MCP23008/MCP23S08 Evaluation 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 website (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.

INTRODUCTION

This chapter contains general information that will be useful to know before using the MCP23008/MCP23S08 Evaluation Board. Items discussed in this chapter include:

- Document Layout
- Conventions Used in this Guide
- Recommended Reading
- The Microchip Website
- Customer Support
- Document Revision History

DOCUMENT LAYOUT

This document describes how to use the MCP23008/MCP23S08 Evaluation Board as a development tool. The manual layout is as follows:

- **Chapter 1. "Product Overview"** – Important information about the MCP23008/MCP23S08 Evaluation Board.
- **Chapter 2. "Installation and Operation"** – Includes instructions on how to get started with the MCP23008/MCP23S08 Evaluation Board.
- **Appendix A. "Schematic and Layouts"** – Shows the schematic and layout diagrams for the MCP23008/MCP23S08 Evaluation Board.
- **Appendix B. "Bill Of Materials (BOM)"** – Lists the parts used to build the MCP23008/MCP23S08 Evaluation Board.
- **Appendix C. "Firmware"** – Identifies where to obtain the latest version of firmware.

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) { ... }`

RECOMMENDED READING

This user's guide describes how to use MCP23008/MCP23S08 Evaluation Board. The following Microchip document is available and recommended as a supplemental reference resource:

- **MCP23008/MCP23S08 Data Sheet – "*8-Bit I/O Expander with Serial Interface*" (DS20001919)**

This data sheet provides detailed information regarding the MCP23008/MCP23S08 devices.

THE MICROCHIP WEBSITE

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- **General Technical Support** – Frequently Asked Questions (FAQs), technical support requests, online discussion groups, Microchip consultant program member listing
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- Technical Support
- Development Systems Information Line

Customers should contact their distributor, representative or field application engineer 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 website at: http://support.microchip.com.

DOCUMENT REVISION HISTORY

Revision C (December 2022)

- Updated **Appendix A. "Schematic and Layouts"**.
- Updated **Appendix B. "Bill Of Materials (BOM)"**.
- Made minor text and formatting changes throughout the document.

Revision B (July 2006)

- Added disclaimer to Bill of Materials regarding RoHS-compliant part numbers.

Revision A (January 2005)

- Initial Release of this Document.

NOTES:

Chapter 1. Product Overview

1.1 INTRODUCTION

This chapter provides an overview of the MCP23008/MCP23S08 Evaluation Board and covers the following topics:

- What is the MCP23008/MCP23S08 Evaluation Board?
- What the MCP23008/MCP23S08 Evaluation Board Kit includes?

1.2 WHAT IS THE MCP23008/MCP23S08 EVALUATION BOARD?

The MCP23008/MCP23S08 Evaluation Board allows the system designer to quickly evaluate the operation of the MCP23X08 8-bit GPIO expanders. The board demonstrates the I/O expansion capabilities/operation of both the MCP23008 (I^2C interface) and MCP23S08 (SPI interface).

1.3 WHAT THE MCP23008/MCP23S08 EVALUATION BOARD KIT INCLUDES?

This MCP23008/MCP23S08 Evaluation Board Kit includes:

- One MCP23008/MCP23S08 Evaluation Board
  - MCP23008 GPIO Expander with I^2C interface (installed)
  - MCP23S08 GPIO Expander with SPI interface (installed)
- MCP23008/MCP23S08 Data Sheet (DS20001919)
  (Electronic Version on CD)
- MCP23008/MCP23S08 Evaluation Board User's Guide (DS50001530)
  (Electronic Version on CD)

NOTES:

Chapter 2. Installation and Operation

2.1 INTRODUCTION

This chapter discusses the setup and operation of the MCP23008/MCP23S08 Evaluation Board.

The MCP23008/MCP23S08 Evaluation Board is designed to demonstrate simple, low-cost input/output expansion using the MCP23X08 devices and a 6-pin PIC10F202 Microcontroller (MCU).

Four MCP23X08 pins are configured as inputs and four as outputs. When an input level is changed, the associated output pin is driven to the same level. This is accomplished by the MCU reading the input pins and writing the appropriate value to the output pins.

The MCP23X08 are provided in small, space-saving 20-Lead SSOP packages. Adding the small 6-Lead PIC10F202 device in a SOT-23 package makes for small overall PCB area.

