

AMC1303, AMC1306, and AMC1336 Evaluation Module

This user's guide describes the characteristics, operation, and use of the AMC13xxEVM (AMC1303EVM, AMC1306EVM, and AMC1336EVM). A complete circuit description as well as schematic diagram and bill of materials are included.

The following related documents are available through the Texas Instruments web site at www.ti.com.

Table 1. Related Documentation

Device	Description
AMC1303	Small, High-Precision, Reinforced Isolated Modulator with Internal Clock
AMC1306	AMC1306x Small-Size, Reinforced Isolated Delta-Sigma Modulators
AMC1336	AMC1306x Small-Size, Reinforced Isolated Delta-Sigma Modulators

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1 EVM Overview

1.1 Features

This EVM supports the following features:

- Full-featured evaluation board for the AMC1303, AMC1306, or AMC1336 single-channel delta-sigma modulator
- Configurable AVDD and DVDD power supplies
- Screw terminals for easy access to analog inputs and outputs

1.2 Introduction

The AMC1303, AMC1306, and AMC1336 devices are 1-bit modulators with an output buffer separated from the input interface circuitry by a silicon dioxide (SiO₂) isolation barrier. The isolation barrier provides galvanic isolation of up to 8000 V_{PEAK}. When used in combination with the AMC1210 or other digital filter, the AMC1303, AMC1306, and AMC1336 can be used to achieve 16-bit analog-to-digital (A/D) conversion with no missing codes.

For use in high-resolution measurement applications, an effective accuracy of 14-bits can be obtained with a digital filter bandwidth of 20 kHz at a modulator rate of 10 MHz.

Throughout this document, the abbreviation *EVM* and the term *evaluation module* are synonymous with the AMC1303EVM, AMC1306EVM, or the AMC1336EVM.

2 Analog Interface

The analog input to the AMC13xxEVM is routed from a two-wire screw terminal screw at J1. This screw terminal gives the user access to the inverting and non-inverting inputs of the AMC1303, AMC1306, or AMC1336 depending on which device is installed on the board.

2.1 Analog Inputs

The analog input to the AMC13xxEVM board is comprised of direct connection to AINP and AINN through 0-Ω resistors R1 and R2. If filtering is required, R/C filter circuit options are possible using the footprints for C4, C5 and C8. The input circuit for the AMC13xxEVM is illustrated in [Figure 1](#).

