RS232 Serial Accessory Board

User's Guide

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RS232 SERIAL ACCESSORY 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 "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 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 RS232 Serial Accessory Board User's Guide. 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 LAYOUT

This document describes how to use the RS232 Serial Accessory Board to evaluate and experiment with Microchip wireless solutions. The manual layout is as follows:

- **Chapter 1. "Overview"** – This chapter introduces the RS232 Serial Accessory Board and its features.
- **Chapter 2. "RS232 Serial Accessory Board Hardware"** – This chapter provides a brief description of the hardware components on the board.
- **Appendix A. "RS232 Serial Accessory Board"** – This appendix illustrates the RS232 Serial Accessory Board schematics followed by the RS232 Serial Accessory Board PCB Layout and the RS232 Serial Accessory Board Bill of Materials.

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
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	`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)`
		`{ ...`
		`}`

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 RS232 Serial Accessory Board User's Guide. Other useful documents are listed below. The following Microchip documents are available and recommended as supplemental reference resources.

Readme Files

For the latest information on using other tools, read the tool-specific Readme files in the Readmes subdirectory of the MPLAB IDE installation directory. The Readme files contain update information and known issues that may not be included in this user's guide.

THE MICROCHIP WEB SITE

Microchip provides online support via our web site at www.microchip.com. This web site is used as a means to make files and information easily available to customers. Accessible by using your favorite Internet browser, 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 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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Microchip's customer notification service helps keep customers current on Microchip products. Subscribers will receive e-mail notification whenever there are changes, updates, revisions or errata related to a specified product family or development tool of interest.

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 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 (January 2011)

- This is the initial release of this document.

Preliminary

Chapter 1. Overview

1.1 INTRODUCTION

This chapter introduces the Recommended Standard 232 (RS232) Serial Accessory Board and provides a brief description of its features.

The RS232 Serial Accessory Board is a demonstration and development daughter board that is used with the PIC18 Wireless Development Board or with any other development boards that have the compatible interface. This daughter board can interface to the development board and any I^2C board, like LCD Serial Accessory Board. The demonstration program for RS232 board can be downloaded from the Microchip website: http://www.microchip.com/wireless

The RS232 is a standard for serial binary single-ended data and control signals that are connecting between the Data Terminal Equipment (DTE) and the Data Communication Equipment (DCE). In general, computers, printers, and terminals are classified as DTE, while a modem is classified as DCE. RS232 is commonly used in serial ports.

1.2 RS232 SERIAL ACCESSORY BOARD

The interface between the RS232 Serial Accessory Board and the development board is through the Serial Accessory Port. The Serial Accessory Port basically supports the external sensors and the modules such as RS232 Serial Accessory Board through SPI, I^2C™ or USART connection.

The RS232 Serial Accessory Board features include:

- RS232 port to connect to a PC
- RS232 level translation from a single 3.0 V–5 V supply voltage
- Automatic Sleep mode (It must be enabled. For more information, see **Section 2.2.6.1 "Enabling Automatic Sleep Mode"**)
- I^2C compatible interface to I^2C accessory boards like LCD Serial Accessory Board

The RS232 Serial Accessory Board can be used with several development boards like, the PIC18 Wireless Development Board. Figure 2-1 illustrates the features of RS232 Serial Accessory Board.

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Chapter 2. RS232 Serial Accessory Board Hardware

2.1   INTRODUCTION

This chapter introduces the hardware layout of the RS232 Serial Accessory Board. It is built using the MAX3221 RS232 transceiver chip which contains a pair of transmitter and receiver.

2.2   FEATURES OF THE RS232 SERIAL ACCESSORY BOARD

Figure 2-1illustrates the ports and features of the RS232 Serial Accessory Board.

