# TPS3780EVM-154 Evaluation Module

This User's Guide describes the operational use of the TPS3780EVM-154 Evaluation Module (EVM) as a reference design for engineering demonstration and evaluation of the TPS3780EVM, two channel voltage detectors with low power and high accuracy comparators. Included in this user's guide are setup instructions, a schematic diagram, PCB layout drawings, and a bill of materials for the evaluation module. This user's guide also discusses how to modify the TPS3780EVM-154 board to evaluate the TPS3779.

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# 1 Introduction

The Texas Instruments TPS3780EVM-154 helps design engineers to evaluate the operation and performance of two TPS3780 ICs with different hysteresis options (TPS3780ADRYR/T and TPS3780BDRYR/T) for possible use in their own circuit application. This particular EVM configuration contains two dual voltage detectors with low quiescent current and high threshold accuracy in a small µSON (1.45 mm x 1 mm) package. This document describes the configuration and set up of the TPS3780EVM-154 EVM board.

# 2 Setup

This section describes the jumpers and connectors on the EVM as well as how to properly connect, setup, and use the TPS3780EVM-154.

## *2.1 Input and Output Connector and Jumper Descriptions*

### 2.1.1 J1 – VCC

This connector is the input power supply connection.

### 2.1.2 J2 – GND

Return connector for the input power supply. This connector is also connected to J4 and J7 in the EVM.

### 2.1.3 J3 – SENSE1

This connector is connected to the voltage that is monitored.

### 2.1.4 J4 – GND

Return connector for the SENSE1 and SENSE2 voltage signal. This connector is also connected to J2 and J7 in the EVM.

### 2.1.5 J5 – SENSE2

This connector is connected to a second voltage that will be monitored.

### 2.1.6 J6 – OUT1

This connector is the open-drain output of comparator 1 that pulls up to VPU through a 50-kΩ resistor in the EVM. Connect a voltage meter or oscilloscope probe from J6 to GND (J7).

### 2.1.7 J7 – GND

Return connector for the OUT1 and OUT2 outputs. This connector is also connected to J2 and J4 in the EVM.

### 2.1.8 J8 – OUT2

This connector is the open-drain output of comparator 2 that pulls up to VPU through a 50-kΩ resistor in the EVM. Connect a voltage meter or oscilloscope probe from J8 to GND (J7).

### 2.1.9 JP1 – VPU

The TPS3780EVM- 154 is designed for OUT1 and OUT2 to pull up to either VCC or an external voltage source. Table 1 shows the connections for choosing between the two. If the shorting jumper is removed, an external voltage can be placed on Pin 2.

**Table 1. Connector JP1 Selections**

| Short Pins | Pull-Up Voltage (VPU) |
|---|---|
| 1 and 2 | VCC |
| OPEN | External Voltage on Pin 2 |

### 2.1.10 J9 – VCC1

This connector is the input power supply connection.

### 2.1.11 J10 – GND

Return connector for the input power supply. This connector is also connected to J12 and J15 in the EVM.

### 2.1.12 J11 – SENSE1

This connector is connected to the voltage that will be monitored.

### 2.1.13 J12 – GND

Return connector for the SENSE1 and SENSE2 voltage signal. This connector is also connected to J10 and J15 in the EVM.

### 2.1.14 J13 – SENSE2

This connector is connected to a second voltage that will be monitored.

### 2.1.15 J14 – OUT1

This connector is the open-drain output of comparator 1 that pulls up to VPU through a 50-kΩ resistor in the EVM. Connect a voltage meter or oscilloscope probe from J14 to GND (J15).

### 2.1.16 J15 – GND

Return connector for the OUT1 and OUT2 outputs. This connector is also connected to J10 and J12 in the EVM.

### 2.1.17 J16 – OUT2

This connector is the open-drain output of comparator 2 that pulls up to VPU through a 50-kΩ resistor in the EVM. Connect a voltage meter or oscilloscope probe from J16 to GND (J15).

### 2.1.18 JP1 – VPU

The TPS3780EVM- 154 is designed for OUT1 and OUT2 to pull up to either VCC1 or an external voltage source. Table 2 shows the connections for choosing between the two. If the shorting jumper is removed, an external voltage can be placed on Pin 2.

**Table 2. Connector JP1 Selections**

| Short Pins | Pull-Up Voltage (VPU) |
|---|---|
| 1 and 2 | VCC1 |
| OPEN | External Voltage on Pin 2 |

### 2.2 Equipment Setup

This setup is described for evaluating U1 (top IC). This setup can also be used for evaluating U2 (bottom IC).

