LM25017 Isolated Buck (FlyBuck) User's Guide

1 Introduction

An isolated bias supply is implemented in this evaluation board with LM25017 Constant-On-Time regulator. LM25017 regulator integrates both the high- and low-side power switches essential for creating isolated buck converter.

Board specifications are as follows:

- Input Range: 15 V to 48 V
- Primary Output Voltage: 5 V
- Secondary (Isolated) Output Voltage: 4.5 V
- Maximum Load Current (Primary + Secondary): 600 mA
- Maximum Power Output: 3 W
- Nominal Switching Frequency: 500 kHz
- Efficiency (FIN = 24 V, IOUT2 = 300 mA): 75 %
- Board Size: 2.5 in. x 2.15 in.

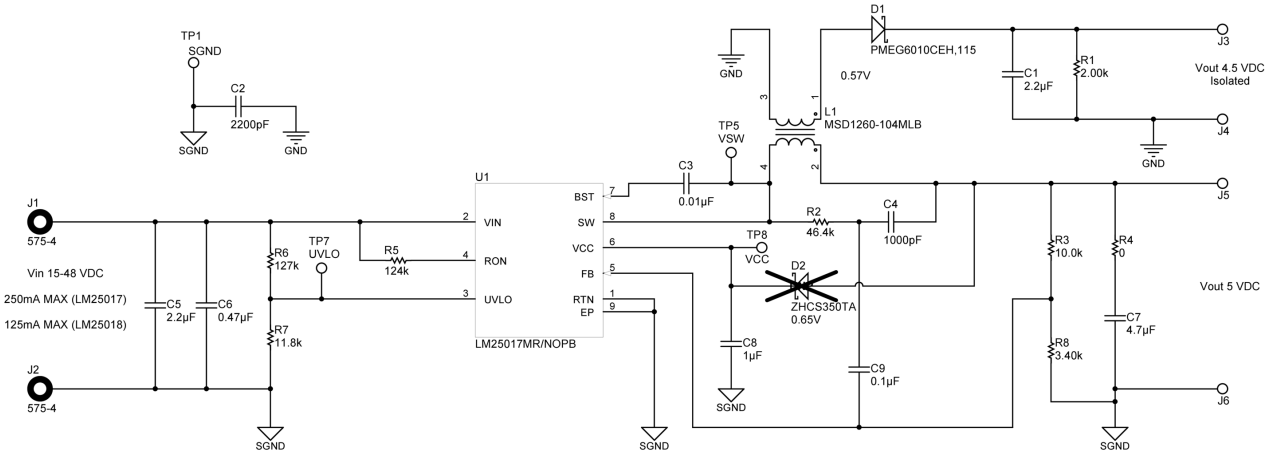

Figure 1. LM25017 Flybuck Evaluation Board Schematic

2 UVLO Threshold and Hysteresis

The UVLO resistors are selected using the following two equations:

$$V_{IN(HYS)} = I_{HYS} R_6 \quad (1)$$

and

$$V_{IN(UVLO,rising)} = 1.225V \times \left(\frac{R_6}{R_7} + 1 \right) \quad (2)$$

On this evaluation board R6 = 127 kΩ and R7 = 11.8 kΩ, resulting in UVLO rising threshold at VIN = 14.5 V and a hysteresis of 2.54 V.

2.1 Board Connection and Start-Up

The input connections are made using J1 (VIN) and J2 (SGND) terminals. The primary output (VOUT) appears across J5 and J6. The secondary (isolated) output is available across J3 and J4. The input voltage should be gradually increased above the UVLO set point of 14.5 V. Both the primary and the isolated outputs should be close to 5 V at this point. The board is designed to function with input voltage range of 15 V to 48 V. The minimum VIN threshold can be changed by changing the UVLO resistors R6 and R7. VIN should not exceed 48 V.

