User's Guide

TLV3811EVM User's Guide

ABSTRACT

The TLV3811EVM is an evaluation board designed to evaluate the high-speed TLV3811 comparator. The TLV3811EVM has layout options intended to make it simple to evaluate timing performance with different measurement tools. The output of the TLV3811 is designed for low-voltage differential signals (LVDS) that provide high-speed signals to interconnect devices such as FPGAs with minimal power dissipation.

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Trademarks

1 Introduction

The TLV3811EVM is an evaluation board designed to evaluate the high-speed TLV3811 comparator. The TLV3811EVM has layout options intended to make it simple to evaluate timing performance with different measurement tools. The output of the TLV3811 is designed for low-voltage differential signals (LVDS) which provide high-speed signals to interconnect devices such as FPGAs with minimal power dissipation.

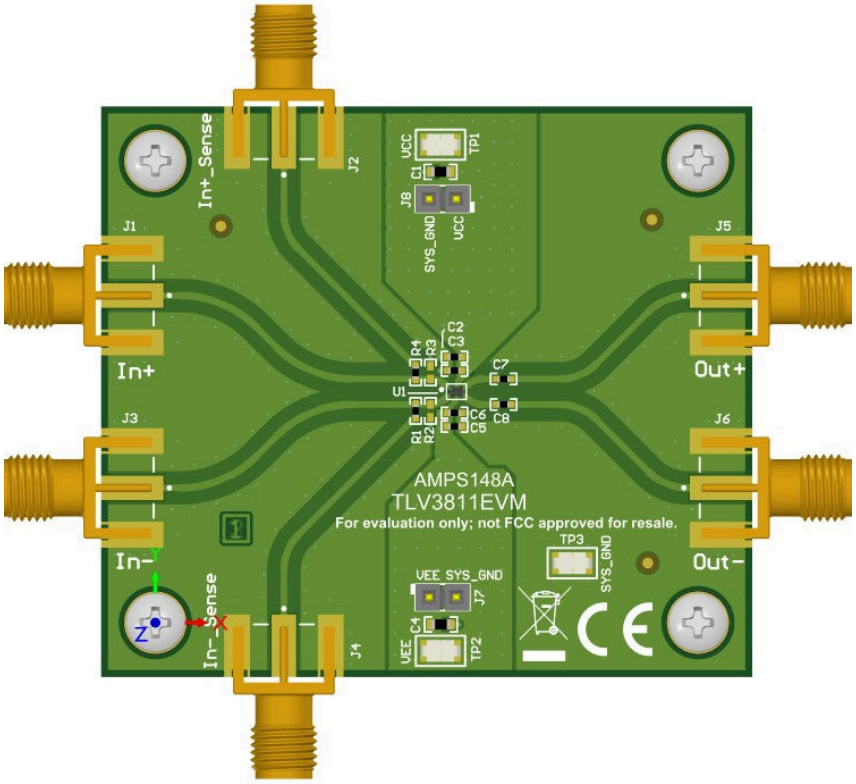


Figure 1-1. TLV3811EVM Board Top View

1.1 Features

- Low Propagation Delay
- Low Overdrive Dispersion
- High Toggle Frequency
- Narrow Pulse Width Detection Capability
- LVDS Output
- Low Input Offset Voltage
- BGA Package 6-pin WCSP

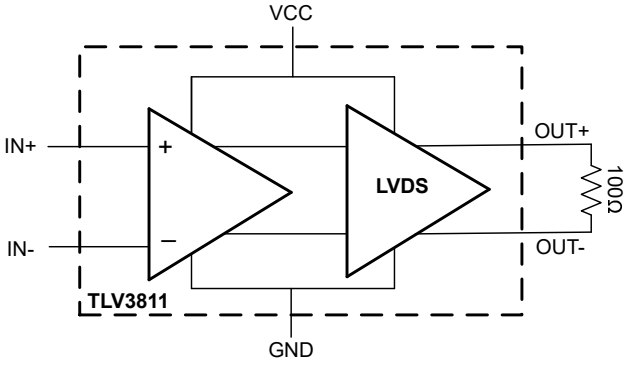


Figure 1-2. TLV3811 Block Diagram

1.2 EVM Specifications

- Supply Range: +2.7 V to +5.25 V (VCC - voltage of GND pin)
  - Pin B2 on TLV3602 (GND) is mapped to "VEE" pin on EVM
- Input Common Mode Range: VEE + 1.5 V to VCC + 0.1 V
- Differential Input Voltage Range: (-1.5 V to 1.5 V)

