

LT3663EDCB-3.3/5.0  
 1.2A, 1MHz Step-Down  
 Switching Regulator with  
 Output Current Limit

## DESCRIPTION

Demonstration Circuit 1570 is a 1.0MHz 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 LT3663-3.3/5.0 to a variety of input sources, including unregulated 12V wall adapters, 24V industrial supplies, and automotive power. The LT3663-3.3/5.0 includes a low current shutdown

mode, input overvoltage lockout and thermal shutdown. The LT3663EDCB-3.3/5.0 is available in an 8-lead (2mm × 3mm) DFN surface mount package with exposed pad.

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**TABLE 1**  
**PERFORMANCE SUMMARY** Specifications are at T<sub>A</sub> = 25°C

SYMBOL	PARAMETER	CONDITIONS	MIN	MAX	UNITS
V <sub>IN</sub>	Input Voltage Range		7.5	to 36.0	V
V <sub>OUTA</sub>	Output Voltage Range	I <sub>out</sub> 0mA to I <sub>LIM</sub>	3.24	to 3.36	V
V <sub>OUTB</sub>	Output Voltage Range	I <sub>out</sub> 0mA to I <sub>LIM</sub>	4.9	to 5.1	V
I <sub>LIM</sub>	Current Limit	Selectable ±20%	0.6	to 1.2	A

## OPERATING PRINCIPLE

Refer to the block diagram within the LT3663-3.3/5.0 data sheet for its operating principle.

The LT3663-3.3/5.0 is a constant frequency, current mode step-down regulator. A switch cycle is initiated when the 1MHz oscillator enables the RS flip flop, turning on an internal power switch, Q1. An amplifier and comparator monitor the current flowing between the V<sub>IN</sub> 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 internal resistor divider tied to the V<sub>OUT</sub> pin and servos the V<sub>C</sub> node. If the error amplifier's output increases, more current is delivered to the out-

put; if it decreases, less current is delivered. An active clamp (not shown) on the V<sub>C</sub> node provides current limit. The LT3663-3.3/5.0 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 V<sub>IN</sub> or BOOST to ensure startup.

# LT3663EDCB-3.3/5.0

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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 LT3663-3.3/5.0 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.

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## 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 settings to start:

<b>JP1</b> = Run	<b>PS1</b> = OFF
<b>JP2</b> = 1	<b>LOAD1</b> = OFF
<b>JP3</b> = 1	

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 the 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 in Table 1.
4. Set LOAD1 to 1.0A. Verify voltage on VOUT in Table 1 and ripple voltage of <50mV.
5. Increase LOAD1 current until VOUT drops below the minimum voltage in Table 1. Verify LOAD1 current is between 0.96A and 1.44A. Reduce LOAD1 current to 120mA.
6. Set JP2 to 1 and JP3 to 0. Increase LOAD1 current until VOUT drops below the minimum

voltage in Table 1. Verify LOAD1 current is between 800mA and 1.12A. Reduce LOAD1 current to 120mA.

7. Set JP2 to 0 and JP3 to 1. Increase LOAD1 current until VOUT drops below the minimum voltage in Table 1. Verify LOAD1 current is between 640mA and 960mA. Reduce LOAD1 current to 120mA.
8. Set JP2 to 0 and JP3 to 0. Increase LOAD1 current until VOUT drops below the minimum voltage in Table 1. Verify LOAD1 current is between 480mA and 720mA. Reduce LOAD1 current to 120mA.
9. Increase PS1 to 36V and verify voltage on VOUT in Table 1.
10. Increase PS1 to 40V and verify voltage on VOUT of <500mV.
11. Decrease PS1 to 30V and verify voltage on VOUT in Table 1.
12. Turn off PS1 and LOAD1.

