TS3300 Demo Board

A 0.6-4.5VIN, 1.8-5.25VOUT, 3.5µA, Low Input Voltage, High-Efficiency Boost + LDO

FEATURES

- Boost Regulator
  - Input Voltage: 0.6V- 4.5V
  - Output Voltage: 3V
  - Shutdown Control Jumper
  - Coilcraft 10µH Inductor (LPS4018-103ML)
  - Resistor Pad Available for Anti-Crush™ Voltage Setting
- LDO
  - Output Voltage: 1.8V
  - Shutdown Control Jumper
  - Switch/FET Enable Jumper

COMPONENT LIST

DESIGNATION	QTY	DESCRIPTION
L1	1	10µH ±20% Shielded Inductor (4mmx4mm), LPS4018-103ML
C1, C4	2	22µF ±10% capacitor (1206), 445-8035-6-ND
C2, C3, C7	3	3.3nF ±10% capacitor (0603), 445-5084-2-ND
C5	1	10µF ±10% capacitor (0805), 445-1371-2-ND
R1, R6	2	1.37MΩ ± 1% (0805), 311-1.37MCRTR-ND
R3, R4	2	6.81MΩ ± 1% (0805), 311-6.81MCRTR-ND
R5	1	2.61MΩ ± 1% (0805), 541-2.61MCTR-ND
U1	1	TS3300
BOOST,BOOST_OUT, REG_OUT, GND (2)	5	Test points
J1, J2, J3	3	Jumper

DESCRIPTION

The demo board for the TS3300 is a completely assembled and tested circuit board that can be used for evaluating the TS3300. The TS3300 is a first generation Touchstone Semi power management product that combines a high-efficiency boost regulator and a low dropout linear regulator (LDO) in one package. The TS3300 LDO's input is connected to the output of the boost regulator, serving as a post-regulator for the boost.

The TS3300 includes an *anti-crush™* feature to prevent the collapse of the input voltage to the boost regulator when the input is a weak (high impedance) source. If the input voltage drops below a pre-determined voltage threshold (settable by a resistor divider), the boost regulator switching cycles are paused, effectively limiting the minimum input voltage. A pull-down resistor pad is available in order to set the *anti-crush™* voltage.

The TS3300 boost regulator is set to an output voltage of 3V while the LDO is set to an output voltage of 1.8V via a resistor divider circuit. The boost regulator and the LDO can be shutdown separately via a jumper. The LDO switch/FET can be fully enhanced via a jumper. The TS3300 is fully specified over the -40°C to +85°C temperature range and is available in a low-profile, thermally-enhanced 16-pin 3x3mm TQFN package with an exposed back-side paddle.

Product datasheet and additional documentation can be found on the factory web site at www.touchstonesemi.com.

ORDERING INFORMATION

Order Number	Description
TS3300DB	TS3300 Demo Board

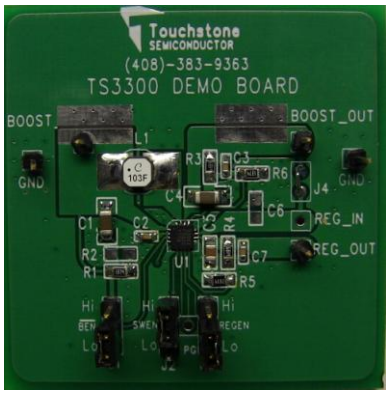

Figure 1. TS3300 Demo Board (Top View)

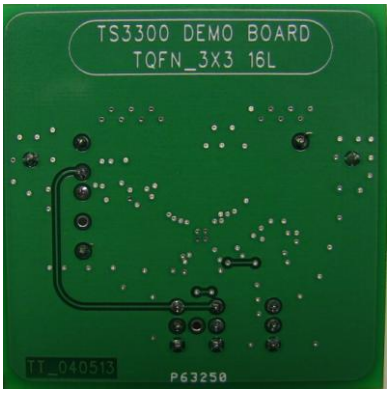

Figure 2. TS3300 Demo Board (Bottom View)

DESCRIPTION

The TS3300 boost regulator is set to an output voltage of 3V while the LDO is set to an output voltage of 1.8V via a resistor divider circuit. The boost regulator and the LDO can be shutdown separately via J1 and the combination of J2 and J3, respectively. The LDO switch/FET can be fully enhanced via the combination of J2 and J3. Refer to Table 1 and Table 2. The complete demo board circuit is shown in Figure 6.

Resistor R1 in combination with R2 create a voltage divider circuit that sets the desired *anti-crush*^{TM} voltage. The demo board does not include R2. Refer to the TS3300 product datasheet "Applications Information" section for more details.

