

# LTC3600

## 16V, 1.5A Synchronous Step-Down Regulator with Programmable Reference

### DESCRIPTION

Demonstration circuit DC1667A is a step-down DC/DC converter using LTC<sup>®</sup>3600 monolithic synchronous buck regulator. DC1667A has an input voltage range of 4.5V to 15V, and is capable of delivering up to 1.5A of output current. The output voltage of the DC1667 can be set by a single resistor from 0V to  $(V_{IN} - 0.5)V$ . At light load conditions, DC1667 can operate in discontinuous mode to improve the efficiency. During shutdown mode, LTC3600 consumes less than 1 $\mu$ A. The switching frequency of LTC3600 is programmable from 200kHz to 4MHz. DC1667A uses low profile surface mount components.

These features and the availability of LTC3600 in a 12-lead DFN/MSOP package, make it ideal for use in point-of-load power supplies, battery-powered equipments and voltage tracking systems. The LTC3600 data sheet must be read in conjunction with this demo manual for working on or modifying the demo circuit DC1667A.

**Design files for this circuit board are available at <http://www.linear.com/demo/DC1667A>**

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### PERFORMANCE SUMMARY $(T_A = 25^\circ\text{C})$

PARAMETER	CONDITIONS	VALUE
Input Voltage Range		4.5V to 15V
Default Output Voltage $V_{OUT}$	$V_{IN} = 4.5V$ to 15V, $I_{OUT} = 0A$ to 1.5A, JP10: CCM	$1.215V \pm 2\%$ (1.19V to 1.24V)
Maximum Continuous Output Current		1.5A
Default Operating Frequency		1MHz
Typical Output Voltage Ripple	$V_{IN} = 5V$ , $V_{OUT} = 1.2V$ , $I_{OUT} = 1.5A$ , $f_{SW} = 1MHz$	<10mV (See Figure 4)
Efficiency	$V_{IN} = 5V$ , $V_{OUT} = 1.2V$ , $I_{OUT} = 1.5A$ , $f_{SW} = 1MHz$	78% (See Figure 3)

# DEMO MANUAL DC1667A

## QUICK START PROCEDURE

Demonstration circuit DC1667A is easy to set up to evaluate the performance of the LTC3600. 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 1.2V output application:

JP2	JP7	JP8	JP9	JP10
<b>1.2V</b>	<b>COMP</b>	<b>PGOOD</b>	<b>RUN</b>	<b>MODE/SYNC</b>
1.2V	EXT	DIS	OFF	CCM

2. With power off, connect the input power supply, load and meters as shown in Figure 1. Preset the load to 0A and  $V_{IN}$  supply to 5V.

3. Turn on the power supply at the input. Measure and make sure the input voltage is 5V. Turn on the circuit by inserting the shunt in header JP9 to the ON position. The output voltage should be  $1.215V \pm 2\%$  (1.19V to 1.24V).
4. 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. Refer to Figure 2 for proper input/output voltage ripple measurement.
5. To select other output voltages, LTC3600 has to be shut down by putting RUN pin jumper to the OFF position or turning off the input supply. After the IC is shut down, move the shunt to other output voltage selections, such as 1.8V or 3.3V, and repeat tests 1 through 4. The output voltage tolerance should remain at  $V_{OUT} \pm 2\%$ .

