

EVM User's Guide: HSEC180ADAPEVM

HSEC Adapter Board



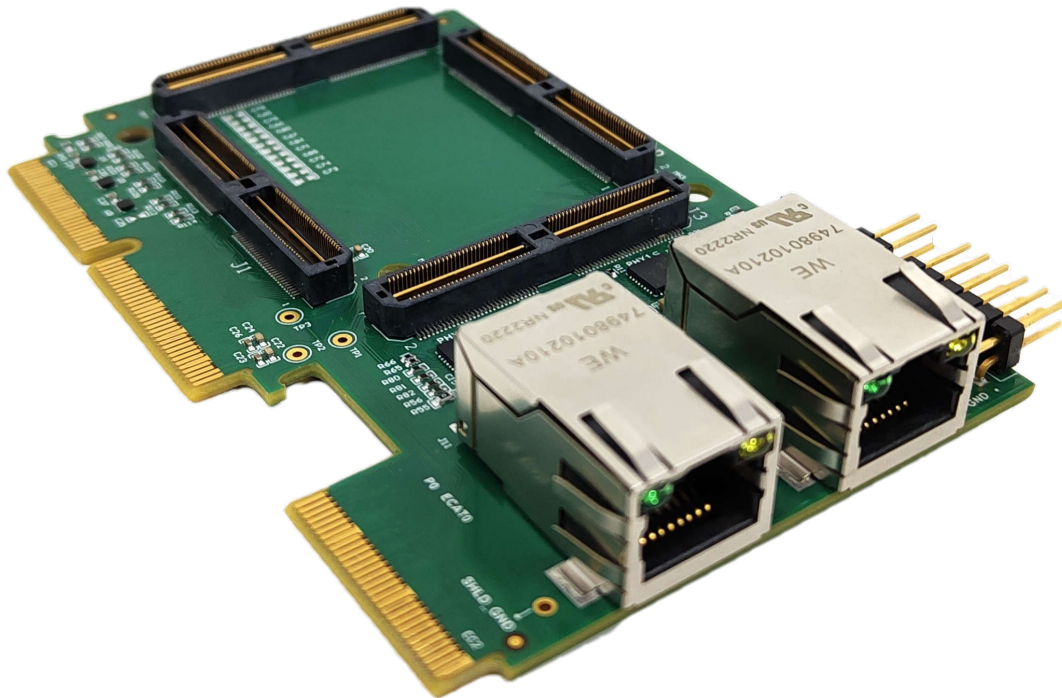
Description

This evaluation module is a 180-pin High Speed Edge Card (HSEC) adapter for TI C2000 System-On-Module (SOM) platforms, allowing for SOM-based platforms to have backwards compatibility with C2000 HSEC-based EVMs. The HSEC180ADAPEVM connects 180 pins from the SOM board to HSEC pins for use with legacy C2000 HSEC Docking Stations, such as the TMDSHSECDOCK. The HSEC180ADAPEVM also features two DP83826 10/100-Mbps Industrial Ethernet PHYs for evaluating

EtherCAT® functionality on C2000 Microcontroller SOM platforms.

Features

- Standard 180-pin HSEC interface
- Compatibility with XDS110ISO-EVM for emulation
- 2x DP83826 10/100-Mbps Industrial Ethernet PHY with 2x RJ-45 Ethernet jacks
- Fast Serial Interface (FSI) header
- ADC filtering and ESD protection for dedicated Analog HSEC pins



1 Evaluation Module Overview

1.1 Introduction

This technical user's guide describes the hardware architecture of the HSEC Adapter Board, an adapter board for the SOM module built around the F28P65x MCU. The HSEC Adapter allows the user to interface with EtherCAT, FSI, JTAG, and other interfaces. This 180-pin Edge connector is intended to provide a well-filtered, robust design capable of working in most environments. The HSEC board is used with a docking station for powering up the SOM board. The XDS110 adapter board also can be interfaced with the SOM board with the help of the HSEC board. The HSEC Adapter Board has two RJ45 connectors for interfacing of EtherCAT, FSI header, and Emulation and DAC connector. The embedded emulation logic allows for emulation and debugging using standard development tools such as Code Composer Studio™ from TI.

Note

This evaluation board is a preproduction release and has several known issues that must not be copied into a production system.

1.2 Kit Contents

The following items are included in the HSEC180ADAPEVM kit:

