

# LTC3613EWKH

## Fast, High Efficiency Step-Down Regulator

### DESCRIPTION

Demonstration circuit 1700A is a fast, high efficiency synchronous buck DC/DC converter with 4.5V to 24V input range. It can supply 15A maximum load current at 1.5V output. The demo board features the LTC®3613EWKH regulator. No external MOSFETs are required. The controlled on-time constant frequency valley current mode architecture allows for both fast transient response and constant frequency switching in steady-state operation. Differential output voltage sensing along with a precision internal reference combine to offer an accurate output regulation. The LTC3613 is ideal for applications such as distributed power systems, servers and point-of-load converters. The LTC3613EWKH is in a 7mm × 9mm 54-pin QFN package.

The light load operation mode of the converter is determined with the MODE/PLLIN pin. Use JP2 jumper to select discontinuous mode (DCM) or forced continuous mode (CCM) operation. Switching frequency is pre-set at about 350kHz. This frequency can be modified from 200kHz to 1MHz by changing the value of a resistor (R18). The converter can also be externally synchronized from 200kHz to 1MHz through the MODE/PLLIN pin (PLLIN terminal on the board). To shut down the converter, one simple way is to force the RUN pin below 1.1V (JP1: OFF). The power good output (PGOOD terminal) is low when the output voltage is outside of the ±7.5% regulation window.

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

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### PERFORMANCE SUMMARY (T<sub>A</sub> = 25°C)

PARAMETER	CONDITIONS	VALUE
Input Voltage Range		4.5V to 24V
Output Voltage, V <sub>OUT</sub>	V <sub>IN</sub> = 4.5V to 24V, I <sub>OUT</sub> = 0A to 15A	1.5V ±2%
Maximum Output Current, I <sub>OUT</sub>	V <sub>IN</sub> = 4.5V to 24V, V <sub>OUT</sub> = 1.5V	15A
Typical Output Ripple	V <sub>IN</sub> = 12V, I <sub>OUT</sub> = 15A (20MHz BW)	40mV <sub>p-p</sub>
Typical Efficiency	V <sub>IN</sub> = 12V, V <sub>OUT</sub> = 1.5V, I <sub>OUT</sub> = 15A	87.5%
Typical Switching Frequency		350kHz

## QUICK START PROCEDURE

Demonstration circuit 1700A is easy to set up to evaluate the performance of the LTC3613. Refer to Figure 1 for the proper measurement equipment setup and follow the procedure below:

1. With power off, connect the input power supply to  $V_{IN}$  (4.5V to 24V) and GND (input return).
2. Connect the 1.5V output load between  $V_{OUT}$  and GND (Initial load: no load).
3. Connect the DVMs to the input and outputs.
4. Turn on the input power supply and check for the proper output voltages.  $V_{OUT}$  should be  $1.5V \pm 2\%$ .

5. Once the proper output voltages are established, adjust the loads within the operating range and observe the output voltage regulation, ripple voltage and other parameters.

Note: When measuring the output or input voltage ripple, do not use the long ground lead on the oscilloscope probe. See Figure 2 for the proper scope probe technique. Short, stiff leads need to be soldered to the (+) and (-) terminals of an output capacitor. The probe's ground ring needs to touch the (-) lead and the probe tip needs to touch the (+) lead.

