ANALOG DEVICES

EVAL-AD5292DBZ User Guide

UG-1439

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Evaluating the AD5292 Digital Potentiometer

FEATURES

- Full featured evaluation board in conjunction with high voltage digital potentiometer motherboard (EVAL-MB-HV-SDZ)
- PC control via SDP-B or SDP-S
- PC software for control
- 20-time programmable
- 1% resistance precision

EVALUATION KIT CONTENTS

- EVAL-AD5292DBZ board
- EVAL-MB-HV-SDZ motherboard
- CD containing
  - Self installing software that allows users to control the EVAL-AD5292DBZ and exercise all functions of the device
  - Electronic version of the AD5292 data sheet
  - Electronic version of the EVAL-AD5292DBZ user guide

GENERAL DESCRIPTION

This user guide describes the full featured EVAL-AD5292DBZ board for evaluating the AD5292 digital potentiometer. The AD5292 is a single-channel, 1024-position digital potentiometer with less than ±1% end to end resistor tolerance error and 20-time programmable (20-TP) memory. The AD5292 is capable of operating at high voltages, supporting both dual supply ±10.5 V to ±16.5 V and single supply 21 V to 33 V operation.

The AD5292 uses a serial interface that operates at clock rates of up to 50 MHz and is compatible with the standard serial peripheral interface (SPI).

The EVAL-AD5292DBZ incorporates an internal power supply from the USB and allows an external power supply for the logic voltage levels. The logic voltage levels operate from single 2.7 V to 5.5 V supplies. The EVAL-AD5292DBZ can operate in single supply and dual supply modes, and incorporates an output buffer.

Complete specifications for the AD5292 can be found in the AD5292 data sheet available from Analog Devices, Inc., and must be consulted in conjunction with this user guide when using the evaluation board.

EVAL-AD5292DBZ WITH EVAL-MB-HV-SDZ MOTHERBOARD PHOTOGRAPH

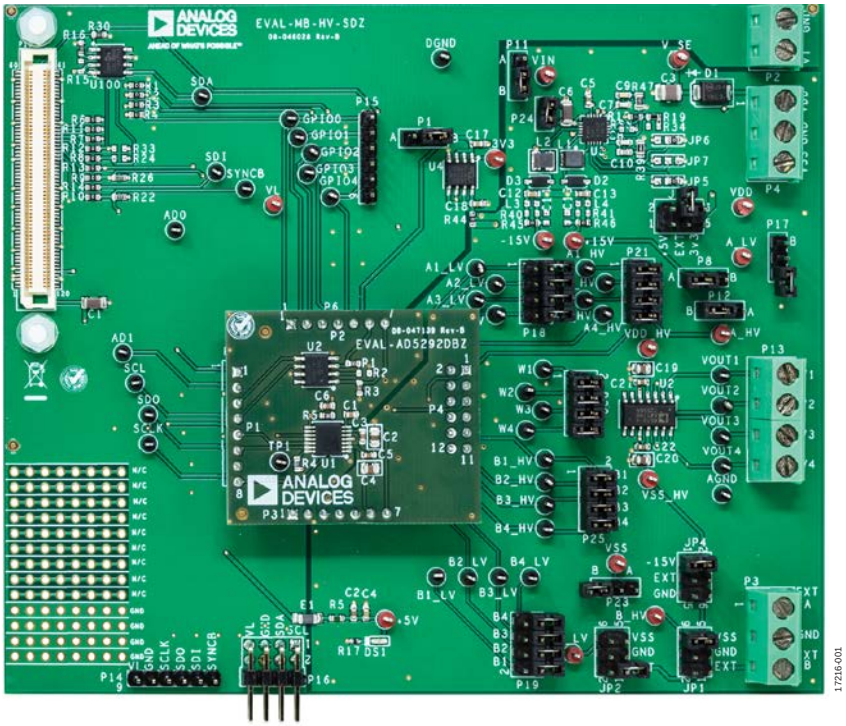

Figure 1.

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REVISION HISTORY

1/2020—Revision 0: Initial Version

EVALUATION BOARD HARDWARE

POWER SUPPLIES

The EVAL-MB-HV-SDZ motherboard supports use of single and dual power supplies. The EVAL-MB-HV-SDZ motherboard can also be used to evaluate a low voltage digital potentiometer using the P9 connector.

The EVAL-AD5292DBZ evaluation board can be powered either from the system demonstration platform (SDP) port or externally by the P4 connector and P2 connector, as described in Table 1.

Link Options

Several link and switch options are incorporated in the EVAL-MB-HV-SDZ motherboard and must be set up before using the EVAL-MB-HV-SDZ. The functions of these link options and the default options are described in detail in Table 2.

Table 1. Maximum and Minimum Voltages of the Connectors

Connector No.	Label	Voltage
P4-1	VDD	Analog positive power supply, V_{DD}. Single supply from 21 V to 33 V. Dual supply from 10.5 V to 16.5 V. Dual supply through the ADP5071, 5 V.
P4-2	GND	Analog ground.
P4-3	VSS	Analog negative power supply, V_{SS}. Single supply operation of 0 V. Dual supply from −10.5 V to −16.5 V.
P2-1	VL	Digital supply, from 2.7 V to 5.5 V.
P2-2	GND	Digital ground.

Table 2. Link Functions

Link No.	Label/Link Function	Default Position	Options
P11	VIN	B	Selects the power supply, V_{IN}, for the ADP5071 A: V_SINGLE (derived from VDD_EXT, external supply from the P4 connector) B: +5 V (5 V from SDP-B or SDP-S)
P1	VL	B	Selects the logic power supply, V_{LOGIC} A: VL_EXT (external supply from the P2 connector) B: VL3V3 (3.3 V from SDP-B or SDP-S)
JP3	VDD	Not inserted	Selects the low voltage positive power supply, V_{DD_LV} A: +5 V (5 V from SDP-B or SDP-S) B: VDD_EXT (external supply from the P4 connector) C: VL3V3 (3.3 V from SDP-B or SDP-S)
P23	VSS	Not inserted	Selects the low voltage negative power supply, V_{SS_LV} A: VSS_EXT (external supply from the P4 connector) B: AGND
P8	VDD_HV	A	Selects the high voltage positive power supply, V_{DD_HV} A: 15 V (+15 V from ADP5071) B: VDD_EXT (external supply from the P4 connector)
JP4	VSS_HV	A	Selects the high voltage negative power supply, V_{SS_HV} A: −15 V (−15 V from ADP5071) B: VSS_EXT (external supply from the P4 connector) C: AGND
P17	A_LV	Not inserted	Selects the voltage at Terminal A for the low voltage digital potentiometer A: A_EXT (external supply from the P3 connector) B: VDD
JP2	B_LV	Not inserted	Selects the voltage at Terminal B for the low voltage digital potentiometer A: VSS B: AGND C: B_EXT (external supply from the P3 connector)
P12	A_HV	B	Selects the voltage at Terminal A for the high voltage digital potentiometer A: A_EXT (external supply from the P3 connector) B: VDD_HV