2.2 FEATURES

The MCP23008/MCP23S08 Evaluation Board has the following features:

- Two (2) 8-bit GPIO expanders:
  - -MCP23008 with I^2C interface
  - -MCP23S08 with SPI interface
- Switch for selecting between the two GPIO expanders
- Four switches and four LEDS (each connected to an individual GPIO pin) to demonstrate the input/output functionality
- Headers for the serial interface and GPIO port to allow evaluation in a user-defined application
- Jumpers (shorted by trace on the bottom of the PCB by default) to isolate the MCP23X08 device from the LEDs, switches and a PIC® MCU so that they can be evaluated in a custom circuit (See Figure 2-1)
- Header used for programming the PIC10F device using the Baseline Flash Microcontroller Programmer (BFMP)

Note: The ICD 2 can also be used to program the PIC® MCU if the cable is modified to use an appropriate connector.

2.3 GETTING STARTED

The MCP23008/MCP23S08 Evaluation Board is a fully functional, assembled and tested board for evaluation of the MCP23008 (I^2C interface) and MCP23S08 (SPI interface) general purpose I/O expanders. The following describes the basic setup and operation (see Figure 2-1):

1. Either connect a power supply (5V) using the V_{DD} and GND test points, or plug a 9V power supply or power adapter into the plug.
2. The "Power" LED will illuminate.
3. The device selector switch (SW1) selects between the two devices. Slide the switch towards the device of choice to select it.
4. Toggling the four switches will change the level on the associated GPIO pin configured as inputs.
5. Firmware will read the inputs and drive the corresponding MCP23X08 device output to the same level.

