

# AM2x Evaluation Module for Industrial Ethernet PHY Add-on Board



## Description

DP83826-EVM-AM2 is an Industrial Ethernet PHY add-on board to be used with AM2x series Sitara™ high-performance microcontroller evaluation modules. This add-on board is an excellent choice for initial Ethernet evaluation and prototyping using AM2x EVMs. DP83826-EVM-AM2 is equipped with a TI DP83826 low latency 10/100-Mbps PHY with MII interface and enhanced mode, and a standard RJ45 Ethernet networking connector. DP83826-EVM-AM2 is currently supported on [TMDSCNCD263P](#) and the [AM263Px MCU PLUS SDK](#).

## Features

The Sitara™ AM2x EVM Industrial Ethernet PHY Add-on Board has the following features:

- [DP83826](#) low latency 10/100-Mbps Industrial Ethernet PHY with MII interface and enhanced mode
- Standard RJ45 Ethernet networking connector
- Shielded DF40GB 48-pin connector for interfacing with Sitara™ AM2x series evaluation modules



# 1 Evaluation Module Overview

## Preface: Read This First

### 1.1.1 Sitara MCU+ Academy

Texas Instruments offers the [MCU+ Academy](#) as a resource for designing with the MCU+ software and tools on supported devices. The MCU+ Academy features easy-to-use training modules that range from the basics of getting started to advanced development topics.

### 1.1.2 If You Need Assistance

If you have any feedback or questions, support for the Sitara AM2x MCUs and the AM2x EVM Industrial Ethernet PHY Add-on Board development kit is provided by the TI Product Information Center (PIC) and the [TI E2E™ Forum](#). Contact information for the PIC can be found on the [TI website](#). Additional device-specific information can be found in [Section 5.1](#).

## 1.1 Introduction

The AM2x EVM Industrial Ethernet PHY Add-on Board was developed to enable additional Ethernet peripheral support on AM2x EVMs and allow for rapid prototyping of the core SoC for Industrial Ethernet applications. This User Guide details the design of the add-on board and how to properly use the interface. The User Guide also details many important aspects of the board including, but not limited to pin header descriptions, test points, and signal routing.

## 1.2 Kit Contents

The Sitara AM2x EVM Industrial Ethernet PHY Add-on Board kit contains the following items:

- DP83826-EVM-AM2 Industrial Ethernet PHY Add-on Board

Not included:

- Sitara AM2x EVM

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### Note

DP83826-EVM-AM2 can be available as a virtual bundle with select Sitara AM2x EVMs. Visit the EVM product page ([DP83826-EVM-AM2](#)) for more information.

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## 1.3 Device Information

The DP83826 offers low and deterministic latency, low power and supports 10BASE-T<sub>e</sub>, 100BASE-TX Ethernet protocols to meet stringent requirements in real-time industrial Ethernet systems. The device includes hardware bootstraps to achieve fast link-up time, fast link-drop detection modes and dedicated reference CLKOUT to clock synchronize other modules on the systems.

The two configurable modes are BASIC standard Ethernet mode that uses a common Ethernet pinout, and ENHANCED Ethernet mode which supports standard Ethernet mode and multiple industrial Ethernet fieldbus applications with the additional features and hardware bootstraps configuration.

For additional information, refer to the [DP83826 data sheet](#).