Link No.	Label/Link Function	Default Position	Options
JP1	B_HV	A	Selects the voltage at Terminal B for the high voltage digital potentiometer A: VSS_HV B: AGND C: B_EXT (external supply from the P3 connector)
P24	Supply for ADP5071	Inserted	Connects V_{IN} to the supply terminal of ADP5071
P21	A_HV channel links		
	A1_HV	Inserted	Connects Terminal A1 to A_HV
	A2_HV	Inserted	Connects Terminal A2 to A_HV
	A3_HV	Inserted	Connects Terminal A3 to A_HV
	A4_HV	Inserted	Connects Terminal A4 to A_HV
P18	A_LV channel links		
	A1_LV	Not inserted	Connects Terminal A1 to A_LV
	A2_LV	Not inserted	Connects Terminal A2 to A_LV
	A3_LV	Not inserted	Connects Terminal A3 to A_LV
	A4_LV	Not inserted	Connects Terminal A4 to A_LV
P19	B_LV channel links		
	B1_LV	Not inserted	Connects Terminal B1 to B_LV
	B2_LV	Not inserted	Connects Terminal B2 to B_LV
	B3_LV	Not inserted	Connects Terminal B3 to B_LV
	B4_LV	Not inserted	Connects Terminal B4 to B_LV
P25	B_HV channel links		
	B1_HV	Inserted	Connects Terminal B1 to B_HV
	B2_HV	Inserted	Connects Terminal B2 to B_HV
	B3_HV	Inserted	Connects Terminal B3 to B_HV
	B4_hV	Inserted	Connects Terminal B4 to B_HV
P20	Buffer connector		
	W1_BUF	Inserted	Connects Terminal W1 to an output buffer
	W2_BUF	Inserted	Connects Terminal W2 to an output buffer
	W3_BUF	Inserted	Connects Terminal W3 to an output buffer
	W4_BUF	Inserted	Connects Terminal W4 to an output buffer

EVALUATION BOARD SOFTWARE

INSTALLING THE SOFTWARE

The EVAL-AD5292DBZ kit includes a CD containing the evaluation board software. The software is compatible with Windows® 7, Windows 8 and Windows 10.

Install the software before connecting the SDP board to the USB port of the PC so that the SDP-B or SDP-S board is recognized when it is connected to the PC.

To install the software, perform the following steps:

1. Start the Windows operating system and insert the CD into the CD-ROM drive.
2. The installation software opens automatically. If it does not open automatically, run the **setup.exe** file from the CD.
3. After the installation is complete, power up the evaluation board as described in the Power Supplies section.
4. Connect the EVAL-AD5292DBZ and EVAL-MB-HV-SDZ to the SDP-B or SDP-S board, and then connect the SDP-B or SDP-S board to the PC using the USB cable included with the SDP-B or SDP-S board.
5. When the software detects the evaluation board, follow the instructions that appear to complete installation.

To run the program, perform the following steps:

1. Select **Start** > **All Programs** > **Analog Devices** > **AD5292** > **AD5292 Eval Board**. To uninstall the program, select **Start** > **Control Panel** > **Add or Remove Programs** > **AD5292 Eval Board**.
2. If the SDP-B or SDP-S board is not connected to the USB port when the software is launched, a connectivity error displays (see Figure 2). Connect the EVAL-AD5292DBZ board to the USB port of the PC, wait a few seconds, click **Rescan**, and follow the instructions.

The main window of the EVAL-AD5292DBZ software then opens, as shown in Figure 3.

