GSMCUXCTUG

User Guide for MCUXpresso Config Tools (Desktop)

Rev. 18.0 — 17 September 2026 **User guide**

Document information

Information	Content
Keywords	MCUXpresso Config Tools
Abstract	MCUXpresso Configuration Tools set is a suite of evaluation and configuration tools that help you from initial evaluation to production software development.

1 Introduction

The MCUXpresso Config Tools set is a suite of evaluation and configuration tools that help you from initial evaluation to production software development. The following tools are included:

1.1 Table MCUXpresso Config Tools

Table 1. MCUXpresso Config Tools

Name	Description
Pins Tool	Enables you to configure the pins of a device. Pins tool enables you to create, inspect, change, and modify any aspect of the pin configuration and muxing of the device.
Clocks Tool	Enables you to configure initialization of the system clock (core, system, bus, and peripheral clocks) and generates the C code with clock initialization functions and configuration structures.
Peripherals Tool	Enables you to configure the initialization for the MCUXpresso SDK drivers.
PLU (Programmable Logic Unit) Tool	Extension for Peripherals tool that configures the PLU peripheral with a simple graphical workflow.
Device Configuration Tool	Enables you to generate a Device Configuration Data (DCD) image using the format and constrains specified in the boot ROM reference manual.
TEE (Trusted Execution Environment) Tool	Enables you to configure the security policies of memory areas, bus masters, and peripherals, to isolate and safeguard sensitive areas of your application.

1.2 Versions

The suite of these tools is called MCUXpresso Config Tools. These tools are provided as an online web application oras a desktop application or as an integrated version in the MCUXpresso IDE.

Note: The desktop version of the tool contacts the NXP server and fetches the list of the available processors. Once used, the processor data is retrieved on demand.

Tip: To use the desktop tool in the offline mode, create a configuration for the given processor while online. The tool then stores the processors locally in the user folder and enables faster access and offline use. Otherwise, it is possible to download and export the data using the **Export** menu.

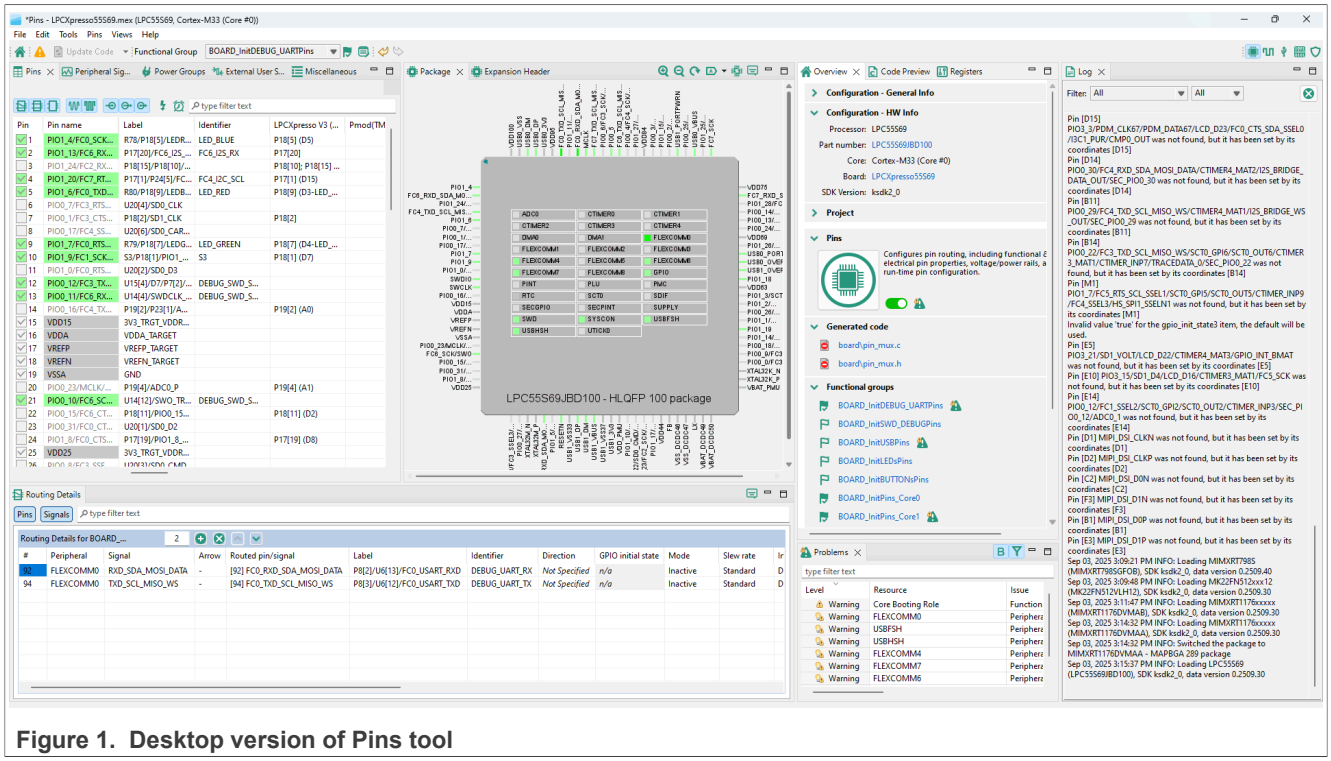


Figure 1. Desktop version of Pins tool

1.3 Tools localization

MCUXpresso Config Tools are available in English and Simplified Chinese only.

The locale of MCUXpresso Config Tools automatically copies the global settings of your computer.

To set the locale manually, add the following parameter to the command line:

```
tools.exe -nl zh
```

You can also set the locale in the tools.ini file by adding the following line:

```
-Duser.language=zh
```

Note: Setting your system locale to Chinese automatically launches the tool with localized Chinese menu items, tool tips, and help. You may need to delete the *[home_dir]/.nxp* folder after switching languages because some menu items may be cached.

2 User interface

This chapter provides a detailed description of the user interface.

2.1 Start development wizard

Upon starting MCUXpresso Config Tools, you are automatically welcomed by a startup wizard. With this wizard, you can create a configuration or open an existing one.

Note: To skip the wizard on subsequent startups, select the **Always open last configuration** checkbox below the **Open an existing configuration** option. You can also perform the same action by selecting the **Automatically open previously used configuration** checkbox in **Preferences**.

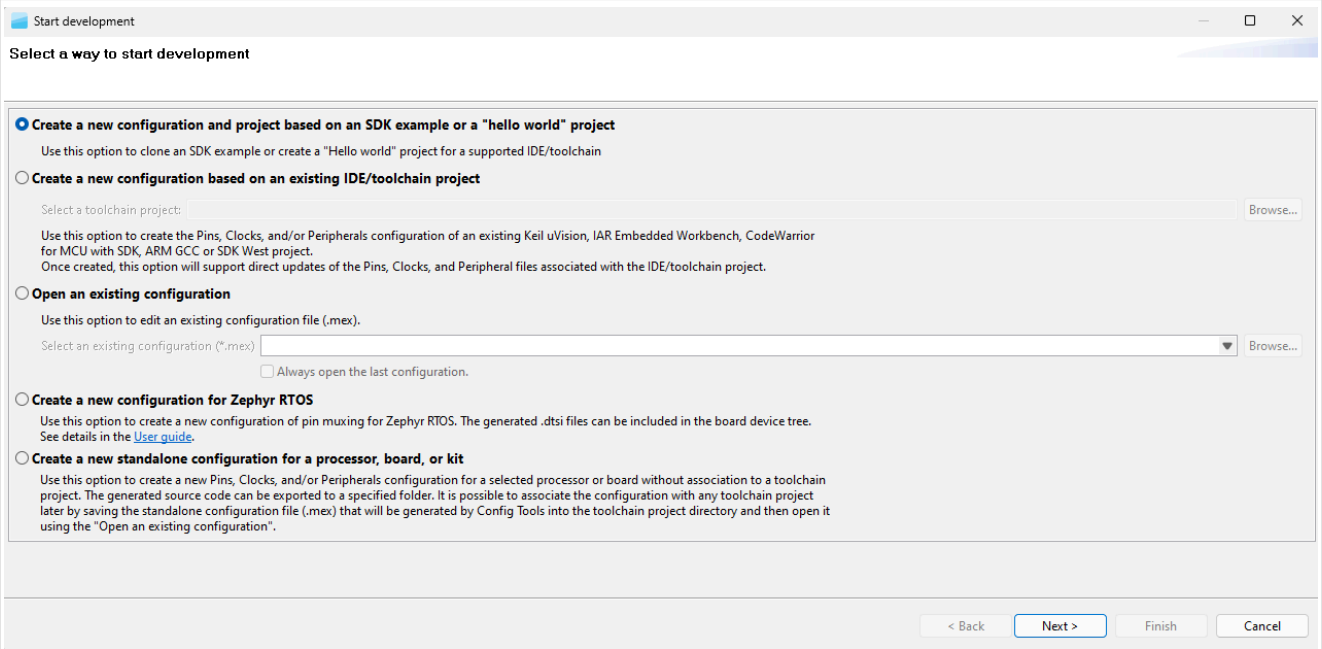


Figure 2. Start development wizard

Note: The content of this wizard is similar to the wizard that you open by selecting **File > New** in the **Menu bar**.

2.2 Creating, saving, and opening a configuration

In this context, configuration stands for common tools settings stored in an MEX (Microcontrollers Export Configuration)file. This file contains the settings of all available tools and can be used in both web and desktop versions.

The folder with the saved MEX file must contain exactly one project file to parse the toolchain project. The file type depends on the toolchain of the project and can be one of the following:

2.2.1 Table Supported toolchain project files

Table 2. Supported toolchain project files

Toolchain	Project file
MCUXpresso for VS Code/SDK West	project_info.json
IAR Embedded Workbench	EWP
Keil MDK uVision	UVPROJX
Arm GCC	CMakeLists.txt
CodeWarrior with SDK	.cproject
Open-CMSIS csolution	*.cbuild-gen-idx.yml

See also MCUXpresso SDK Distribution Formats.

2.2.2 Creating a new configuration

You can create a configuration from the **Start development** wizard or by selecting **File > New** from the **Menu bar**.

There are several options for creating a new configuration:

- Create a new configuration and project based on SDK example - Use this option to clone an SDK example or create a “Hello world” project.
- Create a new configuration based on existing toolchain project - Use this option to create configuration of an existing toolchain project.
- Create a new configuration for Zephyr RTOS - Use this option to create a new configuration of pin muxing for Zephyr RTOS.
- Create a new standalone configuration for a processor, board or kit - Use this option to create a new configuration for selected processor or board without association to a toolchain project.

If you start development for an NXP board or kit, we recommend starting by creating a configuration based on an MCUXpresso SDK example or by creating a new standalone configuration for a board or kit. Such configurations contain board-specific settings. If you select a new standalone configuration for a processor, the configuration will be empty.

After creating the new configuration, you can import an existing configuration from an MEX file. This is useful if you already have a configuration available or want to reuse a previous one. To import, select **File > Import… > Import configuration (*.mex)** from the **Menu bar**.

2.2.2.1 Cloning an SDK example

You can create a configuration by cloning an SDK example project for IAR Embedded Workbench, Keil µVision, CodeWarrior Development Studio, and/or Arm GCC Embedded (command line). The resulting project contains all source files and libraries to build the project and can be easily customized, shared, or put under a control version system.

Note: The creation (cloning) of the projects based on the SDK examples will no longer be supported in the future releases of the MCUXpresso Config Tools. Instead, use the MCUXpresso SDK command line tools and west build system. For detailed documentation, see the MCUXpresso SDK Command Line Development documentation.

SDK example cloning is supported for MCUXpresso SDK 2.2 and higher.

Note: To clone an SDK example or create a “hello_world” project, you must first download an SDK package. For more information about SDK packages offered by NXP Semiconductors, refer to the MCUXpresso Software Development Kit.

Note: If the server is unavailable, and device data is not cached, creating the project fails.

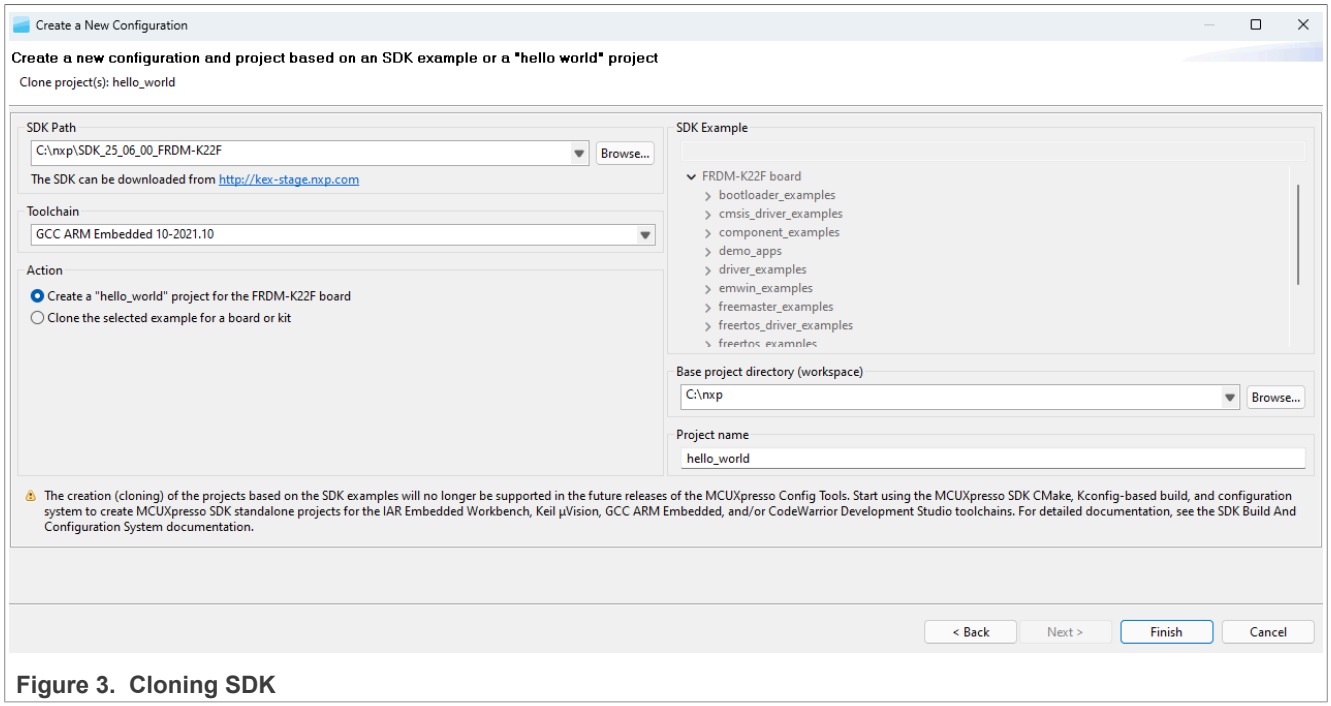


Figure 3. Cloning SDK

To clone an SDK example, do the following:

1. In the **Start development** wizard, select **Create a new configuration based on an SDK example or a "hello world" project**. Alternatively, in the **Menu bar**, select **File > New**.
2. Click **Next**.
3. Specify the path to your locally saved SDK package.
4. Choose the toolchain that you want to create the project for.
5. Choose the SDK example that you want to clone.
6. Specify a base project directory to save your project to.
7. Specify the project name.
8. Click **Finish**.

You can also create a basic, minimally customized "hello_world" project without having to select an SDK example from the package. To create a "hello_world" project, do the following:

1. In the **Start development** wizard, select **Create a new configuration based on an SDK example or a "hello world" project**. Alternatively, in the **Menu bar**, select **File > New**.
2. Click **Next**.
3. Specify the path to your locally saved SDK package.
4. Choose the toolchain that you want to create the project for.
5. Select **Create "hello_world"**.
6. Specify a base project directory to save your project to.
7. Specify the project name.
8. Click **Finish**.

The Config Tools Overview window shows the details of the configuration and supported tools. Select a tool by clicking its icon.

2.2.2.2 Creating a new toolchain configuration

You can create a configuration for an existing toolchain project. After you create the configuration, the associated project configuration files are updated directly.

MCUXpresso Config Tools currently supports the following toolchains:

- MCUXpresso for VS Code/SDK West
- IAR Embedded Workbench
- Keil MDK uVision
- Arm GCC
- CodeWarrior with SDK

Note: For proper functionality of Config Tools, the toolchain project must originate from the SDK package downloaded from MCUXpresso SDK Builder, be created using the cloning feature of Config Tools, or be created using MCUXpresso for VS Code and MCUXpresso SDK GitHub.

To create a configuration based on an existing IDE/Toolchain project, do the following:

1. In the **Start development** wizard, select the **Create a new configuration based on an existing IDE/Toolchain project**. Alternatively, in the **Menu bar**, select **File > New**.
2. Click **Browse**.
3. Select the project file and confirm by clicking **OK**.
4. Click **Finish**.

2.2.2.3 Creating a new configuration for SDK West

For Arm GCC or MCUXpresso for VS Code toolchains, you can create a configuration for a new format of MCUXpresso SDK that uses the SDK West tool.

If you are using **MCUXpresso for Visual Studio Code**, you can open Config Tools from there via the context menu for the project. This also opens or creates a new configuration if it does not exist. See Working with MCUXpresso Config Tools for detailed guidelines. Otherwise, handle the SDK project manually using 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 creates the project information JSON file that Config Tools searches when creating the configuration. The parameters of the command should match the build parameters that will be used for the project.
2. In the **Start development** wizard, select **Create a new configuration** based on the existing IDE/Toolchain project, and select the created “cfg_tools” subfolder as a project folder (for example: …`mcuxsdk/examples/demo_apps/hello_world/cfg_tools/`).

2.2.2.4 Creating a new configuration for Zephyr RTOS

You can create a configuration that generates a .dtsi file with pin control that you can include in the board device tree. Only processors and boards are offered.

After the configuration, move the generated file to the proper location in your Zephyr board, application folder, or repository. Consult Zephyr RTOS documentation for the appropriate placement and usage of the Pin Control file.

In the context of Zephyr RTOS, only the Pins tool is supported, and it allows pin routing and configuration.

You can create a configuration that generates a .dtsi file with pin control that can be included in the board device tree. Only processors and boards compatible with the Zephyr (https://www.nxp.com/zephyr) will be offered as the SDK version.

1. In the **Start development** wizard, select **Create a new standalone configuration for Zephyr RTOS**. Alternatively, in the **Menu bar**, select **File > New**.
2. Click **Next**.
3. Select the processor, board, or kit from the list. **Note:** When working offline, only locally stored options will be available. For further details, refer to the Working Offline section.
4. Name your configuration. Optionally, select the processor package, core, and SDK version.
5. Click **Finish**.

2.2.2.4.1 Using the generated files

There are some additional manual steps needed to integrate the generated files:

1. After the configuration, write the files to disk using the **Update Code** command or via the **Export** command.
2. Move the generated device tree (`.dtsi`) file to the proper location in your Zephyr board, application folder, or repository. If you have custom hardware, create a custom board in Zephyr RTOS rather than modifying standard board files shared by many projects. See Zephyr RTOS documentation for details on pin control and custom board creation. **Note:** Alternatively, you can leverage the content of the `.dtsi` file to create a device tree overlay file for your application.
3. If the project uses features that Zephyr RTOS does not support, the Pins tool provides `pin_mux.c/h` files. Add `pin_mux.c/h` to your `cmake` file so they are part of the build, and call the generated functions in your code.

2.2.2.4.2 Limitations

The pin configuration and routing cannot be restored from the generated `.dtsi` file because there is no import functionality for this format. Keep the original `.mex` file for further regeneration of the file(s).

2.2.2.5 Creating a new standalone configuration

You can create a configuration that is not part of any toolchain project.

You can later include this configuration in a project by saving the configuration (MEX) file in the toolchain project folder.

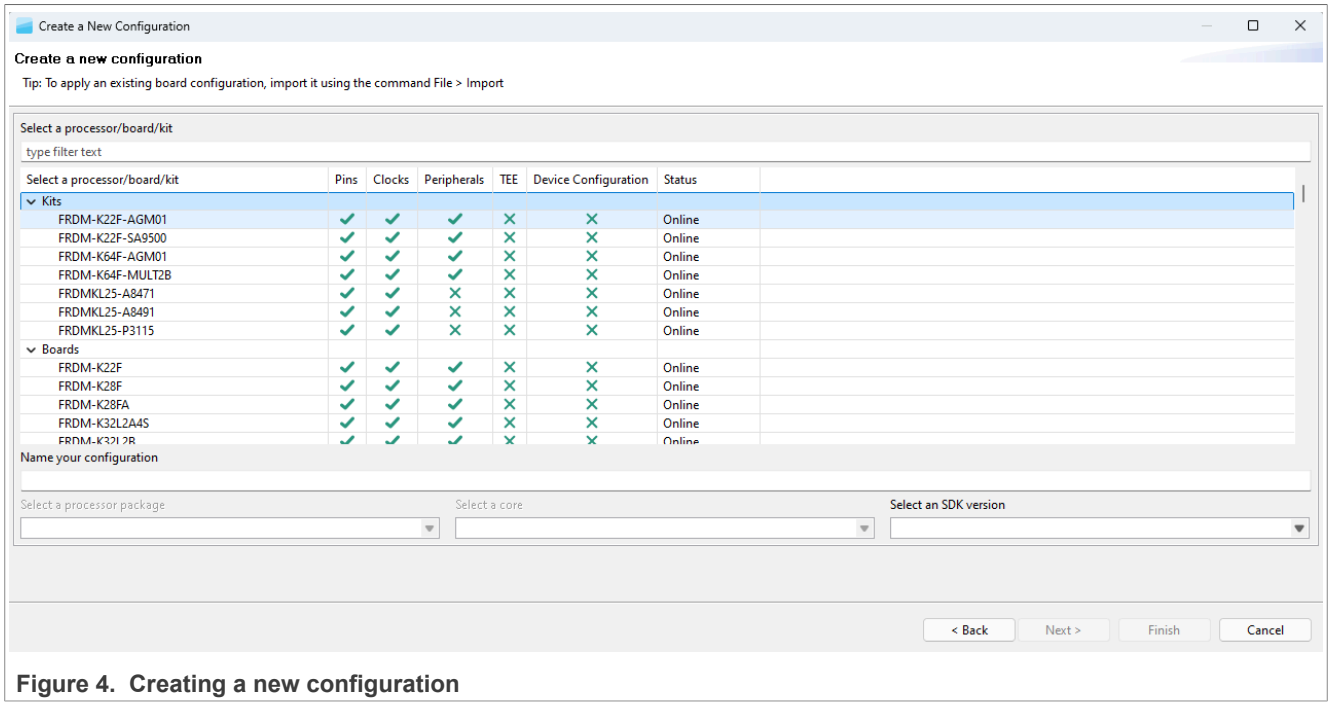


Figure 4. Creating a new configuration

To create a standalone configuration, do the following:

1. In the **Start development** wizard select **Create a new standalone configuration for processor, board, or kit**. Alternatively, in the **Menu bar**, select **File > New**.
2. Click **Next**.
3. Select the processor, board, or kit from the list. **Note:** When working offline, you see only locally saved options. For more information, see the Working offline section.
4. Name your configuration. Optionally, select the processor package, core, and SDK version.
5. Click **Finish**.

2.2.3 Saving a configuration

To save your configuration for future use, select **File > Save** from the **Menu bar**.

To save a back-up of your configuration, do the following:

1. In the **Menu bar**, select **File > Save Copy As**.
2. In the dialog, specify the name and destination of the configuration.
3. Click **Save**.

2.2.3.1 Opening an existing configuration

To open an existing configuration, do the following:

1. In the **Start development** wizard, select **Open an existing configuration**. Alternatively, in the **Menu bar**, select **File > Open**.
2. Click **Browse** to navigate to your configuration file.
3. Select the configuration file and click **Open**.
4. Optionally, select **Always open last configuration** to skip the **Start development** wizard and load the last-saved configuration by default.

2.2.4 Preliminary processor data

Some processors are published for public release before their configuration data reaches full RFP (Ready-For-Production) quality. Such processors are marked as **preliminary** in the processor data.

When you select a processor whose data is marked as preliminary, MCUXpresso Config Tools indicates this in two ways:

- The **Start development** wizard shows a note informing you that the selected processor uses a preliminary version of the processor data.
- The **Problems** view displays a warning that notifies you that the current configuration relies on preliminary processor data.

Note: Preliminary processor data is subject to change. Configurations based on preliminary data should be re-validated once the final (RFP-quality) processor data becomes available.

2.2.5 User templates

You can export and store the current configuration as a user template for later use as a reference configuration file.

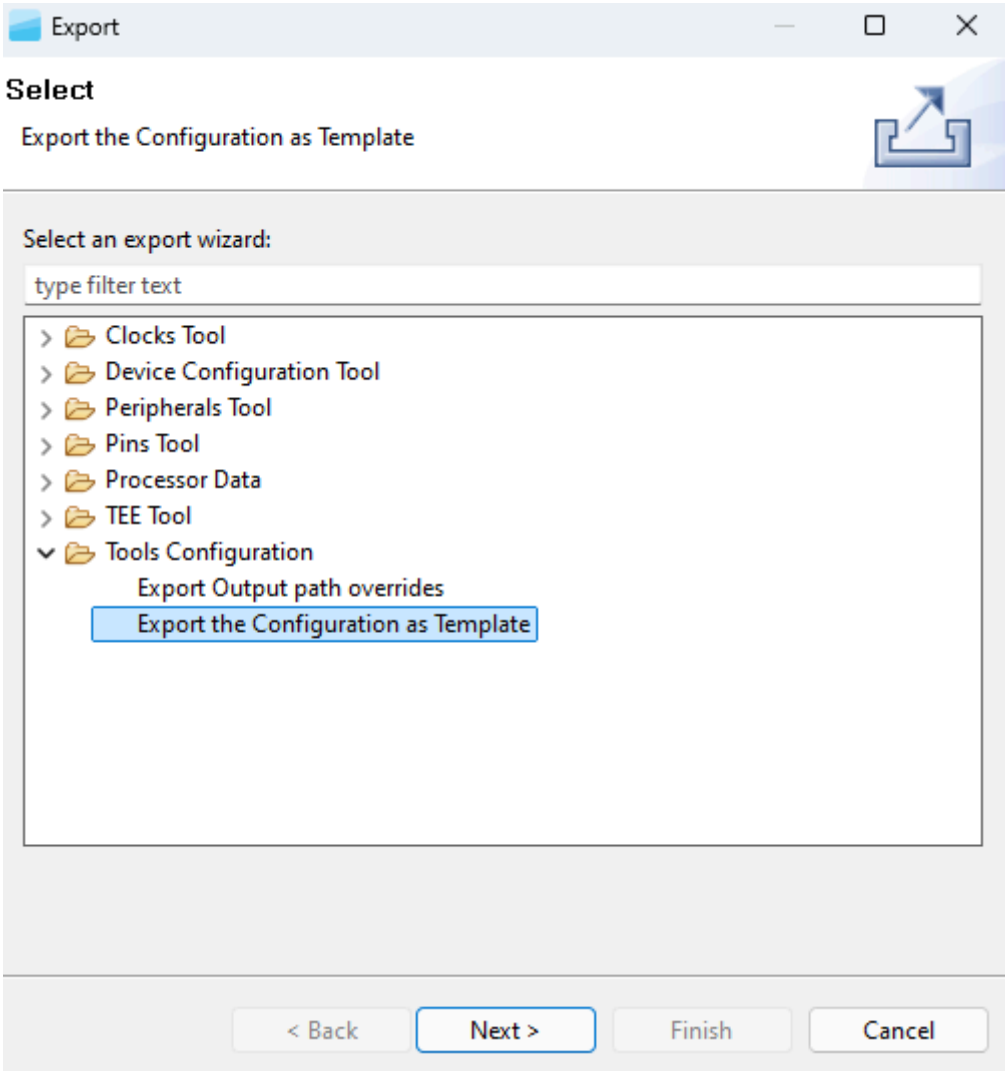


Figure 5. Export template

The exported template is available in the **New Configuration** wizard and can be used to create a configuration. You can also define custom labels for pins or identifiers prefixes for `#define` in the generated code. You can export the configuration by selecting, in the **Menu bar**, **File > Export > Tools Configuration > Export Configuration as Template**.

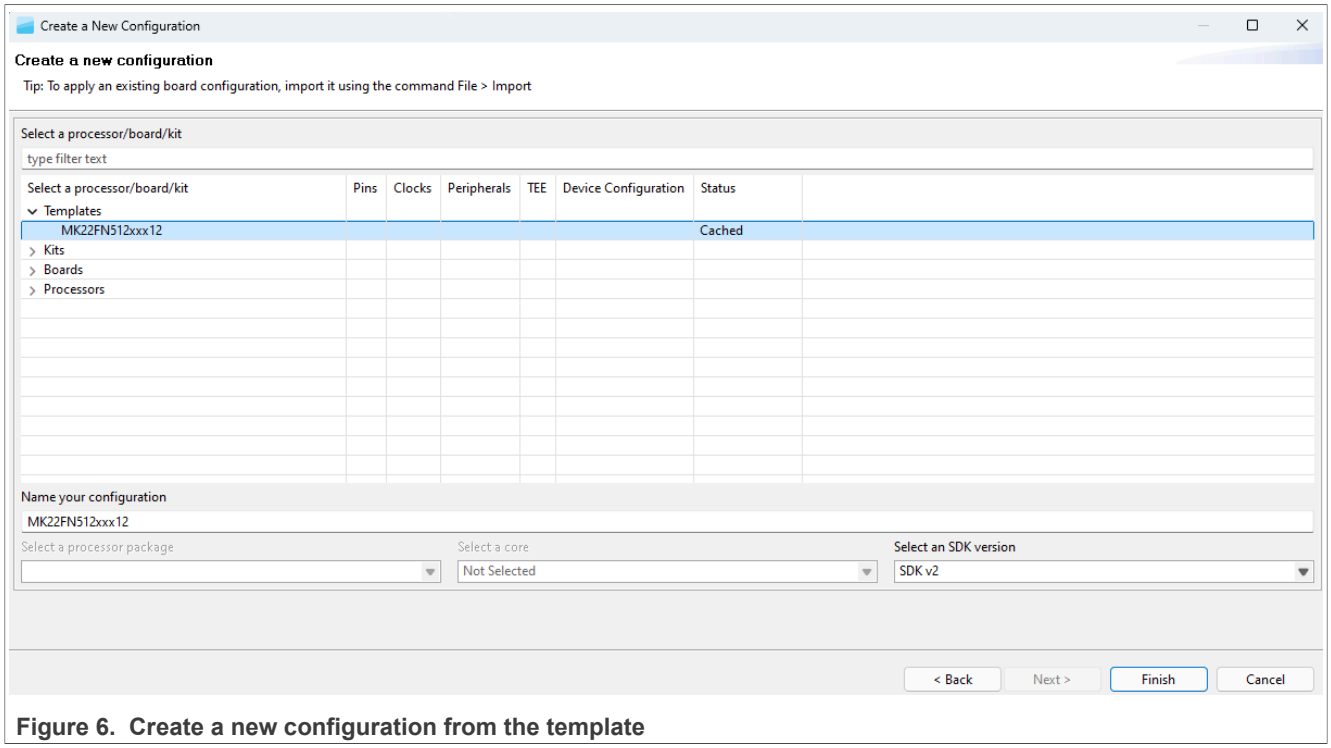


Figure 6. Create a new configuration from the template

Note: The templates are stored in at the following location on your local hard disk: `{$user}/.nxp/{tools_folder}/{version}/templates`.

2.2.6 Importing sources

You can import source code files to use as a basis for further configuration.

Note: You can import only C or DTSI files containing valid YAML configuration blocks generated by the Config Tools. The configuration is reconstructed from the YAML block and the rest of the imported file is ignored.

To import source code files, do the following:

1. In the **Menu bar**, select **File > Import…**.
2. From the list, select **MCUXpresso Config Tools > Import Source**.

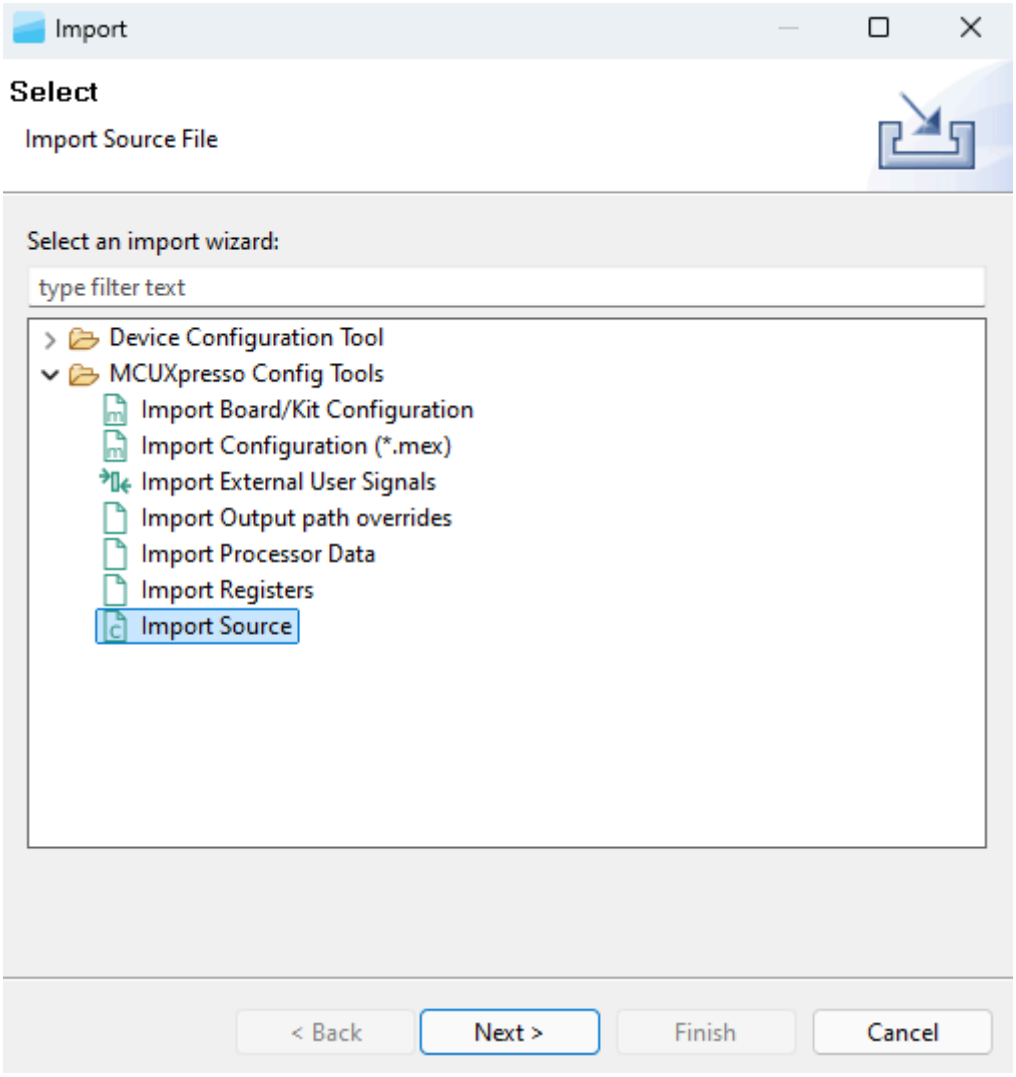


Figure 7. Import Source wizard

3. Click **Next**.
4. On the next page, click **Browse** to specify the location of the source file.
5. Select the source file that you wish to import and click **Open**.
6. On the next page, select which functional groups to import (based on tools) by selecting the checkbox in the left column.
7. Define how to import the functional groups by selecting one of the two available options in the dropdown menu in the right column:
   - **Rename** - All files are merged into the current configuration. It imports all the functions only. If the imported function has the same name as an existing one, it is automatically renamed to the indexed one. For example, if `BOARD_InitPins` exists in the configuration then the imported function is renamed to `BOARD_InitPins1`.
   - **Overwrite** - All files are merged into the current configuration. It imports all the functions only. If the imported function has the same name as an existing one, then the existing one is replaced with the imported one.
8. Click **Finish**.

2.2.6.1 Importing configuration

To import an existing configuration from an MEX file, do the following:

1. In the **Menu bar**, select **File > Import…>**.
2. In the **Import** wizard, select **MCUXpresso Config Tools > Import configuration (*.mex)**.
3. Click **Next**.
4. On the next page, click **Browse** to specify the location of the registers file.
5. Select the MEX file that you wish to import and click **Open**.
6. On the next page, select which functional groups to import (based on tools) by selecting the checkbox in the left column.
7. Define how to import the functional groups by selecting one of the two available options in the dropdown menu in the right column:
   - **Rename** - All files are merged into the current configuration. It imports all the functions only. If the imported function has the same name as an existing one, it is automatically renamed to the indexed one. For example, if `BOARD_InitPins` exists in the configuration then the imported function is renamed to `BOARD_InitPins1`.
   - **Overwrite** - All files are merged into the current configuration. It imports all the functions only. If the imported function has the same name as an existing one, then the existing one is replaced with the imported one.
8. Click **Finish**.

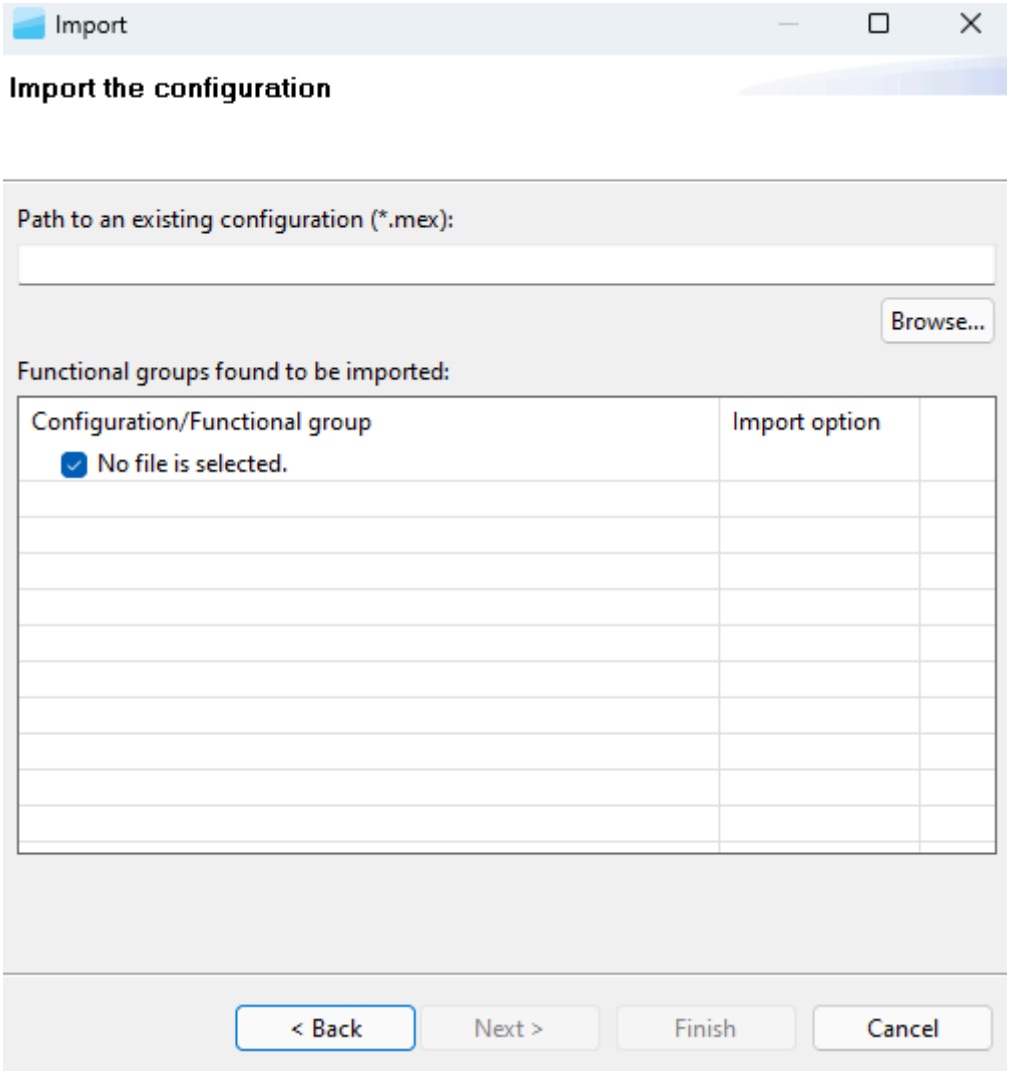


Figure 8. Import configuration

2.2.6.2 Importing Board/Kit Configuration

Use import settings from default board/kit templates provided within CFG tools data for further configuration.

To import a board/kit configuration, do the following:

1. In the **Menu bar**, select **File > Import…>**.
2. In the **Import** wizard, select **MCUXpresso Config Tools > Import Board/Kit Configuration**.
3. Click **Next**.
4. On the next page, select the board/kit variant from the dropdown menu.
5. Select which functional groups to import (based on tools) by selecting the checkbox in the left column.
6. Define how to import the functional groups by selecting one of the two available options in the dropdown menu in the right column:
   - **Rename** - All files are merged into the current configuration. It imports all the functions only. If the imported function has the same name as an existing one, it is automatically renamed to the indexed one. For example, if BOARD_InitPins exists in the configuration then the imported function is renamed to BOARD_InitPins1.

- **Overwrite** - All files are merged into the current configuration. It imports all the functions only. If the imported function has the same name as an existing one, then the existing one is replaced with the imported one.

7. Click **Finish**.

2.2.6.3 Importing registers

You can import a register configuration from a processor memory dump.

Note: Currently, register configuration can be imported into the Clocks tool only.

Note: A processor memory-dump file in the CSV or S19 format is required for importing register configuration.

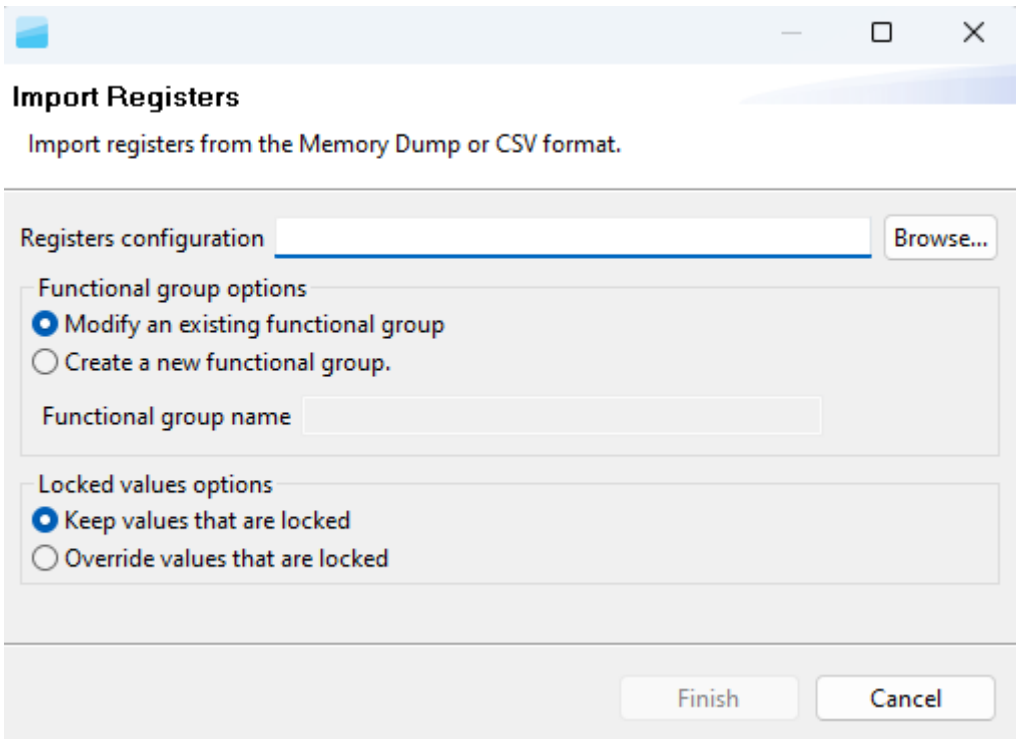


Figure 9. Import registers

To import register configuration, do the following:

1. In the **Menu bar**, select **File > Import…**. Alternatively, click the **Import Registers Configuration** button in the **Registers** view, or drag-and-drop the memory dump file anywhere in the **Registers** view area.

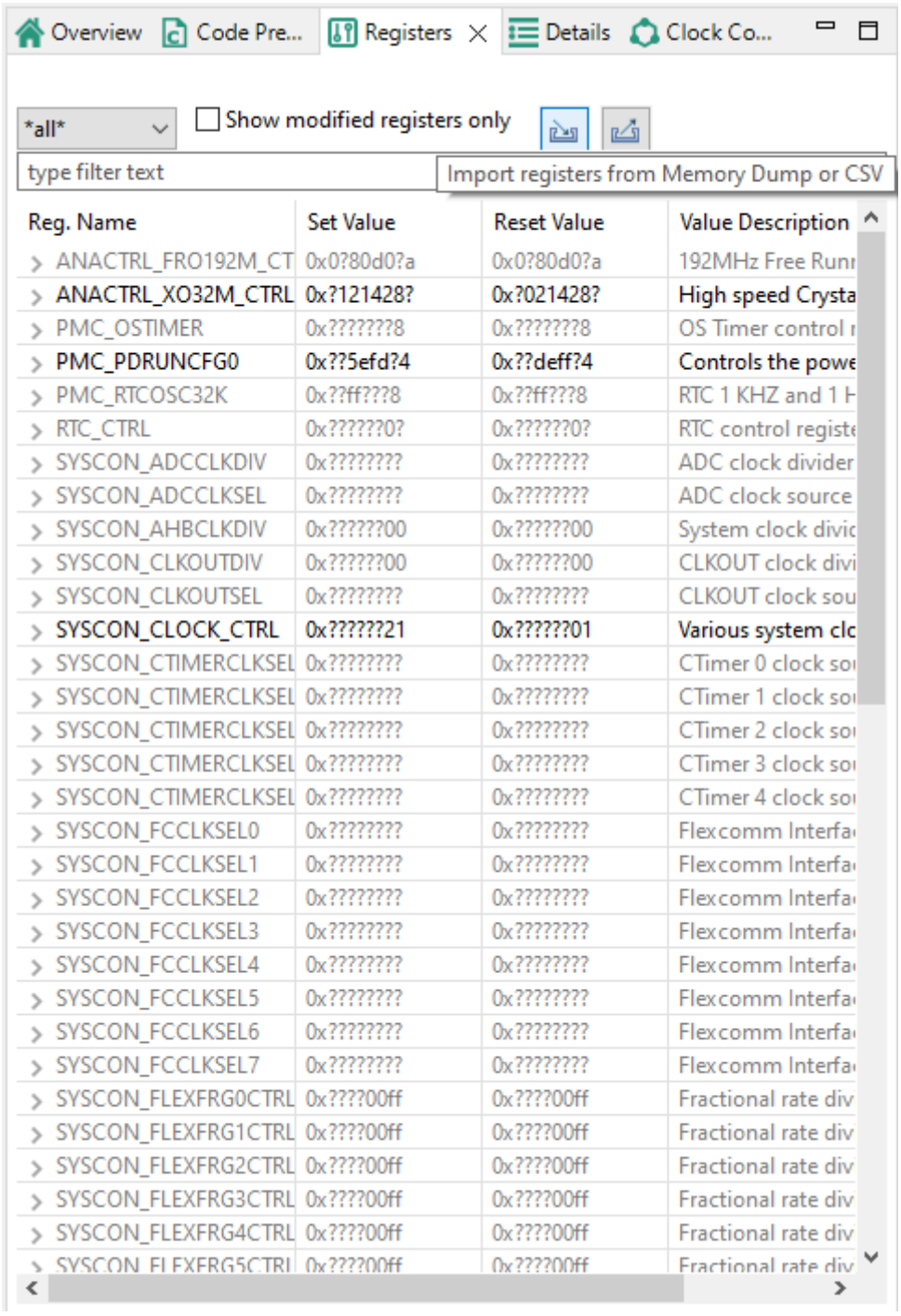


Figure 10. Import registers configuration

2. In the **Import** wizard, select **MCUXpresso Config Tools > Import Registers**.
3. Click **Next**.
4. On the next page, click **Browse** to specify the location of the registers configuration.
5. Select the registers file you wish to import, and click **OK**.

6. By default, the imported register configuration will overwrite the existing functional group. If you want a new functional group to be created instead, select the **Create new functional group** option button, and specify the functional group name.
7. Click **Finish**. **Note:** All registers are imported from the dump file regardless of their relevance to clock configuration, therefore, the list can contain registers not needed by the Clocks tool.

2.2.6.4 Restoring configuration from source code

All Config tools have a possibility of restoring a configuration from the source code. The generated code below contains information about the Clocks tool settings that are used in the tool (block within a comment in YAML format).

The following is an example of the settings information in the generated source code.

```
/*******************************************************************************
 ********************** Configuration BOARD_BootClockRUN ***********************
 *******************************************************************************/
/* TEXT BELOW IS USED AS SETTING FOR TOOLS *************************************
!!Configuration
name: BOARD_BootClockRUN
called_from_default_init: true
outputs:
- {id: Bus_clock.outFreq, value: 20.97152 MHz}
- {id: Core_clock.outFreq, value: 20.97152 MHz}
- {id: Flash_clock.outFreq, value: 10.48576 MHz}
- {id: FlexBus_clock.outFreq, value: 10.48576 MHz}
- {id: LPO_clock.outFreq, value: 1 kHz}
- {id: MCGFFCLK.outFreq, value: 32.768 kHz}
- {id: PLLFLLCLK.outFreq, value: 20.97152 MHz}
- {id: System_clock.outFreq, value: 20.97152 MHz}
 * BE CAREFUL MODIFYING THIS COMMENT - IT IS YAML SETTINGS FOR TOOLS **********/
```

Figure 11. Setting Information in the source code

If this information is not corrupted, it is possible to reimport the clock settings into the tool using the following steps.

1. In the **Menu bar**, select **File > Import…**.
2. From the list, select **MCUXpresso Config Tools > Import Source Files**.
3. Click **Next**.
4. Click **Browse**.
5. Navigate and select the source file previously produced by one of the Config tools (for example, *clock_config.c*).
6. If the settings parse successfully, the clock configurations are added into the current global configuration.

2.3 Menu bar

The **Menu bar** contains six menus: **File, Edit, Tools, Views, Help,** and a **tool-specific menu**.

The **File** menu contains file management items.

2.3.1 Table File menu

Table 3. File menu

Menu item	Description
New…	Create a configuration. For more information, see the Configuration section.
Open	Open a configuration from an MEX file.
Save	Save the current configuration.
Save Copy As…	Create a backup copy of the current configuration.
Switch processor	Switch to a different processor. For more information, see the Switching processor section.
Switch package	Switch to a different processor package. For more information, see the Switching processor section.
Select Core	Select a processor core for further configuration.
Data Manager	Manage local data. For more information, see the Managing data and working offline section.
Import…	Import settings from source files. For more information, see the Advanced Features section.
Export…	Export source files and other tool information. For more information, see the Advanced Features section.
Exit	Exit the application. If there are any unsaved changes, you are prompted to save the changes.

2.3.2 Table Edit menu

The **Edit** menu contains basic editing actions and items modifying the appearance and behavior of the whole framework.

Table 4. Edit menu

Menu item	Description
Open Update Code Dialog	Update code after configuration change. For more information, see the Update code section.
Undo (…)	Cancel a previous action. The action to be undone is always appended.
Redo (…)	Cancel a previous undo action. The action to be redone is always appended.
Copy	Copy the selected text to the clipboard.
Select All	Select the whole text in the current field/view.
Call from default initialization function	Set the currently selected functional group to be called from the default initialization function.
Functional Group Properties	Edit functional group properties.
Preferences	Edit preferences. For more information, see the Preferences section.
Configuration Preferences	Edit configuration preferences. For more information, see the Configuration Preferences section.

2.3.3 Table Tool-specific menu

The **Tools** menu lists all the tools available in the tools framework. Use this menu to switch between the tools.

The **Tool-specific** menu contains items tailor-made for individual tools. Only items relevant to the currently active tool are displayed. The menu name copies the name of the currently active tool.

Table 5. Tool-specific menu

Item	Description
Functional Groups	Open the Functional group properties window.
Refresh	Refresh both the generated code and the whole GUI.
Reset to Board Defaults	Reset the configuration of the Board/Kit defaults.
Reset to Processor Defaults	Reset the configuration of the processor's defaults.
Automatic Routing (Pins)	Attempt to resolve routing issues. Opens the **Automatic Routing** dialog, which displays the routing issues that have been resolved and the ones that require manual correction.
Apply Expansion Board (Pins)	Apply an expansion board to an already created expansion header
Create Default Routing (Pins)	Open a dialog for the creation of a new functional group containing the after-reset state of pins and internal signals.
Unlock All Settings (Clocks)	Unlock all currently active locks.
Unlock Settings on the Active Path (Clocks)	Unlock all settings on the selected path.
Global Settings (Peripherals)	Open a tab aggregating the global settings of all configuration sets.
Component use case library (Peripherals)	Open the component use the case manager dialog.
Customize initialization order (Peripherals)	Open a dialog for customization of peripheral initialization order.
Resolve duplicate names error (Peripherals)	Resolve problems with duplicate names of multiple component instances by renaming all conflicted component instances to usable automatic names.
Clear All Commands (Device Configuration)	Remove all entered commands.
Config Tools Snippets (Peripherals)	Open the Config Tools Snippets view.
Migrate to other component versions (Peripherals)	Launch the dialog allowing to migrate settings to other versions of SDK components.

2.3.4 Table Help menu

The **Views** menu contains a tool-specific list of available views. Select a view from the list to open it. Select an already opened view to highlight it. Choose **Reset views** to reset the current tool perspective to its default state. The **Help** menu contains assistance and general information-related items.

Table 6. Help menu

Item	Description
Contents	Display the User Guide.
Quick Start guide	Open a PDF file of the Quick Start guide.
Release Notes	Display release notes of the installed version.

Table 6. Help menu...*continued*

Item	Description
Community	Display web pages of the product-related community forums.
Processor Information	Display web pages containing information about the currently used processor.
Kit/Board Information	Display web pages containing information about the currently used board or kit.
Open SDK API	Display documentation of the relevant SDK API.
Check for updates	Check for a newer version of the product. If a new version is available, you are prompted to confirm and perform the update.
Open Cheat Sheet	Display a cheat sheet to help with using the tools. You can also load a cheat sheet from a file, or from a URL.
About	Display general product information.

2.4 Toolbar

The toolbar is at the top of the window and includes buttons and menus for frequently used actions common to all tools. See the following sections for more information.

2.4.1 Table Toolbar

Table 7. Toolbar

Item	Description
Config Tools Overview	Open the **Overview** dialog with information about currently used tools.
Show Problems View	Open the **Problems** view.
Update Code	Open the update dialog that allows you to update generated peripheral initialization code directly within the specified toolchain project.
Generate Code	Regenerate source code when the “Enable Code Preview” preference is disabled.
Functional group selection	Select a functional group. A functional group in the Peripherals tool represents a group of peripherals initialized as a group. The tool generates a C function for each function group that contains the initialization code.
Call from default initialization	Set the current functional group to be initialized by the default initialization function.
Functional group properties	Open the **Functional group properties** dialog to modify name and other properties of the function group.
Tool selection	Display icons of individual tools. Use them to switch between tools.
Undo/Redo	Undo/Redo last action.

In addition, the toolbar may contain additional items depending on the selected tool. See the chapters dedicated to individual tools for more information.

2.4.2 Config tools overview button

Click the **Config Tools Overview** button to open **Config Tools Overview** and inspect information about the configuration, hardware, and project. For more information, see the Config Tools Overview section.

2.4.3 Show problems view

Click the **Show Problems View** to open/highlight the **Problems view** and inspect any errors in your configuration. See Problems view for more information.

Button color depends on the issue type. Red indicates at least one error; yellow indicates at least one warning.

2.4.4 Update code

To update the generated code in the related toolchain project, click the **Update Code** button. In the window, select the tools or files you want to update. If the file is updated automatically, the button is filled with a black square. The reason is displayed in the tooltip.

Note: For multicore projects, this command updates only the files related to the currently selected active core. To get files for other cores, use the **export** command instead.

The project information shows the Project name and path or the path to the mex folder, when the configuration is without a project.

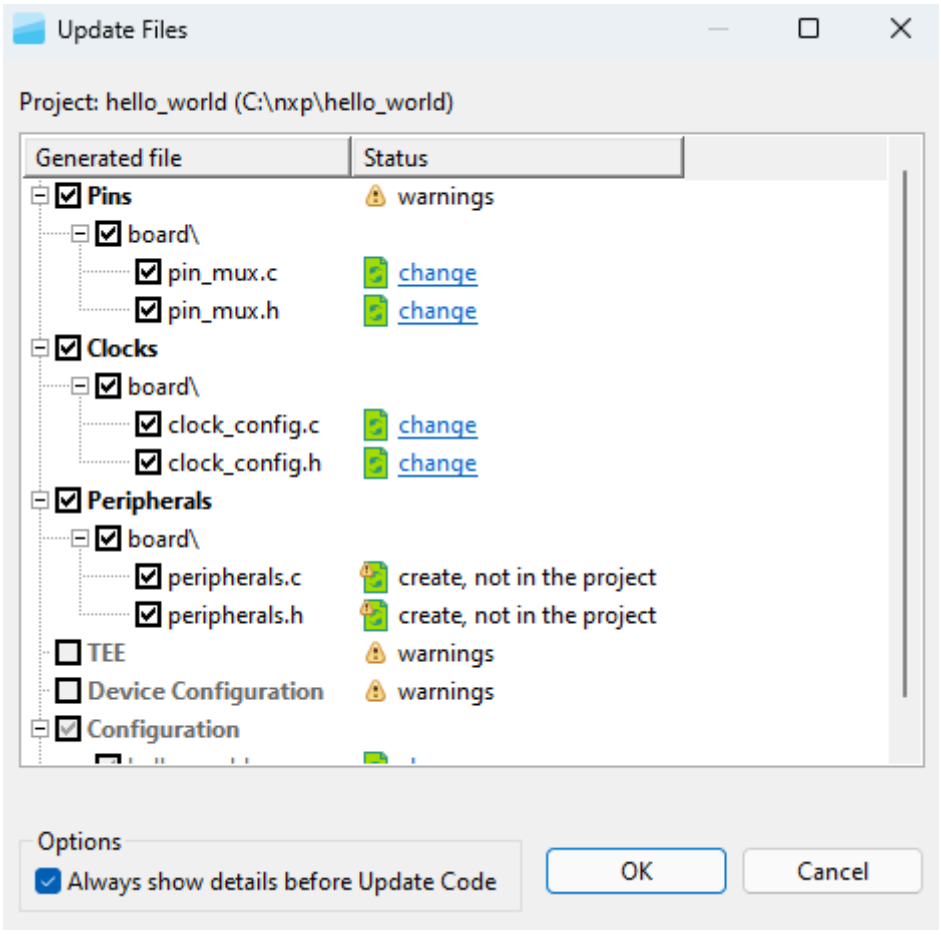


Figure 12. Update Files window

To inspect the code difference between the versions, click the **change** link.

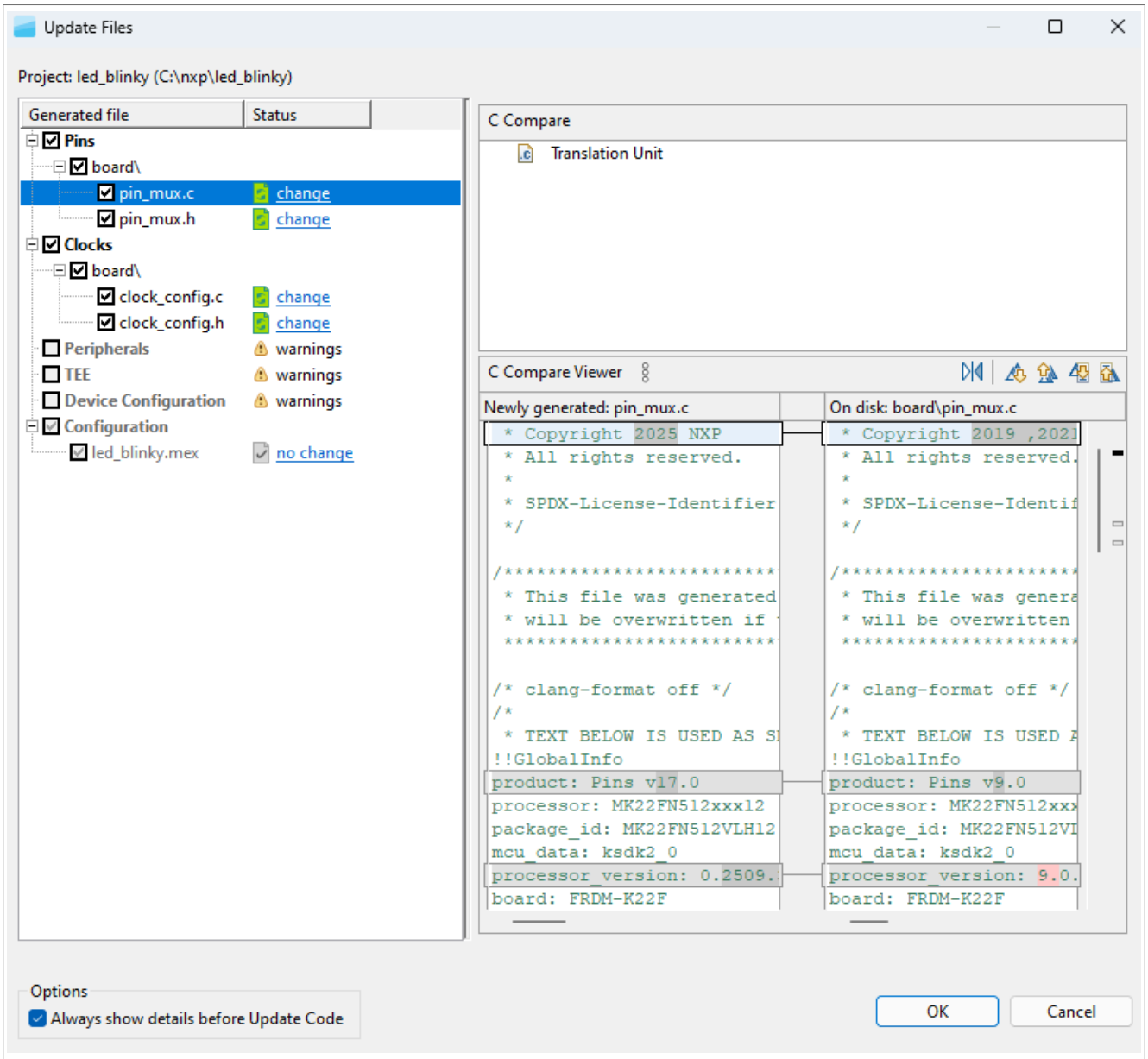


Figure 13. Show differences

To update the project without opening the **Update Files** dialog, deselect the **Always show details before Update Code** checkbox.

To access the **Update Code** dialog from the **Update Code** dropdown menu, select **Open Update Code Dialog**.

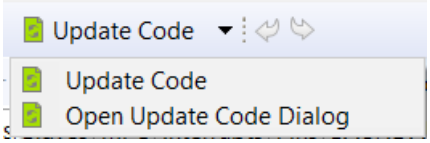


Figure 14. Update Code dropdown menu

Note: The generated code is always overwritten.

Note: Before the current file is overwritten, it is copied with a BAK extension.

The **Update Code** action is enabled under the following conditions:

- MEX configuration file is saved locally
- If the MEX configuration is saved in a toolchain project, the processor selected in the tool matches the processor selected in the toolchain project
- Core is selected (for multicore processors)

2.4.5 Functional groups

Every **Pins/Clocks/Peripherals/TEE** configuration can contain several functional groups.

These groups represent functions generated into the source code. Use the dropdown menu to switch between functional groups and configure them.

Figure 15. Functional groups

You can use two additional buttons to further configure functional groups:

2.4.5.1 Table Functional Groups

Table 8. Functional Groups

Icon	Description
	Toggle “Called from default initialization function” feature (in source code)
	Opens the **Functional group properties** window

Note: Red/orange background indicates errors/warnings in the configuration.

2.4.5.2 Functional group properties

In the **Functional Group Properties** window, you can configure several options for functions and code generation. Each setting applies to the selected function. Specify the generated function name, select the core (for multicore processors only) that affects the generated source code, or write a function description (generated in the C file). You can also add, copy, and remove functional groups as needed.

Aside from name and description, you can choose to set parameters for selected functional groups.

Functional group properties are specific for individual Config Tools:

Pins tool:

- **Set custom #define prefix**- If this property is set, the specific custom prefix is used for macros generated into the `pin_mux.h`. Otherwise the name of the functional group is used as the prefix.
- **Prefix** - The custom prefix string. If it is empty, no prefix is used.
- **Clocks gate enable** - If this property is enabled, the clock gate is enabled in the generated code. The clock gate is needed for access to the peripherals, so have it enabled elsewhere.
- **Core** (for multicore processors only) - Selects the core that is used for executing this function.
- **Full pins initialization** - If this property is set, all pin features are fully initialized in the generated function even if they match the after-reset state of the processor. If it is not set, values “Not specified” or “No init” can be selected.

- **De-initialization function** - If this feature is set, an additional function that sets all pins and peripheral signals in this functional group to their after-reset state is generated. The new function has a suffix `_deinit` by default.
- **Set custom de-initialization function name**- Allows specifying a user-defined name of the de-initialization function.

Clocks tool:

- **Set custom #define prefix** - If this property is set, the custom prefix is used for macros define in `clock_config.h`. Otherwise the name of the functional group is used as the prefix.
- **Prefix** - The custom prefix string. If it is empty, no prefix is used.
- **Other settings** - The processor-specific settings are specific for each processor. See the tooltips for details.

Peripherals tool:

- **Prefix** - It is used for identifiers, constants, and functions related to the functional group that is used in generated code. If it is not specified, no prefix is used.

TEE tool:

- **Set custom #define prefix** - If this property is checked, the custom prefix is used for macros define in the generated code. Otherwise, the name of the functional group is used as the prefix.

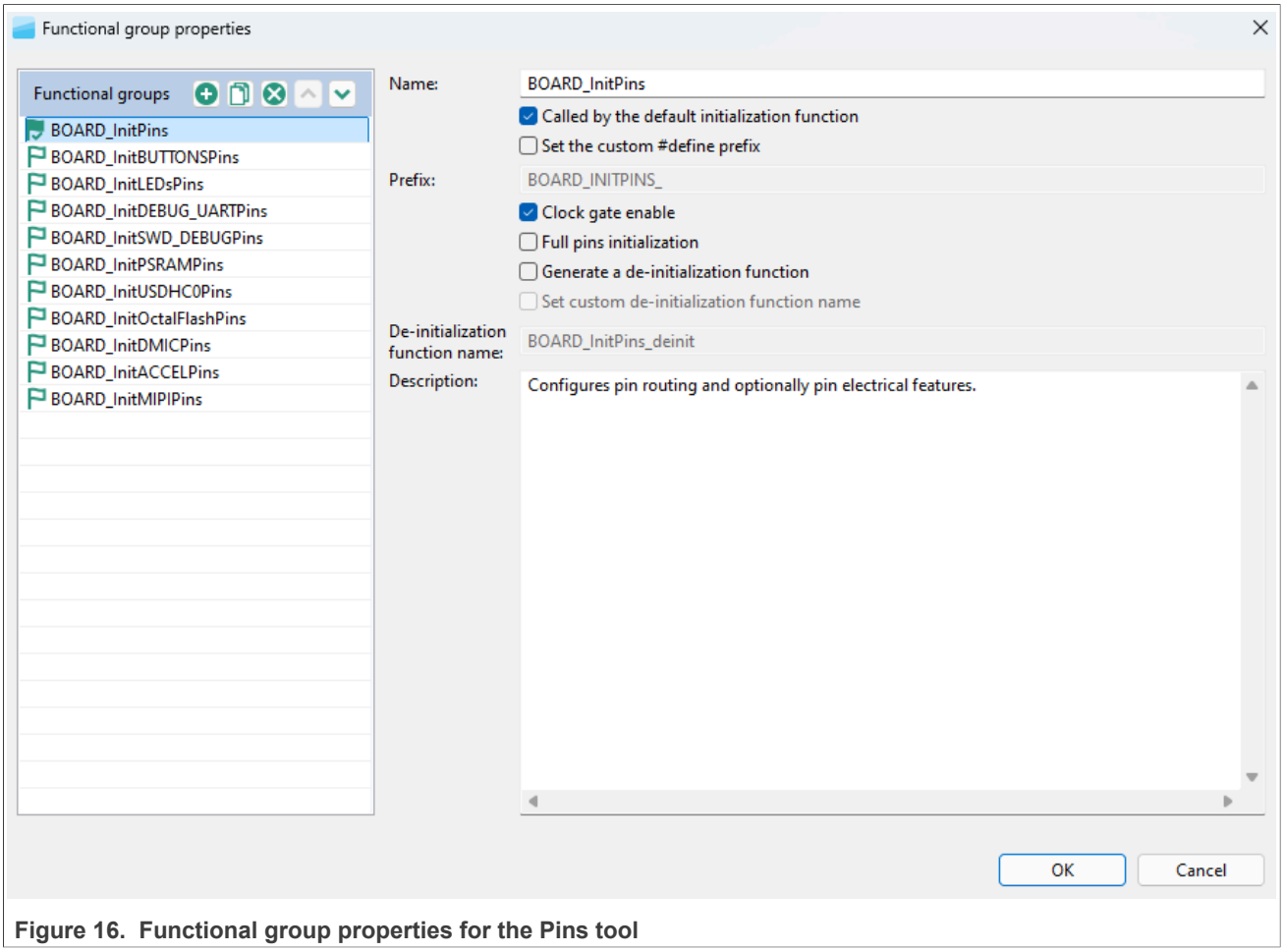


Figure 16. Functional group properties for the Pins tool

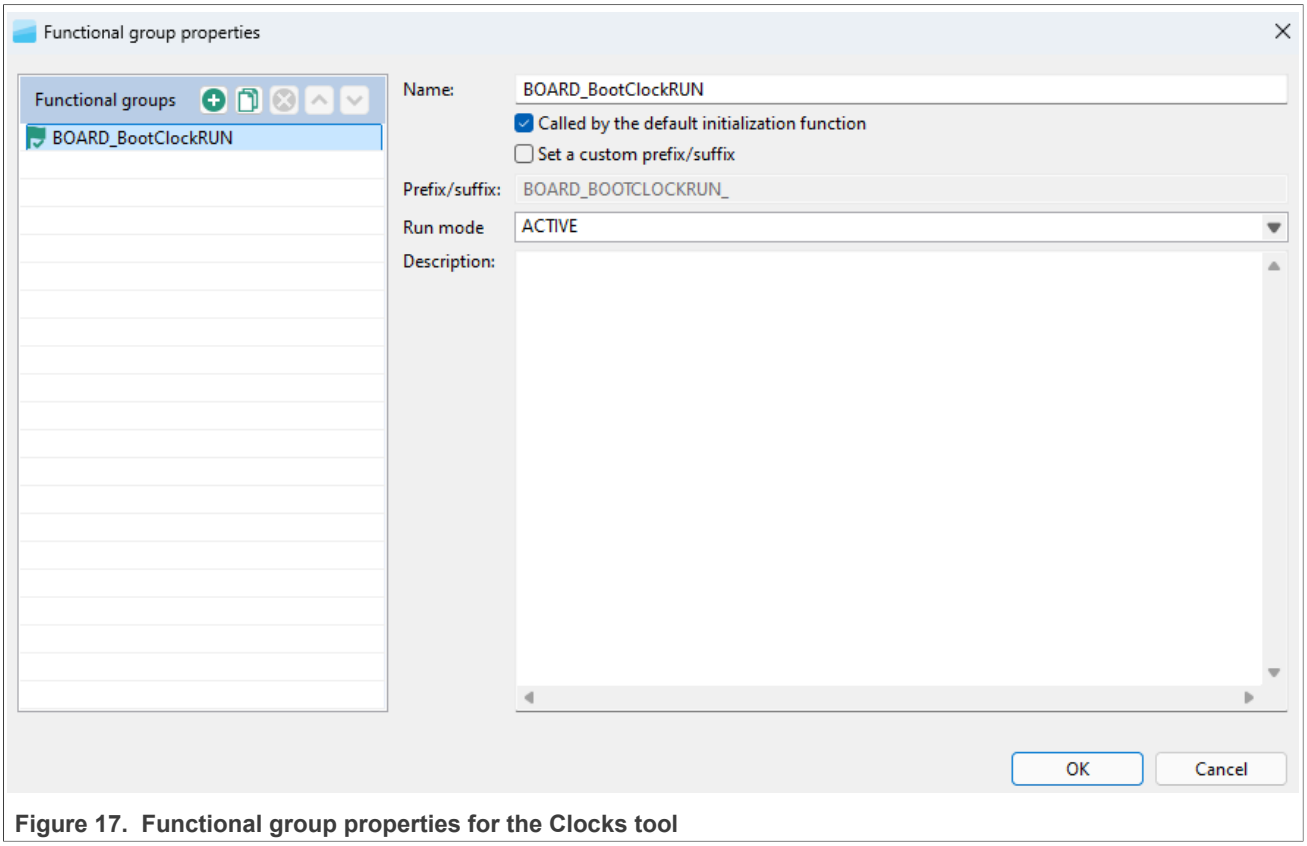


Figure 17. Functional group properties for the Clocks tool

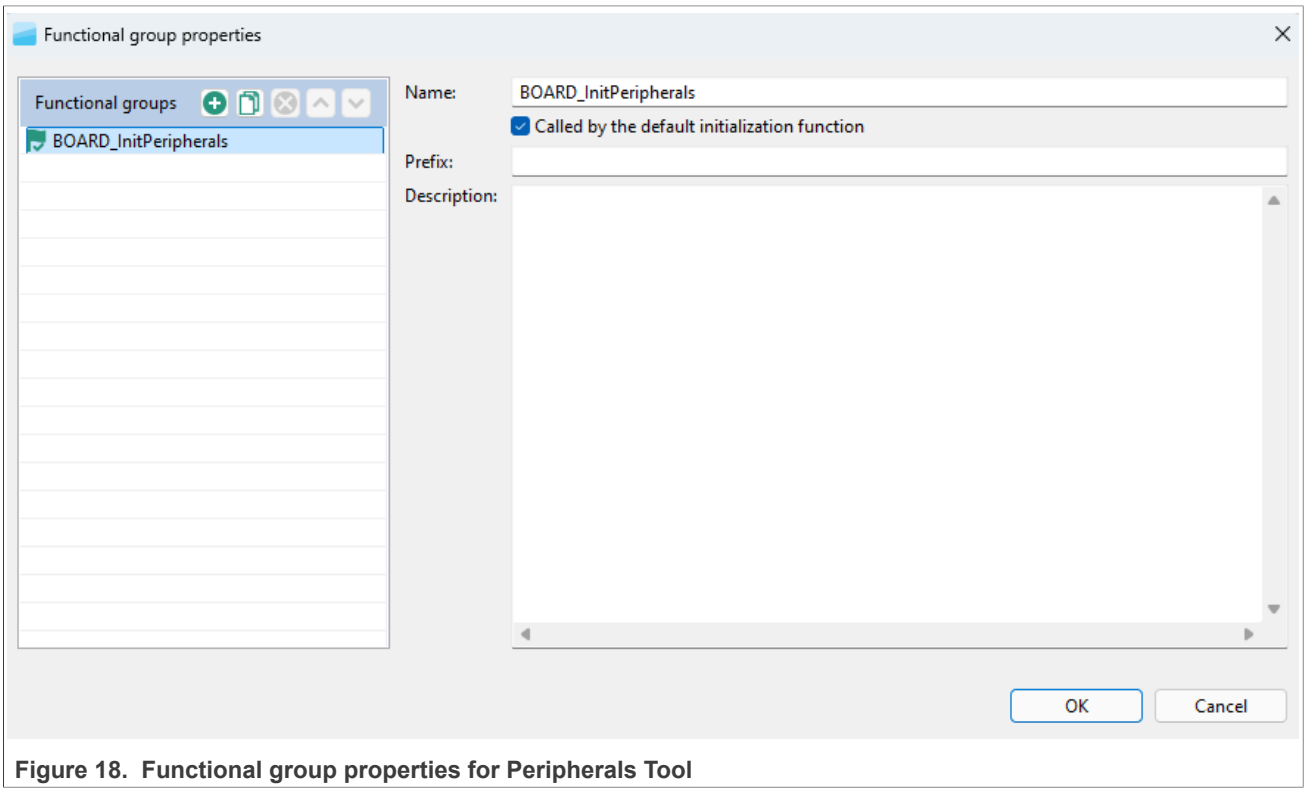


Figure 18. Functional group properties for Peripherals Tool

2.4.6 Undo/Redo actions

You can reverse your actions by using the Undo/Redo buttons available in the **Toolbar**. You can also perform these actions from the **Edit** menu in the **Menu bar**.

