# PIC32MK MCM Curiosity Pro User's Guide

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# Preface

## 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. Please refer to our web site (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.**

**For the most up-to-date information on development tools, see the MPLAB® IDE online help. Select the Help menu, and then Topics to open a list of available online help files.**

## INTRODUCTION

This chapter contains general information that will be useful to know before using the PIC32MK MCM Curiosity Pro. Items discussed in this chapter include:

- Document Layout
- Conventions Used in this Guide
- Recommended Reading
- The Microchip Web Site
- Development Systems Customer Change Notification Service
- Customer Support
- Document Revision History

## DOCUMENT LAYOUT

This document describes how to use the PIC32MK MCM Curiosity Pro as a development tool to emulate and debug firmware on a target board. This user's guide is composed of the following chapters:

- **Chapter 1. "Introduction"** provides a brief overview of the starter kit, highlighting its features and functionality.
- **Chapter 2. "Hardware"** provides the hardware descriptions of the starter kit.
- **Appendix A. "Schematics"** provides a block diagram, board layouts, and detailed schematics of the starter kit.
- **B.1 "APPENDIX B: Bill of Materials"** provides the bill of materials for the components used in the design and manufacture of the starter kit.

## CONVENTIONS USED IN THIS GUIDE

This manual uses the following documentation conventions:

**DOCUMENTATION CONVENTIONS**

| Description | Represents | Examples |
|---|---|---|
| Italic characters | Referenced books | *MPLAB IDE User's Guide* |
| | Emphasized text | ...is the *only* compiler... |
| Initial caps | A window | the Output window |
| | A dialog | the Settings dialog |
| | A menu selection | select Enable Programmer |
| Quotes | A field name in a window or dialog | "Save project before build" |
| Underlined, italic text with right angle bracket | A menu path | *File>Save* |
| Bold characters | A dialog button | Click **OK** |
| | A tab | Click the **Power** tab |
| Text in angle brackets < > | A key on the keyboard | Press <Enter>, <F1> |
| `Plain Courier New` | Sample source code | `#define START` |
| | Filenames | `autoexec.bat` |
| | File paths | `c:\mcc18\h` |
| | Keywords | `_asm, _endasm, static` |
| | Command-line options | `-Opa+, -Opa-` |
| | Bit values | `0, 1` |
| | Constants | `0xFF, 'A'` |
| *`Italic Courier New`* | A variable argument | *`file`*`.o`, where *`file`* can be any valid filename |
| Square brackets [ ] | Optional arguments | `mcc18 [options]` *`file`* `[options]` |
| Curly brackets and pipe character: { \| } | Choice of mutually exclusive arguments; an OR selection | `errorlevel {0\|1}` |
| Ellipses... | Replaces repeated text | `var_name [, var_name...]` |
| | Represents code supplied by user | `void main (void) { ... }` |
| Notes | A Note presents information that we want to re-emphasize, either to help you avoid a common pitfall or to make you aware of operating differences between some device family members. A Note can be in a box, or when used in a table or figure, it is located at the bottom of the table or figure. | **Note:** This is a standard note box.<br>**CAUTION**<br>**This is a caution note.**<br>**Note 1:** This is a note used in a table. |

## RECOMMENDED READING

This user's guide describes how to use the starter kit. The following Microchip documents are available and recommended as supplemental reference resources.

### PIC32MK General Purpose Family Data Sheet (DM320106)

Refer to this document for detailed information on PIC32MK GP family devices. Reference information found in this data sheet includes:

- Device memory maps
- Device pinout and packaging details
- Device electrical specifications
- List of peripherals included on the devices

### MPLAB® XC32 C/C++ Compiler User's Guide (DS50001686)

This document details the use of Microchip's MPLAB XC32 C/C++ Compiler to develop an application.

### MPLAB® X IDE User's Guide (DS50002027)

Refer to this document for more information pertaining to the installation and implementation of the MPLAB X IDE software, as well as the MPLAB SIM Simulator software that is included with it.

