LTC3115-1
40V, 2A Synchronous Buck-Boost DC/DC Converter

DESCRIPTION

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

The DC1687B 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 DC1687B operates with a 2.7V to 40V input voltage range. The demo board has been designed with the output voltage set to 5V. 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.

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

Note: This manual is intended to be used with an updated version of the demo board titled, "Demo Circuit 1687B." See Figure 3.

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 40V. 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 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)

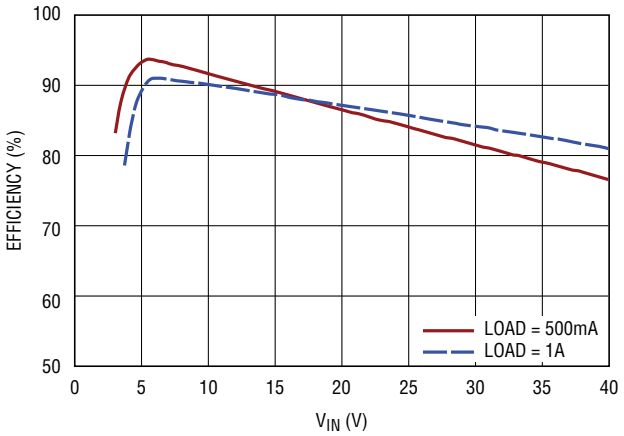


Figure 1. DC1687B Efficiency in PWM Mode

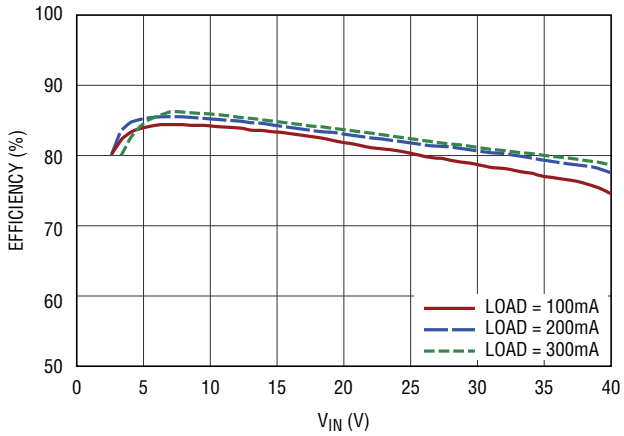


Figure 2. DC1687B Efficiency in Burst Mode Operation