- Set the first power supply voltage between 1.5V - 6.5V. Turn the power supply off. Connect the positive voltage lead from the power supply to J1 (VCC). Connect the ground lead from the power supply to J2 (GND).
- Set the second power supply voltage to 0V. Turn the power supply off. Connect the positive voltage lead from the power supply to J3 (SENSE1). Connect the ground lead from the power supply to J4 (GND).
- Set the third power supply voltage to 0V. Turn the power supply off. Connect the positive voltage lead from the power supply to J5 (SENSE2). Connect the ground lead from the power supply to J4 (GND).
- Place the shorting jumper on JP1 (VPU VCC).
- Turn on all power supplies and vary SENSE1 and SENSE2 as needed to evaluate the TPS3780.

## 3 Operation

This section provides information about the operation of the TPS3780EVM-154.

### 3.1 General Operation

The TPS3780EVM-154 is a dual voltage detector. The device monitors a selected voltage signal (SENSE1 and/or SENSE2). OUT1 triggers HIGH (VPU) when SENSE1 is rises above the VIT+ threshold and triggers LOW (GND) when SENSE1 falls beneath VIT-. OUT2 operates the same way.

The TPS3780EVM-154 is designed for SENSE 1 to monitor a 3.3V rail and trigger when the rail falls below 10% of 3.3V. Specifically, OUT1 will trigger LOW during a -10% drop (2.97V). Otherwise, OUT1 will remain pulled up to the VPU voltage (VCC or VEXT). SENSE 2 is designed to monitor a 2.5V rail and trigger when the rail falls below 10% of 2.5V. Specifically, OUT2 will trigger LOW during a -10% drop (2.25V). Otherwise, OUT2 will remain pulled up to the VPU voltage (VCC or external voltage). Two IC's can be evaluated with different hysteresis options (see Figure 4).

