Signal Chain Power Series
LTC3114-1 Buck-Boost Converter

DESCRIPTION

Demonstration circuit SCP-LTC3114-1-EVALZ features the LTC3114-1, a wide operating range, synchronous monolithic buck-boost converter with programmable average output current. The circuit operates with a 2.2V to 40V input voltage range.

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 LTC3114-1. Please refer to the LTC3114-1 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	Output capacitor rating limited. Replace for higher V_{OUT}.			40	V
$I_{L(LIM)}$	Inductor Current Limit		1.3	1.7	2.3	A

BOARD IMAGE

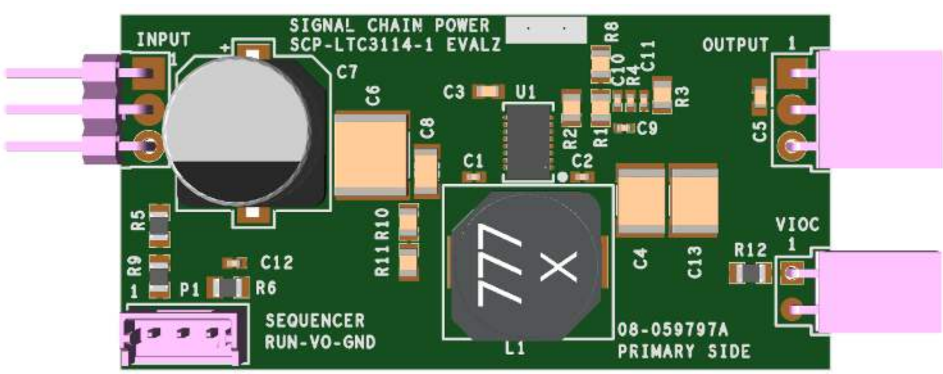


Figure 1. SCP-LTC3114-1-EVALZ Evaluation Board

QUICK START PROCEDURE

Demonstration circuit SCP-LTC3114-1-EVALZ is easy to set up to evaluate the performance of any SCP hardware configuration.

1. The SCP-LTC3114-1-BB-EVALZ 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-LTC3114-1-BB-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-LTC3114-1-BB-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 specification. 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.

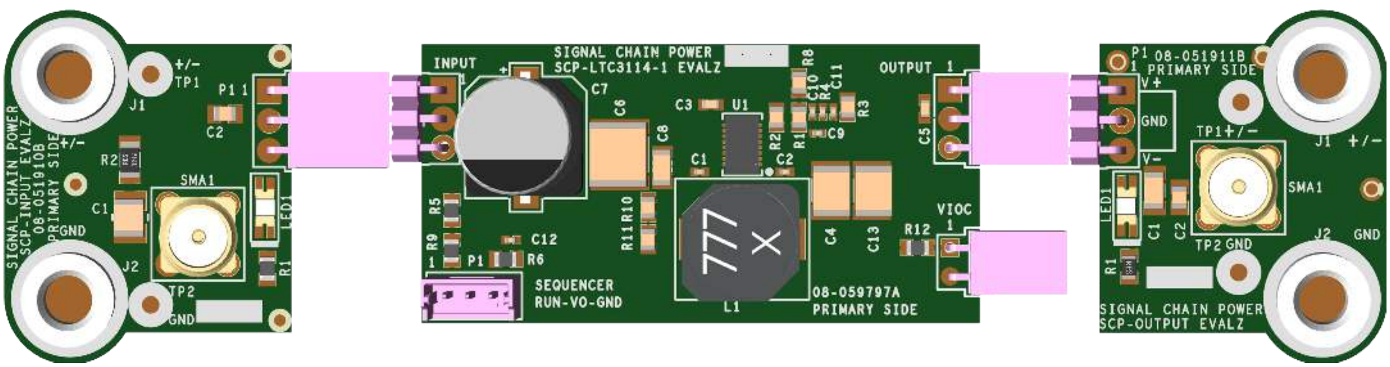


Figure 2. Proper Measurement Equipment Setup (Use SMA connectors for Measuring Input or Output Ripple)

CONFIGURATION SETTINGS

Demonstration circuit SCP-LTC3114-1-EVALZ features the LTC3114-1, a wide operating range, synchronous monolithic buck-boost converter with programmable average output current. The circuit operates with a 2.2V to 40V input voltage range.

The output of the SCP-LTC3114-1-EVALZ is resistor-programmable from 3.0V to 40V. The board can be also configured to drive VIOC-capable linear regulators.

