EVM User's Guide: TLV3802 TLV3802EVM

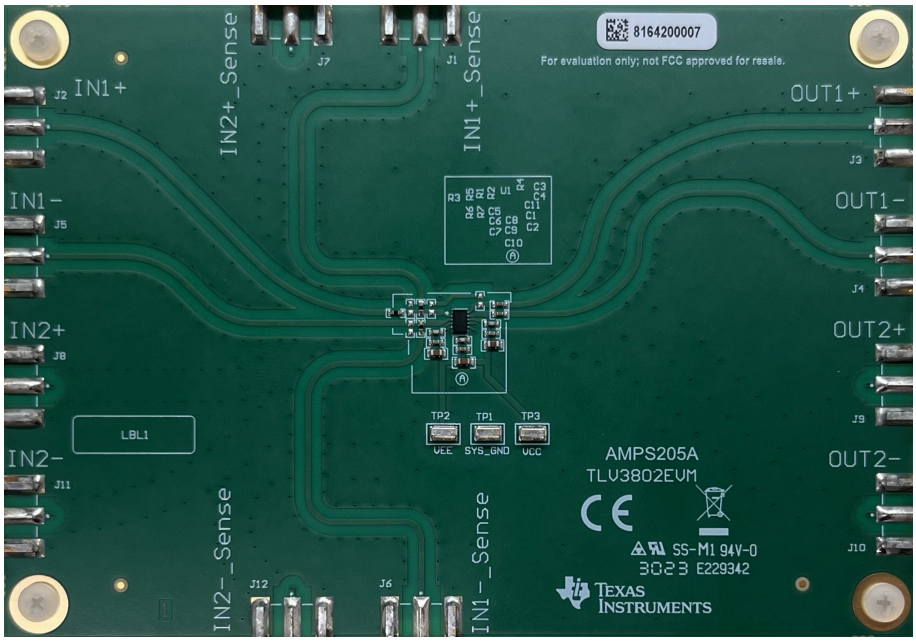
TLV3802 Evaluation Module

Description

The TLV3802EVM is an evaluation board designed to evaluate the high-speed dual channel TLV3802 comparator. The TLV3802EVM has layout options intended to simply evaluate timing performance with different measurement tools. The output of the TLV3802 is designed for low-voltage differential signals (LVDS), which provide high-speed signals to interconnect devices such as FPGAs with minimal power dissipation.

Features

- Low propagation delay
- Low overdrive dispersion
- High toggle frequency
- Narrow pulse width detection capability
- LVDS output
- Low input offset voltage
- WF-DFN Package 12-pin DSS



TLV3802EVM Board (Top View)

1 Evaluation Module Overview

1.1 Introduction

This user's guide describes the functionality and set up procedure of the evaluation board TLV3802EVM, which is designed to evaluate the performance of the high-speed dual channel TLV3802 comparator. Information such as the contents of the kit, specifications of the device, and recommended equipment for the set up is also included.

1.2 Kit Contents

The kit comes with the following:

