MRF24J40MC PICtail™/ PICtail Plus Daughter Board User's Guide

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MRF24J40MC PICtail™/PICtail PLUS DAUGHTER BOARD USER'S GUIDE

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NOTES:

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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 "DSXXXXXA", where "XXXXX" 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 preface contains general information that will be useful to know before using the MRF24J40MC PICtail™/PICtail Plus Daughter Board. 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 MRF24J40MC PICtail™/PICtail Plus Daughter Board 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. "Overview"** This chapter provides a brief overview of the MRF24J40MC PICtail/PICtail Plus Daughter Board, including board contents and features.
- **Chapter 2. "Getting Started"**This chapter describes how to start using your MRF24J40MC PICtail/PICtail Plus Daughter Board.
- **Appendix A. "MRF24J40MC PICtail™/PICtail Plus Daughter Board Schematics"** This appendix contains the schematics, PCB information and Bill of Materials for the MRF24J40MC PICtail/PICtail Plus Daughter Board.

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CONVENTIONS USED IN THIS GUIDE

This manual uses the following documentation conventions:

DOCUMENTATION CONVENTIONS

Description	Represents	Examples
Arial font:		
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>
Courier New font:		
`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 (in source code)	`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) { ... }`

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RECOMMENDED READING

This user's guide describes how to use the MRF24J40MC PICtail™/PICtail Plus Daughter Board. The following Microchip documents are available from the Microchip web site (www.microchip.com), and are recommended as supplemental reference resources.

MRF24J40 IEEE 802.15.4 2.4 GHz RF Transceiver Data Sheet (DS39776)

MRF24J40MC 2.4 GHz IEEE Std. 802.15.4 RF Transceiver Module with PA/LNA and External Antenna Connector (DS75002)

PICDEM™ PIC18 Explorer Demonstration Board User's Guide (DS51721)

Explorer 16 Development Board User's Guide (DS51589)

2K SPI Bus Serial EEPROM with EUI-48™ Node Identity Data Sheet (DS22123)

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The Development Systems product group categories are:

- **Compilers** – The latest information on Microchip C compilers and other language tools. These include the MPLAB® C compiler; MPASM™ and MPLAB 16-bit assemblers; MPLINK™ and MPLAB 16-bit object linkers; and MPLIB™ and MPLAB 16-bit object librarians.
- **Emulators** – The latest information on the Microchip MPLAB REAL ICE™ in-circuit emulator.
- **In-Circuit Debuggers** – The latest information on the Microchip in-circuit debugger, MPLAB ICD 3.
- **MPLAB IDE** – The latest information on Microchip MPLAB IDE, the Windows® Integrated Development Environment for development systems tools. This list is focused on the MPLAB IDE, MPLAB SIM simulator, MPLAB IDE Project Manager and general editing and debugging features.
- **Programmers** – The latest information on Microchip programmers. These include the MPLAB PM3 device programmer and the PICkit™ 3 development programmers.

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 (May 2011)

This is the initial release of the MRF24J40MC PICtail™/PICtail Plus Daughter Board User's Guide.

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Chapter 1. Overview

1.1 INTRODUCTION

The MRF24J40MC PICtail/PICtail Plus Daughter Board is a demonstration and development daughter board for the MRF24J40MC 2.4 GHz IEEE Std. 802.15.4 RF Transceiver Module with PA/LNA and External Antenna Connector.

The daughter board can be plugged into multiple Microchip Technology demonstration and development boards. For example, the daughter board is appropriate for 8-bit microcontroller development using the PIC18 Explorer Board (DM183032) or for 16-bit or 32-bit microcontroller development using the Explorer 16 Development Board (DM240001).

Supporting software stacks and application notes may be downloaded from the Microchip web site http://www.microchip.com/wireless.

This chapter discusses the following topics:

- MRF24J40MC PICtail/PICtail Plus Daughter Board Contents
- MRF24J40MC PICtail/PICtail Plus Daughter Board

1.2 MRF24J40MC PICtail/PICtail PLUS DAUGHTER BOARD CONTENTS

Depending on the development tool ordered, package contents will contain the following development boards listed in Table 1-1.