2.4.6.1 Table Undo/Redo actions

Table 9. Undo/Redo actions

Icon	Description
	Cancels the previous action
	Cancels the previous undo action

2.4.7 Selecting the tools

Buttons on the extreme right-hand side of the toolbar represent available tools. Click the icons to quickly navigate between Pins, Clocks, Peripherals, Device Configuration, and TEE tools.

2.5 Status bar

The status bar is visible at the bottom part of the GUI. The status bar indicates the error and warning state of the currently selected functional group.

2.6 Preferences

To configure preferences in the **Preferences** dialog, select **Edit > Preferences** from the **Menu bar**.

Note: You can restore settings to default by selecting **Restore Defaults** in the lower right corner of the dialog.

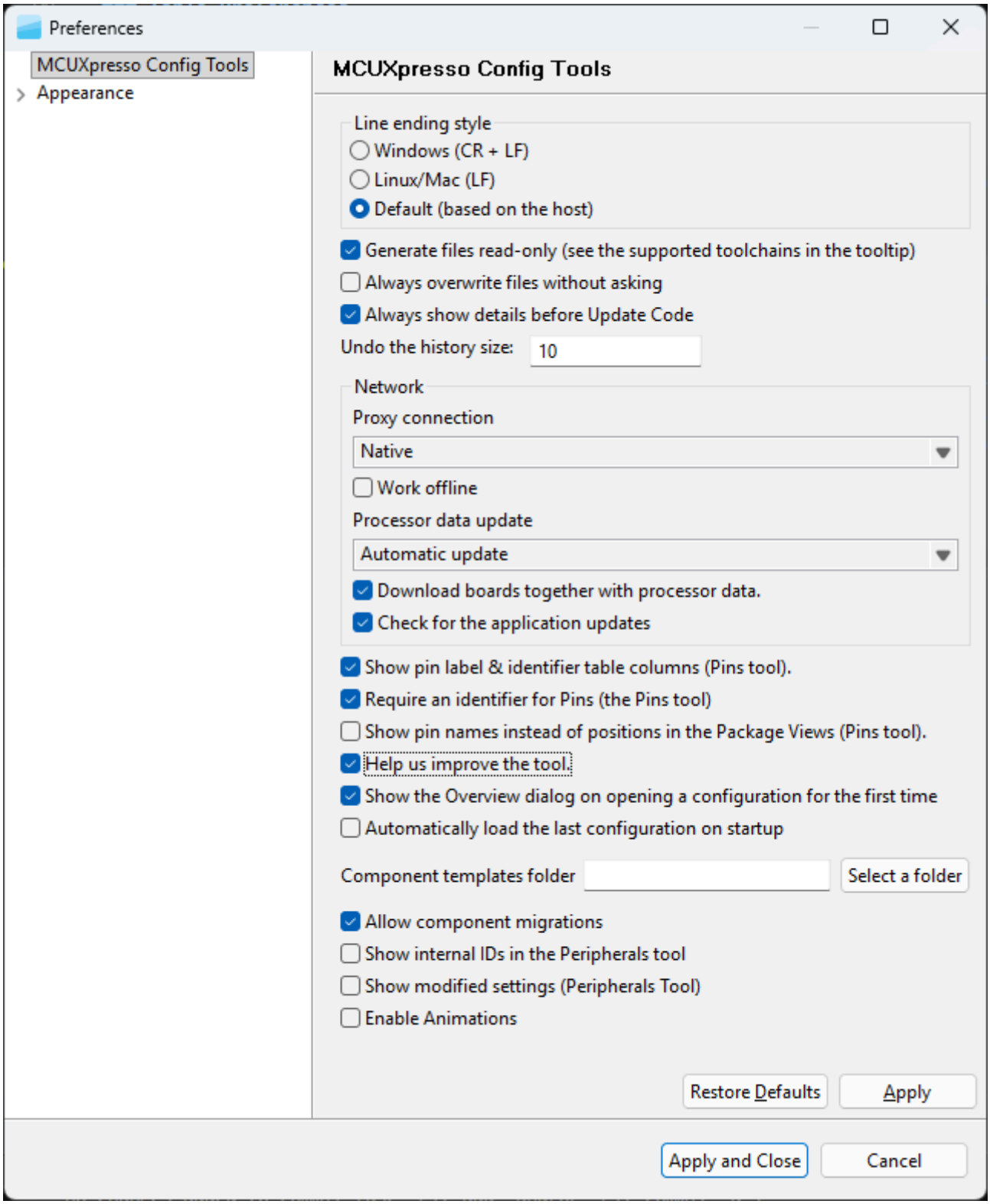


Figure 19. Preferences

Several settings are available.

2.6.1 Table Preferences

Table 10. Preferences

Item	Description
Line ending style	Select between **Windows (CR + LF)**, **Linux/Mac (LF)**, or **Default (based on host)**.
Generate files read-only	Prevent unintentional modification of source files. Generated source files are marked as read-only.
Always overwrite files without asking	Update existing files automatically, without prompting.
Always show details before Update Code	Review changes before the project is updated.
Undo history size	Enter the maximum number of steps that can be undone. Enter 0 to disable.
Proxy connection	- **Direct** - Connect directly and avoid a proxy connection. - **Native** - Use system proxy configuration for network connection. **Note:** The proxy settings are copied from operating system settings. If an error occurs, specify proxy information in the tools.ini file, located in the <install_dir>/bin/ folder. Ensure the file contains the following lines: - Djava.net.useSystemProxies=true (already present by default) - Dhttp.proxyHost=<somecompany.proxy.net> - Dhttp.proxyPort=80 **Note:** Authentication is not supported.
Work Offline	Disable both the connection to NXP cloud and the download of processor/board/kit data.
Download boards together with processor data	When enabled, automatically downloads the board data for all boards associated with the selected processor whenever processor data is downloaded.
Processor data update	Select from the following options:- **Auto Update** - Update the processor data automatically. - **Manual** - Update processor data after confirmation. - **Disabled** - Disable processor data update.
Check for application updates	Check for application updates on a weekly basis.
Show pin label & identifier table columns (Pins Tool)	Select to show the pin label and the label identifier in the relevant views.
Require Identifier for Pins (Pins Tool)	Controls generation of pins “Identifier” related warnings. With this preference enabled, warnings will be generated for bidirectional signals that have no Identifier set.
Show Overview window on opening configuration for the first time	Open the Overview dialog on opening the configuration for the first time.
Help us to improve the tool	Send device-configuration and tool-use information to NXP. Sending this information to NXP helps fix issues and improve the tools.
Automatically load last configuration on startup	Avoid the startup window and load the last used configuration instead.

Table 10. Preferences*...continued*

Item	Description
Component template folder (**Peripherals Tool**)	The path to the folder with component templates. Keep empty to use the default path. The default path is to the folder component_templates in the data of the Config tools.
Allow component migrations (**Peripherals Tool**)	When a configuration associated with a toolchain project is open, the Peripherals tool automatically checks whether the configuration components match the project and suggests a migration if they do not match.
Show internal IDs in Peripherals tool	When enabled, the tooltips in the Peripherals tool contain internal identifications.
Enable animations	Enables animations in the user interface, such as smoother scrolling or opening a drop-down menu.

2.6.2 Appearance

In the **Appearance** window, you can configure the look and feel of the user interface.

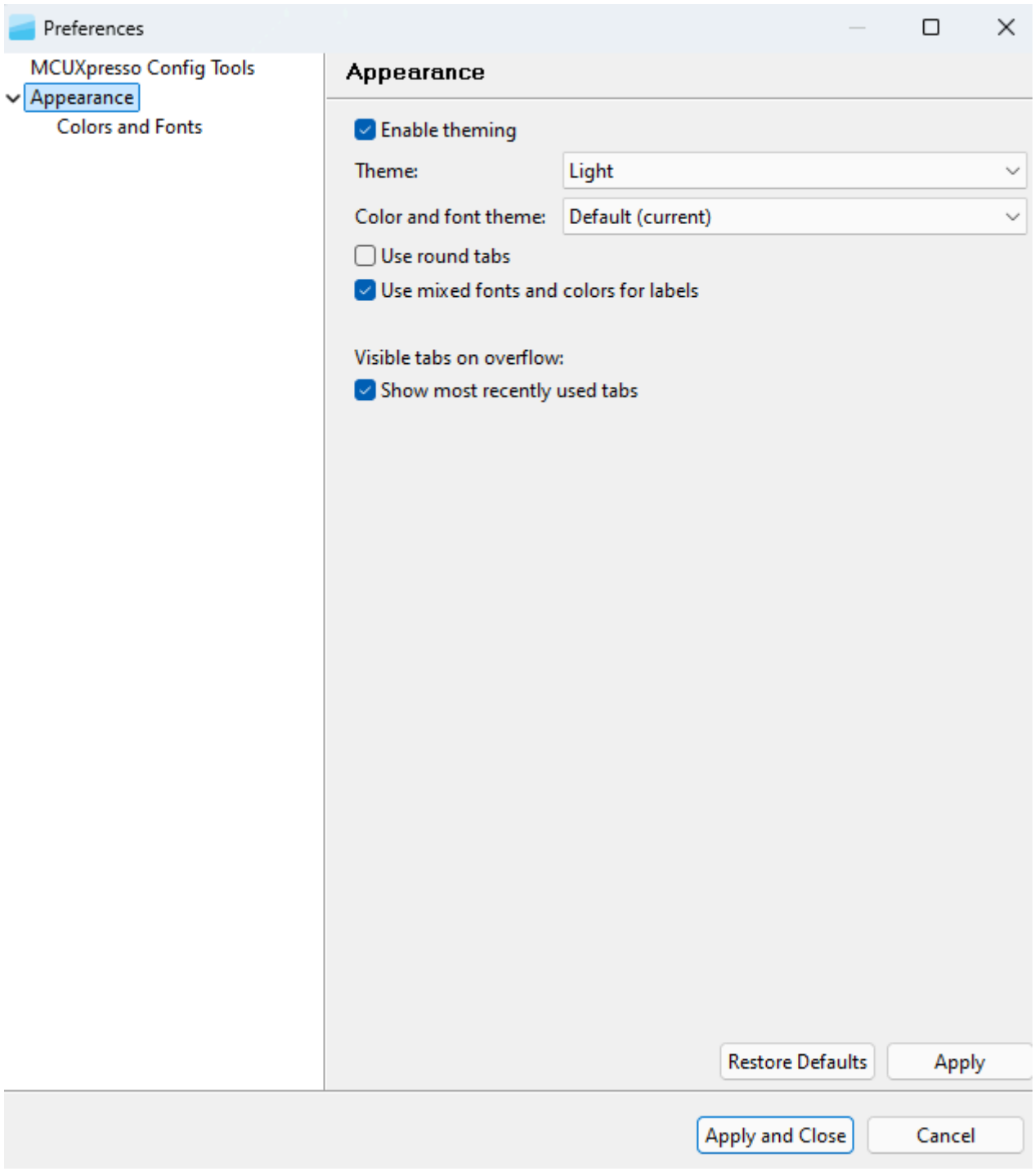


Figure 20. Appearance

The following options are available:

- **Enable theming**
- **Theme**
- **Color and Font Theme**
- **Use round tabs**

- **Use mixed fonts and colors for labels**
- **Show most recently used tabs**

Select the **Colors and Fonts** subwindow to further specify the appearance of interface elements.

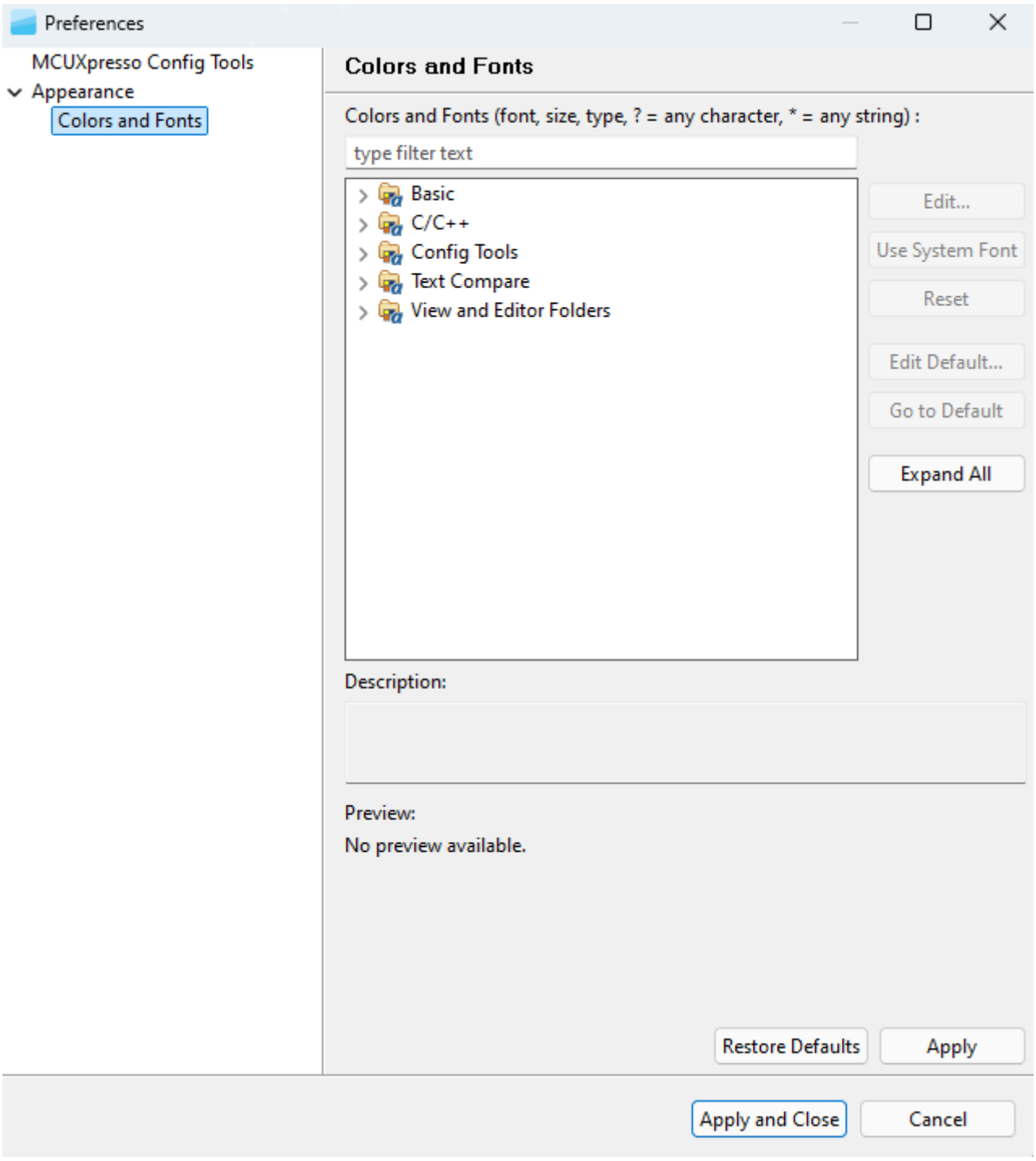


Figure 21. Colors and Fonts

2.7 Configuration preferences

In the **Configuration preferences** window, you can set your preferences for the configuration storage file (MEX).

To configure the preferences related to the configuration, select **Edit > Configuration Preferences** from the **Menu bar**.

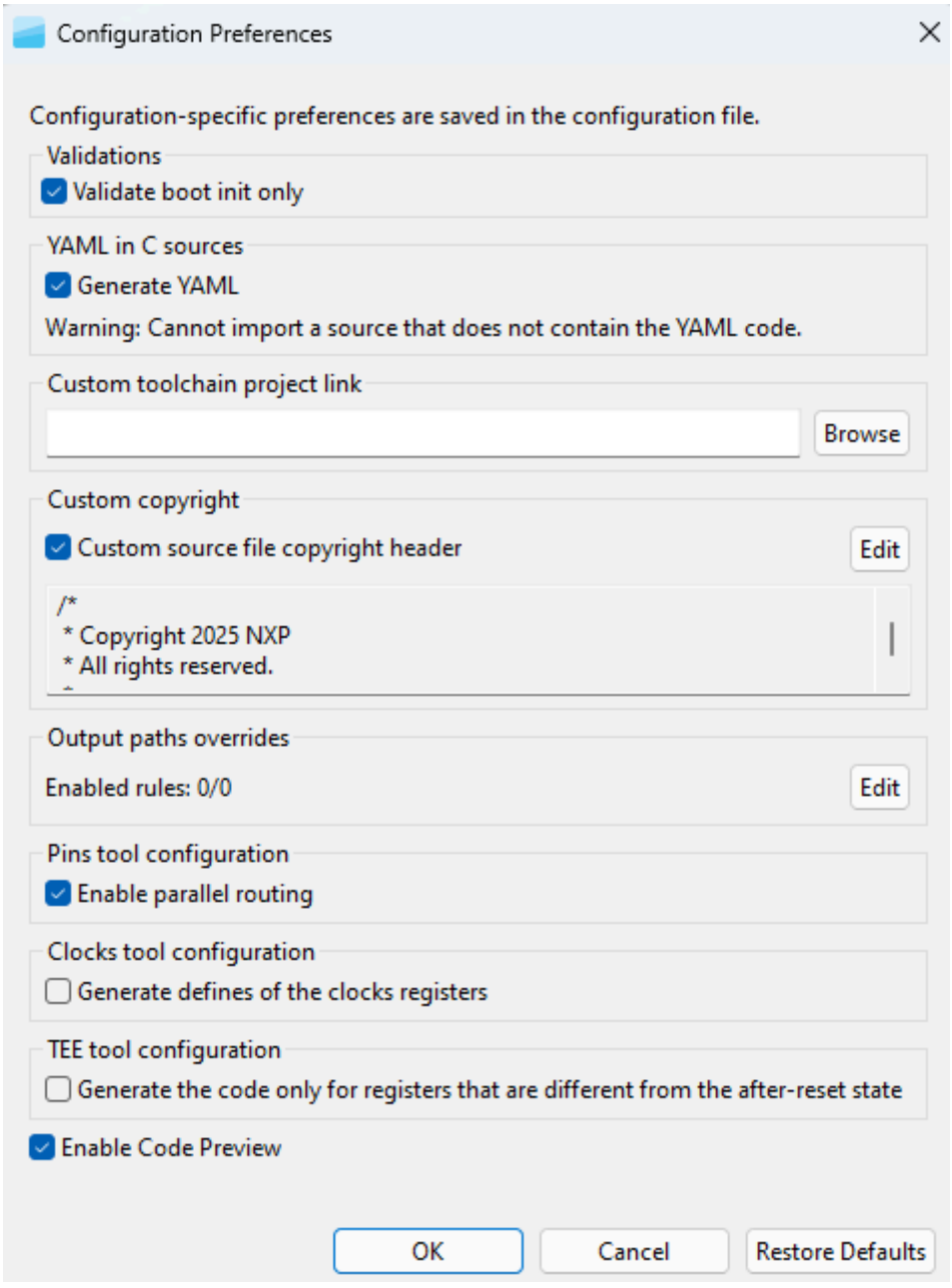


Figure 22. Configuration preferences

Several preferences are available.

2.7.1 Table configuration preferences

Table 11. Configuration Preferences

Item	Description
Validate boot init only	Validate tools' dependencies only against the 'boot init' function group. When selected, dependencies from all functional groups of all tools must be satisfied in the functional groups marked for default initialization. Clearing this option hides warnings in case the user is using complex scenarios with alternating functional groups within the application code.
Generate YAML	Generate YAML into C source files.
Custom toolchain project link	Set the path to the toolchain project folder, otherwise the default path in the same folder as the configuration is used. An absolute path or a relative path to a saved configuration (MEX) can be used. Only for standalone Config Tools.
Custom source file copyright header	Add a custom copyright header to generated source files that do not already contain copyright.
Generate defines of clock registers	This feature is disabled by default (**Edit->Configuration Preferences**). The new `registers.h` file with registers defines is generated in the **Code Preview** tab. The custom prefix can be defined in the Functional group properties.
Generate code only for registers that are different from the after-reset state	Generate code only for registers that are different from the after-reset state. For projects created in earlier MCUXpresso versions, this option is selected by default.
Output path overrides	Rules that override the path of output files generated by the tools. They apply in the Update code and Exports commands. A special dialog allows you to edit them. For more information, see Output path overrides.
Enable Code Preview	Controls how code is generated. When this preference is enabled, code generation runs automatically after every configuration change and the Code Preview updates accordingly. When this preference is disabled, code generation stops, a warning message appears in the **Code Preview** window, and you can manually trigger the action using one of the available options: - By pressing the "generate code" link highlighted in the warning message from the Code Preview window. - By pressing the **Update Code** button in the toolbar, where code update is preceded by code generation.

Warning: When the source does not contain YAML code, it cannot be imported.

2.8 Problems view

The **Problems** view displays issues in individual tools and in the interdependencies between the tools.

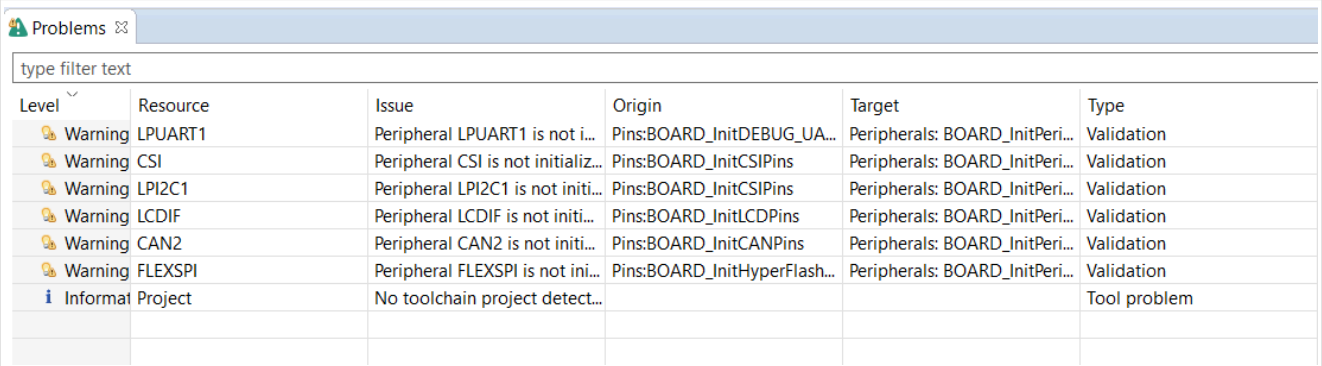


Figure 23. Problems view

To open the **Problems** view, click the **Show Problems view** button in the **Toolbar**, or select **Views > Problems** from the **Menu bar**.

The **Problems** table contains the following information:

2.8.1 Table Problems view

Table 12. Problems view

Item	Description
Level	Severity of the problem: Information, Warning, or Error.
Resource	Resource related to the problem, such as the signal name, the clock signal.
Issue	Description of the problem.
Origin	Information on the dependency source.
Target	Tool that handles the dependency and its resolution.
Type	Type of the problem: either a validation that checks dependencies between tools, or a single-tool issue.

Every issue comes with a context menu accessible by right-clicking the table row. Use this menu to access information about the problem or to apply a quick fix where applicable. You can also copy the rows for later use by right-clicking the row and selecting **Copy** or by using the **Ctrl+C** shortcut. You can use the **Ctrl+left-click** shortcut to add additional rows to the selection.

Note: A quick fix is only available for problems highlighted with the “light bulb” icon.

Filter buttons are available on the right side of the **Problems** view ribbon.

2.8.1.1 Table filter buttons

Table 13. Filter buttons

Button	Description
	Enables the **Validate boot init only** preference. See the Configuration preferences section for details.
	Filters messages in the **Problems** view. If selected, only problems for the active tool are displayed. See the Configuration preferences section for details.

2.9 Registers view

The **Registers** view lists the registers handled by the tool models. You can see the state of the processor registers that correspond to the current configuration settings and also the state that is in the registers by default after the reset. The values of the registers are displayed in the hexadecimal and binary form. If the value of the register (or bit) is not defined, an interrogation mark “?” is displayed instead of the value.

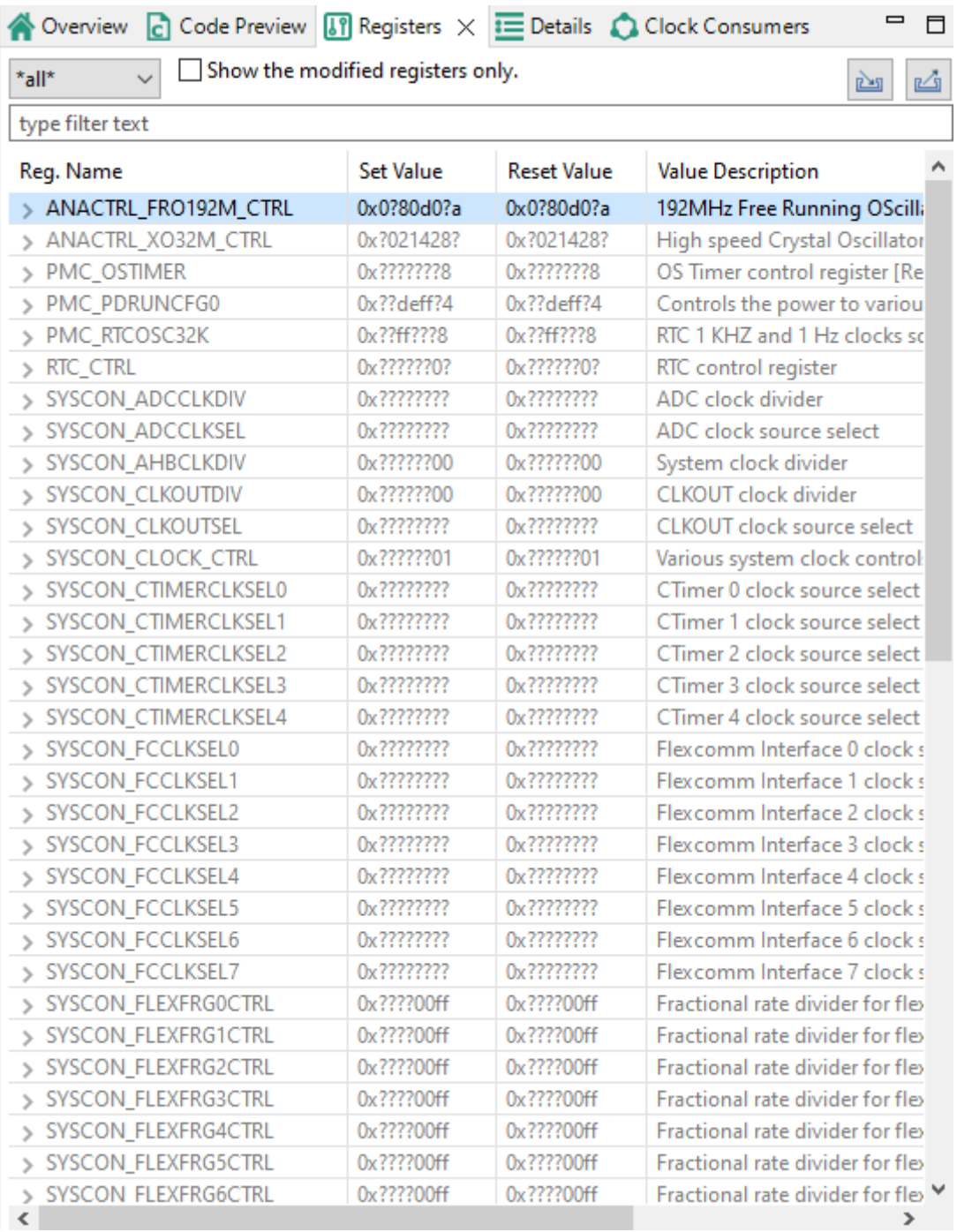


Figure 24. Registers view

The **Registers view** contains several items.

2.9.1 Table registers

Table 14. Registers

Item	Description
Peripheral filter drop-down list	List the registers only for the selected peripheral. Select **all** to list registers for all the peripherals.
Show modified registers only checkbox	Hide the registers that are left in their after-reset state or are not configured.
Text filter	Filter content by text.
Import/Export registers	Import/Export registers from/to CSV (Import is available only for the Clocks tool)

The following table lists the color highlighting styles used in the **Registers** view.

2.9.2 Table Color codes

Table 15. Color codes

Color	Description
Yellow background	Indicates that the bitfield has been affected by the last change made in the tool.
Gray text color	Indicates that the bitfield is not edited and the value is the after-reset value.
Black text	Indicates the bit-fields that the tool modifies.

Note: When the Peripherals tool is active and register initialization components are used, the user can perform manual changes to some of the displayed values.

Note: This view contains registers for the selected tool. The view uses registers as internal parameters but it might not handle all the register writes needed in the code. The register writes are done inside the SDK functions that are called by the generated code. There might be additional registers accessed in the SDK code during the setup process, and such register writes are not known to the tool and are not displayed in the registers view.

2.10 Log view

The **Log** view shows user-specific information about MCUXpresso Config Tools operations. The **Log** view can show up to 100 records across all tools in chronological order.

Each log entry consists of a timestamp, the name of the tool responsible for the entry, severity level, and the actual message. If no tool name is specified, the entry was triggered by shared functionality.

You can filter the content of the **Log** view using the combo boxes to display only specific tool and/or severity level information. Filters in different tools can be set independently.

Buffered log records are cleared using the clear button. It affects **Log** views across all tools.

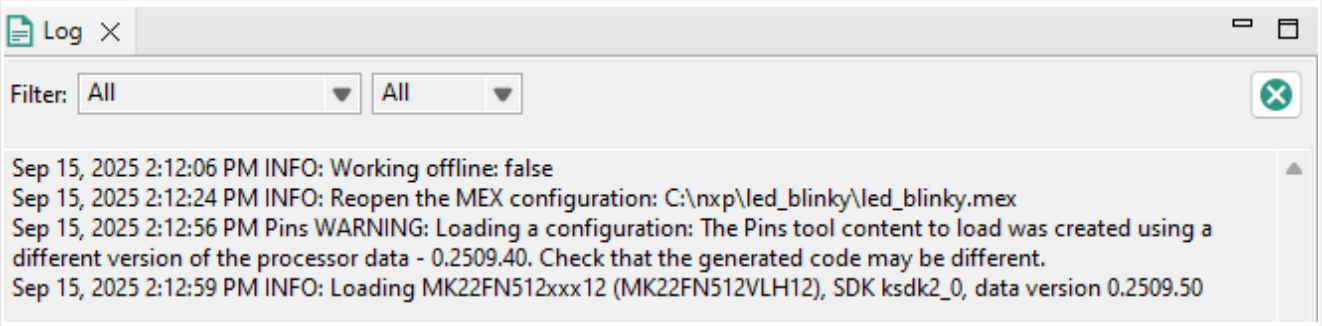


Figure 25. Log view

2.11 Config tools overview

The **Config Tools Overview** provides general information about your currently active configuration, hardware, and project. It also provides a quick overview of the used/active and unused/inactive tools, generated code, and functional groups. By default, the **Config Tools Overview** icon is on the left side of the toolbar.

Config Tools Overview opens automatically when you create and open a new configuration. You can disable this behavior in the **Preferences**.

Config Tools Overview contains several items.

2.11.1 Table Config Tools Overview

Table 16. Config Tools Overview

Item	Description
Configuration - General Info	Displays the name of and the path to the MEX file of the current configuration. Click the link to open the folder containing the MEX file. To import additional settings, click the **Import additional settings into current configuration** button.
Configuration - HW Info	Displays the processor, part number, core, and SDK-version information of the current configuration.
Project	Displays toolchain project information.
Pins/Clocks/Peripherals/TEE/Device Configuration	Displays basic information about the **Pins**, **Clocks**, **Peripherals**, **TEE**, and **Device Configuration** tools.

Note: If you have disabled a tool and want to reopen it, click the tool icon in the upper right corner or select it from the Main Menu. The **Config Tools Overview** opens automatically.

To enable or disable the tools, click the toggle button. Navigate to the tools by clicking their icons. The following information about the tools is also available:

2.11.2 Table Config Tools Overview

Table 17. Config Tools Overview

Item	Description
Generated code	Contains the list of source-code files. Click the links to open the files in the **Code Preview** view.

Table 17. Config Tools Overview*...continued*

Item	Description
Functional groups	Contains the list of the currently active functional groups. To select the groups in the **Functional groups** tab in the toolbar, select the relevant links.

- To open a tool-specific overview, select **Views > Overview** from the main menu.

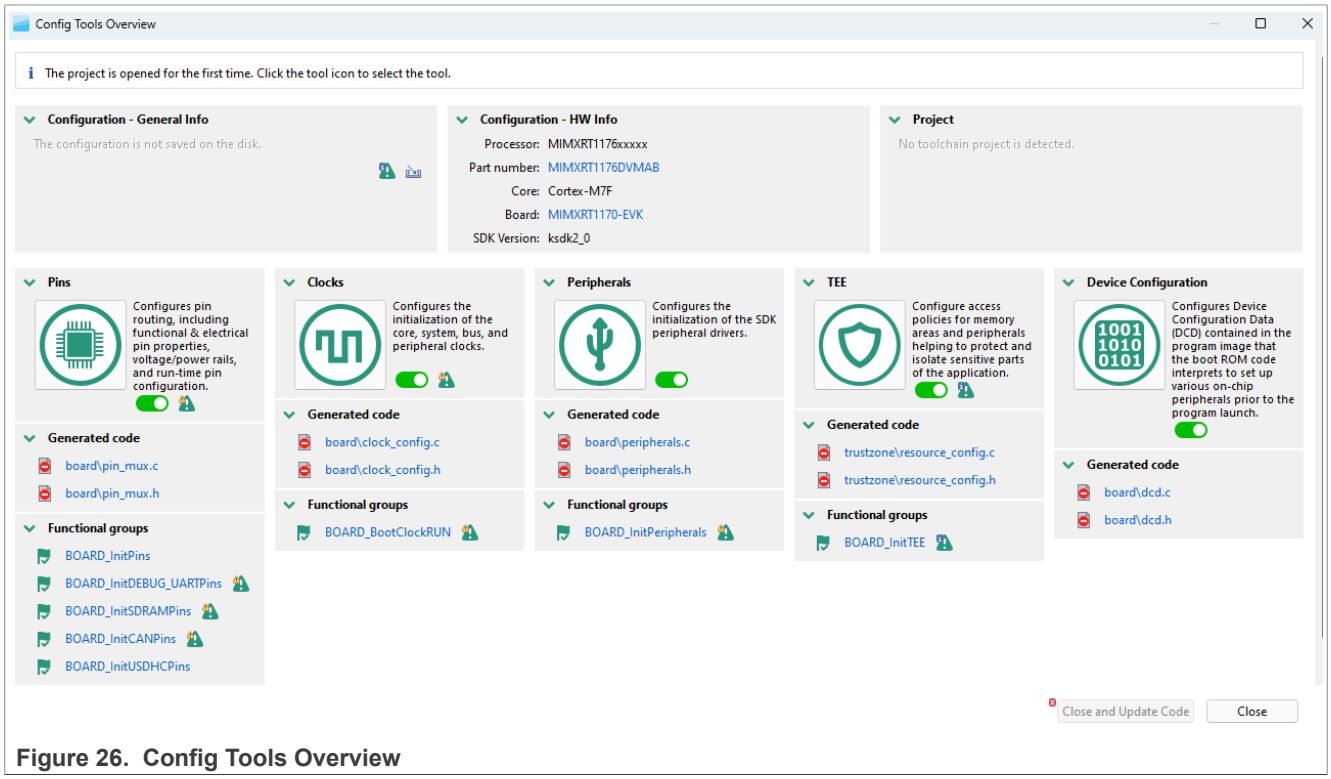


Figure 26. Config Tools Overview

Note: Unsupported tools are not displayed in the overview.

2.12 Config tools snippets

The **Config tools snippets** view can be opened in the Config Tools perspective. The snippets view shows snippets collected from the Peripherals tool. The snippets can be categorized. The hierarchy is controlled by the tool. Use the toolbar action or context menu to copy to the clipboard.

Note: In the current version, the **Config tools snippets** view is supported for the Peripherals tool only.

3 Pins Tool

The **Pins** tool is an easy-to-use tool for configuring device pins. The **Pins** tool software helps create, inspect, and modify any element of pin configuration and device muxing.

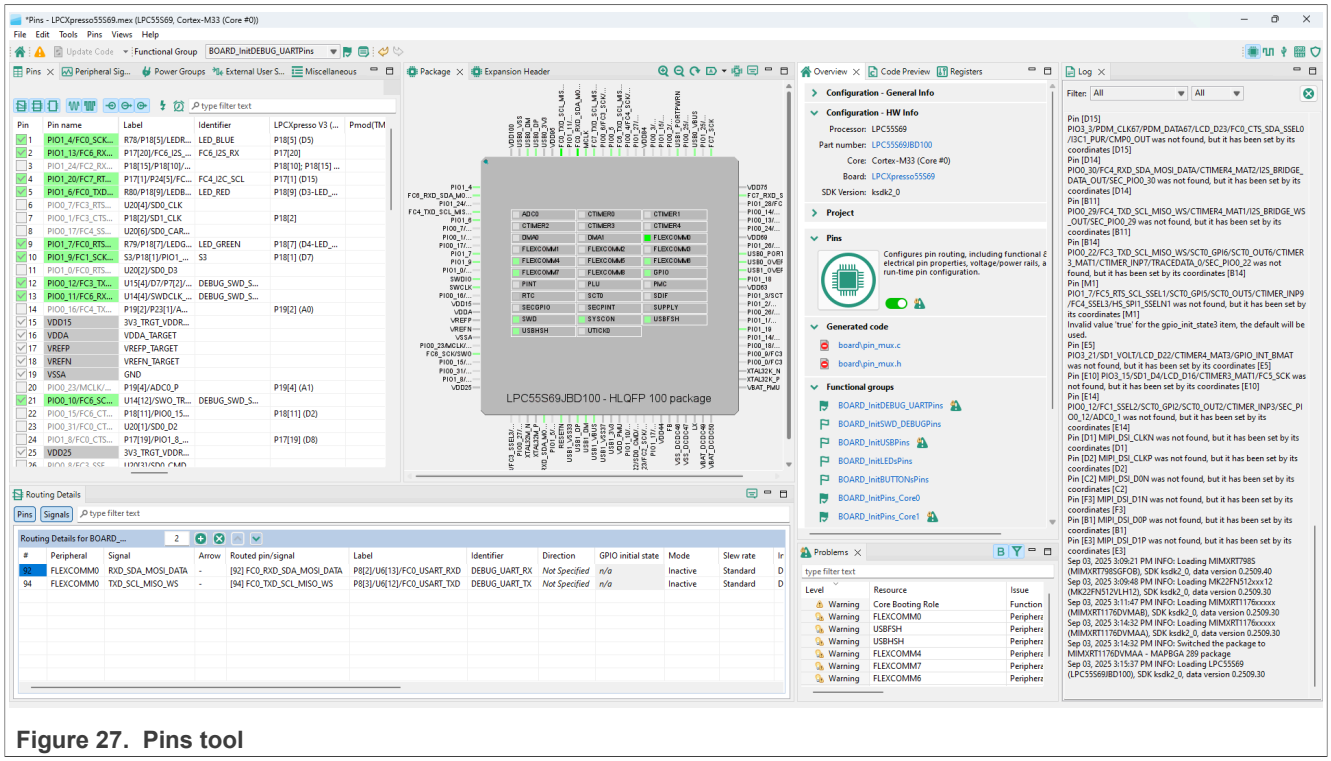


Figure 27. Pins tool

3.1 Pins routing principle

The Pins tool is designed to configure routing peripheral signals either to pins or to internal signals.

An internal signal is an interconnection node that peripheral signals can be connected to (without any pin interaction). Connecting two peripheral signals to an internal signal makes an interconnection of these two peripheral signals.

This routing configuration can be done in the following views:

- **Pins**
- **Peripheral Signals**
- **Package**
- **Routing Details**

The following two sections describe the two methods that you can use to define the routing path.

3.1.1 Beginning with pin/internal signal selection

You can select a pin or an internal signal in the **Routing Details** view.

1. Select the pin/internal signal (**Routed pin/signal**).
2. Select one of the available **Peripherals**.
3. For the selected peripheral, select one of the available **Signals**.
   Items in the **Peripheral** column in the **Routing Details** view have the following symbols:
   - The exclamation mark and default text color indicate that such item selection can cause a register conflict or the item does not support the selected signal.
   - The exclamation mark and gray text color indicate that the item cannot be routed to the selected pin/internal signal. The item is available for different pin/internal signals using the same signal.
     Note: In the **Pins** view and the **Package** view, you can configure only pins and not internal signals.

3.1.2 Routing of peripheral signals

Peripheral signals representing on-chip peripheral input or output can be connected to other on-chip peripherals or to a pin through an interperipheral crossbar. You can configure this connection in the **Routing Details** view.

Three types of peripheral signal routing are available:

1. Routing the signal from the output of an internal peripheral (A) into the input of another internal peripheral (B)
   The signal leads from the output of one internal peripheral (A) to the input node of another internal peripheral (B). In other words, the signal leads from A to B (A > B). To configure a signal in this way, perform the following steps (PWM triggering ADC (PWM > ADC) used as an example):
   a. Add a row in the **Routing Details** view.
   b. Select peripheral B from the drop-down list in the **Peripheral** column.

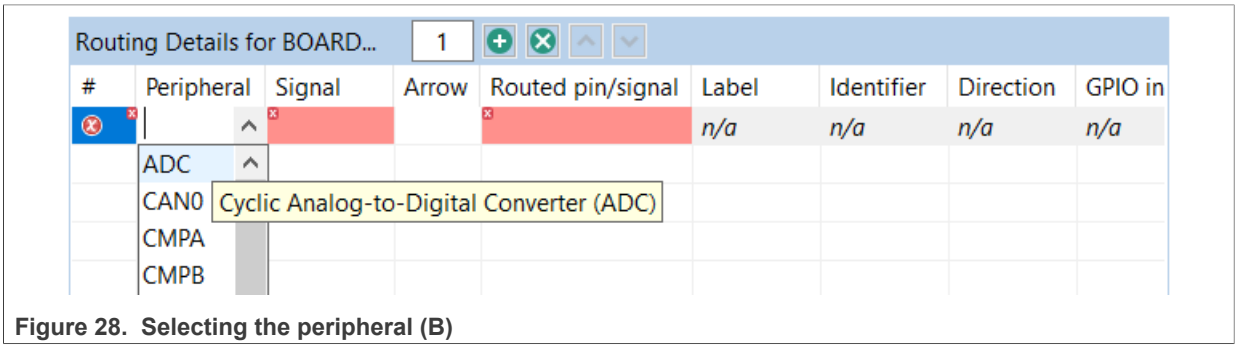


Figure 28. Selecting the peripheral (B)

   c. Select the input node of peripheral B from the drop-down list in the **Signal** column.

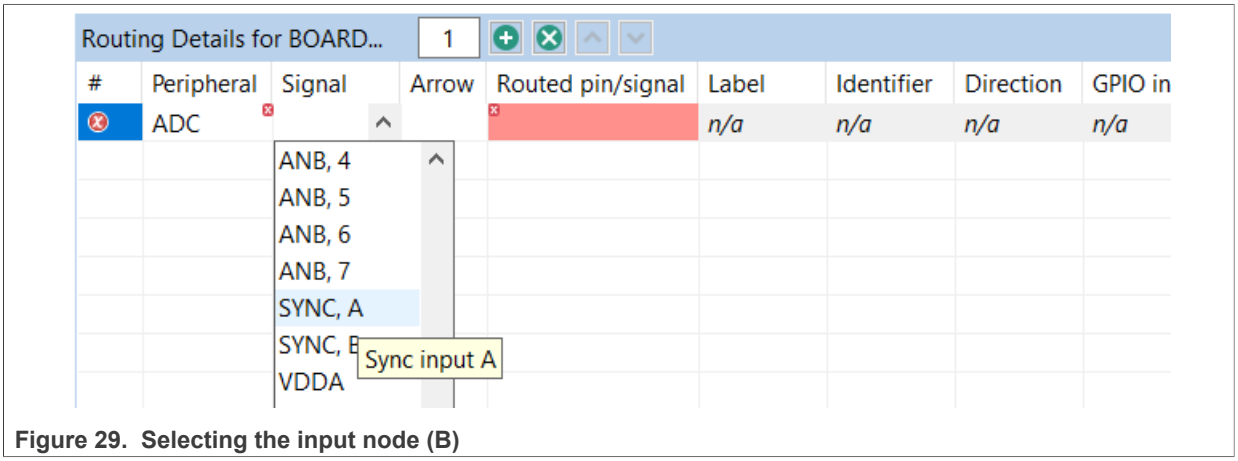


Figure 29. Selecting the input node (B)

   d. Select the output signal of peripheral A from the drop-down list in the **Routed pin/signal** column.

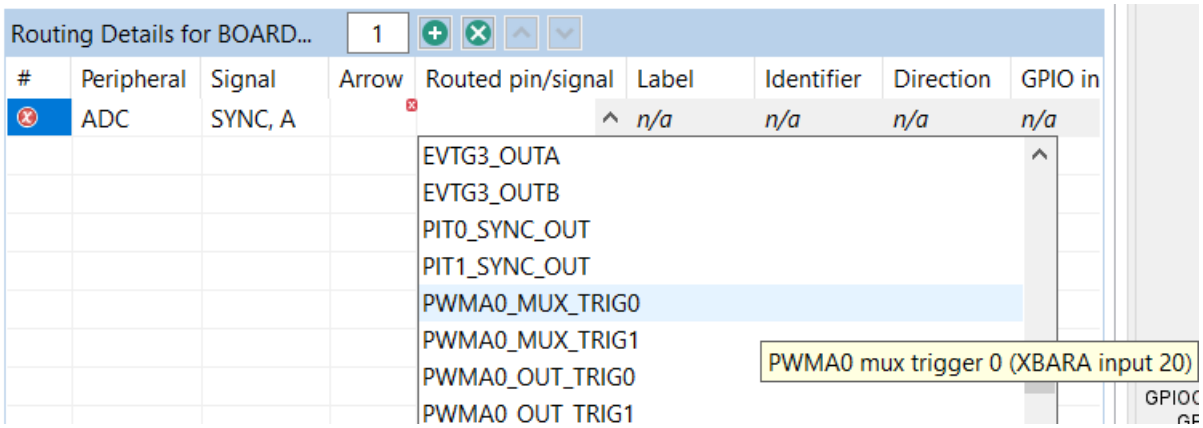


Figure 30. Selecting the output signal

After configuration, the row looks like this:

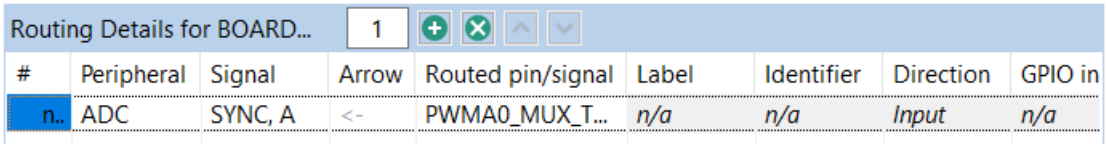


Figure 31. Result

Note: Select the ADC peripheral where the signal leads to (input in ADC). The Pins tool does not list the signal for the PWM peripheral (output). Notice the direction of the signal in the **Arrow** column.

2. Routing the signal from a pin on the package to an internal peripheral input signal through an interperipheral crossbar

   Note: Only if a crossbar switch is present.

   The signal leads from a pin on the package (XB_IN) connected through an interperipheral crossbar, to an internal peripheral (B) input node. In other words, the signal leads from XB_IN to B (XB_IN > B). To configure a signal in this way, perform the following steps (routing pin 55 using XB_IN6 to EVTG0 input A (XB_IN6 > EVTG0) used as an example):

   a. Add a row in the **Routing Details** view.
   b. Select peripheral B from the drop-down list in the **Peripheral** column.

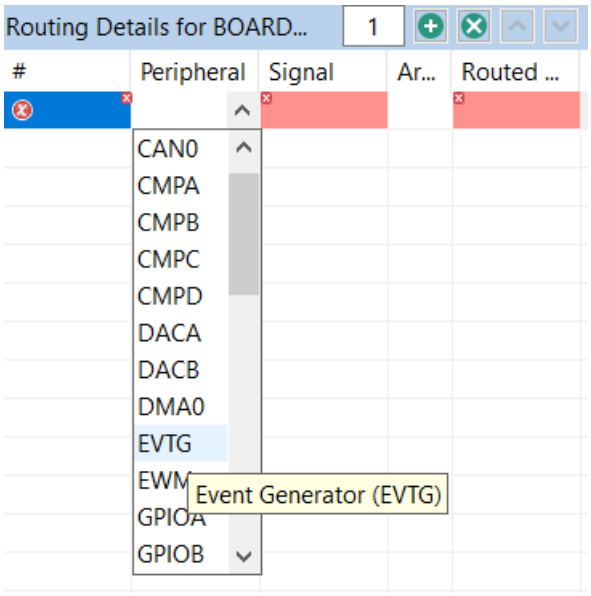


Figure 32. Selecting the peripheral (B)

c. Select the input node of peripheral B from the drop-down list in the **Signal** column.

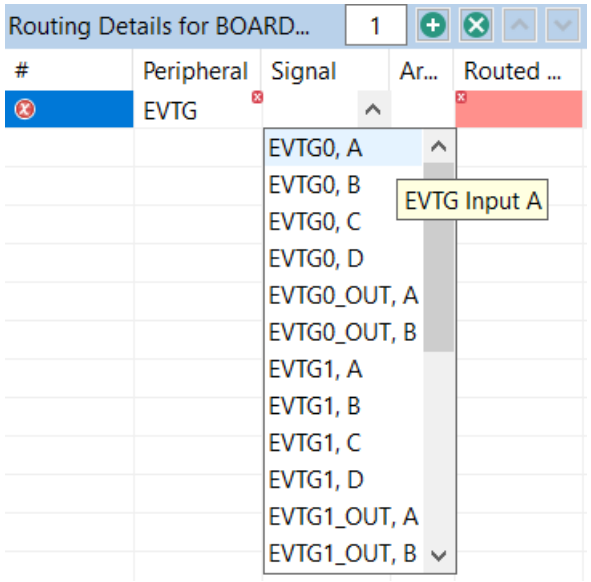


Figure 33. Selecting the input node (B)

d. Select the XB_IN pin from the drop-down list in the **Routed pin/signal** column.

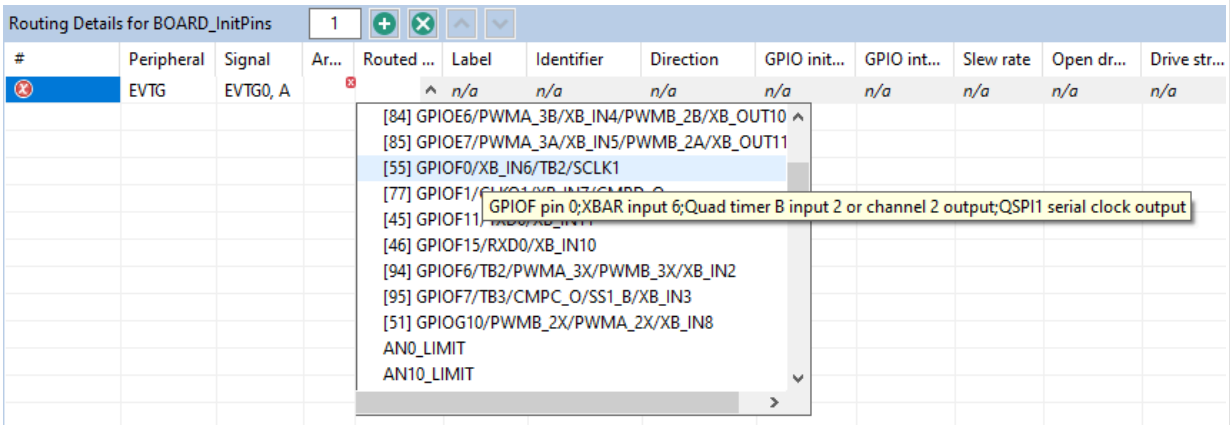


Figure 34. Selecting the pin

Once the configuration is done, the row looks like this:

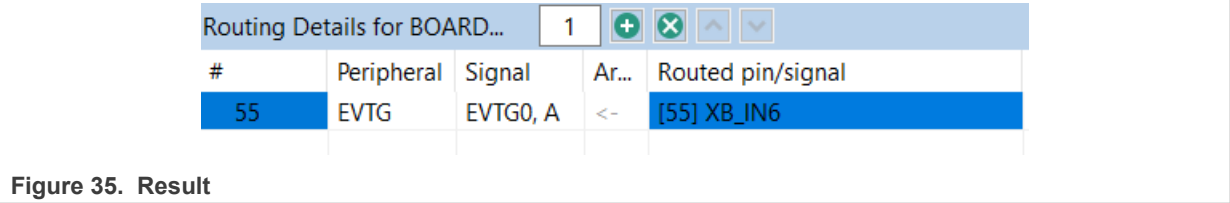


Figure 35. Result

Note: In this example, GPIOF0 is multiplexed with XB_IN6, QTimerB channel 2 output/input and QSPI1 SCLK signal. In this case, the tool automatically picks XB_IN6 for the pin as XB_IN6 is the only option to be routed to EVTG0 input A.

3. Routing the signal from an internal peripheral (A) output to a pin via an interperipheral crossbar
   Note: Only if a crossbar switch is present.
   The signal leads from an internal peripheral (A) output to a pin connected through an interperipheral crossbar on the package (XB_OUT). In other words, the signal leads from A to XB_OUT (A > XB_OUT). To configure a signal in this way, perform the following steps (routing EVTG0 output to pin 87 using XB_OUT4 used as an example):
   a. Add a row in the **Routing Details** view.
   b. Select peripheral A from the drop-down list in the **Peripheral** column.

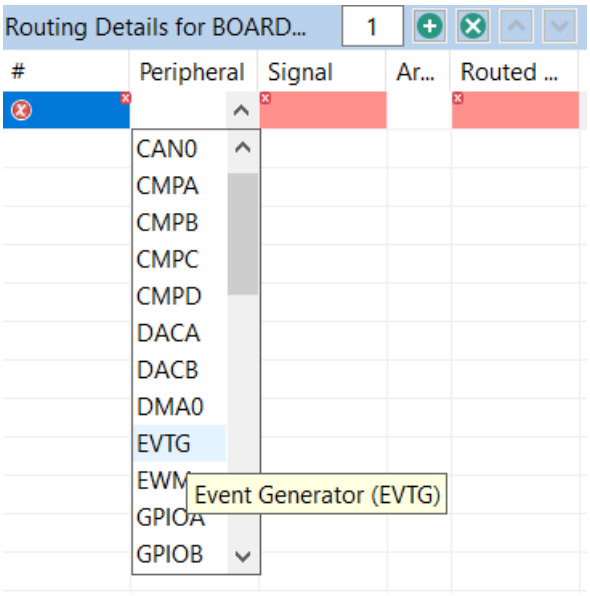


Figure 36. Selecting the peripheral (A)

a. Select the input node of peripheral A from the drop-down list in the **Signal** column.

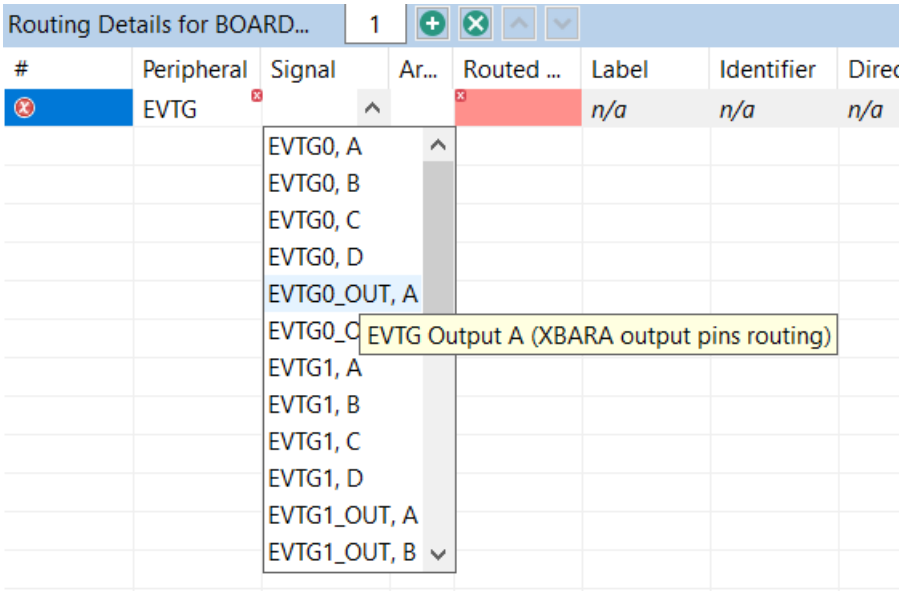


Figure 37. Selecting the output signal (A)

b. Select the XB_OUT pin from the drop-down list in the **Route to** column.

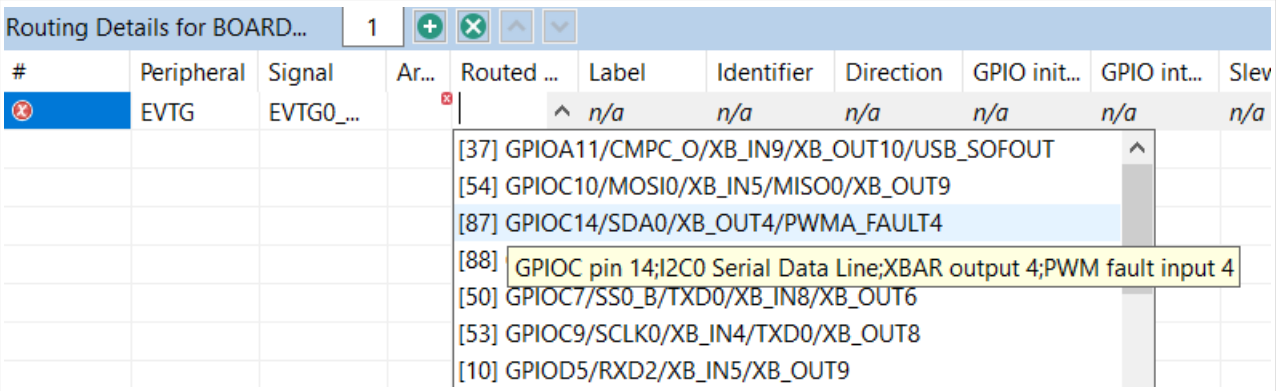


Figure 38. Selecting the pin

Once the configuration is done, the row looks like this:

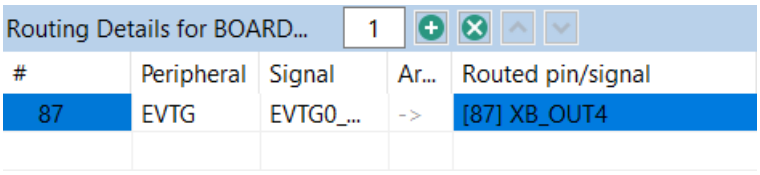


Figure 39. Result

Note: In this example, GPIOC14 is multiplexed with XB_OUT4, SDA of I2C0 and fault4 of eFlexPWMA. In this case, the tool automatically configures XB_OUT4 for the pin GPIOC14 (pin 87) as XB_OUT4 is the only option for EVTG0 output A.

Note: In some cases, multiple routings are configured by the same register change. When such routing is created, the user is offered an option to add the related routing to the functional group. Similarly, when a routing is removed, related routings are offered for removal.

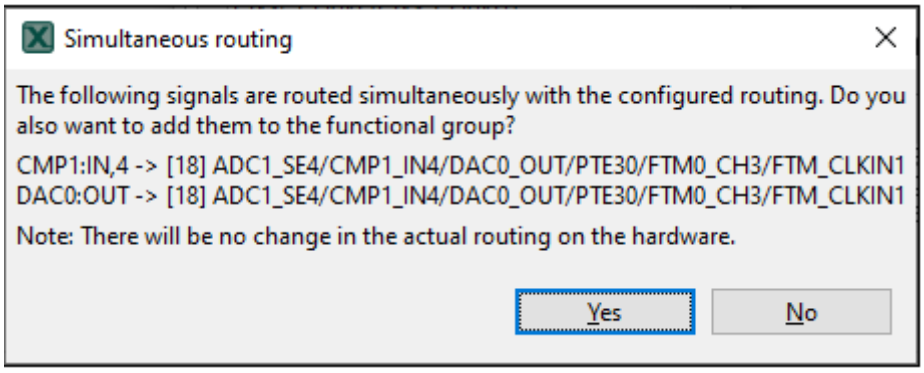


Figure 40. Simultaneous routing

3.2 Example workflow

This section lists the steps to create an example pin configuration, which can then be used in a project.

In this example, three pins **(UART3_RX, UART3_TX and PTB20)** on a board are configured.

You can use the generated files with the application code.

1. In the **Pins** view on the left, select the **UART3_RX** and **TX** signals. To do so, click the cells to make them green.

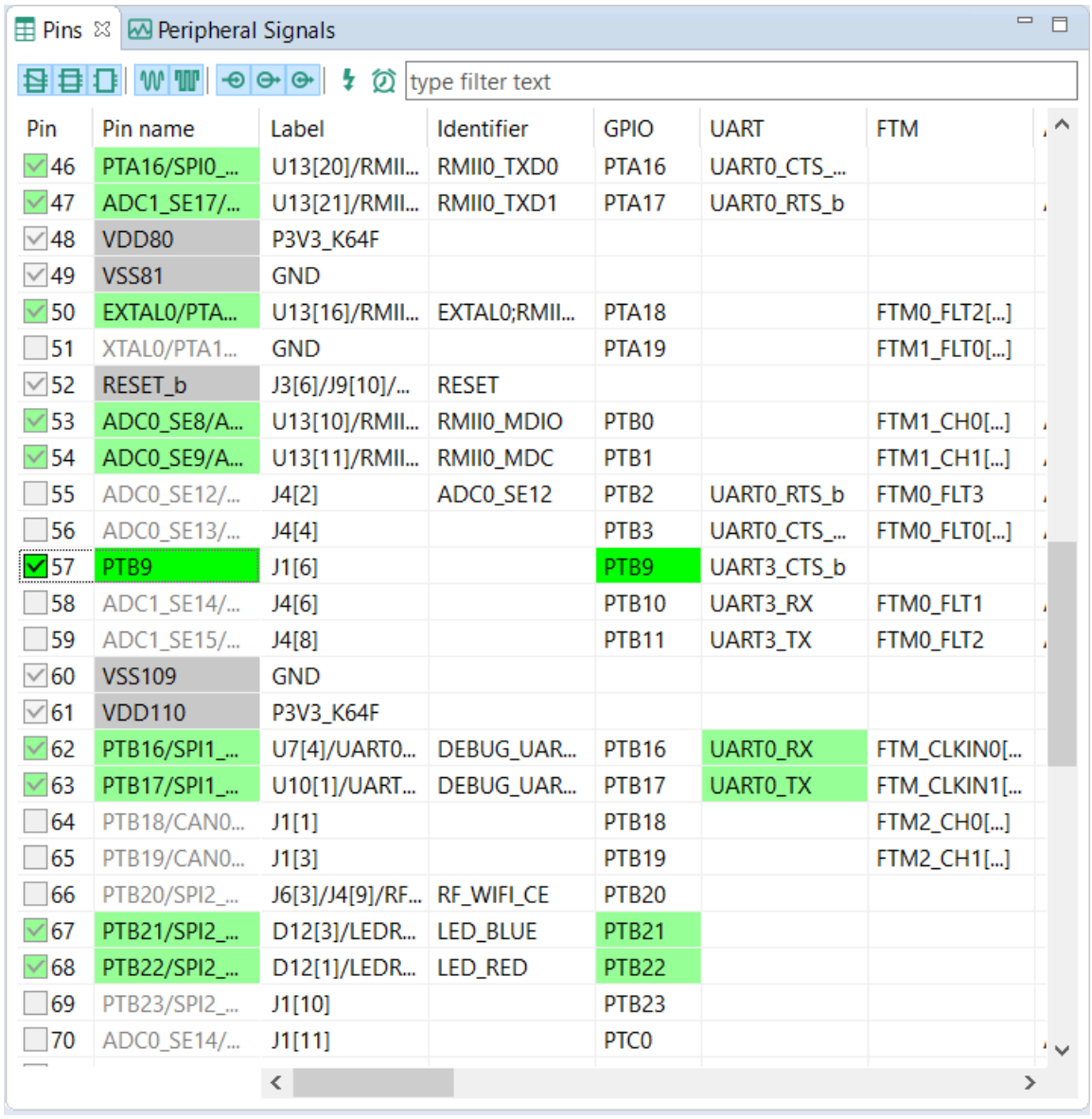


Figure 41. Configuring signals in the Pins view

2. In the **Routing Details** view, select the **Output** direction for the TX and PTB20 signals.

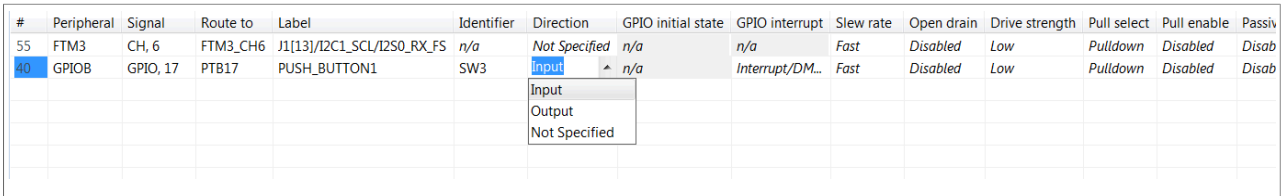


Figure 42. Selecting direction

Note: For GPIO peripherals, set the **Direction** by clicking the cell and selecting from the drop-down menu. If you select **Output**, also set the **GPIO initial state** by clicking the cell in the **GPIO initial state** column. If you select Input, also set the GPIO interrupt by clicking the cell in the **GPIO interrupt** column.

3. The Pins tool automatically generates the source code for `pin_mux.c` and `pin_mux.h` on the right panel of **Code Preview**.

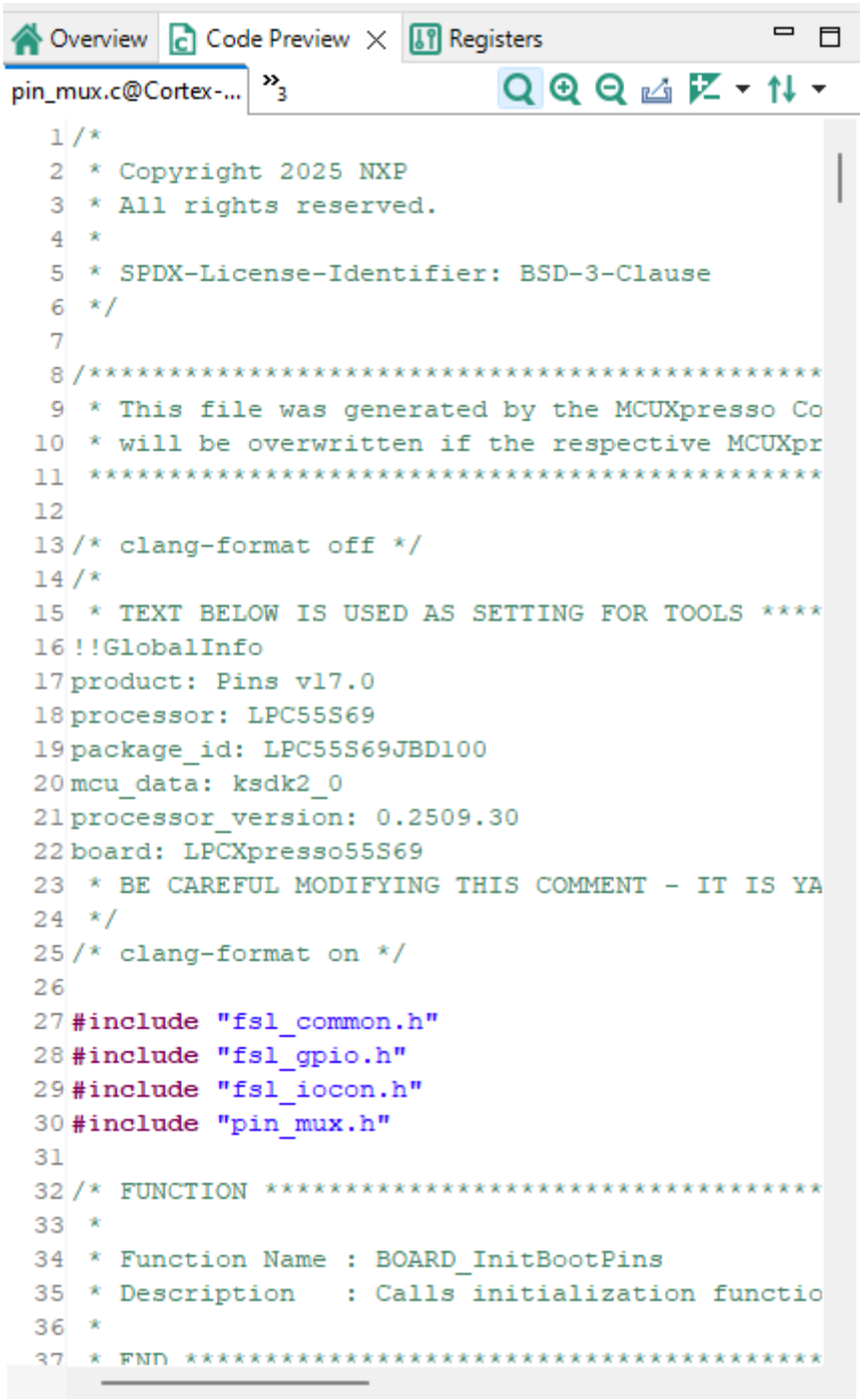


Figure 43. Generated code Pins

4. Copy-paste the content of the source(s) to your application and IDE. Alternatively, export the generated files or update the code with the **Update Code** button in the **Toolbar**. To export the files, select **File > Export** (in the desktop version) or select the menu **Pins > Export** menu (in the web version). In the **Export** dialog, expand the tree control for the tool that you want to export sources for and select the **Export Source Files** option. **Export**, select the **Export Source Files** option.

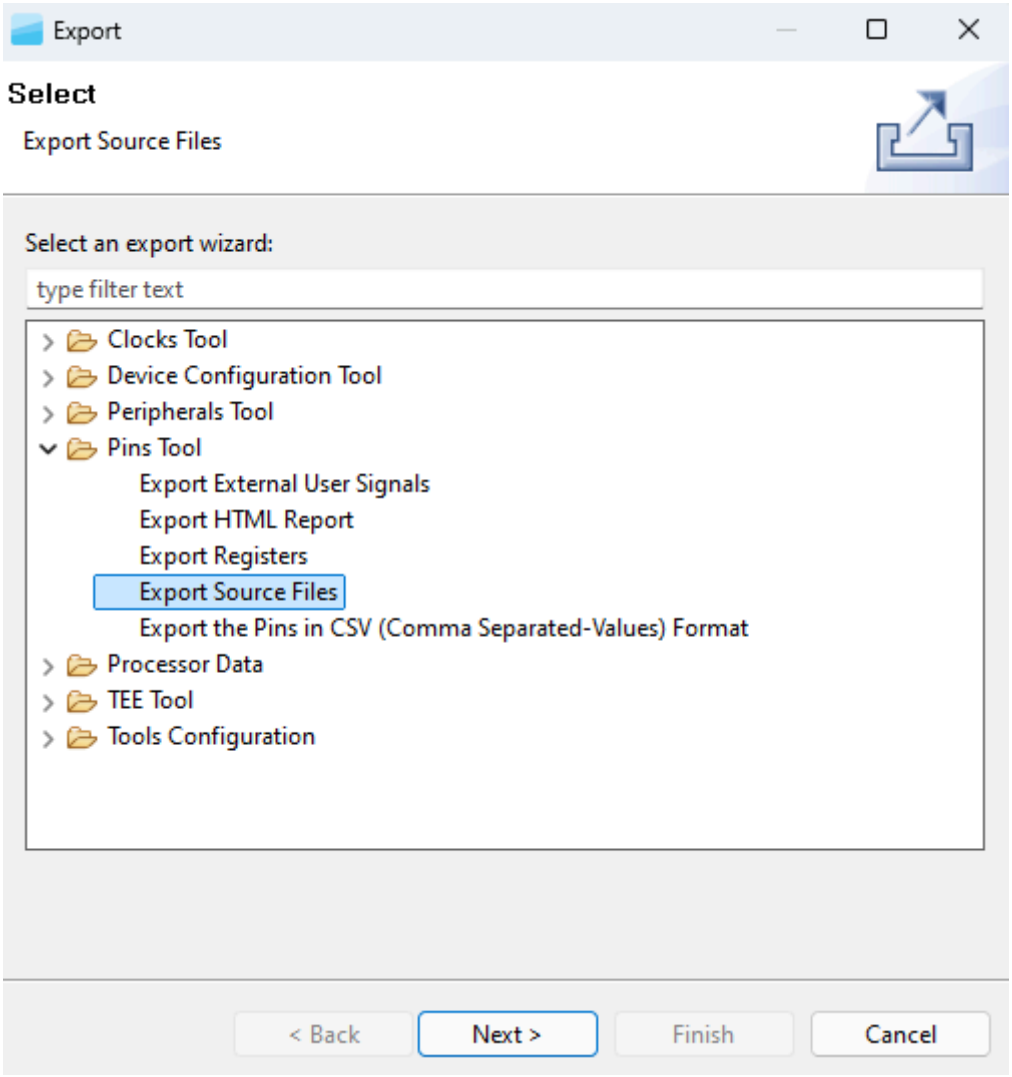


Figure 44. Export

5. Click **Next** and specify the directory for each respective core (in multicore configuration) where you want to store the exported files for each individual core (in case of multicore configuration).
6. Click **Finish** to export the files.
7. Integrate and use the exported files in your application as source files.

3.3 User interface

The Pins tool consists of several views.