SW EN Jumper J2	REG EN Jumper J3	CONDITION	FUNCTION
low	high	REG FB connected to R4, R5	LDO Normal Operation
		REG FB connected to BO pin (See "Quick Start Procedure", step 6)	LDO Shutdown
high	low		Internal FET Hard-on

Table 1. LDO REG EN(J3) and SW EN(J2)Settings

$\overline{\text{BEN}}$ Jumper J1	FUNCTION
low	Boost Enabled
high	Boost Shutdown

Table 2. Boost Regulator Shutdown/Enable Settings

BOOST REGULATOR OUTPUT VOLTAGE SETTING

The output voltage can be set via a voltage divider circuit as shown in Figure 3. The output feedback (BO FB) pin is 505mV. It is recommended to use large resistor values to minimize additional current draw at the output. Resistors values less than 8MΩ are recommended. Boost output voltage can be set by solving for R3 for a given R6 value in the following equation:

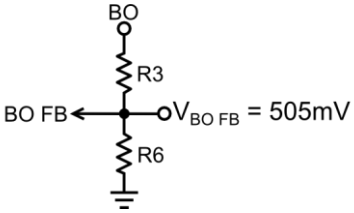

Figure 3: Setting the Boost Output Voltage with a Voltage Divider

$$R3=\frac{(V_{BO} - 0.505)R6}{0.505}$$

To set a 3V output voltage with R6 = 1.37MΩ, R3 is calculated to be 6.77MΩ. A 1% standard resistor value of 6.81MΩ is selected. This results in an output voltage of 3.02V.

LDO OUTPUT VOLTAGE SETTING

The LDO output voltage can be set independently of the boost, via a voltage divider circuit as shown in Figure 4.

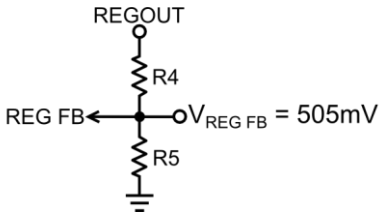

Figure 4: Setting the LDO Output Voltage with a Voltage Divider

The output feedback (REG FB) pin is 505mV. It is recommended to use large resistor values to minimize additional current drawn from the output. The LDO output voltage can be set by solving for R4 for a given R5 value in the following equation:

$$R4=\frac{(V_{REGOUT} - 0.505)R5}{0.505}$$

To set a 1.8V output voltage with R4 = 2.61MΩ, R4 is calculated to be 6.69MΩ. A 1% standard resistor value of 6.81MΩ is selected. This results in an output voltage of 1.82V.

ANTI-CRUSH^{TM} VOLTAGE SETTING

To set the *anti-crush*^{TM} voltage, a feedback pin (BI FB) in conjunction with a voltage divider circuit can be implemented as shown in Figure 5. The feedback pin voltage is 392mV. It is recommended to use large resistor values to minimize additional current draw at the input.

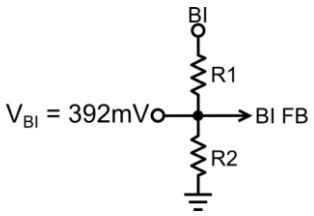

Figure 5: Setting the Anti-Crush™ Voltage with a Voltage Divider

Using the following equation to solve for R1 for a given R2 value, the output voltage can be set:

$$R1 = \frac{(V_{ANTI\text{-}CRUSH}{}^{TM} - 0.392)R2}{0.392}$$

To set a 0.8V output voltage with R2 = 1.37MΩ, R1 is calculated to be 1.42MΩ. A 1% standard resistor value of 1.37MΩ is selected. This results in an anti-crush voltage of 784mV. The *anti-crush™* voltage is to be set above the minimum input voltage specification of the TS3300. Refer to the TS3300 product datasheet "Applications Information" section for more details.

QUICK START PROCEDURE

Required Equipment

- TS3300 Demo Board
- 1.2V Battery
- Two Digital Multimeters
- Solder Iron (for LDO shutdown only)

To evaluate the TS3300 the following steps are to be performed:

1) Connect the battery positive terminal to the test point labeled BOOST. Connect the negative terminal of the battery to the test point labeled GND.

2) To monitor the boost regulator output voltage, connect the positive terminal of the voltmeter to the test point labeled BOOST_OUT. Connect the negative terminal of the voltmeter to the test point labeled GND. The output voltage should be approximately 3.02V.

3) To monitor the LDO output voltage, connect the positive terminal of the voltmeter to the test point labeled BOOST_OUT. Connect the negative terminal of the voltmeter to the test point labeled GND. The output voltage should be approximately 1.82V.

4) To shutdown the boost regulator only, set $\overline{BEN}$ to a *high* state via jumper J1. The output will drop to approximately 1.16V.

5) To enable the LDO internal switch/FET, set SW EN to a *high* state and REG EN to a *low* state via jumper J2 and J3, respectively. The LDO output voltage should be equal to the boost output voltage.

6) To shutdown the LDO only, remove the battery. Then, remove resistor R5. Solder one side of a wire to the bottom side of capacitor C7. Now solder the other side of the wire to the BOOST_OUT test point. The LDO output voltage should be approximately 0V.

