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Multimedia Expansion Board II (MEB II) User's Guide

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Table of Contents

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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 Multimedia Expansion Board II (MEB II). 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 Multimedia Expansion Board II (MEB II) 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 uses.
- **Chapter 2. "Hardware"** provides the hardware descriptions of the starter kit.
- **Appendix A. "Board Layout and Schematics"** provides a block diagram, board layouts, and detailed schematics of the starter kit.
- **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. **CAUTION** **This is a caution note.** **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.

Release Notes for the Multimedia Expansion Board

For the latest information, Microchip has a dedicated web page for the Multimedia Expansion Board II (MEB II), which can be accessed at:
http://www.microchip.com/meb2

Family Reference Manual Sections

Family Reference Manual sections are available, which explain the operation of the PIC32 microcontroller family architecture and peripheral modules. The specifics of each device family are discussed in the individual family's device data sheet.

Device Data Sheets

Refer to the appropriate device data sheet for device-specific information and specifications. These documents may be obtained from the Microchip web site or your local sales office.

Reference information found in these data sheets includes:

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

PIC32MX Flash Programming Specification (DS60001145)

Refer to this document for information on instruction sets and firmware development.

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

This document details the use of Microchip's MPLAB XC32 Compiler for PIC32 microcontrollers to develop 32-bit applications.

MPLAB® X IDE User's Guide (DS50002027)

Consult this document for more information pertaining to the installation and implementation of the MPLAB X IDE software.

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
- **General Technical Support** – Frequently Asked Questions (FAQs), technical support requests, online discussion groups, Microchip consultant program member listings
- **Business of Microchip** – Product selector and ordering guides, latest Microchip press releases, listings of seminars and events; and listings of Microchip sales offices, distributors and factory representatives

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To register, access the Microchip web site at www.microchip.com, click on Customer Change Notification and follow the registration instructions.

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 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 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 (November 2013)

This is the initial release of this document.

Revision B (March 2014)

This revision includes the following updates:

- Added item 9 (MPLAB REAL ICE In-Circuit Emulator) to **1.3 "Multimedia Features"**
- Updated **Figure 1-3: "Multimedia Expansion Board II (MEB II) Layout (Bottom)"**
- Updated **Figure 2-4: "EBI SRAM Memory"**
- Updated **Figure 2-8: "802.11b/g Transceiver"**
- Updated **Figure 2-11: "microSD Card Slot"**
- Updated **Figure 2-14: "Push Button and User Controlled LEDs"**
- Updated **Figure A-1: "MEB II Layout (Top Assembly)"**
- Updated **Figure A-2: "MEB II Layout (Bottom Assembly)"**
- Updated all schematics (see Figure A-5 through Figure A-20)

NOTES:

Chapter 1. Introduction

Thank you for purchasing the Microchip Technology Multimedia Expansion Board II (MEB II). The MEB II is a compact, highly versatile development board, which in conjunction with a PIC32 starter kit and a display daughter board, provides a system for developing a wide range of multimedia applications. The MEB II kit includes a 4.3" WQVGA PCAP touch display daughter board and supports detachable display boards allowing for a variety of resolutions.

This chapter covers the following topics:

1.1 KIT CONTENTS

The Multimedia Expansion Board II (MEB II) contains the following items:

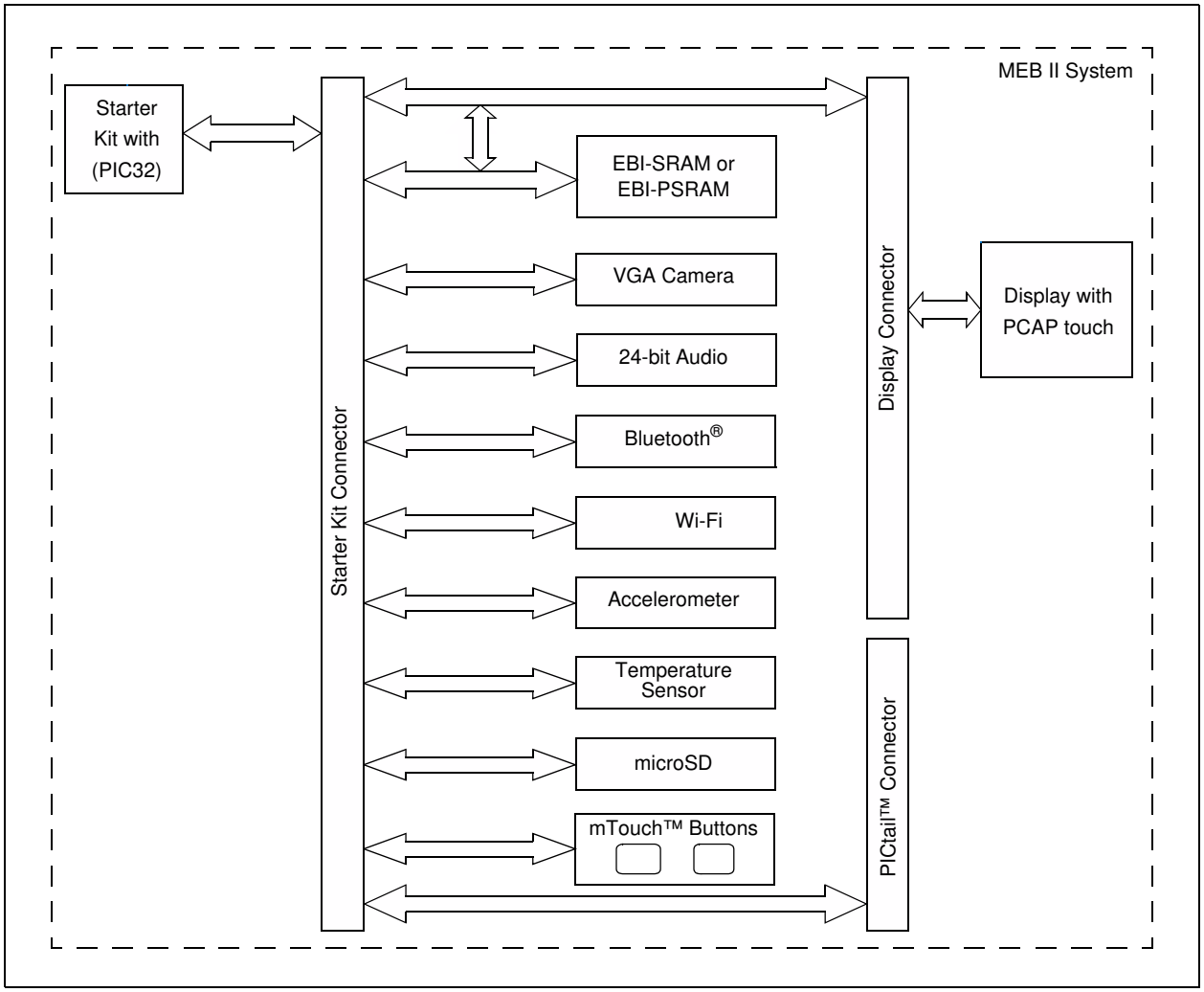
- Multimedia Expansion Board II (MEB II) (Mother Board)
- 4.3" WQVGA Display Board (Daughter Board)
- Multimedia Expansion Board II (MEB II) Information Sheet

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

1.2 SYSTEM DIAGRAM

The MEB II system consists of the PIC32 Starter Kit, MEB II mother board, and a display daughter board (4.3" PCAP touch), as shown in Figure 1-1. MEB II is a mother board that contains all the necessary components and interfaces to support the multimedia features. PIC32 starter kit connects to MEB II through a 168-pin board-to-board connector and contains the PIC32 microcontroller with additional components (debug, memory, communication etc). Refer to http://www.microchip.com/meb2 for supported PIC32 Starter Kits and other additional information. The display daughter board is connected to the MEB II using a 60-pin board-to-board connector (detachable), providing flexibility to support a variety of displays.

