LP592201EVM User Guide

The Texas Instruments LP592201EVM evaluation module (EVM) helps designers evaluate the operation and performance of the adjustable LP592201 LDO voltage regulator. The LP592201EVM contains one LP592201DSC LDO adjustable voltage regulator, programmed to have an output voltage of 1.8 V, in the WSON (DSC) package (see Table 1).

Table 1. Device Information

EVM ORDERABLE NUMBER	V_{OUT}	PART NAME	PACKAGE
LP592201EVM	1.8 V	LP592201DSC	10-pin / WSON / DSC

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Trademarks

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1 Setup

This section describes the jumpers and connectors on the EVM, as well and how to properly connect, set up, and use the LP592201EVM.

The EVM has been designed to provide an output voltage of 1.8 V, with output current up to 2 A, using 22-µF input and output ceramic capacitors. The output voltage can be changed by altering the values of R1 and/or R2.

1.1 Input/Output Connector Descriptions

IN and **GNDIN** are the connection terminals for the input supply. The IN terminal is the positive connection, and the GNDIN terminal is the negative (that is, ground) connection.

OUT and **GNDOUT** are the connection terminals for the output load. The OUT terminal is the positive connection, and the GNDOUT terminal is the negative (that is, ground) connection.

The **TPpg** test terminal is the connection used to monitor the status of the LP592201 Power Good (PG) pin. The PG pin is an open drain connection which requires pull-up to some outside voltage, either V_{IN} or V_{OUT}, through a current limiting resistor. When the PG test terminal is a logic 'high' the output voltage is 'good'. When the PG test terminal is a logic 'low', the output voltage is 'not good'.

J3 is a 3-pin terminal strip used to enable, or disable, the LP592201.

When the shunt is across the center and ON terminal pins the Enable (EN) pin is connected directly to VIN. The LP592201 is enabled when VIN is applied. When the shunt is across the center and OFF terminal pins the Enable (EN) pin is connected directly to GND, the LP592201 is disabled.

If the shunt is not in place the EN pin internal 2-MΩ pulldown disables the LP592201 output. The default, and recommended, shunt position is across the center and ON terminal pins (enabled).

When driving the TPen terminal with an off-board supply or signal generator, the J3 shunt must be removed, and the voltage applied to TPen must be kept between 0 V and 5.5 V.

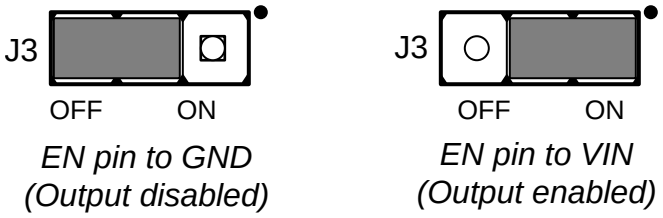


Figure 1. EN Jumper Settings

1.2 Setup

The recommended operating input voltage range for the LP592201EVM is V_{OUT} + 0.5 V (minimum) to 6 V (maximum).

A load should be applied between the OUT terminal and the GNDOUT terminal for proper operation. Load current should be maintained between 1 mA and 2 A.

A digital voltmeter can be connected to the TPpg test terminal to monitor the PG status.

