

QUICK START GUIDE FOR DEMONSTRATION CIRCUIT 448

DUAL OUTPUT ISOLATED POWER SUPPLY

LT3710

DESCRIPTION

Demonstration circuit 448 is a dual output high efficiency isolated DC/DC power supply with 36V to 72V input range. It has two outputs: 3.3V at 10A max and 1.8V or 2.5V at 10A max. LT3710, a secondary side synchronous post regulator controller, is used to generate a tightly regulated second output directly from the transformer secondary winding, thus minimizing the size of

the output inductor and capacitor at the first output stage. Synchronous MOSFETs significantly improve efficiency, making it suitable for low output voltage applications. The complete design is mounted within a standard half brick PCB area with about half inch height.

Design files for this circuit board are available. Call the LTC factory.

Table 1. Performance Summary ($T_A = 25^\circ\text{C}$)

PARAMETER	CONDITION	VALUE
Minimum Input Voltage		36V
Maximum Input Voltage		72V
V_{OUT1}	$V_{IN} = 36\text{V to } 72\text{V}$, $I_{OUT1} = 0\text{A to } 10\text{A}$, $I_{OUT2} = 0\text{A to } 10\text{A}$	$3.3\text{V} \pm 2\%$
V_{OUT2}	$V_{IN} = 36\text{V to } 72\text{V}$, $I_{OUT1} = 0\text{A to } 10\text{A}$, $I_{OUT2} = 0\text{A to } 10\text{A}$	$1.83\text{V} \pm 2\%$ (JP1, JP2: 1.8V position) or $2.53\text{V} \pm 2\%$ (JP1, JP2: 2.5V position)
Typical Output Ripple V_{OUT1}	$V_{IN} = 48\text{V}$, $I_{OUT1} = 10\text{A}$ (20MHz BW)	70mV _{p-p}
Typical Output Ripple V_{OUT2}	$V_{IN} = 48\text{V}$, $I_{OUT2} = 10\text{A}$ (20MHz BW)	50mV _{p-p} for 1.8Vo 60mV _{p-p} for 2.5Vo
Output Regulation	Line	$\pm 0.1\%$
	Load	$\pm 0.2\%$
Nominal Switching Frequency		230kHz
Efficiency	$V_{IN} = 48\text{V}$, $V_{OUT1} = 3.3\text{V}$, $V_{OUT2} = 1.8\text{V}$, $I_{OUT1} = I_{OUT2} = 10\text{A}$	86% Typical
	$V_{IN} = 48\text{V}$, $V_{OUT1} = 3.3\text{V}$, $V_{OUT2} = 2.5\text{V}$, $I_{OUT1} = I_{OUT2} = 10\text{A}$	87% Typical
Output Voltage V_{OUT1} Trim	$V_{O1 \text{ TRIM}} = 3.3\text{V}$	5% Typical
	$V_{O1 \text{ TRIM}} = 0\text{V}$	-5% Typical
On/Off Control	Logic Low Voltage-Off	0.6V Max
	Logic High Voltage-On	1V Min
Isolation Voltage	Basic Insulation	1500VDC

OPERATING PRINCIPLES

Demonstration circuit 448A features the LT3710, LT3781 and LTC1698 controllers. The basic power stage topology is a two-switch forward converter with synchronous rectification. The primary side controller uses the LT3781, a current mode two-switch forward controller with built-in MOSFET drivers. On the secondary side, an LTC1698 is used to provide the voltage feedback for the 3.3V output, as well as the gate drive for the synchronous MOSFETs in the 3.3V output stage. The error amplifier output of the 3.3V circuit is fed into the optocoupler and then relayed to LT3781 on the primary side to complete the 3.3V regulation. The second 1.8V/2.5V output is directly regulated by the LT3710 circuit.

A planar transformer PA0191 built by Pulse Engineering is employed as the power transformer in this design. This transformer is constructed on a PQ20 core with nine turns of primary windings, two turns of secondary

windings and seven turns of auxiliary windings for the LT3781 bias supply. A Vishay Si7892DP is used due to its low $R_{DS(ON)}$, 30V V_{DSS} rating and its compact and thermally enhanced PowerPak SO-8 package.

