

EVM User's Guide: TPS3710XEVM

TPS3710X Evaluation Module

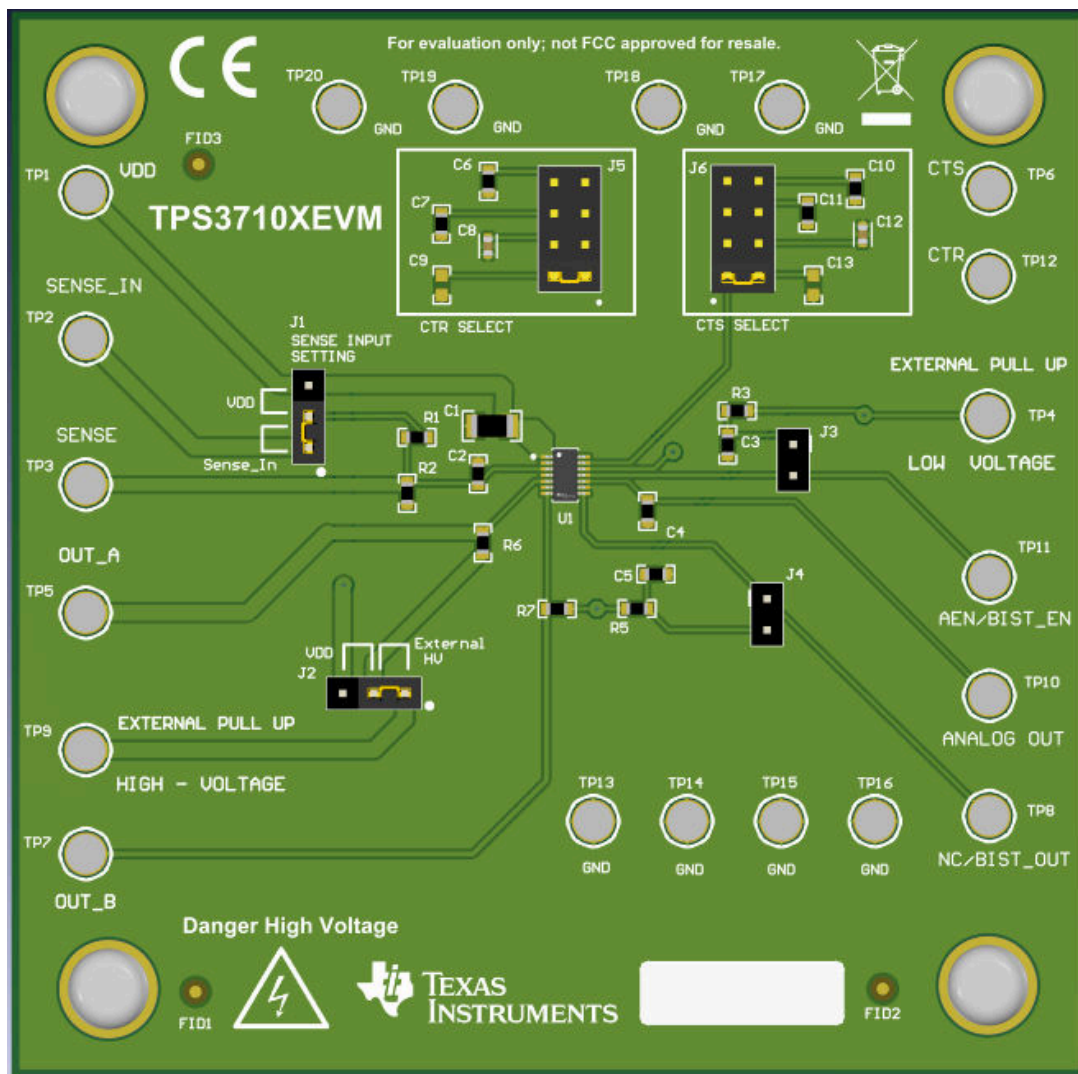


Description

The TPS3710XEVM is an evaluation module (EVM) for the TPS37100-Q1 family of voltage supervisors. The purpose of this EVM is to provide a sample design and test point for all input and output pins of the TPS37100-Q1 and TPS37102-Q1 device to test the functionality of TPS3700-Q1 and TPS37102-Q1.

Features

- Integrated buffer for supply voltage monitoring
 - AOUT pin outputs a scaled down voltage of SENSE
- Directly monitor high voltage power rails
 - Wide input voltage range: 3V to 105V
- Fast UV/OV protection in 24V/48 V systems
 - Output reset latching for overvoltage fault



TPS3710XEVM Board

1 Evaluation Module Overview

1.1 Introduction

The TPS3710XEVM helps design engineers to evaluate the operation and performance of the TPS37100-Q1 and TPS37102-Q1 family of overvoltage and undervoltage monitors.

This particular EVM configuration contains the TPS37100Z91DDYYRQ1, an adjustable undervoltage variant with Analog Enable (AEN) and Analog Out (AOUT) pins. The TPS3710XEVM offers connections to all input and output pins. Test points enable oscilloscope or multimeter measurements.

This user's guide describes the operation of use of the TPS3710XEVM evaluation module (EVM), including setup instructions, a schematic diagram, printed-circuit board (PCB) layout drawings, and a bill of materials.

1.2 Kit Contents

The TPS3710XEVM circuit board comes preinstalled with the TPS37100Z91DDYYRQ1 device comes packaged in a moisture barrier bag inside of antistatic foam layered cardboard box.

Table 1-1. Kit Contents

Item	Quantity
TPS3710XEVM	1

1.3 Specification

		MIN	MAX	UNIT
Voltage	V_{DD}	3.0	105	V
Voltage	$V_{SENSE(ADJ)}, V_{OUTA}$	0	105	V
Voltage	$V_{SENSE(FIX)}$	-105	105	V
Voltage	$V_{OUTB}, V_{CTS}, V_{CTR}, V_{AEN}, V_{AOUT}$	0	5.5	V
Voltage	V_{BIST}, V_{BIST_EN}	0	5.5	V
Current	$I_{OUTA}, I_{OUTB}, I_{BIST}$	0	±5	mA
Temperature	Operating junction temperature, T_J	-40	125	°C

1.4 Device Information

The TPS3710XEVM is shipped pre-installed with the TPS37100Z91DDYYRQ1 device, but can be used with any TPS37100-Q1 and TPS37102-Q1 variant. The TPS3710X-Q1 family has analog out functionality.