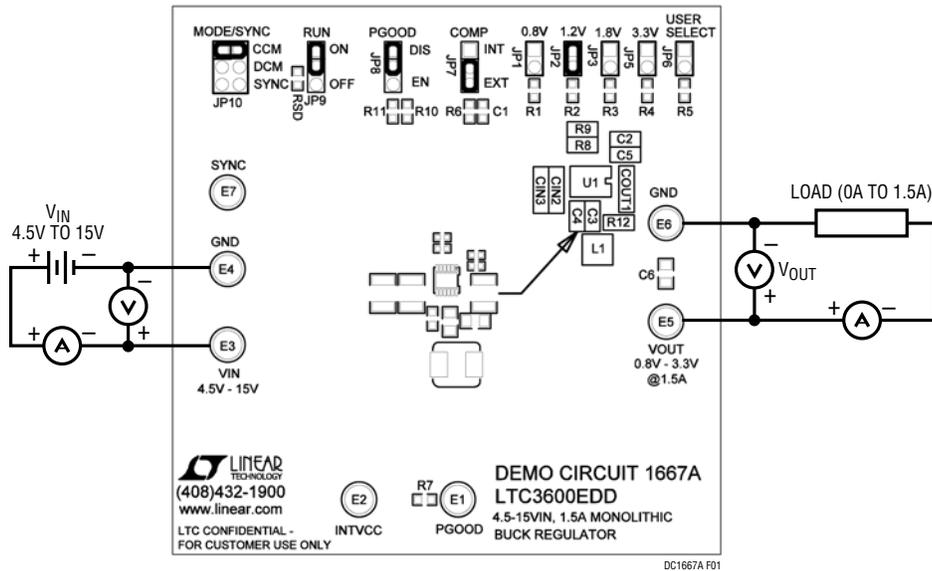


Figure 1. Proper Equipment Measurement Setup

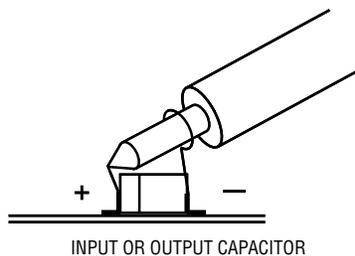


Figure 2. Scope Probe Placements for Measuring Input or Output Ripple

## QUICK START PROCEDURE

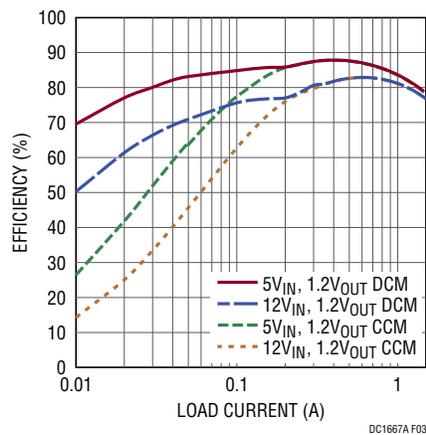


Figure 3. Measured Efficiency ( $V_{OUT} = 1.2V$ )

