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## Evaluation Board for the **AD7298** 8-Channel, 1 MSPS, 12-Bit SAR ADC with Temperature Sensor

### FEATURES

Full-featured evaluation board for the **AD7298** (Rev. C)

Link options

On-board analog bias-up circuit

PC control in conjunction with system demonstration platform (SDP)

PC software for control

### EVALUATION BOARD DESCRIPTION

The EVAL-AD7298SDZ is a full-featured evaluation board designed to allow the user to easily evaluate all features of the AD7298. The evaluation board can be controlled via the SDP connector (J1). The SDP board allows the evaluation board to be controlled through the USB port of a PC using the **AD7298** evaluation software.

On-board components include: the **ADP1706** low dropout CMOS linear regulator, the **AD8022** high speed, a low noise amp, and the **AD8066** high performance 145 MHz *FastFET™* amp.

The evaluation board features analog bias-up circuitry. Bipolar signals are input via the VIN SMB connector and are biased up by the on-board bias-up buffer circuit. The biased up signal is available at the BIASED\_VIN2 SMB and can be applied to any one of the eight VINx SMB connectors using an SMB-to-SMB cable.

Various link options are described in the Evaluation Board Hardware section. The Link Options section of this user guide should be consulted when configuring the board for standalone operation.

### DEVICE DESCRIPTION

This user guide describes the evaluation board for the **AD7298**, which is a 12-bit, 8-channel successive approximation ADC with internal temperature sensor.

The **AD7298** offers a programmable sequencer, which enables the selection of a preprogrammed sequence of channels for conversion. The device has an on-chip 2.5 V reference that can be disabled to allow the use of an external reference.

The **AD7298** includes a high accuracy, band gap, temperature sensor, which is monitored and digitized by the 12-bit ADC to give a resolution of 0.25°C.

Complete specifications for the **AD7298** are provided in the **AD7298** data sheet, available from Analog Devices, Inc., and should be consulted in conjunction with this user guide when using the evaluation board.

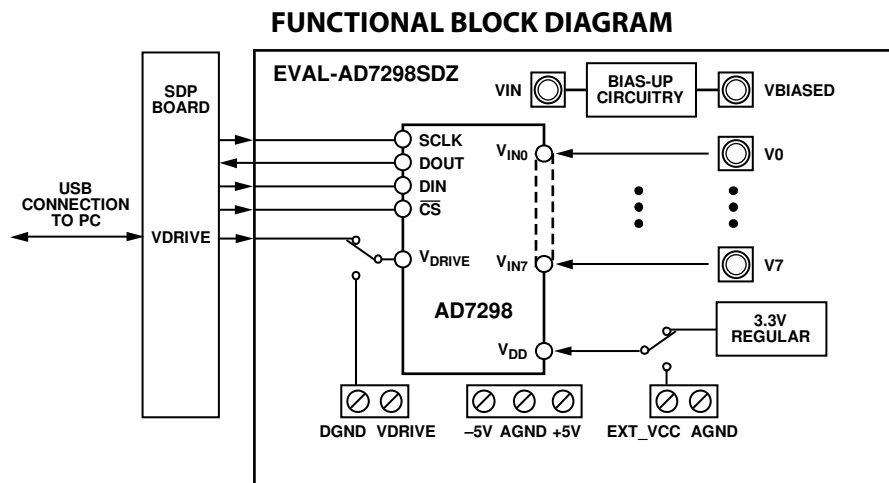


Figure 1.

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**REVISION HISTORY**

**6/11—Rev. 0 to Rev. A**

Changes to Features Section and Evaluation Board Description Section.....	1
Changes to Link Options Section and Table 1.....	3
Changed the Software Operation Section to Launching the Evaluation Board Software Section.....	5
Changes to Figure 6.....	8
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**3/11—Revision 0: Initial Version**

## EVALUATION BOARD HARDWARE

### POWER SUPPLIES

Care should be taken before applying power and signals to the evaluation board to ensure that all link positions are as per the required operating mode.

When using this evaluation board with the SDP board, apply +5 V, -5 V, and GND to Connector J2.  $V_{DRIVE}$  is supplied by the SDP board, and  $V_{CC}$  is supplied by an on-board regulator. Each supply is decoupled on the EVAL-AD7298SDZ using 10  $\mu$ F and 0.1  $\mu$ F capacitors. A single ground plane is used on this board to minimize the effect of high frequency noise interference.

### LINK OPTIONS

Table 1 shows the position in which the links are set when the evaluation board is packaged. The links are set so that the SDP board supplies the control signals and  $V_{DRIVE}$ .

Before using the evaluation board, multiple link and solder link options must be set correctly to select the appropriate operating setup. The default link options are listed in Table 1.

### SOCKETS/CONNECTORS

There are 16 SMB input sockets relevant to the operation of the [AD7298](#) on this evaluation board. When operating the board with the SDP, external  $\pm 5$  V supplies are required for the [AD7298](#) board. The functions of these sockets are outlined in Table 2.

