



ABSTRACT

This user's guide describes the characteristics, operation, and use of the TMUX7208EVM evaluation module (EVM). A complete schematic diagram, printed-circuit board layouts, and bill of materials are included in this document.

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Trademarks

All trademarks are the property of their respective owners.

1 Introduction

The TMUX7208EVM supports evaluation of the TMUX7208 device in the 16-pin TSSOP (PW) package. TMUX7208 is a complementary metal-oxide semiconductor (CMOS) switch with latch-up immunity in a 8:1 single channel configuration. The device supports dual supplies (± 4.5 V to ± 22 V), a single supply (4.5 V to 44 V), or asymmetric supplies (such as $V_{DD} = 12$ V, $V_{SS} = -5$ V). The TMUX7208 supports bidirectional analog and digital signals on the source (Sx) and drain (D) pins ranging from V_{SS} to V_{DD} . All logic control inputs support logic levels from 1.8 V to V_{DD} , ensuring both TTL and CMOS logic compatibility when operating in the valid supply voltage range. The Fail-Safe Logic circuitry applies voltages on the control pins before the supply pin, which protects the device from potential damage.

2 Information About Cautions and Warnings



CAUTION

This EVM contains components that can potentially be damaged by electrostatic discharge. Always transport and store the EVM in its supplied ESD bag when not in use. Handle using an antistatic wristband. Operate on an antistatic work surface. For more information on proper handling, see [Electrostatic Discharge \(ESD\) application report](#)

3 Features of this EVM

The EVM has the following features:

- Quick prototyping and testing setup for the 16-pin TMUX7208 device in the TSSOP (PW) package.
- TMUX7208 control logic truth table listed on board.
- No specific TMUX7208 is supplied or soldered to the evaluation module. Allows flexibility to choose the desired IC for evaluation.
- Support for both single supply and dual supply operation.
- Six power supply decoupling capacitors ($2 \times 0.1 \mu\text{F}$, $2 \times 1 \mu\text{F}$, and $2 \times 10 \mu\text{F}$).
- Jumpers to nine signal lanes, V_{DD} and V_{SS} power rails, and control signals.
- Nine pads are available for placement of SMA connectors.
- Pads are available for pull-up or pull-down resistors on control signal pathways.
- Pads are available for surge protection diodes.
- 0805 capacitor pads are available on all signal pathways referenced to ground.

