EVM User's Guide: TMUX10DGSEVM

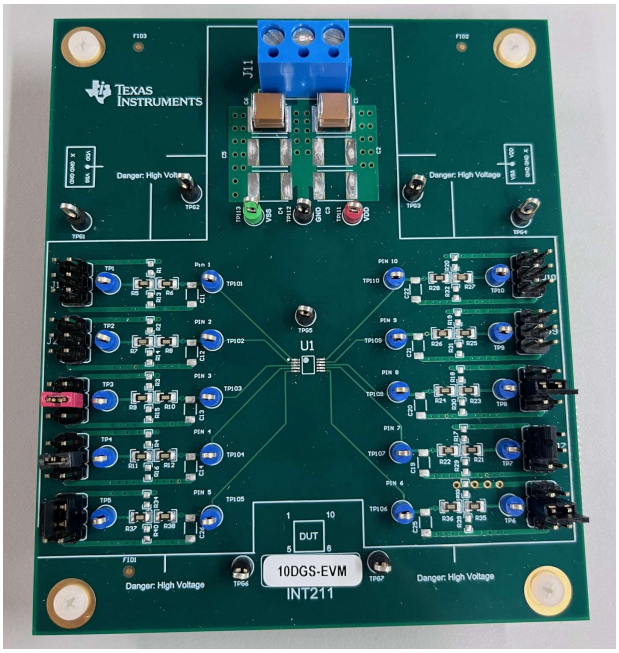
TMUX10DGS Evaluation Module

Description

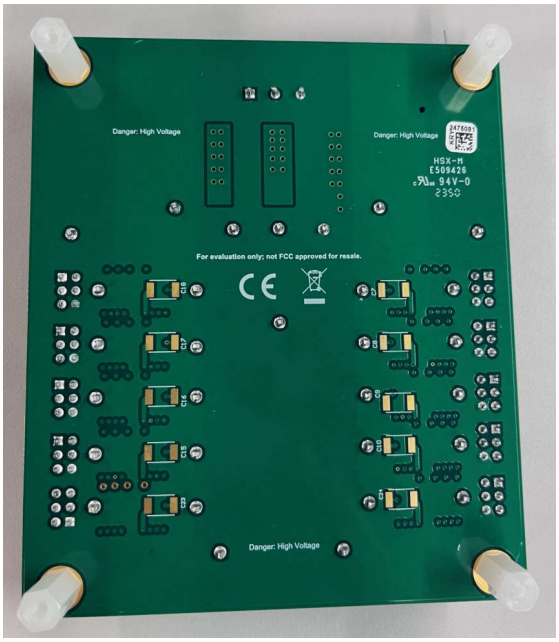
The TMUX10DGSEVM is used to evaluate the performance of the 10 pin DGS package. The evaluation module (EVM) comes with a pad to allow 10 pin DGS devices to be soldered on. Additionally, test points on board are provided to allow for the flexibility to test for various signals.

Features

- One power supply decoupling capacitor from VDD to ground (3.3µF, 6mm × 5mm)
- Two additional power supply decoupling capacitor pads from VDD to ground (6mm × 5mm)
- One power supply decoupling capacitor from VSS to ground (3.3µF, 6mm × 5mm)
- Two additional power supply decoupling capacitor pads from VSS to ground (6mm × 5mm)
- Pads available near VDD and VSS input for TVS Diodes (L × W: 8.13mm × 6.22mm)
- One pad for switches and multiplexers in the 10-pin DGS package
- 10 generic 6-pin headers for power, analog or digital signals being switched, and control signals
- All 10 generic signal pathways have 2 0805 size 0Ω resistors installed between IC pad and header
- All 10 generic signal pathways have 0603 sized pads to add a pull-up, pull-down, or resistive load to the signal pathway
- All 10 generic signal pathways contain an 1812 sized pad to add a capacitive load to the signal pathway
- All 10 generic signal pathways contain a 1206 sized pad to add a capacitive load to the signal pathway
- One common 3-port terminal block for GND, VDD, and VSS power signals



TMUX10DGSEVM (Front Side)



TMUX10DGSEVM (Back Side)

1 Evaluation Module Overview

1.1 Introduction

This user's guide describes the TMUX10DGSEVM evaluation module (EVM) and the intended use. This board allows for the quick prototyping and characterization of TI's multiplexers in a 10-Pin DGS package.