The switching frequency of the circuit is about 230KHz. 1500V input to output isolation is provided. Additional features of this demo board include primary side on/off control, $\pm 5\%$ secondary side trimming on the 3.3V output, input overvoltage protection, under voltage lockout, 3.3V output overvoltage protection, 1.8V/2.5V output current limit and board overtemperature shutdown.

The demo board can deliver the full rated currents (10A at both outputs) at room temperature without airflow. The hottest spot on the demo board (T1 transformer) has a temperature rise of 50°C at 48V input and full loads (without airflow).

QUICK START PROCEDURE

Demonstration circuit DC448 is easy to set up to evaluate the performance of the LT3710, LT3781 and LTC1698. Refer to Figure 1 for proper measurement equipment setup and follow the procedure below:

NOTE: When measuring the input or output voltage ripple, 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 Vin or Vout and GND terminals. See Figure 2 for proper scope probe technique.

Default jumper setting: both jumpers at 1.8V position

1. Select Vout2 1.8V (or 2.5V): Place both jumpers JP1 and JP2 at 1.8V (or 2.5V) position.
2. With power off, connect the input power supply to +Vin (36V–72V) and –Vin (input return).

3. The on/off control pin should be left open for normal operation. (Connecting the on/off pin to the –Vin turns off the converter.)
4. For normal 3.3V output, Vo1 Trim pin should be left open.
5. Connect the 3.3V load (Load 1 in Figure 1) between +Vo1 and Vo RTN; connect the 1.8V/2.5V load (Load 2 in Figure 1) between +Vo2 and Vo RTN.
6. Connect the DVMs to the input and outputs.
7. Turn on the input power supply and check for the proper output voltages. Vo1 should be 3.3V $\pm 2\%$. Vo2 should be 1.83V $\pm 2\%$ if 1.8Vo is selected (or Vo2 should be 2.53V $\pm 2\%$ if 2.5Vo is selected).

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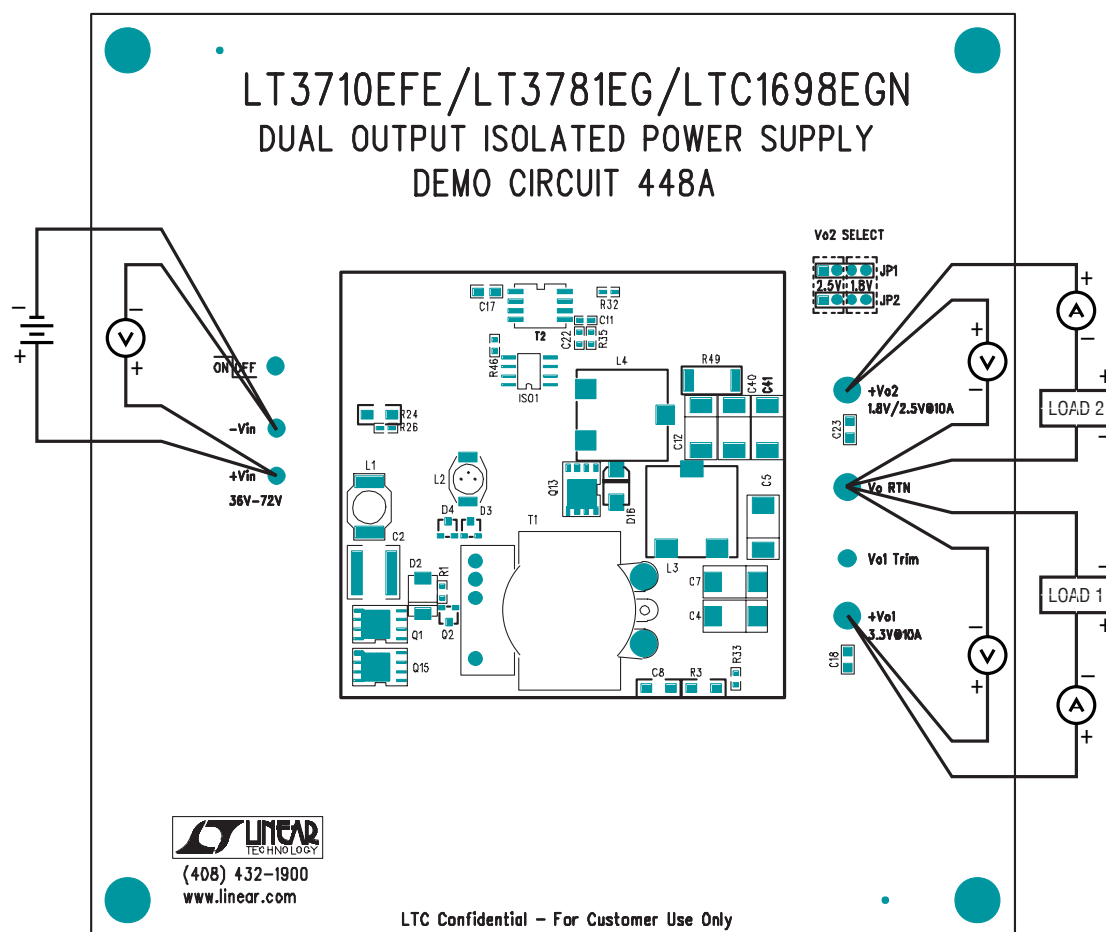


