EVM User's Guide: J7EXPA01EVM
J7EXPA01EVM Evaluation Module

TEXAS INSTRUMENTS

Description

The J7EXPA01EVM add-on board is designed to expand the capability of Jacinto7 EVMs to include video capture capabilities. This hardware system can help kick start the development and evaluation of the Jacinto7 family of processors in many different automotive and industrial applications.

The J7EXPA01EVM provides the ability to interface with external camera sensors, radar sensors, and other similar capture devices through Texas Instruments FPD-Link serial links. The EVM can support up to twelve different inputs, and communicates with the processor through multiple MIPI D-PHY CSI2 interfaces.

Get Started

1. Order the EVM at J7EXPA01EVM.
2. Download the EVM design files.
3. Read this user's guide.
4. Download all related information for the base and host EVM for which this board is mounted. See EVM Compatibility for supported EVMs.

Features

- Designed to work with Jacinto7 Processor EVMs
- Multiple capture inputs using Texas Instruments FPD-Link IV devices
- Supports up to 12 high speed image/data input ports simultaneously
- Each input can support 8MP+ imagers with 8.4Gbps line rates
- Supports variety of different sensors including image and radar modules

Applications

- Automotive and Industrial
  - Automotive front camera systems
  - Automotive surround view and park assistance systems
  - Industrial HMI
  - Robot teach pendant
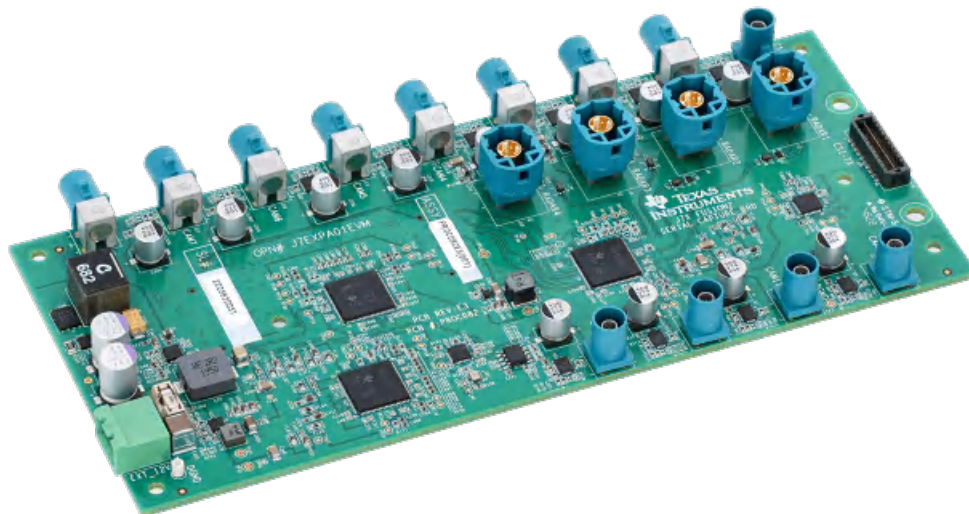
J7EXPA01EVM

1 Evaluation Module Overview

1.1 Introduction

The J7EXPA01EVM is an expansion and add-on module and does not operate stand-alone. The EVM is designed to be matched with Jacinto7 Processor EVMs, including J721EXCPXEVM and J784S4XEVM. Other hardware configurations can be supported but are not covered in this document. This design is not a reference design, as the design includes circuitry for software development, debug, and flexible configurations. The J7EXPA01EVM is supported by multiple feature-rich software development kits (SDK) not covered in this user's guide. This document is intended to be technical description of the hardware and operation, as well as cover architectural and design elements of the EVM.

1.2 Kit Contents

The EVM orderable part number is J7EXPA01EVM. This kit includes:

*   J7EXPA01EVM EVM
*   EVM user's guide pamphlet
*   EVM disclaimer and standard terms

The EVM is not design to be operated stand-alone, but to be an add-on to other EVM systems. For more information on supported EVMs, see Section 2.2.

