User's Guide

TPS22995 Evaluation Module User's Guide

ABSTRACT

This user's guide describes the characteristics, operation, and use of the TPS22995 adjustable rise time load switch Evaluation Module (EVM). This document contains the complete EVM schematic diagram, printed-circuit board layouts, bill of materials, and necessary instructions on how to operate the EVM.

Table of Contents

List of Figures

List of Tables

Trademarks

1 Introduction

The TPS22995EVM is a two-layer PCB containing the TPS22995RZG and TPS22995RZF load switch device. The VIN and VOUT connections to the device and the PCB layout routing are capable of handling high continuous currents and provide a low-resistance pathway into and out of the device under test. Test point connections allow the EVM user to control the device with user-defined test conditions and make accurate R_{ON} measurements.

1.1 Description

Table 1-1 lists a short description of the TPS22995 load switch performance specification. For additional details on load switch performance, application notes, and data sheet, see *Load Switches*.

Table 1-1. TPS22995 Characteristics

EVM	Device	Rise Time Typical (µs)	Vin (V)	V_{BIAS} (V)	Enable (ON Pin)	Quick Output Discharge
PSIL185	TPS22995RZF, TPS22995RZG	Adjustable	0.4 V to 5.5 V	1.5 V to 5.5 V	Active High	Fixed

1.2 Features

This EVM has the following features:

- Vin input voltage range: 0.4 V to 5.5 V
- Access to the VIN, VOUT, ON, and CT pins of the TPS22995RZG and TPS22995RZF load switch
- Onboard CIN and COUT capacitors
- Adjustable rise timing

2 Electrical Performance

See the *TPS22995 5.5-V, 3.5-A, 20-mΩ On-Resistance Load Switch with Adjustable Rise Time* data sheet for detailed electrical characteristics of the TPS22995.

3 Schematic

Figure 3-1 illustrates the TPS22995EVM schematic.

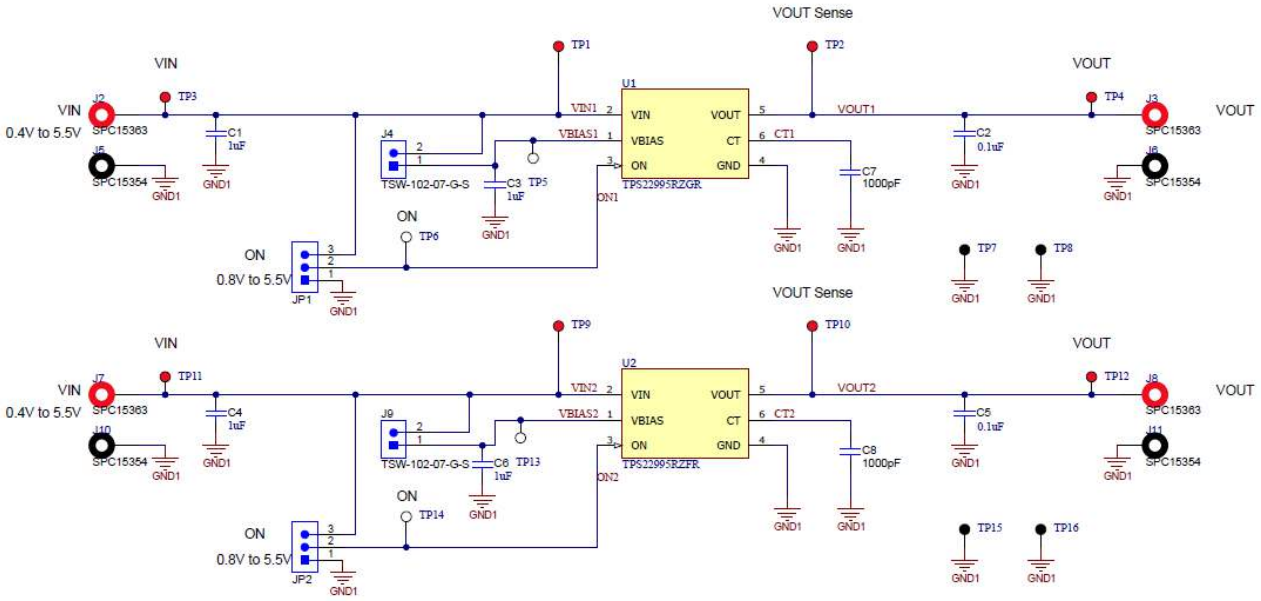

Figure 3-1. TPS22995EVM Schematic

4 PCB Layout

Figure 4-1 and Figure 4-2 show the PCB layout images.

