

# LTM4637

## 20A DC/DC $\mu$ Module Step-Down Regulator

### DESCRIPTION

Demonstration circuit **DC1872A** features the **LTM<sup>®</sup>4637EV**, a high efficiency, high density switch mode step-down power  $\mu$ Module<sup>®</sup> regulator. The input voltage range is from 4.5V to 20V. The output voltage is jumper programmable from 1.0V to 1.8V with a rated load current of 20A. Derating is necessary for certain  $V_{IN}$ ,  $V_{OUT}$ , frequency and thermal conditions. The DC1872A offers the TRACK/SS pin, allowing the user to program output tracking or soft-start period. The DC1872A allows the user to

choose pulse-skipping mode or Burst Mode<sup>®</sup> operation for higher efficiency at light load conditions.

The LTM4637 data sheet must be read in conjunction with this demo manual prior to working on or modifying demo circuit DC1872A.

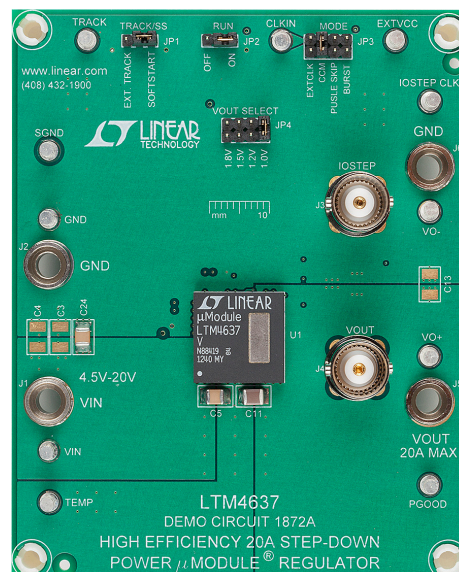
**Design files for this circuit board are available at <http://www.linear.com/demo>**

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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, 1.2V, 1.5V, 1.8V $\pm 1.5\%$ |
| Maximum Continuous Output Current | Derating Is Necessary for Certain Operating Conditions. See Data Sheet for Details | 20ADC                              |
| Operating Frequency               | $R_{ISET} = 124k\Omega$                                                            | 520kHz                             |
| Efficiency                        | $V_{IN} = 12V$ , $V_{OUT} = 1.0V$ , $I_{OUT} = 20A$                                | 82.2% See Figure 2                 |
| Load Transient                    | $V_{IN} = 12V$ , $V_{OUT} = 1.0V$                                                  | See Figure 3                       |

### BOARD PHOTO



dc1872af

## QUICK START PROCEDURE

Demonstration circuit DC1872A is an easy way to evaluate the performance of the LTM4637EV. 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 1.0V<sub>OUT</sub> application:

| RUN | MODE | TRACK/SS | VOUT SELECT |
|-----|------|----------|-------------|
| ON  | CCM  | SS       | 1.0V        |

2. With power off, connect the input power supply, load and meters as shown in Figure 1. Preset the load to 0A and V<sub>IN</sub> supply to be 0V.
3. Turn on the power at the input. Increase V<sub>IN</sub> to 12V (**Do not apply more than the rated maximum voltage of 20V to the board or the part may be damaged**). The output voltage should be regulated and deliver the selected output voltage  $\pm 1.5\%$ .

4. Vary the input voltage from 4.5V to 20V and adjust the load current from 0A to 20A. Observe the output voltage regulation, ripple voltage, efficiency, and other parameters. Output voltage ripple may be measured at J4 with a BNC cable and oscilloscope. The probe channel for V<sub>OUT</sub> should be set at 50 $\Omega$  termination resistance to match the BNC cable.
5. (Optional) For optional load transient test, apply an adjustable pulse signal between IOSTEP\_CLK and GND test points. The pulse amplitude sets the load step current amplitude. Keep the pulse width short (<1ms) and pulse duty cycle low (<5%) 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).

