Multi-Cal-System Cables

This user's guide describes the characteristics, operation, and the use of the Multi-Cal-System cables. The Multi-Cal-System is a set of evaluation modules (EVMs) that is used to calibrate multiple PGA308 sensor modules. This document gives details regarding several different cables used in the system. The document includes the bill of materials (BOM) and cable descriptions.

Contents

1 Overview 2
2 Multi-Cal-Interface Cable 6
3 Slave Ribbon Cable 8
4 Power Cable 9
5 Bills of Material 10

List of Figures

1 Multi-Cal-Interface Cable 2
2 Multi-Cal-Power Cable 3
3 Multi-Cal-Slave Ribbon Cable 3
4 Cable Raw Materials 4

List of Tables

1 Signal Definition on Multi-Cal-Interface Cable 6
2 Wiring for Multi-Cal-Interface Cable 7
3 Signal Definition for Slave Ribbon Cable 8
4 Wiring for Multi-Cal-Power Cable 9
5 Multi-Cal-Interface Cable Parts List 10
6 Multi-Cal-Power Cable Parts List 10
7 Multi-Cal-Slave Ribbon Cable Parts List 10

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1 Overview

The Multi-Cal-System EVM is part of a series of EVMs that is used to calibrate multiple PGA308 sensor modules. The PGA308 is a programmable analog sensor signal conditioner. All components in the Multi-Cal-System can be expanded to calibrate up to 64 sensors simultaneously. For a more detailed description of the PGA308, refer to the product data sheet (SBOS440) available from the Texas Instruments web site at http://www.ti.com. Additional support documents are listed in the section of this guide entitled *Related Documentation from Texas Instruments* .

The complete Multi-Cal-System contains a series of printed circuit assemblies (PCAs), and can be expanded to meet your specific system requirements.

Throughout this document, the abbreviation *EVM* and the term *evaluation module* are synonymous with the Multi-Cal-System, unless otherwise indicated.

1.1 Multi-Cal-System Cables

Figure 1 shows the Multi-Cal-Interface cable. This cable is used to connect the master and slave boards to the interface board. This cable was designed so that it can be used in environmental temperature chambers (that is, from –55°C to +125°C). The length of the cable (8ft, or 2,438m) was selected to accommodate a majority of typical applications. If your application requires longer cables, you can build your own cable using the BOM provided at the end of this document.

