

# EVM User's Guide: TPS25730EVM

## TPS25730 Evaluation Module



### Description

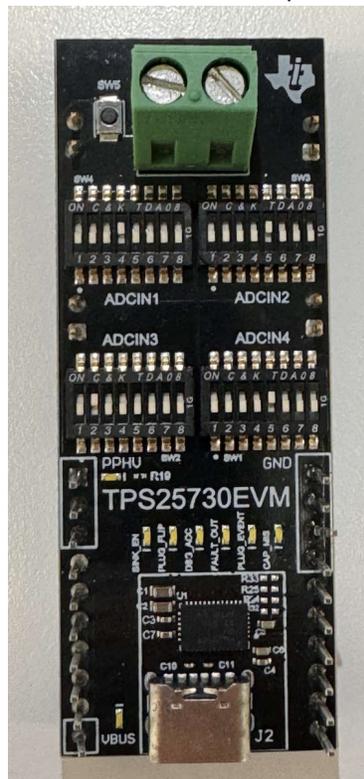
The TPS25730D is a stand-alone USB Type-C® and Power Delivery (PD) controller providing cable plug and orientation detection at the USB Type-C connector. Upon cable plug and orientation detection, the TPS25730D device communicates on the CC line using the USB-PD protocol. Upon connection, the TPS25730D enables the power path. When cable detection and USB-PD negotiation are complete, the negotiated voltage is passed through the power path. Additionally, the EVM has the I2C interface accessible by a header for debugging, as well as various test points for signal probing.

### Get Started

1. Order the EVM on [ti.com](https://www.ti.com)
2. Download the data sheet ([SLVSGP9](#))
3. Download the technical reference manual ([SLVUCJ7](#))
4. Obtain a USB PD source such as [TPS25750EVM](#)

### Features

- Sink only
- Resistor configurable
- No firmware development or external memory required
- Minimum and maximum voltage configurable
- Operating and maximum current configurable
- Capabilities mismatch



TPS25730EVM Top View

# 1 Evaluation Module Overview

## 1.1 Introduction

The TPS25730EVM allows for configuration and testing of the TPS25730 by utilizing four sets of switches for configuration and a terminal block for testing the TPS25730 under load. Labeled LEDs act as indicators of device status, and the potential final design solution size is illustrated by the white box around C1, R33, and J2.

The TPS25730 is a USB-PD controller used for sink-only applications. The TPS25730 is intended for devices that only sink power by the USB-PD, in the Standard Power Range (as defined by the USB-PD 3.1 specification), between 5 V and 20 V. Practically, this means that a design using this device utilizes a USB-C® connector and is compatible with the USB-PD 3.1 specification. To use the TPS25730EVM, a USB-PD capable power source needs to be connected via a USB-C cable to the USB-C port of the TPS25730EVM. This user's guide describes how the TPS25730EVM can be used to test various sink power configurations using on-board switches.

## 1.2 Kit Contents

The kit for the TPS25730EVM contains:

1 TPS25730EVM

## 1.3 Specification

This section describes applications for the TPS25730.

The TPS25730 is a PD controller that enables the sinking of power to the system through a USB-C connector using the USB-PD specification, as shown in [Figure 1-1](#). Due to the ability to configure power settings by voltage dividers at the ADCINx pins, no EEPROM is needed, which reduces BOM cost and saves board space. Additionally, no software or GUI is required, minimizing development time.

With the ADCINx pins configured the desired settings, as described in [Section 2.7](#), the TPS25730 sinks the negotiated amount of power through the PPHV pin from a USB-PD capable source.

How this negotiation occurs is detailed in the Universal Serial Bus Power Delivery Specification. This specification can be accessed at [USB Power Delivery](#).

In broad terms:

1. The USB-C cable that is connected to a source is plugged into the USB-C port of the TPS25730EVM.
2. A 5 V implicit Type-C contract is established.
3. The source sends the capabilities as an ordered list to the sink, through the CC line.
4. The sink makes a request for a specific Power Data Object (PDO) from the list.
5. The source accepts this request and sends a PS\_Ready message to indicate that the bus is ready to deliver power.
6. Power is delivered from the source through the VBUS line of the USB cable, through the TPS25730 power path, and to the load through PPHV.

