

EVM User's Guide: TMUXS1306EVM

TMUXS1306A Evaluation Module

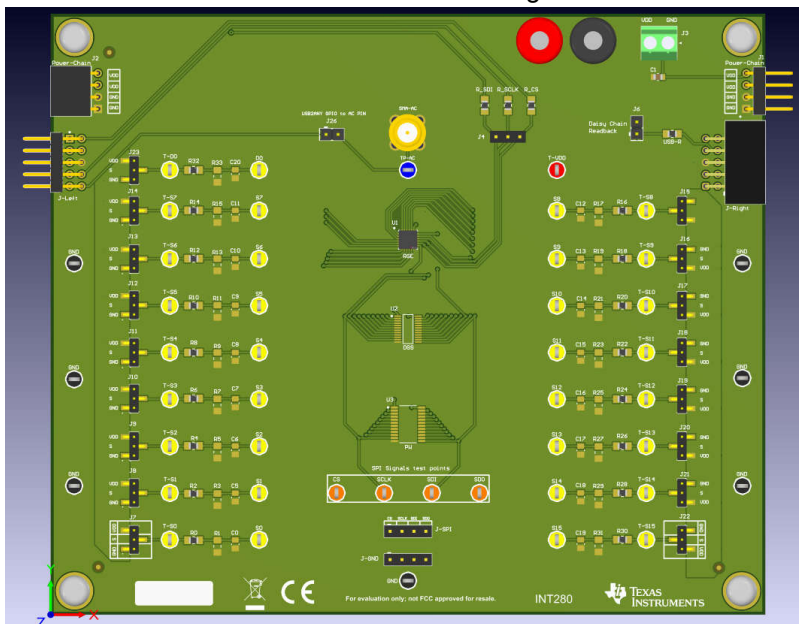


Description

The TMUXS1306EVM is used to evaluate the performance of the TMUXS1306A. The evaluation module (EVM) comes with a soldered TMUXS1306ARGE. The EVM allows for efficient evaluation of the TMUXS1306A SPI capabilities. The EVM has multiple resistor footprints that can be populated to test how the device affects the total resistance on the signal lane. Additionally, the EVM includes multiple test points and USB2ANY daisy chain feature.

Features

- External power supply with decoupling capacitor.
- One power supply decoupling capacitor from VDD to ground (0.1 μ F 0402).
- Two test points on each I/Os before and after RC ladder for full current and voltage capabilities.
- Seven additional GND test points for ease of probing.
- Various male and female connection headers + test points for quick testing.
- Daisy chain capable between multiple EVMs.
- USB2ANY Support for TMUXS1306A SPI configuration.



TMUXS1306EVM (Top View)

1 Evaluation Module Overview

1.1 Introduction

This user's guide describes the TMUXS1306EVM evaluation module (EVM) and the intended use. This board allows for the quick prototyping and characterization of TI's TMUXS1306A multiplexers in RGE, PW, and DDF packages. This EVM allows for evaluation of the device impact on the total resistance on the signal path.

Additional features:

- TMUXS1306ARGE pre-soldered on board
- 24 test points: 17 I/O test points, SPI test points, AC test point, and VDD test point
- 17 3-pin headers to change signal path state of device
- Multiple unpopulated footprints for potential additional RC loads

CAUTION

The EVM comes with jumpers in a side bag, these headers shorting the pins to ground or VDD. Before first use, confirm the state of the pins and adjust accordingly based on application. Failing to do so risks the reliability of the device and EVM.

1.2 Kit Contents

The EVM kit includes the following :

- (1) TMUXS1306EVM

1.3 Specification

The TMUXS1306EVM is used for evaluating TMUXS1306A. The EVM has two 10-pin headers denoted J-Left and J-Right for use with a SPI controller, such as the USB2ANY. There are two more 4 pin headers denoted J1 and J2 to allow for connecting power to the device. All four of these headers are configured so users can connect two or more EVMs in tandem for daisy chain mode.

The EVM has test points on each I/O for a total of 17 test points and test points for SPI signals. Each I/O has two test points before and after the unpopulated RC footprint for testing purposes. 7 extra ground test points are provided to allow for more connection flexibility on the board.

