TPS6269xEVM-076 Evaluation Module

This user's guide describes the characteristics, operation, and use of the TPS6269xEVM-076 evaluation module (EVM). The TPS6269xEVM-076 is a fully assembled and tested platform for evaluating the performance of the TPS6269x high-frequency, synchronous, step-down dc-dc converters optimized for battery-powered portable applications. This document includes schematic diagrams, a printed circuit board (PCB) layout, bill of materials, and test data. Throughout this document, the abbreviations *EVM, TPS6269xEVM*, and the term *evaluation module* are synonymous with the TPS62690/1/2/3EVM-076 unless otherwise noted.

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1 Introduction

The TPS6269x devices are a series of high-frequency, synchronous, step-down dc-dc converters optimized for battery-powered portable applications. Intended for low-power applications, the TPS6269x can support up to 600-mA load current and allows the use of low-cost chip inductors and capacitors. The TPS62691 and TPS62690 have fixed output voltages of 2.2 V and 2.85 V respectively. The TPS6269x operates at a regulated 4-MHz switching frequency and enters a power-save mode operation under light load currents in order to maintain high efficiency over the entire load-current range. A PFM mode extends the battery life by reducing the quiescent current to 19 µA (typical) during light load operation.

1.1 Features

- Input voltage range 2.3 V to 4.8 V
- Fixed output voltage
- Up to a 600-mA output current for TPS62691 and 500 mA for the TPS62690
  - 4-MHz regulated frequency operation
- Up to an 800-mA output current for TPS62692 and 500 mA for the TPS62690
  - 3-MHz regulated frequency operation
- Total solution size is less than 12 mm^2
- Very low quiescent current of 19 µA
- High efficiency

1.2 Applications

- Cell phones, smartphones
- LDO replacement
- Portable audio, portable media
- DC/DC micro-modules

1.3 EVM Ordering Options

Table 1 provides the ordering information for TPS62690/1/2/3EVM-076:

Table 1. Ordering Information for TPS62690/1/2/3EVM

Orderable EVM Number	Device Part Number	Output Voltage	Maximum Output Current
TPS62690EVM-076	TPS62690	2.85 V	500 mA
TPS62691EVM-076	TPS62691	2.2 V	600 mA
TPS62692EVM-076	TPS62692	2.85 V	800 mA
TPS62693EVM-076	TPS62693	2.2 V	800 mA

2 TPS62690/1/2/3EVM Schematic

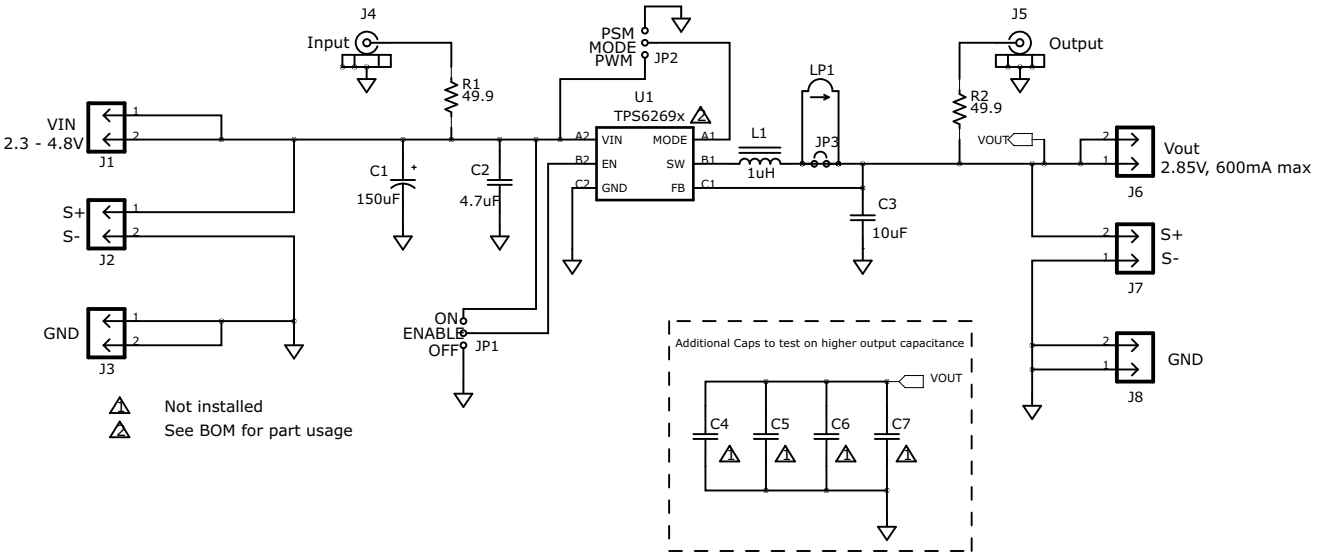

Figure 1. TPS6269xEVM Schematic

3 Connector and Test Point Descriptions

3.1 Input/Output Connectors: TPS6269xEVM

3.1.1 J1 – VIN

This header is the positive connection to the input power supply. The power supply must be connected between J1 (VIN) and J3 (GND). The leads to the input supply must be twisted and kept as short as possible. The input voltage must be between 2.3 V and 4.8 V.