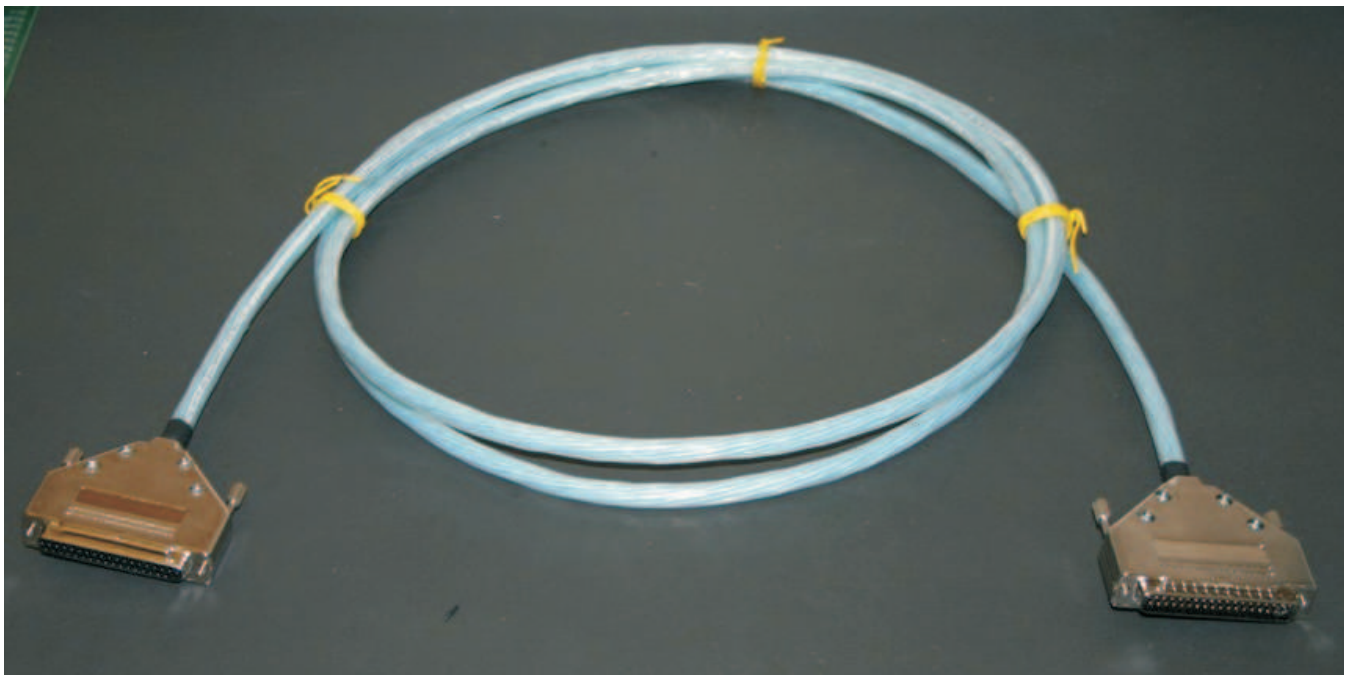

Figure 1. Multi-Cal-Interface Cable

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Figure 2 shows the Multi-Cal-Power cable. This cable connects the Multi-Cal-System to the power supplies and test equipment. Banana jacks that connect to voltmeters are insulated on the outside to prevent shorting of unused connections. The length of the cable (8ft, or 2,438m) was selected to accommodate a majority of typical applications. If your application requires longer cables, you can build your own cable using the BOM provided at the end of this document.

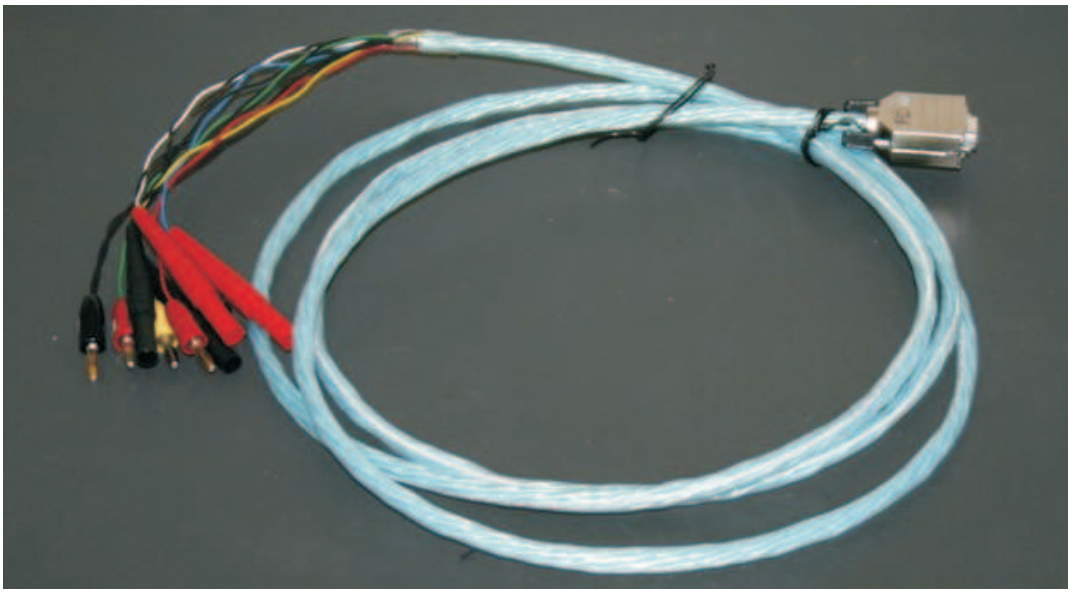

Figure 2. Multi-Cal-Power Cable

Figure 3 shows the Multi-Cal-Slave ribbon cable. This cable is used to interconnect the master and slave boards within the Multi-Cal-System. This cable is included with the Multi-Cal-Slave EVM.

