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ISBN: 978-1-5224-0374-6
Object of Declaration:
PIC32MZ Embedded Connectivity (EC) Starter Kit (DM320006, DM320006-C)

EU Declaration of Conformity

Manufacturer: Microchip Technology Inc.
2355 W. Chandler Blvd.
Chandler, Arizona, 85224-6199
USA

This declaration of conformity is issued by the manufacturer.

The development/evaluation tool is designed to be used for research and development in a laboratory environment. This development/evaluation tool is not a Finished Appliance, nor is it intended for incorporation into Finished Appliances that are made commercially available as single functional units to end users under EU EMC Directive 2004/108/EC and as supported by the European Commission’s Guide for the EMC Directive 2004/108/EC (8th February 2010).

This development/evaluation tool complies with EU RoHS2 Directive 2011/65/EU.

This development/evaluation tool, when incorporating wireless and radio-telecom functionality, is in compliance with the essential requirement and other relevant provisions of the R&TTE Directive 1999/5/EC and the FCC rules as stated in the declaration of conformity provided in the module datasheet and the module product page available at www.microchip.com.

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Signed for and on behalf of Microchip Technology Inc. at Chandler, Arizona, USA

Derek Carlson
VP Development Tools

12-Sep-14
Date
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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
“DSXXXXXXXXXA”, 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
PIC32MZ Embedded Connectivity (EC) Starter Kit. 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 PIC32MZ Embedded Connectivity (EC)
Starter Kit (also referred to as “starter kit”) 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.
• 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

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

PIC32MZ Embedded Connectivity (EC) Family Data Sheet (DS60001191)
Refer to this document for detailed information on PIC32MZ EC 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
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- **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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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

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- 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 (February 2014)
The following sections were updated to reflect the LAN8740 PHY Daughter Board, which is included in the starter kit:
• 1.1 “Kit Contents”
• 1.2 “Starter Kit Functionality and Features”
• 2.1.9 “Ethernet PHY”
• Appendix A. “Schematics”
• Appendix B. “Bill of Materials”

Revision C (March 2016)
This revision includes the following updates:
• The EU Declaration of Conformity was added (see Object of Declaration:)
• The Ethernet PHY Daughter Board in the starter kit has been updated to the LAN8740A:
  - 1.1 “Kit Contents”
  - 1.2.2 “LAN8740A PHY Daughter Board”
  - 2.1.9 “Ethernet PHY”
  - Figure A-6: “LAN8740A PHY Daughter Board Schematics”
  - B.2 “LAN8740A PHY Daughter Board Bill of Materials”
• The SQI memory size listed in item 12 of 1.2.1 “Development Board” was changed to 4 MB
• Updates to component references were implemented throughout the 2.1 “Hardware Features” section
• Figure A-1: “High-Level Block Diagram of the PIC32MZ Embedded Connectivity (EC) Starter Kit” was updated
Chapter 1. Introduction

Thank you for purchasing a Microchip Technology PIC32MZ Embedded Connectivity (EC) Starter Kit. This starter kit provides a low-cost, modular development system for Microchip’s line of 32-bit microcontrollers. Two versions of the starter kit are available:

- PIC32MZ Embedded Connectivity Starter Kit (DM320006)
- PIC32MZ Embedded Connectivity Starter Kit w/Crypto Engine (DM320006-C)

Both versions of the starter kit are preloaded with demonstration software that can be used to explore the new features of the PIC32MZ EC family of devices. It is also expandable through a modular expansion interface, which allows the user to extend its functionality. The starter kit also supplies on-board circuitry for full debug and programming capabilities.

This chapter covers the following topics:

- Kit Contents
- Starter Kit Functionality and Features

The preprogrammed example code on the PIC32MZ EC family MCU is available for download from the Microchip web site at http://www.microchip.com. All project files have been included so that the code may be used directly to restore the PIC32MZ EC family MCU on the starter kit to its original state (i.e., if the sample device has been reprogrammed with another program) or so you can use the tutorial code as a platform for further experimentation.