4 EVM Images

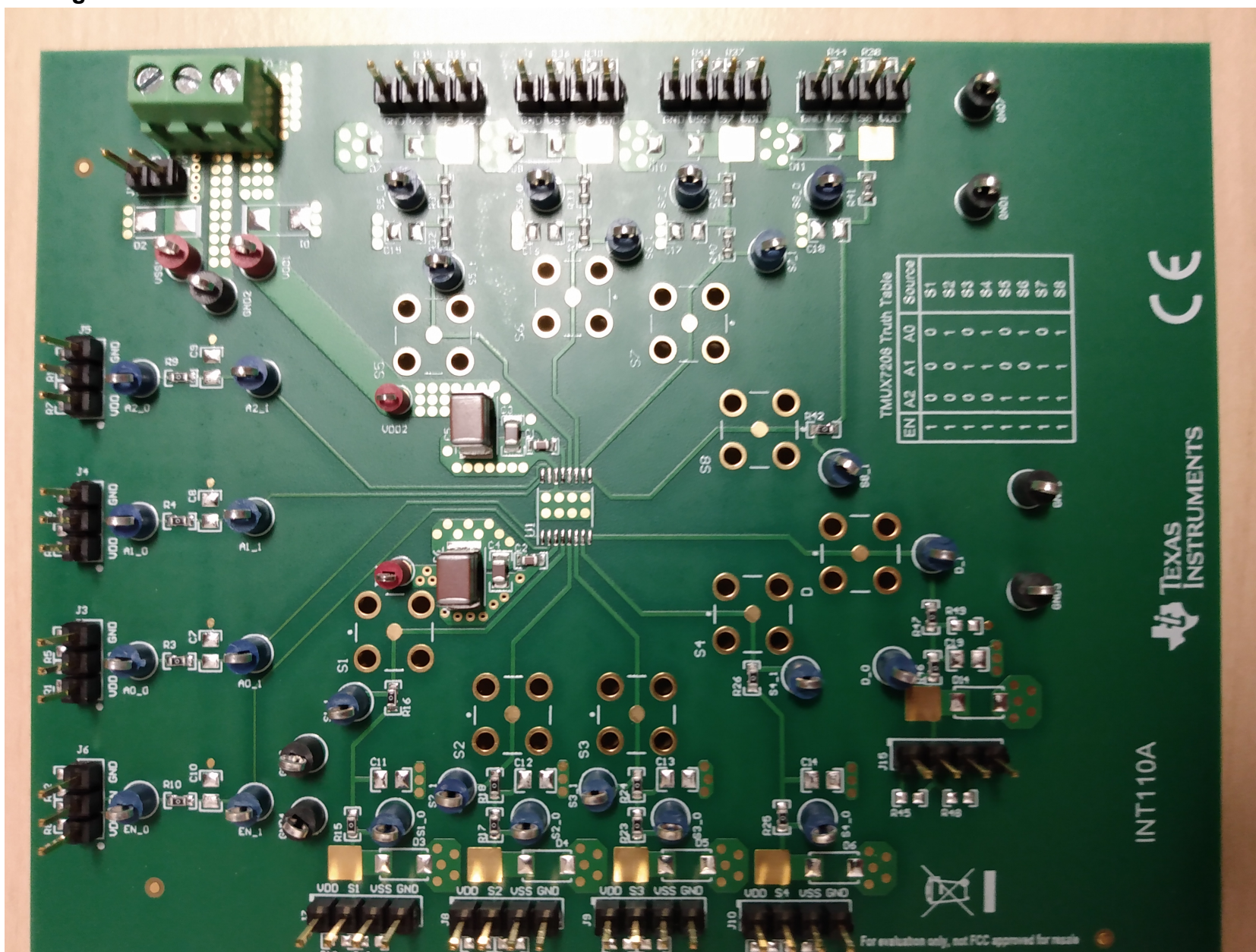


Figure 4-1. TMUX7208EVM Topside View

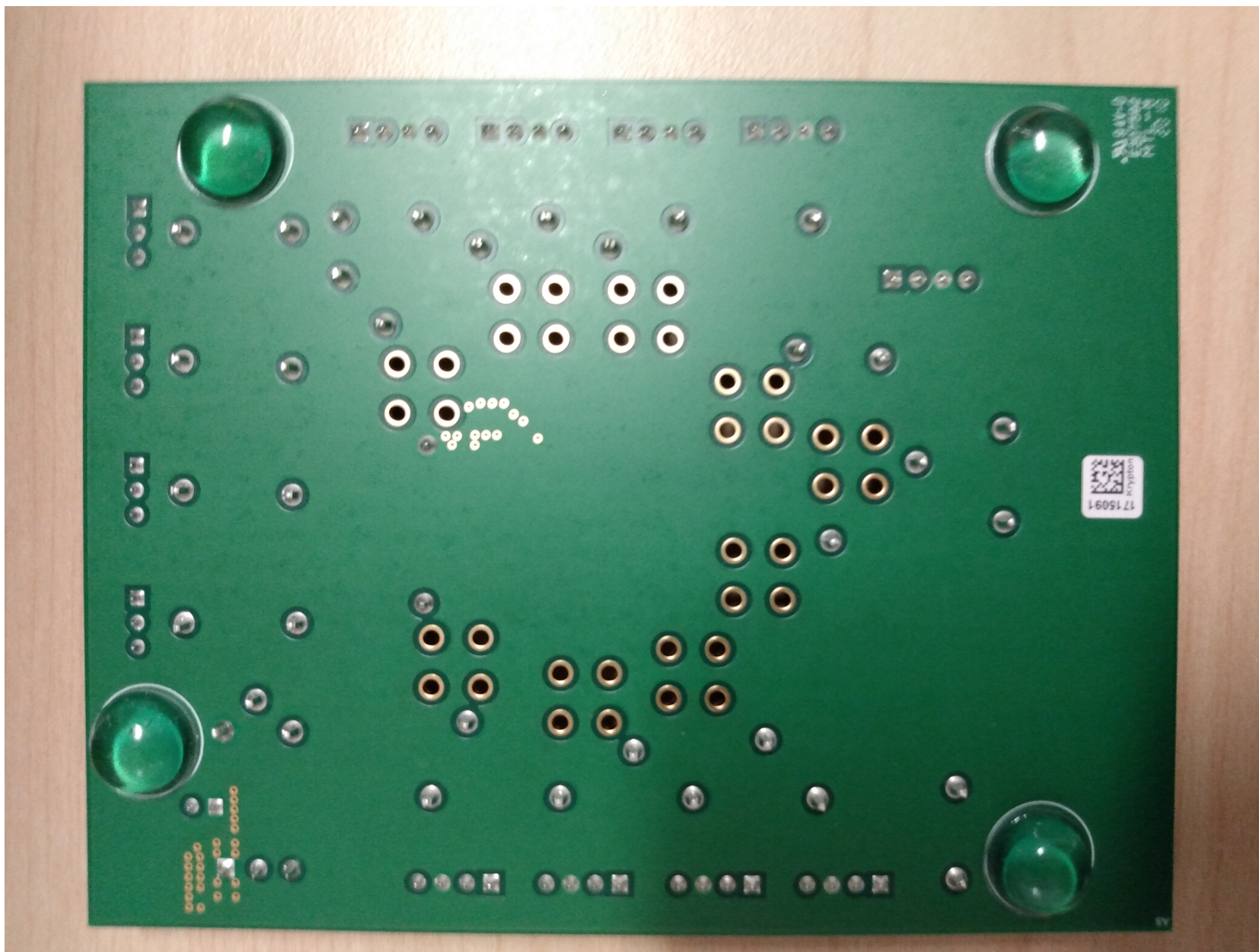


Figure 4-2. TMUX7208EVM Bottom View

5 EVM Setup

The following instructions are for setting up the EVM:

1. The control inputs and signal lines may be loaded by soldering components to signal path pads as needed. describes which load pads correspond to what pin on the DUT. SMA connectors can be soldered to corresponding pads accordingly.

Table 5-1. Component Pad to TMUX7208 Pin Matrix

Pin #	0805 Capacitor Pad ID	Protection Diode Pad	Protection Diode PN#	0603 Pull-up Pad	0603 Pull-Down Pad	Pad Locations
4	C11	D3	SMAJ36CA	R13	R19	Top Layer
5	C12	D4	SMAJ36CA	R14	R20	Top Layer
6	C13	D5	SMAJ36CA	R21	R27	Top Layer
7	C14	D6	SMAJ36CA	R22	R28	Top Layer
8	C19	D14	SMAJ36CA	R45	R48	Top Layer
9	C18	D11	SMAJ36CA	R38	R44	Top Layer
10	C17	D10	SMAJ36CA	R37	R43	Top Layer
11	C16	D8	SMAJ36CA	R30	R36	Top Layer
12	C15	D7	SMAJ36CA	R29	R35	Top Layer

2. The board is powered by attaching ± 5 V to ± 22 V dual power supply or 5 V to 44 V single power supply to the screw terminal J2, with VDD, VSS, and GND oriented as specified in [Table 6-1](#).
3. Jumpers should be placed according to desired functionality. [Figure 5-1](#) displays a generic four-pin jumper, with the indicating white corner to designate position 1.



Figure 5-1. Generic Jumper and Header Position 1 Designator