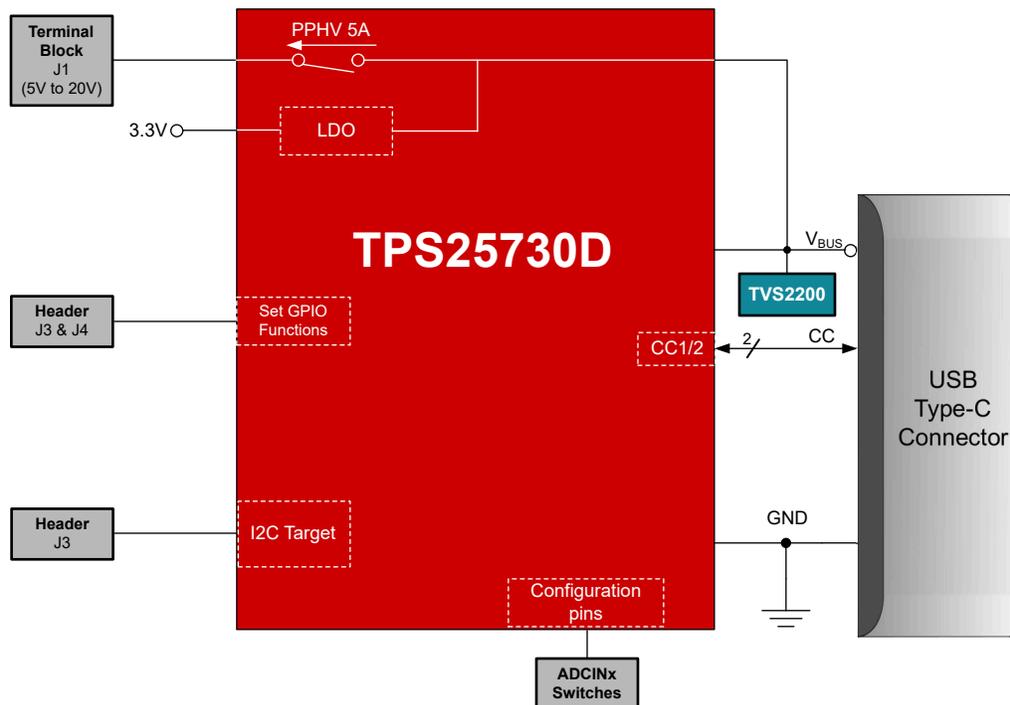


Figure 1-1. TPS25730EVM Block Diagram

## 1.4 Device Information

The TPS25730EVM allows for the configuration of the TPS25730 without the need to program or use software. As the TPS25730 is a USB-PD controller for use in sink-only applications, the following sink capabilities of the TPS25730EVM are configurable:

- Minimum voltage
- Maximum voltage
- Operating current
- Maximum current

The TPS25730EVM configures the aforementioned capabilities using ADCIN1, ADCIN2, ADCIN3, and ADCIN4 input pins of the TPS25730. The TPS25730EVM utilizes four sets of switches; each set of switches corresponding one of the four ADCIN pins.

## 2 Hardware

### 2.1 Power Requirements

The TPS25730 is powered by the USB-C connector located at J2. The power source is to be connected by USB-C cable and connected to the USB-C connector of the TPS25730EVM. The power source needs to be USB-PD capable to enable use of the full set of features of TPS25730EVM. More specifically, the power source needs to operate in the standard power range (SPR) of the USB-PD specification, providing between 5 V and 20 V, and no greater than 5 A.

#### Items Required for Operation

- TPS25750EVM
- USB-C cable
- USB-PD capable power source

### 2.2 Header Information

The TPS25730EVM contains two headers: J3 and J4. J3 allows for access to the high voltage internal power path of the TPS25730, PPHV. Additionally, J3 allows for access to the I2Cs lines of the TPS25730, the CAP\_MIS, PLUG\_FLIP, and DBG\_ACC GPIO outputs, and the VBUS pin of the TPS25730. J4 has connections to ground, the four ADCIN pins of the TPS25730, and the PLUG\_EVENT GPIO output.

The TPS25730EVM has one terminal block to allow for connection of a load at J1. This enables testing of the TPS25730 under load. The positive wire of the load needs to be connected to the hole closest to the TI logo, and the ground wire of the load needs to be connected to the hole closest to the SW5 switch.

### 2.3 Jumper Information

Four jumpers are present on the TPS25730EVM, as shown below, with each jumper connecting a set of switches to the corresponding ADCIN pin on the TPS25730. Jumper J5 connects the switch-set labeled ADCIN4 to the ADCIN4 pin of the TPS25730. Similarly, J6 is connected to ADCIN3, J7 is connected to ADCIN2, and J8 is connected to ADCIN1.



**Figure 2-1. TPS25730EVM Bottom View of the Jumper Locations**

J5 can be removed and resistors populated on the board for a permanent ADCIN4 configuration. R33 is the resistor connected to ground in the ADCIN4 resistor divider and R25 is the resistor connected to LDO\_3V3 in the ADCIN4 resistor divider. Populating these resistors with values that correspond to the same ADCIN decoded value as configured with the ADCIN4 switch set provides the same configuration for ADCIN4.

An analogous process can be followed for all four jumpers to permanently configure any ADCIN configuration. [Table 2-1](#) details which resistor pads correspond to which ADCIN switch set and jumper.

**Table 2-1. ADCIN Inputs for Jumpers**

Jumper	ADCIN Input	Pull-up resistor	Pull-down resistor
J8	ADCIN1	R22	R30
J7	ADCIN2	R23	R31
J6	ADCIN3	R24	R32
J5	ADCIN4	R25	R33

**Table 2-2. Decoding of ADCINx Pins**

DIV = R <sub>DOWN</sub> / (R <sub>UP</sub> + R <sub>DOWN</sub> )			Without Using R <sub>UP</sub> or R <sub>DOWN</sub>	ADCINx Decoded Value
MIN	Target	MAX		
0	0.0114	0.0228	tie to GND	0
0.0229	0.0475	0.0722	N/A	1
0.0723	0.1074	0.1425	N/A	2
0.1425	0.1899	0.2372	N/A	3
0.2373	0.3022	0.3671	N/A	4
0.3672	0.5368	0.7064	tie to LDO_1V5	5
0.7065	0.8062	0.9060	N/A	6
0.9061	0.9530	1.0	tie to LDO_3V3	7

## 2.4 Push Buttons

Push button SW5 controls the  $\overline{\text{FAULT\_IN}}$  GPIO input. Pressing the SW5 button sets  $\overline{\text{FAULT\_IN}}$  to logical high. The use of  $\overline{\text{FAULT\_IN}}$  is detailed in the TPS25730 data sheet ([SLVSGP9](#)).

