Voltage Supervisor SOT-23-5/6 Evaluation Board User's Guide

MICROCHIP

Note the following details of the code protection feature on Microchip devices:

- Microchip products meet the specification contained in their particular Microchip Data Sheet.

- Microchip believes that its family of products is one of the most secure families of its kind on the market today, when used in the intended manner and under normal conditions.

- There are dishonest and possibly illegal methods used to breach the code protection feature. All of these methods, to our knowledge, require using the Microchip products in a manner outside the operating specifications contained in Microchip's Data Sheets. Most likely, the person doing so is engaged in theft of intellectual property.

- Microchip is willing to work with the customer who is concerned about the integrity of their code.

- Neither Microchip nor any other semiconductor manufacturer can guarantee the security of their code. Code protection does not mean that we are guaranteeing the product as "unbreakable."

Code protection is constantly evolving. We at Microchip are committed to continuously improving the code protection features of our products. Attempts to break Microchip's code protection feature may be a violation of the Digital Millennium Copyright Act. If such acts allow unauthorized access to your software or other copyrighted work, you may have a right to sue for relief under that Act.

Trademarks

The Microchip name and logo, the Microchip logo, Accuron, dsPIC, KEELOQ, microID, MPLAB, PIC, PICmicro, PICSTART, PRO MATE, PowerSmart, rfPIC, and SmartShunt are registered trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.

AmpLab, FilterLab, Migratable Memory, MXDEV, MXLAB, PICMASTER, SEEVAL, SmartSensor and The Embedded Control Solutions Company are registered trademarks of Microchip Technology Incorporated in the U.S.A.

Analog-for-the-Digital Age, Application Maestro, dsPICDEM, dsPICDEM.net, dsPICworks, ECAN, ECONOMONITOR, FanSense, FlexROM, fuzzyLAB, In-Circuit Serial Programming, ICSP, ICEPIC, MPASM, MPLIB, MPLINK, MPSIM, PICkit, PICDEM, PICDEM.net, PICLAB, PICtail, PowerCal, PowerInfo, PowerMate, PowerTool, rfLAB, rfPICDEM, Select Mode, Smart Serial, SmartTel and Total Endurance are trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.

SQTP is a service mark of Microchip Technology Incorporated in the U.S.A.

All other trademarks mentioned herein are property of their respective companies.

© 2005, Microchip Technology Incorporated, Printed in the U.S.A., All Rights Reserved.

Printed on recycled paper.

QUALITY MANAGEMENT SYSTEM CERTIFIED BY DNV
ISO/TS 16949:2002

VOLTAGE SUPERVISOR SOT-23-5/6 EVALUATION BOARD USER'S GUIDE

Table of Contents

NOTES:

VOLTAGE SUPERVISOR SOT-23-5/6 EVALUATION BOARD USER'S GUIDE

Preface

INTRODUCTION

This chapter contains general information that will be useful to know before using the Voltage Supervisor SOT-23-5/6 Evaluation Board. Items discussed in this chapter include:

- Document Layout
- Recommended Reading
- The Microchip Web Site
- Customer Support

DOCUMENT LAYOUT

This document describes how to use the Voltage Supervisor SOT-23-5/6 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 Voltage Supervisor SOT-23-5/6 Evaluation Board.
- **Chapter 2: Voltage Supervisor SOT-23-5/6 Evaluation Board** – Includes instructions on how to get started with this evaluation board.
- **Appendix A: Schematic and Layouts** – Shows the schematic and layout diagrams for the Voltage Supervisor SOT-23-5/6 Evaluation Board.
- **Appendix B: Bill of Materials** – Lists the parts used to build the Voltage Supervisor SOT-23-5/6 Evaluation Board.
- **Appendix C: Microchip Analog SOT-23 Device Compatibility** – Explains how this board (PCB) may be used with other Microchip Analog devices in the SOT-23-5 or SOT-23-6 packages.
- **Appendix D: Revision History** – Lists the revision history of this document.

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...

RECOMMENDED READING

For more information regarding the voltage supervisor and voltage detector devices, the specific device data sheet is recommended reading. Table 1 shows the device and associated data sheet literature number. These documents can be downloaded from the Microchip web site at: www.microchip.com.

TABLE 1:   DEVICES AND DATA SHEET LITERATURE NUMBERS

Device	Literature #	Device	Literature #	Device	Literature #
MCP601	21314	**MCP6541**	21690	**TC52**	21430
MCP601R	21314	**MCP6541R**	21690	**TC53**	21432
MCP606	11177	**MCP6546**	21714	**TC54**	21434
MCP6001	21733	**MCP6546R**	21714	**TC105**	21349
MCP6001R	21733	**MCP3221**	21732	**TC77**	20092
MCP6001U	21733	**MCP9800**	21909	**MCP603**	21314
MCP6231	21881	**MCP9802**	21909	**TC1035**	21343
MCP6231R	21881	**MCP4024**	21916	**MCP4022**	21916
MCP6231U	21881	**TC1014**	21335	**MCP4023**	21916
MCP6241	21882	**TC1015**	21335	**MCP73826**	21705
MCP6241R	21882	**TC1017**	21813	**PIC10F200**	41239
MCP6241U	21882	**TC1054**	21350	**PIC10F202**	41239
MCP1316	TBD	**TC1055**	21350	**PIC10F204**	41239
MCP1317	TBD	**TC1070**	21353	**PIC10F206**	41239
MCP1318	TBD	**TC1071**	21353	**TC1185**	21350
MCP1319	TBD	**TC1034**	21343	**TC1186**	21353
MCP1320	TBD	**TC1037**	21344	**TC1187**	21368
MCP1321	TBD	**TC1038**	21344	**TC1223**	21368
MCP1322	TBD	**TC1039**	21344	**TC1224**	21368
TC2014	21662	**TC2054**	21663	**TC2185**	21662
TC2015	21662	**TC2055**	21663	**TC2186**	21663

Note 1:   These devices are expected to be released shortly. Please contact Microchip Technology Inc. marketing for additional information.

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 (FAQ), 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 (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

REVISION HISTORY

Revision A (January 2005)

- Initial Release of this Document.

NOTES:

Chapter 1. Product Overview

1.1 INTRODUCTION

This chapter provides an overview of the Voltage Supervisor SOT-23-5/6 Evaluation Board and covers the following topics:

- What is the Voltage Supervisor SOT-23-5/6 Evaluation Board?
- What the Voltage Supervisor SOT-23-5/6 Evaluation Board kit includes

1.2 WHAT IS THE VOLTAGE SUPERVISOR SOT-23-5/6 EVALUATION BOARD?

The Voltage Supervisor SOT-23-5/6 Evaluation Board allows the system designer to quickly evaluate the operation of Microchip Technology's Voltage Supervisors and Voltage Detectors in the SOT-23-5 (5-pin SOT-23) or SOT-23-6 (6-pin SOT-23) packages.

The Voltage Supervisor SOT-23-5/6 Evaluation Board Printed Circuit Board (PCB) supports the four different SOT-23-6 pinouts (which also supports compatible SOT-23-5 footprints) and one SOT-23-5 footprint.

This board has been made generic so that other devices in the SOT-23-5 and SOT-23-6 packages may be supported with this board. Microchip device families supported by this PCB include:

- Voltage supervisors/voltage detectors
- Nonvolatile Digital Potentiometers (Digi-Pots)
- Operational Amplifiers (Op Amps)
- Comparators
- Low Drop-out Regulators (LDOs)
- Thermal sensors
- A/D Converters (ADCs)
- PFM/PWM step-down DC/DC controllers
- Battery charger controllers
- PICmicro® microcontrollers

1.3 WHAT THE VOLTAGE SUPERVISOR SOT-23-5/6 EVALUATION BOARD KIT INCLUDES

This Voltage Supervisor SOT-23-5/6 Evaluation Board Kit includes:

- Five Voltage Supervisor SOT-23-5/6 Evaluation Board PCBs
- Three Voltage Supervisor device samples that can be installed on the Voltage Supervisor SOT-23-5/6 Evaluation Board PCBs
- Voltage Supervisor SOT-23-5/6 Evaluation Board user's guide (Electronic version on CD)

NOTES:

Chapter 2. Voltage Supervisor SOT-23-5/6 Evaluation Board

2.1   INTRODUCTION

The blank Printed Circuit Board (PCB) allows the desired voltage supervisor/voltage detector device to be installed along with other desired passive components (resistors and capacitors) and connection posts.

The PCB supports four different SOT-23-6 and one SOT-23-5 pinouts. Two of these pinouts are used by the voltage supervisor/voltage detector product family, while the other pinouts are used by other Microchip analog and PICmicro® microcontroller products (see **Appendix C. "Microchip SOT-23-5/6 Device Compatibility"**). The PIC10F2XX devices uses the last pinout. This board is generic so that other devices may be supported. However, the silk-screen markings are designed for ease-of-use with the voltage supervisor devices.

2.2   FEATURES

The Voltage Supervisor SOT-23-5/6 Evaluation Board has the following features:

- Connection terminals may be either through-hole or surface-mount
- Four SOT-23-6 pinouts supported
    - Also supports V_{DD}/V_{SS} footprint-compatible SOT-23-5 devices
- One SOT-23-5 pinout supported
- Footprints for optional passive components for:
    - Power supply filtering
    - Device bypass capacitor
    - Output filtering
    - Output pull-up resistor
    - Output pull-down resistor
    - Output loading resistor
    - Output series resistor
- Footprints for two optional switches for:
    - Voltage supervisor manual resets
    - PIC10F2XX general purpose inputs
- Silk-screen area to write specifics of implemented circuit (on back of PCB), such as TC52 2.7V, 10 kΩ (to indicate that the device is the TC52 with the 2.7V trip point and an external 10 kΩ pull-up resistor on the output)

2.3   GETTING STARTED

The Voltage Supervisor SOT-23-5/6 Evaluation Board is a blank PCB that allows the user to configure the circuit to their exact requirements. The passive components use the surface-mount 805 package layout. Figure 2-1 shows the board circuit.

This evaluation board supports the following Microchip device families:

- Voltage supervisors/voltage detectors
- Nonvolatile Digital Potentiometers (Digi-Pots)
- Operational Amplifiers (Op Amps)
- Comparators
- Low Drop-Out Regulators (LDOs)
- Thermal sensors
- A/D Converters (ADCs)
- PFM/PWM step-down DC/DC controllers
- Battery charger controllers
- PICmicro microcontrollers

Table 2-1 shows these product families, the device(s) that are supported and which SOT-23-5/6 layout option to use. Devices that are in a 5-pin SOT-23 package can be installed into the SOT-23-6 footprint.

Table 2-2 shows which circuit option needs to be used for a given voltage supervisor/voltage detector. There are currently no voltage supervisors/voltage detectors that use the option B, C or E pinout. For other Microchip analog devices, please refer to **Appendix C. "Microchip SOT-23-5/6 Device Compatibility"**.