- 1 x TLV3802EVM

1.3 Specification

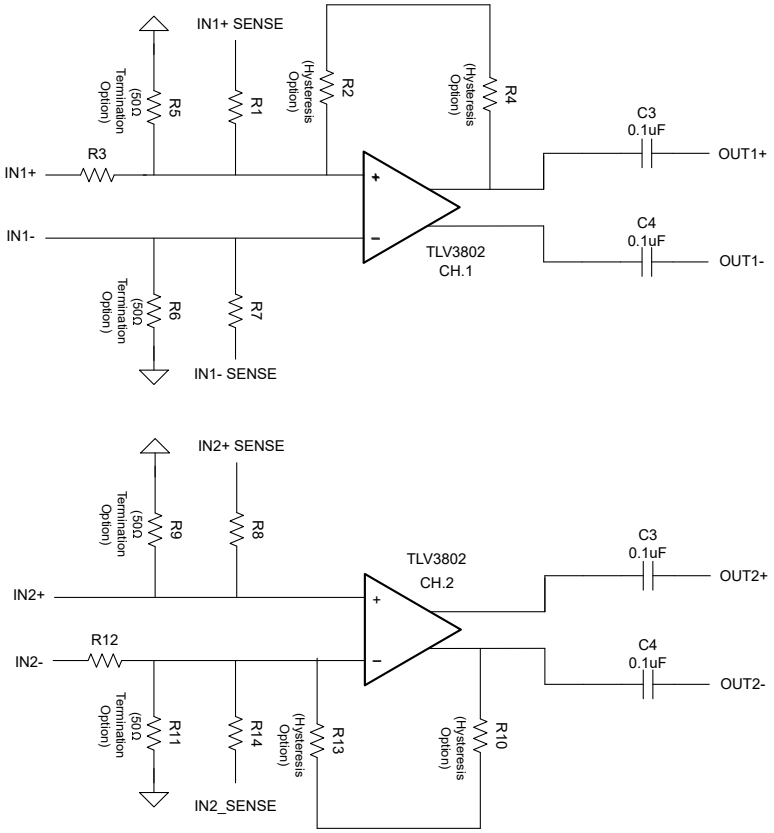


Figure 1-1. TLV3802EVM Block Diagram

- Supply range: +2.7 V to +5.25 V (single supply only)
- Input common mode voltage range: (VEE + 1.5 V) to (VCC + 0.1 V)

Table 1-1. TLV3802EVM SMA and Test Point to DUT Pin Mapping

TLV3607EVM CONNECTIONS	
Test point 1	GND (Pin 1)
SMA J2: IN1+ SMA J1: IN1+_SENSE	IN1+ (Pin 2)
SMA J5: IN1- SMA J6: IN1-_SENSE	IN1- (Pin 3)
Test Point 2	VEE (Pin 4)
SMA J8: IN2+ SMA J7: IN2+_SENSE	IN2+ (Pin 5)
SMA J11: IN2- SMA J12: IN2-_SENSE	IN2- (Pin 6)
Test point 3	VCC (Pin 7)
SMA J10: OUT2-	OUT2- (Pin 8)
SMA J9: OUT2+	OUT2+ (Pin 9)
Test Point 3	VCC (Pin 10)
SMA J4: OUT1-	OUT1- (Pin 11)
SMA J3: OUT1+	OUT1+(Pin 12)

1.4 Device Information

The following device is used in this evaluation module:

- TLV3802DSSR

2 Hardware

2.1 Recommended Equipment Setup

- Power Supply
- High Speed Functional Generator with fast rise/fall time recommended
- High Speed Oscilloscope with 50-Ω terminations
- SMA Cables/adapters
  - All sensed input signals and output signals must have matched cable lengths
    - IN1+_ SENSE, IN1-_ SENSE, IN2+_ SENSE, IN2-_ SENSE, OUT1+, OUT1-, OUT2+, OUT2-

2.2 Board Setup

2.2.1 Power Supplies

The TLV3802EVM can operate in either single or split supply configuration. If using a single supply, then the recommended supply voltage range for VCC - VEE is 2.7 V to 5.25V. If using a split supply configuration, then VCC - VEE has a range of 2.7 V to 5.25 V and VCC - GND has a range of 2.4 V to 5.25 V. Connect GND, VEE, and VCC using TP1, TP2, and TP3 respectively.

