User Guide

EVAL-LT8306-AZ

Low I_Q No-Opto Isolated Flyback Controller

General Description

The EVAL-LT8306-AZ evaluation circuit is a micro-powered no-opto isolated flyback converter that features the LT®8306. This demo circuit outputs 12V and maintains tight regulation with a load current from 15mA to 2.0A and over an input voltage from 6V to 36V. The output current capability increases with the input voltage.

The EVAL-LT8306-AZ needs very small minimum load (15mA) to regulate the output voltage because of the LT8306 ultra-low switching frequency at very light load. To properly limit the output voltage and avoid preloading under a no-load condition, a 13V zener diode is placed between the V_{OUT+} and V_{OUT-} pins.

Transformer leakage inductance causes a voltage spike on the primary side after the power switch turns off. To limit this leakage inductance spike within a MOSFET voltage rating of 120V, an RC snubber and a TVS clamp are installed to dampen the ringing and clamp the MOSFET drain voltage to a safe level. The RC snubber can be removed to improve the efficiency by 3–4% when the load is below 100mA at 24V typical input.

The Performance Summary table summarizes the performance of the evaluation circuit at room temperature. The evaluation circuit can be easily modified for different applications with some predesigned transformers.

The LT8306 is a simple-to-use micropowered isolated flyback controller. By sampling the isolated output voltage directly from the primary-side flyback waveform, the IC does not require a third winding or an opto-isolator for regulation. The IC sets the isolated output voltage with a single external resistor. It integrates loop compensation and an internal soft-start circuit to reduce external components. Boundary mode operation provides a small magnetic solution with excellent load regulation. The low-ripple burst mode operation maintains high efficiency at light load while minimizing the output voltage ripple.

The LT8306 is packaged in a 6-lead ThinSOT™. It is AEC-Q100 qualified for automotive applications. The LT8306 data sheet gives a complete part description, operation, and applications information. Refer to the data sheet in conjunction with the EVAL-LT8306-AZ evaluation circuit quick start guide.

Design files for this circuit board are available.

Performance Summary (T_A = 25°C)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Input Voltage		6	24	36	V
Output Voltage	V_{IN} = 6V – 36V I_{OUT} = 10mA – 2.0A	11.5	11.8	12.1	V
Maximum Output Current	V_{IN} = 6V – 36V			2.0	A
Output Voltage Ripple (Peak to Peak)	V_{IN} = 6V – 36V, I_{OUT} = 2.0A			200	mV
Typical Switching Frequency	V_{IN} = 24V, I_{OUT} = 2.0A		300		kHz
Minimum Switching Frequency	I_{OUT} = 0mA		9		kHz
Input Voltage Turn-On Threshold	V_{IN} rising		5.94		V
Input Voltage Turn-Off Threshold	V_{IN} falling		5.63		V
Efficiency	V_{IN} = 6V, I_{OUT} = 2.0A		85.0		%
	V_{IN} = 12V, I_{OUT} = 2.0A		89.8		%
	V_{IN} = 24V, I_{OUT} = 2.0A		90.0		%
	V_{IN} = 36V, I_{OUT} = 2.0A		89.2		%

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Quick Start Procedure

The EVAL-LT8306-AZ evaluation circuit is easy to set up to evaluate the performance of LT8306. See Figure 1 for proper measurement equipment setup and use the following procedure:

1. With power off, connect the input power supply to the board through the VIN and GND terminals. Connect the load to the VOUT+ and VOUT- terminals on the board.
2. Turn on the power at the input. Increase VIN slowly to 6V.
   NOTE: Make sure that the input voltage is always within the specified range. To operate the board with a higher input/output voltage, an input capacitor, an output capacitor, snubber components, and an output diode with higher voltage ratings are needed.
3. Check for the proper output voltages. The output should be regulated at 12V (±5%).
   NOTE: The LT8306 requires a very small minimum load to maintain good output voltage regulation. Place a Zener diode on the output to clamp the voltage to 13V at no load.
4. Once the proper output voltage is established, adjust the input voltage and load current within the operating range and observe the output voltage regulation, ripple voltage, efficiency, and other parameters.
   NOTE: When measuring the input or output voltage ripples, take care to avoid a long ground lead on the oscilloscope probe. Measure the input or output voltage ripple by touching the probe tip directly across the VIN (E1) and GND (E2), or VOUT+ (E3), and VOUT- (E4) terminals.

