MCP42XXEV

Evaluation Board

User's Guide

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MCP42XXEV EVALUATION BOARD USER'S GUIDE

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NOTES:

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 MCP42XXEV Evaluation Board. Items discussed in this chapter include:

• Document Layout
• Conventions Used in this Guide
• The Microchip Web Site
• Customer Support
• Document Revision History

DOCUMENT LAYOUT

This document describes how to use the MCP42XXEV Evaluation Board as a development tool to emulate and debug firmware on a target board. The manual layout is as follows:

• **Chapter 1. "Product Overview"** – Important information about the MCP42XXEV Evaluation Board.
• **Chapter 2. "Installation and Operation"** – Includes instructions on how to get started with this evaluation board.
• **Appendix A. "Schematic and Layouts"** – Shows the schematic and layout diagrams for the MCP42XXEV Evaluation Board.
• **Appendix B. "Bill of Materials (BOM)"** – Lists the parts used to build the MCP42XXEV Evaluation Board.

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>

RECOMMENDED READING

This user's guide describes how to use the MCP42XXEV Evaluation Board. Other useful documents are listed below. The following Microchip documents are available and recommended as supplemental reference resources.

AN1080 Application Note, "*Understanding Digital Potentiometer Resistor Variations*" (DS01080)

AN1316 Application Note, "*Using Digital Potentiometers for Programmable Amplifier Gain*" (DS01316)

These data sheets provide detailed information regarding the MCP41XX/42XX and product family:

MCP413X/415X/423X/425X Data Sheet, *"7/8-Bit Single/Dual SPI Digital POT with Volatile Memory"* (DS22060)

MCP414X/416X/424X/426X Data Sheet, *"7/8-Bit Single/Dual SPI Digital POT with Non-Volatile Memory"* (DS22059)

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
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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 (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

In addition, there is a Development Systems Information Line which lists the latest versions of Microchip's development systems software products. This line also provides information on how customers can receive currently available upgrade kits.

The Development Systems Information Line numbers are:

1-800-755-2345 – United States and most of Canada

1-480-792-7302 – Other International Locations

DOCUMENT REVISION HISTORY

Revision A (April 2010)

- Initial Release of this Document.

Chapter 1. Product Overview

1.1 INTRODUCTION

This chapter provides an overview of the MCP42XXEV Evaluation Board and covers the following topics:

- What is the MCP42XXEV Evaluation Board?
- What the MCP42XXEV Evaluation Board kit includes

1.2 WHAT IS THE MCP42XXEV EVALUATION BOARD?

The MCP42XXEV Evaluation Board allows the system designer to quickly evaluate the operation of Microchip Technology's MCP4261 Digital Potentiometer device. This device is similar to the following devices:

- MCP4231
- MCP4232
- MCP4241
- MCP4242
- MCP4251
- MCP4252
- MCP4261
- MCP4262
- MCP4331
- MCP4332
- MCP4341
- MCP4342
- MCP4351
- MCP4352
- MCP4362
- MCP4131
- MCP4132
- MCP4141
- MCP4142
- MCP4151
- MCP4152
- MCP4161
- MCP4162

The board uses the TSSOP20EV generic PCB and has been populated for the MCP4261. The 6-pin header (PICkit™ serial) has been jumpered to the MCP4261's appropriate pins. This allows the PICkit serial to communicate with the device.

Additional blank PCBs may be ordered by using the order number: TSSOP20EV. Each TSSOP20EV kit contains 5 PCBs.

Figure 1-1 shows the top view of the populated TSSOP20EV PCB which creates the MCP42XXEV Evaluation Board.

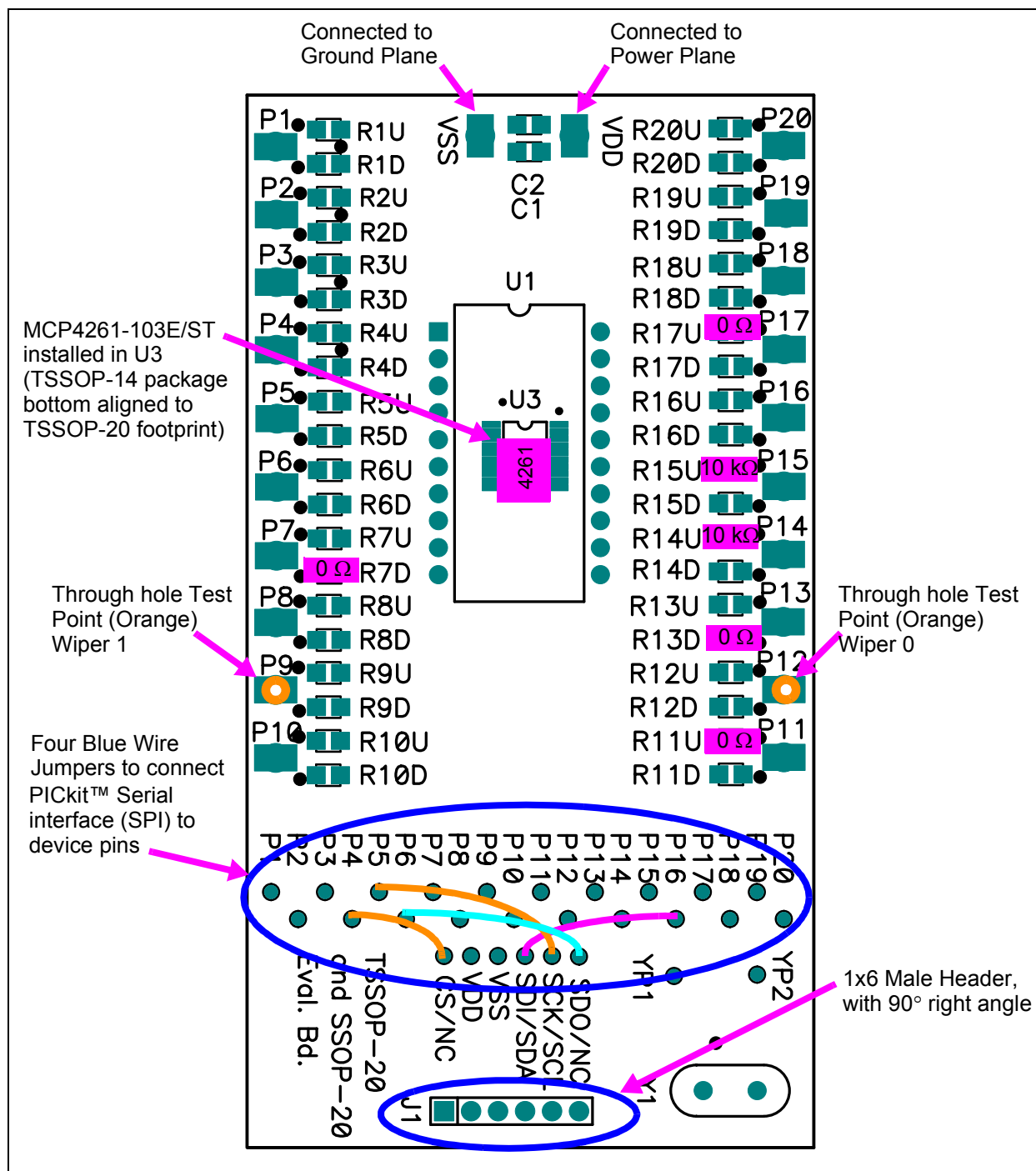**FIGURE 1-1:** *MCP42XXEV Evaluation Board Using the TSSOP20EV Evaluation Board (MCP4361 installed in U3 – Package Bottom Aligned).*

1.3   WHAT THE MCP42XXEV EVALUATION BOARD KIT INCLUDES

This MCP42XXEV Evaluation Board kit includes:

- MCP42XXEV Evaluation Board
- One TSSOP-20 and SSOP-20 Evaluation Board blank PCB, 102-00272.
  Extra blank PCBs can be ordered (order #: TSSOP20EV)
- Important Information Sheet

Chapter 2. Installation and Operation

2.1   INTRODUCTION

The MCP42XXEV Evaluation Board allows the system designer to quickly evaluate the operation of the MCP4261 10 kΩ (-103) digital potentiometer device using the PICkit Serial Analyzer. The PICkit Serial Analyzer is available separately (order number: DV164122).

This board is a minimum configuration for the device. As well as the device, other desired passive components (resistors and capacitors) and connection posts may be installed.

The board can also be very easily jumpered into a customer's existing circuit. This gives an indication of the MCP4261 device performance, but is affected by the jumper lead length and the EM noise that the jumpers pick up.

The device's Resistor Network 0 has been configured in a Potentiometer mode with the A terminal connected to V_{DD} through a 0Ω resistor and the B terminal connected to V_{SS} with a 0Ω resistor. Resistor Network 1 can be evaluated for rheostat operation.

The MCP42XXEV Evaluation Board uses the generic TSSOP20EV Evaluation Board PCB. The kit includes a second PCB which is blank for the user to populate as desired. Additional PCBs may be ordered (order number: TSSOP20EV). The TSSOP20EV kit includes 5 blank PCBs.

Other boards can easily be built up using the TSSOP20EV PCB to allow evaluation of other resistance options (5 kΩ, 50 kΩ, or 100 kΩ) or any of the other digital potentiometer devices in the following packages:

• TSSOP-20 package
  - MCP4331, MCP4341, MCP4351, or MCP4361
• TSSOP-14 package
  - MCP4332, MCP4342, MCP4352, MCP4362, MCP4231, MCP4241, MCP4251, MCP4261, MCP4631, MCP4641, MCP4651, MCP4661, MCP42010, MCP42050, or MCP42100

The board also has a 6-pin interface (PICkit serial, ICSP™, etc.) whose signals can easily be jumpered to any of the device's pins.

Additional information on using the TSSOP20EV Evaluation Board PCB or for modifying the MCP42XXEV Evaluation Board is available in the TSSOP20EV User's Guide (DS51875). **Appendix A. "Schematic and Layouts"** has information on the PCB schematic and layout while Figure 2-2 shows components that are installed on the PCB.

2.2   FEATURES

The MCP42XXEV Evaluation Board has the following features:

- MCP4261-103E/ST is installed (bottom aligned in U3)
- 0Ω resistors connect MCP4261 V_{DD} and V_{SS} signals to the appropriate power or ground plane (see Figure 2-2)
- 0Ω resistors connect MCP4261's Resistor Network 0 A terminal signal to power plane, resistor network is in a voltage divider configuration (see Figure 2-2)
- 0Ω resistors connect MCP4261's Resistor Network 0 B terminal signal to ground plane, resistor network is in a voltage divider configuration (see Figure 2-2)
- Through-hole connection terminal (orange) for all wiper pins
- Connection terminal points for all device pins (either through-hole or surface-mount)
- Footprints for optional passive components (SMT 805 footprint) for:
  - Power supply filtering (C_1 and C_2 footprints)
  - Device bypass capacitor (RxD footprint for device pin connected to V_{DD})
- Silk-screen area to write specifics of implemented circuit (on back of PCB), such as MCP4261 10 kΩ
- PICkit Serial Analyzer Header

The included TSSOP20EV board has the following features:

- Connection terminals may be either through-hole or surface-mount
- Three package type footprints supported:
  - TSSOP-20
  - TSSOP-14
  - TSSOP-8
  - SSOP-20
  - DIP-20 (600 mil body)
- Footprints for optional passive components (SMT 805 footprint) for:
  - Power supply filtering (C_1 and C_2 footprints)
  - Device bypass capacitor (RxD footprint for device pin connected to V_{DD})
  - Output filtering (RxD footprint)
  - Output pull-up resistor (RxU footprint)
  - Output pull-down resistor (RxD footprint)
  - Output loading resistor (RxD footprint)
- Silk-screen area to write specifics of implemented circuit (on back of PCB), such as MCP4261 10 kΩ
- PICkit Serial Analyzer/PICkit 2 programming (ICSP™) Header

2.3   GETTING STARTED

The MCP42XXEV Evaluation Board allows quick evaluation of the MCP4261-103E/ST device. The understanding of the device characteristics (such as the resistor network) is applicable to any of the devices in the MCP42XX family. The MCP4261-103 device has a typically R_{AB} resistance of 10 kΩ. Evaluation can be done by:

- Using the PICkit Serial Analyzer for interface communication
- Jumpering the MCP42XXEV Evaluation Board into your application circuit to control the MCP4261-103 device

This user guide will discuss the steps needed to evaluate the MCP4261-103E/ST device using the PICkit Serial Analyzer (order number: DV164122).

Section 2.5 "Configuring The PICkit™ Serial Analyzer" shows the steps to configure the PICkit Serial Analyzer as well as create User Script files which are used to communicate with the MCP4261, based on the device's SPI communication protocol format.

2.4   MCP42XXEV EVALUATION BOARD DESCRIPTION

The MCP42XXEV Evaluation Board uses the flexible TSSOP20EV Evaluation Board PCB. This simple evaluation board allows the system designer to quickly evaluate the operation of the MCP4261-103 device ($R_{AB(TYP)}$ = 10 kΩ) using the PICkit Serial Analyzer or by jumpering the board into their application system. The PICkit Serial Analyzer is available separately (order number: DV164122).

2.4.1   The Hardware

Figure 2-2 shows the component layout of the MCP42XXEV Evaluation Board. This is a small four-layer board (3.9" x 2.1" (99.06 mm x 53.34 mm)). There are twenty-two connection points/pads that can use either through-hole or surface-mount connector posts.