1.1 KIT CONTENTS

The PIC32MZ Embedded Connectivity (EC) Starter Kit contains the following items:

- PIC32MZ Embedded Connectivity (EC) Starter Kit Development Board
- LAN8740A Ethernet PHY Daughter Board
- USB mini-B to full-sized A cable – USB debug cable to debug and power the Development Board
- USB micro-B to full-sized A cable – PIC32 USB cable to communicate with the PIC32 USB port
- RJ-45 CAT5 Ethernet patch cable – Ethernet CAT5 cable to communicate with the PIC32 Ethernet port

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 STARTER KIT FUNCTIONALITY AND FEATURES

1.2.1 Development Board

Representations of the layout of the development board included in the PIC32MZ Embedded Connectivity (EC) Starter Kit are shown in Figure 1-1 and Figure 1-2. The top assembly of the board includes these key features, as indicated in Figure 1-1:

1. PIC32MZ2048ECH144-I/PH or PIC32MZ2048ECM144-I/PH (Crypto Engine) 32-bit microcontroller.
2. Green power indicator LED.
3. On-board crystal or oscillator for precision microcontroller clocking (24 MHz).
4. USB connectivity for on-board debugger communications.
5. Green debug indicator LED.
6. Three push button switches for user-defined inputs.
7. Three user-defined indicator LEDs.
8. USB Type A receptacle connectivity for PIC32 host-based applications.
9. HOST mode power jumper.
10. Daughter board connectors for flexible Ethernet PHY options.
11. 32 kHz oscillator for RTCC and Timer1 (optional).
12. External 4 MB SQI memory for expanded memory applications.
13. Jumper for using or disconnecting the on-board debugger.

Note: When running self-powered USB device applications, open the jumper JP1 to prevent possibly back-feeding voltage onto the VBus from one port on the host to another (or from one host to another).

For more information on key features, refer to Chapter 2, “Hardware”.

FIGURE 1-1: PIC32MZ EMBEDDED CONNECTIVITY (EC) STARTER KIT LAYOUT (TOP VIEW)
The bottom assembly of the board includes these key features, as indicated in Figure 1-2:

1. PIC24FJ256GB106 USB microcontroller for on-board debugging.
2. Regulated +3.3V power supply for powering the starter kit through USB or expansion board.
3. Connector for various expansion boards.
4. USB Type micro-AB receptacle for OTG and USB device connectivity for PIC32 OTG/device-based applications.
5. 50 MHz Ethernet PHY oscillator.
6. USB Host and OTG power supply for powering PIC32 USB applications.

FIGURE 1-2: PIC32MZ EMBEDDED CONNECTIVITY (EC) STARTER KIT LAYOUT (BOTTOM VIEW)
1.2.2 LAN8740A PHY Daughter Board

Representation of the layout of the daughter board included in the PIC32MZ Embedded Connectivity (EC) Starter Kit is shown in Figure 1-3 and Figure 1-4.

**FIGURE 1-3:** DAUGHTER BOARD LAYOUT (TOP VIEW)

**FIGURE 1-4:** DAUGHTER BOARD LAYOUT (BOTTOM VIEW)
Chapter 2. Hardware

This chapter describes the hardware features of the PIC32MZ Embedded Connectivity (EC) Starter Kit.

2.1 HARDWARE FEATURES

The following key features of the starter kit are presented in the order given in Section 1.2 “Starter Kit Functionality and Features”. Refer to Figure 1-1 for their locations on the development board.

2.1.1 Processor Support

Depending on the starter kit purchased, the development board is designed with a permanently mounted (i.e., soldered) processor, which is either the PIC32MZ2048ECM144 (Crypto Engine) or the PIC32MZ2048ECH144 (without Crypto Engine).