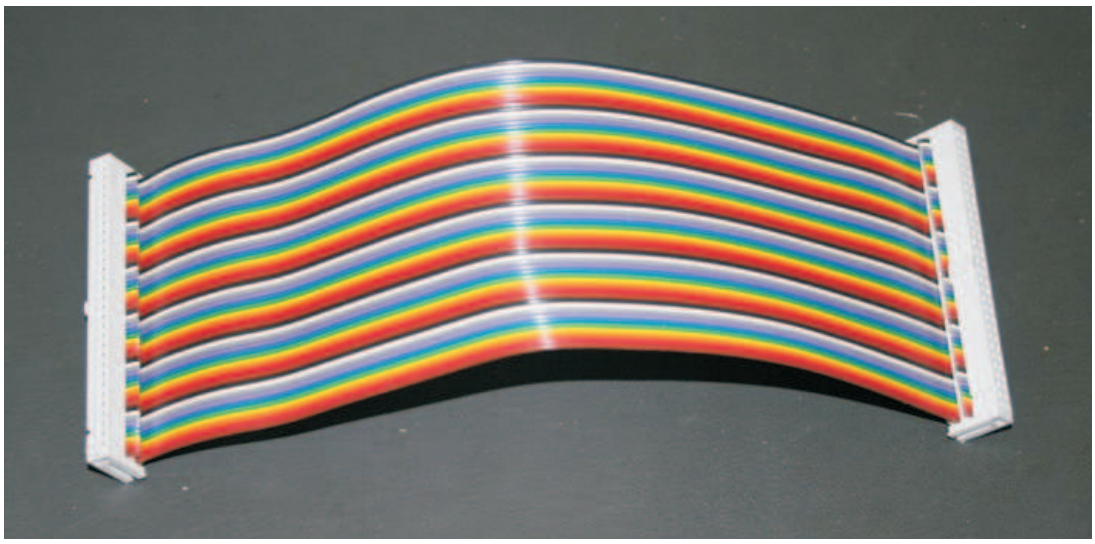

Figure 3. Multi-Cal-Slave Ribbon Cable

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Figure 4 shows the raw material cable that is used in the construction of the Multi-Cal-Interface cable. This cable is rated to operate over the extended industrial temperature range (–55°C to +125°C). This cable contains 12 twisted-pair wires. Each twisted-pair is shielded with an insulated foil shield. Running adjacent to each foil shield is a bare drain wire. The drain wire provides a simple way to connect the foil shield to ground. The foil shield and twisted-pair configuration is helpful in reducing radio frequency interference/electromagnetic interference (RFI/EMI) noise pick-up on the signal connections.

