

# LTM4620A

## High Efficiency, Dual 13A Step-Down Power $\mu$ Module Regulator

### DESCRIPTION

Demonstration circuit 1759A features the LTM<sup>®</sup>4620AEV, the high efficiency, high density, dual 13A, switch mode step-down power module regulator. The input voltage is from 5.5V to 16V. The output voltage is programmable from 0.6V to 5V. DC1759A can deliver 13A maximum current from each channel. As explained in the data sheet, output current derating is necessary for certain  $V_{IN}$ ,  $V_{OUT}$ , and thermal conditions. The board operates in continuous conduction mode in heavy load conditions. For high efficiency at low load currents, the MODE jumper (JP1) selects pulse-skipping mode for noise sensitive applications or Burst Mode<sup>®</sup> operation in less noise sensitive applications. Two outputs can be connected in parallel for a single 26A output solution with optional jumper resistors. The board allows the user to program how its output ramps up and

down through the TRACK/SS pin. The output can be set up to either coincidentally or ratiometrically track with another supply's output. Remote output voltage sensing is available for improved output voltage regulation at the load point. These features and the availability of the LTM4620AEV in a compact 15mm  $\times$  15mm  $\times$  4.41mm LGA package make it ideal for use in many high density point-of-load regulation applications. The LTM4620A data sheet must be read in conjunction with this demo manual for working on or modifying the demo circuit 1759A.

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

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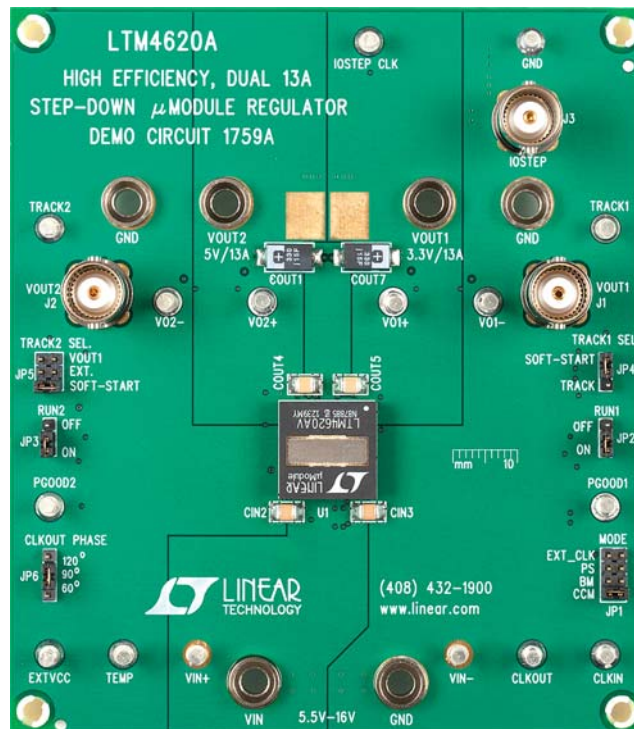


Figure 1. LTM4620A/DC1759A Demo Board

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

| PARAMETER                                     | CONDITION   | VALUE              |
|---|---|--------------------|
| Input Voltage Range                           |   | 5.5V ~ 16V         |
| Output Voltage V <sub>OUT1</sub>              | V <sub>IN</sub> = 5.5V ~ 16V, I <sub>OUT1</sub> = 0A ~ 13A, JP1: CCM  | 3.3V ±1.5%         |
| Output Voltage V <sub>OUT2</sub>              | V <sub>IN</sub> = 5.5V ~ 16V, I <sub>OUT2</sub> = 0A ~ 13A, JP1: CCM  | 5V ±1.5%           |
| Per-Channel Maximum Continuous Output Current | Derating is Necessary for Certain V <sub>IN</sub> , V <sub>OUT</sub> and Thermal Conditions, See Data Sheet for Detail. | 13A (per-Channel)  |
| Default Operating Frequency                   |   | 750kHz             |
| Resistor Programmable Frequency Range         |   | 250kHz to 780kHz   |
| External Clock Sync. Frequency Range          |   | 400kHz to 780kHz   |
| Efficiency of Channel 1                       | V <sub>IN</sub> = 12V, V <sub>OUT1</sub> = 3.3V, I <sub>OUT1</sub> = 13A, f <sub>SW</sub> = 750kHz                      | 91.7% See Figure 3 |
| Efficiency of Channel 2                       | V <sub>IN</sub> = 12V, V <sub>OUT2</sub> = 5V, I <sub>OUT2</sub> = 13A, f <sub>SW</sub> = 750kHz                        | 93.8% See Figure 4 |
| Load Transient of Channel 1                   | V <sub>IN</sub> = 12V, V <sub>OUT1</sub> = 3.3V, I <sub>SETP</sub> = 6.5A ~ 13A   | See Figure 5       |
| Load Transient of Channel 2                   | V <sub>IN</sub> = 12V, V <sub>OUT2</sub> = 5V, I <sub>SETP</sub> = 6.5A ~ 13A   | See Figure 6       |

