TELEFUNKEN
Semiconductors

USER MANUAL

TF6006 Evaluation Kit for 500mA, 26V Synchronous Rectified Step-Down Converter

Features

- **500mA, 3.3V output**
- **Wide input voltage range: 4.5V to 26V**
- **High full load and light load efficiency**
- **Compact 1" x 1" reference layout (Full board size is 2.5" x 1.75")**
- **0.2" headers for IN, OUT and GND connections**
- **Screw-type plug-in terminals for 0.2" headers**
- **0.1" headers for EN, SS and GND connections**
- **25V rated output capacitors for easy transition to higher output voltages**

Description

The TF6006EVK is an evaluation board designed for demonstration of all features and performance of the TF6006. The TF6006 is a monolithic synchronous buck regulator featuring integrated 500 mΩ high side & 400 mΩ low side MOSFETs that provide continuous 500mA output load current. The board operates over a wide 4.5V to 26V input voltage range while providing 3.3V fixed output voltage with very low output ripple.

The TF6006EVK is a compact 2.5" x 1.75" double-sided PCB capable of delivering power to the load with low noise and high efficiency. The board features 0.1" and 0.2" headers for easy connection to instrumentation and / or system prototypes. Its compact reference layout may easily be integrated into the prototype layouts.

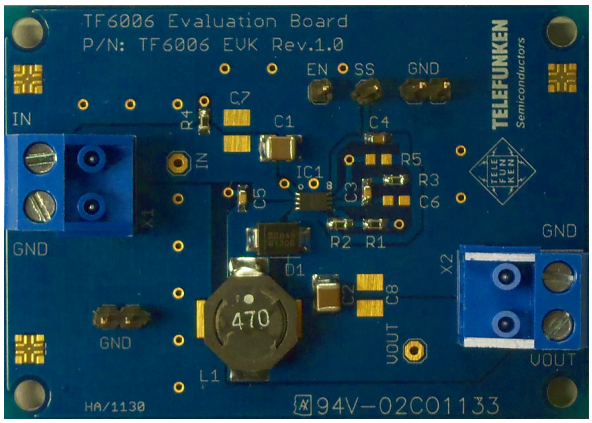
Applications

- High-Density Point-of-Load Regulators
- Distributed Power Systems
- Notebook and Netbook Computers
- Power Supplies for FPGAs, DSP Blocks and ASICs
- Set-Top Boxes
- xDSL Modems

