



**MRF24J40MA/MB
PICtail™/PICtail Plus
Daughter Board 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 “DSXXXXA”, where “XXXX” 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 on-line help. Select the Help menu, and then Topics to open a list of available on-line help files.

INTRODUCTION

This chapter contains general information that will be useful to know before using the MRF24J40MA/MB PICtail™/PICtail Plus Daughter Board. Items discussed in this chapter include:

- Document Layout
- Conventions Used in this Guide
- Warranty Registration
- 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 MRF24J40MA/MB PICtail™/PICtail Plus Daughter Board. The manual layout is as follows:

- **Chapter 1. “Overview”** This chapter provides an overview of the MRF24J40MA/MB PICtail/PICtail Plus Daughter Board, including board contents and features.
- **Chapter 2. “Getting Started”** This chapter describes how to start using your MRF24J40MA/MB PICtail/PICtail Plus Daughter Board.
- **Appendix A. “MRF24J40MA/MB PICtail/PICtail Plus Daughter Board Schematic”** This appendix contains the schematics, PCB information and Bill of Materials for the MRF24J40MA/MB PICtail/PICtail Plus Daughter Board.

CONVENTIONS USED IN THIS GUIDE

This manual uses the following documentation conventions:

DOCUMENTATION CONVENTIONS

Description	Represents	Examples
Arial font:		
Italic characters	Referenced books	<i>MPLAB[®] IDE User's Guide</i>
	Emphasized text	...is the <i>only</i> 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	<u><i>File>Save</i></u>
Bold characters	A dialog button	Click OK
	A tab	Click the Power tab
N'Rnnnn	A number in verilog format, where N is the total number of digits, R is the radix and n is a digit.	4'b0010, 2'hF1
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	0xFF, 'A'
Italic Courier New	A variable argument	<i>file.o</i> , where <i>file</i> can be any valid filename
Square brackets []	Optional arguments	mcc18 [options] <i>file</i> [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) { ... }

WARRANTY REGISTRATION

Please complete the enclosed Warranty Registration Card and mail it promptly. Sending in the Warranty Registration Card entitles users to receive new product updates. Interim software releases are available at the Microchip web site.

RECOMMENDED READING

This user's guide describes how to use the MRF24J40MA/MB PICtail/PICtail Plus Daughter Board. Other useful documents are listed below. The following Microchip documents are available and recommended as supplemental reference resources.

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

MRF24J40MA IEEE 802.15.4 2.4 GHz RF Transceiver Module Data Sheet (DS70329)

MRF24J40MB 2.4 GHz IEEE 802.15.4 20 dBm RF Transceiver Data Sheet (DS70599)

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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- **General Technical Support** – Frequently Asked Questions (FAQs), technical support requests, online discussion groups, Microchip consultant program member listing
- **Business of Microchip** – Product selector and ordering guides, latest Microchip press releases, listing of seminars and events, 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. These include the MPLAB C18 and MPLAB C30 C compilers; MPASM™ and MPLAB ASM30 assemblers; MPLINK™ and MPLAB LINK30 object linkers; and MPLIB™ and MPLAB LIB30 object librarians.
- **Emulators** – The latest information on Microchip in-circuit emulators. This includes the MPLAB ICE 2000 and MPLAB ICE 4000.
- **In-Circuit Debuggers** – The latest information on the Microchip in-circuit debugger, MPLAB ICD 2.
- **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 and PRO MATE II device programmers and the PICSTART® Plus and PICkit™ 1, 2, and 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 (October 2009)

- Initial Release of this Document.

NOTES:

Chapter 1. Overview

1.1 INTRODUCTION

The MRF24J40MA/MB PICtail™/PICtail Plus Daughter Board is a demonstration and development daughter board for the:

- MRF24J40MA IEEE 802.15.4 2.4 GHz RF Transceiver module, or
- MRF24J40MB 2.4 GHz IEEE 802.15.4 20 dBm RF Transceiver module

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

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

This chapter discusses:

- MRF24J40MA/MB PICtail/PICtail Plus Daughter Board Contents
- MRF24J40MA/MB PICtail/PICtail Plus Daughter Board

1.2 MRF24J40MA/MB PICtail/PICtail PLUS DAUGHTER BOARD CONTENTS

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

TABLE 1-1: MRF49XA PICtail™/PICtail PLUS DAUGHTER BOARD

Description	Part Number
MRF24J40MA PICtail™/PICtail Plus Daughter Board	AC164134-1
MRF24J40MB PICtail/PICtail Plus Daughter Board	AC164134-2

1.3 MRF24J40MA/MB PICtail/PICtail PLUS DAUGHTER BOARD

The MRF24J40MA/MB PICtail/PICtail Plus Daughter Board is a complete IEEE 802.15.4 2.4 GHz wireless transceiver. The features are shown in Figure 1-1 and 1-2.

