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MCP2210 Evaluation Kit User's Guide

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MCP2210 EVALUATION KIT 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 online help. Select the Help menu, and then Topics to open a list of available online help files.

INTRODUCTION

This chapter contains general information that will be useful to know before using the MCP2210 Evaluation Kit. 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 MCP2210 Evaluation Kit as a development tool. The manual layout is as follows:

- **Chapter 1. "Product Overview"** – Important information about the MCP2210 Evaluation Kit
- **Chapter 2. "Installation and Operation"** – Covers the initial set-up of this board and Graphical User Interface (GUI)
- **Appendix A. "Schematic and Layouts"** – Shows the schematic and board layouts for the MCP2210 Evaluation Kit User's Guide
- **Appendix B. "Bill of Materials"** – Lists the parts used to populate the MCP2210 Evaluation Kit

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) { ... }`

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RECOMMENDED READING

This user's guide describes how to use MCP2210 Evaluation Kit. Other useful documents are listed below. The following Microchip documents are available and recommended as supplemental reference resources.

- **MCP2210 Data Sheet - *"USB-to-SPI Protocol Converter with GPIO (Master Mode)"* (DS22288)**

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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- 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://www.microchip.com/support.

DOCUMENT REVISION HISTORY

Revision A (March 2012)

- Initial Release of this Document.

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Chapter 1. Product Overview

1.1 INTRODUCTION

This chapter provides an overview of the MCP2210 Evaluation Kit and covers the following topics:

- MCP2210 Evaluation Kit General Description
- What The MCP2210 Evaluation Kit Includes

1.2 MCP2210 EVALUATION KIT GENERAL DESCRIPTION

The MCP2210 Evaluation Kit (ADM00421) is a development and evaluation platform for the MCP2210 device. The kit is comprised of two connected boards:

- MCP2210 Breakout Board (ADM00419)
- MCP2210 SPI Slave Motherboard (ADM00420)

The MCP2210 SPI Slave Motherboard is designed to work together with the MCP2210 Breakout Board (ADM00419). The motherboard provides the test-points required for measurements. It also contains the following SPI slave devices:

- MCP23S08 – 8-bit I/O expander
- MCP3204 – 4 channel, 12-bit ADC
- 25LC02 – 2 kbit EEPROM
- TC77 – Temperature sensor

All devices are SPI slaves, controlled by the MCP2210.

Windows®-based PC software is used to evaluate/demonstrate the MCP2210 as a USB-to-SPI (Master) device. It allows I/O control and custom device configuration. The software is downloadable from the board web page on www.microchip.com.

A DLL package is also available for development of custom PC applications using the MCP2210. The DLL package is downloadable from the board's web page.

1.3 WHAT THE MCP2210 EVALUATION KIT INCLUDES

The MCP2210 Evaluation Kit includes (ADM00421):

- MCP2210 Breakout Board (ADM00419)
- MCP2210 SPI Slave Motherboard (ADM00420)
- Mini-USB cable
- Important Information Sheet

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Chapter 2. Installation and Operation

2.1 INTRODUCTION

The MCP2210 Evaluation Kit is designed to demonstrate the device as a USB-to-SPI (Master) bridge solution.

The Evaluation Kit is comprised of two boards that have the following features:

- MCP2210 Breakout Board:
  - Small plug-in board with DIP form factor (0.6 inches overall row spacing between pins)
  - Mini-USB connector
  - Access to the SPI bus and all GP signals
  - PICkit™ Serial Analyzer compatible header
  - 3.3 or 5V jumper selectable V_{DD}; the Breakout Board can be used to supply up to 500 mA to the rest of the system
- MCP2210 SPI Slave Motherboard:
  - Socket for plugging in the MCP2210 Breakout Board
  - Test-points for the SPI bus and GP signals
  - PICkit™ Serial Analyzer header (it can be used to access only one of the SPI slave chips present on this board – MCP23S08)
  - 8-bit I/O expander (MCP23S08) with eight LEDs
  - Four channel, 12-bit ADC (MCP3204) – a potentiometer is used to vary the voltage on the Channel 1 ADC input
  - 2 kbit EEPROM – 25LC02
  - Temperature sensor – TC77

2.2 KIT SETUP

Follow these steps to set up the MCP2210 Evaluation Kit:

1. Download the support material (PC applications and DLL libraries) that can be found on the board's page (www.microchip.com/mcp2210evaluationkit).
2. Plug the MCP2210 Breakout Board into the MCP2210 SPI Slave Motherboard.
3. Connect the MCP2210 Breakout Board to a PC via a USB port.
4. The system will automatically install the driver for this board. When the installation is complete, the board is ready for operation.
5. Install the downloaded PC software.
6. Start the demo application and exercise the SPI slave chip's features.

2.3 BOARD OPERATION

The MCP2210 device is detected by a Windows®-based PC host as a Human Interface Device (HID). The accompanying software can be used to exercise the Evaluation Kit's features. It also provides a reference point for users that want to create custom applications based on the MCP2210.

2.3.1 MCP2210 Breakout Board Operation

The MCP2210 Breakout Board can be used with either the provided motherboard, or as a stand-alone USB-to-SPI (Master) bridge module. The breakout board provides all the required signals in order to assist the user in building customized boards using the MCP2210.

The breakout board has the following features:

- SPI bus signals (MOSI, MISO, SCK)
- 9 GP signals configurable for:
  - GPIO functionality (digital input or output pins)
  - Chip Select functionality (working with the SPI bus signals)
  - Dedicated function pins
- Jumper selectable power supply: 3.3 or 5V (up to 500 mA). The board has a default connection trace between V_{DD} and 3.3V rail, making the voltage header mounting unnecessary when powering the board with 3.3V. For 5V operation, a 3-pin header must be mounted on the board.
- PICkit™ Serial Analyzer header using GP4 as the Chip Select signal

Note: This function is available only on SPI operations, it does not work on I^2C or UART signals.

- Dip form-factor (0.6 inches overall row spacing between pins)

By using the provided software and libraries, the user can create personalized PC applications using the breakout board as a USB-to-SPI (Master) bridge adapter.

2.3.2 MCP2210 Breakout Board Operation

The MCP2210 Utility software was created for custom device setting requirements. A few of the settings that this utility can alter include VID, PID, power requirements, and string descriptors. A download link for this software can be found on the board web page. For instructions on the use of this software, refer to the software's supporting documentation included within the application install package.

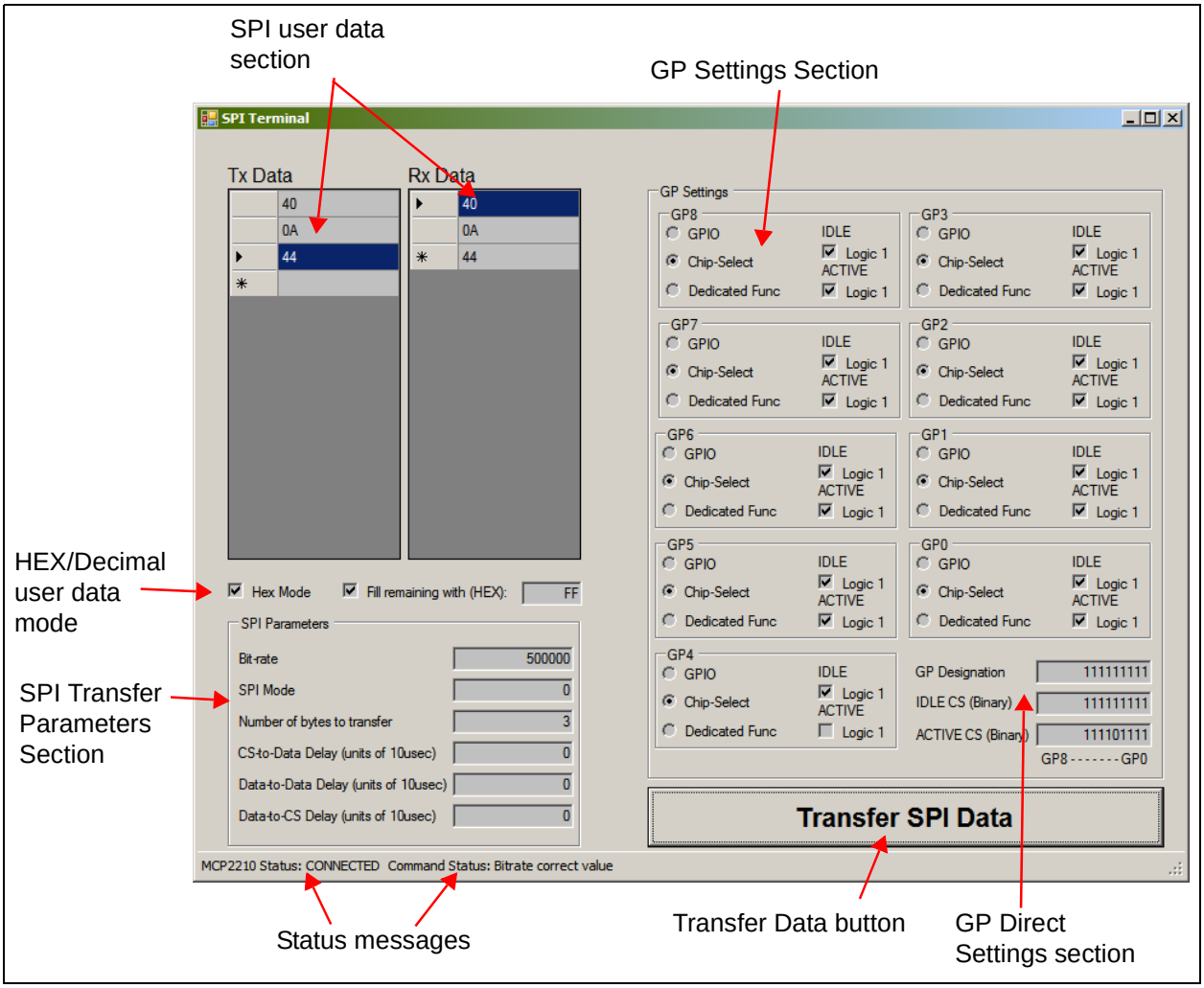
2.3.3 SPI Terminal Utility

The SPI Terminal Utility is a tool that allows low-level data exchange at the SPI bus level. This application is useful for low-level communication and troubleshooting between the MCP2210 and various SPI slave modules.

The utility window has different sections for GP designation, SPI transfer parameters and user data area.

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FIGURE 2-1: SPI TERMINAL UTILITY WINDOW



After the application is started, the state of the connection with the MCP2210 is shown in the Status Messages bar (in the lower left corner of the screen).

The user can establish the GP configuration. The GPs can be used as chip select pins. Each GP Active and Idle value can be established by selecting the appropriate check-boxes, or by directly supplying the correct value in the GP Direct Settings section. The same behavior applies to the GP designation (the GP designation can be established by clicking the appropriate radio-button, or by directly supplying the GP designation value in the GP settings Direct Values section).