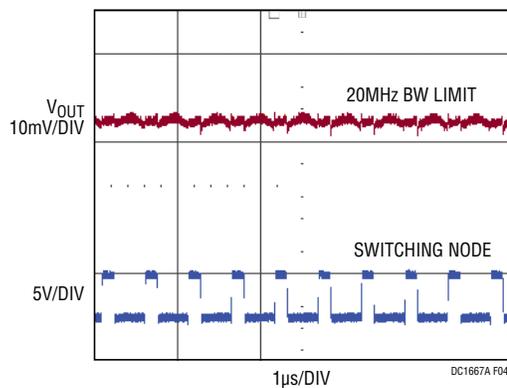


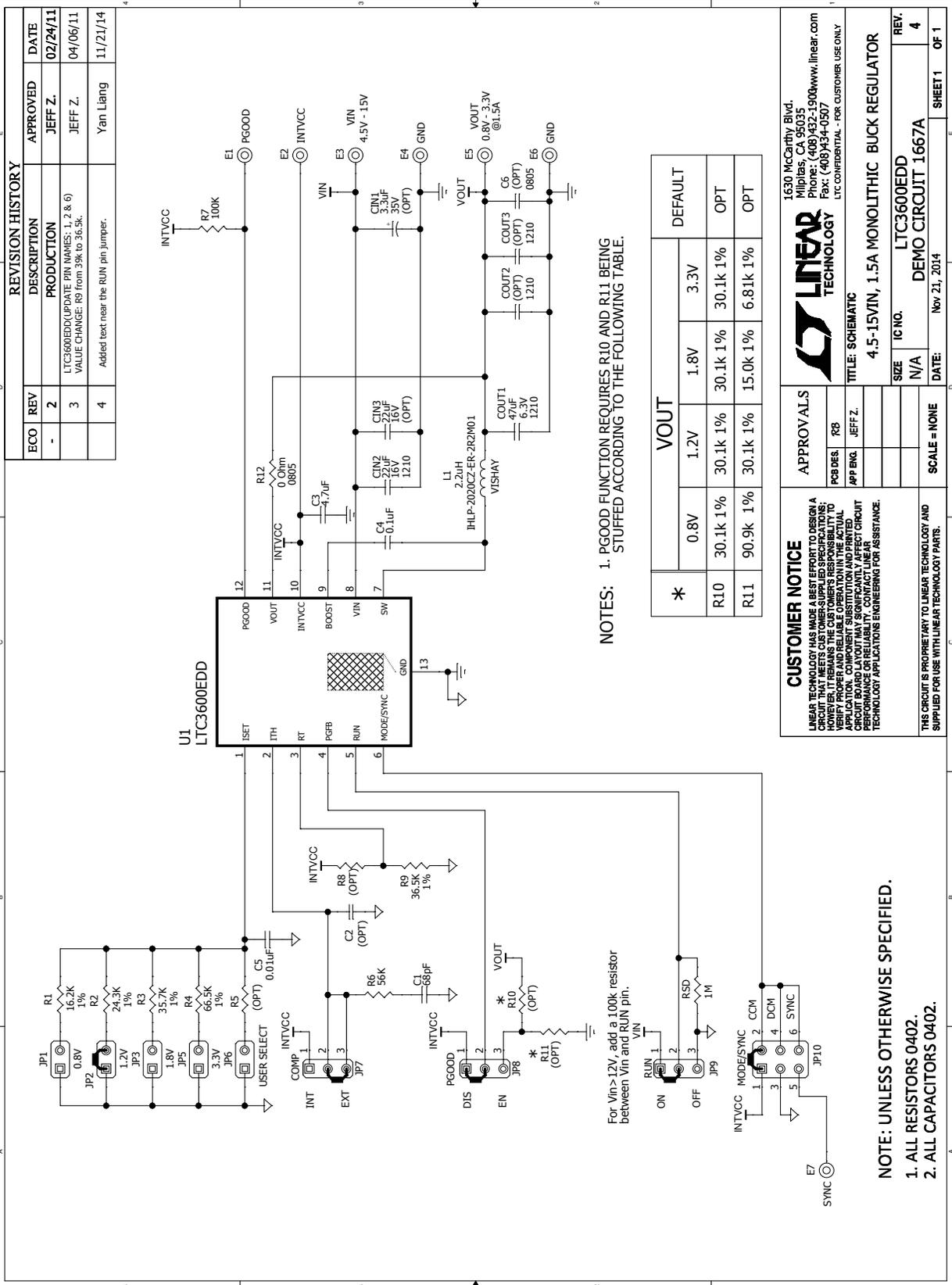
Figure 4. Measured Output Voltage Ripple at 5V Input, 1.2V Output, 1.5A with Standard Demo Circuit Default Setup

