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ADM1075 Mini Evaluation Kit User Guide

FEATURES

Mini evaluation kit for the ADM1075
Supports LFCSP device package
Input voltage range of −30 V to −75 V
PMBus™ communication supported
Isolated PMBus interface for −48 V operation
Special N-MOSFET footprint to accommodate different FET packages
Supports up to 2 sense resistors in parallel
Supports up to 2 field effect transistors (FETs) in parallel
Toggle and push-button switches for easy input control
LED indicated status outputs
Smaller board compared with EVAL-ADM1075EBZ

EVALUATION KIT CONTENTS

EVAL-ADM1075MEBZ mini evaluation board
EVAL-ADM1075-ISOZ isolation board
8-way, 150 mm Micro-MaTch ribbon cable

ADDITIONAL EQUIPMENT NEEDED

USB-to-serial I/O interface USB-SDP-CABLEZ

REQUIRED SOFTWARE

Analog Devices hot swap and power monitoring evaluation software (download from www.analog.com/hotswaptools)

GENERAL DESCRIPTION

The ADM1075 mini evaluation board (EVAL-ADM1075MEBZ) is a compact, reduced feature version of the ADM1075 evaluation board (EVAL-ADM1075EBZ) for the ADM1075-1ACPZ and ADM1075-2ACPZ devices.

The mini evaluation board is designed to power up with a 15 A current limit, a 300 µF load capacitance, and a minimum of 24 Ω load resistance.

Two sense resistor footprints and two FET footprints provide users with flexibility and allow them to simulate a wide range of application setups.

Multiple test points allow easy access to all critical points and pins. There is one LED to provide users with a direct visual indication of IC power good output.

The EVAL-ADM1075MEBZ board is fully compatible with the EVAL-ADM1075EBZ evaluation software tool, which can be downloaded from www.analog.com/hotswaptools.

Users need a USB-SDP-CABLEZ USB-to-I^{2}C dongle to use the evaluation software tools. The Micro-MaTch ribbon cable is required if connecting the mini evaluation board to the isolation board (EVAL-ADM1075-ISOZ).

Complete specifications for the ADM1075 can be found in the ADM1075 data sheet, available at http://www.analog.com/, and should be consulted in conjunction with this user guide when using the evaluation board.

BOARD SETUP

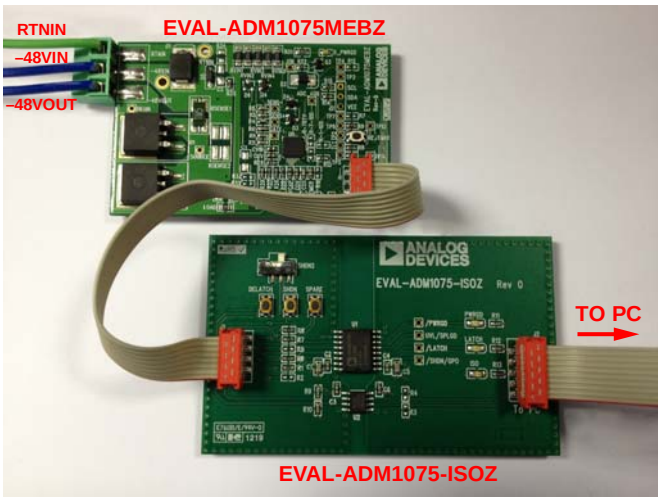

Figure 1.

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REVISION HISTORY

4/14—Rev. 0 to Rev. A

Changes to Evaluation Kit Contents 1
Changes to Figure 11 10
Changes to Table 11 15

4/13—Revision 0: Initial Version

QUICK START GUIDE

1. Download the hot swap and power monitor software from www.analog.com/hotswaptools (see the UG-353 user guide for more information).
2. Connect the mini evaluation board (EVAL-ADM1075MEBZ) to the isolation board (EVAL-ADM1075-ISOZ) using the 8-way connector and a Micro-MaTch ribbon cable.
3. Connect the isolation board (EVAL-ADM1075-ISOZ) to a PC through the 10-way connector and the USB-SDP-CABLEZ dongle. The blue LED, labeled ISO, on the isolation board illuminates.
4. Connect the power supply to the mini evaluation board (EVAL-ADM1075MEBZ) using thick wires.
5. To confirm that the boards are configured correctly, set the output of the power supply to 48 V with less than a 1 A current limit and with no load capacitance. If the boards are configured correctly, the green LEDs, labeled D_PWRGD on the EVAL-ADM1075MEBZ and PWRGD on the EVAL-ADM1075-ISOZ, illuminate.
6. Press the RESTART push-button on the mini evaluation board (EVAL-ADM1075MEBZ). The green LEDs, labeled D_PWRGD and PWRGD, both turn off, and then turn back on after 10 sec.
7. You can use the SHDN2 switch and SHDN push-button on the isolation board (EVAL-ADM1075-ISOZ) to turn off the hot swap.
8. If a latch event occurs (for example, a short circuit during operation), the red LED, labeled LATCH, illuminates on the isolation board (EVAL-ADM1075-ISOZ). The latch event can be cleared with a CLEAR FAULT PMBus command or by pressing the DELATCH push-button.
9. Disable the hot swap using the **Hot Swap Control** section of the **Basic Operation** tab of the GUI. Disabling the hot swap should turn off the green LEDs (D_PWRGD and PWRGD) on both the mini evaluation board and the isolation board.
10. Manually program the sense resistor value and the ADC input resistor divider values (for example, R_{SENSE} = 1.5 mΩ, ADC top = 200 kΩ, ADC bottom = 2.8 kΩ). There is no EEPROM available on the mini evaluation board (EVAL-ADM1075MEBZ); therefore, these values must be programmed each time the software GUI is opened.
11. Check that the voltage and current measurements are as expected in the **Power Monitor** tab of the software GUI.

EVALUATION BOARD DESCRIPTION

The EVAL-ADM1075MEBZ is designed to demonstrate several features of the ADM1075. It is used in conjunction with the isolation board to provide a fully isolated solution. A simplified drawing of the mini evaluation board and isolation board combination is shown in Figure 2.

