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Evaluation Board for 16-Bit, Serial Input, Loop-Powered 4 mA to 20 mA DAC

FEATURES

Full-featured evaluation board for the AD5421
Link options
PC control in conjunction with Analog Devices, Inc., system demonstration platform (SDP)
PC software for control

EQUIPMENT NEEDED

DC power supply unit
SDP for PC control (EVAL-SDP-CB1Z)
Voltmeter or ammeter

DOCUMENTS NEEDED

AD5421 data sheet

SOFTWARE NEEDED

AD5421 evaluation software

EVALUATION BOARD DESCRIPTION

The EVAL-AD5421 is a full-featured evaluation board, designed to allow the user to easily evaluate all features of the AD5421 loop-powered 4 mA to 20 mA DAC. The AD5421 pins are accessible at on-board connectors for external connection. The AD5421 evaluation board is controlled via the PC's USB port in conjunction with Analog Device's system demonstration platform board. The SDP board allows the evaluation board to be controlled through the USB port of a Windows® XP (SP2 or later) or Vista-based (32-bit) PC using the AD5421 evaluation software. The AD5421 serial interface is also accessible at the testpoint connections on the board.

DEVICE DESCRIPTION

The AD5421 is an integrated device designed for use in loop-powered 4 mA to 20 mA smart transmitter applications. The AD5421, in a single chip, provides a 16-bit DAC and current amplifier for digital control of the loop current, a voltage regulator to power the entire transmitter, a voltage reference, fault alert functions, flexible SPI-compatible serial interface, gain and offset adjust registers as well as other features and functions.

Complete specifications for the AD5421 are available in the AD5421 data sheet available from Analog Devices and should be consulted in conjunction with this document when using the evaluation board.

FUNCTIONAL BLOCK DIAGRAM

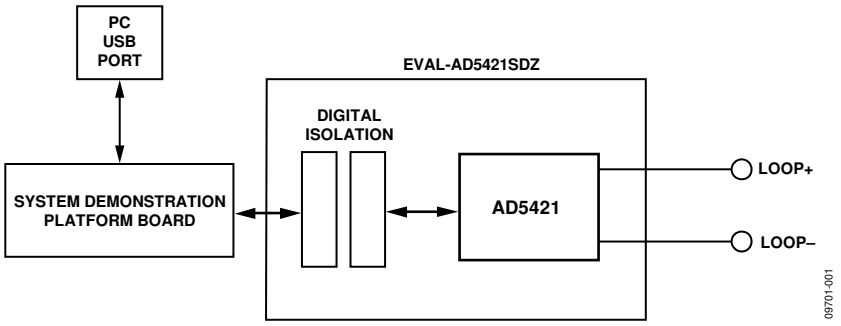

Figure 1.

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REVISION HISTORY

10/11—Rev. 0 to Rev. A

Change to Figure 4 7

3/11—Revision 0: Initial Version

EVALUATION BOARD HARDWARE

POWER SUPPLIES

The AD5421 evaluation board requires one power supply connection from LOOP– to LOOP+ (J7), a voltage in the range from 5.5 V to 52 V can be applied if the on-board MOSFET device (U2) is not enabled. With U2 enabled, the voltage limit is the breakdown voltage of U2, which in this case is 240 V. A load resistor can also be connected at J7.

LINK OPTIONS

Set the link options on the evaluation board for the required operating setup before powering on the board. The functions of the link options are described in Table 2.

Default Link Option Setup

The default link options are listed in Table 1.

Table 1. Link Options

Link No.	Option
LK1	Inserted
LK2	B
LK4	Inserted
LK6	Inserted
LK7	Inserted
Alarm_Dir	B
Rint_Rext	B
Range0	B
Range1	B
Reg_Sel0	A
Reg_Sel1	B
Reg_Sel2	A

