delay sample5 until a new sync input occurs.

uint32_t bitSample6
Control whether delay sample6 until a new sync input occurs.

uint32_t bitSample7
Control whether delay sample7 until a new sync input occurs.

uint32_t bitSample8
Control whether delay sample8 until a new sync input occurs.

uint32_t bitSample9
Control whether delay sample9 until a new sync input occurs.

uint32_t bitSample10
Control whether delay sample10 until a new sync input occurs.

uint32_t bitSample11
Control whether delay sample11 until a new sync input occurs.

uint32_t bitSample12
Control whether delay sample12 until a new sync input occurs.

uint32_t bitSample13
Control whether delay sample13 until a new sync input occurs.

uint32_t bitSample14
Control whether delay sample14 until a new sync input occurs.

uint32_t bitSample15
Control whether delay sample15 until a new sync input occurs.

uint32_t bitsReserved

Reserved 16 bits.

struct __cadc__scan__ctrl__simultParallel__mode

#include <fsl_cadc.h> Cadc scan control for simultaneous parallel scan mode.

Note: Each member of this structure represent one bit of the word. Asserted the structure's member means delay sample until a new sync input occurs. Cleared the structure's member means perform sample immediately after the completion of the current sample.

Public Members

uint32_t bitSample0_8

Control whether delay sample0 and sample8 until a new sync input occurs.

uint32_t bitSample1_9

Control whether delay sample1 and sample9 until a new sync input occurs.

uint32_t bitSample2_10

Control whether delay sample2 and sample10 until a new sync input occurs.

uint32_t bitSample3_11

Control whether delay sample3 and sample11 until a new sync input occurs.

uint32_t bitsReserved1

Reserved 4 bits.

uint32_t bitSample4_12

Control whether delay sample4 and sample12 until a new sync input occurs.

uint32_t bitSample5_13

Control whether delay sample5 and sample13 until a new sync input occurs.

uint32_t bitSample6_14

Control whether delay sample6 and sample14 until a new sync input occurs.

uint32_t bitSample7_15

Control whether delay sample7 and sample15 until a new sync input occurs.

uint32_t bitsReserved2

Reserved 4 bits.

uint32_t bitsReserved3

Reserved 16 bits.

struct __cadc__scan__ctrl__independent__parallel__mode__converterA

#include <fsl_cadc.h> The scan ctrl struture for converterA in independent scan mode.

Public Members

uint32_t bitSample0
Control whether delay converterA's sample0 until a new sync input occurs.

uint32_t bitSample1
Control whether delay converterA's sample1 until a new sync input occurs.

uint32_t bitSample2
Control whether delay converterA's sample2 until a new sync input occurs.

uint32_t bitSample3
Control whether delay converterA's sample3 until a new sync input occurs.

uint32_t bitsReserved1
Reserved 4 bits.

uint32_t bitSample4
Control whether delay converterA's sample4 until a new sync input occurs.

uint32_t bitSample5
Control whether delay converterA's sample5 until a new sync input occurs.

uint32_t bitSample6
Control whether delay converterA's sample6 until a new sync input occurs.

uint32_t bitSample7
Control whether delay converterA's sample7 until a new sync input occurs.

uint32_t bitsReserved2
Reserved 4 bits

uint32_t bitsReserved3
Reserved 16 bits.

struct __cadc__scan__ctrl__independent__parallel__mode__converterB
#include <fsl_cadc.h> The scan ctrl struture for converterB in independent scan mode.

Public Members

uint32_t bitsReserved1
Reserved 4 bits.

uint32_t bitSample8
Control whether delay converterB's sample8 until a new sync input occurs.

uint32_t bitSample9
Control whether delay converterB's sample9 until a new sync input occurs.

uint32_t bitSample10
: Control whether delay converterB's sample10 until a new sync input occurs.

uint32_t bitSample11
: Control whether delay converterB's sample11 until a new sync input occurs.

uint32_t bitsReserved2
: Reserved 4 bits.

uint32_t bitSample12
: Control whether delay converterB's sample12 until a new sync input occurs.

uint32_t bitSample13
: Control whether delay converterB's sample13 until a new sync input occurs.

uint32_t bitSample14
: Control whether delay converterB's sample14 until a new sync input occurs.

uint32_t bitSample15
: Control whether delay converterB's sample15 until a new sync input occurs.

uint32_t bitsReserved3
: Reserved 16 bits.

union __cadc_scan_ctrl_independent_parallel_mode
: *#include <fsl_cadc.h>* The union for converters in independent parallel mode.

Public Members

cadc_scan_ctrl_independent_parallel_mode_converterA_t sConverterA
: Scan control for converterA.

cadc_scan_ctrl_independent_parallel_mode_converterB_t sConverterB
: Scan control for converterB.

union __cadc_scan_control
: *#include <fsl_cadc.h>* The union of the scan control for each scan mode.

Public Members

uint32_t u32ScanCtrlVal
: The 32 bits value of the scan control value.

cadc_scan_ctrl_seq_mode_t sSequential
: Scan control for sequential scan mode.

cadc_scan_ctrl_simultParallel_mode_t sSimultParallel

Scan control for simultaneous parallel scan mode.

cadc_scan_ctrl_independent_parallel_mode_t uIndependentParallel

Scan control for independent scan mode.

struct __cadc__exp__mux__aux__config

#include <fsl_cadc.h> The structure for configuring Cyclic ADC's expansion setting.

Public Members

uint16_t u16AuxControl

The mask of auxiliary control, should be the OR'ed value of *cadc_auxiliary_control_t*.

uint32_t u32MuxChannelMask

The mask of mux selection of all mux solts, should be the OR'ed value of *cadc_expansion_mux_selection_t*.

cadc_expansion_disabled_mux_slot_t disabledMuxSlot

mux slot to disabled in the scan.

struct __cadc__converter__config

#include <fsl_cadc.h> The structure for configuring each converter.

Public Members

uint16_t u16ClockDivisor

Converter's clock divisor for the clock source. Available setting range is 0-63.

- When the clockDivisor is 0, the divisor is 2.
- For all other clockDivisor values, the divisor is 1 more than the decimal value of clockDivisor: clockDivisor + 1

cadc_reference_voltage_source_t eHighReferenceVoltageSource

High voltage reference source.

cadc_reference_voltage_source_t eLowReferenceVoltageSource

Low reference voltage source.

bool bEnableDMA

Enable/Disable DMA.

bool bPowerUp

Power up or power down the converter.

bool bScanInitBySync

The member user to control the initiate method of the scan.

- **true** Use a SYNC input pulse or START command to initiate a scan.
- **false** Scan is initiated by the assertion of START command only.

cadc_exp_mux_aux_config_t muxAuxConfig

Configuration of expansion mux and auxiliary control.

struct __cadc__config

#include <fsl_cadc.h> The structure for configuring the Cyclic ADC's setting.

Public Members

cadc_idle_work_mode_t eIdleWorkMode

Idle work mode for the module.

cadc_dma_trigger_source_t eDMATriggerSource

Selects the dma trigger source for the module.

uint16_t u16PowerUpDelay

The number of ADC clocks to power up the converters (if powered up), before allowing a scan to start. The available range is 0 to 63 .

uint32_t u32EnabledInterruptMask

The mask of the interrupts to be enabled, should be the OR'ed value of *_cadc_interrupt_enable*.

cadc_scan_mode_t eScanMode

The scan mode of the module.

cadc_sample_slot_disabled_t uDisabledSampleSlot

The member used to config the which sample slot is disabled for the scan. The scan will continue until the first disabled sample slot is encountered.

cadc_scan_control_t uScanControl

Scan control provides the ability to pause and await a new sync signal while current sample completed.

uint32_t u32ChannelModeMask

The mask of each channel's mode, should be the OR'ed value of cadc_channel_mode_t. Each channel supports single-end and differential(Fully differentail and Unipolar differential). Some devices also support alternate source mode.

cadc_channel_gain_t eChannelGain[(ADC_RSLT_COUNT)]

The gain value for each channel. Each element of the array represents the gain of the channel. E.g. eChannelGain[0] means channel gain of channel0, which is ANA0.

cadc_channel_number_t eSampleSlot[(ADC_RSLT_COUNT)]
The channel assigned to each sample slot. The index of the array represents sample slot index.

cadc_converter_config_t sConverterA
The configuration for converterA.

cadc_converter_config_t sConverterB
The configuration for converterB.

2.2 The Driver Change Log

2.3 CADC Peripheral and Driver Overview

2.4 Clock Driver

enum _clock_ip_name
List of IP clock name.

Values:

enumerator kCLOCK_GPIOF
GPIOF clock

enumerator kCLOCK_GPIOE
GPIOE clock

enumerator kCLOCK_GPIOD
GPIOD clock

enumerator kCLOCK_GPIOC
GPIOC clock

enumerator kCLOCK_GPIOB
GPIOB clock

enumerator kCLOCK_GPIOA
GPIOA clock

enumerator kCLOCK_TA3
Timer A3 clock

enumerator kCLOCK_TA2
Timer A2 clock

enumerator kCLOCK_TA1
Timer A1 clock

enumerator kCLOCK_TA0
Timer A0 clock

enumerator kCLOCK_LPI2C0
LPI2C0 clock

enumerator kCLOCK_LPI2C1
LPI2C1 clock

enumerator kCLOCK_QSPI0
QSPI0 clock

enumerator kCLOCK_QSCI1
QSCI1 clock

enumerator kCLOCK_QSCI0
QSCI0 clock

enumerator kCLOCK_DAC
DAC clock

enumerator kCLOCK_PIT1
PIT 1 clock

enumerator kCLOCK_PIT0
PIT 0 clock

enumerator kCLOCK_QDC
QDC clock

enumerator kCLOCK_CRC
CRC clock

enumerator kCLOCK_CYCADC
Cyclic ADC clock

enumerator kCLOCK_CMPD
Comparator D clock

enumerator kCLOCK_CMPC
Comparator C clock

enumerator kCLOCK_CMPB
Comparator B clock

enumerator kCLOCK_CMPA
Comparator A clock

enumerator kCLOCK_PWMACH3
Enhanced Flexible PWM A3 clock

enumerator kCLOCK_PWMACH2
Enhanced Flexible PWM A2 clock

enumerator kCLOCK_PWMACH1
Enhanced Flexible PWM A1 clock

enumerator kCLOCK_PWMACH0
Enhanced Flexible PWM A0 clock

enumerator kCLOCK_ROM
ROM clock

enumerator kCLOCK_OPAMPB
OPAMP B clock

enumerator kCLOCK_OPAMPA
OPAMP A clock

enumerator kCLOCK_NOGATE
Peripheral without clock gate control

enumerator kCLOCK_EDMA

enumerator kCLOCK_EWM

enumerator kCLOCK_XBARA

enumerator kCLOCK_NUM
Total IP clock number

enum _clock_name
List of system-level clock name.
Values:

enumerator kCLOCK_Mstr2xClk
Master 2x clock which feed to core and peripheral

enumerator kCLOCK_SysClk
MCU system/core clock

enumerator kCLOCK_BusClk
Bus clock

enumerator kCLOCK_Bus2xClk
Bus 2x clock

enumerator kCLOCK_FlashClk
Flash clock

enumerator kCLOCK_FastIrcClk
Fast internal RC oscillator, 8M/2M

enumerator kCLOCK_SlowIrcClk
Slow internal RC oscillator, 200K

enumerator kCLOCK_CrystalOscClk
Crystal oscillator

enumerator kCLOCK_ExtClk
The selected external clock, it could be crystal oscillator, clkin0, clkin1

enumerator kCLOCK_MstrOscClk
The selected master oscillator clock

enumerator kCLOCK_PllDiv2Clk
PLL output divide 2

enum _clock_crystal_osc_mode
Crystal oscillator mode.
Values:

enumerator kCLOCK_CrystalOscModeFSP
Full swing pierce, high power mode

enumerator kCLOCK_CrystalOscModeLCP
Loop controlled pierce, low power mode

enum _clock_ext_clk_src
List of external clock source.
Values:

enumerator kCLOCK_ExtClkSrcCrystalOsc
External clock source is crystal oscillator

enumerator kCLOCK_ExtClkSrcClkin
External clock source is clock in

enum _clock_ext_clkin_sel
List of clock-in source.
Values:

enumerator kCLOCK_SelClkIn0
Clock in 0 is selected as CLKIN

enumerator kCLOCK_SelClkIn1
Clock in 1 is selected as CLKIN

enum _clock_mstr_osc_clk_src
List of master oscillator source.
Values:

enumerator kCLOCK_MstrOscClkSrcFirc
8M/2M, fast internal RC oscillator

enumerator kCLOCK_MstrOscClkSrcExt
External clock

enumerator kCLOCK_MstrOscClkSrcSirc
200K, slow internal RC oscillator

enum _clock_mstr_2x_clk_src
List of master 2x clock source.
Values:

enumerator kCLOCK_Mstr2xClkSrcMstrOsc
Master oscillator clock

enumerator kCLOCK_Mstr2xClkSrcPllDiv2
PLL output divide 2

enum _clock_output_clk_src
List of output clock source.
Values:

enumerator kCLOCK_OutputClkSrc_Sys
MCU system/core clock

enumerator kCLOCK_OutputClkSrc_Mstr2x
Master 2x clock

enumerator kCLOCK_OutputClkSrc_BusDiv2
Bus clock div 2

enumerator kCLOCK_OutputClkSrc_MstrOSC
Master oscillator clock

enumerator kCLOCK_OutputClkSrc_Firc
Fast IRC clock, 8M/2M

enumerator kCLOCK_OutputClkSrc_Sirc
Slow IRC clock, 200K

enum _clock_output_clk_div

List of output clock divider.

Values:

enumerator kCLOCK_OutputDiv1

output clock = selectedClock/1U

enumerator kCLOCK_OutputDiv2

output clock = selectedClock/2U

enumerator kCLOCK_OutputDiv4

output clock = selectedClock/4U

enumerator kCLOCK_OutputDiv8

output clock = selectedClock/8U

enumerator kCLOCK_OutputDiv16

output clock = selectedClock/16U

enumerator kCLOCK_OutputDiv32

output clock = selectedClock/32U

enumerator kCLOCK_OutputDiv64

output clock = selectedClock/64U

enumerator kCLOCK_OutputDiv128

output clock = selectedClock/128U

enum _clock_protection

List of clock register protection mode.

Values:

enumerator kCLOCK_Protection_Off

No protection, and could be changed any time

enumerator kCLOCK_Protection_On

Protected, and could be changed any time

enumerator kCLOCK_Protection_OffLock

No protection and get locked until chip reset

enumerator kCLOCK_Protection_OnLock

Protected and get locked until chip reset

enum _clock_ip_clk_src

List of specific IP's clock source.

Values:

enumerator kCLOCK_IPClkSrc_BusClk
Bus clock

enumerator kCLOCK_IPClkSrc_Bus2xClk
Bus 2x clock

enum _clock_firc_sel
Fast IRC selection.
Values:

enumerator kCLOCK_FircSel_8M
FIRC normal mode, output 8M

enumerator kCLOCK_FircSel_2M
FIRC standby mode, output 2M

enum _clock_mode
MCU working mode selection.
Values:

enumerator kCLOCK_Mode_Normal
Normal mode, core:bus clock rate = 1:1

enumerator kCLOCK_Mode_Fast
Fast mode, core:bus clock rate = 2:1

enum _clock_postscale
Mstr 2x clock postscale divider.
Values:

enumerator kCLOCK_PostscaleDiv1
Mast 2X clock = clkSrc / 1

enumerator kCLOCK_PostscaleDiv2
Mast 2X clock = clkSrc / 2

enumerator kCLOCK_PostscaleDiv4
Mast 2X clock = clkSrc / 4

enumerator kCLOCK_PostscaleDiv8
Mast 2X clock = clkSrc / 8

enumerator kCLOCK_PostscaleDiv16
Mast 2X clock = clkSrc / 16

enumerator kCLOCK_PostscaleDiv32
Mast 2X clock = clkSrc / 32

enumerator kCLOCK_PostscaleDiv64
Mast 2X clock = clkSrc / 64

enumerator kCLOCK_PostscaleDiv128
Mast 2X clock = clkSrc / 128

enumerator kCLOCK_PostscaleDiv256
Mast 2X clock = clkSrc / 256

enum _clock_pll_monitor_type
PLL monitor type structure.
Values:

enumerator kCLOCK_PllMonitorUnLockCoarse
PLL coarse unlock, due to loss of reference clock, power unstable...etc.

enumerator kCLOCK_PllMonitorUnLockFine
PLL fine unlock, due to loss of reference clock, power unstable...etc.

enumerator kCLOCK_PllMonitorLostofReferClk
PLL lost reference clock.

enumerator kCLOCK_PllMonitorAll
All PLL monitor type.

enum _pit_count_clock_source
Describes PIT clock source.
Values:

enumerator kPIT_CountClockSource0
PIT count clock sourced from IP bus clock

enumerator kPIT_CountClockSource1
PIT count clock sourced from alternate clock 1

enumerator kPIT_CountClockSource2
PIT count clock sourced from alternate clock 2

enumerator kPIT_CountClockSource3
PIT count clock sourced from alternate clock 3

enumerator kPIT_CountBusClk
PIT count clock sourced from bus clock

enumerator kPIT_CountCrystalOscClk
PIT count clock sourced from crystal clock

enumerator kPIT_CountFircClk
PIT count clock sourced from fast IRC(8M/2M) clock

enumerator kPIT_CountSircClk
PIT count clock sourced from slow IRC(200KHz) clock

enum _ewm_lpo_clock_source
Describes EWM clock source.
Values:

enumerator kEWM_LpoClockSource0
EWM clock sourced from lpo_clk[0]

enumerator kEWM_LpoClockSource1
EWM clock sourced from lpo_clk[1]

enumerator kEWM_LpoClockSource2
EWM clock sourced from lpo_clk[2]

enumerator kEWM_LpoClockSource3
EWM clock sourced from lpo_clk[3]

enumerator kEWM_Lpo8MHz2MHzIRCClock
EWM clock sourced from 8MHz/2MHz IRC clock

enumerator kEWM_LpoCrystalClock
EWM clock sourced from crystal clock

enumerator kEWM_LpoBusClock
EWM clock sourced from IP Bus clock

enumerator kEWM_Lpo200KHzIRCClock
EWM clock sourced from 200KHz IRC clock

typedef enum *_clock_ip_name* clock_ip_name_t
List of IP clock name.

typedef enum *_clock_name* clock_name_t
List of system-level clock name.

typedef enum *_clock_crystal_osc_mode* clock_crystal_osc_mode_t
Crystal oscillator mode.

typedef enum *_clock_ext_clk_src* clock_ext_clk_src_t
List of external clock source.

typedef enum *_clock_ext_clkin_sel* clock_ext_clkin_sel_t
List of clock-in source.

typedef enum *_clock_mstr_osc_clk_src* clock_mstr_osc_clk_src_t

List of master oscillator source.

typedef enum *_clock_mstr_2x_clk_src* clock_mstr_2x_clk_src_t

List of master 2x clock source.

typedef enum *_clock_output_clk_src* clock_output_clk_src_t

List of output clock source.

typedef enum *_clock_output_clk_div* clock_output_clk_div_t

List of output clock divider.

typedef enum *_clock_protection* clock_protection_t

List of clock register protection mode.

typedef enum *_clock_ip_clk_src* clock_ip_clk_src_t

List of specific IP's clock source.

typedef enum *_clock_firc_sel* clock_firc_sel_t

Fast IRC selection.

typedef enum *_clock_mode* clock_mode_t

MCU working mode selection.

typedef enum *_clock_postscale* clock_postscale_t

Mstr 2x clock postscale divider.

typedef struct *_clock_protection_config* clock_protection_config_t

Clock register protection configuration.

typedef struct *_clock_output_config* clock_output_config_t

Clock output configuration.

typedef struct *_clock_config* clock_config_t

mcu clock configuration structure.

This is the key configuration structure of clock driver, which define the system clock behavior. The function CLOCK_SetClkConfig deploy this configuration structure onto SOC.

typedef enum *_clock_pll_monitor_type* clock_pll_monitor_type_t

PLL monitor type structure.

typedef enum *_pit_count_clock_source* pit_count_clock_source_t

Describes PIT clock source.

typedef enum *_ewm_lpo_clock_source* ewm_lpo_clock_source_t

Describes EWM clock source.

static inline void CLOCK_EnableClock(*clock_ip_name_t* eIpClkName)

Enable IPs clock.

Parameters

- eIpClkName – IP clock name.

static inline void CLOCK_DisableClock(*clock_ip_name_t* eIpClkName)

Disable IPs clock.

Parameters

- eIpClkName – IP clock name.

static inline void CLOCK_EnableClockInStopMode(*clock_ip_name_t* eIpClkName)

Enable IPs clock in STOP mode.

Parameters

- eIpClkName – IP clock name.

static inline void CLOCK_DisableClockInStopMode(*clock_ip_name_t* eIpClkName)

Disable IPs clock in STOP mode.

Parameters

- eIpClkName – IP clock name.

static inline void CLOCK_ConfigQsciClockSrc(*clock_ip_name_t* eQsciClkName, *clock_ip_clk_src_t* eClkSrc)

Configure QSCI clock source.

QSCI clock could be bus or bus_2x clock. Default is bus clock.

Parameters

- eQsciClkName – IP(only QSCI is valid) clock name.
- eClkSrc – Clock source.

static inline void CLOCK_ConfigQtimerClockSrc(*clock_ip_clk_src_t* eClkSrc)

Configure Qtimer clock source.

Qtimer clock could be bus or bus_2x clock. Default is bus clock.

Parameters

- eClkSrc – Clock source.

static inline void CLOCK_ConfigPWMClockSrc(*clock_ip_clk_src_t* eClkSrc)

Configure PWM clock source.

PWM clock could be bus or bus_2x clock. Default is bus clock.

Parameters

- eClkSrc – Clock source.

static inline void CLOCK_ConfigI2cClockSrc(*clock_ip_name_t* eLpi2cClkName, *clock_ip_clk_src_t* eClkSrc)

Configure LPI2C clock source.

LPI2C clock could be bus or bus_2x clock. Default is bus clock.

Parameters

- eLpi2cClkName – IP(only LPI2C is valid) clock name.
- eClkSrc – Clock source.

static inline void CLOCK_ConfigQDCClockSrc(*clock_ip_clk_src_t* eClkSrc)

Configure QDC clock source.

QDC clock could be bus or bus_2x clock. Default is bus clock.

Parameters

- eClkSrc – Clock source.

static inline void CLOCK_SetSlowIrcTrim(uint16_t u16Trim)

Set trim value to 200K slow internal RC oscillator.

The factory trim value is loaded during reset. User may call this function to fine tune the 200K IRC oscillator.

Parameters

- u16Trim – Slow internal RC oscillator trim value.

static inline void CLOCK_SetFastIrc8MTrim(uint16_t u16Trim)

Set trim value to fast internal RC 8M oscillator.

The factory trim value is loaded during reset. User may call this function to fine tune the FIRC 8M oscillator.

Parameters

- u16Trim – Fast internal 8M RC oscillator trim value. Check OSCTL3 register for u16Trim format.

static inline void CLOCK_SetFastIrc2MTrim(uint16_t u16Trim)

Set trim value to fast internal RC 2M oscillator.

The factory trim value is loaded during reset. User may call this function to fine tune the FIRC 2M oscillator.

Parameters

- u16Trim – Fast internal 2M RC oscillator trim value. Check OSCTL4 register for u16Trim format.

static inline bool CLOCK_GetCrystalOscFailureStatus(void)

Get crystal oscillator failure status.

Note: This function should be called only when crystal osc is on and its monitor(MON_ENABLE in OSCTL2 register) is enabled.

Returns

Crystal oscillator status. true: Crystal oscillator frequency is below 680KHz(typical). false: No clock failure or crystal oscillator is off.

static inline void CLOCK_SetPllLossofRefererntTripPoint(uint8_t u8Trip)

Set PLL loss of reference trip point.

The trip point default value is 2.

Parameters

- u8Trip – Trip point for loss of reference.

static inline void CLOCK_ClearPLLMonitorFlag(*clock_pll_monitor_type_t* eType)

Clear PLL monitor flag.

Parameters

- eType – PLL monitor type.

static inline void CLOCK_EnableFircOutput(bool bEnable)

Enable/Disable FIRC output.

Note: It is not allowed to disable FIRC output when FIRC is selected as master osc clock source. Note: Disable FIRC output doesn't turn off FIRC, FIRC still works but its output is cut off. Note: For the case FIRC is powered on and output disabled, enable FIRC output doesn't require startup time.

Parameters

- bEnable – Enable or disable output.

static inline void CLOCK_DisableFirc8MMonitor(void)

Disable IRC8M monitor.

static inline void CLOCK_EnableFirc8MMonitorInterrupt(bool bEnable)

Enable/Disable IRC8M monitor interrupt.

Parameters

- bEnable – Enable or disable FIRC 8M monitor interrupt.

static inline bool CLOCK_GetFirc8MMonitorInterruptFlag(void)

Get IRC8M monitor interrupt flag.

Returns

IRC8M monitor interrupt flag. true: 8M monitor failed, result exceeds threshold. false: 8M monitor works normal or be turned off.

static inline void CLOCK_ClearFirc8MMonitorInterruptFlag(void)

Clear IRC8M monitor interrupt flag.

uint32_t CLOCK_GetFreq(*clock_name_t* eClkName)

Get system-level clock frequency.

Parameters

- eClkName – System-level clock name.

Returns

The required clock's frequency in Hz.

uint32_t CLOCK_GetIpClkSrcFreq(*clock_ip_name_t* eIpClkName)

Get IP clock frequency.

Parameters

- eIpClkName – IP clock name.

Returns

The required IP clock's frequency in Hz.

void CLOCK_SetClkin0Freq(uint32_t u32Freq)

Set Clock IN 0 frequency.

It is a must to call this function in advance if system is operated by clkin0.

Parameters

- u32Freq – Clock IN 0 frequency in Hz.

void CLOCK_SetClkin1Freq(uint32_t u32Freq)

Set Clock IN 1 frequency.

It is a must to call this function in advance if system is operated by clkin1.

Parameters

- u32Freq – Clock IN 1 frequency in Hz.

void CLOCK_SetXtalFreq(uint32_t u32Freq)

Set crystal oscillator frequency.

It is a must to call this function in advance if system is operated by crystal oscillator.

Parameters

- u32Freq – Crystal oscillator frequency in Hz.

void CLOCK_SetProtectionConfig(*clock_protection_config_t* *psConfig)

Config clock register access protection mode.

Parameters

- psConfig – Pointer for protection configuration.

void CLOCK_SetOutputClockConfig(*clock_output_config_t* *psConfig)

Config output clock.

Parameters

- psConfig – Pointer for clock output configuration.

void CLOCK_SetClkConfig(*clock_config_t* *psConfig)

Config mcu operation clock.

It is recommended to set the multilink debug shift freq to 100KHz or lower when debug the 2M FIRC setting, otherwise the multilink may can't connect to device. Below is a valid FIRC 2M clock setting demo, clock path: FIRC(2M)->MSTR OSC->DIV1->MSTR 2X .bCrystalOscEnable = false; .bFircEnable = true; .bSircEnable = false; .bPllEnable = false; .eFircSel = kCLOCK_FircSel_2M; .eMstrOscClkSrc = kCLOCK_MstrOscClkSrcFirc; .eMstr2xClkSrc = kCLOCK_SysClkSrcMstrOsc; .eMstr2xClkPostScale = kCLOCK_PostscaleDiv1;

If set the SIRC(200KHz) as Mstr2x clock, the debugger can't connect to the device. So be careful to set the SIRC clock configuration, because it's difficult to debug. Below is a valid SIRC 200K clock setting demo, clock path: SIRC->MSTR OSC->DIV1->MSTR 2X .bCrystalOscEnable = false; .bFircEnable = false; .bSircEnable = true; .bPllEnable = false; .eMstrOscClkSrc = kCLOCK_MstrOscClkSrcSirc; .eMstr2xClkSrc = kCLOCK_SysClkSrcMstrOsc; .eMstr2xClkPostScale = kCLOCK_PostscaleDiv1;

Parameters

- psConfig – Pointer for clock configuration.

void CLOCK_SetClockMode(*clock_mode_t* eClkMode)

Set clock mode, normal or fast mode.

Note: This function will do software reset if setting mode differs current mode, otherwise it does nothing.

Parameters

- eClkMode – Setting clock mode.

uint32_t CLOCK_EvaluateExtClkFreq(void)

Evaluate external clock frequency and return its frequency in Hz.

This function should be called only when internal FIRC is on and 8M is selected. The evaluated result accuracy depends on:

a. FIRC accuracy, now it is +/-3% for full temperature range.

b. Truncation error, because the external clock and FIRC is not synchronised.

c. External clock frequency, low accuracy for lower external clock frequency.

d. MCU mstr 2x clock.

For example, for namely 8M external clock, evaluated result may be range in 8M+/-7%.

Returns
Evaluated external frequency in Hz.

void CLOCK_EnablePLLMonitorInterrupt(*clock_pll_monitor_type_t* eType, bool bEnable)

Enable/Disable PLL monitor interrupt.

This function should be called only when PLL is on and its reference clock is external clock. This function is for safety purpose when external clock is lost due to HW failure. The normal flow to call this function:

a. Call CLOCK_SetClkConfig to enable PLL and external clock to feed the PLL.
b. Call CLOCK_ClearPLLMonitorFlag.
c. Call CLOCK_SetPllLossofRefererntTripPoint (optional, setting value is for kCLOCK_PllMonitorLostofReferClk type).
d. Call this function.
e. Enable OCCS interrupt with highest priority 3.
f. When OCCS interrupt occurs, recover clock from the disaster in OCCS_DriveISRHandler function. Such kind of clock recovery is application dependent, and a demo OCCS_DriveISRHandler has been shown in fsl_clock.c

Parameters

- eType – PLL monitor type.
- bEnable – Enable or disable.

void CLOCK_EnableFirc8MMonitor(uint16_t u16LowThre, uint16_t u16HighThre)

Enable IRC8M monitor.

Note: : It requires IRC8M and IRC200K to be enabled.

Parameters

- u16LowThre – Low threshold
- u16HighThre – High threshold.

bool CLOCK_IRC8MMonitorOnce(void)

IRC8M monitor usage.

This function demos the usage of IRC8M monitor via clock driver API.

Returns
IRC8M monitor test result. true: 8M monitor failed, result exceeds threshold, +/-10% false: 8M monitor result is within threshold, +/-10%

FSL_CLOCK_DRIVER_VERSION

CLOCK driver version 2.2.0.

SDK_DEVICE_MAXIMUM_CPU_CLOCK_FREQUENCY

Definition for delay API in clock driver, users can redefine it.

GPIO_CLOCKS

Clock ip name array for GPIO.

TMR_CLOCKS
: Clock ip name array for quad timer.

LPI2C_CLOCKS
: Clock ip name array for LPI2C.

QSPI_CLOCKS
: Clock ip name array for queued SPI.

QSCI_CLOCKS
: Clock ip name array for queued SCI.

DAC_CLOCKS
: Clock ip name array for DAC.

PIT_CLOCKS
: Clock ip name array for PIT.

QDC_CLOCKS
: Clock ip name array for QDC.

CRC_CLOCKS
: Clock ip name array for CRC.

CADC_CLOCKS
: Clock ip name array for cyclic ADC.

CMP_CLOCKS
: Clock ip name array for CMP.

PWM_CLOCKS
: Clock ip name array for PWM.

ROM_CLOCKS
: Clock ip name array for ROM.

OPAMP_CLOCKS
: Clock ip name array for OPAMP.

EDMA_CLOCKS
: Clock ip name array for EDMA.

EWM_CLOCKS
: Clock ip name array for EWM.

XBARA_CLOCKS
: Clock ip name array for XBARA.

CLK_GATE_GET_REG_INDEX(**x**)

CLK_GATE_GET_BIT_INDEX(x)

clock_protection_t eFrqEP
: FRQEP bit field in OCCS PROT register, protect COD & ZSRC.

clock_protection_t eOscEP
: OSCEP bit field in OCCS PROT register, protect OSCTL1, OSCTL2, OSCTL3, OSCTL4, PRECS.

clock_protection_t ePllEP
: PLLEP bit field in OCCS PROT register, protect PLLDP, LOCIE, LORTP, PLLDB bitfield.

bool bClkOut0En
: Clock output 0 enable, CLKDIS0 bit field in SIM CLKOUT register

bool bClkOut1En
: Clock output 1 enable, CLKDIS1 bit field in SIM CLKOUT register

clock_output_clk_src_t eClkOut0Src
: Clock output 0 clock source, CLKOSEL0 bit field in SIM CLKOUT register

clock_output_clk_src_t eClkOut1Src
: Clock output 1 clock source, CLKOSEL1 bit field in SIM CLKOUT register

clock_output_clk_div_t eClkDiv
: Clock output divider, CLKODIV bit field in SIM CLKOUT register ,it apply to clkout0 & clkout1

bool bCrystalOscEnable
: Crystal oscillator enable, COPD bit field in OCCS OSCTL2 register

bool bFircEnable
: Fast internal RC oscillator enable, ROPD bit field in OCCS OSCTL1 register

bool bSircEnable
: Slow internal RC oscillator enable, ROPD200K bit field in OCCS OSCTL2 register

bool bPllEnable
: PLL enable, PLLPD bit field in OCCS CTRL register

bool bCrystalOscMonitorEnable
: Crystal oscillator monitor enable, MON_ENABLE bit field in OCCS OSCTL2 register

clock_firc_sel_t eFircSel
: Fast IRC mode selection, 8M or 2M, ROSB bit field in OCCS OSCTL1 register

clock_crystal_osc_mode_t eCrystalOscMode
: Crystal oscillator mode, COHL bit field in OCCS OSCTL1 register

clock_ext_clk_src_t eExtClkSrc
: External clock source, EXT_SEL bit field in OCCS OSCTL1 register

clock_ext_clkin_sel_t eClkInSel

Clock IN selection(0 or 1), CLKINSEL bit field in SIM MISC0 register

clock_mstr_osc_clk_src_t eMstrOscClkSrc

Master oscillator selection, PRECS bit field in OCCS CTRL register. When selected kCLOCK_MstrOscClkSrcExt, make sure corresponding pins(crystal osc or clkin pin) has been configured.

clock_mstr_2x_clk_src_t eMstr2xClkSrc

Master 2x clock selection, ZSRC bit field in OCCS CTRL register

clock_postscale_t eMstr2xClkPostScale

Master 2x clock post scale, COD bit field in OCCS DIVBY register

uint32_t u32PllClkFreq

Required PLL output frequency before divide 2

FSL_SDK_DISABLE_DRIVER_CLOCK_CONTROL

Configure whether driver controls clock.

When set to 0, peripheral drivers will enable clock in initialize function and disable clock in de-initialize function. When set to 1, peripheral driver will not control the clock, application could control the clock out of the driver.

Note: All drivers share this feature switcher. If it is set to 1, application should handle clock enable and disable for all drivers.

---

struct _clock_protection_config

#include <fsl_clock.h> Clock register protection configuration.

struct _clock_output_config

#include <fsl_clock.h> Clock output configuration.

struct _clock_config

#include <fsl_clock.h> mcu clock configuration structure.

This is the key configuration structure of clock driver, which define the system clock behavior. The function CLOCK_SetClkConfig deploy this configuration structure onto SOC.

2.5 Driver Change Log

2.6 CMP: Comparator Driver

void CMP_GetDefaultConfig(*cmp_config_t* *psConfig)

Initializes the CMP user configuration structure.

This function initializes the user configuration structure to the default values. It is corresponding to the continuous mode configurations.

Parameters

- psConfig – pointer of cmp_config_t.

void CMP_Init(CMP_Type *base, const *cmp_config_t* *psConfig)

Initializes the CMP.

This function initializes the CMP module. The operations included are as follows.

- Enable the clock for CMP module.
- Configure the comparator according to the CMP configuration structure.

Parameters

- base – CMP peripheral base address.
- psConfig – Pointer to the configuration structure.

void CMP_Deinit(CMP_Type *base)

De-initializes the CMP module.

This function de-initializes the CMP module. The operations included are as follows.

- Disabling the CMP module.
- Disabling the clock for CMP module.

Parameters

- base – CMP peripheral base address.

static inline void CMP_Enable(CMP_Type *base, bool bEnable)

Enables/disables the CMP module.

Parameters

- base – CMP peripheral base address.
- bEnable – Enables or disables the module.

static inline void CMP_SetInputChannel(CMP_Type *base, cmp_input_mux_t ePlusChannel, cmp_input_mux_t eMinusChannel)

Sets the input channels for the comparator.

This function sets the input channels for the comparator. Note that two input channels cannot be set the same way in the application. When the user selects the same input from the analog mux to the positive and negative port, the comparator is disabled automatically.

Parameters

- base – CMP peripheral base address.
- ePlusChannel – Plus side input channel number.
- eMinusChannel – Minus side input channel number.

static inline void CMP_SelectOutputSource(CMP_Type *base, *cmp_output_source_t* eOutputSource)

Select comparator output source.

Parameters

- base – CMP peripheral base address.
- eOutputSource – The output signal to be set, please reference *cmp_output_source_t* for details.

static inline void CMP_EnableOuputPin(CMP_Type *base, bool bEnable)

Enable/Disable Comparator output pin.

Parameters

- base – CMP peripheral base address.
- bEnable – Enable/Disable comparator output pin. true — CMPO is available on the associate CMPO output pin. false — CMPO is not available on the associate CMPO output pin.

static inline uint8_t CMP_GetComparatorOutput(CMP_Type *base)

Get Comparator output.

Parameters

- base – CMP peripheral base address.

Return values

current – analog comparator output 0 or 1

static inline void CMP_SetHysteresisLevel(CMP_Type *base, *cmp_hysteresis_level_t* eHysteresisLevel)

Sets hysteresis level.

Parameters

- base – CMP peripheral base address.
- eHysteresisLevel – The programmable hysteresis level to be set, please refer to *cmp_hysteresis_level_t* for details.

static inline void CMP_SetComparasionSpeedMode(CMP_Type *base, *cmp_comparasion_speed_mode_t* eComparatorSpeedMode)

Sets comparison speed mode.

Parameters

- base – CMP peripheral base address.
- eComparatorSpeedMode – The comparison speed mode, please reference *cmp_comparasion_speed_mode_t* for details.

static inline void CMP_EnableInvertOutput(CMP_Type *base, bool bEnable)

Enable/Disable comparator invert feature.

Parameters

- base – CMP peripheral base address.
- bEnable – Enable/Disable comparator invert feature. true — Inverts the comparator output. false — Does not invert the comparator output.

static inline void CMP_EnableWindow(CMP_Type *base, bool bEnable)

Enable the window function.

Parameters

- base – CMP peripheral base address.
- bEnable – true is enable, false is disable.

static inline void CMP_SetWindowOutputMode(CMP_Type *base, *cmp_window_output_mode_t* eWindowOutputMode)

Set the window output mode.

Parameters

- base – CMP peripheral base address.
- eWindowOutputMode – *cmp_window_output_mode_t*.

static inline void CMP_EnableExternalSampleMode(CMP_Type *base, bool bEnable)

Enable/Disable external Sample mode.

Parameters

- base – CMP peripheral base address.
- bEnable – true is using external sample mode, false is using interface sample mode.

static inline void CMP_SetExternalSampleCount(CMP_Type *base, *cmp_external_sample_count_t* eSampleCount)

Sets external sample count.

Parameters

- base – CMP peripheral base address.
- eSampleCount – The number of consecutive samples that must agree prior to the comparator output filter accepting a new output state, *cmp_external_sample_count_t*.

static inline void CMP_SetInternalFilterCount(CMP_Type *base, *cmp_filter_count_t* eFilterCount)

Sets internal filter count.

Parameters

- base – CMP peripheral base address.
- eFilterCount – The number of consecutive samples that must agree prior to the comparator output filter accepting a new output state, *cmp_filter_count_t*.

static inline void CMP_SetInternalFilterPeriod(CMP_Type *base, uint8_t u8FilterPeriod)

Sets the internal filter period. It is used as the divider to bus clock.

Parameters

- base – CMP peripheral base address.
- u8FilterPeriod – Filter Period. The divider to the bus clock. Available range is 0-255.

void CMP_SetDACConfig(CMP_Type *base, const *cmp_dac_config_t* *psConfig)

Configures the internal DAC.

Parameters

- base – CMP peripheral base address.
- psConfig – Pointer to the configuration structure.

static inline void CMP_SetDACOutputVoltage(CMP_Type *base, uint8_t u8OutputVoltageDivider)

Sets DAC output voltage.

Parameters

- base – CMP peripheral base address.
- u8OutputVoltageDivider – The digital value which is related to the desired DAC output voltage,

static inline void CMP_EnableInternalDAC(CMP_Type *base, bool bEnable)

Enable/Disable internal DAC.

Parameters

- base – CMP peripheral base address.
- bEnable – Enable/Disable internal DAC. true — Enable internal DAC. false — Disable internal DAC.

static inline void CMP_SetDACReferenceVoltageSource(CMP_Type *base, *cmp_dac_vref_source_t* eDACVrefSource)

Sets internal DAC's reference voltage source.

Parameters

- base – CMP peripheral base address.
- eDACVrefSource – reference voltage source, please *cmp_dac_vref_source_t*

static inline void CMP_EnableInterrupt(CMP_Type *base, *cmp_interrupt_request_t* eInterruptRequest)

Interrupt request to enable.

Parameters

- base – CMP peripheral base address.
- eInterruptRequest – Mask value for interrupts. See *cmp_interrupt_request_t*.

static inline *cmp_output_flag_t* CMP_GetStatusFlags(CMP_Type *base)

Gets the status flags.

Parameters

- base – CMP peripheral base address.

Return values

Mask – value for the asserted flags. *cmp_output_flag_t*.

static inline void CMP_ClearStatusFlags(CMP_Type *base, *cmp_output_flag_t* eOutputFlag)

Clears the status flags.

Parameters

- base – CMP peripheral base address.
- eOutputFlag – Mask value for the output flags, *cmp_output_flag_t*

static inline void CMP_EnableDMA(CMP_Type *base, *cmp_dma_request_t* eDMARequestType)

Enables CMP DMA request.

Parameters

- base – CMP peripheral base address.
- eDMARequestType – eDMA request type, *cmp_dma_request_t*

static inline uint32_t CMP_GetComparatorResultRegisterAddress(CMP_Type *base)

Get CMP result register address for DMA access.

Parameters

- base – CMP peripheral base address.

Returns

The CMP result register address.

FSL_CMP_DRIVER_VERSION
CMP driver version.

enum _cmp_interrupt_request
CMP Interrupt request type definition.
Values:

enumerator kCMP_InterruptRequestDisabled
interrupt disabled

enumerator kCMP_InterruptRequestEnableOutputRisingEdge
Comparator interrupt request enable rising edge.

enumerator kCMP_InterruptRequestEnableOutputFallingEdge
Comparator interrupt request enable falling edge.

enumerator kCMP_InterrruptRequestEnableAll
comparator interrupt request enable on rising edge or falling edge

enum _cmp_dma_request
CMP DMA request type definition.
Values:

enumerator kCMP_DMARequestDisabled
DMA disabled

enumerator kCMP_DMARequestEnableOutputRisingEdge
Comparator dma request enable on rising edge.

enumerator kCMP_DMARequestEnableOutputFallingEdge
Comparator dnma request enable on falling edge.

enumerator kCMP_DMARequestEnableAll
comparator dma request enable on rising edge or falling edge

enum _cmp_output_flag
CMP output flags' mask.
Values:

enumerator kCMP_OutputFlagRisingEdge
Rising-edge on the comparison output has occurred.

enumerator kCMP_OutputFlagFallingEdge
Falling-edge on the comparison output has occurred.

enumerator kCMP_OutputFlagBothEdge
Rising-edge and Falling-edge on the comparison output has occurred.

enum _cmp_hysteresis_level

CMP Hysteresis level.

Values:

enumerator kCMP_HysteresisLevel0

Hysteresis level 0.

enumerator kCMP_HysteresisLevel1

Hysteresis level 1.

enumerator kCMP_HysteresisLevel2

Hysteresis level 2.

enumerator kCMP_HysteresisLevel3

Hysteresis level 3.

enum _cmp_comparasion_speed_mode

CMP compassion speed mode enumerator.

Values:

enumerator kCMP_ComparsionModeLowSpeed

Low-Speed Comparison mode has lower current consumption

enumerator kCMP_ComparsionModeHighSpeed

High-Speed Comparison mode has higher current consumption.

enum _cmp_dac_vref_source

CMP DAC Voltage Reference source.

Values:

enumerator kCMP_DACVrefSourceVin1

Vin1 is selected as a resistor ladder network supply reference Vin.

enumerator kCMP_DACVrefSourceVin2

Vin2 is selected as a resistor ladder network supply reference Vin.

enum _cmp_window_output_mode

CMP output value of window.

Values:

enumerator kCMP_WindowOuputLastLatchedValue

When WINDOW signal changes from 1 to 0, COUTA output holds the last latched value before WINDOW signal falls to 0

enumerator kCMP_WindowOutputZeroValue

When WINDOW signal changes from 1 to 0, COUTA output is forced to 0

enum _cmp_filter_count

CMP filter count.

Values:

enumerator kCMP_FilterCountDisable

filter is disabled

enumerator kCMP_FilterCount1

1 sample must agrees, the comparator output is simply sampled

enumerator kCMP_FilterCount2

2 consecutive samples must agrees

enumerator kCMP_FilterCount3

3 consecutive samples must agrees

enumerator kCMP_FilterCount4

4 consecutive samples must agrees

enumerator kCMP_FilterCount5

5 consecutive samples must agrees

enumerator kCMP_FilterCount6

6 consecutive samples must agrees

enumerator kCMP_FilterCount7

7 consecutive samples must agrees

enum _cmp_external_sample_count

CMP external sample count.

Values:

enumerator kCMP_ExternalSampleCount1

1 sample must agrees, the comparator output is simply sampled

enumerator kCMP_ExternalSampleCount2

2 consecutive samples must agrees

enumerator kCMP_ExternalSampleCount3

3 consecutive samples must agrees

enumerator kCMP_ExternalSampleCount4

4 consecutive samples must agrees

enumerator kCMP_ExternalSampleCount5

5 consecutive samples must agrees

enumerator kCMP_ExternalSampleCount6
6 consecutive samples must agrees

enumerator kCMP_ExternalSampleCount7
7 consecutive samples must agrees

enum _cmp_output_source
CMP output source enumerator.
Values:

enumerator kCMP_OutputSourceFromFilterCOUT
Set the filtered comparator output to equal COUT.

enumerator kCMP_OutputSourceFromUnfilteredCOUTA
Set the unfiltered comparator output to equal COUTA.

enum _cmp_work_mode
CMP work mode definition.
Values:

enumerator kCMP_WorkModeWindowBypassAndNoExternalSample
window block bypassed, external sampling mode disabled

enumerator kCMP_WorkModeWindowBypassAndExternalSample
window block bypassed, external SAMPLE mode enable

enumerator kCMP_WorkModeWindowEnabledAndNoExternalSample
window block enabled, external sampling mode disabled

typedef enum *_cmp_interrupt_request* cmp_interrupt_request_t
CMP Interrupt request type definition.

typedef enum *_cmp_dma_request* cmp_dma_request_t
CMP DMA request type definition.

typedef enum *_cmp_output_flag* cmp_output_flag_t
CMP output flags' mask.

typedef enum *_cmp_hysteresis_level* cmp_hysteresis_level_t
CMP Hysteresis level.

typedef enum *_cmp_comparasion_speed_mode* cmp_comparasion_speed_mode_t
CMP compassion speed mode enumerator.

typedef enum *_cmp_dac_vref_source* cmp_dac_vref_source_t
CMP DAC Voltage Reference source.

typedef enum *_cmp_window_output_mode* cmp_window_output_mode_t

CMP output value of window.

typedef enum *_cmp_filter_count* cmp_filter_count_t

CMP filter count.

typedef enum *_cmp_external_sample_count* cmp_external_sample_count_t

CMP external sample count.

typedef enum *_cmp_output_source* cmp_output_source_t

CMP output source enumerator.

typedef enum *_cmp_work_mode* cmp_work_mode_t

CMP work mode definition.

typedef struct *_cmp_dac_config* cmp_dac_config_t

CMP internal DAC configuration structure.

typedef union *_cmp_dma_interrupt_config* cmp_dma_interrupt_config_t

CMP dma/interrupt configure union.

Note: , the interrupt request and dma request cannot be used at the same time, that is to say When DMA support is enabled by setting SCR[DMAEN] and the interrupt is enabled by setting SCR[IER], SCR[IEF], or both, the corresponding change on COUT forces a DMA transfer request rather than a CPU interrupt instead

---

typedef struct *_cmp_config* cmp_config_t

CMP configuration structure.

struct _cmp_dac_config

#include <fsl_cmp.h> CMP internal DAC configuration structure.

Public Members

cmp_dac_vref_source_t eDACVrefSource

DAC reference voltage source.

uint8_t u8DACOutputVoltageDivider

divider Value for the DAC Output Voltage, DAC output voltage = (VREF / 256) * (u8DACOutputVoltageDivider + 1).

bool bEnableInternalDAC

flag to control if the internal DAC need to be enabled

union _cmp_dma_interrupt_config

#include <fsl_cmp.h> CMP dma/interrupt configure union.

Note: , the interrupt request and dma request cannot be used at the same time, that is to say When DMA support is enabled by setting SCR[DMAEN] and the interrupt is enabled by setting SCR[IER], SCR[IEF], or both, the corresponding change on COUT forces a DMA transfer request rather than a CPU interrupt instead

Public Members

cmp_dma_request_t eDMARequest

dma request type

cmp_interrupt_request_t eInterruptRequest

interrupt request type

struct __cmp__config

#include <fsl_cmp.h> CMP configuration structure.

Public Members

cmp_hysteresis_level_t eHysteresisLevel

CMP hysteresis leveL

cmp_comparasion_speed_mode_t eComparasionSpeedMode

CMP comparison speed mode

cmp_work_mode_t eWorkMode

CMP work mode

cmp_input_mux_t ePlusInput

CMP plus input mux, the definition of this enum is in soc header file

cmp_input_mux_t eMinusInput

CMP minus input mux, the definition of this enum is in soc header file

cmp_dac_config_t sDacConfig

CMP internal DAC configuration structure *cmp_dac_config_t*

bool bInvertComparatorOutputPolarity

Inverted comparator output polarity.

cmp_window_output_mode_t eWindowOutputMode

only works when cmp work mode is kCMP_WorkModeWindowEnabledAndNoExternalSample

cmp_filter_count_t eFilterCount

Filter Count.Available range is 0-7, 0 is disable internal filter can be used in internal sampling mode only.

uint8_t u8FilterPeriod

Filter Period. The divider to the bus clock. Available range is 0-255, can be used in internal sampling mode. When the filter clock from internal divided bus clock, setting the sample period to 0 will disable the filter

cmp_external_sample_count_t eExternalSampleCount

Available range is 1 - 7, used in external sampling mode only

cmp_output_source_t eOutputSource

cmp output source

bool bEnableOutputPin

the comparator output(CMPO) is driven out on the associated CMPO output pin

cmp_dma_interrupt_config_t uDmaInterruptConfig

CMP interrupt/dma configuration

bool bCMPEnable

flag to control if CMP module start immediately when the configuration is done

2.7 The Driver Change Log

2.8 CMP Peripheral and Driver Overview

2.9 COP: Computer Operating Properly(Watchdog) Driver

void COP_Init(COP_Type *base, const *cop_config_t* *psConfig)

Initializes the COP module with input configuration.

Call this function to do initialization configuration for COP module. The configurations are:

- COP configuration write protect enablement
- Clock source selection for COP module
- Prescaler configuration to the input clock source
- Counter timeout value
- Window value
- WAIT/STOP work mode enablement
- Interrupt enable/disable and interrupt timing value
- Loss of reference counter enablement
- COP enable/disable

note: Once set bEnableWriteProtect=true, the CTRL, INTVAL, WINDOW and TOUT registers are read-only.

Parameters

- base – COP peripheral base address.
- psConfig – The pointer to COP configuration structure, *cop_config_t*.

void COP_GetDefaultConfig(*cop_config_t* *psConfig)

Prepares an available pre-defined setting for module's configuration.

This function initializes the COP configuration structure to default values.

```
psConfig->bEnableWriteProtect = false;
psConfig->bEnableWait = false;
psConfig->bEnableStop = false;
psConfig->bEnableLossOfReference = false;
psConfig->bEnableInterrupt = false;
psConfig->bEnableCOP       = false;
psConfig->ePrescaler = kCOP_ClockPrescalerDivide1;
psConfig->u16TimeoutCount = 0xFFFFU;
psConfig->u16WindowCount = 0xFFFFU;
psConfig->u16InterruptCount = 0xFFU;
psConfig->eClockSource = kCOP_RoscClockSource;
```

Parameters

- psConfig – Pointer to the COP configuration structure, *cop_config_t*.

static inline void COP_Enable(COP_Type *base, bool bEnable)

Enable/Disable the COP module.

This function disables the COP Watchdog. To disable the COP Watchdog, call COP_Enable(base, false).

Parameters

- base – COP peripheral base address.
- bEnable – Enable the feature or not.

static inline void COP_EnableLossOfReferenceCounter(COP_Type *base, bool bEnable)

Enables or disables the COP Loss of Reference counter.

This function writes a value into the COP_CTRL register to enable or disable the COP Loss of Reference counter.

Parameters

- base – COP peripheral base address.
- bEnable – Enable the feature or not.

static inline void COP_SetTimeoutCount(COP_Type *base, uint16_t u16TimeoutCount)

Sets the COP timeout value.

This function sets the COP timeout value, if psConfig->bEnableWriteProtect is set to true for calling WDOG_Init, the set does not take effect. It should be ensured that the time-out value for the COP is always greater than interrupt time + 40 bus clock cycles. This function writes a value into COP_TOUT register, when COP count down to zero from the timeout count value, COP_RST_B signal will be asserted. There are some considerations for setting the timeout count afer COP is enabled:

- The recommended procedure for changing TIMEOUT is to disable the COP by invoking *COP_Enable()*, then call the function COP_SetTimeoutCount, and then re-enable the by invoking *COP_Enable()* again.
- Alternatively, call the function COP_SetTimeoutCount, then feed the COP by invoking *COP_Refresh()* to reload the timeout.

Parameters

- base – COP peripheral base address

- u16TimeoutCount – COP timeout value, count of COP clock tick. Use macro definition MSEC_TO_COUNT to convert value in ms to count of ticks, the COP clock rate is source clock divide prescaler.

static inline void COP_SetInterruptCount(COP_Type *base, uint16_t u16InterruptCount)

Sets the COP interrupt value.

This function sets the COP interrupt value, if psConfig->bEnableWriteProtect is set to true for calling WDOG_Init, the set does not take effect. This function writes a value into COP_INTVAL register, if COP interrupt is enabled and COP count down to the interrupt value configured, an interrupt will be triggered. Ensure the COP counter is disabled while the function is called.

Parameters

- base – COP peripheral base address
- u16InterruptCount – COP interrupt value, count of COP clock tick. Use macro definition MSEC_TO_COUNT to convert value in ms to count of ticks, the COP clock rate is source clock divide prescaler.

static inline void COP_SetWindowCount(COP_Type *base, uint16_t u16WindowCount)

Sets the COP window value.

This function sets the COP window value, if psConfig->bEnableWriteProtect is set to true for calling WDOG_Init, the set does not take effect. This function writes a value into COP_WINDOW register. Ensure the COP counter is disabled while the function is called.

Parameters

- base – COP peripheral base address
- u16WindowCount – COP window value, count of COP clock tick. Use macro definition MSEC_TO_COUNT to convert value in ms to count of ticks, the COP clock rate is source clock divide prescaler.

void COP_Refresh(COP_Type *base)

Refreshes the COP timer.

This function feeds/services the COP.

Parameters

- base – COP peripheral base address.

static inline void COP_EnableInterrupt(COP_Type *base)

Enables the COP interrupt, if psConfig->bEnableWriteProtect is set to true for calling WDOG_Init, the operation does not take effect.

This function writes a value into the COP_CTRL register to enable the COP interrupt.

Parameters

- base – COP peripheral base address

static inline void COP_DisableInterrupt(COP_Type *base)

Disables the COP interrupt, if psConfig->bEnableWriteProtect is set to true for calling WDOG_Init, the operation does not take effect.

This function writes a value into the COP_CTRL register to disable the COP interrupt.

Parameters

- base – COP peripheral base address

FSL_COP_DRIVER_VERSION

COP driver version.

COP_FIRST_WORD_OF_REFRESH
COP refresh key word.
First word of refresh sequence

COP_SECOND_WORD_OF_REFRESH
Second word of refresh sequence

enum _cop_clock_source
enumeration for COP clock source selection.
Values:

enumerator kCOP_RoscClockSource
COP clock sourced from Relaxation oscillator (ROSC)

enumerator kCOP_CoscClockSource
COP clock sourced from Crystal oscillator (COSCs)

enumerator kCOP_BusClockSource
COP clock sourced from IP Bus clock

enumerator kCOP_LpoClockSource
COP clock sourced from Low speed oscillator

enum _cop_clock_prescaler
enumeration for COP clock prescaler to input source clock.
Values:

enumerator kCOP_ClockPrescalerDivide1
Divided by 1

enumerator kCOP_ClockPrescalerDivide16
Divided by 16

enumerator kCOP_ClockPrescalerDivide256
Divided by 256

enumerator kCOP_ClockPrescalerDivide1024
Divided by 1024

typedef enum *_cop_clock_source* cop_clock_source_t
enumeration for COP clock source selection.

typedef enum *_cop_clock_prescaler* cop_clock_prescaler_t
enumeration for COP clock prescaler to input source clock.

typedef struct *_cop_config* cop_config_t
structure for COP module initialization configuration.

struct _cop_config

#include <fsl_cop.h> structure for COP module initialization configuration.

Public Members

bool bEnableWriteProtect

Set COP Write protected

bool bEnableStop

Enable or disable COP in STOP mode

bool bEnableWait

Enable or disable COP in WAIT mode

bool bEnableLossOfReference

Enable or disable COP loss of reference counter

bool bEnableInterrupt

Enables or disables COP interrupt

bool bEnableCOP

Enables or disables COP module

cop_clock_source_t eClockSource

Set COP clock source

cop_clock_prescaler_t ePrescaler

Set COP clock prescaler

uint16_t u16TimeoutCount

Timeout count in clock cycles, Use macro definition MSEC_TO_COUNT to convert value in ms to count of ticks, the COP clock rate is source clock divide prescaler.

uint16_t u16WindowCount

Window count in clock cycles, Use macro definition MSEC_TO_COUNT to convert value in ms to count of ticks, the COP clock rate is source clock divide prescaler.

uint16_t u16InterruptCount

Interrupt count in clock cycles, Use macro definition MSEC_TO_COUNT to convert value in ms to count of ticks, the COP clock rate is source clock divide prescaler.

2.10 The Driver Change Log

2.11 COP Peripheral and Driver Overview

2.12 CRC: Cyclic Redundancy Check Driver

void CRC_Init(CRC_Type *base, const *crc_config_t* *psConfig)

Enables and configures the CRC peripheral module.

This function enables the clock gate in the SIM module for the CRC peripheral. It also configures the CRC module and starts a checksum computation by writing the seed.

Parameters

- base – CRC peripheral address.
- psConfig – CRC module configuration structure.

void CRC_Deinit(CRC_Type *base)

Disables the CRC peripheral module.

This function disables the clock gate in the SIM module for the CRC peripheral.

Parameters

- base – CRC peripheral address.

static inline void CRC_GetDefaultConfig(*crc_config_t* *psConfig, *crc_protocol_type_t* eCrcProtocol)

Provide default CRC protocol configuration.

The purpose of this API is to initialize the configuration structure to default value for *CRC_Init* to use. Provides the configuration of commonly used CRC protocols. refer to *crc_protocol_type_t*.

This is an example:

```
crc_config_t sConfig;
//LoadCRC-16/MAXIM protocol configuration.
CRC_GetDefaultConfig(&sConfig, kCRC_Crc16);
CRC_Init(CRC, &sConfig);
```

Parameters

- psConfig – CRC protocol configuration structure.
- eCrcProtocol – CRC protocol type. refer to *crc_protocol_type_t*

static inline void CRC_SetSeedValue(CRC_Type *base, uint32_t u32CrcSeedValue)

Set the CRC seed value.

This function is help to write a 16/32 bit CRC seed value.

Parameters

- base – CRC peripheral address.
- u32CrcSeedValue – The value of seed.

static inline void CRC_SetPolynomial(CRC_Type *base, uint32_t u32CrcPolynomial)

Set the value of the polynomial for the CRC calculation.

Write a 16-bit or 32-bit polynomial to CRC Polynomial register for the CRC calculation.

Parameters

- base – CRC peripheral address.
- u32CrcPolynomial – The CRC polynomial.

static inline void CRC_SetWriteTransposeType(CRC_Type *base, *crc_transpose_type_t* eTransposeIn)

Set CRC type of transpose of write data.

This function help to configure CRC type of transpose of write data.

Parameters

- base – CRC peripheral address.
- eTransposeIn – Type Of transpose for input. See *crc_transpose_type_t*

static inline void CRC_SetReadTransposeType(CRC_Type *base, *crc_transpose_type_t* eTransposeOut)

Set CRC type of transpose of read data.

This function help to configure CRC type of transpose of read data.

Parameters

- base – CRC peripheral address.
- eTransposeOut – Type Of transpose for output. See *crc_transpose_type_t*

static inline void CRC_EnableComplementChecksum(CRC_Type *base, bool bEnable)

Enable/Disable complement of read CRC checksum.

Set complement of read CRC checksum. Some CRC protocols require the final checksum to be XORed with 0xFFFFFFFF or 0xFFFF.

Parameters

- base – CRC peripheral address.
- bEnable – True or false. True if the result shall be complement of the actual checksum.

static inline void CRC_SetProtocolWidth(CRC_Type *base, *crc_bits_t* eCrcBits)

Set bit width of CRC protocol.

Selects 16-bit or 32-bit CRC protocol.

Parameters

- base – CRC peripheral address.
- eCrcBits – 16 or 32 bit CRC protocol. See *crc_bits_t*

void CRC_WriteData(CRC_Type *base, const uint8_t *pu8Data, uint32_t u32DataSize)

Writes data to the CRC module.

Writes input data buffer bytes to the CRC data register. The configured type of transpose is applied.

Parameters

- base – CRC peripheral address.
- pu8Data – Input data stream, MSByte in data[0].
- u32DataSize – Size in bytes of the input data buffer.

static inline uint32_t CRC_Get32bitResult(CRC_Type *base)

Reads the 32-bit checksum from the CRC module.

Reads the CRC data register (either an intermediate or the final checksum). The configured type of transpose and complement is applied.

Parameters

- base – CRC peripheral address.

Returns
An intermediate or the final 32-bit checksum, after transpose and complement operations configured.

uint16_t CRC_Get16bitResult(CRC_Type *base)

Reads a 16-bit checksum from the CRC module.

Reads the CRC data register (either an intermediate or the final checksum). The configured type of transpose and complement is applied.

Parameters

- base – CRC peripheral address.

Returns
An intermediate or the final 16-bit checksum, after transpose and complement operations configured.

FSL_CRC_DRIVER_VERSION

CRC driver version. Version.

enum _crc_protocol_type

CRC protocol type.

Values:

enumerator kCRC_Crc16

CRC-16/MAXIM protocol.

enumerator kCRC_Crc16CCITT

CRC-16-CCITT protocol.

enumerator kCRC_Crc16Kermit

CRC-16/KERMIT protocol.

enumerator kCRC_Crc32

CRC-32 protocol.

enumerator kCRC_Crc32Posix

CRC-32/POSIX protocol.

enum _crc_bits

CRC protocol bit width.

Values:

enumerator kCRC_Bits16

Generate 16-bit CRC code.

enumerator kCRC_Bits32

Generate 32-bit CRC code.

enum _crc_transpose_type

CRC type of transpose of read/write data.

Values:

enumerator kCRC_TransposeNone
No transpose.

enumerator kCRC_TransposeBits
Transpose bits in bytes.

enumerator kCRC_TransposeBitsAndBytes
Transpose bytes and bits in bytes.

enumerator kCRC_TransposeBytes
Transpose bytes.

typedef enum *_crc_protocol_type* crc_protocol_type_t
CRC protocol type.

typedef enum *_crc_bits* crc_bits_t
CRC protocol bit width.

typedef enum *_crc_transpose_type* crc_transpose_type_t
CRC type of transpose of read/write data.

typedef struct *_crc_config* crc_config_t
CRC protocol configuration.
This structure holds the configuration for the CRC protocol.

struct _crc_config
#include <fsl_crc.h> CRC protocol configuration.
This structure holds the configuration for the CRC protocol.

Public Members

uint32_t u32CrcPolynomial
CRC Polynomial, MSBit first. Example polynomial: 0x1021 = 1_0000_0010_0001 = x^12+x^5+1

uint32_t u32CrcSeedValue
Starting checksum value

bool bEnableComplementChecksum
Enable/Disable complement of read CRC checksum.

crc_transpose_type_t eTransposeIn
Select type of transpose of input data.

crc_transpose_type_t eTransposeOut
Select type of transpose of output data.

crc_bits_t eCrcBits

Select 16-bit or 32-bit CRC protocol.

2.13 The Driver Change Log

2.14 CRC Peripheral and Driver Overview

2.15 DAC: 12-bit Digital-to-Analog Converter Driver

void DAC_Init(DAC_Type *base, const *dac_config_t* *psConfig)

Initializes the DAC resource, including data format, sync signal, operation mode, etc.

Parameters

- base – DAC peripheral base address.
- psConfig – The pointer to *dac_config_t*.

void DAC_Deinit(DAC_Type *base)

De-initializes the DAC resource, the clock and power will be gated off.

Invoking this function to power down the analog portion of DAC and disable the DAC clock.

Parameters

- base – DAC peripheral base address.

void DAC_GetDefaultConfig(*dac_config_t* *psConfig)

Gets the default DAC configs, such as operation mode, watermark level, sync signal, etc.

```
psConfig->eOperationMode = kDAC_NormalOperationMode;
psConfig->uOperationConfig.sNormalModeConfig.u16DataFIFO   = 0U;
psConfig->bEnableDMA                                       = false;
psConfig->eWatermarkLevel = kDAC_WatermarkValue2;
psConfig->eSyncInputEdge                                   = kDAC_RisingEdge;
psConfig->eSpeedMode                                       = kDAC_HighSpeedMode;
psConfig->eDataFormat                                      = kDAC_DataWordRightJustified;
psConfig->eSyncSignal                                      = kDAC_InternalClockSignal;
psConfig->bEnableAnalogPortion                             = false;
psConfig->bEnableGlitchFilter                              = true;
psConfig->u8GlitchFilterCount                              = 29U;
```

Parameters

- psConfig – The pointer to *dac_config_t*.

static inline void DAC_SetSyncEdge(DAC_Type *base, *dac_sync_input_edge_t* eSyncEdge)

Selects which SYNC input edge is used for updates, available selections are “no active edge”, “falling edge”, “rising edge”, “both edge”.

Parameters

- base – DAC peripheral base address.
- eSyncEdge – The input edge to be set, please refer to *dac_sync_input_edge_t* for details.

static inline void DAC_SetLDOK(DAC_Type *base)

Updates the buffered value of stepSize, minValue ,and maxValue at the active edge of the SYNC_IN signal.

Note: Allows new values of minimum, maximum, and step value to be updated by active edge of SYNC_IN. This function should be invoked once new values of these buffered registers have been written by software. The LDOK bit will be cleared by an active edge of SYNC_IN.

Note: This function is only useful when the operation mode is selected as Automatic operation mode.

Parameters

- base – DAC peripheral base address.

static inline bool DAC_GetLDOKValue(DAC_Type *base)

Gets the value of load Okay bit field.

Note: When the SYNC signal is selected as external SYNC_IN signal, the load okay bit will be cleared by an active edge of the SYNC_IN signal. This function can be used to check whether the active edge of the SYNC_IN signal has reached.

Note: This function is only useful when the operation mode is selected as Automatic operation mode.

Parameters

- base – DAC peripheral base address.

Returns

- **true** The active edge of SYNC_IN signal has not reached when the SYNC signal is selected as external SYNC_IN signal.
- **false** The active edge of SYNC_IN signal has reached when the SYNC signal is selected as external SYNC_IN signal

static inline void DAC_EnableOneShot(DAC_Type *base, bool bEnable)

Enables/Disables Oneshot feature, oneshot feature used to determines whether automatic waveform generation creates one waveform or a repeated waveform within the period defined by the active SYNC edges.

Note: This function only useful when the operation mode is selected as automatic operation mode.

Parameters

- base – DAC peripheral base address.
- bEnable – Enable/Disable oneshot feature.
  - **true** Automatic waveform generation logic will create a single pattern and stop at the final value.

– **false** Automatic waveform generation logic will create a repeated (continuous) waveform upon receiving an active SYNC edge.

static inline void DAC_WriteDataFIFO(DAC_Type *base, uint16_t u16Data)

Writes DAC buffered data value based on the data format when the DAC is in normal operation mode.

Parameters

- base – DAC peripheral base address.
- u16Data – The DAC data to be converted to analog. If the data format is set as *kDAC_DataWordRightJustified* then u16Data should range from 0 to 4095, which means the higher 4 bits is useless. If the data format is set as *kDAC_DataWordLeftJustified*, then the u16Data should range from 16 to 65520, which means the lower 4 bits is useless.

static inline void DAC_WriteStepSize(DAC_Type *base, uint16_t u16StepSize)

Writes Step size based on the data format when the DAC is in automatic operation mode.

Note: This function only useful when the operation mode is selected as automatic operation mode.

Parameters

- base – DAC peripheral base address.
- u16StepSize – The step value to be added to or subtracted from the current value. If the data format is set as *kDAC_DataWordRightJustified* then u16StepSize should range from 0 to 4095, which means the higher 4 bits is useless. If the data format is set as *kDAC_DataWordLeftJustified*, then the u16StepSize should range from 16 to 65520, which means the lower 4 bits is useless.

static inline void DAC_WriteMinValue(DAC_Type *base, uint16_t u16MinValue)

Writes the minium value based on the data format when the DAC is in automatic operation mode.

Note: This function only useful when the operation mode is selected as automatic operation mode. If DAC input data is less than the minium value, output is limited to the minium value during automatic waveform generation.

Parameters

- base – DAC peripheral base address.
- u16MinValue – The lower range limit during automatic waveform generation. If the data format is set as *kDAC_DataWordRightJustified* then u16MinValue should range from 0 to 4095, which means the higher 4 bits is useless. If the data format is set as *kDAC_DataWordLeftJustified*, then the u16MinValue should range from 16 to 65520, which means the lower 4 bits is useless.

static inline void DAC_WriteMaxValue(DAC_Type *base, uint16_t u16MaxValue)

Writes the maximum value based on the data format when the DAC is in automatic operation mode.

Note: This function only useful when the operation mode is selected as automatic operation mode. If DAC input data is greater than maximum value, output is limited to maximum value during automatic waveform generation.

Parameters

- base – DAC peripheral base address.
- u16MaxValue – The upper range limit during automatic waveform generation. If the data format is set as *kDAC_DataWordRightJustified* then u16MaxValue should range from 0 to 4095, which means the higher 4 bits is useless. If the data format is set as *kDAC_DataWordLeftJustified*, then the u16MaxValue should range from 16 to 65520, which means the lower 4 bits is useless.

static inline void DAC_ConfigRefreshFrequency(DAC_Type *base, uint16_t u16CompareValue)

Sets refresh frequency that used to decide when the automatically generated waveform value is updated.

Note: This function only useful when the operation mode is selected as automatic operation mode.

Parameters

- base – DAC peripheral base address.
- u16CompareValue – The compare value(0~65535).
  - **u16CompareValue=0** The generated waveform will be updated every clock cycle.
  - **u16CompareValue=N**(N!=0) The generated waveform will be updated every N+1 clock cycles.

static inline void DAC_EnableDMA(DAC_Type *base, bool bEnable)

Enables/Disables DMA request that to be generated when the FIFO is below the watermark level.

Note: This function is only useful when the operation mode is selected as Normal mode.

Parameters

- base – DAC peripheral base address.
- bEnable – Enable/Disable DMA support.
  - **true** Enable DMA support.
  - **false** Disable DMA support.

static inline void DAC_SetWatermarkLevel(DAC_Type *base, *dac_watermark_level_t* eWatermarkLevel)

Sets watermark level which is used for asserting a DMA request.

Note: When the level of FIFO is less than or equal to the Watermark level, a DMA request will be sent. This function is only useful when the operation mode is selected as Normal mode.

Parameters

- base – DAC peripheral base address.
- eWatermarkLevel – The watermark level of FIFO, please refer to *dac_watermark_level_t* for details.

static inline void DAC_EnableGlitchFilter(DAC_Type *base, bool bEnable)

Enables/Disables Glitch filter.

Parameters

- base – DAC peripheral base address.
- bEnable – Enable/Disable Glitch filter.
  - **true** Enable glitch filter.
  - **false** Disable glitch filter.

static inline void DAC_SetGlitchFilterCount(DAC_Type *base, uint8_t u8FilterCount)

Sets glitch filter count value(ranges from 0 to 63) that represents the number of clock cycles for which the DAC output is held unchanged after new data is presented to the analog DAC's inputs.

Parameters

- base – DAC peripheral base address.
- u8FilterCount – The count of glitch filter. This count represents the number of clock cycles for which the DAC output is held unchanged after new data is presented to the analog DAC's inputs.

static inline void DAC_SetSpeedMode(DAC_Type *base, *dac_speed_mode_t* eSpeedMode)

Selects speed mode, high speed mode uses more power and low speed mode saves power.

Parameters

- base – DAC peripheral base address.
- eSpeedMode – The speedMode to be set, please refer to *dac_speed_mode_t* for details.

static inline void DAC_EnableAnalogPortion(DAC_Type *base, bool bEnable)

Enables/Disables the operation of the analog portion of the DAC.

The function controls the power-up of the analog portion of the DAC. If powered up the analog portion, the DAC module will output the value currently presented to the Data register. The analog portion should be powered up when the DAC is in use. If power down the analog portion, the output of the DAC module will be pulled low. The analog portion should be powered down when the DAC is not in use.

Parameters

- base – DAC peripheral base address.
- bEnable – Power up/down the analog portion of the DAC.
  - **true** Power up the analog portion of the DAC, and the DAC will output the value currently presented to its inputs.

– **false** Power down the analog portion of the DAC, and its output will be pulled down.

static inline uint16_t DAC_GetFIFOStatusFlags(DAC_Type *base)

Gets the fifo status flag of selected DAC instance.

Parameters

- base – DAC peripheral base address.

Returns

The status flags of DAC module, should be the OR'ed value of *_dac_fifo_status_flags*.

FSL_DAC_DRIVER_VERSION

DAC driver version.

enum _dac_fifo_status_flags

The enumeration of DAC status flags, including FIFO full status flag and FIFO empty status flag.

Values:

enumerator kDAC_FIFOFullStatusFlag

Indicate the FIFO is full.

enumerator kDAC_FIFOEmptyStatusFlag

Indicate the FIFO is empty.

enum _dac_operation_mode

The enumeration of DAC operation mode, including normal operation mode and automatic operation mode.