**Table 1. Link Options**

Link No.	Option	Function
LK1	Inserted	This link option pulls the <a href="#">AD7298</a> $V_{IN0}$ input to GND via a 10 k $\Omega$ resistor.
LK2	Inserted	This link option pulls the <a href="#">AD7298</a> $V_{IN1}$ input to GND via a 10 k $\Omega$ resistor.
LK3	Inserted	This link option pulls the <a href="#">AD7298</a> $V_{IN6}$ input to GND via a 10 k $\Omega$ resistor.
LK4	Inserted	This link option pulls the <a href="#">AD7298</a> $V_{IN7}$ input to GND via a 10 k $\Omega$ resistor.
LK5	Position A	Connects the $\overline{PD/RST}$ pin to $V_{DRIVE}$ voltage.
LK6	Position A	When in Position A, the 3.3 V $V_{CC}$ supply is supplied by on-board regulator, <a href="#">ADP1706</a> .
LK7	Position A	When in Position A, the $V_{DRIVE}$ supply is taken from the SDP board via the VIO_CONNECTOR.
LK8	Inserted	When inserted the $V_{REF}$ signal is connected to the $V_{REF}$ test point.
LK9	Inserted	When inserted, the buffered internal reference voltage is divided by a factor of 3 and used as the bias input for U10.
LK10	Inserted	This link option pulls the <a href="#">AD7298</a> $V_{IN2}$ input to GND via a 10 k $\Omega$ resistor.
LK11	Inserted	This link option pulls the <a href="#">AD7298</a> $V_{IN3}$ input to GND via a 10 k $\Omega$ resistor.
LK12	Inserted	This link option pulls the <a href="#">AD7298</a> $V_{IN4}$ input to GND via a 10 k $\Omega$ resistor.
LK13	Inserted	This link option pulls the <a href="#">AD7298</a> $V_{IN5}$ input to GND via a 10 k $\Omega$ resistor.
LK14	Inserted	This link option connects +5V to Pin 1 of J1.
LK20	Position A	In Position A, the buffered internal reference is used as the bias input for U10.
SL1	Position B	Buffered output from SMA Connector V7 is routed to SMB connector, BUFF_V7.
SL2	Position A	In Position A, there is no amplifier included in the analog input channel $V_{IN1}$ path.
SL3	Position B	Buffered output from SMA Connector V0 is routed to SMB connector, BUFF_V0.
SL4	Position B	In Position B, there is an amplifier included on the analog input channel $V_{IN0}$ path.

Table 2. Socket Functions

Socket	Function
BIASED_VIN2	SMB socket for the output of the bias-up circuit
BUFF_V0	SMB socket for buffered V0 input (SL3 must be in Position A, and SL4 must be in Position B)
BUFF_V7	SMB socket for buffered V7 input (SL1 must be in Position A)
EXT_OFFSET	SMB socket for an external bias input, which is applied to U10
J3	SMB socket for a single-ended input that is applied to the $V_{IN0}$ pin of the <a href="#">AD7298</a>
J4	SMB socket for a single-ended input that is applied to the $V_{IN1}$ pin of the <a href="#">AD7298</a>
J5	SMB socket for a single-ended input that is applied to the $V_{IN6}$ pin of the <a href="#">AD7298</a>
J6	SMB socket for a single-ended input that is applied to the $V_{IN7}$ pin of the <a href="#">AD7298</a>
J8	SMB socket for a single-ended input that is applied to the $V_{IN2}$ pin of the <a href="#">AD7298</a>
J9	SMB socket for a single-ended input that is applied to the $V_{IN3}$ pin of the <a href="#">AD7298</a>
J10	SMB socket for a single-ended input that is applied to the $V_{IN4}$ pin of the <a href="#">AD7298</a>
J11	SMB socket for a single-ended input that is applied to the $V_{IN5}$ pin of the <a href="#">AD7298</a>
J12	SMB socket connected to the $V_{REF}$ pin of the <a href="#">AD7298</a>
J13	SMB socket connected to the PD/RST pin of the <a href="#">AD7298</a>
VIN	SMB socket to connect the input to the bias-up circuit
VREF_BUFF	SMB socket for the output of the buffered reference

## EVALUATION BOARD SOFTWARE

### SOFTWARE INSTALLATION

The [AD7298](#) 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 the **setup.exe** file 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 [AD7298](#) evaluation board as described in the Power Supplies section. Connect the SDP board (Connector A) to the [AD7298](#) evaluation board (Connector J1) and then to the USB port of your PC using the supplied cable.
2. When the evaluation system is detected, proceed through any dialog boxes that appear. This completes the installation.

