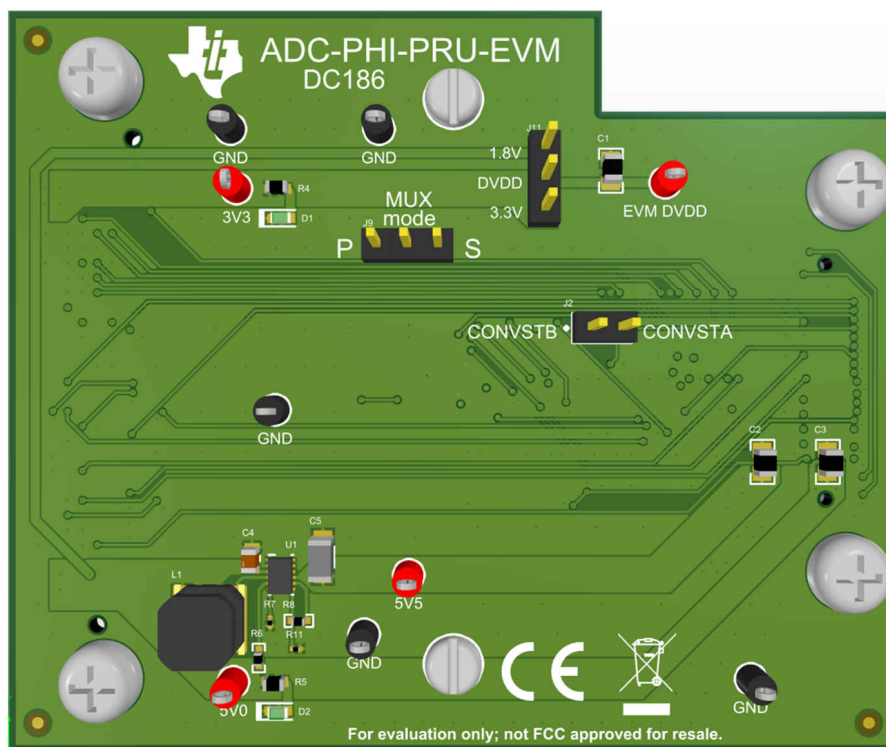


ADC-PHI-PRU-EVM Evaluation Module



ABSTRACT



This user's guide contains information and support documentation for the ADC-PHI-PRU-EVM evaluation module (EVM). Included are the circuit description, schematic, and bill of materials of the ADC-PHI-PRU-EVM. Throughout this document, the terms *evaluation board*, *evaluation module*, and *EVM* are synonymous with the ADC-PHI-PRU-EVM.

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Trademarks

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1 Introduction

The ADC-PHI-PRU-EVM evaluation adapter card interfaces the Sitara™ AM64x processor ([TMDS64GPEVM](#)) or AM243x MCU ([TMDS243GPEVM](#)) development platforms to greater than 25 precision ADC EVMs for communication, data capture, and software development. The adapter card routes the ICSSG-PRU signals to the corresponding serial (SPI and eSPI) or parallel ADC data communication interfaces. The adapter card offers configurability through two jumpers that select between serial or parallel connections, and also offers a user-selectable digital power to match the required digital and analog supply voltage levels of the precision ADC EVM. The programmability of the Sitara ICSSG-PRU peripheral allows for high-speed data capture along with data preprocessing. Remove the extra microcontroller (MCU) or field-programmable gate array (FPGA) on your current design and start your system precision analog-to-digital converter (ADC) and AM64x, AM243x software development today with the ADC-PHI-PRU-EVM.

[Table 1-1](#) lists the precision EVMs compatible with the ADC-PHI-PRU-EVM.

Table 1-1. ADC-PHI-PRU-EVM Compatible Precision ADC EVMs

EVM	CONVST Connection (J2)	MUX Mode Selection (J9)	DVDD Power Supply Voltage (J11)	Comments
AMC131M03EVM-PDK		Serial	3.3 V	
ADC128S102EVM		Serial	3.3 V	
ADS127L11EVM		Serial	1.8 V	
ADS1285EVM-PDK		Serial	3.3 V	
ADS131A04EVM		Serial	3.3 V	
ADS131B04-Q1EVM		Serial	3.3 V	
ADS131B26Q1EVM-PDK		Serial	3.3 V	
ADS131M04EVM		Serial	3.3 V	
ADS704x-5xEVM		Serial	3.3 V	
ADS8168EVM-PDK		Serial	3.3 V	
ADS8332V2EVM-PDK	PRU1_GPIO17	Serial	3.3 V	
ADS8353Q1EVM-PDK		Serial	3.3 V	
ADS8588SEVM-PDK	PRU1_GPIO17	Parallel	3.3 V	Short CONVST A/B together
ADS8681EVM-PDK	PRU1_GPIO17	Serial	3.3 V	
ADS8686SEVM-PDK	PRU1_GPIO17	Parallel	3.3 V	
ADS8688EVM-PDK		Serial	3.3 V	
ADS8860V2EVM-PDK	PRU1_GPIO17	Serial	3.3 V	
ADS8881V2EVM-PDK	PRU1_GPIO17	Serial	3.3 V	
ADS8900BV2EVM-PDK	PRU1_GPIO17	Serial	3.3 V	
ADS9110EVM-PDK	PRU1_GPIO17	Serial	3.3 V	
TLV2553EVM-PDK		Parallel	3.3 V	

1.1 Features

- Provides connection for the AM64x PRU and GPIO pins to the ADC interface for high-speed, flexible, data acquisition, and device configuration
- 5.5-V boosted supply from the AM64x TMDS64GPEVM 5-V supply rail using the TPS61096A
- Jumper configurable support for serial (SPI) and parallel data types (J9)
- Precision ADC EVM DVDD voltages of 1.8 V and 3.3 V are available with jumper configuration (J11)
- No external MCU or processing chip required to interface the TMDS64GPEVM and precision ADC EVM

2 ADC-PHI-PRU-EVM Overview

Figure 2-1 shows the two main connectors of the ADC-PHI-PRU-EVM adapter card. The 150-pin high-speed expansion (HSE) connector is on the left and mates with the AM64x and AM243x general purpose (GP) development platform HSE connectors. The 60-pin Q-strip (QSH) connector is on the right and mates with the precision ADC EVMs listed in Table 3-1. Three jumpers (J2, J9, and J11) on the ADC-PHI-PRU-EVM select the following settings:

- J2 shorts the CONVSTA and CONVSTB signals together for operation with a single CONVST signal
- J9 configures the MUX to select either serial or parallel mode to communicate with the precision ADC EVM
- J11 selects either 1.8 V or 3.3 V as the DVDD voltage for the precision ADC EVM