FIGURE 1-1: MEB II SYSTEM DIAGRAM



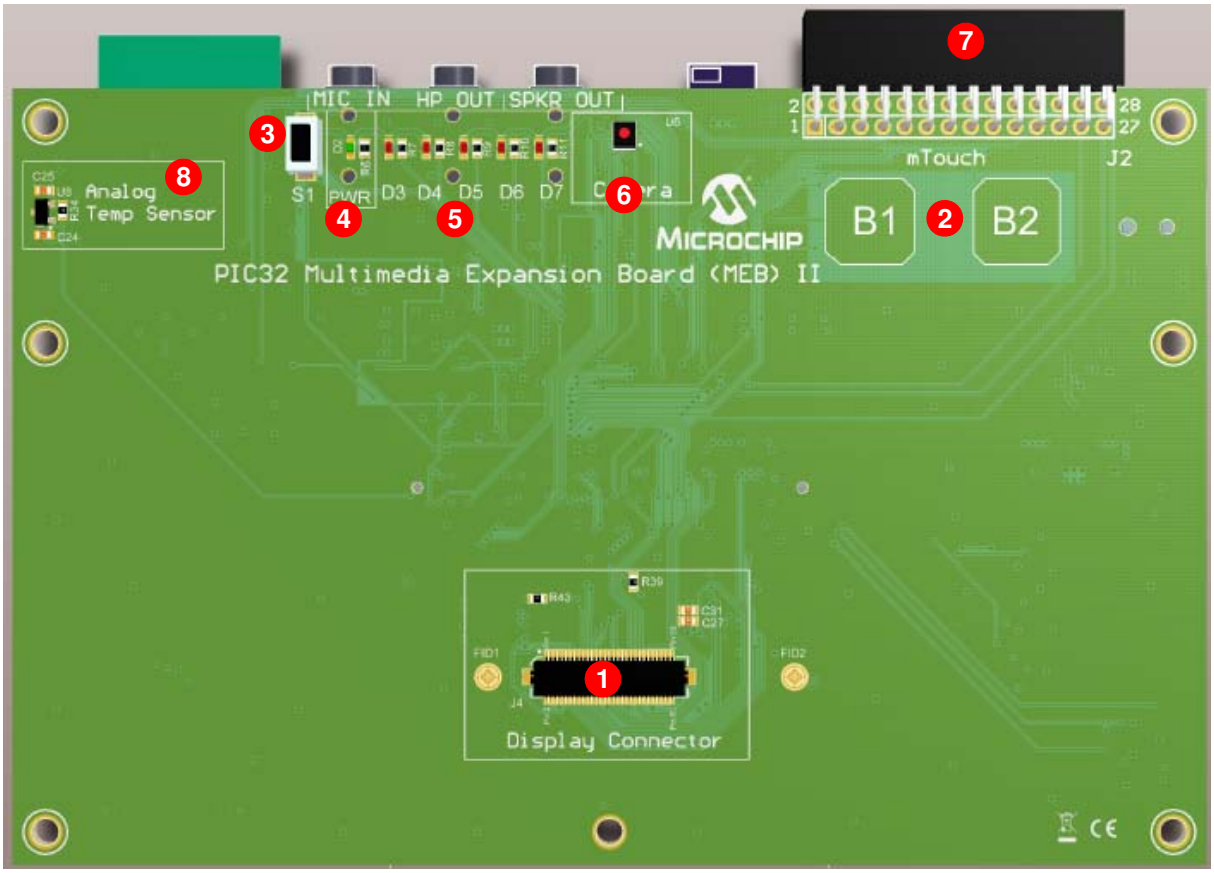
1.3 MULTIMEDIA FEATURES

The component layout of the MEB II is shown in Figure 1-2 and Figure 1-3. As mentioned previously, the MEB II kit also includes a 4.3" PCAP touch display board. The component layout of this board is shown in Figure 1-4 and Figure 1-5.

The top side of the MEB II includes these key features, as shown in Figure 1-2:

1. Display daughter board connector (60-pin Hirose board-to-board connector)
2. mTouch™ buttons
3. Push Button
4. Power LED
5. User LEDs
6. VGA Camera (OVM7690)
7. PICtail™ Connector
8. Analog temperature sensor

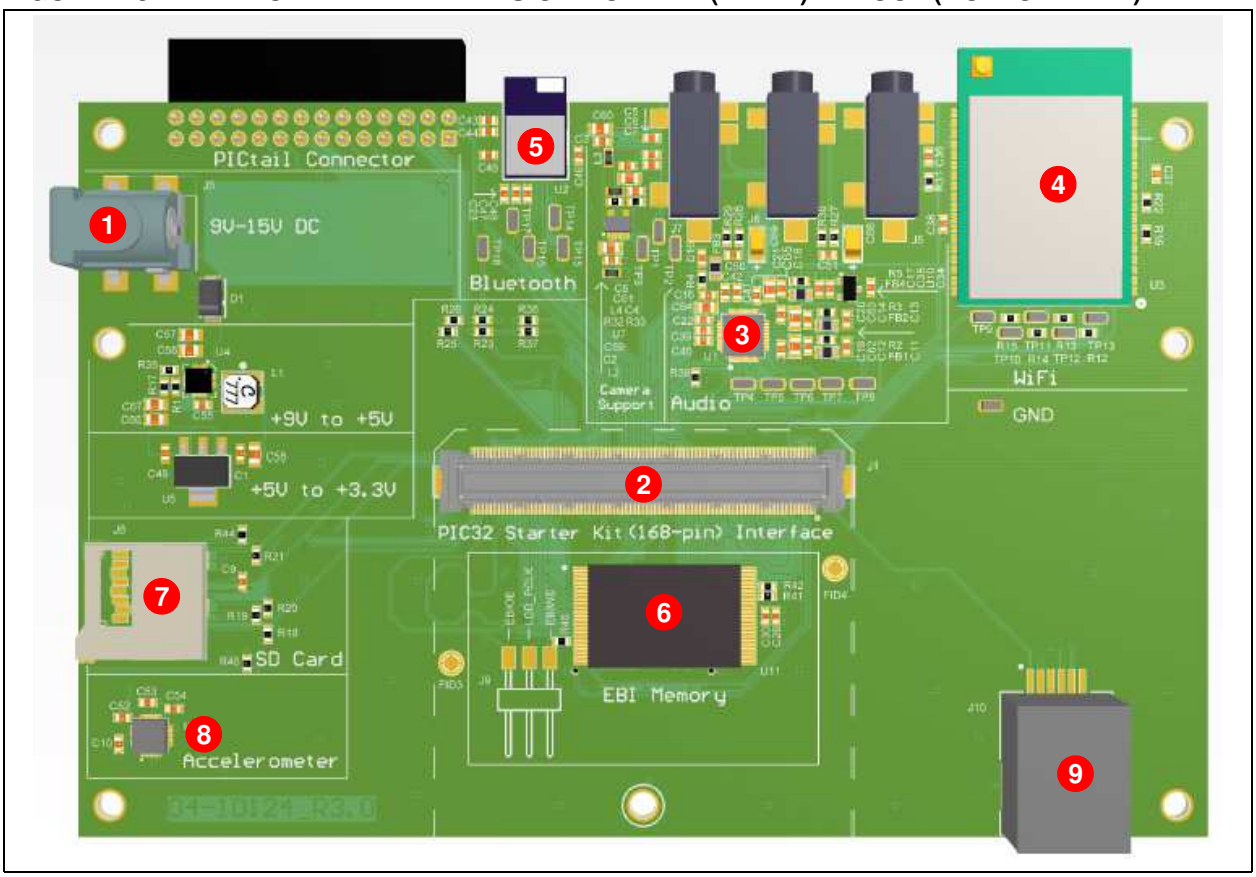
FIGURE 1-2: MULTIMEDIA EXPANSION BOARD II (MEB II) LAYOUT (TOP VIEW)