The pad labeled V_{DD} is connected to the PCB power plane, while the pad labeled V_{SS} is connected to the PCB ground plane. All the passive components that are connected to V_{DD} or V_{SS} are connected to either the power plane or ground plane.

The twenty remaining PCB pads correspond to the device pins (i.e., pad 1 connects to pin 1).

Each pad has two passive components associated with them: a pull-up resistor and a pull-down resistor. The pull-up resistor is always RXU and the pull-down resistor is RXD. The "X" is a numeric value that corresponds to a particular pad (1 to 8). As an example, Pad 5's pull-up resistor is R5U. Capacitor C1 and C2 are the power supply filtering capacitors. For whichever pin is the device's V_{DD}, the RxD component footprint can be used for the device's bypass capacitor. Table 2-2 describes the components.

A 6-pin header interface is available to support the PICkit serial or the PIC® MCU In-Circuit Serial Programming™ (ICSP™) interface.

The MCP4261 is bottom aligned in the U3 footprint so that the interface signals are on the same U3 package pins as the MCP4361 device. This is done to show the footprint compatibility between the MCP42X1 and MCP43X1 devices.
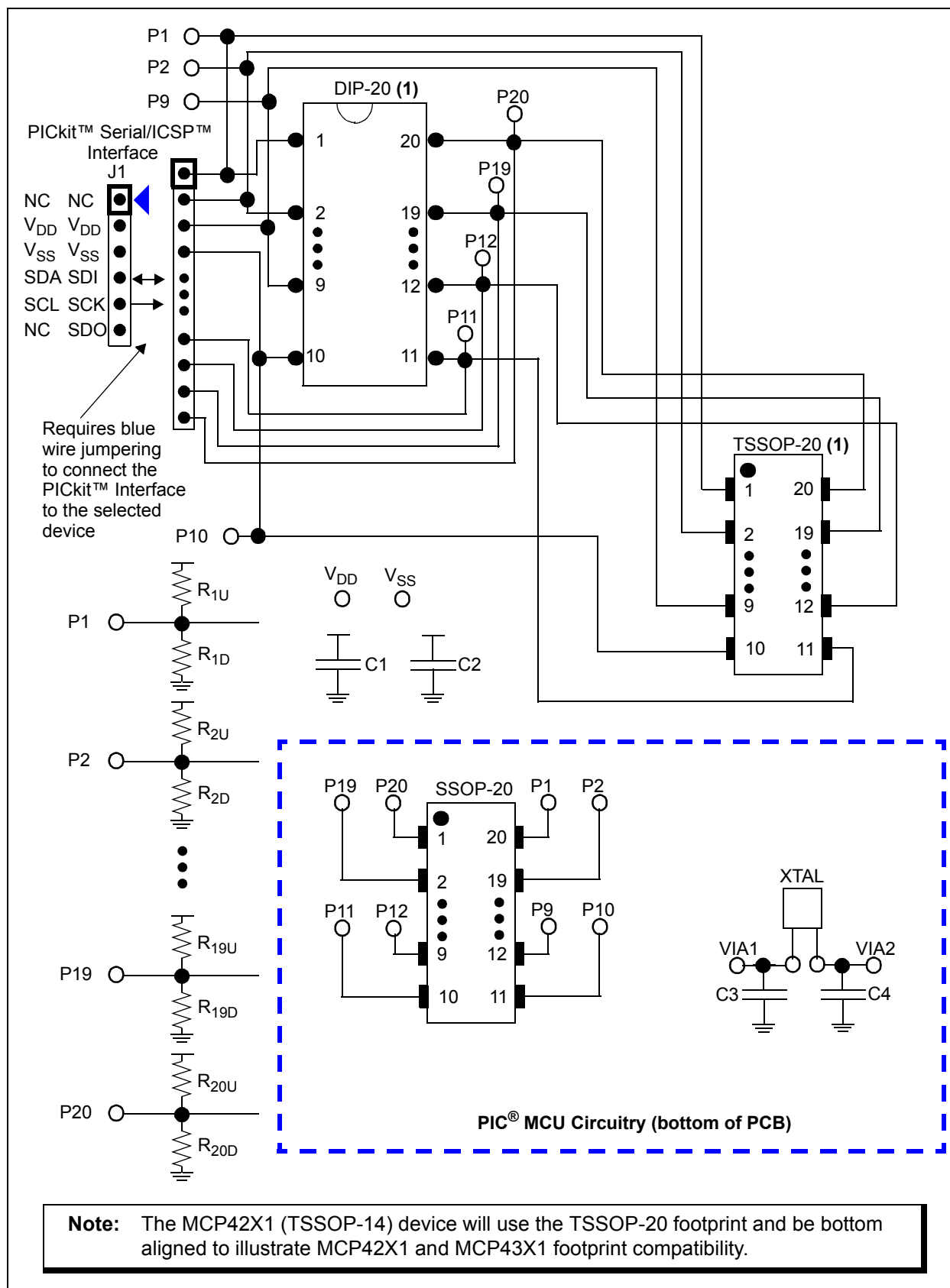
FIGURE 2-1: TSSOP20EV Evaluation Board Circuit.

MCP4261-103E/ST
Installed in U3 (TSSOP-14 package bottom aligned to TSSOP-20 footprint)

Connected to Ground Plane

Connected to Power Plane

Through hole Test Point (Orange) Wiper 1

Through hole Test Point (Orange) Wiper 0

Four Blue Wire Jumpers to connect PICkit™ Serial interface (SPI) to device pins

1x6 Male Header, with 90° right angle
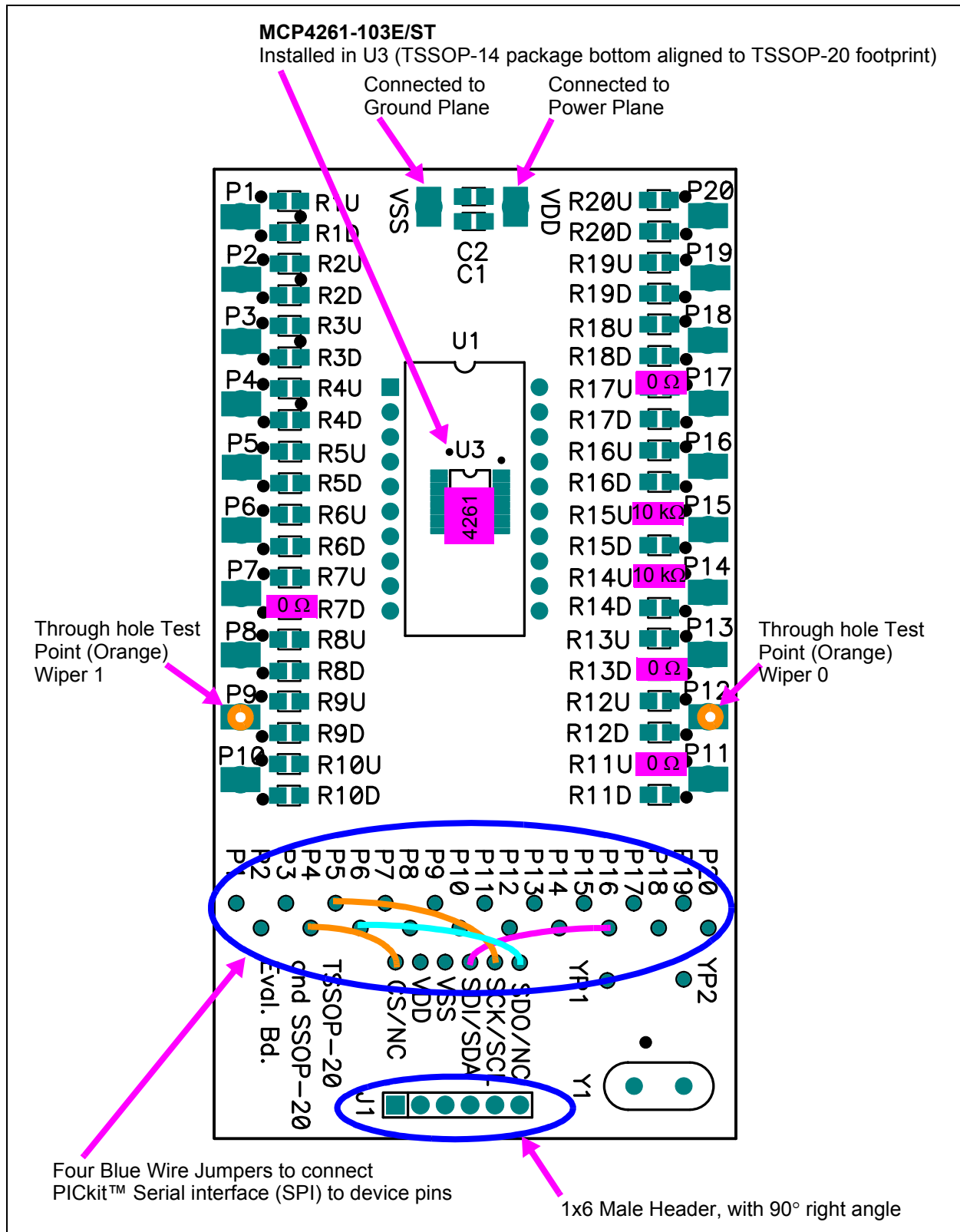
FIGURE 2-2: *MCP42XXEV Evaluation Board Component Placement Using the TSSOP20EV Evaluation Board (Top).*

TABLE 2-1: INSTALLED PASSIVE COMPONENTS [2]

Component	Description	Comment
R11U, R17U	0Ω SMT 805	Pull-up resistor
R14U, R15U	10 kΩ SMT 805	Pull-up resistor
R7D, R13D	0Ω SMT 805	Pull-down resistor [1]
U3	MCP4261-103E/ST	$R_{AB(TYP)}$ = 10 kΩ Device bottom aligned in U3 footprint
P9, P12	Test Point – through-hole connector (orange)	
J1	1x6 Male Header, 100 mil spacing 90° angle.	PICkit™ Serial/ICSP™ Header

—	Blue Wire:
	    J1 CS/NC via to P4 via
	    J1 SDI/SDA via to P16 via
	    J1 SCK/SCL via to P5 via
	    J1 SDO/NC via to P6 via
		See Figure 2-2

Note 1: Whichever pin is the device's V_{DD} pin, that corresponding RXD footprint can be used for the device's bypass capacitor. So if Pin 8 is the device's V_{DD} pin, then install the bypass capacitor in the R8D footprint.

2: All passive components use the surface mount 805 footprint.

TABLE 2-2: **OPTIONAL PASSIVE COMPONENTS – <u>NOT</u> INSTALLED** [2]

Component	Comment
C1, C2	Power supply bypass capacitors [3]
C3, C4	PIC® MCU Crystal capacitors
R1U, R2U, R3U, R4U, R5U, R6U, R7U, R8U, R9U, R12U, R13U, R16U, R18U, R19U, R20U	Pull-up resistor
R1D, R2D, R3D, R4D, R5D, R6D, R8D, R9D, R10D, R11D, R12D, R14D, R15D, R16D, R17D, R18D, R19D, R20D	Pull-down resistor [1]
U1, U2	Alternate package footprints
VDD, GND	Power and Ground plane connection points
Y1	Can connect to either PIC® MCUs main oscillator or to the Timer oscillator circuit.
P1, P2, P3, P4, P5, P6, P8, P10, P11, P13, P14, P15, P16, P17, P18, P19, P20	Test Point connectors

Note 1: Whichever pin is the device's V_{DD} pin, that corresponding RXD footprint can be used for the device's bypass capacitor. So if Pin 8 is the device's V_{DD} pin, then install the bypass capacitor in the R8D footprint.

2: All passive components use the surface mount 805 footprint.

3: If the board is powered via the V_{DD} and GND connection points, the use of bypass capacitors on C1 and C2 may improve performance. The benefit is reduced if the board is powered via the PICkit™ serial interface.

2.4.2 The MCP4261 Device

To make variations to the commands sent to the MCP4261 device (from the commands shown in the demo section), one must know the device memory map (see Table 2-3) and the command formats (see Figure 2-3). For additional device operational information, refer to the MCP4261 device data sheet (DS22059).

TABLE 2-3: MEMORY MAP AND THE SUPPORTED COMMANDS

Address	Function	Memory Type	Allowed Commands	Disallowed Commands [2]
00h	Volatile Wiper 0	RAM	Read, Write, Increment, Decrement	—
01h	Volatile Wiper 1	RAM	Read, Write, Increment, Decrement	—
02h	Nonvolatile Wiper 0	EEPROM	Read, Write [1]	Increment, Decrement
03h	Nonvolatile Wiper 1	EEPROM	Read, Write [1]	Increment, Decrement
04h	Volatile TCON0 Register	RAM	Read, Write	Increment, Decrement
05h	STATUS Register	RAM	Read	Write, Increment, Decrement
06h-0Fh	Data EEPROM	EEPROM	Read, Write [1]	Increment, Decrement

Note 1: When an EEPROM write is active, these are invalid commands and will generate an error condition. The user should use a read of the STATUS register to determine when the write cycle has completed. To exit the error condition, the user must take the $\overline{CS}$ pin to the V_{IH} level and then back to the active state (V_{IL} or V_{IHH}).

