Signal Chain Power Series LT8618 High Efficiency Synchronous Buck Converter

DESCRIPTION

Demonstration circuit SCP-LT8618-BEVALZ is a high efficiency 60V, 100mA synchronous step-down regulator. The wide input range also allows output voltage inversion by using the SCP-LT8618-IEVALZ version of this board.

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-1X5BKOUT-EVALZ
SCP-THRUBRD-EVALZ
SCP-FILTER-EVALZ
SCP-1X2BKOUT-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 LT8618. Please refer to the LT8618 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				60	V
$V_{OUT(MAX)}$	Max Output Voltage				48	V
$I_{OUT(MAX)}$	Max Output Current				100	mA

BOARD IMAGE

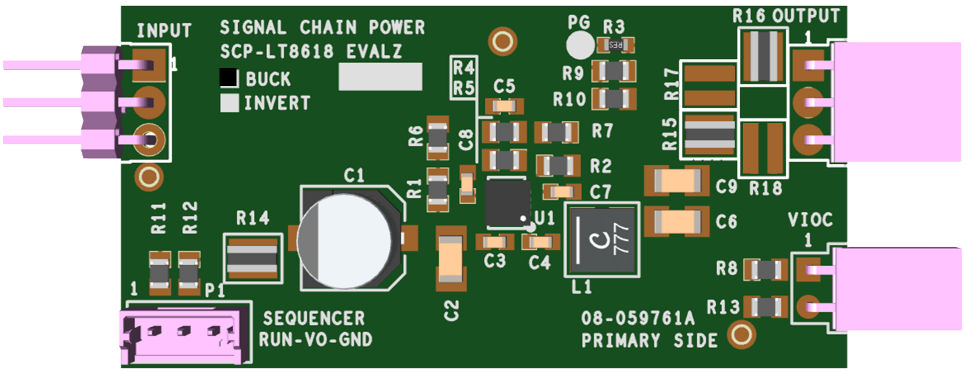


Figure 1. SCP-LT8618-BEVALZ Evaluation Board

QUICK START PROCEDURE

Demonstration circuit SCP-LT8618-BEVALZ is easy to set up to evaluate the performance of any SCP hardware configuration.

1. The SCP-LT8618-BEVALZ ships with a default output voltage of 5V. 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-LT8618-BEVALZ (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-LT8618-BEVALZ 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.

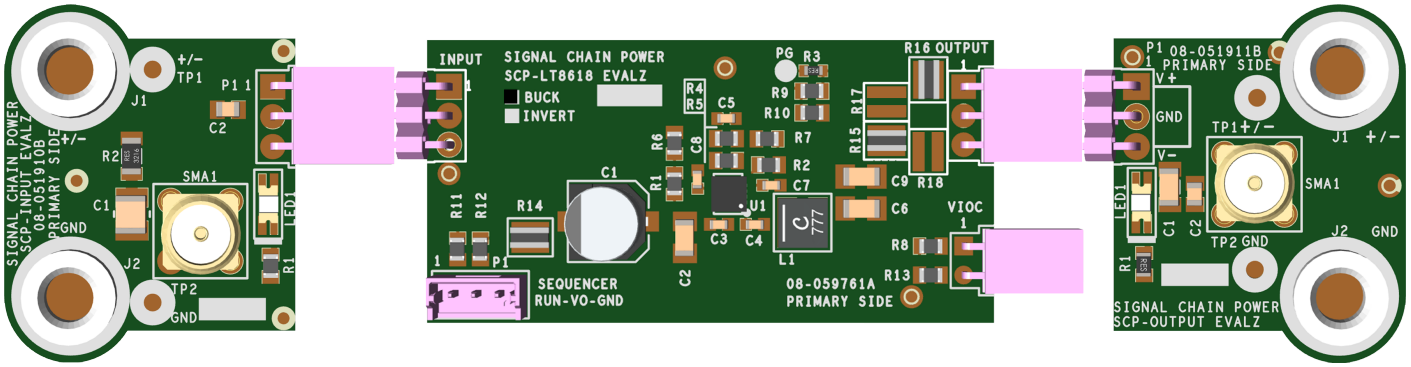


Figure 2. Proper Measurement Equipment Setup (Use SMA connectors for Measuring Input or Output Ripple)

CONFIGURATION SETTINGS

Demonstration circuit SCP-LT8618-BEVALZ is a high efficiency 65V, 100mA synchronous step-down regulator. The wide input range also allows output voltage inversion by using the SCP-LT8618-IEVALZ version of this board.

The output of the SCP-LT8618-BEVALZ is resistor-programmable from 0.8V to 48V. The board can be also configured to drive VIOC-capable linear regulators.