1.3 Specification

The figure below shows the functional block diagram of the EVM.
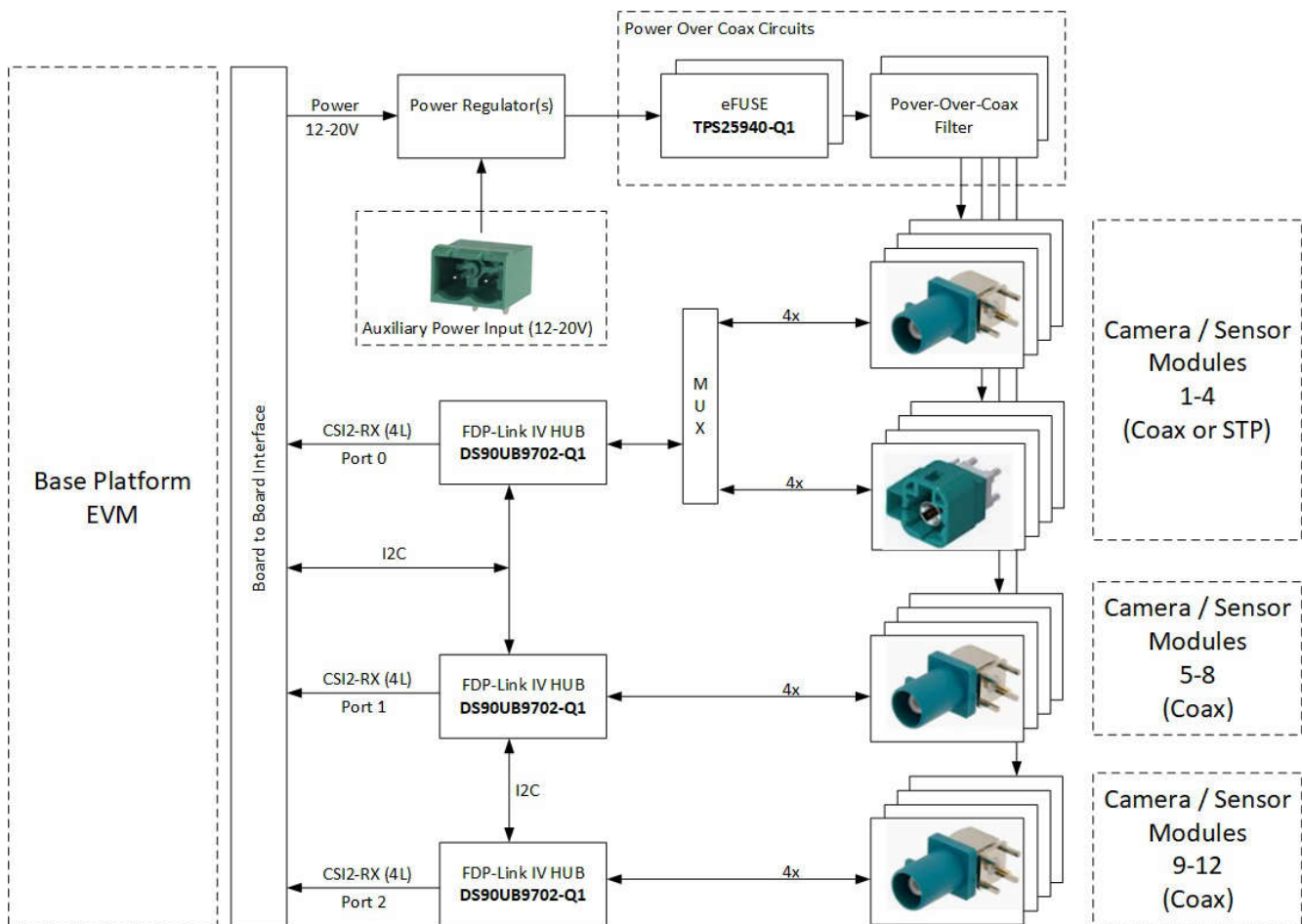
Figure 1-1. J7EXPA01EVM Block Diagram

1.4 Device Information

Many different devices and technologies are used to create this EVM. The list below details some of the Texas Instruments devices included on this design and links to get additional information.

Function	Device Info
FPD-Link IV quad deserializer hub	DS90UB9702-Q1
EFuse with current monitor	TPS25940-Q1
Clock fanout buffer, jow jitter	LMK00105
Power regulators, switching	TPS54618, TPS54620
Power regulators, linear	TPS74801-Q1

2 Hardware

2.1 Key Features and Interfaces

The J7EXPA01EVM is a add-on module that expands the feature set of select TI processor evaluation modules (EVMs) to include advanced video capture features. The combined EVM design provides users the ability to evaluate and develop automotive and industrial applications that utilize advanced video and image processing. A summary of features included with this expansion EVM include:

