

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 × 15mm × 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.

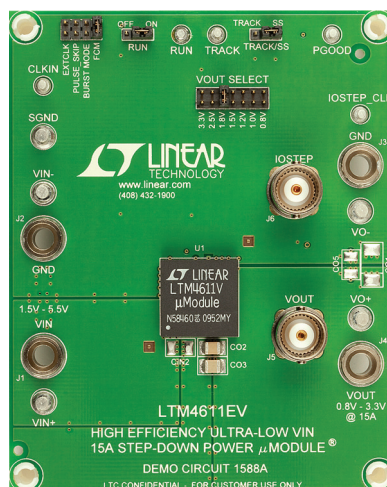
Design files for this circuit board are available at <http://www.linear.com/demo>

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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.

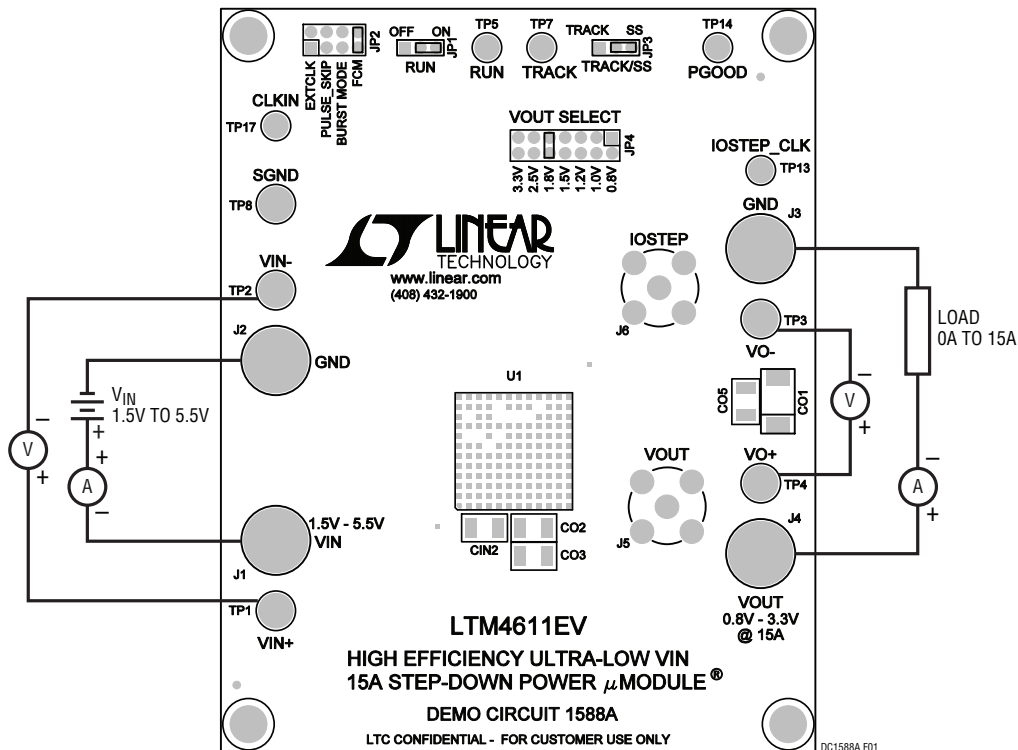


Figure 1. Test Setup of DC1588A