## 2.5 Debug Information

## 2.6 Test Points

The test points available are as follows:

**Table 2-3. TPS25730EVM Test Points**

Test Point	Pin
TP1	VIN_3V3
TP2	LDO_3V3
TP3	LDO_1V5
TP4	CC1
TP5	CC2

## 2.7 Configuring the TPS25730EVM

The TPS25730EVM provides device status information of the TPS25730 using LEDs that correspond to GPIO events of the TPS25730. Each LED has the corresponding event printed to the left when the TPS25730EVM is oriented with *TPS25730EVM* readable.

**Table 2-4. LED Indicator Events**

GPIO Event	Description	Conditions for LED on
SINK_EN	Indicates when PPHV is enabled. Can be used for GPIO control of an external power path.	PPHV is disabled.
PLUG_FLIP	Indicates the orientation of the USB-C plug.	Plug is upside-down.
DBG_ACC	Indicates whether or not a debug accessory is connected.	Debug accessory is connected.
PLUG_EVENT	Indicates a connection to a source device via a USB-C plug.	The LED turns on when connected.
CAP_MIS	Indicates a mismatch in capabilities between the connected source and the TPS25730.	The LED blinks when a capabilities mismatch occurs.

Each switch set must have only one of the eight switches in the on position, for a total of four switches in the ON position for a successful configuration. The table below shows which ADCIN pin configures which setting. Please note that ADCIN3 and ADCIN4 together determine operating current and maximum current based on the combination of the two inputs. ADCIN3 alone does not directly map to operating current and ADCIN4 does not map directly to maximum current.

**Table 2-5. ADCIN Configuration**

ADCINx Pin	Corresponding Setting
ADCIN1	Minimum voltage
ADCIN2	Maximum voltage
ADCIN3 & ADCIN4	Operating current and maximum current

Each labeled switch number on the TPS25730EVM switch sets corresponds to an ADCIN decoded value, shown in the table below.

**Table 2-6. Relationship Between Switch Number and ADCIN Decoded Value**

ADCIN Switch Number	ADCIN Decoded Value
1	0
2	1
3	2
4	3
5	4
6	5
7	6
8	7

### 2.7.1 Minimum Voltage Configuration

The minimum voltage for the USB Power Delivery Sink Capabilities can be set according to the table below. When the received USB PD Source Capabilities do not meet the minimum and maximum voltage range the Capabilities Mismatch bit is set on the USB PD request. When the Minimum Voltage is set greater than 5 V the Higher Capability bit is set in the Sink Capabilities.

**Table 2-7. Minimum Voltage Configuration for Sink Capabilities - ADCIN1 Decoded**

ADCIN1 Decoded Value	Minimum Voltage Configuration
0	5 V
1	9 V
2	12 V
3	15 V
4	20 V
5	Reserved
6	Reserved
7	Reserved

### 2.7.2 Maximum Voltage Configuration

The maximum voltage for the USB Power Delivery Sink Capabilities is set according to the table below. When the received USB PD Source Capabilities do not meet the minimum and maximum voltage range the Capabilities Mismatch bit is set on the USB PD request.

**Table 2-8. Maximum Voltage Configuration for Sink Capabilities - ADCIN2 Decoded**

ADCIN2 Decoded Value	Maximum Voltage Configuration
1	9 V
3	12 V
5	15 V
7	20 V

### 2.7.3 Sink Current Configuration

The sink current is configured according to [Table 2-9](#). The configuration sets Operating and Maximum Current in the USB PD request message. The Operating Current is defined as the the current required for the sink to be functional. The Maximum Current is defined as the maximum current the sink can use. The Operating and Maximum Current can be the same if the Operational Current is the maximum current required for the sink to be functional. The Capabilities Mismatch bit is set when the PD Source Capabilities do not meet the Operating Current. When the Operating Current is set to 0 A the Capability Mismatch bit is not set.

**Table 2-9. ADCIN3 & ADCIN4 Sink Current Configuration**

ADCIN3	ADCIN4	Operating Current	Maximum Current
0	0	0	1.5 A
0	1	0	3 A
0	2	0	4 A
0	3	0	5 A
0	4	0.5 A	1.5 A
0	5	0.5 A	3 A
0	6	0.5 A	4 A
0	7	0.5 A	5 A
1	0	1 A	1.5 A
1	1	1 A	3 A
1	2	1 A	4 A
1	3	1 A	5 A
1	4	1.5 A	1.5 A
1	5	1.5 A	3 A
1	6	1.5 A	4 A
1	7	1.5 A	5 A
2	1	2 A	3 A
2	2	2 A	4 A
2	3	2 A	5 A
2	5	2.5 A	3 A
2	6	2.5 A	4 A
2	7	2.5 A	5 A
3	1	3 A	3 A
3	2	3 A	4 A
3	3	3 A	5 A
3	6	3.5 A	4 A
3	7	3.5 A	5 A
4	2	4 A	4 A
4	3	4 A	5 A
4	7	4.5 A	5 A
5	3	5 A	5 A