- Supported on multiple Texas Instruments Processor EVMs
- Up to 12 total image sensor or data input ports; each supporting up to 8MP sensors /40 FPS. (Depending on the capability of the base EVM, the number of supported inputs can vary)
- Utilizes Texas Instruments' FPD-Link IV technology, can be paired with sensors supporting DS90UB953 or DS90UB971 serializers
- Each deserializer hub aggregates data from up to 4 sensors onto single MIPI CSI2 port
- Includes both Coax and STP configurations
- Support power-over-coax for powering remote sensors
- Provides supplemental power input for higher power configurations

The EVM images identify the locations of key features and user interfaces (top and bottom view).
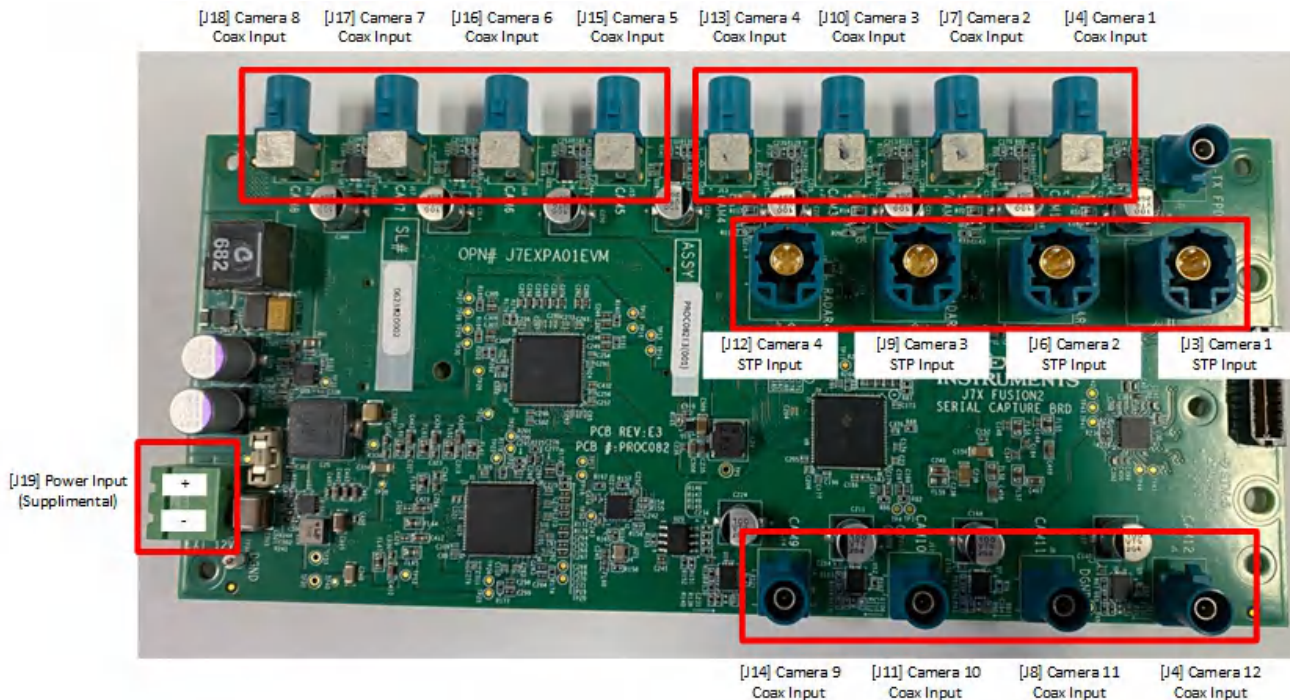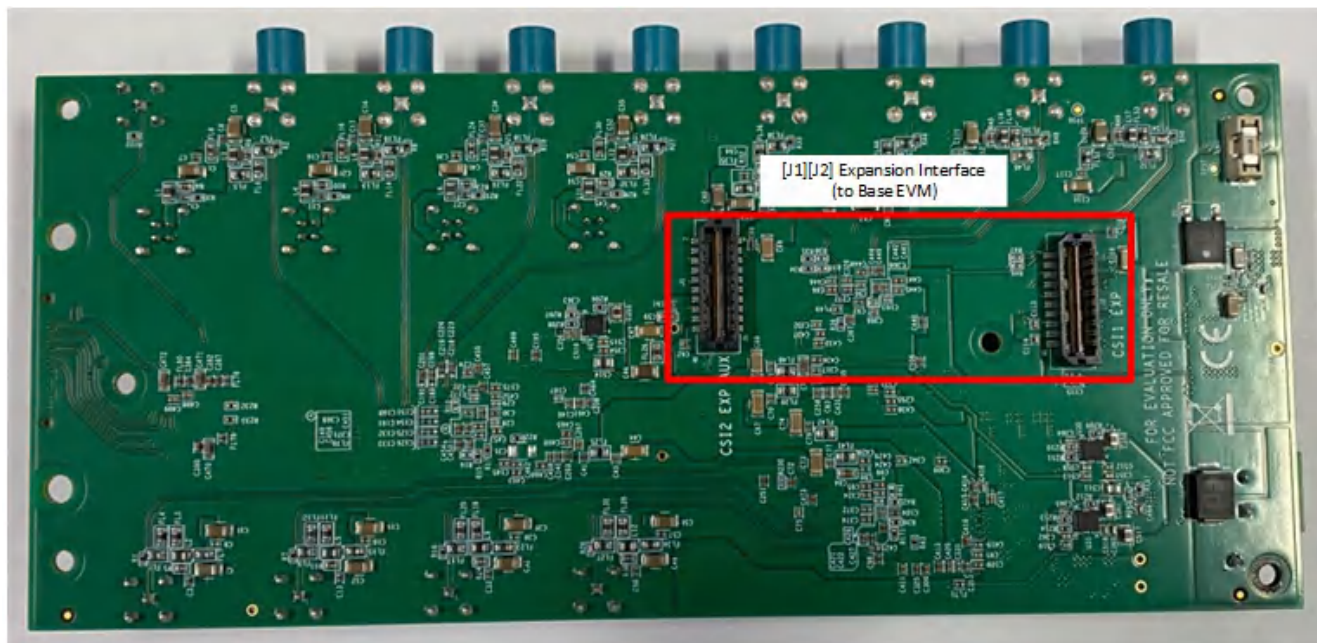

