MPLAB® Code Configurator v3.xx User's Guide

MPLAB® Code Configurator (MCC) User's Guide

Preface

Important: Notice to customers:
All documentation becomes dated, and this manual is no exception. Microchip tools and documentation are constantly evolving to meet customer needs, so some actual dialogs and/or tool descriptions may differ from those in this document. Refer to our website (www.microchip.com) to obtain the latest documentation available.

Documents are identified with a “DS” number. This number is located on the bottom of each page, in front of the page number. The numbering convention for the DS number is “DSXXXXXXXXA”, where “XXXXXXXX” is the document number and “A” is the revision level of the document.

Introduction
This document describes how to install, configure and use the MPLAB® Code Configurator (MCC) software tool during or before starting the development process of an embedded software application designed with PIC® microcontrollers.

Recommended Reading
This user's guide refers to MCC operation only. Other applicable documents are listed below. The following Microchip documents are available and recommended as supplemental reference resources:

- Release Notes for the MPLAB Code Configurator
- MPLAB X IDE User’s Guide

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1. Introduction

The MPLAB® Code Configurator (MCC) generates driver code using a Graphical User Interface (GUI). The generated drivers control the peripherals on PIC® microcontrollers. The GUI provides an easy means for setting up the configuration of the peripherals. MCC is a plugin for the MPLAB® X IDE and MPLAB® Xpress.

Additionally, the MCC is used to configure and generate libraries, allowing code generation and configuration for software libraries and external components.

The generated drivers or libraries can be used in any Microchip PIC or AVR® device application program. MCC requires creating or opening an already existing project in the MPLAB X IDE or MPLAB Xpress before launching the MCC plugin. This is necessary as the MCC needs to know the device used in the project, to have access to device-specific information like registers, bits, configurations, and to set up the MCC GUI.

The MCC generates source and header files based on selections made in the GUI. The generated files are added to the active project of MPLAB X IDE or MPLAB Xpress.

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2. Installation

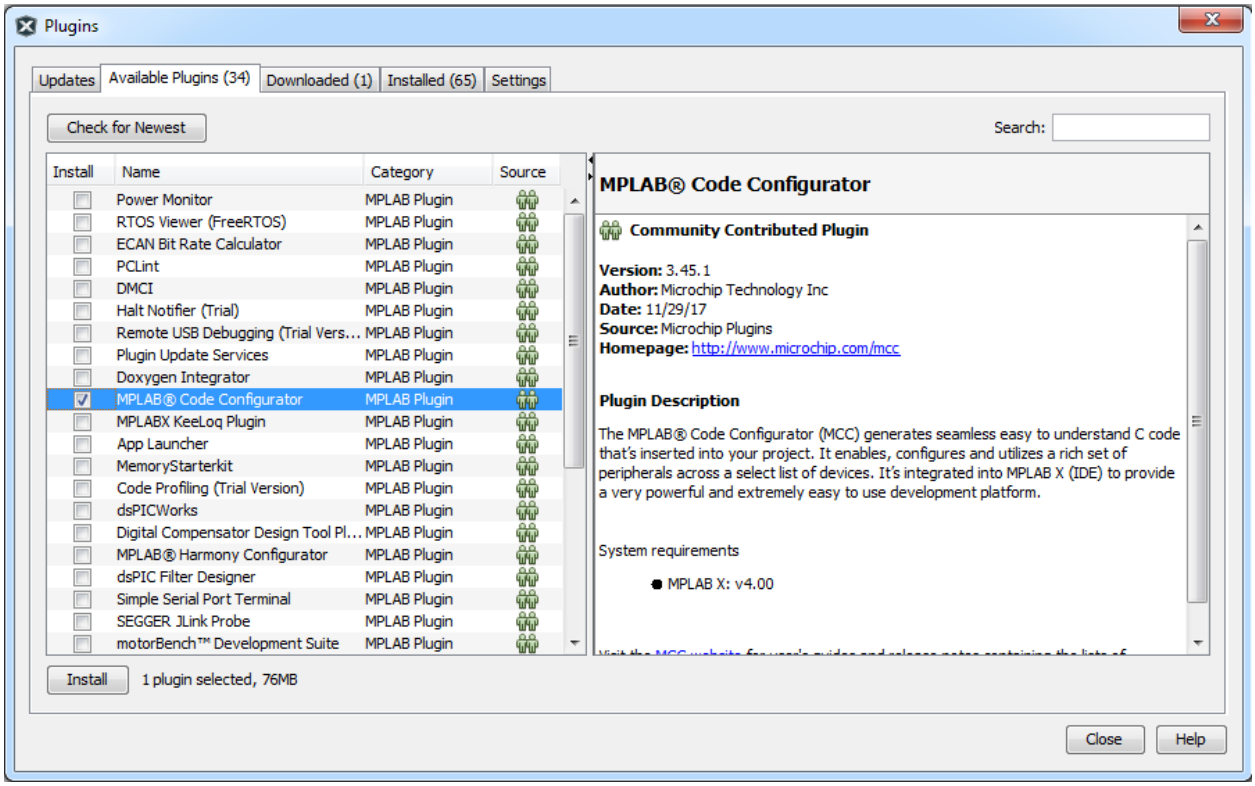
The MPLAB Code Configurator can be installed in two ways: via the Microchip Plugins Update Center or from the Microchip website. The following chapters describe these procedures and also the MCC update process.

2.1 Installing MPLAB® Code Configurator from the Microchip Plugins Update Center

By default, MCC is not installed together with the MPLAB® X IDE and must be downloaded separately and installed. One way to do so is via the Microchip Plugins Update Center:

1. In the MPLAB X IDE, go to **Tools -> Plugins**.
2. Go to the **Available Plugins** tab.
3. Select MPLAB Code Configurator and click the **Install** button. See figure below.
4. The Plugin installer opens. Click **Next** and check the Terms and Agreements. After this step, the Plugin installer begins downloading the MCC plugin.
5. When the MCC plugin download is complete, MPLAB X IDE will ask to be restarted. Upon restart, the plugin is installed.
6. MCC can now be opened on a new or already existing MPLAB X IDE project. See Section 4.1 “Setting Up MPLAB X IDE and Launching MCC.“

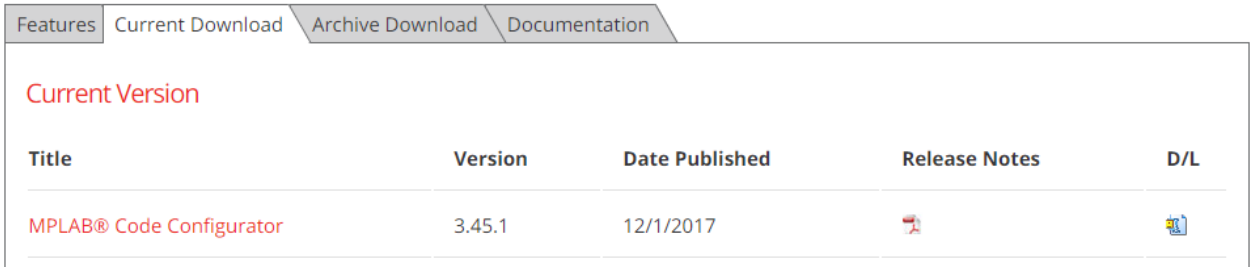
Figure 2-1. Installing MPLAB® Code Configurator



2.2 Installing MPLAB® Code Configurator from the Microchip Website

The MCC plugin can also be downloaded from the Microchip website by typing the address www.microchip.com/mcc in a web browser, selecting the **Current Download** tab, and downloading the Current Version `.zip` file. See Figure 2-2.

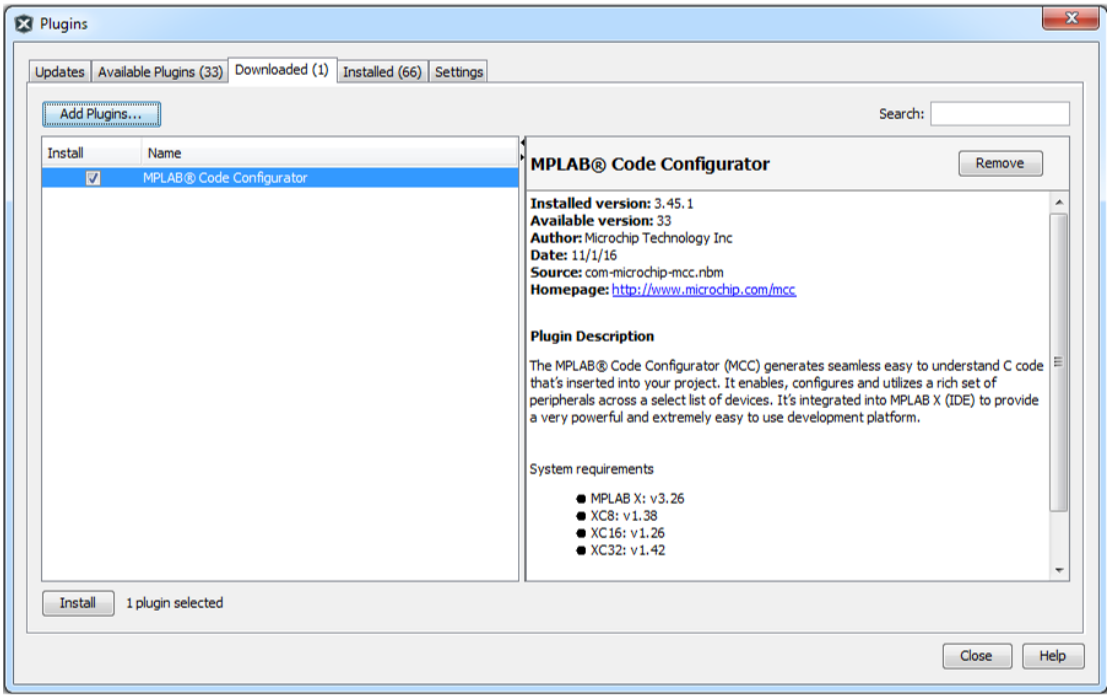
Figure 2-2. Downloading MCC from the Microchip Website



Once downloaded, extract the archive which contains the MCC plugin to a preferred location. To install the downloaded plugin, complete the following instructions:

1. Open MPLAB X IDE.
2. Go to **Tools -> Plugins**.
3. Select the **Downloaded** tab, and click on the **Add Plugins...** button.
4. Navigate to the folder where the downloaded `.zip` file was extracted and select the MCC plugin. It may have a `.nbm` file extension.
5. Click on the **Install** button. MPLAB X IDE will ask to be restarted. Upon restart, the plugin is installed. See figure below.
6. MCC can now be opened on a new or already existing MPLAB X IDE project. See Section 4.1 “Setting Up MPLAB X IDE and Launching MCC.”

