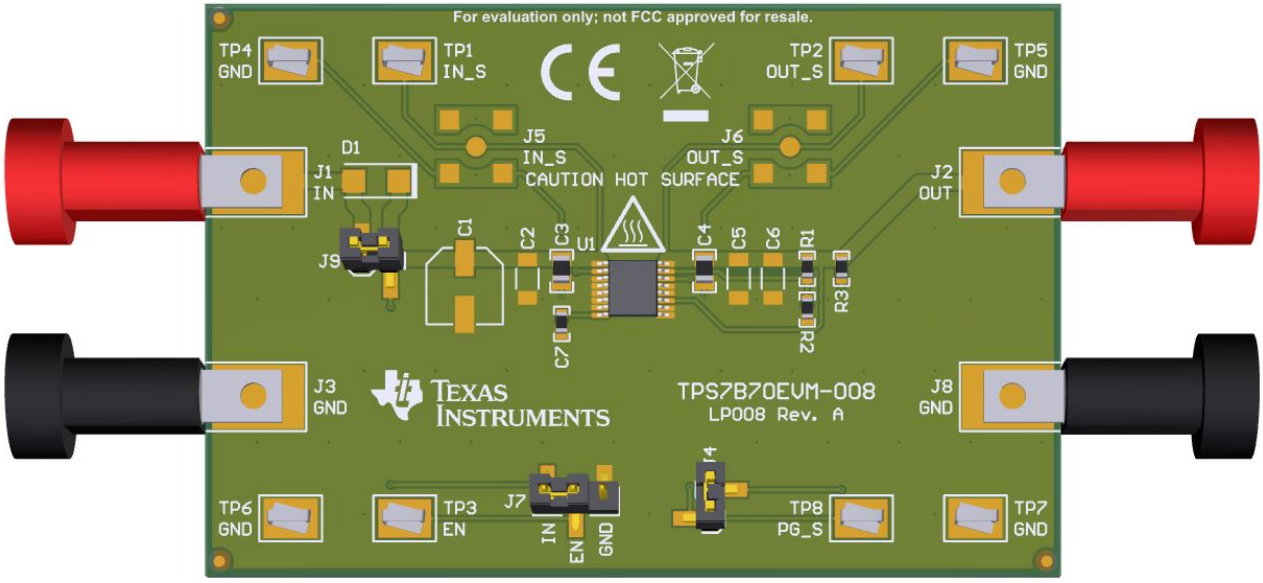
# TPS7B70EVM-008 Evaluation Module




This user's guide describes the operational use of the TPS7B70EVM-008 evaluation module (EVM) as a reference design for engineering demonstration and evaluation of the TPS7B7050QPWPQ1, low-dropout linear regulator (LDO). Included in this user's guide are setup and operating instructions, thermal and layout guidelines, a printed circuit board (PCB) layout, a schematic diagram, and a bill of materials (BOM).

Throughout this document, the terms *demonstration kit*, *evaluation board*, and *evaluation module* are synonymous with the TPS7B70EVM-008.

The following related documents are available through the Texas Instruments web site at www.ti.com.

**Related Documentation**

| Device | Literature Number |
|---|---|
| TPS7B70-Q1 | SLVSEK5 |

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## Trademarks

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# 1 Introduction

Texas Instruments' TPS7B70EVM-008 EVM helps design engineers evaluate the operation and performance of the TPS7B70-Q1 family of linear regulators for possible use in their own circuit application. This particular EVM configuration contains a single low-noise, high-PSRR linear regulator for high-speed communication systems. The regulator is capable of delivering up to 300 mA to the load with low $V_{IN}$ to $V_{OUT}$ dropout voltage. For stability, use a 4.7-µF (or larger) output capacitor for the TPS7B70-Q1.

## *1.1 Before You Begin*

The following warnings and cautions are noted for the safety of anyone using or working close to the TPS7B70EVM-008. Observe all safety precautions.

**Warning** Warning Hot surface. Contact may cause burns. Do not touch.

**CAUTION**

The circuit module may be damaged by overtemperature. To avoid damage, monitor the temperature during evaluation and provide cooling, as needed, for your system environment.

