MCP23008/MCP23S08 Evaluation Board User's Guide

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ISO/TS 16949:2002

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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.

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 Web Site
- 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 documents are available and recommended as supplemental reference resources.

MCP23008/MCP23S08 Data Sheet, *"8-Bit I/O Expander with Serial Interface"* (DS21919)

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

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

CUSTOMER SUPPORT

Users of Microchip products can receive assistance through several channels:

- Distributor or Representative
- Local Sales Office
- Field Application Engineer (FAE)
- 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 web site at: http://support.microchip.com

DOCUMENT REVISION HISTORY

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:

MCP23008/MCP23S08 EVALUATION BOARD USER'S GUIDE

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 (DS21919) (Electronic Version on CD)
- MCP23008/MCP23S08 Evaluation Board User's Guide (DS51530) (Electronic Version on CD)

NOTES:

Chapter 2. Installation and Operation

2.4 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.

2.5 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 PICmicro® 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)

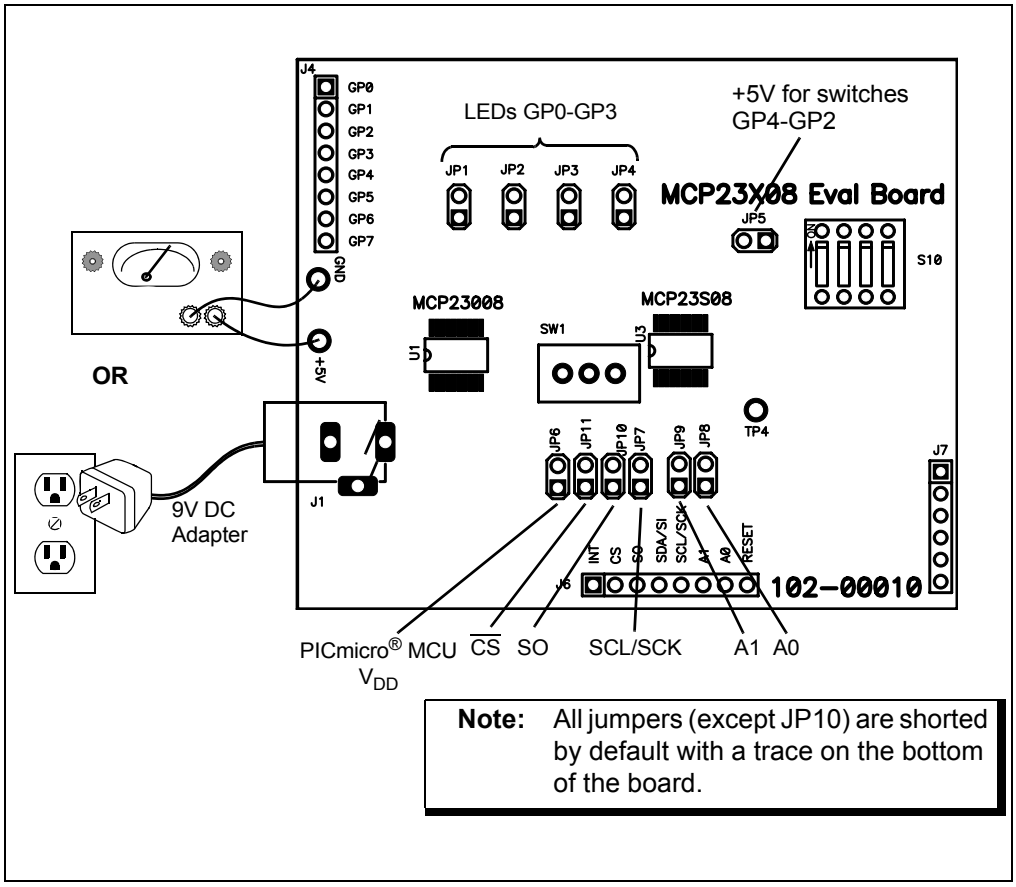
Note: The ICD 2 can also be used to program the PICmicro MCU if the cable is modified to use an appropriate connector.

2.6 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 set-up and operation (see Figure 2-1):

