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MCP1726 EVALUATION BOARD USER'S GUIDE

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NOTES:

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MCP1726 EVALUATION BOARD USER'S GUIDE

Preface

NOTICE TO CUSTOMERS

All documentation becomes dated, and this manual is no exception. Microchip tools and documentation are constantly evolving to meet customer needs, so some actual dialogs and/or tool descriptions may differ from those in this document. Please refer to our web site (www.microchip.com) to obtain the latest documentation available.

Documents are identified with a "DS" number. This number is located on the bottom of each page, in front of the page number. The numbering convention for the DS number is "DSXXXXXA", where "XXXXX" is the document number and "A" is the revision level of the document.

INTRODUCTION

This chapter contains general information that will be useful to know before using the MCP1726 Evaluation Board. Items discussed in this chapter include:

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

DOCUMENT LAYOUT

This document describes how to use the MCP1726 Evaluation Board as a development tool. The manual layout is as follows:

- **Chapter 1. "Product Overview"** – Important information about the MCP1726 Evaluation Board.
- **Chapter 2. "Installation and Operation"** – Includes instructions on how to get started with this evaluation board and a description of the evaluation board operation.
- **Appendix A. "Schematics and Layouts"** – Shows the schematic and layout diagrams for the MCP1726 Evaluation Board.
- **Appendix B. "Bill Of Materials (BOM)"** – Lists the parts used to build the MCP1726 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>
Courier New font:		
Plain Courier New	Sample source code	`#define START`
	Filenames	`autoexec.bat`
	File paths	`c:\mcc18\h`
	Keywords	`_asm, _endasm, static`
	Command-line options	`-Opa+, -Opa-`
	Bit values	`0, 1`
	Constants	`0xFF, 'A'`
Italic Courier New	A variable argument	*`file`*`.o`, where *`file`* can be any valid filename
Square brackets [ ]	Optional arguments	`mcc18 [options]` *`file`* `[options]`
Curly brackets and pipe character: { | }	Choice of mutually exclusive arguments; an OR selection	`errorlevel {0|1}`
Ellipses...	Replaces repeated text	`var_name [, var_name...]`
	Represents code supplied by user	`void main (void) { ... }`

RECOMMENDED READING

This user's guide describes how to use MCP1726 Evaluation Board. The following Microchip documents are available and recommended as supplemental reference resources.

MCP1726 Data Sheet, *"1A, Low-Voltage, Low Quiescent Current LDO Regulator"* (DS21936)

This data sheet provides detailed information regarding the MCP1726 product family.

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- Field Application Engineer (FAE)
- Technical Support
- Development Systems Information Line

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Technical support is available through the web site at: http://support.microchip.com

DOCUMENT REVISION HISTORY

Revision B (August 2006)

- Add disclaimer to Bill of Materials regarding RoHS-Compliant part numbers.

Revision A (April 2005

- Initial Release of this Document.

NOTES:

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Chapter 1. Product Overview

1.1 INTRODUCTION

The MCP1726 1A LDO Evaluation Board is used to evaluate the Microchip MCP1726 1A, low voltage, low-quiescent current, Low-Dropout (LDO) regulator. This evaluation board contains two circuits, one for the 8-pin DFN package and one for the 8-pin SOIC package. Each circuit allows the user to evaluate the adjustable or fixed-voltage version of the part.

This chapter also covers the following topics:

- What is the MCP1726 1A LDO Evaluation Board?
- What the MCP1726 1A LDO Evaluation Board Kit includes