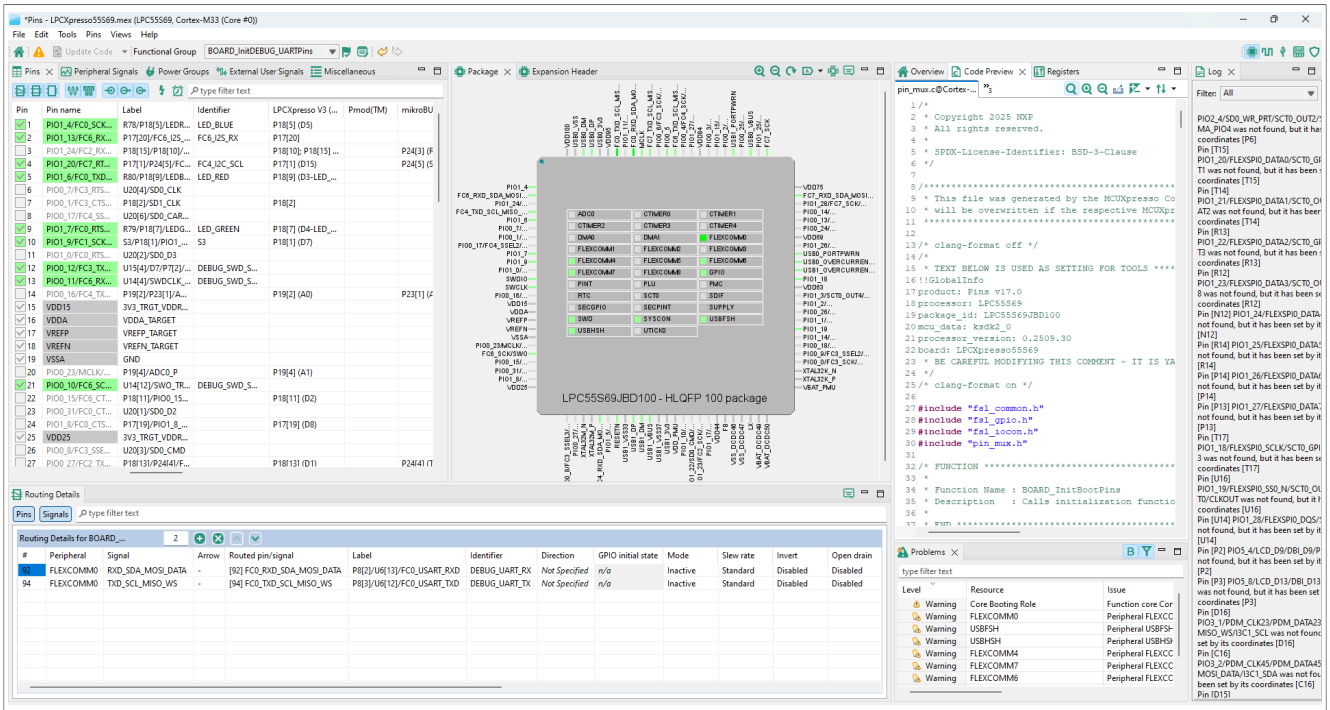


Figure 45. Pins tool user interface

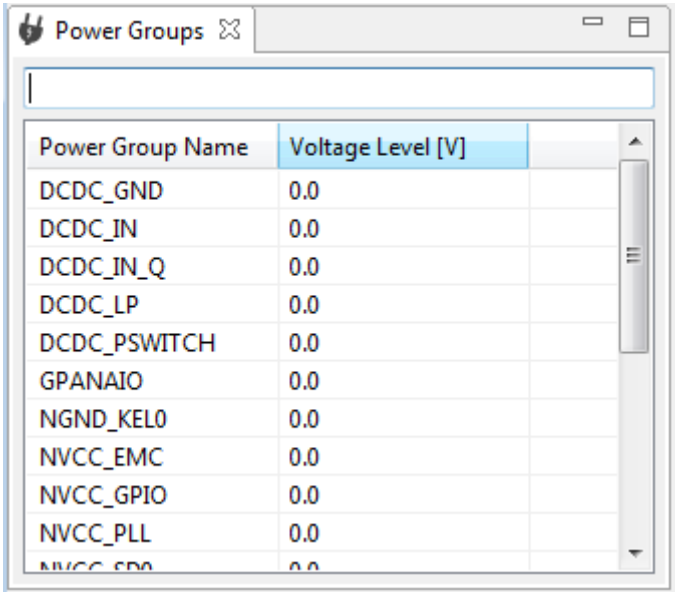
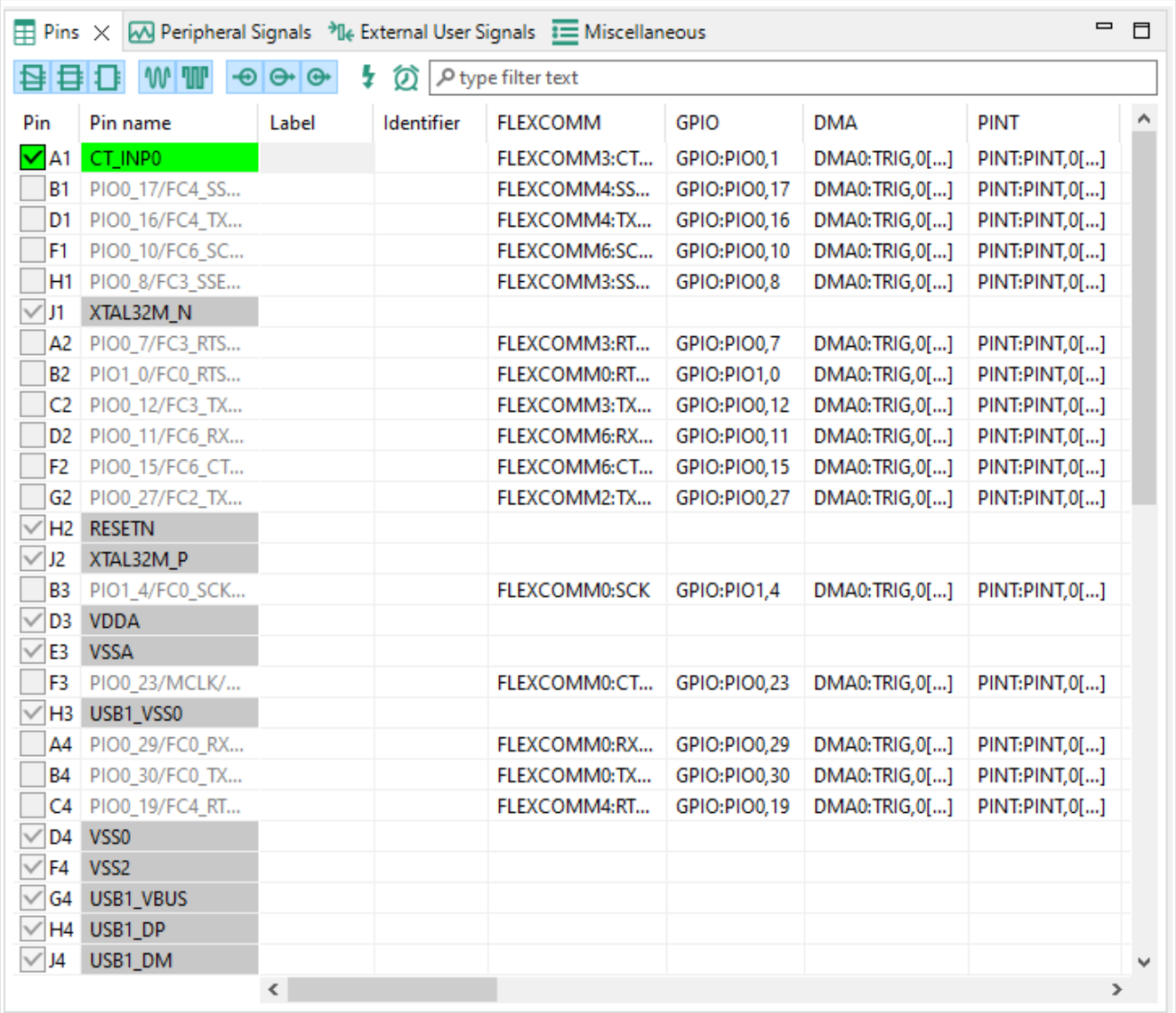


Figure 46. Selecting power group

Note: Power Groups are not supported for all processors.

3.3.1 Pins view

The **Pins** view shows all the pins in a table format.



Pin	Pin name	Label	Identifier	FLEXCOMM	GPIO	DMA	PINT
A1	CT_INP0			FLEXCOMM3:CT...	GPIO:PIO0,1	DMA0:TRIG,0[...]	PINT:PINT,0[...]
B1	PIO0_17/FC4_SS...			FLEXCOMM4:SS...	GPIO:PIO0,17	DMA0:TRIG,0[...]	PINT:PINT,0[...]
D1	PIO0_16/FC4_TX...			FLEXCOMM4:TX...	GPIO:PIO0,16	DMA0:TRIG,0[...]	PINT:PINT,0[...]
F1	PIO0_10/FC6_SC...			FLEXCOMM6:SC...	GPIO:PIO0,10	DMA0:TRIG,0[...]	PINT:PINT,0[...]
H1	PIO0_8/FC3_SSE...			FLEXCOMM3:SS...	GPIO:PIO0,8	DMA0:TRIG,0[...]	PINT:PINT,0[...]
J1	XTAL32M_N						
A2	PIO0_7/FC3_RTS...			FLEXCOMM3:RT...	GPIO:PIO0,7	DMA0:TRIG,0[...]	PINT:PINT,0[...]
B2	PIO1_0/FC0_RTS...			FLEXCOMM0:RT...	GPIO:PIO1,0	DMA0:TRIG,0[...]	PINT:PINT,0[...]
C2	PIO0_12/FC3_TX...			FLEXCOMM3:TX...	GPIO:PIO0,12	DMA0:TRIG,0[...]	PINT:PINT,0[...]
D2	PIO0_11/FC6_RX...			FLEXCOMM6:RX...	GPIO:PIO0,11	DMA0:TRIG,0[...]	PINT:PINT,0[...]
F2	PIO0_15/FC6_CT...			FLEXCOMM6:CT...	GPIO:PIO0,15	DMA0:TRIG,0[...]	PINT:PINT,0[...]
G2	PIO0_27/FC2_TX...			FLEXCOMM2:TX...	GPIO:PIO0,27	DMA0:TRIG,0[...]	PINT:PINT,0[...]
H2	RESETN						
J2	XTAL32M_P						
B3	PIO1_4/FC0_SCK...			FLEXCOMM0:SCK	GPIO:PIO1,4	DMA0:TRIG,0[...]	PINT:PINT,0[...]
D3	VDDA						
E3	VSSA						
F3	PIO0_23/MCLK/...			FLEXCOMM0:CT...	GPIO:PIO0,23	DMA0:TRIG,0[...]	PINT:PINT,0[...]
H3	USB1_VSS0						
A4	PIO0_29/FC0_RX...			FLEXCOMM0:RX...	GPIO:PIO0,29	DMA0:TRIG,0[...]	PINT:PINT,0[...]
B4	PIO0_30/FC0_TX...			FLEXCOMM0:TX...	GPIO:PIO0,30	DMA0:TRIG,0[...]	PINT:PINT,0[...]
C4	PIO0_19/FC4_RT...			FLEXCOMM4:RT...	GPIO:PIO0,19	DMA0:TRIG,0[...]	PINT:PINT,0[...]
D4	VSS0						
F4	VSS2						
G4	USB1_VBUS						
H4	USB1_DP						
J4	USB1_DM						

Figure 47. Pins table view

This view shows the list of all the pins available on a given device. The **Pin name** column shows the default name of the pin, or if the pin is routed. The next columns are optional. They are **Label**, **Identifier, External User Signals,** and **Expansion header connections** (One column for each expansion header). The pin name is changed to show the appropriate function for the selected peripheral if routed. The next column of the table shows peripherals and signals and pin name(s) on a given peripheral. Peripherals with a few items are cumulated in the last column.

To route/unroute a pin to the given peripheral, select the relevant cell in the **Pin** column. Routed pins are highlighted in green. If a conflict in routing exists, the pins are highlighted in red.

Gray background color in the Pin name column indicates that the pin/peripheral is dedicated. It is routed by default and has no impact on the generated code.

Every routed pin appears in the **Routed pins** table.

When multiple functions are specified in the configuration, the **Pins** view shows pins for the selected function primarily. Pins for different functions are shown with light transparency and cannot be configured until switched to this function.

Select a row to open a drop-down list that offers the following options:

- Route/Unroute the pin.
- Highlight the pin in the **Package** view.
- Set the label and identifier for the pin.
- Add a comment to the pin. You can later inspect the comment in the **Code Preview** view.

Tip: The option to route more signals to a single pin is indicated by an ellipsis (…). Select the cell to open a dialog to choose from multiple available signals. The dialog also displays which signals are routed by default.

3.3.2 Package

The **Package** view displays the processor package. The processor package provides an overview of the package including resource allocation.

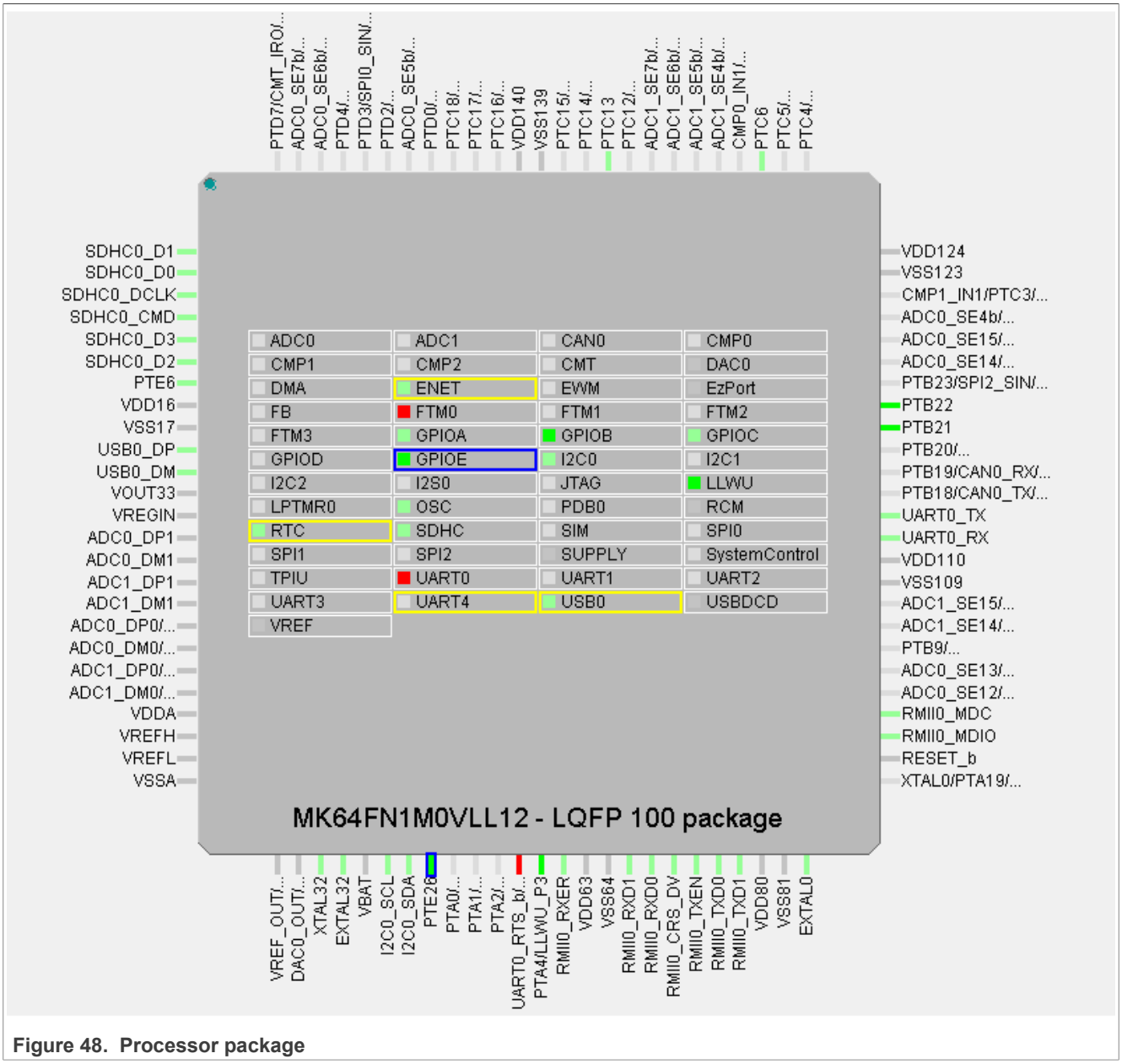


Figure 48. Processor package

This view shows package overview with pins location. In the center are the peripherals.

To highlight the pin/peripheral configuration in the **Pins** and **Routing Details** views, right-click the pin or peripheral and select **Highlight**.

For BGA packages, use the **Resources** icon to see them.

- Green color indicates the routed pins/peripherals.
- Gray color indicates that the pin/peripheral is not routed.
- Dark Gray color indicates that the pin/peripheral is dedicated. It is routed by default and has no impact on generated code.

The view also shows the package variant and the description (type and number of pins).

The following icons are available in the toolbar:

3.3.2.1 Table Toolbar options

Table 18. Toolbar options

Icon	Description
	Zoom in package image.
	Zoom out package image.
	Rotate package image.
	Show pins as you can see it from the bottom. This option is available on BGA packages only.
	Show pins as you can see it from the top. This option is available on BGA packages only.
	Show resources. This option is available on BGA packages only.
	Switch package.
	Package legend.
	Select the information displayed as pin labels. This option is not available on BGA packages.

Note: Depending on the processor package selected, not all views are available.

The **Switch package** icon launches **Switch package for the Processor**.

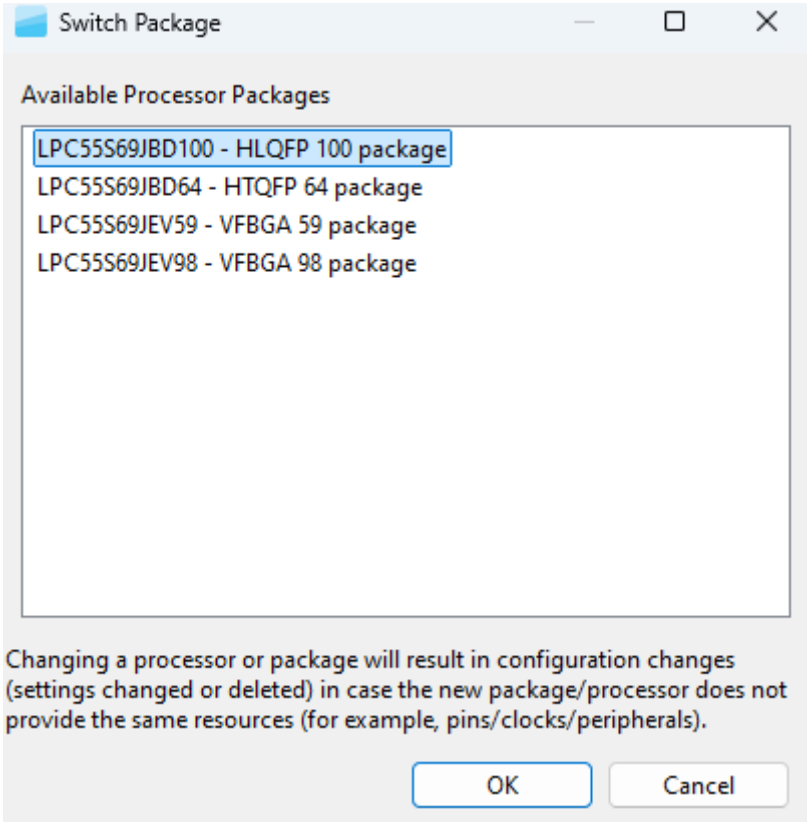


Figure 49. Switch package

The **Switch package for the Processor** window shows list of available processor packages, showing package type and number of pins.

3.3.3 Peripheral Signals view

The **Peripheral Signals** view shows a list of peripherals and their signals. Only the **Peripheral Signals** and **Pins** view show the checkbox (allocated) with status.

3.3.3.1 Table Status codes

Table 19. Status codes

Color code	Status
	Error
	Configured
	Not configured
	Warning
	Dedicated: Device is routed by default and has no impact on the generated code.

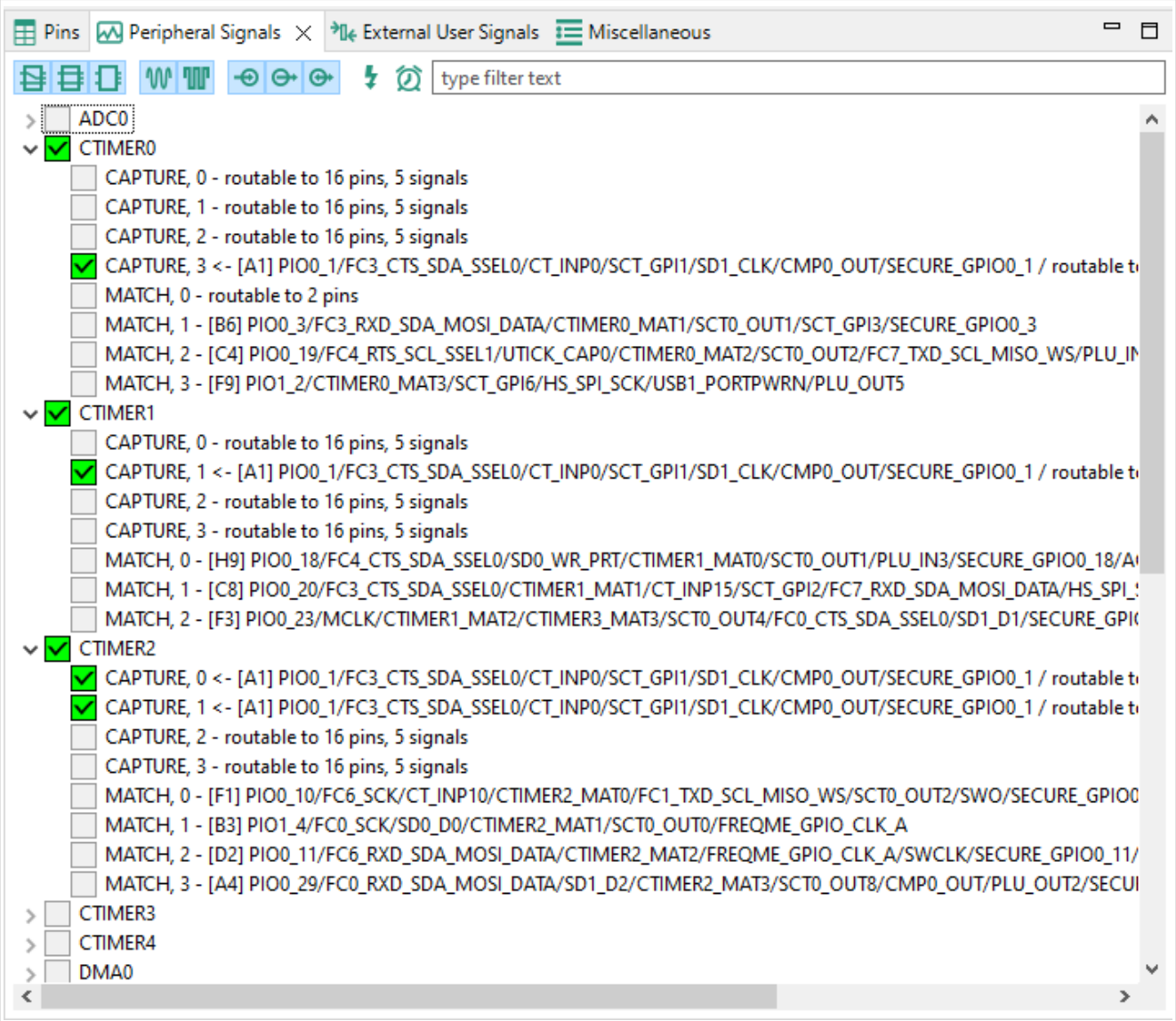


Figure 50. Peripheral Signals view

Use the checkbox to route/unroute the pins.

To highlight the pin/routing configuration about the peripheral in the **Package** and **Routing Details** views, right-click the signal and select **Highlight**.

To route/unroute multiple pins, click the peripheral and select the options in the **Select signals** dialog.

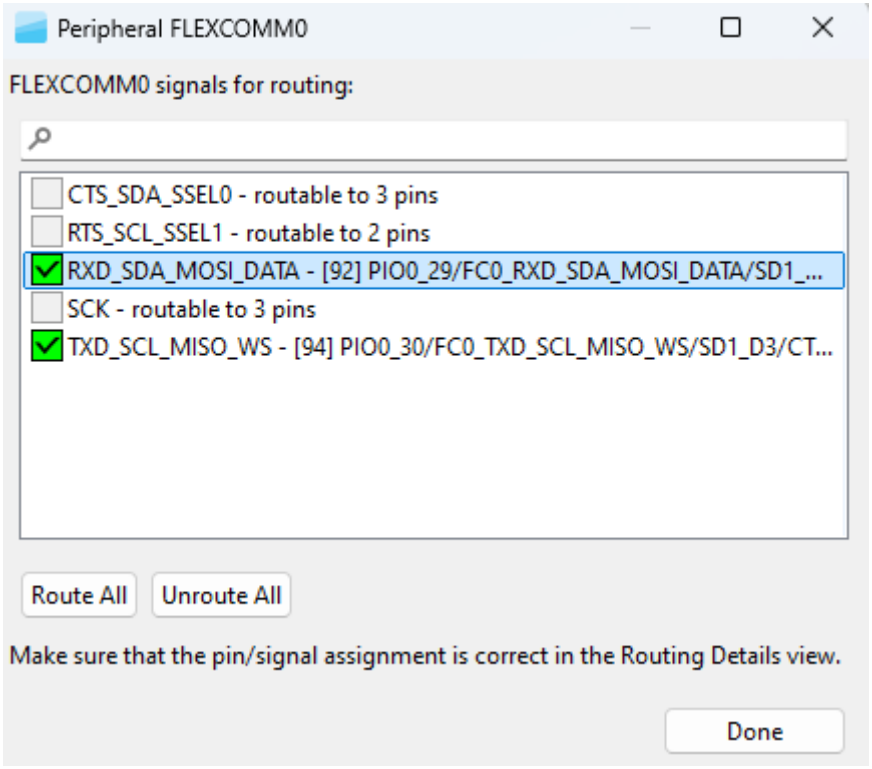


Figure 51. Select signals dialog

3.3.3.2 Filtering in the Pins and Peripheral Signals views

The following image illustrates the filtering controls in the **Pins** and **Peripheral Signals** views.

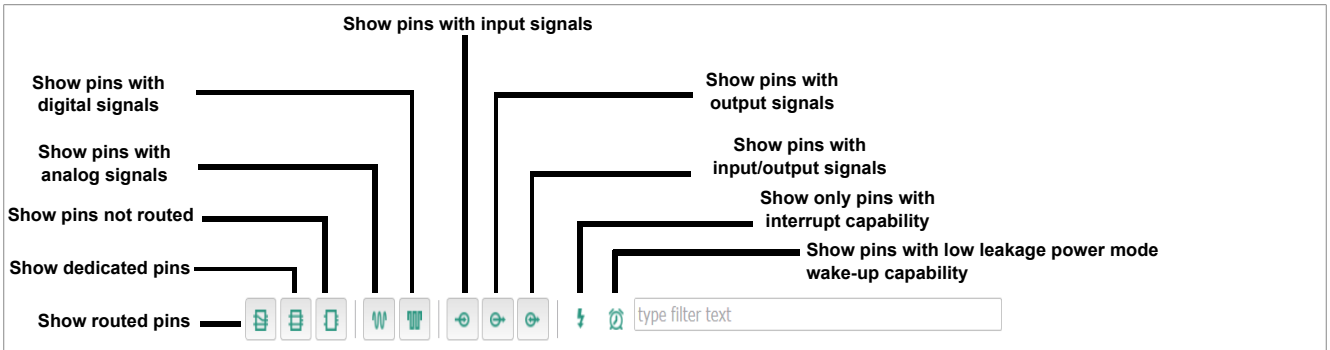


Figure 52. Filtering Controls

Type any text to search across the table/tree. It will search for the pins/peripheral signals containing the specified text. You can also use wildcards “*” and “?” to help you filter results you want. Use “space” to search for multiple strings at the same time.

3.3.4 Routing Details view

In the **Routing Details** view, you can inspect and configure routed pins and internal signals. You can also configure the electrical properties of pins and view them. It displays the pad configuration available in a configuration where each pin is associated with the signal name and the function.

The table is empty when a new configuration is created, which means no pin is configured. Each row represents the configuration of a single pin and if there are no conflicts, then the code is immediately updated. For Boards/Kits, the pins are routed already.

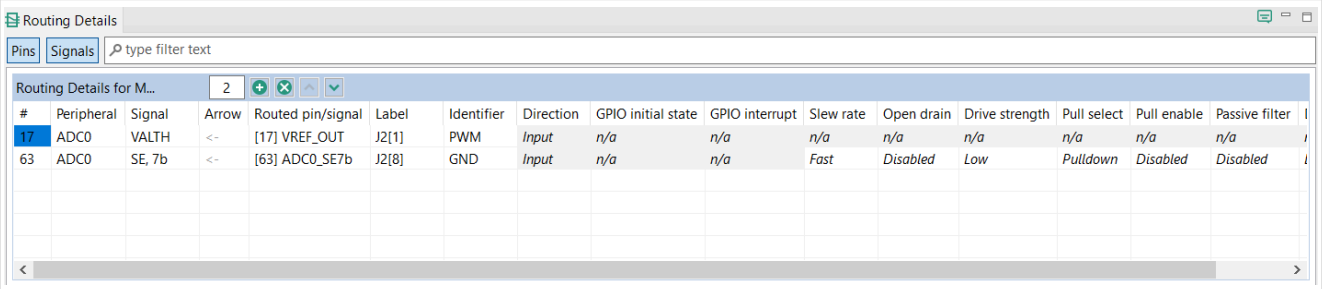


Figure 53. Routing Details

Add a row with the **Add new row** button in the view toolbar.

Configure the pin/signal by selecting the **Peripheral** first, then the required **Signal**, and finally, the pin to **Route to**.

Use the columns in the right side of the table to configure the electrical features.

You can also use the **Pins** and **Peripheral Signals** views to route pins and peripheral signals and view/modify the configuration in the **Routing Details** view. If the feature is not supported, *n/a* is displayed.

To highlight peripheral/pin information in the **Package** and **Pins** views, right-click the row and select **Highlight**.

To filter rows, type the text or the search phrase in the filter area in the view toolbar.

Note: When you enter the search text, it also searches the text in the full pin names display rows that contain the search text.

To display pins or signals only, use the **Pins** and **Signals** buttons in the view toolbar.

To add a row to the end of table, click the **Add new row** button.

To remove the selected row, click the **Delete the selected row** button.

To delete a specific row or insert a new row at a given position, right-click and use the dropdown list commands.

To add a specific number of rows, enter the number in the field.

To clear the table, type 0.

To change the order of the rows, use the arrow icons to move one row up or down.

To filter table entries by text, enter the text string in the **type filter text** field.

To copy the row, right-click any cell in the row and select **Copy**. You can later paste the copied row into the **Routing Details** view of another functional group or configuration by right-clicking the table and choosing **Paste**.

The gray background indicates read-only items.

3.3.4.1 Properties configured in Routing Details view

The properties of pins and internal signals that can be configured are shown in dedicated columns. The properties include:

- Common properties available for all pins and internal signals
  - **#** - Package pin number/coordinate
  - **Peripheral** - Name of the selected peripheral module

  - **Signal** - Name of the selected peripheral signal/signal function
  - **Arrow** - Arrow indicating input, output, input/output, or not specified direction of the signal
  - **Routed pin/signal** - Name of the pin or internal signal
  - **Label** - Pin label with max length of 128 characters; By submitting an empty label the identifier is deleted as well
  - **Identifier** - Pin identifier used for #define code generation
  - **Direction** - Pin direction
- General-Purpose Input Output (GPIO) properties available only for GPIO pins
  - **GPIO initial state** - GPIO output initial state. It is available only if pin direction is set to output.
  - **GPIO interrupt** - Configuration of interrupt request for the pin. It is available only if the pin direction is set to input.
- Processor-specific properties
  - Properties that may differ for different processors, for example configuration of pull ups, open drain, drive strength, slew rate, power groups

Tip:

- Click the **Routing Details Legend** button in the top-right corner of the view to display a dialog explaining all the properties and their values.

Generation of initialization code

The Pins tool generates initialization code only for pins and internal signals configured in the Routing Details view. Generally, initialization code is generated always if it is necessary for proper routing of the pin or internal signal to selected peripheral signal. On the other hand, the code related to the direction, GPIO functionality or processor-specific properties is automatically optimized out in the following cases:

- The user does not explicitly select a value of a property. It is signalized by the italic font of the value. It is the default state after adding a pin or internal signal to the Routing Details view. The displayed value shows either the value set by another configuration of the same pin in the same function or in a function called from the default initialization function. When there is no such configuration, the displayed value matches the after-reset state. To generate the code even if the value is the same as the default value, select the value from the drop-down menu: the value is shown with normal font and code is generated. To return to the default value select “No init” from the drop-down menu: the value is again shown with italic font and no code is generated.
- A “Not specified” value is selected in case of the direction property.

Additionally, it is possible to force generation of full initialization code of all properties using “Full pins initialization option” in Functional groups. If this option is enabled, it is not possible to use the “No init” value from the drop-down menu and the initialization code is generated unless the “Not specified” value is selected (for direction only). For more information about the “Full pins initialization option” option, refer to the Functional group properties section in this documentation.

Validation of routing

The Pins tool automatically performs validation of the selected properties. An error is shown for a property in the Routing Details view in the following cases:

- The value of the property is in conflict with the value of other property. Typically conflicts arise when two pins or internal signals configures same register and bitfield with different initialization value. To resolve the conflict, the configuration of one of the pins or internal signals have to be changed.
- There is no after-reset value specified for the property. In this case the error indicates that the user has to select the value of the property or “Not specified” to indicate that the property can be ignored by the tool.
- The property has to be set by the user. In this case, the “No init” or “Not specified” are not available and the user must decide what value will be used. A typical use case is when routing of the internal signal would not be complete without such selection or when it is necessary to confirm by the user the intended usage of the pin or signal.

3.3.4.2 Labels and identifiers

You can define the label of any pin that can be displayed in the user interface for ease of identification.

Boards and kits have predefined labels. However, it is also possible to define a pin label listed in the **Pins** and **Routing Details** views.

To set\update the **Labels and Identifier** columns visibility, select **Edit> Preferences** from the **Menu bar**, and select the **Show pin label & identifier table columns (Pins tool)** checkbox.

The pin identifier is used to generate the `#define` in the pin_mux.h file. However, it is an optional parameter. If the parameter is not defined, the code for `#define` is not generated. Also, you can define multiple identifiers, using the ";" character as a separator. You can also set the identifier by typing it directly into the cell in the **Identifier** column in the **Routing Details** views.

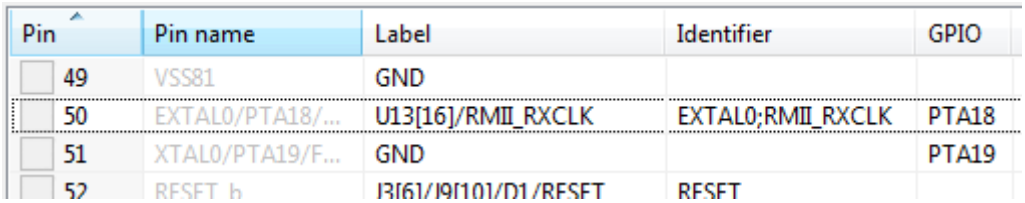


Figure 54. Pin identifier

In this case, it is possible to select from values if the pin is routed. See Routing Details.

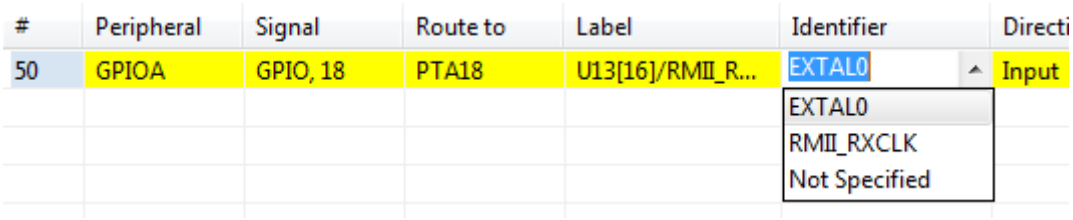


Figure 55. Identifier in Routing Details table

A check is implemented to ensure whether the generated defines are duplicated in the `pin_mux.h` file. These duplications are indicated in the identifier column as errors. See the figure below.

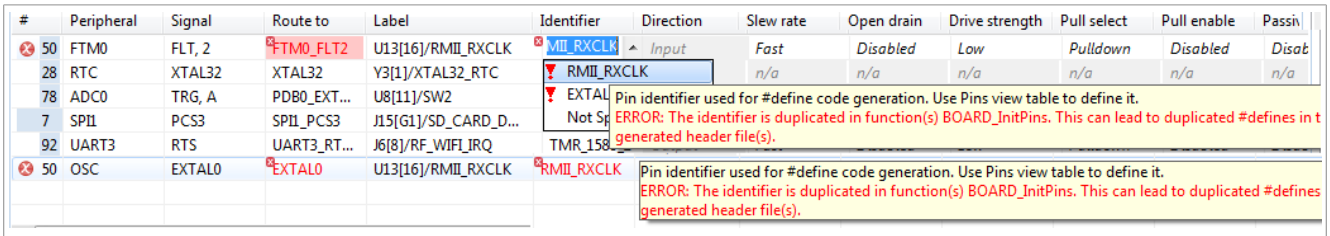


Figure 56. Identifier errors

By typing a text into the Identifier column, you can define a new identifier for the pin. It is automatically used only in the selected routing. Available identifiers can be revised in a dialog invoked from a context menu or in the Pins view.

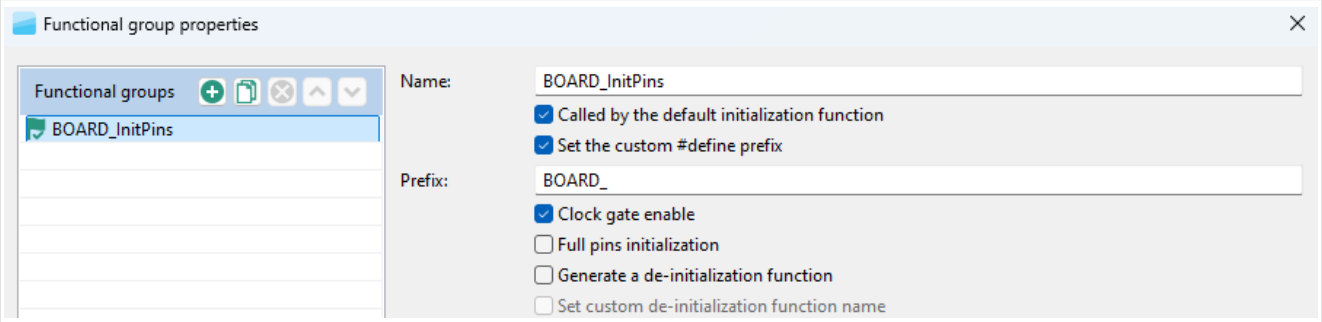


Figure 57. Pins macros prefix

If multiple functions are used, each individual function can include a special prefix. Check the **Pins > Functional Group Properties > Set custom #define prefix** checkbox to enter prefix of macros in a particular function used in the generated code of the pin_mux.h file. Entered prefix text must be a C identifier. If unchecked, the **Function name** is used as a default prefix.

3.3.5 Expansion header

In the **Expansion Header** view, you can add and modify an expansion header configuration, map the connectors, and route the pin signals. You can also import and apply an expansion board to the header.

Certain boards, such as LPCXpresso55S69, come with preconfigured expansion headers.

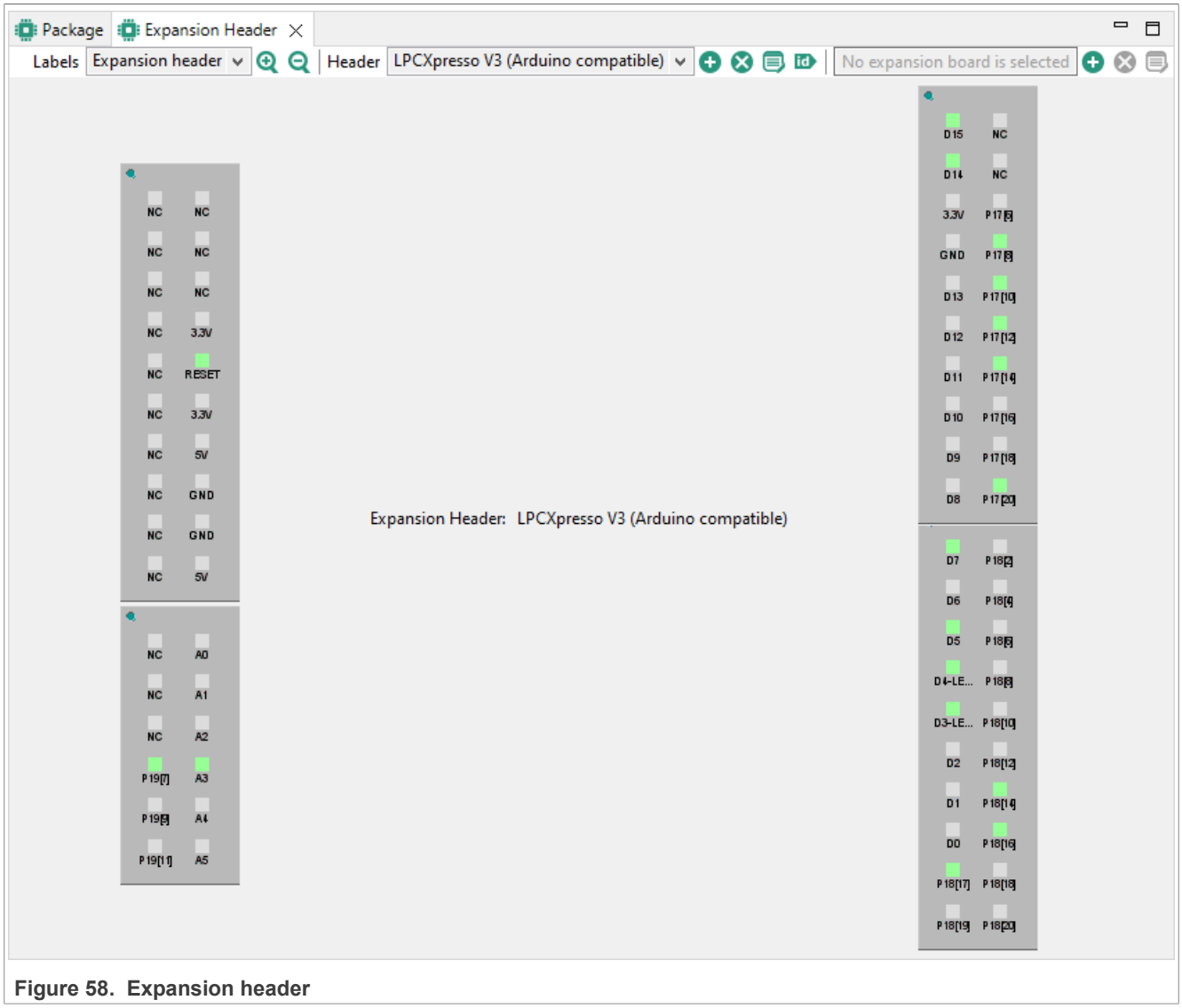


Figure 58. Expansion header

The expansion header is not automatically preset for every supported device. If the header is not preconfigured, follow these steps to create and modify an expansion header configuration:

1. Open the view by selecting **Window> Show view>Expansion Header** from the **Main menu**.
2. Open the view by selecting **Views > Expansion Header** from the **Toolbar**.
3. Add a header by selecting the **Add** button in the view toolbar.
4. In the **Add New Expansion Header** window, select the **Header type** from the drop-down list.

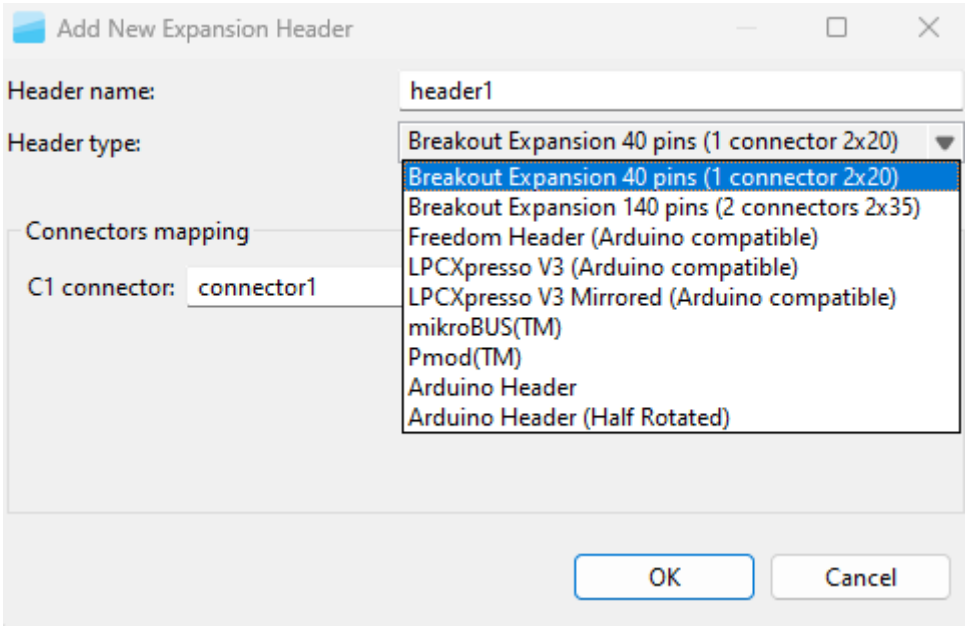


Figure 59. Adding new expansion header

5. Name the header and map the connectors.

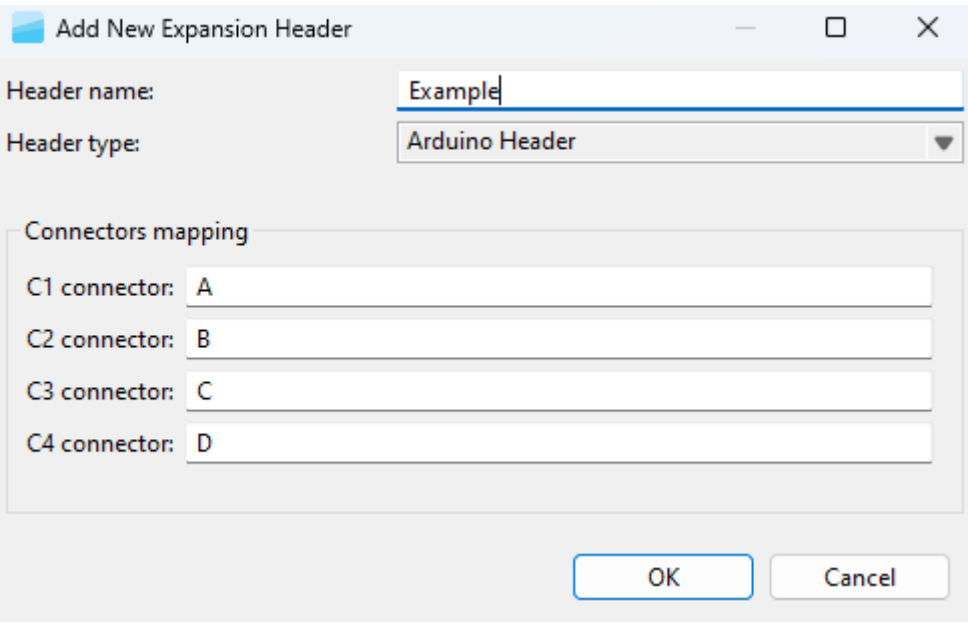


Figure 60. Adding new expansion header

6. Select **OK**.
Expansion Header view now displays the connector layout. You can point your cursor over the pins to display additional information. Right-click the pin to display a shortcut menu of additional options.

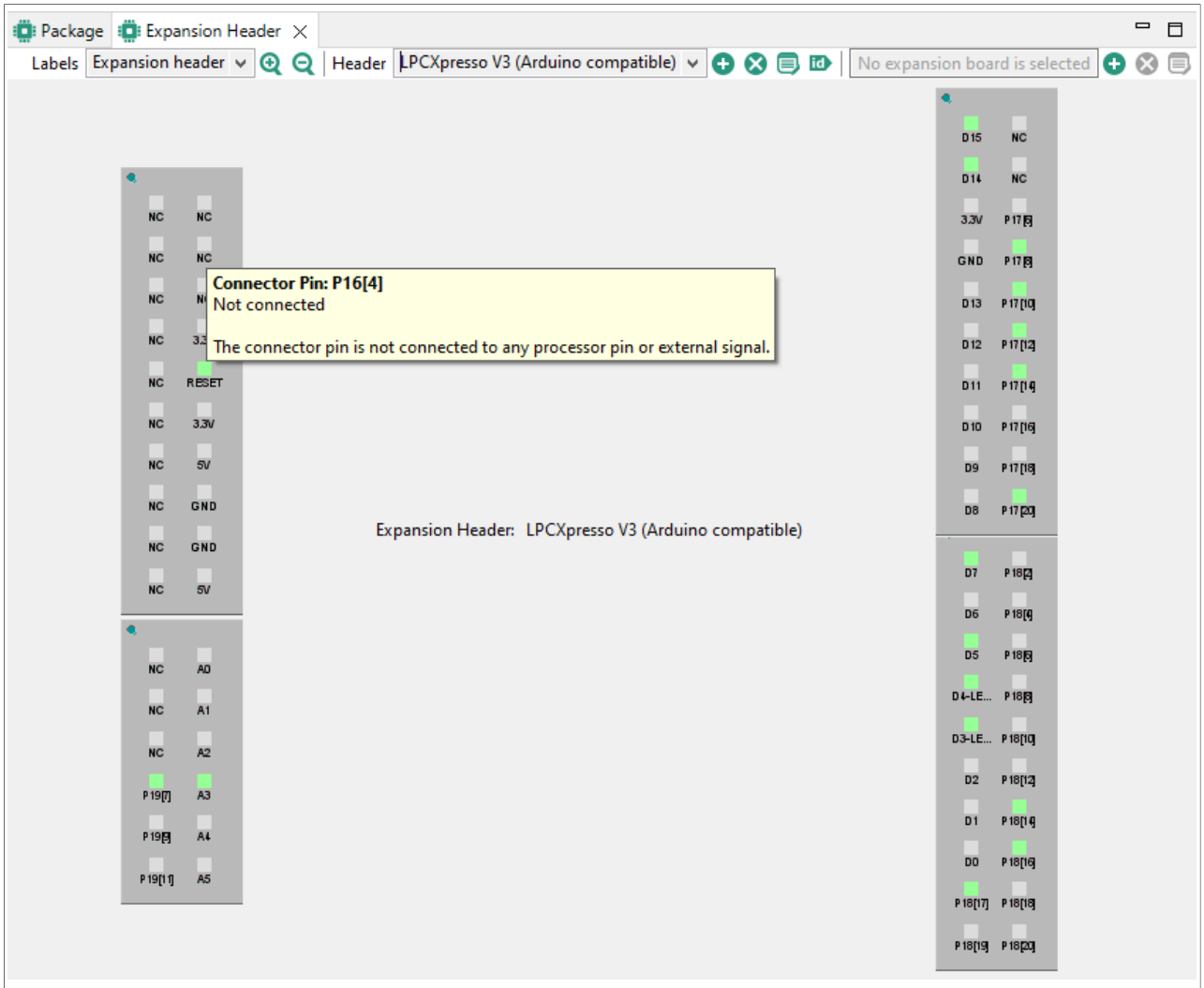


Figure 61. Expansion header

7. To map the header pin to processor pin, right-click the header pin and select **Connect**.
8. In the **Connector Pin** dialog, select the processor pin/external signal from the list and click **OK**.

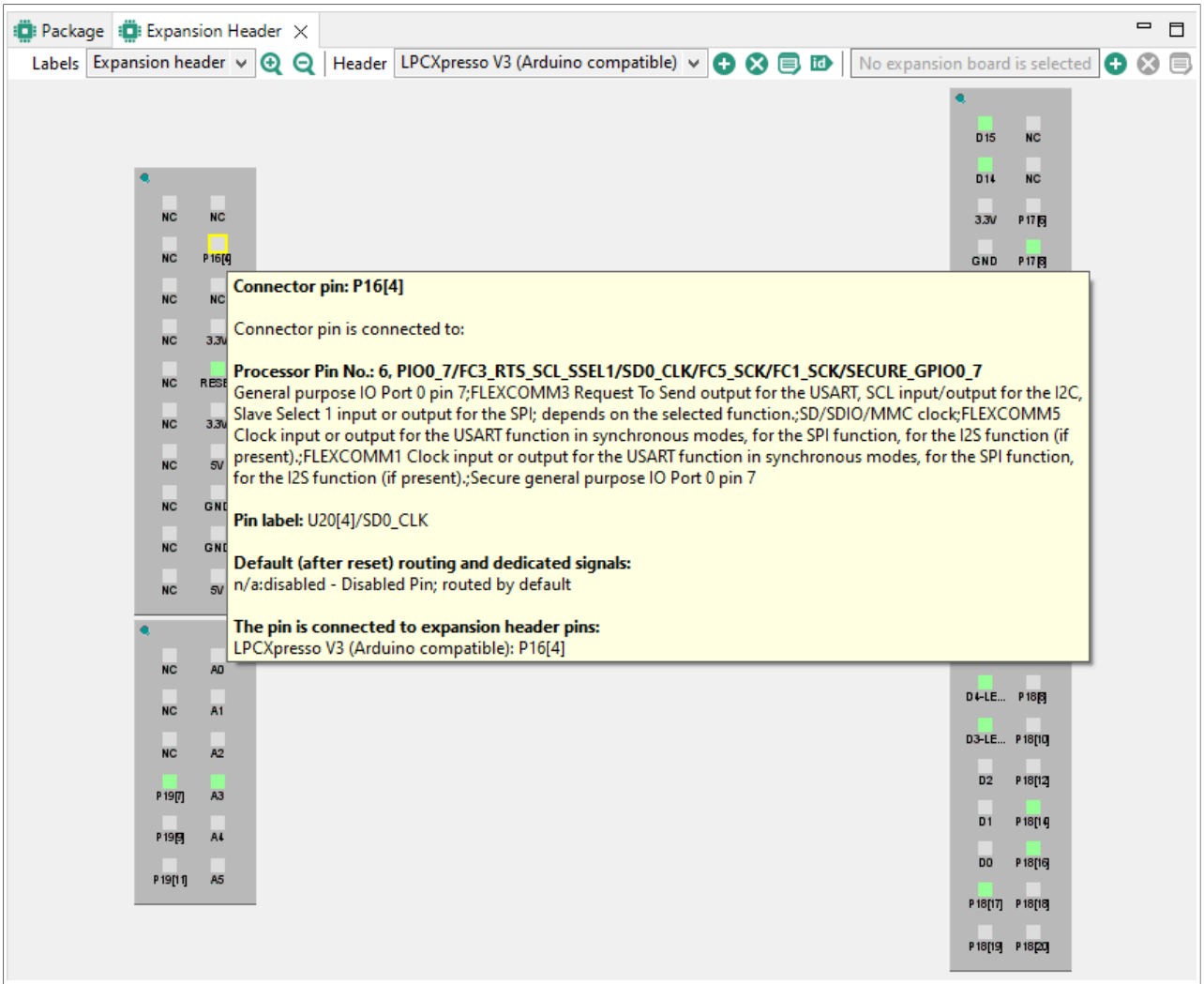


Figure 62. Connected pin

9. To route the pin, right-click the header pin and select **Route**.
10. In the **Pin** dialog, select the signal from the list and click **OK**.
    The connector pin is now routed.

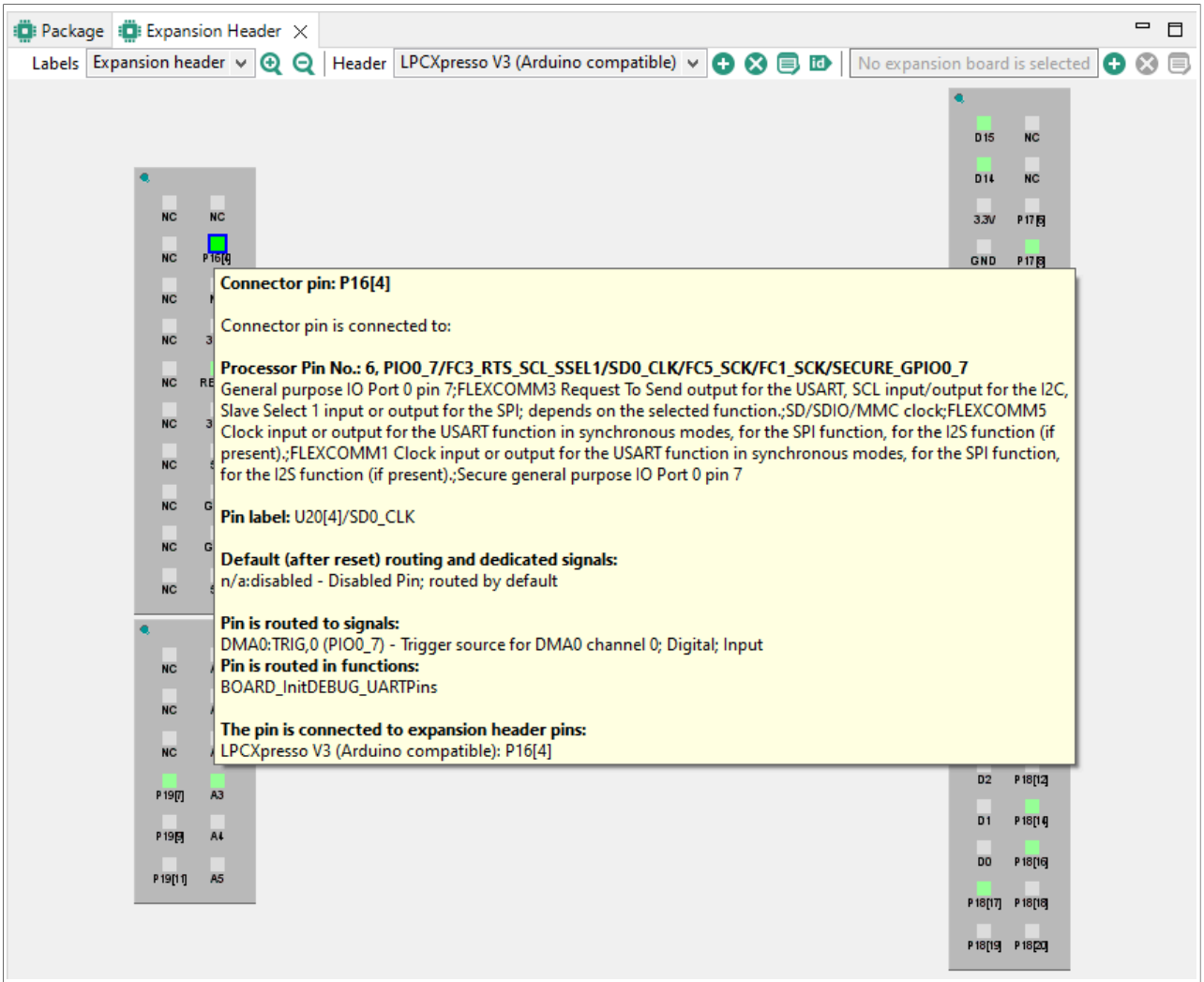


Figure 63. Routed pin

You can create more than one expansion header configuration. Switch between the configurations in the view's drop-down list.

To highlight the pin/routing configuration in the **Pins** and **Routing Details** views, right-click the connector pin and select **Highlight**.

Modify the configuration parameters at any time by selecting the **Edit** button. Information in the **Pins** view is updated automatically. Pin connections between the header and the processor and their labels can be locked to prevent any modifications.

Remove a configuration by selecting the **Remove** button.

Use the **Label** drop-down list to switch between display information for header, board, and routing.

The **ID** button allows setting expansion header pin labels as processor pin identifiers. Upon user selection, the new identifiers can be also explicitly selected.

3.3.5.1 Expansion board

In the **Expansion Header** view, you can also apply an expansion board to an already created expansion header. The expansion board configuration can be imported into Pins tool in the form of an XML file. Based on the chosen processor, the tool will then recommend adequate routing.

Note: Only a single expansion board can be configured per expansion header.

1. In the **Expansion Header** view, click the **Apply expansion board to the selected header**. Alternatively, select **Pins>Apply expansion board** from the **Menu bar**.
2. In the **Apply expansion board** dialog, click **Browse** to locate the XML file with expansion board information and click **OK**.

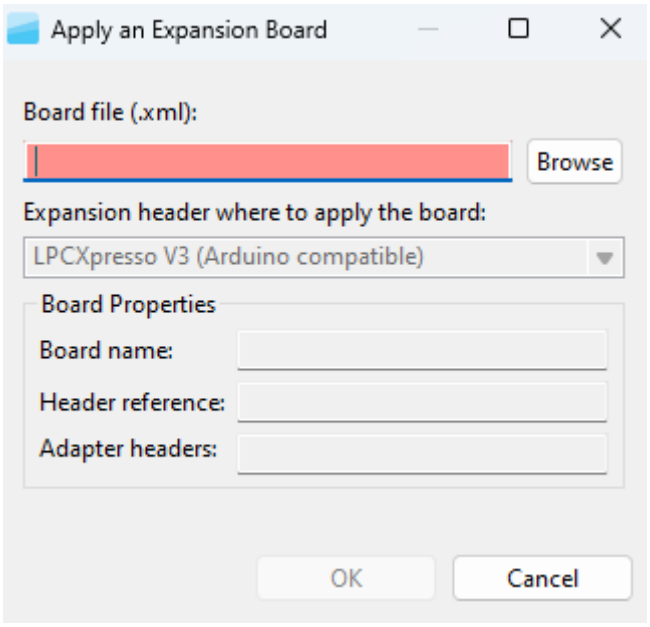


Figure 64. Apply expansion board

3. Click **OK** to apply the expansion board.
4. On the next page, choose if you want to create a new functional group for the expansion board, or modify an existing functional group. In the latter case, use the dropdown list to select from available functional groups.
5. In the **Expansion Board Routing** table, inspect the suggested routing of expansion board pins. If you want to change the route of a pin, click the pin cell in the **Route** column and select the signal in the **Connector pin** dialog and click **Done**.

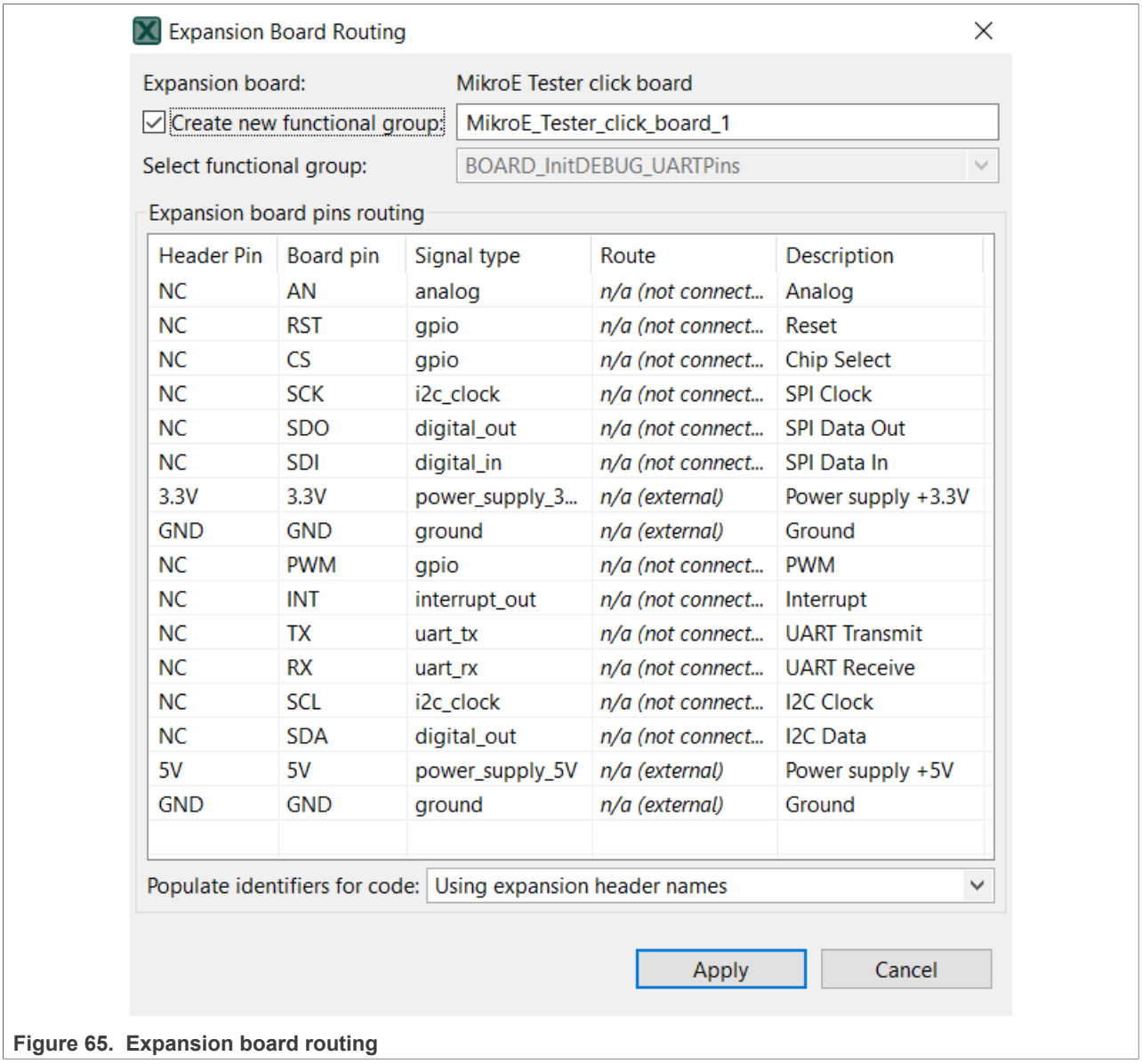


Figure 65. Expansion board routing

6. Choose how you want to populate identifiers for code. Following options are available:
   - Expansion header names
   - Expansion board names
   - None
7. Click **Apply** to apply the settings.
   You can change the expansion board signal routing at any time by clicking the **Configure routing for expansion board** button in the **Expansion Header** view.

3.3.6 Power groups

If your processor supports power groups, an additional tab will appear next to **Pins** and **Peripheral Signals**.

Note: This feature is not supported for all devices.

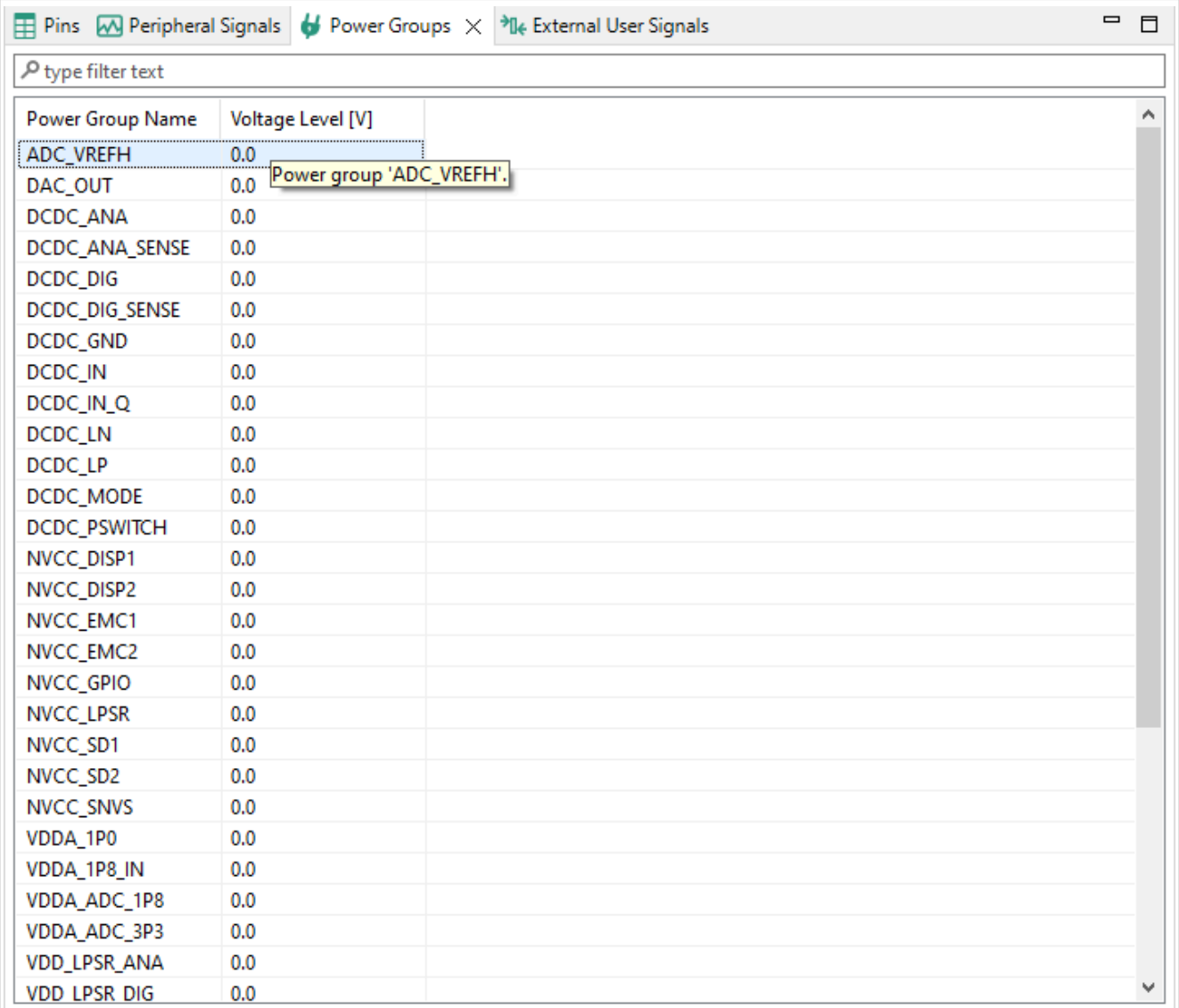


Figure 66. Selecting power group

3.3.7 External User Signals view

This view allows the user to define a custom description of the signals. An External User Signal has a defined unique ID within the table, pins to which it is connected, and any amount of additional text information. All of it can be customized.

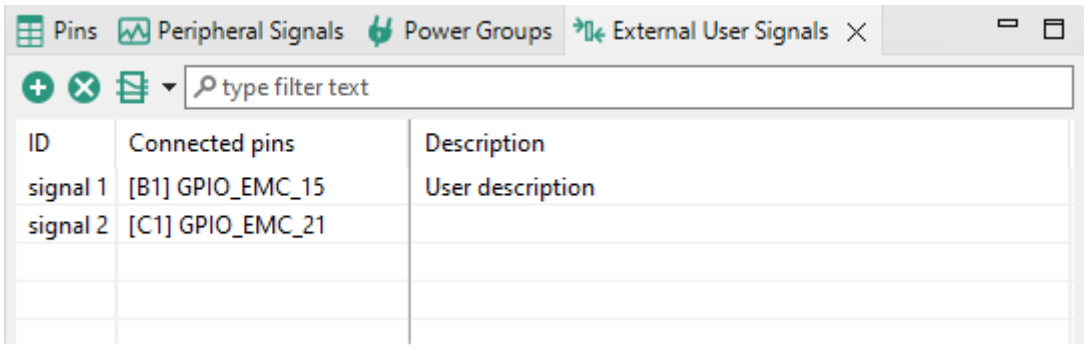


Figure 67. External User Signals view

Connecting to a pin(s) can be done from a context menu of the selected signal. Multiple pins can be connected to the signal as well as multiple signals can be connected to the pin. When some signals are defined, the External User Signals column is added to the **Pins** view. The connection between pins and signals can be also done from there.

Additional columns can be specified using the table header context menu.

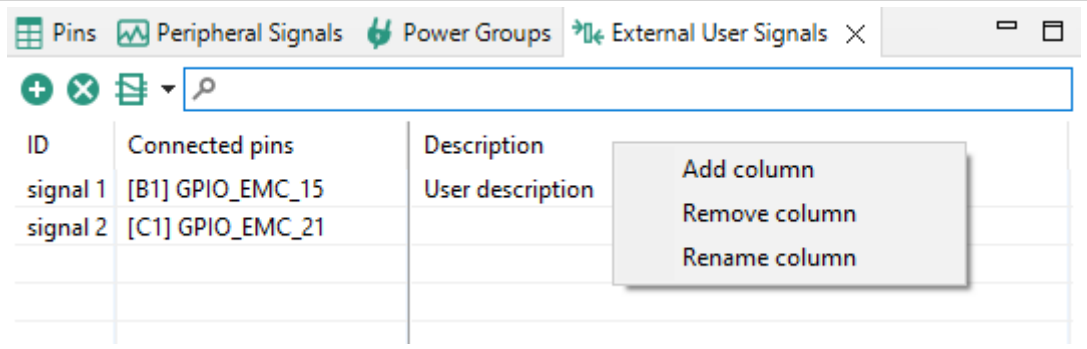


Figure 68. External User Signals header context menu

The button with the **Routing Details** view icon can be used to add routed pins to the table or to display columns from **Routing Details** view in the **External User Signals** view.

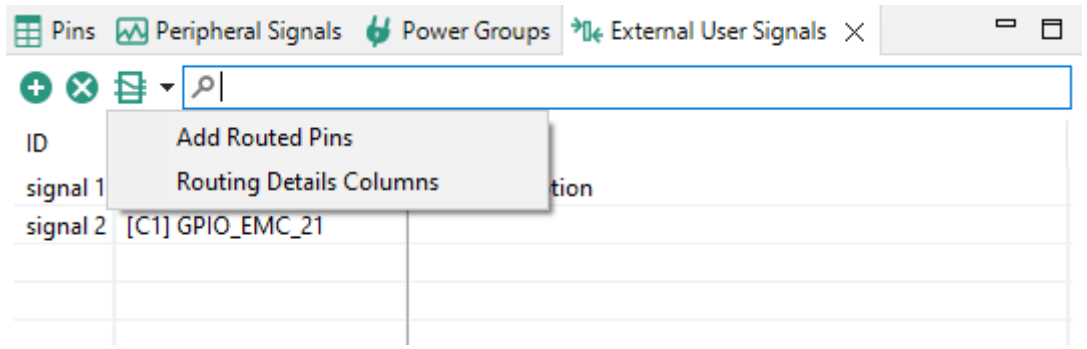


Figure 69. External User Signals view

The **Add Routed Pins** option collects routed pins from all functional groups and adds them to the table when they are not already present. A new signal is created for each added pin.

Select Routing Details Columns to open a dialog with Routing Details columns. The selected columns will be displayed in the table. Those columns are read-only and they always reflect actual values in the **Routing Details** view for all functional groups.

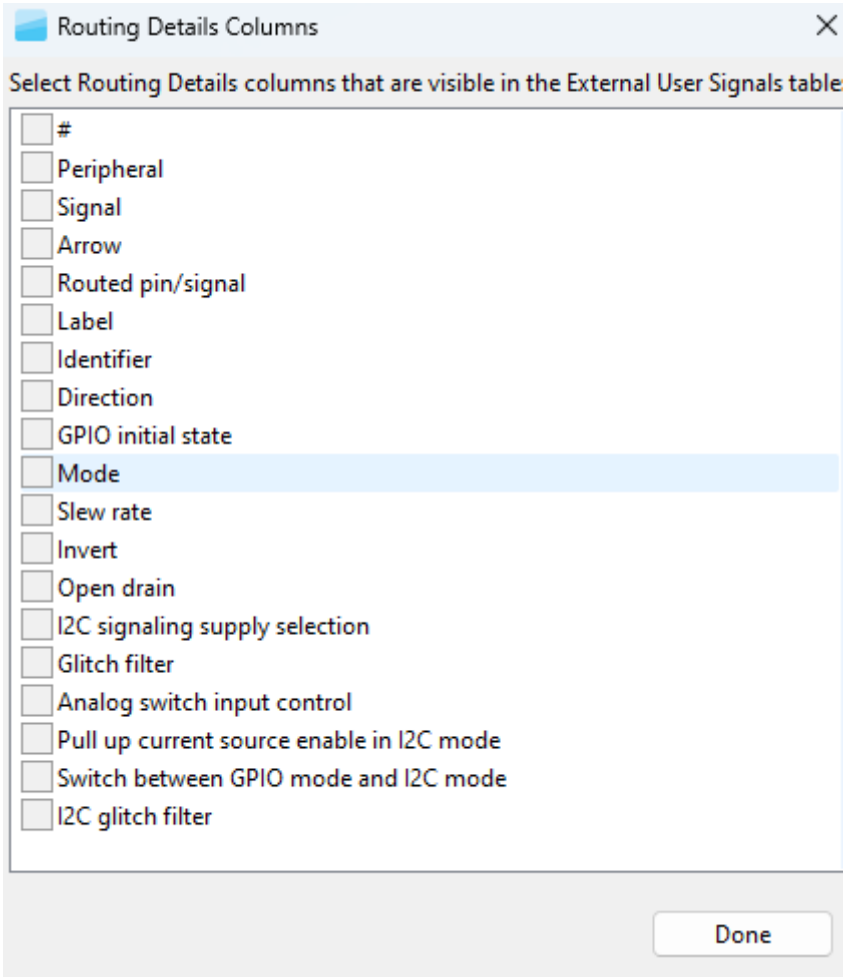


Figure 70. Routing Details columns dialog

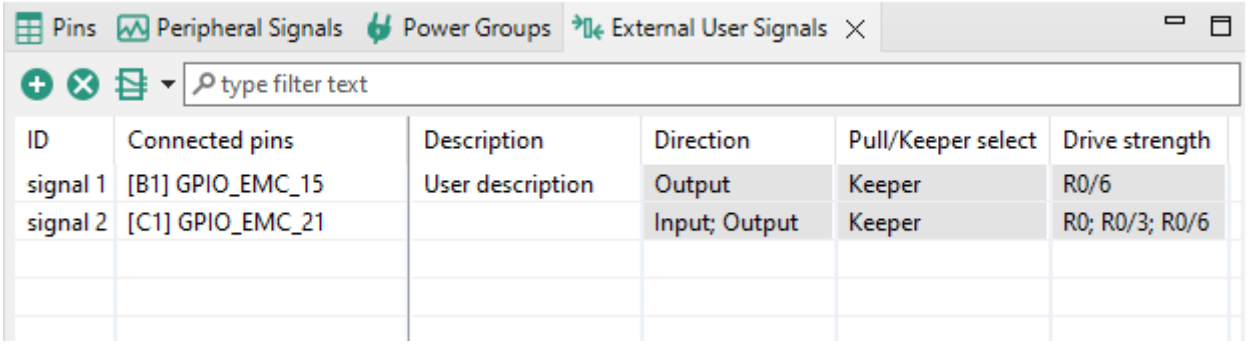


Figure 71. Routing Details table

When needed, External User Signals can be also exported to CSV and then imported to another configuration. Merging of signals is not supported so when some signals are defined for the configuration, they are replaced by imported signals.

3.3.8 Miscellaneous view

This view contains Generate extended information into the header file (previously located in Configuration preferences) and possible processor specific settings.