[Table 5-2](#) is the truth table for the TMUX7208, for reference to configure the corresponding control jumpers. Additional signal path jumpers may be configured as shown in [Table 6-1](#).

Table 5-2. TMUX7208 Truth Table

EN J6	A2 J5	A1 J4	A0 J3	Selected Source Connected to Drain (D) Pin
0	X ⁽¹⁾	X	X	All sources are off (HI-Z)
1	0	0	0	S1
1	0	0	1	S2
1	0	1	0	S3
1	0	1	1	S4
1	1	0	0	S5
1	1	0	1	S6
1	1	1	0	S7
1	1	1	1	S8

(1) X denote do not care.

6 EVM Connectors and Test Points

6.1 Connectors

Table 6-1. Jumper and Header Position Functions

Jumper ID	Header Pos. 1	Header Pos. 2	Header Pos. 3	Header Pos. 4	Header Pos. 5	Board Function	Fitted (Y/N)
J1	GND	VSS	N/A	N/A	N/A	Power	Y
J2	VSS	GND	VDD	N/A	N/A	Power	Y
J3	VDD	A0	GND	N/A	N/A	Control	Y
J4	VDD	A1	GND	N/A	N/A	Control	Y
J5	VDD	A2	GND	N/A	N/A	Control	Y
J6	VDD	EN	GND	N/A	N/A	Control	Y
J7	VDD	S1	VSS	GND	N/A	I/O	Y
J8	VDD	S2	VSS	GND	N/A	I/O	Y
J9	VDD	S3	VSS	GND	N/A	I/O	Y
J10	VDD	S4	VSS	GND	N/A	I/O	Y
J11	VDD	S5	VSS	GND	N/A	I/O	Y
J12	VDD	S6	VSS	GND	N/A	I/O	Y
J13	VDD	S7	VSS	GND	N/A	I/O	Y
J14	VDD	S8	VSS	GND	N/A	I/O	Y
J15	VDD	D	VSS	GND	N/A	I/O	Y
S1	I/O	GND	GND	GND	GND	I/O SMA	N
S2	I/O	GND	GND	GND	GND	I/O SMA	N
S3	I/O	GND	GND	GND	GND	I/O SMA	N
S4	I/O	GND	GND	GND	GND	I/O SMA	N
S5	I/O	GND	GND	GND	GND	I/O SMA	N
S6	I/O	GND	GND	GND	GND	I/O SMA	N
S7	I/O	GND	GND	GND	GND	I/O SMA	N
S8	I/O	GND	GND	GND	GND	I/O SMA	N
D	I/O	GND	GND	GND	GND	I/O SMA	N

