

# LT3668

## 40V Step-Down Regulator with Dual Tracking LDOs

### DESCRIPTION

Demonstration circuit 2243A is a triple power supply that includes one 400mA step-down regulator and two 200mA low dropout (LDO) linear tracking regulators featuring the LT<sup>®</sup>3668. The demo circuit is designed for one 6V and dual 5V outputs from a 7V to 40V input. Two LDO outputs are configured as post-regulators of the switching regulator output. The total current capability of three output channels is up to 400mA, while the two LDO regulators are capable of 200mA each.

The switching frequency of the step-down regulator can be programmed via an oscillator resistor (R8) over a 250kHz to 2.2 MHz range. The default setting is 600kHz.

The LT3668 internal boost diode and loop compensation reduce the components count and solution size. The current mode control scheme creates fast transient response

and good loop stability. The switching regulator has cycle-by-cycle current limit and diode current sense, providing protection against shorted outputs.

JP1 can be used to set the whole LT3668 in shutdown mode. JP3 and JP4 enable and disable the outputs of the dual 5V tracking LDOs respectively.

The LT3668 data sheet gives a complete description of the part, operation and application information. The data sheet must be read in conjunction with this quick start guide for demo circuit 2243A. Proper board layout is essential for both proper operation and maximum thermal performance. See the data sheet section “PCB Layout”.

**Design files for this circuit board are available at <http://www.linear.com/demo/DC2243A>**

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### PERFORMANCE SUMMARY

Specifications are at T<sub>A</sub> = 25°C

| SYMBOL  | PARAMETER                              | CONDITIONS   | MIN  | TYP | MAX  | UNITS |
|---|--|--|------|-----|------|-------|
| V <sub>IN1</sub>  | Input Supply Range of V <sub>IN1</sub> |  | 7    |     | 40   | V     |
| f <sub>SW</sub>   | Switching Frequency                    | V <sub>IN1</sub> = 12V, V <sub>OUT1</sub> = 6V/I <sub>OUT1</sub> = 400mA<br>V <sub>OUT2</sub> = 5V/I <sub>OUT2</sub> = 0<br>V <sub>OUT3</sub> = 5V/I <sub>OUT3</sub> = 0     | 510  |     | 690  | kHz   |
| V <sub>OUT1</sub>   | Output Voltage 1                       | V <sub>IN1</sub> = 12V, V <sub>OUT1</sub> = 6V/I <sub>OUT1</sub> = 0 ~ 400mA<br>V <sub>OUT2</sub> = 5V/I <sub>OUT2</sub> = 0<br>V <sub>OUT3</sub> = 5V/I <sub>OUT3</sub> = 0 | 5.88 |     | 6.12 | V     |
| V <sub>OUT2</sub>   | Output Voltage 2                       | V <sub>IN1</sub> = 12V, V <sub>OUT1</sub> = 6V/I <sub>OUT1</sub> = 0<br>V <sub>OUT2</sub> = 5V/I <sub>OUT2</sub> = 0 ~ 190mA<br>V <sub>OUT3</sub> = 5V/I <sub>OUT3</sub> = 0 | 4.9  |     | 5.1  | V     |
| V <sub>OUT3</sub>   | Output Voltage 3                       | V <sub>IN1</sub> = 12V, V <sub>OUT1</sub> = 6V/I <sub>OUT1</sub> = 0<br>V <sub>OUT2</sub> = 5V/I <sub>OUT2</sub> = 0<br>V <sub>OUT3</sub> = 5V/I <sub>OUT3</sub> = 0 ~ 190mA | 4.9  |     | 5.1  | V     |
| I <sub>OUT1</sub> + I <sub>OUT2</sub> + I <sub>OUT3</sub> | Maximum Total Output Current           |  | 400  |     |      | mA    |
| I <sub>OUT2</sub> , I <sub>OUT3</sub>                     | Maximum LDO Output Current             |  | 190  | 200 |      | mA    |

## DESCRIPTION

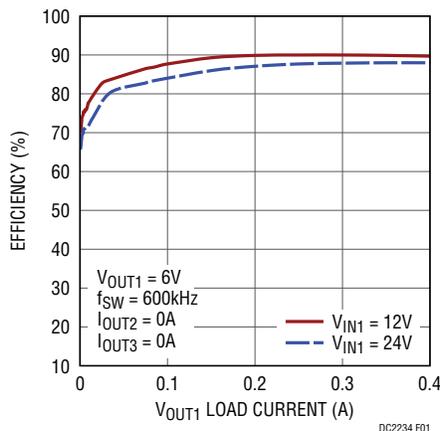


Figure 1. V<sub>OUT1</sub> Typical Efficiency vs. Load Current

## QUICK START PROCEDURE

Demonstration circuit 2243A is easy to set up to evaluate the performance of the LT3668. Refer to Figure 2 for proper measurement equipment setup and follow the procedure below:

NOTE. When measuring the input or output voltage ripple, care must be taken to avoid a long ground lead on the oscilloscope probe. Measure the input or output voltage ripple by touching the probe tip directly across the V<sub>IN</sub> or V<sub>OUT</sub> and GND terminals. See Figure 3 for the proper scope technique.