## QUICK START PROCEDURE

Demonstration circuit 1759A is easy to set up to evaluate the performance of the LTM4620AEV. Please refer to Figure 2 for proper measurement setup and follow the procedure below:

- Place jumpers in the following positions for a typical application:

| JP1  | JP2  | JP3  | JP4         | JP5         | JP6          |
|------|------|------|-------------|-------------|--------------|
| MODE | RUN1 | RUN2 | TRACK1 SEL. | TRACK2 SEL. | CLKOUT PHASE |
| CCM  | ON   | ON   | SOFT-START  | SOFT-START  | 90°          |

- With power off, connect the input power supply, load and meters as shown in Figure 2. Preset the load to 0A and V<sub>IN</sub> supply to 12V.
- Turn on the power supply at the input. The output voltage in channel 1 should be 3.3V ±1.5% (3.2505V ~ 3.3495V) and the output voltage in channel 2 should be 5V ±1.5% (4.925V ~ 5.075V).
- 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 J1 and J2 with BNC cables. 50Ω termination should be set on the oscilloscope or BNC cables.

- (Optional) For optional load transient test, apply an adjustable pulse signal between IOSTEP CLK and GND test point. Pulse amplitude (3V ~ 3.5V) sets the load step current amplitude. The output transient current can be monitored at the BNC connector J3 (15mV/A). The pulse signal should have very small duty cycle (<1%) to limit the thermal stress on the transient load circuit. Switch the jumper resistors R34 or R35 (on the backside of boards) to apply load transient on channel 1 or channel 2 correspondingly.
- (Optional) LTM4620A can be synchronized to an external clock signal. Place the JP1 jumper on EXT\_CLK and apply a clock signal (0V ~ 5V, square wave) on the CLKIN test point.
- (Optional) The outputs of LTM4620A can track another supply. The jumpers JP4 and JP5 allow choosing soft-start or output tracking. If tracking external voltage is selected, the corresponding test points, TRACK1 and TRACK2, need to be connected to a valid voltage signal.
- (Optional) LTM4620A can be configured for a 2-phase single output at up to 26A on DC1759A. Install 0Ω resistors on R14, R17, R28, R39 and remove R7, R19. Output voltage is set by R25 based on equation V<sub>OUT</sub> = 0.6V(1 + 60.4k/R25).