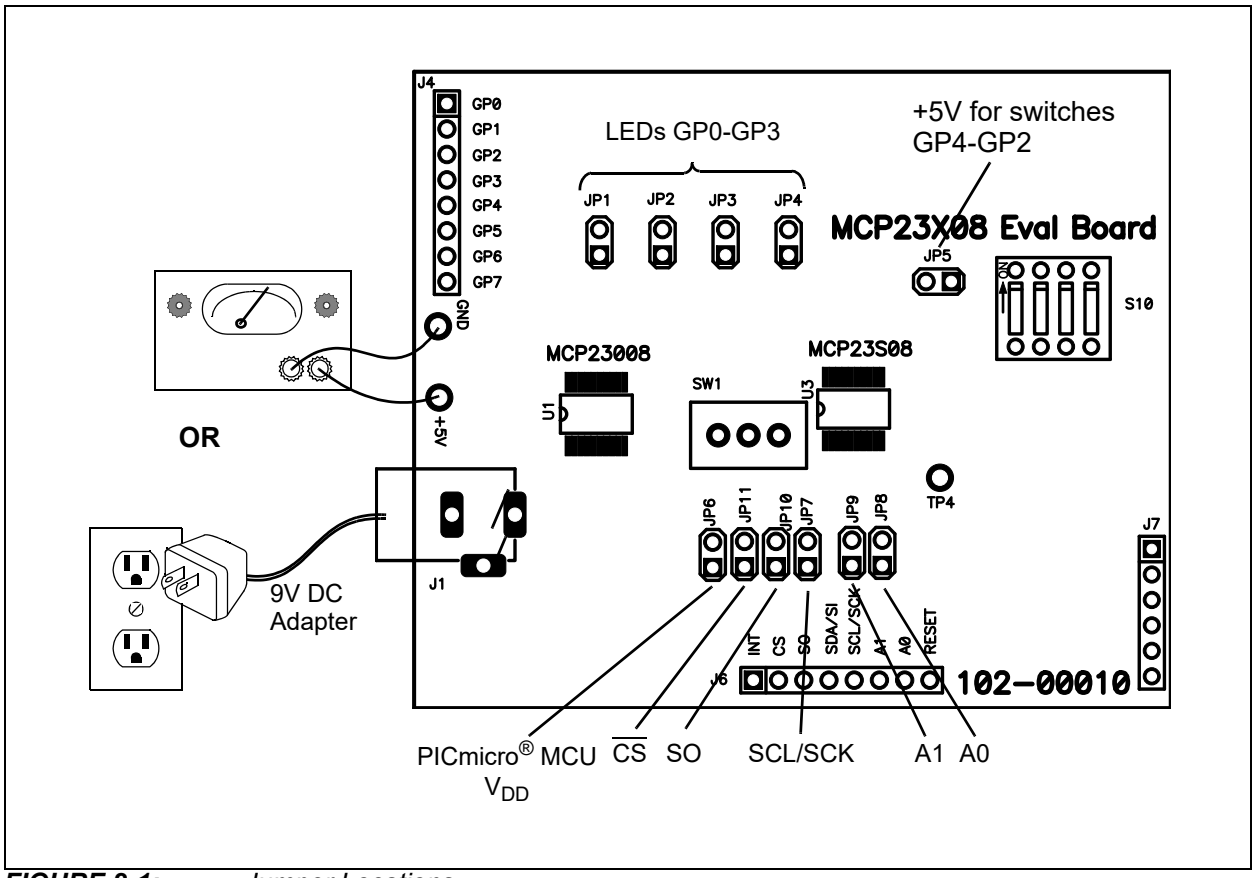

FIGURE 2-1: *Jumper Locations.*

2.4 FIRMWARE DESCRIPTION

See Figure 2-2 for a simple firmware flow diagram.

1. The firmware first configures the PIC10F202 device followed by the two MCP23X08 devices.
2. The firmware checks the device selector switch to determine which device to communicate with during the main loop.
3. The appropriate MCP23X08 device inputs are sampled and the associated outputs are driven to the same level.
4. The program loops back to the toggle switch check.