Values:

enumerator kDAC_NormalOperationMode

Normal Mode to generate an analog representation of digital words.

enumerator kDAC_AutomaticOperationMode

Automatic Mode to generate waveform without requiring CPU or core assistance.

enum _dac_sync_signal_selection

The enumeration of DAC sync signal mode, including internal clock signal and external SYNC_IN signal.

Values:

enumerator kDAC_InternalClockSignal

Internal Clock signal is selected as SYNC signal, data written to the buffered registers is used on the next clock cycle

enumerator kDAC_ExternalSyncInSignal

Peripheral external signal is selected as SYNC signal, the update occurs on the active edge of SYNC_IN signal.

enum _dac_waveform_type

The enumeration of waveform type, such as square waveform, triangle waveform, etc.

Values:

enumerator kDAC_RepeatSawtoothWaveform0

DAC generates repeated sawtooth waveform0. The automatic waveform generation logic will create a repeated sawtooth waveform0 upon receiving an active SYNC edge, and the waveform repeats when it reaches its minimum and maximum value. The waveform increases from starting value to max value firstly. Like this following shown:

enumerator kDAC_RepeatSawtoothWaveform1

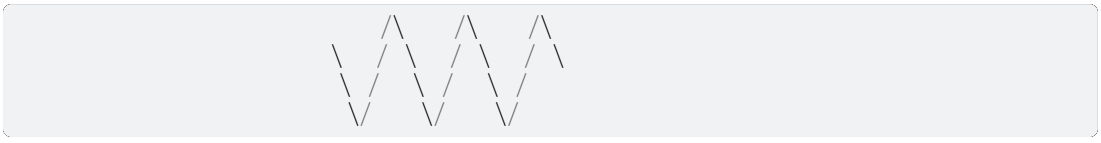
DAC generates sawtooth waveform1. The automatic waveform generation logic will create a repeated sawtooth waveform1 upon receiving an active SYNC edge, and the waveform repeats when it reaches its minimum and maximum value. The waveform decreases from starting value to min value firstly. Like this following shown:

enumerator kDAC_RepeatTriangleWaveform0

The automatic waveform generation logic will create a repeated triangle waveform0 upon receiving an active SYNC edge, and the waveform repeats when it reaches its minimum and maximum value. In this type the generated triangle waveform rises from the starting value. Like this following shown:

enumerator kDAC_RepeatTriangleWaveform1

The automatic waveform generation logic will create a repeated triangle waveform1 upon receiving an active SYNC edge, and the waveform repeats when it reaches its minimum and maximum value. In this type the generated triangle waveform drops from the starting value. Like this following shown:



enumerator kDAC_OneShotSawtoothWaveform0

Automatic waveform generation logic will create a single pattern and stop at the final value. It will remain at the finial value until a new active edge occurs on the SYNC input, and then the waveform will be repeated. Like this following shown:

enumerator kDAC_OneShotSawtoothWaveform1

Automatic waveform generation logic will create a single pattern and stop at the final value. It will remain at the finial value until a new active edge occurs on the SYNC input, and then the waveform will be repeated. Like this following shown:

:

enum _dac_sync_input_edge

The enumeration of sync input edge that used for updates buffered registers, such as Falling edge, etc.

Values:

enumerator kDAC_NoActiveEdge

No active edge is selected, it means the SYNC input is ignored.

enumerator kDAC_FallingEdge

Updates occur on the falling edge of the SYNC input.

enumerator kDAC_RisingEdge

Updates occur on the rising edge of the SYNC input.

enumerator kDAC_BothEdges

Updates occur on both edges of the SYNC input.

enum _dac_speed_mode

The enumeration of DAC speed mode, including high speed mode and low speed mode.

Values:

enumerator kDAC_HighSpeedMode

In High Speed Mode, the setting time of the DAC module is 1us, but the DAC module uses more power.

enumerator kDAC_LowSpeedMode

In Low Speed Mode, the DAC module uses less power but takes more time to settle.

enum _dac_watermark_level

The enumeration of FIFO watermark level.

Values:

enumerator kDAC_WatermarkValue0

Watermark value is 0.

enumerator kDAC_WatermarkValue2
Watermark value is 2.

enumerator kDAC_WatermarkValue4
Watermark value is 4.

enumerator kDAC_WatermarkValue6
Watermark value is 6

enum _dac_data_format
The enumeration of DAC data format, inclding right right-justified and left-justified.

Values:

enumerator kDAC_DataWordRightJustified
The 12 bits data is right-justified.

enumerator kDAC_DataWordLeftJustified
The 12 bits data iss left-justified.

typedef enum *_dac_operation_mode* dac_operation_mode_t
The enumeration of DAC operation mode, including normal operation mode and automatic operation mode.

typedef enum *_dac_sync_signal_selection* dac_sync_signal_selection_t
The enumeration of DAC sync signal mode, including internal clock signal and external SYNC_IN signal.

typedef enum *_dac_waveform_type* dac_waveform_type_t
The enumeration of waveform type, such as square waveform, triangle waveform, etc.

typedef enum *_dac_sync_input_edge* dac_sync_input_edge_t
The enumeration of sync input edge that used for updates buffered registers, such as Falling edge, etc.

typedef enum *_dac_speed_mode* dac_speed_mode_t
The enumeration of DAC speed mode, including high speed mode and low speed mode.

typedef enum *_dac_watermark_level* dac_watermark_level_t
The enumeration of FIFO watermark level.

typedef enum *_dac_data_format* dac_data_format_t
The enumeration of DAC data format, inclding right right-justified and left-justified.

typedef struct *_dac_normal_mode_config* dac_normal_mode_config_t
The structure of configuration when the operation mode is selected are normal operation mode.

typedef struct *_dac_automatic_mode_config* dac_automatic_mode_config_t
The structure of configuration when the operation mode is selected as automatic operation mode.

typedef union *_dac_operation_config* dac_operation_config_u

The union of operation modes' configuration.

typedef struct *_dac_config* dac_config_t

The structure for configuring the DAC.

This structure is used to config the DAC module, to initialize the DAC module, user must set the member of this structure. This structure will cost 20 Byte memory space.

struct _dac_normal_mode_config

#include <fsl_dac.h> The structure of configuration when the operation mode is selected are normal operation mode.

Public Members

bool bEnableDMA

Enable/Disable DMA support.

- **true** Enable DMA support.
- **false** Disable DMA support.

uint16_t u16DataFIFO

The FIFO watermark level, if the level of FIFO is less than or equal to the watermark level field, a DMA request should be sent. The DAC data to be converted to analog. If the data format is set as *kDAC_DataWordRightJustified* then u16DataFIFO should range from 0 to 4095, which means the higher 4 bits is useless. If the data format is set as *kDAC_DataWordLeftJustified*, then the u16DataFIFO should range from 16 to 65520, which means the lower 4 bits is useless.

struct _dac_automatic_mode_config

#include <fsl_dac.h> The structure of configuration when the operation mode is selected as automatic operation mode.

Public Members

dac_waveform_type_t eWaveformType

The type of waveform to be generated.

uint16_t u16MinValue

The step size to be added to or subtracted from the current value. If the data format is set as *kDAC_DataWordRightJustified* then u16StepSize should range from 0 to 4095, which means the higher 4 bits is useless. If the data format is set as *kDAC_DataWordLeftJustified* , then the u16StepSize should range from 16 to 65520, which means the lower 4 bits is useless.

The minimum value is the lower range limit during automatic waveform generation. If the data format is set as *kDAC_DataWordRightJustified* then u16MinValue should range from 0 to 4095, which means the higher 4 bits is useless. If the data format is set as *kDAC_DataWordLeftJustified*, then the u16MinValue should range from 16 to 65520, which means the lower 4 bits is useless.

uint16_t u16MaxValue

The maximum value is the upper range limit during automatic waveform generation. If the data format is set as *kDAC_DataWordRightJustified* then u16MaxValue should range from 0 to 4095, which means the higher 4 bits is useless. If the data format is set as *kDAC_DataWordLeftJustified*, then the u16MaxValue should range from 16 to 65520, which means the lower 4 bits is useless.

uint16_t u16StartValue

The start value of the wavefrom, should larger than the minium value and smaller than the maximum value.

uint16_t u16CompareValue

The compare value that used to decide the frequency of REFRESH signal. The available range is 0 ~ 65535.

- **u16CompareValue=0** The REFRESH signal's frequency is equal to the clock's frequency so that the generated waveform will be updated every clock cycle.
- **u16CompareValue=N**(N!=0) The REFRESH signal's frequency is equal to clock's frequency divided N+1 so that the generated waveform will be updated every N+1 clock cycles

union __dac__operation__config

#include <fsl_dac.h> The union of operation modes' configuration.

Public Members

dac_normal_mode_config_t sNormalModeConfig

The configuration of normal operation mode, such as buffered data, watermark level, etc.

dac_automatic_mode_config_t sAutomaticModeConfig

The configuration of automatic operation mode, such as step size, minimum value, maximum value, etc.

struct __dac__config

#include <fsl_dac.h> The structure for configuring the DAC.

This structure is used to config the DAC module, to initialize the DAC module, user must set the member of this structure. This structure will cost 20 Byte memory space.

Public Members

dac_operation_mode_t eOperationMode

The operation mode. The available selections are *kDAC_NormalOperationMode* and *kDAC_AutomaticOperationMode*.

dac_sync_signal_selection_t eSyncSignal

The selected sync signal that used to update buffered data, the available selections are *kDAC_InternalClockSignal* and *kDAC_ExternalSyncInSignal*

dac_sync_input_edge_t eSyncInputEdge

The SYNC input edge used to update buffered registers. The buffered value will be updated at the selected active edge of SYNC_IN signal.

dac_data_format_t eDataFormat

The data format of DAC instance. The available selections are *kDAC_DataWordRightJustified* and *kDAC_DataWordLeftJustified*

dac_operation_config_u uOperationConfig

The configuration of operation mode.

bool bEnableGlitchFilter

Enable/Disable glitch suppression filter.

- **true** Enable glitch filter.
- **false** Disable glitch filter.

uint8_t u8GlitchFilterCount

The count(ranges from 0 to 63) represents the number of clock cycles for which the DAC output is held unchanged after new data is presented to the analog DAC's inputs.

dac_speed_mode_t eSpeedMode

The speed mode of DAC instance. The available selections are *kDAC_HighSpeedMode* and *kDAC_LowSpeedMode*.

bool bEnableAnalogPortion

Power up/down the analog portion.

- **true** Power up the analog portion of the DAC, and the DAC will output the value currently presented to its inputs.
- **false** Power down the analog portion of the DAC, and its output will be pulled down.

2.16 The Driver Change Log

2.17 DAC Peripheral and Driver Overview

2.18 DMAMUX: DMA Channel Multiplexer Driver

static inline void DMAMUX_ConnectChannelToTriggerSource(DMAMUX_Type *base, *dmamux_dma_channel_t* eChannel, dma_request_source_t eSource)

Connect the DMAMUX channel to trigger source.

This function will connnect a source to the specify dma channel and enable that channel

Parameters

- base – DMAMUX peripheral base address.
- eChannel – DMAMUX channel index, *dmamux_dma_channel_t*.

- eSource – DMA request source.

static inline void DMAMUX_DisconnectChannelFromTriggerSource(DMAMUX_Type *base, *dmamux_dma_channel_t* eChannel)

Disconnect the DMAMUX channel.

This function will disable the specified channel and reset the channel source.

Parameters

- base – DMAMUX peripheral base address.
- eChannel – DMAMUX channel index, *dmamux_dma_channel_t*.

FSL_DMAMUX_DRIVER_VERSION

DMAMUX driver version.

enum _dmamux_dma_channel

List of Dmamux dma channels.

Values:

enumerator kDMAMUX_DMAChannel0

Dmamux dma channel 0

enumerator kDMAMUX_DMAChannel1

Dmamux dma channel 1

enumerator kDMAMUX_DMAChannel2

Dmamux dma channel 2

enumerator kDMAMUX_DMAChannel3

Dmamux dma channel 3

typedef enum *_dmamux_dma_channel* dmamux_dma_channel_t

List of Dmamux dma channels.

2.19 The Driver Change Log

2.20 DMAMUX Peripheral and Driver Overview

2.21 The Driver Change Log

2.22 EDMA: Enhanced Direct Memory Access Driver

void EDMA_GetDefaultConfig(*edma_config_t* *psConfig)

Get default edma peripheral configuration.

Note: This function will reset all of the configuration structure members to zero firstly, then apply default configurations to the structure.

Parameters

- psConfig – pointer to user's eDMA config structure, see edma_config_t for detail.

void EDMA_Init(DMA_Type *base, *edma_config_t* *psConfig)

EDMA initialization.

Parameters

- base – eDMA peripheral base address.
- psConfig – pointer to user's eDMA config structure, see edma_transfer_config_t for detail.

void EDMA_Deinit(DMA_Type *base)

EDMA De-initialization.

Parameters

- base – eDMA peripheral base address.

static inline void EDMA_EnableContinuousChannelLinkMode(DMA_Type *base, bool bEnable)

Enable/Disable arbitration before the channel been activate by minor loop link trigger from itself.

A minor loop channel link made to itself does not go through channel arbitration before being activated again. Upon minor loop completion, the channel activates again if that channel has a minor loop channel link enabled and the link channel is itself. This effectively applies the minor loop offsets and restarts the next minor loop.

Note: Do not use continuous link mode with a channel linking to itself if there is only one minor loop iteration per service request, for example, if the channel's NBYTES value is the same as either the source or destination size. The same data transfer profile can be achieved by simply increasing the NBYTES value, which provides more efficient, faster processing.

Parameters

- base – EDMA peripheral base address.
- bEnable – true is channel link to itself without arbitration false is channel link to itself with arbitration

static inline void EDMA_EnableMinorLoopMapping(DMA_Type *base, bool bEnable)

Enable/Disable redefine the minor loop bytes register.

The TCDn.word2 is redefined to include individual enable fields, an offset field and the NBYTES field, the offset will be applied to source/destination address after minor loop complete

Parameters

- base – EDMA peripheral base address.
- bEnable – true is minor loop bytes register redefined to individual enable/offset/minor loop bytes fields. false is minor loop bytes register defined as minor loop bytes fields only.

static inline void EDMA_EnableHaltOnError(DMA_Type *base, bool bEnable)

Enable/Disable the eDMA halt when error occur feature.

Any error causes the HALT bit to set will cause the EDMA halt. Subsequently, all service requests are ignored until the HALT bit is cleared

Parameters

- base – EDMA peripheral base address.
- bEnable – true is Stall the start of any new channels when error occur. false is eDMA service request operation normal when error occur.

static inline void EDMA_SetArbitration(DMA_Type *base, *edma_arbitration_type_t* eArbitration)

set EDMA arbitration type to fixed priority or round robin.

Parameters

- base – EDMA peripheral base address.
- eArbitration – Arbitration by priority or round robin, *edma_arbitration_type_t*.

void EDMA_GetChannelDefaultTransferConfig(*edma_channel_transfer_config_t* *psTransfer, uint32_t u32SrcAddr, uint32_t u32DstAddr, uint32_t u32BytesEachRequest, uint32_t u32TotalBytes, *edma_channel_transfer_width_t* eTransferWidth, *edma_channel_transfer_type_t* eTransferType)

Get channel default transfer configuration.

Note: 1. This function will reset all of the configuration structure members to zero firstly, then apply default configurations to the structure.

a. No interrupt enabled by this function by default, if application would like to use DMA interrupt please enable it manually by psTransfer->u16EnabledInterruptMask = _edma_channel_interrupt

---

Parameters

- psTransfer – pointer to user's eDMA channel configure structure, see edma_channel_transfer_config_t for detail.
- u32SrcAddr – source address, must be byte address.
- u32DstAddr – destination address, must be byte address.
- u32BytesEachRequest – bytes to be transferred in each request(namely, in each minor loop).
- u32TotalBytes – total bytes to be transferred.
- eTransferWidth – it represents how many bits are transferred in each read/write.
- eTransferType – eDMA channel transfer type.

void EDMA_SetChannelTransferConfig(DMA_Type *base, *edma_channel_t* eChannel, *edma_channel_transfer_config_t* *psTransfer)

EDMA set channel transfer configurations.

Note: 1.This function must not be called while the channel transfer is ongoing or it causes unpredictable results. 2.The psLinkTCD must be configured before invoke this API if scatter/gather function is needed 3.The edma channel request may be enabled after the channel transfer configure done according to the transfer configurations.

Parameters

- base – eDMA peripheral base address.
- eChannel – eDMA channel number.
- psTransfer – pointer to user's eDMA channel configure structure, see edma_channel_transfer_config_t for detail.

void EDMA_SetChannelMinorLoopOffset(DMA_Type *base, *edma_channel_t* eChannel, bool bEnableSrcMinorLoopOffset, bool bEnableDestMinorLoopOffset, int32_t i32MinorLoopOffset)

Configures the eDMA channel minor loop offset value.

The minor offset means that the signed-extended value is added to the source address or destination address after each minor loop.

Parameters

- base – eDMA peripheral base address.
- eChannel – eDMA channel number.
- bEnableSrcMinorLoopOffset – True is enable source address minor offset, otherwise is disable
- bEnableDestMinorLoopOffset – True is enable source address minor offset, otherwise is disable
- i32MinorLoopOffset – Minor loop offset value.

void EDMA_SetChannelPreemption(DMA_Type *base, *edma_channel_t* eChannel, bool bSuspendedByHighPriorityChannel, bool bSuspendLowPriorityChannel, uint8_t u8Priority)

Configures the eDMA channel preemption configurations.

This function configures the channel preemption attribute and the priority of the channel.

Note: , this function is used only in fixed-priority channel arbitration mode.

Parameters

- base – eDMA peripheral base address.
- eChannel – eDMA channel number
- bSuspendedByHighPriorityChannel – True is the channel can be suspended by high priority channel, otherwise cannot.
- bSuspendLowPriorityChannel – True is the channel can suspend low priority channel, otherwise cannot.
- u8Priority – Channel priority.

void EDMA_EnableMinorLoopChannelLink(DMA_Type *base, *edma_channel_t* eChannel, *edma_channel_t* eLinkChannel)

Enable the minor loop channel link and configure the linked channel number.

This function configures the minor link mode. The minor link means that the channel link is triggered every time that the minor loop bytes transferred complete.

Note: Users should ensure that DONE flag is cleared before calling this interface, or the configuration is invalid.

Parameters

- base – eDMA peripheral base address.
- eChannel – eDMA channel number.
- eLinkChannel – The linked channel number.

static inline void EDMA_DisableMinorLoopChannelLink(DMA_Type *base, *edma_channel_t* eChannel)

Disable the minor loop channel link for the eDMA transfer.

Parameters

- base – eDMA peripheral base address.
- eChannel – eDMA channel number.

void EDMA_EnableMajorLoopChannelLink(DMA_Type *base, *edma_channel_t* eChannel, *edma_channel_t* eLinkChannel)

Enable the major loop channel link and configure the linked channel number.

This function configures the major link mode. The major link means that the channel link is triggered when the CITER is exhausted.

Note: Users should ensure that DONE flag is cleared before calling this interface, or the configuration is invalid.

Parameters

- base – eDMA peripheral base address.
- eChannel – eDMA channel number.
- eLinkChannel – The linked channel number.

static inline void EDMA_DisableMajorLoopChannelLink(DMA_Type *base, *edma_channel_t* eChannel)

Disable the major loop channel link for the eDMA transfer.

Parameters

- base – eDMA peripheral base address.
- eChannel – eDMA channel number.

void EDMA_SetChannelBandWidth(DMA_Type *base, *edma_channel_t* eChannel, *edma_channel_bandwidth_t* eBandWidth)

Sets the edma channel stall cycles after each R/W.

Because the eDMA processes the minor loop, it continuously generates read/write sequences until the minor count is exhausted. The bandwidth forces the eDMA to stall after the completion of each read/write access to control the bus request bandwidth seen by the crossbar switch.

Note: : 1.If the source and destination sizes are equal, this field is ignored between the first and second transfers and after the last write of each minor loop. This behavior is a side effect of reducing start-up latency. 2.When executing a large, zero wait-stated memory-to-memory transfer, insert bandwidth control using the TCD_CSR[BWC] bits to avoid: •* Starvation of another master accessing the memory. •* Any delay in writing a TCD duloop the transfer.

Parameters

- base – eDMA peripheral base address.
- eChannel – eDMA channel number.
- eBandWidth – A bandwidth setting, which can be one of the *edma_channel_bandwidth_t*

void EDMA_SetChannelModulo(DMA_Type *base, *edma_channel_t* eChannel, *edma_channel_modulo_t* eSrcModulo, *edma_channel_modulo_t* eDestModulo)

Sets the source address range and the destination address range for the eDMA transfer.

This function defines a specific address range of source/destination address, after the source/destination address hits the range boundary, source/destination address will wrap to origin value.

Setting this field provides the ability to implement a circular data queue easily. For data queues require loop power-of-2 size bytes, the queue should start at a 0-modulo-size address and the SMOD field should be set to the appropriate value for the queue, freezing the desired number of upper address bits. The value programmed into this field specifies the number of lower address bits allowed to change

Parameters

- base – eDMA peripheral base address.
- eChannel – eDMA channel number.
- eSrcModulo – A source modulo value.
- eDestModulo – A destination modulo value.

static inline void EDMA_EnableChannelAsyncRequestInStopMode(DMA_Type *base, *edma_channel_t* eChannel, bool bEnable)

Enables the edma channel async request in stop mode.

The EARS register is used to enable or disable the DMA requests in Enable Request Register (ERQ) by AND'ing the bits of these two registers in stop mode only.

Parameters

- base – eDMA peripheral base address.
- eChannel – eDMA channel number.
- bEnable – The command to enable (true) or disable (false).

static inline void EDMA_EnableChannelAutoStopRequest(DMA_Type *base, *edma_channel_t* eChannel, bool bEnable)

Enables the edma channel auto disable request after major loop complete.

The eDMA hardware automatically clears the corresponding ERQ bit when the current major iteration count reaches zero.

Parameters

- base – eDMA peripheral base address.
- eChannel – eDMA channel number.
- bEnable – The command to enable (true) or disable (false).

void EDMA_SetChannelMajorLoopOffset(DMA_Type *base, *edma_channel_t* eChannel, int32_t i32SourceOffset, int32_t i32DestOffset)

Configures the eDMA channel major loop offset feature.

Adjustment value added to the source/destination address at the completion of the major iteration count

Parameters

- base – eDMA peripheral base address.
- eChannel – edma channel number.
- i32SourceOffset – source address offset.
- i32DestOffset – destination address offset.

static inline void EDMA_EnableChannelRequest(DMA_Type *base, *edma_channel_t* eChannel, bool bEnable)

Enable/disable the eDMA hardware channel request.

This function enables the hardware channel request.

Parameters

- base – eDMA peripheral base address.
- eChannel – eDMA channel number.
- bEnable – true is start, false is stop.

static inline void EDMA_SoftwareTriggerChannelStart(DMA_Type *base, *edma_channel_t* eChannel)

Starts the eDMA transfer by using the software trigger.

This function starts a minor loop transfer only, the channel will halt when minor loop complete, so application should re-call the function to start the transfer again.

Parameters

- base – eDMA peripheral base address.
- eChannel – eDMA channel number.

uint32_t EDMA_GetChannelRemainingMajorLoopCount(DMA_Type *base, *edma_channel_t* eChannel)

Gets the remaining major loop count from the eDMA current channel TCD.

This function checks the TCD (Transfer Control Descriptor) status for a specified eDMA channel and returns the number of major loop count that has not finished.

Note: 1. This function can only be used to get unfinished major loop count of transfer without the next TCD, or it might be inaccuracy.

a. The unfinished/remaining transfer bytes cannot be obtained directly from registers while the channel is running. Because to calculate the remaining bytes, the initial NBYTES configured in DMA_TCDn_NBYTES_MLNO register is needed while the eDMA IP does not support getting it while a channel is active. In another word, the NBYTES value reading is always the actual (decrementing) NBYTES value the dma_engine is working with while a channel is running. Consequently, to get the remaining transfer bytes, a software-saved initial value of NBYTES (for example copied before enabling the channel) is needed. The formula to calculate it is shown below: RemainingBytes = RemainingMajorLoopCount * NBYTES(initially configured)

Parameters

- base – eDMA peripheral base address.
- eChannel – eDMA channel number.

Return values

Major – loop count which has not been transferred yet for the current TCD.

void EDMA_EnableChannelInterrupts(DMA_Type *base, *edma_channel_t* eChannel, uint16_t u16InterruptsMask, bool bEnable)

Enables the edma channel interrupts according to a provided mask, the mask is a logical OR of enumerator members *_edma_channel_interrupt_enable*.

Parameters

- base – eDMA peripheral base address.
- eChannel – eDMA channel number.
- u16InterruptsMask – the mask is a logical OR of enumerator members *_edma_channel_interrupt_enable*.
- bEnable – true is enable, false is disable.

uint16_t EDMA_GetChannelStatusFlags(DMA_Type *base, *edma_channel_t* eChannel)

Gets the eDMA channel status flags.

Note: if the function return error status, application can call *EDMA_GetErrorStatusFlags* for the detail error status.

Parameters

- base – eDMA peripheral base address.
- eChannel – eDMA channel number.

Return values

The – mask of channel status flags. Users need to use the _edma_channel_status_flags type to decode the return variables.

void EDMA_ClearChannelStatusFlags(DMA_Type *base, *edma_channel_t* eChannel, uint16_t u16StatusFlags)

Clears the eDMA channel status flags.

Parameters

- base – eDMA peripheral base address.
- eChannel – eDMA channel number.
- u16StatusFlags – The mask of channel status to be cleared. Users need to use the defined _edma_channel_status_flags type.

static inline uint32_t EDMA_GetErrorStatusFlags(DMA_Type *base)

Gets the eDMA channel error status flags.

Parameters

- base – eDMA peripheral base address.

Returns

The mask of error status flags. Users need to use the *_edma_error_status_flags* type to decode the return variables.

void EDMA_ConfigChannelSoftwareTCD(*edma_channel_tcd_t* *psTcd, *edma_channel_transfer_config_t* *psTransfer)

Sets TCD fields according to the user's channel transfer configuration structure, *edma_channel_transfer_config_t*.

Application should be careful about the TCD pool buffer storage class,

- For the platform has cache, the software TCD should be put in non cache section
- The TCD pool buffer should have a consistent storage class.

Note: Application should be careful when using the minor loop offset feature with this function, please make sure the EMLM bit is asserted, although EDMA_InitChannel will set this bit by default, if the bit is cleared, application can use *EDMA_EnableMinorLoopMapping* to enable the feature.

Note: This function enables the auto stop request feature.

Parameters

- psTcd – Pointer to the TCD structure.
- psTransfer – channel transfer configuration pointer.

void EDMA_InstallChannelSoftwareTCD(DMA_Type *base, *edma_channel_t* eChannel, *edma_channel_tcd_t* *psTcd)

Push content of software TCD structure into hardware TCD register.

Parameters

- base – EDMA peripheral base address.
- eChannel – EDMA channel number.
- psTcd – Point to TCD structure.

void EDMA_TransferCreateHandle(DMA_Type *base, *edma_handle_t* *psHandle, *edma_channel_t* eChannel, *edma_channel_tcd_t* *psTcdPool, uint32_t u32TcdCount, *edma_transfer_callback_t* pfCallback, void *pUserData)

Creates the eDMA channel handle.

This function is called if using the transactional API for eDMA. This function initializes the internal state of the eDMA handle.

Parameters

- base – eDMA peripheral base address.
- psHandle – eDMA handle pointer. The eDMA handle stores callback function and parameters.
- eChannel – eDMA channel number.
- psTcdPool – A memory pool to store TCDs. It must be 32 bytes aligned.
- u32TcdCount – The number of TCD slots.
- pfCallback – eDMA callback function pointer.
- pUserData – A parameter for the callback function.

status_t EDMA_TransferSubmitSingleTransfer(*edma_handle_t* *psHandle, *edma_channel_transfer_config_t* *psTransfer)

Submits the eDMA single transfer configuration.

Application can submit single transfer when

a. channel is idle, the transfer request will be submitted to eDMA channel TCD register directly

b. channel is idle, a previous transfer request is pending, the new transfer request will be submitted to the installed TCD pool and linked to the pending one.

c. channel is active, the transfer request will be submitted to the installed TCD pool and linked to previous one.

It is suggest that application should check the return value of this function to make sure that the transfer request is submitted successfully.

Note: , 1.Please be aware of that tcd pool maintain is unprotect by default, that is to say, the behavior of multiple task trying to access the same channel is undefine, application can protect the channel by itself or overwrite EDMA_ENTER_CRITICAL_SECTION/EDMA_LEAVE_CRITICAL_SECTION to have edma driver protect the TCD pool maintain. 2.Since the destination major loop offset feature register is reused as scatter gather tcd address, so the two features cannot be used together, if the destination major loop offset feature is used, then the transfer request will be submit hardware TCD directly.

Parameters

- psHandle – eDMA handle pointer.
- psTransfer – pointer to user's eDMA channel configure structure, see edma_channel_transfer_config_t for detail.

Return values

- kStatus_Success – It means submit transfer request succeed.
- kStatus_EDMA_ChannelQueueFull – It means TCD queue is full. Submit transfer request is not allowed.

status_t EDMA_TransferSubmitLoopTransfer(*edma_handle_t* *psHandle, *edma_channel_transfer_config_t* *psTransfer, uint32_t transferLoopCount)

Submits the eDMA scatter gather transfer configurations.

The function is target for submit loop transfer request, the ring transfer request means that the transfer request TAIL is link to HEAD, such as, A->B->C->D->A, or A->A

To use the ring transfer feature, the application should allocate several transfer object, such as

```
edma_channel_transfer_config_t transfer[2];
EDMA_TransferSubmitLoopTransfer(psHandle, &transfer, 2U);
```

Then eDMA driver will link transfer[0] and transfer[1] to each other

---

Note: Application should check the return value of this function to avoid transfer request submit failed

---

Parameters

- psHandle – eDMA handle pointer
- psTransfer – pointer to user's eDMA channel configure structure, see edma_channel_transfer_config_t for detail
- transferLoopCount – the count of the transfer ring, if loop count is 1, that means that the one will link to itself.

Return values

- kStatus_Success – It means submit transfer request succeed
- kStatus_EDMA_ChannelBusy – channel is in busy status
- kStatus_EDMA_ChannelQueueFull – It means TCD pool is not len enough for the ring transfer request

void EDMA_TransferStart(*edma_handle_t* *psHandle)

eDMA starts transfer.

This function enables the channel request. Users can call this function after submitting the transfer request or before submitting the transfer request.

Parameters

- psHandle – eDMA handle pointer.

void EDMA_TransferStop(*edma_handle_t* *psHandle)

eDMA stops transfer.

This function disables the channel request to pause the transfer. Users can call EDMA_StartTransfer() again to resume the transfer.

Parameters

- psHandle – eDMA handle pointer.

void EDMA_TransferAbort(*edma_handle_t* *psHandle)

eDMA aborts transfer.

This function disables the channel request and clear transfer status bits. Users can submit another transfer after calling this API.

Parameters

- psHandle – DMA handle pointer.

void EDMA_TransferHandleIRQ(*edma_handle_t* *psHandle)

eDMA IRQ handler for the current major loop transfer completion.

This function clears the channel major interrupt flag and calls the callback function if it is not NULL.

Note: For the case using TCD queue, when the major iteration count is exhausted, additional Interfaces are performed. These include the final address adjustments and reloading of the BITER field into the CITER. Assertion of an optional interrupt request also occurs at this time, as does a possible fetch of a new TCD from memory using the scatter/gather address pointer included in the descriptor (if scatter/gather is enabled).

For instance, when the time interrupt of TCD[0] happens, the TCD[1] has already been loaded into the eDMA engine. As sga and sga_index are calculated based on the DLAST_SGA bit field lies in the TCD_CSR register, the sga_index in this case should be 2 (DLAST_SGA of TCD[1] stores the address of TCD[2]). Thus, the "tcdUsed" updated should be (tcdUsed - 2U) which indicates the number of TCDs can be loaded in the memory pool (because TCD[0] and TCD[1] have been loaded into the eDMA engine at this point already.).

For the last two continuous ISRs in a scatter/gather process, they both load the last TCD (The last ISR does not load a new TCD) from the memory pool to the eDMA engine when major loop completes. Therefore, ensure that the header and tcdUsed updated are identical for them. tcdUsed are both 0 in this case as no TCD to be loaded.

See the "eDMA basic data flow" in the eDMA Functional description section of the Reference Manual for further details.

Parameters

- psHandle – eDMA handle pointer.

void EDMA_DriverIRQHandler(uint32_t instance, uint32_t channel)

eDMA common IRQ handler entry, dispatches to the channel handler.

Parameters

- instance – eDMA peripheral instance number.
- channel – eDMA channel number within the instance.

FSL_EDMA_DRIVER_VERSION

EDMA driver version.

_edma_transfer_status eDMA transfer status The enumerator used for transactional interface only.

Values:

enumerator kStatus_EDMA_ChannelQueueFull

TCD queue is full.

enumerator kStatus_EDMA_ChannelBusy

Channel is busy and can't handle the transfer request.

enum _edma_channel_transfer_type

eDMA transfer type

Values:

enumerator kEDMA_ChannelTransferMemoryToMemory

Transfer type from memory to memory assume that the both source and destination address are incremental

enumerator kEDMA_ChannelTransferPeripheralToMemory

Transfer type peripher to memory assume that the source address is fixed

enumerator kEDMA_ChannelTransferMemoryToPeripheral

Transfer type from memory to peripheral assume that the destination address is fixed

enumerator kEDMA_ChannelTransferPeripheralToPeripheral

Transfer type from Peripheral to peripheral assume that both source and destination address are fixed

enum _edma_channel_interrupt_enable

eDMA interrupt source

The eDMA peripheral support generate interrupt when half of the total request bytes transferred or all of the request bytes transferred.

Values:

enumerator kEDMA_ChannelErrorInterruptEnable

Enable error interrupt

enumerator kEDMA_ChannelMajorLoopCompleteInterruptEnable

Enable interrupt while major count exhausted.

enumerator kEDMA_ChannelMajorLoopHalfCompleteInterruptEnable

Enable interrupt while major count to half value.

enumerator kEDMA_ChannelAllInterruptEnable

Enable all the interrupt.

enum _edma_channel_status_flags

_edma_channel_status_flags eDMA channel status flags.

Values:

enumerator kEDMA_ChannelStatusErrorFlag

eDMA error flag, an error occurred in a transfer

enumerator kEDMA_ChannelStatusMajorLoopCompleteFlag

Major loop complete flag, set while transfer finished, CITER value exhausted

enumerator kEDMA_ChannelStatusMajorLoopHalfCompleteFlag

Major loop half complete flag

enum _edma_error_status_flags

_edma_error_status_flags eDMA channel detail error status flags.

Values:

enumerator kEDMA_ChannelDestinationBusErrorFlag

Bus error on destination address

enumerator kEDMA_ChannelSourceBusErrorFlag

Bus error on the source address

enumerator kEDMA_ChannelScatterGatherErrorFlag

Error on the Scatter/Gather address, not 32byte aligned.

enumerator kEDMA_ChannelNbytesErrorFlag

NBYTES/CITER configuration error

enumerator kEDMA_ChannelDestinationOffsetErrorFlag
Destination offset not aligned with destination size

enumerator kEDMA_ChannelDestinationAddressErrorFlag
Destination address not aligned with destination size

enumerator kEDMA_ChannelSourceOffsetErrorFlag
Source offset not aligned with source size

enumerator kEDMA_ChannelSourceAddressErrorFlag
Source address not aligned with source size

enumerator kEDMA_ChannelErrorChannelFlag
Error channel number of the canceled channel number

enumerator kEDMA_ChannelPriorityErrorFlag
Channel priority is not unique.

enumerator kEDMA_ChannelTransferCanceledFlag
Transfer canceled

enumerator kEDMA_ChannelValidFlag
No error occurred, this bit is 0. Otherwise, it is 1.

enum _edma_arbitration_type
eDMA arbitration type
Values:

enumerator kEDMA_ArbitrationFixedPriority
channel arbitration by fixed priority

enumerator kEDMA_ArbitrationRoundRobin
Channel arbitration by round robin

enum _edma_channel
edma channel index
Values:

enumerator kEDMA_Channel0
EDMA channel 0

enumerator kEDMA_Channel1
EDMA channel 1

enumerator kEDMA_Channel2
EDMA channel 2

enumerator kEDMA_Channel3
EDMA channel 3

enum _edma_channel_transfer_width
eDMA transfer width configuration
Values:

enumerator kEDMA_ChannelTransferWidth8Bits
Source/Destination data transfer width is 1 byte every time

enumerator kEDMA_ChannelTransferWidth16Bits
Source/Destination data transfer width is 2 bytes every time

enumerator kEDMA_ChannelTransferWidth32Bits
Source/Destination data transfer width is 4 bytes every time

enumerator kEDMA_ChannelTransferWidth128Bits
Source/Destination data transfer size is 16 bytes every time

enum _edma_channel_modulo
eDMA channel modulo configuration
The eDMA modulo feature can be used to specify the address range of the source/destination address, it is useful to implement a circular data queue.
Values:

enumerator kEDMA_ChannelModuloDisable
Disable modulo

enumerator kEDMA_ChannelModulo2bytes
Circular buffer size is 2 bytes.

enumerator kEDMA_ChannelModulo4bytes
Circular buffer size is 4 bytes.

enumerator kEDMA_ChannelModulo8bytes
Circular buffer size is 8 bytes.

enumerator kEDMA_ChannelModulo16bytes
Circular buffer size is 16 bytes.

enumerator kEDMA_ChannelModulo32bytes
Circular buffer size is 32 bytes.

enumerator kEDMA_ChannelModulo64bytes
Circular buffer size is 64 bytes.

enumerator kEDMA_ChannelModulo128bytes
Circular buffer size is 128 bytes.

enumerator kEDMA_ChannelModulo256bytes
Circular buffer size is 256 bytes.

enumerator kEDMA_ChannelModulo512bytes
Circular buffer size is 512 bytes.

enumerator kEDMA_ChannelModulo1Kbytes
Circular buffer size is 1 K bytes.

enumerator kEDMA_ChannelModulo2Kbytes
Circular buffer size is 2 K bytes.

enumerator kEDMA_ChannelModulo4Kbytes
Circular buffer size is 4 K bytes.

enumerator kEDMA_ChannelModulo8Kbytes
Circular buffer size is 8 K bytes.

enumerator kEDMA_ChannelModulo16Kbytes
Circular buffer size is 16 K bytes.

enumerator kEDMA_ChannelModulo32Kbytes
Circular buffer size is 32 K bytes.

enumerator kEDMA_ChannelModulo64Kbytes
Circular buffer size is 64 K bytes.

enumerator kEDMA_ChannelModulo128Kbytes
Circular buffer size is 128 K bytes.

enumerator kEDMA_ChannelModulo256Kbytes
Circular buffer size is 256 K bytes.

enumerator kEDMA_ChannelModulo512Kbytes
Circular buffer size is 512 K bytes.

enumerator kEDMA_ChannelModulo1Mbytes
Circular buffer size is 1 M bytes.

enumerator kEDMA_ChannelModulo2Mbytes
Circular buffer size is 2 M bytes.

enumerator kEDMA_ChannelModulo4Mbytes
Circular buffer size is 4 M bytes.

enumerator kEDMA_ChannelModulo8Mbytes
Circular buffer size is 8 M bytes.

enumerator kEDMA_ChannelModulo16Mbytes
Circular buffer size is 16 M bytes.

enumerator kEDMA_ChannelModulo32Mbytes
Circular buffer size is 32 M bytes.

enumerator kEDMA_ChannelModulo64Mbytes
Circular buffer size is 64 M bytes.

enumerator kEDMA_ChannelModulo128Mbytes
Circular buffer size is 128 M bytes.

enumerator kEDMA_ChannelModulo256Mbytes
Circular buffer size is 256 M bytes.

enumerator kEDMA_ChannelModulo512Mbytes
Circular buffer size is 512 M bytes.

enumerator kEDMA_ChannelModulo1Gbytes
Circular buffer size is 1 G bytes.

enumerator kEDMA_ChannelModulo2Gbytes
Circular buffer size is 2 G bytes.

enum _edma_channel_bandwidth
edma channel Bandwidth control

Generally, as the eDMA processes the minor loop, it continuously generates read/write sequences until the minor count is exhausted. This bandwidth field forces the eDMA to stall after the completion of each read/write access to control the bus request bandwidth.

The default configuration is kEDMA_BandwidthStallNone.

Values:

enumerator kEDMA_ChannelBandwidthStallNone
No eDMA engine stalls.

enumerator kEDMA_ChannelBandwidthStall4Cycle
eDMA engine stalls for 4 cycles after each read/write.

enumerator kEDMA_ChannelBandwidthStall8Cycle
eDMA engine stalls for 8 cycles after each read/write.

typedef enum *_edma_channel_transfer_type* edma_channel_transfer_type_t
eDMA transfer type

typedef enum *_edma_arbitration_type* edma_arbitration_type_t
eDMA arbitration type

typedef enum *_edma_channel* edma_channel_t

edma channel index

typedef enum *_edma_channel_transfer_width* edma_channel_transfer_width_t

eDMA transfer width configuration

typedef enum *_edma_channel_modulo* edma_channel_modulo_t

eDMA channel modulo configuration

The eDMA modulo feature can be used to specify the address range of the source/destination address, it is useful to implement a circular data queue.

typedef enum *_edma_channel_bandwidth* edma_channel_bandwidth_t

edma channel Bandwidth control

Generally, as the eDMA processes the minor loop, it continuously generates read/write sequences until the minor count is exhausted. This bandwidth field forces the eDMA to stall after the completion of each read/write access to control the bus request bandwidth.

The default configuration is kEDMA_BandwidthStallNone.

typedef struct *_edma_channel_Preemption_config* edma_channel_Preemption_config_t

eDMA channel priority configuration, useful to the fixed priority arbitration type

typedef struct *_edma_channel_tcd* edma_channel_tcd_t

edma channel software tcd definition

typedef struct *_edma_channel_transfer_config* edma_channel_transfer_config_t

edma channel transfer configuration

The transfer configuration structure support full feature configuration of the transfer control descriptor.

1.To perform a simple transfer, below members should be initialized at least .u32SrcAddr - source address .u32DstAddr - destination address .eSrcWidthOfEachTransfer - data width of source address .eDstWidthOfEachTransfer - data width of destination address, normally it should be as same as eSrcWidthOfEachTransfer .u32BytesEachRequest - bytes to be transferred in each DMA request .u32TotalBytes - total bytes to be transferred .i16SrcOffsetOfEachTransfer - offset value in bytes unit to be applied to source address as each source read is completed .i16DstOffsetOfEachTransfer - offset value in bytes unit to be applied to destination address as each destination write is completed bEnableChannelRequest - channel request can be enabled together with transfer configure submission

2.The transfer configuration structure also support advance feature: Programmable source/destination address range(MODULO) Programmable minor loop offset Programmable major loop offset Programmable channel chain feature Programmable channel transfer control descriptor link feature

---

Note: User should pay attention to the transfer size alignment limitation

a. the u32BytesEachRequest should align with the eSrcWidthOfEachTransfer and the eDstWidthOfEachTransfer that is to say u32BytesEachRequest % eSrcWidthOfEachTransfer should be 0

b. the i16SrcOffsetOfEachTransfer and i16DstOffsetOfEachTransfer must be aligne with transfer width

c. the u32TotalBytes should align with the u32BytesEachRequest

d. the u32SrcAddr should align with the eSrcWidthOfEachTransfer

e. the u32DstAddr should align with the eDstWidthOfEachTransfer

f. the u32SrcAddr should align with eSrcAddrModulo if modulo feature is enabled

g. the u32DstAddr should align with eDstAddrModulo if modulo feature is enabled If anyone of above condition can not be satisfied, the edma interfaces will generate assert error.

---

typedef struct *_edma_config* edma_config_t

edma configuration structure

This structure target for whole edma module configurations.

typedef struct *_edma_handle* edma_handle_t

handler for eDMA

typedef void (*edma_transfer_callback_t)(*edma_handle_t* *psHandle, void *pUserData, bool bTransferDone, uint32_t u32Tcds)

Define callback function for eDMA.

This callback function is called in the EDMA interrupt handler function. In normal mode, running into callback function means the transfer users need is done. In scatter gather mode, run into callback function means a transfer control block (tcd) is finished. Not all transfer finished, users can get the finished tcd numbers using interface EDMA_GetUnusedTCDNumber.

Param handle
EDMA handle pointer, users shall not touch the values inside.

Param userData
The callback user parameter pointer. Users can use this parameter to involve things users need to change in EDMA callback function.

Param transferDone
If the current loaded transfer done. In normal mode it means if all transfer done. In scatter gather mode, this parameter shows is the current transfer block in EDMA register is done. As the load of core is different, it will be different if the new tcd loaded into EDMA registers while this callback called. If true, it always means new tcd still not loaded into registers, while false means new tcd already loaded into registers.

Param tcds
How many tcds are done from the last callback. This parameter only used in scatter gather mode. It tells user how many tcds are finished between the last callback and this.

EDMA_ENTER_CRITICAL_SECTION()

edma transactional tcd pool resource protection lock definition Application should overwrite below two macros if multi task trying to access the same channel.

EDMA_LEAVE_CRITICAL_SECTION()

struct _edma_channel_Preemption_config

#include <fsl_edma.h> eDMA channel priority configuration, useful to the fixed priority arbitration type

Public Members

bool bSuspendedByHighPriorityChannel

a channel can be suspended by other channel with higher priority

bool bSuspendLowPriorityChannel

a channel can suspend other channel with low priority

uint8_t u8ChannelPriority

Channel priority

struct __edma__channel__transfer__config

#include <fsl_edma.h> edma channel transfer configuration

The transfer configuration structure support full feature configuration of the transfer control descriptor.

1.To perform a simple transfer, below members should be initialized at least .u32SrcAddr - source address .u32DstAddr - destination address .eSrcWidthOfEachTransfer - data width of source address .eDstWidthOfEachTransfer - data width of destination address, normally it should be as same as eSrcWidthOfEachTransfer .u32BytesEachRequest - bytes to be transferred in each DMA request .u32TotalBytes - total bytes to be transferred .i16SrcOffsetOfEachTransfer - offset value in bytes unit to be applied to source address as each source read is completed .i16DstOffsetOfEachTransfer - offset value in bytes unit to be applied to destination address as each destination write is completed bEnableChannelRequest - channel request can be enabled together with transfer configure submission

2.The transfer configuration structure also support advance feature: Programmable source/destination address range(MODULO) Programmable minor loop offset Programmable major loop offset Programmable channel chain feature Programmable channel transfer control descriptor link feature

---

Note: User should pay attention to the transfer size alignment limitation

a. the u32BytesEachRequest should align with the eSrcWidthOfEachTransfer and the eDstWidthOfEachTransfer that is to say u32BytesEachRequest % eSrcWidthOfEachTransfer should be 0

b. the i16SrcOffsetOfEachTransfer and i16DstOffsetOfEachTransfer must be aligne with transfer width

c. the u32TotalBytes should align with the u32BytesEachRequest

d. the u32SrcAddr should align with the eSrcWidthOfEachTransfer

e. the u32DstAddr should align with the eDstWidthOfEachTransfer

f. the u32SrcAddr should align with eSrcAddrModulo if modulo feature is enabled

g. the u32DstAddr should align with eDstAddrModulo if modulo feature is enabled If anyone of above condition can not be satisfied, the edma interfaces will generate assert error.

Public Members

uint32_t u32SrcAddr

source address

uint32_t u32DstAddr

destination address

edma_channel_transfer_width_t eSrcWidthOfEachTransfer

source width of each transfer

edma_channel_transfer_width_t eDstWidthOfEachTransfer

destination width of each transfer

uint32_t u32BytesEachMinorLoop

bytes in each minor loop or each request range: 1 - (2^30 -1) when minor loop mapping is enabled range: 1 - (2^10 - 1) when minor loop mapping is enabled and source or dest minor loop offset is enabled range: 1 - (2^32 - 1) when minor loop mapping is disabled

uint16_t u16MinorLoopCountsEachMajorLoop

minor loop counts in each major loop, should be 1 at least for each transfer range: (0 - (2^15 - 1)) when minor loop channel link is disabled range: (0 - (2^9 - 1)) when minor loop channel link is enabled total bytes in a transfer = u16MinorLoopCountsEachMajorLoop * u32BytesEachMinorLoop

uint16_t u16EnabledInterruptMask

channel interrupt to enable, can be OR'ed value of *_edma_channel_interrupt_enable*

int16_t i16SrcOffsetOfEachTransfer

Sign-extended offset value in byte unit applied to the current source address to form the next-state value as each source read is completed

edma_channel_modulo_t eSrcAddrModulo

source circular data queue range

int32_t i32SrcMajorLoopOffset

source major loop offset

int16_t i16DstOffsetOfEachTransfer

Sign-extended offset value in byte unit applied to the current destination address to form the next-state value as each destination write is completed.

edma_channel_modulo_t eDstAddrModulo

destination circular data queue range

int32_t i32DstMajorLoopOffset

destination major loop offset

bool bEnableSrcMinorLoopOffset

enable source minor loop offset

bool bEnableDstMinorLoopOffset
: enable dest minor loop offset

int32_t i32MinorLoopOffset
: burst offset, the offset will be applied after minor loop update

bool bEnableChannelMajorLoopLink
: channel link when major loop complete

edma_channel_t eMajorLoopLinkChannel
: major loop link channel number

bool bEnableChannelMinorLoopLink
: channel link when minor loop complete

edma_channel_t eMinorLoopLinkChannel
: minor loop link channel number

edma_channel_bandwidth_t eChannelBandWidth
: channel bandwidth

bool bDisableRequestAfterMajorLoopComplete
: the channel's ERQ bit can be cleared after the major loop complete automatically

bool bEnableChannelRequest
: enable the channel request signal

edma_channel_tcd_t *psLinkTCD
: pointer to the link transfer control descriptor

struct __edma__channel__tcd
: *#include <fsl_edma.h>* eDMA software Transfer control descriptor structure.

  This structure is same as eDMA hardware channel TCD registers, user doesn't need to understand the structures, since eDMA driver will responsible for configure it.

  The software TCD is useful to configure a software TCD which is linked by the channel hardware TCD to have scatter/gather feature without using transactional interface.

  Public Members

  ___IO uint32_t u32SADDR
  : SADDR register, used to save source address

  ___IO uint16_t u16SOFF
  : SOFF register, offset bytes added to source address every transfer

  ___IO uint16_t u16ATTR
  : ATTR register, source/destination transfer size and modulo

___IO uint32_t u32NBYTES

Nbytes register, minor loop length in bytes

___IO uint32_t u32SLAST

SLAST register, adjustment value added to the source address at the completion of the major loop

___IO uint32_t u32DADDR

DADDR register, used for destination address

___IO uint16_t u16DOFF

DOFF register, offset bytes added to destination address every transfer

___IO uint16_t u16CITER

CITER register, current minor loop numbers, for unfinished minor loop.

___IO uint32_t u32DLAST_SGA

DLASTSGA register, next tcd address used in scatter-gather mode

___IO uint16_t u16CSR

CSR register, for TCD control status

___IO uint16_t u16BITER

BITER register, begin minor loop count.

struct _edma_config

#include <fsl_edma.h> edma configuration structure

This structure target for whole edma module configurations.

Public Members

bool bEnableContinuousLinkMode

Enable (true) continuous link mode. Upon minor loop completion, the channel activates again if that channel has a minor loop channel link enabled and the link channel is itself.

bool bEnableHaltOnError

Enable (true) transfer halt on error. Any error causes the HALT bit to set. Subsequently, all service requests are ignored until the HALT bit is cleared.

bool bEnableDmaInDebugMode

Enable(true) eDMA debug mode. When in debug mode, the eDMA stalls the start of a new channel. Executing channels are allowed to complete.

bool bEnableMinorLoopMapping

TCDn.word2 is redefined to include individual enable fields, an offset field, and the NBYTES field. The individual enable fields allow the minor loop offset to be applied to the source address, the destination address, or both. The NBYTES field is reduced when either offset is enabled

edma_arbitration_type_t eArbitrationType
: Enable (true) round robin channel arbitration method or fixed priority arbitration is used for channel selection

edma_channel_Preemption_config_t sChannelPreemptionConfig[1]
: channel preemption configuration

edma_channel_transfer_config_t *psChannelTransferConfig[1]
: channel transfer configuration pointer

struct _edma_handle
: *#include <fsl_edma.h>* eDMA transfer handle structure

Public Members

edma_transfer_callback_t pfCallback
: Callback function for major count exhausted.

void *pUserData
: Callback function parameter.

DMA_Type *psBase
: eDMA peripheral base address.

edma_channel_tcd_t *psTcdPool
: Pointer to memory stored TCDs.

edma_channel_t eChannel
: eDMA channel number.

volatile uint8_t u8Header
: The first TCD index. Should point to the next TCD to be loaded into the eDMA engine.

volatile uint8_t u8Tail
: The last TCD index. Should point to the next TCD to be stored into the memory pool.

volatile uint8_t u8TcdUsed
: The number of used TCD slots. Should reflect the number of TCDs can be used/loaded in the memory.

volatile uint8_t u8TcdSize
: The total number of TCD slots in the queue.

2.23 The Driver Change Log

2.24 EDMA Peripheral and Driver Overview

2.25 EVTG: Event Generator Driver

void EVTG_Init(EVTG_Type *base, *evtg_index_t* eEvtgIndex, *evtg_config_t* *psConfig)

Initialize EVTG with a user configuration structure.

Parameters

- base – EVTG base address.
- eEvtgIndex – EVTG instance index.
- psConfig – EVTG initial configuration structure pointer.

static inline void EVTG_GetDefaultConfig(*evtg_config_t* *psConfig, *evtg_flipflop_mode_t* eFlipflopMode)

Loads default values to the EVTG configuration structure.

The purpose of this API is to initialize the configuration structure to default value for *EVTG_Init()* to use. The Flip-Flop can be configured as Bypass mode, RS trigger mode, T-FF mode, D-FF mode, JK-FF mode, Latch mode. Please check RM INTC chapter for more details.

Parameters

- psConfig – EVTG initial configuration structure pointer.
- eFlipflopMode – EVTG flip flop mode. see @ ref _evtg_flipflop_mode

static inline void EVTG_ForceFlipflopInitOutput(EVTG_Type *base, *evtg_index_t* eEvtgIndex, *evtg_flipflop_init_output_t* eFlipflopInitOutputValue)

Force Flip-flop initial output value to be presented on flip-flop positive output.

Parameters

- base – EVTG base address.
- eEvtgIndex – EVTG instance index.
- eFlipflopInitOutputValue – EVTG flip-flop initial output control. see *evtg_flipflop_init_output_t*

static inline void EVTG_SetProductTermInput(EVTG_Type *base, *evtg_index_t* eEvtgIndex, *evtg_aoi_index_t* eAOIIndex, *evtg_aoi_product_term_t* eProductTerm, *evtg_input_index_t* eInputIndex, *evtg_aoi_input_config_t* eInput)

Configure each input value of AOI product term. Each selected input term in each product term can be configured to produce a logical 0 or 1 or pass the true or complement of the selected event input. Adapt to some simple aoi expressions.

Parameters

- base – EVTG base address.
- eEvtgIndex – EVTG instance index.
- eAOIIndex – EVTG AOI index. see enum ref evtg_aoi_index_t
- eProductTerm – EVTG product term index.
- eInputIndex – EVTG input index.
- eInput – EVTG input configuration with enum *evtg_aoi_input_config_t*.

void EVTG_ConfigAOIProductTerm(EVTG_Type *base, *evtg_index_t* eEvtgIndex, *evtg_aoi_index_t* eAOIIndex, *evtg_aoi_product_term_t* eProductTerm, *evtg_aoi_product_term_config_t* *psProductTermConfig)

Configure AOI product term by initializing the product term configuration structure.

Parameters

- base – EVTG base address.
- eEvtgIndex – EVTG instance index.
- eAOIIndex – EVTG AOI index. see enum *evtg_aoi_index_t*
- eProductTerm – EVTG AOI product term index.
- psProductTermConfig – Pointer to EVTG product term configuration structure. see ref *_evtg_aoi_product_term_config*

FSL_EVTG_DRIVER_VERSION

EVTG driver version.

enum _evtg_index

EVTG instance index.

Values:

enumerator kEVTG_Index0

EVTG instance index 0.

enumerator kEVTG_Index1

EVTG instance index 1.

enumerator kEVTG_Index2

EVTG instance index 2.

enumerator kEVTG_Index3

EVTG instance index 3.

enum _evtg_input_index

EVTG input index.

Values:

enumerator kEVTG_InputA

EVTG input A.

enumerator kEVTG_InputB

EVTG input B.

enumerator kEVTG_InputC

EVTG input C.

enumerator kEVTG_InputD

EVTG input D.

enum _evtg_aoi_index
EVTG AOI index.
Values:

enumerator kEVTG_AOI0
EVTG AOI index 0.

enumerator kEVTG_AOI1
EVTG AOI index 1.

enum _evtg_aoi_product_term
EVTG AOI product term index.
Values:

enumerator kEVTG_ProductTerm0
EVTG AOI product term index 0.

enumerator kEVTG_ProductTerm1
EVTG AOI product term index 1.

enumerator kEVTG_ProductTerm2
EVTG AOI product term index 2.

enumerator kEVTG_ProductTerm3
EVTG AOI product term index 3.

enum _evtg_aoi_input_config
EVTG input configuration.
Values:

enumerator kEVTG_Input_LogicZero
Force input in product term to a logical zero.

enumerator kEVTG_Input_DirectPass
Pass input in product term.

enumerator kEVTG_Input_Complement
Complement input in product term.

enumerator kEVTG_Input_LogicOne
Force input in product term to a logical one.

enum _evtg_aoi_outfilter_count
EVTG AOI Output Filter Sample Count.
Values:

enumerator kEVTG_AOIOutFilter_SampleCount3
EVTG AOI output filter sample count is 3.

enumerator kEVTG_AOIOutFilter_SampleCount4
EVTG AOI output filter sample count is 4.

enumerator kEVTG_AOIOutFilter_SampleCount5
EVTG AOI output filter sample count is 5.

enumerator kEVTG_AOIOutFilter_SampleCount6
EVTG AOI output filter sample count is 6.

enumerator kEVTG_AOIOutFilter_SampleCount7
EVTG AOI output filter sample count is 7.

enumerator kEVTG_AOIOutFilter_SampleCount8
EVTG AOI output filter sample count is 8.

enumerator kEVTG_AOIOutFilter_SampleCount9
EVTG AOI output filter sample count is 9.

enumerator kEVTG_AOIOutFilter_SampleCount10
EVTG AOI output filter sample count is 10.

enum _evtg_outfdbk_override_input
EVTG output feedback override control mode. When FF is configured as JK-FF mode, need EVTG_OUTA feedback to EVTG input and replace one of the four inputs.

Values:

enumerator kEVTG_Output_OverrideInputA
Replace input A.

enumerator kEVTG_Output_OverrideInputB
Replace input B.

enumerator kEVTG_Output_OverrideInputC
Replace input C.

enumerator kEVTG_Output_OverrideInputD
Replace input D.

enum _evtg_flipflop_mode
EVTG flip flop mode configuration.

Values:

enumerator kEVTG_FFMode_Bypass
Bypass mode (default).In this mode, user can choose to enable or disable input sync logic and filter function.

enumerator kEVTG_FFMode_RSTrigger
RS trigger mode. In this mode, user can choose to enable or disable input sync logic and filter function.

enumerator kEVTG_FFMode_TFF

T-FF mode. In this mode, input sync or filter has to be enabled to remove the possible glitch.

enumerator kEVTG_FFMode_DFF

D-FF mode. In this mode, input sync or filter has to be enabled to remove the possible glitch.

enumerator kEVTG_FFMode_JKFF

JK-FF mode. In this mode, input sync or filter has to be enabled to remove the possible glitch.

enumerator kEVTG_FFMode_Latch

Latch mode. In this mode, input sync or filter has to be enabled to remove the possible glitch.

enum _evtg_flipflop_initoutput

EVTG flip-flop initial value.

Values:

enumerator kEVTG_FF_InitOut0

Configure the positive output of flip-flop as 0.

enumerator kEVTG_FF_InitOut1

Configure the positive output of flip-flop as 1.

typedef enum *_evtg_index* evtg_index_t

EVTG instance index.

typedef enum *_evtg_input_index* evtg_input_index_t

EVTG input index.

typedef enum *_evtg_aoi_index* evtg_aoi_index_t

EVTG AOI index.

typedef enum *_evtg_aoi_product_term* evtg_aoi_product_term_t

EVTG AOI product term index.

typedef enum *_evtg_aoi_input_config* evtg_aoi_input_config_t

EVTG input configuration.

typedef enum *_evtg_aoi_outfilter_count* evtg_aoi_outfilter_count_t

EVTG AOI Output Filter Sample Count.

typedef enum *_evtg_outfdbk_override_input* evtg_outfdbk_override_input_t

EVTG output feedback override control mode. When FF is configured as JK-FF mode, need EVTG_OUTA feedback to EVTG input and replace one of the four inputs.

typedef enum *_evtg_flipflop_mode* evtg_flipflop_mode_t

EVTG flip flop mode configuration.

typedef enum *_evtg_flipflop_initoutput* evtg_flipflop_init_output_t

EVTG flip-flop initial value.

typedef struct *_evtg_aoi_outfilter_config* evtg_aoi_outfilter_config_t

The structure for configuring an AOI output filter sample.

AOI output filter sample count represent the number of consecutive samples that must agree prior to the AOI output filter accepting an transition. AOI output filter sample period represent the sampling period (in IP bus clock cycles) of the AOI output signals. Each AOI output is sampled multiple times at the rate specified by this period.

For the modes with Filter function enabled, filter delay is “(FILT_CNT + 3) x FILT_PER + 2”.

typedef struct *_evtg_aoi_product_term_config* evtg_aoi_product_term_config_t

The structure for configuring an AOI product term.

typedef struct *_evtg_aoi_config* evtg_aoi_config_t

EVTG AOI configuration structure.

typedef struct *_evtg_config* evtg_config_t

EVTG configuration covering all configurable fields.

struct _evtg_aoi_outfilter_config

#include <fsl_evtg.h> The structure for configuring an AOI output filter sample.

AOI output filter sample count represent the number of consecutive samples that must agree prior to the AOI output filter accepting an transition. AOI output filter sample period represent the sampling period (in IP bus clock cycles) of the AOI output signals. Each AOI output is sampled multiple times at the rate specified by this period.

For the modes with Filter function enabled, filter delay is “(FILT_CNT + 3) x FILT_PER + 2”.

Public Members

evtg_aoi_outfilter_count_t eSampleCount

EVTG AOI output filter sample count. refer to *evtg_aoi_outfilter_count_t*.

uint8_t u8SamplePeriod

EVTG AOI output filter sample period, within 0~255. If sample period value is 0x00 (default), then the input filter is bypassed.

struct _evtg_aoi_product_term_config

#include <fsl_evtg.h> The structure for configuring an AOI product term.

Public Members

evtg_aoi_input_config_t eAInput
Input A configuration.

evtg_aoi_input_config_t eBInput
Input B configuration.

evtg_aoi_input_config_t eCInput
Input C configuration.

evtg_aoi_input_config_t eDInput
Input D configuration.

struct __evtg__aoi__config
#include <fsl_evtg.h> EVTG AOI configuration structure.

Public Members

evtg_aoi_outfilter_config_t sAOIOutFilterConfig
EVTG AOI output filter sample configuration structure.

evtg_aoi_product_term_config_t sProductTerm0
Configure AOI product term0.

evtg_aoi_product_term_config_t sProductTerm1
Configure AOI product term1.

evtg_aoi_product_term_config_t sProductTerm2
Configure AOI product term2.

evtg_aoi_product_term_config_t sProductTerm3
Configure AOI product term3.

struct __evtg__config
#include <fsl_evtg.h> EVTG configuration covering all configurable fields.

Public Members

bool bEnableInputASync
Enable/Disable EVTG A input synchronous with bus clk.

bool bEnableInputBSync
Enable/Disable EVTG B input synchronous with bus clk.

bool bEnableInputCSync
Enable/Disable EVTG C input synchronous with bus clk.

bool bEnableInputDSync

Enable/Disable EVTG D input synchronous with bus clk.

evtg_outfdbk_override_input_t eOutfdbkOverideinput

EVTG output feedback to EVTG input and replace one of the four inputs.

evtg_flipflop_mode_t eFlipflopMode

Flip-Flop can be configured as one of Bypass mode, RS trigger mode, T-FF mode, D-FF mode, JK-FF mode, Latch mode.

bool bEnableFlipflopInitOutput

Flip-flop initial output value enable/disable.

evtg_flipflop_init_output_t eFlipflopInitOutputValue

Flip-flop initial output value configuration.

bool bEnableForceBypassFlipFlopAOI0

Enable/Disable force bypass Flip-Flop and route the AOI_0(Filter_0) value directly to EVTG_OUTA

bool bEnableForceBypassFlipFlopAOI1

Enable/Disable force bypass Flip-Flop and route the AOI_1(Filter_1) value directly to EVTG_OUTB

evtg_aoi_config_t sAOI0Config

Configure EVTG AOI0.

evtg_aoi_config_t sAOI1Config

Configure EVTG AOI1.

2.26 The Driver Change Log

2.27 EVTG Peripheral and Driver Overview

2.28 EWM: External Watchdog Monitor Driver

void EWM_Init(EWM_Type *base, const *ewm_config_t* *psConfig)

Initializes the EWM peripheral.

This function is used to initialize the EWM. After calling, the EWM runs immediately according to the configuration.

This is an example.

```
ewm_config_t psConfig;
EWM_GetDefaultConfig(&psConfig);
psConfig.compareHighValue = 0xAAU;
EWM_Init(ewm_base,&psConfig);
```

Note: Except for the interrupt enable control bit, other control bits and registers are write once after a CPU reset. Modifying them more than once generates a bus transfer error.

Parameters

- base – EWM peripheral base address
- psConfig – The configuration of the EWM

void EWM_Deinit(EWM_Type *base)

Deinitializes the EWM peripheral.

This function is used to shut down the EWM.

Parameters

- base – EWM peripheral base address

void EWM_GetDefaultConfig(*ewm_config_t* *psConfig)

Initializes the EWM configuration structure.

This function initializes the EWM configuration structure to default values. The default values are as follows.

```
ewmConfig->bEnableEWM = true;
ewmConfig->bEnableEWMInput = false;
ewmConfig->eInputAssertState = kEWM_EwmInZeroAssert;
ewmConfig->bEnableInterrupt = false;
ewmConfig->eClockSource = kEWM_LpoClockSource0;
ewmConfig->u8ClockDivder = 0;
ewmConfig->u8CompareLowValue = 0;
ewmConfig->u8CompareHighValue = 0xFEU;
```

See also:

ewm_config_t

Parameters

- psConfig – Pointer to the EWM configuration structure.

static inline void EWM_EnableInterrupt(EWM_Type *base)

Enables the EWM interrupt.

This function enables the EWM interrupt.

Parameters

- base – EWM peripheral base address

static inline void EWM_DisableInterrupt(EWM_Type *base)

Disables the EWM interrupt.

This function disables the EWM interrupt.

Parameters

- base – EWM peripheral base address

void EWM_Refresh(EWM_Type *base)

Services the EWM.

This function resets the EWM counter to zero.

Parameters

- base – EWM peripheral base address

FSL_EWM_DRIVER_VERSION

EWM driver version.

enum _ewm_input_assert_state

Assert pin voltage configuration.

Values:

enumerator kEWM_EwmInZeroAssert

EWM-in assert with low-voltage logic

enumerator kEWM_EwmInOneAssert

EWM-in assert with high-voltage logic

typedef enum *_ewm_input_assert_state* ewm_input_assert_state_t

Assert pin voltage configuration.

typedef struct *_ewm_config* ewm_config_t

Data structure for EWM configuration.

This structure is used to configure the EWM.

struct _ewm_config

#include <fsl_ewm.h> Data structure for EWM configuration.

This structure is used to configure the EWM.

Public Members

uint8_t bEnableEWM

Enable EWM module

uint8_t bEnableEWMInput

Enable EWM_in input

uint8_t bEnableInterrupt

Enable EWM interrupt

ewm_input_assert_state_t eInputAssertState

EWM_in signal assertion state select

ewm_lpo_clock_source_t eClockSource

Clock source select

uint8_t u8ClockDivder

EWM counter clock is clockSource/(clockDivder+1)

uint8_t u8CompareLowValue
: Compare low-register value

uint8_t u8CompareHighValue
: Compare high-register value, maximum setting is 0xFE

2.29 The Driver Change Log

2.30 EWM Peripheral and Driver Overview

2.31 C90TFS Flash Driver

2.32 ftfx adapter

2.33 ftfx controller

FTFx driver status codes.

Values:

enumerator kStatus_FTFx_Success
: API is executed successfully

enumerator kStatus_FTFx_InvalidArgument
: Invalid argument

enumerator kStatus_FTFx_SizeError
: Error size

enumerator kStatus_FTFx_AlignmentError
: Parameter is not aligned with the specified baseline

enumerator kStatus_FTFx_AddressError
: Address is out of range

enumerator kStatus_FTFx_AccessError
: Invalid instruction codes and out-of bound addresses

enumerator kStatus_FTFx_ProtectionViolation
: The program/erase operation is requested to execute on protected areas

enumerator kStatus_FTFx_CommandFailure
: Run-time error during command execution.

enumerator kStatus_FTFx_UnknownProperty
Unknown property.

enumerator kStatus_FTFx_EraseKeyError
API erase key is invalid.

enumerator kStatus_FTFx_RegionExecuteOnly
The current region is execute-only.

enumerator kStatus_FTFx_ExecuteInRamFunctionNotReady
Execute-in-RAM function is not available.

enumerator kStatus_FTFx_PartitionStatusUpdateFailure
Failed to update partition status.

enumerator kStatus_FTFx_SetFlexramAsEepromError
Failed to set FlexRAM as EEPROM.

enumerator kStatus_FTFx_RecoverFlexramAsRamError
Failed to recover FlexRAM as RAM.

enumerator kStatus_FTFx_SetFlexramAsRamError
Failed to set FlexRAM as RAM.

enumerator kStatus_FTFx_RecoverFlexramAsEepromError
Failed to recover FlexRAM as EEPROM.

enumerator kStatus_FTFx_CommandNotSupported
Flash API is not supported.

enumerator kStatus_FTFx_SwapSystemNotInUninitialized
Swap system is not in an uninitialzed state.

enumerator kStatus_FTFx_SwapIndicatorAddressError
The swap indicator address is invalid.

enumerator kStatus_FTFx_ReadOnlyProperty
The flash property is read-only.

enumerator kStatus_FTFx_InvalidPropertyValue
The flash property value is out of range.

enumerator kStatus_FTFx_InvalidSpeculationOption
The option of flash prefetch speculation is invalid.

enumerator kStatus_FTFx_CommandOperationInProgress
The option of flash command is processing.

kStatusGroupGeneric

FTFx driver status group.

kStatusGroupFtfxDriver

kFTFx_ApiEraseKey

void FTFx_API_Init(*ftfx_config_t* *config)

Initializes the global flash properties structure members.

This function checks and initializes the Flash module for the other Flash APIs.

Parameters

- config – Pointer to the storage for the driver runtime state.

status_t FTFx_CMD_Erase(*ftfx_config_t* *config, uint32_t start, uint32_t lengthInBytes, uint32_t key)

Erases the flash sectors encompassed by parameters passed into function.

This function erases the appropriate number of flash sectors based on the desired start address and length.

Parameters

- config – The pointer to the storage for the driver runtime state.
- start – The start address of the desired flash memory to be erased. The start address does not need to be sector-aligned but must be word-aligned.
- lengthInBytes – The length, given in bytes (not words or long-words) to be erased. Must be word-aligned.
- key – The value used to validate all flash erase APIs.

Return values

- kStatus_FTFx_Success – API was executed successfully.
- kStatus_FTFx_InvalidArgument – An invalid argument is provided.
- kStatus_FTFx_AlignmentError – The parameter is not aligned with the specified baseline.
- kStatus_FTFx_AddressError – The address is out of range.
- kStatus_FTFx_EraseKeyError – The API erase key is invalid.
- kStatus_FTFx_ExecuteInRamFunctionNotReady – Execute-in-RAM function is not available.
- kStatus_FTFx_AccessError – Invalid instruction codes and out-of bounds addresses.
- kStatus_FTFx_ProtectionViolation – The program/erase operation is requested to execute on protected areas.
- kStatus_FTFx_CommandFailure – Run-time error during the command execution.

status_t FTFx_CMD_EraseAll(*ftfx_config_t* *config, uint32_t key)

Erases entire flash.

Parameters

- config – Pointer to the storage for the driver runtime state.
- key – A value used to validate all flash erase APIs.

Return values

- kStatus_FTFx_Success – API was executed successfully.
- kStatus_FTFx_InvalidArgument – An invalid argument is provided.
- kStatus_FTFx_EraseKeyError – API erase key is invalid.
- kStatus_FTFx_ExecuteInRamFunctionNotReady – Execute-in-RAM function is not available.
- kStatus_FTFx_AccessError – Invalid instruction codes and out-of bounds addresses.
- kStatus_FTFx_ProtectionViolation – The program/erase operation is requested to execute on protected areas.
- kStatus_FTFx_CommandFailure – Run-time error during command execution.
- kStatus_FTFx_PartitionStatusUpdateFailure – Failed to update the partition status.

status_t FTFx_CMD_Program(*ftfx_config_t* *config, uint32_t start, const uint8_t *src, uint32_t lengthInBytes)

Programs flash with data at locations passed in through parameters.

This function programs the flash memory with the desired data for a given flash area as determined by the start address and the length.

Parameters

- config – A pointer to the storage for the driver runtime state.
- start – The start address of the desired flash memory to be programmed. Must be word-aligned.
- src – A pointer to the source buffer of data that is to be programmed into the flash.
- lengthInBytes – The length, given in bytes (not words or long-words), to be programmed. Must be word-aligned.

Return values

- kStatus_FTFx_Success – API was executed successfully.
- kStatus_FTFx_InvalidArgument – An invalid argument is provided.
- kStatus_FTFx_AlignmentError – Parameter is not aligned with the specified baseline.
- kStatus_FTFx_AddressError – Address is out of range.
- kStatus_FTFx_ExecuteInRamFunctionNotReady – Execute-in-RAM function is not available.
- kStatus_FTFx_AccessError – Invalid instruction codes and out-of bounds addresses.
- kStatus_FTFx_ProtectionViolation – The program/erase operation is requested to execute on protected areas.
- kStatus_FTFx_CommandFailure – Run-time error during the command execution.

status_t FTFx_CMD_ProgramOnce(*ftfx_config_t* *config, uint8_t index, const uint8_t *src, uint32_t lengthInBytes)

Programs Program Once Field through parameters.

This function programs the Program Once Field with the desired data for a given flash area as determined by the index and length.

Parameters

- config – A pointer to the storage for the driver runtime state.
- index – The index indicating which area of the Program Once Field to be programmed.
- src – A pointer to the source buffer of data that is to be programmed into the Program Once Field.
- lengthInBytes – The length, given in bytes (not words or long-words), to be programmed. Must be word-aligned.

