TPS65133 Evaluation Module

This user's guide describes the characteristics, operation, and use of the TPS65133 evaluation module (EVM). This EVM contains TI's dual-output power supply IC TPS65133 with an output voltage of ±5 V and a minimum output current capability of 250 mA on both outputs. The user's guide includes EVM specifications, the recommended test setup, the schematic diagram, the bill of materials, and the board layouts.

All typical characteristics measurements in the TPS65133 datasheet (SLVSC01) were done with this evaluation module.

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1 Introduction

TI's TPS65133 evaluation module (EVM) uses a TPS65133 to support dual power supply applications requiring ±5 V. The goal of the EVM is to facilitate evaluation of the TPS65133 dual-output power supply IC. Each output can supply up to 250 mA. The input supply voltage range of 2.9 V to 5 V is suitable for use with Lithium-ion batteries or for 3.3-V supplies.

1.1 Requirements

The output voltages, VPOS and VNEG, are fixed at ±5 V. All components and connectors for the test of the part are supplied on the EVM.

In order to operate this EVM, only a DC power supply capable of delivering between 2.9 V and 5 V at up to 1.2 A is necessary. The EVM is fully functional with just a power supply connected.

1.2 Applications

- LCD bias
- AMOLED supplies
- Operational amplifier supplies
- Headphone amplifier supplies
- Sensor front-end supplies
- Data acquisition supplies
- General ±5-V power supplies

1.3 Features

- Fixed 5-V positive output voltage (V_{POS})
- Fixed –5-V negative output voltage (V_{NEG})
- ±1-% Output voltage accuracy
- 250-mA Output current capability
- Excellent line and load transient response
- Operates in continuous conduction mode to minimize output noise
- Boost converter able to operate with input supply voltages close to 5 V
- 2.9-V to 5-V Input voltage range
- Short-circuit protection
- Thermal shutdown
- Active components area just 5.5 mm x 10.2 mm
- Double-sided, two-active-layer PCB with all components on top side

2 TPS65133 EVM Electrical and Performance Specifications

Table 1. TPS65133 EVM Electrical and Performance Specifications

Parameter		Notes and Conditions	Min	Typ	Max	Unit
Input Characteristics						
V_{IN}	Input voltage		2.9		5.0	V
I_{IN}	Input current(1)	V_{IN} = 3.7 V, I_{OUT} = 250 mA		763		mA
	No-load input current	V_{IN} = 3.7 V, I_{POS} = I_{NEG} = 0 mA		9.6	12.6	mA
Output Characteristics						
V_{POS}	Positive output voltage	V_{IN} = 3.7 V, I_{POS} = 0 mA	4.95	5.0	5.05	V
	Line regulation V_{POS}	V_{IN} = 2.9 V to 5 V, I_{POS} = 100 mA		-1		mV
	Load regulation V_{POS}	I_{POS} = 0 mA to 250 mA, V_{IN} = 3.7 V		-4.5		mV
	Output voltage ripple V_{POS}	V_{IN} = 3.7 V, I_{OUT} = 250 mA		15	20	mV_{PP}
V_{NEG}	Default negative output voltage	V_{IN} = 3.7 V, I_{NEG} = 0 mA	–5.05	–5.0	–5.05	V
	Line regulation V_{NEG}	V_{IN} = 2.9 V to 5 V, I_{NEG} = –100 mA		0.5		mV
	Load regulation V_{NEG}	I_{NEG} = 0 mA to 250 mA, V_{IN} = 3.7 V		3		mV
	Output voltage ripple V_{NEG}	V_{IN} = 3.7 V, I_{OUT} = 250 mA		20	30	mV_{PP}
System Characteristics						
	Switching frequency			1.7		MHz
	Peak efficiency	V_{IN} = 3.7 V, I_{OUT} = 100 mA		92%		

(1) I_{OUT} means that the load is connected from V_{POS} to V_{NEG}.

3 TPS65133 EVM Schematic

Figure 1 is for reference only; see the bill of materials in Table 2 for specific values.

