

# User's Guide

## TPSM83100 Evaluation Module

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### ABSTRACT

This user's guide describes the operation and use of the TPSM83100EVM evaluation module (EVM). The TPSM83100EVM is designed to help users easily evaluate and test the operation and functionality of the TPSM83100 buck-boost module. The TPSM83100EVM has the output voltage set to 3.3 V. The EVM operates from a 1.6-V to 5.5-V input voltage range. Output current can go up to 1.5 A when  $V_{in}$  is higher than 3 V and 1.2 A when  $V_{in}$  is higher than 2.7V. This document includes the following:

- Setup instructions for the hardware
- Schematic diagram
- Bill of materials (BOM)
- Printed-circuit board (PCB) layout drawings for the evaluation module

Throughout this document, the abbreviations EVM, TPSM83100EVM, and the term evaluation module are synonymous with the TPSM83100, unless otherwise noted.

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### Trademarks

All trademarks are the property of their respective owners.

## 1 Introduction

The Texas Instruments TPSM83100 is a highly efficient, internally compensated, buck-boost module in a 8-pin, 2.6-mm × 2.1-mm uSip package.

### 1.1 Background

The TPSM83100EVM uses the TPSM83100 integrated circuit (IC), is set to a 3.3-V output, and operates with an input voltage between 1.6 V and 5.5 V.

### 1.2 Performance Specification

[Table 1-1](#) provides a summary of the TPSM83100EVM performance specifications. All specifications are given for an ambient temperature of 25°C.

**Table 1-1. Performance Specification Summary**

SPECIFICATION	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Input voltage		1.6		5.5	V
Start-up input voltage		1.65		5.5	V
Output voltage		1.2		5.5	V
Output current	VIN ≥ 3 V, VOUT = 3.3 V	0		1500	mA

### 1.3 Modifications

The printed-circuit board (PCB) for this EVM is designed to accommodate the TPSM83100. Extra positions are available for additional input and output capacitors and a feedforward capacitor.

#### 1.3.1 IC U1 Operation

U1 is configured for the evaluation of the adjustable-output version. This EVM is set to 3.3 V. Resistors R4 and R5 can be used to set the output voltage between 1.2 V and 5.5 V. See the data sheet for recommended values.

#### 1.3.2 Device Evaluation

Components JP1 can be populated to evaluate the device enable feature of this IC. When JP1 is connected to HIGH, IC is enabled and be disabled when JP1 connected to LOW.

Components JP2 can be populated to evaluate the device FPWM/PFM feature of this IC. When JP2 is connected to HIGH, IC works in FPWM, with smaller output ripple but lower efficiency in light load. Otherwise, IC works in PFM mode, with bigger output ripple and better efficiency in light load.

## 2 Setup

This section describes how to properly use the TPSM83100EVM.

### 2.1 Input/Output Connector and Header Descriptions

<b>J1, Pin 1 and 2 – VIN</b>	Positive input connection from the input supply for the EVM
<b>J1, Pin 3 and 4 – S+/S– Input</b>	Voltage sense connections. Measure the input voltage at this point.
<b>J1, Pin 5 and 6 – GND</b>	VIN GND return connection from the input supply for the EVM, common with J2, pin 5 and 6
<b>J2, Pin 1 and 2 – VOUT</b>	Output voltage connection
<b>J2, Pin 3 and 4 – S+/S– VOUT</b>	Output voltage connection
<b>J2, Pin 5 and 6 – GND</b>	VOUT GND return connection for the output voltage, common with J1 pin 5 and 6
<b>JP1 – Enable</b>	Shorting the jumper between the center pin EN and HIGH turns on the unit. Shorting the jumper between the center EN and LOW turns the unit off.
<b>JP2 – MODE</b>	Shorting the jumper between the center pin MODE and LOW enables automatic transition to power-saving mode at light-load currents as described in the data sheet. Shorting the jumper between the center pin MODE and HIGH enables forced PWM mode.

### 2.2 Setup

To operate the EVM, connect an input supply with the positive lead to J1, pins 1 and 2 and negative lead to J1, pins 5 and 6. Connect a load with the positive lead to J2, pins 1 and 2 and the negative lead to J2, pins 5 and 6. Short EN and HIGH (pins 1 and 2) of JP1 with a shorting jumper.