### LAUNCHING THE EVALUATION BOARD SOFTWARE

To launch the software, complete the following steps:

1. From the **Start** menu, select **Analog Devices – AD7298 > AD7298 Evaluation Software**. The main window of the software then displays (see Figure 3).
2. If the evaluation system is not connected to the USB port when the software is launched, a connectivity error is displayed (see Figure 2). Connect the evaluation board to the USB port of the PC, wait a few seconds, click **Rescan**, and follow the instructions.

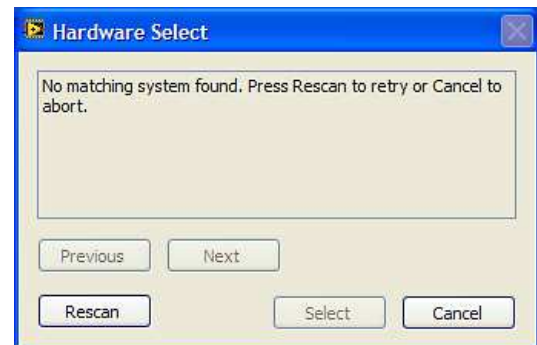


Figure 2. Connectivity Error Alert



Figure 3. Main Window

## SOFTWARE OPERATION

### FRONT PANEL

Figure 3 shows the main window of the [AD7298](#) evaluation software. The device is configurable via the **CONTROL REGISTER** button. Samples can be taken continuously or one at a time, depending on whether **CONTINUOUSLY SAMPLE** or **SAMPLE ADC** is selected.

The lower section of the main window graphically displays the [AD7298](#) data. The tab setting in the data display window allows the user to swap between displaying the ADC conversion results or the internal temperature sensor results.

### CONTROL REGISTER

Consult the control register section of the [AD7298](#) data sheet before configuring the control register settings. To configure the control register, click **CONTROL REGISTER**.

When enabled, **DB15/ WRITE** ensures that the following 15 bits are written to the control register (see Figure 4). If **DB15/ WRITE** is not selected, the remaining 15 bits are not loaded to the control register, and the results remain unchanged. Selecting **DB14/ REPEAT** enables the repeated conversion of the selected sequence of channels. Select the ADC channels required for conversion in the sequence by clicking the relevant button (**DB13 /CH0** to **DB6/ CH7**).

To enable the internal temperature sensor, select **DB5/ TSENSE**. Selecting **DB1/ TSENSE AVERAGE** enables the temperature sensor averaging function. When averaging is enabled, the [AD7298](#) internally computes a running average of the conversion results to determine the final TSENSE result (refer to the [AD7298](#) data sheet for additional information). Note that enabling the averaging feature does not automatically select the TSENSE channel for conversion, **DB5/ TSENSE** must also be selected.

Click **WRITE** to update the control register.