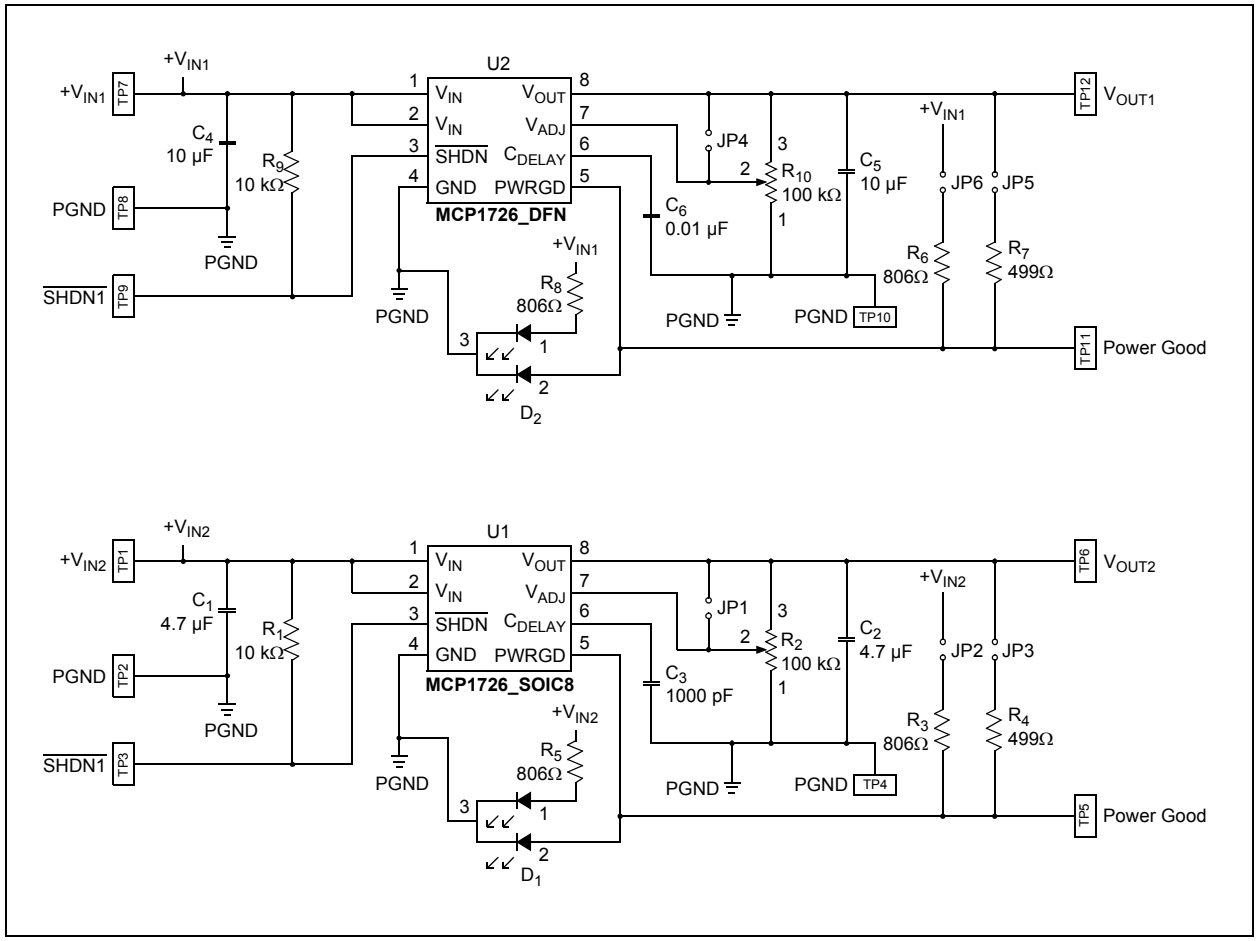

FIGURE 1-1: *MCP1726 Evaluation Board Schematic.*

1.2 WHAT IS THE MCP1726 1A LDO EVALUATION BOARD?

The MCP1726 1A LDO Evaluation Board allows the user to evaluate both the fixed and adjustable versions of the part in the 8-pin SOIC and 8-lead 3X3 DFN packages. An on-board potentiometer allows the user to easily set the output voltage of the adjustable voltage version of the device. Status LEDs indicate when input voltage is applied and when the Power Good (PWRGD) output is in a high condition (output voltage is in regulation).

Connection terminals are provided for the input voltage, output voltage, ground, power good and shutdown.

1.3 WHAT THE MCP1726 1A LDO EVALUATION BOARD KIT INCLUDES

This MCP1726 1A LDO Evaluation Board Kit includes:

- The MCP1726 1A LDO Evaluation Board
- Analog and Interface Products Demonstration Boards CD-ROM (DS21912)
  - MCP1726 1A LDO Evaluation Board User's Guide (DS51550)

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Chapter 2. Installation and Operation

2.1 INTRODUCTION

The MCP1726 Evaluation Board demonstrates Microchip's 1A Low-Quiescent Current, Low-Dropout (LDO) regulator.The evaluation board contains two independent circuits that allow the user to evaluate the MCP1726 in the 8-pin SOIC and the 8-pin 3X3 DFN packages. The evaluation board uses a potentiometer to adjust the output voltage of the MCP1726 device across its entire output voltage range. The evaluation board also allows for fixed-output voltage versions of the device to be used by simply connecting the pins of a jumper connector.

2.2 FEATURES

The MCP1726 Evaluation Board has the following features:

- Input Voltage Range: 2.3V to 6.0V
- Adjustable Output Voltage via a Potentiometer
- Output Voltage Shutdown via the $\overline{\text{SHDN}}$ Input
- Overcurrent Protection (device feature)
- Overtemperature Protection (device feature)
- Input Undervoltage Lockout (UVLO) Protection (device feature)
- Input Power and Power Good Indication (LED)
- Power Good Delay Adjust Capability

2.3 GETTING STARTED

The MCP1726 Evaluation Board is fully assembled and tested over its input voltage, output voltage and output current operating range. This board requires the use of an external input voltage source (+2.3V to +6.0V) and an external load (electronic or resistive). The Printed Circuit Board (PCB) design provides cooling for the MCP1726 devices. When the devices are operating with high power dissipation (over 1.0W at room ambient), additional cooling may be required to keep the devices from going into overtemperature shutdown.

