

LTM4611EV: Ultralow V_{IN} 15A Step-Down Power μ Module[®] Regulator

DESCRIPTION

Demonstration circuit DC1588A features the LTM[®]4611EV, a low input voltage 15A step-down power module. The operating input voltage range is 1.5V to 5.5V with an output voltage range from 0.8V to 5V. DC1588A can support a load current up to 15A, while derating may be necessary for different V_{IN} , V_{OUT} and thermal conditions. The LTM4611EV can operate in pulse-skipping mode or Burst Mode[®] operation for high efficiency under a light load. The DC1588A has a default programmable switching frequency of 500kHz and may be synchronized to an external clock from 360kHz up to 710kHz. The TRACK/SS input allows the output voltage to ramp up and ramp down; coincidentally or ratiometrically with an external voltage. A remote

output voltage sense feature improves the output voltage accuracy under high loads. These features and the availability of the LTM4611EV in a compact 15mm \times 15mm \times 4.32mm LGA package make the demonstration circuit ideal for use in many high density point-of-load regulation applications. The LTM4611 data sheet must be read in conjunction with this demo manual for working on or modifying the demo circuit 1588A.

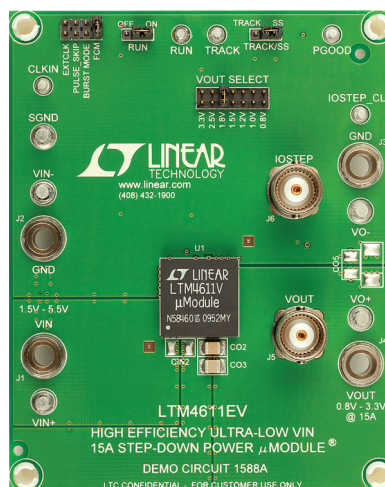
Design files for this circuit board are available at <http://www.linear.com/demo>

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PERFORMANCE SUMMARY ($T_A = 25^\circ\text{C}$)

PARAMETER	CONDITIONS	VALUE
Input Voltage Range		1.5V to 5.5V
Output Voltage V_{OUT}	Selectable with Jumpers (Open for 0.8V)	0.8V, 1.0V, 1.2V, 1.5V, 1.8V, 2.5V, 3.3V
Maximum Continuous Output Current	Derating is Necessary for Certain Operating Conditions. See Data Sheet for Details	15A DC
Default Operating Frequency		500kHz
External Clock Synchronous Frequency Range		360kHz to 710kHz
Efficiency	$V_{IN} = 5V$, $V_{OUT} = 3.3V$, $I_{OUT} = 15A$	93%, See Figure 2

BOARD PHOTO



dc1588af

QUICK START PROCEDURE

Demonstration circuit 1588A is easy to set up to evaluate the performance of the LTM4611EV. Please refer to Figure 1 for proper measurement equipment setup and follow the procedure below:

1. Place jumpers in the following positions for a typical 1.8V_{OUT} application:

JP4	JP1	JP2	JP3
V _{OUT} SELECT	RUN	MODE/PLLIN	TRACK/SS
1.8V	ON	FCM	SS

2. 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 5V.
3. Turn on the power supply at the input. The output voltage should be 1.8V ± 1.5%.
4. Once the proper output voltage is established, adjust the load within the operating range and observe the output voltage regulation, output voltage ripple, efficiency and other parameters. Output ripple should be measured at J5 with a BNC cable.

5. To perform a load transient test, apply a square-wave pulse signal between IOSTEP_CLK and GND pins. The pulse amplitude (3V ~ 3.5V) sets the amplitude of load current step. The pulse signal should have very small duty cycle (<10%) to limit the thermal stress on the transient load circuit. The output transient current can be monitored at BNC connector J6 (15mV/A).
6. The LTM4611 can be synchronized to an external clock signal. Place the jumper JP2 in the EXTCLK position and apply the clock signal on the “CLKIN” (TP17) test point.
7. The output of LTM4611 can track another supply. The jumper JP3 allows selection of the soft-start or output tracking feature. If tracking external voltage is selected, the corresponding test point, “TRACK” (TP7), needs to be connected to a valid reference voltage signal.