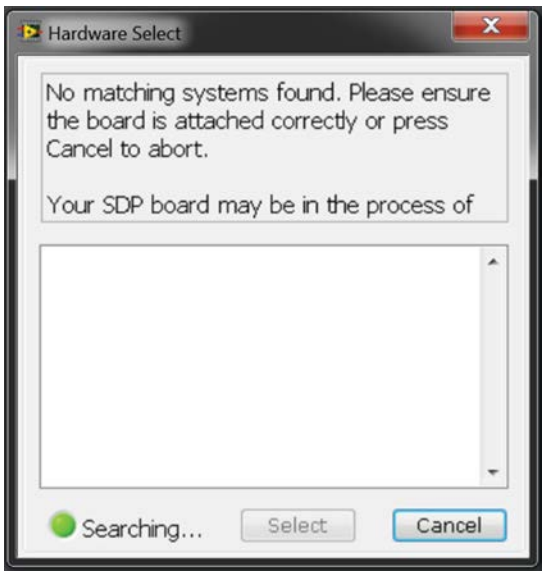

Figure 2. Connectivity Error Window

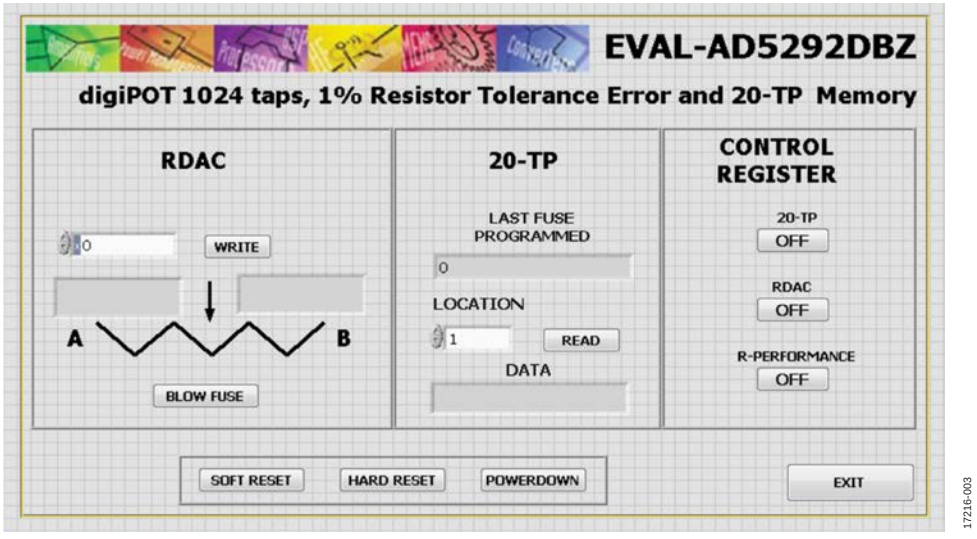

Figure 3. EVAL-AD5292DBZ Software Main Window

SOFTWARE OPERATION

In the main window of the software, there are four buttons. **POWERDOWN** (or **POWERUP** when the device is off) powers the device down and up. When the button is clicked, the software shutdown bit toggles automatically. **SOFT RESET** sends a reset by software. **HARD RESET** sends a reset by hardware. **EXIT** closes the program, but does not reset the device.

The main window is also divided in three sections.

RDAC

Clicking **WRITE** changes the contents of the RDAC register and displays the value of the resistor, as shown in the Figure 4.

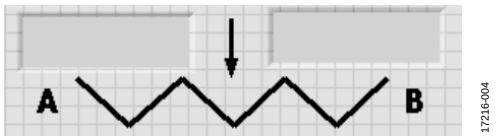

Figure 4. Resistor Value, Left Position Is Resistance from A to W, Right Position Is Resistance from W to B

Clicking **BLOW FUSE** saves the current value stored in the RDAC register into the 20-TP memory. Enable the 20-TP program in the **CONTROL REGISTER** section.

20-TP

Clicking **READ** returns the value stored in the location specified in the **LOCATION** box. **READ** also computes the location of the last fuse programmed.

CONTROL REGISTER

Clicking **20-TP ON/OFF** enables the C0 bit (20-TP program enable). Enable this bit to write into the 20-TP memory.

Clicking **RDAC ON/OFF** enables the C1 bit (RDAC register write protect). Enable this bit to allow updates of the wiper position through the digital interface.

R-PERFORMANCE ON/OFF is the C2 bit (calibration enable).