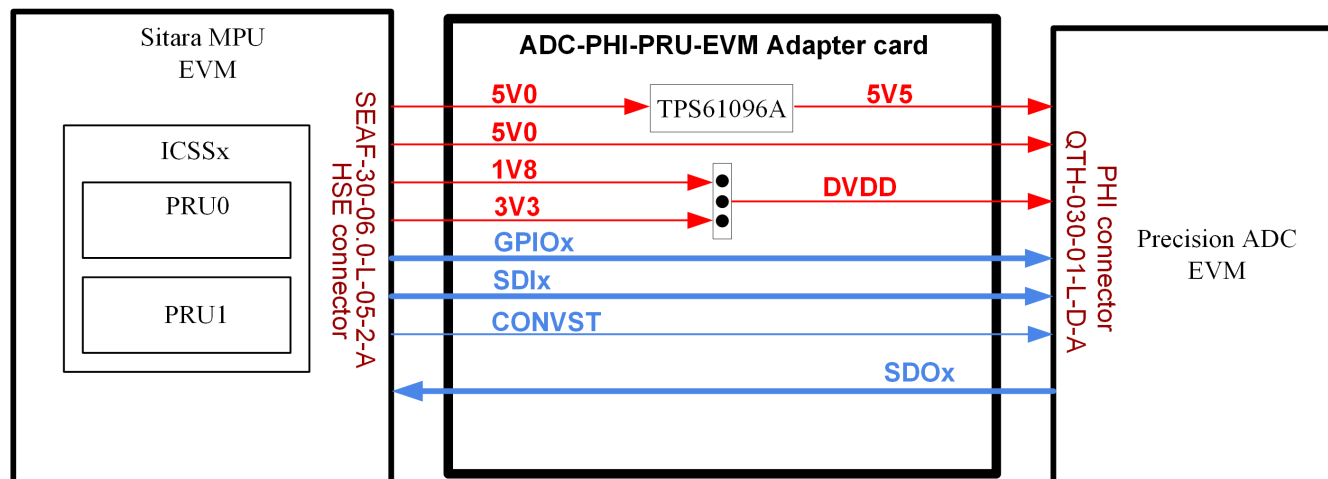


Figure 2-1. ADC-PHI-PRU-EVM System Architecture

3 ADC-PHI-PRU-EVM Circuitry

This section provides an overview of the circuitry used for the jumpers, power circuitry, and MUXes on the ADC-PHI-PRU-EVM.

3.1 Power Circuitry

Most precision ADC EVMs are powered directly from the USB-powered PA007 precision host adapter (PHI) controller board. The PA007 board outputs 5.5 V, which is commonly used for the analog supplies, and either 3.3 V or 1.8 V for digital, I/O, and EEPROM supplies. To match the supply voltages, the ADC-PHI-PRU-EVM converts and routes the 5-V, 3.3-V, and 1.8-V supplies that are featured on the HSE connector to the QSH connector.

As shown in Figure 3-1, J11 selects the DVDD voltage routed to the QSH connector between the 3.3-V and 1.8-V supplies from the AM64x and AM24x HSE connector.

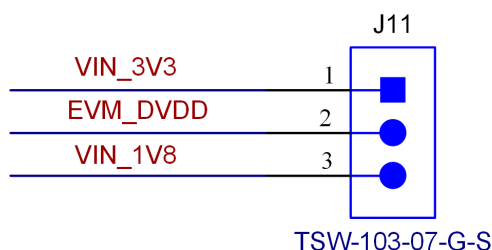


Figure 3-1. J11 Selects Between the 3.3-V and 1.8-V DVDD Supplies for the ADC

Figure 3-2 shows that a TPS61096 boost converter on the ADC-PHI-PRU-EVM converts the 5.0-V HSE output to the 5.5-V output to match the typical output of the PA007 motherboard. The feedback network formed from R8 and R11 sets the output voltage to approximately 5.5 V.

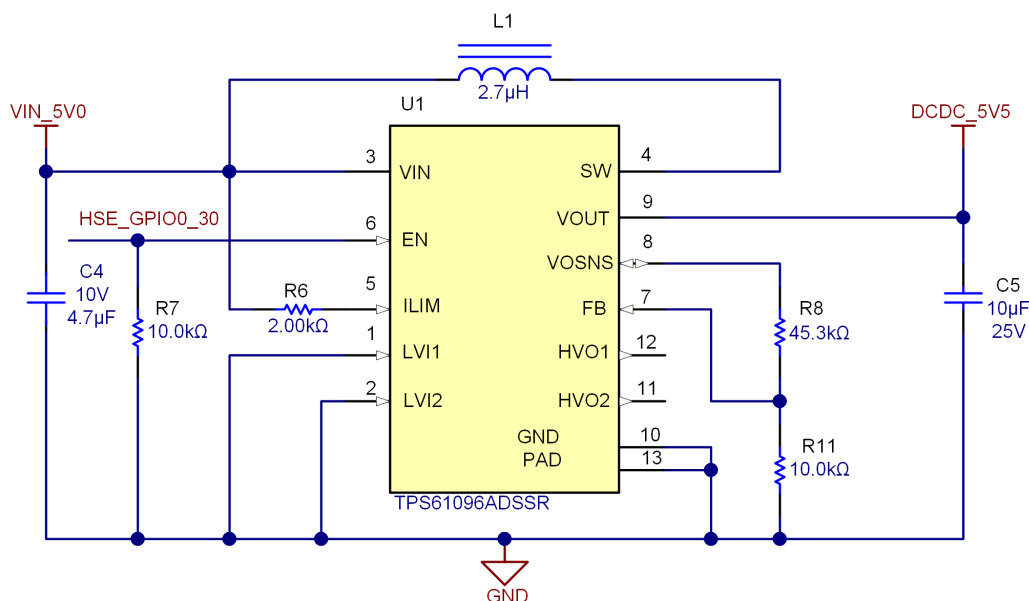


Figure 3-2. TPS61096 Boost Converter Circuitry

Figure 3-3 shows the D1 and D2 indicator LEDs that confirm the presence of the 5-V and 3.3-V supplies from the AM64x and AM24x EVM (TMDS64GPEVM and TMDS243GPEVM) HSE connectors.

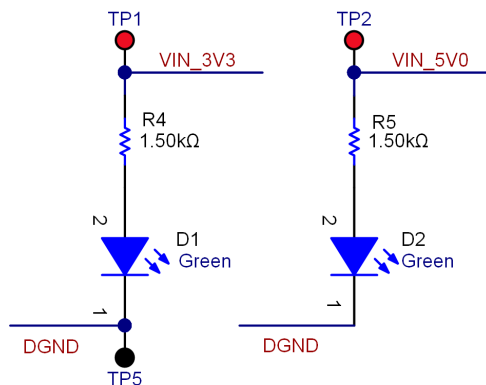


Figure 3-3. D1 and D2 LEDs

3.2 MUX Circuitry

PA007-based precision ADC EVMs share several pins between the parallel and serial modes of operation depending on how the controller card is configured by the EVM GUI. There are two SN74CBTLV16292VR digital multiplexer (MUX) devices on the ADC-PHI-PRU-EVM that route the proper signals from the AM64x and AM243x EVMs (TMDS64GPEVM and TMDS243GPEVM) to communicate with either the parallel or serial precision ADC EVMs. Figure 3-4 shows how the J9 jumper sets the voltage level on the MUX device selection pins that route the A side PRU signals from the HSE connector to either the B1 (parallel) or B2 (serial) connections on the B side. The signal routing to the MUX devices for both parallel and serial communication modes is provided in the full schematics of Section 4.1.

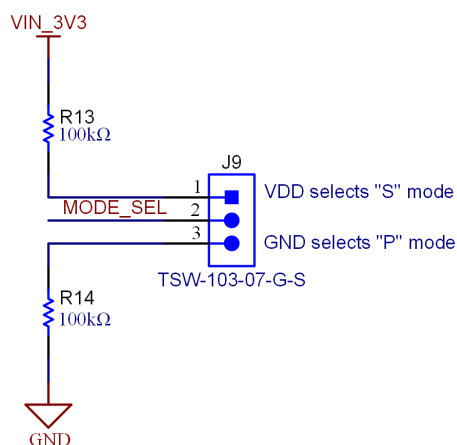


Figure 3-4. J9 Selects Between Serial (S) and Parallel (P) Communication With the ADC

3.3 Board Mating Connections

Table 3-1 and Table 3-2 list the AM64x and AM24x signals that are routed to the ADC-PHI-PRU-EVM QSH connector from the HSE connector.