### 2.3 Precautions



#### CAUTION

Hot surface.  
Contact can cause burns.  
Do not touch!

### 3 Board Layout

This section provides the TPSM83100EVM board layout and illustrations.

#### 3.1 Layout

Figure 3-1 and Figure 3-4 show the board layout for the TPSM83100EVM PCB.

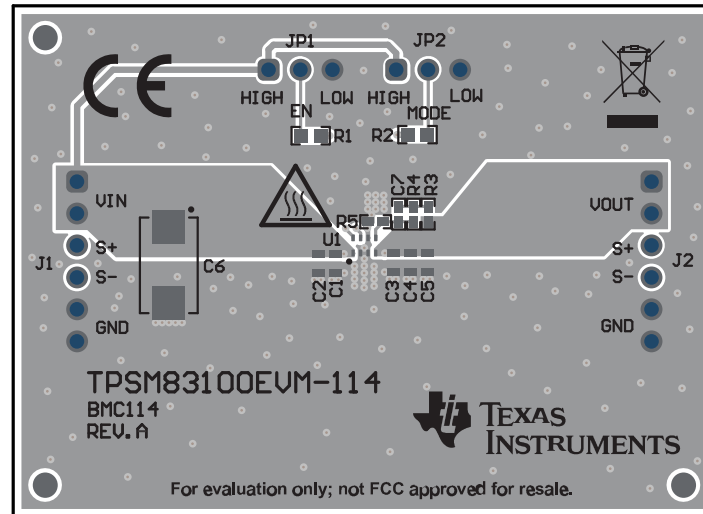


Figure 3-1. Top Layer Routing

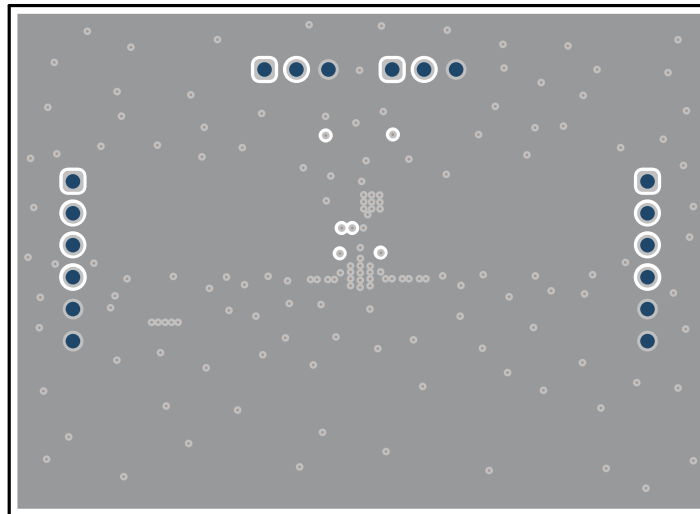
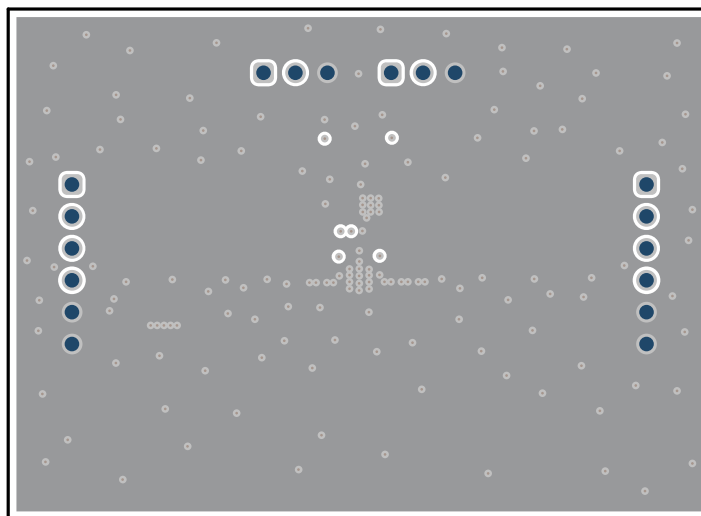
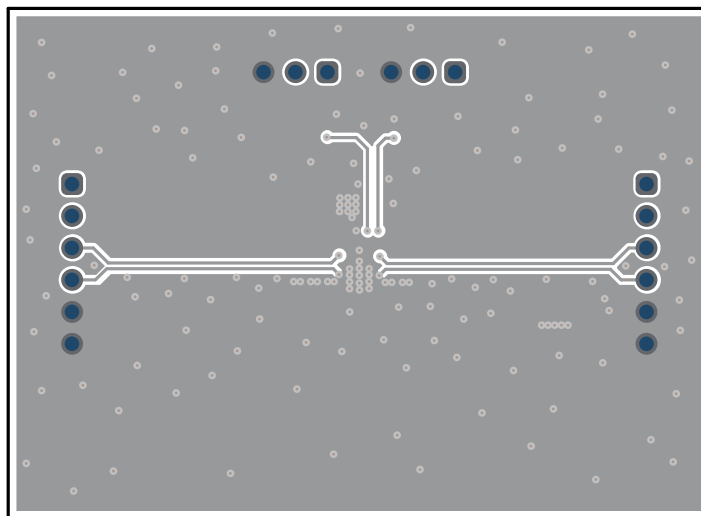