## 2.7.4 Complete Example

Find the appropriate ADCIN decoded values for ADCIN1, ADCIN2, ADCIN3, and ADCIN4 if the system is needed to accept 5 V-20 V, and operate at 3 A. The table below details the appropriate settings:

**Table 2-10. Example Settings**

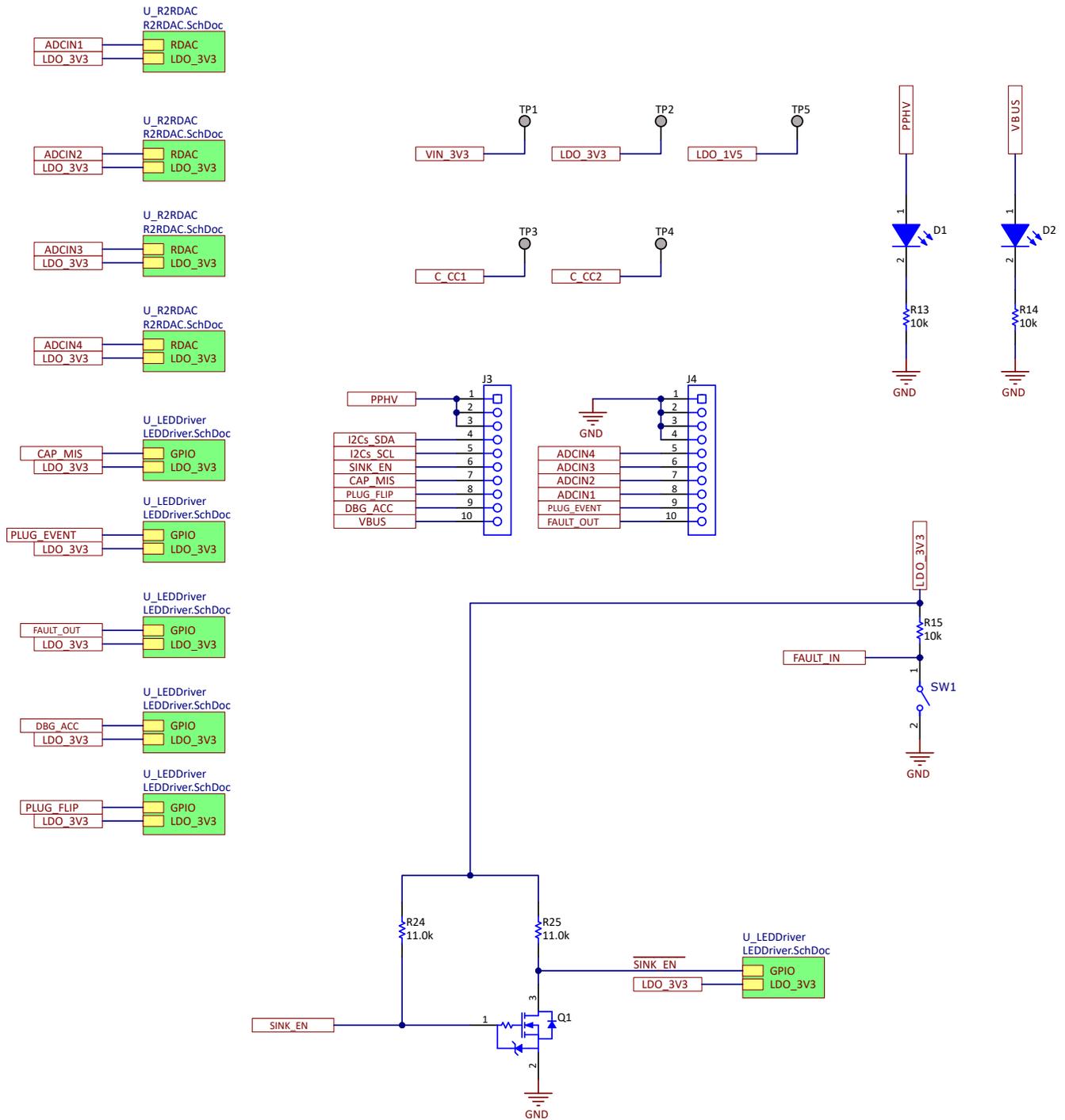
ADCIN Pin	Desired Behavior	ADCIN Decoded Value	ADCIN Switch to Turn ON
ADCIN1	Minimum voltage: 5 V	0	1
ADCIN2	Maximum voltage: 20 V	4	5
ADCIN3	Operating current: 3 A	3	4
ADCIN4	Maximum current: 3 A	1	2

