

Signal Chain Power Series LT8604C High Efficiency Synchronous Buck Converter

DESCRIPTION

Demonstration circuit SCP-LT8604C-BEVALZ is a high efficiency 42V, 120mA synchronous step-down regulator. The wide input range also allows inversion if using the SCP-LT8604C-IEVALZ-version.

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-1X2BKOUT-EVALZ
- SCP-OUTPUT-EVALZ SCP-1X5BKOUT-EVALZ
- SCP-FILTER-EVALZ SCP-5X1-EVALZ
- SCP-THRUBRD-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 [LT8604C](#). Please refer to the [LT8604C datasheet](#) for a complete description of the part.

Design files for this circuit board are available

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Table 1. Performance Summary

SYMBOL	PARAMETER	NOTES	MIN	TYP	MAX	UNITS
V _{IN(MAX)}	Max Input Voltage				42	V
V _{OUT(MAX)}	Max Output Voltage				34	V
I _{OUT(MAX)}	Max Output Current				120	mA

BOARD IMAGE

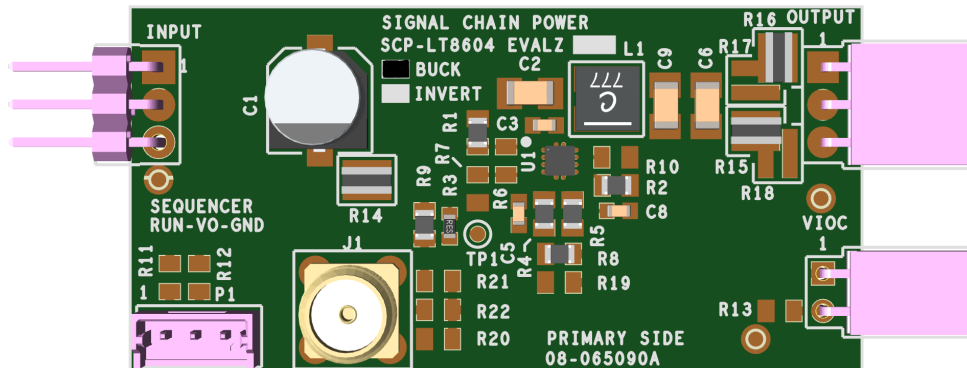


Figure 1. SCP-LT8604C-BEVALZ Evaluation Board

QUICK START PROCEDURE

Demonstration circuit SCP-LT8604C-BEVALZ is easy to set up to evaluate the performance of any SCP hardware configuration. Refer to Figure 2 and follow these steps:

1. The SCP-LT8604C-BEVALZ ships with a default output voltage of 5V. To change the output voltage, see “Configuration Settings” below, 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-LT8604C-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-LT8604C-BEVALZ powers 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 voltages. The output should be regulated at the programmed value ($\pm 5\%$).
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.