The SPI settings pertaining to the needed SPI transfer can be established in the SPI Parameters section.

The data to be sent out is filled in the **Tx Data** field. To send the data to the SPI slave device, press the **SPI Transfer Data** button on the lower right area of the screen. The data received from the SPI slave device is displayed in the **Rx Data** field.

The user data can be supplied in either HEX or Decimal mode. This can be accomplished by selecting the HEX mode checkbox. The data in the Tx and Rx Data fields will be displayed in HEX or Decimal.

A simple test using the SPI Terminal utility shows how the MCP23S08 (an 8-bit I/O expander) uses the GP4 pin of the MCP2210 device as a chip select line. This line should be active low. The GP4 must be set as in the Figure 2-1, with the IDLE option checked (IDLE value is logic '1') and the ACTIVE option unchecked (ACTIVE value is logic '0').

The SPI parameters are set as follows:

- Bit rate - 500000 bps
- SPI Mode – 0
- Number of bytes to transfer – 3
- All the SPI related delays are set to 0

The TX Data should contain the following HEX values: 40, 00, 00. Click on the **SPI Transfer Data** button to complete the procedure and set the MCP23S08's port as an output.

After setting this port, a value can be sent out to the port to light the LEDs on the board. To make this happen, insert the following three HEX values: 40, 0A, FF. By clicking the **SPI Transfer Data** button again, the inserted values are sent out to the MCP23S08 device. This command will light all the LEDs on the board. If any other LED light pattern is desired, the third value (FF) can be changed to any other 8-bit value.

To verify the value written to the MCP23S08's port, another set of data must be written into the TX Data area: 41, 0A and any other 8-bit value (a "Don't care" value for the third position is admissible, because the read value from the MCP23S08 is received on the third byte).

In the RX Data field, the third value should be the identical to the one sent out previously (in the given example, FF).

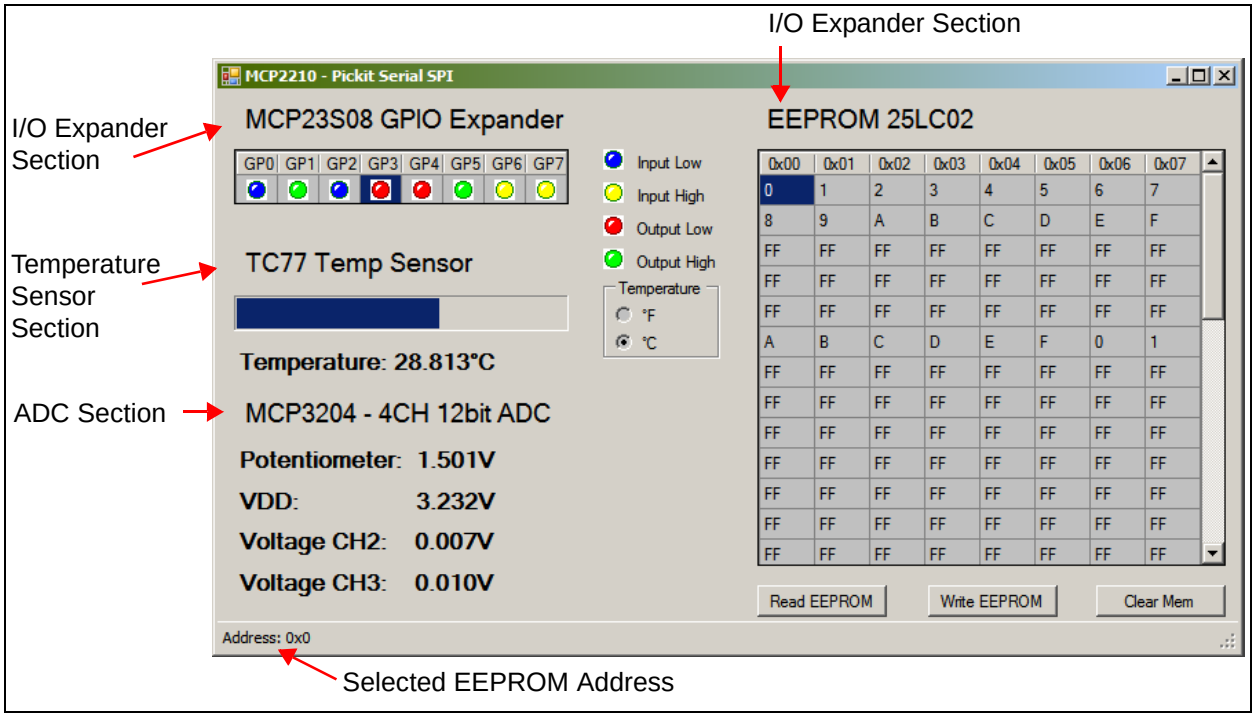
2.3.4 MCP2210 Evaluation Kit demo application

The provided demo application is designed to work with the MCP2210 SPI Slave Motherboard using the MCP2210 Breakout Board as a USB-to-SPI bridge.

The application's source code is provided to facilitate the development of custom PC applications using the MCP2210 and the accompanying DLL package. This application was written in Visual Basic.

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FIGURE 2-2: VISUAL BASIC APPLICATION WINDOW

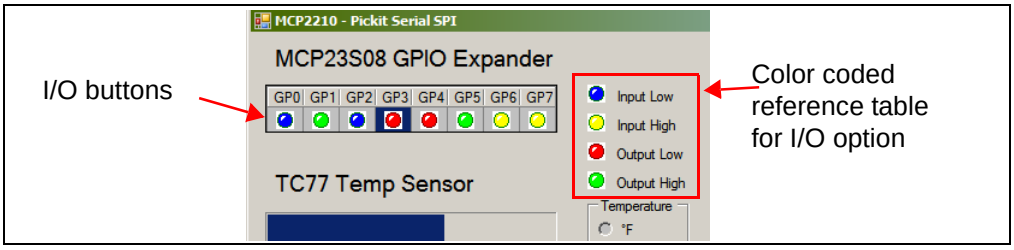


The PC GUI shows typical sections for each of the SPI slave devices present on the MCP2210 SPI Slave Motherboard.

2.3.5 MCP23S08 GPIO Expander controls

The GUI provides specific controls in order to assist the user in exploring the I/O expander features. The control for this chip shows eight color-coded buttons, each representing an I/O option.

FIGURE 2-3: MCP23S08 GPIO EXPANDER SECTION



By double-clicking on any of the buttons, the assigned I/O pin will toggle from being a digital input to digital output and back.

For the I/Os designated as digital inputs, any change on the pins will be shown on the GUI in yellow (for a logic high value) or in blue (for a logic low value).

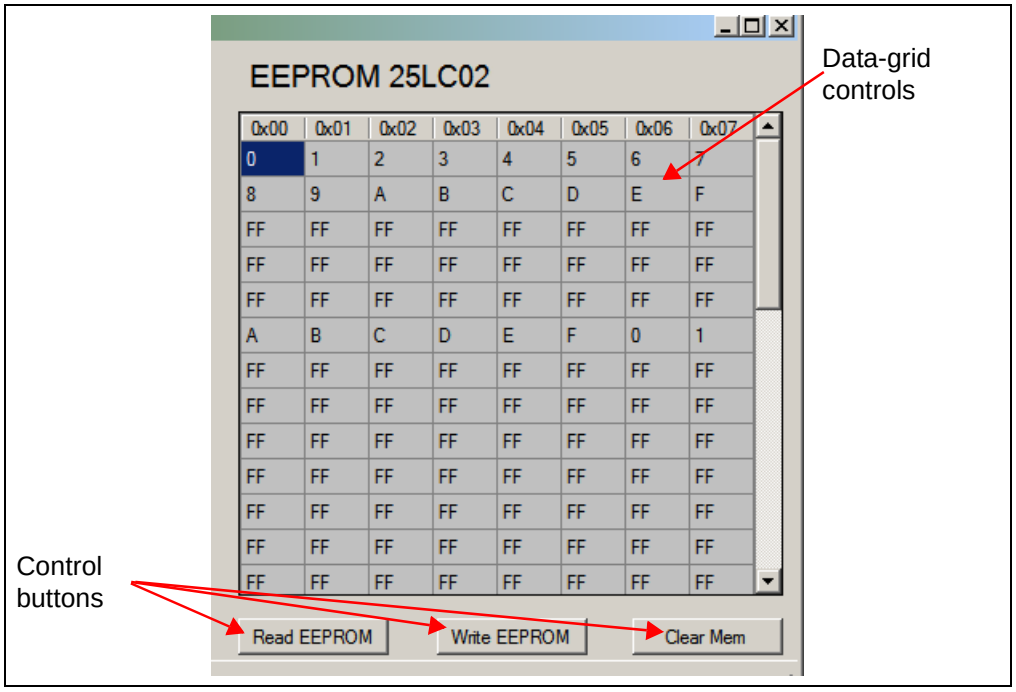
For the I/Os designated as digital outputs, a single click on any of the I/O circles will toggle their output value from logic low (in red) to logic high (in green). When a digital output is set to logic high, the corresponding LED will be lit.

2.3.6 EEPROM 25LC02 Controls

The EEPROM GUI section presents a data-grid control and three buttons (see Figure 2-4). The data-grid is organized in eight columns and sixty-four rows. The EEPROM addresses are read from left to right, top to bottom, starting at location 0 (in

the first line, first column on the left). When, a particular cell in the data grid control is highlighted, the corresponding EEPROM address is displayed in the bottom left corner of the application window.

FIGURE 2-4: EEPROM 25LC02 SECTION



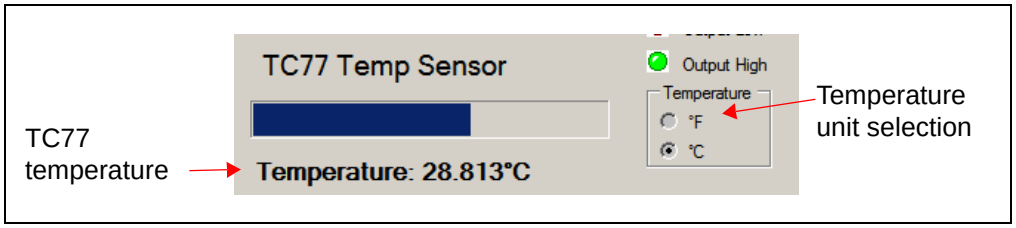
The EEPROM section also shows three buttons:

- **Read EEPROM** – Press this button to read the entire EEPROM memory. The content will show in the data-grid control.
- **Write EEPROM** – The user can modify the data and add other hex-represented byte values in the cells. When all the modifications are done, press this button to write the modified data-grid content on the EEPROM.
- **Clear Mem** – To verify the EEPROM content, press this button. This action clears only the data-grid control, not the EEPROM contents. Later, when the **Read EEPROM** button is pressed again, the actual EEPROM content will display in the data-grid control.

