User's Guide
SBAU008A–September 1997–Revised April 2007

DEM-ADS80xU Evaluation Fixture

FEATURES

- **Provides Fast and Easy Performance Testing for the** ADS803/804/805
- **AC- or DC-Coupled Inputs**
- **Inverting/Noninverting Input Configuration**
- **Onboard Reference**
- **Out-of-Range Indicator**

DESCRIPTION

The DEM-ADS80xU evaluation fixture is designed for ease of use when evaluating the high-speed analog-to-digital converter (ADC) of the ADS80x family. It is designed to be the common evaluation platform for three of the models within the ADS80x family. The board accommodates the following 12-bit converters: the ADS803 (5MSPS version), the ADS804 (10MSPS), and the ADS805 (20MSPS). Because of its flexible design, the user can evaluate the converter in many different configurations: either with dc-coupled or ac-coupled input, and internal or external reference with adjustable reference voltages.

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1 Initial Configuration

By using solder switches and resistor placements, the DEM-ADS80xU demonstration board can be set up in a variety of configurations to accommodate a specific model or function. Before starting an evaluation, the user should decide on the configuration and make the appropriate connections or changes. The demonstration board comes with the following factory-set configurations (see Figure 1):

- OPA842 is set for a noninverting configuration with a gain of +2V/V. R_3, R_5 , R_6, and C_2 are not assembled.
- Using capacitors C_5 and C_8, the output of the driver op amp OPA842 is ac-coupled to the converter input.
- The converter (U4) is set to operate with the internal reference. R_{13} (0Ω) is installed, setting the full-scale input range to $2V_{PP}$. The solder switch (SS1) is open.
- The required common-mode voltage to bias the input of the ADS80x is derived from R_{14} and R_{15} and applied to pin 25 (U4) via R_{10} (0Ω).
- The bias for the complementary input of the ADS80x is developed in a similar fashion using R_{27}, R_{28}, and R_{29}.

The evaluation board typically requires a ±5V supply unit. The negative supply is necessary to appropriately power the OPA842 used in the interface circuit. By selecting a different op amp, such as the OPA690 that is designed for single-supply applications, the evaluation board may be reconfigured to operate with only a +5V supply.

2 Input

The analog input signal is added to SMA connector J1 through a noninverting amplifier, and then ac-coupled to the ADS80x analog input IN (default setting in Figure 1). A common-mode voltage is needed at the input pins IN+ and IN–. This voltage should meet the specifications in the data sheet and should keep same value at both analog input pins.

3 Clock

The DEM-ADS80xU requires an external TTL clock applied at SMA connector J2. This input represents a 50Ω input to the source. In order to preserve the specified performance of the ADS80x converter, the clock source should feature a very low jitter, which is particularly important if the converter is to be evaluated in an undersampling condition. The function of series resistor R_{17} is to dampen any excessive overshoot and undershoot of the applied clock pulse. It may be adjusted according to the amount of overshoot while maintaining a sufficiently fast rise and fall time.

4 External Reference

The ADS80x converter can be operated with an external reference. To do so, solder switch SS3 must be closed, applying 5V to the SEL-input (pin 18), which disables the internal reference of U4. It is important to remove R_{13} before connecting the external reference voltage to the ADS80x, which is done by closing solder switch SS1. The reference voltage is generated using the onboard micro-power reference IC, REF1004 (U1) and the general-purpose, single-supply op amp, OPA237 (U2). The actual reference voltage can be scaled by adjusting the values of resistors R_8 and R_9. The REF1004 produces a stable +2.5V voltage. The selected reference voltage determines the full-scale input signal range of the converter. For example, with V_{REF} = +1.25V, the input range is $2.5V_{PP}$.

5 Data Output

The data output is provided at CMOS logic levels. All ADS80x converters use straight offset binary coding. The data output pins of the converter are buffered from connector P2 by two CMOS octal buffers (HC541 or HCT541).

6 Printed Circuit Board Layout

The DEM-ADS80xU consists of a four-layer printed circuit board (PCB). To achieve the highest level of performance, surface-mount components are used wherever possible. This configuration reduces the trace length and minimizes the effects of parasitic capacitance and inductance. The analog-to-digital converter is treated as an analog component. Therefore, the evaluation fixture has one consistent ground plane. Keep in mind that this approach may not necessarily yield optimum performance results when designing the ADS80x into different individual applications. In any case, thoroughly bypassing the power supply and reference pins of the converter, as demonstrated on the evaluation board, is strongly recommended.

For further application details, please refer to the individual data sheets, available for download from www.ti.com.

