User's Guide

TLV3602EVM User's Guide

ABSTRACT

The TLV3602EVM is an evaluation board designed to evaluate the high-speed TLV3602 comparator. The PCB footprint for the comparator accommodates the 8-pin VSSOP TLV3602 DGK to be soldered on the board.

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Trademarks

All trademarks are the property of their respective owners.

1 Introduction

The TLV3602EVM is an evaluation board designed to evaluate the high-speed TLV3602 comparator. The TLV3602EVM has layout options intended to make it simple to evaluate timing performance with different measurement tools. The output of the TLV3602 allows for direct connection to a 50 Ω terminated oscilloscope.

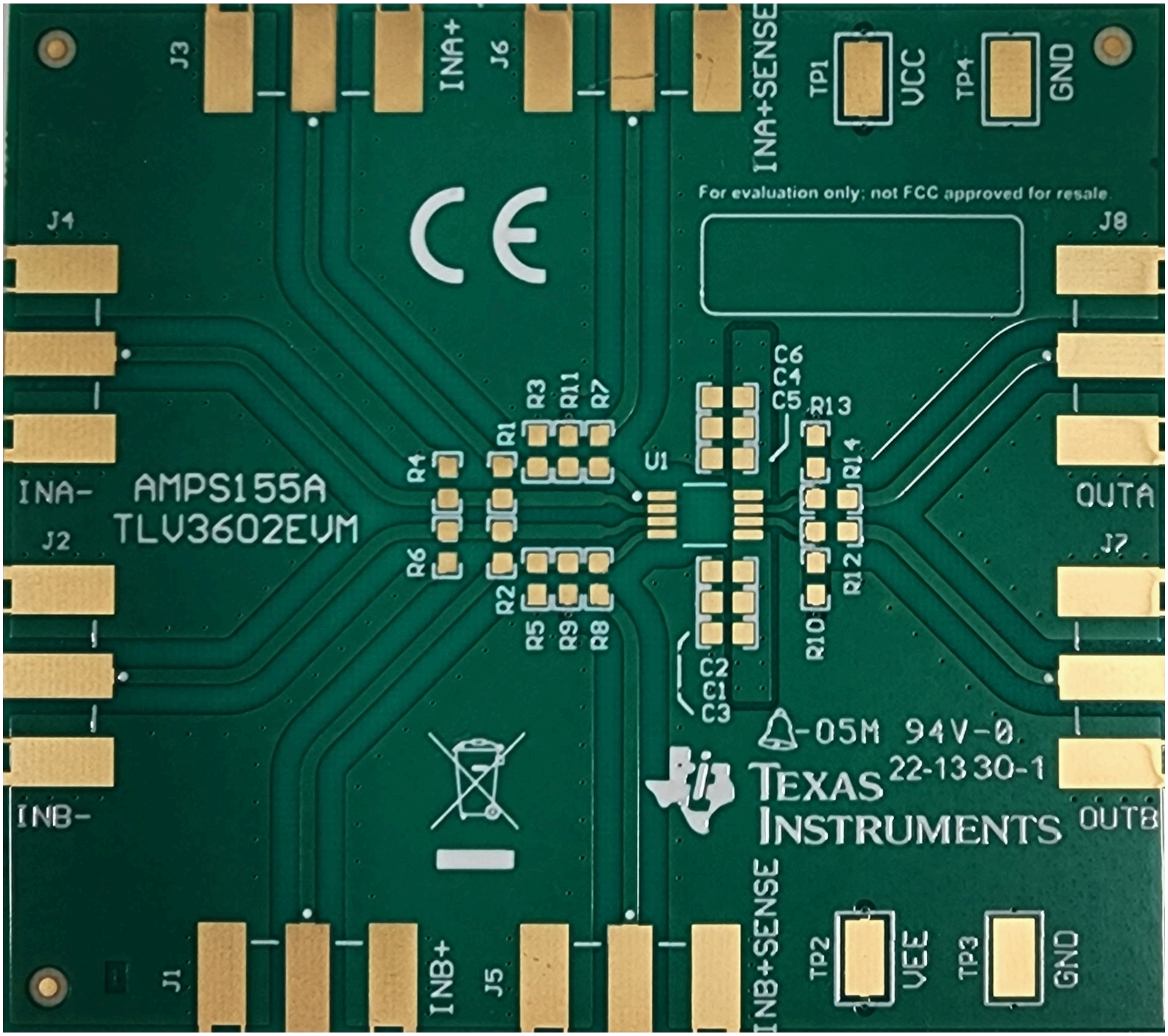

Figure 1-1. TLV3602EVM Board Top View

2 Features

- Low Propagation Delay
- Low Overdrive Dispersion
- High Toggle Frequency
- Narrow Pulse Width Detection Capability
- Single Ended Output Stage Output
- Low Input Offset Voltage
- 8-pin DGK VSSOP Package