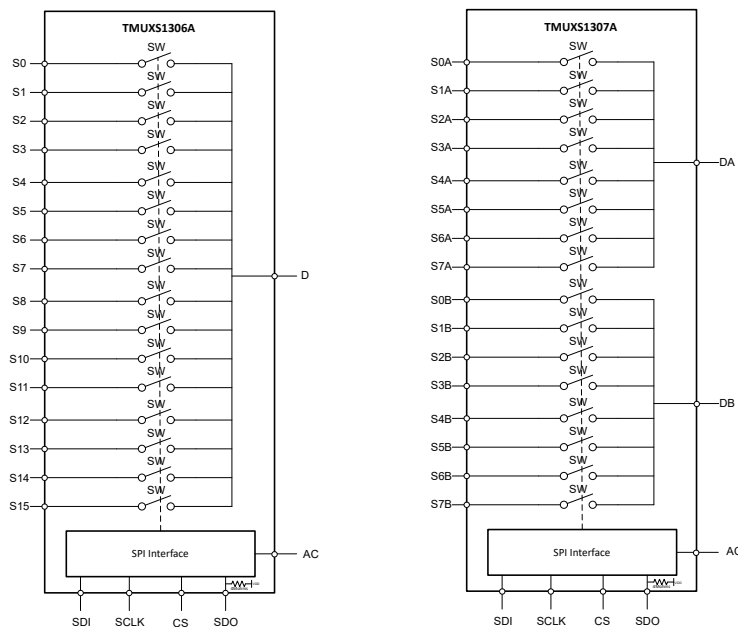


Figure 1-1. TMUXS1306A and TMUXS1307A Simplified Circuit

1.4 Device Information

The TMUXS1306A is a general purpose complementary metal-oxide semiconductor (CMOS) multiplexer (MUX). The TMUXS1306A is an 16:1, 1-channel (single-ended) mux. The devices support bidirectional analog and digital signals on the source (Sx) and drain (Dx) pins ranging from GND to VDD.

The TMUXS1306A devices have an internal injection current control feature, which eliminates the need for external diode and resistor networks typically used to protect the switch and keep the input signals within the supply voltage. The internal injection current control circuitry allows signals on disabled or enabled signal paths to exceed the supply voltage. Disabled channels with voltages above VDD are prevented from affecting the signal of the enabled signal path.

The TMUXS1306A devices do not have an internal diode path to the supply pin, which eliminates the risk of damaging components connected to the supply pin or providing unintended power to the supply rail. Due to these features RC networks on the input side can be reduced. This allows for a much smaller current limiting resistor, which can have a significant impact on the ramp rates.

2 Hardware

2.1 Power Requirements

The TMUXS1306AEVM requires a single supply (1.62V to 5.5V) provided either through the J2/J1 terminals or J3 terminal. The VDD supply can also be provided directly to the VDD test point in the center of the board, as well as the banana jacks.

2.2 Header and Jumper Information

The TMUXS1306EVM has various headers that provide points of functionality on the board. From left to right:

1. Supply Header J7 - J23

Header J7-J23 connects the VDD pin to either the external power or to ground via a jumper. If Header J7-J23 is not connected, then the devices supply is left floating. [Figure 2-1](#) shows header J7-J23.

- a. To connect to the external supply, short the headers VDD pin to the S pin.

2. SPI Control Header J-Left and J-Right

Allows SPI signals to be inputted using USB2ANY hardware and software.

3. Control Header J-SPI and J4

Provides an interface to tap into the SDL, SDO, SCLK and CS pins.

4. J6 allows users to place a jumper to control whether the USB2ANY_SDO_FEEDBACK signal path propagates onto another EVM or device. No jumper on J6 allows for read back via the SDO feedback signal path.

5. Source Header J1 and J2

Header J1 and J2 connects VDD and GND in a daisychain configuration.

- a. To connect to VDD and GND with connecting the Male header J1 to Female connector J2.

6. Source Header J26

Header J26 allows USB2ANY GPIO to act as the AC signal. Disconnecting allows for individual AC toggling.