- ADS803
- ADS804
- ADS805

The schematic diagram is provided as a reference, and is shown in Figure 1. Figure 2 through Figure 5 show the indivudual layers of the printed circuit board (PCB).

Note: Board layouts are not to scale. These figures are intended to show how the board is laid out; they are not intended to be used for manufacturing PCBs.

The bill of materials is provided in Table 1

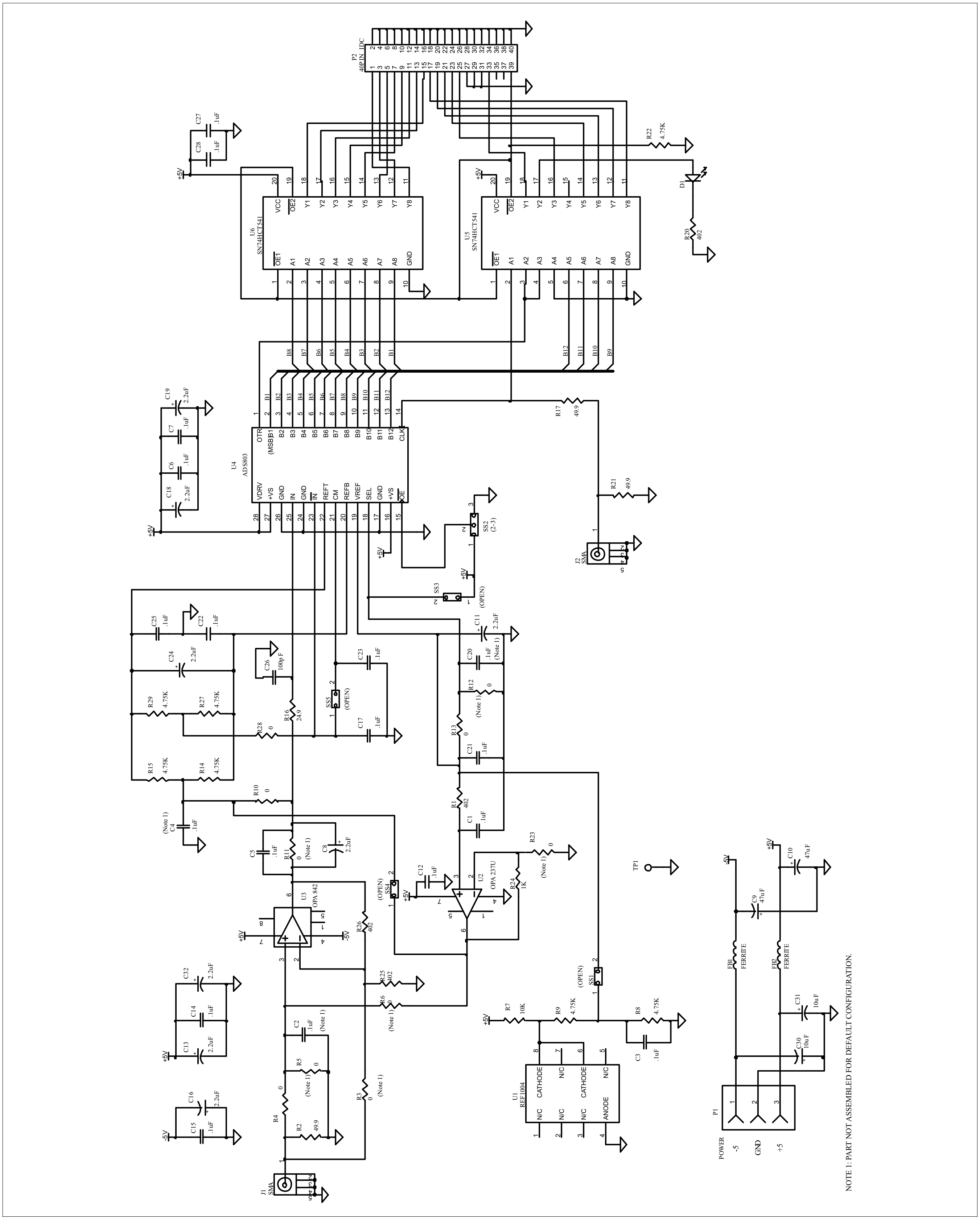

Figure 1. Circuit Schematic for the DEM-ADS80xU

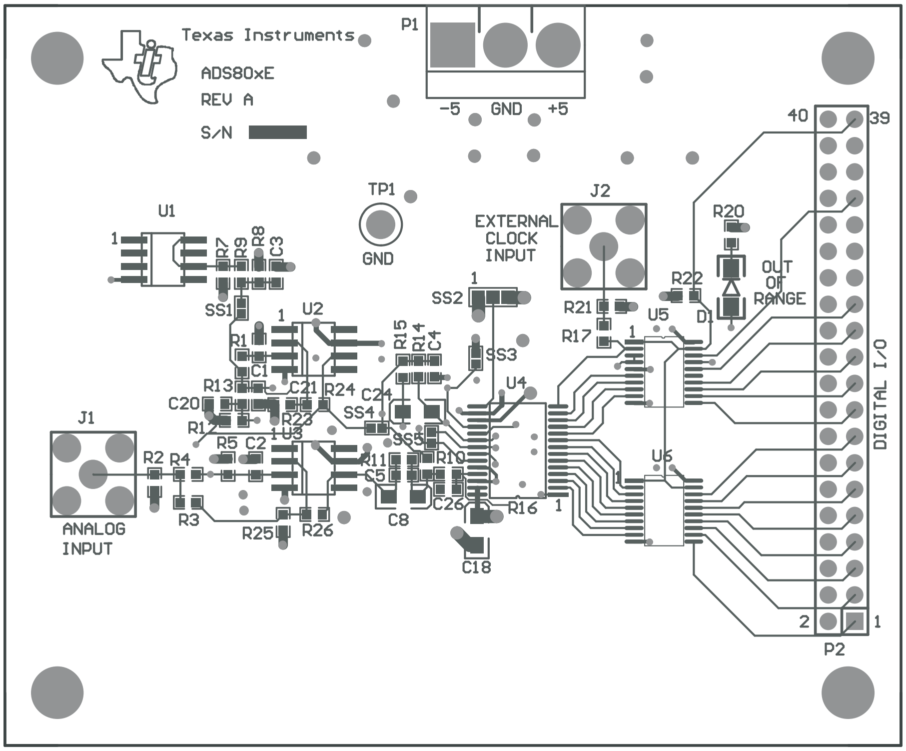

Figure 2. Top Layer Silkscreen

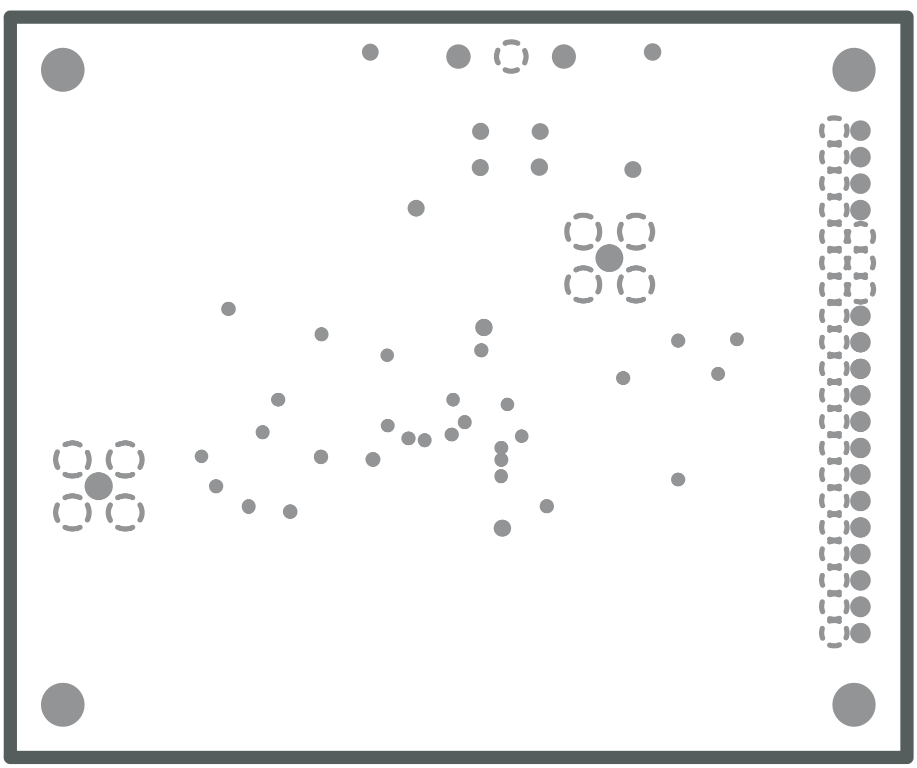

Figure 3. Internal Plane 1

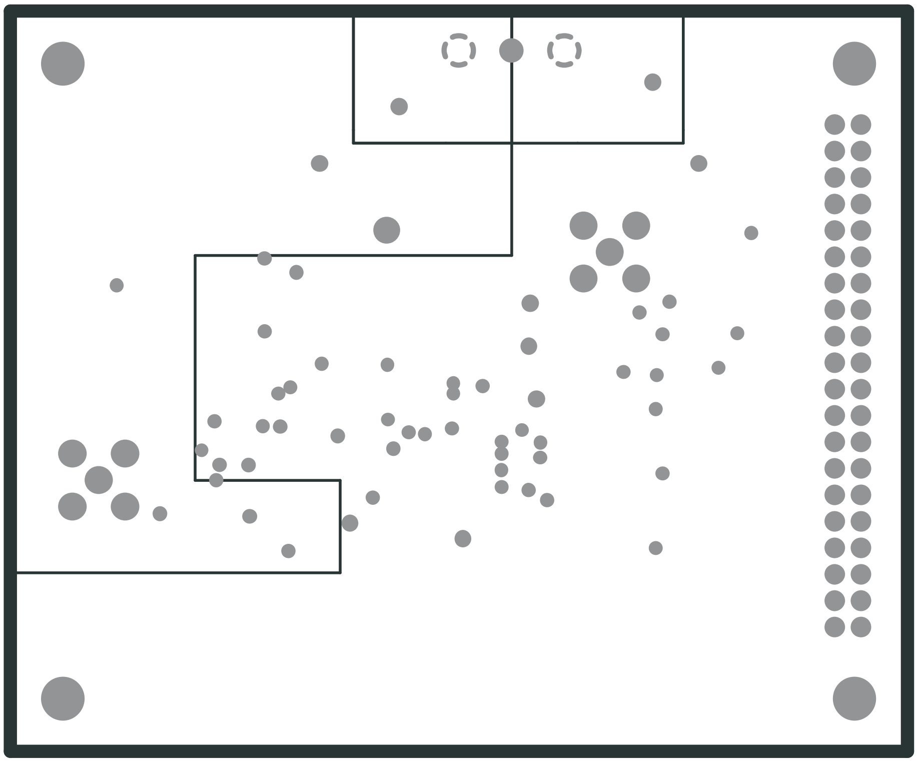

Figure 4. Internal Plane 2

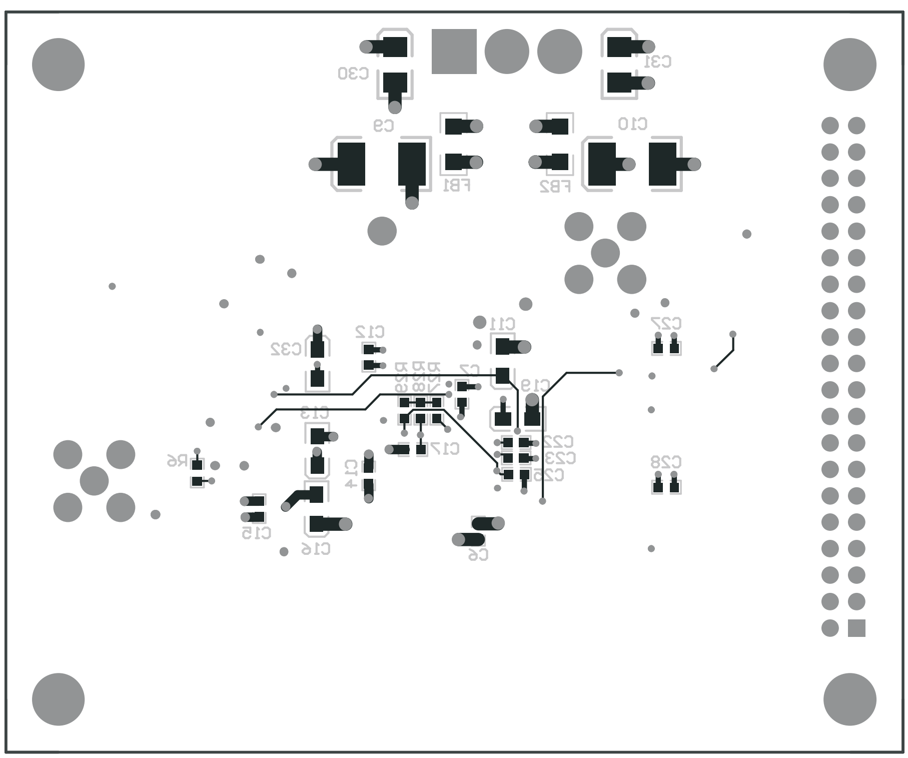

Figure 5. Bottom Layer Silkscreen

7 Component List

Table 1. DEM-ADS1216 Bill of Materials

DESCRIPTION	FOOTPRINT	QTY	PART NO.	VENDOR	DIGI-KEY NO.	REF. DES.	TI PROVIDED	NOT INSTALLED
Capacitors								
47μF, 10%, 10V, Tantalum	7343	2	10TPA47M	Sanyo	PCS2476CT-ND	C9, C10		
10μF, 10V, 10%	3528	2	ECS-T1AX106R	Murata	PCS2106CT-ND	C30, C31		