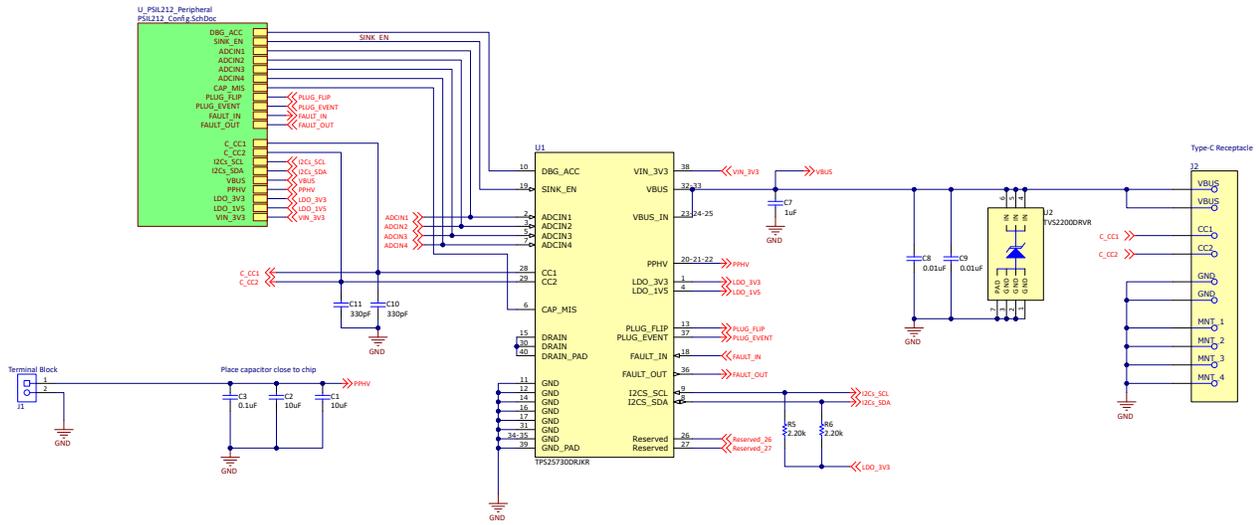
The ADCIN1 decoded value for a minimum voltage configuration of 5 V is 0. The ADCIN2 decoded value for a maximum value of 20 V is 4. The operating current and maximum current needs to be 3 A. The combination of ADCIN3 and ADCIN4 decoded values to meet the required combination of operating current and maximum current is 3 and 1, respectively. Using the Switch to Decoded Table values, set the ADCIN1 switch 1 to on, the ADCIN2 switch 5 to on, the ADCIN3 switch 4 to on, and the ADCIN4 switch 2 to on. All other switches are in the OFF position.

Once the configuration is set, plug in the source by the USB-C connector. The PLUG\_EVENT indicator LED lights up to indicate the cable is plugged in. The CAP\_MIS indicator LED blinks continuously if the Capabilities Mismatch bit is set, which occurs when a source cannot provide a minimum power of 15 W, or a voltage inside the range of 5 V to 20 V (including 5 V and 20 V) cannot be provided. The plug flip LED lights up if the plug is inserted upside down.

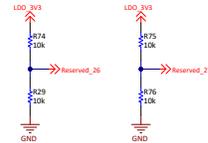
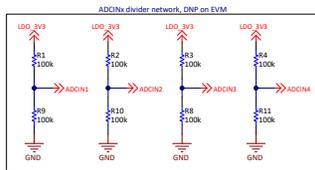
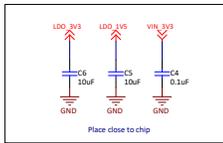
### 3 Hardware Design Files

#### 3.1 Schematics

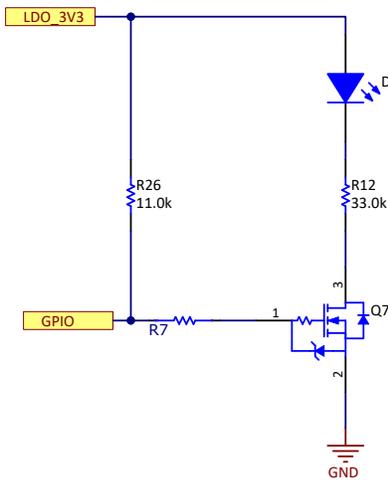


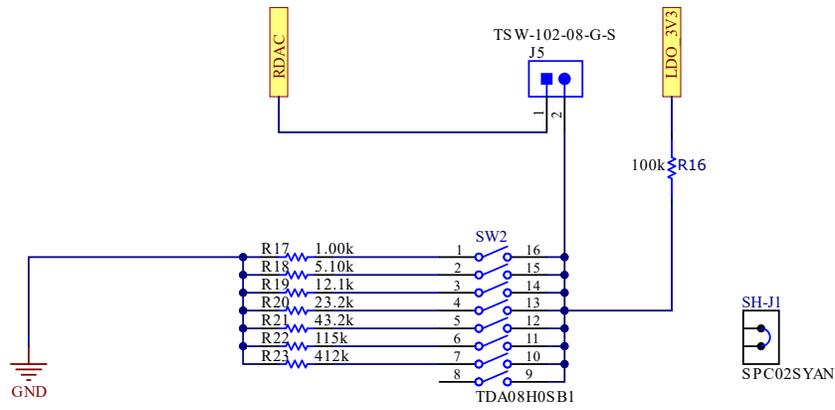


Required passive components



U\_PSL122\_Hardware  
PSL122\_Hardware\_SchDoc





Switch 1 On: Setting 0  
 Switch 2 On: Setting 1  
 Switch 3 On: Setting 2  
 Switch 4 On: Setting 3  
 Switch 5 On: Setting 4  
 Switch 6 On: Setting 5  
 Switch 7 On: Setting 6  
 Switch 8 On: Setting 7

### 3.2 PCB Layouts

Figure 3-1 through Figure 3-6 illustrate the EVM PCB layouts.