Table 3-1. ADC-PHI-PRU-EVM Serial Mode QSH Connector Signal Routing to the AM64x and AM24x

Signal Name	Pin Number	Pin Number	Signal Name
5V	2	1	5.5V
5V	4	3	DGND
PRU1_GPIO7	6	5	—
PRU1_GPIO9	8	7	—
PRU0_GPIO13	10	9	—
PRU0_GPIO12	12	11	—
PRU0_GPIO11	14	13	—
PRU0_GPIO10	16	15	—
PRU0_GPIO9	18	17	—
PRU1_GPIO17_SYNC_OUT1	20	19	—
PRU0_GPIO8	22	21	—
PRU0_GPIO19_SYNC_OUT0	24	23	—
—	26	25	—
—	28	27	—
PRG0_PRU0_GPIO16	30	29	HSE_GPIO0_42
PRU0_GPIO17_SYNC_OUT1	32	31	PRU0_GPIO18_LATCH_IN0
PRU0_GPIO15	34	33	HSE_GPIO0_35
PRU0_GPIO14	36	35	—
PRU0_GPIO0	38	37	HSE_GPIO0_29
PRU0_GPIO1	40	39	HSE_GPIO0_24
PRU0_GPIO2	42	41	HSE_GPIO0_44
PRU0_GPIO3	44	43	PRU0_GPIO6
PRU0_GPIO4	46	45	PRU0_GPIO7_LATCH_IN1
PRU0_GPIO5	48	47	—
DVDD	50	49	HSE_GPIO0_32
PRU1_GPIO14	52	51	HSE_GPIO0_34
PRU1_GPIO16	54	53	HSE_GPIO0_37
SOC_I2C0_SDA	56	55	HSE_GPIO0_39
SOC_I2C0_SCL	58	57	HSE_GPIO0_41
DGND	60	59	ID PWR

Table 3-2. ADC-PHI-PRU-EVM Parallel Mode QSH Connector Signal Routing to the AM64x and AM24x

Signal Name	Pin Number	Pin Number	Signal Name
5V	2	1	5.5V
5V	4	3	DGND
PRU0_GPIO15	6	5	—
PRU0_GPIO14	8	7	—
PRU0_GPIO13	10	9	—
PRU0_GPIO12	12	11	—
PRU0_GPIO11	14	13	—
PRU0_GPIO10	16	15	—
PRU0_GPIO9	18	17	—
PRU0_GPIO8	20	19	—
PRU0_GPIO7_LATCH_IN1	22	21	—
PRU0_GPIO6	24	23	PRU0_GPIO16
PRU0_GPIO5	26	25	—
PRU0_GPIO4	28	27	—
PRU0_GPIO3	30	29	HSE_GPIO0_42
PRU0_GPIO17_SYNC_OUT1	32	31	PRU0_GPIO18_LATCH_IN0
—	34	33	HSE_GPIO0_35
PRU0_GPIO19_SYNC_OUT0	36	35	—
PRU0_GPIO2	38	37	HSE_GPIO0_29
PRU0_GPIO1	40	39	HSE_GPIO0_24
PRU0_GPIO0	42	41	HSE_GPIO0_44
PRU1_GPIO17_SYNC_OUT1	44	43	PRU1_GPIO7
Jumper to 44/MCU GPIO	46	45	PRU1_GPIO9
PRU1_GPIO10	48	47	—
DVDD	50	49	HSE_GPIO0_32
PRU1_GPIO14	52	51	HSE_GPIO0_34
PRU1_GPIO16	54	53	HSE_GPIO0_37
SOC_I2C0_SDA	56	55	HSE_GPIO0_39
SOC_I2C0_SCL	58	57	HSE_GPIO0_41
DGND	60	59	ID PWR

4 Schematics, PCB Layout, and Bill of Materials

The following sections contain images with the full schematics and layout prints, as well as a bill of materials table, for the circuitry on the ADC-PHI-PRU-EVM.

4.1 Schematics

Figure 4-1 to Figure 4-4 illustrate the schematics for the ADC-PHI-PRU-EVM.