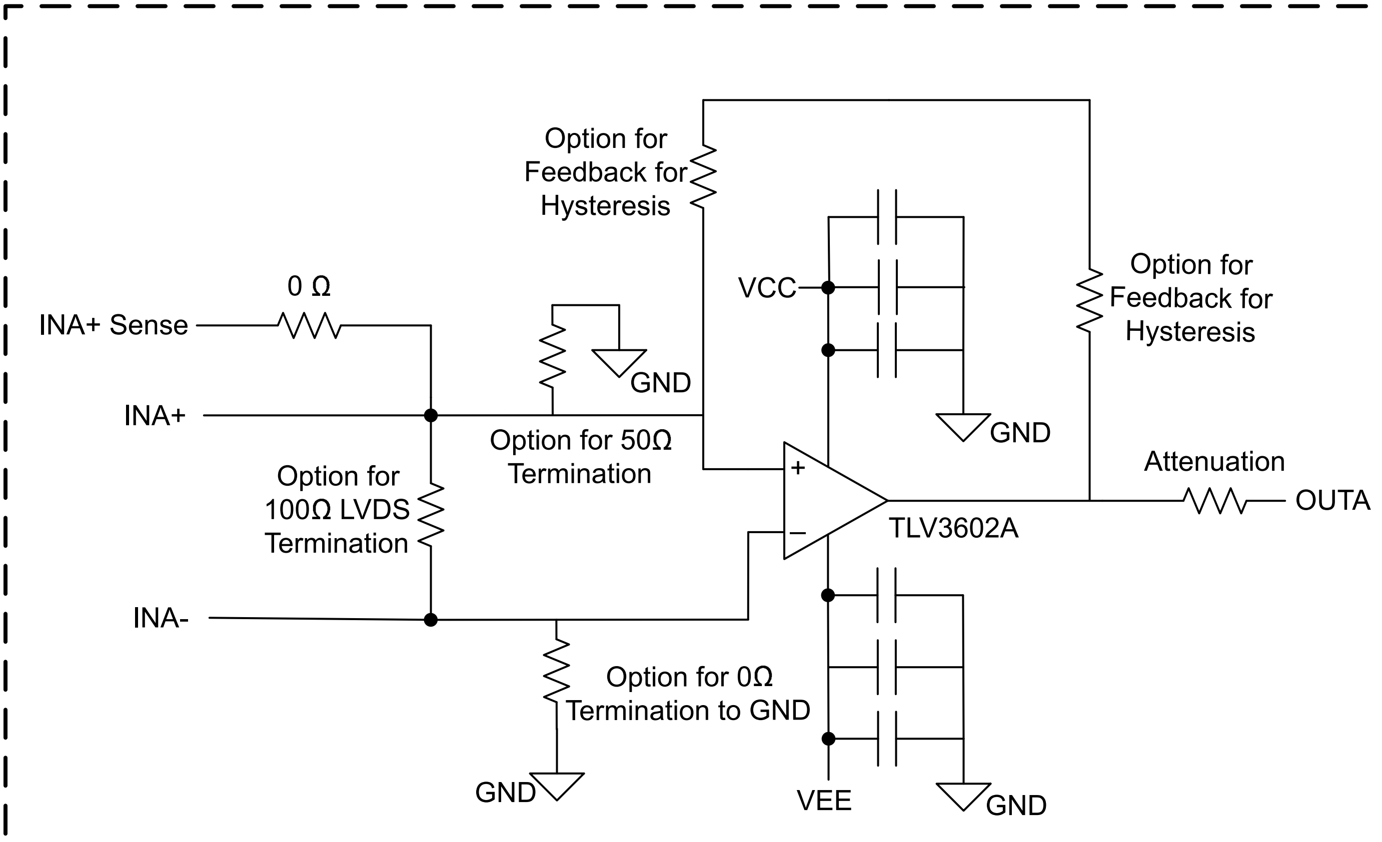

Figure 2-1. Block Diagram Per Channel

3 EVM Specifications

- Supply Range (VCC - VEE): 2.4 V to 5.5 V
- Input Common Mode Range: (Vee -200 mV) to (VCC + 200 mV)

Table 3-1. TLV3602EVM SMA and Test Point to DUT Pin Mapping

TLV3602EVM CONNECTIONS	
SMA J3: INA+ SMA J6: INA+SENSE	INA+ (Pin 1)
SMA J4: INA-	INA- (Pin 2)
SMA J2: INB-	INB- (Pin 3)
SMA J1: INB+ SMA J5: INB+SENSE	INB+ (Pin 4)
Test Point 2: VEE	GND (Pin 5)
SMA J7: OUTB	OUTB (Pin 6)
SMA J8: OUTA	OUTA (Pin 7)
Test Point 1: VCC	VCC (Pin 8)
Test Points 3 and 4: GND	System Ground

3.1 Recommended Equipment

- Power Supply
- High Speed Functional Generator
  - Fast rise/fall time recommended (≤ 500ps)
- High Speed Oscilloscope with 50 Ω Terminations
  - High bandwidth FET probe
- SMA Cables/Adapters
  - Be sure to have matched length cables for INA+SENSE, INB+SENSE, OUTA and OUTB
  - GND Barrel

4 Quick Start Procedure

CAUTION
DO NOT TURN ON POWER SUPPLY UNTIL ALL CONNECTIONS TO THE DEVICE ARE MADE TO THE BOARD.

The following connections are made using a split supply configuration. Split supply configuration is advantageous for measurement purposes. The reference voltage can be set to GND, while the other input can be set to an AC waveform that toggles between negative and positive voltage at a 0-DC offset. Thus, the output will be toggling whenever the AC waveform crosses 0 V.