EVALUATION BOARD SCHEMATICS AND ARTWORK

MOTHERBOARD

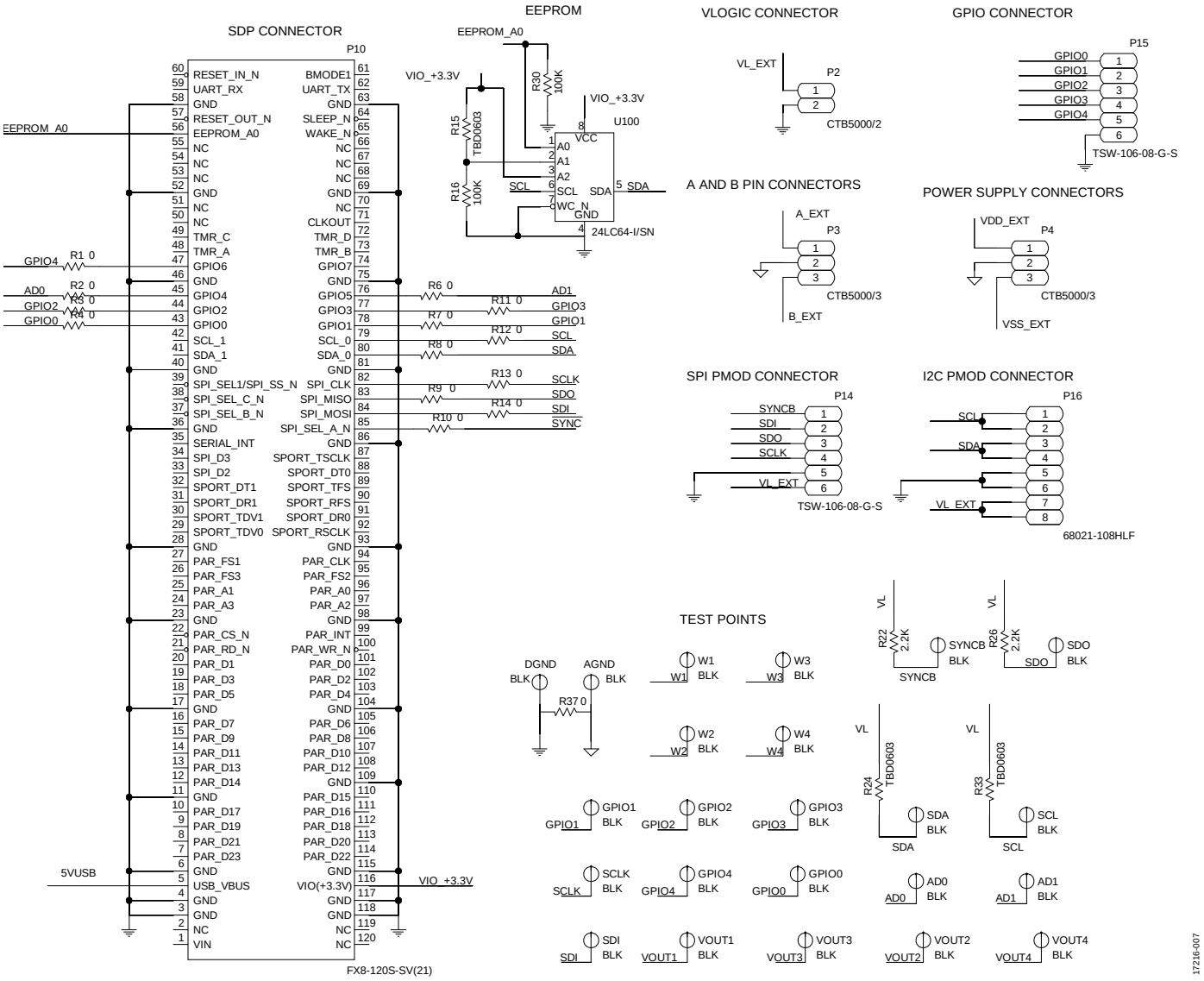

Figure 5. SDP Connector and Power Supply

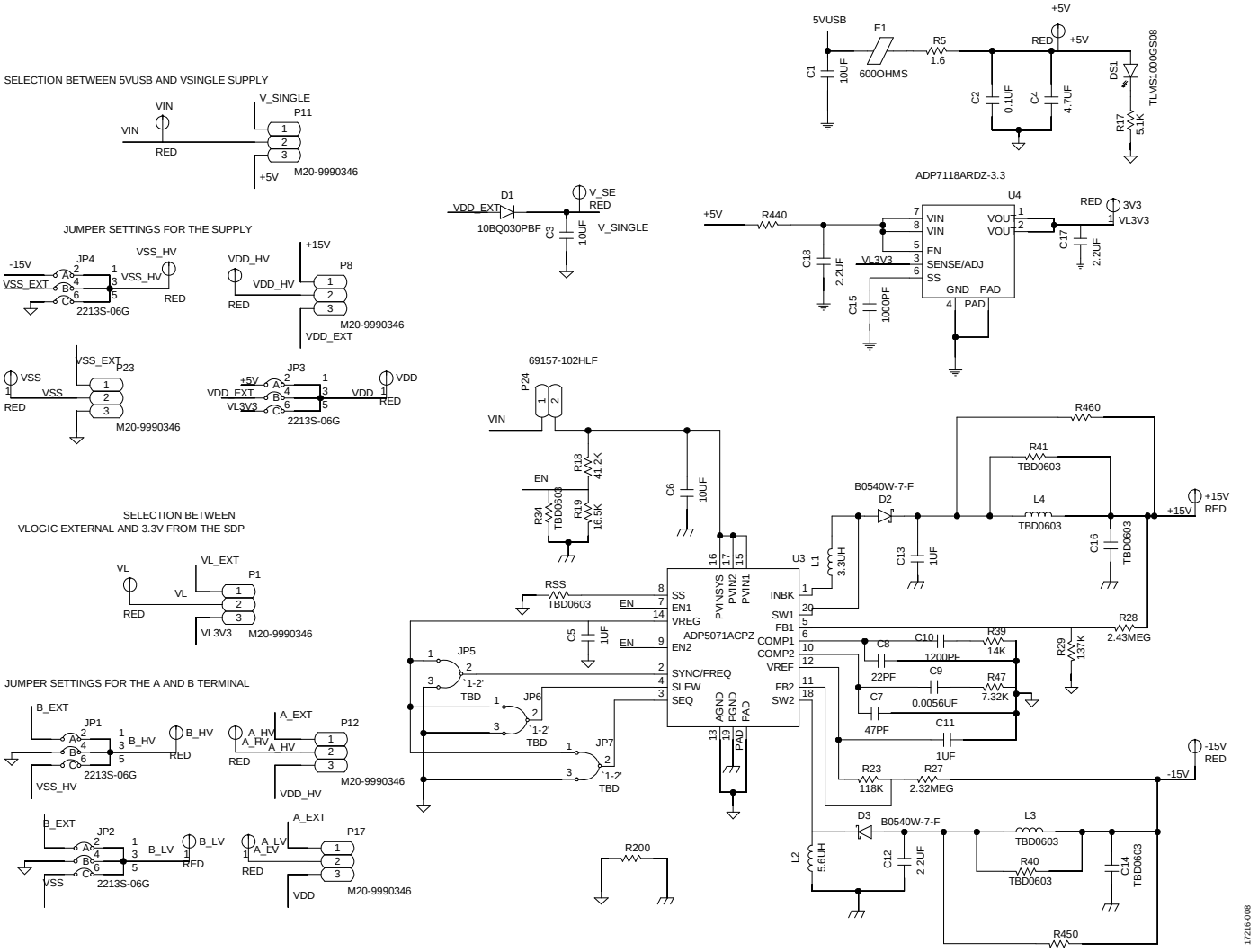

Figure 6. EVAL-MB-HV-SDZ Schematic—Power Supply

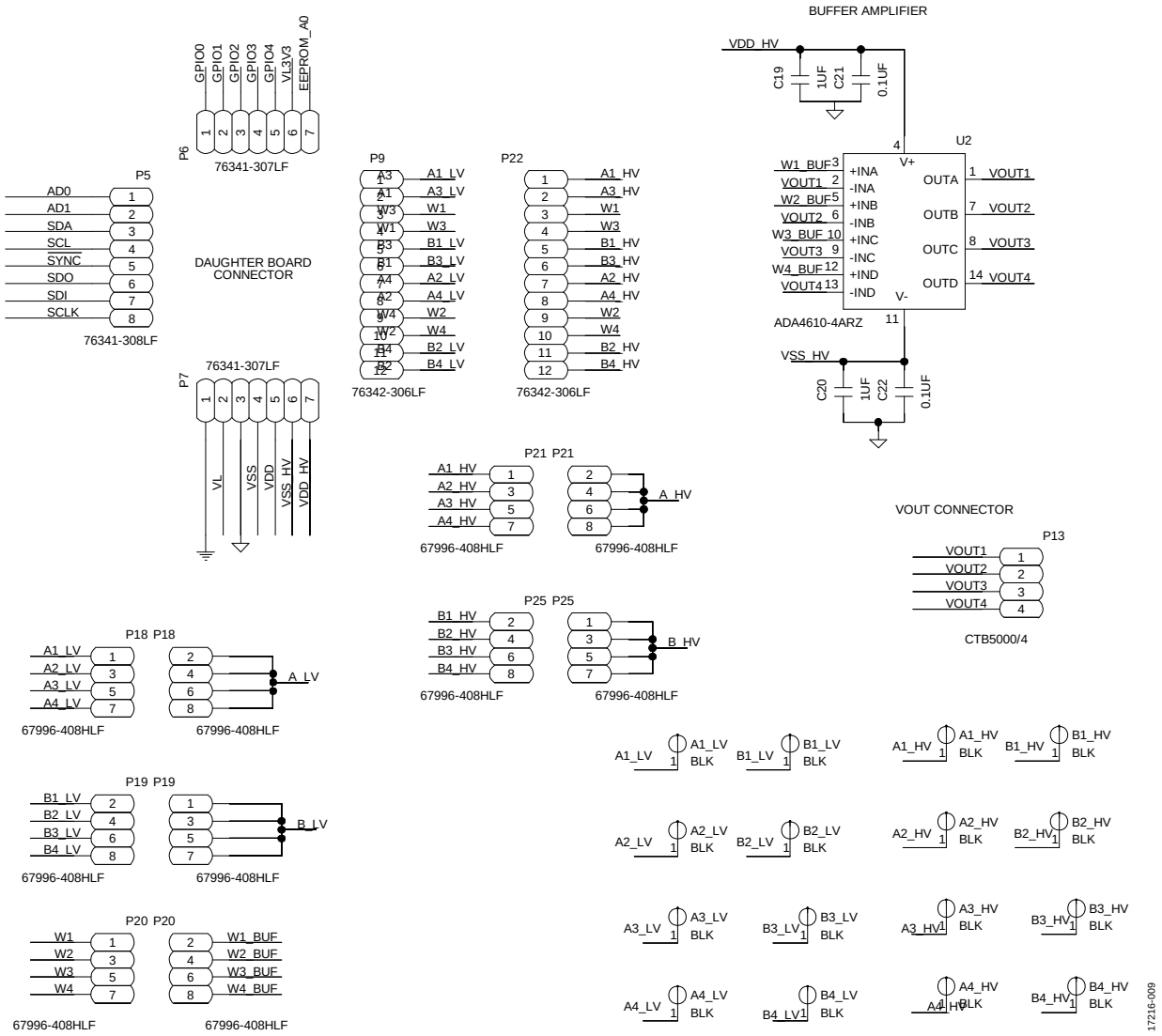

Figure 7. EVAL-MB-HV-SDZ Schematic—Daughterboard Connectors

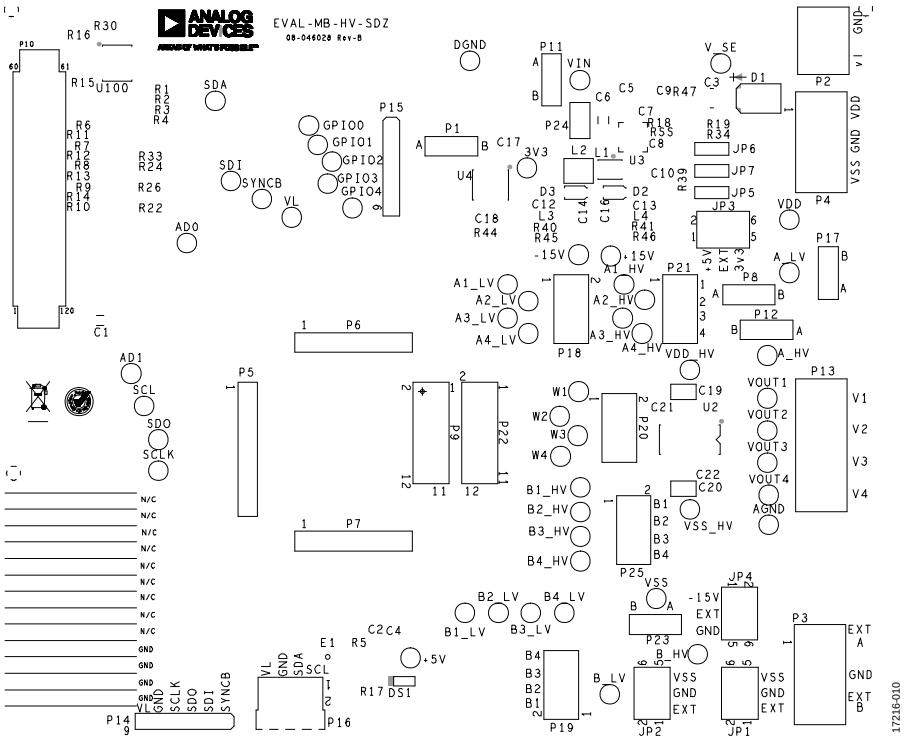

Figure 8. Silkscreen Primary

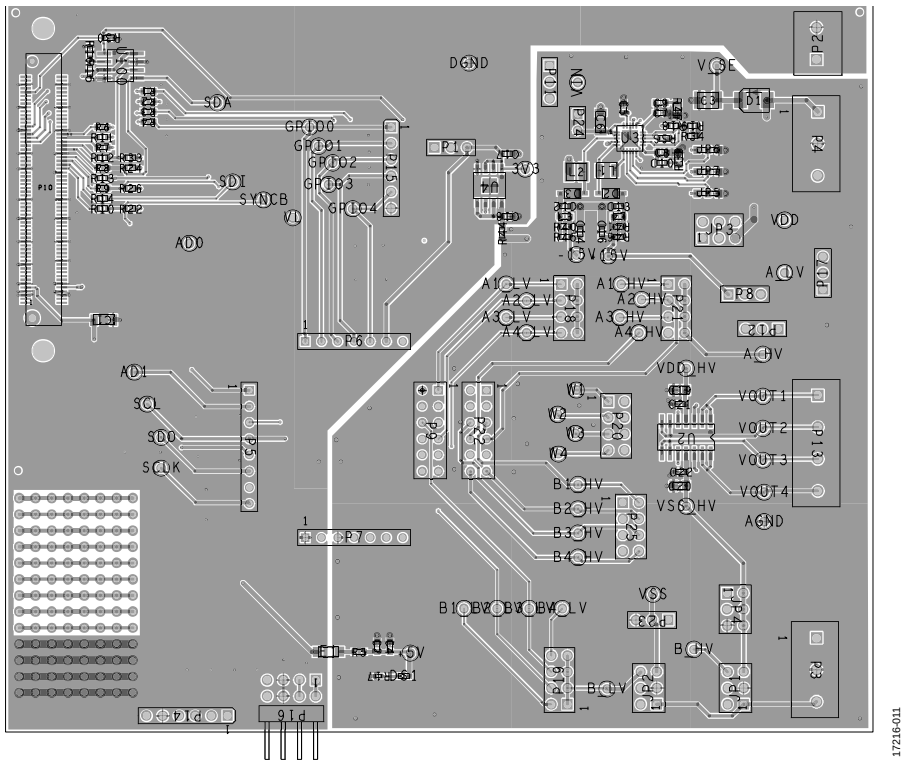

Figure 9. Component Placement Drawing of Motherboard

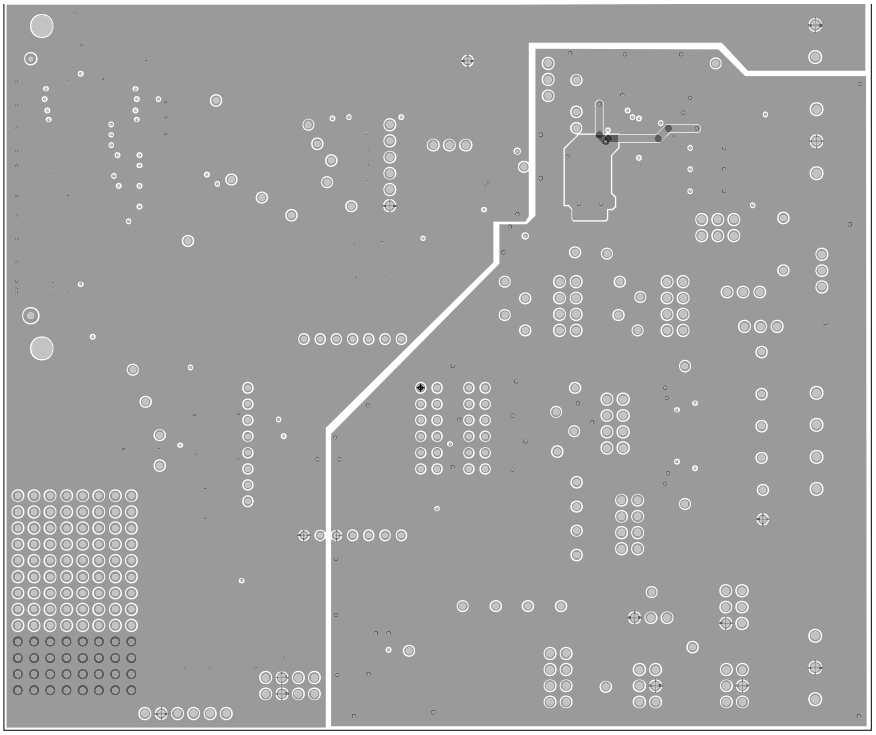

Figure 10. Ground Planes

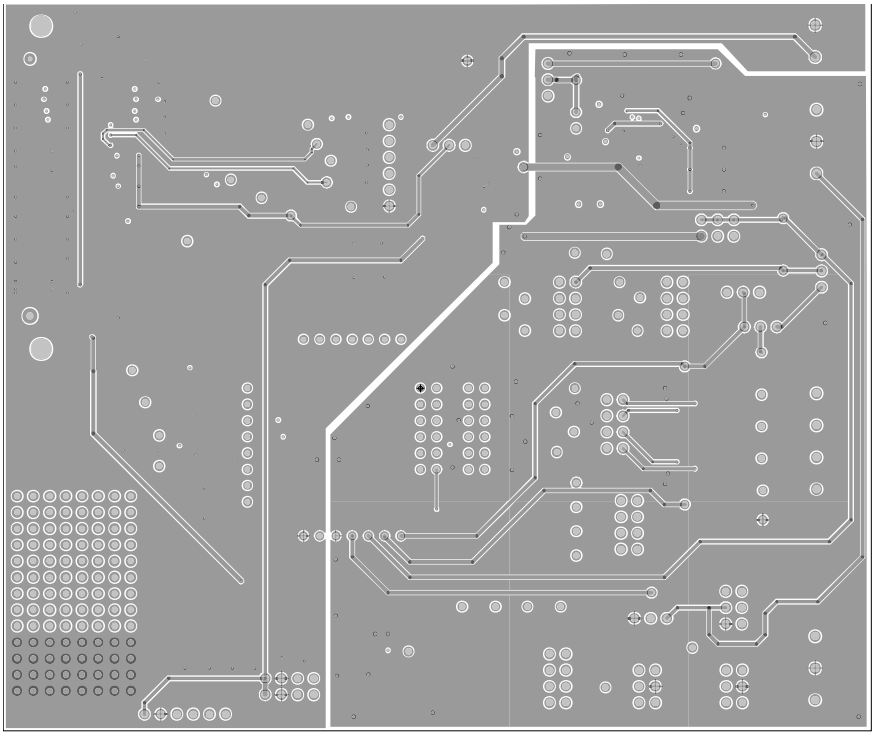

Figure 11. Power Ground Planes

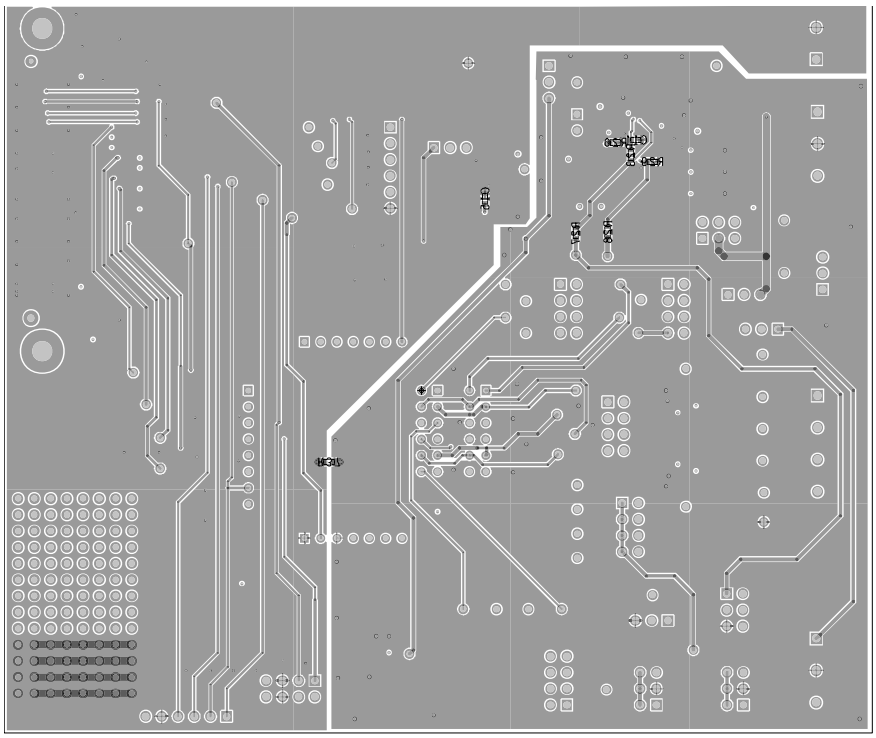

Figure 12. Bottom Layer Side PCB Drawing of Motherboard

DAUGHTER BOARD

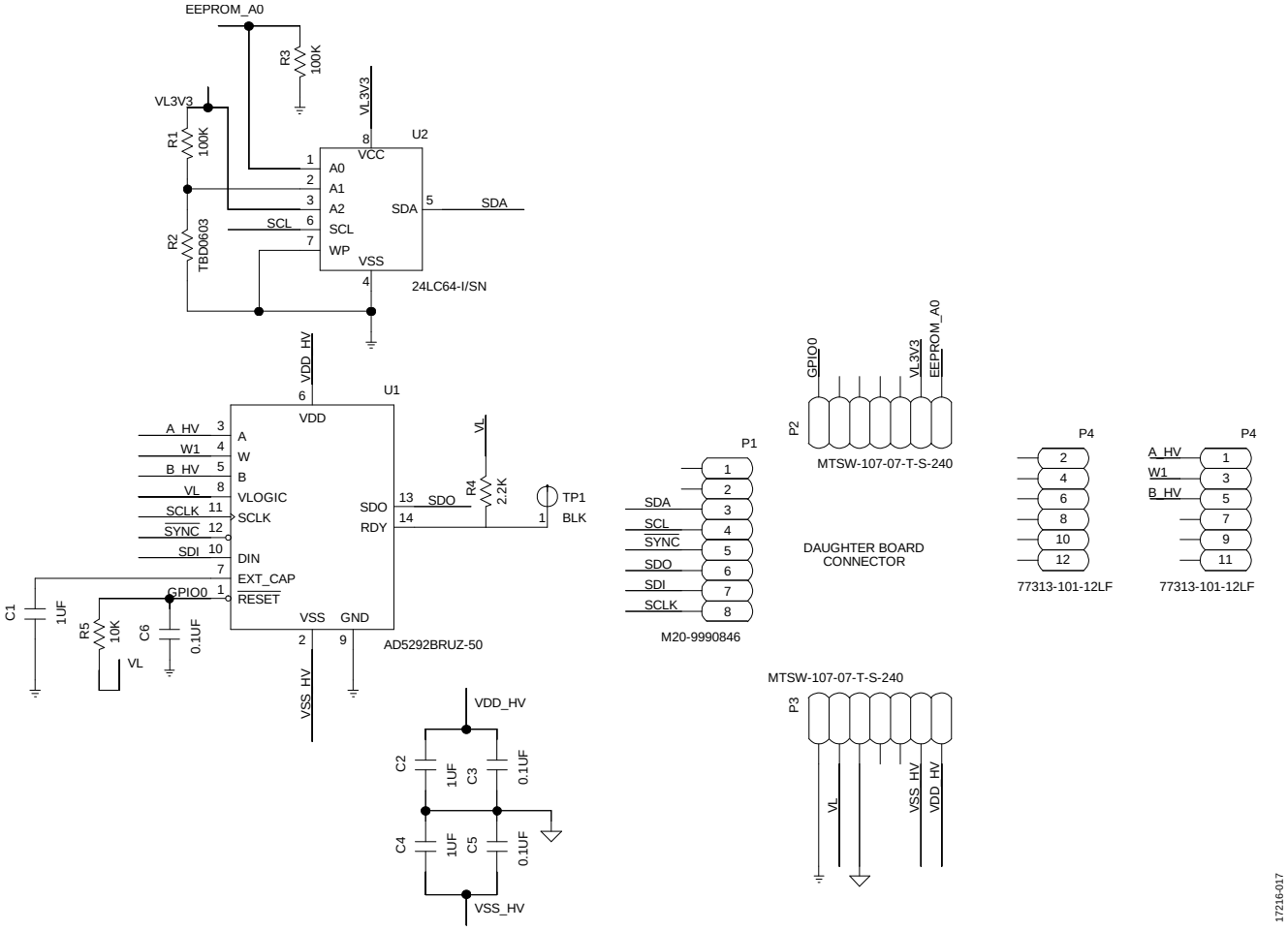

Figure 13. EVAL-AD5290DBZ Schematic

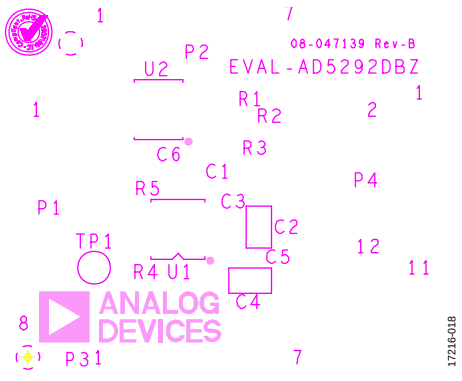

Figure 14. Silkscreen

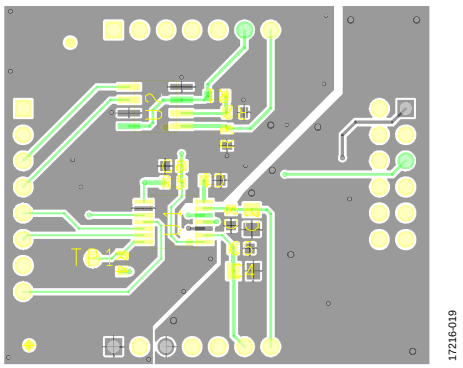

Figure 15. Layer 1, Primary

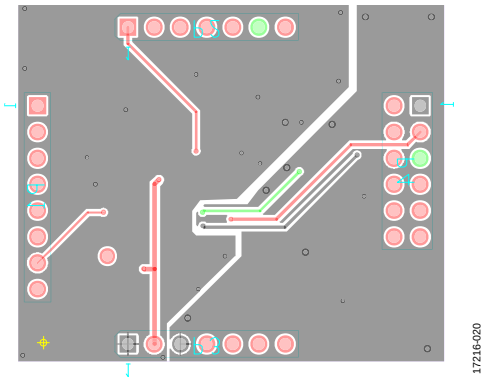