2.1.2 Power Supply

There are two ways to supply power to the starter kit:

- USB bus power is connected to the USB debug connector J3
- An external application board with a regulated DC power supply that provides +5V can be connected to the J1 application board connector that is provided on the bottom side of the board

One green LED (D7) is provided to indicate the PIC32 device is powered up.

2.1.3 Debug USB Connectivity

The starter kit includes a PIC24FJ256GB106 USB microcontroller that provides debugger connectivity over USB. The PIC24FJ256GB106 is hard-wired to the PIC32 device to provide protocol translation through the I/O pins of the PIC24FJ256GB106 to the ICSP™ pins of the PIC32 device.

If MPLAB® REAL ICE™ or MPLAB ICD 3 is used with the starter kit, disconnect the on-board debugger from the PIC32 device by removing the jumper JP2. When the on-board debugger is required, replace the jumper JP2. When the jumper JP2 is installed, pin 1 must be connected to pin 3 and pin 2 must be connected to pin 4.

2.1.4 PIC32 USB Connectivity

There are three possible ways to connect to the PIC32 USB microcontroller:

- HOST Mode – Connect the device to the Type A connector J5, which is located on the top of the starter kit. If using the Debug USB port to power the Host port, install the jumper JP1 to short the back-power prevention diode. Note that 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 JP1 must be removed to prevent back-powering the Debug USB port.
• **DEVICE Mode** – Connect the debug mini-B USB cable to port J3 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 J4, which is located on the bottom of the board. The other end of the cable must have a Type-A connector. Connect the Type-A connector to a USB host. Jumper JP1 should 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 J4, which is located on the bottom side of the board. The starter kit provides an on-board power supply capable of providing 120 mA Max. This supply is controlled by the PIC32MZ2048ECH144 device. Jumper JP1 should be removed.

### 2.1.5 Switches

Push button switches provide the following functionality:

- **SW1**: Active-low switch connected to RB12
- **SW2**: Active-low switch connected to RB13
- **SW3**: Active-low switch connected to RB14

The 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 they are grounded when pressed.

### 2.1.6 LEDs

The LEDs, LED1 through LED3, are connected to PORTH (RH0 through RH2) of the processor. The PORTH pins are set high to illuminate the LEDs.

### 2.1.7 Oscillator Options

A 24 MHz oscillator circuit (Y4) is connected to the on-board microcontroller. This oscillator circuit functions as the controller’s primary oscillator. Depending on which is populated on the starter kit board, a 24 MHz crystal (Y1) may be used instead of Y4.

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 starter kit also has provisions for an external secondary 32 kHz oscillator (Y2); however, this is not populated. A suitable oscillator, the ECS-3X8, can be obtained from Digi-Key: P/N - X801-ND CMR200TB32.768KDZFT.

The PIC24FJ256GB106 is independently clocked and has its own 12 MHz crystal.

### 2.1.8 168-pin Modular Expansion Connector

The PIC32MZ Embedded Connectivity (EC) Starter Kit is designed with a 168-pin modular expansion interface, which allows the board to provide basic generic functionality and easy extendability to new technologies as they become available.

<table>
<thead>
<tr>
<th>TABLE 2-1: STARTER KIT CONNECTOR PART NUMBERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connector</td>
</tr>
<tr>
<td>-----------</td>
</tr>
<tr>
<td>Starter Kit Connector</td>
</tr>
<tr>
<td>Application Board Connector</td>
</tr>
</tbody>
</table>
2.1.9 Ethernet PHY

The Ethernet PHY Daughter Board included in the starter kit is populated with a low-power, small-footprint, 10/100 Fast Ethernet LAN8740A PHY, which features Energy Efficient Ethernet (IEEE 802.3az) and Wake-on-LAN functionality. This daughter board is designed for easy development of RMII Ethernet control applications when it is connected into a compatible PIC32 starter kit.