Figure 1. Proper Measurement Equipment Setup

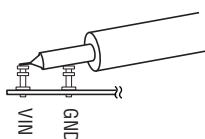


Figure 2. Measuring Input or Output Ripple

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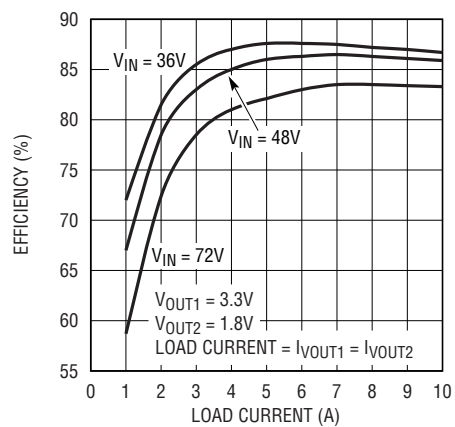


Figure 3. Efficiency vs load current: $V_{out1}=3.3V$ and $V_{out2}=1.8V$

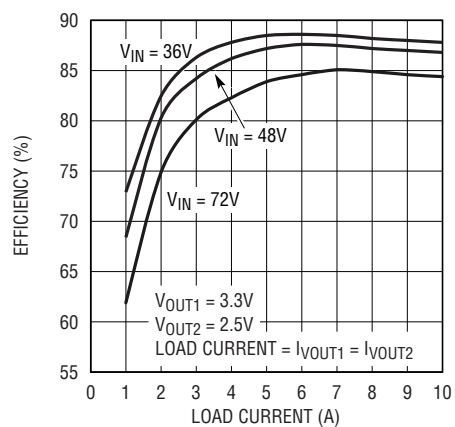
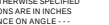
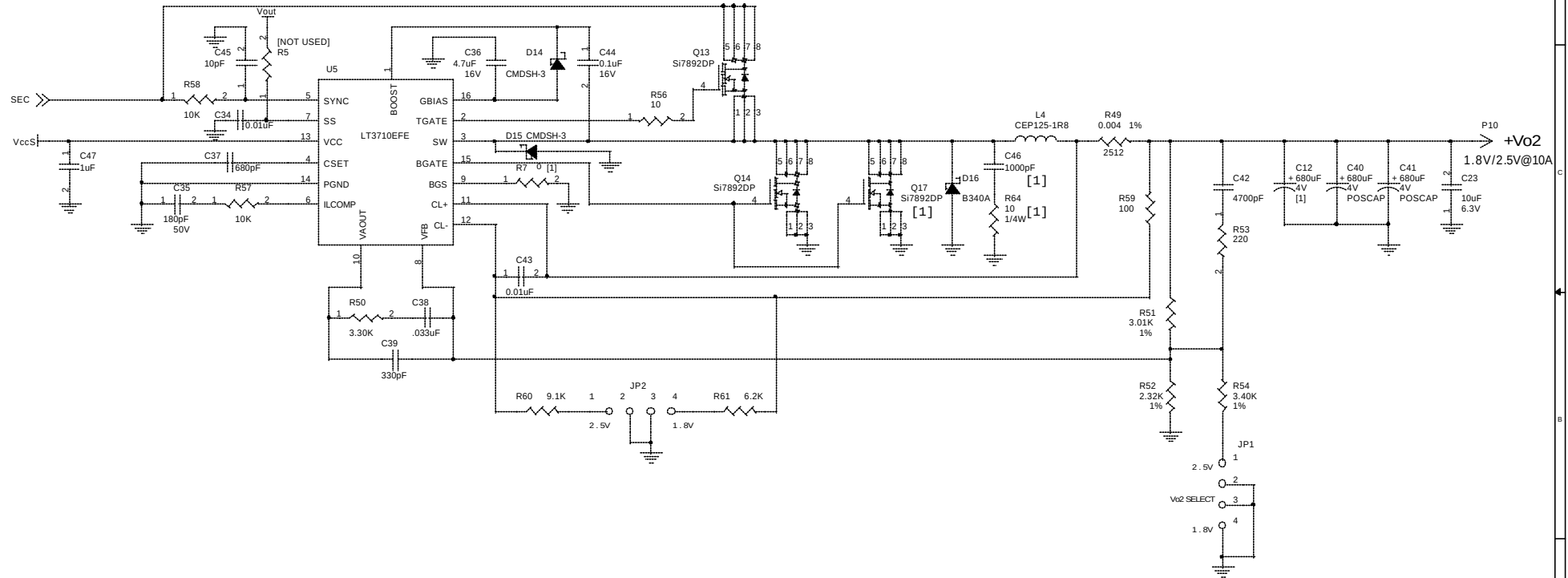
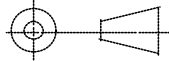


Figure 4. Efficiency vs load current: $V_{out1}=3.3V$ and $V_{out2}=2.5V$

UNLESS OTHERWISE SPECIFIED TOLERANCES ARE IN INCHES .015" - .030" .030" - .063" .063" - .125" .125" - .250" .250" - .500" .500" - 1.000" INTERPRET DIM AND TOL PER ASME Y14.5M-1994 THIRD ANGLE PROJECTION  DO NOT SCALE	CONTRACT NO.	 1630 McCarthy Blvd Milpitas, CA 95026 Phone: (408)432-9200 Fax: (408)432-0007					
	APPROVALS		DATE	TITLE			
	DRAWN: MEI		07/15/02	SCH. LT3710EFLT3781EGLTCL6898GN DUAL OUTPUT ISOLATED POWER SUPPLY			
	CHECKED			SIZE	CAGE CODE	DWG NO	REV
