

# No-Opto Isolated Flyback Converter for PSE Applications

## DESCRIPTION

Demonstration circuit 1860B is an isolated flyback converter featuring the [LT3748](#). This demo circuit is designed for Power Sourcing Equipment (PSE) applications with a 52.5V output from a 10V to 15V DC input, with nominal input voltage of 12V. The output current is from 0mA to 700mA, and is capable of a maximum short period overload current of 900mA. Table 1 summarizes the performance of the demo board. This demo circuit can also be easily modified for different PSE applications with some pre-designed transformers.

The LT3748 is a high input voltage isolated flyback controller operating with input supply voltages from 5V to 100V, and 1.9A average gate drive source and sink current. The LT3748 utilizes boundary mode operation to provide a high

efficiency, small size solution with improved regulation. The part senses the isolated output voltage directly from the primary side flyback waveform during the off time of the power switch. No third winding, opto-coupler, or signal transformer is required for regulation.

The LT3748 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 1860B.

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

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## PERFORMANCE SUMMARY (T<sub>A</sub> = 25°C)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Input Voltage Range		10	12	15	V
Output Voltage	V <sub>IN</sub> = 10V – 15V I <sub>OUT</sub> = 0V – 700 mA	50	52.5	55	V
Maximum Output Current	V <sub>IN</sub> = 10V – 15V	700			mA
Minimum Output Current	V <sub>IN</sub> = 10V – 15V			0	mA
Output Voltage Ripple (Peak to Peak)	V <sub>IN</sub> = 10V – 15V, I <sub>OUT</sub> = 0 – 700mA		150		mV
Efficiency	V <sub>IN</sub> = 13.2V, I <sub>OUT</sub> = 700mA		87.8		%

## QUICK START PROCEDURE

Demo circuit 1860B is easy to set up to evaluate the performance of the LT3748. Refer to Figure 1 for proper 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.
2. Connect the load to the terminals  $V_{OUT}^+$  (E6) and  $V_{OUT}^-$  (E7) on the board.
3. Turn on the power at the input. Increase  $V_{IN}$  slowly to 10V.

**NOTE:** Make sure that the input voltage does not exceed 15V. If higher operating voltage is required, power components with higher voltage ratings should be used.

4. Check for the proper output voltages. The output should be regulated at 52.5V ( $\pm 5\%$ ).

**NOTE:** The LT3748 requires minimum load to maintain good output voltage regulation. A zener diode D1 together with preload resistors R2, R14, R15 and R16 are placed in the output to clamp the output voltage to ~52.5V without

ex-board preload requirement. The efficiency is higher than 90% without the preload resistors, but the output may exceed 57V under no load or transient condition.

5. 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 terminals of the input or output capacitor. See Figure 2 for proper scope probe technique.

**NOTE:** A gate resistor of less than  $10\Omega$  can be added to the demo circuit to slow down the turning off of the switch, and reduce the switching node voltage spike. A RC snubber can be added as well to the primary winding of the transformer to damp the spike and reduce the EMI.