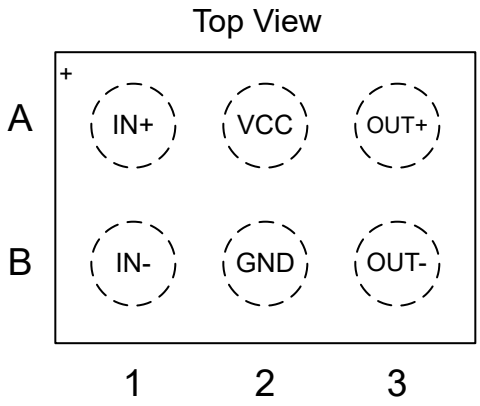


Figure 1-3. TLV3811EVM Pin Assignments

1.2.1 Recommended Equipment

- Dual Channel Power Supply
  - Using split supply operation makes it easy to measure propagation delay since the reference voltage is known to be 0V. Single supply option still available.
- High Speed Functional Generator with fast rise/fall time recommended (≤ 500 ps)
- High Speed Oscilloscope with 50-Ω terminations
- SMA Cables/adapters
  - All sensed input voltages and both output signals must have matched cable lengths
    - IN+SENSE, IN-SENSE (only if AC signal), OUT+, and OUT-
  - All other signals can use non-matched cable lengths

2 How to Make a TPHL Propagation Delay Measurement With Split Supplies

Note

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

1. Set one channel of the DC power supply to output a -2.5 V voltage and set its current limit to 100 mA. After ensuring that this channel is disabled, connect GND/VEE to this supply.
2. Set one channel of the DC power supply to output a 2.5 V voltage and set its current limit to 100 mA. After ensuring that this channel is disabled, connect VCC to this supply.
3. Ensure that cables connecting to IN+SENSE, OUT+, and OUT- are matched length and impedance. Perform any deskewing if no matched cables are available. For this setup, IN- is a DC voltage reference so the cables used for IN- and IN- SENSE do not need to be matched.
4. On the signal generator output, set the function generator to produce a square wave output with 100 mVpp at 10-MHz, with a 0 V DC offset. This results in a 50 mV overdrive and 50 mV underdrive. Disable the signal generator output. Connect the signal generator output to IN+.
5. Connect the inverting input, IN-, to ground to establish the threshold for the comparator at 0 V.
6. Connect OUTP and OUTN to a 50-Ω terminated channel on the oscilloscope. **Note** that with capacitors C7 and C8 populated, the DC component of the outputs will be filtered.
7. Connect IN+SENSE, to another 50-Ω terminated scope channel.
8. Enable the VCC/VEE power supplies.
9. Verify the total supply current is < 30 mA.
10. Enable the signal generator.
11. Monitor and verify the inputs from IN+SENSE and IN- is 0 V DC.
12. Monitor and verify the outputs for OUT+ and OUT-.

