LT8304
Micropower No-Opto Isolated Flyback Converter with 150V/2A Switch

DESCRIPTION

Demonstration circuit 2393A is a micropower no-opto isolated flyback converter featuring the LT®8304. This demo circuit outputs 5.0V, and maintains tight regulation with a load current from 20mA up to 4.2A and over an input voltage from 18V to 72V. The output current capability increases with the input voltage, as shown in the Performance Summary table.

The DC2393A needs less than 0.5% of its full output power as a minimum load to maintain good output voltage regulation. On the DC2393A, in order to avoid pre-loading, a 5.6V Zener diode is placed between its V_{OUT}^+ and V_{OUT}^- to serve as a minimum load.

Transformer leakage inductance causes a voltage spike on the primary side after the power switch turns off. To limit this leakage inductance spike within MOSFET voltage rating of 150V, an RC snubber and a TVS clamp are installed to damp the ringing and clamp the MOSFET drain voltage to a safe level.

The Performance Summary table summarizes the performance of the demo board at room temperature. The demo circuit can be easily modified for different applications with some pre-designed transformers.

The LT8304 is a simple to use monolithic micropower isolated flyback converter. By sampling the isolated output voltage directly from the primary-side flyback waveform, the part requires no third winding or opto-isolator for regulation. The output voltage is programmed with two external resistors and a third optional temperature compensation resistor. By integrating the loop compensation and soft-start inside, the part reduces the number of external components. Boundary mode operation provides a small magnetic solution with excellent load regulation. Low ripple Burst Mode® operation maintains high efficiency at light load while minimizing the output voltage ripple. A 2A, 150V DMOS power switch is integrated along with all the high voltage circuitry and control logic into a thermally enhanced 8-lead SO package.

The LT8304 data sheet gives a complete description of the part, operation and application information. The data sheet must be read in conjunction with this quick start guide for demo circuit 2393A

Design files for this circuit board are available at http://www.linear.com/demo/DC2393A

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PERFORMANCE SUMMARY

Specifications are at T_A = 25°C

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Input Voltage		18	48	72	V
Output Voltage	V_{IN} = 18V – 72V I_{OUT} = 20mA – 2A	4.75	5	5.25	V
Maximum Output Current	V_{IN} = 18V	2			A
	V_{IN} = 24V	2.4			A
	V_{IN} = 48V	3.5			A
	V_{IN} = 72V	4.2			A
Output Voltage Ripple (Peak–to–Peak)	V_{IN} = 48V, I_{OUT} = 3.5A			100	mV
Minimum Switching Frequency	I_{OUT} = 0mA		11		kHz
Efficiency	V_{IN} = 24V, I_{OUT} = 2.4A		83		%
	V_{IN} = 48V, I_{OUT} = 3.5A		84		%

QUICK START PROCEDURE

Demonstration circuit 2393A is easy to set up to evaluate the performance of the LT8304. Refer to Figure 1 for proper measurement equipment setup and follow the procedure below:

1. With power off, connect the input power supply to the board through V_{IN} (E1) and GND (E2) terminals. Connect the load to the terminals V_{OUT}^+ (E3) and V_{OUT}^- (E4) on the board.
2. Turn on the power at the input. Increase V_{IN} slowly to 18V.

   Note: Make sure that the input voltage is always within spec. To operate the board with higher input/output voltage, input capacitor, output capacitor and output diode with higher voltage ratings are needed.
3. Check for the proper output voltages. The output should be regulated at 5.0V (±5%).

   Note: The LT8304 requires very small minimum load to maintain good output voltage regulation. A Zener diode is placed on the output to clamp the voltage to 5.6V. This Zener can be replaced with a 249Ω resistor at the trade off of lower efficiency.
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, care must be taken 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 V_{IN} (E1) and GND (E2), or V_{OUT}^+ (E3) and V_{OUT}^- (E4) terminals. See Figure 2 for proper scope probe technique.