## QUICK START PROCEDURE

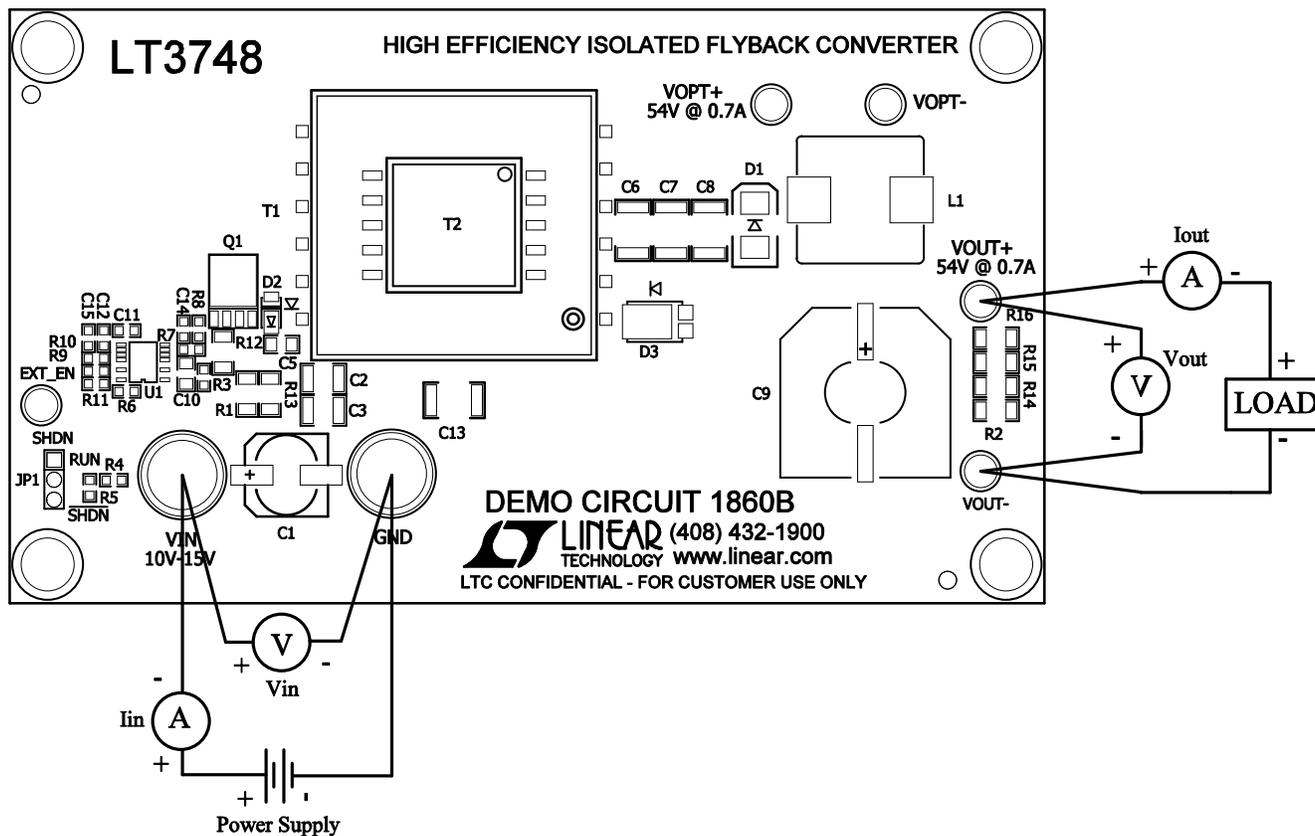


Figure 1. Proper Measurement Equipment Setup

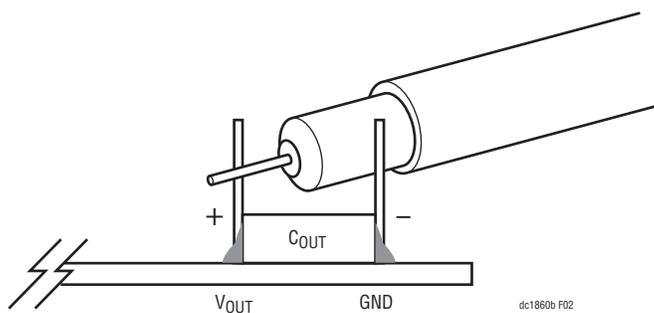


Figure 2. Proper Scope Probe Placement for Measuring Input or Output Ripple

## QUICK START PROCEDURE

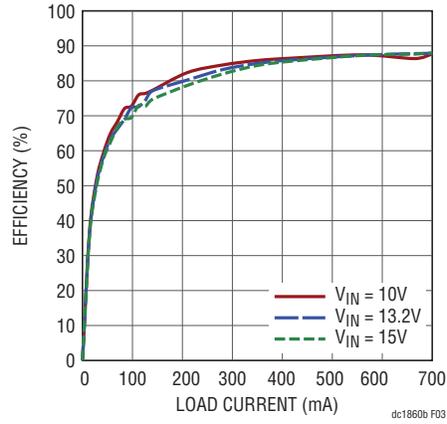


Figure 3. Typical Efficiency Curve, ( $T_A = 25^\circ C$ )