3.1.2 J2 – S+/S–

J2 S+/S– are the sense connections for the input of the converter. Connect a voltmeter, sense connection of a power supply, or oscilloscope to this header.

3.1.3 J3 – GND

This header is the return connection to the input power supply. Connect the power supply between J3 (GND) and J1 (VIN). The leads to the input supply must be twisted and kept as short as possible.

3.1.4 J4

This SMA connector is connected to the input voltage of the dc/dc converter. It can be used to easily analyze the noise spectrum of the input voltage with a spectrum analyzer.

3.1.5 J5

This SMA connector is connected to the output voltage of the DC/DC converter. It can be used to easily analyze the noise spectrum of the output voltage with a spectrum analyzer.

3.1.6 J6

This header is the positive output of the step-down converter. The output voltage of the TPS62691 and TPS62690 devices are fixed to 2.2 V and 2.85 V respectively.

3.1.7 J7

J7 S+/S– are the sense connections for the output of the converter. Connect a voltmeter, sense connection of an electronic load, or oscilloscope to this header.

3.1.8 J8

J8 is the return connection of the converter. A load can be connected between J8 and J6 (VOUT).

3.2 Jumpers and Switches

3.2.1 JP1 – ENABLE

This jumper enables/disables the converter on the EVM. Placing a shorting jumper between ENABLE and ON turns on the converter. Placing a shorting jumper between ENABLE and OFF disables the converter.

3.2.2 JP2 – MODE

This jumper enables/disables the power-saving mode under light loads. Placing a shorting jumper between MODE and PWM disables the power-saving mode. If the power-save mode is disabled, the converter operates in forced PWM mode over the entire load current range.

Placing a shorting jumper between MODE and PSM enables the power-saving mode. This causes the device to operate in power-saving mode under light loads and in PWM mode in heavy loads. See the specific device data sheet for detailed information.

3.2.3 JP3 and LP1

This is the inductor current loop. In order to measure the inductor current, the trace on JP3 needs to be cut and a wire needs to be placed between the two ends of LP1. If the loop is no longer needed, remove the wire on LP1 and shorting JP3.

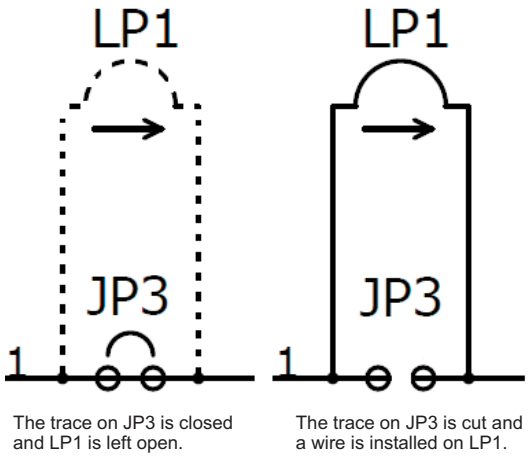

Figure 2. JP3 and LP1 Set Up

4 Test Configurations

4.1 Hardware Setup

Figure 3 illustrates a typical hardware test configuration.

