

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, IOU2 = 250mA): 77 percent
- Board size: 2 inch x 2 inch

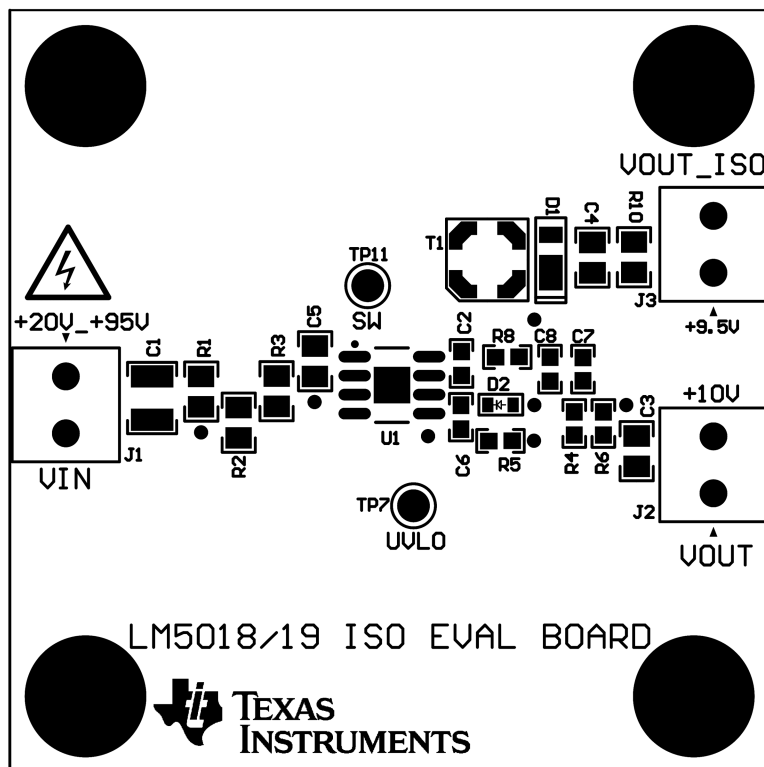


Figure 1. LM5018 Evaluation Board (Top View)

2 UVLO Threshold and Hysteresis

The UVLO resistors are selected using the following two equations:

$$V_{IN(HYS)} = I_{HYS}R_1 \tag{1}$$

and

$$V_{IN(UVLO, rising)} = 1.225V \times \left(\frac{R_1}{R_2} + 1 \right) \tag{2}$$

On this evaluation board R1 = 127kΩ and R2 = 8.25kΩ, resulting in UVLO rising threshold at VIN = 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 VIN threshold can be changed by changing the UVLO resistors R1, R2. VIN 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