When the Generate extended information into the header file option is selected, the extended information is generated into the header file. For projects created in earlier MCUXpresso versions, this option is selected by default.

When option Automatically select property value for a new routing is set, the after-reset state is explicitly set for every electrical property of a new routing.

3.3.9 Functions

Functions are used to group a set of routed pins, and they create code for the configuration in a function which then can be called by the application.

The tool allows to creates multiple functions that can be used to configure pin muxing.

The usage of pins is indicated by 50% opacity in **Pins**, **Peripheral Signals**, and **Package** views. Each function can define a set of routed pins or re-configure already routed pins.

When multiple functions are specified in the configuration, the package view primarily shows the pins and the peripherals for the selected function. Pins and peripherals for different functions are shown with light transparency and cannot be configured, until switched to this function.

3.3.10 Highlighting and color coding

You can easily identify routed pins/peripherals in the package using highlighting. By default, the current selection (pin/peripheral) is highlighted in the **Package** view.

- The pin/peripheral is highlighted by yellow border around it in the **Package** view. If the highlighted pin/peripheral is selected, then it has a blue border around it.
- Red indicates that the pin has an error.
- Green indicates that the pin is muxed or used.
- Light gray indicates that the pin is available for mux, but is not muxed or used.
- Dark gray indicates that the pin/peripheral is dedicated. It is routed by default and has no impact on generated code.

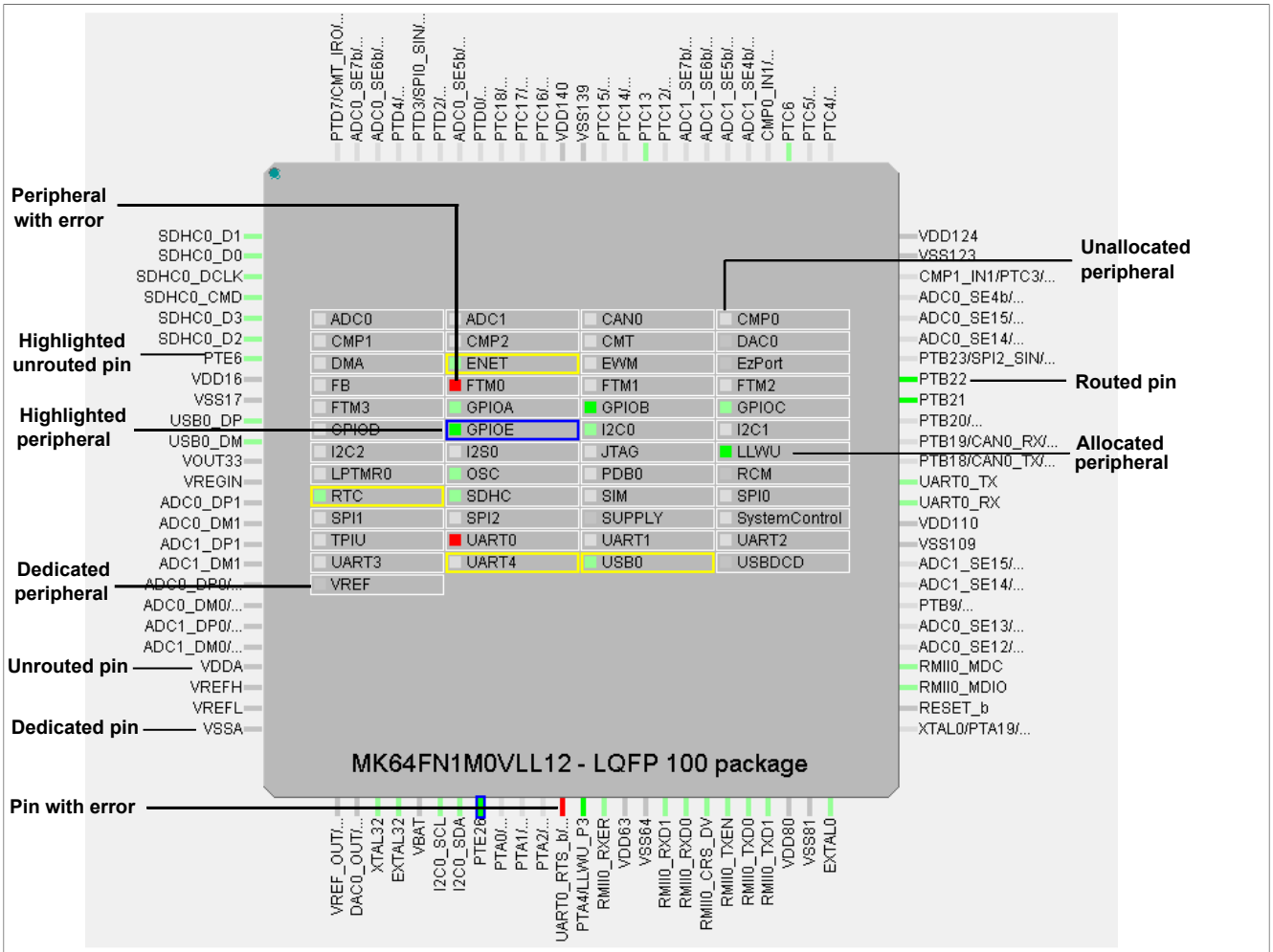


Figure 72. Highlighting and color coding

#	Peripheral	Signal	Route to	Label	Identifier	Direction	Slew rate	Open drain	Drive strenc
80	CMP0	IN, 0	ADC1_SE4...	J1[7]	n/a	n/a	Fast	Disabled	Low
26	CMP1	IN, 1	VREF_OUT...	J2[17]	n/a	n/a	n/a	n/a	n/a
4	GPIOE	GPIO, 3	PTE3	J15[P3]/SDHC0_C...	Not Specified	Not Specifi...	Fast	Disabled	Low
	CMP1	IN, 0			n/a	n/a	n/a	n/a	n/a
6	UART3	RX	UART3_RX	J15[P1]/SDHC0_D2	Not Specified	Input	Fast	Disabled	Low
6	FTM3	CH, 0	FTM3_CH0	J15[P1]/SDHC0_D2	Not Specified	Not Specifi...	Slow	Disabled	Low
					n/a	n/a	n/a	n/a	n/a

Figure 73. Pins conflicts

#	Peripheral	Signal	Route to	Label	Identifier	Direction	Slew rate
33	GPIOE	GPIO, 26	PTE26	J2[1]/D12[4]/LEDRGB_GREEN	Not Specified	Input	Slow
71	FTM0	CH, 0	FTM0_CH0	J1[5]	n/a	Output	Fast

Figure 74. Warnings

- **Package** view
  - Click the peripheral or use the pop-up menu to highlight peripherals:
    - and all allocated pins (to selected peripheral).
    - or all available pins if nothing is allocated yet.

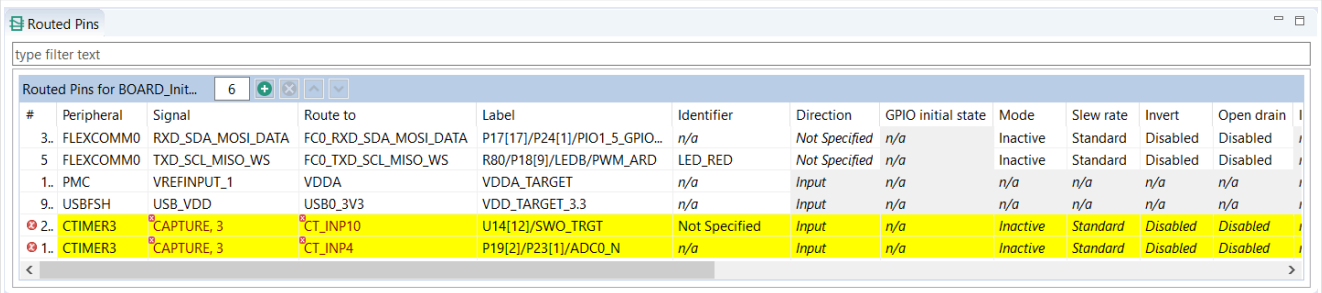
– Click the pin or use the pop-up menu to highlight the pin and the peripherals.
– Click outside the package to cancel the highlight.

- **Peripherals / Pins** view
  – The peripheral and pin behaves as described above.

Note: The tool highlights pins during the drop-down menu traversal on pins.

3.4 Errors and warnings

The Pins Tool checks for any conflict in the routing and also for errors in the configuration. Routing conflicts are checked across all **INIT** functions (default initialization functions). It is possible to configure different routing of one pin in different functions (not INIT functions) to allow dynamic pins routing reconfiguration.



#	Peripheral	Signal	Route to	Label	Identifier	Direction	GPIO initial state	Mode	Slew rate	Invert	Open drain
3..	FLEXCOMM0	RXD_SDA_MOSI_DATA	FC0_RXD_SDA_MOSI_DATA	P17[17]/P24[1]/PIO1_5_GPIO...	n/a	Not Specified	n/a	Inactive	Standard	Disabled	Disabled
5	FLEXCOMM0	TXD_SCL_MISO_WS	FC0_TXD_SCL_MISO_WS	R80/P18[9]/LEDB/PWM_ARD	LED_RED	Not Specified	n/a	Inactive	Standard	Disabled	Disabled
1..	PMC	VREFINPUT_1	VDDA	VDDA_TARGET	n/a	Input	n/a	n/a	n/a	n/a	n/a
9..	USBFSH	USB_VDD	USB0_3V3	VDD_TARGET_3.3	n/a	Input	n/a	n/a	n/a	n/a	n/a
2..	CTIMER3	CAPTURE, 3	CT_INP10	U14[12]/SWO_TRGT	Not Specified	Input	n/a	Inactive	Standard	Disabled	Disabled
1..	CTIMER3	CAPTURE, 3	CT_INP4	P19[2]/P23[1]/ADC0_N	n/a	Input	n/a	Inactive	Standard	Disabled	Disabled

Figure 75. Error and warnings

If an error or warning is encountered, the conflict in the **Routing Details** view is represented in the first column of the row and the error/warning is indicated in the cell, where the conflict was created. The last two rows in the figure above show the peripheral/signal where the erroneous configuration occurs. The detailed error/warning message appears as a tooltip.

For more information on error and warnings color, see the Highlighting and Color Coding section.

3.4.1 Incomplete routing

A cell with incomplete routing is indicated by a red background. To generate proper pin routing, click the drop-down arrow and select the suitable value. A red decorator on a cell indicates an error condition.

#	Peripheral	Signal	Route to	Label	Identifier	Direction	Slew rate	Open drain
1	UART1	TX	UART1_TX	J15[P8]/SD...	Not Specif...	Not Specifi...	Fast	Disabled
10	USBDCD	DP	USB0_DP	J22[3]/K64...	Not Specif...	Input/Out...	n/a	n/a
4		GPIO, 3	ADC0_DM...	J15[P3]/SD...	Not Specif...	n/a	Fast	Disabled

Figure 76. Incomplete routing

The tooltip of the cell shows more details about the conflict or the error, typically it lists the lines where conflict occurs.

You can also select **Pins** > **Automatic Routing** from the Main menu to resolve any routing issues.

Note: Not all routing issues can be resolved automatically. In some cases, manual intervention is required.

3.4.2 Power groups voltage level conflicts

The Pins tool provides information about possible voltage level conflicts when the peripheral signals routed pins are configured from a different power groups and the power groups have different voltage level value set in **Power groups** view.

In case of a potential voltage level conflict, a warning is displayed - a useful feature for hardware board designers.

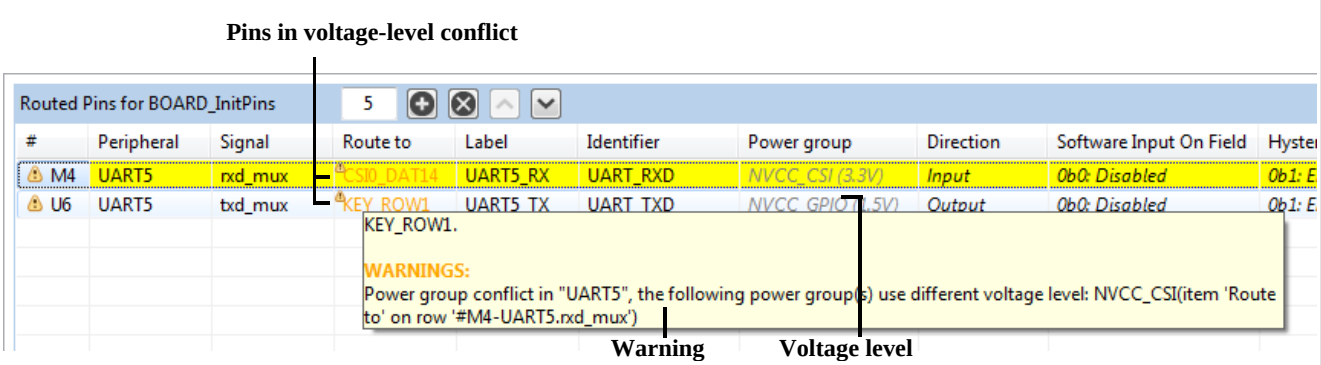


Figure 77. Power group view

3.5 Code generation

If the settings are correct and no error is reported, the code generation engine instantly regenerates the source code. You can view the resulting code the **Code Preview** view of the **Pins** tool.

Code Preview automatically highlights differences between the current and immediately preceding iteration of the code. You can choose between two modes of highlighting by clicking the **Set viewing style for source differences**. You can also disable highlighting altogether from the same dropdown menu. Such features as Copy, Search, Zoom-in, Zoom-out, and Export source are available in the **Code Preview** view. The search can also be invoked by CTRL+F or from the context menu.

For multicores, the sources are generated for each core. Appropriate files are shown with @Core #{number} tag.

Note: The tag name may be different depending on the selected multi-core processor family/type.

You can also copy and paste the generated code into the source files. The view generates code for each function. In addition to the function comments, the tool configuration is stored in a YAML format. This comment is not intended for direct editing and can be used later to restore the pins configuration.

pin_mux.c@Cortex-M33 (Core #0) pin_mux.h@Cortex-M33 (Core #0)

```
/***********************************************************************************************
 * This file was generated by the MCUXpresso Config Tools. Any manual edits made
 * will be overwritten if the respective MCUXpresso Config Tools is used to upda
 **********************************************************************************************/

/* clang-format off */
/*
 * TEXT BELOW IS USED AS SETTING FOR TOOLS ************************************
!!GlobalInfo
product: Pins v14.0
processor: LPC55S69
package_id: LPC55S69JBD100
mcu_data: ksdk2_0
processor_version: 0.14.3
 * BE CAREFUL MODIFYING THIS COMMENT - IT IS YAML SETTINGS FOR TOOLS ***********
 */
/* clang-format on */

#include "fsl_common.h"
#include "pin_mux.h"

/* FUNCTION ************************************************************************
 *
 * Function Name : BOARD_InitBootPins
 * Description   : Calls initialization functions.
 *
 * END ************************************************************************/
void BOARD_InitBootPins(void)
{
    BOARD_InitPins();
}

/* clang-format off */
/*
 * TEXT BELOW IS USED AS SETTING FOR TOOLS ************************************
BOARD_InitPins:
- options: {callFromInitBoot: 'true', coreID: cm33_core0, enableClock: 'true'}
- pin_list: []
 * BE CAREFUL MODIFYING THIS COMMENT - IT IS YAML SETTINGS FOR TOOLS ***********
 */
/* clang-format on */

/* FUNCTION ************************************************************************
 *
 * Function Name : BOARD_InitPins
```

Figure 78. Generated code

YAML configuration contains configuration of each pin. It stores only non-default values.

Tip: For multicore processors, it will generate source files for each core. If processor is supported by SDK, it can generate BOARD_InitBootPins function call from main by default. You can specify “Call from BOARD_InitBootPins” for each function, in order to generate appropriate function call.

3.6 Using pins definitions in code

The Pins tool generates definitions of named constants that can be leveraged in the application code. Using such constants based on user-specified identifiers allows you to write code which is independent of configured routing. In the case you change the pin where the signal is routed, the application will still refer to the proper pin.

For example, when the *LED_RED* is specified an identifier of a pin routed to *PTB22*, the following defines are generated into the pin_mux.h:

```
**\#define** BOARD_LED_RED_GPIO GPIOB /*!<@brief GPIO device name: GPIOB */
**\#define** BOARD_LED_RED_PORT PORTB /*!<@brief PORT device name: PORTB *'/
**\#define** BOARD_LED_RED_PIN 22U /*!<@brief PORTB pin index: 22 */
```

The name of the define is composed from function group prefix and pin identifier. For more details, see Functional groups and Labels and identifiers sections.

To write to this GPIO pin in application using the SDK driver (fsl_gpio.h), you can, for example, use the following code referring to the generated defines for the pin with identifier *LED_RED*:

```
GPIO_PinWrite(BOARD_LED_RED_GPIO, BOARD_LED_RED_PIN, true);
```

3.7 Full initialization of pins

Sometimes, the default values are not reliable, as there may be code running before the application that modifies the pin configuration (for example, a bootloader). The option **Full initialization of pins** ensures that the initialization is fully done even for items that use after-reset state. This option is specific for each **Functional group** allowing to force full initialization of routing. **Full initialization of pins** is not enabled by default. When enabled, the electrical properties of existing routing are changed. The values in italics are changed to explicit values corresponding with them. When the option is disabled, the pins tool removes initialization of values that match the “No init” state.

3.8 Create Default Routing

If necessary, it is possible to create a new functional group that will route default signals to pins and internal signals. The functionality is available in **Pins -> Create Default Routing**. There the user can select:

- Whether all pins and signals will be routed, or only the ones that are not routed in other functional groups.
- The name of the new functional group.
- Whether the routing is created for pins and/or internal signals.

In the created functional group, the Full initialization function of the pins feature will be set. The electrical properties of pins will be set to their after-reset state.

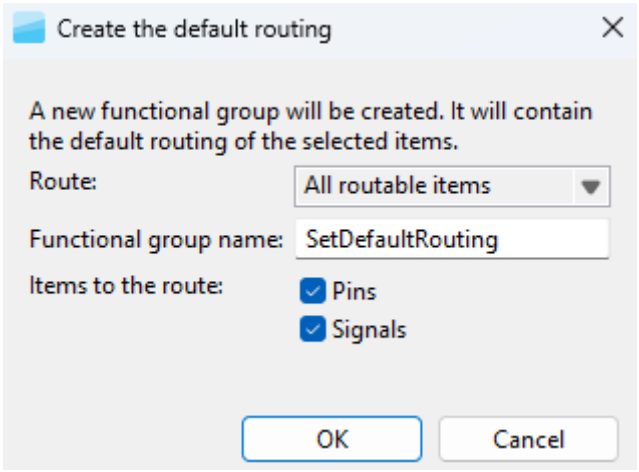


Figure 79. Create the Default Routing

4 Clocks Tool

The Clocks Tool configures initialization of the system clock (core, system, bus, and peripheral clocks) and generates the C code with clock initialization functions and configuration structures.

4.1 Features

The Clocks tool allows you to perform various actions related to the clock initialization, including the following:

- Inspect and modify element configurations on the clock path from the clock source up to the core/peripherals.
- Validate clock elements settings and calculate the resulting output clock frequencies.
- Generate a configuration code using the SDK.
- Modify the settings and provide output using the table view of the clock elements with their parameters.
- Navigate, modify, and display important settings and frequencies easily in **Diagram** view.
- Edit detailed settings in **Details** view.
- Inspect the interconnections between peripherals and consuming clocks in Module Clocks view.
- Find clock elements settings that fulfill given requirements for outputs.
- Fully integrated in tools framework along with other tools.
- The tool shows configuration problems in the **Problems** view and guides the user to the resolution.
- Register values define generation of C.

4.2 User interface overview

The **Clocks** tool is integrated and runs within the MCUXpresso Config Tools framework.

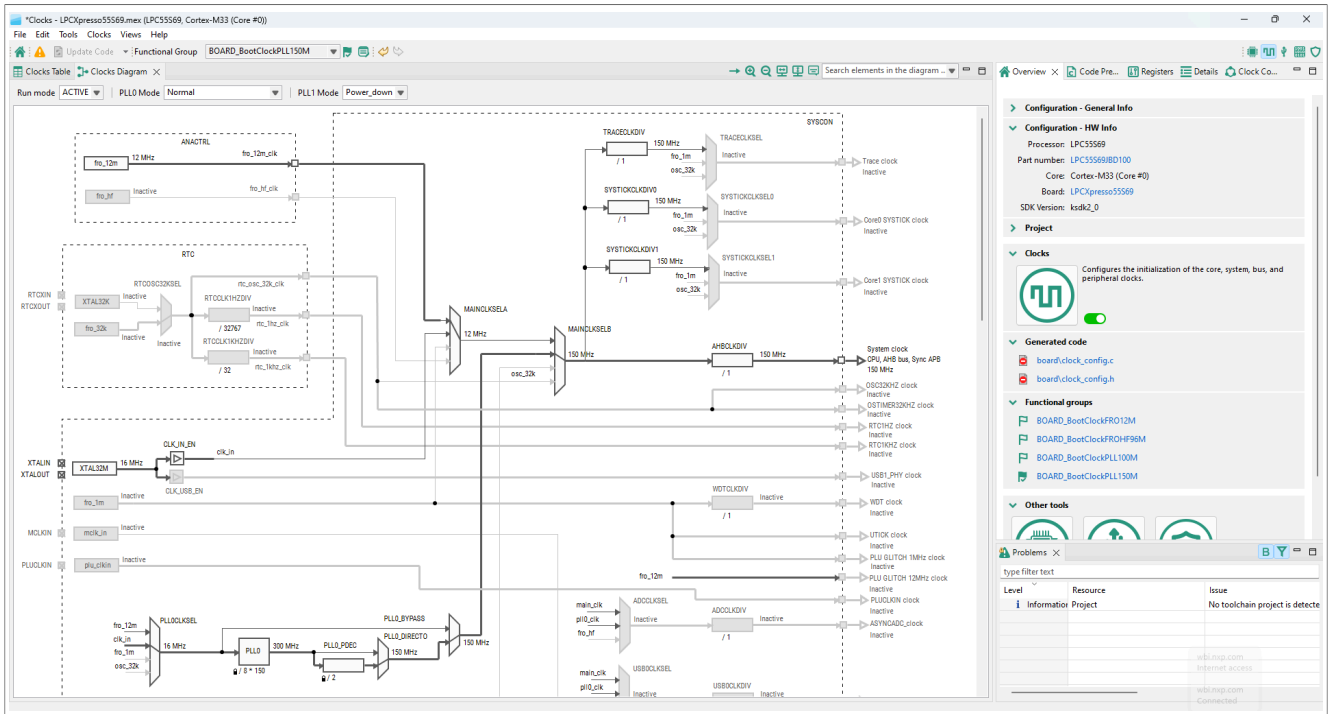


Figure 80. User interface clocks

4.3 Details view

The **Details** view displays clock-element settings information and allows you to change it.

The information is also updated in real-time based on any changes in the **Clocks Diagram** and **Clocks Table**.

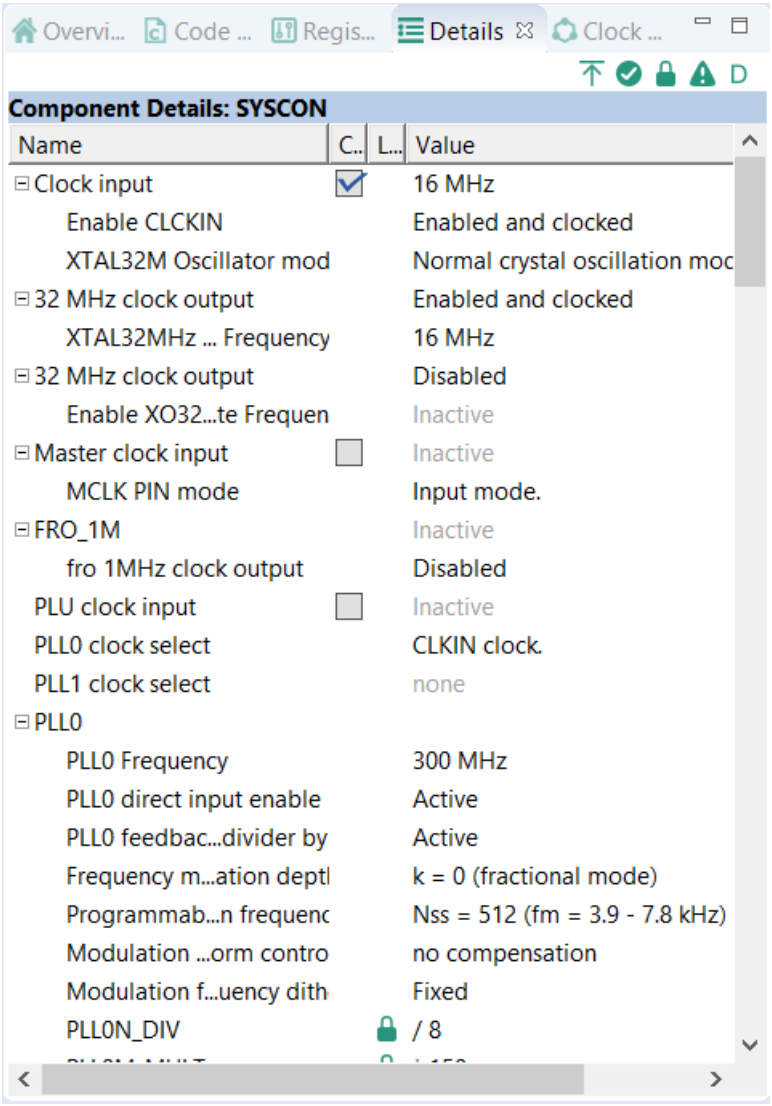


Figure 81. Details view

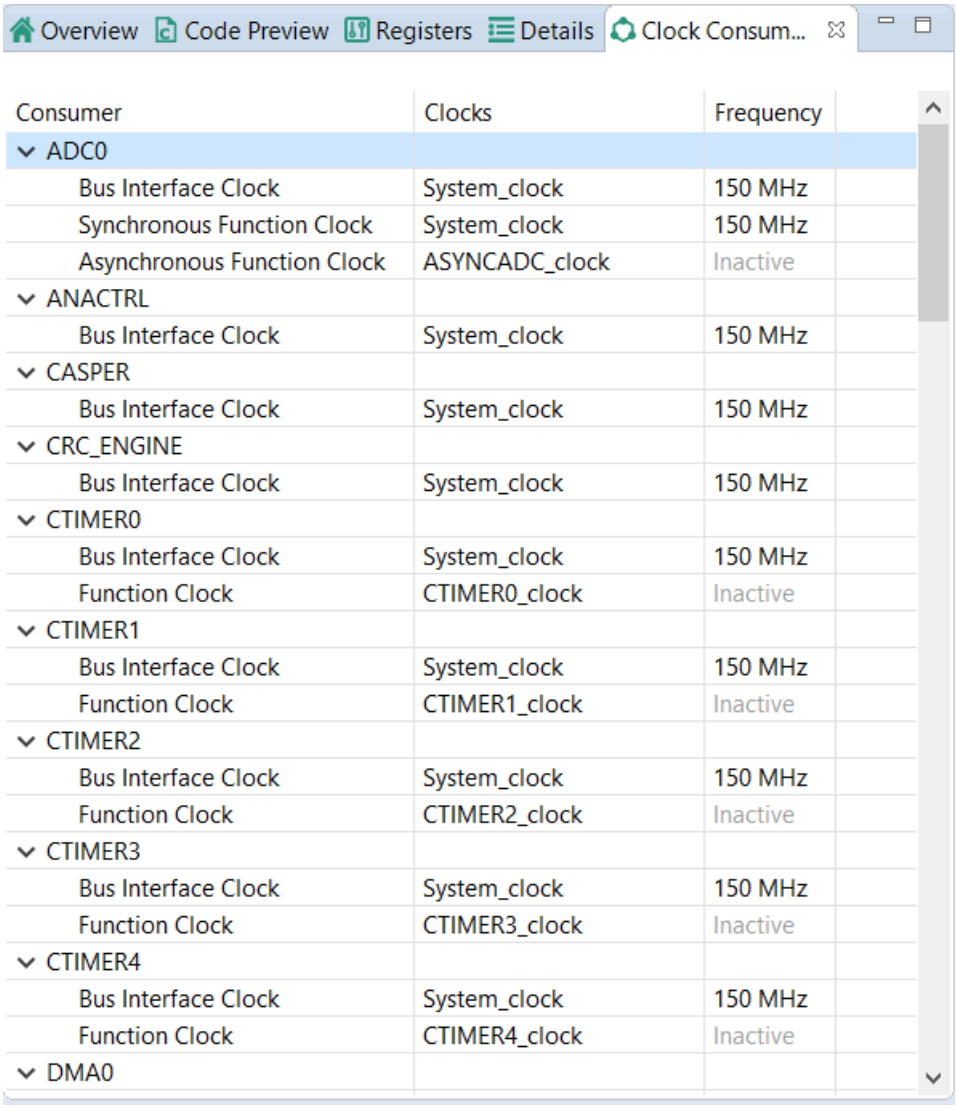
In the **Details** view, you can perform the following actions:

- **Display clock-element information** - Point the mouse cursor at the clock element to display general clock-element information.
- **View the clock-element in Clocks Diagram or Clocks Table** - Left-click on a clock element to highlight it in the **Clocks Diagram** or **Clocks Table** views, depending on which is currently active.
- **View detailed clock-element information** - Double-click a clock element to display element details, as well as highlight the element in **Clocks Diagram** or **Clocks Table**, depending on which is currently active. You can also view element details by clicking the **Open in new window** button in the upper right corner of the **Details** view.
- **Modify clock-element settings** - Left-click in the **Value** column to change clock element value, such as frequency, or select an option from the dropdown menu.
- **Lock/unlock clock elements** - Right-click on a clock element to lock/unlock the element.
- **Filter for active/locked/erroneous clock elements** - Use the buttons in the upper-right corner of the **Details** view to filter for active/locked/erroneous clock elements, or to remove all current filters.

4.4 Clock consumers view

The **Clock Consumers** view provides an overview of peripheral instances. It also provides information on clock-clock instance pairing. This view is not editable and is for information only.

Note: Information about which peripherals are consuming which output clock is available in the clock output tooltip.



Consumer	Clocks	Frequency
ADC0		
Bus Interface Clock	System_clock	150 MHz
Synchronous Function Clock	System_clock	150 MHz
Asynchronous Function Clock	ASYNCADC_clock	Inactive
ANACTRL		
Bus Interface Clock	System_clock	150 MHz
CASPER		
Bus Interface Clock	System_clock	150 MHz
CRC_ENGINE		
Bus Interface Clock	System_clock	150 MHz
CTIMER0		
Bus Interface Clock	System_clock	150 MHz
Function Clock	CTIMER0_clock	Inactive
CTIMER1		
Bus Interface Clock	System_clock	150 MHz
Function Clock	CTIMER1_clock	Inactive
CTIMER2		
Bus Interface Clock	System_clock	150 MHz
Function Clock	CTIMER2_clock	Inactive
CTIMER3		
Bus Interface Clock	System_clock	150 MHz
Function Clock	CTIMER3_clock	Inactive
CTIMER4		
Bus Interface Clock	System_clock	150 MHz
Function Clock	CTIMER4_clock	Inactive
DMA0		

Figure 82. Clock Consumers view

4.5 Clocks diagram

The clocks diagram shows the structure of the entire clock model, including the clock functionality handled by the tool. It visualizes the flow of the clock signal from clock sources to clock output. It is dynamically refreshed after every change and always reflects the current state of the clock model.

At the same time, it allows you to edit the settings of the clock elements.

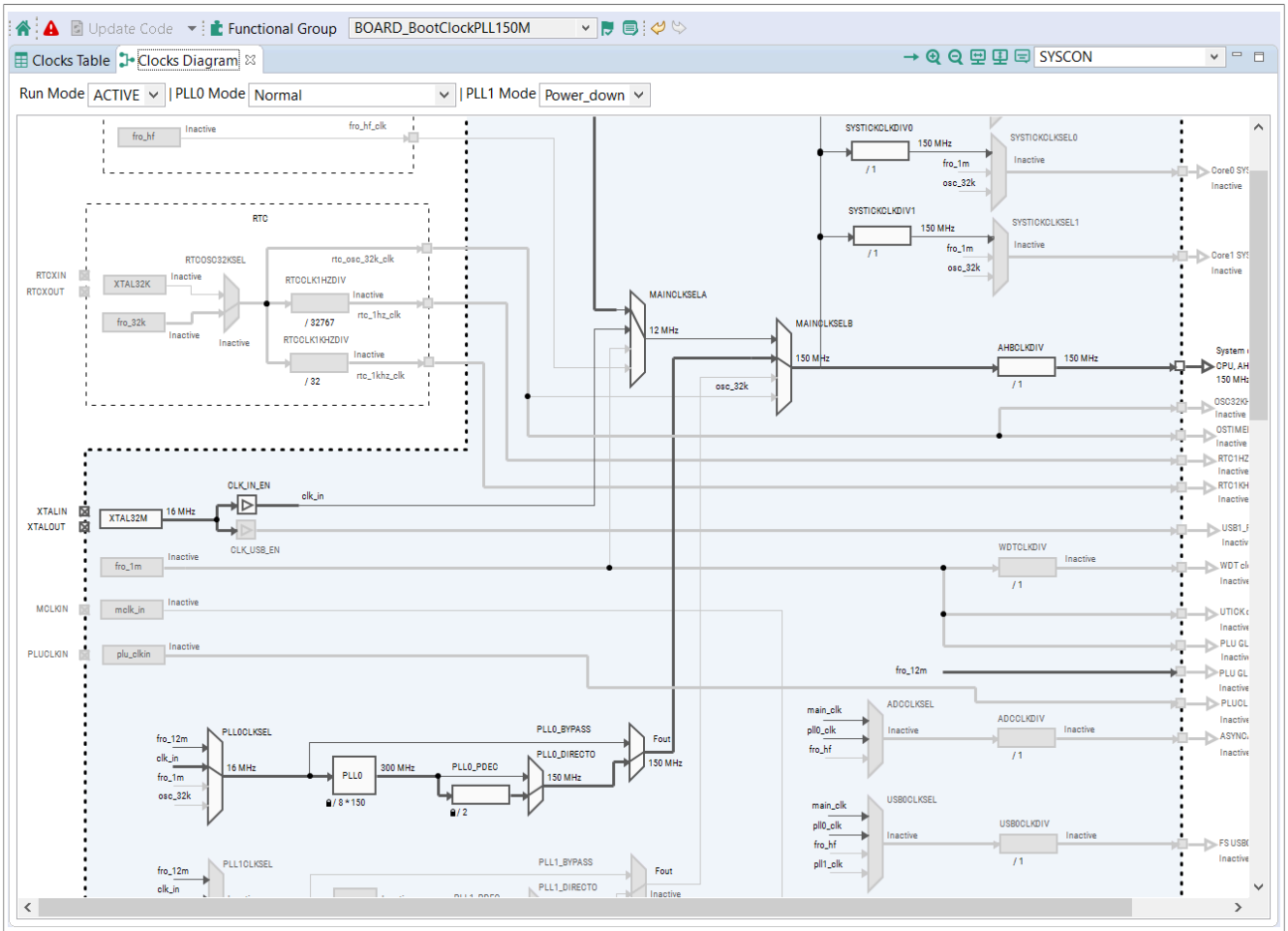


Figure 83. Clocks diagram

4.5.1 Mouse actions in diagram

You can perform the following actions in the **Clocks Diagram** view.

- **Position the mouse cursor on the element** to see the tooltip with the information on the clock element such as status, description, output frequency, constraints, and enable/disable conditions.
- **Single-click on output frequency or scale** to change output frequency or scale.
- **Single-click on lock** to remove the lock.
- **Double-click the element** to show its settings in the **Details** view (force to open the view if closed or not visible).
- **Single-click on the element** to show its settings in the **Details** view.
- **Single-click on a selected Clock source** to display a dropdown menu for enabling or disabling the source.
- **Single-click on a selected Clock selector** to display selector input options.

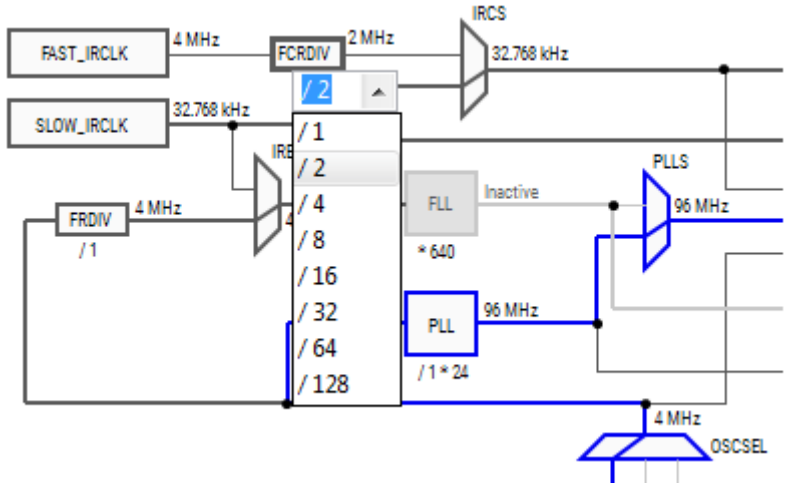


Figure 84. Clocks mouse actions in diagram

- **Right-click the element**, **component, or clock output** to see a pop-up menu with the following options.
  - **Edit settings of: {element}** - Invokes the floating view with the settings for a single element.
  - **Edit all settings** - Invokes the floating view with all the settings for an element.
  - **Edit settings on the path to: {clock output}** - Invokes the floating view with the settings for all elements on the clock path leading to the selected clock output.

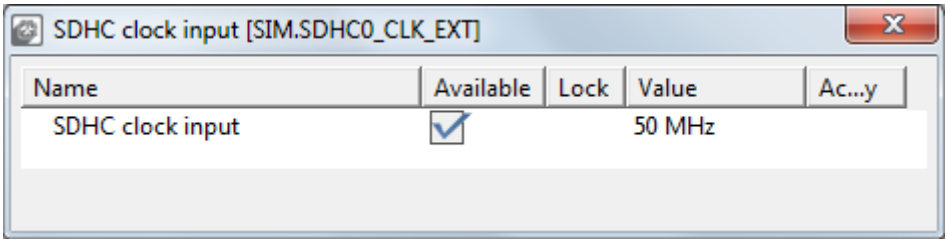


Figure 85. Floating view

4.5.2 Color and line styles

Different color and line styles indicate different information for the element and clock signal paths.

The color and line styles can indicate:

- Active clock path for selected output
- Clock signal path states - used/unused/error/unavailable
- Element states - normal/disabled/error

To inspect colors and style appearance, select **Help > Show diagram legend** from the main menu.

4.5.3 Clock model structure

The clock model consists of interconnected clock elements. The clock signal flows from the clock sources through various clock elements to the clock outputs. The clock element can have specific enable conditions that can stop the signal from reaching the successor. The clock element can also have specific constraints and limits that the Clocks Tool monitors. To inspect these details, position the cursor on the element in the clock diagram to display the tooltip.

The following are the clock model elements.

- **Clock source** - Produces a clock signal of a specified frequency. If it is an external clock source, it can have one or more related pins.

Figure 86. Clock source

- **Clocks selector (multiplexer) -** Selects one input from multiple inputs and passes the signal to the output.

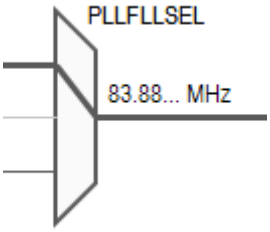


Figure 87. Clocks selector

- **Prescaler -** Divides or multiplies the frequency with a selectable or fixed ratio.

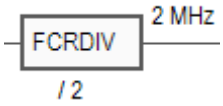


Figure 88. Prescaler

- **Frequency Locked Loop (FLL) -** Multiplies an input frequency with a given factor.

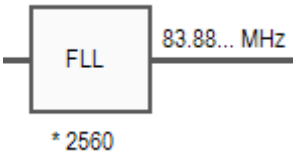


Figure 89. Frequency Locked Loop

- **Phase Locked Loop (PLL) -** Contains a pre-divider and therefore can divide or multiply with a given value.

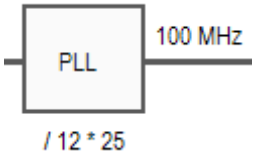


Figure 90. Phase Locked Loop

- **Clock gate** - Stops the propagation of an incoming signal.

Figure 91. Clock gate

- **Clock output** - Marks the clock signal output that has a name and can be used by the peripherals or other parts of the processor. You can add a lock and/or frequency request.

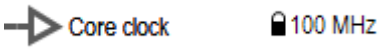


Figure 92. Clock output

- **Clock component** - Group of clock elements surrounded with a border. The clock component can have one or more outputs. The clock component usually corresponds to the processor modules or peripherals. The component output may behave like clock gates, allowing or preventing the signal flow out of the component.

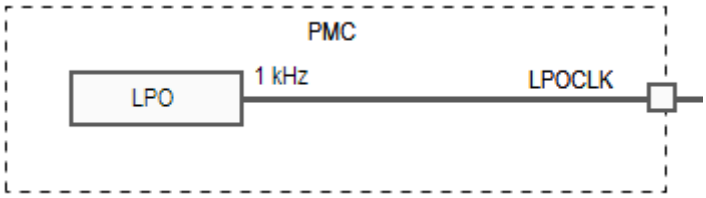


Figure 93. Clock component

- **Configuration element** - Additional setting of an element. Configuration elements do not have graphical representation in the diagram. They are shown in the setting table for the element or the clock path the element is on.

4.6 Clock configuration

Each clock configuration (functional group) lists the settings for the entire clock system and is a part of the global configuration stored in the MEX file. Initially, after you create the new clock configuration, it reflects the default after-reset state of the processor.

There can be one or more clock configurations handled by the Clocks tool. The default clock configuration is created with the name "*BOARD_BootClockRUN*". Multiple configurations provide multiple options for processor initialization.

Note: All clock settings are stored individually for each clock configuration so that each clock configuration is configured independently.

Clock configurations (functional groups) are shown at the top of the view. You can switch between them by selecting them from the dropdown menu.

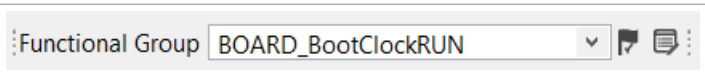


Figure 94. Default clock configuration

Note: The code generation engine of the tool generates a function with the name derived from the Clock configuration name.

4.7 Global settings

Global settings, such as Run Mode and MCG mode, influence the entire clock system. It is recommended to set them first. Global settings can be modified in **Clock Table**, **Clock Diagram**, and **Details** views, and the **Functional group properties** dialog.

Note: Global settings can be changed at any time.

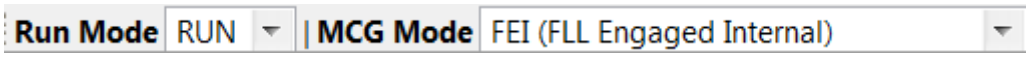


Figure 95. Global settings

4.8 Clock sources

The **Clock Sources** table is in the **Clocks Table** view. You can also edit the clock sources directly from the **Diagram** view or from the **Details** view.

You can configure the availability of external clock sources (check the checkbox) and set their frequencies. Some sources can have additional settings available when you unfold the node.

If the external crystal or the system oscillator clock is available, check the checkbox in the clock source row and specify the frequency.

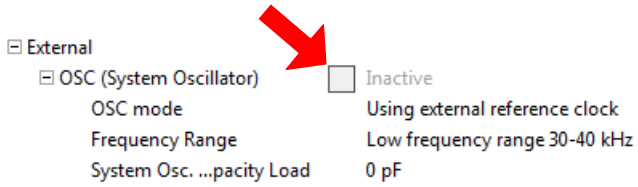


Figure 96. External clock source configuration

Note: Some clock sources remain inactive even though the checkbox is checked. This is because the clock source functionality depends on other settings such as power mode or additional enable/disable options. You can hover over the setting to see a tooltip with information on the element and possible limitations.

4.9 Setting states and markers

The following states, styles, and markers reflect the information shown in the setting rows in the settings tables (clock sources, output, details, or individual).

4.9.1 Table setting states and markers

Table 20. Setting states and markers

State/Style/Marker	Icon	Description
Error marker		Indicates that there is an error in the settings or something related to it. See the tooltip of the setting for details.
Warning marker		Indicates that there is a warning in the settings or something related to it. See the tooltip of the setting for details.
Lock icon		Indicates that the settings (that may be automatically adjusted by the tool) are locked to prevent any automatic adjustment. If a setting can be locked, it is automatically locked when you

Table 20. Setting states and markers...*continued*

State/Style/Marker	Icon	Description
		change the value. To add/remove the lock manually, use the pop-up menu command **Lock/Unlock**.**Note:** The clock element settings that cannot be automatically adjusted by the tool keep their value as is and do not allow locking. They are: clock sources, clock selectors, and configuration elements.
Yellow background	100 MHz	Indicates that the field is directly or indirectly changed by the previous user action.
Gray text	FCTRIM	Indicates that the value of a setting does not actively influence the clock. It is disabled or relates to an inactive clock element. For example, on the clock path following the unavailable clock source or disabled element. The frequency signal also shows the text “inactive” instead of frequency. The value is also gray when the value is read-only. In such a state, it is not possible to modify the value.

4.10 Frequency settings

The Clocks tool instantly recalculates the state of the entire clock system after each change of settings from the clock source up to the clock outputs.

The current state of all clock outputs is listed in the **Clock Outputs** view on the right side of the clock sources. The displayed value can be:

- **Frequency** - Indicates that a clock signal is active and the output is fed with the shown frequency. The tool automatically chooses the appropriate frequency units. In case the number is too long or has more than three decimal places, it is shortened and only two decimal places are shown, followed by an ellipsis (‘…’), indicating that the number is longer.
- **“Inactive”** text - Indicates that no clock signal flows into the clock output or is disabled due to some setting.

If you have a specific requirement for an output clock, click the frequency you would like to set, change it, and press **Enter**.

Figure 97. Setting the core clock frequency

If the tool has reached the required frequency, it appears locked and is displayed as follows:

Figure 98. Tool attains the required frequency

If the tool cannot reach the required frequency or another problem occurs, it is displayed as follows:

Figure 99. Tool encounters problem

The frequency value in square brackets [ ] indicates the value that the tool uses in the calculations instead of the requested value.

Note: You can edit or set requirements only for the clock source and the output frequencies. You can adjust the other values only when no error is reported.

4.10.1 Pop-up menu commands

To access the menu, right-click on the clock output in the clocks view or in the diagram.

- **Lock/Unlock** - Removes the lock on the frequency, which enables the tool to change any valid value that satisfies all other requirements, limits, and constraints.
- **Find Near Valid Value** - Tries to find a valid frequency that lies near the specified value, if the tool fails to reach the requested frequency.
- **Advanced resolver for {Clock output}** - Invokes more advanced search for the valid settings that fulfills the requirements. It may take significant time, so the tool shows a progress dialog. If the resolver is not successful, the tool notifies the user. This command can alter clock selectors and modify various other clock settings on the clock path. If the result is not satisfactory, use the `UNDO` command to return to the original state.
- **Edit settings of: {element}** - Invokes the floating view with the settings for a single element.
- **Edit all settings** - Invokes the floating view with all the settings for an element.
- **Edit settings on the path to: {clock output}** - Invokes the floating view with the settings for all elements on the clock path leading to the selected clock output.

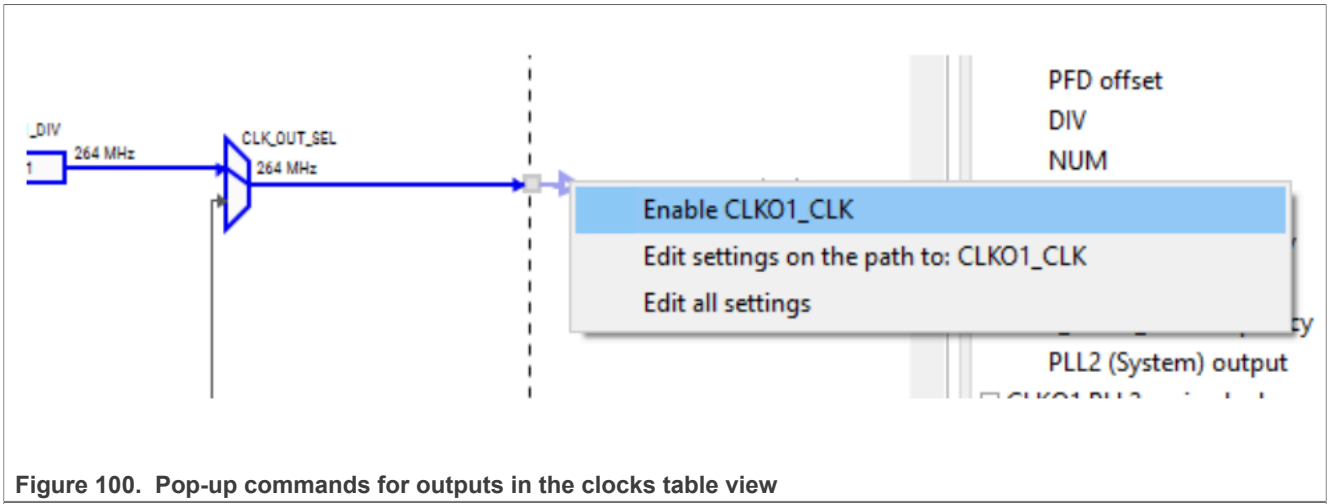


Figure 100. Pop-up commands for outputs in the clocks table view

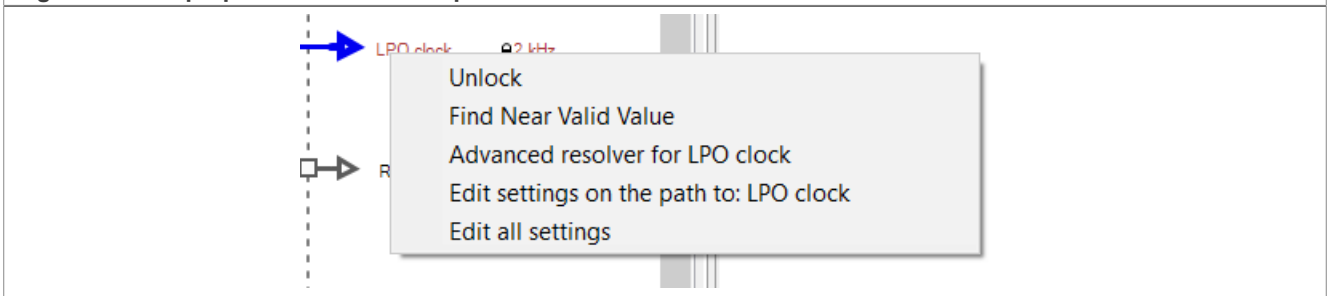


Figure 101. Pop-up commands for outputs in the clocks diagram

4.10.2 Frequency precision

For locked frequency settings (where the user requests a specific value), the frequency precision value is also displayed. By default, the value is 0.1 %, but can be individually adjusted by clicking the value.

Figure 102. Frequency precision

4.11 Dependency arrows

In the **Clocks Table** view, the area between the clock sources and the clock output contains arrows directing the clock source to outputs. The arrows lead from the current clock source used for the selected output into all outputs that are using the signal from the same clock source. This identifies the dependencies and the influences when there is a change in the clock source or elements on a shared clock path.

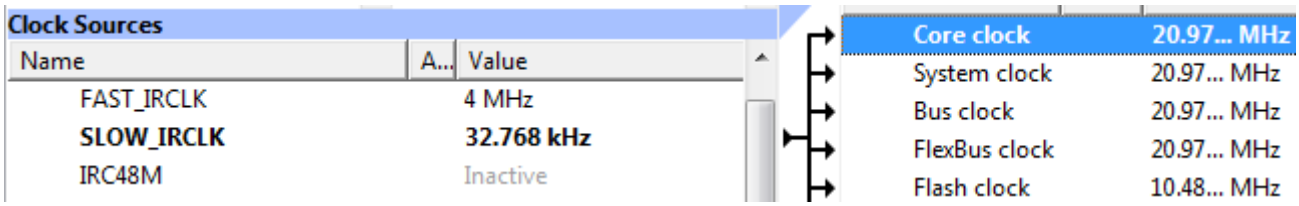


Figure 103. Dependency arrows

4.12 Modular clock initialization

Some MCUs support clock initialization per a clock module. In this case, there is a generated function (`InitClockModule`) that can be used to initialize clock modules separately. This function is also used by the generated initialization function for the current functional group.

The usage of the module initialization function can be configured independently for each module via the **Modular Initialization** view.

4.12.1 Modular Initialization view

This view is displayed only for MCUs that support modular initialization. This view is shown in Figure **Modular Initialization view**.

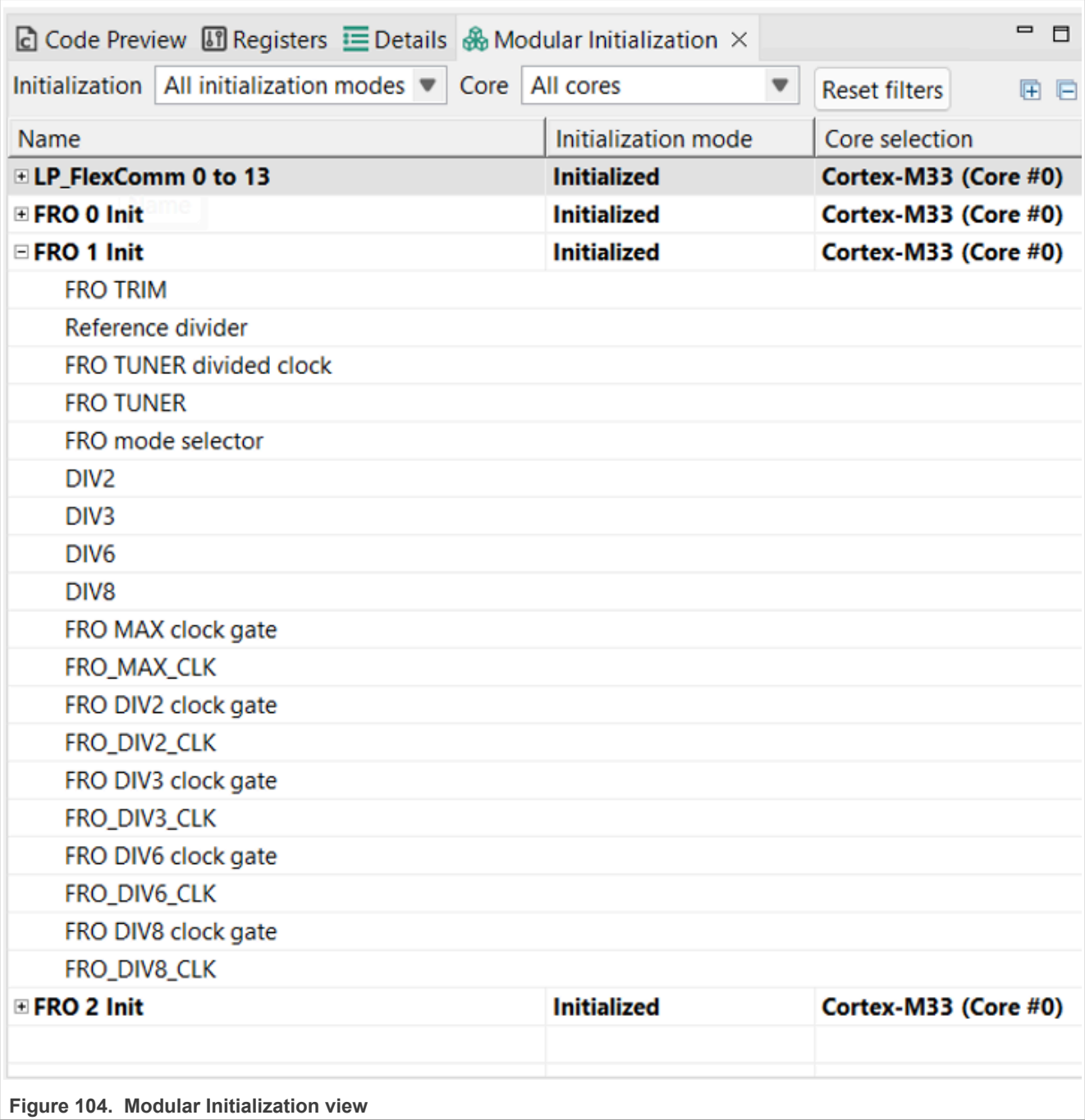


Figure 104. Modular Initialization view

The view contains a table with an expandable list of all clock initialization modules on the MCU in the current functional group. When the modules are expanded using the expand/collapse icon on the left, a list of all clock elements that are parts of the module is shown. Double-click to see the **Details** view, where the double-clicked element is focused and selected. This selection propagates to the clock diagram and other views.

The table has the following columns:

- **Name** is the name of the clock module.
- **Initialization mode** shows how the initialization of the clock module is handled. The following values are available:
  - **Initialized**: the code of the initialization function for the module is generated and the module initialization function is called from the functional group initialization function.
  - **Runtime**: the code of the module is generated, but it is not called from the initialization function for this functional group. Call the module initialization function (`InitClockModule`) for this module if needed during the runtime.
  - **Custom**: the initialization code for that module is not generated. The user must handle its initialization entirely.
- **Core selection** selects the core that handles the initialization of the clock module. As the Clocks tool generates independent files for each core, this determines in which file the code is generated.

4.12.2 Details view

For the supported MCUs, the Details view shows an additional column Init Module. See Figure **Details view extended with Init Module column**.

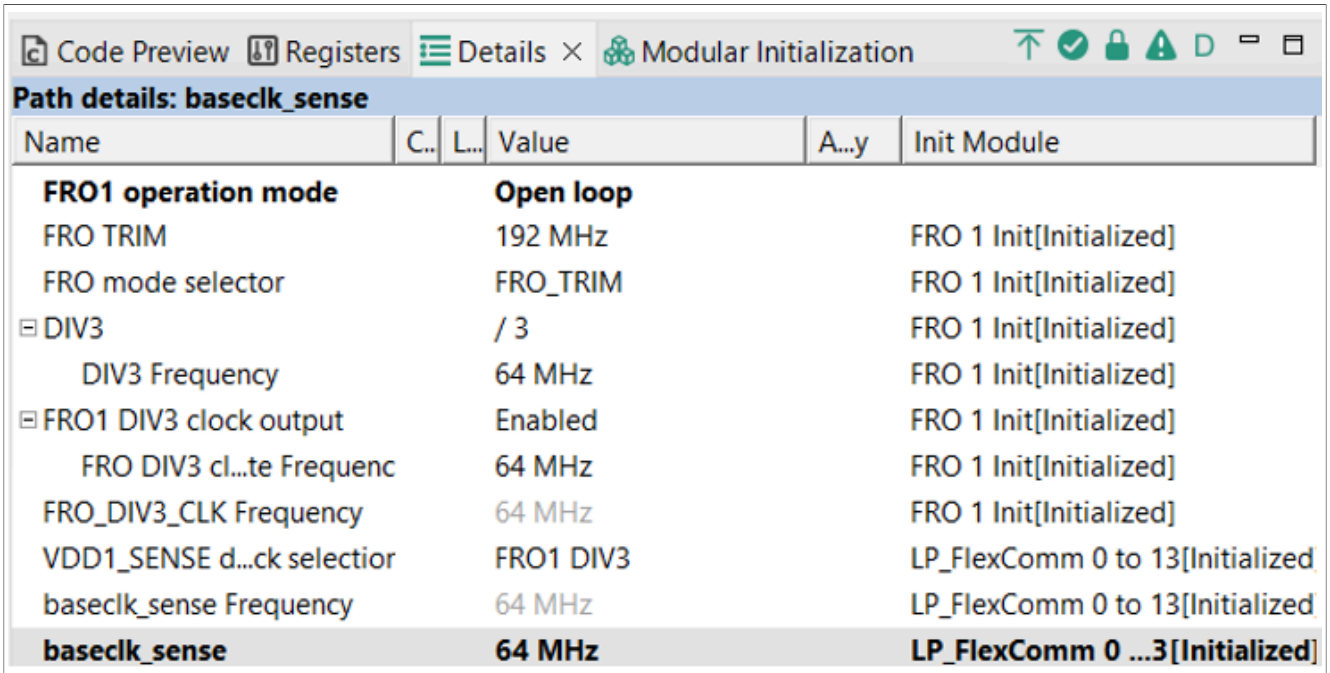


Figure 105. Details view extended with Init Module column

The Init Module column displays the clock initialization module of the clock element in the corresponding row if the element belongs to a module. The module name is followed by the value of the initialization mode in square brackets. When the clock output is selected, all initialization modules that affect the clock element on the path to the corresponding clock output are visible.

Double-click on an initialization module to switch to the **Modular Initialization** view where the module is selected and expanded.

4.12.3 Clock diagram

To alert the user of the potential of non-initialized clock output, the Clock Diagram shows a yellow marker next to the affected clock output. This marker highlights the clock elements on the path to the marked clock output belonging to a clock module in a non-default initialization mode (runtime or custom). The tooltip of that clock

output displays information about the initialization modules that are in the nondefault initialization state. This feature can be seen in Figure **Yellow marker in clock diagram informing about nondefault initialization mode**.

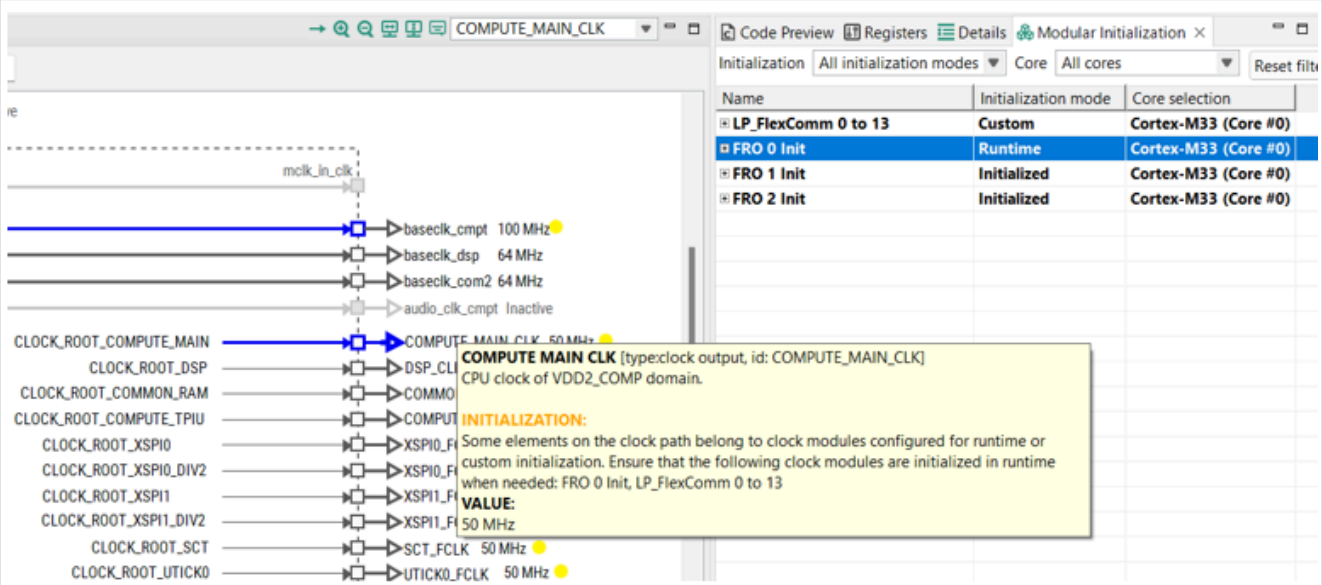


Figure 106. Yellow marker in clock diagram informing about nondefault initialization mode

4.13 Troubleshooting problems

It is possible that problems or conflicts occur while working with the Clocks Tool. Such problems and the overall status are indicated in red on the central status bar of the Clocks Tool. The status bar displays global information on the reported problem.

You may encounter any of the following problems:

1. **Requirements not satisfiable:** Indicates that there are one or more locked frequency or frequency constraints for which the tool is not able to find a valid setting and satisfy those requirements.
2. **Invalid settings or requirements:** [*element list*] - Indicates that the value of a setting is not valid. For example, the current state of settings is beyond the acceptable range.

The following are some tips to troubleshoot encountered problems:

1. Start with only one locked clock output frequency and let the tool find and calculate other ones. After you are successful, you can add more.
2. Go through the locked outputs (if there are any) and verify the requirements (there can possibly be typos in the required frequency, wrong units, and so on).
3. If you want to enable a clock output, use the pop-up menu command **Enable**, which automatically finds settings that provide a valid frequency on the clock output.
4. If the required clock output value cannot be satisfied, use the pop-up menu command “Advanced resolver for {clock output}”.
5. If you want a frequency value close to the requested value but want to keep the clock selectors and clock sources unchanged, right-click and from the pop-up menu select **Clock output > Find near value**.
6. If the problems still persist, find the elements and settings with marked errors in the diagram or tables and see the details in the tooltip.
7. If you cannot reach the values you need, use the diagram view to see the elements on clock path leading to the clock output you want to have set. Try to check and adjust the settings of these elements manually in the Details view.

8. Try to remove locks by selecting **Clocks > Unlock All Settings.** In case too many changes are required and conflicting, you can simply reset the model to the default values and start from the beginning. To reset, select **Clocks > Reset to processor defaults**.

You can resolve most of the reported problems using the **Problems** view. Each problem is listed as a separate row. The following options appear when you right-click on a selected row in the **Problems** view.

- **Show problem** - Shows the problem in the **Clocks Diagram** view.
  If one of the solutions is possible, then the pop-up is extended by:
  – **Remove lock** - Removes the lock from erroneous element.
  – **Find Near value** - Finds the nearest value.
  – **Enable**- If the clock output is disabled, tries to find settings that provide valid frequency on the clock output.
  – **Advanced resolver** - Invokes the advanced resolver that tries to find suitable settings to achieve the required frequency. For more information, see the Advanced resolver in the pop-up menu commands.

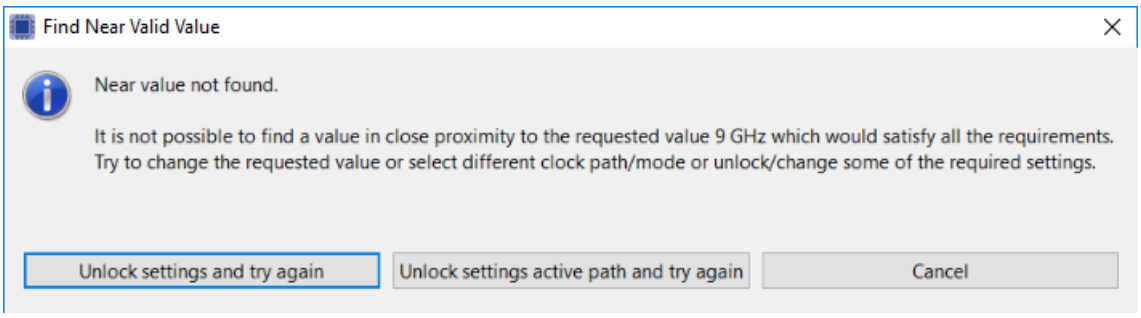


Figure 107. Find Near Value Dialog

```
-   **Unlock settings active path and try again** - unlocks all elements that
 lead to selected output and tries to recompute.
-   **Unlock settings and try again** - unlocks all locked values and tries to
 recompute. If automatic value computation fails, nothing is changed.
-   **Cancel** - cancels the modifications.
```

4.14 Code generation

If the settings are correct and no error is reported, the code generation engine instantly regenerates the source code. The resulting code appears in the **Code Preview** view.

Code Preview automatically highlights differences between the current and immediately preceding iteration of the code. You can choose between two modes of highlighting by clicking **Set viewing style for source differences**. You can also disable highlighting altogether from the same dropdown menu. The Copy, Search, Zoom-in, Zoom-out, and Export source features are available in the **Code Preview** view. The search can also be invoked by pressing CTRL+F or from the context menu.

Figure 108. Code Preview Clocks

4.14.1 Working with the code

The generated code aligns with the SDK. To use the code with the SDK project, transfer the code into your project structure.

To transfer the code into your project, do one of the following in the **Code Preview**:

- Click **Update Code** in the toolbar.

- Copy the content using the COPY command, either by pressing CTRL+C or by right-clicking the pop-up menu after selecting all text.
- Use the export command.
- Click the **Export** button in **Code Preview** view.
  If you need access to values of registers calculated by the tool, the defines with these values can be generated into a new file, registers.h. This option can be enabled by default (**Edit->Configuration Preferences**). For more information, see section Configuration Preferences.

5 Peripherals Tool

5.1 Features

The Peripherals tool features:

- Configuration of initialization for SDK drivers
- User-friendly user interface that allows you to inspect and modify settings
- Smart configuration component selection along the SDK drivers used in toolchain project
- Instant validation of basic constraints and problems in configuration
- Generation of initialization source code using SDK function calls
- Multiple functional-group support for initialization alternatives
- The tool shows configuration problems in the Problems view and marks them with decorators in other views
- Integration in MCUXpresso Config Tools framework along with other tools
- Middleware configuration support (USB, FREEMaster, LwIP)
- The tool can automatically migrate the settings to a different SDK component version
- Support of code snippets

5.2 Basic terms and definitions

Table 21. Basic terms and definitions

Term	Definition
Functional group	Represents a group of peripherals that are initialized as a group. The tool generates a C function for each functional group that contains the initialization code for the peripheral instances in this group. Only one functional group can be selected as default initialization, the others are treated as alternatives that are not initialized by default.
Peripheral instance	Occurrence of a peripheral (device) of specific type. For example, UART peripheral has three instances on the selected processor, so there are UART0, UART1, and UART2 devices.
Configuration component	Provides user interface for configuring SDK software component (for example, peripheral driver) and generates code for its initialization.
Component instance	Configuration component can have multiple instances with different settings. (for example, for each peripheral instance like UART0, UART1).
Component mode	Specific use case of the component instance (for example, TRANSFER mode of DSPI, or interrupt-based mode of communication).

5.3 Workflow

The following steps briefly describe the basic workflow in the Peripherals tool.

1. Select **Tools>Peripherals** from the tools framework main menu to open the **Peripherals** tool.
2. In the **Peripherals** view, select the peripheral instance you would like to configure (use the checkbox).
3. In case more components are available for use by the peripheral, the **Select component** dialog appears. The dialog displays the list of suitable configuration components for the selected peripheral matching the SDK driver for the selected processor.
4. Select the component that you want to use and click **OK**.
5. In the settings editor that automatically opens, select the **Component mode** that you would like to use and configure individual settings.
   Note: The selection of the component mode may impact the appearance of some settings. Therefore, always select the mode as the first step.
6. Open the **Code Preview** and see the output source code.
   Note: The source code preview is automatically generated after each change if no error is reported.
7. Use the **Update Code** button from the toolbar. Alternatively, export the source code by selecting **File>Export…** from the **Menu bar**.
   Note: To export the source code, you can also click the **Export** button in the **Code Preview** view.
8. Save settings in MEX format (used for all settings of all tools) by selecting **File>Save** from the **Menu bar**.

5.4 User interface overview

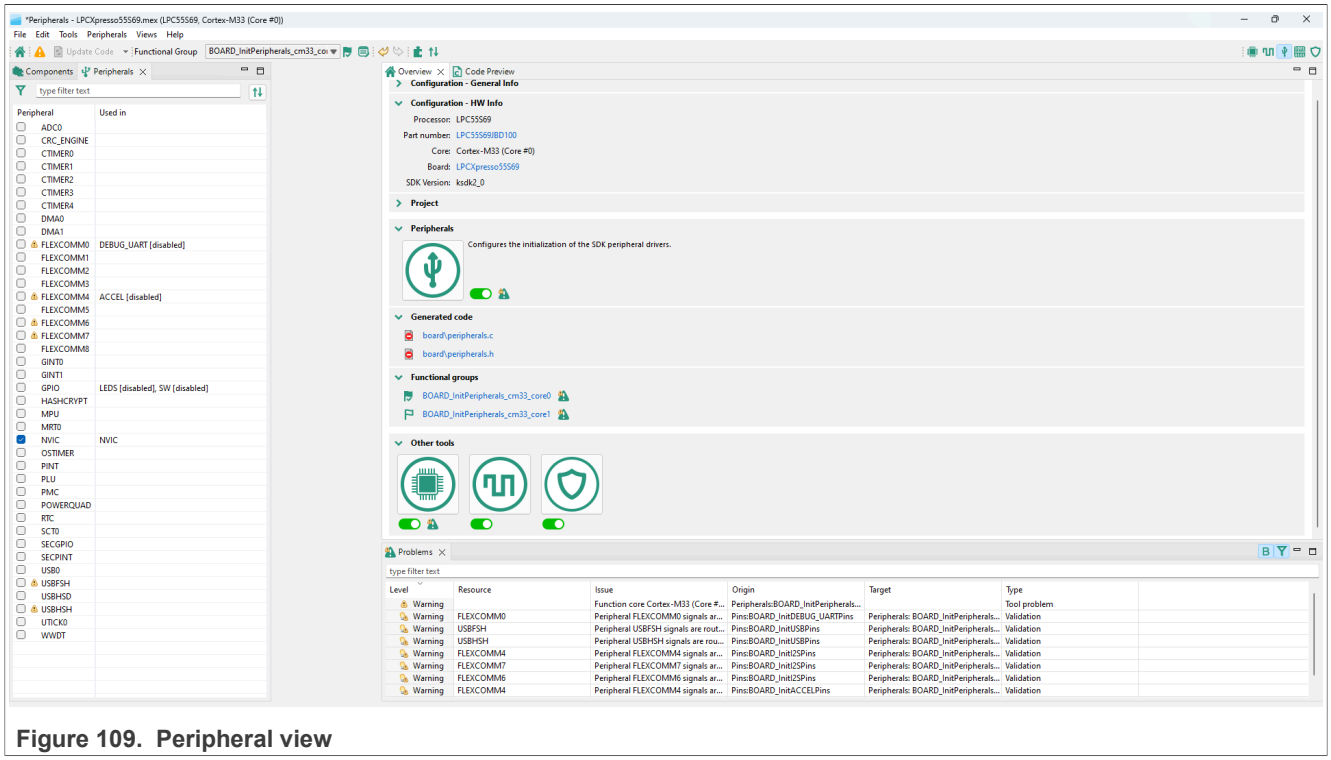


Figure 109. Peripheral view

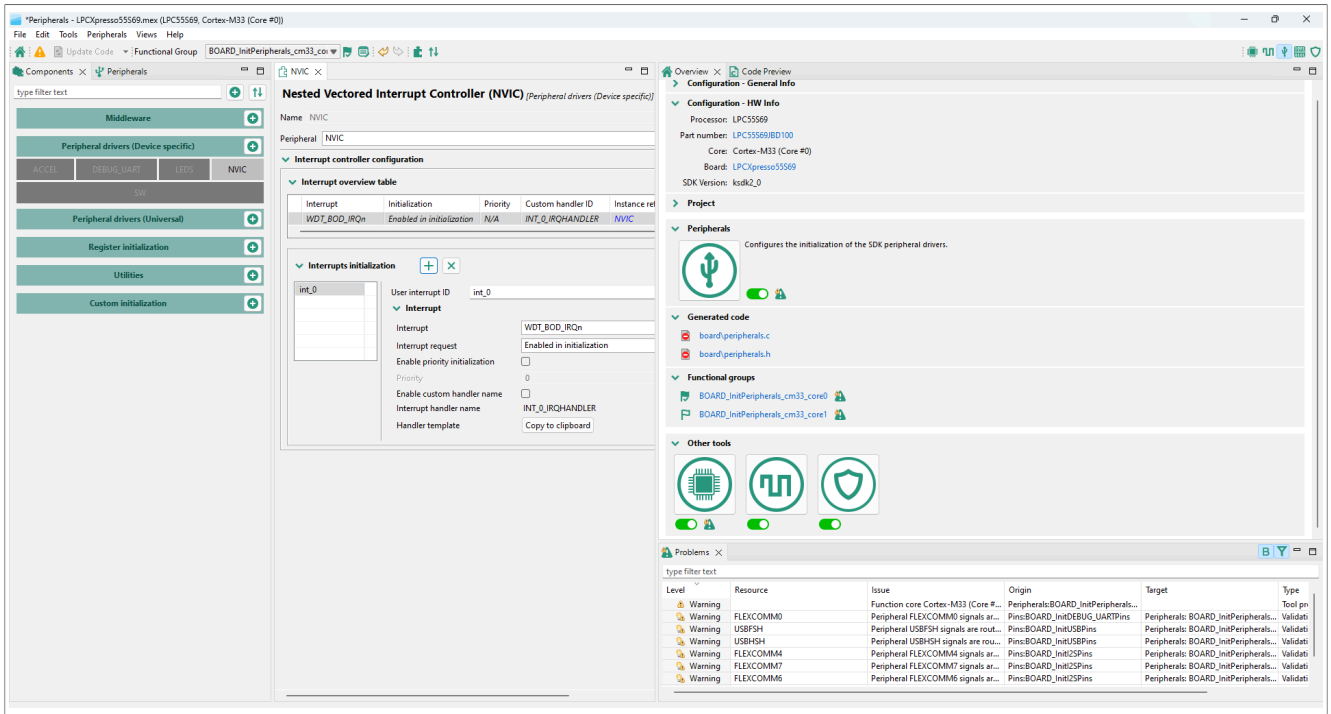


Figure 110. Components view

5.4.1 Common toolbar (Peripherals)

In addition to general items available to all tools, the **Toolbar** of the **Peripherals** tool contains two additional items:

5.4.1.1 Table toolbar

Table 22. Toolbar

Item	Description
Global settings	Open a tab aggregating global settings of all configuration sets.
Initialization order	Open a dialog for customization of peripheral initialization order.