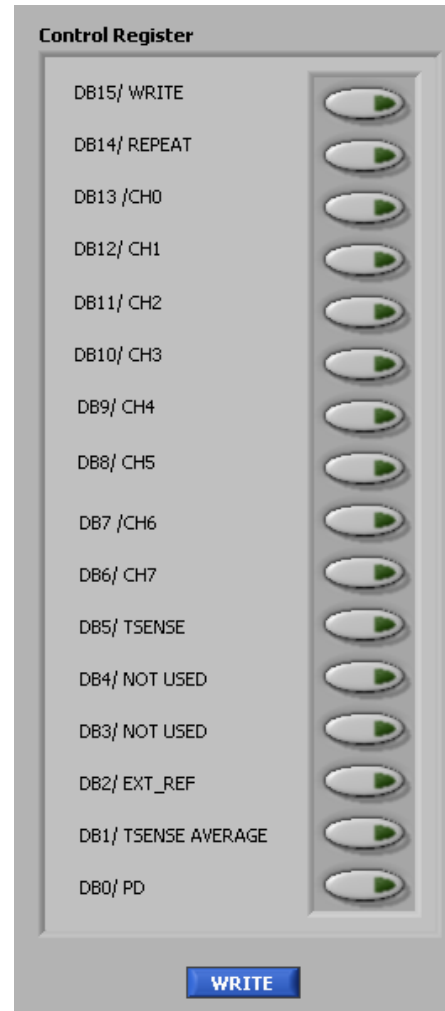


Figure 4. Control Register

08711-004

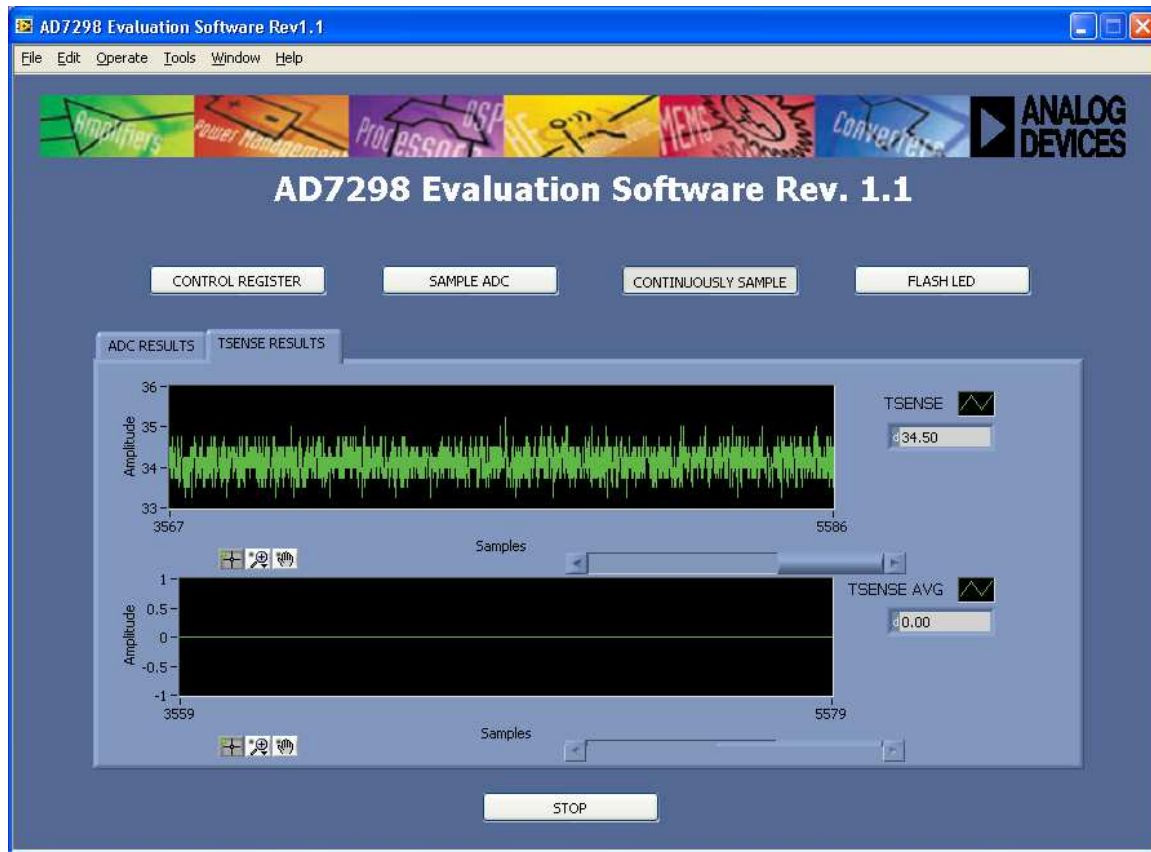


Figure 5. Temperature Sensor Results (Note that Either the Temperature Sensor Results or the Averaged Results Display at Any Given Time)

### SAMPLE ADC/CONTINUOUSLY SAMPLE

To gather sample data on the selected channels, click **SAMPLE ADC** or **CONTINUOUSLY SAMPLE**. Both buttons are located on the middle of the main window. If **CONTINUOUSLY SAMPLE** is pressed and the user wishes to stop sampling, click **CONTINUOUSLY SAMPLE** a second time.

### FLASH LED

Clicking the **FLASH LED** on the main window causes the orange **LED1A** on the SDP board to flash, which can be a useful debug tool.



