

LTM4627EV: 15A Step-Down μ Module Regulator

DESCRIPTION

Demonstration circuit 1669A features the LTM[®]4627EV μ Module[®] regulator, a high performance high efficiency step-down regulator. The LTM4627EV has an operating input voltage range of 4.5V to 20V and is able to provide an output current of up to 15A. The output voltage is programmable from 0.6V to 5V and can be remotely sensed with the internal optional differential remote sensing amplifier. The LTM4627EV is a complete DC/DC point-of-load regulator in a thermally enhanced 15mm \times 15mm \times 4.32mm LGA package requiring only a few input and output capacitors. This regulator is internally compensated and employs constant frequency current mode architecture, enabling a fast transient response and stable control

loop over a wide range of output capacitance. It supports frequency synchronization and Burst Mode[®] operation for increased light-load efficiency. Output voltage tracking is also available through the TRACK/SS pin for supply rail sequencing. The LTM4627 data sheet must be read in conjunction with this demo manual for working on or modifying demo circuit 1669.

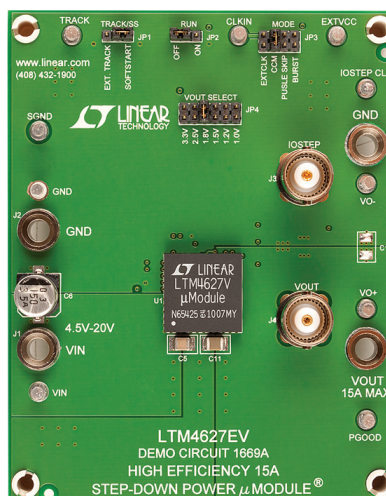
Design files for this circuit board are available at <http://www.linear.com/demo>

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PERFORMANCE SUMMARY

| PARAMETER | CONDITIONS / NOTES | VALUE |
|--|--|---|
| Input Voltage Range | | 4.5V to 20V |
| Output Voltage, V_{OUT} | Jumper Selectable | 1.0V _{DC} , 1.2V _{DC} , 1.5V _{DC} , 2.5V _{DC} , 1.8V _{DC} , 3.3V _{DC} |
| 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 | | 250kHz to 770kHz |
| Efficiency | $V_{IN} = 12V, V_{OUT} = 1.8V, I_{OUT} = 15A$ | 86.6%, See Figure 2 |

BOARD PHOTO



dc1669af

DEMO MANUAL DC1669A

QUICK START PROCEDURE

Demonstration circuit 1669 is easy to set up to evaluate the performance of the LTM4627EV. Please refer to Figure 1 for test setup connections and follow the procedure below.

1. With power off, place the jumpers in the following positions for a typical 1.8V_{out} application:

| JP1 | JP2 | JP3 | JP4 |
|-----------|-----|------|-------------------------|
| TRACK/SS | RUN | MODE | V _{OUT} Select |
| SOFTSTART | ON | CCM | 1.8V |

2. Before connecting input supply, load and meters, preset the input voltage supply to be less than 20V. Preset the load current to 0A.
3. With power off, connect the load, input voltage supply and meters as shown in Figure 1.
4. Turn on input power supply. The output voltage meter should display the selected output voltage $\pm 2\%$.
5. Once the proper output voltage is established, adjust the load current within the 0A to 15A range and observe the load regulation, efficiency and other parameters. Output voltage ripple should be measured at J4 with a BNC cable and oscilloscope.

6. To observe increased light load efficiency place the Mode pin jumper (JP3) in the Burst Mode position. To observe increased light load efficiency with a reduced output ripple as compared to Burst Mode operation place the MODE pin jumper in the pulse-skipping position.
7. For optional load transient testing apply an adjustable positive pulse signal between IOSTEP CLK and GND pins. The pulse amplitude sets the load step current amplitude. The pulse width should be short ($<1\mu\text{s}$) and pulse duty cycle should be low ($<15\%$) to limit the thermal stress on the load transient circuit. The load step current can be monitored with a BNC connected to J3 (15mV/A).

