

EVM User's Guide: TMCS-A-ADAPTER-EVM

TMCS-A-Adapter Evaluation Module

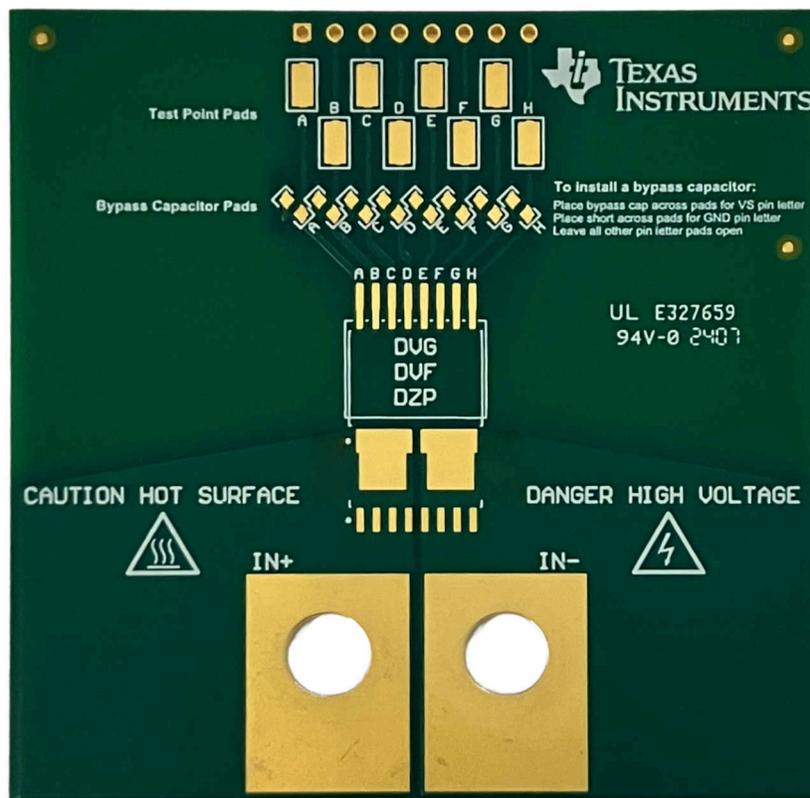


Description

The TMCS-A-ADAPTER-EVM is an evaluation module (EVM) intended to facilitate rapid, convenient use of TMCS isolated hall-effect precision current sense monitors that use the DVG, DVF, or DZP packages. This EVM allows the user push up to 90A current through the hall-input side while measuring the isolated output through an isolation barrier. The TMCS-A-ADAPTER-EVM consists of a single unpopulated PCB with locations to populate test points and breakout header pins for device evaluation. The PCB pads are overlapped so that any DVG, DVF, or DZP TMCS part can be used with TMCS-A-ADAPTER-EVM.

Features

- Evaluation of TMCS devices in DVG, DVF, and DZP packages at all sensitivity and measurement ranges
- Test points and header pins to allow ease of access to all device pins
- Component pads allow for proper power supply bypassing
- Large copper planes to help with heat dissipation
- Lug connectors to connect the EVM to current carrying leads carrying up to 90A



1 Evaluation Module Overview

CAUTION

The TMCS-A-ADAPTER-EVM does not include a TMCS isolated Hall-effect current sense amplifier. To use this evaluation module, a TMCS device using the DVG, DVF, or DZP packages must be ordered and soldered onto the evaluation board.

1.1 Introduction

This user's guide describes the characteristics, operation, and use of the TMCS-A-Adapter evaluation module (EVM). This EVM is designed to evaluate the performance of TMCS voltage output isolated Hall-effect current sense amplifiers in the [DVG](#), [DVF](#), and [DZP](#) Packages. Throughout this document, the terms evaluation board, evaluation module, and EVM are synonymous with the TMCS-A-ADAPTER-EVM. This document includes a schematic, reference printed-circuit board (PCB) layouts, and a complete bill of materials (BOM).

The TMCS Hall-effect current sense amplifiers (also called an isolated current-sense amplifier) sense magnetic flux generated from current passing through the device lead frame. TMCS devices utilize isolation at common-mode voltages independent of the supply voltage. Devices are available with the common zero-input reference point configurations of 2.5V (A), 1.65V (B), and 0.33V (C), with various fixed sensitivities available.