Note: For details on other items, refer to the Toolbar chapter.

5.4.1.2 Initialization order dialog

In the **Initialization order** dialog, you can customize the initialization order of peripherals within selected functional groups.

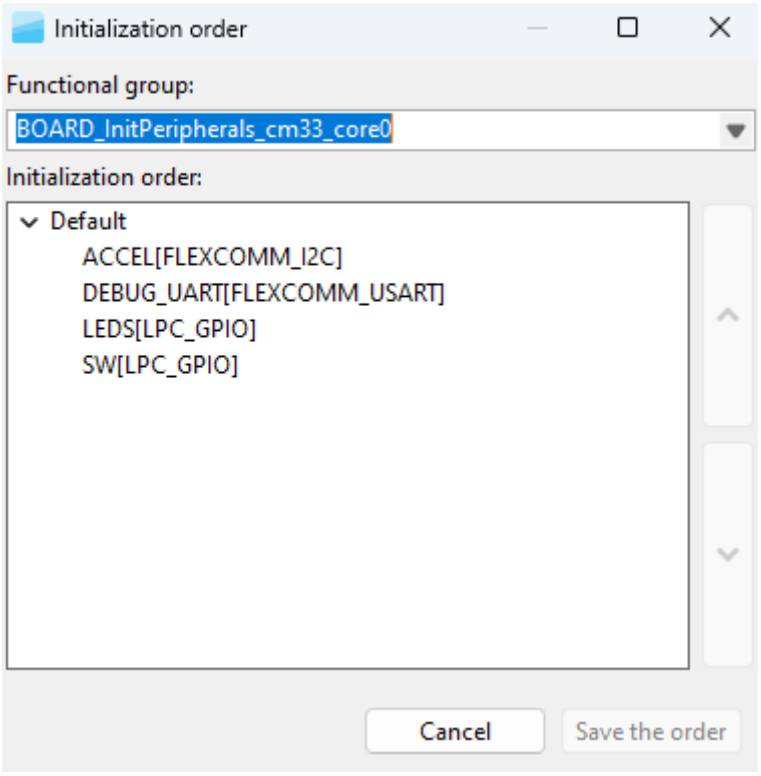


Figure 111. Initialization order dialog

1. Select the functional group you want to modify using the **Functional group** dropdown list.
2. In the **Initialization order** list, use the up and down arrows to adjust the sequence of initialization.
3. Click **Save order** to save your settings, or **Cancel** to close the dialog without changes.

5.4.2 Components view

The components view shows a list of configuration components, sorted by category into groups such as Middleware, Peripheral drivers and others.

The view highlights configuration components based on their status.

5.4.2.1 Table component status

Table 23. Component status

Status	Color highlighting
Enabled	Light gray.
Enabled/with warning	Light gray with the alert symbol.
Enabled/with error	Red with the error symbol.
Disabled	Dark gray.

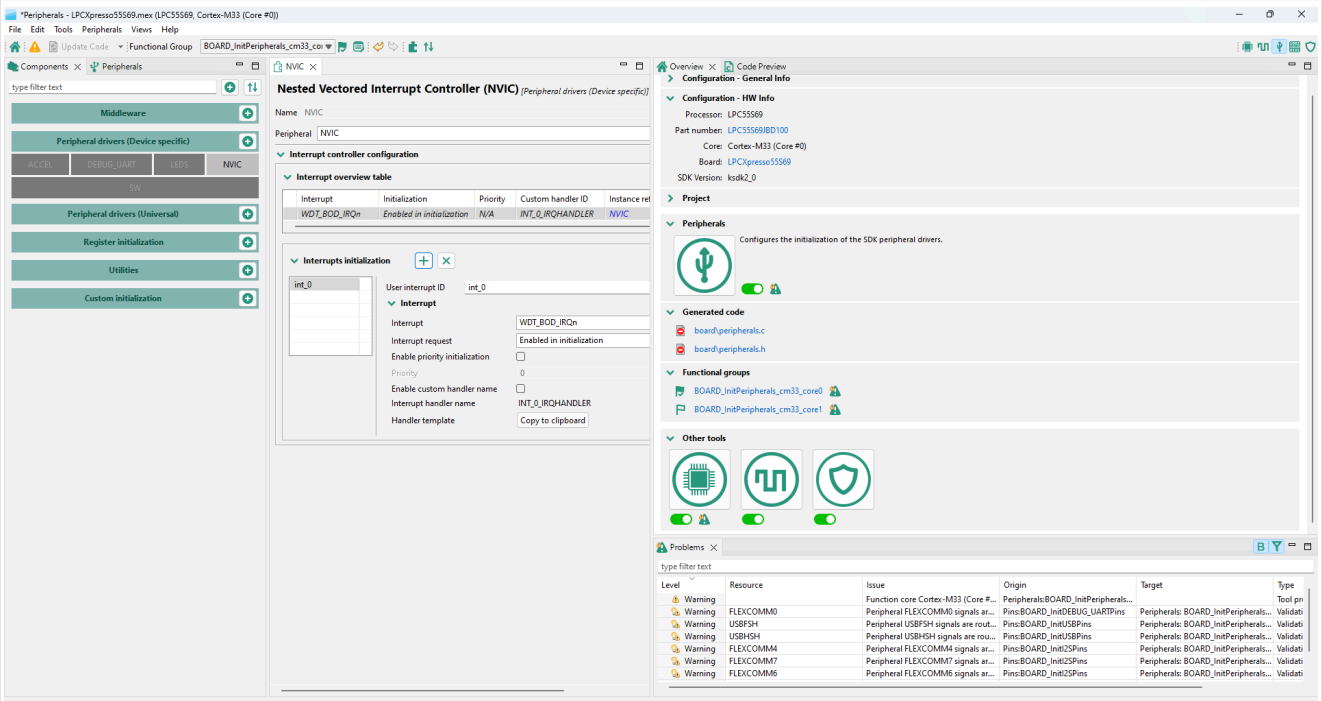


Figure 112. Components view

In the **Components** view, you can perform several actions.

5.4.2.2 Table components view actions

Table 24. Components view actions

Option	Description
Display configuration-component information	Point the mouse cursor at the configuration component to display general configuration-component information.
Open the Settings Editor of the configuration component	Left-click the configuration component to open its **Settings Editor**.
Add new configuration components	Left-click the **+** button and select from the list to add a component. In the **Select component** dialog, you can filter the list to show only toolchain-project-relevant, or latest version components. You can also click the **+** buttons next to **Middleware/Peripheral drivers/Other** categories to add new components in them directly as shown in the figure below the table.
Filter configuration components by name	Type a text string to filter configuration component names in the search bar.

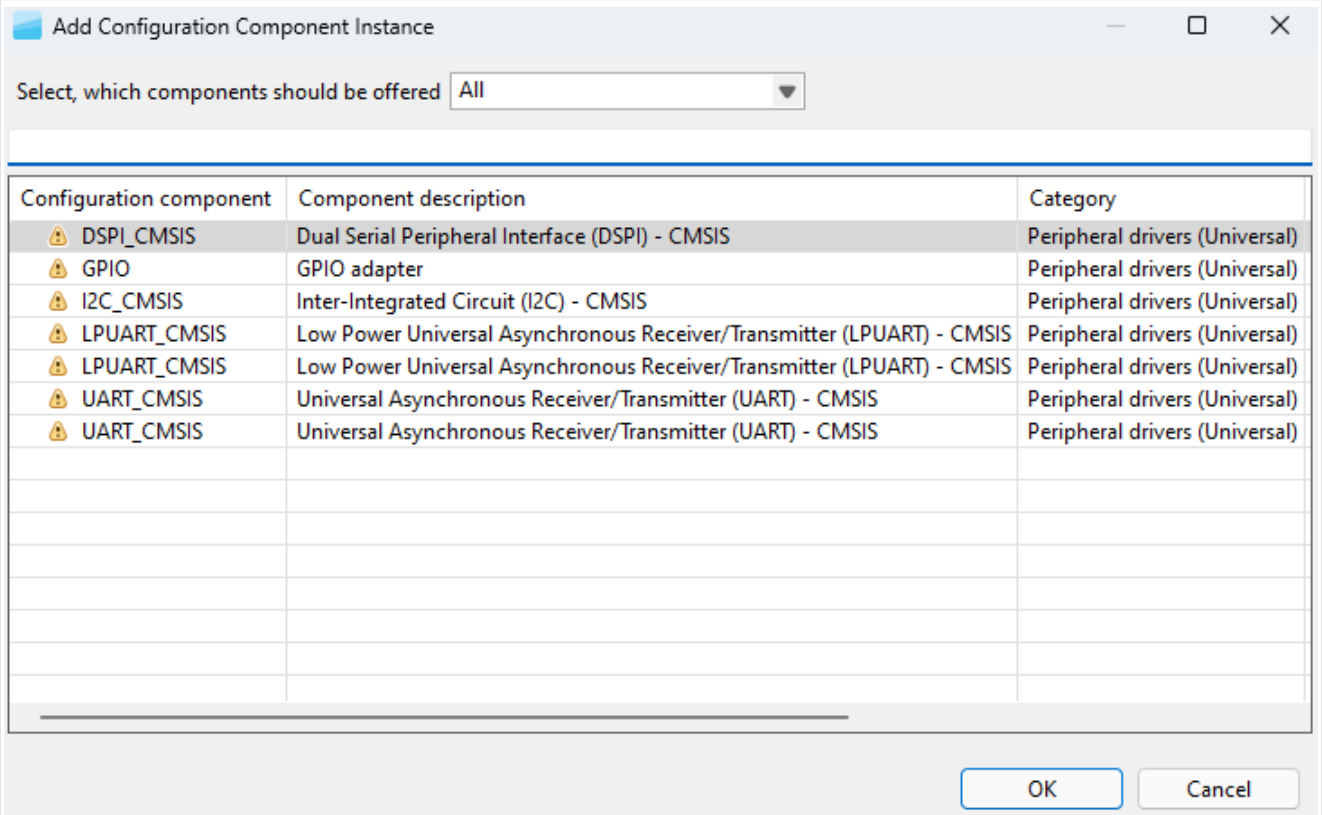


Figure 113. Add component dialog

Right-click the configuration component to open a shortcut menu. Several options are available in the shortcut menu.

5.4.2.3 Table Shortcut menu options

Table 25. Shortcut menu options

Option	Description
Open	Open the configuration component in the **Settings Editor**.
Open in another view	Duplicates the configuration component in the **Settings Editor**.
Enable/Disable	Enable/Disable the configuration component.
Edit comment	Create/Edit custom notes for the configuration component.
Lock/Unlock editing of component instance	Lock/Unlock the editing of the component instance.
Save to use case library	Create a template from the configuration component.
Documentation	Display the documentation of the configuration component, if available.
Remove	Remove the component from configuration. **Note:** If the component has any global settings, a dialog appears prompting you to confirm the removal. If the component does not have any global settings, the component is deleted after removing the last instance.

Table 25. Shortcut menu options*...continued*

Option	Description
Migrate	Migrate the component to a different component type or to a component with a newer driver version.
Move to	Choose from available functional groups to move the configuration component to.
Copy to	Choose from available functional groups to copy the configuration component to.

5.4.3 Peripherals view

The **Peripherals** view contains a table showing a list of available peripherals on the currently selected processor that can be configured by the **Peripherals** tool. In case of multicore processors, the displayed peripherals are also core-specific.

Each instance of a peripheral (for example, UART0) occupies one row. The first column contains the peripheral name and a checkbox indicating whether the peripheral is used by any component instance.

The second column contains the name of the component instance handling the peripheral. This name is customizable in the settings editor and it is used in generated code. The name of the component instance cannot contain spaces.

You can enable an instance by selecting the checkbox, or by clicking the switch in the settings editor of the component instance.

Disable a component instance by unchecking the checkbox.

Double-click the second column to open the **Settings Editor** for the component instance.

Right-click the peripheral to open a shortcut menu. Several options are available in the shortcut menu.

5.4.3.1 Table Shortcut menu options

Table 26. Shortcut menu options

Option	Description
Open	Open the component instance in the **Settings Editor**.
Open in another view	Duplicate the component instance in the **Settings Editor**.
Enable/Disable	Enable/Disable the component instance.
Add component instance	Add a component instance to the peripheral.
Initialized in user code	Mark the peripheral as configured by user code (available on not configured peripherals).
Edit comment	Create/Edit custom notes for the component instance.
Lock/Unlock editing of component instance	Lock/Unlock the editing of the component instance.
Save to use case library	Create a template from the component instance.
Documentation	Display the documentation of the component instance, if available.
Remove	Remove the component instance from configuration. If more instances are in use, a confirmation window allows you to select which instance you want to remove.
Migrate	Migrate the component to a different component type or to a component with a newer driver version.

Table 26. Shortcut menu options...*continued*

Option	Description
Move to	Choose from available functional groups to move the component instance to.
Copy to	Choose from available functional groups to copy the component instance to.

5.4.4 Settings editor

You can edit peripheral component settings in the **Settings Editor**. Open editors are shown in the central area of the screen, each with its own tab. Multiple editors can be opened at the same time. Changes done in the editor are immediately applied and kept even if the settings editor is closed. Settings that are disabled are highlighted in gray. In case that a component instance is disabled, all settings are highlighted in gray. Tooltips are displayed for all enabled settings when the mouse cursor is placed at settings.

To open **Settings Editor**, do the following:

- Double-click the component instance in the **Peripherals** or **Components** view to display component instance settings.
- Left-click the component in the **Components** view to display global settings of the component.

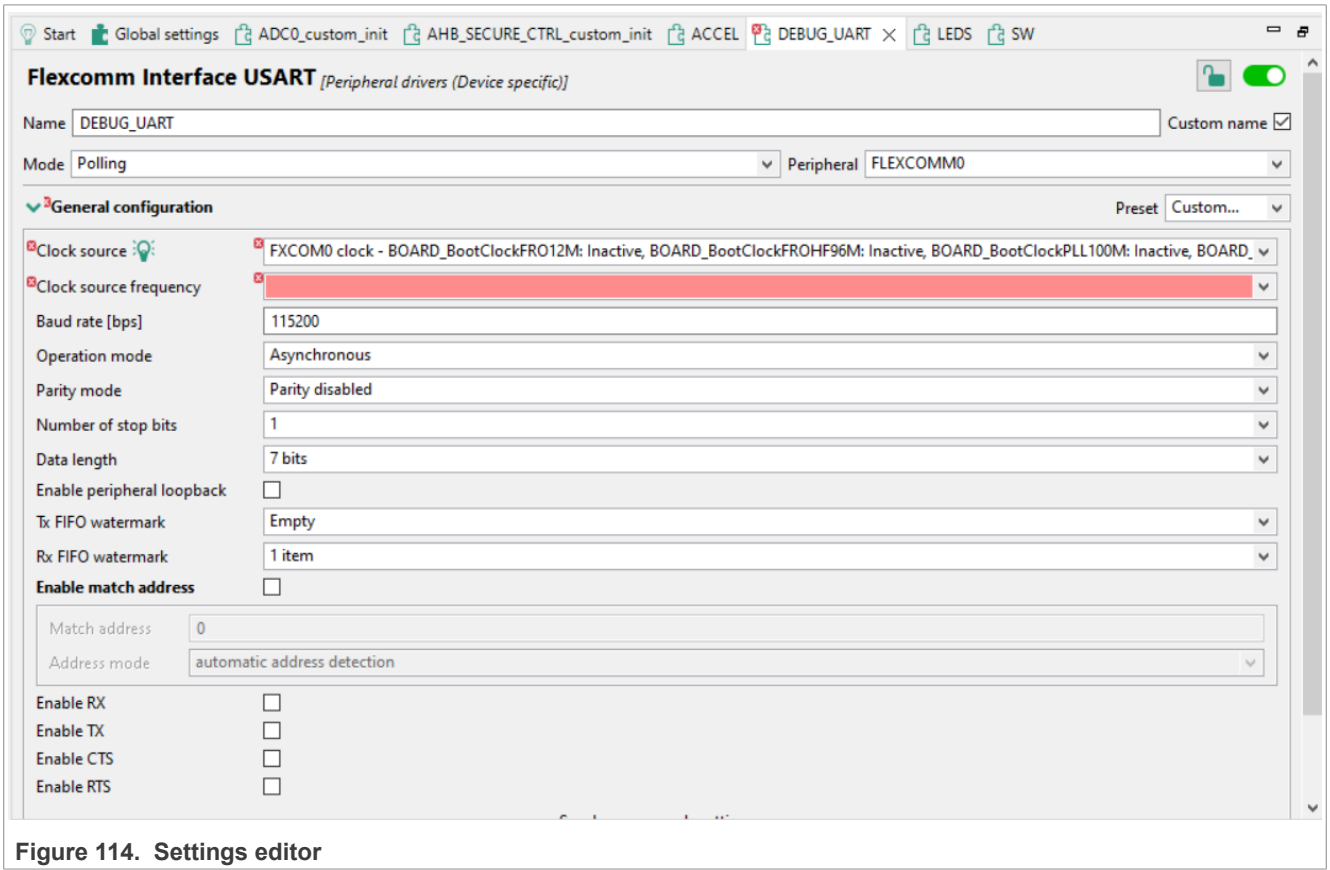


Figure 114. Settings editor

5.4.4.1 Settings Editor header

All components share the **Settings Editor** header. In the header, you can view and change component information, enable or disable the component, and view component documentation (where applicable).

Figure 115. Settings Editor header

5.4.4.1.1 Table Settings Editor header

Table 27. Settings Editor header

Header item	Description
Description	Displays the configuration component title.
Name	Displays the component instance name. This name is used in the generated code in constants and function identifiers and is derived from the peripheral name. You can change it at any time by clicking the **Custom name** button and editing the field.
Mode	Displays the required usage for the component instance and influences available settings. Use the dropdown menu to change the mode (where applicable).
Peripheral	Displays the name of the peripheral to be associated with the component instance. Use the dropdown menu to change it.
Documentation	Click the button to view configuration component-specific documentation in the **Documentation** view. Not all configuration components are documented, therefore not all setting headers contain the **Documentation** icon.
Lock editing	Click the button to lock/unlock component editing. Source code is still generated.
Enable/disable component instance switch	Use the switch to enable or disable selected component instance. By disabling the instance, you don't remove it from the tools configuration, but prevent its inclusion in the generated code.

5.4.4.2 Presets

Settings are grouped into larger groups (config sets) that may provide presets with typical values. You can use these presets to quickly set the desired typical combination of settings or return to the default state.

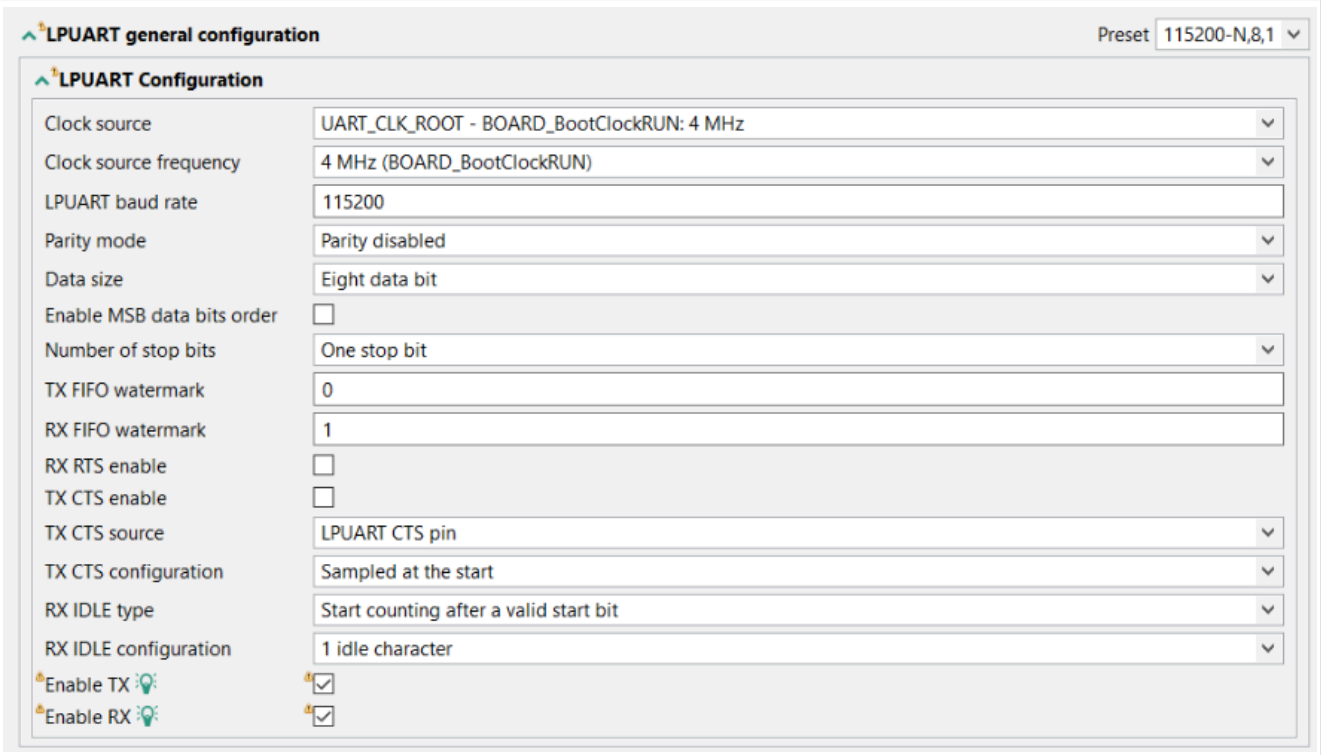


Figure 116. Quick selection example

5.4.4.3 Settings

The following setting types are available in the **Settings Editor**.

- **Boolean** - Two state setting (yes/no, true/false).

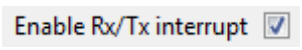


Figure 117. Boolean setting example

- **Integer, Float** - Integer or float number.

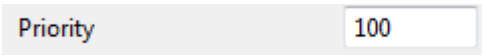


Figure 118. Integer/Float setting example

- **String** - Textual input. Supports more than a single line.

Figure 119. String setting example

- **Enumeration** - Selection of one item from a list of values.

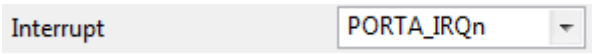


Figure 120. Enumeration setting example

- **Set** - List of values, multiple of them can be selected.

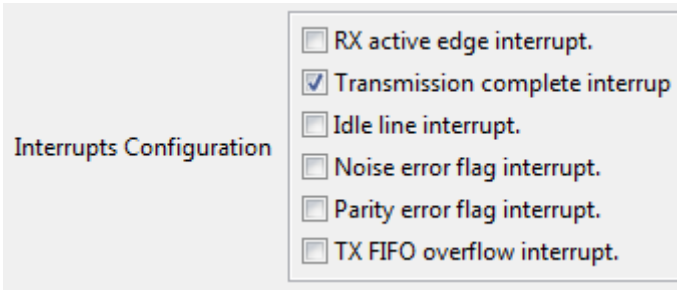


Figure 121. Set setting example

- **Structure** - Group of multiple settings of different types, may contain settings of any type including nested structures.

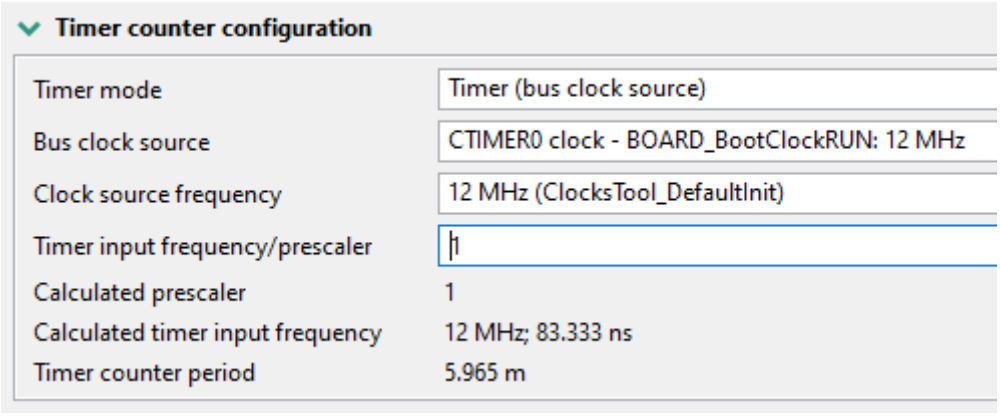


Figure 122. Structure setting example

- **Array** - Array of multiple settings of the same type - you can add/remove items. The array of simple structures may also be represented as a table grid, master-detail, tabs, and radio buttons.

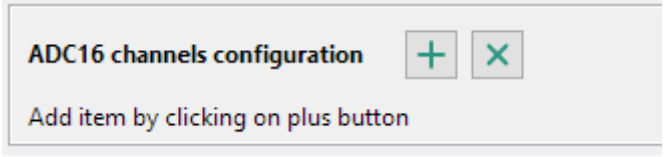


Figure 123. Array

The '+' button adds a new item at the end of the array. To rearrange the position or delete an item, right-click the item and select one of the following options: **Move up, Move down, Move to top, Move to bottom**, or **Remove**. You can also copy-paste an array from one instance to another by right-clicking the array label and choosing **Copy**. You can then navigate to another instance array, right-click the table, and choose **Paste** to add it.

Note: The array can be copied and pasted to another configuration, including in the second running instance of Config Tools.

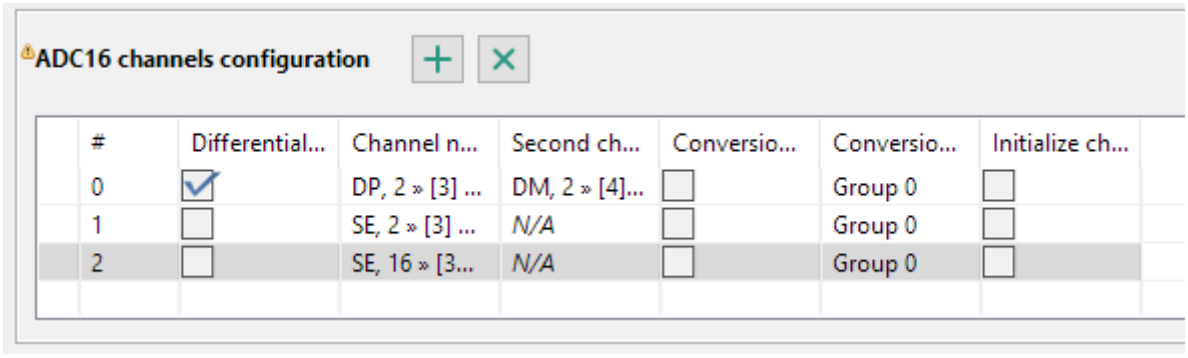


Figure 124. Array setting example

- **Info** - Read-only information for the user.

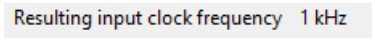


Figure 125. Info setting example

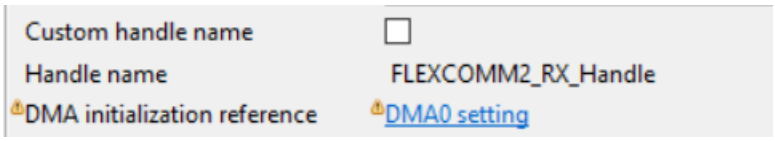


Figure 126. Info setting as link example

- **File setting** - Link/import an external settings file.

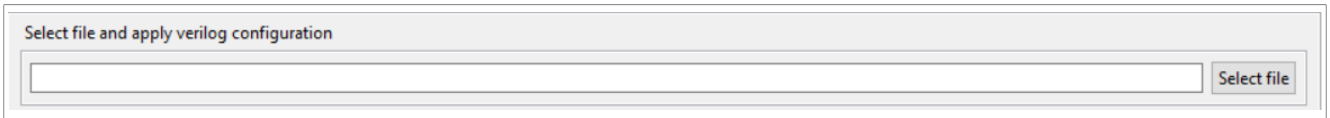


Figure 127. File setting

5.4.5 Documentation view

You can display component-specific documentation by opening the **Documentation** view.

Note: Not all components might have this option enabled.

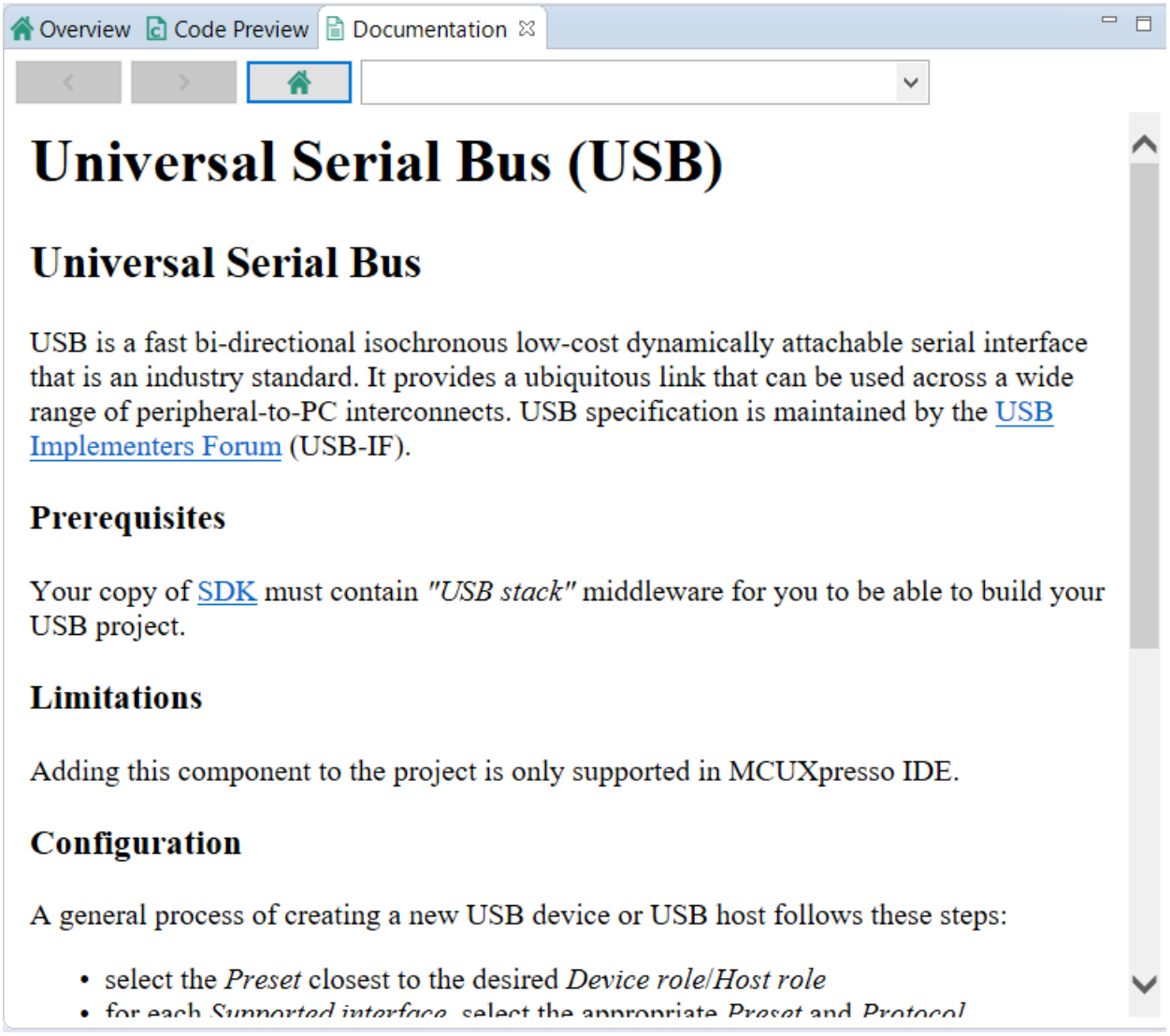


Figure 128. Documentation view

You can open the **Documentation** view in several ways:

- In the **Peripherals** view, right-click the peripheral checkbox and choose **Documentation** from the list.
- In the **Components** view, right-click the component and choose **Documentation** from the list.
- In the **Settings Editor**, click the **Documentation** button next to the component name.
- In the **Settings Editor**, click the question mark next to the settings label.

5.4.6 Component use case library

In the Peripherals tool, you can save, edit, and import/export component use cases for future use. Use cases are saved in a MEX format and can be viewed and modified in the **Component use case library**. The library displays all created/imported use cases by component type.

To open the **Component use case library**, select **Peripherals>Component use case library** from the **Menu bar**.

To create a component use case, do the following:

1. Right-click an entry in the **Peripherals** or **Components** views.
2. Select **Save to use case library** from the context menu.
3. Enter the name and description in the **Use case detail** dialog.
4. Click **OK**.

5.4.7 Component migration to a different version

Configuration components that generate configuration code for SDK components often require specific versions (or range of versions) of one or more SDK components.

The SDK component and its version that are expected for the proper function of the configuration component are visible when components are added to the selection dialog:

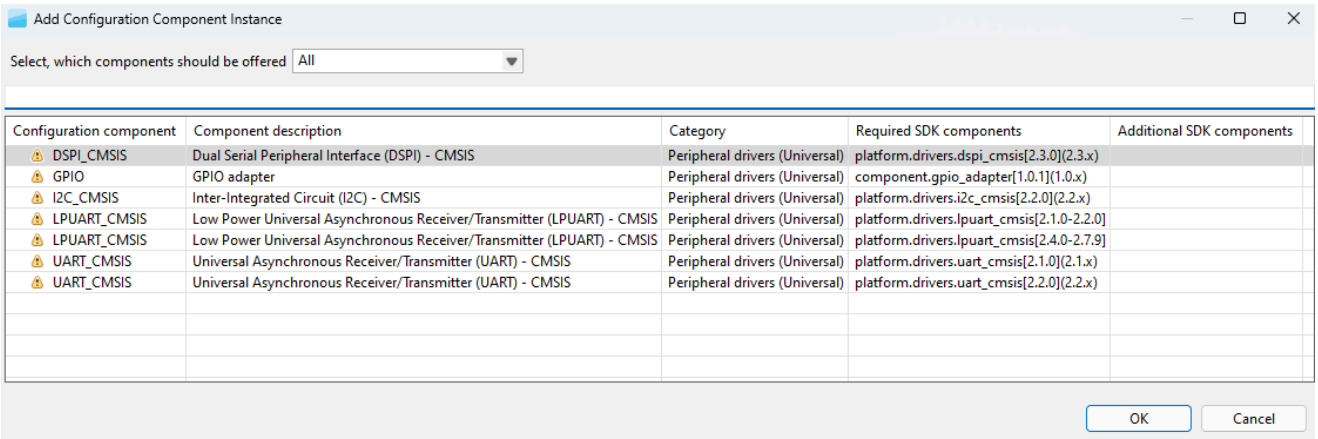


Figure 129. Component selection

It is also visible in the tooltip in the Component view:

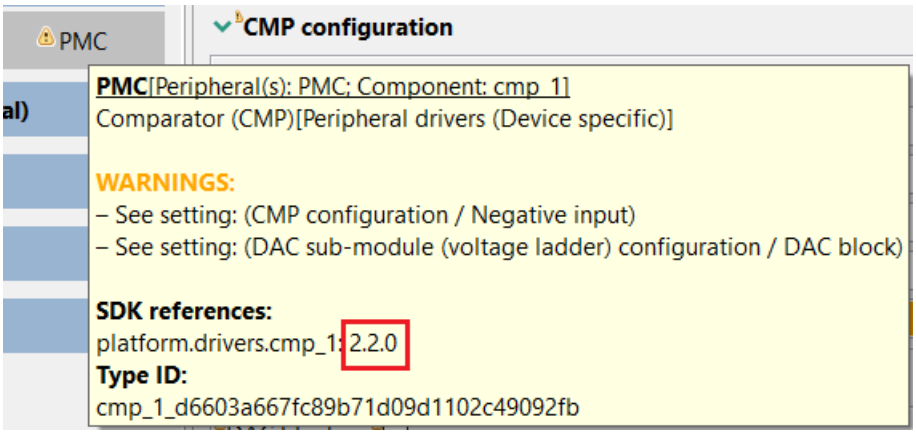


Figure 130. Tooltip in the Component view

You can update the SDK components in the toolchain/IDE project.

When a configuration is open and the SDK component versions in the toolchain project do not match the version referenced in the configuration component, automatic migration is offered in the Component migration dialog. The migration can also be launched manually in the Peripherals tool using the menu **Peripherals > Migrate to other component versions.**

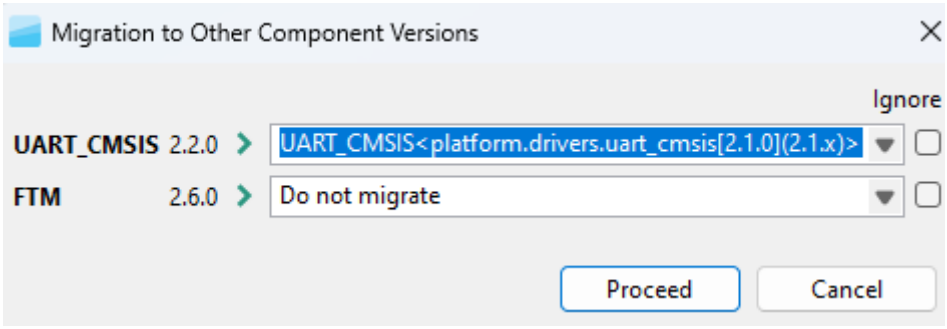


Figure 131. Migration dialog

Each row in the dialog corresponds to one configuration component that can be migrated to another version. The dialog above displays the current version specified in the current configuration component and a combo box that allows you to select the new version that replaces the current one.

In standalone Config Tools, it is possible to migrate settings to any available version. In IDE/toolchain project mode, the combo box contains only the component with the version matching the SDK component currently used in the project.

The default selection in the toolchain-less configuration is “Do not migrate”. In the toolchain configuration, the default selection is the only version to which migration can be performed. If “Do not migrate” is selected, no changes are made to the particular component.

The **Ignore** checkbox prevents the component from the migration during next check.

After you confirm the dialog by selecting “**Migrate**”, the component is replaced by the component matching the selected version of the SDK component. The settings are migrated to the corresponding settings in the new version of the component, where it is possible.

If the new version of the component contains some new settings, these settings are filled with the default values. Check manually if the components are set properly.

The **Migration result** dialog is a dialog with the summary of the migration. It automatically opens after migration is successfully completed. This dialog contains the summary of events with various impact that happened during the migration. It also contains a link that opens the generated detailed report in HTML format, and a button that copies the path to the report to the system clipboard.

The generated Migration report contains the date and information about the configuration location, MCU, and toolchain project in its header. It helps identify which configuration it is related to. Below that is a table that contains rows for each migration. A short description of the migration is provided. Each row has two columns where the first contains the path to the migrated setting and the second contains the description of the migration. Each row can have differently colored text that indicates the importance of the message.

5.5 Problems

The tool validates the settings, and problems and errors are reported in the Problems view.

If there is an error related to the setting or component, an error decorator is shown next to the element containing an error.

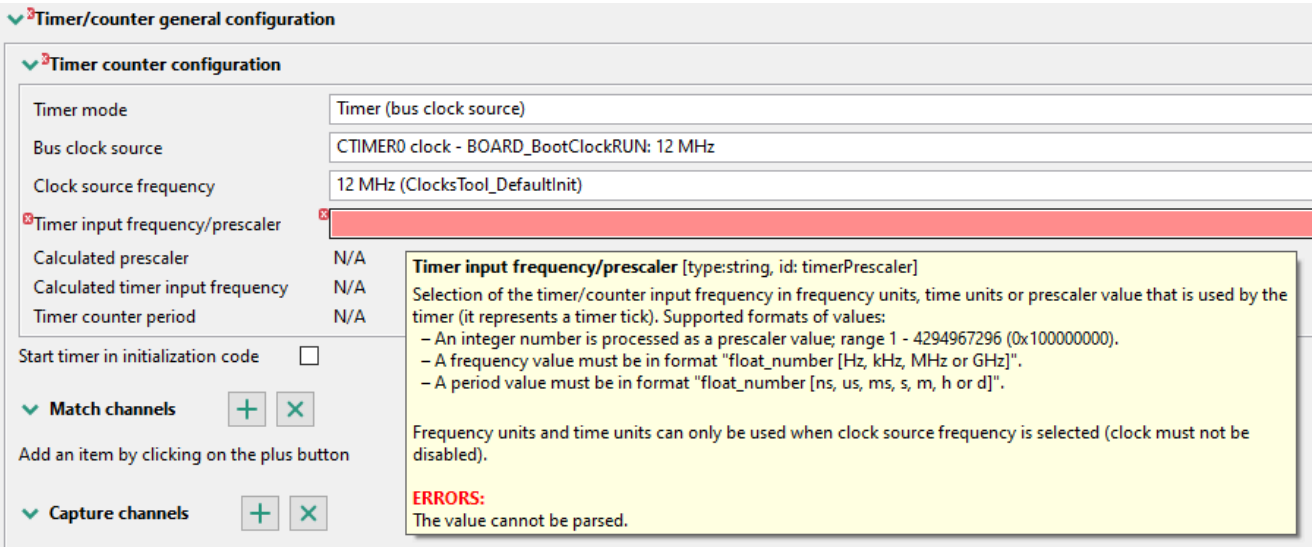


Figure 132. Error decorators

In the case of a dependency error, a quick-fix button is displayed.

Figure 133. Quick fix 1

Right-click the button to display a list of issues, then left-click the issue to display possible solutions.

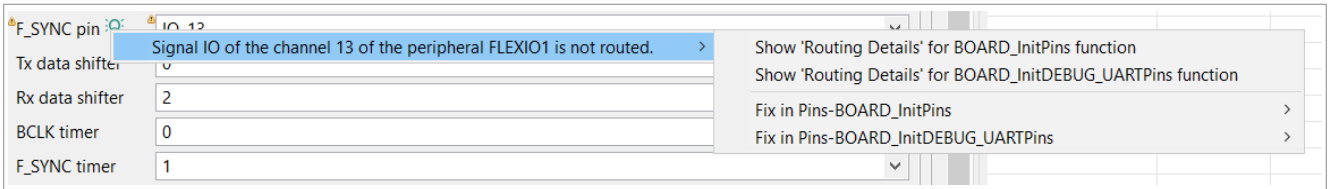


Figure 134. Quick fix 2

You can quickly fix the problem even when it is reported from a table cell as the context menu contains the list of possible quick fixes (see register initialized SCTimer, for example LPC54114 **Resources->Outputs setting**).

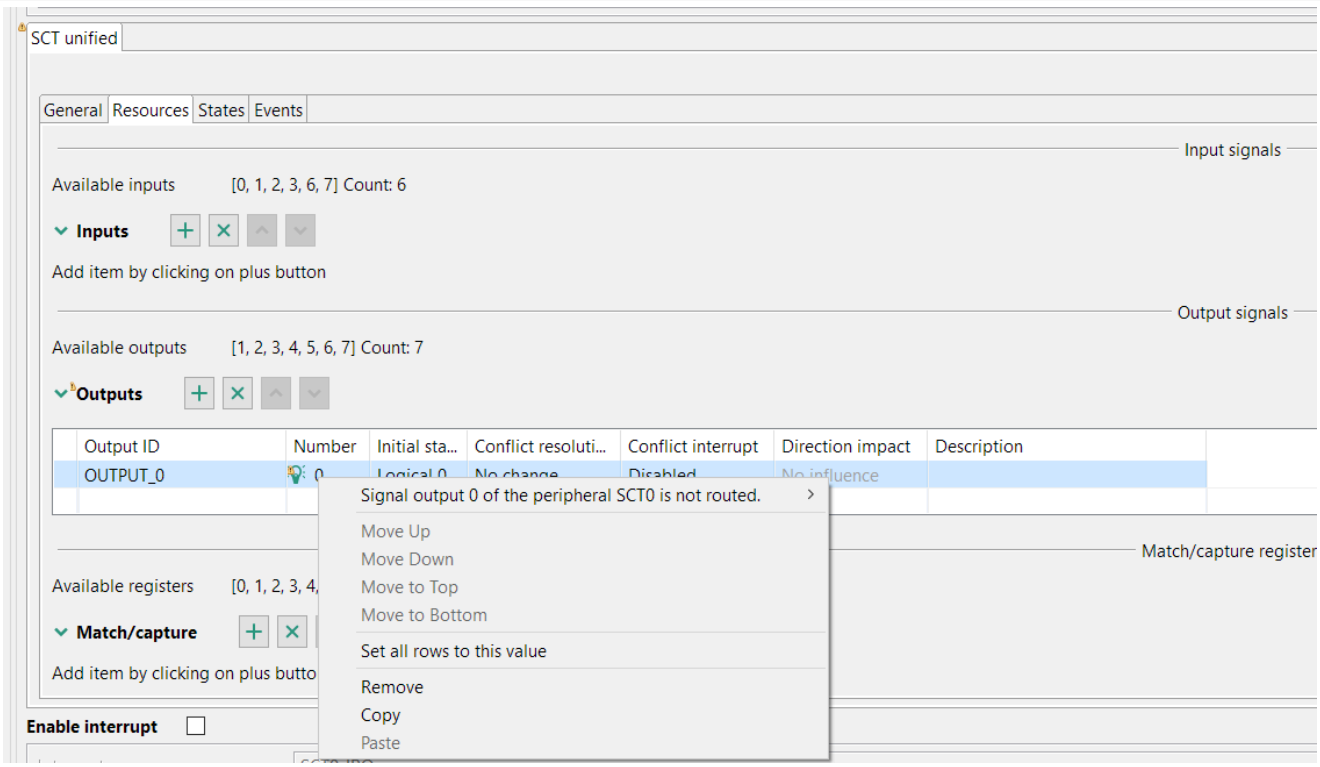


Figure 135. Quick fix 3

5.6 Code generation

If the settings are correct and no error is reported, the tool's code generation engine instantly regenerates the source code. You can view the resulting code in the **Code Preview** view of the **Peripherals** tool.

Code Preview automatically highlights differences between the current and immediately preceding iteration of the code. You can choose between two modes of highlighting by clicking the **Set viewing style for source differences**. You can also disable highlighting altogether from the same dropdown menu. Such features as Copy, Search, Zoom-in, Zoom-out, and Export source are available in the **Code Preview** view. You can also invoke the search by pressing CTRL+F or from the context menu.

The **Peripherals** tool produces the following C files:

- peripherals.c
- peripherals.h
  Note: For multicore processors, the tool generates peripherals.c/.h for each core, containing functional groups associated with that core. It can be configured in functional group properties.
  Note: Some components, such as the USB or FlexSPI, may generate additional output files.

These files contain initialization code for peripherals produced by selected configuration components including:

- Constants and function declarations in the header file.
- Initialized configuration structure variables (constants).
- Global variables for the user application that are used in the initialization. For example, handles and buffers.
- Initialization function for each configuration component.
- Initialization function for each functional group. The function name is the same as the functional group name. It is prefixed by the "prefix" property if defined in the functional group dialog. These functions execute all assigned component initialization functions.

- Default initialization function that calls the function initializing the selected functional group of peripherals.
  Note: The prefixes of the global definitions (defines, constants, variables, and functions) can be configured in the Properties of the functional group.

Figure 136. Code Preview Peripherals

6 PLU Configuration Tool

The PLU Tool is an extension of the Peripheral Tool and configures the register initialization configuration component from the Peripheral Tool. The purpose of this tool is to configure the PLU peripheral using a user-friendly graphical approach instead of manually connecting the LUTs in the register initialization component.

6.1 Modes

PLU Tool supports all modes from the PLU register initialization component.

6.1.1 Direct

Direct mode configures the LUTs as they are mapped and connected in the tool. No optimizations are performed.

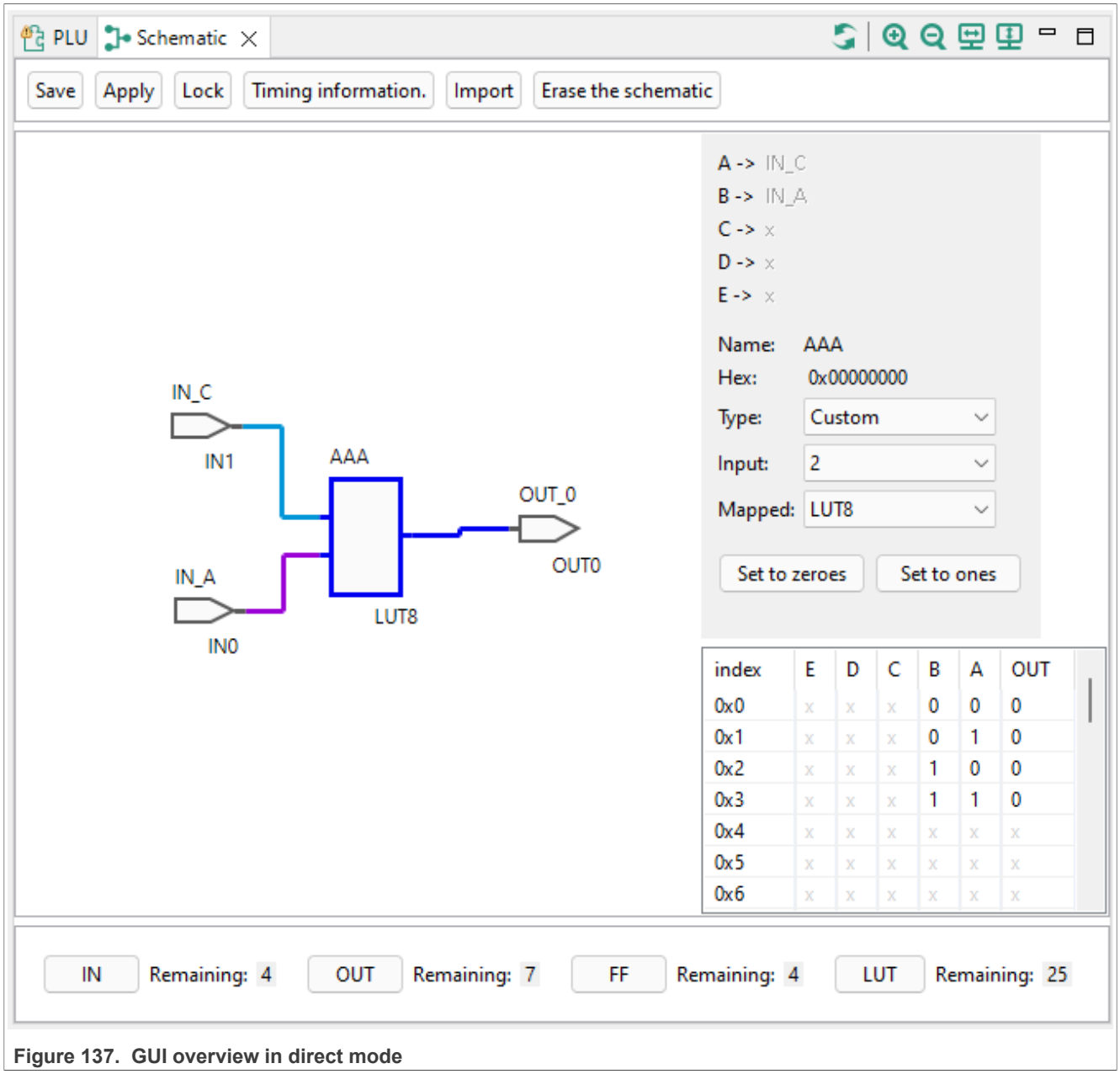


Figure 137. GUI overview in direct mode

6.1.2 Logic gates

Logic gates (Schematic) mode lets users optimize the schematic to use only some of the LUTs in the peripheral, effectively allowing more logic gates than there are LUTs available in the peripheral.

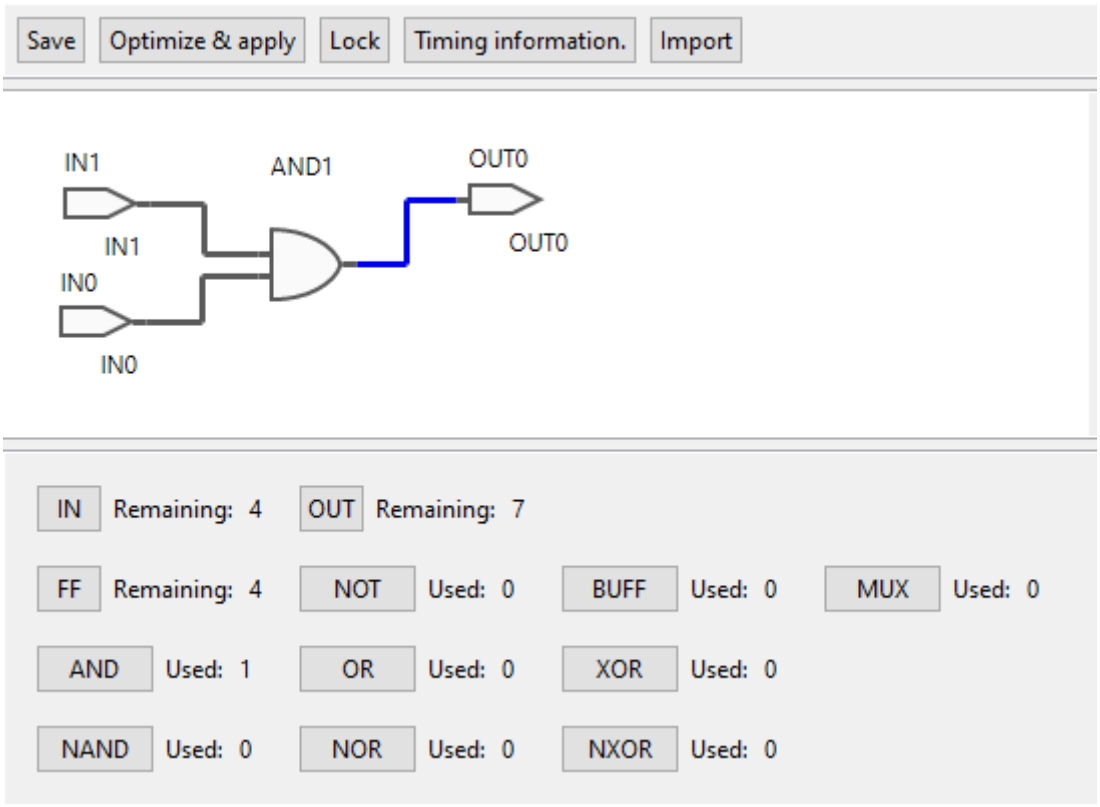


Figure 138. GUI overview in logic gates mode

6.1.3 Verilog

The tool can synthesize and optimize the model created by Verilog. Both Verilog modes take a given Verilog file/ text, run the synthesis and optimization processes, and ask users to provide a mapping of some elements used in the Verilog (IN, OUT). Users can either select a file with Verilog or write Verilog code in the textbox inside the component.

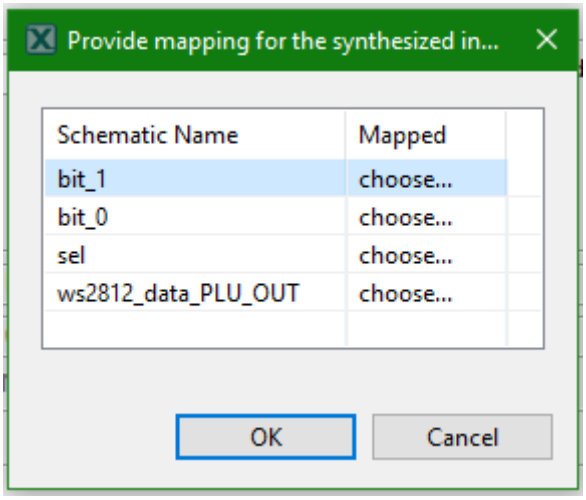


Figure 139. Mapping dialog of signals used in given Verilog code

6.1.4 Mapping information in Verilog code

The PLU Tool supports mapping specified in Verilog code for easier usage of the tool. This feature enables the capability to regenerate the PLU configuration from a command-line application and provides default values for mapping in the GUI.

```
Block/code:
/**
 * ---Config tools mapping header---
 * symbol : pluSignal
 * r : IN3
 * s : IN5
 * q : OUT3
 * q_ : OUT7
 */
```

6.2 Workflow of Direct and Logic gates modes

6.2.1 Direct mode

In Direct mode, IN, OUT, LUT, and FF symbols can be added. IN and OUT symbols are selected from the PLU component instance and more can be added through the selection dialog. LUT symbols must have a name specified when created and have the custom type selected by default. They can be either changed to a different predefined type or the truth table can be modified by clicking the output value.

6.2.2 Logic gates

In Logic gates mode, IN, OUT and FF symbols can be added the same way as in Direct mode. LUT symbols are not supported, logic gate symbols must be added instead. The final LUT count and their configuration will be determined by optimizing the schematic later.

6.2.3 Inputs and outputs dialog

The dialog offers users unused inputs and outputs defined in the component. Users can create new inputs and outputs by opening a dialog to create them.

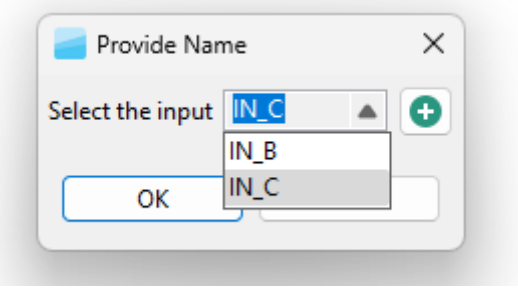


Figure 140. Selection of existing input

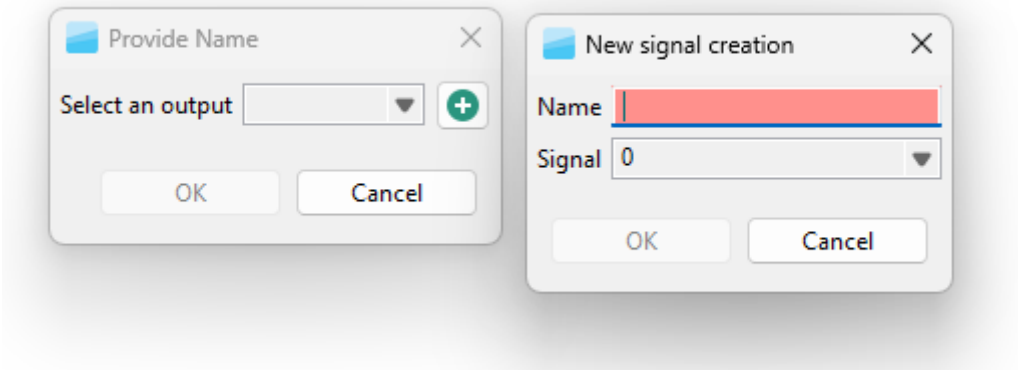


Figure 141. Creation of new input

6.2.4 Creating LUT in schematic

When the PLU is being configured in Direct mode, only a common LUT symbol can be added. In this mode, the name of the LUT must be provided during creation.

When the PLU is being configured in Logic gates mode, only a logic gate can be added to the schematic. In this mode, the name is automatically created from the logic gate type and the first available number (for example, AND3).

In both modes, the name and number of connections can be changed after the LUT symbol or logic gate symbol is created. The change can be performed by either double-clicking the symbol in the schematic or by selecting it. Then the details are displayed on the right side of the Schematic view.

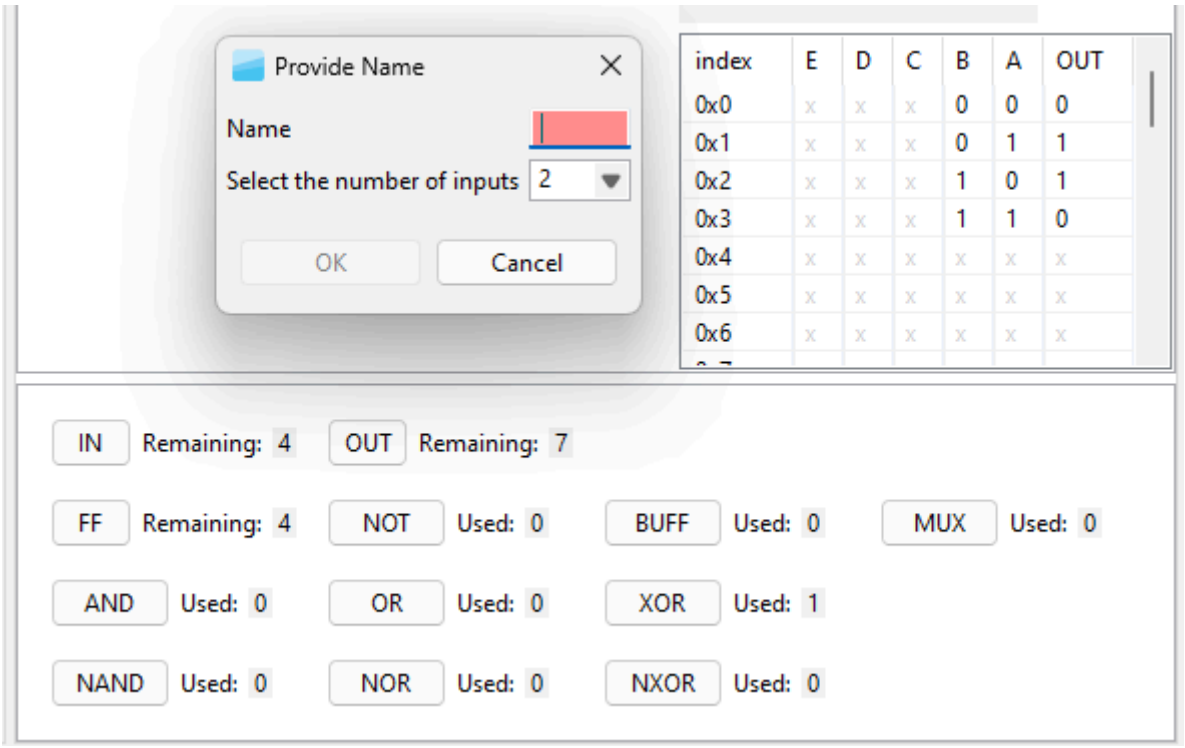


Figure 142. Editing of logic gate symbol

6.2.5 Connecting elements in schematic

Users can either start the connection by left-clicking the output pin or right-clicking the body of the element to switch to connection mode. In connection mode, the future connection is drawn as a line from the output pin of the element to the position of the mouse. The input pins of elements are also highlighted by green circles. When users click the green circle with the left mouse button, the connection is created.

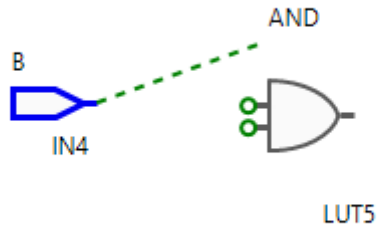


Figure 143. Connection mode

7 Device Configuration Tool

The **Device Configuration** tool allows you to configure the initialization of memory interfaces of your hardware. Use the **Device Configuration Data (DCD)** view to create different types of commands and specify their sequence, define their address, values, sizes, and polls.

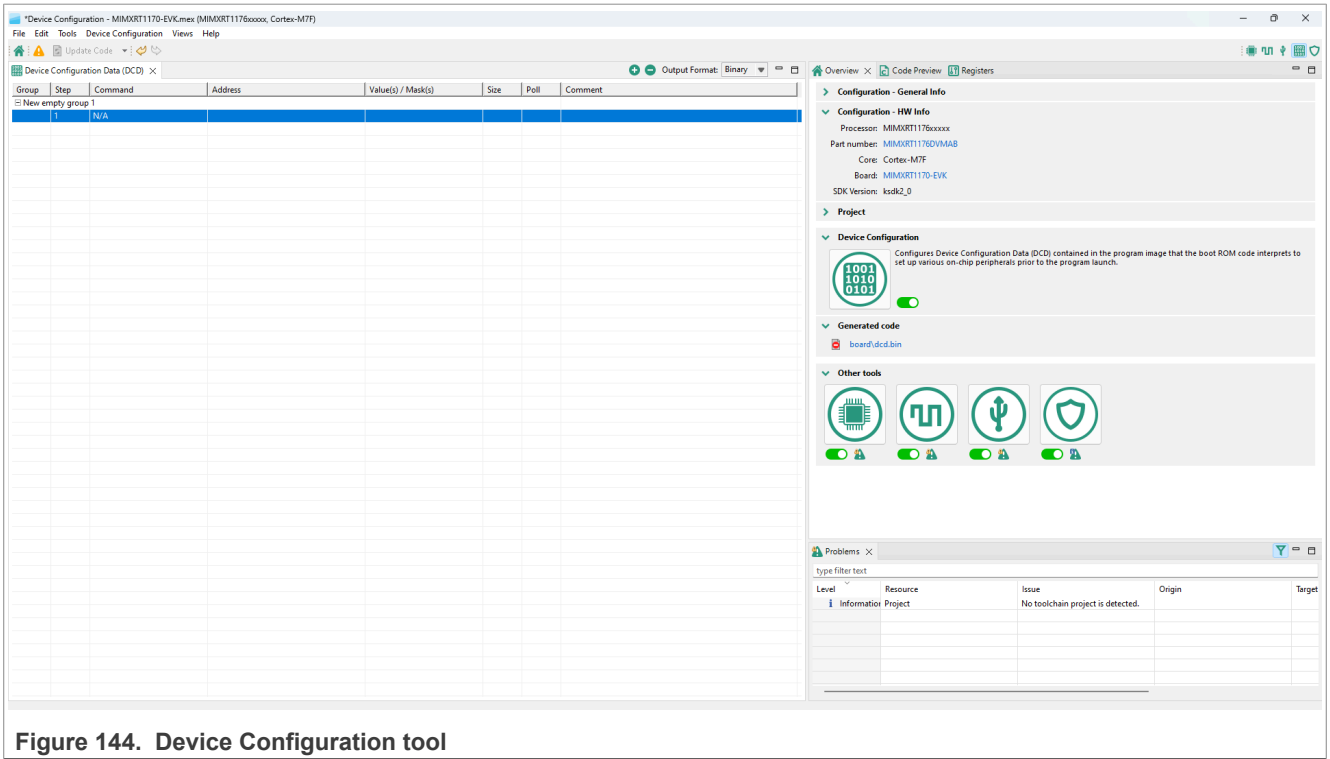


Figure 144. Device Configuration tool

7.1 Device Configuration Data (DCD) view

The **Device Configuration Data (DCD)** view displays memory initialization commands of your currently active configuration. Here, you can create command groups and commands and specify their parameters.

7.1.1 Device Configuration Data (DCD) view actions

The following is a list of command and command group-relevant actions that you can perform in the **Device Configuration Data (DCD)** view:

- **Create a new command group** - Right-click the table and choose **Add Group** from the context menu.
- **Re/Name a command group** - Left-click the command group cell and enter the required name.
- **Disable a command group** - Right-click the command group row and choose **Disable Group** from the context menu.
- **Remove a command group** - Right-click the command group row and choose **Remove Group** from the context menu.
- **Collapse all command groups** - Right-click the table and choose **Collapse All Groups** from the context menu.
- **Expand all command groups** - Right-click the table and choose **Expand All Groups** from the context menu.
- **Add a command to a group** - Right-click the table and choose **Add Command** from the context menu. Alternatively, click the **Add Command** button in the tool's toolbar.
- **Specify command type** - Left-click the row's **Command** cell and choose from the dropdown menu.
- **Specify register address for a command** - Left-click the row's **Address** cell and choose from the dropdown menu.
- **Specify a value or a mask for a command** - Left-click the row's **Value(s) / Mask(s)** cell to open the mask window. Enter the value into the field and select **OK**. Alternatively, select **Cancel** to cancel the operation, or **Reset** to reset the value.

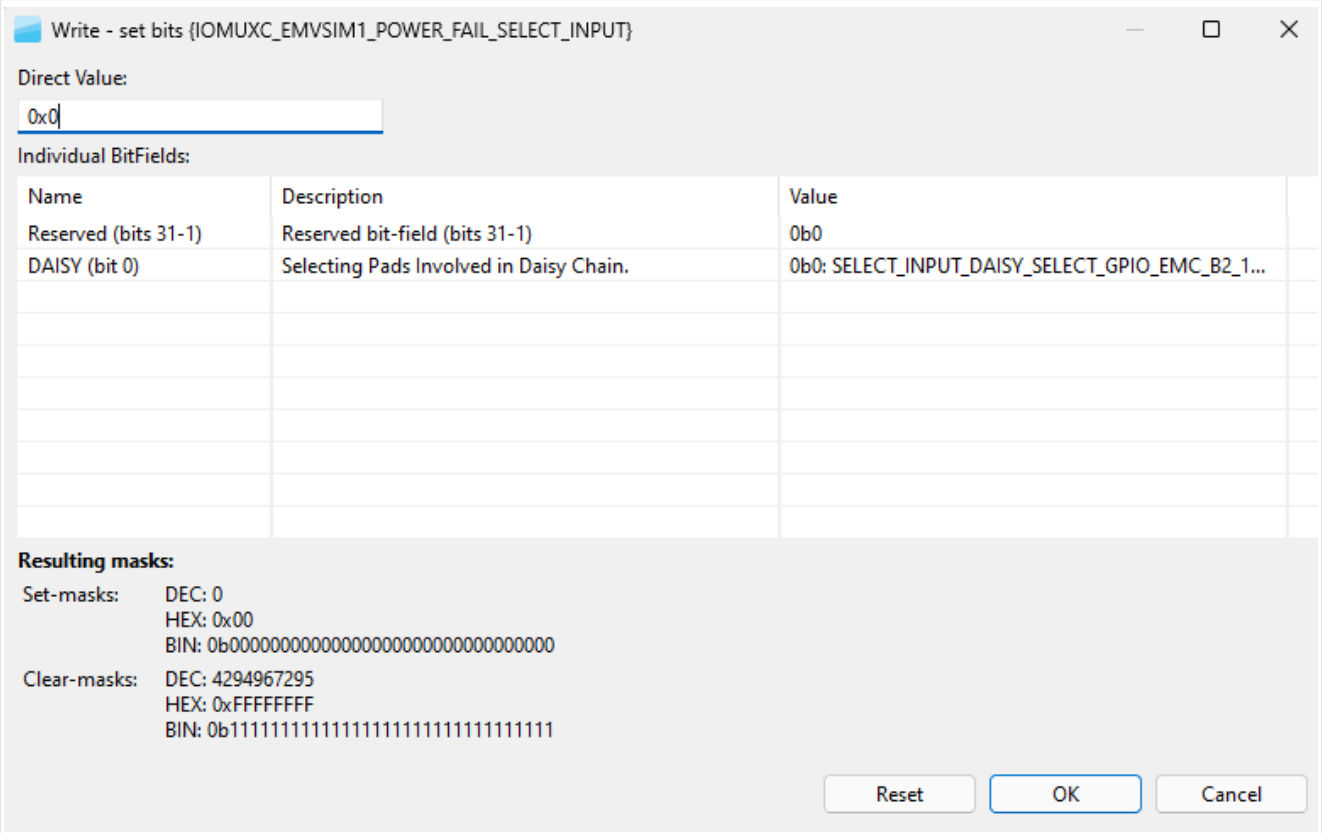


Figure 145. Mask

- **Specify the size of write/read data for a command** - Left-click the row's **Size** cell and choose from the dropdown menu.
- **Specify the number of polls of a command** - Left-click the row's **Poll** cell and enter the required value.
- **Add a comment to a command** - Left-click the row's **Comment** cell.
- **Remove a command** - Right-click the command row and choose **Remove Command** from the context menu. Alternatively, click the **Remove Command** button in the tool's toolbar.
- **Cut a command** - Right-click the command row and choose **Cut** from the context menu.
- **Copy a command** - Right-click the command row and choose **Copy** from the context menu.
- **Paste a command** - Right-click the command row and choose **Paste** from the context menu.

Note: You can remove all commands by clicking **Device Configuration** in the **Menu bar** and choosing **Clear All Commands** from the dropdown menu.

Basic cell selection shortcuts are applicable.

- **Select additional commands** - Ctrl+Left-click the command row.

7.2 Code generation

If the settings are correct and no error is reported, the code generation engine instantly regenerates the source code. You can view the resulting code in the **Code Preview** view of the **Device Configuration** tool.

Code Preview automatically highlights differences between the current and immediately preceding iteration of the code. You can choose between two modes of highlighting by clicking the **Set viewing style for source differences**. You can also disable highlighting altogether from the same dropdown menu. Such features as

Copy, Search, Zoom-in, Zoom-out, and Export source are available in the **Code Preview** view. The search can also be invoked by CTRL+F or from the context menu.

Device Configuration source code can be generated in a C array (default) or binary format.

The code in a C array format is generated in two files:

- dcd.c
- dcd.h

The code in a binary format is generated in a single file:

- dcd.bin

To change the code format, choose the required option from the dropdown menu in the **Device Configuration Data (DCD)** view.

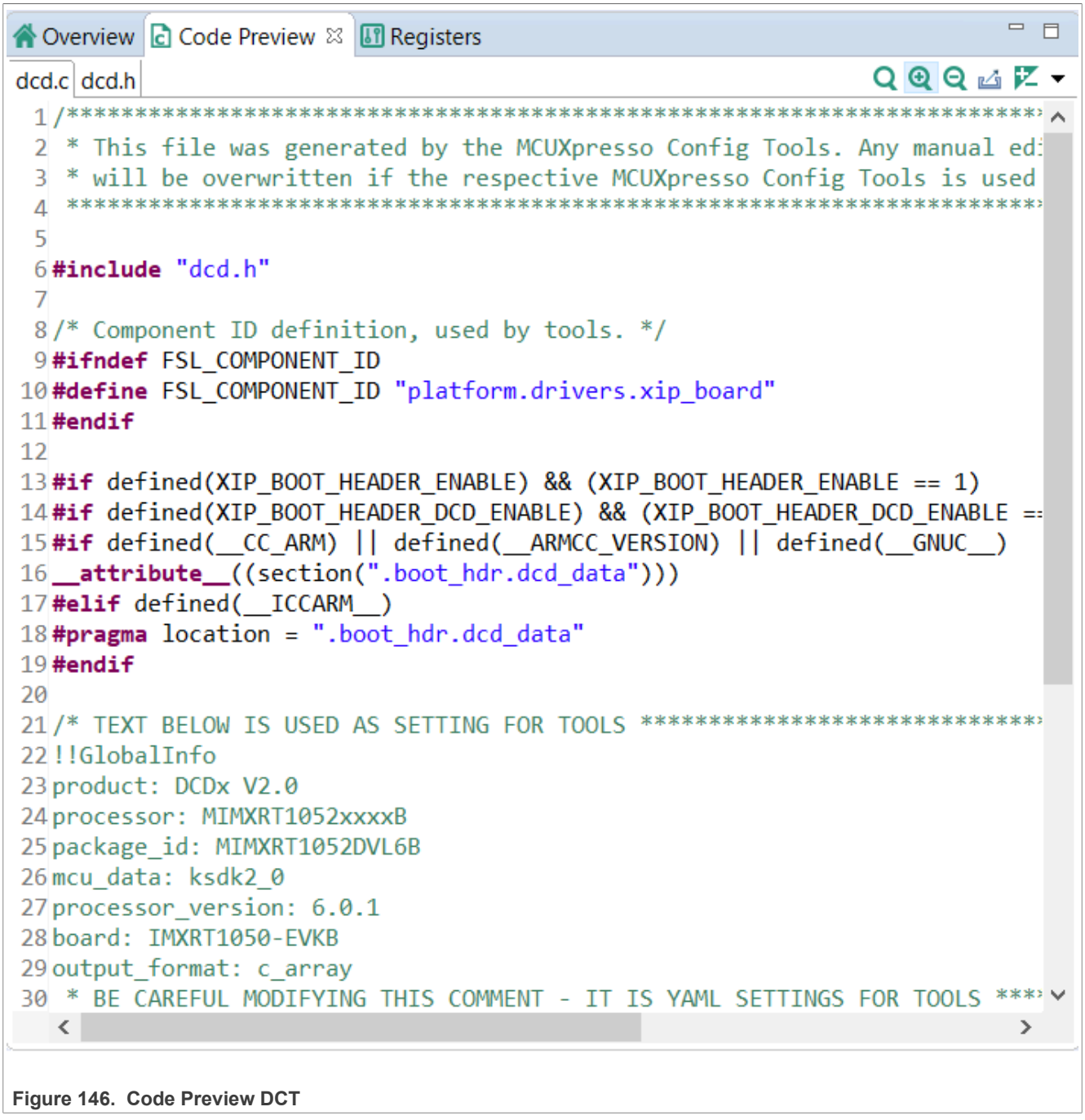


Figure 146. Code Preview DCT

8 Trusted Execution Environment Tool

In the **Trusted Execution Environment**, or **TEE** tool, you can configure security policies of memory areas, bus masters, and peripherals to isolate and safeguard sensitive areas of your application.

