

Wide Input Voltage Range Boost/SEPIC/Inverting Converter

DESCRIPTION

The LT[®]3959 is a current mode DC/DC converter with an integrated 6A, 40V switch. It can operate over an input range of 1.6V to 40V, suitable for applications from single-cell lithium-ion battery portable electronics up to high voltage automotive and industrial power supplies. It also exhibits low shutdown quiescent current of <1 μ A, making it an ideal fit for battery-operated systems. Thanks to a novel FBX pin architecture, the LT3959 can be connected directly to a divider from either positive or negative output to ground. It also packs many popular features such as soft-start, input undervoltage lockout, adjustable frequency and synchronization.

Demonstration circuit 1853A features LT3959 in a 300kHz boost converter, designed for 12V output from 2V to 10V input (V_{IN}). The performance is summarized in the table below.

The demo circuit has small circuit footprint, and can be modified to generate different output voltages. The performance can be optimized for different input voltage ranges as well. It is a high performance and cost-effective solution for battery-operated systems, telecom, and automotive applications.

The LT3959 data sheet gives a complete description of the part, operation and application information. The data sheet must be read in conjunction with this quick start guide. Proper board layout is essential for both proper operation and maximum thermal performance. See the Applications Information section of the data sheet for more information.

Design files for this circuit board are available at <http://www.linear.com/demo>

LT, LT, LTC, LTM, Linear Technology and the Linear logo are registered trademarks of Linear Technology Corporation. All other trademarks are the property of their respective owners.

PERFORMANCE SUMMARY

Specifications are at $T_A = 25^\circ\text{C}$

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Input Voltage Range		2		10	V
Input Turn-On Voltage (Rising)			2.5		V
Input Undervoltage Lockout (Falling)			2		V
Switching Frequency	$I_{OUT} = 0.5\text{A}$		300		kHz
Output Voltage		11.64	12	12.36	V
Maximum Output Current	$V_{IN} \geq 2\text{V}$	0.5			A
	$V_{IN} \geq 5\text{V}$	1			A
	$V_{IN} \geq 9\text{V}$	2			A
Output Voltage Ripple	$V_{IN} = 5\text{V}$, $I_{OUT} = 1\text{A}$		75	100	mV
Efficiency	$V_{IN} = 10\text{V}$, $I_{OUT} = 2\text{A}$		94		%

QUICK START PROCEDURE

Demo circuit 1853A is easy to set up to evaluate the performance of LT3959. Refer to Figure 1 for proper measurement equipment setup and follow the procedure below.

1. With power off, connect the input power supply, load and meters as shown in Figure 1. Preset the load to 0A, and V_{IN} supply to be 0V. Place jumpers in the following positions.

EN (JP1)	SYNC (JP2)
ON	OFF

2. Turn on V_{IN} and increase to 2.5V. Check for proper output voltages. The output should be regulated at 12V ($\pm 3\%$). The switching frequency should be about 300kHz.

NOTE. If there is no output, or the output is out of spec, temporarily disconnect the load to make sure that the load is not set too high.

NOTE. Make sure that the input voltage does not exceed specification. If higher operating voltage is required, power components with higher voltage ratings should be used. The maximum voltage is 40V for the integrated switch of LT3959.

NOTE. The demo circuit configures the shutdown voltage at 2V, which means that the input voltage can be dropped to as low as 2V, once it starts up. The startup voltage is set at 2.5V, and can be adjusted by changing R1 and R2 values.

NOTE. The output current capability depends on the input voltage. The output current is up to 0.5A for V_{IN} higher than 2V, 1A for V_{IN} higher than 5V, and 2A for V_{IN} higher than 9V.

3. Once the proper output voltage is established, adjust the input voltage and load within the operating range and observe the output voltage regulation, ripple voltage, efficiency and other parameters. Typical efficiency curve is shown in Figure 3.

NOTE. When measuring the input or output voltage ripples, care must be taken to avoid a long ground lead on the oscilloscope probe. Measure the input or output voltage ripple by touching the probe tip directly across the V_{IN} and GND, or V_{OUT} and GND terminals. See Figure 2 for proper scope probe technique.

