CAN EVM User Guide

This User Guide details the CAN EVM (Controller Area Network Evaluation Module) transceiver operation. It comes with the SN65HVD255 CAN transceiver factory installed. The CAN EVM may be user-reconfigured for use with the all TI CAN transceiver families: SN65HVD23x, SN65HVD25x, SN65HVD10x0 and SN65HVDA54x by replacing the transceiver and setting jumpers on the EVM as outlined in this document. This User Guide explains the EVM configurations for basic CAN evaluation, various load and termination settings.

Topic **Page**

1 Introduction 2
2 2 EVM Setup and Operation 5
3 CAN EVM Configuration for SN65HVD255 (Factory Installed) 9

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1 Introduction

1.1 Overview

Texas Instruments offers a broad portfolio of High Speed (HS) CAN transceivers compatible with the ISO11898-2 High Speed CAN standards. These include 5V V_{CC} only, 3.3V V_{CC} only, 5V V_{CC} with I/O level shifting and galvanic-isolated CAN transceivers. These CAN transceiver families include product mixes with varying features such as low power standby modes with and without wake up, silent modes, loop back and diagnostic modes.

The Texas Instruments CAN EVM helps designers evaluate the operation and performance of various TI CAN transceivers. It also provides PCB footprints for different bus termination, bus filtering and protection concepts. The CAN EVM is provided with the SN65HVD255 installed. It is easily configured by the customer for the SN65HVD23x, SN65HVD25x, SN65HVD10x0 and SN65HVDA54x CAN transceiver families as needed by jumper settings, simple soldering tasks and replacement of standard components. A separate EVM is available for the galvanic-isolated CAN transceiver family.

1.2 CAN EVM

The CAN EVM has simple connections to all necessary pins of the CAN transceiver device, and jumpers where necessary to provide flexibility for device pin and CAN bus configuration. There are test points (loops) for all main points where probing is necessary for evaluation such as GND, V_{CC}, TXD, RXD, CANH, CANL, Pin 8 (mode pin), Pin 5 (various functions). The EVM supports many options for CAN bus configuration. It is pre-configured with two 120Ω resistors that may be connected on the bus via jumpers: a single resistor is used with the EVM as a terminated line end (CAN is defined for 120Ω impedance twisted pair cable) or both resistors in parallel for electrical measurements representing the 60Ω load the transceiver “sees” in a properly terminated network (i.e. 120Ω termination resistors at both ends of the cable). If the application requires “split” termination, TVS diodes for protection, or Common Mode (CM) Choke, the EVM has footprints available for this via customer installation of the desired component(s).