The mini evaluation board (EVAL-ADM1075MEBZ) is connected to the isolation board (EVAL-ADM1075-ISOZ) using a Micro-MaTch cable and is connected to a PC using a USB-SDP-CABLEZ dongle for isolated I²C communication.

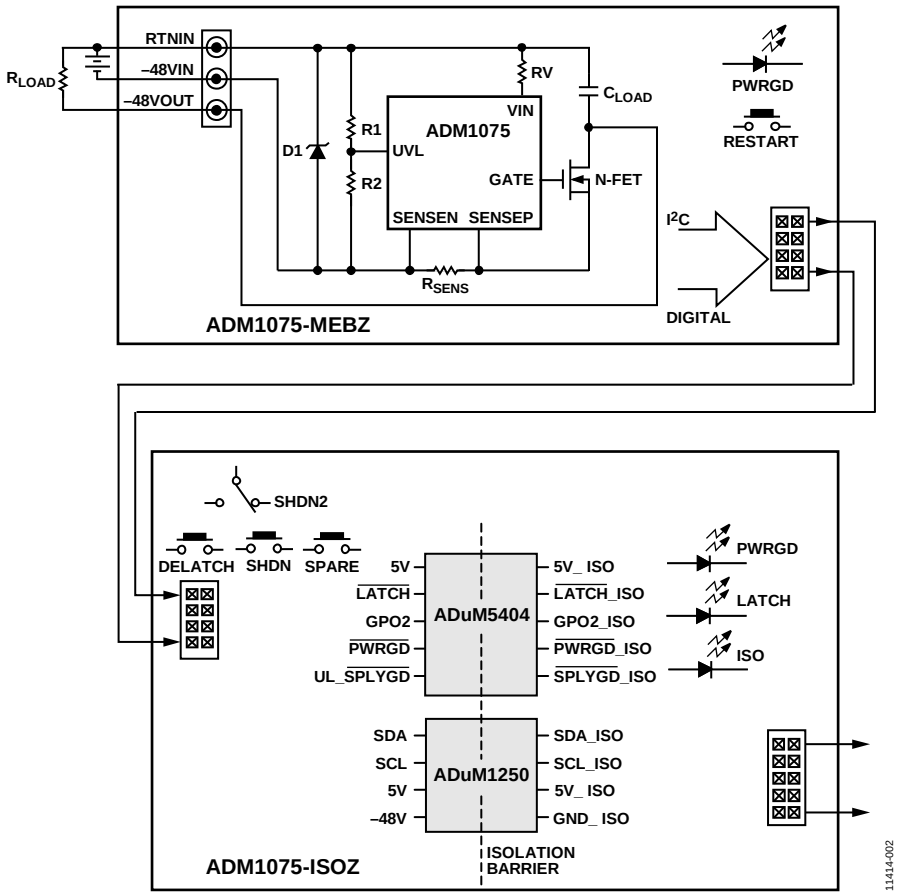

Figure 2. Basic Block Diagram

EVAL-ADM1075MEBZ

The ADM1075 mini evaluation board (EVAL-ADM1075MEBZ) is shown in Figure 3.

Thick wires should be used between the power supply and the EVAL-ADM1075MEBZ board connector to minimize inductance. The D_PWRGD LED illuminates green after the board is powered and the ADM1075 GATE pin is high (FET fully enhanced). Pressing the RESTART push-button triggers a shutdown that lasts for 10 sec.

The board is intended to be plugged into a system where load capacitance already exists. Two through-hole vias are provided to allow the placement of a load capacitor on the board when testing the board outside of a real system. All testing performed on the board was done with a 330 µF load capacitor.

The EVAL-ADM1075MEBZ uses a 470 nF timer capacitor to maintain a 10 ms FET safe operating area. The undervoltage and overvoltage thresholds were set using resistor dividers to achieve the values shown in Table 1. A resistor divider was also used on the ISET pin to set the current limit to approximately 15 A. The constant power level was set to the maximum allowable level for the FET safe operating area to allow power-up in one attempt. These values can all be fine-tuned further if necessary. Isolation is required in most −48 V applications because there is a large ground potential difference between the −48 V section of the board and a PC or microcontroller.