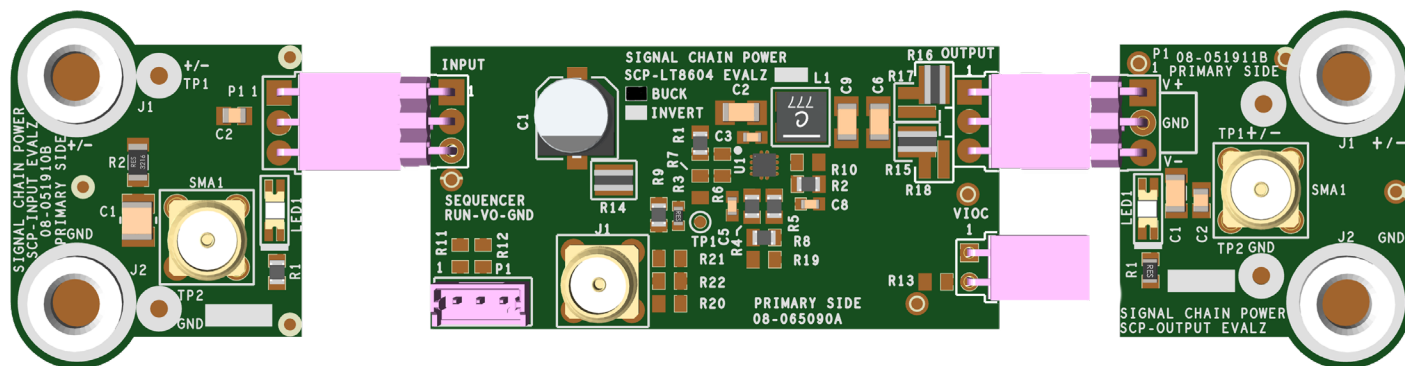


Figure 2. Proper Measurement Equipment Setup (Use SMA connectors for Measuring Input or Output Ripple)

CONFIGURATION SETTINGS

Demonstration circuit SCP-LT8604C-BEVALZ is a high efficiency 42V, 120mA synchronous step-down regulator. The wide input range also allows inversion if using the SCP-LT8604C-IEVALZ version.

The output of the SCP-LT8604C-BEVALZ is resistor-programmable from 0.8V to 34V.

OUTPUT VOLTAGE

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

For output voltage greater than 25V, disconnect BIAS pin from output by removing R9.

Table 2. Resistor selection guide for common output voltages.

V _{OUT} (V)	R4 (Ω)	R5 (Ω)
0.8V	3.24K	115K
0.9V	3.83K	137K
1.0V	102K	357K
1.1V	42.2K	102K
1.2V	102K	187K
1.25V	162K	267K
1.5V	205K	221K
1.8V	1.00M	768K
2.0V	1.15M	732K
2.5V	1.47M	665K
3.0V	1.02M	357K
3.3V	590K	182K
3.5V	357K	102K
4.0V	422K	102K
4.5V	511K	107K
5.0V	1.02M	187K
5.5V	698K	115K
6.0V	1.13M	169K
6.5V	787K	107K
7.0V	1.50M	187K
7.5V	1.27M	147K
8.0V	1.30M	140K
12.0V	1.47M	102K
16.0V	1.50M	76.8K
20.0V	1.50M	60.4K
24.0V	1.50M	49.9K
25.0V	1.62M	52.3K
28.0V	1.62M	46.4K
30.0V	1.62M	43.2K
34.0V	1.33M	30.9K

ENABLE PIN/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 the default 1.00M for either pull-up or pull-down resistors R1, R6 and R7, short R11 with 0Ω, and use the drive signal from connector P1. Also, short R12 with 0Ω for V_{OUT} monitoring.

If precision UVLO operation is desired, program enable divider R1, R6 and R7 such that:

R6 is 10k to 100k, nominal

$$R1 = (R6 + R7) \left(\frac{V_{IN} - 1.04V}{1.04V} \right)$$

The LT8604C has an accurate 1.04V threshold which places the part into under voltage lockout. The hysteresis threshold on the rising edge is typically 40mV and scales by the factor:

$$V_{HYST} = 40mV \frac{R1 + R6}{R6}$$

Additional hysteresis may be added with the use of the HYST pin (LT8604C only) by adding a pull-down resistor R7 in the HYST pin, forming voltage divider with R1 and R6.

$$\text{RISING } V_{HYST(TH)} = 1.04V \frac{R1 + R6}{R6}$$

$$\text{FALLING } V_{HYST(TH)} = 1.00V \frac{R1 + R6 + R7}{R6 + R7}$$

Be aware that the HYST pin cannot be allowed to exceed its absolute maximum rating of 12V.

$$V_{IN(MAX)} \cdot \left(\frac{R7}{R1 + R6 + R7} \right) < 12V$$

VOLTAGE INPUT-TO-OUTPUT CONTROL (VIOC) IMPLEMENTATION

To implement the VIOC, set $R_{19} = R_{13} = 0\Omega$ and refer to the configuration sheet for the VIOC for the V_{LDOOUT} voltage configuration values (set on the LDO board), and use the following configuration for this board:

Table 3. VIOC Reference Designation

VIOC SETTING REFS	R_{BOT}	R_{TOP}	R_{MAX}
VOUT Refs	R5	R4	R8

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

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

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

FREQUENCY PIN CONFIGURATION

The LT8604C 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 necessitate a change in inductor and compensation component values. Contact the SCP team for applications support if shifting the switching frequency greater than $\pm 10\%$.