CAUTION

Power to the MRF24J40MA/MB PICtail/PICtail Plus Daughter Board should be in the range of 2.4-3.6V. Ensure that the development/demonstration board that the daughter board is plugged into meets this voltage requirement; otherwise, damage to the MRF24J40 may occur.

MRF24J40MA/MB PICtail™/PICtail Plus Daughter Board User's Guide

FIGURE 1-1: MRF24J40MA PICtail™/PICtail PLUS DAUGHTER BOARD

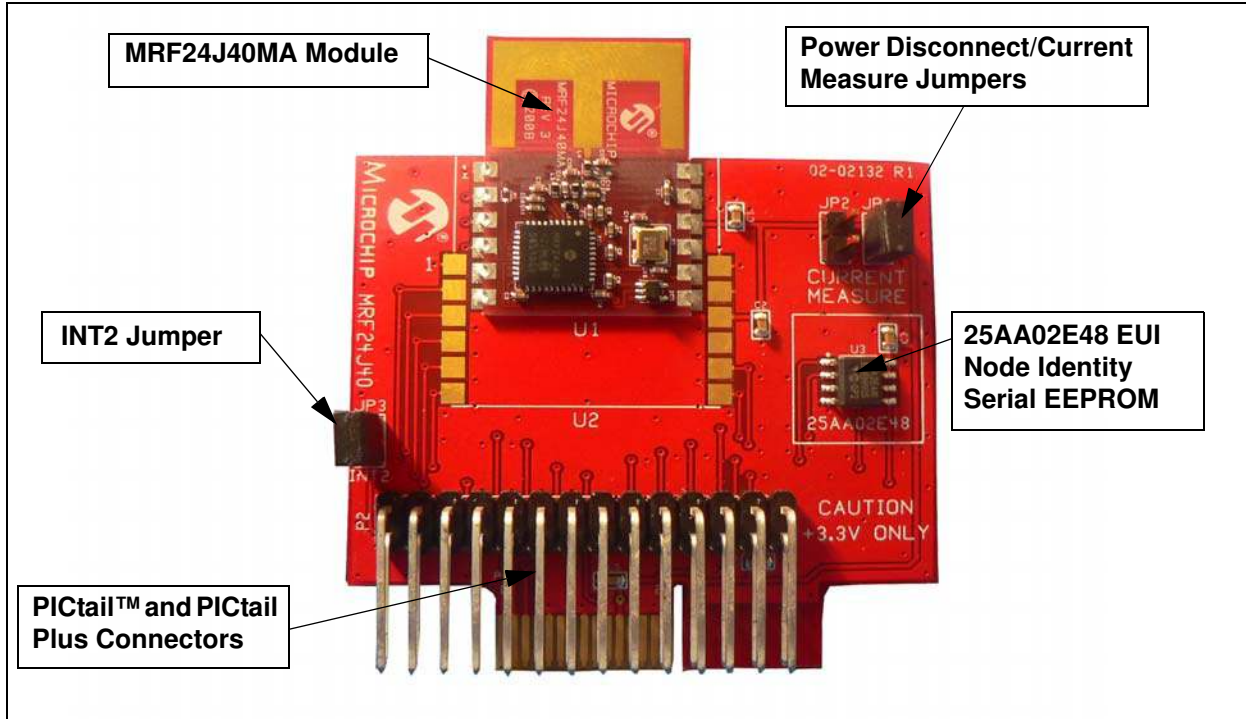
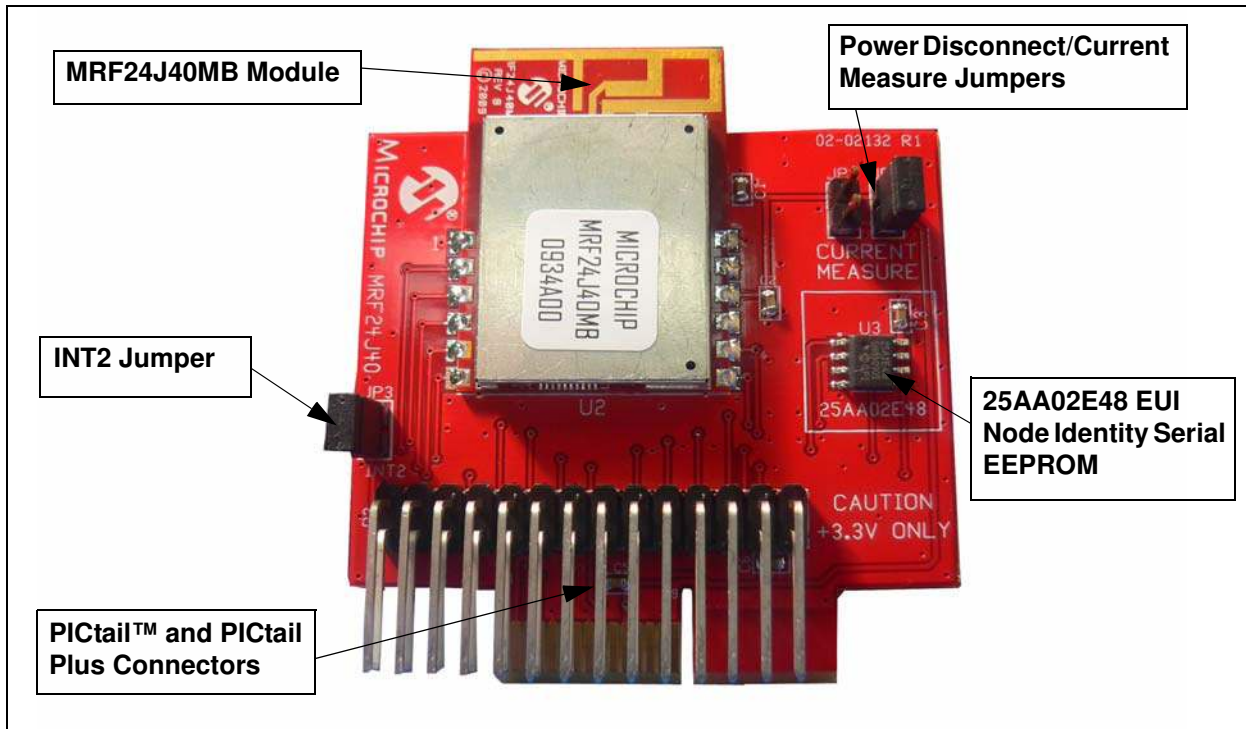