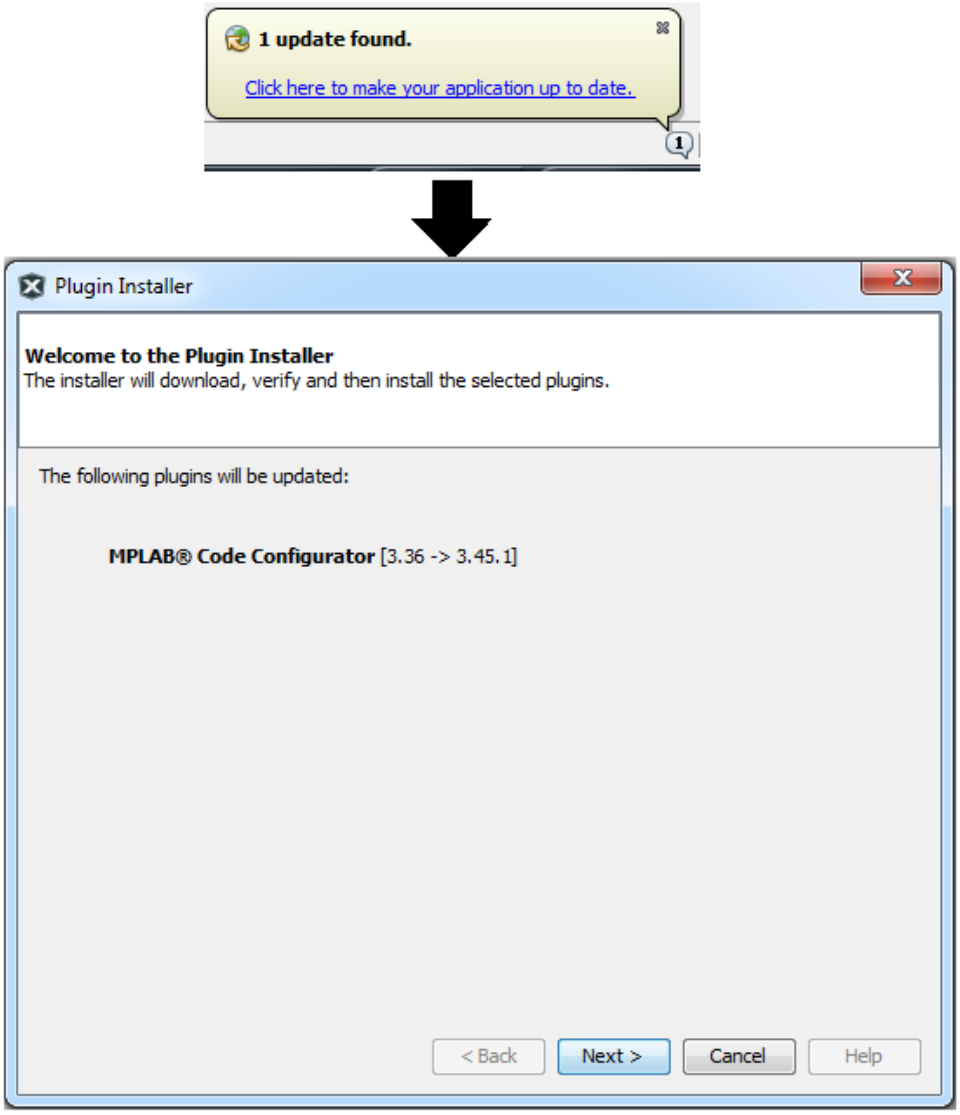
Figure 2-3. Installing MCC from Downloaded File



2.3 Updating MPLAB® Code Configurator

When an MCC version newer than the one installed is available, the MPLAB X IDE will display a notification in the bottom right corner of the IDE window. By clicking on it, the plugin update wizard is launched. In the wizard, click on the **Install** button, and the software will download and install the new MCC plugin version. See figure below.

Figure 2-4. Updating MPLAB® Code Configurator



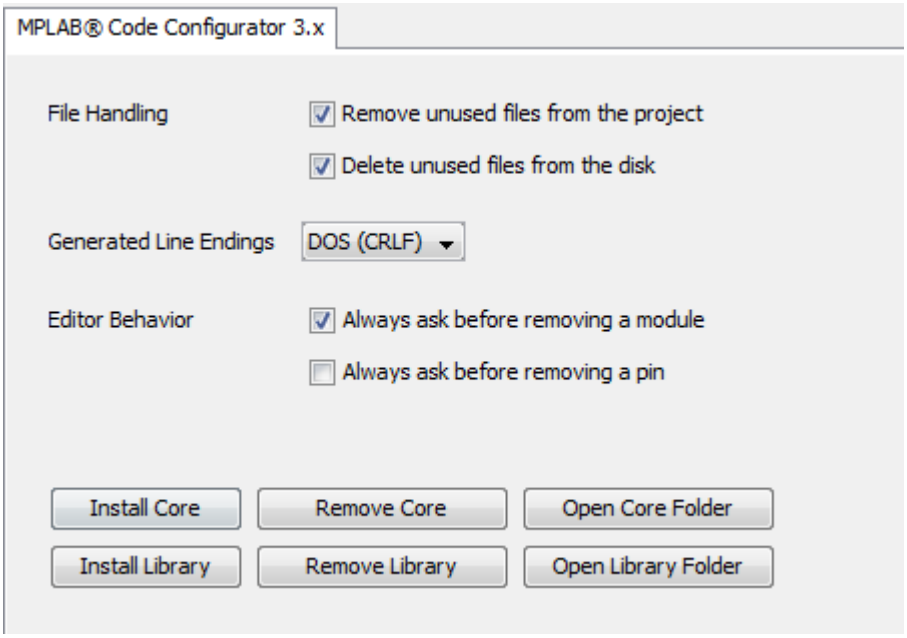
2.4 Older MPLAB® Code Configurator Versions

Older MCC versions are available at the same www.microchip.com/mcc address, under the **Archive Download** tab.

3. MCC Plugin Options

Several aspects of the operation of the MCC can be managed by using the “Options” panel (see figure below), which can be invoked by clicking **Tools** → **Options** → **Plugins** → **MPLAB Code Configurator** in the menu bar of the MPLAB X IDE.

Figure 3-1. The MCC Option Panel



The MCC Options panel offers the following controls:

- File Handling
- Generated Line Endings
- Editor Behavior

3.1 File Handling

1. **Remove unused files from the project:** Enabling this option tells the MCC to remove `.c` and `.h` files from modules which were removed from the MCC configuration between the subsequent generation procedures. This option ensures that the files included in the project (and thus in the compilation) are only those which are strictly necessary. However, this will not delete the files from the disk.
2. **Delete unused files from the disk:** This option gets enabled only when selecting “Remove unused files from the project,” which performs the additional task of deleting unused files from the disk. Once a file is deleted, it cannot be recovered.

3.2 MCC Line Endings

Specify the type of line endings to use in the files generated by MCC. The default is DOS (<CR><LF>). Unix line endings (<LF>) may be specified.

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3.3 Editor Behavior

1. **Always ask before removing a module:** Enabling this control enables the “Are you sure?” dialog box which appears while disabling or removing an enabled module.
2. **Always ask before removing a pin:** Enabling this control enables the “Are you sure?” dialog box which appears while deallocating or removing a pin from a peripheral.

3.4 Installing an MPLAB® Code Configurator Library

The MPLAB Code Configurator provides a peripheral or software library installation feature. This feature can be used to add MCC-compatible libraries. There are several libraries for various applications the user can choose from on the http://www.microchip.com/mcc webpage. An MCC Library file may have a `.jar` or a `.mc3lib` file extension. Once this file is downloaded, open the MPLAB X IDE, and in the above menu go to **Tools** → **Options** → **Plugins** → **MPLAB Code Configurator 3.x**, click on the **Install Library** button and select the `.jar` file via the **Open File** dialog box. The Versions window will now list the newly added library as installed.

If there are multiple versions of a library, the newly installed one will not be the loaded one. To load a particular version of a library, right-click on it and select “Mark for Load,” which will then highlight the user’s choice. If the user has multiple libraries with multiple versions in each, one from each can be highlighted before loading them. See Section 3.3. “Versions Area” for more details about switching library versions.

Removing a library is done using the **Remove Library** button. The File selection dialogue window will open the **Library** folder. Select the library to remove and click on the **Remove** button on the File selection dialogue. The library can be verified if it is no longer present on the computer by going to the Versions operating area - the removed library version is not present on the computer anymore. It may be present as available for download.

If a library currently in use is attempted to be removed (green tick in the Versions area), MCC will not allow this to happen. To remove that library version, switch to another version, go back to the Options window and press the **Remove Library** button again for the library version to delete.

3.5 Installing an MPLAB® Code Configurator Core

The MPLAB Code Configurator provides a core switching feature. This feature works simultaneously on various projects with different core versions without uninstalling or reinstalling the plugin. To install a new core, download first the new core from the Microchip MCC webpage (http://www.microchip.com/mcc). This file may have a `.mc3core` file extension. Once this file is downloaded, open the MPLAB X IDE and in the above menu go to **Tools** → **Options** → **Plugins** → **MPLAB Code Configurator 3.x**, click on the **Install Core** button and select the `.mc3core` file via the **Open File** dialog box. The Versions window will now list the fresh core installation.

To switch to another core version, either double click on it, or right-click on it and select “Switch Core Version.” The Versions window will now refresh the core selection with the user’s choice. The core installations can always be checked by opening the **Core** folder, from **Tools** → **Options** → **Plugins** → **MPLAB Code Configurator 3.x** path. Refer to Section 3.4. “Versions Area” for more details about core switching.

Removing a core version is done from the **Remove Core** button. The Folder selection dialogue window will open the "Core" folder. Select the core version to remove and click on the **Remove** button on the Folder selection dialogue. The core version can be verified it is no longer present on the computer anymore by going to the Versions operating area - the core version removed is not present on the computer anymore. It may be present as available for download.

If a core version currently in use is attempted to be removed (green tick in the Versions area), MCC will not allow this to happen. To remove that core version, switch to another core version, go back to the Options window and press the **Remove Core** button again for the core version to delete.

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4. Generating MCC Code

Now that MCC has been installed and its main operating areas are learned, it is time to set up MCC according to the user's needs and begin configuring the project. The following subsections cover basic MCC operation and the code generation process.

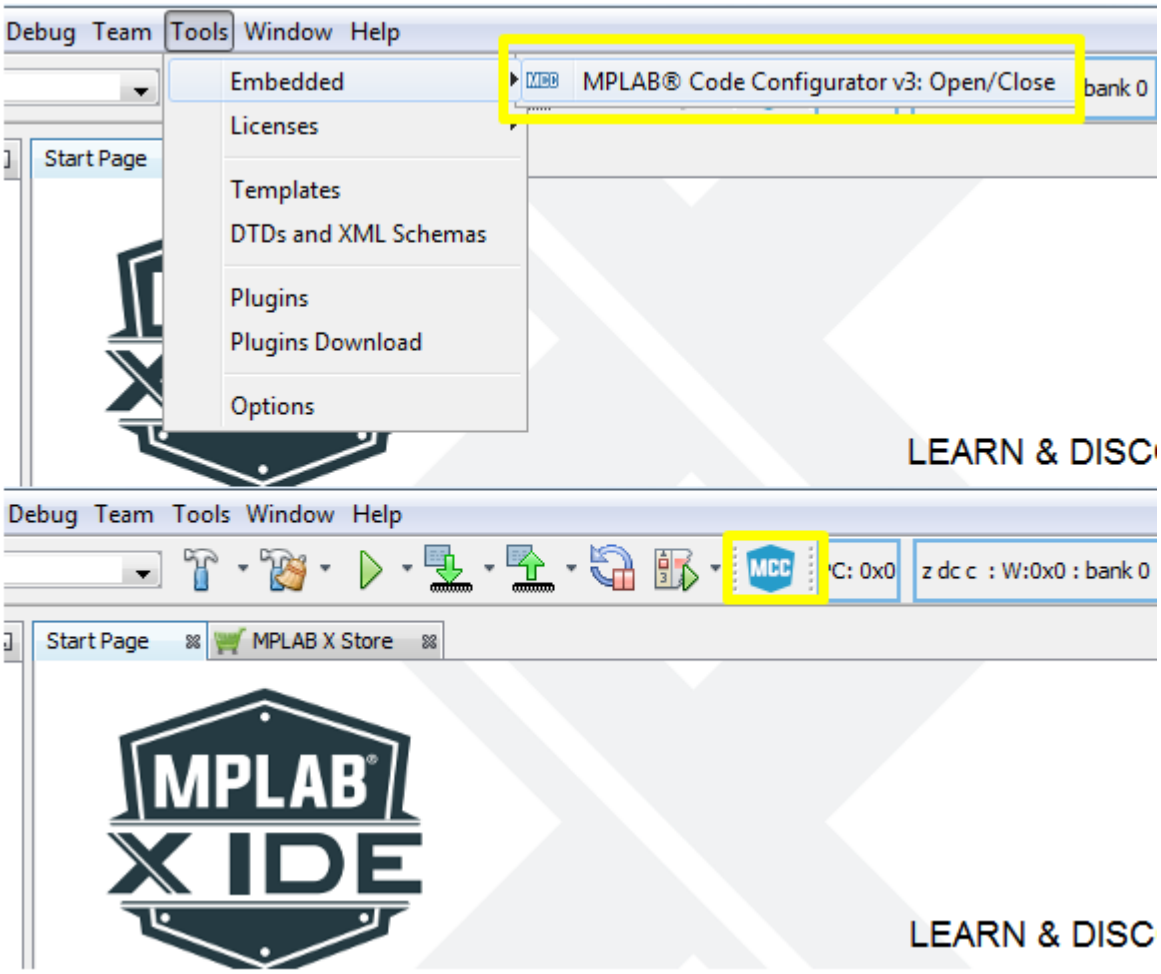
4.1 Setting Up MPLAB® X IDE and Launching MCC

To generate drivers using the MCC in MPLAB X IDE, follow these steps:

1. Create a new MPLAB X IDE project or open an existing project (see figure below).
2. If multiple projects are open in MPLAB X IDE, set one as the main (active) project by selecting "Set as Main Project" in the MPLAB X IDE. For the active project, the MCC automatically includes the generated driver files.
3. Open the MCC plugin tool. In the menu bar of the MPLAB X IDE, go to **Tools** → **Embedded** → **MPLAB Code Configurator 3.x: Open/Close**. Or click on the MCC icon in the MPLAB X IDE toolbar.