1.2 Kit Contents

The EVM kit includes the following:

1. TMUX10DGSEVM board

1.3 Specification

The TMUX10DGSEVM is used for quick prototyping of TI's Analog Switches and Multiplexers in 10 pin DGS packages. The EVM has two test points on each I/O for a total of twenty total test points to support testing of 10DGS packages. Five extra ground test points are provided to allow for easy testing of the board.

2 Hardware

2.1 Power Requirements

TMUX10DGSEVM requires a supply provided either through the J11 terminal, or directly hooked to the red VDD test point to provide a passive signal pathway between the Sx and Dx pins in according to the logic selected.

2.2 Setup

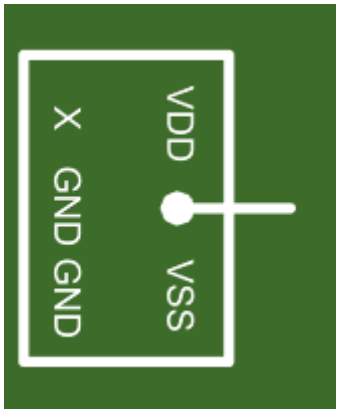
1. The default setup of the board has all 10 generic pathways grounded, with the IC set to single supply operation as the pad voltage is also set to ground.
2. All 10 generic signal pathway headers contain six pins. Figure 2-1 and Figure 2-2 show the generalized pinout of the headers for the left and right side of the board respectively. Note that the orientation is based on J11 being on the top of the board.
3. 

Figure 2-1. Left Side Jumper (J1-J5) Configuration or Pinout

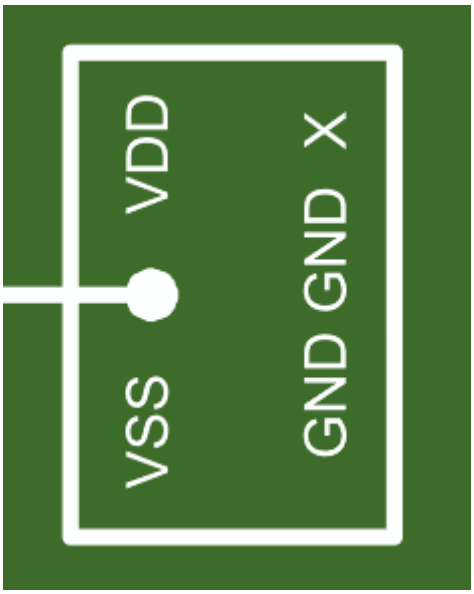


Figure 2-2. Right Side Jumper (J6-J10) Configuration or Pinout

2.3 Jumper Information

For the left side header, pin 1 is at the top left corner pin (denoted as an X). The right side header has pin 1 (denoted as an X), which is at the top right corner. Table 2-1 shows the jumper configurations. Note: U1 refers to the signal pathway that connects to the U1 10-pin DGS footprint.

Table 2-1. Generic Jumper Pinout Map

Jumper ID	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6
J1	Floating	VDD	GND	U1 Pin 1	GND	VSS
J2	Floating	VDD	GND	U1 Pin 2	GND	VSS
J3	Floating	VDD	GND	U1 Pin 3	GND	VSS
J4	Floating	VDD	GND	U1 Pin 4	GND	VSS
J5	Floating	VDD	GND	U1 Pin 5	GND	VSS
J6	Floating	VDD	GND	U1 Pin 6	GND	VSS
J7	Floating	VDD	GND	U1 Pin 7	GND	VSS
J8	Floating	VDD	GND	U1 Pin 8	GND	VSS
J9	Floating	VDD	GND	U1 Pin 9	GND	VSS
J10	Floating	VDD	GND	U1 Pin 10	GND	VSS

Check the device specific data sheet for the pin-out. For power (VDD or VSS) and ground (GND), lines connect shunts on the appropriate jumpers to short the U1 pin to the respective VDD, VSS, or GND line. For testing where control pins do not change state (such as the select or enable pin always being at a logic ‘1’ for the duration of testing), shunts can be connected on the appropriate jumpers to short the U1 control pins to VDD or GND. For the remaining I/O pins (VDD, VSS, and GND), signals can be applied using shunts in the same manner as before or the shunt can be removed and an external signal can be applied to the U1 pin of the jumper or the respective test point.