## 2 Hardware

### 2.1 Component Identification

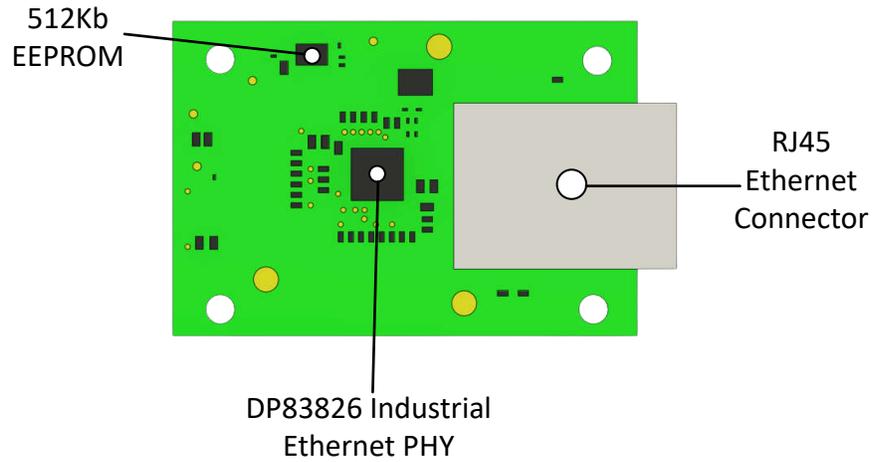


Figure 2-1. DP83826-EVM-AM2 Top Side

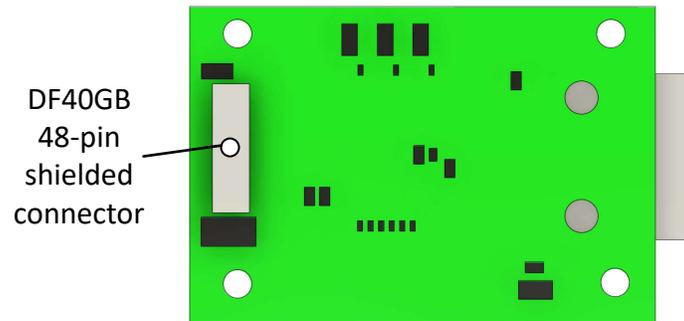


Figure 2-2. DP83826-EVM-AM2 Bottom Side

## 2.2 Power Requirements

The AM2x EVM Industrial Ethernet PHY Add-on Board is powered from a 3.3V input from the DF40GB 48-pin connector that interfaces the DP83826-EVM-AM2 with the main MCU EVM. The following sections describe the power distribution network topology that supply the AM2x EVM Industrial Ethernet PHY Add-on Board, supporting components, and reference voltages.

### 2.2.1 Power Tree

The DP83826-EVM-AM2 power is supplied from the main Sitara AM2x EVM via the DF40GB connector.

3.3V (VDDIO) is connected to pin 44 and 46 on the DF40GB connector, and is passed to the source inputs on the DP83826ERHBT Industrial Ethernet PHY through a pair of ferrite beads (one per supply net).

Figure 2-3 shows the power connections of DP83826-EVM-AM2.