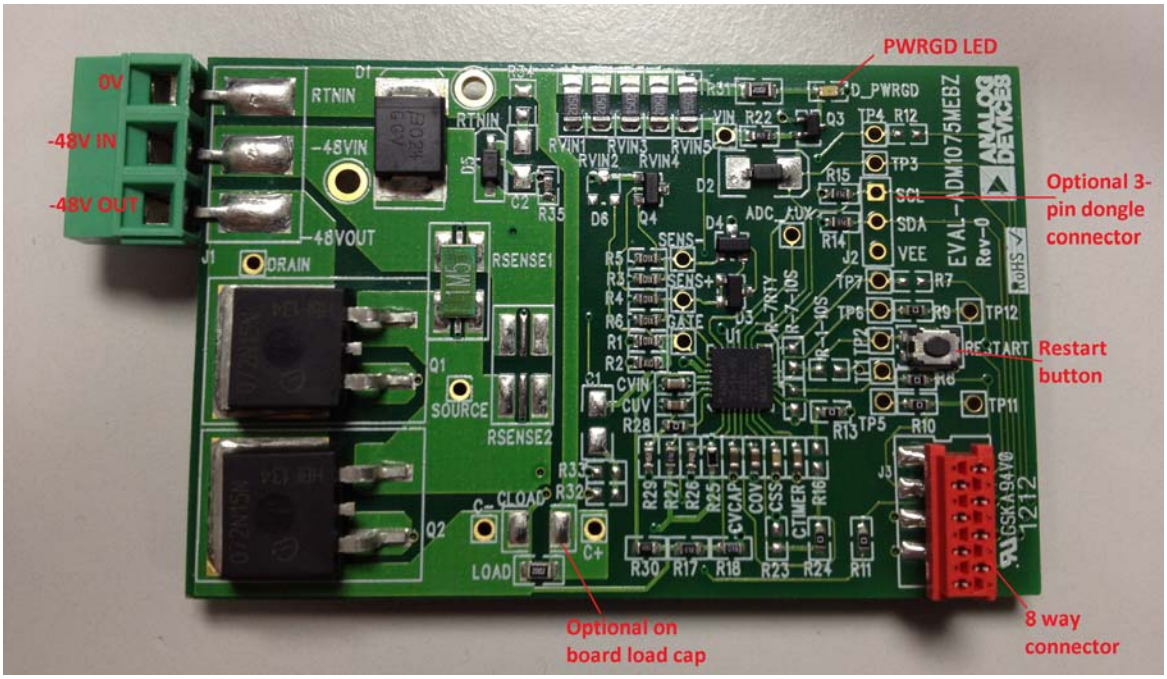

Figure 3. EVAL-ADM1075MEBZ Board

Specifications

Table 1.

Parameter	Min	Typ	Max	Unit
Undervoltage Rising Threshold, V_{UVH}	−34.0	−35.0	−36.0	V
Undervoltage Falling Threshold, V_{UVL}	−30.6	−31.5	−32.4	V
Overvoltage Rising Threshold, V_{OVR}	−70.3	−72.4	−74.6	V
Overvoltage Falling Threshold, V_{OVF}	−68.9	−71.4	−74.0	V
Trip Current	12.1	12.75	13.4	A
Regulation Current	12.9	13.3	13.8	A
Constant Power Level	127	135	142	W

EVAL-ADM1075-ISOZ

The ADM1075 isolation board (EVAL-ADM1075-ISOZ) includes the following isolators:

- The ADuM1250 is used to demonstrate the I^2C isolation and the digital signal.
- The ADuM5404 provides quad-channel digital isolation with *iso*Power®. When the isolated section is powered, the *iso*Power device powers the 5 V components on the primary side of the board.

The push-buttons and switch on the isolation board (EVAL-ADM1075-ISOZ) allow the user to control the mini evaluation board (EVAL-ADM1075MEBZ). The three on-board LEDs provide users with a direct visual indication of IC power good, latch event occurrence, and 5 V power supply from USB-SDP-CABLEZ. The 8-way connector is used to connect the mini evaluation board (EVAL-ADM1075MEBZ) to the isolation board (EVAL-ADM1075-ISOZ), and the 10-way connector is used with the USB-SDP-CABLEZ dongle to connect the isolation board (EVAL-ADM1075-ISOZ) to a PC.

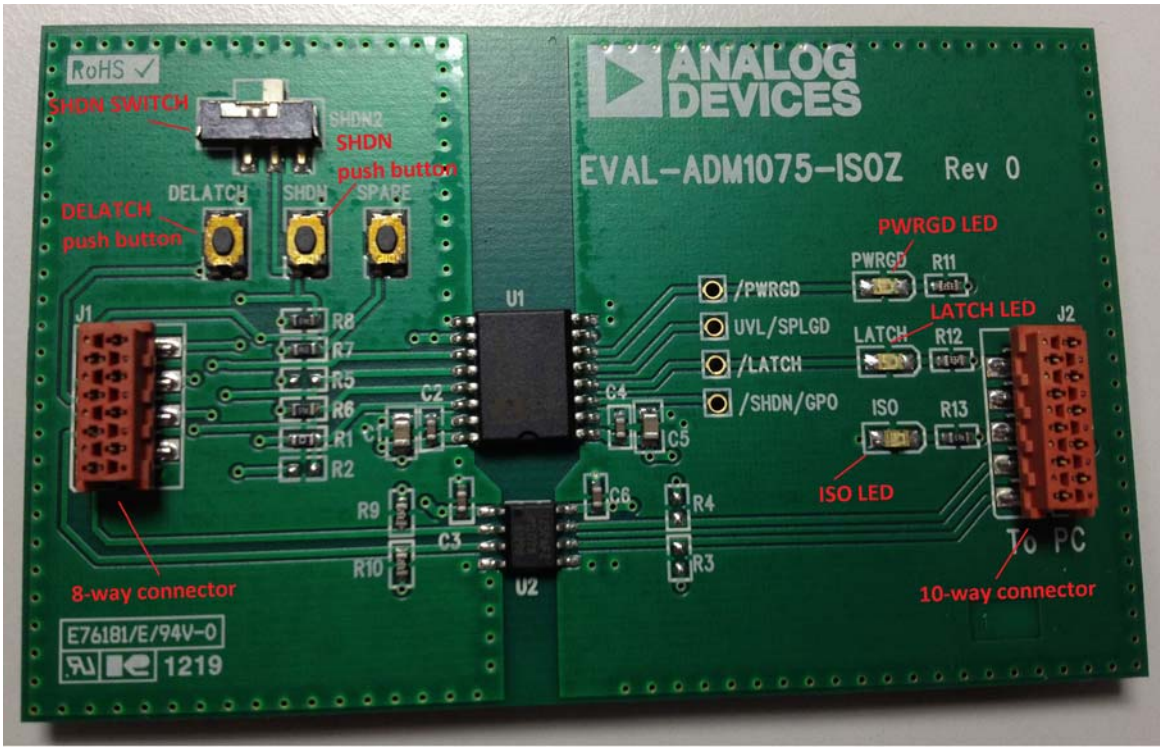

Figure 4. EVAL-ADM1075-ISOZ Board

EVALUATION BOARD HARDWARE

SWITCH, JUMPER, AND LED FUNCTIONS

EVAL-ADM1075MEBZ

Table 2. Connector Functions

Connector	Description
RTNIN, −48VIN	Hot swap line voltage inputs that also power the board components. The input voltage ranges from −30 V to −75 V.
−48VOUT	Hot swap line voltage output.
J3	8-way connector; use a Micro-MaTch ribbon cable to connect to an EVAL-ADM1075-ISOZ isolation board.

Table 3. Switch Functions

Switch	Description
RESTART	Push-button switch to trigger a shutdown that lasts for 10 sec.