The MCP1726 Evaluation Board contains two circuits to evaluate; one for the SOIC package and one for the 3X3 DFN package. These circuits are powered independently of each other through separate connectors/test points. The circuitry for evaluating the 3X3 DFN package has inputs labeled VIN1 and SHDN1, and outputs labeled PWRGD1 and VOUT1. The circuitry for evaluating the SOIC package has inputs labeled VIN2 and SHDN2, and outputs labeled PWRGD2 and VOUT2. The ground connections for the board are all common to each other and are labeled as GND. There are a total of four connection points for ground.

All of the connections to the MCP1726 Evaluation Board are made through surface-mount test points. These test points can be removed with a soldering iron if you wish to solder wires directly to the pads that are provided on the board.

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2.4 TESTING CIRCUIT 1 OF THE MCP1726 EVALUATION BOARD

2.4.1 Power Input and Output Connections

Powering the MCP1726 Evaluation Board

1. Apply the input voltage to test points TP7 (VIN1) and TP8 (GND). Connect the positive side of the input source (+) to test point TP7 (VIN1). Connect the negative, or return, side (–) of the input source to the test point TP8 (GND). These two test points are located on the upper left side of the board. The power supply input voltage must be in the specified operating range for the board to operate correctly. The UVLO feature of the MCP1726 prevents the device from operating when the input voltage is too low (see data sheet for UVLO thresholds).
2. When input voltage is applied and is above the input UVLO threshold, the LDO output will turn on automatically. The $\overline{\text{SHDN1}}$ input has been pulled up to VIN1 which turns the device on. The LDO output can be turned off by pulling the $\overline{\text{SHDN1}}$ input (TP9) low (short $\overline{\text{SHDN1}}$ to GND).
3. When input voltage is applied, the red portion of the D2 LED will illuminate. As long as input voltage is present, the red portion of this LED will be on.

Applying the load to the MCP1726 Evaluation Board

1. To apply a load to VOUT1 of the MCP1726 Evaluation Board, the positive-side of the load (+) should be connected to test point TP12 (VOUT1). The negative side of the load (–) should be connected to test point TP10 (GND).
2. The maximum output current of the MCP1726 is 1.0A. If the output load exceeds this level, the MCP1726 will go into current limit at 1.7A. If, during the overload condition, the device junction temperature exceeds the overtemperature limit of 150°C, the output of the LDO will turn off and wait for the junction temperature to cool down before turning the LDO output back on. Circuit 1 of the MCP1726 Evaluation Board evaluates the 3X3 DFN package. When operating at room ambient, this circuit will go into overtemperature shutdown when the power dissipation in the device reaches about 2.1W.

2.4.2 Adjusting the Output Voltage of the LDO

The MCP1726 Evaluation Board comes with the output voltage preset to 2.5V. To adjust the output voltage (VOUT1) of circuit 1, the potentiometer, R10, is used. R10 is a top-side adjust potentiometer. If the desired output voltage is higher than 2.5V, raise the input voltage to a level that is higher than your desired output voltage. Use a small flathead screwdriver to adjust the R10 potentiometer and monitor the VOUT1 (TP12) voltage. If your desired output voltage is less than 2.5V, the input voltage of the LDO must be set to a minimum of 2.3V, as this is the minimum input voltage of the LDO. The output voltage of the LDO can then be adjusted using the R10 potentiometer.

The potentiometer will allow you to adjust the output voltage over the full range of 0.8V to 5.0V. If you would like to use fixed resistor values to set the output voltage of the LDO, the potentiometer can be removed and the pads for the potentiometer can be used to solder your fixed value resistors into the circuit.

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2.4.3 Power Present and Power Good (PWRGD1) Indication

The MCP1726 Evaluation Board has one dual status LED. The dual LED (D2) contains a red LED and a green LED. The red portion of the LED illuminates to indicate that input voltage is present.

The green portion of the LED (D2) is used for power good (PWRGD) indication. During normal operation, if the LDO output is in regulation, the green portion of D2 is illuminated to provide indication that power is good. If the output voltage of the LDO falls below the power good threshold limit (below 92% (typical) of the nominal output voltage regulation value) for any reason (input voltage too low, overtemperature, output short circuit), the green portion of the LED will turn off. The green portion of the LED is driven off of the PWRGD1 output.