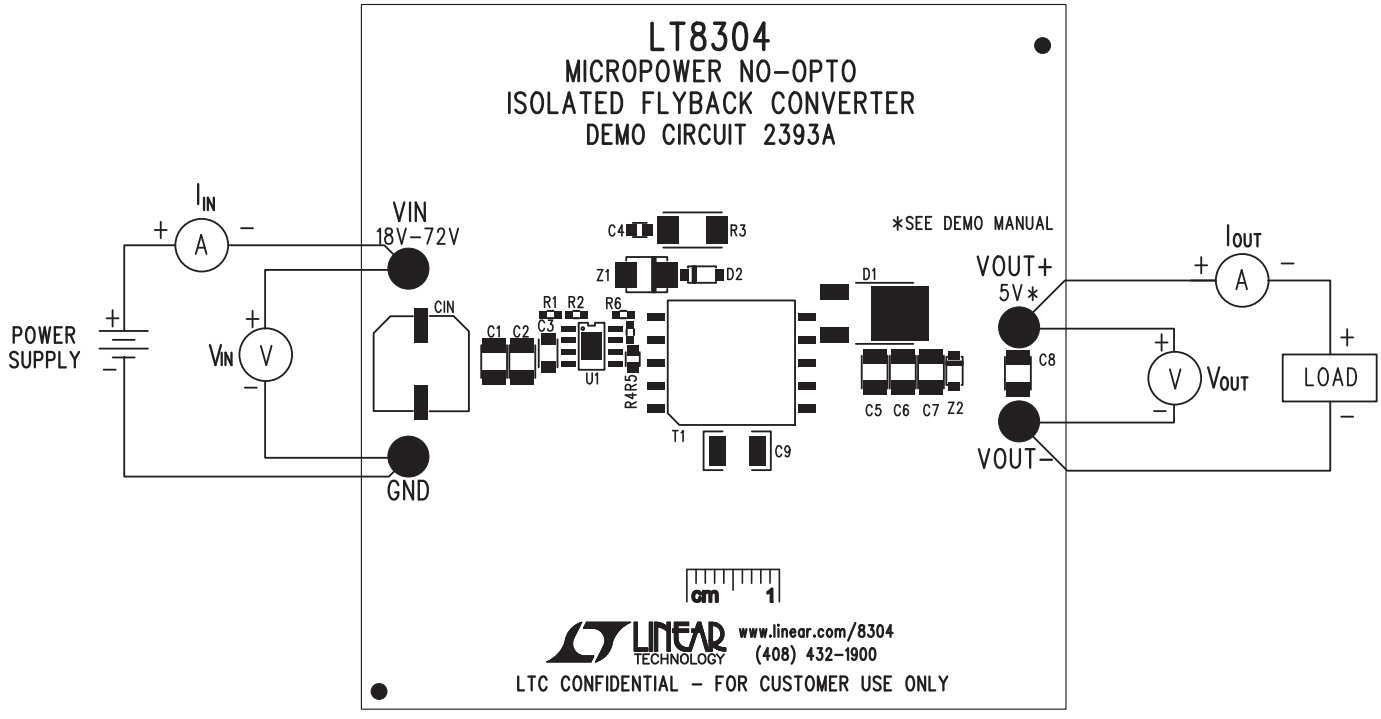


Figure 1. Proper Measurement Equipment Setup

QUICK START PROCEDURE

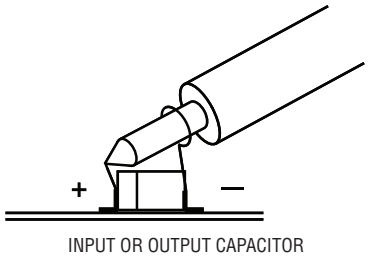


Figure 2. Proper Scope Probe Placement for Measuring Input or Output Ripple