Figure 2-1. Header J7-J23: Supply and RC Ladder

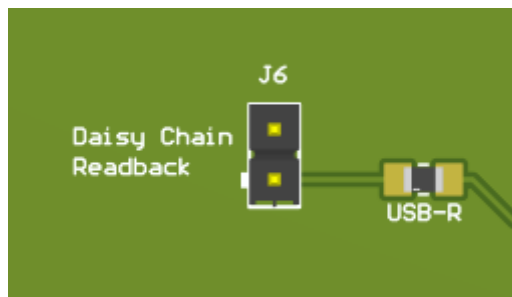


Figure 2-2. Header J6 :Daisy Chain Readback

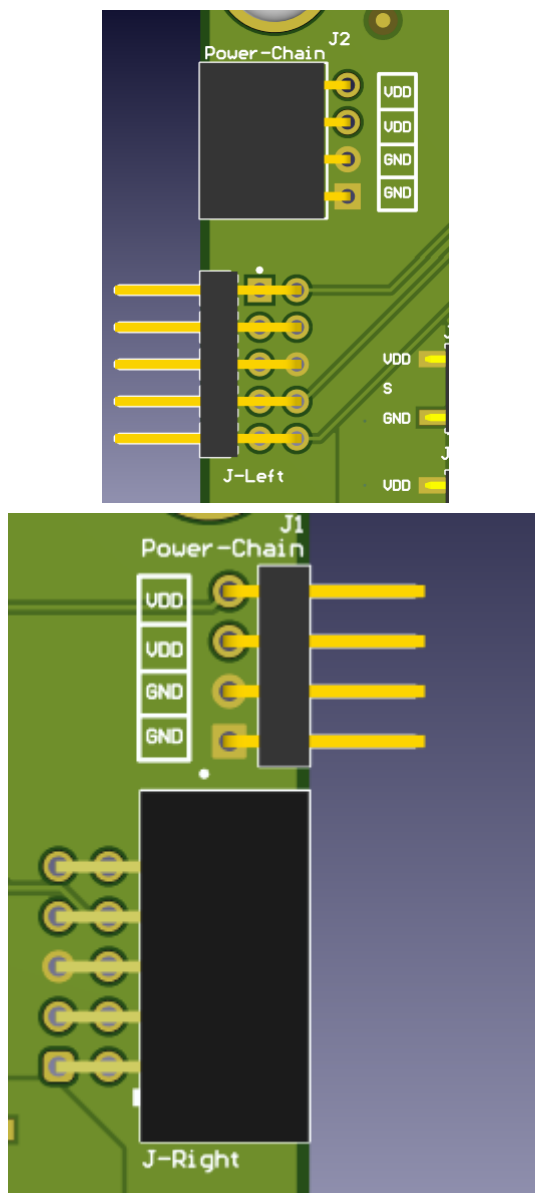


Figure 2-3. Header J1, J2, J-Left and J-Right :Daisy Chain

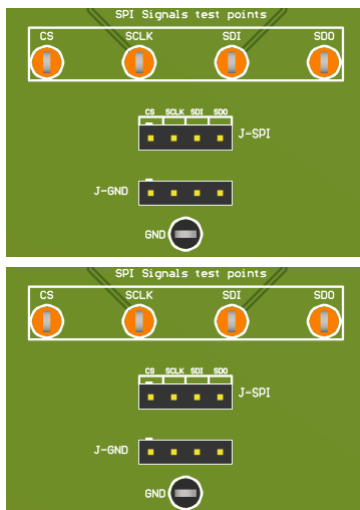