TABLE 1-1: MRF24J40MC PICtail™/PICtail PLUS DAUGHTER BOARD

Description	Part Number
MRF24J40MC PICtail/PICtail Plus Daughter Board	AC164143

1.3 MRF24J40MC PICtail/PICtail PLUS DAUGHTER BOARD

The MRF24J40MC PICtail/PICtail Plus Daughter Board is a complete IEEE 802.15.4 2.4 GHz wireless transceiver. The daughter board is shown in Figure 1-1.

IMPORTANT

The MRF24J40MC module contains a power amplifier (PA) and low noise amplifier (LNA). It is important that the MRF24J40 be configured to control the PA and LNA. Refer to **Section 4.2 External PA/LNA Control** in the *MRF24J40 IEEE 802.15.4 2.4 GHz RF Transceiver Data Sheet* (DS39776). When using the source code, refer to the compile options to enable the PA and LNA.

CAUTION

Power to the MRF24J40MC PICtail/PICtail Plus Daughter Board should be in the range of 2.7V – 3.6V. Ensure that the development/demonstration board that the daughter board is plugged into meets this voltage requirement; otherwise, damage to the MRF24J40 may occur.

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FIGURE 1-1: MRF24J40MC PICtail™/PICtail PLUS DAUGHTER BOARD

PICtail Plus Connector (P1) – 30-pin card edge connector for connecting into 16-bit and 32-bit development boards' PICtail Plus connector.

PICtail Connector (P2) – 28-pin right angle connector to connect to 8-bit development boards' PICtail connector.

MRF24J40MC (U2) – 2.4 GHz IEEE 802.15.4 RF Transceiver Module.

Power Disconnect/Current Measure Jumpers (JP1/JP2) – Two 2-pin headers are connected in parallel. A shunt on one of the two headers connects power to the MRF24J40MC module. A current meter can be placed on the open header and when the shunt is removed from the opposite header, current consumption can be measured without interrupting power. A useful cable that can be connected to the 2-pin header and current meter, using banana plugs, is the XLP Current Measurement Cable (AC002023).

External Antenna – 2 dBi dipole whip antenna P/N RFA-02-L2H1-70B-150 from Aristotle Enterprises Inc.

INT2 Jumper (JP3) – Jumpering JP3 with a shunt allows you to connect RA5 to RB2/INT2, this enables push button switch S2 on the PIC18 Explorer to trigger an interrupt. For more information, see **Section 2.2.1 "Configuring Push Button Switch S2 to RB2/INT2"**.

EUI Node Identity Serial EEPROM (U3) – Contains a unique IEEE EUI address. For more information, refer to the "*2K SPI Bus Serial EEPROM with EUI-48™ Node Identity Data Sheet*" (DS22123).

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Chapter 2. Getting Started

2.1 INTRODUCTION

The MRF24J40MC PICtail™/PICtail Plus Daughter Board can be plugged into multiple Microchip Technology demonstration and development boards. This allows the developer to choose the microcontroller that best suits the customer's development environment.

The PICtail connector right-angle header, P2, can be plugged into 8-bit demonstration and development board PIC18 Explorer Board (DM183032). The PICtail Plus card-edge connector, P1, can be plugged into 16-bit or 32-bit Explorer 16 Development Board (DM240001).

This chapter describes how the MRF24J40MC PICtail/PICtail Plus Daughter Board is plugged into the PIC18 Explorer and Explorer 16 Development Boards.

2.2 PLUGGING INTO THE PIC18 EXPLORER BOARD

The MRF24J40MC PICtail/PICtail Plus Daughter Board can be plugged into the PIC18 Explorer Board PICtail connector, J3, as shown in Figure 2-1. Make sure to align pin 1 to RE2 as shown.