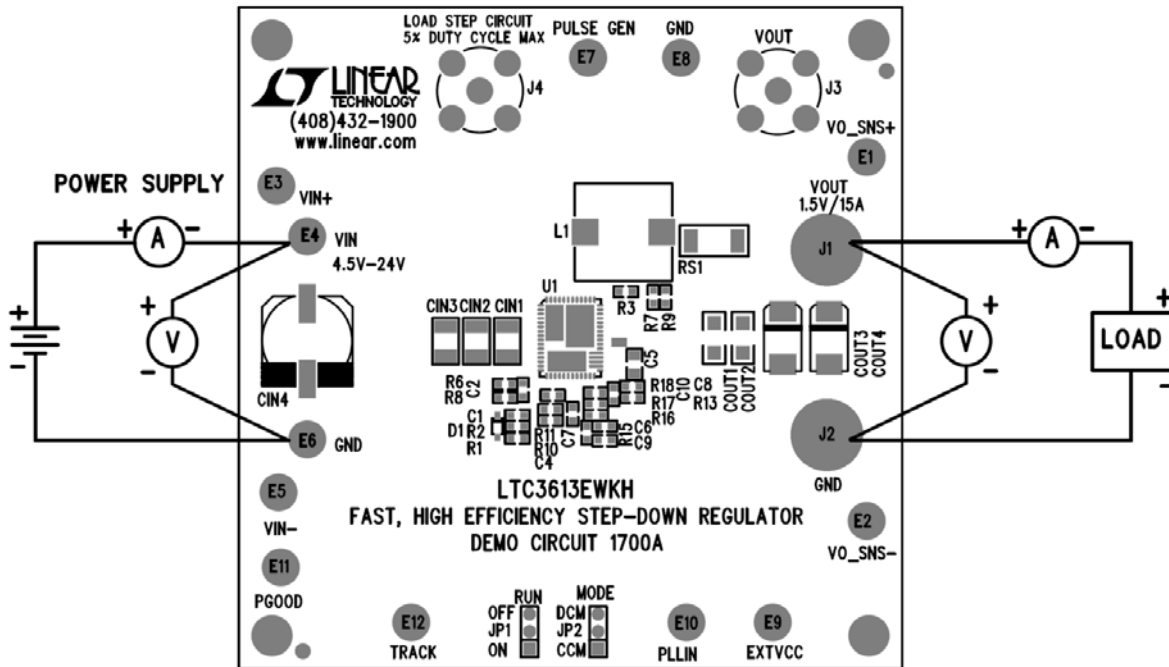


Figure 1. Proper Measurement Equipment Setup

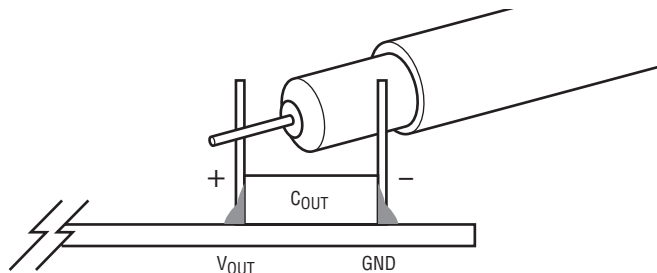
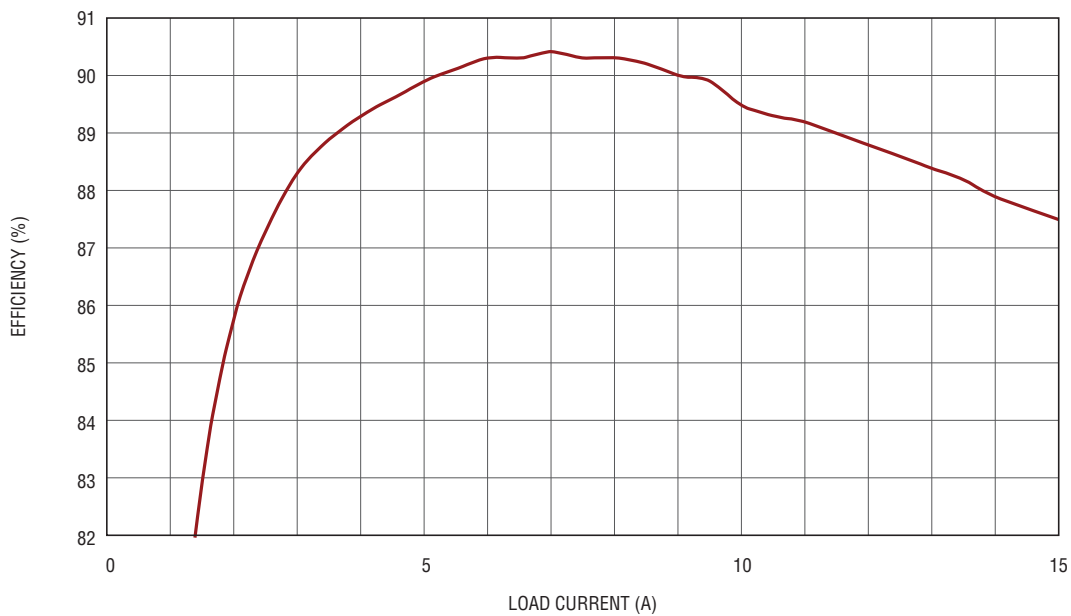