2.3.7 TC77 Temp Sensor Section

The temperature sensor displays the temperature of the sensor device present on the motherboard in either Fahrenheit or Celsius scales.

FIGURE 2-5: TC77 TEMPERATURE SENSOR SECTION

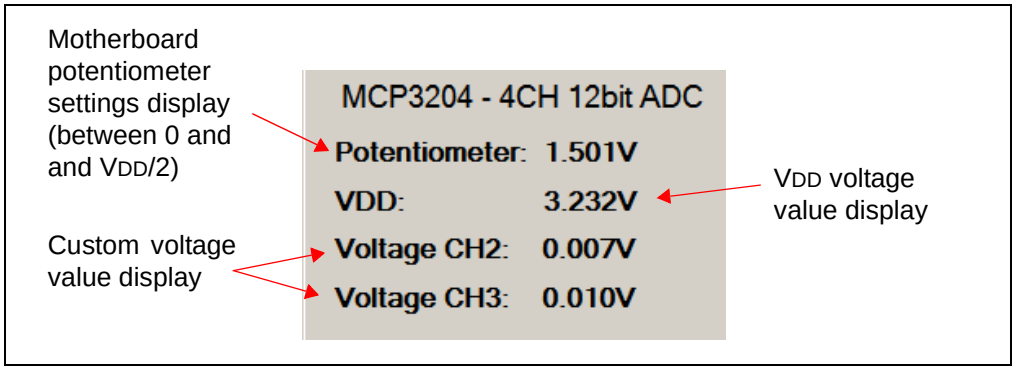


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2.3.8 MCP3204 ADC Display Section

The MCP3201 12-bit ADC section displays the board's measured V_{DD} voltage and a voltage between 0 and VDD/2, corresponding to the voltage value set by the motherboard potentiometer.

FIGURE 2-6: MCP3204 ADC VALUES DISPLAY



The remaining channels (channels 2 and 3) can also display custom user measurements of voltages between 0V – 2.5V (maximum).

2.4 MCP2210 TYPICAL USAGE SCENARIOS

The MCP2210 can be used in systems where an SPI bus is available. The MCP2210 device can be either the single master on the bus, or one of the masters sharing the bus, if a proper master-access arbitration scheme is in place.

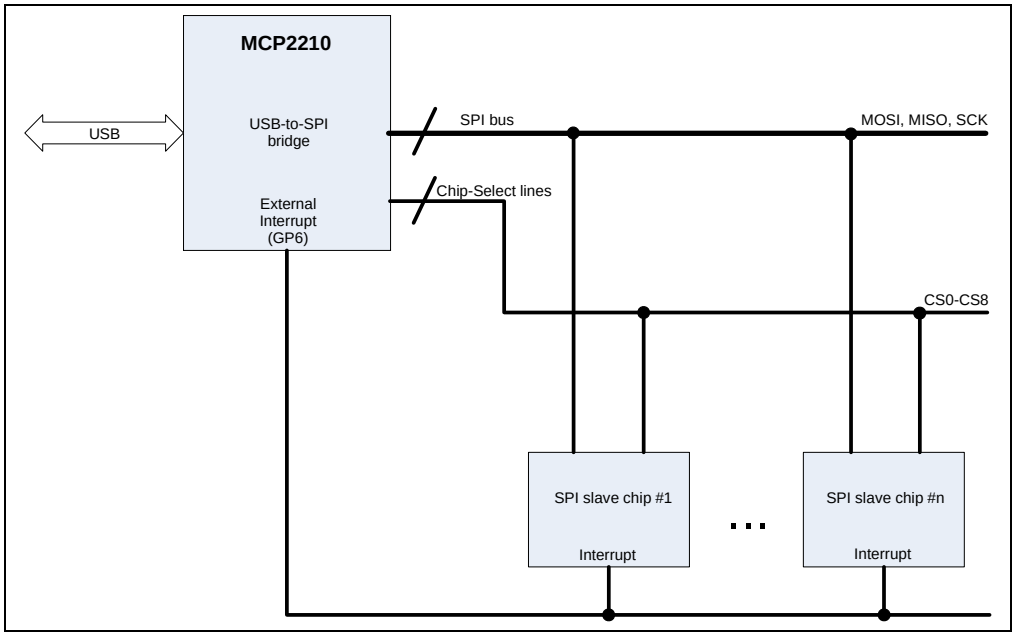
In cases where the MCP2210 is the only master on the SPI bus, a typical usage scenario is shown in Figure 2-7. The SPI bus links the SPI slave chips to the system, while a few GPs (configured for chip select function) can be used as chip select lines.

If SPI slave interrupt monitoring is required, the GP6 needs to be configured for its dedicated function, in order to monitor the interrupts coming from the SPI slave chips.

The PC application will handle all the details necessary for data transfer between the MCP2210 and the SPI slave devices.

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FIGURE 2-7: MCP2210 TYPICAL USAGE DIAGRAM



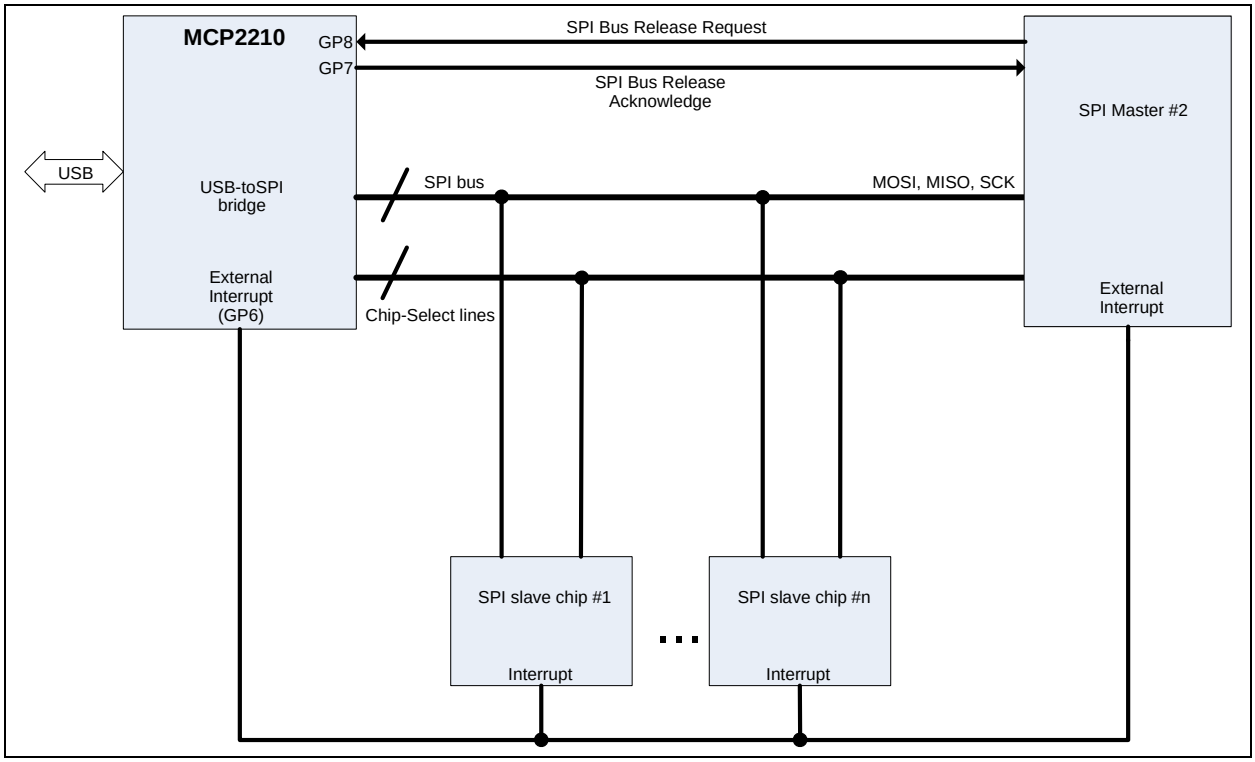
When a system requires more than one SPI master sharing the same bus, an arbitration scheme needs to be developed, to prevent multiple SPI masters trying to access the bus at the same time. MCP2210 has support for such a mechanism, using GP7 and GP8 (configured for dedicated pin functionality) for this purpose.

When GP8 is configured for its dedicated functionality, the pin can be used as a bus release request for MCP2210 coming from another master. GP7 (configured for its dedicated functionality) is used as an SPI bus release acknowledge signal towards the requesting master. When an external SPI master requests that the MCP2210 release the bus, the MCP2210 completes the current SPI transfer (or it can be cancelled by the PC application by sending the proper USB command). Then it releases the bus, and signals this event on the acknowledge pin (GP7). The second master now has ownership of the bus and can keep it as long as the SPI bus request pin (GP8) is kept asserted.

In conclusion, when the dedicated functionality of the GP7 and GP8 are used, MCP2210 can be used in a multiple SPI master system.

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FIGURE 2-8: MCP2210 TYPICAL USAGE DIAGRAM



NOTES:

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Appendix A. Schematic and Layouts