### Universal Serial Bus Specification and Associated Documents

The Universal Serial Bus is defined by the USB 2.0 specification and its associated supplements and class-specific documents. These documents are available from the USB Implementers Forum. See their web site at: http://www.usb.org

## THE MICROCHIP WEB SITE

Microchip provides online support via our web site at http://www.microchip.com. This web site makes files and information easily available to customers. Accessible by most Internet browsers, the web site contains the following information:

- **Product Support** – Data sheets and errata, application notes and sample programs, design resources, user's guides and hardware support documents, latest software releases and archived software
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The Development Systems product group categories are:

- **Compilers** – The latest information on Microchip C compilers and other language tools
- **Emulators** – The latest information on the Microchip in-circuit emulator, MPLAB REAL ICE™
- **In-Circuit Debuggers** – The latest information on the Microchip in-circuit debugger, MPLAB ICD 3 / MPLAB ICD 4
- **MPLAB X IDE** – The latest information on Microchip MPLAB X IDE, the Windows® Integrated Development Environment for development systems tools
- **Programmers** – The latest information on Microchip programmers including the PICkit™ 3 / PICkit™ 4 development programmer

## CUSTOMER SUPPORT

Users of Microchip products can receive assistance through several channels:

- Distributor or Representative
- Local Sales Office
- Field Application Engineer (FAE)
- Technical Support

Customers should contact their distributor, representative or field application engineer (FAE) for support. Local sales offices are also available to help customers. A listing of sales offices and locations is included in the back of this document.

Technical support is available through the web site at: http://support.microchip.com

## DOCUMENT REVISION HISTORY

### Revision A (March 2020)

This is the initial released version of this document.

### Revision B (February 2021)

Updated **1.1 "Kit Contents"** to remove inclusion of Micro USB (Type B) to Type A cable in the kit.

Appendix A: Schematics and Appendix B: Bill of Materials were removed from this document. Please refer to product web page for this board to access the board design files.

**NOTES:**

# Chapter 1. Introduction

Thank you for purchasing a Microchip Technology PIC32MK MCM Curiosity Pro development board. This development board provides a low-cost, modular development system for Microchip's line of 32-bit microcontrollers.

For a free Microchip demonstration code and additional information, visit the MPLAB Harmony web page at: http://www.microchip.com/MPLABHarmony. The MPLAB Harmony Integrated Software Framework includes several demonstrations that have configurations for the PIC32MK GP Development Board.

These demonstrations are available in the `<install-dir>/apps` folder of the MPLAB Harmony installation, where `<install-dir>` is either `:/microchip/harmony/<version>` (for Windows OS) or `~/microchip/harmony/<version>` (for MAC or Linux OS).

For additional information on demonstrations and for building or running steps, refer to the documents available in the `<install-dir>/doc` folder.

This chapter covers the following topics:

- Kit Contents
- Starter Kit Functionality and Features

The preprogrammed example code on the PIC32MK MCM family MCU is available for download from the Microchip web site at: http://www.microchip.com/design-centers/32-bit. All project files are included, hence the code may be used to restore the PIC32MK MCM family MCU on the starter kit to its original state (that is, if the sample device is reprogrammed with another program) or you can use the tutorial code as a platform for further experiment.

