AN-2239 LM5018 Isolated Evaluation Board

1 Introduction

An isolated bias supply is implemented in this evaluation board with LM5018 Constant-On-Time regulator. LM5018 regulator integrates both the high and low side power switches essential for creating isolated buck converter.

Board Specifications:

- Input Range: 20V to 100V
- Primary Output Voltage: 10V
- Secondary (Isolated) Output Voltage: 9.5V
- Maximum Load Current (Primary + Secondary): 250mA
- Maximum Power Output: 2.5W
- Nominal Switching Frequency: 750kHz
- Efficiency (FIN = 36V, IOUT2 = 250mA): 77 percent
- Board size: 2 inch × 2 inch

Figure 1. LM5018 Evaluation Board (Top View)
2 UVLO Threshold and Hysteresis

The UVLO resistors are selected using the following two equations:

\[ V_{\text{IN(UVLO)}} = I_{\text{UVLO}} R_1 \]  

(1)

and

\[ V_{\text{IN(UVLO, rising)}} = 1.225V \times \left( \frac{R_1}{R_2} + 1 \right) \]  

(2)

On this evaluation board \( R_1 = 127k\Omega \) and \( R_2 = 8.25k\Omega \), resulting in UVLO rising threshold at \( V_{\text{IN}} = 20.5V \) and a hysteresis of 2.54V.

3 Board Connection and Start-Up

The input connections are made using TP1 (VIN) and TP2 (GND) terminals. The primary output appears at TP3 (VOUT1) and TP4 (GND). The secondary (isolated) output is available across TP5 (VOUT2) and TP6 (IGND). The input voltage should be gradually increased above UVLO set point of 20.5V. Both the outputs (VOUT1 and VOUT2) should be close to 10V at this point. This board is designed to function with input voltage range of 20V to 100V. The minimum \( V_{\text{IN}} \) threshold can be changed by changing the UVLO resistors \( R_1, R_2 \). \( V_{\text{IN}} \) should not exceed 100V.

The magnetics in this design is optimized for solution size, and therefore limits the output power. The total load at the output should not exceed 250mA, otherwise the coupled inductor will saturate/overheat, which can destroy both the coupled inductor and the regulator IC U1. If a sustained over-current situation is to be tolerated, a coupled inductor with higher saturation and rms ratings should be used.

4 Complete Evaluation Board Schematic

![Complete Evaluation Board Schematic](image-url)
<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Mfg., Part Number</th>
<th>Package</th>
<th>Value</th>
</tr>
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<tbody>
<tr>
<td>U1</td>
<td>Sync Switching Regulator</td>
<td>Texas Instruments, LM5018</td>
<td>SO PowerPAD-8</td>
<td>100V, 300mA</td>
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<tr>
<td>T1</td>
<td>Coupled Inductor, 1500 VDC</td>
<td>Coilcraft, LPD5030V-473ME</td>
<td>5mm × 5mm</td>
<td>47uH, 0.47A</td>
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<tr>
<td></td>
<td>Alternate Part</td>
<td>Wurth, 750312750</td>
<td>8.26mm × 6.60mm</td>
<td>22uH, 0.76A</td>
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<td>D1</td>
<td>Schottky Diode</td>
<td>Diodes Inc., DFLS1100-7</td>
<td>Pwr--DI123</td>
<td>100V, 1A</td>
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<tr>
<td>D2</td>
<td>Schottky Diode</td>
<td>Diodes Inc., SDM10U45-7</td>
<td>SOD–523</td>
<td>40V, 100mA</td>
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<td>C1</td>
<td>Ceramic Capacitor</td>
<td>Murata, GRM32CR72A105KA35L</td>
<td>1210</td>
<td>1uF, 100V, X7R</td>
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<td>C2</td>
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<td>TDK, C1608X7R1C103K</td>
<td>0603</td>
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<td>C3, C4</td>
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<td>TDK, C2012X7R1E105K</td>
<td>0805</td>
<td>1uF, 25V, X7R</td>
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<td>C5</td>
<td>Ceramic Capacitor</td>
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<td>0805</td>
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<tr>
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<td>0603</td>
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<td>Murata, GRM188R71E102KA01D</td>
<td>0603</td>
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<td>Ceramic Capacitor</td>
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<td>0.1uF, 16V, X7R</td>
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<td>R1</td>
<td>Resistor</td>
<td>Vishay/Dale, CRCW0805127KFKEA</td>
<td>0805</td>
<td>127kΩ, 1%</td>
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<td>R4</td>
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<td>Resistor</td>
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<td>1.0kΩ, 1%</td>
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<tr>
<td>R6</td>
<td>Resistor</td>
<td>Yageo, RC0603JR-070RL</td>
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<td>R10</td>
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<td>Panasonic, ERJ-6GEYJ202V</td>
<td>0805</td>
<td>2kΩ, 5%</td>
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</tbody>
</table>
# Performance Curves

## Figure 3. Efficiency at 750 kHz, VOUT1 = 10V

VIN = 36V, VIN = 24V, VIN = 48V

VOUT2 = 10V, IOUT1 = 0

## Figure 4. Steady State Waveform

(VIN = 48V, IOUT1 = 0mA, IOUT2 = 100mA)

## Figure 5. Step Load Response

(VIN = 48V, IOUT1 = 0, Step Load on IOUT2 = 80mA to 180mA)
Figure 6. Board Silkscreen
Figure 7. Board Top Layer

Figure 8. Board Bottom Layer
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