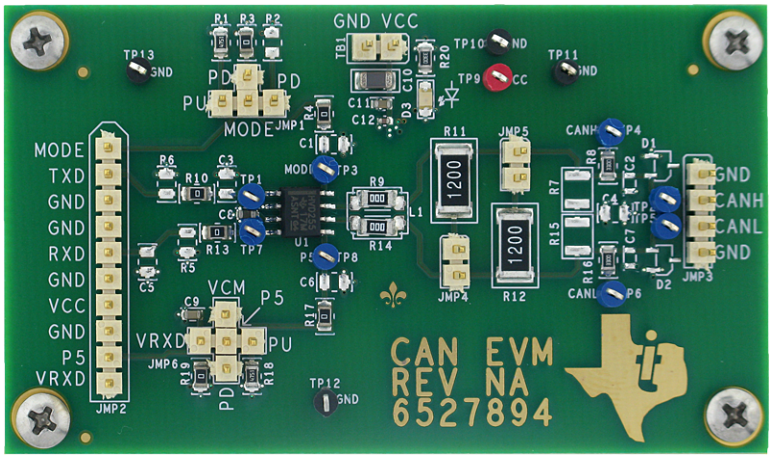


Figure 1. EVM PC Board

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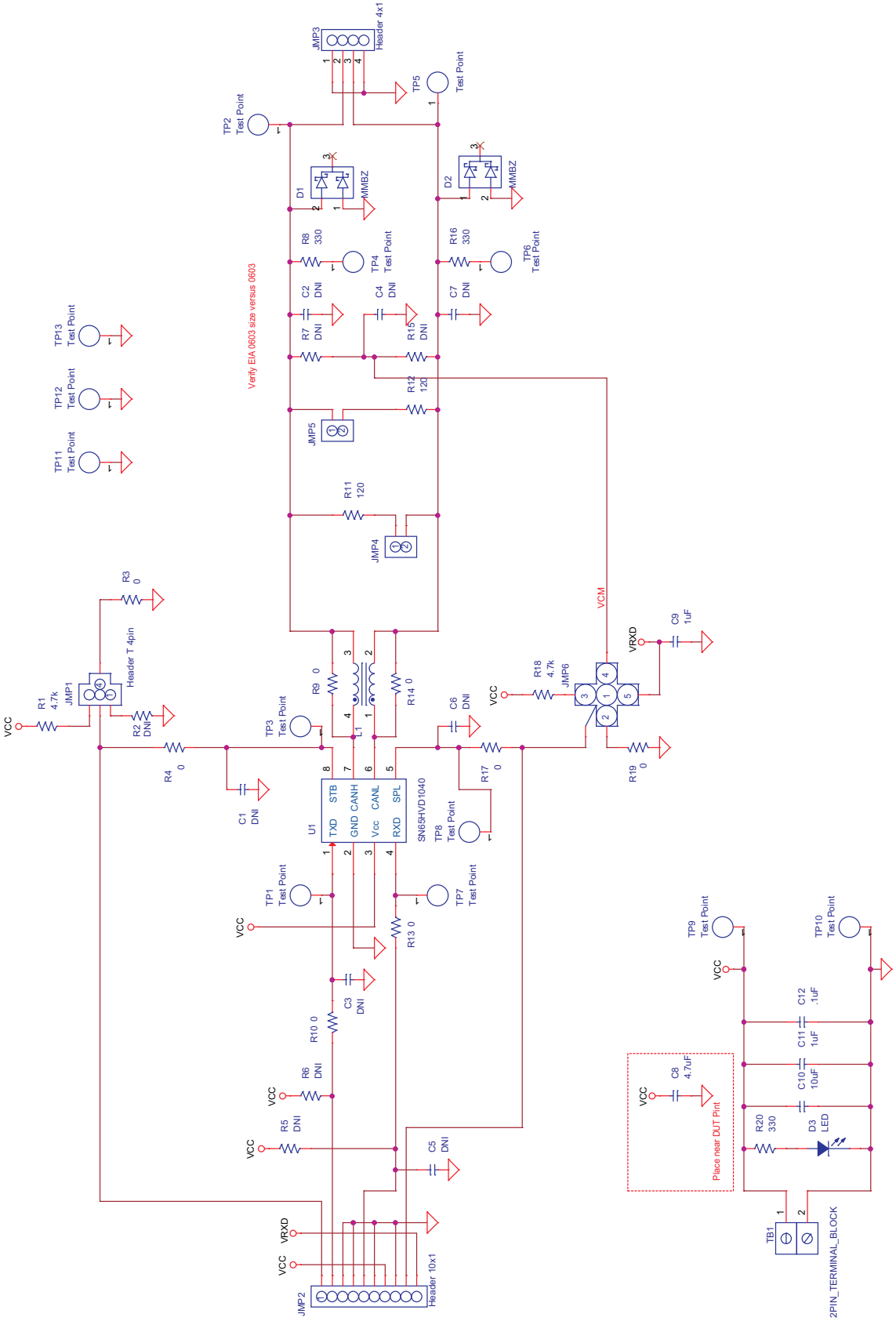


Figure 2. EVM Schematic

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Table 1.

Connection	Type	Description
JMP1	4 pin jumper	Used for mode selection on pin 8 (4.7kΩ pull up to V_{CC}, 0Ω pull down to GND, customer installable pull down for devices with slew rate control R_S pin).
JMP2	10 pin header	Connection for access to all critical digital I/O, supply and GND for driving the CAN transceiver externally with test equipment or interfaced to a processor EVM
JMP3	4 pin header	CAN bus connection (CANH, CANL) and GND
JMP4	2 pin jumper	Connect 120Ω CAN termination to the bus. Used separately for a single termination if EVM is at end of the CAN bus and termination isn't in the cable. Used in combination with JMP5 to get to second CAN termination to represent the combined 60Ω load for CAN transceiver parametric measurement.
JMP5	2 pin jumper	Connect 120Ω CAN termination to the bus. Used in combination with JMP4 to get to second CAN termination to represent the combined 60Ω load for CAN transceiver parametric measurement.
JMP6	5 pin jumper	Functional use of pin 5. Options for use are:A) 4.7kΩ pull up to V_{CC} for transceiver with digital input on pin 5B) 0Ω pull down to GND for transceiver with digital input on pin 5C) Active split termination: for CAN transceiver with V_{REF} or SPLIT pin where active split termination is desired. Connect to V_{CM} and populate the components R7/R15 and C4 as required for the system.D) V_{RXD} (V_{IO}) for CAN transceivers with a separate V_{RXD} (V_{IO}) for I/O level shifting.
TB1	2 pin jumper	V_{CC} supply and GND connection for the EVM
TP1	Test Point	TXD, Device Pin 1 test point
TP2		CANH (bus) test point
TP3		Device Pin 8 test point
TP4		CANH via 330Ω serial resistor test point
TP5		CANL (bus) test point
TP6		CANL via 330Ω serial resistor test point
TP7		RXD, Device Pin 4 test point
TP8		Device Pin 5 test point
TP9		V_{CC} test point
TP10		GND test point
TP11		
TP12		
TP13		