OUTPUT VOLTAGE PROGRAMMING

$$V_{OUT} = 1.0V\left(1+\frac{R1}{R2}\right)$$

Table 2. Resistor Selection Guide for Common Output Voltages

V_{OUT} (V)	R_1 (Ω)	R_2 (Ω)
3.0	2M	1M
5.0	2M	499k
6.0	2M	402k
7.0	2M	332k
8.0	2M	287k
9.0	2M	249k
10.0	2M	221k
11.0	2M	200k
12.0	2M	182k
13.0	2M	165k
14.0	2M	154k
15.0	2M	143k
16.0	2M	133k
17.0	2M	124k
18.0	2M	118k
19.0	2M	110k
20.0	2M	105k
21.0	2M	100k
22.0	2M	95.3k
23.0	2M	90.9k
24.0	2M	86.6k
25.0 (Note 1)	2M	82.5k
30.0 (Note 1)	2M	69.8k
35.0 (Note 1)	2M	59k
40.0 (Note 1)	2M	51.1k

Note 1. Output capacitor rating limited. Replace for higher V_{OUT}.

RUN PIN CONFIGURATION

The RUN 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 1.00MΩ for either pull-up or pull-down resistors R5 and R6, short R9 with 0Ω, and use the drive signal from connector P1.

VOLTAGE INPUT-TO-OUTPUT CONTROL (VIOC) IMPLEMENTATION

To implement the VIOC function for this regulator, set R_{12} to 0Ω. 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	R2	R1	R8

$$V_{LDOIN} - V_{LDOOUT} = V_{VIOC} = 1.0V\left(\frac{R_{BOT}+R_{TOP}}{R_{BOT}}\right)$$

$$V_{(MAX)LDOIN} = 1.0V\left(\frac{R_{BOT}+R_{TOP}+R_{MAX}}{R_{BOT}}\right)+I_{SINK}R_{MAX}$$

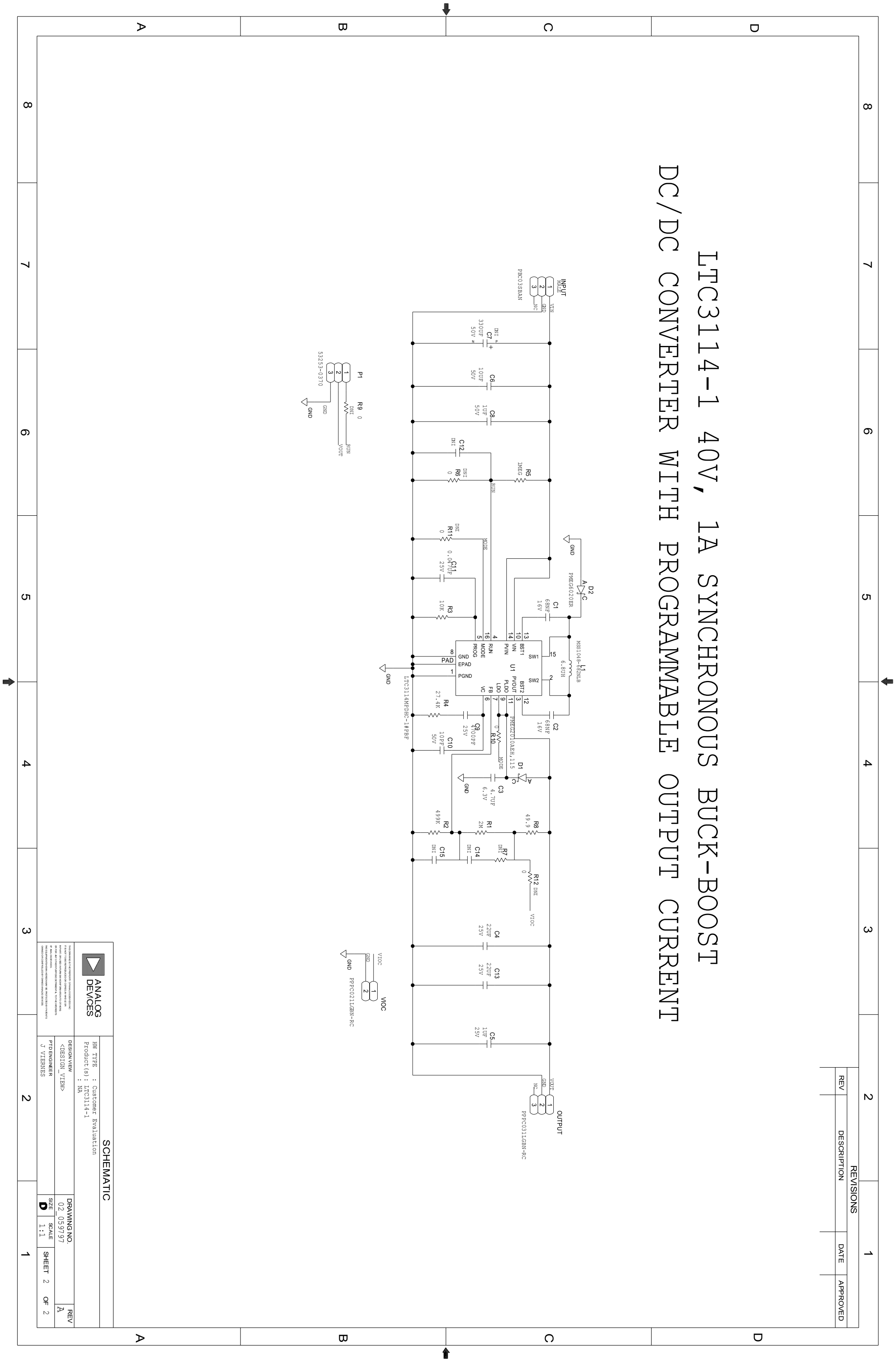
I_{SINK} is the current through R_{MAX}, typically 15μA, so R_{BOT} should be sized such that the divider current runs a minimum of 100μA to minimize the I_{SINK} error term.