Note: For MAC users, the "Embedded" selection will be under the Preferences menu. This launches the MCC GUI.

Figure 4-1. Opening the MCC in MPLAB® X IDE



When opening MCC for the first time on an MPLAB X project, the configuration saving dialog will be displayed asking for a name and saving path for the MCC configuration file attached to the project. The MCC configuration is also saved to the disk when the **Generate** button is pressed or if the MPLAB X IDE **Save** button is clicked. An existing

MCC configuration file can be loaded by double-clicking on the desired `.mc3` file in the **Important Files** section of the MPLAB X IDE project.

4.2 Generating Code

When the MCC **Generate** button is pressed in the Project Resources window, the listed actions are performed by MCC. Details of the code generation are shown in the MCC **Output** tab. See 6.4.2. The MPLAB® Code Configurator - Output Tab.

1. The MCC configuration file is saved.
2. MCC generates code for the peripheral or library module if the module's configuration has changed since the last time MCC generated code for that module.

Note: All modules can be forced to be generated by MCC by right-clicking in the Project Resources section from the 6.1. Resource Management Area and selecting "Force Update," before clicking on the **Generate** button.

If MCC attempts to regenerate a file on the disk that has been modified outside of MCC, the **Merge [MCC]** window is displayed. Use the **Merge [MCC]** window to select whether to keep the modified file (default action) or replace the modified content with the content generated by MCC.

The **Merge [MCC]** window is discussed in Section 4.3.2 "The Merge [MCC] Window."

4.2.1 Saving and Loading the MCC Configuration

Saving and loading the MCC configuration is integrated into the MPLAB X IDE Save and Load functions. The MCC configuration is saved whenever the **Generate** button is pressed. The MCC configuration can also be saved by clicking on the MPLAB X IDE Save tool or selecting **Save** from the File menu.

The MCC configuration file is included in the MPLAB X IDE project under the **Important Files** folder. The configuration file uses the extension `.mc3`. Double-clicking on the MCC configuration file will cause that MCC configuration to be loaded.

4.2.2 The Merge [MCC] Window

If any of the files generated by the MCC have been edited outside of MCC and saved to the disk, then the **Merge [MCC]** window appears in the Composer Area. Use the **Merge [MCC]** window to select whether to keep the edits or replace them with the newly generated MCC code.

Note: The user's edits will never be overwritten by the MCC-generated code, except explicit action in the **Merge [MCC]** window.

When changes have been made to both a generated file and the corresponding MCC UI within the Composer Area, the **Merge [MCC]** window shown in Figure 4-2 will be displayed. The **Merge [MCC]** window allows resolving the conflicts between the newly generated file and the edits made to the file.

When the newly generated MCC content has been accepted, MCC makes the changes to the file. To the MPLAB X IDE, these changes are the same as if they were typed in the new content. The normal MPLAB X IDE edit undo can be used in the MCC Merge operation.

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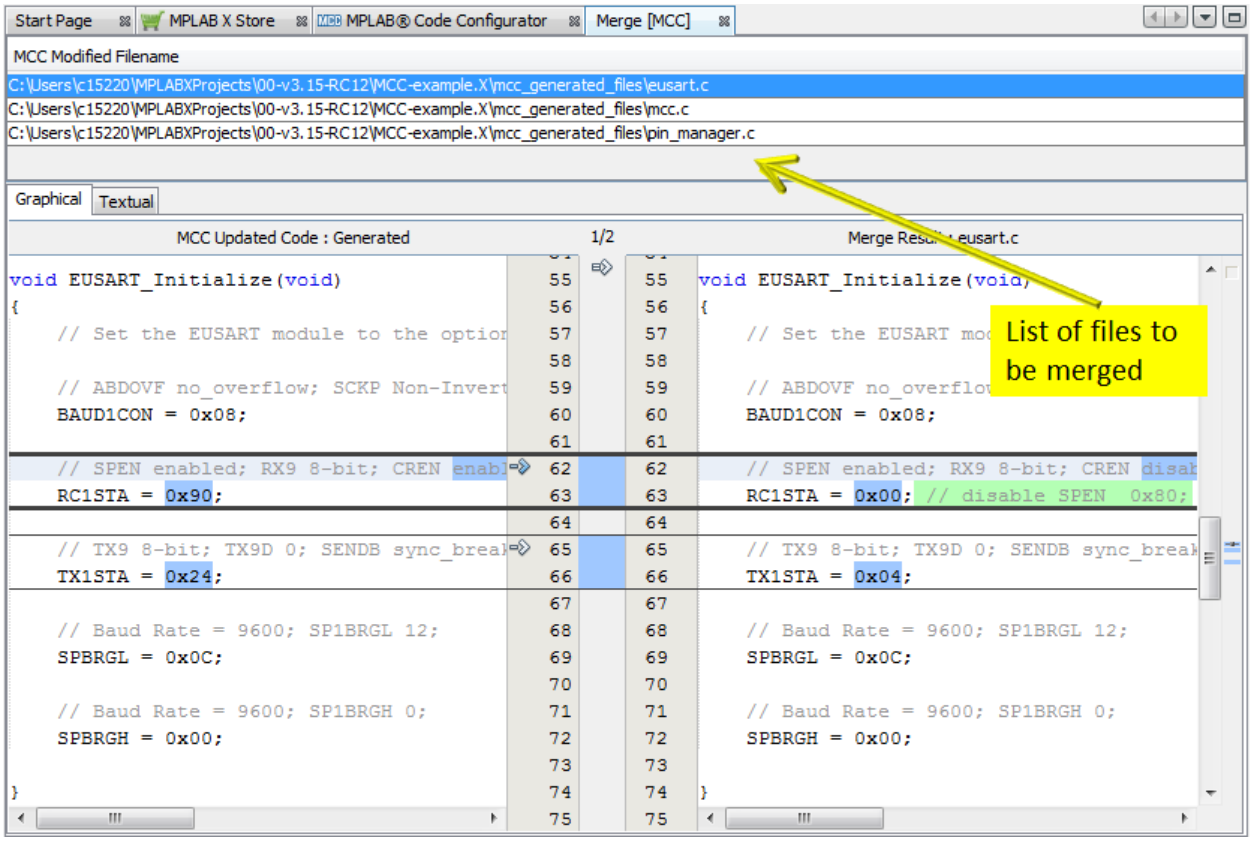
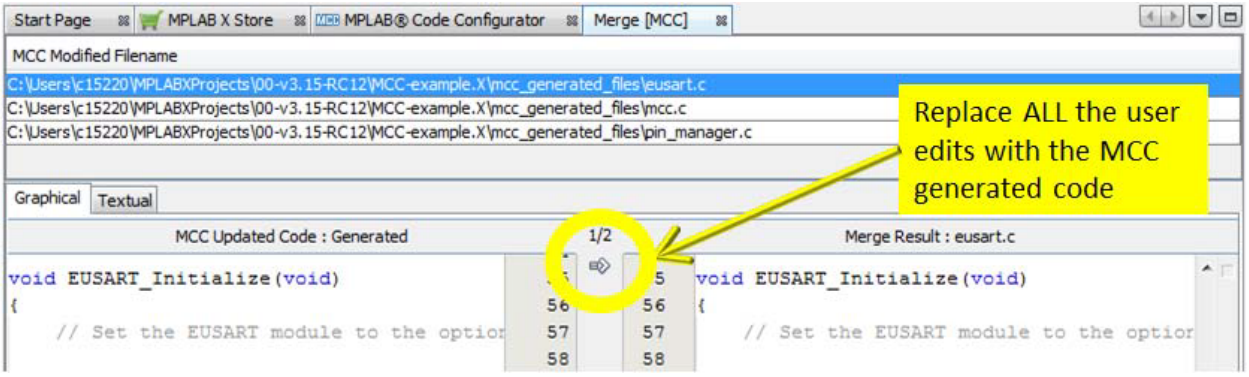
Figure 4-2. Merge [MCC] Window - File List



A list of all the files that need to be merged is shown at the top of the **Merge [MCC]** window. Each file in the list must be selected, in turn, to ensure that all of the newly generated code is incorporated into the project.

At the top of the **Merge [MCC]** window, in the center margin, there is an arrow, as shown in Figure 4-3. Clicking on the arrow will replace all the edits in the current file with the MCC updated code that the MCC has just generated. The numbers above the arrow indicate the current difference and the total number of differences.

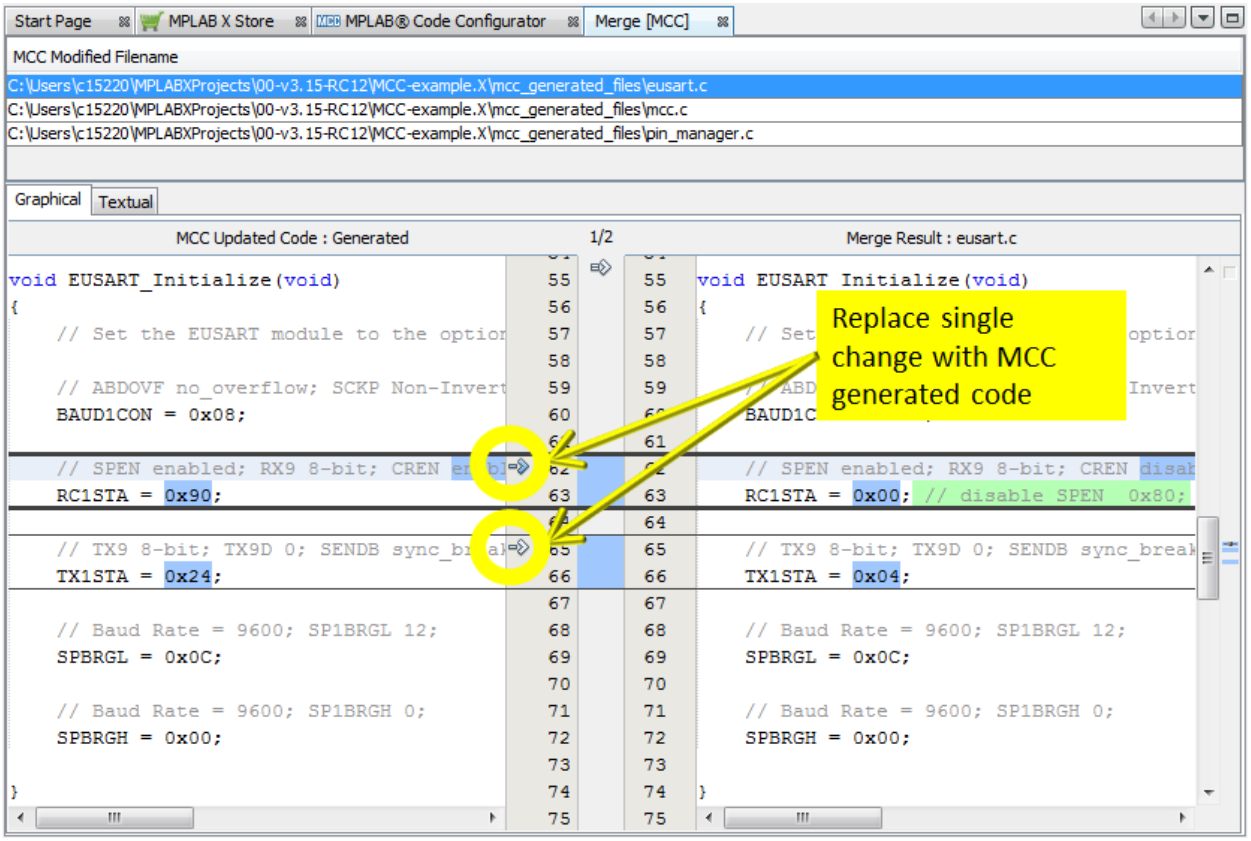
Figure 4-3. Merge [MCC] Window - Replacing All Edits with MCC Generated Code



The individual lines of **MCC Updated Code** can be selected to replace the edited code. As shown in Figure 4-4, clicking on the arrows in the right margin of the left window will copy the **MCC Updated Code** to the generated driver file. Once the changes are accepted, the Merge mechanism will remove the highlighted file and highlight the next file

on the list. A warning will be generated if the Merge mechanism is closed before all the changes are accepted to ensure all updates are completed.