Table 4. Resistor Selection Guide for Switching Frequency Setting

fsw	R2 (Ω)	fsw	R2 (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		

DEMO MANUAL SCP-LT8604C-BEVALZ

PARTS LIST

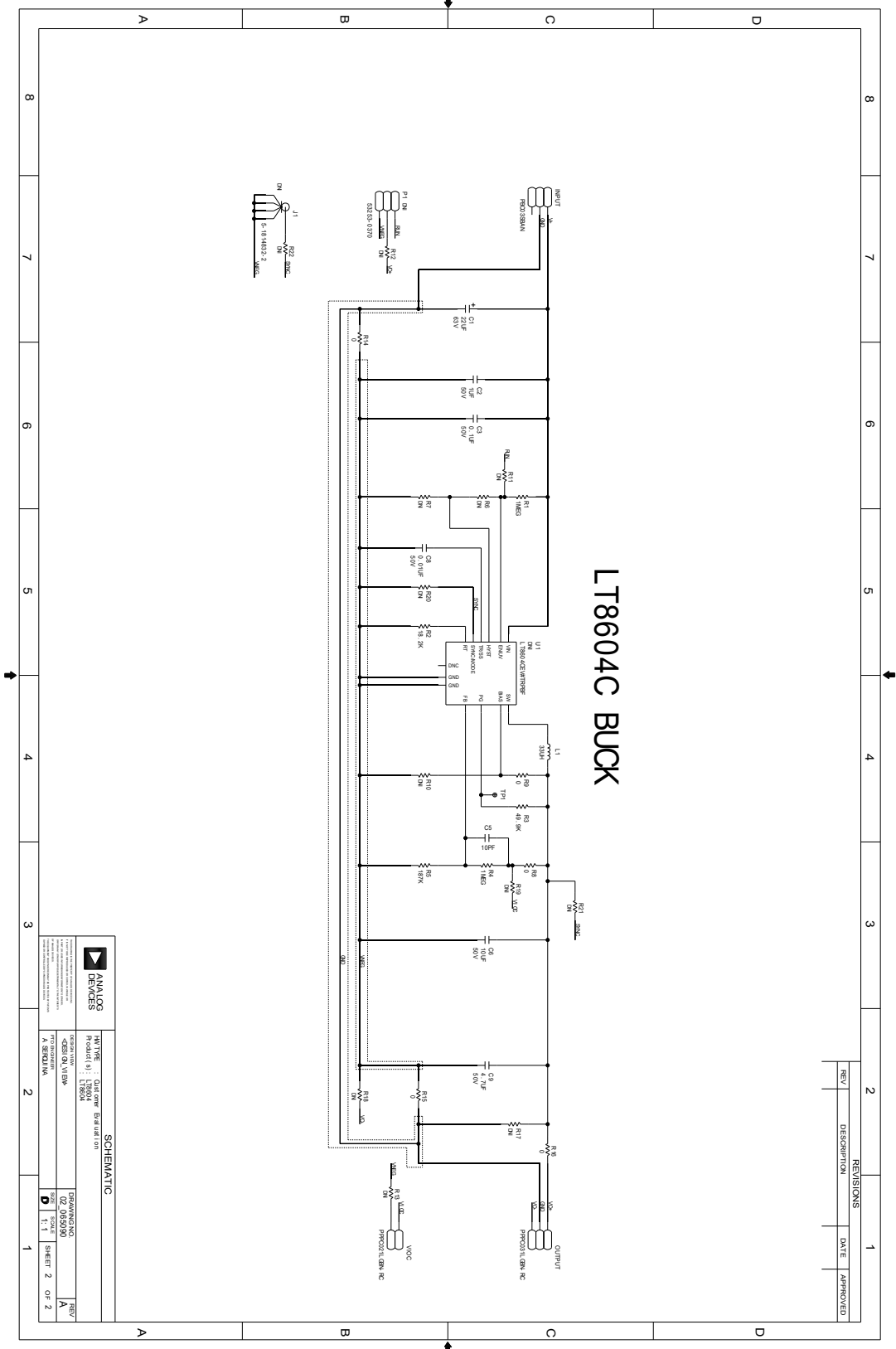
ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
1	1	PCB	PCB	ANALOG DEVICES 08_065090a
2	1	C1	CAP ALUM ELECT 22uF 63V 20% 6.3X7.7mm	UNITED CHEMI CON EMVE630ADA220MF80G
3	1	C2	CAP CER 1uF 50V 10% X7R 1206	YAGEO CC1206KKX7R9BB105
4	1	C3	CAP CER 0.1uF 50V 10% X7R 0603	SAMSUNG CL10B104KB8NNNC
5	1	C5	CAP CER 10pF 50V 5% C0G 0603	SAMSUNG CL10C100JB8NNNC
6	1	C6	CAP CER 10uF 50V 20% X5R 1206	SAMSUNG CL31A106MBHNNNE
7	1	C8	CAP CER 0.01uF 50V 10% X7R 0603	YAGEO CC0603KRX7R9BB103
8	1	C9	CAP CER 4.7uF 50V 10% X7R 1206	SAMSUNG CL31B475KBHNNNE
9	1	INPUT	CONN-PCB MALE HEADER 3POS 2.54MM PITCH R/A GOLD	SULLINS PBC03SBAN
10	1	J1	CONN-PCB STRAIGHT SMA PCB DIE CAST (Note 1)	TE CONNECTIVITY LTD 5-1814832-2
11	1	L1	IND SHIELDED POWER, 33uH 0.66OHM DCR 0.42A	WURTH ELEKTRONIK 744031330
12	1	OUTPUT	CONN FEMALE 3POS 2.54MM PITCH R/A GOLD	SULLINS PPPC031LGBN-RC