**CAUTION**

Some power supplies can be damaged by application of external voltages. If using more than one power supply, check your equipment requirements and use blocking diodes or other isolation techniques, as needed, to prevent damage to your equipment.

# 2 EVM Setup

This section describes how to properly connect and setup the TPS7B70EVM-008, including the jumpers and connectors on the EVM board.

## 2.1 Input/Output Connector and Jumper Descriptions

### 2.1.1 J1 – IN

Input power-supply voltage connector. Twist together the positive input lead and ground return lead from the input power supply, and keep them as short as possible to minimize input inductance.

### 2.1.2 J2 – OUT

Regulated output voltage connector.

### 2.1.3 J3 – GND

Input ground return connector.

### 2.1.4 J4 – VPU

Pullup-voltage selector for PG. This EVM is designed so that PG can be pulled up either to VOUT by shorting J4, or pulled up to another voltage by applying an external voltage to the VPU post.

### 2.1.5 J5 – IN_S

Input sense.

### 2.1.6 J6 – OUT_S

Output sense.

### 2.1.7 J7 – ENABLE

Output enable. To enable the output, connect a jumper to short IN to EN. To disable the output, connect a jumper between GND and EN

### 2.1.8 J8 – GND

Output ground return connector.

### 2.1.9 J9 – D1 Bypass

If D1 is not required connect a jumper to bypass D1.

### 2.1.10 TP1 – IN_S

Input sense test point.

### 2.1.11 TP2 – OUT_S

Output sense test point.

### 2.1.12 TP3 – EN

Enable test point.

### 2.1.13 TP4 – GND

Ground test point.

#### 2.1.14 TP5 – GND

Ground test point.

#### 2.1.15 TP6 – GND

Ground test point.

#### 2.1.16 TP7 – GND

Ground test point.

#### 2.1.17 TP8 – PG_S

PG test point.

### *2.2 Soldering Guidelines*

To avoid damaging the LDO, use a hot-air system for any solder rework to modify the EVM for the purpose of repair or other application reasons.

### *2.3 Equipment Connection*

Connect the equipment as shown in the following steps:

1. Set the input power supply to 40 V (max), and turn the power supplies off.
2. Connect the positive voltage lead from the input power supply to IN at the J1 connector of the EVM.
3. Connect the ground lead from the input power supply to GND at the J3 connector of the EVM.
4. Connect a 0-A to 300-mA load between OUT and GND.
5. Disable the output by shorting EN to GND through J7.

## 3 Operation

Operate the equipment using the following steps:

1. Turn on the power supplies.
2. Enable the output by jumping J6 (the EN pin) to VIN.
3. Vary the respective load and input voltage, as necessary, for test purposes.

## 4 PCB Layout

Figure 1 to Figure 3 illustrate the PCB layout for this EVM.