FIGURE 2-1:   RS232 SERIAL ACCESSORY BOARD CONNECTIONS
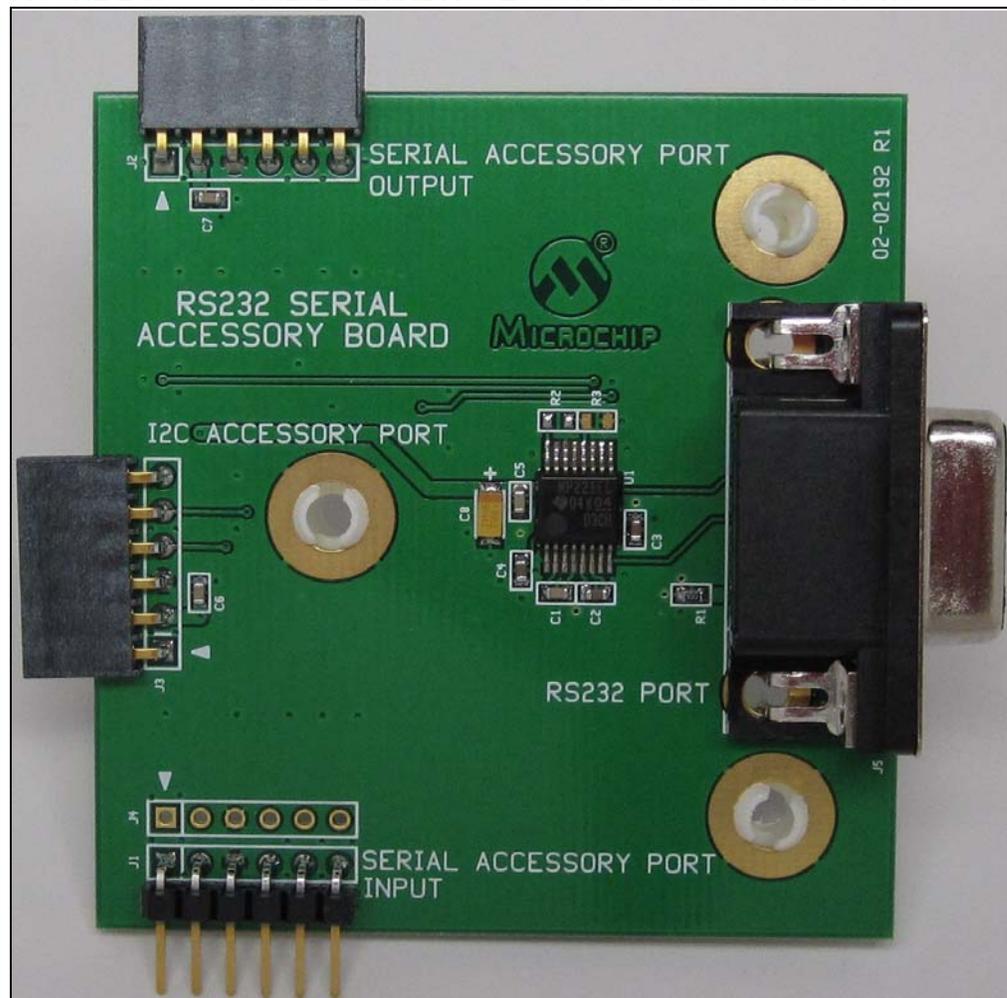
RS232 SERIAL ACCESSORY BOARD USER'S GUIDE

RS232 Serial Accessory Board has the following connectors:

• Serial Accessory Port Input
• Serial Accessory Port Output
• Logic Tester Header (optional)
• I^{2}C™ Accessory Port
• RS232 Port

2.2.1   Serial Accessory Port Input

The Serial Accessory Port Input header is connected to the Serial Accessory Port of the development board and supports I^{2}C, SPI and USART interfaces. For more information on the protocol and port pin details, and configuration, refer to the "*8-Bit Wireless Development Kit"* User's Guide (DS70654A).

2.2.2   Serial Accessory Port Output

The Serial Accessory Port Output socket enables the attachment of the additional accessory modules to the board by expanding the development board's Serial Accessory Port. This port supports the I^{2}C, SPI and USART interfaces. For more information on the protocol and port pin details, and configuration, refer to the "*8-Bit Wireless Development Kit*' User's Guide (DS70654A).

2.2.3   Logic Tester Header

The Logic Tester Header helps the user in hardware debugging. It provides direct access to the interface lines of the development kit's Serial Accessory Port. It enables the user to clip the logic probes to the appropriate pin header and monitor the signals. The header is optional and the user can populate it if required for further developments.

