

# LT3663EDCB

## 1.2A, 1.5MHz Step-Down Switching Regulator with Output Current Limit

### DESCRIPTION

Demonstration Circuit 1419 is a 1.5MHz current mode step-down switching regulator with programmable output current limit. The current limit accurately controls the system power dissipation and reduces the size of the power path components.

The wide operating input voltage range of 7.5V to 36V (60V maximum) suits the LT3663 to a variety of input sources, including unregulated 12V wall adapters, 24V industrial supplies, and automotive power.

The LT3663 includes a low current shutdown mode, input overvoltage lockout and thermal shutdown.

The LT3663EDCB is available in an 8-lead (2mm × 3mm) DFN surface mount package with exposed pad.

**Design files for this circuit board are available. Call the LTC factory.**

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### PERFORMANCE SUMMARY

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

| SYMBOL | PARAMETER            | CONDITIONS                   | MIN | MAX     | UNITS |
|--------|----------------------|------------------------------|-----|---------|-------|
| VIN    | Input Voltage Range  |                              | 7.5 | to 36.0 | V     |
| VOUT   | Output Voltage Range | I <sub>OUT</sub> 0mA to ILIM | 3.3 | or 5.0  | V     |
| ILIM   | Current Limit        |                              | 0.6 | 1.2     | A     |

### OPERATING PRINCIPLE

Refer to the block diagram within the LT3663 data sheet for its operating principle.

The LT3663 is a constant frequency, current mode step down regulator. A switch cycle is initiated when the 1.5MHz oscillator enables the RS flip flop, turning on an internal power switch, Q1. An amplifier and comparator monitor the current flowing between the VIN and SW pins, turning the switch off when the current reaches a level determined by the voltage at node V<sub>C</sub>. The error amplifier measures the output voltage through an external resistor divider tied to the FB pin and servos the V<sub>C</sub> node. If the error amplifier's output increases, more current is delivered to the output; if it decreases, less current is delivered. An active clamp (not shown) on the V<sub>C</sub>

node provides current limit. The LT3663 is internally compensated with a pole zero combination on the output of the gm amplifier.

An external capacitor and internal diode are used to generate a voltage at the BOOST pin that is higher than the input supply. This allows the driver to fully saturate the internal bipolar NPN power switch for efficient operation. The switch driver operates from either VIN or BOOST to ensure startup.

An internal regulator provides power to the control circuitry. This regulator includes an input under-voltage and overvoltage protection which disable switching action when VIN is out of range. When switching is disabled, the LT3663 can safely sustain input voltages up to 60V.

Note that while switching is disabled the output will start to discharge.

Output current limiting is provided via the servo action of an amplifier. It compares the voltage across an inductor current sense resistor, RSENSE2, and compares it to a voltage programmed by external resistor R1 on the ILIM

pin. A capacitor averages the inductor ripple current. If the averaged inductor current exceeds the programmed value then the  $V_C$  voltage is pulled low, reducing the current in the regulator. The output current limit circuit allows for a lower current rated inductor and diode and provides better control of system power dissipation.

## QUICK START PROCEDURE

Using short twisted pair leads for any power connections, with all loads and power supplies off, refer to Figure 1 for the proper measurement and equipment setup.

Follow the procedure below:

1. Jumper, PS and LOAD 1 settings to start:

|                  |                    |
|------------------|--------------------|
| <b>JP1</b> = Run | <b>JP4</b> = 5.0V  |
| <b>JP2</b> = 1   | <b>PS1</b> = OFF   |
| <b>JP3</b> = 1   | <b>LOAD1</b> = OFF |

2. Turn on PS1 and slowly increase voltage to 5.5V while monitoring the input current. If the current remains less than 50mA, increase PS1 until output turns on. Verify input voltage UVLO of 6.5V to 7.5V.
3. Increase PS1 to 12V and set LOAD1 to 120mA. Verify voltage on VOUT of 4.85V to 5.15V.
4. Set LOAD1 to 1.0A. Verify voltage on VOUT of 4.85V to 5.15V and ripple voltage of <50mV.
5. Increase LOAD1 current until VOUT drops below 4.9V. Verify LOAD1 current is between 1.1A and 1.4A. Reduce LOAD1 current to 120mA.