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2 2 EVM Setup and Operation

This section describes the setup and operation of the EVM for parameter performance evaluation.

2.1 Overview & Basic Operation Settings

2.1.1 V_{CC} Power Supply (TB1 or TP9 or JMP2)

The basic setup of the CAN EVM uses a single power supply required to evaluate standard 5V or 3.3V single supply transceiver devices performance. For single-supply transceivers, connect the 5V or 3.3V V_{CC} supply to the TB1 jumper header, or the V_{CC} and GND test-point loops. The power supplied should meet the required specification of V_{CC} for the transceiver being tested. LED D3 is used to indicate V_{CC} presence.

2.1.2 I/O Power Supply V_{RXD} or V_{IO} (JMP2, JMP6 or TP8)

For devices with I/O level shifting, a second supply pin for the I/O or RXD pin is on Pin 5 of the transceiver device. A second power supply is needed to test one of these devices and should be connected via JMP2, JMP6 or TP8. A local buffering and decoupling capacitor should be installed at C6 if the EVM is used for one of these devices.

2.1.3 Main Supply and I/O Header (JMP2)

All key I/O and supply GND functions are brought to this header. It may be used on either interface to test equipment or a short cable could be made to connect to either an existing customer application board or MCU/DSP EVM board for a processor with a CAN controller

Table 2.

Pin	Connection	Description
1	MODE	Pin 8 of Transceiver, normally used for Mode control. Examples: R_S, S, STB.
2	TXD	Pin 1 of Transceiver. TXD (Transmit Data)
3	GND	Pin 2 of Transceiver. GND.
4	GND	Pin 2 of Transceiver. GND.
5	RXD	Pin 4 of Transceiver. RXD (Receive Data)
6	GND	Pin 2 of Transceiver. GND.
7	V_{CC}	Pin 3 of Transceiver. V_{CC}
8	GND	Pin 2 of Transceiver. GND.
9	P5	Pin 5 of Transceiver, various functions depending on transceiver. Examples: V_{REF}, SPLIT, V_{RXD}, V_{IO}, LBK, EN, AB and No Connect (NC).
10	V_{RXD}	Connects to Jumper JMP6 V_{RXD} header to allow flexibility in using device with power supply for I/O on Pin 5 of transceiver.

This header is arranged to provide a separate grounds for each signal pair (TXD/GND and RXD/GND). If the EVM is being used with lab equipment, separate cables can be connected to these main points via simple 2 pin header connectors.If the board is being connected to a processor based system, a single cable with all power & signals can be connected via a 10 pin header cable to this port.

2.1.4 TXD Input (JMP2 or TP1)

The TXD (pin 1) of the transceiver, transmit data is routed to JMP2 and TP1. The signal path to the JMP2 header is pre-installed with a 0Ω series resistor, R10.

2.1.5 RXD Output (JMP2 or TP7)

The RXD (pin 4) of the transceiver, receive data is routed to JMP2 and TP7. The signal path to the JMP2 header is pre-installed with a 0Ω series resistor, R13.

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2.1.6 MODE Select/ Pin 8 (JMP1, JMP2 or TP3)

Pin 8 of the transceiver is normally a mode control pin of the device. Pin 8 of the device is routed to JMP1, JMP2 and TP7.

2.1.7 MODE - JMP1 configurations (3 way jumper)

If using separate I/O inputs JMP1 will be used to configure pin 8 to a pull up to V_{CC} or pull down to GND configuration. For most devices when Pin 8 is pulled to GND the device will be in “normal” or high speed mode. R3 is pre-installed with 0Ω resistor to GND for this purpose. For most devices when Pin 8 is pulled to V_{CC} the device will be in a silent or low power standby mode. Devices with slope control mode use the resistance to ground value to determine the slope of the driver output. R2 is left open for customers who want to install a resistance to ground and use slope mode.