FIGURE 2-1: VOLTAGE SUPERVISOR SOT-23-5/6 EVALUATION BOARD CIRCUIT
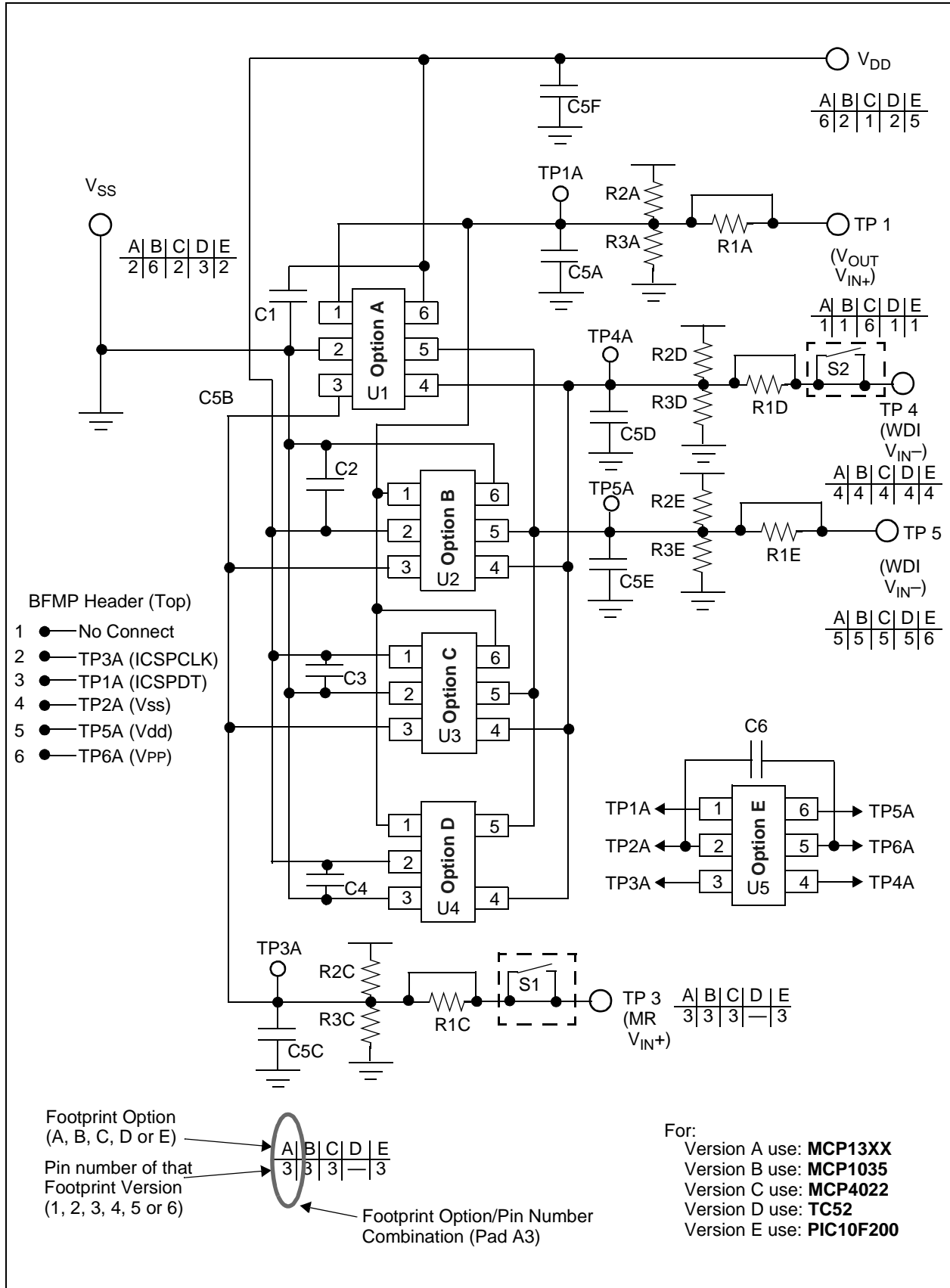
TABLE 2-1:   SUPPORTED SOT-23-5 AND SOT-23-6 DEVICES

Family	Device	Option	# of Pins
Voltage Supervisors/Detectors	TC52	D	5
	TC53C	D	5
	TC53N	D	5
	TC54	D	5
	MCP13XX [1]	A	5
Digital Potentiometers (Digi-Pots) – Nonvolatile	MCP4022 [1]	C	6
	MCP4023 [1]	C	6
	MCP4024 [1]	C	5
Operational Amplifiers (Op Amps)	MCP601	A	5
	MCP601R	B	5
	MCP603	A	6
	MCP606	A	5
	MCP6001	A	5
	MCP6001R	B	5
	MCP6001U	A	5
	MCP6231	A	5
	MCP6231R	B	5
	MCP6231U	A	5
	MCP6241	A	5
	MCP6241R	B	5
	MCP6241U	A	5
	TC1034	B	5
	TC1035	B	6
Comparators	MCP6541	A	5
	MCP6541R	B	5
	MCP6546	A	5
	MCP6546R	B	5
	TC1037	A	5
	TC1038	A	6
	TC1039	A	6
Thermal Sensors	MCP9800	C	5
	MCP9802	C	5
	TC77	A	5
A/D Converter (ADC)	MCP3221	C	5
PICmicro® Microcontrollers	PIC10F200	E	6
	PIC10F202	E	6
	PIC10F204	E	6
	PIC10F206	E	6

Note 1:   These devices are expected to be released shortly. Please contact Microchip Technology Inc. marketing for additional information.

TABLE 2-1: SUPPORTED SOT-23-5 AND SOT-23-6 DEVICES (CONTINUED)

Family	Device	Option	# of Pins
Low Drop-Out Regulators (LDOs)	TC1014	C	5
	TC1015	C	5
	TC1017	C	5
	TC1054	C	5
	TC1055	C	5
	TC1070	C	5
	TC1071	C	5
	TC1185	C	5
	TC1186	C	5
	TC1187	C	5
	TC1223	C	5
	TC1224	C	5
	TC2014	C	5
	TC2015	C	5
	TC2054	C	5
	TC2055	C	5
	TC2185	C	5
	TC2186	C	5
PFM/PWM Step-Down DC/DC Controller	TC105	D	5
Battery Charger Controller	MCP73826	E	6

Note 1: These devices are expected to be released shortly. Please contact Microchip Technology Inc. marketing for additional information.

TABLE 2-2: **VOLTAGE SUPERVISOR / VOLTAGE DETECTOR DEVICES AND EVALUATION BOARD CIRCUIT/FOOTPRINT OPTION**

Device	Supported on	Output Signal (Active State)	Output Type	Comment/Recommended Component Values
MCP1316 [1]	Option A	$\overline{RST}$ (L)	Push-Pull	
MCP1317 [1]	Option A	RST (H)	Push-Pull	
MCP1318 [1]	Option A	RST (H) and $\overline{RST}$ (L)	Push-Pull	
MCP1319 [1]	Option A	RST (H) and $\overline{RST}$ (L)	Push-Pull	
MCP1320 [1]	Option A	$\overline{RST}$ (L)	Open-Drain	R = TBD
MCP1321 [1]	Option A	RST (H) and $\overline{RST}$ (L)	Push-Pull and Open-Drain	R = TBD
MCP1322 [1]	Option A	RST (H) and $\overline{RST}$ (L)	Push-Pull and Open-Drain	R = TBD
TC52	Option D	$\overline{V_{OUT1}}$ (L), $\overline{V_{OUT2}}$ (L)	Open-Drain	C4 = 0.1 µF, R2A = 47 kΩ R2E = 47 kΩ, C1 = 1 µF
TC53C	Option D	$\overline{V_{OUT}}$ (L)	Push-Pull	
TC53N	Option D	$\overline{V_{OUT}}$ (L)	Open-Drain	R2A = 47 kΩ
TC54VC	Option D	$\overline{V_{OUT}}$ (L)	Push-Pull	
TC54VN	Option D	$\overline{V_{OUT}}$ (L)	Open-Drain	R2A = 47 kΩ

Note 1: These devices are planned future devices.
Please contact Microchip Technology Inc. marketing for additional information.

2.3.1 The Hardware

Figure 2-2 shows the layout of the Voltage Supervisor SOT-23-5/6 Evaluation Board. This is a small four-layer board (1.5" x 2" (38.1 mm x 50.8 mm)). There are six connection points/pads that can use either through-hole or surface-mount connector posts.

Additionally, a test point is available between the device pin and the PCB pad that may be useful if the in-line resistor (R1A, R1C, R1D or R1E) is installed.

The different SOT-23 layout options are outlined in **Section 2.4.3 "SOT-23-6 and SOT-23-5 Footprints"**, with Opt A, Opt B, Opt C, Opt D and Opt E indicating the layout option of that SOT-23-5/6 footprint.

There are six pads on the PCB. One is labeled VDD, one is labeled VSS, with all pads having a label that indicates the footprint option used (shown as "A B C D E") and a label underneath that indicates the pin number of that footprint. This footprint option/pin number combination will be used to indicate the remaining pads. If the device is placed in the option A footprint, the remaining pads would be A1, A3, A4 and A6, where the VDD pad is also A6 and the VSS pad is A2. Figure 2-2 has text added on each pad to show what the "pad name" would be (A1, A2, A3, A4, A5 and A6). If the device required the option C footprint, what is currently A1 for option A would then be referred to as pad C6 for option C.

Each of these four pads has four passive components associated with them. A pull-up resistor, a pull-down resistor, an in-line resistor and a filtering/load capacitor. The pull-up resistor is always R2x, the pull-down resistor is R3x, the in-line resistor is R1x and the filtering/load capacitor is C5x. The "x" is an alpha character that corresponds to a particular pad. So pad A1's pull-up resistor is R2A.

The green area of Figure 2-2 shows the silk screen on the bottom layer of the PCB. This is where the details of the implemented circuit can be written.

Resistor R2x is a pull-up resistor that may need to be installed for devices with an open-drain output. Though resistor R3x is not currently required, it was placed for possible future requirements. Resistor R1x is not required, but may be useful if this board is to be interfaced into existing circuits. If resistor R1x is to be installed, remember to cut the trace that "shorts out" R3. Capacitors C1, C2, C3, C4, C6, C5A, C5C, C5D, C5E and C5F are bypass capacitors that may be required to be installed, depending on the device selected and the system requirements (such as the noise present on the power supply). Table 2-3 describes the components.

FIGURE 2-2: **VOLTAGE SUPERVISOR SOT-23-5/6 EVALUATION BOARD LAYOUT WITH ADDED "PAD NAMES"**
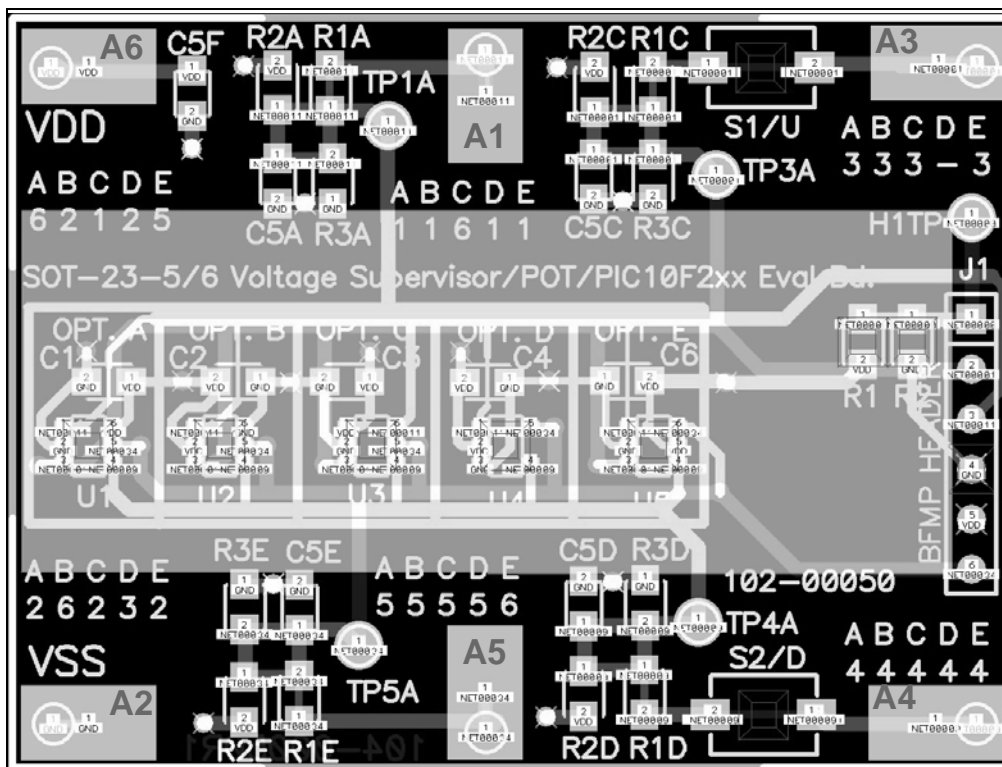

TABLE 2-3: **OPTIONAL PASSIVE COMPONENTS**

Device	Comment
C1, C2, C3, C4, C5, C5F, C6	Power supply bypass capacitor
C5A, C5C, C5D, C5E	Output filter capacitor
R1, R3A, R3C, R3D, R3E	Pull-up resistor
R2, R2A, R2C, R2D, R2E	Pull-down resistor
R1A, R1C, R1D, R1E	In-line resistance of device output
S1, S2	Switches

2.4   VOLTAGE SUPERVISOR SOT-23-5/6 EVALUATION BOARD DESCRIPTION

The Voltage Supervisor SOT-23-5/6 Evaluation Board PCB is designed to be flexible in the type of device evaluation that can be implemented.