The power good output (PWRGD1) can be monitored by connecting to TP11. The power good output of the MCP1726 device is an open-drain output. On the MCP1726 Evaluation Board, the PWRGD1 output can be pulled up to either the LDO input or output voltage. This can be done through jumpers JP6 and JP5, respectively. To pull the PWRGD1 output up to the input voltage of the LDO, populate jumper JP6 (place one of the black shorting tabs on the jumper) and make sure that jumper JP5 is not populated. To pull the PWRGD1 output up to the output voltage, populate jumper JP5 and make sure that jumper JP6 is not populated. Upon shipment, the board is configured to have PWRGD1 pulled up to the input voltage. Because the PWRGD1 output is driving the green portion of the D2 LED, the voltage at the PWRGD1 test point will be clamped to the forward voltage of the LED. If you want to have the PWRGD1 voltage be pulled all the way up to the input or output voltage, remove the D2 LED.

2.4.4 Power Good Time Delay

The MCP1726 device has a power good time delay feature that allows the user to set the time delay from when the output voltage is in regulation to when the power good output (PWRGD) goes high. This feature is implemented by the C_{DELAY} pin on the device (see data sheet for more details). Circuit 1 of the MCP1726 Evaluation Board is populated with a 0.01 µF capacitor (C6) for the C_{DELAY} pin capacitor. This gives a typical delay time of 30 ms.

2.4.5 Input and Output Capacitors

The input and output capacitors (C4 and C5, respectively) for Circuit 1 of the MCP1726 Evaluation Board are populated with 10 µF, 6.3V ceramic capacitors. The pads for these devices have been constructed in such a manner that 0805, 1206 and 1210 size surface-mount capacitors can be used. This allows the user to populate the board with capacitors of various values and voltage ratings that mimic their application.

2.4.6 Testing Fixed-Output Voltage Devices

As stated earlier, the MCP1726 Evaluation Board is designed to handle either the adjustable or fixed-output voltage version of the device (board comes populated with the adjustable output voltage version). When testing a fixed-output voltage version of the device, jumper JP4 should be populated (use the additional black jumper top that is provided). This will connect pin 7 of U2 to the VOUT1 output (for the fixed-output voltage devices, pins 7 and 8 of the MCP1726 are both V_{OUT}) which is necessary for proper operation.

2.5 TESTING CIRCUIT 2 OF THE MCP1726 EVALUATION BOARD

2.5.1 Power Input and Output Connections

Powering the MCP1726 Evaluation Board

Apply the input voltage to test points TP1 (VIN2) and TP2 (GND). Connect the positive-side of the input source (+) to test point TP1 (VIN2). Connect the negative, or return, side (–) of the input source to the test point TP2 (GND). These two test points are located on the lower-left side of the board. The power supply input voltage must be in the specified operating range for the board to operate correctly. The UVLO feature of the MCP1726 prevents the device from operating when the input voltage is too low (see data sheet for UVLO thresholds).

When input voltage is applied and is above the input UVLO threshold, the LDO output will turn on automatically. The $\overline{\text{SHDN2}}$ input has been pulled up to VIN2 which turns the device on. The LDO output can be turned off by pulling the $\overline{\text{SHDN2}}$ input (TP3) low (short $\overline{\text{SHDN2}}$ to GND).

When input voltage is applied, the red portion of the D1 LED will illuminate. As long as input voltage is present, the red portion of this LED will be on.

Applying the load to the MCP1726 Evaluation Board

To apply a load to VOUT2 of the MCP1726 Evaluation Board, the positive-side of the load (+) should be connected to test point TP6 (VOUT2). The negative-side of the load (–) should be connected to test point TP4 (GND).

The maximum output current of the MCP1726 is 1.0A. If the output load exceeds this level, the MCP1726 will go into current limit at 1.7A. If, during the overload condition, the device junction temperature exceeds the overtemperature limit of 150°C, the output of the LDO will turn off and wait for the junction temperature to cool down before turning the LDO output back on. Circuit 2 of the MCP1726 Evaluation Board evaluates the SOIC package. When operating at room ambient, this circuit will go into overtemperature shutdown when the power dissipation in the device reaches about 1.3W.

2.5.2 Adjusting the Output Voltage of the LDO

The MCP1726 Evaluation Board comes with the output voltage preset to 2.5V. To adjust the output voltage (VOUT2) of circuit 2, the potentiometer (R2) is used. R2 is a top-side adjust potentiometer. If the desired output voltage is higher than 2.5V, raise the input voltage to a level that is higher than your desired output voltage. Use a small flat head screw driver to adjust the R2 potentiometer and monitor the VOUT2 (TP6) voltage. If your desired output voltage is less than 2.5V, the input voltage of the LDO must be set to a minimum of 2.3V, as this is the minimum input voltage of the LDO. The output voltage of the LDO can then be adjusted using the R2 potentiometer.