Table 4. LED Functions

LED	Description
D_PWRGD	$\overline{\text{PWRGD}}$, active low; green.

Table 5. On-Board ICs

IC	Description
U1	ADM1075 main IC.

Table 6. Retry Configuration

	Bill of Materials Component		
Retry Scheme	**R-7RTY**	**R-1-10S**	**R-7-10S**
No Retries (Latch Off)	Not populated	Not populated	Not populated
Seven Retries, Then Latch Off (Default)	0 Ω	Not populated	Not populated
One Retry Every 10 sec	Not populated	0 Ω	Not populated
Seven Retries Every 10 sec	Not populated	Not populated	0 Ω

EVAL-ADM1075-ISOZ

Table 7. Connector Functions

Connector	Description
J1	8-way connector; use a Micro-MaTch ribbon cable to connect to an EVAL-ADM1075MEBZ board.
J2	10-way connector; use a USB-SDP-CABLEZ dongle to connect to a PC.

Table 8. Switch Functions

Switch	Description
SHDN2	Toggle switch to shut down hot swap. Right = hot swap enabled; left = hot swap disabled.
SHDN	Push-button switch to generate a shutdown. This push-button can be used to clear faults. Note that SHDN has a retry counter capable of counting up to seven shutdown events. After seven shutdown events, GPO2 goes active low, and then a restart or clear via a PMBus is required to enable the hot swap again.
DELATCH	Push-button switch to clear a latch event after seven shutdown events.
SPARE	Push-button switch connected to GPO1_TP.

Table 9. LED Functions

LED	Description
PWRGD	$\overline{\text{PWRGD}}$, active low; green.
LATCH	$\overline{\text{LATCH}}$, active low; red.
ISO	5 V power supply from USB-SDP-CABLEZ, active high; blue.

Table 10. On-Board ICs

IC	Description
U1	ADuM5404, quad-channel isolator with integrated dc-to-dc converter.
U2	ADuM1250 dual I^2C isolator.

TEST PLOTS

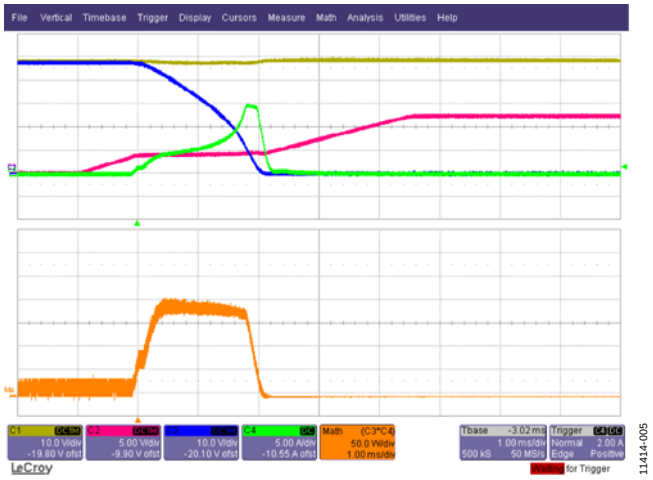

Figure 5. Power Up; Test Points Are as Follows: Channel 1 = V_{IN} (Yellow), Channel 2 = GATE (Pink), Channel 3 = V_{DS} (Blue), Channel 4 = System Current (Green), M1 = FET Power (CH2 × CH4) (Orange)

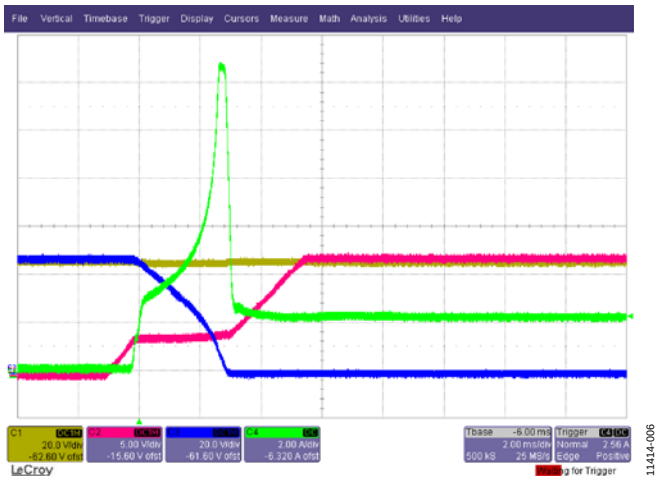

Figure 6. Power Up into 24 Ω Resistive Load; Test Points Are as Follows: Channel 1 = V_{IN}, Channel 2 = GATE, Channel 3 = V_{DS}, Channel 4 = System Current

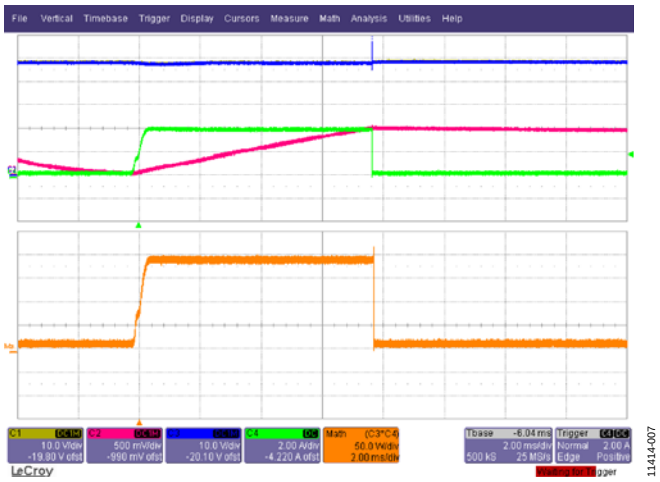

Figure 7. Power Up into a Fault Condition; Test Points Are as Follows: Channel = V_{IN}, Channel 2 = TIMER, Channel 3 = V_{DS}, Channel 4 = System Current, Math Channel = FET Power