Return values

- kStatus_FTFx_Success – API was executed successfully.
- kStatus_FTFx_InvalidArgument – An invalid argument is provided.
- kStatus_FTFx_ExecuteInRamFunctionNotReady – Execute-in-RAM function is not available.
- kStatus_FTFx_AccessError – Invalid instruction codes and out-of bounds addresses.
- kStatus_FTFx_ProtectionViolation – The program/erase operation is requested to execute on protected areas.
- kStatus_FTFx_CommandFailure – Run-time error during the command execution.

status_t FTFx_CMD_ReadOnce(*ftfx_config_t* *config, uint8_t index, uint8_t *dst, uint32_t lengthInBytes)

Reads the Program Once Field through parameters.

This function reads the read once feild with given index and length.

Parameters

- config – A pointer to the storage for the driver runtime state.
- index – The index indicating the area of program once field to be read.
- dst – A pointer to the destination buffer of data that is used to store data to be read.
- lengthInBytes – The length, given in bytes (not words or long-words), to be programmed. Must be word-aligned.

Return values

- kStatus_FTFx_Success – API was executed successfully.
- kStatus_FTFx_InvalidArgument – An invalid argument is provided.
- kStatus_FTFx_ExecuteInRamFunctionNotReady – Execute-in-RAM function is not available.
- kStatus_FTFx_AccessError – Invalid instruction codes and out-of bounds addresses.
- kStatus_FTFx_ProtectionViolation – The program/erase operation is requested to execute on protected areas.

- kStatus_FTFx_CommandFailure – Run-time error during the command execution.

status_t FTFx_CMD_VerifyErase(*ftfx_config_t* *config, uint32_t start, uint32_t lengthInBytes, uint8_t margin)

Verifies an erasure of the desired flash area at a specified margin level.

This function checks the appropriate number of flash sectors based on the desired start address and length to check whether the flash is erased to the specified read margin level.

Parameters

- config – A pointer to the storage for the driver runtime state.
- start – The start address of the desired flash memory to be verified. The start address does not need to be sector-aligned but must be word-aligned.
- lengthInBytes – The length, given in bytes (not words or long-words), to be verified. Must be word-aligned.
- margin – Read margin choice.

Return values

- kStatus_FTFx_Success – API was executed successfully.
- kStatus_FTFx_InvalidArgument – An invalid argument is provided.
- kStatus_FTFx_AlignmentError – Parameter is not aligned with specified baseline.
- kStatus_FTFx_AddressError – Address is out of range.
- kStatus_FTFx_ExecuteInRamFunctionNotReady – Execute-in-RAM function is not available.
- kStatus_FTFx_AccessError – Invalid instruction codes and out-of bounds addresses.
- kStatus_FTFx_ProtectionViolation – The program/erase operation is requested to execute on protected areas.
- kStatus_FTFx_CommandFailure – Run-time error during the command execution.

status_t FTFx_CMD_VerifyEraseAll(*ftfx_config_t* *config, uint8_t margin)

Verifies erasure of the entire flash at a specified margin level.

This function checks whether the flash is erased to the specified read margin level.

Parameters

- config – A pointer to the storage for the driver runtime state.
- margin – Read margin choice.

Return values

- kStatus_FTFx_Success – API was executed successfully.
- kStatus_FTFx_InvalidArgument – An invalid argument is provided.
- kStatus_FTFx_ExecuteInRamFunctionNotReady – Execute-in-RAM function is not available.
- kStatus_FTFx_AccessError – Invalid instruction codes and out-of bounds addresses.
- kStatus_FTFx_ProtectionViolation – The program/erase operation is requested to execute on protected areas.

- kStatus_FTFx_CommandFailure – Run-time error during the command execution.

status_t FTFx_CMD_VerifyProgram(*ftfx_config_t* *config, uint32_t start, uint32_t lengthInBytes, const uint8_t *expectedData, uint8_t margin, uint32_t *failedAddress, uint32_t *failedData)

Verifies programming of the desired flash area at a specified margin level.

This function verifies the data programed in the flash memory using the Flash Program Check Command and compares it to the expected data for a given flash area as determined by the start address and length.

Parameters

- config – A pointer to the storage for the driver runtime state.
- start – The start address of the desired flash memory to be verified. Must be word-aligned.
- lengthInBytes – The length, given in bytes (not words or long-words), to be verified. Must be word-aligned.
- expectedData – A pointer to the expected data that is to be verified against.
- margin – Read margin choice.
- failedAddress – A pointer to the returned failing address.
- failedData – A pointer to the returned failing data. Some derivatives do not include failed data as part of the FCCOBx registers. In this case, zeros are returned upon failure.

Return values

- kStatus_FTFx_Success – API was executed successfully.
- kStatus_FTFx_InvalidArgument – An invalid argument is provided.
- kStatus_FTFx_AlignmentError – Parameter is not aligned with specified baseline.
- kStatus_FTFx_AddressError – Address is out of range.
- kStatus_FTFx_ExecuteInRamFunctionNotReady – Execute-in-RAM function is not available.
- kStatus_FTFx_AccessError – Invalid instruction codes and out-of bounds addresses.
- kStatus_FTFx_ProtectionViolation – The program/erase operation is requested to execute on protected areas.
- kStatus_FTFx_CommandFailure – Run-time error during the command execution.

status_t FTFx_REG_GetSecurityState(*ftfx_config_t* *config, *ftfx_security_state_t* *state)

Returns the security state via the pointer passed into the function.

This function retrieves the current flash security status, including the security enabling state and the backdoor key enabling state.

Parameters

- config – A pointer to storage for the driver runtime state.
- state – A pointer to the value returned for the current security status code:

Return values

- kStatus_FTFx_Success – API was executed successfully.

- kStatus_FTFx_InvalidArgument – An invalid argument is provided.

enum _ftfx_partition_flexram_load_option

Enumeration for the FlexRAM load during reset option.

Values:

enumerator kFTFx_PartitionFlexramLoadOptLoadedWithValidEepromData

FlexRAM is loaded with valid EEPROM data during reset sequence.

enumerator kFTFx_PartitionFlexramLoadOptNotLoaded

FlexRAM is not loaded during reset sequence.

enum _ftfx_security_state

Enumeration for the three possible FTFx security states.

Values:

enumerator kFTFx_SecurityStateNotSecure

Flash is not secure.

enumerator kFTFx_SecurityStateBackdoorEnabled

Flash backdoor is enabled.

enumerator kFTFx_SecurityStateBackdoorDisabled

Flash backdoor is disabled.

enum _ftfx_flexram_function_option

Enumeration for the two possilbe options of set FlexRAM function command.

Values:

enumerator kFTFx_FlexramFuncOptAvailableAsRam

An option used to make FlexRAM available as RAM

enumerator kFTFx_FlexramFuncOptAvailableForEeprom

An option used to make FlexRAM available for EEPROM

enum _ftfx_swap_state

Enumeration for the possible flash Swap status.

Values:

enumerator kFTFx_SwapStateUninitialized

Flash Swap system is in an uninitialized state.

enumerator kFTFx_SwapStateReady

Flash Swap system is in a ready state.

enumerator kFTFx_SwapStateUpdate

Flash Swap system is in an update state.

enumerator kFTFx_SwapStateUpdateErased
Flash Swap system is in an updateErased state.

enumerator kFTFx_SwapStateComplete
Flash Swap system is in a complete state.

enumerator kFTFx_SwapStateDisabled
Flash Swap system is in a disabled state.

enum _ftfx_memory_type
Enumeration for FTFx memory type.

Values:

enumerator kFTFx_MemTypePflash

enumerator kFTFx_MemTypeFlexnvm

typedef enum *_ftfx_partition_flexram_load_option* ftfx_partition_flexram_load_opt_t
Enumeration for the FlexRAM load during reset option.

typedef enum *_ftfx_security_state* ftfx_security_state_t
Enumeration for the three possible FTFx security states.

typedef enum *_ftfx_flexram_function_option* ftfx_flexram_func_opt_t
Enumeration for the two possilbe options of set FlexRAM function command.

typedef enum *_ftfx_swap_state* ftfx_swap_state_t
Enumeration for the possible flash Swap status.

typedef struct *_ftfx_special_mem* ftfx_spec_mem_t
ftfx special memory access information.

typedef struct *_ftfx_mem_descriptor* ftfx_mem_desc_t
Flash memory descriptor.

typedef struct *_ftfx_ops_config* ftfx_ops_config_t
Active FTFx information for the current operation.

typedef struct *_ftfx_ifr_descriptor* ftfx_ifr_desc_t
Flash IFR memory descriptor.

typedef struct *_ftfx_config* ftfx_config_t
Flash driver state information.

An instance of this structure is allocated by the user of the flash driver and passed into each of the driver APIs.

kFTFx_ResourceOptionFlashIfr
: Macro for the two possible options of flash read resource command.

  Select code for Program flash 0 IFR, Program flash swap 0 IFR, Data flash 0 IFR

kFTFx_ResourceOptionVersionId
: Select code for the version ID

kFTFx_MarginValueNormal
: Macro for supported FTFx margin levels.

kFTFx_MarginValueUser
: Apply the 'User' margin to the normal read-1 level.

kFTFx_MarginValueFactory
: Apply the 'Factory' margin to the normal read-1 level.

kFTFx_MarginValueInvalid
: Not real margin level, Used to determine the range of valid margin level.

struct _ftfx_special_mem
: *#include <fsl_ftfx_controller.h>* ftfx special memory access information.

Public Members

uint32_t base
: Base address of flash special memory.

uint32_t size
: size of flash special memory.

uint32_t count
: flash special memory count.

struct _ftfx_mem_descriptor
: *#include <fsl_ftfx_controller.h>* Flash memory descriptor.

Public Members

uint32_t blockBase
: A base address of the flash block

uint32_t totalSize
: The size of the flash block.

uint32_t sectorSize
: The size in bytes of a sector of flash.

uint32_t blockCount

A number of flash blocks.

struct _ftfx_ops_config

#include <fsl_ftfx_controller.h> Active FTFx information for the current operation.

Public Members

uint32_t convertedAddress

A converted address for the current flash type.

struct _ftfx_ifr_descriptor

#include <fsl_ftfx_controller.h> Flash IFR memory descriptor.

union function_ptr_t

#include <fsl_ftfx_controller.h>

Public Members

uint32_t commadAddr

void (*callFlashCommand)(volatile uint8_t *FTMRx_fstat)

struct _ftfx_config

#include <fsl_ftfx_controller.h> Flash driver state information.

An instance of this structure is allocated by the user of the flash driver and passed into each of the driver APIs.

Public Members

uint32_t flexramBlockBase

The base address of the FlexRAM/acceleration RAM

uint32_t flexramTotalSize

The size of the FlexRAM/acceleration RAM

uint16_t eepromTotalSize

The size of EEPROM area which was partitioned from FlexRAM

function_ptr_t runCmdFuncAddr

An buffer point to the flash execute-in-RAM function.

struct ___unnamed4___

Public Members

uint8_t type
: Type of flash block.

uint8_t index
: Index of flash block.

struct feature

struct addrAligment

struct feature

struct resRange

Public Members

uint8_t versionIdStart
: Version ID start address

uint32_t pflashIfrStart
: Program Flash 0 IFR start address

uint32_t dflashIfrStart
: Data Flash 0 IFR start address

uint32_t pflashSwapIfrStart
: Program Flash Swap IFR start address

struct idxInfo

2.34 ftfx feature

FTFx_DRIVER_IS_FLASH_RESIDENT
: Flash driver location.

  Used for the flash resident application.

FTFx_DRIVER_IS_EXPORTED
: Flash Driver Export option.

  Used for the MCUXpresso SDK application.

FTFx_FLASH1_HAS_PROT_CONTROL
: Indicates whether the secondary flash has its own protection register in flash module.

FTFx_FLASH1_HAS_XACC_CONTROL

Indicates whether the secondary flash has its own Execute-Only access register in flash module.

FTFx_DRIVER_HAS_FLASH1_SUPPORT

Indicates whether the secondary flash is supported in the Flash driver.

FTFx_FLASH_COUNT

FTFx_FLASH1_IS_INDEPENDENT_BLOCK

2.35 Ftftx FLASH Driver

status_t FLASH_Init(*flash_config_t* *config)

Initializes the global flash properties structure members.

This function checks and initializes the Flash module for the other Flash APIs.

Parameters

- config – Pointer to the storage for the driver runtime state.

Return values

- kStatus_FTFx_Success – API was executed successfully.
- kStatus_FTFx_InvalidArgument – An invalid argument is provided.
- kStatus_FTFx_ExecuteInRamFunctionNotReady – Execute-in-RAM function is not available.
- kStatus_FTFx_PartitionStatusUpdateFailure – Failed to update the partition status.

status_t FLASH_Erase(*flash_config_t* *config, uint32_t start, uint32_t lengthInBytes, uint32_t key)

Erases the Dflash sectors encompassed by parameters passed into function.

This function erases the appropriate number of flash sectors based on the desired start address and length.

Parameters

- config – The pointer to the storage for the driver runtime state.
- start – The start address of the desired flash memory to be erased. The start address does not need to be sector-aligned but must be word-aligned.
- lengthInBytes – The length, given in bytes (not words or long-words) to be erased. Must be word-aligned.
- key – The value used to validate all flash erase APIs.

Return values

- kStatus_FTFx_Success – API was executed successfully; the appropriate number of flash sectors based on the desired start address and length were erased successfully.
- kStatus_FTFx_InvalidArgument – An invalid argument is provided.
- kStatus_FTFx_AlignmentError – The parameter is not aligned with the specified baseline.

- kStatus_FTFx_AddressError – The address is out of range.
- kStatus_FTFx_EraseKeyError – The API erase key is invalid.
- kStatus_FTFx_ExecuteInRamFunctionNotReady – Execute-in-RAM function is not available.
- kStatus_FTFx_AccessError – Invalid instruction codes and out-of bounds addresses.
- kStatus_FTFx_ProtectionViolation – The program/erase operation is requested to execute on protected areas.
- kStatus_FTFx_CommandFailure – Run-time error during the command execution.

status_t FLASH_EraseAll(*flash_config_t* *config, uint32_t key)

Erases entire flexnvm.

Parameters

- config – Pointer to the storage for the driver runtime state.
- key – A value used to validate all flash erase APIs.

Return values

- kStatus_FTFx_Success – API was executed successfully; the all pflash and flexnvm were erased successfully, the swap and eeprom have been reset to unconfigured state.
- kStatus_FTFx_InvalidArgument – An invalid argument is provided.
- kStatus_FTFx_EraseKeyError – API erase key is invalid.
- kStatus_FTFx_ExecuteInRamFunctionNotReady – Execute-in-RAM function is not available.
- kStatus_FTFx_AccessError – Invalid instruction codes and out-of bounds addresses.
- kStatus_FTFx_ProtectionViolation – The program/erase operation is requested to execute on protected areas.
- kStatus_FTFx_CommandFailure – Run-time error during command execution.
- kStatus_FTFx_PartitionStatusUpdateFailure – Failed to update the partition status.

status_t FLASH_Program(*flash_config_t* *config, uint32_t start, uint8_t *src, uint32_t lengthInBytes)

Programs flash with data at locations passed in through parameters.

This function programs the flash memory with the desired data for a given flash area as determined by the start address and the length.

Parameters

- config – A pointer to the storage for the driver runtime state.
- start – The start address of the desired flash memory to be programmed. Must be word-aligned.
- src – A pointer to the source buffer of data that is to be programmed into the flash.
- lengthInBytes – The length, given in bytes (not words or long-words), to be programmed. Must be word-aligned.

Return values

- kStatus_FTFx_Success – API was executed successfully; the desired data were programed successfully into flash based on desired start address and length.
- kStatus_FTFx_InvalidArgument – An invalid argument is provided.
- kStatus_FTFx_AlignmentError – Parameter is not aligned with the specified baseline.
- kStatus_FTFx_AddressError – Address is out of range.
- kStatus_FTFx_ExecuteInRamFunctionNotReady – Execute-in-RAM function is not available.
- kStatus_FTFx_AccessError – Invalid instruction codes and out-of bounds addresses.
- kStatus_FTFx_ProtectionViolation – The program/erase operation is requested to execute on protected areas.
- kStatus_FTFx_CommandFailure – Run-time error during the command execution.

status_t FLASH_ProgramOnce(*flash_config_t* *config, uint8_t index, uint8_t *src, uint32_t lengthInBytes)

Program the Program-Once-Field through parameters.

This function Program the Program-once-feild with given index and length.

Parameters

- config – A pointer to the storage for the driver runtime state.
- index – The index indicating the area of program once field to be read.
- src – A pointer to the source buffer of data that is used to store data to be write.
- lengthInBytes – The length, given in bytes (not words or long-words), to be programmed. Must be word-aligned.

Return values

- kStatus_FTFx_Success – API was executed successfully; The index indicating the area of program once field was programed successfully.
- kStatus_FTFx_InvalidArgument – An invalid argument is provided.
- kStatus_FTFx_ExecuteInRamFunctionNotReady – Execute-in-RAM function is not available.
- kStatus_FTFx_AccessError – Invalid instruction codes and out-of bounds addresses.
- kStatus_FTFx_ProtectionViolation – The program/erase operation is requested to execute on protected areas.
- kStatus_FTFx_CommandFailure – Run-time error during the command execution.

status_t FLASH_ReadOnce(*flash_config_t* *config, uint8_t index, uint8_t *dst, uint32_t lengthInBytes)

Reads the Program Once Field through parameters.

This function reads the read once feild with given index and length.

Parameters

- config – A pointer to the storage for the driver runtime state.

- index – The index indicating the area of program once field to be read.
- dst – A pointer to the destination buffer of data that is used to store data to be read.
- lengthInBytes – The length, given in bytes (not words or long-words), to be programmed. Must be word-aligned.

Return values

- kStatus_FTFx_Success – API was executed successfully; the data have been successfuly read form Program flash0 IFR map and Program Once field based on index and length.
- kStatus_FTFx_InvalidArgument – An invalid argument is provided.
- kStatus_FTFx_ExecuteInRamFunctionNotReady – Execute-in-RAM function is not available.
- kStatus_FTFx_AccessError – Invalid instruction codes and out-of bounds addresses.
- kStatus_FTFx_ProtectionViolation – The program/erase operation is requested to execute on protected areas.
- kStatus_FTFx_CommandFailure – Run-time error during the command execution.

status_t FLASH_VerifyErase(*flash_config_t* *config, uint32_t start, uint32_t lengthInBytes, uint8_t margin)

Verifies an erasure of the desired flash area at a specified margin level.

This function checks the appropriate number of flash sectors based on the desired start address and length to check whether the flash is erased to the specified read margin level.

Parameters

- config – A pointer to the storage for the driver runtime state.
- start – The start address of the desired flash memory to be verified. The start address does not need to be sector-aligned but must be word-aligned.
- lengthInBytes – The length, given in bytes (not words or long-words), to be verified. Must be word-aligned.
- margin – Read margin choice.

Return values

- kStatus_FTFx_Success – API was executed successfully; the specified FLASH region has been erased.
- kStatus_FTFx_InvalidArgument – An invalid argument is provided.
- kStatus_FTFx_AlignmentError – Parameter is not aligned with specified baseline.
- kStatus_FTFx_AddressError – Address is out of range.
- kStatus_FTFx_ExecuteInRamFunctionNotReady – Execute-in-RAM function is not available.
- kStatus_FTFx_AccessError – Invalid instruction codes and out-of bounds addresses.
- kStatus_FTFx_ProtectionViolation – The program/erase operation is requested to execute on protected areas.
- kStatus_FTFx_CommandFailure – Run-time error during the command execution.

status_t FLASH_VerifyEraseAll(*flash_config_t* *config, uint8_t margin)

Verifies erasure of the entire flash at a specified margin level.

This function checks whether the flash is erased to the specified read margin level.

Parameters

- config – A pointer to the storage for the driver runtime state.
- margin – Read margin choice.

Return values

- kStatus_FTFx_Success – API was executed successfully; all program flash and flexnvm were in erased state.
- kStatus_FTFx_InvalidArgument – An invalid argument is provided.
- kStatus_FTFx_ExecuteInRamFunctionNotReady – Execute-in-RAM function is not available.
- kStatus_FTFx_AccessError – Invalid instruction codes and out-of bounds addresses.
- kStatus_FTFx_ProtectionViolation – The program/erase operation is requested to execute on protected areas.
- kStatus_FTFx_CommandFailure – Run-time error during the command execution.

status_t FLASH_VerifyProgram(*flash_config_t* *config, uint32_t start, uint32_t lengthInBytes, const uint8_t *expectedData, uint8_t margin, uint32_t *failedAddress, uint32_t *failedData)

Verifies programming of the desired flash area at a specified margin level.

This function verifies the data programmed in the flash memory using the Flash Program Check Command and compares it to the expected data for a given flash area as determined by the start address and length.

Parameters

- config – A pointer to the storage for the driver runtime state.
- start – The start address of the desired flash memory to be verified. Must be word-aligned.
- lengthInBytes – The length, given in bytes (not words or long-words), to be verified. Must be word-aligned.
- expectedData – A pointer to the expected data that is to be verified against.
- margin – Read margin choice.
- failedAddress – A pointer to the returned failing address.
- failedData – A pointer to the returned failing data. Some derivatives do not include failed data as part of the FCCOBx registers. In this case, zeros are returned upon failure.

Return values

- kStatus_FTFx_Success – API was executed successfully; the desired data have been successfully programed into specified FLASH region.
- kStatus_FTFx_InvalidArgument – An invalid argument is provided.
- kStatus_FTFx_AlignmentError – Parameter is not aligned with specified baseline.
- kStatus_FTFx_AddressError – Address is out of range.

- kStatus_FTFx_ExecuteInRamFunctionNotReady – Execute-in-RAM function is not available.
- kStatus_FTFx_AccessError – Invalid instruction codes and out-of bounds addresses.
- kStatus_FTFx_ProtectionViolation – The program/erase operation is requested to execute on protected areas.
- kStatus_FTFx_CommandFailure – Run-time error during the command execution.

status_t FLASH_GetSecurityState(*flash_config_t* *config, *ftfx_security_state_t* *state)

Returns the security state via the pointer passed into the function.

This function retrieves the current flash security status, including the security enabling state and the backdoor key enabling state.

Parameters

- config – A pointer to storage for the driver runtime state.
- state – A pointer to the value returned for the current security status code:

Return values

- kStatus_FTFx_Success – API was executed successfully; the security state of flash was stored to state.
- kStatus_FTFx_InvalidArgument – An invalid argument is provided.

status_t FLASH_GetProperty(*flash_config_t* *config, *flash_property_tag_t* whichProperty, uint32_t *value)

Returns the desired flash property.

Parameters

- config – A pointer to the storage for the driver runtime state.
- whichProperty – The desired property from the list of properties in enum flash_property_tag_t
- value – A pointer to the value returned for the desired flash property.

Return values

- kStatus_FTFx_Success – API was executed successfully; the flash property was stored to value.
- kStatus_FTFx_InvalidArgument – An invalid argument is provided.
- kStatus_FTFx_UnknownProperty – An unknown property tag.

FSL_FLASH_DRIVER_VERSION

Flash driver version for SDK.

Version 3.0.0.

enum _flash_protection_state

Enumeration for the three possible flash protection levels.

Values:

enumerator kFLASH_ProtectionStateUnprotected

Flash region is not protected.

enumerator kFLASH_ProtectionStateProtected
Flash region is protected.

enumerator kFLASH_ProtectionStateMixed
Flash is mixed with protected and unprotected region.

enum _flash_property_tag
Enumeration for various flash properties.

Values:

enumerator kFLASH_PropertyPflash0SectorSize
Pflash sector size property.

enumerator kFLASH_PropertyPflash0TotalSize
Pflash total size property.

enumerator kFLASH_PropertyPflash0BlockSize
Pflash block size property.

enumerator kFLASH_PropertyPflash0BlockCount
Pflash block count property.

enumerator kFLASH_PropertyPflash0BlockBaseAddr
Pflash block base address property.

enumerator kFLASH_PropertyPflash0FacSupport
Pflash fac support property.

enumerator kFLASH_PropertyPflash0AccessSegmentSize
Pflash access segment size property.

enumerator kFLASH_PropertyPflash0AccessSegmentCount
Pflash access segment count property.

enumerator kFLASH_PropertyPflash1SectorSize
Pflash sector size property.

enumerator kFLASH_PropertyPflash1TotalSize
Pflash total size property.

enumerator kFLASH_PropertyPflash1BlockSize
Pflash block size property.

enumerator kFLASH_PropertyPflash1BlockCount
Pflash block count property.

enumerator kFLASH_PropertyPflash1BlockBaseAddr
Pflash block base address property.

enumerator kFLASH_PropertyPflash1FacSupport
Pflash fac support property.

enumerator kFLASH_PropertyPflash1AccessSegmentSize
Pflash access segment size property.

enumerator kFLASH_PropertyPflash1AccessSegmentCount
Pflash access segment count property.

enumerator kFLASH_PropertyFlexRamBlockBaseAddr
FlexRam block base address property.

enumerator kFLASH_PropertyFlexRamTotalSize
FlexRam total size property.

typedef enum *_flash_protection_state* flash_prot_state_t
Enumeration for the three possible flash protection levels.

typedef union *_pflash_protection_status* pflash_prot_status_t
PFlash protection status.

typedef enum *_flash_property_tag* flash_property_tag_t
Enumeration for various flash properties.

typedef struct *_flash_config* flash_config_t
Flash driver state information.
An instance of this structure is allocated by the user of the flash driver and passed into each of the driver APIs.

kStatus_FLASH_Success

kFLASH_ApiEraseKey

union _pflash_protection_status
#include <fsl_ftfx_flash.h> PFlash protection status.

Public Members

uint32_t protl
PROT[31:0] .

uint32_t proth
PROT[63:32].

uint8_t protsl
PROTS[7:0] .

uint8_t protsh
: PROTS[15:8] .

uint8_t reserved[2]

struct _flash_config
: *#include <fsl_ftfx_flash.h>* Flash driver state information.

  An instance of this structure is allocated by the user of the flash driver and passed into each of the driver APIs.

2.36 ftfx utilities

MAKE_VERSION(major, minor, bugfix)
: Constructs the version number for drivers.

MAKE_STATUS(group, code)
: Constructs a status code value from a group and a code number.

FOUR_CHAR_CODE(a, b, c, d)
: Constructs the four character code for the Flash driver API key.

ALIGN_DOWN(x, a)
: Alignment(down) utility.

ALIGN_UP(x, a)
: Alignment(up) utility.

B1P4(b)
: bytes2word utility.

B1P3(b)

B1P2(b)

B1P1(b)

B2P3(b)

B2P2(b)

B2P1(b)

B3P2(b)

B3P1(b)

BYTE2WORD_1_3(x, y)

BYTE2WORD_2_2(x, y)

BYTE2WORD_3_1(x, y)

BYTE2WORD_1_1_2(x, y, z)

BYTE2WORD_1_2_1(x, y, z)

BYTE2WORD_2_1_1(x, y, z)

BYTE2WORD_1_1_1_1(x, y, z, w)

2.37 GPIO: General-Purpose Input/Output Driver

void GPIO_PinInit(GPIO_Type *base, *gpio_pin_t* ePin, const *gpio_config_t* *psConfig)

Initializes a GPIO pin with provided structure *gpio_config_t* covering all configuration fields.

To initialize the GPIO, define a pin configuration, as either input or output, in the user file. Then, call the *GPIO_PinInit()* function.

This is function to configure all GPIO Pin configurable fields.

```
gpio_config_t sConfig = {
    .eDirection     = kGPIO_DigitalOutput,
    .eMode          = kGPIO_ModeGpio,
    .eOutMode       = kGPIO_OutputOpenDrain,
    .eSlewRate      = kGPIO_SlewRateFast,
    .eOutLevel      = kGPIO_OutputLow,
    .eDriveStrength = kGPIO_DriveStrengthLow,
    .ePull          = kGPIO_PullDisable,
    .eInterruptMode = kGPIO_InterruptDisable,
}
 GPIO_PinInit(GPIOA, kGPIO_Pin1, &psConfig);
```

Note: If GPIO glitch is critical for your application, do not use this API instead using the API in GPIO pin configuration interfaces to do with the glitch during GPIO mode transition in accordance to your board design.

Parameters

- base – GPIO peripheral base pointer (GPIOA, GPIOB, GPIOC, and so on.)
- ePin – GPIO pin identifier. User enumerator provided by *gpio_pin_t*. Note that not all Pins existed in SoC and user need to check the data sheet.
- psConfig – GPIO pin configuration pointer

static inline void GPIO_PinSetPeripheralMode(GPIO_Type *base, *gpio_pin_t* ePin, *gpio_peripheral_mode_t* eMode)

Configure the GPIO Pin as Peripheral mode or GPIO mode for one pin.

Configure GPIO can be configured as Peripheral mode or GPIO mode for one pin.

Parameters

- base – GPIO peripheral base pointer
- ePin – GPIO pin identifier. User enumerator provided by *gpio_pin_t*. Note that not all Pins existed in SoC and user need to check the data sheet.
- eMode – Peripheral mode or GPIO mode for this pin. See *gpio_peripheral_mode_t*

static inline void GPIO_PinSetPeripheralMux(gpio_peripheral_mux_t eMux)

Configure the multiplexing of GPIO pins to different peripheral.

Configure the MUX of GPIO pins to different peripheral functionality.

Note: User still need to call the GPIO_PinSetPeripheralMode.

Parameters

- eMux – GPIO peripheral MUX when configured as peripheral mode.

static inline void GPIO_PinSetDirection(GPIO_Type *base, *gpio_pin_t* ePin, *gpio_direction_t* eDirection)

Configure the GPIO pin as Input or Output for one pin.

Configure the GPIO pin as Input or Output for one pin.

Parameters

- base – GPIO peripheral base pointer
- ePin – GPIO pin identifier. User enumerator provided by *gpio_pin_t*. Note that not all Pins existed in SoC and user need to check the data sheet.
- eDirection – Direction of GPIO pin. *gpio_direction_t*

static inline void GPIO_PinSetOutputMode(GPIO_Type *base, *gpio_pin_t* ePin, *gpio_output_mode_t* eOutMode)

Configure GPIO pin output as Push-Pull or Open-Drain for one pin.

Configure GPIO pin output as Push-Pull or Open-Drain. This function applies while pin is configured as output. See *gpio_direction_t* and API GPIO_PinSetDirection.

Parameters

- base – GPIO peripheral base pointer
- ePin – GPIO pin identifier. User enumerator provided by *gpio_pin_t*. Note that not all Pins existed in SoC and user need to check the data sheet.
- eOutMode – Push-Pull/Open-Drain output mode. See *gpio_output_mode_t*.

static inline void GPIO_PinSetDriveStrength(GPIO_Type *base, *gpio_pin_t* ePin, *gpio_output_drive_strength_t* eDriveStrength)

Configure High/Low drive strength when Pin is configured as output for one pin.

Configure High/Low drive strength when Pin is configured as output. See *gpio_direction_t* and API GPIO_PinSetDirection.

Parameters

- base – GPIO peripheral base pointer
- ePin – GPIO pin identifier. User enumerator provided by *gpio_pin_t*. Note that not all Pins existed in SoC and user need to check the data sheet.
- eDriveStrength – High/Low driver strength. See *gpio_output_drive_strength_t*

static inline void GPIO_PinSetSlewRate(GPIO_Type *base, *gpio_pin_t* ePin, *gpio_output_slew_rate_t* eSlewRate)

Configure GPIO pin Fast/Slow slew rate when pin is configured as output.

Configure GPIO pin Fast/Slow slew rate when pin is configured as output. See *gpio_direction_t* and API GPIO_PinSetDirection.

Parameters

- base – GPIO peripheral base pointer
- ePin – GPIO pin identifier. User enumerator provided by *gpio_pin_t*. Note that not all Pins existed in SoC and user need to check the data sheet.
- eSlewRate – Fast/Slow slewrate. See *gpio_output_slew_rate_t*

static inline void GPIO_PinSetPullResistorMode(GPIO_Type *base, *gpio_pin_t* ePin, *gpio_pull_mode_t* ePullMode)

Configure Pull resistor for GPIO pin to Disable/Pull-Up/Pull-Down.

Configure Pull resistor for GPIO pin to Disable/Pull-Up/Pull-Down.

Parameters

- base – GPIO peripheral base pointer
- ePin – GPIO pin identifier. User enumerator provided by *gpio_pin_t*. Note that not all Pins existed in SoC and user need to check the data sheet.
- ePullMode – Pull Mode as Disable/Pull-Up/Pull-Down. See *gpio_pull_mode_t*

static inline void GPIO_PinWrite(GPIO_Type *base, *gpio_pin_t* ePin, *gpio_output_level_t* eOutput)

Set GPIO Pin as High/Low voltage level on Output.

Set GPIO Pin as High/Low voltage level on Output.

Parameters

- base – GPIO peripheral base pointer
- ePin – GPIO pin identifier. User enumerator provided by *gpio_pin_t*. Note that not all Pins existed in SoC and user need to check the data sheet.
- eOutput – Output as High level or Low Level. See *gpio_output_level_t*.

static inline void GPIO_PortSet(GPIO_Type *base, uint16_t u16Pins)

Set GPIO multiple pins output High voltage level without impact pins.

Set GPIO multiple pins output High voltage level without impact other pins. Multiple pins are configured by OR enumerator from *gpio_pin_t*

Parameters

- base – GPIO peripheral base pointer
- u16Pins – GPIO pins which is ORed by *gpio_pin_t*. # kGPIO_Pin0 | kGPIO_Pin3 means Pin 0 and Pin 3.

static inline void GPIO_PinSet(GPIO_Type *base, *gpio_pin_t* ePin)

Output High voltage level for GPIO Pin when configured as Output.

Output High voltage level for GPIO Pin when configured as Output.

Parameters

- base – GPIO peripheral base pointer
- ePin – GPIO pin identifier. User enumerator provided by *gpio_pin_t*. Note that not all Pins existed in SoC and user need to check the data sheet.

static inline void GPIO_PortClear(GPIO_Type *base, uint16_t u16Pins)

Set GPIO multiple pins belong to same PORT output Low voltage level when these pins are configured as output.

Set GPIO multiple pins belong to same PORT output Low voltage level when these pins are configured as output. Multiple pins are configured by ORing enumerators from *gpio_pin_t*

Parameters

- base – GPIO peripheral base pointer
- u16Pins – GPIO pins which is ORed by *gpio_pin_t*. # kGPIO_Pin0 | kGPIO_Pin3 means Pin 0 and Pin 3.

static inline void GPIO_PinClear(GPIO_Type *base, *gpio_pin_t* ePin)

Output Low voltage level for GPIO Pin when configured as Output.

Output Low voltage level for GPIO Pin when configured as Output.

Parameters

- base – GPIO peripheral base pointer
- ePin – GPIO pin identifier. User enumerator provided by *gpio_pin_t*. Note that not all Pins existed in SoC and user need to check the data sheet.

static inline void GPIO_PortToggle(GPIO_Type *base, uint16_t u16Pins)

Toggle GPIO multiple pins belong to same PORT when these pins are configured as output.

Toggle GPIO multiple pins belong to same PORT when these pins are configured as output. Multiple pins are configured by ORing enumerators from *gpio_pin_t*

Parameters

- base – GPIO peripheral base pointer
- u16Pins – GPIO pins which is ORed by *gpio_pin_t*. # kGPIO_Pin0 | kGPIO_Pin3 means Pin 0 and Pin 3.

static inline void GPIO_PinToggle(GPIO_Type *base, *gpio_pin_t* ePin)

Toggle the GPIO output voltage level when configured as Output.

Toggle the GPIO output voltage level when configured as Output.

Note: GPIO peripheral register do not get register to toggle directly. It is implemented by read back the GPIO output level and write to the register with reverted level.

Parameters

- base – GPIO peripheral base pointer
- ePin – GPIO pin identifier. User enumerator provided by *gpio_pin_t*. Note that not all Pins existed in SoC and user need to check the data sheet.

static inline uint16_t GPIO_PortRead(GPIO_Type *base)

Read High/Low voltage level for multiple GPIO pins from the pin or the data bus.

Read High/Low voltage level for multiple GPIO pins from the pin if the pin is configured as input or the data bus. When the device comes out of reset, GPIO pins are configured as inputs with internal pull disabled. As a result, the reset value of this pin is undefined. For different PORT, the available pins number is different. User need use the return value to OR with the *gpio_pin_t* to decide whether that pin is logic high or low.

```
if (GPIO_PortRead(GPIOA) & (uint16_t)kGPIO_Pin0)
{
   //GPIOA Pin 0 is High
}
else
{
   //GPIOA Pin 0 is Low
}
```

Parameters

- base – GPIO peripheral base pointer

Returns

Voltage level for multiple GPIO pins from the pin or the data bus.

static inline uint8_t GPIO_PinRead(GPIO_Type *base, *gpio_pin_t* ePin)

Read High/Low voltage level for one GPIO pin from the pin or the data bus.

Read High/Low voltage level from the pin if the pin is configured as input or the data bus.

Note: When the device comes out of reset, GPIO pins are configured as inputs with internal pull disabled. As a result, the reset value of this pin is undefined.

Parameters

- base – GPIO peripheral base pointer
- ePin – GPIO pin identifier. User enumerator provided by *gpio_pin_t*. Note that not all Pins existed in SoC and user need to check the data sheet.

Return values

- 1 – Voltage level for one GPIO pin from the pin or the data bus is high.
- 0 – Voltage level for one GPIO pin from the pin or the data bus is low.

static inline uint16_t GPIO_PortReadRawData(GPIO_Type *base)

Read Raw voltage high/low level data from the pins or peripheral bus for multiple pins belong to same PORT.

Read Raw voltage high/low level data from the pins or peripheral bus. Values are not clocked and are subject to change at any time. Read several times to ensure a stable value. The reset value of this register depends on the default PIN state. User need use the return value to OR with the *gpio_pin_t* to decide whether that pin is logic high or low.

```
if (GPIO_PortReadRawData(GPIOA) & (uint16_t)kGPIO_Pin0)
{
   //GPIOA Pin 0 is High
}
else
{
   //GPIOA Pin 0 is Low
}
```

Parameters

- base – GPIO peripheral base pointer

Returns

Voltage high/low level data from the pins or peripheral bus for multiple pins belong to same PORT.

static inline uint8_t GPIO_PinReadRawData(GPIO_Type *base, *gpio_pin_t* ePin)

Read Raw logic level data from the pins or peripheral bus for one pin.

Read Raw voltage high/low level data from the pins or peripheral bus. Values are not clocked and are subject to change at any time. Read several times to ensure a stable value. The reset value of this register depends on the default PIN state.

Parameters

- base – GPIO peripheral base pointer
- ePin – GPIO pin identifier. User enumerator provided by *gpio_pin_t*. Note that not all Pins existed in SoC and user need to check the data sheet.

Return values

- 1 – Raw voltage level data from the pins or peripheral bus is high.

- 0 – Raw voltage level data from the pins or peripheral bus is low.

static inline void GPIO_PinSetInterruptConfig(GPIO_Type *base, *gpio_pin_t* ePin, *gpio_interrupt_mode_t* eIntConfig)

Configure GPIO Pin interrupt detection condition.

Configure GPIO Pin interrupt detection condition

Parameters

- base – GPIO peripheral base pointer
- ePin – GPIO pin identifier. User enumerator provided by *gpio_pin_t*. Note that not all Pins existed in SoC and user need to check the data sheet.
- eIntConfig – Interrupt detection condition for rising edge/down edge or no detection. See *gpio_interrupt_mode_t*

static inline void GPIO_PortAssertSWInterrupts(GPIO_Type *base, uint16_t u16Pins)

Assert software interrupt for multiple pins belong to same port which will generate interrupt.

This API is only for software testing of a software interrupt capability. When the software interrupt is asserted, an interrupt is generated. The interrupt is generated continually until this software interrupt is de-asserted.

Parameters

- base – GPIO peripheral base pointer
- u16Pins – GPIO pins which is ORed by *gpio_pin_t*. # kGPIO_Pin0 | kGPIO_Pin3 means Pin 0 and Pin 3.

static inline void GPIO_PortDeassertSWInterrupts(GPIO_Type *base, uint16_t u16Pins)

De-Assert software interrupt for multiple pins belong to same port which will stop generating interrupt.

This API is only for software testing of a software interrupt capability.

Parameters

- base – GPIO peripheral base pointer
- u16Pins – GPIO pins which is ORed by *gpio_pin_t*. # kGPIO_Pin0 | kGPIO_Pin3 means Pin 0 and Pin 3.

static inline void GPIO_PinAssertSWInterrupt(GPIO_Type *base, *gpio_pin_t* ePin)

Assert software interrupt for one pin which will generate interrupt.

This API is only for software testing of a software interrupt capability. When the software interrupt is asserted, an interrupt is generated. The interrupt is generated continually until this software interrupt is de-asserted.

Parameters

- base – GPIO peripheral base pointer
- ePin – GPIO pin identifier. User enumerator provided by *gpio_pin_t*. Note that not all Pins existed in SoC and user need to check the data sheet.

static inline void GPIO_PinDeassertSWInterrupt(GPIO_Type *base, *gpio_pin_t* ePin)

De-Assert software interrupt for one pin which will stop generating interrupt.

This API is only for software testing of a software interrupt capability.

Parameters

- base – GPIO peripheral base pointer

- ePin – GPIO pin identifier. User enumerator provided by *gpio_pin_t*. Note that not all Pins existed in SoC and user need to check the data sheet.

static inline void GPIO_PortEnableInterrupts(GPIO_Type *base, uint16_t u16Pins)

Enable interrupt detection for multiple pins belong to same port.

This API is to enable interrupt detection on rising edge or falling edge.

Parameters

- base – GPIO peripheral base pointer
- u16Pins – GPIO pins which is ORed by *gpio_pin_t*. # kGPIO_Pin0 | kGPIO_Pin3 means Pin 0 and Pin 3.

static inline void GPIO_PortDisableInterrupts(GPIO_Type *base, uint16_t u16Pins)

Disable interrupt detection for multiple pins belong to same port.

This API is to disable interrupt detection on rising edge or falling edge.

Parameters

- base – GPIO peripheral base pointer
- u16Pins – GPIO pins which is ORed by *gpio_pin_t*. # kGPIO_Pin0 | kGPIO_Pin3 means Pin 0 and Pin 3.

static inline void GPIO_PinEnableInterrupt(GPIO_Type *base, *gpio_pin_t* ePin)

Enable interrupt detection for one pin.

This API is to enable interrupt detection on rising edge or falling edge.

Parameters

- base – GPIO peripheral base pointer
- ePin – GPIO pin identifier. User enumerator provided by *gpio_pin_t*. Note that not all Pins existed in SoC and user need to check the data sheet.

static inline void GPIO_PinDisableInterrupt(GPIO_Type *base, *gpio_pin_t* ePin)

Disable interrupt detection for one pin.

This API is to disable interrupt detection on rising edge or falling edge.

Parameters

- base – GPIO peripheral base pointer
- ePin – GPIO pin identifier. User enumerator provided by *gpio_pin_t*. Note that not all Pins existed in SoC and user need to check the data sheet.

static inline uint16_t GPIO_PortGetInterruptPendingStatusFlags(GPIO_Type *base)

Get interrupt pending status flags all pins belong to same port.

Get interrupt pending status flags for all pins belong to same port. User need to use the *gpio_pin_t* to OR with the return value, if the result is not 0, this flag is set. otherwise, this flag is not set.

Note: this flags can only be cleared by calling GPIO_PortClearEdgeDetectedStatusFlag if it is caused by edge detected or by calling GPIO_PortEnableSWInterrupt if it is caused by SW interrupt.

```
if (GPIO_PortGetInterruptPendingStatusFlags(GPIOA) & (uint16_t)kGPIO_Pin0)
{
    //Interrupt occurred on GPIOA Pin 0.
}
else
```

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(continued from previous page)

```
{
    //No Interrupt on GPIOA Pin 0.
}
```

Parameters

- base – GPIO peripheral base pointer

Returns

Interrupt pending status flags all pins belong to same port.

static inline uint16_t GPIO_PinGetInterruptPendingStatusFlags(GPIO_Type *base, *gpio_pin_t* ePin)

Get interrupt pending status flags for one pin.

Get interrupt pending status flags for one pin.

Note: this flags can only be cleared by calling GPIO_PortClearEdgeDetectedStatusFlag if it is caused by edge detected or by calling GPIO_PortEnableSWInterrupt if it is caused by SW interrupt.

Parameters

- base – GPIO peripheral base pointer
- ePin – GPIO pin identifier. User enumerator provided by *gpio_pin_t*. Note that not all Pins existed in SoC and user need to check the data sheet.

Return values

- 1 – Interrupt occurred.
- 0 – No Interrupt.

static inline uint16_t GPIO_PortGetEdgeDetectedStatusFlags(GPIO_Type *base)

Get Edge detected status flags for all pins belong to same port.

Get edge detected status flags for all pins in the PORT. This status flag can only be detected when interrupt detection is enabled by GPIO_PortEnableInterrupt or GPIO_PinEnableInterrupt.

```
if (GPIO_PortGetEdgeDetectedStatusFlags(GPIOA) & (uint16_t)kGPIO_Pin0)
{
    //An edge detected on GPIOA Pin 0.
}
else
{
    //No edge detected on GPIOA Pin 0.
}
```

Parameters

- base – GPIO peripheral base pointer

Returns

Detected edge status flags for all pins belong to same port.

static inline uint8_t GPIO_PinGetEdgeDetectedStatusFlag(GPIO_Type *base, *gpio_pin_t* ePin)

Get Edge detected status flags for one pin.

Get edge detected status flags for one pin. This status flag can only be detected when interrupt detection is enabled by GPIO_PortEnableInterrupt or GPIO_PinEnableInterrupt.

Parameters

- base – GPIO peripheral base pointer
- ePin – GPIO pin identifier. User enumerator provided by *gpio_pin_t*. Note that not all Pins existed in SoC and user need to check the data sheet.

Return values

- 1 – An edge detected.
- 0 – No edge detected.

static inline void GPIO_PortClearEdgeDetectedStatusFlags(GPIO_Type *base, uint16_t u16Pins)

Clear Edge detected status flags for multiple pins belong to same port.

Clear Edge Detected status flags for multiple pins belong to same port.

Parameters

- base – GPIO peripheral base pointer
- u16Pins – GPIO pins which is ORed by *gpio_pin_t*. # kGPIO_Pin0 | kGPIO_Pin3 means Pin 0 and Pin 3.

static inline void GPIO_PinClearEdgeDetectedStatusFlags(GPIO_Type *base, *gpio_pin_t* ePin)

Clear Edge detected status flags for one pin.

Clear Edge Detected status flags for one pin.

Parameters

- base – GPIO peripheral base pointer
- ePin – GPIO pin identifier. User enumerator provided by *gpio_pin_t*. Note that not all Pins existed in SoC and user need to check the data sheet.

FSL_GPIO_DRIVER_VERSION

GPIO driver version.

enum _gpio_pin

GPIO Pin identifier with each pin get a unique bit thus they can be ORed.

Values:

enumerator kGPIO_Pin0

GPIO PORT Pin 0.

enumerator kGPIO_Pin1

GPIO PORT Pin 1.

enumerator kGPIO_Pin2

GPIO PORT Pin 2.

enumerator kGPIO_Pin3

GPIO PORT Pin 3.

enumerator kGPIO_Pin4
GPIO PORT Pin 4.

enumerator kGPIO_Pin5
GPIO PORT Pin 5.

enumerator kGPIO_Pin6
GPIO PORT Pin 6.

enumerator kGPIO_Pin7
GPIO PORT Pin 7.

enumerator kGPIO_Pin8
GPIO PORT Pin 8.

enumerator kGPIO_Pin9
GPIO PORT Pin 9.

enumerator kGPIO_Pin10
GPIO PORT Pin 10.

enumerator kGPIO_Pin11
GPIO PORT Pin 11.

enumerator kGPIO_Pin12
GPIO PORT Pin 12.

enumerator kGPIO_Pin13
GPIO PORT Pin 13.

enumerator kGPIO_Pin14
GPIO PORT Pin 14.

enumerator kGPIO_Pin15
GPIO PORT Pin 15.

enum _gpio_peripheral_mode
GPIO Pin peripheral/gpio mode option.

Values:

enumerator kGPIO_ModeGpio
Set GPIO pin as GPIO Mode.

enumerator kGPIO_ModePeripheral
Set GPIO pin as Peripheral Mode.

enum _gpio_direction
GPIO Pin input/output direction option.

Values:

enumerator kGPIO_DigitalInput
Set GPIO pin as digital input.

enumerator kGPIO_DigitalOutput
Set GPIO pin as digital output.

enum _gpio_pull_mode
GPIO Pin pull resistor mode option.
Values:

enumerator kGPIO_PullDown
Internal pull-down resistor is enabled.

enumerator kGPIO_PullUp
Internal pull-up resistor is enabled.

enumerator kGPIO_PullDisable
Internal pull-up/down resistor is disabled.

enum _gpio_output_mode
GPIO Pin output mode option.
Values:

enumerator kGPIO_OutputOpenDrain
Open drain output mode.

enumerator kGPIO_OutputPushPull
Push pull output mode.

enum _gpio_output_level
GPIO Pin output High/Low level option.
Values:

enumerator kGPIO_OutputLow
Set GPIO pin output low voltage level.

enumerator kGPIO_OutputHigh
Set GPIO pin output high voltage level.

enum _gpio_output_slew_rate
GPIO Pin output Fast/Slow slew rate option.
Values:

enumerator kGPIO_SlewRateFast
Set GPIO pin output Fast slew rate.

enumerator kGPIO_SlewRateSlow
Set GPIO pin output Slow slew rate.

enum _gpio_output_drive_strength

GPIO Pin output High/Low drive strength option.

Values:

enumerator kGPIO_DriveStrengthLow

Set GPIO pin output Low-drive strength.

enumerator kGPIO_DriveStrengthHigh

Set GPIO pin output High-drive strength.

enum _gpio_interrupt_mode

GPIO Pin interrupt detect option.

Values:

enumerator kGPIO_InterruptRisingEdge

Interrupt on rising edge.

enumerator kGPIO_InterruptFallingEdge

Interrupt on falling edge.

enumerator kGPIO_InterruptDisable

Interrupt is disabled.

typedef enum *_gpio_pin* gpio_pin_t

GPIO Pin identifier with each pin get a unique bit thus they can be ORed.

typedef enum *_gpio_peripheral_mode* gpio_peripheral_mode_t

GPIO Pin peripheral/gpio mode option.

typedef enum *_gpio_direction* gpio_direction_t

GPIO Pin input/output direction option.

typedef enum *_gpio_pull_mode* gpio_pull_mode_t

GPIO Pin pull resistor mode option.

typedef enum *_gpio_output_mode* gpio_output_mode_t

GPIO Pin output mode option.

typedef enum *_gpio_output_level* gpio_output_level_t

GPIO Pin output High/Low level option.

typedef enum *_gpio_output_slew_rate* gpio_output_slew_rate_t

GPIO Pin output Fast/Slow slew rate option.

typedef enum *_gpio_output_drive_strength* gpio_output_drive_strength_t

GPIO Pin output High/Low drive strength option.

typedef enum *_gpio_interrupt_mode* gpio_interrupt_mode_t

GPIO Pin interrupt detect option.

typedef struct *_gpio_config* gpio_config_t

GPIO Pin configuration covering all configurable fields when GPIO is configured in GPIO mode.

GPIO_MUX_ENUM_TO_PORT_INDEX(emux)

Helper MACRO function to extract Port Index. (GPIOA, GPIOB, GPIOC, and so on.) The fields located in bit 8 - bit 11.

GPIO_MUX_ENUM_TO_PIN_INDEX(emux)

Helper MACRO function to extract Pin Index. The fields located in bit 4 - bit 7.

GPIO_MUX_ENUM_TO_REG_VALUE(emux)

Helper MACRO function to extract Pin mux config register value. The fields located in bit 0 - bit 1.

GPIO_MUX_ENUM_TO_PIN_MASK(emux)

Helper MACRO function to extract Pin mux config mask.

GPIO_MUX_ENUM_TO_PIN_VALUE(emux)

Helper MACRO function to extract Pin mux config register value on a GPIO Pin.

struct _gpio_config

#include <fsl_gpio.h> GPIO Pin configuration covering all configurable fields when GPIO is configured in GPIO mode.

Public Members

gpio_direction_t eDirection

GPIO direction, input or output

gpio_peripheral_mode_t eMode

GPIO mode as peripheral or GPIO

gpio_peripheral_mux_t eMux

Set the peripheral type if GPIO is configured as peripheral

gpio_output_mode_t eOutMode

GPIO Open-Drain/Push-Pull output mode.

gpio_output_slew_rate_t eSlewRate

GPIO Fast/Slow slew rate output mode.

gpio_output_level_t eOutLevel

GPIO Output High/Low level.

gpio_output_drive_strength_t eDriveStrength

GPIO output Drive strength High/Low.

gpio_pull_mode_t ePull

GPIO Pull resistor mode configuration.

gpio_interrupt_mode_t eInterruptMode

GPIO interrupt detection condition configuration.

2.38 The Driver Change Log

2.39 GPIO Peripheral and Driver Overview

2.40 INTC: Interrupt Controller Driver

static inline void INTC_SetIRQPriorityNum(IRQn_Type eIrq, uint8_t u8PriorityNum)

Disable IRQ or Enable IRQ with priority.

There are similar function in fsl_common:

- EnableIRQWithPriority,
- DisableIRQ,
- EnableIRQ,
- IRQ_SetPriority.

This function is faster and simpler than those in fsl_common. Generally, this function and IRQ functions in fsl_common are either-or, don't use them together for same IRQn type, but feasible that different IRQn type use them simultaneously, for example: It is OK OCCS_IRQn use INTC_SetIRQPriorityLevel, and ADC12_CC1_IRQn use EnableIRQWithPriority. It is NOT OK that OCCS_IRQn use INTC_SetIRQPriorityLevel and EnableIRQWithPriority simultaneously.

Note: Please note a none-zero priority number does directly map to priority level, simple summary is as below, you could check RM INTC chapter for more details.

- Some IPs have priority level 1~3, maps priority number 1 to priority 1, 2 to priority 2, 3 to priority 3.
- Some IPs have priority level 0~2, maps priority number 1 to priority 0, 2 to priority 1, 3 to priority 2.

Parameters

- eIrq – The IRQ number.
- u8PriorityNum – IRQ interrupt priority number.
  - 0: disable IRQ.
  - 1-3: enable IRQ and set its priority, 3 is the highest priority for this IRQ and 1 is the lowest priority.

static inline void INTC_SetVectorBaseAddress(uint32_t u32VectorBaseAddr)

Set the base address vector table. The value in INTC_VBA is used as the upper 13 bits of the interrupt vector VAB[20:0].

Parameters

- u32VectorBaseAddr – Vector table base address. The address requires 256 words (512 bytes) aligned. Take the vector table in MC56F83xxx_Vectors.c as example for how to implement this table.

static inline void INTC_SetFastIRQVectorHandler0(vector_type_t eVector, *fast_irq_handler* pfHandler)

Set the IRQ handler for fast IRQ0. The INTC takes the vector address from the appropriate FIVAL0 and FIVAH0 registers, instead of generating an address that is an offset from the vector base address (VBA).

Parameters

- eVector – The vector number.
- pfHandler – Pointer to the fast IRQ handler function, see *fast_irq_handler* definition for more info.

static inline void INTC_SetFastIRQVectorHandler1(vector_type_t eVector, *fast_irq_handler* pfHandler)

Set the IRQ handler for fast IRQ1. The INTC takes the vector address from the appropriate FIVAL1 and FIVAH1 registers, instead of generating an address that is an offset from the vector base address (VBA).

Parameters

- eVector – The eVector number.
- pfHandler – Pointer to the fast IRQ handler function, see @ ref fast_irq_handler definition for more info.

static inline uint8_t INTC_GetIRQPermittedPriorityLevel(void)

Get IRQ permitted priority levels. Interrupt exceptions may be nested to allow the servicing of an IRQ with higher priority than the current exception.

The return value indicate the priority level needed for a new IRQ to interrupt the current interrupt being sent to the Core.

Return values

- 0 – Required nested exception priority levels are 0, 1, 2, or 3.
- 1 – Required nested exception priority levels are 1, 2, or 3.
- 2 – Required nested exception priority levels are 2 or 3.
- 3 – Required nested exception priority level is 3.

static inline bool INTC_GetPendingIRQ(vector_type_t eVector)

Check if IRQ is pending for execution. Before the ISR is entered, IRQ is pending. After the ISR is entered, the IRQ is not pending.

Parameters

- eVector – The IRQ vector number.

Return values

True – if interrupt is pending, otherwise return false.

static inline uint16_t INTC_GetLatestRespondedVectorNumber(void)

Get the latest responded IRQ's vector number. It shows the Vector Address Bus used at the time the last IRQ was taken.

Note: Return value of the function call could be different according to where the function call is invoked.

- when called in normal ISR handler, it returns current ISR's vector number defined in vector_type_t.

- when called in fast IRQ handler, it returns the lower address bits of the jump address.
- when called in none ISR handler code, it returns previous responded IRQ vector number defined in vector_type_t or fast IRQ low address bits.

Returns
The latest vector number.

FSL_INTC_DRIVER_VERSION
INTC driver version.

typedef void (*fast_irq_handler)(void)
The handle of the fast irq handler function.

Normally this function should be guarded by: #pragma interrupt fast and #pragma interrupt off.

INTC_DisableIRQ(x)
VBA register address shift. The default value is 8, SOC can override this macro.

Macro to disable the IRQ.

INTC_PEND_REG_INDEX(x)
Helper Macro function to extract IRQ pending register index comparing to INTC_IRQP0.

INTC_PEND_BIT_INDEX(x)
Helper Macro function to extract pending IRQs bit index.

INTC_TYPE_REG_INDEX(x)
Helper Macro function to extract IRQ priority register index comparing to INTC_IRP0.

INTC_TYPE_BIT_INDEX(x)
Helper Macro function to extract IRQs priority bit index.

2.41 The Driver Change Log

2.42 INTC Peripheral and Driver Overview

2.43 Common Driver

status_t EnableIRQWithPriority(IRQn_Type irq, uint8_t priNum)
Enable the IRQ, and also set the interrupt priority.

- Some IPs maps 1 to priority 1, 2 to priority 2, 3 to priority 3
- Some IPs maps 1 to priority 0, 2 to priority 1, 3 to priority 2

User should check chip's RM to get its corresponding interrupt priority.

When priNum set as 0, then *SDK_DSC_DEFAULT_INT_PRIO* is set instead. When priNum set as number larger than 3, then only the 2 LSB take effect, for example, setting priNum to 5 is the same with setting it to 1.

This function configures INTC module, application could call the INTC driver directly for the same purpose.

Note: The parameter priNum is range in 1~3, and its value is **NOT** directly map to interrupt priority.

Parameters

- irq – The IRQ to enable.
- priNum – Priority number set to interrupt controller register. Larger number means higher priority. The allowed range is 1~3, and its value is **NOT** directly map to interrupt priority. In other words, the same priority number means different interrupt priority levels for different IRQ, please check reference manual for the relationship. When pass in 0, then *SDK_DSC_DEFAULT_INT_PRIO* is set to priority register.

Returns

Currently only returns kStatus_Success, will enhance in the future.

status_t DisableIRQ(IRQn_Type irq)

Disable specific interrupt.

This function configures INTC module, application could call the INTC driver directly for the same purpose.

Parameters

- irq – The IRQ to disable.

Returns

Currently only returns kStatus_Success, will enhance in the future.

status_t EnableIRQ(IRQn_Type irq)

Enable specific interrupt.

The recommended workflow is calling *IRQ_SetPriority* first, then call *EnableIRQ*. If *IRQ_SetPriority* is not called first, then the interrupt is enabled with default priority value *SDK_DSC_DEFAULT_INT_PRIO*.

Another recommended workflow is calling *EnableIRQWithPriority* directly, it is the same with calling *IRQ_SetPriority* + *EnableIRQ*.

This function configures INTC module, application could call the INTC driver directly for the same purpose.

Parameters

- irq – The IRQ to enable.

Returns

Currently only returns kStatus_Success, will enhance in the future.

status_t IRQ_SetPriority(IRQn_Type irq, uint8_t priNum)

Set the IRQ priority.

- Some IPs maps 1 to priority 1, 2 to priority 2, 3 to priority 3
- Some IPs maps 1 to priority 0, 2 to priority 1, 3 to priority 2

User should check chip's RM to get its corresponding interrupt priority

When priNum set as 0, then *SDK_DSC_DEFAULT_INT_PRIO* is set instead. When priNum set as number larger than 3, then only the 2 LSB take effect, for example, setting priNum to 5 is the same with setting it to 1.

This function configures INTC module, application could call the INTC driver directly for the same purpose.

Note: The parameter priNum is range in 1~3, and its value is **NOT** directly map to interrupt priority.

Parameters

- irq – The IRQ to set.
- priNum – Priority number set to interrupt controller register. Larger number means higher priority, 0 means disable the interrupt. The allowed range is 0~3, and its value is **NOT** directly map to interrupt priority. In other words, the same priority number means different interrupt priority levels for different IRQ, please check reference manual for the relationship.

Returns

Currently only returns kStatus_Success, will enhance in the future.

FSL_COMMON_DRIVER_VERSION

common driver version.

DEBUG_CONSOLE_DEVICE_TYPE_NONE

No debug console.

DEBUG_CONSOLE_DEVICE_TYPE_UART

Debug console based on UART.

DEBUG_CONSOLE_DEVICE_TYPE_LPUART

Debug console based on LPUART.

DEBUG_CONSOLE_DEVICE_TYPE_LPSCI

Debug console based on LPSCI.

DEBUG_CONSOLE_DEVICE_TYPE_USBCDC

Debug console based on USBCDC.

DEBUG_CONSOLE_DEVICE_TYPE_FLEXCOMM

Debug console based on FLEXCOMM.

DEBUG_CONSOLE_DEVICE_TYPE_IUART

Debug console based on i.MX UART.

DEBUG_CONSOLE_DEVICE_TYPE_VUSART

Debug console based on LPC_VUSART.

DEBUG_CONSOLE_DEVICE_TYPE_MINI_USART

Debug console based on LPC_USART.

DEBUG_CONSOLE_DEVICE_TYPE_SWO

Debug console based on SWO.

DEBUG_CONSOLE_DEVICE_TYPE_QSCI
: Debug console based on QSCI.

MIN(a, b)
: Computes the minimum of *a* and *b*.

MAX(a, b)
: Computes the maximum of *a* and *b*.

UINT16_MAX
: Max value of uint16_t type.

UINT32_MAX
: Max value of uint32_t type.

UINTPTR_SIZE

UINT64_H(X)
: Macro to get upper 32 bits of a 64-bit value

UINT64_L(X)
: Macro to get lower 32 bits of a 64-bit value

MCUX_MASK_INVERT_8(mask)
: 8-bit mask inversion.

MCUX_MASK_INVERT_16(mask)
: 16-bit mask inversion.

MCUX_MASK_INVERT_32(mask)
: 32-bit mask inversion for completeness.

MCUX_REG_WRITE8(reg, value)
: 8-bit register write macro

MCUX_REG_WRITE16(reg, value)
: 16-bit register write macro

MCUX_REG_WRITE32(reg, value)
: 32-bit register write macro

MCUX_REG_READ8(reg)
: 8-bit register read macro

MCUX_REG_READ16(reg)
: 16-bit register read macro

MCUX_REG_READ32(reg)
: 32-bit register read macro

MCUX_REG_BIT_SET8(reg, mask)
: 8-bit register bit set macro

MCUX_REG_BIT_SET16(reg, mask)
: 16-bit register bit set macro

MCUX_REG_BIT_SET32(reg, mask)
: 32-bit register bit set macro

MCUX_REG_BIT_CLEAR8(reg, mask)
8-bit register bit clear macro

MCUX_REG_BIT_CLEAR16(reg, mask)
16-bit register bit clear macro

MCUX_REG_BIT_CLEAR32(reg, mask)
32-bit register bit clear macro

MCUX_REG_BIT_GET8(reg, mask)
8-bit register bit get macro

MCUX_REG_BIT_GET16(reg, mask)
16-bit register bit get macro

MCUX_REG_BIT_GET32(reg, mask)
32-bit register bit get macro

MCUX_REG_MODIFY8(reg, mask, value)
32-bit register read-modify-write macro

MCUX_REG_MODIFY16(reg, mask, value)
16-bit register read-modify-write macro

MCUX_REG_MODIFY32(reg, mask, value)
32-bit register read-modify-write macro

USEC_TO_COUNT(us, clockFreqInHz)
Macro to convert a microsecond period to raw count value

COUNT_TO_USEC(count, clockFreqInHz)
Macro to convert a raw count value to microsecond

MSEC_TO_COUNT(ms, clockFreqInHz)
Macro to convert a millisecond period to raw count value

COUNT_TO_MSEC(count, clockFreqInHz)
Macro to convert a raw count value to millisecond

SDK_ALIGN(var, alignbytes)
Macro to define a variable with alignbytes alignment

AT_NONCACHEABLE_SECTION(var)

AT_NONCACHEABLE_SECTION_ALIGN(var, alignbytes)

AT_NONCACHEABLE_SECTION_INIT(var)

AT_NONCACHEABLE_SECTION_ALIGN_INIT(var, alignbytes)

enum _status_groups
Status group numbers.

Values:

enumerator kStatusGroup_Generic
Group number for generic status codes.

enumerator kStatusGroup_FLASH
Group number for FLASH status codes.

enumerator kStatusGroup_LPSPI
Group number for LPSPI status codes.

enumerator kStatusGroup_FLEXIO_SPI
Group number for FLEXIO SPI status codes.

enumerator kStatusGroup_DSPI
Group number for DSPI status codes.

enumerator kStatusGroup_FLEXIO_UART
Group number for FLEXIO UART status codes.

enumerator kStatusGroup_FLEXIO_I2C
Group number for FLEXIO I2C status codes.

enumerator kStatusGroup_LPI2C
Group number for LPI2C status codes.

enumerator kStatusGroup_UART
Group number for UART status codes.

enumerator kStatusGroup_I2C
Group number for UART status codes.

enumerator kStatusGroup_LPSCI
Group number for LPSCI status codes.

enumerator kStatusGroup_LPUART
Group number for LPUART status codes.

enumerator kStatusGroup_SPI
Group number for SPI status code.

enumerator kStatusGroup_XRDC
Group number for XRDC status code.

enumerator kStatusGroup_SEMA42
Group number for SEMA42 status code.

enumerator kStatusGroup_SDHC
Group number for SDHC status code

enumerator kStatusGroup_SDMMC
Group number for SDMMC status code

enumerator kStatusGroup_SAI
Group number for SAI status code

enumerator kStatusGroup_MCG
Group number for MCG status codes.

enumerator kStatusGroup_SCG
Group number for SCG status codes.

enumerator kStatusGroup_SDSPI
Group number for SDSPI status codes.

enumerator kStatusGroup_FLEXIO_I2S
Group number for FLEXIO I2S status codes

enumerator kStatusGroup_FLEXIO_MCULCD
Group number for FLEXIO LCD status codes

enumerator kStatusGroup_FLASHIAP
Group number for FLASHIAP status codes

enumerator kStatusGroup_FLEXCOMM_I2C
Group number for FLEXCOMM I2C status codes

enumerator kStatusGroup_I2S
Group number for I2S status codes

enumerator kStatusGroup_IUART
Group number for IUART status codes

enumerator kStatusGroup_CSI
Group number for CSI status codes

enumerator kStatusGroup_MIPI_DSI
Group number for MIPI DSI status codes

enumerator kStatusGroup_SDRAMC
Group number for SDRAMC status codes.

enumerator kStatusGroup_POWER
Group number for POWER status codes.

enumerator kStatusGroup_ENET
Group number for ENET status codes.

enumerator kStatusGroup_PHY
Group number for PHY status codes.

enumerator kStatusGroup_TRGMUX
Group number for TRGMUX status codes.

enumerator kStatusGroup_SMARTCARD
Group number for SMARTCARD status codes.

enumerator kStatusGroup_LMEM
Group number for LMEM status codes.

enumerator kStatusGroup_QSPI
Group number for QSPI status codes.

enumerator kStatusGroup_DMA
Group number for DMA status codes.

enumerator kStatusGroup_EDMA
Group number for EDMA status codes.

enumerator kStatusGroup_DMAMGR
Group number for DMAMGR status codes.

enumerator kStatusGroup_FLEXCAN
Group number for FlexCAN status codes.

enumerator kStatusGroup_LTC
Group number for LTC status codes.

enumerator kStatusGroup_FLEXIO_CAMERA
Group number for FLEXIO CAMERA status codes.

enumerator kStatusGroup_LPC_SPI
Group number for LPC_SPI status codes.

enumerator kStatusGroup_LPC_USART
Group number for LPC_USART status codes.

enumerator kStatusGroup_DMIC
Group number for DMIC status codes.

enumerator kStatusGroup_SDIF
Group number for SDIF status codes.

enumerator kStatusGroup_SPIFI
Group number for SPIFI status codes.

enumerator kStatusGroup_OTP
Group number for OTP status codes.

enumerator kStatusGroup_MCAN
Group number for MCAN status codes.

enumerator kStatusGroup_CAAM
Group number for CAAM status codes.

enumerator kStatusGroup_ECSPI
Group number for ECSPI status codes.

enumerator kStatusGroup_USDHC
Group number for USDHC status codes.

enumerator kStatusGroup_LPC_I2C
Group number for LPC_I2C status codes.

enumerator kStatusGroup_DCP
Group number for DCP status codes.

enumerator kStatusGroup_MSCAN
Group number for MSCAN status codes.

enumerator kStatusGroup_ESAI
Group number for ESAI status codes.

enumerator kStatusGroup_FLEXSPI
Group number for FLEXSPI status codes.

enumerator kStatusGroup_MMDC
Group number for MMDC status codes.

enumerator kStatusGroup_PDM
Group number for MIC status codes.

enumerator kStatusGroup_SDMA
Group number for SDMA status codes.

enumerator kStatusGroup_ICS
Group number for ICS status codes.

enumerator kStatusGroup_SPDIF
Group number for SPDIF status codes.

enumerator kStatusGroup_LPC_MINISPI
Group number for LPC_MINISPI status codes.

enumerator kStatusGroup_HASHCRYPT
Group number for Hashcrypt status codes

enumerator kStatusGroup_LPC_SPI_SSP
Group number for LPC_SPI_SSP status codes.

enumerator kStatusGroup_I3C
Group number for I3C status codes

enumerator kStatusGroup_LPC_I2C_1
Group number for LPC_I2C_1 status codes.

enumerator kStatusGroup_NOTIFIER
Group number for NOTIFIER status codes.

enumerator kStatusGroup_DebugConsole
Group number for debug console status codes.

enumerator kStatusGroup_SEMC
Group number for SEMC status codes.

enumerator kStatusGroup_ApplicationRangeStart
Starting number for application groups.

enumerator kStatusGroup_IAP
Group number for IAP status codes

enumerator kStatusGroup_SFA
Group number for SFA status codes

enumerator kStatusGroup_SPC
Group number for SPC status codes.

enumerator kStatusGroup_PUF
Group number for PUF status codes.

enumerator kStatusGroup_TOUCH_PANEL
Group number for touch panel status codes

enumerator kStatusGroup_VBAT
Group number for VBAT status codes

enumerator kStatusGroup_XSPI
Group number for XSPI status codes

enumerator kStatusGroup_PNGDEC
Group number for PNGDEC status codes

enumerator kStatusGroup_JPEGDEC
Group number for JPEGDEC status codes

enumerator kStatusGroup_AUDMIX
Group number for AUDMIX status codes

enumerator kStatusGroup_HAL_GPIO
Group number for HAL GPIO status codes.

enumerator kStatusGroup_HAL_UART
Group number for HAL UART status codes.

enumerator kStatusGroup_HAL_TIMER
Group number for HAL TIMER status codes.

enumerator kStatusGroup_HAL_SPI
Group number for HAL SPI status codes.

enumerator kStatusGroup_HAL_I2C
Group number for HAL I2C status codes.

enumerator kStatusGroup_HAL_FLASH
Group number for HAL FLASH status codes.

enumerator kStatusGroup_HAL_PWM
Group number for HAL PWM status codes.

enumerator kStatusGroup_HAL_RNG
Group number for HAL RNG status codes.

enumerator kStatusGroup_HAL_I2S
Group number for HAL I2S status codes.

enumerator kStatusGroup_HAL_ADC_SENSOR
Group number for HAL ADC SENSOR status codes.

enumerator kStatusGroup_TIMERMANAGER
Group number for TiMER MANAGER status codes.

enumerator kStatusGroup_SERIALMANAGER
Group number for SERIAL MANAGER status codes.

enumerator kStatusGroup_LED
Group number for LED status codes.

enumerator kStatusGroup_BUTTON
Group number for BUTTON status codes.

enumerator kStatusGroup_EXTERN_EEPROM
Group number for EXTERN EEPROM status codes.

enumerator kStatusGroup_SHELL
Group number for SHELL status codes.

enumerator kStatusGroup_MEM_MANAGER
Group number for MEM MANAGER status codes.

enumerator kStatusGroup_LIST
Group number for List status codes.

enumerator kStatusGroup_OSA
Group number for OSA status codes.

enumerator kStatusGroup_COMMON_TASK
Group number for Common task status codes.

enumerator kStatusGroup_MSG
Group number for messaging status codes.

enumerator kStatusGroup_SDK_OCOTP
Group number for OCOTP status codes.

enumerator kStatusGroup_SDK_FLEXSPINOR
Group number for FLEXSPINOR status codes.

enumerator kStatusGroup_CODEC
Group number for codec status codes.

enumerator kStatusGroup_ASRC
Group number for codec status ASRC.

enumerator kStatusGroup_OTFAD
Group number for codec status codes.

enumerator kStatusGroup_SDIOSLV
Group number for SDIOSLV status codes.

enumerator kStatusGroup_MECC
Group number for MECC status codes.

enumerator kStatusGroup_ENET_QOS
Group number for ENET_QOS status codes.

enumerator kStatusGroup_LOG
Group number for LOG status codes.

enumerator kStatusGroup_I3CBUS
Group number for I3CBUS status codes.

enumerator kStatusGroup_QSCI
Group number for QSCI status codes.

enumerator kStatusGroup_ELEMU
Group number for ELEMU status codes.

enumerator kStatusGroup_QUEUEDSPI
Group number for QSPI status codes.

enumerator kStatusGroup_POWER_MANAGER
Group number for POWER_MANAGER status codes.

enumerator kStatusGroup_IPED
Group number for IPED status codes.

enumerator kStatusGroup_ELS_PKC
Group number for ELS PKC status codes.

enumerator kStatusGroup_CSS_PKC
Group number for CSS PKC status codes.

enumerator kStatusGroup_HOSTIF
Group number for HOSTIF status codes.

enumerator kStatusGroup_CLIF
Group number for CLIF status codes.

enumerator kStatusGroup_BMA
Group number for BMA status codes.

enumerator kStatusGroup_NETC
Group number for NETC status codes.

enumerator kStatusGroup_ELE
Group number for ELE status codes.

enumerator kStatusGroup_GLIKEY
Group number for GLIKEY status codes.

enumerator kStatusGroup_AON_POWER
Group number for AON_POWER status codes.

enumerator kStatusGroup_AON_COMMON
Group number for AON_COMMON status codes.

enumerator kStatusGroup_ENDAT3
Group number for ENDAT3 status codes.

enumerator kStatusGroup_HIPERFACE
Group number for HIPERFACE status codes.

enumerator kStatusGroup_NPX
Group number for NPX status codes.

enumerator kStatusGroup_ELA_CSEC
Group number for ELA_CSEC status codes.

enumerator kStatusGroup_FLEXIO_T_FORMAT
Group number for T-format status codes.

enumerator kStatusGroup_FLEXIO_A_FORMAT
Group number for A-format status codes.

enumerator kStatusGroup_LPC_QSPI
Group number for LPC QSPI status codes.

enumerator kStatusGroup_EVENT_CTRL
Group number for Event controller status codes.