Figure 16. Layer 2, Secondary

ORDERING INFORMATION

BILL OF MATERIALS

Table 3. Motherboard

Qty	Reference Designator	Description	Part Number
15	+5V, +15V, −15V, 3V3, A_HV, A_LV, B_HV, B_LV, VDD, VDD_HV, VIN, VL, VSS, VSS_HV, V_SE	Red test point	20-313137
39	A1_HV, A1_LV, A2_HV, A2_LV, A3_HV, A3_LV, A4_HV, A4_LV, AD0, AD1, AGND, B1_HV, B1_LV, B2_HV, B2_LV, B3_HV, B3_LV, B4_HV, B4_LV, DGND, GPIO0, GPIO1, GPIO2, GPIO3, GPIO4, SCL, SCLK, SDA, SDI, SDO, SYNCB, VOUT1, VOUT2, VOUT3, VOUT4, W1, W2, W3, W4	Black test point	20-2137
2	C1, C6	10 µF capacitor	GRM31CR71A106K
1	C10	1200 pF capacitor	C1608C0G1H122J
2	C5, C11	1 µF capacitor	JMK107B7105MA
1	C12	2.2 µF capacitor	GRM188R6YA225KA12D
1	C13	1 µF capacitor	GRM188R61E105KA12D
2	C14, C16	Not populated	Not populated
1	C15	1000 pF capacitor	GRM188R71H102KA01D
2	C17, C18	2.2 µF capacitor	GRM188R60J225KE19D
2	C19, C20	1 µF capacitor	GRM216R61E105KA12D
3	C2, C21, C22	0.1 µF capacitor	GRM188R71H104KA93D
1	C3	10 µF capacitor	GRM32ER61H106KA12L