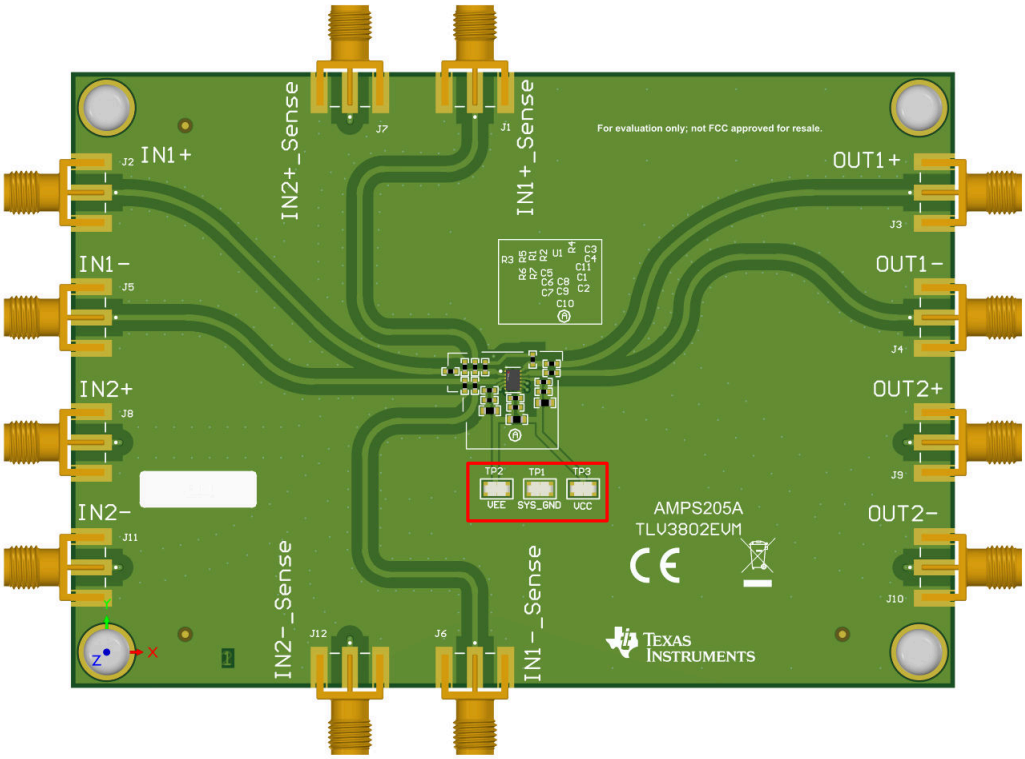


Figure 2-1. TLV3802EVM Power Supplies Connection

2.2.2 Inputs

Resistors R1, R7, R8, and R14 are 0-Ω resistors. The input terminals (IN1+, IN1-, IN2+, and IN2-) have corresponding sense lines so that the inputs to the device can be terminated on the lines with 50-Ω to an oscilloscope. This allows the input signals to be observed with minimal loading and distortion. There are also optional input resistors (R5, R6, R9, and R11) for direct 50-Ω termination if required by the input signal generator, otherwise the input resistors can be left uninstalled.

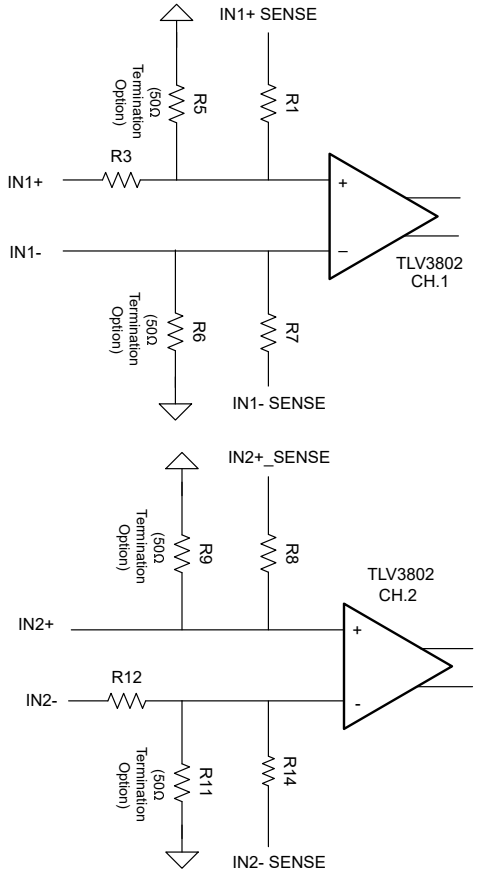


Figure 2-2. Input Side Block Diagram

2.2.3 Outputs

C3, C4, C12, and C13 are installed with 0.1-uF capacitors. If a 100-Ω differential probe is unavailable to measure the LVDS output, then these capacitors allow for the AC portion of the signal to be seen on a 50-Ω terminated scope. Keep in mind that any duty cycle other than 50% results in a DC portion of the signal that is not halfway between V_{OH} and V_{OL} due to the charging and discharging of the capacitors.