Generic status return codes.

Values:

enumerator kStatus_Success
Generic status for Success.

enumerator kStatus_Fail
Generic status for Fail.

enumerator kStatus_ReadOnly
Generic status for read only failure.

enumerator kStatus_OutOfRange
Generic status for out of range access.

enumerator kStatus_InvalidArgument
Generic status for invalid argument check.

enumerator kStatus_Timeout
Generic status for timeout.

enumerator kStatus_NoTransferInProgress
Generic status for no transfer in progress.

enumerator kStatus_Busy
Generic status for module is busy.

enumerator kStatus_NoData
Generic status for no data is found for the operation.

typedef int32_t status_t

Type used for all status and error return values.

uint8_t bool

void *SDK_Malloc(size_t size, size_t alignbytes)

Allocate memory with given alignment and aligned size.

This is provided to support the dynamically allocated memory used in cache-able region.

Parameters

- size – The length required to malloc.
- alignbytes – The alignment size.

Return values

The – allocated memory.

void SDK_Free(void *ptr)

Free memory.

Parameters

- ptr – The memory to be release.

void SDK_DelayAtLeastUs(uint32_t delayTime_us, uint32_t coreClock_Hz)

Delay at least for some time. Please note that, this API uses while loop for delay, different run-time environments make the time not precise, if precise delay count was needed, please implement a new delay function with hardware timer.

Parameters

- delayTime_us – Delay time in unit of microsecond.
- coreClock_Hz – Core clock frequency with Hz.

static inline uint32_t DisableGlobalIRQ(void)

Disable the global IRQ.

static inline void EnableGlobalIRQ(uint32_t irqSts)

Enable the global IRQ.

static inline bool isIRQAllowed(void)

Check if currently core is able to response IRQ.

void SDK_DelayCoreCycles(uint32_t u32Num)

Delay core cycles. Please note that, this API uses software loop for delay, the actual delayed time depends on core clock frequency, where the function is located (ram or flash), flash clock, possible interrupt.

Parameters

- u32Num – Number of core clock cycle which needs to be delayed.

uint32_t SDK_CovertUsToCount(uint32_t u32Us, uint32_t u32Hz)

Covert us to count with fixed-point calculation.

Note: u32Us must not be greater than 4294

Parameters

- u32Us – Time in us

- u32Hz – Clock frequency in Hz

Returns
The count value

uint32_t SDK_CovertCountToUs(uint32_t u32Count, uint32_t u32Hz)

Covert count to us with fixed-point calculation.

Note: u32Hz must not be greater than 429496729UL(0xFFFFFFFFUL/10UL)

Parameters

- u32Count – Count value
- u32Hz – Clock frequency in Hz

Returns
The us value

uint32_t SDK_CovertMsToCount(uint32_t u32Ms, uint32_t u32Hz)

Covert ms to count with fixed-point calculation.

Note: u32Ms must not be greater than 42949UL @ u32Hz = 100M

Parameters

- u32Ms – Time in us
- u32Hz – Clock frequency in Hz

Returns
The count value

uint32_t SDK_CovertCountToMs(uint32_t u32Count, uint32_t u32Hz)

Covert count to ms with fixed-point calculation.

Note: u32Hz must not be greater than 429496729UL(0xFFFFFFFFUL/10UL)

Parameters

- u32Count – Count value
- u32Hz – Clock frequency in Hz

Returns
The us value

void SDK_DelayAtLeastMs(uint32_t delayTime_ms, uint32_t coreClock_Hz)

Delay at least for some time in millisecond unit. Please note that, this API uses while loop for delay, different run-time environments make the time not precise, if precise delay count was needed, please implement a new delay function with hardware timer.

Parameters

- delayTime_ms – Delay time in unit of millisecond.
- coreClock_Hz – Core clock frequency with Hz.

FSL_DRIVER_TRANSFER_DOUBLE_WEAK_IRQ

Macro to use the default weak IRQ handler in drivers.

MAKE_STATUS(group, code)

Construct a status code value from a group and code number.

MAKE_VERSION(major, minor, bugfix)

Construct the version number for drivers.

The driver version is a 32-bit number, for both 32-bit platforms(such as Cortex M) and 16-bit platforms(such as DSC).

```
| Unused    || Major Version || Minor Version ||  Bug Fix    |
31       25  24          17  16          9  8           0
```

ARRAY_SIZE(x)

Computes the number of elements in an array.

SUPPRESS_FALL_THROUGH_WARNING()

For switch case code block, if case section ends without "break;" statement, there wil be fallthrough warning with compiler flag -Wextra or -Wimplicit-fallthrough=n when using armgcc. To suppress this warning, "SUPPRESS_FALL_THROUGH_WARNING();" need to be added at the end of each case section which misses "break;"statement.

true

false

SDK_ISR_EXIT_BARRIER

SDK_DSC_DEFAULT_INT_PRIO

Default DSC interrupt priority number.

SetIRQBasePriority(x)

Set base core IRQ priority, that core will response the interrupt request with priority >= base IRQ priority.

PeriphReadReg(reg)

Read register value.

Example: val = PeriphReadReg(OCCS->OSCTL2);

Parameters

- reg – Register name.

Returns

The value of register.

PeriphWriteReg(reg, data)

Write data to register.

Example: PeriphWriteReg(OCCS->OSCTL2, 0x278U);

Parameters

- reg – Register name.
- data – Data wrote to register.

PeriphSetBits(reg, bitMask)

Set specified bits in register.

Example: PeriphSetBits(OCCS->OSCTL2, 0x12U);

Parameters

- reg – Register name.
- bitMask – Bits mask, set bits will be set in the register.

PeriphClearBits(reg, bitMask)

Clear specified bits in register.

Example: PeriphClearBits(OCCS->OSCTL2, 0x12U);

Parameters

- reg – Register name.
- bitMask – Bits mask, set bits will be cleared in the register.

PeriphInvertBits(reg, bitMask)

Invert specified bits in register.

Example: PeriphInvertBits(OCCS->OSCTL2, 0x12U);

Parameters

- reg – Register name.
- bitMask – Bits mask, set bits will be inverted in the register.

PeriphGetBits(reg, bitMask)

Get specified bits in register.

Example: val = PeriphGetBits(OCCS->OSCTL2, 0x23U);

Parameters

- reg – Register name.
- bitMask – Bits mask, specify the getting bits.

Returns

The value of specified bits.

PeriphWriteBitGroup(reg, bitMask, bitValue)

Write group of bits to register.

Example: PeriphWriteBitGroup(OCCS->DIVBY, OCCS_DIVBY_COD_MASK, OCCS_DIVBY_COD(23U)); PeriphWriteBitGroup(OCCS->DIVBY, OCCS_DIVBY_COD_MASK | OCCS_DIVBY_PLLDB_MASK, \ OCCS_DIVBY_COD(23U) | OCCS_DIVBY_PLLDB(49U));

Parameters

- reg – Register name.
- bitMask – Bits mask, mask of the group of bits.
- bitValue – This value will be written into the bit group specified by parameter bitMask.

PeriphSafeClearFlags(reg, allFlagsMask, flagMask)

Clear (acknowledge) flags which are active-high and are cleared-by-write-one.

This macro is useful when a register is comprised by normal read-write bits and cleared-by-write-one bits. Example: PeriphSafeClearFlags(PWMA->FAULT[0].FSTS, PWM_FSTS_FFLAG_MASK, PWM_FSTS_FFLAG(2));

Parameters

- reg – Register name.
- allFlagsMask – Mask for all flags which are active-high and are cleared-by-write-one.
- flagMask – The selected flags(cleared-by-write-one) which are supposed to be cleared.

PeriphSafeClearBits(reg, allFlagsMask, bitMask)

Clear selected bits without modifying (acknowledge) bit flags which are active-high and are cleared-by-write-one.

This macro is useful when a register is comprised by normal read-write bits and cleared-by-write-one bits. Example: PeriphSafeClearBits(PWMA->FAULT[0].FSTS, PWM_FSTS_FFLAG_MASK, PWM_FSTS_FHALF(2));

Parameters

- reg – Register name.
- allFlagsMask – Mask for all flags which are active-high and are cleared-by-write-one.
- bitMask – The selected bits which are supposed to be cleared.

PeriphSafeSetBits(reg, allFlagsMask, bitMask)

Set selected bits without modifying (acknowledge) bit flags which are active-high and are cleared-by-write-one.

This macro is useful when a register is comprised by normal read-write bits and cleared-by-write-one bits. Example: PeriphSafeSetBits(PWMA->FAULT[0].FSTS, PWM_FSTS_FFLAG_MASK, PWM_FSTS_FHALF(2));

Parameters

- reg – Register name.
- allFlagsMask – Mask for all flags which are active-high and are cleared-by-write-one.
- bitMask – The selected bits which are supposed to be set.

PeriphSafeWriteBitGroup(reg, allFlagsMask, bitMask, bitValue)

Write group of bits without modifying (acknowledge) bit flags which are active-high and are cleared-by-write-one.

This macro is useful when a register is comprised by normal read-write bits and cleared-by-write-one bits. Example: PeriphSafeWriteBitGroup(PWMA->FAULT[0].FSTS, PWM_FSTS_FFLAG_MASK, PWM_FSTS_FHALF_MASK, PWM_FSTS_FHALF(3U)); PeriphSafeWriteBitGroup(PWMA->FAULT[0].FSTS, PWM_FSTS_FFLAG_MASK, PWM_FSTS_FHALF_MASK | PWM_FSTS_FFULL_MASK, \ PWM_FSTS_FHALF(3U) | PWM_FSTS_FFULL(2U));

Parameters

- reg – Register name.
- allFlagsMask – Mask for all flags which are active-high and are cleared-by-write-one.
- bitMask – Bits mask, mask of the group of bits.
- bitValue – This value will be written into the bit group specified by parameter bitMask.

SDK_GET_REGISTER_BYTE_ADDR(ipType, ipBase, regName)

Get IP register byte address with uint32_t type.

This macro is useful when a register byte address is required, especially in SDM mode. Example: *SDK_GET_REGISTER_BYTE_ADDR(ADC_Type, ADC, RSLT[0])*;

Parameters

- ipType – IP register mapping struct type.
- ipBase – IP instance base pointer, WORD address.
- regName – Member register name of IP register mapping struct.

MSDK_REG_SECURE_ADDR(x)

MSDK_REG_NONSECURE_ADDR(x)

MCUX_DEPRECATED

MCUX_DEPRECATED_MACRO

MCUX_EXPERIMENTAL

MCUX_EXPERIMENTAL_MACRO

2.44 LPI2C: Low Power Inter-Integrated Circuit Driver

enum _lpi2c_master_status_flags

LPI2C master peripheral flags.

The following status register flags can be cleared:

- *kLPI2C_MasterEndOfPacketInterruptFlag*
- *kLPI2C_MasterStopDetectInterruptFlag*
- *kLPI2C_MasterNackDetectInterruptFlag*
- *kLPI2C_MasterArbitrationLostInterruptFlag*
- *kLPI2C_MasterFifoErrInterruptFlag*
- *kLPI2C_MasterPinLowTimeoutInterruptFlag*
- *kLPI2C_MasterDataMatchInterruptFlag*

All flags except *kLPI2C_MasterBusyFlag* and *kLPI2C_MasterBusBusyFlag* can be enabled as interrupts.

Note: These enums are meant to be OR'd together to form a bit mask.

Values:

enumerator kLPI2C_MasterTxReadyInterruptFlag

Transmit data interrupt flag

enumerator kLPI2C_MasterRxReadyInterruptFlag
Receive data interrupt flag

enumerator kLPI2C_MasterEndOfPacketInterruptFlag
End Packet interrupt flag

enumerator kLPI2C_MasterStopDetectInterruptFlag
Stop detect interrupt flag

enumerator kLPI2C_MasterNackDetectInterruptFlag
NACK detect interrupt flag

enumerator kLPI2C_MasterArbitrationLostInterruptFlag
Arbitration lost interrupt flag

enumerator kLPI2C_MasterFifoErrInterruptFlag
FIFO error interrupt flag

enumerator kLPI2C_MasterPinLowTimeoutInterruptFlag
Pin low timeout interrupt flag

enumerator kLPI2C_MasterDataMatchInterruptFlag
Data match interrupt flag

enumerator kLPI2C_MasterBusyFlag
Master busy flag

enumerator kLPI2C_MasterBusBusyFlag
Bus busy flag All flags

enumerator kLPI2C_MasterStatusAllFlags

enumerator kLPI2C_MasterClearInterruptFlags
All flags which are cleared by the driver upon starting a transfer.

enumerator kLPI2C_MasterIrqFlags
IRQ sources enabled by the non-blocking transactional API.

enumerator kLPI2C_MasterErrorInterruptFlags
Errors to check for.

enum _lpi2c_slave_status_flags
LPI2C slave peripheral flags.

The following status register flags can be cleared:

- *kLPI2C_SlaveRepeatedStartDetectInterruptFlag*
- *kLPI2C_SlaveStopDetectInterruptFlag*
- *kLPI2C_SlaveBitErrInterruptFlag*

- *kLPI2C_SlaveFifoErrInterruptFlag*

All flags except *kLPI2C_SlaveBusyFlag* and *kLPI2C_SlaveBusBusyFlag* can be enabled as interrupts.

Note: These enumerations are meant to be OR'd together to form a bit mask.

Values:

enumerator kLPI2C_SlaveTxReadyInterruptFlag
Transmit data interrupt flag

enumerator kLPI2C_SlaveRxReadyInterruptFlag
Receive data interrupt flag

enumerator kLPI2C_SlaveAddressValidInterruptFlag
Address valid interrupt flag

enumerator kLPI2C_SlaveTransmitAckInterruptFlag
Transmit ACK interrupt flag

enumerator kLPI2C_SlaveRepeatedStartDetectInterruptFlag
Repeated start detect interrupt flag

enumerator kLPI2C_SlaveStopDetectInterruptFlag
Stop detect interrupt flag

enumerator kLPI2C_SlaveBitErrInterruptFlag
Bit error interrupt flag

enumerator kLPI2C_SlaveFifoErrInterruptFlag
FIFO error interrupt flag

enumerator kLPI2C_SlaveAddressMatch0InterruptFlag
Address match 0 interrupt flag

enumerator kLPI2C_SlaveAddressMatch1InterruptFlag
Address match 1 interrupt flag

enumerator kLPI2C_SlaveGeneralCallInterruptFlag
General call interrupt flag

enumerator kLPI2C_SlaveSmbusAlertRespInterruptFlag
SMBus alert response interrupt flag

enumerator kLPI2C_SlaveBusyFlag
Master busy flag

enumerator kLPI2C_SlaveBusBusyFlag
Bus busy flag All flags

enumerator kLPI2C_SlaveStatusAllFlags

enumerator kLPI2C_SlaveClearInterruptFlags

All flags which are cleared by the driver upon starting a transfer.

enumerator kLPI2C_SlaveIrqFlags

IRQ sources enabled by the non-blocking transactional API.

enumerator kLPI2C_SlaveErrorInterruptFlags

Errors to check for.

static inline uint16_t LPI2C_MasterGetStatusFlags(LPI2C_Type *base)

Gets the LPI2C master status flags.

A bit mask with the state of all LPI2C master status flags is returned. For each flag, the corresponding bit in the return value is set if the flag is asserted.

See also:

_lpi2c_master_status_flags

Parameters

- base – The LPI2C peripheral base address.

Returns

State of the status flags:

- 1: related status flag is set.
- 0: related status flag is not set.

static inline void LPI2C_MasterClearStatusFlags(LPI2C_Type *base, uint16_t u16StatusFlags)

Clears the LPI2C master status flag state.

The following status register flags can be cleared:

- *kLPI2C_MasterEndOfPacketInterruptFlag*
- *kLPI2C_MasterStopDetectInterruptFlag*
- *kLPI2C_MasterNackDetectInterruptFlag*
- *kLPI2C_MasterArbitrationLostInterruptFlag*
- *kLPI2C_MasterFifoErrInterruptFlag*
- *kLPI2C_MasterPinLowTimeoutInterruptFlag*
- *kLPI2C_MasterDataMatchInterruptFlag*

Attempts to clear other flags has no effect.

See also:

_lpi2c_master_status_flags.

Parameters

- base – The LPI2C peripheral base address.

- u16StatusFlags – A bitmask of status flags that are to be cleared. The mask is composed of *_lpi2c_master_status_flags* enumerators OR'd together. You may pass the result of a previous call to *LPI2C_MasterGetStatusFlags()*.

static inline uint16_t LPI2C_SlaveGetStatusFlags(LPI2C_Type *base)

Gets the LPI2C slave status flags.

A bit mask with the state of all LPI2C slave status flags is returned. For each flag, the corresponding bit in the return value is set if the flag is asserted.

See also:

_lpi2c_slave_status_flags

Parameters

- base – The LPI2C peripheral base address.

Returns

State of the status flags:

- 1: related status flag is set.
- 0: related status flag is not set.

static inline void LPI2C_SlaveClearStatusFlags(LPI2C_Type *base, uint16_t u16StatusFlags)

Clears the LPI2C status flag state.

The following status register flags can be cleared:

- *kLPI2C_SlaveRepeatedStartDetectInterruptFlag*
- *kLPI2C_SlaveStopDetectInterruptFlag*
- *kLPI2C_SlaveBitErrInterruptFlag*
- *kLPI2C_SlaveFifoErrInterruptFlag*

Attempts to clear other flags has no effect.

See also:

_lpi2c_slave_status_flags.

Parameters

- base – The LPI2C peripheral base address.
- u16StatusFlags – A bitmask of status flags that are to be cleared. The mask is composed of *_lpi2c_slave_status_flags* enumerators OR'd together. You may pass the result of a previous call to *LPI2C_SlaveGetStatusFlags()*.

enum _lpi2c_master_pin_config

LPI2C pin configuration.

Values:

enumerator kLPI2C_2PinOpenDrain

LPI2C Configured for 2-pin open drain mode

enumerator kLPI2C_2PinOutputOnly
LPI2C Configured for 2-pin output only mode (ultra-fast mode)

enumerator kLPI2C_2PinPushPull
LPI2C Configured for 2-pin push-pull mode

enumerator kLPI2C_4PinPushPull
LPI2C Configured for 4-pin push-pull mode

enumerator kLPI2C_2PinOpenDrainWithSeparateSlave
LPI2C Configured for 2-pin open drain mode with separate LPI2C slave

enumerator kLPI2C_2PinOutputOnlyWithSeparateSlave
LPI2C Configured for 2-pin output only mode(ultra-fast mode) with separate LPI2C slave

enumerator kLPI2C_2PinPushPullWithSeparateSlave
LPI2C Configured for 2-pin push-pull mode with separate LPI2C slave

enumerator kLPI2C_4PinPushPullWithInvertedOutput
LPI2C Configured for 4-pin push-pull mode(inverted outputs)

enum _lpi2c_host_request_source
LPI2C master host request selection.
Values:

enumerator kLPI2C_HostRequestExternalPin
Select the LPI2C_HREQ pin as the host request input

enumerator kLPI2C_HostRequestInputTrigger
Select the input trigger as the host request input

enum _lpi2c_host_request_polarity
LPI2C master host request pin polarity configuration.
Values:

enumerator kLPI2C_HostRequestPinActiveLow
Configure the LPI2C_HREQ pin active low

enumerator kLPI2C_HostRequestPinActiveHigh
Configure the LPI2C_HREQ pin active high

enum _lpi2c_data_match_config_mode
LPI2C master data match configuration modes.
Values:

enumerator kLPI2C_MatchDisabled
LPI2C Match Disabled

enumerator kLPI2C_1stWordEqualsM0OrM1
LPI2C Match Enabled and 1st data word equals MATCH0 OR MATCH1

enumerator kLPI2C_AnyWordEqualsM0OrM1
LPI2C Match Enabled and any data word equals MATCH0 OR MATCH1

enumerator kLPI2C_1stWordEqualsM0And2ndWordEqualsM1
LPI2C Match Enabled and 1st data word equals MATCH0, 2nd data equals MATCH1

enumerator kLPI2C_AnyWordEqualsM0AndNextWordEqualsM1
LPI2C Match Enabled and any data word equals MATCH0, next data equals MATCH1

enumerator kLPI2C_1stWordAndM1EqualsM0AndM1
LPI2C Match Enabled and 1st data word and MATCH0 equals MATCH0 and MATCH1

enumerator kLPI2C_AnyWordAndM1EqualsM0AndM1
LPI2C Match Enabled and any data word and MATCH0 equals MATCH0 and MATCH1

typedef enum *_lpi2c_master_pin_config* lpi2c_master_pin_config_t
LPI2C pin configuration.

typedef enum *_lpi2c_host_request_source* lpi2c_host_request_source_t
LPI2C master host request selection.

typedef enum *_lpi2c_host_request_polarity* lpi2c_host_request_polarity_t
LPI2C master host request pin polarity configuration.

typedef enum *_lpi2c_data_match_config_mode* lpi2c_data_match_config_mode_t
LPI2C master data match configuration modes.

typedef struct *_lpi2c_match_config* lpi2c_data_match_config_t
LPI2C master data match configuration structure.

void LPI2C_MasterSetBaudRate(LPI2C_Type *base, uint32_t u32SrcClockHz, uint32_t u32BaudRateBps)
Sets the I2C bus frequency for master transactions.

The LPI2C master is automatically disabled and re-enabled as necessary to configure the baud rate. Do not call this function during a transfer, or the transfer is aborted.

Note: Please note that the second parameter is the clock frequency of LPI2C module, the third parameter means user configured bus baudrate, this implementation is different from other I2C drivers which use baudrate configuration as second parameter and source clock frequency as third parameter.

Parameters

- base – The LPI2C peripheral base address.
- u32SrcClockHz – LPI2C functional clock frequency in Hertz.
- u32BaudRateBps – Requested bus frequency in Hertz.

void LPI2C_MasterSetGlitchFilter(LPI2C_Type *base, uint32_t u32SdaFilterWidthNs, uint32_t u32SclFilterWidthNs, uint32_t u32SrcClockHz)

Sets the LPI2C master glitch filter width.

After the LPI2C module is initialized as master, user can call this function to change the glitch filter width.

Parameters

- base – The LPI2C peripheral base address.
- u32SdaFilterWidthNs – The SDA glitch filter length in nano seconds.
- u32SclFilterWidthNs – The SCL glitch filter length in nano seconds.
- u32SrcClockHz – LPI2C peripheral clock frequency in Hz

void LPI2C_MasterSetDataMatch(LPI2C_Type *base, const *lpi2c_data_match_config_t* *psConfig)

Configures LPI2C master data match feature.

Parameters

- base – The LPI2C peripheral base address.
- psConfig – Settings for the data match feature.

static inline void LPI2C_MasterReset(LPI2C_Type *base)

Performs a software reset.

Restores the LPI2C master peripheral to reset conditions.

Parameters

- base – The LPI2C peripheral base address.

static inline void LPI2C_MasterEnable(LPI2C_Type *base, bool bEnable)

Enables or disables the LPI2C module as master.

Parameters

- base – The LPI2C peripheral base address.
- bEnable – Pass true to enable or false to disable the specified LPI2C as master.

static inline void LPI2C_MasterSetWatermarks(LPI2C_Type *base, uint16_t u16TxWords, uint16_t u16RxWords)

Sets the watermarks for LPI2C master FIFOs.

Parameters

- base – The LPI2C peripheral base address.
- u16TxWords – Transmit FIFO watermark value in words. The *kLPI2C_MasterTxReadyInterruptFlag* flag is set whenever the number of words in the transmit FIFO is equal or less than *u16TxWords*. Writing a value equal or greater than the FIFO size is truncated.
- u16RxWords – Receive FIFO watermark value in words. The *kLPI2C_MasterRxReadyInterruptFlag* flag is set whenever the number of words in the receive FIFO is greater than *u16RxWords*. Writing a value equal or greater than the FIFO size is truncated.

static inline void LPI2C_MasterGetFifoCounts(LPI2C_Type *base, uint16_t *pu16RxCount, uint16_t *pu16TxCount)

Gets the current number of words in the LPI2C master FIFOs.

Parameters

- base – The LPI2C peripheral base address.
- pu16RxCount – Pointer through which the current number of words in the transmit FIFO is returned. Pass NULL if this value is not required.
- pu16TxCount – Pointer through which the current number of words in the receive FIFO is returned. Pass NULL if this value is not required.

enum _lpi2c_slave_address_match

LPI2C slave address match options.

Values:

enumerator kLPI2C_Match7BitAddress0

Match only 7 bit address 0.

enumerator kLPI2C_Match10BitAddress0

Match only 10 bit address 0.

enumerator kLPI2C_Match7BitAddress0Or7BitAddress1

Match either 7 bit address 0 or 7 bit address 1.

enumerator kLPI2C_Match10BitAddress0Or10BitAddress1

Match either 10 bit address 0 or 10 bit address 1.

enumerator kLPI2C_Match7BitAddress0Or10BitAddress1

Match either 7 bit address 0 or 10 bit address 1.

enumerator kLPI2C_Match10BitAddress0Or7BitAddress1

Match either 10 bit address 0 or 7 bit address 1.

enumerator kLPI2C_Match7BitAddress0Through7BitAddress1

Match a range of slave addresses from 7 bit address 0 through 7 bit address 1.

enumerator kLPI2C_Match10BitAddress0Through10BitAddress1

Match a range of slave addresses from 10 bit address 0 through 10 bit address 1.

typedef enum *_lpi2c_slave_address_match* lpi2c_slave_address_match_t

LPI2C slave address match options.

void LPI2C_SlaveSetGlitchFilter(LPI2C_Type *base, uint32_t u32SdaFilterWidthNs, uint32_t u32SclFilterWidthNs, uint32_t u32SrcClockHz)

Sets the LPI2C slave glitch filter width.

After the LPI2C module is initialized as slave, user can call this function to change the glitch filter width.

Parameters

- base – The LPI2C peripheral base address.
- u32SdaFilterWidthNs – The SDA glitch filter length in nano seconds.
- u32SclFilterWidthNs – The SCL glitch filter length in nano seconds.
- u32SrcClockHz – LPI2C peripheral clock frequency in Hz

void LPI2C_SlaveSetAddressingMode(LPI2C_Type *base, *lpi2c_slave_address_match_t* eAddressMatchMode, uint16_t u16Address0, uint16_t u16Address1)

Configure the slave addressing mode.

After the LPI2C module is initialized as slave, user can call this function to change the configuration of slave addressing mode.

Parameters

- base – The LPI2C peripheral base address.
- eAddressMatchMode – The slave addressing match mode.
- u16Address0 – LPI2C slave address 0. For 7-bit address low 7-bit is used, for 10-bit address low 10-bit is used.
- u16Address1 – LPI2C slave address 1. For 7-bit address low 7-bit is used, for 10-bit address low 10-bit is used.

static inline void LPI2C_SlaveReset(LPI2C_Type *base)

Performs a software reset of the LPI2C slave peripheral.

Parameters

- base – The LPI2C peripheral base address.

static inline void LPI2C_SlaveEnable(LPI2C_Type *base, bool bEnable)

Enables or disables the LPI2C module as slave.

Parameters

- base – The LPI2C peripheral base address.
- bEnable – Pass true to enable or false to disable the specified LPI2C as slave.

enum _lpi2c_data_direction

Direction of master and slave transfers.

Values:

enumerator kLPI2C_Write

Master transmit.

enumerator kLPI2C_Read

Master receive.

typedef enum *_lpi2c_data_direction* lpi2c_data_direction_t

Direction of master and slave transfers.

status_t LPI2C_MasterCheckAndClearError(LPI2C_Type *base, uint16_t u16Status)

status_t LPI2C_MasterCheckForBusyBus(LPI2C_Type *base)

status_t LPI2C_MasterStartInternal(LPI2C_Type *base, uint8_t u8Address, *lpi2c_data_direction_t* eDir, bool bIsRepeatedStart)

static inline *status_t* LPI2C_MasterStart(LPI2C_Type *base, uint8_t u8Address, *lpi2c_data_direction_t* eDir)

Sends a START signal and slave address on the I2C bus.

This function is used to initiate a new master mode transfer. First, the bus state is checked to ensure that another master is not occupying the bus. Then a START signal is transmitted, followed by the 7-bit address specified in the *address* parameter. Note that this function

does not actually wait until the START and address are successfully sent on the bus before returning.

Parameters

- base – The LPI2C peripheral base address.
- u8Address – 7-bit slave device address, in bits [6:0].
- eDir – Master transfer direction, either *kLPI2C_Read* or *kLPI2C_Write*. This parameter is used to set the R/w bit (bit 0) in the transmitted slave address.

Return values

- kStatus_Success – START signal and address were successfully enqueued in the transmit FIFO.
- kStatus_LPI2C_Busy – Another master is currently utilizing the bus.

static inline *status_t* LPI2C_MasterRepeatedStart(LPI2C_Type *base, uint8_t u8Address, *lpi2c_data_direction_t* eDir)

Sends a repeated START signal and slave address on the I2C bus.

This function is used to send a Repeated START signal when a transfer is already in progress. Like *LPI2C_MasterStart()*, it also sends the specified 7-bit address.

Note: This function exists primarily to maintain compatible APIs between LPI2C and I2C drivers, as well as to better document the intent of code that uses these APIs.

Parameters

- base – The LPI2C peripheral base address.
- u8Address – 7-bit slave device address, in bits [6:0].
- eDir – Master transfer direction, either *kLPI2C_Read* or *kLPI2C_Write*. This parameter is used to set the R/w bit (bit 0) in the transmitted slave address.

Return values

- kStatus_Success – Repeated START signal and address were successfully enqueued in the transmit FIFO.
- kStatus_LPI2C_Busy – Another master is currently utilizing the bus.

status_t LPI2C_MasterStop(LPI2C_Type *base)

Sends a STOP signal on the I2C bus.

This function does not return until the STOP signal is seen on the bus, or an error occurs.

Parameters

- base – The LPI2C peripheral base address.

Return values

- kStatus_Success – The STOP signal was successfully sent on the bus and the transaction terminated.
- kStatus_LPI2C_Busy – Another master is currently utilizing the bus.
- kStatus_LPI2C_Nak – The slave device sent a NAK in response to a byte.
- kStatus_LPI2C_FifoError – FIFO under run or overrun.
- kStatus_LPI2C_ArbitrationLost – Arbitration lost error.
- kStatus_LPI2C_PinLowTimeout – SCL or SDA were held low longer than the timeout.

status_t LPI2C_MasterSend(LPI2C_Type *base, void *pTxBuff, uint16_t u16TxSize, bool bPecEnable)

Performs a polling send transfer on the I2C bus.

Sends up to *u16TxSize* number of bytes to the previously addressed slave device. The slave may reply with a NAK to any byte in order to terminate the transfer early. If this happens, this function returns *kStatus_LPI2C_Nak*.

Parameters

- base – The LPI2C peripheral base address.
- pTxBuff – The pointer to the data to be transferred.
- u16TxSize – The length in bytes of the data to be transferred.
- bPecEnable – It decides whether one byte PEC is needed to send.

Return values

- kStatus_Success – Data was sent successfully.
- kStatus_LPI2C_Busy – Another master is currently utilizing the bus.
- kStatus_LPI2C_Nak – The slave device sent a NAK in response to a byte.
- kStatus_LPI2C_FifoError – FIFO under run or over run.
- kStatus_LPI2C_ArbitrationLost – Arbitration lost error.
- kStatus_LPI2C_PinLowTimeout – SCL or SDA were held low longer than the timeout.

status_t LPI2C_MasterReceive(LPI2C_Type *base, void *pRxBuff, uint16_t u16RxSize, bool bPecEnable)

Performs a polling receive transfer on the I2C bus.

Parameters

- base – The LPI2C peripheral base address.
- pRxBuff – The pointer to the data to be transferred.
- u16RxSize – The length in bytes of the data to be transferred.
- bPecEnable – It decides whether one byte PEC is needed to receive.

Return values

- kStatus_Success – Data was received successfully.
- kStatus_LPI2C_Busy – Another master is currently utilizing the bus.
- kStatus_LPI2C_Nak – The slave device sent a NAK in response to a byte.
- kStatus_LPI2C_FifoError – FIFO under run or overrun.
- kStatus_LPI2C_ArbitrationLost – Arbitration lost error.
- kStatus_LPI2C_PinLowTimeout – SCL or SDA were held low longer than the timeout.

enum _lpi2c_master_transfer_control_flags

Transfer option flags.

Note: These enumerations are intended to be OR'd together to form a bit mask of options for the *_lpi2c_master_transfer::u8ControlFlagMask* field.

Values:

enumerator kLPI2C_TransferStartStopFlag

Transfer starts with a start signal, stops with a stop signal.

enumerator kLPI2C_TransferNoStartFlag

Don't send a start condition, address, and sub address

enumerator kLPI2C_TransferRepeatedStartFlag

Send a repeated start condition

enumerator kLPI2C_TransferNoStopFlag

Don't send a stop condition.

typedef struct *_lpi2c_master_transfer* lpi2c_master_transfer_t

lpi2c_master_transfer_t forward definition.

typedef struct *_lpi2c_master_transfer_handle* lpi2c_master_transfer_handle_t

lpi2c_master_transfer_handle_t forward definition.

typedef void (*lpi2c_master_transfer_callback_t)(*lpi2c_master_transfer_handle_t* *psHandle)

Master completion callback function pointer type.

This callback is used only for the non-blocking master transfer API. Specify the callback you wish to use in the call to *LPI2C_MasterTransferCreateHandle()*.

Param psHandle
Pointer to the LPI2C master driver handle.

status_t LPI2C_MasterTransferBlocking(LPI2C_Type *base, *lpi2c_master_transfer_t* *psTransfer)

Performs a master polling transfer on the I2C bus.

Note: The API does not return until the transfer succeeds or fails due to error happens during transfer.

Parameters

- base – The LPI2C peripheral base address.
- psTransfer – Pointer to the transfer structure.

Return values

- kStatus_Success – Data was received successfully.
- kStatus_LPI2C_Busy – Another master is currently utilizing the bus.
- kStatus_LPI2C_Nak – The slave device sent a NAK in response to a byte.
- kStatus_LPI2C_FifoError – FIFO under run or overrun.
- kStatus_LPI2C_ArbitrationLost – Arbitration lost error.
- kStatus_LPI2C_PinLowTimeout – SCL or SDA were held low longer than the timeout.

void LPI2C_MasterTransferCreateHandle(LPI2C_Type *base, *lpi2c_master_transfer_handle_t* *psHandle, *lpi2c_master_transfer_callback_t* pfCallback, void *pUserData)

Creates a new handle for the LPI2C master non-blocking APIs.

The creation of a handle is for use with the non-blocking APIs. Once a handle is created, there is not a corresponding destroy handle. If the user wants to terminate a transfer, the *LPI2C_MasterTransferAbort()* API shall be called.

Note: The function also enables the NVIC IRQ for the input LPI2C. Need to notice that on some SoCs the LPI2C IRQ is connected to INTMUX, in this case user needs to enable the associated INTMUX IRQ in application.

Parameters

- base – The LPI2C peripheral base address.
- psHandle – Pointer to the LPI2C master driver handle.
- pfCallback – User provided pointer to the asynchronous callback function.
- pUserData – User provided pointer to the application callback data.

status_t LPI2C_MasterTransferNonBlocking(*lpi2c_master_transfer_handle_t* *psHandle, *lpi2c_master_transfer_t* *psTransfer)

Performs a non-blocking transaction on the I2C bus.

Parameters

- psHandle – Pointer to the LPI2C master driver handle.
- psTransfer – The pointer to the transfer descriptor.

Return values

- kStatus_Success – The transaction was started successfully.
- kStatus_LPI2C_Busy – Either another master is currently utilizing the bus, or a non-blocking transaction is already in progress.

status_t LPI2C_MasterTransferGetCount(*lpi2c_master_transfer_handle_t* *psHandle, uint16_t *pu16Count)

Returns number of bytes transferred so far.

Parameters

- psHandle – Pointer to the LPI2C master driver handle.
- pu16Count – Number of bytes transferred so far by the non-blocking transaction.

Return values

- kStatus_Success –
- kStatus_NoTransferInProgress – There is not a non-blocking transaction currently in progress.

void LPI2C_MasterTransferAbort(*lpi2c_master_transfer_handle_t* *psHandle)

Terminates a non-blocking LPI2C master transmission early.

Note: It is not safe to call this function from an IRQ handler that has a higher priority than the LPI2C peripheral's IRQ priority.

Parameters

- psHandle – Pointer to the LPI2C master driver handle.

Return values

- kStatus_Success – A transaction was successfully aborted.
- kStatus_LPI2C_Idle – There is not a non-blocking transaction currently in progress.

void LPI2C_MasterTransferHandleIRQ(*lpi2c_master_transfer_handle_t* *psHandle)

Reusable routine to handle master interrupts.

Note: This function does not need to be called unless you are reimplementing the non-blocking API's interrupt handler routines to add special functionality.

Parameters

- psHandle – Pointer to the LPI2C master driver handle.

enum _lpi2c_slave_transfer_event

Set of events sent to the callback for non blocking slave transfers.

These event enumerations are used for two related purposes. First, a bit mask created by OR'ing together events is passed to *LPI2C_SlaveTransferNonBlocking()* in order to specify which events to enable. Then, when the slave callback is invoked, it is passed the current event through its *transfer* parameter.

Note: These enumerations are meant to be OR'd together to form a bit mask of events.

Values:

enumerator kLPI2C_SlaveAddressMatchEvent

Received the slave address after a start or repeated start.

enumerator kLPI2C_SlaveTransmitEvent

Callback is requested to provide data to transmit (slave-transmitter role).

enumerator kLPI2C_SlaveReceiveEvent

Callback is requested to provide a buffer in which to place received data (slave-receiver role).

enumerator kLPI2C_SlaveTransmitAckEvent

Callback needs to either transmit an ACK or NACK.

enumerator kLPI2C_SlaveRepeatedStartEvent

A repeated start was detected.

enumerator kLPI2C_SlaveCompletionEvent

A stop was detected, completing the transfer.

enumerator kLPI2C_SlaveAllEvents

Bit mask of all available events.

typedef struct *_lpi2c_slave_transfer* lpi2c_slave_transfer_t

lpi2c_slave_transfer_t forward definition.

typedef struct *_lpi2c_slave_transfer_handle* lpi2c_slave_transfer_handle_t

lpi2c_slave_transfer_handle_t forward definition.

typedef void (*lpi2c_slave_transfer_callback_t)(*lpi2c_slave_transfer_handle_t* *psHandle)

Slave event callback function pointer type.

This callback is used only for the slave non-blocking transfer API. To install a callback, use the LPI2C_SlaveSetCallback() function after you have created a handle.

Param psHandle
Pointer to the LPI2C slave driver handle.

typedef enum *_lpi2c_slave_transfer_event* lpi2c_slave_transfer_event_t

Set of events sent to the callback for non blocking slave transfers.

These event enumerations are used for two related purposes. First, a bit mask created by OR'ing together events is passed to *LPI2C_SlaveTransferNonBlocking()* in order to specify which events to enable. Then, when the slave callback is invoked, it is passed the current event through its *transfer* parameter.

Note: These enumerations are meant to be OR'd together to form a bit mask of events.

void LPI2C_SlaveTransferCreateHandle(LPI2C_Type *base, *lpi2c_slave_transfer_handle_t* *psHandle, *lpi2c_slave_transfer_callback_t* pfCallback, void *pUserData)

Creates a new handle for the LPI2C slave non-blocking APIs.

The creation of a handle is for use with the non-blocking APIs. Once a handle is created, there is not a corresponding destroy handle. If the user wants to terminate a transfer, the *LPI2C_SlaveTransferAbort()* API shall be called.

Note: The function also enables the NVIC IRQ for the input LPI2C. Need to notice that on some SoCs the LPI2C IRQ is connected to INTMUX, in this case user needs to enable the associated INTMUX IRQ in application.

Parameters

- base – The LPI2C peripheral base address.
- psHandle – Pointer to the LPI2C slave driver handle.
- pfCallback – User provided pointer to the asynchronous callback function.
- pUserData – User provided pointer to the application callback data.

status_t LPI2C_SlaveTransferNonBlocking(*lpi2c_slave_transfer_handle_t* *psHandle, uint8_t u8EventMask)

Starts accepting slave transfers.

Call this API after calling I2C_SlaveInit() and *LPI2C_SlaveTransferCreateHandle()* to start processing transactions driven by an I2C master. The slave monitors the I2C bus and pass events to the callback that was passed into the call to *LPI2C_SlaveTransferCreateHandle()*. The callback is always invoked from the interrupt context.

The set of events received by the callback is customizable. To do so, set the *eventMask* parameter to the OR'd combination of *lpi2c_slave_transfer_event_t* enumerators for the events you wish to receive. The *kLPI2C_SlaveTransmitEvent* and *kLPI2C_SlaveReceiveEvent* events are always enabled and do not need to be included in the mask. Alternatively, you can pass 0 to get a default set of only the transmit and receive events that are always enabled. In addition, the *kLPI2C_SlaveAllEvents* constant is provided as a convenient way to enable all events.

Parameters

- psHandle – Pointer to *lpi2c_slave_transfer_handle_t* structure which stores the transfer state.
- u8EventMask – Bit mask formed by OR'ing together *lpi2c_slave_transfer_event_t* enumerators to specify which events to send to the callback. Other accepted values are 0 to get a default set of only the transmit and receive events, and *kLPI2C_SlaveAllEvents* to enable all events.

Return values

- kStatus_Success – Slave transfers were successfully started.
- kStatus_LPI2C_Busy – Slave transfers have already been started on this handle.

status_t LPI2C_SlaveTransferGetCount(*lpi2c_slave_transfer_handle_t* *psHandle, uint16_t *pu16Count)

Gets the slave transfer status during a non-blocking transfer.

Parameters

- psHandle – Pointer to i2c_slave_handle_t structure.
- pu16Count – Pointer to a value to hold the number of bytes transferred. May be NULL if the count is not required.

Return values

- kStatus_Success –
- kStatus_NoTransferInProgress –

void LPI2C_SlaveTransferAbort(*lpi2c_slave_transfer_handle_t* *psHandle)

Aborts the slave non-blocking transfers.

Note: This API could be called at any time to stop slave for handling the bus events.

Parameters

- psHandle – Pointer to *lpi2c_slave_transfer_handle_t* structure which stores the transfer state.

Return values

- kStatus_Success –
- kStatus_LPI2C_Idle –

void LPI2C_SlaveTransferHandleIRQ(*lpi2c_slave_transfer_handle_t* *psHandle)

Reusable routine to handle slave interrupts.

Note: This function does not need to be called unless you are reimplementing the non blocking API's interrupt handler routines to add special functionality.

Parameters

- psHandle – Pointer to *lpi2c_slave_transfer_handle_t* structure which stores the transfer state.

typedef struct *_lpi2c_master_config* lpi2c_master_config_t

Structure with settings to initialize the LPI2C master module.

This structure holds configuration settings for the LPI2C peripheral. To initialize this structure to reasonable defaults, call the *LPI2C_MasterGetDefaultConfig()* function and pass a pointer to your configuration structure instance.

The configuration structure can be made constant so it resides in flash.

typedef struct *_lpi2c_slave_config* lpi2c_slave_config_t

Structure with settings to initialize the LPI2C slave module.

This structure holds configuration settings for the LPI2C slave peripheral. To initialize this structure to reasonable defaults, call the *LPI2C_SlaveGetDefaultConfig()* function and pass a pointer to your configuration structure instance.

The configuration structure can be made constant so it resides in flash.

typedef struct *_lpi2c_config* lpi2c_config_t

Structure with settings to initialize the LPI2C module.

This structure holds configuration settings for the LPI2C peripheral. To initialize this structure to reasonable defaults, call the *LPI2C_GetDefaultConfig* function and pass a pointer to your configuration structure instance.

The configuration structure can be made constant so it resides in flash.

void LPI2C_GetDefaultConfig(*lpi2c_config_t* *psConfig, uint16_t u16SlaveAddress, uint32_t u32SrcClockHz)

Provides a default configuration for the LPI2C peripheral, including master and slave.

This is an example:

```
lpi2c_config_t sConfig;
LPI2C_GetDefaultConfig(&sConfig, u16SlaveAddress, u32SrcClockHz);
sConfig.u32BaudRateBps = 100000U;
LPI2C_Init(LPI2C0, &sConfig);
```

After calling this function, you can override any settings in order to customize the configuration, prior to initializing the driver with *LPI2C_Init()*.

Parameters

- psConfig – User provided configuration structure for default values. Refer to *lpi2c_config_t*.
- u16SlaveAddress – Slave address raw value, driver will shift it.
- u32SrcClockHz – Frequency in Hertz of the LPI2C functional clock. Used to calculate the baud rate divisors, filter widths, and timeout periods.

void LPI2C_Init(LPI2C_Type *base, const *lpi2c_config_t* *psConfig)

Initializes the LPI2C peripheral, including master and slave.

This function enables the peripheral clock and initializes the LPI2C peripheral as described by the user provided configuration. A software reset is performed prior to configuration. This function can enable master and slave together. If only want to use one of them, please call LPI2C_MasterInit or LPI2C_SlaveInit.

Note: If FSL_SDK_DISABLE_DRIVER_CLOCK_CONTROL is enabled by user, the init function will not ungate I2C clock source before initialization, to avoid hardfault, user has to manually enable ungate the clock source before calling the API.

Parameters

- base – The LPI2C peripheral base address.
- psConfig – User provided peripheral configuration. Use LPI2C_GetDefaultConfig to get a set of defaults that you can override.

void LPI2C_Deinit(LPI2C_Type *base)

Deinitializes the LPI2C peripheral, including master and slave.

This function disables the LPI2C peripheral and gates the clock. It also performs a software reset to restore the peripheral to reset conditions.

Parameters

- base – The LPI2C peripheral base address.

void LPI2C_MasterGetDefaultConfig(*lpi2c_master_config_t* *psMasterConfig, uint32_t u32SrcClockHz)

Provides a default configuration for the LPI2C master peripheral.

This is an example:

```
lpi2c_master_config_t sConfig;
LPI2C_MasterGetDefaultConfig(&sConfig, 12000000U);
sConfig.u32BaudRateBps = 100000U;
LPI2C_MasterInit(LPI2C1, &sConfig);
```

After calling this function, you can override any settings in order to customize the configuration, prior to initializing the master driver with *LPI2C_MasterInit()*.

Parameters

- psMasterConfig – User provided configuration structure for default values. Refer to *lpi2c_master_config_t*.
- u32SrcClockHz – Frequency in Hertz of the LPI2C functional clock. Used to calculate the baud rate divisors, filter widths, and timeout periods.

void LPI2C_MasterInit(LPI2C_Type *base, const *lpi2c_master_config_t* *psMasterConfig)

Initializes the LPI2C master peripheral.

This function enables the peripheral clock and initializes the LPI2C master peripheral as described by the user provided configuration. A software reset is performed prior to configuration. User just needs to call this function to enable LPI2C master if only use I2C master operation.

Note: If FSL_SDK_DISABLE_DRIVER_CLOCK_CONTROL is enabled by user, the init function will not ungate I2C clock source before initialization, to avoid hardfault, user has to

manually enable ungate the clock source before calling the API.

Parameters

- base – The LPI2C peripheral base address.
- psMasterConfig – User provided peripheral configuration. Use *LPI2C_MasterGetDefaultConfig()* to get a set of defaults that you can override.

void LPI2C_MasterDeinit(LPI2C_Type *base)

Deinitializes the LPI2C master peripheral.

This function disables the LPI2C master peripheral and gates the clock. It also performs a software reset to restore the peripheral to reset conditions.

Parameters

- base – The LPI2C peripheral base address.

void LPI2C_SlaveGetDefaultConfig(*lpi2c_slave_config_t* *psSlaveConfig, uint16_t u16SlaveAddress, uint32_t u32SrcClockHz)

Provides a default configuration for the LPI2C slave peripheral.

This is an example:

```
lpi2c_slave_config_t sConfig;
LPI2C_SlaveGetDefaultConfig(&sConfig, u16SlaveAddress, u32SrcClockHz);
LPI2C_SlaveInit(LPI2C1, &sConfig);
```

After calling this function, override any settings to customize the configuration, prior to initializing the master driver with *LPI2C_SlaveInit()*. Be sure to override at least the *u8Address0* member of the configuration structure with the desired slave address.

Parameters

- psSlaveConfig – User provided configuration structure that is set to default values. Refer to *lpi2c_slave_config_t*.
- u16SlaveAddress – Slave address raw value, driver will shift it.
- u32SrcClockHz – Frequency in Hertz of the LPI2C functional clock. Used to calculate the filter widths, data valid delay, and clock hold time.

void LPI2C_SlaveInit(LPI2C_Type *base, const *lpi2c_slave_config_t* *psSlaveConfig)

Initializes the LPI2C slave peripheral.

This function enables the peripheral clock and initializes the LPI2C slave peripheral as described by the user provided configuration. User just needs to call this function to enable LPI2C slave if only use I2C slave operation.

Note: If FSL_SDK_DISABLE_DRIVER_CLOCK_CONTROL is enabled by user, the init function will not ungate I2C clock source before initialization, to avoid hardfault, user has to manually enable ungate the clock source before calling the API.

Parameters

- base – The LPI2C peripheral base address.
- psSlaveConfig – User provided peripheral configuration. Use *LPI2C_SlaveGetDefaultConfig()* to get a set of defaults that you can override.

void LPI2C_SlaveDeinit(LPI2C_Type *base)

Deinitializes the LPI2C slave peripheral.

This function disables the LPI2C slave peripheral and gates the clock. It also performs a software reset to restore the peripheral to reset conditions.

Parameters

- base – The LPI2C peripheral base address.

static inline void LPI2C_MasterEnableInterrupts(LPI2C_Type *base, uint16_t u16Interrupts)

Enables the LPI2C master interrupt requests.

All flags except *kLPI2C_MasterBusyFlag* and *kLPI2C_MasterBusBusyFlag* can be enabled as interrupts.

Parameters

- base – The LPI2C peripheral base address.
- u16Interrupts – Bit mask of interrupts to enable. See *_lpi2c_master_status_flags* for the set of constants that should be OR'd together to form the bit mask.

static inline void LPI2C_MasterDisableInterrupts(LPI2C_Type *base, uint16_t u16Interrupts)

Disables the LPI2C master interrupt requests.

All flags except *kLPI2C_MasterBusyFlag* and *kLPI2C_MasterBusBusyFlag* can be enabled as interrupts.

Parameters

- base – The LPI2C peripheral base address.
- u16Interrupts – Bit mask of interrupts to disable. See *_lpi2c_master_status_flags* for the set of constants that should be OR'd together to form the bit mask.

static inline uint16_t LPI2C_MasterGetEnabledInterrupts(LPI2C_Type *base)

Returns the set of currently enabled LPI2C master interrupt requests.

Parameters

- base – The LPI2C peripheral base address.

Returns

A bitmask composed of *_lpi2c_master_status_flags* enumerators OR'd together to indicate the set of enabled interrupts.

static inline void LPI2C_SlaveEnableInterrupts(LPI2C_Type *base, uint16_t u16Interrupts)

Enables the LPI2C slave interrupt requests.

All flags except *kLPI2C_SlaveBusyFlag* and *kLPI2C_SlaveBusBusyFlag* can be enabled as interrupts.

Parameters

- base – The LPI2C peripheral base address.
- u16Interrupts – Bit mask of interrupts to enable. See *_lpi2c_slave_status_flags* for the set of constants that should be OR'd together to form the bit mask.

static inline void LPI2C_SlaveDisableInterrupts(LPI2C_Type *base, uint16_t u16Interrupts)

Disables the LPI2C slave interrupt requests.

All flags except *kLPI2C_SlaveBusyFlag* and *kLPI2C_SlaveBusBusyFlag* can be enabled as interrupts.

Parameters

- base – The LPI2C peripheral base address.
- u16Interrupts – Bit mask of interrupts to disable. See *_lpi2c_slave_status_flags* for the set of constants that should be OR'd together to form the bit mask.

static inline uint16_t LPI2C_SlaveGetEnabledInterrupts(LPI2C_Type *base)

Returns the set of currently enabled LPI2C slave interrupt requests.

Parameters

- base – The LPI2C peripheral base address.

Returns

A bitmask composed of *_lpi2c_slave_status_flags* enumerators OR'd together to indicate the set of enabled interrupts.

static inline void LPI2C_MasterEnableDMA(LPI2C_Type *base, bool bEnableTx, bool bEnableRx)

Enables or disables LPI2C master DMA requests.

Parameters

- base – The LPI2C peripheral base address.
- bEnableTx – Enable flag for transmit DMA request. Pass true for enable, false for disable.
- bEnableRx – Enable flag for receive DMA request. Pass true for enable, false for disable.

static inline uint32_t LPI2C_MasterGetTxFifoAddress(LPI2C_Type *base)

Gets LPI2C master transmit data register address for DMA transfer.

Parameters

- base – The LPI2C peripheral base address.

Returns

The LPI2C Master Transmit Data Register address.

static inline uint32_t LPI2C_MasterGetRxFifoAddress(LPI2C_Type *base)

Gets LPI2C master receive data register address for DMA transfer.

Parameters

- base – The LPI2C peripheral base address.

Returns

The LPI2C Master Receive Data Register address.

static inline void LPI2C_SlaveEnableDMA(LPI2C_Type *base, bool bEnableAddressValid, bool bEnableRx, bool bEnableTx)

Enables or disables the LPI2C slave peripheral DMA requests.

Parameters

- base – The LPI2C peripheral base address.
- bEnableAddressValid – Enable flag for the address valid DMA request. Pass true for enable, false for disable. The address valid DMA request is shared with the receive data DMA request.
- bEnableRx – Enable flag for the receive data DMA request. Pass true for enable, false for disable.

- bEnableTx – Enable flag for the transmit data DMA request. Pass true for enable, false for disable.

static inline bool LPI2C_SlaveGetBusIdleState(LPI2C_Type *base)

Returns whether the bus is idle.

Requires the slave mode to be enabled.

Parameters

- base – The LPI2C peripheral base address.

Return values

- true – Bus is busy.
- false – Bus is idle.

static inline void LPI2C_SlaveTransmitAck(LPI2C_Type *base, bool bSendAck)

Transmits either an ACK or NAK on the I2C bus in response to a byte from the master.

Use this function to send an ACK or NAK when the *kLPI2C_SlaveTransmitAckInterruptFlag* is asserted. This only happens if you enable the sclStall.enableAck field of the *lpi2c_slave_config_t* configuration structure used to initialize the slave peripheral.

Parameters

- base – The LPI2C peripheral base address.
- bSendAck – Pass true for an ACK or false for a NAK.

static inline uint16_t LPI2C_SlaveGetReceivedAddress(LPI2C_Type *base)

Returns the slave address sent by the I2C master.

This function should only be called if the *kLPI2C_SlaveAddressValidInterruptFlag* is asserted.

Parameters

- base – The LPI2C peripheral base address.

Returns

The 8-bit address matched by the LPI2C slave. Bit 0 contains the R/w direction bit, and the 7-bit slave address is in the upper 7 bits.

status_t LPI2C_SlaveSend(LPI2C_Type *base, void *pTxBuff, uint16_t u16TxSize, uint16_t *pu16ActualTxSize)

Performs a polling send transfer on the I2C bus.

Parameters

- base – The LPI2C peripheral base address.
- pTxBuff – The pointer to the data to be transferred.
- u16TxSize – The length in bytes of the data to be transferred.
- pu16ActualTxSize –

Returns

Error or success status returned by API.

status_t LPI2C_SlaveReceive(LPI2C_Type *base, void *pRxBuff, uint16_t u16RxSize, uint16_t *pu16ActualRxSize)

Performs a polling receive transfer on the I2C bus.

Parameters

- base – The LPI2C peripheral base address.
- pRxBuff – The pointer to the data to be transferred.

- u16RxSize – The length in bytes of the data to be transferred.
- pu16ActualRxSize –

Returns
Error or success status returned by API.

FSL_LPI2C_DRIVER_VERSION
LPI2C driver version.

LPI2C status return codes.

Values:

enumerator kStatus_LPI2C_Busy
The master is already performing a transfer.

enumerator kStatus_LPI2C_Idle
The slave driver is idle.

enumerator kStatus_LPI2C_Nak
The slave device sent a NAK in response to a byte.

enumerator kStatus_LPI2C_FifoError
FIFO under run or overrun.

enumerator kStatus_LPI2C_BitError
Transferred bit was not seen on the bus.

enumerator kStatus_LPI2C_ArbitrationLost
Arbitration lost error.

enumerator kStatus_LPI2C_PinLowTimeout
SCL or SDA were held low longer than the timeout.

enumerator kStatus_LPI2C_NoTransferInProgress
Attempt to abort a transfer when one is not in progress.

enumerator kStatus_LPI2C_DmaRequestFail
DMA request failed.

enumerator kStatus_LPI2C_Timeout
Timeout polling status flags.

void LPI2C_DriverIRQHandler(uint32_t instance)
LPI2C driver IRQ handler common entry.

This function provides the common IRQ request entry for LPI2C.

Parameters

- instance – LPI2C instance.

FSL_SDK_DISABLE_DRIVER_CLOCK_CONTROL

Clock enable/disable controlled by driver or not.

I2C_RETRY_TIMES

Retry times for waiting flag.

I2C_SMBUS_ENABLE

Control whether to use SMBus features.

LPI2C_GET_TRANSFER_COMPLETION_STATUS(psHandle)

LPI2C_GET_TRANSFER_USER_DATA(psHandle)

LPI2C_GET_SLAVE_TRANSFER_EVENT(psHandle)

LPI2C_GET_SLAVE_TRANSFER_DATA_POINTER(psHandle)

LPI2C_GET_SLAVE_TRANSFER_DATASIZE(psHandle)

LPI2C_GET_SLAVE_TRANSFERRED_COUNT(psHandle)

struct _lpi2c_master_config

#include <fsl_lpi2c.h> Structure with settings to initialize the LPI2C master module.

This structure holds configuration settings for the LPI2C peripheral. To initialize this structure to reasonable defaults, call the *LPI2C_MasterGetDefaultConfig()* function and pass a pointer to your configuration structure instance.

The configuration structure can be made constant so it resides in flash.

Public Members

bool bEnableMaster

Whether to enable master mode.

bool bEnableDoze

Whether master is enabled in doze mode.

bool bDebugEnable

Enable transfers to continue when halted in debug mode.

bool bIgnoreAck

Whether to ignore ACK/NACK.

uint16_t ePinConfig

The pin configuration option chosen from *lpi2c_master_pin_config_t*.

struct *_lpi2c_master_config* hostRequest

Host request options.

uint32_t u32SrcClockHz

Frequency in Hertz of the LPI2C functional clock.

uint32_t u32BaudRateBps
: Desired baud rate in Hertz.

uint32_t u32BusIdleTimeoutNs
: Bus idle timeout in nanoseconds. Set to 0 to disable.

uint32_t u32PinLowTimeoutNs
: Pin low timeout in nanoseconds. Set to 0 to disable.

uint32_t u32SdaGlitchFilterWidthNs
: Width in nanoseconds of glitch filter on SDA pin. Set to 0 to disable.

uint32_t u32SclGlitchFilterWidthNs
: Width in nanoseconds of glitch filter on SCL pin. Set to 0 to disable.

struct __lpi2c__slave__config

#include <fsl_lpi2c.h> Structure with settings to initialize the LPI2C slave module.

This structure holds configuration settings for the LPI2C slave peripheral. To initialize this structure to reasonable defaults, call the *LPI2C_SlaveGetDefaultConfig()* function and pass a pointer to your configuration structure instance.

The configuration structure can be made constant so it resides in flash.

Public Members

bool bEnableSlave
: Enable slave mode.

bool bFilterDozeEnable
: Enable digital glitch filter in doze mode.

bool bFilterEnable
: Enable digital glitch filter.

bool bIgnoreAck
: Continue transfers after a NACK is detected.

bool bEnableGeneralCall
: Enable general call address matching.

bool bEnableSmbusAlert
: Enable SMBus Alert.

bool bEnableReceivedAddressRead
: Enable reading the address received address as the first byte of data.

uint16_t eAddressMatchMode
: Address matching options chosen from *lpi2c_slave_address_match_t*.

uint16_t u16Address0
: Slave's 7-bit address.

uint16_t u16Address1
: Alternate slave 7-bit address.

uint32_t u32SdaGlitchFilterWidthNs
: Width in nanoseconds of the digital filter on the SDA signal.

uint32_t u32SclGlitchFilterWidthNs
: Width in nanoseconds of the digital filter on the SCL signal.

uint32_t u32DataValidDelayNs
: Width in nanoseconds of the data valid delay.

uint32_t u32ClockHoldTimeNs
: Width in nanoseconds of the clock hold time.

uint32_t u32SrcClockHz
: Frequency in Hertz of the LPI2C functional clock.

struct __lpi2c__config
: *#include <fsl_lpi2c.h>* Structure with settings to initialize the LPI2C module.

  This structure holds configuration settings for the LPI2C peripheral. To initialize this structure to reasonable defaults, call the *LPI2C_GetDefaultConfig* function and pass a pointer to your configuration structure instance.

  The configuration structure can be made constant so it resides in flash.

  Public Members

  bool bEnableMaster
  : < Master configuration. Whether to enable master mode.

  bool bEnableDoze
  : Whether master is enabled in doze mode.

  bool bDebugEnable
  : Enable transfers to continue when halted in debug mode.

  bool bMasterIgnoreAck
  : Whether to ignore ACK/NACK.

  uint16_t ePinConfig
  : The pin configuration option chosen from *lpi2c_master_pin_config_t*.

  struct *_lpi2c_config* hostRequest
  : Host request options.

uint32_t u32BaudRateBps
: Desired baud rate in Hertz.

uint32_t u32BusIdleTimeoutNs
: Bus idle timeout in nanoseconds. Set to 0 to disable.

uint32_t u32PinLowTimeoutNs
: Pin low timeout in nanoseconds. Set to 0 to disable.

uint32_t u32MasterSdaGlitchFilterWidthNs
: Width in nanoseconds of glitch filter on SDA pin. Set to 0 to disable.

uint32_t u32MasterSclGlitchFilterWidthNs
: Width in nanoseconds of glitch filter on SCL pin. Set to 0 to disable. Slave configuration.

bool bEnableSlave
: Enable slave mode.

bool bFilterDozeEnable
: Enable digital glitch filter in doze mode.

bool bFilterEnable
: Enable digital glitch filter.

bool bSlaveIgnoreAck
: Continue transfers after a NACK is detected.

bool bEnableGeneralCall
: Enable general call address matching.

bool bEnableSmbusAlert
: Enable SMBus Alert.

bool bEnableReceivedAddressRead
: Enable reading the address received address as the first byte of data.

uint16_t eAddressMatchMode
: Address matching options chosen from *lpi2c_slave_address_match_t*.

uint16_t u16Address0
: Slave's 7-bit address.

uint16_t u16Address1
: Alternate slave 7-bit address.

uint32_t u32SlaveSdaGlitchFilterWidthNs
: Width in nanoseconds of the digital filter on the SDA signal.

uint32_t u32SlaveSclGlitchFilterWidthNs
: Width in nanoseconds of the digital filter on the SCL signal.

uint32_t u32DataValidDelayNs
: Width in nanoseconds of the data valid delay.

uint32_t u32ClockHoldTimeNs
: Width in nanoseconds of the clock hold time.

uint32_t u32SrcClockHz
: Frequency in Hertz of the LPI2C functional clock.

struct __lpi2c_match_config
: *#include <fsl_lpi2c.h>* LPI2C master data match configuration structure.

Public Members

lpi2c_data_match_config_mode_t eMatchMode
: Data match configuration setting.

bool bRxDataMatchOnly
: When set to true, received data is ignored until a successful match.

uint8_t u8Match0
: Match value 0.

uint8_t u8Match1
: Match value 1.

struct __lpi2c_master_transfer
: *#include <fsl_lpi2c.h>* Non-blocking transfer descriptor structure.

This structure is used to pass transaction parameters to the *LPI2C_MasterTransferNonBlocking()* API.

Public Members

uint8_t u8ControlFlagMask
: Bit mask of options for the transfer. See enumeration *_lpi2c_master_transfer_control_flags* for available options. Set to 0 or *kLPI2C_TransferStartStopFlag* for normal transfers.

uint16_t u8SlaveAddress
: The 7-bit slave address.

lpi2c_data_direction_t eDirection
: Either *kLPI2C_Read* or *kLPI2C_Write*.

uint8_t *pu8Command
Pointer to command code.

uint8_t u8CommandSize
Length of sub address to send in bytes.

void *pData
Pointer to data to transfer.

uint16_t u16DataSize
Number of bytes to transfer.

struct __lpi2c_master_transfer_handle
#include <fsl_lpi2c.h> Driver handle for master non-blocking APIs.

Note: The contents of this structure are private and subject to change.

Public Members

LPI2C_Type *base
The peripheral register address base.

uint8_t u8State
Transfer state machine current state.

uint16_t u16RemainingBytes
Remaining byte count in current state.

uint8_t *pu8Buf
Buffer pointer for current state.

uint16_t u16CommandBuffer[7]
LPI2C command sequence.

lpi2c_master_transfer_t sTransfer
Copy of the current transfer info.

lpi2c_master_transfer_callback_t pfCompletionCallback
Callback function pointer.

status_t completionStatus
Master transfer complete status indicating how the transfer ends.

void *pUserData
Application data passed to callback.

struct __lpi2c_slave_transfer
#include <fsl_lpi2c.h> LPI2C slave transfer structure.

Public Members

uint8_t u8EventMask
: Mask of enabled events, set correspond bit if user wants to handle this event.

lpi2c_slave_transfer_event_t eEvent
: Reason the callback is being invoked lpi2c_slave_transfer_event_t.

uint16_t u16ReceivedAddress
: Matching address send by master.

uint8_t *pu8Data
: Transfer buffer

uint16_t u16DataSize
: Transfer size

status_t completionStatus
: Success or error code describing how the transfer completed. Only applies for *kLPI2C_SlaveCompletionEvent*.

uint16_t u16TransferredCount
: Number of bytes actually transferred since start or last repeated start.

struct __lpi2c_slave_transfer_handle
: *#include <fsl_lpi2c.h>* LPI2C slave handle structure.

Note: The contents of this structure are private and subject to change.

Public Members

LPI2C_Type *base
: The peripheral register address base.

lpi2c_slave_transfer_t sTransfer
: LPI2C slave transfer copy.

bool bIsBusy
: Whether transfer is busy.

bool bWasTransmit
: Whether the last transfer was a transmit.

uint8_t u8State
: A transfer state maintained during transfer.

uint16_t u16TransferredCount

Count of bytes transferred.

lpi2c_slave_transfer_callback_t pfCallback

Callback function called at transfer event.

void *pUserData

Callback parameter passed to callback.

struct hostRequest

Public Members

bool bEnable

Whether to enable host request.

uint16_t eSource

Host request source chosen from *lpi2c_host_request_source_t*.

uint16_t ePolarity

Host request pin polarity chosen from *lpi2c_host_request_polarity_t*.

struct sSclStall

Public Members

bool bEnableAck

Enables SCL clock stretching during slave-transmit address byte(s) and slave-receiver address and data byte(s) to allow software to write the Transmit ACK Register before the ACK or NACK is transmitted. Clock stretching occurs when transmitting the 9th bit. When enableAckSCLStall is enabled, there is no need to set either enableRxDataSCLStall or enableAddressSCLStall.

bool bEnableTx

Enables SCL clock stretching when the transmit data flag is set during a slave-transmit transfer.

bool bEnableRx

Enables SCL clock stretching when receive data flag is set during a slave-receive transfer.

bool bEnableAddress

Enables SCL clock stretching when the address valid flag is asserted.

struct hostRequest

Public Members

bool bEnable
: Whether to enable host request.

uint16_t eSource
: Host request source chosen from *lpi2c_host_request_source_t*.

uint16_t ePolarity
: Host request pin polarity chosen from *lpi2c_host_request_polarity_t*.

struct sSclStall

Public Members

bool bEnableAck
: Enables SCL clock stretching during slave-transmit address byte(s) and slave-receiver address and data byte(s) to allow software to write the Transmit ACK Register before the ACK or NACK is transmitted. Clock stretching occurs when transmitting the 9th bit. When enableAckSCLStall is enabled, there is no need to set either enableRxDataSCLStall or enableAddressSCLStall.

bool bEnableTx
: Enables SCL clock stretching when the transmit data flag is set during a slave-transmit transfer.

bool bEnableRx
: Enables SCL clock stretching when receive data flag is set during a slave-receive transfer.

bool bEnableAddress
: Enables SCL clock stretching when the address valid flag is asserted.

2.45 The Driver Change Log

2.46 LPI2C_EDMA: EDMA based LPI2C Driver

void LPI2C_MasterCreateEDMAHandle(LPI2C_Type *base, *lpi2c_master_edma_transfer_handle_t* *psHandle, *lpi2c_master_edma_transfer_callback_t* pfcallback, void *pUserData, DMA_Type *edmaBase, *edma_channel_t* eEdmaTxChannel, *edma_channel_t* eEdmaRxChannel)

Create a new handle for the LPI2C master DMA APIs.

The creation of a handle is for use with the DMA APIs. Once a handle is created, there is not a corresponding destroy handle. If the user wants to terminate a transfer, the *LPI2C_MasterTransferAbortEDMA()* API shall be called.

For devices where the LPI2C send and receive DMA requests are OR'd together, the *txDmaHandle* parameter is ignored and may be set to NULL.

Parameters

- base – The LPI2C peripheral base address.
- psHandle – Pointer to the LPI2C master driver handle.
- pfcallback – User provided pointer to the asynchronous callback function.
- pUserData – User provided pointer to the application callback data.
- edmaBase – Edma base address.
- eEdmaTxChannel – eDMA channel for master transfer Tx request.
- eEdmaRxChannel – eDMA channel for master transfer Rx request.

status_t LPI2C_MasterTransferEDMA(*lpi2c_master_edma_transfer_handle_t* *psHandle, *lpi2c_master_transfer_t* *psTransfer)

Performs a non-blocking DMA-based transaction on the I2C bus.

The callback specified when the *handle* was created is invoked when the transaction has completed.

Parameters

- psHandle – Pointer to the LPI2C master driver handle.
- psTransfer – The pointer to the transfer descriptor.

Return values

- kStatus_Success – The transaction was started successfully.
- kStatus_LPI2C_Busy – Either another master is currently utilizing the bus, or another DMA transaction is already in progress.

status_t LPI2C_MasterTransferGetCountEDMA(*lpi2c_master_edma_transfer_handle_t* *psHandle, uint16_t *pu16Count)

Returns number of bytes transferred so far.

Parameters

- psHandle – Pointer to the LPI2C master driver handle.
- pu16Count – Number of bytes transferred so far by the non-blocking transaction.

Return values

- kStatus_Success –
- kStatus_NoTransferInProgress – There is not a DMA transaction currently in progress.

status_t LPI2C_MasterTransferAbortEDMA(*lpi2c_master_edma_transfer_handle_t* *psHandle)

Terminates a non-blocking LPI2C master transmission early.

Note: It is not safe to call this function from an IRQ handler that has a higher priority than the eDMA peripheral's IRQ priority.

Parameters

- psHandle – Pointer to the LPI2C master driver handle.

Return values

- kStatus_Success – A transaction was successfully aborted.

- kStatus_LPI2C_Idle – There is not a DMA transaction currently in progress.

FSL_LPI2C_EDMA_DRIVER_VERSION

LPI2C EDMA driver version.

typedef struct *_lpi2c_master_edma_transfer_handle* lpi2c_master_edma_transfer_handle_t

typedef void (*lpi2c_master_edma_transfer_callback_t)(*lpi2c_master_edma_transfer_handle_t* *psHandle)

Master DMA completion callback function pointer type.

This callback is used only for the non-blocking master transfer API. Specify the callback you wish to use in the call to *LPI2C_MasterCreateEDMAHandle()*.

Param psHandle
Handle associated with the completed transfer.

struct _lpi2c_master_edma_transfer_handle

#include <fsl_lpi2c_edma.h> Driver handle for master DMA APIs.

Note: The contents of this structure are private and subject to change. This struct address should be sizeof(edma_channel_tcd_t) aligned.

Public Members

edma_channel_tcd_t sRxTcd[1]

TCD for RX EDMA transfer.

edma_channel_tcd_t sTxTcd[3]

TCD for TX EDMA transfer.

LPI2C_Type *base

LPI2C base pointer.

bool bIsBusy

Transfer state machine current state.

uint8_t u8Nbytes

eDMA minor byte transfer count initially configured.

uint16_t u16CommandBuffer[7]

LPI2C command sequence.

lpi2c_master_transfer_t sTransfer

Copy of the current transfer info.

lpi2c_master_edma_transfer_callback_t pfCallback

Callback function pointer.

status_t completionStatus

Either *kStatus_Success* or an error code describing how the transfer completed.

void *pUserData

Application data passed to callback.

edma_handle_t sRxDmaHandle

Handle for receive DMA channel.

edma_handle_t sTxDmaHandle

Handle for transmit DMA channel.

2.47 LPI2C Peripheral and Driver Overview

2.48 MCM: Miscellaneous Control Module Driver

static inline *mcm_datapath_width_t* MCM_GetDataPathWidth(MCM_Type *base)

Indicates if the datapath is 32 or 64 bits wide.

Parameters

- base – MCM base address.

Returns

The device's datapath width, please refer to *mcm_datapath_width_t*.

static inline uint16_t MCM_GetCrossbarSwitchSlaveConfig(MCM_Type *base)

Gets crossbar switch (AXBS) slave configuration that indicates the presence/absence of bus slave connections to the device's crossbar switch.

Parameters

- base – MCM base address.

Returns

Crossbar switch (AXBS) slave configuration, each bit in the return value indicates if there is a corresponding connection to the AXBS slave input port. For example if the result is 0x1, it means a bus slave connection to AXBS input port 0 is present.

static inline uint16_t MCM_GetCrossbarSwitchMasterConfig(MCM_Type *base)

Gets crossbar switch (AXBS) master configuration that indicates the presence/absence of bus master connections to the device's crossbar switch.

Parameters

- base – MCM base address.

Returns

Crossbar switch (AXBS) master configuration, each bit in the return value indicates if there is a corresponding connection to the AXBS master input port. For example if the result is 0x1, it means a bus master connection to AXBS input port 0 is present.

static inline void MCM_ClearFlashControllerCache(MCM_Type *base)

Clears Flash Controller Cache, 1 cycle active.

Parameters

- base – MCM base address.

static inline void MCM_DisableFlashControllerDataCaching(MCM_Type *base, bool bDisable)

Disables/Enables flash controller data caching.