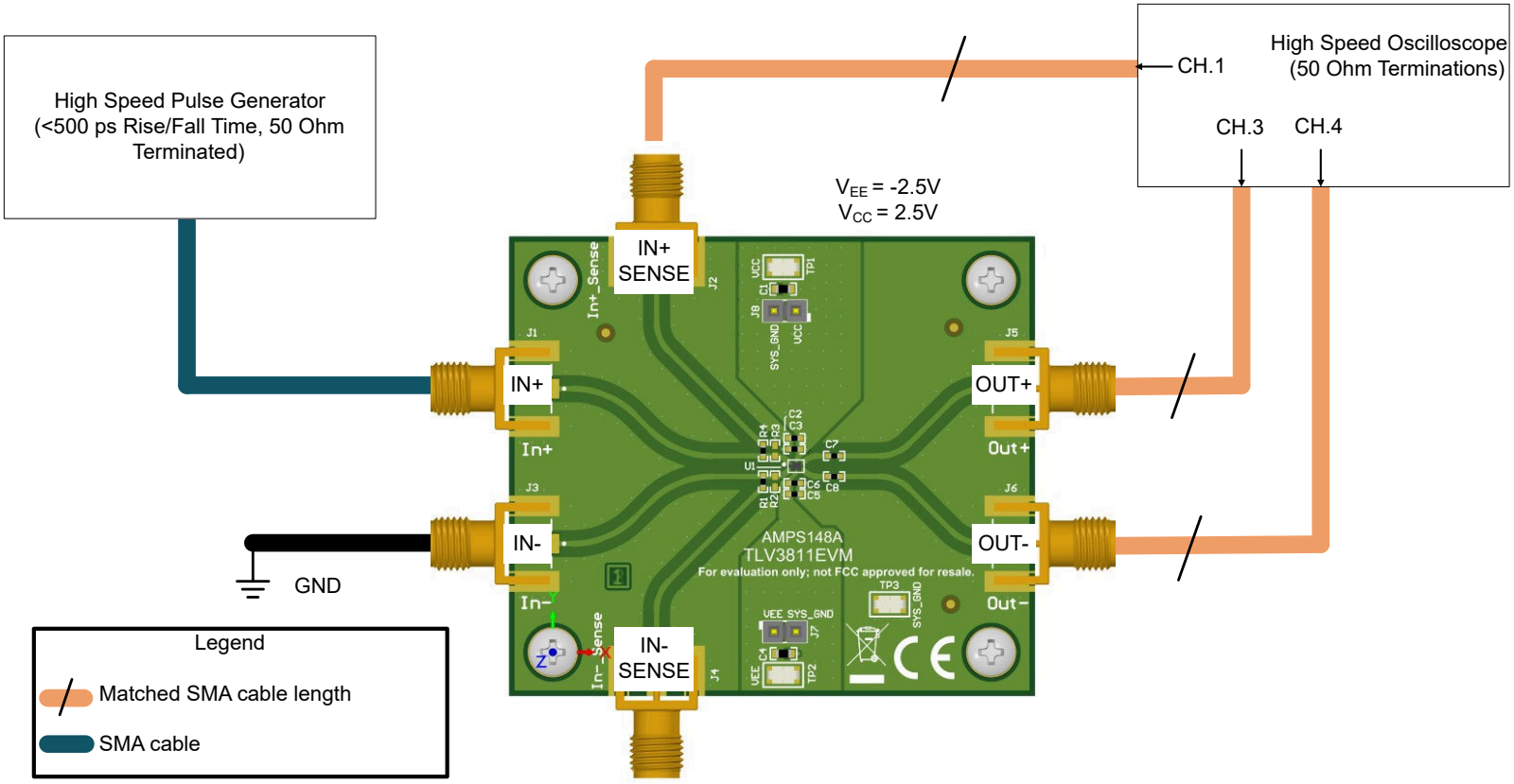


Figure 2-1. TLV3811 EVM Propagation Delay Setup

Figure 2-2 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 206 ps with the setup described.

