LTC3839EUH
Fast Transient
Step-Down DC/DC Converter

DESCRIPTION

Demonstration circuit 1632A is a single output 1.5V/40A dual phase synchronous buck converter operating with a switching frequency of 300kHz over an input voltage range of 4.5V to 14V. The controlled on-time valley current mode architecture of the LTC3839 allows for a fast load step response (see Figure 4). The load step response can be tested with the on-board load step circuit and a bench pulse generator.

Other features of the board include remote sensing, selectable light load operating modes of forced continuous mode (FCM) and discontinuous mode (DCM), a PLLIN pin for synchronizing to an external clock, a CLKOUT pin, an $EXTV_{CC}$ pin to reduce losses in the controller, and RUN and TRACK/SS pins. Up to 12-phase operation can be achieved by daisy-chaining the CLKOUT and PLLIN signals of multiple boards and programming the relative phase with the PHASMD jumper.

The demo board uses a high density, two sided drop-in layout. The entire converter, excluding the bulk output and input capacitors, fits within a compact 1.6″ × 1.2″ area on the board. The package style for the LTC3839EUH is a 32-lead 5mm × 5mm QFN with an exposed ground pad.

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

PERFORMANCE SUMMARY (T_A = 25°C)

PARAMETER	CONDITIONS	VALUE
Minimum Input Voltage		4.5V
Maximum Input Voltage		14V
Output Voltage V_{OUT}	I_{OUT} = 0A to 40A, V_{IN} = 4.5V to 14V	1.5V ± 2%
V_{OUT} Maximum Output Current, I_{OUT}	V_{IN} = 4.5V to 14V, V_{OUT} = 1.5V	40A
Nominal Switching Frequency		300kHz
Efficiency (see Figures 2 and 3)	V_{OUT} = 1.5V, I_{OUT} = 40A, V_{IN} = 12V	90.7% Typical

QUICK START PROCEDURE

Demonstration circuit 1632A is easy to set up to evaluate the performance of the LTC3839EUH. Please refer to Figure 1 for proper measurement equipment setup and follow the procedure below.

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

JP1	RUN	ON
JP3	MODE	FCM

2) Adjust the input voltage to be between 4.5V and 14V. V_{OUT} should be 1.5V ±2%.

3) Next, apply 40A load and re-check V_{OUT}.

4) Once the DC regulation is confirmed, observe the output voltage ripple, load step response, efficiency and other parameters.

Note 1. Use the BNC connector labeled V_{OUT} to measure the output voltage ripple.

Note 2. Do not apply the load from the VO_SNS+ pin to the VO_SNS– pin. This may damage the converter. These pins are only intended to monitor the voltage across the bulk output capacitors at C_{OUT}1-4.

Load Step Testing (Optional)

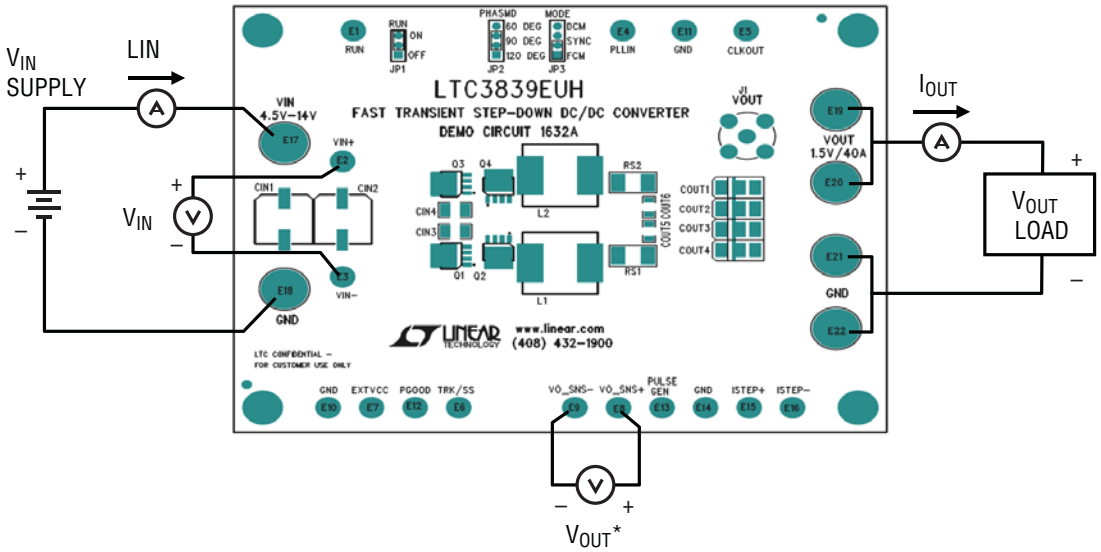
Demonstration circuit 1632A provides a simple load step circuit consisting of a MOSFET and sense resistor for each rail. To apply a load step, follow the steps below.

