TPS61252 Evaluation Module

This user's guide describes the characteristics, operation, and use of the TPS61252 evaluation module (EVM). This EVM contains the Texas Instruments 3.25 MHz, up to 6.5 V, step-up DC-DC converter TPS61252 with an adjustable input current limit. The user's guide includes EVM specifications, recommended test setup, the schematic diagram, bill of materials, the board layout, and test data.

CAUTION

Please be aware that the input current is limited to 500 mA on this EVM. For maximum output current operation remove R3 and connect ILIM to VIN.

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1 Introduction

The TPS61252 device provides a power supply solution for products powered by either a three-cell alkaline, NiCd or NiMH battery, or a one-cell Li-Ion or Li-polymer battery. The wide input voltage range is ideal to power portable applications like mobile phones or computer peripherals. The device has a resistor programmable (RILIM) input current limit and is suitable for a wide variety of applications.

1.1 Requirements

The TPS61252 EVM is designed to operate over the full input voltage range and produces an output voltage of 5.0 V. The output voltage can be adjusted by changing the feedback resistor divider network.

In order to operate this EVM, only a DC power supply capable of delivering between 2.3 V and 6.0 V at up to 500 mA is necessary.

1.2 Applications

- USB Host Supplies from a Single Li-Ion Battery
- Current Limited Applications
- Li-Ion Applications
- Audio Applications
- RF-PA Buffers

1.3 Features

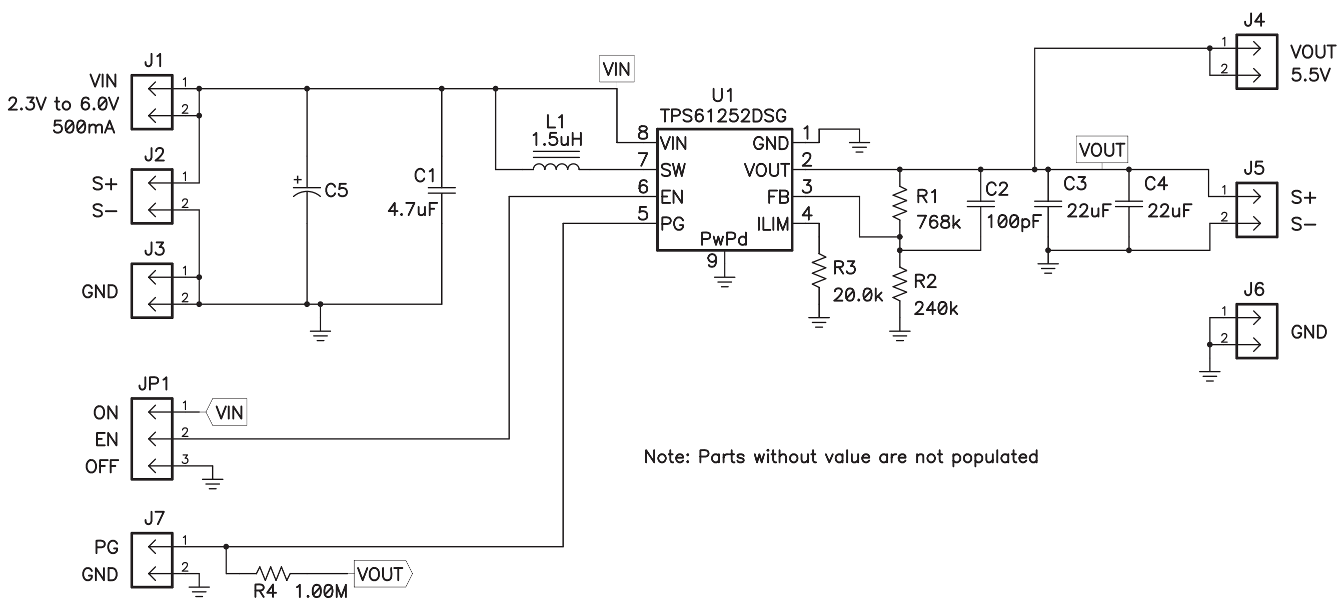
- Resistor Programmable Input Current Limit
  - ±20% Current Accuracy at 500 mA over Full Temperature Range
  - Programmable from 100 mA up to 1500 mA
- Up to 92% Efficiency
- V_{IN} Range from 2.3 V to 6.0 V
- Power Good Indicates the Appropriate Output Voltage Level
- Adjustable Output Voltage up to 6.5 V
- 100% Duty-Cycle Mode When $V_{IN} > V_{OUT}$
- Load Disconnect and Reverse Current Protection
- Double-sided, two-active-layer PCB with all components on top side
- Active converter area of approximately 60 mm^2