Figure 2-1. Key Features and Interfaces (Top)

Figure 2-2. Key Features and Interfaces (Bottom)

2.2 EVM Compatibility

The J7EXPA01EVM is not a stand-alone EVM but is an add-on or expansion board that must be combined with a base EVM. Table 2-1 includes several Texas Instruments EVMs that can support the J7EXPA01EVM. This list is not meant to be all inclusive and the J7EXPA01EVM can be supported with other EVM systems.

Table 2-1. EVMs Supporting J7EXPA01EVM

| J721EXSOMXEVM (requires base J721EXCPXEVM) |
| --- |
| J721S2XSOMXEVM (requires base J721EXCPXEVM) |
| J784S4XEVM |

2.3 Assembly Instructions

For assembly of the J7EXPA01EVM add-on module with the J721EXCPXEVM and J784S4XEVM systems, follow the instructions and illustration below.

1. If assembling with previously used base EVM, then make sure all power cables and other accessory cables are removed. The EVM must be configured similar to as originally delivered.
2. Orient the EVM such that the processor is facing downward. The expansion connectors of the EVM must be facing upward.
3. Remove the four stand-offs in the area of expansion connector to the washer, leaving the threaded stand-off still attached.
4. Install the J7EXPA01EVM module by aligning the mounting holes and mating connectors. Press firmly to make sure the connectors are seated.
5. Re-install the four removed stand-offs, but without the thin washer.