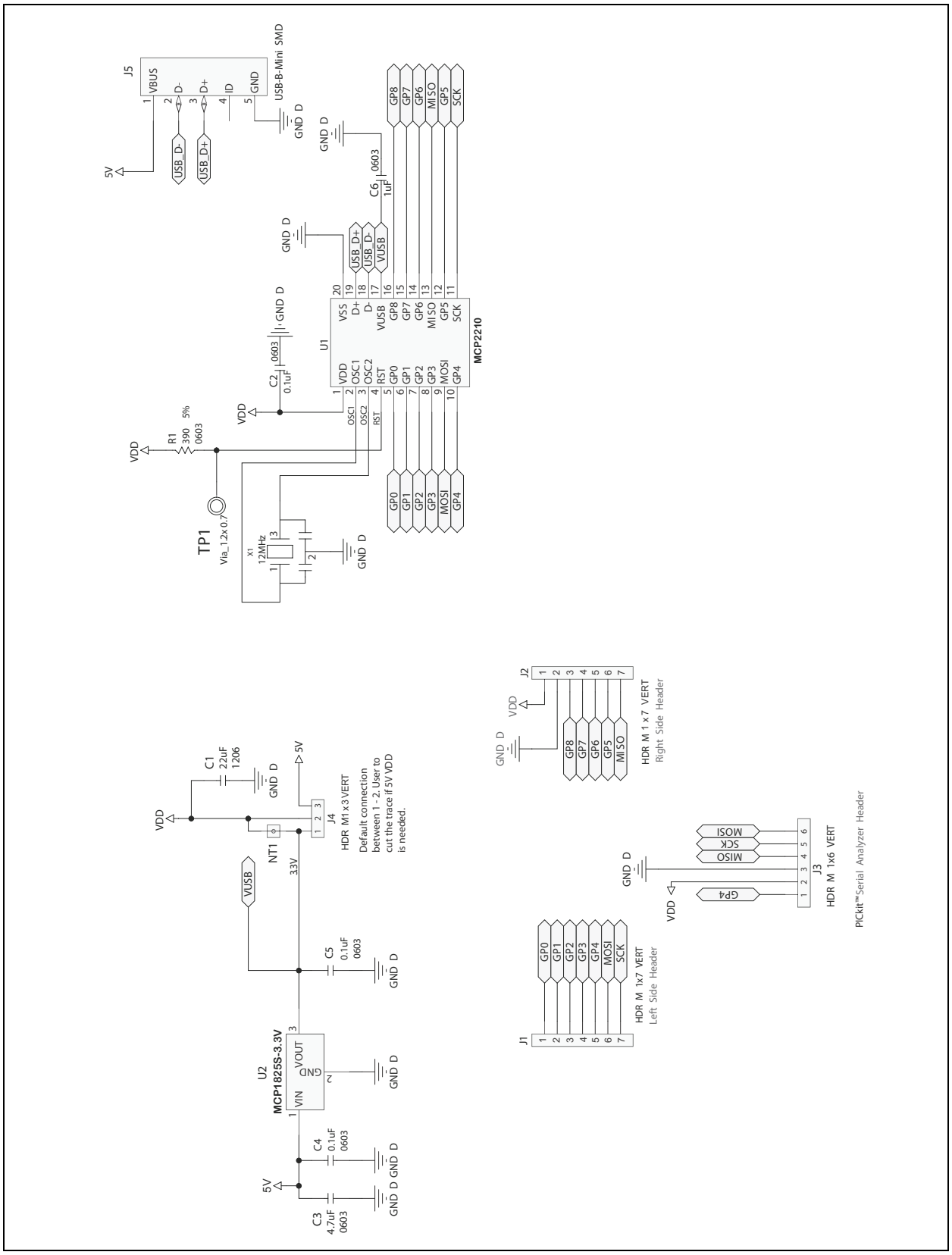
A.1 INTRODUCTION

This appendix contains the following schematics and layouts for the MCP2210 Evaluation Kit:

- MCP2210 Breakout Board Schematic and Layouts
  - Board – Schematic
  - Board – Top Silk and Pads
  - Board – Top Silk, Pads and Copper
  - Board – Top Pads and Copper
  - Board – Bottom Silk and Pads
  - Board – Bottom Silk, Pads and Copper
  - Board – Bottom Pads and Copper
- MCP2210 SPI Slave Motherboard Schematic and Layouts
  - Board – Schematic
  - Board – Top Silk
  - Board – Top Silk and Copper
  - Board – Top Copper
  - Board – Bottom Silk
  - Board – Bottom Silk and Copper

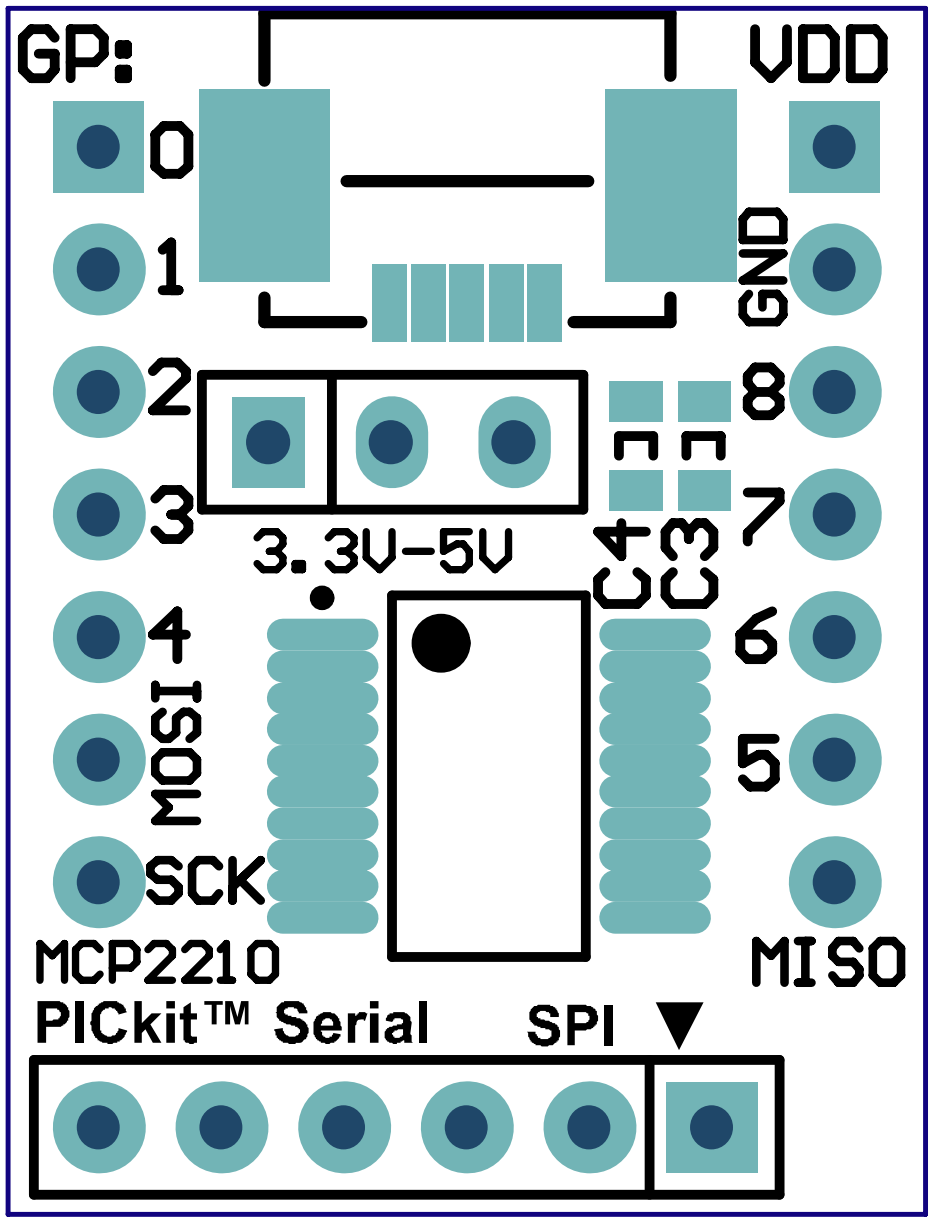
A.2 MCP2210 BREAKOUT BOARD SCHEMATIC AND LAYOUTS

A.2.1 Board – Schematic

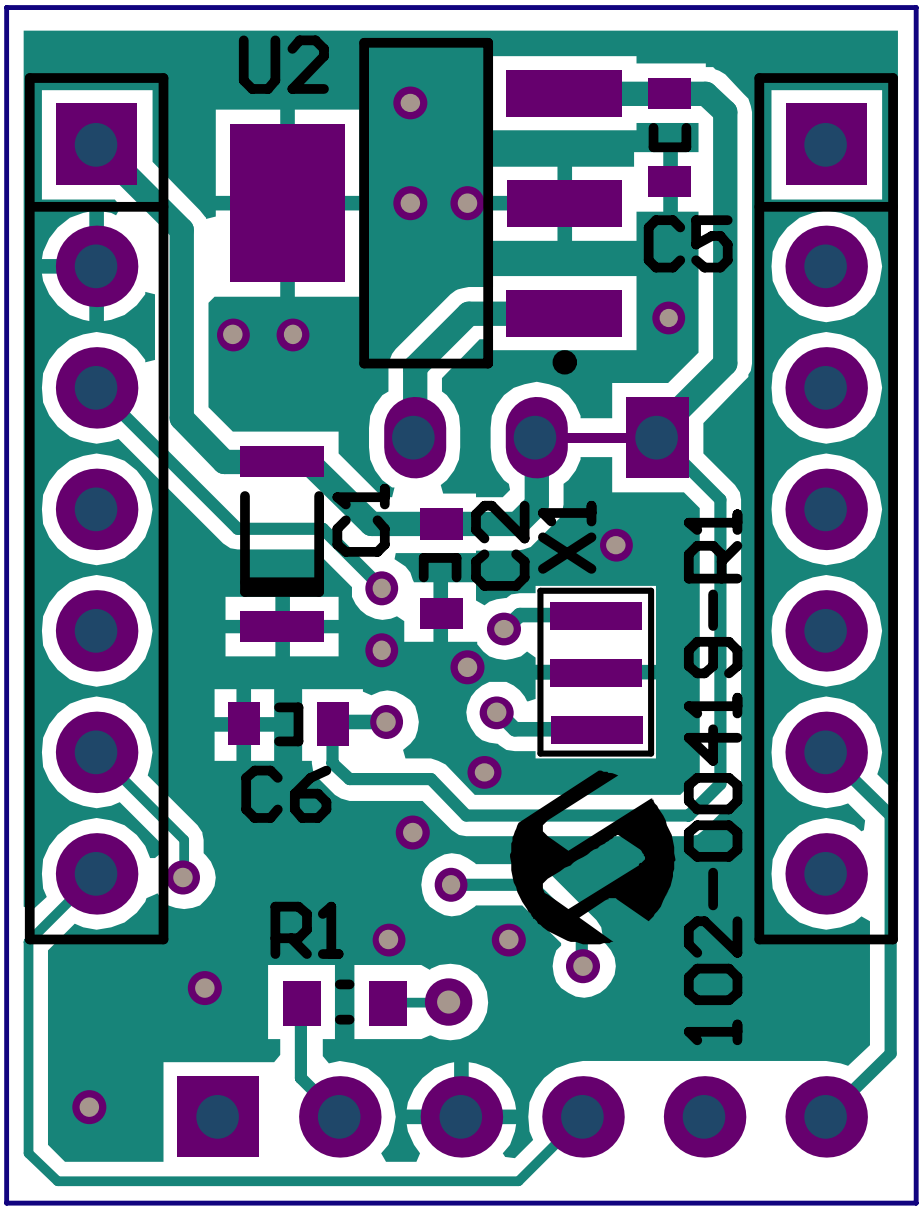


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A.2.2 Board – Top Silk and Pads