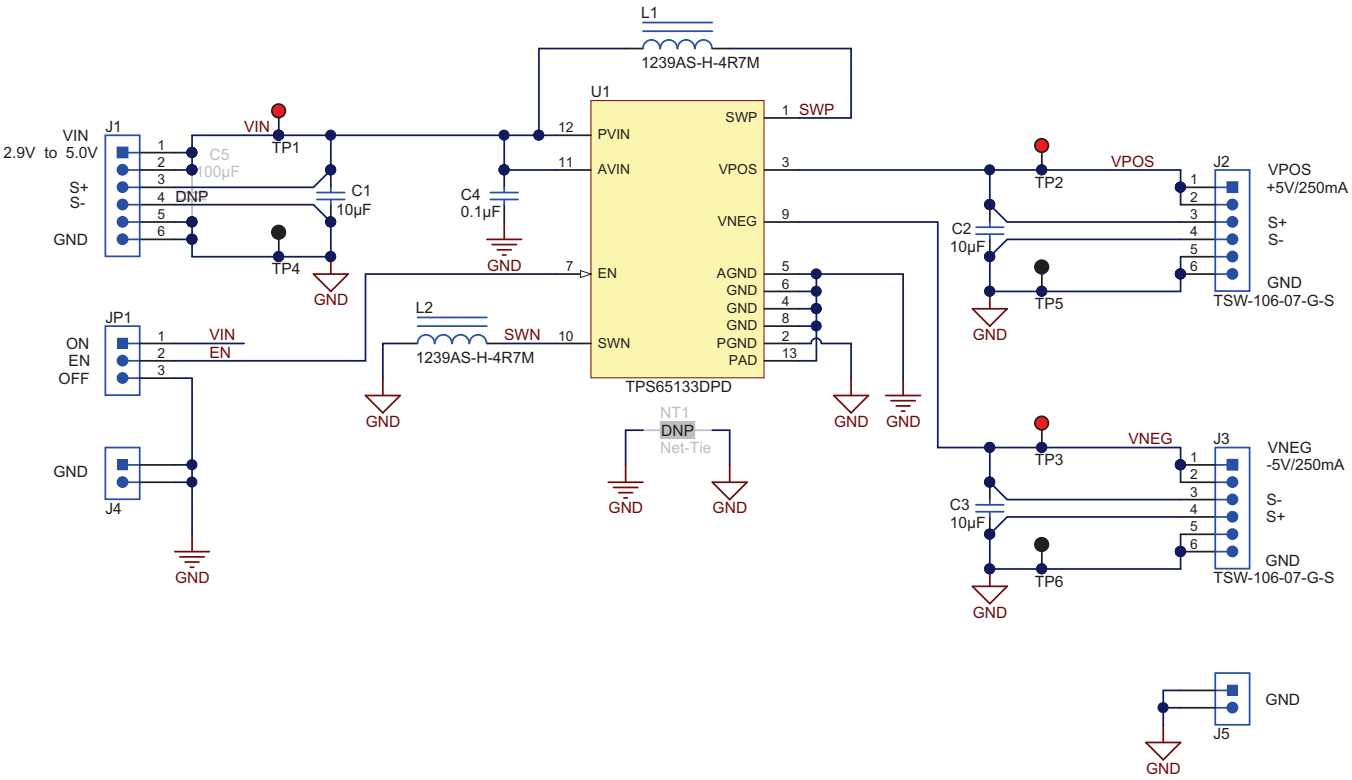

Figure 1. TPS65133 EVM Schematic

4 Connector and Test Point Descriptions

4.1 Input Connector

4.1.1 J1 – VIN, Input Sense and GND Connector

This header is the connection to the input power supply as well as its sense connection. The power supply must be connected between pins 1 and 2 (VIN) and pins 5 and 6 (GND). Twist the leads to the input supply and keep them as short as possible. The input voltage has to be between 2.9 V and 5 V.

Capacitor C5 close to this connector can be used to compensate the impedance of the leads.

The middle 2 pins of this header are 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.

4.2 Output Connectors

4.2.1 J2 – VPOS, VPOS Output Sense and GND Connector

This header is the connection of the output voltage of the boost converter as well as its sense connection. Connect the boost converter's load between pins 1 and 2 (VPOS) and pins 5 and 6 (GND).

The middle 2 pins of this header are intended to measure the output voltage of the boost converter directly on the output capacitors.

4.2.2 J3 – VNEG, VNEG Output Sense and GND Connector

This header is the connection of the output voltage of the negative buck-boost converter as well as its sense connection. Connect the charge pump's load between pins 1 and 2 (VNEG) and pins 5 and 6 (GND).

The middle 2 pins of this header are intended to measure the output voltage of the charge pump directly on the output capacitors.

4.3 Additional Jumpers and Connectors

4.3.1 JP1 – Enable Jumper- EN

This is the enable pin for the TPS65133. Placing a jumper across pins 2 and 3 shorts the EN pin to OFF, thereby disabling the IC. Placing a jumper across pins 1 and 2 shorts the EN pin to ON, thereby enabling the IC.

4.3.2 J4 – GND Connector

This header is connecting to the GND plane for easy GND connections during measurements.