The potentiometer will allow you to adjust the output voltage over the full range of 0.8V to 5.0V. If you would like to use fixed resistor values to set the output voltage of the LDO, the potentiometer can be removed and the pads for the potentiometer can be used to solder your fixed-value resistors into the circuit.

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2.5.3 Power Present and Power Good (PWRGD2) Indication

The MCP1726 Evaluation Board has one dual-status LED. The dual LED (D1) contains a red LED and a green LED. The red portion of the LED illuminates to indicate that input voltage is present.

The green portion of the LED (D1) is used for power good (PWRGD) indication. During normal operation, if the LDO output is in regulation, the green portion of D1 is illuminated to provide indication that power is good. If the output voltage of the LDO falls below the power good threshold limit (below 92% (typical) of the nominal output voltage regulation value) for any reason (input voltage too low, overtemperature, output short circuit), the green portion of the LED will turn off. The green portion of the LED is driven off of the PWRGD2 output.

The power good output (PWRGD2) can be monitored by connecting to TP5. The power good output of the MCP1726 device is an open-drain output. On the MCP1726 Evaluation Board, the PWRGD2 output can be pulled up to either the LDO input or output voltage. This can be accomplished through jumpers JP2 and JP3, respectively. To pull the PWRGD2 output up to the input voltage of the LDO, populate jumper JP2 (place one of the black shorting tabs on the jumper) and make sure that jumper JP3 is not populated. To pull the PWRGD2 output up to the output voltage, populate jumper JP3 and make sure that jumper JP2 is not populated. Upon shipment, the board is configured to have PWRGD2 pulled up to the input voltage. Because the PWRGD2 output is driving the green portion of the D1 LED, the voltage at the PWRGD2 test point will be clamped to the forward voltage of the LED. If you want to have the PWRGD2 voltage be pulled all the way up to the input or output voltage, remove the D1 LED.

2.5.4 Power Good Time Delay

The MCP1726 device has a power good time delay feature that allows the user to set the time delay from when the output voltage is in regulation to when the power good output (PWRGD) goes high. This feature is implemented by the C_{DELAY} pin on the device (see data sheet for more details). Circuit 2 of the MCP1726 Evaluation Board is populated with a 1000 pF capacitor (C3) for the C_{DELAY} pin capacitor. This gives a typical delay time of 3 ms.

2.5.5 Input and Output Capacitors

The input and output capacitors (C1 and C2, respectively) for Circuit 2 of the MCP1726 Evaluation Board are populated with 4.7μF, 6.3V ceramic capacitors. The pads for these devices have been constructed in such a manner that 0805, 1206 and 1210 size surface-mount capacitors can be used. This allows the user to populate the board with capacitors of various values and voltage ratings that mimic their application.

2.5.6 Testing Fixed-Output Voltage Devices

As stated earlier, the MCP1726 Evaluation Board is designed to handle either the adjustable or fixed-output voltage version of the device (board comes populated with the adjustable output voltage version). When testing a fixed-output voltage version of the device, jumper JP1 should be populated (use the additional black jumper top that is provided). This will connect pin 7 of U1 to the VOUT2 output (for the fixed-output voltage devices, pins 7 and 8 of the MCP1726 are both V_{OUT}), which is necessary for proper operation.

NOTES:

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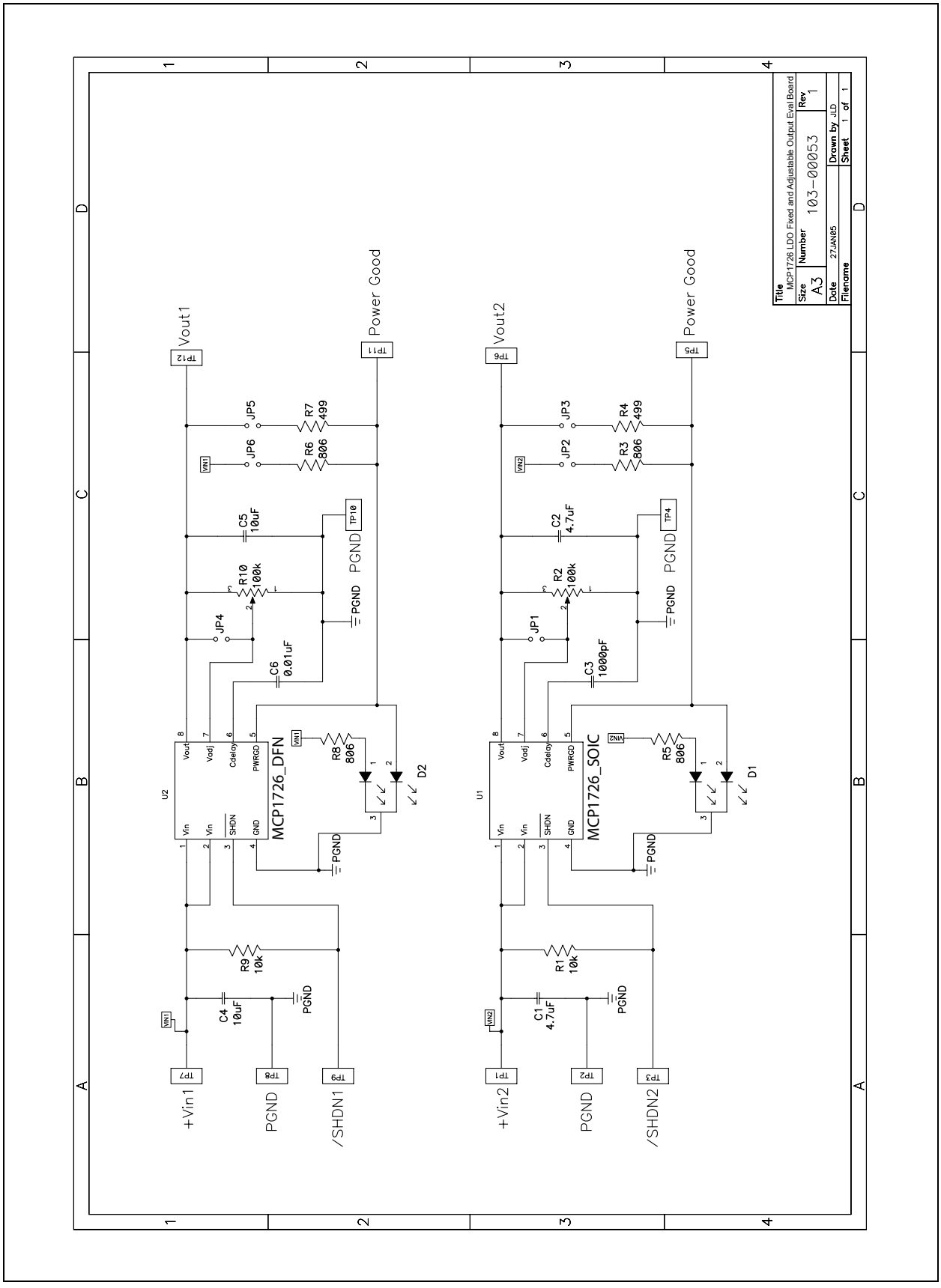
Appendix A. Schematics and Layouts

A.1 INTRODUCTION

This appendix contains the following schematics and layouts for the MCP1726 Evaluation Board.

- Board Schematic
- Board Outline
- Board – Top Layer
- Board – Bottom Layer

A.2 BOARD SCHEMATIC



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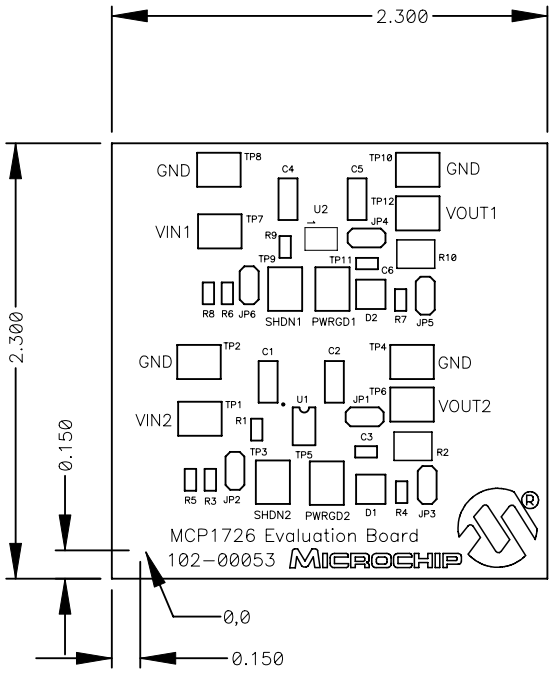
A.3 BOARD - OUTLINE