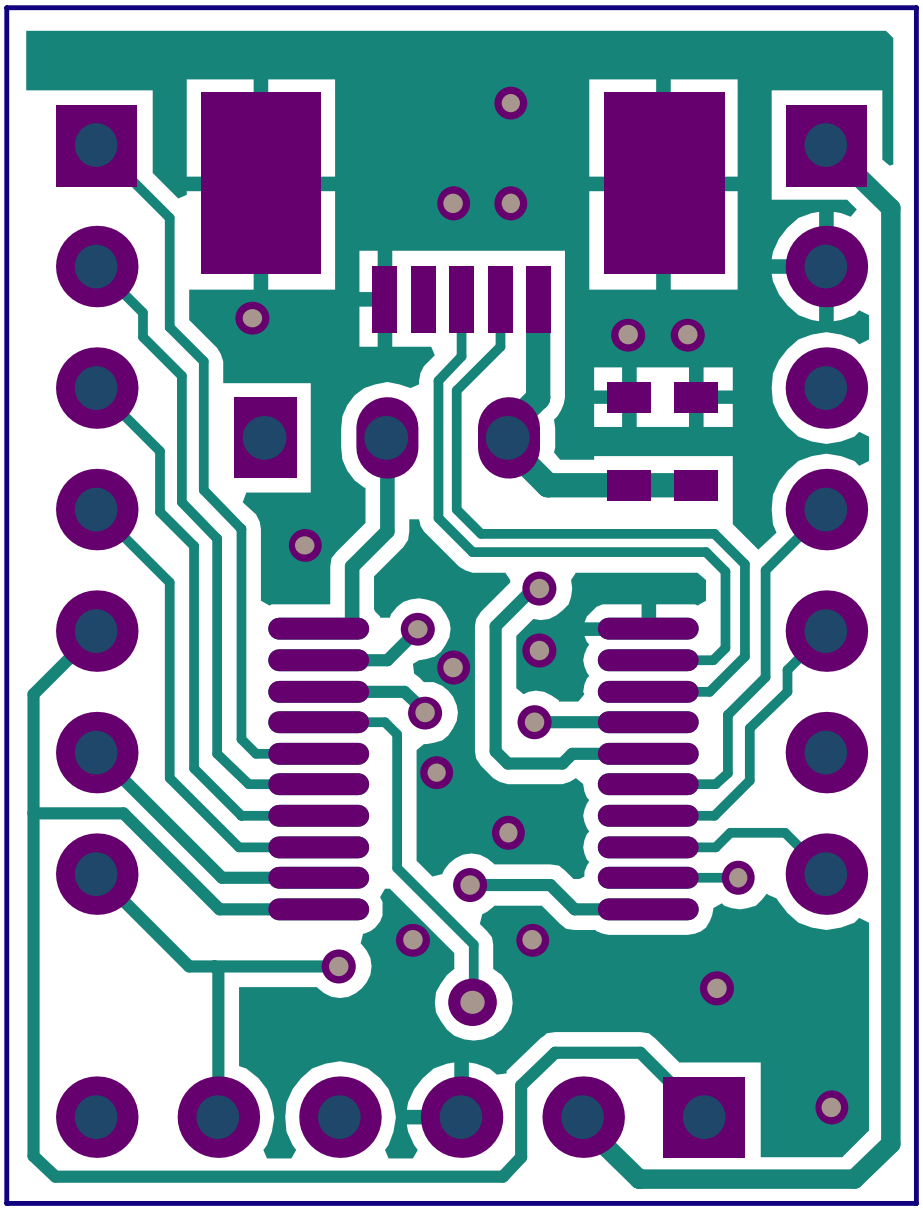


A.2.3 Board – Top Silk, Pads and Copper

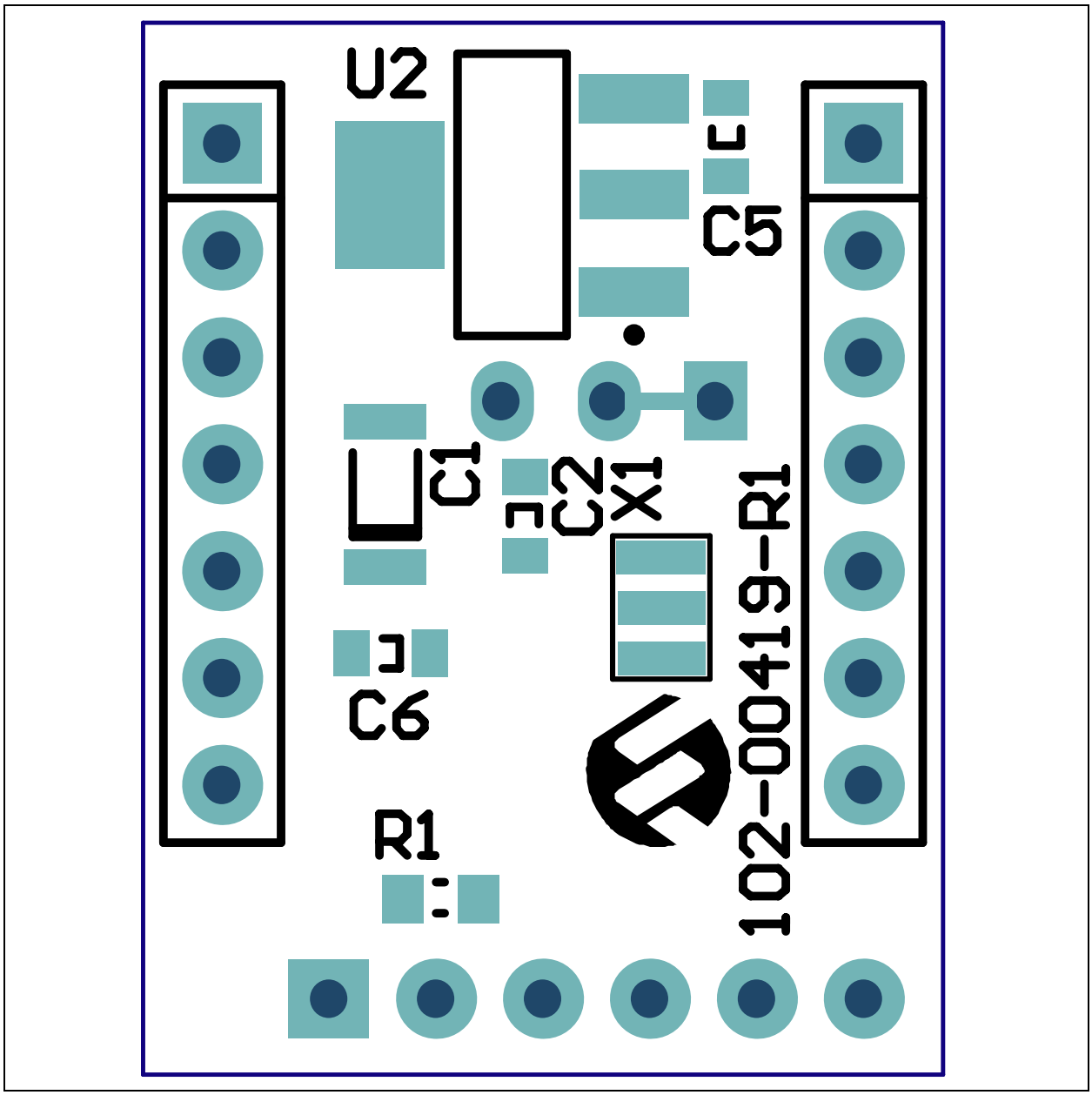


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A.2.4 Board – Top Pads and Copper