FIGURE 1-2: MRF24J40MB PICtail™/PICtail PLUS DAUGHTER BOARD



PICtail Plus Connector (P1) – 30-pin card edge connector for connecting into 16 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.

MRF24J40MA (U1) – IEEE 802.15.4 2.4 GHz Transceiver.

MRF24J40MB (U2) – IEEE 802.15.4 2.4 GHz 20 dBm Transceiver.

<p>Note: Only one MRF24J40 module, U1 or U2, will be populated on the PICtail/PICtail Plus Daughter Board depending on the development tool ordered.</p>

Power Disconnect/Current Measure Jumpers (JP1/JP2) – Two 2-pin headers are connected in parallel. A shunt connects power to the MRF24J40 module. A current meter can be placed on the header and the shunt removed to measure current consumption.

TIP: To prevent power interruption to the MRF24J40 module, keep the shunt on the header while connecting the current meter. Once connected, remove the shunt to measure current.

INT2 Jumper (JP3) – Jumpering JP3 with a shunt allows the connection of RA5 to RB2/INT2 to allow push button switch S2 to trigger an interrupt. See **Section 2.1.1 Configuring Push Button Switch S2 to RB2/INT2** for more information.

EUI Node Identity Serial EEPROM (U3) – Contains a unique IEEE EUI address. For more information, refer to “*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 MRF24J40MA/MB 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 plug into 8-bit demonstration and development boards, such as the PIC18 Explorer Board (DM183032). The PICtail Plus card edge connector, P1, can plug into Explorer 16 Development Board (DM240001).