- HSEC180ADAPEVM PCB
- Quick Start Guide

2 Hardware

2.1 System Description

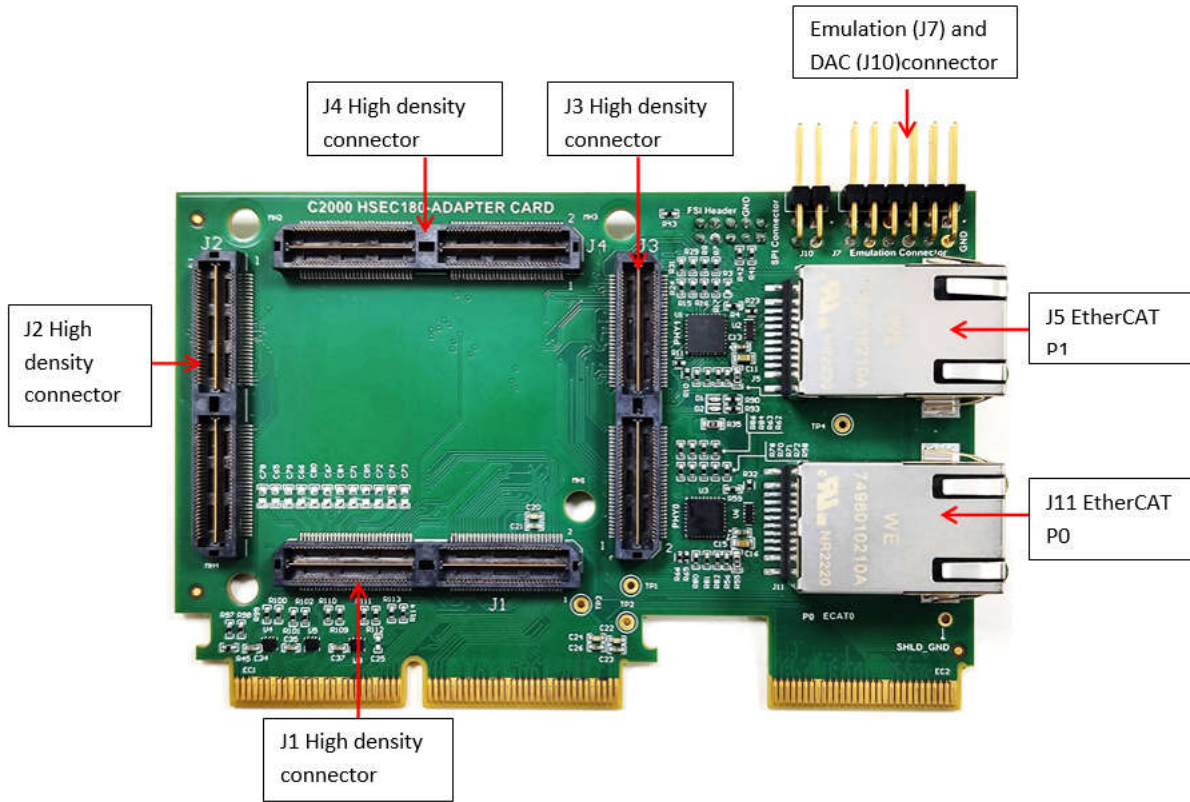


Figure 2-1. PCBA Top Side

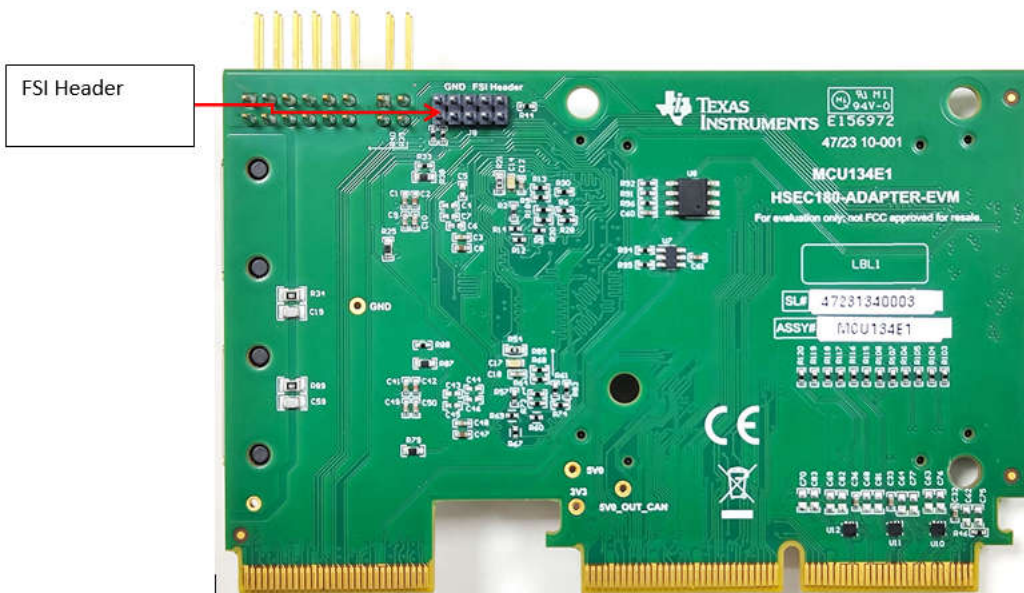


Figure 2-2. PCBA Bottom Side

2.1.1 Key Features

The HSEC Adapter board is a development platform that enables users to evaluate and develop industrial applications for Texas Instrument's C2000 F28P65x SOM board.

The following sections discuss the adapter board's key features.

2.1.1.1 Power Supply

HSEC adapter board utilizes the power from the SOM board provided by the PMIC to supply the EtherCAT PHYs and EEPROM and other components on the board.

The figure below shows the distribution of power to various.

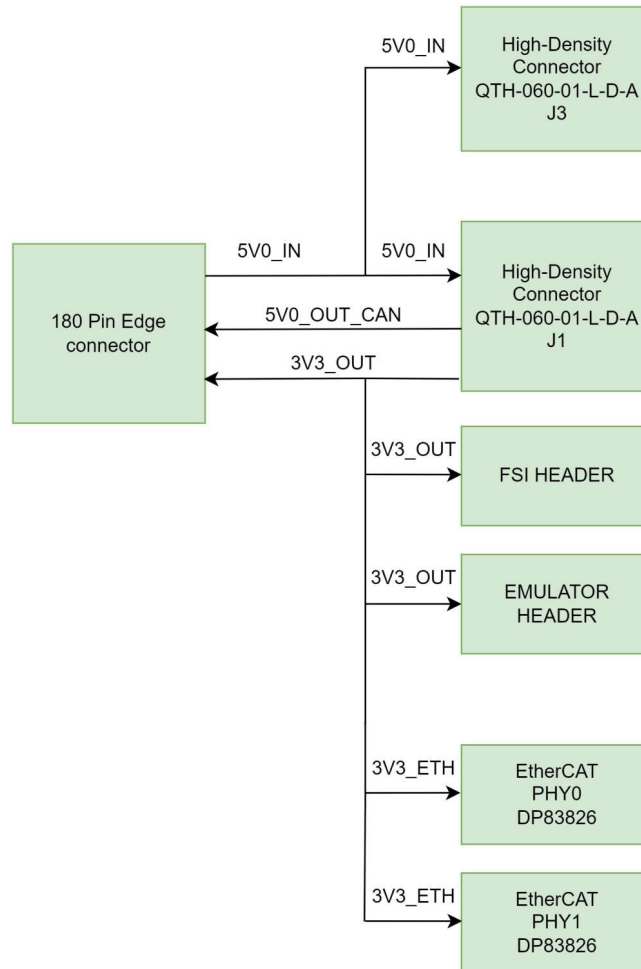


Figure 2-3. Power Tree

The following sections describe the power distribution network topology that supplies the HSEC board, supporting components, and reference voltages.

The HSEC adapter board is the input 5V source for the SOM board which is provided by the docking station. The 5V is then transferred as input to the SOM through a high-density connector, which utilizes this input to generate the powers that go to the HSEC board through a high-density connector. The HSEC adapter board gets 3V3 input from the PMIC and this is the input for the EtherCAT PHY's and EEPROM.

2.1.1.2 Memory

- 16KB Inter-Integrated Circuit (I2C) EEPROM

2.1.1.3 JTAG Emulator

- Supports 12-pin JTAG connection from external emulator.

2.1.1.4 Supported Interfaces and Peripherals

- 2x EtherCAT ports supporting 10/100 Mbps data rate on two connectors (RJ45).

2.1.1.5 Expansion Connectors/Headers to Support Application-specific Add-On Boards

- FSI header for FSI interface.
- DAC connector for interfacing DAC on XDS110 board.
- 4x High-density connector for interfacing with the SOM board.
- A 180-pin edge connector is used to connect the board with the docking station which gives the power to the system.

2.1.1.6 ADC

- ADC Clamping – ADC inputs are clamped by protection diodes.
- Anti-Aliasing Filters – Noise filters (small RC filters) can be easily added on ADC input pins.

2.1.2 Important Usage Notes:

2.1.2.1 Electrostatic Discharge (ESD) Compliance

Components installed on the product are sensitive to Electrostatic Discharge (ESD). TI recommends this product be used in ESD controlled environment. This can include a temperature or humidity controlled environment to limit the buildup of ESD. TI also recommends to use ESD protection such as wrist straps and ESD mats when interfacing with the product.

2.1.2.2 IO Cable Length

The maximum length of all the IO cables must not exceed 3 meters.

2.1.3 Functional Block Diagram

The functional block diagram of the HSEC adapter Board is shown below.