Figure 4-4. Merge [MCC] Window - Replacing Single Changes with MCC Generated Code



Notes:

1. Remember to merge the code for every file shown in the file list of the **Merge [MCC]** window.
2. Be sure to save all the changed files from the Merge process.

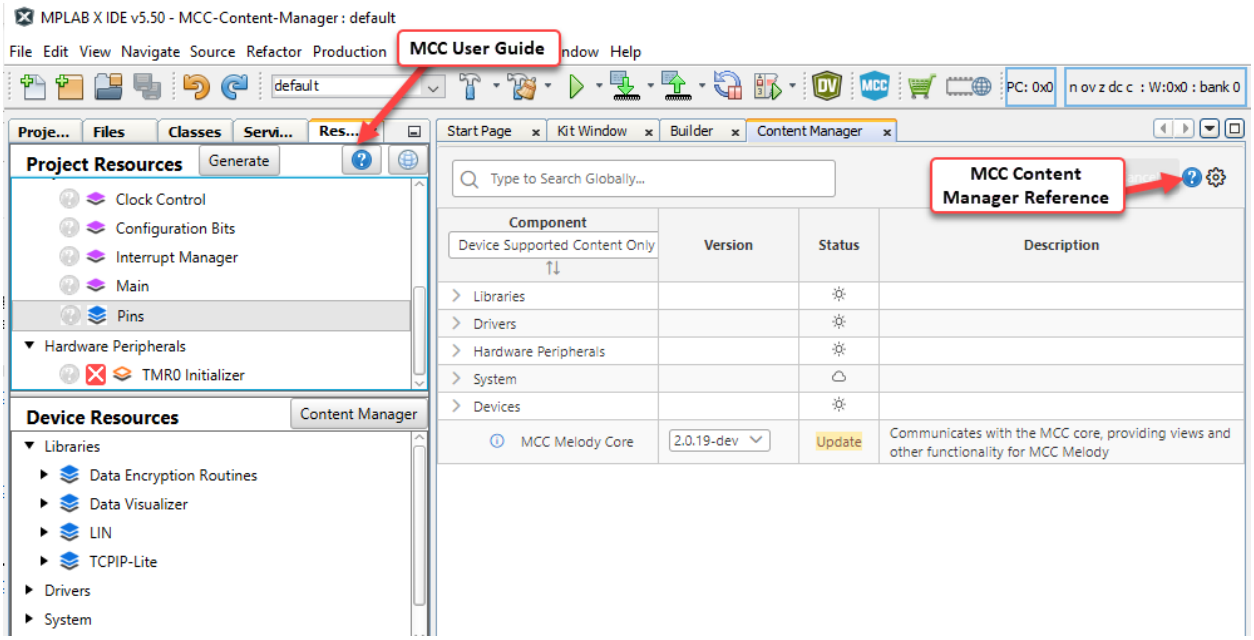
5. MCC Content Manager

The MCC Content Manager (CMT) allows users to select specific versions of the component modules and libraries to be used for their MCC projects. Refer to the MCC Content Manager Reference for more information.

The MCC Melody Content Manager, supports content management and versioning at a component level.

- This means that component modules of a project can be updated on its own, separate from the other modules. For example, if you have a working project, except for a bug on the ADC driver. Now, rather than needing to update all the other drivers in your system, like the UART and Timers, you will be able to update just the ADC.
- This component level content versioning granularity will be especially useful in the latter stages of your project development, as you near production. At this stage, when almost everything is working perfectly, one may want to change one modules one needs to, due to either bugs or needed features.

Figure 5-1. Opening the MCC Content Manager Reference, MCC User Guide

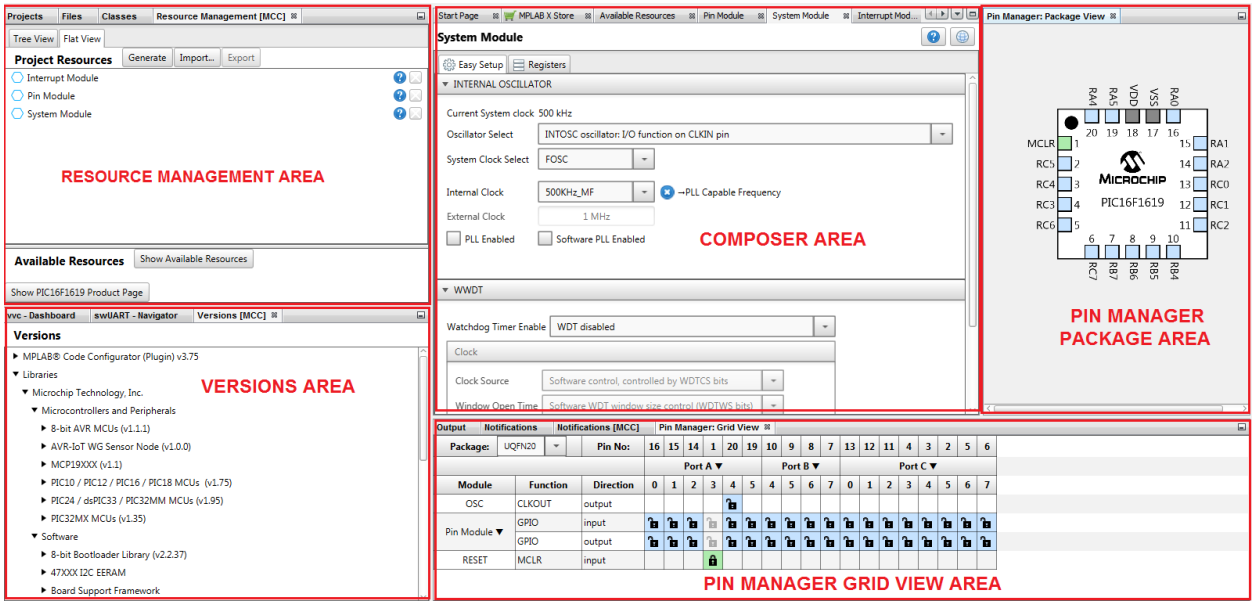


6. MCC Classic

MCC Classic is the original plugin and user interface for the MPLAB® Code Configurator. It consists of six main operating areas, as shown in Figure 3-1.

1. **Resource Management Area:** Contains the Project Resources and all the available/device resources. See 6.1. Resource Management Area section for more details.
2. **Versions Area:** Shows the complete list of MCC Cores, Peripheral Libraries, and Software Libraries which can be used with the selected device. Some of these are installed together with MCC. Others are available for download. Depending on the selected device, some core and library versions are interchangeable. See 6.2. Versions Area section for more details.
3. **Pin Manager Package View Area:** Graphic interface for pin selection and configuration. Bidirectional operation with the Pin Manager Grid View. See 6.3. Pin Manager Package View Area section for more details.
4. **Pin Manager Grid View Area:** Contains three inner tabs: Notifications (errors, warnings and general information regarding the current selections), Pin Manager - Grid View (a table version of the Pin Module Package View) and Output (MCC Log & MPLAB X IDE Log). See 6.4. Pin Manager Grid View Area chapter for more details.
5. **Composer Area:** This is the main area in which a peripheral or library driver can be configured. It displays the possible configurations of the peripheral/library. See 6.5. The Composer Area chapter for more details.

Figure 6-1. MCC Operating Areas



Note: All operating areas are dockable. Each can be dragged and dropped into another position, even out of the MPLAB X IDE main window (closing the IDE, however, will close all MCC windows, including those moved outside the IDE).

6.1 Resource Management Area

The Resource Management Area comes with two separate views: the tree view and the flat view. Both provide access to the complete list of software/peripheral components and the selected components for the current project configuration. For more details on each view, refer to 6.1.1. Resource Management Area - Tree View and 6.1.2. Resource Management Area - Flat View sections.

The Project Resources section is common to both views of the Resource Management Area. This section displays the list of on-chip peripherals, external components, and libraries that have been selected for the current MCC project. The information specific to each of the two views regarding this section is available in 6.1.1. Resource Management Area - Tree View and 6.1.2. Resource Management Area - Flat View sections.

There system modules are always available in the Project Resources section. These modules cannot be removed. The modules are:

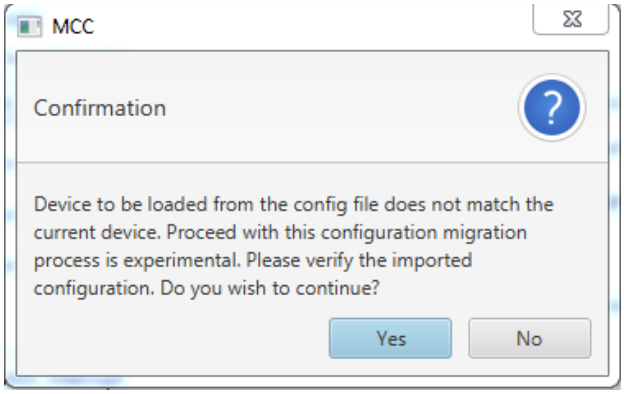
1. **Interrupt Module:** Configures the interrupts for the device.
2. **Pin Module:** Configures the pins for the device.
3. **System Module:** Configures the system clock, Configuration bits, and other device-level functions for the device.

A module in the Project Resources window can be removed from the project by clicking the or button to the right of the module name in the Project Resources section. The module will be removed from the MPLAB X IDE project. When a module is removed from the Project Resources, all the unsaved configuration information for that module is lost.

At the top of the Project Resources section, there are three buttons:

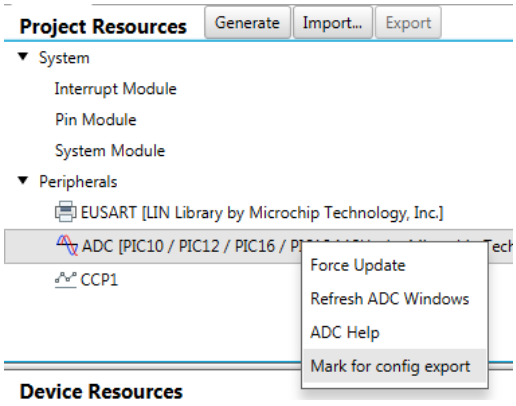
- **Generate:** Once the project configuration has been completed, clicking this button will trigger the code generation process for that specific configuration.
- **Import:** An MCC configuration file (`.mc3` extension) can be imported into the current project. If the selected configuration has been created for a device other than the one used in the current project, an alert message pops up offering the possibility of an experimental configuration migration. Once a configuration file is selected, MCC loads and configures all modules detailed in the selected configuration file. If there is a match between a module from the configuration and a module already loaded in the current project, the settings for the loaded module are overwritten with the ones from the imported configuration file. This is useful for the partial configurations created manually or provided by the Export functionality detailed below. In the case of importing a configuration created for a different device than the one used in the current project, an alert message pops up offering the possibility of an experimental configuration migration or canceling the import process (See Figure 6-2). During device migration, the import process might fail due to hardware mismatches between the two devices. In this case, a backup configuration file is created and saved in the project folder. (See Section 6 “MCC Device Migration”).

  Figure 6-2. Importing a Configuration Created for a Different Device



- **Export:** Allows the export of partial configurations. Any loaded module in the Project Resources, except System modules, can be selected for a partial configuration by right-clicking on the module and selecting "**Mark for config export**" (see figure below for more details). All modules marked for export are shown in bold. Clicking the **Export** button creates an MCC configuration consisting only of the modules marked for export. To remove the selection, use "Unmark from config export" for a specific module or "Unmark all for config export" for all modules/components selected for export.

Figure 6-3. The Context Menu of the Project Resources Area



Besides the partial configuration export mechanism, the Context menu of the Project Resources Area (displayed above) includes several other operations on the loaded components or modules, such as:

- **Force Update**: Regenerates code for all the selected modules/components, even if no modifications were added to their configuration. See Section 4.3 “Generating Code”.
- **Refresh [module_name] Windows:** Reopens the configuration window of the selected module if that window has been closed previously. If the Context menu is invoked by right-clicking under the Resources list with no module/component selected, this option will be available as Refresh Module Windows, and its effect will be global. All previously closed MCC windows will be reopened.
- **[module_name] Help:** Opens the help content for the user interface of the selected module/component, if available.