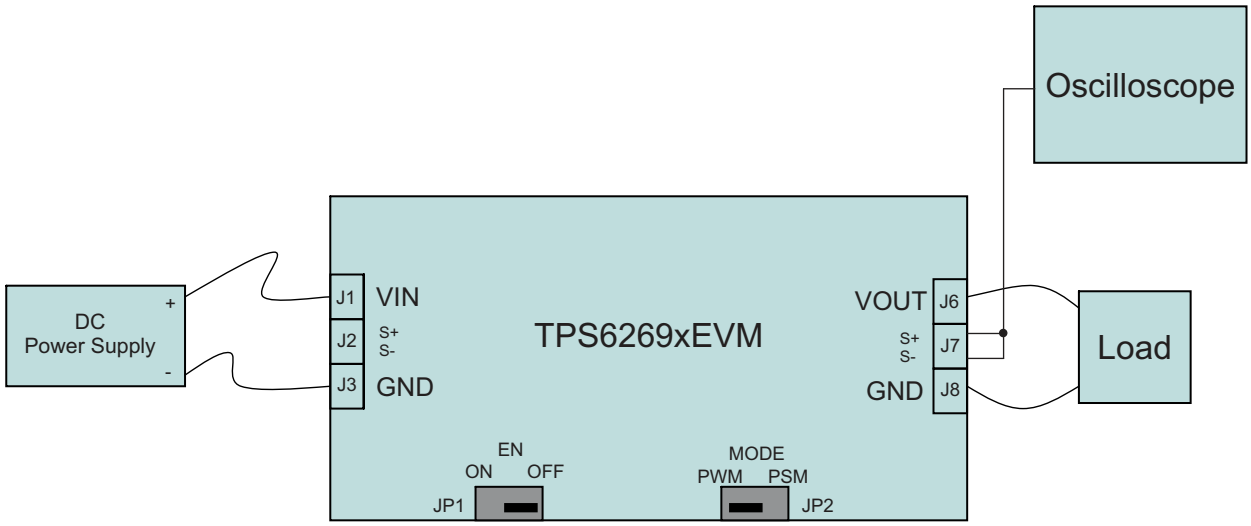

Figure 3. Hardware Board Connection

4.2 Procedure

Follow these procedures when configuring the EVM for testing.

CAUTION

Many of the components on the TPS62690EVM-076 and TPS62691EVM-076 are susceptible to damage by electrostatic discharge (ESD). Customers are advised to observe proper ESD handling precautions when unpacking and handling the EVM, Including the use of a grounded wrist strap, bootstraps, or mats at an approved ESD workstation. An electrostatic smock and safety glasses should also be worn.

1. Work at an ESD workstation. Make sure that any wrist straps, bootstraps, or mats are connected and secure the user to earth ground before power is applied to the EVM. Electrostatic smock and safety glasses should also be worn.
2. Connect a dc power supply between J1 and J3 on the TPS62690/1/2/3EVM. Note that the input voltage must range from 2.3 V to 4.8 V. Keep the wires from the input power supply to the EVM twisted and as short as possible.
3. Connect a dc voltmeter or oscilloscope to the output sense connection of the EVM.
4. A load can be connected between J6 and J8 on the TPS62690/1/2/3EVM.
5. To enable the converter, connect the shorting jumper on JP1 between ENABLE and ON located on the TPS62690/1/2/3EVM.
6. Use jumper JP2 to switch the TPS62690/1/2/3EVM between power-save mode under light loads and forced PWM mode.

5 TPS62691EVM Test Data

Figure 4 through Figure 9 present typical performance graphs for the TPS62690/1/2/3EVM. Actual performance data can be affected by measurement techniques and environmental variables; therefore, these curves are presented for reference and may differ from actual results obtained by some users.

5.1 Efficiency

Figure 4 shows the typical efficiency performance for the TPS62691EVM.

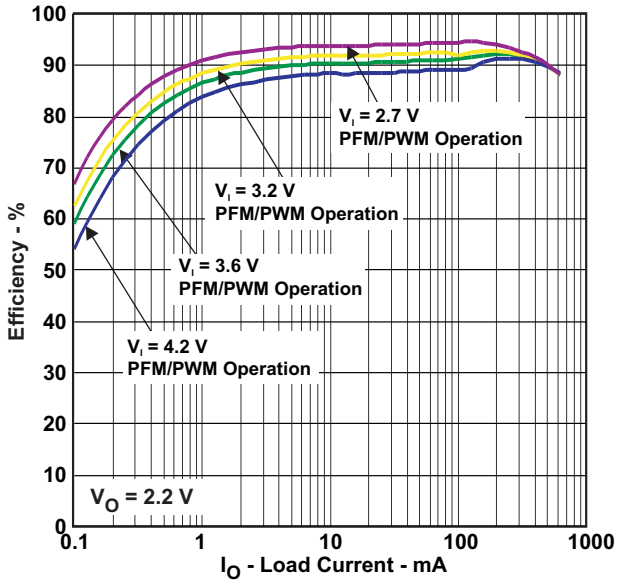

Figure 4. Efficiency vs Load current for the TPS62691

5.2 Start-up

Figure 5 and Figure 6 show the typical start-up performance for different loads for the TPS62691EVM board.