2 TPS61252 EVM Electrical Performance Specifications

Table 1. TPS61252 EVM Electrical and Performance Specifications

Parameter		Notes & Conditions	Min	Typ	Max	Unit
Input Characteristics						
V_{IN}	Input Voltage		2.3		6.0	V
I_{IN}	Average Input Current		400	500	600	mA
	No Load Input Current				1	mA
V_{IN_UVLO}	Input UVLO	Falling		2.0	2.1	V
Output Characteristics						
V_{OUT}	Output Voltage	V_{IN} = 3.6 V, I_{OUT} = 300 mA	4.9	4.99	5.1	V
	Line Regulation	V_{IN} = 2.3 V to 6.0 V		0.5%		
	Load Regulation	I_{OUT} = 0 mA to 300 mA		0.5%		
$V_{OUTripple}$	Output Voltage Ripple	V_{IN} = 3.6 V, I_{OUT} = 330 mA			50	mVpp
I_{OUT}	Output Current	V_{IN} = 3.6 V			330	mA
Systems Characteristics						
f	Switching Frequency			3.25		MHz
η_{pk}	Peak Efficiency	V_{IN} = 3.6 V		92%		
η	Full Load Efficiency	V_{IN} = 3.6 V, I_{OUT} = 330 mA		90%		

3 TPS61252 EVM Schematic



For Reference Only, See Table 2 for Specific Values

Figure 1. TPS61252 EVM Schematic

4 Connector and Test Point Descriptions

4.1 Input Connectors

4.1.1 J1 – VIN

This header is the positive connection to the input power supply. The power supply must be connected between these pins and J3 (GND). Twist the leads to the input supply and keep them as short as possible. The input voltage has to be between 2.3 V and 6.0 V.

4.1.2 J2 – Input Sense Connector

This header is intended to measure the input voltage directly on the input capacitor. Therefore, a 4-wire power and sense supply can be connected. Twist the leads to the sensing connector.

4.1.3 J3 –GND

This header is the return connection to the input power supply. Connect the power supply between these pins and J1 (VIN). Twist the leads to the input supply and keep them as short as possible. The input voltage must be between 2.3 V and 6.0 V.

4.2 Output Connectors

4.2.1 J4 – VOUT

This header is the positive connection of the output voltage. Connect the load between these pins and J6 (GND).

4.2.2 J5 – Output Sense Connector

This header is intended to measure the output voltage directly on the output capacitors.

4.2.3 J6 – GND

This header is the return connection of the output voltage. Connect the load between these pins and J4 (VOUT).

4.3 Other Connectors

4.3.1 J7 – Power Good Connector

The Power Good Output (PG) of the IC is an open-drain output and there is a 1 MΩ resistor connected between PG and VOUT. Pin 1 of this connector is connected to PG and Pin2 is connected to GND.

4.4 Jumpers

4.4.1 JP1 – Enable Jumper

Placing a jumper across pins EN and ON ties the EN pin to VIN, thereby enabling the device. Placing a jumper across pins EN and OFF ties the EN pin to GND, which disables the device.

5 TPS61252 EVM Test Data

Figure 5 through Figure 11 present typical performance curves for the TPS61252 EVM. Since actual performance data can be affected by measurement techniques and environmental variables, these curves are presented for reference and may differ from actual field measurements.