Note:

To set the output voltage to 5V turn off the input supply power, apply the following changes listed below.

| R7 | R6 | R12 | JP4 |
|--------|------------|------------|-----|
| Remove | 0 Ω | 8.25k (1%) | 1V |

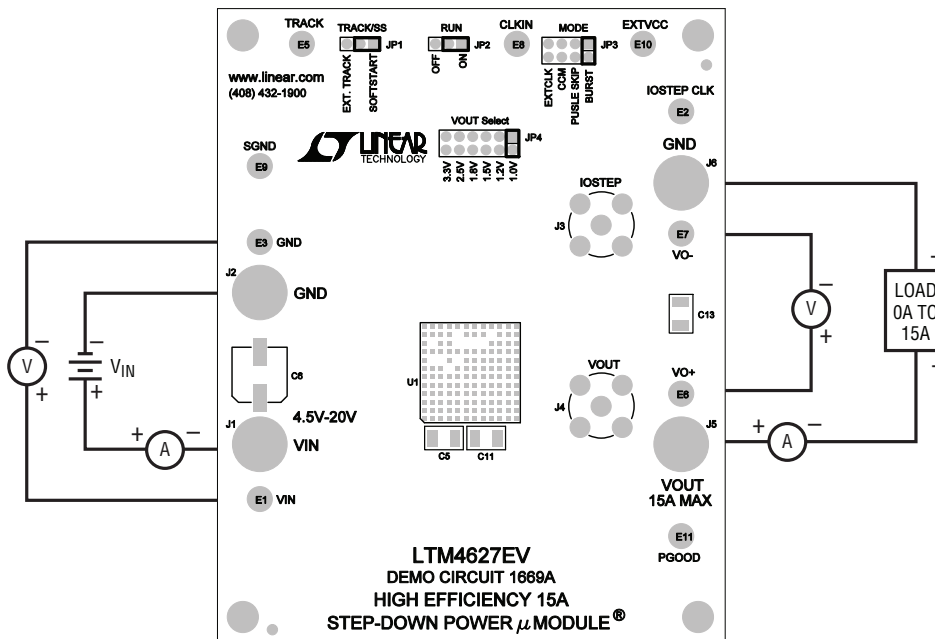
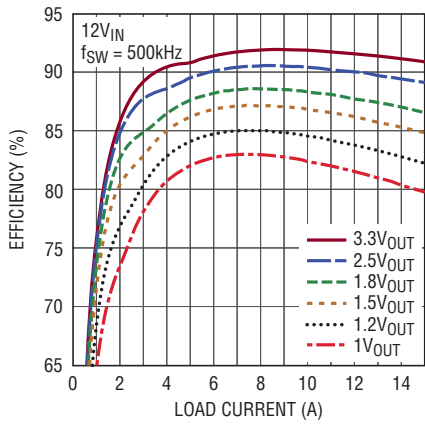