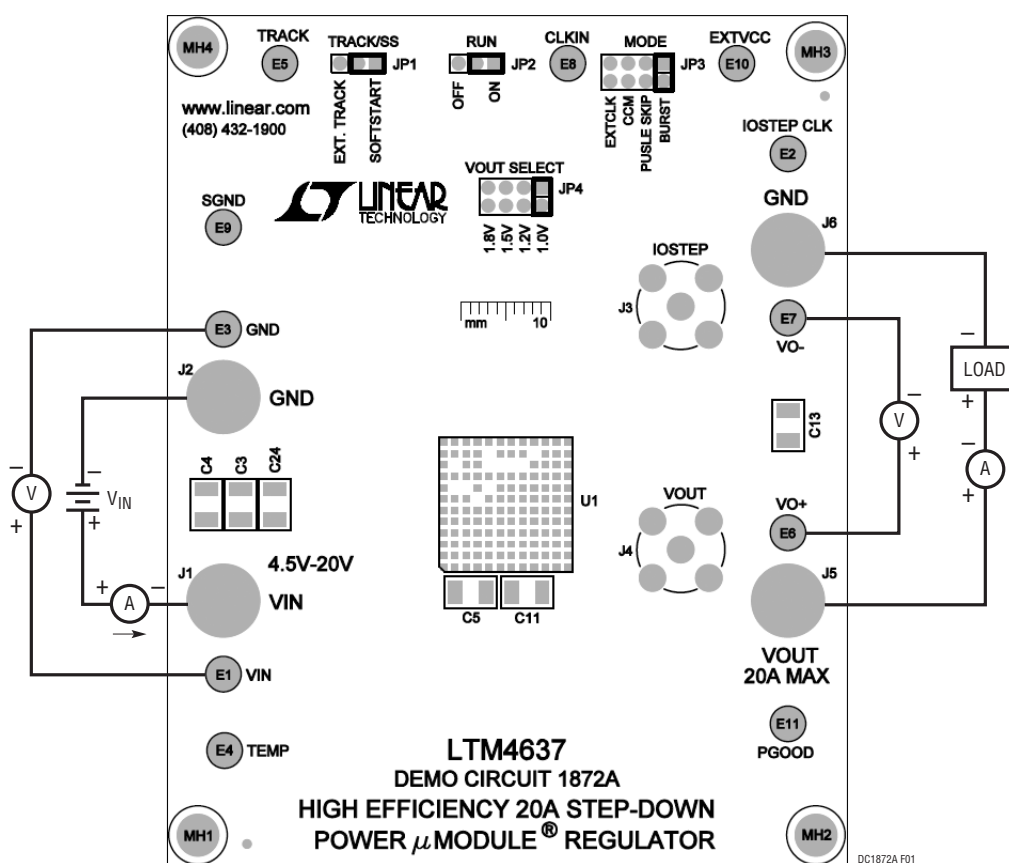
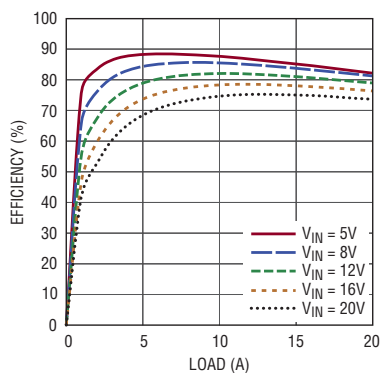


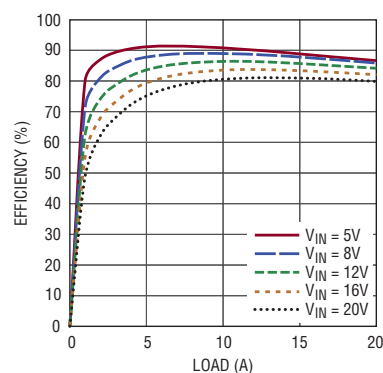
Figure 1. Proper Measurement Equipment Setup