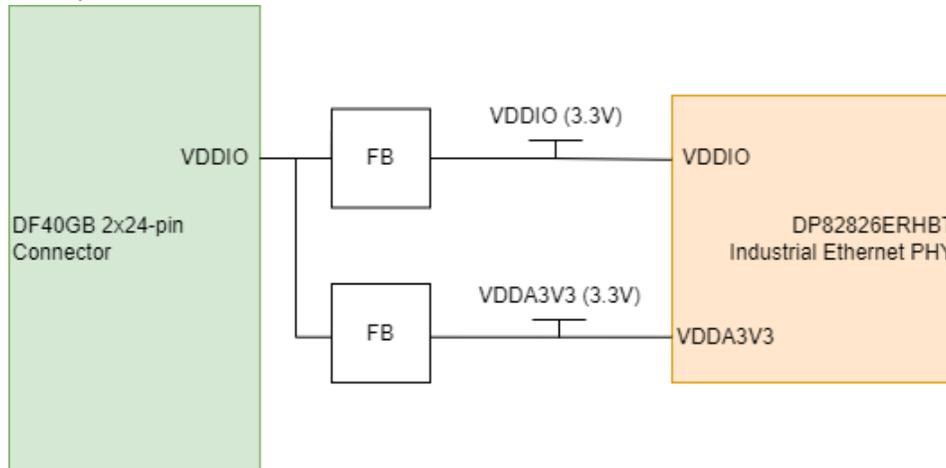


Figure 2-3. Power Tree

### 2.3 Functional Block Diagram

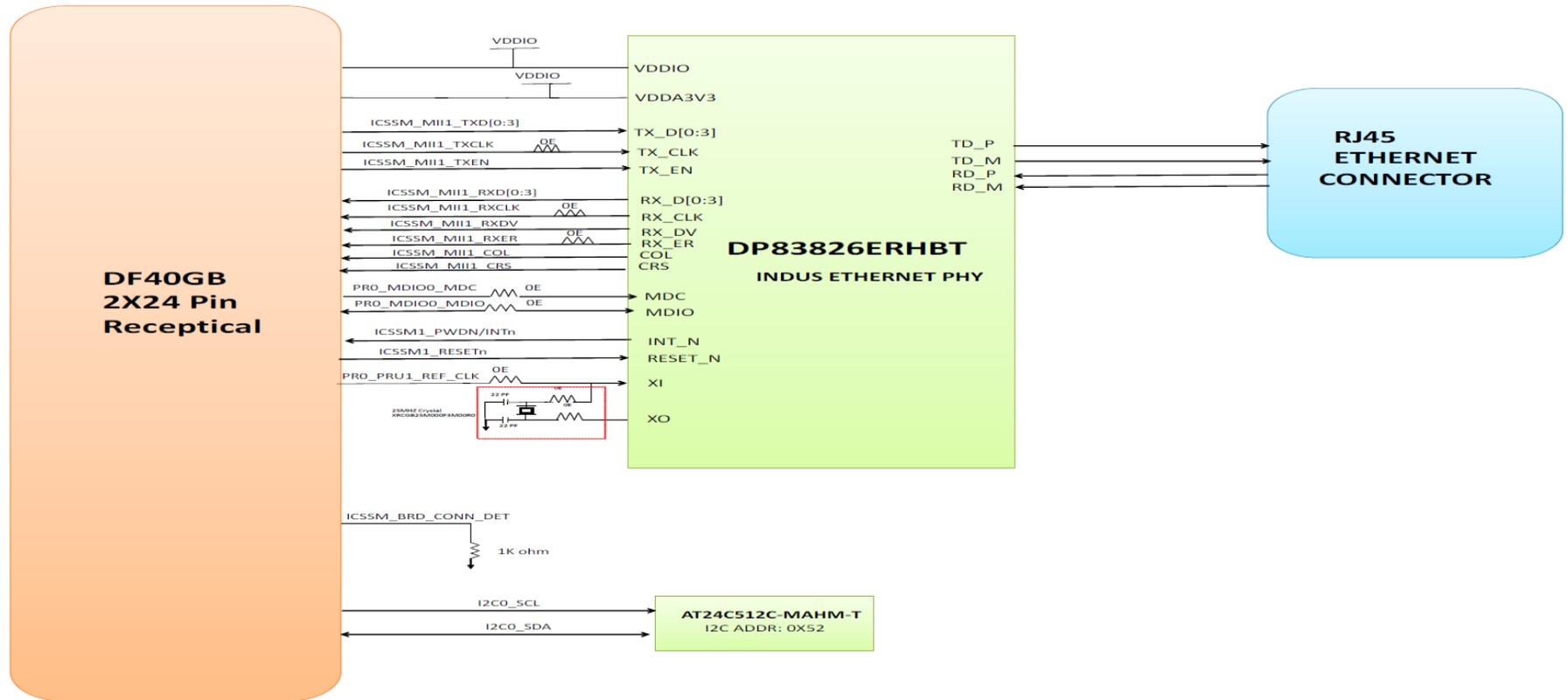


Figure 2-4. AM2x Industrial Ethernet PHY Add-on Board Block Diagram

## 2.4 Header Information

The DP83826-EVM-AM2 is equipped with a [Hirose DF40GB](#) 2x24-pin connector (J2) to connect to Sitara AM2x EVMs. Listed below are the features of this connector relevant to this EVM:

- 2x24 pins
- Shielded type to support high-speed signals and prevent noise
- High density mounting

Refer to [Table 2-1](#) for a complete list of the header pins and descriptions.