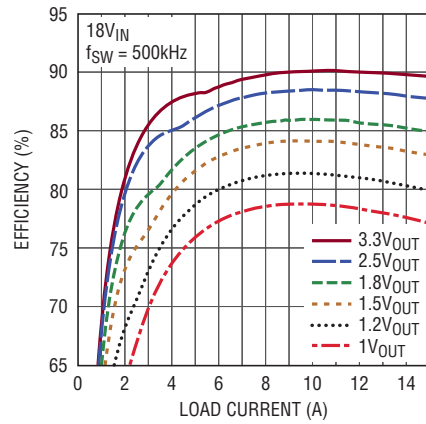
Figure 1. Test Setup of DC1669A

dc1669af

QUICK START PROCEDURE

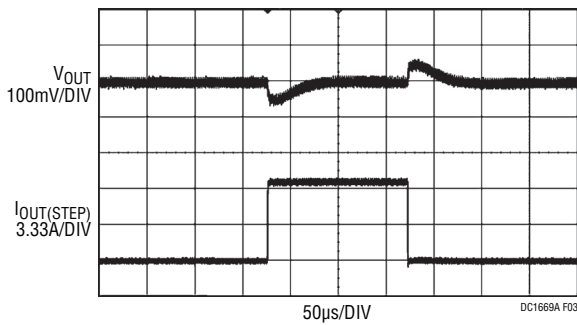


DC1669 F02b



DC1669 F02a

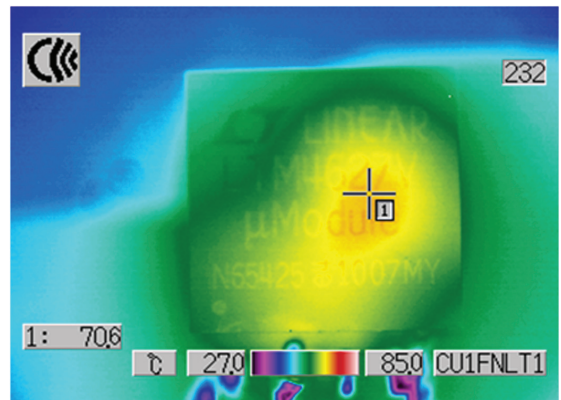
Figure 2. Measured Supply Efficiency at 12VIN and 18VIN



DC1669A F03

| V _{IN} (V) | V _{OUT} (V) | C _{OUT} BULK | C _{OUT} CERAMIC | OTHER |
|---------------------|----------------------|-----------------------|--------------------------|---------------------------|
| 12 | 1.8 | 330µF/6.3V POSCAP | 2 × 100µF, 6.3V | C10 = 47pF C19 = 330pF |

Figure 3. Measured Load Transient Response (7.5A to 15A Load Step)



| V _{IN} (V) | V _{OUT} (V) | I _{OUT} (A) | AIRFLOW | AMBIENT (°C) |
|---------------------|----------------------|----------------------|--------------------|--------------|
| 12 | 1.8 | 15 | Natural Convection | 27 |