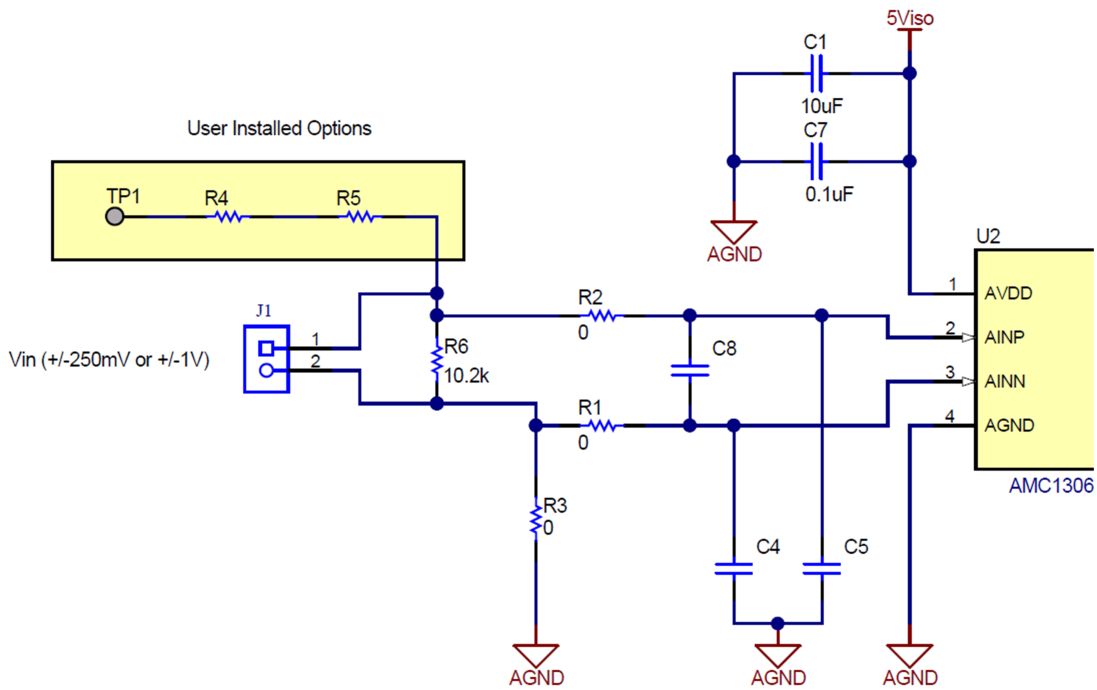


Figure 1. AMC13xxEVM Schematic: Analog Input Section

3 Digital Interface

The AMC13xxEVM digital input/output is a simple three terminal screw connector located at J4. J4 pin 1 is the output data from the modulator installed in location U2. For the AMC1306 and AMC1336, pin 7 is the modulator clock input as shown below. A 5 MHz to 20 MHz modulator clock can be applied to J4.2 referenced to J4.3. For the AMC1303, pin 7 is the modulator clock output which can be monitored at J4.2 relative to J4.3.

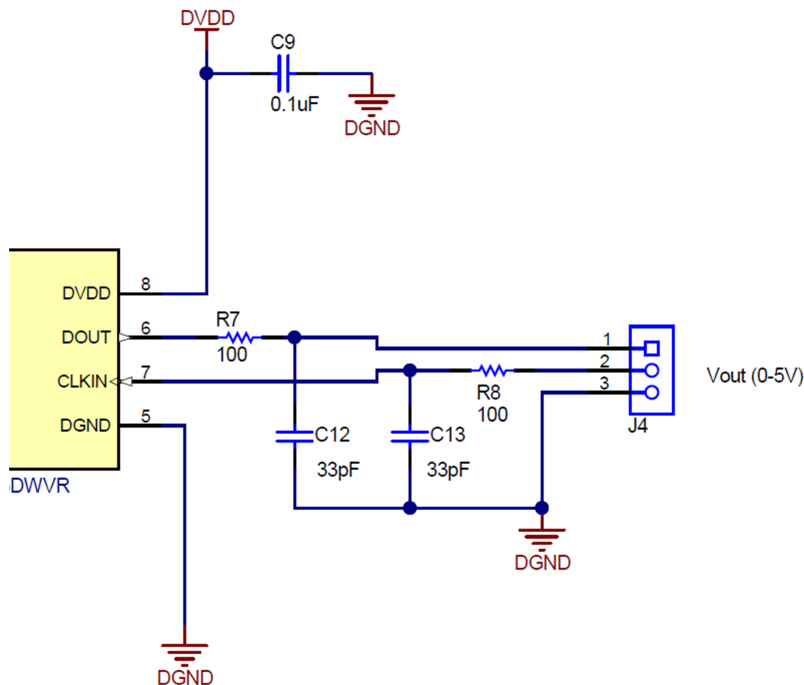


Figure 2. Digital I/O

The screw terminal at J3 allows the user to provide the DVDD source. The DVDD supply should be between 3 and 5.5 V_{DC}.

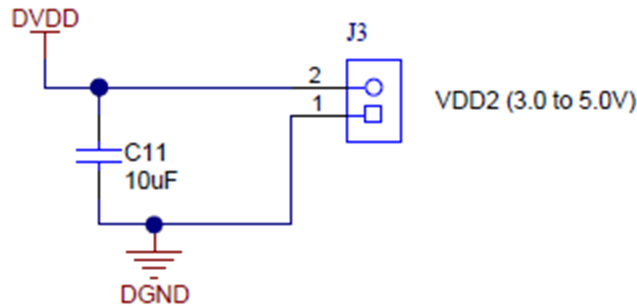


Figure 4. DVDD Input

4.2 Isolated Power and Analog Inputs: J1 and J2

The isolated power input to the AMC13xxEVM printed circuit board (PCB) can be applied directly to J2 pins 1 and 2.

Table 2 lists the details of J2.