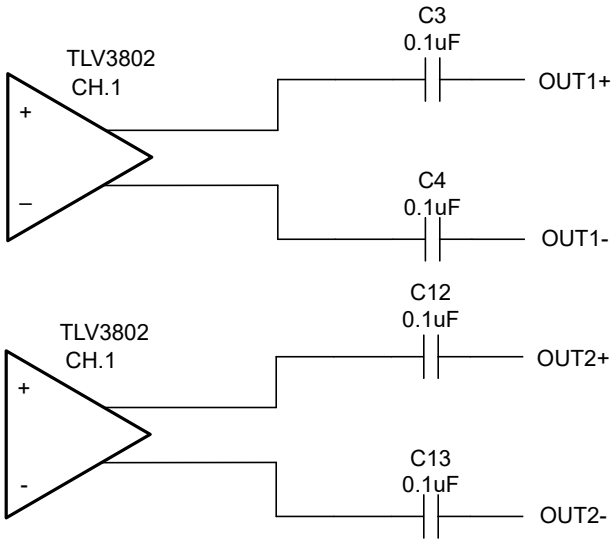


Figure 2-3. Output Side Block Diagram

2.2.4 Hysteresis

The TLV3802EVM is able to support external hysteresis on the non-inverting side for channel 1 and the inverting side for channel 2. Input resistors R3 and R12 are 0-Ω resistors but can be replaced accordingly for desired amount of hysteresis. For channel 1, the feedback resistor is the combination of R2 and R4. Likewise, for channel 2, the feedback resistor is the combination of R10 and R13. All resistors must be populated. If external hysteresis is not required, then these optional feedback resistors can be left uninstalled.

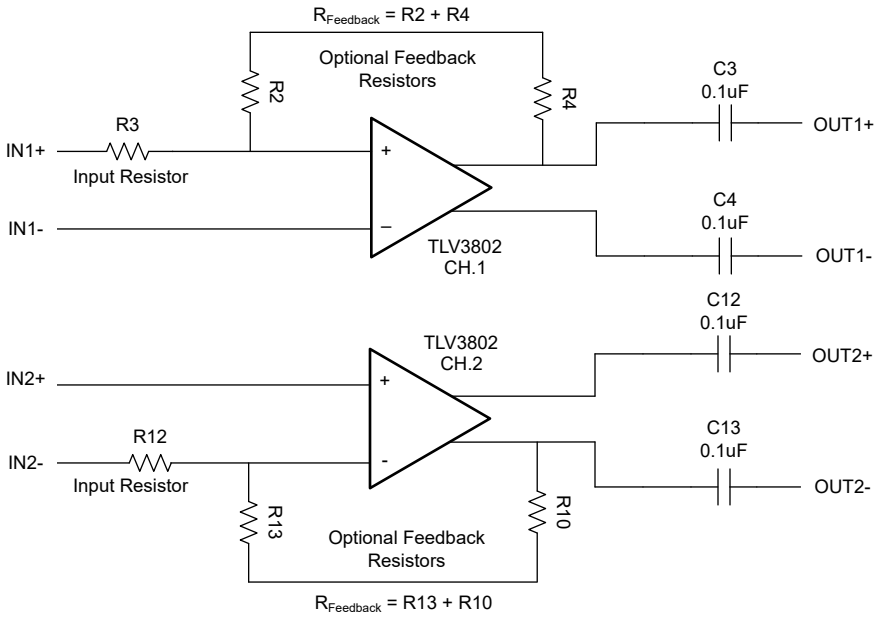


Figure 2-4. Hysteresis Block Diagram

2.3 Quick-Start Procedure

Note

Do not turn on power supply until all connections to the device are made to the board.

The procedures listed below are the steps for a quick-start set-up using channel 1.