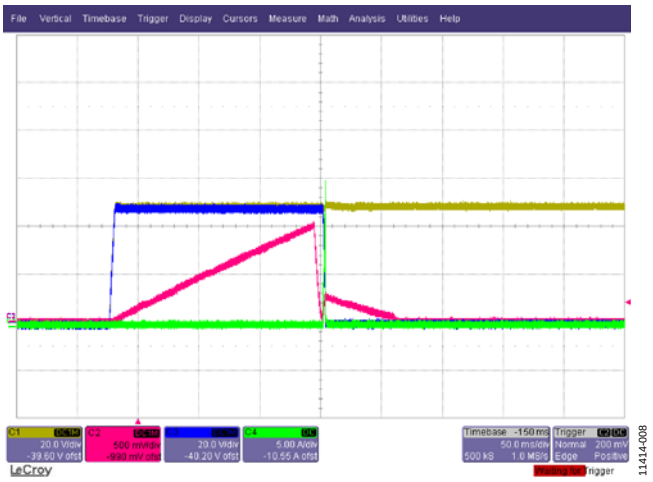

Figure 8. Timer Cycle at Power-Up; Test Points Are as Follows: Channel 1 = V_{IN}, Channel 2 = TIMER, Channel 3 = V_{DS}, Channel 4 = System Current

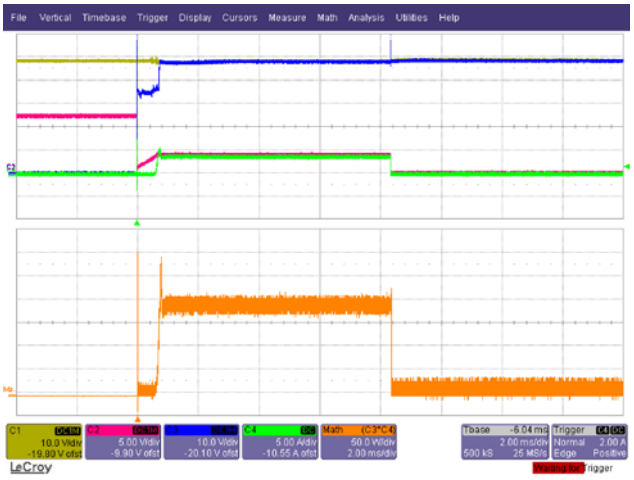

Figure 9. Short-Circuit Event; Test Points Are as Follows: Channel 1 = V_{IN}, Channel 2 = GATE, Channel 3 = V_{DS}, Channel 4 = System Current, Math Channel = FET Power

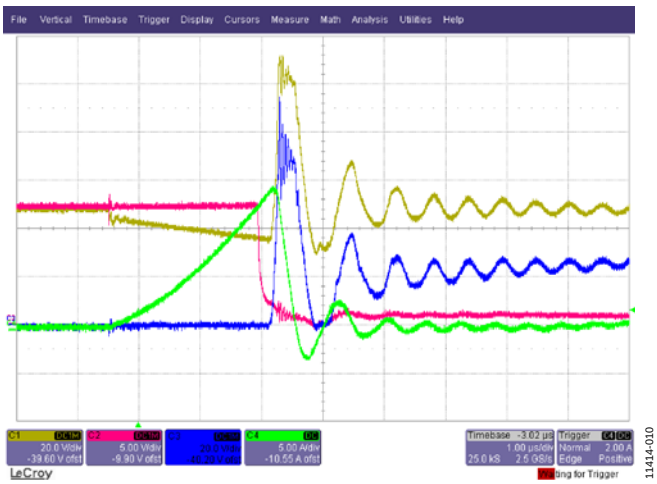

Figure 10. Short Circuit (Zoom); Test Points Are as Follows: Channel 1 = V_{IN}, Channel 2 = GATE, Channel 3 = V_{DS}, Channel 4 = System Current