The following sections describe each element of this evaluation board in further detail.

2.4.1   Power and Ground

The Voltage Supervisor SOT-23-5/6 Evaluation Board can have connection posts installed for the power (V_{DD}) and ground (V_{SS}) planes. The layout allows either through-hole or surface-mount connectors.

For device evaluation, the use of an external variable power supply or waveform generator is required. The type of equipment used will determine the evaluation that may be performed.

2.4.2   Pads A1, A3, A4 and A5 (for Footprint Option A)

The Voltage Supervisor SOT-23-5/6 Evaluation Board can have a connection post installed for the pads A1, A3, A4 and A5 signals. Depending on the device installed, this could be an input, output or bidirectional I/O signal. The layout allows either a through-hole connector or a surface mount connector.

For device evaluation, the use of an oscilloscope or Digital Voltmeter (DVM) is required. The type of equipment used will determine the evaluation that may be performed.

2.4.3 SOT-23-6 and SOT-23-5 Footprints

There are four SOT-23-6 and one SOT-23-5 pinout options that the Voltage Supervisor SOT-23-5/6 Evaluation Board PCB supports. Figure 2-3 shows these four pinouts. Figure 2-4 shows the single SOT-23-5 pinout option. Some devices may use different nomenclature for the pin names, such as GND instead of V_{SS}, V_{IN} instead of V_{DD} and RESET (or $\overline{\text{RESET}}$) or RST instead of V_{OUT}.

Other Microchip analog devices may be used with this PCB if the power and ground pins match one of these four options. **Appendix C. "Microchip SOT-23-5/6 Device Compatibility"** discusses other Microchip analog devices that may be used with this PCB.

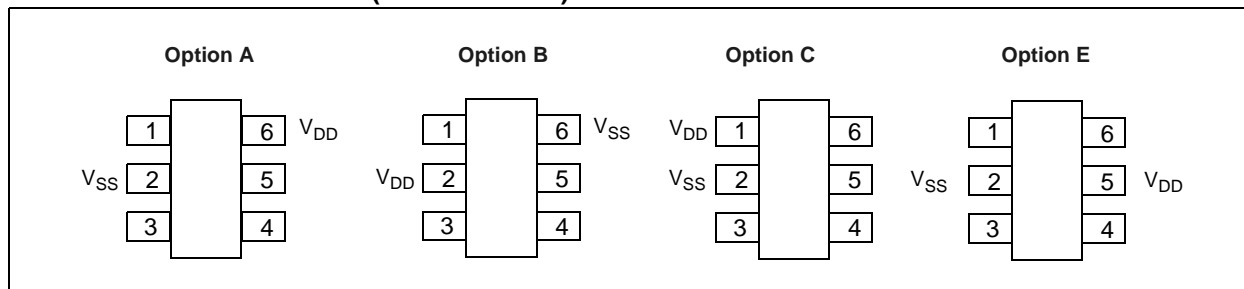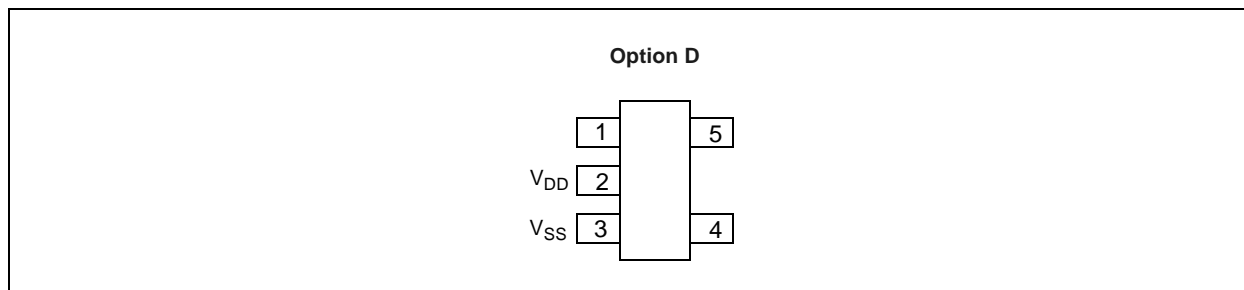**FIGURE 2-3:   SOT-23-6 (AND SOT-23-5) PINOUT OPTIONS**

FIGURE 2-4:   SOT-23-5 PINOUT OPTION

2.4.4 Passive Components (R1x, R2x, R3x, C5x, R1, R2, C1, C2, C3, C4 and C6)

The footprints for these components are present to allow maximum flexibility in the use of this PCB to evaluate a wide range of SOT-23-3 devices. The purpose of these components may vary depending on the device under evaluation and how it is to be used in the desired circuit. Please refer to the device data sheet for the recommended components that should be used when evaluating that device.

2.4.5 Switches (S1 and S2)

The footprints for these components are present to allow maximum flexibility in the use of this PCB to evaluate a wide range of SOT-23-5 and SOT-23-6 devices. The purpose of these components may vary depending on the device under evaluation and how it is to be used in the desired circuit. Please refer to the device data sheet for the recommended components that should be used when evaluating that device.

2.4.6 BFMP Interface (Header J1)

The Baseline Flash Microcontroller Programmer (BFMP) interface allows a PIC10F2XX device that is populated in the SOT-23-6 version E footprint to be programmed with programmers that support this interface, such as the BFMP programmer (part number PG164101).

2.5 VOLTAGE SUPERVISOR/VOLTAGE DETECTOR CIRCUITS

Currently, the voltage detectors/voltage supervisors only use footprint option D. There are some devices that will use footprint option A that are soon-to-be-released.

2.5.1 Option D Circuit

Using the TC53C or TC54VC, no passive components would be required and the device V_{OUT} could be monitored on the D1 pad.

Using the TC53N or TC54VN, an external pull-up resistor is required. This resistor would be installed in the R2A location and the device V_{OUT} could be monitored on the D1 pad.

The TC52 is a dual-channel voltage detector. This means that the device has a V_{OUT1} and a V_{OUT2} output. Both outputs are open-drain and require a pull-up resistor. Locations R2A and R2E should be installed with 47 kΩ resistors.

Detect voltage 2 (V_{OUT2}) is lower than detect voltage 1 (V_{OUT1}). Therefore, V_{OUT1} is typically used to indicate a low-power situation, with V_{OUT2} being used to reset the system. Typically, a 0.1 µF capacitor would be on the V_{OUT2} pin (installed in the C5E location).

Power supply filtering may be required, so a 0.1 µF capacitor is suggested in the C4 location.

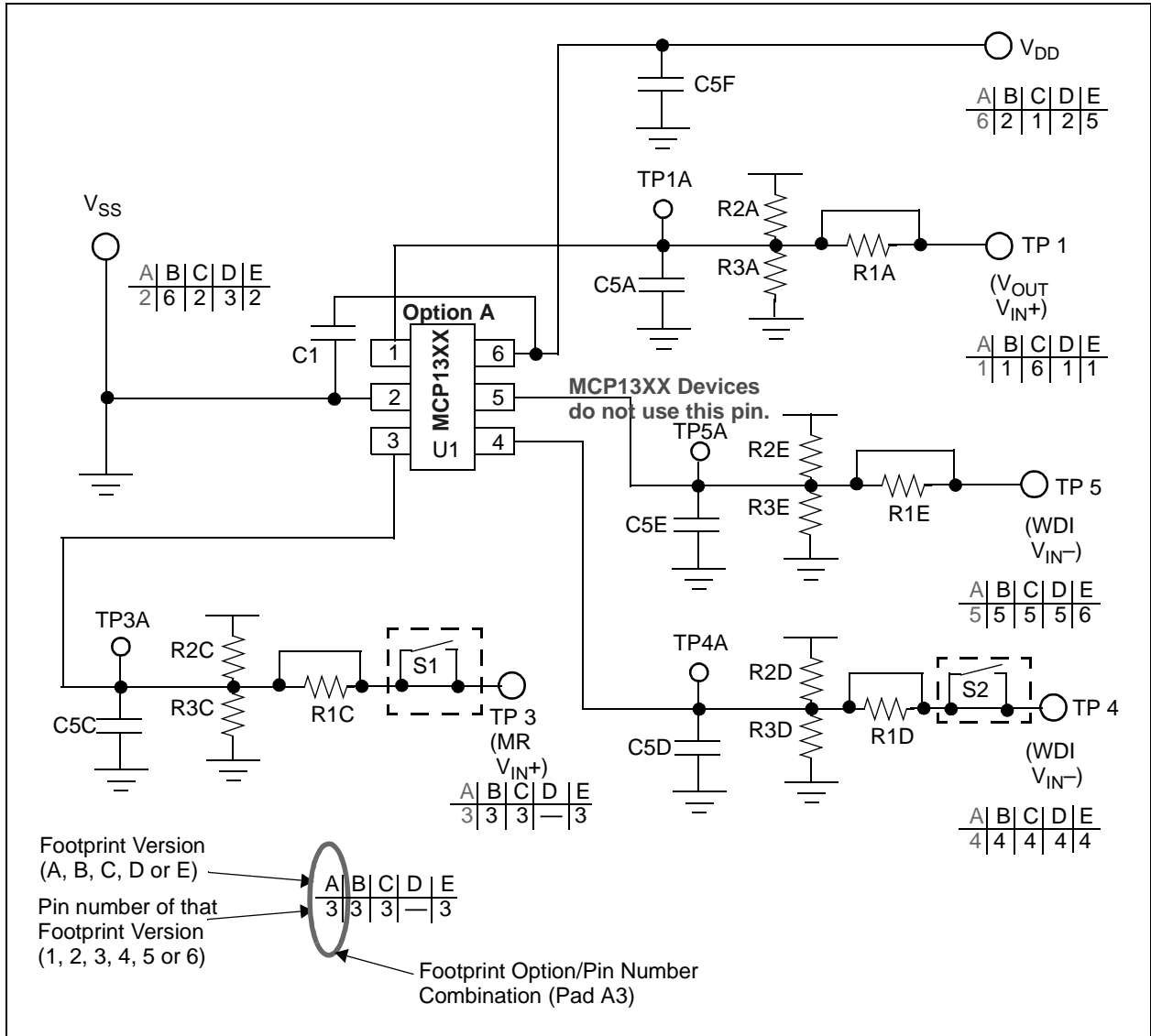**FIGURE 2-5:** **VOLTAGE SUPERVISOR CIRCUIT USING OPTION D FOOTPRINT**
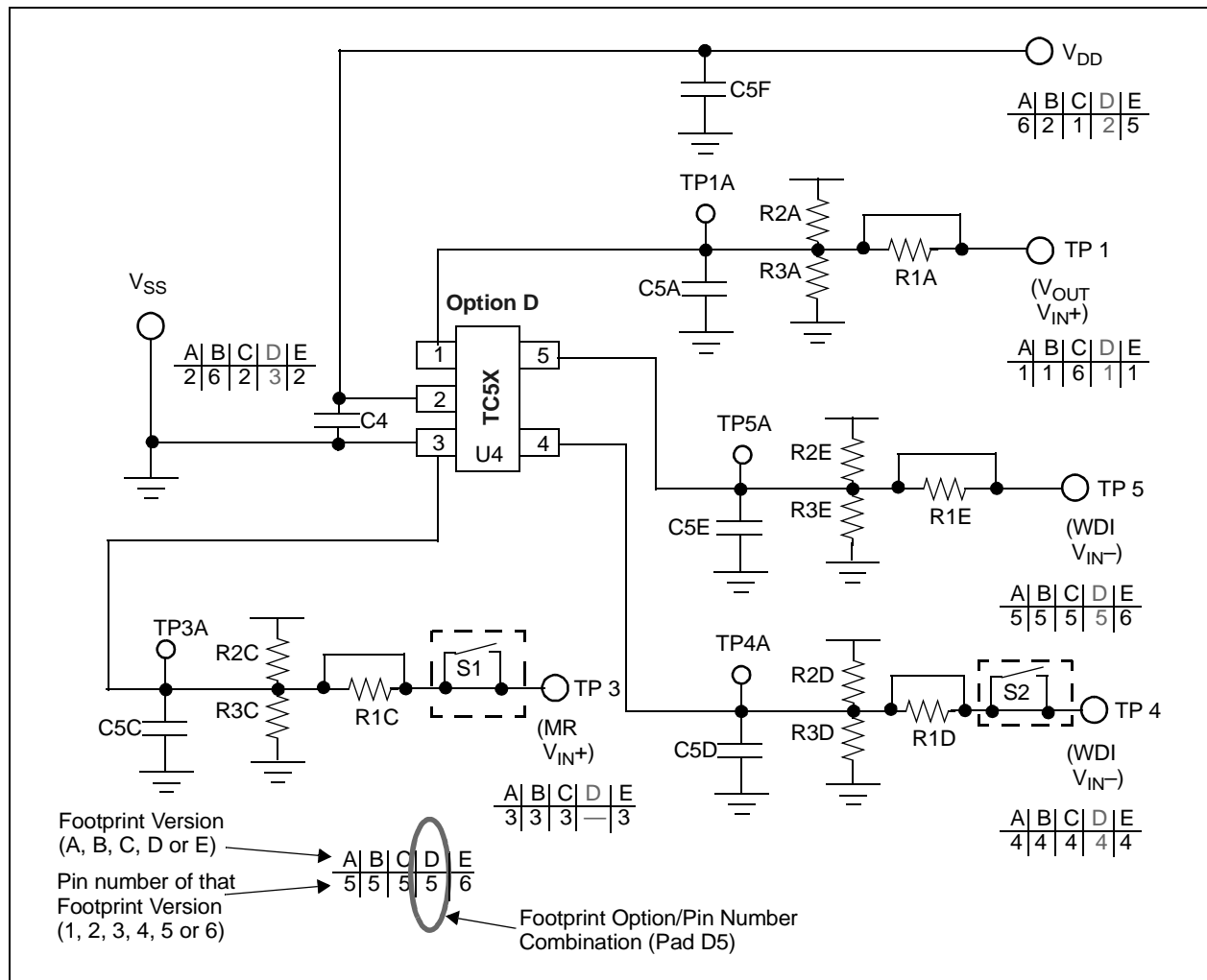
2.5.2 Option A Circuit