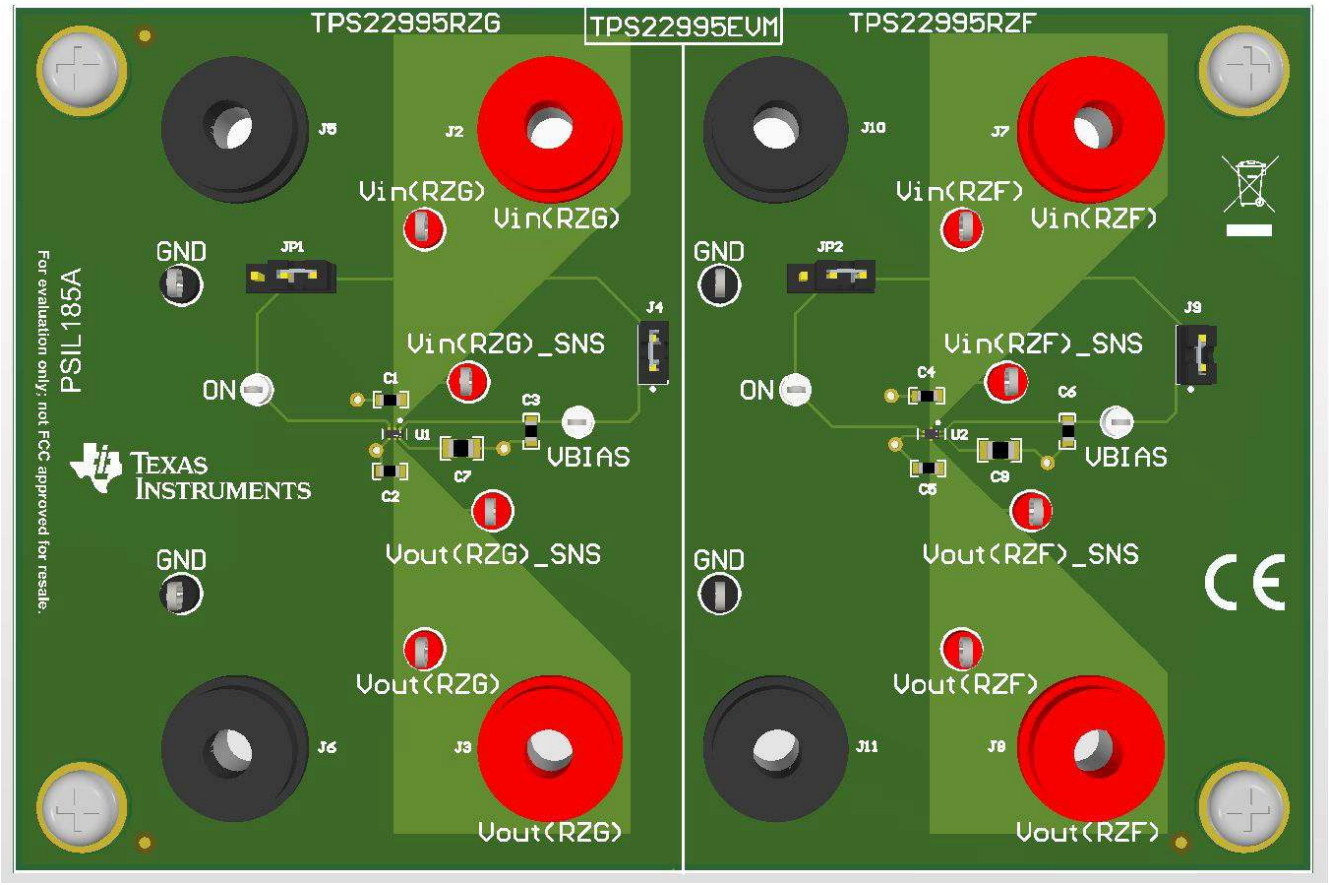

Figure 4-1. TPS22995EVM Top Layout

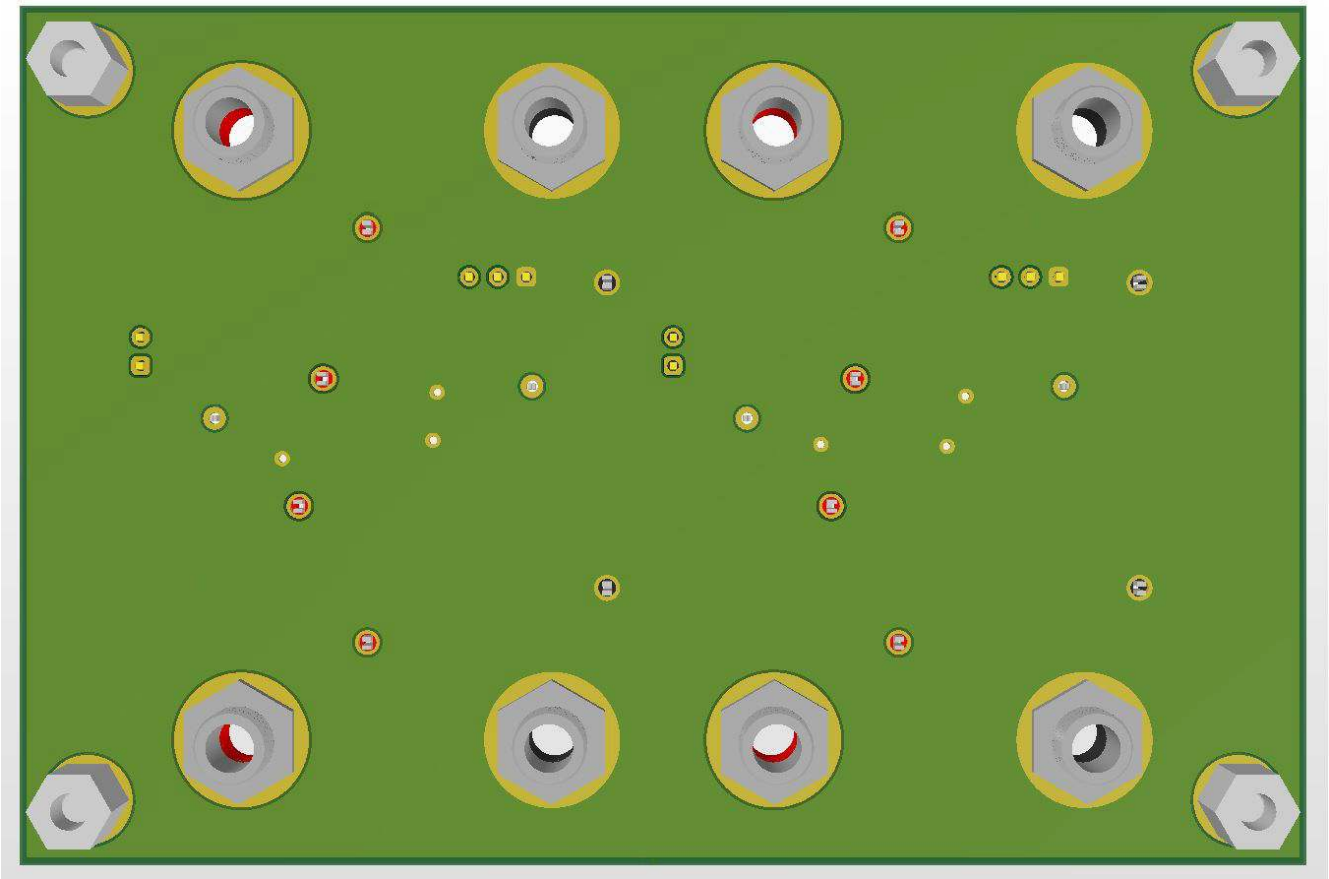

Figure 4-2. TPS22995EVM Bottom Layout

4.1 Setup

This section describes the jumpers and connectors on the EVM as well as how to properly connect, set up, and use the EVM. Table 4-1 describes the input and output connectors and jumpers. Table 4-2 describes the different test points and functionality. Table 4-3 describes the jumper functionality and configurations.