5.1 Efficiency

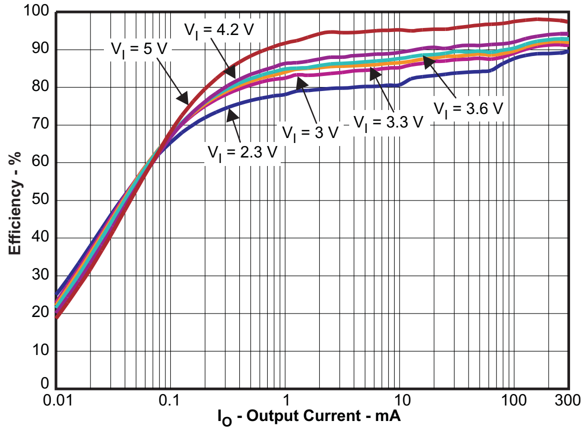


Figure 2. TPS61252 EVM Efficiency vs Load Current

5.2 Line and Load Regulation

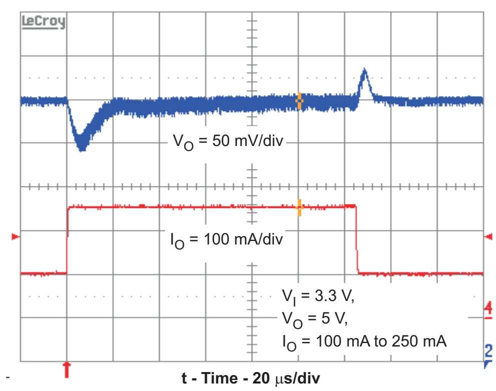


Figure 3. TPS61252 EVM Load Transient Response Continuous Conduction Mode

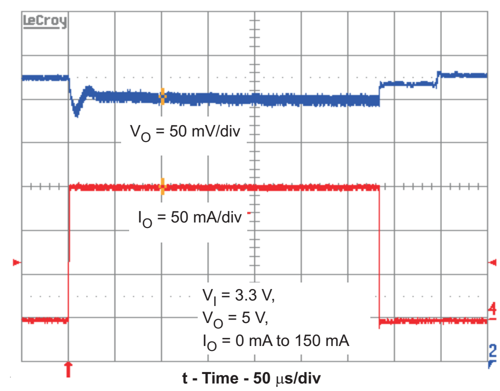


Figure 4. TPS61252 EVM Load Transient Response with Mode Change, Snooze Mode to Pulse Frequency Mode