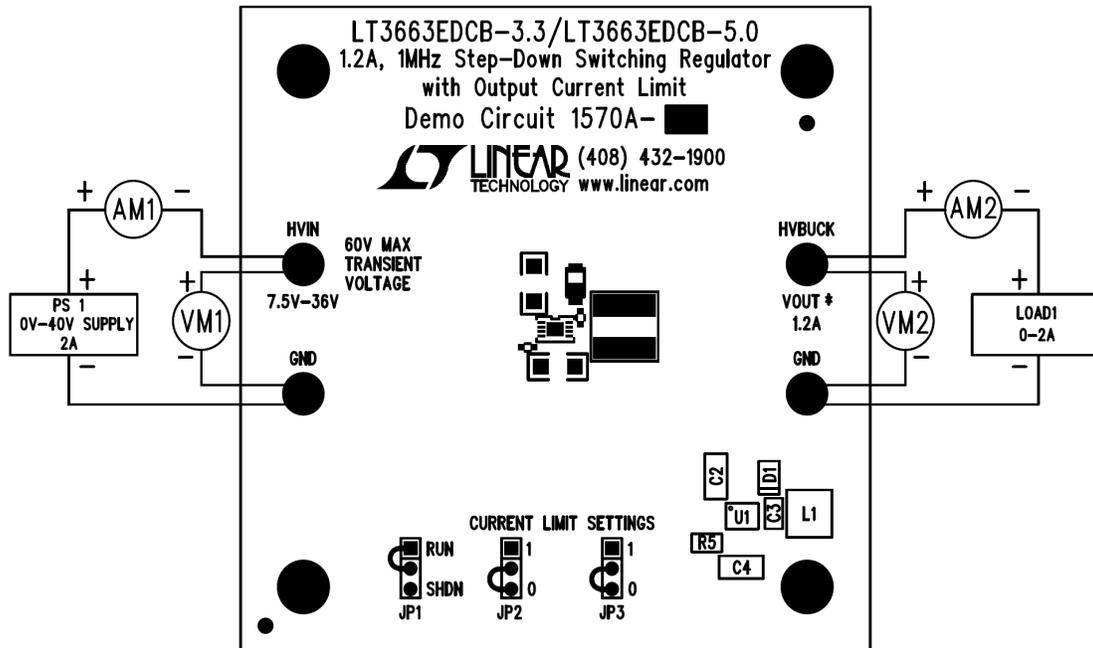


Figure 1: Proper Measurement Equipment Setup

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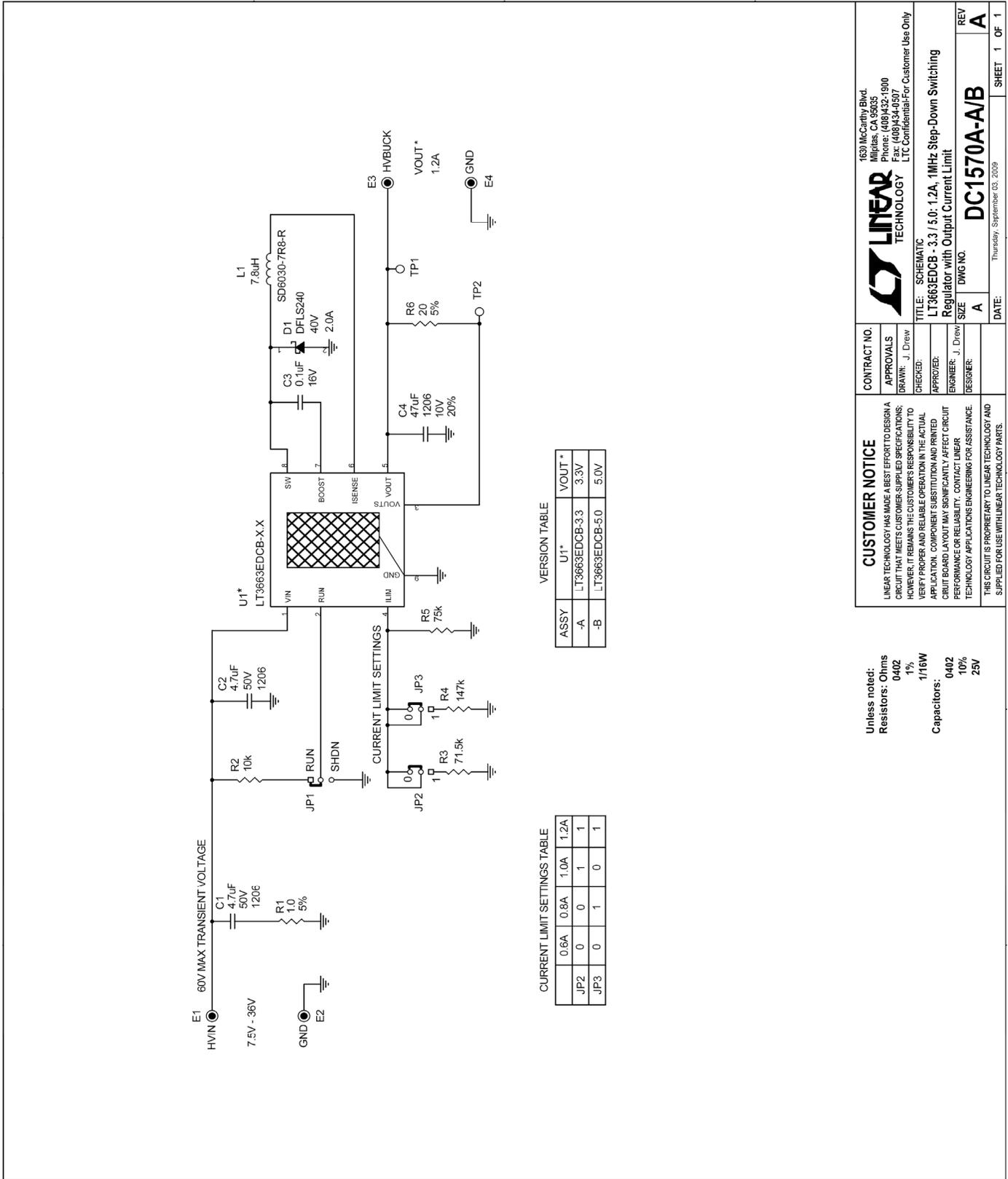


