User's Guide
SNVU452–July 2014

LM5000EVAL Non-Isolated Flyback Evaluation Module User's Guide

The LM5000EVAL evaluation module (EVM) provides the design engineer with a fully functional non-isolated flyback converter to evaluate the LM5000-3 high-voltage switch-mode regulator integrated circuit (IC). The EVM provides 3.3-V output with 2-A current capability. The input voltage range is from 20 V to 55 V. This user's guide contains the electrical specification, quick setup procedure, performance curves, application schematic, and bill of materials (BOM).

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1 Introduction

The LM5000-3 is a monolithic IC specifically designed and optimized for flyback, boost, and SEPIC power converter applications. It has an internal power switch rated for a maximum of 80 V, with a current limit set to 2 A (typical). The LM5000-3 switching frequency is pin selectable for either 300 kHz (FS grounded) or 700 kHz (FS open). This EVM is designed to demonstrate a non-isolated flyback converter operating with 300 kHz of switching frequency. Table 1 contains the electrical specifications.

Table 1. Key Electrical Specifications

EVM	Input Voltage Range	Output Voltage	Output Current Range
LM5000EVAL	20 V to 55 V	3.3 V	0 A to 2 A

2 Test Setup

2.1 Connectors and Test Points Description

Table 2 shows the I/O connectors and test points included in this EVM. A power supply capable of supplying at least 1 A must be connected to input connectors IN and GND1. The load must be connected to output connectors OUT and GND2. The maximum load current capability must be at least 2 A. Test point SD provides a connection to monitor shutdown control signal with GND1 as the ground reference.

Table 2. Connectors and Test Points

Reference Designator	Description
IN	Input voltage connection and test point
GND1	Input voltage return connection and test point
OUT	Output voltage connection and test point
GND2	Output voltage return connection and test point
SD	Shutdown control input pin test point

2.2 Quick Setup Procedure

The following steps provide the quick setup procedures:

Step 1. Set the power supply current limit to 1 A. Turn off the power supply. Connect the positive output of the power supply to IN and the negative output to GND1.

Step 2. Connect the load to OUT for the positive connection and GND2 for the negative connection.

Step 3. Set the power supply voltage to 20 V and the load to 0.1 A. The electronic load voltage should be in regulation with a nominal 3.3-V output.

Step 4. Slowly increase the load while monitoring the output voltage between OUT and GND2. It should remain in regulation with a nominal 3.3-V output as the load is increased up to 2 A.

Step 5. Slowly sweep the input voltage from 20 V to 55 V. The output voltage should remain in regulation with a nominal 3.3-V output.

Step 6. Turn off the load, and decrease the input voltage down to 0 V to shut down the flyback converter, and then turn on the load to discharge the output capacitors.

3 Performance Curves

Figure 1 to Figure 4 illustrate the performance curves for the EVM.