1	C4	4.7 µF capacitor	GRM188R60J475KE19
1	C7	47 pF capacitor	06035A470JAT2A
1	C8	22 pF capacitor	CC0603JRNP09BN220
1	C9	0.0056 µF capacitor	06035C562JAT2A
1	D1	Schottky diode	10BQ030PBF
2	D2, D3	Schottky diode	B0540W-7-F
1	DS1	Red LED	TLMS1000-GS08
1	E1	Ferrite bead, 600 Ω	BLM31PG601SN1L
4	JP1, JP2, JP3, JP4	3 row, 2-pin header	2213S-06G
3	JP5, JP6, JP7	Not populated	Not populated
1	L1	3.3 µH inductor	LQH32PN3R3NN0L
1	L2	5.6 µH inductor	ME3220-562MLB
2	L3, L4	Not populated	Not populated
6	P1, P8, P11, P12, P17, P23	3-pin header	M20-9990346
1	P10	120-pin connector	FX8-120S-SV(21)
1	P13	Four contacts, wire to board connector	CTB5000/4
2	P14, P15	6-pin header	TSW-106-08-G-S
1	P16	2-row, 2-pin right angle header	68021-108HLF
5	P18, P19, P20, P21, P25	4-row, 2-pin header	67996-408HLF
1	P2	Two contacts, wire to board connector	CTB5000/2
2	P9, P22	6-row, 2-pin female header	76342-306LF
1	P24	2-pin header	69157-102HLF
2	P3, P4	Three contacts, wire to board connector	CTB5000/3
1	P5	8-pin female header	76341-308LF
