Signal Chain Power Series LT8330 Boost Converter

DESCRIPTION

Demonstration circuit SCP-LT8330-EVALZ features the LT8330, a boost/SEPIC/inverting converter with a 1A, 60V switch. The demo circuit is specifically a boost converter with an operating input voltage range from 10V to 36V and an output voltage of 48V. With a 12V input, the maximum output current is 135mA.

Like all boards in the Signal Chain Power series, this board is designed to be easily plugged into other SCP boards to form a complete signal chain power system, enabling fast evaluation of low power signal chains. To evaluate this board, some universal SCP hardware is required, namely:

SCP-INPUT-EVALZ
SCP-OUTPUT-EVALZ
SCP-FILTER-EVALZ
SCP-THRUBRD-EVALZ
SCP-1X2BKOUT-EVALZ
SCP-1X5BKOUT-EVALZ
SCP-5X1-EVALZ

To properly evaluate SCP series demo boards, you will need the SCP Configurator companion software. SCP Configurator can help you choose the right board and topology for your design.

Note that this Demo Manual does not cover details important to the operation and configuration regarding the LT8330. Please refer to the LT8330 datasheet for a complete description of the part.

Design files for this circuit board are available.

Table 1. Performance Summary

SYMBOL	PARAMETER	NOTES	MIN	TYP	MAX	UNITS
$V_{IN(MAX)}$	Max Input Voltage				40	V
$V_{OUT(MAX)}$	Max Output Voltage				59	V
$I_{SW(LIM)}$	Switch Current Limit				1.0	A

BOARD IMAGE

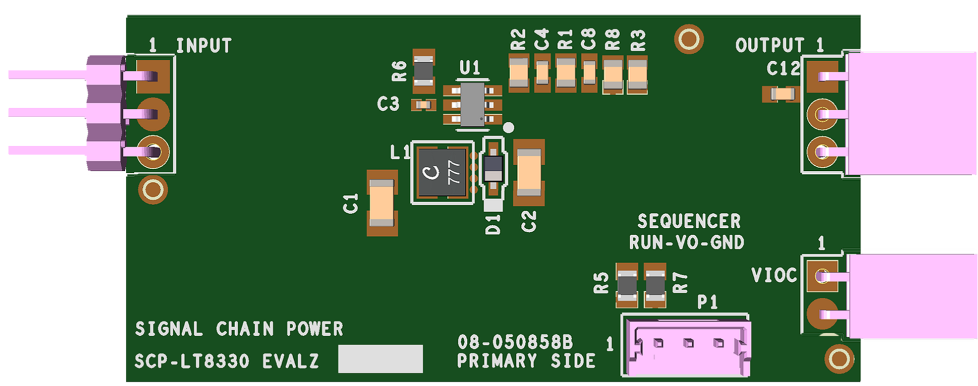


Figure 1. SCP-LT8330-EVALZ Evaluation Board

QUICK START PROCEDURE

Demonstration circuit SCP-LT8330-EVALZ is easy to set up to evaluate the performance of any SCP hardware configuration.

1. The SCP-LT8330-EVALZ ships with a default output voltage of 48V. To change the output voltage, see "Configuration Settings" section, and modify the board accordingly. Be sure to check for open connections or solder shorts after making any modifications.
2. Connect the SCP-INPUT-EVALZ and SCP-OUTPUT-EVALZ boards to the SCP-LT8330-EVALZ (refer to Figure 2) and connect the input board to a voltage source, V_{SOURCE}. Connect the output board to a voltmeter or dynamic load. Slowly raise the input voltage until the SCP-LT8330-EVALZ powers up into regulation and sweep V_{SOURCE} through the desired range of operation.

   NOTE: Make sure that the input voltage is always within spec. If using a dynamic load to measure output voltage, make sure the load is initially set to zero.
3. Check for proper output voltage. The output should be regulated at the programmed value (±5%).
4. Once the proper output voltage is established, power off V_{SOURCE} and similarly test other boards in the SCP system until all elements have been individually verified prior to assembling into the final circuit configuration.

   NOTE: When measuring the input or output voltage ripple, use the optional SMA connector locations available on the input, output, 1 × 5, 1 × 2, and 5 × 1 breakout boards. Avoid using the test point connections with long scope leads.