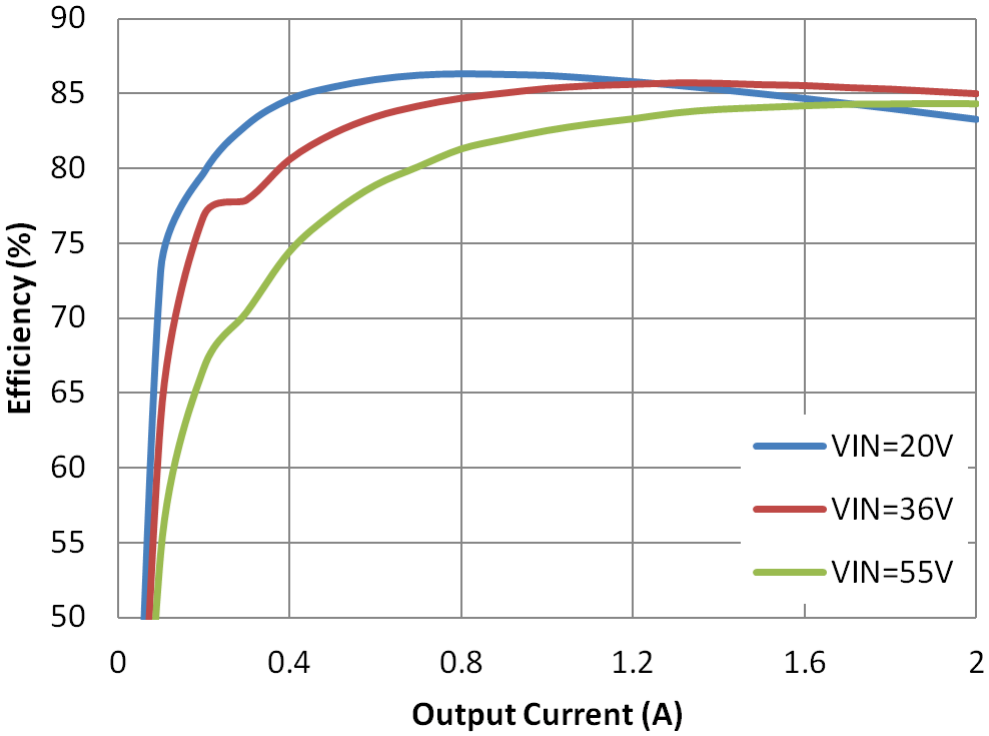

Figure 1. Efficiency with Respect to Load Current

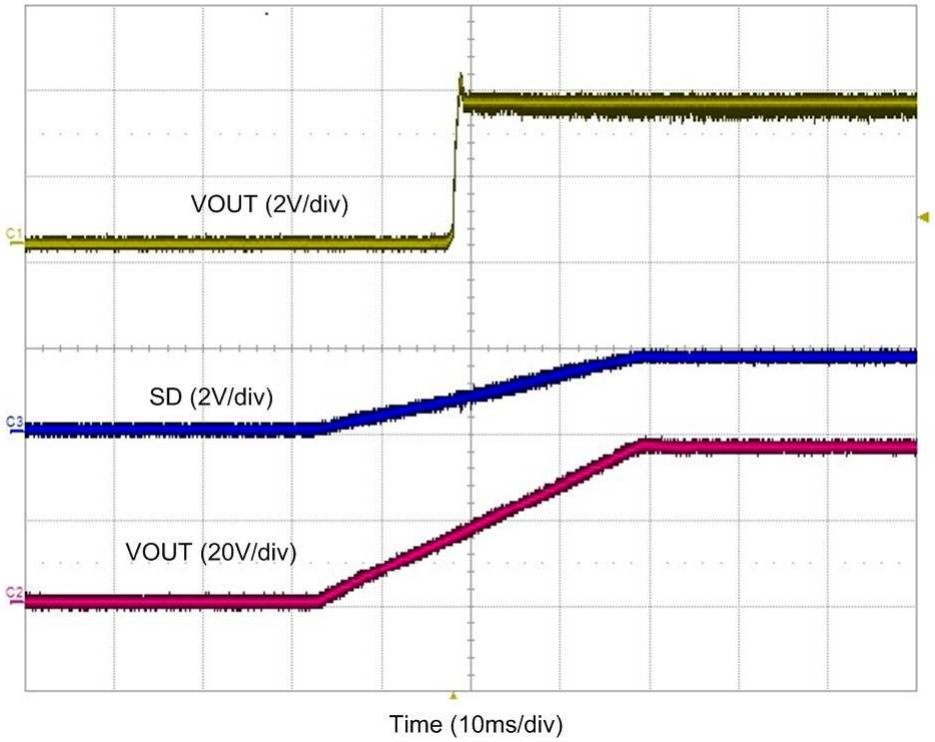

Figure 2. Turn-On Waveforms (VIN = 36 V, IOUT = 2 A)