EVALUATION BOARD SCHEMATICS, ARTWORK, AND SILKSCREEN

900-11460

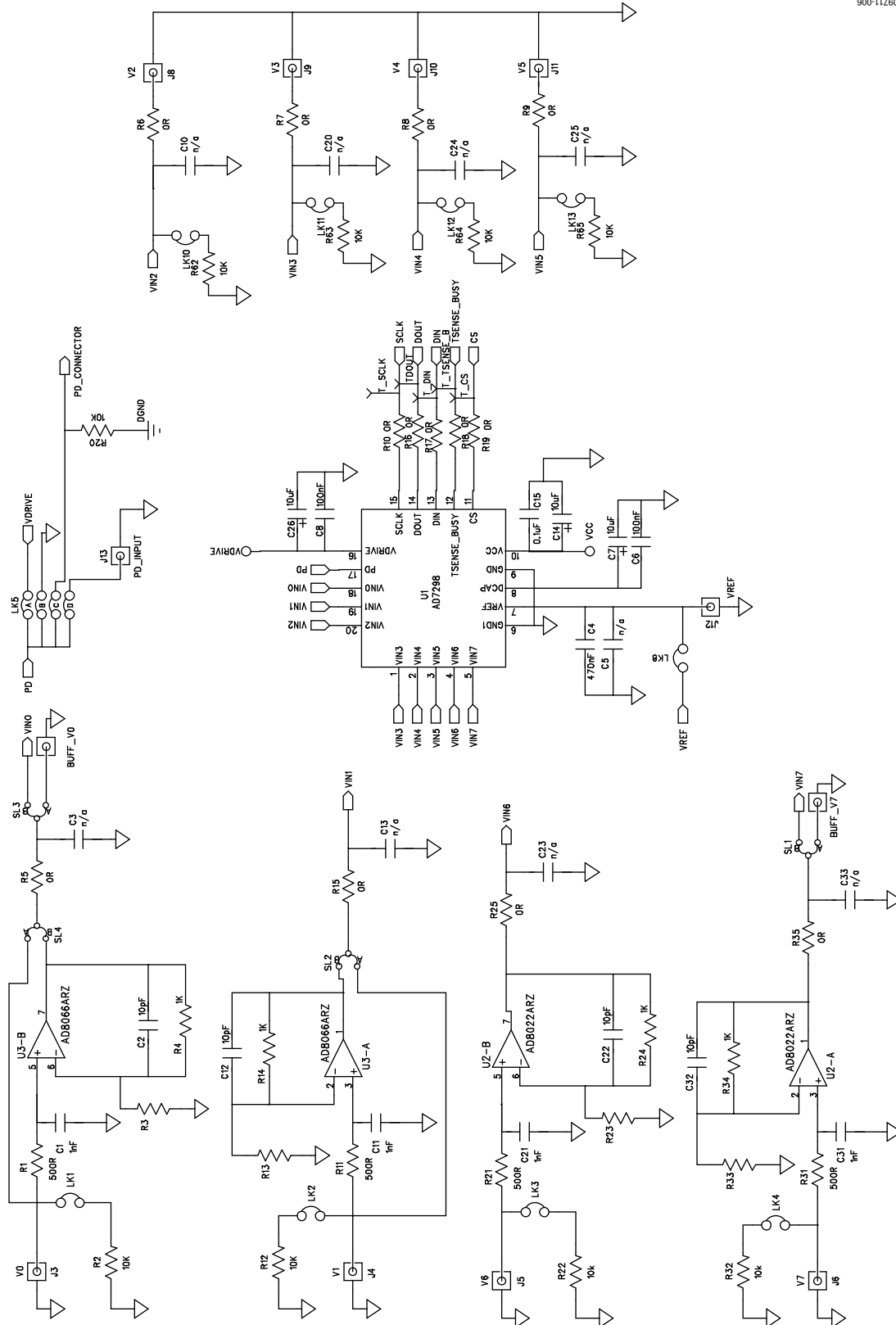