Table 2. Link Options

Link No.	Description			
LK1	This link connects the V_{LOOP} input pin to the LOOP+ voltage via a 20:1 resistor divider. When this link is inserted, the V_{LOOP} pin is connected to the resistor divider. When this link is removed, the V_{LOOP} pin is unconnected and can be connected to another voltage (maximum 2.5 V) via TP26.			
LK2	This link enables/disables the MOSFET device. Position A disables the MOSFET device. Position B enables the MOSFET device and the loop supply is connected directly to the REG_{IN} pin.			
LK4	This link enables/disables the *i*Coupler® digital isolators. When this link is inserted, the isolators are enabled. When this link is removed, the isolators are disabled.			
LK6	This link should be inserted when the MOSFET device is enabled (LK2 in Position B). This link should be removed when the MOSFET device is disabled (LK2 in Position A).			
LK7	This link completes the loop connection if a load resistor is not connected at Connector J7. This link should be inserted if a load resistor is not connected at Connector J7. This link should be removed if a load resistor is connected at Connector J7.			
Alarm_Dir	This link selects the alarm current direction. Position A selects an upscale alarm current (22.8 mA or 24 mA). Position B selects a downscale alarm current (3.2 mA).			
Rint_Rext	This link selects to use either the internal or external current setting resistor. Position A selects the internal resistor. Position B selects the external resistor.			
Range0, Range1	These links select the loop current range.			
	Range1	**Range0**	**Loop Range**	
	B	B	4 mA to 20 mA	
	B	A	3.8 mA to 21 mA	
	A	B	3.2 mA to 24 mA	
	A	A	3.8 mA to 21 mA	
Reg_Sel2, Reg_Sel1, Reg_Sel0	These links select the voltage regulator output voltage.			
	Reg_Sel2	**Reg_Sel1**	**Reg_Sel0**	**Regulator Output Voltage**
	B	B	B	1.8 V
	B	B	A	2.5 V
	B	A	B	3 V
	B	A	A	3.3 V
	A	B	B	5 V
	A	B	A	9 V
	A	A	B	12 V

EVALUATION BOARD SOFTWARE QUICK START PROCEDURES

SOFTWARE INSTALLATION

The AD5421 evaluation kit includes self-installing software on a CD. The software is compatible with Windows XP (SP2) and Vista (32-bit). If the setup file does not run automatically, you can run **setup.exe** from the CD.

Install the evaluation software before connecting the evaluation board and SDP board to the USB port of the PC to ensure that the evaluation system is correctly recognized when connected to the PC.

1. After installation from the CD is complete, power up the AD5421 evaluation board as described in the Power Supplies section.
2. Connect the SDP board to the AD5421 evaluation board and then to the USB port of your PC using the supplied cable. Either connector of the SDP board may be used.
3. When the evaluation system is detected, proceed through any dialog boxes that appear. This finishes the installation.

SOFTWARE OPERATION

To launch the software, complete the following steps:

1. From the **Start** menu, select **Analog Devices – AD5421**; then select **AD5421 Evaluation Software**. The main window of the software displays (see Figure 3).
2. If the evaluation system is not connected to the USB port when the software is launched, or if the AD5421 board is not connected to the SDP board, a connectivity error displays (see Figure 2). Simply connect the evaluation board to the USB port of the PC, wait a number of seconds, click **Rescan**, and follow the instructions.

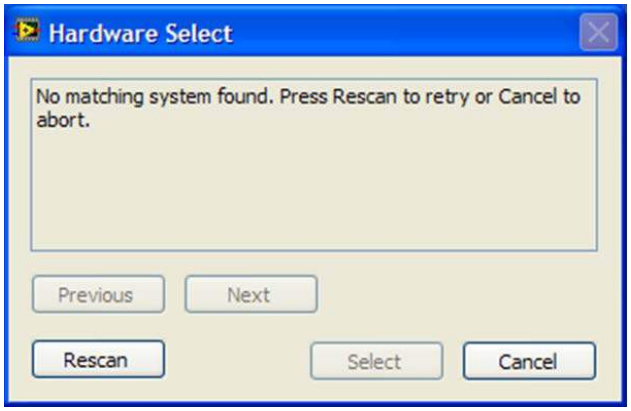

Figure 2. Connectivity Error Alert

Figure 3. Main Window

MAIN WINDOW

As can be seen in Figure 3, the main window is made up of 5 tabs; **Control Register**, **DAC Register**, **Fault Register**, **Program Loop Current**, and **Command Write.** Outside of the tab structure at the top right of the window are two control items; **LDAC PIN** to set the state of the LDAC pin and **USE PEC** to select whether packet error checking is used in the communications with the AD5421. There is also an indicator item; **PEC Error**, this alerts to a packet error in the data received from the AD5421. At the bottom of the window is a display of the contents of the fault register, this is updated on every communication with the AD5421 if **Auto Fault Readback** is enabled.