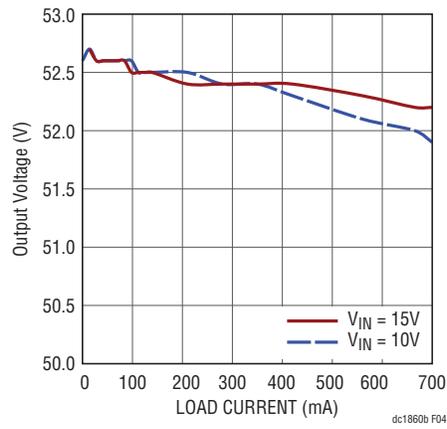


Figure 4. Load Regulation

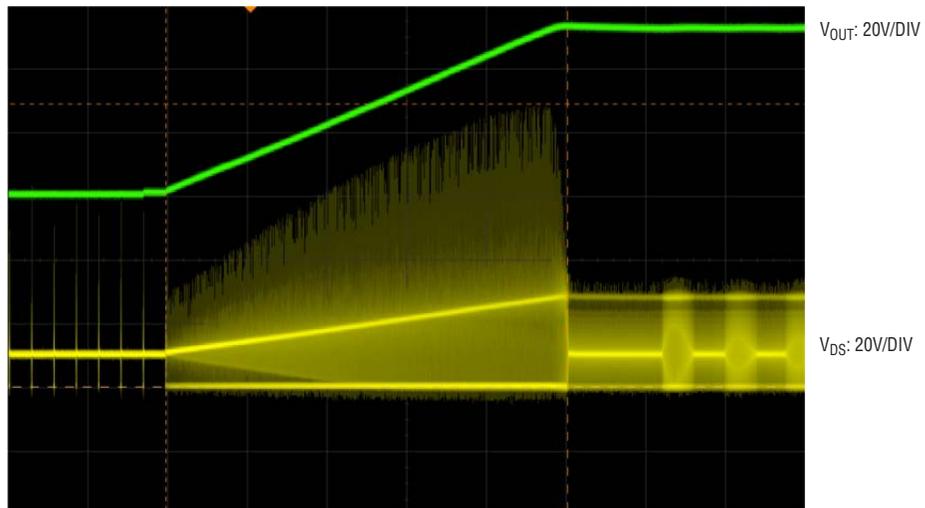