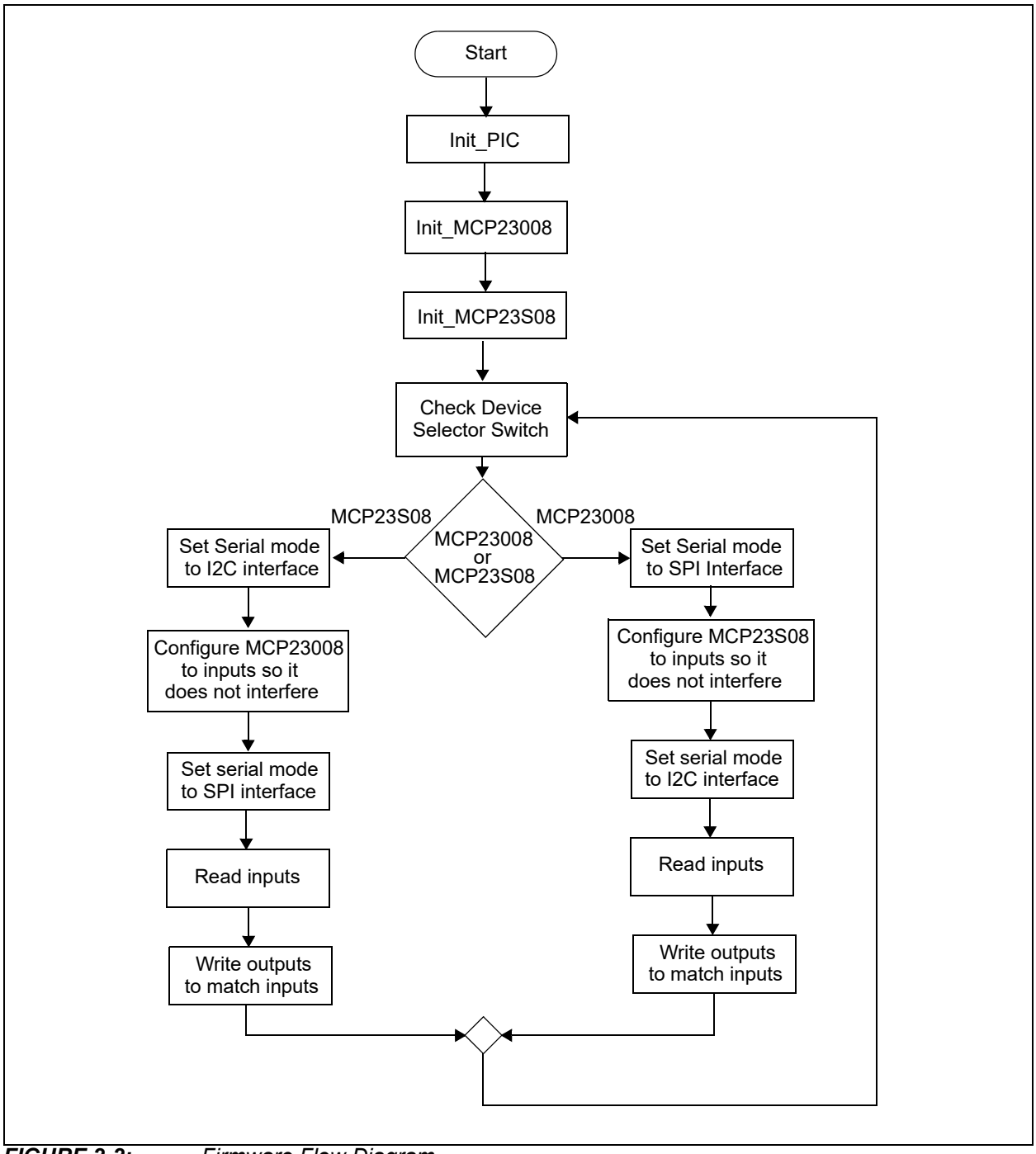

FIGURE 2-2: *Firmware Flow Diagram.*

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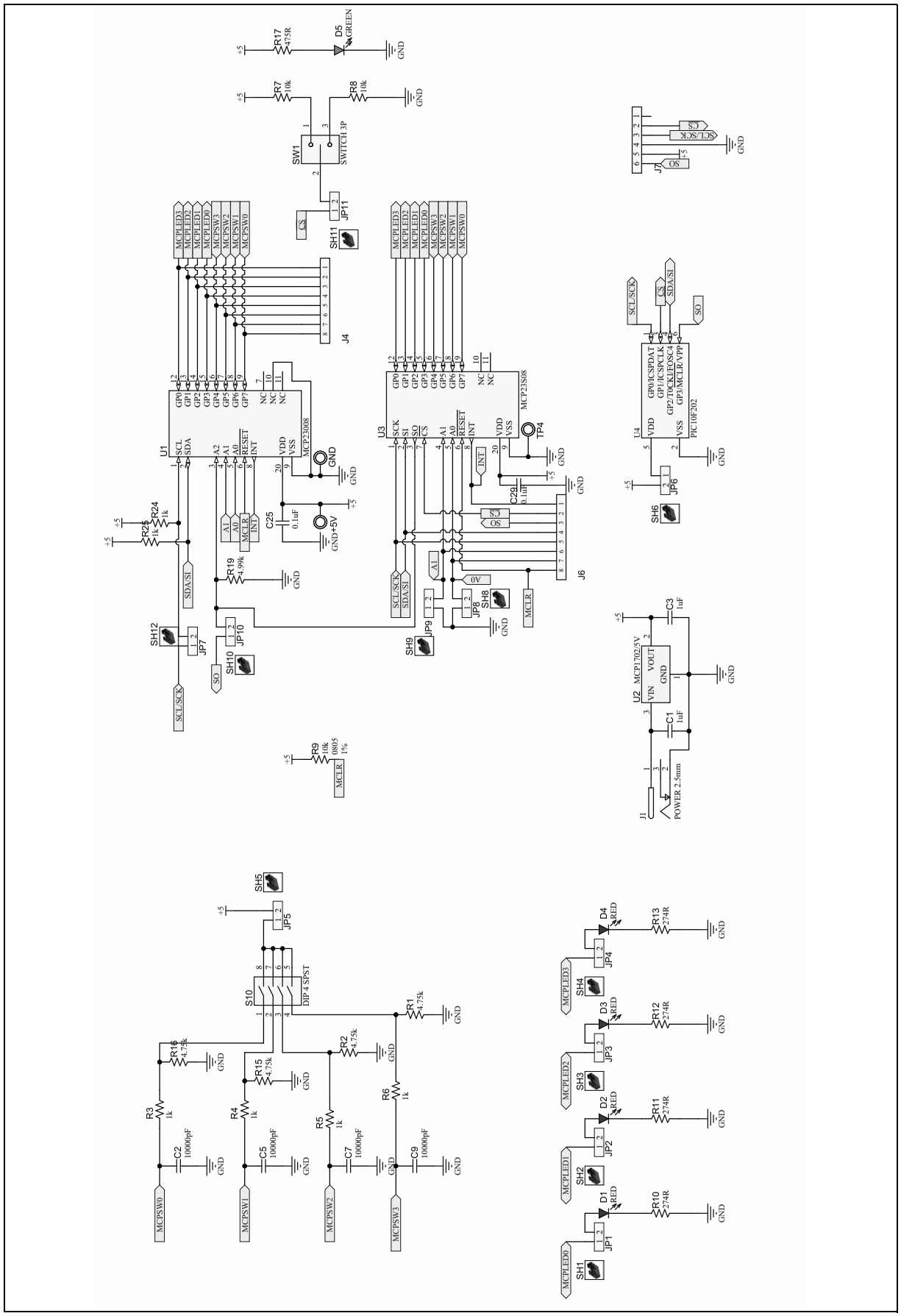
Appendix A. Schematic and Layouts