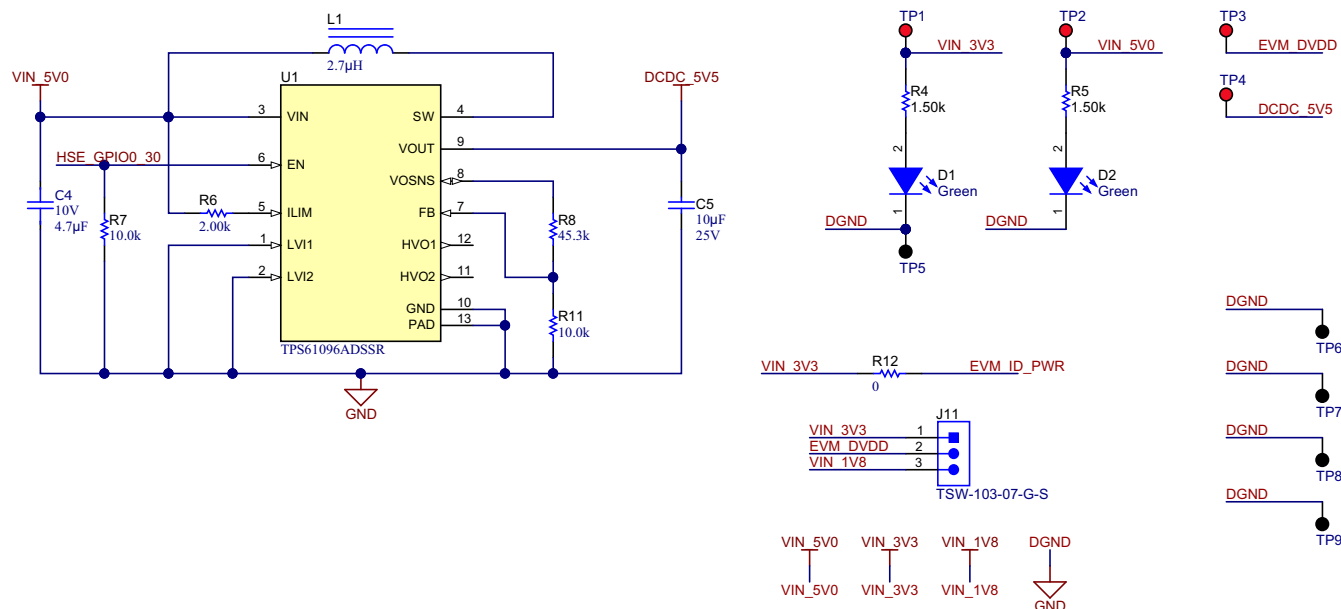


Figure 4-1. ADC-PHI-PRU-EVM Power Schematic Page

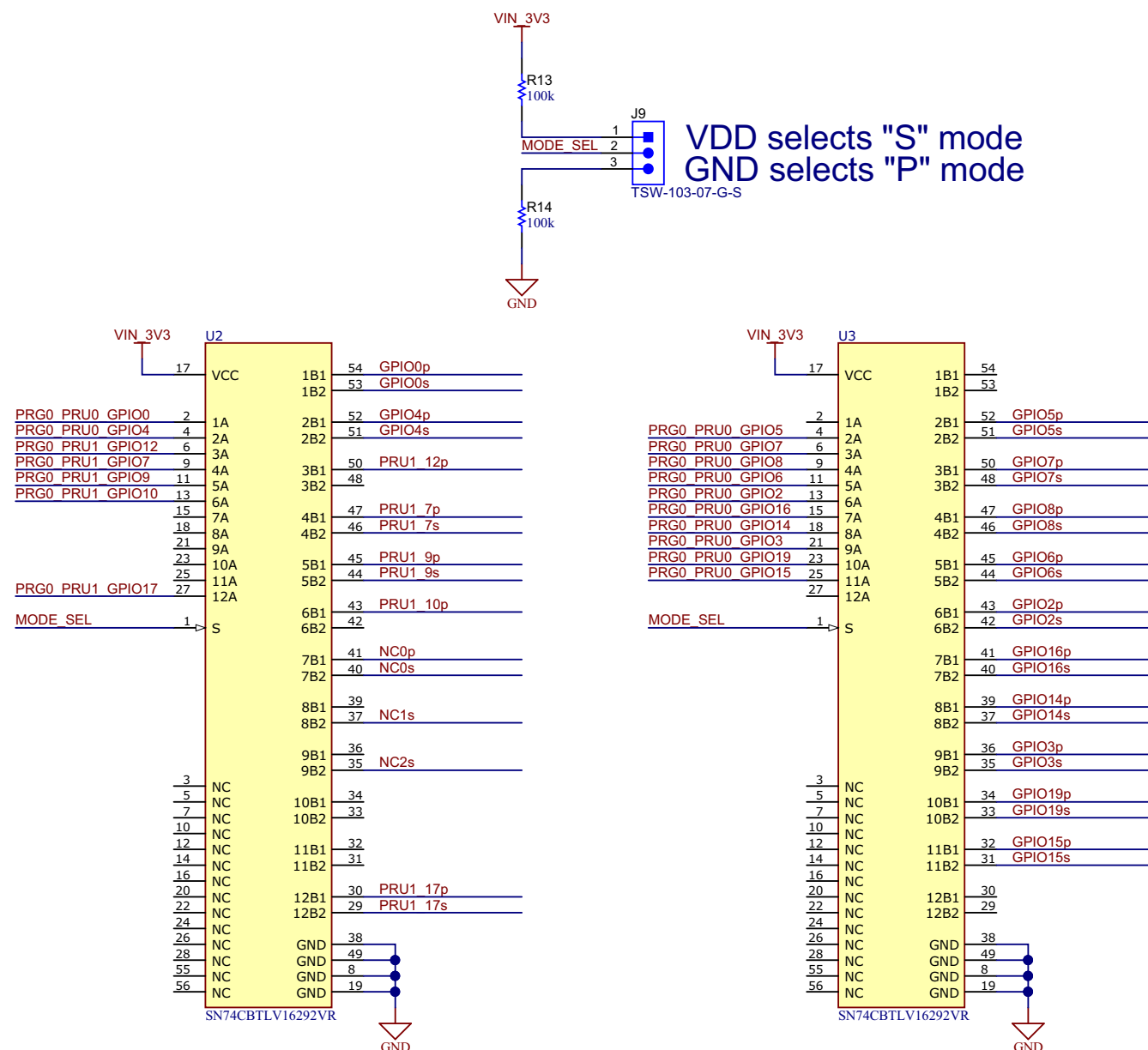
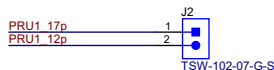


Figure 4-2. ADC-PHI-PRU-EVM MUX Schematic Page

		J1		
DCDC_SV5	1	□	2	VIN_SV0
DGND	3	□	4	VIN_SV0
	5	□	6	GPIO15p PRU1_7s
	7	□	8	GPIO14p PRU11_7s
	9	□	10	PRG0 PRU0 GPIO13
	11	□	12	PRG0 PRU0 GPIO12
	13	□	14	PRG0 PRU0 GPIO11
	15	□	16	PRG0 PRU0 GPIO10
	17	□	18	PRG0 PRU0 GPIO9
	19	□	20	GPIO8p PRU11_7Ts
	21	□	22	GPIO7p GPIO08s
GPIO16p NC2s	23	□	24	GPIO6p GPIO19s
	25	□	26	GPIO5p NC0s
	27	□	28	GPIO4s NC1s
HSE GPIO0_42	29	□	30	GPIO3p GPIO16s
PRG0 PRU0 GPIO18	31	□	32	PRG0 PRU0 GPIO17
HSE GPIO0_35	33	□	34	GPIO15p GPIO15s
	35	□	36	GPIO19p GPIO14s
HSE GPIO0_29	37	□	38	GPIO2p GPIO08s
HSE GPIO0_24	39	□	40	PRG0 PRU0 GPIO1
HSE GPIO0_44	41	□	42	GPIO0p GPIO2s
PRU1_7p GPIO6s	43	□	44	PRU1_7p GPIO3s
PRU1_9p GPIO7s	45	□	46	PRU1_12p GPIO4s
	47	□	48	PRU1_10p GPIO5s
HSE GPIO0_32	49	□	50	EVM_DVDD
HSE GPIO0_34	51	□	52	PRG0 PRU1 GPIO14
HSE GPIO0_37	53	□	54	PRG0 PRU1 GPIO16
HSE GPIO0_39	55	□	56	SOC I2C0_SDA
HSE GPIO0_41	57	□	58	SOC I2C0_SCL
EVM_ID_FWR	59	□	60	DGND
DGND	MP1	MP1		
DGND	MP2	MP2		
DGND	MP3	MP3		
DGND	MP4	MP4		