The MCP13XX devices are only in the SOT-23-5 (5-pin) package, therefore option A footprint pin 5 is not connected to the device. Once the device is released, please refer to the data sheet to determine your desired circuit.

**FIGURE 2-6:** **VOLTAGE SUPERVISOR CIRCUIT USING OPTION A FOOTPRINT**

2.5.3   A circuit with the PIC10F200 and a Voltage Supervisor (MCP13XX)

The PIC10F200 can be used to show the operation of the Watchdog Timer feature (WDI) or the Manual Reset ($\overline{\text{MR}}$) Inputs that are available on some of the MCP13XX devices.

Figure 2-7 shows the schematic to interface the appropriate MCP13XX device to the PIC10F200 to exercise the Watch Dog Timer (WDI) and Manual Reset ($\overline{\text{MR}}$) functionality of the device.

After the release of the MCP13xx devices, please check the Microchip web site for an application note or technical brief that will demonstrate one of the MCP13XX devices using the Voltage Supervisor SOT-23-5/6 Evaluation Board.

FIGURE 2-7:   MCP13XX AND A PIC10F200 CIRCUIT
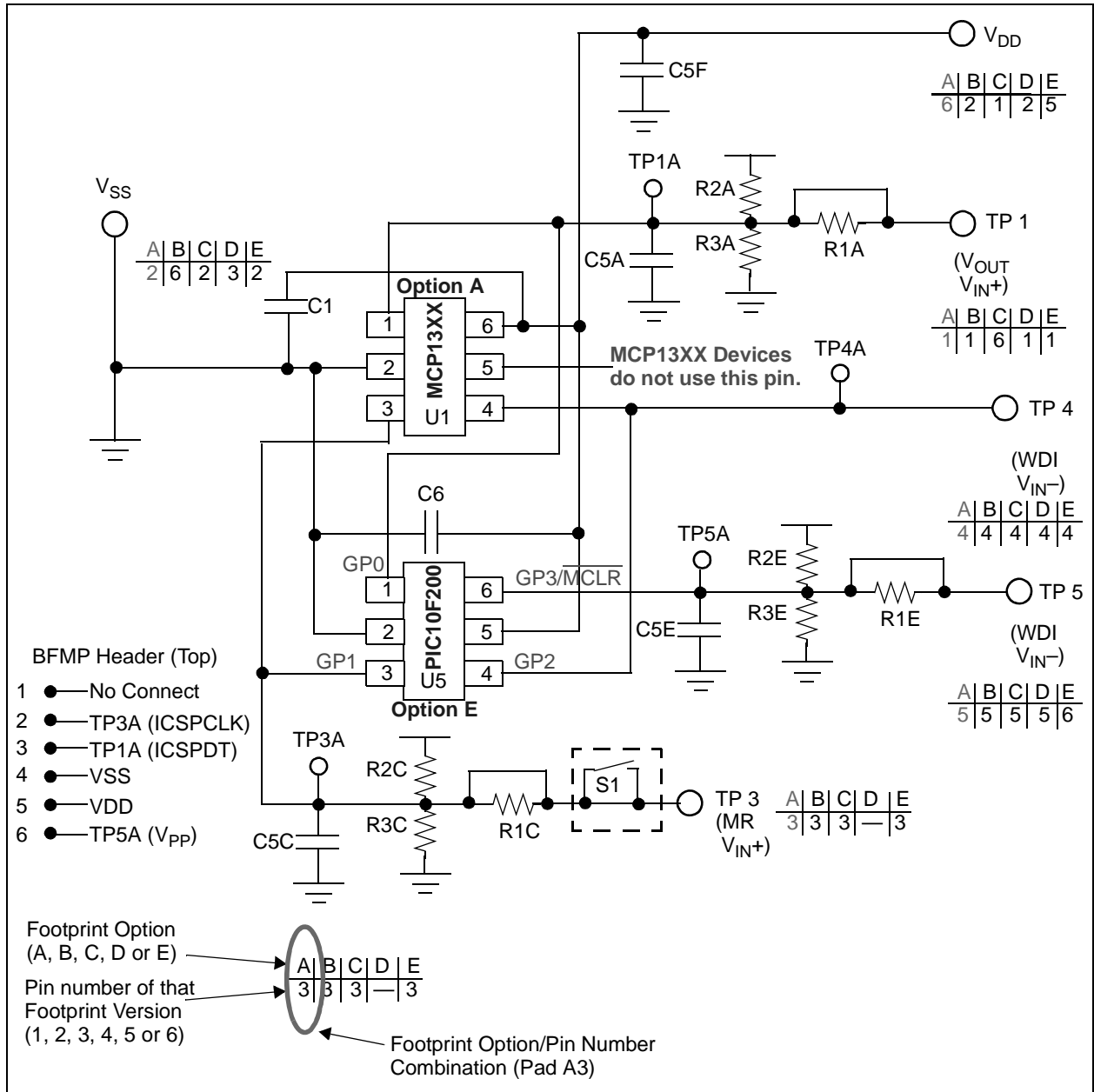
2.5.4 Evaluating a Voltage Supervisor or Voltage Detector Device

When evaluating a voltage supervisor/voltage detector device, a minimum set of test equipment should be available. Table 2-4 shows the recommended test equipment.

TABLE 2-4: TEST EQUIPMENT

Hardware	Connect to:	Comment
Variable Power Supply	VDD, VSS	This allows the voltage to the SOT23 Evaluation Board to be varied so the device output can be monitored.
Arbitrary Waveform Generator	VDD, VSS	This is like a variable power supply, but allows programmability into the input signal that the device will be subjected to. This also allows a particular waveform to be repeated (such as a 60 Hz sine wave that varies from 1V to 5V).
Digital Multi-Meter (D.M.M.)	V_{OUT} **(1)**	Used to indicate the output state (low or high) of the voltage supervisor/voltage detector.
Oscilloscope	V_{OUT} **(1)**	Allows the device conditions and response to be evaluated due to the ability to capture this information. This is useful for faster signals and cases where small spikes need to be detected.
Test Light (LED)	V_{OUT} **(1)**	Used to visually indicate the output state (low or high) of the voltage supervisor/voltage detector. Ensure that the current requirements of this LED can be supplied by the device's output pin.

Note 1: The pad connection to connect to the V_{OUT} or RST pin will be dependent on the device and the footprint option used.

A typical system that would be used to evaluate the voltage supervisor or voltage detector device is shown in Figure 2-8. This also shows an example input and output waveforms for a voltage supervisor or voltage detector device.

FIGURE 2-8: EVALUATION SYSTEM
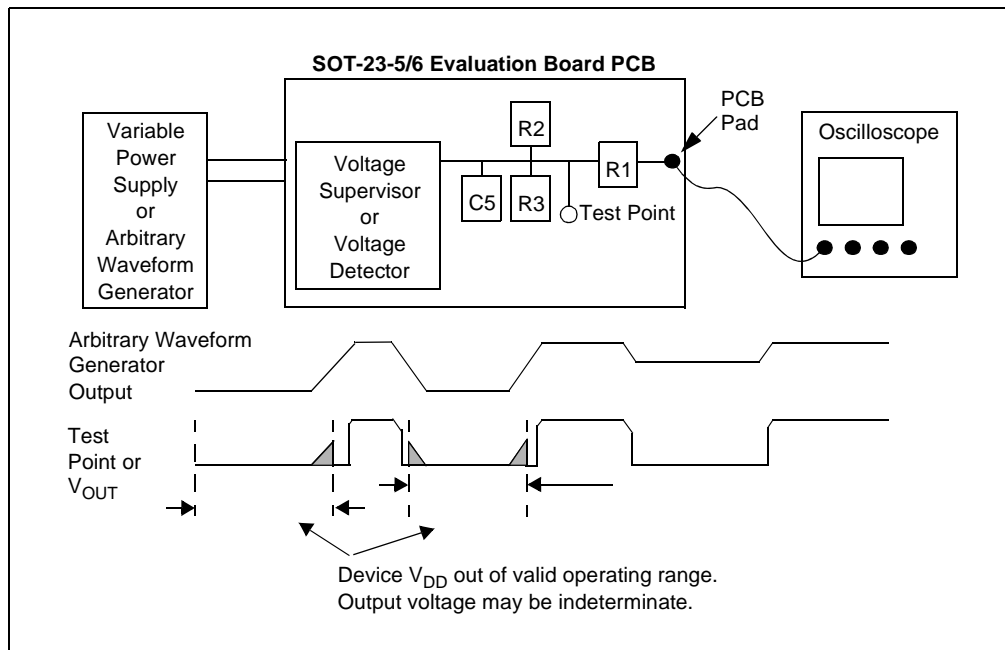
2.6   DIGITAL POTENTIOMETER CIRCUIT

The Voltage Supervisor SOT-23-5/6 Evaluation Board can be utilized to demonstrate and test Microchip's SOT-23-5 and SOT-23-6 nonvolatile digital potentiometers. This is accomplished by populating the PCB with the desired MCP402X device (the nonvolatile digital potentiometer), a PIC10F2XX Microcontroller, two momentary switches and a few resistors.

> **Note:**   Microchip Technology offers a built-up evaluation board for the MCP402X digital potentiometer (MCP402XEV) that uses the Voltage Supervisor SOT-23-5/6 Evaluation Board PCB. Additional information regarding this evaluation board may be found on the CD-ROM directory:
> `CD-ROM:\00052 - MCP402X SOT-23 Digital POT Eval Board`
> Within this directory you will find the user's guide for this evaluation board, the PIC10F200 program (firmware) and assembled hex file (`00052.R1.hex`).

Figure 2-9 illustrates the circuit of the MCP402X SOT-23 Digital POT Evaluation Board. This board uses the MCP4023 and PIC10F200 devices with all the components installed. The PCB silk-screen indicates the VDD and VSS pads. The remaining PCB pads will be referred to by their footprint option/pin number combination. These combinations are C3, C4, C5 and C6.

The PIC10F2XX will need to be programmed to make the system work. **Section 2.6.1 "PIC10F200 Firmware to Operate MCP4023"** discusses the program's (firmware) functionality. The current program (firmware) can operate any of the MCP402X devices.