General Texas Instruments High Voltage Evaluation (TI HV EVM) User Safety Guidelines



Always follow TI's set-up and application instructions, including use of all interface components within the recommended electrical rated voltage and power limits. Always use electrical safety precautions to help ensure your personal safety and those working around you. Contact TI's Product Information Center <http://ti.com/customer-support> for further information.

Save all warnings and instructions for future reference.

WARNING

Failure to follow warnings and instructions can result in personal injury, property damage or death due to electrical shock and burn hazards.

The term TI HV EVM refers to an electronic device typically provided as an open framed, unenclosed printed circuit board assembly. It is *intended strictly for use in development laboratory environments, solely for qualified professional users having training, expertise and knowledge of electrical safety risks in development and application of high voltage electrical circuits. Any other use and/or application are strictly prohibited by Texas Instruments.* If you are not suitably qualified, you should immediately stop from further use of the HV EVM.

1. Work Area Safety:

- a. Keep work area clean and orderly.
- b. Qualified observers must be present anytime circuits are energized.
- c. Effective barriers and signage must be present in the area where the TI HV EVM and the interface electronics are energized, indicating operation of accessible high voltages can be present, for the purpose of protecting inadvertent access.
- d. All interface circuits, power supplies, evaluation modules, instruments, meters, scopes, and other related apparatus used in a development environment exceeding 50Vrms/75VDC must be electrically located within a protected Emergency Power Off EPO protected power strip.
- e. Use stable and non-conductive work surface.
- f. Use adequately insulated clamps and wires to attach measurement probes and instruments. No freehand testing whenever possible.

2. Electrical Safety:

- a. As a precautionary measure, a good engineering practice is to assume that the entire EVM can have fully accessible and active high voltages.
- b. De-energize the TI HV EVM and all the inputs, outputs and electrical loads before performing any electrical or other diagnostic measurements. Revalidate that TI HV EVM power has been safely de-energized.
- c. With the EVM confirmed de-energized, proceed with required electrical circuit configurations, wiring, measurement equipment hook-ups and other application needs, while still assuming the EVM circuit and measuring instruments are electrically live.
- d. Once EVM readiness is complete, energize the EVM as intended.

WARNING

While the EVM is energized, never touch the EVM or the electrical circuits, as the EVM or the electrical circuits can be at high voltages capable of causing electrical shock hazard.

3. Personal Safety

- a. Wear personal protective equipment e.g. latex gloves or safety glasses with side shields or protect EVM in an adequate lucent plastic box with interlocks from accidental touch.

Limitation for safe use:

EVMs are not to be used as all or part of a production unit.

2 Hardware

2.1 EVM Connectors

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

2.1.1 EVM Jumpers

Table 2-1 lists the default jumper connections and functional description for the device configuration.

Table 2-1. Pinout & Onboard Jumpers

PIN NAME	JUMPER CONNECTION	DEFAULT CONNECTION	DESCRIPTION
SENSE	J1	Closed (pin 1, pin 2)	Jumper J1 configures the SENSE pin. Connect a shunt jumper to pins 1 & 2 to connect to TP2 or pins 2 & 3 to connect to VDD.
OUT A	J2	Closed (pin 1, pin 2)	Jumper J2 configures the Pull-up voltage for Out A. By using J2, it is possible to pull up OUT A to either VDD or an External Pull-up High Voltage (TP9). External Pull-Up High Voltage can go up to 105V(maximum).
BIST_EN (TPS37102-Q1)	J3	Closed (pin 1, pin 2)	Jumper J3 configures PIN 11. Keep the shunt jumper to pins 1 & 2 to configure the BIST_EN pin for TPS37102-Q1
AEN (TPS37100-Q1)			Jumper J3 configures PIN 11. Keep the shunt jumper to pins 1 & 2 to configure the AEN pin for TPS37100-Q1
BIST (TPS37102-Q1)	J4	Closed (pin 1, pin 2)	Jumper J5 configures PIN 8. Keep the shunt jumper to pins 1 & 2 to configure BISTpin for TPS37102-Q.
NC (TPS37100-Q1)			Jumper J5 configures PIN 8. Remove the shunt jumper from pins 1 & 2. Pin 8 is a No Connect (NC) pin for TPS37100-Q1
CTR	J5	Closed (pin 7, pin 8)	Jumper J6 configures the CTR pin. Connect a shunt jumper to: pins 1 & 2 to leave the pin floating for the shortest reset delay, pins 3 & 4 to connect to 33nF, pins 5 & 6 to connect to 100nF, pins 7 & 8 to connect to 1uF. Refer to Table 2-4 for capacitor values and reset delay timings.
CTS	J6	Closed (pin 7, pin 8)	Jumper J7 configures the CTS pin. Connect a shunt jumper to: pins 1 & 2 to leave the pin floating for the shortest sense delay, pins 3 & 4 to connect to 33nF, pins 5 & 6 to connect to 100nF, pins 7 & 8 to connect to 1uF. Refer to Table 2-4 for capacitor values and sense delay timings.

2.1.2 EVM Test Points

Table 2-2 lists the test point connections and functional description for the device configuration. Test points are placed throughout the board to verify pin functionality.

Table 2-2. Test Points

Connection Point	Test Point	Description
VDD	TP1	Test point TP1 connects to VDD.
SENSE / J1	TP2	Test point TP2 connects SENSE pin to an external source if a shunt jumper is connected to pins 1 & 2 of J1.
SENSE	TP3	Test point TP3 connects to SENSE pin.
External Pull-Up Low Voltage	TP4	Test point TP4 connects External Pull-Up Low Voltage to Pin 7 (OUT B), Pin 8 (BIST_OUT for TPS37102-Q1), and Pin 11 (AEN for TPS37100-Q1 and BIST_EN for TPS37102-Q1). To ensure proper AEN, OUT B, BIST_EN, BIST_OUT features, External Pull-Up Low Voltage (TP4) must be connected to a DC supply, which can go up to 5.5V (maximum).
OUT A	TP5	Test point TP5 connects to OUT A.
CTS	TP6	Test point TP6 connects J6 to CTS pin.
OUT B	TP7	Test point TP7 connects to OUT B.

Table 2-2. Test Points (continued)

Connection Point	Test Point	Description
BIST_OUT (TPS37102-Q1)	TP8	Test point TP8 connects PIN 8 to J4.
NC (TPS37100-Q1)		
External Pull-Up High Voltage	TP9	Test point TP9 connects to External Pull-Up High Voltage. If a shunt jumper is connected to pins 1 & 2 of J2, then TP9 connects to OUT A pullup (Used to set external OUT A pull-up voltage).
AOUT	TP10	Test point TP10 connects to AOUT.
AEN	TP11	Test point TP11 connects to Pin11.
BIST_EN		
CTR	TP12	Test point TP12 connects to CTR.
GND	TP13 -TP20	Test points between TP13 to TP20 connect to Ground.