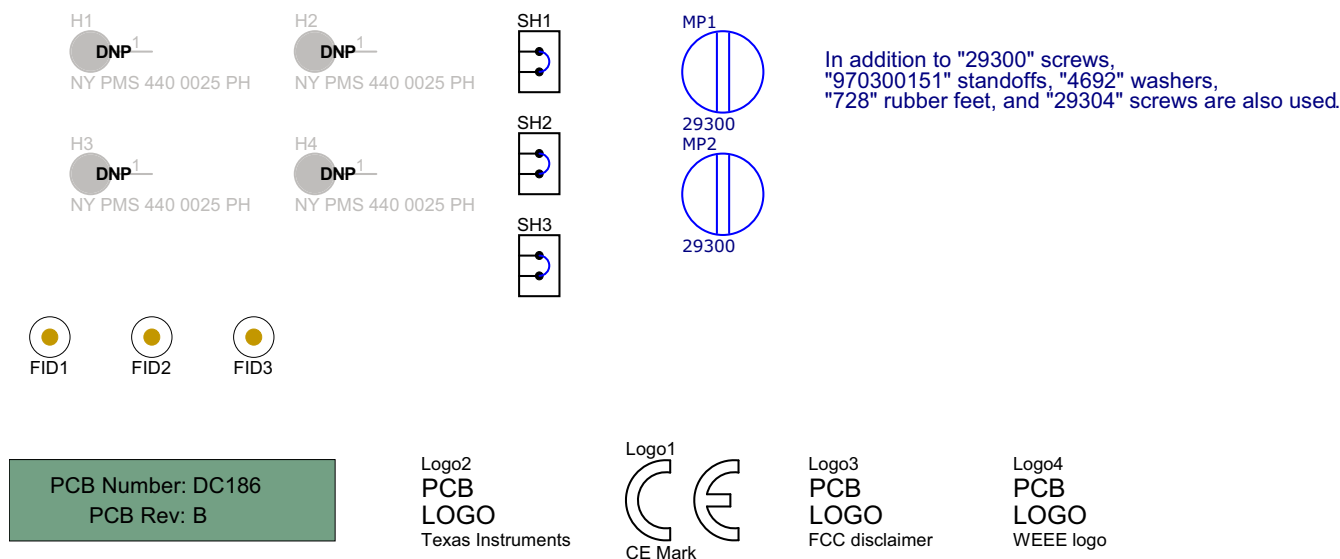
J8A



QSH-030-01-L-D-A										J8A				J8B				J8C				J8D				J8E																	
SEAM-30-XX-X-XX-05-X-A										SEAM-30-XX-X-XX-05-X-A				SEAM-30-XX-X-XX-05-X-A				SEAM-30-XX-X-XX-05-X-A				SEAM-30-XX-X-XX-05-X-A																					
VIN 5V0	A1	A1								B1	B1									C1	C1							D1	D1							E1	E1						
VIN 5V0	A2	A2								B2	B2									C2	C2							D2	D2							E2	E2						
VIN 5V0	A3	A3								B3	B3									C3	C3							D3	D3							E3	E3						
	A4	A4								B4	B4									C4	C4							D4	D4							E4	E4						
	A5	A5								B5	B5									C5	C5							D5	D5							E5	E5						
PRG0 PRU0 GPIO8	A6	A6								B6	B6									C6	C6							D6	D6							E6	E6						
PRG0 PRU0 GPIO2	A7	A7								B7	B7									C7	C7							D7	D7							E7	E7						
PRG0 PRU0 GPIO3	A8	A8								B8	B8									C8	C8							D8	D8							E8	E8						
	A9	A9								B9	B9									C9	C9							D9	D9							E9	E9						
	A10	A10								B10	B10									C10	C10							D10	D10							E10	E10						
PRG0 PRU1 GPIO1	A11	A11								B11	B11									C11	C11							D11	D11							E11	E11						
PRG0 PRU1 GPIO2	A12	A12								B12	B12									C12	C12							D12	D12							E12	E12						
PRG0 PRU0 GPIO4	A13	A13								B13	B13									C13	C13							D13	D13							E13	E13						
PRG0 PRU0 GPIO12	A14	A14								B14	B14									C14	C14							D14	D14							E14	E14						
PRG0 PRU1 GPIO16	A15	A15								B15	B15									C15	C15							D15	D15							E15	E15						
	A16	A16								B16	B16									C16	C16							D16	D16							E16	E16						
	A17	A17								B17	B17									C17	C17							D17	D17							E17	E17						
HSE GPIO0 30	A18	A18								B18	B18									C18	C18							D18	D18</														

Figure 4-3. ADC-PHI-PRU-EVM Connectors Schematic Page

Standoff hardware



Variant/Label Table	
Variant	Label Text
001	MPU/PADC adapter card

ZZ1

Assembly Note

These assemblies must comply with workmanship standards IPC-A-610 Class 2, unless otherwise specified.

ZZ2

Assembly Note

These assemblies are ESD sensitive, ESD precautions shall be observed.

ZZ3

Assembly Note

These assemblies must be clean and free from flux and all contaminants. Use of no clean flux is not acceptable.

ZZ4

Label Assembly Note

This Assembly Note is for PCB labels only

Figure 4-4. ADC-PHI-PRU-EVM Hardware Schematic Page

4.2 ADC-PHI-PRU-EVM Layout

Figure 4-5 to Figure 4-8 illustrate the layout for the ADC-PHI-PRU-EVM.