	APPROVED			C		DC448A	
ENGINEER		SCALE: NONE	FILENAME: 448A.DSN	SHEET 1	OF		
DESIGNER							
	Friday, October 25, 2002						

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UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCE ON ANGLE . . . 2 PLACES . . . 3 PLACES . . . INTERPRET DIM AND TOL PER ASME Y14.5M -1994 THIRD ANGLE PROJECTION  DO NOT SCALE DRAWING	CONTRACT NO.		 1630 McCarthy Blvd. Milpitas, CA 95035 Phone: (408)432-1900 Fax: (408)434-0507		
	APPROVALS DRAWN MEI	DATE 08-02-01	TITLE SCH, LT3710EFE/LT3781EG/LTC1698EGN DUAL OUTPUT ISOLATED POWER SUPPLY		
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	ENGINEER				
DESIGNER		SIZE B	CAGE CODE	DWG NO DC448A	REV 5
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Офис по работе с юридическими лицами:

105318, г.Москва, ул.Щербаковская д.3, офис 1107, 1118, ДЦ «Щербаковский»

Телефон: +7 495 668-12-70 (многоканальный)

Факс: +7 495 668-12-70 (доб.304)

E-mail: info@moschip.ru

Skype отдела продаж:

moschip.ru

moschip.ru_4

moschip.ru_6

moschip.ru_9