EVALUATION BOARD SCHEMATICS AND LAYOUT

EVAL-ADM1075MEBZ

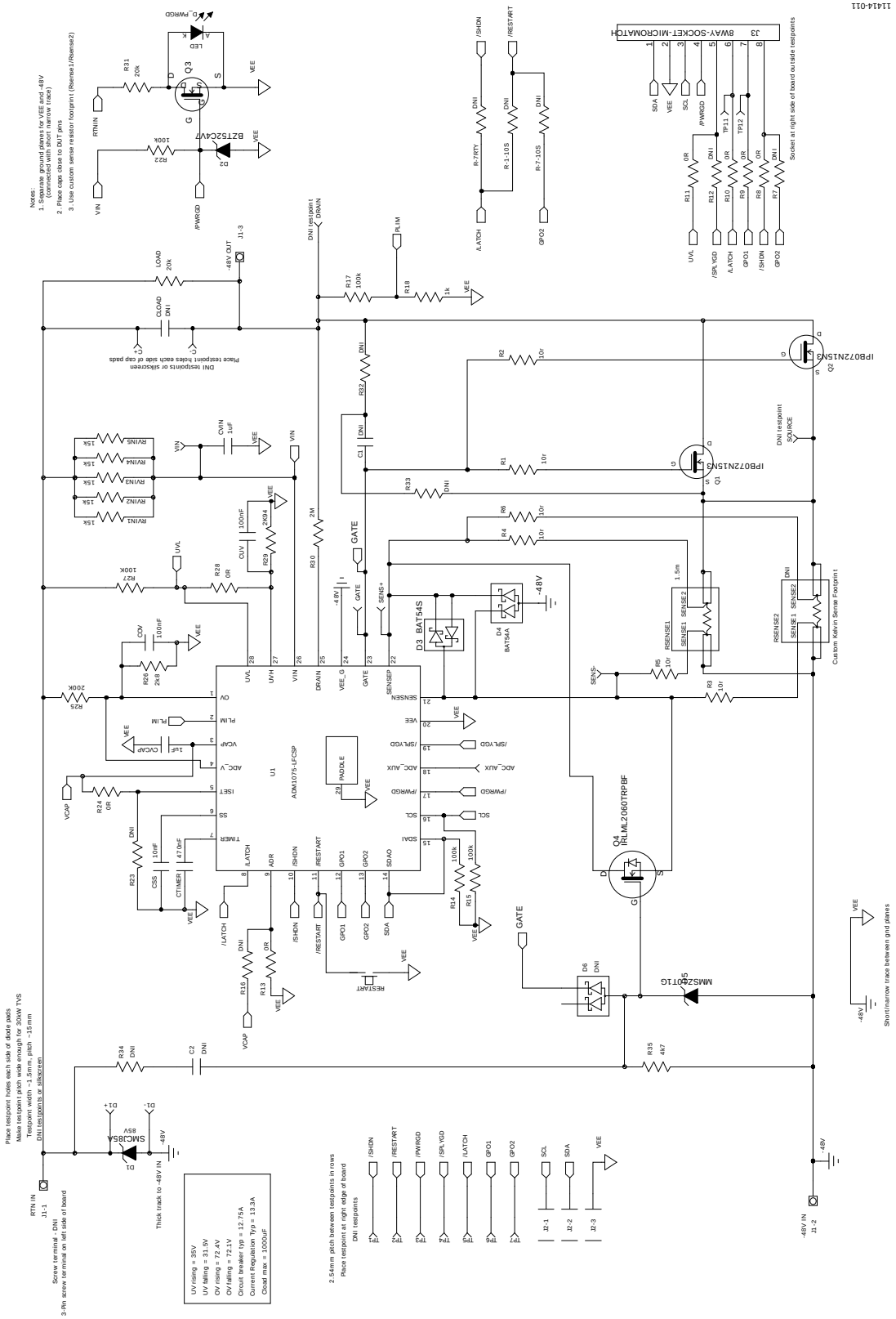

Figure 11. EVAL-ADM1075MEBZ Schematic

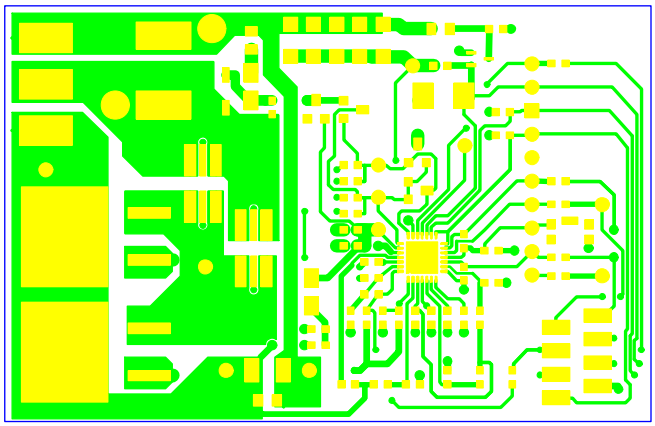

Figure 12. Top Layer

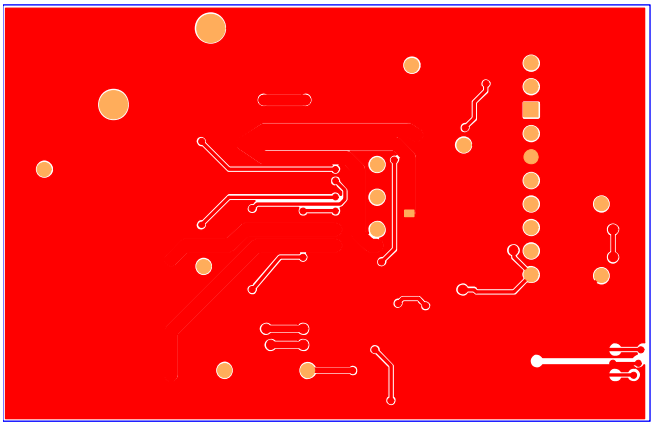

Figure 13. Inner Layer 2

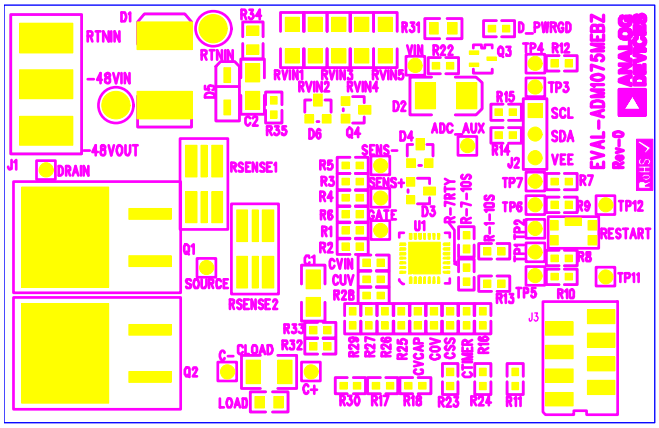

Figure 14. Assembly Top

EVAL-ADM1075-ISOZ

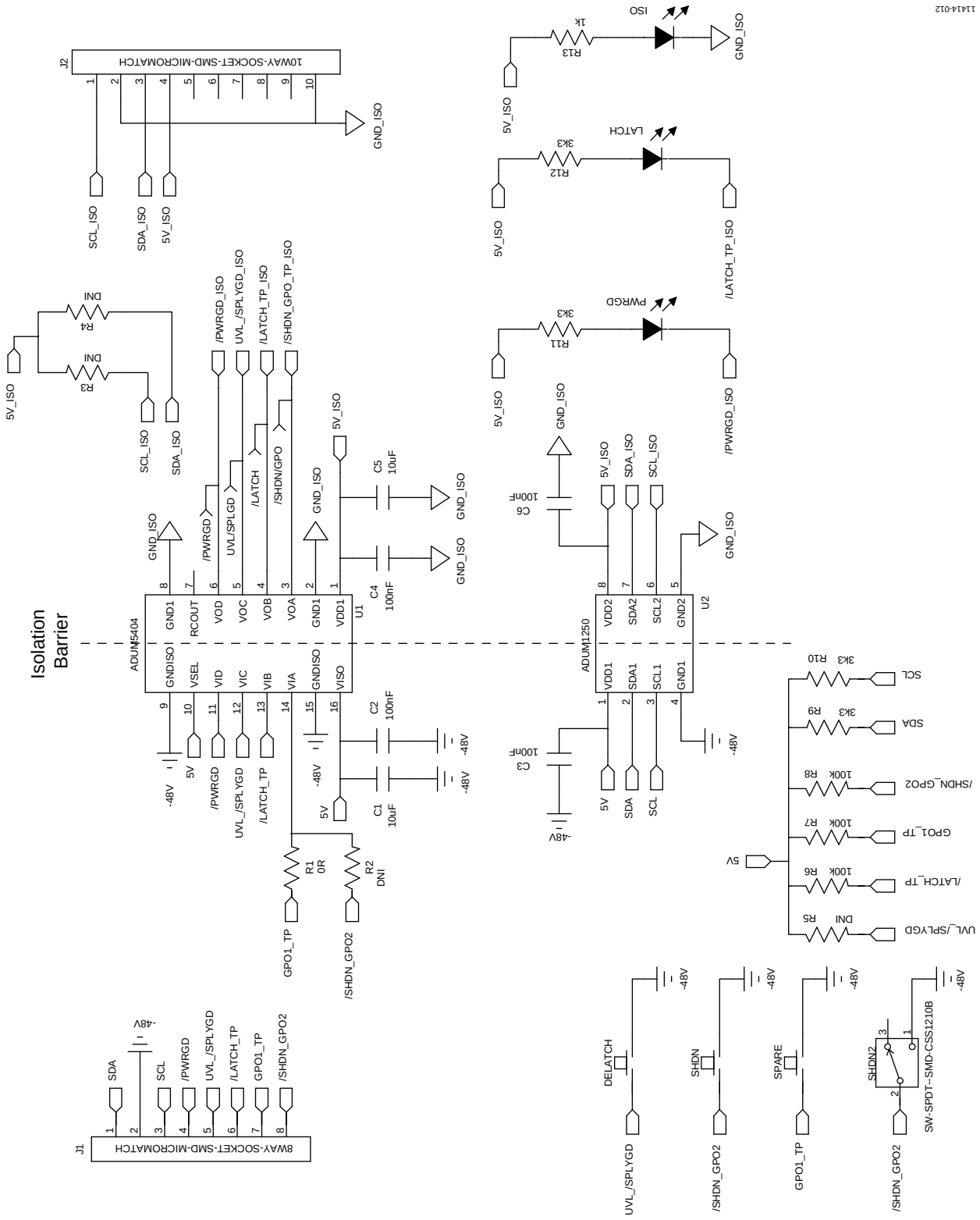

Figure 15. EVAL-ADM1075-ISOZ Schematic

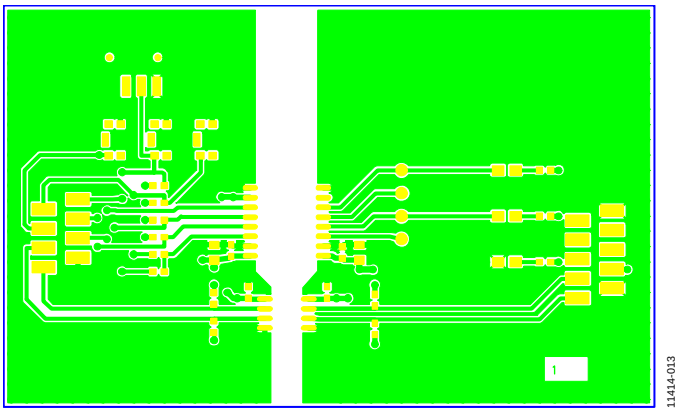

Figure 16. Top Layer

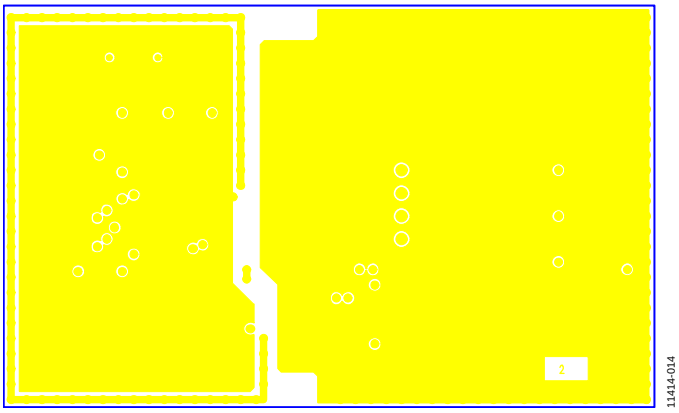

Figure 17. Inner Layer 2

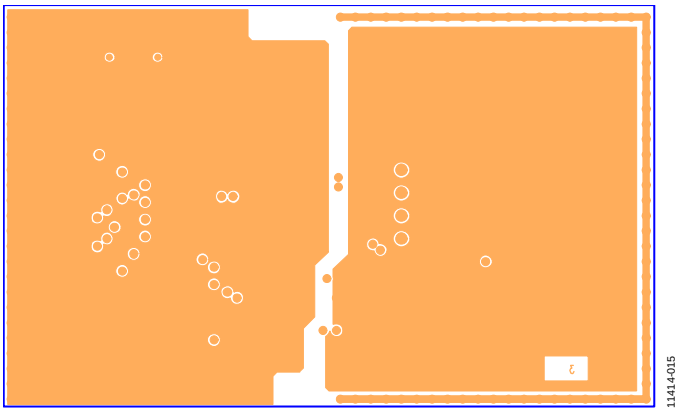

Figure 18. Inner Layer 3

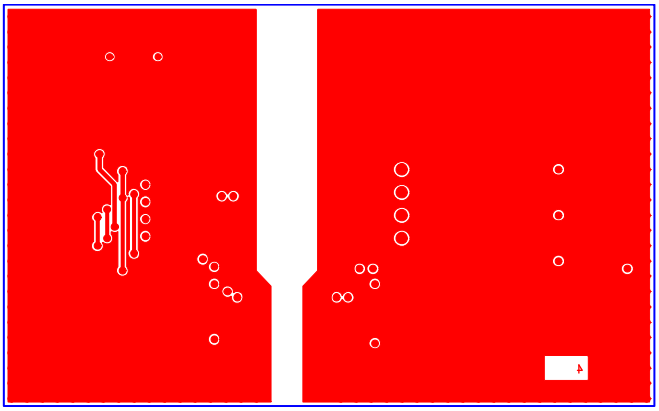

Figure 19. Bottom Layer

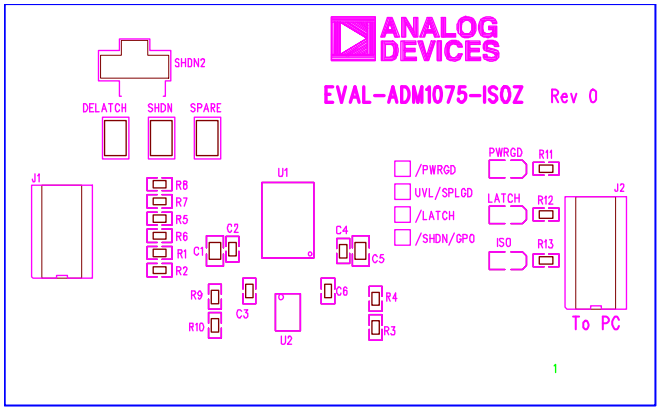

Figure 20. Assembly Top

BILL OF MATERIALS

EVAL-ADM1075MEBZ

Table 11. EVAL-ADM1075MEBZ Bill of Materials

Designator	Description	Part/Order Code
C1, C2	Capacitor	Do not insert
CLOAD	Capacitor	Do not insert
COV CUV	Capacitor, 100 nF	Farnell 1692286
CSS	Capacitor, 10 nF	Farnell 1639964
CTIMER	Capacitor, 470 nF	Farnell 1828894
CVCAP	Capacitor, 1 µF	Farnell 1288256
CVIN	Capacitor, 1 µF	Farnell 1650836
D1	Diode, SMCJ85A, 85 V	Digi-Key SMCJ85ABCT-ND