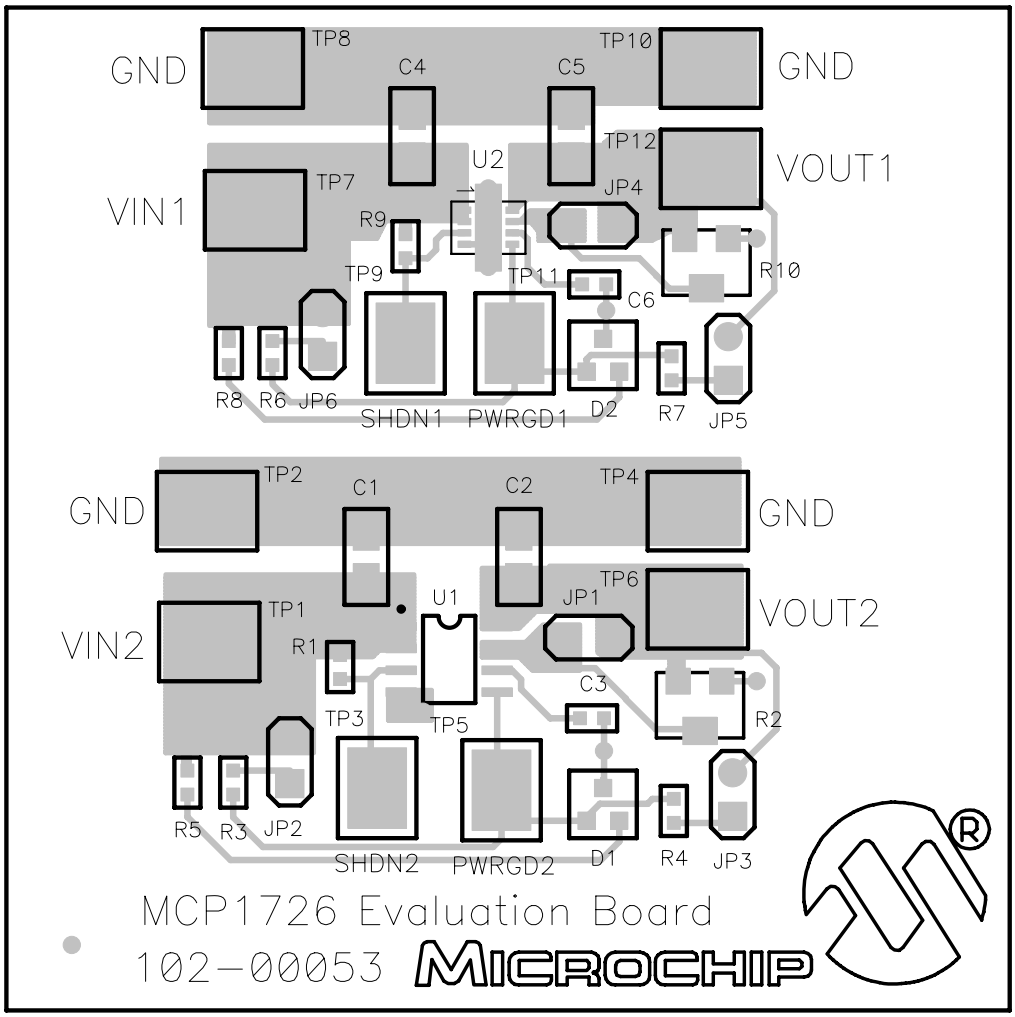


NOTES

1. BOARD MATERIAL FR4 OR EQUIVALENT 0.062" THICK.
2. 2 LAYERS OF 1oz. COPPER
3. SOLDERMASK ON BOTH SIDES WITH HASL ON EXPOSED COPPER.
4. WHITE SILKSCREEN ON TOP LAYER.

Drill Table			
Hole Dia (inch)	Symbol	Quantity	Plated
0.018	+	27	Yes
0.042	×	12	Yes