This configuration allows for 2 distinct advantages compared to a single supply input. The first advantage is that the reference voltage is at GND; a non-noisy voltage level. If the reference voltage level needs to be changed in relation to the supplies, the supply voltages can be altered instead. The second advantage being able to zoom into the input as much as possible due to the 0 DC offset of the waveform.

Below are the procedures for making a propagation delay measurement using channel A.

1. Set power supply positive terminal to 2.5 V and negative terminal to -2.5 V. Disable power supply output.
2. Connect positive terminal supply to TP1, negative terminal to TP2, and GND to TP3 or TP4.
3. Ensure that cables connecting to INA+SENSE and OUTA are matched length and impedance. Perform any deskewing if necessary.
4. Set the function generator to produce a square wave output with 100 m Vpp at 1 MHz, with a DC offset of 0 V. Disable the signal generator output. Connect the output to IN+.
5. Connect IN- to GND through an SMA 50 Ω termination barrel.
6. Connect OUTA to a 50 Ω terminated scope channel.
7. Connect IN+SENSE to a 50 Ω terminated scope channel.
8. Enable the power supply and the signal generator.
9. Verify the total supply current is < 50 mA.
10. Monitor and verify the input from INA+SENSE.
11. Monitor and verify OUTA.

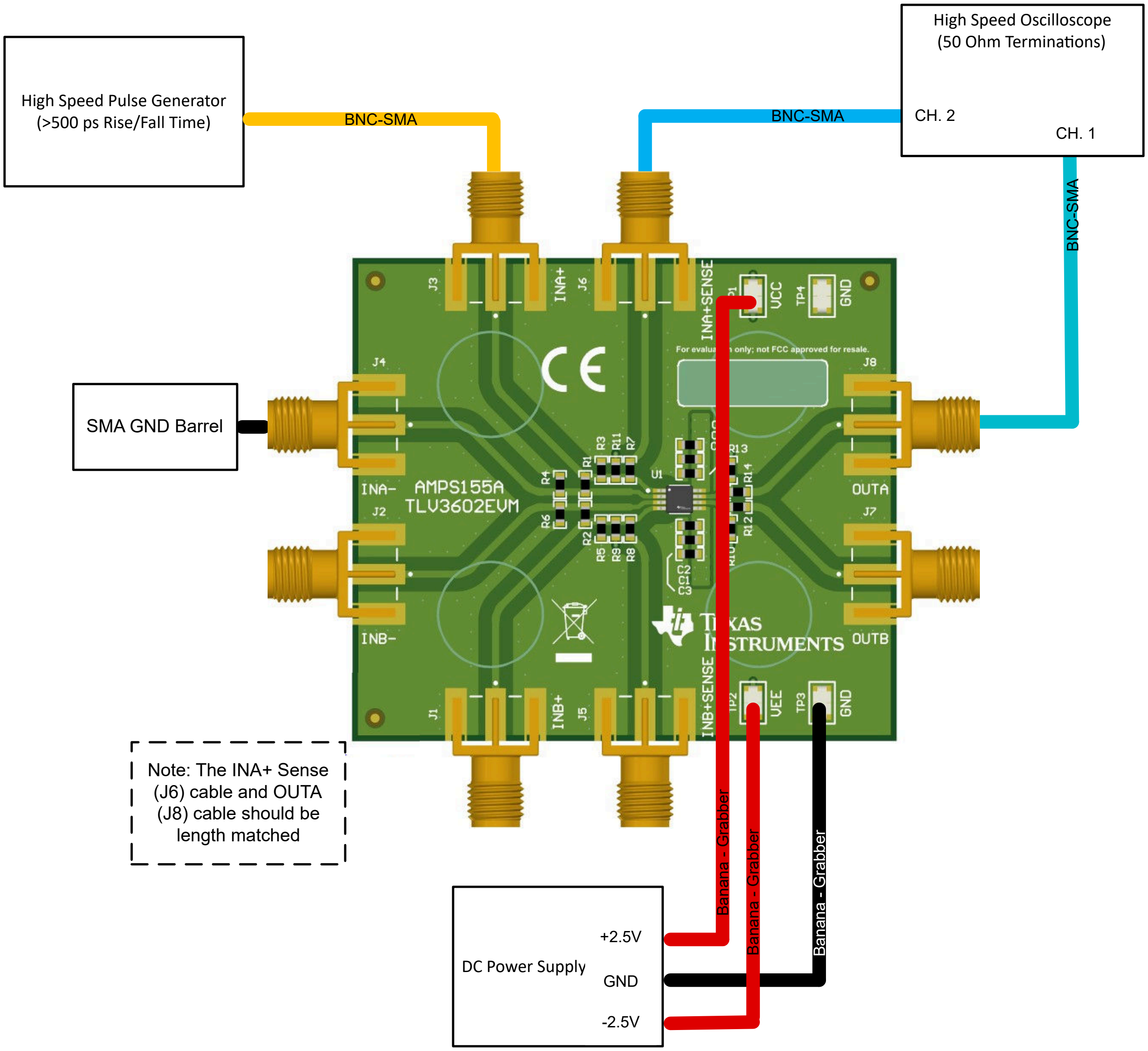

Figure 4-1. TLV3602EVM Quick Start Setup

Figure 4-2 and Figure 4-3 are screen captures of the inputs and outputs described in the quick start procedure. Here, the propagation delay between IN+ and OUT is measured by taking the time delta between when IN+ and OUT reach 50% of their respective transitions. The low to high propagation delay in Figure 4-2 was calculated to be 2.184 ns while the high to low propagation delay in Figure 4-3 was measured to be 2.155 ns.