A.1 INTRODUCTION

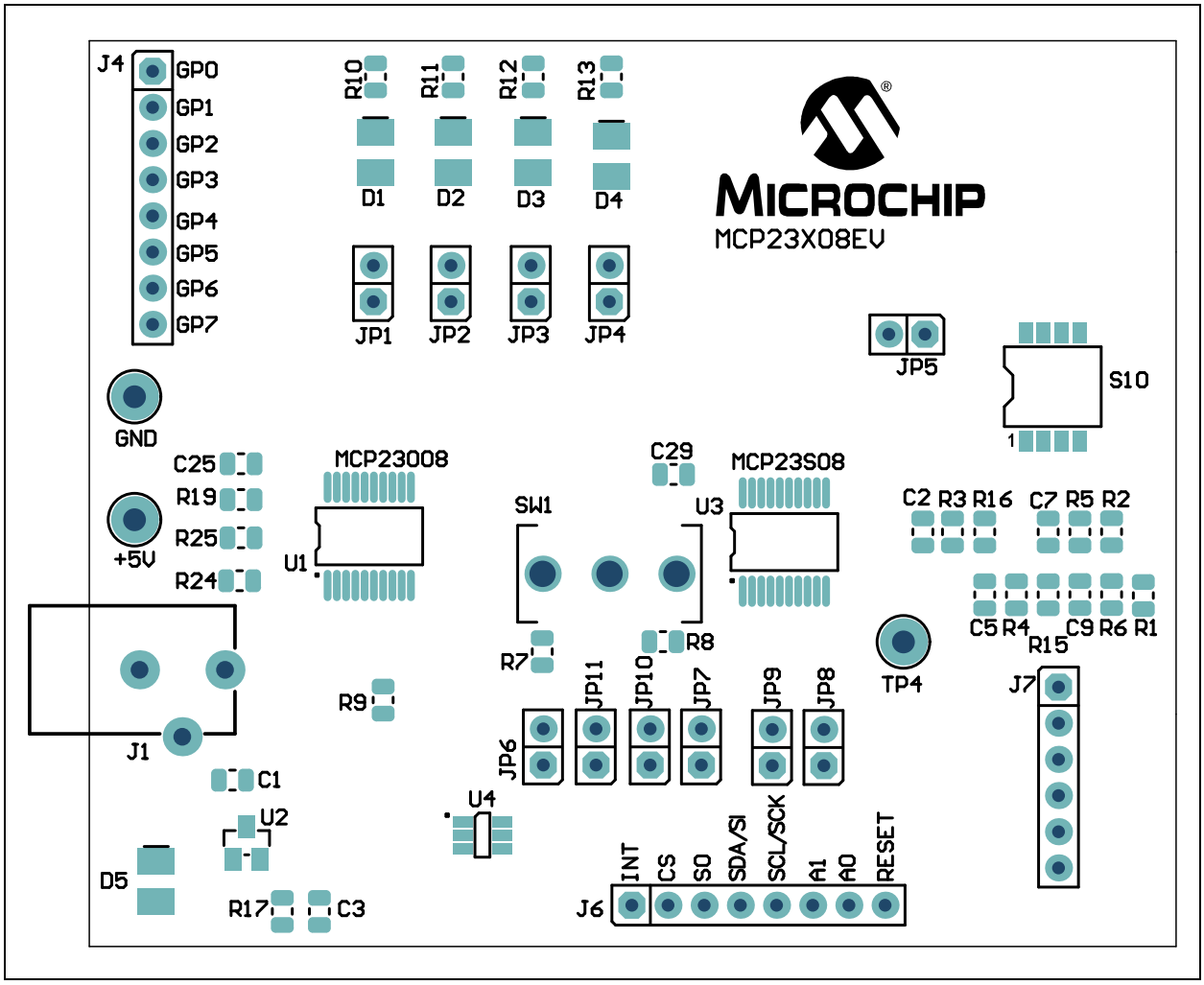
This appendix contains the schematic and PCB layout for the MCP23008/MCP23S08 Evaluation Board. Diagrams included:

- Board – Schematic
- Board – Top Layer (with Silk Screen Only)
- Board – Top Layer
- Board – Bottom Layer