To use a different Ethernet PHY other than what is offered, visit the microchipDIRECT website (www.microchipdirect.com) for the list of alternate options.
Appendix A. Schematics

A.1 BLOCK DIAGRAM

FIGURE A-1: HIGH-LEVEL BLOCK DIAGRAM OF THE PIC32MZ EMBEDDED CONNECTIVITY (EC) STARTER KIT

---

**Power Circuit**

- **V_{USB}** (or)
- +5V_EXT

---

** Debugger Circuit (PIC24FJ256GB106)**

---

**+3.3V Power Supply**

---

**USB Host**

- Host (Type A)

---

**USB OTG**

- Device/OTG (Type micro-A/B)

---

**ICSP™**

---

**PIC32MZ2048ECH144** (without Crypto Engine) or **PIC32MZ2048ECM144** (with Crypto Engine)

---

**4 MB SQI Memory (SST26VF032-80)**

---

**Switches**

---

**LEDs**

---

**LAN8740A Ethernet PHY Daughter Board**

---

**10/100 Jack**

---

**Application Board Connector**

---

**Debugger Circuit**

---

**Note 1:** From Debugger USB Port.
A.2 SCHEMATICS

FIGURE A-2: PIC32MZ EMBEDDED CONNECTIVITY (EC) STARTER KIT (PIC32MZ EC FAMILY DEVICE)
Figure A-3: PIC32MZ Embedded Connectivity (EC) Starter Kit (USB Host and OTG Power Supplies)

PHY Daughter Board Connections

USB OTG/Device Power Supply (120mA MAX)

USB HOST Power Supply

Current Limiting Switch
FIGURE A-4: PIC32MZ EMBEDDED CONNECTIVITY (EC) STARTER KIT (DEBUGGER)

TARGET POWER ENABLE

SERIAL EEPROM (25LC256)

JP2 Jumper Positions

PKOB Mode
pins 1-3: Shorted
pins 2-4: Shorted

REAL ICE Mode
pins 1-3: Open
pins 2-4: Open

TARGET ICSP SIGNALS

POWER DISTRIBUTION/SWITCHING

USB INTERFACE (BUS POWERED)
FIGURE A-5: PIC32MZ EMBEDDED CONNECTIVITY (EC) STARTER KIT (APPLICATION BOARD CONNECTOR, SQI MEMORY AND POWER, LEDS, AND SWITCHES)
FIGURE A-6: LAN8740A PHY DAUGHTER BOARD SCHEMATICS

- MODE[2:0] = 111
- Place close to U1
- Create EGND copper pour around RJ-45 Conn
### Appendix B. Bill of Materials