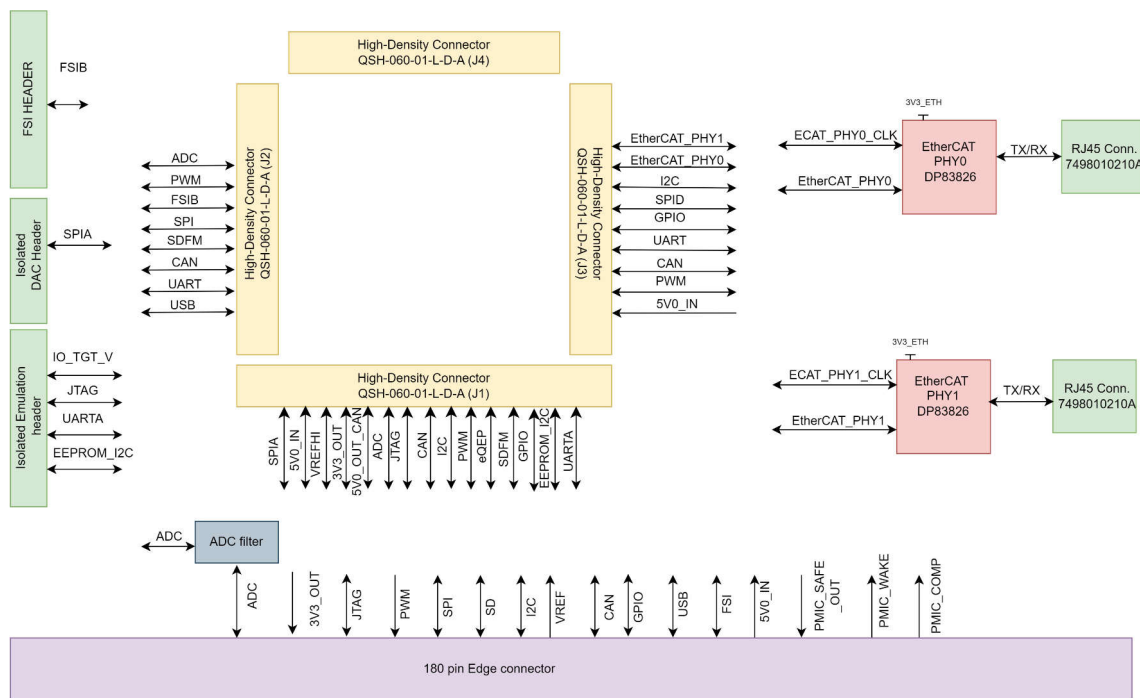


Figure 2-4. Block Diagram

2.1.4 Power ON/OFF Procedures

Power to the HSEC is provided through an external power supply to the docking station which is connected to the HSEC adapter board through finger edge pins.

2.1.4.1 Power-On Procedure

1. Connect the HSEC adapter board with the SOM board through High-density connectors J1, J2, J3, J4.
2. Connect the setup with SOM and HSEC with the docking station and attach the type C USB cable to the docking station.
3. Connect the other end of the Type-C cable to the source or Type-C source device (such as a Laptop computer).
4. Visually inspect that LED1 and LED2 are illuminated.
5. XDS110JTAG and DAC are routed to the emulation connector and DAC connector J7 and J10 respectively.

2.1.4.2 Power-Off Procedure

1. Disconnect the Type C Cable from the Laptop or Type C source.
2. Remove the USB Type-C cable from the SKEVM.

2.1.4.3 Power Test Points

Test points for each power input/output on the board are mentioned in [Table 2-1](#).

Table 2-1. Power Test Points

SI #	Power Supply	Test Point	Voltage
1	5V0_IN	TP1	5
2	3V3_OUT	TP2	3.3
3	5V0_OUT_CAN	TP3	5
4	IO_TGT_V	J7A.1	3.3
5	3V3_ETH	R35	3.3

2.1.5 Peripheral and Major Component Description

The following sections provide an overview of the different interfaces and circuits on the HSEC Adapter board.

2.1.5.1 Clocking

The Clock architecture of the HSEC Adapter board is shown below.

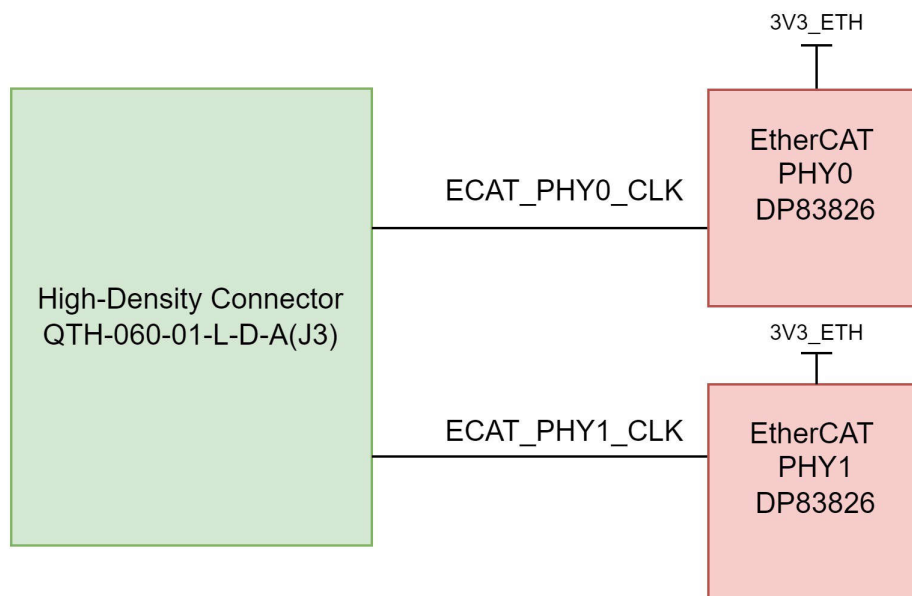


Figure 2-5. Clock Architecture

A clock generator of part number LMK1C1103PWR is used in SOM to drive the 25MHz clock to two EtherCATPHYs, and F28P65x MCU Clock. LMK1C1103PWR is a 1:3 LVCMOS clock buffer, which takes the 25MHz crystal/LVCMOS reference input and provides four 25MHz LVCMOS clock outputs. The clock signal for EtherCAT PHYs is routed from SOM to High-density connector.

2.1.5.2 EtherCAT Interface

The HSEC adapter board provides two EtherCAT interfaces for the SOM module which is going to connect with the High-density connector through the two RJ45 connectors with integrated magnetics. PHY DP83826 is configured as Enhanced mode which supports 10/100Mbps speed. Both the EtherCAT ports use a common MDIO Bus to communicate with the external PHY Transceiver.

Two Single port RJ45 Connectors Mfr Part# 7498010210A from Link-PP are used on the board for Ethernet 10/100 Connectivity. RJ45 Connectors have integrated magnetics and LEDs for indicating 100BASE-T link as well as receive or transmit activity.