1.2 Kit Contents

[Table 1-1](#) lists the contents of the TMCS-A-ADAPTER-EVM kit. Contact the nearest [Texas Instruments Customer Support Center](#) if any component is missing. TI highly recommends checking the family product folder on the TI website at www.ti.com for further information regarding the TMCS device under evaluation.

Table 1-1. TMCS-A-ADAPTER-EVM Kit Contents

Item	Part Number	Quantity	Manufacturer
TMCS-A-ADAPTER-EVM Printed Circuit Board	SENS127	1	Texas Instruments
CAP, CERM, 0.1uF, 100V, +/- 10%, X7S, AEC-Q200 Grade 1, 0603	CGA3E3X7S2A104K080AB	2	TDK
RES, 0, 5%, 0.125 W, 0603	MCT06030Z0000ZP500	2	Vishay/Beyschlag
Test Point, Miniature, SMT	5015	8	Keystone Electronics
Header, 100mil, 8x1, TH	800-10-008-10-001000	1	Mill-Max
Terminal Connector Rectangular Lug, Grounding 1/4 Stud	CB70-14-CY	2	Panduit
Medium-Strength Steel Hex Nut	95462A029	2	McMaster-Carr
Passivated 18-8 Stainless Steel Pan Head Socket Head Screw 1/4"-20 Thread Size, 1/2" Long	92196A537	2	McMaster-Carr
Zinc-Plated Steel External-Tooth Lock Washers for M6 Screw Size, 6.4mm ID, 11mm OD	97985A560	2	McMaster-Carr

1.3 Specification

The following are instructions to set up and use the TMCS-A-ADAPTER-EVM. [Figure 1-1](#) shows an example of a simple setup using the TMCS1123 pinout. This device has reinforced isolation up to 1300V DC, and external supplies are distinguished by *high current* (HC) for load and *low voltage* (LV) for DUT supply. The HC supply can be isolated and at a different potential than the LV supply.

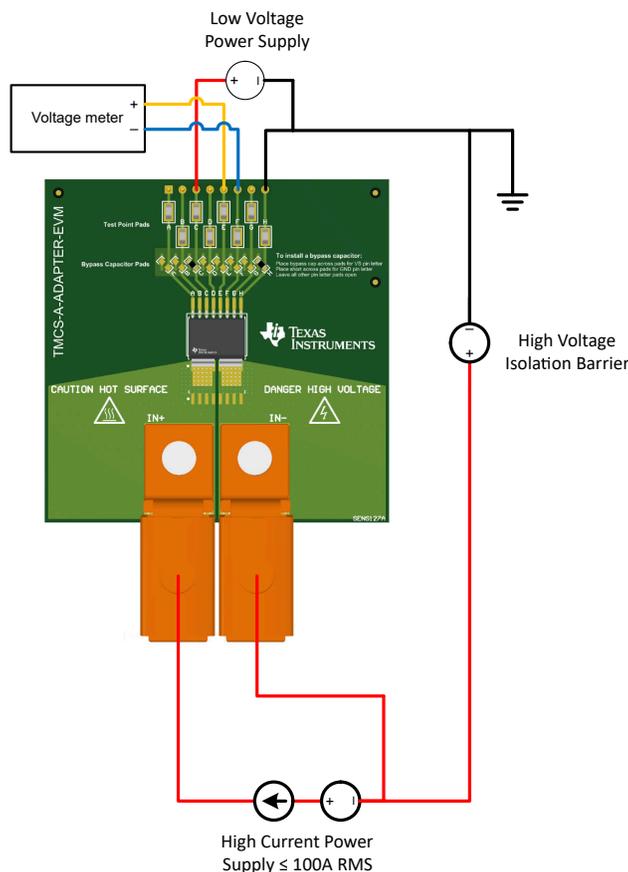


Figure 1-1. Low-Side Forward Current Setup for Reinforced Isolation

1. Assemble the board per the instructions in [Section 2.2](#).
2. Connect the terminals of an external LV supply to the GND and VCC test points for the particular TMCS device used. Be sure to connect GND first and make sure that the external LV supply is between 3V and 5.5V.
3. Connect the input per [Section 2.3](#).