2: This command on this address will generate an error condition. To exit the error condition, the user must take the $\overline{CS}$ pin to the V_{IH} level and then back to the active state (V_{IL} or V_{IHH}).
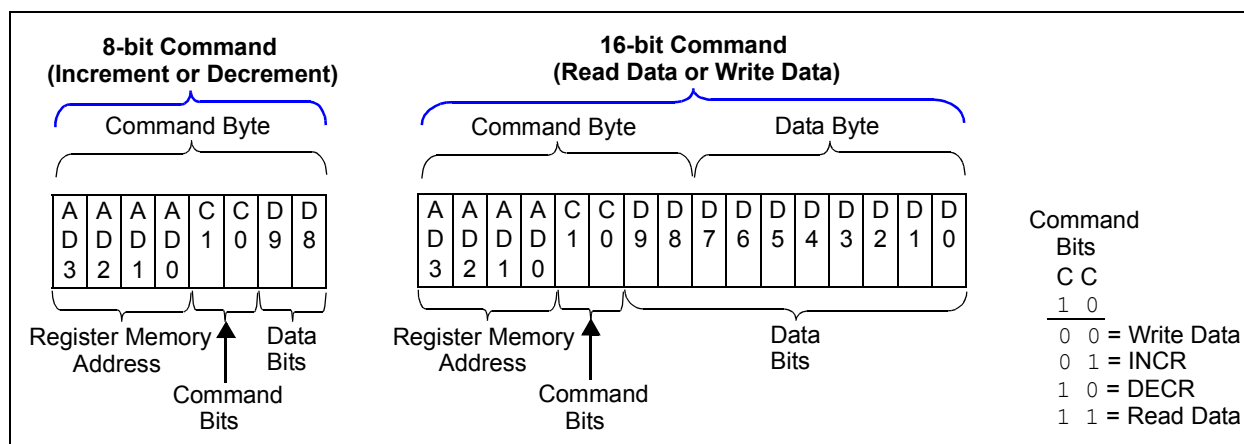

FIGURE 2-3: *MCP42XX SPI Command Formats.*

2.5   CONFIGURING THE PICkit™ SERIAL ANALYZER

2.5.1   Modifying the `CommScripts.txt` file

Example 2-1 shows the User Scripts for the MCP43XX devices (from MCP43XXEV Evaluation Board). These script files are compatible with the MCP42XX devices, with the exception of commands to Wiper 2, Wiper 3, or TCON1 registers (commands shaded in red).

These User Scripts need to be added to the PICkit serial's `CommScripts.txt` file. The default install location of this file is:

        C:\Program Files\Microchip\PICkit Serial Analyzer

Once these are saved in the `CommScripts.txt` file and the Master SPI mode is selected as the communication mode, these User Scripts will be available to select from.

NOTICE

Note 1: It is recommended that you make a backup of your `CommScript.txt` file before making any edits with a text editor.

2: It has been observed that coping the text from this PDF and pasting into the PICkit serial's `CommScript.txt` file will cause errors due to the blank spacing used in the PDF file. Please copy from the MCP43XX `CommScript.txt` file available from the Microchip web site (MCP43XXEV Evaluation Board product page).

EXAMPLE 2-1:   MCP43XX SCRIPT FILE (`COMMSCRIPTS.TXT`)

```
WriteWiper0     SPI    SPICSON    SPIDATOUT    0x02    0x00    0x3F    SPICSOFF
ReadWiper0      SPI    SPICSON    SPIDATIO     0x02    0x0C    0xA5    SPICSOFF
WriteWiper1     SPI    SPICSON    SPIDATOUT    0x02    0x10    0x3F    SPICSOFF
ReadWiper1      SPI    SPICSON    SPIDATIO     0x02    0x1C    0xA5    SPICSOFF

WriteWiper2     SPI    SPICSON    SPIDATOUT    0x02    0x60    0x3F    SPICSOFF
ReadWiper2      SPI    SPICSON    SPIDATIO     0x02    0x6C    0xA5    SPICSOFF
WriteWiper3     SPI    SPICSON    SPIDATOUT    0x02    0x70    0x3F    SPICSOFF
ReadWiper3      SPI    SPICSON    SPIDATIO     0x02    0x7C    0xA5    SPICSOFF

WriteWiper0NV   SPI    SPICSON    SPIDATOUT    0x02    0x20    0x3F    SPICSOFF
ReadWiper0NV    SPI    SPICSON    SPIDATIO     0x02    0x2C    0xA5    SPICSOFF
WriteTCON0      SPI    SPICSON    SPIDATOUT    0x02    0x40    0xFF    SPICSOFF
ReadTCON0       SPI    SPICSON    SPIDATIO     0x02    0x4C    0xA5    SPICSOFF

WriteTCON1      SPI    SPICSON    SPIDATOUT    0x02    0xA0    0xFF    SPICSOFF
ReadTCON1       SPI    SPICSON    SPIDATIO     0x02    0xAC    0xA5    SPICSOFF

ReadSTATUS      SPI    SPICSON    SPIDATIO     0x02    0x5C    0xA5    SPICSOFF
INCRWiper0      SPI    SPICSON    SPIDATIO     0x01    0x04    SPICSOFF
DECRWiper0      SPI    SPICSON    SPIDATIO     0x01    0x08    SPICSOFF
```

2.5.2 Working With the PICkit™ Serial Analyzer

Figure 2-4 shows the PICkit Serial window after the program has started. The Transaction window indicates if the PICkit serial GUI located the PICkit Serial Analyzer hardware. When starting the PICkit Serial Analyzer for the first time, some setup questions may be asked. If you have any questions, please refer to the PICkit Serial Analyzer documentation, available at www.Microchip.com/PICkitSerial.
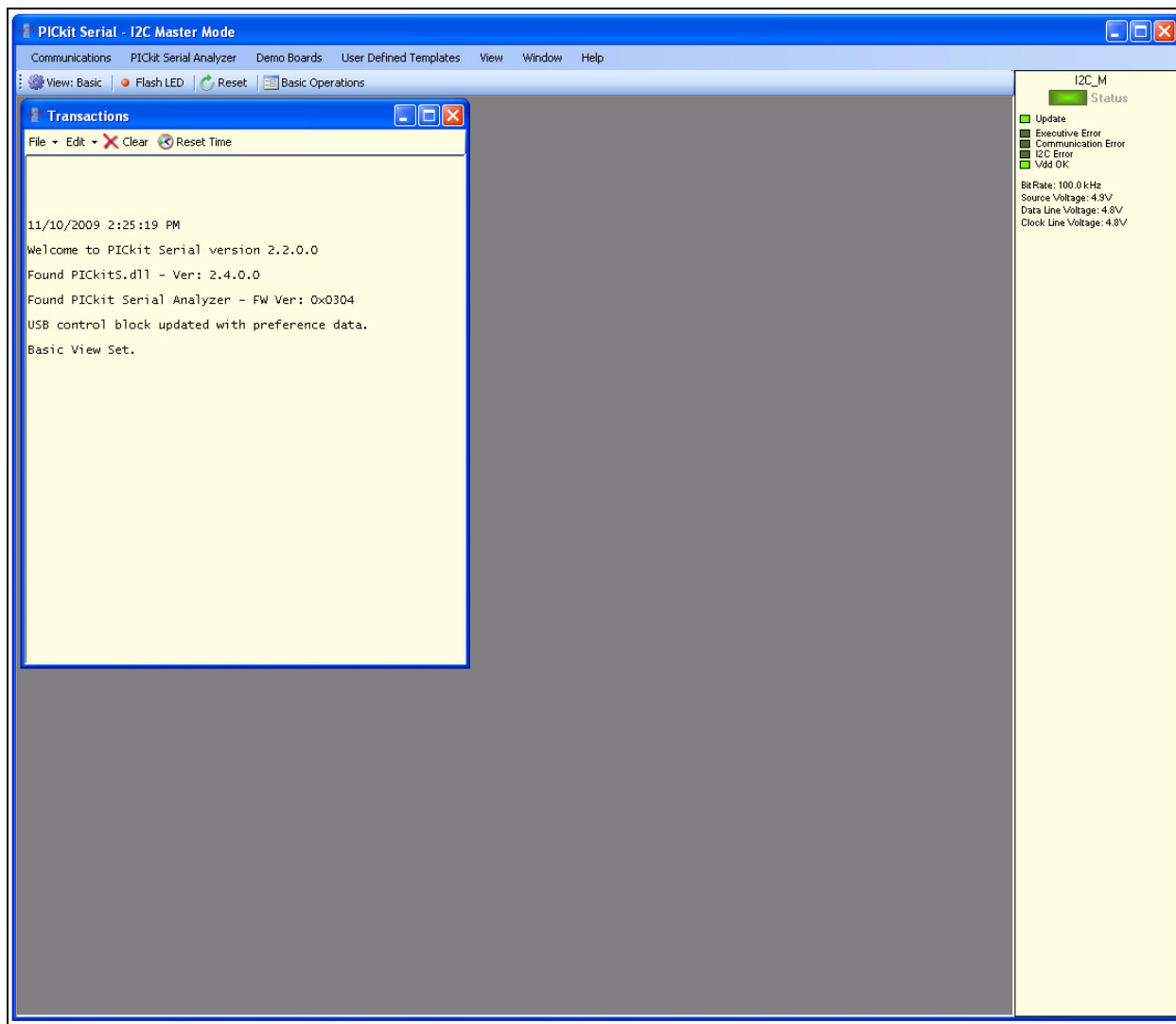

FIGURE 2-4: PICkit™ Serial Main Window at Start-up.

Installation and Operation

We need to select the PICkit Serial Analyzer GUI to be in SPI Master mode. Figure 2-5 shows how to select the proper mode. Select *PICkit Serial Analyzer -> Select Communications Mode -> SPI Master* menu item (make sure the SPI Master item is checked).
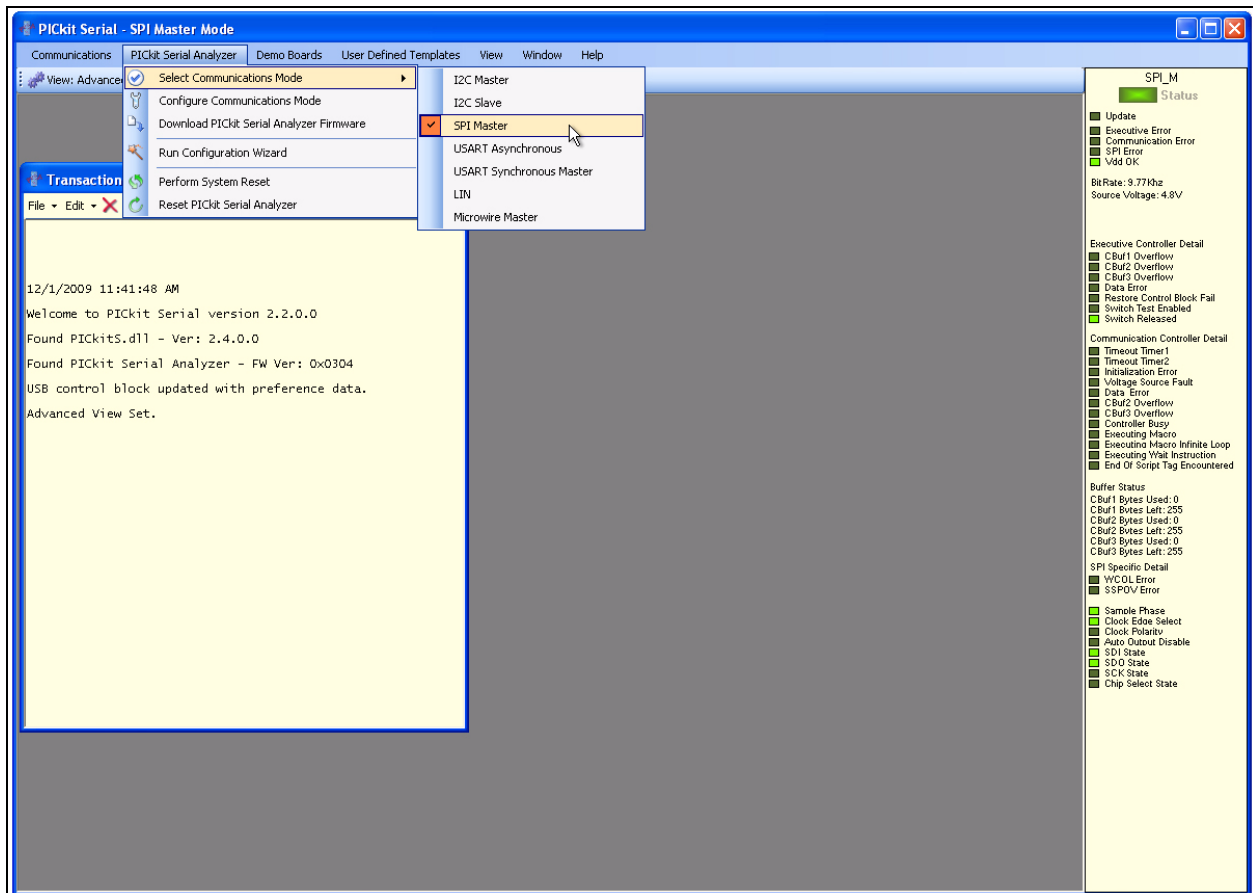

FIGURE 2-5: *PICkit™ Serial Selecting Communications Mode.*

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Now we need to configure the mode that we selected. Figure 2-6 shows how to configure the Communications mode. Select *PICkit Serial Analyzer -> Configure Communications Mode* menu item. This will open a new window:

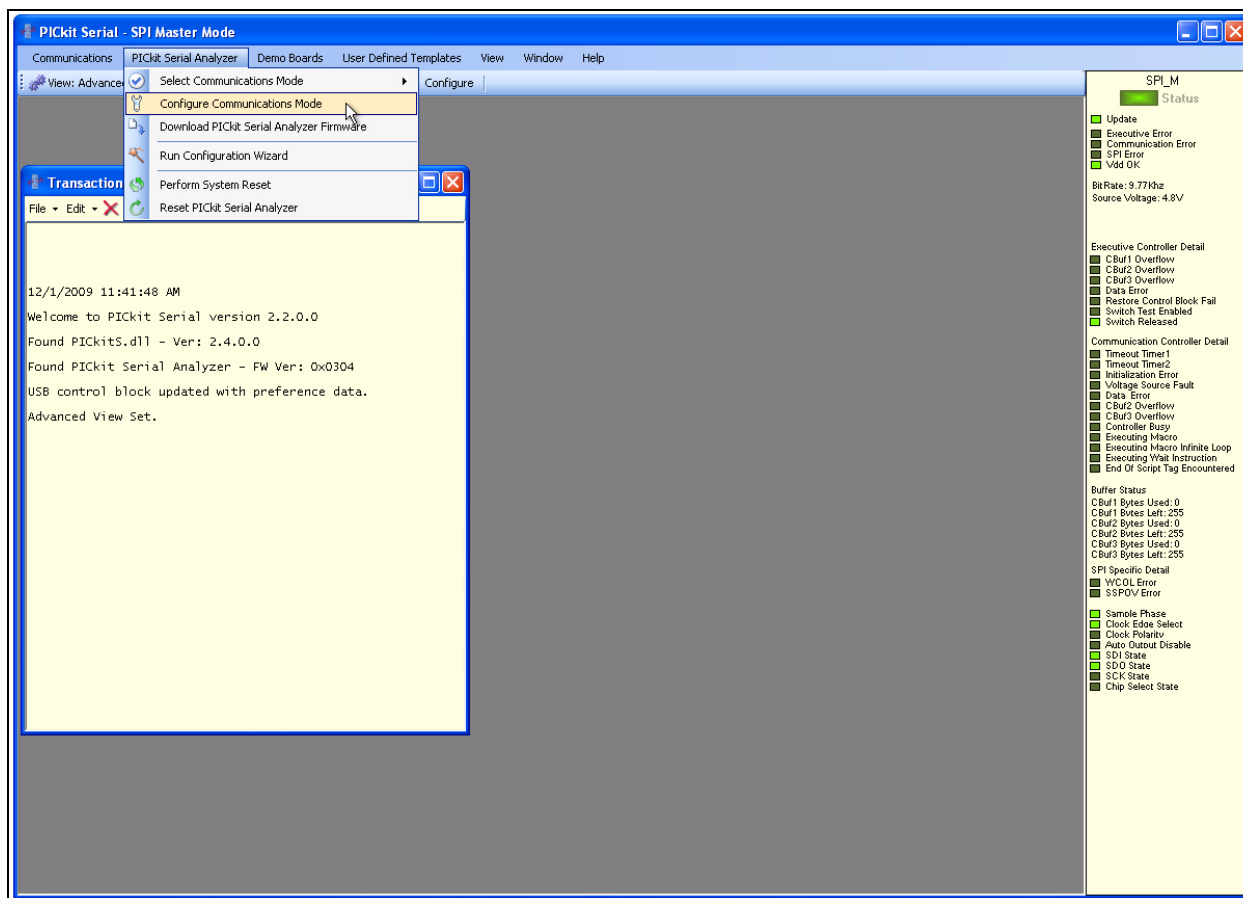**FIGURE 2-6:** *PICkit™ Serial Main Window at Start-up.*

Figure 2-7 shows the Configure Communications Mode window. Ensure that your window options and settings are the same as this window, and then select the **Save Changes** button. The Configure Communications Mode window may now be closed.
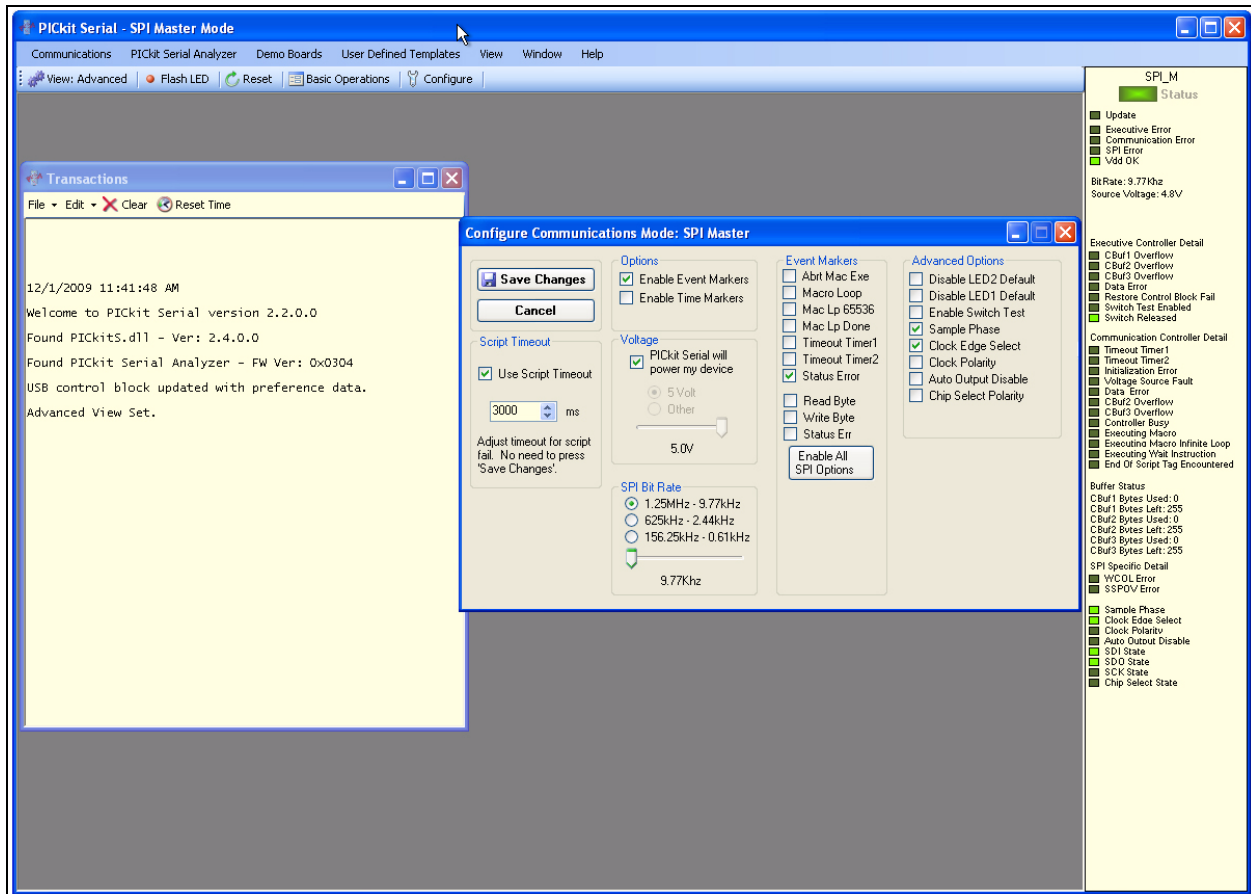
FIGURE 2-7: *PICkit™ Serial Configure Communications Mode Window.*

Now we are going to open the Script Builder window, select the Communications -> Script -> Script Builder menu item (see Figure 2-8).
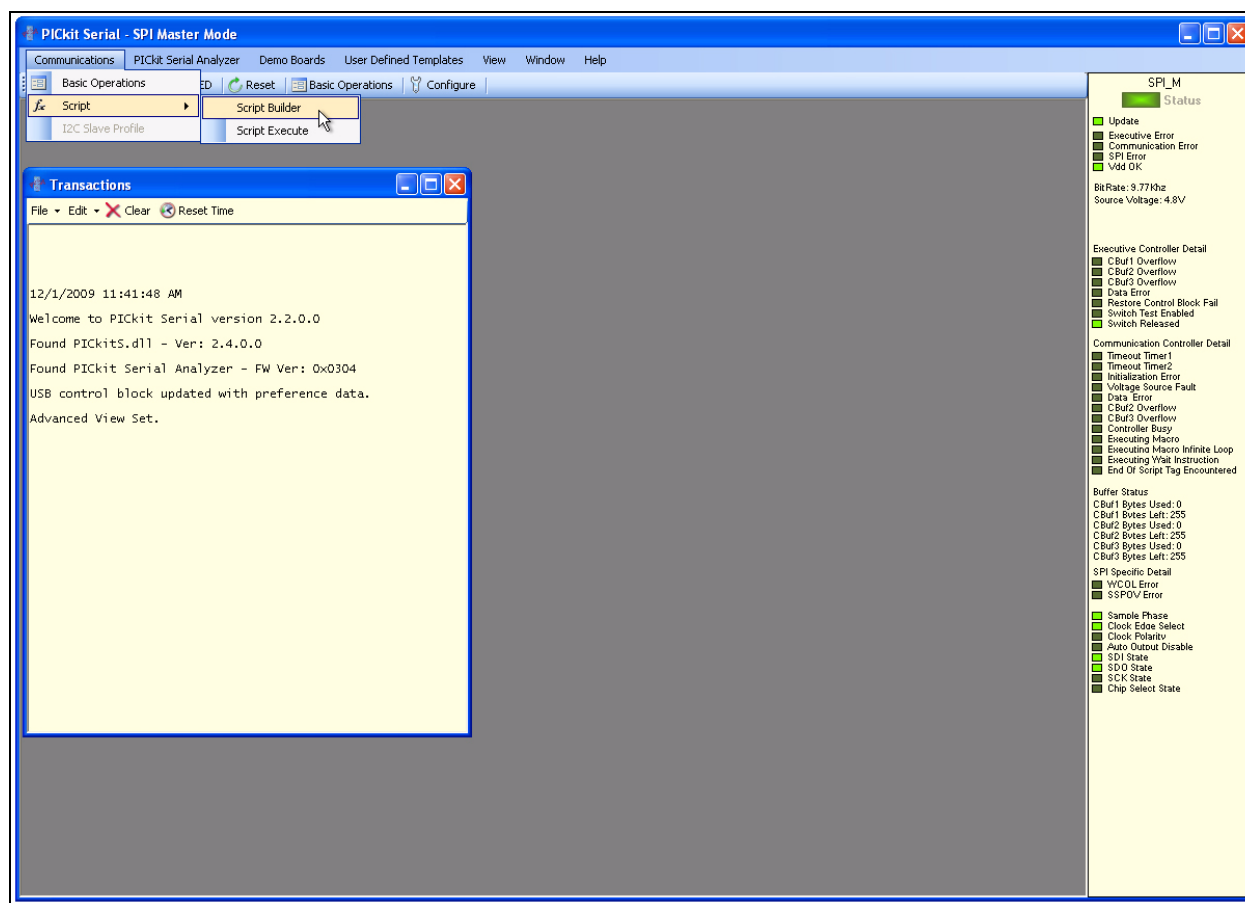
FIGURE 2-8: *PICkit™ Serial – Script Builder Menu Selection.*

Installation and Operation

The Script Builder window is shown in Figure 2-9. In this window we see the User SPI Scripts including the ones that were added to the `CommScripts.txt` file.
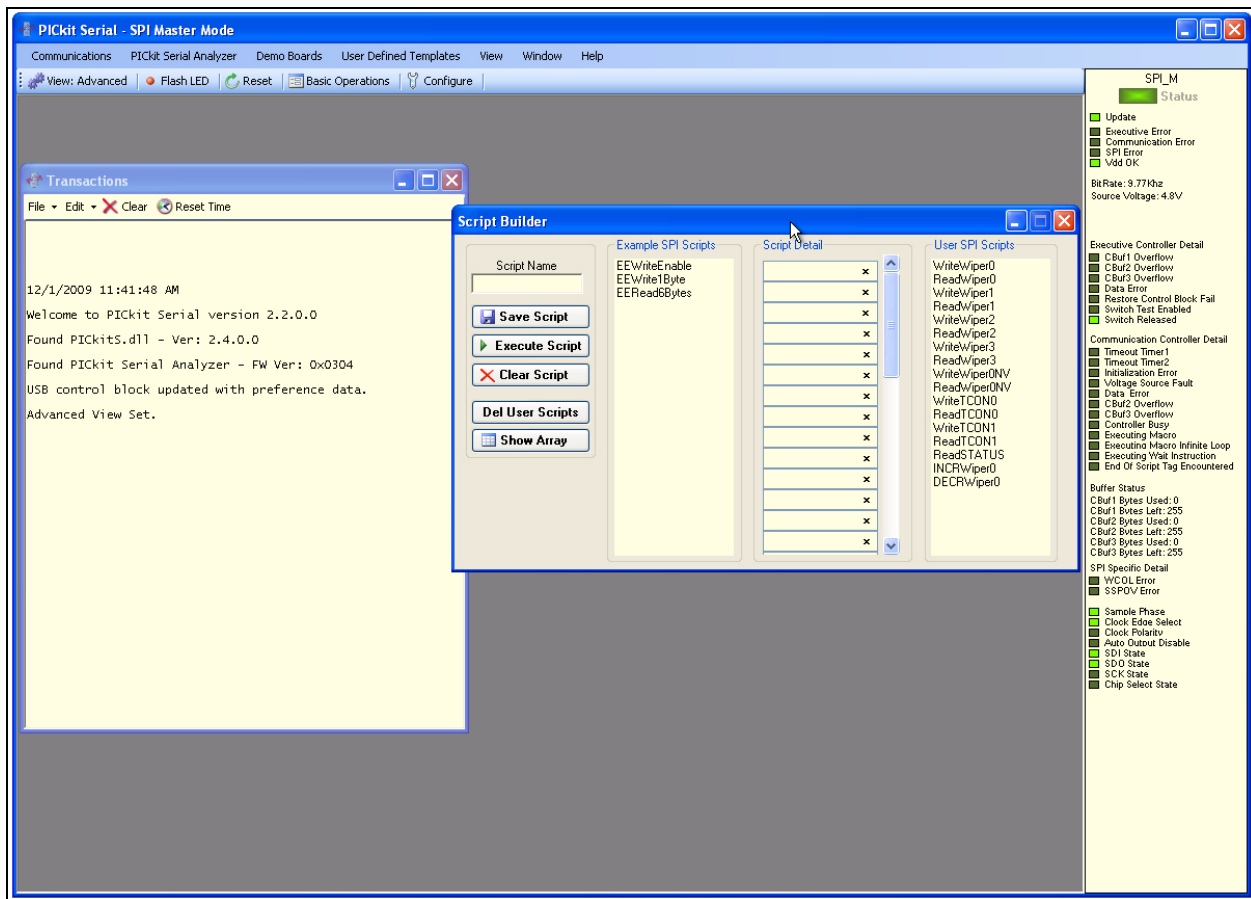
FIGURE 2-9: *PICkit™ Serial Main Window at Start-up.*

Double clicking on the WriteWiper0 User SPI Script will load the script details. Figure 2-10 shows what the values mean in the Script Details. These values are hex numbers.