2.2 EVM Setup and Operation

This section describes the functionality and operation of the TPS3710XEVM. This EVM comes with the TPS37100Z91DDYYRQ1 device installed. Read the TPS37100-Q1 and TPS37102-Q1 data sheet ([SNVSCN2](#)) for electrical characteristics of this device.

To make sure the EVM properly powered please check the below steps.

1. Connect a power supply to TP1 (VDD) and another one to TP4(Pull-up Low Voltage) TP1 can go up to 105V and TP4 can go up to 5.5V max.
2. Decide the Pull-up High Voltage source for OUT A. By using J2, you can connect OUT A to either VDD or TP9 (External pull-up high voltage). TP9 can go up to 105V.
3. Decide how you need to configure the Sense Pin. You can directly apply a DC voltage to TP3 to test the device behavior without needing a resistor divider or you can replicate your design and connect the resistor divider values you need to R1 and R2. By using J2, you can pick which rail to monitor either VDD or TP2 (External Sense Input).
4. Decide the Jumper configurations for sense delay, reset delay, AOUT and BIST.

2.2.1 Input Supply Voltage (V_{DD})

The input supply voltage (V_{DD}) is connected through the TP1 on the board. The input supply voltage range is 3V to 105V a 0.1 μ F decoupling capacitor is placed at the input for reducing noise that can propagate through the device.

2.2.2 SENSE

The SENSE voltage can be directly connected through TP3 on the board (without needing a resistor divider). Apply a voltage in accordance with the threshold voltage requirement. The default option of the TPS3710XEVM is populated with the device TPS37100Z91DDYYRQ, which has a 0.8V threshold.

Jumper J1 can also configure the SENSE pin to connect to TP2 and a resistor divider. We offer alternatives when necessary. (Refer to [Table 2-1](#) for configuration options).

2.2.3 OUT A and OUT B

The TPS3710X-Q1 family has two reset output pin; OUT A and OUT B connected through TP5 and TP7 on the board.

Table 2-3. Output Behaviors

	Window Variant	UV only Variant	OV Only Variant
OUT A	Asserts only when OV events happen	Both OUT A and OUT B asserts when an UV event happens	Both OUT A and OUT B asserts when an OV event happens
OUT B	Asserts only when UV events happen		

For window variants, to assert the OUT A or OUT B the sense pins needs to meet one of the conditions below:

- For OUT A, the SENSE voltage need to cross the lower boundary (VITP).
- For OUT B, the SENSE voltage needs to cross the upper boundary (VITN).

For UV only variants, to assert the OUT A or OUT B the sense pins needs to meet the condition below:

- For OUT A and OUT B, the SENSE voltage need to cross the lower boundary (VITN).

For OV only variants, to assert the OUT A or OUT B the sense pins needs to meet the condition below:

- For OUT A and OUT B, the SENSE voltage needs to cross the upper boundary (VITP)

Both the output pins are active-low and open-drain output.

2.2.4 AEN & AOUT

TPS37100-Q1 contain a Analog Enable (AEN) pin for enabling the AOUT output. The AEN is connected through TP11 on the board. Jumper J3 can also configure the AEN pin to also connect to TP11 (Refer to [Table 2-1](#) for configuration options).

The TPS3710X devices are distinguished by their inclusion of AOUT. The AOUT pin provides a scaled output voltage from the SENSE for both fixed and adjustable options. The AOUT pin is intended to be sampled with an ADC for voltage telemetry. The AOUT and supervisor combination simplifies high voltage rail monitoring for low voltage ADCs.

2.2.5 Built-In Self-Test (BIST)

The TPS37102-Q1 contain a Built-In Self-Test (BIST) pin for assessing internal device faults at the startup. BIST is asserted via the BIST_EN pin and remains asserted for a time period, TD_BIST. If BIST encounters a fault, then BIST remains asserted for a period longer than TD_BIST. BIST is an active-low open drain output and requires an external pull-up resistor and voltage. Please refer to the device data sheet for additional details.

The $\overline{\text{BIST}}$ is connected through TP8 on the board. Jumper J4 can also configure the BIST pin to also connect to TP8. Keep a shunt jumper for TPS37102-Q1 so that $\overline{\text{BIST}}$ output pin can be pulled up to External Pull-Up Low Voltage. Remove the shunt jumper for TPS37100-Q1 . (Refer to [Table 2-1](#) for configuration options).

2.2.6 Built-In Self-Test Enable (BIST_EN)

The BIST_EN is connected through TP11 on the board. Jumper J3 can also configure the BIST_EN pin to also connect to TP11 (Refer to [Table 2-1](#) for configuration options).

The TPS37102-Q1 contain a Built-In Self-Test Enable (BIST_EN) pin for enabling the BIST, as well as clearing a BIST fault. The BIST_EN asserts BIST for a time period, TD_BIST. If BIST encounters a fault, then BIST remains asserted for a period longer than TD_BIST.

This pin also controls the overvoltage latch.

2.2.7 CTR & CTS Time Delays

The TPS3710X-Q1 family of devices contain an adjustable reset time delay pin (CTR) that controls the time with which both the OUT A pin and OUT B pin de-asserts after reaching the valid condition. The user can adjust the configuration of this pin via the jumper located at J5.

The TPS37100-Q1 family of devices contain an adjustable sense time delay pin (CTS) that controls the time with which both the OUT A and OUT B asserts after reaching the invalid condition. The user can adjust

the configuration of this pin via the jumper located at J6. Refer to [Section 2.1.1](#) for jumper connections and TPS37100-Q1 data sheet for capacitor values and sense delay timing.

[Table 2-4](#) show the calculated typical delay values for the capacitor options on the TPS3710XEVM.

Table 2-4. Delay Options

Capacitor Values	Calculated Delay
CTS & CTR = 33nF	119ms
CTS & CTR = 100nF	360ms
CTS & CTR = 1uF	3.6s

3 Implementation Results

3.1 EVM Performance Results

The following measurements are taken using the default TPS3710XEVM with the TPS37100Z91DYRQ1 device.