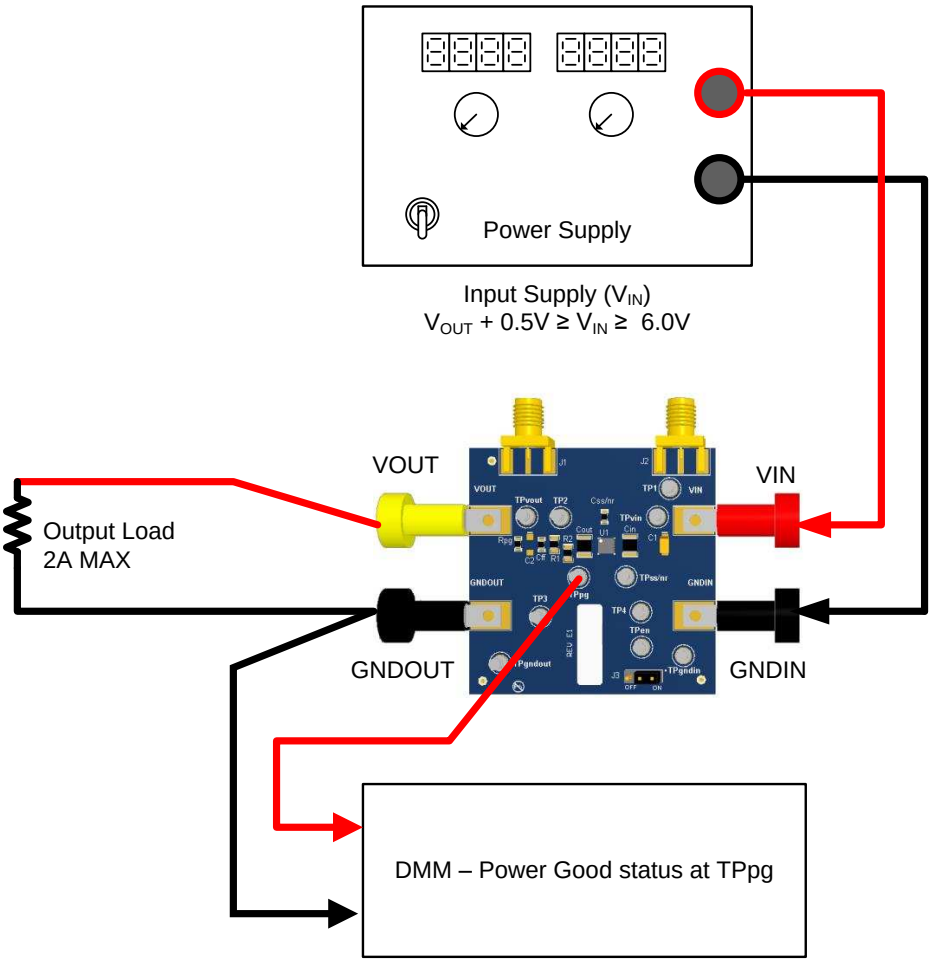


Figure 2. LP592201EVM Setup

1.3 Operation

For proper operation of the LP592201EVM, the J3 terminals must be properly configured. The recommended jumper setting is:

J3 shunt is across the center and ON pins.

In this configuration, the device powers up when power is applied at the IN terminal.

1.4 Options

The LP592201EVM has some assorted unpopulated footprints that some users may find useful:

- Footprint for an optional input capacitor at C1 (1206)
- Footprints for optional output capacitor at C2 (1206)
- Footprints for optional SMA connectors (Emerson 142-0701-851, or equivalent) at VIN (J2) and VOUT (J1) for noise or PSRR testing.

2 Changing the Output Voltage

The LP592201 EVM uses R1 and R2 to set the output voltage to 1.8 V. It is possible to change the output voltage within the range of 500 mV to 5.0V by changing only R1 to an appropriate value while keeping R2 at the installed value of 12.4 kΩ.

The R1 value for a desired output voltage can be found by using Equation 1 :

$$R1 = ((V_{OUT} - V_{FB}) \times R2) / V_{FB} \quad (1)$$

where

- V_{OUT} is the desired output voltage
- R2 is the installed value of 12.4 kΩ
- V_{FB} is 500 mV

Table 2.

TARGET V_{OUT}	R1 VALUE	R2 VALUE	Typical V_{OUT}	ERROR
0.50 V	0 Ω	12.4 kΩ	0.500 V	0 %
0.80 V	7.50 kΩ	12.4 kΩ	0.802 V	0.30 %
1.00 V	12.4 kΩ	12.4 kΩ	1.000 V	0 %
1.20 V	17.4 kΩ	12.4 kΩ	1.202 V	0.13 %
1.80 V(1)	32.4 kΩ(1)	12.4 kΩ(1)	1.806 V	0.36 %
2.50 V	49.9 kΩ	12.4 kΩ	2.512 V	0.48 %
3.00 V	61.9 kΩ	12.4 kΩ	2.996 V	–0.13 %
3.30 V	69.8 kΩ	12.4 kΩ	3.315 V	0.44 %
4.00 V	86.6 kΩ	12.4 kΩ	3.992 V	–0.20 %
5.00 V	113 kΩ	12.4 kΩ	5.056 V	1.12 %

(1) Default values

By changing both R1 and R2 values it may be possible to achieve better accuracy in some cases. It is recommenced that the value for the lower resistor, R2, be no more than 100 kΩ.

