

Signal Chain Power Series LT8609S Synchronous Inverting Step-Down Regulator

DESCRIPTION

Demonstration circuit SCP-LT8609S-IEVALZ is a 42V, 2A/3A peak micropower synchronous step-down regulator featuring the LT8609S. The demo board is designed for -5V output from a 5.5V to 42V input.

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 [LT8609S](#). Please refer to the [LT8609S datasheet](#) for a complete description of the part.

Design files for this circuit board are available.

All registered trademarks and trademarks are property of their respective owners.

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				-24	V
I _{OUT(MAX)}	Max Output Current				2	A

BOARD IMAGE

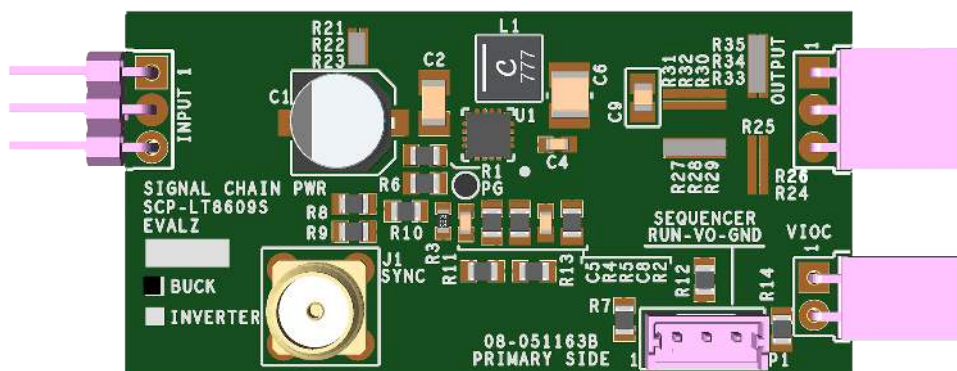


Figure 1. SCP-LT8609S-IEVALZ Evaluation Board

QUICK START PROCEDURE

Demonstration circuit SCP-LT8609S-IEVALZ is easy to set up to evaluate the performance of any SCP hardware configuration.

1. The SCP-LT8609S-IEVALZ 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-LT8609S-IEVALZ (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-LT8609S-IEVALZ 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 ($\pm 5\%$).
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.

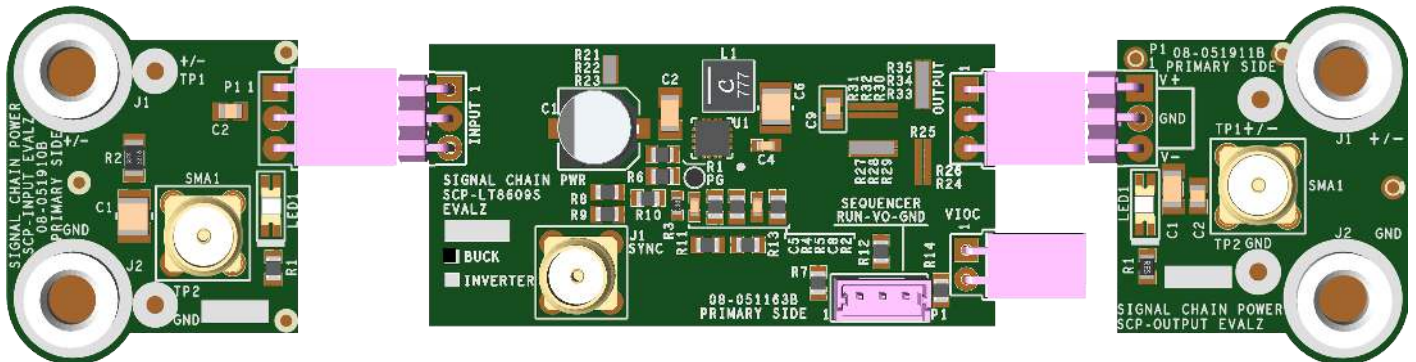


Figure 2. Proper Measurement Equipment Setup (Use SMA connectors for Measuring Input or Output Ripple)

CONFIGURATION SETTINGS

Demonstration circuit SCP-LT8609S-IEVALZ is a 42V, 2A/3A peak micropower synchronous step-down regulator featuring the LT8609S. The demo board is designed for -5V output from a 5.5V to 42V input.

The output of the SCP-LT8609S-IEVALZ is resistor-programmable from -0.8V to -24V.

