

LTC3115EDHD-1 40V, 2A Synchronous Buck-Boost DC/DC Converter

DESCRIPTION

Demonstration circuit 1687A features the LTC[®]3115-1, a high voltage monolithic synchronous buck-boost converter.

The DC1687A demo board has two user selectable operating modes: Burst Mode[®] operation and forced continuous operation (fixed frequency PWM) (JP1). There is also an accurate programmable RUN pin which is used to enable the converter (JP2).

The DC1687A operates with a 2.7V to 40V input voltage range. The demo board has been designed with the output voltage set to 5.0V. The LTC3115-1 incorporates a proprietary low noise switching algorithm which optimizes efficiency with input voltages above, below or equal to the output voltage and ensures seamless transitions between operating modes.

The demo board has been programmed to operate at 1MHz in PWM mode to optimize small size with high efficiency operation.

The demo board also has optional provisions to back feed V_{CC} in order to increase efficiency in some 5V output applications. There is also a provision for an optional Schottky diode from SW2 to V_{OUT} for applications where V_{OUT} is greater than 20V and short circuit protection is desired. Consult the data sheet for more information on these options.

Figures 1 and 2 show typical demo board efficiency.

The LTC3115-1 data sheet has detailed information about the operation, specifications, and applications of the part. The data sheet should be read in conjunction with this quick start guide.

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

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PERFORMANCE SUMMARY

PARAMETER	VALUE
Input Voltage Range	2.7V to 40V
V_{OUT}	5.0V
I_{OUT} (See Note 1)	1A For $V_{IN} \geq 3.6V$, 2A For $V_{IN} > 6V$
Efficiency	See Figures 1 and 2

Note 1: The Demo Board output current is a function of V_{IN} . Please refer to the data sheet for more information

QUICK START PROCEDURE

Using short twisted pair leads for any power connections and with all loads and power supplies off, refer to Figure 3 for the proper measurement and equipment setup. The battery/power supply (PS1) should not be connected to the circuit until told to do so in the procedure below.

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_{IN} or V_{OUT} and GND terminals (see Figure 4), or by using an oscilloscope probe tip jack.

1. Jumper and PS1 settings to start:

PS1 = OFF

JP1 (PWM) = fixed frequency

JP2 (RUN) = ON

2. With power OFF connect the power supply (PS1) as shown in Figure 3. If accurate current measurements are desired (for efficiency calculation for example) then connect an ammeter in series with the supply as shown. The ammeter is not required however.

3. Connect a 500mA load to V_{OUT} as shown in Figure 3 (10Ω for $V_{OUT} = 5V$). Connect an ammeter if accurate current measurement or monitoring is desired.
4. Turn on PS1 and slowly increase voltage until the voltage at V_{IN} is 4.0V.
5. Verify V_{OUT} is ~5.0V.
6. V_{IN} can now be varied between 2.7V and 40.0V. I_{OUT} may need to be reduced for $V_{IN} < 4V$. V_{OUT} should remain in regulation.
7. Load current (I_{OUT}) can also be varied. The maximum I_{OUT} is a function of V_{IN} and the current limit. Consult the data sheet for more information on I_{OUT} vs V_{IN} . In general for $V_{IN} > 3.6V$ I_{OUT} can be increased to 1A. For $V_{IN} > 6V$ I_{OUT} can be increased to 2A.
8. For operation in Burst Mode operation move Jumper JP1 to burst. I_{OUT} is limited in Burst Mode operation. See the data sheet for more information.
9. NOTE: If V_{OUT} drops out of regulation, check to be sure the maximum load has not been exceeded, or that V_{IN} is not below the minimum value for regulation (see data sheet)