The bottom side of the MEB II includes these key features, as shown in Figure 1-3:

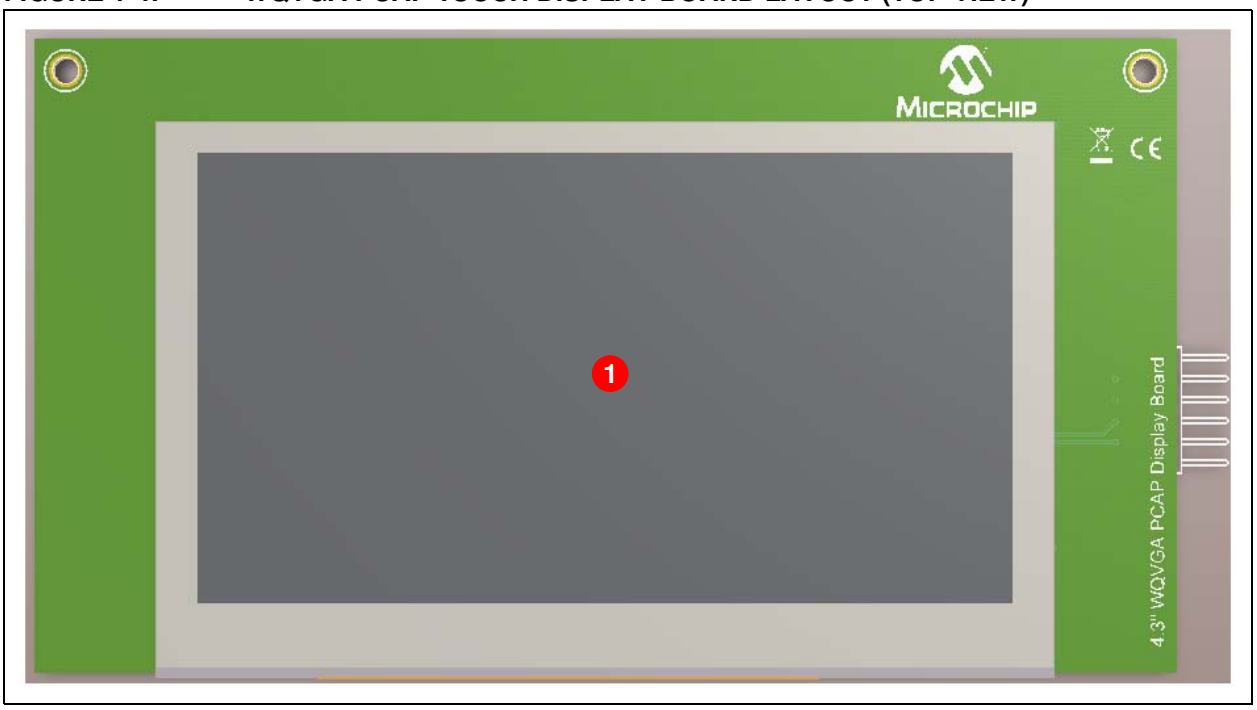
1. Regulated 5V and 3.3V power supply for powering the board through a 9-15V DC Adapter.
2. PIC32 Starter Kit connector (168-pin Hirose board-to-board connector).
3. 24-bit stereo audio codec (AK4953A).
4. Integrated 802.11bg wireless module (MRF24WG0MA).
5. Low-cost Bluetooth® HCI transceiver (BTM805).
6. EBI SRAM memory (IS61WV102416BLL).
7. microSD slot.
8. Analog accelerometer (ADXL325).
9. MPLAB® REAL ICE™ In-Circuit Emulator.