6.2 Test Points

Table 6-2. Test Point Signal Connections

Signal	Test Point ID
VDD	TP1 and TP10
GND	TP3, TP4, TP5, TP6, TP7, TP8, and TP9
VSS	TP2 and TP11
D	TP20 and TP21
S1	TP22 and TP23
S2	TP24 and TP25
S3	TP26 and TP27
S4	TP28 and TP29
S5	TP30 and TP31
S6	TP32 and TP33
S7	TP34 and TP35
S8	TP36 and TP37
A0	TP12 and TP13
A1	TP14 and TP15
A2	TP16 and TP17

Table 6-2. Test Point Signal Connections (continued)

Signal	Test Point ID
EN	TP18 and TP19

7 PCB Layouts

Figure 7-1 and Figure 7-2 show the EVM PCB layout images.

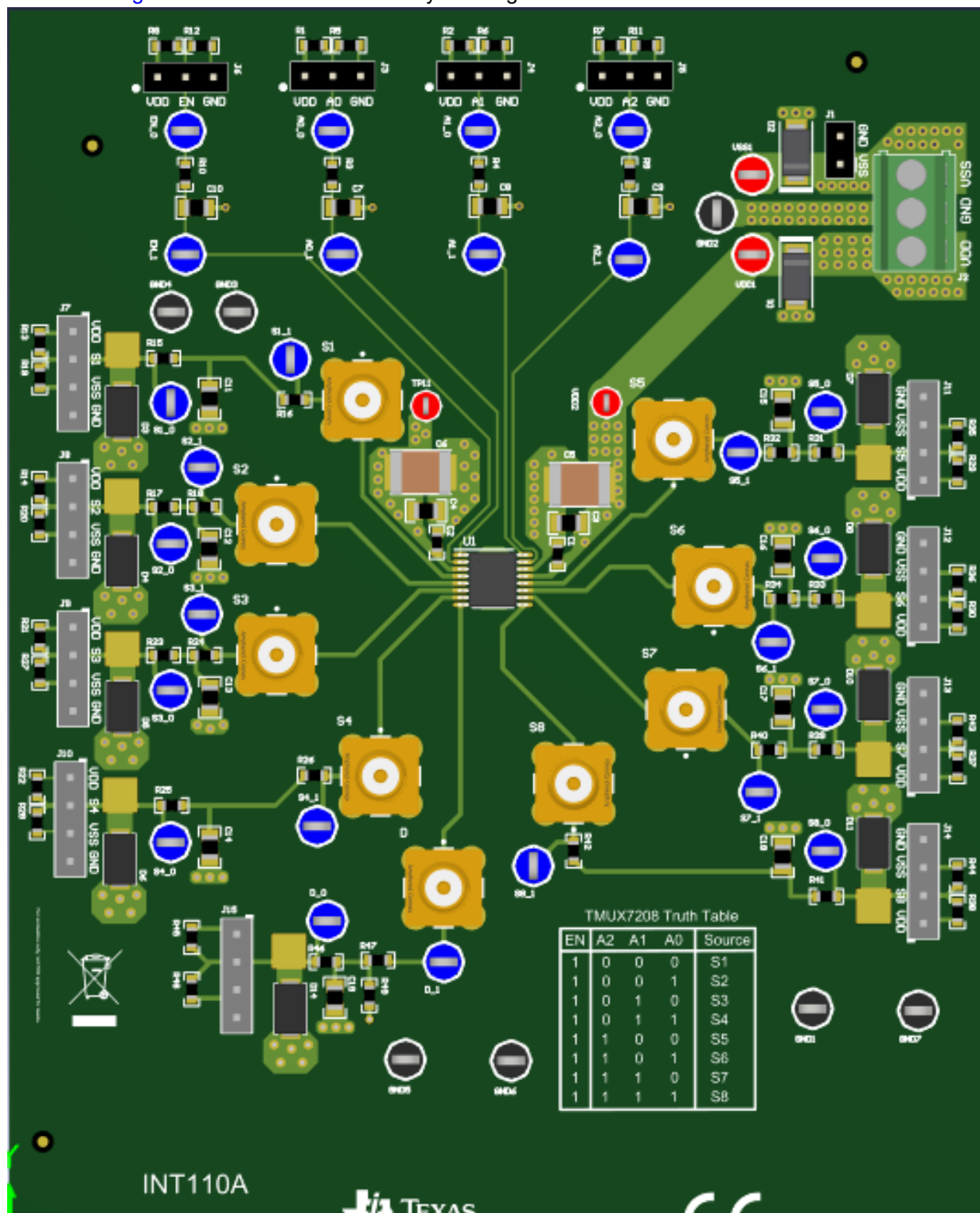


Figure 7-1. Top View Illustration of the TMUX7208EVM Layout

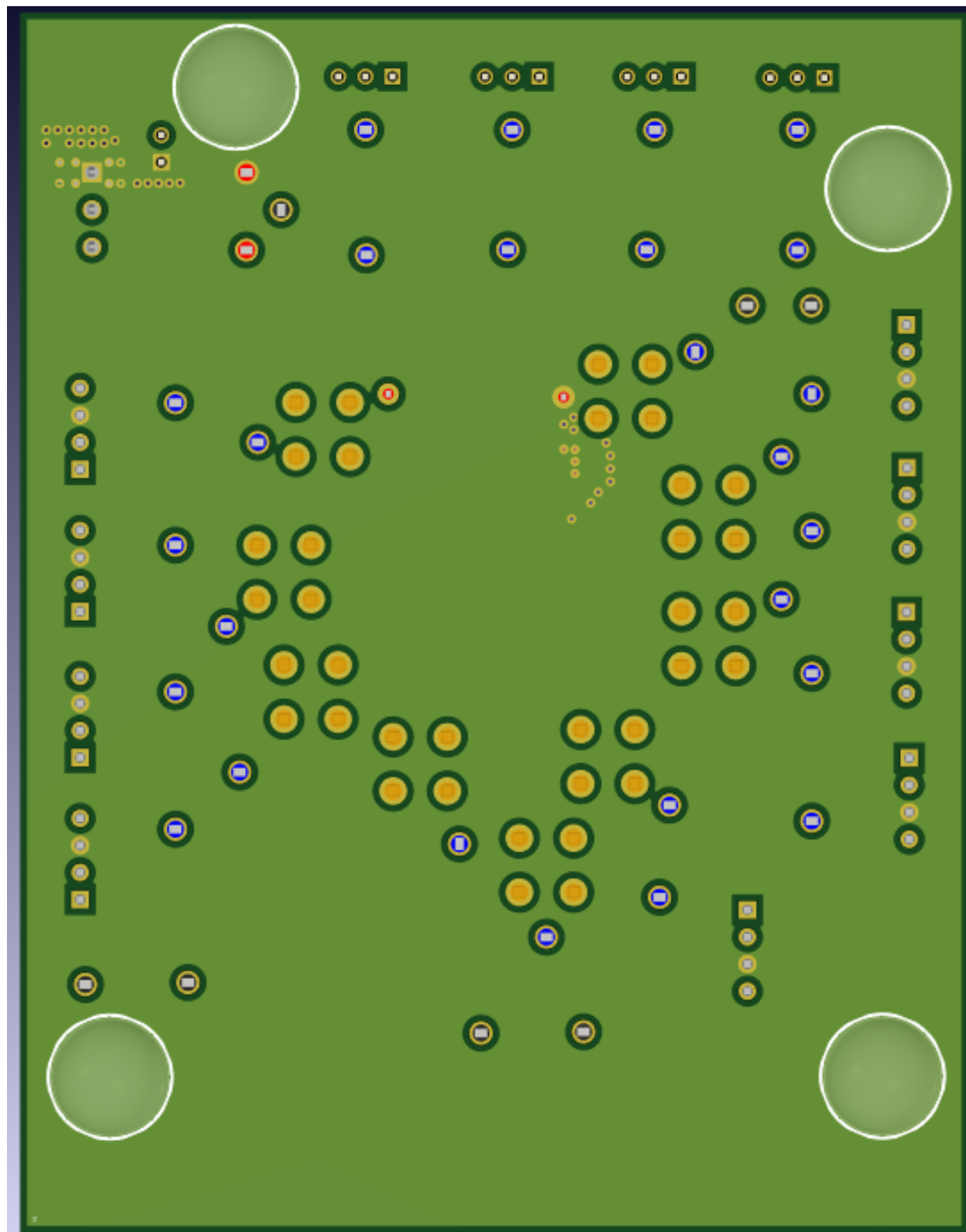


Figure 7-2. Bottom View Illustration of the TMUX7208EVM Layout

8 Schematics

Schematic views for the TMUX7208EVM. [Figure 8-1](#) shows the editor view, which includes all connections and parts that are DNI. [Figure 8-2](#) shows DNI view, removing DNI parts which are not included on the evaluation model out-of-the-box.