The first value (02h), is the number of bytes that will be written. The second byte is a data byte and contains the device register address, the Device command, and the two Most Significant bits (MSb) of the write data. The third byte is the 2nd data byte and contains the remaining 8 bits of the write data.

FIGURE 2-10: *Example Write Script.*

Double clicking on the ReadWiper0 User SPI Script will load the script details. Figure 2-11 shows what the values mean in the Script Details. These values are hex numbers.

The first value (02h), is the number of bytes that will be written. The second byte is a data byte and contains the device register address, the Device command, and the two Most Significant bits (MSb) of the read data. The third byte is the 2nd data byte and contains the remaining 8 bits of the read data.
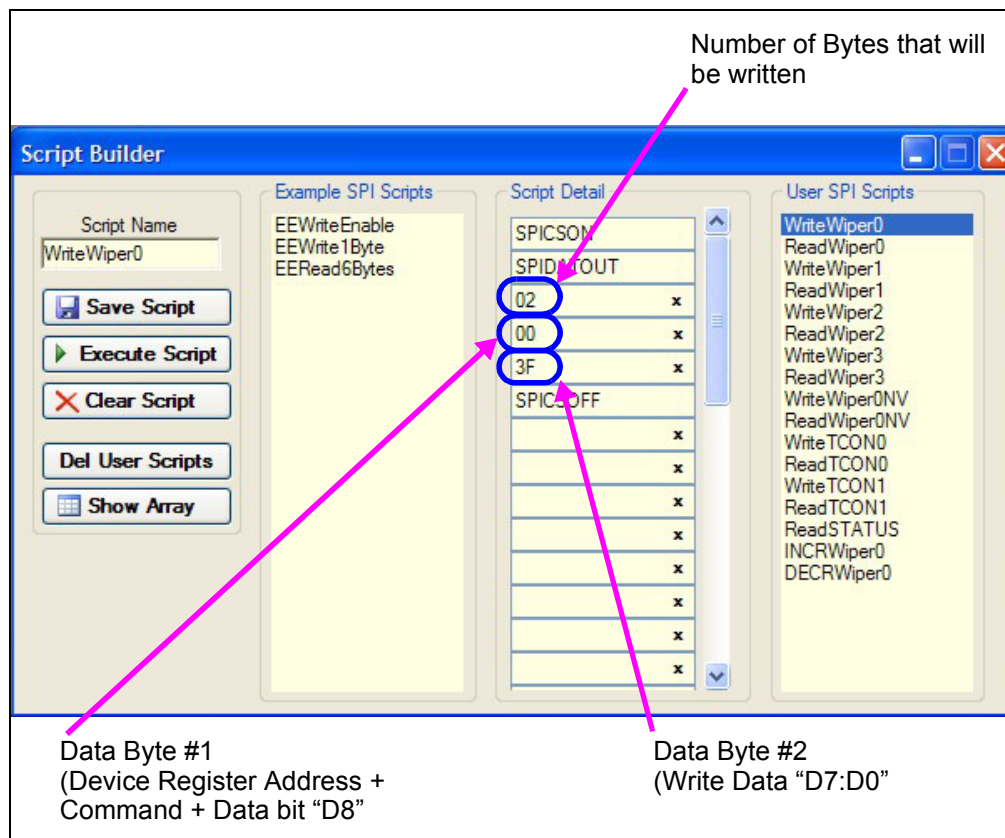
During Read commands, the value of the two LSbs of Data Byte #1 and all of the bits of Data Byte #2 are not important. The bytes are required for the SPI clock generation.
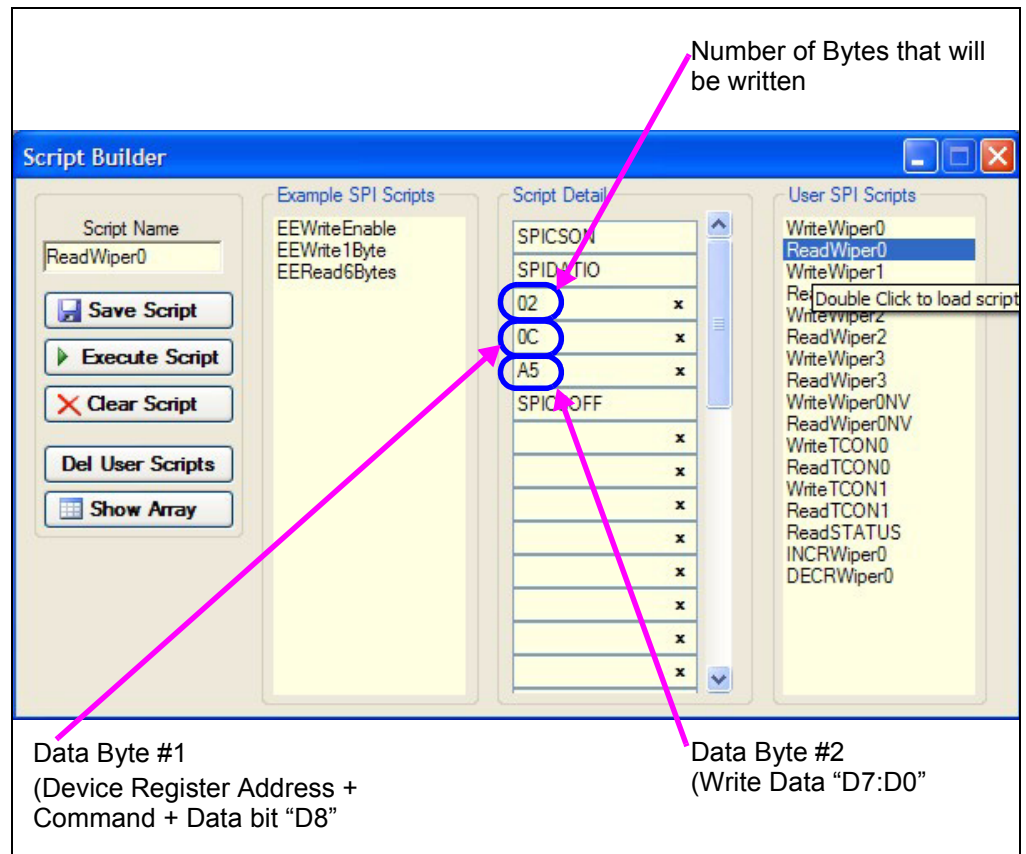

FIGURE 2-11:   *Example Read Script.*

2.6   MCP4261 DEMO STEPS

This demo assumes that you know how to configure the PICkit Serial Analyzer for Master SPI operation. See **Section 2.5 "Configuring The PICkit™ Serial Analyzer"** or the "*PICkit Serial Analyzer User's Guide"* (DS51647) for additional information.

1. Plug the PICkit serial device into the PC's USB port.
2. Plug the MCP42XXEV board into the PICkit serial.
3. Add the User Scripts (see Example 2-1) to the `CommScripts.TXT` file.
4. Start the PICkit serial GUI.
5. Ensure the GUI is in Master SPI Communication mode (see Figure 2-5).
6. Ensure that the Master SPI configuration is appropriately configured (see Figure 2-7).
7. Measure the Wiper 0 voltage on the MCP42XXEV board (see Figure 2-2) using an oscilloscope or digital multimeter. Measure voltage from the ground plane (GND) to the wiper (P12). The voltage on the wiper should be ~ V_{DD}/2 (~2.5V).
8. Open the Script Builder window (see Figure 2-8).
9. Double click on the "WriteWiper0" script in the Example SPI Scripts column. This loads the Script Detail column (see Figure 2-10).
10. Click on the **Execute Script** button. This executes the script shown in the Script Detail column, which will update the wiper value to 3Fh. The wiper voltage will now be ~V_{DD}/4 (~1.25V). The Transaction window (see Figure 2-13) will be updated to indicate the execution of the script.
11. Select the "ReadWiper0" script in the User SPI Scripts column. It should look like Figure 2-11.
12. Click on the **Execute Script** button. This executes the script shown in the Script Detail column. The Transaction window (see Figure 2-13) will be updated to indicate the execution of the script. The data read is shown in the last line.
13. Double click on the "WriteWiper0" script in the Example SPI Scripts column. This loads the Script Detail column and modifies the Wiper 0 data to 1FFh (see Figure 2-12).
14. Click on the **Execute Script** button. This executes the script shown in the Script Detail column, which will update the wiper value to 1FFh. The wiper voltage will now be ~V_{DD} (~5V). The Transaction window (see Figure 2-13) will be updated to indicate the execution of the script.
15. Select the "ReadWiper0" script in the User SPI Scripts column. It should look like Figure 2-11.
16. Click on the **Execute Script** button. This executes the script shown in the Script Detail column. The Transaction window (see Figure 2-13) will be updated to indicate the execution of the script. The data read is shown in the last line.
17. In the Transaction window, click the **Clear** button.
18. On the PICkit Serial Analyzer command bar, click the **Reset** button.
19. Select the "WriteWiper0" script in the User SPI Scripts column and then click on the **Execute Script** button.
20. Select the "ReadWiper0" script in the User SPI Scripts column and then click on the **Execute Script** button.

21. Select the "DECRWiper0" script in the User SPI Scripts column and then click on the **Execute Script** button three times.

22. Select the "ReadWiper0" script in the User SPI Scripts column and then click on the **Execute Script** button. The Transaction window shows the scripts that were executed and the current value of the Wiper 0 (see Figure 2-14).

23. In the Transaction window, click the **Clear** button.

24. On the PICkit Serial Analyzer command bar, click the **Reset** button.

25. Select the "WriteWiper0" script in the User SPI Scripts column and then click on the **Execute Script** button.

26. Select the "ReadWiper0" script in the User SPI Scripts column and then click on the **Execute Script** button.

27. Select the "INCRWiper0" script in the User SPI Scripts column and then click on the **Execute Script** button three times.

28. Select the "ReadWiper0" script in the User SPI Scripts column and then click on the **Execute Script** button. The Transaction window shows the scripts that were executed and the current value of the Wiper 0 (see Figure 2-15)

29. You can repeat the sequence of writing values to the wiper register or writing then reading the values back.

NOTICE

If at any time during script execution, an error message is generated in the Transaction window, it is good practice to reset the PICkit™ Serial Analyzer (PKSA). The PKSA can be reset using the "Reset" toolbar icon. Verify that subsequent script operations do not generate errors.