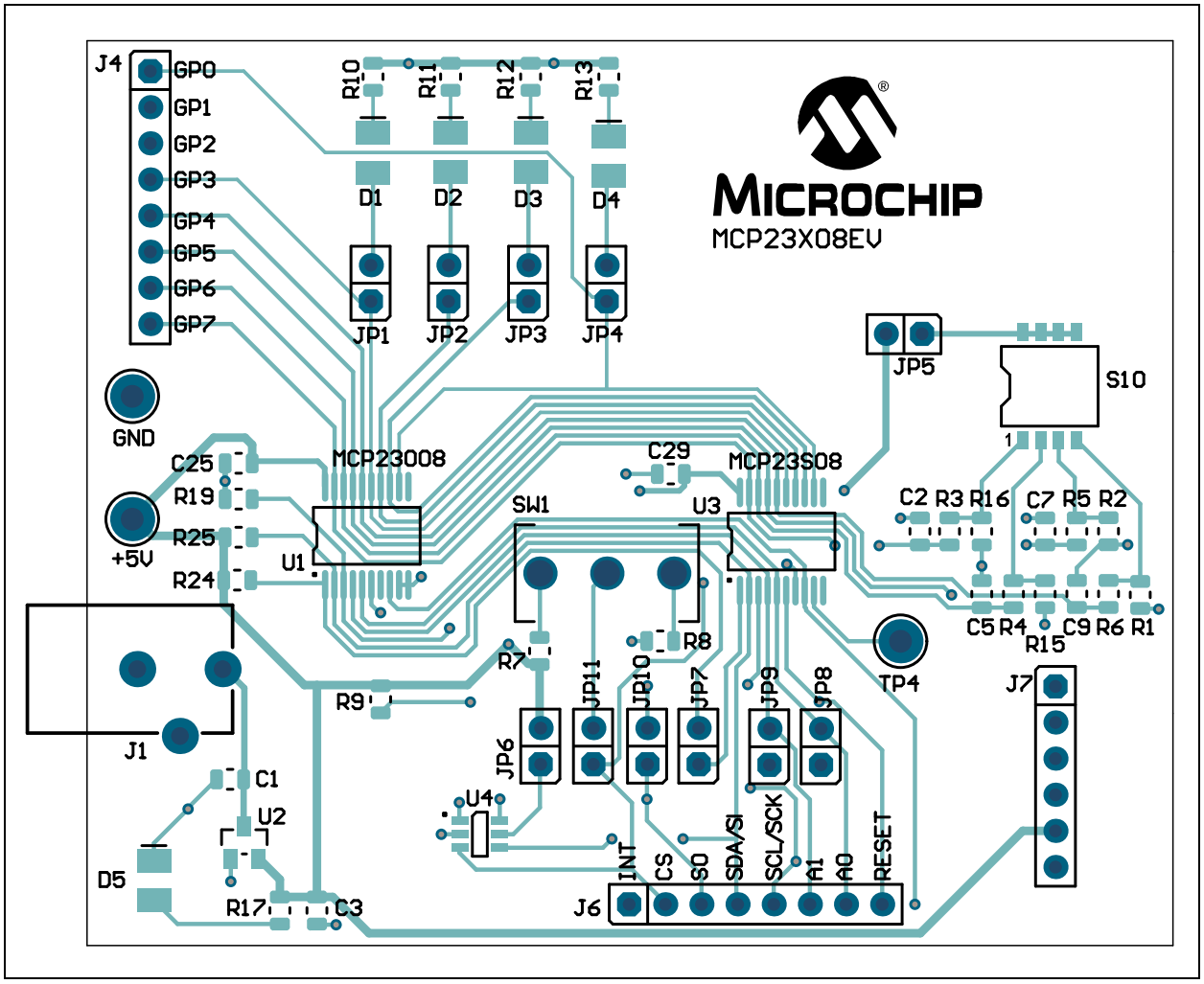
A.2 BOARD – SCHEMATIC



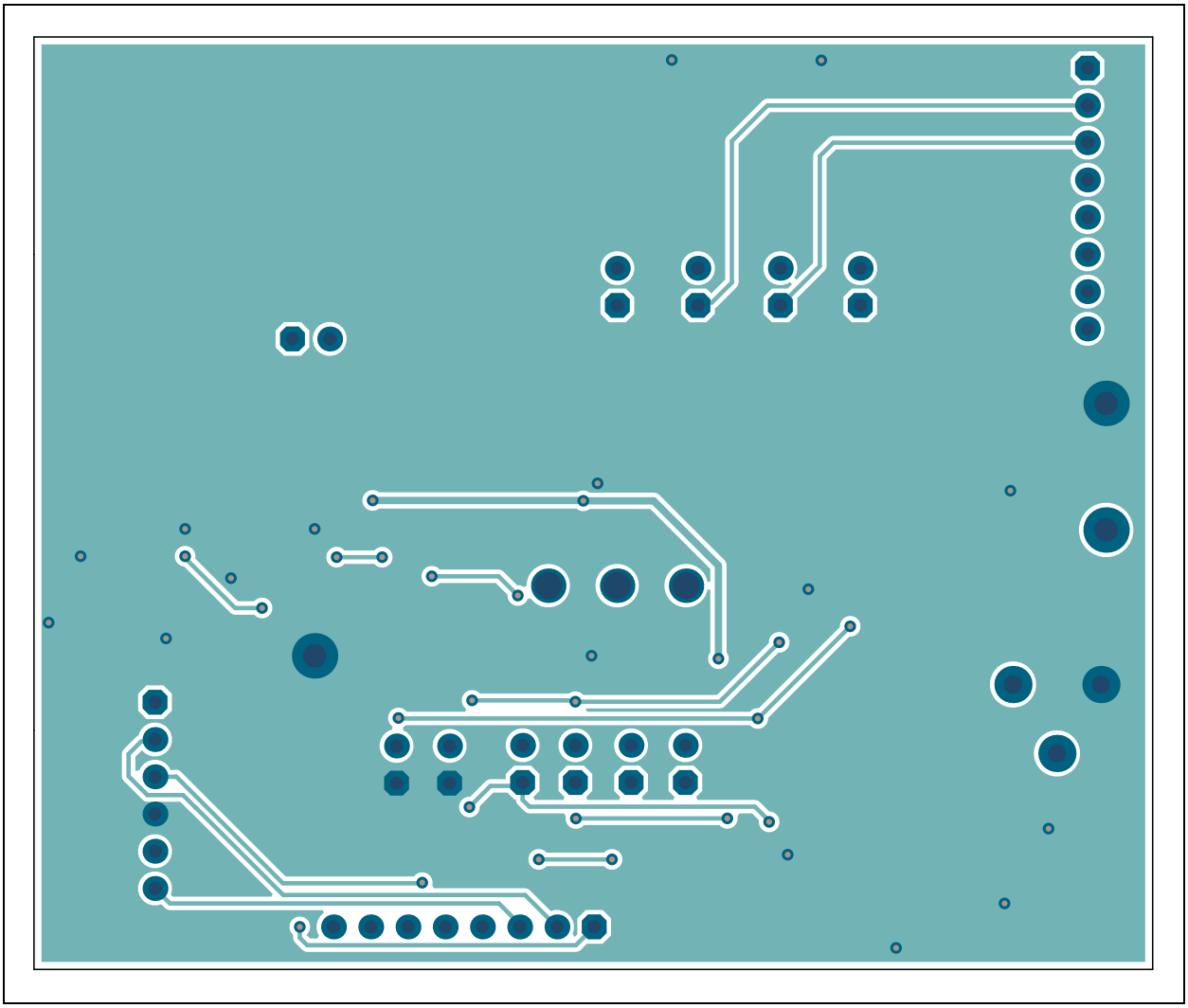
A.3 BOARD – TOP LAYER (WITH SILK SCREEN ONLY)



A.4 BOARD – TOP LAYER



A.5 BOARD – BOTTOM LAYER



NOTES:

Appendix B. Bill Of Materials (BOM)

TABLE B-1: BILL OF MATERIALS (BOM)