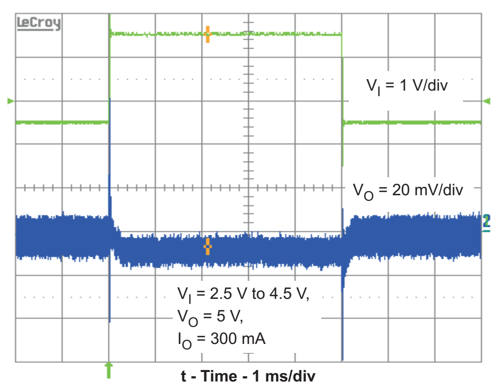


Figure 5. TPS61252 EVM Line Transient Response

5.3 Output Voltage Ripple

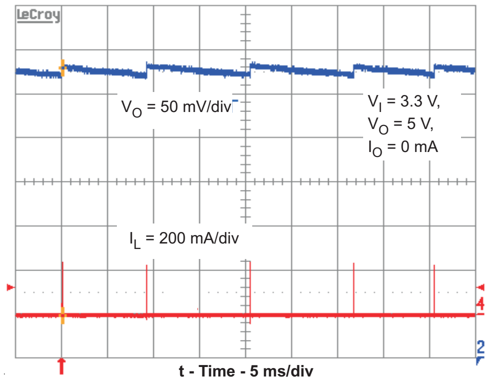


Figure 6. TPS61252 EVM Output Voltage Ripple at No Load

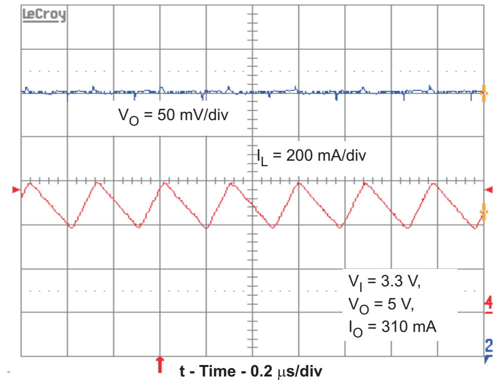


Figure 7. TPS61252 EVM Output Voltage Ripple at Load Limit

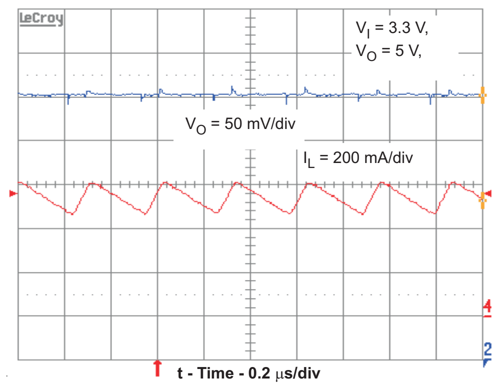


Figure 8. TPS61252 EVM Output Voltage Ripple at Overload

5.4 Control Loop Bode Diagram

The stability was measured with an input voltage of 3.3 V and an output current of 244 mA. The crossover frequency of 47 kHz and the phase margin of 42° correlate with the good load transient response of the part.

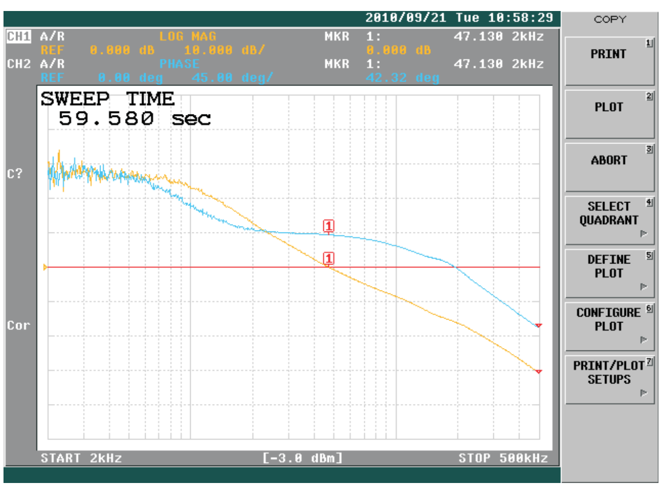


Figure 9. TPS61252 EVM Gain and Phase vs. Frequency

6 TPS61252 EVM Assembly Drawings and Layout

Figure 10 through Figure 12 show the design of the TPS61252 EVM printed circuit board. The EVM uses a 2-Layer, 1-oz copper-clad circuit board 61 mm x 51 mm with all components in a 7 mm x 11 mm active area on the top side. All active top and bottom layer traces allow easy viewing and probing for evaluating the TPS61252 control IC in a practical double-sided application. Moving components to both sides of the PCB, or using additional internal layers, can offer additional size reduction for space-constrained systems.

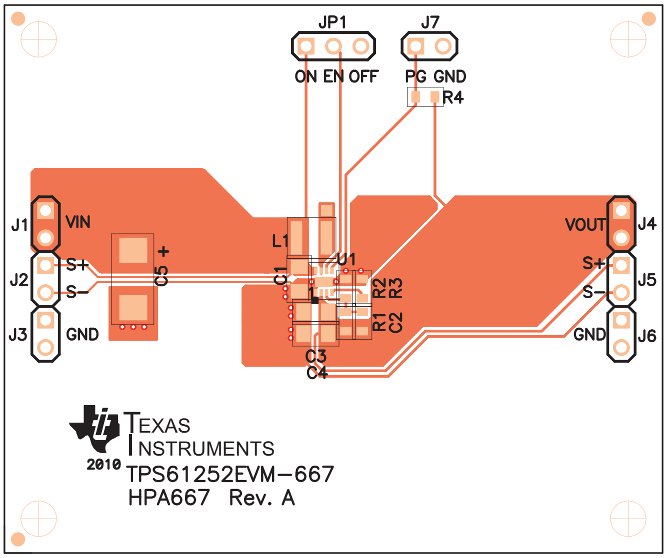


Figure 10. TPS61252 EVM Component Placement (Viewed from Top)