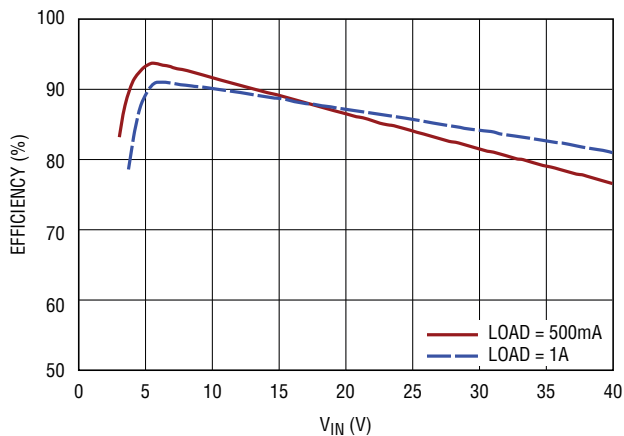


Figure 1. DC1687A Efficiency in PWM Mode

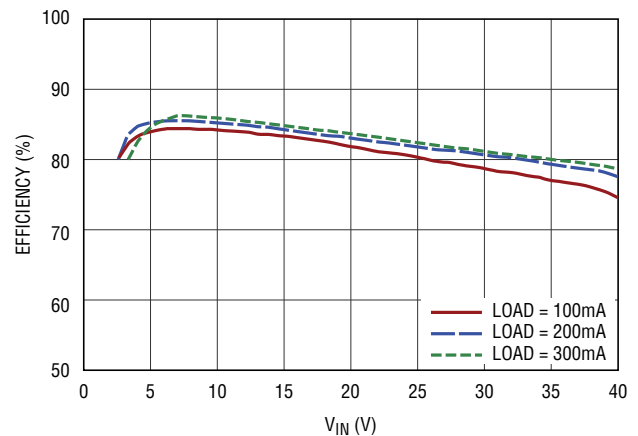


Figure 2. DC1687A Efficiency in Burst Mode Operation

QUICK START PROCEDURE

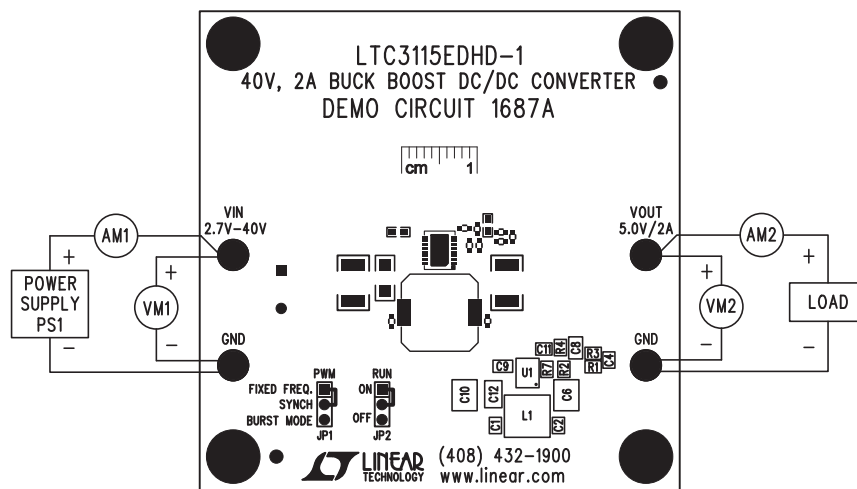


Figure 3. Proper Measurement Equipment Setup

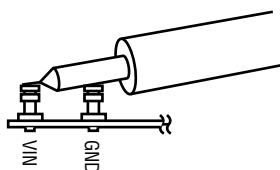


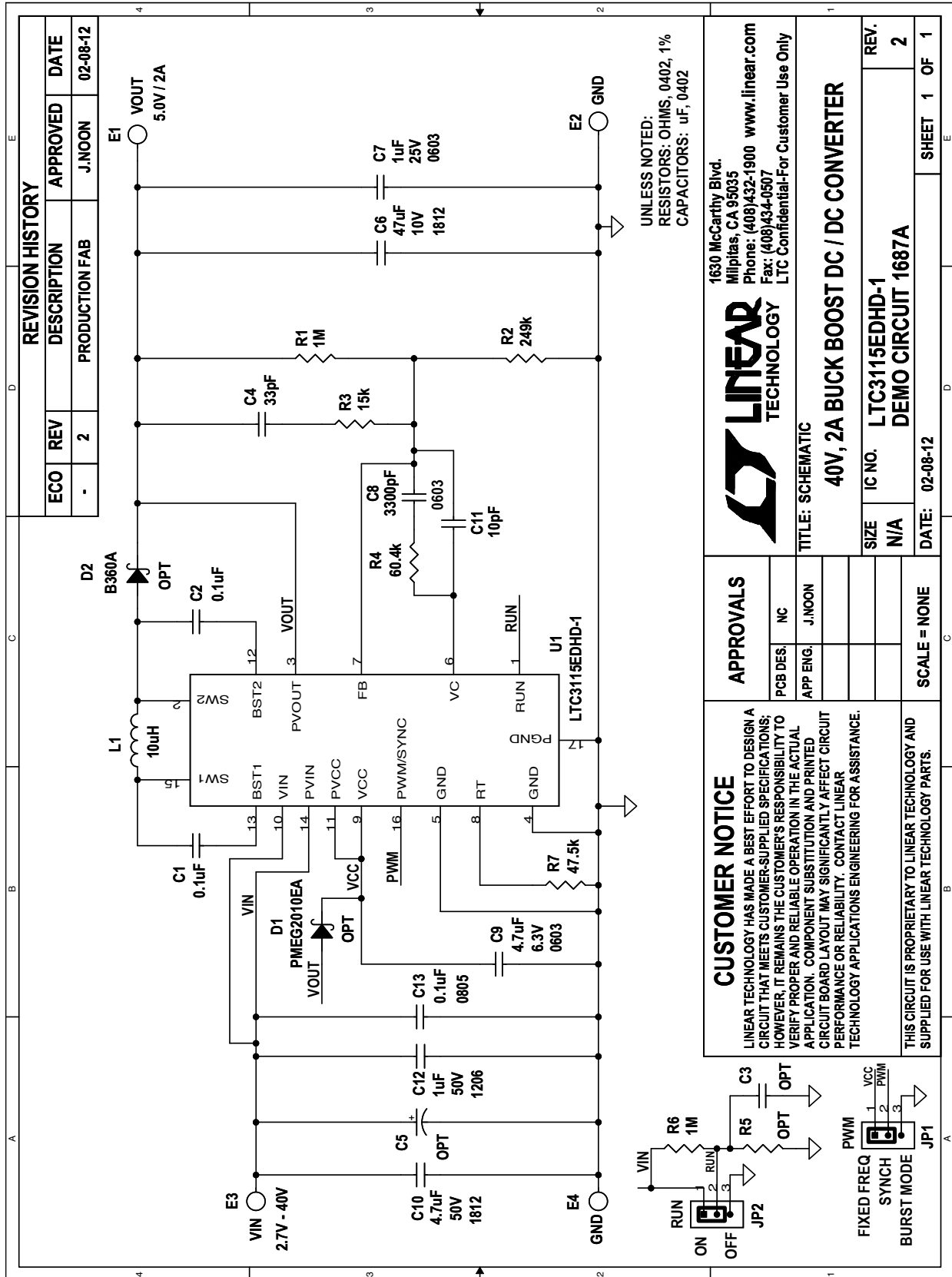
Figure 4. Measuring Input or Output Ripple