3 Bill of Materials

Designator	Qty	Value	Description	Pkg Ref	PartNumber	Mfr
C1	1	2.2uF	CAP, CERM, 2.2uF, 25V, +/-10%, X7R, 0805	0805	GRM21BR71E225KA73L	MuRata
C2	1	2200pF	CAP, CERM, 2200pF, 630V, +/-10%, X7R, 1206	1206	GRM31BR72J222KW01L	MuRata
C3	1	0.01uF	CAP, CERM, 0.01uF, 50V, +/-10%, X7R, 0603	0603	GRM188R71H103KA01D	MuRata
C4	1	1000pF	CAP, CERM, 1000pF, 50V, +/-10%, X7R, 0603	0603	GRM188R71H102KA01D	MuRata
C5	1	2.2uF	CAP, CERM, 2.2uF, 50V, +/-10%, X7R, 1206	1206	GRM31CR71H225KA88L	MuRata
C6	1	0.47uF	CAP, CERM, 0.47uF, 50V, +/-10%, X7R, 0805	0805	GRM21BR71H474KA88L	MuRata
C7	1	4.7uF	CAP, CERM, 4.7uF, 16V, +/-10%, X7R, 0805	0805	GRM21BR71C475KA73L	MuRata
C8	1	1uF	CAP, CERM, 1uF, 16V, +/-10%, X7R, 0603	0603	GRM188R71C105KA12D	MuRata
C9	1	0.1uF	CAP, CERM, 0.1uF, 50V, +/-10%, X7R, 0603	0603	GRM188R71H104KA93D	MuRata
D1	1	0.57V	Diode, Schottky, 60V, 1A, SOD-123F	SOD-123F	PMEG6010CEH,115	NXP Semiconductor
L1	1	100uH	Coupled inductor, 100uH, 2.2A, 0.322 ohm, +/-20%, SMD	MSD1260	MSD1260-104MLB	Coilcraft
R1	1	2.00k	RES, 2.00k ohm, 1%, 0.125W, 0805	0805	CRCW08052K00FKEA	Vishay-Dale
R2	1	46.4k	RES, 46.4k ohm, 1%, 0.1W, 0603	0603	RC0603FR-0746K4L	Yageo America
R3	1	10.0k	RES, 10.0k ohm, 1%, 0.1W, 0603	0603	RC0603FR-0710KL	Yageo America
R4	1	0	RES, 0 ohm, 5%, 0.125W, 0805	0805	CRCW08050000Z0EA	Vishay-Dale
R5	1	124k	RES, 124k ohm, 1%, 0.1W, 0603	0603	RC0603FR-07124KL	Yageo America
R6	1	127k	RES, 127k ohm, 1%, 0.1W, 0603	0603	RC0603FR-07127KL	Yageo America
R7	1	11.8k	RES, 11.8k ohm, 1%, 0.1W, 0603	0603	RC0603FR-0711K8L	Yageo America
R8	1	3.40k	RES, 3.40k ohm, 1%, 0.1W, 0603	0603	RC0603FR-073K4L	Yageo America
U1	1		48V, 650mA Constant On-Time Synchronous Buck Regulator, DDA0008B	DDA0008B	LM25017MR/NOPB	Texas Instruments
D2	0	0.65V	Diode, Schottky, 40V, 0.35A, SOD-523	SOD-523	ZHCS350TA	Diodes Inc.