**Table 2-1. DF40GB Header Pinout**

Pin #	Signal	Description	Description	Signal	Pin #
1	GND	Ground	PMIC External Voltage Monitor	EXT_VMON2	2
3	TX_CLK	Transmit Clock	2.5V supply	VDD_2V5	4
5	GND	Ground	2.5V supply	VDD_2V5	6
7	TX_D0	Transmit Data 0	Ground	GND	8
9	TX_D1	Transmit Data 1	Interrupt To Ethernet PHY	PWDN/INTn	10
11	TX_D2	Transmit Data 2	Reset input to Ethernet PHY	RESETn	12
13	TX_D3	Transmit Data 3	Collision Detected	COL	14
15	GND	Ground	Ground	GND	16
17	GND	Ground	Ground	GND	18
19	RX_CLK	Receive Clock	MDIO Clock	MDIO_MDC	20
21	GND	Ground	MDIO Data	MDIO_MDIO	22
23	RX_D0	Receive Data 0	Ground	GND	24
25	RX_D1	Receive Data 1	Inhibit	INH	26
27	RX_D2	Receive Data 2	PRUx Reference Clock	REF_CLK	28
29	RX_D3	Receive Data 3	Carrier Sense	CRS	30
31	GND	Ground	Ground	GND	32
33	GND	Ground	Ground	GND	34
35	TXEN	Transmit Enable	Board Connection Detect	BRD_CONN_DET	36
37	GND	Ground	Test Point (open)	TP	38
39	RX_ER	Receive Data Error	I2C Clock	I2C_SCL	40
41	GND	Ground	I2C Data	I2C_SDA	42
43	RX_LINK	Receive Indicator	IO Voltage Supply	VDDIO	44
45	RXDV	Receive Data Valid	IO Voltage Supply	VDDIO	46
47	NC	No Connect	No Connect	NC	48

## 2.5 Test Points

DP83826-EVM-AM2 is equipped with multiple test points for hardware debug and bench testing. [Table 2-2](#) shows the test points on the board and their associated signal net.

**Table 2-2. DP83826-EVM-AM2 Test Points**

Test Point	Signal	Description
TP1	GND	Ground
TP2	GND	Ground
TP3	GND	Ground
TP4	GND	Ground
TP5	RXDV	Receive Data Valid
TP6	RXD0	Receive Data 0
TP7	RXD1	Receive Data 1
TP8	RXD2	Receive Data 2
TP9	RXD3	Receive Data 3
TP10	MDIO_MDC	MDIO Clock
TP11	MDIO_MDIO	MDIO Data
TP12	RXCLK	Receive Clock
TP13	J2-38	DF40GB add-on board connector pin 38
TP14	RXER	Receive Data Error
TP15	INH	Inhibit
TP16	TXEN	Transmit Enable
TP17	TXCLK	Transmit Clock
TP18	TXD0	Transmit Data 0
TP19	TXD2	Transmit Data 2
TP20	TXD1	Transmit Data 1
TP21	TXD3	Transmit Data 3
TP22	CRS	Carrier Sense
TP23	COL	Collision Detected
TP24	RXLINK	Receive Indicator
TP25	EXT_VMON	PMIC External Voltage Monitor
TP26	GND	Ground
TP27	GND	Ground