Figure 6. EVAL-AD7298SDZ Schematic 1 of 3

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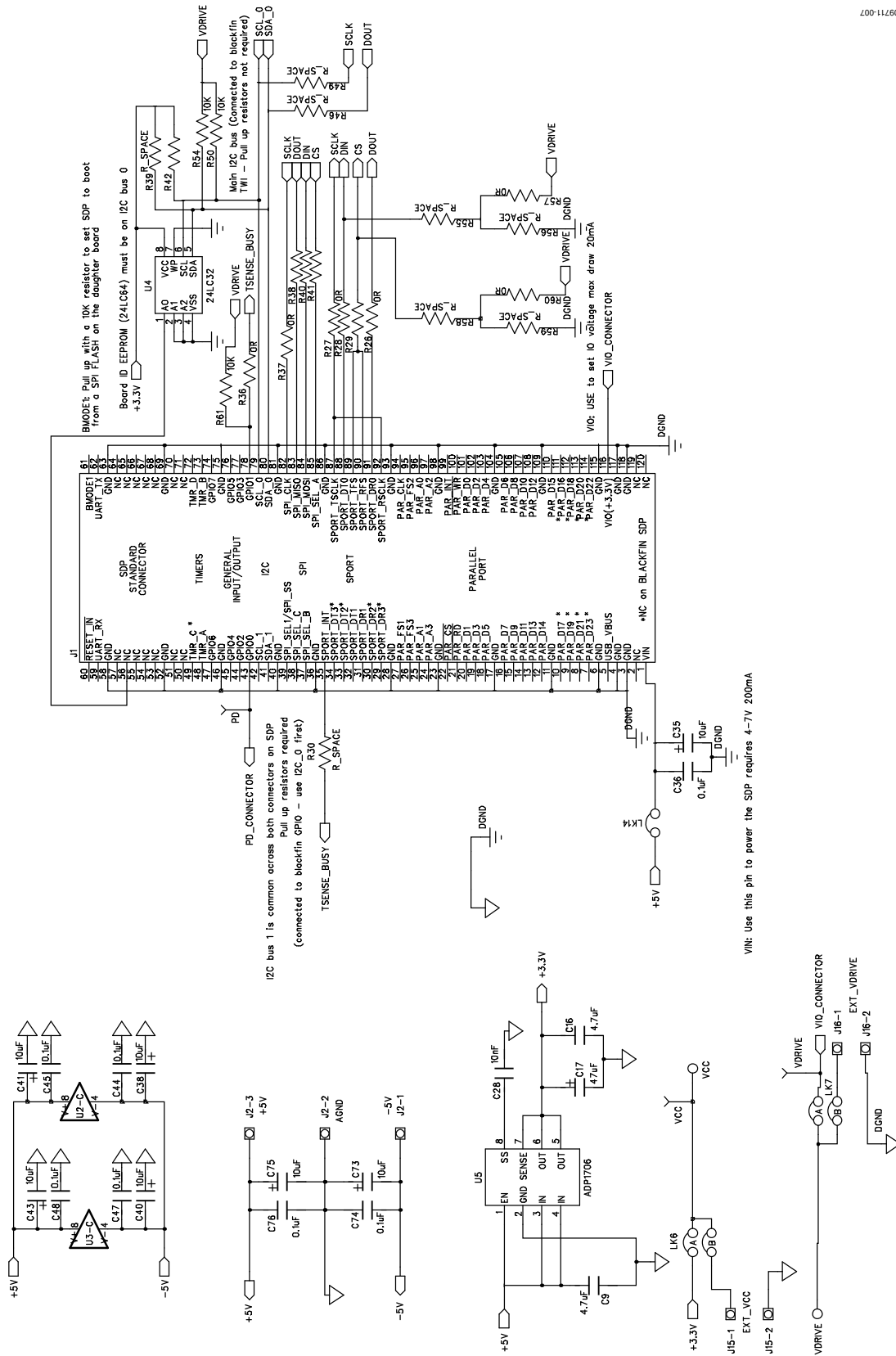