## QUICK START PROCEDURE



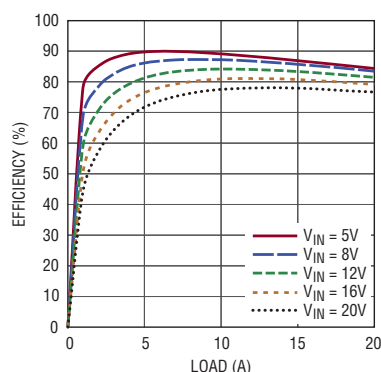
DC1872A F02a

(2a)  $V_{OUT} = 1.0V$



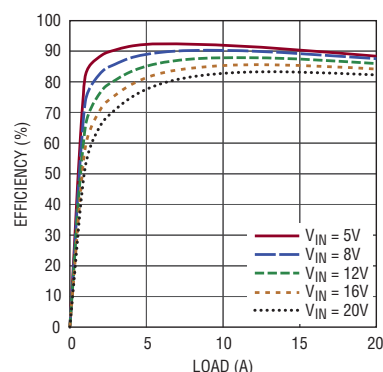
DC1872A F02c

(2c)  $V_{OUT} = 1.5V$



DC1872A F02b

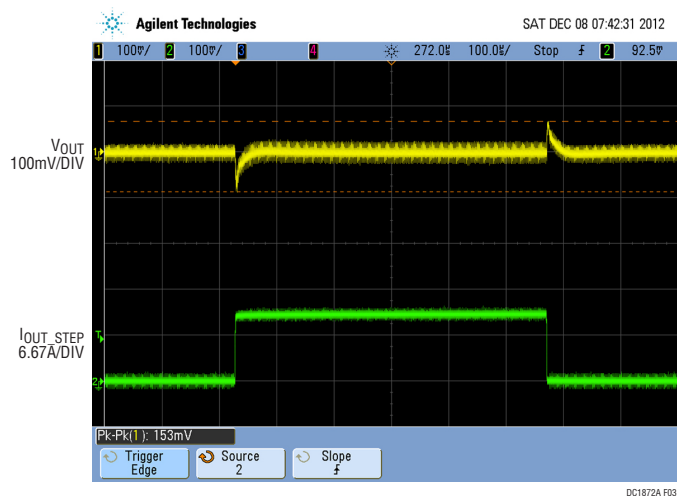
(2b)  $V_{OUT} = 1.2V$



DC1872A F02d

(2d)  $V_{OUT} = 1.8V$

Figure 2. Measured DC1872A Efficiency at Different  $V_{IN}$  and  $V_{OUT}$  Values (CCM Mode Enabled)



DC1872A F03

Figure 3. Measured Load Transient Response ( $V_{IN} = 12V$ ,  $V_{OUT} = 1.0V$ , 0A to 10A Load Step)