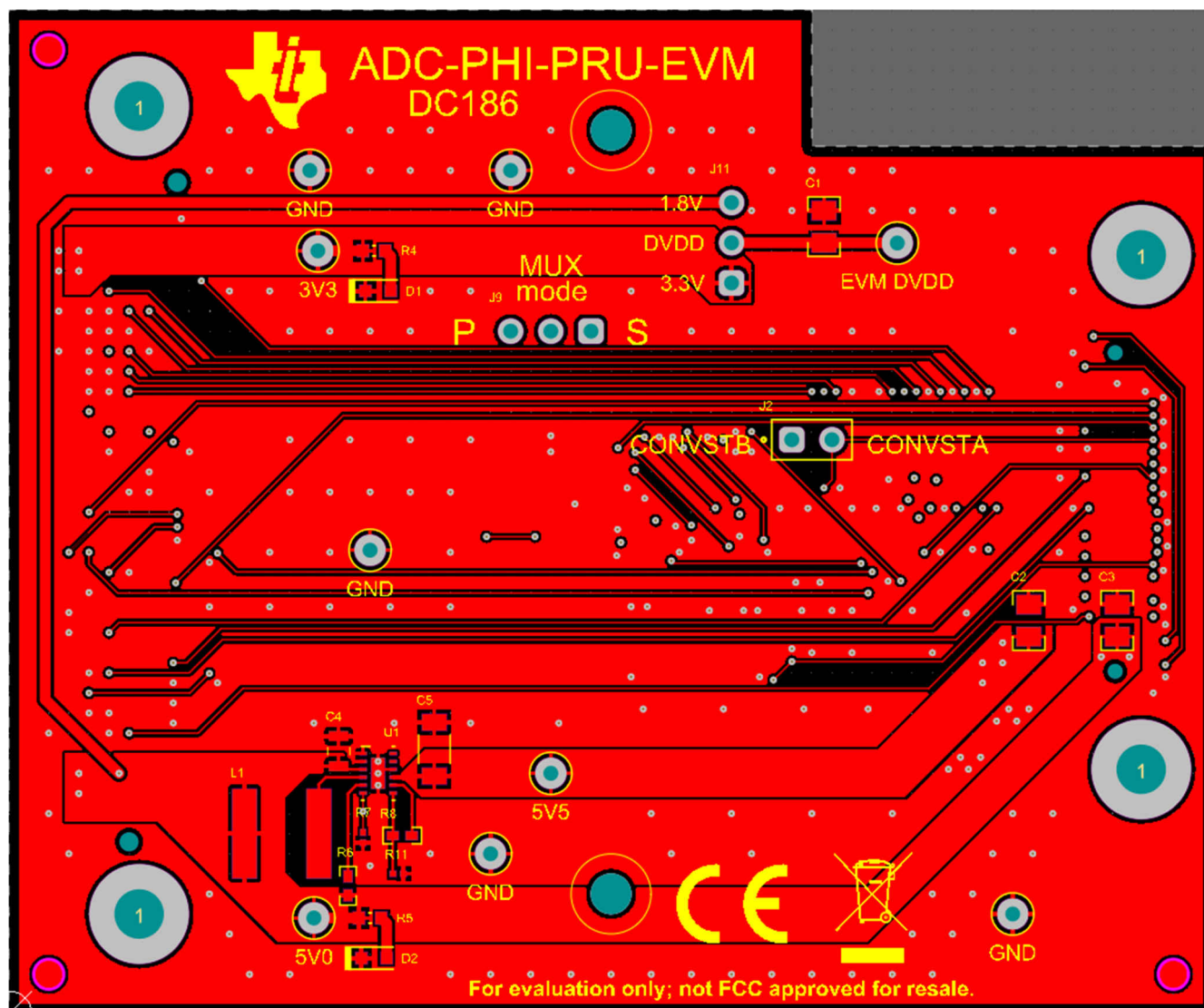


Figure 4-5. ADC-PHI-PRU-EVM Layout Layer 1

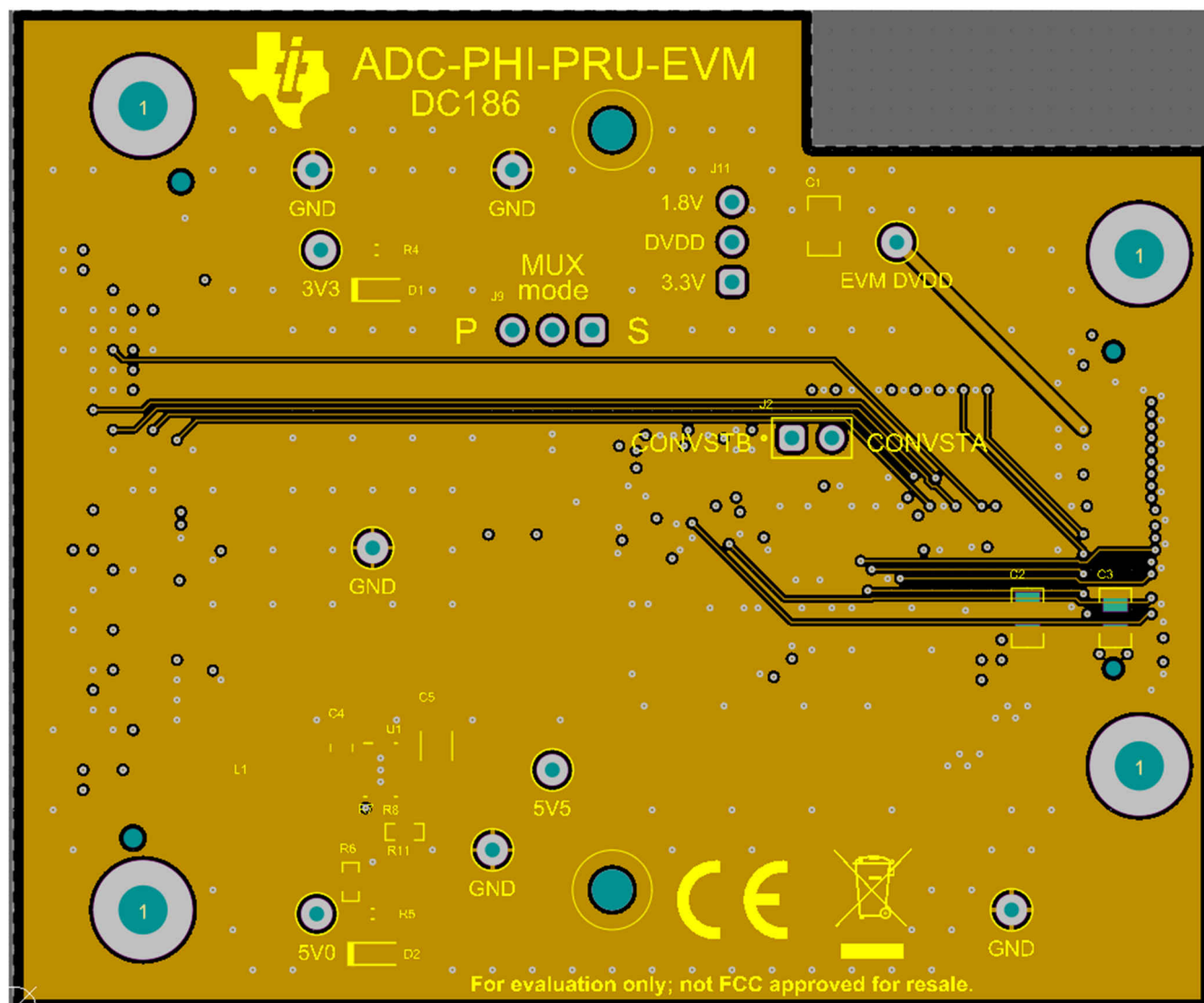


Figure 4-6. ADC-PHI-PRU-EVM Layout Layer 2



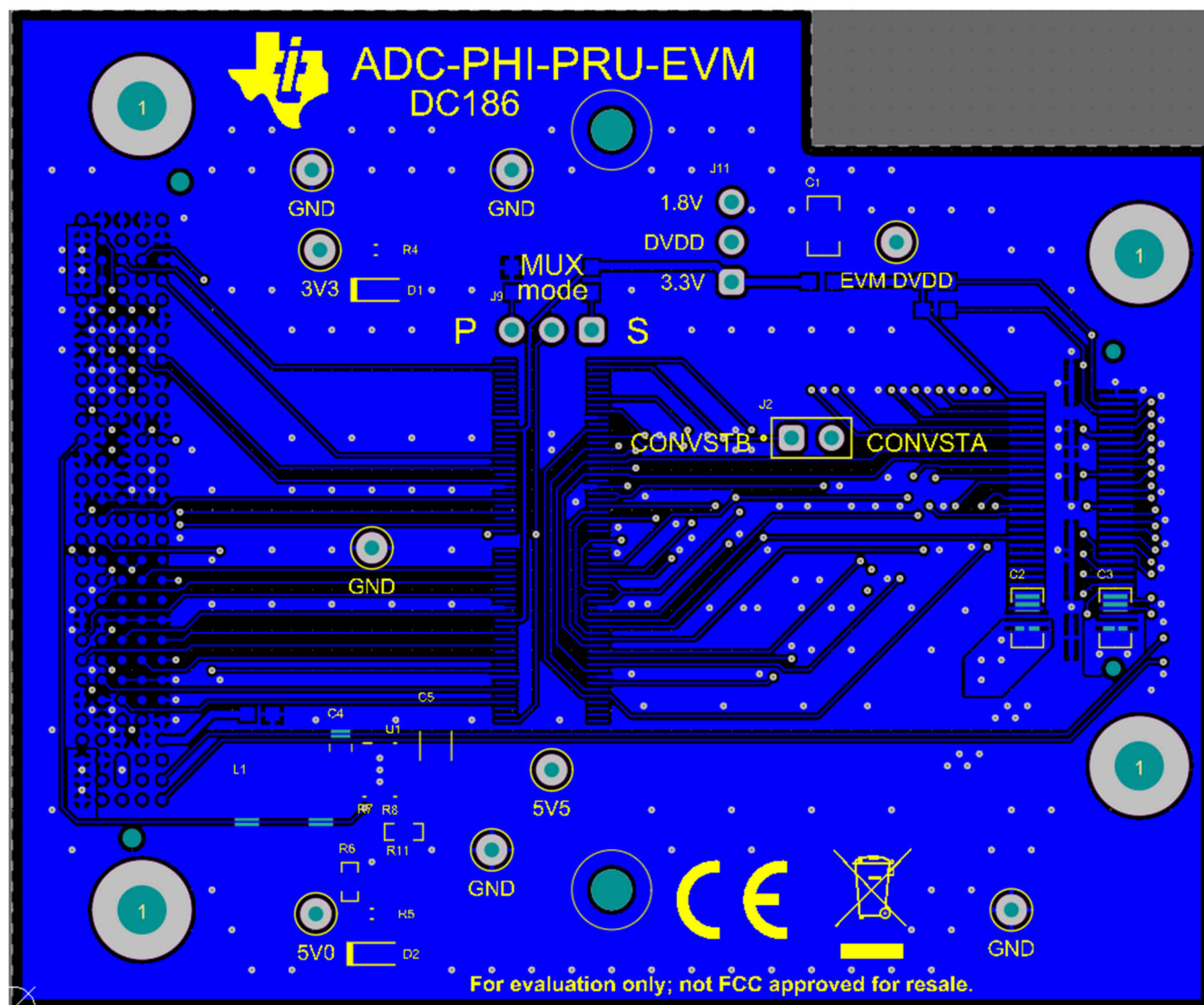


Figure 4-8. ADC-PHI-PRU-EVM Layout Layer 4

4.3 Bill of Materials

Table 4-1 lists the bill of materials (BOM).