Figure 7. EVAL-AD7298SDZ Schematic 2 of 3

800-111260

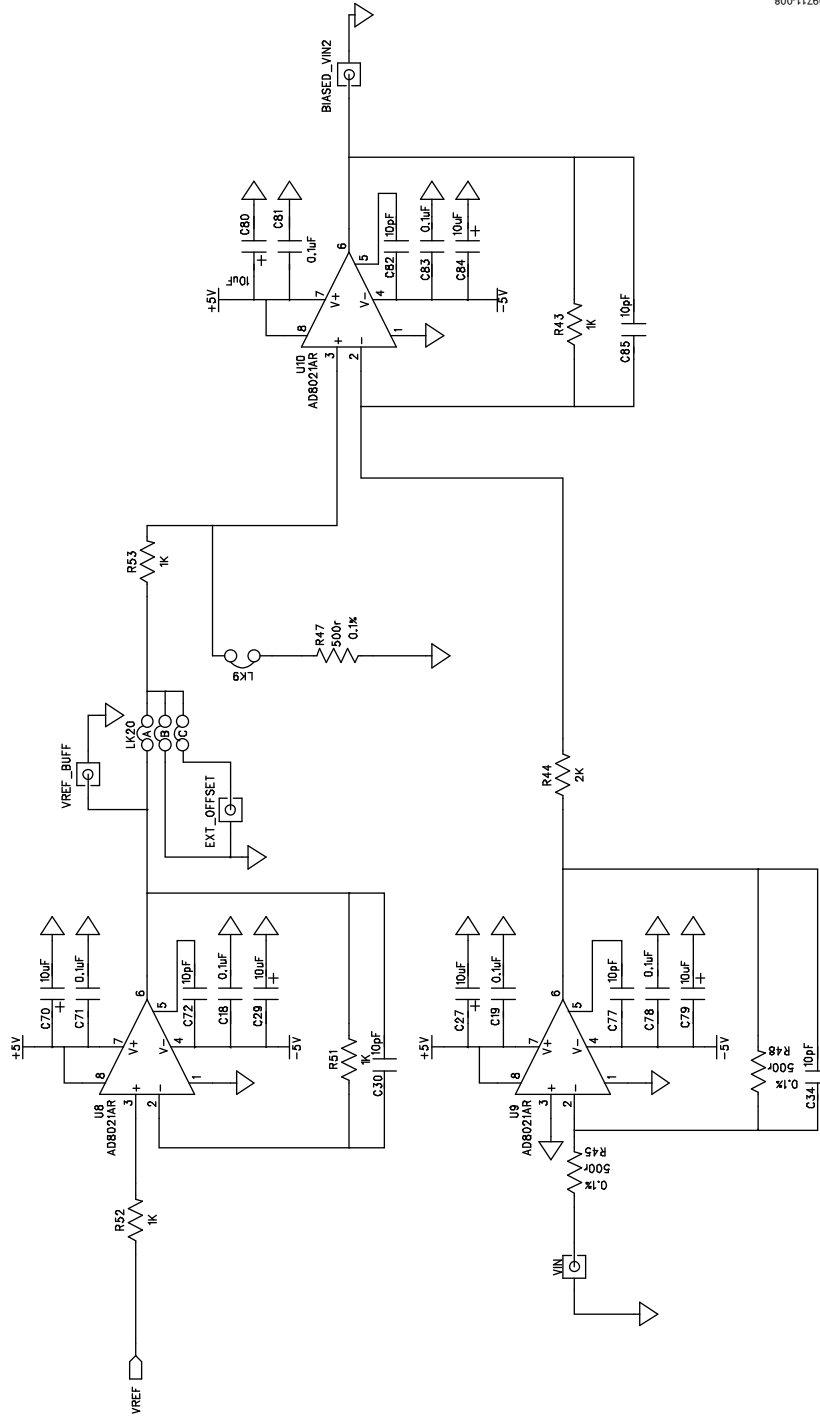


Figure 8. EVAL-AD7298SDZ Schematic 3 of 3

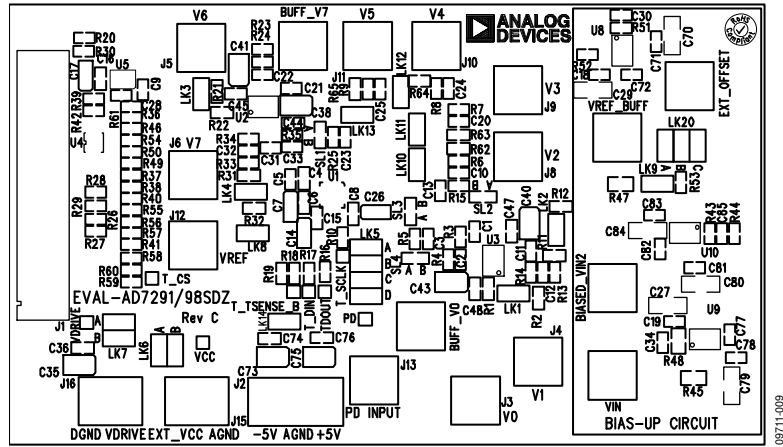


Figure 9. Component Side Artwork

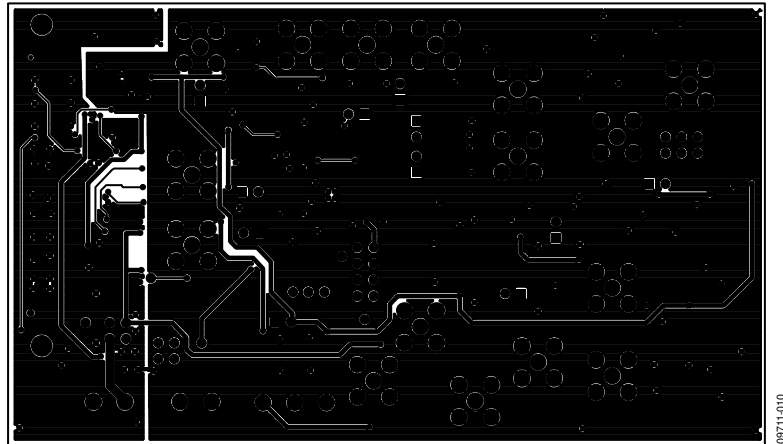


Figure 10. Solder Side Artwork

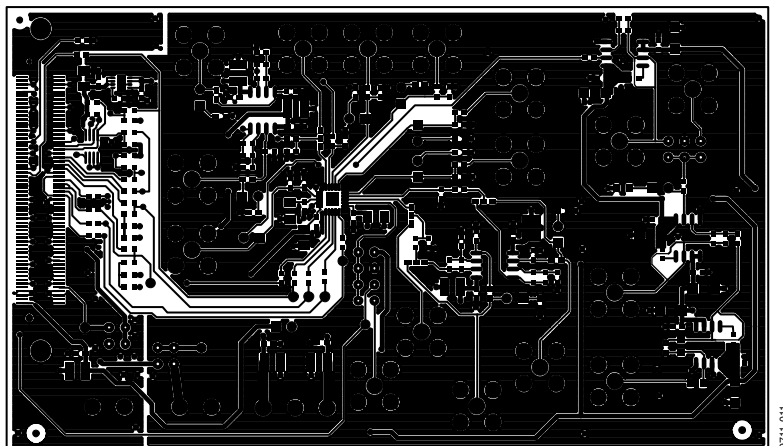


Figure 11. Component Side Silkscreen

## ORDERING INFORMATION

## BILL OF MATERIALS

Table 3.