#### B.1 STARTER KIT BILL OF MATERIALS

<table>
<thead>
<tr>
<th>Reference</th>
<th>Description</th>
<th>Manufacturer</th>
<th>Part No.</th>
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<tbody>
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<td>C1, C2, C3, C4, C5, C6, C7, C8, C9, C10, C11, C12, C13, C14, C15, C16, C17, C18, C19</td>
<td>CAP CER.10 µF 50V X7R 0603</td>
<td>TDK Corporation</td>
<td>C1608XR1H104M</td>
</tr>
<tr>
<td>C20, C21, C22, C23, C24, C25, C26, C27, C28, C29, C30, C48</td>
<td>CAP CER 10000 pF 50V X7R 0603</td>
<td>TDK Corporation</td>
<td>C1608X7R1H103M</td>
</tr>
<tr>
<td>C31, C32, C33</td>
<td>CAP CER 1.0 µF 16V X5R 10% 0603</td>
<td>TDK Corporation</td>
<td>C1608X5R1C105K</td>
</tr>
<tr>
<td>C38, C39</td>
<td>CAP CER 8 pF 50V NP0 0603</td>
<td>Murata</td>
<td>GRM1885C1H8R0D201D</td>
</tr>
<tr>
<td>C40, C41</td>
<td>CAP CER 2.2 µF 16V X5R 0603</td>
<td>TDK Corporation</td>
<td>C1608X5R1C225K</td>
</tr>
<tr>
<td>C42</td>
<td>CAP CER 4.7 µF 6.3V 10% X5R 0603</td>
<td>Taiyo Yuden</td>
<td>JMK107BJ475KA-T</td>
</tr>
<tr>
<td>C43, C44, C45</td>
<td>CAP CER 10 µF 16V Y5V 0805</td>
<td>Murata</td>
<td>GRM218F51C106ZE15L</td>
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<tr>
<td>C46</td>
<td>CAP CER 100 µF 6.3V Y5V 1206</td>
<td>Murata</td>
<td>GRM31CF50J107ZE01L</td>
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<tr>
<td>D1, D2</td>
<td>DIODE SCHOTTKY 20V 0.5A SOD123</td>
<td>ON Semiconductor</td>
<td>MBR0520LT1G</td>
</tr>
<tr>
<td>D3</td>
<td>LED, SMD, RED, 0603 package</td>
<td>Kingbright Corp</td>
<td>APT1608EC</td>
</tr>
<tr>
<td>D4</td>
<td>LED, SMD, YEL, 0603 package</td>
<td>Kingbright Corp</td>
<td>APT1608YC</td>
</tr>
<tr>
<td>D5, D6, D7</td>
<td>LED, SMD, GRN, 0603 package</td>
<td>Kingbright Corp</td>
<td>APT1608SGC</td>
</tr>
<tr>
<td>J1</td>
<td>Hirose FX10_168-pin Header</td>
<td>Hirose Electric Co Ltd</td>
<td>FX10A-168P-SV1(71)</td>
</tr>
<tr>
<td>J7</td>
<td>CONN HEADER .050&quot; 6 POS PCB GOLD</td>
<td>Samtec</td>
<td>TMS-106-01-G-S</td>
</tr>
<tr>
<td>J3</td>
<td>CONN RECEPT MINI USB 2.0 5 POS</td>
<td>Hirose Electric Co Ltd</td>
<td>UX60-MB-5ST</td>
</tr>
<tr>
<td>J4</td>
<td>CONN USB TYPE MICRO_A/B</td>
<td>Hirose Electric Co Ltd</td>
<td>ZX62-AB-5PA(11)</td>
</tr>
<tr>
<td>J5</td>
<td>CONN USB TYPE A R/A BLACK</td>
<td>On Shore Technology Inc</td>
<td>USB-A1H586</td>
</tr>
<tr>
<td>J6</td>
<td>12 POS 0.05&quot; SINGLE ROW TH HEADER</td>
<td>Samtec</td>
<td>SLM-103-112-L-S</td>
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<tr>
<td>@ J6</td>
<td>3POS 0.05&quot; SINGLE ROW TH HEADER</td>
<td>Samtec</td>
<td>SLM-103-113-L-S</td>
</tr>
<tr>
<td>JP2</td>
<td>2X2 (0.05&quot;x 0.05&quot;) TH HEADER</td>
<td>Samtec</td>
<td>FTS-102-01-L-D</td>
</tr>
<tr>
<td>JP1</td>
<td>CONN HEADER .100&quot; SNGL STR 2POS</td>
<td>SULLINS</td>
<td>NPB02DFV-FR-RC</td>
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<tr>
<td>Q1</td>
<td>TRANS SS PNP 40V 300MW SOT23</td>
<td>Micro Commercial Co.</td>
<td>MMBT3906-TP</td>
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<tr>
<td>Q2, Q3</td>
<td>TRANSISTOR NPN GP 40V SOT23</td>
<td>Micro Commercial Co.</td>
<td>MMBT3904-TP</td>
</tr>
<tr>
<td>Q5</td>
<td>MOSFET P-CH 8V 3.7A SOT23-3</td>
<td>ON Semiconductor</td>
<td>NTR2101PT1G</td>
</tr>
<tr>
<td>R1, R2, R3, R4</td>
<td>RES 4.7K OHM 1/10W 1% 0603 SMD</td>
<td>Stackpole Electronics Inc.</td>
<td>RMCF0603FT4K70</td>
</tr>
<tr>
<td>R5, R6, R7, R8, R9, R10, R11, R12, R13</td>
<td>RES 330 OHM 1/10W 1% 0603 SMD</td>
<td>Stackpole Electronics Inc.</td>
<td>RMCF0603FT330R</td>
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</table>