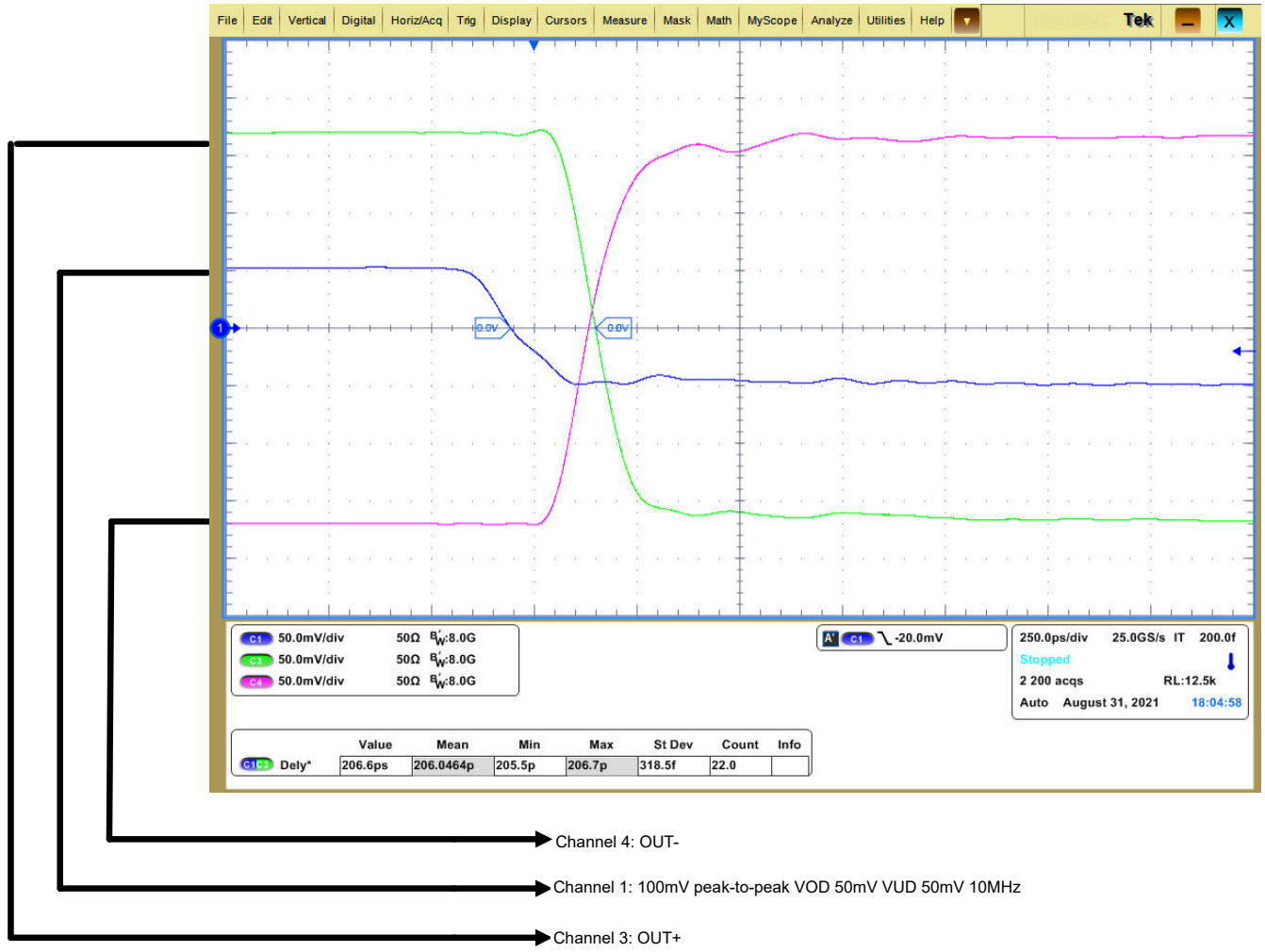


Figure 2-2. Quick Start Example

3 Board Setup

3.1 Supply Voltage

The TLV3811EVM can operate from a single supply or split supply configuration. The recommended voltage range is from 2.7-V to 5.5-V. Connect VCC, VEE, and SYS_GND using TP1, TP2, and TP3 respectively.