# 4 Board Layout

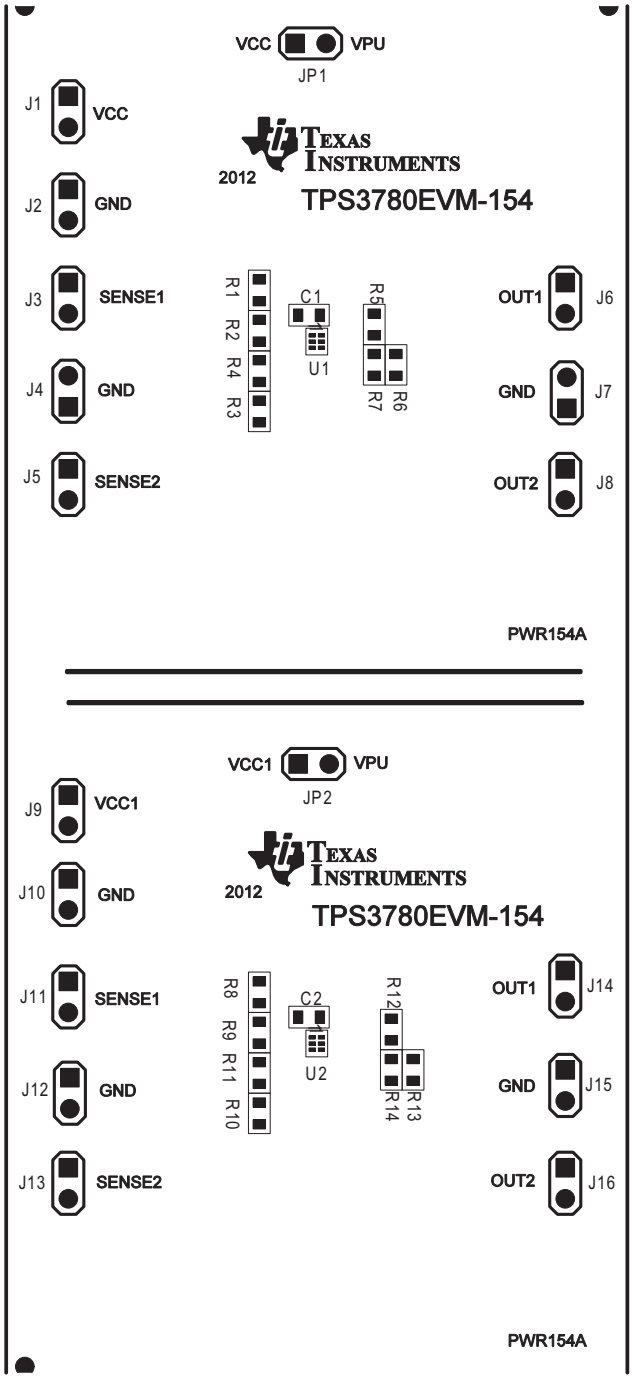


**Figure 1. Assembly Layer**

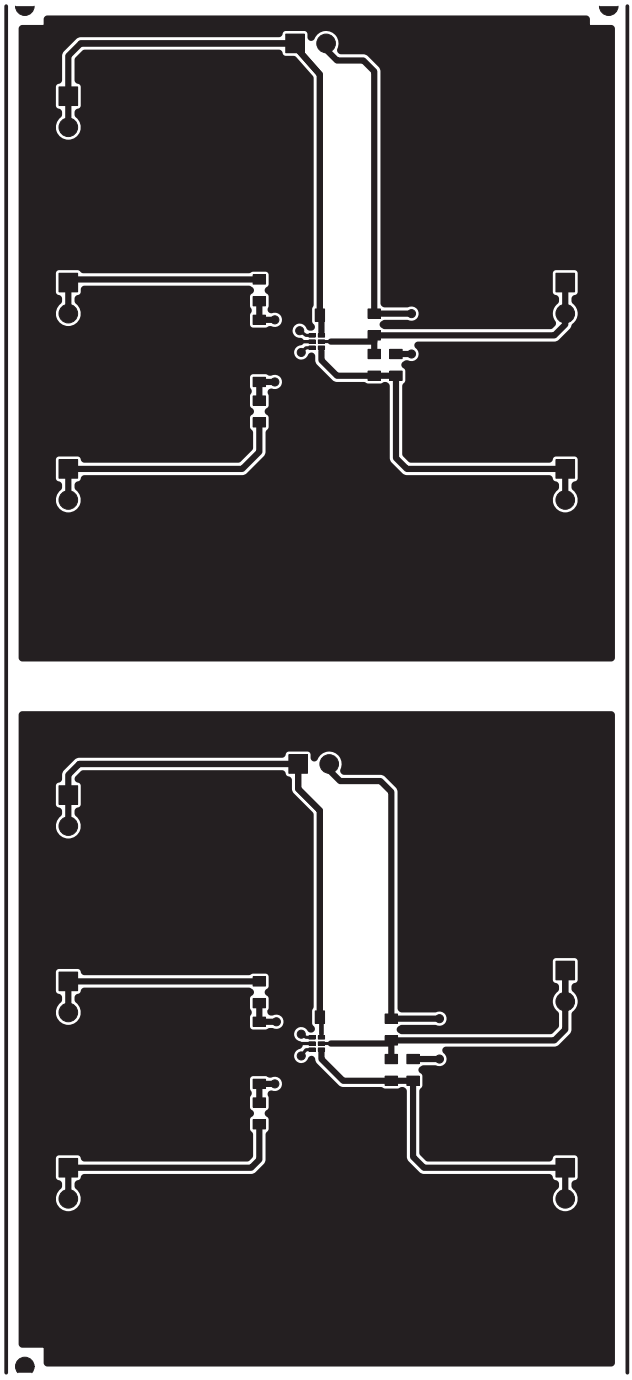

**Figure 2. Top Layer Routing**

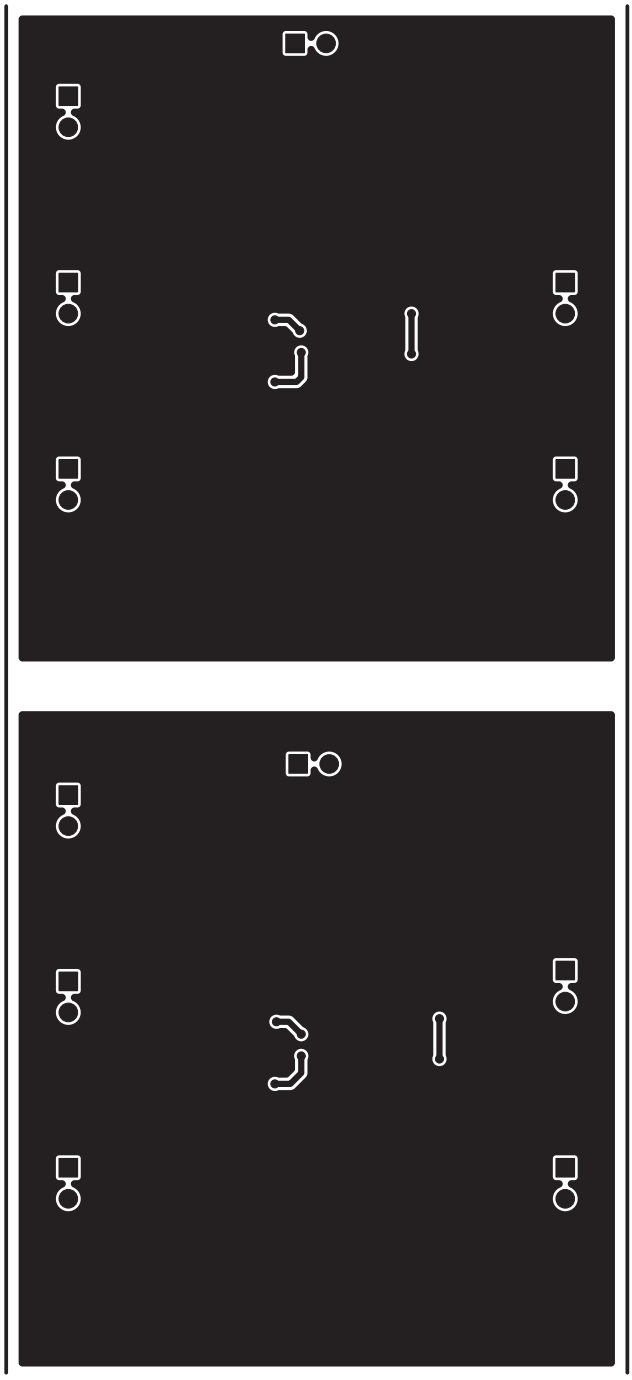

**Figure 3. Bottom Layer Routing**

# 5 Schematic

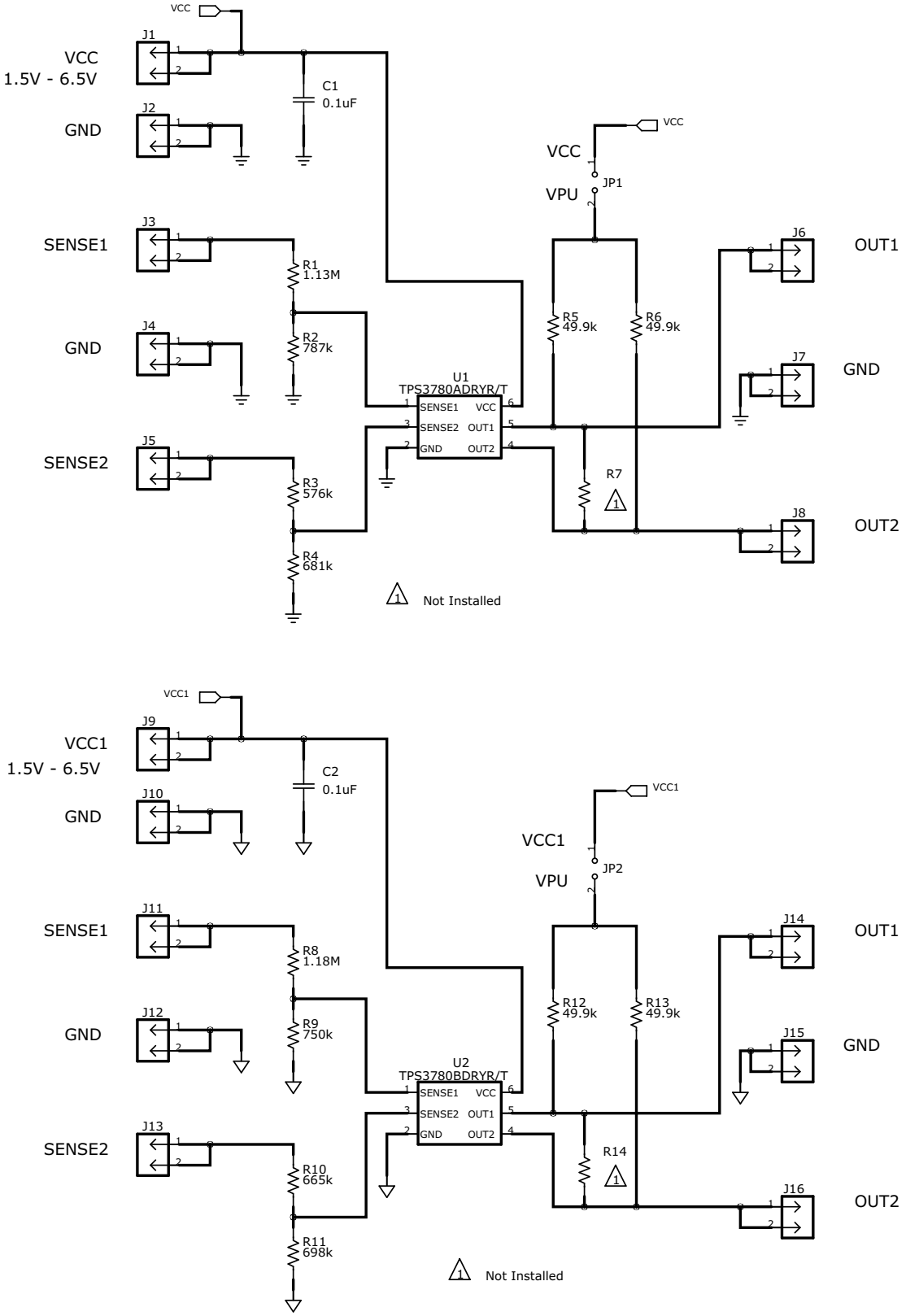


**Figure 4. TPS3780EVM-154 Schematic**

# 6 Bill of Material

**Table 3. TPS3780EVM-154 Bill of Material**

| COUNT | RefDes | Value | Description | Size | Part Number | MFR |
|---|---|---|---|---|---|---|
| 2 | C1-2 | 0.1uF | Capacitor, Ceramic Chip, X5R, 16V, ±10% | 0603 | STD | STD |
| 16 | J1-16 | PEC02SAAN | Header, Male 2-pin, 100mil spacing, | 0.100 inch x 2 | PEC02SAAN | Sullins |
| 2 | JP1-2 | PEC02SAAN | Header, Male 2-pin, 100mil spacing, | 0.100 inch x 2 | PEC02SAAN | Sullins |
| 1 | R1 | 1.13M | Resistor, Chip, 1/16W, 1% | 0603 | STD | STD |
| 1 | R2 | 787k | Resistor, Chip, 1/16W, 1% | 0603 | STD | STD |
| 1 | R3 | 576k | Resistor, Chip, 1/16W, 1% | 0603 | STD | STD |
| 1 | R4 | 681k | Resistor, Chip, 1/16W, 1% | 0603 | STD | STD |