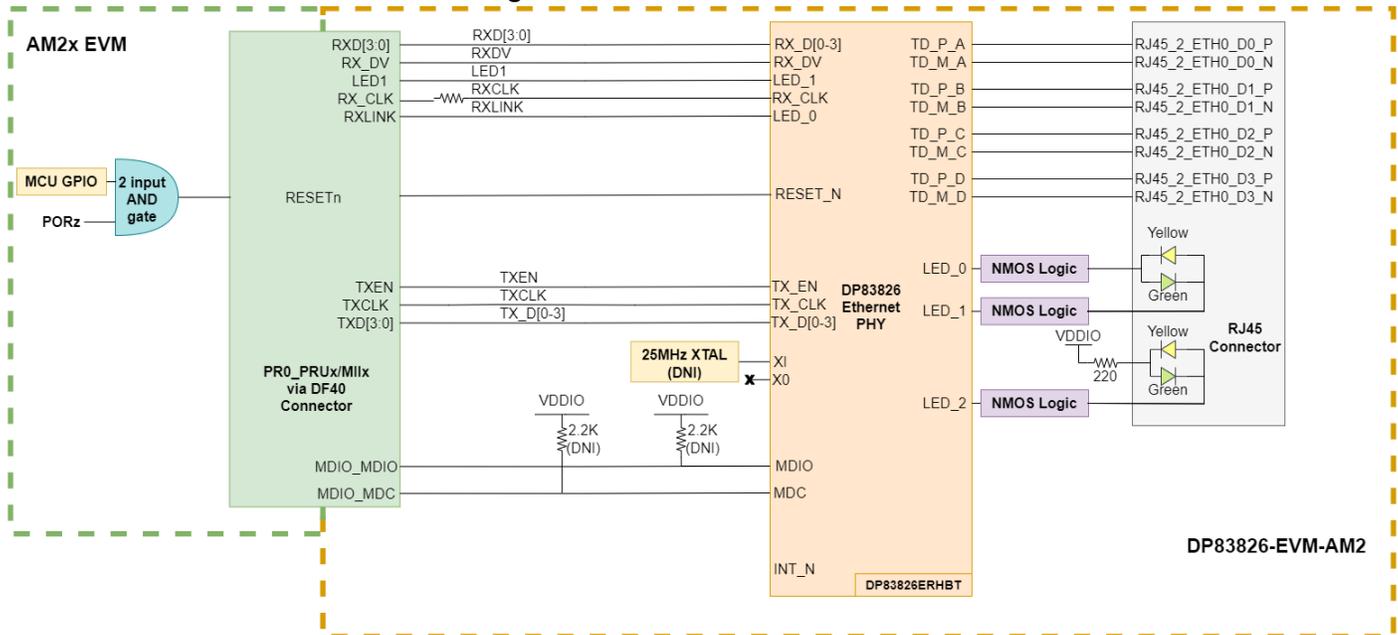
## 2.6 Interfaces

### 2.6.1 Ethernet Interface

#### 2.6.1.1 Industrial Ethernet PHY

The AM2x EVM Industrial Ethernet PHY Add-on Board uses one port of RGMII signals and the PRUx core of the PRU-ICSS to be connected to a 32-pin Ethernet PHY (DP83826ERHBT). The PHY is configured to advertise 10/100 Mb operation. The Ethernet data signals of the PHY are terminated to an RJ45 Connector. LEDs are used to indicate link status and activity.

Figure 2-5. Industrial Ethernet PHY



The Ethernet PHY requires two power sources, VDDIO (3.3V or 1.8V) and VDDA3V3 (3.3V) which are supplied through the DF40GB connector (J2).

On some AM2x EVMs, the RGMII port of the CPSW signals are internally muxed on the same balls of the MCU as the PRU-ICSS ethernet signals. To use RGMII, the balls must be set to the appropriate mux mode for RGMII.

The MDIO and Interrupt signals from the main EVM SoC to the PHY require 2.2K $\Omega$  pull up resistors to the I/O supply voltage for proper operation. These resistors are not assembled by default on the DP83826-EVM-AM2, but there are footprints if the main EVM does not have these signals pulled up. The interrupt signal is driven by a GPIO signal that is mapped from the main EVM SoC.

The reset signal for the Ethernet PHY is most often driven by a 2-input AND gate. The AND gate's inputs are a GPIO signal that is generated by the main SoC EVM and a power-on reset signal on the main EVM.