Figure 3-2. Signal Layer 1



**Figure 3-3. Signal Layer 2**



**Figure 3-4. Bottom Layer Routing**

## 4 Schematic and Bill of Materials

This section provides the TPSM83100EVM schematic and bill of materials.

### 4.1 Schematic

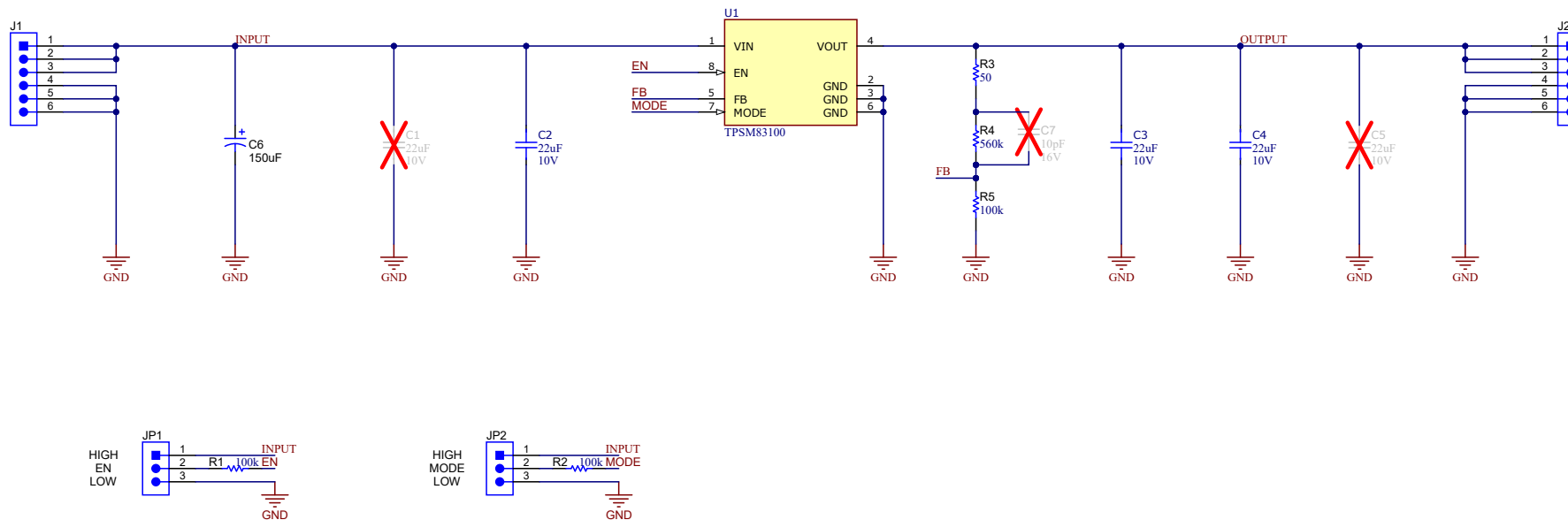


Figure 4-1. Schematic

## 5 Bill of Materials

**Table 5-1. TPSM83100EVM Bill of Materials**

DESIGNATOR	QTY	VALUE	DESCRIPTION	PACKAGE REFERENCE	PART NUMBER	MANUFACTURER
C6	1	150uF	CAP, Tantalum Polymer, 150 uF, 10 V, +/- 20%, 0.005 ohm, 7343-31 SMD	7343-31	T530D157M010ATE005	Kemet
C2, C3, C4	3	22µF	Multi-Layer Ceramic Capacitor 22uF 10V X5R ±20% 0603 Paper T/R	0603	GRT188R61A226ME13D	Murata
J1, J2	2		Header, 2.54 mm, 6x1, Gold, TH	Header, 2.54mm, 6x1, TH	61300611121	Würth Elektronik
JP1, JP2	2		Header, 2.54 mm, 3x1, Gold, TH	Header, 2.54mm, 3x1, TH	61300311121	Würth Elektronik
R1, R2	2	100k	RES, 100 k, 5%, 0.1 W, 0603	0603	CRCW0603100KJNEAC	Vishay-Dale
R3	1	50	RES, 50, 0.1%, 0.5 W, 0402	0402	FC0402E50R0BTBST1	Vishay Thin Film
R4	1	560k	RES, 560 k, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW0402560KJNED	Vishay-Dale
R5	1	100k	RES, 100 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW0402100KFKED	Vishay-Dale
SH-JP1, SH-JP2	2	1x2	Shunt, 100mil, Flash Gold, Black	Closed Top 100mil Shunt	SPC02SYAN	Sullins Connector Solutions
U1	1		1.5-A Output Current, Buck-Boost Converter With I2C Interface	MicroSiP8	TPSM83100	Texas Instruments
C1, C5	0	22µF	Multi-Layer Ceramic Capacitor 22uF 10V X5R ±20% 0603 Paper T/R	0603	GRT188R61A226ME13D	Murata
C7	0	10pF	CAP, CERM, 10 pF, 16 V, +/- 10%, C0G, 0402	0402	C0402C100K4GACTU	Kemet
FID1, FID2, FID3	0		Fiducial mark. There is nothing to buy or mount.	N/A	N/A	N/A

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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.
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**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:

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##### 3.1.1 Notice applicable to EVMs not FCC-Approved:

**FCC NOTICE:** This kit is designed to allow product developers to evaluate electronic components, circuitry, or software associated with the kit to determine whether to incorporate such items in a finished product and software developers to write software applications for use with the end product. This kit is not a finished product and when assembled may not be resold or otherwise marketed unless all required FCC equipment authorizations are first obtained. Operation is subject to the condition that this product not cause harmful interference to licensed radio stations and that this product accept harmful interference. Unless the assembled kit is designed to operate under part 15, part 18 or part 95 of this chapter, the operator of the kit must operate under the authority of an FCC license holder or must secure an experimental authorization under part 5 of this chapter.

##### 3.1.2 For EVMs annotated as FCC – FEDERAL COMMUNICATIONS COMMISSION Part 15 Compliant:

#### **CAUTION**

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