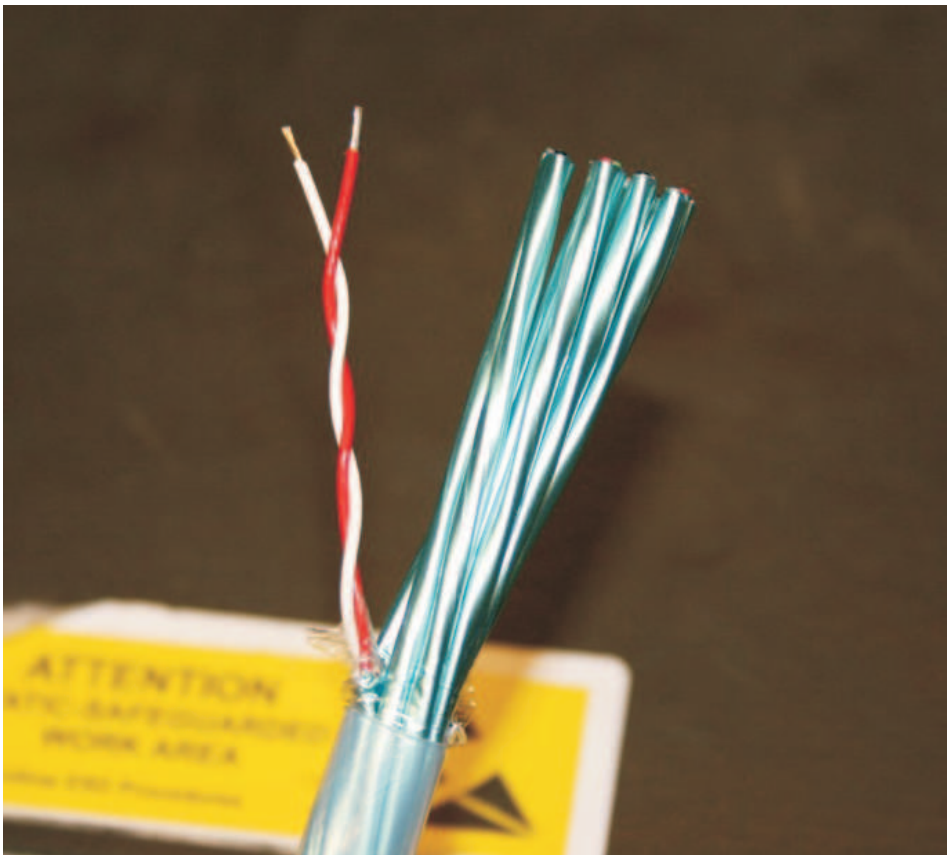

Figure 4. Cable Raw Materials

Note that the one-wire digital signal is sent on a separate shielded line to prevent capacitive coupling of digital signals into the analog signals or into other digital signals. Preventing channel-to-channel capacitive coupling of digital signals is important because it prevents erroneous data transfer to adjacent channels.

In some cases, you will need to develop your own cable (for example, the length of the Texas Instruments cable is not sufficient). If you must develop your own cable, ***it is highly recommended that you use a similar type of cable*** (that is, one with individually shielded, twisted-pair wires). The manufacturer information is given in the BOM for the interface cable.

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1.2 Related Documentation from Texas Instruments

The following document provides information regarding Texas Instruments integrated circuits used in the assembly of the Multi-Cal-System EVM. This cable user's guide is available from the TI website under literature number SBOU092. Any letter appended to the literature number corresponds to the document revision that is current at the time of the writing of this document. Newer revisions may be available from the TI web site at http://www.ti.com/, or call the Texas Instruments Literature Response Center at (800) 477-8924 or the Product Information Center at (972) 644-5580. When ordering, identify the document by both title and literature number.

Document	Literature Number
PGA308 Product Data Sheet	SBOS440
XTR115 Product Data Sheet	SBOS124A
USB DAQ Platform User's Guide	SBOU056
Multi-Cal-System EVM User's Guide	SBOU087
Multi-Cal-Test User's Guide	SBOU088
Multi-Cal-Master EVM User's Guide	SBOU089
Multi-Cal-Slave EVM User's Guide	SBOU094
Multi-Cal-Interface User's Guide	SBOU093

1.3 Applications Questions

If you have questions about this or other Texas Instruments evaluation modules, post a question in the *Amplifiers* forum at http://e2e.ti.com. Include in the subject heading the product in which you are interested.

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2 Multi-Cal-Interface Cable

2.1 Signal Definitions

Table 1 summarizes the signal definitions on the Multi-Cal-Interface cable.

Table 1. Signal Definition on Multi-Cal-Interface Cable

Pin P0	Signal	Function on P0
1	Chassis ground	Chassis ground
2	One0	One-wire digital communication line.
3	Pos0	Positive device supply.
4	Neg0	Negative device supply.
5	GND0	Ground force for current modules. Ground sense for voltage modules.
6	$V_{OUT}0$	Output voltage measurement.
7	SCK0	SPI SCK for XTR108.
8	CS0	SPI CS0 for XTR108
9	IO0	SPI Input / Output for XTR108
10	Chassis ground	Pins 10 to 18 repeat the function of Pins 1 to 9 for channel 2
11	One1	
12	Pos1	
13	Neg1	
14	GND1	
15	$V_{OUT}1$	
16	SCK1	
17	CS1	
18	IO1	
19	—	No connection
20	Chassis ground	Pins 20 to 28 repeat the function of Pins 1 to 9 for channel 3
21	One2	
22	Pos2	
23	Neg2	
24	GND2	
25	Vout2	
26	SCK2	
27	CS2	
28	IO2	
29	Chassis ground	Pins 29 to 37 repeat the function of Pins 1 to 9 for channel 4
30	One3	
31	Pos3	
32	Neg3	
33	GND3	
34	Vout3	
35	SCK3	
36	CS3	
37	IO3	

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2.2 Wiring Definitions

The wiring guidelines and definitions for the Multi-Cal-Interface cable are listed in Table 2.