2.1.8 JMP2 configuration

Using header JMP2 which assumes all the digital I/O signals, V_{CC}, GND are routed to an external system. Ensure that the MODE (JMP1) jumper settings are not conflicting with signals to JMP2.

2.1.9 TP3 configuration

This connects directly to device pin 8. Ensure JMP1 configuration isn’t conflicting if TP3 is used as the input connection.

2.1.10 Pin 5 (JMP6, JMP2 or TP8)

Pin 5 of the transceiver have various uses depending on the transceiver. Examples are V_{REF}, SPLIT, V_{RXD}, V_{IO}, LBK, EN, AB and No Connect (NC). Pin 5 of the device is routed to JMP6, JMP2 and TP8.

2.1.11 Pin 5 – JMP6 configurations (4 way jumper)

If using separate I/O inputs JMP6 will be used to configure pin 5 to: pull up to V_{CC}, pull down to GND, V_{RXD} / V_{IO} supply input or V_{REF}/SPLIT termination output.

- **V_{REF}/SPLIT termination:** If the device & application support split termination then JMP6 should be set to V_{CM} (V Common Mode) to drive the V_{REF}/SPLIT pin common mode stabilizing voltage output to the center tap of the split termination capacitor. These components will need to be installed on the EVM as outlined in the CAN bus termination section.
- **No Connection:** If the device & application require no use of pin 5 then it may be left open. If the device has V_{REF} or SPLIT pin but the application isn’t using the pin for split termination then a capacitor may be added on C6 to improve EMC performance.
- **2nd Mode / Control Input:** if the device & application use pin 5 as a second mode or control pin then JMP6 should be set to as either a pull up to V_{CC} or pull down to GND as necessary.
- **I/O** & **RXD level shifting supply:** if the device & application use with V_{IO} or V_{RXD} to level shift I/O pins on the transceiver then JMP6 may be set to V_{RXD} which connects pin 5 of the device to V_{RXD} pin on JMP2. Local buffering and bypass capacitor C6 should be installed.

2.1.12 JMP2 configuration

Using header JMP2 assumes all the digital I/O signals, V_{CC}, GND are routed to an external system. Ensure that Pin 5 (JMP6) jumper settings are not conflicting with signals to JMP2. For power supply V_{RXD} the jumper needs to be set to route JMP2 supply input to the transceiver pin.

2.1.13 TP8 configuration

This connects directly to device pin 5. Ensure JMP6 configuration isn’t conflicting if TP8 is used as an input connection.

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2.2 Using CAN Bus Load, Termination and Protection Configurations

The CAN EVM is populated with two 120Ω power resistors selectable via jumpers between CANH and CANL. By using one, the EVM may be used as a terminated end of a bus. For electrical measurements to represent the total loading of the bus, use both 120Ω resistors in parallel to give the standard 60Ω load for parametric measurement. The EVM also has footprints is split termination is needed for the application. The table below summarizes how to use these termination options. If split termination is used, care must be taken to match the resistors. The common mode filter frequency may be calculated by: $f_C = 1/(2\pi RC)$. Normally, the split capacitance is in the range of 4.7nF to 100nF. Keep in mind this is the common mode filter frequency, not a differential filter that will impact the differential CAN signal directly.

Table 3. Bus Termination Configuration

Termination Configuration	120Ω Resistors		Split Termination Footprints		Split Termination Footprints
	JMP4	JMP5	R7	R15	C4
Standard Termination (120Ω)	shorted	open	N/A	N/A	N/A
60Ω load - Electrical Parameterics	shorted	shorted			
Split Termination (Common Mode Stabilization)	open	open	60Ω	60Ω	populated

The EVM also has footprints for various protection schemes to enhance robustness for extreme system level EMC requirements. The table below summarizes these options.

Table 4. Protection and Filtering Configuration

Configuration	Footprint Reference	Use Case	Population & Description
Series Resistors or Common Mode Choke	R9 / R14 or L1 (common footprint)	Direct CAN transceiver to bus connection	R9 and R14 populated with 0Ω (default population)
		Series resistance protection CAN transceiver to bus connection	R9 and R14 populated with MELF resistor as necessary for harsh EMC environment
		CM choke (bus filter)	L1 populated with CM choke to filter noise as necessary for harsh EMC environment
Bus Filtering Caps Transient Protection	C2 / C7	Bus filter	Filter noise as necessary for harsh EMC environment. Filter caps may be used in combination with L1 CM choke.
	C2 / C7 or D1 / D2	Transient & ESD Protection	To add extra protection for system level transients and ESD protection TVS diode population option via D1/D2 footprint or varistor population via C2 / C7 footprint.