This chapter shows how the daughter board is plugged into the PIC18 Explorer and Explorer 16 Development Boards.

2.2 PLUGGING INTO THE PIC18 EXPLORER BOARD

The MRF24J40MA/MB 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.

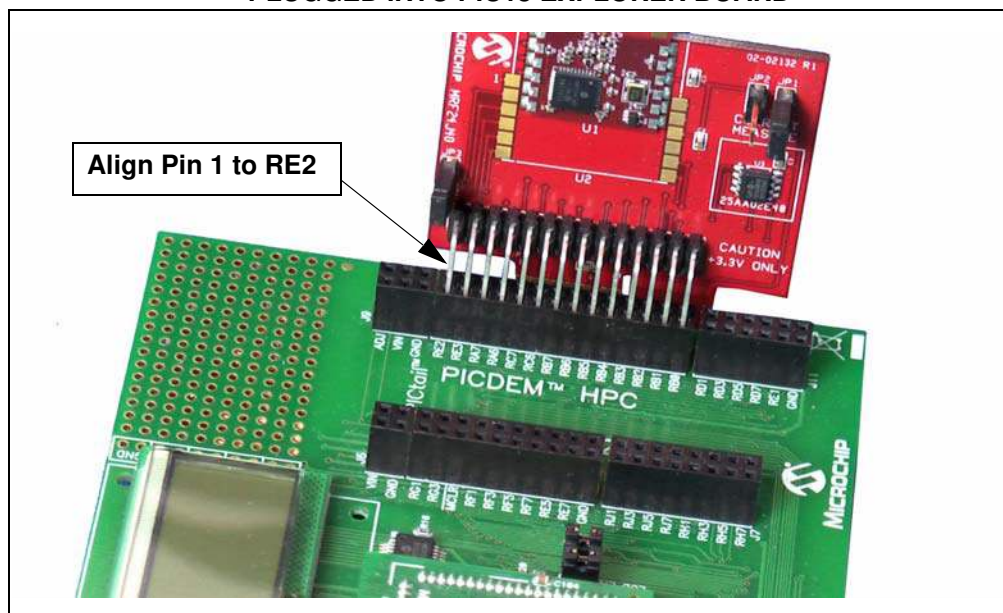
CAUTION

Ensure that the PIC18F87J11 PIM is plugged into the PIC18 Explorer Board. This sets the system VDD voltage to 3.3 volts, which is required by the MRF24J40MA/MB 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 a change on interrupt or external interrupt capable I/O pin. Jumping JP3 with a shunt allows the connection of RA5 to RB2/INT2 to allow push button switch S2 to trigger an interrupt. Keep in mind 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).