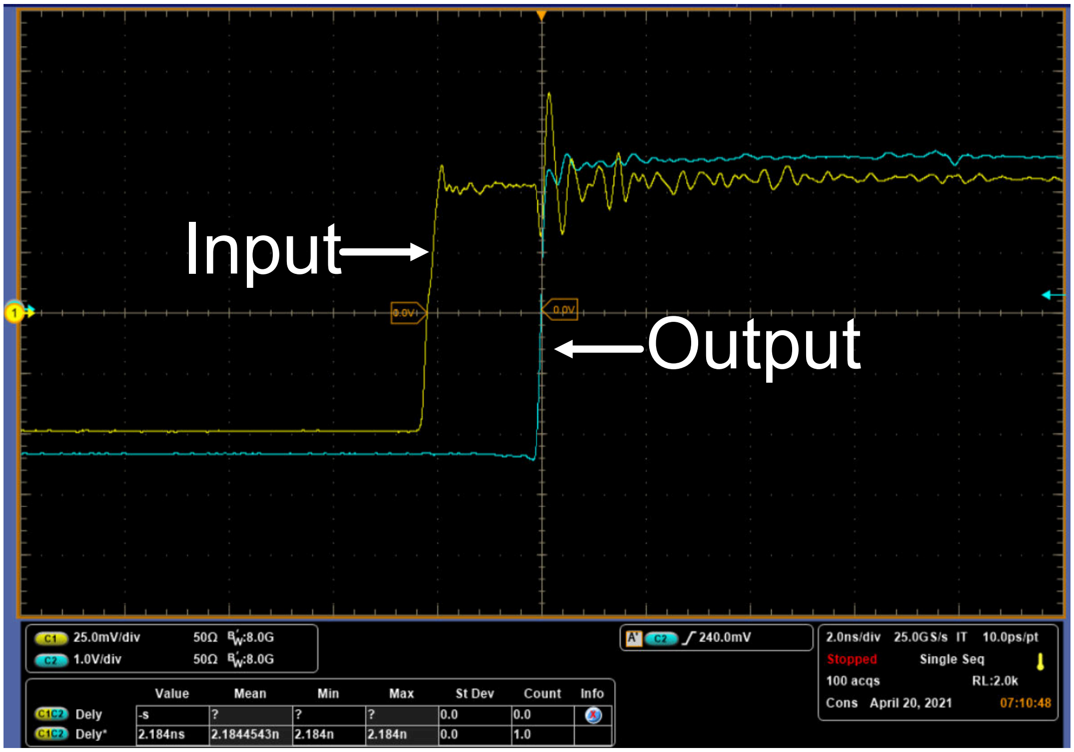

Figure 4-2. Propagation Delay Rise Portion

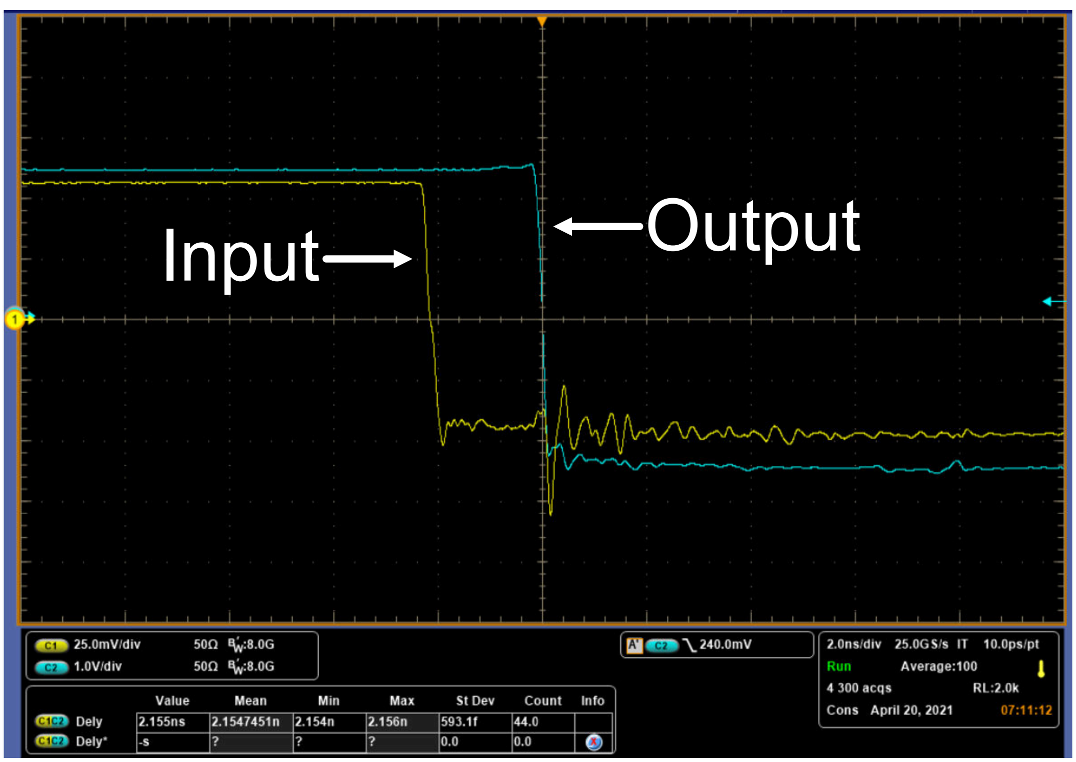

Figure 4-3. Propagation Delay Fall Portion

5 Board Setup

5.1 Supply Voltage

The TLV3602EVM operates using a V_S (Supply Voltage, or VCC - VEE) from 2.4 V to 5.5 V. Connect VCC to TP1, VEE to TP2, and GND to either TP3 or TP4. If using single supply configuration, connect system ground to GND and VEE.

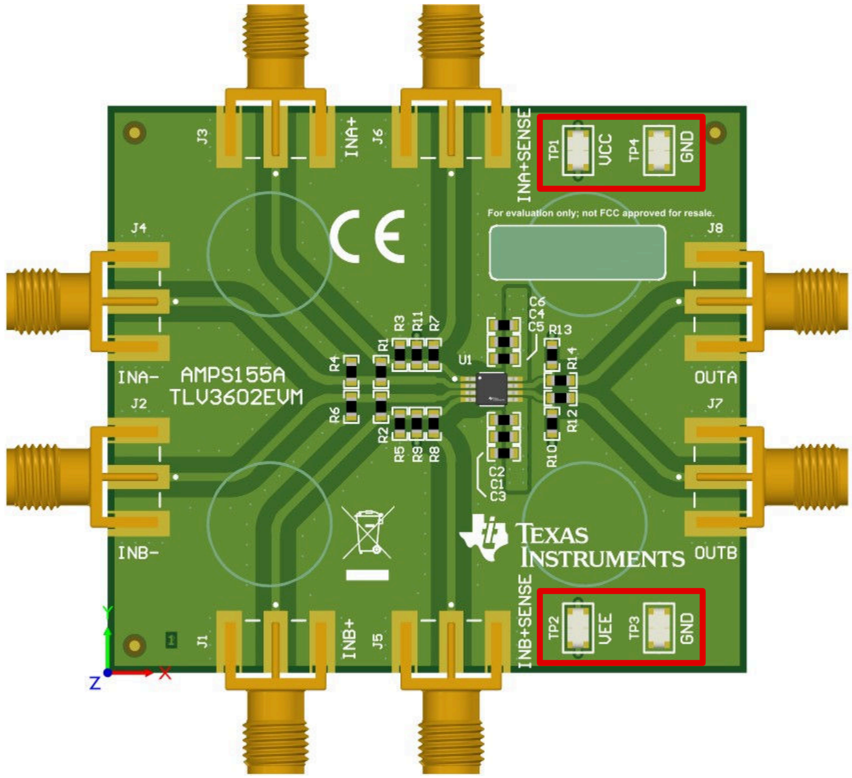

Figure 5-1. TLV3602EVM Supply Voltage Connection

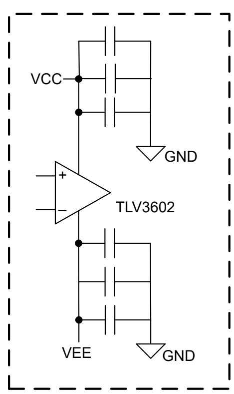

Figure 5-2. TLV3602EVM Supply Voltage Schematic

5.2 Inputs

Resistors R7 and R8 are 0 Ω resistors used by each channel's sense lines. There are also various input configurations offered by additional input side resistors. R1 and R2 are optional 100 Ω resistors for terminating an LVDS signal on the inputs of channel A and channel B, respectively. R3 and R5 are optional 50 Ω resistors if there is a need to terminate the noninverting inputs of each channel to a 50 Ω load. R4 and R6 are optional 0 Ω resistors if there is a need to ground the inverting inputs to establish the threshold level. R4 and R6 are intended for split supply operation of the TLV3602.