IMPORTANT

The MRF24J40MC module contains a power amplifier (PA) and low noise amplifier (LNA). It is important that the MRF24J40 be configured to control the PA and LNA. For more information, refer to **Section 4.2 External PA/LNA Control** in the *MRF24J40 IEEE 802.15.4 2.4 GHz RF Transceiver Data Sheet* (DS39776). When using the source code, refer to the compile options to enable the PA and LNA.

CAUTION

Ensure that the PIC18F87J11 PIM is plugged into the PIC18 Explorer Board. This sets the system V_{DD} voltage to 3.3 volts, which is required by the MRF24J40MC PICtail/PICtail Plus Daughter Board.

2.2.1 Configuring Push Button Switch S2 to RB2/INT2

On the PIC18 Explorer Board, push button switch S2 is normally connected to I/O port pin RA5. RA5 is not an interrupt-on-change or external interrupt capable I/O pin. Jumpering JP3 with a shunt allows the connection of RA5 to RB2/INT2 to allow push button switch S2 to trigger an interrupt. Remember that RB2 also connects to pin 10 (input) of U6 (RS232 level shifter) which is a Clear-to-Send (CTS) signal on P2 pin 8 (DE9 receptacle).

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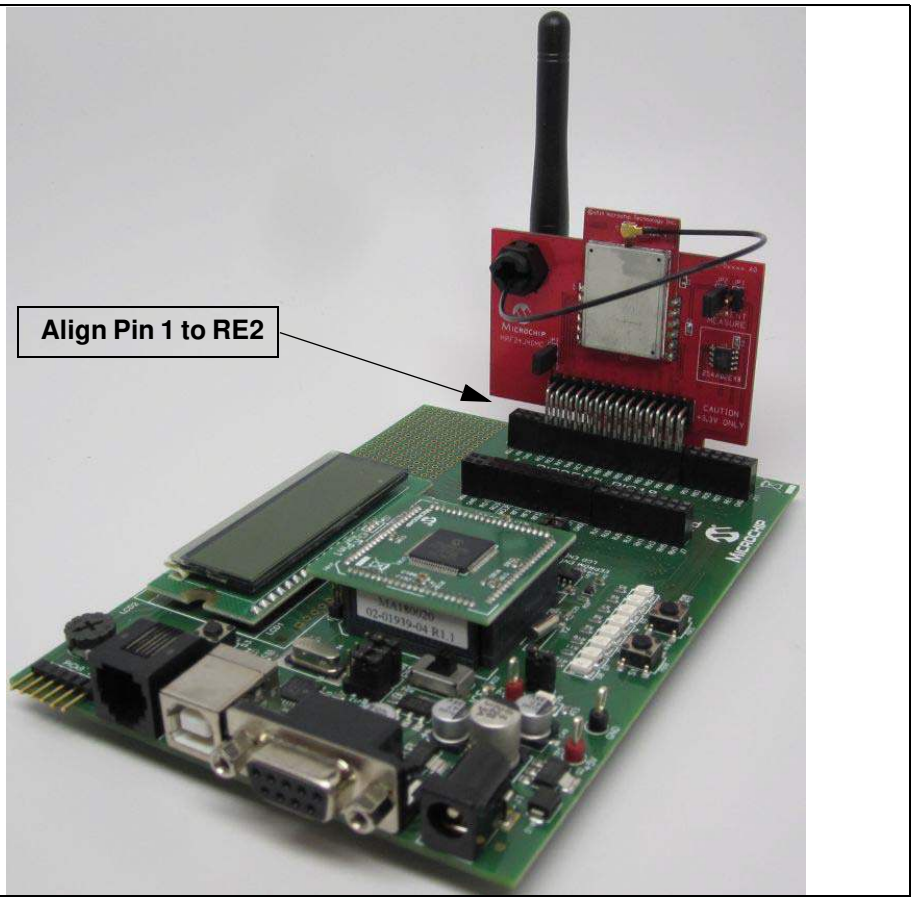
FIGURE 2-1: MRF24J40MC PICtail™/PICtail PLUS DAUGHTER BOARD PLUGGED INTO PIC18 EXPLORER BOARD



2.3 PLUGGING INTO THE EXPLORER 16 DEVELOPMENT BOARD

The MRF24J40MC PICtail/PICtail Plus Daughter Board can be plugged into the Explorer 16 Development Board as shown in Figure 2-2.