1. Either connect a power supply (5 V) 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



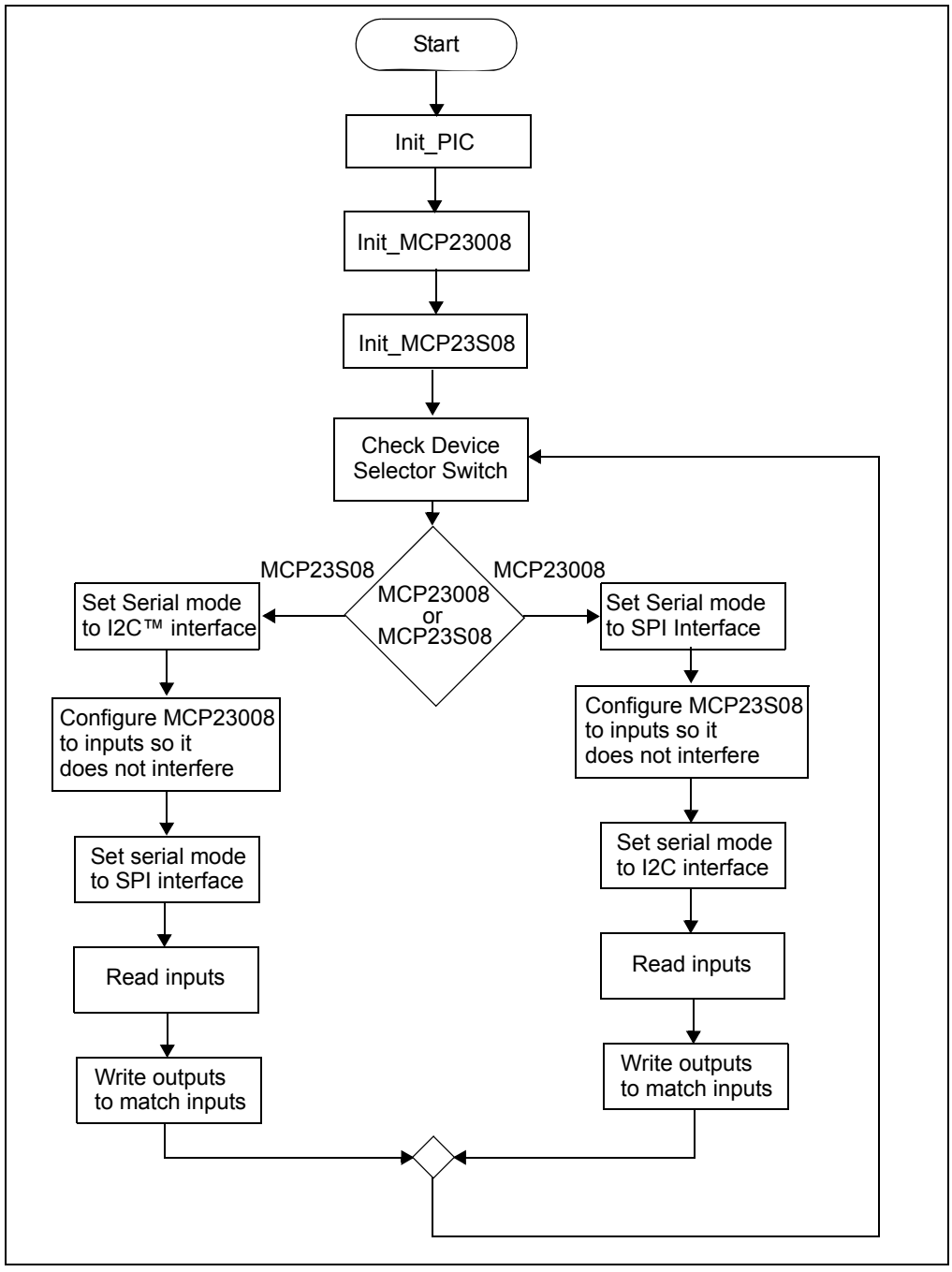
Note: All jumpers (except JP10) are shorted by default with a trace on the bottom of the board.

2.7 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



NOTES:

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 (Sheet 1 thru 4)
- Board - Top Layer (with silk screen only)
- Board - Top Layer
- Board - Bottom Layer

FIGURE A-1: BOARD SCHEMATIC (SHEET 1 OF 4)