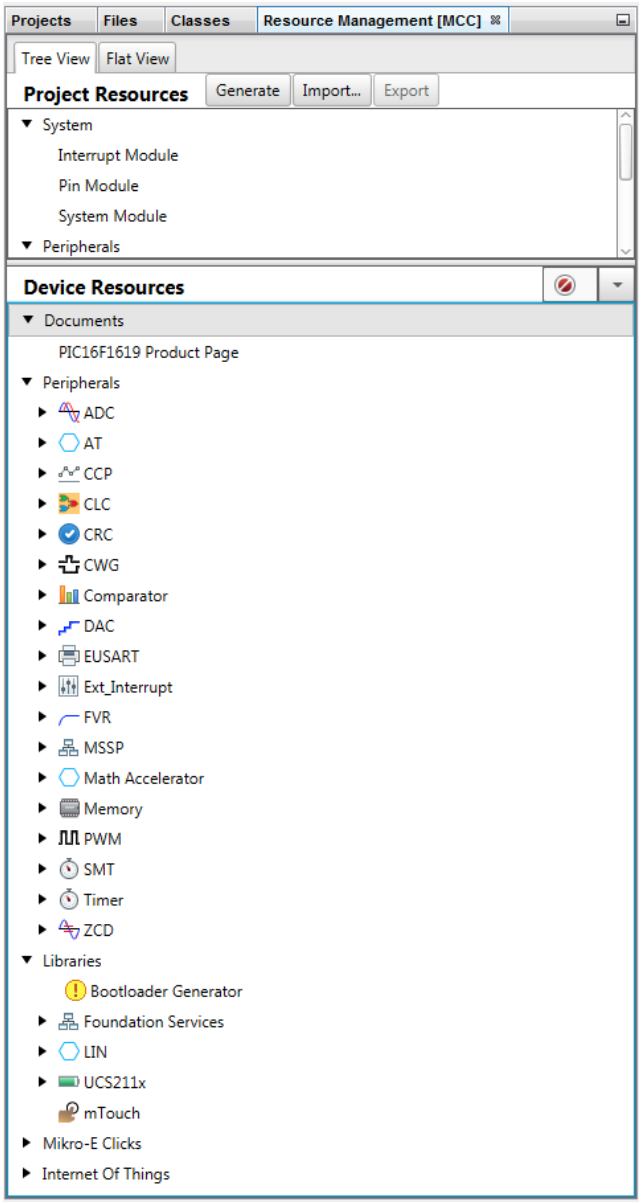
6.1.1 Resource Management Area - Tree View

This view is further split into the Projects Resources section (detailed at the beginning of 6.1. Resource Management Area chapter) and the Device Resources section. See Figure 6-4.

Both sections in the Tree View can also be navigated and handled by using the following keys:

- **Up and down arrow keys**: For moving up and down in the tree, respectively.
- **Right arrow key**: For expanding a node.
- **Left arrow key**: For collapsing a node.

Figure 6-4. Resource Management Area - Tree View



6.1.1.1 The Project Resources section

This section displays the peripherals, libraries or external components selected for the current project. The selection is done via the Device Resources section. The System Module, Pin Module, and Interrupt Module are selected by default. The configuration for each of the selected modules is done through the Composer Area. The peripheral and libraries are added to the project by selecting them from the Device Resources section. To add a peripheral or library to the Project Resources section, double-click on its name in the Device Resources section. The configuration can then be done via the corresponding GUI in the Composer Area. A module in the Project Resources window can be removed from the project by clicking the ☒ button to the right of the module name in the Project Resources section. The module will be removed from the MPLAB X IDE project. When a module is removed from the Project Resources, all of the unsaved configuration information for that module is lost.

6.1.1.2 The Device Resources section

The Device Resources section (see figure below) lists the data sheet, external components, and libraries available for the device configured in the MPLAB X IDE project, based on the loaded libraries in the Versions area. When

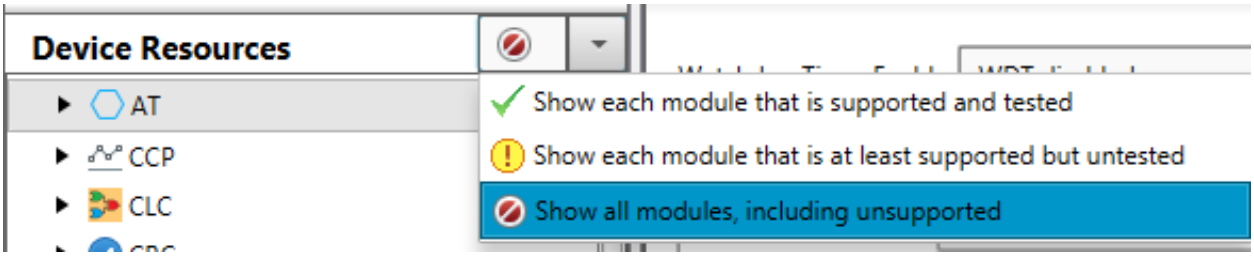
the name of a peripheral or library is double-clicked, it is moved from the Device Resources area to the Project Resources area, simultaneously invoking the Pin Manager with all associated I/O pins.

Note: The Documents section of the Device Resources area provides a link to the data sheet of the selected device on www.microchip.com.

Right-clicking on a module or component in this tree shows the Device Resources context menu through which the help content of the selected module can be invoked. The Device Resources list can be filtered via the top combo box (see figure below). The available filters are:

- all supported and tested modules
- all supported modules (including untested ones)
- all modules (including unsupported ones)

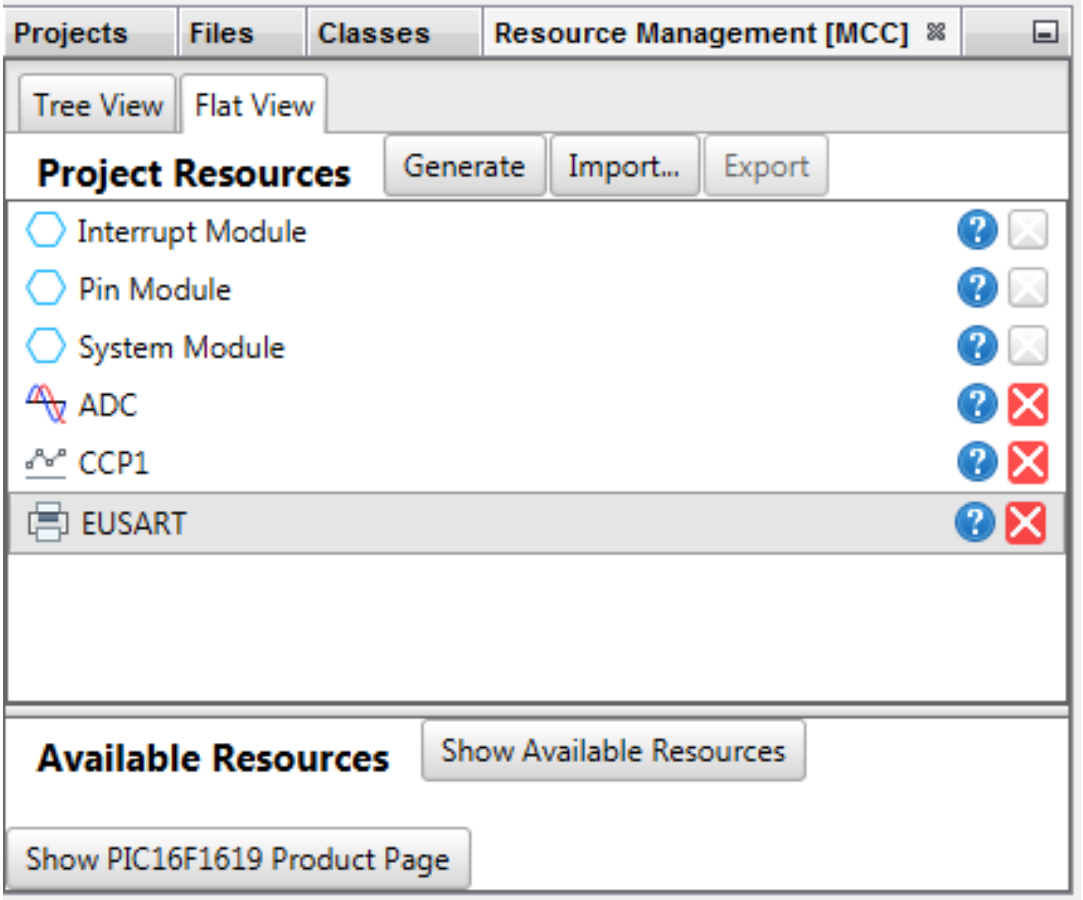
Figure 6-5. Resource Filtering in Device Resources - Tree View



6.1.2 Resource Management Area - Flat View

This view is further split into the Projects Resources section (detailed at the beginning of 6.1. Resource Management Area chapter) and the available resources section. See figure below.

Figure 6-6. Resource Management Area - Flat View



6.1.2.1 The Project Resources section

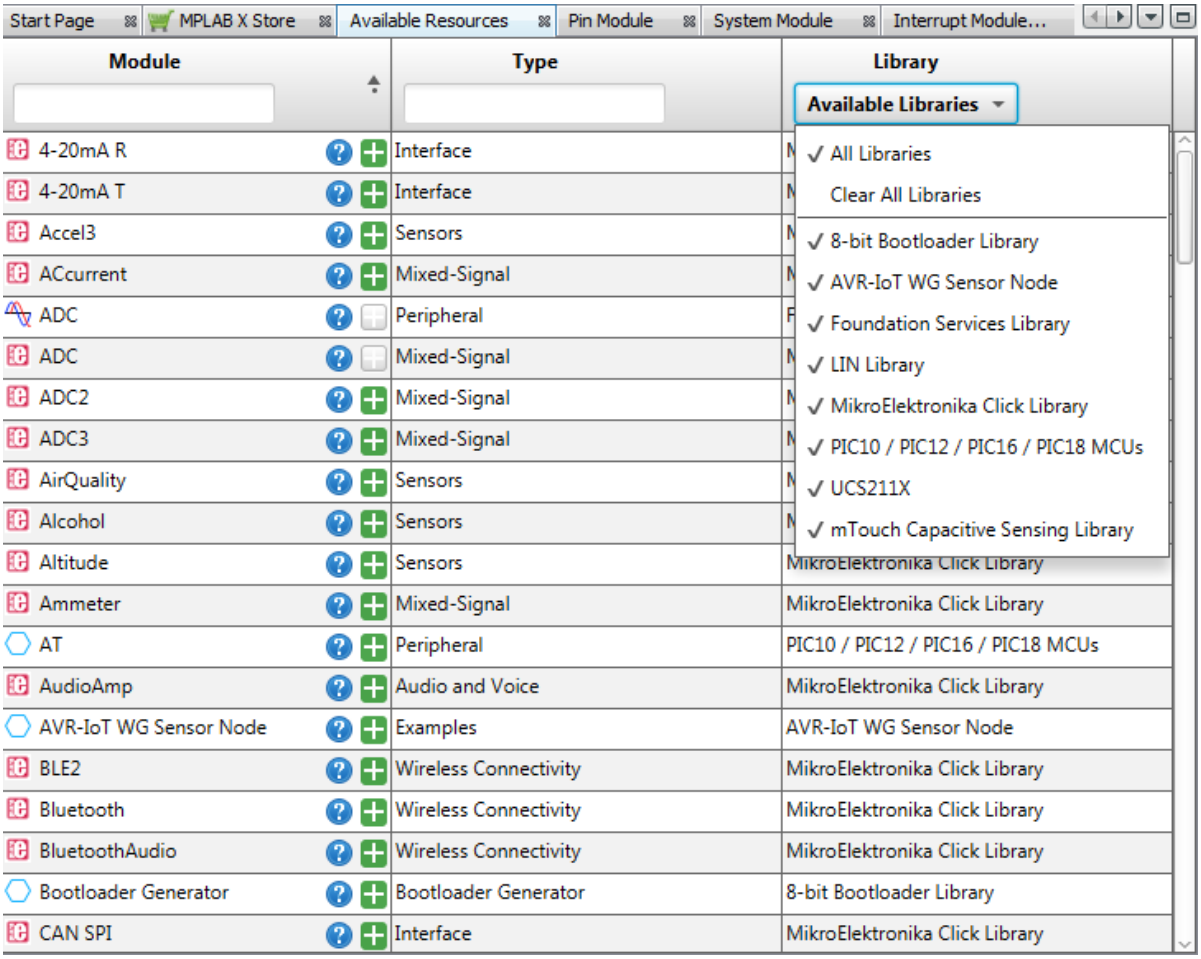
This section displays the peripherals, libraries or external components selected for the current project. Selection is done via the Available Resources window, which can be accessed from the Available Resources section (see 6.1.2.2. The Available Resources section). The Project Resources section in the Flat View is similar to the Project Resources in the Tree View (see 6.1.1.1. The Project Resources section). A module in the Project Resources section in the Flat View can be removed from the project by clicking the button to the right of the module name. The module will be removed from the MPLAB X IDE project. When a module is removed from the Project Resources, all the unsaved configuration information for that module is lost. Next to the button, the button offers insight into a specifically selected module. The same module information can be retrieved from the [module_name] Help option in the Project Resources context menu (see Figure 6-3).