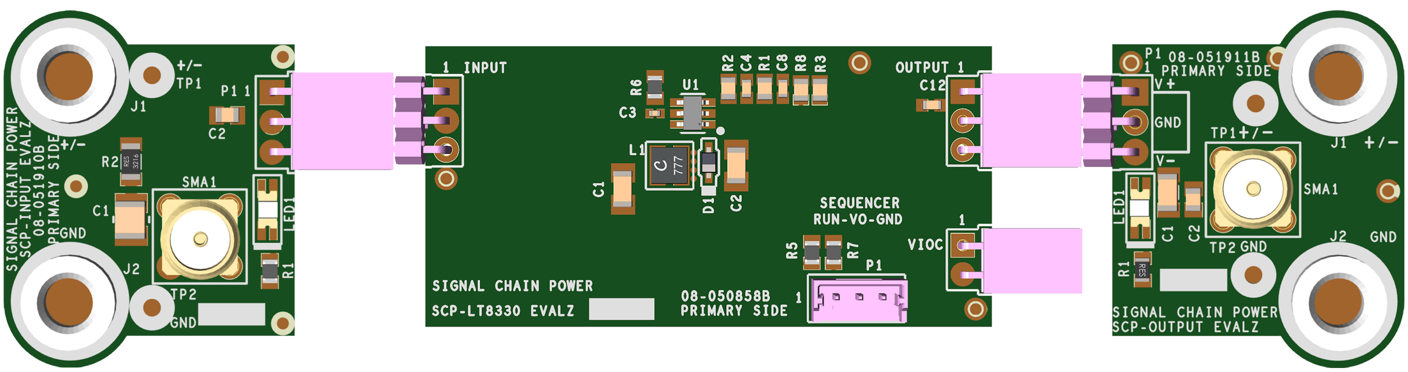


Figure 2. Proper Measurement Equipment Setup (Use SMA connectors for Measuring Input or Output Ripple)

CONFIGURATION SETTINGS

Demonstration circuit SCP-LT8330-EVALZ features the LT8330, a boost/SEPIC/inverting converter with a 1A, 60V switch. The demo circuit is specifically a boost converter with an operating input voltage range from 10V to 36V and an output voltage of 48V. With a 12V input, the maximum output current is 135mA.

The output of the SCP-LT8330-EVALZ is resistor-programmable from 5V to 59V. The board can be also configured to drive VIOC-capable linear regulators.

OUTPUT VOLTAGE PROGRAMMING

$$V_{OUT} = 1.6V_{FBX}\left(1+\frac{R1}{R2}\right)$$

Table 2. Resistor selection guide for common output voltages

V_{OUT} (V)	R1 (Ω)	R2 (Ω)
5.0	24.3k	11.5k
6.0	31.6k	11.5k
7.0	115k	34.0k
8.0	102k	25.5k
9.0	118k	25.5k
10.0	105k	20.0k
11.0	107k	18.2k
12.0	71.5k	11.0k
13.0	97.6k	13.7k
14.0	78.7k	10.2k
15.0	115k	13.7k
16.0	102k	11.3k
17.0	162k	16.9k
18.0	205k	20.0k
19.0	150k	13.7k
20.0	115k	10.0k
21.0	243k	20.0k
22.0	255k	20.0k
23.0	226k	16.9k
24.0	140k	10.0k
25.0	215k	14.7k
30.0	442k	24.9k
35.0	287k	13.7k
40.0	255k	10.7k
45.0	374k	13.7k
50.0	357k	11.8k
55.0	357k	10.7k
59.0	412k	11.5k

EN/UVLO PIN CONFIGURATION

The EN/UVLO pin is tied to the optional SCP Run/Sequence header P1. To create a harness for this function, use Molex part 0510650300 with crimp pin 50212-8000.

To use an active run signal, use a 100kΩ resistor for either pull-up or pull-down resistors R5 and R6, short R7 with 0Ω, and use the drive signal from connector P1.

If precision undervoltage lockout (UVLO) operation is desired, program enable divider R5 and R6 such that:

R6 is 10k to 100k, nominal

$$R5 = R6\left(\frac{V_{IN} - 1.60V_{TH}}{1.60V_{TH}}\right)$$

The LT8330 has an accurate 1.60V threshold which places the part into under voltage lockout. The hysteresis threshold on the rising edge is typically 80mV and scales by the factor:

$$V_{HYST} = 130mV\frac{R5+R6}{R6}$$

VOLTAGE INPUT-TO-OUTPUT CONTROL (VIOC) IMPLEMENTATION

To implement the VIOC function for this regulator, set R_3 to 0Ω. Refer to the "Configuration Settings" section in the Demo Manual for the LDO board and use the following configuration for this board.