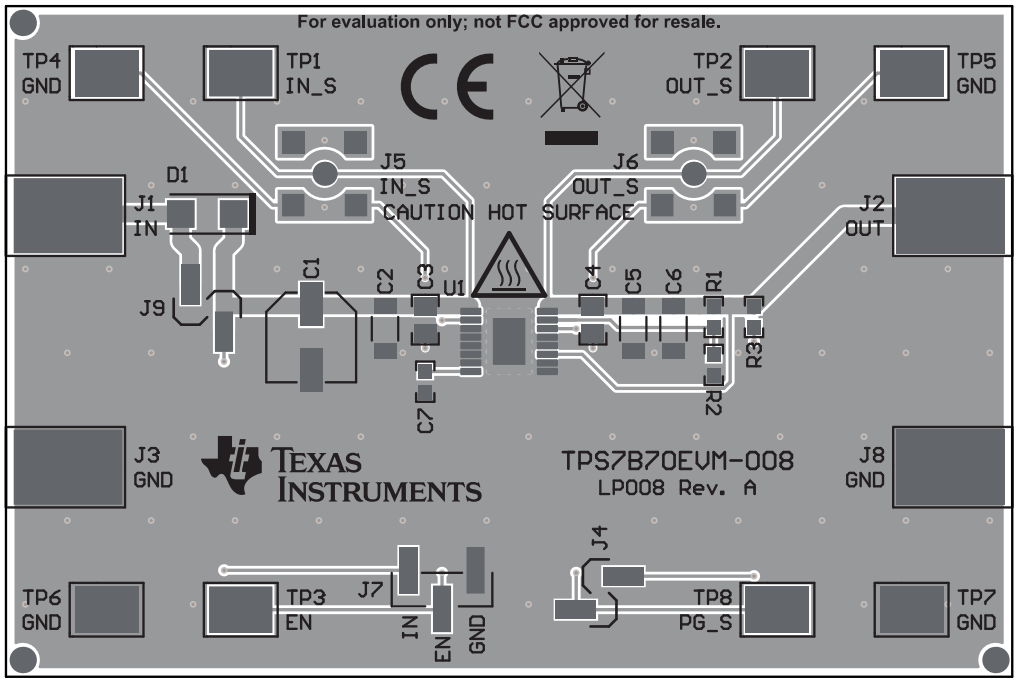


**Figure 1. Assembly Layer**

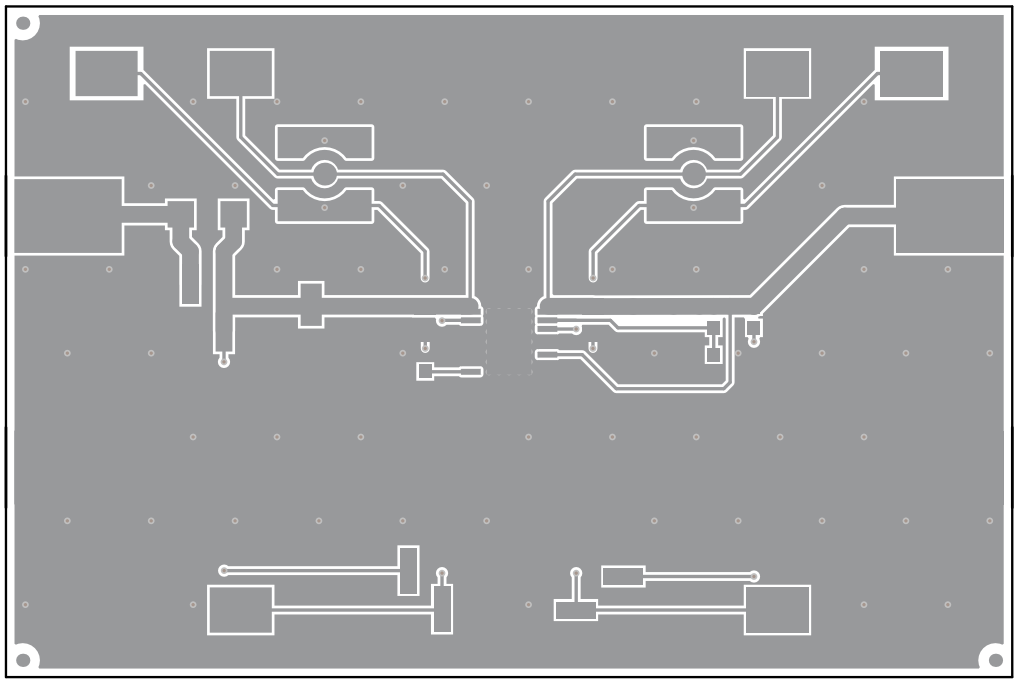

**Figure 2. Top Layer Routing**

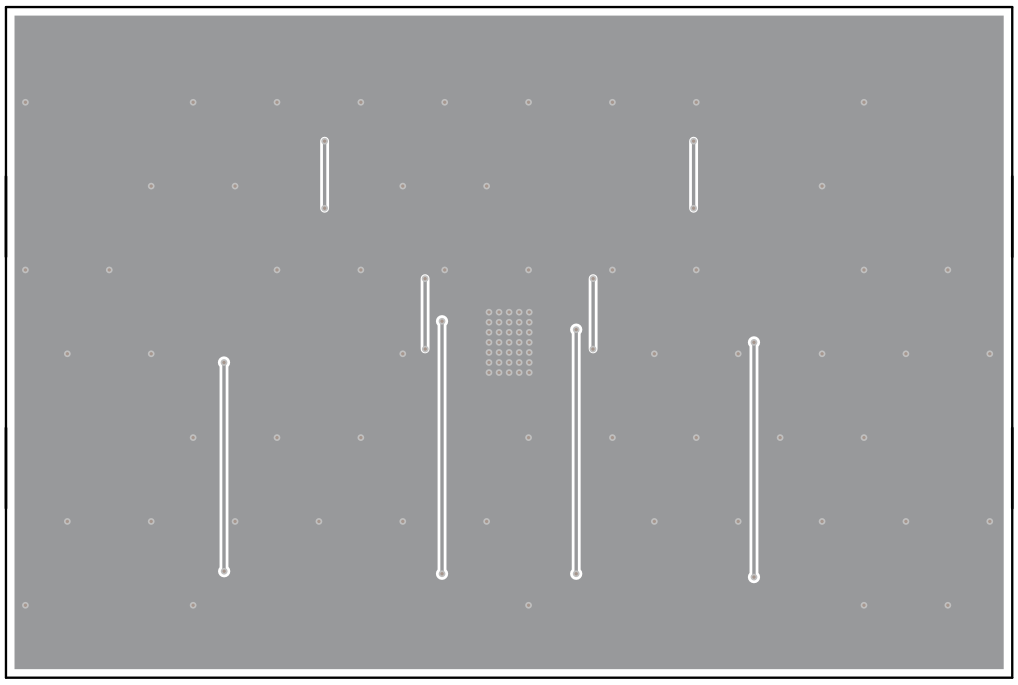