In cases where the tests requires pull-up or pull-down resistors versus directly attaching the source to the respective U1 pin, all 8 generic pathways contain 0603 resistor pads to add these components. Table 2-2 shows the IDs.

Table 2-2. Pull-Up or Pull-Down Resistor Configuration Map

0603 Sized Resistor Pad ID	Jumper ID	Function
R1	J1	Pull up
R13	J1	Pull down
R2	J2	Pull up
R14	J2	Pull down
R3	J3	Pull up
R15	J3	Pull down
R4	J4	Pull up
R16	J4	Pull down
R34	J5	Pull up
R40	J5	Pull down
R33	J6	Pull up
R39	J6	Pull down
R17	J7	Pull up
R29	J7	Pull down
R18	J8	Pull up
R30	J8	Pull down
R19	J9	Pull up
R31	J9	Pull down
R20	J10	Pull up
R32	J10	Pull down

Now loads can be attached to the board. If a pull-down pad was unused, then this pad can now be used as a pad for a resistive load. There are also pads for capacitive loads for each of the 10 generic signal pathways that can also be utilized. Table 2-3 shows the corresponding pad and jumper IDs.

Note

The 1812 sized capacitor pads are on the bottom side of the EVM.

Table 2-3. RC Load Configuration Map

Jumper ID	0603 Sized Resistor Pad ID	1206 Sized Capacitor Pad ID	1812 Sized Capacitor Pad ID
J1	R13	C11	C7
J2	R14	C12	C8
J3	R15	C13	C9
J4	R16	C14	C10
J5	R40	C26	C24
J6	R39	C25	C23
J7	R29	C19	C15
J8	R30	C20	C16
J9	R31	C21	C17
J10	R32	C22	C18

Now that the loading is complete for the board, additional supply decoupling capacitance to ground can be added for the VDD or VSS lines. Table 2-4 shows the power supply decoupling capacitance for each VDD or VSS line. If the default capacitance is enough, then move on to step 8.

Table 2-4. Capacitors

Capacitor Pad ID	Pad Size (LxW)	Associated Power Signal
C1	6mm × 5mm	VDD
C2	6mm × 5mm	VDD
C5	6mm × 5mm	VSS
C6	6mm × 5mm	VSS

Finally, attach the supply signals (VDD, GND, or VSS) to the appropriate pins of the terminal block labeled J11. Power is now ready to be applied to the board. For test points, please see the next section.

2.4 Test Points

There are multiple test points (30) on the board that can be used to either measure the associated trace or apply external signals to for testing purposes. Table 2-5 shows the test points for the eight generic U1 connections. There are two test points per pin of the IC, which are colored blue. The test points with format TPX are farther from the U1 device than test points with the format TP1XX.

Table 2-5. Test Points for Generic Jumpers Map

Jumper ID	Test Point ID	Test Point ID	U1 Pin
J1	TP1	TP101	1
J2	TP2	TP102	2
J3	TP3	TP103	3
J4	TP4	TP104	4
J5	TP5	TP105	5
J6	TP6	TP106	6
J7	TP7	TP107	7
J8	TP8	TP108	8
J9	TP9	TP109	9
J10	TP10	TP110	10

There are also test points that connect to VSS, VDD, and GND planes. Table 2-6 shows these test points.