13	1	P1	CONN-PCB 3POS HEADER WIRE TO BRD WAFER ASSY STRAIGHT 2MM PITCH (Note 1)	MOLEX 53253-0370
14	1	R1	RES SMD 1MEG 0hm 5% 1/8W 0805	YAGEO RC0805JR-071ML
15	10	R6, R7, R10, R11, R12, R13, R19, R20, R21, R22	DO NOT INSTALL (Note 1)	TBD0805
16	3	R14, R15, R16	RES SMD 0 Ohm 3/4W 0612	VISHAY RCL06120000Z0EA
17	2	R17, R18	RES SMD 0 Ohm 3/4W 0612 (Note 1)	VISHAY RCL06120000Z0EA
18	1	R2	RES SMD 18.2K Ohm 1% 1/8W 0805	PANASONIC ERJ-6ENF1822V
19	1	R3	RES SMD 49.9K Ohm 1% 1/10W 0603	PANASONIC ERJ-3EKF4992V
20	1	R4	RES SMD 1MEG Ohm 1% 1/8W 0805	PANASONIC ERJ-6ENF1004V
21	1	R5	RES SMD 187K Ohm 1% 1/8W 0805	PANASONIC ERJ-6ENF1873V
22	2	R8, R9	RES SMD 0 Ohm JUMPER 1/8W 0805 (Note 2)	VISHAY CRCW08050000Z0EA
23	1	U1	IC-ADI HIGH EFFICIENCY 42V/120MA SYNCHRONOUS BUCK	ANALOG DEVICES LT8604CEV#TRPBF
24	1	VIOC	CONN FEMALE 2POS 2.54MM PITCH R/A GOLD	SULLINS PPPC021LGBN-RC

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

Note 2. Keep R9 stuffed for output voltages of 3.3V to 25V.

DEMO MANUAL SCP-LT8604C-BEVALZ

SCHEMATIC DIAGRAM



DEMO MANUAL SCP-LT8604C-BEVALZ



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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