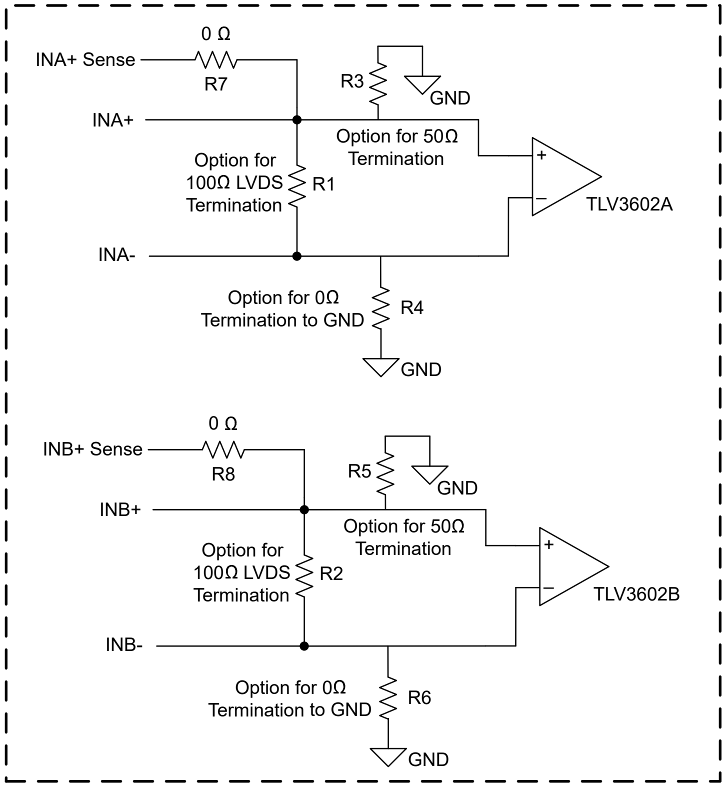

Figure 5-3. Input Side Schematic

5.3 Outputs

R12 and R14 are known as attenuation resistors, and they are used to attenuate the output by setting the top half of a voltage divider circuit, with the bottom half supplied by the load, such as an oscilloscope's internal termination. It is not advisable to populate these pads with a low value resistor as the TLV3602 outputs are not intended to drive a 50 Ω load; the amount of current sourced would be significant. A 1 kΩ resistor is recommended for this footprint which, coupled with a scope's internal 50 Ω termination creates an attenuation factor of 21:1 which can be rectified using oscilloscope settings. A high speed probe may be used for measurement of the output, but rise and fall times may be limited.

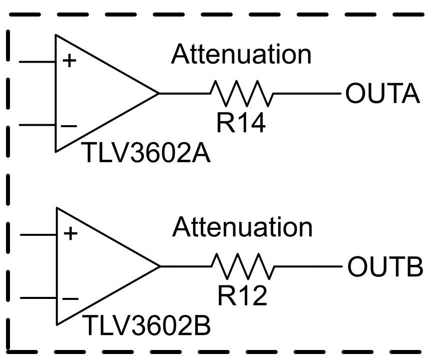

Figure 5-4. Output Side Block Diagram

5.4 Hysteresis

The TLV3602EVM is able to support external hysteresis for each TLV3602 non-inverting input. When configuring the EVM for hysteresis, the non-inverting input signal should now be connected to the INA+SENSE SMA connector. The reason for this is hysteresis requires both a series input resistor and a feedback resistor from output to input. There is no series resistance on the INA+ SMA connector. For this reason, the INA+SENSE series resistor, R7, will act as the input resistor.

The feedback resistor for hysteresis on channel A will be the combination of R11 and R13. Both resistors must be populated. When measuring the INA+ input signal on an oscilloscope, we recommend using a dual channel function generator so that one of its outputs can be directly connected to the oscilloscope. Ensure that both signal generator channels are outputting the same signal.

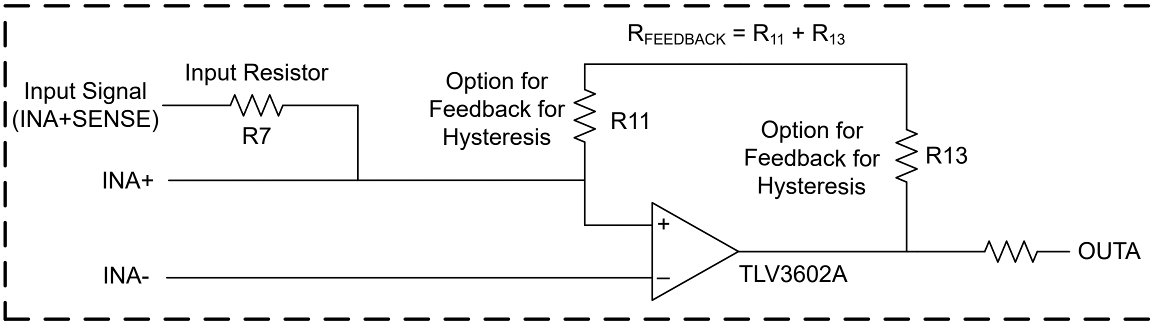

Figure 5-5. TLV3602 Hysteresis Schematic for Channel A

For non-inverting hysteresis on Channel B, the INB+SENSE SMA connection will serve as the input to the device. The input resistor will be series resistor R8. The feedback resistor for hysteresis on channel B will be the combination of R9 and R10. Both resistors must be populated. When measuring the INB+ input signal on an oscilloscope, we recommend following the same recommendations as Channel A.