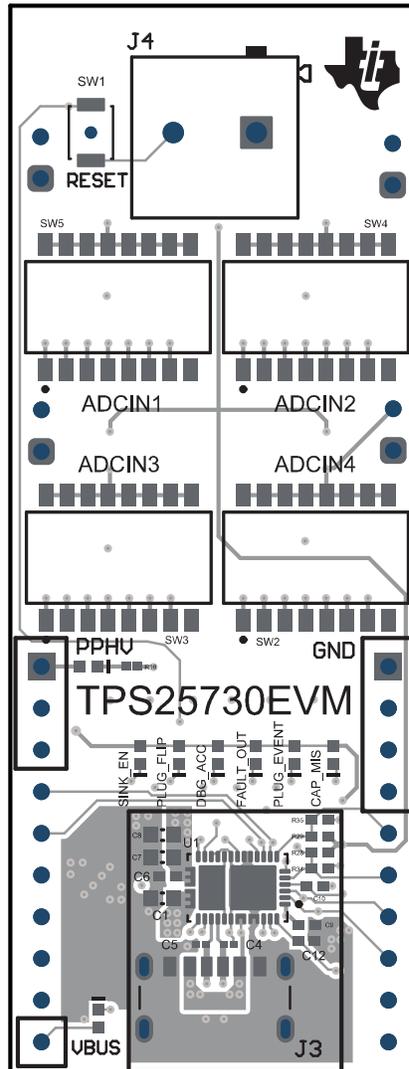
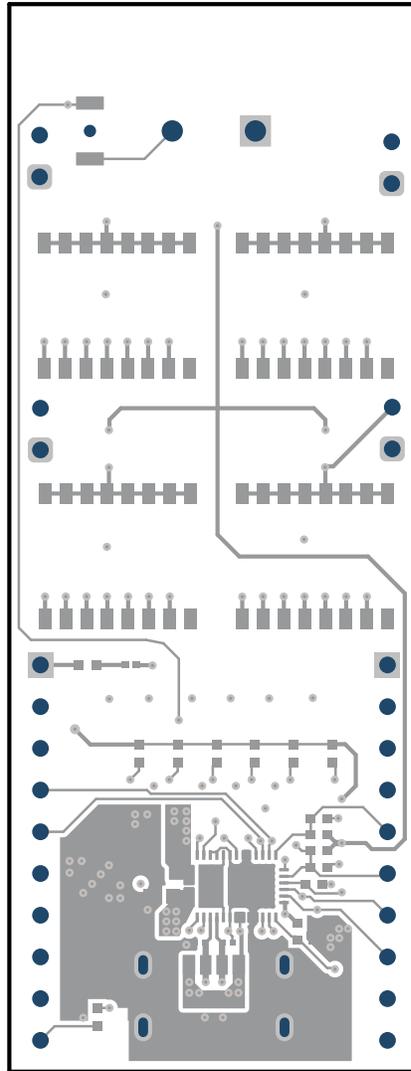
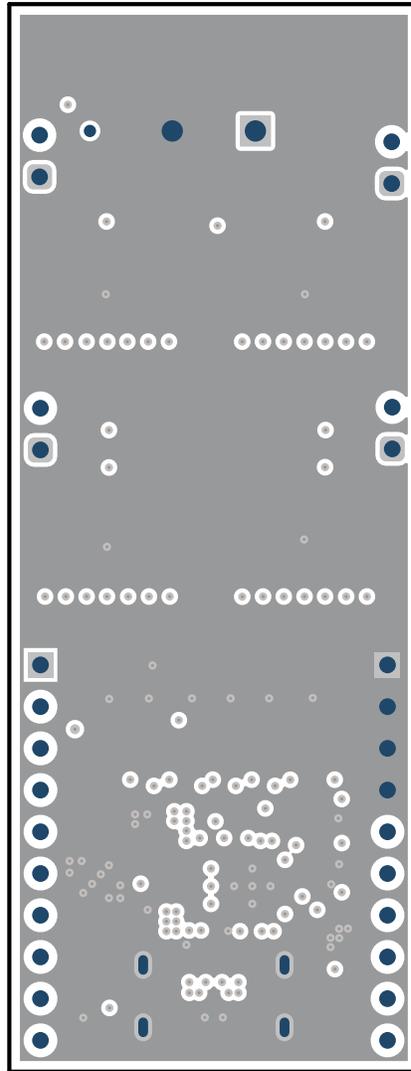


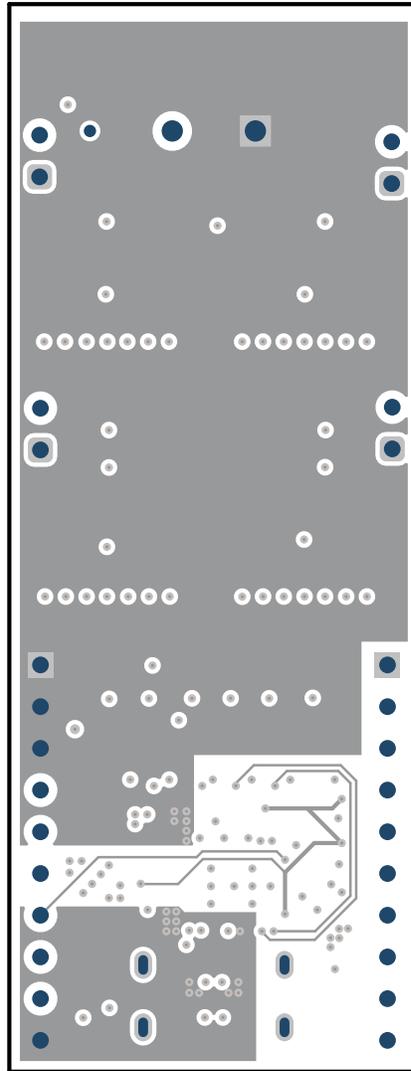
Figure 3-1. TPS25730EVM Top Composite View