2	P6, P7	7-pin female header	76341-307LF
18	R1, R2, R3, R4, R6, R7, R8, R9, R10, R11, R12, R13, R14, R20, R37, R44, R45, R46	0 Ω resistors	MC0603WG00000T5E-TC
7	R15, R24, R33, R34, R40, R41, RSS	Not populated	Not populated
2	R16, R30	100 kΩ resistors	MC 0.063W 0603 1% 100K
1	R17	5.1 kΩ resistors	CRCW04025K10FKED

Qty	Reference Designator	Description	Part Number
1	R18	41.2 kΩ resistors	CRCW060341K2FKEA
1	R19	16.5 kΩ resistors	ERA-3AEB1652V
2	R22, R26	2.2 kΩ resistors	MC 0.063W 0603 1% 2K2
1	R23	118 kΩ resistors	ERJ-3EKF1183V
1	R27	2.32 MΩ resistors	CRCW06032M32FKEA
1	R28	2.43 MΩ resistors	CRCW06032M43FKEA
1	R29	137 kΩ resistors	MC0063W06031137K
1	R39	14 kΩ resistors	ERJ-6ENF1402V
1	R47	7.32 kΩ resistors	ERJ-6ENF7321V
1	R5	1.6 Ω resistors	SG73S1JTTD1R60F
1	U100	I^2C serial electronically erasable programmable read only memory (EEPROM)	24LC64-I-SN
1	U2	Low noise, precision, rail-to-rail output, junction field effect transistor (JFET) dual op amp	ADA4610-4ARZ
1	U3	DC-to-dc switching regulator	ADP5071ACPZ-R7