Note
The washer is to help level the board accounting for an expansion board PCB thickness.
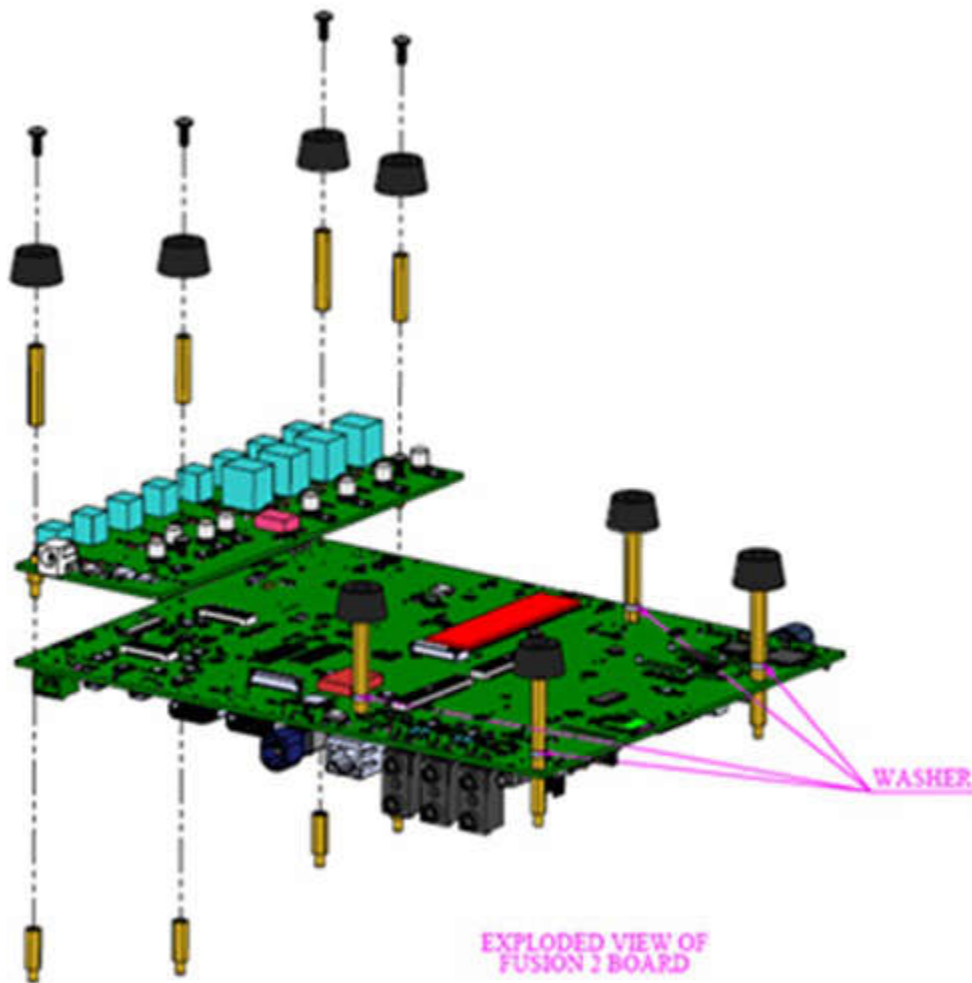
Figure 2-3. Assembly Illustration

2.4 Power Budget Considerations

The exact power required for the EVM and add-on modules is largely dependent on the application, usage of the on-board peripherals, and power needs of add-on devices. The base EVM does provide power to the J7EXPA01EVM add-on module and is sufficient to cover basic power needs. If the attached sensors require have more substantial power requirements, then users have to supplement the EVM and, specifically, the J7EXPA01EVM requires additional power input. The supplemental power connector [J15] is provided for this purpose.

2.5 Interfaces

The add-on module supports several interfaces for connecting with base EVMs and peripheral sensors. Each of those interfaces are introduced and additional information provided.

2.5.1 EVM Interface

The add-on module supports two 40-pin high speed connectors [J1] [J2] for interfacing with the base EVM or EVMs. The interface (two connectors) support three MIPI CSI2 receiver ports, each supporting up to 4-lanes of data. The interface also includes a control and configuration mechanism (I2C) and multiple IO for various interrupts and syncs are provided. This IO voltage level can be either 1.8V or 3.3V, and must match the IO power pin.

Power for the add-on module plus power for plug-in sensor modules is also supplied through the interface.

Table 2-2. Expansion Interface Pin Definition [J1]