Parameters

- base – MCM peripheral base address.
- bDisable – Used to enable/disable flash controller data caching.
  - **true** Disable flash controller data caching.
  - **false** Enable flash controller data caching.

static inline void MCM_DisableFlashControllerInstructionCaching(MCM_Type *base, bool bDisable)

Disables/Enables flash controller instruction caching.

Parameters

- base – MCM peripheral base address.
- bDisable – Used to enable/disable flash contoller instruction caching.
  - **true** Disable flash controller instruction caching.
  - **false** Enable flash controller instruction caching.

static inline void MCM_DisableFlashControllerCache(MCM_Type *base, bool bDisable)

Disables/Enables flash controller cache.

Parameters

- base – MCM peripheral base address.
- bDisable – Used to enable/disable flash controller cache.
  - **true** Disable flash controller cache.
  - **false** Enable flash controller cache.

static inline void MCM_DisableFlashControllerDataSpeculation(MCM_Type *base, bool bDisable)

Disables/Enables flash controller data speculation.

Parameters

- base – MCM peripheral base address.
- bDisable – Used to enable/disable flash controller data speculation.
  - **true** Disable flash controller data speculation.
  - **false** Enable flash controller data speculation.

static inline void MCM_DisableFlashControllerSpeculation(MCM_Type *base, bool bDisable)

Disables/Enables flash controller speculation.

Parameters

- base – MCM peripheral base address.
- bDisable – Used to enable/disable flash controller speculation.
  - **true** Disable flash controller speculation.
  - **false** Enable flash controller speculation.

static inline void MCM_DisableDSP56800EXCoreInstructions(MCM_Type *base, bool bDisable)

Disables/Enables the instruction support only by DSP56800EX core, the instructions supported only by the DSP56800EX core are the BPSC and 32-bit multiply and MAC instructions.

Parameters

- base – MCM peripheral base address.
- bDisable – Used to enable/disable 32-bit multiply and MAC instructions.
  - **true** BFSC and 32-bit multiply and MAC instructions disabled.
  - **false** BFSC and 32-bit multiply and MAC instructions enabled.

static inline void MCM_DisableCoreReverseCarry(MCM_Type *base, bool bDisable)

Disables/Enables core reverse carry.

Parameters

- base – MCM peripheral base address.
- bDisable – Used to enable/disable reverse carry.
  - **true** Disable bit-reverse addressing mode.
  - **false** Enable bit-reverse addressing mode.

static inline void MCM_DisableDSP56800EXNewShadowRegion(MCM_Type *base, bool bDisable)

Disables/Enables the additional AGU shadow registers on the DSP56800EX core.

Parameters

- base – MCM peripheral base address.
- bDisable – Used to disable/enable the additional AGU shadow register on the DPS core.
  - **true** Only the AGU shadow registers supported by the DSP56800E core are enabled.
  - **false** The additional AGU shadow registers on the DSP56800EX core are also enabled.

static inline void MCM_DisableCoreInstructionBuffer(MCM_Type *base, bool bDisable)

Disables/Enables core instruction buffer.

Parameters

- base – MCM peripheral base address.
- bDisable – Used to disable/enable core longword instruction buffer.
  - **true** Disable core longword instruction buffer.
  - **false** Enable core longword instruction buffer.

static inline void MCM_DisableFlashMemoryControllerStall(MCM_Type *base, bool bDisable)

Disables/Enables the flash memory controller's ability to allow flash memory access to initiate when a flash memory command is executing.

Parameters

- base – MCM peripheral base address.
- bDisable – Used to disable/enable stall logic.
  - **true** Stall logic is disabled. While a flash memory command is executing, an attempted flash memory access causes a bus error.
  - **false** Stall logic is disabled. While a flash memory command is executing, a flash memory access can occur without causing a bus error. The flash memory command completes execution, and then the flash memory access occurs.

static inline void MCM_SetAxbsDMAControllerPriority(MCM_Type *base, *mcm_axbs_dma_core_priority_t* ePriority)

Sets the priority of the DMA controller in the AXBS crossbar switch arbitration scheme.

Parameters

- base – MCM base address.
- ePriority – The selected DMA controller priority in Crossbar switch arbitration scheme, please refer to *mcm_axbs_dma_core_priority_t*.

static inline uint32_t MCM_GetCoreFaultAddr(MCM_Type *base)

Gets the address of the last core access terminated with an error response.

Parameters

- base – MCM base address.

Returns

address of the last core access terminated with an error response.

void MCM_GetCoreFaultAttribute(MCM_Type *base, *mcm_core_fault_attribute_t* *psAttribute)

Gets the processor's attributes of the last faulted core access to the system bus.

Parameters

- base – MCM peripheral base address.
- psAttribute – The pointer of structure *mcm_core_fault_attribute_t*.

static inline *mcm_last_fault_access_location_t* MCM_GetCoreFaultLocation(MCM_Type *base)

Gets the location of the last captured fault.

Parameters

- base – MCM peripheral base address.

Returns

The location of the last captured fault, please refer to *mcm_last_fault_access_location_t*.

static inline uint32_t MCM_GetCoreFaultData(MCM_Type *base)

Gets the data associated with the last faulted processor write data access from the device's internal bus.

Parameters

- base – MCM base address.

Returns

The data associated with the last faulted processor write data access.

static inline void MCM_EnableCoreFaultInterrupt(MCM_Type *base, bool bEnable)

Enables/Disables core fault error interrupt.

Parameters

- base – MCM peripheral base address.
- bEnable – Used to enable/disable the core fault error interrupt.
  - **true** Enables core fault error interrupt, so an error interrupt will be generated to the interrupt controller on a faulted system bus cycle.
  - **false** Disables core fault error interrupt, so an error interrupt will not be generated to the interrupt controller on a faulted system bus cycle.

static inline uint8_t MCM_GetCoreFaultStatusFlags(MCM_Type *base)

Gets the core fault error status flags, including core fault error interrupt flag and core fault error data lost flag.

Parameters

- base – MCM peripheral base address.

Returns

The current status flags, should be the OR'ed value of *_mcm_status_flags*.

static inline void MCM_ClearCoreFaultStatusFlags(MCM_Type *base, uint8_t u8StatusFlags)

Clears the core fault error status flags, including core fault error interrupt flag and core fault error data lost flag.

Parameters

- base – MCM peripheral base address.
- u8StatusFlags – The status flags to be cleared, should be the OR'ed value of *_mcm_status_flags*.

static inline void MCM_EnableResourceProtection(MCM_Type *base, bool bEnable)

Enables/Disables resource protection.

Parameters

- base – MCM peripheral base address.
- bEnable – Used to enable/disable memory resource protection.
  - **true** Enable memory resource protection.
  - **false** Disable memory resource protection.

static inline void MCM_LockResourceProtectionRegisters(MCM_Type *base)

Locks the value of the resource protection related registers, after locked the registers' value can not be changed until a system reset.

Parameters

- base – MCM peripheral base address.

status_t MCM_SetResourceProtectionConfig(MCM_Type *base, const *mcm_resource_protection_config_t* *psConfig)

Sets the configuration of resource protection, including flash base address, ram base address, etc.

Parameters

- base – MCM peripheral base address.
- psConfig – The pointer of structure *mcm_resource_protection_config_t*.

Return values

- kStatus_Success – Succeed to setting resource protection related options.
- kStatus_Fail – Fail to set resource protection related options.

static inline uint32_t MCM_GetResourceProtectionIllegalFaultPC(MCM_Type *base)

Gets the 21-bit illegal faulting PC that only for a resource protection fault.

Parameters

- base – MCM peripheral base address.

Returns

The resource protection illegal faulting PC.

static inline bool MCM_IsResourceProtectionIllegalFaultValid(MCM_Type *base)

Indicates whether an resource protection illegal PC fault has occurred.

Parameters

- base – MCM peripheral base address.

Return values

- true – The resource protection illegal PC fault has occurred.
- false – The resource protection illegal PC fault has not occurred.

static inline void MCM_ClearResourceProtectionIllegalFaultValid(MCM_Type *base)

Clears the resource protection illegal fault bit.

Parameters

- base – MCM peripheral base address.

static inline uint32_t MCM_GetResourceProtectionMisalignedFaultPC(MCM_Type *base)

Gets the 21-bit misaligned faulting PC that only for a resource protection fault.

Parameters

- base – MCM peripheral base address.

Returns

The resource protection misaligned faulting PC.

static inline bool MCM_IsResourceProtectionMisalignedFaultValid(MCM_Type *base)

Indicates whether an resource protection misaligned PC fault has occurred.

Parameters

- base – MCM peripheral base address.

Return values

- true – The resource protection misaligned PC fault has occurred.
- false – The resource protection misaligned PC fault has not occurred.

static inline void MCM_ClearResourceProtectionMisalignedFaultValid(MCM_Type *base)

Clears the resource protection misaligned fault bit.

Parameters

- base – MCM peripheral base address.

FSL_MCM_DRIVER_VERSION

MCM driver version.

enum _mcm_status_flags

The enumeration of status flags, including core fault error interrupt flag and core fault error data lost flag.

Values:

enumerator kMCM_CoreFaultErrorInterruptFlag

A bus error has occurred.

enumerator kMCM_CoreFaultErrorDataLostFlag

A bus error has occurred before the previous error condition was cleared.

enum _mcm_datapath_width

The enumeration of datapath width, including 32 bits and 64 bits.

Values:

enumerator kMCM_Datapath32b

Datapath width is 32 bits.

enumerator kMCM_Datapath64b

Datapath width is 64 bits.

enum _mcm_axbs_dma_core_priority

The enumeration of DMA controller priority in the Crossbar switch arbitration scheme.

Values:

enumerator kMCM_AxbsPriorityCoreHigherThanDMA

Fixed-priority arbitration is selected: DSC core has a higher priority than the DMA Controller's priority.

enumerator kMCM_AxbsPriorityCoreDMARoundRobin

Round-robin priority arbitration is selected: DMA Controller and DSC core have equal priority.

enum _mcm_last_fault_access___dir

The enumeration of last faulted core access direction.

Values:

enumerator kMCM_CoreRead

Core read access.

enumerator kMCM_CoreWrite

Core write access.

enum _mcm_last_fault_access_size

The enumeration of last faulted core access size.

Values:

enumerator kMCM_Access8b

Last faulted core access size is 8-bit.

enumerator kMCM_Access16b

Last faulted core access size is 16-bit.

enumerator kMCM_Access32b

Last faulted core access size is 32-bit.

enum _mcm_last_fault_access_type

The enumeration of last faulted core access type.

Values:

enumerator kMCM_AccessInstruction
Last faulted core access is instruction.

enumerator kMCM_AccessData
Last faulted core access is data.

enum _mcm_last_fault_access_location
The enumeration of last captured fault Location.
Values:

enumerator kMCM_ErrOnInstructionBus
Error occurred on M0 (instruction bus).

enumerator kMCM_ErrOnOperandABus
Error occurred on M1 (operand A bus).

enumerator kMCM_ErrOnOperandBBus
Error occurred on M2 (operand B bus).

typedef enum *_mcm_datapath_width* mcm_datapath_width_t
The enumeration of datapath width, including 32 bits and 64 bits.

typedef enum *_mcm_axbs_dma_core_priority* mcm_axbs_dma_core_priority_t
The enumeration of DMA controller priority in the Crossbar switch arbitration scheme.

typedef enum *_mcm_last_fault_access_dir* mcm_last_fault_access_dir_t
The enumeration of last faulted core access direction.

typedef enum *_mcm_last_fault_access_size* mcm_last_fault_access_size_t
The enumeration of last faulted core access size.

typedef enum *_mcm_last_fault_access_type* mcm_last_fault_access_type_t
The enumeration of last faulted core access type.

typedef enum *_mcm_last_fault_access_location* mcm_last_fault_access_location_t
The enumeration of last captured fault Location.

typedef struct *_mcm_core_fault_attribute* mcm_core_fault_attribute_t
The structure of core fault attributes, contains access type, access size, access direction, etc.

typedef struct *_mcm_resource_protection_config* mcm_resource_protection_config_t
The structure of the resource protection config, the set value can be used only when the resource protection is enabled, and this value can be changed only when the resource protection is disabled.

struct _mcm_core_fault_attribute
#include <fsl_mcm.h> The structure of core fault attributes, contains access type, access size, access direction, etc.

Public Members

mcm_last_fault_access_type_t eType
Indicates the last faulted core access type, please refer to *mcm_last_fault_access_type_t*.

uint8_t bitReserved1
Reserved 1 bit.

bool bBufferable
Indicates if last faulted core access was bufferable.
- **true** Last faulted core access is bufferable.
- **false** Last faulted core access is non-bufferable.

uint8_t bitReserved2
Reserved 1 bit.

mcm_last_fault_access_size_t eSize
Indicates last faulted core access size.

mcm_last_fault_access_dir_t eDirection
Indicates the last faulted core access direction.

struct __mcm_resource_protection_config
#include <fsl_mcm.h> The structure of the resource protection config, the set value can be used only when the resource protection is enabled, and this value can be changed only when the resource protection is disabled.

Public Members

bool bEnableResourceProtection
Enable/Disable resource protection.
- **true** Enable Resource protection.
- **false** Disable Resource protection.

uint8_t u8FlashBaseAddress
Flash base address for user region, supports 4 KB granularity.

uint8_t u8RamBaseAddress
Program RAM base address for user region, support 256 byte granularity.

uint32_t u32BootRomBaseAddress
Boot ROM base address for user region

uint32_t u32ResourceProtectionOtherSP
Resource protection other stack pointer.

2.49 The Driver Change Log

2.50 MCM Peripheral and Driver Overview

2.51 OPAMP: Operational Amplifier Driver

void OPAMP_Init(OPAMP_Type *base, const *opamp_config_t* *psConfig)

Initializes the OPAMP module.

This function does initialization when using OPAMP module. The operations are:

- Enable the clock for OPAMP.
- Enable the write protection.
- Enable the load completion interrupt.
- Set configuration register for OPAMP.
- Set Positive channel and Negative channel.
- Set the power mode.
- Set the gain value.
- Set the load mode.
- Enable the OPAMP.

Parameters

- base – OPAMP peripheral base address.
- psConfig – Pointer to configuration structure.See *opamp_config_t*.

void OPAMP_GetDefaultConfig(*opamp_config_t* *psConfig)

Gets default configuration for OPAMP.

The default value:

```
psConfig->bEnableLoadCompletionInterrupt = false;
psConfig->bEnableWriteProtection = false;
psConfig->eLoadMode = kOPAMP_LoadModeDelayLoad;
psConfig->ePowerMode = kOPAMP_PowerModeLowPower;
psConfig->eConfigRegSel  = kOPAMP_ConfigRegSelCFG0;

psConfig->sConfigSet0.eWorkMode = kOPAMP_WorkModeBufferMode;
psConfig->sConfigSet0.eNegChannel = kOPAMP_NegChannel0;
psConfig->sConfigSet0.ePosChannel = kOPAMP_PosChannel0;

psConfig->sConfigSet1.eWorkMode = kOPAMP_WorkModeBufferMode;
psConfig->sConfigSet1.eNegChannel = kOPAMP_NegChannel0;
psConfig->sConfigSet1.ePosChannel = kOPAMP_PosChannel0;

psConfig->sConfigSet2.eWorkMode = kOPAMP_WorkModeBufferMode;
psConfig->sConfigSet2.eNegChannel = kOPAMP_NegChannel0;
psConfig->sConfigSet2.ePosChannel = kOPAMP_PosChannel0;

psConfig->sConfigSet3.eWorkMode = kOPAMP_WorkModeBufferMode;
psConfig->sConfigSet3.eNegChannel = kOPAMP_NegChannel0;
psConfig->sConfigSet3.ePosChannel = kOPAMP_PosChannel0;
```

Parameters

- psConfig – Pointer to configuration structure.

void OPAMP_Deinit(OPAMP_Type *base)

De-initializes the OPAMP module.

This function does de-initialization when using OPAMP module. The operations are:

- Disable the OPAMP.
- Disable the clock for OPAMP.

Parameters

- base – OPAMP peripheral base address.

void OPAMP_SetOneConfigSet(OPAMP_Type *base, *opamp_config_set_index_t* eIndex, const *opamp_config_set_t* *psConfigSet)

Sets configuration set.

This function only sets the configuration set, application should call *OPAMP_EnableConfigLoad* to enable the load after setting all desired configuration sets.

Parameters

- base – OPAMP peripheral base address.
- eIndex – Index of configuration set,please see *opamp_config_set_index_t* for details.
- psConfigSet – Pointer to the configure structure,please see *opamp_config_set_t* for details.

void OPAMP_SetConfigSelection(OPAMP_Type *base, *opamp_config_reg_sel_t* eConfigRegSel)

Changes configuration register selection.

This function can configure the working registers of the software and external signal. When the configuration set is updated using *OPAMP_SetOneConfigSet* and the external signal is not used, the software working register should also select the corresponding software working register according to the update of the configuration set.

Parameters

- base – OPAMP peripheral base address.
- eConfigRegSel – configuration register selection, please see *opamp_config_reg_sel_t* for details.

static inline void OPAMP_EnableOPAMP(OPAMP_Type *base, bool bEnable)

Enables the OPAMP.

Note: Please use function *OPAMP_EnableOPAMP* to re-enable the OPAMP if it is disabled. Then load it with function *OPAMP_EnableConfigLoad*.

Parameters

- base – OPAMP peripheral base address.
- bEnable – Enables/disables the module.

static inline void OPAMP_EnableConfigLoad(OPAMP_Type *base)

Enables the new configuration load.

After configuration load enabled, the new set configuration will be loaded at the time determined by load mode. Application could monitor the load completion by *OPAMP_CheckLoadCompletionFlag* or the interrupt. When the load finishes, the configuration load shall be disabled automatically.

Parameters

- base – OPAMP peripheral base address.

static inline void OPAMP_DisableWriteProtection(OPAMP_Type *base)

Disables write protection.

Write 10b to this field to disable the write protection.

Parameters

- base – OPAMP peripheral base address.

static inline void OPAMP_SetPowerMode(OPAMP_Type *base, *opamp_power_mode_t* ePowerMode)

Changes the power mode.

Parameters

- base – OPAMP peripheral base address.
- ePowerMode – Power mode, please see *opamp_power_mode_t* for details.

static inline void OPAMP_SetLoadMode(OPAMP_Type *base, *opamp_load_mode_t* eLoadMode)

Changes the load mode.

Parameters

- base – OPAMP peripheral base address.
- eLoadMode – load mode, please see *opamp_load_mode_t* for details.

static inline void OPAMP_EnableLoadCompletionInterrupt(OPAMP_Type *base)

Enables load completion interrupt.

Parameters

- base – OPAMP peripheral base address.

static inline void OPAMP_DisableLoadCompletionInterrupt(OPAMP_Type *base)

Disables load completion interrupt.

Parameters

- base – OPAMP peripheral base address.

static inline bool OPAMP_CheckLoadCompletionFlag(OPAMP_Type *base)

Checks the configuration load completion flag status.

Parameters

- base – OPAMP peripheral base address.

Returns

Return true if the flag is set, otherwise return false.

static inline void OPAMP_ClearLoadCompletionFlag(OPAMP_Type *base)

Clears the configuration load completion flag.

Parameters

- base – OPAMP peripheral base address.

FSL_OPAMP_DRIVER_VERSION

OPAMP driver version.

enum _opamp_config_reg_sel

The enumeration lists all options for software controlled opamps and other external signal controlled opamps.

Values:

enumerator kOPAMP_ConfigRegSelCFG0

Software work register select CFG0 (internal signal).

enumerator kOPAMP_ConfigRegSelCFG1

Software work register select CFG1 (internal signal).

enumerator kOPAMP_ConfigRegSelCFG2

Software work register select CFG2 (internal signal).

enumerator kOPAMP_ConfigRegSelCFG3

Software work register select CFG3 (internal signal).

enumerator kOPAMP_ConfigRegSelA1OrA0

External signal cfg_sel_a1 or cfg_sel_a0 selects configuartion register.

enumerator kOPAMP_ConfigRegSelA1OrB0

External signal cfg_sel_a1 or cfg_sel_b0 selects configuartion register.

enumerator kOPAMP_ConfigRegSelA1OrC0

External signal cfg_sel_a1 or cfg_sel_c0 selects configuartion register.

enumerator kOPAMP_configRegSelB1OrA0

External signal cfg_sel_b1 or cfg_sel_a0 selects configuartion register.

enumerator kOPAMP_configRegSelB1OrB0

External signal cfg_sel_b1 or cfg_sel_b0 selects configuartion register.

enumerator kOPAMP_configRegSelB1OrC0

External signal cfg_sel_b1 or cfg_sel_c0 selects configuartion register.

enumerator kOPAMP_ConfigRegSelC1OrA0

External signal cfg_sel_c1 or cfg_sel_a0 selects configuartion register.

enumerator kOPAMP_ConfigRegSelC1OrB0

External signal cfg_sel_c1 or cfg_sel_b0 selects configuartion register.

enumerator kOPAMP_ConfigRegSelC1OrC0

External signal cfg_sel_c1 or cfg_sel_c0 selects configuartion register.

enum _opamp_load_mode

The enumeration lists the opamp buffer's loading modes, delay loading and immediately loading modes.

Values:

enumerator kOPAMP_LoadModeDelayLoad

The buffer registers are loaded when the next configuration is complete, if CTRL[LDOK] is set.

enumerator kOPAMP_LoadModeImmediatelyLoad

The buffer register shall be loaded immediately after CTRL[LDOK] is set.

enum _opamp_power_mode

The enumeration lists the power modes of the opamp, including low power and high power modes.

Values:

enumerator kOPAMP_PowerModeLowPower

Lower current consumption with slower slew rate and narrower unity gain bandwidth performance.

enumerator kOPAMP_PowerModeHighSpeed

Higher current consumption with higher slew rate and wider unity gain bandwidth performance.

enum _opamp_positive_channel

The enumeration of positive input channel selection.

Values:

enumerator kOPAMP_PosChannel0

Positive channel 0.

enumerator kOPAMP_PosChannel1

Positive channel 1.

enumerator kOPAMP_PosChannel2

Positive channel 2.

enumerator kOPAMP_PosChannel3

Positive channel 3.

enum _opamp_negative_channel

The enumeration of negative input channel selection.

Values:

enumerator kOPAMP_NegChannel0

Negative channel 0.

enumerator kOPAMP_NegChannel1
Negative channel 1.

enumerator kOPAMP_NegChannel2
Negative channel 2.

enumerator kOPAMP_NegChannel3
Negative channel 3.

enum _opamp_config_set_index
The enumeration of configuration set index.
Values:

enumerator kOPAMP_ConfigSet0
Configuration set 0.

enumerator kOPAMP_ConfigSet1
Configuration set 1.

enumerator kOPAMP_ConfigSet2
Configuration set 2.

enumerator kOPAMP_ConfigSet3
Configuration set 3.

enum _opamp_work_mode
The enumeration lists the operating modes of the opamp, including buffer mode, internal gain and external gain mode.
Values:

enumerator kOPAMP_WorkModeBufferMode
Buffer mode.

enumerator kOPAMP_WorkModeInternalGain2X
Internal gain 2X mode.

enumerator kOPAMP_WorkModeInternalGain4X
Internal gain 4X mode.

enumerator kOPAMP_WorkModeInternalGain8X
Internal gain 8X mode.

enumerator kOPAMP_WorkModeInternalGain16X
Internal gain 16X mode.

enumerator kOPAMP_WorkModeExternalGain
External gain mode.

typedef enum *_opamp_config_reg_sel* opamp_config_reg_sel_t

The enumeration lists all options for software controlled opamps and other external signal controlled opamps.

typedef enum *_opamp_load_mode* opamp_load_mode_t

The enumeration lists the opamp buffer's loading modes, delay loading and immediately loading modes.

typedef enum *_opamp_power_mode* opamp_power_mode_t

The enumeration lists the power modes of the opamp, including low power and high power modes.

typedef enum *_opamp_positive_channel* opamp_positive_channel_t

The enumeration of positive input channel selection.

typedef enum *_opamp_negative_channel* opamp_negative_channel_t

The enumeration of negative input channel selection.

typedef enum *_opamp_config_set_index* opamp_config_set_index_t

The enumeration of configuration set index.

typedef enum *_opamp_work_mode* opamp_work_mode_t

The enumeration lists the operating modes of the opamp, including buffer mode, internal gain and external gain mode.

typedef struct *_opamp_config_set* opamp_config_set_t

Configuration set information.

typedef struct *_opamp_config* opamp_config_t

Configuration structure.

struct _opamp_config_set

#include <fsl_opamp.h> Configuration set information.

Public Members

opamp_work_mode_t eWorkMode

Opamp work mode.

opamp_negative_channel_t eNegChannel

Negative channel selection.

opamp_positive_channel_t ePosChannel

Positive channel selection.

struct _opamp_config

#include <fsl_opamp.h> Configuration structure.

Public Members

bool bEnableLoadCompletionInterrupt
: Enable load completion interrupt

bool bEnableWriteProtection
: Enable write protection.

opamp_load_mode_t eLoadMode
: Configuration load mode.

opamp_power_mode_t ePowerMode
: Configuration Power mode.

opamp_config_reg_sel_t eConfigRegSel
: Selects configuration register.

opamp_config_set_t sConfigSet0
: Configuration register set 0.

opamp_config_set_t sConfigSet1
: Configuration register set 1.

opamp_config_set_t sConfigSet2
: Configuration register set 2.

opamp_config_set_t sConfigSet3
: Configuration register set 3.

2.52 The Driver Change Log

2.53 OPAMP Peripheral and Driver Overview

2.54 PIT: Periodic Interrupt Timer (PIT) Driver

void PIT_Init(PIT_Type *base, const *pit_config_t* *psConfig)
: Ungates the PIT clock, configures the PIT features. The configurations are:

  - Clock source selection for PIT module
  - Prescaler configuration to the input clock source
  - PIT period interval
  - PIT slave mode enable/disable
  - Interrupt enable/disable
  - PIT timer enable/disable

- Preset Polarity positive edge/negative edge

Note: This API should be called at the beginning of the application using the PIT driver and call *PIT_StartTimer()* API to start PIT timer.

Parameters

- base – PIT peripheral base address
- psConfig – Pointer to the user's PIT config structure

void PIT_Deinit(PIT_Type *base)

Gates the PIT clock and disables the PIT module.

Parameters

- base – PIT peripheral base address

void PIT_GetDefaultConfig(*pit_config_t* *psConfig)

Fill in the PIT config structure with the default settings.

This function initializes the PIT configuration structure to default values.

```
psConfig->eClockSource = kPIT_CountClockSource0;
psConfig->bEnableTimer = false;
psConfig->bEnableSlaveMode = false;
psConfig->ePrescaler = kPIT_PrescalerDivBy1;
psConfig->bEnableInterrupt = false;
psConfig->u32PeriodCount = 0xFFFFFFFFU;
psConfig->bEnableNegativeEdge = false;
psConfig->sPresetFilter.u16FilterSamplePeriod = 0x0U;
psConfig->sPresetFilter.u16FilterSampleCount = 0x0U;
psConfig->sPresetFilter.bFilterClock = true;
psConfig->sPresetFilter.eFilterPrescalerPeripheral = kPIT_PrescalerDivBy1;
psConfig->sSyncSource.u8StretchCount = 0x0U;
psConfig->sSyncSource.eSyncOutSel = kPIT_Syncout_Default;
```

Parameters

- psConfig – Pointer to user's PIT config structure.

static inline void PIT_EnableSlaveMode(PIT_Type *base, bool bEnable)

Enable/Disable PIT slave mode.

Parameters

- base – PIT peripheral base address
- bEnable – enable/disable slave mode

static inline void PIT_SetTimerPrescaler(PIT_Type *base, *pit_prescaler_value_t* ePrescaler)

Sets the PIT clock prescaler.

Parameters

- base – PIT peripheral base address
- ePrescaler – Timer prescaler value

static inline void PIT_SetTimerPeriod(PIT_Type *base, uint32_t u32PeriodCount)

Sets the timer period in units of count.

Timers begin counting from 0 until it reaches the value set by this function, then it generates an interrupt and counter resumes counting from 0 again.

Note: Users can call the utility macros provided in fsl_common.h to convert to ticks.

Parameters

- base – PIT peripheral base address
- u32PeriodCount – Timer period in units of ticks, use macro definition MSEC_TO_COUNT to convert value in ms to count of ticks, the PIT clock rate is source clock divide prescaler.

static inline uint32_t PIT_GetCurrentTimerCount(PIT_Type *base)

Reads the current timer counting value.

This function returns the real-time timer counting value, in a range from 0 to a timer period.

Note: Users can call the utility macros provided in fsl_common.h to convert ticks to usec or msec.

Parameters

- base – PIT peripheral base address

Returns

Current timer counting value in ticks, use macro definition COUNT_TO_MSEC to convert value in ticks to count of millisecond, the PIT clock rate is source clock divide prescaler.

static inline void PIT_StartTimer(PIT_Type *base)

Starts the timer counting.

After calling this function, timers load period value, count down to 0 and then load the respective start value again. Each time a timer reaches 0, it generates a trigger pulse and sets the timeout interrupt flag.

Parameters

- base – PIT peripheral base address

static inline void PIT_StopTimer(PIT_Type *base)

Stops the timer counting.

This function stops timer counting, and the counter remains at or returns to a 0 value.

Parameters

- base – PIT peripheral base address

static inline void PIT_EnableInterrupt(PIT_Type *base)

Enables the PIT interrupts.

Parameters

- base – PIT peripheral base address

static inline void PIT_DisableInterrupt(PIT_Type *base)

Disables the selected PIT interrupts.

Parameters

- base – PIT peripheral base address

static inline uint16_t PIT_GetStatusFlags(PIT_Type *base)

Gets the PIT status flags.

Parameters

- base – PIT peripheral base address

Returns

The status flags. This is the logical OR of members of the enumeration *_pit_status_flags*

static inline void PIT_ClearStatusFlags(PIT_Type *base)

Clears the PIT status flags.

Parameters

- base – PIT peripheral base address

static inline void PIT_SetPresetFiltConfig(PIT_Type *base, const *pit_config_filt_t* psConfig)

Set FILT configurations.

Parameters

- base – PIT peripheral base address
- psConfig – Pointer to user's PIT FILT config structure

static inline void PIT_SetSyncOutConfig(PIT_Type *base, const *pit_config_ctrl2_t* psConfig)

Set Sync configurations.

Parameters

- base – PIT peripheral base address
- psConfig – Pointer to user's PIT SYNC config structure

FSL_PIT_DRIVER_VERSION

PIT driver version.

enum _pit_prescaler_value

PIT clock prescaler values.

Values:

enumerator kPIT_PrescalerDivBy1

Clock divided by 1

enumerator kPIT_PrescalerDivBy2

Clock divided by 2

enumerator kPIT_PrescalerDivBy4

Clock divided by 4

enumerator kPIT_PrescalerDivBy8

Clock divided by 8

enumerator kPIT_PrescalerDivBy16

Clock divided by 16

enumerator kPIT_PrescalerDivBy32
Clock divided by 32

enumerator kPIT_PrescalerDivBy64
Clock divided by 64

enumerator kPIT_PrescalerDivBy128
Clock divided by 128

enumerator kPIT_PrescalerDivBy256
Clock divided by 256

enumerator kPIT_PrescalerDivBy512
Clock divided by 512

enumerator kPIT_PrescalerDivBy1024
Clock divided by 1024

enumerator kPIT_PrescalerDivBy2048
Clock divided by 2048

enumerator kPIT_PrescalerDivBy4096
Clock divided by 4096

enumerator kPIT_PrescalerDivBy8192
Clock divided by 8192

enumerator kPIT_PrescalerDivBy16384
Clock divided by 16384

enumerator kPIT_PrescalerDivBy32768
Clock divided by 32768

enum _pit_status_flags
List of PIT status flags.
Values:

enumerator kPIT_Timer_RollOverFlag
Timer roll over flag

enum _pit_syncout_mode
List of SYNC_OUT output mode.
Values:

enumerator kPIT_Syncout_Default
SYNC_OUT takes affect when PIT counter equals to the MODULO value (default)

enumerator kPIT_Syncout_Toggle
SYNC_OUT is in toggle mode

typedef enum *_pit_prescaler_value* pit_prescaler_value_t
PIT clock prescaler values.

typedef enum *_pit_syncout_mode* pit_syncout_mode_t
List of SYNC_OUT output mode.

typedef struct *_pit_config_filt* pit_config_filt_t
PIT FILT configuration structure.

This structure holds the configuration settings for the PIT FILT register. To initialize this structure to reasonable defaults, call the *PIT_GetDefaultConfig()* function and pass a pointer to your config structure instance.

The configuration structure can be made constant so it resides in flash.

typedef struct *_pit_config_ctrl2* pit_config_ctrl2_t
PIT CTRL2 configuration structure.

This structure holds the configuration settings for the PIT CTRL2 register. To initialize this structure to reasonable defaults, call the *PIT_GetDefaultConfig()* function and pass a pointer to your config structure instance.

The configuration structure can be made constant so it resides in flash.

typedef struct *_pit_config* pit_config_t
PIT configuration structure.

This structure holds the configuration settings for the PIT peripheral. To initialize this structure to reasonable defaults, call the *PIT_GetDefaultConfig()* function and pass a pointer to your config structure instance.

The configuration structure can be made constant so it resides in flash.

struct pit_config_filt
#include <fsl_pit.h> PIT FILT configuration structure.

This structure holds the configuration settings for the PIT FILT register. To initialize this structure to reasonable defaults, call the *PIT_GetDefaultConfig()* function and pass a pointer to your config structure instance.

The configuration structure can be made constant so it resides in flash.

Public Members

bool bFilterClock
Filter Clock Source selection.

pit_prescaler_value_t eFilterPrescalerPeripheral
Sets the peripheral clock prescaler.

uint8_t u16FilterSampleCount
Input Filter Sample Count.

uint8_t u16FilterSamplePeriod

Input Filter Sample Period.

struct __pit__config__ctrl2

#include <fsl_pit.h> PIT CTRL2 configuration structure.

This structure holds the configuration settings for the PIT CTRL2 register. To initialize this structure to reasonable defaults, call the *PIT_GetDefaultConfig()* function and pass a pointer to your config structure instance.

The configuration structure can be made constant so it resides in flash.

Public Members

uint8_t u8StretchCount

The cycle number to be stretched for SYNC_OUT signal.

pit_syncout_mode_t eSyncOutSel

Select the output mode of SYNC_OUT.

struct __pit__config

#include <fsl_pit.h> PIT configuration structure.

This structure holds the configuration settings for the PIT peripheral. To initialize this structure to reasonable defaults, call the *PIT_GetDefaultConfig()* function and pass a pointer to your config structure instance.

The configuration structure can be made constant so it resides in flash.

Public Members

pit_prescaler_value_t ePrescaler

Clock prescaler value

bool bEnableInterrupt

Enable PIT Roll-Over Interrupt

bool bEnableSlaveMode

Enable the PIT module in slave mode, in which mode the timer will be triggered by master PIT enable.

bool bEnableTimer

PIT timer enable flag, which is false by default

pit_count_clock_source_t eClockSource

Specify the PIT count clock source

uint32_t u32PeriodCount

Timer period in clock cycles, Use macro definition MSEC_TO_COUNT to convert value in ms to count of ticks, the COP clock rate is source clock divide prescaler.

bool bEnableNegativeEdge
: choose the polarity of Preset input.

pit_config_filt_t sPresetFilter
: Specify the PIT preset filter source

pit_config_ctrl2_t sSyncSource
: Specify the PIT Sync source

2.55 The Driver Change Log

2.56 PIT Peripheral and Driver Overview

2.57 PMC: Power Management Controller Driver

static inline void PMC_SetBandgapTrim(PMC_Type *base, uint8_t u8TrimValue)

Sets the trim value of the bandgap reference in the regulator.

Parameters

- base – PMC peripheral base address.
- u8TrimValue – The bandgap's trim value, ranges from 0 to 15.

static inline void PMC_EnableVoltageReferenceBuffer(PMC_Type *base, bool bEnable)

Enables/Disables a buffer that drivers the 1.2V bandgap reference to the ADC.

If the users want to calibrate the ADC using the 1.2V reference voltage, then the voltage reference buffer should be enabled. When ADC calibration is not being performed, the voltage reference buffer should be disabled to save power.

Parameters

- base – PMC peripheral base address.
- bEnable – Used to control the behaviour of voltage reference buffer.
  - **true** Enable voltage reference buffer.
  - **false** Disable voltage reference buffer.

static inline void PMC_EnableInterrupts(PMC_Type *base, uint16_t u16Interrupts)

Enables the interrups, including 2.2V high voltage interrupt, 2.7V/2.65V high voltage interrupt, 2.2V low voltage interrupt, 2.7V/2.65V low voltage interrupt.

Parameters

- base – PMC peripheral base address.
- u16Interrupts – The interupts to be enabled, should be the OR'ed value of *_pmc_interrupt_enable*.

static inline void PMC_DisableInterrupts(PMC_Type *base, uint16_t u16Interrupts)

Disables the interrups, including 2.2V high voltage interrupt, 2.7V/2.65V high voltage interrupt, 2.2V low voltage interrupt, 2.7V/2.65V low voltage interrupt.

Parameters

- base – PMC peripheral base address.

- u16Interrupts – The interupts to be disabled, should be the OR'ed value of *_pmc_interrupt_enable*.

static inline uint16_t PMC_GetStatusFlags(PMC_Type *base)

Gets the status flags of PMC module, such as low voltage interrpt flag, small regulator 2.7 active flag, etc.

Parameters

- base – PMC peripheral base address.

Returns

The status flags of PMC module, should be the OR'ed value of *_pmc_status_flags*.

static inline void PMC_ClearStatusFlags(PMC_Type *base, uint16_t u16StatusFlags)

Clears the status flags of PMC module, only low voltage interrupt flag, sticky 2.7V/2.65V low voltage flag, and sticky 2.2V low voltage flag can be cleared.

Parameters

- base – PMC peripheral base address.
- u16StatusFlags – The status flags to be cleared, should be the OR'ed value of *kPMC_LowVoltageInterruptFlag*, and kPMC_Sticky2P7VLowVoltageFlag/kPMC_Sticky2P65VLowVoltageFlag, and *kPMC_Sticky2P2VLowVoltageFlag*,

static inline void PMC_SetVrefTrim(PMC_Type *base, uint16_t u16TrimValue)

Sets the trim value of the Vref reference in the regulator.

Parameters

- base – PMC peripheral base address.
- u16TrimValue – The Vref's trim value, ranges from 0 to 31.

static inline void PMC_SetVcapTrim(PMC_Type *base, uint16_t u16TrimValue)

Sets the trim value of the Vacp reference in the regulator.

Parameters

- base – PMC peripheral base address.
- u16TrimValue – The Vacp's trim value, ranges from 0 to 15.

FSL_PMC_DRIVER_VERSION

PMC driver version.

enum _pmc_interrupt_enable

The enumeration of PMC voltage detection interrupts.

Values:

enumerator kPMC_2P2VLowVoltageInterruptEnable

If the input supply is currently dropped below the 2.2V level, generate the low voltage interrupt.

enumerator kPMC_2P2VHighVoltageInterruptEnable

If the input supply is currently raised above the 2.2V level, generate the low voltage interrupt.

enumerator kPMC_AllInterruptsEnable

enum _pmc_status_flags

The enumeration of PMC status flags.

Values:

enumerator kPMC_SmallRegulator2P7VActiveFlag

The small regulator 2.7V supply is ready to be used.

enumerator kPMC_LowVoltageInterruptFlag

The low voltage interrupt flag, used to indicate whether the low voltage interrupt is asserted.

enumerator kPMC_Sticky2P2VLowVoltageFlag

Input supply has dropped below the 2.2V threshold. This sticky flag indicates that the input supply dropped below the 2.2V level at some point.

enumerator kPMC_2P2VLowVoltageFlag

Input supply is below the 2.2V threshold.

enumerator kPMC_AllStatusFlags

2.58 The Driver Change Log

2.59 PMC Peripheral and Driver Overview

2.60 eFlexPWM: Enhanced Flexible Pulse Width Modulator Driver

void PWM_Init(PWM_Type *base, const *pwm_config_t* *psConfig)

Initialization PWM module with provided structure *pwm_config_t*.

This function can initial one or more submodules of the PWM module.

This examples shows how only initial submodule 0 without fault protection channel.

```
pwm_config_t sPwmConfig = {0};
pwm_sm_config_t sPwmSm0Config;
sPwmConfig.psPwmSubmoduleConfig[0] = &sPwmSm0Config;
PWM_GetSmDefaultConfig(&sPwmSm0Config);
PWM_Init(PWM, sPwmConfig);
```

Note: This API should be called at the beginning of the application using the PWM driver.

Parameters

- base – PWM peripheral base address.
- psConfig – Pointer to PWM module configure structure. See *pwm_config_t*.

void PWM_Deinit(PWM_Type *base)

De-initialization a PWM module.

Parameters

- base – PWM peripheral base address

void PWM_GetSMDefaultConfig(*pwm_sm_config_t* *psConfig)

Gets an default PWM submodule's configuration.

This function fills in the initialization structure member, which can make submodule generate 50% duty cycle center aligned PWM_A/B output.

The default effective values are:

```
psConfig->enableDebugMode = false;
psConfig->enableWaitMode = false;
psConfig->enableRun = false;
psConfig->sCounterConfig.eCountClockSource = kPWM_ClockSrcBusClock;
psConfig->sCounterConfig.eCountClockPrescale = kPWM_ClockPrescaleDivide1;
psConfig->sCounterConfig.eCountInitSource = kPWM_InitOnLocalSync;
psConfig->sReloadConfig.eReloadSignalSelect = kPWM_LocalReloadSignal;
psConfig->sReloadConfig.eLoclReloadEffectTime = kPWM_TakeEffectAtReloadOportunity;
psConfig->sReloadConfig.eLocalReloadOportunity = kPWM_LoadEveryOportunity;
psConfig->sReloadConfig.bEnableFullCycleReloadOportunity = true;
psConfig->sReloadConfig.bEnableHalfCycleReloadOportunity = false;
psConfig->sValRegisterConfig.u16CounterInitialValue = 0xFF00U;
psConfig->sValRegisterConfig.u16ValRegister0 = 0x0U;
psConfig->sValRegisterConfig.u16ValRegister1 = 0x00FFU;
psConfig->sValRegisterConfig.u16ValRegister2 = 0xFF80U;
psConfig->sValRegisterConfig.u16ValRegister3 = 0x80U;
psConfig->sValRegisterConfig.u16ValRegister4 = 0xFF80U;
psConfig->sValRegisterConfig.u16ValRegister5 = 0x80U;
psConfig->sForceConfig.eForceSignalSelect = kPWM_LocalSoftwareForce;
psConfig->sForceConfig.eSoftOutputFor23 = kPWM_SoftwareOutputLow;
psConfig->sForceConfig.eSoftOutputFor45 = kPWM_SoftwareOutputLow;
psConfig->sForceConfig.eForceOutput23 = kPWM_GeneratedPwm;
psConfig->sForceConfig.eForceOutput45 = kPWM_GeneratedPwm;
psConfig->sDeadTimeConfig.eMode = kPWM_Independent;
psConfig->sOutputConfig.ePwmXSignalSelect = kPWM_RawPwmX;
psConfig->sOutputConfig.bEnablePwmxOutput = true;
psConfig->sOutputConfig.bEnablePwmaOutput = true;
psConfig->sOutputConfig.bEnablePwmbOutput = true;
psConfig->sOutputConfig.ePwmxFaultState = kPWM_OutputLowOnFault;
psConfig->sOutputConfig.ePwmaFaultState = kPWM_OutputLowOnFault;
psConfig->sOutputConfig.ePwmbFaultState = kPWM_OutputLowOnFault;
```

Parameters

- psConfig – Pointer to user's PWM submodule config structure. See *pwm_sm_config_t*.

void PWM_GetFaultProtectionDefaultConfig(*pwm_fault_protection_config_t* *psConfig)

Gets an default fault protection channel's configuration.

The default effective values are:

```
psConfig->sFaultInput[i].eFaultActiveLevel = kPWM_Logic0;
psConfig->sFaultInput[i].bEnableAutoFaultClear = true;
psConfig->sFaultInput[i].bEnableFaultFullCycleRecovery = true;
```

Parameters

- psConfig – Pointer to user's PWM fault protection config structure. See *pwm_fault_protection_config_t*.

void PWM_SetupSMConfig(PWM_Type *base, *pwm_sm_number_t* eSubModule, const *pwm_sm_config_t* *psConfig)

Sets up the PWM submodule configure.

Parameters

- base – PWM peripheral base address
- eSubModule – PWM submodule number, see *pwm_sm_number_t*.
- psConfig – Pointer to submodule configure structure, see *pwm_sm_config_t*.

static inline void PWM_SetupCounterConfig(PWM_Type *base, *pwm_sm_number_t* eSubModule, const *pwm_sm_counter_config_t* *psConfig)

Sets up the PWM submodule counter configure.

Parameters

- base – PWM peripheral base address
- eSubModule – PWM submodule number, see *pwm_sm_number_t*.
- psConfig – Pointer to submodule counter configure structure, see *pwm_sm_counter_config_t*.

static inline void PWM_SetCounterInitialValue(PWM_Type *base, *pwm_sm_number_t* eSubModule, uint16_t u16InitialValue)

Sets the PWM submodule counter initial register value.

This function set the INIT register value, the counter will start counting from INIT register value when initial signal assert or software force set. This write value will be loaded into inner set of buffered registers according to reload logic configure.

Parameters

- base – PWM peripheral base address
- eSubModule – PWM submodule number, see *pwm_sm_number_t*.
- u16InitialValue – The submodule number counter initialize value.

static inline void PWM_SetupReloadLogicConfig(PWM_Type *base, *pwm_sm_number_t* eSubModule, const *pwm_sm_reload_logic_config_t* *psConfig)

Sets up the PWM submodule reload logic configure.

Parameters

- base – PWM peripheral base address.
- eSubModule – PWM submodule number, see *pwm_sm_number_t*.
- psConfig – Pointer to submodule reload logic configure structure, see *pwm_sm_reload_logic_config_t*.

void PWM_GetValueConfig(*pwm_sm_value_register_config_t* *psConfig, *pwm_sm_typical_output_mode_t* eTypicalOutputMode, uint16_t u16PwmPeriod, uint16_t u16PwmAPulseWidth, uint16_t u16PwmBPulseWidth)

Update PWM submodule compare value configuration according to the typical output mode.

Parameters

- psConfig – See *pwm_sm_config_t*.

- eTypicalOutputMode – Typical PWM_A/B output mode. See *pwm_sm_typical_output_mode_t*.
- u16PwmPeriod – PWM output period value in counter ticks. This value can be got by (main counter clock in Hz) / (wanted PWM signal frequency in Hz).
- u16PwmAPulseWidth – PWM_A pulse width value in counter ticks. Can got by (wanted PWM duty Cycle) * u16PwmPeriod.
- u16PwmBPulseWidth – PWM_B pulse width value in counter ticks. Can got by (wanted PWM duty Cycle) * u16PwmPeriod.

static inline void PWM_SetupValRegisterConfig(PWM_Type *base, *pwm_sm_number_t* eSubModule, const *pwm_sm_value_register_config_t* *psConfig)

Sets up the PWM submodule VALn registers logic configure.

Parameters

- base – PWM peripheral base address.
- eSubModule – PWM submodule number, see *pwm_sm_number_t*.
- psConfig – Pointer to VALn registers configure structure, see *pwm_sm_value_register_config_t*.

static inline void PWM_SetValueRegister(PWM_Type *base, *pwm_sm_number_t* eSubModule, *pwm_sm_val_register_t* eRegister, uint16_t u16Value)

Sets the PWM submodule VALn register value.

Note: These write value will be loaded into inner set of buffered registers according to reload logic configure.

Parameters

- base – PWM peripheral base address.
- eSubModule – PWM submodule number, see *pwm_sm_number_t*.
- eRegister – Value register index (range in 0~5), see *pwm_sm_val_register_t*.
- u16Value – The value for VALn register.

static inline uint16_t PWM_GetValueRegister(PWM_Type *base, *pwm_sm_number_t* eSubModule, *pwm_sm_val_register_t* eRegister)

Gets the PWM submodule VALn register value.

Parameters

- base – PWM peripheral base address.
- eSubModule – PWM submodule number, see *pwm_sm_number_t*.
- eRegister – Value register index (range in 0~5), see *pwm_sm_val_register_t*.

Returns

The VALn register value.

static inline void PWM_SetFracvalRegister(PWM_Type *base, *pwm_sm_number_t* eSubModule, *pwm_sm_fracval_register_t* eRegister, uint16_t u16Value)

Sets the PWM submodule fractional value register value.

Note: These write value will be loaded into inner set of buffered registers according to reload logic configure.

Parameters

- base – PWM peripheral base address.
- eSubModule – PWM submodule number, see *pwm_sm_number_t*.
- eRegister – Fractional value register index (range in 1~5), see *pwm_sm_val_register_t*.
- u16Value – The value for FRACVALn register.

static inline uint16_t PWM_GetFracvalRegister(PWM_Type *base, *pwm_sm_number_t* eSubModule, *pwm_sm_fracval_register_t* eRegister)

Sets the PWM submodule fractional value register value.

Parameters

- base – PWM peripheral base address.
- eSubModule – PWM submodule number, see *pwm_sm_number_t*.
- eRegister – Fractional value register index (range in 1~5), see *pwm_sm_fracval_register_t*.

Returns

The VALn FRACVALn value.

static inline void PWM_SetValueAndFracRegister(PWM_Type *base, *pwm_sm_number_t* eSubModule, *pwm_sm_fracval_register_t* eRegister, uint32_t u32Value)

Set submodule register VALx and its FRAC value with 32bit access.

Parameters

- base – PWM peripheral base address.
- eSubModule – Submodule ID.
- eRegister – Fractional value register index (range in 1~5), see *pwm_sm_fracval_register_t*.
- u32Value – 32bit value for VALx and its FRAC. VALx: BIT16~BIT31. FRACVALx: BIT11~BIT15. RESERVED: BIT10~BIT0.

static inline uint32_t PWM_GetValueAndFracRegister(PWM_Type *base, *pwm_sm_number_t* eSubModule, *pwm_sm_fracval_register_t* eRegister)

Get submodule register VALx and its FRAC value with 32bit access.

Parameters

- base – PWM peripheral base address.
- eSubModule – Submodule ID.
- eRegister – Fractional value register index (range in 1~5), see *pwm_sm_fracval_register_t*.

Returns

The value of submodule register VALx and its FRAC, combined into 32bit. VALx: BIT16~BIT31. FRACVALx: BIT11~BIT15. RESERVED: BIT10~BIT0.

static inline void PWM_SetPwmLdok(PWM_Type *base, uint16_t u16Mask)

Set the PWM LDOK bit on a single or multiple submodules.

Enable this feature can make buffered CTRL[PRSC] and the INIT, FRACVAL and VAL registers values take effect after next local load signal assert. The timing of take effect can be the next PWM reload or immediately. After loading, MCTRL[LDOK] is automatically cleared and need to enable again before the next register updated.

Note: The VALx, FRACVALx,INIT, and CTRL[PRSC] registers of the corresponding submodule cannot be written while the the corresponding MCTRL[LDOK] bit is set.

Parameters

- base – PWM peripheral base address
- u16Mask – PWM submodules to set the LDOK bit, Logical OR of *_pwm_sm_enable*.

static inline void PWM_ClearPwmLdok(PWM_Type *base, uint16_t u16Mask)

Clear the PWM LDOK bit on a single or multiple submodules.

Parameters

- base – PWM peripheral base address
- u16Mask – PWM submodules to clear the LDOK bit, Logical OR of *_pwm_sm_enable*.

static inline void PWM_SetupForceLogicConfig(PWM_Type *base, *pwm_sm_number_t* eSubModule, const *pwm_sm_force_logic_config_t* *psConfig)

brief Sets up the PWM submodule force logic configure.

param base PWM peripheral base address. param eSubModule PWM submodule number, see *pwm_sm_number_t*. param psConfig Poniter to submodule force logic configure structure, see *pwm_sm_force_logic_config_t*.

static inline void PWM_SetSoftwareForce(PWM_Type *base, *pwm_sm_number_t* eSubModule)

Sets up the PWM Sub-Module to trigger a software FORCE_OUT event.

Note: Only works when the CTRL2[FORCE_SEL] select kPWM_ForceOutOnLocalSoftware.

Parameters

- base – PWM peripheral base address.
- eSubModule – PWM submodule number, see *pwm_sm_number_t*.

void PWM_SetupDeadtimeConfig(PWM_Type *base, *pwm_sm_number_t* eSubModule, const *pwm_sm_deadtime_logic_config_t* *psConfig)

Sets up the PWM submodule deadtime logic configure.

Parameters

- base – PWM peripheral base address.
- eSubModule – PWM submodule number, see *pwm_sm_number_t*.
- psConfig – Pointer to deadtime logic configure structure, see *pwm_sm_deadtime_logic_config_t*.

static inline uint16_t PWM_GetDeadtimeSampleValue(PWM_Type *base, *pwm_sm_number_t* eSubModule)

Get the sampled values of the PWM_X input at the end of each deadtime.

When use PWM_A/B in complementary mode and connect to transistor to controls the output voltage. Need insert deadtime to avoid overlap of conducting interval between the top and bottom transistor. And both transistors in complementary mode are off during deadtime. Then connect the PWM_X input to complementary transistors output, then it sampling input at the end of deadtime 0 for DT[0] and the end of deadtime 1 for DT[1]. Which DT value is not 0 indicates that there is a problem with the corresponding deadtime value. This can help to decide if there need do a deadtime correction for current complementary PWM output.

Parameters

- base – PWM peripheral base address
- eSubModule – PWM submodule number, see *pwm_sm_number_t*.

Returns

The PWM_X input sampled values.

void PWM_SetupFractionalDelayConfig(PWM_Type *base, *pwm_sm_number_t* eSubModule, const *pwm_sm_fractional_delay_logic_config_t* *psConfig)

Sets up the PWM submodule fractional delay logic configure.

Note: The fractional delay logic can only be used when the IPBus clock is running at 100 MHz.

Parameters

- base – PWM peripheral base address.
- eSubModule – PWM submodule number, see *pwm_sm_number_t*.
- psConfig – Pointer to fractional delay logic configure structure, see *pwm_sm_fractional_delay_logic_config_t*.

void PWM_SetupOutputConfig(PWM_Type *base, *pwm_sm_number_t* eSubModule, const *pwm_sm_output_logic_config_t* *psConfig)

Sets up the PWM submodule output logic configure.

Parameters

- base – PWM peripheral base address.
- eSubModule – PWM submodule number, see *pwm_sm_number_t*.
- psConfig – Pointer to output logic configure structure, see *pwm_sm_output_logic_config_t*.

static inline void PWM_EnableOutput(PWM_Type *base, uint16_t u16SubModules, *pwm_sm_pwm_out_t* eOutput)

Enables the PWM submodule pin output.

This function handles PWMX_EN/PWMA_EN/PWMB_EN bit filed of OUTEN register, whcih can enable one or more submodule pin in PWMX/A/B.

Parameters

- base – PWM peripheral base address
- u16SubModules – The submodules that enable eOutput output, logical OR of *_pwm_sm_enable*.

- eOutput – PWM output pin ID, see *pwm_sm_pwm_out_t*.

static inline void PWM_DisableOutput(PWM_Type *base, uint16_t u16SubModules, *pwm_sm_pwm_out_t* eOutput)

Disables the PWM submodule pin output.

This function handles PWMX_EN/PWMA_EN/PWMB_EN bit filed of OUTEN register, whcih can disable one or more submodule pin in PWMX/A/B.

Parameters

- base – PWM peripheral base address
- u16SubModules – The submodules that disable eOutput output, logical OR of *_pwm_sm_enable*.
- eOutput – PWM output pin ID, see *pwm_sm_pwm_out_t*.

static inline void PWM_EnableCombinedOutput(PWM_Type *base, uint16_t u16XSubModules, uint16_t u16ASubModules, uint16_t u16BSubModules)

Enables the PWM pin combination output.

This function handles PWMX_EN/PWMA_EN/PWMB_EN bit filed of OUTEN register at the same time.

Parameters

- base – PWM peripheral base address
- u16XSubModules – The submodules that enable PWMX output, should be logical OR of *_pwm_sm_enable*.
- u16ASubModules – The submodules that enable PWMA output, should be logical OR of *_pwm_sm_enable*.
- u16BSubModules – The submodules that enable PWMB output, should be logical OR of *_pwm_sm_enable*.

static inline void PWM_DisableCombinedOutput(PWM_Type *base, uint16_t u16XSubModules, uint16_t u16ASubModules, uint16_t u16BSubModules)

Disables the PWM pin combination output.

This function handles PWMX_EN/PWMA_EN/PWMB_EN bit filed of OUTEN register at the same time.

Parameters

- base – PWM peripheral base address
- u16XSubModules – The submodules that disable PWMX output, should be logical OR of *_pwm_sm_enable*.
- u16ASubModules – The submodules that disable PWMA output, should be logical OR of *_pwm_sm_enable*.
- u16BSubModules – The submodules that disable PWMB output, should be logical OR of *_pwm_sm_enable*.

static inline void PWM_MaskOutput(PWM_Type *base, uint16_t u16SubModules, *pwm_sm_pwm_out_t* eOutput)

Mask the PWM pin output.

This function handles MASKA/MASKB/MASKX bit filed of MASK register, which can mask one or more submodule pin in PWMX/A/B.

Note: The mask bits is buffered and can be updated until a FORCE_OUT event occurs or a software update command.

Parameters

- base – PWM peripheral base address.
- u16SubModules – The submodules that mask eOutput output, logical OR of *_pwm_sm_enable*.
- eOutput – PWM output pin ID, see *pwm_sm_pwm_out_t*.

static inline void PWM_UnmaskOutput(PWM_Type *base, uint16_t u16SubModules, *pwm_sm_pwm_out_t* eOutput)

Unmask the PWM pin output.

This function handles MASKA/MASKB/MASKX bit filed of MASK register, which can mask one or more submodule pin in PWMX/A/B.

Note: The mask bits is buffered and can be updated until a FORCE_OUT event occurs or a software update command.

Parameters

- base – PWM peripheral base address
- u16SubModules – The submodules that unmask eOutput output, logical OR of *_pwm_sm_enable*.
- eOutput – PWM output pin ID, see *pwm_sm_pwm_out_t*.

static inline void PWM_MaskCombinedOutput(PWM_Type *base, uint16_t u16XSubModules, uint16_t u16ASubModules, uint16_t u16BSubModules)

Mask the PWM pin combination output.

This function handles MASKA/MASKB/MASKX bit filed of MASK register at the same time.

Note: The mask bits is buffered and can be updated until a FORCE_OUT event occurs or a software update command.

Parameters

- base – PWM peripheral base address
- u16XSubModules – The submodules that mask PWMX output, should be logical OR of *_pwm_sm_enable*.
- u16ASubModules – The submodules that mask PWMA output, should be logical OR of *_pwm_sm_enable*.
- u16BSubModules – The submodules that mask PWMB output, should be logical OR of *_pwm_sm_enable*.

static inline void PWM_UnmaskCombinedOutput(PWM_Type *base, uint16_t u16XSubModules, uint16_t u16ASubModules, uint16_t u16BSubModules)

Unmask the PWM pin combination output.

This function handles MASKA/MASKB/MASKX bit filed of MASK register at the same time.

Note: The mask bits is buffered and can be updated until a FORCE_OUT event occurs or a software update command.

Parameters

- base – PWM peripheral base address
- u16XSubModules – The submodules that unmask PWMX output, should be logical OR of *_pwm_sm_enable*.
- u16ASubModules – The submodules that unmask PWMA output, should be logical OR of *_pwm_sm_enable*.
- u16BSubModules – The submodules that unmask PWMB output, should be logical OR of *_pwm_sm_enable*.

static inline void PWM_UpdateMask(PWM_Type *base, *pwm_sm_number_t* eSubModule)

Update PWM output mask bits immediately with a software command.

Parameters

- base – PWM peripheral base address
- eSubModule – PWM submodule number, see *pwm_sm_number_t*.

static inline void PWM_EnablePwmRunInDebug(PWM_Type *base, *pwm_sm_number_t* eSubModule, bool bEnable)

Enables/Disables the PWM submodule continue to run while the chip is in DEBUG mode.

Parameters

- base – PWM peripheral base address
- eSubModule – PWM submodule number, see *pwm_sm_number_t*.
- bEnable – Enable the feature or not.
  - **true** Enable load feature.
  - **false** Disable load feature.

static inline void PWM_EnablePwmRunInWait(PWM_Type *base, *pwm_sm_number_t* eSubModule, bool bEnable)

Enables/Disables the PWM submodule continue to run while the chip is in WAIT mode.

Parameters

- base – PWM peripheral base address
- eSubModule – PWM submodule number, see *pwm_sm_number_t*.
- bEnable – Enable the feature or not.
  - **true** Enable load feature.
  - **false** Disable load feature.

static inline void PWM_EnableCounters(PWM_Type *base, uint16_t u16Mask)

Starts the PWM submodule counter for a single or multiple submodules.

Sets the Run bit which enables the clocks to the PWM submodule. This function can start multiple submodules at the same time.

Parameters

- base – PWM peripheral base address
- u16Mask – PWM submodules to start run, Logical OR of *_pwm_sm_enable*.

static inline void PWM_DisableCounters(PWM_Type *base, uint16_t u16Mask)

Stops the PWM counter for a single or multiple submodules.

Clears the Run bit which resets the submodule's counter. This function can stop multiple submodules at the same time.

Parameters

- base – PWM peripheral base address
- u16Mask – PWM submodules to start run, Logical OR of *_pwm_sm_enable*.

static inline uint16_t PWM_GetCaptureValue(PWM_Type *base, *pwm_sm_number_t* eSubModule, *pwm_sm_input_capture_register_t* eRegister)

Reads PWM submodule input capture value register.

This function read the CVALn register value, stores the value captured from the submodule counter.

Parameters

- base – PWM peripheral base address.
- eSubModule – PWM submodule number, see *pwm_sm_number_t*.
- eRegister – PWM submodule input capture value register, see *pwm_sm_input_capture_register_t*.

Returns

The input capture value.

static inline uint16_t PWM_GetCaptureValueCycle(PWM_Type *base, *pwm_sm_number_t* eSubModule, *pwm_sm_input_capture_register_t* eRegister)

Reads PWM submodule input capture value cycle register.

This function read the CVALnCYC register value, stores the cycle number corresponding to the value captured in CVALn. This register is incremented each time the counter is loaded with the INIT value at the end of a PWM modulo cycle.

Parameters

- base – PWM peripheral base address.
- eSubModule – PWM submodule number, see *pwm_sm_number_t*.
- eRegister – PWM submodule input capture value register, see *pwm_sm_input_capture_register_t*.

Returns

The input capture register cycle value.

static inline uint16_t PWM_GetCaptureEdgeCounterVaule(PWM_Type *base, *pwm_sm_number_t* eSubModule, *pwm_sm_input_capture_pin_t* eInputPin)

Reads the PWM submodule input capture logic edge counter value.

Each input capture logic has a edge counter, which counts both the rising and falling edges of the input capture signal and it compare signal can select as input capture trigger source.

Parameters

- base – PWM peripheral base address.
- eSubModule – PWM submodule number, see *pwm_sm_number_t*.
- eInputPin – PWM submodule input capture pin number, see *pwm_sm_input_capture_pin_t*.

void PWM_SetupInputCaptureConfig(PWM_Type *base, *pwm_sm_number_t* eSubModule, *pwm_sm_input_capture_pin_t* eInputPin, const *pwm_sm_input_capture_config_t* *psConfig)

Sets up the PWM submodule input capture configure.

Each PWM submodule has 3 pins that can be configured for use as input capture pins. This function sets up the capture parameters for each pin and enables the input capture operation.

Parameters

- base – PWM peripheral base address.
- eSubModule – PWM submodule number, see *pwm_sm_number_t*.
- eInputPin – PWM submodule input capture pin number, see *pwm_sm_input_capture_pin_t*.
- psConfig – Pointer to input capture configure structure, see *pwm_sm_input_capture_config_t*.

static inline void PWM_EnableInputCapture(PWM_Type *base, *pwm_sm_number_t* eSubModule, *pwm_sm_input_capture_pin_t* eInputPin)

Enables the PWM submodule input capture operation.

Enables input capture operation will start the input capture process. The enable bit is self-cleared when in one shot mode and one or more of the enabled capture circuits has had a capture event.

Parameters

- base – PWM peripheral base address.
- eSubModule – PWM submodule number, see *pwm_sm_number_t*.
- eInputPin – PWM submodule input capture pin number, see *pwm_sm_input_capture_pin_t*.

static inline void PWM_DisableInputCapture(PWM_Type *base, *pwm_sm_number_t* eSubModule, *pwm_sm_input_capture_pin_t* eInputPin)

Disables the PWM submodule input capture operation.

The enable bit can be cleared at any time to disable input capture operation.

Parameters

- base – PWM peripheral base address.
- eSubModule – PWM submodule number, see *pwm_sm_number_t*.
- eInputPin – PWM submodule input capture pin number, see *pwm_sm_input_capture_pin_t*.

static inline uint16_t PWM_GetInputValue(PWM_Type *base, *pwm_sm_number_t* eSubModule, *pwm_sm_input_capture_pin_t* eInputPin)

Get the logic value currently being driven into the PWM inputs.

Parameters

- base – PWM peripheral base address

- eSubModule – PWM submodule number, see *pwm_sm_number_t*.
- eInputPin – PWM submodule input capture pin number, see *pwm_sm_input_capture_pin_t*.

Returns

The PWM submodule input capture pin logic value.

void PWM_SetupFaultProtectionConfig(PWM_Type *base, *pwm_fault_protection_channel_t* eFaultProtection, const *pwm_fault_protection_config_t* *psConfig)

Sets up the PWM fault protection channel configure.

Parameters

- base – PWM peripheral base address.
- eFaultProtection – PWM fault protection channel number, see *pwm_fault_protection_channel_t*.
- psConfig – Pointer to fault protection channel configure structure, see *pwm_fault_protection_config_t*.

static inline void PWM_SetupSMFaultInputMapping(PWM_Type *base, *pwm_sm_number_t* eSubModule, *pwm_sm_pwm_out_t* ePwmOutput, const *pwm_sm_fault_input_mapping_t* *psMapping)

Mapping fault protection channel fault input status to PWM submodule output,.

Note: Each PWM output can be mapping anyone or more fault inputs. The mapped fault protection channel inputs can disable PWM output.

Parameters

- base – PWM peripheral base address.
- eSubModule – PWM submodule number, see *pwm_sm_number_t*.
- ePwmOutput – PWM submodule output, see *pwm_sm_pwm_out_t*.
- psMapping – The fault input disable mapping structure, see *pwm_sm_fault_input_mapping_t*.

void PWM_SetupDmaConfig(PWM_Type *base, *pwm_sm_number_t* eSubModule, const *pwm_sm_dma_config_t* *psConfig)

Sets up the PWM submodule DMA configure.

Parameters

- base – PWM peripheral base address.
- eSubModule – PWM submodule number, see *pwm_sm_number_t*.
- psConfig – Pointer to PWM submodule DMA configure, see *pwm_sm_dma_config_t*.

static inline void PWM_SetEnabledCaptureDmaSource(PWM_Type *base, *pwm_sm_number_t* eSubModule, *pwm_sm_capture_dma_source_t* eCaptureDmaSource)

Select the trigger source for enabled capture FIFOs DMA read request.

Note: This function only can be used when the bEnableCaptureDMA be true.

Parameters

- base – PWM peripheral base address.
- eSubModule – PWM submodule number, see *pwm_sm_number_t*.
- eCaptureDmaSource – The PWM DMA capture source.

static inline void PWM_EnableSMInterrupts(PWM_Type *base, *pwm_sm_number_t* eSubModule, uint16_t u16Mask)

Enables the PWM submodule interrupts according to a provided mask.

This examples shows how to enable VAL 0 compare interrupt and VAL 1 compare interrupt.

```
PWM_EnableSMInterrupts(PWM, kPWM_SubModule0, kPWM_CompareVal0InterruptEnable |
kPWM_CompareVal1InterruptEnable);
```

Parameters

- base – PWM peripheral base address
- eSubModule – PWM submodule number, see *pwm_sm_number_t*.
- u16Mask – The PWM submodule interrupts to enable. Logical OR of *_pwm_sm_interrupt_enable*.

static inline void PWM_DisbaleSMInterrupts(PWM_Type *base, *pwm_sm_number_t* eSubModule, uint16_t u16Mask)

Disables the PWM submodule interrupts according to a provided mask.

This examples shows how to disable VAL 0 compare interrupt and VAL 1 compare interrupt.

```
PWM_DisbaleSMInterrupts(PWM, kPWM_SubModule0, kPWM_CompareVal0InterruptEnable |
kPWM_CompareVal1InterruptEnable);
```

Parameters

- base – PWM peripheral base address
- eSubModule – PWM submodule number, see *pwm_sm_number_t*.
- u16Mask – The PWM submodule interrupts to enable. Logical OR of *_pwm_sm_interrupt_enable*.

static inline void PWM_EnableFaultInterrupts(PWM_Type *base, *pwm_fault_protection_channel_t* eFaultProtection, uint16_t u16Mask)

Enables the PWM fault protection channel interrupt according to a provided mask.

This examples shows how to enable fault pin 0 interrupt and fault pin 1 interrupt.

```
PWM_EnableFaultInterrupts(PWM, kPWM_FaultProtection0, kPWM_Fault0InterruptEnable |
kPWM_Fault1InterruptEnable);
```

Parameters

- base – PWM peripheral base address
- eFaultProtection – PWM fault protection channel number, see *pwm_fault_protection_channel_t*.

- u16Mask – The PWM fault protection channel interrupts to enable. Logical OR of *_pwm_fault_protection_interrupt_enable*.

static inline void PWM_DisableFaultInterrupts(PWM_Type *base, *pwm_fault_protection_channel_t* eFaultProtection, uint16_t u16Mask)

Disables the PWM fault protection channel interrupt according to a provided mask.

This examples shows how to disable fault pin 0 interrupt and fault pin 1 interrupt.

```
PWM_DisableFaultInterrupts(PWM, kPWM_FaultProtection0, kPWM_Fault0InterruptEnable |
kPWM_Fault1InterruptEnable);
```

Parameters

- base – PWM peripheral base address
- eFaultProtection – PWM fault protection channel number, see *pwm_fault_protection_channel_t*.
- u16Mask – The PWM fault protection channel interrupts to disable. Logical OR of *_pwm_fault_protection_interrupt_enable*.

static inline uint16_t PWM_GetSMStatusFlags(PWM_Type *base, *pwm_sm_number_t* eSubModule)

Gets the PWM submodule status flags.

This examples shows how to check whether the submodule VAL0 compare flag set.

```
if((PWM_GetSMStatusFlags(PWM, kPWM_SubModule0) & kPWM_CompareVal0Flag) != 0U)
{
    ...
}
```

Parameters

- base – PWM peripheral base address
- eSubModule – PWM submodule number, see *pwm_sm_number_t*.

Returns

The PWM submodule status flags. This is the logical OR of *pwm_sm_status_flags_t*.

static inline void PWM_ClearSMStatusFlags(PWM_Type *base, *pwm_sm_number_t* eSubModule, uint16_t u16Mask)

Clears the PWM submodule status flags.

This examples shows how to clear the submodule VAL0 compare flag.

```
PWM_ClearSMStatusFlags(PWM, kPWM_SubModule0, kPWM_CompareVal0Flag);
```

Note: The kPWM_RegUpdatedFlag can't be cleared by software.

Parameters

- base – PWM peripheral base address
- eSubModule – PWM submodule number, see *pwm_sm_number_t*.

- u16Mask – The status flags to clear. This is the logical OR of *pwm_sm_status_flags_t*.

static inline uint16_t PWM_GetFaultStatusFlags(PWM_Type *base, *pwm_fault_protection_channel_t* eFaultProtection)

Gets the PWM fault protection status flags.

This examples shows how to check whether the fault protection channel fault input pin 0 set.

```
if((PWM_GetFaultStatusFlags(PWM, kPWM_FaultProtection0) & kPWM_FaultPin0Flag) != 0U)
{
    ...
}
```

Parameters

- base – PWM peripheral base address
- eFaultProtection – PWM fault protection channel number, see *pwm_fault_protection_channel_t*.

Returns

The PWM fault protection channel status flags. This is the logical OR of *_pwm_fault_protection_status_flags*.

static inline void PWM_ClearFaultStatusFlags(PWM_Type *base, *pwm_fault_protection_channel_t* eFaultProtection, uint16_t u16Mask)

Clears the PWM fault protection status flags according to a provided mask.

This examples shows how to clear the fault protection channel fault 0 flag.

```
PWM_ClearFaultStatusFlags(PWM, kPWM_FaultProtection0, kPWM_Fault0Flag);
```

Note: The kPWM_FaultPin0ActiveFlag ~ kPWM_FaultPin3ActiveFlag can't be cleared by software.

Parameters

- base – PWM peripheral base address
- eFaultProtection – PWM fault protection channel number, see *pwm_fault_protection_channel_t*.
- u16Mask – The PWM fault protection status flags to be clear. Logical OR of *_pwm_fault_protection_status_flags*.

FSL_PWM_DRIVER_VERSION

PWM driver version.

enum _pwm_sm_number

The enumeration for PWM submodule number.

Values:

enumerator kPWM_SubModule0
PWM Submodule 0

enumerator kPWM_SubModule1
PWM Submodule 1

enumerator kPWM_SubModule2
PWM Submodule 2

enumerator kPWM_SubModule3
PWM Submodule 3

enum __pwm_sm_enable
The enumeration for PWM submodule enable.
Values:

enumerator kPWM_SubModule0Enable
PWM Submodule 0 enable.

enumerator kPWM_SubModule1Enable
PWM Submodule 1 enable.

enumerator kPWM_SubModule2Enable
PWM Submodule 2 enable.

enumerator kPWM_SubModule3Enable
PWM Submodule 3 enable.

enumerator kPWM_ALLSubModuleEnable

enum __pwm_sm_count_clock_source
The enumeration for PWM submodule clock source.
Values:

enumerator kPWM_ClockSrcBusClock
The IPBus clock is used as the source clock

enumerator kPWM_ClockSrcExternalClock
EXT_CLK is used as the source clock

enumerator kPWM_ClockSrcSubmodule0Clock
Clock of the submodule 0 (AUX_CLK) is used as the source clock

enum __pwm_sm_count_clock_prescaler
The enumeration for PWM submodule prescaler factor selection for clock source.
Values:

enumerator kPWM_ClockPrescaleDivide1
PWM submodule clock frequency = fclk/1

enumerator kPWM_ClockPrescaleDivide2
PWM submodule clock frequency = fclk/2

enumerator kPWM_ClockPrescaleDivide4
PWM submodule clock frequency = fclk/4

enumerator kPWM_ClockPrescaleDivide8
PWM submodule clock frequency = fclk/8

enumerator kPWM_ClockPrescaleDivide16
PWM submodule clock frequency = fclk/16

enumerator kPWM_ClockPrescaleDivide32
PWM submodule clock frequency = fclk/32

enumerator kPWM_ClockPrescaleDivide64
PWM submodule clock frequency = fclk/64

enumerator kPWM_ClockPrescaleDivide128
PWM submodule clock frequency = fclk/128

enum __pwm_sm_count_init_source
The enumeration for PWM submodule counter initialization options.
Values:

enumerator kPWM_InitOnLocalSync
Local sync causes initialization

enumerator kPWM_InitOnMasterReload
Master reload from submodule 0 causes initialization

enumerator kPWM_InitOnMasterSync
Master sync from submodule 0 causes initialization

enumerator kPWM_InitOnExtSync
EXT_SYNC causes initialization

enum __pwm_ml2_stretch_count_clock_prescaler
The enumeration for PWM stretch IPBus clock count prescaler for mux0_trig/mux1_trig/out0_trig/out1_trig/pwma_trig/pwmb_trig.
Values:

enumerator kPWM_StretchIPBusClockPrescaler1
Stretch count is zero, no stretch.

enumerator kPWM_StretchIPBusClockPrescaler2

Stretch mux0_trig/mux1_trig/out0_trig/out1_trig/pwma_trig/pwmb_trig for 2 IPBus clock period.

enumerator kPWM_StretchIPBusClockPrescaler4

Stretch mux0_trig/mux1_trig/out0_trig/out1_trig/pwma_trig/pwmb_trig for 4 IPBus clock period.

enumerator kPWM_StretchIPBusClockPrescaler8

Stretch mux0_trig/mux1_trig/out0_trig/out1_trig/pwma_trig/pwmb_trig for 8 IPBus clock period.

enum __pwm_sm_reload_signal_select

The enumeration for PWM submodule local reload take effect timing.