1. Set one channel of the DC power supply to output a -2.5 V voltage and set the current limit to 100 mA. After making sure that this channel is disabled, connect VEE via TP2 to this supply.
2. Set one channel of the DC power supply to output a +2.5 V voltage and set the current limit to 100 mA. After making sure that this channel is disabled, connect VCC via TP3 to this supply.
3. Connect common ground of the DC power supply to SYS_GND via TP1.
4. Ground the inverting input, IN1-, to ground to establish the threshold for the comparator at 0 V.
5. Verify that cables connecting to IN1+_SENSE, OUT1+, and OUT1- are matched length and impedance. Perform any de-skewing if necessary. Set the function generator (50-Ω terminated) to produce a square wave output with 400mVpp at 10 MHz, with a 0 V DC offset. Disable the signal generator output. Connect the signal generator output to IN1+.
6. Connect IN1+ SENSE, to a 50-Ω terminated scope channel.
7. Connect OUT1+ and OUT1- to 50-Ω terminated channels on the oscilloscope.
8. Enable the DC power supply.
9. Verify the total supply current is < 60 mA.
10. Enable the signal generator.
11. Monitor and verify the input from IN1+_SENSE.
12. Monitor and verify the outputs for OUT1+ and OUT1-.

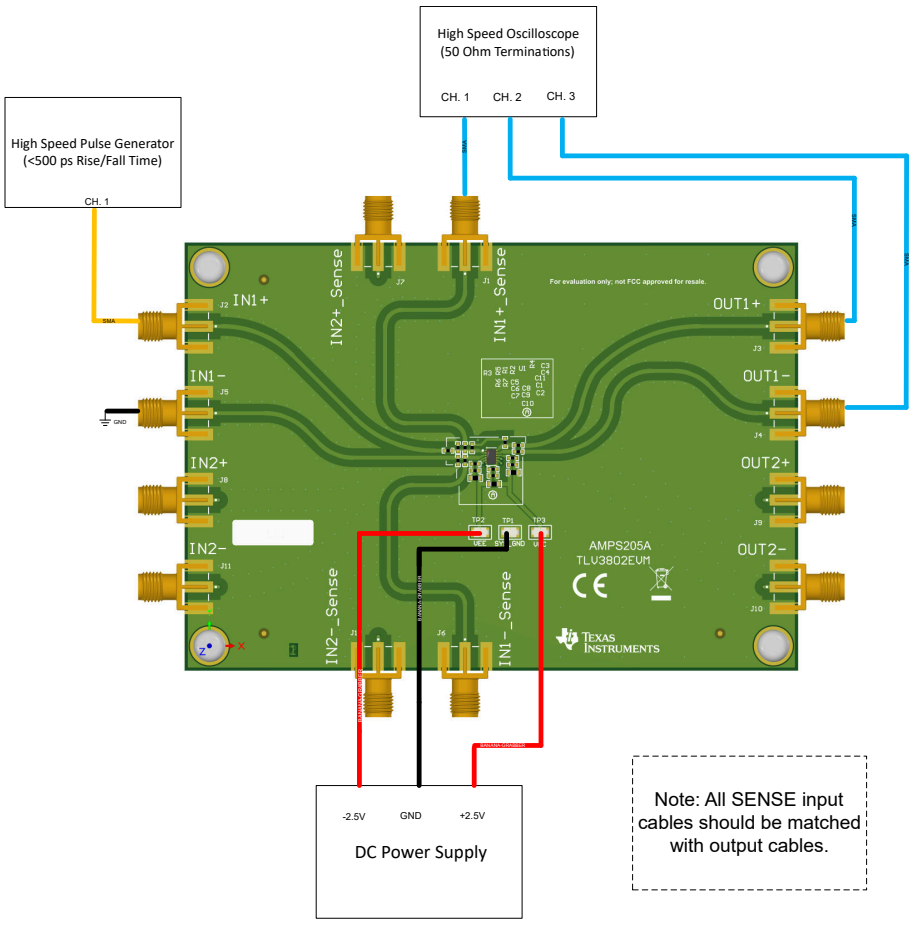


Figure 2-5. TLV3802EVM Quick Start Setup

Next, is a scope shot capture of the inputs and outputs described in the propagation delay procedure. High to Low propagation delay is defined as when the signal generator input (IN+) reaches 0 V to when OUT- reaches 0 V. The propagation delay was measured at approximately 220 ps with the setup described.