Pin #	Pin Name	Description	Direction
1	Power	Power (12-20V)	Input
2	I2C_SCL	I2C Clock	Bi-Dir
3	Power	Power (12-20V)	Input
4	I2C_SDA	I2C Data	Bi-Dir
5	CSI_0_CLK_P	CSI Port 0 Clock	Output
6	INTn_Port0	GPIO, see Table 2-6	Output
7	CSI_0_CLK_N	CSI Port 0 Clock	Output
8	INTn_Port1	GPIO, see Table 2-6	Output
9	CSI_0_D0_P	CSI Port 0 Data Lane 0	Output
10	REF_CLK	Optional reference clock for FPD-Link deserializer	Input
11	CSI_0_D0_N	CSI Port 0 Data Lane 0	Output
12	GND	Ground	
13	CSI_0_D1_P	CSI Port 0 Data Lane 1	Output
14	Reset	GPIO, see Table 2-6	Input
15	CSI_0_D1_N	CSI Port 0 Data Lane 1	Output
16	GND	Ground	
17	CSI_0_D2_P	CSI Port 0 Data Lane 2	Output
18	Sync_Port0	GPIO, see Table 2-6	Bi-Dir
19	CSI_0_D2_N	CSI Port 0 Data Lane 2	Output
20		Open / Unused	
21	CSI_0_D3_P	CSI Port 0 Data Lane 3	Output
22	Sync_Port1	GPIO, see Table 2-6	Bi-Dir
23	CSI_0_D3_N	CSI Port 0 Data Lane 3	Output
24	GND	Ground	
25	CSI_1_CLK_P	CSI Port 1 Clock	Output
26	CSI_1_D3_P	CSI Port 1 Data Lane 3	Output
27	CSI_1_CLK_N	CSI Port 1 Clock	Output
28	CSI_1_D3_N	CSI Port 1 Data Lane 3	Output
29	CSI_1_D0_P	CSI Port 1 Data Lane 0	Output
30	Power_3V3	Power, 3.3V	Input
31	CSI_1_D0_N	CSI Port 1 Data Lane 0	Output
32	Power_3V3	Power, 3.3V	Input
33	CSI_1_D1_P	CSI Port 1 Data Lane 1	Output
34	Power_3V3	Power, 3.3V	Input
35	CSI_1_D1_N	CSI Port 1 Data Lane 1	Output
36	Power_3V3	Power, 3.3V	Input
37	CSI_1_D2_P	CSI Port 1 data lane 2	Output

Table 2-2. Expansion Interface Pin Definition [J1] (continued)

Pin #	Pin Name	Description	Direction
38	Power_IO	Power, IO voltage level (1.8V or 3.3V)	Input
39	CSI_1_D2_N	CSI Port 1 data lane 2	Output
40	Power_IO	Power, IO voltage level (1.8V or 3.3V)	Input

Table 2-3. Expansion Interface Pin Definition [J2]

Pin #	Pin Name	Description	Direction
1	Power	Power (12-20V)	Input
2		Open / Unused	
3	Power	Power (12-20V)	Input
4		Open / Unused	
5	CSI_2_CLK_P	CSI Port 2 Clock	Output
6		Open / Unused	
7	CSI_2_CLK_N	CSI Port 2 Clock	Output
8	INTn_Port2	GPIO, see Table 2-6	Output
9	CSI_2_D0_P	CSI Port 2 Data Lane 0	Output
10		Open / Unused	
11	CSI_2_D0_N	CSI Port 2 Data Lane 0	Output
12	GND	Ground	
13	CSI_2_D1_P	CSI Port 2 Data Lane 1	Output
14		Open / Unused	
15	CSI_2_D1_N	CSI Port 2 Data Lane 1	Output
16	GND	Ground	
17	CSI_2_D2_P	CSI Port 2 Data Lane 2	Output
18	Sync_Port2	GPIO, see Table 2-6	Bi-Dir
19	CSI_2_D2_N	CSI Port 2 Data Lane 2	Output
20		Open/Unused	
21	CSI_2_D3_P	CSI Port 2 Data Lane 3	Output
22		Open / Unused	
23	CSI_2_D3_N	CSI Port 2 Data Lane 3	Output
24	GND	Ground	
25		Open / Unused	
26		Open / Unused	
27		Open / Unused	
28		Open / Unused	
29		Open / Unused	
30	Power_3V3	Power, 3.3V	Input
31		Open / Unused	
32	Power_3V3	Power, 3.3V	Input
33		Open / Unused	
34	Power_3V3	Power, 3.3V	Input
35		Open / Unused	
36	Power_3V3	Power, 3.3V	Input
37		Open / Unused	
38	Power_IO	Power, IO voltage level (1.8V or 3.3V)	Input
39		Open / Unused	

Table 2-3. Expansion Interface Pin Definition [J2] (continued)

Pin #	Pin Name	Description	Direction
40	Power_IO	Power, IO voltage level (1.8V or 3.3V)	Input

2.5.2 Sensor Interface / Coax

The add-on board supports a total of 12 coax inputs for interfacing with image sensors. Each coax interface supports sensors paired with either DS90UB953 or DS90UB971 serializers. The design uses Rosenberger FAKRA connectors for connecting with coax cables.

Power-over-coax is provided on each interface to power the image sensor or serializer. The voltage provided to each is 12 volts and is current limited to 2A.

> **Note**
> Design is limited to about 10Amps on the 12V regulator, thus cannot support maximum power simultaneously to all 12 interfaces.