1) Pre-set the amplitude of a pulse generator to 0.0V and the duty cycle to 5% or less.

2) Connect the scope to the VOUT BNC connectors for the rail under test with a coax cable. To monitor the load step current, connect the scope probe across the ISTEP± pins.

3) Connect the output of the pulse generator to the PULSE GEN pin and connect the return to the GND pin.

4) With the converter running, slowly increase the amplitude of the pulse generator output to provide the desired load step pulse height. The scaling for the LOAD STEP signal is 5mV/Amp.



* MONITOR THE VOLTAGE ACROSS C_{OUT5} FOR ACCURATE EFFICIENCY MEASUREMENTS.

Figure 1. Proper Measurement Equipment Setup

QUICK START PROCEDURE

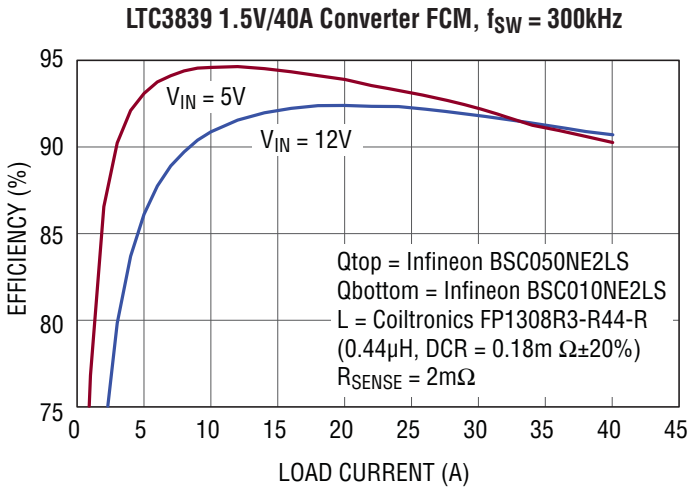


Figure 2. Efficiency Curves for the DC1632A in FCM

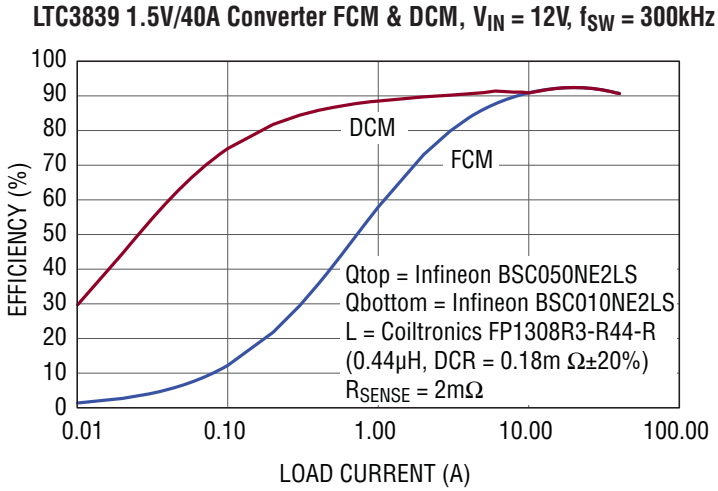


Figure 3. Efficiency Curves for the DC1632A in FCM and DCM

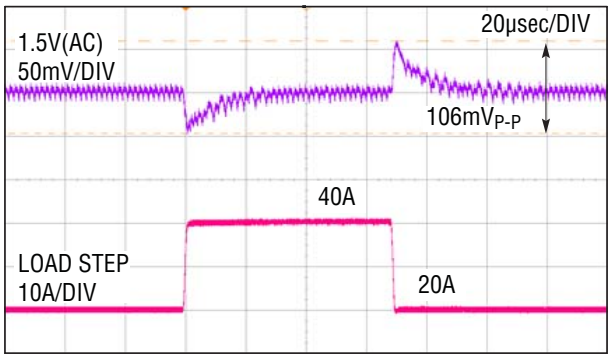
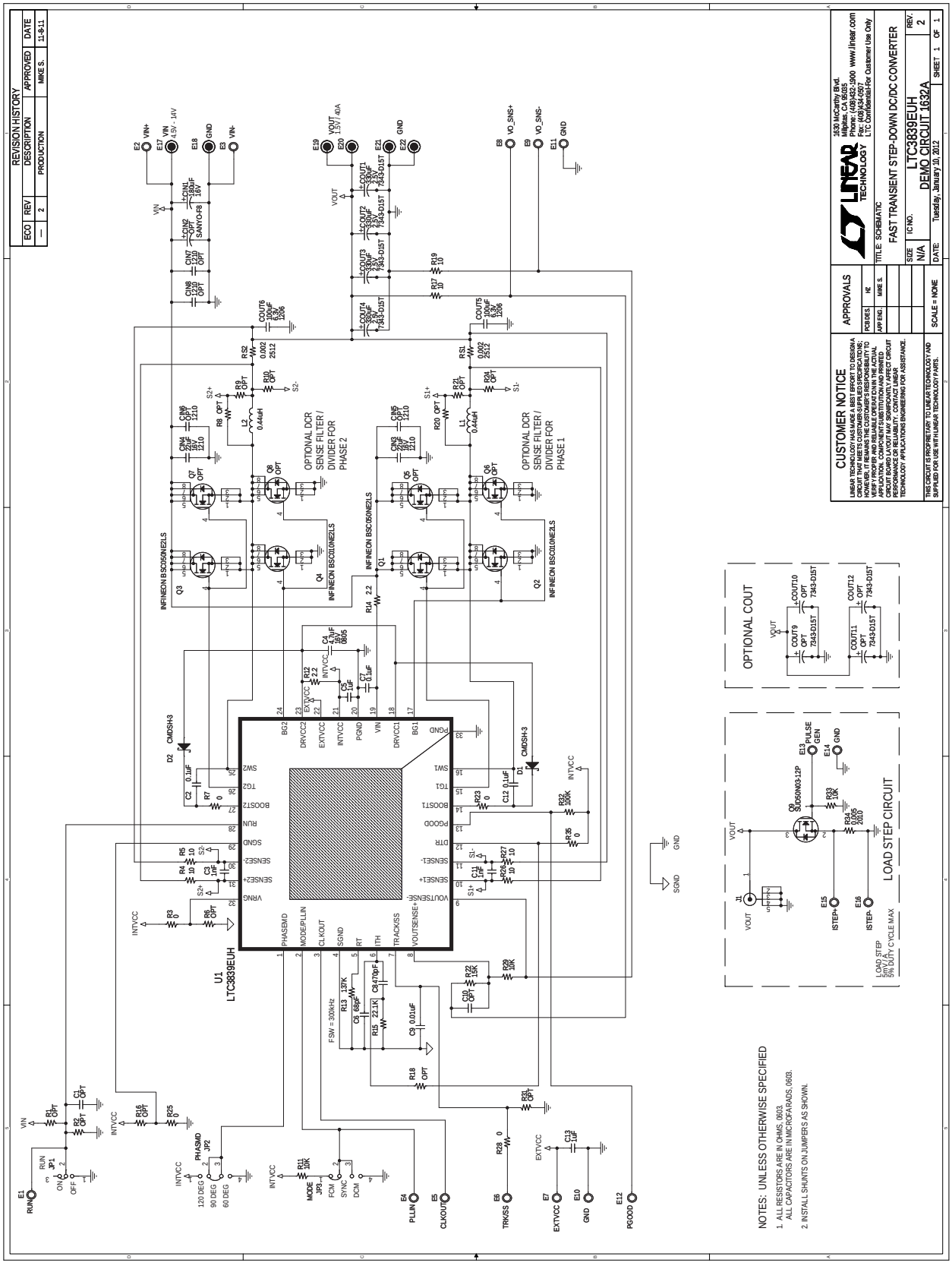


Figure 4. Load Step Response of the DC1632A at V_{IN} = 12V. C_{OUT} = 4× Sanyo 2R5TPE330M9 || 2× 100µF X5R 6.3V 1206, L1, 2 = 0.44µH, f_{SW}=300kHz