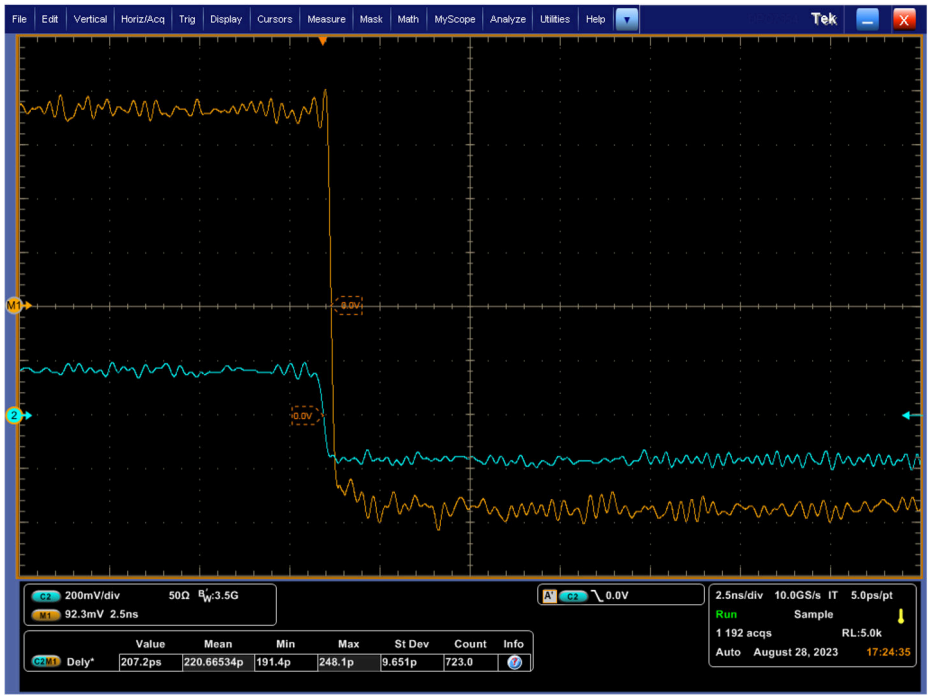


Figure 2-6. Quick-Start Example

3 Hardware Design Files

3.1 Schematic

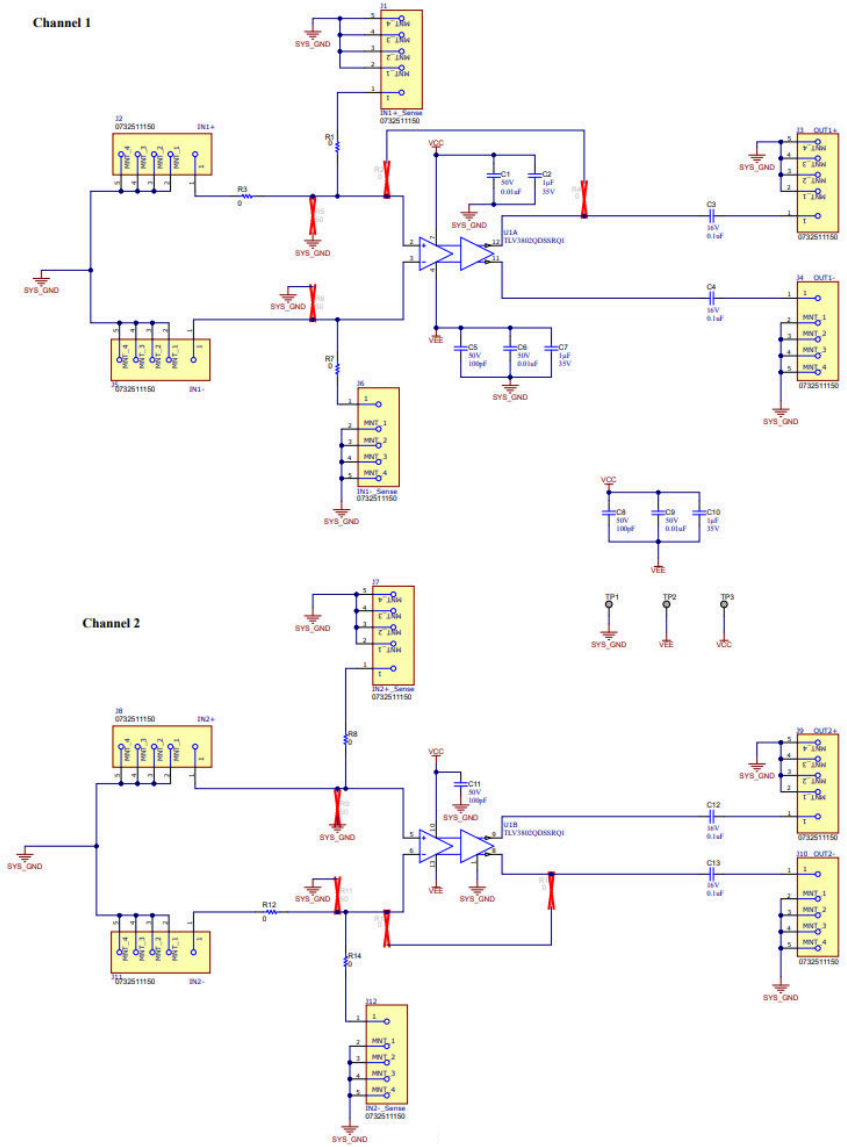


Figure 3-1. TLV3802EVM Schematic

3.2 PCB Layouts

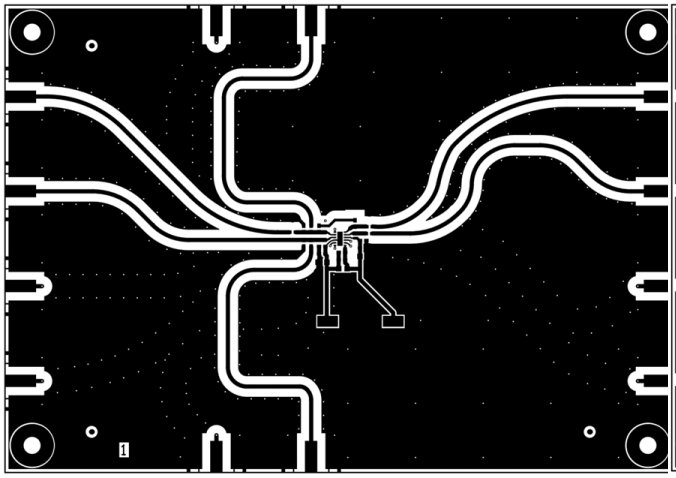


Figure 3-2. Top Layer

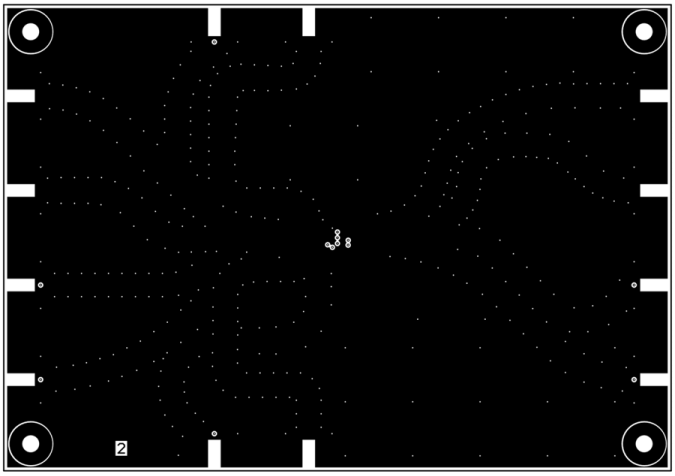


Figure 3-3. GND-1

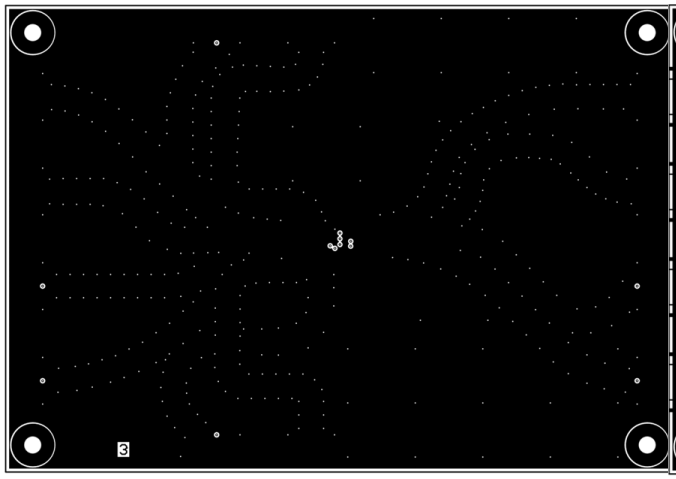


Figure 3-4. GND-2

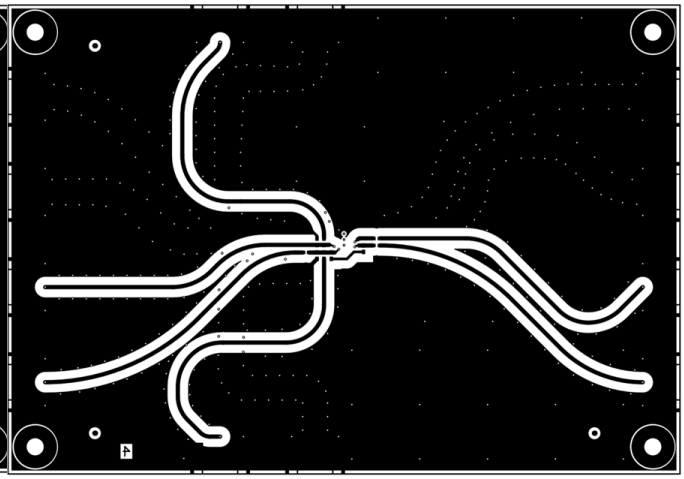


Figure 3-5. Bottom Layer

3.3 Bill of Materials

Table 3-1. Bill of Materials (BOM)

DESIGNATOR	QTY	VALUE	DESCRIPTION	PACKAGE REFERENCE	PART NUMBER	MANUFACTURER
C1, C6, C9	3	0.01uF	CAP, CERM, 0.01 uF, 50 V, +/- 10%, X7R, 0402	0402	GRM155R71H103KA88D	MuRata