## 1.1 KIT CONTENTS

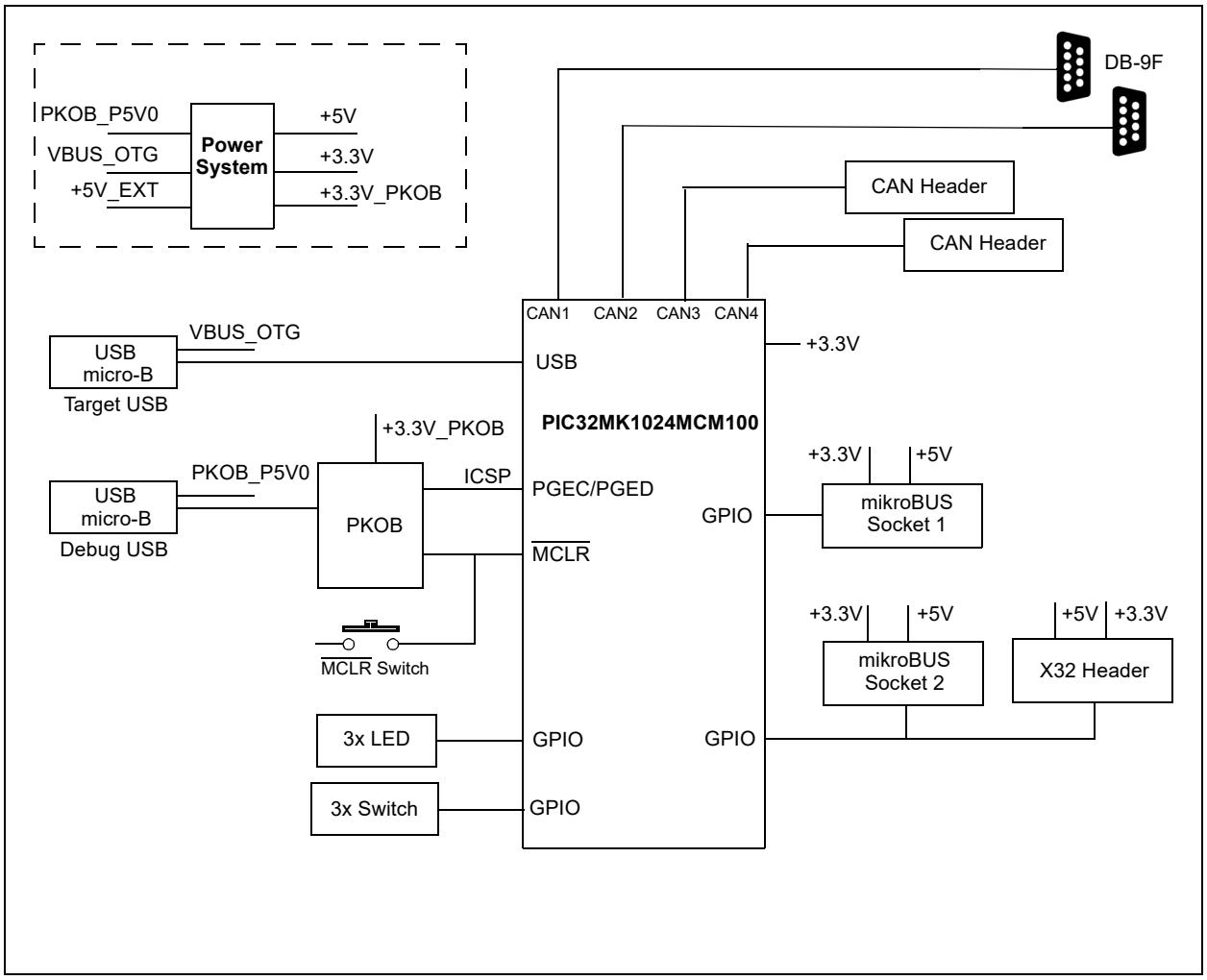
The PIC32MK MCM Curiosity Pro kit contains the PIC32MK MCM Curiosity Pro development board.

**Note:** If you are missing any part of the PIC32MK MCM Curiosity Pro kit, contact a Microchip sales office for assistance. A list of Microchip offices for sales and service is provided on the last page of this document.

## 1.2 BLOCK DIAGRAM

Figure 1-1 illustrates the high-level block diagram of the PIC32MK MCM Curiosity Pro.