**Figure 3. Bottom Layer Routing**

## 5 Schematic

Figure 4 is the schematic for this EVM.

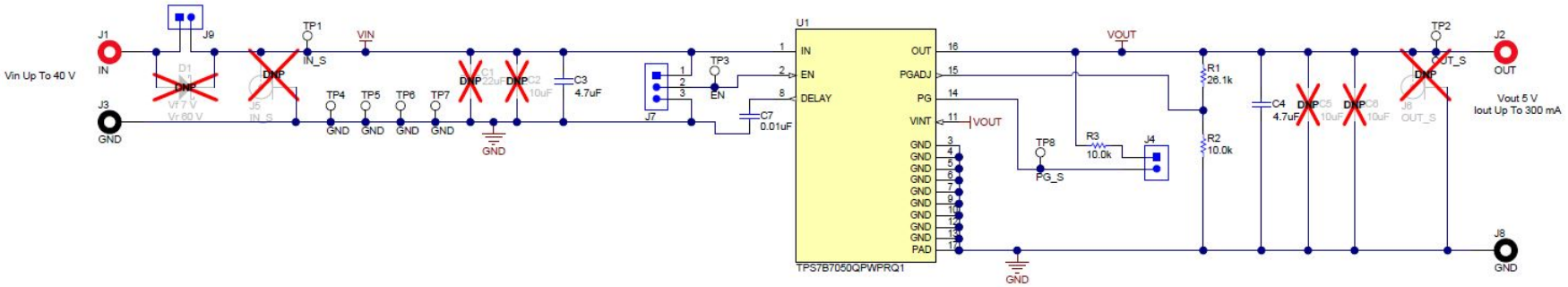


**Figure 4. TPS7B70EVM-008 Schematic**

## 6 Bill of Materials

The BOM for this EVM is shown in Table 1.