QUICK START PROCEDURE

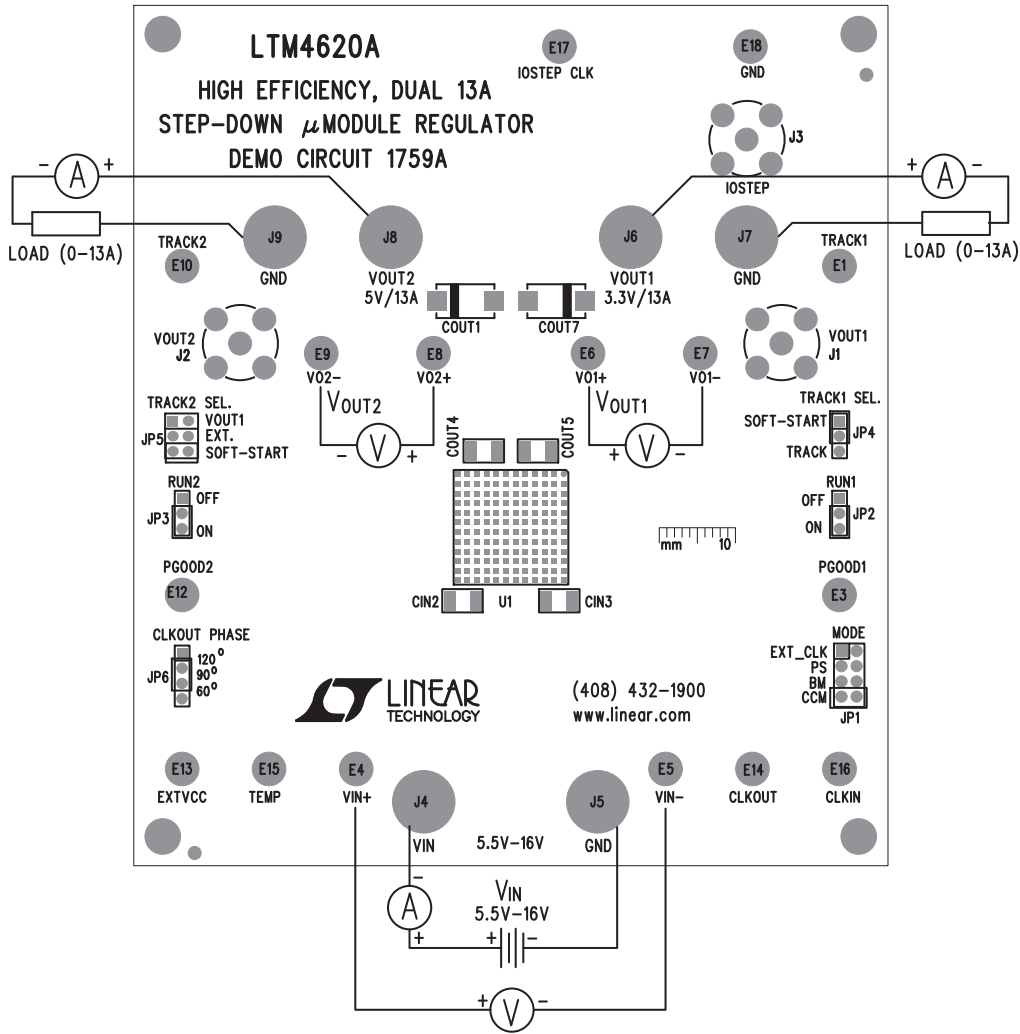


Figure 2. Test Setup of DC1759A

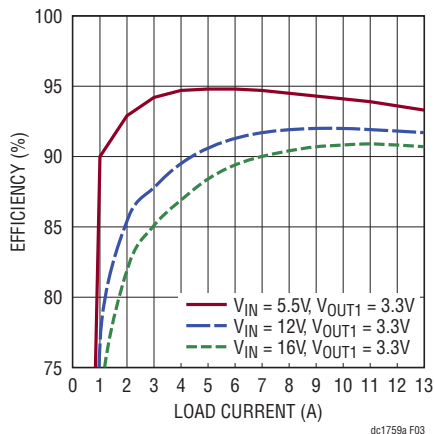


Figure 3. Measured Efficiency on Channel 1 (V<sub>OUT1</sub> = 3.3V, f<sub>sw</sub> = 750kHz, Channel 2 Disabled)

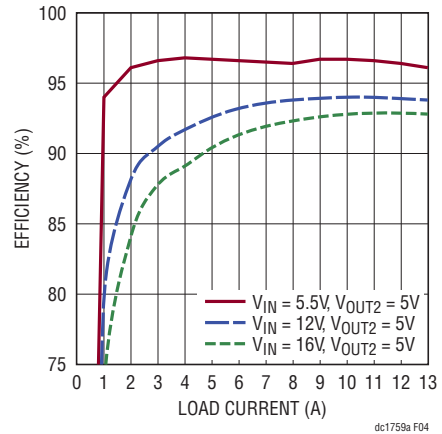


Figure 4. Measured Efficiency on Channel 2 (V<sub>OUT2</sub> = 5V, f<sub>sw</sub> = 750kHz, Channel 1 Disabled)