FIGURE 2-9: **CIRCUIT UTILIZING THE MCP4023 DIGITAL POT AND THE PIC10F200 MICROCONTROLLER**
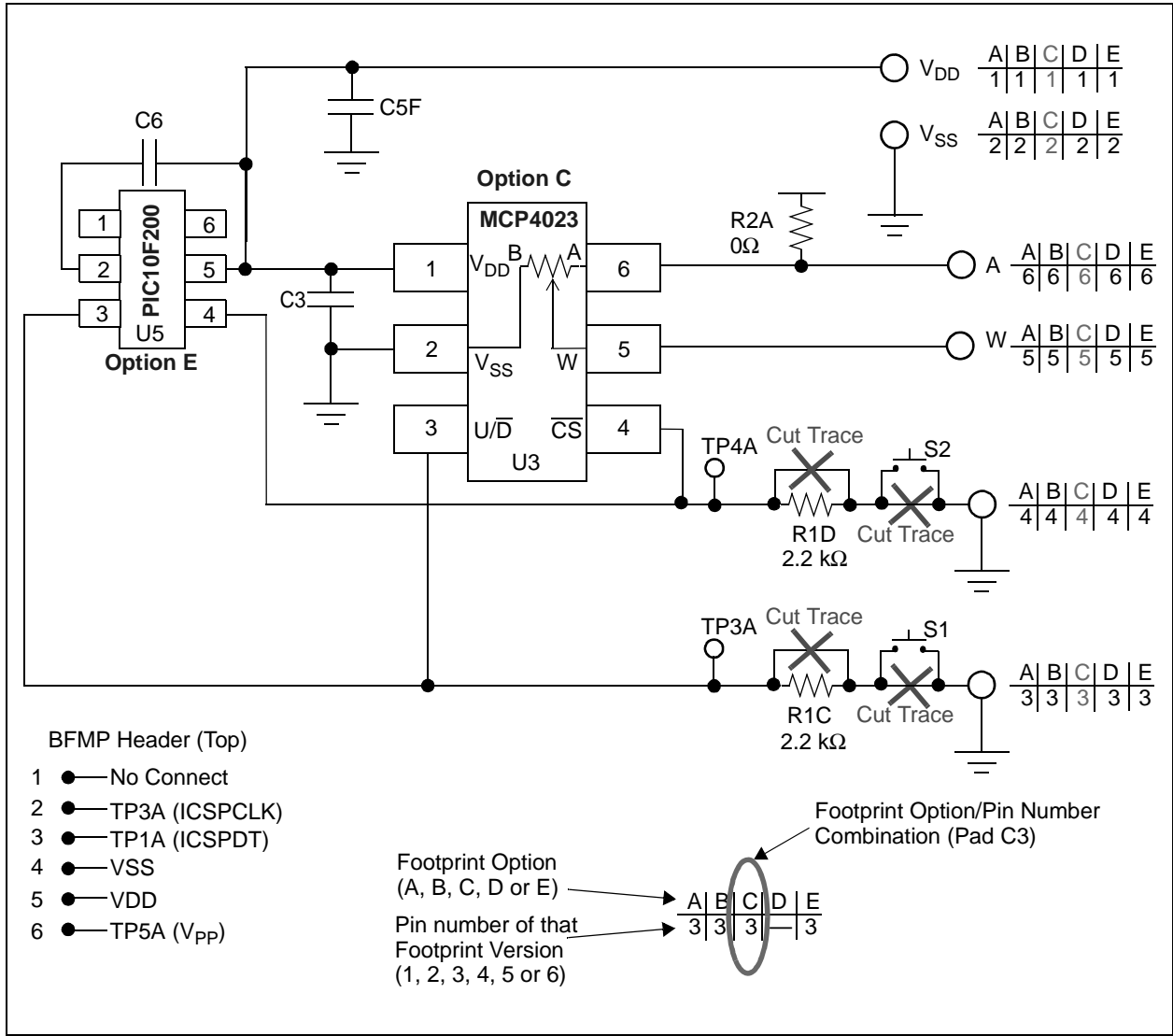
2.6.1   PIC10F200 Firmware to Operate MCP4023

> **Note:**   This firmware is available on the CD-ROM, located in the directory:
> `CD-ROM:\00052 - MCP402X SOT-23 Digital POT Eval`
> `Board\102-00052 source code`
>
> The executable has the filename: `00052.R1.hex`.
>
> The remainder of this section gives an overview of how to program the PIC10F200 and the operation of this circuit using the PIC10F200 program (firmware).

The PIC10F2XX device can be programmed via the Baseline Flash Microcontroller Programmer (BFMP) header (J1). The program (firmware) configures the GP1 and GP2 pins to be outputs (driving high) and the GP0 and GP3 pins to be inputs. The GP1 and GP2 pins are individually polled to determine if either switch S1/D (down) and S2/U (up) are depressed.

If the switch S1/D is depressed, the program (firmware) decrements the wiper value (wiper moves toward Terminal B) and stores the new setting in the nonvolatile memory (EEPROM). If the S1/D switch is depressed for more than 2 seconds, the wiper value is forced to Terminal B (64 wiper decrement with EE commands are executed).

If the switch S2/U is depressed, the program (firmware) increments the wiper value (wiper moves toward Terminal A) and stores the new setting in the nonvolatile memory (EEPROM). If the S2/U switch is depressed for more than 2 seconds, the wiper value is forced to Terminal A (64 wiper increment w/EE commands are executed).

Since the digital potentiometer setting is stored in nonvolatile memory, power can be cycled and the digital potentiometer will be at the last saved setting.

> **Note:**   The PIC10F2XX program (firmware) must take care in the timing requirements of the GP1 and GP2 pins, due to the multiplexing of the PIC10F2XX GP1 pin with the MCP4023 U/$\overline{\text{D}}$ pin and Switch S1, and the multiplexing of the PIC10F2XX GP2 pin with the MCP4023 CS pin and switch S2.
> After the release of the MCP402X nonvolatile digital potentiometer devices, look for an application note which will show a working program interfacing the PIC10F2XX to the MCP4023 using the Voltage Supervisor SOT-23-5/6 Evaluation Board.

NOTES:

Appendix A. Schematic and Layouts

A.1 INTRODUCTION

This appendix contains the schematics and layouts for the Voltage Supervisor SOT-23-5/6 Evaluation Board. Diagrams included in this appendix:
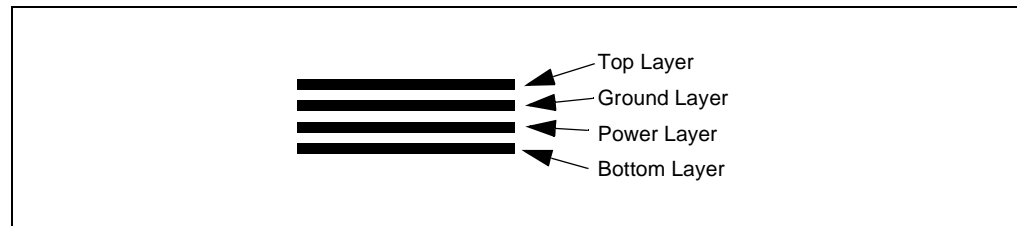
- Board Schematic - Digital Circuitry
- Board - Top Layer

A.2 SCHEMATICS AND PCB LAYOUT

Figure A-2 shows the schematic of the Voltage Supervisor SOT-23-5/6 Evaluation Board.

Figure A-3 shows the layout for the top layer of the Voltage Supervisor SOT-23-5/6 Evaluation Board. The layer order is shown in Figure A-1.

FIGURE A-1:   **LAYER ORDER**

FIGURE A-2: **VOLTAGE SUPERVISOR SOT-23-5/6 EVALUATION BOARD SCHEMATIC 1**
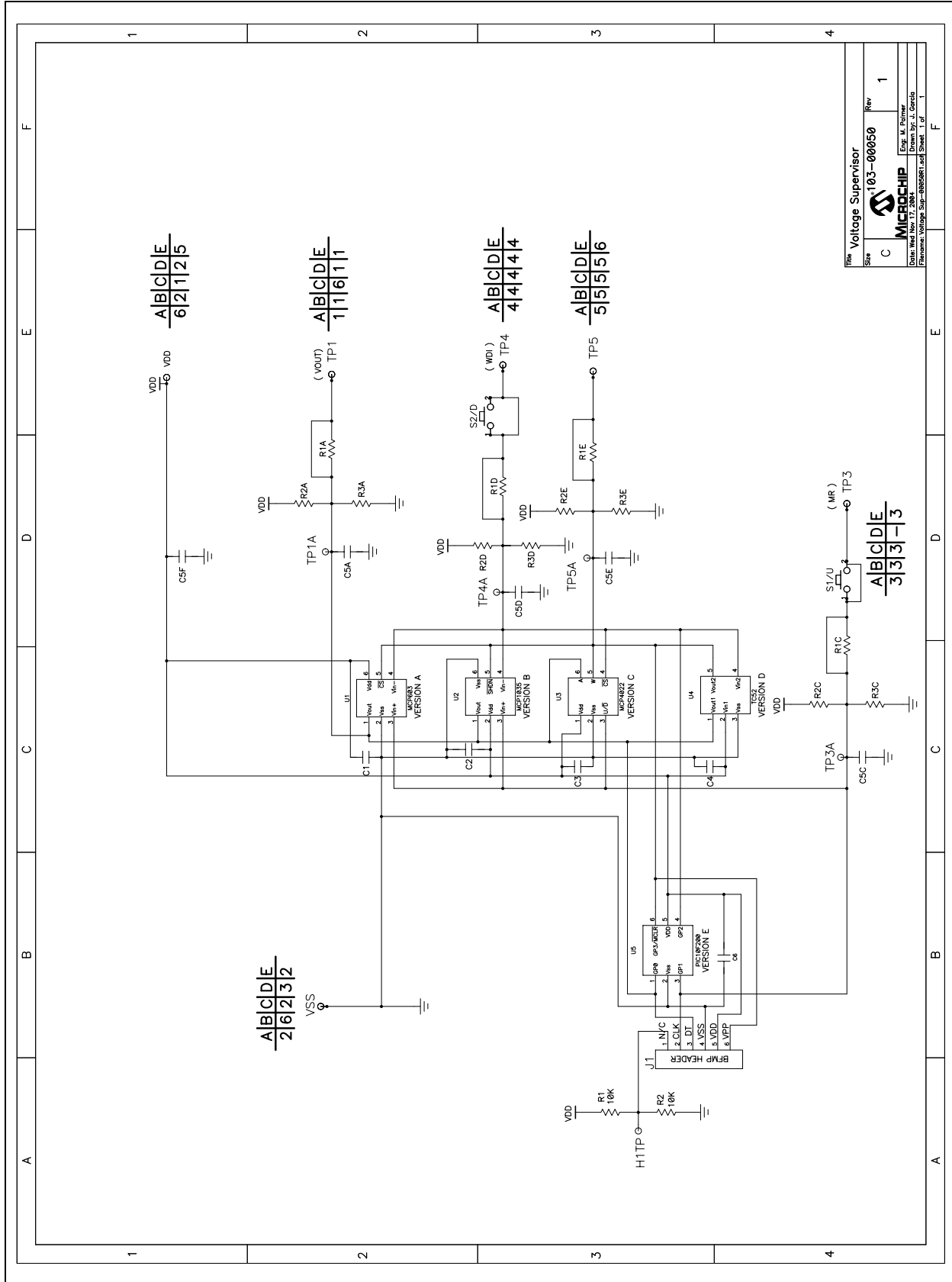
FIGURE A-3: **VOLTAGE SUPERVISOR SOT-23-5/6 EVALUATION BOARD LAYOUT - TOP LAYER + BOTTOM LAYER + SILK-SCREEN**
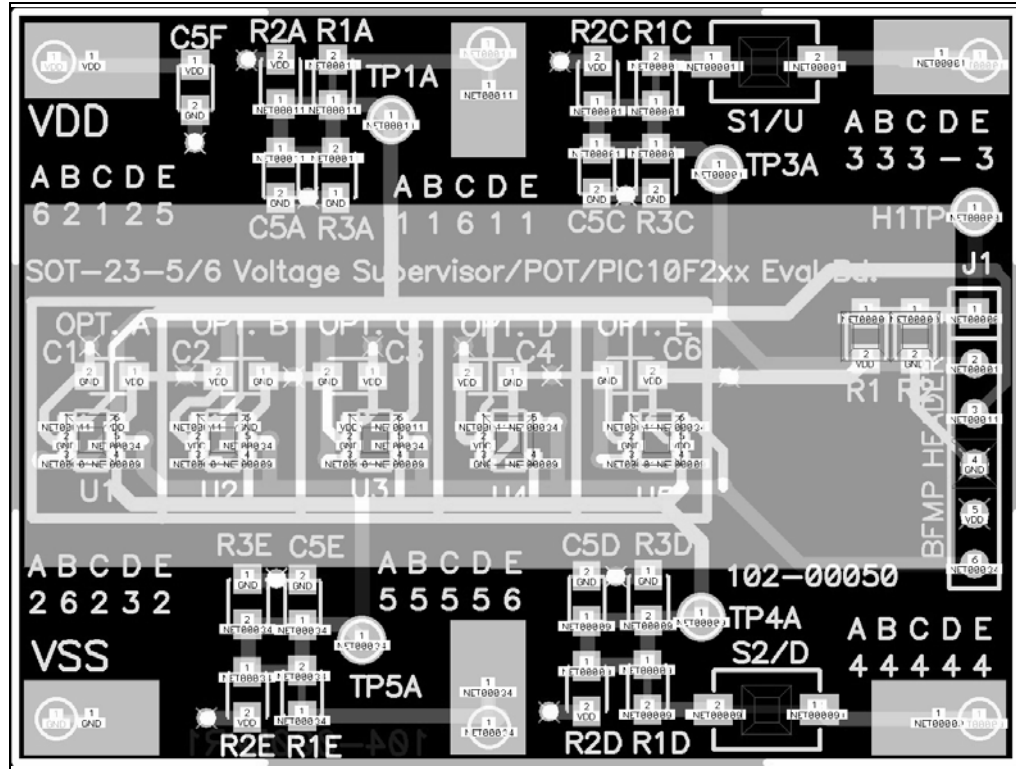
FIGURE A-4: **VOLTAGE SUPERVISOR SOT-23-5/6 EVALUATION BOARD GERBER – TOP LAYER + SILK-SCREEN**