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
1	1	PCB	PRINTED CIRCUIT BOARD	ANALOG DEVICES 08_059797a
2	2	C1, C2	CAP CER 68NF 16V 10% X7R 0402	SAMSUNG CL05B683KO5NNNC
3	1	C10	CAP CER C0G, FOR COMMERCIAL APP	VISHAY VJ0402A100JXAAP54
4	1	C11	CAP MONO CER CHIP FOR AUTOMOTIVE, X7R	MURATA GCM155R71E473KA55D
5	1	C12	CAP MLCC 0402 (Note 2)	N/A
6	2	C4, C13	CAP CER 22UF 25V 20% X7R 1812	TDK C4532X7R1E226M250KC
7	2	C14, C15	CAP MLCC 0402 (Note 2)	N/A
8	1	C3	CAP CER X7R	SAMSUNG CL10B475KQ8NQNC
9	1	C5	CAP CER X5R, GENERAL PURPOSE	AVX CORPORATION 06033D105KAT2A
10	1	C6	CAP CER CHIP X7R	TDK C5750X7R1H106M
11	1	C7	CAP ELECTROLYTIC (Note 2)	N/A
12	1	C8	CAP CER X7R	AVX 12065C105KAT2A
13	1	C9	CAP CER 4700PF 25V 10% X7R 0402	SAMSUNG CL05B472KA5NNNC
14	1	D1	DIODE LOW VF MEGA SCHOTTKY BARR RECT	NXP SEMICONDUCTORS PMEG2010AEH,115
15	1	D2	DIO SCHOTTKY BARRIER RECTIFIER, 2A	NEXPERIA PMEG6020ER
16	1	INPUT	CONN-PCB MALE HEADER 3POS 2.54MM PITCH R/A GOLD	SULLINS PBC03SBAN
17	1	L1	IND SHIELDED POWER 0.0163OHM DCR, 6.01A	COILCRAFT INC. MSS1048-682NLB
18	1	OUTPUT	CONN FEMALE 3POS 2.54MM PITCH R/A GOLD	SULLINS PPPC031LGBN-RC
19	1	P1	CONN-PCB 3POS HEADER WIRE TO BRD WAFER ASSY STRAIGHT 2MM PITCH	MOLEX 53253-0370
20	1	R1	RES SMD 2M OHM 1% 1/8W 0805	YAGEO RC0805FR-072ML
21	1	R10	RES STANDARD THICK FILM CHIP JUMPER, FOR AUTOMOTIVE	VISHAY CRCW08050000Z0EA
22	4	R6, R9, R11, R12	RES THICK FILM 0805 (Note 2)	N/A
23	1	R2	RES PRECISION THICK FILM CHIP	PANASONIC ERJ-6ENF4993V
24	1	R3	RES PRECISION THICK FILM CHIP	PANASONIC ERJ-6ENF1002V
25	1	R4	RES PRECISION THICK FILM CHIP	PANASONIC ERJ-2RKF2742X
26	1	R5	RES THICK FILM CHIP, GENERAL PURPOSE	YAGEO RC0805JR-071ML
27	1	R7	RES THICK FILM 0402 (Note 2)	N/A
28	1	R8	RES PRECISION THICK FILM CHIP	PANASONIC ERJ-6ENF49R9V
29	1	U1	IC-ADI 40V, 1A SYNCHRONOUS BUCK-BOOST DC/DC CONVERTER WITH PROGRAMMABLE OUTPUT CURRENT	ANALOG DEVICES LTC3114MPDHC-1#PBF
30	1	VIOC	CONN FEMALE 2POS 2.54MM PITCH R/A GOLD	SULLINS PPPC021LGBN-RC

Note 2. 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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