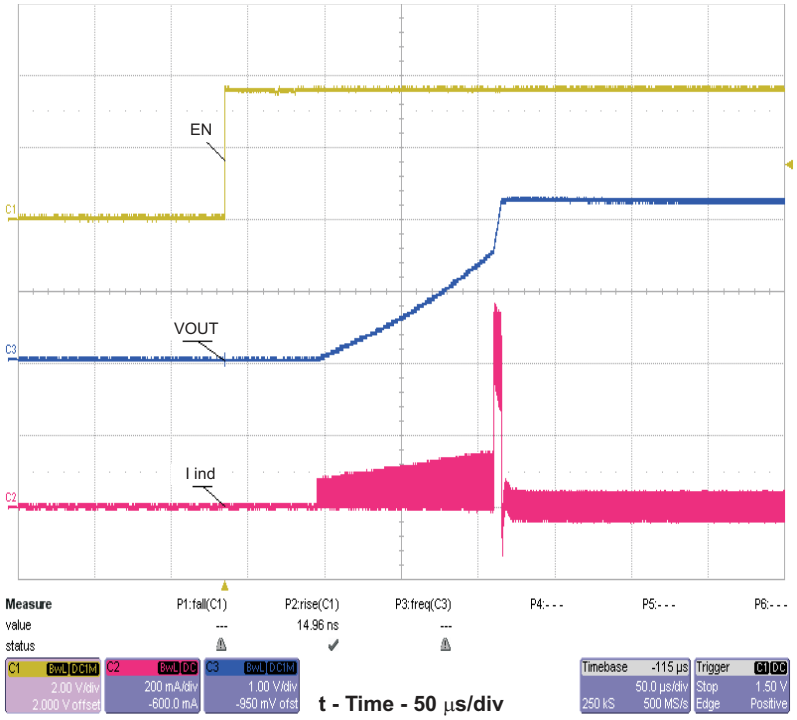

Figure 5. TPS62691 Start-Up Using EN With No Load, Vin = 3.6 V and Vout = 2.2 V

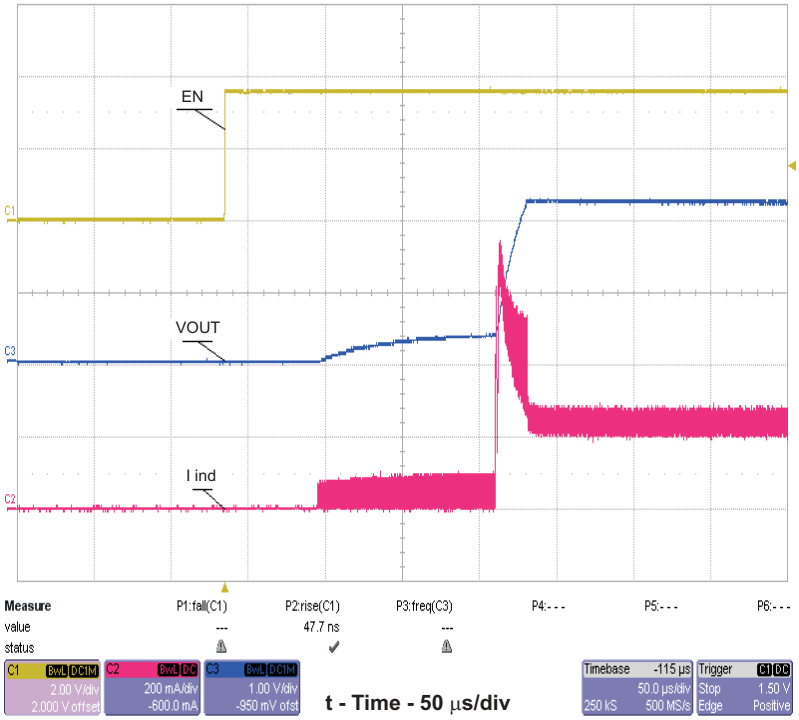

Figure 6. TPS62691 Start-up Using EN With 200-mA Load, Vin = 3.6 V and Vout = 2.2 V

5.3 Output Voltage Ripple (Power-Save Mode)

Figure 7 illustrates the typical output voltage ripple for the TPS62691EVM in power-save mode.

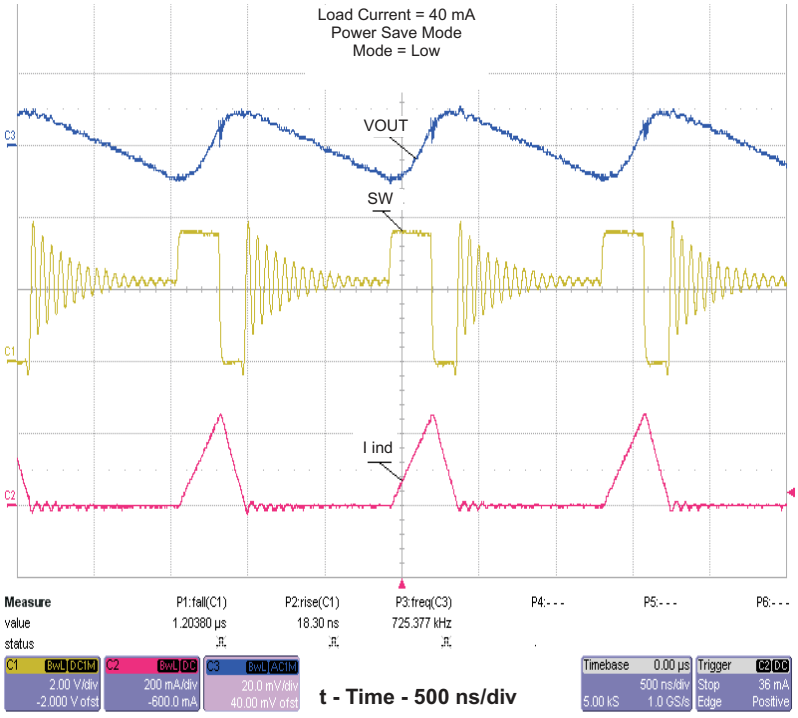

Figure 7. Power-Save Mode Ripple at Vin = 3.6 V and Vout = 2.2 V With Iload = 40 mA