DEMO MANUAL DC1687A

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	2	C1, C2	CAP, CER, 0.10 μ F, 16V, X7R, \pm 20%, 0402	TDK, C1005X7R1C104M
2	1	C4	CAP, CER, 33pF, 50V, C0G, 5%, 0402	TDK, C1005C0G1H330J
3	1	C6	CAP, CER, 47 μ F, 10V, 20%, X5R, 1812	TDK, C4532X5R1A476M
4	1	C7	CAP, CER, 1.0 μ F, 25V, X5R, 0603	TDK, C1608X5R1E105M
5	1	C8	CAP, CER, 3300pF, 50V, 5%, NP0, 0603	TDK, C1608C0G1H332J
6	1	C9	CAP, CER, 4.7 μ F, 6.3V, X5R, 20%, 0603	TDK, C1608X5R0J475M
7	1	C10	CAP, CER, 4.7 μ F, 50V, 20%, X7R, 1812	TDK, C4532X7R1H475M/2.00
8	1	C11	CAP, CER, 10pF, 50V, C0G, 0402	TDK, C1005C0G1H100D
9	1	C12	CAP, CER, 1.0 μ F, 50V, X7R, 20%, 1206	TDK, C3216X7R1H105M
10	1	C13	CAP, CER, 0.1 μ F, 50V, 20%, X7R, 0805	TDK, C2012X7R1H104M/0.85
11	1	L1	INDUCTOR, 10 μ H, \pm 20%	COILCRAFT, MSS1048-103MLB
12	2	R1, R6	RES, 1.00M Ω , 1/16W, 1%, 0402, SMD	VISHAY, CRCW04021M00FKED
13	1	R2	RES, 249k Ω , 1/16W, 1%, 0402, SMD	VISHAY, CRCW0402249KFKED
14	1	R3	RES, 15.0k Ω , 1/10W, 1%, 0402, SMD	PANASONIC, ERJ-2RKF1502X
15	1	R4	RES, 60.4k Ω , 1/10W, 1%, 0402, SMD	PANASONIC, ERJ-2RKF6042X
16	1	R7	RES, 47.5k Ω , 1/16W, 1%, 0402, SMD	VISHAY, CRCW040247K5FKED
17	1	U1	40V, 2A Buck Boost DC/DC Converter	LINEAR TECHNOLOGY, LTC3115EDHD-1
Additional Demo Board Circuit Components				
1	0	C3	CAP, CER, 1000PF, 50V, 20%, X7R, 0402 (OPT)	TDK, C1005X7R1H102M
2	0	C5	CAP, ALUM, 150 μ F, 50V, 20%, RADIAL (OPT)	PANASONIC, EEU-FM1H151
3	0	D1	DIODE SCHOTTKY, 20V, 1A, SOD323 (OPT)	NXP SEMI, PMEG2010EA
4	0	D2	DIODE SCHOTTKY, 60V, 3A, SMA (OPT)	DIODES INC., B360A-13
5	0	R5	RES, 0402 (OPT)	
Hardware For Demo Board Only:				
1	4	E1-E4	TP, TURRET, 0.094", PBF	MILL-MAX, 2501-2-00-80-00-00-07-0
2	2	JP1, JP2	JMP, 3-PIN 1 ROW .079CC	SAMTEC, TMM-103-02-L-S
3	2	XJP1, XJP2	SHUNT, .079" CENTER	SAMTEC, 2SN-BK-G
4	4		SPACER STACKING #4 SCREW NYLON .500"	KEYSTONE, 8833

SCHEMATIC DIAGRAM



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DEMONSTRATION BOARD IMPORTANT NOTICE

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Please read the DEMO BOARD manual prior to handling the product. Persons handling this product must have electronics training and observe good laboratory practice standards. **Common sense is encouraged.**

This notice contains important safety information about temperatures and voltages. For further safety concerns, please contact a LTC application engineer.

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