QUICK START PROCEDURE

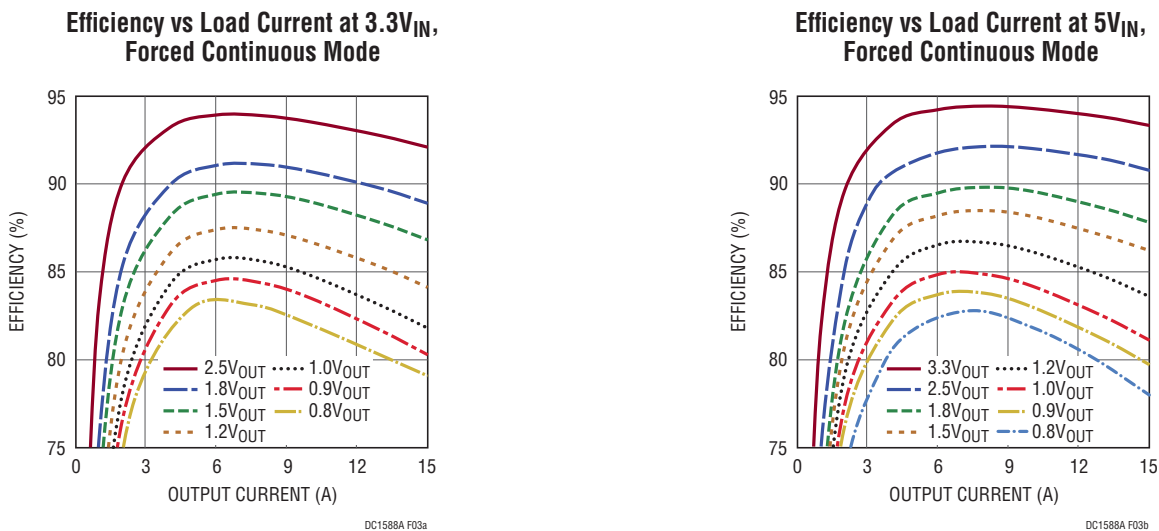


Figure 2. Measured Supply Efficiency with Different V_{IN} and V_{OUT}

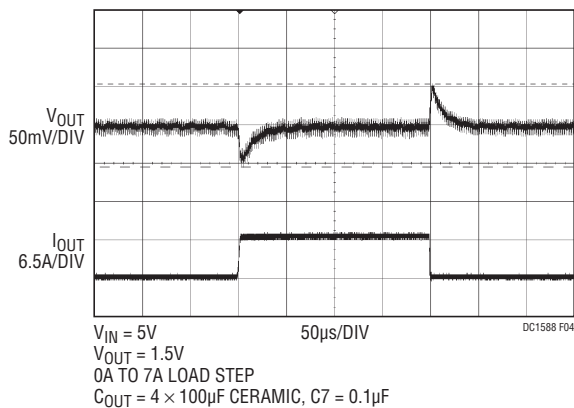


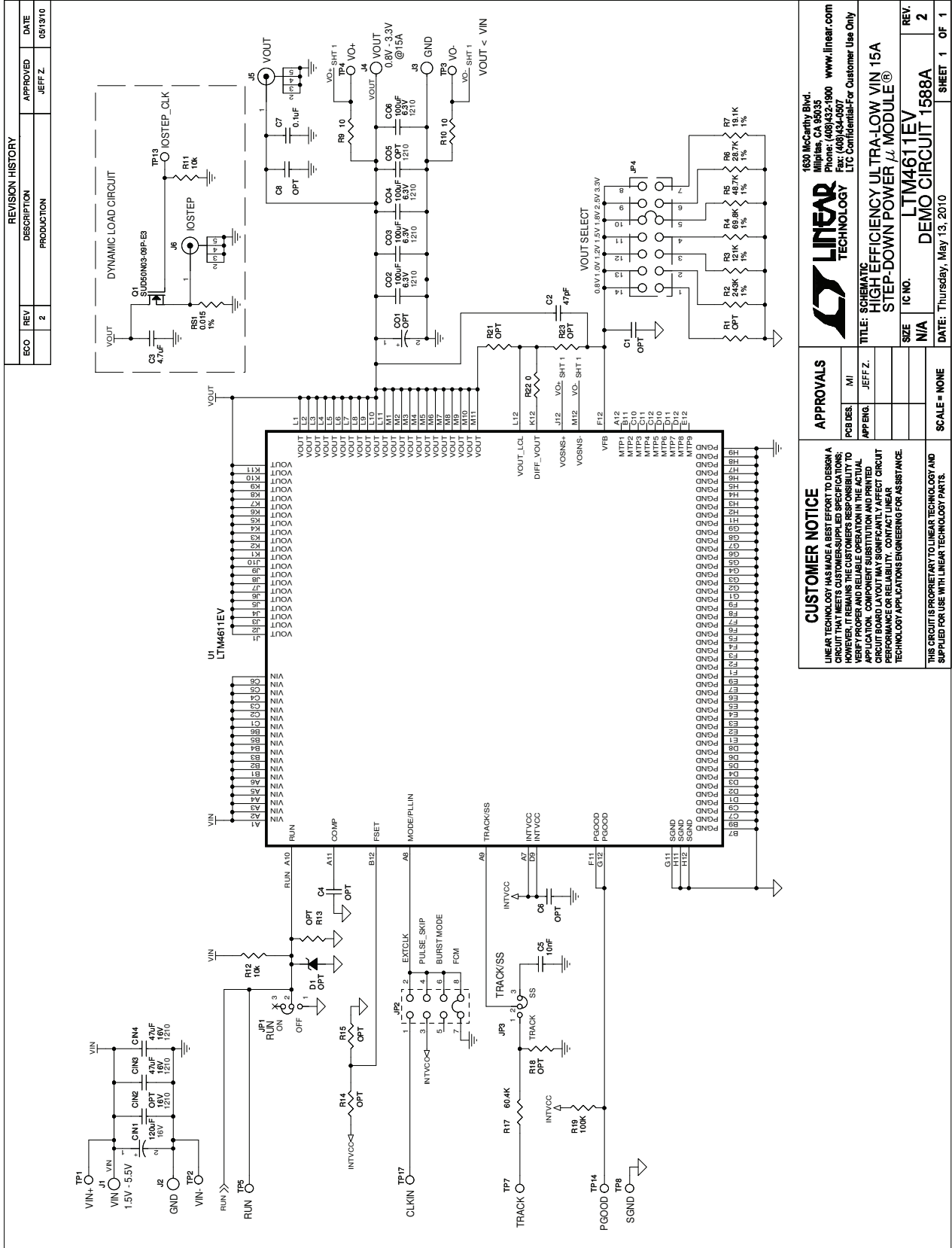
Figure 3. Measured Load Transient Response (0A to 7A Step)

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



DEMO MANUAL DC1588A

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