1. Place JP1, JP3 and JP4 on the EN position.
2. With power off, connect the input power supply to V<sub>IN1</sub> and GND.
3. With power off, connect loads from V<sub>OUT1</sub> to GND, from V<sub>OUT2</sub> to GND, and from V<sub>OUT3</sub> to GND.

4. Turn on the power at the input.

NOTE: Make sure that the input voltage does not exceed 40V.

5. Check for the proper output voltages:  
V<sub>OUT1</sub> = 6V, V<sub>OUT2</sub> = 5V, V<sub>OUT3</sub> = 5V

NOTE: If there is no output, temporarily disconnect the load to make sure that the loads are not set too high or are shorted.

6. Once the proper output voltages are established, adjust the loads within the operating ranges and observe the output voltage regulation, ripple voltage, efficiency and other parameters.

**QUICK START PROCEDURE**

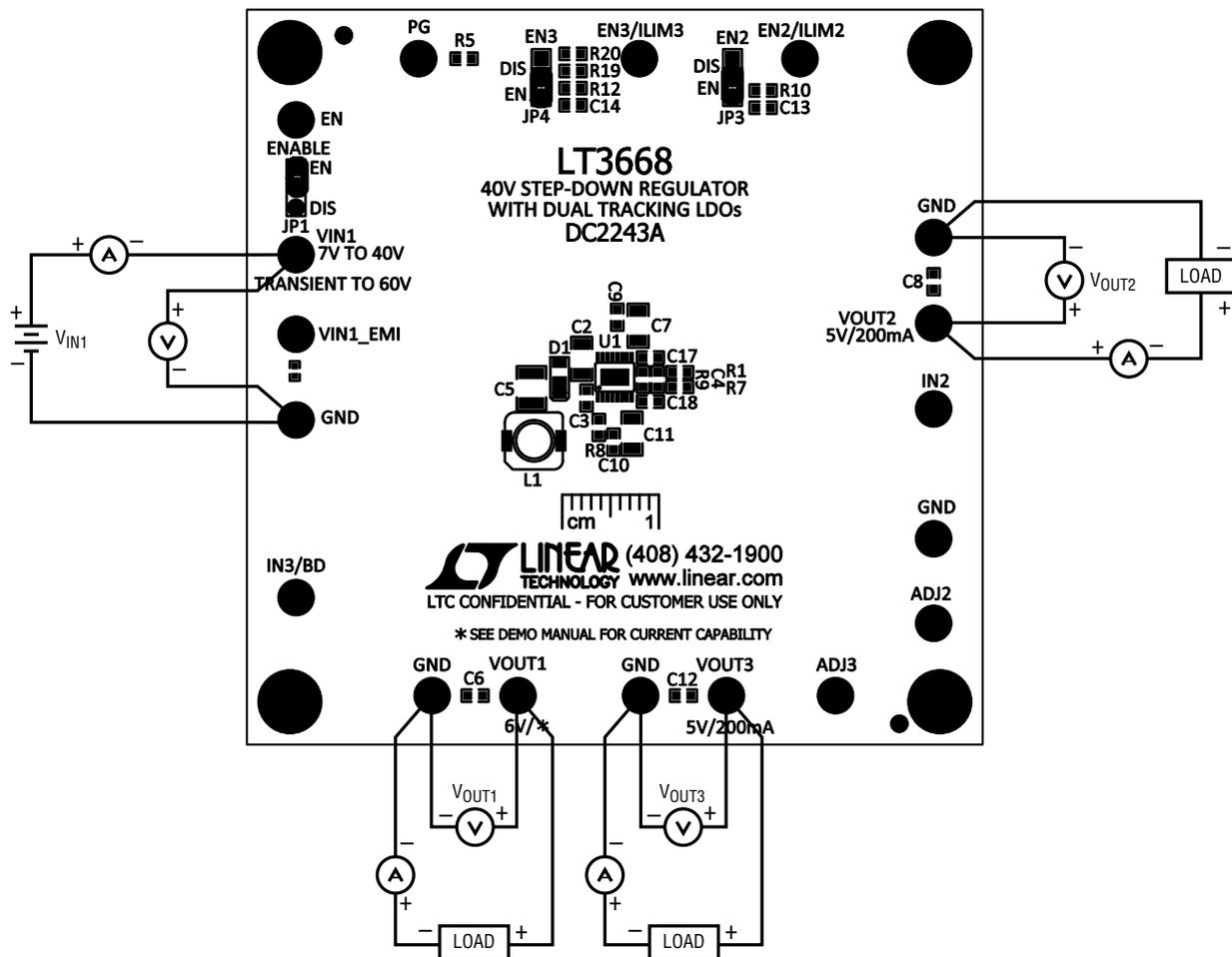


Figure 2. Proper Measurement Equipment Setup

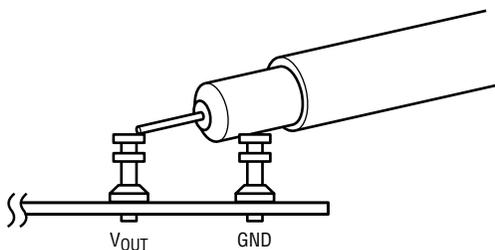


Figure 3. Measuring Input or Output Ripple

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## PARTS LIST

| ITEM  | QTY | REFERENCE               | PART DESCRIPTION                    | MANUFACTURER/PART NUMBER            |
|---|-----|-------------------------|-------------------------------------|-------------------------------------|
| <b>Required Circuit Components</b>              |     |                         |                                     |                                     |
| 1   | 1   | C2                      | CAP, X7R 2.2µF 100V 10% 1206        | AVX, 12061C225KAT2A                 |
| 2   | 1   | C3                      | CAP, X7R 0.22µF 25V 10% 0603        | AVX, 06033C224KAT2A                 |
| 3   | 1   | C4                      | CAP, NPO 22pF 25V 5% 0603           | AVX, 06033A220JAT2A                 |
| 4   | 1   | C5                      | CAP, X5R 22µF 25V 20% 1210          | MURATA, GRM32ER61E226ME15L          |
| 5   | 2   | C7, C11                 | CAP, X5R 10µF 10V 10% 1206          | AVX, 1206ZD106KAT2A                 |
| 6   | 2   | C9, C10                 | CAP, X5R 1µF 25V 20% 0603           | AVX, 06033D105MAT2A                 |
| 7   | 1   | D1                      | DIODE, SCHOTTKY 60V 1A POWERDI123   | DIODES INC., DFLS160-7              |
| 8   | 1   | L1                      | INDUCTOR, 27µH                      | SUMIDA, CDRH5D28RHPNP-270MC         |
| 9   | 1   | R1                      | RES., CHIP 243k 0.10W 1% 0603       | VISHAY, CRCW0603243KFKEA            |
| 10  | 1   | R5                      | RES., CHIP 150k 0.10W 5% 0603       | VISHAY, CRCW0603150KJNEA            |