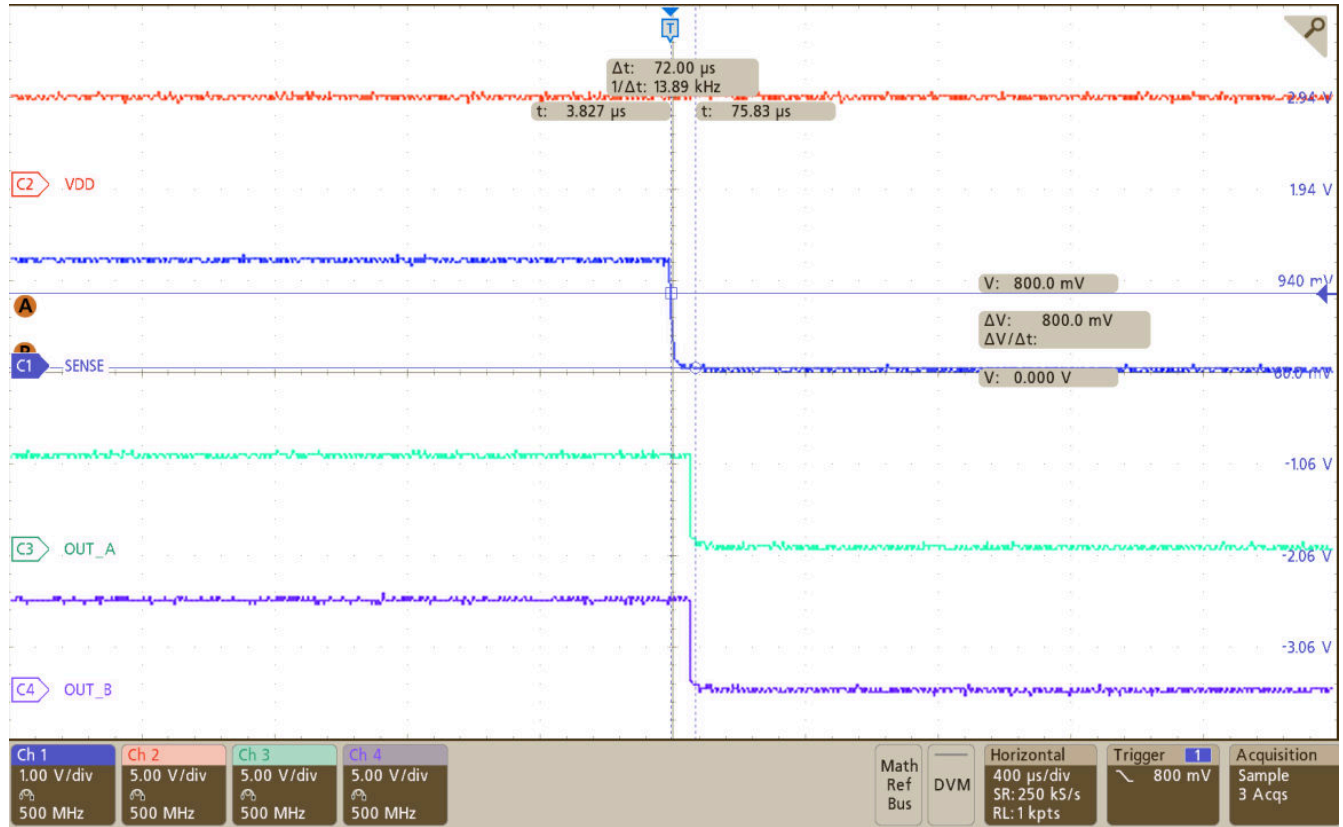


Figure 3-1. Sense Delay when CTS = OPEN

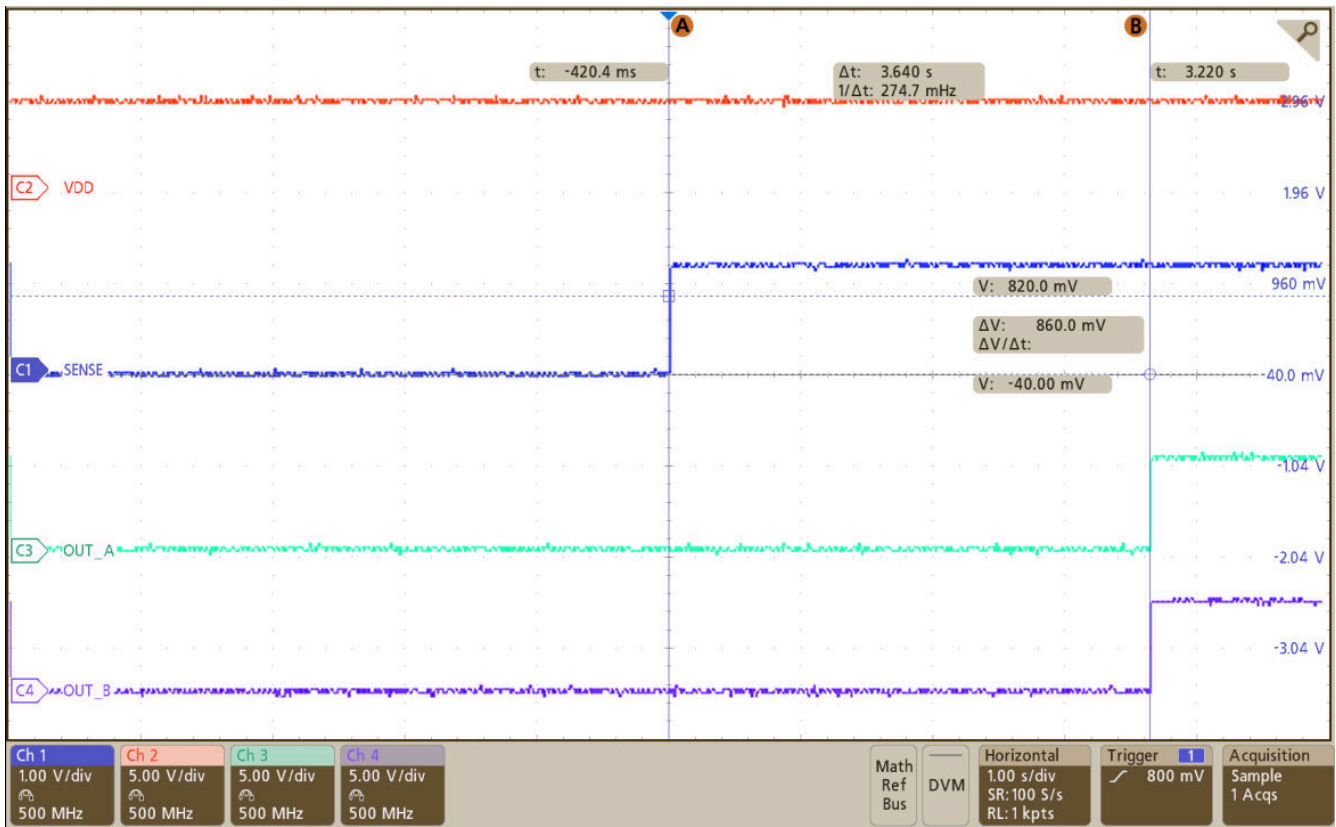


Figure 3-2. Reset Delay when CTR= 1 uF

4 Hardware Design Files

4.1 Schematics

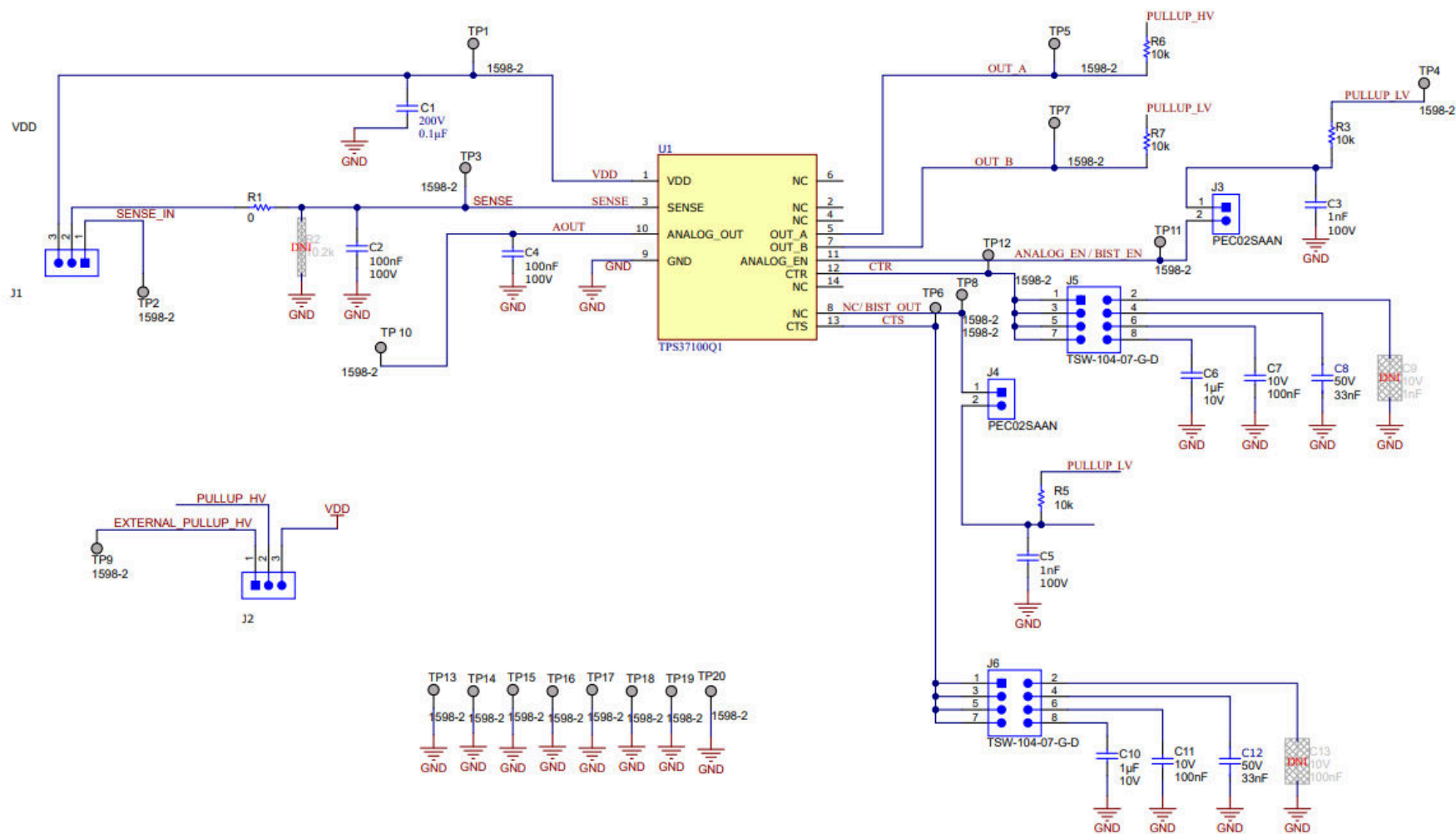


Figure 4-1. TPS376XEVM Schematic

4.2 PCB Layout

Figure 4-2 and Figure 4-3 show the top and bottom assemblies of the printed circuit board (PCB) to display the component placement of the EVM.

Figure 4-4 and Figure 4-5 show the top and bottom layouts, Figure 4-6 and Figure 4-7 show the top and bottom layers, and Figure 4-8 shows the top solder mask of the EVM.