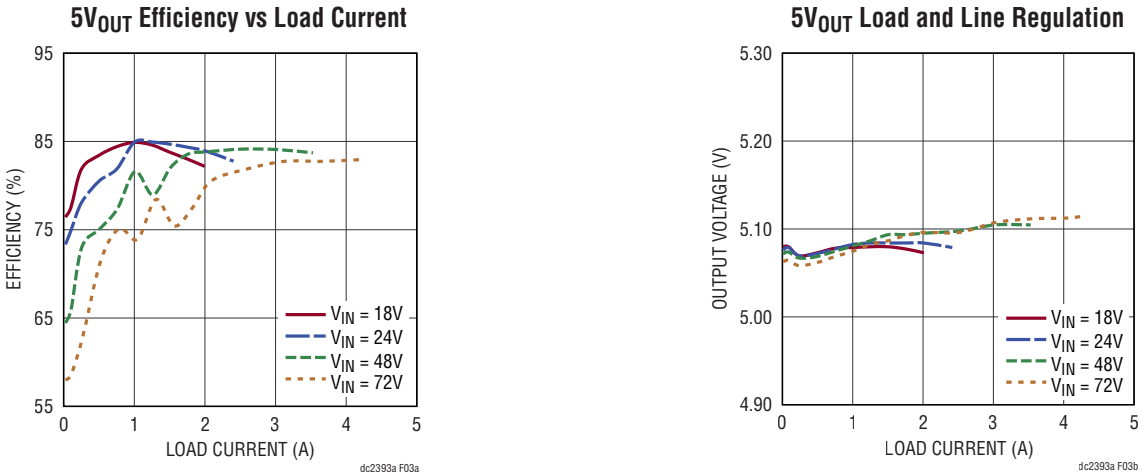


Figure 3. Typical Efficiency and Regulation Curves

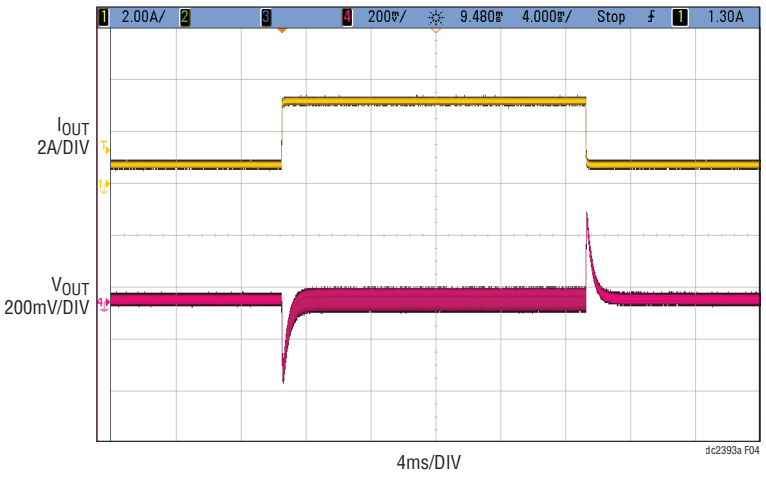
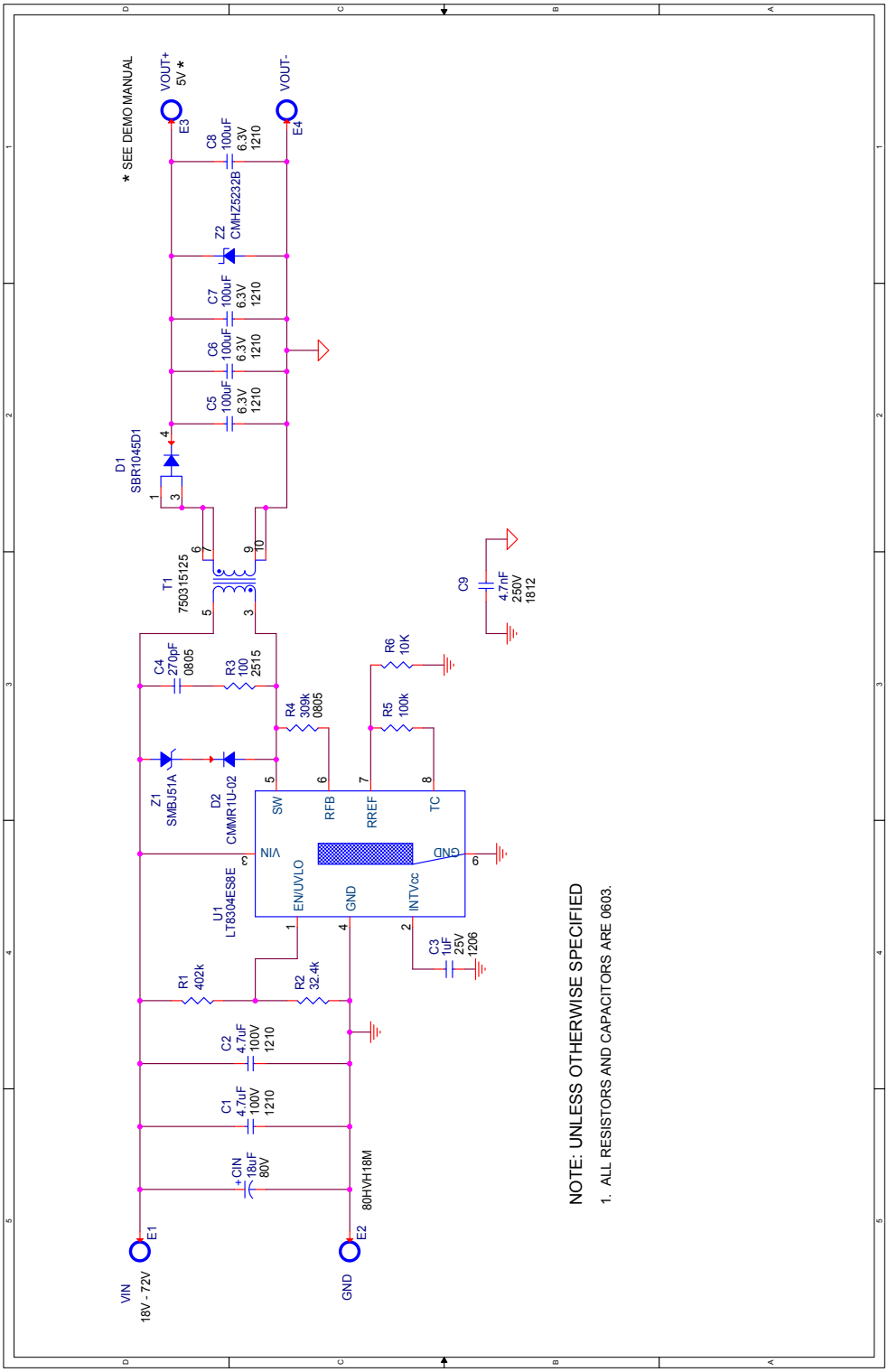