If the output voltage is set to 800 mV, or less, the output capacitance needs to be increased in order to maintain stability. A C_{OUT} value of 47 µF is recommended. Since the applied DC voltage is low, the de-rating of the capacitance value due to the applied DC voltage is not a meaningful consideration. One possible capacitor that could be used is:

Murata: 47 µF, ±10%, 6.3V, X7R, 1210; GRM32ER70J476KE20L

3 Board Layout

Figure 3 through Figure 8 show the board layout for the LP592201EVM PCB. The EVM offers resistors R1 and R2 to set the output voltage, resistor Rpg for pull-up of the PG pin, a C_{FF} capacitor to enhance phase margin, capacitors C1 and C2 to add additional capacitance to the input and output, and J3 3-pin terminal to set the EN pin status.

The LP592201 dissipates power. The WSON DSC 6-pin package offers an exposed thermal pad to enhance thermal performance. The exposed thermal pad must be soldered to the copper landing on the PCB for optimal thermal performance. The PCB provides 1 oz. (0.0014 inch) copper planes on all four layers, and four thermal vias under the exposed thermal pad, to enhance thermal performance.

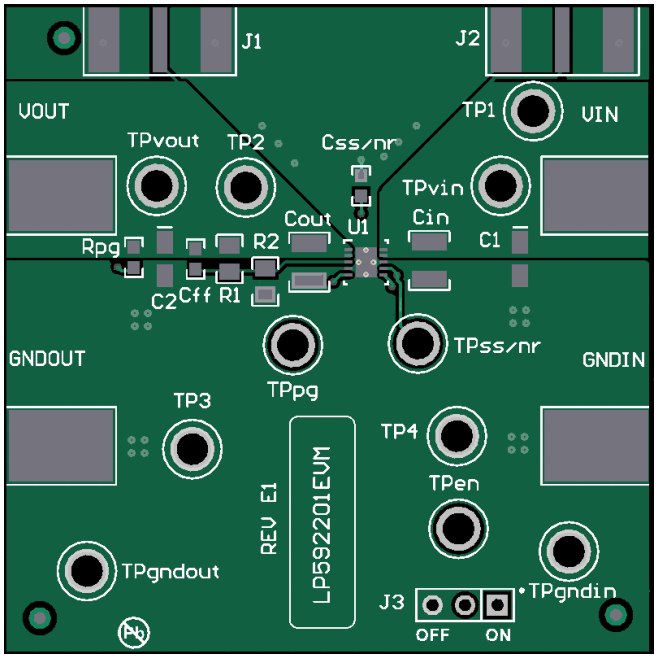


Figure 3. Top Assembly Layer and Silk-Screen

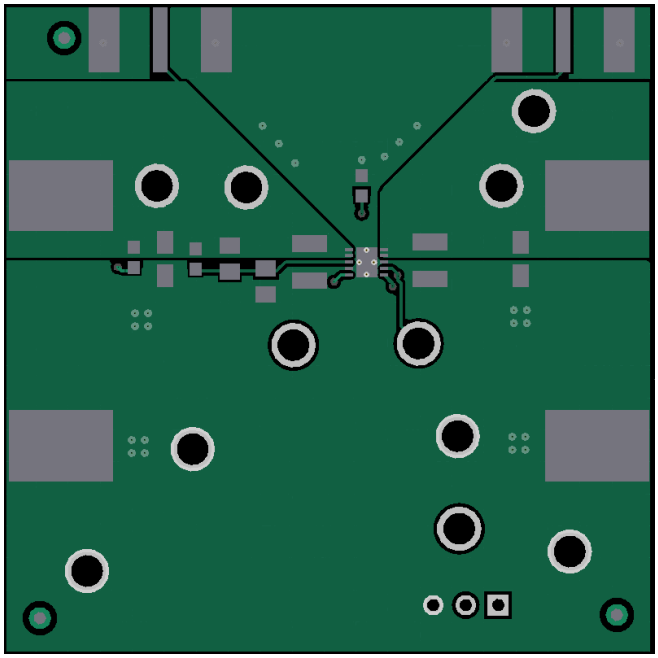


Figure 4. Top-Layer Routing

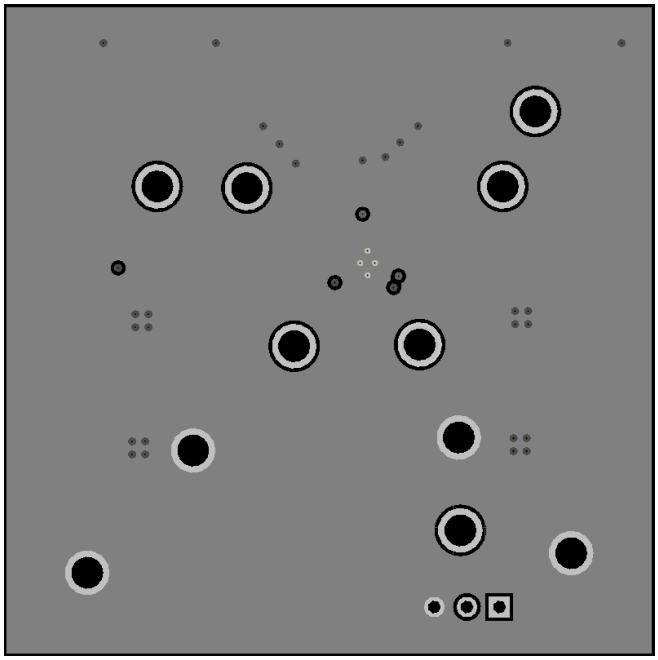


Figure 5. Layer 2: GND Plane

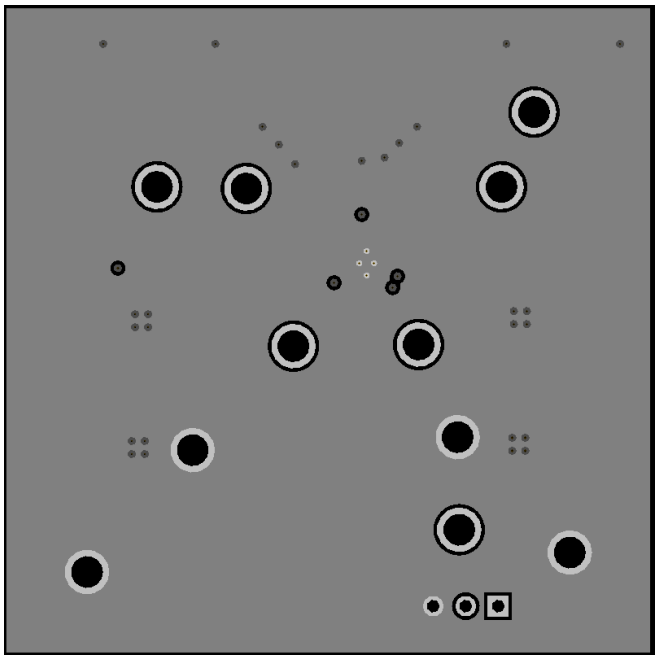


Figure 6. Layer 3: GND Plane

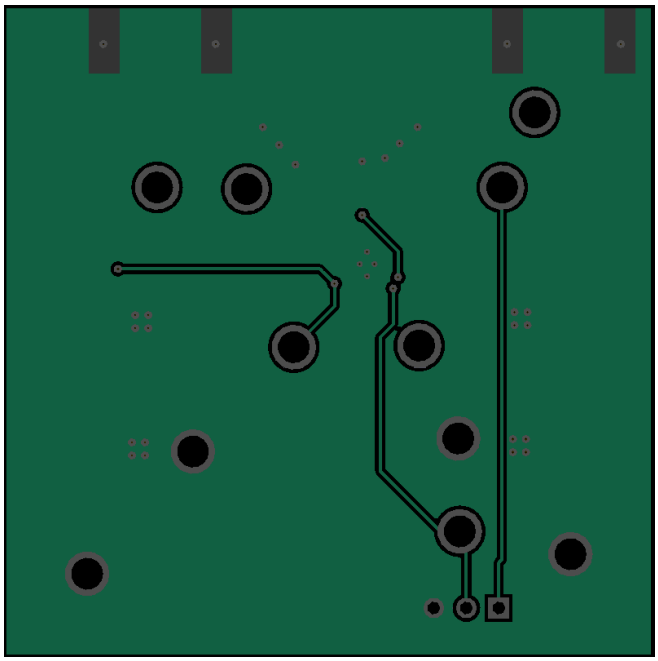


Figure 7. Bottom-Layer Routing

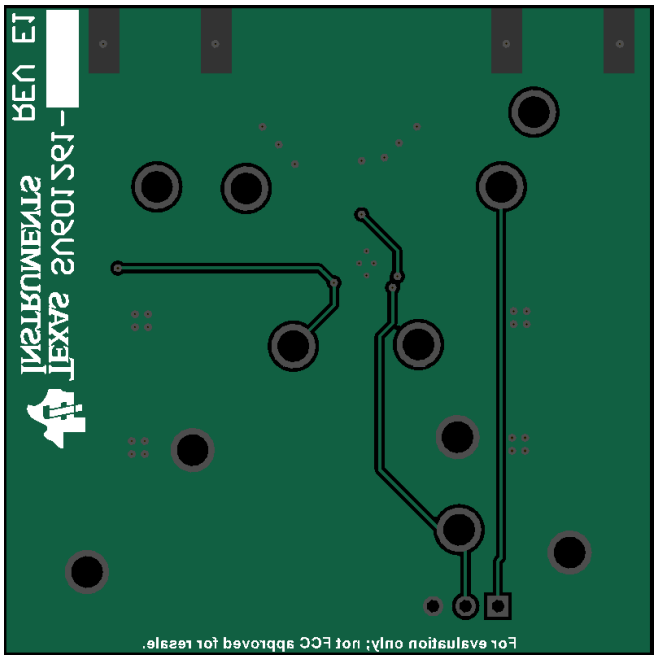
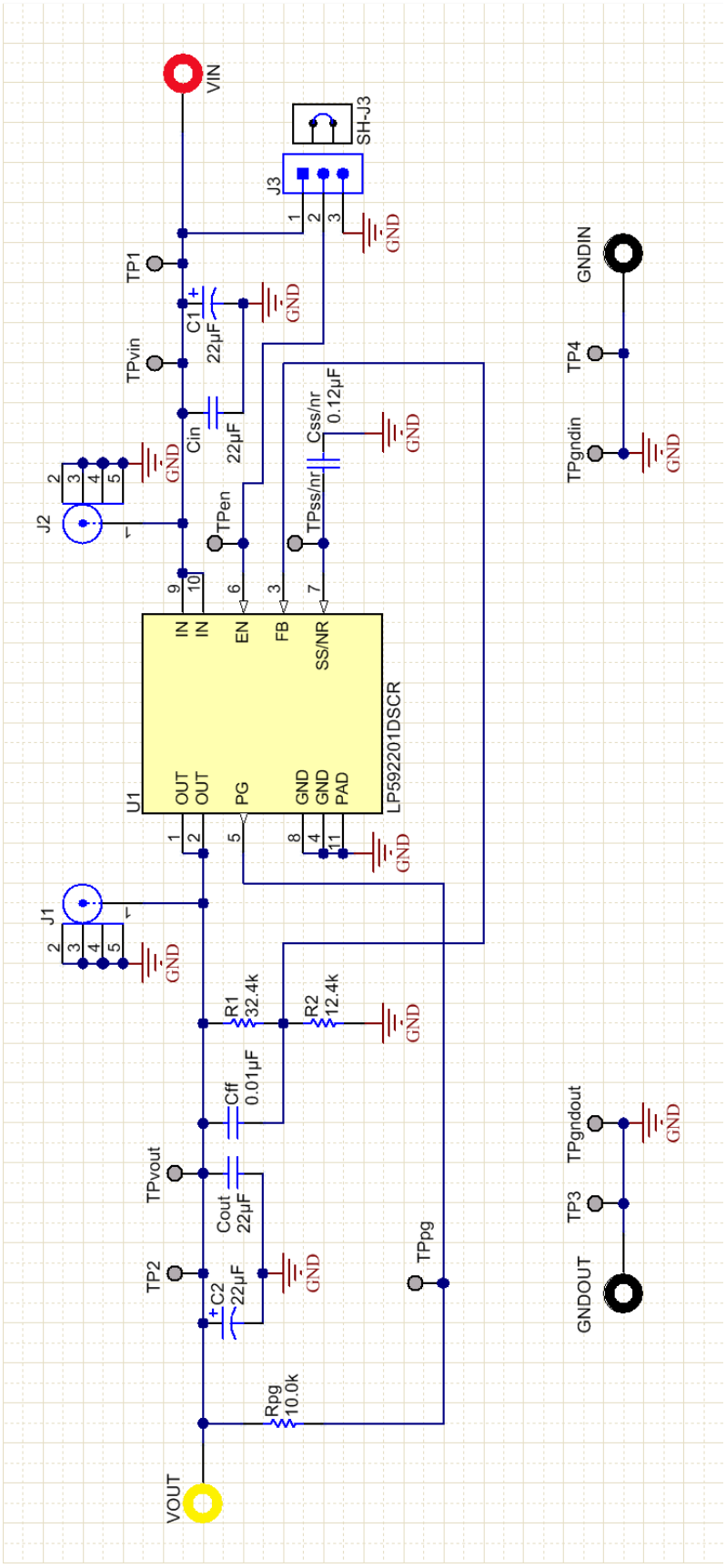