4.3.3 J5 – AGND Connector

This header is connecting to the AGND signal for easy AGND connections during measurements.

5 Test Setup

An input power supply set between 2.9 V and 5 V must be connected between pins 1 and 2 (VIN) and pins 5 and 6 (GND) of header J1 in order for the EVM to operate. The absolute maximum input voltage is 6 V.

Connect a load resistance between the positive and negative output voltage, VPOS and VNEG; or the two output voltages, VPOS or VNEG, and GND.

Figure 2 details the connection of the power supply and the load. The connection of the load is just an example; the load(s) can also be connected between VPOS and GND, or VNEG and GND, or both.

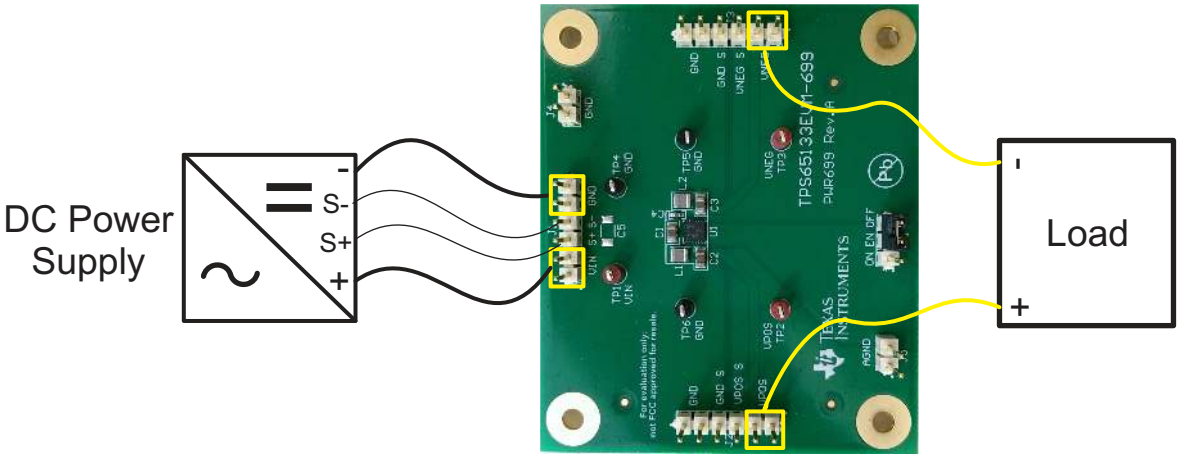

Figure 2. Connection of the Board and Load

6 TPS65133 EVM Assembly Drawings and Layout

Figure 3 through Figure 5 show the design of the TPS65133 EVM printed-circuit board (PCB). The EVM has been designed using a two-layer, 35-µm (1 oz), copper-clad circuit board. All components are on the top side, and all active traces on the top and bottom layers allow the user to easily view, probe, and evaluate the TPS65133 control IC. Moving components to both sides of the PCB can offer additional size reduction for space-constrained systems.