D2	Diode, Zener, 4.7 V	Farnell 1902435
D3	Diode, Schottky, BAT54S	Farnell 1467519
D4	Diode, Schottky, BAT54A	Farnell 1228222
D6	Diode	Do not insert
D5	Diode, Zener	Farnell 1431256
D_PWRGD	LED	Farnell 1219743
GL1	Ground link	N/A
J1	Connector/Power 3	Farnell 151790
J2	3-pin header	Do not insert
J3	8-way socket Micro-MaTch	Digi-Key A99475CT-ND
LOAD, R31	Resistor, 20 kΩ	Farnell 1894202
Q1, Q2	MOSFET, N-channel, 150 V, 100 A, PG-TO263-3	Farnell 1775544
Q3	MOSFET, N-channel, 3-SC-70	Farnell 1470156
Q4	MOSFET, N-channel, 60 V, 1.2 A, SOT-23	Farnell 1791578
R-1-10S, R-7-10S, R-7RTY	Resistor	Do not insert
R1 to R6	Resistor, 10 Ω	Farnell 1738878
R7, R12, R16, R23	Resistor	Do not insert
R8 to R11, R13, R24, R28	Resistor, 0 Ω	Farnell 9331662
R14, R15	Resistor, 100 kΩ	Farnell 9330402
R17	Resistor, 100 kΩ	Farnell 1750700
R18	Resistor, 1 kΩ	Farnell 9330380
R22	Resistor, 100 kΩ	Farnell 9331719
R25	Resistor, 200 kΩ	Farnell 1894148
R26	Resistor, 2.8 kΩ	Farnell 1170832
R27	Resistor, 100 kΩ	Farnell 1750700
R29	Resistor, 2.94 kΩ	Farnell 1170835
R30	Resistor, 2 MΩ	Farnell 1469773
R32 to R34	Resistor	Do not insert
R35	Resistor, 4.7 kΩ	FEC 9331247