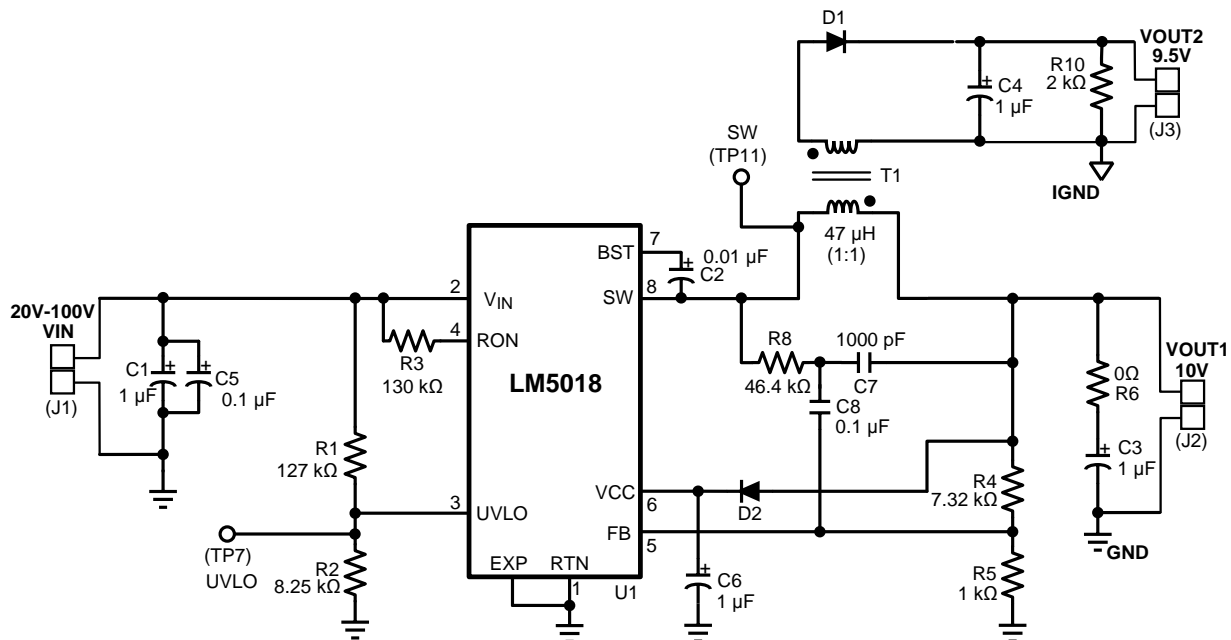


Figure 2. Complete Evaluation Board Schematic

5 Bill of Materials

Item	Description	Mfg., Part Number	Package	Value
U1	Sync Switching Regulator	Texas Instruments, LM5018	SO PowerPAD-8	100V, 300mA
T1	Coupled Inductor, 1500 VDC	Coilcraft, LPD5030V-473ME	5mm x 5mm	47uH, 0.47A
	Alternate Part	Würth, 750312750	8.26mm x 6.60mm	22uH, 0.76A
D1	Schottky Diode	Diodes Inc., DFSL1100-7	Pwr-DI123	100V, 1A
D2	Schottky Diode	Diodes Inc., SDM10U45-7	SOD-523	40V, 100mA
C1	Ceramic Capacitor	MuRata, GRM32CR72A105KA35L	1210	1uF, 100V, X7R
C2	Ceramic Capacitor	TDK, C1608X7R1C103K	0603	0.01uF, 16V, X7R
C3, C4	Ceramic Capacitor	TDK, C2012X7R1E105K	0805	1uF, 25V, X7R
C5	Ceramic Capacitor	Kemet, C0805C104K1RACTU	0805	0.1uF, 100V, X7R
C6	Ceramic Capacitor	TDK, C1608X7R1C105K	0603	1uF, 16V, X7R
C7	Ceramic Capacitor	Murata, GRM188R71E102KA01D	0603	1000pF, 25V, X7R
C8	Ceramic Capacitor	AVX, 0603YC104KAT2A	0603	0.1uF, 16V, X7R
R1	Resistor	Vishay/Dale, CRCW0805127KFKEA	0805	127kΩ, 1%
R2	Resistor	Vishay/Dale, CRCW08058K25FKEA	0805	8.25kΩ, 1%
R3	Resistor	Vishay/Dale, CRCW0805130KFKEA	0805	130kΩ, 1%
R4	Resistor	Panasonic, ERJ-3EKF7321V	0603	7.32kΩ, 1%
R5	Resistor	Panasonic, ERJ-3EKF1001V	0603	1.0kΩ, 1%
R6	Resistor	Yageo, RC0603JR-070RL	0603	0Ω
R8	Resistor	Panasonic, ERJ-3EKF4642V	0603	46.4kΩ, 1%
R10	Resistor	Panasonic, ERJ-6GEYJ202V	0805	2kΩ, 5%