Table 4-1. TPS22995EVM Input and Output Connector Functionality

Input	Connector and Test Point	Label	Description	RZG or RZF
VIN	J2	J2	Input banana connector for VIN	RZG
	TP1	VIN(RZG)_SNS	Sense test point for VIN	RZG
	TP3	VIN(RZG)	Input test point for VIN	RZG
	J7	J7	Input banana connector for VIN	RZF
	TP9	VIN(RZF)_SNS	Sense test point for VIN	RZF
	TP11	VIN(RZF)	Input test point for VIN	RZF

Table 4-1. TPS22995EVM Input and Output Connector Functionality (continued)

Input	Connector and Test Point	Label	Description	RZG or RZF
VOUT	J3	J3	Output banana connector for VOUT	RZG
	TP2	VOUT(RZG)_SNS	Sense test point for VOUT	RZG
	TP4	VOUT(RZG)	Output test point for VOUT	RZG
	J8	J8	Output banana connector for VOUT	RZF
	TP10	VOUT(RZF)_SNS	Sense test point for VOUT	RZF
	TP12	VOUT(RZF)	Output test point for VOUT	RZF
GND	TP7, TP8, TP15, TP16	GND	Test point for GND	RZG/RZF
	J5, J6, J10, J11	J5, J6, J10, J11	Banana connector for GND	RZG/RZF

Table 4-2. TPS22995EVM Test Point Description

Pin	Test Point	Label	Description
ON	TP6(RZG), TP14(RZF)	ON	Enable signal test point
VBIAS	TP5(RZG), TP13(RZF)	VBIAS	Bias voltage test point

Table 4-3. TPS22995EVM Jumper Configuration

Input	Jumper	Label	Description
VIN	JP1(RZG)/JP2(RZF)	ON	• Position 1 and 2 sets ON-pin LO • Position 2 and 3 sets ON-pin HI
	J4(RZG)/J9(RZF)	VBIAS	BIAS voltage pullup to VIN

5 Operation

Connect the VIN power supply to the J2 terminal for RZG or J7 for RZF. The input voltage range of the TPS22995EVM is 0.4 V to 5.5 V. Connect an acceptable bias voltage to VBIAS TP or populate JP1, JP2 to use VIN as VBIAS. The bias voltage range of the TPS22995EVM is 1.5 V to 5.5 V. Note that VIN cannot be greater than VBIAS for correct operation of the device.

External output loads can be applied to the switch by using the J3, J8 terminals for RZG, RZF respectively. When the ON pin is asserted high, the output of the TPS22995 is enabled.

6 Test Configurations

6.1 On-Resistance (R_{on}) Test Setup

Figure 6-1 shows the typical setup for measuring on-resistance. The voltage drop across the switch is measured using the sense connections, and this result can be divided by the load current to calculate the R_{on} resistance.