WARNING

When measuring current, first make sure that equipment (wires, connectors) can support the amperage and power dissipation. Also ensure the wires and connectors are securely fastened so that they may not move or make unintentional connections. Secondly, make sure that current flowing through the inputs of the device and the voltage levels across the device isolation are kept within the safe operating area limits of the device specified in the data sheet. Failure to do so can result in damage to the EVM, or personal injury.

Do not touch the HV terminals!

Hot surface. Contact can cause burns. Do not touch!

1.4 Device Information

The TMCS devices are isolated, Hall-effect based current-sense amplifiers that provides ease-of-use and high performance. The TMCS-A-ADAPTER-EVM is a blank PCB intended to provide basic, functional evaluation of all TMCS devices in the [DVG](#), [DVF](#), and [DZP](#) packages. The TMCS-A-ADAPTER-EVM is not laid out for electromagnetic compatibility (EMC) testing. The EVM consists of a single printed circuit board (PCB) that has not been populated with any electrical components and must be assembled before use. Included in the EVM kit are the board components required for testing with the EVM as well as high-current lug connectors used for supplying measurement signals to the current sensor.

1.5 General Texas Instruments High Voltage Evaluation (TI HV EVM) User Safety Guidelines



Always follow TI's setup and application instructions, including use of all interface components within the recommended electrical rated voltage and power limits. Always use electrical safety precautions to help ensure your personal safety and those working around you. Contact TI's Product Information Center <http://support/ti.com> for further information.

Save all warnings and instructions for future reference.

WARNING

Failure to follow warnings and instructions can result in personal injury, property damage or death due to electrical shock and burn hazards.

The term TI HV EVM refers to an electronic device typically provided as an open framed, unenclosed printed circuit board assembly. It is *intended strictly for use in development laboratory environments, solely for qualified professional users having training, expertise and knowledge of electrical safety risks in development and application of high voltage electrical circuits. Any other use and/or application are strictly prohibited by Texas Instruments.* If you are not suitably qualified, then immediately stop from further use of the HV EVM.

1. Work Area Safety

- a. Keep work area clean and orderly.
- b. Qualified observers must be present anytime circuits are energized.
- c. Effective barriers and signage must be present in the area where the TI HV EVM and the interface electronics are energized, indicating operation of accessible high voltages can be present, for the purpose of protecting inadvertent access.
- d. All interface circuits, power supplies, evaluation modules, instruments, meters, scopes and other related apparatus used in a development environment exceeding 50Vrms/75VDC must be electrically located within a protected Emergency Power Off EPO protected power strip.
- e. Use stable and nonconductive work surface.
- f. Use adequately insulated clamps and wires to attach measurement probes and instruments. No freehand testing whenever possible.

2. Electrical Safety

As a precautionary measure, a good engineering practice is to assume that the entire EVM can have fully accessible and active high voltages.

- a. De-energize the TI HV EVM and all the inputs, outputs and electrical loads before performing any electrical or other diagnostic measurements. Revalidate that TI HV EVM power has been safely de-energized.
- b. With the EVM confirmed de-energized, proceed with required electrical circuit configurations, wiring, measurement equipment connection, and other application needs, while still assuming the EVM circuit and measuring instruments are electrically live.
- c. After EVM readiness is complete, energize the EVM as intended.

WARNING

While the EVM is energized, never touch the EVM or electrical circuits, as the EVM or electrical circuits can be at high voltages capable of causing electrical shock hazard.

3. Personal Safety

- a. Wear personal protective equipment (for example, latex gloves or safety glasses with side shields) or protect EVM in an adequate lucent plastic box with interlocks to protect from accidental touch.

Limitation for safe use:

EVMs are not to be used as all or part of a production unit.

2 Hardware

2.1 Circuitry

This section summarizes the TMCS-A-ADAPTER-EVM components.

2.1.1 Pin Headers and Test Points

The TMCS-A-ADAPTER-EVM includes connections to the isolated low voltage pins of the device, which can be routed out to a breadboard through the inline header pins or connected to external equipment for device evaluation and system prototyping. These connections allow full evaluation of the TMCS devices used with the EVM through external configuration. The header pins are spaced 0.1in apart and are compatible with most solderless prototype boards. External equipment such as power supplies and digital multimeters (DMMs) can also be used with hook clips attached to the surface mounted test points.