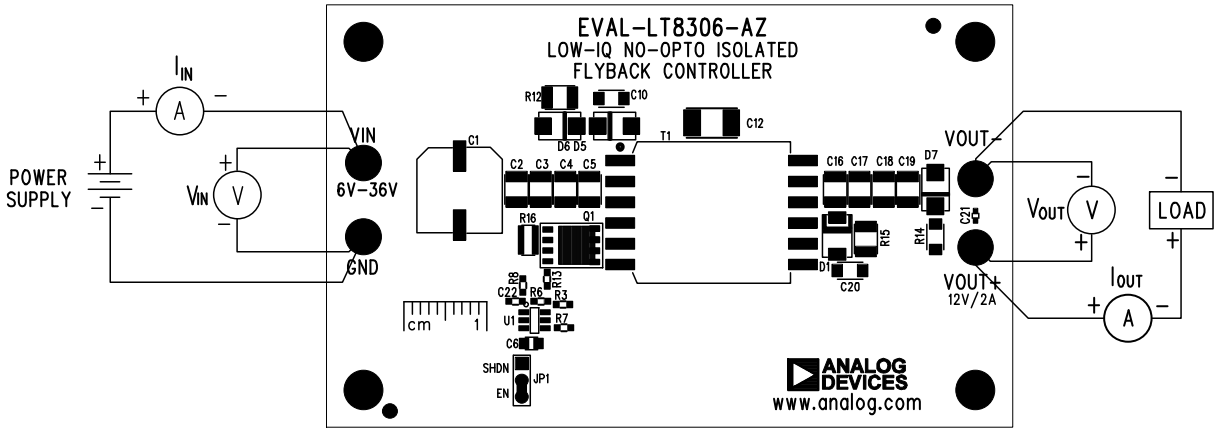


Figure 1. EVAL-LT8306-AZ Board Connections

Table 1. Controller EN/UVLO Jumper (JP1) Setting

SHUNT POSITION	EN/UVLO PIN	OUTPUT
1-2	Connected to GND	Disabled
Not Installed	Unconnected	Enabled
2-3*	Unconnected	Enabled

**Default position*

Performance

(V_{IN} = 24V, V_{OUT} = 12V, T_A = +25°C unless otherwise noted.)

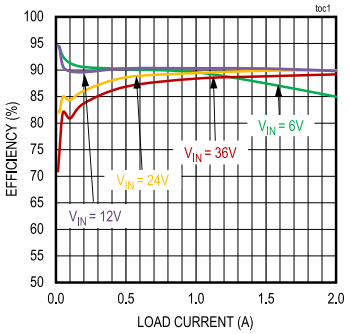


Figure 2. Efficiency vs. Load Current

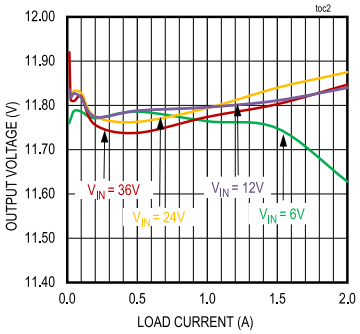
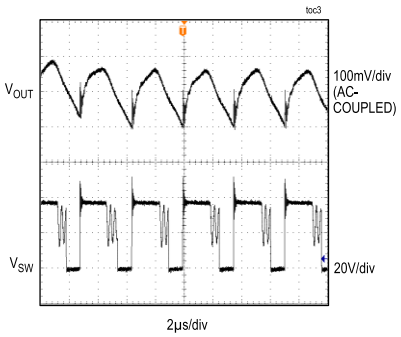
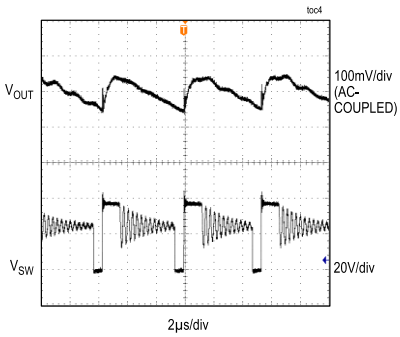