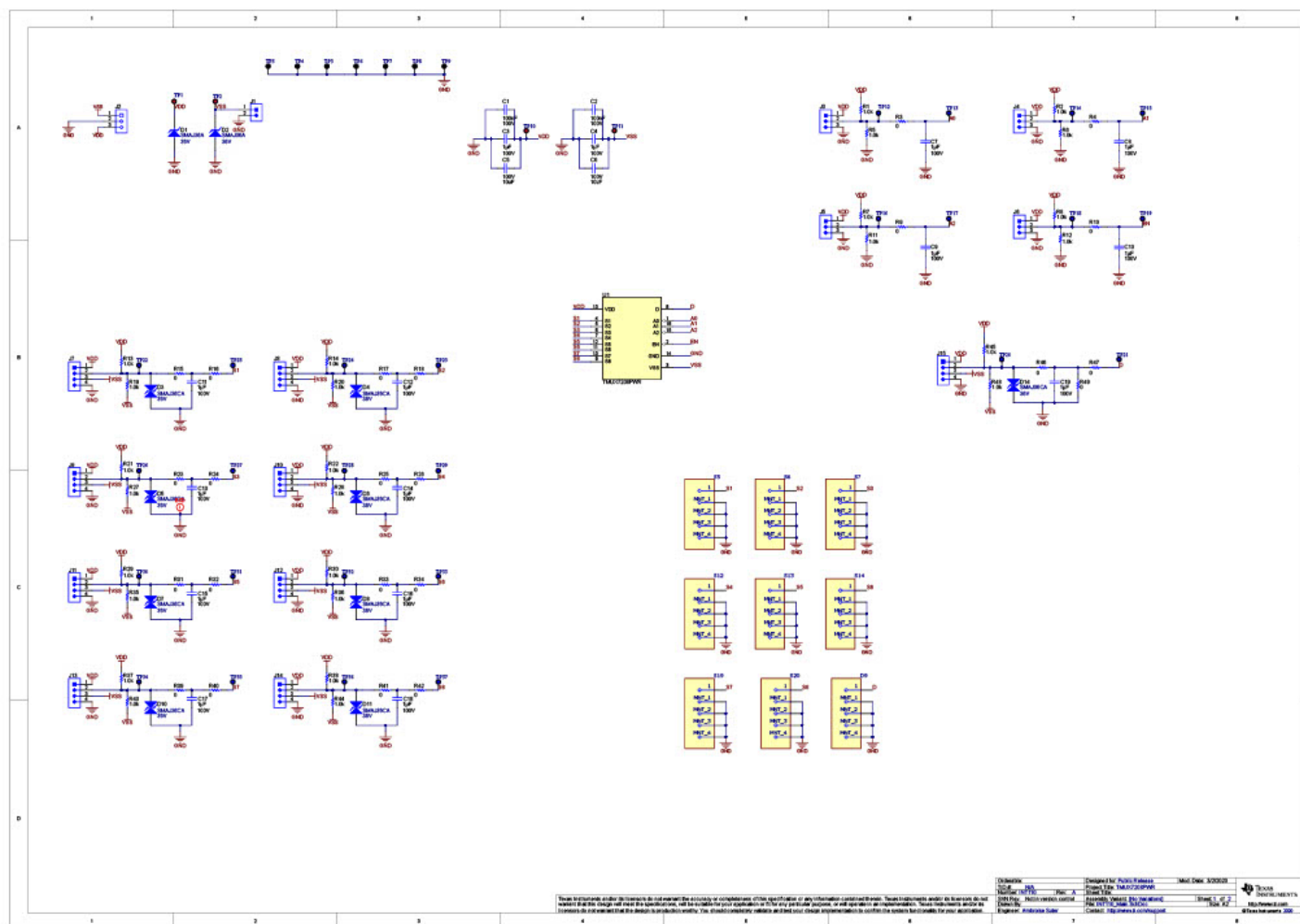


Figure 8-1. Schematic of the TMUX7208EVM (Editor View)