6.1.2.2 The Available Resources section

This section contains two buttons:

- **Show** [device_name] **Product Page**: Opens the product page from the Microchip website in the default browser.
- **Show Available Resources**: Opens, or brings into focus, the Available Resources window in the Composer Area. See Figure 6-7 below.

Figure 6-7. Available Resources Window



The Available Resources window in the Composer Area represents a table of all software/peripheral components available for the selected device with search and filter capabilities. Each module in this table is indexed by three attributes: Module name, module type, and the library containing the module. These attributes are mapped on each table column as follows:

- **Module**: Displays the module icon, module name, link to module help (via the button and module selection (via the button). When a module is selected, it is added to the Project Resources section under the Resources Management area. A module can be searched by its name using the text field in the Module column header. The Available Resources table can be sorted alphabetically by module name when clicking on the arrow in the column header.
- **Type:** Displays the type of functionality provided by each module (i.e., Peripheral, Interface, Mixed-Signal). The table entries can be filtered by module type using the text field in the Type column header. The Available Resources table can be sorted alphabetically by module type when clicking on the arrow in the column header.
- **Library:** Shows the name of the library containing a certain module. The table entries can be filtered using the Available Libraries drop-down in the Library column header. When using the Available Libraries drop-down, the table contents can be filtered to include modules from one or several libraries. Also, it is possible to show modules from all libraries (using the All Libraries option) or clear the whole table (using the Clear All Libraries option). The Available Resources table can be sorted alphabetically by library name when clicking on the arrow in the column header. Depending on the selected device and the selected filters, the Available Resources window might show several modules with the same name but coming from different libraries. For example, in the case detailed in Figure 6-7, there are two ADC modules shown: One from the peripheral library and the other from the MikroElektronika Clicks library. Generally, modules bearing the same name are mutually exclusive. After a module selection, no other module with the same name can be selected. The module selection button

becomes grayed out, and clicking on it will yield a pop-up message saying that the operation cannot be completed (see Figure 6-8).

Figure 6-8. Module Selection Disabled

6.2 Versions Area

The Versions Area provides information about the versions of each MCC Core, Peripheral Library, Software Library, or other component installed on the local computer. Over time, multiple versions of the libraries may be available. MCC can be configured to use a specific version of a Library for the current MCC project.

Loaded versions are displayed with a green checkmark, compatible but not loaded versions are shown with a grey circle, and available versions which are unsupported by the selected core version are displayed with a circle backslash symbol (see Figure 6-9).

The MCC Core versions can be switched by right-clicking on an available core version and selecting "Switch core version" from the Context menu. Library versions can be loaded by right-clicking on a version of a component/module and selecting "Mark For Load." This action triggers the **Load Selected Library** button to appear at the top of the Versions Area. By clicking the button, all library versions which have been marked are loaded into MCC. Multiple selection are allowed; several components can be loaded at the same time. Only one version for each module/component is allowed to be loaded at a time.

If the component is already installed on the local computer, the absolute path to the corresponding `.jar` file is displayed next to the component's name. If the component has not yet been installed, the "Available for download" message is displayed instead. Selecting an uninstalled component for load and then pressing the **Load Selected Libraries** button will download the corresponding `.jar` file from a Microchip server and will subsequently load it in MCC, provided that the selected version is compatible with the loaded core version.

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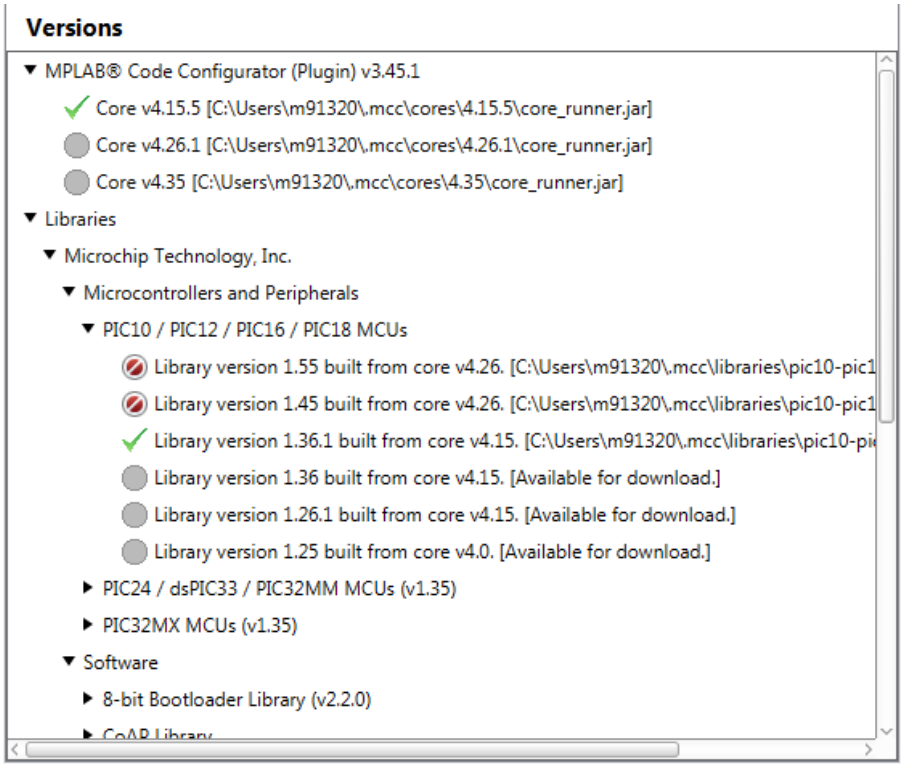
Figure 6-9. Versions Area



Besides the Versions Area, a core or a library can also be loaded via the MPLABX IDE menu in **Tools** → **Options** → **Plugins** → **MPLAB Code Configurator** (see Section 3.8 “MCC Options”).

Note: All MCC libraries are published via the Microchip website: www.microchip.com/mcc.

6.3 Pin Manager Package View Area

The following color combinations are associated with the pins in Graphical or Table View:

1. **Gray colored pin:** The pin is not usable in the selected configuration, and no enabled module that has any functionality on that pin. There are also grayed-out locks on a white background that indicate pins locked out by selected system functions.
2. **Blue colored pin:** Pins that are available to be allocated to a module.
3. **Green colored pin (with a lock):** The pin has been allocated and selected for a module. The name displayed against the pin is either the pin name of the module’s context or a custom name entered.
4. **Green colored pin (with chain link):** The pin is shared between multiple functions.
5. **Yellow colored pin:** A possible alternate pin for an already allocated pin function.
6. **Grayed out locks on a white background:** Pins locked out by selected system functions.

The graphical Pin Manager can be zoomed in and out to adjust its visibility. This can be done by scrolling the mouse wheel when the mouse is over the Package View. Zooming can also be achieved by the “+” and “-” keys on the keyboard (useful if the mouse is not available).

By right-clicking on a specific pin, all available pin functions are listed for selection. A snapshot of the package view configuration can be saved in PNG format by right-clicking on the package and selecting "Export Image."

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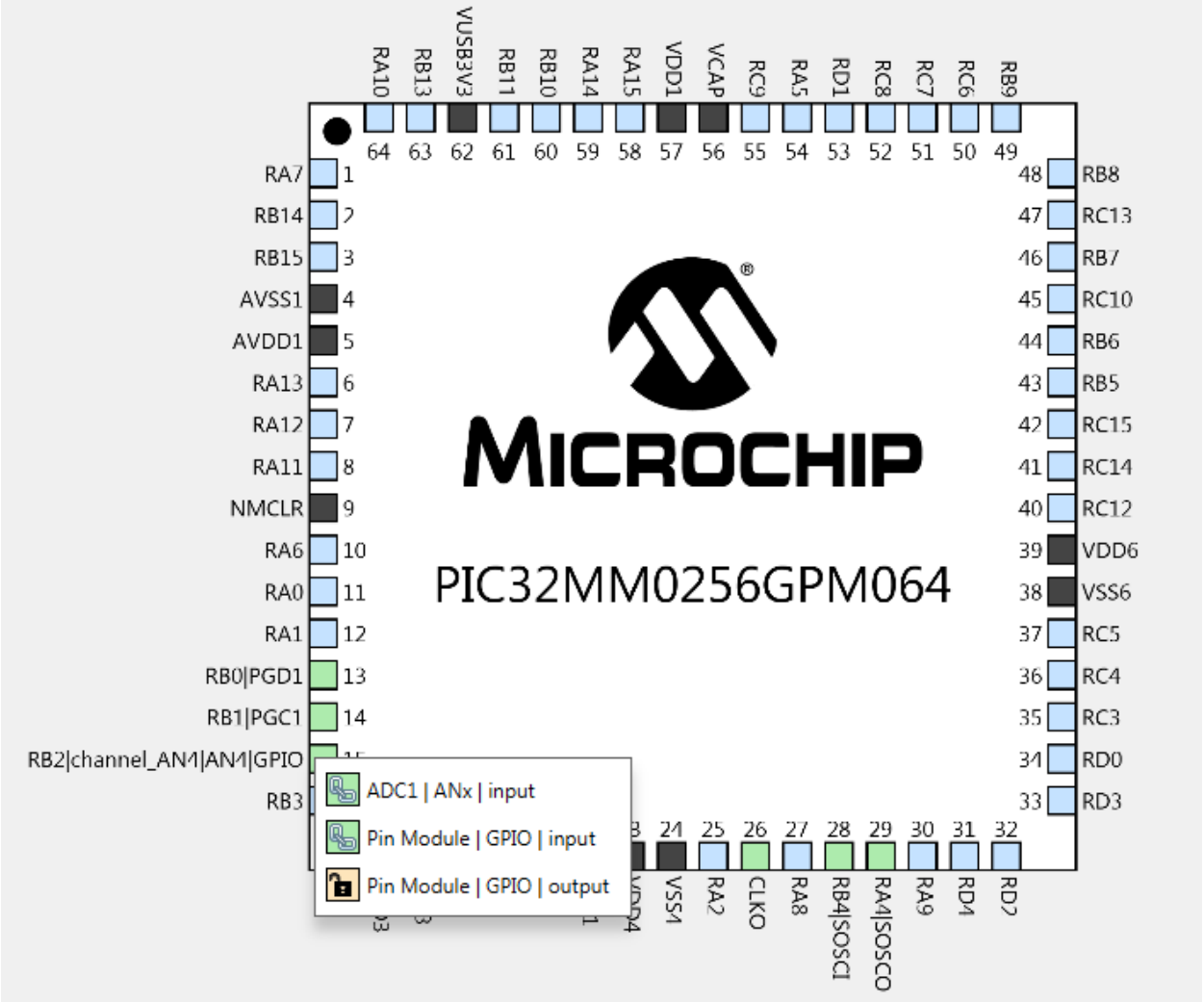
Figure 6-10. Package View Area



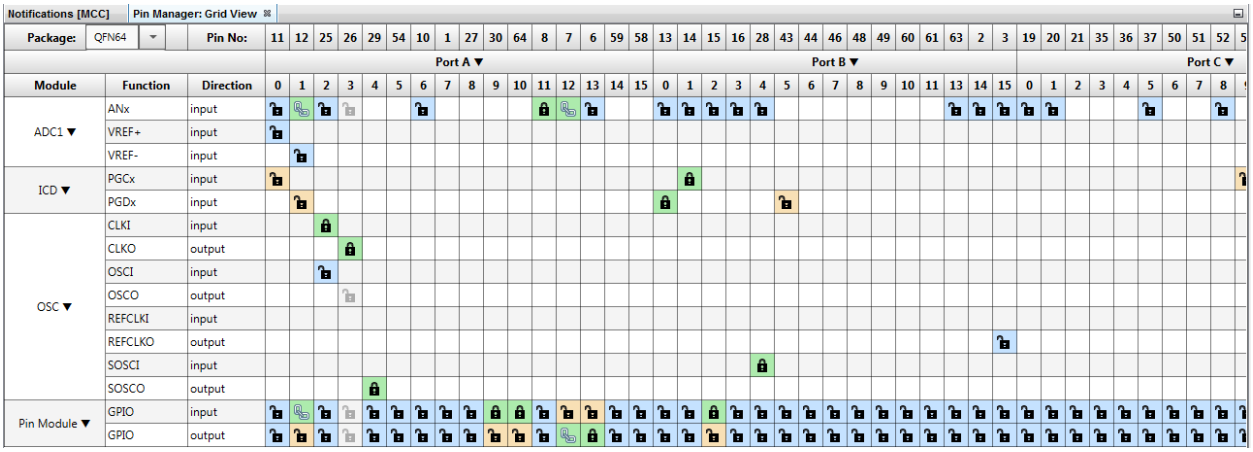
6.4 Pin Manager Grid View Area

This area contains three inner tabs: Pin Manager Grid View, Output and Notifications.