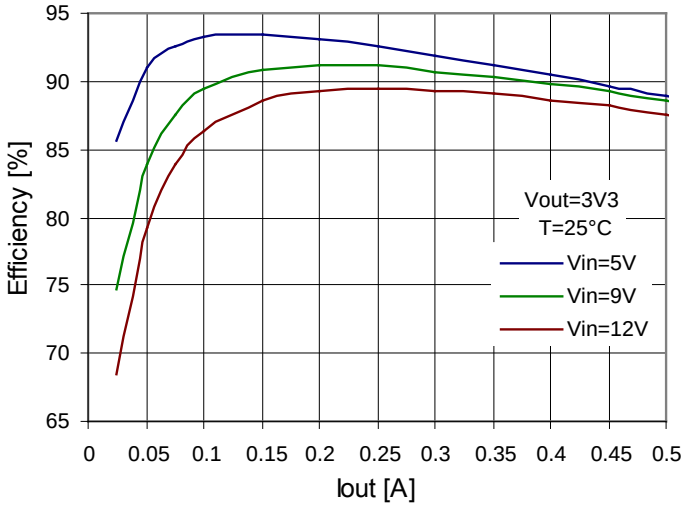
Ordering Information

PART NUMBER	MAIN IC (U1) PART NUMBER
TF6006EVK	TF6006-TAU

Evaluation Board Photo

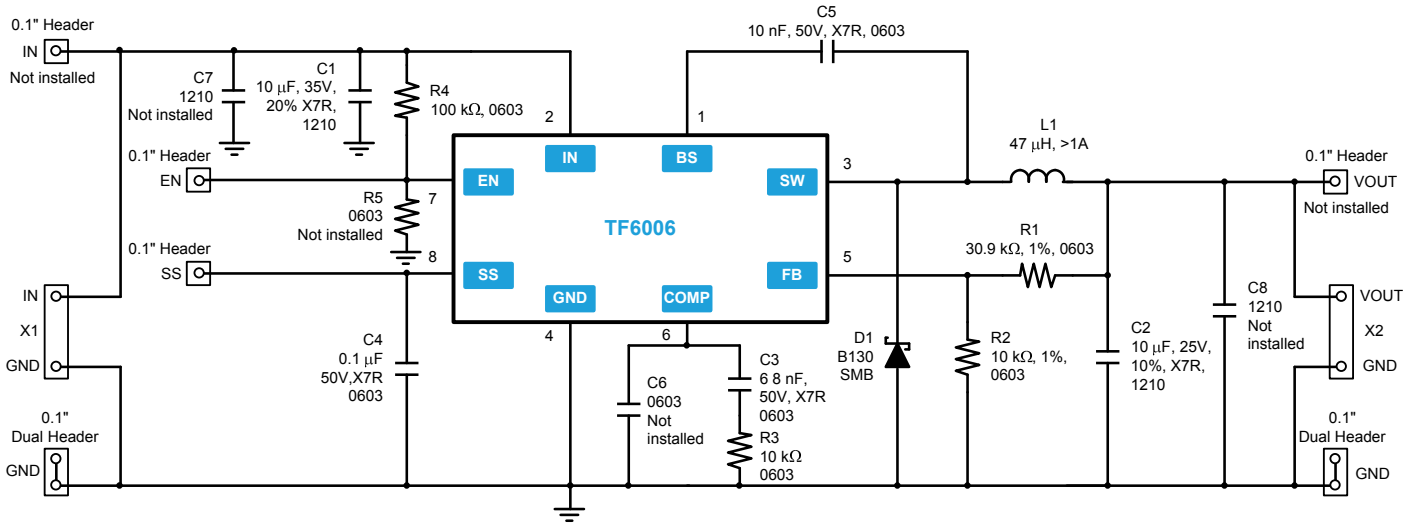


Typical Efficiency



Note: The inductor used on the TF6006EVK is a compromise between efficiency and size. If needed, especially the low load efficiency can be increased by using a coil with lower core losses.

Evaluation Board Schematic



Bill of Materials

Qty	Ref	Value	Description	Package	Manufacturer	Part Number
2	EN, SS		1-pin, 0.1" header	1x01		TSW-101-07-G-S
2	IN, VOUT		1-pin, 0.1" header, not installed	1x01		TSW-101-07-G-S
2	GND		2-pin, 0.1" header	1x02		TSW-102-07-G-S
2	X1, X2		Pin header	OSTTH02	OST	ED1660-ND
2	X1, X2		Pluggable terminal blocks	OSTTH02	OST	ED1613-ND
1	C1	10 µF	35V, X7R, 20%, ceramic capacitor	1210	Taiyo Yuden	GMK325AB7106MM-T
1	C2	10 µF	25V, X7R, 10%, ceramic capacitor	1210	Murata	GRM32DR71E106KA12L
1	C3	6.8 nF	50V, X7R, ceramic capacitor	0603	Murata	GRM188R71H682KA01D
1	C4	0.1 µF	50V, X7R, ceramic capacitor	0603	Murata	GRM188R71H104KA93D
1	C5	10 nF	50V, X7R, ceramic capacitor	0603	Murata	GRM188R71H103KA01D
0	C6	NS	Not installed	0603		
1	C7	NS	Not installed	1210		
1	C8	NS	Not installed	1210		
1	D1		30V, 1A schottky diode	SMB	Diodes Inc	B130B-13-F
1	L1	47 µH	1.65A, L_BOURNS_SRU_ALL2	10x10mm	BOURNS	SRU1038-470YCT-ND
					Alt1: Wurth	744066470
					Alt2: Taiyo Yuden	NR10050T470M
1	R1	30.9 kΩ	0.1W, 1% thick film resistor	0603	any	
1	R2	10 kΩ	0.1W, 1% thick film resistor	0603	any	
1	R3	10 kΩ	0.1W, 1% thick film resistor	0603	any	
1	R4	100 kΩ	0.1W, 1% thick film resistor	0603	any	
0	R5	NS	Not installed	0603		
1	U1		500mA Step Down Converter	TDFN-8 2x3	Telefunken	TF6006-NDP