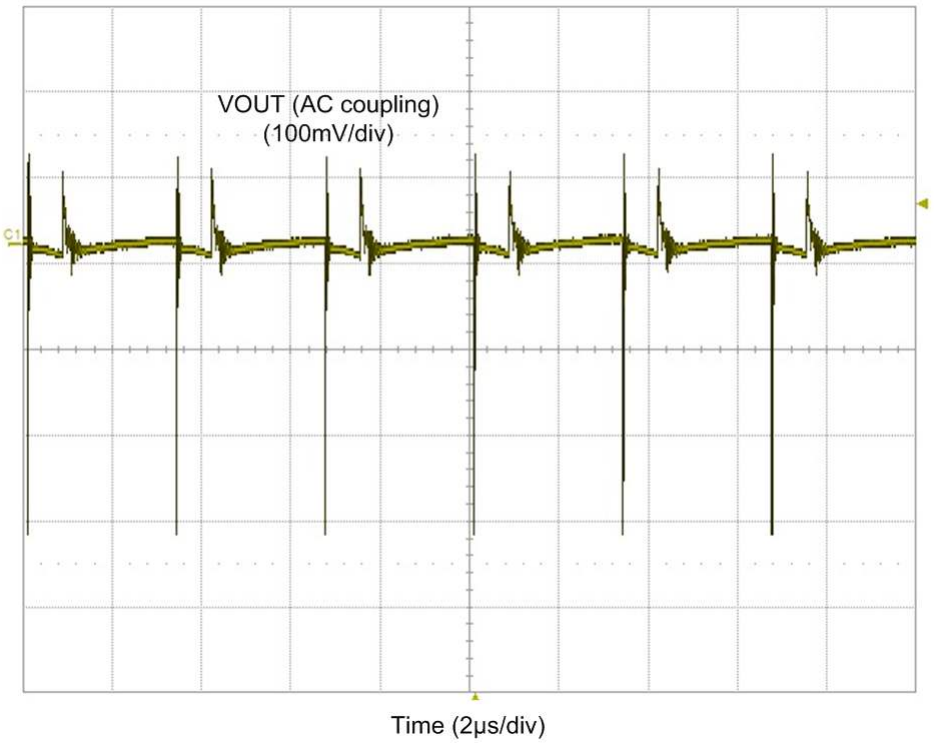

Figure 3. Output Voltage Ripple (VIN = 36 V, IOUT = 2 A)

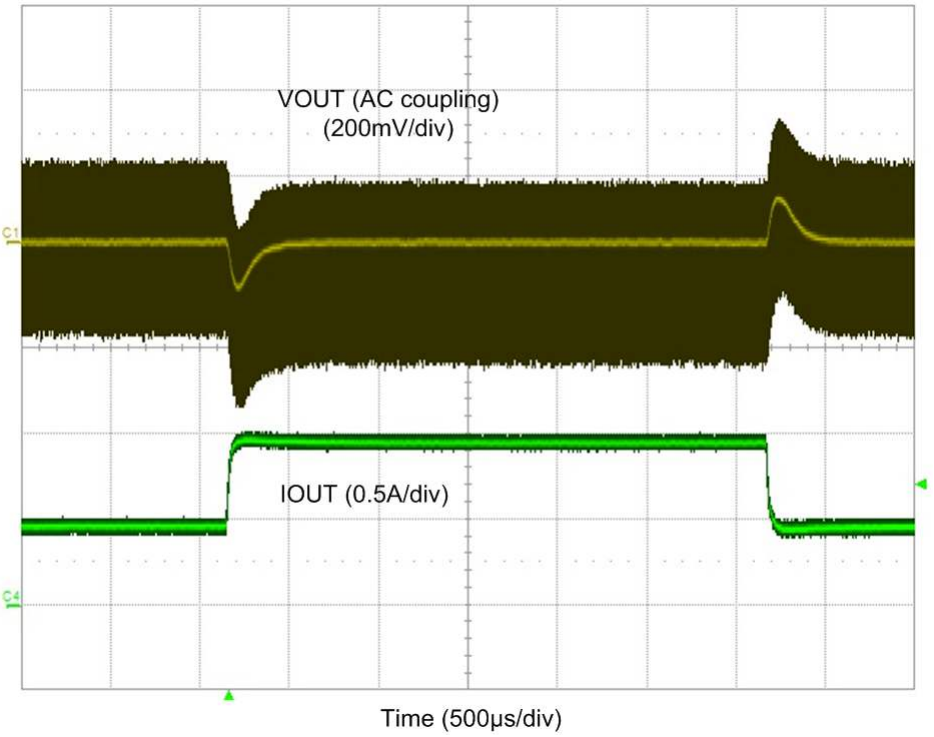

Figure 4. Load Transient Response (VIN = 36 V)

4 Schematic

Figure 5 shows the LM5000EVAL EVM schematic.