OUTPUT VOLTAGE PROGRAMMING

$$V_{OUT} = 0.778V\left(1+\frac{R4}{R5}\right)$$

Table 2. Resistor Selection Guide for Common Output Voltages

V_{OUT} (V)	R4 (Ω)	R5 (Ω)
0.8	3.24k	115k
0.9	3.83k	137k
1.0	102k	357k
1.1	42.2k	102k
1.2	102k	187k
1.25	162k	267k
1.5	205k	221k
1.8	1.00M	768k
2.0	1.15M	732k
2.5	1.47M	665k
3.0	1.02M	357k
3.3	590k	182k
3.5	357k	102k
4.0	422k	102k
4.5	511k	107k
5.0	1.02M	187k
5.5	698k	115k
6.0	1.13M	169k
6.5	787k	107k
7.0	1.50M	187k
7.5	1.27M	147k
8.0	1.30M	140k
12.0	1.47M	102k
16.0	1.50M	76.8k
20.0	1.50M	60.4k
24.0	1.50M	49.9k
30.0	1.50M	40.2k
36.0	1.50M	33.2k
42.0	1.50M	28.0k
48.0	1.50M	24.9k

EN/UV PIN CONFIGURATION

The EN/UV 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 1.00M resistor for either pull-up or pull-down resistors R1 and R6, short R11 with 0Ω, and use the drive signal from connector P1. Also, short R12 with 0Ω for output voltage monitoring.

If precision UVLO operation is desired, program enable divider R1 and R6 such that:

R6 is 10k to 100k, nominal

$$R1 = R6\left(\frac{V_{IN}-1.05V}{1.05V}\right)$$

The LT8618 has an accurate 1.05V threshold which places the part into under voltage lockout. The hysteresis threshold on the rising edge is typically 50mV and scales by the factor:

$$V_{HYST} = 50mV\frac{R1+R6}{R6}$$

VOLTAGE INPUT-TO-OUTPUT CONTROL (VIOC) IMPLEMENTATION

To implement the VIOC function for this regulator, set R8 and R13 to 0Ω, respectively. Refer to the "Configuration Settings" section in the Demo Manual for the low-dropout (LDO) linear regulator 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	R5	R4	R7

$$V_{LDOIN} - V_{LDOOUT} = V_{VIOC} = 0.778V\left(\frac{R_{BOT}+R_{TOP}}{R_{BOT}}\right)$$

$$V_{(MAX)LDOIN} = 0.778V\left(\frac{R_{BOT}+R_{TOP}+R_{MAX}}{R_{BOT}}\right)+I_{SINK}R_{MAX}$$

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.

FREQUENCY PIN CONFIGURATION

The LT8618 allows the user to program an operating frequency by a single resistor. The default operating frequency is 2.0MHz. Note that changing the switching frequency may affect other parameters and likely necessitates a change in inductor and compensation component values. Contact the SCP team for applications support if shifting the switching frequency greater than ±10%.

Table 4. Resistor Selection Guide for Switching Frequency Setting

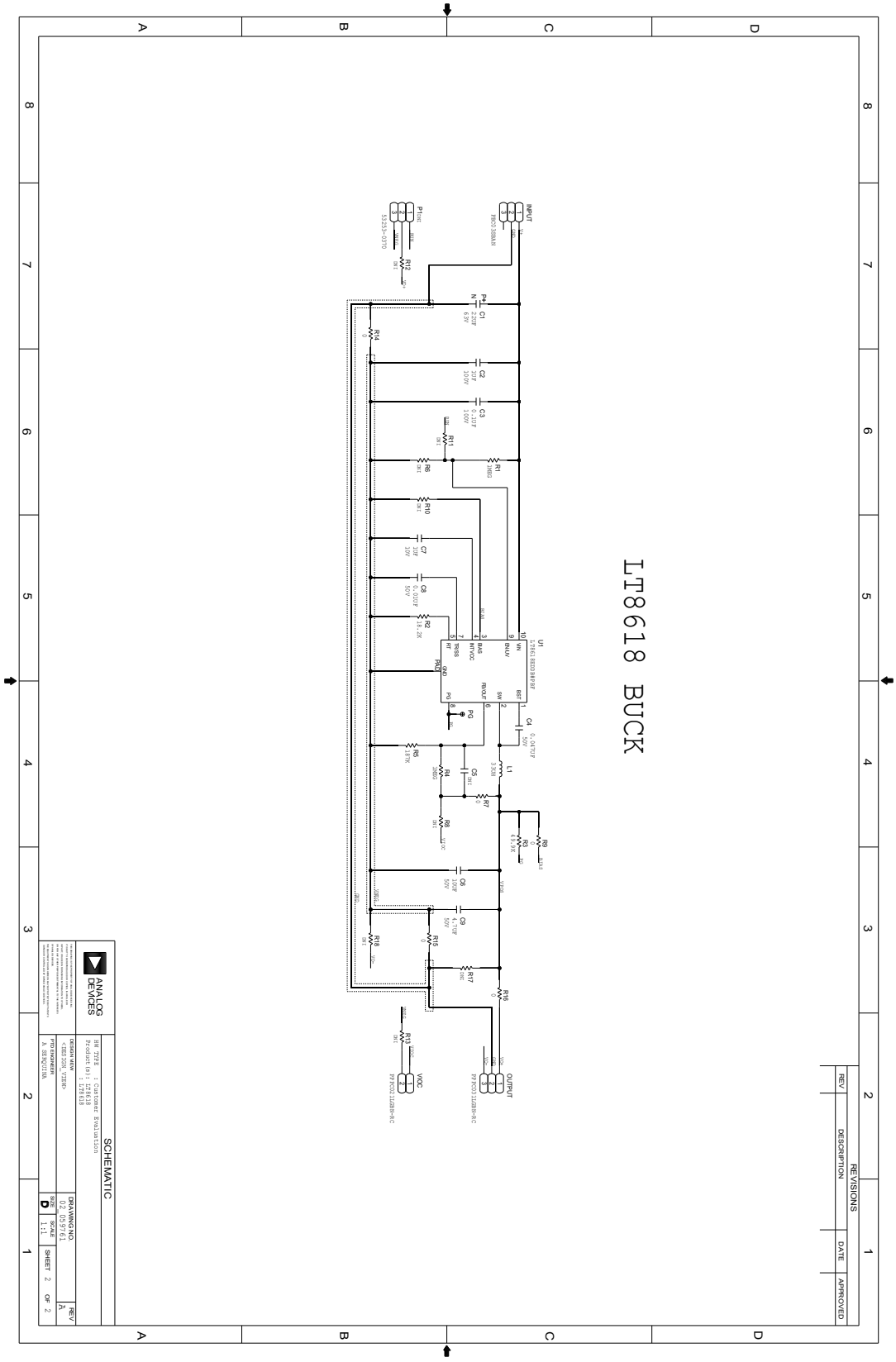
f_{SW}	R_2 (Ω)	f_{SW}	R_2 (Ω)
200kHz	221k	1.30MHz	30.1k
300kHz	143k	1.40MHz	27.4k
400kHz	110k	1.50MHz	25.5k
500kHz	86.6k	1.60MHz	23.7k
600kHz	71.5k	1.70MHz	22.1k
700kHz	60.4k	1.80MHz	20.5k
800kHz	52.3k	1.90MHz	19.1k
900kHz	46.4k	2.00MHz	18.2k
1.00MHz	40.2k	2.10MHz	16.9k
1.10MHz	36.5k	2.20MHz	16.2k
1.20MHz	33.2k		