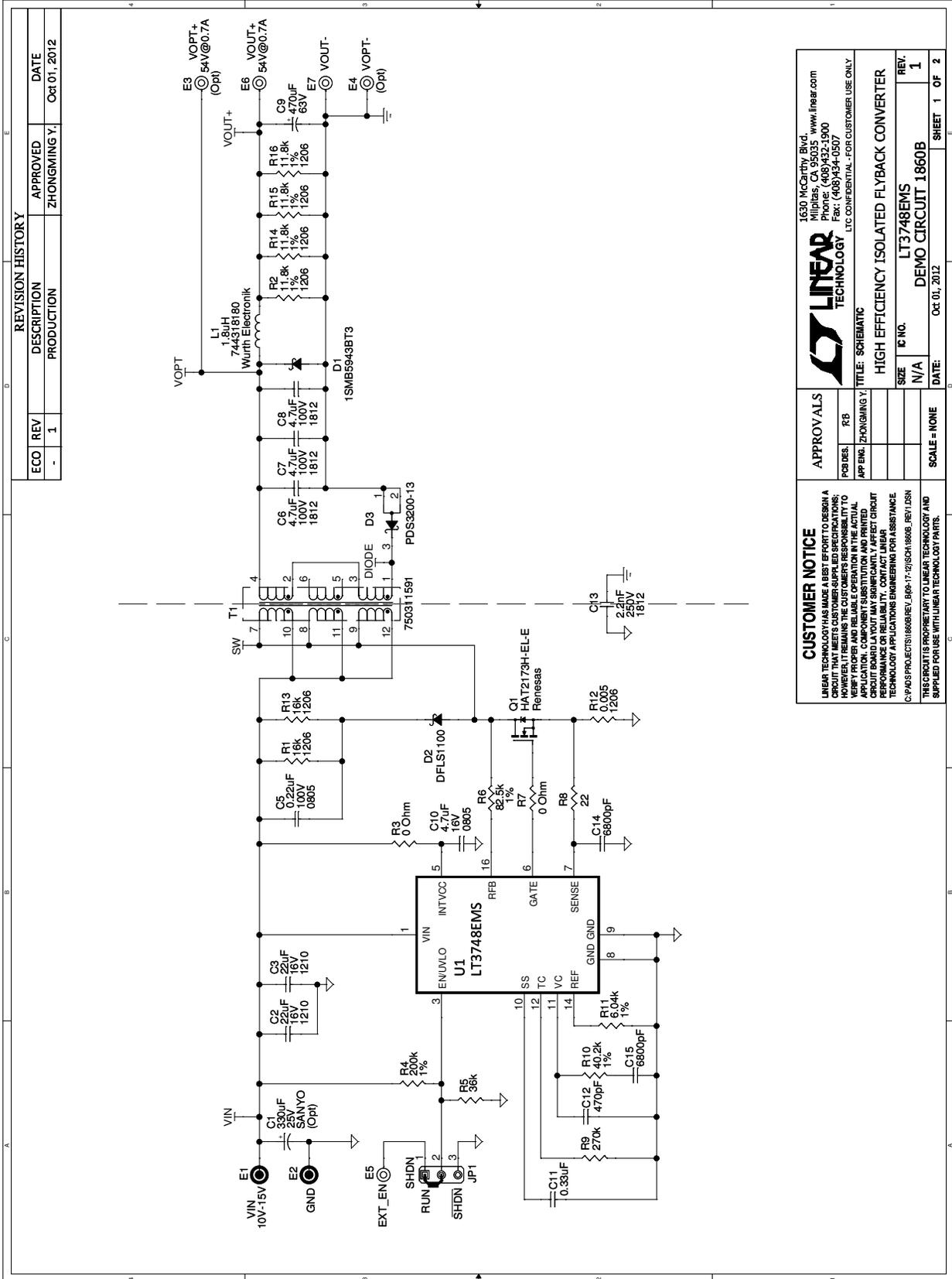
Figure 5. Recovery from Short Circuit Fault

## PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
<b>Required Circuit Components</b>				
1	2	C2, C3	Cap., X5R, 22µF, 16V, 20%, 1210	Taiyo Yuden EMK325BJ226MN
2	1	C5	Cap., X7S, 0.22µF, 100V, 10%, 0805	TDK C2012X7S2A224KT
3	3	C6, C7, C8	Cap., X7S, 4.7µF, 100V, 20%, 1812	TDK C4532X7S2A475MT
4	1	C9	Cap., Elect. 470µF, 63V, 20%, J16-PANASONIC	PANASONIC EEVFK1J471M
5	1	C10	Cap., X5R, 4.7µF, 16V, 20%, 0805	Taiyo Yuden EMK212BJ475MG
6	1	C11	Cap., X5R, 0.33µF, 10V, 20%, 0603	AVX 0603ZD334MAT1A
7	1	C12	Cap., NPO, 470pF, 25V, 10%, 0603	AVX 06033A471KAT2A
8	1	C13	Cap., Ceramic 2.2nF, 250V, 10%, 1812	Murata GA343QR7GD222KW01L
9	2	C14, C15	Cap., X7R, 6800pF, 25V, 20%, 0603	AVX 06033C682MAT2A
10	1	D1	Diode Zener 62V	ON Semi. 1SMB5943BT3
11	1	D2	Schottky Diode 1A/100V, PowerDItm123	Diodes Inc. DFSL1100
12	1	D3	Schottky Diode 3A, PowerDi5	Diodes Inc. PDS3200-13
13	1	L1	Inductor, 1.8µH	Würth Elektronik 744318180
14	1	Q1	Mosfet N-Channel, 100V, LPAK	Renesas HAT2173H-EL-E
15	2	R1, R13	Res., Chip, 16k, 0.25W, 5%, 1206	Vishay CRCW120616K0JNED
16	4	R2, R14, R15, R16	Res., Chip, 11.8k, 0.25W, 1%, 1206	Vishay CRCW120611K8FKEA
17	2	R3, R7	Res/Jumper, Chip, 0Ω, 1/16W, 1 AMP 0603	Vishay CRCW06030000Z0EA
18	1	R4	Res., Chip, 200k, 0.06W, 1%, 0603	Vishay CRCW0603200KFKEA
19	1	R5	Res., Chip, 36k, 0.06W, 5%, 0603	Vishay CRCW060336K0JNEA
20	1	R6	Res., Chip, 82.5k, 0.06W, 1%, 0603	Vishay CRCW060382K5FKEA
21	1	R8	Res., Chip, 22, 0.06W, 5%, 0603	Vishay CRCW060322R0JNEA
22	1	R9	Res., Chip, 270k, 0.06W, 5%, 0603	Vishay CRCW0603270KJNEA
23	1	R10	Res., Chip, 40.2k, 0.06W, 1%, 0603	Vishay CRCW060340K2FKEA
24	1	R11	Res., Chip, 6.04k, 0.06W, 1%, 0603	Vishay CRCW06036K04FKEA
25	1	R12	Res., 0.005, 0.25W, 1%, 1206	Vishay Dale WSL-1206-5L000-1%
26	1	T1	Transformer, XFMR	Würth Elektronik 750311591
27	1	U1	I.C., LT3748EMS	Linear Tech. Corp. LT3748EMS
<b>Hardware For Demo Board Only</b>				
1	2	E1, E2	Connector, Banana Jack	Keystone 575-4
2	3	E5, E6, E7	Turret, Testpoint	Mill Max 2501-2-00-80-00-00-07-0
3	1	JP1	Headers, Sgl. Row, 3 Pins, 2mm Ctrs.	Samtec TMM-103-02-L-S
4	4	MH1, MH2, MH3, MH4	STAND-OFF, NYLON 0.25" tall	KEYSTONE, 8831(SNAP ON)
5	1	XJP1	Shunt, 2mm Ctrs.	Samtec 2SN-BK-G
6	1		FAB, 1860B, Rev 3.PCB	DEMO CIRCUIT 1860B
7	2		STENCILS - TOP & BOTTOM	STENCIL DC1860B
<b>Additional Demo Board Circuit Components</b>				
1	0	C1 (Opt)	Cap., Alum 330µF 25V, 10%, 25cv330gX	SANYO 25CV330gX
2	0	C16 (Opt)	Cap., Alum. Elect. 100µF, 63V, ±20%, NipponChemi-Con/JA0	Nippon Chemi-Con EMZA630ADA101MJA0G
3	0	L2 (Opt)	Inductor, 47µH, IHLP4040	VISHAY IHLP-4040DZ-ER-470-M11
4	0	T2 (Opt)	Transformer, XFMR	Würth Elektronik 750311456
5	0	T3 (Opt)	Transformer, XFMR	Würth Elektronik 750311604
6	0	E3, E4 (Opt)	Turret, Testpoint	Mill Max 2501-2-00-80-00-00-07-0