6.4.1 The Pin Manager Grid View

In the Pin Manager Grid View, the device package can be selected from a drop-down list. The package selection is on the upper left side of the Pin Manager Table View. In the figure below, the drop-down list shows that the QFN64 package has been selected. The selected package will be displayed in the Package View. The pin numbers in the Table View will also show the pin numbers for the selected package.

Figure 6-11. The Grid View Area



The three leftmost columns in the Table View indicate the module's name, functionality name, and direction, respectively.

The Table View allows to:

- Expand/collapse rows and ports (Figure 6-12)
- Hide and show ports and rows (Figure 6-13 and Figure 6-14)
- Show only the pins that are configured (Isolate) (Figure 6-15)

Figure 6-12. Collapsing Ports and Rows

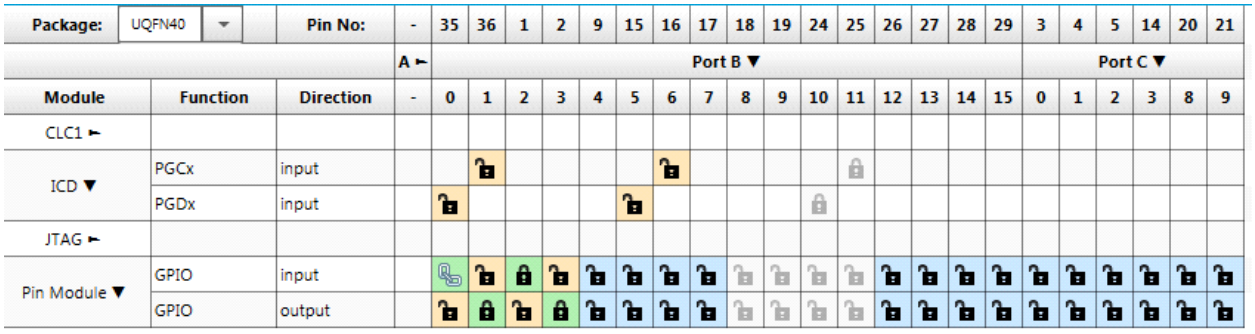


Figure 6-13. Hiding Ports and Rows

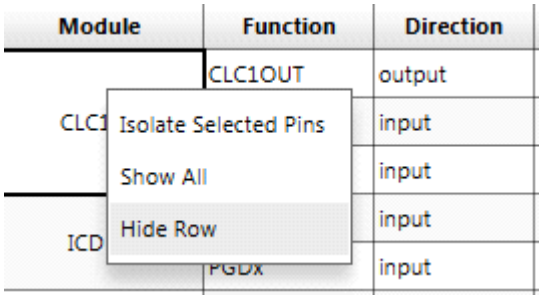


Figure 6-14. Restoring Ports and Rows (Show All)

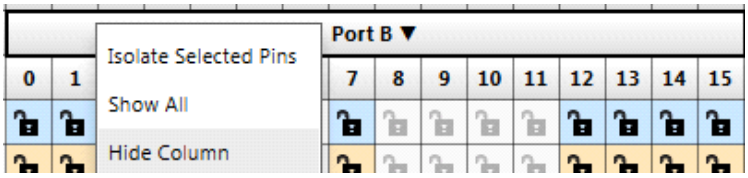
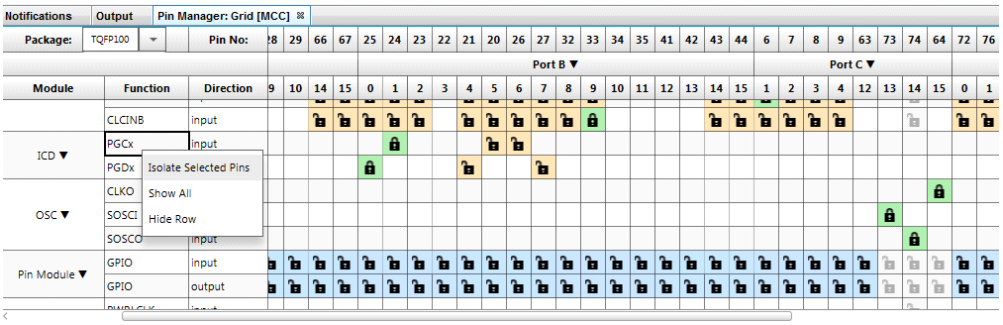


Figure 6-15. Isolating the Selected Pins



6.4.2 The MPLAB® Code Configurator - Output Tab

This tab displays the MCC operation results (see figure below). The MPLAB X IDE Log is also displayed under the **Output** tab when specifically opened from the **View -> IDE Log** menu.

Figure 6-16. The MPLAB® Code Configurator - Output Tab

6.4.3 The Notifications Tab

During the configuration process, several messages may be displayed in the **Notifications** tab (Figure 3-15) to help identify issues or simply to make sure a specific setting is configured as intended. These are indexed in the **Notifications** tab by:

1. **Category:** Identifies the notification as an alert or information that the module depends on another module.
2. **Module Name:** Is the name of the module that generated the notification.
3. **Type:** Indicates the severity of the notification.

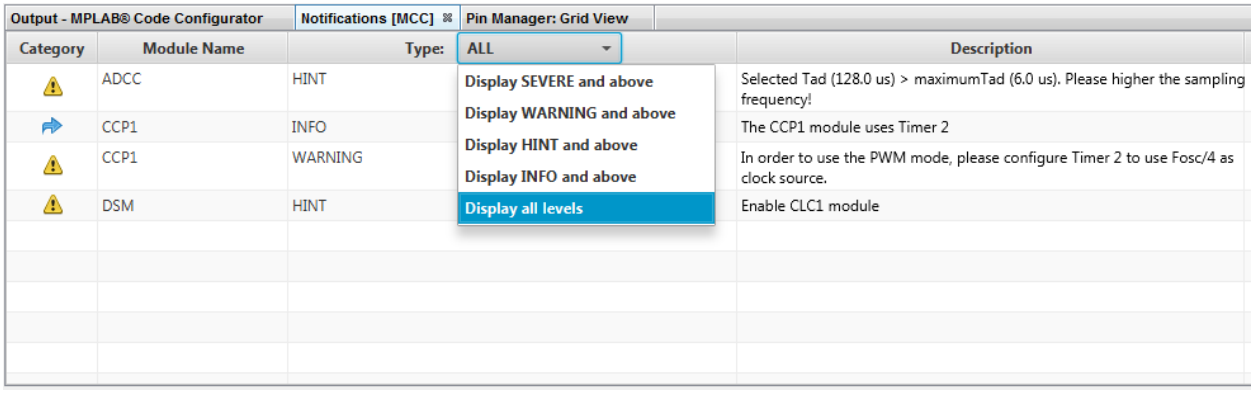
There are four types of notifications:

- SEVERE: Either the code generation or the compilation process will be faulty with the current configuration.
- WARNING: The code will be generated according to the settings made. It may compile, but it might also fail to function as intended.

- HINT: This provides information to assist in the successful configuration of the module. The module and the MCC can still be used. An action might be required.
- INFO: Information only, no action is required.

These can be filtered out using the Type combo box. If there are any WARNING or SEVERE type messages present in the **Notifications** tab when the **Generate** button is clicked, a message box displays, giving the option of reconfiguration to eliminate the possible errors in the current settings. This action can be skipped, assuming the notifications have been reviewed and taken into consideration.

Figure 6-17. The Notifications Tab



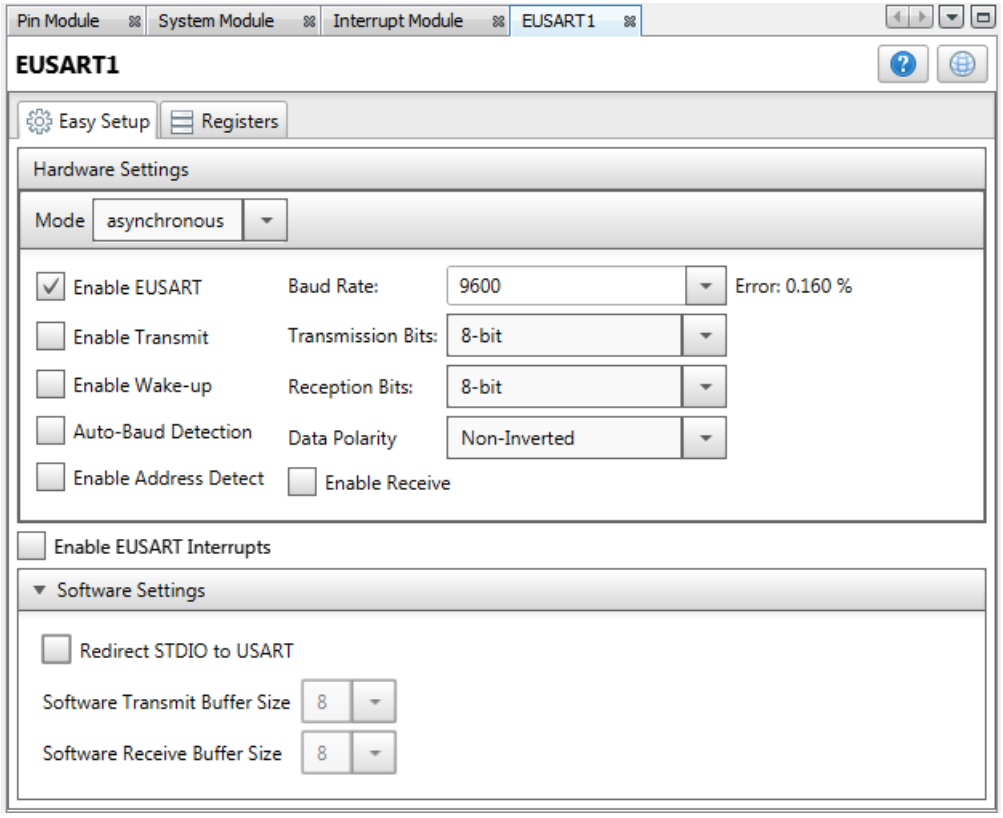
Note: The notification type may change as the MCC configuration changes. For example, WARNING might indicate that a module requires another module to be added to the project to operate correctly. After adding the module, the notification type would change to INFO.

6.5 The Composer Area

When a peripheral, library or other external component is selected from the Project Resources Area, its corresponding configuration GUI is displayed in the Composer Area. The Composer Area (Figure 6-18) is where peripherals and libraries are configured based on the application's requirements.