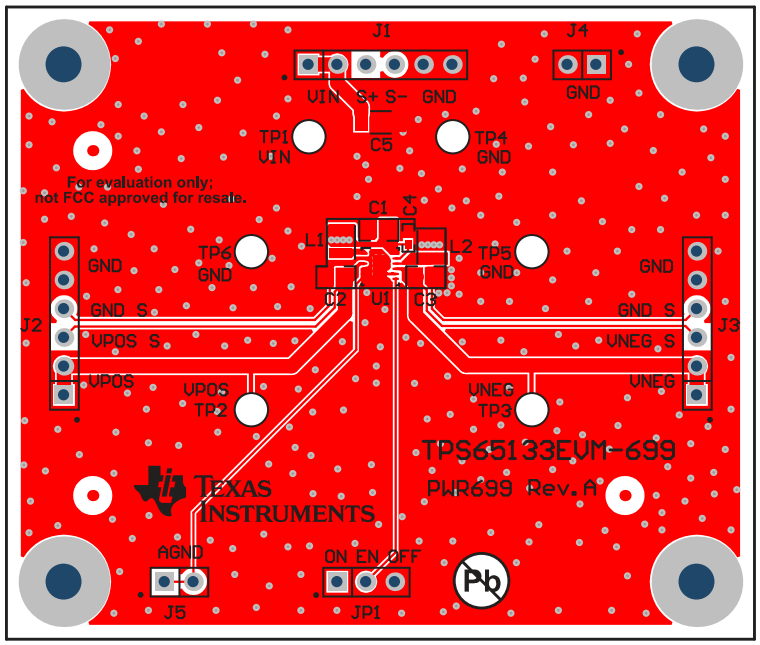

Figure 3. TPS65133 EVM Component Placement, Viewed from Top

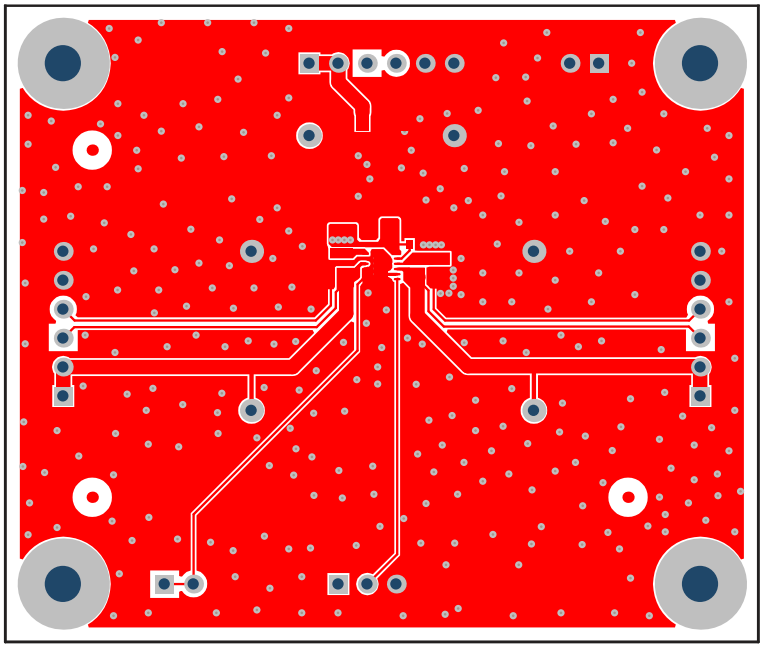

Figure 4. TPS65133 EVM Top Copper, Viewed from Top

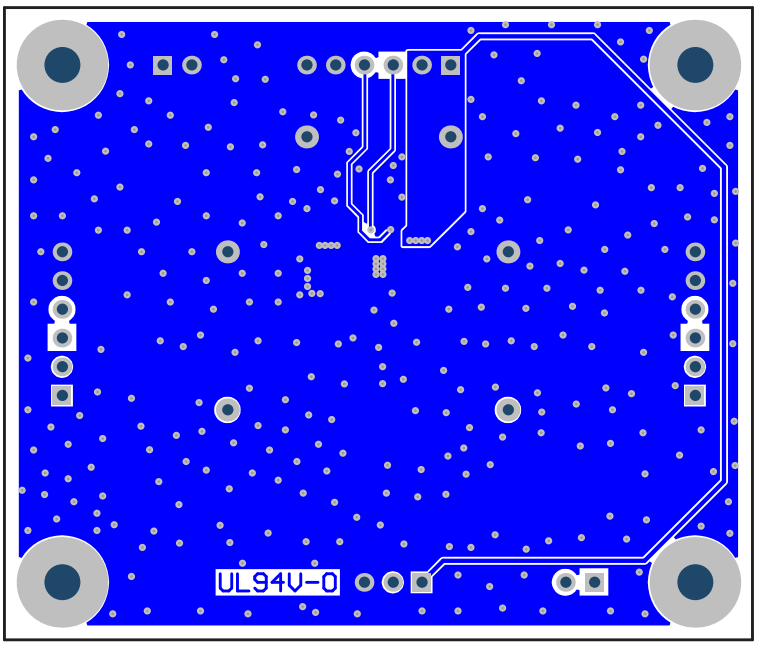

Figure 5. TPS65133 EVM Bottom Copper, Viewed from Bottom

7 List of Materials

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

Table 2. TPS65133 EVM Bill of Materials(1)

Designator	QTY	Value	Description	Package Reference	Part Number	Manufacturer
C1, C2, C3	3	10 µF	CAP, CERM, 10 µF, 10 V, +/-10%, X5R, 0805	0805	GRM219R61A106KE44D	Murata
C4	1	0.1 µF	CAP, CERM, 0.1 µF, 16 V, +/- 10%, X7R, 0402	0402	GRM155R71C104KA88D	Murata
L1, L2	2	4.7 µH	Inductor, Shielded, Ferrite, 4.7 µH, 1.3 A, 0.2 Ω, SMD	2.5x1.2x2mm	1239AS-H-4R7M	Toko
U1	1		±5-V, 250-mA, Dual-Output Power Supply	DPD0012A	TPS65133DPD	Texas Instruments

(1) All parts may be substituted with equivalents.

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- *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.*

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