You can set security policies of different parts of your application in the **Security Access Configuration** and its subviews, and review these policies in the **Memory Attribution Map**, **Access Overview** and **Domains Overview** views. Use the **User Memory Regions** view to create a convenient overview of memory regions and their security levels.

You can also view registers handled by the **TEE** tool in the **Registers** view, and inspect the code in the **Code Preview** tool.

Note: For your configuration to take effect, enable the relevant enable secure check option in the **Miscellaneous** subview of the **Security Access Configuration** view.

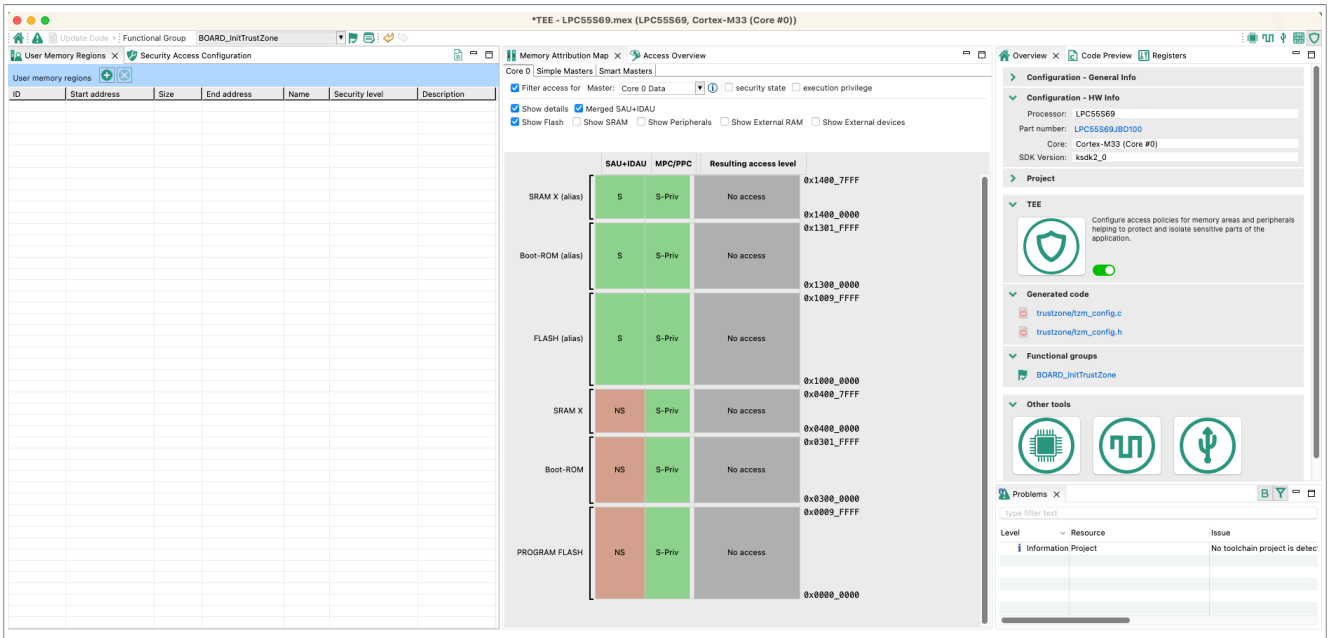


Figure 147. TEE tool user interface (TrustZone-M with AHBSC)

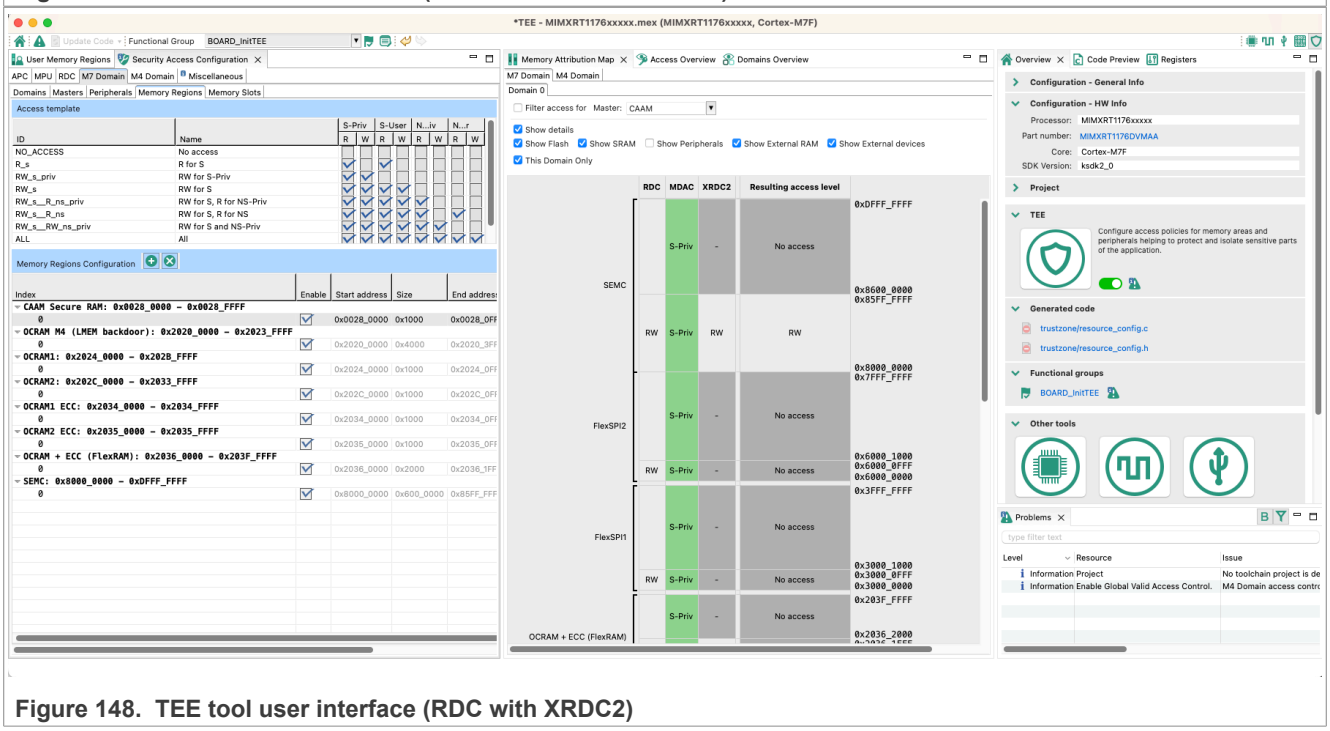


Figure 148. TEE tool user interface (RDC with XRDC2)

8.1 AHBSC with security extension-enabled devices

The features and appearance of the TEE tool are based on the security model of the loaded device.

This section describes the features and appearance of the tool for devices with a security extension — TrustZone-M with AHBSC.

Currently, the following devices of this type are supported:

- LPC55Sxx
  - LPC55S69, LPC55S66
  - LPC55S16, LPC55S14, LPC55S36
  - LPC55S06, LPC55S04
- RT6xx, RT5xx, RT7xx
  - MIMXRT685S, MIMXRT633S
  - MIMXRT595S, MIMXRT555S, MIMXRT533S1
  - MIMXRT735, MIMXRT758, MIMXRT798
- MCXN
  - MCXN546, MCXN547, MCXN946, MCXN947, MCXN236, MCXN235

8.1.1 User Memory Regions view

In the **User Memory Regions** view, you can create and maintain a high-level configuration of memory regions and their security levels. You can create the regions, name them, specify their address, size, security level, and provide them with a description. You can then fix any errors in the settings with the help of the **Problems** view.

Create a new memory region by clicking the **Add new memory region button** in the view's header.

Enter or change the memory region's parameters by clicking the row's cells. In the **Security Level** column, you have these options to choose from:

- **NS-User** - Non-secure user
- **NS-Priv** - Non-secure privileged
- **S-User** - Secure user
- **S-Priv** - Secure privileged
- **NSC-User** - Non-secure callable user
- **NSC-Priv** - Non-secure callable privileged
- **Any**

Errors in configuration are highlighted by a red icon in the relevant cell. If the issue is easily fixed, right-click the cell to display a dropdown list of offered solutions.

Remove the memory region by selecting the table row and clicking the **Remove selected memory region(s)** button in the view's header.

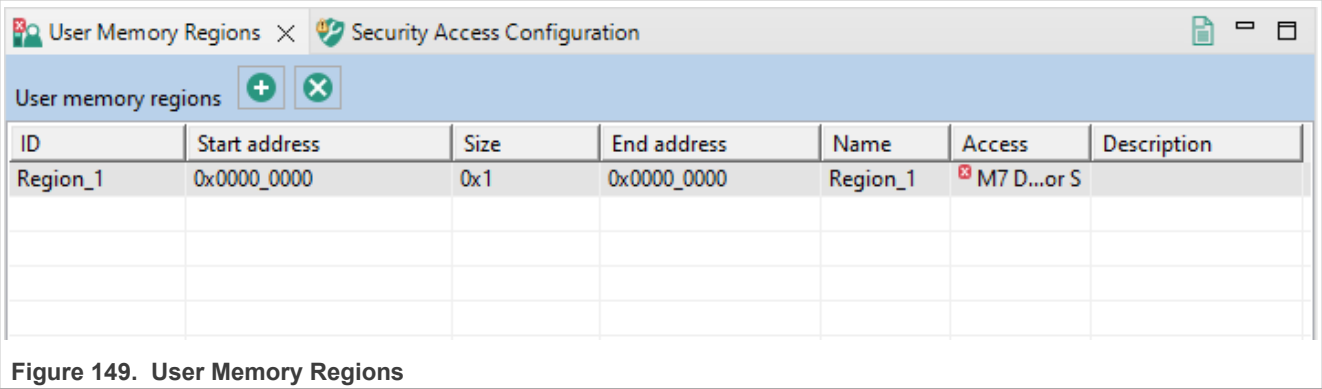


Figure 149. User Memory Regions

8.1.2 Security Access Configuration view

In the **Security Access Configuration** view, you can configure your application's security policies in a number of ways. See the following sections for more details.

8.1.2.1 SAU

In the **SAU** subview, you can enable and configure the SAU (Security Attribution Unit).

When enabled, you can set up SAU memory regions, specify their start and size or end address, and specify their access level. SAU automatically sets the entire memory space to a Secure access level when disabled. When enabled, SAU deems every uncovered (that is, unconfigured) memory region as Secure, so only NS or NSC can be selected for a covered (configured) memory region.

You can choose between two access levels:

- **NS** - Non-secure
- **NSC** - Non-secure callable

Alternatively, set all SAU memory regions to non-secure access level by selecting **All Non-Secure**.

Note: This option is only available when SAU is disabled.

To generate code for disabled memory regions, select the **Generate sources for disabled regions** option.

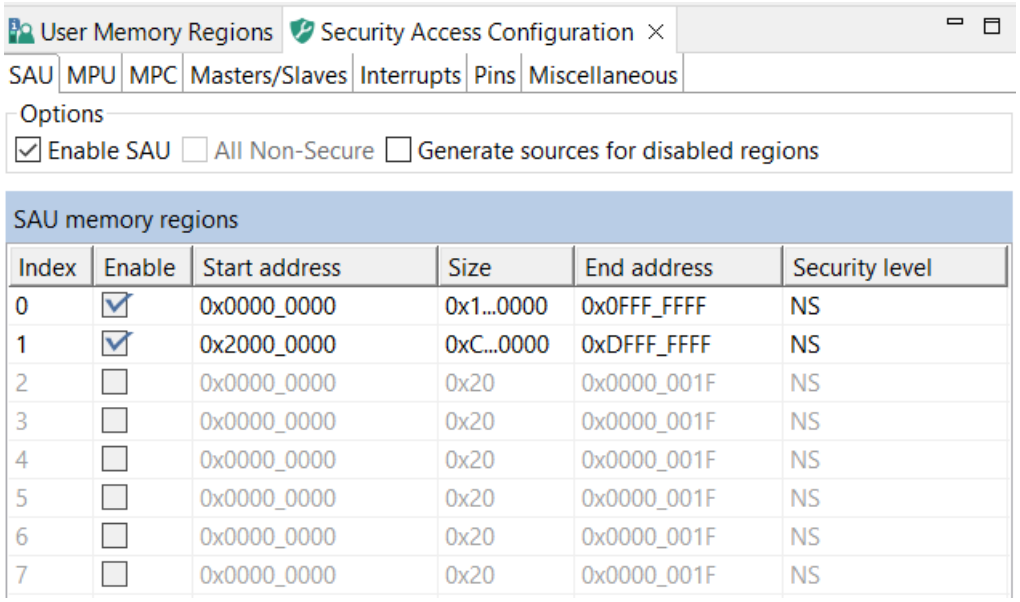


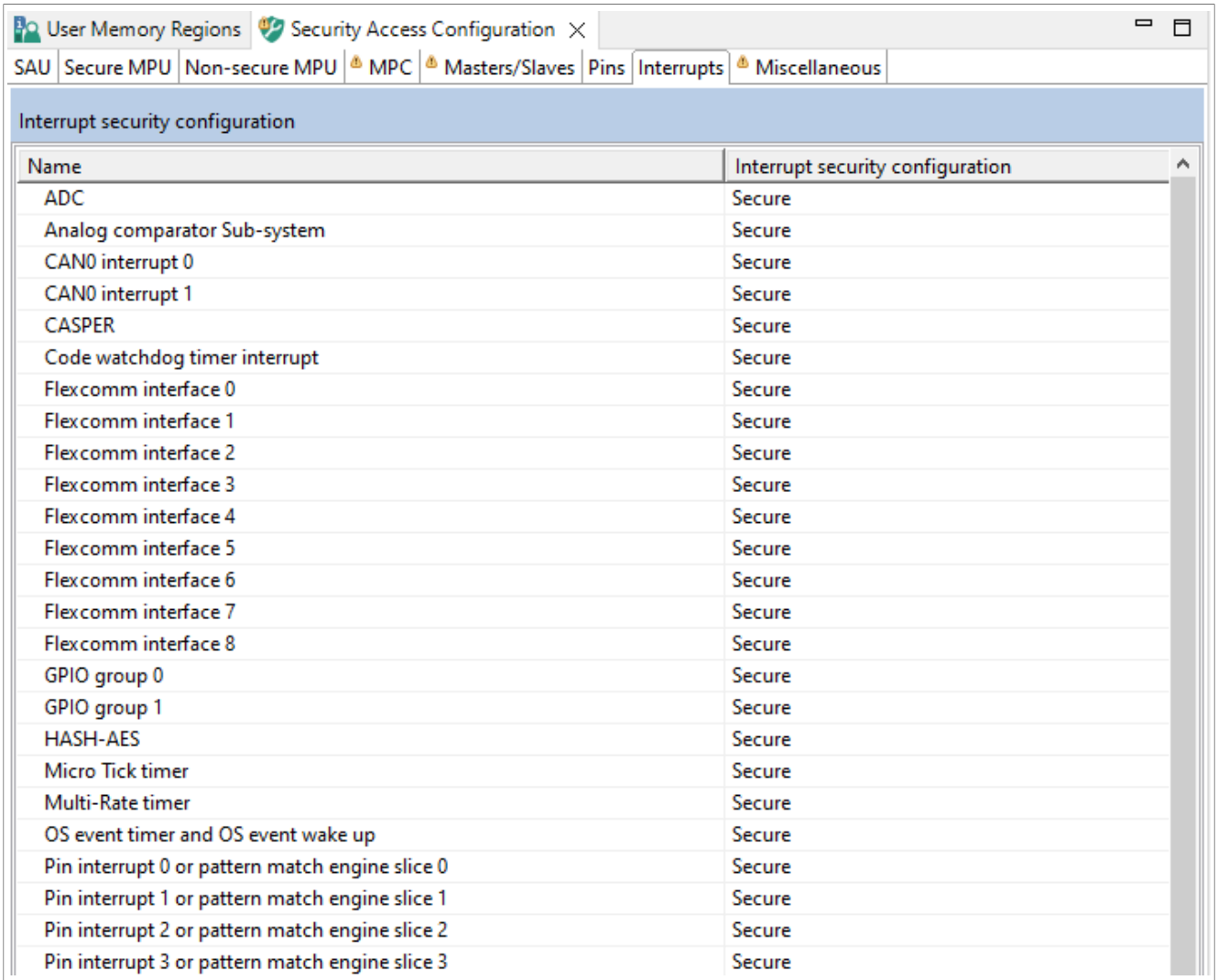
Figure 150. SAU/IDAU

8.1.2.2 Interrupts

In the **Interrupts** subview, you can set the security designation for the device's peripheral interrupts. If the processor contains more than one core or processing unit, additional **Handling by Core** tables might appear. In these tables, you can specify whether the interrupts from the peripheral can be handled by the core or processing unit.

All interrupts are set to **Secure** by default. To change the interrupt source's security designation, left-click the **Secure** cell of the interrupt and choose from the dropdown menu. Alternatively, right-click the interrupt's **Name** cell and choose the security designation from the context menu. To select multiple entries, use the **Ctrl+Left-**

click shortcut, then right-click the selected area for the context menu. Alternatively, use **Shift+Up/Down** after selecting the row to expand the selection.



Name	Interrupt security configuration
ADC	Secure
Analog comparator Sub-system	Secure
CAN0 interrupt 0	Secure
CAN0 interrupt 1	Secure
CASPER	Secure
Code watchdog timer interrupt	Secure
Flexcomm interface 0	Secure
Flexcomm interface 1	Secure
Flexcomm interface 2	Secure
Flexcomm interface 3	Secure
Flexcomm interface 4	Secure
Flexcomm interface 5	Secure
Flexcomm interface 6	Secure
Flexcomm interface 7	Secure
Flexcomm interface 8	Secure
GPIO group 0	Secure
GPIO group 1	Secure
HASH-AES	Secure
Micro Tick timer	Secure
Multi-Rate timer	Secure
OS event timer and OS event wake up	Secure
Pin interrupt 0 or pattern match engine slice 0	Secure
Pin interrupt 1 or pattern match engine slice 1	Secure
Pin interrupt 2 or pattern match engine slice 2	Secure
Pin interrupt 3 or pattern match engine slice 3	Secure

Figure 151. Interrupts

8.1.2.3 Secure/Non-secure MPU

In the **Secure MPU** and **Non-secure MPU** sub-views, you can enable and configure the MPU (Memory Protection Unit). You can create regions and specify their address, size, and other parameters. Use the **Secure MPU** sub-view to configure the secure security level, and **Non-secure MPU** to configure the non-secure security level.

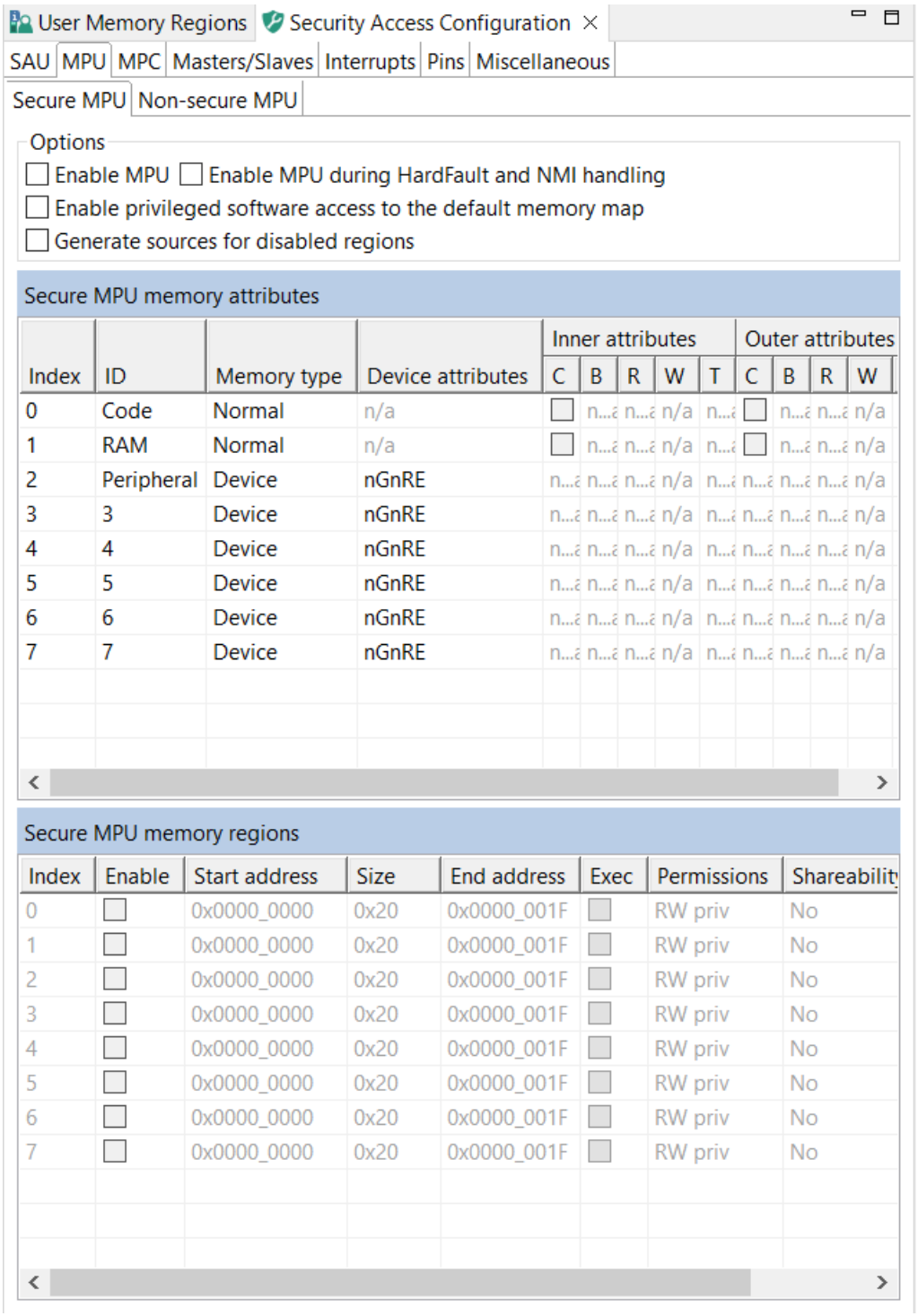


Figure 152. MPU

MPU is disabled by default and must be enabled by selecting the **Enable MPU** option.

Note: Not every device supports MPU.

Use the **MPU Memory Attributes** table to name and configure MPU memory attribute sets. Click the cells of the **Memory Type** and **Device Attributes** columns to display the available choices.

Use the **MPU Memory Regions** table to enable and configure MPU memory regions.

1. **Enable** the region.
2. Specify the **Address**.
3. Specify either the **Size** or the **End Address**.
4. Set the **Exec** option to allow the region to run code.
5. Set the **Permissions** (Read Only or Read/Write).
6. Set the **Privileges**.
   Note: Privileged access can be set by default for all memory regions not handled by MPU by selecting the **Enable privileged software access to the default memory map** option.
7. Set the **Shareability**, or the caching options.
8. Allocate one of the sets from the **MPU Memory Attributes** table in **Mem.Attr.**. Sets can be allocated to more than one region.

8.1.2.4 MPC

In the **MPC** (Memory Protection Checker) subview, you can set security policies on entire memory sectors as defined by physical addresses.

Set the memory sector security level by left-clicking the relevant cell in the **Security level** column and choosing from the dropdown list. Alternatively, you can right-click the relevant cell in the **Sector** column and choose the security level from the context menu. To select multiple entries, use the **Ctrl+Left-click** shortcut, then right-click the selected area for the context menu.

You have four security levels to choose from, in ascending order of security:

- **NS-User** - Non-secure user
- **NS-Priv** - Non-secure privileged
- **S-User** - Secure user
- **S-Priv** - Secure privileged

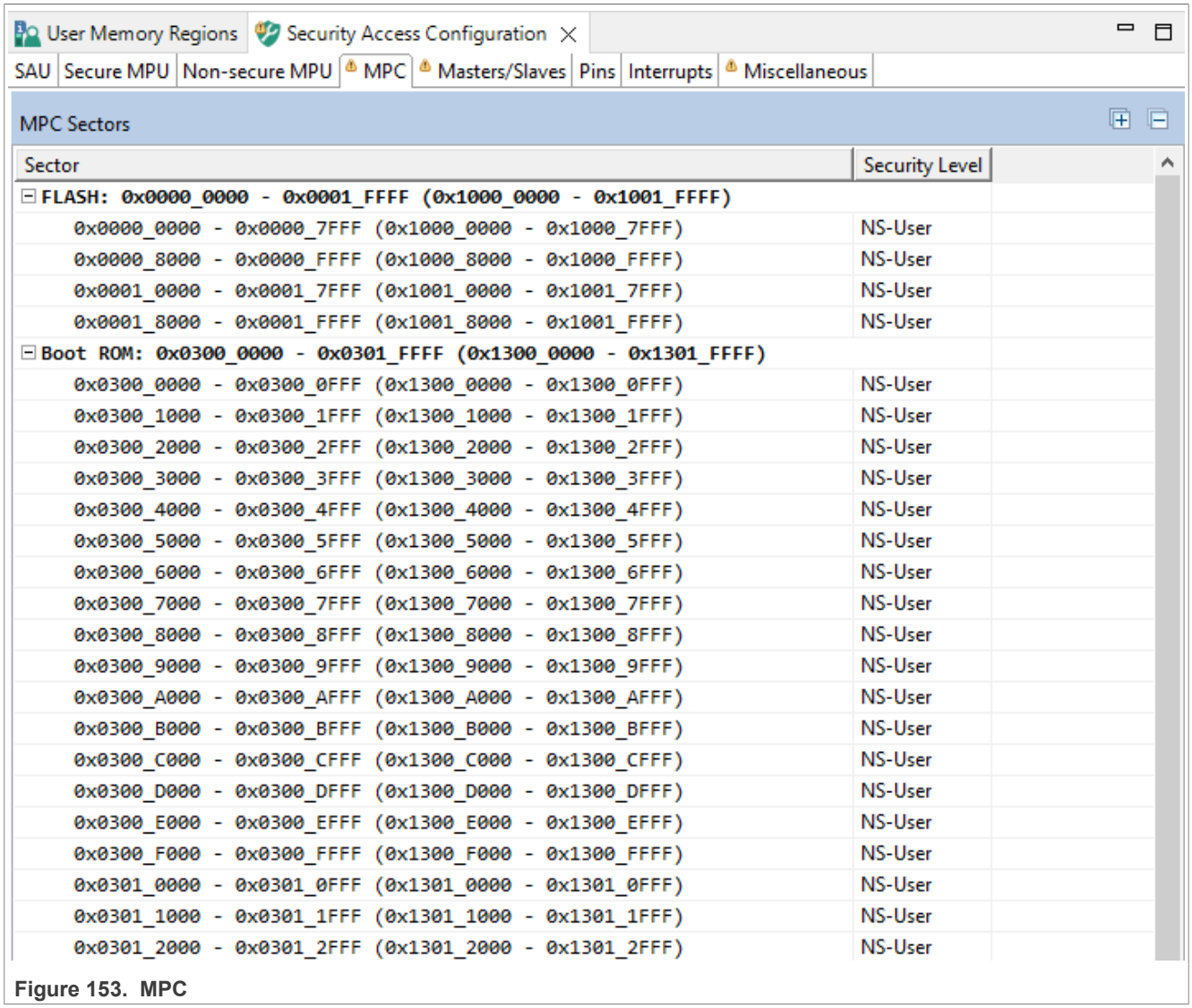


Figure 153. MPC

8.1.2.5 Masters/Slaves

In the **Masters/Slaves** subview, you can configure security levels for bus masters and slaves.

Set the bus master/slave security level by left-clicking the relevant cell in the **Security level** column and choosing from the dropdown list. Alternatively, you can right-click the relevant cell in the **Master** and **Slave** column and choose from the security level from the context menu. To select multiple entries, use the **Ctrl+Left-click** shortcut, then right-click the selected area for the context menu.

You have four security levels to choose from, in ascending order of security:

- **NS-User** - Non-secure user
- **NS-Priv** - Non-secure privileged
- **S-User** - Secure user
- **S-Priv** - Secure privileged

You can further specify the interrelation between master and slave security levels by selecting the following options:

- **Simple Master in Strict Mode** - Select to allow the simple bus master to read and write at the same level only. De-select to allow reading and writing at the same and lower levels.
- **Smart Master in Strict Mode** - Select to allow the smart bus master to execute, read, and write at the same level only. De-select to allow executing, reading, and writing at the same and lower levels.

Note: The instruction-type bus master security level must equal the bus slave security level. The data and other security levels must be equal to or higher than the bus slave security level.

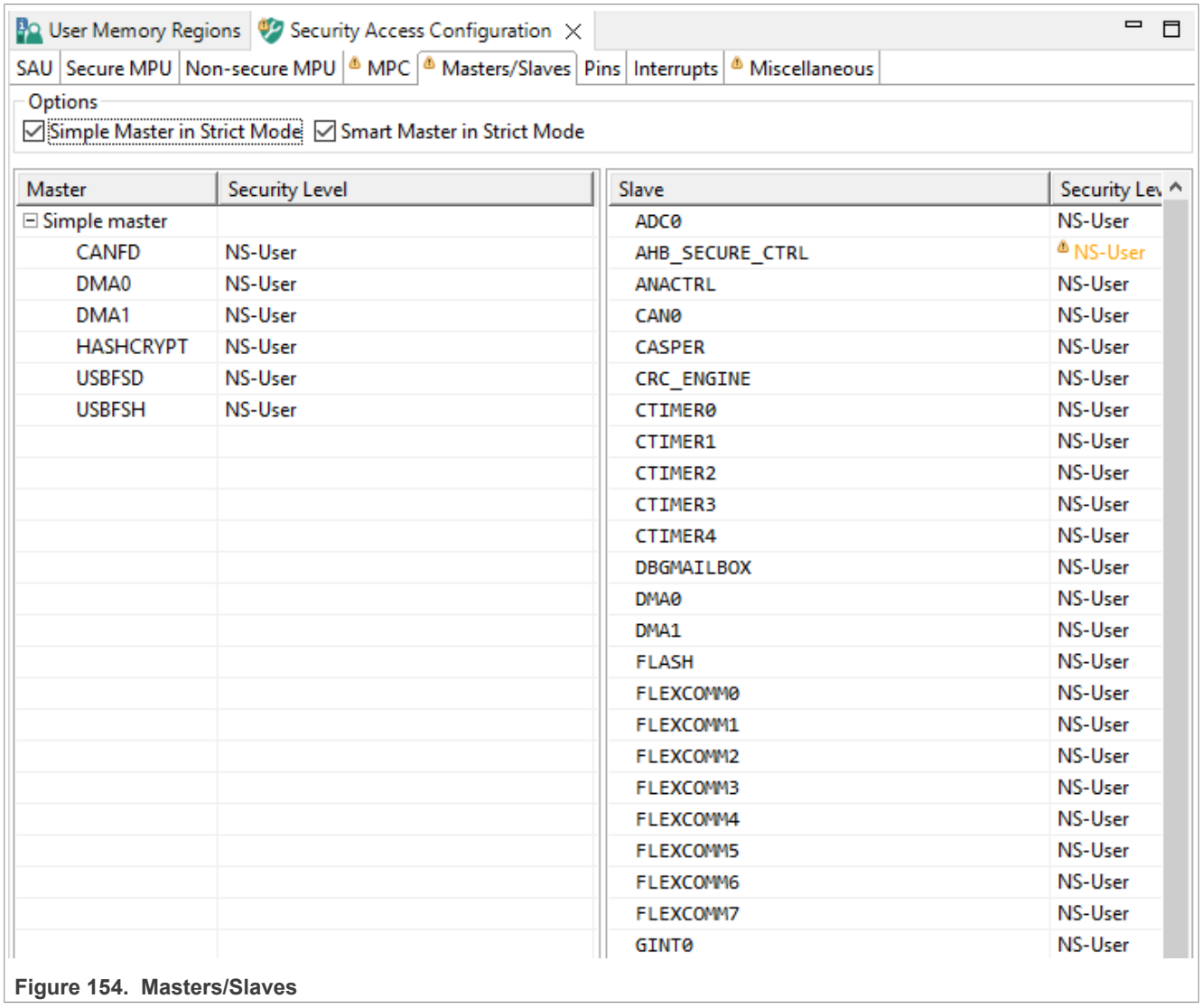


Figure 154. Masters/Slaves

8.1.2.6 Pins

In the **Pins** subview, you can specify if the reading GPIO state is allowed or denied.

All pins' reading GPIO state is set to **Allow** by default. To change the pins reading GPIO state, left-click the **Reading GPIO state** cell of the pin and choose from the dropdown menu. Alternatively, right-click the pin's **Name** cell and choose the reading GPIO state from the context menu. To select multiple entries, use the **Ctrl +Left-click** shortcut, then right-click the selected area for the context menu. Alternatively, use **Shift+Up/Down** after selecting the row to expand the selection.

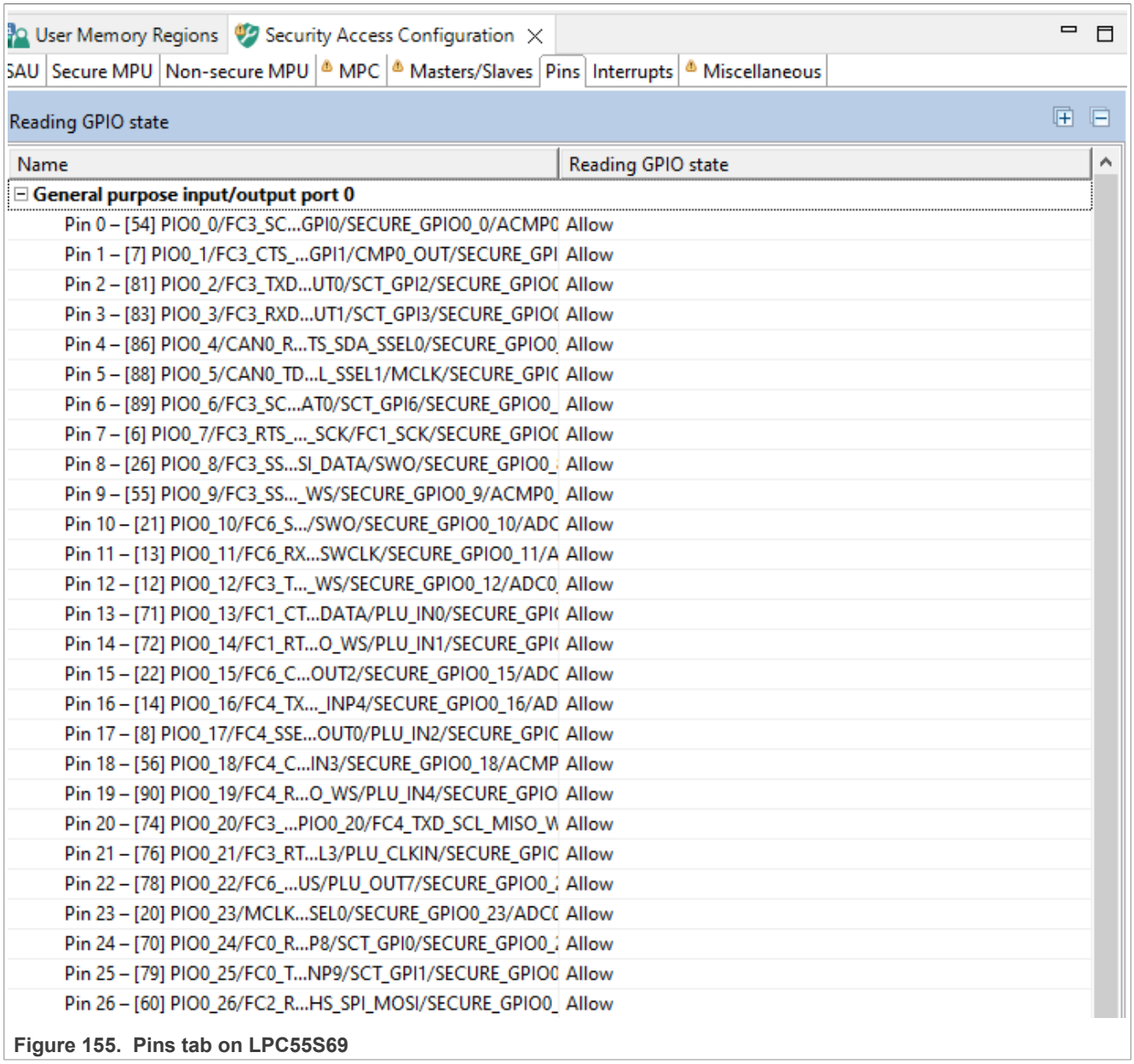


Figure 155. Pins tab on LPC55S69

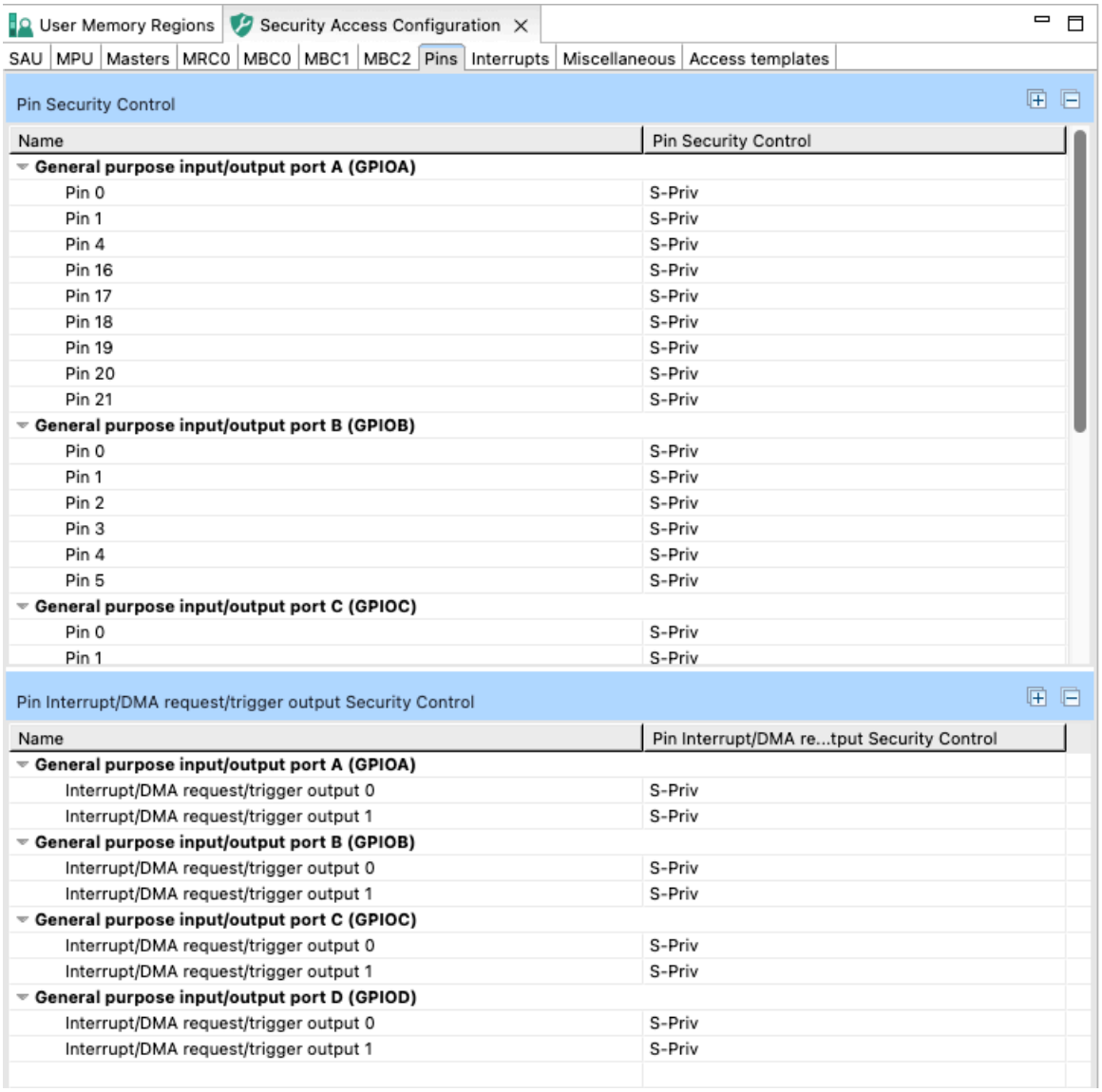


Figure 156. Pins tab on KW45

8.1.2.7 Trigger sources

In the **ITRC Triggers** subview, configure triggers of the Intrusion and Tamper Response Controller (ITRC) that provides a mechanism to configure the response action for an intrusion event detected by on-chip security sensors. The rows in the table represent input signals - explicit and implicit intrusion event detectors that generate a level and a latched signal toward the interrupt controller. Output signals are represented by columns and contain two configurable fields:

- Signal selected shows if the input signal is selected as a trigger or not.
- Writable field shows whether the input signal field is writable. Once the field is locked, it cannot be changed until a reset to ITRC is asserted.

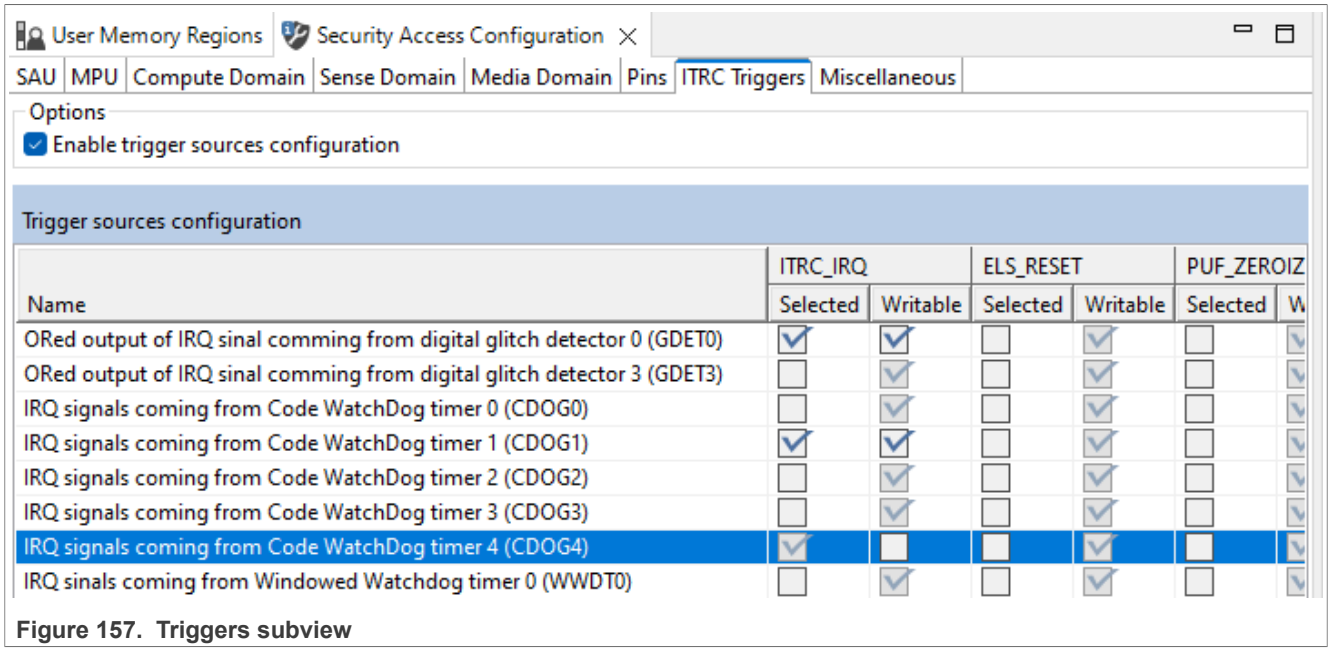


Figure 157. Triggers subview

All trigger source fields are set to “the signal is not selected” and “the signal field is writable” by default. To change the trigger sources setting, left-click the **Selected/Writable** check-box.

Note: The check-box can be disabled to prevent the non-selected and non-writable states.

8.1.2.8 Miscellaneous

In the **Miscellaneous** subview, you can set various configuration options. The list of these options depends on processor data and varies greatly. All the options influence your register settings and can be inspected in the **Register** view. Only some of the options directly influence the configuration made in the **Security Access Configuration** view. Point your cursor over individual options to display a tooltip explaining the function of each option.

A togglable checkbox enables or disables the code generation for the entire group. When the group is disabled, the code generation for that group is suspended, the generation options within it cannot be edited, and all option configurations revert to their default values (either reset values or default values).

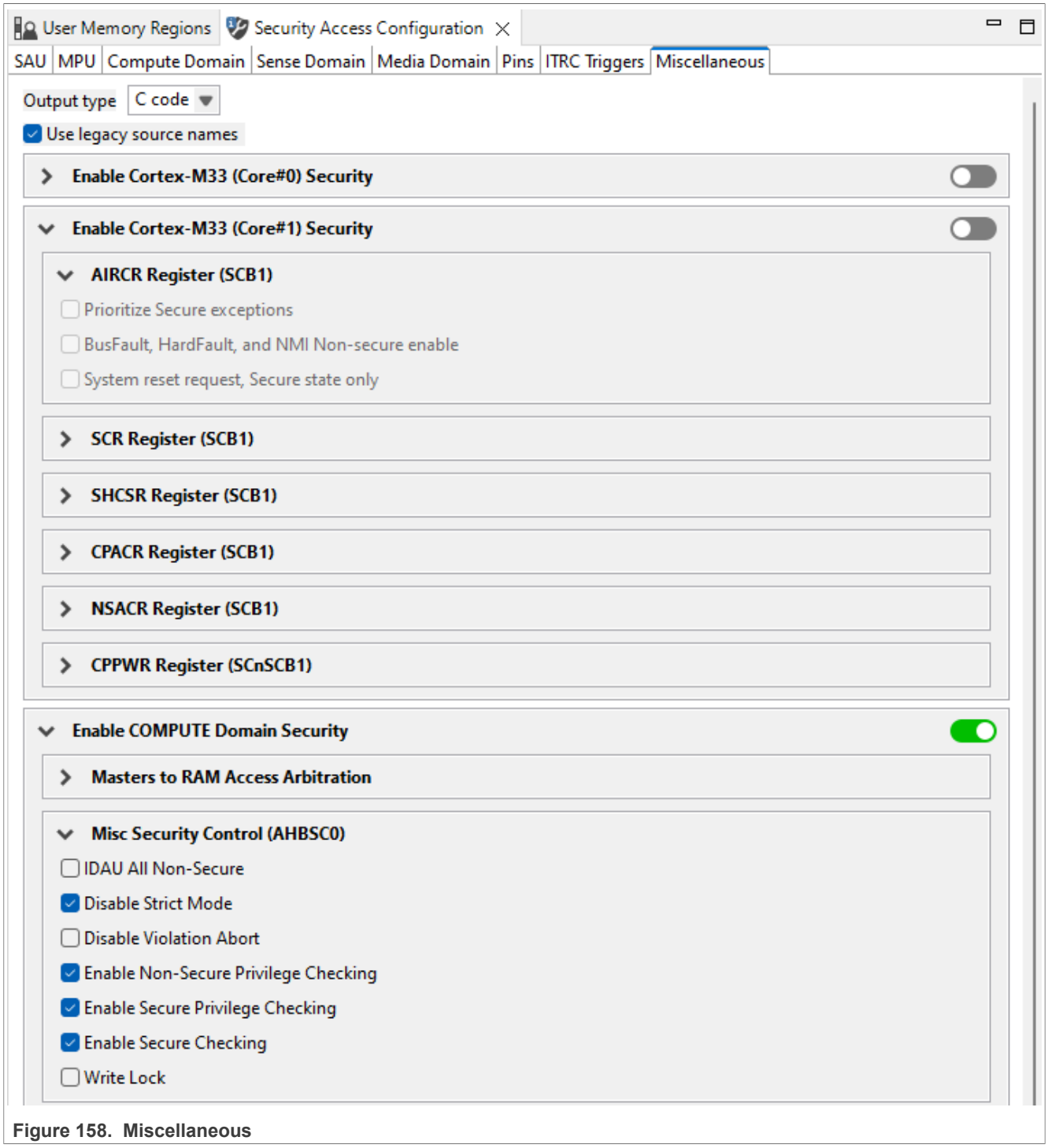


Figure 158. Miscellaneous

8.1.2.8.1 TEE global options

The following global options are available:

1. The **output type** list lets the user select the output type to generate (C code, JSON, or YAML preset).
2. The **use legacy source names** checkbox lets the user switch between the current source names `resource_config.c` and `tzm_config.c` for legacy projects.

3. The **use instruction glitch resilient code for register writes** checkbox lets the user generate more resilient (instruction glitch) code of register writes.

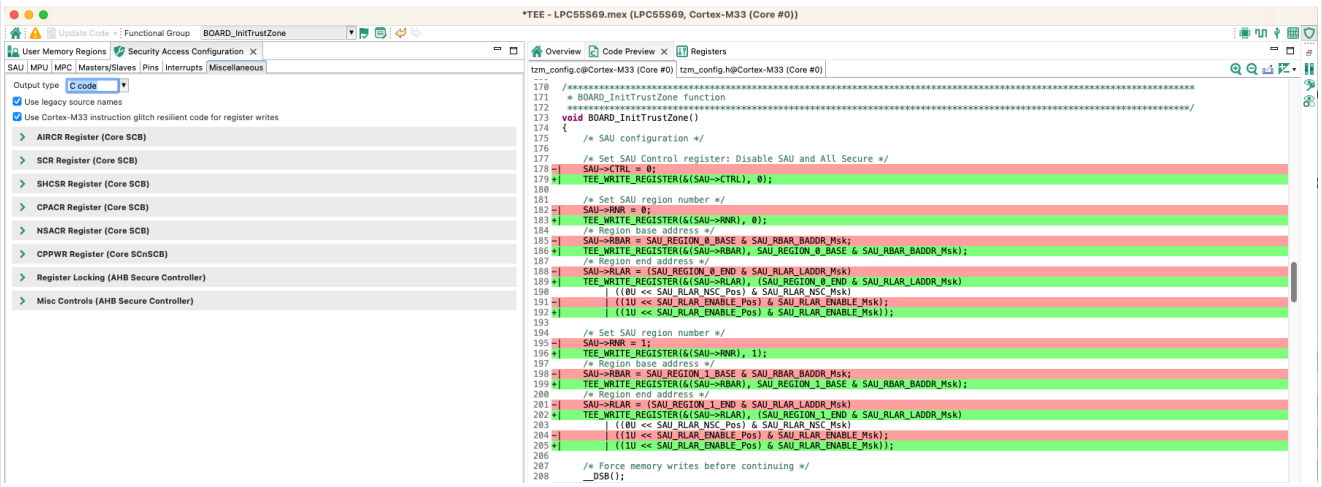


Figure 159. TEE global options

8.1.3 Memory attribution map

In the **Memory attribution map**, you can view security levels set for memory regions. This view is read-only.

8.1.3.1 Core 0

In the **Core 0** subview, you can review security levels set for Core 0 to the code, data, and peripherals memory regions. The table is read-only.

The **Access by Master** table displays **MSW** or **SAU+IDAU**, **MPC** (Memory Protection Checker) security level, and **Resulting access level** status of listed code, data, and peripherals memory regions, alongside their physical addresses.

To set the display options, do the following:

1. Click the **Filter access for** checkbox to enable filtering options.
2. Select the master security access that you want to review by choosing from the **Master** dropdown menu.
3. Optionally, set the security state and execution privilege check-boxes when the master allows more security levels. This setting has no effect on the configuration.
4. Optionally, customize the output by de-selecting the **Show details** and **Merged SAU+IDAU** options.
5. Optionally, filter displayed memory regions in the **Filter** area.

Point your cursor over the color-coded cells to display a tooltip with information about the security level combination.

Double-click the cell to open the pertinent settings in **Security Access Configuration**.

Figure 160. Core 0

8.1.3.2 Simple and Smart masters

In the **Simple Masters** and **Smart Masters subviews**, you can review security attributes of memory in relation to access rights by simple/smart masters. The table is read-only.

To set the display options, do the following:

1. Click the **Filter access for** checkbox to enable filtering options.
2. Select the master type security access that you want to review by choosing from the **Master** dropdown menu.

3. Optionally, customize the output by de-selecting the **Show Details**, **Show Code**, **Show Data**, **Show Peripherals**, and **"This Domain Only"** options.
4. Optionally, filter displayed memory regions in the **Filter** area.

Point your cursor over the color-coded fields to display a tooltip with information about the security level combination.

Double-click the cell to open the pertinent settings in **Security Access Configuration**.

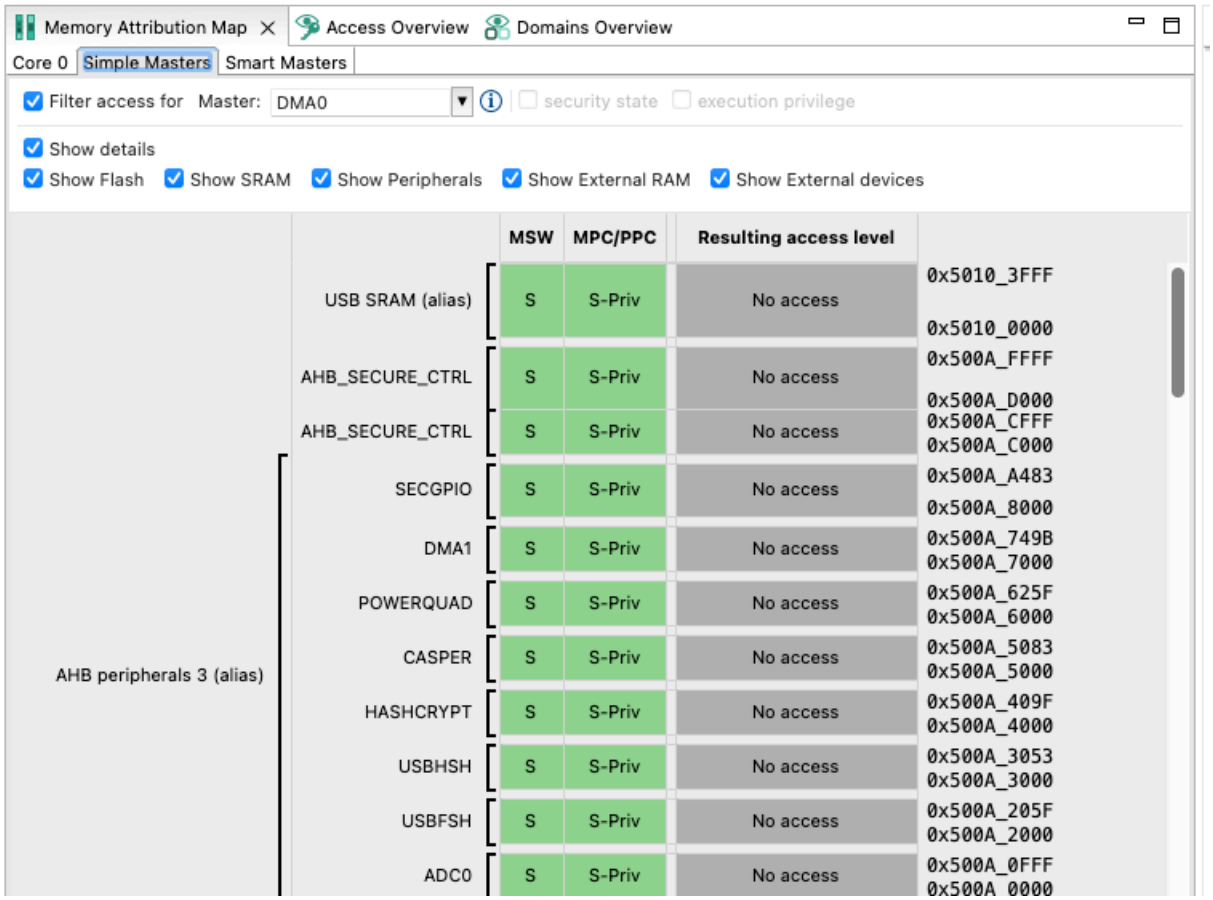


Figure 161. Simple/Smart masters

8.1.4 Access Overview

In **Access Overview**, you can review security policies you have set in **Security Access Configuration** view.

The vertical axis displays all masters, divided into color-coded groups by their security settings.

The horizontal axis displays memory ranges and slave buses/peripherals.

Point your cursor at an entry to display a tooltip with information about the entry.

Group the displayed information by security or by masters using the button on the right-hand side of the toolbar.

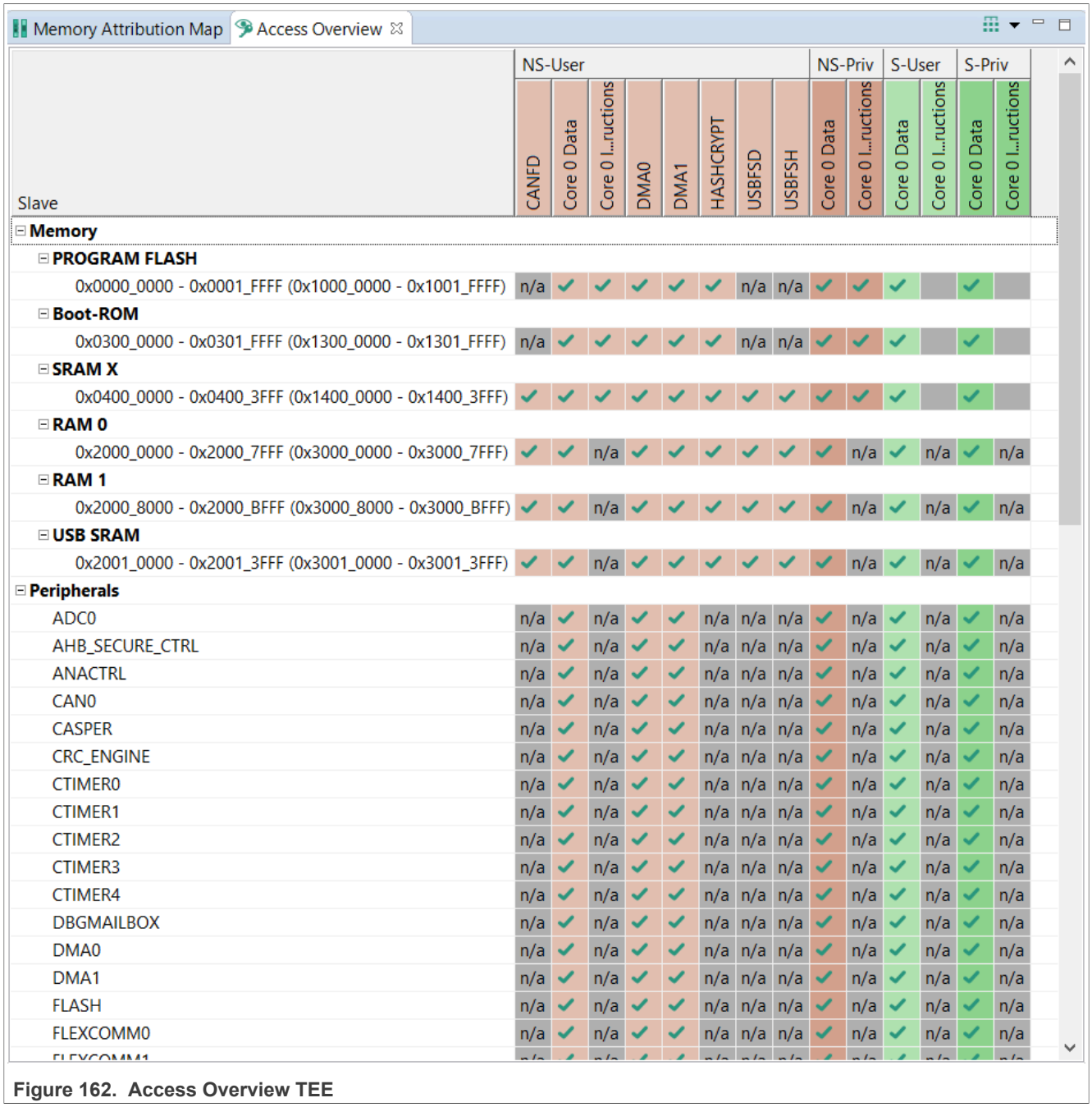


Figure 162. Access Overview TEE

8.1.5 Code generation

If the settings are correct and no error is reported, the code generation engine regenerates the source code. You can view the resulting code in the **Code Preview** view of the **Trusted Execution Environment** tool.

Code Preview automatically highlights differences between the current and immediately preceding iteration of the code. You can choose between two modes of highlighting by clicking the **Set viewing style for source differences**. You can also disable highlighting altogether from the same dropdown menu. Such features as Copy, Search, Zoom-in, Zoom-out, and Export source are available in the **Code Preview** view. The search can also be invoked by CTRL+F or from the context menu.

Some AHBSC and TRDC with security extension-enabled devices support ROM preset as well as C code. You can choose to have the code generated in the ROM preset by selecting the option in the **Miscellaneous** subview.

8.2 RDC-enabled devices

The features and appearance of the TEE tool are based on the security model of the loaded device.

This section describes the features and appearance of the tool devices enabled with RDC (Resource Domain Controller), XRDC2 (eXtended Resource Controller 2), and TrustZone-M with TRDC.

Currently, the following devices of this type are supported:

- RT1170
  - Dual core (Cortex-M7 + Cortex-M4): MIMXRT1176, MIMXRT1175, MIMXRT1173
  - Single core only (Cortex-M7): MIMXRT1172, MIMXRT1171
- Kinetis W
  - KW45B41Z
  - KW45B410
  - KW47B42Z
  - KW47B420
- i.MX RT
  - MIMXRT1181
  - MIMXRT1182
  - MIMXRT1187
  - MIMXRT1189
- MCXW
  - MCXW716A
  - MCXW716C
- i.MX 91
  - MIMX930x
  - MIMX931x
  - MIMX933x
  - MIMX935x

8.2.1 User Memory Regions view

In the **User Memory Regions** view, you can create and maintain a high-level configuration of memory regions and their access templates. You can create the regions, name them, and specify their address, size, security level, and description. To fix any errors in the settings, use the **Problems** view.

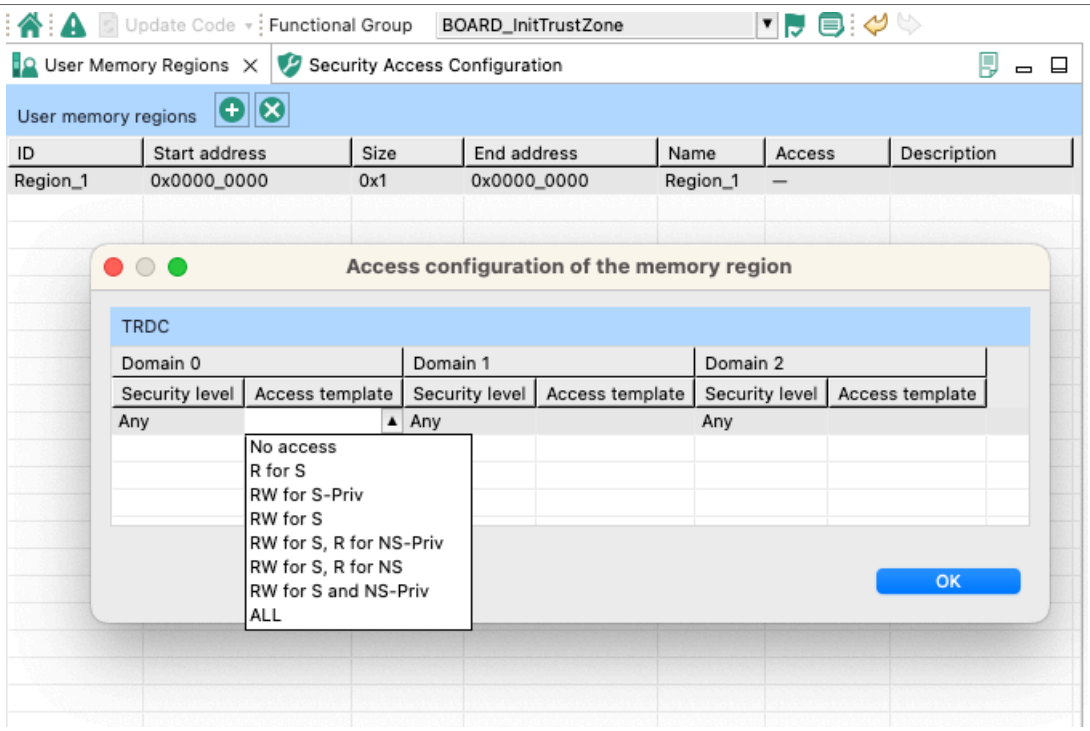


Figure 163. User Memory Regions

Create a new memory region by clicking the **Add new memory region button** in the view's header.

Enter or change the memory region parameters by clicking the row cells.

Modify the access policy of memory regions by clicking the cell in the **Access** column. This action opens the Access templates dialog.

Errors in configuration are highlighted by a red icon in the relevant cell. If the issue is easily fixed, right-click the cell to display a dropdown list of offered solutions.

Remove the memory region by selecting the table row and clicking the **Remove selected memory region(s)** button in the view's header.

8.2.1.1 Access templates

In the **Access templates** dialog, you can modify access templates for device domains. The dialog displays the device RDC domains, as well as all user-created XRDC2 domains.

Note: First specify the number of domains in the **M4 Domain/M7 Domain > Domains**.

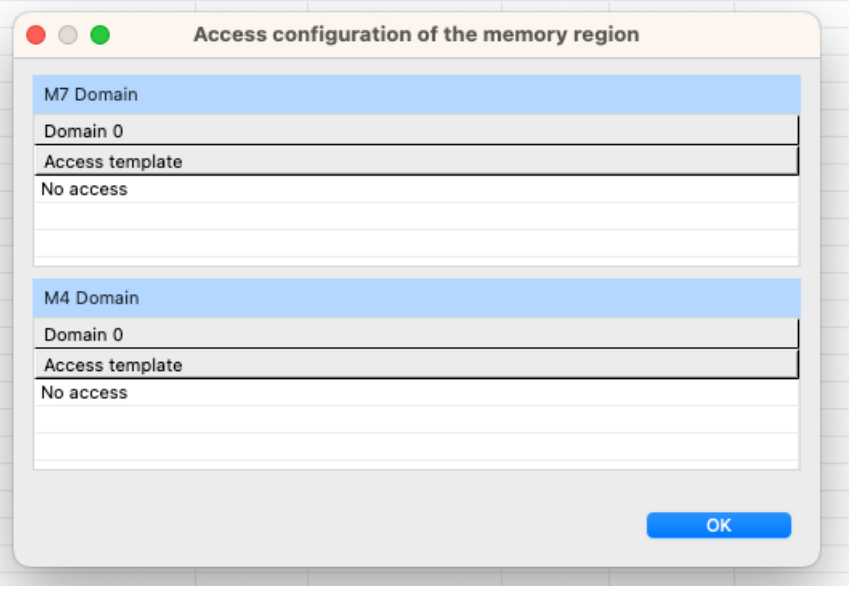


Figure 164. Access template

Select an access template by clicking the topmost cell of the domain column to open a dropdown list containing all options.

Once you have selected access templates for all domains, click **OK** to return to the **User Memory Regions** view.

8.2.2 Security Access Configuration view

In the **Security Access Configuration** view, you can configure your application's security policies in a number of ways. See the following sections for more details.

8.2.2.1 RDC

In the **RDC** subview, you can assign masters to domains and specify access rules for slaves for each domain.

8.2.2.1.1 RDC Masters

In the **RDC Masters** subview, you can view available bus masters, allocate them to available domains (cores), and lock/unlock the allocation.

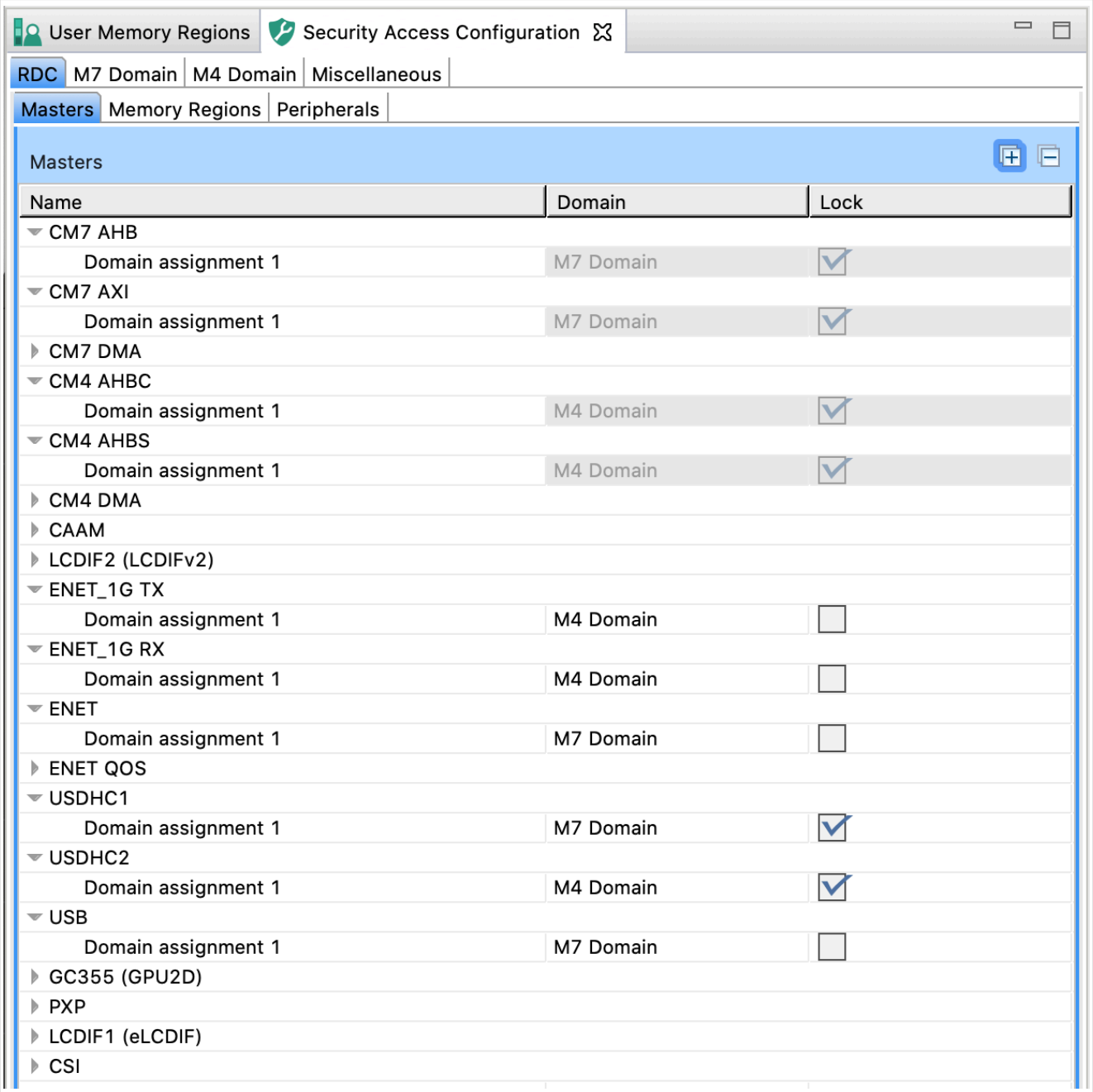


Figure 165. RDC Masters

Allocate a master to a domain by clicking the cell in the **Domain** column in the **Masters** table and selecting the domain from the dropdown list.

Select the **Lock** checkbox to prevent further register modifications.

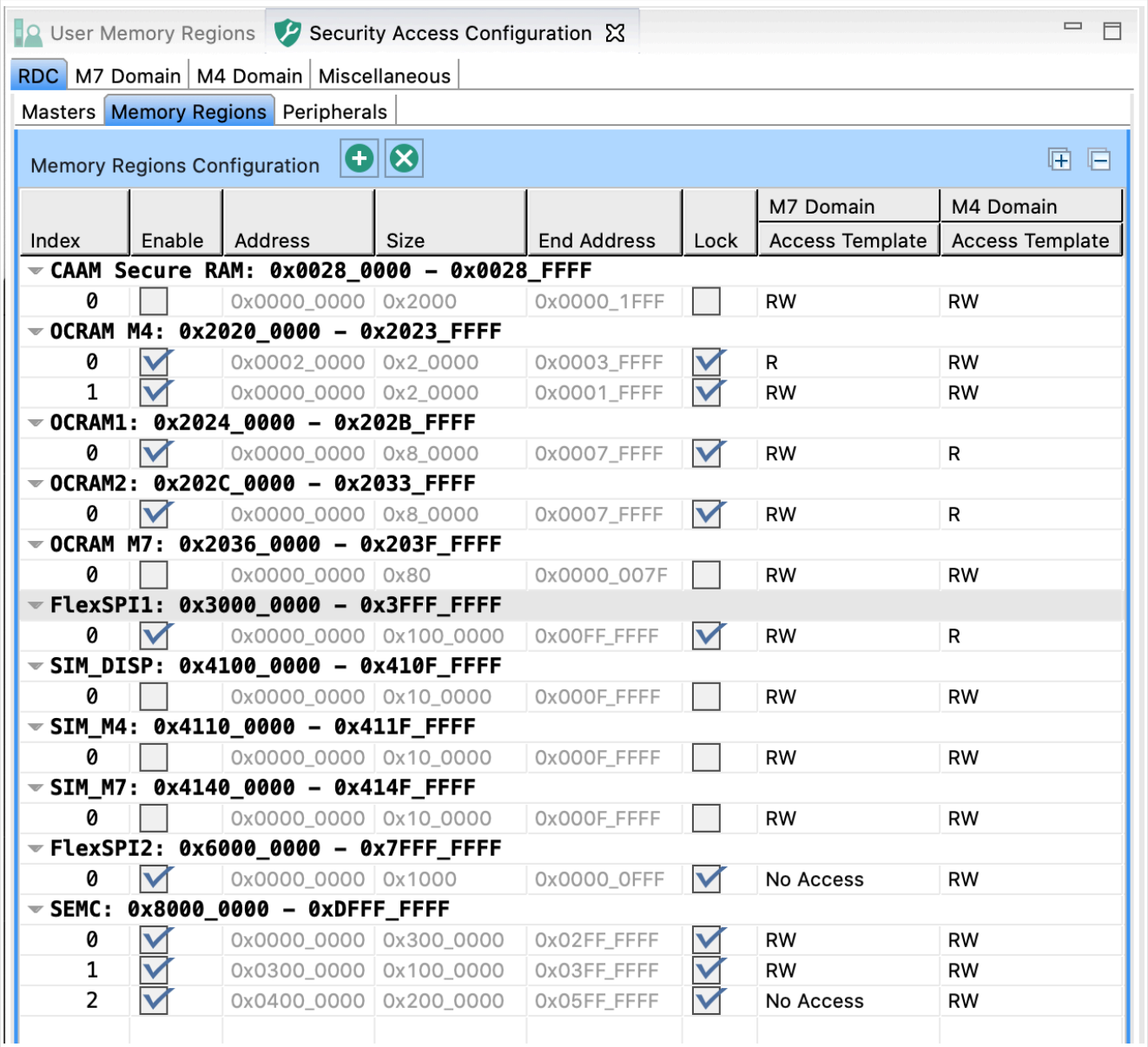
Alternatively, you can select the options by right-clicking the master and using the dropdown list.

Note: Some masters are allocated to specific domains by default and cannot be reallocated.

8.2.2.1.2 Memory Regions

In the **Memory Regions** subview, you can view, enable/disable, and configure the MRC (Memory Region Controller) bus slaves and their domain access.

Memory Region Controller implements the access controls for slave memories based on the pre-programmed Memory Region Descriptor registers.