RESTART	Switch, 2.8 mm × 3.8 mm, vertical push	Farnell 1605470
RSENSE1	Sense resistor, 2512, 1.5 mΩ	Farnell 1292507
RSENSE2	Sense resistor, 2512	Do not insert
RVIN1 to RVIN5	Resistor, 15 kΩ	Farnell 1739028
U1	Hot swap controller	Analog Devices ADM1075-1ACPZ or ADM1075-2ACPZ

EVAL-ADM1075-ISOZ

Table 12. EVAL-ADM1075-ISOZ Bill of Materials

Designator	Description	Part/Order Code
C1, C5	Capacitor, 10 µF	Farnell 1288204
C2 to C4, C6	Capacitor, 100 nF	Farnell 1692286
DELATCH, SHDN, SPARE	Switch, 2.8 mm × 3.8 mm, vertical push	Farnell 1605470
ISO	LED	Farnell 8529876
J1	8-way socket SMD Micro-MaTch	Digi-Key A99475CT-ND
J2	10-way socket SMD Micro-MaTch	Digi-Key A99476CT-ND
LATCH	LED	Farnell 1328348
PWRGD	LED	Farnell 1226376
R1	Resistor, 0 Ω	Farnell 9331662
R2 to R5	Resistor	Do not insert
R6 to R8	Resistor, 100 kΩ	Farnell 2008342
R9 to R12	Resistor, 3.3 kΩ	Farnell 9332022
R13	Resistor, 1 kΩ	Farnell 2008335
SHDN2	SPDT switch SMD	Digi-Key 563-1091-2-ND
U1	Quad-channel isolator	Analog Devices ADuM5404ARWZ
U2	Hot swappable dual I^2C isolator	Analog Devices ADuM1250ARZ

ESD Caution
ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

UG11414-0-4/14(A)

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