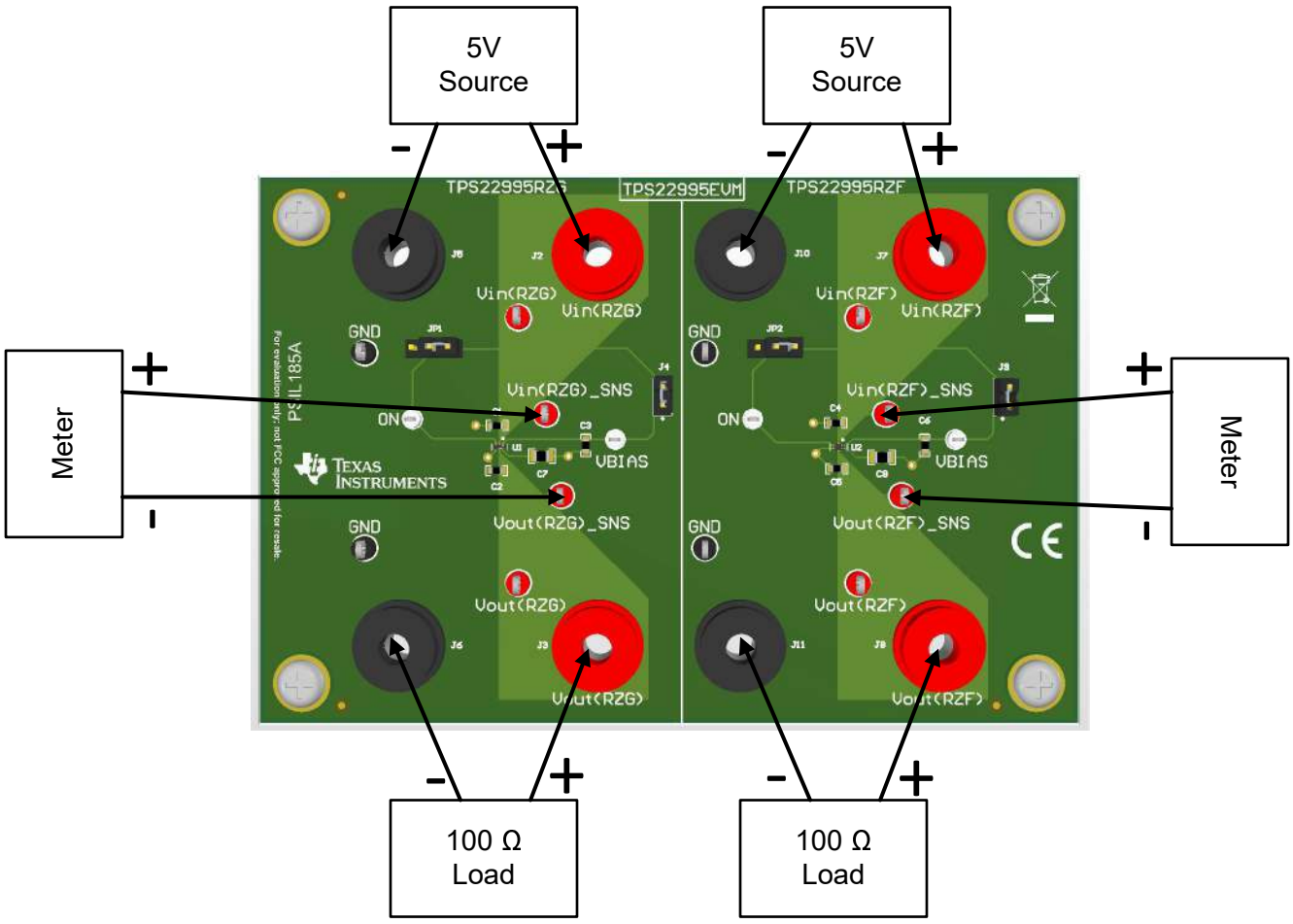

Figure 6-1. R_{on} Test Setup

6.2 Rise Time Test Setup

Figure 6-2 shows the test setup for measuring the rise time of the TPS22995. Apply a squarewave to the ON pin of the switch using a function generator and apply a voltage to the VIN terminal using a power supply. Observe the waveform at VOUT Sense with an oscilloscope to measure the slew rate and rise time of the switch with a given input voltage.