### 2.6.1.2 Industrial Ethernet PHY Strapping Resistors

The Ethernet PHY uses many functional pins as strap option to place the device into specific modes of operation.

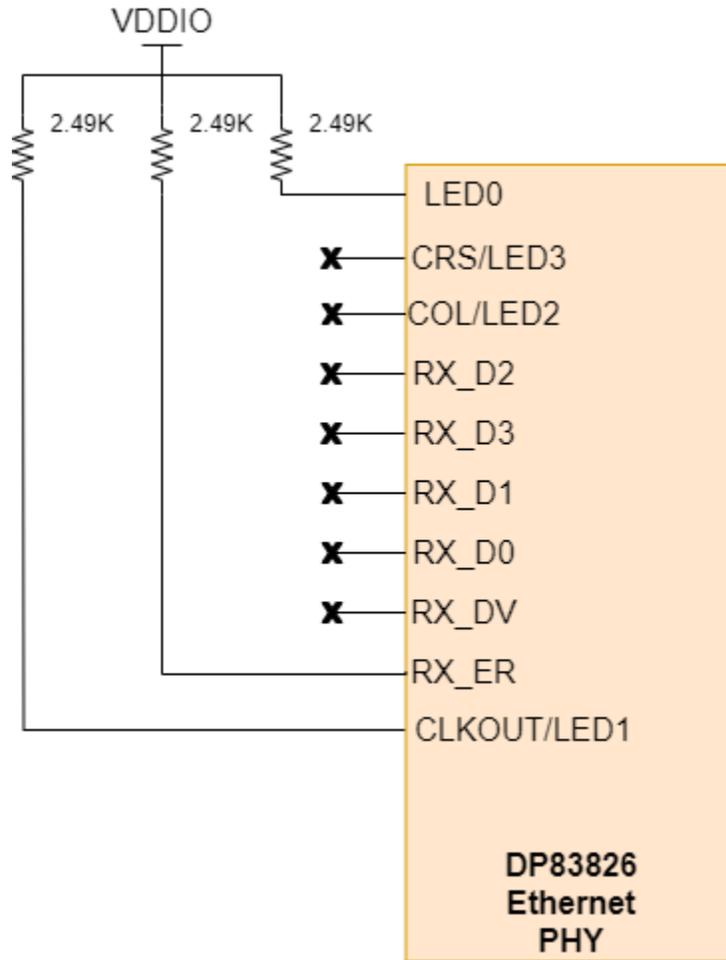


Figure 2-6. Industrial Ethernet PHY Strapping Resistors

Table 2-3. Industrial 10/100 Mbit Ethernet PHY Strapping Resistors

Functional Pin	Default Mode	Mode on DP83826-EVM-AM2	Function
LED0	0	1	PHY address: 001
CRS/LED3	0	0	
COL/LED2	0	0	
RX_D2	0	0	MII MAC Mode
RX_D3	0	0	Fast link-drop disable
RX_D1	0	0	auto MDIX enable
RX_D0	0	0	auto-negotiation enable
RX_DV	0	0	
RX_ER	0	1	LED1 on PHY Pin 31
CLKOUT/LED1	1	1	Odd nibble detection enabled

### 2.6.1.3 LED Indication in RJ45 Connector

The AM2x EVM Industrial Ethernet PHY Add-on Board has one RJ45 network ports for the ICSSM port on PRU0 of the main EVM SoC. The RJ45 connector contains two bi-color LEDs that are used to indicate link and activity.