2.1.2 Bypass Capacitors

A supply bypass capacitor can be populated for the TMCS-A-ADAPTER-EVM using the unpopulated 0603 component pads with the kitted 0.1 μ F ceramic capacitor and zero-ohm resistor. Install the capacitor and zero-ohm resistor onto the pads for the voltage supply and ground pins respectively for the desired device. These components connect the ground pin to a layer on the back of the board providing the ground connection for the bypass capacitor. These components are present to help smooth the supply voltage of the TMCS magnetic current-sensing device. Other ground connections can also be made using the 0603 passive component pads.

2.1.3 Load Connectors

The input connectors labeled IN+ and IN- correspond to the high-current rated load connector lugs supplied with the EVM. These components must be screwed to the board to make contact. The acceptable load input maximum for the included connectors is 90A for DC measurements. However, the continuous allowable load is bounded by the safe operating area (SOA) described in the data sheet of the TMCS device under test. Although the high-current connector pads are labeled IN+ and IN- the polarity required to sense current with the TMCS-A-ADAPTER-EVM is device dependent and are described in the data sheet of the TMCS device if applicable.

2.1.4 TMCS Isolated Current-Sense Amplifier

The TMCS devices are isolated current-sense amplifiers. The TMCS-A-ADAPTER-EVM board can be populated with any TMCS device that uses the [DVG](#), [DVF](#), or [DZP](#) packages. This enables users to test all possible variants of the devices to determine the best device for a given application.

- A magnetic field is generated based on the load current that is connected across the inputs IN+ and IN-, and flows through the TMCS device leadframe.
- The device pinout, output voltage swing limitation, and required load current sensing range are the key factors when determining device selection.
- The selected device must allow the output voltage to remain within the output swing range after the load current is transduced and amplified by the respective device sensitivity. The input current must remain within the measurement range for the selected device.
- Choose an appropriate sensitivity to create the largest appropriate output swing and minimize error.

2.2 Board Assembly

Assembling the TMCS-A-ADAPTER EVM with the provided components and a TMCS Hall-effect isolated current sense amplifier device is necessary before using the EVM to evaluate the performance of the TMCS device. The recommended procedure for assembling the board is as follows:

1. Solder the surface-mount components onto the board. This includes a TMCS device in the [DVG](#), [DVF](#), or [DZP](#) packages, a voltage supply bypass capacitor, a jumper resistor to ground, and (optional) surface mount test points.
 - a. As an example, the TMCS1123 device uses the DVG package pins 8 and 3 for GND and V_s respectively. These pins correspond to the EVM traces labeled **C** and **H** respectively, so the bypass capacitor should be soldered to C and the jumper resistor should be soldered to H. An illustration of this is shown in [Figure 1-1](#), and a picture is shown in [Figure 2-1](#) below.
2. Solder the (optional) through-hole pin headers to the board.
3. Connect the high-current input lugs to the IN+ and IN- pads with the supplied screw, lock washer, and hex nut.
 - a. The Lugs must not touch when tightened.
 - b. Make sure that the lugs are positioned so that the lugs make contact with the maximum possible surface area of the PCB pad.
 - c. The connectors must be tightly fastened so that the connectors cannot be moved by hand, to a torque of about 40in-lbs.

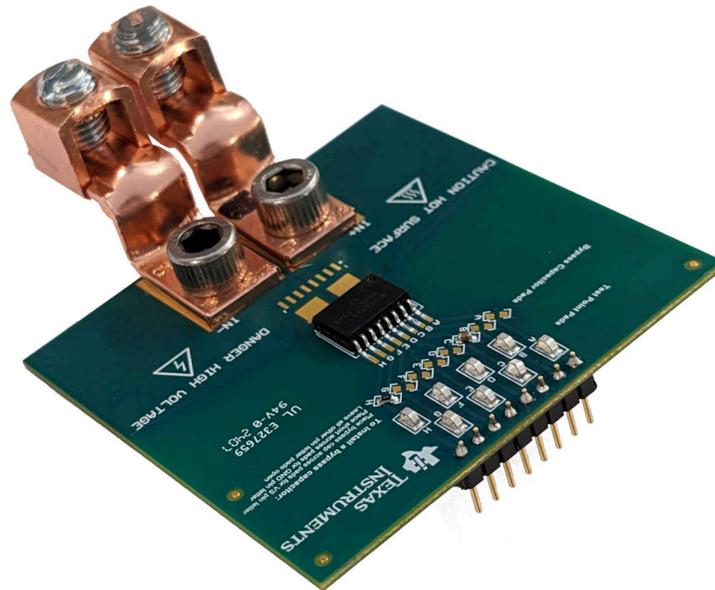


Figure 2-1. Fully Assembled EVM with TMCS1123 device

2.3 Measurements

The following procedures are used to configure a measurement evaluation with an electronic load.