6. Set JP2 to 1 and JP3 to 0. Increase LOAD1 current until VOUT drops below 4.9V. Verify LOAD1 current is between 900mA and 1.1A. Reduce LOAD1 current to 120mA.
7. Set JP2 to 0 and JP3 to 1. Increase LOAD1 current until VOUT drops below 4.9V. Verify LOAD1 current is between 700mA and 900mA. Reduce LOAD1 current to 120mA.
8. Set JP2 to 0 and JP3 to 0. Increase LOAD1 current until VOUT drops below 4.9V. Verify LOAD1 current is between 500mA and 700mA. Reduce LOAD1 current to 120mA.
9. Set JP2 to 1, JP3 to 1 and JP4 to 3.3V. Verify voltage on VOUT of 3.2V to 3.4V
10. Set LOAD1 to 1.0A. Verify voltage on VOUT of 3.2V to 3.4V and ripple voltage of <50mV.
11. Increase PS1 to 36V and verify voltage on VOUT of 3.2V to 3.4V.
12. Increase PS1 to 40V and verify voltage on VOUT of 500mV.
13. Decrease PS1 to 30V and verify voltage on VOUT of 3.2V to 3.4V.
14. Turn off PS1 and Load 1.

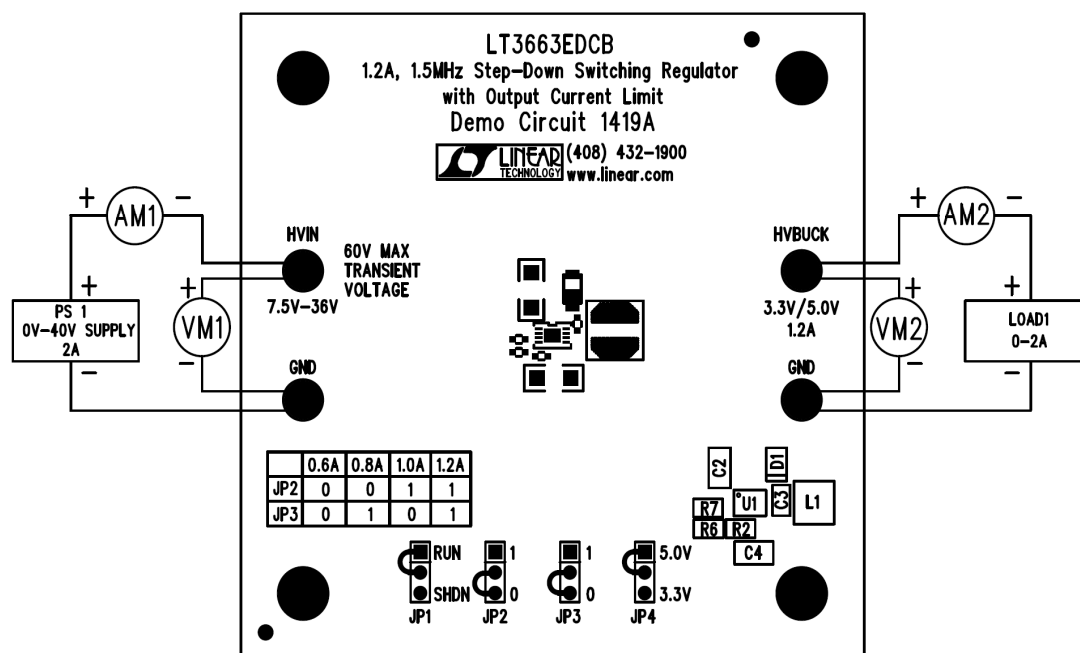


Figure 1. Proper Measurement Equipment Setup

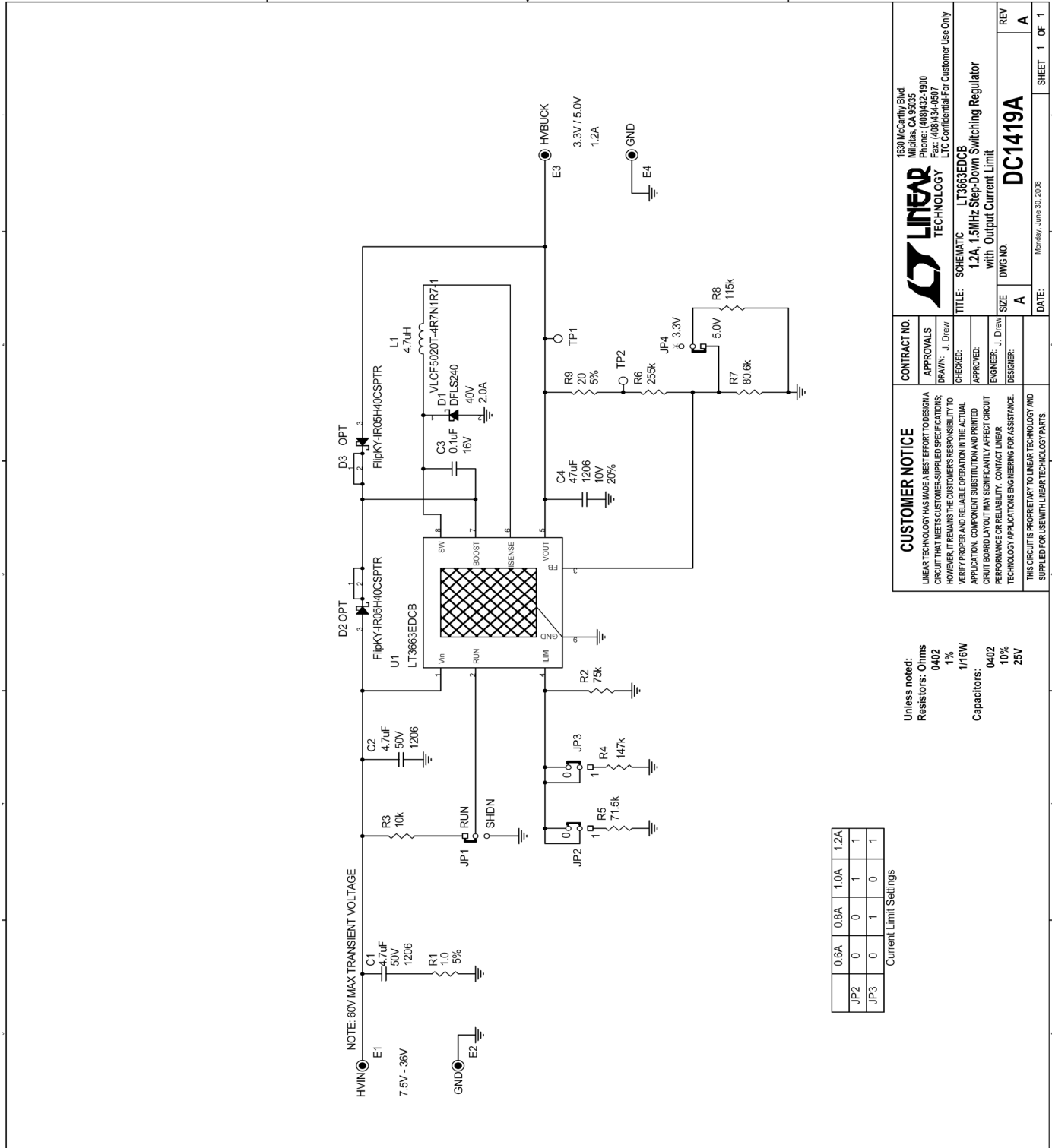


Figure 2: Schematic diagram

**Linear Technology Corporation**  
LT3663EDCB

*Bill Of Material*  
**Demo Bd. #: DC1419A**  
9/10/2008

**Bill of Materials**

LT3663EDCB

| Qty  | Reference       | Part Description  | Manufacture / Part #         | Kit Qty | In Stock | Qty On Order |
|--|-----------------|---|------------------------------|---------|----------|--------------|
|  |                 |   |                              |         |          |              |
|  |                 |   |                              |         |          |              |
|  |                 |   | <b>NUMBER OF BOARDS = 10</b> |         |          |              |
|  |                 |   |                              |         |          |              |
| <b>REQUIRED CIRCUIT COMPONENTS:</b>              |                 |   |                              |         |          |              |