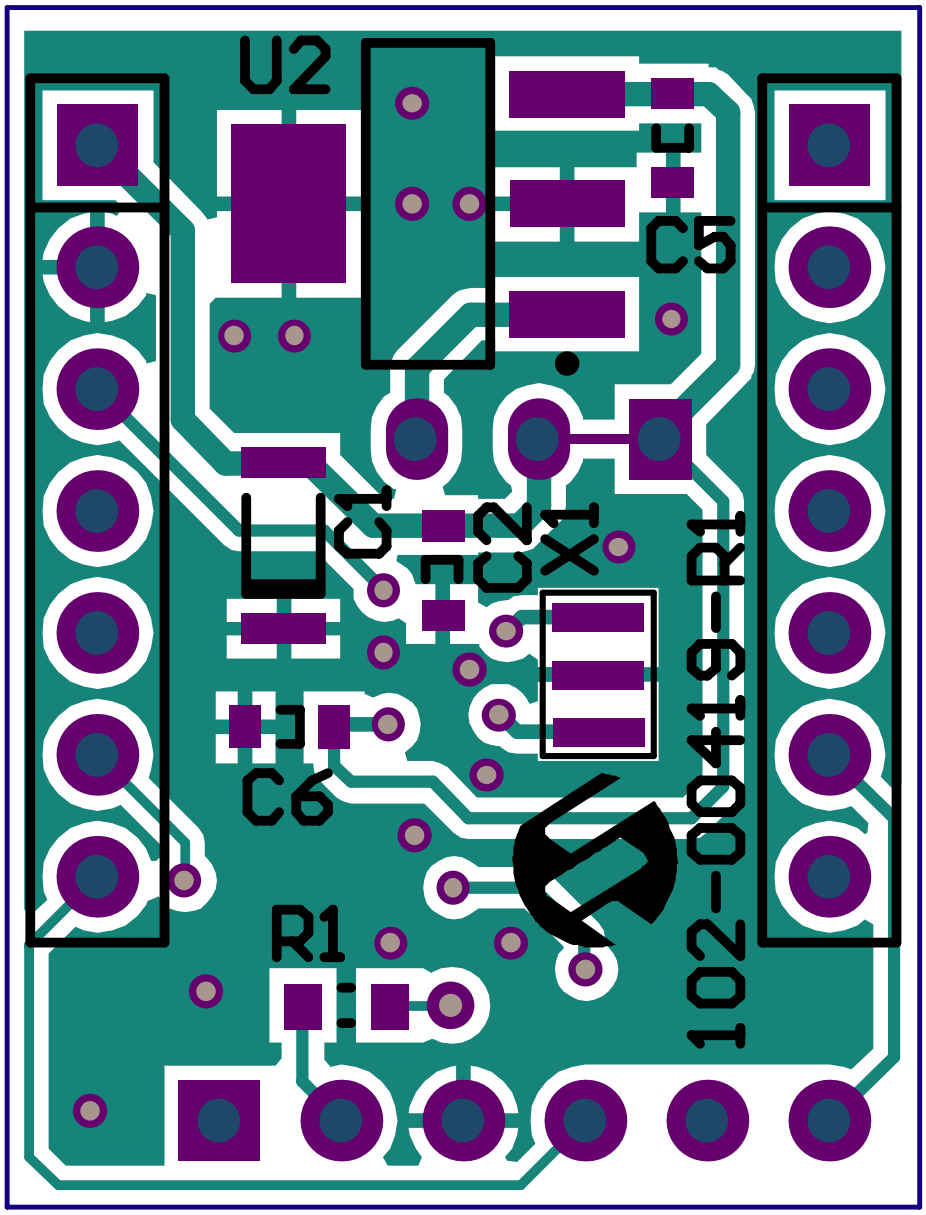


A.2.5 Board – Bottom Silk and Pads

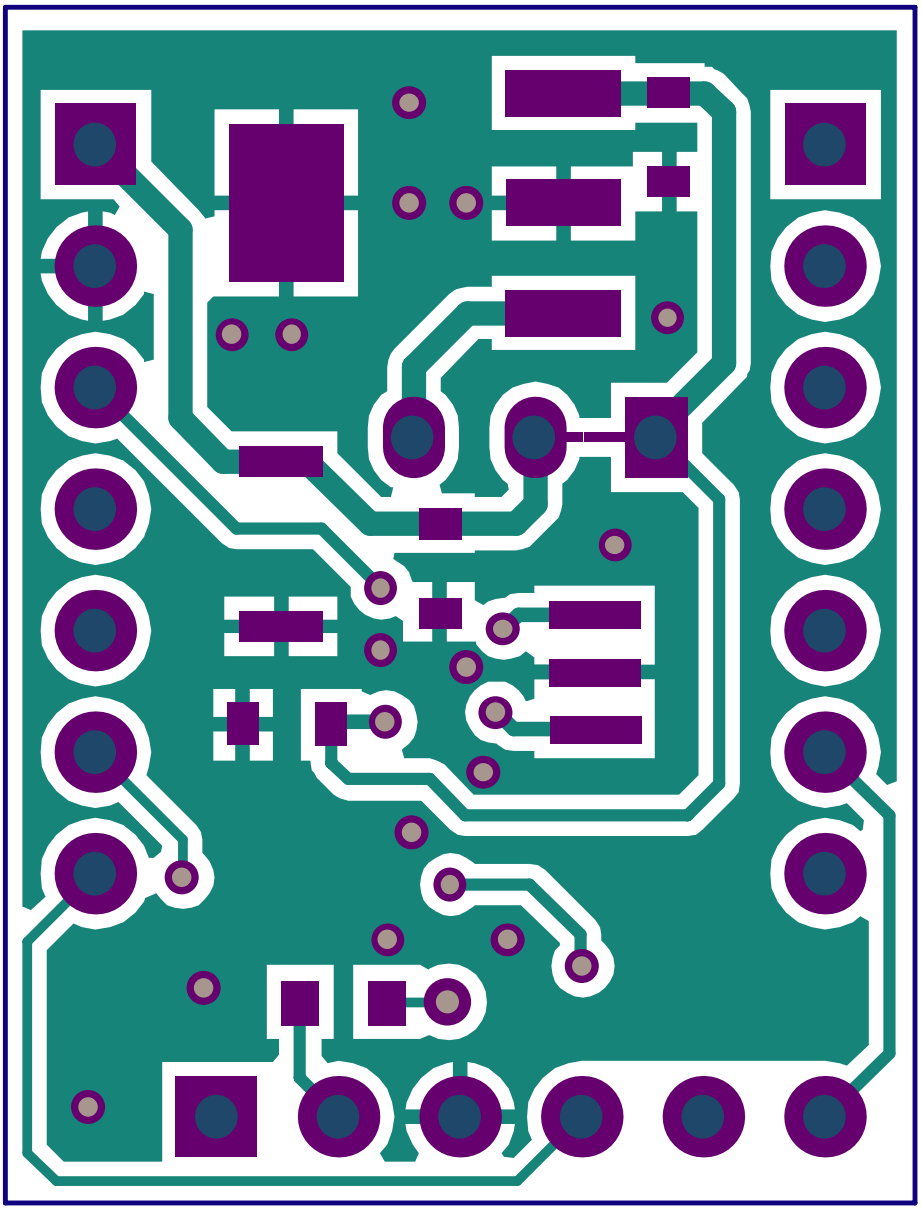


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A.2.6 Board – Bottom Silk, Pads and Copper



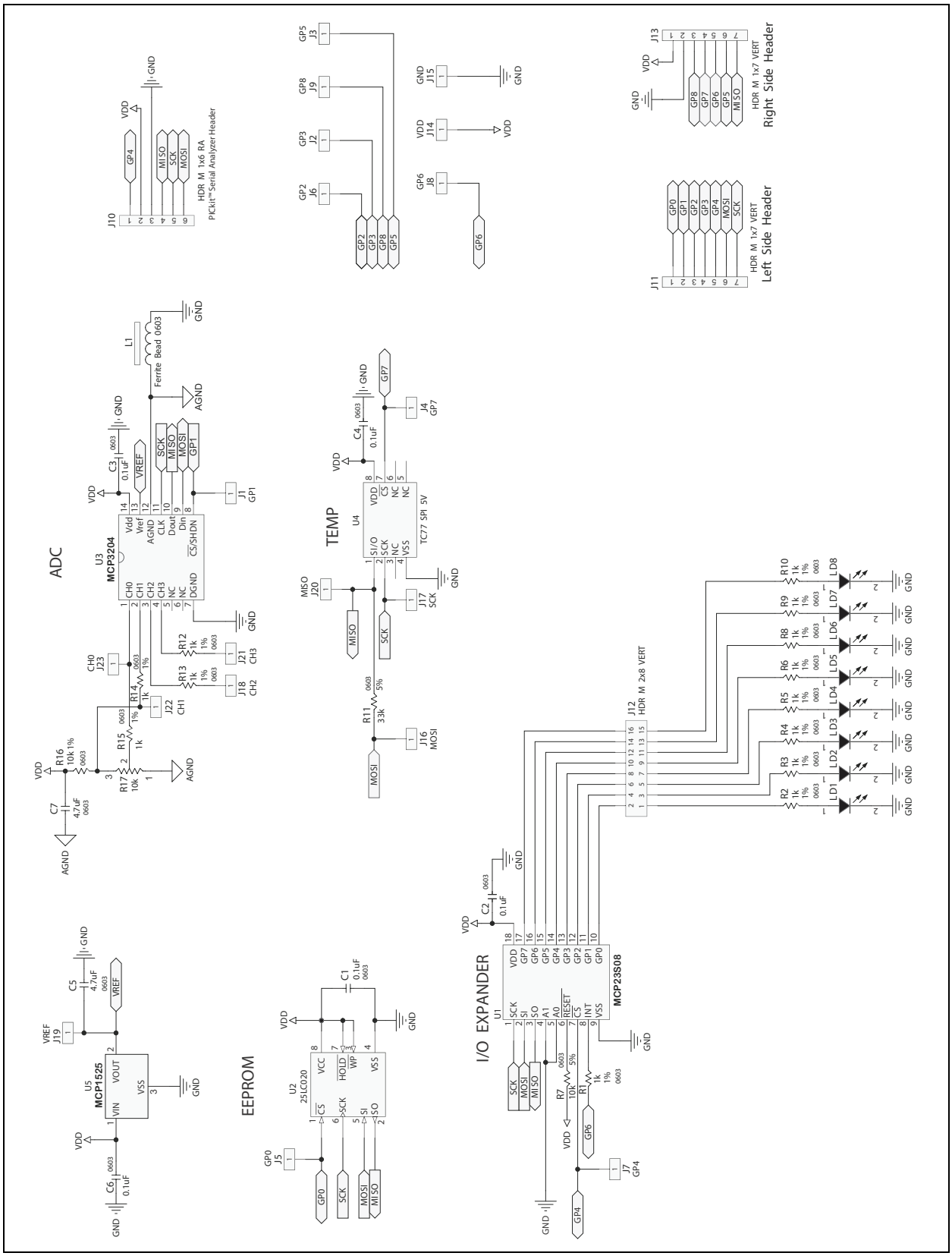
A.2.7 Board – Bottom Pads and Copper



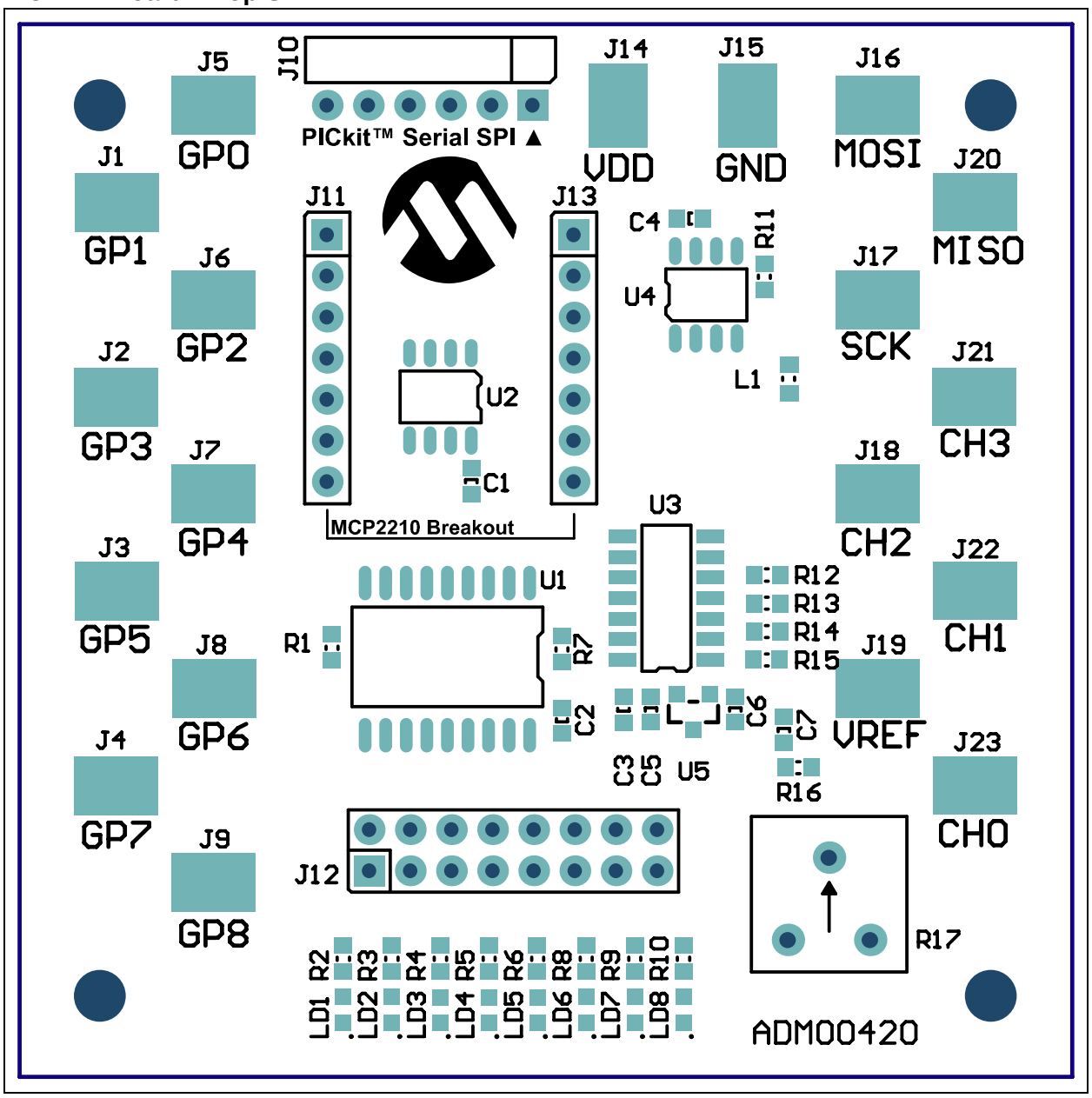
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A.3 MCP2210 SPI SLAVE MOTHERBOARD SCHEMATIC AND LAYOUTS