Evaluation Board Layout

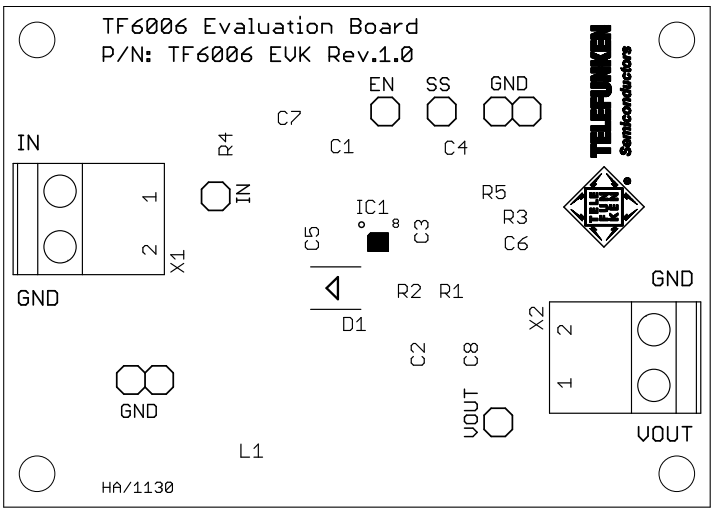


Figure 1. TF6006EVK Top Silkscreen Layer

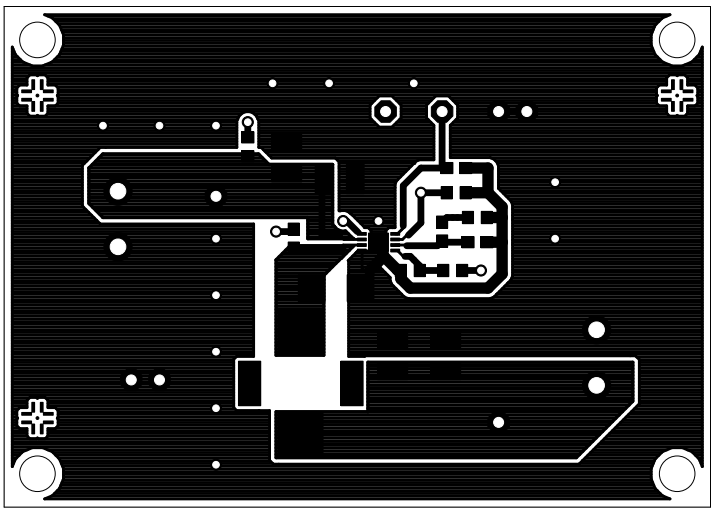


Figure 2. TF6006EVK Top Copper Layer

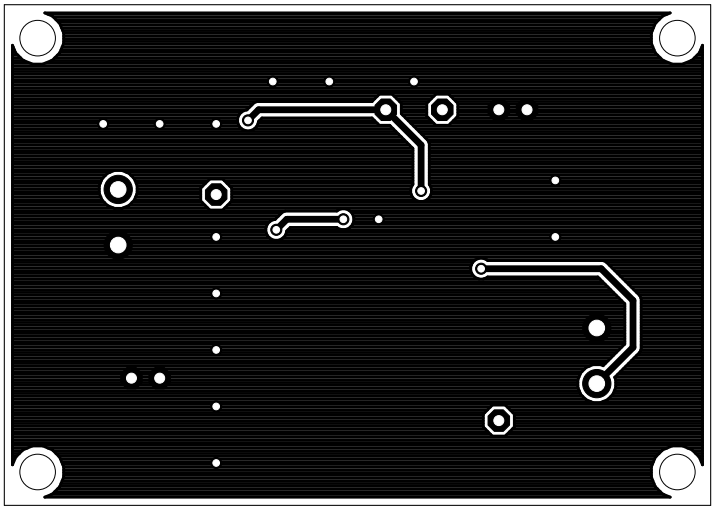


Figure 3. TF6006EVK Bottom Copper Layer

Quick Start Guide

1. Connect load terminals to the VOUT and GND pins of the X2 connector on the TF6006EVK. Keep the resistance of the connection medium (e.g. wire) at very low levels to minimize any ohmic losses.
2. Connect the IN and GND pins of the X1 connector on the TF6006EVK to the external power supply. The recommended input voltage is between 4.5V and 26V. Applying a voltage that exceeds the absolute maximum rating of the TF6006 VIN pin (28V) may damage the device. Please note that the absolute maximum voltage rating of the EN pin is 6V.
3. Use a voltmeter and / or an oscilloscope with voltage and current probes to check the operation of the TF6006.