Control Register

The **Control Register** tab is displayed by default. This tab allows the user to program the control register.

DAC Register

The **DAC Register** tab allows the user to program the DAC register, offset adjust register, and gain adjust register.

Fault Register

The **Fault Register** tab allows the user to read the contents of the fault register. The fault register can also be polled continuously.

Program Loop Current

The **Program Loop Current** tab allows the user to program a loop current value directly by entering the value in milliamps after having first selected the loop current range that is set by the Range0 and Range1 link options.

Command Write

The **Command Write** tab allows the user to read/write all of the AD5421s registers as well as issue commands.

EVALUATION BOARD SCHEMATICS AND ARTWORK

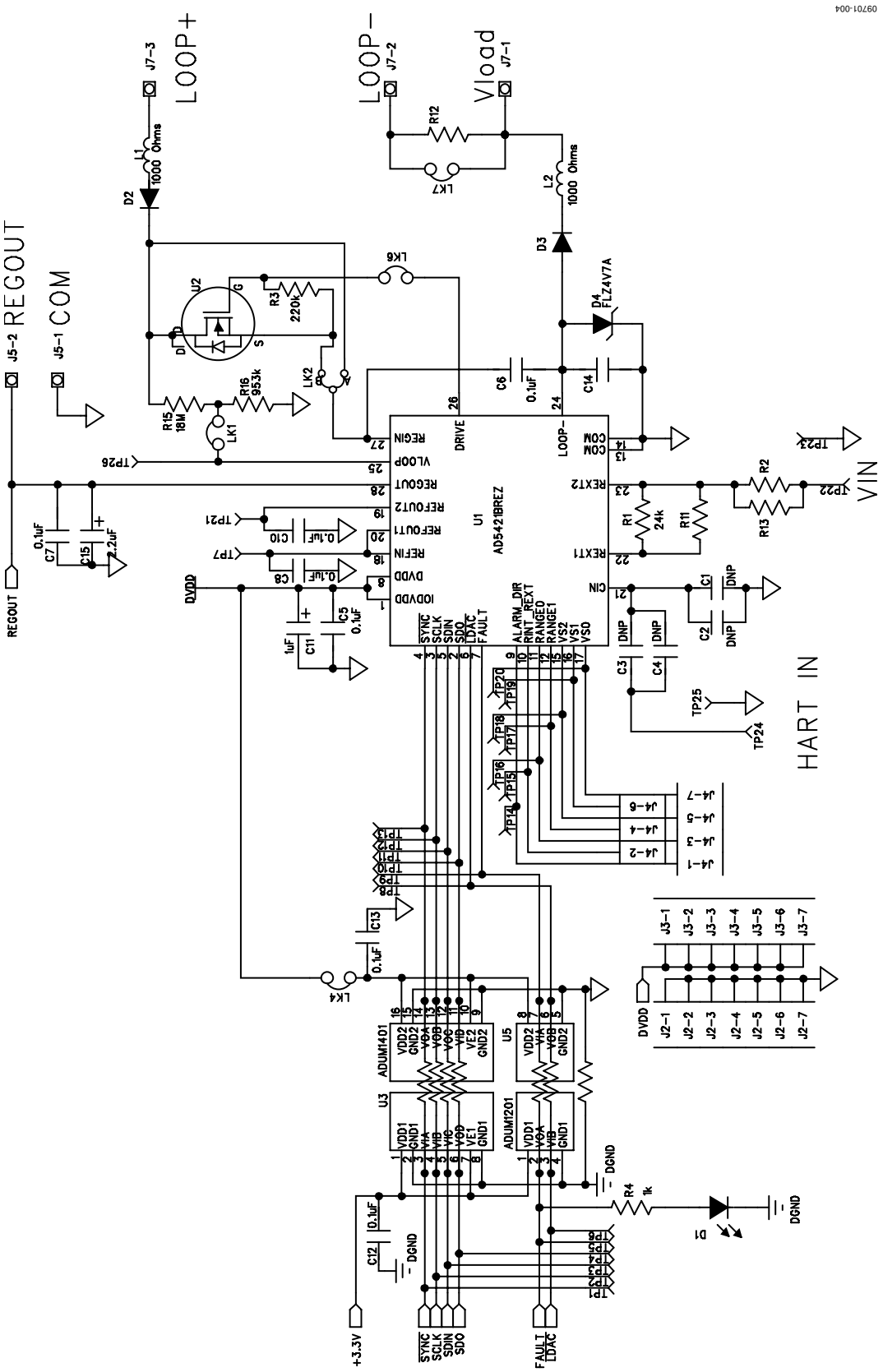

Figure 4. Schematic of the AD5421 Circuitry

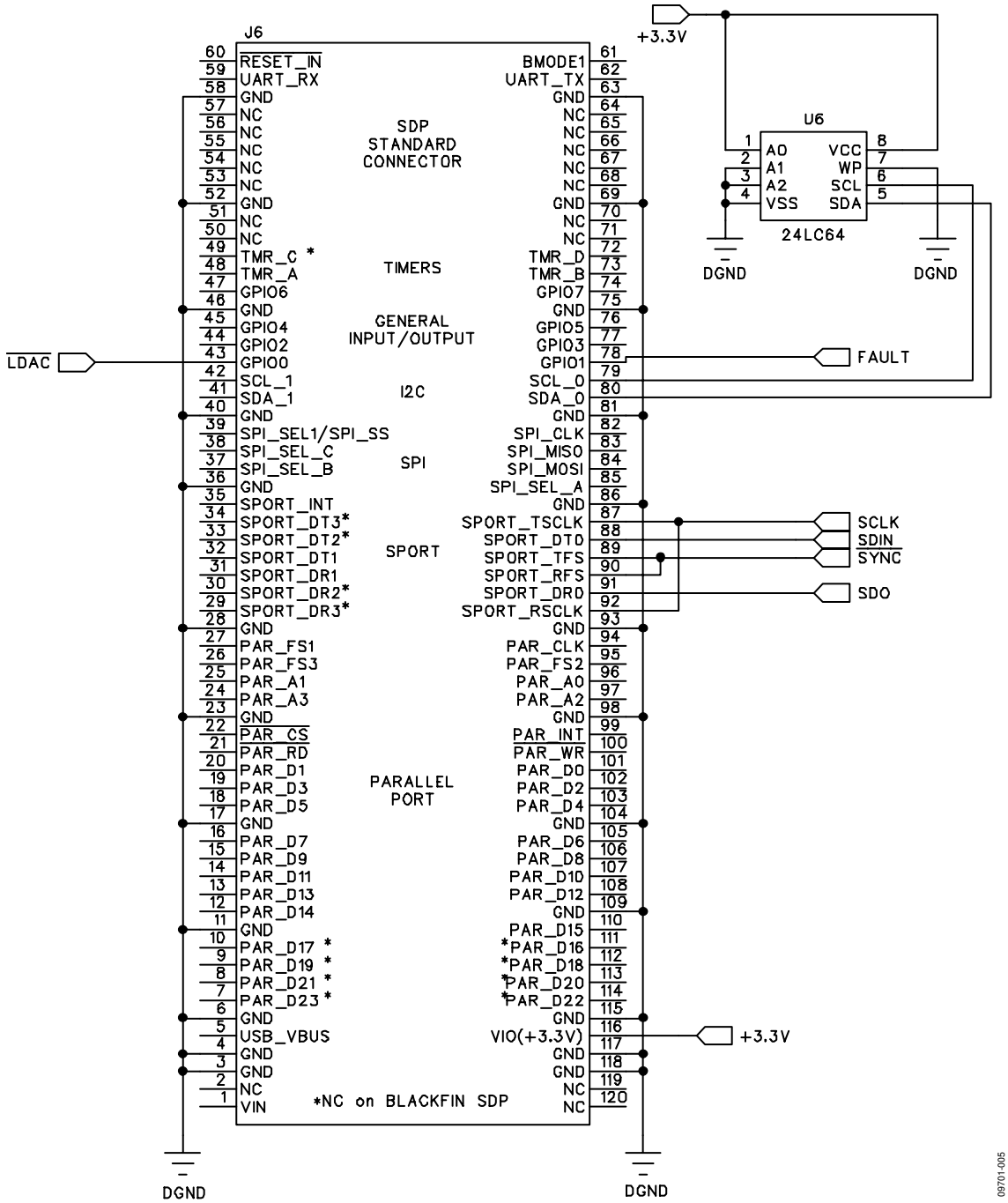