Figure 2: Schematic diagram

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**LINEAR TECHNOLOGY**

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CONTRACT NO.  
APPROVALS  
DRAWN: J. Driew  
CHECKED:  
APPROVED:  
ENGINEER: J. Driew  
DESIGNER:

TITLE: SCHEMATIC  
LT3663EDCB - 3.3 / 5.0 : 1.2A, 1MHz, Step-Down Switching  
Regulator with Output Current Limit

SIZE  
DWG NO. **DC1570A-A/B**

DATE: Thursday, September 03, 2009  
SHEET 1 OF 1

**CUSTOMER NOTICE**  
LINEAR TECHNOLOGY HAS MADE A BEST EFFORT TO DESIGN A CIRCUIT THAT MEETS CUSTOMER-SUPPLIED SPECIFICATIONS; HOWEVER, IT REMAINS THE CUSTOMER'S RESPONSIBILITY TO VERIFY PROPER AND RELIABLE OPERATION IN THE ACTUAL APPLICATION. COMPONENT SUBSTITUTION AND PRINTED CIRCUIT BOARD LAYOUT MAY SIGNIFICANTLY AFFECT CIRCUIT PERFORMANCE OR RELIABILITY. CONTACT LINEAR TECHNOLOGY APPLICATIONS ENGINEERING FOR ASSISTANCE.  
THIS CIRCUIT IS PROPRIETARY TO LINEAR TECHNOLOGY AND IS SUPPLIED FOR USE WITH LINEAR TECHNOLOGY PARTS.

Unless noted:  
Resistors: Ohms  
0402  
1%  
1/16W  
Capacitors: 0402  
10%  
25V

Qty	Reference	Part Description	Manufacture / Part #
<b>REQUIRED CIRCUIT COMPONENTS:</b>			
1	C2	CAP, CHIP, X7R, 4.7µF, ±10%, 50V, 1206	MURATA, GRM31CR71H475KA12L
2	C3	CAP, CHIP, X7R, 0.1µF, ±10%, 16V, 0402	MURATA, GRM155R71C104KA88
3	C4	CAP, CHIP, X5R, 47µF, ±20%, 10V, 1206	TAIYO YUDEN, LMK316BJ476ML-T
4	D1	DIODE, SCHOTTKY, 2A, 40V, SMB	DIODES INC, DFLS240L
5	L1	IND, SMT, 7.8µH, 1.6A, ±30%, 53mΩ, 6mm x 6mm	COILTRONICS, SD6030-7R8-R
6	R5	RES, CHIP, 75.0kΩ, 100ppm, 1/16W, 1%, 0402	VISHAY, CRCW040275K0FKED
1	U1 (DC1570A-A)	IC, SMT, 1.2A, 1MHz Step-Down Switching Regulator with Output Current Limit	LINEAR TECH., LT3663EDCB-3.3
1	U1 (DC1570A-B)		LINEAR TECH., LT3663EDCB-5.0
<b>ADDITIONAL DEMO BOARD CIRCUIT COMPONENTS:</b>			
1	C1	CAP, CHIP, X5R, 4.7µF, ±10%, 50V, 1206	MURATA, GRM31CR71H475KA12L
2	R1	RES, CHIP, 1.0Ω, 200ppm, 1/16W, 5%, 0402	VISHAY, CRCW04021R00JNED
3	R2	RES, CHIP, 10.0kΩ, 100ppm, 1/16W, 1%, 0402	VISHAY, CRCW040210K0FKED
4	R4	RES, CHIP, 147kΩ, 100ppm, 1/16W, 1%, 0402	VISHAY, CRCW0402147KFKED
5	R3	RES, CHIP, 71.5kΩ, 100ppm, 1/16W, 1%, 0402	VISHAY, CRCW040271K5FKED
6	R6	RES, CHIP, 20Ω, 200ppm, 1/16W, 5%, 0402	VISHAY, CRCW040220R0JNED
<b>HARDWARE FOR DEMO BOARD ONLY:</b>			
4	E1,E2,E3,E4	Turret, 0.09"	MIL-MAX, 2501-2
3	JP1,JP2,JP3	3 Pin Jumper, 2mm	SAMTEC, TMM-103-02-L-S
3	JP1,JP2,JP3	SHUNT, 2mm	SAMTEC, 2SN-BK-G
4		STAND-OFF, NYLON 0.375" tall (SNAP ON)	KEYSTONE, 8832 (SNAP ON)

Bill of Materials