Index	Enable	Address	Size	End Address	Lock	M7 Domain Access Template	M4 Domain Access Template
CAAM Secure RAM: 0x0028_0000 – 0x0028_FFFF							
0	☐	0x0000_0000	0x2000	0x0000_1FFF	☐	RW	RW
OCRAM M4: 0x2020_0000 – 0x2023_FFFF							
0	☑	0x0002_0000	0x2_0000	0x0003_FFFF	☑	R	RW
1	☑	0x0000_0000	0x2_0000	0x0001_FFFF	☑	RW	RW
OCRAM1: 0x2024_0000 – 0x202B_FFFF							
0	☑	0x0000_0000	0x8_0000	0x0007_FFFF	☑	RW	R
OCRAM2: 0x202C_0000 – 0x2033_FFFF							
0	☑	0x0000_0000	0x8_0000	0x0007_FFFF	☑	RW	R
OCRAM M7: 0x2036_0000 – 0x203F_FFFF							
0	☐	0x0000_0000	0x80	0x0000_007F	☐	RW	RW
FlexSPI1: 0x3000_0000 – 0x3FFF_FFFF							
0	☑	0x0000_0000	0x100_0000	0x00FF_FFFF	☑	RW	R
SIM_DISP: 0x4100_0000 – 0x410F_FFFF							
0	☐	0x0000_0000	0x10_0000	0x000F_FFFF	☐	RW	RW
SIM_M4: 0x4110_0000 – 0x411F_FFFF							
0	☐	0x0000_0000	0x10_0000	0x000F_FFFF	☐	RW	RW
SIM_M7: 0x4140_0000 – 0x414F_FFFF							
0	☐	0x0000_0000	0x10_0000	0x000F_FFFF	☐	RW	RW
FlexSPI2: 0x6000_0000 – 0x7FFF_FFFF							
0	☑	0x0000_0000	0x1000	0x0000_0FFF	☑	No Access	RW
SEMC: 0x8000_0000 – 0xDFFF_FFFF							
0	☑	0x0000_0000	0x300_0000	0x02FF_FFFF	☑	RW	RW
1	☑	0x0300_0000	0x100_0000	0x03FF_FFFF	☑	RW	RW
2	☑	0x0400_0000	0x200_0000	0x05FF_FFFF	☑	No Access	RW

Figure 166. Memory Regions

Use the **Memory Regions Configuration** table to enable and configure MRC slaves:

1. **Enable** the region.
2. Specify the **Address**.
3. Specify either the **Size** or the **End Address**.
4. Optional: **Lock** the settings to prevent further register modifications.
5. Set the **Access Template** for available domains.

Alternatively, you can select the options by right-clicking the master and using the dropdown list.

8.2.2.1.3 Peripherals

In the **Peripherals** subview, you can view and configure the PDAP (Peripheral Domain Access Permissions) for peripherals.

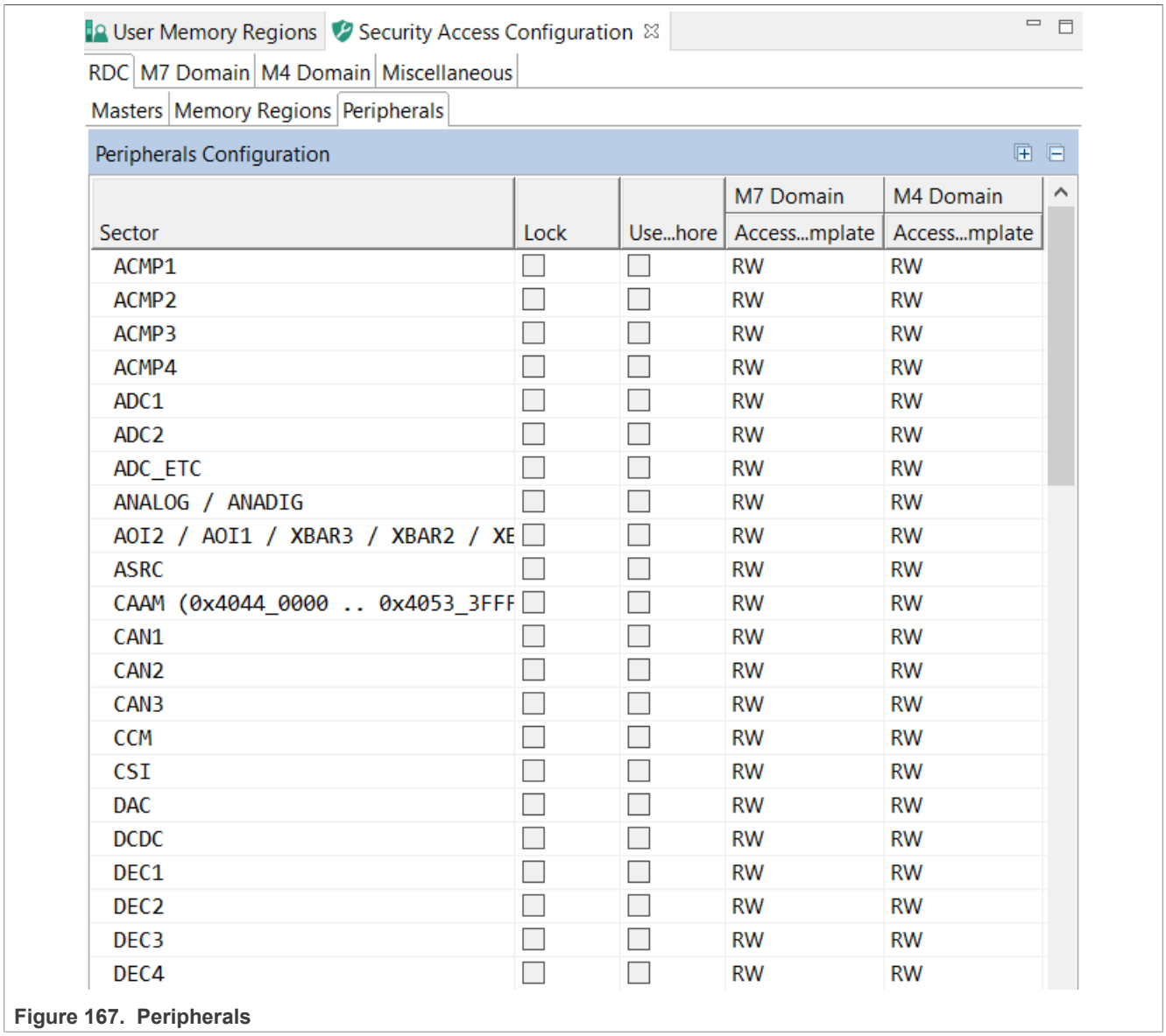


Figure 167. Peripherals

Use the **Peripherals Configuration** table to enable and configure PDAP:

1. Optional: **Lock** the settings to prevent further register entries.
2. Select **Use semaphore** to enable the semaphore function for the peripheral.
   Note: When enabled, the master cannot access this peripheral until obtaining a semaphore. During the time that the domain has the semaphore in possession, its bus masters have exclusive access to the peripheral.
3. Set the **Access Template** for available domains.

8.2.2.2 XRDC2 Domains view

In the **M7/M4 Domain** subviews, you can view and configure security policies of the XRDC2(eXtended Resource Domain Controller 2) domains. Each CPU can contain up to 16 domains.

8.2.2.2.1 MPU subview

In the **MPU** subview, you can enable and configure MPU (Memory Protection Unit). You can create regions, specify their address, size, and other parameters.

The MPU enforces privilege rules, separates processes, and enforces access rules to memory, and supports the standard ARMv7 Protected Memory System Architecture model.

MPU is disabled by default and must be enabled by selecting the **Enable MPU** option.

Note: Not every device supports MPU.

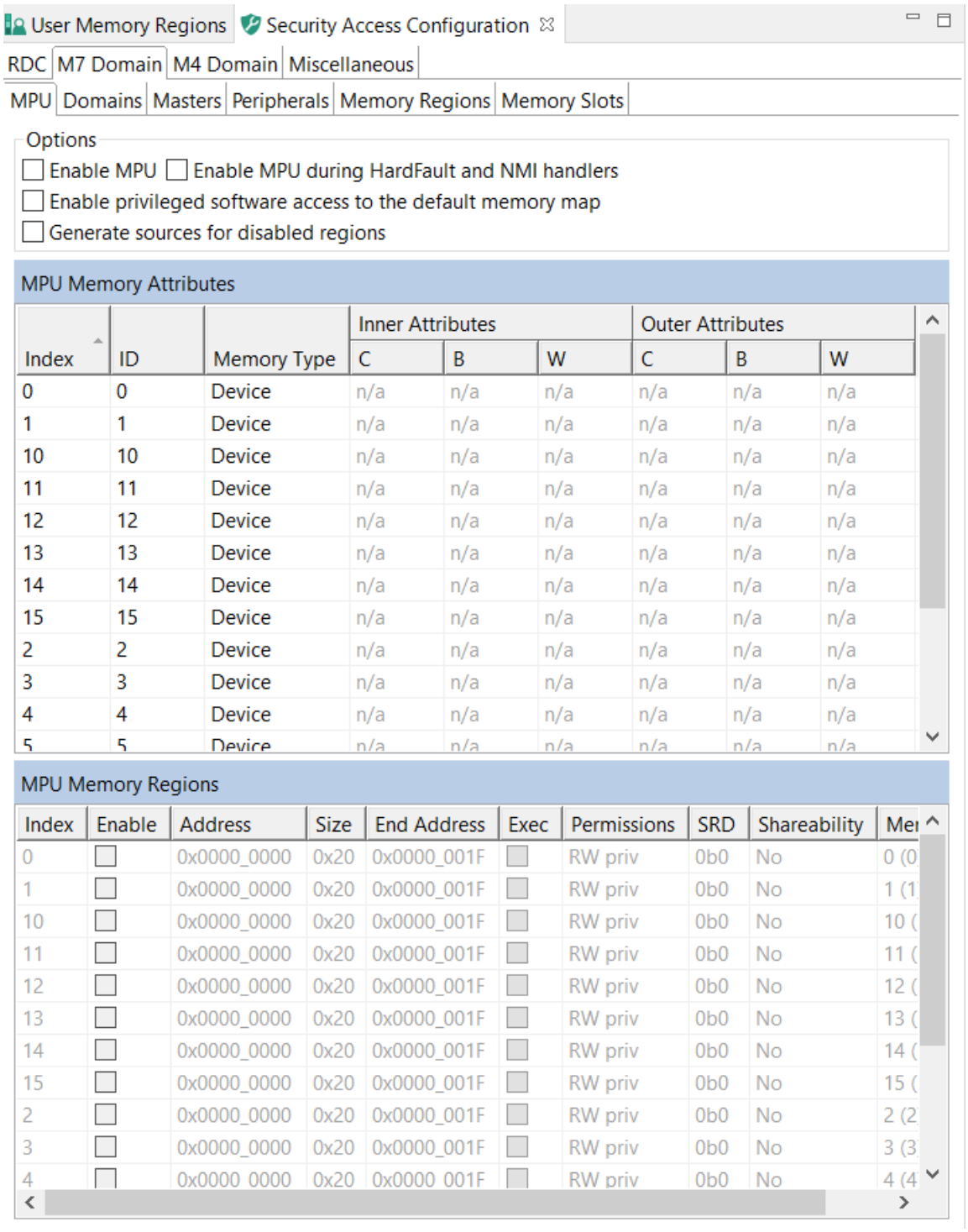


Figure 168. MPU

Use the **MPU Memory Attributes** table to name and configure MPU memory attribute sets. Click the cells of the **Memory Type** and **Inner/Outer Attributes** columns to display the available options.

Use the **MPU Memory Regions** table to enable and configure MPU memory regions.

1. **Enable** the region.

2. Specify the **Address**.
3. Specify either the **Size** or the **End Address**.
4. Set the **Exec** option to allow the region to run code.
5. Set the **Permissions**.
6. Set the **SRD** (Sub Region Disable) bits.
7. Set the **Shareability**, or the caching options.

8.2.2.2.2 Domains

In the **Domains** subview, you can view, add/remove, and rename XRDC2 domains. Each CPU supports up to 16 XRDC2 domains.

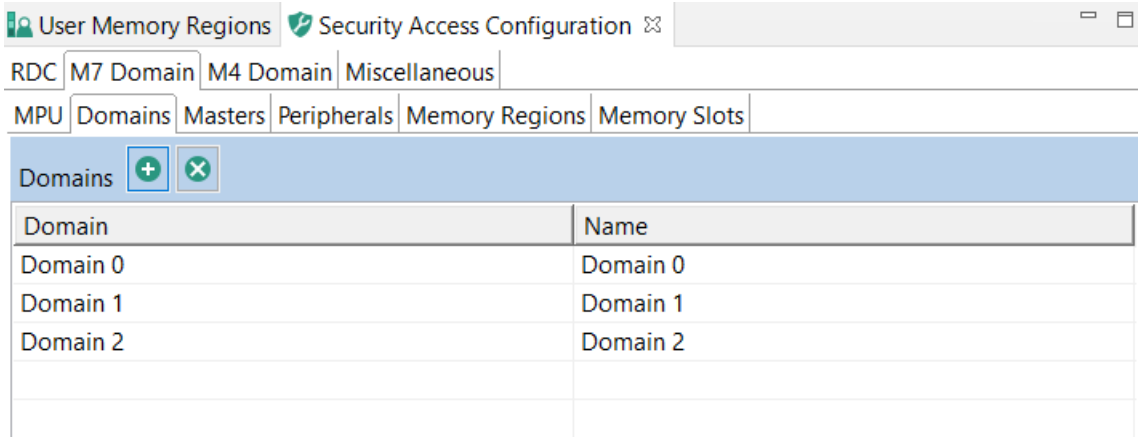


Figure 169. Domains

Add a new domain by clicking the **Add new domain** button.

Rename the domain by entering a new name in the **Name** column.

Remove a domain by clicking the **Remove last domain** button.

8.2.2.2.3 Masters

In the **Masters** subview, you can add/remove, view, configure XRDC2 domain assignments to available RDC masters.

Master Domain Assignment Controller (MDAC) is responsible for the generation of the DID, nonsecure and privileged attributes for every system bus transaction in the device based on pre-programmed Master Domain Assignment (MDA) registers.

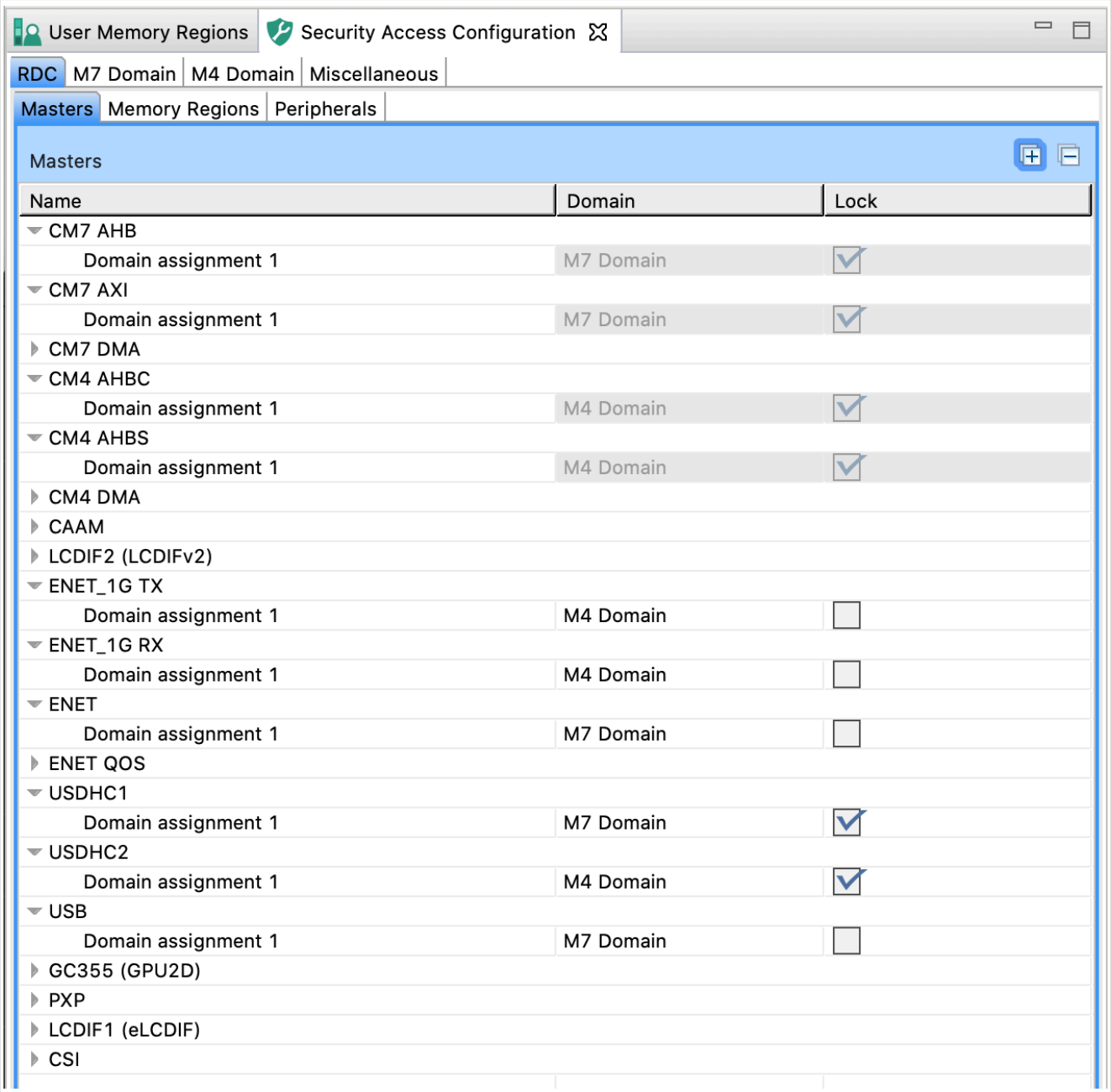


Figure 170. Masters

To add a new domain assignment:

1. Click the **Add new domain assignment for the selected master** button.
2. Select the **Enable** checkbox.
3. Enter the **Match Input** value.

Note: The match field specifies the reference value for the comparison with the MDAC match input. The match field width varies by MDAC instance from 0 to 16 bits. Unimplemented bits are read as 0. A size of 0 bits generates a hit on all comparisons.

1. Enter the **Mask Input** value.

Note: The mask field specifies which bits are valid for the match comparison. Only bit positions in which the mask value is zero are compared. The mask field width is the same as the mask field which varies by MDAC instance from 0 to 16 bits. A mask value of all ones generates a hit on all comparisons.

2. Select the XRDC2 domain assignment from the dropdown list in the **Domain** column.
3. Select the security access type from the dropdown list in the **Secure** column.
4. Select the privileged access type from the dropdown list in the **Privileged** column.
5. Optional: select the **Lock** checkbox to prevent further register modifications.

8.2.2.2.4 Peripherals

In the **Peripherals** subview, you can view the access templates for PAC (Peripheral Access Controller) and configure access for all peripherals managed by PAC on the selected RDC domain.

The Peripheral Access Controller submodule performs access control for a set of peripherals connected to a peripheral bus bridge or integrated into a peripheral subsystem.

The **Access Template** table displays the ID and name of all access templates available for the PAC on the selected device. The information is data driven and display-only.

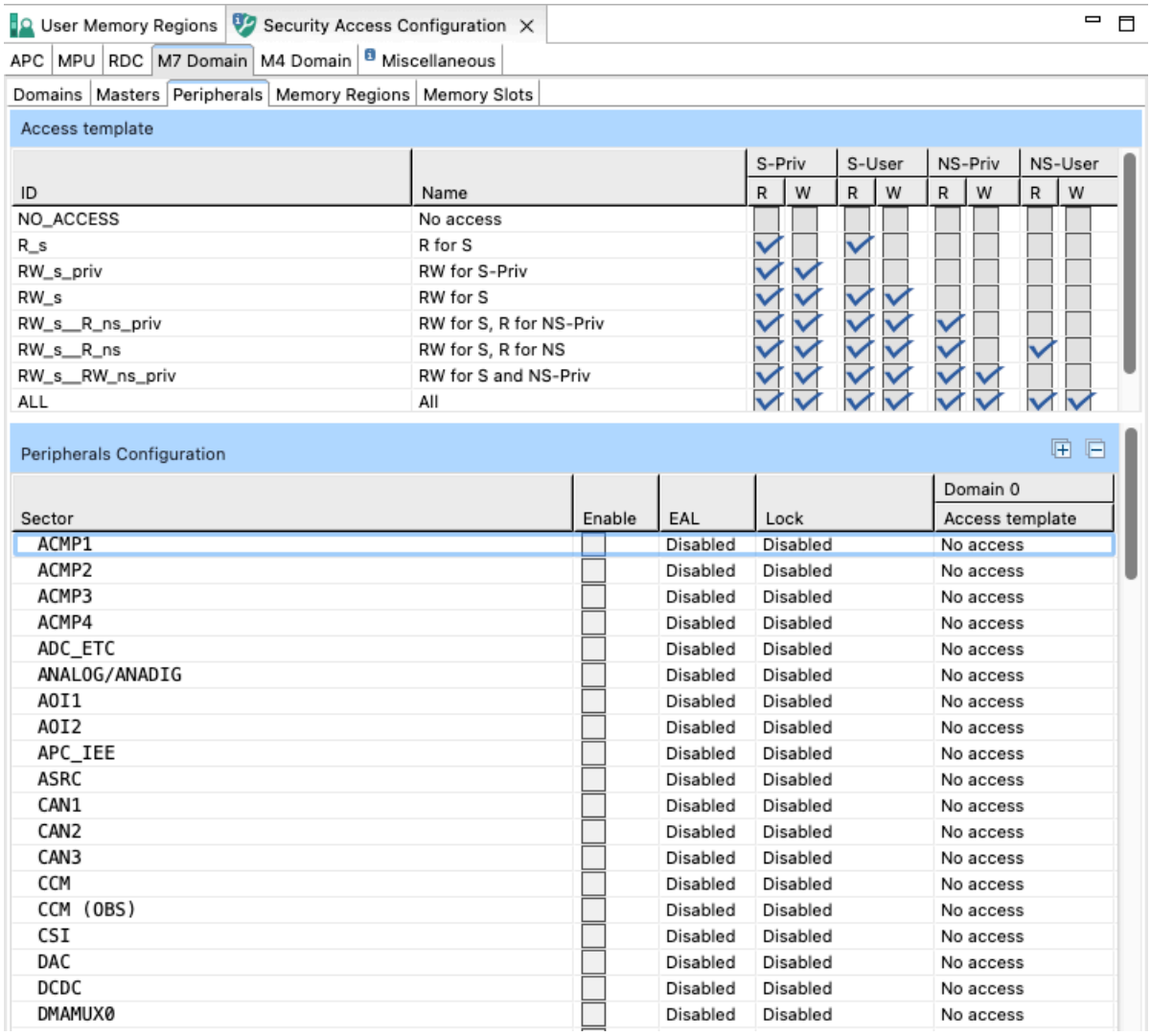


Figure 171. Peripherals

Use the **Peripherals Configuration** table to configure access for a peripheral:

1. Select the **Enable** checkbox.
2. Set the **Lock** to the desired state.
3. Set the **Access Template** for all listed domains.

Alternatively, you can select the options by right-clicking the master and using the dropdown list.

8.2.2.2.5 Memory Regions

In the **Memory Regions** subview, you can view the access templates for MRC (Memory Region Controller) and configure access for all non-peripheral memory spaces managed by MRC on the selected RDC domain.

The Memory Region Controller (MRC) provides domain-based, hardware access control for all system bus references targeted at non-peripheral memory spaces.

The **Access Template** table displays the ID and name of all access templates available for the MRC on the selected device. The information is data driven and display-only.

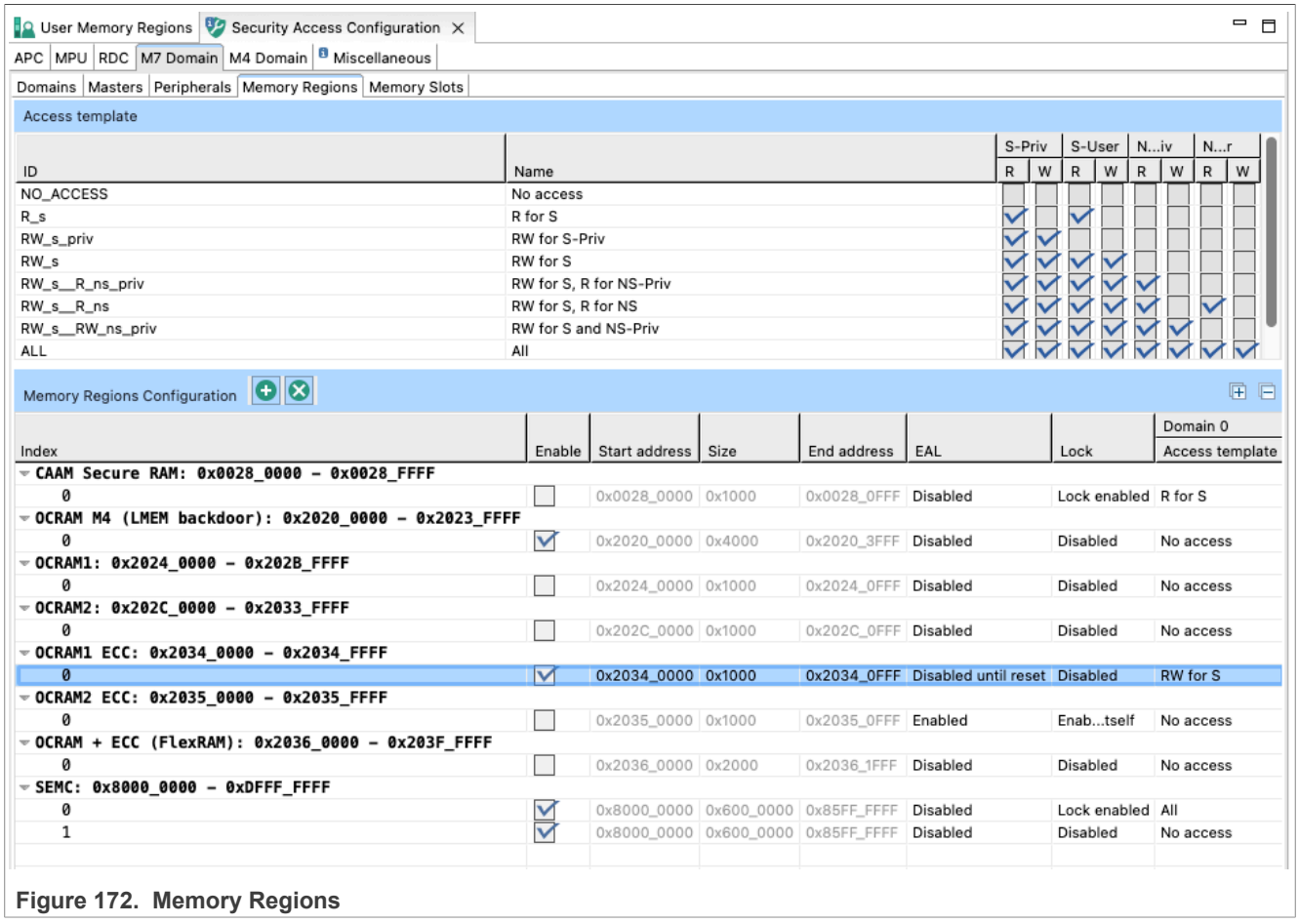


Figure 172. Memory Regions

Use the **Memory Regions Configuration** table to configure access for a non-peripheral memory space:

1. Select the **Enable** checkbox.
2. Specify the **Start Address**.
3. Specify either **Size** or **End Address**.
4. Set the **Lock** to the desired state.
5. Set the **Access Template** for all listed domains.

Alternatively, you can select the options by right-clicking the master and using the dropdown list.

8.2.2.2.6 Memory Slots

In the **Memory Slots** subview, you can view the access templates for MSC (Memory Slot Controller) and configure access for all memory spaces managed by MSC on the selected RDC domain.

The Memory Slot Controller (MSC) performs access control for a peripheral or memory space with a fixed address range.

The **Access Template** table displays the ID and name of all access templates available for the MSC on the selected device. The information is data driven and display-only.

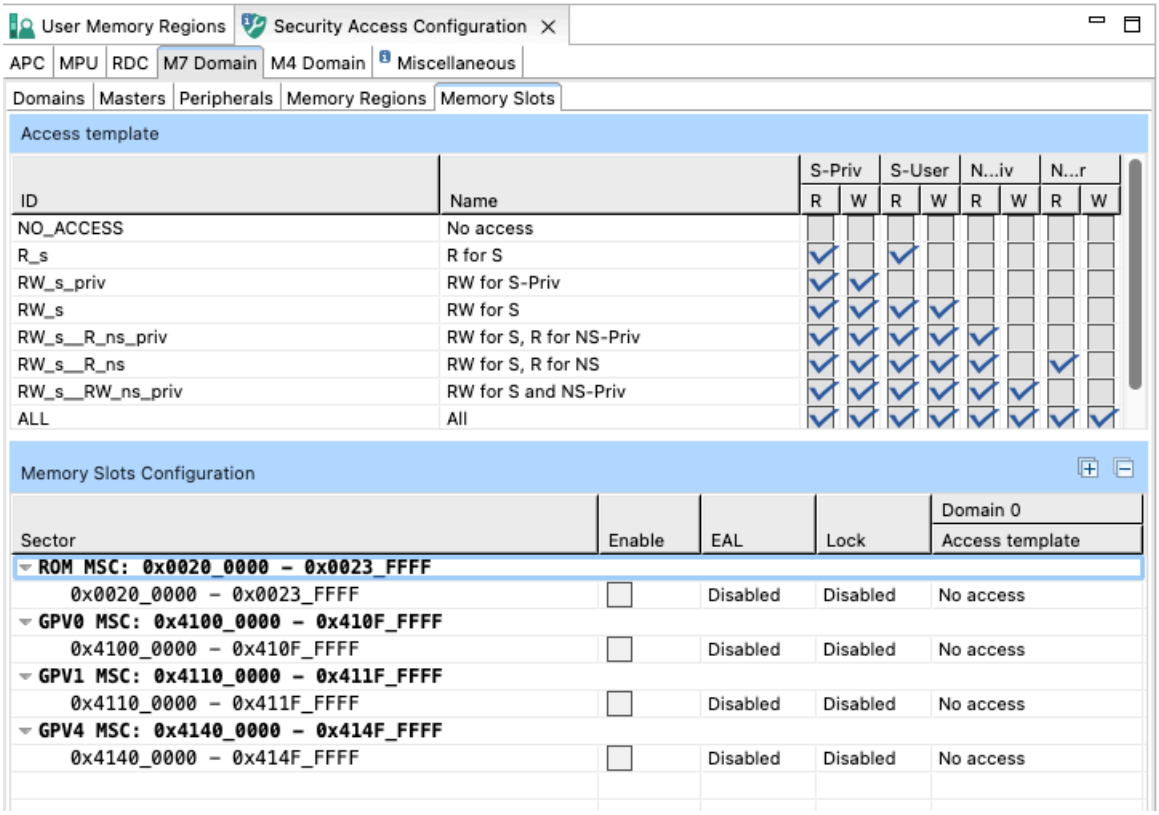


Figure 173. Memory Slots

Use the **Memory Slots Configuration** table to configure access for a memory space:

1. Select the **Enable** checkbox.
2. Set the **Lock** to the desired state.
3. Set the **Access Template** for all listed domains.

Alternatively, you can select the options by right-clicking the master and using the dropdown list.

8.2.2.3 XRDC (eXtended Trusted Resource Domain Controller) on Cortex-A35 in i.MX8 ULP

The XRDC (eXtended Trusted Resource Domain Controller) on Cortex-A35 in i.MX8 ULP provides advanced resource partitioning and access control for secure and non-secure domains. It extends the functionality of TRDC by introducing PID-based domain identification, flexible masking through PIDM, and enhanced access control modes. XRDC ensures fine-grained isolation of memory and peripherals, enabling robust security for multi-domain systems while supporting dynamic configuration through exclusive access mechanisms.

8.2.2.3.1 XRDC Masters

XRDC masters are similar to TRDC masters. In addition, the following features are supported:

- **PID (Process Identifier)** is combined with the PIDM field to determine the domain hit.
- **PIDM (PID Mask)** provides a masking capability so that multiple process identifiers can be included as part of the domain hit determination. If a bit in the PIDM is set, the corresponding bit of the PID is ignored in the comparison.
- **PID enable** provides the ability to include inclusive or exclusive sets of masked PID values. Allowed values are 00b, 01b, 10b, and 11b. For more info, see the corresponding Reference Manual.

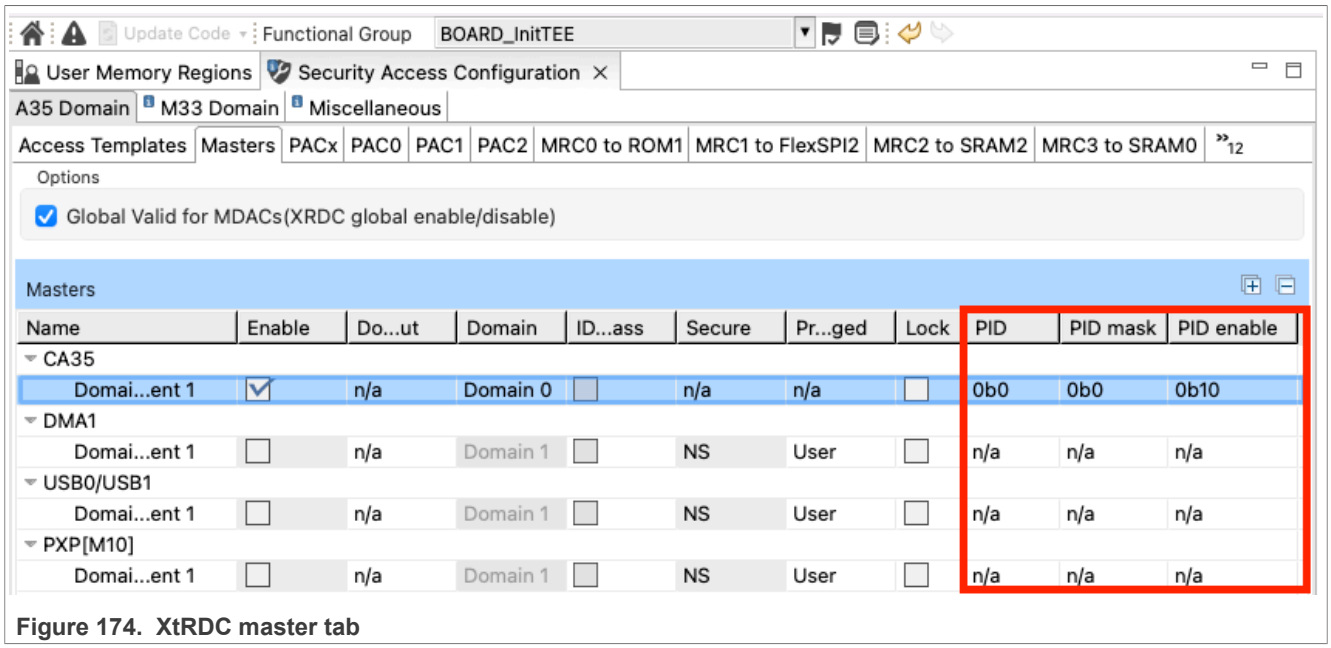


Figure 174. XtRDC master tab

8.2.2.3.2 MRC

MRC on XRDC is similar to MRC on TRDC. There are several minor differences:

1. There is only one instance of the memory regions table because address ranges are shared across all domains. For each memory region, the user can specify an access template for each domain.
2. The code region specifies which templates would be used (0= data, 1 = code). The templates are now hybrid. It means that there are two templates for the same ID and name - the first row is for the data region and the second row is for the code region. These templates, which have the lock field, can be edited by clicking the desired access box.
3. EAL (Exclusive Access Lock) is a hardware mechanism to dynamically modify the DxACP permission evaluation so that only one domain has access to a peripheral or memory region at any given time.
4. For overlapping MRC regions, when determining access, operate the merge strategy using && operator. If any of the regions restricts access, the access is restricted.

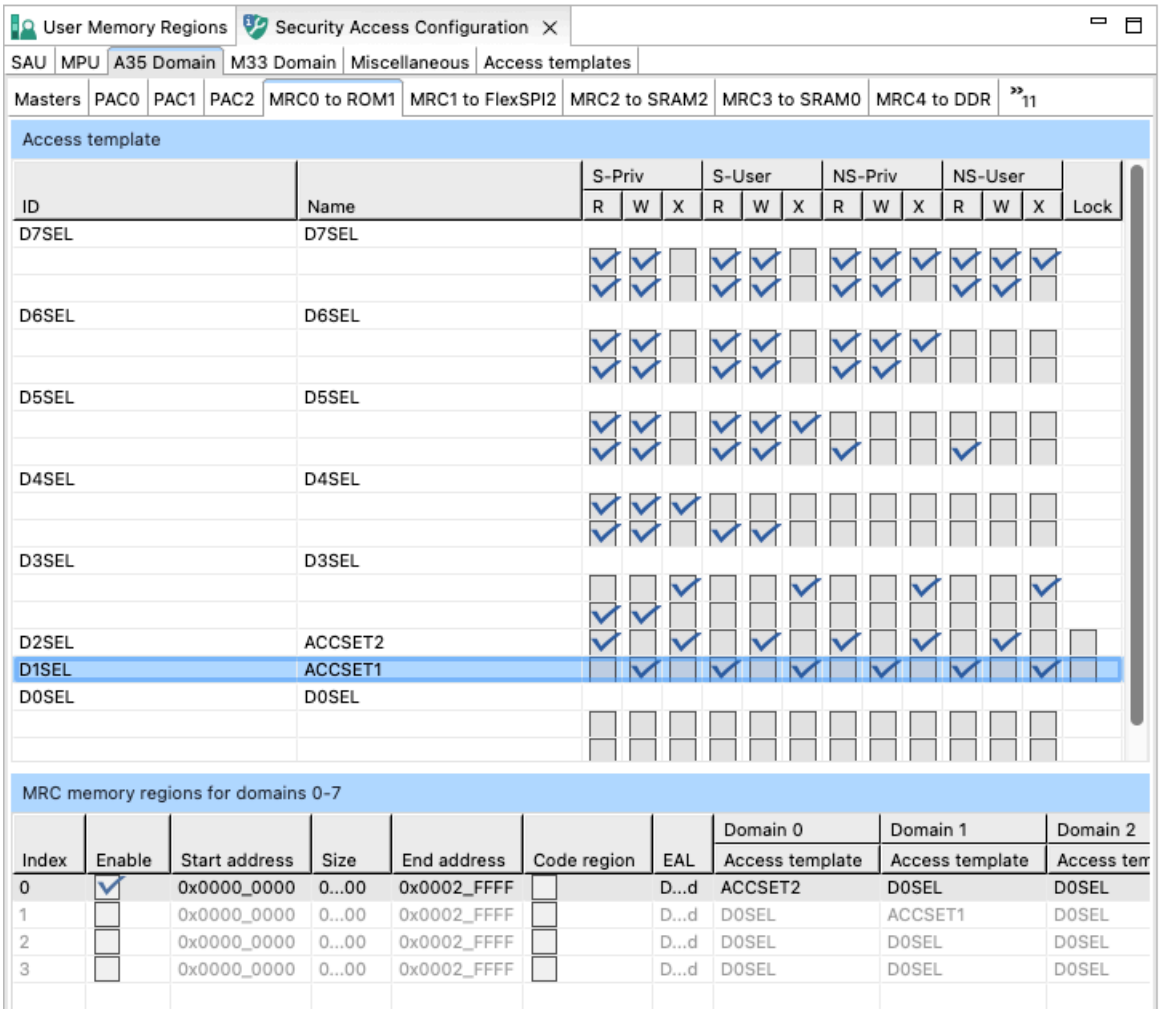


Figure 175. XtRDC MRC tab

8.2.2.3.3 Access control modes

There are two modes that can be enabled for PID.

For processors only supporting TSM, the Three-State Model (SecurePriv, SecureUser, NonsecureUser), the nonsecure[n] output signal from the MDAC submodule is forced to zero while in privileged mode to enable precise state transitions between the user and privileged modes. When SP4SM, the Special 4-State Model, is enabled, the MDAC does not use the MDA[DIDS,DID] fields. The MDAC tracks the current access level and generates specific domainIDs for specific access levels.

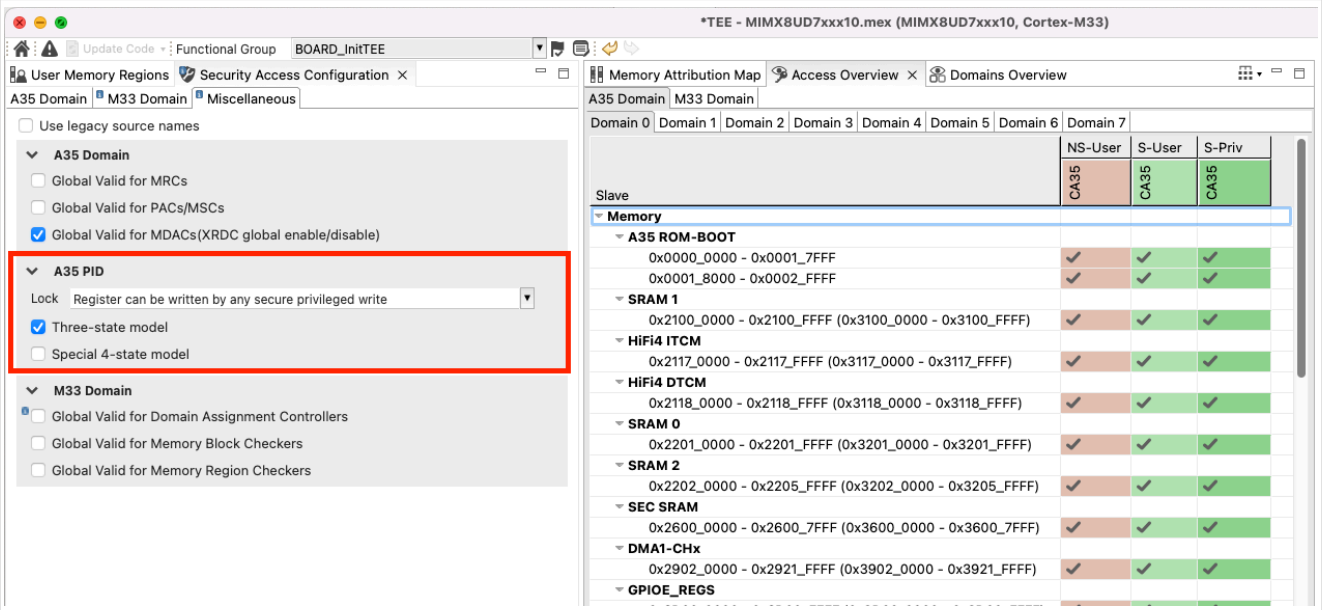


Figure 176. Access modes

8.2.2.4 Trusted Resource Domain Controller on Cortex-M33 in i.MX8 ULP and KW45 (TRDC)

The Trusted Resource Domain Controller (TRDC) manages secure resource allocation and access control for Cortex-M33 cores in i.MX8 ULP and KW45 devices. It provides mechanisms for defining processing domains, assigning resources, and enforcing access policies. TRDC integrates features such as Memory Protection Unit (MPU) for memory protection, domain-based resource partitioning, master identification, and flexible access templates. Additional components include Memory Region Controllers (MRC) for region-level permissions, a crossbar switch for efficient bus arbitration, and Flash Logical Window (FLW) for address remapping.

8.2.2.4.1 MPU

This MPU is identical to other MPUs with Cortex-M33 (for details, see MPU) or other cores based on the Armv8-M architecture or above with Secure/Non-Secure register banks.

8.2.2.4.2 Domains

The domains are similar to RDC/XRDC2/XRDC (for details, see XRDC2): assignment of chip resources to processing “domains”, where a unique domain identifier (domainID, DID) is assigned to each processing domain. The number of supported DIDs is typically the number of CPUs plus one.

8.2.2.4.3 TRDC masters

Masters are similar to Masters in XRDC2 on MIMXRT117x. The user can also choose the domain ID input or ID bypass depending on the master type.

8.2.2.4.4 Access templates

Access templates are similar to patterns in XRDC2 on MIXRT117x. The main difference is as follows: you can switch between “global” (for the entire RDC, used by all checkers, and editable) and “local” (specific to the checker and immutable) templates; meanwhile access templates in XRDC2 are always validator-dependent and editable.

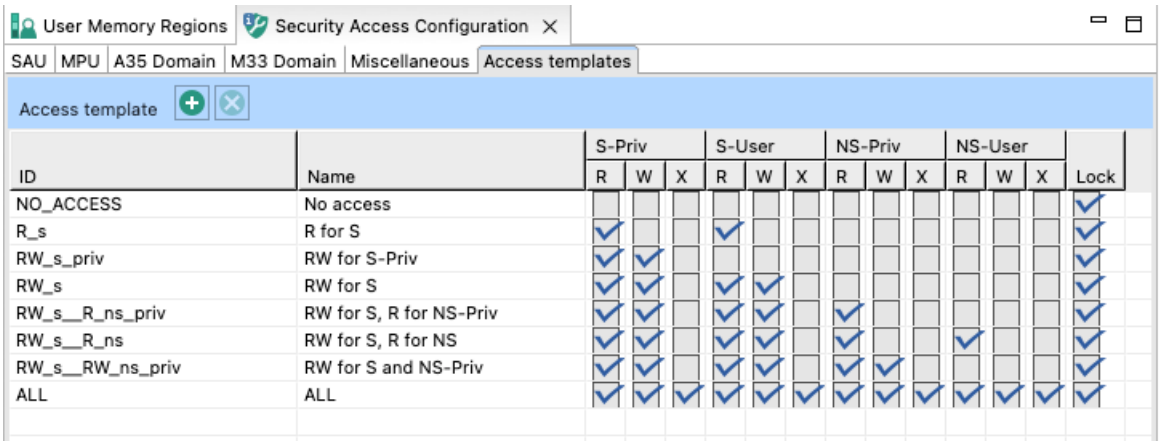


Figure 177. Access templates

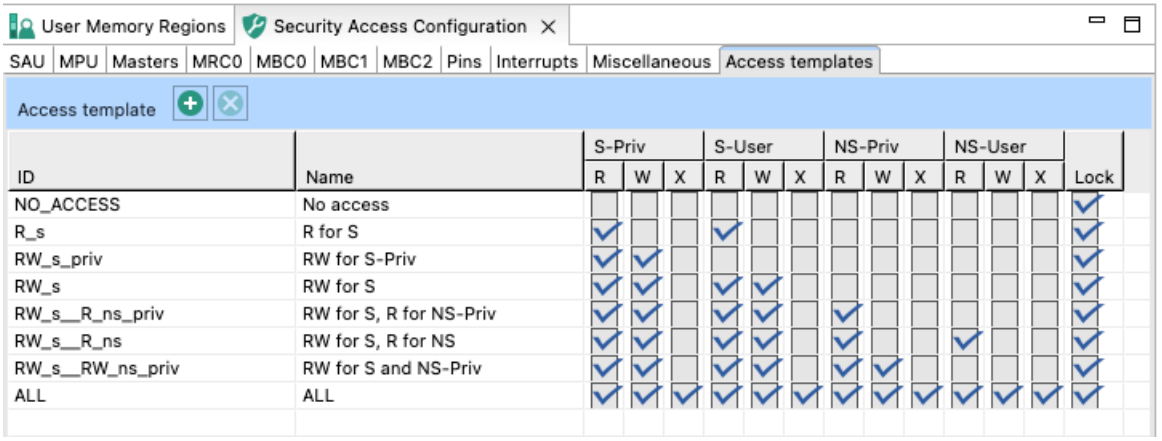


Figure 178. Global access templates

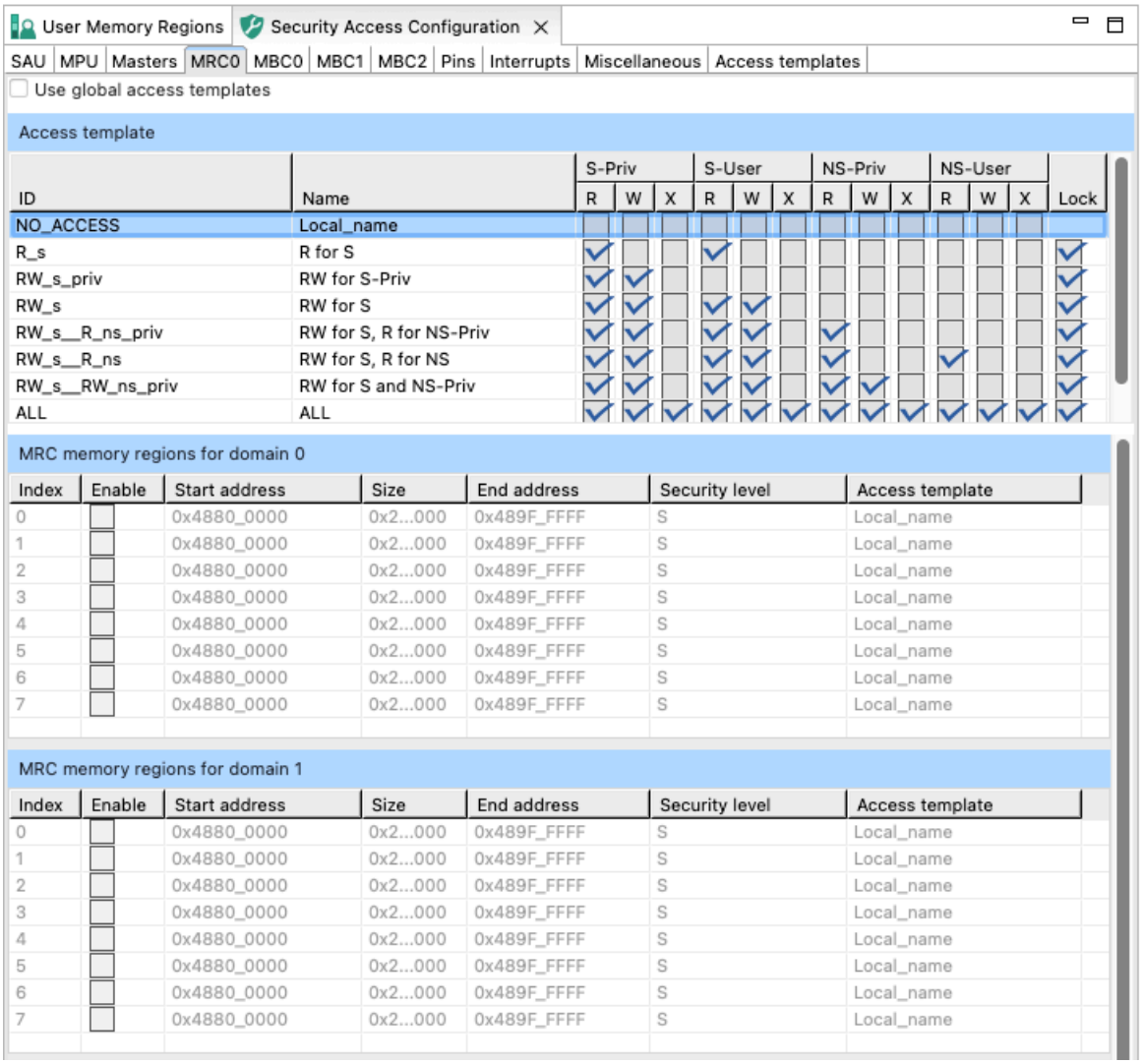


Figure 179. Local access templates

8.2.2.4.5 MRC

MRC on TRDC is similar to MRC Memory Regions in XRDC2.

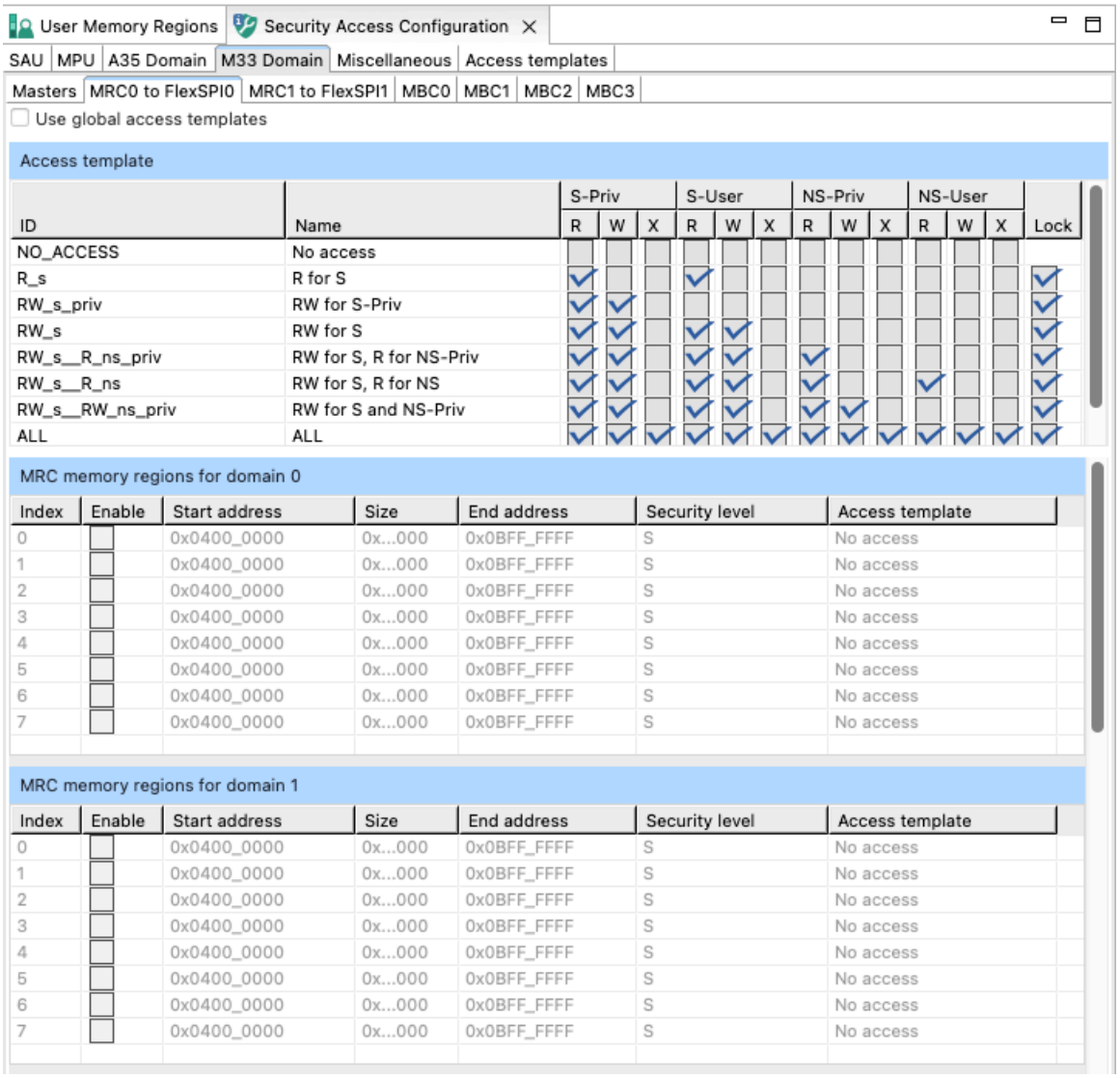


Figure 180. MRC

8.2.2.4.6 Crossbar-switch

The crossbar switch connects bus masters and bus slaves using a crossbar switch structure. This structure allows all bus masters to access different bus slaves simultaneously, while providing arbitration among the bus masters when they access the same slave. A variety of bus arbitration methods and attributes may be programmed on a slave-by-slave basis.

User Memory Regions | Security Access Configuration

SAU | MPU | Masters | MRC0 | MBC0 | MBC1 | MBC2 | Interrupts | Pins | Crossbar-switch | Miscellaneous | Access templates

Options

Enable crossbar-switch configuration

Master General Purpose Control

Master name	Arbitrates on undefined length burst
CM33 Code Chache	No arbitration is allowed during an undefined length burst
CM33 Data Cache	No arbitration is allowed during an undefined length burst
DMA0	No arbitration is allowed during an undefined length burst
EdgeLock secure enclave	No arbitration is allowed during an undefined length burst
Data Stream Buffer	No arbitration is allowed during an undefined length burst
NBU	No arbitration is allowed during an undefined length burst
DSP	No arbitration is allowed during an undefined length burst

Slaves Control

Slave(s) name	Park	Parking Control	Arbitration Mode	Halt Low Priority	Read-only
FMC, FMU	Master port M0	Park field	Fixed priority	Highest priority	Writable
CTCM	Master port M0	Park field	Fixed priority	Highest priority	Writable
STCM2, STCM3	Master port M0	Park field	Fixed priority	Highest priority	Writable
STCM0, S...1, STCM4	Master port M0	Park field	Fixed priority	Highest priority	Writable
STCM5	Master port M0	Park field	Fixed priority	Highest priority	Writable
PRIDGE2	Master port M0	Park field	Fixed priority	Highest priority	Writable
GPIOA, G...B, GPIOC	Master port M0	Park field	Fixed priority	Highest priority	Writable
Radio	Master port M0	Park field	Fixed priority	Highest priority	Writable

Priority Configuration

Slave(s) name	CM33...hache	CM33...Cache	DMA0	EdgeL...clave	Data S... Buffer	NBU	DSP
FMC, FMU	1 (high...priority	2 priority	3 priority	4 priority	5 priority	6 priority	7 priority
CTCM	1 (high...priority	2 priority	3 priority	4 priority	5 priority	6 priority	7 priority
STCM2, STCM3	1 (high...priority	2 priority	3 priority	4 priority	5 priority	6 priority	7 priority
STCM...TCM4	1 (high...priority	2 priority	3 priority	4 priority	5 priority	6 priority	7 priority
STCM5	1 (high...priority	2 priority	3 priority	4 priority	5 priority	6 priority	7 priority
PRIDGE2	1 (high...priority	2 priority	3 priority	4 priority	5 priority	6 priority	7 priority
GPIOA,... GPIOC	1 (high...priority	2 priority	3 priority	4 priority	5 priority	6 priority	7 priority
Radio	1 (high...priority	2 priority	3 priority	4 priority	5 priority	6 priority	7 priority

Figure 181. Crossbar-switch

8.2.2.4.6.1 Flash logical window (FLW)

The FLW logic provides a logical window (remapping) between a fixed physical address window and a programmable flash array window.

8.2.2.5 Miscellaneous

In the **Miscellaneous** subview, you can set various configuration options. The list of these options depends on processor data, and varies greatly. All the options influence your register settings, and can be inspected in the **Register** view. Only some of the options directly influence the configuration you made in the **Security Access Configuration** view. Point your cursor over individual options to display a tooltip explaining the function of each option.

A togglable checkbox enables or disables the code generation for the entire group. When the group is disabled, the code generation for that group is suspended, the generation options within it cannot be edited, and all option configurations revert to their default values (either reset values or default values).

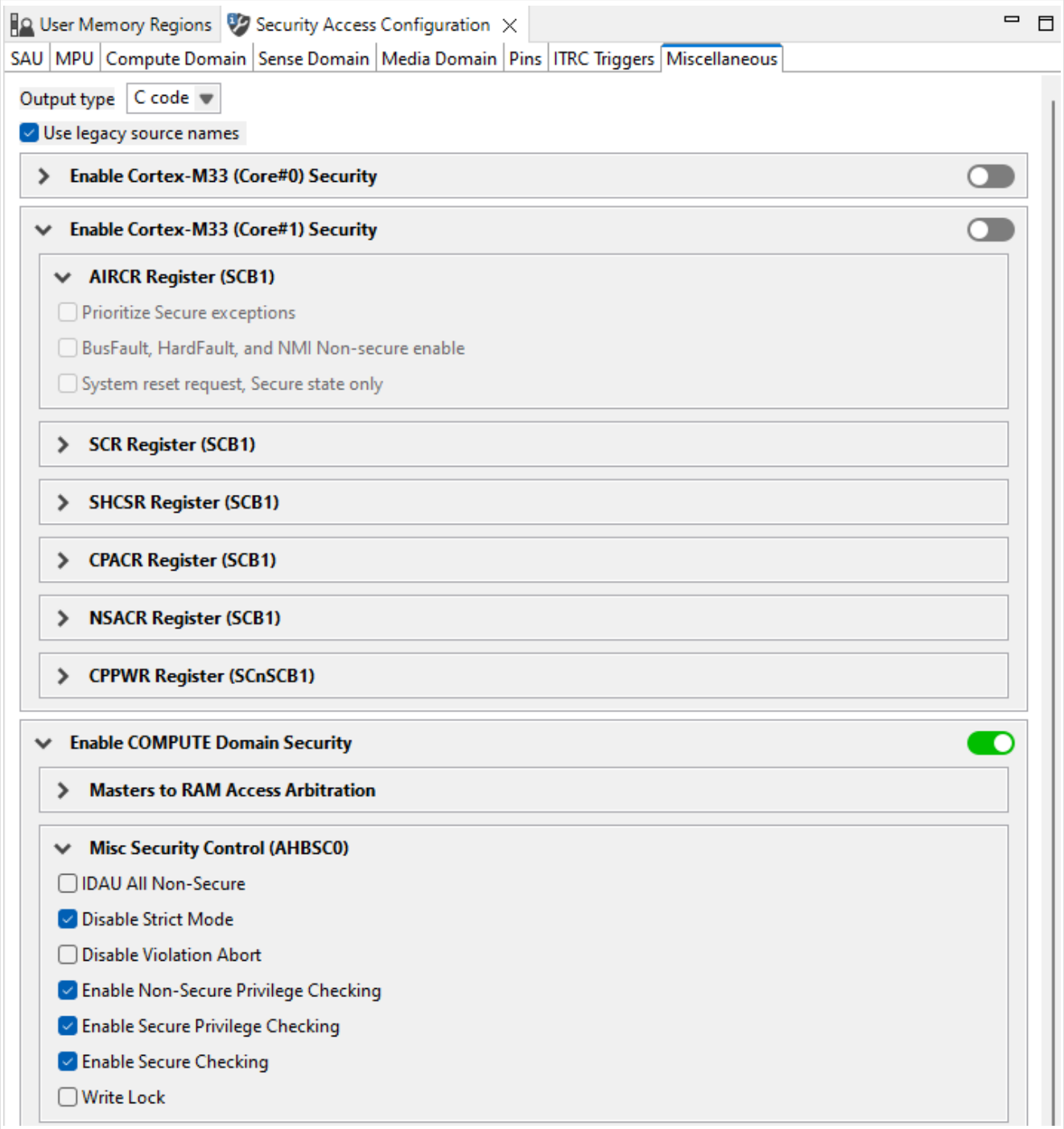


Figure 182. Miscellaneous

8.2.3 Memory Attribution Map

In the **Memory Attribution Map** view, you can review access levels set for all masters to the code, data, and peripherals memory regions on a domain level. The table is read-only.

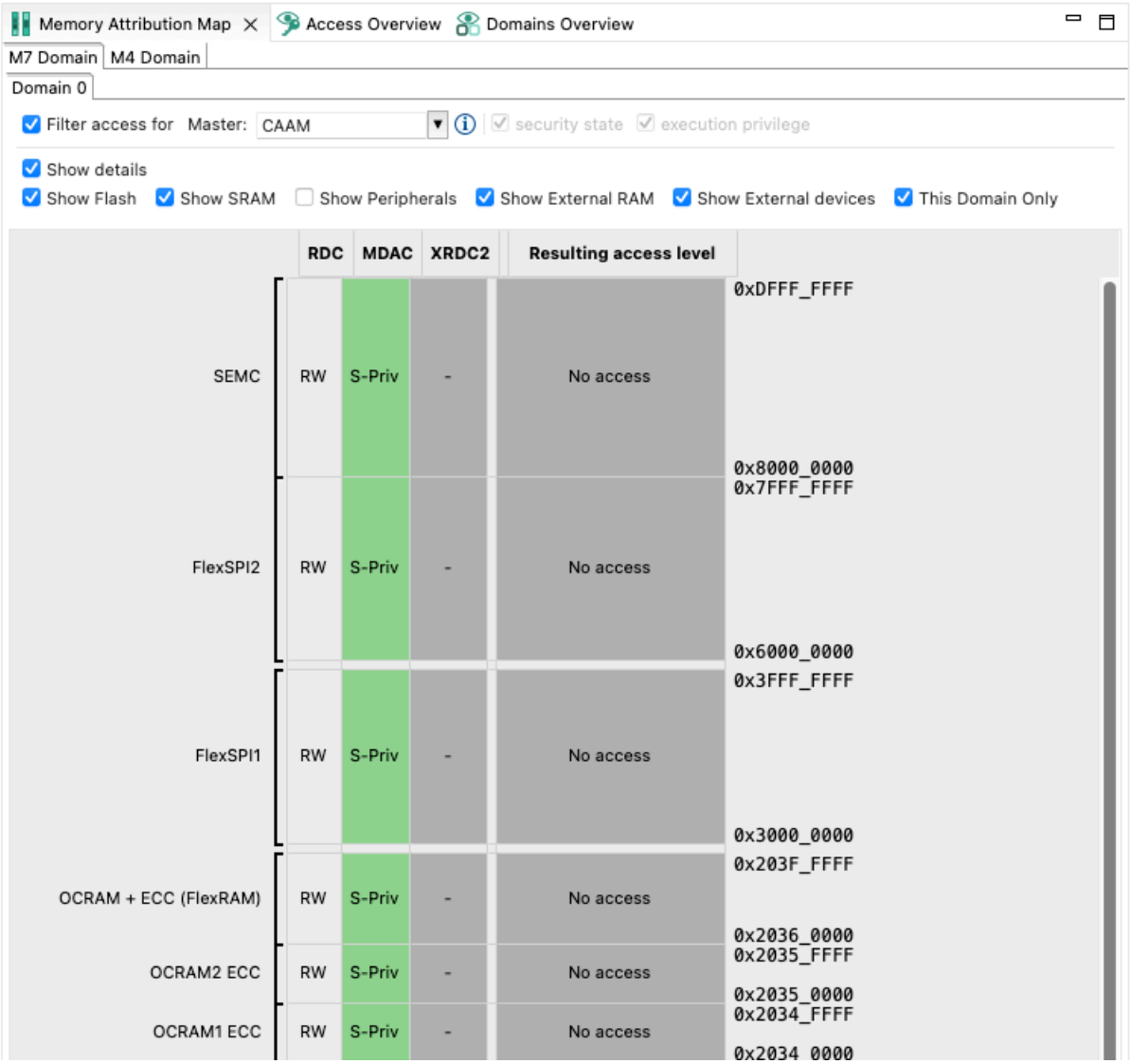


Figure 183. Memory Attribution Map

To set the display options, do the following:

1. Click the **Filter access for** checkbox to enable filtering options.
2. Select the master that you want to review by choosing from the **Master** dropdown menu.
3. Optionally, set the security state and execution privilege check-boxes when the master allows more security levels. This setting has no effect on the configuration.
4. Optionally, customize the output by de-selecting the **Show Details**, **Show Flash**, **Show SRAM**, **Show Peripherals**, and **Show External RAM, Show External Devices**, and **This Domain Only** options.
5. Optionally, filter displayed memory regions in the **Filter** area.

Point your cursor over the cells to display a tooltip with information about the security level combination.

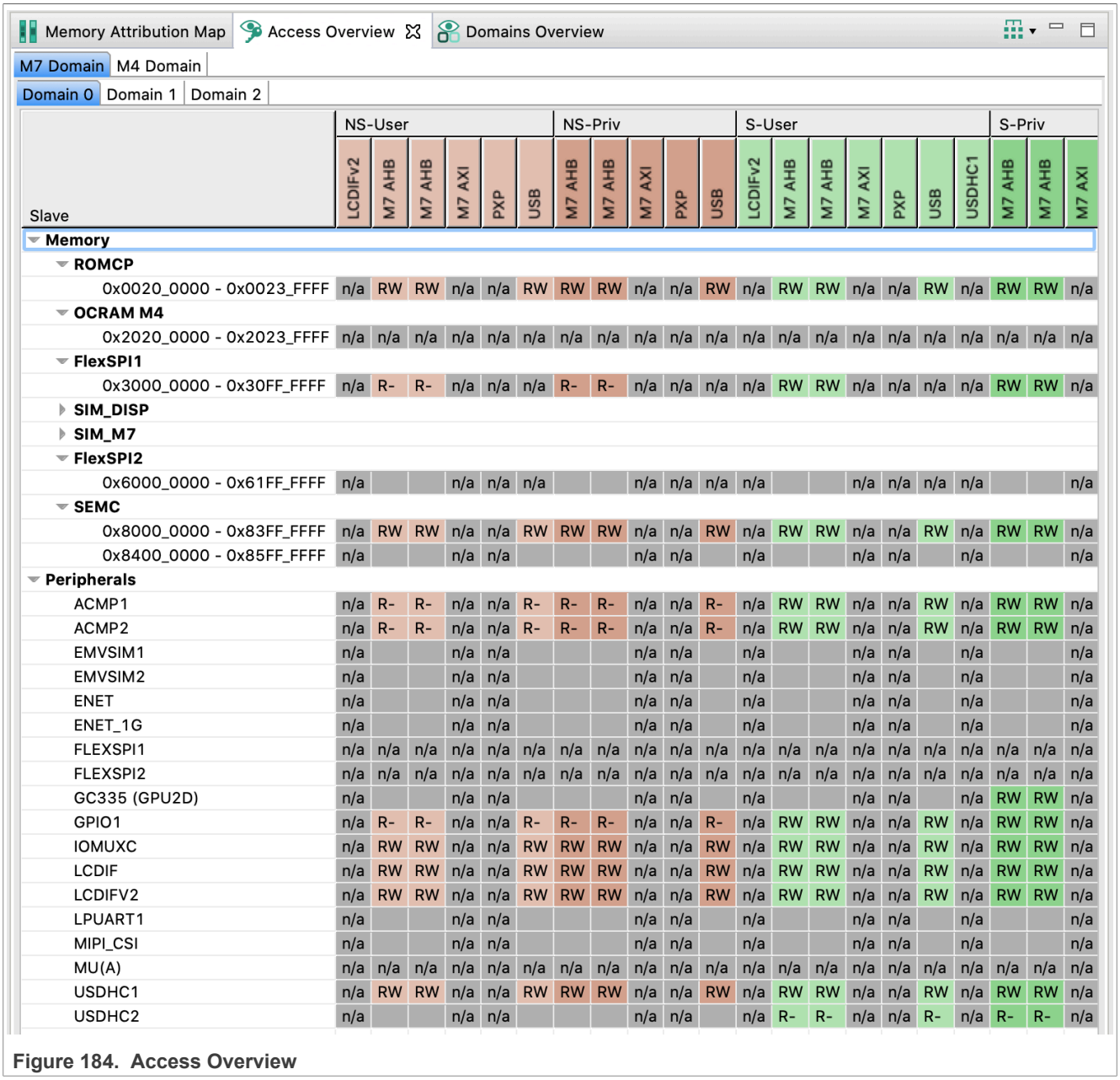
Double-click the cell to open the pertinent settings in **Security Access Configuration**.

8.2.4 Access Overview

In **Access Overview**, you can review security policies you have set in **Security Access Configuration** view. The view is divided into subviews displaying access overview for specific XRDC2 domains.

The vertical axis displays all masters, divided into color-coded groups by their security settings.

The horizontal axis displays memory ranges and slave buses/peripherals.



Slave	NS-User						NS-Priv					S-User							S-Priv		
	LCDIFv2	M7 AHB	M7 AHB	M7 AXI	PXP	USB	M7 AHB	M7 AHB	M7 AXI	PXP	USB	LCDIFv2	M7 AHB	M7 AHB	M7 AXI	PXP	USB	USDHC1	M7 AHB	M7 AHB	M7 AXI
Memory																					
ROMCP																					
0x0020_0000 - 0x0023_FFFF	n/a	RW	RW	n/a	n/a	RW	RW	RW	n/a	n/a	RW	n/a	RW	RW	n/a	n/a	RW	n/a	RW	RW	n/a
OCRAM M4																					
0x2020_0000 - 0x2023_FFFF	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
FlexSPI1																					
0x3000_0000 - 0x30FF_FFFF	n/a	R-	R-	n/a	n/a	n/a	R-	R-	n/a	n/a	n/a	n/a	RW	RW	n/a	n/a	n/a	n/a	RW	RW	n/a
SIM_DISP																					
SIM_M7																					
FlexSPI2																					
0x6000_0000 - 0x61FF_FFFF	n/a			n/a	n/a	n/a			n/a	n/a	n/a	n/a			n/a	n/a	n/a	n/a			n/a
SEMC																					
0x8000_0000 - 0x83FF_FFFF	n/a	RW	RW	n/a	n/a	RW	RW	RW	n/a	n/a	RW	n/a	RW	RW	n/a	n/a	RW	n/a	RW	RW	n/a
0x8400_0000 - 0x85FF_FFFF	n/a			n/a	n/a				n/a	n/a		n/a			n/a	n/a		n/a			n/a
Peripherals																					
ACMP1	n/a	R-	R-	n/a	n/a	R-	R-	R-	n/a	n/a	R-	n/a	RW	RW	n/a	n/a	RW	n/a	RW	RW	n/a
ACMP2	n/a	R-	R-	n/a	n/a	R-	R-	R-	n/a	n/a	R-	n/a	RW	RW	n/a	n/a	RW	n/a	RW	RW	n/a
EMVSIM1	n/a			n/a	n/a				n/a	n/a		n/a			n/a	n/a		n/a			n/a
EMVSIM2	n/a			n/a	n/a				n/a	n/a		n/a			n/a	n/a		n/a			n/a
ENET	n/a			n/a	n/a				n/a	n/a		n/a			n/a	n/a		n/a			n/a
ENET_1G	n/a			n/a	n/a				n/a	n/a		n/a			n/a	n/a		n/a			n/a
FLEXSPI1	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
FLEXSPI2	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
GC335 (GPU2D)	n/a			n/a	n/a				n/a	n/a		n/a			n/a	n/a		n/a	RW	RW	n/a
GPIO1	n/a	R-	R-	n/a	n/a	R-	R-	R-	n/a	n/a	R-	n/a	RW	RW	n/a	n/a	RW	n/a	RW	RW	n/a
IOMUXC	n/a	RW	RW	n/a	n/a	RW	RW	RW	n/a	n/a	RW	n/a	RW	RW	n/a	n/a	RW	n/a	RW	RW	n/a
LCDIF	n/a	RW	RW	n/a	n/a	RW	RW	RW	n/a	n/a	RW	n/a	RW	RW	n/a	n/a	RW	n/a	RW	RW	n/a
LCDIFV2	n/a	RW	RW	n/a	n/a	RW	RW	RW	n/a	n/a	RW	n/a	RW	RW	n/a	n/a	RW	n/a	RW	RW	n/a
LPUART1	n/a			n/a	n/a				n/a	n/a		n/a			n/a	n/a		n/a			n/a
MIPI_CSI	n/a			n/a	n/a				n/a	n/a		n/a			n/a	n/a		n/a			n/a
MU(A)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
USDHC1	n/a	RW	RW	n/a	n/a	RW	RW	RW	n/a	n/a	RW	n/a	RW	RW	n/a	n/a	RW	n/a	RW	RW	n/a
USDHC2	n/a			n/a	n/a				n/a	n/a		n/a	R-	R-	n/a	n/a	R-	n/a	R-	R-	n/a

Figure 184. Access Overview

Point your cursor at an entry to display a tooltip with information about the entry.

You can group the displayed information by security or by masters by using the button on the right-hand side of the toolbar.

8.2.5 Domains Overview

In **Domains Overview**, you can review access policies of XRDC2 domains you have configured in the subviews of the **Domain** view.

Point your cursor over the cells to display a tooltip with information about the security level combination.

Memory Attribution Map | Access Overview | Domains Overview

Resource	M7 Domain			M4 Domain	
	Domain 0	Domain 1	Domain 2	Domain 0	Domain 1
Masters					
CAAM		✓			
CM4 AHBC				✓	
CM4 AHBS				✓	
CM4 DMA				✓	
CM7 AHB	✓				
CM7 AXI	✓				
CM7 DMA	✓				
CSI					
ENET					
ENET QOS					
ENET_1G RX					✓
ENET_1G TX					✓
GC355 (GPU2D)			✓		
LCDIF1 (eLCDIF)			✓		
LCDIF2 (LCDIFv2)	✓				
PXP	✓				
USB	✓				
USDHC1	✓				
USDHC2				✓	
Memory					
ITCM (FlexRAM)					
ROMCP					
0x0020_0000 - 0x0023_FFFF	RW	RW			
CAAM Secure RAM					
0x0028_0000 - 0x0028_FFFF					
ITCM M4					
DTCM M4					
DTCM (FlexRAM)					
OCRAM M4					
0x2020_0000 - 0x2021_FFFF	R-			RW	RW
0x2022_0000 - 0x2023_FFFF	R-	R-		R-	
OCRAM1					
0x2024_0000 - 0x202B_FFFF	RW	RW	RW	R-	R-
OCRAM2					
0x202C_0000 - 0x2033_FFFF	RW	RW	RW	R-	R-
OCRAM1 ECC					
OCRAM2 ECC					
OCRAM M7					
FlexSPI1					
0x3000_0000 - 0x30FF_FFFF	RW	RW		R-	R-
0x3100_0000 - 0x3FFF_FFFF					

Figure 185. Domain Overview

8.2.6 Code generation

If the settings are correct and no error is reported, the code generation engine regenerates the source code. You can view the resulting code in the **Code Preview** view of the **Trusted Execution Environment** tool.

Code Preview automatically highlights differences between the current and immediately preceding iteration of the code. You can choose between two modes of highlighting by clicking the **Set viewing style for source differences**. You can also disable highlighting altogether from the same dropdown menu. Such features as Copy, Search, Zoom-in, Zoom-out, and Export source are available in the **Code Preview** view. The search can also be invoked by CTRL+F or from the context menu.