Reference Designator	Part Description	Part Number	Stock Code
C1, C11, C21, C31	1 nF, multilayer ceramic capacitor, 50 V, X7R, $\pm 10\%$	U0603R102KCT	FEC 9406174
C2, C12, C22, C30, C32, C34, C72, C77, C82, C85	10 pF multilayer ceramic capacitor, 50 V, NPO, $\pm 5\%$	06035A100JAT2A	FEC 499110
C3, C5, C7, C10, C13, C20, C23, C24, C25, C33	0603, capacitor spacing (not inserted)	Not applicable	Not applicable
C4	10 $\mu\text{F}$ , 6.3 V, X5R, ceramic capacitor, $\pm 20\%$	C0603C106M9PACTU	FEC 1288201
C6, C8, C15, C36, C44, C45, C47, C48, C74, C76	100 nF, 16 V, X7R, ceramic capacitor, $\pm 5\%$	0603YC104JAT2A	FEC 432210
C9, C16	4.7 $\mu\text{F}$ multilayer ceramic capacitor, 10 V, X7R, 603, $\pm 10\%$	C0603C475K8PAC 7867	FEC 1572625
C14, C26	10 $\mu\text{F}$ , 10 V, SMD tantalum capacitor, $\pm 10\%$	TAJA106K010R	FEC 197130
C17	47 $\mu\text{F}$ , SMD, tantalum capacitor, $\pm 20\%$	TAKA106010R	FEC 1658411
C18, C19, C71, C78, C81, C83	0.1 $\mu\text{F}$ multilayer ceramic capacitor, 16 V, X7R, $\pm 10\%$	B0603R104KCT	FEC 9406140
C27, C29, C70, C79, C80, C84	10 $\mu\text{F}$ multilayer ceramic capacitor, 16 V, X5R, 1206, $\pm 20\%$	ECJ-HVB1C106M	Digi-Key PCC2417CT-ND
C28	10 nF multilayer ceramic capacitor, 50 V, NPO, $\pm 10\%$	06035C103KAZ2A	FEC 7569548
C35, C38, C40, C41, C43, C73, C75	10 $\mu\text{F}$ tantalum capacitor, 16 V, SMD, $\pm 10\%$	AVX TAJB106K016R	FEC 498737
J1	120-way connector, 0.6 mm pitch, CON-120	FX8-120S-SV(21)	FEC 1324660
J2	3-pin terminal block, 5 mm pitch, CON/POWER3	CTB5000/3	FEC 151790
J3 to J6, J8 to J13, BUFF_V0, BUFF_V7	50 W gold plated PCB SMB jack	1-1337482-0	FEC 1206013
J15, J16	2-pin terminal block, 5 mm pitch, CON/POWER	CTB5000/2	FEC 151789
LK1 to LK4, LK8 to LK14	2-pin header and shorting shunt	M20-9990206	FEC 1022247 and FEC 150411
LK5	8-pin (4 $\times$ 2) header and shorting shunt	M20-9990206	FEC 1022231 and FEC 150411
LK6, LK7	4-pin (2 $\times$ 2) header and shorting shunt	M20-9990206	FEC 1022233 and FEC 150411
LK20	6-pin (3 $\times$ 2) header and shorting shunt	M20-9983646	FEC 1022244 and FEC 150411
R1, R11, R21, R31	500 $\Omega$ , 0603, SMD resistor, $\pm 1\%$	MC0.063W06031%499R	FEC 1170758
R2, R12, R20, R22, R32, R50, R54, R61 R62, R63, R64, R65	10 k $\Omega$ , 0603, SMD resistor, $\pm 1\%$	MC0.063W06031%10K	FEC 9330399
R3, R13, R23, R30, R33, R39, R42, R46, R49, R55, R56, R58, R59	0603, resistor space (not inserted)	Not applicable	Not applicable
R4, R14, R24, R34, R43, R51, R52, R53	1 k $\Omega$ , 0603, SMD resistor, $\pm 1\%$	MC0.063W06031%1K	FEC 9330380
R5 to R10, R15 to R19, R25, R26 to R29, R35, R36, R37, R38, R40, R41, R57, R60 R44	0 $\Omega$ , 0603, SMD resistor, $\pm 1\%$	MC0.063W06030R	FEC 9331662
R45, R47, R48	2 k $\Omega$ , 0603, SMD resistor, $\pm 1\%$	MC0.063W06031%2K	FEC 9330763
SL1 to SL4	500 $\Omega$ , 0805, SMD resistor, $\pm 1\%$	CRCW0805499RFKEA	FEC 1152405
	2-way solder bridge solder link	Not applicable	Not applicable

Reference Designator	Part Description	Part Number	Stock Code
U1	8-channel, I <sup>2</sup> C, 12-bit SAR ADC with temperature sensor	AD7291BCPZ	AD7291BCPZ
U2	Dual high speed, low noise op amp	AD8022ARZ	AD8022ARZ
U3	High performance, 145 MHz FastFET™ op amp	AD8066ARZ	AD8066ARZ
U4	32 kΩ, I <sup>2</sup> C serial EEPROM	24LC32A-1/MS	FEC 1331330
U5	1 A, low dropout, CMOS linear regulator	ADP1706ACPZ-3.3V-R7	ADP1706ACPZ-3.3V-R7
U8, U9, U10	Low noise, high speed amplifier for 16-bit systems	AD8021ARZ	AD8021ARZ
T_SCLK, PD, T_CS, T_DIN, T_TENSE_B, TDOUT, VCC, VDRIVE	Black test point	20-2137	FEC 8731128
BIASED_VIN2, EXT_OFFSET, VIN, VREF_BUFF	50 Ω SMB jack	SMB1251B1-3GT30G-50	FEC 1111349

**NOTES**

**NOTES**



## 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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