Figure 5. Schematic of the SDP Board Connector

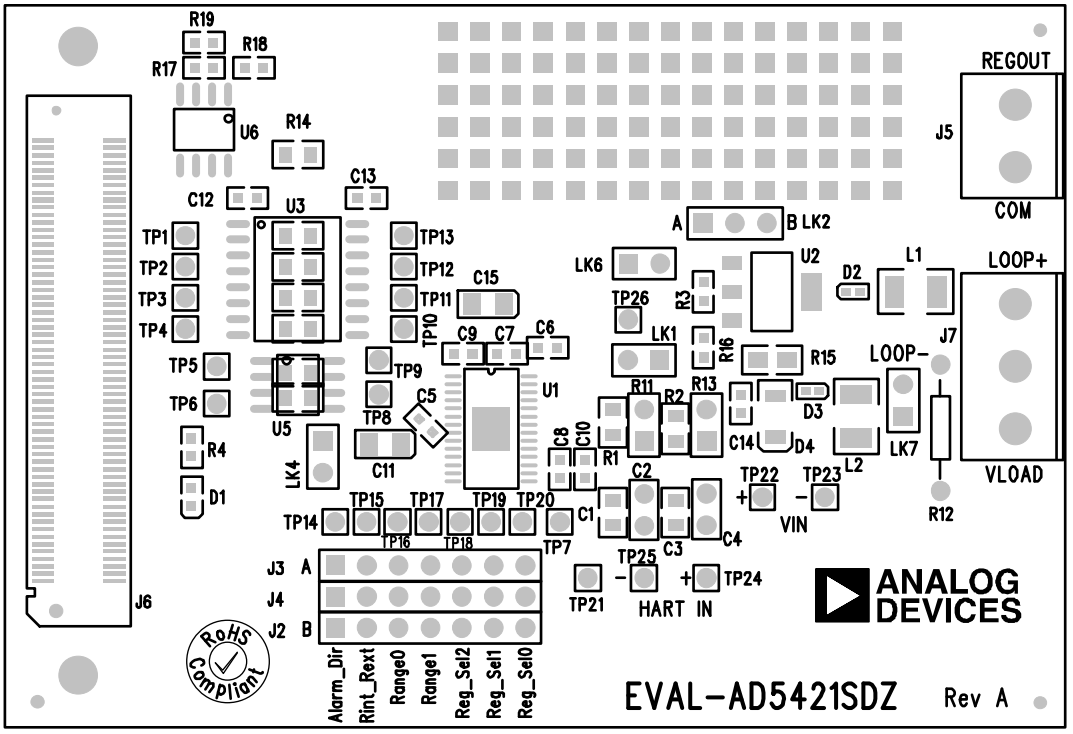

Figure 6. Component Placement Drawing

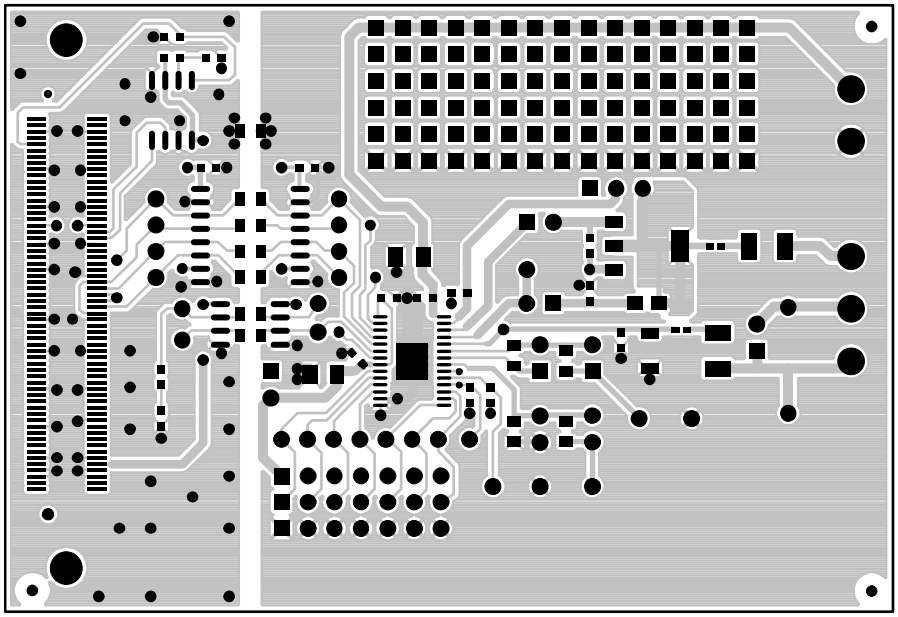

Figure 7. Component Side PCB Drawing

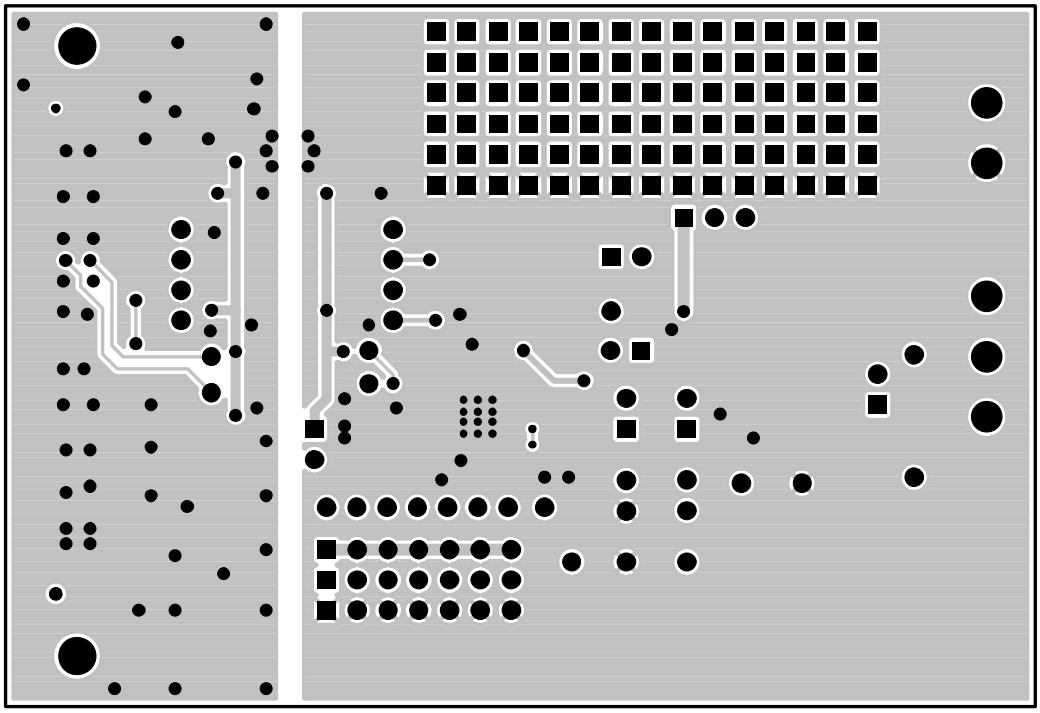

Figure 8. Solder Side PCB Drawing

ORDERING INFORMATION

BILL OF MATERIALS

Table 3.