FIGURE 1-3: MULTIMEDIA EXPANSION BOARD II (MEB II) LAYOUT (BOTTOM VIEW)



The top side of the 4.3" WQVGA PCAP touch display board includes this key feature, as shown in Figure 1-4: 1) 4.3" WQVGA glass with PCAP touch panel.

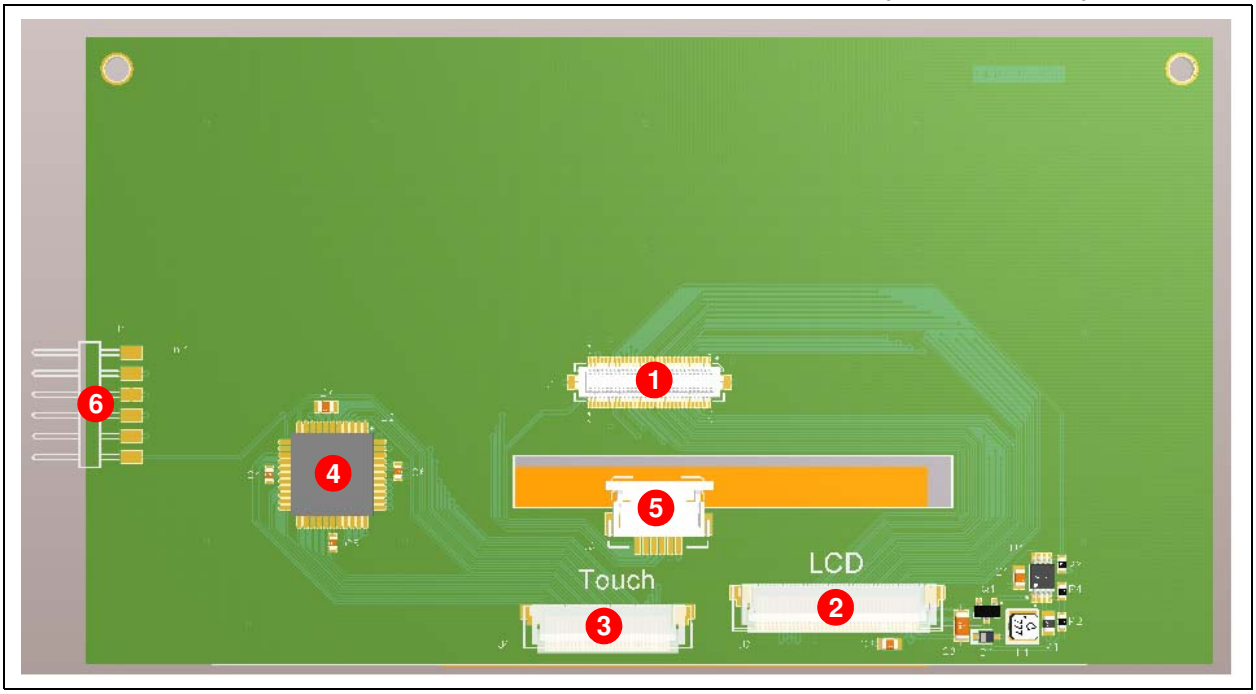
FIGURE 1-4: WQVGA PCAP TOUCH DISPLAY BOARD LAYOUT (TOP VIEW)



The bottom side of the 4.3" WQVGA PCAP touch display board includes these key features, as shown in Figure 1-5:

1. 60-pin MEB II connector.
2. Display panel connector.
3. PCAP touch connector.
4. Microchip touch controller (MTCH6301).
5. 6-in PCAP touch connector for future use.
6. PICkit™ Serial Analyzer interface (optional)

FIGURE 1-5: WQVGA PCAP TOUCH DISPLAY BOARD LAYOUT (BOTTOM VIEW)



1.4 MEB AND MEB II DIFFERENCES

Table 1-1 describes the differences between the first (MEB) and second (MEB II) generation boards.

TABLE 1-1: MEB BOARD DIFFERENCES

Feature	MEB II	MEB
Starter Kit Connector	160-pin Hirose FX10 series board-to-board connector	132-pin Hirose FX10 series board-to-board connector
Starter Kit	Refer to: http://www.microchip.com/meb2	Refer to: http://www.microchip.com/meb
Display	Low-Cost Controllerless (LCC) graphics	On-board graphics controller (SSD1926)
	60-pin display connector	N/A
	Includes a 4.3" WQVGA display with projected capacitive touch(MTCH6301)	3.2" QVGA display with resistive touch
	Supports up to 7" WVGA display through a connector	N/A
External SRAM (EBI)	ISSI 2 MB external synchronous RAM (IS61WV102416BLL-10TLI)	N/A
VGA Camera	Available on board	N/A
Audio	24-bit audio codec (AK4953A)	24-bit audio codec (WM8731)
Bluetooth®	Low cost Bluetooth™ HCI transceiver	N/A
Wi-Fi	IEEE 802.11b/g (MRF24WG0MA) transceiver module	IEEE 802.11b (MRF24WB0MA) transceiver module
Accelerometer	ADXL325 3-axis analog accelerometer	BMA150 3-axis digital accelerometer and temperature sensor
Temperature Sensor	MCP9700T analog temperature sensor	Temperature sensor in BMA150
microSD	Connects to Host CPU on the starter kit	Connects to the graphics controller
mTouch™ Buttons	Two touch buttons; additional touch button support through a PICtail™ connector	Touch button support through a PICtail™ connector
PICtail™ Connector	Yes	Yes
EEPROM	N/A	128-byte EEPROM (24LC08)
SPI Flash	See **Note 1**	2 MB SST25VF016 serial Flash
CPLD	See **Note 2**	Xilinx XC2C64A for port enhancement
Joystick	N/A	Available