Table 4-1. Bill of Materials

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer
!PCB1	1		Printed Circuit Board		DC186	Any
C1, C2, C3	3	1 μ F	CAP, CERM, 1 μ F, 10 V, \pm 10%, X7R, 0805	0805	LMK212B7105KD-T	Taiyo Yuden
C4	1	4.7 μ F	Chip Multilayer Ceramic Capacitors for General Purpose, 0805, 4.7 μ F, X7R, 15%, 10%, 10 V	0805	GRM21BR71A475KE51L	Murata
C5	1	10 μ F	CAP, CERM, 10 μ F, 25 V, \pm 10%, X7R, AEC-Q200 Grade 1, 1206	1206	CGA5L1X7R1E106K160AE	TDK
D1, D2	2	Green	LED, Green, SMD	LED_0603	150060GS75000	Würth Elektronik
FID1, FID2, FID3	3		Fiducial mark. There is nothing to buy or mount.	N/A	N/A	N/A
J1	1		Receptacle, 0.5 mm, 30 x 2, Gold, TH	Receptacle, 0.5 mm, 30 x 2, TH	QSH-030-01-L-D-A	Samtec
J2	1		Header, 100 mil, 2 x 1, Gold, TH	2 x 1 Header	TSW-102-07-G-S	Samtec
J8	1		Terminal Array Assembly, Surface Mount, 0.050" Pitch, 150 Pins			SAMTEC
J9, J11	2		Header, 100 mil, 3 x 1, Gold, TH	3 x 1 Header	TSW-103-07-G-S	Samtec
L1	1	2.7 μ H	Inductor, Shielded, Ferrite, 2.7 μ H, 4.6 A, 0.018 Ω , SMD	6 x 6 mm	1255AY-2R7N=P3	MuRata
MP1, MP2	2		M2.5 x 0.45 Pan Head Machine Screw Slotted Drive Steel	SCREW_M2.5	29300	Keystone Electronics
R1, R2, R4, R5	4	1.50 k Ω	RES, 1.50 k Ω , 1%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW06031K50FKEA	Vishay-Dale
R3	1	0 Ω	RES, 0, 5%, 0.1 W, 0603	0603	MCR03EZPJ000	Rohm
R6	1	2.00 k Ω	RES, 2.00 k Ω , 1%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW04022K00FKED	Vishay-Dale
R7, R11	2	10.0 k Ω	RES, 10.0 k Ω , 1%, 0.05 W, 0201	0201	RC0201FR-0710KL	Yageo America
R8	1	45.3 k Ω	RES, 45.3 k Ω , 1%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW040245K3FKED	Vishay-Dale
R12	1	0 Ω	RES, 0, 5%, 0.1 W, 0603	0603	CRCW06030000Z0EA	Vishay-Dale
R13, R14	2	100 k Ω	RES, 100 k Ω , 1%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW0603100KFKEA	Vishay-Dale
SH1, SH2, SH3	3	1 x 2	Shunt, 100 mil, Gold Plated, Black	Shunt	SNT-100-BK-G	Samtec
TP1, TP2, TP3, TP4	4		Test Point, Miniature, Red, TH	Red Miniature Testpoint	5000	Keystone
TP5, TP6, TP7, TP8, TP9	5		Test Point, Miniature, Black, TH	Black Miniature Testpoint	5001	Keystone
U1	1		28-V Output Voltage Boost Converter with Ultra-Low Quiescent Current, DSS0012A (WSON-12)	DSS0012A	TPS61096ADSSR	Texas Instruments
U2, U3	2		Multiplexer / Demultiplexer Bus Switch 1-Element CMOS 24-IN 56-Pin TVSOP T/R	TVSOP56	SN74CBTLV16292VR	Texas Instruments
H1, H2, H3, H4	0		Machine Screw, Round, #4-40 x 1/4, Nylon, Philips Pan Head	Screw	NY PMS 440 0025 PH	B&F Fastener Supply

STANDARD TERMS FOR EVALUATION MODULES

1. *Delivery:* TI delivers TI evaluation boards, kits, or modules, including any accompanying demonstration software, components, and/or documentation which may be provided together or separately (collectively, an "EVM" or "EVMs") to the User ("User") in accordance with the terms set forth herein. User's acceptance of the EVM is expressly subject to the following terms.
 - 1.1 EVMs are intended solely for product or software developers for use in a research and development setting to facilitate feasibility evaluation, experimentation, or scientific analysis of TI semiconductors products. EVMs have no direct function and are not finished products. EVMs shall not be directly or indirectly assembled as a part or subassembly in any finished product. For clarification, any software or software tools provided with the EVM ("Software") shall not be subject to the terms and conditions set forth herein but rather shall be subject to the applicable terms that accompany such Software
 - 1.2 EVMs are not intended for consumer or household use. EVMs may not be sold, sublicensed, leased, rented, loaned, assigned, or otherwise distributed for commercial purposes by Users, in whole or in part, or used in any finished product or production system.
2. *Limited Warranty and Related Remedies/Disclaimers:*
 - 2.1 These terms do not apply to Software. The warranty, if any, for Software is covered in the applicable Software License Agreement.
 - 2.2 TI warrants that the TI EVM will conform to TI's published specifications for ninety (90) days after the date TI delivers such EVM to User. Notwithstanding the foregoing, TI shall not be liable for a nonconforming EVM if (a) the nonconformity was caused by neglect, misuse or mistreatment by an entity other than TI, including improper installation or testing, or for any EVMs that have been altered or modified in any way by an entity other than TI, (b) the nonconformity resulted from User's design, specifications or instructions for such EVMs or improper system design, or (c) User has not paid on time. Testing and other quality control techniques are used to the extent TI deems necessary. TI does not test all parameters of each EVM. User's claims against TI under this Section 2 are void if User fails to notify TI of any apparent defects in the EVMs within ten (10) business days after delivery, or of any hidden defects with ten (10) business days after the defect has been detected.
 - 2.3 TI's sole liability shall be at its option to repair or replace EVMs that fail to conform to the warranty set forth above, or credit User's account for such EVM. TI's liability under this warranty shall be limited to EVMs that are returned during the warranty period to the address designated by TI and that are determined by TI not to conform to such warranty. If TI elects to repair or replace such EVM, TI shall have a reasonable time to repair such EVM or provide replacements. Repaired EVMs shall be warranted for the remainder of the original warranty period. Replaced EVMs shall be warranted for a new full ninety (90) day warranty period.

WARNING

Evaluation Kits are intended solely for use by technically qualified, professional electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems, and subsystems.

User shall operate the Evaluation Kit within TI's recommended guidelines and any applicable legal or environmental requirements as well as reasonable and customary safeguards. Failure to set up and/or operate the Evaluation Kit within TI's recommended guidelines may result in personal injury or death or property damage. Proper set up entails following TI's instructions for electrical ratings of interface circuits such as input, output and electrical loads.

NOTE:

EXPOSURE TO ELECTROSTATIC DISCHARGE (ESD) MAY CAUSE DEGRADATION OR FAILURE OF THE EVALUATION KIT; TI RECOMMENDS STORAGE OF THE EVALUATION KIT IN A PROTECTIVE ESD BAG.

3 Regulatory Notices:

3.1 United States

3.1.1 Notice applicable to EVMs not FCC-Approved:

FCC NOTICE: This kit is designed to allow product developers to evaluate electronic components, circuitry, or software associated with the kit to determine whether to incorporate such items in a finished product and software developers to write software applications for use with the end product. This kit is not a finished product and when assembled may not be resold or otherwise marketed unless all required FCC equipment authorizations are first obtained. Operation is subject to the condition that this product not cause harmful interference to licensed radio stations and that this product accept harmful interference. Unless the assembled kit is designed to operate under part 15, part 18 or part 95 of this chapter, the operator of the kit must operate under the authority of an FCC license holder or must secure an experimental authorization under part 5 of this chapter.

3.1.2 For EVMs annotated as FCC – FEDERAL COMMUNICATIONS COMMISSION Part 15 Compliant:

CAUTION

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

FCC Interference Statement for Class A EVM devices

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

FCC Interference Statement for Class B EVM devices

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- *Reorient or relocate the receiving antenna.*
- *Increase the separation between the equipment and receiver.*
- *Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.*
- *Consult the dealer or an experienced radio/TV technician for help.*

3.2 Canada

3.2.1 For EVMs issued with an Industry Canada Certificate of Conformance to RSS-210 or RSS-247

Concerning EVMs Including Radio Transmitters:

This device complies with Industry Canada license-exempt RSSs. Operation is subject to the following two conditions:

(1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Concernant les EVMs avec appareils radio:

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Concerning EVMs Including Detachable Antennas:

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication. This radio transmitter has been approved by Industry Canada to operate with the antenna types listed in the user guide with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Concernant les EVMs avec antennes détachables

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante. Le présent émetteur radio a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés dans le manuel d'usage et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

3.3 Japan

3.3.1 *Notice for EVMs delivered in Japan:* Please see http://www.tij.co.jp/lscs/ti_ja/general/eStore/notice_01.page 日本国内に輸入される評価用キット、ボードについては、次のところをご覧ください。
http://www.tij.co.jp/lscs/ti_ja/general/eStore/notice_01.page

3.3.2 *Notice for Users of EVMs Considered "Radio Frequency Products" in Japan:* EVMs entering Japan may not be certified by TI as conforming to Technical Regulations of Radio Law of Japan.