2.2μF, 10V, 10%	3216	8		Kemet		C8, C11, C13, C16, C18, C19, C24, C32		
0.1μF, 16V, 10%	603	15	ECJ-1VB1C104K	Panasonic	PCC1762CT-ND	C1, C3, C5, C6, C7, C12, C14, C15, C17, C21, C22, C23, C25, C27, C28		C2, C4, C20
100pF, 50V, 5%	603	1		Panasonic	PCC-ND	C26		
Resistors								
0Ω, 1/16W, 1%	603	4	ERJ-3GEY0R00V	Panasonic	P0.0GCT-ND	R4, R10, R13, R28		R3, R5, R6, R11, R12, R23
24.9Ω, 1/16W, 1%	603	1	ERJ-3EKF24R9V	Panasonic	P24.9HCT-ND	R16		
49.9Ω, 1/16W, 1%	603	3	ERJ-3EKF49R9V	Panasonic	P49.9HCT-ND	R2, R17, R21		
402Ω, 1/16W, 1%	603	4	ERJ-3EKF402V	Panasonic	P402KHCT-ND	R1, R20, R25, R26		
1kΩ, 1/16W, 1%	603	1	ERJ-3EKF1001V	Panasonic	P1.00KHCT-ND	R24		
4.75kΩ, 1/16W, 1%	603	7	ERJ-3EKF4R75KV	Panasonic	P4.75KHCT-ND	R8, R9, R14, R15, R22, R27, R29		
10kΩ, 1/16W, 1%	603	1	ERJ-3EKF10KV	Panasonic	P10KHCT-ND	R7		
Connectors, Jumpers, Headers, Ferrite Beads, Transformers, ICs								
Ferrite Bead	1206	2	EXC-ML32A680U		P10437CT-ND	FB1, FB2		
SMA connectors	SMA_Jack	2	2262-0000-09	Newark	13C3465	J1, J2		
3 Circuit Jumpers	SJP3	0				SS2 (2-3)		
2 Circuit Jumpers	SJP2	0						SS1, SS3, SS4, SS5
Diode	LED-1206	1	CMD15-21VGC/TR8	Panasonic	L62205CT-ND	D1		