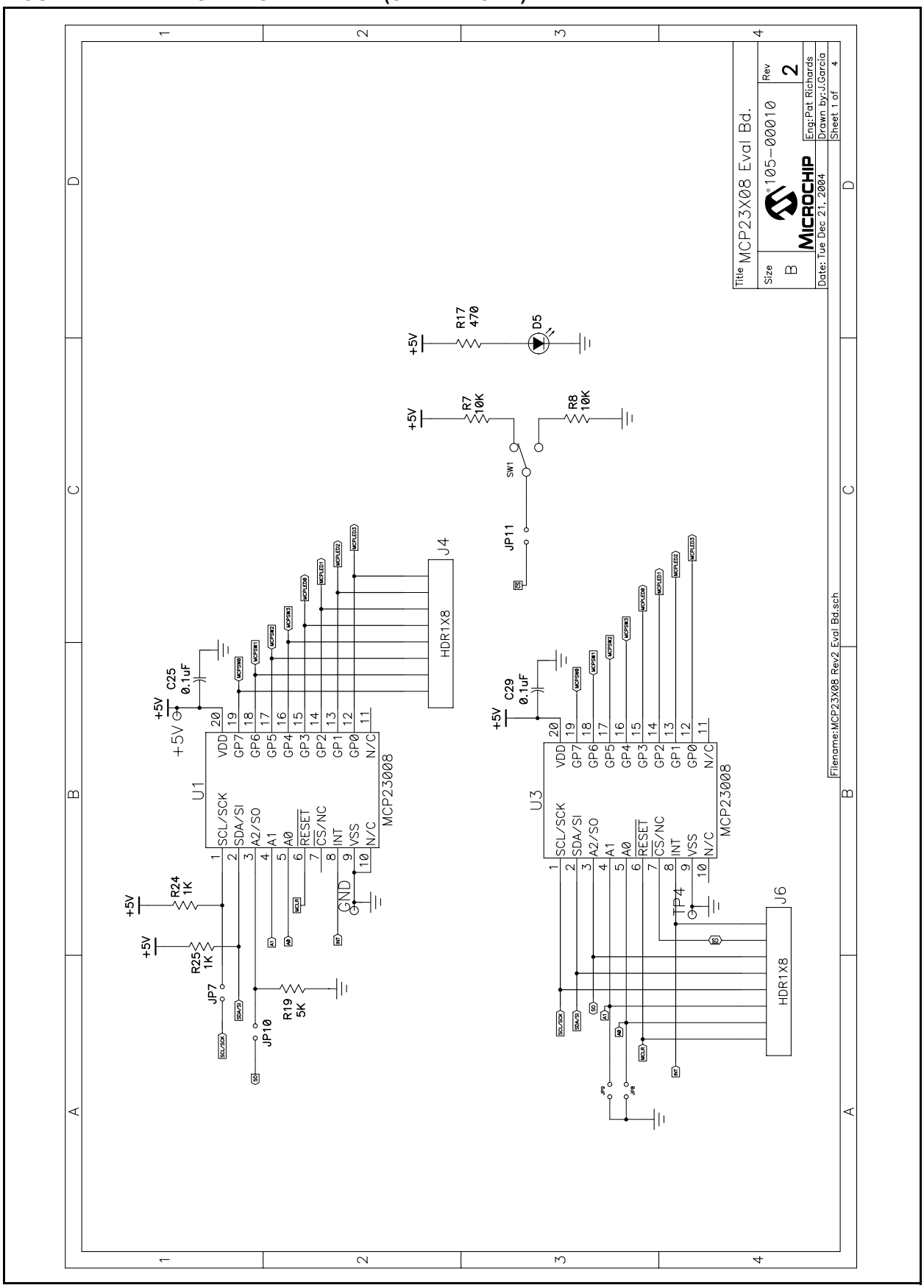


FIGURE A-2: BOARD SCHEMATIC (SHEET 2 OF 4)

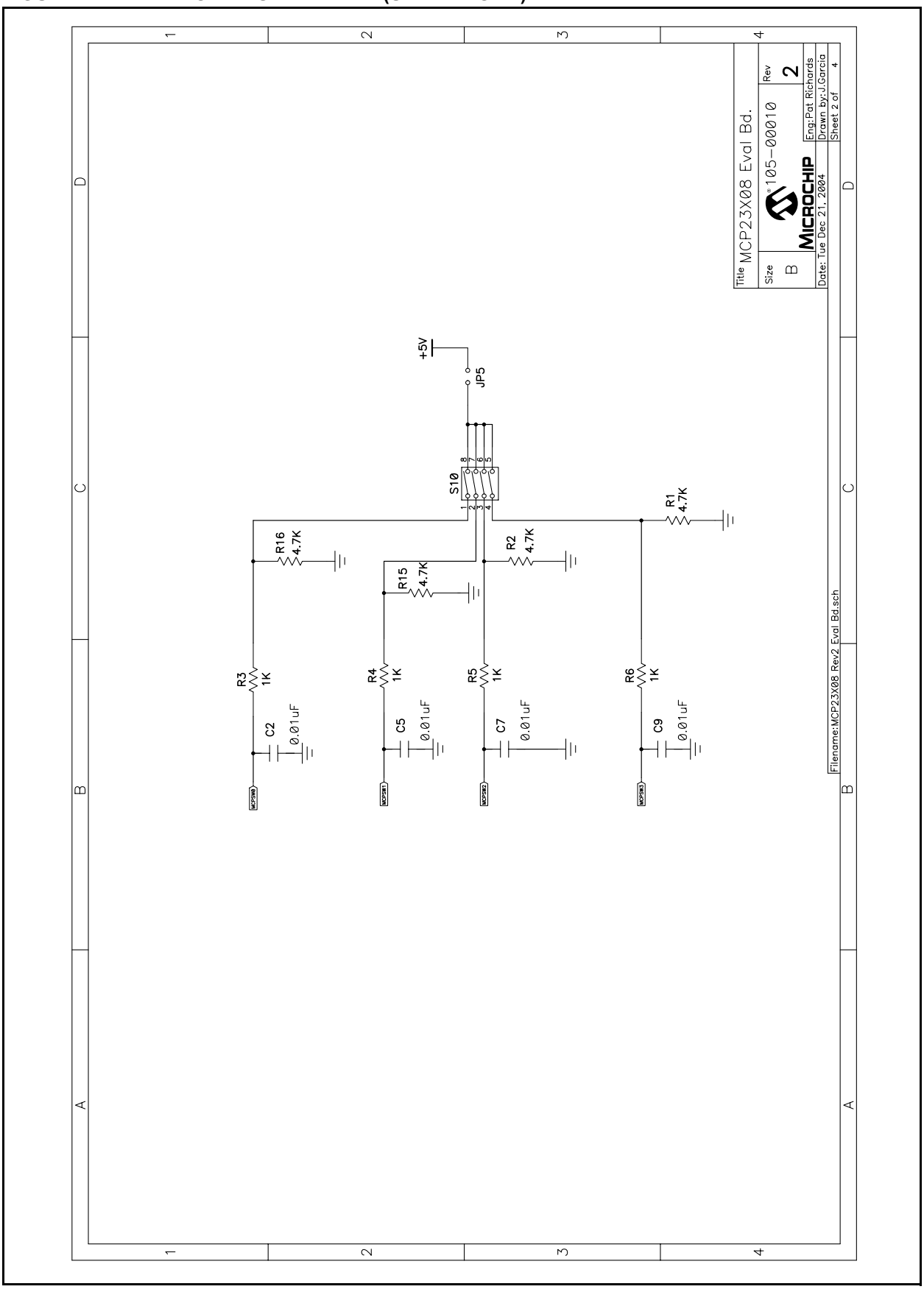


FIGURE A-3: BOARD SCHEMATIC (SHEET 3 OF 4)