2.3.1 Input Connection

1. As illustrated in [Figure 1-1](#), for a low-side measurement, connect the electronic load positive input terminal to the positive terminal of a supply capable of sourcing the desired amount of maximum load current. For a high-side measurement, connect the electronic load positive input terminal to the load sourcing terminal (IN+ or IN-) of the EVM. For high-side measurement of forward current, IN- sources to the electronic load; for reverse current, IN+ sources to the load.
2. Connect the electronic load negative output terminal to the external supply GND terminal for high-side measurements, or to the load sinking terminal of the EVM for low-side measurements.
3. For high-side measurements, connect the external supply to the load sinking terminal of the EVM. Otherwise, for low-side measurements, connect the load sourcing terminal of the EVM (IN+ or IN-) to the external supply GND.
4. Turn on all the connected supplies.
5. Apply load with electronic load or actual system load.
6. Measure the output voltage at the test point for the VOUT pin of the DUT.

Note

The output voltage is equal to the sensitivity of the device multiplied by the load current passing through the leadframe of the DUT.

2.3.2 Advanced Measurement Tips

To assess whether the expected load matches the measured load, use a precision shunt resistor rated for the maximum intended current in series with the DUT. The precision shunt has a kelvin connection where the generated sense voltage can be measured by a precision multimeter, such as the 3458a multimeter. Sensing an external shunt voltage is preferred, as a typical multimeter can have a current limit far below the needed current measurement limits in question. Additionally, some meters have better voltage measurement precision than current measurement precision.

For evaluating performance when the DUT is subjected to quick current pulses, use short, large-gauge wire, or short bus bars, to reduce the inductance and resistance between the HV-supply, load, and EVM. By minimizing the inductance, the rate of load slew can be increased. If assessing the performance over large transient current spikes (>20 A) is desired, then be sure to use a supply with sufficient voltage headroom to accommodate the series resistance of the wires/bus bars, board planes, and DUT lead frame resistance. A large capacitor bank between the supply terminals can be used to make sure there is an adequate charge reservoir available to prevent the supply from drooping and helping supply the large current inrush through the device.

If assessing temperature performance is desired, then use wide, thin bus bars to reduce the thermal sinking ability of the system and minimize the inductance of the system. Board temperature is not an exact indicator of DUT temperature. More precise measurements can be obtained by placing a layer of thermally conductive grease on top of the DUT package and placing a thermal sensor directly on the thermal grease. See [Thermal Implementation Guide for In-Package Magnetic Current Sensors](#) for additional information and for details regarding thermal best practices.

3 Hardware Design Files

3.1 Schematics

Figure 3-1 shows the schematic of the TMCS-A-ADAPTER-EVM.