Figure 4. Load Transient Responses (V_{IN} = 48V, Load Transient Between 1A and 3.5A)

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	1	CIN	CAP., ALUM 18µF 80V	SUN ELECTRONIC INDUSTRIES CORPORATION, 80HVH18M
2	2	C1, C2	CAP., 4.7µF, X7S, 100V, 10% 1210	TDK, C3225X7S2A475K200AB
3	1	C3	CAP., 1µF, X7R, 25V, 10% 1206	MURATA, GRM31MR71E105KA01L
4	1	C4	CAP., 270pF, C0G, 50V, 5% 0805	MURATA, GRM2165C1H271JA01D
5	4	C5, C6, C7, C8	CAP., 100µF, X5R, 6.3V, 20% 1210	MURATA, GRM32ER60J107ME20L
6	1	C9	CAP., 4.7nF, X7R, 250V, 10% 1812	MURATA, GA343DR7GD472KW01L
7	1	D1	DIODE, SBR1045D1, DPAK	DIODES INC., SBR1045D1-13
8	1	Z2	DIODE, CMHZ5232B, SOD-123	CENTRAL SEMI., CMHZ5232B
9	1	Z1	DIODE, SMBJ51A, SMB	DIODES INC., SMBJ51A-13-F
10	1	D2	DIODE, CMMR1U-02, SOD-123F	CENTRAL SEMI., CMMR1U-02
11	1	R1	RES., 402k, 1/10W, 1% 0603	VISHAY, CRCW0603402KFKEA
12	1	R2	RES., 32.4k, 1/10W, 1% 0603	VISHAY, CRCW060332K4FKEA
13	1	R3	RES., 100Ω, 1W, 1% 2515	VISHAY, WSC2515100R0FEA
14	1	R4	RES., 309k, 1/8W, 1% 0805	VISHAY, CRCW0805309KFKEA
15	1	R5	RES., 100k, 1/10W, 1% 0603	VISHAY, CRCW0603100KFKEA
16	1	R6	RES., 10k, 1/10W, 1% 0603	VISHAY, CRCW060310K0FKEA
17	1	T1	TRANSFORMER, 750315125	WURTH ELEKTRONIK, 750315125
18	1	U1	IC LT8304 SO8E	LINEAR TECH., LT8304ES8E#PBF
Hardware: For Demo Board Only				
1	4	E1 – E4	TESTPOINT, TURRET, .094" PBF	MILL-MAX, 2501-2-00-80-00-00-07-0

SCHEMATIC DIAGRAM



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