Features of the DP83826:

- TX latency: 40ns, RX latency: 170ns
- Two selectable pin modes ENHANCED mode, BASIC mode
- Low power consumption of less than 160 mW
- Single, 3.3V power supply
- MAC interfaces: MII, RMII
- I/O voltages: 1.8V or 3.3V

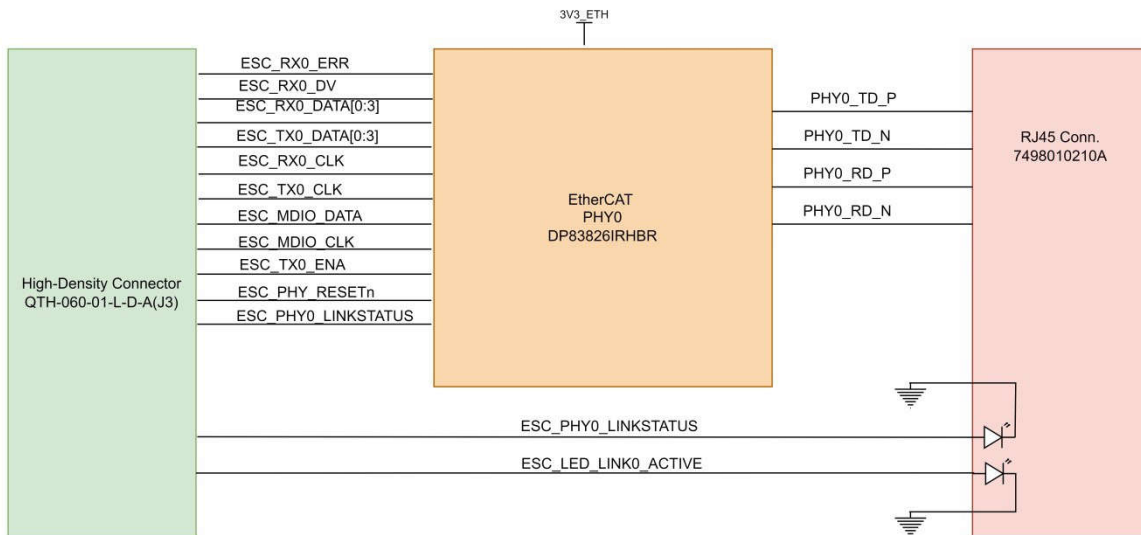


Figure 2-6. EtherCAT PHY0

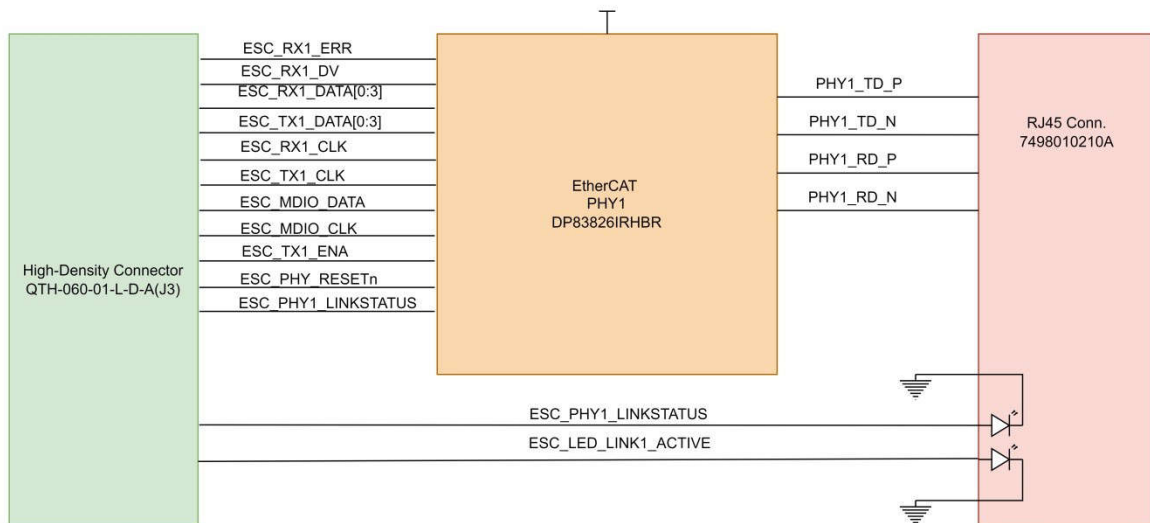


Figure 2-7. EtherCAT PHY1

2.1.5.2.1 DP83826 PHY Strapping Configuration

The DP83826 PHY uses two-level configurations based on resistor strapping which generate two distinct voltage ranges. The PHY Address strapping is provided for PHY0 to set address -000 and for the PHY1 to set address 001.

Table 2-2 shows the default values of the boot strap configurations.

Table 2-2. EtherCAT PHY Strap Value

Strap Setting	Pin Name	Strap Function	Value of Strap Function	Description
PHY address	LED0	PHY_ADD0	0/1	PHY0Address:000
	CRS/LED3	PHY_ADD1	0	PHY1 Address: 001
	COL/LED2	PHY_ADD2	0	
MAC Mode selection	RX_D2	MAC Mode selection	1	RMII MAC mode
RMII MAC Mode	TX_CLK	Controller/peripheral mode selection	0	RMII controller mode
	RX_D3	RMII_CRS_DV/ RMII_RX_DV	0	RMII_CRS_DV
Auto negotiation	RX_D1	auto MDIX enable/ disable	0	auto MDIX enable
	RX_D0	auto-negotiation enable/disable	0	auto-negotiation enable
	RX_DV	MDIX/MDI	0	MDIX
CLKOUT/LED1	RX_ER	CLKOUT 25MHz on Pin 31 LED1 on Pin 31	1	LED1 on Pin 31
Odd Nibble Detection	CLKOUT/LED1	Odd Nibble Detection disabled/enabled	0	Odd Nibble Detection disabled

2.1.5.3 Power

2.1.5.3.1 Power Requirement

HSEC Adapter board is powered through the 180-pin edge connector. For powering of the HSEC Adapter board, plug with the docking station and mount the SOM module. The HSEC adapter board transfers the input 5V0 voltage from the docking station to the SOM board. The SOM board has the PMIC, which provides the various powers required for the HSEC board and SOM board.

2.1.5.3.2 Power Input

The HSEC adapter board is the intermediate board to transfer the input 5V0 voltage to the SOM from docking station. The input source for the HSEC is from the 180-pin edge connector. The SOM board provides the 3V3 voltages which required for the various peripherals in the HSEC board.

Figure 2-8 shows the power architecture of the HSEC adapter board.