2.2.4   I^{2}C Accessory Port

The I^{2}C Accessory Port is the subset of the development board's Serial Accessory Port. I^{2}C Accessory Port is designed to connect I^{2}C sensors or accessory devices. I^{2}C Accessory Port also handles LCD Serial Accessory Board.

> **Note 1:**   The I^{2}C and SPI modes (hardware) cannot run parallely.
>
> **2:**   The USART and SPI cannot run parallely. Only I^{2}C and USART can be used together in the RS232 Board.

Figure 2-2 illustrates the I^{2}C Accessory Port pin out.

FIGURE 2-2:   **I2C ACCESSORY PORT PIN OUT**
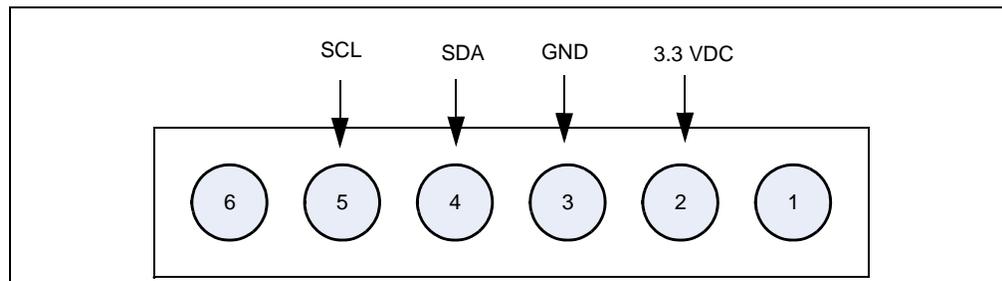
2.2.5   RS232 Port

The RS232 Port connects the two systems through their DB9 interfaces without a modem. It is generally called back-to-back or NULL modem connection. Figure 2-3 illustrates the DB9 connector pin out.

FIGURE 2-3:   RS232 CONNECTOR PIN OUT
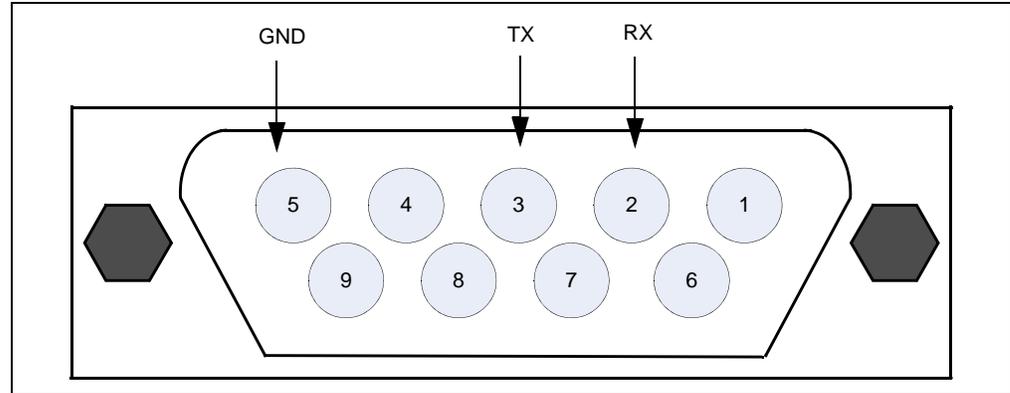
2.2.6   Automatic Sleep Mode

The RS232 Serial Accessory Board has an automatic Power-Saving mode that is handled automatically by the RS232 chip if enabled. The RS232 Serial Accessory Board enters the Sleep mode and uses approximately 1uA of supply current. The voltage level of pin 2 of the RS232 port connector determines the state of the RS232 Serial Accessory Board. Figure 2-4 illustrates the voltage levels and working mode of the RS232 Serial Accessory Board.