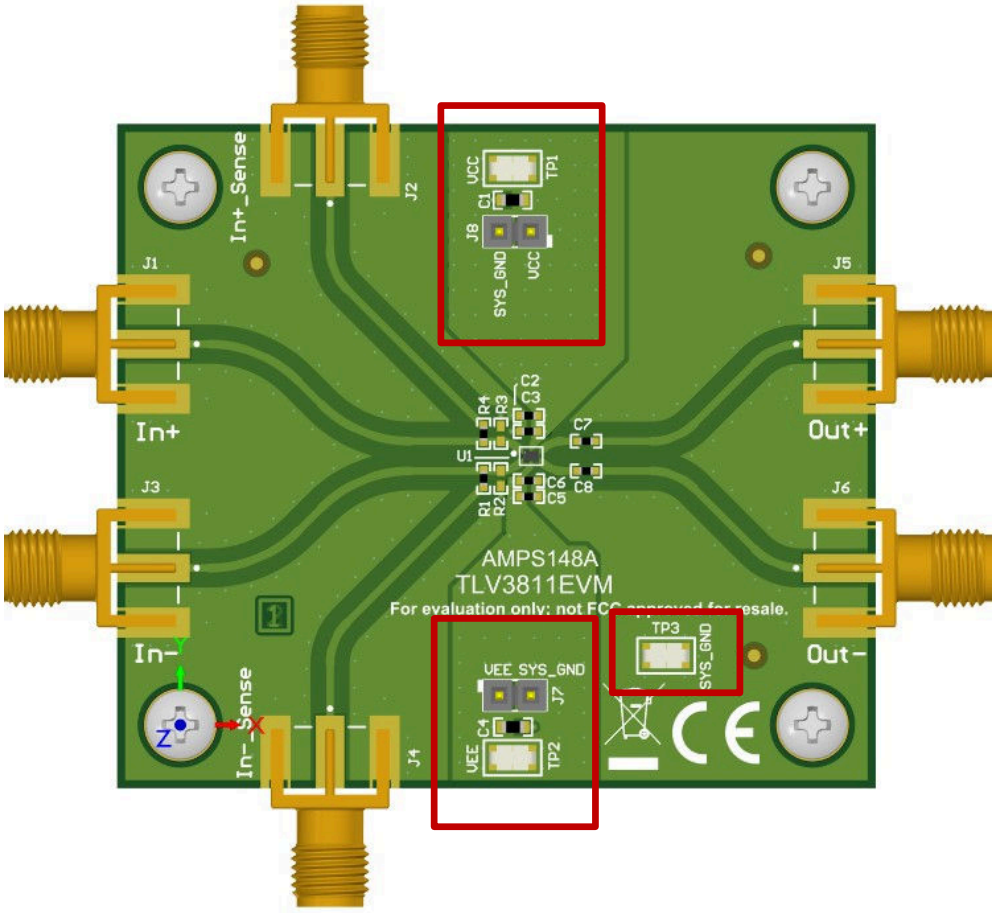


Figure 3-1. TLV3811EVM Supply Voltage Connection

3.2 Inputs

Resistors R1 and R4 are 0-Ω resistors. The input terminals (IN+ and IN-) 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 R2 and R3 for direct 50-Ω terminations if required by the input signal generator, otherwise they can be left uninstalled.

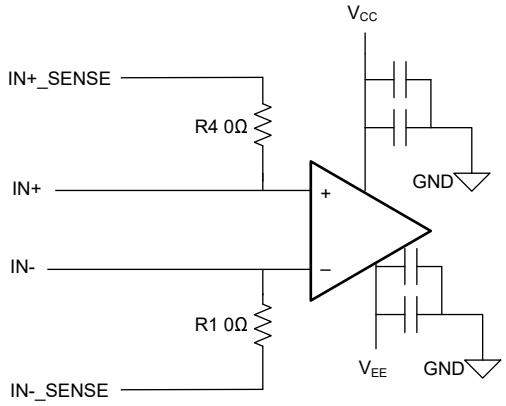


Figure 3-2. Input Side Schematic Without Optional Resistors R2 and R3

Additionally, the pads from R2 and R3 can be used to solder a 100-Ω termination resistor for LVDS input signals.

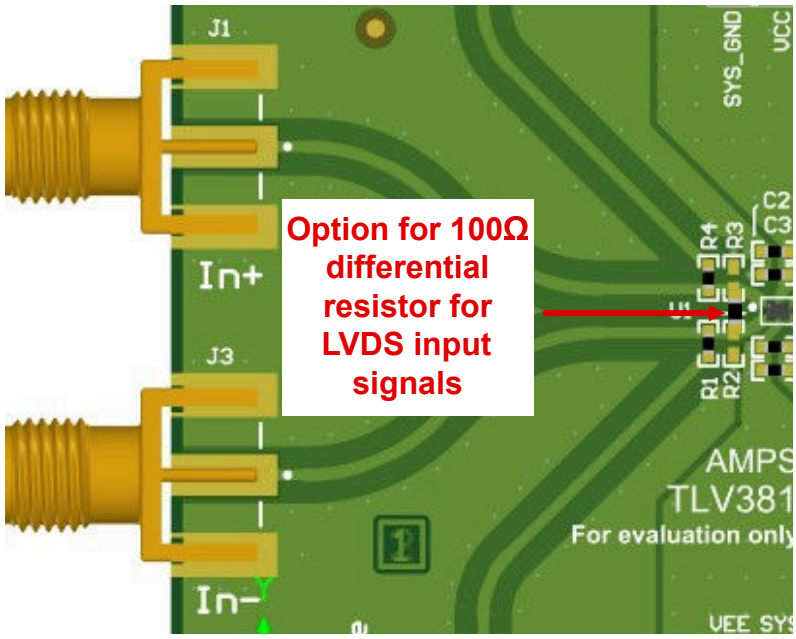


Figure 3-3. Configuration for LVDS Inputs Using the Unused Pads of R2 and R3

3.3 Outputs

C7 and C8 are installed with 0.1-uF capacitors. If a 100-Ω differential probe is unavailable to measure the LVDS output, 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% will result in a DC portion of the signal that is not halfway between V_{OH} and V_{OL}. As mentioned earlier, this is because of the charging and discharging of the capacitors. A higher duty cycle will result in a higher DC output voltage because the capacitors are charging more than they are discharging.