FIGURE 2-1: MRF24J40MA/MB PICtail™/PICtail PLUS DAUGHTER BOARD PLUGGED INTO PIC18 EXPLORER BOARD

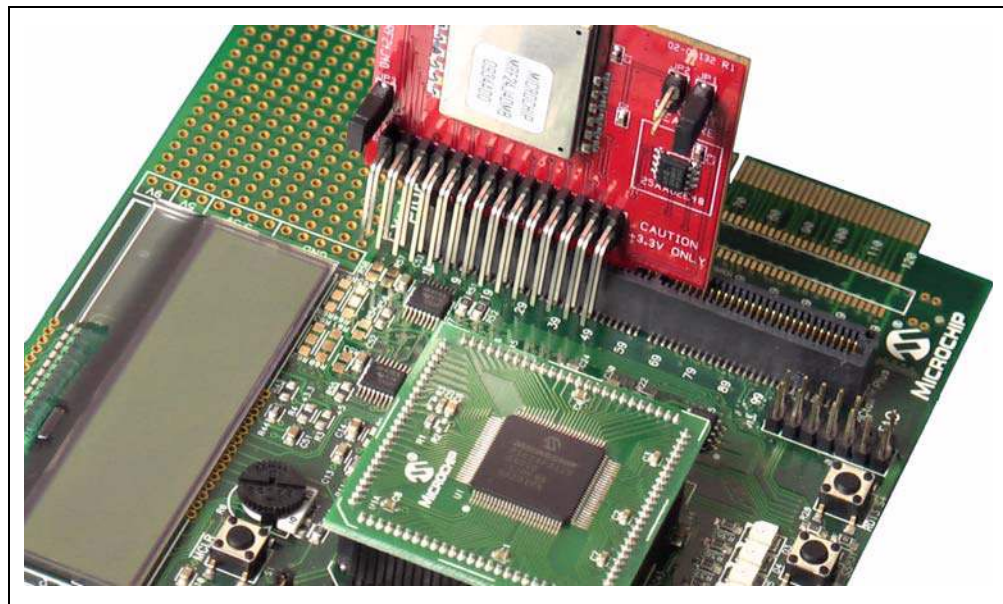


2.3 PLUGGING INTO THE EXPLORER 16 DEVELOPMENT BOARD

The MRF24J40MA/MB PICtail/PICtail Plus Daughter Board can be plugged into the Explorer 16 Development Board as shown in Figure 2-2.

The Daughter Board 30-pin card edge connector can be 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 PIM socket. If the Daughter Board is plugged into the mid-section of the PICtail Plus connector, this will connect to SPI Port 2 on the PIC microcontroller.

FIGURE 2-2: MRF24J40MA/MB 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 Design Environment, MiMAC and MiApp. Each is described in application notes AN1283 and AN1284, respectively. 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 website <http://www.microchip.com/wireless>.

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Appendix A. MRF24J40MA/MB PICtail/PICtail Plus Daughter Board Schematic