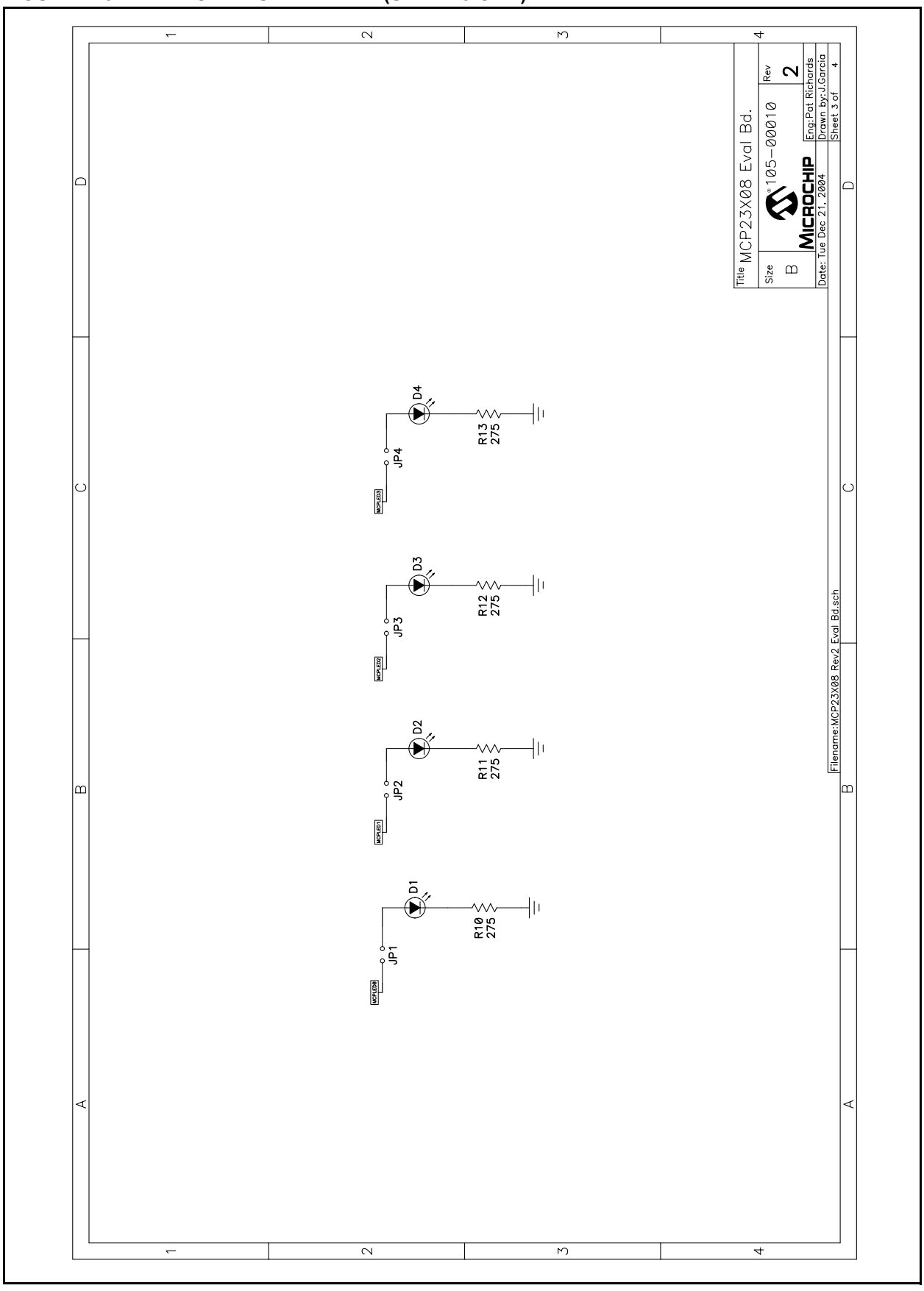


FIGURE A-4: BOARD SCHEMATIC (SHEET 4 OF 4)