A.4 BOARD - TOP LAYER



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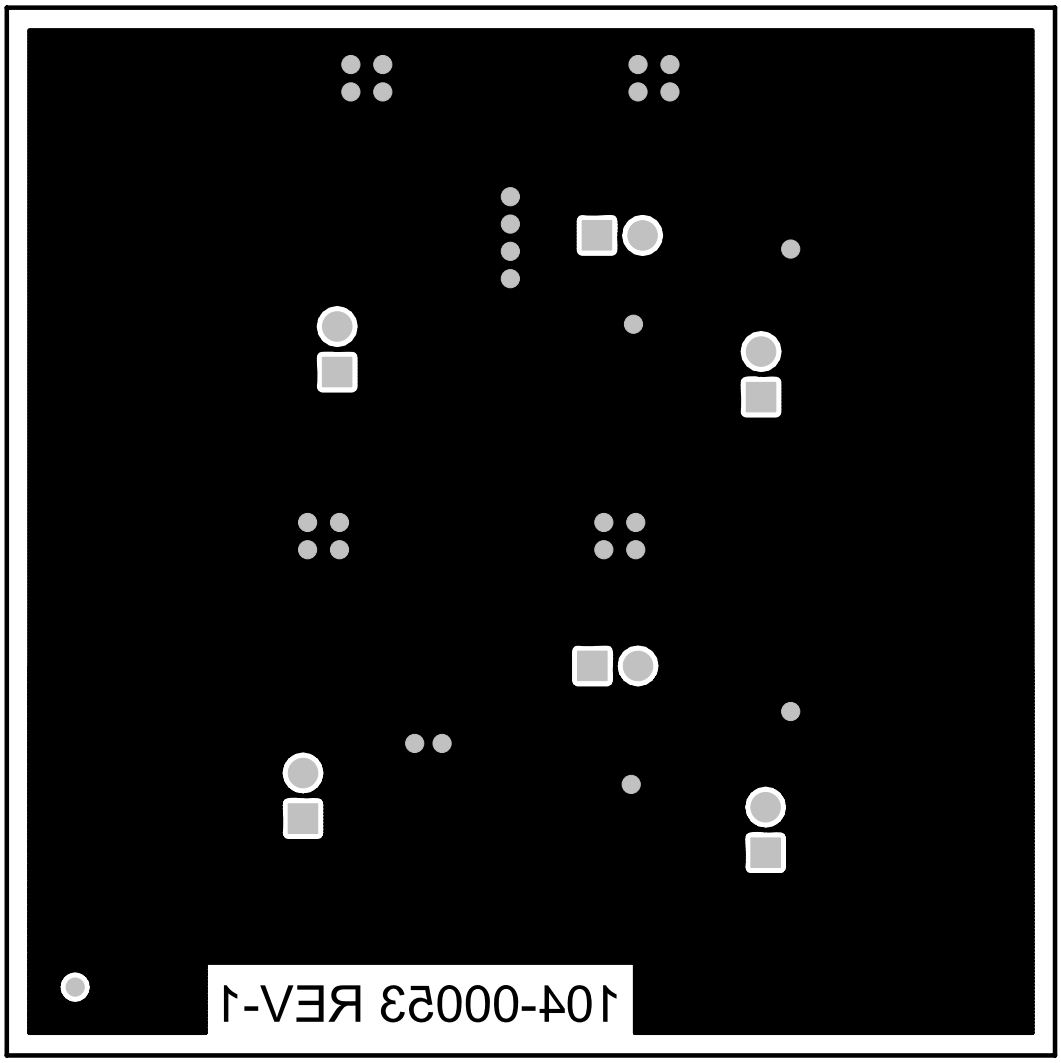
A.5 BOARD - BOTTOM LAYER



NOTES:

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Appendix B. Bill Of Materials (BOM)

TABLE B-1: BILL OF MATERIALS (BOM)

Qty	Reference	Description	Manufacturer	Part Number
4		Jumper Shorting Posts	Sullens	STC02SYAN
2	C1, C2	CAP 4.7UF 6.3V CERAMIC X5R 0805	Panasonic® Corp.	ECJ-2FB0J475M
1	C3	CAP 1000PF 50V CERAMIC 0603 SMD	Panasonic Corp.	ECJ1VB1H102K
2	C4, C5	CAP 10UF 6.3V CERAMIC X5R 0805	Panasonic Corp.	ECJ-2FB0J106M
1	C6	CAP 10000PF 50V CERAMIC 0603 SMD	Kemet®	C0603C103K5RACTU
2	D1, D2	LED Dual Green/Red Clear SOT-23	Lumex® Opto/Components	SSL-LX15IGC-RP-TR
6	JP1, JP2, JP3, JP4, JP5, JP6	Connector Header 2POS .100 VERT TIN	Molex®/Waldom®	22-03-2021
2	R1, R9	RES 10.0K Ohm 1/16W 1% 0603 SMD	Panasonic	ERJ-3EKF1002V
2	R2, R10	TRIMPOT 100K Ohm 4mm Top Adj SMD	Bourns®	3214W-1-104E
4	R3, R5, R6, R8	RES 806 Ohm 1/16W 1% 0603 SMD	Panasonic	ERJ-3EKF8060V
2	R4, R7	RES 499 Ohm 1/16W 1% 0603 SMD	Panasonic	ERJ-3EKF4990V
12	TP1, TP2, TP3, TP4, TP5, TP6, TP7, TP8, TP9, TP10, TP11, TP12	SMT Test Point/Connector	Keystone Electronics®	5016
1	U1	1A Low Quiescent Current LDO, Adjustable Output, 8-Pin SOIC Package	Microchip Techonology Inc.	MCP1726-ADJE/SN
1	U2	1A Low Quiescent Current LDO, Adjustable Output, 3X3 DFN Package	Microchip Techonology Inc.	MCP1726-ADJE/MF

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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