Table 2-6. Test Points

Test Point ID	Color	Signal
TP111	Red	VDD
TP112	Black	GND
TP113	Green	VSS
TPG1	Black	GND
TPG2	Black	GND
TPG3	Black	GND
TPG4	Black	GND
TPG5	Black	GND
TPG6	Black	GND
TPG7	Black	GND

3 Hardware Design Files

3.1 Schematics

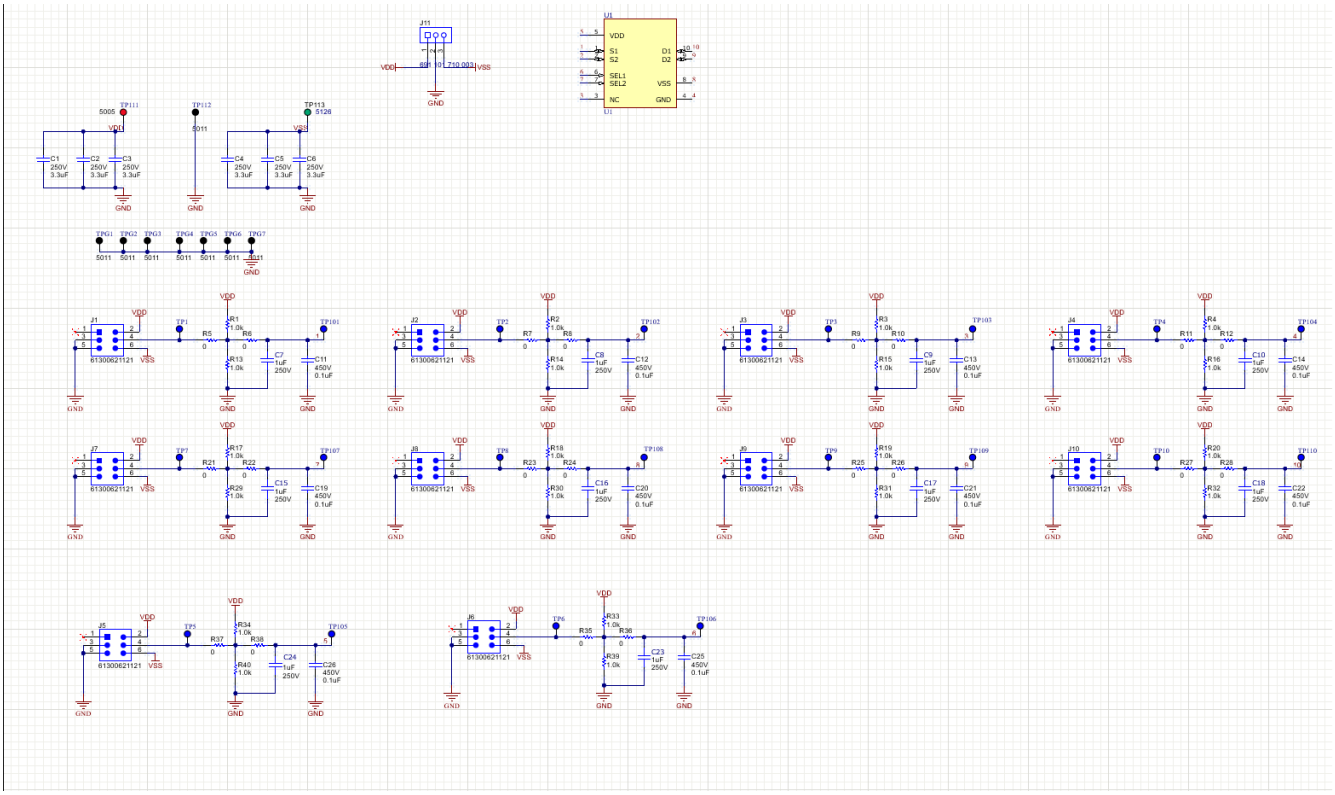


Figure 3-1. Main Schematic – TMUX10DGS All Components Shown

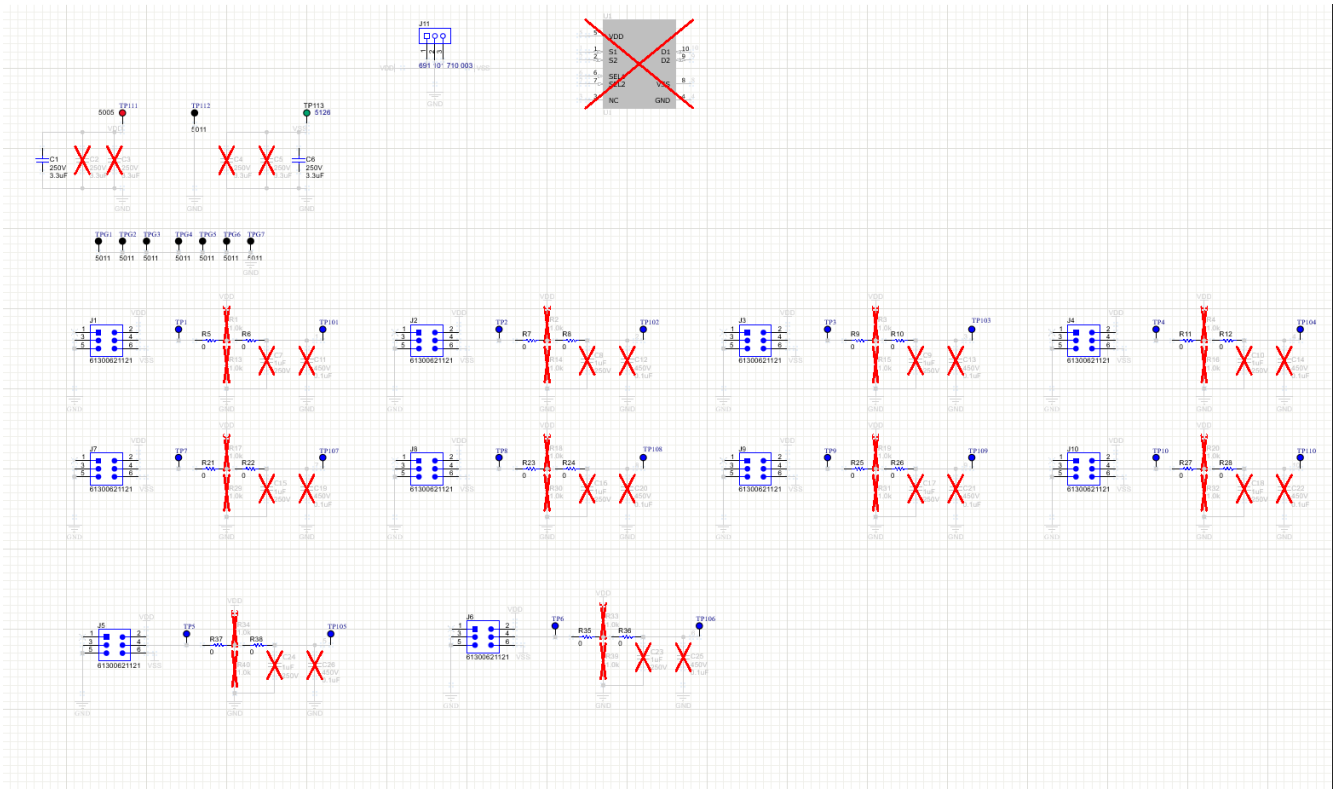


Figure 3-2. Main Schematic – TMUX10DGS Default

3.2 PCB Layouts

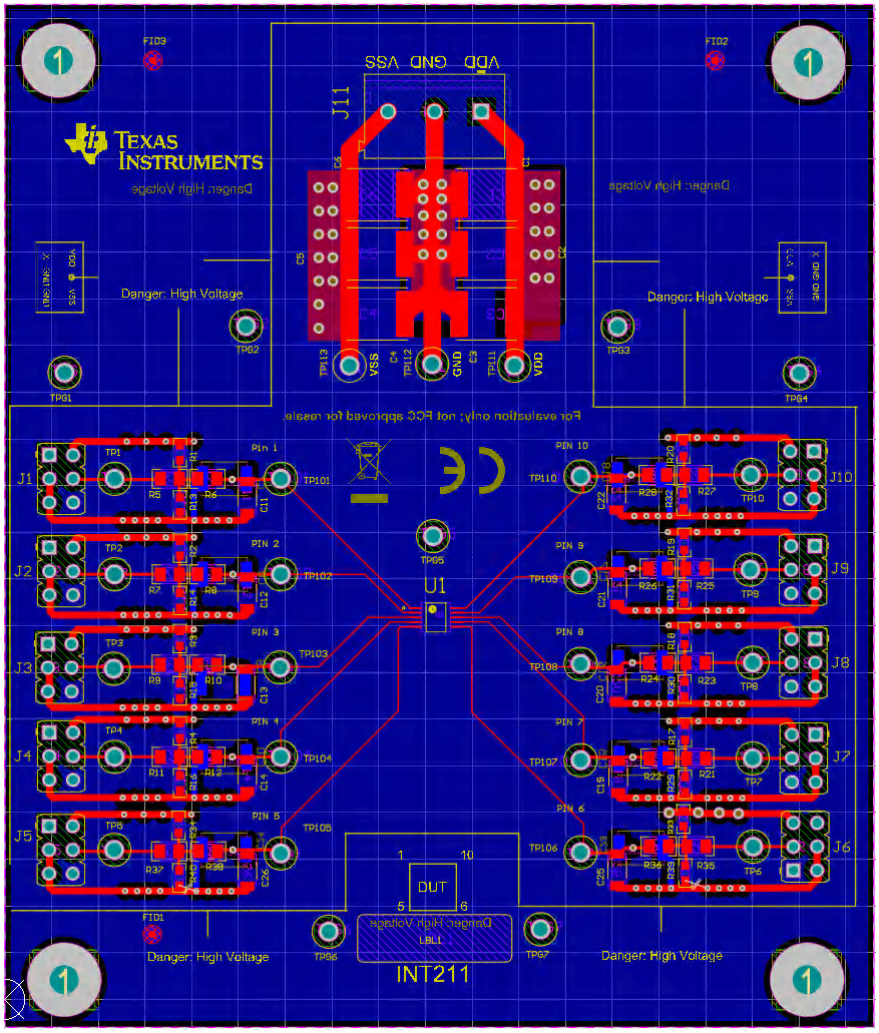


Figure 3-3. TMUX10DGSEVM Top Layer Layout

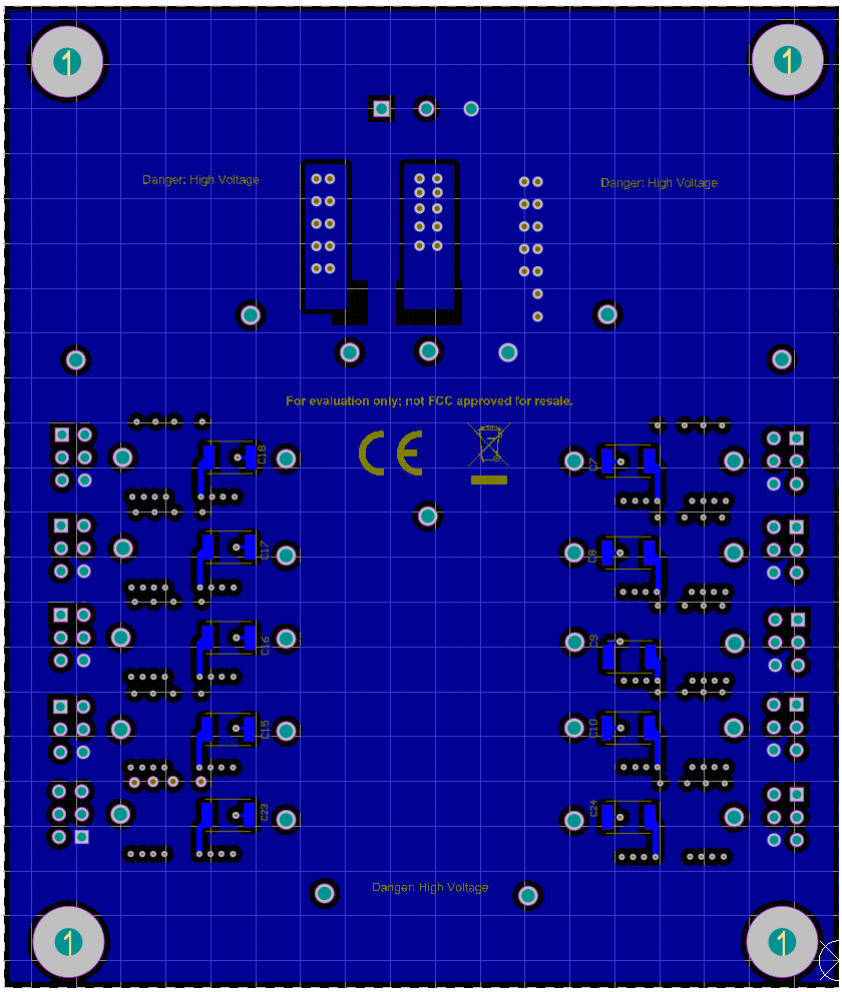


Figure 3-4. TMUX10DGSEVM Bottom Layer Layout

3.3 Bill of Materials (BOM)

Table 3-1. Bill of Materials

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer
!PCB1	1		Printed Circuit Board		INT211	Any
C1, C6	2	3.3uF	CAP, CERM, 3.3uF, 250V, +/- 20%, X7T, AEC-Q200 Grade 1, 6x5x5mm	6x5x5mm	CKG57NX7T2E335M500JH	TDK