6 Performance Curves

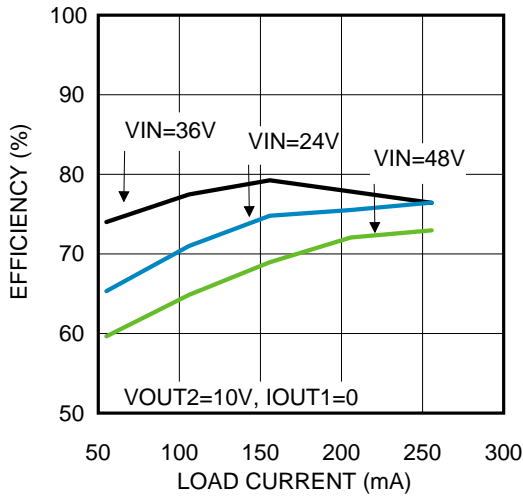


Figure 3. Efficiency at 750 kHz, VOUT1 = 10V

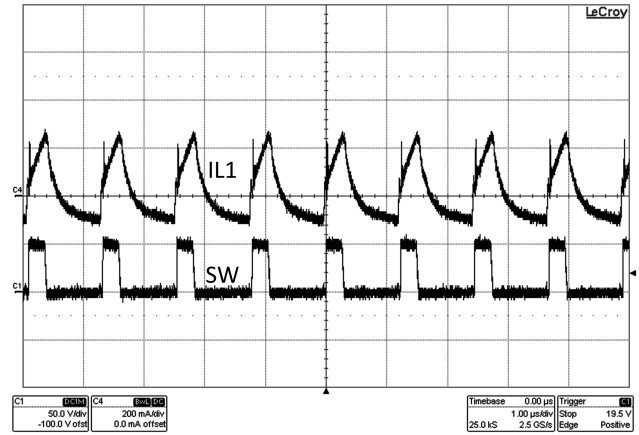


Figure 4. Steady State Waveform (VIN = 48V, IOU1 = 0mA, IOU2 = 100mA)

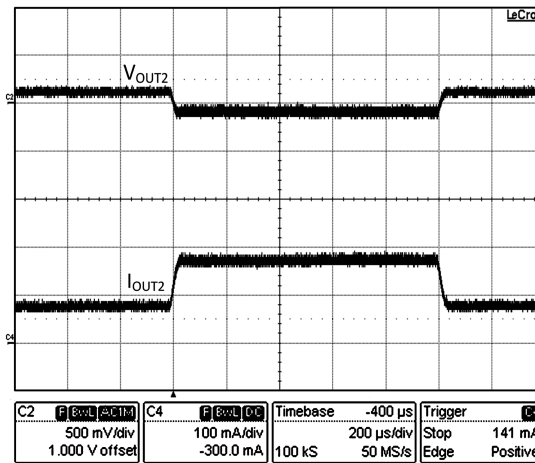


Figure 5. Step Load Response (VIN = 48V, IOU1 = 0, Step Load on IOU2 = 80mA to 180mA)