Figure 8. Bottom Assembly Layer and Silk-Screen

4 LP592201EVM Schematic



5 Bill of Materials

COUNT	REF DES	DESCRIPTION	SIZE	MFR	PART NUMBER
1	C1	Capacitor: Tantalum, 22 µF, ±10%, 10 V, 3 Ω	1206	AVX	TAJA226K010RNJ
0	C2	Capacitor: (n/a)	-	-	-
2	CIN, COUT	Capacitor: Ceramic, 22 µF, ±10%, 16 V, X7R, 1210	1210	Murata Electronics	GRM32ER71C226KE18L
1	Cff	Capacitor, Ceramic, 0.01 µF, ±10%, 50 V, X7R, 0603	0603	Murata Electronics	GRM188R71H103KA01D
1	Css/nr	Capacitor, Ceramic, 0.12 µF, ±10%, 10 V, X7R, 0603	0603	Murata Electronics	GRM188R71A124KA01D
2	GNDIN, GNDOUT	Standard Banana Jack, Insulated, Black	-	Keystone	6092
1	VIN	Standard Banana Jack, Insulated, Red	-	Keystone	6091
1	VOUT	Standard Banana Jack, Insulated, Yellow	-	Cinch	108-0907-001
1	J3	Header, 3-pin, 100-mil spacing	0.100" × 3	Samtec	HTSW-103-07-G-S
1	SH-J3	Shunt, 100 mil, Gold plated, Black	0.100" × 2	Samtec	SNT-100-BK-G
1	R1	Resistor, 32.4 kΩ, ±1%, 0.125 W, 0805	0805	Vishay-Dale	CRCW080532K4FKEA
1	R2	Resistor, 12.4 kΩ, ±1%, 0.125 W, 0805	0805	Vishay-Dale	CRCW080512K4FKEA
1	Rpg	Resistor, 10.0 kΩ, ±1%, 0.100 W, 0603	0603	Vishay-Dale	RCG060310K0FKEA
11	TP1, TP2, TP3, TP4, TPen, TPgndin,TPgndout, TPpg, TPss/nr, TPvin, TPvout	Terminal, Turret, Through-Hole, Double	0.090" (2.29 mm)	Keystone	1502-2
1	U1	IC LDO: Adjustable	DSC010	TI	LP592201DSC
1	LP592201EVM PCB	PCB, 2 inch × 2 inch × 0.062	-	TI	SV601261

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      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.

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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.*

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3.2.1 *For EVMs issued with an Industry Canada Certificate of Conformance to RSS-210*

Concerning EVMs Including Radio Transmitters:

This device complies with Industry Canada license-exempt RSS standard(s). 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.

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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.

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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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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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