6.5.1 The Easy Setup Tab

Figure 6-18. The Easy Setup Tab of the PIC16F1947 EUSART Module



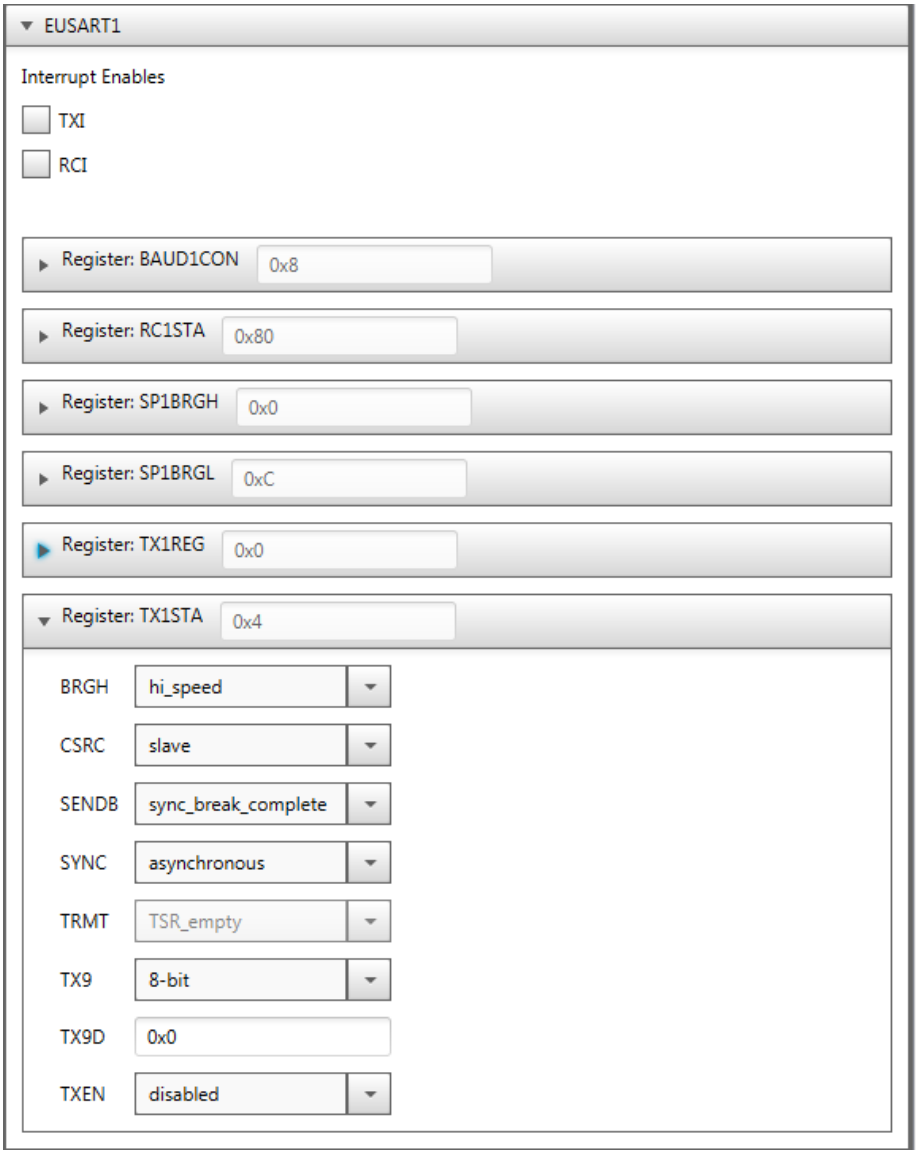
The EUSART **Easy Setup** tab in the Composer Area allows configuring various EUSART parameters related to transmission and reception operations.

6.5.2 The Registers Tab

In addition to the **Easy Setup** tab in the module's Composer, MCC also provides a **Registers** tab (Figure 6-19). The **Registers** tab provides direct access to configure the module's registers and settings, providing unrestricted access to the configuration of the module.

Any module configuration done using the **Easy Setup** tab will be reflected in the values displayed in the **Registers** tab. Likewise, changes performed in the **Registers** tab reflecteds in the values in the **Easy Setup** tab.

Figure 6-19. The Register View



6.5.3 The Pin Module Tab

For any pin which has been configured in the Pin Manager Table View, additional configuration of that pin can be done using the Pin Module View in the Composer Area. To display the Pin Module View, click on the **Pin Module** tab in the Project Resources Area (see Figure 6-20.)

The following settings are available in this tab (depending on the selected pin).

- **Pin Name**: The port pin name
- **Module**: The name of the module containing the function of the pin.
- **Function**: Module-specific functionality available on the pin. A pin may have one or more selectable functions. Typically, a pin may be configured to have several functions at the same time if it s also configured as an input (Output column unchecked). Only one function per each pin can be matched with an output direction. Refer to the device data sheet for more details.
- **Custom Name**: A useful pin alias which can be used in the generated code. A set of macros are made available in the Pin Module generated code for each selected pin in MCC.

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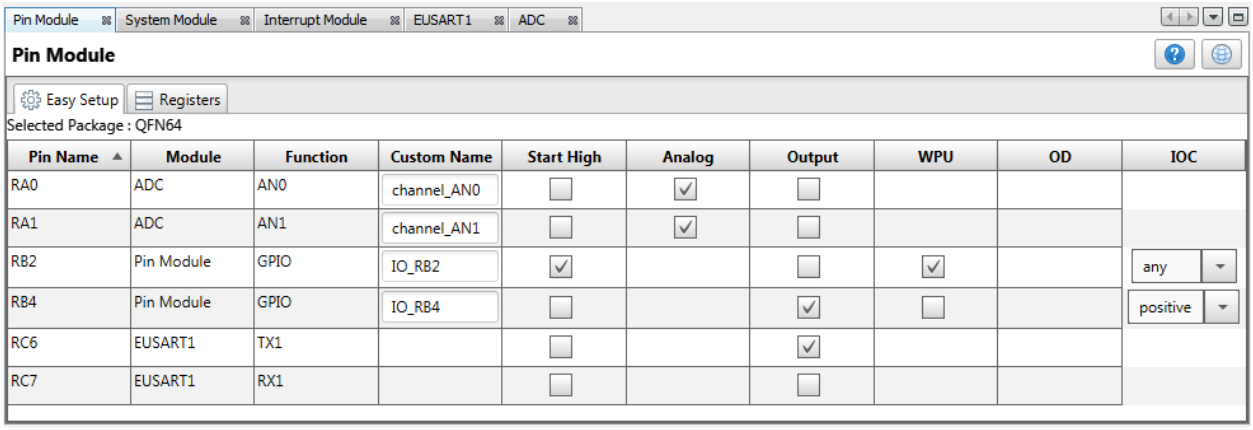
- **Start High**: Sets the pin to a high/low logic level at device initialization.
- **Analog**: Configures the pin as analog or digital.
- **Output**: Sets the pin direction of the pin.
- **WPU**: Enables the weak pull-up resistor on the pin.
- **WPD**: Enables the weak pull-down resistor on the pin.
- **OD**: Enables the open-drain capability on the pin.
- **IOC**: Configures the interrupt-on-change capability of the pin.

Note: Some of the settings detailed above may be missing on some pins or from the device completely. Refer to the pins configuration section in the device data sheet.

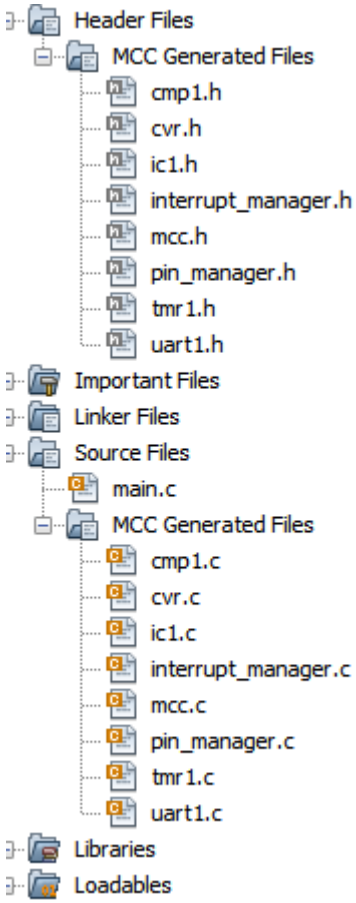
Figure 6-20. The Pin Module Tab



6.6 Generated Sources and Header Files

The generated drivers will be included in the active MPLAB X IDE project, as shown in the figure below.

Figure 6-21. Generated Source and Header Files



1. The `mcc.h` and `mcc.c` files include the definitions of Configuration bits and the '`OSCILLATOR_initializer`' function. These definitions are based on the settings made for the System module in the Composer. Also included is the '`SYSTEM_initializer`' function, which can be called in the application program to call all the other default initializers (the ones marked in the GUI by sprocket symbol).
2. The `pin_manager.h` and `pin_manager.c` files include the Pin Manager initializer functions based on the configurations made in the Pin Manager GUI.
3. The `interrupt_manager.h` and `interrupt_manager.c` files are optional files generated only when peripheral interrupts are enabled, and they include interrupt initializer functions.
4. The `.c` and `.h` are module-specific files and include each module's peripheral\library configuration functions.
5. The **main.c** file is generated even if a main.c already exists in the project. The user can review the code in the generated main.c file and merge the changes to the existing main.c file if required. The main.c file generated by the MCC may include commented-out code lines to enable interrupts. Remove the comments from the appropriate lines if the application requires interrupts to be enabled when it starts.
   Note: When using a main.c not generated by the MCC, the following lines need to be added to the main.c file'#include "mcc_generated_files/mcc.h";' and 'SYSTEM_Initializer()'.

The functions provided in these MCC-generated files can be called from the user application code, as required. The MPLAB X IDE provides auto-completion assistance of all of the MCC-generated content. While editing source code in the project, start typing in an MCC API or MCC variable name, and press **<CTRL+ Space>**. The MPLAB X IDE will show a list of options to complete the entry.

6.7 MCC Device Migration

Using an MCC configuration created for one device on a different device is called MCC device migration.

Note: MCC device migration is not supported in MCC.

It is possible that attempting to use an MCC configuration on a device other than the one for which it was created might appear not to fail. It is entirely the user's responsibility to determine if the MCC code generated as the result of device migration is suitable for use in their application.

Unintended MCC device migration may occur if the selected device in the MPLAB X IDE project is changed after MCC has been configured for that project. Copying an MCC configuration file (`*.mc3`) to another MPLAB X IDE project may also cause MCC device migration or other unintended operations.

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7. MCC Melody

MCC Melody is a new flavor of MCC that provides Libraries, Drivers, Peripheral Libraries (PLIB), and Hardware Initializers (HWI) for the development of embedded software for Microchip PIC® and AVR® Microcontrollers (MCUs) and dsPIC® Digital Signal Controllers (DSCs).

Its key features include:

1. A structured relationship manager (MCC Builder) which provides a clear visualization of a component's related dependencies and context in your project.
2. An implementation that can enable components available to be configured in the new online development ecosystem, i.e., in MPLAB Xpress IDE.
3. A content manager which allows more granular, component-level versioning and selection.

For more information, go to the MCC Melody Technical Reference.

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8. MCC Harmony

MPLAB Harmony 3 provides a Chip Support Package (CSP), core hardware abstraction libraries, extensive middleware, and a graphical configuration tool for the development of C language embedded software for Microchip 32-bit microcontrollers and microprocessors. For more information, refer to the Microchip MPLAB Harmony Github Page.

9. Revision History

Doc. Rev.	Date	Comments
E	09/2021	Added section to cover MCC Content Manager and Melody. Reorganized sections. Added metadata to MCC Classic section.
D	03/2019	Updated Chapter 3 content
C	05/2018	Added Chapter 2 Installation; updated text in Chapter 3 Operating Areas; removed previous Figures 1-1, 2-8, 2-13, 2-16, 2-17, 2-18 and 2-19; changed or replaced various figures; added Figures 3-3, 3-4, 3-6, added text in Chapter 3 in Project Resources Area and Versions Area; moved text to Package View Area; added subchapter 3.5.3. The Notification Tab; subchapter 3.6.3 The Pin Module Tab; subchapter 3.7.4 Installing an MPLAB Code Configurator Library; subchapter 3.7.5 Installing an MPLAB Code Configurator Core and different text corrections throughout the document.
B	05/2016	Revised Figure 1-1; Revised Chapter 2; Revised Figure 2-5 Title; Added Figures 2-6 through 2-10; Revised Chapter 3.
A	01/2016	Initial document release

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