## QUICK START PROCEDURE

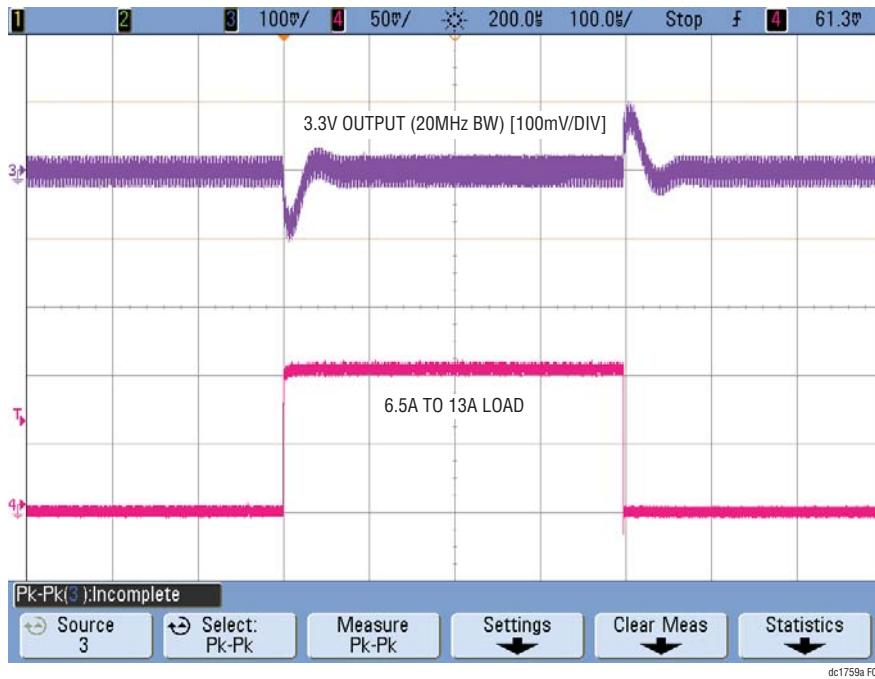


Figure 5. Measured Channel 1 6.5A to 13A Load Transient ( $V_{IN} = 12V$ ,  $V_{OUT1} = 3.3V$ )

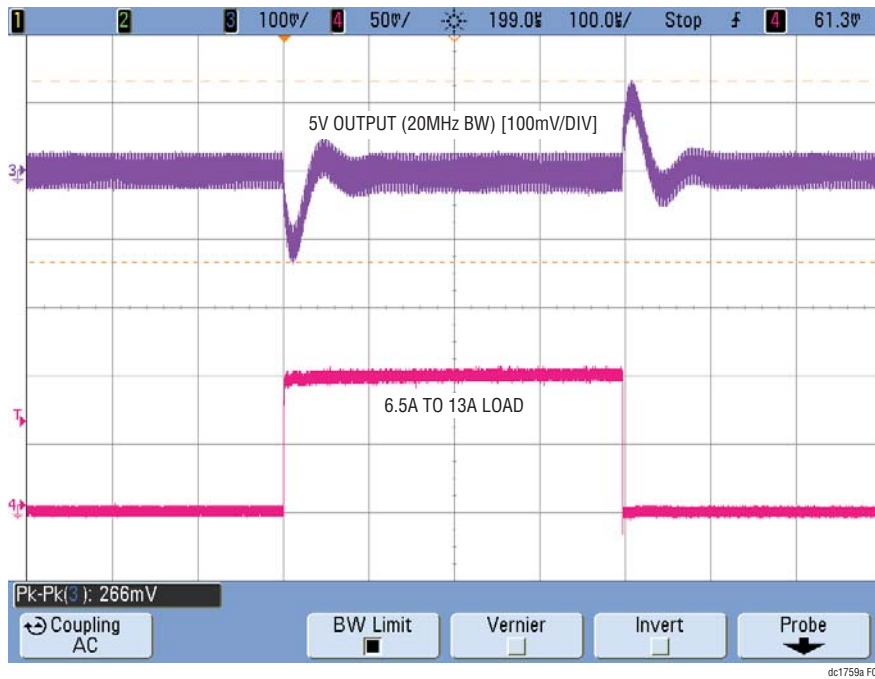


Figure 6. Measured Channel 2 6.5A to 13A Load Transient ( $V_{IN} = 12V$ ,  $V_{OUT2} = 5V$ )

**QUICK START PROCEDURE**

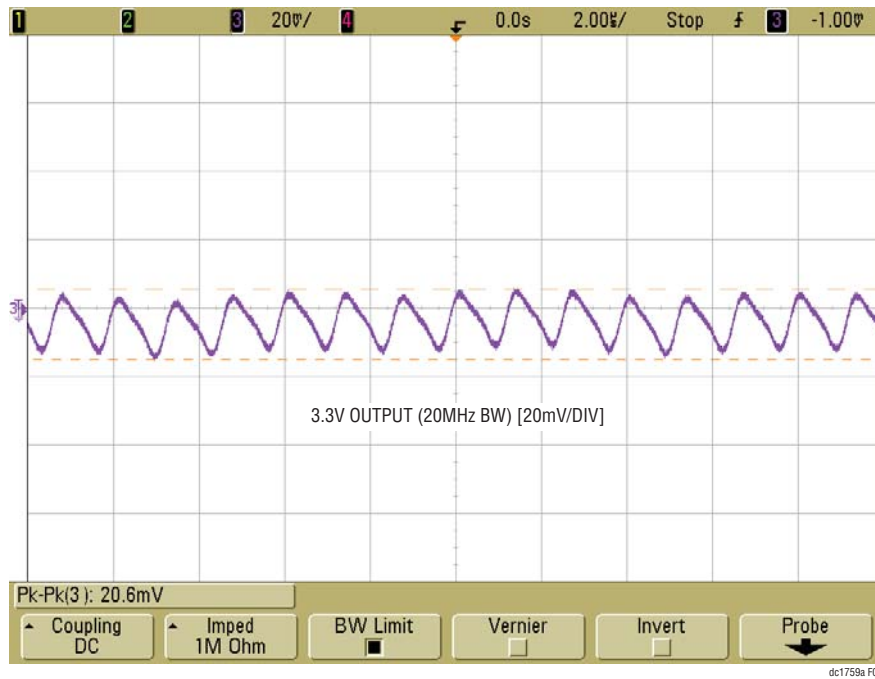


Figure 7. Measured Output Voltage Ripple at 12V Input, 3.3V/13A Output with Standard Demo Circuit Default Setup