OUTPUT VOLTAGE PROGRAMMING

$$|V_{OUT}| = 0.774V_{FB} \left(1 + \frac{R4}{R5} \right)$$

Table 2. Resistor Selection Guide for Common Output Voltages

V _{OUT} (V)	R4 (Ω)	R5 (Ω)
0.8	3.57k	107k
0.9	17.4k	107k
1.0	102k	348k
1.1	29.4k	69.8k
1.2	73.2k	133k
1.25	115k	187k
1.5	187k	200k
1.8	215k	162k
2.0	187k	118k
2.5	255k	115k
3.0	348k	121k
3.3	332k	102k
3.5	357k	102k
4.0	442k	102k
4.5	511k	107k
5.0	549k	100k
5.5	698k	115k
6.0	931k	137k
6.5	787k	107k
7.0	909k	113k
7.5	887k	102k
8.0	953k	102k
8.5	1.00M	100k
9.0	1.00M	93.1k
9.5	1.00M	88.7k
10.0	1.00M	84.5k
12.0	1.00M	68.1k
16.0	1.00M	51.1k
20.0	1.00M	20.2k
24.0	1.00M	33.2k

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.

IMPORTANT: Do not connect harness to pin 3.

To use an active run signal, use a 1.00MΩ for either pull-up or pull-down resistors R1 and R6, short R7 and R12 with 0Ω, and use the drive signal from connector P1.

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

R6 is 10k to 100k, nominal

$$R5 = R6 \left(\frac{V_{IN} - 1.05V_{TH}}{1.05V_{TH}} \right)$$

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:

$$V_{HYST} = 50mV \frac{R5 + R6}{R6}$$

VOLTAGE INPUT-TO-OUTPUT CONTROL (VIOC) IMPLEMENTATION

VIOC cannot be implemented with the board in inverting buck configuration. If using a VIOC-capable negative linear regulator, ensure R13 and R14 are open on the linear regulator evaluation board. Output voltages must be set independently on both the SCP-LT8609S-IEVALZ and the negative linear regulator board.

DEMO MANUAL SCP-LT8609S-IEVALZ

SYNC PIN CONFIGURATION

The table below shows the various configurations possible with the SYNC pin.

If clock synchronization option is desired, the SCP-LT8609S-IEVALZ can be driven from an external source via the optional SMA connector.

IMPORTANT: Direct coupling is not possible without level-shifting the clock source.

Table 3. SYNC Pin Configuration

MODE	R8	R9	R10
Burst Mode (default)	0 Ω	Open	Open
External Clock Synchronized	Open	0 Ω	Open
Pulse Skip/Spread Spectrum	Open	Open	0 Ω
Pulse Skip	Open	Open	Open

FREQUENCY (RT) PIN CONFIGURATION

The LT8609S allows the user to program the switching frequency (f_{sw}) by a single resistor (R_2). The default operating frequency is 2.0MHz. Note that changing the switching frequency may affect other parameters and likely will necessitate a change in inductor and compensation component values. Contact the SCP team for support if shifting the switching frequency greater than $\pm 10\%$.