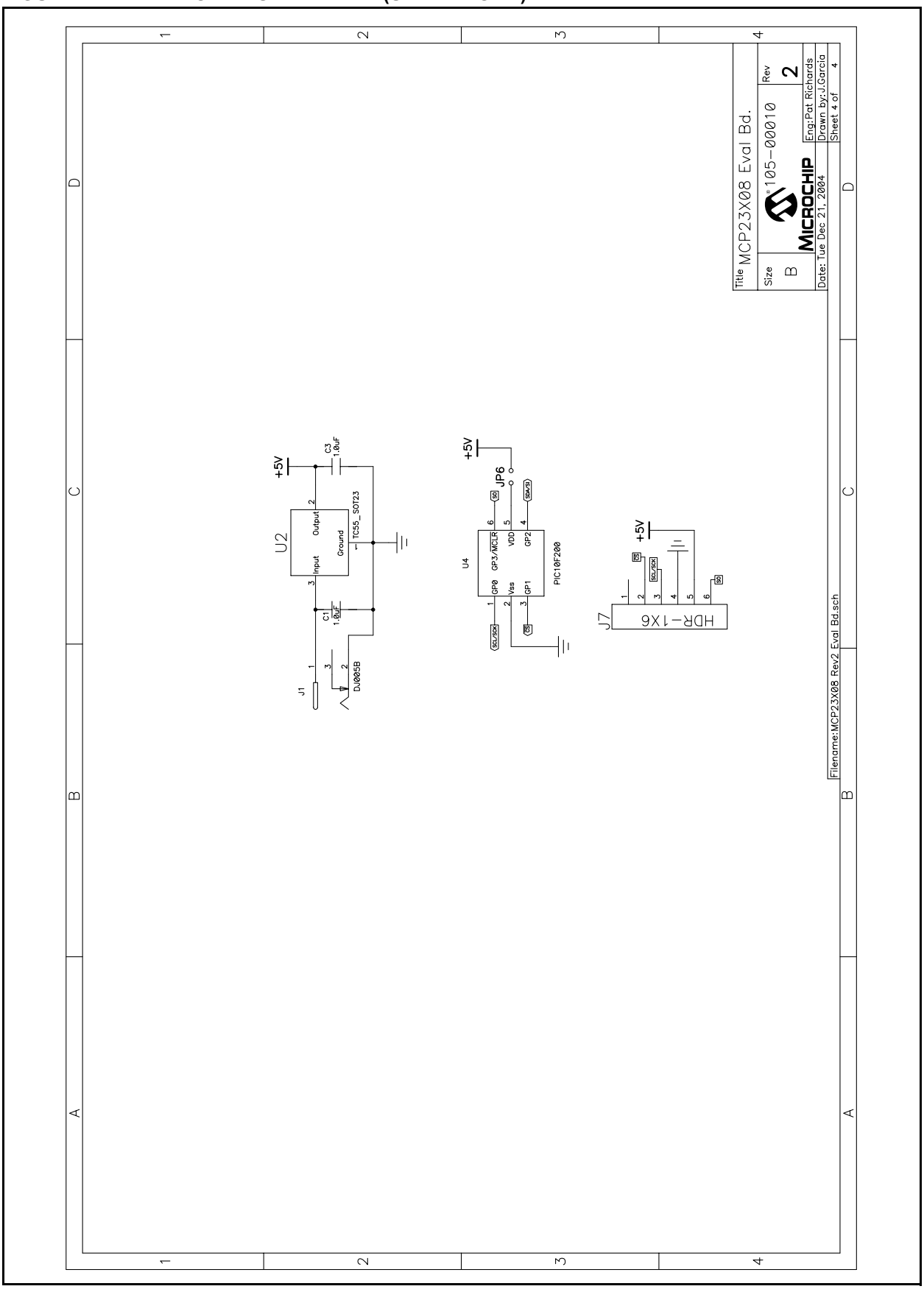


FIGURE A-5: BOARD - TOP LAYER (WITH SILK SCREEN ONLY)