**FIGURE A-5:   VOLTAGE SUPERVISOR SOT-23-5/6 EVALUATION BOARD GERBER –
                  BOTTOM LAYER**

FIGURE A-6: **VOLTAGE SUPERVISOR SOT-23-5/6 EVALUATION BOARD GERBER –
GROUND PLANE**

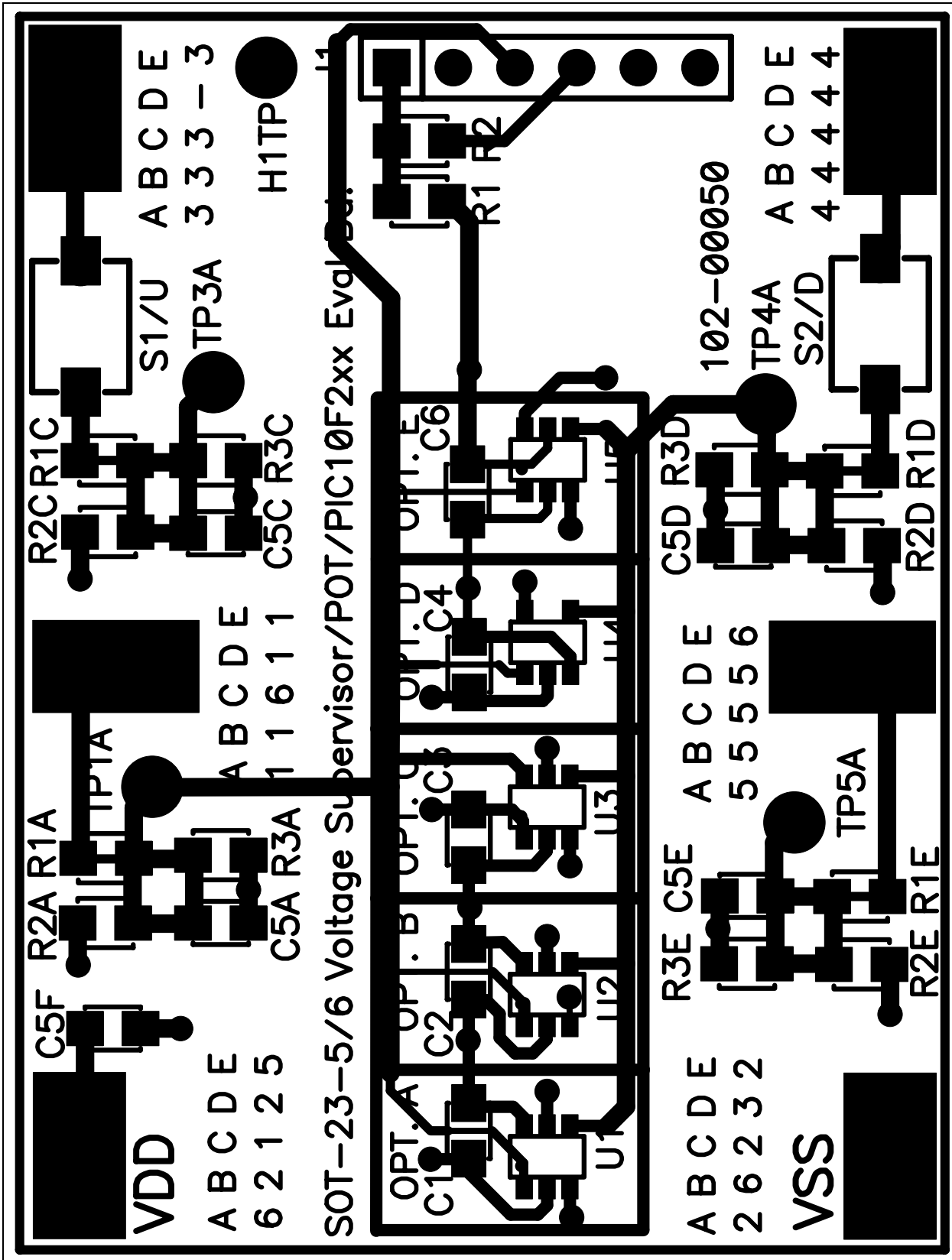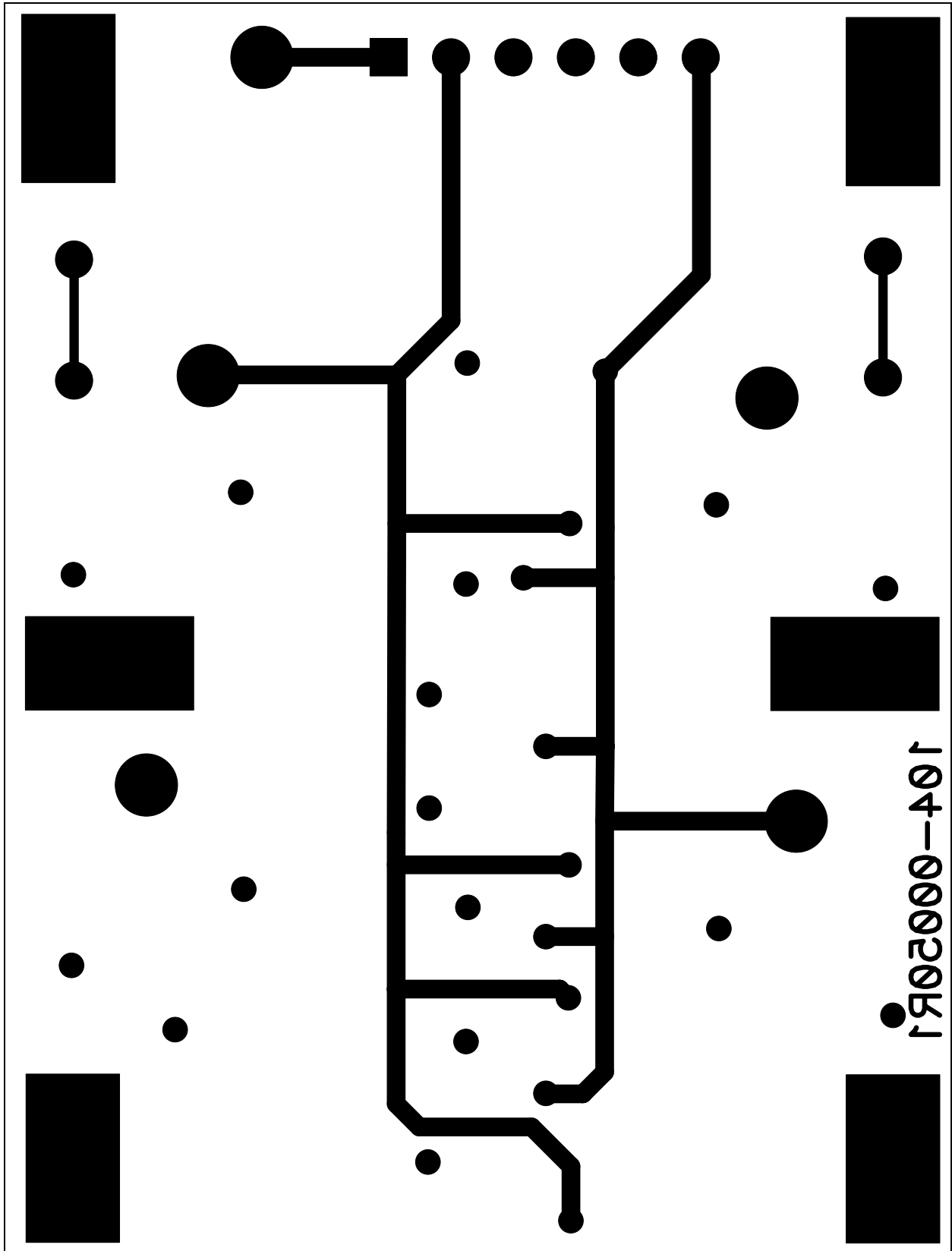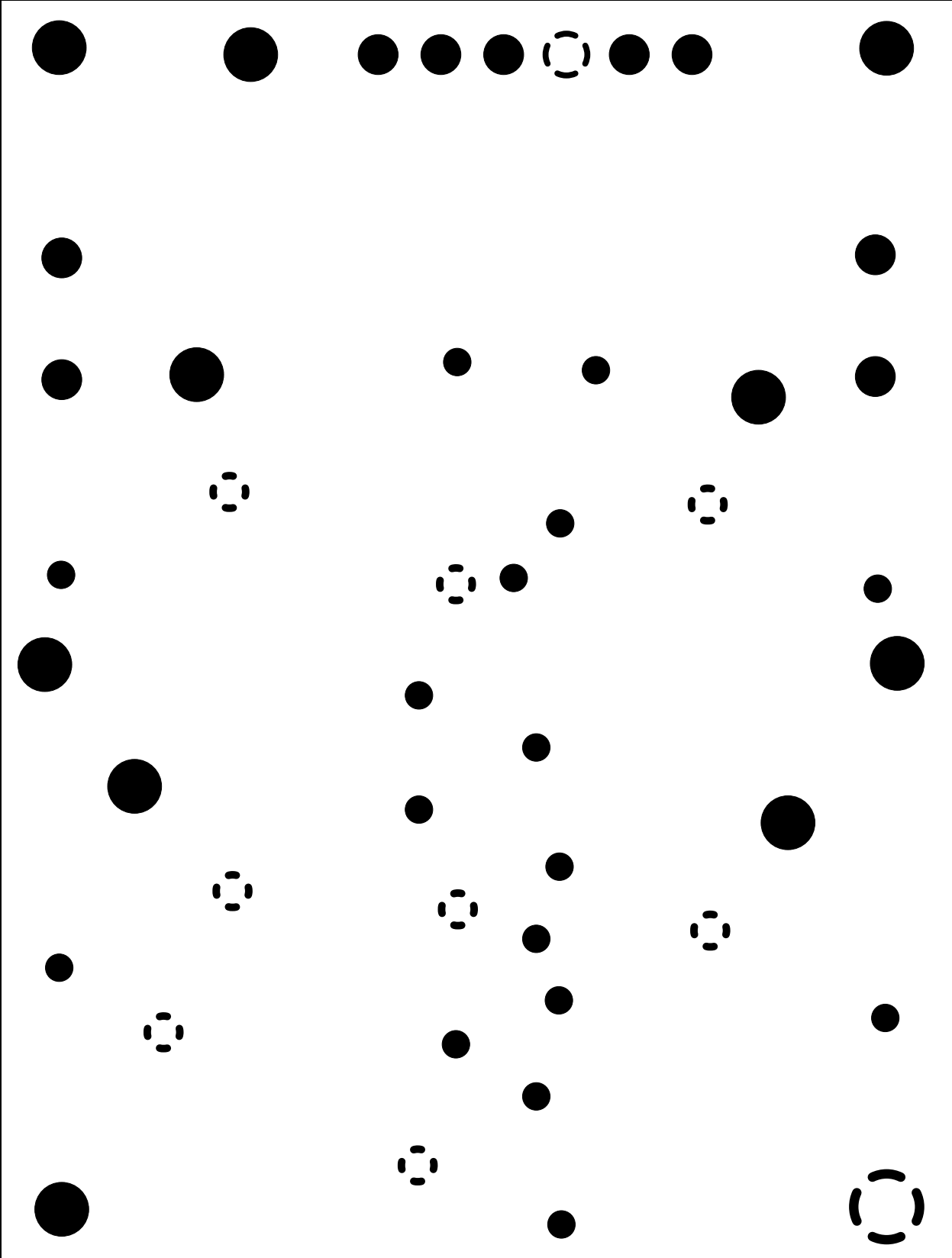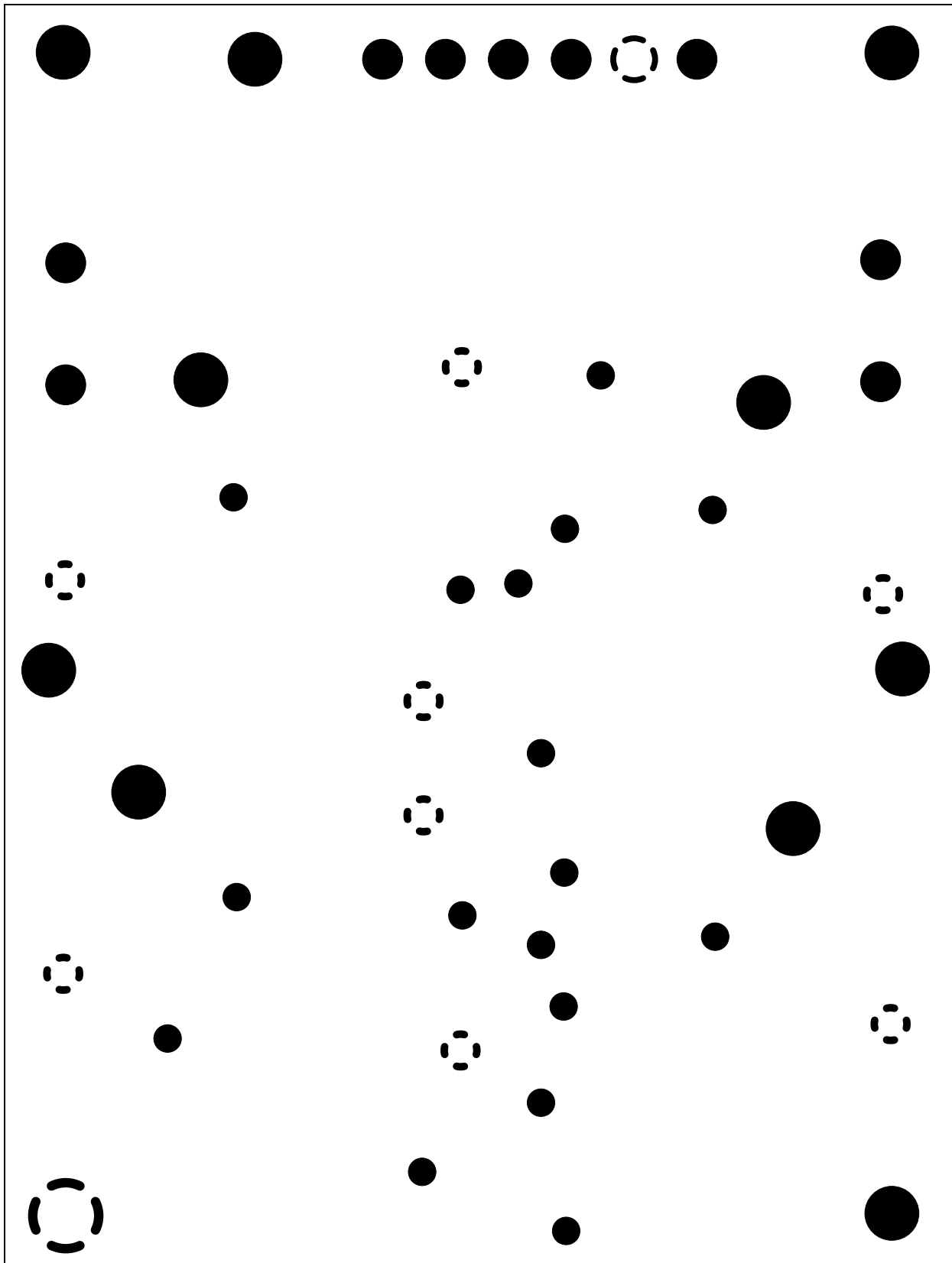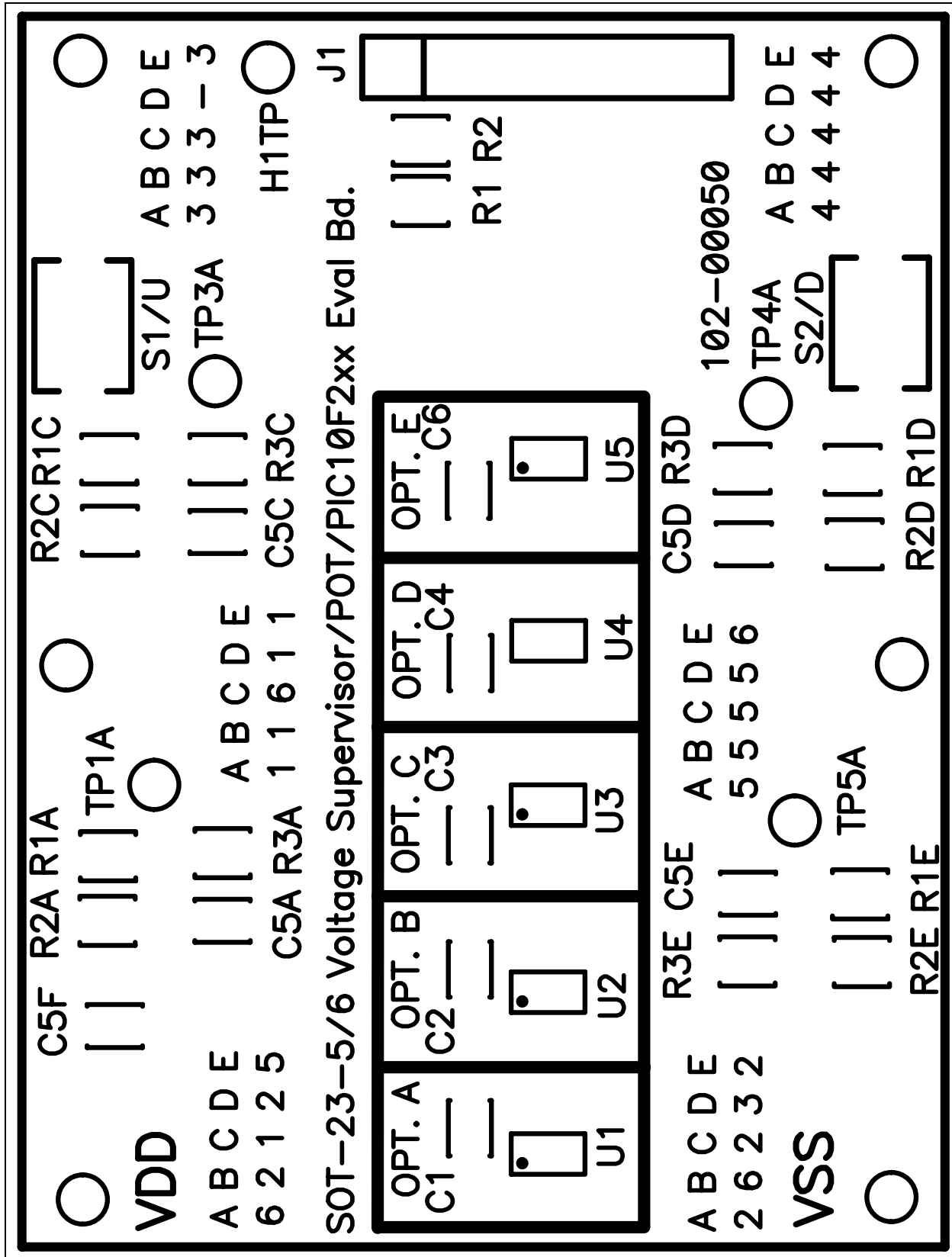**FIGURE A-7:** **VOLTAGE SUPERVISOR SOT-23-5/6 EVALUATION BOARD GERBER –**
POWER LAYER