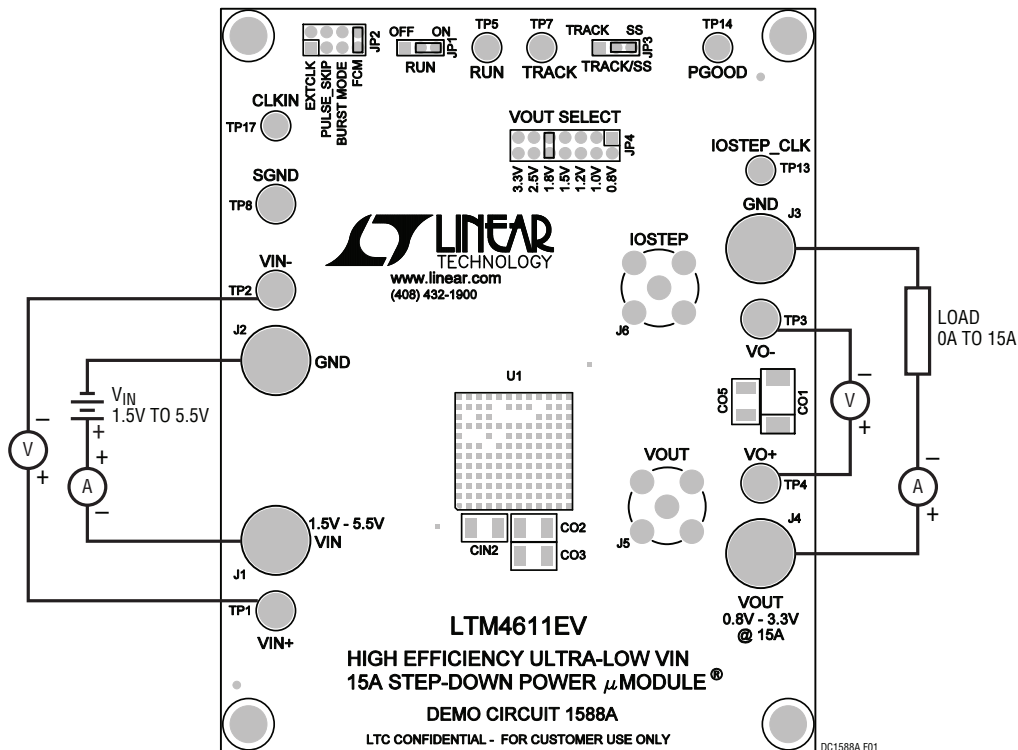


Figure 1. Test Setup of DC1588A

QUICK START PROCEDURE

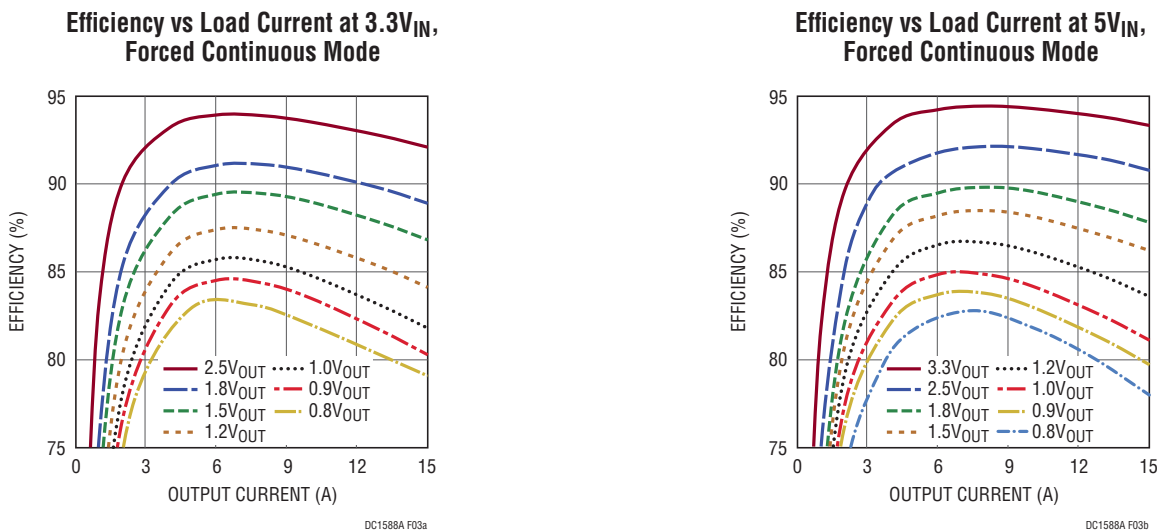


Figure 2. Measured Supply Efficiency