FIGURE 2-4:   RX SIGNAL VOLTAGE LEVELS
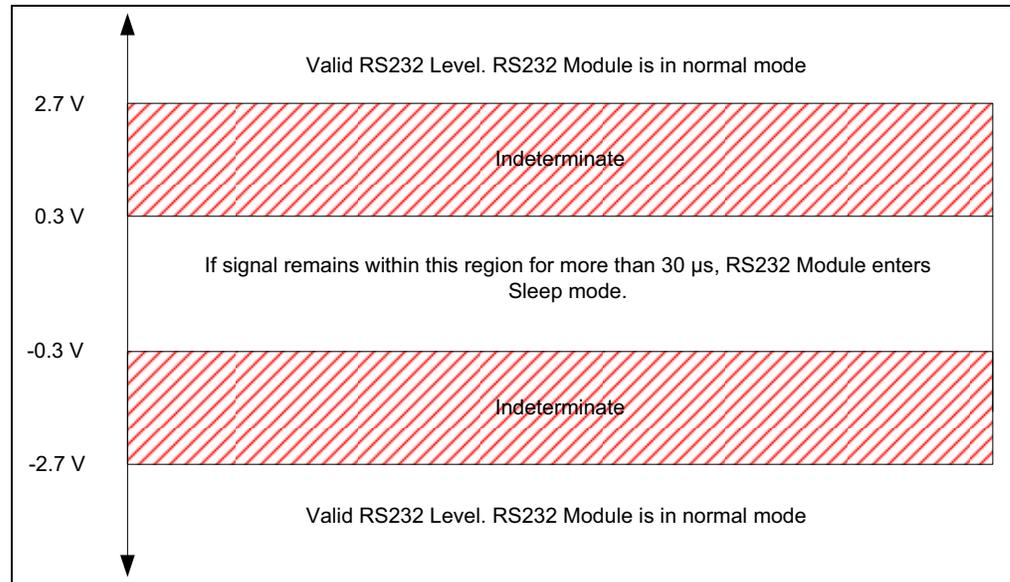
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2.2.6.1   ENABLING AUTOMATIC SLEEP MODE

The RS232 Serial Accessory Board remains in the indeterminate state, if the RS232 external device, which is connected to the RS232 Serial Accessory Board, is unable to produce the required voltage level to keep the RS232 Serial Accessory Board operating in a normal mode.

Figure 2-4 illustrates the required voltage levels. To prevent malfunctioning, the Automatic Sleep mode is disabled using R2 and R3 jumpers.

Table 2-1 lists the possible configuration options.

TABLE 2-1:   ENABLING AND DISABLING AUTOMATIC SLEEP MODE

Automatic Sleep Mode	R2	R3
Enabled	Unpopulated	Populated
Disabled	Populated	Unpopulated

Note: R3 jumper is not populated.

CAUTION

Power to the RS232 Serial Accessory Board should be in the range of 3.0–5.5V. Ensure that the development or demonstration board that the RS232 Serial Accessory Board is plugged into meets this voltage requirement or it may damage the devices on board.

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Appendix A. RS232 Serial Accessory Board

A.1 INTRODUCTION

This chapter illustrates the RS232 Serial Accessory Board schematics followed by the RS232 Serial Accessory Board PCB layout and the RS232 Serial Accessory Board Bill of Materials (BOM).