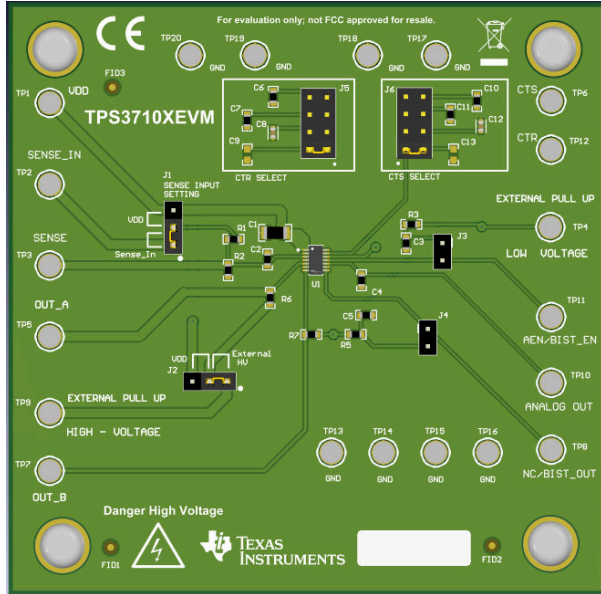


Figure 4-2. Component Placement - Top Assembly

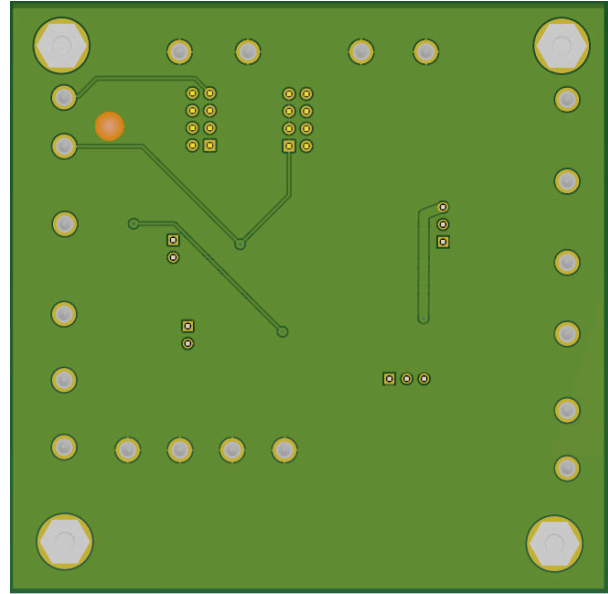


Figure 4-3. Component Placement - Bottom Assembly

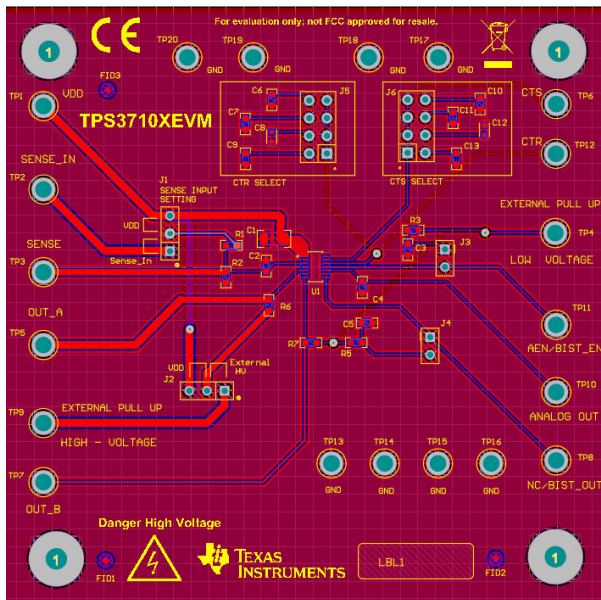


Figure 4-4. Layout - Top

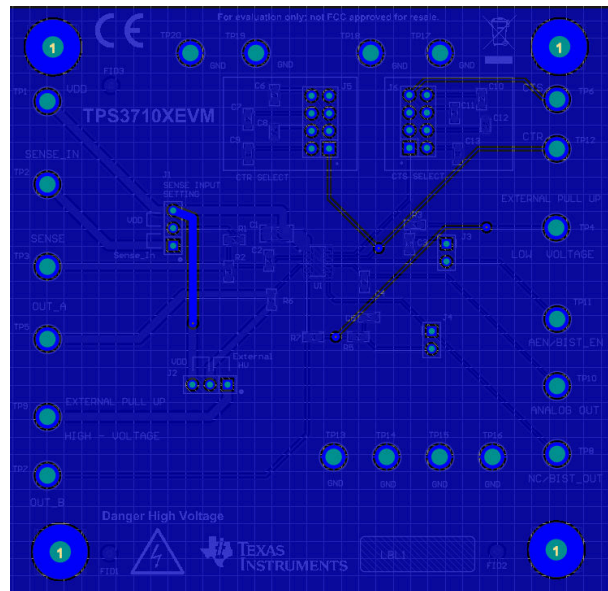


Figure 4-5. Layout - Bottom

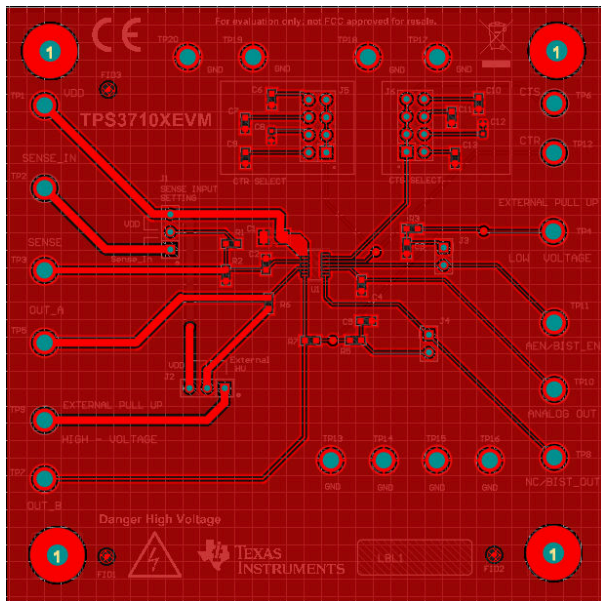


Figure 4-6. Top Layer

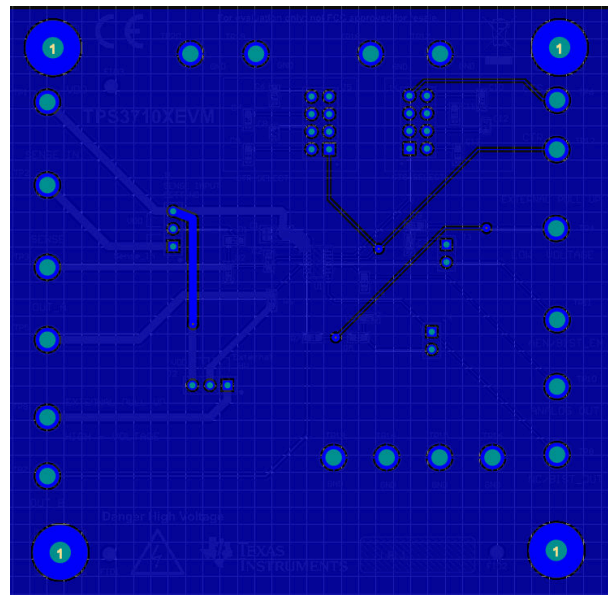


Figure 4-7. Bottom Layer

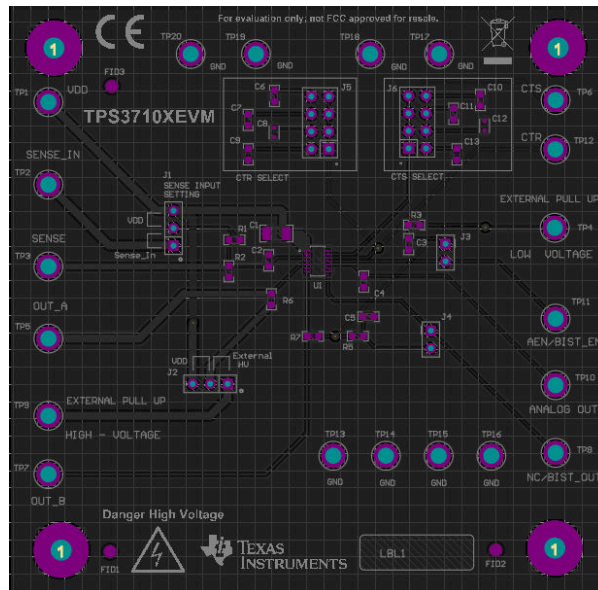


Figure 4-8. Top Solder Mask

4.3 Bill of Materials

Table 4-1. TPS376XEVM Bill of Materials

Designator	Qty	Value	Description	Package Reference	Part Number	Manufacturer
!PCB	1		Printed Circuit Board		LP132	
C1	1	0.1uF	CAP, CERM, 0.1µF, 200V, +/- 10%, X7R, 1206	1206	VJ1206Y104KXCAT	Vishay Vitramon
C2, C3, C4, C5	4	0.1uF	CAP, CERM, 0.1uF, 100V, +/- 10%, X7R, 0603	0603	GRM188R72A104KA35J	Murata Electronics
C6, C10	2	1uF	CAP, CERM, 1µF, 10V, +/- 10%, X7R, 0603	0603	CL10B105KP8NNNC	Samsung Electro-Mechanics
C7, C11	2	0.1uF	CAP, CERM, 0.1uF, 10V, +/- 10%, X7R, 0603	0603	C0603C104K8RACTU	KEMET
C8, C12	2	33nF	Cap Ceramic 33nF 50V X7R 10% Pad SMD 0603 +125°C Automotive T/R	Screw	CGA3E2X7R1H333K080AA	TDK Corpration
H1, H2, H3, H4	4		Machine Screw, Round, #4-40 x 1/4, Nylon, Philips panhead	Standoff	NY PMS 440 0025 PH	B&F Fastener Supply
H5, H6, H7, H8	4		Standoff, Hex, 0.5"L #4-40 Nylon	10x2 Receptacle	1902C	Keystone Electronics
J1, J2	3		Header, 100mil, 3x1, Tin, TH	4x2 Header	PEC03SAAN	Sullins Connector Solutions
J3, J4	2		Header, 100mil, 2x1, Tin, TH	3x1 Header	PEC02SAAN	Sullins Connector Solutions
J5, J6	2		Header, 100mil, 4x2, Gold, TH	4x1 Header	TSW-104-07-G-D	Samtech Inc.
LBL1	1		Thermal Transfer Printable Labels, 0.650" W x 0.200" H	PCB Label 0.650 x 0.200 inch	THT-14-423-10	Brady Corporation
R1	1	0	RES, 0, 5%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	ERJ-3GEY0R00V	Panasonic Electronic Components
R3, R5, R6, R7	4	10k	RES, 10 k, 5%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW060310K0JNEA	Vishay Dale
SH-J1, SH-J2, SH-J3, SH-J4, SH-J5, SH-J6,	6		Shunt, 100mil, Gold plated, Black	Shunt	SNT-100-BK-G	Samtec Inc.
TP1 - TP20	20		Terminal, Turret, TH, Triple	Keystone1598-2	1598-2	Keystone Electronics
U1	1		Wide VIN 105V 105V Window (OV & UV) Supervisor with Integrated Buffer for Supply Voltage Measurements for Automotive	SOT023-14	TPS37100Z91DDYRQ1	Texas Instruments

5 Additional Information

Trademarks

All trademarks are the property of their respective owners.

6 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

DATE	REVISION	NOTES
September 2024	*	Initial Release

STANDARD TERMS FOR EVALUATION MODULES

1. *Delivery:* TI delivers TI evaluation boards, kits, or modules, including any accompanying demonstration software, components, and/or documentation which may be provided together or separately (collectively, an "EVM" or "EVMs") to the User ("User") in accordance with the terms set forth herein. User's acceptance of the EVM is expressly subject to the following terms.