4 Performance Curves

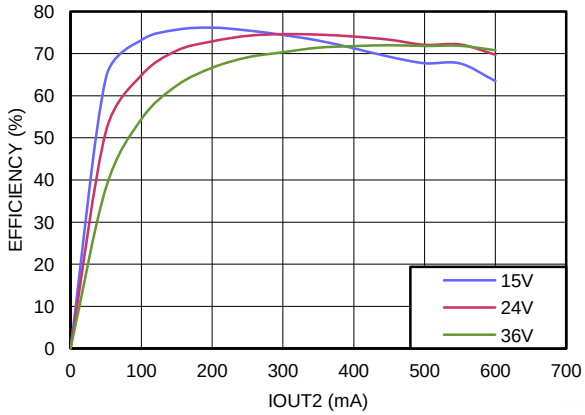

Figure 2. Efficiency at 500 kHz, V_{OUT1} = 5 V, V_{OUT2} = 4.5 V

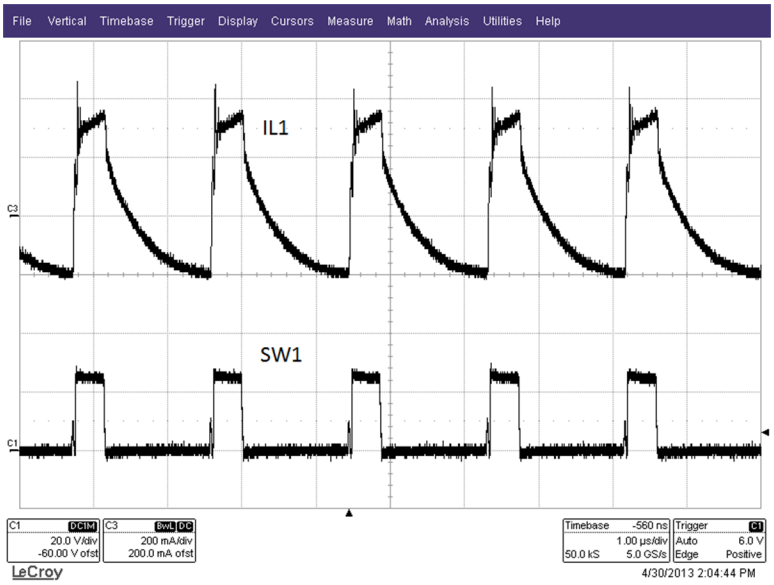

Figure 3. Steady State Waveform (VIN = 24 V, I_{OUT1} = 100 mA, I_{OUT2} = 200 mA)

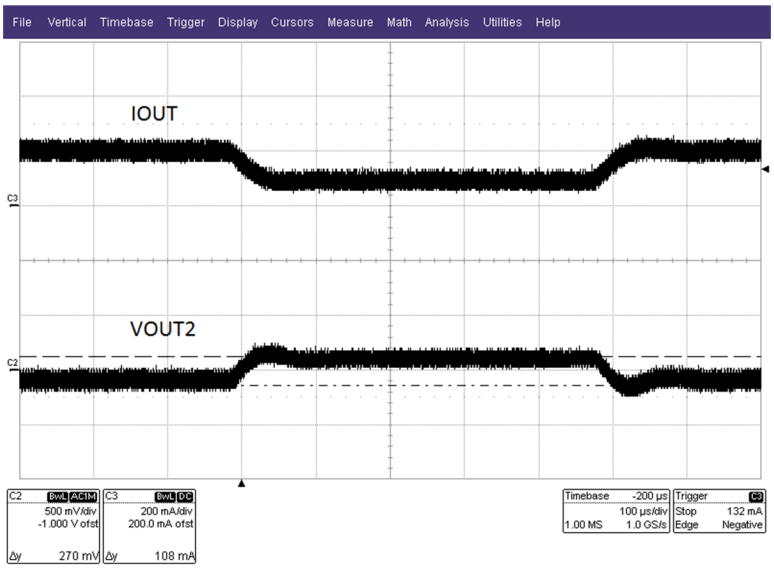

Figure 4. Step Load Response (VIN = 24 V, I_{OUT1} = 0, Step Load on I_{OUT2} = 100 mA to 200 mA)