A.2 RS232 SERIAL ACCESSORY BOARD SCHEMATIC

FIGURE A-1: RS232 SERIAL ACCESSORY BOARD SCHEMATIC
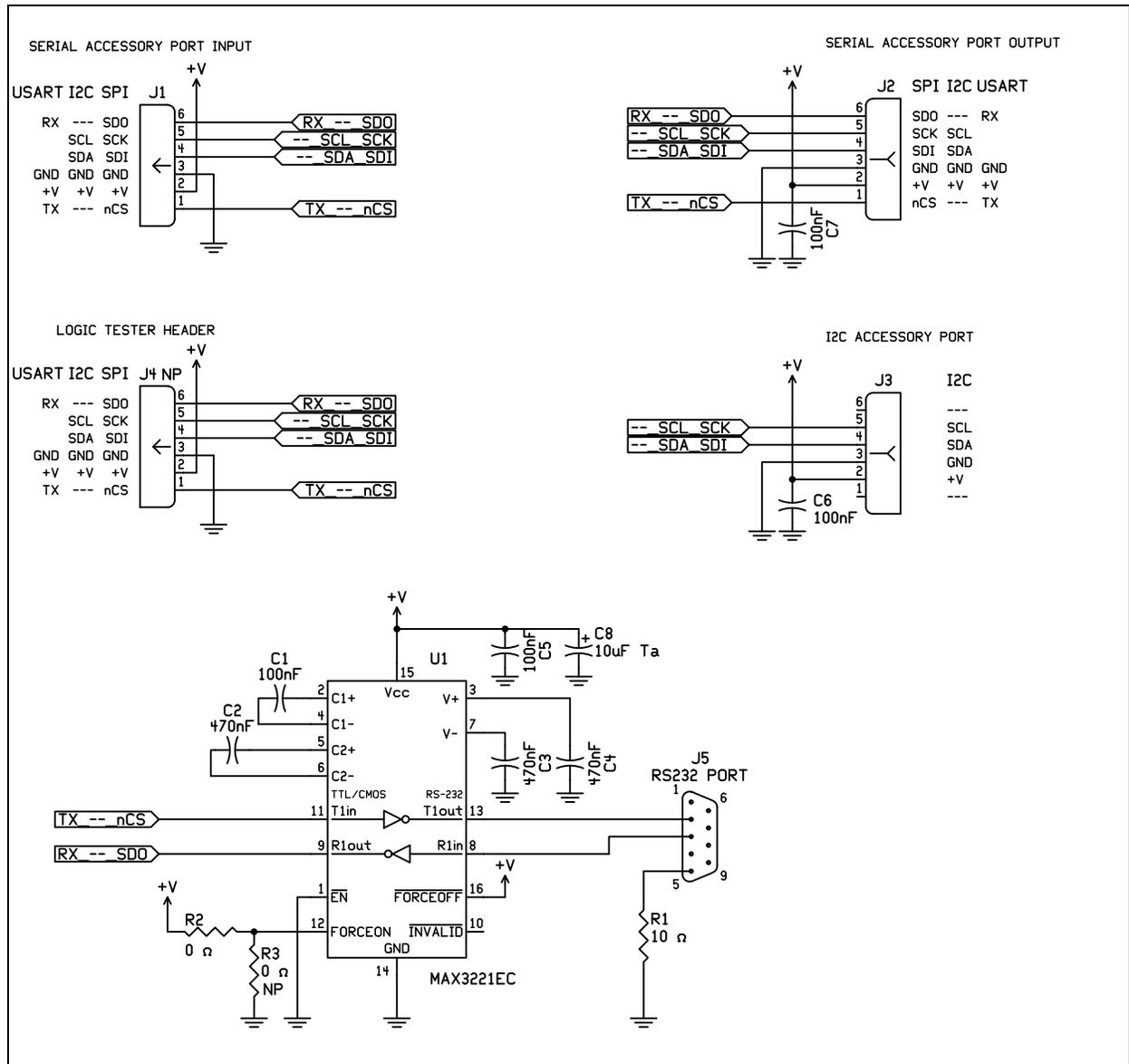
A.3   RS232 SERIAL ACCESSORY BOARD PCB LAYOUT

The RS232 Serial Accessory Board is a two-layer, FR4, 0.062 inch, plated through-hole PCB construction.Figure A-1 illustrates the RS232 Serial Accessory Board top silk screen.

FIGURE A-2:   RS232 SERIAL ACCESSORY BOARD TOP SILKSCREEN
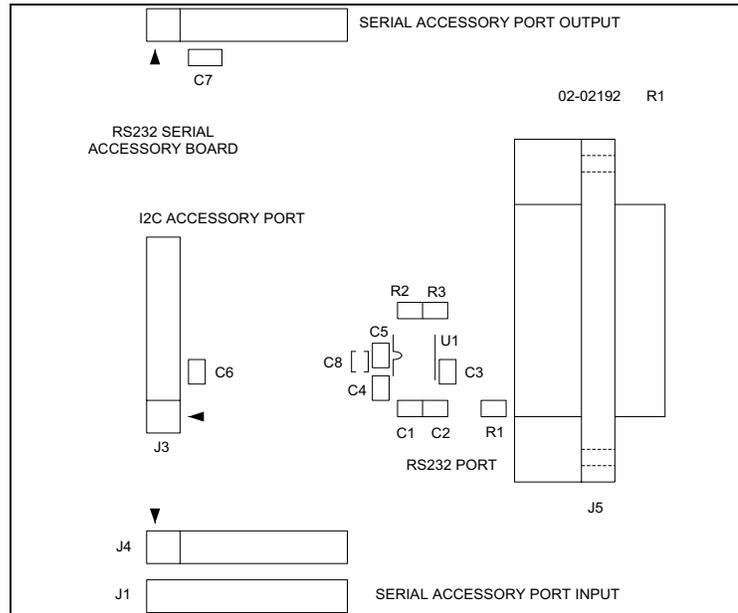
Figure A-2 illustrates the RS232 Serial Accessory Board top copper.