**FIGURE 1-1: PIC32MK MCM CURIOSITY PRO BLOCK DIAGRAM**



## 1.3 KIT FUNCTIONALITY AND FEATURES

### 1.3.1 Development Board

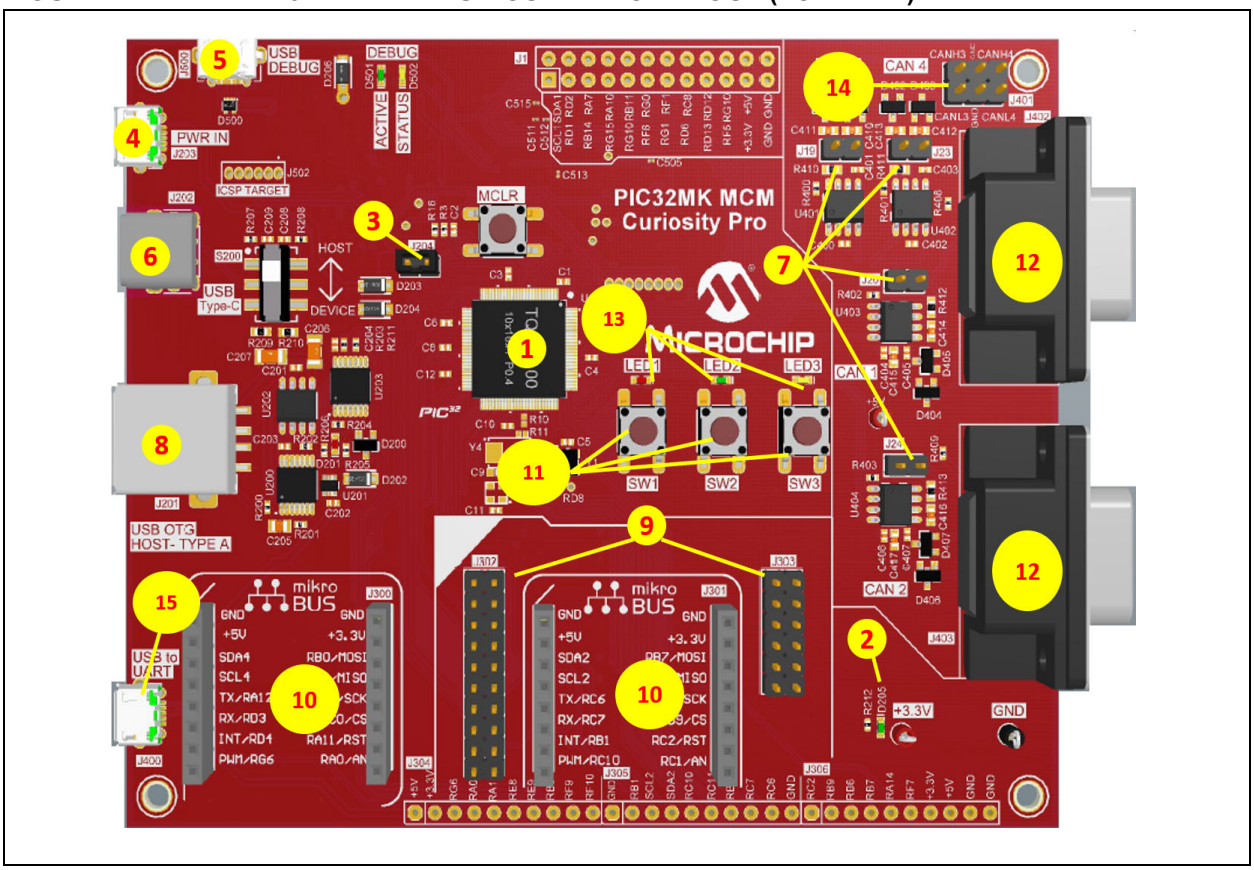
Representations of the layout of the development board included in the PIC32MK MCM Curiosity Pro are shown in Figure 1-2 and Figure 1-3.

The top assembly of the PIC32MK MCM Curiosity Board includes these key features, as indicated in Figure 1-2:

1. PIC32MK1024MCM100
2. Green power indicator LED
3. Power diode shunt
4. Power in
5. Mini-USB 2.0 connector (debug)
6. USB Type-C connection
7. CAN 120 Ohm terminations
8. USB Type-A receptacle connectivity for PIC32 host-based applications
9. X32 header
10. MikroBus socket
11. Three user-defined switches
12. DB-9F CAN connectors
13. Three user-defined LEDs
14. CAN 3 & 4 header connectors.
15. USB-to-UART Bridge

For additional information about these features, refer to **Chapter 2. "Hardware"**.