| 4 | R5-6, R12-13 | 49.9k | Resistor, Chip, 1/16W, 1% | 0603 | STD | STD |
| 0 | R7 | Open | Resistor, Chip, 1/16W, 1% | 0603 | STD | STD |
| 1 | R8 | 1.18M | Resistor, Chip, 1/16W, 1% | 0603 | STD | STD |
| 1 | R9 | 750k | Resistor, Chip, 1/16W, 1% | 0603 | STD | STD |
| 1 | R10 | 665k | Resistor, Chip, 1/16W, 1% | 0603 | STD | STD |
| 1 | R11 | 698k | Resistor, Chip, 1/16W, 1% | 0603 | STD | STD |
| 0 | R14 | Open | Resistor, Chip, 1/16W, 1% | 0603 | STD | STD |
| 1 | U1 | TPS3780ADRY | IC, Low Power, Dual Voltage Detector | 1.45mmx1mm | TPS3780ADRY | TI |
| 1 | U2 | TPS3780BDRY | IC, Low Power, Dual Voltage Detector | 1.45mmx1mm | TPS3780BDRY | TI |
| 1 | – | | PCB, 2 In x 4.5 In x 0.062 In | | PWR154 | Any |
| 2 | JP1-2 | | Shunt, Black | 100-mil | 929950-00 | 3M |

# 7 Evaluating the TPS3779 using the TPS3780EVM-154 Board

The TPS3779 and TPS3780 are a family of two channel voltage detectors with low power and high accuracy comparators. The TPS3779 and TPS3780 perform the same functions; however, they use different output stages. The TPS3780 uses an open drain output while the TPS3779 uses a push-pull output.

## *7.1 Modifying the TPS3780EVM-154 Board*

The TPS3779 uses a push-pull output stage; therefore, pull-up resistors are not needed. The following modifications to the TPS3780EVM-154 board can be made to evaluate the TPS3779:

- Remove resistors R5-R6, and R12-R13 or
- Remove JP1 and JP2

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**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**

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.

**For EVMs annotated as IC – INDUSTRY CANADA Compliant**

This Class A or B digital apparatus complies with Canadian ICES-003.

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**Concerning EVMs including radio transmitters**

This device complies with Industry Canada licence-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.

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**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.

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