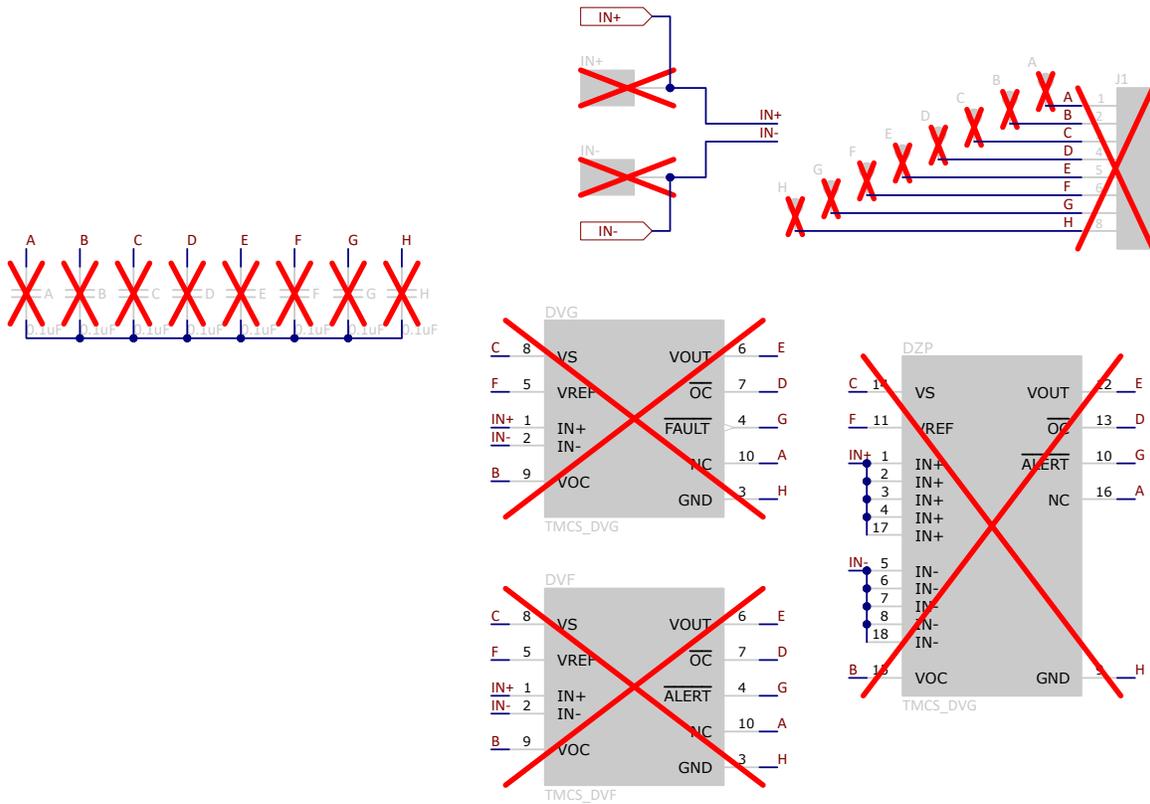


Figure 3-1. Schematic for the TMCS-A-ADAPTER-EVM

3.2 PCB Layout

Figure 3-2 through Figure 3-7 illustrate the PCB layers of the TMCS-A-ADAPTER-EVM.

Note

Board layouts are not to scale. These figures are intended to show how the board is laid out. The figures are not intended to be used for manufacturing TMCS-A-ADAPTER-EVM PCBs.