with Different V_{IN} and V_{OUT}

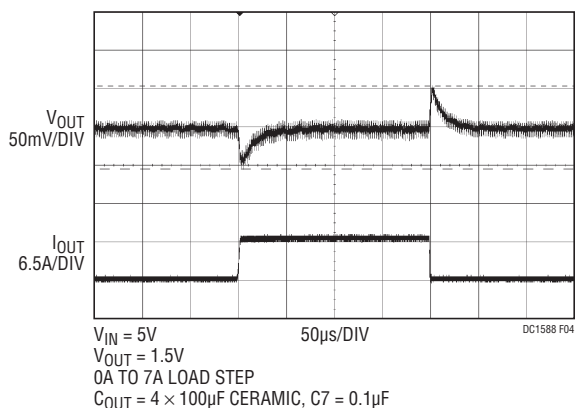


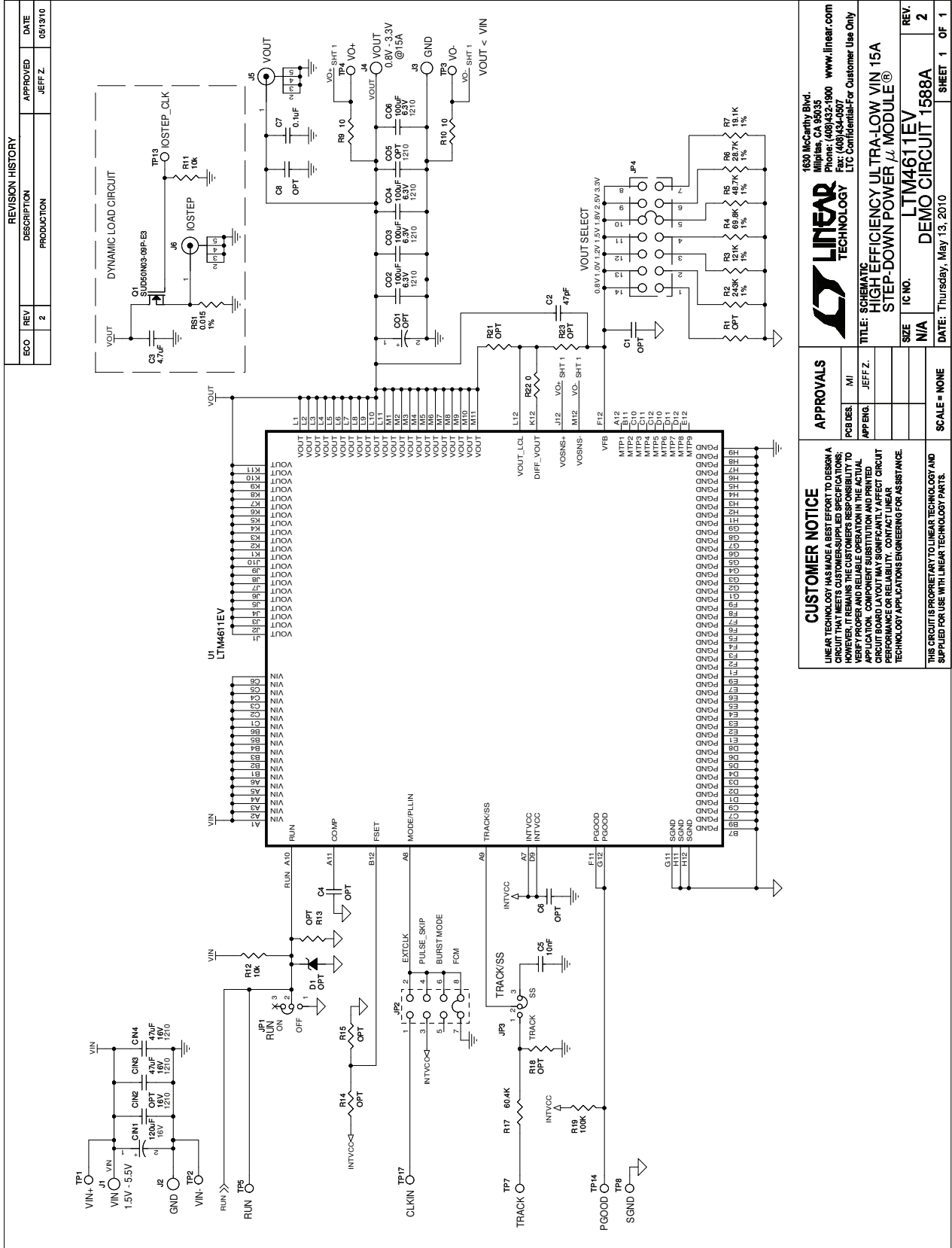
Figure 3. Measured Load Transient Response (0A to 7A Step)