Note 1: Serial Quad Flash support through the PIC32 Starter Kit.

2: Port enhancement is not necessary due to extended connector and available device pins.

NOTES:

Chapter 2. Hardware

This chapter describes the hardware features used in the MEB II and the 4.3" WQVGA PCAP Touch Display Board.

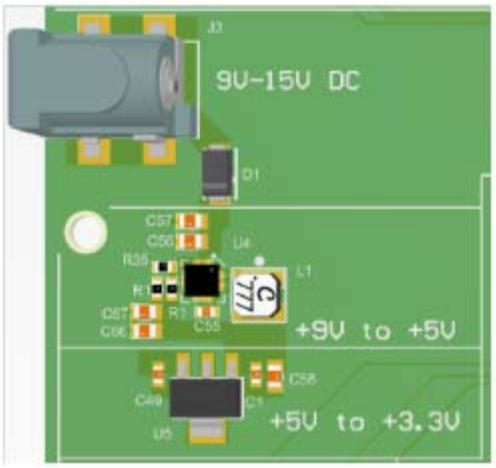
2.1 HARDWARE FEATURES

Note: Refer to **Appendix A. "Board Layout and Schematics"** and **Appendix B. "Bill of Materials"** for the schematics and manufacturer and part number information of the hardware components used in the Multimedia Expansion Board II (MEB II) and the 4.3" WQVGA PCAP Touch Display Board.

2.1.1 Power Supply

Power can be supplied to the MEB II in two ways: 1) through the DC connector (J3) located on the MEB II (Figure 2-1), and 2) through the USB on the Starter Kit. By connecting a 9-15V power supply to the DC connector or the USB device on the Starter Kit, the MEB II, Display Daughter Board and the Starter Kit will receive the proper voltages. However, if the application plans to use multiple features of the MEB II, it is recommended to use a 9V to 15V DC power supply.

FIGURE 2-1: 9V TO 15V DC POWER SUPPLY



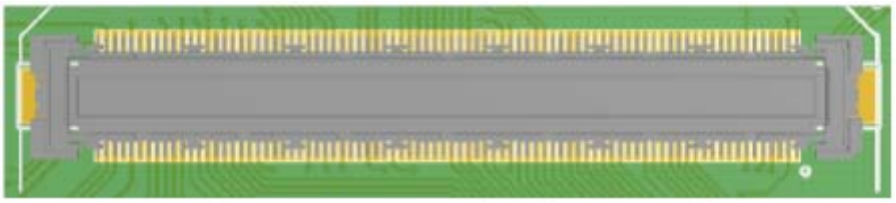
CAUTION

When connecting the Multimedia Expansion Board II (MEB II) to a starter kit, do not have power applied to either the starter kit or the DC power supply. Failure to heed this caution could result in hardware damage.

2.1.2 Starter Kit Connector

The starter kit connector, as shown in Figure 2-2, is a high-speed, 168-pin Hirose FX10 board-to-board connector that is used to connect the MEB II to PIC32 starter kits.

FIGURE 2-2: STARTER KIT CONNECTOR



CAUTION

When connecting the Multimedia Expansion Board II (MEB II) to a starter kit, do not have power applied through either the starter kit or the DC power supply. Failure to heed this caution could result in hardware damage.

After connecting a PIC32 starter kit, applications can be developed and run using the rich features of the MEB II. Table 2-1 shows the Starter Kit Connector pin and the MEB II component mapping.