# DEMO MANUAL DC1860B

## SCHEMATIC DIAGRAM



1650 McCarthy Blvd. www.linear.com  
 Milpitas, CA 95035-5000  
 Phone: (408) 328-3900  
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**TITLE: SCHEMATIC**

**HIGH EFFICIENCY ISOLATED FLYBACK CONVERTER**

SIZE: N/A    I.C. NO.: LT3748EMS    REV.: 1

DATE: Oct 01, 2012    DEMO CIRCUIT 1860B    SHEET 1 OF 2

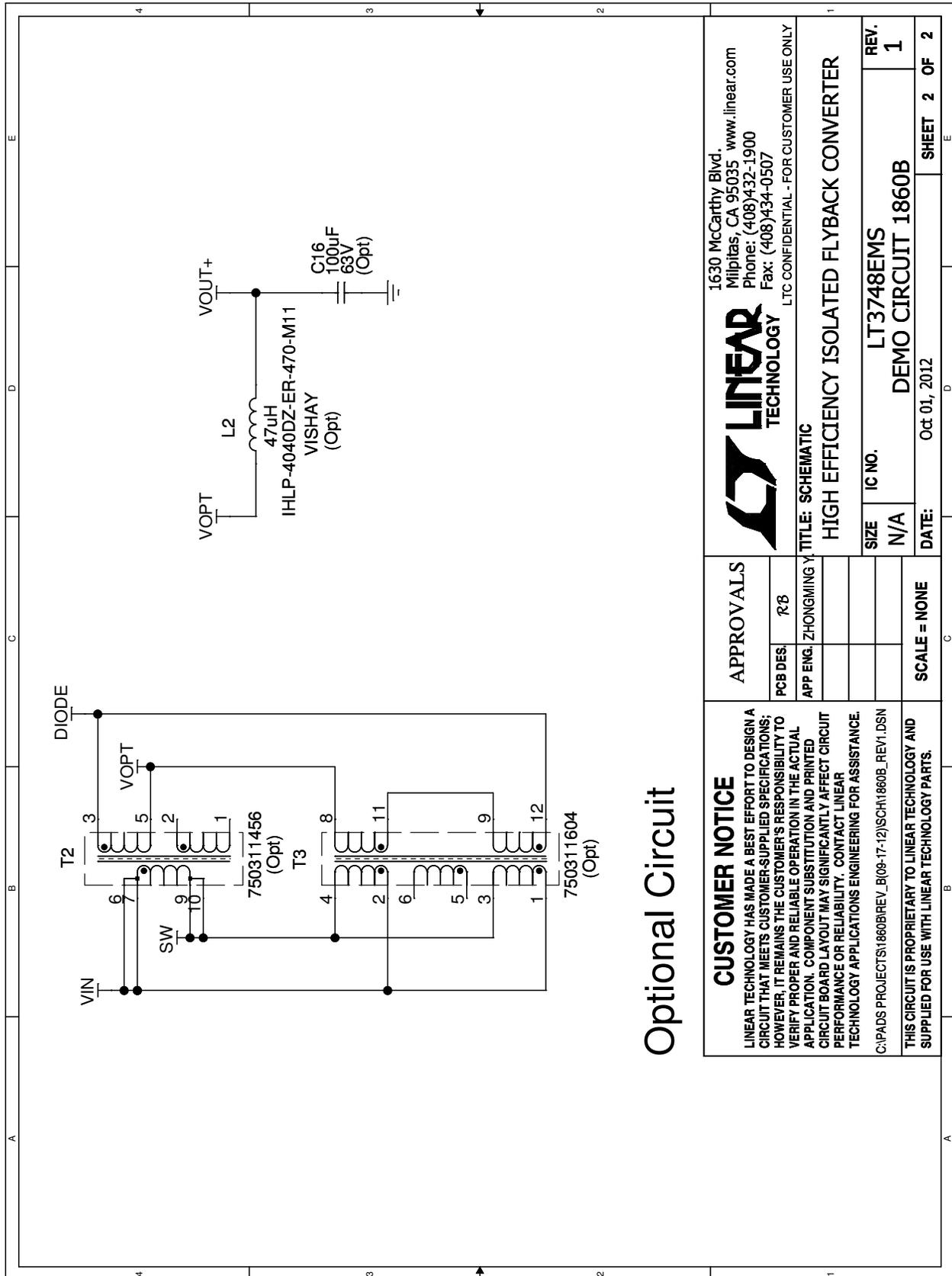
SCALE = NONE

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**SCHEMATIC DIAGRAM**



**Optional Circuit**

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PCB DES.	R B						
APP ENG.	ZHONGMING Y						
<p><b>LINEAR TECHNOLOGY</b>                  1630 McCarthy Blvd.                  Milpitas, CA 95035 www.linear.com                  Phone: (408)432-1900                  Fax: (408)434-0507                  LTC CONFIDENTIAL - FOR CUSTOMER USE ONLY</p>		<p><b>TITLE: SCHEMATIC</b>  <b>HIGH EFFICIENCY ISOLATED FLYBACK CONVERTER</b></p>					
<p><b>SCALE = NONE</b></p>		<p><b>REV. 1</b></p>					
<p><b>SIZE N/A</b></p>		<p><b>IC NO. LT3748EMS</b></p>					
<p><b>DATE: Oct 01, 2012</b></p>		<p><b>DEMO CIRCUIT 1860B</b></p>					
<p><b>SHEET 2 OF 2</b></p>		<p><b>REV. 1</b></p>					

dc1860bfa

# DEMO MANUAL DC1860B

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Тел: +7 (812) 336 43 04 (многоканальный)

Email: [org@lifeelectronics.ru](mailto:org@lifeelectronics.ru)

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