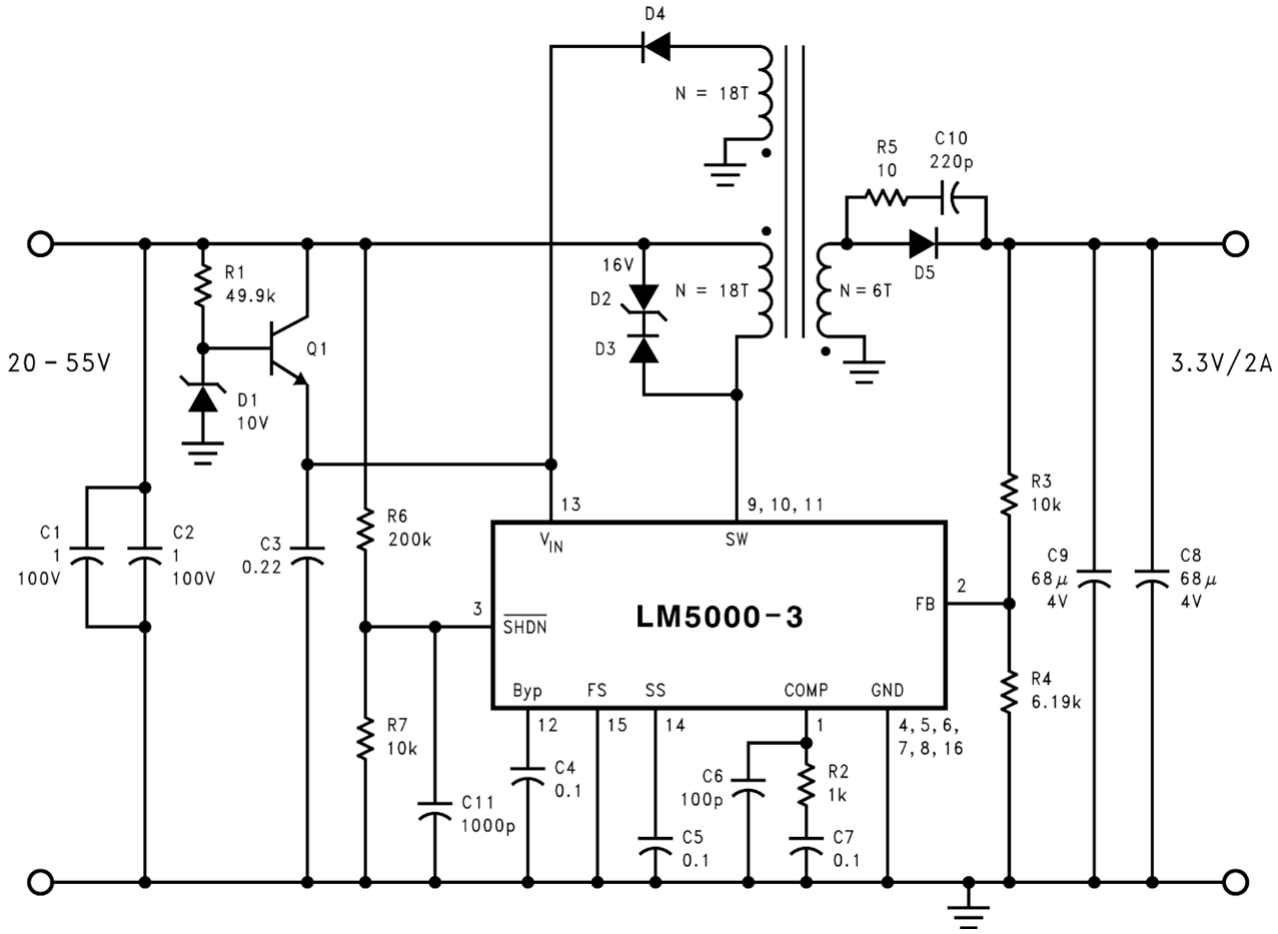

Figure 5. Non-Isolated Flyback Converter Schematic

5 Layout

The printed-circuit board layout for the LM5000EVAL is shown in Figure 6 through Figure 8.