Table 2. J2: Analog Inputs

Pin Number	Signal	Description
J2.1	AGND	Connection to the AMC1303, AMC1306, or AMC1336 AGND terminal (pin 4)
J2.2	AVDD	Connection to the AMC1303, AMC1306, or AMC1336 AVDD terminal (pin 1)

The analog input to the AMC13xxEVM printed circuit board (PCB) can be applied directly to J1 pins 1 and 2.

CAUTION

Carefully review the AMC1303, AMC1306, and AMC1336 product data sheets for the limitations of the analog input range, and ensure that the appropriate analog/digital voltages are applied prior to connecting any analog input to the EVM. The EVM uses the ± 250 mV versions of the devices for the AMC1303 and AMC1306. The EVM uses ± 1 V for the AMC1336.

Table 3 lists the details of J1.

Table 3. J1: Analog Inputs

Pin Number	Signal	Description
J1.1	AINP	Noninverting analog input to the AMC1303, AMC1306, or AMC1336
J1.2	AINN	Inverting input to the AMC1303, AMC1306, or AMC1336

4.3 Device Operation

Once the analog and isolated power is applied to the AMC13xxEVM, the digital outputs become active. If the AMC1303 is installed at location U2, the device uses its own internal modulator clock. Screw terminal J4 has the connections as shown in [Table 4](#).

Table 4. J4: AMC1303EVM Digital Output

Pin Number	Signal	Description
J4.1	DOUT	AMC1303 bit stream data output
J4.2	CLOCK	AMC1303 modulator clock output
J4.3	DGND	Digital ground reference

If the AMC1306 is installed at location U2, the device requires an external modulator clock between 5 and 20 MHz. Screw terminal J4 has the connections as shown in [Table 5](#).

Table 5. J4: AMC1306EVM, AMC1336EVM Digital Output

Pin Number	Signal	Description
J4.1	DOUT	AMC1306, AMC1336 bit stream data output
J4.2	CLOCK	AMC1306, AMC1336 modulator clock input
J4.3	DGND	Digital ground reference

An analog input signal may be applied directly at screw terminal J1. Refer to [Figure 1](#) and [Table 3](#) for details. The linear analog input range, $(V_{IN+}) - (V_{IN-})$, is ± 250 mV for the AMC1303 and AMC1306. The linear analog input range, $(V_{IN+}) - (V_{IN-})$, is ± 1 V for the AMC1336.

For the AMC1303 and AMC1306, as the input voltage approaches the maximum input level of +250 mV, the 1s density of the modulator output will approach 92%. Likewise, when the input voltage approaches the lower limit of -250 mV the 1s density will be approximately 8%.

For the AMC1336, as the input voltage approaches the maximum input level of +1 V, the 1s density of the modulator output approaches 92%. Likewise, when the input voltage approaches the lower limit of -1 V the 1s density is approximately 8%.

5 Layout, BOM, and Schematic

This section contains the complete bill of materials, schematic diagram and printed circuit board (PCB) layout of the AMC1303/06EVM.

NOTE: Board layouts are not to scale. These are intended to show how the board is laid out; they are not intended to be used for manufacturing AMC13xxEVM PCBs.