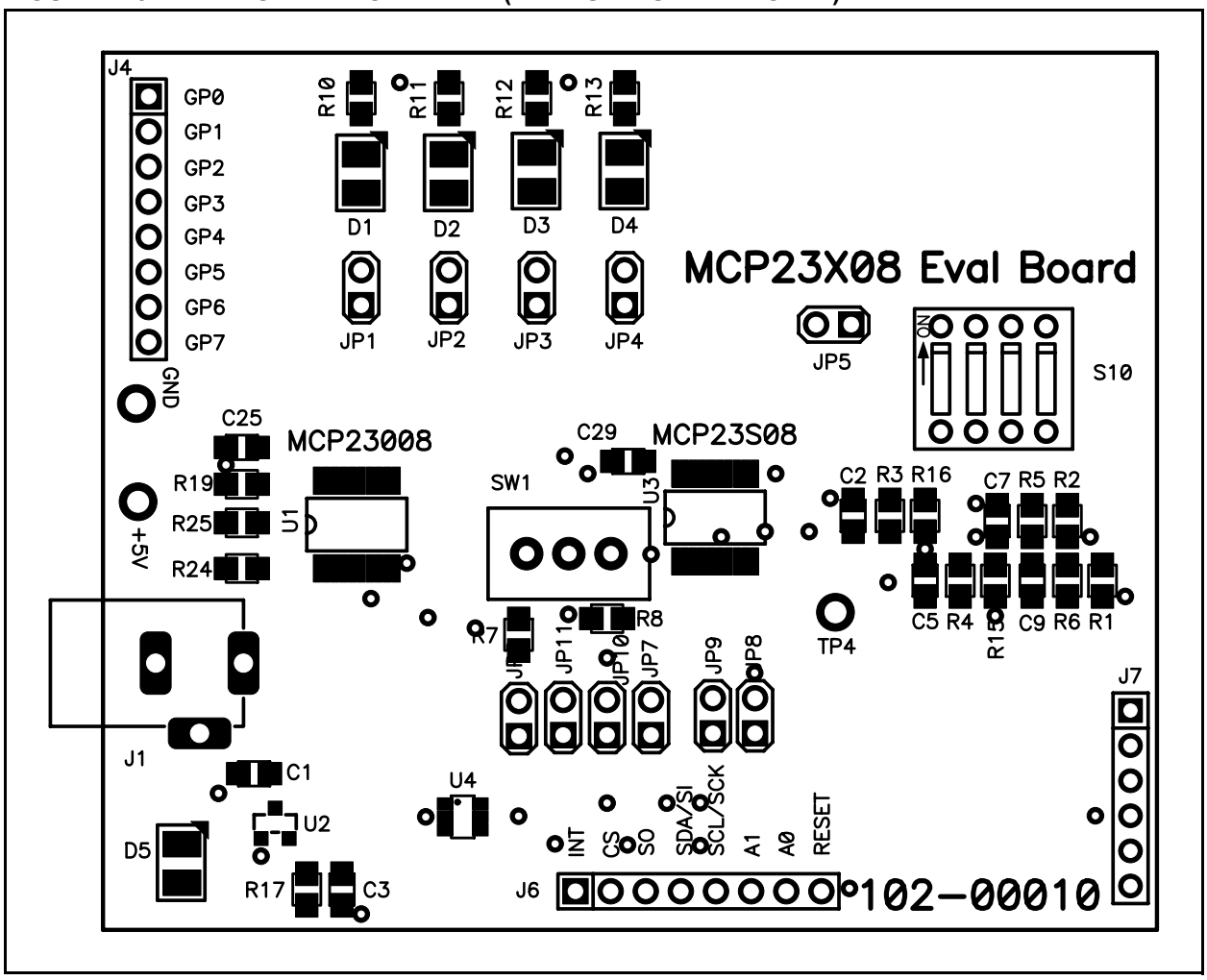


FIGURE A-6: BOARD - TOP LAYER