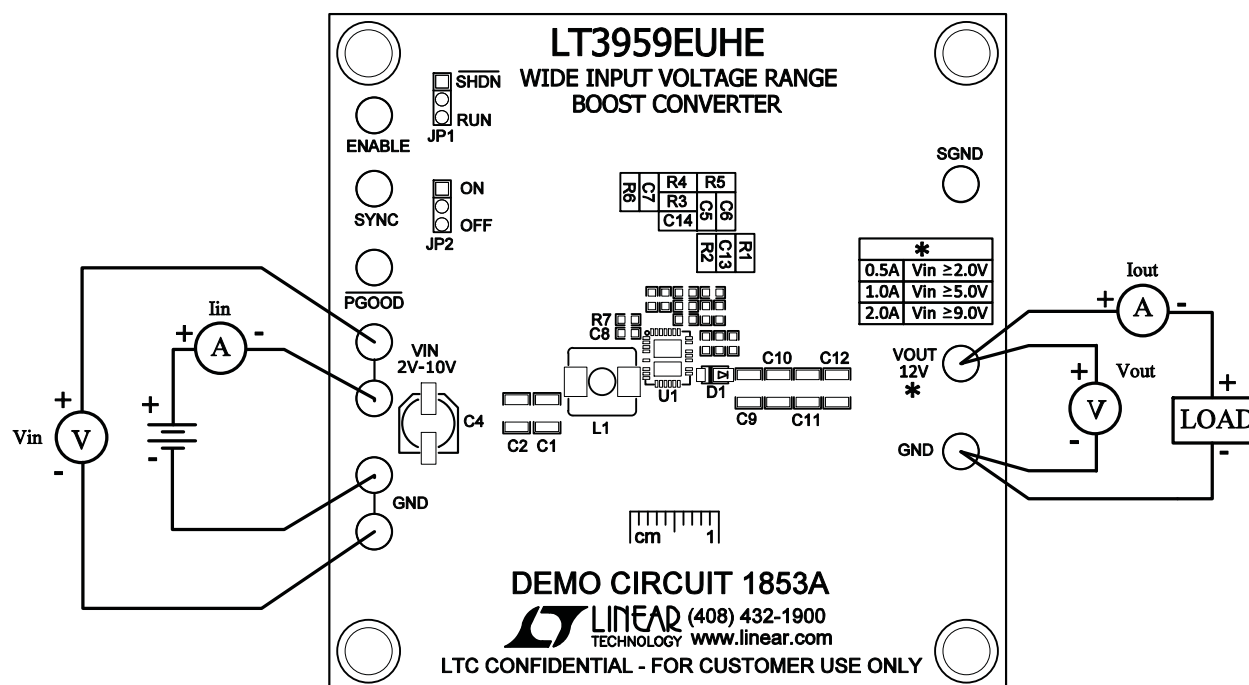


Figure 1. Proper Measurement Equipment Setup

dc1853af

QUICK START PROCEDURE

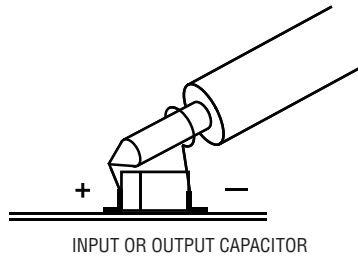


Figure 2. Proper Scope Probe Placement for Measuring Input or Output Ripple

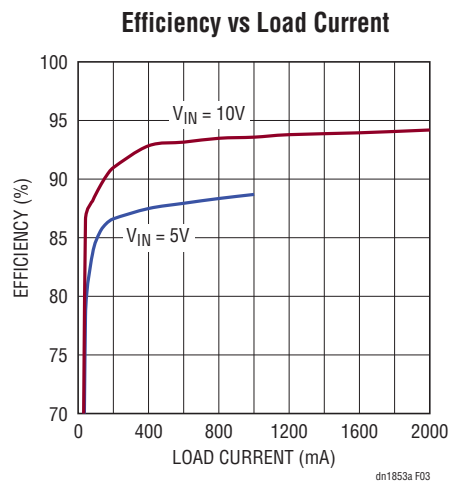


Figure 3. Efficiency with Different Input Voltages

DEMO MANUAL DC1853A

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	5	C1, C9, C10, C11, C12	CAP., X7R, 22µF 16V, 10%, 1210	AVX, 1210YC226KAT2A
2	1	C4	CAP., SVPC 68µF 16V, 20%, OSCON-C6	SANYO, 16SVPC68MV
3	1	C5	CAP., NPO, 120pF 25V, 10%, 0603	AVX, 06033A121KAT
4	1	C6	CAP., X7R 18nF 25V, 20%, 0603	AVX 06033C183MAT2A
5	1	C7	CAP., X5R, 0.33µF 16V, 10%, 0603	AVX, 0603YD334KAT
6	1	C8	CAP., X5R, 4.7µF 10V, 10%, 0603	TAIYO YUDEN, LMK107BJ475KA-T
7	1	D1	SCHOTTKY DIODE, 2A/30V POWERDI-123	DIODES/ZETEX DFLS230LH-7
8	1	L1	IND., 3.3µH	COOPER BUSSMANN, DR74-3R3-R
9	1	R1	RES., CHIP 332k 1/10W, 1%, 0603	VISHAY, CRCW0603332KFKEA
10	1	R2	RES., 200k 1%, 1/10W, 0603	VISHAY, CRCW0603200KFKEA
11	1	R3	RES., 102k 1%, 1/10W, 0603	VISHAY, CRCW0603102KFKEA
12	1	R4	RES., 15.8k 1%, 1/10W, 0603	VISHAY, CRCW060315K8FKEA
13	1	R5	RES., CHIP 10.5k 1/10W, 1%, 0603	VISHAY, CRCW060310K5FKEA
14	1	R6	RES., 27.4k 1%, 1/10W, 0603	VISHAY, CRCW060327K4FKEA
15	1	R7	RES., 100k 1%, 1/10W, 0603	VISHAY, CRCW0603100KFKEA
16	1	U1	I.C., DC/DC CONVERTER QFN (36) (UHE28MA) (5MMX6MM) (1836-REVC)	LINEAR TECH., LT3959EUHE
Additional Demo Board Circuit Components				
1	0	C2	CAP., X7R, 22µF 16V, 10%, 1210	AVX, 1210YC226KAT2A
2	0	C13, C14	CAP., 0603	
Hardware: For Demo Board Only				
1	10	E1-E10	TESTPOINT, TURRET, 0.094"	MILL-MAX, 2501-2-00-80-00-00-07-0
2	2	JP1, JP2	HEADER, 3 PIN 1 ROW, 0.079"	SAMTEC, TMM-103-02-L-S
3	2	XJP1, XJP2	SHUNT, 0.079" CENTER	SAMTEC, 2SN-BK-G
4	4	M1-M4	STANDOFF, NYLON 0.25"	KEYSTONE, 8831 (SNAP-ON)
5	1		FAB, 1853A_REV2	DEMO CIRCUIT 1853A
6	1		STENCIL - TOP	STENCIL 1853A



DEMO MANUAL DC1853A

DEMONSTRATION BOARD IMPORTANT NOTICE

Linear Technology Corporation (LTC) provides the enclosed product(s) under the following **AS IS** conditions:

This demonstration board (DEMO BOARD) kit being sold or provided by Linear Technology is intended for use for **ENGINEERING DEVELOPMENT OR EVALUATION PURPOSES ONLY** and is not provided by LTC for commercial use. As such, the DEMO BOARD herein may not be complete in terms of required design-, marketing-, and/or manufacturing-related protective considerations, including but not limited to product safety measures typically found in finished commercial goods. As a prototype, this product does not fall within the scope of the European Union directive on electromagnetic compatibility and therefore may or may not meet the technical requirements of the directive, or other regulations.