7 PC Board Layout

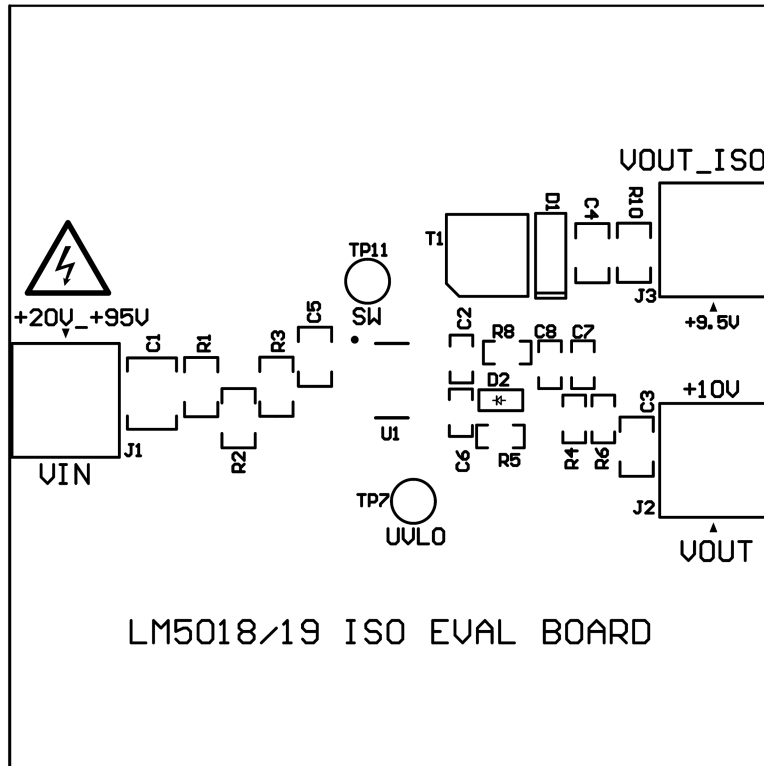


Figure 6. Board Silkscreen

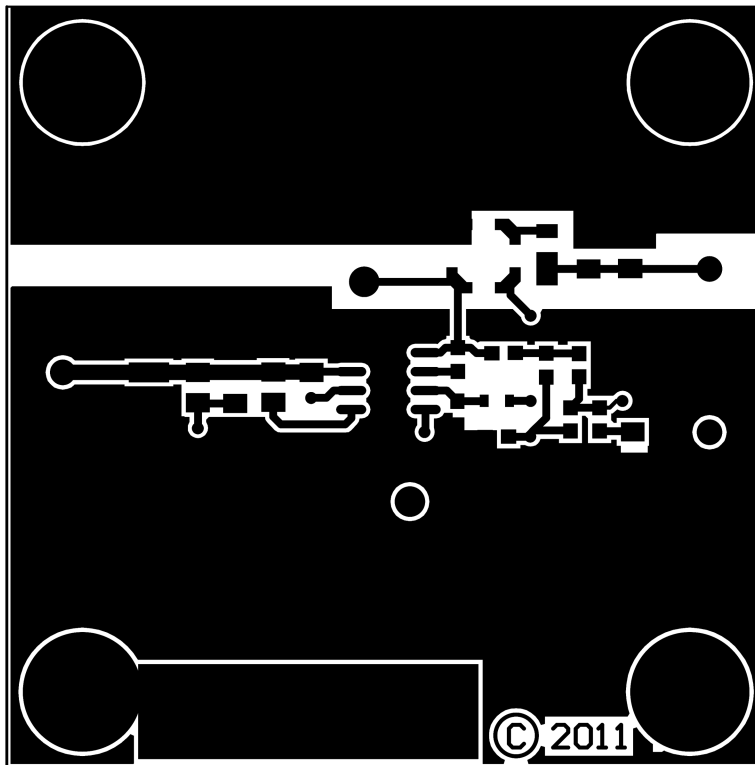


Figure 7. Board Top Layer

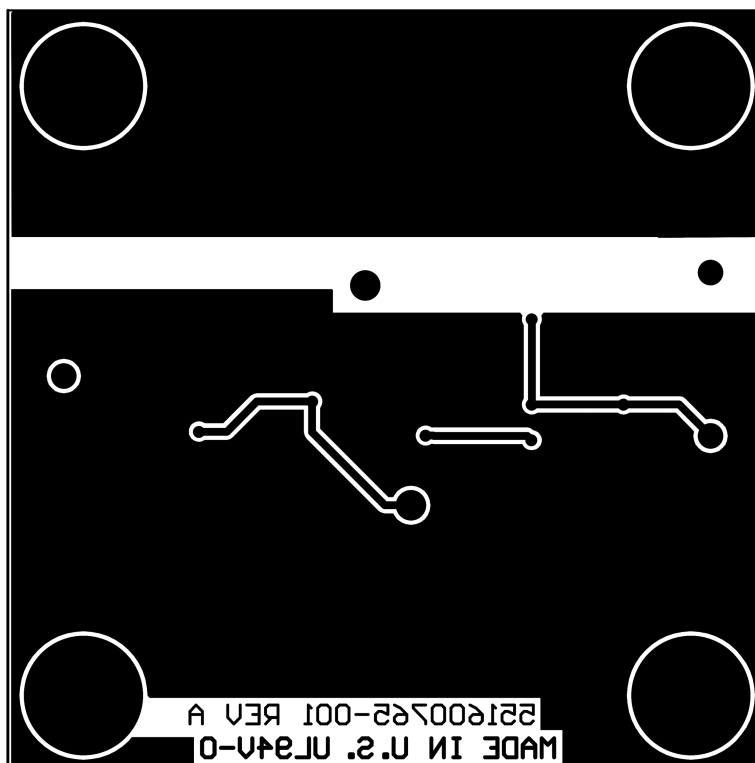


Figure 8. Board Bottom Layer

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CAUTION

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

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- Reorient or relocate the receiving antenna.
- 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.

3.2 Canada

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(1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Concernant les EVMs avec appareils radio:

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

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Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication. This radio transmitter has been approved by Industry Canada to operate with the antenna types listed in the user guide with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

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<https://www.ti.com/ja-jp/legal/notice-for-evaluation-kits-delivered-in-japan.html>

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2. Use EVMs only after User obtains the license of Test Radio Station as provided in Radio Law of Japan with respect to EVMs, or
3. Use of EVMs only after User obtains the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to EVMs. Also, do not transfer EVMs, unless User gives the same notice above to the transferee. Please note that if User does not follow the instructions above, User will be subject to penalties of Radio Law of Japan.

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