Figure 3. Output Voltage vs. Load Current



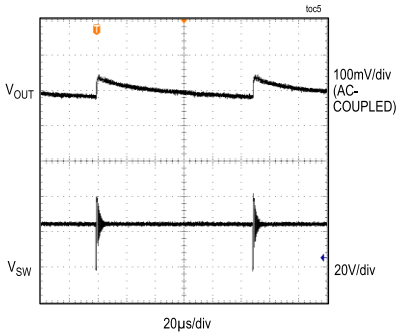
I_{OUT} = 2A, Discontinuous Mode

Figure 4. Steady-State Switching Waveform



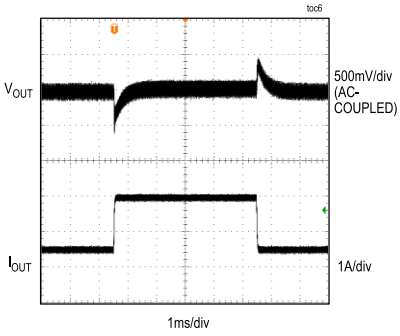
I_{OUT} = 0.5A, Discontinuous Mode

Figure 5. Steady-State Switching Waveform



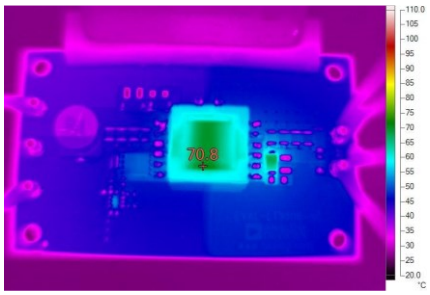
I_{OUT} = 0A, Burst Mode

Figure 6. Steady-State Switching Waveform



I_{OUT} = 0.5A to 2A

Figure 7. Load Transient Response



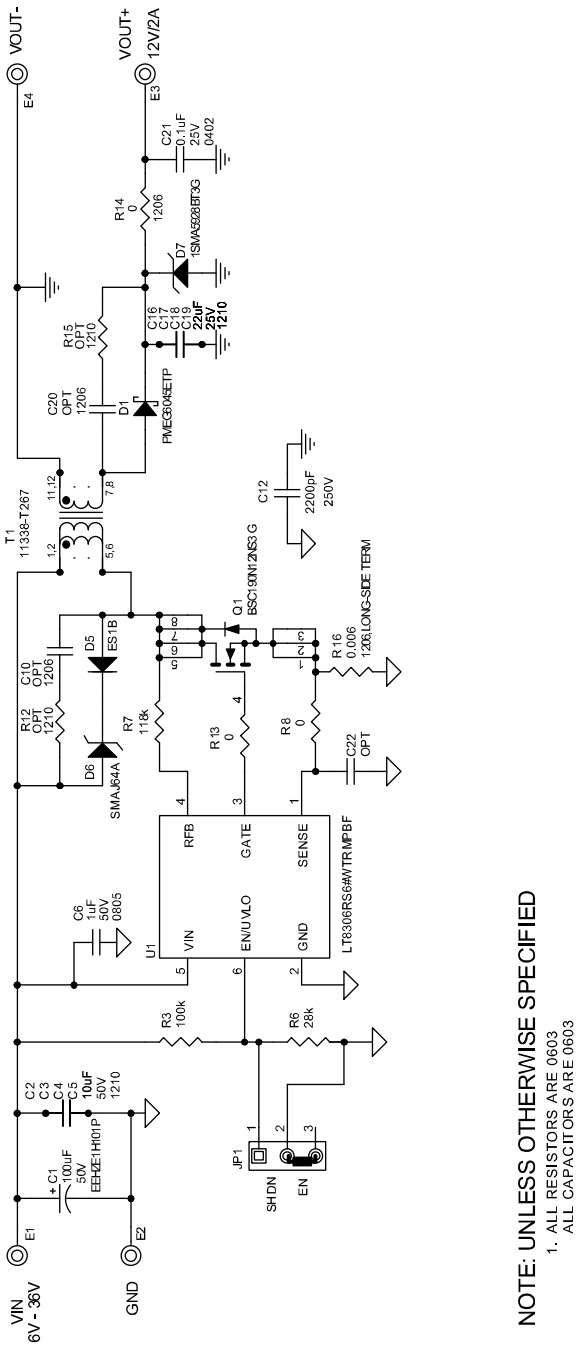
V_{IN} = 24V, V_{OUT} = 12V, I_{OUT} = 2A