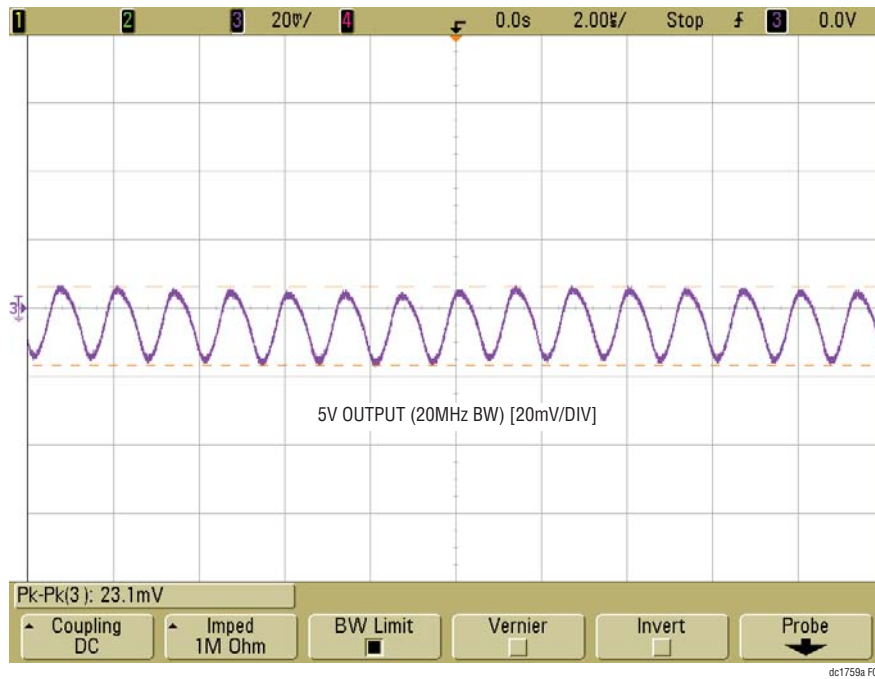


Figure 8. Measured Output Voltage Ripple at 12V Input, 5V/13A Output with Standard Demo Circuit Default Setup