If this evaluation kit does not meet the specifications recited in the DEMO BOARD manual the kit may be returned within 30 days from the date of delivery for a full refund. THE FOREGOING WARRANTY IS THE EXCLUSIVE WARRANTY MADE BY THE SELLER TO BUYER AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED, OR STATUTORY, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE. EXCEPT TO THE EXTENT OF THIS INDEMNITY, NEITHER PARTY SHALL BE LIABLE TO THE OTHER FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES.

The user assumes all responsibility and liability for proper and safe handling of the goods. Further, the user releases LTC from all claims arising from the handling or use of the goods. Due to the open construction of the product, it is the user's responsibility to take any and all appropriate precautions with regard to electrostatic discharge. Also be aware that the products herein may not be regulatory compliant or agency certified (FCC, UL, CE, etc.).

No License is granted under any patent right or other intellectual property whatsoever. **LTC assumes no liability for applications assistance, customer product design, software performance, or infringement of patents or any other intellectual property rights of any kind.**

LTC currently services a variety of customers for products around the world, and therefore this transaction **is not exclusive**.

Please read the DEMO BOARD manual prior to handling the product. Persons handling this product must have electronics training and observe good laboratory practice standards. **Common sense is encouraged.**

This notice contains important safety information about temperatures and voltages. For further safety concerns, please contact a LTC application engineer.

Mailing Address:

Linear Technology
1630 McCarthy Blvd.
Milpitas, CA 95035

Copyright © 2004, Linear Technology Corporation

dc1853af

6

Linear Technology Corporation

1630 McCarthy Blvd., Milpitas, CA 95035-7417

(408) 432-1900 • FAX: (408) 434-0507 • www.linear.com

LT 0912 • PRINTED IN USA



© LINEAR TECHNOLOGY CORPORATION 2012