TABLE 2-1: STARTER KIT CONNECTOR MAPPING

Starter Kit Connector			MEB II	
Pin Number	**Signal**	**Pin Type**	**Component**	**Description**
1	$\overline{SS1}$	O	Audio Codec	Left-Right Clock
64	RH3	O		Audio Power Down
82	SDA2	I/O		I^2C Data
94	SDI1	I		Audio Serial Data Output
96	REFCLKO1	O		External Master Clock Input
112	SCL2	I/O		Serial Clock
117	SDO1	O		Audio Serial Data Input
118	SCK1	O		Audio Bit Clock
7	RB1	O	EBI-SRAM/Display	Horizontal Sync.
68	EBIWE	O		Pixel Clock
77	RJ3	O		Reset
78	EBICS2	O		Chip Select
103	RB4	O		Data Enable
108	RH9	O		Vertical Sync
116	RH13	O		Stand-by
131	EBID15	I/O		R0
132	LCD_B7	I/O		B7
133	LCD_R1	I/O		R1
134	EBID3	I/O		B6
135	LCD_R2	I/O		R2
136	EBID2	I/O		B5
137	EBID11	I/O		R3

TABLE 2-1: STARTER KIT CONNECTOR MAPPING (CONTINUED)

Starter Kit Connector			MEB II	
Pin Number	**Signal**	**Pin Type**	**Component**	**Description**
138	EBID1	I/O	EBI-SRAM/Display	B4
139	EBID12	I/O		R4
140	EBID0	I/O		B3
141	EBID13	I/O		R5
142	EBID4	I/O		B2
143	EBID14	I/O		R6
144	LCD_B1	I/O		B1
145	LCD_R7	I/O		R7
146	LCD_B0	I/O		B0
147	EBID10	I/O		G0
148	LCD_G7	I/O		G7
149	LCD_G1	I/O		G1
150	EBID9	I/O		G6
151	EBID5	I/O		G2
152	EBID8	I/O		G5
153	EBID6	I/O		G3
154	EBID7	I/O		G4
155	EBIOE	O		Pixel Clock
13	$\overline{\text{MCLR}}$	I/O	Touch	Touch Controller Reset (System Reset in general)
110	RH10	O		Touch Wake-up
124	SCL1	I/O		Serial Clock
126	SDA1	I/O		Serial Data
92	AN42	I	mTouch button	Touch Button B1
111	AN28	I		Touch Button B2
80	RJ7	O	VGA Camera	Power Down
86	RA9	I		Vertical Sync
90	OC5	O		System Input Clock
104	SDA3	I/O		Serial Data
106	SCL3	I/O		Serial Clock
19	INT2	I		VGA Camera Pixel
93	RE8	O	VGA Camera Regulator	Shutdown
27	EBIA1/RK1	I/O	EBI-SRAM/ VGA Camera	Address 1/VGA Camera Data 1
31	EBIA3/RK2	I/O		Address 3/VGA Camera Data 2
61	EBIA16/RK0	I/O		Address 16/VGA Camera Data 0
63	EBIA17/RK3	I/O		Address 17/VGA Camera Data 3
65	EBIA18/RK4	I/O		Address 17/VGA Camera Data 4
67	EBIA19/RK5	I/O		Address 17/VGA Camera Data 5
73	EBIA20/RK6	I/O		Address 17/VGA Camera Data 6
75	EBIA21/RK7	I/O		Address 17/VGA Camera Data 7

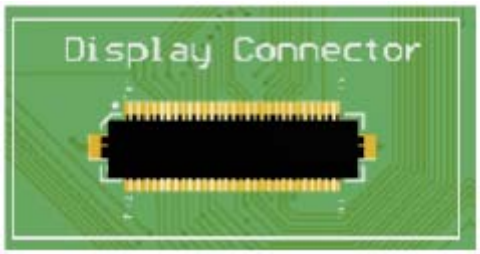
TABLE 2-1: STARTER KIT CONNECTOR MAPPING (CONTINUED)

Starter Kit Connector			MEB II	
Pin Number	Signal	Pin Type	Component	Description
25	EBIA0	O	EBI-SRAM	Address 0
29	EBIA2	O		Address 2
33	EBIA4	O		Address 4
35	EBIA5	O		Address 5
37	EBIA6	O		Address 6
43	EBIA7	O		Address 7
47	EBIA9	O		Address 9
49	EBIA10	O		Address 10
51	EBIA11	O		Address 11
53	EBIA12	O		Address 12
55	EBIA13	O		Address 13
57	EBIA14	O		Address 14
59	EBIA15	O		Address 15
79	EBIA23	O		Sleep Enable
81	EBIBS0	O		Bank Select 0 (Lower Bank)
83	EBIBS1	O		Bank Select 1 (Upper Bank)
14	INT0	I	Wi-Fi	Wi-Fi Interrupt
85	RH14	O		Sleep
89	SDI4	I		Serial Data Out
105	SDO4	O		Serial Data In
95	$\overline{SS4}$	O		Chip Select
120	RJ0	O		Reset
114	SCK4	I/O		Serial Clock
87	SCK2	I	Bluetooth	Serial Transmit
107	RB2	O		Regulator Enable
122	$\overline{U2RTS}$	O		Request-to-Send
91	$\overline{U2CTS}$	I/O		Serial Clear-to-Send
88	U2TX	O		Serial Receive/mTouch Button Analog Channel
119	AN6	O	Accelerometer	X-axis Out
121	AN7	O		Y-axis Out
123	AN8	O		Z-axis Out
23	AN23	I	Temperature Sensor	Temp. Sense channel
163	SD_DATA3/SD_CD	I/O	microSD	Data 3/Card Detect
164	SD_DATA2	I/O		Data 2
165	SD_DATA1	I/O		Data 1
166	SD_DATA0	I/O		Data 0
167	SD_CLK	O		Clock
168	SD_CMD	O		Command
76	RJ5	I		Mechanical Card Detect
4	RA0	O	Fire Button	
113	RH0	O	LED1	
62	RH2	O	LED2	
115	RH1	O	LED3	
92	RH6	O	LED4	
84	RH11	O	LED5	