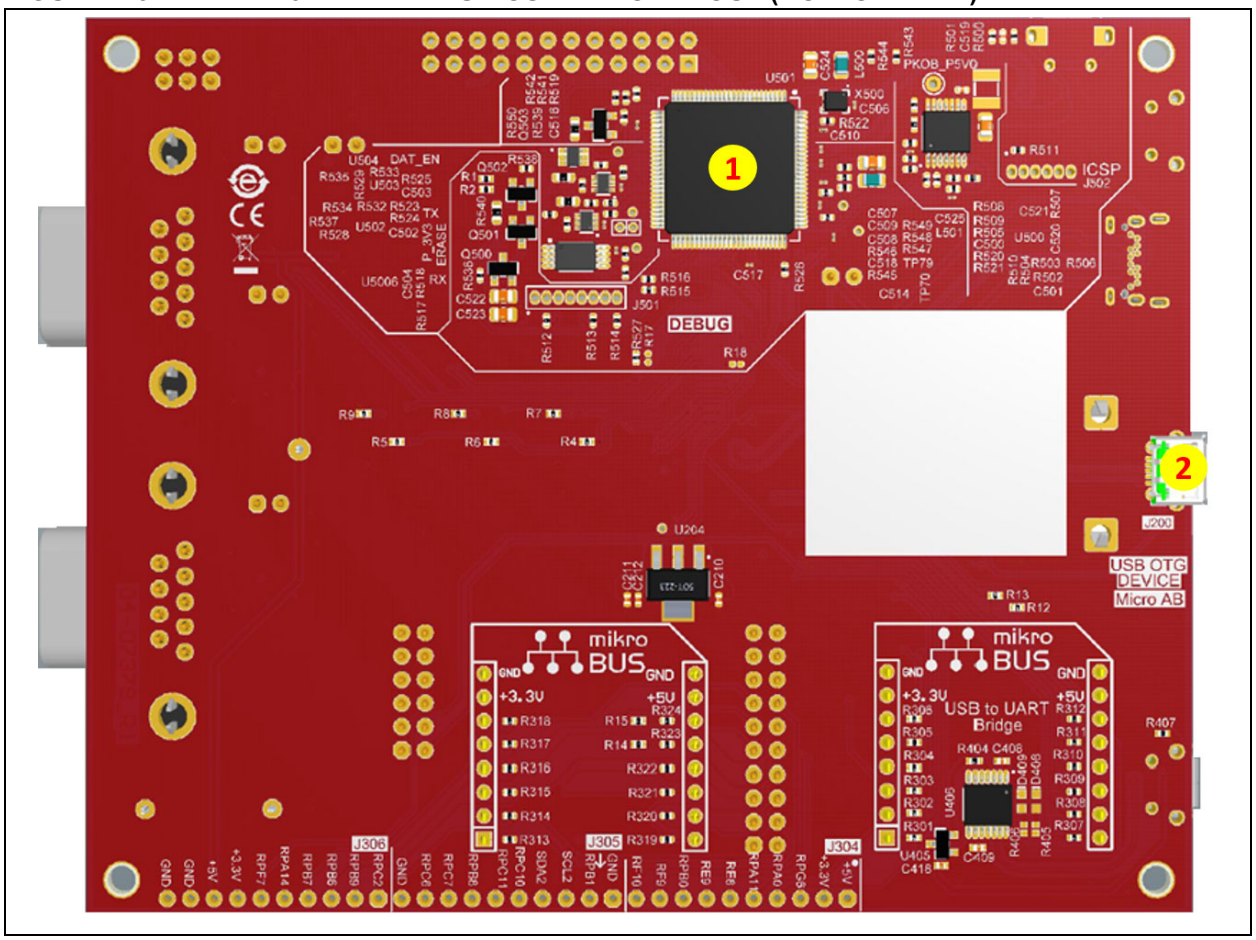
**FIGURE 1-2: PIC32MK MCM CURIOSITY PRO LAYOUT (TOP VIEW)**



The bottom assembly of the PIC32MK MCM Curiosity Pro includes these key features, as indicated in Figure 1-3:

1. Pickit On Board (PKoB4) Debugger IC.
2. USB OTG Connector for PIC32 USB OTG applications.

**FIGURE 1-3: PIC32MK MCM CURIOSITY PRO LAYOUT (BOTTOM VIEW)**



# Chapter 2. Hardware

This chapter describes the hardware features of the PIC32MK MCM Curiosity Pro development board.