Table 4. Switching Frequency f_{sw} vs Resistor R_2 Value

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		

DEMO MANUAL SCP-LT8609S-IEVALZ

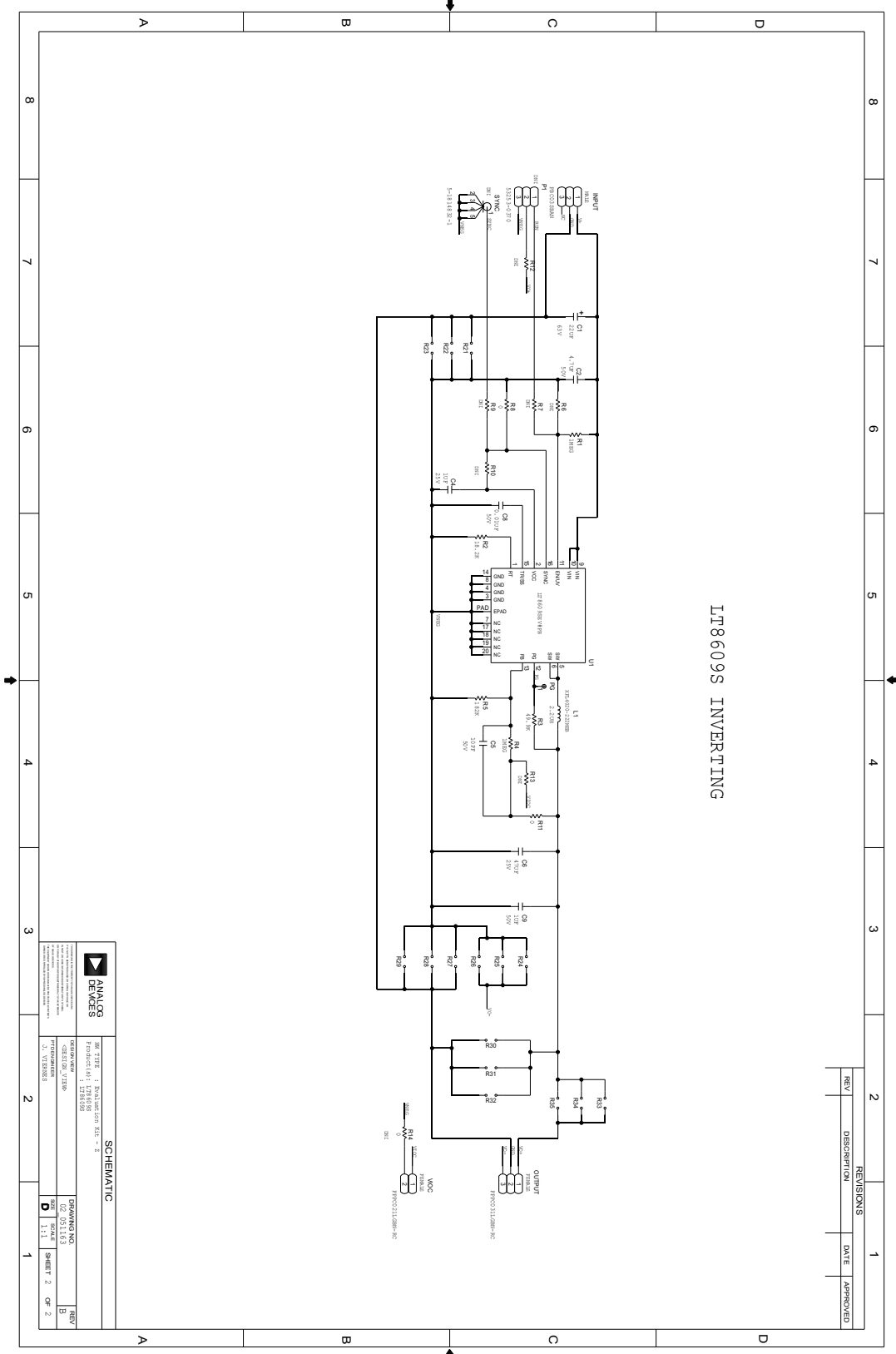
PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
1	1	PCB	PCB	ANALOG DEVICES 08_051163b
2	1	C1	CAP ALUM 22UF 63V 20% 6X6MM	UNITED CHEMI CON EMVE630ADA220MF80G
3	1	C2	CAP CER 4.7UF 50V 10% X7R 1206	SAMSUNG CL31B475KBHNNNE
4	1	C4	CAP CER X7R, AUTOMOTIVE GRADE	TDK CGA3E1X7R1E105K080AD
5	1	C5	CAP CER 10PF 50V 5% C0G 0603	SAMSUNG CL10C100JB8NNNC
6	1	C6	CAP CER 47UF 25V 20% X5R 1210	TAIYO YUDEN TMK325ABJ476MM-P
7	1	C8	CAP CER X7R	YAGEO CC0603KRX7R9B103
8	1	C9	CAP CER X7R	SAMSUNG CL21B105KBFNNNE
9	1	INPUT	CONN-PCB MALE HEADER 3POS 2.54MM PITCH R/A GOLD	SULLINS PBC03SBAN
10	1	L1	IND SHIELDED POWER	COILCRAFT XFL4020-222MEB
11	1	OUTPUT	CONN FEMALE 3POS 2.54MM PITCH R/A GOLD	SULLINS PPPC031LGBN-RC
12	1	P1	CONN-PCB 3POS HEADER WIRE TO BRD WAFER ASSY STRAIGHT 2MM PITCH (Note 1)	MOLEX 53253-0370
13	1	R1	RES THICK FILM CHIP, GENERAL PURPOSE	YAGEO RC0805JR-071ML
14	1	R14	RES THICK FILM 0805 (Note 1)	N/A
15	1	R2	RES PRECISION THICK FILM CHIP	PANASONIC ERJ-6ENF1822V
16	1	R3	RES PRECISION THICK FILM CHIP	PANASONIC ERJ-3EKF4992V
17	1	R4	RES PRECISION THICK FILM CHIP	PANASONIC ERJ-6ENF1004V
18	1	R5	RES THICK FILM CHIP	VISHAY CRCW0805182KFKEA
19	6	R6, R7, R9, R10, R12, R13	RES THICK FILM 0805 (Note 1)	N/A
20	2	R8, R11	RES STANDARD THICK FILM CHIP JUMPER, FOR AUTOMOTIVE	VISHAY CRCW08050000Z0EA
21	1	SYNC	CONN-PCB STRAIGHT SMA PCB DIE CAST (Note 1)	TE CONNECTIVITY LTD 5-1814832-1
22	1	U1	IC-LIN 42V, 2A/3A PEAK SYNCHRONOUS STEP-DOWN REGULATOR WITH 2.5UA QUIESCENT CURRENT	LINEAR TECHNOLOGY LT8609SEV#PBF
23	1	VIOC	CONN FEMALE 2POS 2.54MM PITCH R/A GOLD	SULLINS PPPC021LGBN-RC

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

DEMO MANUAL SCP-LT8609S-IEVALZ

SCHEMATIC DIAGRAM



DEMO MANUAL SCP-LT8609S-IEVALZ



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.