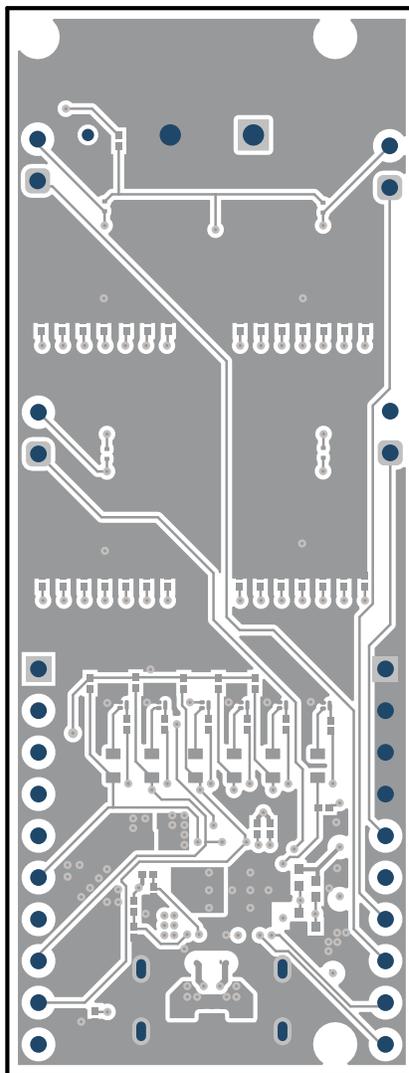
**Figure 3-2. TPS25730EVM Top Layer**



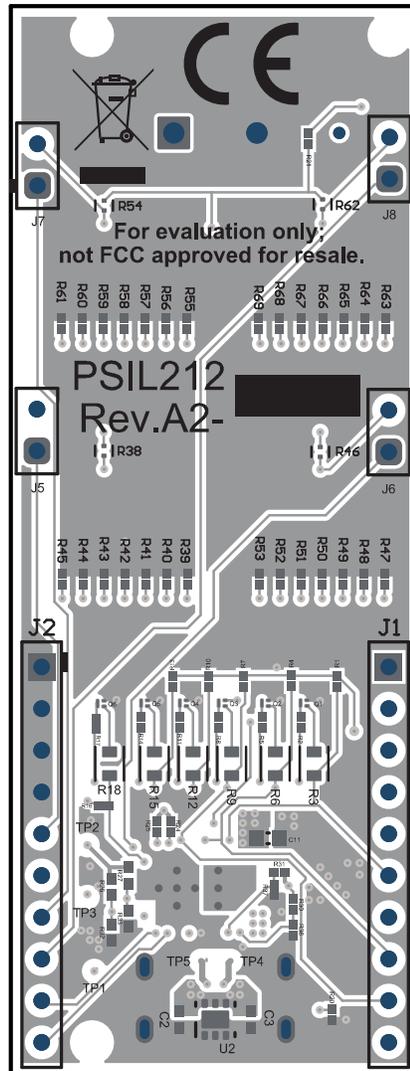
**Figure 3-3. TPS25730EVM Ground Plane**



**Figure 3-4. TPS25730EVM Power Layer**



**Figure 3-5. TPS25730 Bottom Layer**



**Figure 3-6. TPS25730 Bottom Composite View**

### 3.3 Bill of Materials (BOM)

Table 3-1 lists the EVM BOM.