A.3.1 Board – Schematic

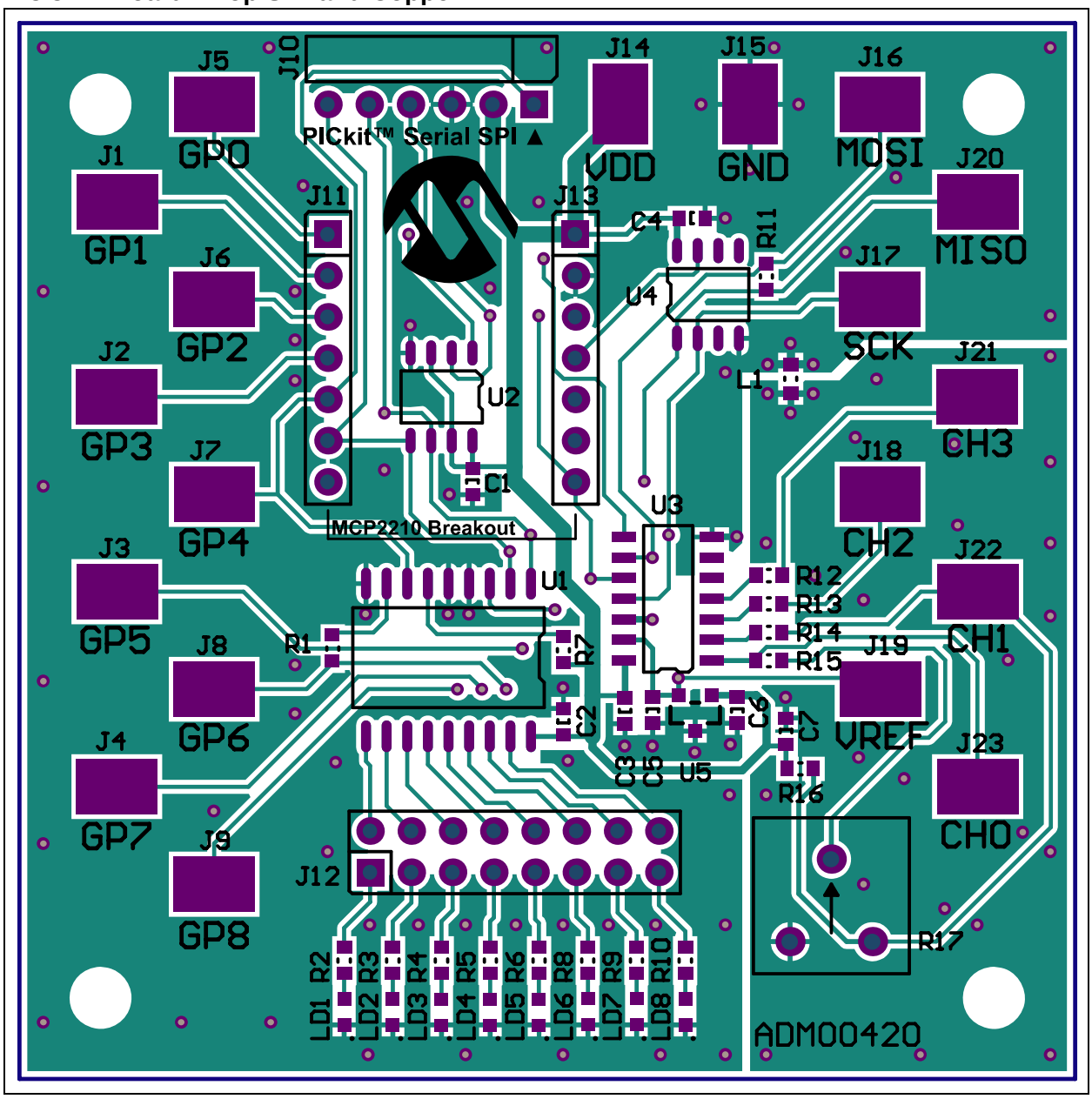


A.3.2 Board – Top Silk

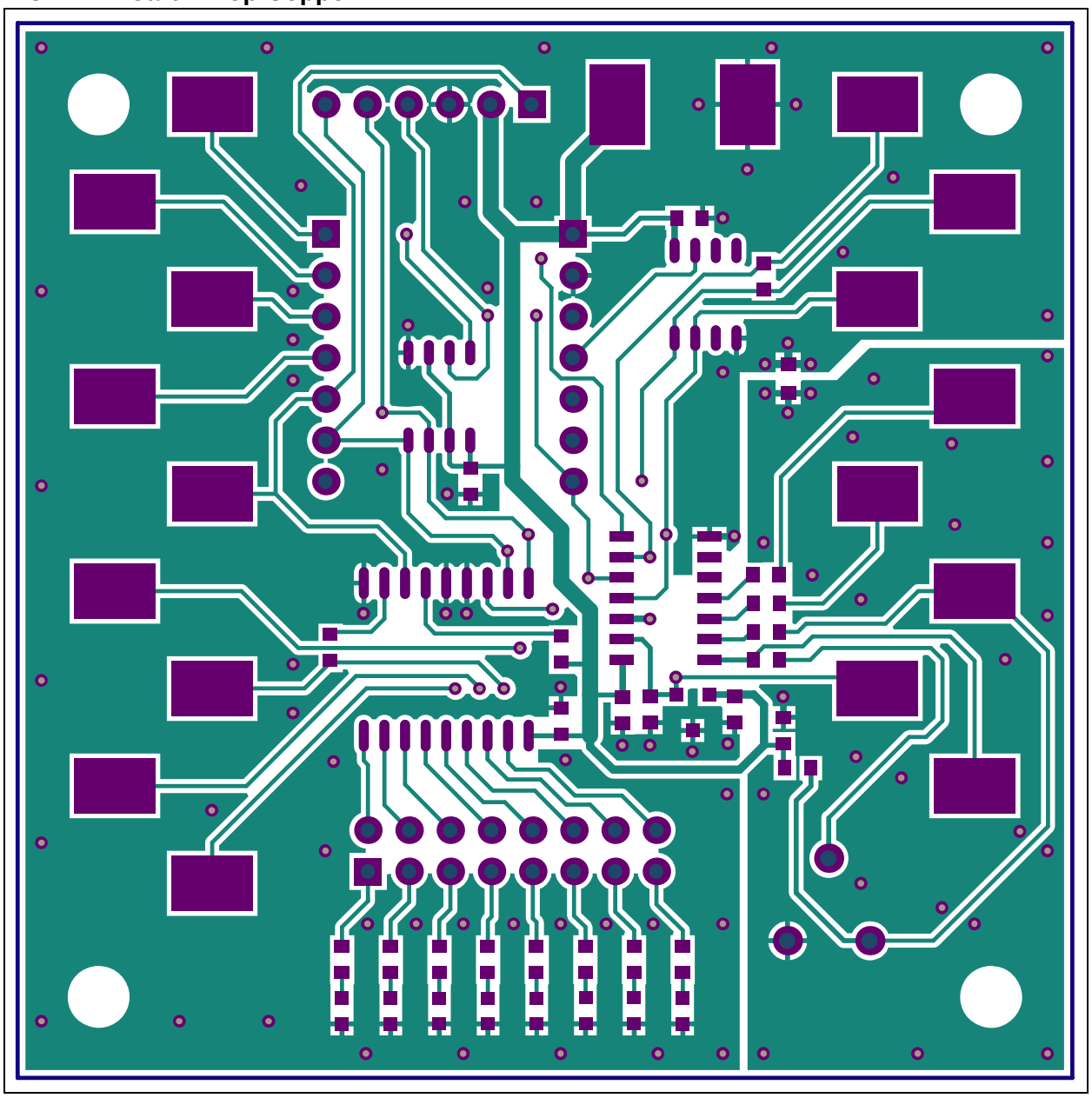


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A.3.3 Board – Top Silk and Copper