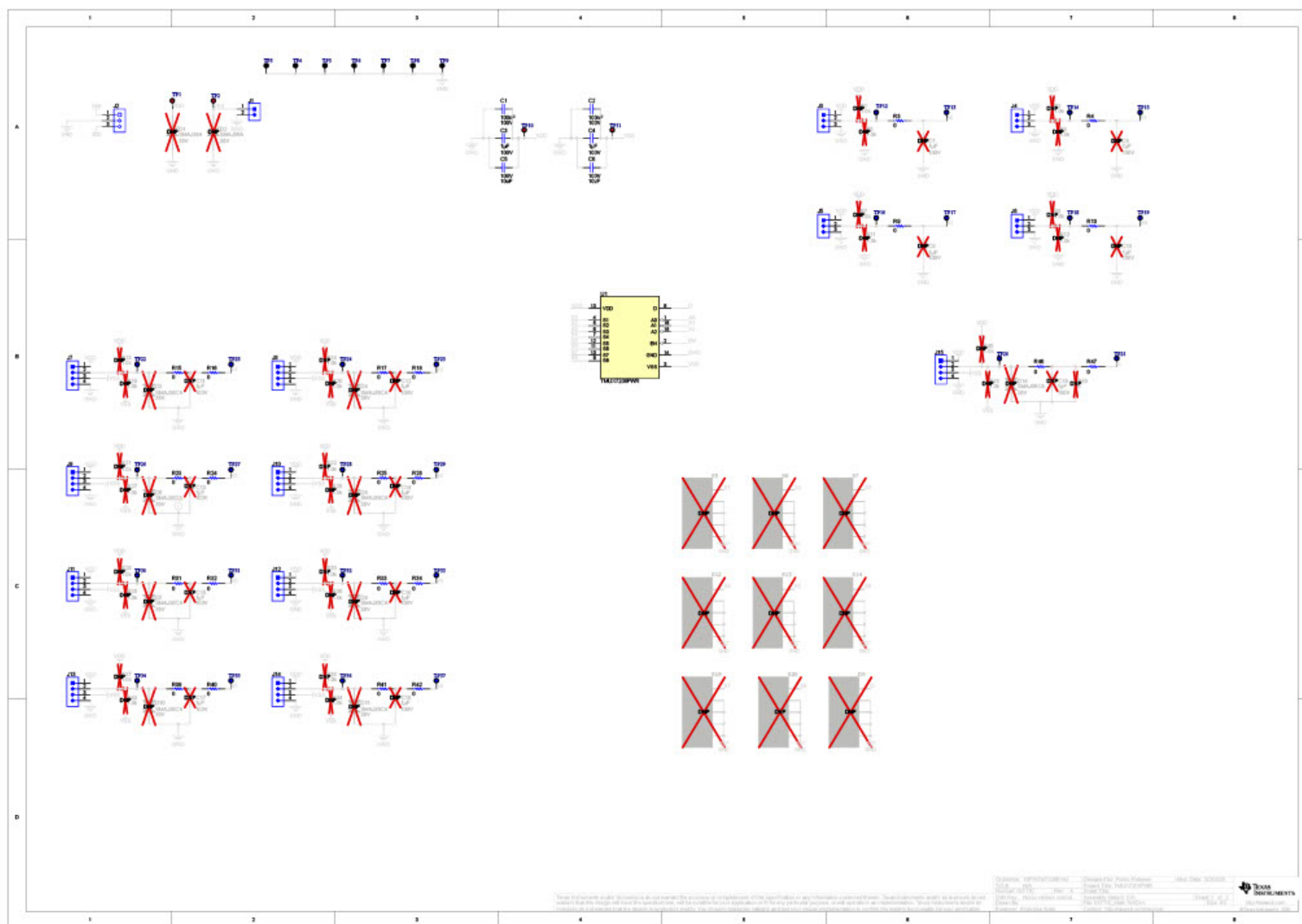


Figure 8-2. Schematic of the TMUX7208EVM (DNI View)

9 Bill of Materials

Table 9-1 details the EVM bill of materials.