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	2	C13, C5	CAP, X5R 1µF 16V 10% 0603	AVX 0603YD105KAT2A
2	3	C2, C7, C12	CAP, X5R 0.1µF 25V 10% 0603	AVX 06033C104KAT2A
3	2	C3, C11	CAP, X7R 1000pF 16V 0603	AVX 0603YC102KAT2A
4	1	C4	CAP, X5R 4.7µF 16V 10% 0805	AVX 0805YD475KAT2A
5	1	C6	CAP, NPO 68pF 25V 10% 0603	AVX 06033A680KAT2A
6	1	C8	CAP, X7R 470pF 16V 5% 0603	AVX 0603YC471JAT2A
7	1	C9	CAP, X5R 0.01µF 25V 10% 0603	AVX 06033C103KAT2A
8	1	CIN1	CAP, 180µF 16V	SANYO 16SVP180MX
9	2	CIN3, CIN4	CAP, X5R 22µF 16V 1210	MURATA GRM32ER61C226KE20L
10	4	COUT1, COUT2, COUT3, COUT4	CAP, 330µF 2.5V SIZE 7343	SANYO 2R5TPE330M9
11	2	COUT6, COUT5	CAP, X5R 100µF 6.3V 1206	MURATA GRM31CR60J107ME 39L
12	2	D1,D2	DIODE, SCHOTTKY SOD-323	CENTRAL SEMI CMDSH-4E TR
13	2	L1,L2	IND, 0.44µH	COILTRONICS FP1308R3-R44-R
14	2	Q1,Q3	MOSFET, N CHANNEL POWERPAK SO-8	INFINEON BSC050NE2LS
15	2	Q2,Q4	MOSFET, N CHANNEL POWERPAK SO-8	INFINEON BSC010NE2LS
16	3	R11, R29, R33	RES, CHIP 10k 1% 0603	VISHAY CRCW060310K0FKEA
17	1	R15	RES, CHIP 22.1k 1% 0603	VISHAY CRCW060322K1FKEA
18	1	R13	RES, CHIP 137k 1% 0603	VISHAY CRCW0603137KFKEA
19	2	R14, R12	RES, CHIP 2.2 1% 0603	VISHAY CRCW06032R20FKEA
20	1	R22	RES, CHIP 15k 1% 0603	VISHAY CRCW060315K0FKEA
21	6	R3, R7, R23, R28, R35, R25	RES, CHIP 0 0603	VISHAY CRCW06030000Z0EA
22	1	R32	RES, CHIP 100k 1% 0603	VISHAY CRCW0603100KFKEA
23	6	R4, R5, R17, R19, R26, R27	RES, CHIP 10 1% 0603	VISHAY CRCW060310R0FKEA
24	2	RS1, RS2	RES, CHIP 0.002 1W 1% 2512	VISHAY WSL25122L000FEA
25	1	U1	IC LTC3839EUH QFN 5mm × 5mm	LINEAR TECH. LTC3839EUH#PBF
Additional Circuit Components				
1	0	CIN2	CAP, SVP-F8, OPT	
2	0	CIN5, CIN6, CIN7, CIN8	CAP, 1210, OPT	
3	0	C1, C10	CAP, 0603, OPT	
4	0	COUT9-COUT12	CAP, SIZE 7343, OPT	
5	0	Q5-Q8	POWERPAK SO-8, OPT	
6	1	Q9	N-Channel MOSFET, TO-252	VISHAY SUD50N03-12P-E3
7	0	R1, R2, R6, R16, R18, R21, R31, R8, R9, R10, R20, R24	RES, CHIP 0603, OPT	
8	1	R33	RES, CHIP 10k 1% 0603	VISHAY CRCW060310K0FKEA
9	1	R34	RES, CHIP 0.005 1W 1% 2010	VISHAY WSL20105L000FEA
Hardware				
1	16	E1-E16	TESTPOINT, TURRET .095"	MILL-MAX 2501-2-00-80-00-00-07-0
2	1	JP1	2mm SINGLE ROW HEADER 3 PIN	SAMTEC TMM-103-02-L-S
3	2	JP3, JP2	2mm SINGLE ROW HEADER 4 PIN	SAMTEC TMM-104-02-L-S
4	6	E17-E22	JACK, BANANA	KEYSTONE 575-4
5	1	J1	CONN, BNC, 5PINS	CONNEX 112404
6	4	(STAND-OFF)	STAND-OFF, NYLON 0.25"	KEYSTONE 8831 (SNAP ON)

SCHEMATIC DIAGRAM



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