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
1	1	PCB	PRINTED CIRCUIT BOARD	ANALOG DEVICES 08_059761a
2	1	C1	CAP 22uF 63V ALUM 8x10.5	SUN ELECTRONIC 63CE22BSA
3	1	C2	CAP 1uF 100V CER, X7R 1206	TAIYO YUDEN HMK316B7105KL-T
4	1	C3	CAP 0.1uF 100V CER X7R 0603	SAMSUNG CL10B104KC8NNNC
5	1	C4	CAP 47nF 50V CER X7R 0603	KEMET C0603X473K5RACTU
6	1	C5	CAP MLCC 0603 (Note 1)	N/A
7	1	C6	CAP 10uF 50V X5R 1206	SAMSUNG CL31A106MBHNNNE
8	1	C7	CAP 1uF 10V X7R 0603	SAMSUNG CL10B105KP8NNNC
9	1	C8	CAP 10nF 50V CER X7R 0603	YAGEO CC0603KRX7R9BB103
10	1	C9	CAP 4.7uF 50V CER X7R 1206	SAMSUNG CL31B475KBHNNNE
11	1	INPUT	CONN MALE 3POS 2.54MM PITCH R/A	SULLINS PBC03SBAN
12	1	L1	IND 33uH 0.42A 0.66OHM	WURTH ELEKTRONIK 44031330
13	1	OUTPUT	CONN FEMALE 3POS 2.54MM PITCH R/A	SULLINS PPPC031LGBN-RC
14	1	P1	CONN-PCB 3POS HEADER WIRE TO BRD WAFER ASSY STRAIGHT 2MM PITCH (Note 1)	MOLEX 53253-0370
15	1	R1	RES 1M 1%THICK FILM 0805	YAGEO RC0805JR-071ML
16	6	R6, R8, R10, R11, R12, R13	RED THICK FILM 0805 (Note 1)	N/A
17	3	R14, R15, R16	RES 0 OHM 1% 3/4W 0612	VISHAY RCL06120000Z0EA
18	2	R17, R18	RES THICK FILM 0612 (Note 1)	N/A
19	1	R2	RES 18.2K 1% THICK FILM 0805	PANASONIC ERJ-6ENF1822V
20	1	R3	RES 49.9K 1% THICK FILM 0805	PANASONIC ERJ-3EKF4992V
21	1	R4	RES 1M 1% THICK FILM 0805	PANASONIC ERJ-6ENF1004V
22	1	R5	RES 187K 1% THICK FILM 0805	PANASONIC ERJ-6ENF1873V
23	2	R7, R9	RES 0-OHM 1%THICK FILM 0805	VISHAY CRCW08050000Z0EA
24	1	U1	IC-ADI HIGH EFFICIENCY 60V/100MA SYNCHRONOUS BUCK	ANALOG DEVICES LT8618EDDB#PBF
25	1	VIOC	CONN FEMALE 2POS 2.54MM PITCH R/A	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.

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