Connectors [J4] [J7] [J10] [J13] are connected to one UB9702-Q1 and are aggregated on CSI Port 0. Connectors [J15] [J16] [J17] [J18] are connected a second UB9702-Q1 and are aggregated to CSI Port 1. Connectors [J14] [J11] [J8] [J4] are connected to a third UB9702-Q1 and are aggregated to CSI Port 2.

Depending on the capability of the base EVM, the number of supported CSI ports and camera inputs can vary.

2.5.3 Sensor Interface / Twisted Pair

The add-on board can support a total of four twisted pair (TP) inputs for interfacing with image sensors. The four TP interfaces are not supported by default. The Port 0 deserializer (UB9702-Q1) supports Coax by default, but can be updated to support TP my moving of in-line capacitors (requires soldering). See schematic for details on which components are to be moved to switch from Coax to TP.

Similar to the coax interfaces, each TP interface supports sensors paired with either DS90UB953 or DS90UB971 serializers. The design uses Rosenberger HSD connectors for TP. The HSD connector supports four separate wires and connections, two used for the TP data, one for power, and one for ground and return.

2.6 Circuit Details

This section provides additional details on the add-on board and the support with other EVMs. The top level block diagram, Figure 1-1, shows the overall connectivity of the add-on module.

2.6.1 Interface Mapping

The add-on modules interface connections to the host processor or processors are provided in Table 2-4.

Table 2-4. Interface Mapping

Connected EVM	J7EXPA01EVM Add-On Module			
	CSI2-RX Port 0	CSI2-RX Port 1	CSI2-RX Port 2	I2C
J721EXSOMXEVM	CSI0_RX	CSI1_RX	Not available	I2C6
J721S2XSOMXEVM	CSI0_RX	CSI1_RX	Not available	I2C0
J784S4XEVM	CSI0_RX	CSI1_RX	CSI2_RX	I2C5

> **Note**
> Some processor EVMs require a common base board (J721EXCPXEVM) to operate. This includes the J721EXSOMXEVM and J721S2XSOMXEVM.

2.6.2 I2C Address Map

Table 2-5 provides the complete I2C address mapping details for the J7EXPA01EVM add-on module. Please see the table below for details on which I2C is connected based on the base EVM.

Table 2-5. I2C Mapping

Interface Name	I2C Port	Address	Components / Part Numbers
FPD-Link IV Deserializer CSI2-RX Port 0	See Table 2-4	0x3D	Texas Instruments DS90UB9702-Q1
FPD-Link IV Deserializer CSI2-RX Port 1	See Table 2-4	0x30	Texas Instruments DS90UB9702-Q1
FPD-Link IV Deserializer CSI2-RX Port 2	See Table 2-4	0x32	Texas Instruments DS90UB9702-Q1
Configuration EEPROM	See Table 2-4	0x52	Microchip Tech AT24C512C
Reserved	Reserved	0x18	Reserved

2.6.3 GPIO Map

The General Purpose IO (GPIO) can either be supported directly from processor's pin or via an external IO expander. This table list and describes the IO used on the module. For a detailed mapping of these IO to the various supported base EVM systems, please see the specific EVM User's Guide.

Table 2-6. Add-On Module IO Definition

IO Name	Function	Direction	Remarks
Reset	Reset for the J7EXPA01EVM Add-on module	Input	'0' - Device reset '1' - Normal operation
	CSI-RX Port 0 interrupt	Output	'0' - Active interrupt request '1' - No interrupt request
INTn_Port1	CSI-RX Port 1 interrupt	Output	'0' - Active interrupt request '1' - No interrupt request
INTn_Port2	CSI-RX Port 2 interrupt	Output	'0' - Active interrupt request '1' - No interrupt request
Sync_Port0	Frame synchronization for CSI-RX Port 0	Bir-Dir	Optional, see UB9702 Programming Manual
Sync_Port1	Frame synchronization for CSI-RX Port 1	Bir-Dir	Optional, see UB9702 Programming Manual
Sync_Port2	Frame synchronization for CSI-RX Port 2	Bir-Dir	Optional, see UB9702 Programming Manual

2.6.4 Identification EEPROM

The add-on module includes and EEPROM device to store identification and revision information. The first bytes of the memory are preprogrammed and format of data is provided in the table below. The remaining bytes are available for data or code storage.