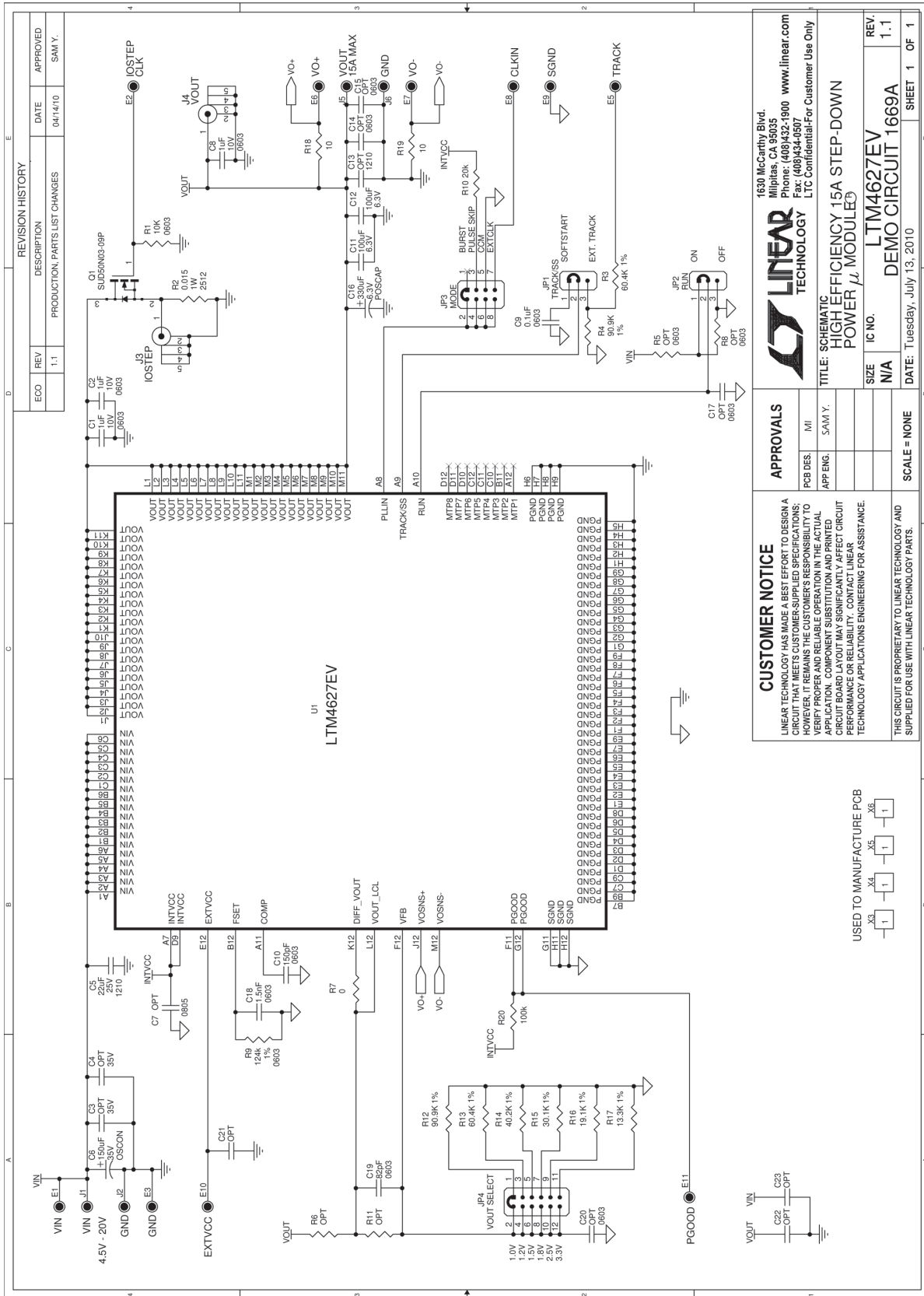
Figure 4. Measured Thermal Capture

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PARTS LIST

| ITEM | QTY | REFERENCE | PART DESCRIPTION | MANUFACTURER/PART NUMBER |
|---|-----|-------------------------|---------------------------------------|----------------------------------|
| Required Circuit Components | | | | |
| 1 | 1 | C5 | CAP, 1210 22 μ F 10% 25V X5R | MURATA GRM32ER61E226KE15L |
| 3 | 1 | C10 | CAP, 0603 150pF 10% 25V NPO | AVX 06033A151KAT2A |
| 4 | 2 | C11, C12 | CAP, 1210 100 μ F 20% 6.3V X5R | TAIYOYUDEN JMK325BJ107MM-T |
| 5 | 1 | C16 | CAP, 7343 330 μ F 20% 6.3V POSCAP | SANYO 6TPF330M9L |
| 6 | 1 | C19 | CAP, 0603 82pF 5% 25V NPO | AVX 06033A820JAT2A |
| 7 | 1 | R7 | RES, 0603 0 Ω JUMPER | VISHAY CRCW06030000Z0ED |
| 8 | 1 | R9 | RES, 0603 124k 5% 1/10W | VISHAY CRCW0603124K0JNEA |
| 9 | 1 | R15 | RES, 0603 30.1k 1% 1/10W | VISHAY CRCW060330K1FKEA |
| 10 | 2 | R18, R19 | RES, 0603 10 Ω 5% 1/10W | VISHAY CRCW060310R0JNEA |
| 11 | 1 | U1 | IC, MICRO MODULE | LINEAR TECH LTM4627EV |
| Additional Demo Board Circuit Components | | | | |
| 1 | 1 | C6 | CAP, 150 μ F 35V ALUM | SUNCON ELEC 35CE150AX |
| 2 | 0 | C3, C4, C13, C22, C23 | CAP, 1210 OPTION | OPTION |
| 3 | 0 | C7 | CAP, 0805 OPTION | OPTION |
| 4 | 0 | C14, C15, C17, C20, C21 | CAP, 0603 OPTION | OPTION |
| 5 | 1 | Q1 | XSTR, MOSFET, N-CHANNEL 30V | VISHAY SUD50N03-09P |
| 6 | 4 | R5, R6, R8, R11 | RES, 0603 OPTION | OPTION |
| 7 | 3 | C1, C2, C8 | CAP, 0603 1 μ F 20% 10V X5R | TAIYO YUDEN LMK107BJ105MA-T |
| 8 | 1 | C9 | CAP, 0603 0.1 μ F 10% 50V X7R | TDK C1608X7R1H104K |
| 9 | 1 | C18 | CAP, 0603 1.5nF 5% 25V X7R | AVX 06033A152JAT2A |
| 10 | 1 | R1 | RES, 0603 10k 5% 1/10W | VISHAY CRCW060310K0JNEA |