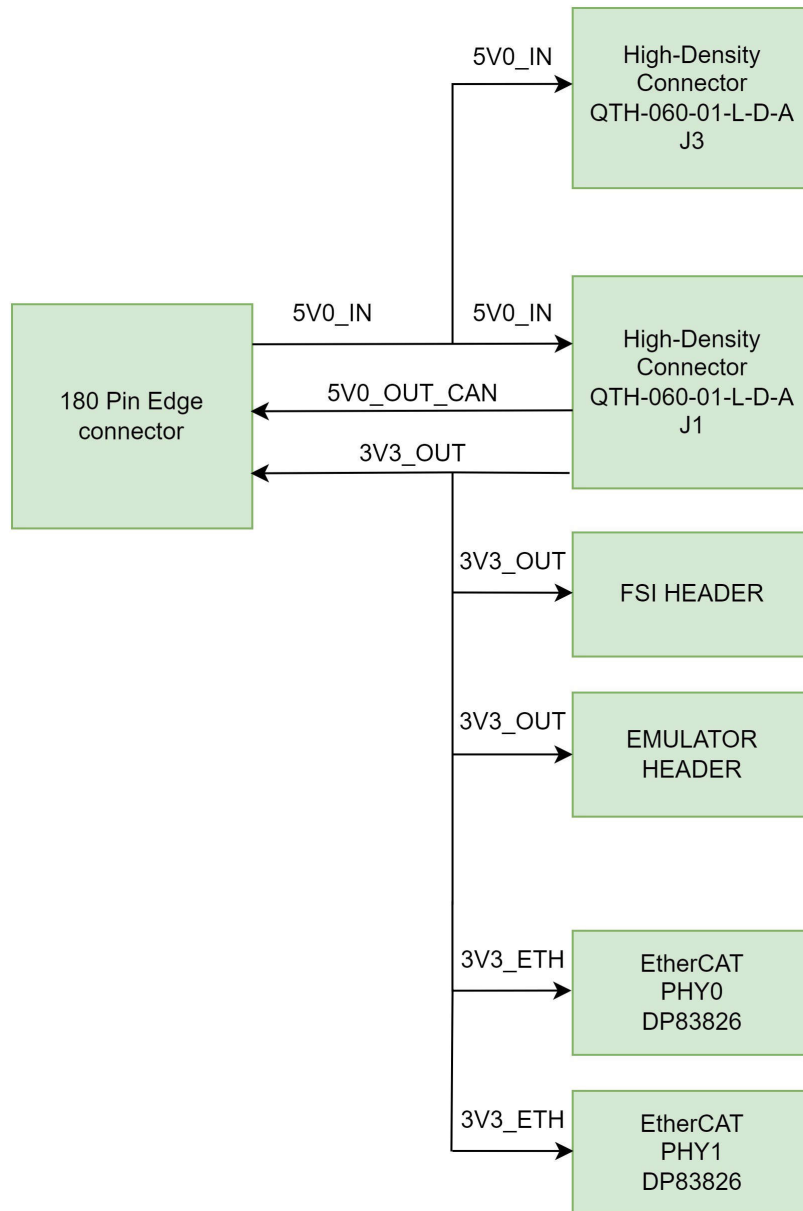


Figure 2-8. Power Architecture

2.1.5.4 Emulator Connector (TSW-106-16-G-D) and DAC Connector (TSW-102-16-G-D)

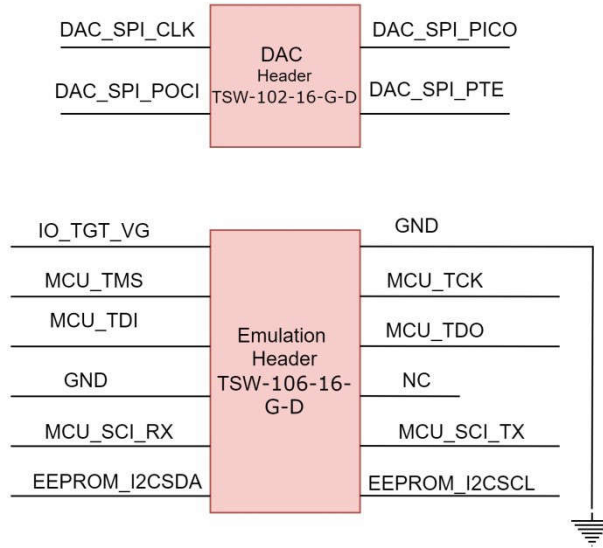


Figure 2-9. Isolated Signal from XDS110 Board Mating Connector

Find [Table 2-3](#) and [Table 2-4](#) for the connector pins details with the interfaced signal names.

Table 2-3. 4 Pin DAC Connector

Pin No	Signal	Pin No	Signal
1	DAC_SPI_CLK	2	DAC_SPI_PICO
3	DAC_SPI_POCI	4	DAC_SPI_PTE

Table 2-4. 12 Pin Emulator Connector

Pin No	Signal	Pin No	Signal
1	IO_TGT_V	2	GND
3	MCU_TMS	4	MCU_TCK
5	MCU_TDI	6	MCU_TDO
7	GND	8	NC
9	MCU_SCI_RX	10	MCU_SCI_TX
11	EEPROM_I2CSDA	12	EEPROM_I2CSCL

2.1.5.4.1 TSW-106-16-G-D

The TSW-106-16-G-D is a Mating part for SSW-106-02-G-D-RA connector on the isolated section of XDS110 boards. The connector supports I2C, UART and JTAG Interfaces.

2.1.5.4.2 TSW-102-16-G-D

The TSW-102-16-G-D is a mating part for SSW-102-02-G-D-RA connector on the isolated section of XDS110 boards. The connector supports SPI signals.

2.1.5.5 FSI Header

Figure 2-10 shows the FSI header connection to the High-density connector.

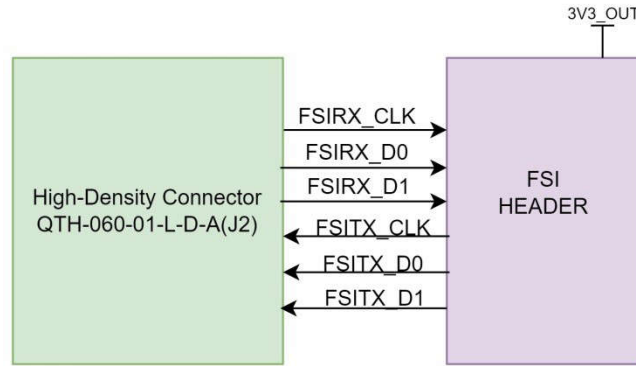


Figure 2-10. FSI Header

2.1.5.6 High Density Connector

There are four High density connectors in the HSEC Adapter Board which are referenced as J1, J2, J3 and J4.

J1 Connector

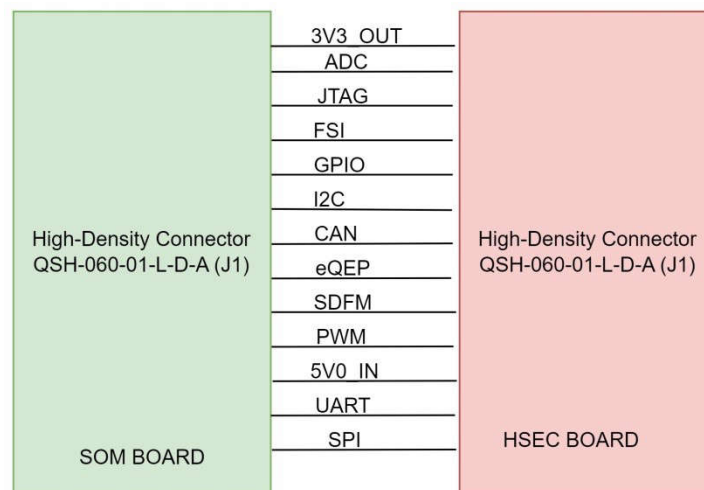


Figure 2-11. J1 Connector

J1 connector supports the ADC (Analog to Digital Converter), FSI (Fast serial interface), eQEP (Enhanced quadrature encoder plus), SDFM (Sigma Delta Filter Module), I2C, JTAG, CAN, PWM, SPI, UART, and GPIO signals. Also, the HSEC Adapter board get the 3V3 supply from the J1 connector.