**Note 1:** Depending on the starter kit purchased, the development board will be populated with either a PIC32MZ2048ECM144 (w/Crypto Engine) device or a PIC32MZ2048ECH144 device.
### TABLE B-1: PIC32MZ EMBEDDED CONNECTIVITY (EC) STARTER KIT BILL OF MATERIALS (CONTINUED)

<table>
<thead>
<tr>
<th>Reference</th>
<th>Description</th>
<th>Manufacturer</th>
<th>Part No.</th>
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</thead>
<tbody>
<tr>
<td>R14, R15, R16, R17, R18, R19, R20, R21, R22, R23</td>
<td>RES 10K OHM 1/10W 1% 0603 SMD</td>
<td>Stackpole Electronics Inc.</td>
<td>RMCF0603FT10K0</td>
</tr>
<tr>
<td>R24, R25, R26, R27</td>
<td>RES 100K OHM 1/10W 1% 0603 SMD</td>
<td>Stackpole Electronics Inc.</td>
<td>RMCF0603FT100K</td>
</tr>
<tr>
<td>R28, R29</td>
<td>RES 200K OHM 1/10W 1% 0603 SMD</td>
<td>Stackpole Electronics Inc.</td>
<td>RMCF0603FT200K</td>
</tr>
<tr>
<td>R30, R31, R32</td>
<td>RES 2.21K OHM 1/10W 1% 0603 SMD</td>
<td>Panasonic - ECG</td>
<td>ERJ-3JEF2211V</td>
</tr>
<tr>
<td>R33</td>
<td>RES 3.92K OHM 1/10W 1% 0603 SMD</td>
<td>Yageo</td>
<td>RC0603FR-073K92L</td>
</tr>
<tr>
<td>R34</td>
<td>RES 1K OHM 1/10W 1% 0603 SMD</td>
<td>Stackpole Electronics Inc.</td>
<td>RMCF0603FT1K00</td>
</tr>
<tr>
<td>R35</td>
<td>RES 100 OHM 1/10W 5% 0603 SMD</td>
<td>Yageo</td>
<td>RC0603JR-07100RL</td>
</tr>
<tr>
<td>R36</td>
<td>RES 100 OHM 1/10W 1% 1206 SMD</td>
<td>Yageo</td>
<td>RC1206FR-07100RL</td>
</tr>
<tr>
<td>R37</td>
<td>RES 3.16K OHM 1/10W 1% 0603 SMD</td>
<td>Yageo</td>
<td>RC0603FR-073K16L</td>
</tr>
<tr>
<td>R38, R39, R42, R55</td>
<td>RES 0.0 OHM 1/10W 0603 SMD</td>
<td>Rohm Semiconductor</td>
<td>MCR03EZPJ000</td>
</tr>
<tr>
<td>R48, R49, R50, R51, R52, R53</td>
<td>RES 33 OHM 1/10W 1% 0603 SMD</td>
<td>Stackpole Electronics Inc.</td>
<td>RMCF0603FT33R0</td>
</tr>
<tr>
<td>S1, S2, S3</td>
<td>Switch, Tact, PB MOM SMT, Series TL3302</td>
<td>C&amp;K</td>
<td>PTS6355K255MSTR LFS</td>
</tr>
<tr>
<td>U1(1)</td>
<td>PIC32MZ2048ECH144-I/PH or PIC32MZ2048ECM144-I/PH</td>
<td>Microchip Technology Inc.</td>
<td>PIC32MZ2048ECH144-I/PH or PIC32MZ2048ECM144-I/PH</td>
</tr>
<tr>
<td>U2</td>
<td>IC PIC MCU FLASH 256K 64-TQFP</td>
<td>Microchip Technology Inc.</td>