 - 1.1 EVMs are intended solely for product or software developers for use in a research and development setting to facilitate feasibility evaluation, experimentation, or scientific analysis of TI semiconductor products. EVMs have no direct function and are not finished products. EVMs shall not be directly or indirectly assembled as a part or subassembly in any finished product. For clarification, any software or software tools provided with the EVM ("Software") shall not be subject to the terms and conditions set forth herein but rather shall be subject to the applicable terms that accompany such Software
 - 1.2 EVMs are not intended for consumer or household use. EVMs may not be sold, sublicensed, leased, rented, loaned, assigned, or otherwise distributed for commercial purposes by Users, in whole or in part, or used in any finished product or production system.
2. *Limited Warranty and Related Remedies/Disclaimers:*
 - 2.1 These terms do not apply to Software. The warranty, if any, for Software is covered in the applicable Software License Agreement.
 - 2.2 TI warrants that the TI EVM will conform to TI's published specifications for ninety (90) days after the date TI delivers such EVM to User. Notwithstanding the foregoing, TI shall not be liable for a nonconforming EVM if (a) the nonconformity was caused by neglect, misuse or mistreatment by an entity other than TI, including improper installation or testing, or for any EVMs that have been altered or modified in any way by an entity other than TI, (b) the nonconformity resulted from User's design, specifications or instructions for such EVMs or improper system design, or (c) User has not paid on time. Testing and other quality control techniques are used to the extent TI deems necessary. TI does not test all parameters of each EVM. User's claims against TI under this Section 2 are void if User fails to notify TI of any apparent defects in the EVMs within ten (10) business days after delivery, or of any hidden defects with ten (10) business days after the defect has been detected.
 - 2.3 TI's sole liability shall be at its option to repair or replace EVMs that fail to conform to the warranty set forth above, or credit User's account for such EVM. TI's liability under this warranty shall be limited to EVMs that are returned during the warranty period to the address designated by TI and that are determined by TI not to conform to such warranty. If TI elects to repair or replace such EVM, TI shall have a reasonable time to repair such EVM or provide replacements. Repaired EVMs shall be warranted for the remainder of the original warranty period. Replaced EVMs shall be warranted for a new full ninety (90) day warranty period.

WARNING

Evaluation Kits 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 shall operate the Evaluation Kit within TI's recommended guidelines and any applicable legal or environmental requirements as well as reasonable and customary safeguards. Failure to set up and/or operate the Evaluation Kit within TI's recommended guidelines may result in personal injury or death or property damage. Proper set up entails following TI's instructions for electrical ratings of interface circuits such as input, output and electrical loads.