5.4 Output Voltage Ripple (PWM)

Figure 8 and Figure 9 illustrate a typical output voltage ripple for the TPS62691 in PWM mode

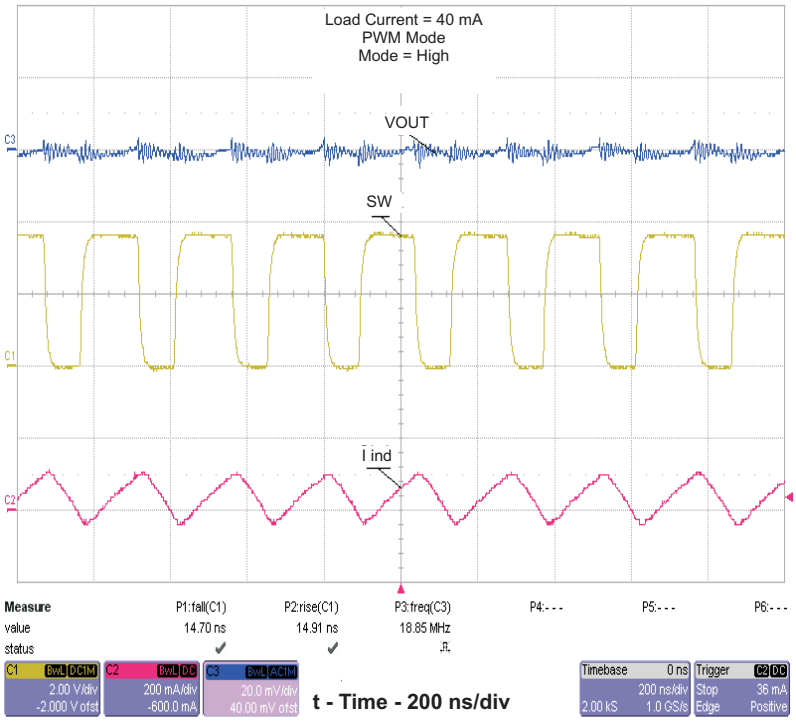

Figure 8. PWM Mode Ripple at Vin = 3.6 V and Vout = 2.2 V With Iload = 40 mA

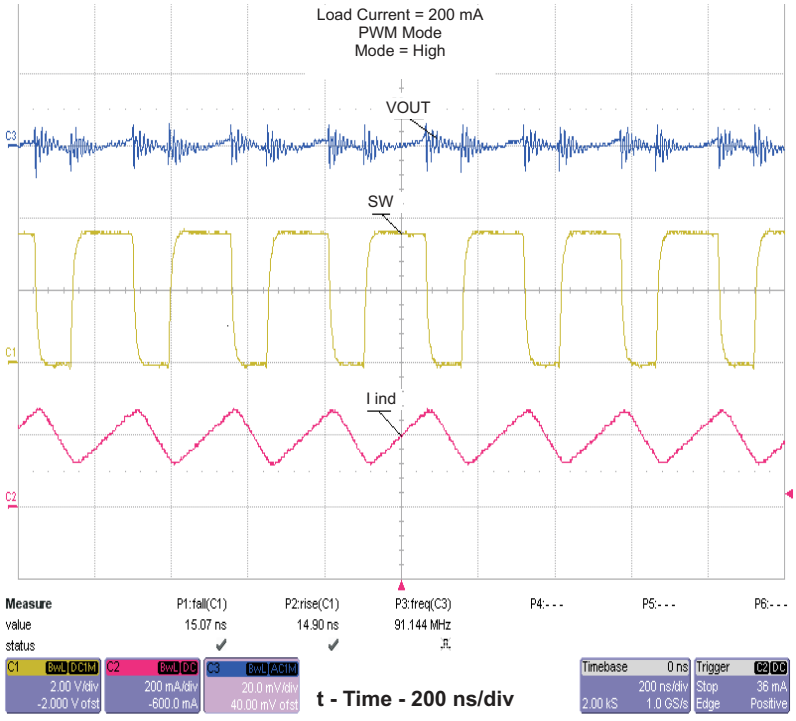

Figure 9. PWM Mode Ripple at Vin = 3.6 V and Vout = 2.2 V With Iload = 200 mA

6 TPS62690/1/2/3EVM Assembly Drawing and Layout

Figure 10 through Figure 14 show the design of the TPS62690/1/2/3EVM-076 printed-circuit boards (PCB). The EVM has been designed using a two-layer, 1-ounce copper-clad PCB with all components in an active area on the top side of the board. Moving components to both sides of the PCB or using additional internal layers can offer additional size reduction for space-constrained systems.