Figure 2-4. Header J-SPI and J4:SPI Control

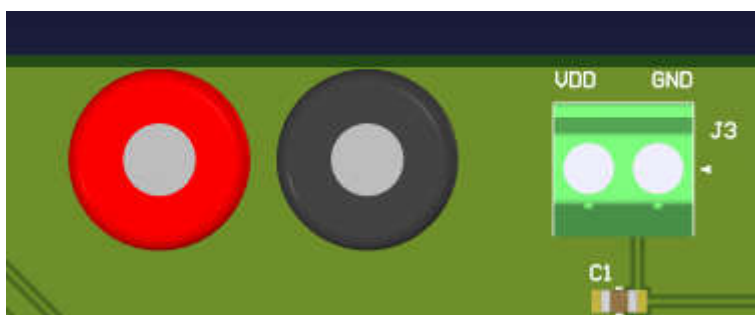


Figure 2-5. Header J3 : Supply for VDD and GND

2.3 Test Points

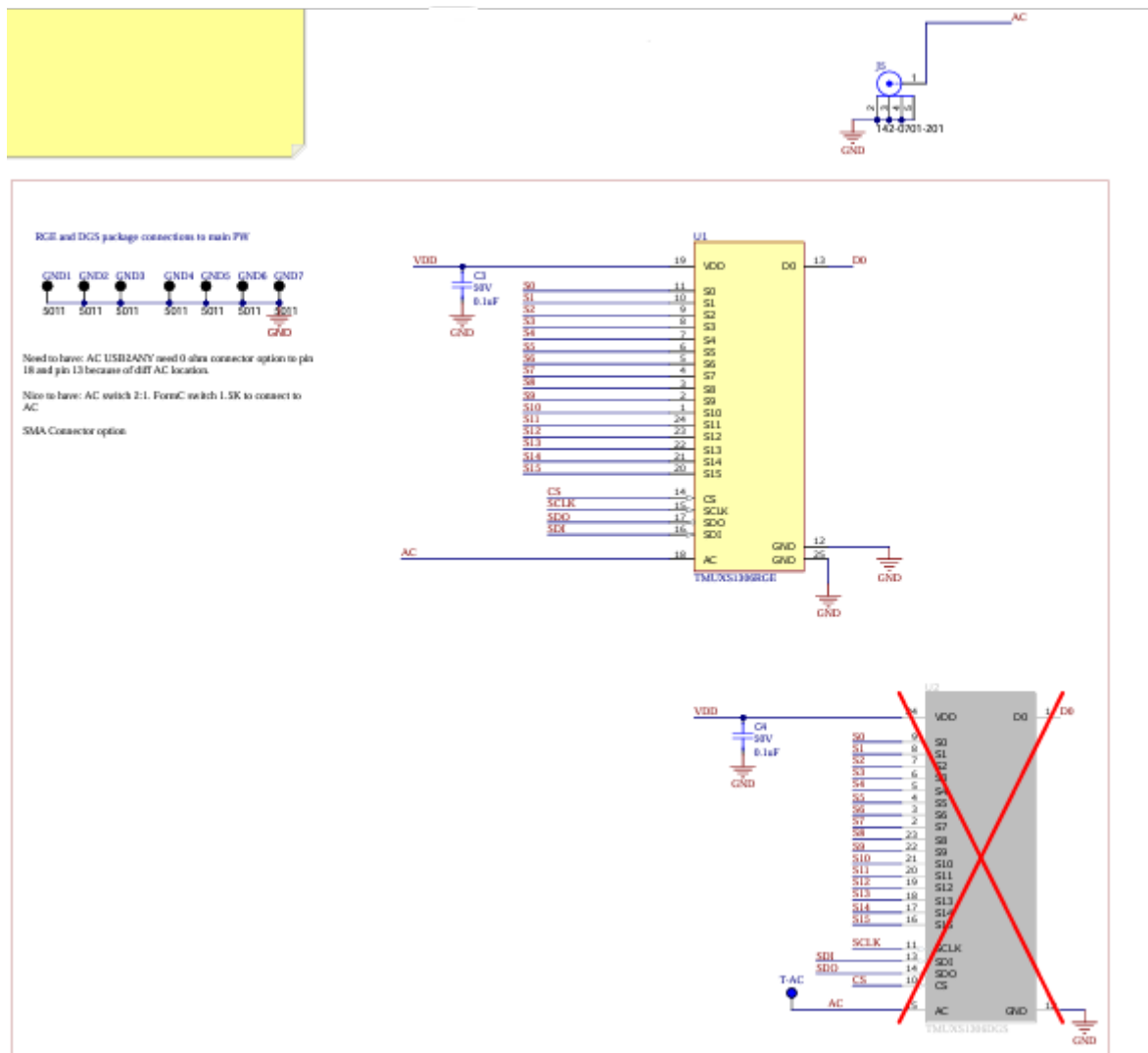
The board has a total of 45 test points: 7 GND, 4 SPI Signals, 1 VDD, and 34 I/O.