## QUICK START PROCEDURE

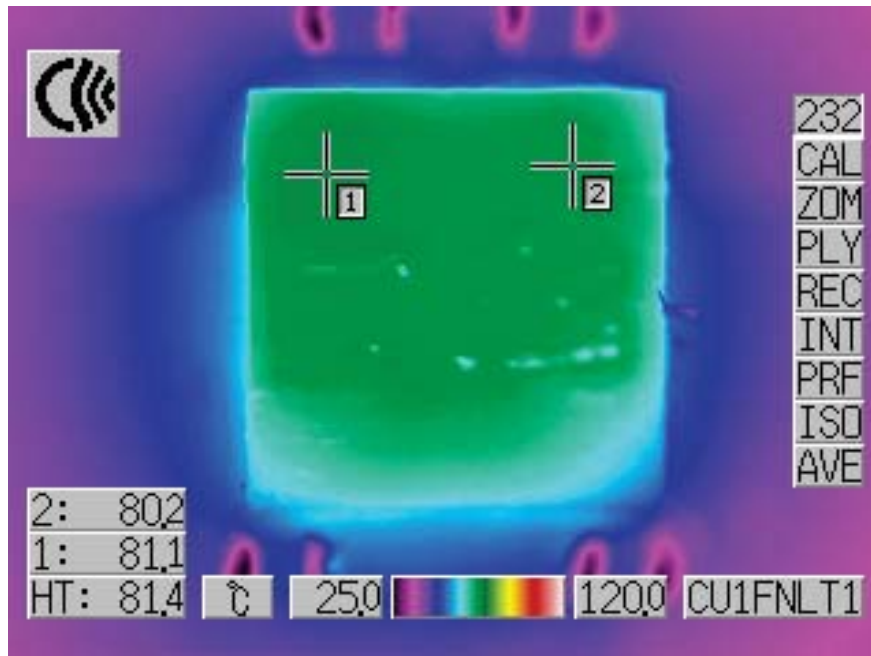


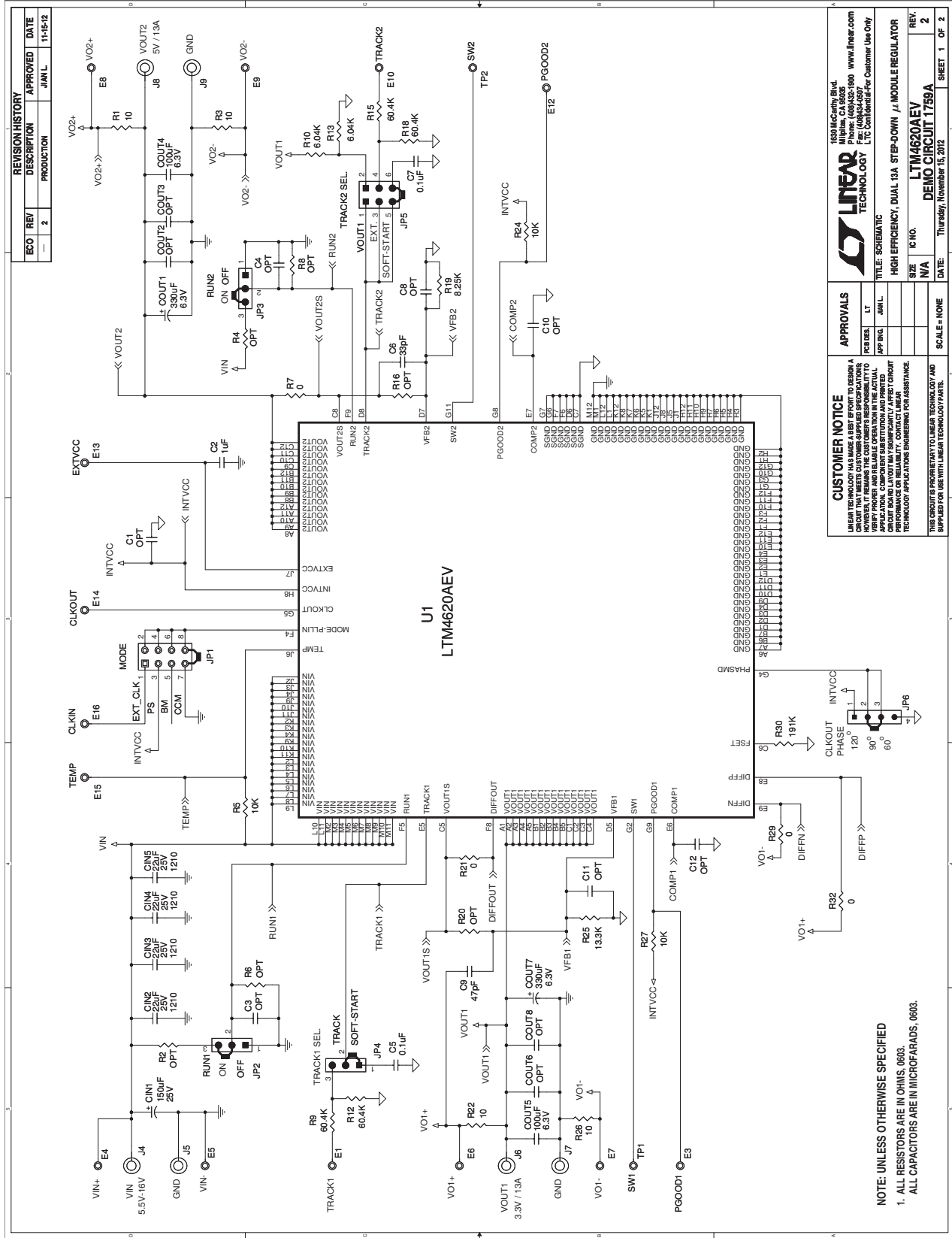
Figure 9. Thermal Capture at 12V<sub>IN</sub>, 3.3V<sub>OUT</sub> at 13A and 5V<sub>OUT</sub> at 13A  
(Ambient Temperature = 23°C, 200LFM Airflow and No Heat Sink)