If User uses EVMs in Japan, not certified to Technical Regulations of Radio Law of Japan, User is required to follow the instructions set forth by Radio Law of Japan, which includes, but is not limited to, the instructions below with respect to EVMs (which for the avoidance of doubt are stated strictly for convenience and should be verified by User):

1. Use EVMs in a shielded room or any other test facility as defined in the notification #173 issued by Ministry of Internal Affairs and Communications on March 28, 2006, based on Sub-section 1.1 of Article 6 of the Ministry's Rule for Enforcement of Radio Law of Japan,
2. Use EVMs only after User obtains the license of Test Radio Station as provided in Radio Law of Japan with respect to EVMs, or
3. Use of EVMs only after User obtains the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to EVMs. Also, do not transfer EVMs, unless User gives the same notice above to the transferee. Please note that if User does not follow the instructions above, User will be subject to penalties of Radio Law of Japan.

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1. 電波法施行規則第6条第1項第1号に基づく平成18年3月28日総務省告示第173号で定められた電波暗室等の試験設備でご使用いただく。
2. 実験局の免許を取得後ご使用いただく。
3. 技術基準適合証明を取得後ご使用いただく。

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3.4 European Union

3.4.1 *For EVMs subject to EU Directive 2014/30/EU (Electromagnetic Compatibility Directive):*

This is a class A product intended for use in environments other than domestic environments that are connected to a low-voltage power-supply network that supplies buildings used for domestic purposes. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

4 *EVM Use Restrictions and Warnings:*

4.1 EVMS ARE NOT FOR USE IN FUNCTIONAL SAFETY AND/OR SAFETY CRITICAL EVALUATIONS, INCLUDING BUT NOT LIMITED TO EVALUATIONS OF LIFE SUPPORT APPLICATIONS.

4.2 User must read and apply the user guide and other available documentation provided by TI regarding the EVM prior to handling or using the EVM, including without limitation any warning or restriction notices. The notices contain important safety information related to, for example, temperatures and voltages.

4.3 *Safety-Related Warnings and Restrictions:*

4.3.1 User shall operate the EVM within TI's recommended specifications and environmental considerations stated in the user guide, other available documentation provided by TI, and any other applicable requirements and employ reasonable and customary safeguards. Exceeding the specified performance ratings and specifications (including but not limited to input and output voltage, current, power, and environmental ranges) for the EVM may cause personal injury or death, or property damage. If there are questions concerning performance ratings and specifications, User should contact a TI field representative prior to connecting interface electronics including input power and intended loads. Any loads applied outside of the specified output range may also result in unintended and/or inaccurate operation and/or possible permanent damage to the EVM and/or interface electronics. Please consult the EVM user 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, even with the inputs and outputs kept within the specified allowable ranges, some circuit components may have elevated case temperatures. These components include but are not limited to linear regulators, switching transistors, pass transistors, current sense resistors, and heat sinks, which can be identified using the information in the associated documentation. When working with the EVM, please be aware that the EVM may become very warm.

4.3.2 EVMs are intended solely for use by technically qualified, professional electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems, and subsystems. User assumes all responsibility and liability for proper and safe handling and use of the EVM by User or its employees, affiliates, contractors or designees. User assumes all responsibility and liability to ensure that any interfaces (electronic and/or mechanical) between the EVM and any human body are designed with suitable isolation and means to safely limit accessible leakage currents to minimize the risk of electrical shock hazard. User assumes all responsibility and liability for any improper or unsafe handling or use of the EVM by User or its employees, affiliates, contractors or designees.

4.4 User assumes all responsibility and liability to determine whether the EVM is subject to any applicable international, federal, state, or local laws and regulations related to User's handling and use of the EVM and, if applicable, User assumes all responsibility and liability for compliance in all respects with such laws and regulations. User assumes all responsibility and liability for proper disposal and recycling of the EVM consistent with all applicable international, federal, state, and local requirements.

5. *Accuracy of Information:* To the extent TI provides information on the availability and function of EVMs, TI attempts to be as accurate as possible. However, TI does not warrant the accuracy of EVM descriptions, EVM availability or other information on its websites as accurate, complete, reliable, current, or error-free.

6. *Disclaimers:*

6.1 EXCEPT AS SET FORTH ABOVE, EVMS AND ANY MATERIALS PROVIDED WITH THE EVM (INCLUDING, BUT NOT LIMITED TO, REFERENCE DESIGNS AND THE DESIGN OF THE EVM ITSELF) ARE PROVIDED "AS IS" AND "WITH ALL FAULTS." TI DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, REGARDING SUCH ITEMS, INCLUDING BUT NOT LIMITED TO ANY EPIDEMIC FAILURE WARRANTY OR IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF ANY THIRD PARTY PATENTS, COPYRIGHTS, TRADE SECRETS OR OTHER INTELLECTUAL PROPERTY RIGHTS.

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8. *Limitations on Damages and Liability:*

8.1 *General Limitations.* IN NO EVENT SHALL TI BE LIABLE FOR ANY SPECIAL, COLLATERAL, INDIRECT, PUNITIVE, INCIDENTAL, CONSEQUENTIAL, OR EXEMPLARY DAMAGES IN CONNECTION WITH OR ARISING OUT OF THESE TERMS OR THE USE OF THE EVMS , REGARDLESS OF WHETHER TI HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. EXCLUDED DAMAGES INCLUDE, BUT ARE NOT LIMITED TO, COST OF REMOVAL OR REINSTALLATION, ANCILLARY COSTS TO THE PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES, RETESTING, OUTSIDE COMPUTER TIME, LABOR COSTS, LOSS OF GOODWILL, LOSS OF PROFITS, LOSS OF SAVINGS, LOSS OF USE, LOSS OF DATA, OR BUSINESS INTERRUPTION. NO CLAIM, SUIT OR ACTION SHALL BE BROUGHT AGAINST TI MORE THAN TWELVE (12) MONTHS AFTER THE EVENT THAT GAVE RISE TO THE CAUSE OF ACTION HAS OCCURRED.

8.2 *Specific Limitations.* IN NO EVENT SHALL TI'S AGGREGATE LIABILITY FROM ANY USE OF AN EVM PROVIDED HEREUNDER, INCLUDING FROM ANY WARRANTY, INDEMNITY OR OTHER OBLIGATION ARISING OUT OF OR IN CONNECTION WITH THESE TERMS, , EXCEED THE TOTAL AMOUNT PAID TO TI BY USER FOR THE PARTICULAR EVM(S) AT ISSUE DURING THE PRIOR TWELVE (12) MONTHS WITH RESPECT TO WHICH LOSSES OR DAMAGES ARE CLAIMED. THE EXISTENCE OF MORE THAN ONE CLAIM SHALL NOT ENLARGE OR EXTEND THIS LIMIT.

9. *Return Policy.* Except as otherwise provided, TI does not offer any refunds, returns, or exchanges. Furthermore, no return of EVM(s) will be accepted if the package has been opened and no return of the EVM(s) will be accepted if they are damaged or otherwise not in a resalable condition. If User feels it has been incorrectly charged for the EVM(s) it ordered or that delivery violates the applicable order, User should contact TI. All refunds will be made in full within thirty (30) working days from the return of the components(s), excluding any postage or packaging costs.

10. *Governing Law:* These terms and conditions shall be governed by and interpreted in accordance with the laws of the State of Texas, without reference to conflict-of-laws principles. User agrees that non-exclusive jurisdiction for any dispute arising out of or relating to these terms and conditions lies within courts located in the State of Texas and consents to venue in Dallas County, Texas. Notwithstanding the foregoing, any judgment may be enforced in any United States or foreign court, and TI may seek injunctive relief in any United States or foreign court.

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