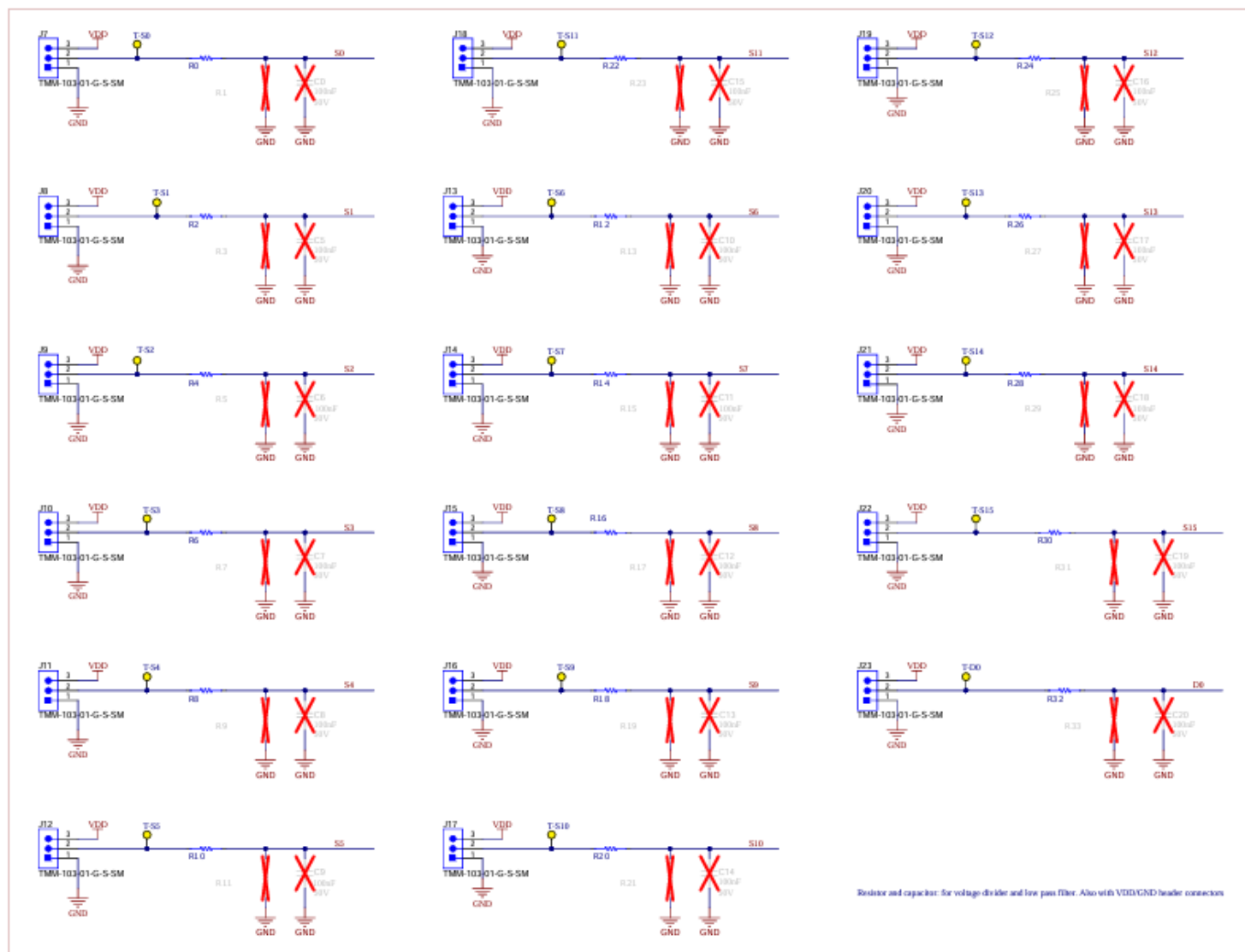
Test Point ID	Description	Signal
T-Sx/T-Dx x17	Yellow	S0-S15/D0
Sx/Dx x17	Yellow	S0-S15/D0
GND x7	Black	Ground
VDD	Red	VDD
AC	Blue	Auto cycle
CS, SCLK, SDI, SDO	Orange	CS, SCLK, SDI, SDO

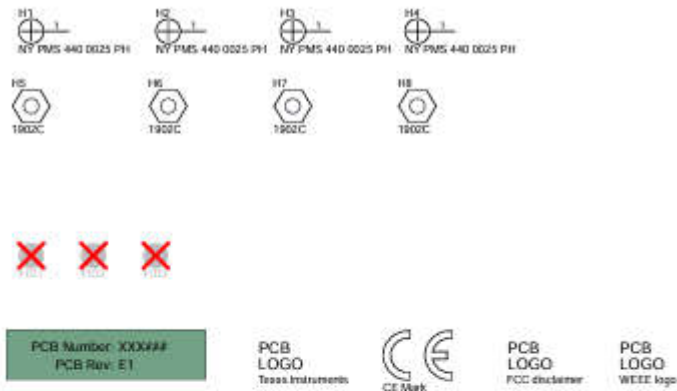
Section 3 includes hardware design files for TMUXS1306EVM . This section includes the board level schematic, PCB layout, and the bill of materials (BOM).

3.1 Schematics









LBL1
PCB Label
TH14-423-10
Size: 0.65" x 0.20"

ZZ1
Label Assembly Note
This Assembly Note is for PCB labels only

ZZ2
Assembly Note
These assemblies are ESD sensitive, ESD precautions shall be observed.

ZZ3
Assembly Note
These assemblies must be clean and free from flux and all contaminants. Use of no clean flux is not acceptable.

ZZ4
Assembly Note
These assemblies must comply with workmanship standards IPC-A-610 Class 2, unless otherwise specified.

Variant	Label Text
001	ChangeMe!
002	ChangeMe!