## PARTS LIST

| ITEM   | QTY | REFERENCE   | PART DESCRIPTION                    | MANUFACTURER/PART NUMBER          |
|--|-----|---|-------------------------------------|-----------------------------------|
| <b>Required Circuit Components</b>               |     |   |                                     |                                   |
| 1  | 1   | CIN1  | Cap., 150µF, 25V, Aluminum Electr., | SUN ELECT., 25CE150AX             |
| 2  | 3   | CIN2, CIN3, CIN4, CIN5  | Cap., X5R, 22µF, 25V, 10%, 1210     | MURATA, GRM32ER61E226KE15         |
| 3  | 2   | COUT1, COUT7  | Cap., 330µF, 6.3V, POSCAP 7343      | SANYO, 6TPF330M9L                 |
| 4  | 2   | COUT4, COUT5  | Cap., X5R, 100µF, 6.3V, 20% 1210    | AVX, 12106D107MAT2A               |
| 5  | 1   | C2  | Cap., X7R, 1µF, 25V, 10%, 0805      | AVX, 08053C105KAT2A               |
| 6  | 2   | C5, C7  | Cap., X5R, 0.1µF, 25V, 10%, 0603    | AVX, 06033D104KAT                 |
| 7  | 1   | C6  | Cap., 33pF, 10V, 10%, 0603          | AVX, 0603ZC330KAT2A               |
| 8  | 1   | C9  | Cap., 47pF, 10V, 10%, 0603          | AVX, 0603ZC470KAT2A               |
| 9  | 4   | C13, C14, C15, C16  | Cap., X7R, 1µF, 10V, 10%, 0603      | AVX, 0603ZC105KAT                 |
| 10   | 1   | Q1  | N-Channel 30-V Mosfet               | VISHAY, SUD50N03-09P              |
| 11   | 4   | R1, R3, R22, R26  | Res., Chip, 10Ω, 1%, 0603           | NIC, NRC06F10R0TRF                |
| 12   | 4   | R5, R24, R27, R36   | Res., Chip, 10k, 1%, 0603           | YAGEO, RC0603FR-0710KL            |
| 13   | 4   | R7, R21, R29, R32   | Res., Chip, 0Ω, 1%, 0603            | VISHAY, CRCW06030000Z0ED          |
| 14   | 4   | R9, R12, R15, R18   | Res., Chip, 60.4k, 1%, 0603         | VISHAY, CRCW060360K4FKED          |
| 15   | 2   | R10, R13  | Res., Chip, 6.04k, 1%, 0603         | YAGEO, RC060FR-0760K4L            |
| 16   | 1   | R19   | Res., Chip, 8.25k, 1%, 0603         | VISHAY, CRCW06038K25FKED          |
| 17   | 1   | R25   | Res., Chip, 13.3k, 1%, 0603         | VISHAY, CRCW060313K3FKED          |
| 18   | 1   | R30   | Res., Chip, 191k, 1%, 0603          | VISHAY, CRCW0603191KFKED          |
| 19   | 1   | R34   | Res., Chip, 0Ω, 0.5W, 2010          | TEPRO, RN6083                     |
| 20   | 1   | R37   | Res., Chip, 0.015Ω, 2W, 2512        | VISHAY, WSL2512R0150FEA           |
| 21   | 1   | U1  | LTM4620AEV 15X15X4.41-LGA           | LINEAR TECH., LTM4620AEV          |
| <b>Additional Circuits</b>                       |     |   |                                     |                                   |
| 22   | 0   | COUT2, COUT3, COUT6, COUT8,   | OPT 1210                            | OPT                               |
| 23   | 0   | C1  | OPT 0805                            | OPT                               |
| 24   | 0   | C3, C4, C8, C10, C11, C12   | OPT 0603                            | OPT                               |
| 25   | 0   | R2, R4, R6, R8, R11, R14, R16, R17, R20, R23, R28, R31, R33, R39, R40 | OPT 0603                            | OPT                               |
| 26   | 0   | R35   | OPT 2010                            | OPT                               |
| 27   | 0   | R38   | OPT 2512                            | OPT                               |
| <b>Hardware/Components (For Demo Board Only)</b> |     |   |                                     |                                   |
| 28   | 16  | E1, E3-E10, E12-E18   | TESTPOINT, TURRET, 0.094"           | MILL-MAX, 2501-2-00-80-00-00-07-0 |
| 29   | 3   | J1, J2, J3  | CONN, BNC, 5 PINS                   | CONNEX 112404                     |
| 30   | 6   | J4-J9   | CONN, BANANA JACK, KEYSTONE-575-4   | KEYSTONE 575-4                    |
| 31   | 1   | JP1   | HEADER 4 PIN 0.079 DOUBLE ROW       | SAMTEC, TMM104-02-L-D             |
| 32   | 1   | JP6   | HEADER 4 PIN 0.079 SINGLE ROW       | SAMTEC, TMM104-02-L-S             |
| 33   | 3   | JP2, JP3, JP4   | HEADER 3 PIN 0.079 SINGLE ROW       | SAMTEC, TMM103-02-L-S             |
| 34   | 1   | JP5   | HEADER 3 PIN 0.079 DOUBLE ROW       | SAMTEC, TMM-103-02-L-D            |
| 35   | 4   | MTGS at 4 corners   | STAND-OFF, NYLON 0.50"              | KEYSTONE, 8833(SNAP-ON)           |
| 36   | 6   | XJP1-XJP6   | SHUNT, 0.079" CENTER                | SAMTEC, 2SN-BK-G                  |