Figure 2. Measuring Output Voltage Ripple

**QUICK START PROCEDURE**



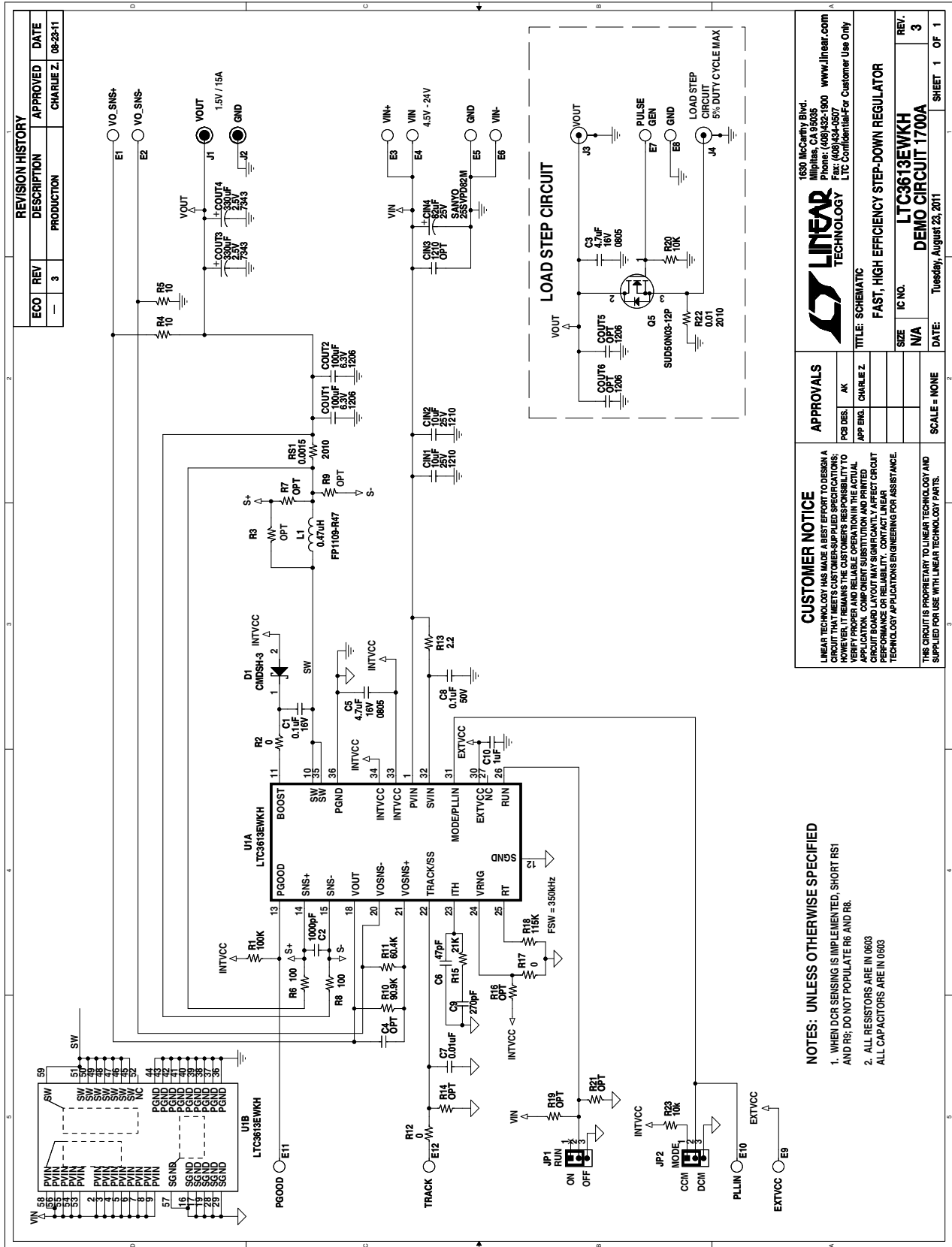
**Figure 3. Efficiency vs Load Current ( $V_{IN} = 12V$ ,  $V_O = 1.5V$ , CCM)**