Qty	Reference	Description	Manufacturer	Part Number
1	+5V	Connector, TP, LOOP, Red, TH	Keystone® Electronics Corp.	5010
2	C1, C3	Capacitor Ceramic, 1 µF, 16V, 20%, Y5V, SMD, 0805	Kyocera AVX Components	0805YG105ZAT2A
4	C2, C5, C7, C9	Capacitor Ceramic, 10000 pF, 50V, 10% X7R, SMD, 0805	Kyocera AVX Components	08055C103KAT2A
2	C25, C29	Capacitor Ceramic, 0.1 µF, 16V, 10%, X7R, SMD, 0805	Panasonic® - ECG	ECJ-2VB1C104K
4	D1, D2, D3, D4	Diode, LED, Red 2V, 30 mA, 3228	Visual Communications Company, Inc.	CMD67-21VRC/TR8
1	D5	Diode, LED, Green, 2.1V, 25 mA, 3228	Visual Communications Company, Inc.	CMD67-21VGC/TR8
2	GND,TP4	Connector, TP, LOOP, Black, TH	Keystone® Electronics Corp.	5011
1	J1	Connector, Power, 2.5 mm, 5.5 mm Switch, TH, R/A	CUI Inc.	PJ-102B
2	J4,J6	Connector, HDR-2.54, Male, 1x8 Gold, 5.84MH, TH, VERT	Nextronics Engineering Corp.	211-081A7-0021-400
1	J7	Connector, HDR-2.54 Male, 1x6 Tin, 5.84MH, TH, VERT	Sullins Connector Solutions	PEC06SAAN
11	JP1, JP2, JP3, JP4, JP5, JP6, JP7, JP8, JP9, JP10, JP11	Connector, HDR-2.54 Male, 1x2 Tin, 5.84MH, TH, VERT	Sullins Connector Solutions	PREC002SAAN-RC
1	PCB	MCP23008/MCP23S08 Evaluation Board – Printed Circuit Board	—	04-105-00010-R4
4	R1, R2, R15, R16	Resistor, TKF, 4.75k, 1%, 1/8W, SMD, 0805	Panasonic® - ECG	ERJ-6ENF4751V
7	R3, R4, R5, R6, R9, R24, R25	Resistor, TKF, 1k, 1%, 1/8W, SMD, 0805	Vishay/Dale	CRCW08051K00FKEA
2	R7,R8	Resistor, TKF, 10k, 1%, 1/8W, SMD, 0805	Panasonic® - ECG	ERJ-6ENF1002V
4	R10, R11, R12, R13	Resistor, TKF, 274R, 1%, 1/8W, SMD, 0805, AEC-Q200	Panasonic® - ECG	ERJ-6ENF2740V
1	R17	Resistor, TKF, 475R, 1%, 1/8W, SMD, 0805	Panasonic® - ECG	ERJ-6ENF4750V
1	R19	Resistor, TF, 4.99k, 1%, 1/8W, SMD, 0805, AEC-Q200	Panasonic® - ECG	ERJ-6ENF4991V
1	S10	Switch, DIP, 4-POS, Slide SMD, 6V	Nidec Copal Electronics Corporation	CHS-04TB
1	SW1	Switch, Slide, SPDT, 0.4VA, 20V, TH	E-Switch®, Inc.	500SSP1S1M2REA

Note 1: The components listed in this Bill of Materials (BOM) are representative of the PCB assembly. The released BOM used in manufacturing uses all RoHS-compliant parts.

TABLE B-2: BILL OF MATERIALS (BOM) – MICROCHIP PARTS

Qty	Reference	Description	Manufacturer	Part Number
1	U1	Interface GPIO-PORT Expand I^2C 8-Port MCP23008T-E/SS, SSOP-208	Microchip Technology Inc.	MCP23008T-E/SS
1	U2	Analog LDO, 5V, MCP1702T-5002E/CB, SOT-23A-3	Microchip Technology Inc.	MCP1702T-5002E/CB
1	U3	Interface GPIO-PORT Expand SPI 8-Port MCP23S08-E/SS, SSOP-20	Microchip Technology Inc.	MCP23S08T-E/SS
1	U4	MCU 8-BIT 4 MHz, 768B, 24B, PIC10F202T-I/OT, SOT-23-6	Microchip Technology Inc.	PIC10F202-I/OT

Note 1: The components listed in this Bill of Materials (BOM) are representative of the PCB assembly. The released BOM used in manufacturing uses all RoHS-compliant parts.

TABLE B-3: BILL OF MATERIALS (BOM) – MECHANICAL PARTS

Qty	Reference	Description	Manufacturer	Part Number
11	SH1, SH2, SH3, SH4, SH5, SH6, SH8, SH9, SH10, SH11, SH12	Jumper, HW, 2.54 mm, 2x2	Samtec, Inc.	MNT-102-BK-T

Note 1: The components listed in this Bill of Materials (BOM) are representative of the PCB assembly. The released BOM used in manufacturing uses all RoHS-compliant parts.

Appendix C. Firmware

C.1 DEVICE FIRMWARE

For the latest version of the MCP23008/MCP23S08 Evaluation Board firmware, visit the Microchip website @ www.microchip.com.

NOTES:

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Fax: 31-416-690340

Norway - Trondheim
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