The MRF24J40MC PICtail/PICtail Plus Daughter Board's 30-pin card-edge connector is plugged into the top section of the PICtail Plus connector. This will connect to the SPI Port 1 on the PIC® microcontroller plugged into the Plug in Module (PIM) socket.

The MRF24J40MC PICtail/PICtail Plus Daughter Board's 30-pin card-edge connector is plugged into the mid-section of the PICtail Plus connector. This will connect to SPI Port 2 on the PIC microcontroller that is plugged into the PIM socket.

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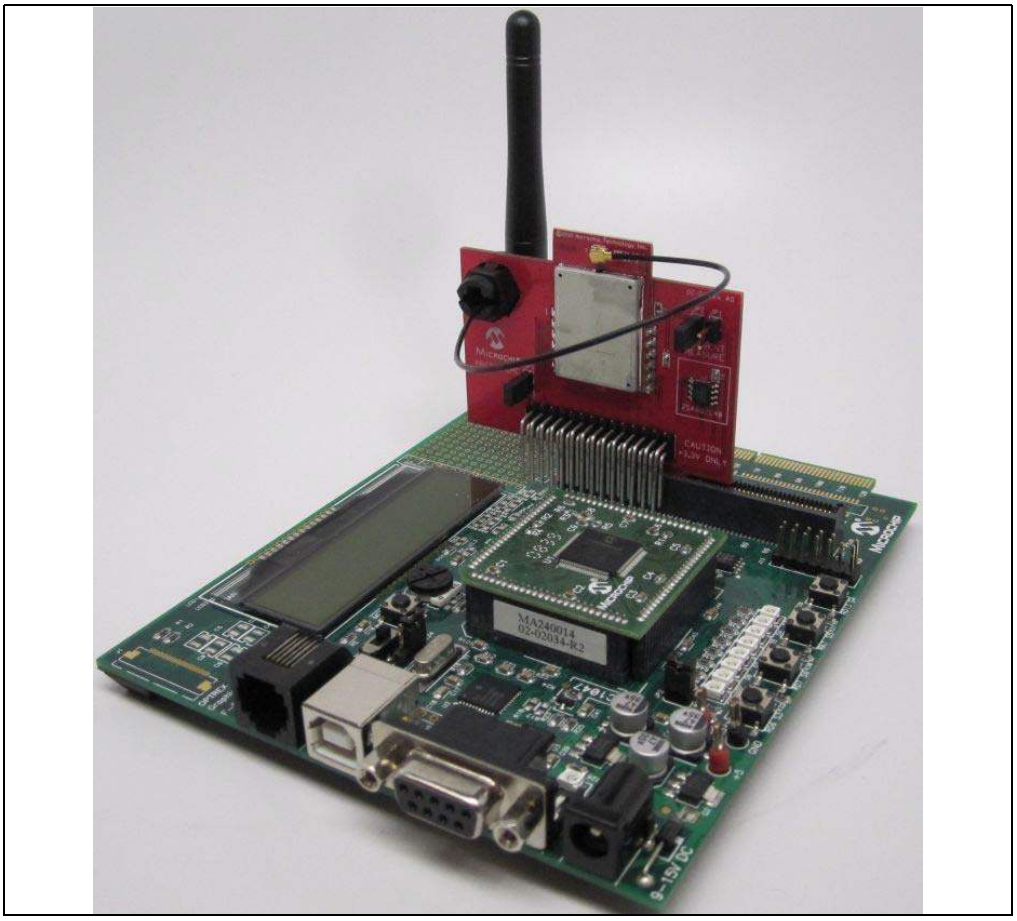
FIGURE 2-2: MRF24J40MC PICtail™/PICtail PLUS DAUGHTER BOARD PLUGGED INTO EXPLORER 16 DEVELOPMENT BOARD