Values:

enumerator kPWM_LocalReloadSignal

The local RELOAD signal is used to reload buffered-registers.

enumerator kPWM_MasterReloadSignal

The master RELOAD signal (from submodule 0) is used to reload buffered-registers (should not be used in submodule 0).

enum __pwm_sm_local_reload_effect_timing

The enumeration for PWM submodule local reload take effect timing.

Values:

enumerator kPWM_TakeEffectAtReloadOportunity

Buffered-registers reload after one/more reload opportunities, and a load opportunity can generate on a PWM half or/and full cycle.

enumerator kPWM_TakeEffectImmediately

Buffered-registers reload with new values as soon as MCTRL[LDOK] bit is set when choose local reload.

enum __pwm_sm_local_reload_oportunity

The enumeration for PWM submodule reload opportunities selection under kPWM_ReloadWithLocalReloadOportunity.

Values:

enumerator kPWM_LoadEveryOportunity

Every PWM submodule reload opportunity

enumerator kPWM_LoadEvery2Oportunity

Every 2 PWM submodule reload opportunities

enumerator kPWM_LoadEvery3Oportunity

Every 3 PWM submodule reload opportunities

enumerator kPWM_LoadEvery4Oportunity
Every 4 PWM submodule reload opportunities

enumerator kPWM_LoadEvery5Oportunity
Every 5 PWM submodule reload opportunities

enumerator kPWM_LoadEvery6Oportunity
Every 6 PWM submodule reload opportunities

enumerator kPWM_LoadEvery7Oportunity
Every 7 PWM submodule reload opportunities

enumerator kPWM_LoadEvery8Oportunity
Every 8 PWM submodule reload opportunities

enumerator kPWM_LoadEvery9Oportunity
Every 9 PWM submodule reload opportunities

enumerator kPWM_LoadEvery10Oportunity
Every 10 PWM submodule reload opportunities

enumerator kPWM_LoadEvery11Oportunity
Every 11 PWM submodule reload opportunities

enumerator kPWM_LoadEvery12Oportunity
Every 12 PWM submodule reload opportunities

enumerator kPWM_LoadEvery13Oportunity
Every 13 PWM submodule reload opportunities

enumerator kPWM_LoadEvery14Oportunity
Every 14 PWM submodule reload opportunities

enumerator kPWM_LoadEvery15Oportunity
Every 15 PWM submodule reload opportunities

enumerator kPWM_LoadEvery16Oportunity
Every 16 PWM submodule reload opportunities

enum __pwm_sm_val_compare_mode
The enumeration for PWM submodule VALn register compare mode.
Values:

enumerator kPWM_CompareOnEqual
The VALn registers and the PWM counter are compared using an “equal to” method.

enumerator kPWM_CompareOnEqualOrGreater
The VALn registers and the PWM counter are compared using an “equal to or greater than” method.

enum _pwm_sm_val_register

The enumeration for PWM submodule VAL registers.

Values:

enumerator kPWM_VAL0

PWM submodule value register 0.

enumerator kPWM_VAL1

PWM submodule value register 1.

enumerator kPWM_VAL2

PWM submodule value register 2.

enumerator kPWM_VAL3

PWM submodule value register 3.

enumerator kPWM_VAL4

PWM submodule value register 4.

enumerator kPWM_VAL5

PWM submodule value register 5.

enum _pwm_sm_force_signal_select

The enumeration for PWM submodule FORCE_OUT source which can trigger force logic output update.

Values:

enumerator kPWM_LocalSoftwareForce

The local software force signal CTRL2[FORCE] is used to force updates.

enumerator kPWM_MasterSoftwareForce

The master software force signal from submodule 0 is used to force updates.

enumerator kPWM_LocalReloadForce

The local reload signal from this submodule is used to force updates without regard to the state of LDOK.

enumerator kPWM_MasterReloadForce

The master reload signal from submodule 0 is used to force updates if LDOK is set, should not be used in submodule 0.

enumerator kPWM_LocalSyncForce

The local sync (VAL1 match event) signal from this submodule is used to force updates.

enumerator kPWM_MasterSyncForce

The master sync signal from submodule0 is used to force updates.

enumerator kPWM_ExternalForceForce

The external force signal EXT_FORCE, from outside the PWM module causes updates.

enumerator kPWM_ExternalSyncForce

The external sync signal EXT_SYNC, from outside the PWM module causes updates.

enum _pwm_sm_force_deadtime_source

The enumeration for PWM submodule force out logic output (PWM23 and PWM45) source, which will transfer to output logic when a FORCE_OUT signal is asserted.

Values:

enumerator kPWM_GeneratedPwm

Generated PWM signal is used as the deadtime logic output.

enumerator kPWM_InvertedGeneratedPwm

Inverted PWM signal is used as the deadtime logic output.

enumerator kPWM_SoftwareControlValue

Software controlled value is used as the deadtime logic output.

enumerator kPWM_UseExternal

PWM_EXTA signal is used as the deadtime logic output.

enum _pwm_sm_force_software_output_value

The enumeration for PWM submodule software controlled force out signal value.

Values:

enumerator kPWM_SoftwareOutputLow

A logic 0 is supplied to the deadtime generator when chose Software controlled value as output source.

enumerator kPWM_SoftwareOutputHigh

A logic 1 is supplied to the deadtime generator when chose Software controlled value as output source.

enum _pwm_sm_deadtime_logic_mode

The enumeration for PWM submodule deadtime logic mode, which decide how the deadtime logic process the force logic output signal.

Values:

enumerator kPWM_Independent

The PWMA (PWM23) and PWMB (PWM45) signal from force logic transfer to output logic independent.

enumerator kPWM_IndependentWithDoubleSwitchPwm

The PWMA (PWM23) and PWMB (PWM45) signals from force logic will XOR first, then the XOR signal transfer to output logic independent.

enumerator kPWM_IndependentWithSplitDoubleSwitchPwm

The PWMA (PWM23) and PWMB (PWM45) signals from force_out logic will XOR first, then the XOR signal transfer to output logic independent.

enumerator kPWM_ComplementaryWithPwmA

The PWMA (PWM23) signal from force logic will transfer to output logic with complementary mode.

enumerator kPWM_ComplementaryWithPwmB

The PWMB (PWM45) signal from force logic will transfer to output logic with complementary mode.

enumerator kPWM_ComplementaryWithDoubleSwitchPwm

The PWMA (PWM23) and PWMB (PWM45) signals from force logic will XOR first, then the XOR signal transfer to output logic with complementary mode.

enum _pwm_sm_fracval_register

The enumeration for PWM submodule FRACVAL registers.

Values:

enumerator kPWM_FRACVAL1

PWM submodule fractional value register 1.

enumerator kPWM_FRACVAL2

PWM submodule fractional value register 2.

enumerator kPWM_FRACVAL3

PWM submodule fractional value register 3.

enumerator kPWM_FRACVAL4

PWM submodule fractional value register 4.

enumerator kPWM_FRACVAL5

PWM submodule fractional value register 5.

enum _pwm_sm_mux_trigger_source

The enumeration for PWM submodule output logic final trigger output port signal.

Values:

enumerator kPWM_ActualCompareEvent

Route the PWM_OUT_TRIG signal (OR of VALx compare signal) to the mux trigger output port.

enumerator kPWM_PwmOutput

Route the PWM output (after polarity/mask/enable control) to the mux trigger output port.

enum _pwm_sm_pwm_output_on_fault

The enumeration for PWM submodule output logic PWM output fault status.

Values:

enumerator kPWM_OutputLowOnFault

The output is forced to logic 0 state prior to consideration of output polarity/mask/enable control during fault conditions and STOP mode.

enumerator kPWM_OutputHighOnFault

The output is forced to logic 1 state prior to consideration of output polarity/mask/enable control during fault conditions and STOP mode.

enumerator kPWM_OutputTristatedOnFault

The output status be tristated during fault conditions and STOP mode.

enum _pwm_sm_pwmx_signal_select

The enumeration for PWM submodule output logic PwmX signal input source (before output polarity/mask/enable control).

Values:

enumerator kPWM_RawPwmX

The PWM_X source is raw Pwm01_fractional_delay signal.

enumerator kPWM_DoubleSwitch

The PWM_X source is Pwm23_fractional_delay XOR Pwm23_fractional_delay signal.

enum _pwm_sm_pwm_out

The enumeration for PWM submodule PWM output.

Values:

enumerator kPWM_PwmX

The PWM output PWM_X.

enumerator kPWM_PwmB

The PWM output PWM_B.

enumerator kPWM_PwmA

The PWM output PWM_A.

enum _pwm_sm_input_capture_pin

The enumeration for PWM submodule input capture pins.

Values:

enumerator kPWM_InputCapturePwmX

The input capture pin PwmX, need disable PwmX output when enable input capture.

enumerator kPWM_InputCapturePwmA

The input capture pin PwmA, need disable PwmA output when enable input capture.

enumerator kPWM_InputCapturePwmB

The input capture pin PwmB, need disable PwmB output when enable input capture.

enum _pwm_sm_input_capture_source

The enumeration for PWM submodule input capture source.

Values:

enumerator kPWM_RawInput

The capture source is the raw input signal.

enumerator kPWM_InputEdgeCounter

The capture source is edge counter which counts rising and falling edges on the raw input signal.

enum _pwm_sm_input_capture_edge

The enumeration for PWM submodule input capture edge when choose raw input as capture source.

Values:

enumerator kPWM_Noedge

Disabled capture on source falling/falling edge.

enumerator kPWM_FallingEdge

Enable input capture, and capture on source falling edge when chose the raw input signal as capture source.

enumerator kPWM_RisingEdge

Enable input capture, and capture on source rising edge when chose the raw input signal as capture source.

enumerator kPWM_RiseAndFallEdge

Enable input capture, and capture on source rising or falling edge when chose the raw input signal as capture source.

enum _pwm_sm_input_capture_register

The enumeration for PWM submodule input capture value register.

Values:

enumerator kPWM_InpCaptureVal0

Stores the value captured from the submodule counter when the PWM_X circuitry 0 logic capture occurs.

enumerator kPWM_InpCaptureVal1

Stores the value captured from the submodule counter when the PWM_X circuitry 1 logic capture occurs.

enumerator kPWM_InpCaptureVal2

Stores the value captured from the submodule counter when the PWM_A circuitry 0 logic capture occurs.

enumerator kPWM_InpCaptureVal3

Stores the value captured from the submodule counter when the PWM_A circuitry 1 logic capture occurs.

enumerator kPWM_InpCaptureVal4

Stores the value captured from the submodule counter when the PWM_B circuitry 0 logic capture occurs.

enumerator kPWM_InpCaptureVal5

Stores the value captured from the submodule counter when the PWM_B circuitry 1 logic capture occurs.

enum __pwm_sm_input_capture_filter_count

The enumeration for input filter count Represent the number of consecutive samples that must agree prior to the input filter accepting an input transition.

Values:

enumerator kPWM_InputCaptureFilterCount3Samples

3 samples.

enumerator kPWM_InputCaptureFilterCount4Samples

4 samples.

enumerator kPWM_InputCaptureFilterCount5Samples

5 samples.

enumerator kPWM_InputCaptureFilterCount6Samples

6 samples.

enumerator kPWM_InputCaptureFilterCount7Samples

7 samples.

enumerator kPWM_InputCaptureFilterCount8Samples

8 samples.

enumerator kPWM_InputCaptureFilterCount9Samples

9 samples.

enumerator kPWM_InputCaptureFilterCount10Samples

10 samples.

enum __pwm_sm_capture_dma_source

The enumeration for the source which can trigger the DMA read requests for the capture FIFOs.

Values:

enumerator kPWM_FIFOWatermarksORDma

Selected FIFO watermarks are OR'ed together to sets the read DMA request.

enumerator kPWM_FIFOWatermarksANDDma

Selected FIFO watermarks are AND'ed together to sets the read DMA request.

enumerator kPWM_LocalSyncDma
A local sync (VAL1 match event) sets the read DMA request.

enumerator kPWM_LocalReloadDma
A local reload (STS[RF] being set) sets the read DMA request.

enum _pwm_sm_interrupt_enable
The enumeration for PWM submodule interrupt enable.
Values:

enumerator kPWM_CompareVal0InterruptEnable
PWM submodule VAL0 compare interrupt.

enumerator kPWM_CompareVal1InterruptEnable
PWM submodule VAL1 compare interrupt.

enumerator kPWM_CompareVal2InterruptEnable
PWM submodule VAL2 compare interrupt.

enumerator kPWM_CompareVal3InterruptEnable
PWM submodule VAL3 compare interrupt.

enumerator kPWM_CompareVal4InterruptEnable
PWM submodule VAL4 compare interrupt.

enumerator kPWM_CompareVal5InterruptEnable
PWM submodule VAL5 compare interrupt.

enumerator kPWM_CaptureX0InterruptEnable
PWM submodule capture X0 interrupt.

enumerator kPWM_CaptureX1InterruptEnable
PWM submodule capture X1 interrupt.

enumerator kPWM_CaptureB0InterruptEnable
PWM submodule capture B0 interrupt.

enumerator kPWM_CaptureB1InterruptEnable
PWM submodule capture B1 interrupt.

enumerator kPWM_CaptureA0InterruptEnable
PWM submodule capture A0 interrupt.

enumerator kPWM_CaptureA1InterruptEnable
PWM submodule capture A1 interrupt.

enumerator kPWM_ReloadInterruptEnable
PWM submodule reload interrupt.

enumerator kPWM_ReloadErrorInterruptEnable
PWM submodule reload error interrupt.

enumerator kPWM_ALLSubModuleInterruptEnable

enum _pwm_sm_status_flags
The enumeration for PWM submodule status flags.
Values:

enumerator kPWM_CompareVal0Flag
PWM submodule VAL0 compare flag.

enumerator kPWM_CompareVal1Flag
PWM submodule VAL1 compare flag.

enumerator kPWM_CompareVal2Flag
PWM submodule VAL2 compare flag.

enumerator kPWM_CompareVal3Flag
PWM submodule VAL3 compare flag.

enumerator kPWM_CompareVal4Flag
PWM submodule VAL4 compare flag.

enumerator kPWM_CompareVal5Flag
PWM submodule VAL5 compare flag.

enumerator kPWM_CaptureX0Flag
PWM submodule capture X0 flag.

enumerator kPWM_CaptureX1Flag
PWM submodule capture X1 flag.

enumerator kPWM_CaptureB0Flag
PWM submodule capture B0 flag.

enumerator kPWM_CaptureB1Flag
PWM submodule capture B1 flag.

enumerator kPWM_CaptureA0Flag
PWM submodule capture A0 flag.

enumerator kPWM_CaptureA1Flag
PWM submodule capture A1 flag.

enumerator kPWM_ReloadFlag
PWM submodule reload flag.

enumerator kPWM_ReloadErrorFlag
PWM submodule reload error flag.

enumerator kPWM_RegUpdatedFlag
PWM submodule registers updated flag.

enumerator kPWM_ALLSMStatusFlags

enum _pwm_sm_typical_output_mode
The enumeration for some PWM submodule PWM_A/B typical output mode.
Values:

enumerator kPWM_SignedCenterAligned
Center-aligned PWM with signed compare value.

enumerator kPWM_CenterAligned
Center-aligned PWM with unsigned compare value.

enumerator kPWM_SignedEdgeAligned
Edge-aligned PWM with signed compare value.

enumerator kPWM_EdgeAligned
Edge-aligned PWM with signed compare value.

enum _pwm_fault_protection_channel
The enumeration for PWM fault protection channel number.
Values:

enumerator kPWM_FaultProtection0
PWM fault protection channel 0

enum _pwm_fault_protection_interrupt_enable
The enumeration for PWM module fault protection channel interrupt enable.
Values:

enumerator kPWM_Fault0InterruptEnable
Fault protection channel fault 0 interrupt

enumerator kPWM_Fault1InterruptEnable
Fault protection channel fault 1 interrupt

enumerator kPWM_Fault2InterruptEnable
Fault protection channel fault 2 interrupt

enumerator kPWM_Fault3InterruptEnable
Fault protection channel fault 3 interrupt

enumerator kPWM_ALLfaultInterruptEnable

enum _pwm_fault_protection_status_flags

The enumeration for PWM module fault protection status flags.

Values:

enumerator kPWM_Fault0Flag

Fault protection channel fault 0 flag, set within two CPU cycles after a transition to active on the fault input pin 0.

enumerator kPWM_Fault1Flag

Fault protection channel fault 1 flag, set within two CPU cycles after a transition to active on the fault input pin 1.

enumerator kPWM_Fault2Flag

Fault protection channel fault 2 flag, set within two CPU cycles after a transition to active on the fault input pin 2.

enumerator kPWM_Fault3Flag

Fault protection channel fault 3 flag, set within two CPU cycles after a transition to active on the fault input pin 3.

enumerator kPWM_FaultPin0ActiveFlag

Fault protection channel fault input pin 0 active flag.

enumerator kPWM_FaultPin1ActiveFlag

Fault protection channel fault input pin 1 active flag.

enumerator kPWM_FaultPin2ActiveFlag

Fault protection channel fault input pin 2 active flag.

enumerator kPWM_FaultPin3ActiveFlag

Fault protection channel fault input pin 3 active flag.

enumerator kPWM_ALLFaultStatusFlags

enum _pwm_fault_active_level

The enumeration for PWM fault protection channel number.

Values:

enumerator kPWM_Logic0

A logic 0 on the fault input indicates a fault condition.

enumerator kPWM_Logic1

A logic 0 on the fault input indicates a fault condition.

typedef enum *_pwm_sm_number* pwm_sm_number_t

The enumeration for PWM submodule number.

typedef enum *_pwm_sm_count_clock_source* pwm_sm_count_clock_source_t

The enumeration for PWM submodule clock source.

typedef enum *_pwm_sm_count_clock_prescaler* pwm_sm_count_clock_prescaler_t

The enumeration for PWM submodule prescaler factor selection for clock source.

typedef enum *_pwm_sm_count_init_source* pwm_sm_count_init_source_t

The enumeration for PWM submodule counter initialization options.

typedef enum *_pwm_ml2_stretch_count_clock_prescaler* pwm_ml2_stretch_count_clock_prescaler_t

The enumeration for PWM stretch IPBus clock count prescaler for mux0_trig/mux1_trig/out0_trig/out1_trig/pwma_trig/pwmb_trig.

typedef struct *_pwm_sm_counter_config* pwm_sm_counter_config_t

The structure for configuring PWM submodule counter logic.

typedef enum *_pwm_sm_reload_signal_select* pwm_sm_reload_signal_select_t

The enumeration for PWM submodule local reload take effect timing.

typedef enum *_pwm_sm_local_reload_effect_timing* pwm_sm_local_reload_effect_timing_t

The enumeration for PWM submodule local reload take effect timing.

typedef enum *_pwm_sm_local_reload_oportunity* pwm_sm_local_reload_oportunity_t

The enumeration for PWM submodule reload opportunities selection under kPWM_ReloadWithLocalReloadOportunity.

typedef struct *_pwm_sm_reload_logic_config* pwm_sm_reload_logic_config_t

The structure for configuring PWM submodule reload logic.

typedef enum *_pwm_sm_val_compare_mode* pwm_sm_val_compare_mode_t

The enumeration for PWM submodule VALn register compare mode.

typedef enum *_pwm_sm_val_register* pwm_sm_val_register_t

The enumeration for PWM submodule VAL registers.

typedef struct *_pwm_sm_value_register_config* pwm_sm_value_register_config_t

The structure for configuring PWM submodule value registers.

typedef enum *_pwm_sm_force_signal_select* pwm_sm_force_signal_select_t

The enumeration for PWM submodule FORCE_OUT source which can trigger force logic output update.

typedef enum *_pwm_sm_force_deadtime_source* pwm_sm_force_deadtime_source_t

The enumeration for PWM submodule force out logic output (PWM23 and PWM45) source, which will transfer to output logic when a FORCE_OUT signal is asserted.

typedef enum *_pwm_sm_force_software_output_value* pwm_sm_force_software_output_value_t

The enumeration for PWM submodule software controlled force out signal value.

typedef struct *_pwm_sm_force_logic_config* pwm_sm_force_logic_config_t

The structure for configuring PWM submodule force logic.

typedef enum *_pwm_sm_deadtime_logic_mode* pwm_sm_deadtime_logic_mode_t

The enumeration for PWM submodule deadtime logic mode, which decide how the deadtime logic process the force logic output signal.

typedef struct *_pwm_sm_deadtime_value* pwm_sm_deadtime_value_t

The structure of the inserted dead time value, applies only to KPWM_Complementaryxxx mode.

typedef struct *_pwm_sm_deadtime_logic_config* pwm_sm_deadtime_logic_config_t

The structure for configuring PWM submodule force out logic, works on the deadtime logic output.

typedef enum *_pwm_sm_fracval_register* pwm_sm_fracval_register_t

The enumeration for PWM submodule FRACVAL registers.

typedef struct *_pwm_sm_fractional_delay_logic_config* pwm_sm_fractional_delay_logic_config_t

The structure for configuring PWM submodule fractional delay logic, works on the deadtime logic output.

typedef enum *_pwm_sm_mux_trigger_source* pwm_sm_mux_trigger_source_t

The enumeration for PWM submodule output logic final trigger output port signal.

typedef enum *_pwm_sm_pwm_output_on_fault* pwm_sm_pwm_output_on_fault_t

The enumeration for PWM submodule output logic PWM output fault status.

typedef enum *_pwm_sm_pwmx_signal_select* pwm_sm_pwmx_signal_select_t

The enumeration for PWM submodule output logic PwmX signal input source (before output polarity/mask/enable control).

typedef enum *_pwm_sm_pwm_out* pwm_sm_pwm_out_t

The enumeration for PWM submodule PWM output.

typedef struct *_pwm_sm_output_logic_config_t* pwm_sm_output_logic_config_t

The structure for configuring PWM submodule output logic.

typedef enum *_pwm_sm_input_capture_pin* pwm_sm_input_capture_pin_t

The enumeration for PWM submodule input capture pins.

typedef enum *_pwm_sm_input_capture_source* pwm_sm_input_capture_source_t

The enumeration for PWM submodule input capture source.

typedef enum *_pwm_sm_input_capture_edge* pwm_sm_input_capture_edge_t

The enumeration for PWM submodule input capture edge when choose raw input as capture source.

typedef enum *_pwm_sm_input_capture_register* pwm_sm_input_capture_register_t

The enumeration for PWM submodule input capture value register.

typedef enum *_pwm_sm_input_capture_filter_count* pwm_sm_input_capture_filter_count_t

The enumeration for input filter count Represent the number of consecutive samples that must agree prior to the input filter accepting an input transition.

typedef struct *_pwm_sm_input_capture_config* pwm_sm_input_capture_config_t

The structure for configuring PWM submodule input capture logic.

Note: When choosing kPWM_InputEdgeCounter as circuit 0/1 capture source, the eCircuit0CaptureEdge and eCircuit1CaptureEdge selected trigger edge will be ignored, but still need place a value other than kPWM_Noedge in either or both of the eCaptureCircuit0 and/or CaptureCircuit1 fields in order to enable one or both of the capture registers.

typedef enum *_pwm_sm_capture_dma_source* pwm_sm_capture_dma_source_t

The enumeration for the source which can trigger the DMA read requests for the capture FIFOs.

typedef struct *_pwm_sm_capture_dma_config* pwm_sm_capture_dma_config_t

The structure for configuring PWM submodule read capture DMA.

typedef struct *_pwm_sm_dma_config* pwm_sm_dma_config_t

The structure for configuring PWM submodule DMA.

typedef struct *_pwm_sm_fault_input_mapping* pwm_sm_fault_input_mapping_t

The enumeration for PWM submodule output fault enable mask for one fault protection channel.

The structure for configuring PWM submodule fault input disable mapping.

Note: The channel 0 input 0 and channel 1 input 0 are different pins.

Note: Each PWM output can be mapping anyone or more fault inputs. The mapped fault protection channel inputs can disable PWM output.

typedef enum *_pwm_sm_status_flags* pwm_sm_status_flags_t

The enumeration for PWM submodule status flags.

typedef enum *_pwm_sm_typical_output_mode* pwm_sm_typical_output_mode_t

The enumeration for some PWM submodule PWM_A/B typical output mode.

typedef struct *_pwm_sm_config* pwm_sm_config_t

PWM submodule config structure.

This structure holds the configuration settings for the PWM peripheral. To initialize this structure to reasonable defaults, call the PWM_GetDefaultConfig() function and pass a pointer to your config structure instance.

typedef enum *_pwm_fault_protection_channel* pwm_fault_protection_channel_t

The enumeration for PWM fault protection channel number.

typedef enum *_pwm_fault_active_level* pwm_fault_input_active_level_t

The enumeration for PWM fault protection channel number.

typedef struct *_pwm_fault_protection_input_config* pwm_fault_protection_input_config_t

typedef struct *_pwm_fault_protection_config* pwm_fault_protection_config_t

The structure for configuring PWM fault protection channel, a PWM module can have multiple fault protection channels, PWM sub-module can choose to mapping any one or more fault input from fault protection channels.

typedef struct *_pwm_config* pwm_config_t

PWM module config structure which contain submodule config structure pointers and fault protection filter config structure pointers.

Note: Need use submodule structure address to init the structure pointers, when the submodule or fault protection structure pointers is NULL, it will be ignored by PWM_Init API. This can save stack space when only one or two submodules are used.

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struct __pwm_sm_counter_config

#include <fsl_pwm.h> The structure for configuring PWM submodule counter logic.

Public Members

pwm_sm_count_clock_source_t eCountClockSource

Configures PWM submodule counter clock source.

pwm_sm_count_clock_prescaler_t eCountClockPrescaler

Configures PWM submodule counter clock source prescaler.

pwm_sm_count_init_source_t eCountInitSource

Configures PWM submodule counter initial source.

bool bEnableForceInitial

Enable force-controlled initialization. The assert FORCE_OUT signal can to initialize the counter without regard to the selected initial source.

uint16_t u16PhaseDelayValue

Defines the delay from the master sync signal of submodule 0 to this submodule counter (the unit of delay is the PWM clock cycle), only works when chose kPWM_InitOnMasterSync as initial source.

struct __pwm_sm_reload_logic_config

#include <fsl_pwm.h> The structure for configuring PWM submodule reload logic.

Public Members

pwm_sm_reload_signal_select_t eReloadSignalSelect

Configures PWM submodule RELOAD signal source to be local reload signal or master reload signal.

pwm_sm_local_reload_effect_timing_t eLoclReloadEffectTime

Configures PWM submodule local reload signal effective timing when choose it as RELOAD signal source.

bool bEnableFullCycleReloadOportunity

Enable generate a reload opportunity on PWM half cycle (count from INIT value to VAL0).

bool bEnableHalfCycleReloadOportunity

Enable generate a reload opportunity on PWM full cycle (count from INIT value to VAL1).

pwm_sm_local_reload_oportunity_t eLocalReloadOportunity

Configures PWM submodule reload frequency when using local reload opportunities mode .

struct __pwm__sm__value__register__config

#include <fsl_pwm.h> The structure for configuring PWM submodule value registers.

Public Members

uint16_t u16CounterInitialValue

Configures PWM submodule counter initial value.

uint16_t u16ValRegister0

Configures PWM submodule value register 0 (VAL0) value.

uint16_t u16ValRegister1

Configures PWM submodule value register 1 (VAL1) value.

uint16_t u16ValRegister2

Configures PWM submodule value register 2 (VAL2) value.

uint16_t u16ValRegister3

Configures PWM submodule value register 3 (VAL3) value.

uint16_t u16ValRegister4

Configures PWM submodule value register 4 (VAL4) value.

uint16_t u16ValRegister5

Configures PWM submodule value register 5 (VAL5) value.

struct __pwm__sm__force__logic__config

#include <fsl_pwm.h> The structure for configuring PWM submodule force logic.

Public Members

uint8_t bitPWM23OutputInitialVaule

Configures PWM submodule compare output x (PwmX) initial value.

uint8_t bitPWM45OutputInitialVaule

Configures PWM submodule compare output A (PwmA) initial value.

uint8_t bitPWMXOutputInitialVaule

Configures PWM submodule compare output B (PwmB) initial value.

pwm_sm_force_signal_select_t eForceSignalSelect

Configures PWM submodule force out select update trigger source.

pwm_sm_force_software_output_value_t eSoftOutputFor23

Configures PWM submodule force out PwmA value when select software as output source.

pwm_sm_force_software_output_value_t eSoftOutputFor45

Configures PWM submodule force out PwmB value when select software as output source.

pwm_sm_force_deadtime_source_t eForceOutput23

Configures the source of Pwm23, which will be force to deadtime logic.

pwm_sm_force_deadtime_source_t eForceOutput45

Configures the source of Pwm45, which will be force to deadtime logic.

struct __pwm__sm__deadtime__value

#include <fsl_pwm.h> The structure of the inserted dead time value, applies only to KPWM_Complementaryxxx mode.

struct __pwm__sm__deadtime__logic__config

#include <fsl_pwm.h> The structure for configuring PWM submodule force out logic, works on the deadtime logic output.

Public Members

pwm_sm_deadtime_logic_mode_t eMode

The mode in which Deadtime logic process the force logic output signal.

pwm_sm_deadtime_value_t sDeadTimeValue0

Control the deadtime during 0 to 1 transitions of the PWM_23 output (assuming normal polarity). When disable fractional delays, the maximum value is 0x7FF which represents 2047 cycles of IP bus cycles. When enable fractional delays, the maximum value is 0xFFFF which represents 2047 31/32 cycles cycles of IP bus cycles.

pwm_sm_deadtime_value_t sDeadTimeValue1

Control the deadtime during 0 to 1 transitions of the PWM_45 output (assuming normal polarity). When disable fractional delays, the maximum value is 0x7FF which represents 2047 cycles of IP bus cycles. When enable fractional delays, the maximum value is 0xFFFF which represents 2047 31/32 cycles cycles of IP bus cycles.

struct __pwm__sm__fractional__delay__logic__config

#include <fsl_pwm.h> The structure for configuring PWM submodule fractional delay logic, works on the deadtime logic output.

Public Members

uint8_t bitsFracValue1

Configures PWM submodule compare register VAL1 fractional delay value, the unit is 1/32 IP bus clock.

bool bEnableVal1FractionalDelay

Enable the fractional delay feature of bitsFracValue1.

uint8_t bitsFracValue2

Configures PWM submodule compare register VAL2 fractional delay value, the unit is 1/32 IP bus clock.

uint8_t bitsFracValue3

Configures PWM submodule compare register VAL3 fractional delay value, the unit is 1/32 IP bus clock.

bool bEnableVal23FractionalDelay

Enable the fractional delay feature of bitsFracValue2 and bitsFracValue3.

uint8_t bitsFracValue4

Configures PWM submodule compare register VAL4 fractional delay value, the unit is 1/32 IP bus clock.

uint8_t bitsFracValue5

Configures PWM submodule compare register VAL5 fractional delay value, the unit is 1/32 IP bus clock.

bool bEnableVal45FractionalDelay

Enable the fractional delay feature of bitsFracValue4 and bitsFracValue5.

struct __pwm__sm__output__logic__config__t

#include <fsl_pwm.h> The structure for configuring PWM submodule output logic.

Public Members

bool bVal0TriggerEnable

Enable VAL0 register compare event trigger.

bool bVal1TriggerEnable

Enable VAL1 register compare event trigger.

bool bVal2TriggerEnable

Enable VAL2 register compare event trigger.

bool bVal3TriggerEnable

Enable VAL3 register compare event trigger.

bool bVal4TriggerEnable

Enable VAL4 register compare event trigger.

bool bVal5TriggerEnable

Enable VAL5 register compare event trigger.

bool bEnableTriggerPostScaler

True : Trigger outputs are generated only during the final PWM period prior to a reload opportunity, false : Trigger outputs are generated during every PWM period. Configures PWM submodule mux trigger output signal 0 source.

pwm_sm_mux_trigger_source_t eMuxTrigger0

Configures PWM submodule mux trigger output signal 1 source.

pwm_sm_mux_trigger_source_t eMuxTrigger1

Configures PWM submodule PWM_X output source (before polarity/mask/enable control).

bool bInvertPwmxOutput

True : invert PWM_X output, false : no invert PWM_X output.

bool bInvertPwmaOutput

True : invert PWM_A output, false : no invert PWM_A output.

bool bInvertPwmbOutput

True : invert PWM_B output, false : no invert PWM_B output.

bool bMaskPwmxOutput

True : PWM_X output masked, false : PWM_X output normal. Mask bit is buffered, and take effect until FORCE_OUT event or software update command.

bool bMaskPwmaOutput

True : PWM_A output masked, false : PWM_A output normal. Mask bit is buffered, and take effect until FORCE_OUT event or software update command.

bool bMaskPwmbOutput

True : PWM_B output masked, false : PWM_B output normal. Mask bit is buffered, and take effect until FORCE_OUT event or software update command.

bool bEnablePwmxOutput

True : Enable PWM_X output. false : PWM_X is disabled and output is tristated.

bool bEnablePwmaOutput

True : Enable PWM_A output. false : PWM_A is disabled and output is tristated.

bool bEnablePwmbOutput

True : Enable PWM_B output. false : PWM_B is disabled and output is tristated. Configures PWM submodule PWM_X output during fault status (only works when fault status enable).

pwm_sm_pwm_output_on_fault_t ePwmxFaultState

Configures PWM submodule PWM_A output during fault status (only works when fault status enable).

pwm_sm_pwm_output_on_fault_t ePwmaFaultState

Configures PWM submodule PWM_B output during fault status (only works when fault status enable).

struct __pwm__sm__input__capture__config

#include <fsl_pwm.h> The structure for configuring PWM submodule input capture logic.

Note: When choosing kPWM_InputEdgeCounter as circuit 0/1 capture source, the eCircuit0CaptureEdge and eCircuit1CaptureEdge selected trigger edge will be ignored, but still need place a value other than kPWM_Noedge in either or both of the eCaptureCircuit0 and/or CaptureCircuit1 fields in order to enable one or both of the capture registers.

Public Members

bool bEnableInputCapture

True: enable the input capture process, false : disable the input capture process.

pwm_sm_input_capture_source_t eInCaptureSource

Configures capture circuit 0/1 input source

pwm_sm_input_capture_edge_t eCircuit0CaptureEdge

Configures which edge causes a capture for capture circuit 0 , will be ignore when use edge counter as capture source.

pwm_sm_input_capture_edge_t eCircuit1CaptureEdge

Configures which edge causes a capture for capture circuit 1 , will be ignore when use edge counter as capture source.

bool bEnableOneShotCapture

True: Enable one-shot capture mode, the bEnableInputCapture will self-cleared when one or more of the enabled capture circuits has had a capture event; false: Capture circuit 0/1 will perform capture continue;

uint8_t bitsCaptureFifoWatermark

Watermark level for circuit 0/1 capture FIFO. The capture flags in the status register will set if the word count in the circuit 0/1 capture FIFO is greater than this watermark level

uint8_t u8EdgeCounterCompareValue

Edge counter compare value, used only if edge counter is used as capture circuit 0/1 input source

uint8_t u8FilterPeriod

Sampling period (in IPBus clock cycles) of the input filter, set to 0 to bypass the filter.

pwm_sm_input_capture_filter_count_t eFilterCount

Filter sample count.

struct __pwm__sm__capture__dma__config

#include <fsl_pwm.h> The structure for configuring PWM submodule read capture DMA.

Public Members

bool bEnableCaptureDMA

Enables DMA read requests for the Capture FIFOs.

pwm_sm_capture_dma_source_t eCaptureDMASource

Select the source to enables DMA read requests for the Capture FIFOs. Will be ignored when bEnableCaptureDMA be false.

struct __pwm__sm__dma__config

#include <fsl_pwm.h> The structure for configuring PWM submodule DMA.

Public Members

bool bEnableWriteValDMA

STS[RF] set enables DMA write requests for VALx and FRACVALx registers.

bool bEnableReadCaptureX0DMA

STS[CFX0] set enables DMA read requests for Capture X0 FIFO. And X0 FIFO watermark is selected for sCaptureDma *pwm_sm_capture_dma_config_t*.

bool bEnableReadCaptureX1DMA

STS[CFX1] set enables DMA read requests for Capture X1 FIFO. And X1 FIFO watermark is selected for sCaptureDma *pwm_sm_capture_dma_config_t*.

bool bEnableReadCaptureA0DMA

STS[CFA0] set enables DMA read requests for Capture A0 FIFO. And A0 FIFO watermark is selected for sCaptureDma *pwm_sm_capture_dma_config_t*.

bool bEnableReadCaptureA1DMA

STS[CFA1] set enables DMA read requests for Capture A1 FIFO. And A1 FIFO watermark is selected for sCaptureDma *pwm_sm_capture_dma_config_t*.

bool bEnableReadCaptureB0DMA

STS[CFB0] set enables DMA read requests for Capture B0 FIFO. And B0 FIFO watermark is selected for sCaptureDma *pwm_sm_capture_dma_config_t*.

bool bEnableReadCaptureB1DMA

STS[CFB1] set enables DMA read requests for Capture B1 FIFO. And B1 FIFO watermark is selected for sCaptureDma *pwm_sm_capture_dma_config_t*.

pwm_sm_capture_dma_config_t sCaptureDma

DMA read requests for the capture FIFOs configure.

struct __pwm_sm_fault_input_mapping

#include <fsl_pwm.h> The enumeration for PWM submodule output fault enable mask for one fault protection channel.

The structure for configuring PWM submodule fault input disable mapping.

Note: The channel 0 input 0 and channel 1 input 0 are different pins.

Note: Each PWM output can be mapping anyone or more fault inputs. The mapped fault protection channel inputs can disable PWM output.

Public Members

bool bFaultInput0Mapping

Mapping fault input 0 (from fault protection channel 0) to PWM output.

bool bFaultInput1Mapping

Mapping fault input 1 (from fault protection channel 0) to PWM output.

bool bFaultInput2Mapping

Mapping fault input 2 (from fault protection channel 0) to PWM output.

bool bFaultInput3Mapping

Mapping fault input 3 (from fault protection channel 0) to PWM output.

bool bFaultInput4Mapping

Mapping fault input 4 (from fault protection channel 1) to PWM output.

bool bFaultInput5Mapping

Mapping fault input 5 (from fault protection channel 1) to PWM output.

bool bFaultInput6Mapping

Mapping fault input 6 (from fault protection channel 1) to PWM output.

bool bFaultInput7Mapping

Mapping fault input 7 (from fault protection channel 1) to PWM output.

struct __pwm__sm__config

#include <fsl_pwm.h> PWM submodule config structure.

This structure holds the configuration settings for the PWM peripheral. To initialize this structure to reasonable defaults, call the PWM_GetDefaultConfig() function and pass a pointer to your config structure instance.

Public Members

bool enableDebugMode

true: PWM continues to run in debug mode; false: PWM is paused in debug mode.

bool enableWaitMode

true: PWM continues to run in WAIT mode; false: PWM is paused in WAIT mode.

bool enableRun

true: PWM submodule is enabled; false: PWM submodule is disabled. Configures submodule value registers compare mode, only can be written one time.

pwm_sm_counter_config_t sCounterConfig

Submodule counter logic config.

pwm_sm_reload_logic_config_t sReloadConfig

Submodule reload control logic config.

pwm_sm_value_register_config_t sValRegisterConfig

Submodule value registers config.

pwm_sm_force_logic_config_t sForceConfig

Submodule force out logic config.

pwm_sm_deadtime_logic_config_t sDeadTimeConfig

Submodule deadtime logic config.

pwm_sm_fractional_delay_logic_config_t sFracDelayConfig

Submodule fractional logic config.

pwm_sm_output_logic_config_t sOutputConfig

Submodule output logic config.

pwm_sm_input_capture_config_t sInCaptureConfig[3]

Submodule input capture config for PWM_X/A/B pins.

pwm_sm_dma_config_t sDMAConfig

Submodule DMA config. PWM_X output fault input mapping, determines which fault inputs can disable PWM_X output.

pwm_sm_fault_input_mapping_t sPwmXFaultInputMapping

PWM_A output fault input mapping, determines which fault inputs can disable PWM_A output.

pwm_sm_fault_input_mapping_t sPwmAFaultInputMapping

PWM_B output fault input mapping, determines which fault inputs can disable PWM_B output.

pwm_sm_fault_input_mapping_t sPwmBFaultInputMapping

Submodule interrupt enable mask, logic OR of *_pwm_sm_interrupt_enable*.

pwm_ml2_stretch_count_clock_prescaler_t eStrBusClock

PWM stretch IPBus clock count prescaler.

struct __pwm__fault__protection__input__config

#include <fsl_pwm.h>

Public Members

pwm_fault_input_active_level_t eFaultActiveLevel

Select the active logic level of the fault input.

bool bEnableAutoFaultClear

True : Enable automatic fault clearing, fault recovery (PWM outputs can re-enable) occurs when FSTS[FFPINx] is clear , false : Use manual fault clearing, fault recovery (PWM outputs can re-enable) occurs when FSTS[FFLAGx] is manual clear (and FSTS[FFPINx] is clear).

bool bEnableManualFaultClearSafeMode

True : fault recovery (PWM outputs can re-enable) occurs when FSTS[FFLAGx] is manual clear and FSTS[FFPINx] is clear, false : fault recovery (PWM outputs can re-enable) occurs when FSTS[FFLAGx] is manual clear.

bool bEnableFaultFullCycleRecovery

Enable full cycle fault recovery, which make PWM outputs are re-enabled at the start of a half cycle after fault recovery occurs.

bool bEnableFaultHalfCycleRecovery

Enable half cycle fault recovery, which make PWM outputs are re-enabled at the start of a half cycle after fault recovery occurs.

bool bEnableFaultNoCombinationalPath

True : The fault inputs are combined with the filtered and latched fault signals to disable the PWM outputs , false : the filtered and latched fault signals are used to disable the PWM outputs.

bool bEnableFaultInterrupt

Enable the fault input interrupt.

struct __pwm__fault__protection__config

#include <fsl_pwm.h> The structure for configuring PWM fault protection channel, a PWM module can have multiple fault protection channels, PWM sub-module can choose to mapping any one or more fault input from fault protection channels.

Public Members

bool bEnableFaultGlitchStretch

Fault Glitch Stretch Enable: A logic 1 means that input fault signals will be stretched to at least 2 IPBus clock cycles.

uint8_t bitsFaultFilterCount

Configures PWM fault protection channel fault filter count.

uint8_t u8FaultFilterPeriod

Configures PWM fault protection channel fault filter period, value of 0 will bypass the filter.

struct __pwm__config

#include <fsl_pwm.h> PWM module config structure which contain submodule config structure pointers and fault protection filter config structure pointers.

Note: Need use submodule structure address to init the structure pointers, when the submodule or fault protection structure pointers is NULL, it will be ignored by PWM_Init API. This can save stack space when only one or two submodules are used.

Public Members

pwm_sm_config_t *psPwmSubmoduleConfig[1]

< PWM submodule config. PWM fault protection channel config, will take effect for all submodules.

2.61 The Driver Change Log

2.62 eFlexPWM Peripheral and Driver Overview

2.63 QDC: Quadrature Decoder Driver

void QDC_Init(QDC_Type *base, const *qdc_config_t* *psConfig)

Initializes the QDC module.

This function initializes the QDC by:

a. Enable the IP bus clock (optional).

b. Configure module based on the configuration structure.

Parameters

- base – QDC peripheral base address.
- psConfig – Pointer to configuration structure.

void QDC_GetDefaultConfig(*qdc_config_t* *psConfig)

Gets an available pre-defined configuration.

The default value are:

```
psConfig->bEnableReverseDirection            = false;
psConfig->eDecoderWorkMode                   = kQDC_DecoderQuadratureMode;
psConfig->eHomeInitPosCounterMode            = kQDC_HomeInitPosCounterDisabled;
psConfig->eIndexInitPosCounterMode           = kQDC_IndexInitPosCounterDisabled;
psConfig->bEnableTriggerInitPositionCounter  = false;
psConfig->bEnableTriggerClearPositionRegisters = false;
psConfig->bEnableTriggerHoldPositionRegisters  = false;
psConfig->bEnableWatchdog                    = false;
psConfig->u16WatchdogTimeoutValue            = 0xFFFFU;
psConfig->eFilterSampleCount                 = kQDC_Filter3Samples;
psConfig->u8FilterSamplePeriod               = 0U;
psConfig->eOutputPulseMode                   = kQDC_OutputPulseOnCounterEqualCompare;
psConfig->u32PositionCompareValue            = 0xFFFFFFFFU;
psConfig->u32PositionCompare1Value           = 0xFFFFFFFFU;
psConfig->eRevolutionCountCondition          = kQDC_RevolutionCountOnIndexPulse;
psConfig->bEnableModuloCountMode             = false;
psConfig->u32PositionModulusValue            = 0U;
psConfig->u32PositionInitialValue            = 0U;
psConfig->u32PositionCounterValue            = 0U;
psConfig->bEnablePeriodMeasurement           = false;
psConfig->ePrescaler                         = kQDC_Prescaler1;
psConfig->u16EnabledInterruptsMask           = 0U;
```

Parameters

- psConfig – Pointer to configuration structure.

void QDC_Deinit(QDC_Type *base)

De-initializes the QDC module.

This function deinitializes the QDC by:

a. Disables the IP bus clock (optional).

Parameters

- base – QDC peripheral base address.

static inline void QDC_EnableWatchdog(QDC_Type *base, bool bEnable)

Enable watchdog for QDC module.

Parameters

- base – QDC peripheral base address
- bEnable – Enables or disables the watchdog

static inline void QDC_SetWatchdogTimeout(QDC_Type *base, uint16_t u16Timeout)

Set watchdog timeout value.

Parameters

- base – QDC peripheral base address

- u16Timeout – Number of clock cycles, plus one clock cycle that the watchdog timer counts before timing out

static inline uint16_t QDC_GetStatusFlags(QDC_Type *base)

Get the status flags.

Parameters

- base – QDC peripheral base address.

Returns

Logical OR'ed value of the status flags, *_qdc_status_flags*.

static inline void QDC_ClearStatusFlags(QDC_Type *base, uint16_t u16Flags)

Clear the status flags.

Parameters

- base – QDC peripheral base address.
- u16Flags – Logical OR'ed value of the flags to clear, *_qdc_status_flags*.

static inline uint16_t QDC_GetSignalStatusFlags(QDC_Type *base)

Get the signals' real-time status.

Parameters

- base – QDC peripheral base address.

Returns

Logical OR'ed value of the real-time signal status, *_qdc_signal_status*.

static inline *qdc_count_direction_flag_t* QDC_GetLastCountDirection(QDC_Type *base)

Get the direction of the last count.

Parameters

- base – QDC peripheral base address.

Returns

Direction of the last count.

static inline void QDC_EnableInterrupts(QDC_Type *base, uint16_t u16Interrupts)

Enable the interrupts.

Parameters

- base – QDC peripheral base address.
- u16Interrupts – Logical OR'ed value of the interrupts, *_qdc_interrupt_enable*.

static inline void QDC_DisableInterrupts(QDC_Type *base, uint16_t u16Interrupts)

Disable the interrupts.

Parameters

- base – QDC peripheral base address.
- u16Interrupts – Logical OR'ed value of the interrupts, *_qdc_interrupt_enable*.

static inline void QDC_DoSoftwareLoadInitialPositionValue(QDC_Type *base)

Load the initial position value to position counter.

Software trigger to load the initial position value (UINIT and LINIT) contents to position counter (UPOS and LPOS), so that to provide the consistent operation the position counter registers.

Parameters

- base – QDC peripheral base address.

static inline void QDC_SetInitialPositionValue(QDC_Type *base, uint32_t u32PositionInitValue)

Set initial position value for QDC module.

Set the position counter initial value (INIT or UINIT, LINIT).

Parameters

- base – QDC peripheral base address
- u32PositionInitValue – Position initial value

static inline void QDC_SetPositionCounterValue(QDC_Type *base, uint32_t u32PositionCounterValue)

Set position counter value.

Set the position counter value (POS or UPOS, LPOS).

Parameters

- base – QDC peripheral base address
- u32PositionCounterValue – Position counter value

static inline void QDC_SetPositionModulusValue(QDC_Type *base, uint32_t u32PositionModulusValue)

Set position counter modulus value.

Set the position counter modulus value (MOD or UMOD, LMOD).

Parameters

- base – QDC peripheral base address
- u32PositionModulusValue – Position modulus value

static inline void QDC_SetPositionCompareValue(QDC_Type *base, uint32_t u32PositionCompValue)

Set position counter compare value.

Set the position counter compare value (COMP or UCOMP, LCOMP).

Parameters

- base – QDC peripheral base address
- u32PositionCompValue – Position modulus value

static inline void QDC_SetPositionCompare1Value(QDC_Type *base, uint32_t u32PositionComp1Value)

Set position counter compare 1 value.

Set the position counter compare 1 value (COMP1 or UCOMP1, LCOMP1).

Parameters

- base – QDC peripheral base address
- u32PositionComp1Value – Position modulus value

static inline uint32_t QDC_GetPosition(QDC_Type *base)

Get the current position counter's value.

Parameters

- base – QDC peripheral base address.

Returns

Current position counter's value.

static inline uint32_t QDC_GetHoldPosition(QDC_Type *base)

Get the hold position counter's value.

The position counter (POS or UPOS, LPOS) value is loaded to hold position (POSH or UPOSH, LPOSH) when:

a. Position register (POS or UPOS, LPOS), or position difference register (POSD), or revolution register (REV) is read.

b. TRIGGER happens and TRIGGER is enabled to update the hold registers.

Parameters

- base – QDC peripheral base address.

Returns

Hold position counter's value.

static inline uint16_t QDC_GetPositionDifference(QDC_Type *base)

Get the position difference counter's value.

Parameters

- base – QDC peripheral base address.

Returns

The position difference counter's value.

static inline uint16_t QDC_GetHoldPositionDifference(QDC_Type *base)

Get the hold position difference counter's value.

The position difference (POSD) value is loaded to hold position difference (POSDH) when:

a. Position register (POS or UPOS, LPOS), or position difference register (POSD), or revolution register (REV) is read. When Period Measurement is enabled (CTRL3[PMEN] = 1), POSDH will only be udpated when reading POSD.

b. TRIGGER happens and TRIGGER is enabled to update the hold registers.

Parameters

- base – QDC peripheral base address.

Returns

Hold position difference counter's value.

static inline uint16_t QDC_GetRevolution(QDC_Type *base)

Get the revolution counter's value.

Get the revolution counter (REV) value.

Parameters

- base – QDC peripheral base address.

Returns

The revolution counter's value.

static inline uint16_t QDC_GetHoldRevolution(QDC_Type *base)

Get the hold revolution counter's value.

The revolution counter (REV) value is loaded to hold revolution (REVH) when:

a. Position register (POS or UPOS, LPOS), or position difference register (POSD), or revolution register (REV) is read.

b. TRIGGER happens and TRIGGER is enabled to update the hold registers.

Parameters

- base – QDC peripheral base address.

Returns
Hold position revolution counter's value.

static inline uint16_t QDC_GetLastEdgeTime(QDC_Type *base)

Get the last edge time.

Last edge time (LASTEDGE) is the time since the last edge occurred on PHASEA or PHASEB. The last edge time register counts up using the peripheral clock after prescaler. Any edge on PHASEA or PHASEB will reset this register to 0 and start counting. If the last edge timer count reaches 0xffff, the counting will stop in order to prevent an overflow.

Parameters

- base – QDC peripheral base address.

Returns
The last edge time.

static inline uint16_t QDC_GetHoldLastEdgeTime(QDC_Type *base)

Get the hold last edge time.

The hold of last edge time(LASTEDGEH) is update to last edge time(LASTEDGE) when the position difference register register (POSD) is read.

Parameters

- base – QDC peripheral base address.

Returns
Hold of last edge time.

static inline uint16_t QDC_GetPositionDifferencePeriod(QDC_Type *base)

Get the Position Difference Period counter value.

The Position Difference Period counter (POSDPER) counts up using the prescaled peripheral clock. When reading the position difference register(POSD), the last edge time (LASTEDGE) will be loaded to position difference period counter(POSDPER). If the POSDPER count reaches 0xffff, the counting will stop in order to prevent an overflow. Counting will continue when an edge occurs on PHASEA or PHASEB.

Parameters

- base – QDC peripheral base address.

Returns
The position difference period counter value.

static inline uint16_t QDC_GetBufferedPositionDifferencePeriod(QDC_Type *base)

Get buffered Position Difference Period counter value.

The Bufferd Position Difference Period (POSDPERBFR) value is updated with the position difference period counter(POSDPER) when any edge occurs on PHASEA or PHASEB.

Parameters

- base – QDC peripheral base address.

Returns
The buffered position difference period counter value.

static inline uint16_t QDC_GetHoldPositionDifferencePeriod(QDC_Type *base)

Get Hold Position Difference Period counter value.

The hold position difference period(POSDPERH) is updated with the value of buffered position difference period(POSDPERBFR) when the position difference(POSD) register is read.

Parameters

- base – QDC peripheral base address.

Returns

The hold position difference period counter value.

FSL_QDC_DRIVER_VERSION

QDC driver version.

enum _qdc_status_flags

QDC status flags, these flags indicate the counter's events. .

Values:

enumerator kQDC_HomeTransitionFlag

HOME signal transition occured.

enumerator kQDC_IndexPulseFlag

INDEX pulse occured.

enumerator kQDC_WatchdogTimeoutFlag

Watchdog timeout occured.

enumerator kQDC_PositionCompareFlag

Position counter match the COMP value.

enumerator kQDC_SimultPhaseChangeFlag

Simultaneous change of PHASEA and PHASEB occured.

enumerator kQDC_PositionRollOverFlag

Position counter rolls over from 0xFFFFFFFF to 0, or from MOD value to INIT value.

enumerator kQDC_PositionRollUnderFlag

Position register roll under from 0 to 0xFFFFFFFF, or from INIT value to MOD value.

enumerator kQDC_PositionCompare1Flag

Position counter match the COMP1 value.

enumerator kQDC_StatusAllFlags

enum _qdc_signal_status

Signal status, these flags indicate the raw and filtered input signal status. .

Values:

enumerator kQDC_SignalStatusRawHome

Raw HOME input.

enumerator kQDC_SignalStatusRawIndex

Raw INDEX input.

enumerator kQDC_SignalStatusRawPhaseB
Raw PHASEB input.

enumerator kQDC_SignalStatusRawPhaseA
Raw PHASEA input.

enumerator kQDC_SignalStatusFilteredHome
The filtered HOME input.

enumerator kQDC_SignalStatusFilteredIndex
The filtered INDEX input.

enumerator kQDC_SignalStatusFilteredPhaseB
The filtered PHASEB input.

enumerator kQDC_SignalStatusFilteredPhaseA
The filtered PHASEA input.

enumerator kQDC_SignalStatusAllFlags

enum _qdc_interrupt_enable
Interrupt enable/disable mask. .
Values:

enumerator kQDC_HomeTransitionInterruptEnable
HOME signal transition interrupt enable.

enumerator kQDC_IndexPulseInterruptEnable
INDEX pulse interrupt enable.

enumerator kQDC_WatchdogTimeoutInterruptEnable
Watchdog timeout interrupt enable.

enumerator kQDC_PositionCompareInerruptEnable
Position compare interrupt enable.

enumerator kQDC_SimultPhaseChangeInterruptEnable
Simultaneous PHASEA and PHASEB change interrupt enable.

enumerator kQDC_PositionRollOverInterruptEnable
Roll-over interrupt enable.

enumerator kQDC_PositionRollUnderInterruptEnable
Roll-under interrupt enable.

enumerator kQDC_PositionCompare1InerruptEnable
Position compare 1 interrupt enable.

enumerator kQDC_AllInterruptEnable

enum _qdc_home_init_pos_counter_mode

Define HOME signal's trigger mode.

Values:

enumerator kQDC_HomeInitPosCounterDisabled

Don't use HOME signal to initialize the position counter.

enumerator kQDC_HomeInitPosCounterOnRisingEdge

Use positive going edge to trigger initialization of position counters.

enumerator kQDC_HomeInitPosCounterOnFallingEdge

Use negative going edge to trigger initialization of position counters.

enum _qdc_index_init_pos_counter_mode

Define INDEX signal's trigger mode.

Values:

enumerator kQDC_IndexInitPosCounterDisabled

INDEX pulse does not initialize the position counter.

enumerator kQDC_IndexInitPosCounterOnRisingEdge

Use INDEX pulse rising edge to initialize position counter.

enumerator kQDC_IndexInitPosCounterOnFallingEdge

Use INDEX pulse falling edge to initialize position counter.

enum _qdc_decoder_work_mode

Define type for decoder work mode.

In normal work mode uses the standard quadrature decoder with PHASEA and PHASEB. In signal phase count mode, a positive transition of the PHASEA input generates a count signal while the PHASEB input and the reverse direction control the counter direction. If the reverse direction is not enabled, PHASEB = 0 means counting up and PHASEB = 1 means counting down. If the reverse direction is enabled, PHASEB = 0 means counting down and PHASEB = 1 means counting up.

Values:

enumerator kQDC_DecoderQuadratureMode

Use standard quadrature decoder with PHASEA and PHASEB.

enumerator kQDC_DecoderSignalPhaseCountMode

PHASEA input generates a count signal while PHASEB input control the direction.

enum _qdc_output_pulse_mode

Define type for the condition of POSMATCH pulses.

Values:

enumerator kQDC_OutputPulseOnCounterEqualCompare

POSMATCH pulses when a match occurs between the position counters (POS) and the compare value (COMP, COMP1).

enumerator kQDC_OutputPulseOnReadingPositionCounter

POSMATCH pulses when reading position counter(POS), revolution counter(REV), position difference counter(POSD).

enum _qdc_revolution_count_condition

Define type for determining how the revolution counter (REV) is incremented/decremented.

Values:

enumerator kQDC_RevolutionCountOnIndexPulse

Use INDEX pulse to increment/decrement revolution counter.

enumerator kQDC_RevolutionCountOnRollOverModulus

Use modulus counting roll-over/under to increment/decrement revolution counter.

enum _qdc_filter_sample_count

Input Filter Sample Count.

The Input Filter Sample Count represents the number of consecutive samples that must agree, before the input filter accepts an input transition

Values:

enumerator kQDC_Filter3Samples

3 samples.

enumerator kQDC_Filter4Samples

4 samples.

enumerator kQDC_Filter5Samples

5 samples.

enumerator kQDC_Filter6Samples

6 samples.

enumerator kQDC_Filter7Samples

7 samples.

enumerator kQDC_Filter8Samples

8 samples.

enumerator kQDC_Filter9Samples

9 samples.

enumerator kQDC_Filter10Samples

10 samples.

enum _qdc_filter_prescaler

Prescaler Divide IPBus Clock to filter Clock.

Values:

enumerator kQDC_FilterPrescaler1

Prescaler value 1.

enumerator kQDC_FilterPrescaler2

Prescaler value 2.

enumerator kQDC_FilterPrescaler4

Prescaler value 4.

enumerator kQDC_FilterPrescaler8

Prescaler value 8.

enumerator kQDC_FilterPrescaler16

Prescaler value 16.

enumerator kQDC_FilterPrescaler32

Prescaler value 32.

enumerator kQDC_FilterPrescaler64

Prescaler value 64.

enumerator kQDC_FilterPrescaler128

Prescaler value 128.

enum _qdc_count_direction_flag

Count direction.

Values:

enumerator kQDC_CountDirectionDown

Last count was in down direction.

enumerator kQDC_CountDirectionUp

Last count was in up direction.

enum _qdc_prescaler

Prescaler used by Last Edge Time (LASTEDGE) and Position Difference Period Counter (POSDPER).

Values:

enumerator kQDC_Prescaler1

Prescaler value 1.

enumerator kQDC_Prescaler2

Prescaler value 2.

enumerator kQDC_Prescaler4
Prescaler value 4.

enumerator kQDC_Prescaler8
Prescaler value 8.

enumerator kQDC_Prescaler16
Prescaler value 16.

enumerator kQDC_Prescaler32
Prescaler value 32.

enumerator kQDC_Prescaler64
Prescaler value 64.

enumerator kQDC_Prescaler128
Prescaler value 128.

enumerator kQDC_Prescaler256
Prescaler value 256.

enumerator kQDC_Prescaler512
Prescaler value 512.

enumerator kQDC_Prescaler1024
Prescaler value 1024.

enumerator kQDC_Prescaler2048
Prescaler value 2048.

enumerator kQDC_Prescaler4096
Prescaler value 4096.

enumerator kQDC_Prescaler8192
Prescaler value 8192.

enumerator kQDC_Prescaler16384
Prescaler value 16384.

enumerator kQDC_Prescaler32768
Prescaler value 32768.

typedef enum *_qdc_home_init_pos_counter_mode* qdc_home_init_pos_counter_mode_t
Define HOME signal's trigger mode.

typedef enum *_qdc_index_init_pos_counter_mode* qdc_index_init_pos_counter_mode_t
Define INDEX signal's trigger mode.

typedef enum *_qdc_decoder_work_mode* qdc_decoder_work_mode_t

Define type for decoder work mode.

In normal work mode uses the standard quadrature decoder with PHASEA and PHASEB. In signal phase count mode, a positive transition of the PHASEA input generates a count signal while the PHASEB input and the reverse direction control the counter direction. If the reverse direction is not enabled, PHASEB = 0 means counting up and PHASEB = 1 means counting down. If the reverse direction is enabled, PHASEB = 0 means counting down and PHASEB = 1 means counting up.

typedef enum *_qdc_output_pulse_mode* qdc_output_pulse_mode_t

Define type for the condition of POSMATCH pulses.

typedef enum *_qdc_revolution_count_condition* qdc_revolution_count_condition_t

Define type for determining how the revolution counter (REV) is incremented/decremented.

typedef enum *_qdc_filter_sample_count* qdc_filter_sample_count_t

Input Filter Sample Count.

The Input Filter Sample Count represents the number of consecutive samples that must agree, before the input filter accepts an input transition

typedef enum *_qdc_filter_prescaler* qdc_filter_prescaler_t

Prescaler Divide IPBus Clock to filter Clock.

typedef enum *_qdc_count_direction_flag* qdc_count_direction_flag_t

Count direction.

typedef enum *_qdc_prescaler* qdc_prescaler_t

Prescaler used by Last Edge Time (LASTEDGE) and Position Difference Period Counter (POSDPER).

typedef struct *_qdc_config* qdc_config_t

Define user configuration structure for QDC module.

QDC_CTRL_W1C_FLAGS

W1C bits in QDC CTRL registers.

QDC_CTRL2_W1C_FLAGS

W1C bits in QDC CTRL2 registers.

QDC_CTRL3_W1C_FLAGS

W1C bits in QDC CTRL3 registers.

QDC_CTRL_INT_EN

Interrupt enable bits in QDC CTRL registers.

QDC_CTRL2_INT_EN

Interrupt enable bits in QDC CTRL2 registers.

QDC_CTRL3_INT_EN
: Interrupt enable bits in QDC CTRL3 registers.

QDC_CTRL_INT_FLAGS
: Interrupt flag bits in QDC CTRL registers.

QDC_CTRL2_INT_FLAGS
: Interrupt flag bits in QDC CTRL2 registers.

QDC_CTRL3_INT_FLAGS
: Interrupt flag bits in QDC CTRL3 registers.

struct _qdc_config
: *#include <fsl_qdc.h>* Define user configuration structure for QDC module.

Public Members

bool bEnableReverseDirection
: Enable reverse direction counting.

qdc_decoder_work_mode_t eDecoderWorkMode
: Use standard quadrature decoder mode or signal phase count mode.

qdc_home_init_pos_counter_mode_t eHomeInitPosCounterMode
: Select how HOME signal used to initialize position counters.

qdc_index_init_pos_counter_mode_t eIndexInitPosCounterMode
: Select how INDEX signal used to initialize position counters.

bool bEnableTriggerInitPositionCounter
: Initialize position counter with initial register(UINIT, LINIT) value on TRIGGER's rising edge.

bool bEnableTriggerClearPositionRegisters
: Clear position counter(POS), revolution counter(REV), position difference counter (POSD) on TRIGGER's rising edge.

bool bEnableTriggerHoldPositionRegisters
: Load position counter(POS), revolution counter(REV), position difference counter (POSD) values to hold registers on TRIGGER's rising edge.

bool bEnableIndexInitPositionCounter
: Enables the feature that the position counter to be initialized by Index Event Edge Mark.

  This option works together with *eIndexInitPosCounterMode* and *bEnableReverseDirection*. If enabled, the behavior is like this:

  When PHA leads PHB (Clockwise): If *eIndexInitPosCounterMode* is *kQDC_IndexInitPosCounterOnRisingEdge*, then INDEX rising edge reset position

counter. If *eIndexInitPosCounterMode* is *kQDC_IndexInitPosCounterOnFallingEdge*, then INDEX falling edge reset position counter. If *bEnableReverseDirection* is false, then Reset position counter to initial value. If *bEnableReverseDirection* is true, then reset position counter to modulus value.

When PHA lags PHB (Counter Clockwise): If *eIndexInitPosCounterMode* is *kQDC_IndexInitPosCounterOnRisingEdge*, then INDEX falling edge reset position counter. If *eIndexInitPosCounterMode* is *kQDC_IndexInitPosCounterOnFallingEdge*, then INDEX rising edge reset position counter. If *bEnableReverseDirection* is false, then Reset position counter to modulus value. If *bEnableReverseDirection* is true, then reset position counter to initial value.

bool bEnableWatchdog

Enable the watchdog to detect if the target is moving or not.

uint16_t u16WatchdogTimeoutValue

Watchdog timeout count value. It stores the timeout count for the quadrature decoder module watchdog timer.

qdc_filter_prescaler_t eFilterPrescaler

Input signal filter prescaler.

qdc_filter_sample_count_t eFilterSampleCount

Input Filter Sample Count. This value should be chosen to reduce the probability of noisy samples causing an incorrect transition to be recognized. The value represent the number of consecutive samples that must agree prior to the input filter accepting an input transition.

uint8_t u8FilterSamplePeriod

Input Filter Sample Period. This value should be set such that the sampling period is larger than the period of the expected noise. This value represents the sampling period (in IPBus clock cycles) of the decoder input signals. The available range is 0 - 255.

qdc_output_pulse_mode_t eOutputPulseMode

The condition of POSMATCH pulses.

uint32_t u32PositionCompareValue

Position compare value. The available value is a 32-bit number.

uint32_t u32PositionCompare1Value

Position compare 1 value. The available value is a 32-bit number.

qdc_revolution_count_condition_t eRevolutionCountCondition

Revolution Counter Modulus Enable.

bool bEnableModuloCountMode

Enable Modulo Counting.

uint32_t u32PositionModulusValue

Position modulus value. Only used when *bEnableModuloCountMode* is true. The available value is a 32-bit number.

uint32_t u32PositionInitialValue

Position initial value. The available value is a 32-bit number.

uint32_t u32PositionCounterValue

Position counter value. When Modulo mode enabled, the u32PositionCounterValue should be in the range of *u32PositionInitialValue* and *u32PositionModulusValue*.

bool bEnablePeriodMeasurement

Enable period measurement. When enabled, the position difference hold register (POSDH) is only updated when position difference register (POSD) is read.

qdc_prescaler_t ePrescaler

Prescaler.

uint16_t u16EnabledInterruptsMask

Mask of interrupts to be enabled, should be OR'ed value of *_qdc_interrupt_enable*.

2.64 QDC Peripheral and Driver Overview

2.65 QSCI: Queued Serial Communications Interface Driver

void QSCI_GetDefaultConfig(*qsci_config_t* *psConfig, uint32_t u32BaudRateBps, uint32_t u32SrcClockHz)

Sets the QSCI configuration structure to default values.

The purpose of this API is to initialize the configuration structure to default value for *QSCI_Init* to use. Use the unchanged structure in *QSCI_Init* or modify the structure before calling *QSCI_Init*. This is an example:

```
qsci_config_t sConfig;
QSCI_GetDefaultConfig(&sConfig, 115200, 12000000U);
QSCI_Init(QSCI0, &config);
```

Parameters

- psConfig – Pointer to configuration structure.
- u32BaudRateBps – Baudrate setting.
- u32SrcClockHz – The clock source frequency for QSCI module.

status_t QSCI_Init(QSCI_Type *base, *qsci_config_t* *psConfig)

Initializes the QSCI instance with a user configuration structure.

This function configures the QSCI module with the customed settings. User can configure the configuration structure manually or get the default configuration by using the *QSCI_GetDefaultConfig* function. The example below shows how to use this API to configure QSCI.

```
qsci_config_t sConfig;
QSCI_GetDefaultConfig(&sConfig, 115200, 12000000U);
QSCI_Init(QSCI0, &sConfig);
```

Parameters

- base – QSCI peripheral base address.
- psConfig – Pointer to the user-defined configuration structure.

Return values

- kStatus_QSCI_BaudrateNotSupport – Baudrate is not supported in the current clock source.
- kStatus_Success – Set baudrate succeeded.

void QSCI_Deinit(QSCI_Type *base)

Deinitializes a QSCI instance.

This function waits for transmiting complete, then disables TX and RX.

Parameters

- base – QSCI peripheral base address.

static inline uint16_t QSCI_GetStatusFlags(QSCI_Type *base)

Gets QSCI hardware status flags.

Parameters

- base – QSCI peripheral base address.

Returns

QSCI status flags, can be a single flag or several flags in *_qsci_status_flags* combined by OR.

void QSCI_ClearStatusFlags(QSCI_Type *base, uint16_t u16StatusFlags)

Clears QSCI status flags.

This function clears QSCI status flags. Members in kQSCI_Group0Flags can't be cleared by this function, they are cleared or set by hardware.

Parameters

- base – QSCI peripheral base address.
- u16StatusFlags – The status flag mask, can be a single flag or several flags in *_qsci_status_flags* combined by OR.

void QSCI_EnableInterrupts(QSCI_Type *base, uint8_t u8Interrupts)

Enables QSCI interrupts according to the provided mask.

This function enables the QSCI interrupts according to the provided mask. The mask is a logical OR of enumeration members in *_qsci_interrupt_enable*.

Parameters

- base – QSCI peripheral base address.
- u8Interrupts – The interrupt source mask, can be a single source or several sources in *_qsci_interrupt_enable* combined by OR.

void QSCI_DisableInterrupts(QSCI_Type *base, uint8_t u8Interrupts)

Disables QSCI interrupts according to the provided mask.

This function disables the QSCI interrupts according to the provided mask. The mask is a logical OR of enumeration members in *_qsci_interrupt_enable*.

Parameters

- base – QSCI peripheral base address.
- u8Interrupts – The interrupt source mask, can be a single source or several sources in *_qsci_interrupt_enable* combined by OR.

uint8_t QSCI_GetEnabledInterrupts(QSCI_Type *base)

Gets the enabled QSCI interrupts.

This function gets the enabled QSCI interrupts. The enabled interrupts are returned as the logical OR value of the enumerators *_qsci_interrupt_enable*.

Parameters

- base – QSCI peripheral base address.

Returns

The interrupt source mask, can be a single source or several sources in *_qsci_interrupt_enable* combined by OR.

static inline void QSCI_Reset(QSCI_Type *base)

Sets the QSCI register value to reset value.

Parameters

- base – QSCI peripheral base address.

static inline void QSCI_EnableTx(QSCI_Type *base, bool bEnable)

Enables or disables the QSCI transmitter.

This function enables or disables the QSCI transmitter.

Parameters

- base – QSCI peripheral base address.
- bEnable – True to enable, false to disable.

static inline void QSCI_EnableRx(QSCI_Type *base, bool bEnable)

Enables or disables the QSCI receiver.

This function enables or disables the QSCI receiver.

Parameters

- base – QSCI peripheral base address.
- bEnable – True to enable, false to disable.

static inline void QSCI_EnableStopInWait(QSCI_Type *base, bool bEnable)

Enables/disables stop in wait.

Parameters

- base – QSCI peripheral base address.
- bEnable – true to enable, QSCI stops working in wait mode, false to disable, QSCI keeps working in wait mode

static inline void QSCI_Enable9bitMode(QSCI_Type *base, bool bEnable)

Enables/Disables 9-bit data mode for QSCI.

Parameters

- base – QSCI peripheral base address.
- bEnable – true to enable, false to disable.

static inline void QSCI_EnableStandbyMode(QSCI_Type *base, bool bEnable)

Enables/Disables standby mode.

When QSCI is in standby mode, further receiver interrupt requests are inhibited waiting to be wake up. The wakeup mode can be configured by *QSCI_SetWakeupMode*. Hardware wakes the receiver by automatically disabling standby.

Parameters

- base – QSCI peripheral base address.
- bEnable – true to enable, false to disable.

static inline void QSCI_EnableLINSlaveMode(QSCI_Type *base, bool bEnable)

Enable/Disable LIN slave mode.

If enabled QSCI is in LIN slave mode. When break is detected, the baudrate register is automatically adjusted to match the value measured from the sync character that follows.

Parameters

- base – QSCI peripheral base address.
- bEnable – true to enable, false to disable.

static inline void QSCI_EnableStopHold(QSCI_Type *base, bool bEnable)

Enable/Disable stop mode hold off.

When enabled, if chip level stop mode occurs and transmiter or receiver is still busy, QSCI will hold off stop mode until both transmiter and receiver are idle.

Parameters

- base – QSCI peripheral base address.
- bEnable – true to enable, false to disable.

static inline void QSCI_SetTransferMode(QSCI_Type *base, *qsci_transfer_mode_t* eTransferMode)

Sets the QSCI transfer mode.

Parameters

- base – QSCI peripheral base address.
- eTransferMode – The QSCI tx/rx loop mode, *kQSCI_Normal* to use normal transfer, *kQSCI_LoopInternal* to let internal tx feed back to rx, *kQSCI_SingleWire* to use single wire mode using tx pin as tx and rx.

static inline void QSCI_SetWakeupMode(QSCI_Type *base, *qsci_wakeup_mode_t* eWakeupMode)

Sets wakeup mode for QSCI.