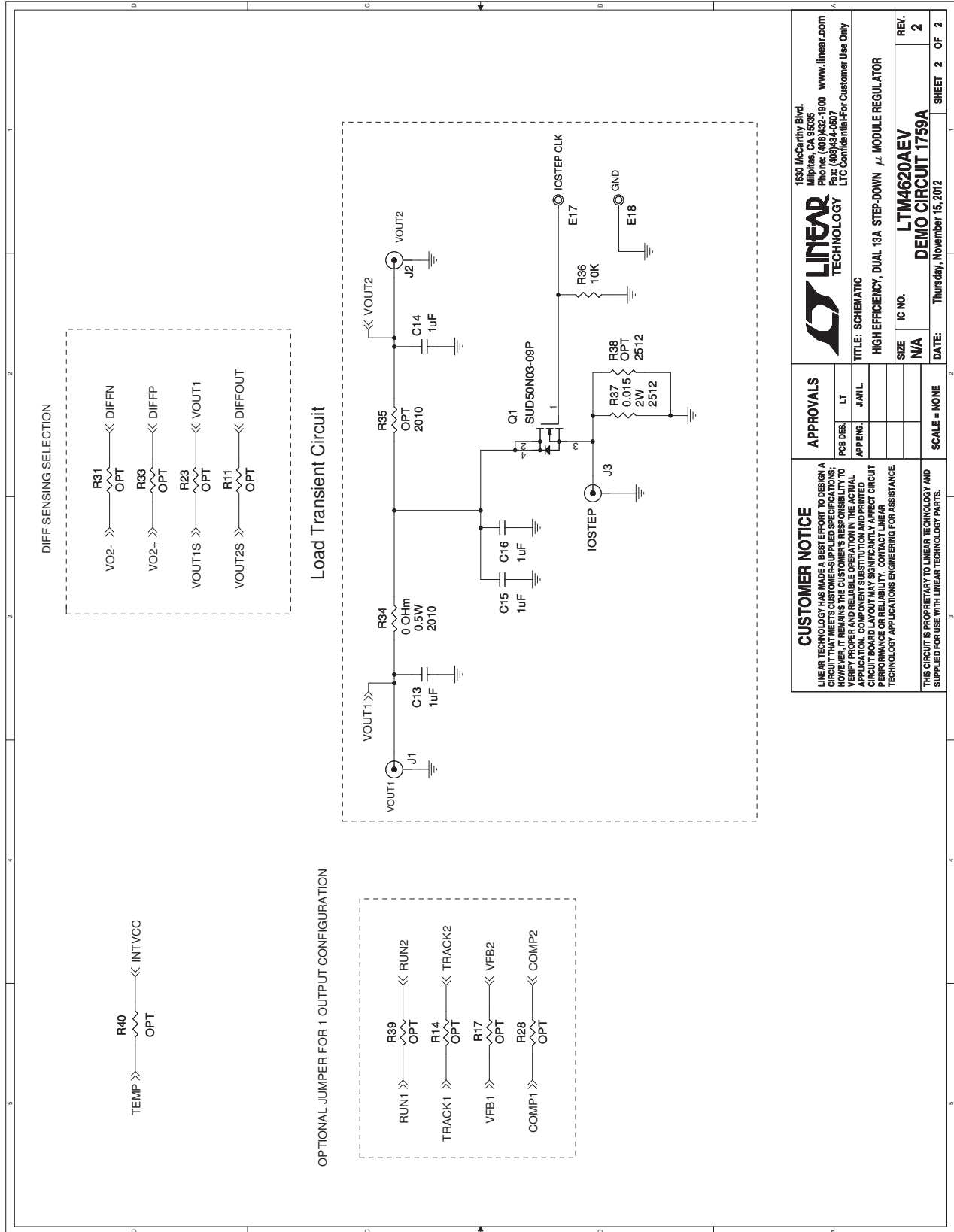
# DEMO MANUAL DC1759A

## SCHEMATIC DIAGRAM





**SCHEMATIC DIAGRAM**



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|--|---|---|
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|  | <p>PCB DES: LT</p> <p>APP ENG: JAN L.</p> | <p>TITLE: SCHEMATIC</p> <p>SIZE: N/A</p> <p>IC NO: LTM4620AEV</p> <p>DATE: Thursday, November 15, 2012</p>  |



# DEMO MANUAL DC1759A

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