## 2.1 HARDWARE FEATURES

The following key features of the development board are presented in the order given in **Section 1.3 "Kit Functionality and Features"**. See Figure 1-2 for their locations on the development board.

### 2.1.1 Processor Support

The development board kit is designed with a permanently mounted (that is, soldered) processor, PIC32MK1024MCM100.

### 2.1.2 Power Supply

Power is supplied to the development board by a USB bus power, which is connected to the USB debug connector J500.

One green LED (D205) is provided to indicate the PIC32 device is powered up.

### 2.1.3 PIC32 USB Connectivity

Using any one of the following options, users can connect to the PIC32 USB microcontroller:

- Host mode – Connect the device to the Type-A connector J201, which is located on the top of the starter kit. If using the Debug USB port to power the Host port, install the jumper JP204 to short the back-power prevention diode. A maximum of ~400 mA can be supplied from the Debug USB port to the Host port using this method. If the full 500 mA supply is needed, an external supply must be connected to the application board, and jumper J204 must be removed to prevent back-powering the Debug USB port.
- Device mode – Connect the debug mini-B USB cable to port J500 and then connect the starter kit to the host by using a cable with a Type-B micro-connector to the starter kit's micro-A/B port J200. The other end of the cable must have a Type-A connector. Connect the Type-A connector to a USB host. Jumper J204 must be removed.
- OTG mode – Connect the starter kit to the OTG device using an OTG micro-A/B cable to the micro-A/B port J200, which is located on the bottom of the board. The starter kit provides an on-board power supply capable of providing 120 mA maximum. This supply is controlled by the PIC32MK1024MCM100 device. Jumper J204 must be removed.

### 2.1.4 Switches

Push button switches provide the following functionality:

- S1: Active-low switch connected to RG11
- S2: Active-low switch connected to RF13
- S3: Active-low switch connected to RF12
- /MCLR: Connected to Microcontroller/MCLR

These switches do not have any debounce circuitry and require internal pull-up resistors, this enables the user to investigate software debounce techniques. When Idle, the switches are pulled high (+3.3V), and when pressed, they are grounded.

### 2.1.5 LEDs

The LEDs, LED1 through LED3, are connected to the PORTG pins (RG12 through RG14) of the processor. The PORTG pins are set high to illuminate the LEDs.

### 2.1.6 Oscillator Options

A 12 MHz oscillator circuit (Y4) is connected to the on-board microcontroller. This oscillator circuit functions as the controller's primary oscillator.

Use of an external crystal or external oscillator is required to develop USB applications. The USB specification dictates a frequency tolerance of ±0.05% for high speed. Non-USB applications can use the internal oscillators.

The development board kit also has provisions for an external secondary 32 kHz oscillator (Y4); however, this is not populated. A suitable oscillator, ECS-3X8, can be obtained from Digi-Key: P/N - X801-ND CMR200TB32.768KDZFTR.

The PKoB 4 Debugger IC is independently clocked and has its own 12 MHz clock oscillator.

### 2.1.7 mikroBUS™ Sockets

Two mikroBUS sockets, J300 and J301, are available on the development board. These sockets can be used to expand the functionality using the MikroElectronika Click adapter boards. The mikroBUS connector consists of two 1x8 female headers with SPI, $I^2C$, UART, RST, PWM, analog, and interrupt lines as well as 3.3V, 5V, and GND power lines.