NOTE: Board layouts are not to scale. These figures show how the board is laid out; they are not intended to be used for manufacturing TPS62690/1/2/3EVM-076 PCBs. Note the connection of the TPS6269x feedback (FB) pin. It is recommended that the FB pin be connected directly to the inductor, not directly on the VOUT connection of the output capacitor. The connection to the inductor provides better transient response performance.

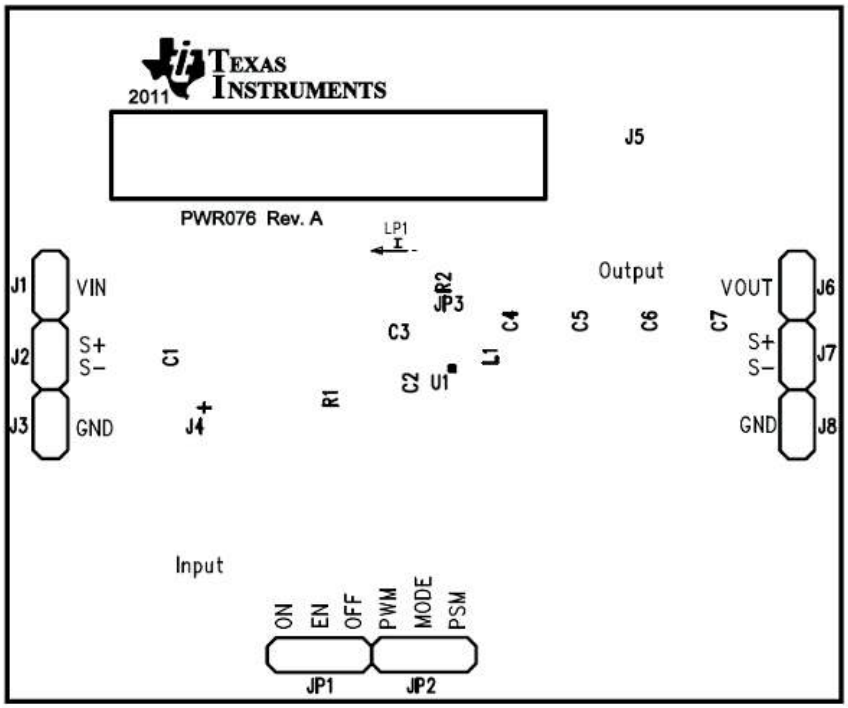

Figure 10. TPS62690/1/2/3EVM Component Placement (Top View)

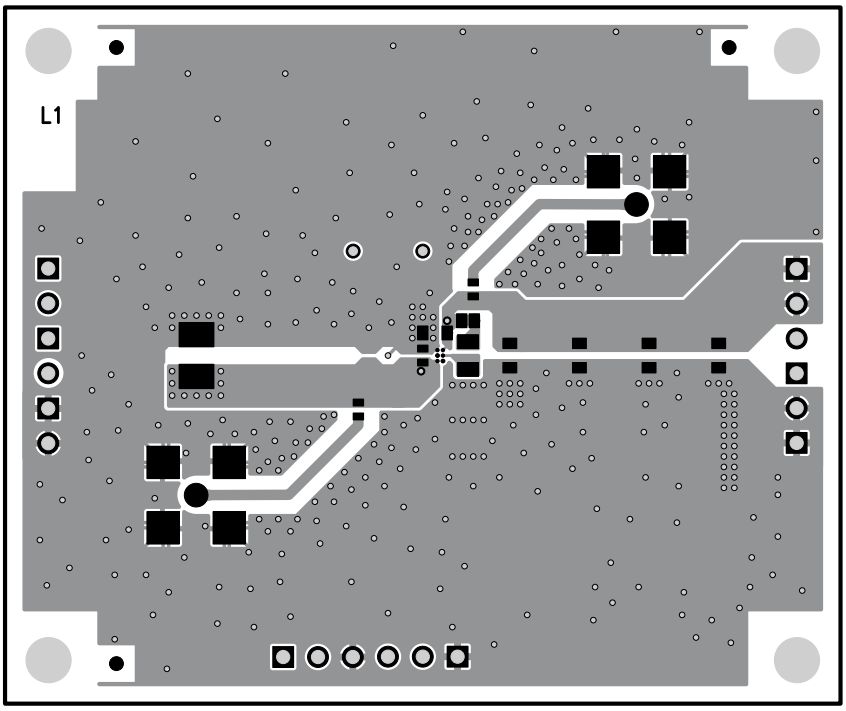

Figure 11. TPS62690/1/2/3EVM Top-Side Copper (Top View)