- RJ45 Connector LED indication for the ICSSM PRU0 port:

**Table 2-4. ICSSM PRU1 RJ45 Connector LED indication**

LED	Color	Indication
Right LED	Green	Ethernet PHY power established
	Yellow	10BT speed link is up
Left LED	Green	Link OK
	Yellow	1000BT speed link is up

## 2.7 Integration Guide

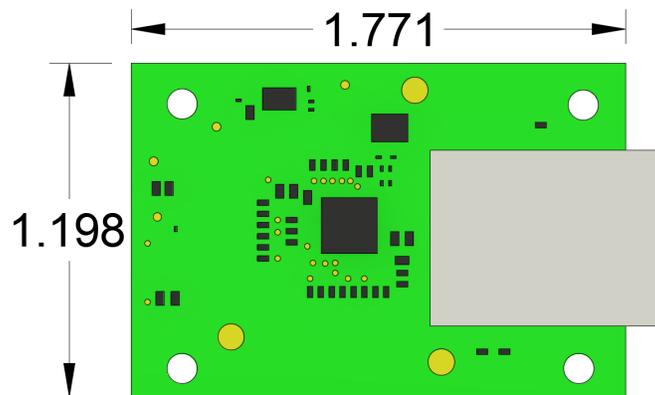
The Sitara AM2x Ethernet Add-on Board ecosystem is not limited to the DP83826x Industrial Ethernet PHY. A wide variety of Industrial Ethernet PHYs with Sitara AM2x MCU compatible signals can be designed onto add-on boards to be used across Sitara AM2x MCU EVMs. This section details the mechanical information and provide the necessary dimensions for designing an Industrial Ethernet PHY add-on board.

### Note

All dimensions are measured in inches.

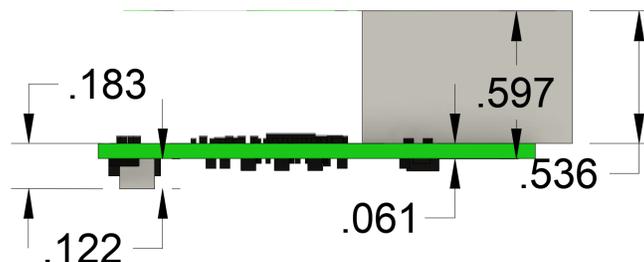
### 2.7.1 Board Dimensions

Figure 2-7 shows the proper PCB dimensions for an Industrial Ethernet PHY add-on board to be compatible with Sitara AM2x EVMs.



**Figure 2-7. Industrial Ethernet PHY Add-on Board Dimensions**

Figure 2-8 shows the side profile of the PCB.



**Figure 2-8. Industrial Ethernet PHY Add-on Board Side Profile**

### 2.7.2 DF40GB Connector

TI recommends the 48-pin (2x24) [Hirose DF40GB](#) high-density, shielded connector for Ethernet PHY Add-on Boards interfacing with Sitara AM2x EVMs. [Figure 2-9](#) shows the mounting position of the DF40GB connector on the DP83826-EVM-AM2.

The origin of the connector is to be placed at  $(x,y)=(0.157,0.537)$ .

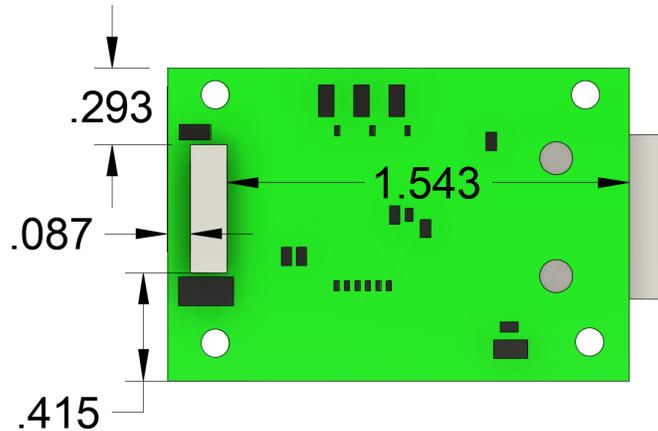


Figure 2-9. DF40GB Connector Mounting Position

### 2.7.3 Mounting Holes

The DP83826-EVM-AM2 is designed with mounting holes to securely attach to the main Sitara AM2x MCU EVM. The compatible Sitara AM2x EVMs are designed to have matching mounting holes for an Ethernet Add-on Board to connect to. Screws and spacers can be inserted into the mounting holes for a more permanent configuration. [Figure 2-10](#) shows the positions of the mounting holes on the DP83826-EVM-AM2.