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2.3 Using Customer Installable I/O options for Current Limiting, Pullup/Pulldown, Noise Filtering

The CAN EVM has footprints on the PCB for the installation of various filtering and protection options to adapt the EVM to match CAN network topology requirements if the EVM is being used as a CAN node.

Each digital input or output pin has footprints to allow for series current limiting resistors (default populated with 0Ω), pull up or down resistors depending on pin use and a capacitor to GND which configured with the serial resistor allows for RC filters (noisy environments). The table below lists these features for each of the digital input and output pins of the EVM. Replace or populate the RC components as necessary for the application.

Table 5. RC Filter / Protection Lists

Device Pin			Jumperable		Series R	Pull Up/Down	C to GND	Description
No.	Description	Type	Pull Up	Pull Down				
1	TXD	Input	N/A	N/A	R10	R6 PU	C3	
2	RXD	Output	N/A	N/A	R13	R5 PU	C5	
5	NC	No Connect	N/A	N/A	N/A	N/A	N/A	
	V_{REF}/SPLIT	Output	N/A	N/A	R17	N/A	C4 / C6	Split termination: JMP6 to route output to split termination center point capacitor C4. EMC for systems not using split termination: C6 to GND.
	V_{RXD}/V_{IO}	Supply Input	N/A	N/A	R17	N/A	C9 / C6	Use TM6, JMP6 & JMP2 as necessary to provide supply input.
	AB / EN / LBK	Input	R18 (JMP6)	R19 (JMP6)	R17	N/A	C6	
8	S, R_S, STB	Input	R1 (JMP1)	R2 / R3 (JMP1)	R4	N/A	C1	R2 pull down to GND (JMP1) user installable for use with slope mode on devices with R_S pin.
	NC	No Connect	N/A	N/A	N/A	N/A	N/A	

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3 CAN EVM Configuration for SN65HVD255 (Factory Installed)

The SN65HVD255 meets ISO1189-2 High Speed CAN (Controller Area Network) Physical Layer standard (transceiver). It is designed as a next generation CAN for the ‘251 & ‘1050 pinout. It has very fast loop times with a wide range of bus loading allowing for data rates up to 1 megabit per second (Mbps) in long and highly loaded networks and higher data rates in small networks. The device includes many protection features providing device and CAN network robustness. The device has two modes: normal mode and silent mode selected on pin 8.

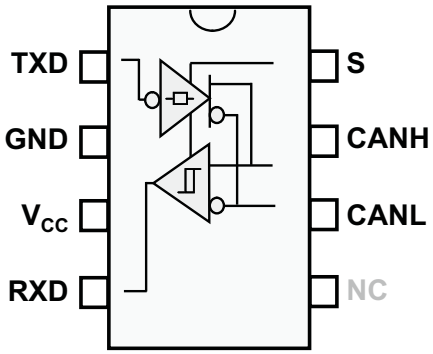


Figure 3. SN65HVD255 Basic Block Diagram & Pin Out

Table 6. EVM Connection Settings for SN65HVD255

Connection	Description
JMP1	Mode selection: Pull up to V_{CC} for Silent Mode, Pull down to GND for normal mode
JMP2	Connection for access to all critical digital I/O, supply and GND if being externally driven by test equipment or interfaced to a processor EVM. Note: ensure that JMP1, JMP6 & TB1 settings don't conflict with JMP2 if it is used.
JMP3	CAN bus connection (CANH, CANL) and GND as necessary if interfacing EVM to a CAN network
JMP4	Connect if necessary for a single CAN network termination
JMP5	Connect if necessary for in parallel with JMP4 to get a 60Ω load to measure CAN parametrics
JMP6	N/A: SN65HVD255 is no connect on pin 5 of the transceiver

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EVM Warnings and Restrictions

It is important to operate this EVM within the input voltage range of (specified in SN65HVD25x data sheet) and the output voltage range of (specified in SN65HVD25x data sheet) .

Exceeding the specified input range may cause unexpected operation and/or irreversible damage to the EVM. If there are questions concerning the input range, please contact a TI field representative prior to connecting the input power.

Applying loads outside of the specified output range may result in unintended operation and/or possible permanent damage to the EVM. Please consult the EVM User's 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, some circuit components may have case temperatures greater than 125° C. The EVM is designed to operate properly with certain components above 125° C as long as the input and output ranges are maintained. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors. These types of devices can be identified using the EVM schematic located in the EVM User's Guide. When placing measurement probes near these devices during operation, please be aware that these devices may be very warm to the touch.