Write Command to Wiper 0 Register (D8 = 1)   Wiper 0 Data (D7:D0 = 'FFh')

FIGURE 2-12:   *MCP42XX Write Wiper 0 Script File – Updating Wiper Value.*

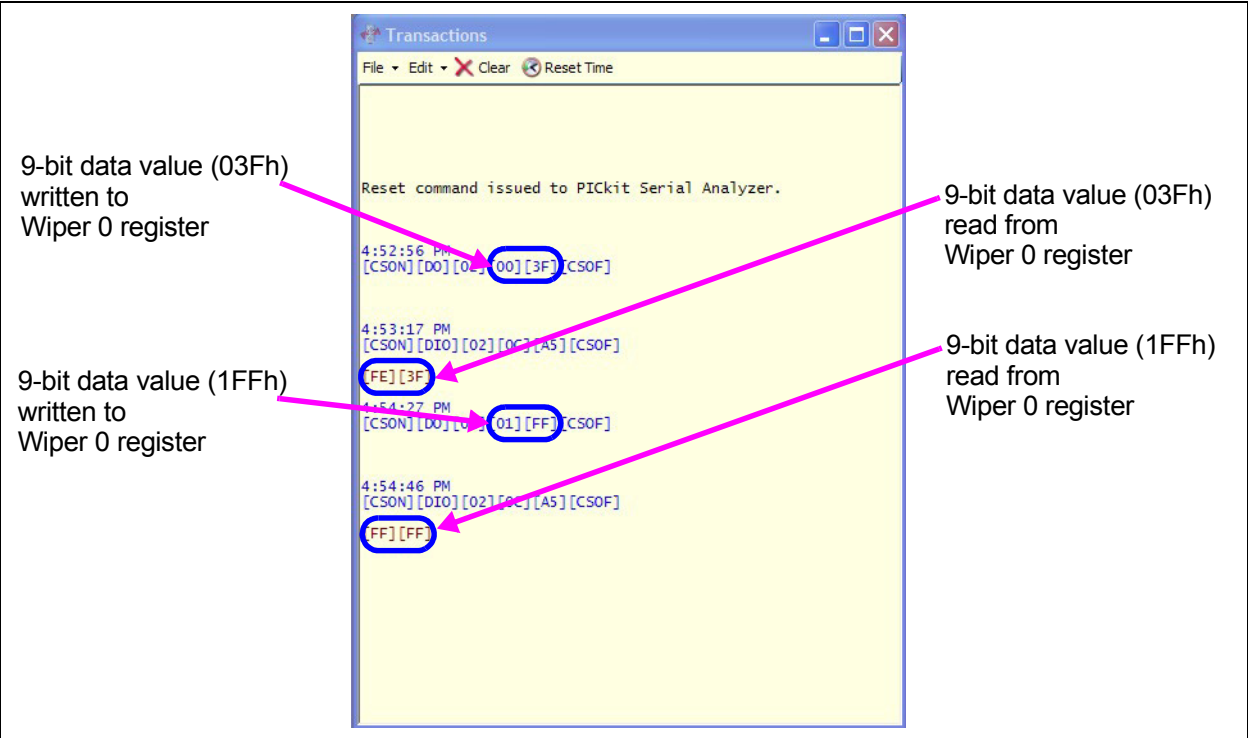**FIGURE 2-13:** *MCP4261 Transaction Window – Wiper 0 Writes and Reads.*
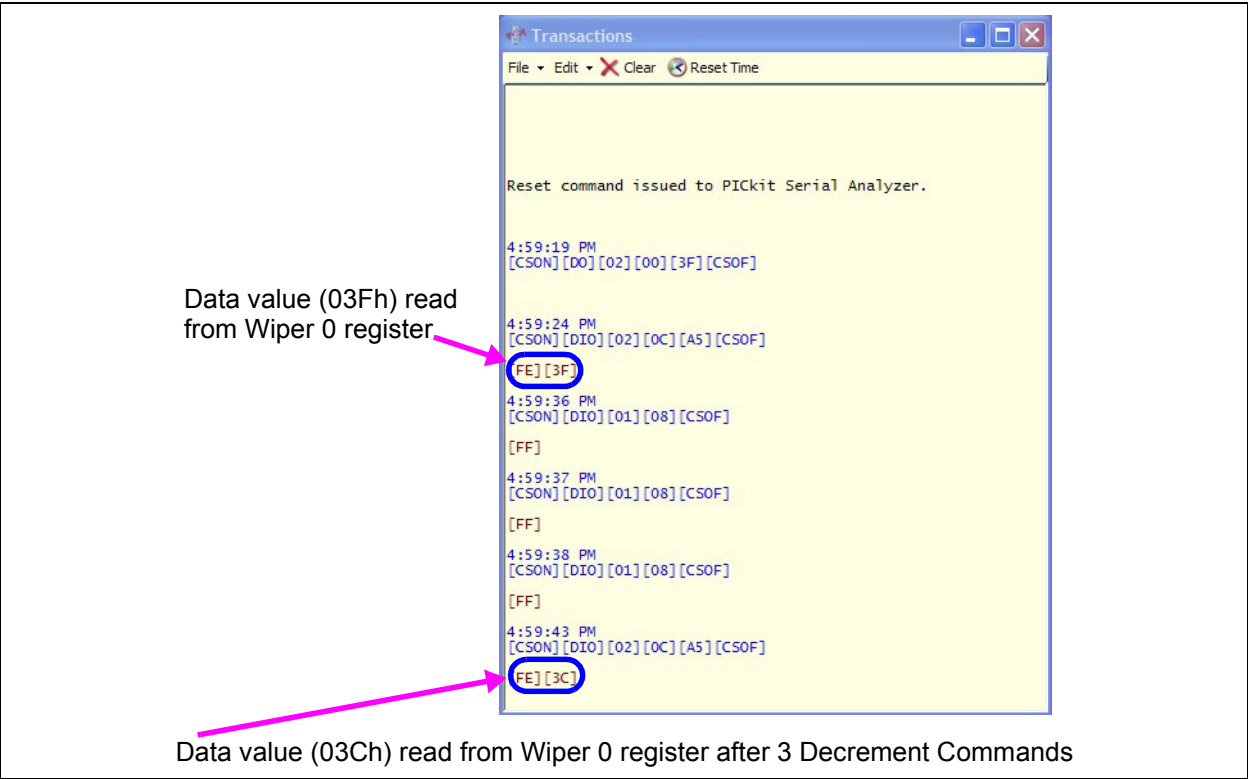
FIGURE 2-14: *MCP4261 Transaction Window – Wiper 0 Decrements.*

Data value (03Fh) read from Wiper 0 register

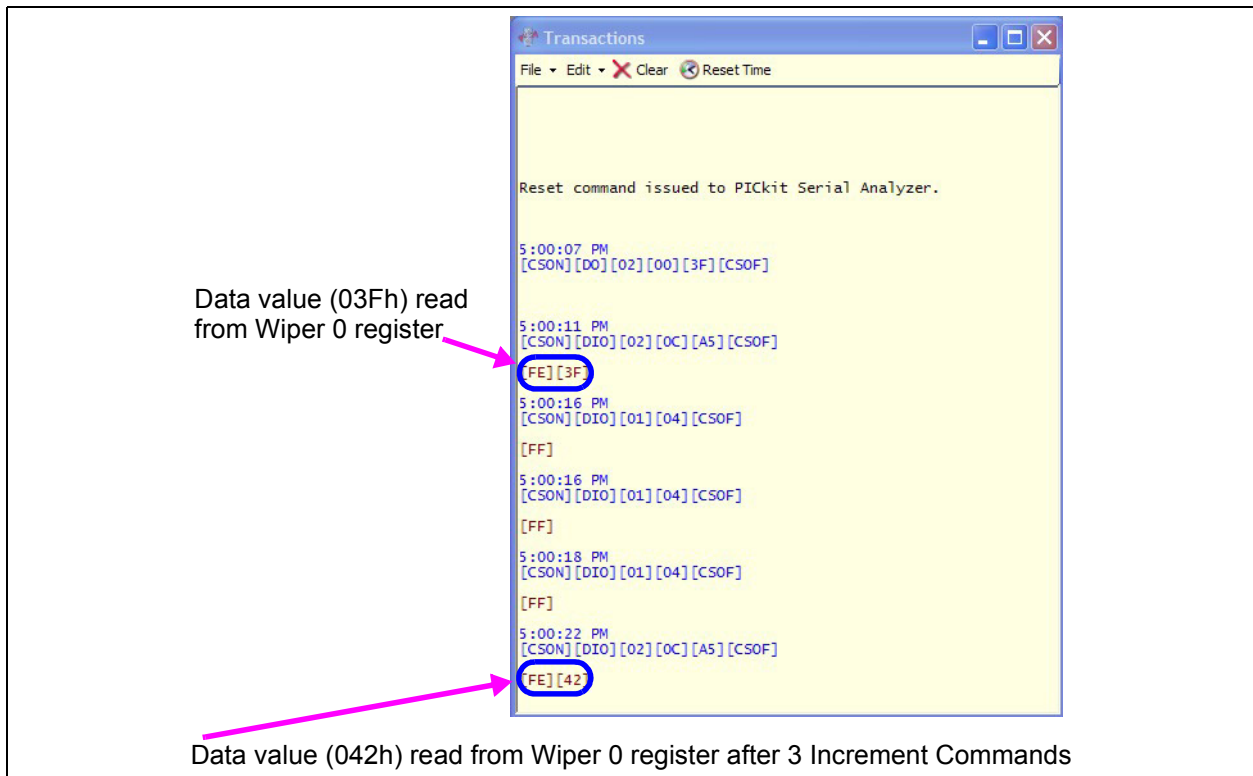Data value (042h) read from Wiper 0 register after 3 Increment Commands

FIGURE 2-15:   *MCP4261 Transaction Window – Wiper 0 Increments.*

2.6.1 The TSSOP20EV PCB and Supported Digital Potentiometers

Table 2-4 shows the current digital potentiometers that are supported by the TSSOP20EV PCB.

TABLE 2-4: TSSOP20EV PCB SUPPORTED DIGITAL POTENTIOMETERS

Device	TSSOP-20	TSSOP-14	Comment
MCP4231	—	Yes	Dual Pot, SPI Interface
MCP4241	—	Yes	Dual Pot, SPI Interface
MCP4251	—	Yes	Dual Pot, SPI Interface
MCP4261	—	Yes	Dual Pot, SPI Interface
MCP4331	Yes	—	Quad Pot, SPI Interface
MCP4341	Yes	—	Quad Pot, SPI Interface
MCP4351	Yes	—	Quad Pot, SPI Interface
MCP4361	Yes	—	Quad Pot, SPI Interface
MCP4631	—	Yes	Dual Pot, I^{2}C™ Interface
MCP4641	—	Yes	Dual Pot, I^{2}C™ Interface
MCP4651	—	Yes	Dual Pot, I^{2}C™ Interface
MCP4661	—	Yes	Dual Pot, I^{2}C™ Interface
MCP42010	—	Yes	Dual Pot, SPI Interface
MCP42050	—	Yes	Dual Pot, SPI Interface
MCP42100	—	Yes	Dual Pot, SPI Interface

Appendix A. Schematic and Layouts

A.1   INTRODUCTION

This appendix contains the schematics and layouts for the MCP42XXEV Evaluation Board. Diagrams included in this appendix:

- Board – Schematic
- Board – Top Trace, Silk and Pads
- Board – Bottom Trace and Pads
- Board – Layer 2 Ground Plane
- Board – Layer 3 Power Plane
- Board Layout – Top Components
- Board – Bottom Silk, Trace and Pads