FIGURE A-3:   RS232 SERIAL ACCESSORY BOARD TOP COPPER
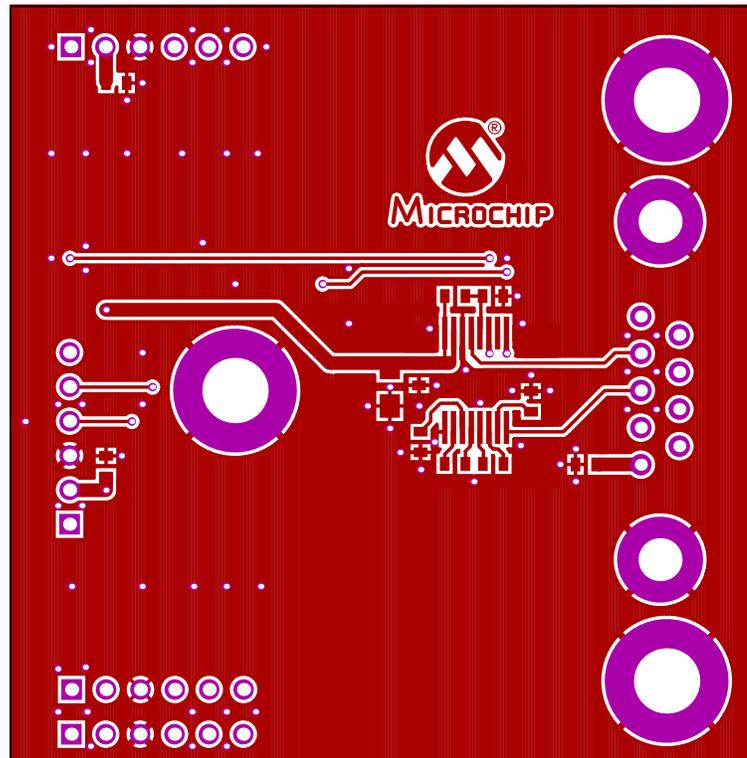
Figure A-4 illustrates the RS232 Serial Accessory Board bottom copper mirrored.

FIGURE A-4: **RS232 SERIAL ACCESSORY BOARD BOTTOM COPPER — MIRRORED**
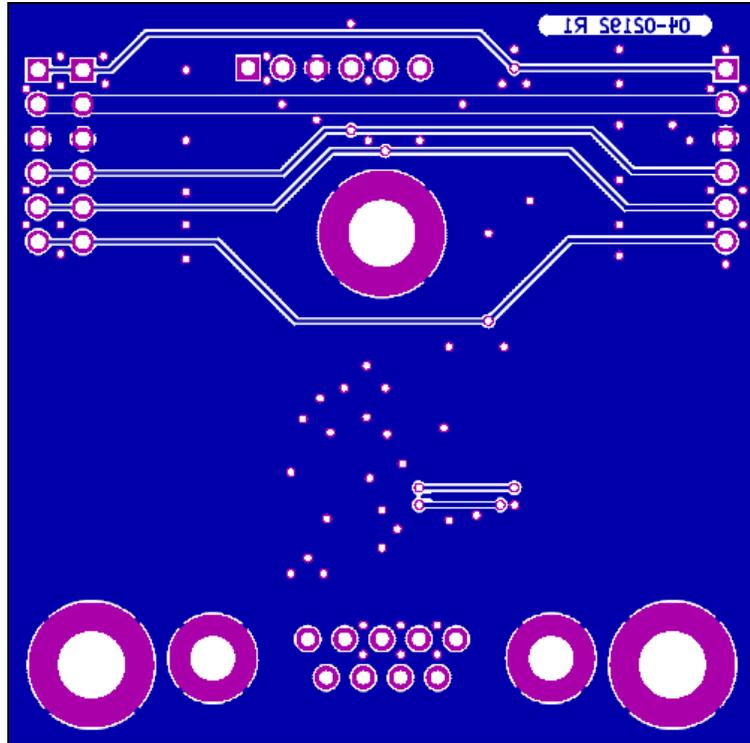
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A.4   RS232 SERIAL ACCESSORY BOARD BILL OF MATERIALS

Table A-1 provides the detailed description of the RS232 Serial Accessory Board Bill of Materials (BOM).