1	U4	Low noise, complementary metal-oxide semiconductor (CMOS) low dropout (LDO) linear regulator	ADP7118ARDZ-3.3

Table 4. Daughter Board

Qty	Reference Designator	Description	Part Number
1	C1	1 µF capacitor	GRM188R71A105KA61D
2	C2, C4	1 µF capacitor	GRM216R61E105KA12D
2	C3, C5	0.1 µF capacitor	GRM188R71H104KA93D
1	C6	0.1 µF capacitor	C0603C104K4RAC
1	P1	8-pin jumpers	76341-308LF
2	P2, P3	7-pin jumpers	76341-307LF
1	P4	Six-row, 2-pin header	76342-306LF
2	R1, R3	100 kΩ resistor	ERJ-3EKF1003V
1	R2	Not populated	Not populated
1	R4	2.2 kΩ resistor	ERJ-3EKF2201V
1	R5	10 kΩ resistor	ERJ-3EKF1002V
1	TP1	Black test point	20-2137
1	U1	Compact, +30 V or ±15 V, 256-position digital potentiometer	AD5292BRUZ-50
1	U2	I^2C serial EEPROM	24LC64-I/SN

NOTES

I²C refers to a communications protocol originally developed by Philips Semiconductors (now NXP Semiconductors).

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.

UG17216-0-1/20(0)

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