Figure 8. EVAL-LT8306-AZ Thermal Image

Bill of Materials

ITEM	QTY	DESIGNATOR	DESCRIPTION	MANUFACTURER PART NUMBER
REQUIRED CIRCUIT COMPONENTS				
1	1	C1	CAP., ALUM. ELEC., 100µF, 50V,	PANASONIC, EEHZE1H101P
2	4	C2, C3, C4, C5	CAP., CHIP, X5R, 10µF, 50V, 10%, 1210	MURATA, GRM32ER61H106KA12L
3	1	C6	CAP., CHIP, X7R, 1µF, 50V, 10%, 0805	MURATA, GRM21BR71H105KA12L
4	1	C12	CAP., 2200pF, X7R, 250V,10%,1812	MURATA, GA343QR7GD222KW01L
5	4	C16, C17, C18, C19	CAP., 22µF, X7R, 25V,10%,1210	MURATA, GRM32ER71E226KE15L
6	1	C21	CAP., 0.1µF, X7R, 25V, 10%, 0402	TAIYO YUDEN, TMK105B7104KV-FR
7	1	D1	DIODE, SCHOTTKY, 60V, 4.5A, SOD-128	NEXPERIA, PMEG6045ETPX
8	1	D5	DIODE, SWITCHING, 100V, 1A, 2-PIN, SMA	VISHAY, ES1BHE3_A/H
9	1	D6	DIODE, TVS, UNI-DIRECT, 64V, 400W, SMA	LITTELFUSE, SMAJ64A
10	1	D7	DIODE, ZENER, 13V, 1.5W, SMA, AEC-Q101	ONSEMI, 1SMA5928BT3G
11	1	Q1	XSTR., MOSFET, N-CH, 120V, 8.6A, TDSON-8	INFINEON, BSC190N12NS3 G
12	1	R3	RES., CHIP, 100k, 1/10W, 1%, 0603	VISHAY, CRCW0603100KFKEA
13	1	R6	RES., CHIP, 28K, 1/10W, 1%, 0603	VISHAY, CRCW060328K0FKEA
14	3	R8, R13, R17	RES., CHIP, 0 OHM, 1/10W, 1%, 0603	VISHAY, CRCW06030000Z0EA
15	1	R14	RES., 0 OHM, 1/4W, 1206, AEC-Q200	VISHAY, CRCW12060000Z0EA
16	1	R16	RES., 0.006 OHM, 1%, 1.5W, 1206	SUSUMU, KRL3216E-C-R006-F-T1
17	1	T1	TRANSFORMER, LPRIM=3.0µH, NP:NS=1:1	SUMIDA, 11338-T267 (CEEH178)
18	1	U1	IC, FLYBACK CONVERTER, 6-PIN SOT-23	ANALOG DEVICES, LT8306RS6#WTRMPBF
OPTIONAL CIRCUIT COMPONENTS				
1	0	C10, C20	CAP., OPTION, 1206	
2	1	C21	CAP., 0.1µF, X7R, 25V, 10%, 0402	TAIYO YUDEN, TMK105B7104KV-FR
3	0	C22	CAP., OPTION, 0603	
4	0	R12, R15	RES., OPTION, 1210	
5	1	R14	RES., 0 OHM, 1/4W, 1206	VISHAY, CRCW12060000Z0EA
HARDWARE – FOR DEMO BOARD ONLY				
1	4	E1-E4	TESTPOINT, TURRET, .094", PBF	MILL-MAX, 2501-2-00-80-00-00-07-0

Schematic



NOTE: UNLESS OTHERWISE SPECIFIED
1. ALL RESISTORS ARE 0603
ALL CAPACITORS ARE 0603

Revision History

	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	1/23	Initial release	—