# DEMO MANUAL DC1667A

## PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
<b>Required Circuit Components</b>				
1	1	CIN2	Capacitor, X5R 22 $\mu$ F 16V 20% 1210	TDK C3225X5R1C226M
2	1	COUT1	Capacitor, X5R 47 $\mu$ F 6.3V 20% 1210	Taiyo Yuden JMK325BJ476MM-T
3	1	C3	Capacitor, X5R 4.7 $\mu$ F 16V 20% 0805	Taiyo Yuden EMK212BJ475MG
4	1	C4	Capacitor, X7R 0.1 $\mu$ F 25V 10% 0603	AVX 06033C104KAT2A
5	1	L1	Inductor, 2.2 $\mu$ H IHLP-2020CZ-01	Vishay IHLP-2020CZ-ER 2R2M01
6	1	R2	Resistor, Chip 24.3K 0.06W 1% 0603	Vishay CRCW060324K3FKEA
7	1	R9	Resistor, Chip 36.5K 0.06W 1% 0402	Vishay CRCW040236K5FKED
8	1	U1	I.C., Voltage Regulator DFN(12)(DD) 3mm $\times$ 3mm	Linear Technology Corporation LTC3600EDD
<b>Additional Demo Board Circuit Components</b>				
1	1	CIN1	Capacitor, Tantalum 3.3 $\mu$ F 35V 20% 6032	AVX TAJW335M035R
2	1	CIN3	Capacitor, X5R 22 $\mu$ F 16V 20% 1210	TDK C3225X5R1C226M
3	2	COUT2, COUT3	Capacitor, 1210	
4	1	C1	Capacitor, NPO 68pF 50V 10% 0603	AVX 06035A680KAT1A
5	1	C2	Capacitor, 0402	
6	1	C5	Capacitor, X7R 0.01 $\mu$ F 16V 20% 0402	AVX 0402YC103MAT2A
7	1	C6	Capacitor, 0805	
8	1	RSD	Resistor, Chip 1M 0.06W 5% 0603	Vishay CRCW06031M00JNEA
9	1	R1	Resistor, Chip 16.2k 0.06W 1% 0603	Vishay CRCW060316K2FKEA
10	1	R3	Resistor, Chip 35K7 0.06W 1% 0603	Vishay CRCW060335K7FKEA
11	1	R4	Resistor, Chip 66.5k 0.06W 1% 0603	Vishay CRCW060366K5FKEA
12	1	R5	Resistor, 0603	
13	1	R6	Resistor, Chip 56k 0.06W 5% 0603	Vishay CRCW060356K0JKEA
14	1	R7	Resistor, Chip 100k 0.06W 5% 0603	Vishay CRCW0603100KJNEA
15	1	R8	Resistor, 0402	
16	2	R10, R11	Resistor, 0603	
17	1	R12	Resistor/Jumper, Chip 0 $\Omega$ 1/8W 1A 0805	Vishay CRCW08050000Z0EA
<b>Hardware-For Demo Board Only</b>				
1	7	E1-E7	Turret, Testpoint .062 Thick Board	Mill Max 2501-2-00-80-00-00-07-0
2	4	JP1-JP3, JP5	Jumper, 2 Pins 2mm Ctrs.	Samtec TMM-102-02-L-S
3	1	JP6		Samtec TMM-102-02-L-S
4	3	JP7-JP9	Headers, Single Row 3 Pins 2mm Ctrs.	Samtec TMM-103-02-L-S
5	1	JP10	Headers, Double Row 2mm $\times$ 3 2mm Ctrs.	Samtec TMM-103-02-L-D
6	5	XJP2, XJP7-XJP10	Shunt, 2mm Ctrs.	Samtec 2SN-BK-G
7	1		Stencil	Stencil DC1667A

**SCHEMATIC DIAGRAM**



REVISION HISTORY				
ECO	REV	DESCRIPTION	APPROVED	DATE
-	2	PRODUCTION	JEFF Z.	02/24/11
	3	LTC3600EDD(UPDATE PIN NAMES: 1, 2 & 6) VALUE CHANGE: R9 from 35k to 36.5k.	JEFF Z.	04/06/11
	4	Added text near the RUN pin jumper.	Yan Liang	11/21/14

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**APPROVALS**

PCB DES.	RB
APP ENG.	JEFF Z.

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**LINEAR TECHNOLOGY**

TITLE: SCHEMATIC  
 4.5-15VIN, 1.5A MONOLITHIC BUCK REGULATOR

SIZE	IC NO.	REV.
N/A	LTC3600EDD	4

DATE: Nov 21, 2014  
 SCALE = NONE  
 SHEET 1 OF 1

**NOTE: UNLESS OTHERWISE SPECIFIED.**

- ALL RESISTORS 0402.
- ALL CAPACITORS 0402.



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# DEMO MANUAL DC1667A

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