5.1 Printed Circuit Board Layout

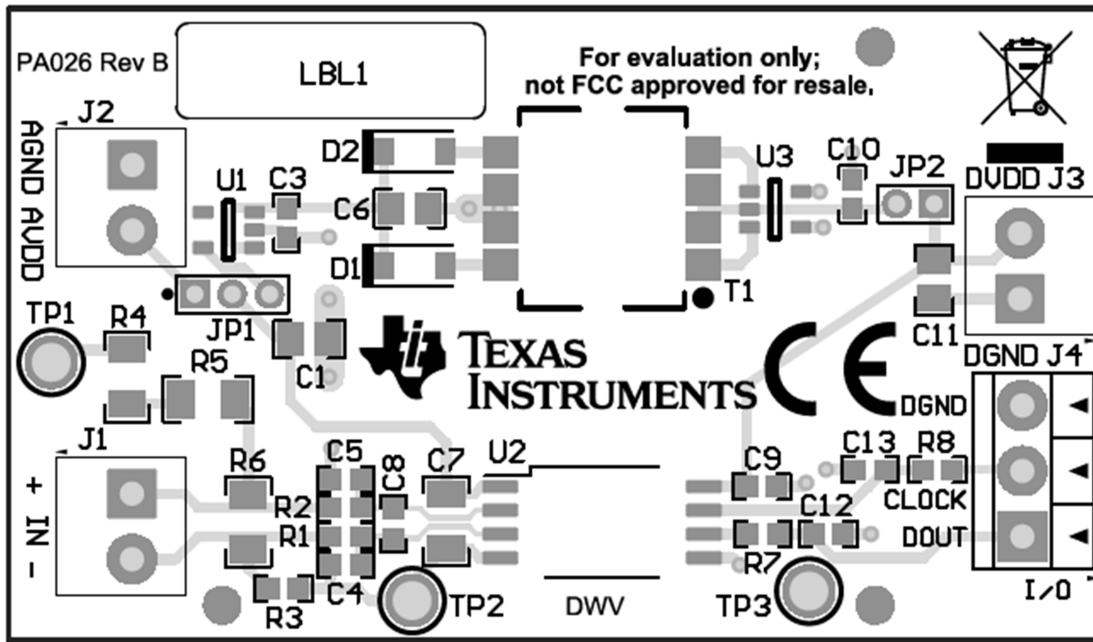


Figure 5. AMC13xxEVM Silkscreen Drawing

5.2 Bill of Material

Table 6. AMC13xxEVM Bill of Materials

Designators	Description	Manufacturer	Mfg. Part Number
C1, C6, C11	CAP, CERM, 10 uF, 10 V, +/- 10%, X5R, 0805	Kemet	C0805C106K8PACTU
C3, C9	CAP, CERM, 0.1 uF, 25 V, +/- 10%, X7R, 0603	AVX	06033C104KAT2A
C7	CAP, CERM, 0.1 uF, 50 V, +/- 10%, X7R, 1206	Yageo America	CC1206KRX7R9BB104
C10	CAP, CERM, 1 uF, 10 V, +/- 10%, X5R, 0603	Kemet	C0603C105K8PACTU
C12, C13	CAP, CERM, 33 pF, 50 V, +/- 5%, C0G/NP0, AEC-Q200 Grade 0, 0603	TDK	CGA3E2NP01H330J080AA
D1, D2	Diode, Schottky, 20 V, 0.5 A, SOD-123	ON Semiconductor	MBR0520LT1G
J1, J2, J3	Terminal Block, 3.5mm Pitch, 2x1, TH	On-Shore Technology	ED555/2DS
J4	Terminal Block, 3.5mm Pitch, 3x1, TH	On-Shore Technology	ED555/3DS
JP1	Header, 2mm, 3x1, Tin, TH	Samtec	TMM-103-01-T-S
JP2	Header, 2mm, 2x1, Tin, TH	Samtec	TMM-102-01-T-S
LBL1	Thermal Transfer Printable Labels, 0.650" W x 0.200" H - 10,000 per roll	Brady	THT-14-423-10
R1, R2, R3	RES, 0, 5%, 0.1 W, AEC-Q200 Grade 0, 0603	Panasonic	ERJ-3GEY0R00V
R7, R8	RES, 100, 5%, 0.1 W, AEC-Q200 Grade 0, 0603	Vishay-Dale	CRCW0603100RJNEA
SH-J1, SH-J2	Shunt, 2mm, Gold plated, Black	Samtec	2SN-BK-G
T1	Transformer, 45.6 uH SMT	Coilcraft	DA2303-ALB
TP2, TP3	Terminal, Turret, TH, Double	Keystone	1573-2
U1	Single Output LDO, 150 mA, Fixed 5 V Output, 2.7 to 10 V Input, with Low IQ, 5-pin SOT-23 (DBV), -40 to 125 degC, Green (RoHS & no Sb/Br)	Texas Instruments	TPS76350DBVR
U2	Small Reinforced Isolated Modulator With +/-250mV Input and CMOS Interface, DWV0008A (SOIC-8)	Texas Instruments	AMC1306M25DWVR or AMC1303M2510DWVR AMC1336MDWVR
U3	Low-Noise 350 mA, 410 kHz Transformer Driver, DBV0005A (SOT-23-5)	Texas Instruments	SN6501DBVR
TP1	Terminal, Turret, TH, Double	Not Installed	
R4, R5, R6	RES, 10.2 k, 1%, 0.25 W, 1206	Not Installed	
C4, C5, C8	CAP, CERM, 10 pF, 50 V, +/- 5%, C0G/NP0, 0603	Not Installed	

5.3 Schematic

Figure 6 illustrates the AMC1306EVM schematic.