2.1.3 Display Connector

The MEB II supports display on a separate daughter card through a 60-pin Hirose DF12 board-to-board display connector, as shown in Figure 2-3.

FIGURE 2-3: DISPLAY CONNECTOR



CAUTION

When connecting the Multimedia Expansion Board II (MEB II) to a starter kit or to the display daughter board, do not have power applied through either the starter kit or the DC power supply. Failure to heed this caution could result in hardware damage.

The MEB II supports a variety of displays through the daughter board and the kit includes a 4.3" WQVGA Projected Capacitive (PCAP) Touch display. Refer to **2.1.15 "4.3" WQVGA PCAP Touch Display Daughter Board"** for additional details. Table 2-2 shows the display connector functional mapping.

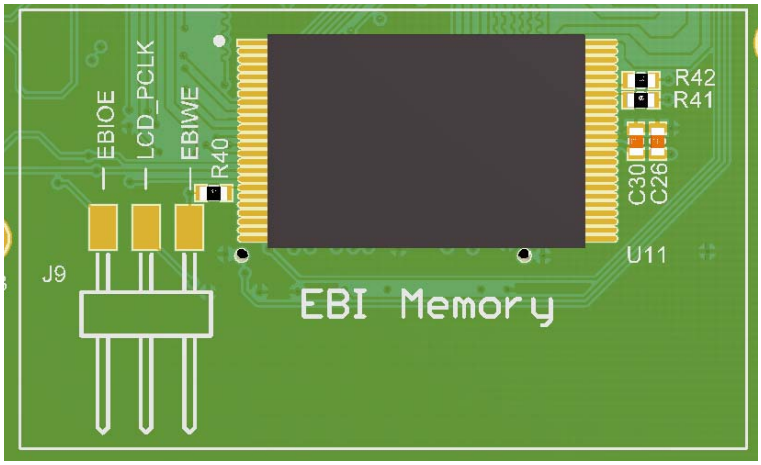
TABLE 2-2: DISPLAY CONNECTOR

Display Connector			
Pin Number	**Signal**	**Pin Type**	**Description**
9	G4	I/O	Display RGB Data
10	G0	I/O	
11	G5	I/O	
12	G1	I/O	
13	G6	I/O	
14	G2	I/O	
15	G7	I/O	
16	G3	I/O	
17	R0	I/O	
18	B0	I/O	
19	R1	I/O	
20	B1	I/O	
21	R2	I/O	
22	B2	I/O	
23	R3	I/O	
24	B3	I/O	
25	R4	I/O	
26	B4	I/O	
31	R5	I/O	
32	B5	I/O	
33	R6	I/O	
34	B6	I/O	
35	R7	I/O	
36	B7	I/O	
37	PCLK	I/O	Display Pixel Clock
38	STBYB	I/O	Display Stand-by
39	VSYNC	I/O	Display Vertical Sync
40	HSYNC	I/O	Display Horizontal Sync
41	DE	I/O	Display Data Enable
42	CS	I/O	Display Chip Select
43	INT	I/O	Touch interrupt
44	SCL	I/O	Touch Serial Clock
45	$\overline{\text{WAKE}}$	I/O	Touch Wake
46	SDA	I/O	Touch Serial Data
47	BLEN	I/O	Display Backlight Enable
48	RESET	I/O	Display Reset
55	$\overline{\text{MCLR}}$	I/O	System Reset

2.1.4 EBI SRAM Memory (Optional)

The MEB II includes an External Bus Interface (EBI) routed to support both asynchronous SRAM and pseudo-SRAM memories. By default, these memories are not populated on the board and users can populate them as needed. The interface is routed considering both ISSI SRAM (IS61WV51216BLL-10TLI) and pseudo-SRAM (IS66WVE4M16BLL-70BLI) memories, as shown in Figure 2-4.

FIGURE 2-4: EBI SRAM MEMORY



2.1.5 VGA Camera Sensor

The MEB II includes an Omnivision OVM7690 VGA camera sensor with an active array size of 640 x 480 (VGA resolution), as shown in Figure 2-5. The PIC32 microcontroller uses the I^2C interface to control the sensor and the sensor communicates the image data through an 8-bit (DATA7-DATA0) data bus.

FIGURE 2-5: VGA CAMERA SENSOR