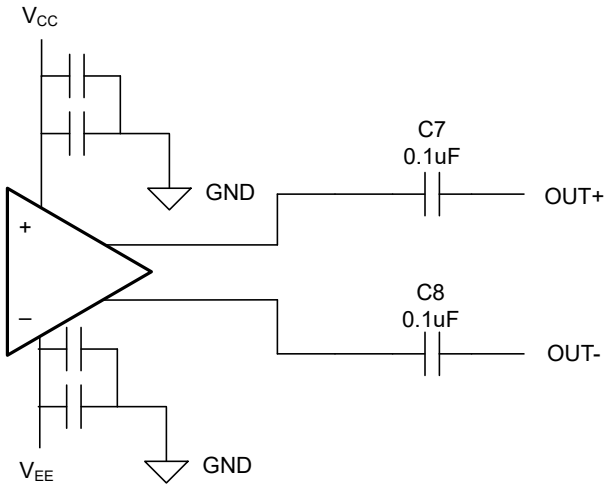
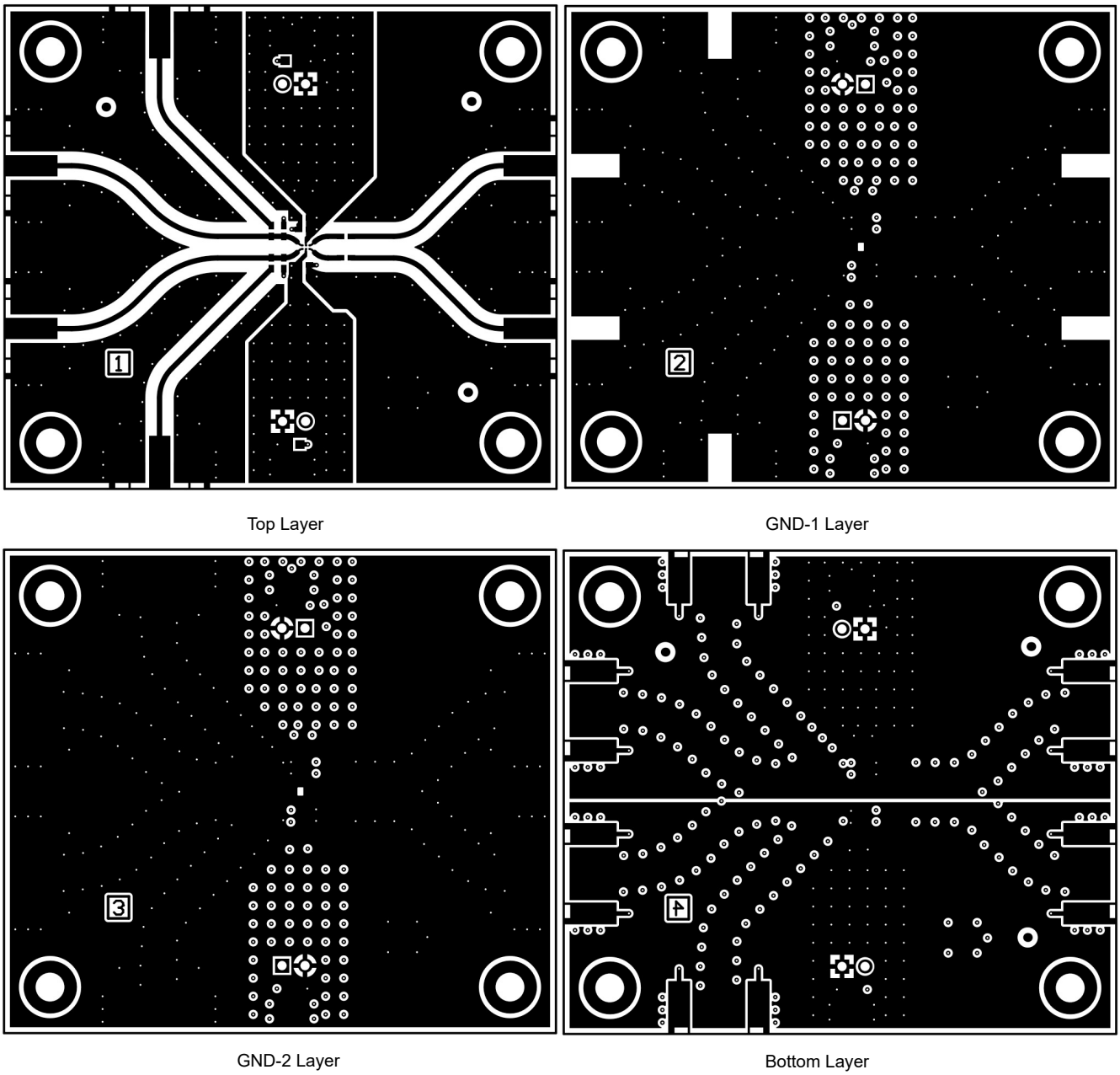


Figure 3-4. Output Side Schematic

If equipment is available to measure the LVDS output with a respect to the 100-Ω resistor or with a differential probe, then C7 and C8 can be replaced with 0-Ω resistors to keep the DC integrity of the output signal.