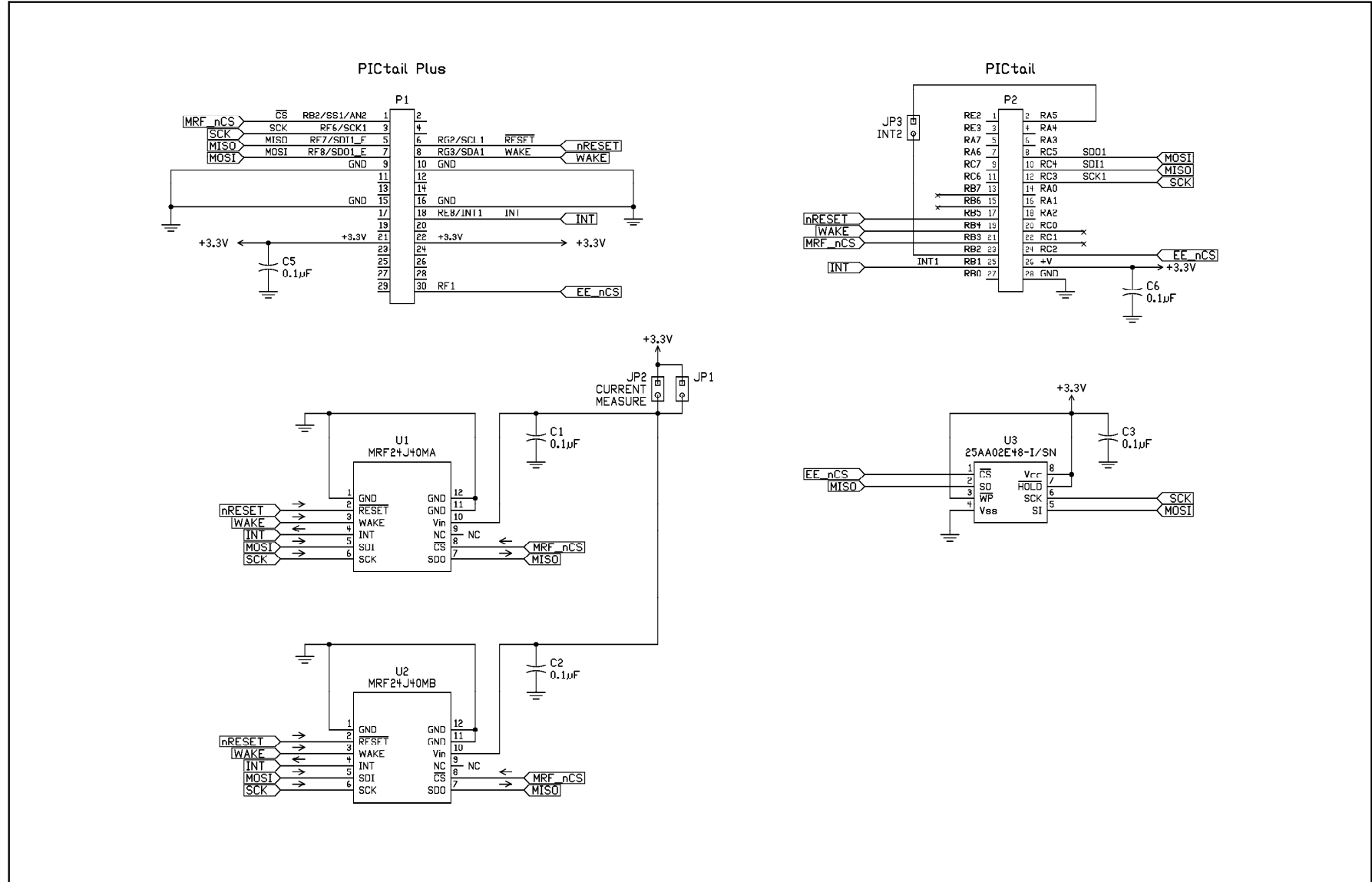
A.1 INTRODUCTION

This appendix provides the MRF24J40MA/MB PICtail/PICtail Plus Daughter Board schematics, PCB layout and Bill of Materials (BOM).

- MRF24J40MA/MB PICtail/PICtail Plus Daughter Board Schematic
- MRF24J40MA/MB PICtail/PICtail Plus Daughter Board PCB Layout
- MRF24J40MA/MB PICtail/PICtail Plus Daughter Board Bill of Materials

A.2 MRF24J40MA/MB PICtail/PICtail PLUS DAUGHTER BOARD SCHEMATIC

FIGURE A-1: MRF24J40MA/MB PICtail™/PICtail PLUS DAUGHTER BOARD SCHEMATIC



MRF24J40MA/MB PICtail/PICtail Plus Daughter Board Schematic

A.3 MRF24J40MA/MB PICtail/PICtail PLUS DAUGHTER BOARD PCB LAYOUT

The MRF24J40MA/MB PICtail/PICtail Plus Daughter Board is a 2-layer, FR4, 0.062 inch, plated through hole PCB construction.