2.4 DOWNLOADING AND RUNNING THE DEMO PROGRAM

Sample source code is available from the Microchip Wireless Development Environment, MiWi Media Access Controller (MiMAC) and MiWi Application Programming Interface (MiApp). For detailed description on MiMAC and MiAPP refer to the application notes AN1283 "*Microchip Wireless (MiWi™) Media Access Controller – MiMAC*" (DS01283A) and AN1284 "*Microchip Wireless (MiWi™) Application Programming Interface – MiApp*" (DS01284A). A Quick Start Guide is included in the software installation package that explains the installation and operation of the demonstration program. It may be downloaded from the Microchip web site http://www.microchip.com/miwi.

NOTES:

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Appendix A. MRF24J40MC PICtail™/PICtail Plus Daughter Board Schematics

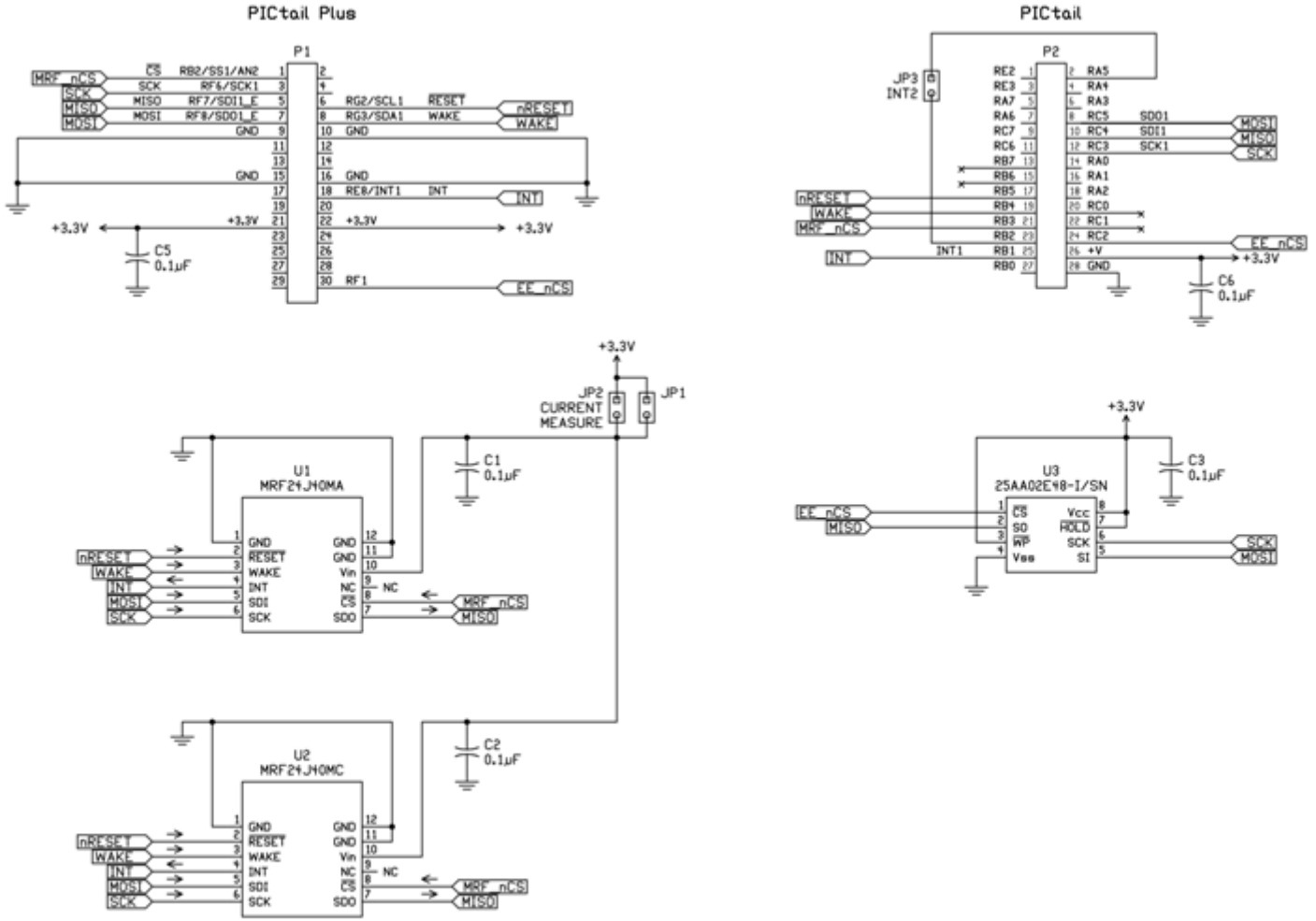
A.1 INTRODUCTION

This appendix provides the MRF24J40MC PICtail/PICtail Plus Daughter Board schematics, PCB layout and Bill of Materials (BOM).

- MRF24J40MC PICtail/PICtail Plus Daughter Board Schematic
- MRF24J40MC PICtail/PICtail Plus Daughter Board PCB Layout
- MRF24J40MC PICtail/PICtail Plus Daughter Board Bill of Materials

A.2 MRF24J40MC PICtail™/PICtail PLUS DAUGHTER BOARD SCHEMATIC

FIGURE A-1: MRF24J40MC PICtail™/PICtail PLUS DAUGHTER BOARD SCHEMATIC



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A.3 MRF24J40MC PICtail™/PICtail PLUS DAUGHTER BOARD PCB LAYOUT

The MRF24J40MC PICtail/PICtail Plus Daughter Board is a 2-layer, FR4, 0.062 inch, plated through hole PCB construction.