Table 9-1. TMUX7208EVM Bill of Materials

Designator	Component	Manufacturer	Description	Quantity
C1, C2	CKG45NX7S2A106M500JJ	TDK	CAP, CERM, 10 μ F, 100 V, $\pm$ 20%, X7S, AEC-Q200 Grade 1, 1812	2
C4, C5	C1608X7S2A104K080AB	TDK	CAP, CERM, 0.1 μ F, 100 V, $\pm$ 10%, X7S, 0603	2
C6, C7	C2012X7S2A105K125AB	TDK	CAP, CERM, 1 μ F, 100 V, $\pm$ 10%, X7S, 0805	2
H1, H2, H3, H4	SJ-5303 (CLEAR)	Bumper Specialties, Inc.	Bumpon, Hemisphere, 0.44 X 0.20, Clear	4
J1	691214110003	Würth Electronics	Terminal Block, 3.5 mm, 3 $\times$ 1, Tin, TH	1
J2	PEC02SAAN	Sullins Connector Solutions	Header, 100 mil, 2 $\times$ 1, Tin, TH	1
J3, J8, J5, J9, J10	PEC03SAAN	Sullins Connector Solutions	Header, 100 mil, 3 $\times$ 1, Tin, TH	5
R3, R4, R5, R6, R9, R10, R13, R14	RMCF0603ZT0R00	Stackpole Electronics Inc	RES, 0, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	8
SH-J?	SPC02SYAN	Sullins Connector Solutions	Shunt, 100 mil, Flash Gold, Black	7
TP1, TP3, TP4, TP6, TP8, TP9, TP10, TP11, TP14, TP15, TP17, TP18	5000	Keystone	Test Point, Miniature, Red, TH	12
J2	691214110003	Würth Elektronik	Terminal Block, 3.5 mm, 3 $\times$ 1, Tin, TH	1
J7, J8, J9, J10, J11, J12, J13, J14, J15	PEC04SAAN	Sullins Connector Solutions	Header, 100 mil, 4 $\times$ 1, Tin, TH	9
A0.0, A0.1, A1.0, A1.1, A2.0, A2.1, D0, D1, EN0, EN1, S1.0, S1.1, S2.0, S2.1, S3.0, S3.1, S4.0, S4.1, S5.0, S5.1, S6.0, S6.1, S7.0, S7.1, S8.0, S8.1	5122	Keystone Electronics	Test Point, Compact, Blue, TH	26
GND1, GND2, GND3, GND4, GND5, GND6, GND7	5006	Keystone Electronics	Test Point, Compact, Black, TH	7
VDD1, VSS1	5005	Keystone Electronics	Test Point, Compact, Red, TH	2
VDD2	5000	Keystone Electronics	Test Point, Miniature, Red, TH	1
VSS2	5000	Keystone Electronics	Test Point, Miniature, Red, TH	1
J3, J4, J5, J6	PEC03SAAN	Sullins Connector Solutions	Header, 100 mil, 3 $\times$ 1, Tin, TH	4
J1	PEC02SAAN	Sullins Connector Solutions	Header, 100 mil, 2 $\times$ 1, Tin, TH	1
C5, C6	CKG45NX7S2A106M500JJ	TDK Corporation	CAP, CERM, 10 μ F, 100 V, $\pm$ 20%, X7S, AEC-Q200 Grade 1, 1812	2
H9, H10, H11, H12	SJ-5303 (CLEAR)	3M	Bumpon, Hemisphere, 0.44 X 0.20, Clear	4
C3, C4	C2012X7S2A105K125AB	TDK Corporation	CAP, CERM, 1 μ F, 100 V, $\pm$ 10%, X7S, 0805	2
C1, C2	C1608X7S2A104K080AB	TDK Corporation	CAP, CERM, 0.1 μ F, 100 V, $\pm$ 10%, X7S, 0603	2
R3, R4, R9, R10, R15, R16, R17, R18, R23, R24, R25, R26, R31, R32, R33, R34, R39, R40, R41, R42, R46, R47, R49	RMCF0603ZT0R00	Stackpole Electronics Inc.	RES, 0, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	23

10 Related Documentation

- Texas Instruments, [Electrostatic Discharge \(ESD\) application report](#)

11 Revision History

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

Changes from Revision * (December 2020) to Revision A (December 2020)	Page
• Added link to Electrostatic Discharge (ESD) application report in the <i>Information About Cautions and Warnings</i> section.....	2

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 DEGRADATION OR FAILURE OF THE EVALUATION KIT; TI RECOMMENDS STORAGE OF THE EVALUATION KIT IN A PROTECTIVE ESD BAG.

3 Regulatory Notices:

3.1 United States

3.1.1 Notice applicable to EVMs not FCC-Approved:

FCC NOTICE: This kit is designed to allow product developers to evaluate electronic components, circuitry, or software associated with the kit to determine whether to incorporate such items in a finished product and software developers to write software applications for use with the end product. This kit is not a finished product and when assembled may not be resold or otherwise marketed unless all required FCC equipment authorizations are first obtained. Operation is subject to the condition that this product not cause harmful interference to licensed radio stations and that this product accept harmful interference. Unless the assembled kit is designed to operate under part 15, part 18 or part 95 of this chapter, the operator of the kit must operate under the authority of an FCC license holder or must secure an experimental authorization under part 5 of this chapter.

3.1.2 For EVMs annotated as FCC – FEDERAL COMMUNICATIONS COMMISSION Part 15 Compliant:

CAUTION

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

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

FCC Interference Statement for Class A EVM devices

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, 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/lscs/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。
http://www.tij.co.jp/lscs/ti_ja/general/eStore/notice_01.page

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。

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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。

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3.3.3 *Notice for EVMs for Power Line Communication:* Please see http://www.tij.co.jp/lscs/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。 http://www.tij.co.jp/lscs/ti_ja/general/eStore/notice_02.page

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:*

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