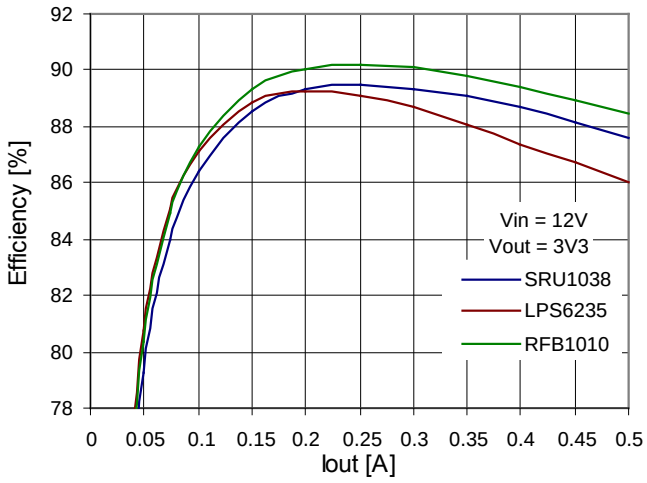


Figure 5. Efficiency measurements with different inductors

TYPICAL PERFORMANCE

Figure 4 shows typical steady state operation waveforms measured with a digital storage oscilloscope and current and voltage probes.

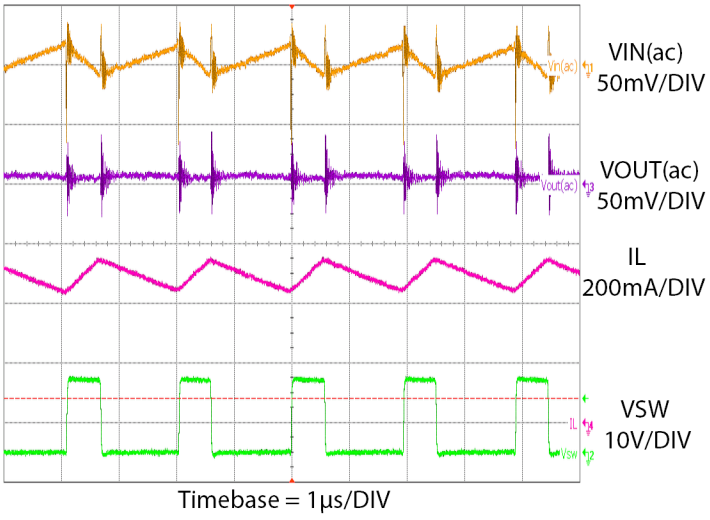


Figure 4. TF6006EVK Typical Operation

The waveforms of Figure 4 represent the TF6006EVK typical steady state operation with the input voltage of 12V and a 500mA load.

Note that the efficiency of the whole circuit is depending on the used inductor. The curves presented in Figure 5 show the typical efficiency of the TF6006EVK with different inductors for Vin = 12V at output currents of 40 to 500mA. The "SRU1038" is the Bourns indctor used for the EVK whereas the Coilcraft "LPS6235" and "RFB1010" are inductors with very low core losses and in case of the LPS6235 very small size. These low core losses help to get a better low load efficiency at the cost of space (RFB1010) or ohmic losses at high currents (LPS6235).

SETTING THE OUTPUT VOLTAGE

The TF6006EVK output is preset to 3.3V. However, it may easily be adjusted to other common values. By looking at the TF6006EVK schematic, the output voltage depends on the feedback voltage, V_{FB}, and the resistor divider network consisting of R1 and R2, as expressed with the following equation:

$$V_{OUT} = V_{FB} \bullet \frac{R_1 + R_2}{R_2}$$

The R2 resistor value may be as high as 100 kΩ, however 10 kΩ resistor value is typically recommended. Given this and the typical V_{FB} of 0.8V, the R1 resistor may easily be calculated for a desired output voltage. Table 1 exemplifies several standard resistor values needed to achieve desired output voltage. If standard resistor values are not available a parallel combination of two standard resistors may also be used.

V_{OUT} [V]	R1 [kΩ]	R2 [kΩ]
1.2	4.99	10
1.8	12.4	10
2.5	21.5	10
3.3	30.9	10
5	52.3	10
12	140	10

Table 1. Examples of Standard Value Resistors for a Desired Output Voltage

In addition to updating R1 and R2 for a different output voltage, the compensation network (C3, R3) as well as the inductor (L1) may also require additional updating. Refer to the TF6006 datasheet for calculating optimal components for the compensation network and the inductor.

Notes

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