| 11  | 1   | R7                      | RES., CHIP 931k 0.10W 1% 0603       | VISHAY, CRCW0603931KFKEA            |
| 12  | 1   | R8                      | RES., CHIP 174k 0.10W 1% 0603       | VISHAY, CRCW0603174KFKEA            |
| 13  | 1   | R9                      | RES., CHIP 294k 0.10W 1% 0603       | VISHAY, CRCW0603294KFKEA            |
| 14  | 1   | U1                      | I.C., VOLTAGE REG. MSOP(16)-MSE16   | LINEAR TECH., LT3668EMSE#PBF        |
| <b>Additional Demo Board Circuit Components</b> |     |                         |                                     |                                     |
| 1   | 1   | C1                      | CAP, Alum 10µF 63V 20% OSCON-CE-6.3 | SUN ELECTRONIC INDUSTRIES, 63CE10GA |
| 2   | 1   | C6                      | CAP, X7R 0.1µF 25V 10% 0603         | MURATA, GRM188R71E104KA01D          |
| 3   | 0   | C8, C12, C17, C18 (Opt) | CAP, 0603                           |                                     |
| 4   | 2   | C13, C14                | CAP, X7R 0.047µF 25V 20% 0603       | AVX, 06033C473MAT2A                 |
| 5   | 0   | C15, C16 (OPT)          | CAP, OSCON-CE-6.3                   |                                     |
| 6   | 0   | C19, C20 (OPT)          | CAP, 1206                           |                                     |
| 7   | 0   | FB1 (OPT)               | FERRITE BEAD, 600Ω/500mA 0603       | TDK, MMZ1608S601AT                  |
| 8   | 0   | L2 (OPT)                | INDUCTOR, 4.7µH                     | SUMIDA, CDRH2D18/LDNP-4R7NC         |
| 9   | 4   | R6, R13, R17, R18       | RES/JUMPER, CHIP 0Ω 0.25W 5A 0603   | VISHAY, CRCW06030000Z0EA            |
| 10  | 2   | R10, R12                | RES., CHIP 1.50k 0.10W 1% 0603      | VISHAY, CRCW06031K50FKEA            |
| 11  | 2   | R19, R20                | RES., CHIP 200k 0.10W 5% 0603       | VISHAY, CRCW0603200KJNEA            |
| <b>Hardware: For Demo Board Only</b>            |     |                         |                                     |                                     |
| 1   | 18  | E1-E18                  | TURRET, TESTPOINT                   | MILL-MAX, 2501-2-00-80-00-00-07-0   |
| 2   | 3   | JP1, JP3, JP4           | HEADERS, 3 PINS 2mm CTRS.           | SULLINS, NRPN031PAEN-RC             |
| 3   | 3   | XJP1, XJP3, XJP4        | SHUNT, 2mm CTRS.                    | SAMTEC, 2SN-BK-G                    |
| 4   | 4   | MH1-MH4                 | STANDOFF, NYLON 0.25"               | KEYSTONE, 8831(SNAP ON)             |



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