**Table 3-1. TPS25730EVM Bill of Materials**

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer
C1	1	4.7uF	CAP, CERM, 4.7 uF, 35 V, +/- 10%, X5R, 0603	0603	GRM188R6YA475KE15D	MuRata
C2, C3	2	0.01uF	CAP, CERM, 0.01 uF, 50 V, +/- 5%, X7R, 0402	0402	C0402C103J5RACTU	Kemet
C4, C5	2	330 pF	CAP, CERM, 330 pF, 50 V, +/- 10%, X7R, AEC-Q200 Grade 1, 0201	0201	CGA1A2X7R1H331K030BA	TDK
C6	1	0.1uF	CAP, CERM, 0.1 uF, 35 V, +/- 10%, X5R, 0402	0402	GMK105BJ104KV-F	Taiyo Yuden
C7, C8, C11	3	10uF	CAP, CERM, 10 uF, 35 V, +/- 20%, X5R, 0603	0603	GRM188R6YA106MA73D	Murata
C9, C10, C12	3	10uF	CAP, CERM, 10 uF, 10 V, +/- 20%, X5R, 0402	0402	CL05A106MP5NUNC	Samsung Electro-Mechanics
D1, D2, D3, D4, D5, D6, D7, D8	8	White	LED, White, SMD	0402	LW QH8G-Q2S2-3K5L-1	OSRAM
J1, J2	2		Receptacle, 2.54mm, 10x1, Gold, TH	Receptacle, 2.54mm, 10x1, Gold, TH	SSQ-110-23-F-S	Samtec
J3	1		24 (6+18 Dummy) Position USB-C (USB TYPE-C) USB 2.0 Receptacle Connector	USB-C Connector	USB4125-GF-A-0190	GCT
J4	1		Terminal Block, 5.08 mm, 2x1, TH	Terminal Block, 5.08 mm, 2x1, TH	1715721	Phoenix Contact
J5, J6, J7, J8	4		Header, 2.54mm, 2x1, Gold, TH	Header, 2.54mm, 2x1, Gold, TH	TSW-102-08-G-S	Samtec
Q1, Q2, Q3, Q4, Q5, Q6	6	20 V	MOSFET, N-CH, 20 V, 0.5 A, YJM0003A (PICOSTAR-3)	YJM0003A	CSD15380F3	Texas Instruments
R1, R4, R7, R10, R13, R16	6	10k	RES, 10.0 k, 1%, 0.05 W, 0201	0201	RC0201FS-7D10KL	Yageo America
R2, R5, R8, R11, R14, R17	6	33k	RES, 33.0 k, 1%, 0.05 W, 0201	0201	RC0201FR-0733KL	Yageo America
R3, R6, R9, R12, R15, R18	6	0	0 Ohms Jumper 0.1W, 1/10W Chip Resistor 0603 (1608 Metric) Automotive AEC-Q200 Thick Film	0603	ERJ-3GEY0R00V	Panasonic
R19, R20, R21	3	1k	RES, 10 k, 5%, 0.05 W, 0201	0201	RC0201JR-7D10KL	Yageo America
R24, R25	2	2.2k	RES, 2.20 k, 1%, 0.05 W, 0201	0201	CRCW02012K20FKED	Vishay-Dale
R36, R37	2	10k	RES, 10 k, 5%, 0.05 W, 0201	0201	RC0201JS-7D10KL	Yageo America

**Table 3-1. TPS25730EVM Bill of Materials (continued)**

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer
R38, R46, R54, R62	4	100k	100 kOhms $\pm$ 1% 0.05W, 1/20W Chip Resistor 0201 (0603 Metric) Automotive AEC-Q200 Thick Film	0603	ERJ-1GNF1003C	Panasonic Electronic Components
R39, R47, R55, R63	4	1k	RES, 1.00 k, 1%, 0.05 W, 0201	0201	RC0201FR-071KL	Yageo America
R40, R48, R56, R64	4	5.1k	RES, 5.10 k, 1%, 0.05 W, 0201	0201	RC0201FR-075K1L	Yageo America
R41, R49, R57, R65	4	12.1k	RES, 12.1 k, 1%, 0.05 W, 0201	0201	RC0201FS-7D12K1L	Yageo America
R42, R50, R58, R66	4	23.2k	RES, 23.2 k, 1%, 0.05 W, 0201	0201	RC0201FR-0723K2L	Yageo America
R43, R51, R59, R67	4	43.2k	RES, 43.2 k, 1%, 0.05 W, 0201	0201	RC0201FR-0743K2L	Yageo America
R44, R52, R60, R68	4	115k	RES, 115 k, 1%, 0.05 W, 0201	0201	RC0201FR-07115KL	Yageo America
R45, R53, R61, R69	4	412k	RES, 412 k, 1%, 0.05 W, 0201	0201	RC0201FR-07412KL	Yageo America
SH-J1, SH-J2, SH-J3, SH-J4	4		Shunt, 100mil, Flash Gold, Black	Shunt, 100mil, Flash Gold, Black	SPC02SYAN	Sullins Connector Solutions
SW1	1		Tactile Switch SPST-NO Top Actuated Surface Mount	Tactile Switch SPST-NO Top Actuated Surface Mount	B3U-1000P-B	Omron
SW2, SW3, SW4, SW5	4		Ultra-miniature Surface Mount Half-pitch DIP Switch, -40 to 85 degC, 16-Pin SMD (DIP), RoHS, Tube	SMD, 16-Leads, Body 11.29x6.2mm, Pitch 1.27mm	TDA08H0SB1	C&K Components
U1	1		USB Type-C and USB PD Controller with Integrated Power Switches Optimized for Power Applications	RJK0038B-MFG	TPS25730DRJKR	Texas Instruments
U2	1	22 V	22-V Precision Surge Protection Clamp, DRV0006A (WSON-6)	DRV0006A	TVS2200DRVR	Texas Instruments

## **4 Additional Information**

### **4.1 Trademarks**

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  - 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](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.

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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。

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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](http://www.tij.co.jp/lstds/ti_ja/general/eStore/notice_02.page)

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#### 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.
  6. *Disclaimers:*
    - 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.
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8.2 *Specific Limitations.* IN NO EVENT SHALL TI'S AGGREGATE LIABILITY FROM ANY USE OF AN EVM PROVIDED HEREUNDER, INCLUDING FROM ANY WARRANTY, INDEMNITY OR OTHER OBLIGATION ARISING OUT OF OR IN CONNECTION WITH THESE TERMS, , EXCEED THE TOTAL AMOUNT PAID TO TI BY USER FOR THE PARTICULAR EVM(S) AT ISSUE DURING THE PRIOR TWELVE (12) MONTHS WITH RESPECT TO WHICH LOSSES OR DAMAGES ARE CLAIMED. THE EXISTENCE OF MORE THAN ONE CLAIM SHALL NOT ENLARGE OR EXTEND THIS LIMIT.

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.

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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