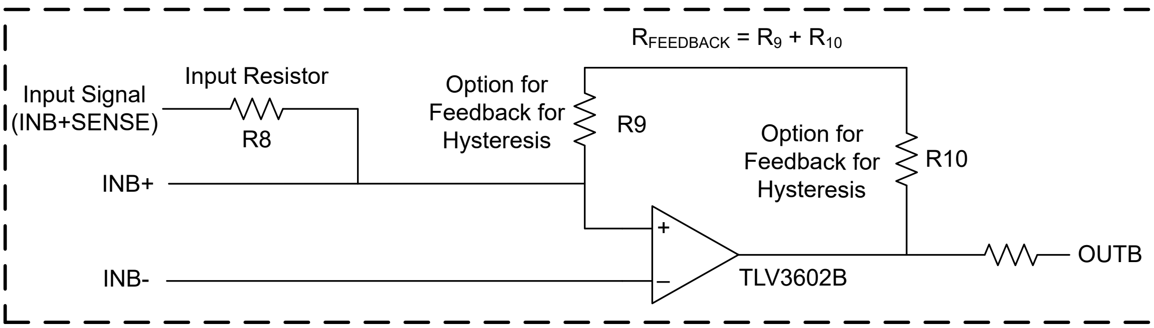

Figure 5-6. TLV3602 Hysteresis Schematic for Channel B

6 Layout Guidelines

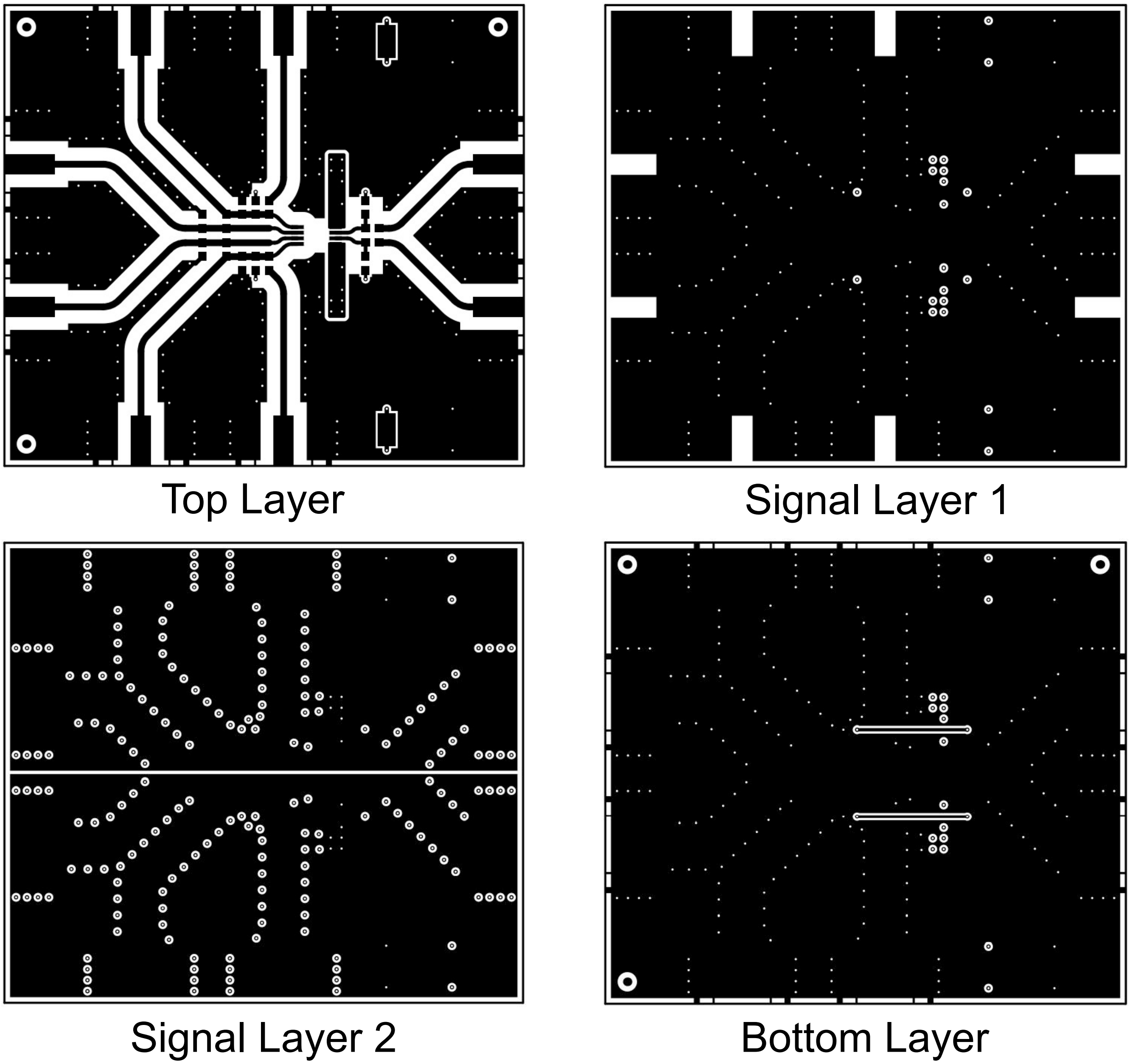

Figure 6-1. Layers

7 Schematic

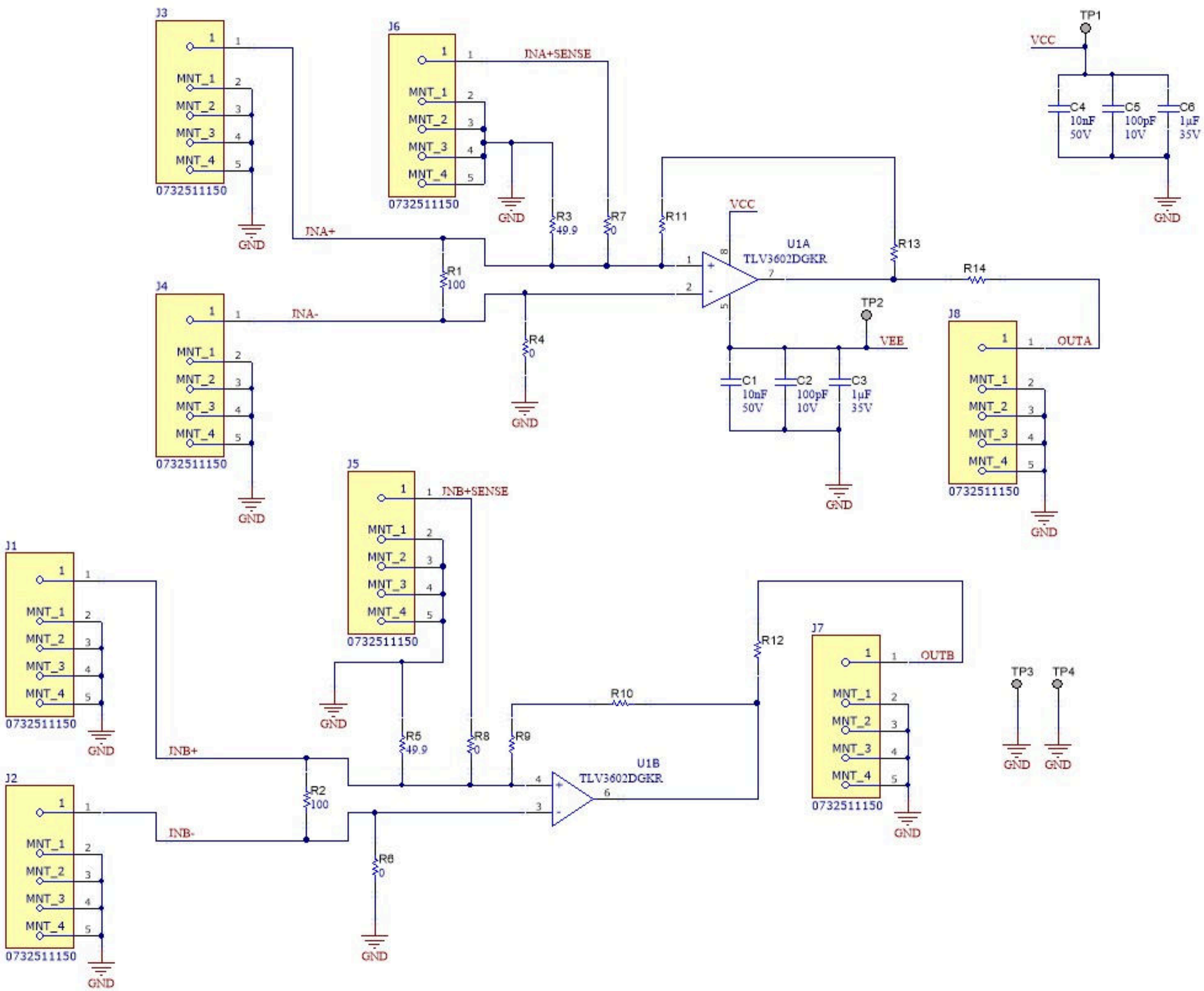

Figure 7-1. TLV3602EVM Schematic

8 Bill of Materials

Table 8-1. TLV3602EVM Bill of Materials

DESIGNATOR	QTY	VALUE	DESCRIPTION	PACKAGE REFERENCE	PART NUMBER	MANUFACTURER
C1, C4	0	0.01µF	CAP, CERM, 0.01 uF, 50 V, +/- 10%, X7R, 0603	0603	GRM188R71H103KA01D	MuRata
C2, C5	0	100pF	CAP, CERM, 100 pF, 10 V, +/- 10%, X7R, 0603	0603	0603ZC101KAT2A	AVX
C3, C6	0	1uF	CAP, CERM, 1 uF, 35 V, +/- 10%, X7R, 0603	0603	C1608X7R1V105K080AC	TDK
FID1, FID2, FID3, FID4, FID5, FID6	0		Fiducial mark. There is nothing to buy or mount.	N/A	N/A	N/A
H1, H2, H3, H4	0		Bumpon, Hemisphere, 0.44 X 0.20, Clear	Transparent Bumpon	SJ-5303 (CLEAR)	3M
J1, J2, J3, J4, J5, J6, J7, J8	0		SMA Connector Receptacle, Female Socket 50Ohm Board Edge, End Launch Solder		0732511150	Molex Inc
LBL1	0		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, R2	0	100	RES, 100, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	ERJ-3EKF1000V	Panasonic
R3, R5	0	49.9	RES, 49.9, 1%, 0.1 W, 0603	0603	RC0603FR-0749R9L	Yageo
R4, R6, R7, R8, R9, R10, R11, R12, R13, R14	0	0	RES, 0, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	RMCF0603ZT0R00	Stackpole Electronics Inc
TP1, TP2, TP3, TP4	0		Test Point, Miniature, SMT	Test Point, Miniature, SMT	5019	Keystone
U1	0		325 MHz High-Speed Comparators with 2.5 ns Propagation Delay	SOP8	TLV3602DGKR	Texas Instruments

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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.

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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.

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- *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*

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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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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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4.3.2 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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