FIGURE A-8: VOLTAGE SUPERVISOR SOT-23-5/6 EVALUATION BOARD GERBER – TOP COMPONENTS PLUS SILK

Appendix B. Bill of Materials (BOM)

TABLE B-1:   BILL OF MATERIALS

Qty	Reference	Description	Manufacturer	Part Number
1	PCB 103-00050	SOT23 Evaluation Board PCB	Microchip Technology Inc.	103-00050
0	U1, U2, U3, U5	SOT-23-6 Device (Only one of U1 - U5 installed per board)	Microchip Technology Inc.	User-specified
0	U4	SOT-23-5 Device (Only one of U1 - U5 installed per board)	Microchip Technology Inc.	User-specified
0	C1, C2, C3, C4, C6	Device Power Supply Bypass Capacitor Surface-mount (805 package) (Optional - Application-dependent)	—	User-specified
0	C5F	Power Supply Bypass Capacitor Surface-mount (805 package) (Optional - Application-dependent)	—	User-specified
0	C5A, C5C, C5D, C5E	Output Filer Capacitor Surface-mount (805 package) (Optional - Application-dependent)	—	User-specified
0	R2A, R2C, R2D, R2E	Output Pull-up resistor Surface-mount (805 package) (Optional - Application-dependent)	—	User-specified
0	R3A, R3C, R3D, R3E	Output Pull-down resistor Surface-mount (805 package) (Optional - Application-dependent)	—	User-specified
0	R1A, R1C, R1D, R1E	Output inline resistor Surface-mount (805 package) (Optional - Application-dependent)	—	User-specified
0	R1	BFMP Header pin 1 pull up resistor [2]	—	—
0	R2	BFMP Header pin 1 pull down resistor [2]	—	—
0	J1	BFMP Header (6-pin, 100 mil spacing)	—	—
0	TP1A, TP3A, TP4A, TP5A, H1TP	Through-hole Test Point connector	Keystone Electronics®	5012
0	S1, S2 [3]	Through-hole Switch [3]	Panasonic®	EVQ-ATA048
0	S1, S2	Surface-mount Switch	Panasonic	EVQ-PJ504K
0	V_{DD}, V_{SS}, A1 [1], A3 [1], A4 [1], A5 [1]	V_{DD}, V_{SS} and the other PCB Pads (A1 [1], A3 [1], A4 [1], A5 [1]) through-hole connector	Keystone Electronics®	5012
0	V_{DD}, V_{SS}, A1 [1], A3 [1], A4 [1], A5 [1]	V_{DD}, V_{SS} and the other PCB Pads (A1 [1], A3 [1], A4 [1], A5 [1]) surface-mount connector	Keystone Electronics®	5016

Note 1:   This reference is a description of the silk-screen name "A B C D E" that matches the footprint version option to the package pin number ("1 2 3 4 5 6").
For example, A1 means footprint version option A, package pin number 1.

2:   The current BFMP programming specifications has pin 1 (J1-1) unconnected. These footprints are to support possible future functionality enhancements.

3:   Revision 1 of the PCB has through-holes that are too small to support this switch. For Revision 1 boards, please use surface-mount switches.

NOTES:

Appendix C. Microchip SOT-23-5/6 Device Compatibility

C.1 INTRODUCTION

This appendix documents other Microchip analog devices that can be evaluated using the Voltage Supervisor SOT-23-5/6 Evaluation Board. New devices may be introduced after the publication of this document that may be supported. Compare the pinout of the device to the PCB schematic/layout to determine compatibility of any SOT-23-5 (5-pin SOT-23) or SOT-23-6 (6-pin SOT-23) packaged device.