FIGURE A-2: MRF24J40MC PICtail™/PICtail PLUS DAUGHTER BOARD TOP SILKSCREEN

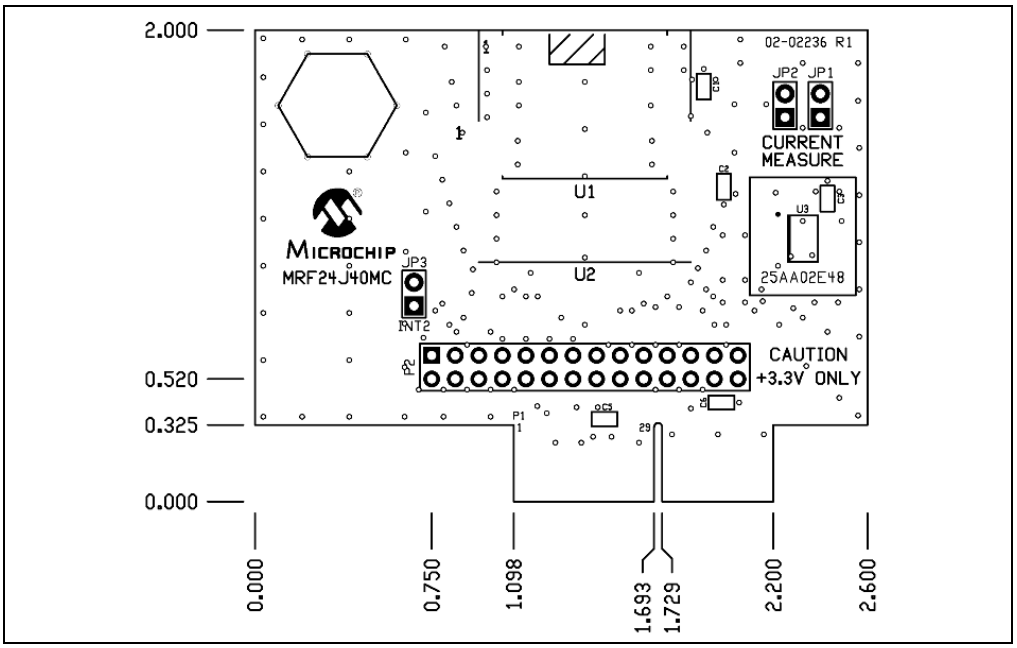


FIGURE A-3: MRF24J40MC PICtail™/PICtail PLUS DAUGHTER BOARD TOP COPPER

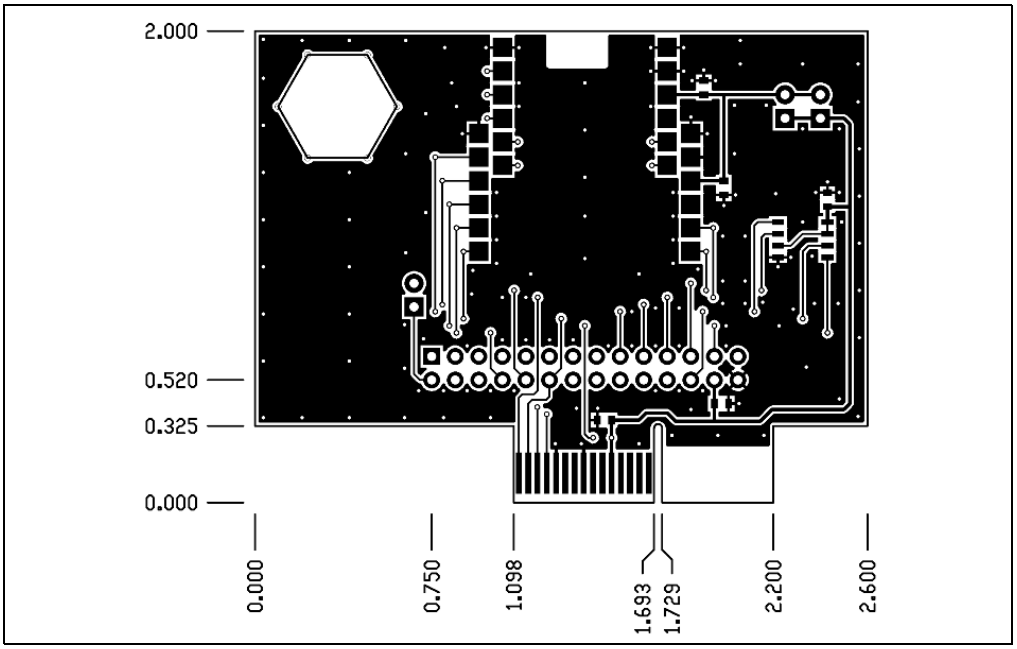


FIGURE A-4: MRF24J40MC PICtail™/PICtail PLUS DAUGHTER BOARD BOTTOM COPPER

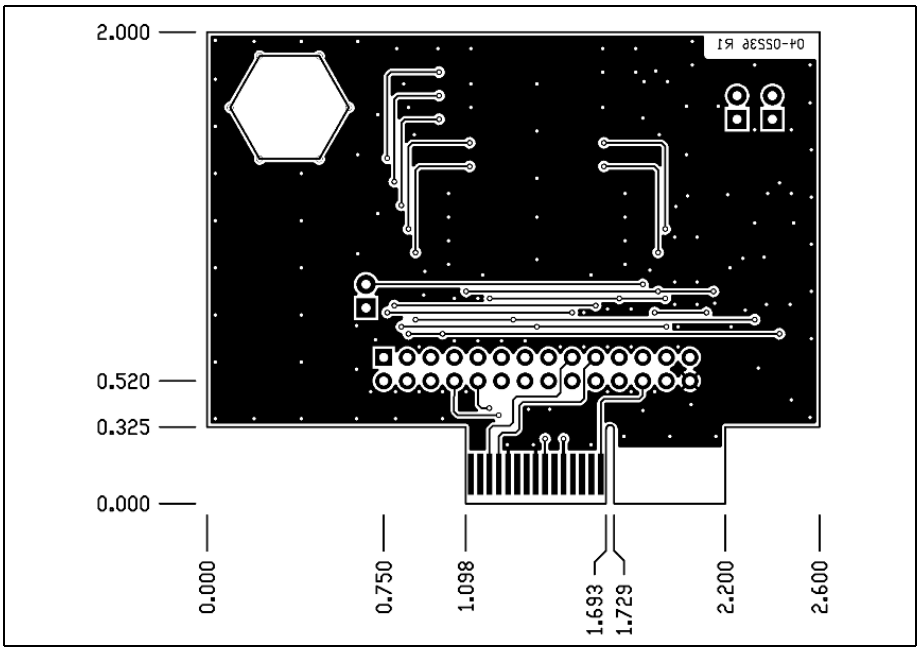
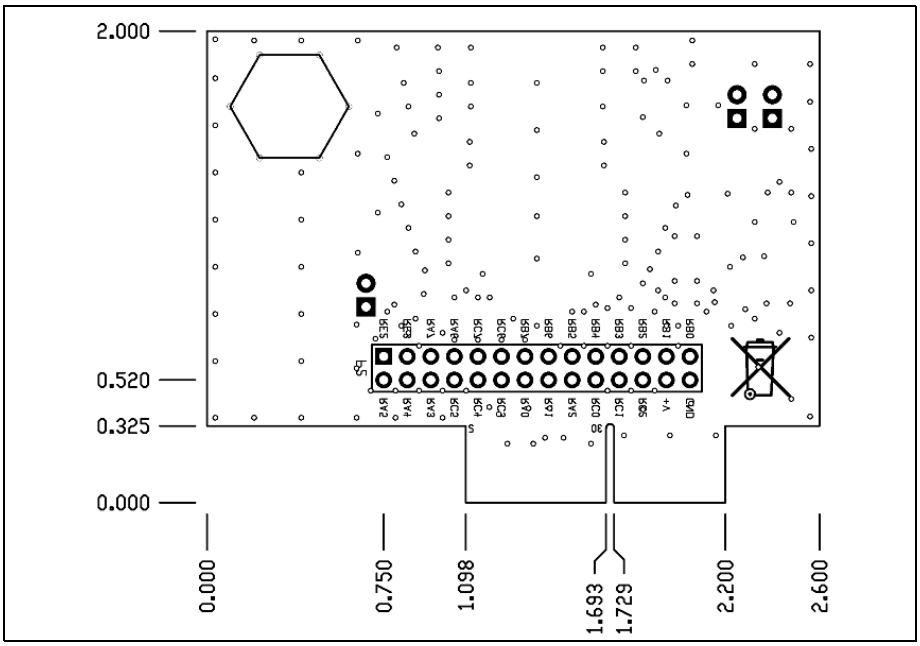


FIGURE A-5: MRF24J40MC PICtail™/PICtail PLUS DAUGHTER BOARD BOTTOM SILKSCREEN



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A.4 MRF24J40MC PICtail™/PICtail PLUS DAUGHTER BOARD BILL OF MATERIALS

TABLE A-1: MRF24J40MC PICtail™/PICtail PLUS DAUGHTER BOARD BILL OF MATERIALS

Reference	Value	Description	Vendor	Vendor P/N	Comments
C1, C2, C3, C5, C6	0.1 µF	Capacitor, Ceramic, 50V, C0G, SMT 0603	Panasonic	ECJ-1VB1C104K	Bypass capacitor
JP1, JP2, JP3	—	Connector, Header, 1x2, 0.100” pitch, 0.025” sq post	SPC TECHNOLOGY	SPC20481	—
Shunt	—	Connector, Shunt, 0.100” pitch	Sullins Connector Solutions	STC02SYAN	Shunts for JP1 and JP3
P2	—	Connector, Header, 2x14, 0.100” pitch, right angle 0.390/0.230	Sullins Connector Solutions	GBC14DBDN	—
U2	MRF24J40MC	MRF24J40MC RF Transceiver Module	Microchip Technology	MRF24J40MC-I/RM	—
U3	25AA02E48	EUI-48 Node Identity Serial EEPROM	Microchip Technology	25AA02E48-I/SN	—

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