Table 2. Wiring for Multi-Cal-Interface Cable

Connector Pin #	Connection	Pair		Signal	Connection	Connector Pin #
1	Shield			Shield0	NC	1
2	Coax			One	Coax	2
3	Red	Pair1 (red blk)		V_P0	Red	3
4	Blk	Pair1 (red blk)		V_N0	Blk	4
5	Red	Pair2 (red yel)		GND_S0	Red	5
6	Yel	Pair2 (red yel)		$V_{OUT}0$	Yel	6
7	NC-XTR				NC-XTR	7
8	NC-XTR				NC-XTR	8
9	NC-XTR				NC-XTR	9
10	Shield			Shield0	NC	10
11	Coax			One	Coax	11
12	Red	Pair3 (red wht)		V_P1	Red	12
13	Wht	Pair3 (red wht)		V_N1	Wht	13
14	Blk	Pair4 (blk yel)		GND_S1	Blk	14
15	Yel	Pair4 (blk yel)		$V_{OUT}1$	Yel	15
16	NC-XTR				NC-XTR	16
17	NC-XTR				NC-XTR	17
18	NC-XTR				NC-XTR	18
19	NC-BLANK	BLANK		BLANK	NC-BLANK	19
20	Shield			Shield0	NC	20
21	Coax			One	Coax	21
22	Blk	Pair4 (blk wht)		V_P2	Blk	22
23	Wht	Pair4 (blk wht)		V_N2	Wht	23
24	Yel	Pair5 (yel wht)		GND_S2	Yel	24
25	Wht	Pair5 (yel wht)		$V_{OUT}2$	Wht	25
26	NC				NC	26
27	NC				NC	27
28	NC				NC	28
29	Shield			Shield0	NC	29
30	Coax			One	Coax	30
31	Red	Pair1 (red blue)		V_P3	Red	31
32	Blue	Pair1 (red blue)		V_N3	Blue	32
33	Blk	Pair2 (blk blue)		GND_S3	Blk	33
34	Blue	Pair2 (blk blue)		$V_{OUT}3$	Blue	34
35	NC-XTR				NC-XTR	35
36	NC-XTR				NC-XTR	36
37	NC-XTR				NC-XTR	37

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3 Slave Ribbon Cable

3.1 Signal Definitions

The signal definitions for the Slave ribbon cable are shown in Table 3.

Table 3. Signal Definition for Slave Ribbon Cable

Pin	Signal	Comments
1, 2, 3, 4, 5	V_{POS_Slave}	Positive device power supply passed to the slave.
6, 7, 8, 9, 10	V_{NEG_Slave}	Negative device power supply passed to the slave.
11, 12, 13, 14, 15, 16	GND	±15V power supply GND.
17, 18, 19	–15V slave	+15V passed to the slave.
20, 21, 22, 23, 24	+15V slave	–15V passed to the slave.
25	I_{M-}	Current meter negative connection
26	DVM–	Voltmeter negative connection.
27	DVM+	Voltmeter positive connection.
28	Earth GND	Used as RFI/EMI shield. Also prevents capacitive coupling between adjacent signals.
29	SPI_SCK	Communications on XTR108
30	Earth GND	
31	SPI_CS1	Communications on XTR108
32	Earth GND	
33	SPI_IO	Communications on XTR108
34	Earth GND	
35	ONE_WIRE	Communications for PGA309/308
36	Earth GND	
37	I2C_SDA_ISO	Used to set up bus expansion on slaves
38	Earth GND	
39	I2C_SCK_ISO	Used to set up bus expansion on slaves
40	Earth GND	
41	I2C_SCK	Used to set up bus expansion on slaves
42	Earth GND	
43	I2C_SDA2	Used to set up bus expansion on slaves
44	Earth GND	
45	SLAVE1	Gated clocks to select slave
46	SLAVE2	
47	SLAVE3	
48	SLAVE4	
49	SLAVE5	
50	SLAVE6	
51	SLAVE7	
52	V_{DUT}	Power control signal for three-wire mode
53	CTRL1	Mux select signals
54	CTRL2	
55	CTRL3	
56	CTRL4	
57	CTRL5	
58	CTRL6	
59	CTRL7	
60	CTRL8	

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4 Power Cable

Table 4 lists the wiring specifications for the Multi-Cal-System Power cable.