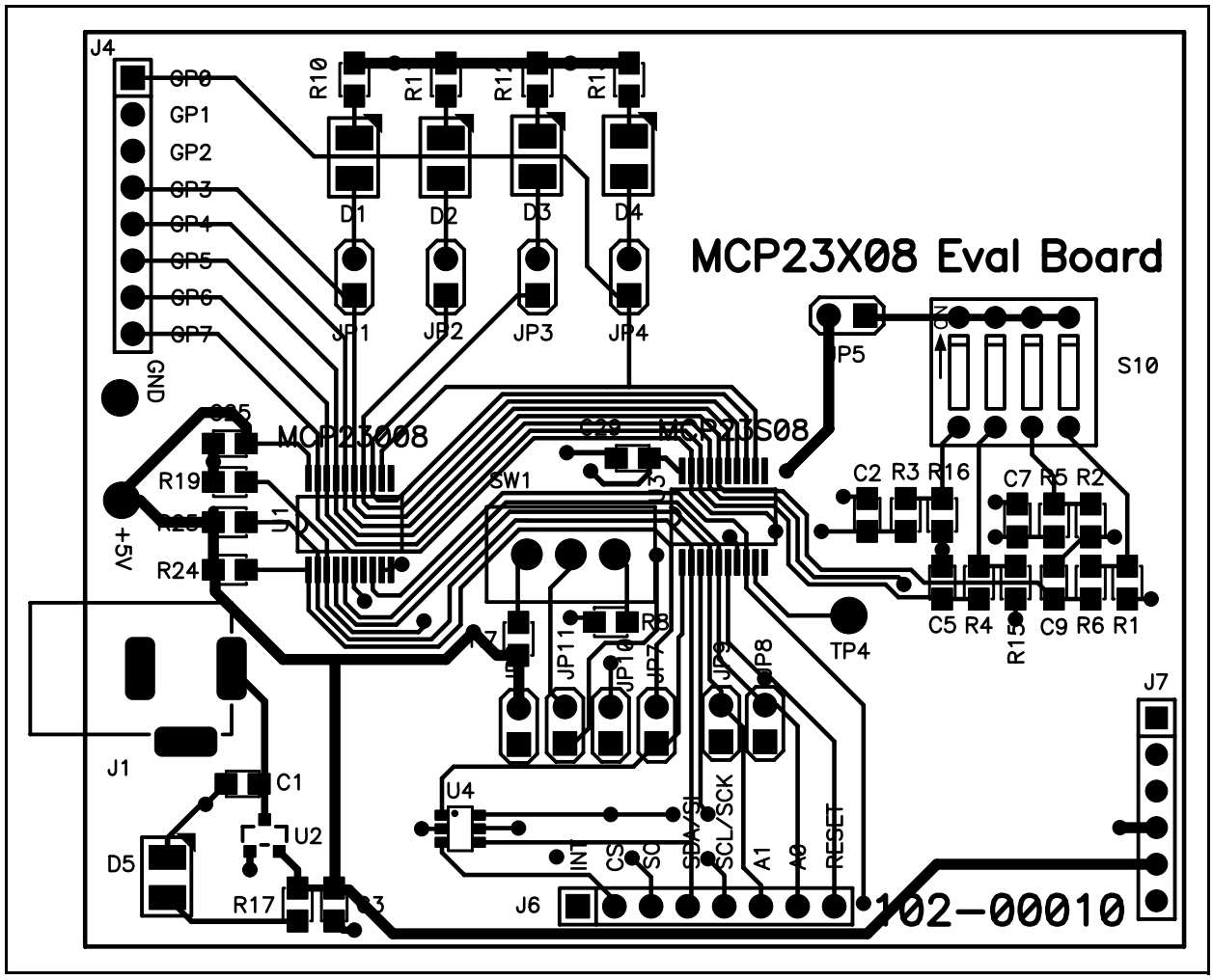
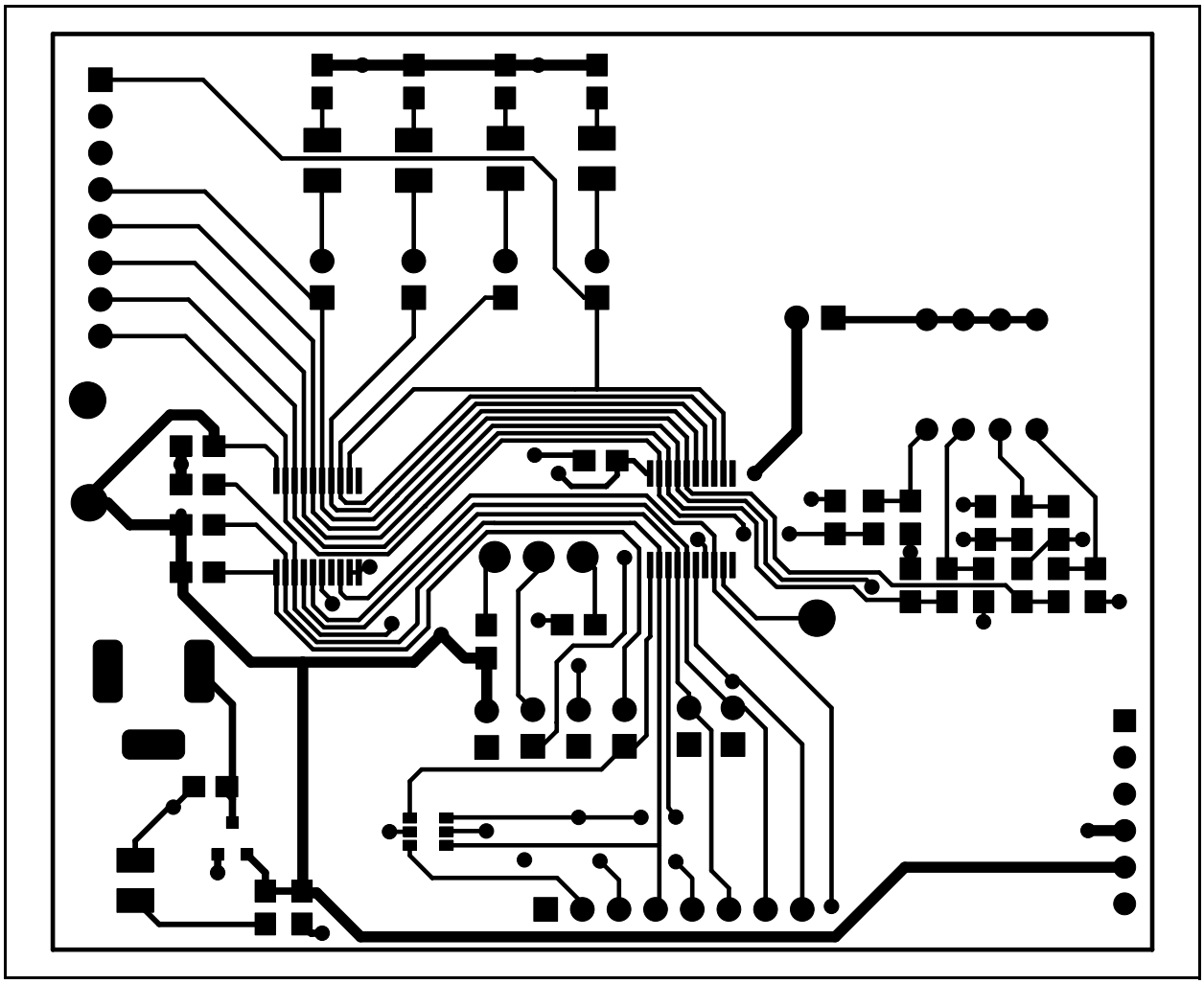