TABLE A-1:   RS232 SERIAL ACCESSORY BOARD BILL OF MATERIALS

Reference IDs	Qty	Type/Value	Description	Manufacturer	Manufacturer P/N
C1, C5, C6, C7	4	0.1 µF	Capacitor, Ceramic, 25V, 10%, X7R, SMT 0603	Panasonic - ECG	ECJ-1VB1E104K
C2, C3, C4	3	0.47 µF	Capacitor, Ceramic, 10V, 10%, X5R, SMT 0603	Panasonic - ECG	ECJ-1VB1A474K
C8	1	10uF	CAP TANTALUM 10UF 6.3V 10% SMD	AVX Corporation	TAJS106K006RNJ
R1	1	10 ohms	Resistor, SMT 0603	Stackpole Electronics Inc	RMCF 1/16 10 1% R
R2	1	0 ohms	Resistor, SMT 0603	Stackpole Electronics Inc	RMCF 1/16 0 R
J1	1	SERIAL ACCESSORY PORT HEADER	Connector, Header, Right Angle, 0.100" spacing, 0.025" sq.	Mill-Max	800-10-006-20-001000
J2, J3	2	SERIAL ACCESSORY PORT SOCKET and I^{2}C SOCKET	Connector, Socket, Right Angle, 0.100" spacing, 0.025" sq.	Mill-Max	801-43-006-20-001000
J5	1	RS232 Female Connector	CONN DB9 FEMALE.318" R/A NICKEL	Norcomp Inc.	182-009-213R531
U1	1	MAX3221ECAE+	IC TXRX RS232 250KBPS SD 16-SSOP	Maxim Integrated Products	MAX3221ECAE
	3	SPACER STACKING #4 SCREW NYLON	Stand-off	Keystone Electronics	8834

Unpopulated Parts					
R3	1	0 ohms	Resistor, SMT 0603	Stackpole Electronics Inc	RMCF 1/16 0 R
J4	1	LOGIC TESTER HEADER	Connector, Socket, 0.100" spacing, 0.025" sq.	Mill-Max	

Alternative parts for U1				
U1	1	MAX3221ECAE+T	IC TXRX RS232 250KBPS SD 16-SSOP	Maxim Integrated Products	MAX3221ECAE+T
U1	1	MAX3221CUE+T	IC TXRX RS232 250KBPS SD 16-SSOP	Maxim Integrated Products	MAX3221CUE+T
U1	1	MAX3221ECUE+T	IC TXRX RS232 250KBPS SD 16-SSOP	Maxim Integrated Products	MAX3221ECUE+T
U1	1	MAX3221CDBR	IC DRVR/RCVR RS-232 1-CH 16-SSOP	Texas Instruments	MAX3221CDBR
U1	1	MAX3221ECDBR	IC RS232 3V-5.5V DRVR 16-SSOP	Texas Instruments	MAX3221ECDBR
U1	1	MAX3221CPWR	IC DVR/RCVR RS232 ESD 16TSSOP	Texas Instruments	MAX3221CPWR
U1	1	MAX3221ECPWR	IC RS232 3V-5.5V DRVR 16-TSSOP	Texas Instruments	MAX3221ECPWR
U1	1	TRS3221CDBR	IC DVR/RCVR RS232 ESD SGL 16SSOP	Texas Instruments	TRS3221CDBR
U1	1	TRS3221ECDBR	IC RS232 3V-5.5V DRVR 16-SSOP	Texas Instruments	TRS3221ECDBR
U1	1	TRS3221CPWR	IC DVR/RCVR RS232 ESD 16TSSOP	Texas Instruments	TRS3221CPWR
U1	1	TRS3221ECPWR	IC RS232 LINE DVR/RCVR 16-TSSOP	Texas Instruments	TRS3221ECPWR

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