H1, H2, H3, H4	4		Machine Screw, Round, #4-40 x 1/4, Nylon, Philips panhead	Screw	NY PMS 440 0025 PH	B&F Fastener Supply
H5, H6, H7, H8	4		Standoff, Hex, 0.5"L #4-40 Nylon	Standoff	1902C	Keystone
J1, J2, J3, J4, J5, J6, J7, J8, J9, J10	10		Header, 2.54mm, 3x2, Gold, TH	Header, 2.54mm, 3x2, TH	61300621121	Wurth Elektronik
J11	1		Terminal Block, 5mm, 3x1, Tin, TH	Terminal Block, 5mm, 3x1, TH	691 101 710 003	Wurth Elektronik
LBL1	1		Thermal Transfer Printable Labels, 0.650" W x 0.200" H - 10,000 per roll	PCB Label 0.650 x 0.200 inch	THT-14-423-10	Brady
R5, R6, R7, R8, R9, R10, R11, R12, R21, R22, R23, R24, R25, R26, R27, R28, R35, R36, R37, R38	20	0	RES, 0, 0%, W, AEC-Q200 Grade 0, 0805	0805	PMR10EZPJ000	Rohm
TP1, TP2, TP3, TP4, TP5, TP6, TP7, TP8, TP9, TP10, TP101, TP102, TP103, TP104, TP105, TP106, TP107, TP108, TP109, TP110	20		Test Point, Compact, Blue, TH	Blue Compact Test point	5122	Keystone