Black Test Point	Test_point	1	5011K	Keystone	5011K-ND	TP1		
40-Pin Shrouded Header	20X2X.1	1	IDH-40LP-S3-TG	Robinson-Nugent		P2		
3-Pin Power Connector	3term_screw_con	1	ED555/3DS	On-Shore Technology		P1		
ADS805	28-SSOP(DB)	1	ADS805	TI	ADS805E	U4		
OPA237U	8-SOP(D)	1	OPA237U	TI	OPA237U	U2	Yes	
OPA842	8-SOP(D)	1	OPA842	TI	OPA842	U3	Yes	
RF1004	8-SOP(D)	1	RF1004	TI	RF1004	U1	Yes	
SN74HCT541	20-TSSOP(PW)	2	SN74HCT541	TI	SN74HCT541	U5, U6	Yes	
Screws	4-40 screw	4						
Stand Off Hex (1/4 x 0.5")	4-40 screw	4	1902CK-ND	Allied				

Revision History

Changes from Original (September 1997) to A Revision — **Page**

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

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EVM WARNINGS AND RESTRICTIONS

It is important to operate this EVM within the input voltage range of –0.3V to Vs + 0.3V (where Vs is the ADS80x analog supply voltage, and the input voltage range is for the ADC) and the output voltage range of –0.3V to Vdr + 0.3V (where Vdr is the ADS80x internal output buffer supply voltage, and the output voltage range is for the ADC).

Exceeding the specified input range may cause unexpected operation and/or irreversible damage to the EVM. If there are questions concerning the input range, please contact a TI field representative prior to connecting the input power.

Applying loads outside of the specified output range may result in unintended operation and/or possible permanent damage to the EVM. Please consult the EVM User's Guide prior to connecting any load to the EVM output. If there is uncertainty as to the load specification, please contact a TI field representative.

During normal operation, some circuit components may have case temperatures greater than +60°C. The EVM is designed to operate properly with certain components above +60°C as long as the input and output ranges are maintained. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors. These types of devices can be identified using the EVM schematic located in the EVM User's Guide. When placing measurement probes near these devices during operation, please be aware that these devices may be very warm to the touch.

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