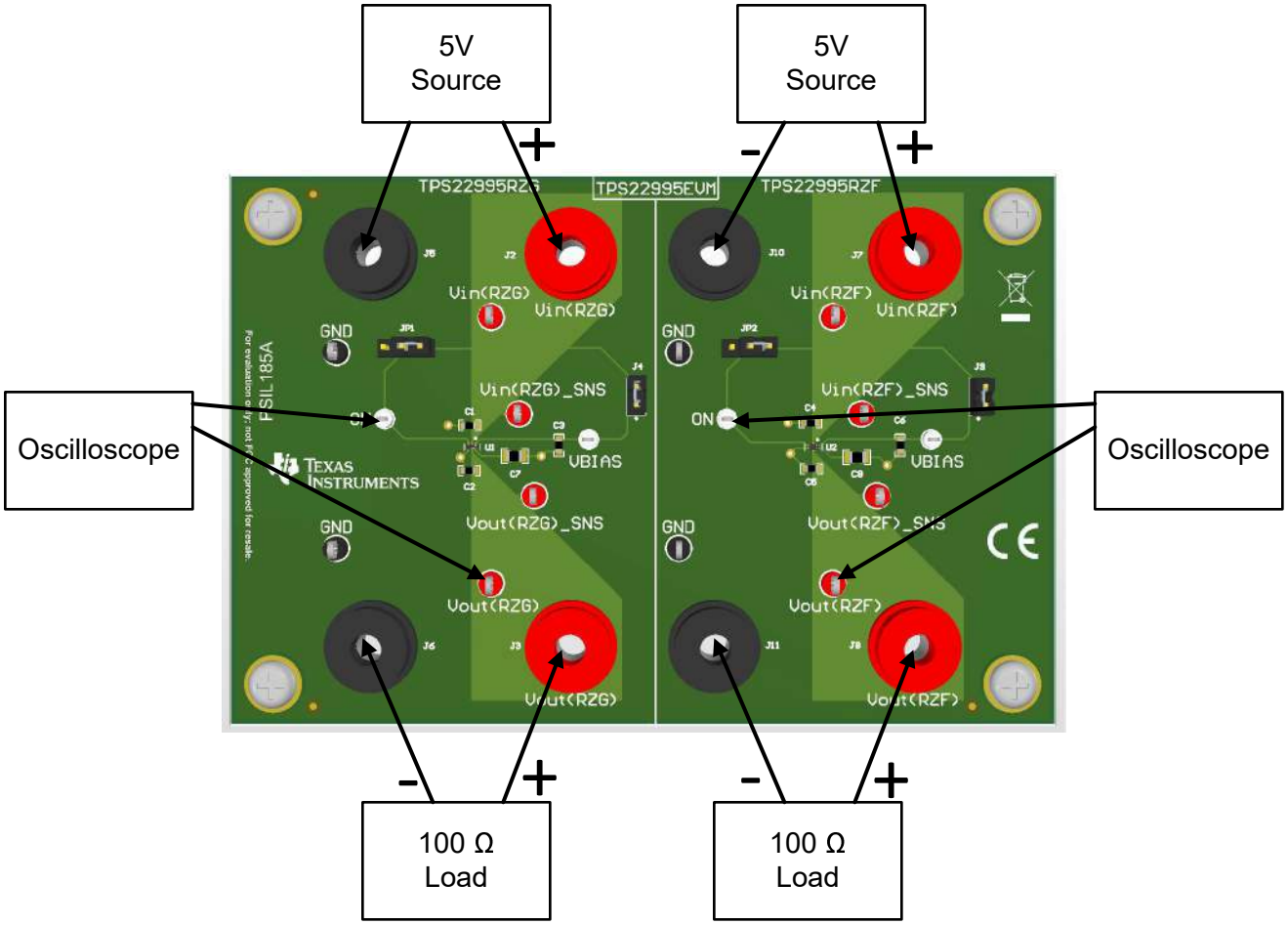

Figure 6-2. Rise Time Test Setup

7 Bill of Materials (BOM)

Table 7-1 lists the TPS22995EVM BOM

Table 7-1. Bill of Materials

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer
!PCB	1		Printed Circuit Board		PSIL185	Any
C1, C3, C4, C6	4	1 uF	CAP, CERM, 1 uF, 25 V, +/- 10%, X7R, 0603	603	06033C105KAT2A	AVX
C2, C5	2	0.1 uF	CAP, CERM, 0.1 uF, 16 V, +/- 5%, X7R, 0603	603	0603YC104JAT2A	AVX
C7, C8	2	1000 pF	CAP, CERM, 1000 pF, 50 V, +/- 5%, X7R, 0805	805	C0805C102J5RACTU	Kemet
H1, H2, H3, H4	4		Machine Screw, Round, #4-40 x 1/4, Nylon, Philips panhead	Screw	NY PMS 440 0025 PH	B&F Fastener Supply
H5, H6, H7, H8	4		Standoff, Hex, 0.5"L #4-40 Nylon	Standoff	1902C	Keystone
J2, J3, J7, J8	4		BANANA JACK, SOLDER LUG, RED, TH	Red Insulated Banana Jack	SPC15363	Tenma
J4, J9	2		Header, 100mil, 2x1, Gold, TH	2x1 Header	TSW-102-07-G-S	Samtec
J5, J6, J10, J11	4		BANANA JACK, SOLDER LUG, BLACK, TH	Black Insulated Banana Jack	SPC15354	Tenma
JP1, JP2	2		Header, 100mil, 3x1, Gold, TH	3x1 Header	TSW-103-07-G-S	Samtec
SH-J1, SH-J2, SH-J3, SH-J4	4		Shunt, 2.54 mm, Gold, Black	Shunt, 2.54mm, Black	60900213421	Wurth Elektronik
TP1, TP2, TP3, TP4, TP9, TP10, TP11, TP12	8		Test Point, Multipurpose, Red, TH	Red Multipurpose Testpoint	5010	Keystone
TP5, TP6, TP13, TP14	4		Test Point, Miniature, White, TH	White Miniature Testpoint	5002	Keystone, Keystone Electronics
TP7, TP8, TP15, TP16	4		Test Point, Multipurpose, Black, TH	Black Multipurpose Testpoint	5011	Keystone
U1	1		5-V, 20-mΩ, 3.8-A Load Switch with Adjustable Rise Time	WSON6	TPS22995RZGR	Texas Instruments
U2	1		5-V, 20-mΩ, 3.8-A Load Switch with Adjustable Rise Time WQFN6	WQFN6	TPS22995RZFR	Texas Instruments

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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.

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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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
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