Figure 3-1. TMUXS1306EVM Schematic

3.2 PCB Layouts

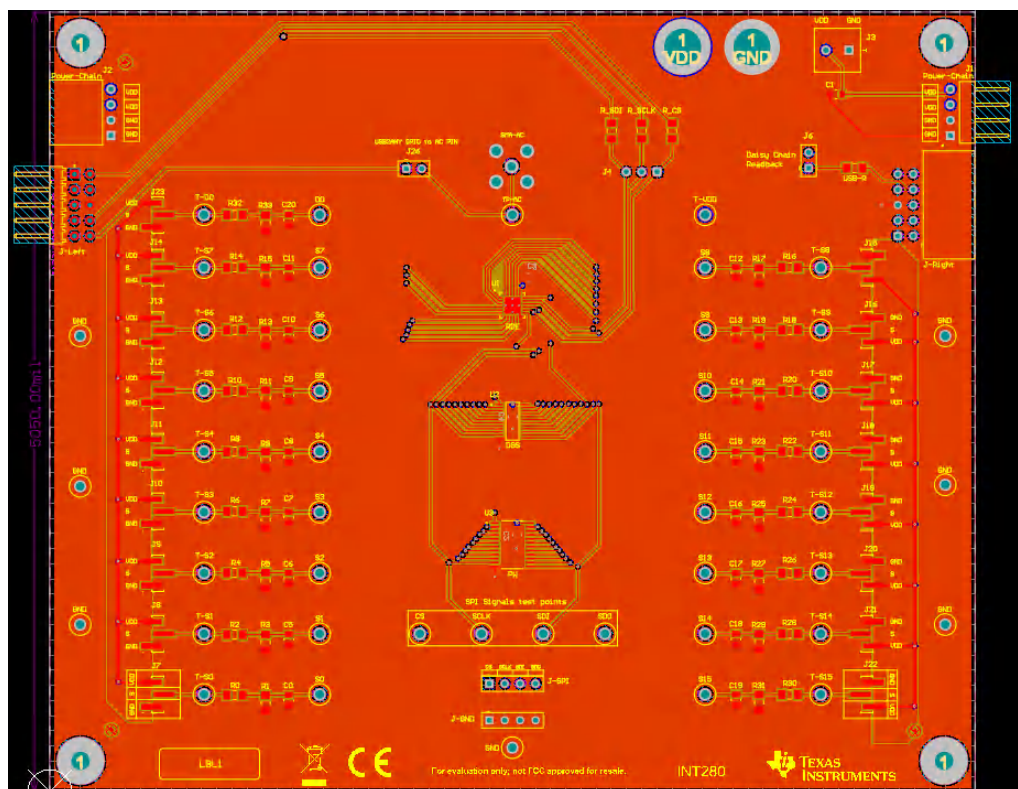


Figure 3-2. TMUXS1306EVM Top Layer Layout

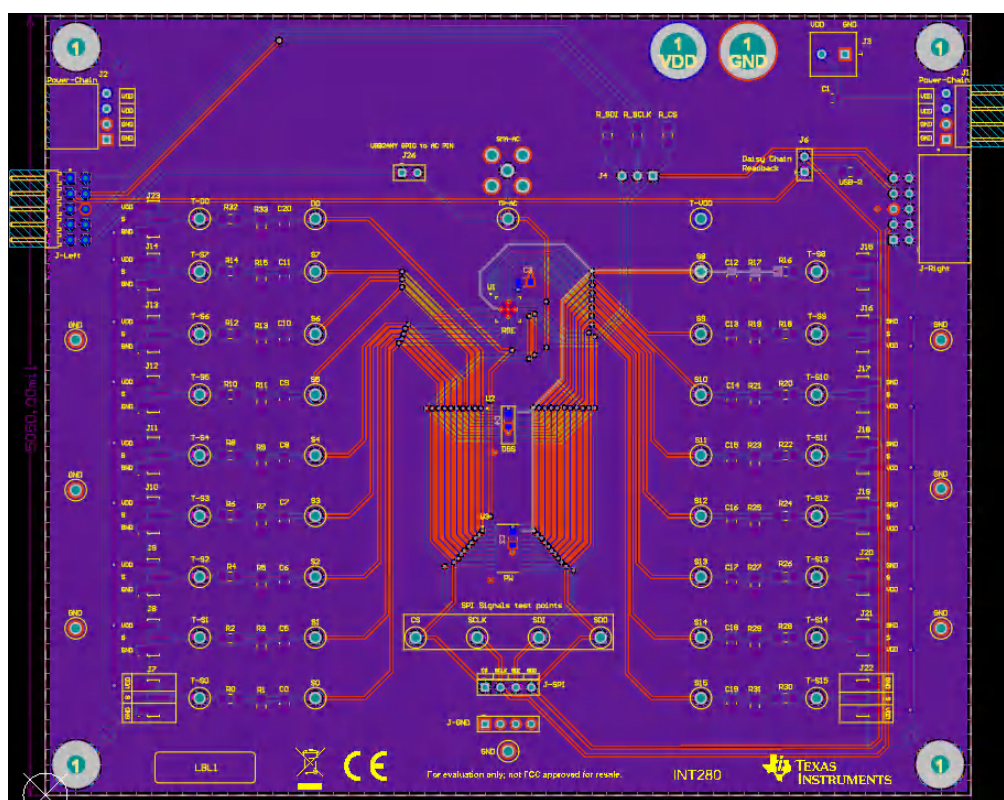


Figure 3-3. TMUXS1306EVM Bottom Layer Layout

3.3 Bill of Materials (BOM)

Table 3-1. Bill of Materials

Designator	Qty	Value	Description	Manufacturer	Part Number
D0, S0, S1, S2, S3, S4, S5, S6, S7, S8, S9, S10, S11, S12, S13, S14, S15, T-D0, T-S0, T-S1, T-S2, T-S3, T-S4, T-S5, T-S6, T-S7, T-S8, T-S9, T-S10, T-S11, T-S12, T-S13, T-S14, T-S15	34		Test Point, Multipurpose, Yellow, TH	Keystone Electronics	5014
GND	7		Test Point, Multipurpose, Black, TH	Keystone Electronics	5011
C1, C2, C3, C4	4	6.8nF	±1% 50V Ceramic Capacitor C0G, NP0 0805 (2012 Metric)	CAL-CHIP ELECTRONICS	GMC21CG682F50NT
CS, SCLK, SDI, SDO	4		Test Point, Multipurpose, Orange, TH	Keystone Electronics	5013
H1, H2, H3, H4	4		Machine Screw, Round, #4-40 × 1/4, Nylon, Philips panhead	B&F Fastener Supply	NY PMS 440 0025 PH
H5, H6, H7, H8	4		Standoff, Hex, 0.5"L #4-40 Nylon	Keystone	1902C
J1	1		Header, 100mil, 4x1, Gold, R/A, TH	Samtec	TSW-104-08-G-S-RA
J2	1		Receptacle, 100mil, 4x1, Gold, R/A, TH	Sullins Connector Solutions	PPPC041LGBN-RC
J3	1		Conn Term Block, 2POS, 3.81mm, TH	Phoenix Contact	1727010
J4	1		Header, 100mil, 3x1, Gold, TH	Samtec	TSW-103-07-G-S
J5	1		Connector, SMA, TH	Cinch Connectivity	142-0701-201
J6, J26	2		Header, 2.54mm, 2x1, Gold, TH	Samtec	TSW-102-08-G-S