Table 4. Wiring for Multi-Cal-Power Cable

Connector Pin	Connection	Pair		Signal	Termination	Label
1	$-V_{LOOP}$	Red/Green		Red	Black Banana	$-V_{DUT}$
2	$+V_{LOOP}$	Red/Green		Green	Red Banana	$+V_{DUT}$
3	I_{M+}	White/Black		White	Insulated Red Banana	I_{M+}
4	I_{M-}	White/Black		Black	Insulated Black Banana	I_{M-}
5	V_{M-}	Blue/Black		Black	Insulated Black Banana	V_{M-}
6	V_{M+}	Blue/Black		Blue	Insulated Red Banana	V_{M+}
7	+12V	Red/Black		Red	Red Banana	+12V
8	–12V	Yellow/Black		Yellow	Yellow Banana	–12V
9	GND	Red/Black and Yellow/Black		Black (two wires)	Black Banana	GND

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5 Bills of Material

Table 5 through Table 7 show the parts lists for the Multi-Cal-Interface cable, the Multi-Cal-Power cable, and the Multi-Cal-Slave ribbon cable, respectively.

Table 5. Multi-Cal-Interface Cable Parts List

Qty (Units)	Description	Manufacturer	Part Number
Ea	Connector Backshell D Sub Series: ADK	AMP-Tyco	3-1478762-7
Ea	Connector D-Shell, Cable Mount, Plug, 37	AMP-Tyco	4-1393483-1
Ea	Connector D-Shell, Cable Mount, Socket, 37	AMP-Tyco	5-1393483-0
8 ft length	Cable, 12 shield twisted-pair	Multi/Cable Corp	59024-12SP
2 in length	Tubing, Teflon .047" ID 100' CLR	Alpha Wire	TFT20017 NA005
1 in Length	Heatshrink 3/8" x 4' Black	3M	EPS-200 3/8" BL48"BX

Table 6. Multi-Cal-Power Cable Parts List

Qty (Units)	Description	Manufacturer	Part Number
8 ft	Cable, 5 pair, twisted and shielded, 20GA	59020-5SP	Multi/Cable Corp
1	Patch Cord Stkg Banana Plug 18" BLK	B-18-0	Pomona Electronics
2	Black Conn Plug Banana Solderless insulated	108-0303-001	Emerson Network Power Connectivity Solutions
2	Red Conn Plug Banana Solderless insulated	108-0302-001	Emerson Network Power Connectivity Solutions
1	Yellow Conn Plug Banana Solderless insulated	108-0307-001	Emerson Network Power Connectivity Solutions
2	Plug Banana Sheath DIY Red 10PC	6383-2	Pomona Electronics
2	Plug Banana Sheath DIY Black 10PC	6383-0	Pomona Electronics
1	Wire Crimp Socket used for drain wires.	83-9091	Ideal
1	Backshell DB9 Str Metal ShlD	8655MH0901BLF	FCI
1	Conn DB9 Female Sld Cup Nickel	171-009-203L001	Norcomp Inc.

Table 7. Multi-Cal-Slave Ribbon Cable Parts List

Qty (Units)	Description	Manufacturer	Part Number
1	Ribbon cable, Cable 60 cond 300ft multi-color	3M	3302/60 300SF
2	Ribbon connector, Conn socket idc 60pos w/str gold	Assmann Electronics Inc	AWP60-7241-T-R

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EVM Warnings and Restrictions

It is important to operate this EVM within the input voltage range of 5.7V to 9V and the output voltage range of 0V to 5V.

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 +25°C. The EVM is designed to operate properly with certain components above +25°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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