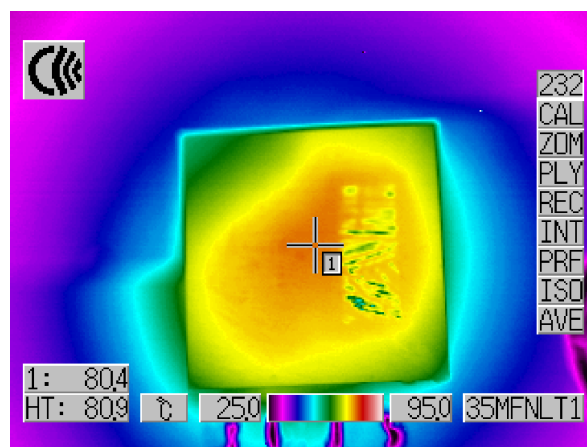


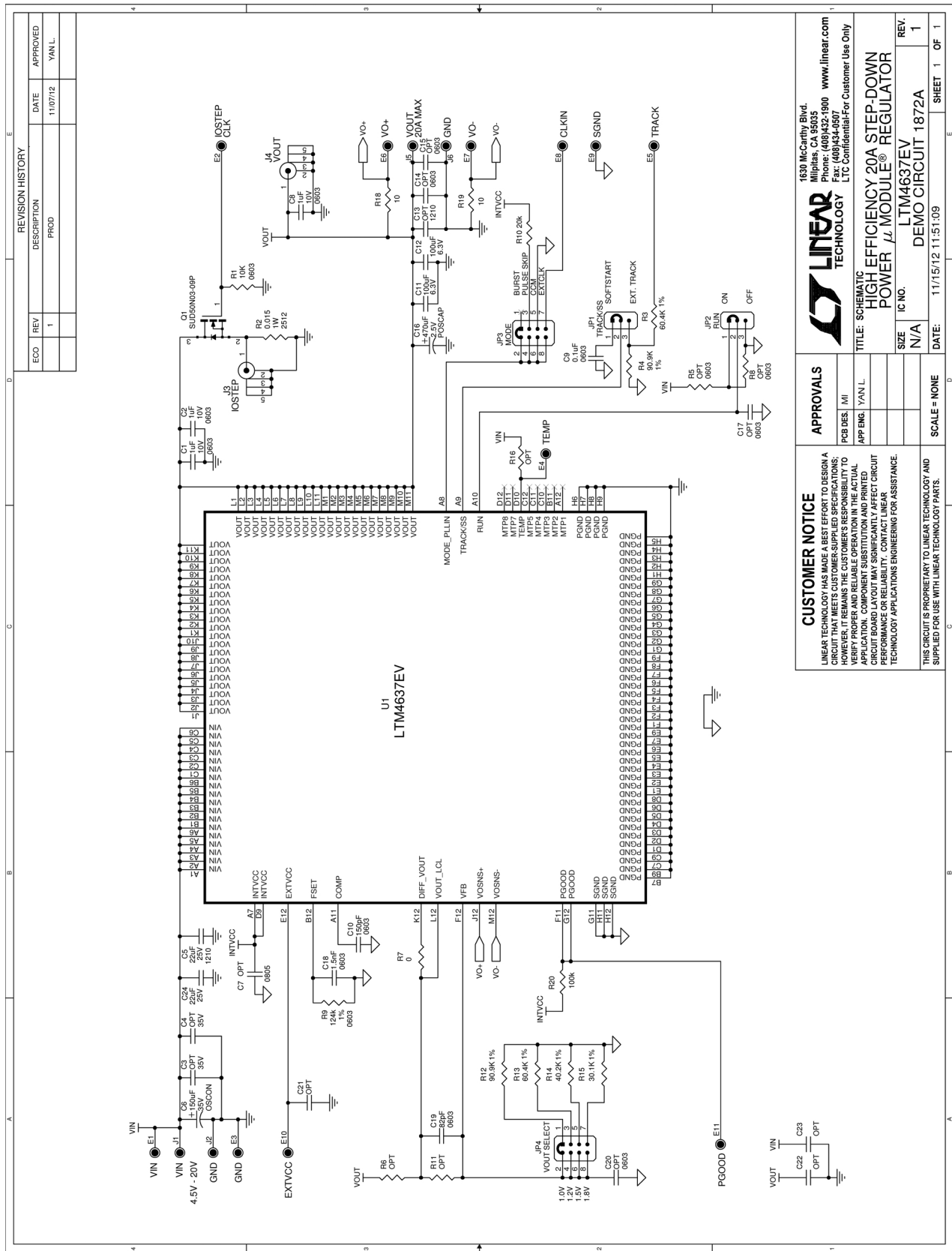
Figure 4. Thermal Image of LTM4637 ( $V_{IN} = 12V$ ,  $V_{OUT} = 1.0V$ ,  $I_{LOAD} = 20A$ , Ambient Temperature = 21.6°, No Forced Air Flow)