Table 3. VIOC Cross-Reference Designators

VIOC SETTING REFERENCES	R_{BOT}	R_{TOP}	R_{MAX}
V_{OUT} Reference Designators	R2	R1	R8

$$V_{LDOIN} - V_{LDOOUT} = V_{VIOC} = 1.6V_{FB}\left(\frac{R_{BOT}+R_{TOP}}{R_{BOT}}\right)$$

$$V_{(MAX)LDOIN} = 1.6V_{FB}\left(\frac{R_{BOT}+R_{TOP}+R_{MAX}}{R_{BOT}}\right)+I_{SINK}R_{MAX}$$

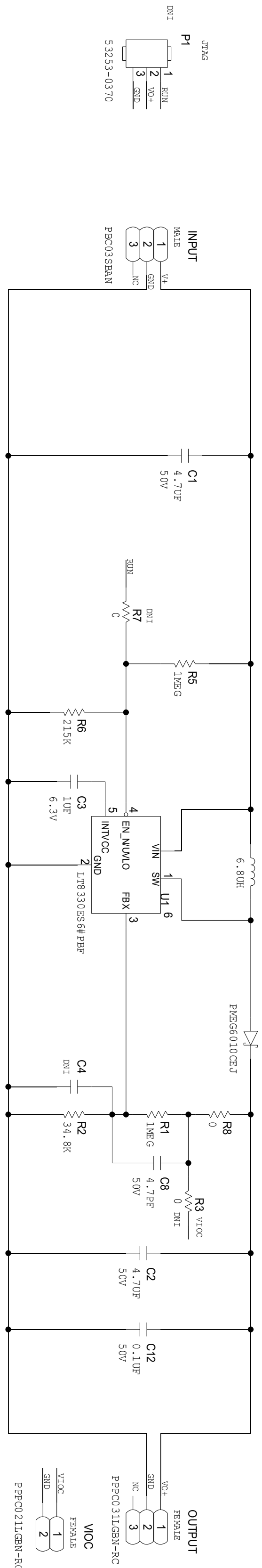
I_{SINK} is the current through R_{MAX}, typically 15µA, so R_{BOT} should be sized such that the divider current runs a minimum of 100µA to minimize the I_{SINK} error term.

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
1	1	PCB	PCB	ANALOG DEVICES 08_050858b
2	2	C1, C2	CAP CER 4.7UF 50V 10% X7R 1206	SAMSUNG CL31B475KBHNNNE
3	1	C12	CAP CER 0.1UF 50V 10% X7R 0603	SAMSUNG CL10B104KB8NNNC
4	1	C3	CAP CER X7R, GENERAL PURPOSE	MURATA GRM155R70J105KA12D
5	1	C4	CAP MLCC 0603 (Note 1)	N/A
6	1	C8	CAP CER NP0	PHYCOMP (YAGEO) 2238 867 15478
7	1	D1	DIO SCHOTTKY BARRIER RECTIFIER, 1A	NEXPERIA PMEG6010CEJ
8	1	INPUT	CONN-PCB MALE HEADER 3POS 2.54MM PITCH R/A GOLD	SULLINS PBC03SBAN
9	1	L1	IC SHIELDED POWER, 0.287OHM DCR, 1.1A	WURTH ELEKTRONIK74438335068
10	1	OUTPUT	CONN FEMALE 3POS 2.54MM PITCH R/A GOLD	SULLINS PPPC031LGBN-RC
11	1	P1	CONN-PCB 3POS HEADER WIRE TO BRD WAFER ASSY STRAIGHT 2MM PITCH (Note 1)	MOLEX 53253-0370
12	1	R1	RES PRECISION THICK FILM CHIP	PANASONIC ERJ-6ENF1004V
13	1	R2	RES HIGH PRECISION SMD	TYCO ELECTRONICS RN73C2A34K8BTG
14	2	R3, R7	RES THICK FILM 0805 (Note 1)	N/A
15	1	R5	RES THICK FILM CHIP, GENERAL PURPOSE	YAGEO RC0805JR-071ML
16	1	R6	RES STANDARD THICK FILM CHIP, FOR AUTOMOTIVE	VISHAY CRCW0805215KFKEA
17	1	R8	RES STANDARD THICK FILM CHIP JUMPER, FOR AUTOMOTIVE	VISHAY CRCW08050000Z0EA
18	1	U1	IC-LIN LOW IQ BOOST/SEPIC/INVERTING CONVERTER WITH 1A, 60V SWITCH	LINEAR TECHNOLOGY LT8330ES6#PBF
19	1	VIOC	CONN FEMALE 2POS 2.54MM PITCH R/A GOLD	SULLINS PPPC021LGBN-RC

Note 1. These items are not stuffed (DNI).

SCHEMATIC DIAGRAM



ESD Caution

ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.