A.2   SCHEMATICS AND PCB LAYOUT

Board – Schematic shows the schematic of the MCP42XXEV Evaluation Board. The layer order is shown in Figure A-1.
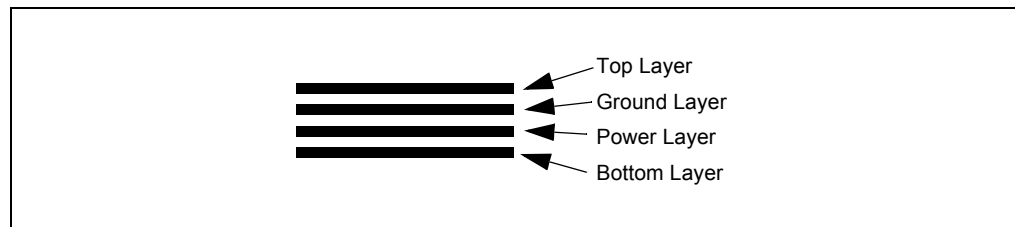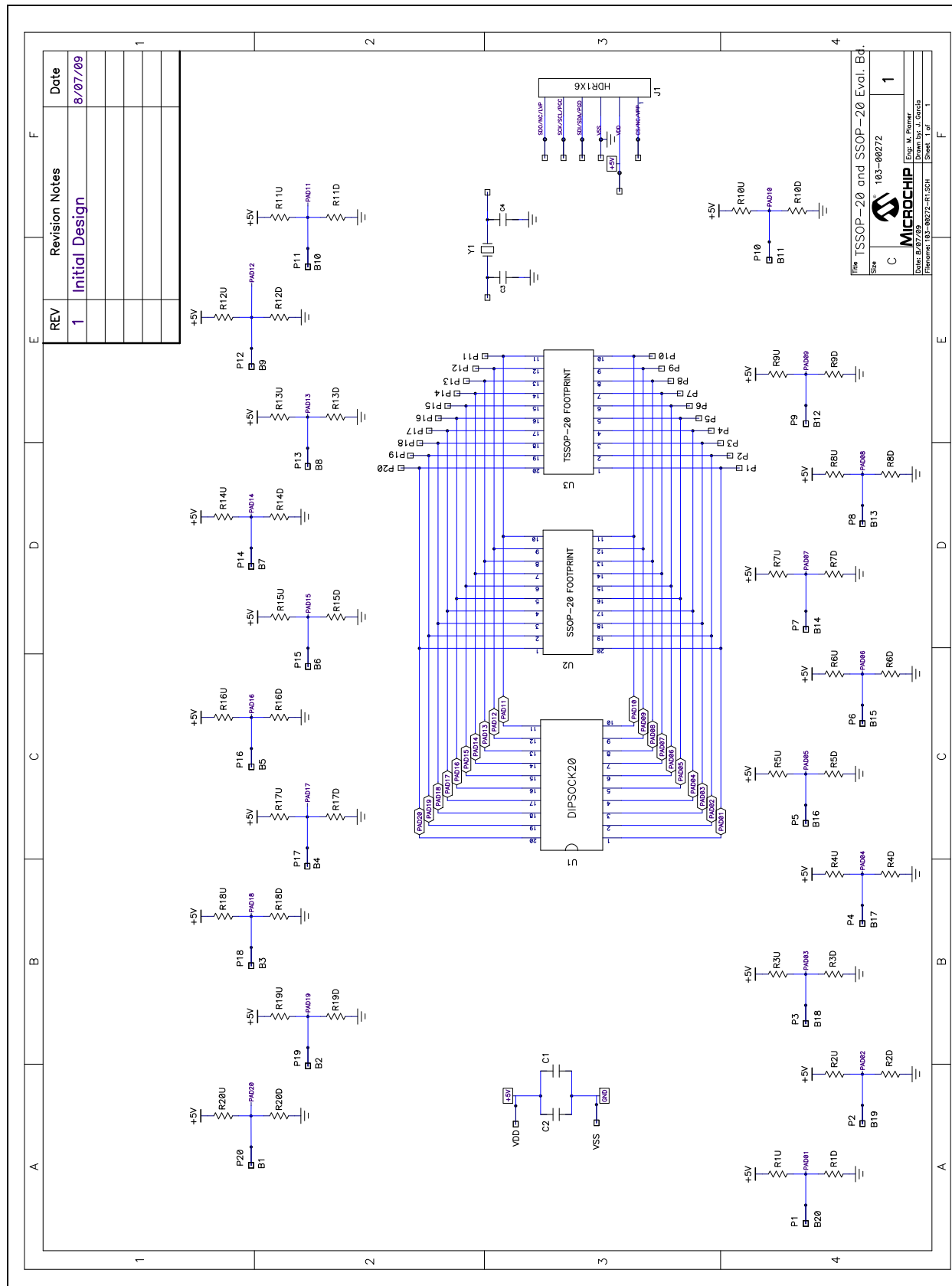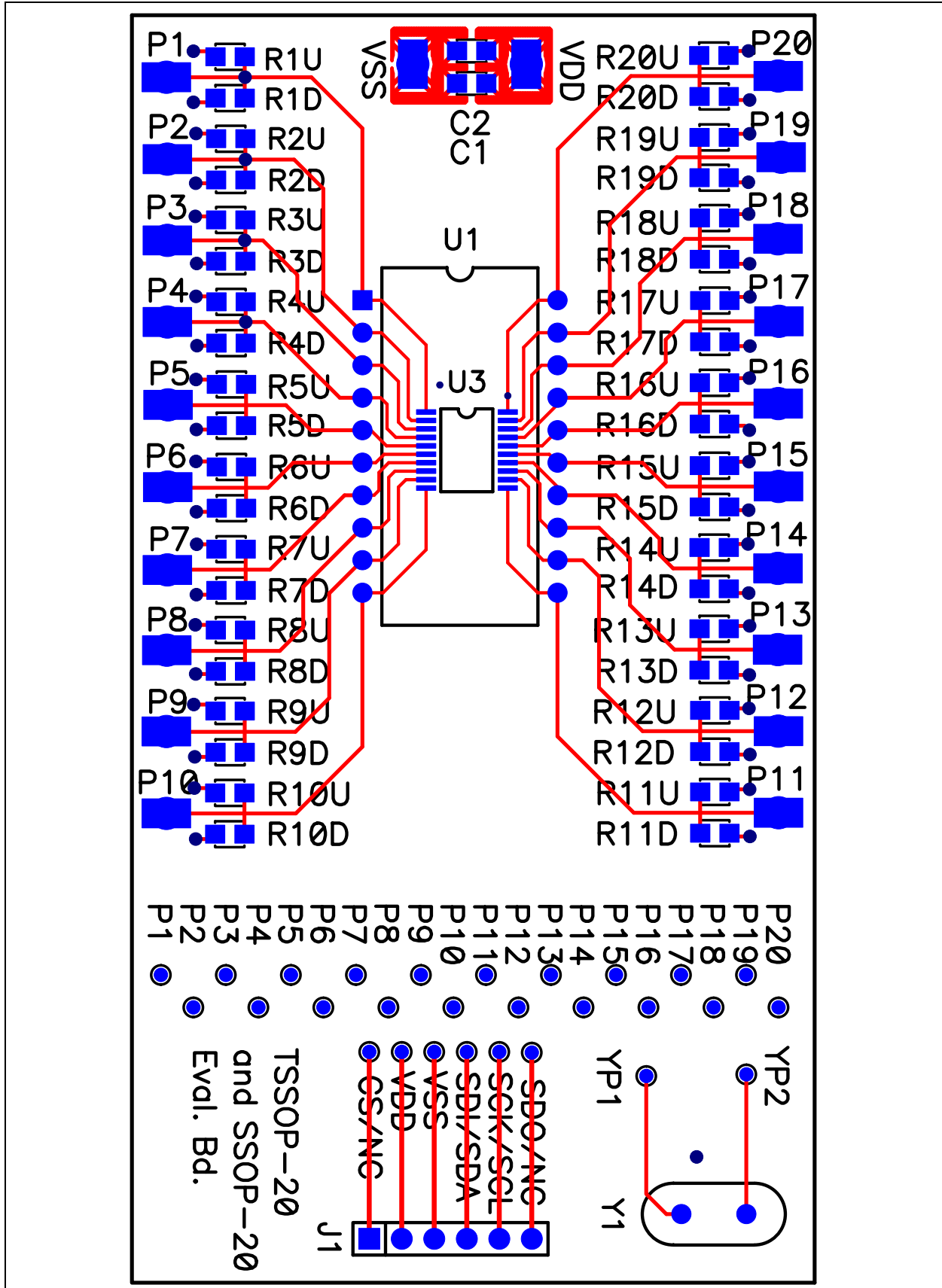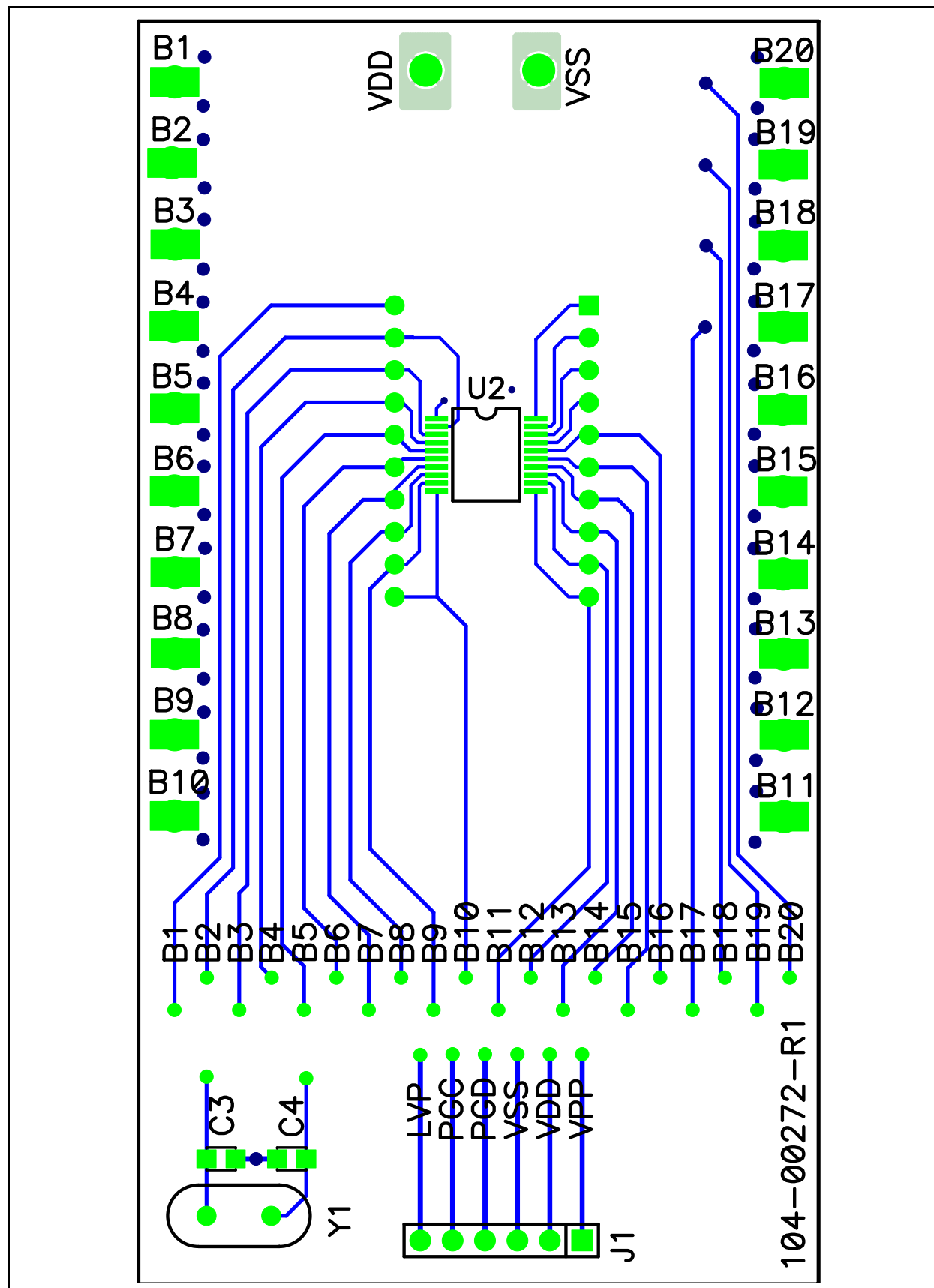

FIGURE A-1:   *Layer Order.*

MCP42XXEV Evaluation Board User's Guide
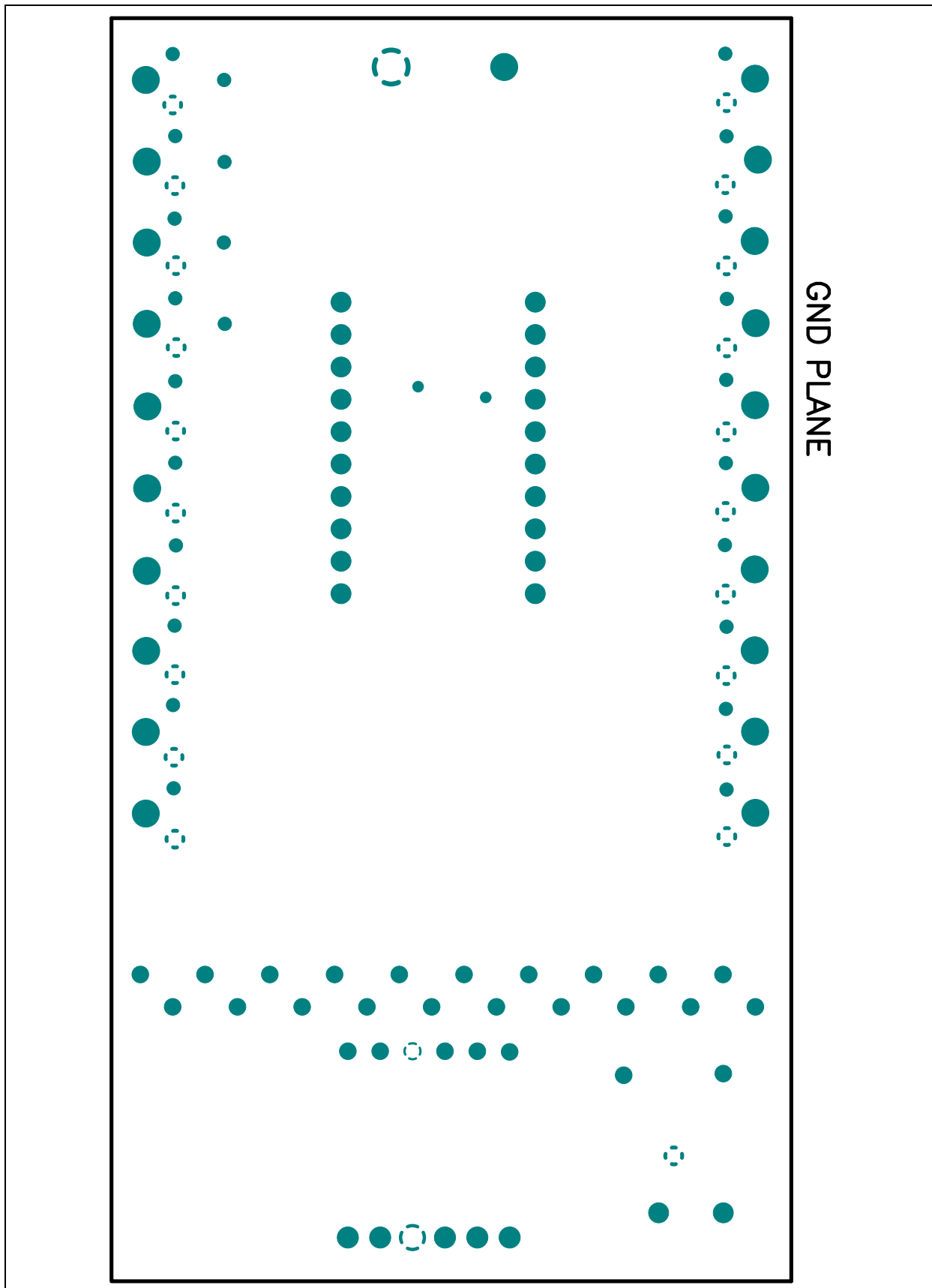
A.3   BOARD – SCHEMATIC