C.2 PCB COMPATIBILITY

There are four SOT-23-6 (6-pin SOT-23) pinouts that the Voltage Supervisor SOT-23-5/6 Evaluation Board PCB supports. Figure C-1 shows these four pinouts. There is an additional SOT-23-5 (5-pin SOT-23) pinouts that the Voltage Supervisor SOT-23-5/6 Evaluation Board PCB supports. Figure C-2 shows this pinout. Other Microchip analog devices may be used with this PCB if the power and ground pins match these available options. Though these devices may use different nomenclature for the pin names, as long as the power and ground signals match one of the four options, this PCB should be able to be used to evaluate that device.

Table C-1 shows the Microchip analog device part number, the analog family the device belongs to, which footprint option to use and the recommended components to use for the circuit. Please refer to the device data sheet for complete information on the application circuit.
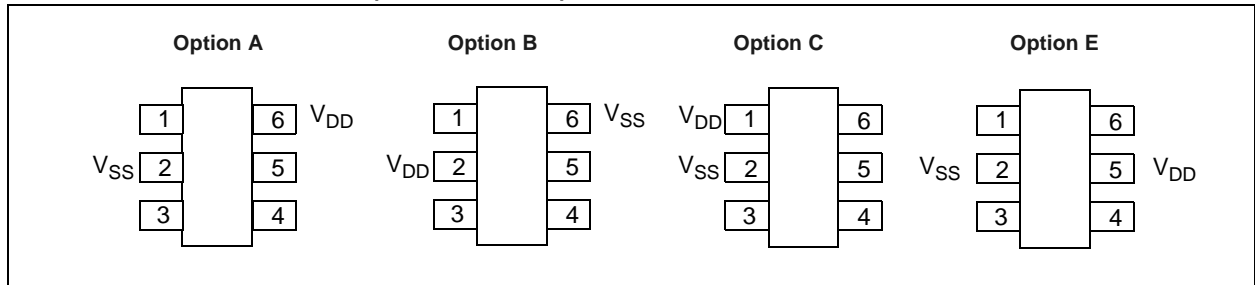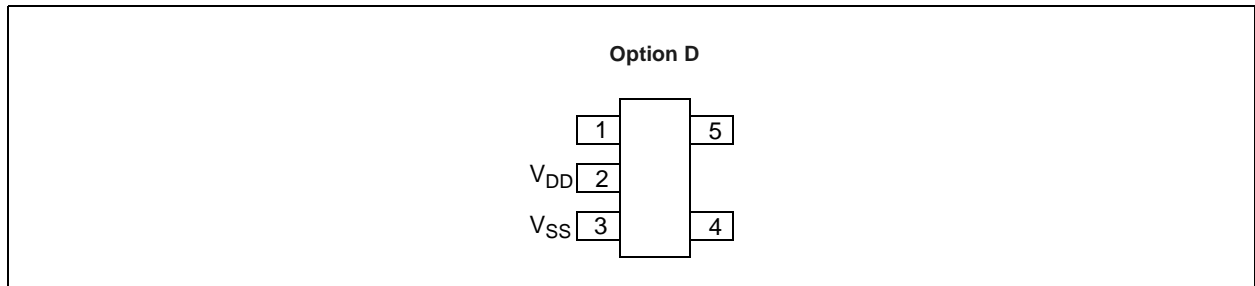
FIGURE C-1: SOT-23-6 (AND SOT-23-5) PINOUT OPTIONS

FIGURE C-2: SOT-23-5 PINOUT OPTION

TABLE C-1:   MICROCHIP ANALOG AND PICMICRO DEVICES AND SOT-23-5/6 EVALUATION BOARD CIRCUIT/FOOTPRINT OPTION SELECTION

Device Family	Device	Option Supported On	# of Pins	Comment Recommended Component Values:
Digital Potentiometers (Digi-Pots) – Nonvolatile	MCP4022 [1]	C	6	See Device Data Sheet for recommended components
	MCP4023 [1]	C	6	See Device Data Sheet for recommended components
	MCP4024 [1]	C	5	See Device Data Sheet for recommended components
Operational Amplifiers (Op Amps)	MCP601	A	5	See Device Data Sheet for recommended components
	MCP601R	B	5	See Device Data Sheet for recommended components
	MCP603	A	6	See Device Data Sheet for recommended components
	MCP606	A	5	See Device Data Sheet for recommended components
	MCP6001	A	5	See Device Data Sheet for recommended components
	MCP6001R	B	5	See Device Data Sheet for recommended components
	MCP6001U	A	5	See Device Data Sheet for recommended components
	MCP6231	A	5	See Device Data Sheet for recommended components
	MCP6231R	B	5	See Device Data Sheet for recommended components
	MCP6231U	A	5	See Device Data Sheet for recommended components
	MCP6241	A	5	See Device Data Sheet for recommended components
	MCP6241R	B	5	See Device Data Sheet for recommended components
	MCP6241U	A	5	See Device Data Sheet for recommended components
	TC1034	B	5	See Device Data Sheet for recommended components
	TC1035	B	6	See Device Data Sheet for recommended components
Comparators	MCP6541	A	5	See Device Data Sheet for recommended components
	MCP6541R	B	5	See Device Data Sheet for recommended components
	MCP6546	A	5	See Device Data Sheet for recommended components
	MCP6546R	B	5	See Device Data Sheet for recommended components
	TC1037	A	5	See Device Data Sheet for recommended components
	TC1038	A	6	See Device Data Sheet for recommended components
	TC1039	A	6	See Device Data Sheet for recommended components

TABLE C-1: **MICROCHIP ANALOG AND PICMICRO DEVICES AND SOT-23-5/6 EVALUATION BOARD CIRCUIT/FOOTPRINT OPTION SELECTION (CONTINUED)**

Device Family	Device	Option Supported On	# of Pins	Comment Recommended Component Values:
Thermal Sensors	MCP9800	C	5	C3 = 0.1 µF R2C = 10 kΩ R2D = 10 kΩ R2A = 10 kΩ
	MCP9802	C	5	C3 = 0.1 µF R2C = 10 kΩ R2D = 10 kΩ R2A = 10 kΩ
	TC77	A	5	C1 = 0.1 µF
A/D Converter (ADC)	MCP3221	C	5	See Device Data Sheet for recommended components
Low Drop-Out Regulators (LDOs)	TC1014	C	5	C3 = 1 µF C5A = 1 µF C5D = 470 pF Pad C3 (schematic TP3) connected to pad V_{DD}
	TC1015	C	5	See Device Data Sheet for recommended components
	TC1017	C	5	See Device Data Sheet for recommended components
	TC1054	C	5	See Device Data Sheet for recommended components
	TC1055	C	5	See Device Data Sheet for recommended components
	TC1070	C	5	See Device Data Sheet for recommended components
	TC1071	C	5	See Device Data Sheet for recommended components
	TC1185	C	5	See Device Data Sheet for recommended components
	TC1186	C	5	See Device Data Sheet for recommended components
	TC1187	C	5	See Device Data Sheet for recommended components
	TC1223	C	5	See Device Data Sheet for recommended components
	TC1224	C	5	See Device Data Sheet for recommended components
	TC2014	C	5	See Device Data Sheet for recommended components
	TC2015	C	5	See Device Data Sheet for recommended components
	TC2054	C	5	See Device Data Sheet for recommended components
	TC2055	C	5	See Device Data Sheet for recommended components
	TC2185	C	5	See Device Data Sheet for recommended components
	TC2186	C	5	See Device Data Sheet for recommended components

Voltage Supervisor SOT-23-5/6 Evaluation Board User's Guide

TABLE C-1: **MICROCHIP ANALOG AND PICMICRO DEVICES AND SOT-23-5/6 EVALUATION BOARD CIRCUIT/FOOTPRINT OPTION SELECTION (CONTINUED)**

| Device Family	Device	Option Supported On	# of Pins	Comment Recommended Component Values:
PICmicro® Microcontrollers	PIC10F200	E	6	C6 = 1 µF
	PIC10F202	E	6	C6 = 1 µF
	PIC10F204	E	6	C6 = 1 µF
	PIC10F206	E	6	C6 = 1 µF
PFM/PWM Step-Down DC/DC Controller	TC105	D	5	See Device Data Sheet for recommended components
Battery Charger Controller	MCP73826	E	6	See Device Data Sheet for recommended components

Note 1: These devices are expected to be released shortly. Please contact Microchip Technology Inc. marketing for additional information.

C.3   IDEAS ON EVALUATING AN LDO

One of the characteristics that a designer may wish to evaluate on a LDO is how the LDO responds to transient loads. Figure C-3 shows a system block diagram for evaluating a LDO and a typical waveform response (at test point) for the function generator signal. The output of the function generator connects to a BJT transistor to simulate the fast switching loads of the circuit.

The value of C2, R3 and C_L will depend on the LDO used and the load of the circuit. Look at both the worst-case amplitude load requirements for a loaded and unloaded system. As the output response of the LDOs become faster, the selection of a smaller (cheaper) output load capacitor (C_L) becomes possible (for the same system performance).

FIGURE C-3:   LDO EVALUATION SYSTEM
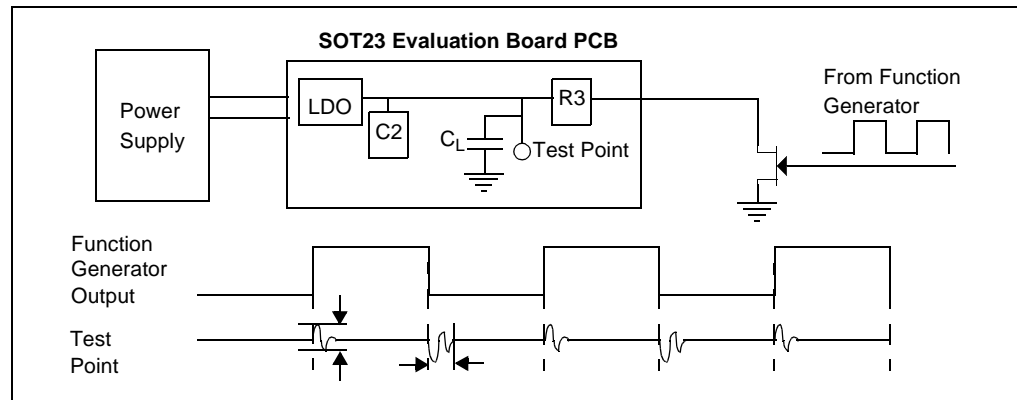
WORLDWIDE SALES AND SERVICE

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

Atlanta
Alpharetta, GA
Tel: 770-640-0034
Fax: 770-640-0307

Boston
Westford, MA
Tel: 978-692-3848
Fax: 978-692-3821

Chicago
Itasca, IL
Tel: 630-285-0071
Fax: 630-285-0075

Dallas
Addison, TX
Tel: 972-818-7423
Fax: 972-818-2924

Detroit
Farmington Hills, MI
Tel: 248-538-2250
Fax: 248-538-2260

Kokomo
Kokomo, IN
Tel: 765-864-8360
Fax: 765-864-8387

Los Angeles
Mission Viejo, CA
Tel: 949-462-9523
Fax: 949-462-9608

San Jose
Mountain View, CA
Tel: 650-215-1444
Fax: 650-961-0286

Toronto
Mississauga, Ontario,
Canada
Tel: 905-673-0699
Fax: 905-673-6509

ASIA/PACIFIC

Australia - Sydney
Tel: 61-2-9868-6733
Fax: 61-2-9868-6755

China - Beijing
Tel: 86-10-8528-2100
Fax: 86-10-8528-2104

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

China - Fuzhou
Tel: 86-591-8750-3506
Fax: 86-591-8750-3521

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

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 - Qingdao
Tel: 86-532-502-7355
Fax: 86-532-502-7205

ASIA/PACIFIC

India - Bangalore
Tel: 91-80-2229-0061
Fax: 91-80-2229-0062

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

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

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

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

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

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

Taiwan - Hsinchu
Tel: 886-3-572-9526
Fax: 886-3-572-6459

EUROPE

Austria - Weis
Tel: 43-7242-2244-399
Fax: 43-7242-2244-393

Denmark - Ballerup
Tel: 45-4450-2828
Fax: 45-4485-2829

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

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

Italy - Milan
Tel: 39-0331-742611
Fax: 39-0331-466781

Netherlands - Drunen
Tel: 31-416-690399
Fax: 31-416-690340

England - Berkshire
Tel: 44-118-921-5869
Fax: 44-118-921-5820

10/20/04