Some AHBSC and TRDC with security extension-enabled devices support ROM preset as well as C code. You can choose to have the code generated in the ROM preset by selecting the option in the **Miscellaneous** subview.

9 Advanced features

This section gives an overview of the advanced features.

9.1 Switching the processor

You can switch the processor or the package of the current configuration to a different one. However, switching to a completely different processor may lead to various issues, such as inaccessible pin routing or unsatisfiable clock-output frequency. In that case, it's necessary to fix the problem manually. For example, go to the **Routing Details** view and reconfigure all pins which report an error or conflict. Alternatively, you may need to change the required frequencies on clock output.

To change the processor in the selected configuration, select **File > Switch processor** from the **Menu bar**.

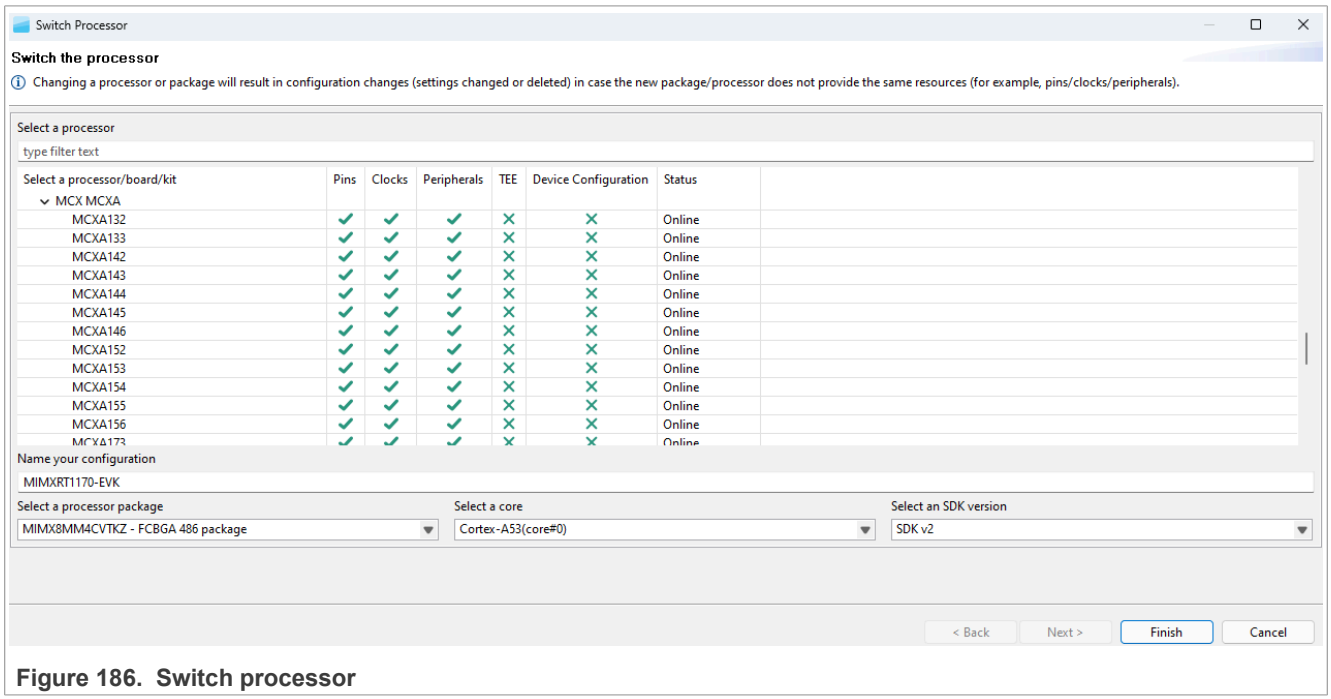


Figure 186. Switch processor

To change the package of the currently selected processor, select **File > Switch package** from the **Menu bar**.

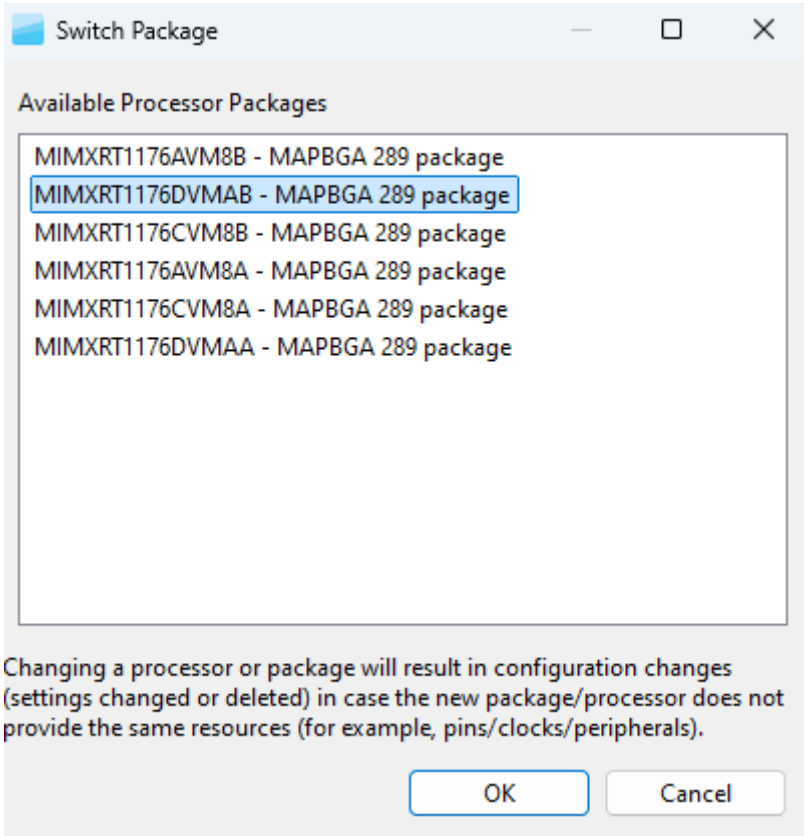


Figure 187. Switch package for the processor

9.2 Exporting the Pins table

To export the Pins table, do the following:

1. In the **Menu bar**, select **File > Export**.
2. In the **Export** wizard, select **Export the Pins in CSV (Comma Separated Values) Format**.

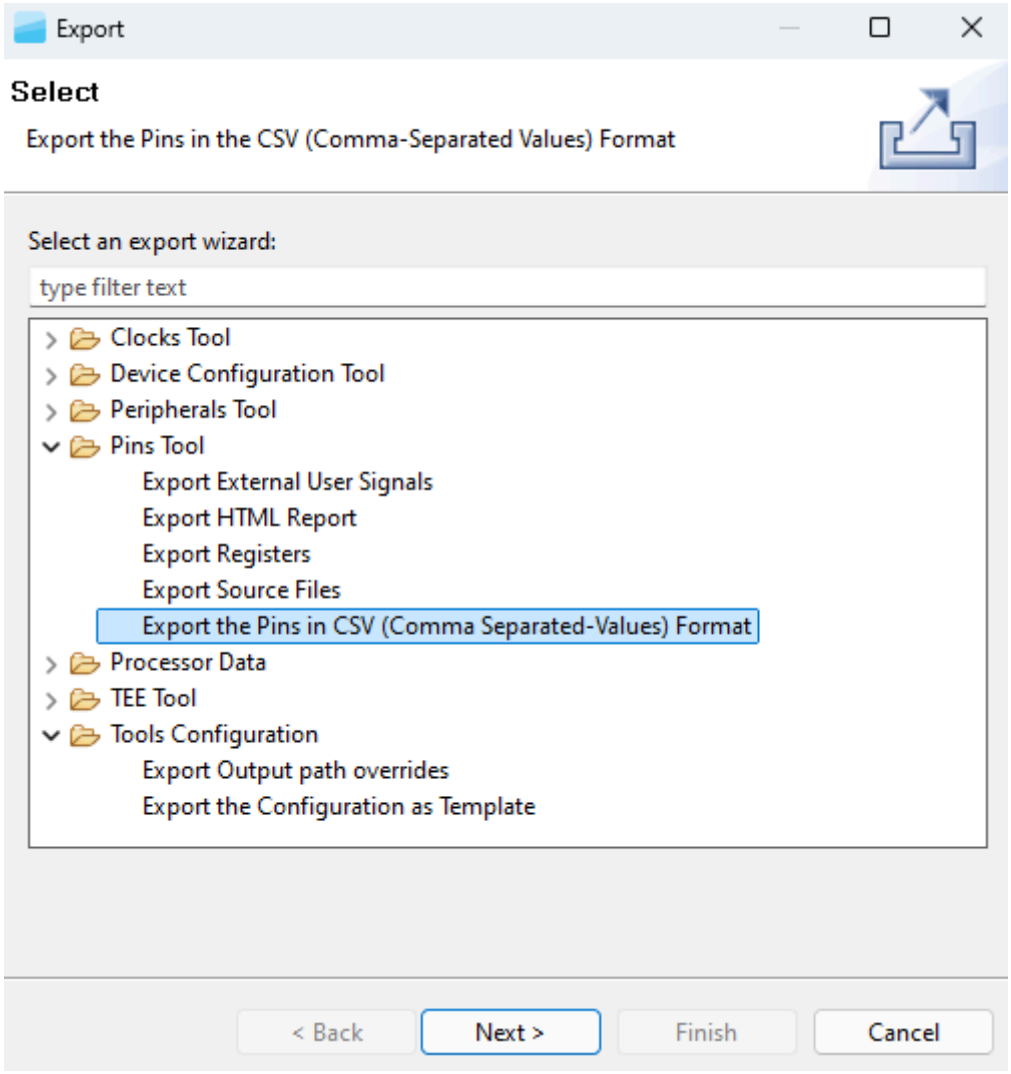


Figure 188. Export dialog

3. Click **Next**.
4. Select the folder and specify the filename to which you want to export.

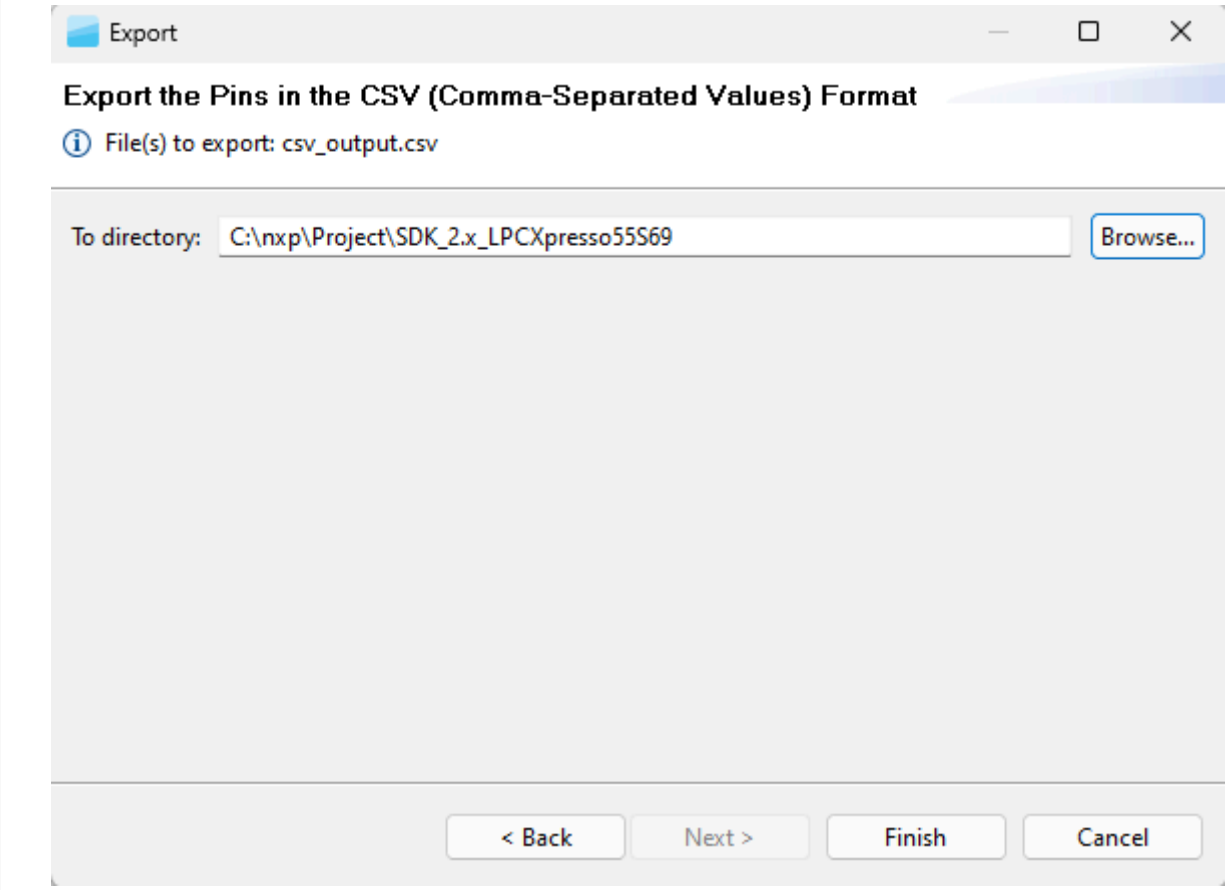


Figure 189. Export the Pins in CSV

5. The exported file contains the content of the Pins view table, and lists the functions and the selected routed pins.

```
sep=;
Pin;Pin name;GPIO;FTM;ADC;UART;SPI;I2S;LLWU;I2C;CMP;SUPPLY;LPUART;USB;SIM;JTAG;RTC;EWM;Other;Routing for BOARD_InitPins
A1;PTE0/CLKOUT32K;PTE0/CLKOUT32K(GPIOE,GPIO,0);;ADC1_SE4a(ADC1,SEa,4);UART1_TX(UART1,TX);SPI1_PCS1(SPI1,PCS1);;;I2C1_SDA(I2C1,SDA);;;;;PTE0
B1;PTE1/LLWU_P0;PTE1/LLWU_P0(GPIOE,GPIO,1);;ADC1_SE5a(ADC1,SEa,5);UART1_RX(UART1,RX);SPI1_SOUT(SPI1,SOUT)/SPI1_SIN(SPI1,SIN);;PTE1/LLWU_P0(
C1;PTD5;PTD5(GPIOD,GPIO,5);FTM0_CH5(FTM0,CH,5);ADC0_SE6b(ADC0,SEb,6);UART0_CTS_b(UART0,CTS);SPI0_PCS2(SPI0,PCS2)/SPI1_SCK(SPI1,SCK);;;;;;;;
D1;USB0_DM;;;;;;;;;;;;USB0_DM(USB0,DM);;;;;;
E1;USB0_DP;;;;;;;;;;;;USB0_DP(USB0,DP);;;;;;
F1;ADC0_DM0/ADC1_DM3;;;ADC0_DM0/ADC1_DM3(ADC0,DM,0)/ADC0_DM0/ADC1_DM3(ADC0,SE,19)/ADC0_DM0/ADC1_DM3(ADC1,DM,3);;;;;;;;;;;;;;;ADC0_DM0/ADC1_
G1;ADC0_DP0/ADC1_DP3;;;ADC0_DP0/ADC1_DP3(ADC0,DP,0)/ADC0_DP0/ADC1_DP3(ADC0,SE,0)/ADC0_DP0/ADC1_DP3(ADC1,DP,3)/ADC0_DP0/ADC1_DP3(ADC1,SE,3);
H1;VREF_OUT/CMP1_IN5/CMP0_IN5/ADC1_SE18;;;VREF_OUT/CMP1_IN5/CMP0_IN5/ADC1_SE18(ADC1,SE,18);;;;;;VREF_OUT/CMP1_IN5/CMP0_IN5/ADC1_SE18(CMP1,I
A2;PTD7/UART0_TX/FTM0_CH7/FTM0_FLT1/SPI1_SIN;PTD7(GPIOD,GPIO,7);FTM0_CH7(FTM0,CH,7)/FTM0_FLT1(FTM0,FLT,1);;UART0_TX(UART0,TX);SPI1_SIN(SPI1
B2;ADC0_SE7b/PTD6/LLWU_P15/SPI0_PCS3/UART0_RX/FTM0_CH6/FTM0_FLT0/SPI1_SOUT;PTD6/LLWU_P15(GPIOD,GPIO,6);FTM0_CH6(FTM0,CH,6)/FTM0_FLT0(FTM0,F
C2;PTD2/LLWU_P13/SPI0_SOUT/UART2_RX/LPUART0_RX/I2C0_SCL;PTD2/LLWU_P13(GPIOD,GPIO,2);;;UART2_RX(UART2,RX);SPI0_SOUT(SPI0,SOUT);;PTD2/LLWU_P1
D2;VREGIN;;;;;;;;;;;;VREGIN(USB0,VREGIN);;;;;;
E2;VOUT33;;;;;;;;;;;;VOUT33(USB0,VOUT33);;;;;;
F2;ADC1_DM0/ADC0_DM3;;;ADC1_DM0/ADC0_DM3(ADC1,DM,0)/ADC1_DM0/ADC0_DM3(ADC1,SE,19)/ADC1_DM0/ADC0_DM3(ADC0,DM,3);;;;;;;;;;;;;;;
G2;ADC1_DP0/ADC0_DP3;;;ADC1_DP0/ADC0_DP3(ADC1,DP,0)/ADC1_DP0/ADC0_DP3(ADC1,SE,0)/ADC1_DP0/ADC0_DP3(ADC0,DP,3)/ADC1_DP0/ADC0_DP3(ADC0,SE,3);
H2;DAC0_OUT/CMP1_IN3/ADC0_SE23;;;DAC0_OUT/CMP1_IN3/ADC0_SE23(ADC0,SE,23);;;;;;DAC0_OUT/CMP1_IN3/ADC0_SE23(CMP1,IN,3);;;;;;;;DAC0_OUT/CMP1_I
A3;PTD4/LLWU_P14/SPI0_PCS1/UART0_RTS_b/FTM0_CH4/EWM_IN/SPI1_PCS0;PTD4/LLWU_P14(GPIOD,GPIO,4);FTM0_CH4(FTM0,CH,4);;UART0_RTS_b(UART0,RTS);SP
B3;PTD3/SPI0_SIN/UART2_TX/LPUART0_TX/I2C0_SDA;PTD3(GPIOD,GPIO,3);;;UART2_TX(UART2,TX);SPI0_SIN(SPI0,SIN);;;I2C0_SDA(I2C0,SDA);;;LPUART0_TX(
C3;PTD0/LLWU_P12;PTD0/LLWU_P12(GPIOD,GPIO,0);;;UART2_RTS_b(UART2,RTS);SPI0_PCS0(SPI0,PCS0/SS);;PTD0/LLWU_P12(LLWU,WAKEUP,P12);;;;LPUART0_RT
D3;PTA0/UART0_CTS_b/FTM0_CH5/JTAG_TCLK/SWD_CLK/EZP_CLK;PTA0(GPIOA,GPIO,0);FTM0_CH5(FTM0,CH,5);;UART0_CTS_b(UART0,CTS);;;;;;;;;;JTAG_TCLK(JT
```

Figure 190. Exported file content

The exported content can be used in other tools for further processing. For example, see it after aligning to blocks in the image below.

```
sep=;
Pin ;Pin name                                                               ;GPIO                        ;FTM                                                            ;ADC
A1  ;PTE0/CLKOUT32K                                                         ;PTE0/CLKOUT32K(GPIOE,GPIO,0);                                                               ;ADC1_SE4a(ADC1,SEa,4)
B1  ;PTE1/LLWU_P0                                                           ;PTE1/LLWU_P0(GPIOE,GPIO,1)  ;                                                               ;ADC1_SE5a(ADC1,SEa,5)
C1  ;PTD5                                                                   ;PTD5(GPIOD,GPIO,5)          ;FTM0_CH5(FTM0,CH,5)                                            ;ADC0_SE6b(ADC0,SEb,6)
D1  ;USB0_DM                                                                ;                            ;                                                               ;
E1  ;USB0_DP                                                                ;                            ;                                                               ;
F1  ;ADC0_DM0/ADC1_DM3                                                      ;                            ;                                                               ;ADC0_DM0/ADC1_DM3(ADC0,DM,0)/ADC0_DM0/ADC
G1  ;ADC0_DP0/ADC1_DP3                                                      ;                            ;                                                               ;ADC0_DP0/ADC1_DP3(ADC0,DP,0)/ADC0_DP0/ADC
H1  ;VREF_OUT/CMP1_IN5/CMP0_IN5/ADC1_SE18                                   ;                            ;                                                               ;VREF_OUT/CMP1_IN5/CMP0_IN5/ADC1_SE18(ADC1
A2  ;PTD7/UART0_TX/FTM0_CH7/FTM0_FLT1/SPI1_SIN                              ;PTD7(GPIOD,GPIO,7)          ;FTM0_CH7(FTM0,CH,7)/FTM0_FLT1(FTM0,FLT,1)                      ;
B2  ;ADC0_SE7b/PTD6/LLWU_P15/SPI0_PCS3/UART0_RX/FTM0_CH6/FTM0_FLT0/SPI1_SOUT;PTD6/LLWU_P15(GPIOD,GPIO,6) ;FTM0_CH6(FTM0,CH,6)/FTM0_FLT0(FTM0,FLT,0)/FTM0_FLT0(FTM0,TRG,2);ADC0_SE7b(ADC0,SEb,7)
C2  ;PTD2/LLWU_P13/SPI0_SOUT/UART2_RX/LPUART0_RX/I2C0_SCL                   ;PTD2/LLWU_P13(GPIOD,GPIO,2) ;                                                               ;
D2  ;VREGIN                                                                 ;                            ;                                                               ;
E2  ;VOUT33                                                                 ;                            ;                                                               ;
F2  ;ADC1_DM0/ADC0_DM3                                                      ;                            ;                                                               ;ADC1_DM0/ADC0_DM3(ADC1,DM,0)/ADC1_DM0/ADC
G2  ;ADC1_DP0/ADC0_DP3                                                      ;                            ;                                                               ;ADC1_DP0/ADC0_DP3(ADC1,DP,0)/ADC1_DP0/ADC
H2  ;DAC0_OUT/CMP1_IN3/ADC0_SE23                                            ;                            ;                                                               ;DAC0_OUT/CMP1_IN3/ADC0_SE23(ADC0,SE,23)
A3  ;PTD4/LLWU_P14/SPI0_PCS1/UART0_RTS_b/FTM0_CH4/EWM_IN/SPI1_PCS0          ;PTD4/LLWU_P14(GPIOD,GPIO,4) ;FTM0_CH4(FTM0,CH,4)                                            ;
B3  ;PTD3/SPI0_SIN/UART2_TX/LPUART0_TX/I2C0_SDA                             ;PTD3(GPIOD,GPIO,3)          ;                                                               ;
C3  ;PTD0/LLWU_P12                                                          ;PTD0/LLWU_P12(GPIOD,GPIO,0) ;                                                               ;
D3  ;PTA0/UART0_CTS_b/FTM0_CH5/JTAG_TCLK/SWD_CLK/EZP_CLK                    ;PTA0(GPIOA,GPIO,0)          ;FTM0_CH5(FTM0,CH,5)                                            ;
E3  ;VSS80                                                                  ;                            ;                                                               ;
F3  ;VSSA                                                                   ;                            ;                                                               ;VSSA(ADC0,SE,30)/VSSA(ADC1,SE,30)/VSSA(AD
G3  ;VREFL                                                                  ;                            ;                                                               ;VREFL(ADC0,SE,30)/VREFL(ADC1,SE,30)/VREFL
H3  ;XTAL32                                                                 ;                            ;                                                               ;
A4  ;ADC0_SE5b/PTD1/SPI0_SCK/UART2_CTS_b/LPUART0_CTS_b                      ;PTD1(GPIOD,GPIO,1)          ;                                                               ;ADC0_SE5b(ADC0,SEb,5)
B4  ;ADC1_SE6b/PTC10/I2C1_SCL/I2S0_RX_FS                                    ;PTC10(GPIOC,GPIO,10)        ;                                                               ;ADC1_SE6b(ADC1,SEb,6)
C4  ;VSS9                                                                   ;                            ;                                                               ;
D4  ;PTA1/UART0_RX/FTM0_CH6/JTAG_TDI/EZP_DI                                 ;PTA1(GPIOA,GPIO,1)          ;FTM0_CH6(FTM0,CH,6)                                            ;
E4  ;VDD81                                                                  ;                            ;                                                               ;
F4  ;VDDA                                                                   ;                            ;                                                               ;VDDA(ADC0,SE,29)/VDDA(ADC1,SE,29)/VDDA(AD
G4  ;VREFH                                                                  ;                            ;                                                               ;VREFH(ADC0,SE,29)/VREFH(ADC1,SE,29)/VREFH
```

Figure 191. Aligning to block

9.3 Tools advanced configuration

Use the tools.ini file to configure the processor data directory location. Define the “com.nxp.mcudata.dir” property to set the data directory location.

For example: `-Dcom.nxp.mcudata.dir=C:/my/data/directory.`

9.4 Generating HTML reports

You can generate an HTML report file that displays your configuration of Pins, Clocks, and Peripherals tool for future reference.

To generate the HTML report, select **Export > Pins/Clocks/Peripherals Tool > Export HTML Report**.

9.5 Exporting sources

It is possible to export the generated source using the Export wizard.

To launch the Export wizard:

1. Select **File > Export** from the **Menu bar**.
2. Select **Export Source Files**.

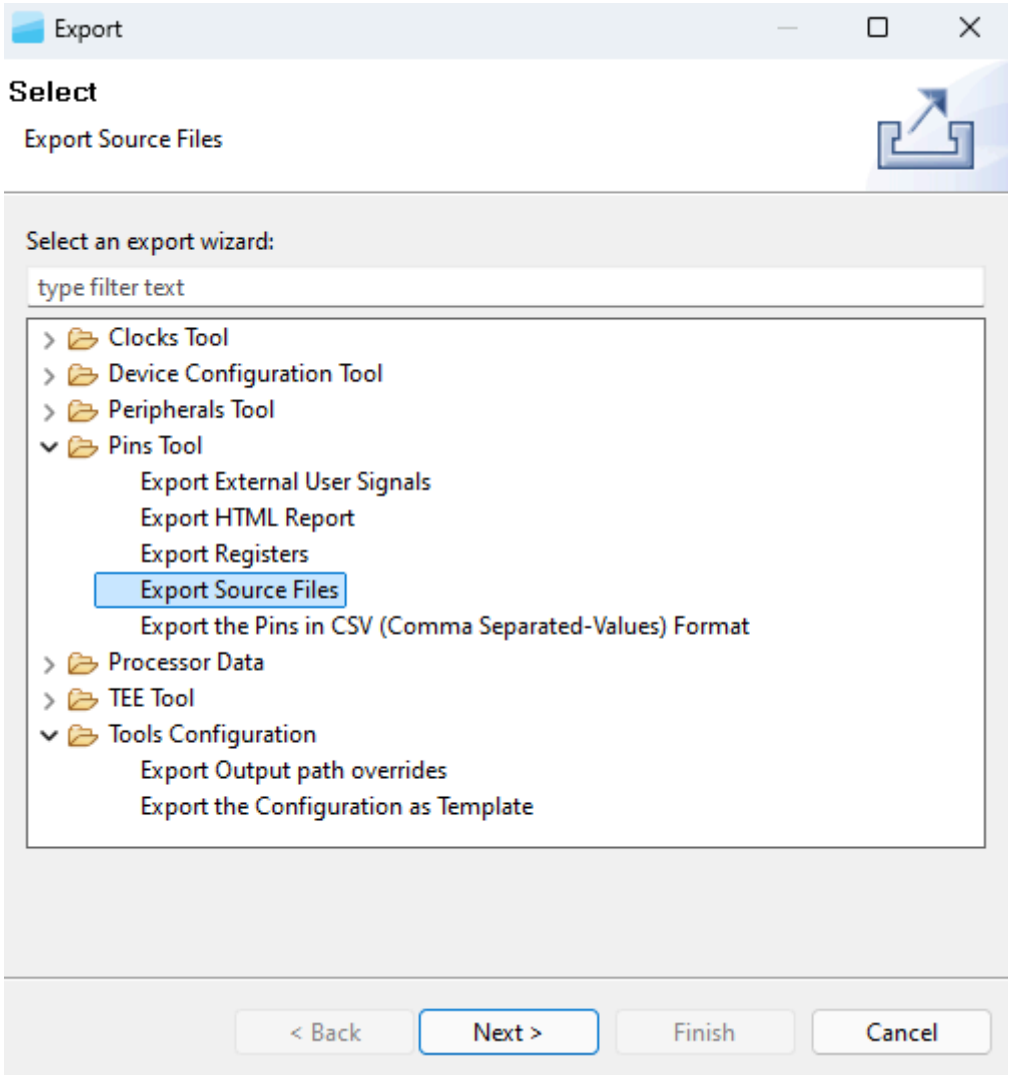


Figure 192. Export wizard

3. Click **Next**.
4. Select the target folder where you want to store the generated files.

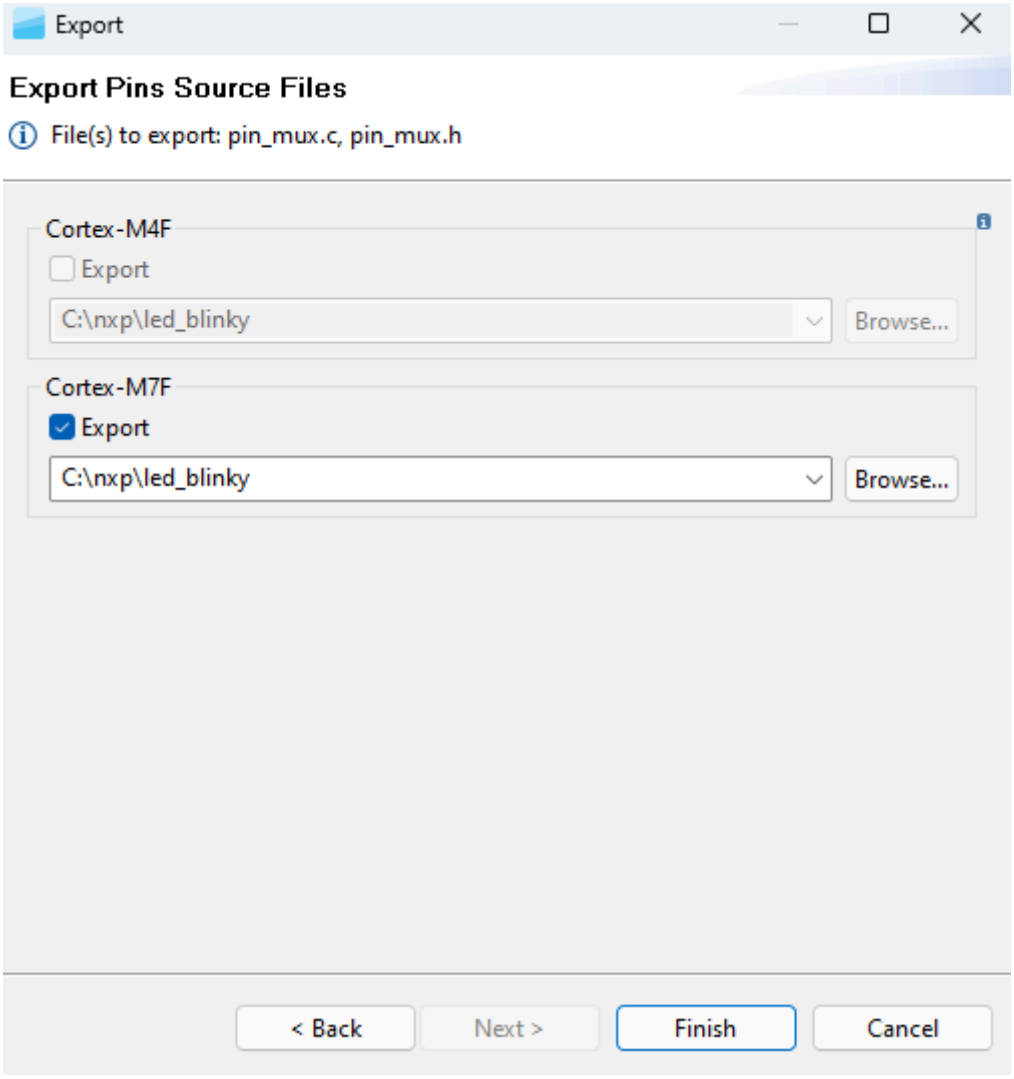


Figure 193. Select target folder

5. In case of multicore processors, select the cores you want to export.
6. Click **Finish**.

9.6 Exporting registers

You can export the content of tool-modified registers data using the Export wizard.

To export registers, follow these steps:

1. Select **File > Export** from the main menu.
2. Select the **Pins Tool > Export Registers** option.

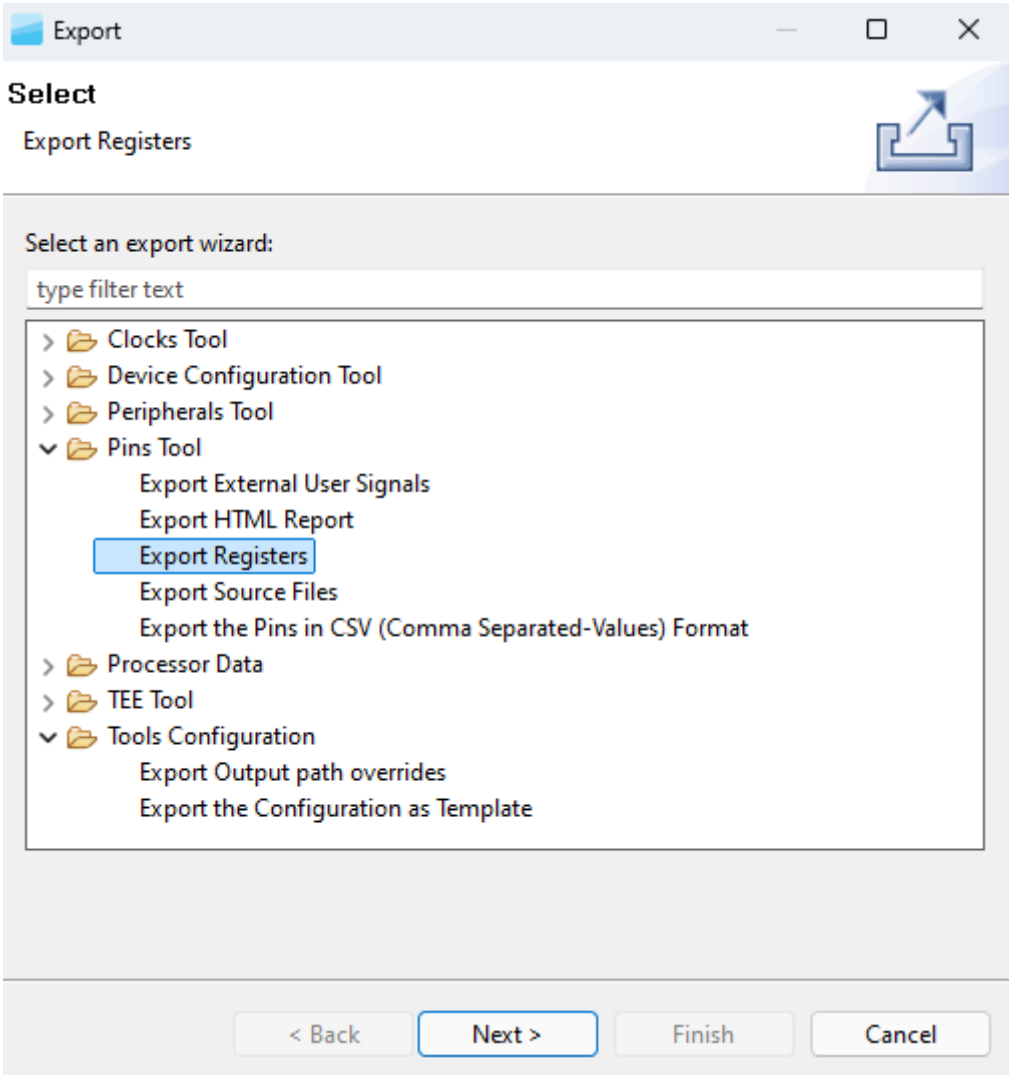


Figure 194. Export registers

3. Click **Next**.
4. Select the target file path where you want to export modified registers content.

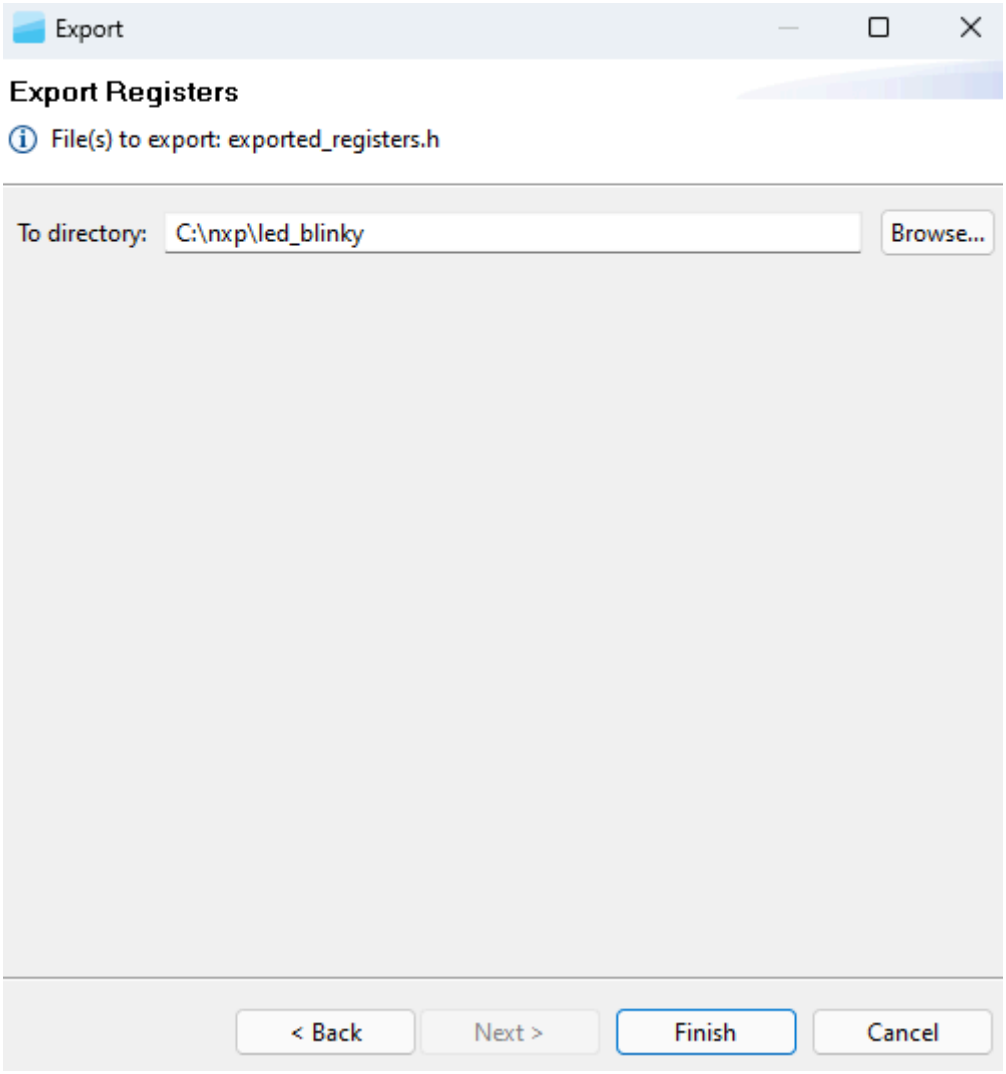


Figure 195. Export registers directory

5. Click **Finish**.

Note: The Export wizard can also be opened by clicking the **Export registers to CSV** button in the **Registers** view.

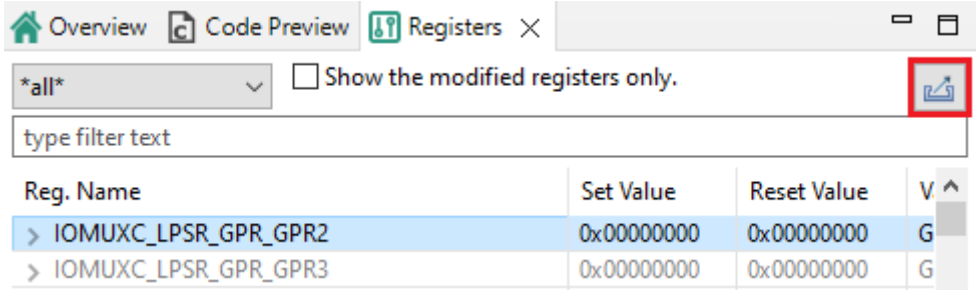


Figure 196. Export registers to CSV

9.7 Updating the SDK West project

MCUXpresso Config Tools generates source code modules. It 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 apply the required updates to a toolchain project managed by the SDK West tool. For details on creating the configuration for this project type, see Creating a new configuration for SDK West.

If you are using **MCUXpresso for Visual Studio Code**, it is recommended to invoke the Config Tools from there. In this case, a resolution of the requested changes in this IDE is offered. See Working with MCUXpresso Config Tools in the MCUXpresso for VS Code documentation for detailed guidelines.

To resolve the changes in the project manually, follow these steps:

1. After finishing the configuration, use the Update Code command to write the generated files to disk. The written files include a JSON file with the required changes in the toolchain project.
2. 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 appropriate cmake and kconfig files to address the changes needed.

9.8 Command-line execution

This section describes the Command-Line Interface (CLI) commands supported by the desktop application.

On error, the application exits:

- Tools v4.1 and older:
  - With ‘123321’ error code. The reason should be logged.
- Tools v5.0 and newer:
  - when a parameter is missing
  - when a tool error occurs

You can chain commands in CLI.

Notes regarding command-line execution:

- Command **-HeadlessTool** is used as a separator of each command chain.
- Each command chain works independently.
- Every chain starts with the **-HeadlessTool** command and continues to the next **-HeadlessTool** command, or end. (The only exception are commands from the framework that do not need the **-HeadlessTool** command).
- Commands that do not need the **-HeadlessTool** command, can be placed before the first **-HeadlessTool** if chained, or without **-HeadlessTool** when not chained.
- Commands from each tool are executed in a given order.
- Commands from the framework are not executed in a given order.
- The following commands are not executed in a given order:
  - ImportProject
  - Export MEX
  - ExportAll
- The application can exit with the following codes when unexpected behavior occurs:
  - When a parameter is missing: 1
  - When a tool error occurs: 2

Command example:

```
-HeadlessTool Clocks -MCU MK64FX512xxx12 -SDKVersion ksdk2_0 -ExportSrc C:/
exports/src -HeadlessTool Pins -MCU MK64FX512xxx12 -SDKVersion ksdk2_0 -ExportSrc
C:/exports/src -HeadlessTool Peripherals -MCU MK64FX512xxx12 -SDKVersion ksdk2_0 -
ExportSrc C:/exports/src
```

For performance reasons, when CLI is expected to be used multiple times with the same processor, the data is only loaded **if it is not already on disk**. If there is newer data on the server, it is **not updated.**

Long-running jobs share data, so they do not get updated in the middle of execution. To update local data that may have a newer version on the server, use the `-updateData` parameter.

Recommended usage:

- For manual one-time usage, include the `-updateData` parameter on the CLI.
- For multiple executions, for example, continuous integration, set your job up:
  - Use the first simple command with `-updateData`, which updates possibly outdated data.
  - Use all other commands in a batch run without this parameter: `copy /Y tools.exe toolsc.exe`

```
@rem updates all local data if newer exists
tools.exe -updateData -consoleLog -HeadlessTool Pins
@rem now runs tools many times
tools.exe -consoleLog -HeadlessTool Pins -Load some.mex -ExportAll c:/directory
tools.exe -consoleLog -HeadlessTool Pins -Load other.mex -ExportAll c:/
other_directory
@rem and so on.
```

The following commands are supported in the **framework**:

9.8.1 Table commands supported in the framework

Table 28. Commands supported in the framework

Command name	Definition and parameters	Description	Restriction	Example
Version of the product	`-version`	Shows the build version of the product to stdout and continues parsing other parameters. (since 6.0)		`-version`
Force language	`-nl {lang}`	Forces set language. {lang} is in ISO-639-1 standard	Removal of the '.nxp' folder from home directory is recommended, as some text might be cached. Only 'zh' and 'en' are supported.	`-nl zh`
Show console	`-consoleLog`	Log output is also sent to Java's System.out (typically back to the command shell if any)	None	
Empty configuration	`-EmptyConfig`	Ensures creating a new empty configuration without any content	Requires the `-HeadlessTool` command	`-HeadlessTool Pins -EmptyConfig`
Select MCU	`-MCU`	MCU to be selected by framework. Changes the processor in the	Requires the `-HeadlessTool`	`-HeadlessTool Pins -MCU MK64 FX512xxx12 -`

Table 28. Commands supported in the framework*...continued*

Command name	Definition and parameters	Description	Restriction	Example
		result configuration of the previous chain	and `-SDKversion` commands.	`SDKversion ksdk2_0 -HeadlessTool Pins -Load C:/conf/conf.mex -SDKVersion ksdk2_0 -MCU MK64FN1M0xxx12 -ExportMEX C:/conf/MK64.mex`
Select core	`-Core`	Select core for the configuration	Requires the `HeadlessTool, -MCU, -SDKversion` commands.	`-HeadlessTool Pins -Core core0`
Select board	`-Board`	Board to be selected by framework (MCU is automatically selected too) (since 6.0)	Requires the `-HeadlessTool` and `-SDKversion` commands.	`-HeadlessTool Pins -Board FRDM-K22F -SDKversion ksdk2_0`
Select kit	`-Kit`	Kit to be selected by framework (MCU and board are automatically selected too) (since 6.0)	Requires the `-HeadlessTool` and `-SDKversion` commands.	`-HeadlessTool Pins -Kit FRDM-K22F-AGM01 -SDKversion ksdk2_0`
Select SDK version	`-SDKversion`	Version of the MCU to be selected by framework	Requires the `-HeadlessTool` command	`-HeadlessTool Pins -MCU MK64FX512xxx12 -SDKversion ksdk2_0`
Select part number	`-PartNum`	Selects specific package of the MCU. Changes package in result configuration of previous chain, see the command about "-MCU"	Requires the `-MCU` and `-SDKversion` commands	`-HeadlessTool Pins -MCU MK64FX512xxx12 -SDKversion ksdk2_0 -PartNum MK64FX512VLL12`
Configuration name	`-ConfigName`	Name of newly created configuration - used in export. Rename the configuration	Requires the `-HeadlessTool` command	`-HeadlessTool Pins -MCU MK64FX512xxx12 -SDKversion ksdk2_0 -ConfigName "MyConfig" -HeadlessTool Pins -ConfigName "My RenameConfig"`
Select tool	`-HeadlessTool`	Selects a tool that must be run in headless mode	If the tool is disabled in the configuration, it is not enabled by this option. Use `-Enable` if the tool must be enabled via cmd line.	`-HeadlessTool Clocks`

Table 28. Commands supported in the framework*...continued*

Command name	Definition and parameters	Description	Restriction	Example
Load configuration	`-Load`	Loads the existing configuration from a (*.mex) file	None	`-Load C:/conf/conf.mex`
Export Mex	`-ExportMEX`	Exports the .mex configuration file after tools run. The argument is expected to be a folder or path to specify the .mex file	Requires the `-HeadlessTool` command	`-HeadlessTool Pins -MCU xxx -SDKversion xxx -ExportMEX C:/exports/my_config_folder -HeadlessTool Pins -ExportMEX C:/exports/my_config_folder/my.mex`
Export all generated files	`-ExportAll`	Exports all generated files (with source code, and so on). Code is regenerated before export. Includes `-ExportSrc` and in framework `-ExportMEX`. The Argument is expected to be a folder name.	Requires the `-HeadlessTool` command	`-HeadlessTool Pins -ExportAll C:/exports/generated`
Create a new configuration by importing a toolchain project	`-ImportProject {path}`	Creates a new configuration by importing the toolchain project. The parameter is a path to the root of the toolchain project.	Requires the `-HeadlessTool` command	`-HeadlessTool PrjCloner -ImportProject c:\test\myproject -HeadlessTool Peripherals -ImportProject c:\test\myproject -HeadlessTool PrjCloner -ImportProject c:\test\myproject\myproject.cbuild-gen-idx.yml -HeadlessTool Peripherals -ImportProject c:\test\myproject -sdkPath c:\test\sdk_dir`
Create a new configuration from toolchain project	`-CreateFromProject {path}`	Creates a new configuration (memory only) by importing a toolchain project based on the found .mex or YAML info. It makes no changes on the disk (mex and update code) and validates	None	`-HeadlessTool PrjCloner -CreateFromProject c:\test\myproject -HeadlessTool Peripherals -CreateFromProject c:\test\myproject -`

Table 28. Commands supported in the framework*...continued*

Command name	Definition and parameters	Description	Restriction	Example
		the configuration. The parameter is a path to the root of the toolchain project. Since v16: allows setting the toolchain project file path directly (for example, *.cbuild-gen-idx.yml, *.uvprojx, *.ewp, CMakeLists.txt); allows creating/opening configuration directly in UI from the toolchain project		`CreateFromProject c:\test\myproject\myproject.cbuild-gen-idx.yml`
Generate source files with custom copyright	`-CustomCopyright`	The file content is inserted as a copyright header comment into generated source files (.c, .h, .dts, .dtsi) that do not contain copyright	Requires the `-HeadlessTool` command	`-HeadlessTool Pins -Custom Copyright c:\test\copyright.txt`
Override the output path of the generated files	`-OutputPath Overrides`	Path to the file with rules that will be used to override output paths of the generated file. An empty list of rules removes the set rules.	Requires the `-HeadlessTool` command	`-HeadlessTool Pins -Output PathOverrides c:\test\outputPathOverrideRules.yaml`
Batch processing	`-BatchFile`	Path to the file with commands that are run on defined paths. For details, see: Batch processing	Requires the `-HeadlessTool` command; intended without other commands.	`-HeadlessTool Pins -BatchFile C:/conf/batchCommands.yaml`
Project link	`-ProjectLink`	A custom path to the toolchain project folder. It can be used as the absolute path or relative against the saved configuration. Empty string for default that is not saved in the configuration (since v14).	When the command is not used along with the `-HeadlessTool` command, the `-Load` command is required.	`-HeadlessTool Pins -ProjectLink C:/project -HeadlessTool Pins -ProjectLink armgcc -HeadlessTool Pins -ProjectLink "" -Load C:/conf/conf.mex -ProjectLink armgcc`
Update locally downloaded data	`-updateData`	Downloads data for already locally downloaded data if they have an update.	None	`-updateData`
Update code generated by tools	`-UpdateCode`	Performs the update code operation for all tools, the same way as is the default	Requires the `-HeadlessTool` command. Requires selection of a saved	`-HeadlessTool Clocks -UpdateCode -Load C:/conf/conf.`

Table 28. Commands supported in the framework*...continued*

Command name	Definition and parameters	Description	Restriction	Example
		behavior of the Update Code button and then clicking OK. If the configuration was modified in UI tools to generate only some sources, only these sources are generated. Select a saved configuration, for example via the `-Load` argument. The output folder is determined from the location of the saved configuration. That can be changed using the `-Project Link` argument.	configuration, for example, using the `-Load` argument.	`mex -Load C:/conf/conf.mex -HeadlessTool Clocks -Update Code` **Note:** "-Load" can be both before or after "-HeadlessTool" argument, "-Update Code" must be after "-HeadlessTool"
Run tools in Open CMSIS "generator mode"	`-Opencmsis GeneratorCgen`	It generates the Open CMSIS cgen.yml file into the project output folder specified by *.cbuild-gen-idx.yml.		`-CreateFrom Project c:\test\myproject\myproject.cbuild-gen-idx.yml -Opencmsis GeneratorCgen`

9.8.2 Command-line execution - Pins Tool

This section describes the Command Line Interface (CLI) commands supported in the Pins Tool.

9.8.2.1 Table Commands supported in Pins Tool

Table 29. Commands supported in Pins Tool

Command name	Definition and parameters	Description	Restriction	Example
Enable tool	`-Enable`	Enables the tool if it is disabled in the current configuration	Requires the `-HeadlessTool Pins` command	`-HeadlessTool Pins -Enable`
Import C files	`-ImportC`	Imports .c files into configuration. Importing is done after loading mex and before generating outputs	Requires the `-HeadlessTool Pins` command	`-HeadlessTool Pins -ImportC C:/imports/file1.c C:/imports/file2.c`
Export all generated files (to simplify all exports commands to one command)	`-ExportAll`	Exports generated files (with the source code, and so on). The code is regenerated before the export. Includes -ExportSrc, -Export CSV, -ExportHTML and	Requires the `-HeadlessTool Pins` command	`-HeadlessTool Pins -Export All C:/exports/generated`

Table 29. Commands supported in Pins Tool...*continued*

Command name	Definition and parameters	Description	Restriction	Example
		in framework -Export MEX. The argument is expected to be a folder		
Export Source files	`-ExportSrc`	Exports generated source files. The code is regenerated before the export. The argument is expected to be a folder	Requires the `-HeadlessTool Pins` command	`-HeadlessTool Pins -ExportSrc C:/exports/src`
Export CSV file	`-ExportCSV`	Exports the generated .csv file. The code is regenerated before export. The argument is expected to be a folder	Requires the `-HeadlessTool Pins` command	`-HeadlessTool Pins -ExportCSV C:/exports/csv`
Export HTML report file	`-ExportHTML`	Exports the generated HTML report file. The code is regenerated before the export. The argument is expected to be a folder	Requires the `-HeadlessTool Pins` command	`-HeadlessTool Pins -ExportHTML C:/exports/html`
Export registers	`-ExportRegisters`	Exports the registers tab into a folder. The code is regenerated before the export. The argument is expected to be a folder	Requires the `-HeadlessTool Pins` command	`-HeadlessTool Pins -Export Registers C:/exports/regs`

9.8.3 Command-line execution - Clocks Tool

This section describes the Command-Line Interface (CLI) commands supported by the Clocks Tool.

9.8.3.1 Table Commands supported in Clocks Tool

Table 30. Commands supported in Clocks Tool

Command name	Definition and parameters	Description	Restriction	Example
Enable tool	`-Enable`	Enables the tool if it is disabled in the current configuration	Requires the `-HeadlessTool Clocks` command	`-HeadlessTool Clocks -Enable`
Import C files	`-ImportC`	Imports .c files into the configuration (disables other tools when importing into an empty configuration)	Requires the `-HeadlessTool Clocks` command	`-HeadlessTool Clocks -ImportC C:/imports/file1.c C:/imports/file2.c`
Export all generated files (to simplify all exports commands to one command)	`-ExportAll`	Exports generated files (with the source code and all the available export objects). The code is regenerated	Requires the `-HeadlessTool Clocks` command	`-HeadlessTool Clocks -Export All C:/exports/generated`

Table 30. Commands supported in Clocks Tool...*continued*

Command name	Definition and parameters	Description	Restriction	Example
		before the export. Includes -ExportSrc and in framework -ExportMEX. The argument is expected to be a folder		
Export Source files	`-ExportSrc`	Exports generated source files. The code is regenerated before the export. The argument is expected to be a folder	Requires the `-HeadlessTool Clocks` command	`-HeadlessTool Clocks -ExportSrc C:/exports/src`
Export HTML report file	`-ExportHTML`	Exports the generated HTML report file. The code is regenerated before the export. The argument is expected to be a folder	Requires the `-HeadlessTool Clocks` command	`-HeadlessTool Clocks -Export HTML C:/exports/html`
Export registers	`-ExportRegisters`	Exports the registers tab into the folder. The code is regenerated before the export. The argument is expected to be a folder	Requires the `-HeadlessTool Clocks` command	`-HeadlessTool Clocks -Export Registers C:/exports/regs`

9.8.4 Command-line execution - Peripherals Tool

This section describes the Command-Line Interface (CLI) commands supported by the Peripherals Tool.

9.8.4.1 Table Commands supported in Peripherals Tool

Table 31. Commands supported in Peripherals Tool

Command name	Definition and parameters	Description	Restriction	Example
Enable tool	`-Enable`	Enables the tool if it is disabled in the current configuration	Requires the `-HeadlessTool Peripherals` command	`-HeadlessTool Peripherals -Enable`
Import C files	`-ImportC`	Imports .c files into the configuration. Importing is done after loading mex and before generating outputs	Requires the `-HeadlessTool Peripherals` command	`-HeadlessTool Peripherals -ImportC C:/imports/file1.c C:/imports/file2.c`
Export all generated files (to simplify all exports commands to one command)	`-ExportAll`	Exports generated files (with source code and so on). The code is regenerated before the export. Includes -ExportSrc, -Export HTML, and in the	Requires the `-HeadlessTool Peripherals` command	`-HeadlessTool Peripherals -ExportAll C:/exports/generated`

Table 31. Commands supported in Peripherals Tool*...continued*

Command name	Definition and parameters	Description	Restriction	Example
		framework -Export MEX. The argument is expected to be a folder		
Export Source files	`-ExportSrc`	Exports generated source files. The code is regenerated before the export. The argument is expected to be a folder	Requires the `-HeadlessTool Peripherals` command	`-HeadlessTool Peripherals -ExportSrc C:/exports/src`
Export the HTML report file	`-ExportHTML`	Exports the generated HTML report file. The code is regenerated before the export. The argument is expected to be a folder	Requires the `-HeadlessTool Peripherals` command	`-HeadlessTool Peripherals -ExportHTML C:/exports/html`
Migrate all Peripherals tool components to the versions used in the toolchain project	`-Migrate ComponentsTo ToolchainVersion`	Migrates all instances of Peripherals tool components, which are not configuring the version used in the toolchain project, to the version of SDK component used in the toolchain project. No changes are done when the toolchain is not linked or the Peripherals tool component already configures the version of the SDK component used in the toolchain project	Requires the `-HeadlessTool Peripherals` command	`-HeadlessTool Peripherals -MigrateComponents ToToolchain Version -Export All C:/exports/ toolchainVersions`
Migrate all Peripherals tool components to the highest supported version of the SDK component	`-Migrate ComponentsTo LatestVersion`	Migrates all instances of Peripherals tool components to the MCU's highest supported version of the SDK component, which the Peripherals tool component configures. No changes are done when already using the highest version available on the MCU	Requires the `-HeadlessTool Peripherals` command	`-HeadlessTool Peripherals -MigrateComponents ToLatestVersion -ExportAll C:/exports/toolchain Versions`
Regenerate all PLU configurations	`-PLURegenerate Configurations`	Regenerates the content of all PLU instances present in the configuration. Currently only the PLU instances in Verilog file and Verilog text	Requires the `-HeadlessTool Peripherals` command	`-Load C:/xyz.mex -Headless Tool Peripherals -PLURegenerate Configurations`

Table 31. Commands supported in Peripherals Tool*...continued*

Command name	Definition and parameters	Description	Restriction	Example
		modes are regenerated by new Verilog code synthesis and optimization of the model. Requires usage of mapping comment in the Verilog code		`-ExportAll C:/exports/plu`

9.8.5 Command-line execution - TEE Tool

This section describes the Command Line Interface (CLI) commands supported in the TEE Tool.

9.8.5.1 Table Commands supported in TEE Tool

Table 32. Commands supported in TEE Tool

Command name	Definition and parameters	Description	Restriction	Example
Enable tool	`-Enable`	Enables the tool if it is disabled in the current configuration	Requires the `-HeadlessTool TEE` command	`-HeadlessTool TEE -Enable`
Export all generated files (to simplify all exports commands to one command)	`-ExportAll`	Exports generated files (with source code and so on). The code is regenerated before the export. Includes -ExportSrc, -ExportHTML, and in framework -Export MEX. The argument is expected to be a folder	Requires the `-HeadlessTool TEE` command	`-HeadlessTool TEE -ExportAll C:/exports/generated`
Export Source files	`-ExportSrc`	Exports generated source files. The code is regenerated before the export. The argument is expected to be a folder	Requires the `-HeadlessTool TEE` command	`-HeadlessTool TEE -ExportSrc C:/exports/src`
Export registers	`-ExportRegisters`	Exports the registers tab into a folder. The code is regenerated before the export. The argument is expected to be a folder	Requires the `-HeadlessTool TEE` command	`-HeadlessTool TEE -Enable -Export Registers C:/exports/regs`

9.8.6 Command-line execution - Project Cloner

This section describes the Command Line Interface (CLI) commands supported in Project Cloner.

9.8.6.1 Table Commands supported in Project Cloner

Table 33. Commands supported in Project Cloner

Command name	Definition and parameters	Description	Restriction	Example
Specify SDK path	`-SDKpath {path}`	Specify an absolute path to the root directory of the SDK package	@since v3.0	`-SDKpath c:\\nxp\\SDK_2.0_MKL43Z256xxx4`
Clone SDK example project	`-PG_clone {board} {example} {toolchain} {wrkspc} {prjName}`	Clones the specified SDK example project under a new name: 1. {board} - subdirectory of the board in the SDK package 2. {example} - a relative path from the board subdirectory and name of the example, for example demo_apps/hello_world; use '/' as a path separator 3. {toolchain} - id of the toolchain to create a project (see toolchains - toolchain - id) 4. {wrkspc} - an absolute path where a new project must be created, for example, projects workspace 5. {prjName} - name of the new project	Requires `-HeadlessTool PrjCloner` and `-SDKpath {path}` @since v3.0	`-HeadlessTool PrjCloner -SDKpath c:\\nxp\\SDK_2.0_MKL43Z256xxx4 -PG_clone twrk64f120m demo_apps/hello kds c:\\tmp exmpl`

9.8.7 Command-line execution - DCDx (Device configuration)

This section describes the Command Line Interface (CLI) commands supported in DCDx.

9.8.7.1 Table Commands supported in DCDx

Table 34. Commands supported in DCDx

Command name	Definition and parameters	Description	Restriction	Example
Enable tool	`-Enable`	Enables the tool if it is disabled in the current configuration.	Requires the `-HeadlessTool DCDx` command	--HeadlessTool DCDx -Enable
Import C file	`-ImportC`	Imports the `.c` file into the configuration.	Requires the `-HeadlessTool DCDx` command	-HeadlessTool DCDx -MCU MIMXRT1052xxxxB -SDKversion ksdk2_0 -ImportC c:\import\evkbimxrt1050_sdram_ini_dcd.c

Table 34. Commands supported in DCDx*...continued*

Command name	Definition and parameters	Description	Restriction	Example
Export all generated files(to simplify all exports commands to one command)	`-ExportAll`	Exports generated files (with source code, and so on) The code is regenerated before the export. Includes -ExportSrc and in framework -Export MEX. The argument is expected to be a folder.	Requires the `-HeadlessTool DCDx` command	-HeadlessTool DCDx -MCU MIMXRT1052xxxxB -SDKversion ksdk2_0 -ExportAll c:\export
Export Source files	`-ExportSrc`	Exports generated source files. The code is regenerated before the export. The argument is expected to be a folder.	Requires the `-HeadlessTool DCDx` command	-HeadlessTool DCDx -MCU MIMXRT1052xxxxB -SDKversion ksdk2_0 -ExportSrc c:\export
Source file name without ext	`-SrcName`	This option can be used with -ExportSrc. The argument specifies the source file name without the extension to be used for naming generated source files.	Requires the `-HeadlessTool DCDx` command	-HeadlessTool DCDx -MCU MIMXRT1052xxxx B -SDKversion ksdk2_0 -ExportSrc c:\export -SrcName evkbimxrt1050_sdram_ini_dcd
Import Legacy C file	`-ImportLegacyC`	Imports the `.c` file into the configuration. The file is expected to be a valid DCD `.c` file, DCD data array that does not contain a YAML configuration.	Requires the `-HeadlessTool DCDx` command	-HeadlessTool DCDx -MCU MIMXRT1052xxxxB -SDKversion ksdk2_0 -ImportLegacyC c:\import\evkbimxrt1050_sdram_ini_dcd.c
Keep the name of the imported source file	`-KeepSrcName`	This option can be used with -Import LegacyC. The name of the imported source file must be used for generated source files names.	Requires the `-HeadlessTool DCDx` command	-HeadlessTool DCDx -MCU MIMXRT1052xxxxB -SDKversion ksdk2_0 -ImportLegacyC c:\import\evkbimxrt1050_sdram_ini_dcd.c -ExportMcuTemplate c:\export -KeepSrcName

9.9 Managing data and working offline

With the **Data Manager**, you can download, import, and export processor data. This feature is especially useful if you want to make the best out of the tools while staying offline.

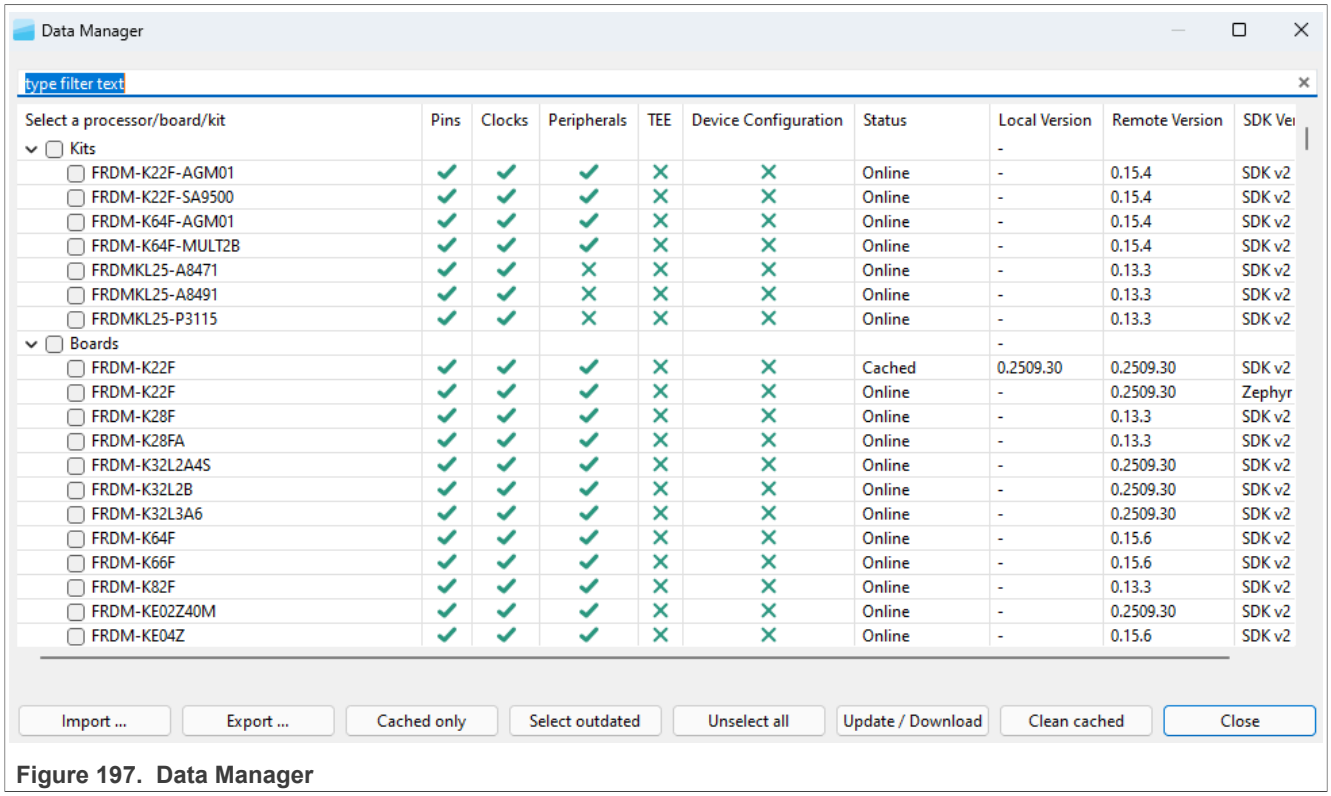


Figure 197. Data Manager

9.9.1 Working offline

You can create a new configuration even without access to the Internet by working with cached processor data. To do so you must download processor-specific data before going offline, or import data downloaded and exported from an online computer.

To work offline, select **Edit > Preferences > Work offline** from the **Menu bar**.

9.9.2 Downloading data

You can download required processor data with **Data Manager**.

Note: By default, the data is downloaded and cached automatically during the **Creating a new standalone configuration for processor, board, or kit** process.

To download processor data, do the following:

Note: Internet connection is required for data download.

1. In **Menu bar**, select **File > Data Manager**.
2. In **Data Manager**, select the processor/board/kit you want to work with from the list.
3. Click **Update / Download** and confirm.
   The data is now downloaded on your local computer, as shown by the **Cached** status in **Data Manager**.

You can now close your Internet connection and work with the data by selecting **File > New… > Create new standalone configuration for processor, board, or kit** in the **Start development** wizard.

9.9.3 Downloading data from MCUXpresso SDK Builder

You can download required processor data from **MCUXpresso SDK Builder** website.

Note: An NXP account is required for data download from the **MCUXpresso SDK Builder** website.

To download processor, board, or kit data, do the following:

1. Go to MCUXpresso SDK Builder home page.
2. Open **Select Development Board**.
3. In the left-side menu, select **Offline data**.
4. Use the **Search for HW platform** filter field or use the tree view to find your processor, board, or kit.
5. Use the **Download Config Tools Data** button under **Actions** to download data for a specific version of the Config Tools.

You can also download processor, board, or kit data for an existing SDK Build in your **SDK Dashboard**:

1. Go to MCUXpresso SDK Builder home page.
2. Open **Access My SDK Dashboard**.
3. Select the SDK Build for which you want to download Config Tools data and click the **Download** button.
4. In the **Downloads** window, select **MCUXpresso Config Tools > Download Config Tools Data**.
5. In the next menu, use the **Download Config Tools Data** button to download data for a specific version of the Config Tools.

To import the downloaded data, see Importing data.

9.9.4 Exporting data

With **Data Manager**, you can export downloaded processor data in a ZIP format.

To export data, do the following:

1. In **Menu bar**, select **File > Data Manager**.
2. In **Data Manager**, click **Export**.
3. In **Export Processor Data** window, select the processor data you want to export.
4. Click **Browse** to specify the location and name of the resulting ZIP file.
5. Click **Finish**.
   Data is now saved on your local computer in a ZIP format. You can physically (for example, with a USB stick) move it to an offline computer.
   Note: You can also export downloaded data by selecting **File > Export > Processor Data > Export Processor Data** from the **Menu bar**.

9.9.5 Importing data

You can import processor data from another computer with **Data Manager**, provided this data is available locally.

To import data, do the following:

1. In **Menu bar**, select **File > Data Manager**.
2. In **Data Manager**, select **Import**.
3. In **Import Processor Data** dialog, click **Browse**.
4. Specify the location of the ZIP file that you want to import and click **OK**.
5. Choose the data to import by selecting the checkbox in the table.
6. Click **Finish**.
   The data is now imported to your offline computer, as shown by the **Cached** status in **Data Manager**. You can now work with the data by selecting **New…> Create new standalone configuration for processor, board, or kit** in the **Start development** wizard.
   Note: You can also import data by selecting **File > Import > Import Processor Data** from the **Menu bar**.

9.9.6 Updating data

You can keep cached data up to date with the **Data Manager**.

Note: If you select the relevant option in **Edit > Preferences** in the **Menu bar**, data is updated automatically or after a prompt.

Note: Internet connection is required for data update.

To update cached data, do the following:

1. In **Menu bar**, select **File** > **Data Manager**.
2. In **Data Manager**, filter outdated data by clicking **Select outdated**.
3. Click **Update / Download** and confirm.
   You can always check versions of your data by clicking **Cached only** and comparing version information in the **Local Version** and **Remote Version** columns.
   You can clean all cached data by selecting **Clean cached**. It removes all processor, board, kit, and component data, as well as SDK info files from your computer.
   Note: This action does not affect user templates.

9.10 Output path overrides

This section contains rules that override the path, including the name, of the output files generated by the tools. The rules are applied in the Update Code, Export Wizard, and Command-Line Export commands. The rules are stored in the MEX configuration.

Note: An invalid path is logged as a warning and the original non-overridden path is used.

Rules can be edited in the Output Path Override dialog box in the configuration settings. The new rule is added to the end of the list, the removal is performed for the selected element. The rules are applied to the path in a defined order, which can be changed. The rule contains:

- Enabled - defines whether the rule is used by the applied path or skipped.
- Description - used as a user-friendly description of the rule
- Regular expression - matches the overriding parts in the whole output path. The format follows the Java regular expression syntax.
- Replacement expression - used as a replacement of all matches in the path. Substring groups can be referenced by using placeholders $1, $2, and so on.

The output path override rules can be exported using the wizard to a YAML file. The structure of the YAML file is similar to that of the dialog box.

Example content of the output path override YAML file:

```
outputPathOverrides:
-description: Rule group.h
enabled:true
regex:(bo)ar(d)(/.*\.h)
replacement: $2ar$1$3
-description:Rule2
...
```

The second way to set the rules is to replace them by overriding the output path from the yaml file using wizards or the command line. Rules are used only if all rules are valid. An empty list deletes the current rules. An empty list in the output path overrides the yaml file.

```
outputPathOverrides: [
]
```

9.11 Batch processing

Batch processing can be used to simplify and speed up processing of multiple configurations in an automated way using the command-line interface.

Batch processing is initiated by the headless command "`-BatchFile`". When the command is used, the tool operation is controlled by the specified batch file passed as an argument.

Example:

```
-HeadlessTool Pins -BatchFile C:/conf/batchCommands.yaml
```

Note: Use this command without specifying other tool commands except "`-HeadlessTool`".

9.11.1 Content of the batch file

The batch file content is in YAML format and consists of the folders or files list and the list of command steps. The tool executes all steps for each individual path in the given order. If the 'folders' entity is used, the 'files' entity cannot be used, and vice versa.

Note: Paths can be defined as absolute or relative to the batch file.

9.11.1.1 Folders list

The entity "folders" contains a list of the folders to be processed.

Example of the folders list:

```
!!batch_process
folders:
- c:/ test/frdm64
- c:/_ddm/tmp/test/lpc69
steps:
- action: ImportC
  tool: Pins
  args: ${folder}/src/board/pin_mux.c
- action: ImportC
      tool: Clocks
      args: ${folder}/src/board/clock_config.c
- action: ExportAll
      tool: Clocks
      args: ${folder}/export/clocks
```

Note: The steps element description is given below.

9.11.1.2 Files list

The entity "files" specifies the list of the files to be processed.

Example of the list of files:

```
!!batch_process
files:
- c:/_ddm/tmp/test/frdm64/src/board/pin_mux.c
- c:/_ddm/tmp/test/lpc69/src/board/pin_mux.c
steps:
- action: ImportC
  args: ${file}
  tool: Pins
```

```
- action: ImportC
  tool: Clocks
  args: ${folder}/clock_config.c
```

9.11.1.3 Steps list

The steps entity contains a list of steps to be processed for every listed path in a similar way as standard headless command-line tool commands.

Each step is defined as a structure:

- Action - the name of a command-line tool command without "-" at the beginning.
- Tool - the name of the tool in the product that runs the action.
- Args - arguments of the actions, a space between the parameters is expected.
  - The following variables can be used and are substituted with the appropriate value when the "files" list is processed:
    - `${folder}` - replaced by folder (without separator at the end) where the file is located
    - `${file}` - the full file path
    - `${fileName\}` - for filename without path
  - In case the "folders" list is processed:
    - `${folder}` - the folder path without separator at the end

See the section Command-line execution for the list of commands and their description.

The configuration is always automatically cleaned after processing each path (as if the `-EmptyConfig` command was used). The batch file without any paths runs once and cannot use any variables.

Note: All paths on loading are converted to the path format with "/" as a separator.

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11 Revision history

Table 35. Revision history

Document ID	Release date	Description
GSMCUXCTUG v.18.0	17 September 2026	Updated for v.26.09
GSMCUXCTUG v.17.0	24 June 2026	Updated for v.26.06
GSMCUXCTUG v.16.0	25 March 2026	Updated for v.26.03
GSMCUXCTUG v.15.0	16 December 2025	Updated for v. 25.12
GSMCUXCTUG v.14.0	18 September 2025	Updated for v. 25.09
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GSMCUXCTUG v.11.0	15 January 2025	Updated for v. 24.12
GSMCUXCTUG v.10.0	24 September 2024	Updated for v.16.1
GSMCUXCTUG v.9.0	01 July 2024	Updated for v.16
GSMCUXCTUG v.8.0	19 April 2024	Updated for v.15.1
GSMCUXCTUG v.7.0	10 January 2024	Updated for v.15
GSMCUXCTUG v.6.0	31 July 2023	Updated for v.14
GSMCUXCTUG v.5.0	2 January 2023	Screenshots are updated, minor updates
GSMCUXCTUG v.4.0	20 September 2022	Updated for v.12.1
GSMCUXCTUG v.3.0	30 June 2022	Updated for v.12
GSMCUXCTUG v.2.0	22 December 2021	New features are added, screenshots are updated.
GSMCUXCTUG v.1.0	01 July 2021	Minor changes
GSMCUXCTUG v.0	27 April 2020	Initial version

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