Legal Terms and Conditions

By using the evaluation board discussed herein (together with any tools, components documentation or support materials, the "Evaluation Board"), you are agreeing to be bound by the terms and conditions set forth below ("Agreement") unless you have purchased the Evaluation Board, in which case the Analog Devices Standard Terms and Conditions of Sale shall govern. Do not use the Evaluation Board until you have read and agreed to the Agreement. Your use of the Evaluation Board shall signify your acceptance of the Agreement. This Agreement is made by and between you ("Customer") and Analog Devices, Inc. ("ADI"), with its principal place of business at One Technology Way, Norwood, MA 02062, USA. Subject to the terms and conditions of the Agreement, ADI hereby grants to Customer a free, limited, personal, temporary, non-exclusive, non-sublicensable, non-transferable license to use the Evaluation Board FOR EVALUATION PURPOSES ONLY. Customer understands and agrees that the Evaluation Board is provided for the sole and exclusive purpose referenced above, and agrees not to use the Evaluation Board for any other purpose. Furthermore, the license granted is expressly made subject to the following additional limitations: Customer shall not (i) rent, lease, display, sell, transfer, assign, sublicense, or distribute the Evaluation Board; and (ii) permit any Third Party to access the Evaluation Board. As used herein, the term "Third Party" includes any entity other than ADI, Customer, their employees, affiliates and in-house consultants. The Evaluation Board is NOT sold to Customer; all rights not expressly granted herein, including ownership of the Evaluation Board, are reserved by ADI. CONFIDENTIALITY. This Agreement and the Evaluation Board shall all be considered the confidential and proprietary information of ADI. Customer may not disclose or transfer any portion of the Evaluation Board to any other party for any reason. Upon discontinuation of use of the Evaluation Board or termination of this Agreement, Customer agrees to promptly return the Evaluation Board to ADI. ADDITIONAL RESTRICTIONS. Customer may not disassemble, decompile or reverse engineer chips on the Evaluation Board. Customer shall inform ADI of any occurred damages or any modifications or alterations it makes to the Evaluation Board, including but not limited to soldering or any other activity that affects the material content of the Evaluation Board. Modifications to the Evaluation Board must comply with applicable law, including but not limited to the RoHS Directive. TERMINATION. ADI may terminate this Agreement at any time upon giving written notice to Customer. Customer agrees to return to ADI the Evaluation Board at that time. LIMITATION OF LIABILITY. THE EVALUATION BOARD PROVIDED HEREUNDER IS PROVIDED "AS IS" AND ADI MAKES NO WARRANTIES OR REPRESENTATIONS OF ANY KIND WITH RESPECT TO IT. ADI SPECIFICALLY DISCLAIMS ANY REPRESENTATIONS, ENDORSEMENTS, GUARANTEES, OR WARRANTIES, EXPRESS OR IMPLIED, RELATED TO THE EVALUATION BOARD INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTY OF MERCHANTABILITY, TITLE, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF INTELLECTUAL PROPERTY RIGHTS. IN NO EVENT WILL ADI AND ITS LICENSORS BE LIABLE FOR ANY INCIDENTAL, SPECIAL, INDIRECT OR CONSEQUENTIAL DAMAGES RESULTING FROM CUSTOMER'S POSSESSION OR USE OF THE EVALUATION BOARD, INCLUDING BUT NOT LIMITED TO LOST PROFITS, DELAY COSTS, LABOR COSTS OR LOSS OF GOODWILL. ADI'S TOTAL LIABILITY FROM ANY AND ALL CAUSES SHALL BE LIMITED TO THE AMOUNT OF ONE HUNDRED US DOLLARS (\$100.00). EXPORT. Customer agrees that it will not directly or indirectly export the Evaluation Board to another country, and that it will comply with all applicable United States federal laws and regulations relating to exports. GOVERNING LAW. This Agreement shall be governed by and construed in accordance with the substantive laws of the Commonwealth of Massachusetts (excluding conflict of law rules). Any legal action regarding this Agreement will be heard in the state or federal courts having jurisdiction in Suffolk County, Massachusetts, and Customer hereby submits to the personal jurisdiction and venue of such courts. The United Nations Convention on Contracts for the International Sale of Goods shall not apply to this Agreement and is expressly disclaimed.