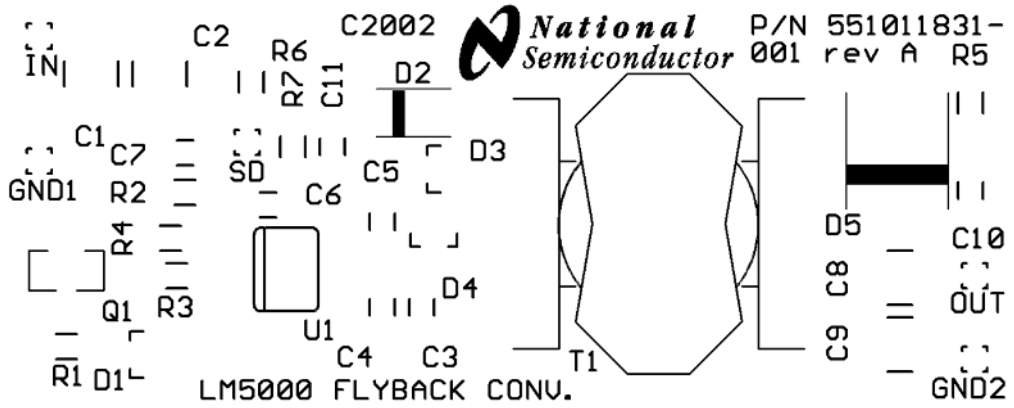

Figure 6. Top Silkscreen

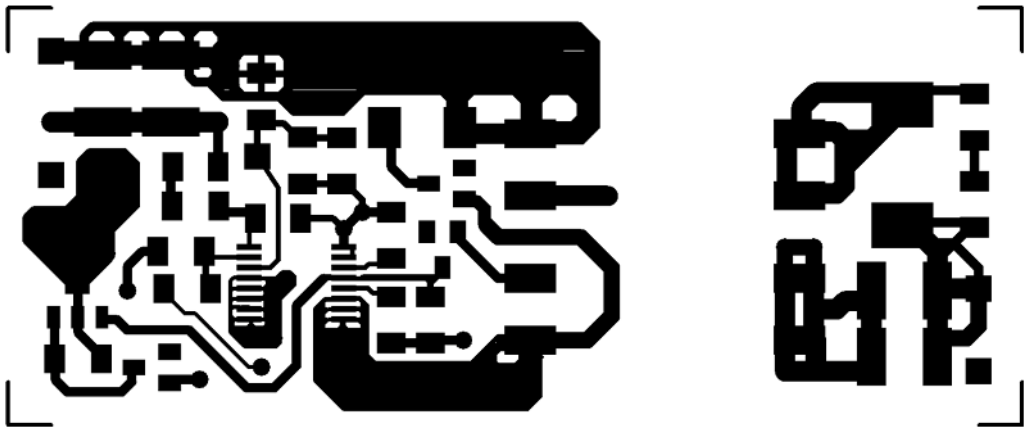

Figure 7. Top Layer

Figure 8. Bottom Layer

6 Bill of Materials

Table 3 presents the BOM for the LM5000EVAL EVM.

Table 3. LM5000EVAL EVM Bill of Materials

Item		Part Number	Description	Value
C	1	C4532X7R2A105MT	Capacitor, CER, TDK	1 µF, 100 V
C	2	C4532X7R2A105MT	Capacitor, CER, TDK	1 µF, 100 V
C	3	C1206C224K5RAC	Capacitor, CER, KEMET	0.22 µF, 50 V
C	4	C1206C104K5RAC	Capacitor, CER, KEMET	0.1 µF, 50 V
C	5	C1206C104K5RAC	Capacitor, CER, KEMET	0.1 µF, 50 V
C	6	C1206C101K1GAC	Capacitor, CER, KEMET	100 pF, 100 V
C	7	C1206C104K5RAC	Capacitor, CER, KEMET	0.1 µF, 50 V
C	8	C4532X7S0G686M	Capacitor, CER, TDK	68 µF, 4 V
C	9	C4532X7S0G686M	Capacitor, CER, TDK	68 µF, 4 V
C	10	C1206C221K1GAC	Capacitor, CER, KEMET	220 pF, 100 V
C	11	C1206C102K5RAC	Capacitor, CER, KEMET	1000 pF, 500 V
D	1	BZX84C10-NSA	Central, 10 V Zener, SOT-23	
D	2	CMZ5930B-NSA	Central, 16 V Zener, SMA	
D	3	CMPD914-NSA	Central, Switching, SOT-23	
D	4	CMPD914-NSA	Central, Switching, SOT-23	
D	5	CMSH3-40L-NSA	Central, Schottky, SMC	
T	1	A0009-A	Coilcraft, Transformer	
R	1	CRCW12064992F	Resistor	49.9 kΩ
R	2	CRCW12061001F	Resistor	1 kΩ
R	3	CRCW12061002F	Resistor	10 kΩ
R	4	CRCW12066191F	Resistor	6.19 kΩ
R	5	CRCW120610R0F	Resistor	10 Ω
R	6	CRCW12062003F	Resistor	200 kΩ
R	7	CRCW12061002F	Resistor	10 kΩ
Q	1	CXT5551-NSA	Central, NPN, 180 V	
U	1	LM5000-3	Regulator, TI	

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- Increase the separation between the equipment and receiver.
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