J7, J8, J9, J10, J11, J12, J13, J14, J15, J16, J17, J18, J19, J20, J21, J22, J23	17		Header, 2mm, 3x1, Gold, SMT	Samtec	TMM-103-01-G-S-SM
J32	1		Banana Jack BIL 20 Black, TH	Hirschmann	930 176-100
J40	1		Banana Jack BIL 20 Red, TH	Hirschmann	930 176-101
J-GND, J-SPI	2		Header, 2.54mm, 4x1, Gold, TH	Sullins Connector Solutions	PBC04SAAN
LBL1	1		Thermal Transfer Printable Labels, 0.650" W × 0.200" H	Brady	THT-14-423-10
R0, R2, R4, R6, R8, R10, R12, R14, R16, R18, R20, R22, R24, R26, R28, R30, R32, R_CS, R_SCLK, R_SDI, USB2ANY_SCLK	21	0Ω	RES, 0, 0%, W, AEC-Q200 Grade 0, 0805	RΩ	PMR10EZPJ000
SPI_L_Connect1	1		Header, 100mil, 5x2, R/A, Gold, TH	FCI	68021-210HLF
SPI_R_Connect1	1		Receptacle, 2.54mm, 5x2, Gold, R/A, TH	Sullins Connector Solutions	SFH11-PBPC-D05-RA-BK
U1	1		TMUXS1306ARGE	Texas Instruments	TMUXS1306ARGE

Table 3-1. Bill of Materials (continued)

Designator	Qty	Value	Description	Manufacturer	Part Number
C0, C5, C6, C7, C8, C9, C10, C11, C12, C13, C14, C15, C16, C17, C18, C19, C20	0		CAP, CERM, 0.1uF, 50V, +/- 10%, X7R, AEC-Q200 Grade 1, 0805	TDK	CEU4J2X7R1H104K125AE
R1, R3, R5, R7, R9, R11, R13, R15, R17, R19, R21, R23, R25, R27, R29, R31, R33	0		1 k Ω $\pm$ 0.01% 0.1W, 1/10W Chip Resistor 0805 (2012 Metric) Anti-Sulfur, Automotive AEC-Q200 Thin Film	Susumu	URG2012L-102-L-T05
U2	0		TMUXS1306ADGS	Texas Instruments	TMUXS1306ADGS
U3	0		TMUXS1306APW	Texas Instruments	TMUXS1306APW

4 Additional Information

4.1 Trademarks

All trademarks are the property of their respective owners.