| 1  | C2              | CAP, CHIP, X7R, 4.7µF, ±10%, 50V, 1206  | MURATA, GRM31CR71H475KA12L   | 10      |          |              |
| 2  | C3              | CAP, CHIP, X7R, 0.1µF, ±10%, 16V, 0402  | MURATA, GRM155R71C104KA88    | 10      |          |              |
| 3  | C4              | CAP, CHIP, X5R, 47µF, ±20%, 10V, 1206   | TAIYO YUDEN, LMK316BJ476ML-T | 10      |          |              |
| 4  | D1              | DIODE, SCHOTTKY, 2A, 40V, SMB   | DIODES INC, DFLS240L         | 10      |          |              |
| 5  | L1              | IND, SMT, 4.7µH, 1.7A, ±30%, 102mΩ, 5mm x 5mm                                 | TDK, VLF5020T-4R7N1R7-1      | 10      |          |              |
| 6  | R2              | RES, CHIP, 75kΩ, 100ppm, 1/16W, 1%, 0402                                      | VISHAY, CRCW040275K0FKED     | 10      |          |              |
| 7  | R6              | RES, CHIP, 255kΩ, 100ppm, 1/16W, 1%, 0402                                     | VISHAY, CRCW0402255KFKED     | 10      |          |              |
| 8  | R7              | RES, CHIP, 80.6kΩ, 100ppm, 1/16W, 1%, 0402                                    | VISHAY, CRCW040280K6FKED     | 10      |          |              |
| 9  | U1              | IC, SMT, 1.2A, 1.5MHz Step-Down Switching Regulator with Output Current Limit | LINEAR TECH, LT3663EDCB      | 10      |          |              |
| <b>ADDITIONAL DEMO BOARD CIRCUIT COMPONENTS:</b> |                 |   |                              |         |          |              |
| 1  | C1              | CAP, CHIP, X5R, 4.7µF, ±10%, 50V, 1206  | MURATA, GRM31CR71H475KA12L   | 10      |          |              |
| 2  | R1              | RES, CHIP, 1.0Ω, 200ppm, 1/16W, 5%, 0402                                      | VISHAY, CRCW04021R00JNED     | 10      |          |              |