| 11 | 1 | R2 | RES, 2512 0.015 Ω 1% 1W | VISHAY WSL2512R0150FEA |
| 12 | 2 | R3, R13 | RES, 0603 60.4k 1% 1/10W | VISHAY CRCW060360K4FKEA |
| 13 | 2 | R4, R12 | RES, 0603 90.9k 1% 1/10W | VISHAY CRCW060390K9FKEA |
| 14 | 1 | R10 | RES, 0603 20k 5% 1/10W | VISHAY CRCW060320K0JNEA |
| 15 | 1 | R14 | RES, 0603 40.2k 1% 1/10W | VISHAY CRCW060340K2FKEA |
| 16 | 1 | R16 | RES, 0603 19.1k 1% 1/10W | VISHAY CRCW060319K1FKEA |
| 17 | 1 | R17 | RES, 0603 13.3k 1% 1/10W | VISHAY CRCW060313K3FKEA |
| 18 | 1 | R20 | RES, 0603 100k 5% 1/10W | VISHAY CRCW0603100KJNEA |
| Hardware | | | | |
| 1 | 10 | E1-E3, E5-E11 | TURRET | MILL-MAX 2501-2-00-80-00-00-07-0 |
| 2 | 4 | JP1, JP2, JP3, JP4 | SHUNT | SAMTEC 2SN-BK-G |
| 3 | 2 | JP1, JP2 | HEADER, 3-PIN, 2mm | SAMTEC TMM-103-02-L-S |
| 4 | 1 | JP3 | HEADER, 4-PIN, DOUBLE ROW, 2mm | SAMTEC TMM-104-02-L-D |
| 5 | 1 | JP4 | HEADER, 6-PIN, DOUBLE ROW, 2mm | SAMTEC TMM-106-02-L-D |
| 6 | 4 | J1, J2, J5, J6 | JACK, BANANA | KEYSTONE 575-4 |
| 7 | 2 | J3, J4 | CONN., VERT. PC-MNT, BNC 50 Ω | CONNEX 112404 |
| 8 | 4 | | STANDOFF, SNAP ON | KEYSTONE_8834 |

SCHEMATIC DIAGRAM



| REVISION HISTORY | | |
|------------------|-----|-------------------------------|
| ECO | REV | DESCRIPTION |
| | 1.1 | PRODUCTION PARTS LIST CHANGES |
| | | DATE |
| | | APPROVED |
| | | SAM Y. |

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LINEAR TECHNOLOGY

TITLE: SCHEMATIC
HIGH EFFICIENCY 15A STEP-DOWN
POWER μMODULE

IC NO. LTM4627EV
REV. 1.1

DATE: Tuesday, July 13, 2010

SHEET 1 OF 1

APPROVALS

| | |
|-----------|--------|
| PCB DES. | MI |
| APP. ENG. | SAM Y. |

SCALE = NONE

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USED TO MANUFACTURE PCB

X3 X4 X5 X6

1 1 1 1



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