FIGURE A-7: BOARD - BOTTOM LAYER



Appendix B. Bill Of Materials (BOM)

TABLE B-1: BILL OF MATERIALS (BOM)

Qty	Reference	Description	Manufacturer	Part Number
2	C1.C3	Cap 1 µF 16V CERAMIC Y5V 0805	Panasonic® - ECG	ECJ-2VF1C105Z
4	C2,C5,C7,C9	Cap 10000 PF 50V CERAMIC X7R 0805	KEMET®	C0805C103K5RACTU
2	C25,C29	Cap .1 µF 16V CERAMIC X7R 0805	Panasonic - ECG	ECJ-2VB1C104K
4	D1-D4	LED, RED, 635NM PLCC 120DEG	Lite-On Trading USA, Inc.	LTST-T670EKT
1	D5	LED, GREEN, 565NM PLCC 120DEG	Lite-On Trading USA, Inc.	LTST-T670GKT
1	J1	Conn Power JACK 2.5MM PCB CIRC	CUI Inc	PJ-102B
2	J4,J6	Conn Header 8-POS .100 VERT TIN	Molex®/Waldom® Electronics Corp	22-28-4080
1	J7	Conn Header 6-POS .100 VERT TIN	Molex/Waldom Electronics Corp	22-28-4060
9	JP1 - JP9,JP11	Conn Header 2-POS .100 VERT TIN NOT POPULATED	Molex/Waldom Electronics Corp	22-28-4020
1	JP10	Conn Header 2-POS .100 VERT TIN	Molex/Waldom Electronics Corp	22-28-4019
4	R1,R2,R15,R16	Res 4.75 kΩ, 1/10W, 1%, 0805 SMD	Panasonic - ECG	ERJ-6ENF4751V
6	R3,R4,R5,R6 R24,R25	Res 1.00 kΩ, 1/10W, 1%, 0805 SMD	Panasonic - ECG	ERJ-6ENF1001V
2	R7,R8	Res 10.0 kΩ, 1/10W, 1%, 0805 SMD	Panasonic - ECG	ERJ-6ENF1002V
4	R10,R11 R12,R13	Res 274Ω, 1/10W, 1%, 0805 SMD	Panasonic - ECG	ERJ-6ENF2740V
1	R17	Res 475Ω, 1/10W, 1%, 0805 SMD	Panasonic - ECG	ERJ-6ENF4750V
1	R19	Res 4.99 kΩ, 1/10W, 1%, 0805 SMD	Panasonic - ECG	ERJ-6ENF4991V
1	S2	Switch, SLD, MIN, SPDT, ON-ON, PCB MTG, 50VDC@.5A, SOLDER PINS		
1	S10	Switch, 4-POS DIP EXT ROCK UNSEALD	Grayhill Inc.	76SB04
2	GND,TP4	Test Point PC MULTI-PURPOSE BLK	Keystone Electronics®	5011
1	+5V	Test Point PC MULTI-PURPOSE RED	Keystone Electronics	5010
1	U1	8-Bit I/O Expander with I^2C™ Interface	Microchip Technology Inc.	MCP23008-E/SS
1	U2	1 µA Low Dropout Positive Voltage Regulator	Microchip Technology Inc.	TC55RP5002ECB713
1	U3	8-Bit I/O Expander with SPI™ Interface	Microchip Technology Inc.	MCP23S08-E/SS
1	U4	6-Pin, 8-Bit Flash Microcontroller	Microchip Technology Inc.	PIC10F202T-E/OTG

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.

NOTES:

Appendix C. Firmware

C.1 DEVICE FIRMWARE

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

WORLDWIDE SALES AND SERVICE

AMERICAS

Corporate Office
2355 West Chandler Blvd.
Chandler, AZ 85224-6199
Tel: 480-792-7200
Fax: 480-792-7277
Technical Support:
http://support.microchip.com
Web Address:
www.microchip.com

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Habour City, Kowloon
Hong Kong
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Fax: 852-2401-3431

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Fax: 770-640-0307

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Fax: 774-760-0088

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Fax: 630-285-0075

Dallas
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Fax: 972-818-2924

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Fax: 248-538-2260

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Fax: 765-864-8387

Los Angeles
Mission Viejo, CA
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Fax: 949-462-9608

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Fax: 650-961-0286

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Canada
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Fax: 905-673-6509

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Fax: 61-2-9868-6755

China - Beijing
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Fax: 86-10-8528-2104

China - Chengdu
Tel: 86-28-8676-6200
Fax: 86-28-8676-6599

China - Fuzhou
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Fax: 86-591-8750-3521

China - Hong Kong SAR
Tel: 852-2401-1200
Fax: 852-2401-3431

China - Qingdao
Tel: 86-532-8502-7355
Fax: 86-532-8502-7205

China - Shanghai
Tel: 86-21-5407-5533
Fax: 86-21-5407-5066

China - Shenyang
Tel: 86-24-2334-2829
Fax: 86-24-2334-2393

China - Shenzhen
Tel: 86-755-8203-2660
Fax: 86-755-8203-1760

China - Shunde
Tel: 86-757-2839-5507
Fax: 86-757-2839-5571

China - Wuhan
Tel: 86-27-5980-5300
Fax: 86-27-5980-5118

China - Xian
Tel: 86-29-8833-7250
Fax: 86-29-8833-7256

ASIA/PACIFIC

India - Bangalore
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Fax: 91-80-4182-8422

India - New Delhi
Tel: 91-11-5160-8631
Fax: 91-11-5160-8632

India - Pune
Tel: 91-20-2566-1512
Fax: 91-20-2566-1513

Japan - Yokohama
Tel: 81-45-471- 6166
Fax: 81-45-471-6122

Korea - Gumi
Tel: 82-54-473-4301
Fax: 82-54-473-4302

Korea - Seoul
Tel: 82-2-554-7200
Fax: 82-2-558-5932 or
82-2-558-5934

Malaysia - Penang
Tel: 60-4-646-8870
Fax: 60-4-646-5086

Philippines - Manila
Tel: 63-2-634-9065
Fax: 63-2-634-9069

Singapore
Tel: 65-6334-8870
Fax: 65-6334-8850

Taiwan - Hsin Chu
Tel: 886-3-572-9526
Fax: 886-3-572-6459

Taiwan - Kaohsiung
Tel: 886-7-536-4818
Fax: 886-7-536-4803

Taiwan - Taipei
Tel: 886-2-2500-6610
Fax: 886-2-2508-0102

Thailand - Bangkok
Tel: 66-2-694-1351
Fax: 66-2-694-1350

EUROPE

Austria - Wels
Tel: 43-7242-2244-3910
Fax: 43-7242-2244-393

Denmark - Copenhagen
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Fax: 45-4485-2829

France - Paris
Tel: 33-1-69-53-63-20
Fax: 33-1-69-30-90-79

Germany - Munich
Tel: 49-89-627-144-0
Fax: 49-89-627-144-44

Italy - Milan
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Fax: 39-0331-466781

Netherlands - Drunen
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Fax: 31-416-690340

Spain - Madrid
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Tel: 44-118-921-5869
Fax: 44-118-921-5820

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