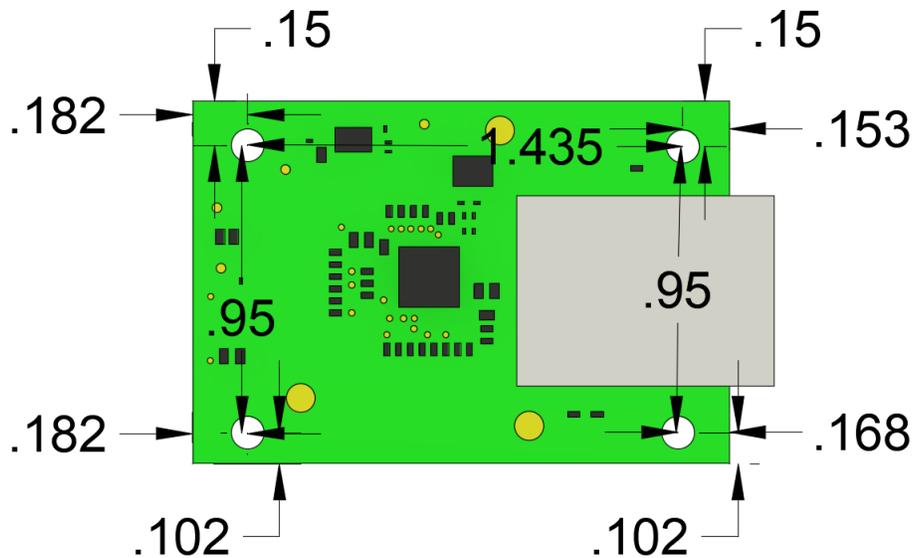
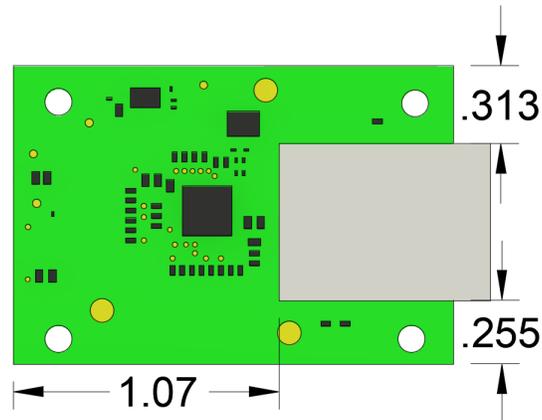


Figure 2-10. Mounting Hole Positions

### 2.7.4 RJ45 Ethernet Connector

The DP83826-EVM-AM2 has an RJ45 Ethernet Connector for sending and receiving signals from the DP83826 Ethernet PHY. Different Industrial Ethernet PHYs utilize the same connector, and must be used on custom Industrial Ethernet PHY Add-on Boards. [Figure 2-11](#) shows the position of the RJ45 connector on the DP83826-EVM-AM2.



**Figure 2-11. RJ45 Connector Position**

### 3 Hardware Design Files

To download the zip file containing the latest design files for the EVM, go to the EVM product page on ti.com ([DP83826-EVM-AM2](#)).

### 4 Additional Information

#### 4.1 Trademarks

Sitara™ and E2E™ are trademarks of Texas Instruments.  
All trademarks are the property of their respective owners.

### 5 References

#### 5.1 Reference Documents

In addition to this document, the following references are available for download at [www.ti.com](http://www.ti.com).

- [AM263P controlCARD Evaluation Module Tool Folder](#)
- [AM263P controlCARD Evaluation Module User's Guide](#)
- [Texas Instruments Code Composer Studio](#)

#### 5.2 Compatible Sitara™ MCU AM2x EVMs

This Ethernet add-on board is compatible with the following EVMs:

- [TMDSCNCD263P](#)

## 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.
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  - 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](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.

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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.

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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.

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