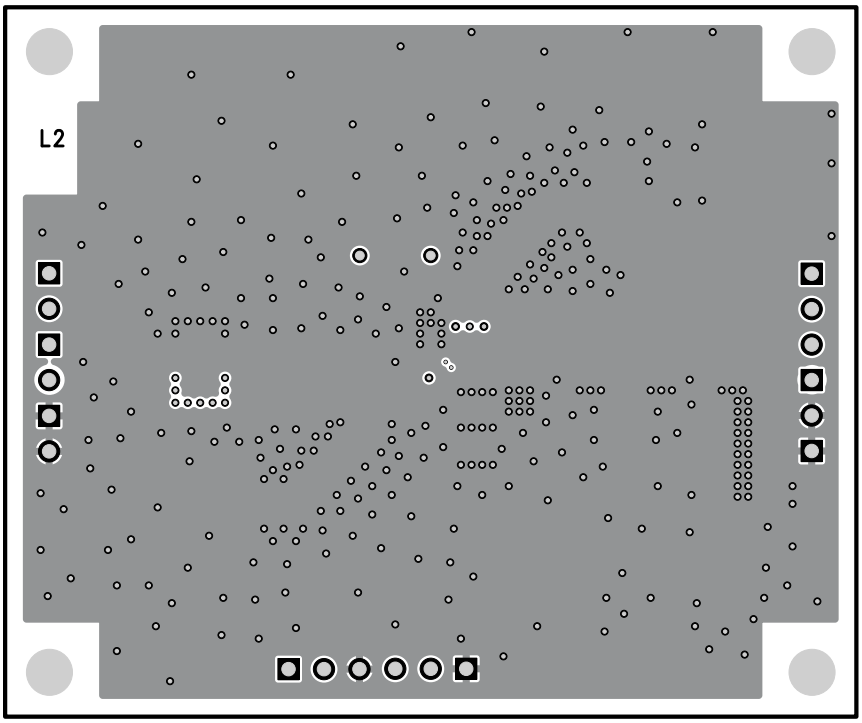

Figure 12. TPS62690/1/2/3EVM L2-Side Copper

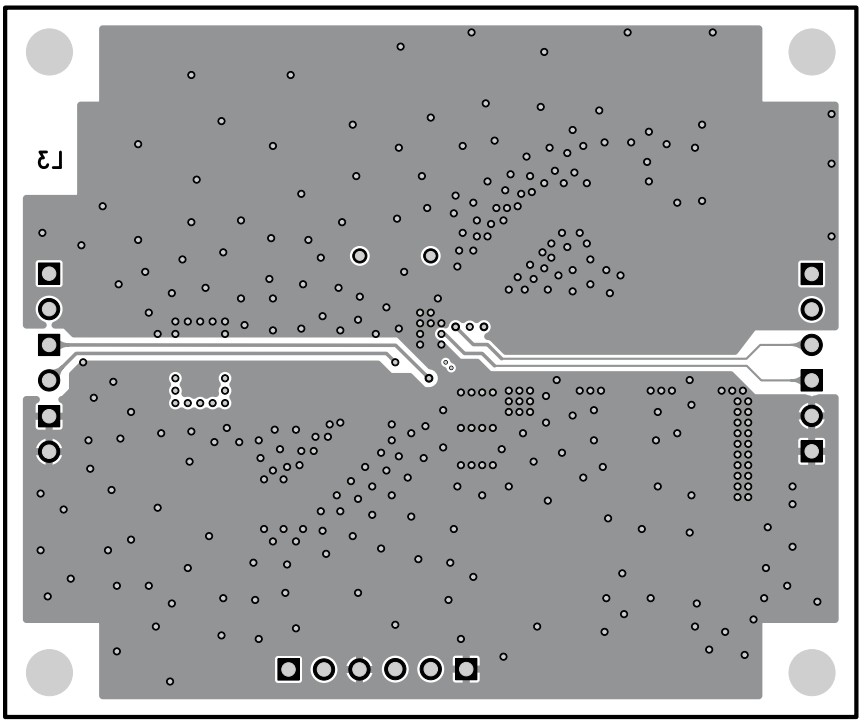

Figure 13. TPS62690/1/2/3EVM L3-Side Copper

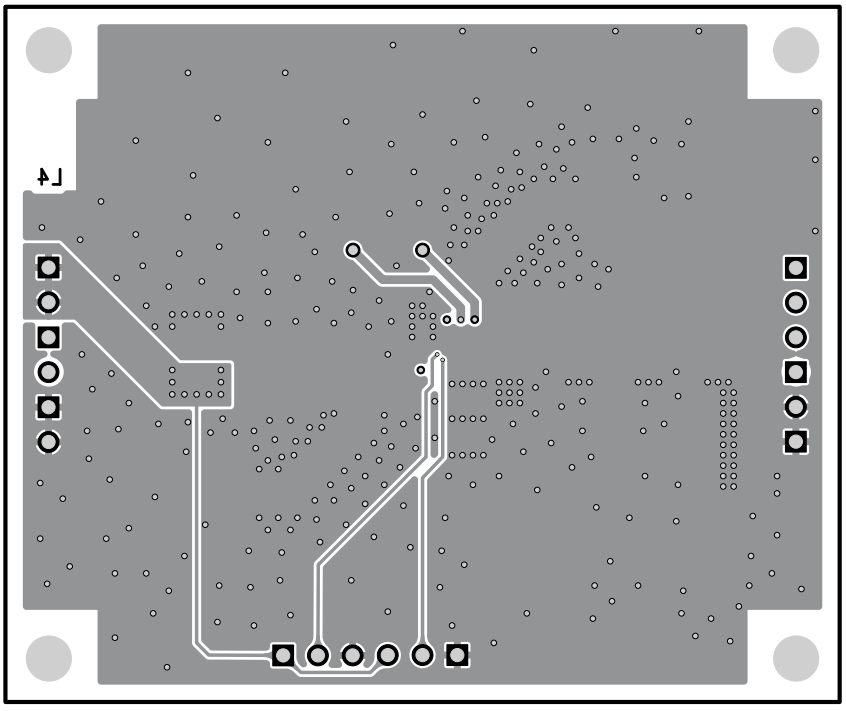

Figure 14. TPS62690/1/2/3EVM Bottom-Side Copper (Bottom View)

7 TPS62690/1/2/3EVM Bill of Material

Table 2 lists the bill of materials for the TPS6269xEVM.

Table 2. Bill of Material for the TPS62690/1/2/3EVM

TPS62690	TPS62691	TPS62692	TPS62693					
Qty	Qty	Qty	Qty	RefDes	Value	Size	Description	Part Number
1	1	1	1	C2(1)	4.7 µF	402	Capacitor, Ceramic, 6.3 V, X5R, 20%	GRM155R60J475M
1	1	1	1	C3(1)	10 µF	603	Capacitor, Ceramic, 6.3 V, X5R, 20%	GRM188R60J106ME84
4	4	4	4	C4, C5, C7, C8	Open	603	Capacitor, Ceramic	STD
1	1	1	1	C1	150 µF	0.110 x 0.215 in	Capacitor, Tantalum Poly, 6.3 V, 70 mΩ, 20%	T520B157M006ATE070
1	1	1	1	L1(1)	1 µH	2012	Inductor, SMT, 0.9 A, 180 mΩ	MDT2012-CH1R0A
2	2	2	2	R1, R2	49.9 Ω	402	Resistor, Chip, 1/16 W, 1%	STD
1	0	0	0	U1	TPS62690YFF	WCSP-6	IC, 2.85-V, 500-mA, 4-MHz Synchronous Step-Down Converter	TPS62690YFF
0	1	0	0	U1	TPS62691YFF	WCSP-6	IC, 2.2-V, 600-mA, 4-MHz Synchronous Step-Down Converter	TPS62691YFF
0	0	1	0	U1	TPS62692YFF	WCSP-6	IC, 2.85-V, 800-mA, 3-MHz Synchronous Step-Down Converter	TPS62692YFF
0	0	0	1	U1	TPS62693YFF	WCSP-6	IC, 2.2-V, 800-mA, 3-MHz Synchronous Step-Down Converter	TPS62693YFF

(1) These are recommended but can be replaced with specified parts listed in the datasheet.

8 Marking Information for this EVM

Table 3. Marking Information

Assembly Number	Marking Text
PWR076-001	TPS62690EVM-076
PWR076-002	TPS62691EVM-076
PWR076-003	TPS62692EVM-076
PWR076-004	TPS62693EVM-076

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EVM Warnings and Restrictions

It is important to operate this EVM within the input voltage range of 2.3 V to 4.8 V and the output voltage range of fixed 2.2 V ('691) to fixed 2.85 V ('690) .

Exceeding the specified input range may cause unexpected operation and/or irreversible damage to the EVM. If there are questions concerning the input range, please contact a TI field representative prior to connecting the input power.

Applying loads outside of the specified output range may result in unintended operation and/or possible permanent damage to the EVM. Please consult the EVM User's 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, some circuit components may have case temperatures greater than 60° C. The EVM is designed to operate properly with certain components above 60° C as long as the input and output ranges are maintained. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors. These types of devices can be identified using the EVM schematic located in the EVM User's Guide. When placing measurement probes near these devices during operation, please be aware that these devices may be very warm to the touch.

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