Parameters

- base – QSCI peripheral base address.
- eWakeupMode – Wakeup mode, *kQSCI_WakeupOnIdleLine* or *kQSCI_WakeupOnAddressMark*.

static inline void QSCI_SetPolarityMode(QSCI_Type *base, *qsci_polarity_mode_t* ePolarityMode)

Sets polarity mode for QSCI.

Parameters

- base – QSCI peripheral base address.
- ePolarityMode – Polarity mode, *kQSCI_PolarityNormal* or *kQSCI_PolarityInvert*.

static inline void QSCI_SetParityMode(QSCI_Type *base, *qsci_parity_mode_t* eParityMode)

Sets parity mode for QSCI.

Parameters

- base – QSCI peripheral base address.
- eParityMode – Polarity mode, *kQSCI_ParityDisabled*, *kQSCI_ParityEven* or *kQSCI_ParityOdd*.

status_t QSCI_SetBaudRate(QSCI_Type *base, uint32_t u32BaudRateBps, uint32_t u32SrcClockHz)

Sets the QSCI instance baud rate.

This function configures the QSCI module baud rate. This function can be used to update QSCI module baud rate after the QSCI module is initialized by the *QSCI_Init*.

Parameters

- base – QSCI peripheral base address.
- u32BaudRateBps – QSCI baudrate to be set.
- u32SrcClockHz – QSCI clock source frequency in Hz.

Return values

- kStatus_QSCI_BaudrateNotSupport – Baudrate is not supported in the current clock source.
- kStatus_Success – Set baudrate succeeded.

static inline void QSCI_EnableFifo(QSCI_Type *base, bool bEnable)

Enables/Disables transmitter/receiver FIFO.

Parameters

- base – QSCI peripheral base address.
- bEnable – true to enable, false to disable.

static inline void QSCI_SetTxWaterMark(QSCI_Type *base, *qsci_tx_water_t* eTxFifoWatermark)

Sets transmitter watermark.

Parameters

- base – QSCI peripheral base address.
- eTxFifoWatermark – Tx water mark level.

static inline void QSCI_SetRxWaterMark(QSCI_Type *base, *qsci_rx_water_t* eRxFifoWatermark)

Sets receiver watermark.

Parameters

- base – QSCI peripheral base address.
- eRxFifoWatermark – Rx water mark level.

static inline void QSCI_EnableTxDMA(QSCI_Type *base, bool bEnable)

Enables or disables the QSCI transmitter DMA request.

This function enables or disables CTRL2[TDE], to generate the DMA requests when Tx data register is empty.

Parameters

- base – QSCI peripheral base address.
- bEnable – True to enable, false to disable.

static inline void QSCI_EnableRxDMA(QSCI_Type *base, bool bEnable)

Enables or disables the QSCI receiver DMA request.

This function enables or disables CTRL2[RDE], to generate DMA requests when receiver data register is full.

Parameters

- base – QSCI peripheral base address.
- bEnable – True to enable, false to disable.

static inline uint32_t QSCI_GetDataRegisterAddress(QSCI_Type *base)

Gets the QSCI data register byte address.

This function returns the QSCI data register address, which is mainly used by DMA/eDMA.

Parameters

- base – QSCI peripheral base address.

Returns

QSCI data register byte addresses which are used both by the transmitter and the receiver.

static inline void QSCI_WriteByte(QSCI_Type *base, uint8_t u8Data)

Writes to the TX register.

This function writes data to the TX register directly. The upper layer must ensure that the TX register is empty or TX FIFO has room before calling this function.

Parameters

- base – QSCI peripheral base address.
- u8Data – The byte to write.

static inline void QSCI_SendAddress(QSCI_Type *base, uint8_t u8Address)

Sends an address frame in 9-bit data mode.

Parameters

- base – QSCI peripheral base address.
- u8Address – QSCI slave address.

static inline uint8_t QSCI_ReadByte(QSCI_Type *base)

Reads the RX register directly.

This function reads data from the RX register directly. The upper layer must ensure that the RX register is full or that the TX FIFO has data before calling this function.

Parameters

- base – QSCI peripheral base address.

Returns

The byte read from QSCI data register.

void QSCI_WriteBlocking(QSCI_Type *base, const uint8_t *pu8Data, uint32_t u32Length)

Writes TX register using a blocking method.

This function polls the TX register, waits TX register to be empty or TX FIFO have room then writes data to the TX buffer.

Parameters

- base – QSCI peripheral base address.
- pu8Data – Start address of the data to write.
- u32Length – Size of the data to write.

status_t QSCI_ReadBlocking(QSCI_Type *base, uint8_t *pu8Data, uint32_t u32Length)

Reads RX data register using a blocking method.

This function polls the RX register, waits RX register to be full or RX FIFO have data, then reads data from the RX register.

Parameters

- base – QSCI peripheral base address.

- pu8Data – Start address of the buffer to store the received data.
- u32Length – Size of the buffer.

Return values

- kStatus_Fail – Receiver error occurred while receiving data.
- kStatus_QSCI_RxHardwareOverrun – Receiver overrun occurred while receiving data
- kStatus_QSCI_NoiseError – Noise error occurred while receiving data
- kStatus_QSCI_FramingError – error occurred while receiving data
- kStatus_QSCI_ParityError – Parity error occurred while receiving data
- kStatus_Success – Successfully received all data.

static inline void QSCI_SendBreak(QSCI_Type *base)

Sends one break character (10 or 11 bits of zeroes).

Parameters

- base – QSCI peripheral base address.

void QSCI_TransferCreateHandle(QSCI_Type *base, *qsci_transfer_handle_t* *psHandle, *qsci_transfer_callback_t* pfCallback, void *pUserData)

Initializes the QSCI handle.

This function initializes the QSCI handle which can be used for other QSCI transactional APIs. Usually, for a specified QSCI instance, call this API once to get the initialized handle.

Parameters

- base – QSCI peripheral base address.
- psHandle – QSCI handle pointer.
- pfCallback – The callback function.
- pUserData – The parameter of the callback function.

void QSCI_TransferStartRingBuffer(*qsci_transfer_handle_t* *psHandle, uint8_t *pu8RxRingBuffer, uint16_t u16RxRingBufferSize)

Sets up the RX ring buffer.

This function sets up the RX ring buffer to a specific QSCI handle.

When the RX ring buffer is used, data received are stored into the ring buffer even when the user doesn't call the *QSCI_TransferReceiveNonBlocking()* API. If data is already received in the ring buffer, the user can get the received data from the ring buffer directly.

Note: When using the RX ring buffer, one byte is reserved for internal use. In other words, if ringBufferSize is 32, only 31 bytes are used for saving data.

Parameters

- psHandle – QSCI handle pointer.
- pu8RxRingBuffer – Start address of the ring buffer for background receiving. Pass NULL to disable the ring buffer.
- u16RxRingBufferSize – Size of the ring buffer.

void QSCI_TransferStopRingBuffer(*qsci_transfer_handle_t* *psHandle)

Aborts the background transfer and uninstalls the ring buffer.

This function aborts the background transfer and uninstalls the ring buffer.

Parameters

- psHandle – QSCI handle pointer.

uint16_t QSCI_TransferGetRxRingBufferLength(*qsci_transfer_handle_t* *psHandle)

Get the ring buffer valid data length.

Parameters

- psHandle – QSCI handle pointer.

Returns

Valid data length in ring buffer.

status_t QSCI_TransferSendNonBlocking(*qsci_transfer_handle_t* *psHandle, *qsci_transfer_t* *psTransfer)

Transmits a buffer of data using the interrupt method.

This function sends data using an interrupt method. This is a non-blocking function, which returns directly without waiting for all data to be written to the TX register. When all data is sent out, the QSCI driver calls the callback function and passes the *kStatus_QSCI_TxIdle* as status parameter.

Parameters

- psHandle – QSCI handle pointer.
- psTransfer – QSCI transfer structure. See *qsci_transfer_t*.

Return values

- kStatus_Success – Successfully start the data transmission.
- kStatus_QSCI_TxBusy – Previous transmission still not finished; data not all written to TX register yet.

void QSCI_TransferAbortSend(*qsci_transfer_handle_t* *psHandle)

Aborts the interrupt-driven data transmit.

This function aborts the interrupt-driven data sending. The user can get the remainBytes to find out how many bytes are not sent out.

Parameters

- psHandle – QSCI handle pointer.

status_t QSCI_TransferGetSendCount(*qsci_transfer_handle_t* *psHandle, uint32_t *pu32Count)

Gets the number of bytes sent out to bus.

This function gets the number of bytes sent out to bus by using the interrupt method.

Parameters

- psHandle – QSCI handle pointer.
- pu32Count – Send bytes count.

Return values

- kStatus_NoTransferInProgress – No send in progress.
- kStatus_Success – Get successfully through the parameter count;

status_t QSCI_TransferReceiveNonBlocking(*qsci_transfer_handle_t* *psHandle, *qsci_transfer_t* *psTransfer, uint32_t *pu32ReceivedBytes)

Receives a buffer of data using an interrupt method.

This function receives data using an interrupt method. This is a non-blocking function, which returns without waiting for all data to be received. If the RX ring buffer is used and not empty, the data in the ring buffer is copied and the parameter pu32ReceivedBytes shows how many bytes are copied from the ring buffer. After copying, if the data in the ring buffer is not enough to read, the receive request is saved by the QSCI driver. When the new data arrives, the receive request is serviced first. When all data is received, the QSCI driver notifies the upper layer through a callback function and passes the status parameter *kStatus_QSCI_RxIdle*. For example, the upper layer needs 10 bytes but there are only 5 bytes in the ring buffer. The 5 bytes are copied to the psTransfer->data and this function returns with the parameter pu32ReceivedBytes set to 5. For the left 5 bytes, newly arrived data is saved from the psTransfer->data[5]. When 5 bytes are received, the QSCI driver notifies the upper layer. If the RX ring buffer is not enabled, this function enables the RX and RX interrupt to receive data to the psTransfer->data. When all data is received, the upper layer is notified.

Parameters

- psHandle – QSCI handle pointer.
- psTransfer – QSCI transfer structure, see *qsci_transfer_t*.
- pu32ReceivedBytes – Bytes received from the ring buffer directly.

Return values

- kStatus_Success – Successfully queue the transfer into transmit queue.
- kStatus_QSCI_RxBusy – Previous receive request is not finished.

void QSCI_TransferAbortReceive(*qsci_transfer_handle_t* *psHandle)

Aborts the interrupt-driven data receiving.

This function aborts the interrupt-driven data receiving. The user can get the remainBytes to know how many bytes are not received yet.

Parameters

- psHandle – QSCI handle pointer.

status_t QSCI_TransferGetReceivedCount(*qsci_transfer_handle_t* *psHandle, uint32_t *pu32Count)

Gets the number of bytes that have been received.

This function gets the number of bytes that have been received.

Parameters

- psHandle – QSCI handle pointer.
- pu32Count – Receive bytes count.

Return values

- kStatus_NoTransferInProgress – No receive in progress.
- kStatus_InvalidArgument – Parameter is invalid.
- kStatus_Success – Get successfully through the parameter pu32Count;

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QSCI driver version.

Status codes for the QSCI driver.

Values:

enumerator kStatus_QSCI_TxBusy
Transmitter is busy.

enumerator kStatus_QSCI_RxBusy
Receiver is busy.

enumerator kStatus_QSCI_TxIdle
Transmitter is idle.

enumerator kStatus_QSCI_RxIdle
Receiver is idle.

enumerator kStatus_QSCI_FlagCannotClearManually
Status flag can't be manually cleared.

enumerator kStatus_QSCI_RxRingBufferOverrun
QSCI RX software ring buffer overrun.

enumerator kStatus_QSCI_RxHardwareOverrun
QSCI receiver hardware overrun.

enumerator kStatus_QSCI_NoiseError
QSCI noise error.

enumerator kStatus_QSCI_FramingError
QSCI framing error.

enumerator kStatus_QSCI_ParityError
QSCI parity error.

enumerator kStatus_QSCI_BaudrateNotSupport
Baudrate is not supported in current clock source

enumerator kStatus_QSCI_IdleLineDetected
QSCI IDLE line detected.

enumerator kStatus_QSCI_Timeout
Timeout happens when waiting for status flags to change.

enum _qsci_status_flags
QSCI hardware status flags.

These enumerations can be ORed together to form bit masks.

Values:

enumerator kQSCI_TxDataRegEmptyFlag
TX data register empty flag.

enumerator kQSCI_TxIdleFlag
Transmission idle flag.

enumerator kQSCI_RxDataRegFullFlag
RX data register full flag.

enumerator kQSCI_RxIdleLineFlag
Rx Idle line flag.

enumerator kQSCI_RxOverrunFlag
RX overrun flag.

enumerator kQSCI_RxNoiseFlag
RX detect noise on Rx input.

enumerator kQSCI_RxFrameErrorFlag
Rx frame error flag, sets if logic 0 was detected for stop bit

enumerator kQSCI_RxParityErrorFlag
Rx parity error if parity enabled, sets upon parity error detection

enumerator kQSCI_RxInputEdgeFlag
RX pin active edge interrupt flag, sets when active edge detected

enumerator kQSCI_LINSyncErrorFlag
Only for LIN mode.

enumerator kQSCI_TxDMARequestFlag
Tx DMA request is ongoing.

enumerator kQSCI_RxDMARequestFlag
Rx DMA request is ongoing.

enumerator kQSCI_RxActiveFlag

enumerator kQSCI_Group0Flags
Members in kQSCI_Group0Flags can't be cleared by QSCI_ClearStatusFlags, they are handled by HW.

enumerator kQSCI_Group1Flags
Whole kQSCI_Group1Flags will be cleared if trying to clear any member in kQSCI_Group1Flags or kQSCI_Group2Flags in the mask.

enumerator kQSCI_Group2Flags
Member in kQSCI_Group2Flags can be cleared individually

enumerator kQSCI_StatusAllFlags

enum _qsci_interrupt_enable

QSCI interrupt enable/disable source.

These enumerations can be ORed together to form bit masks.

Values:

enumerator kQSCI_TxEmptyInterruptEnable

Transmit data register empty interrupt.

enumerator kQSCI_TxIdleInterruptEnable

Transmission idle interrupt.

enumerator kQSCI_RxFullInterruptEnable

Receive data register full interrupt.

enumerator kQSCI_RxErrorInterruptEnable

Receive error interrupt.

enumerator kQSCI_RxInputEdgeInterruptEnable

Receive input edge interrupt.

enumerator kQSCI_RxIdleLineInterruptEnable

Receive idle interrupt.

enumerator kQSCI_AllInterruptEnable

enum _qsci_transfer_mode

QSCI transmiter/receiver loop mode.

Values:

enumerator kQSCI_Normal

Normal mode, 2 signal pins, no loop.

enumerator kQSCI_LoopInternal

Loop mode with internal TXD fed back to RXD.

enumerator kQSCI_SingleWire

Use tx pin as input and output half-duplex transfer.

enum _qsci_data_bit_mode

QSCI data bit count.

Values:

enumerator kQSCI_Data8Bit

1 start bit, 8 data bit, 1 stop bit

enumerator kQSCI_Data9Bit
1 start bit, 9 data bit, 1 stop bit. This mode actually is not supported yet in driver.

enum _qsci_wakeup_mode
QSCI wakeup mode.
Values:

enumerator kQSCI_WakeupOnIdleLine
Idle condition wakes the QSCI module.

enumerator kQSCI_WakeupOnAddressMark
Address mark wakes the QSCI module.

enum _qsci_polarity_mode
QSCI signal polarity mode.
Values:

enumerator kQSCI_PolarityNormal
Normal mode, no inversion.

enumerator kQSCI_PolarityInvert
Invert transmit and receive data bits.

enum _qsci_parity_mode
QSCI parity mode.
Values:

enumerator kQSCI_ParityDisabled
Parity disabled

enumerator kQSCI_ParityEven
Parity enabled, type even, bit setting: PE|PT = 10

enumerator kQSCI_ParityOdd
Parity enabled, type odd, bit setting: PE|PT = 11

enum _qsci_tx_water
QSCI transmitter watermark level.
Values:

enumerator kQSCI_TxWater0Word
Tx interrupt sets when tx fifo empty.

enumerator kQSCI_TxWater1Word
Tx interrupt sets when tx fifo has 1 or few word.

enumerator kQSCI_TxWater2Word
Tx interrupt sets when tx fifo has 2 or few words.

enumerator kQSCI_TxWater3Word
Tx interrupt sets when tx fifo not full.

enum _qsci_rx_water
QSCI receiver watermark level.
Values:

enumerator kQSCI_RxWater1Word
Rx interrupt sets when rx fifo not empty.

enumerator kQSCI_RxWater2Word
Rx interrupt sets when rx fifo has at least 1 word.

enumerator kQSCI_RxWater3Word
Rx interrupt sets when rx fifo has at least 2 words.

enumerator kQSCI_RxWater4Word
Rx interrupt sets when rx fifo full.

typedef enum *_qsci_transfer_mode* qsci_transfer_mode_t
QSCI transmiter/receiver loop mode.

typedef enum *_qsci_data_bit_mode* qsci_data_bit_mode_t
QSCI data bit count.

typedef enum *_qsci_wakeup_mode* qsci_wakeup_mode_t
QSCI wakeup mode.

typedef enum *_qsci_polarity_mode* qsci_polarity_mode_t
QSCI signal polarity mode.

typedef enum *_qsci_parity_mode* qsci_parity_mode_t
QSCI parity mode.

typedef enum *_qsci_tx_water* qsci_tx_water_t
QSCI transmitter watermark level.

typedef enum *_qsci_rx_water* qsci_rx_water_t
QSCI receiver watermark level.

typedef struct *_qsci_config* qsci_config_t
QSCI configuration structure.

typedef struct *_qsci_transfer_handle_t* qsci_transfer_handle_t
Forward declaration of the handle typedef .

typedef void (*qsci_transfer_callback_t)(*qsci_transfer_handle_t* *psHandle)

QSCI interrupt transfer callback function definition.

Defines the interface of user callback function used in QSCI interrupt transfer using transactional APIs. The callback function shall be defined and declared in application level by user. Before starting QSCI transmiting or receiving by calling *QSCI_TransferSendNonBlocking* or *QSCI_TransferReceiveNonBlocking*, call *QSCI_TransferCreateHandle* to install the user callback. When the transmiting or receiving ends or any bus error like hardware overrun occurs, user callback will be invoked by driver.

Param psHandle
Transfer handle that contains bus status, user data.

typedef struct *_qsci_transfer* qsci_transfer_t

QSCI transfer structure.

typedef void (*qsci_isr_t)(void *handle)

qsci_isr_t s_pfQsciIsr

void *s_psQsciHandles[]

IRQn_Type const s_eQsciTXIdleIRQs[]

uint16_t QSCI_GetInstance(QSCI_Type *base)

Get the QSCI instance from peripheral base address.

Parameters

- base – QSCI peripheral base address.

Returns
QSCI instance.

void QSCI_DriverIRQHandler(uint32_t instance)

QSCI driver IRQ handler common entry.

This function provides the common IRQ request entry for QSCI.

Parameters

- instance – QSCI instance.

QSCI_RETRY_TIMES

Retry times when checking status flags.

QSCI_GET_BUS_STATUS(psHandle)

Macros to be used inside user callback.

QSCI_GET_TRANSFER_USER_DATA(psHandle)

struct _qsci_config

#include <fsl_qsci.h> QSCI configuration structure.

Public Members

qsci_transfer_mode_t eTransferMode
: Transmitter/receiver loop mode.

bool bStopInWaitEnable
: Enable/disable module stops working in wait mode.

qsci_data_bit_mode_t eDataBitMode
: Number of data bits.

qsci_wakeup_mode_t eWakeupMode
: Receiver wakeup mode, idle line or addressmark.

qsci_polarity_mode_t ePolarityMode
: Polarity of transmit/receive data.

qsci_parity_mode_t eParityMode
: Parity mode, disabled (default), even, odd.

bool bEnableStopHold
: Control the stop hold enable.

bool bEnableTx
: Enable TX

bool bEnableRx
: Enable RX

bool bEnableFifo
: Enable Tx/Rx FIFO

bool bEnableTxDMA
: Enable Tx DMA

bool bEnableRxDMA
: Enable Rx DMA

qsci_tx_water_t eTxFifoWatermark
: TX FIFO watermark

qsci_rx_water_t eRxFifoWatermark
: RX FIFO watermark

uint8_t u8Interrupts
: Mask of QSCI interrupt sources to enable.

uint32_t u32BaudRateBps
: QSCI baud rate

uint32_t u32SrcClockHz

The clock source frequency for QSCI module.

struct __qsci__transfer__handle__t

#include <fsl_qsci.h> QSCI transfer handle.

Note: If user wants to use the transactional API to transfer data in interrupt way, one QSCI instance should and can only be allocated one handle.

Note: The handle is maintained by QSCI driver internally, which means the transfer state is retained and user shall not modify its state *u8TxState* or *u8RxState* in application level. If user only wish to use transactional APIs without understanding its machanism, it is not necessary to understand these members.

Public Members

QSCI_Type *pu8TxData

QSCI base pointer to the instance belongs to this handle.

uint8_t *pu8TxData

Address of remaining data to send.

volatile uint32_t u32TxRemainingSize

Size of the remaining data to send.

uint32_t u32TxDataSize

Size of the data to send out.

uint8_t *pu8RxData

Address of remaining data to receive.

volatile uint32_t u32RxRemainingSize

Size of the remaining data to receive.

uint32_t u32RxDataSize

Size of the data to receive.

uint8_t *pu8RxRingBuffer

Start address of the receiver ring buffer.

uint16_t u16RxRingBufferSize

Size of the ring buffer.

volatile uint16_t u16RxRingBufferHead

Index for the driver to store received data into ring buffer.

volatile uint16_t u16RxRingBufferTail
: Index for the user to get data from the ring buffer.

qsci_transfer_callback_t pfCallback
: Callback function.

void *pUserData
: QSCI callback function parameter.

volatile uint8_t u8TxState
: TX transfer state.

volatile uint8_t u8RxState
: RX transfer state

status_t busStatus
: QSCI bus status.

struct __qsci_transfer
: *#include <fsl_qsci.h>* QSCI transfer structure.

Public Members

uint8_t *pu8Data
: The buffer pointer of data to be transferred.

uint32_t u32DataSize
: The byte count to be transferred.

2.66 The Driver Change Log

2.67 QSCI_EDMA: EDMA based QSCI Driver

void QSCI_TransferCreateHandleEDMA(QSCI_Type *base, *qsci_edma_transfer_handle_t* *psHandle, *qsci_edma_transfer_callback_t* pfCallback, void *pUserData, DMA_Type *edmaBase, *edma_channel_t* eEdmaTxChannel, *edma_channel_t* eEdmaRxChannel)
: Initializes the QSCI edma handle.

  This function initializes the QSCI edma handle which can be used for other QSCI transactional APIs. Usually, for a specified QSCI instance, call this API once to get the initialized handle.

  Parameters

  - base – QSCI peripheral base address.
  - psHandle – Pointer to qsci_edma_transfer_handle_t structure.

- pfCallback – Callback function.
- pUserData – User data.
- edmaBase – Edma base address.
- eEdmaTxChannel – eDMA channel for TX transfer.
- eEdmaRxChannel – eDMA channel for RX transfer.

status_t QSCI_TransferSendEDMA(*qsci_edma_transfer_handle_t* *psHandle, *qsci_transfer_t* *psTransfer)

Initiate data transmit using EDMA.

This function initiates a data transmit process using eDMA. This is a non-blocking function, which returns right away. When all the data is sent, the send callback function is called.

Parameters

- psHandle – QSCI handle pointer.
- psTransfer – QSCI eDMA transfer structure. See *qsci_transfer_t*.

Return values

- kStatus_Success – if succeed, others failed.
- kStatus_QSCI_TxBusy – Previous transfer on going.
- kStatus_InvalidArgument – Invalid argument.

status_t QSCI_TransferReceiveEDMA(*qsci_edma_transfer_handle_t* *psHandle, *qsci_transfer_t* *psTransfer)

Initiate data receive using EDMA.

This function initiates a data receive process using eDMA. This is a non-blocking function, which returns right away. When all the data is received, the receive callback function is called.

Parameters

- psHandle – Pointer to qsci_edma_transfer_handle_t structure.
- psTransfer – QSCI eDMA transfer structure, see *qsci_transfer_t*.

Return values

- kStatus_Success – if succeed, others fail.
- kStatus_QSCI_RxBusy – Previous transfer ongoing.
- kStatus_InvalidArgument – Invalid argument.

void QSCI_TransferAbortSendEDMA(*qsci_edma_transfer_handle_t* *psHandle)

Aborts the data transmit process using EDMA.

Parameters

- psHandle – Pointer to qsci_edma_transfer_handle_t structure.

void QSCI_TransferAbortReceiveEDMA(*qsci_edma_transfer_handle_t* *psHandle)

Aborts the data receive process using EDMA.

Parameters

- psHandle – Pointer to qsci_edma_transfer_handle_t structure.

status_t QSCI_TransferGetReceivedCountEDMA(*qsci_edma_transfer_handle_t* *psHandle, uint32_t *pu32Count)

Gets the number of received bytes.

This function gets the number of received bytes.

Parameters

- psHandle – QSCI handle pointer.
- pu32Count – Receive bytes count.

Return values

- kStatus_NoTransferInProgress – No receive in progress.
- kStatus_Success – Get successfully through the parameter count;

status_t QSCI_TransferGetSendCountEDMA(*qsci_edma_transfer_handle_t* *psHandle, uint32_t *pu32Count)

Gets the number of bytes written to the QSCI TX register.

This function gets the number of bytes written to the QSCI TX register by DMA.

Parameters

- psHandle – QSCI handle pointer.
- pu32Count – Send bytes count.

Return values

- kStatus_NoTransferInProgress – No send in progress.
- kStatus_Success – Get successfully through the parameter count;

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QSCI EDMA driver version.

typedef struct *_qsci_edma_transfer_handle* qsci_edma_transfer_handle_t

Forward declaration of the qsci edma handle typedef. .

typedef void (*qsci_edma_transfer_callback_t)(*qsci_edma_transfer_handle_t* *psHandle)

QSCI edma transfer callback function definition.

Defines the interface of user callback function used in QSCI edma transfer using transactional APIs. The callback function shall be defined and declared in application level by user. Before starting QSCI transmiting or receiving by calling *QSCI_TransferSendEDMA* or *QSCI_TransferReceiveEDMA*, call *QSCI_TransferCreateHandleEDMA* to install the user callback. When the transmiting or receiving ends, user callback will be invoked by driver.

Param psHandle
Transfer handle that contains bus status, user data.

struct _qsci_edma_transfer_handle

#include <fsl_qsci_edma.h> QSCI edma transfer handle.

This struct address should be sizeof(edma_channel_tcd_t) aligned.

Note: If user wants to use the transactional API to transfer data in edma way, one QSCI instance should and can only be allocated one handle.

Note: The handle is maintained by QSCI driver internally, which means the transfer state is retained and user shall not modify its state *u8TxState* or *u8RxState* in application level. If user only wish to use transactional APIs without understanding its machanism, it is not necessary to understand these members.

Public Members

edma_channel_tcd_t sTxTcd
TCD for EDMA TX transfer.

edma_channel_tcd_t sRxTcd
TCD for EDMA RX transfer.

QSCI_Type *base
Pointer to the QSCI base that belongs to this handle.

qsci_edma_transfer_callback_t pfCallback
Callback function.

uint32_t u32RxDataSizeAll
Size of the data to receive.

uint32_t u32TxDataSizeAll
Size of the data to send out.

edma_handle_t sTxEdmaHandle
The eDMA TX channel used.

edma_handle_t sRxEdmaHandle
The eDMA RX channel used.

volatile uint8_t u8TxState
TX transfer state.

volatile uint8_t u8RxState
RX transfer state

status_t busStatus
QSCI bus status.

void *pUserData
User configurable pointer to any data, function, structure etc that user wish to use in the callback

2.68 QSCI Peripheral and Driver Overview

2.69 QSPI: Queued SPI Driver

void QSPI_MasterInit(QSPI_Type *base, const *qspi_master_config_t* *psConfig)
Initializes the QUEUEDSPI as Master.

Use helpher function QSPI_MasterGetDefaultConfig to get ready-to-use structure.

Parameters

- base – QUEUEDSPI peripheral address.
- psConfig – Pointer to the structure qspi_master_config_t.

void QSPI_MasterGetDefaultConfig(*qspi_master_config_t* *psConfig, uint32_t u32ClockFreqHz)

Helper function to create ready-to-user maste init structure.

The purpose of this API is to get the configuration structure initialized for the QSPI_MasterInit. Users may use the initialized structure unchanged in the QSPI_MasterInit or modify the structure before calling the QSPI_MasterInit. Example:

```
qspi_master_config_t sMasterConfig;
QSPI_MasterGetDefaultConfig(&sMasterConfig);
```

The default values are: Example:

```
// Parameter provided by user
psConfig->u32BaudRateBps = u32BaudRateBps;
psConfig->u32ClockFrequencyHz = u32ClockFreqHz;
psConfig->eDataWidth = eDataWidth;

// Default configuration
psConfig->eClkPolarity = kQSPI_ClockPolarityActiveRisingEdge;
psConfig->eClkPhase = kQSPI_ClockPhaseSlaveSelectHighBetweenWords;
psConfig->eShiftDirection = kQSPI_MsbFirst;
psConfig->u16DelayBetweenFrameInCLK = 1U;
psConfig->bEnableWiredOrMode = false;
psConfig->bEnableModeFault = false;
psConfig->u8DmaEnableFlags = 0U;    // Disable TX/RX Dma
psConfig->bEnableFIFO = false;
psConfig->bEnableStopModeHoldOff = false;
psConfig->u8Interrupts = 0U;
psConfig->bEnableModule = false;
@todo To be added
```

Parameters

- psConfig – pointer to qspi_master_config_t structure.
- u32ClockFreqHz – Peripheral clock frequency in Hz

void QSPI_SlaveInit(QSPI_Type *base, const *qspi_slave_config_t* *psConfig)

Initializes the QUEUEDSPI as slave.

Use helpher function QSPI_SlaveGetDefaultConfig to get ready-to-use structure.

Parameters

- base – QUEUEDSPI peripheral address.
- psConfig – Pointer to the structure qspi_slave_config_t.

void QSPI_SlaveGetDefaultConfig(*qspi_slave_config_t* *psConfig)

Set the qspi_slave_config_t structure to default values.

The purpose of this API is to get the configuration structure initialized for the QSPI_SlaveInit. Users may use the initialized structure unchanged in the QSPI_SlaveInit or modify the structure before calling the QSPI_SlaveInit. Example:

```
qspi_slave_config_t slaveConfig;
QSPI_SlaveGetDefaultConfig(&slaveConfig);
```

The default values are: Example:

@todo

Parameters

- psConfig – Pointer to the qspi_slave_config_t structure.

void QSPI_Deinit(QSPI_Type *base)

De-initialize the QUEUEDSPI peripheral for either Master or Slave.

Parameters

- base – QUEUEDSPI peripheral address.

static inline void QSPI_EnableInterrupts(QSPI_Type *base, uint8_t u8Interrupts)

Enable one or multiple interrupts.

This function enable one or multiple interrupts.

Note: for TX and RX requests, while enabling the interrupt request the DMA request will be disabled as well. Do not use this API while QUEUEDSPI is in running state.

Parameters

- base – QUEUEDSPI peripheral address.
- u8Interrupts – The interrupt mask which is ORed by the *_qspi_interrupt_enable*.

static inline void QSPI_DisableInterrupts(QSPI_Type *base, uint8_t u8Interrupts)

Disable one or multiple interrupts.

This function

Parameters

- base – QUEUEDSPI peripheral address.
- u8Interrupts – The interrupt mask which is ORed by the *_qspi_interrupt_enable*.

static inline void QSPI_EnableDMA(QSPI_Type *base, uint8_t u8DmaFlags)

Enable one or multiple DMA.

Note that if the DMA is enabled for Transmit or Receive, make sure the interurpt is disabled for Transmit or Receive.

Parameters

- base – QUEUEDSPI peripheral address.
- u8DmaFlags – DMA Flags ORed from *_qspi_dma_enable_flags*.

static inline void QSPI_DisableDMA(QSPI_Type *base, uint8_t u8DmaFlags)

Enable one or multiple DMA.

Note that if the DMA is enabled for Transmit or Receive, make sure the interurpt is disabled for Transmit or Receive.

Parameters

- base – QUEUEDSPI peripheral address.
- u8DmaFlags – DMA Flags ORed from *_qspi_dma_enable_flags*.

static inline uint32_t QSPI_GetTxRegisterAddress(QSPI_Type *base)

Get the QUEUEDSPI transmit data register address for the DMA operation.

Parameters

- base – QUEUEDSPI peripheral address.

Returns

The QUEUEDSPI master PUSHR data register address.

static inline uint32_t QSPI_GetRxRegisterAddress(QSPI_Type *base)

Get the QUEUEDSPI receive data register address for the DMA operation.

Parameters

- base – QUEUEDSPI peripheral address.

Returns

The QUEUEDSPI POPR data register address.

static inline uint16_t QSPI_GetStatusFlags(QSPI_Type *base)

Get the QUEUEDSPI status flag state.

Parameters

- base – QUEUEDSPI peripheral address.

Returns

QUEUEDSPI status.

static inline void QSPI_ClearStatusFlags(QSPI_Type *base, uint16_t u16StatusFlags)

Clear the status flag only for the mode fault.

Clear the status flag only for mode fault.

Note: only kQSPI_ModeFaultFlag can be cleared by this API.

Parameters

- base – QUEUEDSPI peripheral address.
- u16StatusFlags – status flags ORed from *_qspi_status_flags*

static inline void QSPI_Enable(QSPI_Type *base, bool bEnable)

Enable or disable the QUEUEDSPI peripheral.

Parameters

- base – QUEUEDSPI peripheral address.
- bEnable – true to enable module, otherwise disable module

uint32_t QSPI_MasterSetBaudRate(QSPI_Type *base, uint32_t u32BaudRateBps, uint32_t u32SrcClockHz)

Set the QUEUEDSPI baud rate in bits-per-second.

This function takes in the desired baud rate, calculates the nearest possible baud rate, and returns the calculated baud rate in bits-per-second.

Parameters

- base – QUEUEDSPI peripheral address.
- u32BaudRateBps – The desired baud rate in bits-per-second.
- u32SrcClockHz – Module source input clock in Hertz.

Returns
The actual calculated baud rate.

static inline void QSPI_SetMasterSlaveMode(QSPI_Type *base, *qspi_master_slave_mode_t* eMode)

Set the QUEUEDSPI as master or slave.

Parameters

- base – QUEUEDSPI peripheral address.
- eMode – Mode setting of type qspi_master_slave_mode_t.

static inline bool QSPI_IsMaster(QSPI_Type *base)

Return whether the QUEUEDSPI module is in master mode.

Parameters

- base – QUEUEDSPI peripheral address.

Returns
Returns true if the module is in master mode or false if the module is in slave mode.

static inline void QSPI_SetDataShiftOrder(QSPI_Type *base, *qspi_data_shift_direction_t* eDataShiftOrder)

Set Data Shift Order as MSB first or LSB first.

Parameters

- base – QUEUEDSPI peripheral address.
- eDataShiftOrder – MSB or LSB first from *qspi_data_shift_direction_t*

static inline void QSPI_EnableModeFault(QSPI_Type *base, bool bEnable)

Enable/Disable mode fault detection.

If enable, allows the kQSPI_ModeFaultFlag flag to be set. If the kQSPI_ModeFaultFlag flag is set, disable the Mod detection does not clear the flag. If the mod detection is disabled, the level of the SS_B pin does not affect the operation of an enabled SPI configured as a master. If configured as a master and mod fault detection is enabled, a transaction in progress will stop if SS_B goes low. For an enabled SPI configured as a slave, having this feature disabled only prevents the flag from being set. It does not affect any other part of SPI operation

Parameters

- base – QUEUEDSPI peripheral address.
- bEnable – true to enable Mode Fault detection, false to disable

static inline void QSPI_SetClockPolarity(QSPI_Type *base, *qspi_clock_polarity_t* ePolarity)

Set clock polarity.

Note: module shall be disabled before change the polarity by calling QSPI_Enable.

Parameters

- base – QUEUEDSPI peripheral address.
- ePolarity – clock polarity option

static inline void QSPI_SetClockPhase(QSPI_Type *base, *qspi_clock_phase_t* eClockPhase)

Set clock phase.

Configure whether get the Slave Select signal toggle high during 2 data frames. Get the SS toggle high between data frames will lead to SPI to be trigged with transaction for the falling edge of SS signal. Otherwise, the data transaction is started on the first active SCLK edge.

Note: module shall be disabled before change the polarity by calling QSPI_Enable.

Note: Do not use kQSPI_ClockPhaseSlaveSelectHighBetweenWords in DMA mode.

Parameters

- base – QUEUEDSPI peripheral address.
- eClockPhase – Option for clock phase

static inline void QSPI_EnableWiredORMode(QSPI_Type *base, bool bEnable)

Enable/Disable Wired OR mode for SPI pins which means open-drain when enabled and push-pull when disabled.

Parameters

- base – QUEUEDSPI peripheral address.
- bEnable – true to configure SPI pins as open-drain, false to configure as push-pull

static inline void QSPI_SetTransactionDataSize(QSPI_Type *base, *qspi_data_width_t* eDataWidth)

Set the transaction data width.

Parameters

- base – QUEUEDSPI peripheral address.
- eDataWidth – datawidth for bits in each data frame.

static inline void QSPI_MasterSetWaitDelay(QSPI_Type *base, uint16_t u16WaitDelayInPeriClockCount)

For master mode, set wait delay in clock cycle with delay is set value + 1 peripheral bus clock.

This controls the time between data transactions in master mode. Delay will not be added if no word is waiting for transmitting.

Parameters

- base – QUEUEDSPI peripheral address.
- u16WaitDelayInPeriClockCount – Clock count for the delay during data frames

static inline void QSPI_EnableStopModeHoldOff(QSPI_Type *base, bool bEnable)

Enable/Disable hold off entry to stop mode is a word is being transmitted/received for Master Mode.

When enabled, this bit allows the SPI module to hold off entry to chip level stop mode if a word is being transmitted or received. Stop mode will be entered after the SPI finishes transmitting/receiving. This bit does not allow the SPI to wake the chip from stop mode in any way. The SHEN bit can only delay the entry into stop mode. This bit should not be set in slave mode because the state of SS_B (which would be controlled by an external master device) may cause the logic to hold off stop mode entry forever.

Parameters

- base – QUEUEDSPI peripheral address.
- bEnable – true to enable hold-off entrying stop mode if there is transmitting/receiving

uint32_t QSPI_GetInstance(QSPI_Type *base)

Helper function exported for QSPI DMA driver.

Get the instance index from the base address. User need not understand this function.

Parameters

- base – QUEUEDSPI peripheral address.

Returns

uint32_t Index of the peripheral instance for given base address.

static inline *qspi_ss_data_logic_level_t* QSPI_MasterGetSlaveSelectLogicLevel(QSPI_Type *base)

For master mode, get the SS_B input logic level while true means drive High and false means drive Low.

Get the value to drive on the SS_B pin. This bit is disabled when SSB_AUTO=1 or SSB_STRB=1. Only apply for Master mode.

Parameters

- base – QUEUEDSPI peripheral address.

Returns

true SS_B input level High

Returns

false SS_B input level Low

static inline void QSPI_MasterSetSlaveSelectLogicLevel(QSPI_Type *base, *qspi_ss_data_logic_level_t* eLogicLevel)

for master mode, drive Slave Select pin logic high or low

This feature is disabled if Slave Select automatic mode is enabled or Slave Select Strobe feature is enabled

Parameters

- base – QUEUEDSPI peripheral address.
- eLogicLevel – logic level

static inline void QSPI_MasterEnableSlaveSelectOpenDrainMode(QSPI_Type *base, bool bEnable)

For master mode, Enable open drain in SSB pad pin.

Enable it means SS_B is configured for high and low drive. This mode is generally used in single master systems. Disable it means SS_B is configured as an open drain pin (only drives low output level). This mode is useful for multiple master systems

Parameters

- base – QUEUEDSPI peripheral address.
- bEnable – Enable/Disable option.

static inline void QSPI_MasterEnableSlaveSelectAutomaticMode(QSPI_Type *base, bool bEnable)

For master mode, Enable/Disable Slave Select pin automatic mode.

Parameters

- base – QUEUEDSPI peripheral address.
- bEnable – Enable/Disable option.

static inline void QSPI_SetSlaveSelectDirection(QSPI_Type *base, *qspi_ss_direction_t* eDirection)

Set Input/Output mode for SSB signal.

Parameters

- base – QUEUEDSPI peripheral address.
- eDirection – options from *qspi_ss_direction_t*

static inline void QSPI_MasterEnableSlaveSelectStrobe(QSPI_Type *base, bool bEnable)

For master, set strobe mode for SSB signal.

If enabled, Slave select pulse high during data frames irrespective of Clock Phase configuration

Parameters

- base – QUEUEDSPI peripheral address.
- bEnable – Enable/Disable option.

static inline void QSPI_EnableSlaveSelectOverride(QSPI_Type *base, bool bEnable)

Enable / Disable SSB signal from Master/Slave configuration or GPIO pin state.

Parameters

- base – QUEUEDSPI peripheral address.
- bEnable – Enable/Disable option.

void QSPI_SetDummyData(QSPI_Type *base, uint8_t u8DummyData)

Set up the dummy data used when there is not transmit data provided.

Parameters

- base – QUEUEDSPI peripheral address.
- u8DummyData – Data to be transferred when tx buffer is NULL.

uint8_t QSPI_GetDummyData(QSPI_Type *base)

Get the dummy data for each peripheral.

Parameters

- base – QUEUEDSPI peripheral base address.

static inline void QSPI_WriteData(QSPI_Type *base, uint16_t data)

Write data into the transmit data register without polling the status of shifting.

Parameters

- base – QUEUEDSPI peripheral address.
- data – The data to send.

static inline uint16_t QSPI_ReadData(QSPI_Type *base)

Read data from the receive data register.

Parameters

- base – QUEUEDSPI peripheral address.

Returns

The data from the receive data register.

static inline void QSPI_EnableFifo(QSPI_Type *base, bool bEnable)

Enable or disable the QUEUEDSPI FIFOs.

This function allows the caller to disable or enable the TX and RX FIFOs together.

Parameters

- base – QUEUEDSPI peripheral address.
- bEnable – Pass true to enable, pass false to disable

static inline uint16_t QSPI_GetTxFIFOCount(QSPI_Type *base)

Get TX FIFO level.

This function gets how many words are in the TX FIFO.

Parameters

- base – QUEUEDSPI peripheral address.

Returns

TX FIFO word count.

static inline uint16_t QSPI_GetRxFIFOCount(QSPI_Type *base)

Get RX FIFO level.

This function gets how many words are in the RX FIFO.

Parameters

- base – QUEUEDSPI peripheral address.

Returns

RX FIFO word count.

static inline void QSPI_SetFifoWatermarks(QSPI_Type *base, uint16_t txWatermark, uint16_t rxWatermark)

Set the transmit and receive FIFO watermark values.

Parameters

- base – QUEUEDSPI peripheral address.
- txWatermark – The TX FIFO watermark value. Refer to qspi_txfifo_watermark_t for available values.
- rxWatermark – The RX FIFO watermark value. Refer to qspi_rxfifo_watermark_t for available values.

static inline void QSPI_GetFifoWatermarks(QSPI_Type *base, uint8_t *pu8TxWatermark, uint8_t *pu8RxWatermark)

Get the transmit and receive FIFO watermark values.

Parameters

- base – QUEUEDSPI peripheral address.
- pu8TxWatermark – The TX FIFO watermark value.
- pu8RxWatermark – The RX FIFO watermark value.

static inline void QSPI_EmptyRxFifo(QSPI_Type *base)

Empty the QUEUEDSPI RX FIFO.

Parameters

- base – QUEUEDSPI peripheral address.

void QSPI_MasterTransferCreateHandle(QSPI_Type *base, *qspi_master_transfer_handle_t* *psHandle, *qspi_master_transfer_callback_t* pfCallback, void *pUserData)

Initialize the QUEUEDSPI master handle.

This function initializes the QUEUEDSPI handle, which can be used for other QUEUEDSPI transactional APIs. Usually, for a specified QUEUEDSPI instance, call this API once to get the initialized handle.

Note: If only use the QSPI_MasterTransferBlocking, this API is not necessary be called.

Parameters

- base – QUEUEDSPI peripheral address.
- psHandle – QUEUEDSPI handle pointer to qspi_master_transfer_handle_t.
- pfCallback – QUEUEDSPI callback.
- pUserData – Callback function parameter.

status_t QSPI_MasterTransferBlocking(QSPI_Type *base, *qspi_transfer_t* *psXfer)

Polling method of QUEUEDSPI master transfer.

This function transfers data using a polling method for master. This is a blocking function, which does not return until all transfers have been completed.

Parameters

- base – QUEUEDSPI peripheral address.
- psXfer – Pointer to the qspi_transfer_t structure.

Returns

status of status_t.

status_t QSPI_MasterTransferNonBlocking(*qspi_master_transfer_handle_t* *psHandle, *qspi_transfer_t* *psXfer)

Interrupt method of QUEUEDSPI master transfer.

This function transfers data using interrupts for master. This is a non-blocking function, which returns right away. When all data is transferred, the callback function is called.

Parameters

- psHandle – QUEUEDSPI handle pointer to qspi_master_transfer_handle_t.
- psXfer – Pointer to the qspi_transfer_t structure.

Returns

status of status_t.

status_t QSPI_MasterTransferGetCount(*qspi_master_transfer_handle_t* *psHandle, uint16_t *pu16Count)

Get the master transfer count.

Parameters

- psHandle – QUEUEDSPI handle pointer to qspi_master_transfer_handle_t.
- pu16Count – The number of bytes transferred by using the non-blocking transaction.

Returns

status of status_t.

void QSPI_MasterTransferAbort(*qspi_master_transfer_handle_t* *psHandle)

Abort a transfer that uses interrupts for master.

Parameters

- psHandle – QUEUEDSPI handle pointer to qspi_master_transfer_handle_t.

void QSPI_MasterTransferHandleIRQ(*qspi_master_transfer_handle_t* *psHandle)

QUEUEDSPI Master IRQ handler function.

This function processes the QUEUEDSPI transmit and receive IRQ.

Parameters

- psHandle – QUEUEDSPI handle pointer to qspi_master_transfer_handle_t.

void QSPI_SlaveTransferCreateHandle(QSPI_Type *base, *qspi_slave_transfer_handle_t* *psHandle, *qspi_slave_transfer_callback_t* pfCallback, void *pUserData)

Initialize the QUEUEDSPI slave handle.

This function initializes the QUEUEDSPI handle, which can be used for other QUEUEDSPI transactional APIs. Usually, for a specified QUEUEDSPI instance, call this API once to get the initialized handle.

Parameters

- base – QUEUEDSPI peripheral base address.
- psHandle – QUEUEDSPI handle pointer to the qspi_slave_transfer_handle_t.
- pfCallback – QUEUEDSPI callback.
- pUserData – Callback function parameter.

status_t QSPI_SlaveTransferNonBlocking(*qspi_slave_transfer_handle_t* *psHandle, *qspi_transfer_t* *psXfer)

Interrupt driven method of QUEUEDSPI slave transfer with completion will be notified by registered callback.

This function transfers data using interrupts for slave. This is a non-blocking function, which returns right away. When all data is transferred, the callback function is called.

Parameters

- psHandle – Pointer to the qspi_slave_transfer_handle_t structure which stores the transfer state.
- psXfer – Pointer to the qspi_transfer_t structure.

Returns

status of status_t.

status_t QSPI_SlaveTransferGetCount(*qspi_slave_transfer_handle_t* *psHandle, uint16_t *pu16Count)

Get the slave transfer count already transmitted/received.

Parameters

- psHandle – Pointer to the qspi_slave_transfer_handle_t structure which stores the transfer state.
- pu16Count – The number of bytes transferred by using the non-blocking transaction.

Returns

status of status_t.

void QSPI_SlaveTransferAbort(*qspi_slave_transfer_handle_t* *psHandle)

Abort a transaction.

Parameters

- psHandle – Pointer to the qspi_slave_transfer_handle_t structure which stores the transfer state.

void QSPI_SlaveTransferHandleIRQ(*qspi_slave_transfer_handle_t* *psHandle)

QUEUEDSPI slave IRQ handler function.

This function processes the QUEUEDSPI transmit and receive IRQ.

Parameters

- psHandle – Pointer to the qspi_slave_transfer_handle_t structure which stores the transfer state.

FSL_QSPI_DRIVER_VERSION

QSPI driver version.

QSPI_TRANSFER_GET_BASE(handle)

Extract Base Address from handle for master or slave handle.

QSPI_TRANSFER_GET_USER_DATA(handle)

Extract user data from handle for master or slave handle.

Status return code for the QUEUEDSPI driver. Only used in transactional layer in this driver.
.

Values:

enumerator kStatus_QSPI_Busy

QUEUEDSPI transfer is busy.

enumerator kStatus_QSPI_Error

QUEUEDSPI driver error.

enumerator kStatus_QSPI_Idle

QUEUEDSPI is idle.

enumerator kStatus_QSPI_OutOfRange

QUEUEDSPI transfer out of range.

enum _qspi_status_flags

QUEUEDSPI peripheral status flags.

Values:

enumerator kQSPI_TxEmptyFlag

Transmitter Empty Flag.

enumerator kQSPI_ModeFaultFlag

Mode Fault Flag.

enumerator kQSPI_RxOverflowFlag

Receiver Overflow Flag.

enumerator kQSPI_RxFullFlag

Receiver Full Flag.

enumerator kQSPI_AllStatusFlags

enum _qspi_interrupt_enable

QUEUEDSPI interrupt source.

Values:

enumerator kQSPI_TxInterruptEnable

SPTE interrupt enable.

enumerator kQSPI_RxInterruptEnable

SPRF interrupt enable.

enumerator kQSPI_RxOverFlowInterruptEnable

Bus error interrupt enable.

enumerator kQSPI_AllInterrupts

enum _qspi_ss_direction

options for Slave Select (SSB) signal direction.

Values:

enumerator kQSPI_SlaveSelectDirectionInput

SSB signal as input for slave mode or master mode with Mode fault enabled.

enumerator kQSPI_SlaveSelectDIrectionOutput

SSB signal as output.

enum _qspi_ss_data_logic_level

logical level for Slave Select (SSB) signal data

Values:

enumerator kQSPI_SlaveSelectLogicLow

Slave select logic level low

enumerator kQSPI_SlaveSelectLogicHigh

Slave select logic level high

enum _qspi_txfifo_watermark

QUEUEDSPI Transmit FIFO watermark settings.

Values:

enumerator kQSPI_TxFifoWatermarkEmpty

Transmit interrupt active when Tx FIFO is empty

enumerator kQSPI_TxFifoWatermarkOneWord

Transmit interrupt active when Tx FIFO has one or fewer words available

enumerator kQSPI_TxFifoWatermarkTwoWord
Transmit interrupt active when Tx FIFO has two or fewer words available

enumerator kQSPI_TxFifoWatermarkThreeWord
Transmit interrupt active when Tx FIFO has three or fewer words available

enum _qspi_rxfifo_watermark
QUEUEDSPI Receive FIFO watermark settings.
Values:

enumerator kQSPI_RxFifoWatermarkOneWord
Receive interrupt active when Rx FIFO has at least one word used

enumerator kQSPI_RxFifoWatermarkTwoWord
Receive interrupt active when Rx FIFO has at least two words used

enumerator kQSPI_RxFifoWatermarkThreeWord
Receive interrupt active when Rx FIFO has at least three words used

enumerator kQSPI_RxFifowatermarkFull
Receive interrupt active when Rx FIFO is full

enum _qspi_data_width
Transfer data width in each frame.
Values:

enumerator kQSPI_Data2Bits
2 bits data width

enumerator kQSPI_Data3Bits
3 bits data width

enumerator kQSPI_Data4Bits
4 bits data width

enumerator kQSPI_Data5Bits
5 bits data width

enumerator kQSPI_Data6Bits
6 bits data width

enumerator kQSPI_Data7Bits
7 bits data width

enumerator kQSPI_Data8Bits
8 bits data width

enumerator kQSPI_Data9Bits
9 bits data width

enumerator kQSPI_Data10Bits
10 bits data width

enumerator kQSPI_Data11Bits
11 bits data width

enumerator kQSPI_Data12Bits
12 bits data width

enumerator kQSPI_Data13Bits
13 bits data width

enumerator kQSPI_Data14Bits
14 bits data width

enumerator kQSPI_Data15Bits
15 bits data width

enumerator kQSPI_Data16Bits
16 bits data width

enum _qspi_dma_enable_flags
QUEUEDSPI DMA configuration for Transmit and Receive.
Values:

enumerator kQSPI_DmaRx
Receive DMA Enable Flag.

enumerator kQSPI_DmaTx
Transmit DMA Enable Flag.

enum _qspi_master_slave_mode
QUEUEDSPI master or slave mode configuration.
Values:

enumerator kQSPI_Slave
QUEUEDSPI peripheral operates in slave mode.

enumerator kQSPI_Master
QUEUEDSPI peripheral operates in master mode.

enum _qspi_clock_polarity
QUEUEDSPI clock polarity configuration.
Values:

enumerator kQSPI_ClockPolarityActiveRisingEdge

CPOL=0. Active-high QUEUEDSPI clock (idles low), rising edge of SCLK starts transaction.

enumerator kQSPI_ClockPolarityActiveFallingEdge

CPOL=1. Active-low QUEUEDSPI clock (idles high), falling edge of SCLK starts transaction.

enum _qspi_clock_phase

QUEUEDSPI clock phase configuration.

Values:

enumerator kQSPI_ClockPhaseSlaveSelectHighBetweenWords

CPHA=0, Slave Select toggle high during data frames.

enumerator kQSPI_ClockPhaseSlaveSelectLowBetweenWords

CPHA=1, Slave Select keep low during data frames.

enum _qspi_data_shift_direction

QUEUEDSPI data shifter direction options for a given CTAR.

Values:

enumerator kQSPI_MsbFirst

Data transfers start with most significant bit.

enumerator kQSPI_LsbFirst

Data transfers start with least significant bit.

enum _qspi_pcs_polarity_config

QUEUEDSPI Peripheral Chip Select Polarity configuration.

Values:

enumerator kQSPI_PcsActiveHigh

Pcs Active High (idles low).

enumerator kQSPI_PcsActiveLow

Pcs Active Low (idles high).

enum _qspi_master_transfer_flag

transaction layer configuration options for each transaction

Values:

enumerator kQSPI_MasterPCSContinous

Indicates whether the PCS signal de-asserts during transfer between frames, note this flag should not be used when CPHA is 0.

enumerator kQSPI_MasterActiveAfterTransfer

Indicates whether the PCS signal is active after the last frame transfer, note 1. this flag should not be used when CPHA is 0, 2. this flag can only be used when kQSPI_MasterPCSContinous is used.

enum _qspi_transfer_state

QUEUEDSPI transfer state, used internally for transactional layer.

Values:

enumerator kQSPI_Idle

Nothing in the transmitter/receiver.

enumerator kQSPI_Busy

Transfer queue is not finished.

enumerator kQSPI_Error

Transfer error.

typedef enum *_qspi_ss_direction* qspi_ss_direction_t

options for Slave Select (SSB) signal direction.

typedef enum *_qspi_ss_data_logic_level* qspi_ss_data_logic_level_t

logical level for Slave Select (SSB) signal data

typedef enum *_qspi_txfifo_watermark* qspi_txfifo_watermark_t

QUEUEDSPI Transmit FIFO watermark settings.

typedef enum *_qspi_rxfifo_watermark* qspi_rxfifo_watermark_t

QUEUEDSPI Receive FIFO watermark settings.

typedef enum *_qspi_data_width* qspi_data_width_t

Transfer data width in each frame.

typedef enum *_qspi_master_slave_mode* qspi_master_slave_mode_t

QUEUEDSPI master or slave mode configuration.

typedef enum *_qspi_clock_polarity* qspi_clock_polarity_t

QUEUEDSPI clock polarity configuration.

typedef enum *_qspi_clock_phase* qspi_clock_phase_t

QUEUEDSPI clock phase configuration.

typedef enum *_qspi_data_shift_direction* qspi_data_shift_direction_t

QUEUEDSPI data shifter direction options for a given CTAR.

typedef struct *_qspi_master_config* qspi_master_config_t

QUEUEDSPI master configuration structure with all master configuration fields covered.

typedef struct *_qspi_slave_config* qspi_slave_config_t

QUEUEDSPI slave configuration structure with all slave configuration fields covered.

typedef enum *_qspi_pcs_polarity_config* qspi_pcs_polarity_config_t

QUEUEDSPI Peripheral Chip Select Polarity configuration.

typedef struct *_qspi_transfer* qspi_transfer_t

QUEUEDSPI master/slave transfer structure.

typedef struct *_qspi_master_handle* qspi_master_transfer_handle_t

Forward declaration of the *_qspi_master_handle* typedefs. .

typedef void (*qspi_master_transfer_callback_t)(*qspi_master_transfer_handle_t* *psHandle, *status_t* eCompletionStatus, void *pUserData)

Completion callback function pointer type.

Param base
QUEUEDSPI peripheral address.

Param psHandle
Pointer to the handle for the QUEUEDSPI master.

Param eCompletionStatus
Success or error code describing whether the transfer completed.

Param pUserData
Arbitrary pointer-dataSized value passed from the application.

typedef struct *_qspi_master_handle* qspi_slave_transfer_handle_t

Forward declaration of the *_qspi_master_handle* typedefs. .

typedef void (*qspi_slave_transfer_callback_t)(*qspi_slave_transfer_handle_t* *psHandle, *status_t* eCompletionStatus, void *pUserData)

Completion callback function pointer type.

Param base
QUEUEDSPI peripheral address.

Param handle
Pointer to the handle for the QUEUEDSPI slave.

Param status
Success or error code describing whether the transfer completed.

Param pUserData
Arbitrary pointer-dataSized value passed from the application.

void QSPI_DriverIRQHandler(uint32_t instance)

QSPI driver IRQ handler common entry.

This function provides the common IRQ request entry for QSPI.

Parameters

- instance – QSPI instance.

QSPI_DUMMY_DATA

User Configuraiton item dummy data filled into Output signal if there is no Tx data.

Dummy data used for Tx if there is no txData.

struct __qspi__master__config

#include <fsl_queued_spi.h> QUEUEDSPI master configuration structure with all master configuration fields covered.

Public Members

uint32_t u32BaudRateBps

Baud Rate for QUEUEDSPI.

qspi_data_width_t eDataWidth

Data width in SPI transfer

qspi_clock_polarity_t eClkPolarity

Clock polarity.

qspi_clock_phase_t eClkPhase

Clock phase.

qspi_data_shift_direction_t eShiftDirection

MSB or LSB data shift direction.

bool bEnableWiredOrMode

SPI pin configuration, when enabled the SPI pins are configured as open-drain drivers with the pull-ups disabled.

bool bEnableModeFault

Enable/Disable mode fault detect for Slave Select Signal

bool bEnableStrobe

Enable/Disable strobe between data frames irrespective of clock pahse setting

bool bEnableSlaveSelAutoMode

Enable/Disable Slave Select Auto mode.

bool bEnableSlaveSelOpenDrain

Enable the open-drain mode of SPI Pins, otherwise Push-Pull

uint16_t u16DelayBetweenFrameInCLK

The delay between frame.

bool bEnableFIFO

Enable / Disable FIFO for Transmit/Receive

qspi_txfifo_watermark_t eTxFIFOWatermark

Watermark config for Transmit FIFO

qspi_txfifo_watermark_t eRxFIFOWatermark

Watermark config for Receive FIFO

bool bEnableModule
: Enable / Disable module

uint8_t u8Interrupts
: Interrupt enabled ORed from *_qspi_interrupt_enable*

uint8_t u8DmaEnableFlags
: Configure DMA Enable/Disable for Transmit/Receive

struct __qspi_slave_config
: *#include <fsl_queued_spi.h>* QUEUEDSPI slave configuration structure with all slave configuration fields covered.

Public Members

qspi_data_width_t eDataWidth
: Data width in SPI transfer

qspi_clock_polarity_t eClkPolarity
: Clock polarity.

qspi_clock_phase_t eClkPhase
: Clock phase.

qspi_data_shift_direction_t eShiftDirection
: MSB or LSB data shift direction.

bool bEnableWiredOrMode
: SPI pin configuration, when enabled the SPI pins are configured as open-drain drivers with the pull-ups disabled.

bool bEnableModeFault
: Enable/Disable mode fault detect for Slave Select Signal

bool bEnableSlaveSelOverride
: Enable/Disble override Slave Select (SS) singal with Master/Slave Mode config

bool bEnableFIFO
: Enable / Disable FIFO for Transmit/Receive

qspi_txfifo_watermark_t eTxFIFOWatermark
: Watermark config for Transmit FIFO

qspi_txfifo_watermark_t eRxFIFOWatermark
: Watermark config for Receive FIFO

bool bEnableModule
: Enable/Disable Module

uint8_t u8DmaEnableFlags

Configure DMA Enable/Disable for Transmit/Receive

struct __qspi__transfer

#include <fsl_queued_spi.h> QUEUEDSPI master/slave transfer structure.

Public Members

void *pTxData

Transmit buffer.

void *pRxData

Receive buffer.

volatile uint16_t u16DataSize

Transfer bytes.

uint8_t u8ConfigFlags

Transfer configuration flags; set from *_qspi_master_transfer_flag*. This is not used in slave transfer.

struct __qspi__master__handle

#include <fsl_queued_spi.h> QUEUEDSPI master transfer handle structure used for transactional API.

Public Members

QSPI_Type *base

Base address for the QSPI peripheral

qspi_data_width_t eDataWidth

The desired number of bits per frame.

volatile bool bIsPcsActiveAfterTransfer

Indicates whether the PCS signal is active after the last frame transfer, This is not used in slave transfer.

uint8_t *volatile pu8TxData

Send buffer.

uint8_t *volatile pu8RxData

Receive buffer.

volatile uint16_t u16RemainingSendByteCount

A number of bytes remaining to send.

volatile uint16_t u16RemainingReceiveByteCount
: A number of bytes remaining to receive.

uint16_t u16TotalByteCount
: A number of transfer bytes

volatile uint8_t u8State
: QUEUEDSPI transfer state, see _qspi_transfer_state.

qspi_master_transfer_callback_t pfCallback
: Completion callback.

void *pUserData
: Callback user data.

volatile uint16_t u16ErrorCount
: Error count for slave transfer, this is not used in master transfer.

2.70 QSPI Peripheral and Driver Overview

2.71 QSPI_EDMA: EDMA based QSPI Driver

FSL_QSPI_EDMA_DRIVER_VERSION
: QSPI EDMA driver version.

typedef struct *_qspi_master_edma_handle* qspi_master_edma_handle_t
: Forward declaration of the *_qspi_master_edma_handle* typedefs.

typedef struct *_qspi_master_edma_handle* qspi_slave_edma_handle_t
: Forward declaration of the *_qspi_master_edma_handle* typedefs.

typedef void (*qspi_edma_transfer_callback_t)(*qspi_master_edma_handle_t* *psHandle, *status_t* eCompletionStatus, void *pUserData)
: Completion callback function pointer type.

  Param base
  : QUEUEDSPI peripheral base address.

  Param psHandle
  : Pointer to the handle for the QUEUEDSPI master.

  Param eCompletionStatus
  : Success or error code describing whether the transfer completed.

  Param pUserData
  : Arbitrary pointer-dataSized value passed from the application.

void QSPI_MasterTransferCreateHandleEDMA(QSPI_Type *base, *qspi_master_edma_handle_t* *psHandle, *qspi_edma_transfer_callback_t* pfCallback, void *pUserData, DMA_Type *psEdmaBase, *edma_channel_t* eEdmaTxChannel, *edma_channel_t* eEdmaRxChannel)

Initialize the QUEUEDSPI master EDMA handle.

This function initializes the QUEUEDSPI EDMA master handle which can be used for QUEUEDSPI EDMA master transactional APIs. Usually, for a specified QUEUEDSPI instance, call this API once to get the initialized handle.

Parameters

- base – QUEUEDSPI peripheral base address.
- psHandle – QUEUEDSPI handle pointer to qspi_master_edma_handle_t.
- pfCallback – QUEUEDSPI callback.
- pUserData – callback function parameter.
- psEdmaBase – base address for the EDMA
- eEdmaTxChannel – Channel of the EDMA used for QSPI Tx
- eEdmaRxChannel – Channel of the EDMA used for QSPI Rx

status_t QSPI_MasterTransferEDMA(*qspi_master_edma_handle_t* *psHandle, *qspi_transfer_t* *psXfer)

EDMA method of QUEUEDSPI master transfer.

This function transfers data using EDMA. This is a non-blocking function, which returns right away. When all data is transferred, the callback function is called.

Note: : The transfer data size should be even, if the transfer data width is larger than 8.

Parameters

- psHandle – pointer to qspi_master_edma_handle_t structure which stores the transfer state.
- psXfer – pointer to qspi_transfer_t structure.

Returns

status of status_t.

status_t QSPI_MasterTransferGetCountEDMA(*qspi_master_edma_handle_t* *psHandle, uint16_t *pu16Count)

Get the master EDMA transfer count.

Parameters

- psHandle – Pointer to the qspi_master_edma_handle_t structure which stores the transfer state.
- pu16Count – The number of bytes transferred by using the EDMA transaction.

Returns

status of status_t.

void QSPI_MasterTransferAbortEDMA(*qspi_master_edma_handle_t* *psHandle)

Abort a transfer that uses EDMA for master.

Parameters

- psHandle – Pointer to the qspi_master_edma_handle_t structure which stores the transfer state.

void QSPI_SlaveTransferCreateHandleEDMA(QSPI_Type *base, *qspi_slave_edma_handle_t* *psHandle, *qspi_edma_transfer_callback_t* pfCallback, void *pUserData, DMA_Type *psEdmaBase, *edma_channel_t* eEdmaTxChannel, *edma_channel_t* eEdmaRxChannel)

Initialize the QUEUEDSPI slave EDMA handle.

This function initializes the QUEUEDSPI EDMA handle which can be used for other QUEUEDSPI transactional APIs. Usually, for a specified QUEUEDSPI instance, call this API once to get the initialized handle.

Parameters

- base – QUEUEDSPI peripheral base address.
- psHandle – QUEUEDSPI handle pointer to qspi_slave_edma_handle_t.
- pfCallback – QUEUEDSPI callback.
- pUserData – callback function parameter.
- psEdmaBase – base address for the EDMA
- eEdmaTxChannel – Channel of the EDMA used for QSPI Tx
- eEdmaRxChannel – Channel of the EDMA used for QSPI Rx

status_t QSPI_SlaveTransferEDMA(*qspi_slave_edma_handle_t* *psHandle, *qspi_transfer_t* *psXfer)

EDMA method of QUEUEDSPI slave transfer.

This function transfers data using EDMA. This is a non-blocking function, which returns right away. When all data is transferred, the callback function is called.

Note: : The transfer data size should be even if the transfer data width is larger than 8.

Parameters

- psHandle – pointer to qspi_slave_edma_handle_t structure which stores the transfer state.
- psXfer – pointer to qspi_transfer_t structure.

Returns

status of status_t.

status_t QSPI_SlaveTransferGetCountEDMA(*qspi_slave_edma_handle_t* *psHandle, uint16_t *pu16Count)

Get the slave EDMA transfer count.

Parameters

- psHandle – Pointer to the qspi_slave_edma_handle_t structure which stores the transfer state.
- pu16Count – The number of bytes transferred by using the EDMA transaction.

Returns

status of status_t.

void QSPI_SlaveTransferAbortEDMA(*qspi_slave_edma_handle_t* *psHandle)

Abort a transfer that uses EDMA for slave.

Parameters

- psHandle – Pointer to the qspi_slave_edma_handle_t structure which stores the transfer state.

struct _qspi_master_edma_handle

#include <fsl_queued_spi_edma.h> QUEUEDSPI master EDMA transfer handle structure used for transactional API. This struct should be sizeof(edma_channel_tcd_t) aligned.

Public Members

QSPI_Type *base

Base address of the QSPI Peripheral

volatile uint8_t u8State

QUEUEDSPI transfer state , defined in _qspi_transfer_state.

uint16_t u16TotalByteCount

A number of transfer bytes.

qspi_data_width_t eDataWidth

The desired number of bits per frame.

uint16_t u16TxDummyData

Used if txData is NULL.

uint16_t u16RxDummyData

Used if rxData is NULL.

edma_handle_t sTxHandle

edma_handle_t handle point used for transmitting data.

edma_handle_t sRxHandle

edma_handle_t handle point used for receiving data.

bool bIsTxInProgress

Indicates whether the transmit is in progress.

bool bIsRxInProgress

Indicates whether the receive is in progress.

qspi_edma_transfer_callback_t pfCallback

Completion callback.

void *pUserData

Callback user data.

volatile bool bIsPcsActiveAfterTransfer

Indicates whether the PCS signal is active after the last frame transfer, This is not used in slave transfer.

2.72 QTMR: Quad Timer Driver

void QTMR_Init(TMR_Type *base, const *qtmr_config_t* *psConfig)

Initialization Quad Timer module with provided structure.

This function can initial one or more channels of the Quad Timer module.

This examples shows how only initial channel 0.

```
qtmr_config_t sConfig = {0};
qtmr_channel_config_t sChannel0Config;
sConfig.psChannelConfig[0] = &sChannel0Config;
QTMR_GetChannelDefaultConfig(&sChannel0Config);
QTMR_Init(QTMR, sConfig);
```

Note: This API should be called at the beginning of the application using the Quad Timer module.

Parameters

- base – Quad Timer peripheral base address.
- psConfig – Pointer to user's Quad Timer config structure. See *qtmr_config_t*.

void QTMR_Deinit(TMR_Type *base)

De-initialization Quad Timer module.

Parameters

- base – Quad Timer peripheral base address.

void QTMR_GetChannelDefaultConfig(*qtmr_channel_config_t* *psConfig)

Gets an available pre-defined options for Quad Timer channel module's configuration.