<td>PIC24FJ256GB106-I/PT</td>
</tr>
<tr>
<td>U3</td>
<td>IC REG LDO 1.5A 3.3V 8DFN</td>
<td>Microchip Technology Inc.</td>
<td>MCP1727-3302E/MF</td>
</tr>
<tr>
<td>U4</td>
<td>IC EEPROM 256 KBIT 10 MHz 8TSSOP</td>
<td>Microchip Technology Inc.</td>
<td>25LC256-I/ST</td>
</tr>
<tr>
<td>U5</td>
<td>IC MULT CONFIG 3.3/5V .12A 8MSOP</td>
<td>Microchip Technology Inc.</td>
<td>MCP1253-3X50I/MS</td>
</tr>
<tr>
<td>U6</td>
<td>IC PWR DIST SWITCH SNGL SOT23-5</td>
<td>Texas Instruments</td>
<td>TPS2051DBVR</td>
</tr>
<tr>
<td>U7</td>
<td>IC SWITCH LOAD FULL FUNC SOT23-5</td>
<td>Fairchild Semiconductor</td>
<td>FPF2104</td>
</tr>
<tr>
<td>U9</td>
<td>IC FLASH 32 MBIT 8-pin SOIC</td>
<td>Microchip Technology Inc.</td>
<td>SST26VF032-80-5I-S2AE</td>
</tr>
<tr>
<td>Y3</td>
<td>CRYSTAL 12.000000 MHZ 8 pF SMD</td>
<td>NDK</td>
<td>NX3225SA-12.000000MHZ</td>
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<tr>
<td>Y4</td>
<td>OSC MEMS 24.000 MHz SMD</td>
<td>Abracon Corporation</td>
<td>ASDMB-24.000MHZ-1C-T</td>
</tr>
<tr>
<td>Y5</td>
<td>OSC MEMS 50.000 MHz_1.8V ~3.3V SMD</td>
<td>Abracon Corporation</td>
<td>ASEMB-50.000MHZ-1C-T</td>
</tr>
<tr>
<td>+3.3V_PKOB, GND</td>
<td>PC TEST POINT MINIATURE SMT</td>
<td>Keystone Electronics</td>
<td>5015</td>
</tr>
<tr>
<td>bottom of board</td>
<td>BUMPON CYLINDRICAL .375X.135 BLK</td>
<td>3M</td>
<td>SJ61A8</td>
</tr>
<tr>
<td>Y1</td>
<td>CRYSTAL 24 MHz 8 pF SMD</td>
<td>AVX</td>
<td>CX3225GA24000D0PTVZ1</td>
</tr>
<tr>
<td>Y2</td>
<td>OSCILLATOR 32.768 kHz 3.3V SM</td>
<td>Abracon Corporation</td>
<td>TC25L532K7680</td>
</tr>
<tr>
<td>C34, C35</td>
<td>CAP CER 8 pF 50V NPO 0603</td>
<td>TDK Corporation</td>
<td>C1608C0G1H080DD080A</td>
</tr>
<tr>
<td>C36</td>
<td>CAP CER 10000 pF 50V X7R 0603</td>
<td>TDK Corporation</td>
<td>C1608X7R1H103M</td>
</tr>
<tr>
<td>R56</td>
<td>RES 1M OHM 1/8W 1% 0805 SMD</td>
<td>Vishay Dale</td>
<td>RMCF0805FT1M00</td>
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</tbody>
</table>

**Note 1:** Depending on the starter kit purchased, the development board will be populated with either a PIC32MZ2048ECH144 (w/Crypto Engine) device or a PIC32MZ2048ECM144 device.
# LAN8740A PHY DAUGHTER BOARD BILL OF MATERIALS