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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/sds/ti_ja/general/eStore/notice_01.page 日本国内に輸入される評価用キット、ボードについては、次のところをご覧ください。

<https://www.ti.com/ja-jp/legal/notice-for-evaluation-kits-delivered-in-japan.html>

3.3.2 *Notice for Users of EVMs Considered "Radio Frequency Products" in Japan:* EVMs entering Japan may not be certified by TI as conforming to Technical Regulations of Radio Law of Japan.

If User uses EVMs in Japan, not certified to Technical Regulations of Radio Law of Japan, User is required to follow the instructions set forth by Radio Law of Japan, which includes, but is not limited to, the instructions below with respect to EVMs (which for the avoidance of doubt are stated strictly for convenience and should be verified by User):

1. Use EVMs in a shielded room or any other test facility as defined in the notification #173 issued by Ministry of Internal Affairs and Communications on March 28, 2006, based on Sub-section 1.1 of Article 6 of the Ministry's Rule for Enforcement of Radio Law of Japan,
2. Use EVMs only after User obtains the license of Test Radio Station as provided in Radio Law of Japan with respect to EVMs, or
3. Use of EVMs only after User obtains the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to EVMs. Also, do not transfer EVMs, unless User gives the same notice above to the transferee. Please note that if User does not follow the instructions above, User will be subject to penalties of Radio Law of Japan.

【無線電波を送信する製品の開発キットをお使いになる際の注意事項】 開発キットの中には技術基準適合証明を受けていないものがあります。技術適合証明を受けていないもののご使用に際しては、電波法遵守のため、以下のいずれかの措置を取っていただく必要がありますのでご注意ください。

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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/sds/ti_ja/general/eStore/notice_02.page

電力線搬送波通信についての開発キットをお使いになる際の注意事項については、次のところをご覧ください。<https://www.ti.com/ja-jp/legal/notice-for-evaluation-kits-for-power-line-communication.html>

3.4 European Union

3.4.1 *For EVMs subject to EU Directive 2014/30/EU (Electromagnetic Compatibility Directive):*

This is a class A product intended for use in environments other than domestic environments that are connected to a low-voltage power-supply network that supplies buildings used for domestic purposes. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

4 *EVM Use Restrictions and Warnings:*

4.1 EVMS ARE NOT FOR USE IN FUNCTIONAL SAFETY AND/OR SAFETY CRITICAL EVALUATIONS, INCLUDING BUT NOT LIMITED TO EVALUATIONS OF LIFE SUPPORT APPLICATIONS.

4.2 User must read and apply the user guide and other available documentation provided by TI regarding the EVM prior to handling or using the EVM, including without limitation any warning or restriction notices. The notices contain important safety information related to, for example, temperatures and voltages.

4.3 *Safety-Related Warnings and Restrictions:*

4.3.1 User shall operate the EVM within TI's recommended specifications and environmental considerations stated in the user guide, other available documentation provided by TI, and any other applicable requirements and employ reasonable and customary safeguards. Exceeding the specified performance ratings and specifications (including but not limited to input and output voltage, current, power, and environmental ranges) for the EVM may cause personal injury or death, or property damage. If there are questions concerning performance ratings and specifications, User should contact a TI field representative prior to connecting interface electronics including input power and intended loads. Any loads applied outside of the specified output range may also result in unintended and/or inaccurate operation and/or possible permanent damage to the EVM and/or interface electronics. Please consult the EVM user guide prior to connecting any load to the EVM output. If there is uncertainty as to the load specification, please contact a TI field representative. During normal operation, even with the inputs and outputs kept within the specified allowable ranges, some circuit components may have elevated case temperatures. These components include but are not limited to linear regulators, switching transistors, pass transistors, current sense resistors, and heat sinks, which can be identified using the information in the associated documentation. When working with the EVM, please be aware that the EVM may become very warm.

4.3.2 EVMs are intended solely for use by technically qualified, professional electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems, and subsystems. User assumes all responsibility and liability for proper and safe handling and use of the EVM by User or its employees, affiliates, contractors or designees. User assumes all responsibility and liability to ensure that any interfaces (electronic and/or mechanical) between the EVM and any human body are designed with suitable isolation and means to safely limit accessible leakage currents to minimize the risk of electrical shock hazard. User assumes all responsibility and liability for any improper or unsafe handling or use of the EVM by User or its employees, affiliates, contractors or designees.

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