J2 Connector

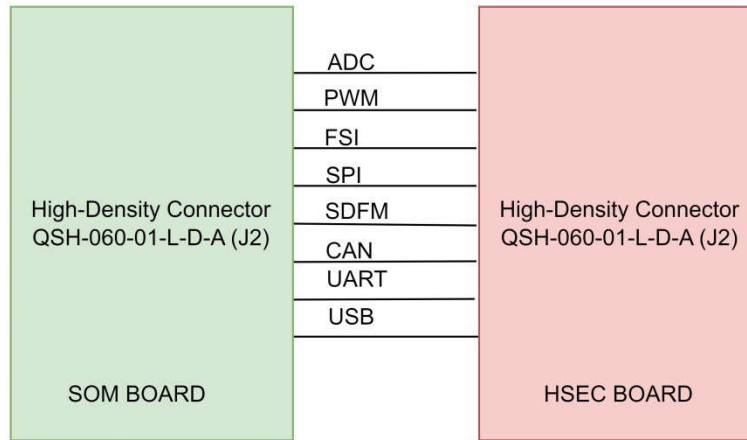


Figure 2-12. J2 Connector

J2 connector supports the ADC (Analog to digital converter), FSI (Fast serial interface), SDFM (Sigma Delta Filter), PWM, SPI, CAN, UART, and USB signals.

J3 Connector

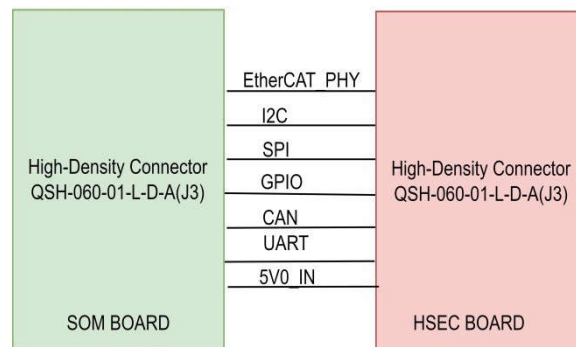


Figure 2-13. J3 Connector

J3 connector supports the SPI, CAN, I2C, GPIO, UART and EtherCAT PHY. Also, HSEC module gets the power from the J3 connector.

2.1.5.6.1 180-pin HSEC Edge Connector

The 180-pin HSEC edge connector provides the power to the SOM, which is going to connect with the HSEC through a high-density connector. For powering and validating various interfaces the 180-pin edge connector is mated with the docking station (TMDSHSECDOCK). The interfaces like SPI, I2C, UART, FSI, JTAG, ADC can be validated through the docking station pins.

Refer to the image below for the connector pins details with the interfaced signal names.

DATE:	HSEC Adapter Pinout:				SomToHSEC				HSEC Pin out
02/26/2023	HSEC pin	MCU User For Ref	MCU User For Ref	HSEC (CASO standard)	HSEC (CASO standard)	MCU User For Ref	MCU User For Ref	HSEC pin	
Analog	1	J1.24	JTAG-TMS (a,b,i)	JTAG-TMS	JTAG-TMS	JTAG-TMS (a,b,i)	JTAG-TMS	4	
	2	J1.25	JTAG-TCK (a,b,i)	JTAG-TCK	JTAG-TCK	JTAG-TCK (a,b,i)	JTAG-TCK	5	
	3	J1.26	JTAG-TDI (a,b,i)	JTAG-TDI	JTAG-TDI	JTAG-TDI (a,b,i)	JTAG-TDI	6	
	4	J1.27	JTAG-TDO (a,b,i)	JTAG-TDO	JTAG-TDO	JTAG-TDO (a,b,i)	JTAG-TDO	7	
	5	J1.28	JTAG-TDI (a,b,i)	JTAG-TDI	JTAG-TDI	JTAG-TDI (a,b,i)	JTAG-TDI	8	
	6	J1.29	JTAG-TDO (a,b,i)	JTAG-TDO	JTAG-TDO	JTAG-TDO (a,b,i)	JTAG-TDO	9	
	7	J1.30	JTAG-TDI (a,b,i)	JTAG-TDI	JTAG-TDI	JTAG-TDI (a,b,i)	JTAG-TDI	10	
	8	J1.31	JTAG-TDO (a,b,i)	JTAG-TDO	JTAG-TDO	JTAG-TDO (a,b,i)	JTAG-TDO	11	
	9	J1.32	JTAG-TDI (a,b,i)	JTAG-TDI	JTAG-TDI	JTAG-TDI (a,b,i)	JTAG-TDI	12	
	10	J1.33	JTAG-TDO (a,b,i)	JTAG-TDO	JTAG-TDO	JTAG-TDO (a,b,i)	JTAG-TDO	13	
Analog	11	J1.34	JTAG-TDI (a,b,i)	JTAG-TDI	JTAG-TDI	JTAG-TDI (a,b,i)	JTAG-TDI	14	
	12	J1.35	JTAG-TDO (a,b,i)	JTAG-TDO	JTAG-TDO	JTAG-TDO (a,b,i)	JTAG-TDO	15	
	13	J1.36	JTAG-TDI (a,b,i)	JTAG-TDI	JTAG-TDI	JTAG-TDI (a,b,i)	JTAG-TDI	16	
	14	J1.37	JTAG-TDO (a,b,i)	JTAG-TDO	JTAG-TDO	JTAG-TDO (a,b,i)	JTAG-TDO	17	
	15	J1.38	JTAG-TDI (a,b,i)	JTAG-TDI	JTAG-TDI	JTAG-TDI (a,b,i)	JTAG-TDI	18	
	16	J1.39	JTAG-TDO (a,b,i)	JTAG-TDO	JTAG-TDO	JTAG-TDO (a,b,i)	JTAG-TDO	19	
	17	J1.40	JTAG-TDI (a,b,i)	JTAG-TDI	JTAG-TDI	JTAG-TDI (a,b,i)	JTAG-TDI	20	
	18	J1.41	JTAG-TDO (a,b,i)	JTAG-TDO	JTAG-TDO	JTAG-TDO (a,b,i)	JTAG-TDO	21	
	19	J1.42	JTAG-TDI (a,b,i)	JTAG-TDI	JTAG-TDI	JTAG-TDI (a,b,i)	JTAG-TDI	22	
	20	J1.43	JTAG-TDO (a,b,i)	JTAG-TDO	JTAG-TDO	JTAG-TDO (a,b,i)	JTAG-TDO	23	
Digital	21	J1.44	JTAG-TDI (a,b,i)	JTAG-TDI	JTAG-TDI	JTAG-TDI (a,b,i)	JTAG-TDI	24	
	22	J1.45	JTAG-TDO (a,b,i)	JTAG-TDO	JTAG-TDO	JTAG-TDO (a,b,i)	JTAG-TDO	25	
	23	J1.46	JTAG-TDI (a,b,i)	JTAG-TDI	JTAG-TDI	JTAG-TDI (a,b,i)	JTAG-TDI	26	
	24	J1.47	JTAG-TDO (a,b,i)	JTAG-TDO	JTAG-TDO	JTAG-TDO (a,b,i)	JTAG-TDO	27	
	25	J1.48	JTAG-TDI (a,b,i)	JTAG-TDI	JTAG-TDI	JTAG-TDI (a,b,i)	JTAG-TDI	28	
	26	J1.49	JTAG-TDO (a,b,i)	JTAG-TDO	JTAG-TDO	JTAG-TDO (a,b,i)	JTAG-TDO	29	
	27	J1.50	JTAG-TDI (a,b,i)	JTAG-TDI	JTAG-TDI	JTAG-TDI (a,b,i)	JTAG-TDI	30	
	28	J1.51	JTAG-TDO (a,b,i)	JTAG-TDO	JTAG-TDO	JTAG-TDO (a,b,i)	JTAG-TDO	31	
	29	J1.52	JTAG-TDI (a,b,i)	JTAG-TDI	JTAG-TDI	JTAG-TDI (a,b,i)	JTAG-TDI	32	
	30	J1.53	JTAG-TDO (a,b,i)	JTAG-TDO	JTAG-TDO	JTAG-TDO (a,b,i)	JTAG-TDO	33	