# DEMO MANUAL DC1872A

## PARTS LIST

| ITEM                                    | QTY | REFERENCE               | PART DESCRIPTION                      | MANUFACTURER/PART NUMBER         |
|-----------------------------------------|-----|-------------------------|---------------------------------------|----------------------------------|
| <b>Required Circuit Components</b>      |     |                         |                                       |                                  |
| 1                                       | 1   | U1                      | IC, MICRO MODULE                      | LINEAR TECH LTM4637EV            |
| 2                                       | 2   | C5, C24                 | CAP, 1210 22 $\mu$ F 10% 25V X5R      | MURATA GRM32ER61E226KE15L        |
| 3                                       | 1   | C6                      | CAP, 150 $\mu$ F 35V ELEC             | SUN ELEC 35CE150AX               |
| 4                                       | 1   | C9                      | CAP, 0603 0.1 $\mu$ F 10% 50V X7R     | TDK C1608X7R1H104K               |
| 5                                       | 1   | C10                     | CAP, 0603 150pF 10% 25V NPO           | AVX 06033A151KAT2A               |
| 6                                       | 2   | C11, C12                | CAP, 1210 100 $\mu$ F 20% 6.3V X5R    | TDK C3225X5R0J107M               |
| 7                                       | 1   | C16                     | CAP, 7343 470 $\mu$ F 20% 2.5V POSCAP | SANYO 2R5TPE470M9                |
| 8                                       | 1   | C18                     | CAP, 0603 1.5nF 5% 25V X7R            | AVX 06033C152JAT2A               |
| 9                                       | 1   | C19                     | CAP, 0603 82pF 5% 25V NPO             | AVX 06033A820JAT2A               |
| 10                                      | 1   | R9                      | RES, 0603 124k 1% 1/10W               | VISHAY CRCW0603124K0FKEA         |
| 11                                      | 1   | R20                     | RES, 0603 100k 5% 1/10W               | VISHAY CRCW0603100KJNEA          |
| 12                                      | 1   | R15                     | RES, 0603 30.1k 1% 1/10W              | VISHAY CRCW060330K1FKEA          |
| <b>Additional Demo Board Components</b> |     |                         |                                       |                                  |
| 1                                       | 1   | Q1                      | XSTR, MOSFET, N-CHANNEL 30V           | VISHAY SUD50N03-09P-GE3          |
| 2                                       | 1   | R1                      | RES, 0603 10k 5% 1/10W                | VISHAY CRCW060310K0JNEA          |
| 3                                       | 1   | R2                      | RES, 2512 0.015 $\Omega$ 1% 1W        | VISHAY WSL2512R0150FEA           |
| 4                                       | 2   | R3, R13                 | RES, 0603 60.4k 1% 1/10W              | VISHAY CRCW060360K4FKEA          |
| 5                                       | 2   | R4, R12                 | RES, 0603 90.9k 1% 1/10W              | VISHAY CRCW060390K9FKEA          |
| 6                                       | 1   | R7                      | RES, 0603 0 $\Omega$ JUMPER           | VISHAY CRCW06030000Z0ED          |
| 7                                       | 1   | R10                     | RES, 0603 20k 5% 1/10W                | VISHAY CRCW060320K0JNEA          |
| 8                                       | 1   | R14                     | RES, 0603 40.2k 1% 1/10W              | VISHAY CRCW060340K2FKEA          |
| 9                                       | 2   | R18, R19                | RES, 0603 10 $\Omega$ 5% 1/10W        | VISHAY CRCW060310R0JNEA          |
| 10                                      | 3   | C1, C2, C8              | CAP, 0603 1 $\mu$ F 20% 10V X5R       | TAIYO YUDEN LMK107BJ105MA-T      |
| 11                                      | 0   | C3, C4, C13, C22, C23   | CAP, 1210 OPTION                      | OPTION                           |
| 12                                      | 0   | C7                      | CAP, 0805 OPTION                      | OPTION                           |
| 13                                      | 0   | C14, C15, C17, C20, C21 | CAP, 0603 OPTION                      | OPTION                           |
| 14                                      | 0   | R5, R6, R8, R11, R16    | RES, 0603 OPTION                      | OPTION                           |
| <b>Hardware</b>                         |     |                         |                                       |                                  |
| 1                                       | 11  | E1-E11                  | TURRET                                | MILL-MAX 2501-2-00-80-00-00-07-0 |
| 2                                       | 2   | JP1, JP2                | HEADER, 3-PIN, 2mm                    | SAMTEC TMM-103-02-L-S            |
| 3                                       | 4   | JP1, JP2, JP3, JP4      | SHUNT                                 | SAMTEC 2SN-BK-G                  |
| 4                                       | 2   | JP3, JP4                | HEADER, 4-PIN, DOUBLE ROW, 2mm        | SAMTEC TMM-104-02-L-D            |
| 5                                       | 4   | J1, J2, J5, J6          | JACK, BANANA                          | KEYSTONE 575-4                   |
| 6                                       | 2   | J3, J4                  | CONN., VERT. PC-MNT, BNC 50 OHM       | CONNEX 112404                    |
| 7                                       | 4   | MH1, MH2, MH3, MH4      | STANDOFF, SNAP ON                     | KEYSTONE_8834                    |

## SCHEMATIC DIAGRAM



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# DEMO MANUAL DC1872A

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Mailing Address:

Linear Technology  
1630 McCarthy Blvd.  
Milpitas, CA 95035

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### Офис по работе с юридическими лицами:

105318, г.Москва, ул.Щербаковская д.3, офис 1107, 1118, ДЦ «Щербаковский»

Телефон: +7 495 668-12-70 (многоканальный)

Факс: +7 495 668-12-70 (доб.304)

E-mail: [info@moschip.ru](mailto:info@moschip.ru)

Skype отдела продаж:

moschip.ru

moschip.ru\_4

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