Reference Designator	Part Description	Part Number	Supplier/Number
C5	Capacitor, F/TERM, 100 nF, 50 V, X7R	06035C104KAZ2A	FEC 1301894
C6	Capacitor, F/TERM, 100 nF, 50 V, X7R	06035C104KAZ2A	FEC 1301894
C7	Capacitor, F/TERM, 100 nF, 50 V, X7R	06035C104KAZ2A	FEC 1301894
C8	Capacitor, F/TERM, 100 nF, 50 V, X7R	06035C104KAZ2A	FEC 1301894
C9	Capacitor, F/TERM, 100 nF, 50 V, X7R	06035C104KAZ2A	FEC 1301894
C10	Capacitor, F/TERM, 100 nF, 50 V, X7R	06035C104KAZ2A	FEC 1301894
C11	Capacitor, 1 µF, 16 V, Case A tantalum	MCCTA105M016	FEC 1190114
C12	Capacitor, F/TERM, 100 nF, 50 V, X7R	06035C104KAZ2A	FEC 1301894
C13	Capacitor, F/TERM, 100 nF, 50 V, X7R	06035C104KAZ2A	FEC 1301894
C15	Capacitor, 2.2 µF, 16 V, Case A tantalum	MCCTA225M016	FEC 1190115
D1	LED, yellow, 0603	LY Q971-H1K1-36-0-20-R18	Digi-Key 475-2557-1-ND
D2	BAS516, high speed switching diodes	BAS516	FEC 8734402
D3	BAS516, high speed switching diodes	BAS516	FEC 8734402
D4	Diode ZENER, 4.7 V, 500 MW, SOD-80	FLZ4V7A	Digi-Key FLZ4V7ACT-ND
J2	Header, TIN, SIL, 32-way	3-826936-2	FEC 5217805 and FEC 1212164 (x7)
J3	Header, TIN, SIL, 32-way	3-826936-2	FEC 5217805 and FEC 1212164 (x7)
J4	Header, TIN, SIL, 32-way	3-826936-2	FEC 5217805 and FEC 1212164 (x7)
J5	2-pin terminal block (5 mm pitch)	CTB5000/2	FEC 151789
J6	120-way connector, 0.6 mm pitch	FX8-120S-SV(21)	FEC 1324660
J7	3-pin terminal block (5 mm pitch)	CTB5000/3	FEC 151790
L1	Ferrite bead chip, series FB FB	FBMH3225HM102NT	FEC 1651731
L2	Ferrite bead chip, series FB FB	FBMH3225HM102NT	FEC 1651731
LK1	2-pin (0.1" pitch) header and shorting shunt	M20-9990246	FEC 1022247 and FEC 150-411
LK2	3-pin SIL header and shorting link	M20-9990345 and M7567-05	FEC 1022248 and FEC 150410
LK4	2-pin (0.1" pitch) header and shorting shunt	M20-9990246	FEC 1022247 and FEC 150-411
LK6	2-pin (0.1" pitch) header and shorting shunt	M20-9990246	FEC 1022247 and FEC 150-411
LK7	2-pin (0.1" pitch) header and shorting shunt	M20-9990246	FEC 1022247 and FEC 150-411
R1	Resistor, 24 kΩ, 0805, 5 ppm	PCF0805-13-24K-B-T1	FEC 1108901
R3	Resistor, 220 kΩ, 5%, 50 V, 0.063W, 0603	MC 0.063W 0603 5% 220K	FEC 9331930
R4	Resistor, 1 kΩ, 5%, 50 V, 0.063W, 0603	MC 0.063W 0603 5% 1K	FEC 9331697
R15	Resistor, HRC11 0805 18M	RC0805JR-0718ML	Yageo (Phycomp) FEC 9236422
R16	MULTICOMP, resistor, 0603 953 kΩ	MC 0.063W 0603 1% 953K	FEC 1171085
R18	RESISTOR, 0603, 100 kΩ, 1%	MC 0.063W 0603 1% 100K	FEC 9330402
R19	RESISTOR, 0603, 100 kΩ, 1%	MC 0.063W 0603 1% 100K	FEC 9330402
U1	Loop powered, 4 mA to 20 mA DAC	AD5421CREZ	AD5421CREZ
U2	Depletion mode, N-channel MOSFET	BSP129	FEC 1214279
U3	Digital isolator	ADUM1401ARWZ	ADuM1401ARWZ
U5	Digital isolator	ADuM1201ARZ	ADuM1201ARZ
U6	64K I^2C serial EEPROM	24LC64-I/SN	FEC 9758070

NOTES

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.

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