NOTE:

EXPOSURE TO ELECTROSTATIC DISCHARGE (ESD) MAY CAUSE DEGRADATION OR FAILURE OF THE EVALUATION KIT; TI RECOMMENDS STORAGE OF THE EVALUATION KIT IN A PROTECTIVE ESD BAG.

3 Regulatory Notices:

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.

3.3 Japan

3.3.1 *Notice for EVMs delivered in Japan:* Please see http://www.tij.co.jp/lstds/ti_ja/general/eStore/notice_01.page 日本国内に輸入される評価用キット、ボードについては、次のところをご覧ください。

<https://www.ti.com/ja-jp/legal/notice-for-evaluation-kits-delivered-in-japan.html>

3.3.2 *Notice for Users of EVMs Considered "Radio Frequency Products" in Japan:* EVMs entering Japan may not be certified by TI as conforming to Technical Regulations of Radio Law of Japan.

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.

【無線電波を送信する製品の開発キットをお使いになる際の注意事項】 開発キットの中には技術基準適合証明を受けていないものがあります。技術適合証明を受けていないものご使用に際しては、電波法遵守のため、以下のいずれかの措置を取っていただく必要がありますのでご注意ください。

1. 電波法施行規則第6条第1項第1号に基づく平成18年3月28日総務省告示第173号で定められた電波暗室等の試験設備でご使用いただく。
2. 実験局の免許を取得後ご使用いただく。
3. 技術基準適合証明を取得後ご使用いただく。

なお、本製品は、上記の「ご使用にあたっての注意」を譲渡先、移転先に通知しない限り、譲渡、移転できないものとします。

上記を遵守頂けない場合は、電波法の罰則が適用される可能性があることをご留意ください。日本テキサス・イ

ンスツルメンツ株式会社

東京都新宿区西新宿 6 丁目 2 4 番 1 号

西新宿三井ビル

3.3.3 *Notice for EVMs for Power Line Communication:* Please see http://www.tij.co.jp/lstds/ti_ja/general/eStore/notice_02.page

電力線搬送波通信についての開発キットをお使いになる際の注意事項については、次のところをご覧ください。 <https://www.ti.com/ja-jp/legal/notice-for-evaluation-kits-for-power-line-communication.html>

3.4 European Union

3.4.1 *For EVMs subject to EU Directive 2014/30/EU (Electromagnetic Compatibility Directive):*

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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4. *EVM Use Restrictions and Warnings:*
 - 4.1 EVMS ARE NOT FOR USE IN FUNCTIONAL SAFETY AND/OR SAFETY CRITICAL EVALUATIONS, INCLUDING BUT NOT LIMITED TO EVALUATIONS OF LIFE SUPPORT APPLICATIONS.
 - 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.
 - 4.3 *Safety-Related Warnings and Restrictions:*
 - 4.3.1 User shall operate the EVM within TI's recommended specifications and environmental considerations stated in the user guide, other available documentation provided by TI, and any other applicable requirements and employ reasonable and customary safeguards. Exceeding the specified performance ratings and specifications (including but not limited to input and output voltage, current, power, and environmental ranges) for the EVM may cause personal injury or death, or property damage. If there are questions concerning performance ratings and specifications, User should contact a TI field representative prior to connecting interface electronics including input power and intended loads. Any loads applied outside of the specified output range may also result in unintended and/or inaccurate operation and/or possible permanent damage to the EVM and/or interface electronics. Please consult the EVM user guide prior to connecting any load to the EVM output. If there is uncertainty as to the load specification, please contact a TI field representative. During normal operation, even with the inputs and outputs kept within the specified allowable ranges, some circuit components may have elevated case temperatures. These components include but are not limited to linear regulators, switching transistors, pass transistors, current sense resistors, and heat sinks, which can be identified using the information in the associated documentation. When working with the EVM, please be aware that the EVM may become very warm.
 - 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.
 - 4.4 User assumes all responsibility and liability to determine whether the EVM is subject to any applicable international, federal, state, or local laws and regulations related to User's handling and use of the EVM and, if applicable, User assumes all responsibility and liability for compliance in all respects with such laws and regulations. User assumes all responsibility and liability for proper disposal and recycling of the EVM consistent with all applicable international, federal, state, and local requirements.
 5. *Accuracy of Information:* To the extent TI provides information on the availability and function of EVMs, TI attempts to be as accurate as possible. However, TI does not warrant the accuracy of EVM descriptions, EVM availability or other information on its websites as accurate, complete, reliable, current, or error-free.
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 - 6.1 EXCEPT AS SET FORTH ABOVE, EVMS AND ANY MATERIALS PROVIDED WITH THE EVM (INCLUDING, BUT NOT LIMITED TO, REFERENCE DESIGNS AND THE DESIGN OF THE EVM ITSELF) ARE PROVIDED "AS IS" AND "WITH ALL FAULTS." TI DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, REGARDING SUCH ITEMS, INCLUDING BUT NOT LIMITED TO ANY EPIDEMIC FAILURE WARRANTY OR IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF ANY THIRD PARTY PATENTS, COPYRIGHTS, TRADE SECRETS OR OTHER INTELLECTUAL PROPERTY RIGHTS.
 - 6.2 EXCEPT FOR THE LIMITED RIGHT TO USE THE EVM SET FORTH HEREIN, NOTHING IN THESE TERMS SHALL BE CONSTRUED AS GRANTING OR CONFERRING ANY RIGHTS BY LICENSE, PATENT, OR ANY OTHER INDUSTRIAL OR INTELLECTUAL PROPERTY RIGHT OF TI, ITS SUPPLIERS/LICENSORS OR ANY OTHER THIRD PARTY, TO USE THE EVM IN ANY FINISHED END-USER OR READY-TO-USE FINAL PRODUCT, OR FOR ANY INVENTION, DISCOVERY OR IMPROVEMENT, REGARDLESS OF WHEN MADE, CONCEIVED OR ACQUIRED.
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9. *Return Policy.* Except as otherwise provided, TI does not offer any refunds, returns, or exchanges. Furthermore, no return of EVM(s) will be accepted if the package has been opened and no return of the EVM(s) will be accepted if they are damaged or otherwise not in a resalable condition. If User feels it has been incorrectly charged for the EVM(s) it ordered or that delivery violates the applicable order, User should contact TI. All refunds will be made in full within thirty (30) working days from the return of the components(s), excluding any postage or packaging costs.

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