## TABLE B-2: LAN8740A PHY DAUGHTER BOARD BILL OF MATERIALS

<table>
<thead>
<tr>
<th>Reference</th>
<th>Description</th>
<th>Manufacturer</th>
<th>Part No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1, C3, C7, C8</td>
<td>Cap, Ceramic, 1 µF, 16V X5R</td>
<td>TDK Corporation</td>
<td>C1608X5R1C105K</td>
</tr>
<tr>
<td>C2, C4, C5, C6</td>
<td>Cap, Ceramic, 0.1 µF, 50V X7R</td>
<td>TDK Corporation</td>
<td>C1608X7R1H104M</td>
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<tr>
<td>C9</td>
<td>CAP 470 pF 50V CERAMIC X7R 0603</td>
<td>Yageo</td>
<td>CC0603KRX7R9BB471</td>
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<tr>
<td>C10, C11, C12, C13</td>
<td>CAP CER 12 pF 50V 5% NPO 0603</td>
<td>Yageo</td>
<td>CC0603JRNP09BN120</td>
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<tr>
<td>C14</td>
<td>CAP CER 0.022 µF 50V 20% X7R 0603</td>
<td>Murata Electronics North America</td>
<td>GRM188R71H223MA01D</td>
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<td>FB1</td>
<td>FERRITE CHIP 600 OHM 500MA 0805</td>
<td>TDK Corporation</td>
<td>MMZ22012Y601B</td>
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<tr>
<td>J1</td>
<td>TWO CONN HEADER .050” 12 POS PCB GOLD</td>
<td>Samtec</td>
<td>TMS-112-02-L-S</td>
</tr>
<tr>
<td>@J1</td>
<td>TWO CONN HEADER .050” 3 POS PCB GOLD</td>
<td>Samtec</td>
<td>TMS-103-02-L-S</td>
</tr>
<tr>
<td>J2</td>
<td>CONN MAGJACK 1PORT 100 BASE-TX</td>
<td>Pulse Electronics Corporation</td>
<td>J3011G210NL</td>
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<tr>
<td>R1, R2, R3, R4, R6, R8</td>
<td>RES 4.70K OHM 1/10W 1% 0603 SMD</td>
<td>Panasonic - ECG</td>
<td>ERJ-3EKF4701V</td>
</tr>
<tr>
<td>R5, R16</td>
<td>RES 10K OHM 1/10W 1% 0603 SMD</td>
<td>Stackpole Electronics Inc</td>
<td>RMCF0603FT10K0</td>
</tr>
<tr>
<td>R7</td>
<td>RES 1.50K OHM 1/10W 1% 0603 SMD</td>
<td>Vishay Dale</td>
<td>CRCW06031K5FKEA</td>
</tr>
<tr>
<td>R11, R12, R13, R14</td>
<td>RES 33 OHM 1/10W 1% 0603 SMD</td>
<td>Stackpole Electronics Inc</td>
<td>RMCF0603FT33R0</td>
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<tr>
<td>R15</td>
<td>RES 12.1K OHM 1/10W 1% 0603 SMD</td>
<td>Stackpole Electronics Inc</td>
<td>RMCF0603FT12K1</td>
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<tr>
<td>R17, R18, R19, R20</td>
<td>RES TF 1/10W 49.9 OHM 1% 0603</td>
<td>Stackpole Electronics Inc</td>
<td>RMCF0603FG49R9</td>
</tr>
<tr>
<td>R21, R22</td>
<td>RES TF 1/10W 249 OHM 1% 0603</td>
<td>Stackpole Electronics Inc</td>
<td>RMCF0603FG24R9</td>
</tr>
<tr>
<td>R23</td>
<td>RES 0.0 OHM 1/4W 1208 SMD</td>
<td>Yageo</td>
<td>RC1206JR-070RL</td>
</tr>
<tr>
<td>U1</td>
<td>TX/RX ETHERNET 10/100 PHY Energy Efficient Ethernet and Wake-On-LAN</td>
<td>Microchip Technology Inc.</td>
<td>LAN8740A-EN</td>
</tr>
</tbody>
</table>
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