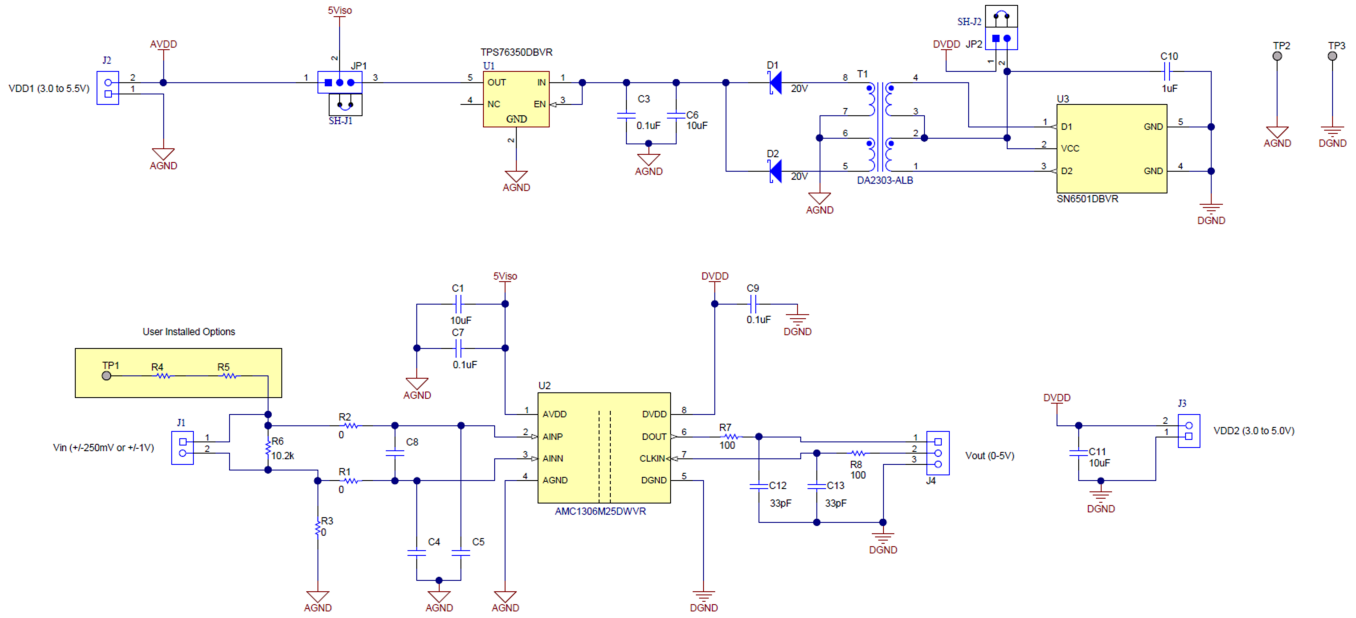


Figure 6. AMC1306EVM Schematic

5.4 Trademarks

All trademarks are the property of their respective owners.

Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from Original (January 2017) to A Revision	Page
• Added AMC1336EVM to document.....	1
• Changed VDD1 to AVDD and VDD2 to DVDD in <i>Power Supplies</i> section.....	4
• Changed <i>Signal</i> column in J2: <i>Analog Inputs</i> table.....	5
• Changed clock output to clock input in CLOCK row of J4: <i>AMC1306EVM, AMC1336EVM Digital Output</i> table	6
• Changed <i>AMC13xxEVM Bill of Materials</i> table.....	8

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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

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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.

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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
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-
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8. *Limitations on Damages and Liability:*

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

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

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

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

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