Table 2-7. Board ID Memory Header Information

Field Name	Offset / Size	Value	Comments
MAGIC	0000 / 4B	0xEE3355AA	Header identifier
M_TYPE	0004 / 1B	0x1	Fixed length and variable position board ID header
M_LENGTH	0005 / 2B	0xF7	Size of payload
B_TYPE	0007 / 1B	0x10	Payload type
B_LENGTH	0008 / 2B	0x2E	Offset to next header
B_NAME	000A / 16B	J7X-FUSION2-EXP	Name of board
DESIGN_REV	001A / 2B	E3	Revision number of the design
PROC_NBR	001C / 4B	0084	Design reference number
VARIANT	0020 / 2B	1	Design variant number
PCB_REV	0022 / 2B	E3	Revision number of the PCB
SCHBOM_REV	0024 / 2B	0	Revision number of the schematic
SWR_REV	0026 / 2B	1	First software release number
VENDORID	0028 / 2B	1	
BUILD_WK	002A /2B		Week number of production
BUILD_YR	002C / 2B		Year of production
BOARDID	002E / 6B	0	
SERIAL_NBR	0034 / 4B		Incrementing board number
RESERVED	0038 / 197B		Reserved information
END_LIST	00FD / 1B	0xFE	End marker

3 Hardware Design Files

The hardware design files are combined into a single package and available for download at Design Files. The package file can contain multiple board revisions (directories). The naming convention is as follows for PROC*xyz*E*wq*_RP where:

- PROC: Indicates TI's Processor Product.

- *xyz*: Unique ID for this Evaluation Board (example is '082' for this design).

- E: E indicates Pre-Production, blank for Production.

- *wq*: Indicates Revision (*w* - Major, blank/*q* - Minor)

- _RP: Release Package Notation

Example (oldest to latest revision):

PROC082E1A: Pre-Production, version '1A'.

PROC082E3: Pre-Production, version '3'.

PROC082A: Production Version 'A'.

See schematic history/change log for complete list of changes for each version.

3.1 Schematics

The schematics are available in both design format, Cadence Allegro, (*_SCH.DSN) and PDF (*_SCH.PDF). Both are included as part of the design package and available at design files.

3.2 PCB Layouts

The PCB design and manufacturing information is available in several different file formats. The table below lists he PCB files that included in the design package, and is also available for download at design files.

Table 3-1. PCB Design and Manufacturing Files

| File Type (Extension)	Description
Design file (*_BRD.ZIP)	Allegro PCB design file/zip
Design file (*_ODBGRB.ZIP)	Design file exported to ODB++/Zip
Design file extract (ALG)	For import into other design tools
Fabrication drawing (*_FAB.PDF)	Fabrication info in viewable format
Manufacturing file (_274XGBR.ZIP)	Gerber data, RS-274/ZIP
Manufacturing file (*_STL.ZIP)	Gerber data, STL/Zip
Manufacturing file (*_BRD.IPC)	IPC-D 465 Gerber data supplement
Layers drawing (*_LAYERS.PDF)	Viewable images of each PCB Layer
Stack-up (*_STACKUP.PDF)	PCB Stack-up from PCB manufacturer

3.3 Bill of Materials (BOM)

The Bill Of Materials (BOM) is available in spreadsheet format (Microsoft Excel, *_BOM.XLSX) and is included as part of the design package download at Design Files.

4 Compliance Information

4.1 Thermal Compliance

There is opportunity for elevated heat on and near the processor or other ICs, use caution particularly at elevated ambient temperatures!

Although the devices are not burn hazards, caution must be used when handling the EVM due to increased heat in the processor area.

⚠️	**Caution**	Hot surface. Contact can cause burns. Do not touch.
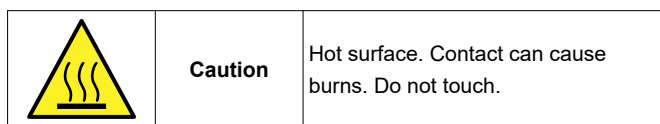
4.2 EMC, EMI, and ESD Compliance

Components installed on the product are sensitive to Electrostatic Discharge (ESD). TI recommends this product be used in an ESD controlled environment. This can include a temperature and/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.

The product is used in the basic electromagnetic environment as in laboratory condition and the applied standard is as per ENC IEC 61326-1:2021.

5 Additional Information

5.1 Known Hardware or Software Issues

There are no known issues with the EVM.

5.2 Trademarks

All trademarks are the property of their respective owners.

6 Related Documentation

UB9702 Programming Manual: contact your TI representative to access this document.

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 DEGREDATION 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/lsds/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２４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/lsds/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, INDEMITY 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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