# DEMO MANUAL DC1700A

## PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
<b>Required Circuit Components</b>				
1	2	CIN1, CIN2	CAP, 1210 10 $\mu$ F 10% 16V X5R	AVX, 1210YD106KAT
2	1	CIN4	CAP, 82 $\mu$ F, 25V, Sanyo	SANYO, 25SVPD82M
3	2	COUT1, COUT2	CAP, 1206 100 $\mu$ F 20% 6.3V X5R	MURATA, GRM31CR60J107ME39L
4	2	COUT3, COUT4	CAP, 7343 330 $\mu$ F 20% 2.5V POSCAP	SANYO 2R5TPE330M9
5	2	C1, C8	CAP, 0603 0.1 $\mu$ F 10% 25V X7R	TDK C1608X7R1E104K
6	1	C2	CAP, 0603 1000pF 10% 50V X7R	AVX, 06035C102KAT
7	2	C3, C5	CAP, 0805 4.7 $\mu$ F 10% 16V X5R	TDK C2012X5R1C475K
8	1	C6	CAP, 0603 47pF 10% 25V NPO	AVX, 06033A470KAT2A
9	1	C7	CAP, 0603 0.01 $\mu$ F 10% 50V X7R	AVX, 06035C103KAT
10	1	C9	CAP, 0603 270pF 10% 25V NPO	AVX, 06033A271KAT2A
11	1	C10	CAP, 0603 1 $\mu$ F 10% 25V X5R	AVX, 06033D105KAT
12	1	D1	DIODE, CMDSH-3 SOD323	CENTRAL CMDSH-3
13	1	L1	IND., 0.47 $\mu$ H, FP1109 series	COILTRONICS, FP1109-R47-R
14	1	Q5	XSTR, MOSFET, DPAK-TO252AA	VISHAY SUD50N03-12P-E3
15	1	RS1	RES, 2010 0.0015 $\Omega$ 1% 1/2W	VISHAY WSL20101L500FEA
16	1	R1	RES, 0603 100k 1% 1/10W	VISHAY CRCW0603100KFKEA
17	3	R2, R12, R17	RES, 0603 0 $\Omega$ JUMPER	VISHAY CRCW06030000Z0EA
18	2	R4, R5	RES, 0603 10 $\Omega$ 1% 1/10W	VISHAY CRCW060310R0FKEA
19	2	R6, R8	RES, 0603 100 $\Omega$ 1% 1/10W	PANASONIC, ERJ-3EKF1000V
20	1	R10	RES, 0603 90.9k 1% 1/10W	PANASONIC, ERJ-3EKF9092V
21	1	R11	RES, 0603 60.4k 1% 1/10W	VISHAY, CRCW060360K4FKEA
22	1	R13	RES, 0603 2.2 $\Omega$ 1% 1/10W	NIC, NRC06F2R20TRF
23	1	R15	RES, 0603 21k 1% 1/10W	VISHAY, CRCW060321K0FKEA
24	1	R18	RES, 0603 115k 1% 1/10W	VISHAY, CRCW0603115KFKEA
25	2	R20, R23	RES, 0603 10k 1% 1/10W	NIC, NRC06F1002TRF
25	1	R22	RES, 2010 0.01 $\Omega$ 1% 1/2W	VISHAY WSL2010R0100FEA
27	1	U1	LTC3613EWKH	QFN-56-7X9
<b>Additional Demo Board Circuit Components</b>				
28	1	CIN3	OPT, 1210	
29	2	COUT5, COUT6	OPT	
30	3	C4, R9, R16	OPT	
31	1	R3	OPT	
32	4	R7, R14, R19, R21	OPT	
<b>Demo Board Only</b>				
33	12	E1, E2, E3, E4, E5, E6, E7, E8,	TURRET	MILL-MAX 2501-2-00-80-00-00-07-0
34		E9, E10, E11, E12		
35	2	JP1, JP2	HEADER, 3PIN, 2mm	SAMTEC TMM-103-02-L-S
36	2	XJP1, XJP2	SHUNT, 2mm	SAMTEC 2SN-BK-G
37	2	J1, J2	JACK, BANANA	KEYSTONE 575-4
38	2	J3, J4	CONN, BNC, 5 PINS	CONNEX 112404

SCHEMATIC DIAGRAM



REVISION HISTORY			APPROVED	DATE
ECO	REV	DESCRIPTION	CHARLE Z.	08-23-11
—	3	PRODUCTION		

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**APPROVALS**

PCB DES.	AK
APP ENG.	CHARLE Z.

TITLE: SCHEMATIC  
 FAST, HIGH EFFICIENCY STEP-DOWN REGULATOR

SIZE: IC NO. N/A  
 REV. 3  
 DEMO CIRCUIT 1700A

DATE: Tuesday, August 23, 2011  
 SHEET 1 OF 1

SCALE = NONE

**CUSTOMER NOTICE**  
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**NOTES: UNLESS OTHERWISE SPECIFIED**

1. WHEN DCR SENSING IS IMPLEMENTED, SHORT R8 AND R9;
2. ALL RESISTORS ARE IN 0603  
 ALL CAPACITORS ARE IN 0603



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# DEMO MANUAL DC1700A

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