4 Layout Guidelines



Top Layer

GND-1 Layer

GND-2 Layer

Bottom Layer

Figure 4-1. Layers

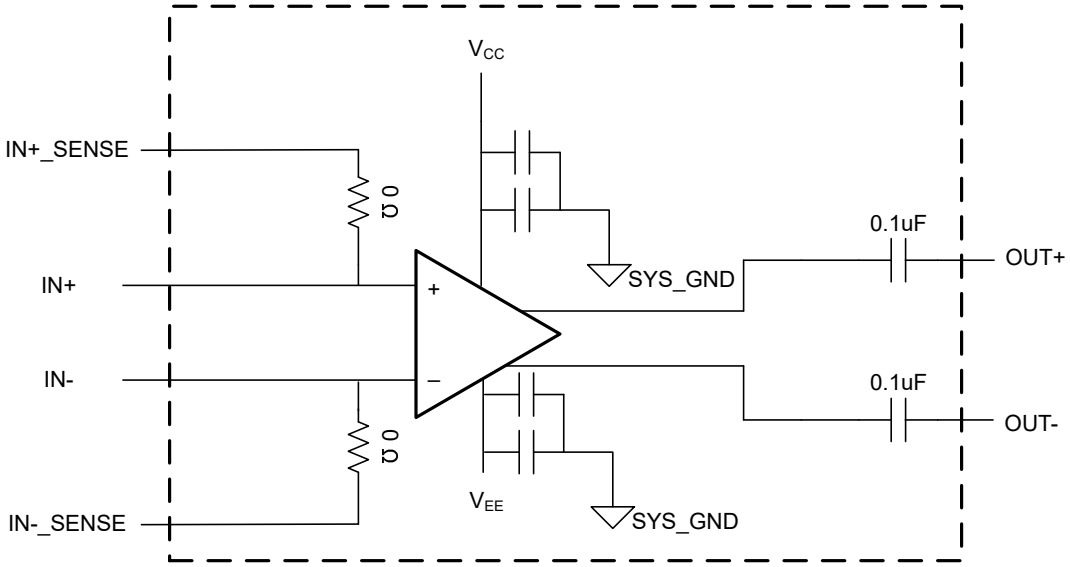


Figure 4-2. TLV3811 EVM Block Diagram

5 Schematic

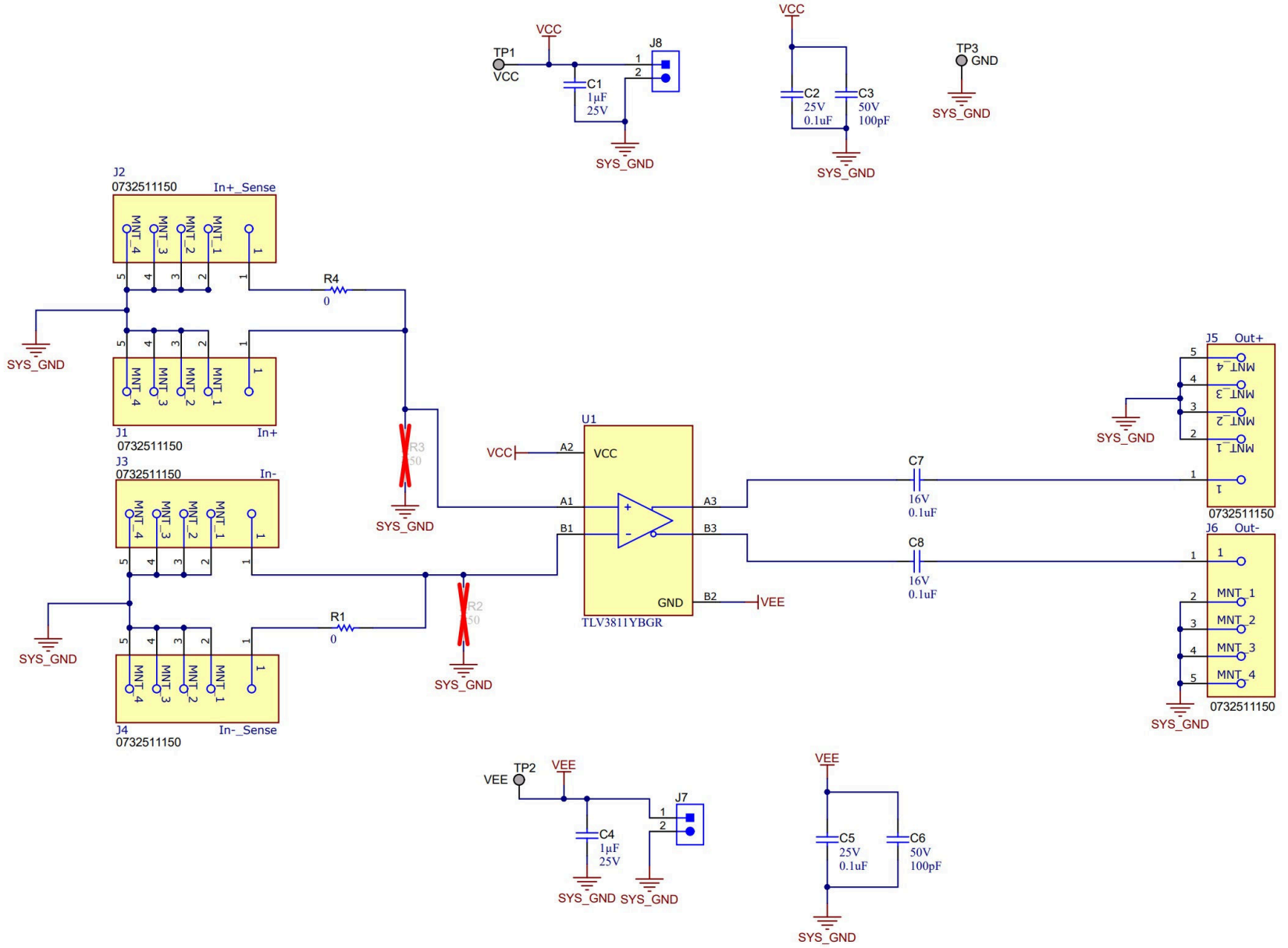


Figure 5-1. TLV3811 EVM Schematic

6 Bill of Materials

Table 6-1. BOM

DESIGNATOR	QTY	VALUE	DESCRIPTION	PACKAGE REFERENCE	PART NUMBER	MANUFACTURER
C1, C4	2	1uF	CAP, CERM, 1 uF, 25 V, +/- 10%, X7R, AEC-Q200 Grade 1, 0603	0603	GCM188R71E105KA64D	MuRata
C2, C5	2	0.1uF	CAP, CERM, 0.1 uF, 25 V, +/- 10%, X7R, 0402	0402	GRM155R71E104KE14D	MuRata
C3, C6	2	100pF	CAP, CERM, 100 pF, 50 V, +/- 10%, X7R, 0402	0402	885012205055	Wurth Elektronik
C7, C8	2	0.1uF	CAP, CERM, 0.1 uF, 16 V, +/- 10%, X7R, 0402	0402	GCM155R71C104KA55D	MuRata
H1, H2, H3, H4	4		MACHINE SCREW PAN PHILLIPS 4-40	Machine Screw, 4-40, 1/4 inch	PMSSS 440 0025 PH	B&F Fastener Supply
H5, H6, H7, H8	4		HEX STANDOFF 4-40 ALUMINUM 1/2"	4-40 HEX Aluminum standoff 0.500 inches	1893	Keystone
J1, J2, J3, J4, J5, J6	6		SMA Connector Receptacle, Female Socket 50Ohm Board Edge, End Launch Solder		0732511150	Molex Inc
J7, J8	2		Header, 100mil, 2x1, Gold, TH	Header, 2.54mm, 2x1, TH	HMTSW-102-07-G-S-240	Samtec
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, R4	2	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 Outputs, WSON8	WCSP6	TLV3811YBGR	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, R3	0	50	RES, 50, 0.1%, 0.5 W, 0402	0402	FC0402E50R0BTBST1	Vishay Thin Film

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NOTE:

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3 *Regulatory Notices:*

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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

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

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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.

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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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