C2, C7, C10	3	1uF	CAP, CERM, 1 uF, 35 V, +/- 10%, X7R, 0603	0603	C1608X7R1V105K080AC	TDK
C3, C4, C12, C13	4	0.1uF	CAP, CERM, 0.1 uF, 16 V, +/- 10%, X7R, 0402	0402	GCM155R71C104KA55D	MuRata
C5, C8, C11	3	100 pF	CAP, CERM, 100 pF, 50 V, +/- 10%, X7R, 0402	0402	885012205055	Wurth Elektronik
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, J11, J12	12		SMA Connector Receptacle, Female Socket 50Ohm Board Edge, End Launch Solder		0732511150	Molex Inc
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
R1, R3, R7, R8, R12, R14	6	0	RES, 0, 0%, 0.2 W, AEC-Q200 Grade 0, 0402	0402	CRCW04020000Z0EDHP	Vishay-Dale
TP1, TP2, TP3	3		Test Point, Miniature, SMT	Test Point, Miniature, SMT	5019	Keystone
U1	1		225-ps High-Speed Comparator with LVDS Outputs0402	WF-DFN12	TLV3802QDSSRQ1	Texas Instruments
FID1, FID2, FID3, FID4, FID5, FID6	0		Fiducial mark. There is nothing to buy or mount.	N/A	N/A	N/A
R2, R4, R10, R13	0	0	RES, 0, 0%, 0.2 W, AEC-Q200 Grade 0, 0402	0402	CRCW04020000Z0EDHP	Vishay-Dale
R5, R6, R9, R11	0	50	RES, 50, 0.1%, 0.5 W, 0402	0402	FC0402E50R0BTBST1	Vishay Thin Film

4 Additional Information

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   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 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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3.4 *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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