DEMO MANUAL DC1588A

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	1	CIN1	CAP, 120 μ F 20% 16V OS-CON	SANYO OS-CON 16SVP120M
2	2	CIN3, CIN4	CAP, 1210 47 μ F 20% 16V X5R	TAIYO YUDEN EMK325BJ476MM-T
3	4	C02, C03, C04, C06	CAP, 1210 100 μ F 20% 6.3V X5R	AVX 12106D107MAT2A
4	2	R9, R10	RES, 0603 10 Ω 5% 1/10W	VISHAY CRCW060310R0JNEA
5	1	R5	RES, 0603 48.7k 1% 1/10W	VISHAY CRCW060348K7FKEA
6	1	C2	CAP, 0603 47pF 10% 50V NPO	AVX 06035A470KAT
7	1	U1	IC, HIGH EFFICIENCY STEP-DOWN MODULE	LINEAR TECH.LTM4611EV
Additional Demo Board Circuit Components				
1	0	CIN2	CAP, 1210 22 μ F 20% 16V X5R OPTION	TDK C3225X5R1C226M OPTION
2	0	C01	CAP, 7343 330 μ F 20% 4V POSCAP OPTION	SANYO POSCAP 4TPE330MI OPTION
3	0	C05	CAP, 1210 100 μ F 20% 6.3V X5R OPTION	AVX 12106D107MAT2A OPTION
4	0	C1	CAP, 0603 220pF 10% 50V NPO OPTION	AVX 06035A221KAT OPTION
5	1	C3	CAP, 0603 4.7 μ F 20% 10V X5R	TAIYO YUDEN LMK107BJ475MA-T
6	0	C4,C6	CAP, 0603 OPTION	OPTION
7	1	C5	CAP, 0603 10nF 10% 50V X7R	TDK C1608X7R1H103K
8	1	C7	CAP, 0603 0.1 μ F 20% 16V X7R	TAIYO YUDEN EMK107BJ104MA-T
9	0	C8	CAP, 0805 OPTION	OPTION
10	0	D1	DIODE, ZENER 350mW OPTION	DIODES INC. BZX84C5V6 OPTION
11	1	Q1	XSTR, MOSFET	VISHAY SILICONIX SUD50N03-09P-E3
12	1	RS1	RES, 2512 0.015 Ω 1% 1W	PANASONIC ERJM1WSF15MU
13	0	R1,R13-R15, R18, R21, R23	RES, 0603 OPTION	OPTION
14	1	R2	RES, 0603 243k 1% 1/10W	VISHAY CRCW0603243KFKEA
15	1	R3	RES, 0603 121k 1% 1/10W	VISHAY CRCW0603121KFKEA
16	1	R4	RES, 0603 69.8k 1% 1/10W	VISHAY CRCW060369K8FKEA
17	1	R6	RES, 0603 28.7k 1% 1/10W	VISHAY CRCW060328K7FKEA
18	1	R7	RES, 0603 19.1k 1% 1/10W	VISHAY CRCW060319K1FKEA
19	2	R11, R12	RES, 0603 10k 5% 1/10W	VISHAY CRCW060310K0JNEA
20	1	R17	RES, 0603 60.4k 1% 1/10W	VISHAY CRCW060360K4FKEA
21	1	R19	RES, 0603 100k 5% 1/10W	VISHAY CRCW0603100KJNEA
22	1	R22	RES, 0603 0 Ω JUMPER	VISHAY CRCW06030000Z0EA
Hardware				
1	2	JP1, JP3	HEADER, 3 PIN, 2mm	SAMTEC TMM-103-02-L-S
2	1	JP2	HEADER, 2MM DOUBLE ROW, 2X4	SAMTEC TMM-104-02-L-D
3	1	JP4	HEADER, 2MM DOUBLE ROW, 2X7	SAMTEC TMM-107-02-L-D
4	4	J1, J2, J3, J4	JACK, BANANA	KEYSTONE 575-4
5	2	J5, J6	CONN, BNC, 5 PINS	CONNEX 112404
6	5	TP1, TP2, TP3, TP4, TP8	TURRET	MILL MAX 2501-2-00-80-00-00-07-0
7	5	TP5, TP7, TP13, TP14, TP17	TURRET	MILL MAX 2308-2-00-80-00-00-07-0
8	4	XJP1, XJP2, XJP3, XJP4	SHUNT, 2mm	SAMTEC 2SN-BK-G
9	4		STANDOFF, SNAP ON	KEYSTONE_8834

SCHEMATIC DIAGRAMS



REVISION HISTORY			
ECO	REV	DESCRIPTION	DATE
	2	PRODUCTION	05/19/10
		APPROVED	JEFF.Z.

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LINEAR TECHNOLOGY

TITLE: SCHEMATIC HIGH EFFICIENCY UL TRA-LOW VIN 15A STEP-DOWN POWER / I MODULE

SIZE I.C. NO. LTM4611EV

SCALE = NONE DEMO CIRCUIT 1588A

DATE: Thursday, May 13, 2010 SHEET 1 OF 1

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APPROVALS

PCB DES.	MI
APP ENGR.	JEFF.Z.

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DEMO MANUAL DC1588A

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