5 PC Board Layout

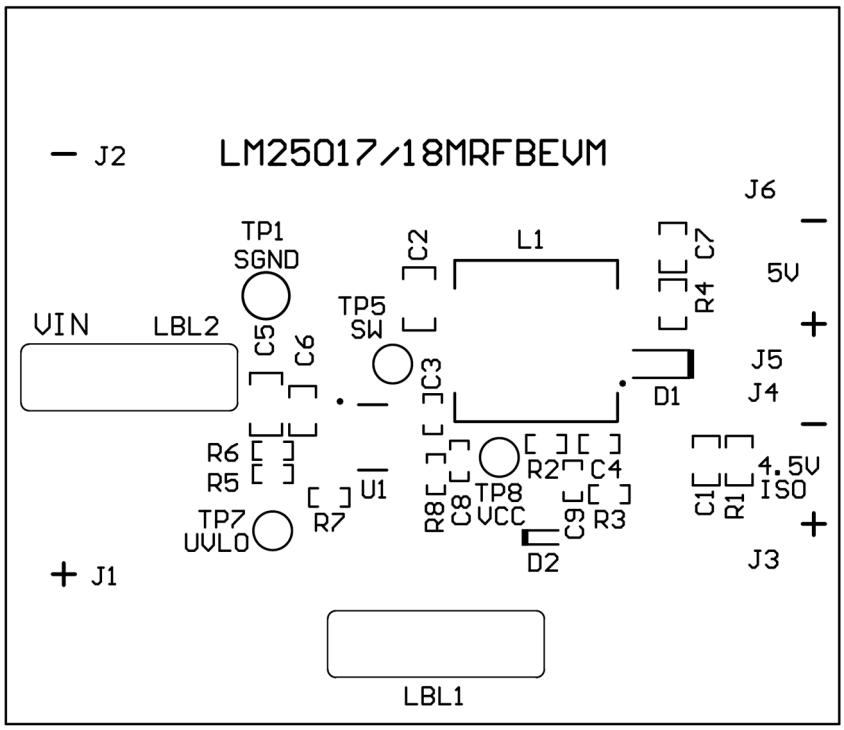

Figure 5. TopSilk

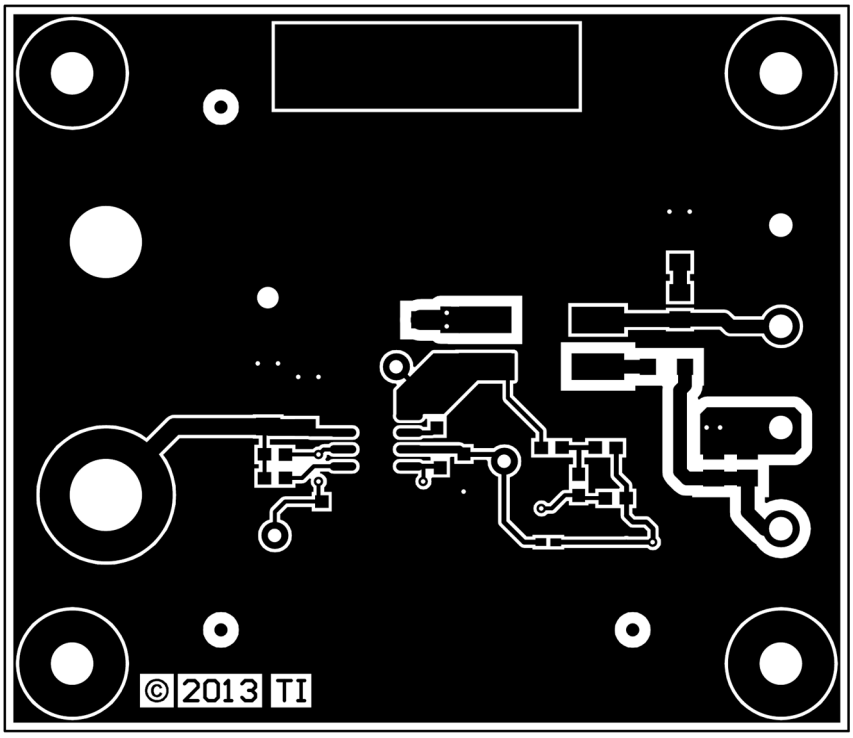

Figure 6. Top Copper

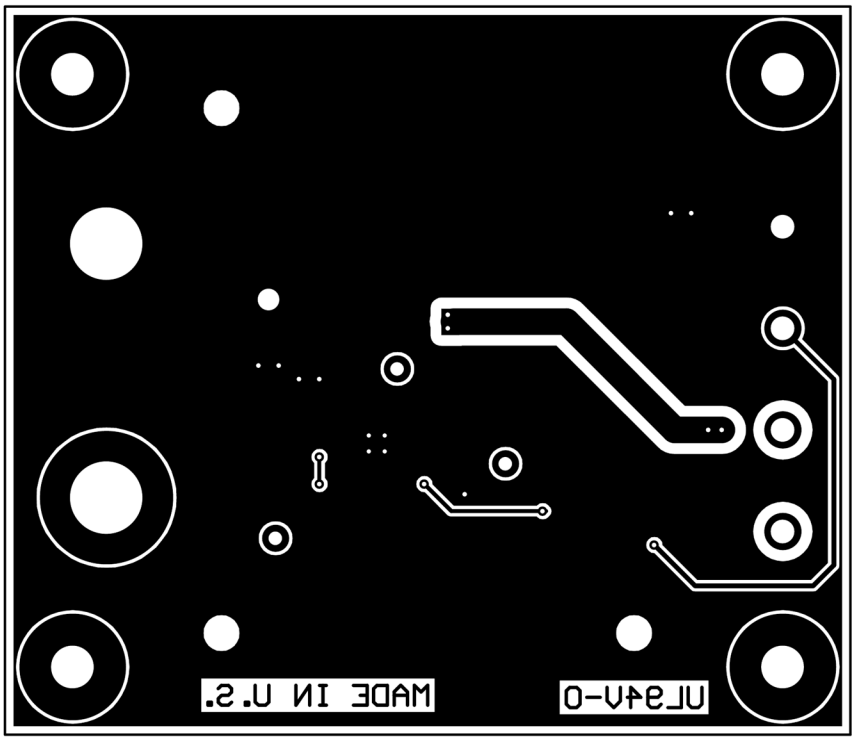

Figure 7. Bottom Copper

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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.*
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Only those TI components which TI has specifically designated as military grade or “enhanced plastic” are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have ***not*** been so designated is solely at the Buyer's risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

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