The GPIO pins for the mikroBUS sockets are assigned to route, as follows:

- UART4, I2C4, SPI6, and OC1 peripheral instances to mikroBUS socket J300
- UART3, I2C2, SPI2, and OC3 peripheral instances to mikroBUS socket J301

**Note:** UART3, I2C2, and SPI2 peripherals are also routed to the X32 audio header.

### 2.1.8 Audio Header

The PIC32MK MCM Curiosity Pro includes two X32 headers, J302 and J303, to enable a connection to the Microchip Audio Codec Daughter Board. Table 2-2 provides the details of the available Audio Codec Daughter Board, and for additional information, contact your local Microchip sales office.

For a complete list of currently available Audio Codec Daughter Boards, visit the microchipDIRECT web site: www.microchipdirect.com.

**TABLE 2-1: AUDIO CODEC DAUGHTER BOARD**

| Daughter Board | Part No. |
|---|---|
| PIC32 Audio Coded Daughter Board | AC320100 |

### 2.1.9 Peripheral Resource Assignment

The MCU peripheral instances, assigned for different hardware interfaces, are provided in Table 2-2. The correct peripheral instance must be used in the application to use the respective hardware interface.

**TABLE 2-2: RESOURCE ASSIGNMENT**

| Resource Assignment | Peripheral | | | | | Reference Clock |
|---|---|---|---|---|---|---|
| | $I^2C$ | SPI | UART | Output Compare | Interrupt | |
| MikroBus1 (J300) | I2C4 | SPI6 | UART4 | OC1 | INT1 | — |
| MikroBus2 (J301) | I2C2 | SPI2 | UART3 | OC3 | INT2 | — |
| X32 (J302, J303) | I2C2 | SPI2 | UART3 | — | — | REFCLK |

### 2.1.10 PICKit™ on-board 4

MPLAB PICkit™ On-Board 4 (PKoB4) is a new generation of In-Circuit Debugger. The MPLAB PKoB4 programs faster than its predecessor and is design to use a high-speed 2.0 USB interface and provide a feature rich debugging experience through one USB cable. The PKoB4 is intended to support programming debugging and Data Gateway interface.

The MPLAB PKoB4 In-Circuit Debugger is compatible with these platforms:

- Microsoft Windows 7 or later
- Linux®
- macOS™

The MPLAB PKoB4 In-Circuit Debugger system provides the following advantages:

Features/Capabilities:

- Connects to computer through, high-speed USB 2.0 (480 Mbits/s) cable
- Programs devices using MPLAB X IDE or MPLAB IPE
- Supports multiple hardware and software breakpoints, stopwatch, and source
- Code file debugging
- Debugs your application in real time
- Sets breakpoints based on internal events
- Monitors internal file registers
- Debugs at full speed
- Configures pin drivers
- Field-upgradeable through an MPLAB X IDE firmware download
- Virtual COM support, which can establish UART communication between host PC and the target device using the following UART configuration:
  - Baud rate: 115,200 bps
  - Only 8-bit character format
  - No hardware flow control
  - One stop-bit
- Adds new device support and features by installing the latest version of MPLAB X IDE (available as a free download at https://www.microchip.com/mplabx/)
- Indicates debugger status through on-board LEDs

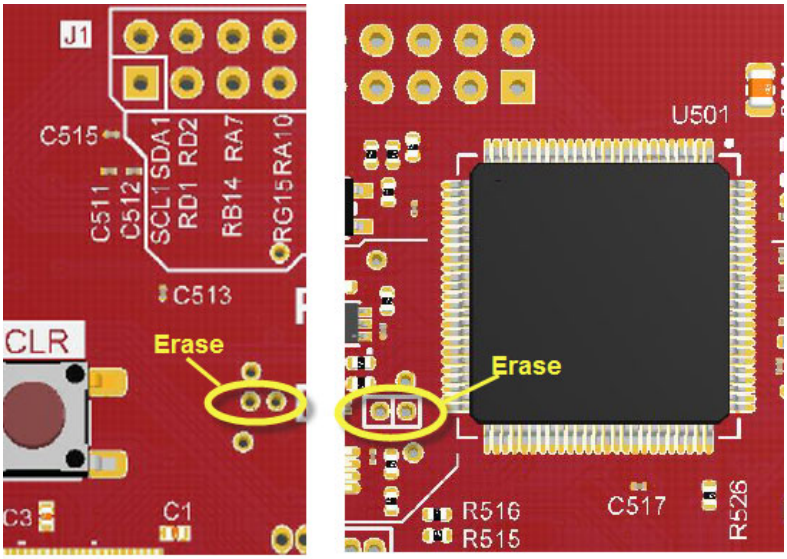
Performance/Speed:

- More and faster memory
- A Real-Time Operating System (RTOS)
- No firmware download delays incurred when switching devices
- A 32-bit MCU running at 300 MHz

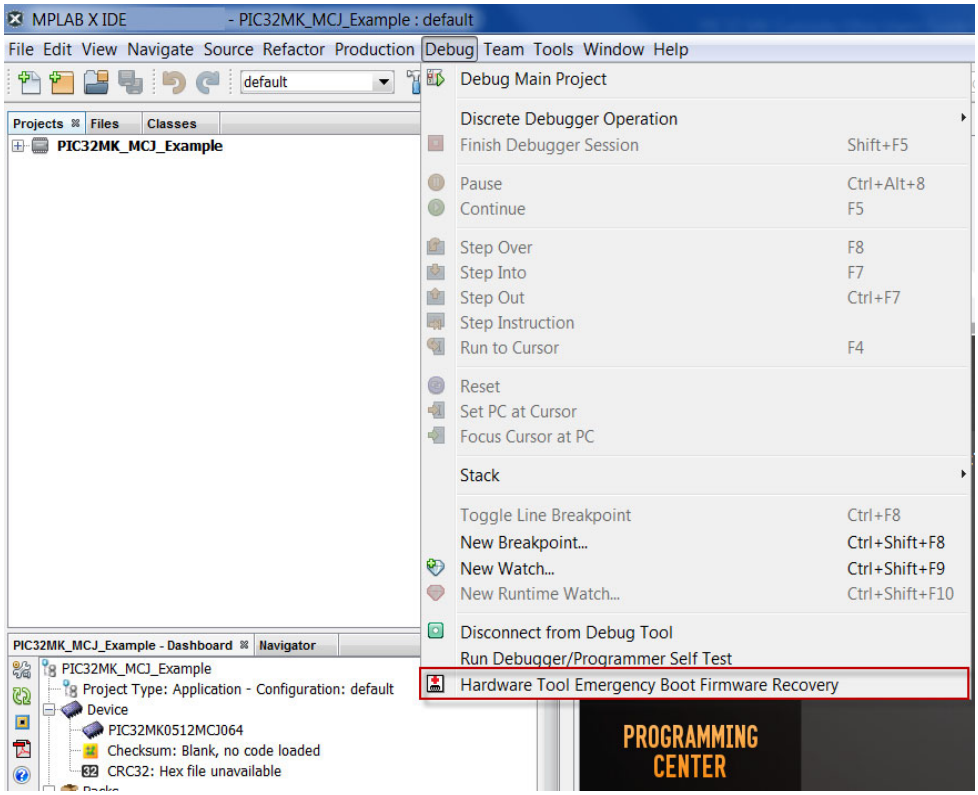
#### 2.1.10.1 RECOVERY METHOD

If the PKoB4 becomes unresponsive, users can recover the tool by following these steps:

1. With the PIC32MK MCM Curiosity Pro still powered, short the 2 pads for approximately 10 seconds.




2. Open The latest version of MPLAB X IDE.
3. Click on *Debug > Hardware Tool Emergency Boot Firmware Recovery.*



4. Follow the instructions prompted on the screen to reset the tool back to the factory conditions.

For additional information on PKoB4, refer to the "***MPLAB PICkit™4 In-Circuit Debugger User guide***" (DS50002751), which is available for download at the following location:
http://ww1.microchip.com/downloads/en/DeviceDoc/MPLAB%20PICkit%204%20ICD%20Users%20Guide%20DS50002751C.pdf.

**NOTES:**

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