This function initializes the channel configuration structure with a free run 16bit timer work setting. The default values are:

```
psConfig->sInputConfig.ePrimarySource = kQTMR_PrimarySrcIPBusClockDivide2;
psConfig->sInputConfig.eSecondarySource = kQTMR_SecondarySrcInputPin0;
psConfig->sInputConfig.eSecondarySourceCaptureMode = kQTMR_SecondarySrcCaptureNoCapture;
psConfig->sInputConfig.bEnableSecondarySrcFaultFunction = false;
psConfig->sInputConfig.eEnableInputInvert = false;
psConfig->sCountConfig.eCountMode = kQTMR_CountPrimarySrcRiseEdge;
psConfig->sCountConfig.eCountLength = kQTMR_CountLengthUntilRollOver;
psConfig->sCountConfig.eCountDir = kQTMR_CountDirectionUp;
psConfig->sCountConfig.eCountTimes = kQTMR_CountTimesRepeat;
psConfig->sCountConfig.eCountLoadMode = kQTMR_CountLoadNormal;
psConfig->sCountConfig.eCountPreload1 = kQTMR_CountPreloadNoLoad;
psConfig->sCountConfig.eCountPreload2 = kQTMR_CountPreloadNoLoad;
psConfig->sOutputConfig.eOutputMode = kQTMR_OutputAssertWhenCountActive;
psConfig->sOutputConfig.eOutputValueOnForce = kQTMR_OutputValueClearOnForce;
psConfig->sOutputConfig.bEnableOutputInvert = false;
psConfig->sOutputConfig.bEnableSwForceOutput = false;
psConfig->sOutputConfig.bEnableOutputPin = false;
psConfig->sCooperationConfig.bEnableMasterReInit = false;
psConfig->sCooperationConfig.bEnableMasterForceOFLAG = false;
psConfig->sCooperationConfig.bEnableMasterMode = false;
psConfig->eDebugMode = kQTMR_DebugRunNormal;
psConfig->u16EnabledInterruptMask = 0x0U;
psConfig->u16EnabledDMAMask = 0x0U;
psConfig->u16Comp1 = 0x0U;
```

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```
psConfig->u16Comp2 = 0x0U;
psConfig->u16Comp1Preload = 0x0U;
psConfig->u16Comp1Preload = 0x0U;
psConfig->u16Load = 0x0U;
psConfig->u16Count = 0x0U;
psConfig->bEnableChannel = false;
```

Parameters

- psConfig – Pointer to user's Quad Timer channel config structure. See *qtmr_channel_config_t*.

void QTMR_SetupChannleConfig(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber, const *qtmr_channel_config_t* *psConfig)

Setup a Quad Timer channel with provided structure.

Parameters

- base – Quad Timer peripheral base address.
- eChannelNumber – Quad Timer channel number. See *qtmr_channel_number_t*.
- psConfig – Pointer to user's Quad Timer channel config structure. See *qtmr_channel_config_t*.

static inline void QTMR_SetPrimaryCountSource(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber, *qtmr_channel_primary_count_source_t* ePrimarySource)

Sets primary input source.

This function select the primary input source, it can select from "input pin 0~3", "channel output

0~3" and "IP bus clock prescaler".

Parameters

- base – Quad Timer peripheral base address.
- eChannelNumber – Quad Timer channel number. See *qtmr_channel_number_t*.
- ePrimarySource – The primary input source. See *qtmr_channel_primary_count_source_t*.

static inline void QTMR_SetSecondaryCountSource(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber, *qtmr_channel_secondary_count_source_t* source)

Sets secondary input source.

This function select the secondary input source, it can select from "input pin 0~3".

Parameters

- base – Quad Timer peripheral base address.
- eChannelNumber – Quad Timer channel number. See *qtmr_channel_number_t*.

- source – The Secondary input source. See *qtmr_channel_secondary_count_source_t*.

void QTMR_SetSecondarySourceInputCaptureMode(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber, *qtmr_channel_secondary_source_capture_mode_t* eCaptureMode)

Sets secondary input capture mode.

This function select the capture mode for secondary input, it can select from “disable capture”, “capture on

rising/falling edge” and “capture on both edges”. Need enable capture mode when input edge interrupt is needed.

Parameters

- base – Quad Timer peripheral base address.
- eChannelNumber – Quad Timer channel number. See *qtmr_channel_number_t*.
- eCaptureMode – The capture mode of secondary input. See *qtmr_channel_secondary_source_capture_mode_t*.

static inline void QTMR_EnableSecondarySourceFault(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber, bool bEnable)

Enables/Disables secondary input source signal fault feature.

Enable fault feature will make secondary input acts as a fault signal so that the channel output signal (OFLAG) is cleared when the secondary input is set.

Parameters

- base – Quad Timer peripheral base address.
- eChannelNumber – Quad Timer channel number. See *qtmr_channel_number_t*.
- bEnable – Enable the feature or not.
  - **true** Enable secondary source fault feature.
  - **false** Disable secondary source fault feature.

static inline void QTMR_EnableInputInvert(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber, bool bEnable)

Enables/Disables input pin signal polarity invert feature.

This function enables/disables input pin signal polarity invert feature.

Note: Invert feature only affects “input pin 0~3”, and acts on the channel input node, not the input pin, so it only affect current channel and not share by other channel

---

Parameters

- base – Quad Timer peripheral base address.
- eChannelNumber – Quad Timer channel number. See *qtmr_channel_number_t*.
- bEnable – Enable the feature or not.
  - **true** Invert input pin signal polarity.

– **false** No invert for input pin signal polarity.

static inline void QTMR_SetInputFilter(TMR_Type *base, *qtmr_input_pin_t* ePin, uint8_t u8Count, uint8_t u8Period)

Sets input filter for one input pin.

Sets input filter if the input signal is noisy.

Note: The input filter acts on the input pin directly, so the input filter config will affect all channels that select this input pin as source. Turning on the input filter(setting FILT_PER to a non-zero value) introduces a latency of (((u8Count + 3) x u8Period) + 2) IP bus clock periods.

Parameters

- base – Quad Timer peripheral base address.
- ePin – Quad Timer input pin number. See *qtmr_input_pin_t*.
- u8Count – Range is 0~7, represent the number of consecutive samples that must agree prior to the input filter accepting an input transition. Actual consecutive samples numbers is (u8Count + 3).
- u8Period – Represent the sampling period (in IP bus clock cycles) of the input pin signals. Each input is sampled multiple times at the rate specified by this field. If u8Period is 0, then the input pin filter is bypassed.

static inline uint16_t QTMR_GetInputPinValueInSecondarySource(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber)

Gets the external input signal value selected via the secondary input source.

This function read the value of the secondary input source, the input pin IPS and filtering have been applied to the read back value.

Parameters

- base – Quad Timer peripheral base address.
- eChannelNumber – Quad Timer channel number. See *qtmr_channel_number_t*.

Returns

The state of the current state of the external input pin selected via the secondary count source after application of IPS and filtering.

void QTMR_SetCountMode(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber, *qtmr_channel_count_mode_t* eCountMode)

Sets channel count mode.

This function select channel basic count mode which trigger by primary input or/and secondary input events.

Parameters

- base – Quad Timer peripheral base address.
- eChannelNumber – Quad Timer channel number. See *qtmr_channel_number_t*.
- eCountMode – The mode of operation for the count. See *qtmr_channel_count_mode_t*.

static inline void QTMR_SetCountLength(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber, *qtmr_channel_count_length_t* eLength)

Sets channel count length.

This function select channel single count length from “until roll over” or “until compare”. “until roll over” means count until 0xFFFF, “until compare” means count until reach COMP1 (for count up) or COMP2 (for count up) value (unless the output signal is in alternating compare mode, this mode make channel use COMP1 and COMP2 alternately).

Parameters

- base – Quad Timer peripheral base address.
- eChannelNumber – Quad Timer channel number. See *qtmr_channel_number_t*.
- eLength – The channel count length. See *qtmr_channel_count_length_t*.

static inline void QTMR_SetCountDirection(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber, *qtmr_channel_count_direction_t* eDirection)

Sets channel count direction.

This function select channel count direction from “count up” or “count down”. Under normal count mode, this function decide the count direction directly, when chose “secondary specifies direction” count mode, count direction decide by “the secondary input level” XOR with “the function selection”.

Parameters

- base – Quad Timer peripheral base address.
- eChannelNumber – Quad Timer channel number. See *qtmr_channel_number_t*.
- eDirection – The channel count direction. See *qtmr_channel_count_direction_t*.

static inline *qtmr_channel_count_direction_t* QTMR_GetCountDirection(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber)

Gets channel count direction.

This function read the channel count direction of the last count during quadrature encoded count mode.

Parameters

- base – Quad Timer peripheral base address.
- eChannelNumber – Quad Timer channel number. See *qtmr_channel_number_t*.

Returns

The direction of the last count. Value see *qtmr_channel_count_direction_t*.

static inline void QTMR_SetCountTimes(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber, *qtmr_channel_count_times_t* eTimes)

Sets channel count times.

This function select channel count times from “once” or “repeatedly”. If select “once” with “until compare”, channel will stop when reach COMP1 (for count up) or COMP2 (for count up) (unless the output signal is in alternating compare mode, this mode will make channel reaching COMP1, re-initializes then count reaching COMP2, and then stops).

Parameters

- base – Quad Timer peripheral base address.
- eChannelNumber – Quad Timer channel number. See *qtmr_channel_number_t*.
- eTimes – The channel count times. See *qtmr_channel_count_times_t*.

static inline void QTMR_SetCountLoadMode(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber, *qtmr_channel_count_load_mode_t* eLoadMode)

Sets channel count load mode.

This function select channel count re-initialized load mode from “normal” or “alternative”. “normal” means channel counter re-initialized from LOAD register when compare event, “alternative” means channel counter can re-initialized from LOAD (count up) or CMPLD2 (count down) when compare event.

Parameters

- base – Quad Timer peripheral base address.
- eChannelNumber – Quad Timer channel number. See *qtmr_channel_number_t*.
- eLoadMode – The channel count load mode. See *qtmr_channel_count_load_mode_t*.

static inline void QTMR_SetCompare1PreloadControl(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber, *qtmr_channel_count_preload_mode_t* ePreloadMode)

Sets channel preload mode for compare register 1.

This function select channel preload mode for compare register 1. Default the COMP1 register never preload, when enabled, the COMP1 can preload from CMPLD1 register when COMP1 or COMP2 compare event.

Parameters

- base – Quad Timer peripheral base address.
- eChannelNumber – Quad Timer channel number. See *qtmr_channel_number_t*.
- ePreloadMode – The compare register 1 preload mode. See *qtmr_channel_count_preload_mode_t*.

static inline void QTMR_SetCompare2PreloadControl(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber, *qtmr_channel_count_preload_mode_t* ePreloadMode)

Sets channel preload mode for compare register 2.

This function select channel preload mode for compare register 2. Default the COMP2 register never preload, when enabled, the COMP2 can preload from CMPLD2 register when COMP1 or COMP2 compare event.

Parameters

- base – Quad Timer peripheral base address.
- eChannelNumber – Quad Timer channel number. See *qtmr_channel_number_t*.
- ePreloadMode – The compare register 2 preload mode. See *qtmr_channel_count_preload_mode_t*.

static inline void QTMR_SetCompare1PreloadValue(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber, uint16_t u16Comp1Preload)

Sets channel compare register 1 preload register value.

This function set the CMPLD1 register value. The COMP1 can preload from CMPLD1 register when preload mode is not "never preload".

Parameters

- base – Quad Timer peripheral base address.
- eChannelNumber – Quad Timer channel number. See *qtmr_channel_number_t*.
- u16Comp1Preload – Value for Channel compare register 1 preload register.

static inline void QTMR_SetCompare2PreloadValue(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber, uint16_t u16Comp2Preload)

Sets channel compare register 2 preload register value.

This function set the CMPLD2 register value. The COMP2 can preload from CMPLD2 register when preload mode is not "never preload".

Parameters

- base – Quad Timer peripheral base address.
- eChannelNumber – Quad Timer channel number. See *qtmr_channel_number_t*.
- u16Comp2Preload – Value for Channel compare register 2 preload register.

static inline void QTMR_SetLoadValue(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber, uint16_t u16Load)

Sets channel load register value.

This function set the LOAD register value. The channel will re-initialize the counter value with this register after counter compare or overflow event.

Parameters

- base – Quad Timer peripheral base address.
- eChannelNumber – Quad Timer channel number. See *qtmr_channel_number_t*.
- u16Load – Value used to initialize the counter after counter compare or overflow event.

static inline void QTMR_SetCompare1Value(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber, uint16_t u16Comp1)

Sets channel count compare register 1.

This function set the COMP1 register value. It use to trigger compare event in count up mode or alternating compare mode.

Parameters

- base – Quad Timer peripheral base address.
- eChannelNumber – Quad Timer channel number. See *qtmr_channel_number_t*.
- u16Comp1 – Value for Channel compare register 1.

static inline void QTMR_SetCompare2Value(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber, uint16_t u16Comp2)

Sets channel count compare register 2.

This function set the COMP2 register value. It use to trigger compare event in count down mode or alternating compare mode.

Parameters

- base – Quad Timer peripheral base address.
- eChannelNumber – Quad Timer channel number. See *qtmr_channel_number_t*.
- u16Comp2 – Value for Channel compare register 2.

static inline uint16_t QTMR_ReadCaptureValue(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber)

Gets channel capture register value.

This function read the CAPT register value, which store the real-time channel counter value when input capture event.

Parameters

- base – Quad Timer peripheral base address.
- eChannelNumber – Quad Timer channel number. See *qtmr_channel_number_t*.

Returns

The value captured from the channel counter.

static inline uint16_t QTMR_GetHoldValue(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber)

Gets channel hold register value.

This function read the HOLD register value, which stores the channel counter's values of specific channels whenever any of the four channels within a module is read.

Parameters

- base – Quad Timer peripheral base address.
- eChannelNumber – Quad Timer channel number. See *qtmr_channel_number_t*.

Returns

The channel counter value when any read operation occurs.

static inline void QTMR_SetCounterValue(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber, uint16_t u16Count)

Sets channel counter register value.

This function set the CNTR register value, the channel will start counting based on this value.

Parameters

- base – Quad Timer peripheral base address.
- eChannelNumber – Quad Timer channel number. See *qtmr_channel_number_t*.
- u16Count – The channel counter initialize value.

static inline uint16_t QTMR_GetCounterValue(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber)

Reads channel counter register value.

This function read the CNTR register value, which stores the channel real-time channel counting value. This read operation will trigger HOLD register update.

Note: User can call the utility macros provided in fsl_common.h to convert ticks to usec or msec.

Parameters

- base – Quad Timer peripheral base address.
- eChannelNumber – Quad Timer channel number. See *qtmr_channel_number_t*.

Returns

The real-time channel counter value.

static inline void QTMR_SetOutputMode(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber, *qtmr_channel_output_mode_t* eOutputMode)

Sets Channel output signal (OFLAG) work mode.

This function select channel output signal (OFLAG) work mode base on different channel event.

Parameters

- base – Quad Timer peripheral base address.
- eChannelNumber – Quad Timer channel number. See *qtmr_channel_number_t*.
- eOutputMode – The mode of operation for the OFLAG output signal. See *qtmr_channel_output_mode_t*.

static inline void QTMR_SetOutputValueOnForce(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber, *qtmr_channel_output_value_on_force_t* eValue)

Sets the value of output signal when a force event occurs.

This function config the value of output signal when a force event occurs. Force events can be a software command or compare event from a master channel.

Parameters

- base – Quad Timer peripheral base address.
- eChannelNumber – Quad Timer channel number. See *qtmr_channel_number_t*.
- eValue – The value of output signal when force event occur. See *qtmr_channel_output_value_on_force_t*.

static inline void QTMR_EnableOutputInvert(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber, bool bEnable)

Enables/Disables output signal polarity invert feature.

This function enables/disables the invert feature of output signal (OFLAG).

Parameters

- base – Quad Timer peripheral base address.

- eChannelNumber – Quad Timer channel number. See *qtmr_channel_number_t*.
- bEnable – Enable the feature or not.
  - **true** Invert output signal polarity.
  - **false** No invert for output signal polarity.

static inline void QTMR_EnableSwForceOutput(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber)

Enables software triggers a FORCE command to output signal.

This function uses a software command to trigger force event, which can force the current value of SCTRL[VAL] bit to be written to the OFLAG output.

Note: This function can be called only if the counter is disabled.

```
QTMR_SetOutputValueOnForce(QTMR, kQTMR_Channel0, kQTMR_OutputValueSetOnForce);
QTMR_EnableSwForceOutput(QTMR, kQTMR_Channel0);
```

Parameters

- base – Quad Timer peripheral base address.
- eChannelNumber – Quad Timer channel number. See *qtmr_channel_number_t*.

static inline void QTMR_EnableOutputPin(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber, bool bEnable)

Enables/Disables output signal (OFLAG) drive on the external pin feature.

This function enables/disables output signal (OFLAG) drive on the external pin feature.

Parameters

- base – Quad Timer peripheral base address.
- eChannelNumber – Quad Timer channel number. See *qtmr_channel_number_t*.
- bEnable – Enable the feature or not.
  - **true** The output signal is driven on the external pin.
  - **false** The external pin is configured as an input.

static inline void QTMR_EnableMasterMode(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber, bool bEnable)

Enables/Disables channel master mode.

This function enables/disables channel master mode.

Note: Master channel can broadcast compare event to all channels within the module to re-initialize channel and/or force channel output signal.

Parameters

- base – Quad Timer peripheral base address.
- eChannelNumber – Quad Timer channel number. See *qtmr_channel_number_t*.
- bEnable – Enable the feature or not.

- **true** Enables channel master mode.
- **false** Disables channel master mode.

static inline void QTMR_EnableMasterForceOFLAG(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber, bool bEnable)

Enables/Disables force the channel output signal (OFLAG) state by master channel compare event.

This function enables/disables the compare event from master channel within the same module to force the state of this channel OFLAG output signal.

Parameters

- base – Quad Timer peripheral base address.
- eChannelNumber – Quad Timer channel number. See *qtmr_channel_number_t*.
- bEnable – Enable the feature or not.
  - **true** Enables OFLAG state to be forced by master channel compare event.
  - **false** Disables OFLAG state to be forced by master channel compare event.

static inline void QTMR_EnableMasterReInit(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber, bool bEnable)

Enables/Disables channel be re-initialized by master channel compare event feature.

This function enables/disables the compare event from master channel within the same module to force the re-initialization of this channel.

Parameters

- base – Quad Timer peripheral base address.
- eChannelNumber – Quad Timer channel number. See *qtmr_channel_number_t*.
- bEnable – Enable the feature or not.
  - **true** Enables channel be re-initialized by master channel compare event.
  - **false** Disables channel be re-initialized by master channel compare event.

static inline void QTMR_EnableDma(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber, uint16_t u16Mask)

Enables the Quad Timer DMA request according to a provided mask.

This function enables the Quad Timer DMA request according to a provided mask. The mask is a logical OR of enumerators members. See *_qtmr_channel_dma_enable*. This examples shows how to enable compare 1 register preload DMA request and compare 2 register preload DMA request.

```
QTMR_EnableDma((QTMR, kQTMR_Channel0,kQTMR_Compare1PreloadDmaEnable | kQTMR_
↪Compare2PreloadDmaEnable);
```

Parameters

- base – Quad Timer peripheral base address.
- eChannelNumber – Quad Timer channel number. See *qtmr_channel_number_t*.

- u16Mask – The QTMR DMA requests to enable. Logical OR of *_qtmr_channel_dma_enable*.

static inline void QTMR_DisableDma(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber, uint16_t u16Mask)

Disables the Quad Timer DMA request according to a provided mask.

This function disables the Quad Timer DMA request according to a provided mask. The mask is a logical OR of enumerators members. See *_qtmr_channel_dma_enable*. This examples shows how to disable compare 1 register preload DMA request and compare 2 register preload DMA request.

```
QTMR_DisableDma((QTMR, kQTMR_Channel0, kQTMR_Compare1PreloadDmaEnable | kQTMR_
↪Compare2PreloadDmaEnable);
```

Parameters

- base – Quad Timer peripheral base address.
- eChannelNumber – Quad Timer channel number. See *qtmr_channel_number_t*.
- u16Mask – The QTMR DMA requests to disable. Logical OR of *_qtmr_channel_dma_enable*.

static inline void QTMR_EnableInterrupts(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber, uint16_t u16Mask)

Enables the Quad Timer interrupts according to a provided mask.

This function enables the Quad Timer interrupts according to a provided mask. The mask is a logical OR of enumerators members. See *_qtmr_channel_interrupt_enable*. This examples shows how to enable compare 1 interrupt and compare 2 interrupt.

```
QTMR_EnableInterrupts((QTMR, kQTMR_Channel0, kQTMR_Compare1InterruptEnable |␣
↪kQTMR_Compare2InterruptEnable);
```

Parameters

- base – Quad Timer peripheral base address.
- eChannelNumber – Quad Timer channel number. See *qtmr_channel_number_t*.
- u16Mask – The QTMR DMA interrupts to enable. Logical OR of *_qtmr_channel_interrupt_enable*.

static inline void QTMR_DisableInterrupts(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber, uint16_t u16Mask)

Disables the Quad Timer interrupts according to a provided mask.

This function disables the Quad Timer interrupts according to a provided mask. The mask is a logical OR of enumerators members. See *_qtmr_channel_interrupt_enable*. This examples shows how to disable compare 1 interrupt and compare 2 interrupt.

```
QTMR_DisableInterrupts((QTMR, kQTMR_Channel0, kQTMR_Compare1InterruptEnable |␣
↪kQTMR_Compare2InterruptEnable);
```

Parameters

- base – Quad Timer peripheral base address.
- eChannelNumber – Quad Timer channel number. See *qtmr_channel_number_t*.

- u16Mask – The QTMR DMA interrupts to disable. Logical OR of *_qtmr_channel_interrupt_enable*.

static inline uint16_t QTMR_GetStatusFlags(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber)

Gets the Quad Timer status flags.

This function gets all QTMR channel status flags. The flags are returned as the logical OR value of the enumerators *_qtmr_channel_status_flags*. To check for a specific status, compare the return value with enumerators in the *_qtmr_channel_status_flags*. For example, to check whether the compare flag set.

```
if((QTMR_GetStatusFlags(QTMR, kQTMR_Channel0) & kQTMR_CompareFlag) != 0U)
{
    ...
}
```

Parameters

- base – Quad Timer peripheral base address.
- eChannelNumber – Quad Timer channel number. See *qtmr_channel_number_t*.

Returns

The QTMR status flags which is the logical OR of the enumerators *_qtmr_channel_status_flags*.

static inline void QTMR_ClearStatusFlags(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber, uint16_t u16Mask)

Clears the Quad Timer status flags.

This function clears QTMR channel status flags with a provide mask. The mask is a logical OR of enumerators *_qtmr_channel_status_flags*. This examples shows how to clear compare 1 flag and compare 2 flag.

```
QTMR_ClearStatusFlags((QTMR, kQTMR_Channel0, kQTMR_Compare1Flag | kQTMR_
↪Compare2Flag);
```

Parameters

- base – Quad Timer peripheral base address
- eChannelNumber – Quad Timer channel number. See *qtmr_channel_number_t*
- u16Mask – The QTMR status flags to clear. Logical OR of *_qtmr_channel_status_flags*

static inline void QTMR_SetDebugActions(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber, *qtmr_channel_debug_action_t* eDebugMode)

Sets channel debug actions.

This function selects the certain actions which will perform when the chip entering debug mode.

Parameters

- base – Quad Timer peripheral base address.
- eChannelNumber – Quad Timer channel number. See *qtmr_channel_number_t*.

- eDebugMode – The Quad Timer channel actions in response to the chip entering debug mode. See *qtmr_channel_debug_action_t*.

static inline void QTMR_EnableChannels(TMR_Type *base, uint16_t u16Mask)

Enables the Quad Timer channels according to a provided mask.

This function enables the Quad Timer channels according to a provided mask. The mask is a logical OR of enumerators *_qtmr_channel_enable*. This examples shows how to enable channel 0 and channel 1.

```
QTMR_EnableChannels(QTMR, kQTMR_Channel0Enable | kQTMR_Channel1Enable);
```

Note: If one channel has effective count mode, it will start its counter as soon as the channel be enabled.

Parameters

- base – Quad Timer peripheral base address.
- u16Mask – The QTMR channels to enable. Logical OR of *_qtmr_channel_enable*.

static inline void QTMR_DisableChannels(TMR_Type *base, uint16_t u16Mask)

Disables the Quad Timer channels according to a provided mask.

This function disables the Quad Timer channels according to a provided mask. The mask is a logical OR of enumerators *_qtmr_channel_enable*. This examples shows how to disable channel 0 and channel 1.

```
QTMR_DisableChannels(QTMR, kQTMR_Channel0Enable | kQTMR_Channel1Enable);
```

Parameters

- base – Quad Timer peripheral base address.
- u16Mask – The QTMR channels to enable. Logical OR of *_qtmr_channel_enable*.

static inline uint32_t TMR_GetCaptureRegAddr(TMR_Type *base, *qtmr_channel_number_t* nChannel)

Gets the TMR capture register address. This API is used to provide the transfer address for TMR capture transfer.

Parameters

- base – TMR base pointer
- nChannel – Quad Timer channel number. See *qtmr_channel_number_t*.

Returns

capture register address

FSL_QTMR_DRIVER_VERSION

QTMR driver version.

enum _qtmr_input_pin

The enumeration for Quad Timer module input pin source.

Values:

enumerator kQTMR_InputPin0
Quad Timer input pin 0.

enumerator kQTMR_InputPin1
Quad Timer input pin 1.

enumerator kQTMR_InputPin2
Quad Timer input pin 2.

enumerator kQTMR_InputPin3
Quad Timer input pin 3.

enum _qtmr_channel_number
The enumeration for Quad Timer module channel number.
Values:

enumerator kQTMR_Channel0
Quad Timer Channel 0.

enumerator kQTMR_Channel1
Quad Timer Channel 1.

enumerator kQTMR_Channel2
Quad Timer Channel 2.

enumerator kQTMR_Channel3
Quad Timer Channel 3.

enum _qtmr_channel_primary_count_source
The enumeration for Quad Timer channel primary input source.
Values:

enumerator kQTMR_PrimarySrcInputPin0
Quad Timer input pin 0.

enumerator kQTMR_PrimarySrcInputPin1
Quad Timer input pin 1.

enumerator kQTMR_PrimarySrcInputPin2
Quad Timer input pin 2.

enumerator kQTMR_PrimarySrcInputPin3
Quad Timer input pin 3.

enumerator kQTMR_PrimarySrcChannel0Output
Quad Timer channel 0 output.

enumerator kQTMR_PrimarySrcChannel1Output
Quad Timer channel 1 output.

enumerator kQTMR_PrimarySrcChannel2Output
Quad Timer channel 2 output.

enumerator kQTMR_PrimarySrcChannel3Output
Quad Timer channel 3 output.

enumerator kQTMR_PrimarySrcIPBusClockDivide1
IP bus clock divide by 1.

enumerator kQTMR_PrimarySrcIPBusClockDivide2
IP bus clock divide by 2.

enumerator kQTMR_PrimarySrcIPBusClockDivide4
IP bus clock divide by 4.

enumerator kQTMR_PrimarySrcIPBusClockDivide8
IP bus clock divide by 8.

enumerator kQTMR_PrimarySrcIPBusClockDivide16
IP bus clock divide by 16.

enumerator kQTMR_PrimarySrcIPBusClockDivide32
IP bus clock divide by 32.

enumerator kQTMR_PrimarySrcIPBusClockDivide64
IP bus clock divide by 64.

enumerator kQTMR_PrimarySrcIPBusClockDivide128
IP bus clock divide by 128.

enum _qtmr_channel_secondary_count_source
The enumeration for Quad Timer channel secondary input source.
Values:

enumerator kQTMR_SecondarySrcInputPin0
Quad Timer input pin 0.

enumerator kQTMR_SecondarySrcInputPin1
Quad Timer input pin 1.

enumerator kQTMR_SecondarySrcInputPin2
Quad Timer input pin 2.

enumerator kQTMR_SecondarySrcInputPin3
Quad Timer input pin 3.

enum _qtmr_channel_secondary_source_capture_mode

The enumeration for Quad Timer channel secondary input source capture mode.

Values:

enumerator kQTMR_SecondarySrcCaptureNoCapture

Secondary source capture is disabled.

enumerator kQTMR_SecondarySrcCaptureRisingEdge

Secondary source capture on rising edge.

enumerator kQTMR_SecondarySrcCaptureFallingEdge

Secondary source capture on falling edge.

enumerator kQTMR_SecondarySrcCaptureRisingAndFallingEdge

Secondary source capture on both edges.

enumerator kQTMR_SecondarySrcCaptureRisingEdgeWithReload

Secondary source capture on rising edge while cause the channel to be reloaded.

enumerator kQTMR_SecondarySrcCaptureFallingEdgeWithReload

Secondary source capture on falling edge while cause the channel to be reloaded.

enumerator kQTMR_SecondarySrcCaptureRisingAndFallingEdgeWithReload

Secondary source capture on both edges while cause the channel to be reloaded.

enum _qtmr_channel_count_mode

The enumeration for Quad Timer channel count mode.

When “channel output 0~3” or “IP bus clock prescaler” is chosen, active edge is the rising edge. When “input pin 0~3” is chosen, active edge and active level is determined by input invert feature (IPS). Disable input invert feature means active edge is rising edge, active level is high level, enable input invert feature means active edge is falling edge, active level is low level.

Values:

enumerator kQTMR_CountNoOperation

No operation.

enumerator kQTMR_CountPrimarySrcRiseEdge

Count active edge of primary input source.

enumerator kQTMR_CountPrimarySrcRiseAndFallEdge

Count rising and falling edges of primary input source.

enumerator kQTMR_CountPrimarySrcRiseEdgeSecondarySrcInHigh

Count active edge of primary input source when secondary input is at a active level.

enumerator kQTMR_CountPrimarySecondarySrcInQuadDecode

Quadrature count mode, uses primary and secondary sources.

enumerator kQTMR_CountPrimarySrcRiseEdgeSecondarySrcDir

Count active edge of primary input source; secondary input source specifies count direction.

enumerator kQTMR_CountPrimarySrcRiseEdgeSecondarySrcRiseEdgeTrig

The active edge of secondary input source triggers count active edge of primary input source, and the channel counter will stop upon receiving a second trigger event while it's still counting from the first trigger event.

enumerator kQTMR_CountCascadeWithOtherChannel

Cascaded count mode, the channel will count as compare events occur in the selected source chennel (use a special high-speed signal path rather than the OFLAG output signal). The active edge of secondary input source triggers count active edge of primary input source, and the channel counter will re-initialized upon receiving a second trigger event while it's still counting from the first trigger event.

enumerator kQTMR_CountPrimarySrcRiseEdgeSecondarySrcRiseEdgeTrigWithReInit

enum _qtmr_channel_count_length

The enumeration for Quad Timer channel count length.

Values:

enumerator kQTMR_CountLengthUntilRollOver

Count until roll over at $FFFF.

enumerator kQTMR_CountLengthUntilCompare

Count until compare.

enum _qtmr_channel_count_direction

The enumeration for Quad Timer channel count direction.

Values:

enumerator kQTMR_CountDirectionUp

Count direction up.

enumerator kQTMR_CountDirectionDown

Count direction down.

enum _qtmr_channel_count_times

The enumeration for Quad Timer channel count times.

Values:

enumerator kQTMR_CountTimesRepeat

Count repeatedly.

enumerator kQTMR_CountTimesOnce

Count time once.

enum _qtmr_channel_count_load_mode

The enumeration for Quad Timer channel count load mode.

Values:

enumerator kQTMR_CountLoadNormal

Count can be re-initialized only with the LOAD register when match event occurs.

enumerator kQTMR_CountLoadAlternative

Channel can be re-initialized with the LOAD register when count up and a match with COMP1 occurs, or with CMPLD2 register when count down and a match with COMP2 occurs.

enum _qtmr_channel_count_preload_mode

The enumeration for Quad Timer channel COMP1 & COMP2 preload mode.

Values:

enumerator kQTMR_CountPreloadNoLoad

Not load CMPLDn into COMPn register when compare event occurs.

enumerator kQTMR_CountPreloadOnComp1CompareEvent

Load CMPLDn register into COMPn when occurs a successful comparison of channel counter value and the COMP1 register.

enumerator kQTMR_CountPreloadOnComp2CompareEvent

Load CMPLDn register into COMPn when occurs a successful comparison of channel counter value and the COMP2 register.

enum _qtmr_channel_output_mode

The enumeration for Quad Timer channel output signal (OFLAG signal) work mode.

Values:

enumerator kQTMR_OutputAssertWhenCountActive

OFLAG output assert while counter is active.

enumerator kQTMR_OutputClearOnCompare

OFLAG output clear on successful compare.

enumerator kQTMR_OutputSetOnCompare

OFLAG output set on successful compare.

enumerator kQTMR_OutputToggleOnCompare

OFLAG output toggle on successful compare.

enumerator kQTMR_OutputToggleOnAltCompareReg

OFLAG output toggle using alternating compare registers.

enumerator kQTMR_OutputSetOnComareClearOnSecSrcActiveEdge

OFLAG output set on compare, clear on secondary source input edge.

enumerator kQTMR_OutputSetOnCompareClearOnCountRoll

OFLAG output set on compare, clear on counter rollover.

enumerator kQTMR_OutputGateClockOutWhenCountActive

OFLAG output gated while count is active.

enum _qtmr_qtmr_channel_output_value_on_force

The enumeration for Quad Timer channel output signal (OFLAG) value on force event occur.

Values:

enumerator kQTMR_OutputValueClearOnForce

OFLAG output clear (low) when software triggers a FORCE command or master channel force the OFLAG (EEOF need set).

enumerator kQTMR_OutputValueSetOnForce

OFLAG output set (high) when software triggers a FORCE command or master channel force the OFLAG (EEOF need set).

enum _qtmr_channel_debug_action

The enumeration for Quad Timer channel run options when the chip entering debug mode.

Values:

enumerator kQTMR_DebugRunNormal

Continue with normal operation.

enumerator kQTMR_DebugHaltCounter

Halt counter.

enumerator kQTMR_DebugForceOutToZero

Force output to logic 0.

enumerator kQTMR_DebugHaltCountForceOutZero

Halt counter and force output to logic 0.

enum _qtmr_channel_interrupt_enable

The enumeration for Quad Timer channel interrupts.

Values:

enumerator kQTMR_CompareInterruptEnable

Compare interrupt.

enumerator kQTMR_Compare1InterruptEnable

Compare 1 interrupt.

enumerator kQTMR_Compare2InterruptEnable

Compare 2 interrupt.

enumerator kQTMR_OverflowInterruptEnable
Timer overflow interrupt.

enumerator kQTMR_EdgeInterruptEnable
Input edge interrupt.

enumerator kQTMR_ALLInterruptEnable

enum _qtmr_channel_status_flags
The enumeration for Quad Timer channel work status.
Values:

enumerator kQTMR_CompareFlag
Compare flag.

enumerator kQTMR_Compare1Flag
Compare 1 flag.

enumerator kQTMR_Compare2Flag
Compare 2 flag.

enumerator kQTMR_OverflowFlag
Timer overflow flag.

enumerator kQTMR_EdgeFlag
Input edge flag.

enumerator kQTMR_StatusAllFlags

enum _qtmr_channel_enable
The enumeration for Quad Timer channel enable.
Values:

enumerator kQTMR_Channel0Enable
Channel 0 enable.

enumerator kQTMR_Channel1Enable
Channel 1 enable.

enumerator kQTMR_Channel2Enable
Channel 2 enable.

enumerator kQTMR_Channel3Enable
Channel 3 enable.

enumerator kQTMR_ALLChannelEnable

enum _qtmr_channel_dma_enable

The enumeration for Quad Timer channel DMA trigger source.

Values:

enumerator kQTMR_InputEdgeFlagDmaEnable

Input edge flag setting will trigger DMA read request for CAPT register.

enumerator kQTMR_Compare1PreloadDmaEnable

Channel load CMPLD1 register into COMP1 will trigger DMA write request for CMPLD1.

enumerator kQTMR_Compare2PreloadDmaEnable

Channel load CMPLD2 register into COMP2 will trigger DMA write request for CMPLD2.

enumerator kQTMR_AllDMAEnable

typedef enum *_qtmr_input_pin* qtmr_input_pin_t

The enumeration for Quad Timer module input pin source.

typedef enum *_qtmr_channel_number* qtmr_channel_number_t

The enumeration for Quad Timer module channel number.

typedef enum *_qtmr_channel_primary_count_source* qtmr_channel_primary_count_source_t

The enumeration for Quad Timer channel primary input source.

typedef enum *_qtmr_channel_secondary_count_source* qtmr_channel_secondary_count_source_t

The enumeration for Quad Timer channel secondary input source.

typedef enum *_qtmr_channel_secondary_source_capture_mode* qtmr_channel_secondary_source_capture_mode_t

The enumeration for Quad Timer channel secondary input source capture mode.

typedef enum *_qtmr_channel_count_mode* qtmr_channel_count_mode_t

The enumeration for Quad Timer channel count mode.

When “channel output 0~3” or “IP bus clock prescaler” is chosen, active edge is the rising edge. When “input pin 0~3” is chosen, active edge and active level is determined by input invert feature (IPS). Disable input invert feature means active edge is rising edge, active level is high level, enable input invert feature means active edge is falling edge, active level is low level.

typedef enum *_qtmr_channel_count_length* qtmr_channel_count_length_t

The enumeration for Quad Timer channel count length.

typedef enum *_qtmr_channel_count_direction* qtmr_channel_count_direction_t

The enumeration for Quad Timer channel count direction.

typedef enum *_qtmr_channel_count_times* qtmr_channel_count_times_t

The enumeration for Quad Timer channel count times.

typedef enum *_qtmr_channel_count_load_mode* qtmr_channel_count_load_mode_t

The enumeration for Quad Timer channel count load mode.

typedef enum *_qtmr_channel_count_preload_mode* qtmr_channel_count_preload_mode_t

The enumeration for Quad Timer channel COMP1 & COMP2 preload mode.

typedef enum *_qtmr_channel_output_mode* qtmr_channel_output_mode_t

The enumeration for Quad Timer channel output signal (OFLAG signal) work mode.

typedef enum *_qtmr_qtmr_channel_output_value_on_force* qtmr_channel_output_value_on_force_t

The enumeration for Quad Timer channel output signal (OFLAG) value on force event occur.

typedef enum *_qtmr_channel_debug_action* qtmr_channel_debug_action_t

The enumeration for Quad Timer channel run options when the chip entering debug mode.

typedef struct *_qtmr_channel_input_config* qtmr_channel_input_config_t

The structure for configuring Quad Timer channel input signal.

typedef struct *_qtmr_channel_count_config* qtmr_channel_count_config_t

The structure for configuring Quad Timer channel counting behaviors.

typedef struct *_qtmr_channel_output_config* qtmr_channel_output_config_t

The structure for configuring Quad Timer channel output signal (OFLAG).

typedef struct *_qtmr_channel_cooperation_config* qtmr_channel_cooperation_config_t

The structure for configuring Quad Timer channel cooperation mode with other channels.

typedef struct *_qtmr_channel_config* qtmr_channel_config_t

Quad Timer channel configuration covering all channel configurable fields.

typedef struct *_qtmr_input_pin_filter_config* qtmr_input_pin_filter_config_t

The structure for configuring Quad Timer module input pin filter.

typedef struct *_qtmr_config* qtmr_config_t

Quad Timer module configuration which contain channel config structure pointers and input pin filter config structure pointers.

Note: Need use channel structure address to init the structure pointers, when the channel or input pin structure pointers is NULL, it will be ignored by QTMR_Init API. This can save stack space when only one or two channels are used.

---

struct qtmr_channel_input_config

#include <fsl_qtmr.h> The structure for configuring Quad Timer channel input signal.

Public Members

qtmr_channel_primary_count_source_t ePrimarySource

Specify the primary input source.

qtmr_channel_secondary_count_source_t eSecondarySource

Specify the secondary input source.

bool bEnableSecondarySrcFaultFunction

true: The selected secondary input acts as a fault signal which can clear the channel output signal when it is set, false: Fault function disabled.

bool eEnableInputInvert

true: Invert input signal value when select input pin as primary or/and secondary input source false: no operation.

struct __qtmr_channel_count_config

#include <fsl_qtmr.h> The structure for configuring Quad Timer channel counting behaviors.

Public Members

qtmr_channel_count_mode_t eCountMode

Configures channel count mode.

qtmr_channel_count_length_t eCountLength

Configures channel count length.

qtmr_channel_count_direction_t eCountDir

Configures channel count direction.

qtmr_channel_count_times_t eCountTimes

Configures channel count times.

qtmr_channel_count_load_mode_t eCountLoadMode

Configures channel count load mode.

struct __qtmr_channel_output_config

#include <fsl_qtmr.h> The structure for configuring Quad Timer channel output signal (OFLAG).

Public Members

qtmr_channel_output_mode_t eOutputMode

Configures channel output signal work mode.

qtmr_channel_output_value_on_force_t eOutputValueOnForce

The value of output signal when force event occur.

bool bEnableOutputInvert

True: the polarity of output signal will be inverted, false: The output signal is not inverted.

bool bEnableSwForceOutput

True: forces the current value of eOFLAGValueOnForce to output signal. false: no operation.

bool bEnableOutputPin

True: the output signal is driven on the external pin. false: the external pin is configured as an input.

struct _qtmr_channel_cooperation_config

#include <fsl_qtmr.h> The structure for configuring Quad Timer channel cooperation mode with other channels.

Public Members

bool bEnableMasterReInit

true: Master channel within the module can re-initialize this channel when it has a compare event, false: no operation.

bool bEnableMasterForceOFLAG

true: Master channel within the module can force this channel OFLAG signal when it has a compare event, false: no operation.

bool bEnableMasterMode

true: This channel is configured as mater channel, it can broadcast compare event to all channels within the module to re-initialize channel and/or force channel output signal, false: no operation.

struct _qtmr_channel_config

#include <fsl_qtmr.h> Quad Timer channel configuration covering all channel configurable fields.

Public Members

qtmr_channel_input_config_t sInputConfig

Configures channel input signal.

qtmr_channel_count_config_t sCountConfig

Configures channel count work mode.

qtmr_channel_output_config_t sOutputConfig

Configures channel output signal (OFLAG) work mode.

qtmr_channel_debug_action_t eDebugMode

Configures channel operation in chip debug mode.

uint16_t u16EnabledInterruptMask

The mask of the interrupts to be enabled, should be the OR'ed of *_qtmr_channel_interrupt_enable*.

uint16_t u16EnabledDMAMask

The mask of the interrupts to be enabled, should be the OR'ed of *_qtmr_channel_dma_enable*.

uint16_t u16Comp1

Value for Channel compare register 1.

uint16_t u16Comp2

Value for Channel compare register 2.

uint16_t u16Comp1Preload

Value for Channel compare 1 preload register.

uint16_t u16Comp2Preload

Value for Channel compare 2 preload register.

uint16_t u16Load

Value for Channel load register.

uint16_t u16Count

Value for Channel counter value register.

bool bEnableChannel

True: enable the channel prescaler (if it is being used) and counter false: disable channel.

struct __qtmr__input__pin__filter__config

#include <fsl_qtmr.h> The structure for configuring Quad Timer module input pin filter.

Public Members

uint8_t u8Period

Value for input filter sample period.

uint8_t u8Count

Value for input filter sample count (sample count = count +3).

struct __qtmr__config

#include <fsl_qtmr.h> Quad Timer module configuration which contain channel config structure pointers and input pin filter config structure pointers.

Note: Need use channel structure address to init the structure pointers, when the channel or input pin structure pointers is NULL, it will be ignored by QTMR_Init API. This can save stack space when only one or two channels are used.

2.73 The Driver Change Log

2.74 QTMR Peripheral and Driver Overview

2.75 The Driver Change Log

2.76 SIM: System Integration Module Driver

FSL_SIM_DRIVER_VERSION

SIM driver version.

2.77 The Driver Change Log

static inline void SIM_SetWaitModeOperation(SIM_Type *base, *sim_wait_mode_operation_t* eOperation)

Sets the operation of wait mode, enable/disable the entry of wait mode.

Parameters

- base – SIM peripheral base address.
- eOperation – Used to enable/disable the wait mode, please refer to *sim_wait_mode_operation_t*.

static inline void SIM_SetStopModeOperation(SIM_Type *base, *sim_stop_mode_operation_t* eOperation)

Sets the operation of stop mode, enable/disable the entry of stop mode.

Parameters

- base – SIM peripheral base address.
- eOperation – Used to enable/disable the stop mode, please refer to *sim_stop_mode_operation_t*.

static inline void SIM_EnterLPMode(SIM_Type *base)

Enters into LPMode when the advanced power mode is enabled(register FOPT[1] bit is set).

Note: Please make sure the power mode register is not set as write protected before invoking this function.

Note: This function is useful only when the FTFE module's FOPT[0] bit is set(advanced power mode is enabled).

Parameters

- base – SIM peripheral base address.

static inline void SIM_ExitLPMode(SIM_Type *base)

Exits from LPMode when the advanced power mode is enabled(register FOPT[1] bit is set).

Note: Please make sure the power mode register is not set as write protected before invoking this function.

Note: This function is useful only when the FTFE module's FOPT[0] bit is set(advanced power mode is enabled).

Parameters

- base – SIM peripheral base address.

static inline void SIM_EnterVLPMode(SIM_Type *base)

Enters into VLPMode when the advanced power mode is enabled(register FOPT[1] bit is set).

Note: Please make sure the power mode register is not set as write protected before invoking this function. If both set to enter LPMode and VLPMode, the VLPMode has higher priority.

Note: This function is useful only when the FTFE module's FOPT[0] bit is set(advanced power mode is enabled).

Parameters

- base – SIM peripheral base address.

static inline void SIM_ExitVLPMode(SIM_Type *base)

Exits from VLPMode when the advanced power mode is enabled(register FOPT[1] bit is set).

Note: Please make sure the power mode register is not set as write protected before invoking this function.

Note: This function is useful only when the FTFE module's FOPT[0] bit is set(advanced power mode is enabled).

Parameters

- base – SIM peripheral base address.

static inline bool SIM_IsInLPMode(SIM_Type *base)

Indicates whether the chip is in LPMode when the advanced power mode is enabled(register FOPT[1] bit is set).

Note: This function is useful only when the FTFE module's FOPT[0] bit is set(advanced power mode is enabled).

Parameters

- base – SIM peripheral base address.

Return values

- true – The chip is in LPMode.
- false – The chip is not in LPMode.

static inline bool SIM_IsInVLPMode(SIM_Type *base)

Indicates whether the chip is in VLPMode when the advanced power mode is enabled(register FOPT[1] bit is set).

Note: This function is useful only when the FTFE module's FOPT[0] bit is set(advanced power mode is enabled).

Parameters

- base – SIM peripheral base address.

Return values

- true – The chip is in VLPMode.
- false – The chip is not in VLPMode.

static inline void SIM_TriggerSoftwareReset(SIM_Type *base)

Triggers the software reset for device.

Parameters

- base – SIM base address.

static inline uint16_t SIM_GetResetStatusFlags(SIM_Type *base)

Gets the cause of the most recent reset.

Note: At any given time, the only one reset source is indicated. When multiple reset source assert simultaneously, the reset source with the highest precedence is indicated. The precedence from highest to lowest is POR, external reset, COP loss of reference reset, COP CPU time-out reset, software reset, COP window time-out reset. The POR is always set during a power-on reset. However, POR is cleared and the external reset is set if the external reset pin is asserted or remains asserted after the power-on reset has de-asserted.

Parameters

- base – SIM peripheral base address.

Returns

The current reset status flags, should be the OR'ed value of *_sim_reset_status_flags*.

static inline void SIM_TriggerPeripheralSoftwareReset(SIM_Type *base,
sim_swReset_peri_index_t ePeriIndex)

Triggers the software reset of specific peripheral.

Parameters

- base – SIM peripheral base address.
- ePeriIndex – The index of the peripheral to be reset.

static inline void SIM_EnableResetPadCellInputFilter(SIM_Type *base, bool bEnable)

Enables/Disables the input filter on external reset padcell.

If the input filter is enabled, the filter will remove transient signals on the input at the expense of an increased input delay.

Note: If the input filter is enabled, the filter will affect all input functions supported by that padcell, including GPIO.

Parameters

- base – SIM peripheral base address.
- bEnable – Used to control the behaviour of input filter.
  - **true** Enable the input filter on external input padcell.
  - **false** Disable the input filter on external input padcell.

static inline void SIM_SetInternalPeriInput(SIM_Type *base, sim_internal_peri_index_t eIndex, sim_internal_peri_input_t eInput)

Sets internal peripheral inputs, some peripheral inputs have the ability to be connected to either XBAR outputs or GPIO.

Parameters

- base – SIM base address.
- eIndex – The internal peripherals that supply multi-inputs.
- eInput – The specific input that connected to the selected internal peripheral.

static inline void SIM_SetXbarInputAdcTmrSelection(SIM_Type *base, sim_xbar_input_adc_tmr_index_t eIndex, sim_xbar_input_adc_tmr_selection_t eSelection)

Selects the Xbar input from ADC and TMR A/B.

Parameters

- base – SIM base address.
- eIndex – SIM ADC and TMR select register field index.
- eSelection – Xbar input ADC and TMR selection.

static inline void SIM_SetSmallRegulator1P2VControlMode(SIM_Type *base, *sim_small_regulator_1P2V_control_mode_t* eControlMode)

Sets the control mode of small regulator 1.2V supply, the available control modes are normal mode, standby mode, etc.

Note: This function is useful only when the flash module's FOPT[0] bit is 0.

Parameters

- base – SIM peripheral base address.
- eControlMode – The control mode to be set, please refer to *sim_small_regulator_1P2V_control_mode_t*.

static inline void SIM_SetSmallRegulator2P7VControlMode(SIM_Type *base, *sim_small_regulator_2P7V_control_mode_t* eControlMode)

Sets the control mode of small regulator 2.7 supply, the available control modes are normal mode, standby mode, etc.

Note: This function is useful only when the flash module's FOPT[0] bit is 0.

Parameters

- base – SIM peripheral base address.
- eControlMode – THe control mode to be set, please refer to *sim_small_regulator_2P7V_control_mode_t*.

static inline void SIM_SetLargeRegulatorControlMode(SIM_Type *base, *sim_large_regulator_control_mode_t* eControlMode)

Sets the control mode of large regulator, the available control mode are normal mode, standby mode, etc.

Note: This function is useful only when the flash module's FOPT[0] bit is 0.

Parameters

- base – SIM peripheral base address.
- eControlMode – The control mode to be set, please refer to *sim_large_regulator_control_mode_t*.

static inline void SIM_SetRegisterProtectionMode(SIM_Type *base, *sim_write_protection_module_t* eModule, *sim_write_protection_mode_t* eMode)

Sets the write protection mode of the selected register.

Parameters

- base – SIM peripheral base address.
- eModule – The module to be set, please refer to *sim_write_protection_module_t*.
- eMode – The specific write protection mode to be set, please refer to *sim_write_protection_mode_t*.

static inline uint32_t SIM_GetJTAGID(SIM_Type *base)

Gets JTAG ID, the JTAG ID is 32bits width.

Parameters

- base – SIM base address.

Returns

The 32bits width JTAG ID.

static inline void SIM_SetIOShortAddressValue(SIM_Type *base, uint32_t u32IOShortAddressValue)

Sets the I/O short address location value which specifies the memory referenced through the I/O short address mode.

The I/O short address mode allows the instrution to specify the lower 6 bits of the address. And the upper 18 bits of the address can be controlled by invoking this function.

Note: The pipeline delay between setting the related register set and using short I/O addrssing with the new value is five cycles.

Parameters

- base – SIM base address.
- u32IOShortAddressValue – The value of I/O short address location, this address value should be 24 bits width.

static inline uint16_t SIM_GetSoftwareControlData(SIM_Type *base, sim_software_contrl_register_index_t eIndex)

Gets the software control data by the software control register index.

Parameters

- base – SIM base address.
- eIndex – SIM software control register index.

Returns

Software control registers value.

static inline void SIM_SetSoftwareControlData(SIM_Type *base, sim_software_contrl_register_index_t eIndex, uint16_t u16Value)

Sets the software control data by the software contorl register index, the data is for general-purpose use by software.

Parameters

- base – SIM base address.
- eIndex – SIM software control register index.
- u16Value – Software control registers value.

static inline void SIM_SetOnCEClockOperationMode(SIM_Type *base, *sim_onceclk_operation_mode_t* eOperationMode)

Sets the operation mode of the OnCE clock, the available operation modes are always enabled and enabled when the core TAP is enabled.

Parameters

- base – SIM peripheral base address.
- eOperationMode – The operation mode of OnCE clock, please refer to *sim_onceclk_operation_mode_t*.

static inline void SIM_SetDMAOperationMode(SIM_Type *base, *sim_dma_operation_mode_t* eOperationMode)

Sets the operation mode of DMA, such as disabled, enabled in run mode only, etc.

Parameters

- base – SIM peripheral base address.
- eOperationMode – The operation mode to be set, please refer to *sim_dma_operation_mode_t*.

static inline *sim_boot_mode_t* SIM_GetBootMode(SIM_Type *base)

Gets the device's boot mode, the available boot modes are ROM boot and NVM flash boot.

Parameters

- base – SIM peripheral base address.

Returns

The device's boot mode, please refer to *sim_boot_mode_t*.

static inline void SIM_SetLPI2C1TriggerSelection(SIM_Type *base, *sim_lpi2c_trigger_selection_t* eTriggerSelection)

Sets the trigger selection of lpi2c1, the available selections are master trigger and slave trigger.

This function can be used to selection the LPI2C1 output trigger. If selected as master trigger, the LPI2C1 master will generate an output trigger that can be connected to other peripherals on the device. If selected as slave trigger, the LPI2C1 slave will generate an output trigger that can be connected to other peripherals on the device.

Parameters

- base – SIM peripheral base address.
- eTriggerSelection – The trigger selection to set, please refer to *sim_lpi2c_trigger_selection_t*.

static inline void SIM_SetLPI2C0TriggerSelection(SIM_Type *base, *sim_lpi2c_trigger_selection_t* eTriggerSelection)

Sets the trigger selection of lpi2c0, the available selections are master trigger and slave trigger.

This function can be used to selection the LPI2C0 output trigger. If selected as master trigger, the LPI2C0 master will generate an output trigger that can be connected to other peripherals on the device. If selected as slave trigger, the LPI2C0 slave will generate an output trigger that can be connected to other peripherals on the device.

Parameters

- base – SIM peripheral base address.
- eTriggerSelection – The trigger selection to set, please refer to *sim_lpi2c_trigger_selection_t*.

static inline *sim_device_operate_mode_t* SIM_GetDeviceOperateMode(SIM_Type *base)

Gets device currently operate mode, the possible result is normal operate mode or fast operate mode.

Parameters

- base – SIM peripheral base address.

Returns

Current device's operate mode.

static inline void SIM_SetDeviceOperateMode(SIM_Type *base, *sim_device_operate_mode_t* eOperateMode)

Sets device operate mode, including normal operate mode and fast operate mode.

Note: The setting by invoking this function is valid after executing the software reset. To change the device operation mode, the clock-related settings also need to be changed. Please use this API with caution.

Parameters

- base – SIM peripheral base address.
- eOperateMode – The operate mode to be set, please refer to *sim_device_operate_mode_t*.

static inline void SIM_EnableADCScanControlReorder(SIM_Type *base, bool bEnable)

Enables/Disables the ADC scan control register reorder feature.

Parameters

- base – SIM peripheral base address.
- bEnable – Used to control the ADC scan control register reorder feature.
  - **true** Enable the re-ordering of ADC scan control bits.
  - **false** ADC scan control register works in normal order.

static inline void SIM_SetMasterPIT(SIM_Type *base, *sim_master_pit_selection_t* eMasterPit)

Sets master programmable interval timer.

Parameters

- base – SIM peripheral base address.
- eMasterPit – The master PIT to be selected, please refer to *sim_master_pit_selection_t*.

static inline void SIM_SetBootOverRide(SIM_Type *base, sim_boot_override_mode_t eMode)

Sets the boot over ride mode, this API can be used to determine the boot option in the next reset excluding POR.

Parameters

- base – SIM peripheral base address.
- eMode – THe boot over ride mode.

static inline void SIM_ReadDeviceUID(SIM_Type *base, uint16_t *pDevUID)

Reads device UID.

Parameters

- base – SIM peripheral base address.
- pDevUID – The pointer of external data buffer for device UID.

enum _sim_reset_status_flags

The enumeration of system reset status flags, such as power on reset, software reset, etc.

Values:

enumerator kSIM_PowerONResetFlag

The Power on reset caused the most recent reset.

enumerator kSIM_ExternalResetFlag

The external reset caused the most recent reset, that means the external reset pin was asserted or remained asserted after the power-on reset de-asserted.

enumerator kSIM_COPLossOfReferenceResetFlag

The computer operating properly module signaled a PLL loss of reference clock reset caused the most recent reset.

enumerator kSIM_COPCPUTimeOutResetFlag

The computer operating properly module signaled a CPU time-out reset caused the most recent reset.

enumerator kSIM_SofwareResetFlag

The previous system reset occurred as a result of a software reset

enumerator kSIM_COPWindowTimeOutResetFlag

The previous system reset occurred as a result of a cop_window reset.

enum _sim_stop_mode_operation

The enumeration of stop mode operation can be used to enable/disable stop mode enter.

Values:

enumerator kSIM_STOPInstrutionEnterStopMode

Stop mode is entered when the DSC core executes a STOP instruction.

enumerator kSIM_STOPInstrutionNotEnterStopMode

The DSC core STOP instruction does not cause entry into stop mode.

enumerator kSIM_STOPInstrutionEnterStopModeWriteProtect

Stop mode is entered when the DSC core executes a STOP instruction, and the realted register bit field is write protected until the next reset.

enumerator kSIM_STOPInstructionNotEnterStopModeWriteProtect

The DSC core STOP instruction does not cause entry into stop mode, and the related register bit field is write protected until the next reset.

enum _sim_wait_mode_operation

The enumeration of wait mode operation can be used to enable/disable wait mode enter.

Values:

enumerator kSIM_WAITInstrutionEnterWaitMode

Wait mode is entered when the DSC core executes a WAIT instruction.

enumerator kSIM_WAITInstrutionNotEnterWaitMode

The DSC core WAIT instruction does not cause entry into wait mode.

enumerator kSIM_WAITInstrutionEnterWaitModeWriteProtect

Wait mode is entered when the DSC core executes a WAIT instruction, and the realted register bit field is write protected until the next reset.

enumerator kSIM_WAITInstructionNotEnterWaitModeWriteProtect

The DSC core WAIT instruction does not cause entry into wait mode, and the related register bit field is write protected until the next reset.

enum _sim_onceclk_operation_mode

The enumeration of OnCE clock operation mode, such as enabled when core TAP is enabled and always enabled.

Values:

enumerator kSIM_OnCEClkEnabledWhenCoreTapEnabled

The OnCE clock to the DSC core is enabled when the core TAP is enabled.

enumerator kSIM_OnCEClkAlwaysEnabled

The OnCE clock to the DSC core is always enabled.

enum _sim_dma_operation_mode

The enumeration of dma operation mode, this enumeration can be used to disable/enable DMA module in different power modes.

Values:

enumerator kSIM_DMADisable

DMA module is disabled.

enumerator kSIM_DMAEnableAtRunModeOnly

DMA module is enabled in run mode only.

enumerator kSIM_DMAEnableAtRunModeWaitMode

DMA module is enabled in run and wait modes only.

enumerator kSIM_DMAEnableAtAllPowerModes

DMA module is enabled in all power modes.

enumerator kSIM_DMADisableWriteProtect

DMA module is disabled and the related register bit field is write protected until the next reset.

enumerator kSIM_DMAEnableAtRunModeOnlyWriteProtect

DMA module is enabled in run mode only and the related bit field is write protected until the next reset.

enumerator kSIM_DMAEnableAtRunModeWaitModeWriteProtect

DMA module is enabled in run and wait modes only and the related register bit field is write protected until the next reset.

enumerator kSIM_DMAEnableAtAllPowerModesWriteProtect

DMA module is enabled in all low power modes and the related register bit field is write protected until the next reset.

enum _sim_boot_mode

The enumeration of device's boot mode, including ROM boot and NVM flash boot.

Values:

enumerator kSIM_BootFromNVMFlash

Indicates the chip is boot from NVM Flash.

enumerator kSIM_BootFromROM

Indicates the chip is boot from ROM.

enum _sim_small_regulator_1P2V_control_mode

The enumeration of small regualtor 1P2V control mode, such as normal mode and standby mode.

Values:

enumerator kSIM_SmallRegulator1P2VInNormalMode

Small regulator 1.2V supply placed in normal mode.

enumerator kSIM_SmallRegulator1P2VInStandbyMode

Small regulator 1.2V supply placed in standby mode.

enumerator kSIM_SmallRegulator1P2VInNormalModeWriteProtect

Small regulator 1.2V supply placed in nomal mode, and the related register bit field is write protected until the next reset.

enumerator kSIM_SmallRegulator1P2VInStandbyModeWriteProtect

Small regulator 1.2V supply placed in standby mode, and the related register bit field is write protected until the next reset.

enum _sim_small_regulator_2P7V_control_mode

The enumeration of small regulator 2P7V control mode, such as normal mode, standby mode, powerdown mode, etc.

Values:

enumerator kSIM_SmallRegulator2P7VInNormalMode

Small regulator 2.7V supply placed in normal mode.

enumerator kSIM_SmallRegulator2P7VInStandbyMode

Small regulator 2.7V supply placed in standby mode.

enumerator kSIM_SmallRegulator2P7VInPowerdownMode

Small regulator 2.7V supply placed in powerdown mode.

enumerator kSIM_SmallRegulator2P7VInNormalModeWriteProtect

Small regulator 2.7V supply placed in normal mode and the related bit field is write protected until chip reset.

enumerator kSIM_SmallRegulator2P7VInStandbyModeWriteProtect

Small regulator 2.7V supply placed in standby mode and the related bit field is write protected until chip reset.

enumerator kSIM_SmallRegulator2P7VInPowerdownModeWriteProtect

Small regulator placed in powerdown mode and the related bit field is write protected until chip reset.

enum _sim_large_regulator_control_mode

The enumeration of large regulator contorl mode, such as normal mode, standby mode.

Values:

enumerator kSIM_LargeRegulatorInNormalMode

Large regulator placed in normal mode.

enumerator kSIM_LargeRegulatorInStandbyMode

Large regulator placed in standby mode.

enumerator kSIM_LargeRegulatorInNormalModeWriteProtect

Large regulator placed in normal mode, and the related register bit field is write protected until chip reset.

enumerator kSIM_LargeRegulatorInStandbyModeWriteProtect

Large regulator placed in standby mode, and the related register bit field is write protected until chip reset.

enum _sim_write_protection_module

The enumeration of modules that support various protection mode.

Values:

enumerator kSIM_GPIOInternalPeripheralSelectProtection

Used to control the protection mode GPSn and IPSn registers in the SIM, all XBAR, EVTG, GPIOn_PER, GPIOn_PPMODE, GPIOn_DRIVE.

enumerator kSIM_PeripheralClockEnableProtection

Used to control the protection mode of PCEn, SDn, PSWRn, and PCR register.

enumerator kSIM_GPIOPortDProtection

Used to control the protection mode of GPIO_D_PER, GPIO_D_PPMODE, and GPIO_D_DRIVE register.

enumerator kSIM_PowerModeControlWriteProtection

Used to control the protection mode of the PWRMODE register.

enum _sim_write_protection_mode

The enumeration of write protection mode, such as write protection off, write protection on, etc.

Values:

enumerator kSIM_WriteProtectionOff

Write protection off.

enumerator kSIM_WriteProtectionOn

Write protection on.

enumerator kSIM_WriteProtectionOffAndLocked

Write protection off and locked until chip reset.

enumerator kSIM_WriteProtectionOnAndLocked

Write protection on and locked until chip reset.

enum _sim_lpi2c_trigger_selection

The enumeration of lpi2c trigger selection, including slave trigger and master trigger.

Values:

enumerator kSIM_Lpi2cSlaveTrigger

Selects slave trigger.

enumerator kSIM_Lpi2cMasterTrigger

Selects master trigger.

enum _sim_device_operate_mode

The enumeration of device operate mode, including normal mode and fast mode.

Values:

enumerator kSIM_NormalOperateMode

Device in normal operating mode, core:bus frequency as 1:1

enumerator kSIM_FastOperateMode

Device in fast operate mode, core:bus frequency as 2:1

enum _sim_master_pit_selection

The enumeration of master pit.

Values:

enumerator kSIM_PIT0MasterPIT1Slave

PIT0 is master PIT and PIT1 is slave PIT.

enumerator kSIM_PIT1MasterPIT0Slave

PIT0 is master PIT and PIT1 is slave PIT.

typedef enum *_sim_stop_mode_operation* sim_stop_mode_operation_t

The enumeration of stop mode operation can be used to enable/disable stop mode enter.

typedef enum *_sim_wait_mode_operation* sim_wait_mode_operation_t

The enumeration of wait mode operation can be used to enable/disable wait mode enter.

typedef enum *_sim_onceclk_operation_mode* sim_onceclk_operation_mode_t

The enumeration of OnCE clock operation mode, such as enabled when core TAP is enabled and always enabled.

typedef enum *_sim_dma_operation_mode* sim_dma_operation_mode_t

The enumeration of dma operation mode, this enumeration can be used to disable/enable DMA module in different power modes.

typedef enum *_sim_boot_mode* sim_boot_mode_t

The enumeration of device's boot mode, including ROM boot and NVM flash boot.

typedef enum *_sim_small_regulator_1P2V_control_mode*
sim_small_regulator_1P2V_control_mode_t

The enumeration of small regualtor 1P2V control mode, such as normal mode and standby mode.

typedef enum *_sim_small_regulator_2P7V_control_mode*
sim_small_regulator_2P7V_control_mode_t

The enumeration of small regulator 2P7V control mode, such as normal mode, standby mode, powerdown mode, etc.

typedef enum *_sim_large_regulator_control_mode* sim_large_regulator_control_mode_t

The enumeration of large regulator contorl mode, such as normal mode, standby mode.

typedef enum *_sim_write_protection_module* sim_write_protection_module_t

The enumeration of modules that support various protection mode.

typedef enum *_sim_write_protection_mode* sim_write_protection_mode_t

The enumeration of write protection mode, such as write protection off, write protection on, etc.

typedef enum *_sim_lpi2c_trigger_selection* sim_lpi2c_trigger_selection_t

The enumeration of lpi2c trigger selection, including slave trigger and master trigger.

typedef enum *_sim_device_operate_mode* sim_device_operate_mode_t

The enumeration of device operate mode, including normal mode and fast mode.

typedef enum *_sim_master_pit_selection* sim_master_pit_selection_t

The enumeration of master pit.

FSL_COMPONENT_ID

SIM_RESET_STATUS_MASK

The macro of REST status bit field mask.

SIM_PWR_SR27_CONTROL_MODE_MASK

The definition of the short regulator control mode bit field mask.

SIM_PWR_SR27_CONTROL_MODE_SHIFT

The definition of the short regulator control mode bit field shift.

SIM_PWR_SR27_CONTROL_MODE(x)

The macro that can be used to set the bit field of PWR register's short regulator bit field.

SIM_PROT_BIT_FIELD_MASK(moduleName)

The definition of the PORT register bit filed mask.

SIM_PORT_SET_MODE_PROTECTION_MODE(moduleName, protectionMode)

The macro that can be used to set module's protection mode.

2.78 SIM Peripheral and Driver Overview

2.79 XBAR: Inter-Peripheral Crossbar Switch Driver

void XBARA_Init(XBARA_Type *base)

Initializes the XBARA module.

This function un-gates the XBARA clock.

Parameters

- base – XBARA peripheral address.

void XBARA_Deinit(XBARA_Type *base)

Shuts down the XBARA module.

This function disables XBARA clock.

Parameters

- base – XBARA peripheral address.

static inline void XBARA_SetSignalsConnection(XBARA_Type *base, xbar_input_signal_t eInput, xbar_output_signal_t eOutput)

Sets a connection between the selected XBARA_IN[*] input and the XBARA_OUT[*] output signal.

This function connects the XBARA input to the selected XBARA output. If more than one XBARA module is available, only the inputs and outputs from the same module can be connected.

Example:

```
XBARA_SetSignalsConnection(XBARA, kXBARA_InputPIT_TRG0, kXBARA_
↪OutputDMAMUX18);
```

Parameters

- base – XBARA peripheral address.
- eInput – XBARA input signal.
- eOutput – XBARA output signal.

static inline void XBARA_SetActiveEdgeDetectMode(XBARA_Type *base, xbar_output_signal_t eOutput, *xbara_active_edge_t* eActiveEdgeMode)

Sets active edge detection mode for the XBARA_OUT[*] output signal.

Parameters

- base – XBARA peripheral address.
- eOutput – XBARA output signal.
- eActiveEdgeMode – Active edge mode.

static inline void XBARA_SetInterruptDMARequestMode(XBARA_Type *base, xbar_output_signal_t eOutput, *xbara_request_t* eRequest)

Sets DMA, Interrupt or disabled request generation mode for the XBARA_OUT[*] output signal.

Parameters

- base – XBARA peripheral address.
- eOutput – XBARA output signal.
- eRequest – Request type.

void XBARA_SetOutputSignalConfig(XBARA_Type *base, xbar_output_signal_t eOutput, const *xbara_control_config_t* *psControlConfig)

Configures the XBARA output signal edge detection and interrupt/dma featues.

This function configures an XBARA control register. The active edge detection and the DMA/IRQ function on the corresponding XBARA output can be set.

Example:

```
xbara_control_config_t userConfig;
userConfig.activeEdge = kXBARA_EdgeRising;
userConfig.requestType = kXBARA_RequestInterruptEnable;
XBARA_SetOutputSignalConfig(XBARA, kXBARA_OutputDMAMUX18, &userConfig);
```

Note: Only a subset of the XBARA output signal can be called with this API. On debug mode code will check whether the output signal eOutput satisfy the requirement.

Parameters

- base – XBARA peripheral address.
- eOutput – XBARA output number.
- psControlConfig – Pointer to structure that keeps configuration of control register.

uint16_t XBARA_GetStatusFlags(XBARA_Type *base)

Gets the active edge detection status for all XBAR output signal supporting this feature.

This function gets the active edge detect status of all XBARA_OUTs. If the active edge occurs, the return value is asserted. When the interrupt or the DMA functionality is enabled for the XBARA_OUTx, this field is 1 when the interrupt or DMA request is asserted and 0 when the interrupt or DMA request has been cleared.

Parameters

- base – XBARA peripheral address.

Returns

ORed value from all status flag from *xbara_status_flag_t*.

static inline void XBARA_ClearStatusFlags(XBARA_Type *base, uint16_t u16Flags)

Clear the edge detection status flags of relative mask.

Parameters

- base – XBARA peripheral address.
- u16Flags – status flags composed from ORed *xbara_status_flag_t* indicating flags to be cleared.

FSL_XBAR_DRIVER_VERSION

XBAR driver version.

enum _xbara_active_edge

XBARA active edge for detection.

Values:

enumerator kXBARA_EdgeNone

Edge detection status bit never asserts.

enumerator kXBARA_EdgeRising

Edge detection status bit asserts on rising edges.

enumerator kXBARA_EdgeFalling

Edge detection status bit asserts on falling edges.

enumerator kXBARA_EdgeRisingAndFalling

Edge detection status bit asserts on rising and falling edges.

enum _xbara_request

XBARA DMA and interrupt configurations. Note it only apply for a subset of XBARA output signal.

Values:

enumerator kXBARA_RequestDisable

Interrupt and DMA are disabled.

enumerator kXBARA_RequestDMAEnable

DMA enabled, interrupt disabled.

enumerator kXBARA_RequestInterruptEnable

Interrupt enabled, DMA disabled.

enum _xbara_status_flag

XBARA status flags.

This provides constants for the XBARA status flags for use in the XBARA functions. The enumerator value is designed to make sure Flags in same register can be created with register value to write/read register.

Values:

enumerator kXBARA_EdgeDetectionOut0Flag

XBAR_OUT0 active edge interrupt flag, sets when active edge detected.

enumerator kXBARA_EdgeDetectionOut1Flag

XBAR_OUT1 active edge interrupt flag, sets when active edge detected.

enumerator kXBARA_EdgeDetectionOut2Flag

XBAR_OUT2 active edge interrupt flag, sets when active edge detected.

enumerator kXBARA_EdgeDetectionOut3Flag

XBAR_OUT3 active edge interrupt flag, sets when active edge detected.

enumerator kXBARA_AllStatusFlags

typedef enum *_xbara_active_edge* xbara_active_edge_t

XBARA active edge for detection.

typedef enum *_xbara_request* xbara_request_t

XBARA DMA and interrupt configurations. Note it only apply for a subset of XBARA output signal.

typedef enum *_xbara_status_flag* xbara_status_flag_t

XBARA status flags.

This provides constants for the XBARA status flags for use in the XBARA functions. The enumerator value is designed to make sure Flags in same register can be created with register value to write/read register.

typedef struct *_xbara_control_config* xbara_control_config_t

Defines the configuration structure of the XBARA control register.

This structure keeps the configuration of XBARA control register for one output. Control registers are available only for a few outputs. Not every XBARA module has control registers.

XBARA_SELx(base, output)

Macro function to extract the XBAR select register address for a given xbar output signal.

XBARA_CTRLx(base, output)

Macro function to extract the XBAR Ctrl register address for a given xbar output signal.

XBARA_SELx_SELn_SHIFT(output)

Macro function to get SELn field shift in XBARA_SELx register for a given output signal.

XBARA_SELx_SELn_MASK(output)

Macro function to get SELn field mask in XBARA_SELx register for a given output signal.

XBARA_SELx_SELn(output, input_signal)

Macro function to create SELn field value in XBARA_SELx register for given output signal and input signal value input_signal, see xbar_input_signal_t.

XBARA_CTRLx_DIENn_MASK(output)

Macro function to get DIENn field mask in XBARA_CTRLx register for a given output signal.

XBARA_CTRLx_DIENn_SHIFT(output)

Macro function to get DIENn field shift in XBARA_CTRLx register for a given output signal.

XBARA_CTRLx_DIENn(output, x)

Macro function to create DIENn field value in XBARA_CTRLx register for given output signal and DMA/Interrupt mode x, see *xbara_request_t*.

XBARA_CTRLx_EDGEn_MASK(output)

Macro function to get EDGEn field mask in XBARA_CTRLx register for a given output signal.

XBARA_CTRLx_EDGEn_SHIFT(output)

Macro function to get EDGEn field shift in XBARA_CTRLx register for a given output signal.

XBARA_CTRLx_EDGEn(output, x)

Macro function to create EDGEn field value in XBARA_CTRLx register for given output signal and edge mode x, see *xbara_active_edge_t*.

XBARA_CTRLx_STS_MASK

Macro value for the Status bits in CTRL register.

struct _xbara_control_config

#include <fsl_xbara.h> Defines the configuration structure of the XBARA control register.

This structure keeps the configuration of XBARA control register for one output. Control registers are available only for a few outputs. Not every XBARA module has control registers.

Public Members

xbara_active_edge_t eActiveEdge

Active edge to be detected.

xbara_request_t eRequestType

Selects DMA/Interrupt request.

2.80 The Driver Change Log

2.81 XBAR Peripheral and Driver Overview

Chapter 3

Middleware

3.1 Multicore SDK

Multicore Software Development Kit (MCSDK) provides comprehensive software support for NXP multicore devices. The MCSDK is combined with the MCUXpresso SDK to form a framework for easy development of multicore applications.

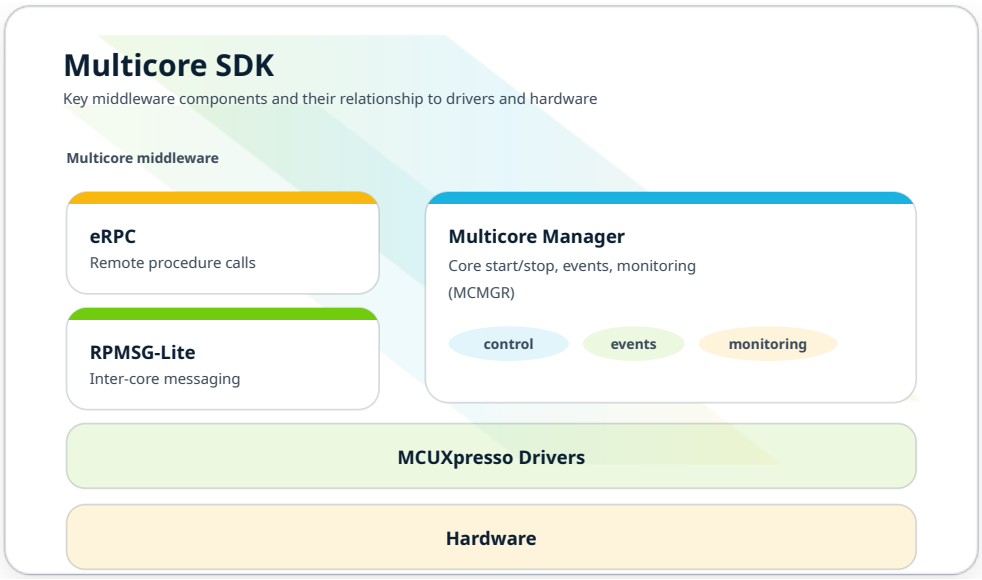

Fig. 1: Multicore SDK software stack (simplified).

3.1.1 Quick links

- *Release Notes*
- *Getting Started*
- Multicore SDK Changelog

3.1.2 Components

Component	Description
RPMSG-Lite	Lightweight implementation of the Remote Processor Messaging (RPMsg) protocol for inter-core messaging.
Multicore Manager	Services for multicore systems (core start/stop, events, and monitoring).
eRPC	Embedded RPC system suitable for multicore and multiprocessor designs.

MCSDK Release Notes

MCSDK Getting Started

RPMSG-Lite

Quick links

- Changelog
- API documentation (Doxygen): https://nxp-mcuxpresso.github.io/rpmsg-lite/

Multicore Manager (MCMGR)

Quick links

- Changelog
- API documentation (Doxygen): https://nxp-mcuxpresso.github.io/mcux-mcmgr/

eRPC

eRPC (Embedded RPC) is an open-source remote procedure call (RPC) system suitable for multicore and multiprocessor embedded systems.

Quick links

- *Getting Started*
- Changelog
- Upstream project: https://github.com/EmbeddedRPC/erpc

eRPC Getting Started

Chapter 4

RTOS

4.1 FreeRTOS

4.1.1 FreeRTOS kernel

Open source RTOS kernel for small devices.

FreeRTOS kernel for MCUXpresso SDK Readme

FreeRTOS kernel for MCUXpresso SDK ChangeLog

FreeRTOS kernel Readme

4.1.2 FreeRTOS drivers

This is set of NXP provided FreeRTOS reentrant bus drivers.

4.1.3 backoffalgorithm

Algorithm for calculating exponential backoff with jitter for network retry attempts.

Readme

4.1.4 corehttp

C language HTTP client library designed for embedded platforms.

4.1.5 corejson

JSON parser.

Readme

4.1.6 coremqtt

MQTT publish/subscribe messaging library.

4.1.7 corepkcs11

PKCS #11 key management library.

Readme

4.1.8 freertos-plus-tcp

Open source RTOS FreeRTOS Plus TCP.

Readme

Chapter 5

Downloads

This page is generated automatically by the “downloads_index“ Sphinx extension.
4 downloadable file(s) referenced across 3 page(s), grouped into 2 categories:

5.1 boards

- mcuxsdk-mc56f81000evk.pdf — from *boards/DSC/mc56f81000evk/index*

5.2 develop

- evkbmimxrt1170_custom (.zip) — from develop/sdk/custom_board_development
- frdmmcxa346_custom (.zip) — from develop/sdk/custom_board_development
- example (.zip) — from develop/sdk/integration

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