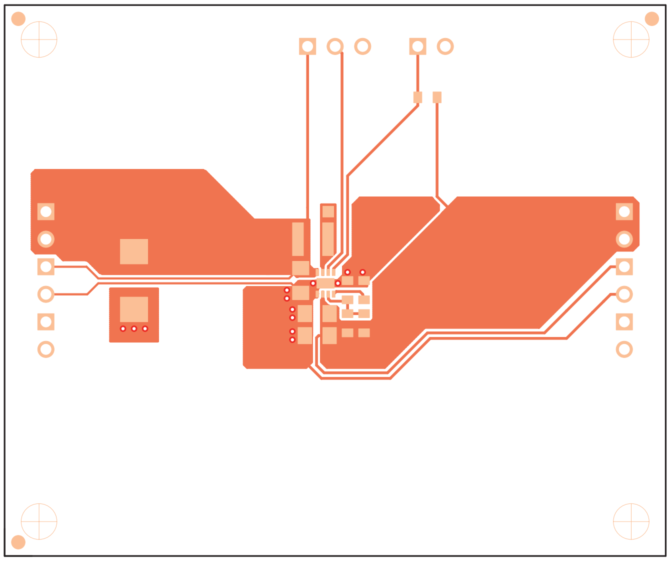


Figure 11. TPS61252 EVM Top Copper (Viewed from Top)

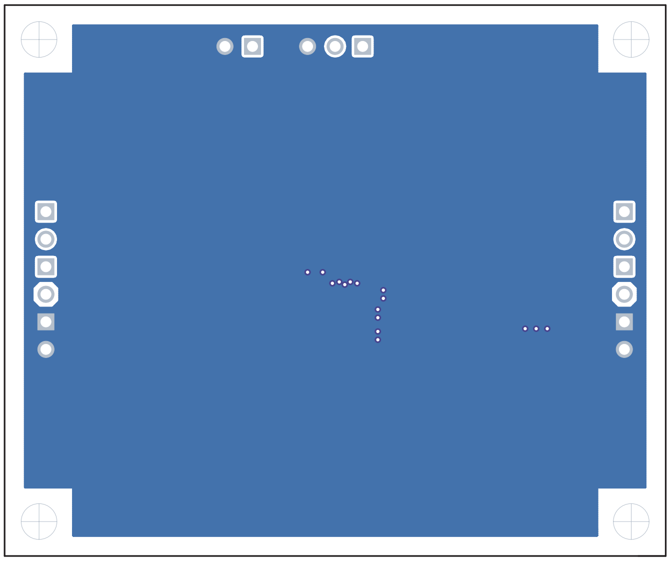


Figure 12. TPS61252 EVM Bottom Copper (Viewed from Bottom)

7 List of Materials

Table 2 lists the EVM components as configured according to the schematic shown in Figure 1.

Table 2. TPS61252 EVM Bill of Materials

Count	RefDes	Value	Description	Size	Part Number	MFR
1	C1	4.7 µF	Capacitor, Ceramic, 10V, X7R, 10%	0805	GRM21BR71A475KA73	Murata
1	C2	100pF	Capacitor, Ceramic, 50V, X7R, 10%	0603	STD	STD
2	C3, C4	22 µF	Capacitor, Ceramic, 6.3V, X5R, 20%	0805	GRM21BR61A226ME51	Murata
0	C5	open	Capacitor, Aluminum	6032 (C)	STD	STD
1	L1	1.5 µH	Inductor, SMT, 2.2A, 72milliohm	0.118 X 0.118 inch	XFL3012-152ME	Coilcraft
1	R1	768k	Resistor, Chip, 1/16W, 1%	0603	STD	STD
1	R2	240k	Resistor, Chip, 1/16W, 1%	0603	STD	STD
1	R3	20.0k	Resistor, Chip, 1/16W, 1%	0603	STD	STD
1	R4	1.00M	Resistor, Chip, 1/16W, 1%	0603	STD	STD
1	U1	TPS61252DSG	IC, High Frequency Step-Up Converter, Variable Vout	QFN	TPS61252DSG	TI

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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 6 V and the output voltage range of 3.0 V to 6.5 V .

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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