#### **FCC Interference Statement for Class A EVM devices**

*NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.*

#### **FCC Interference Statement for Class B EVM devices**

*NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:*

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

#### 3.2 Canada

##### 3.2.1 For EVMs issued with an Industry Canada Certificate of Conformance to RSS-210 or RSS-247

#### **Concerning EVMs Including Radio Transmitters:**

This device complies with Industry Canada license-exempt RSSs. Operation is subject to the following two conditions:

(1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

#### **Concernant les EVMs avec appareils radio:**

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

#### **Concerning EVMs Including Detachable Antennas:**

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication. This radio transmitter has been approved by Industry Canada to operate with the antenna types listed in the user guide with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

### Concernant les EVMs avec antennes détachables

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante. Le présent émetteur radio a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés dans le manuel d'usage et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

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

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1. Use EVMs in a shielded room or any other test facility as defined in the notification #173 issued by Ministry of Internal Affairs and Communications on March 28, 2006, based on Sub-section 1.1 of Article 6 of the Ministry's Rule for Enforcement of Radio Law of Japan,
2. Use EVMs only after User obtains the license of Test Radio Station as provided in Radio Law of Japan with respect to EVMs, or
3. Use of EVMs only after User obtains the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to EVMs. Also, do not transfer EVMs, unless User gives the same notice above to the transferee. Please note that if User does not follow the instructions above, User will be subject to penalties of Radio Law of Japan.

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This is a class A product intended for use in environments other than domestic environments that are connected to a low-voltage power-supply network that supplies buildings used for domestic purposes. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

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

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