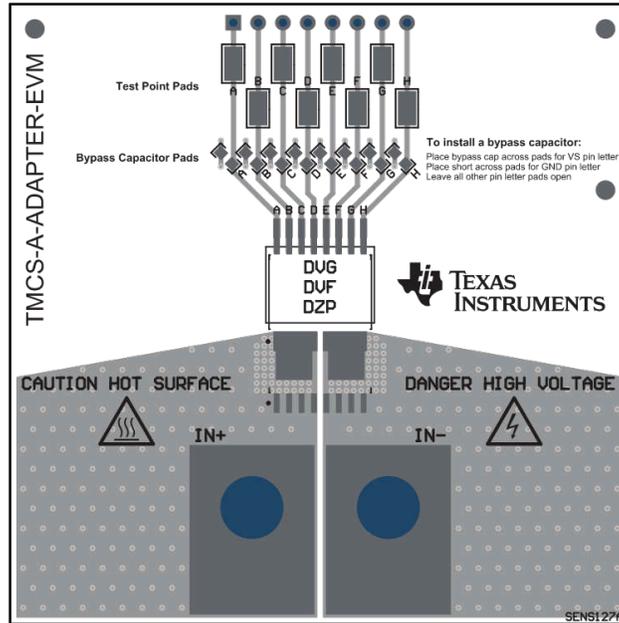


Figure 3-2. Top Overlay

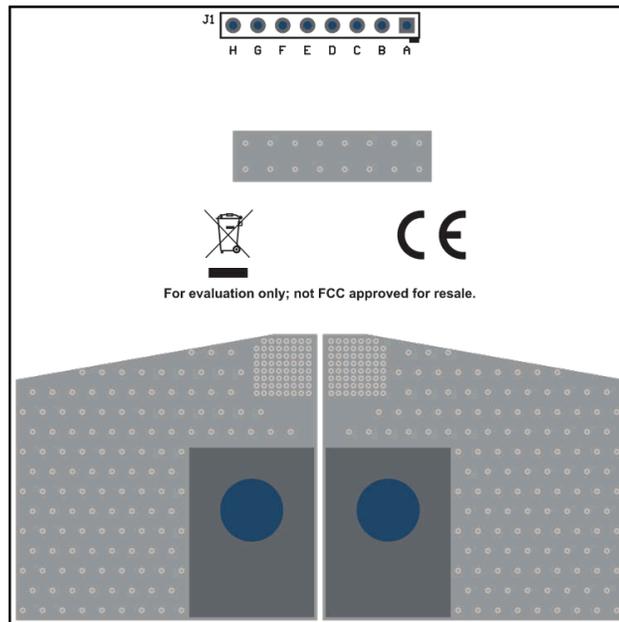


Figure 3-3. Bottom Overlay

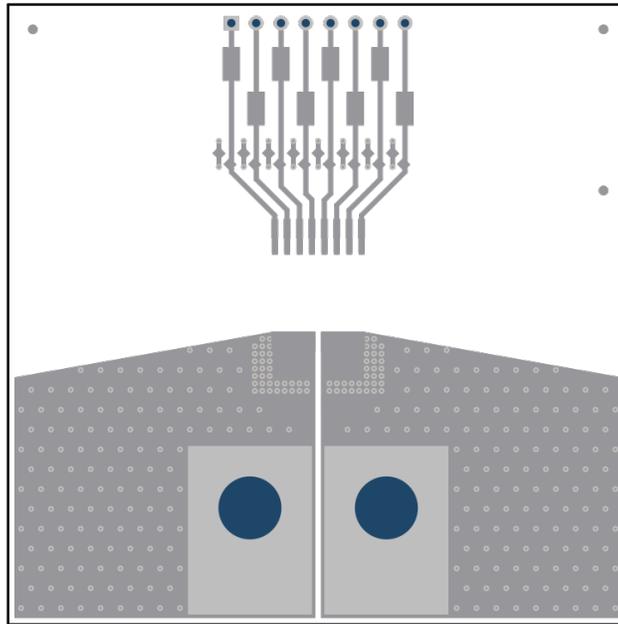


Figure 3-4. Top Layer

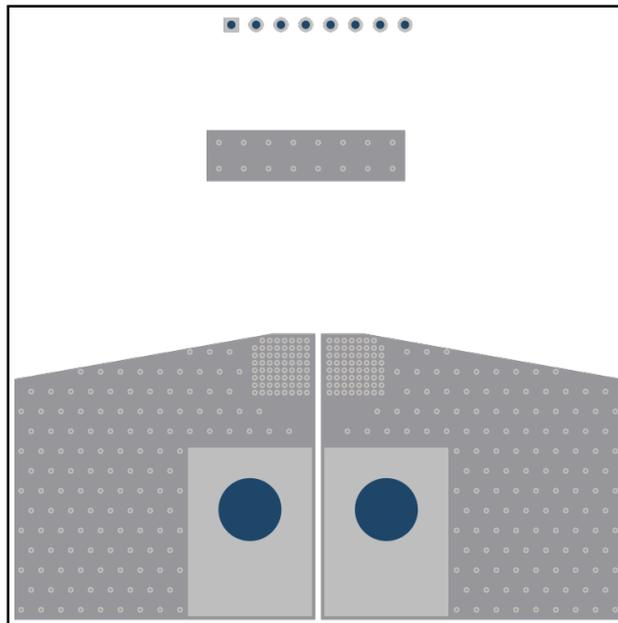


Figure 3-5. Copper Layer 1

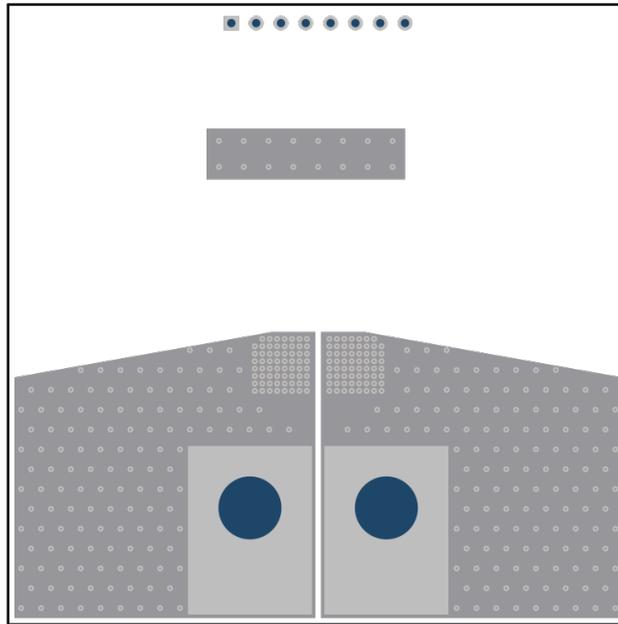


Figure 3-6. Copper Layer 2

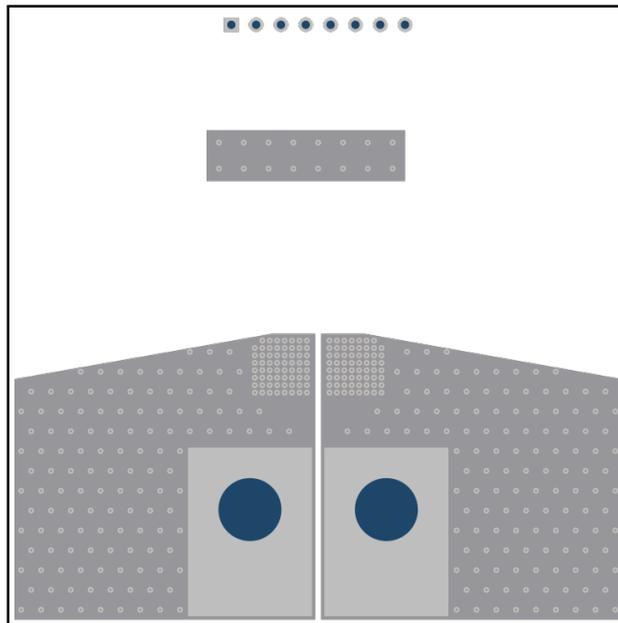


Figure 3-7. Bottom Layer

3.3 Bill of Materials

Table 3-1. Bill of Materials for TMCS-A-ADAPTER-EVM

Designator	Quantity	Value	Description	Part Number	Manufacturer
!PCB1	1		Printed Circuit Board	SENS127	Any
A, B, C, D, E, F, G, H	0	0.1uF	CAP, CERM, 0.1uF, 100V, +/- 10%, X7S, AEC-Q200 Grade 1, 0603	CGA3E3X7S2A104K080AB	TDK
DVF	0			TMCS_DVF	Texas Instruments
DVG	0		TMCS1123A1QDVGR	TMCS_DVG	Texas Instruments
DZP	0			TMCS_DVG	Texas Instruments
IN-, IN+	0		Terminal 90A Lug	CB70-14-CY	Panduit
J1	0		Header, 100mil, 8x1, TH	800-10-008-10-001000	Mill-Max
TP1, TP2, TP3, TP4, TP5, TP6, TP7, TP8	0		Test Point, Miniature, SMT	5015	Keystone Electronics

4 Additional Information

4.1 Trademarks

All trademarks are the property of their respective owners.

5 Related Documentation From Texas Instruments

[Table 5-1](#) provides literature references for the TI package drawings used in the layout of the TMCS-A-ADAPTER-EVM. This user's guide is available from the TI website under literature number SBAU452. Any letter appended to the literature number corresponds to the document revision that is current at the time of the writing of this document. Newer revisions are available from www.ti.com or the Texas Instruments' Literature Response Center at (800) 477-8924 or the Product Information Center at (972) 644-5580. When ordering, identify the document by both title and literature number.

Table 5-1. Related Documentation

Document	Literature Number
DVG package drawing	MPSS146
DVF package drawing	TBD
DZP package drawing	TBD

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 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/lstds/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。

1. 電波法施行規則第6条第1項第1号に基づく平成18年3月28日総務省告示第173号で定められた電波暗室等の試験設備でご使用いただく。
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。

なお、本製品は、上記の「ご使用にあたっての注意」を譲渡先、移転先に通知しない限り、譲渡、移転できないものとします。

上記を遵守頂けない場合は、電波法の罰則が適用される可能性があることをご留意ください。日本テキサス・イ

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西新宿三井ビル

3.3.3 *Notice for EVMs for Power Line Communication:* Please see http://www.tij.co.jp/lstds/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.

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- 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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