**Table 1. TPS7B70EVM-008 BOM(1)(2)(3)(4)**

| Designator | QTY | Value | Description | Package Reference | Part Number | Manufacturer | Alternate Part Number | Alternate Manufacturer |
|---|---|---|---|---|---|---|---|---|
| !PCB1 | 1 | | Printed Circuit Board | | LP008 | Any | | |
| C3, C4 | 2 | 4.7uF | CAP, CERM, 4.7 uF, 50 V, +/- 10%, X5R, 0805 | 0805 | GRM21BR61H475KE51L | MuRata | | |
| C7 | 1 | 0.01uF | CAP, CERM, 0.01 uF, 50 V, +/- 10%, X7R, 0603 | 0603 | C1608X7R1H103K080AA | TDK | | |
| J1, J2 | 2 | | Standard Banana Jack, Insulated, Red | 6091 | 6091 | Keystone | | |
| J3, J8 | 2 | | Standard Banana Jack, Insulated, Black | 6092 | 6092 | Keystone | | |
| J4, J9 | 2 | | Header, 2.54 mm, 2x1, Gold, R/A, SMT | Header, 2.54 mm, 2x1, R/A, SMT | 878980204 | Molex | | |
| J7 | 1 | | Header, 100mil, 3x1, Gold, SMT | Samtec_TSM-103-01-X-SV | TSM-103-01-L-SV | Samtec | | |
| R1 | 1 | 26.1k | RES, 26.1 k, 1%, 0.1 W, 0603 | 0603 | RC0603FR-0726K1L | Yageo America | | |
| R2, R3 | 2 | 10.0k | RES, 10.0 k, 1%, 0.1 W, 0603 | 0603 | RCG060310K0FKEA | Vishay Draloric | | |
| SH-J1, SH-J2, SH-J3 | 3 | 1x2 | Shunt, 100mil, Gold plated, Black | Shunt | 969102-0000-DA | 3M | SNT-100-BK-G | Samtec |
| TP1, TP2, TP3, TP4, TP5, TP6, TP7, TP8 | 8 | | Test Point, Compact, SMT | Testpoint_Keystone_Compact | 5016 | Keystone | | |
| U1 | 1 | | Automotive 300-mA, 40-V, Low-Quiescent-Current LDO with PG Functionality , PWP0016J (TSSOP-16) | PWP0016J | TPS7B7050QPWPRQ1 | Texas Instruments | | |
| C1 | 0 | 22uF | CAP, AL, 22 uF, 50 V, +/- 20%, 0.88 ohm, AEC-Q200 Grade 2, SMD | SMT Radial D | EEE-FK1H220P | Panasonic | | |
| C2, C5, C6 | 0 | 10uF | CAP, CERM, 10 uF, 50 V, +/- 10%, X5R, 1206 | 1206 | GRM31CR61H106KA12L | MuRata | | |
| D1 | 0 | 60V | Diode, Schottky, 60 V, 2 A, SMA | SMA | B260A-13-F | Diodes Inc. | | |
| FID1, FID2, FID3 | 0 | | Fiducial mark. There is nothing to buy or mount. | N/A | N/A | N/A | | |
| J5, J6 | 0 | | Connector, SMA Jack, Vertical, Gold, SMD | SMA | 142-0711-201 | Cinch Connectivity | | |

(1) These assemblies are ESD sensitive, observe ESD precautions.
(2) These assemblies must be clean and free from flux and all contaminants. Use of no-clean flux is not acceptable.
(3) These assemblies must comply with workmanship standards IPC-A-610 Class 2.
(4) Unless otherwise noted in the *Alternate Part Number* or *Alternate Manufacturer* columns, all parts may be substituted with equivalents.

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   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

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http://www.tij.co.jp/lsds/ti_ja/general/eStore/notice_01.page

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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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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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10. *Governing Law:* These terms and conditions shall be governed by and interpreted in accordance with the laws of the State of Texas, without reference to conflict-of-laws principles. User agrees that non-exclusive jurisdiction for any dispute arising out of or relating to these terms and conditions lies within courts located in the State of Texas and consents to venue in Dallas County, Texas. Notwithstanding the foregoing, any judgment may be enforced in any United States or foreign court, and TI may seek injunctive relief in any United States or foreign court.

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