TP111	1		Test Point, Compact, Red, TH	Red Compact Test point	5005	Keystone
TP112, TPG1, TPG2, TPG3, TPG4, TPG5, TPG6, TPG7	8		Test Point, Multipurpose, Black, TH	Black Multipurpose Test point	5011	Keystone
TP113	1		Test Point, Multipurpose, Green, TH	Green Multipurpose Test point	5126	Keystone

Table 3-1. Bill of Materials (continued)

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer
C2, C3, C4, C5	0	3.3uF	CAP, CERM, 3.3uF, 250V, +/- 20%, X7T, AEC-Q200 Grade 1, 6x5x5mm	6x5x5mm	CKG57NX7T2E335M500JH	TDK
C7, C8, C9, C10, C15, C16, C17, C18, C23, C24	0	1µF	Multilayer Ceramic Capacitors 1uF ±10% 250V X7T SMD 1812	1812	C4532X7T2E105K250KA	TDK
C11, C12, C13, C14, C19, C20, C21, C22, C25, C26	0	0.1uF	CAP, CERM, 0.1uF, 450V, +/- 10%, X7T, 1206	1206	C3216X7T2W104K160AE	TDK
FID1, FID2, FID3	0		Fiducial mark. There is nothing to buy or mount.	N/A	N/A	N/A
R1, R2, R3, R4, R13, R14, R15, R16, R17, R18, R19, R20, R29, R30, R31, R32, R33, R34, R39, R40	0	1.0k	RES, 1.0 k, 5%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW06031K00JNEA	Vishay-Dale
U1	0		44V, Low-RON, 1:1 (SPST), 2-Channel Precision Switches with Latch-Up Immunity and 1.8V Logic	VSSOP10	PTMUX7221DGSR	Texas Instruments

4 Additional Information

4.1 Trademarks

All trademarks are the property of their respective owners.

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   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.

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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

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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.

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.

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