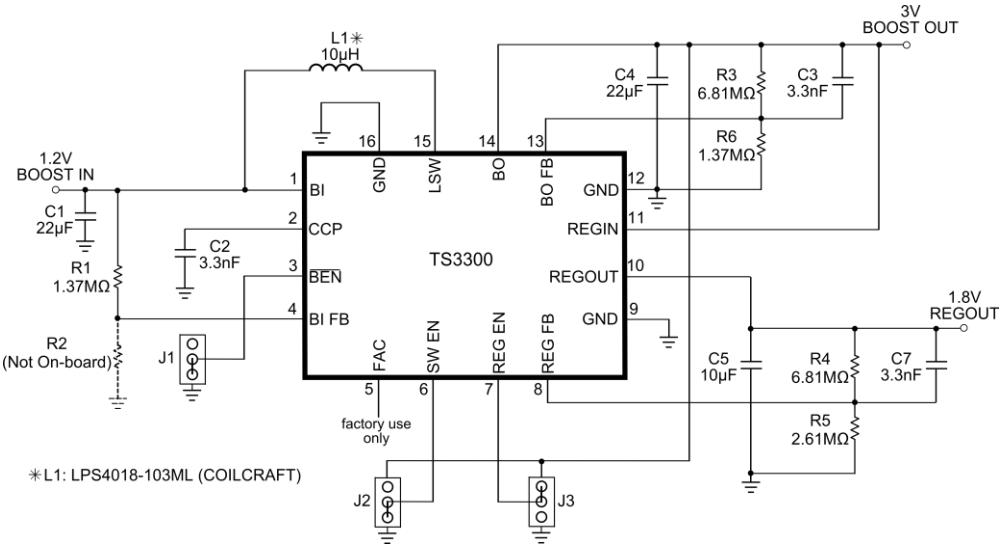

Figure 6. TS3300 Demo Board Circuit

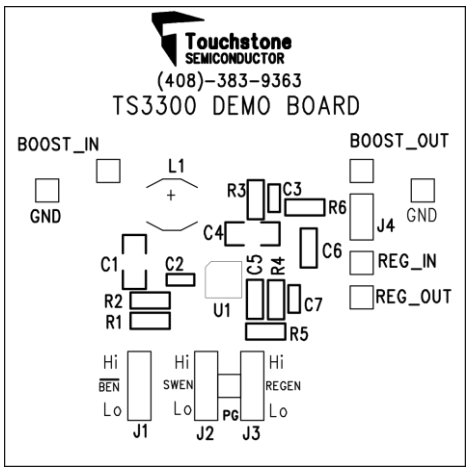

Figure 7. Top Layer View #1

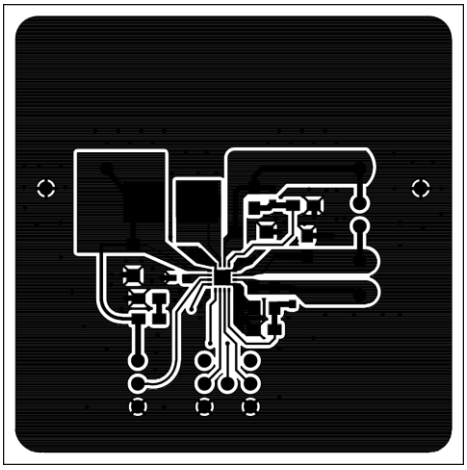

Figure 8. Top Layer View #2

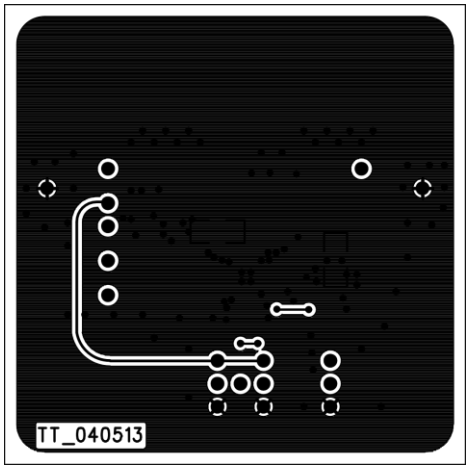

Figure 9. Bottom Layer (GND) #1

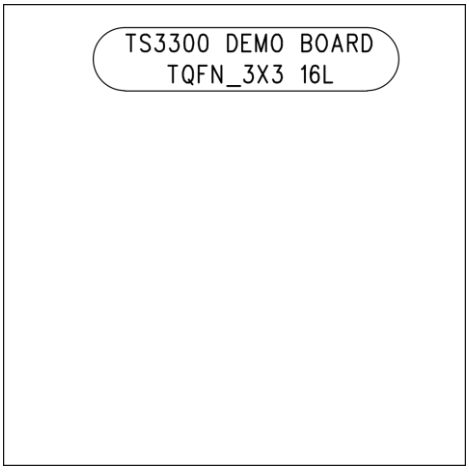

Figure 10. Bottom Layer (GND) #2