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General Statement for EVMs including a radio

User Power/Frequency Use Obligations: This radio is intended for development/professional use only in legally allocated frequency and power limits. Any use of radio frequencies and/or power availability of this EVM and its development application(s) must comply with local laws governing radio spectrum allocation and power limits for this evaluation module. It is the user's sole responsibility to only operate this radio in legally acceptable frequency space and within legally mandated power limitations. Any exceptions to this are strictly prohibited and unauthorized by Texas Instruments unless user has obtained appropriate experimental/development licenses from local regulatory authorities, which is responsibility of user including its acceptable authorization.

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

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

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.

For EVMs annotated as IC – INDUSTRY CANADA Compliant

This Class A or B digital apparatus complies with Canadian ICES-003.

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

Concerning EVMs including radio transmitters

This device complies with Industry Canada licence-exempt RSS standard(s). 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.

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.

Cet appareil numérique de la classe A ou B est conforme à la norme NMB-003 du Canada.

Les changements ou les modifications pas expressément approuvés par la partie responsable de la conformité ont pu vider l'autorité de l'utilisateur pour actionner l'équipement.

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.

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.

【Important Notice for Users of this Product in Japan】

This development kit is NOT certified as Confirming to Technical Regulations of Radio Law of Japan

If you use this product in Japan, you are required by Radio Law of Japan to follow the instructions below with respect to this product:

1. Use this product 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 this product only after you obtained the license of Test Radio Station as provided in Radio Law of Japan with respect to this product, or
3. Use of this product only after you obtained the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to this product. Also, please do not transfer this product, unless you give the same notice above to the transferee. Please note that if you could not follow the instructions above, you will be subject to penalties of Radio Law of Japan.

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EVALUATION BOARD/KIT/MODULE (EVM)
WARNINGS, RESTRICTIONS AND DISCLAIMERS

For Feasibility Evaluation Only, in Laboratory/Development Environments. Unless otherwise indicated, this EVM is not a finished electrical equipment and not intended for consumer use. It is intended solely for use for preliminary feasibility evaluation in laboratory/development environments by technically qualified electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems and subsystems. It should not be used as all or part of a finished end product.

Your Sole Responsibility and Risk. You acknowledge, represent and agree that:

1. You have unique knowledge concerning Federal, State and local regulatory requirements (including but not limited to Food and Drug Administration regulations, if applicable) which relate to your products and which relate to your use (and/or that of your employees, affiliates, contractors or designees) of the EVM for evaluation, testing and other purposes.
2. You have full and exclusive responsibility to assure the safety and compliance of your products with all such laws and other applicable regulatory requirements, and also to assure the safety of any activities to be conducted by you and/or your employees, affiliates, contractors or designees, using the EVM. Further, you are responsible to assure 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.
3. You will employ reasonable safeguards to ensure that your use of the EVM will not result in any property damage, injury or death, even if the EVM should fail to perform as described or expected.
4. You will take care of proper disposal and recycling of the EVM's electronic components and packing materials.

Certain Instructions. It is important to operate this EVM within TI's recommended specifications and environmental considerations per the user guidelines. Exceeding the specified EVM ratings (including but not limited to input and output voltage, current, power, and environmental ranges) may cause property damage, personal injury or death. If there are questions concerning these ratings please 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 result in unintended and/or inaccurate operation and/or possible permanent damage to the EVM and/or interface electronics. Please consult the EVM User's 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, some circuit components may have case temperatures greater than 60°C as long as the input and output are maintained at a normal ambient operating temperature. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors which can be identified using the EVM schematic located in the EVM User's Guide. When placing measurement probes near these devices during normal operation, please be aware that these devices may be very warm to the touch. As with all electronic evaluation tools, only qualified personnel knowledgeable in electronic measurement and diagnostics normally found in development environments should use these EVMs.

Agreement to Defend, Indemnify and Hold Harmless. You agree to 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 use of the EVM that is not in accordance with the terms of the agreement. This obligation shall apply whether Claims arise under law of tort or contract or any other legal theory, and even if the EVM fails to perform as described or expected.

Safety-Critical or Life-Critical Applications. If you intend to evaluate the components for possible use in safety critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, such as devices which are classified as FDA Class III or similar classification, then you must specifically notify TI of such intent and enter into a separate Assurance and Indemnity Agreement.

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