A.4 BOARD – TOP TRACE, SILK AND PADS
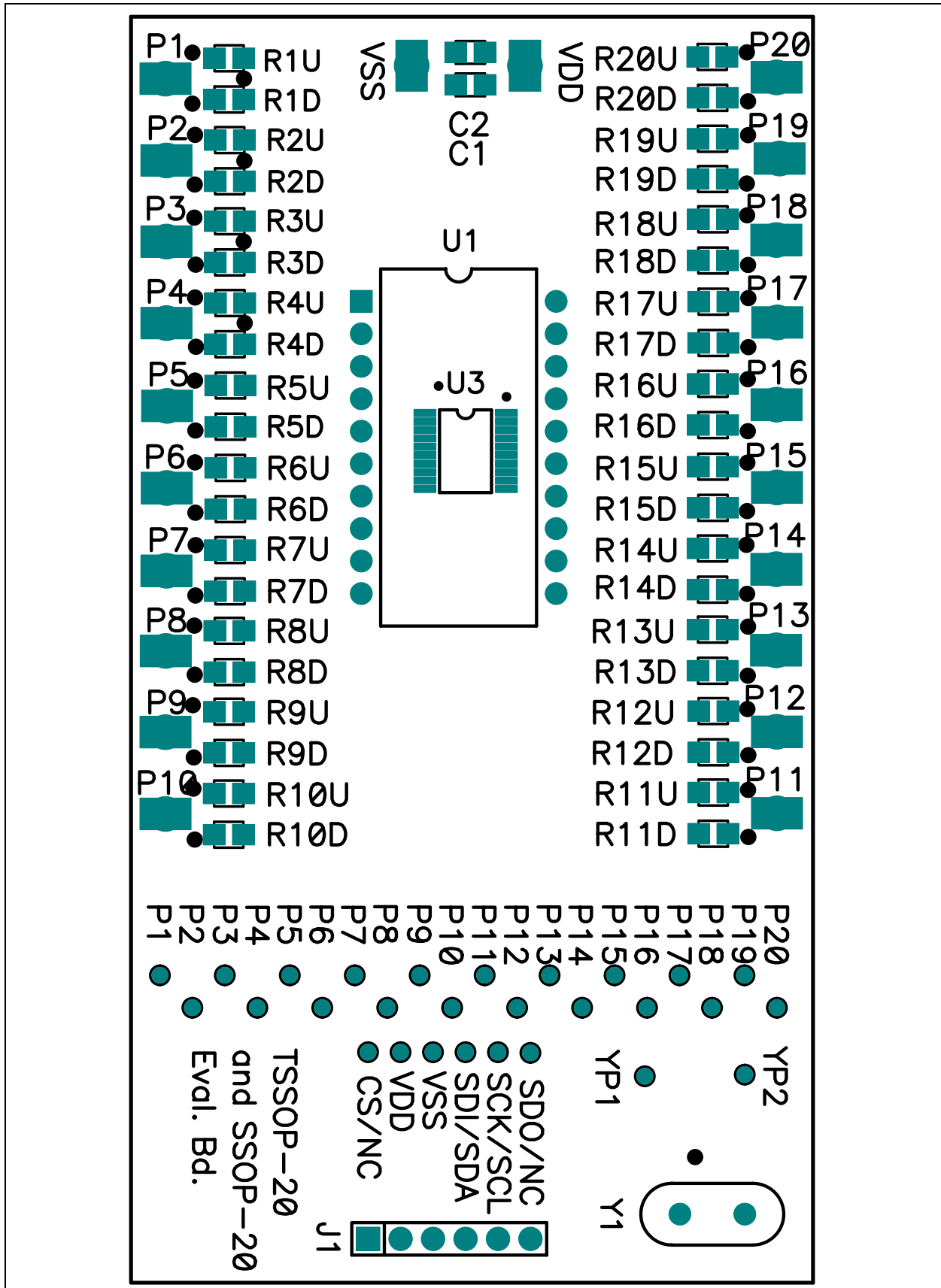
A.5   BOARD – BOTTOM TRACE AND PADS
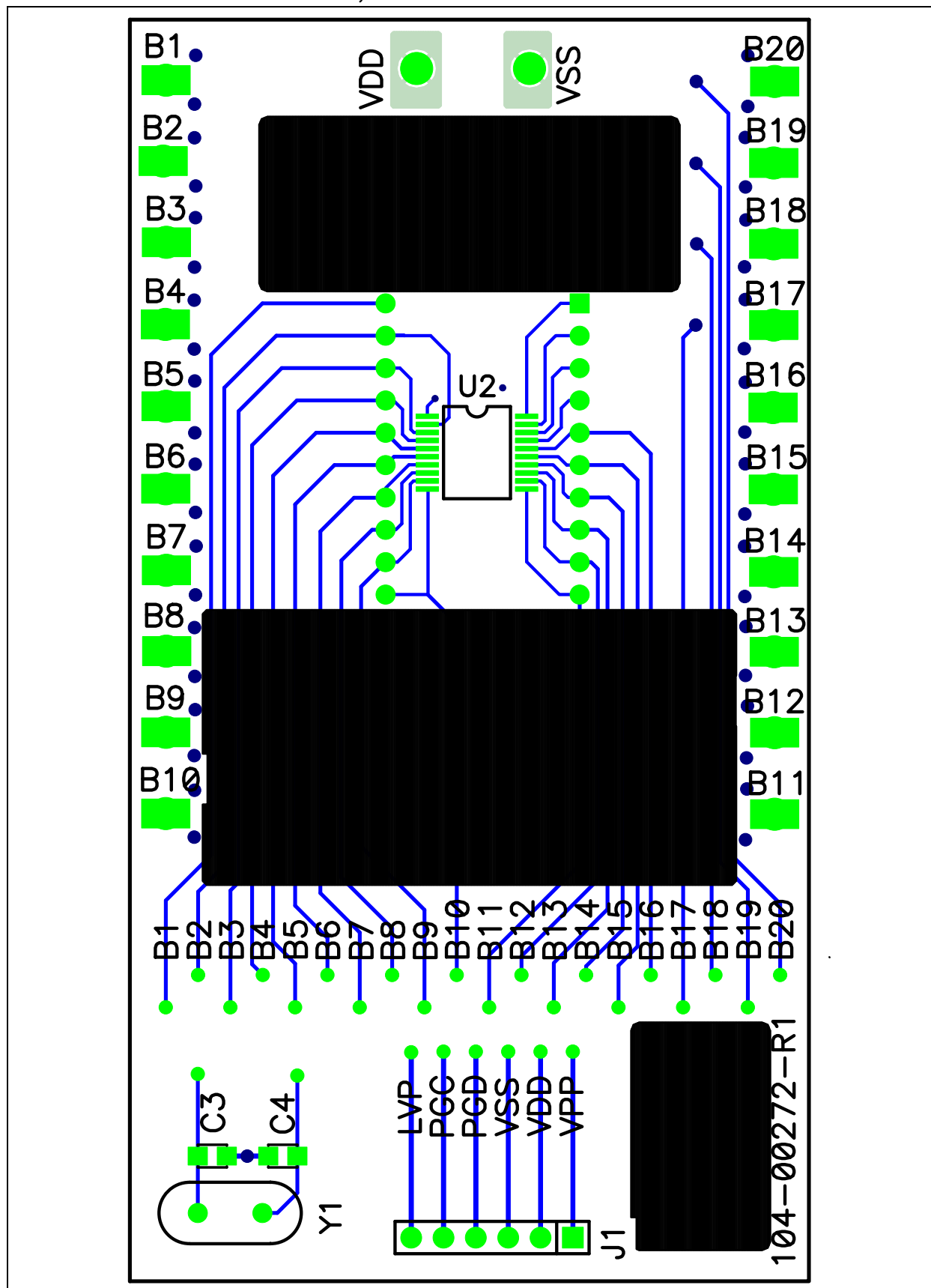
A.6 BOARD – LAYER 2 GROUND PLANE

GND PLANE

A.7   BOARD – LAYER 3 POWER PLANE

VDD PLANE
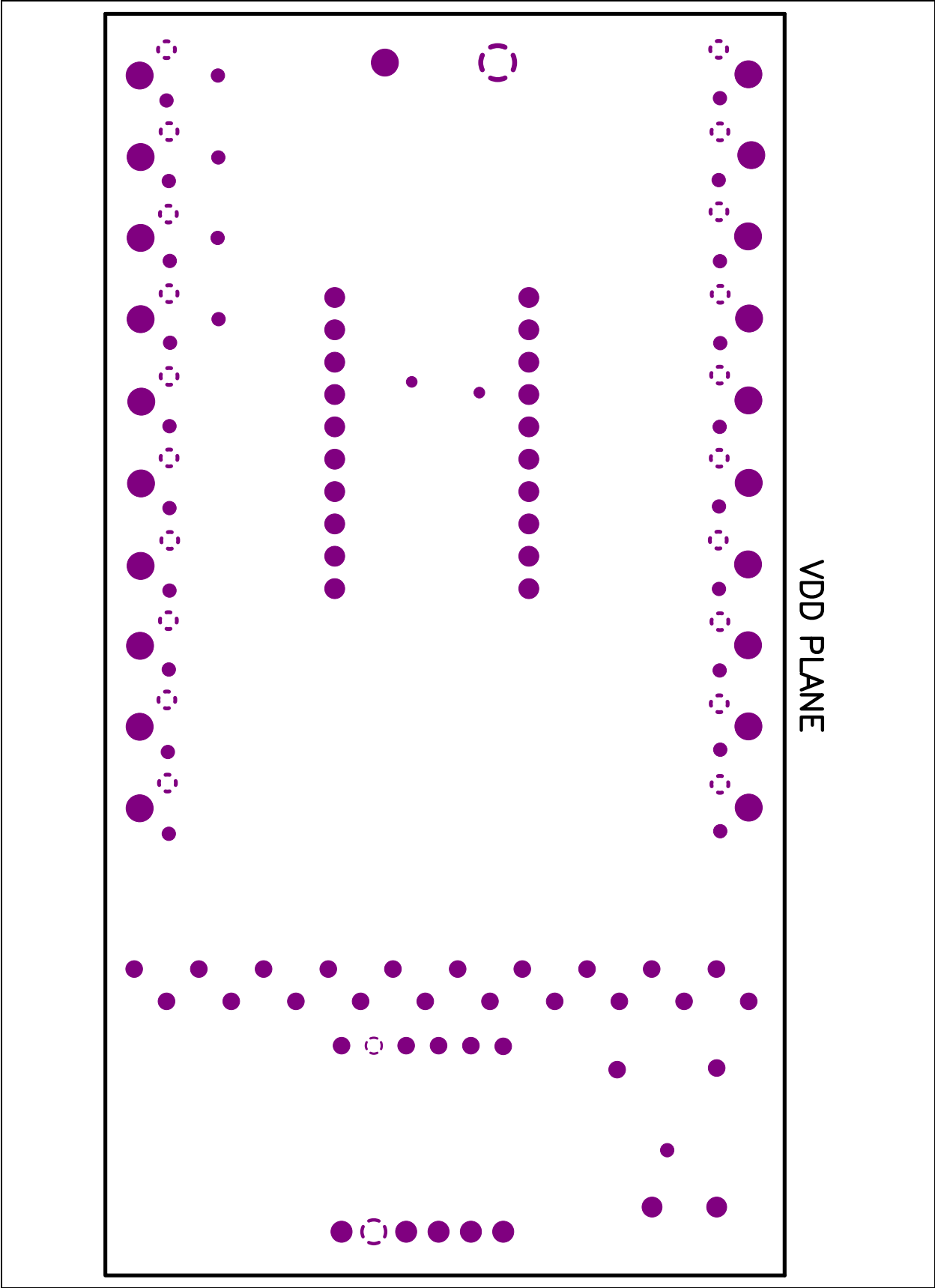
A.8   BOARD LAYOUT – TOP COMPONENTS

A.9   BOARD – BOTTOM SILK, TRACE AND PADS

Appendix B. Bill of Materials (BOM)

TABLE B-1:   BILL OF MATERIALS

Qty	Reference	Description	Manufacturer	Part Number
1	J1	CONN HEADER 6POS .100 R/A TIN	Molex/Waldom Electronics Corp	22-05-2061
2	P9, P12	TEST POINT PC MULTI PURPOSE THROUGH HOLE (Orange)	Keystone Electronics	5013
1	PCB	**Note 1**	Microchip Technology Inc.	104-00295
2	R14U, R15U	RES 10K OHM 1/8W 5% 0805 SMD	Panasonic – ECG	ERJ-6GEYJ103V
4	R7D, R11U R13D, R17U	RES 0.0 OHM 1/8W 5% 0805 SMD	Panasonic – ECG	ERJ-6GEY0R00V
1	U3	MCP4261 10 K OHM Digital Potentiometer device Device bottom aligned in U3 footprint (See Assembly Drawing)	Microchip Technology Inc.	MCP4261-103E/ST

Note 1:   This assembly uses RoHS Compliant TSSOP-20 to DIP-20 Evaluation Board.

2:   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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Fax: 86-23-8980-9500

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Fax: 852-2401-3431

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Fax: 86-25-8473-2470

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Fax: 86-532-8502-7205

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Fax: 86-21-5407-5066

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Fax: 86-24-2334-2393

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Fax: 86-755-8203-1760

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Fax: 86-29-8833-7256

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Fax: 86-592-2388130

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