2.1.5.7 Use Case for HSEC Adapter Board

2.1.5.7.1 Case 1: Isolated XDS110 on HSEC Adapter, SOM ,Baseboard

SOM plugs into the HSEC adapter (through 4 High-density connectors J1, J2, J3, J4), 180-pin edge connector (EC1 & EC2) of HSEC adapter plugs into the docking station and XDS110 isolated connector (J3 & J4) plugs vertically into Emulation header (J7) and DAC header (J10) of HSEC adapter board.

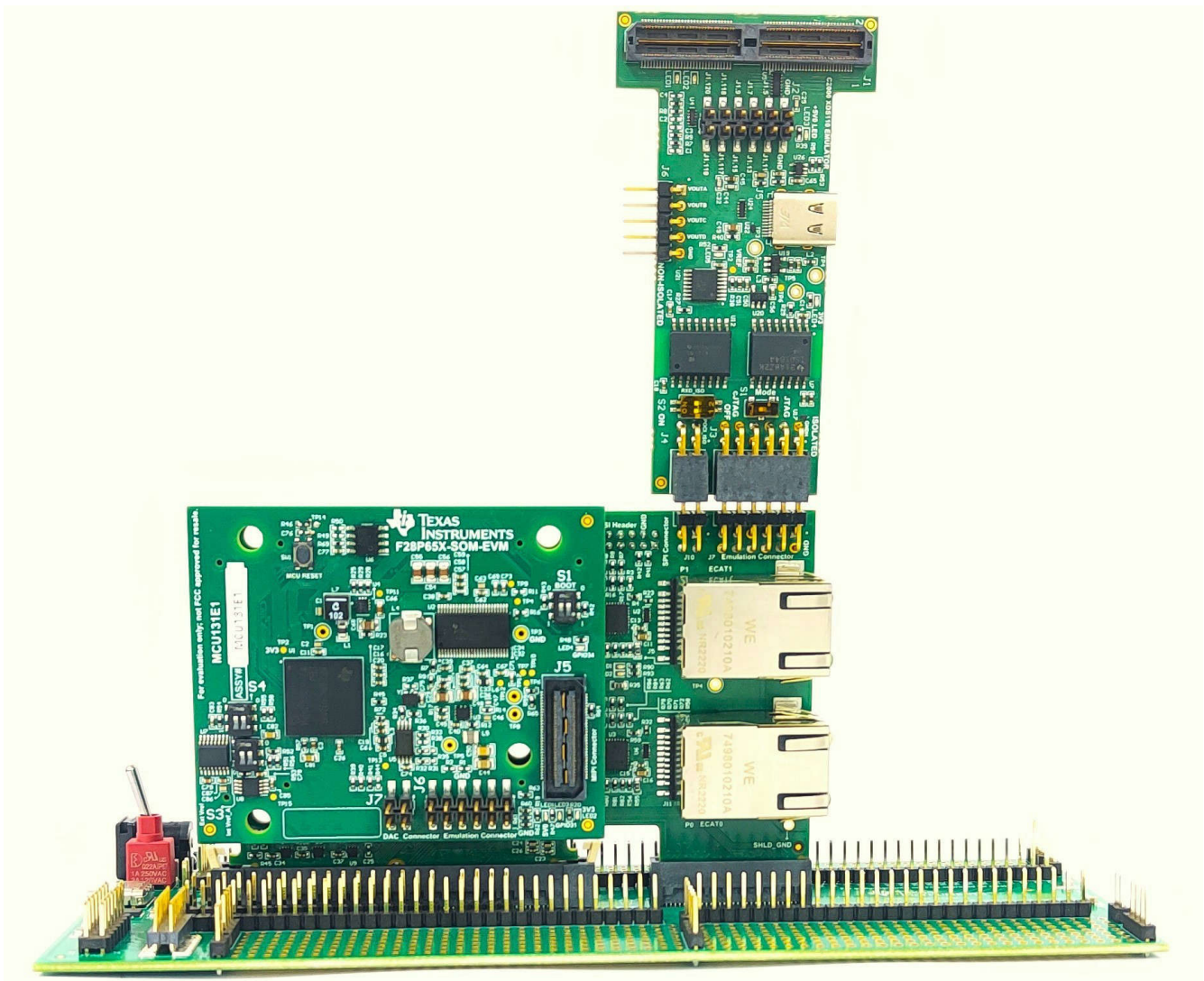


Figure 2-14. Isolated XDS110 on HSEC Adapter + SOM

2.1.5.7.2 Case 2: HSEC Adapter, Isolated XDS110 on SOM, Baseboard

SOM plugs into the HSEC adapter (through 4 High-density connectors J1, J2, J3, J4), 180-pin edge connector (EC1 & EC2) of HSEC adapter plugs into the docking station and XDS110 isolated connector (J3 & J4) plugs horizontally into Emulation header (J6) and DAC header (J7) of SOM.