FIGURE A-2: MRF24J40MA/MB PICtail™/PICtail PLUS DAUGHTER BOARD SILKSCREEN

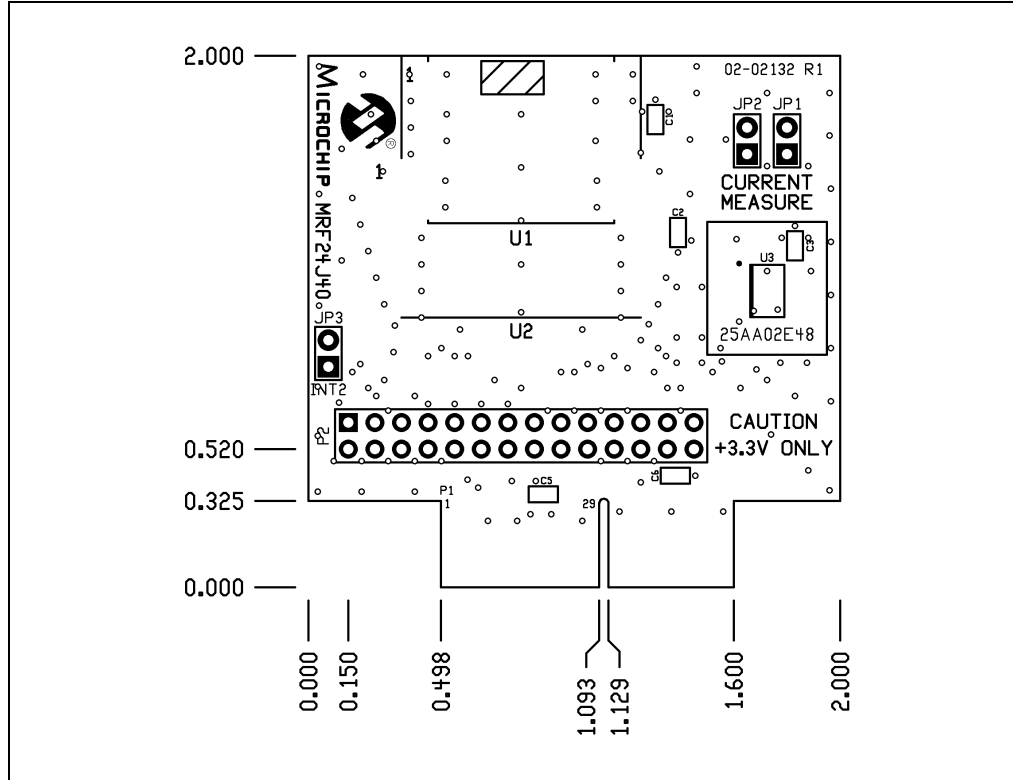


FIGURE A-3: MRF24J40MA/MB PICtail™/PICtail PLUS DAUGHTER BOARD TOP COPPER

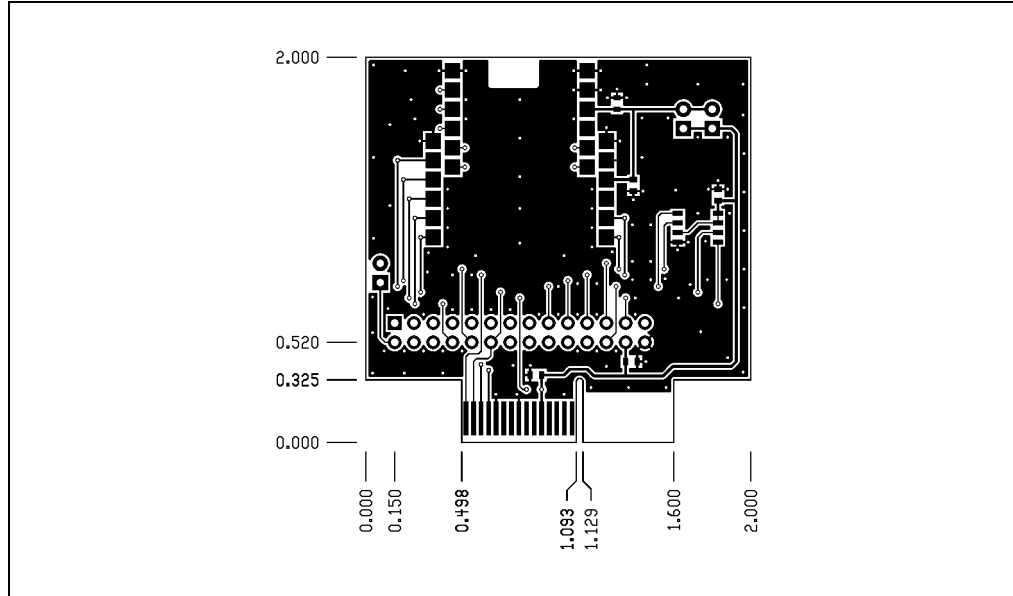


FIGURE A-4: MRF24J40MA/MB PICtail™/PICtail PLUS DAUGHTER BOARD BOTTOM COPPER

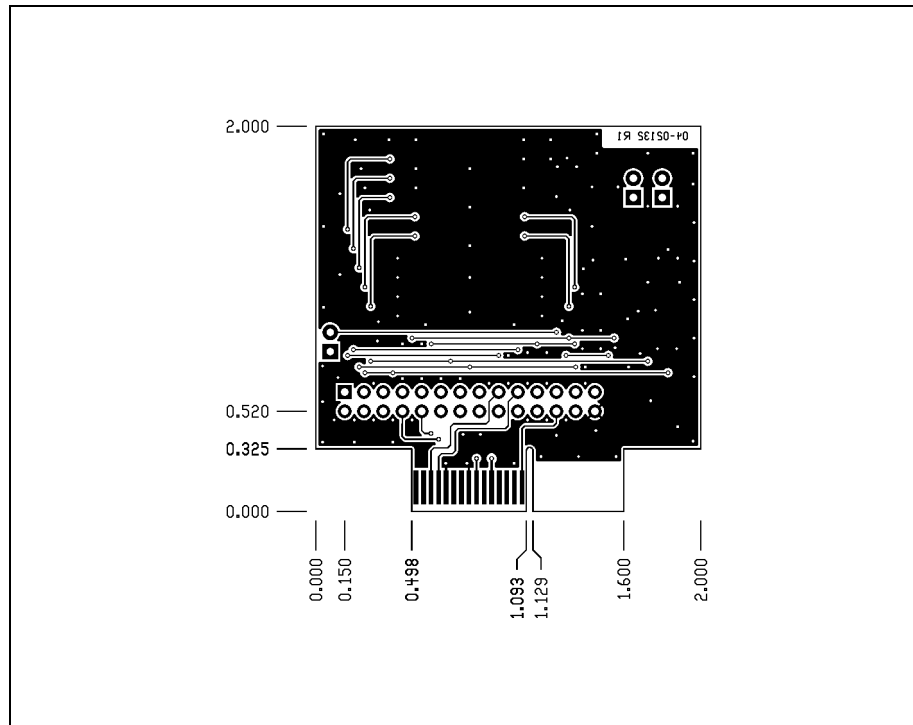
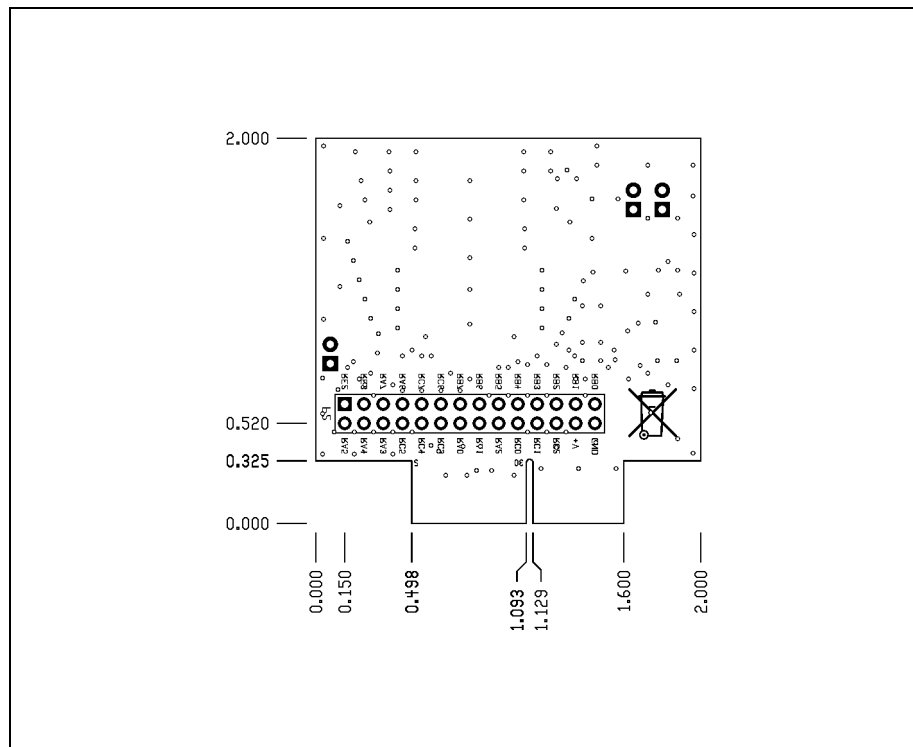


FIGURE A-5: MRF24J40MA/MB PICtail™/PICtail PLUS DAUGHTER BOARD BOTTOM SILKSCREEN



MRF24J40MA/MB PICtail/PICtail Plus Daughter Board Schematic

A.4 MRF24J40MA/MB PICtail/PICtail PLUS DAUGHTER BOARD BILL OF MATERIALS

TABLE A-1: MRF24J40MA PICtail™/PICtail PLUS DAUGHTER BOARD BILL OF MATERIALS

Reference	Value	Description	Vendor	Vendor P/N	Comments
C1, C2, C3, C5, C6	0.1 uF	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	
U1	MRF24J40MA	MRF24J40MA RF Transceiver Module	Microchip Technology	MRF24J40MA-I/RM	Populated only on MRF24J40MA PICtail/PICtail Plus Daughter Board
U2	MRF24J40MB	MRF24J40MA 20 dBm RF Transceiver Module	Microchip Technology	MRF24J40MB-I/RM	Populated only on MRF24J40MB PICtail/PICtail Plus Daughter Board
U3	25AA02E48	EUI-48 Node Identity Serial EEPROM	Microchip Technology	25AA02E48-I/SN	



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