| 3  | R3              | RES, CHIP, 10.0kΩ, 100ppm, 1/16W, 1%, 0402                                    | VISHAY, CRCW040210K0FKED     | 10      |          |              |
| 4  | R4              | RES, CHIP, 147kΩ, 100ppm, 1/16W, 1%, 0402                                     | VISHAY, CRCW0402147KFKED     | 10      |          |              |
| 5  | R5              | RES, CHIP, 71.5kΩ, 100ppm, 1/16W, 1%, 0402                                    | VISHAY, CRCW040271K5FKED     | 10      |          |              |
| 6  | R8              | RES, CHIP, 115kΩ, 100ppm, 1/16W, 1%, 0402                                     | VISHAY, CRCW0402115KFKED     | 10      |          |              |
| 7  | R9              | RES, CHIP, 20Ω, 200ppm, 1/16W, 5%, 0402                                       | VISHAY, CRCW040220R0JNED     | 10      |          |              |
| <b>OPTIONAL DEMO BOARD CIRCUIT COMPONENTS:</b>   |                 |   |                              |         |          |              |
| 1  | D2,D3           | DIODE, SCHOTTKY, 40V, 0.5A  | VISHAY, IR05H40CSPTR         | 0       |          |              |
| <b>HARDWARE FOR DEMO BOARD ONLY:</b>             |                 |   |                              |         |          |              |
| 1  | E1,E2,E3,E4     | Turret, 0.09"   | MIL-MAX, 2501-2              | 40      |          |              |
| 2  | JP1,JP2,JP3,JP4 | 3 Pin Jumper, 2mm   | SAMTEC, TMM-103-02-L-S       | 40      |          |              |
| 3  | JP1,JP2,JP3,JP4 | SHUNT, 2mm  | SAMTEC, 2SN-BK-G             | 40      |          |              |
| 4  |                 | STAND-OFF, NYLON 0.375" tall (SNAP ON)  | KEYSTONE, 8832 (SNAP ON)     | 40      |          |              |

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