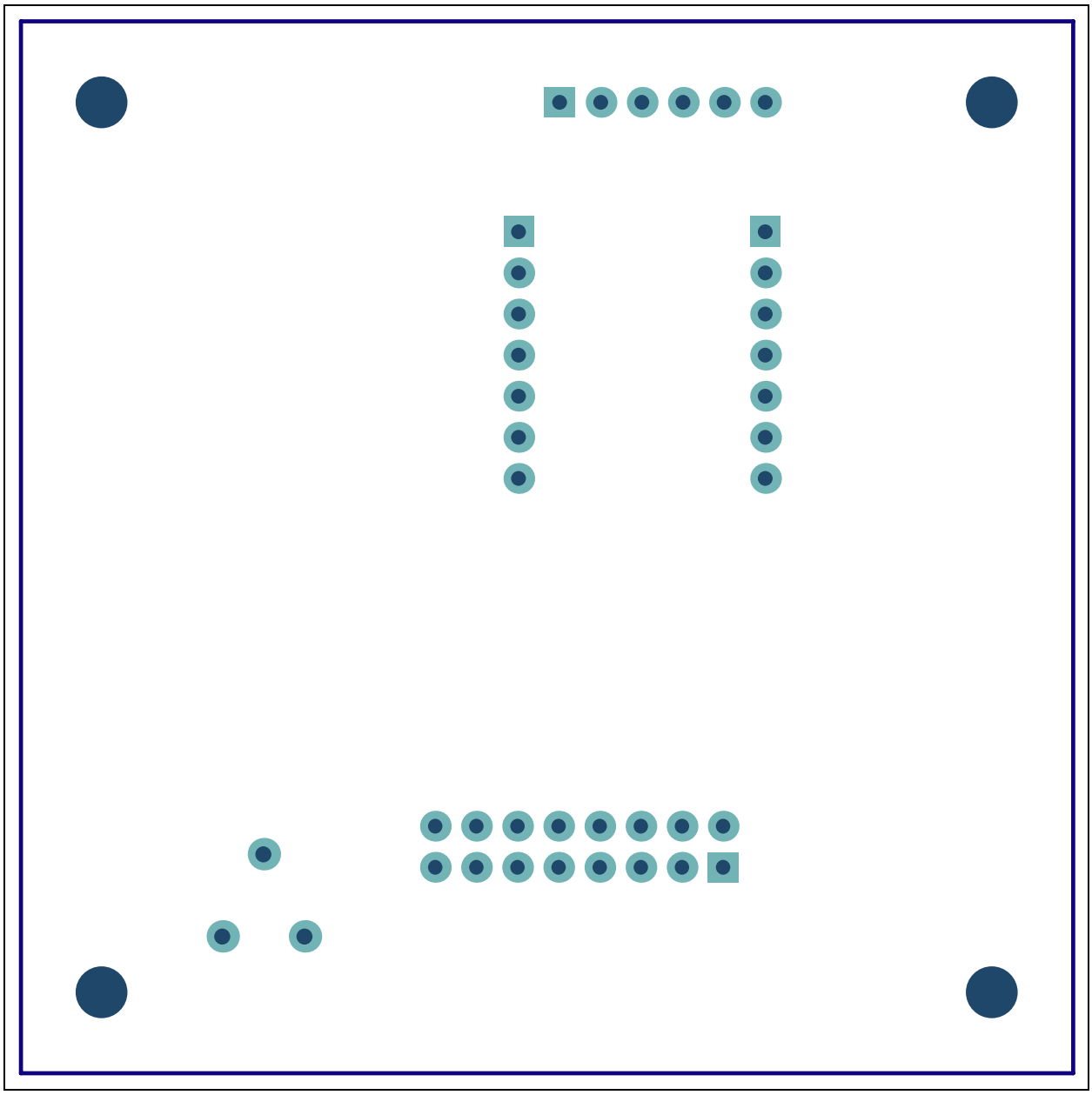


A.3.4 Board – Top Copper

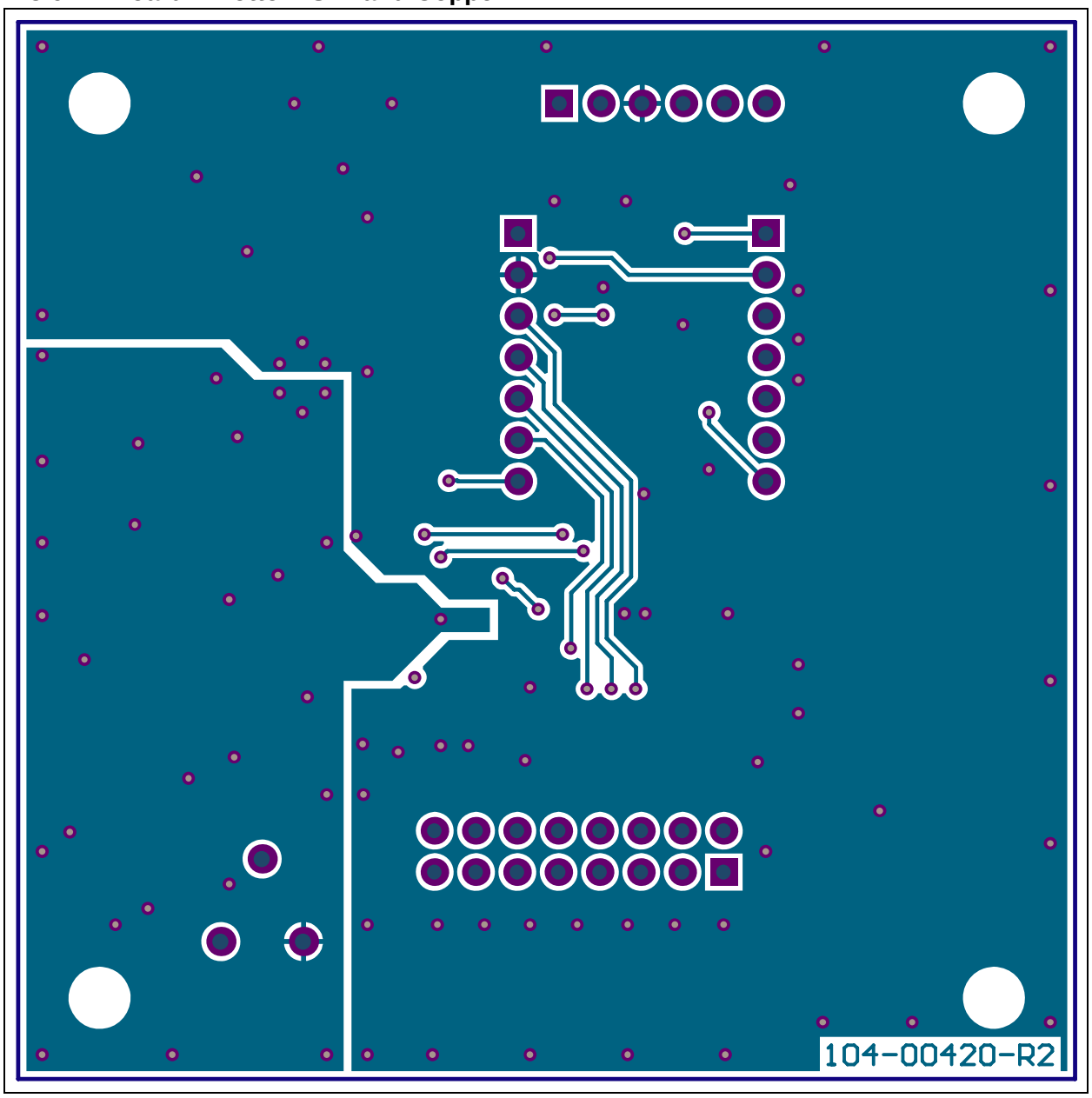


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A.3.5 Board – Bottom Silk



A.3.6 Board – Bottom Silk and Copper



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Appendix B. Bill of Materials

TABLE B-1: BILL OF MATERIALS - MCP2210 BREAKOUT BOARD

Qty	Reference	Description_	Manufacturer	Part Number
1	C1	Cap. Cer. 22 uF 10V 20% Y5V 1206	TDK®Corporation	C3216Y5V1A226Z
3	C2, C4, C5	Cap. Cer. 1 uF 10% 16V X7R 0603	AVX Corporation	0603YC104KAT2A
1	C3	Cap. Cer. 4.7 uF 6.3V 10% X5R 0603	TDK Corporation	C1608X5R0J475K
1	C6	Cap. Cer. 1 uF 16V 10% X7R 0603	TDK Corporation	C1608X7R1C105K
2	J1, J2	**DO NOT POPULATE** Conn. Hdr. Male .100 1x7 POS Vert.	TE Connectivity Ltd.	HDR M 1x7 Vertical
1	J3	**DO NOT POPULATE** Conn. Hdr. Male .100 1x6 POS Vert.	TE Connectivity Ltd.	HDR M 1x6 Vertical
1	J4	**DO NOT POPULATE** Conn. Hdr. Male .100 1x3 POS Vert.	TE Connectivity Ltd.	HDR M 1x3 Vertical
1	J5	Conn. Rcpt. USB Mini B R/A SMD	Hirose Electric Co. Ltd.	UX60SC-MB-5ST(80)
1	PCB	RoHS compliant bare PCB, MCP2210 Breakout Board	—	104-00419
1	R1	Res. 390 Ohm 1/10W 5% 0603 SMD	Panasonic® - ECG	ERJ-3GEYJ391V
1	U1	IC USB-TO-SPI SSOP-20	Microchip Technology Inc.	**MCP2210-I/SS**
1	U2	IC LDO Reg. 500 mA 3.3V SOT-223-3	Microchip Technology Inc.	**MCP1825S-3302E/DB**
1	X1	Cer. Resonator 12.0 MHz SMD	Murata Electronics®	CSTCE12M0G55-R0

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

TABLE B-2: BILL OF MATERIALS - MCP2210 SPI SLAVE MOTHERBOARD

Qty	Reference	Description_	Manufacturer	Part Number
5	C1, C2, C3, C4, C6	Cap. Cer. 0.1 uF 50V X7R 10% 0603	TDK Corporation	C1608X7R1H104K
2	C5, C7	Cap. Cer. 4.7 uF 6.3V 10% X5R 0603	TDK Corporation	C1608X5R0J475K
19	J1, J2, J3, J4, J5, J6, J7, J8, J9, J14, J15, J16, J17, J18, J19, J20, J21, J22, J23	PC test point Tin SMD	Harwin Plc.	S1751-46R
1	J10	Conn. Hdr. Male .100 1x6 Pos. RA	TE Connectivity Ltd.	HDR M 1x6 RA
2	J11, J13	Conn. Hdr. Male .100 1x7 Pos. Vert.	TE Connectivity Ltd.	HDR M 1x7 Vertical
1	J12	Conn. Hdr. Male .100 2x8 Pos. Vert.	TE Connectivity Ltd.	HDR M 2x8 Vertical
1	L1	Ferrite Chip 47 Ohms 500 mA 0603	Laird Technologies®	LI0603E470R-10

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

TABLE B-2: BILL OF MATERIALS - MCP2210 SPI SLAVE MOTHERBOARD (CONTINUED)

Qty	Reference	Description_	Manufacturer	Part Number
8	LD1, LD2, LD3, LD4, LD5, LD6, LD7, LD8	LED Smartled Red 630 nm 0603	OSRAM Opto Semiconductors GmbH.	LS L29K-G1J2-1-0-2-R18-Z
1	PCB	RoHS compliant bare PCB, MCP2210 SPI Slave Motherboard	—	104-00420
13	R1, R2, R3, R4, R5, R6, R8, R9, R10, R12, R13, R14, R15	Res. 1k Ohm 1/10W 1% 0603 SMD	Panasonic - ECG	ERJ-3EKF1001V
1	R7	Res. 10k Ohm 1/10W 5% 0603 SMD	Panasonic - ECG	ERJ-3GEYJ103V
1	R11	Res. 33k Ohm 1/10W 5% 0603 SMD	Panasonic - ECG	ERJ-3GEYJ333V
1	R16	Res. 10k Ohm 1/10W 1% 0603 SMD	Panasonic - ECG	ERJ-3EKF1002V
1	R17	Trimmer 10K OHM 0.5W TH	Bourns®, Inc.	3386F-1-103TLF
1	U1	IC I/O Expander SPI 8B SOIC-18	Microchip Technology Inc.	**MCP23S08-E/SO**
1	U2	IC EEPROM 2k Bit 10 MHz SOIC-8	Microchip Technology Inc.	**25LC020A-I/SN**
1	U3	IC ADC 12 BIT 2.7V 4 Ch. SPI SOIC-14	Microchip Technology Inc.	**MCP3204T-CI/SL**
1	U4	IC Sensor Thermal SPI 5V SOIC-8	Microchip Technology Inc.	**TC77-5.0MOA**
1	U5	IC Volt. Ref. 2.5V SOT-23-3	Microchip Technology Inc.	**MCP1525T-I/TT**

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

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