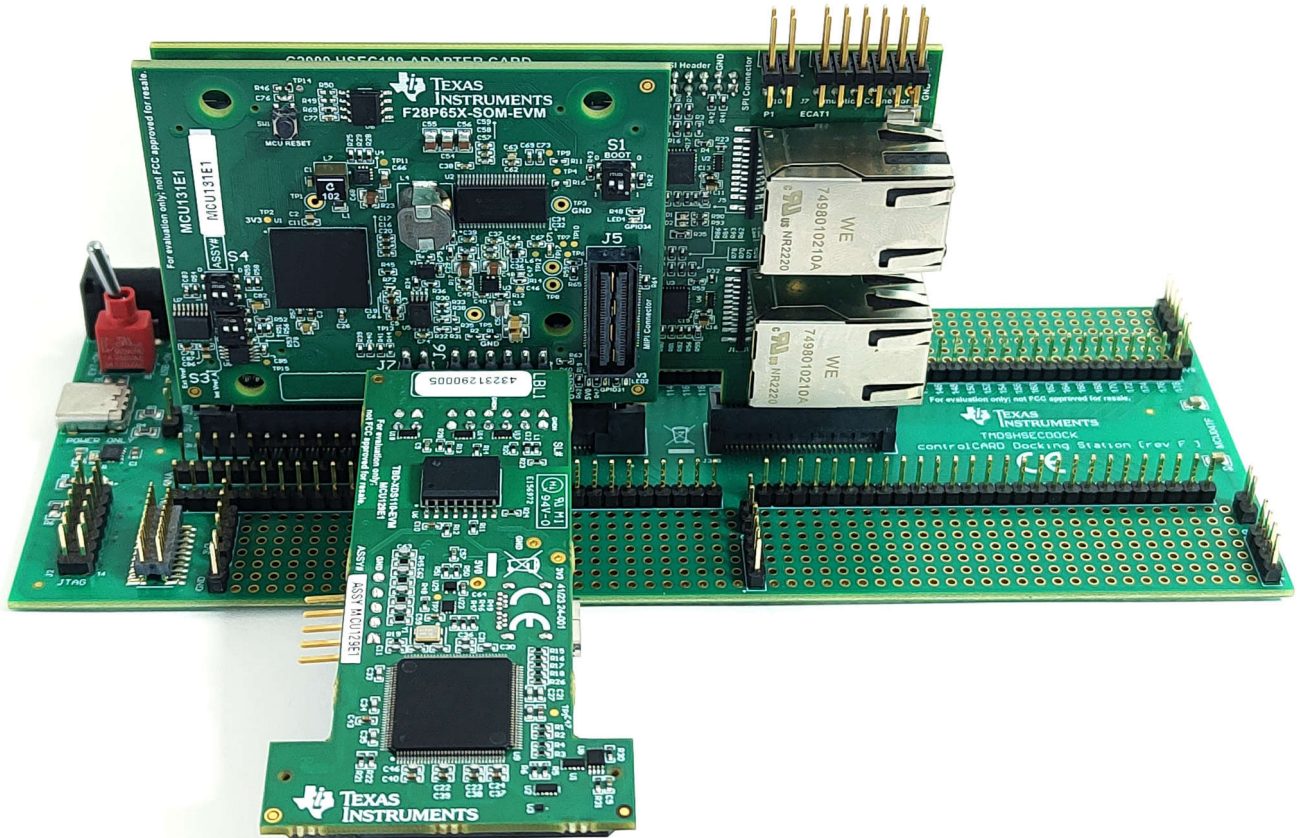


Figure 2-15. HSEC Adapter and Isolated XDS110 on SOM

3 Hardware Design Files

The HSEC180ADAPEVM design files can be found on the [EVM tool page](#).

4 Additional Information

4.1 Trademarks

Code Composer Studio™ is a trademark of Code Composer Studio.

EtherCAT® is a registered trademark of Beckhoff Automation GmbH, Germany.

All trademarks are the property of their respective owners.

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/lstds/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。

<https://www.ti.com/ja-jp/legal/notice-for-evaluation-kits-delivered-in-japan.html>

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.

【無線電波を送信する製品の開発キットをお使いになる際の注意事項】 開発キットの中には技術基準適合証明を受けていないものがあります。技術適合証明を受けていないものご使用に際しては、電波法遵守のため、以下のいずれかの措置を取っていただく必要がありますのでご注意ください。

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。

なお、本製品は、上記の「ご使用にあたっての注意」を譲渡先、移転先に通知しない限り、譲渡、移転できないものとします。

上記を遵守頂けない場合は、電波法の罰則が適用される可能性があることをご留意ください。日本テキサス・イ

ンスツルメンツ株式会社

東京都新宿区西新宿 6 丁目 2 4 番 1 号

西新宿三井ビル

3.3.3 *Notice for EVMs for Power Line Communication:* Please see http://www.tij.co.jp/lstds/ti_ja/general/eStore/notice_02.page

電力線搬送波通信についての開発キットをお使いになる際の注意事項については、次のところをご覧ください。 <https://www.ti.com/ja-jp/legal/notice-for-evaluation-kits-for-power-line-communication.html>

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.
 - 6.2 EXCEPT FOR THE LIMITED RIGHT TO USE THE EVM SET FORTH HEREIN, NOTHING IN THESE TERMS SHALL BE CONSTRUED AS GRANTING OR CONFERRING ANY RIGHTS BY LICENSE, PATENT, OR ANY OTHER INDUSTRIAL OR INTELLECTUAL PROPERTY RIGHT OF TI, ITS SUPPLIERS/LICENSORS OR ANY OTHER THIRD PARTY, TO USE THE EVM IN ANY FINISHED END-USER OR READY-TO-USE FINAL PRODUCT, OR FOR ANY INVENTION, DISCOVERY OR IMPROVEMENT, REGARDLESS OF WHEN MADE, CONCEIVED OR ACQUIRED.
 7. *USER'S INDEMNITY OBLIGATIONS AND REPRESENTATIONS.* USER WILL DEFEND, INDEMNIFY AND HOLD TI, ITS LICENSORS AND THEIR REPRESENTATIVES HARMLESS FROM AND AGAINST ANY AND ALL CLAIMS, DAMAGES, LOSSES, EXPENSES, COSTS AND LIABILITIES (COLLECTIVELY, "CLAIMS") ARISING OUT OF OR IN CONNECTION WITH ANY HANDLING OR USE OF THE EVM THAT IS NOT IN ACCORDANCE WITH THESE TERMS. THIS OBLIGATION SHALL APPLY WHETHER CLAIMS ARISE UNDER STATUTE, REGULATION, OR THE LAW OF TORT, CONTRACT OR ANY OTHER LEGAL THEORY, AND EVEN IF THE EVM FAILS TO PERFORM AS DESCRIBED OR EXPECTED.
-

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.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2023, Texas Instruments Incorporated

IMPORTANT NOTICE AND DISCLAIMER

TI PROVIDES TECHNICAL AND RELIABILITY DATA (INCLUDING DATA SHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES "AS IS" AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS AND IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for skilled developers designing with TI products. You are solely responsible for (1) selecting the appropriate TI products for your application, (2) designing, validating and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, regulatory or other requirements.

These resources are subject to change without notice. TI grants you permission to use these resources only for development of an application that uses the TI products described in the resource. Other reproduction and display of these resources is prohibited. No license is granted to any other TI intellectual property right or to any third party intellectual property right. TI disclaims responsibility for, and you will fully indemnify TI and its representatives against, any claims, damages, costs, losses, and liabilities arising out of your use of these resources.

TI's products are provided subject to [TI's Terms of Sale](#) or other applicable terms available either on [ti.com](https://www.ti.com) or provided in conjunction with such TI products. TI's provision of these resources does not expand or otherwise alter TI's applicable warranties or warranty disclaimers for TI products.

TI objects to and rejects any additional or different terms you may have proposed.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2024, Texas Instruments Incorporated