QUICK START PROCEDURE

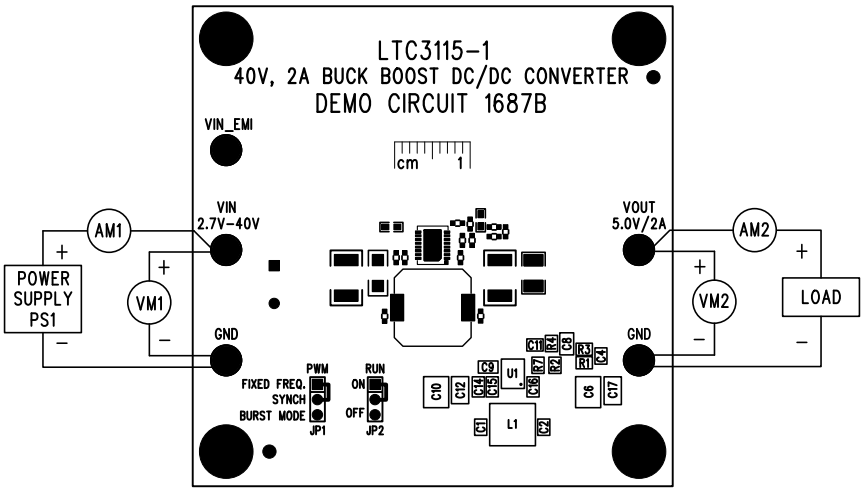


Figure 3. Proper Measurement Equipment Setup

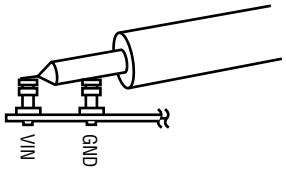
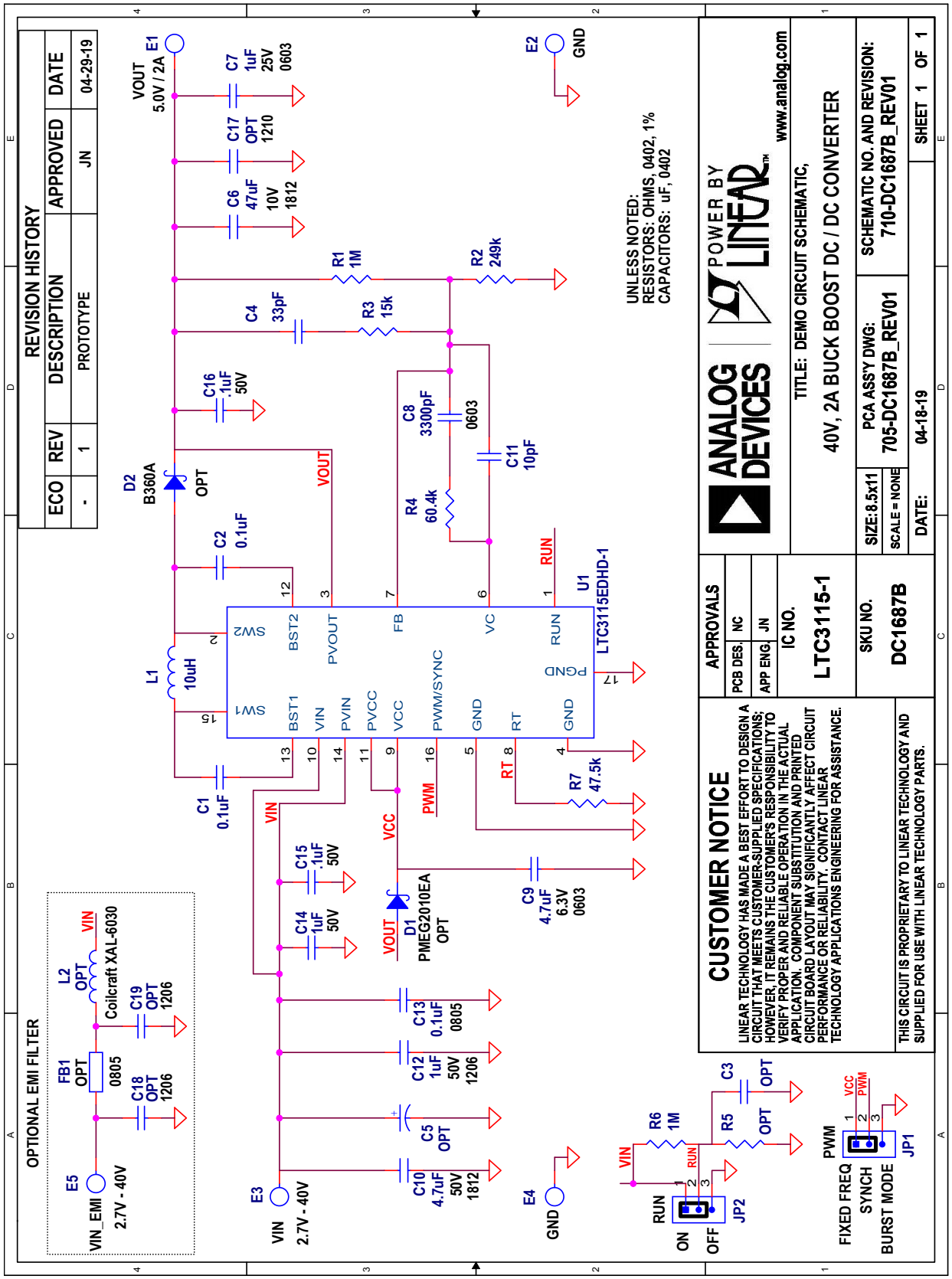


Figure 4. Measuring Input or Output Ripple

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION		MANUFACTURER/PART NUMBER
Required Circuit Components					
1	2	C1,C2	CAP CER 0.10uF 16V X7R ±20% 0402		TDK, C1005X7R1C104M
2	1	C4	CAP CER 33pF 50V C0G 5% 0402		TDK, C1005C0G1H330J
3	1	C6	CAP CER 47uF 10V 20% X5R 1812		TDK, C4532X5R1A476M
4	1	C7	CAP CER 1.0uF 25V X5R 0603		TDK, C1608X5R1E105M
5	1	C8	CAP CER 3300pF 50V 5% NP0 0603		TDK, C1608C0G1H332J
6	1	C9	CAP CER 4.7uF 6.3V X5R 20% 0603		TDK, C1608X5R0J475M
7	1	C10	CAP CER 4.7uF 50V 20% X7R 1812		TDK, C4532X7R1H475M/2.00
8	1	C11	CAP CER 10pF 50V C0G 0402		TDK, C1005C0G1H100D
9	1	C12	CAP CER 1.0uF 50V X7R 20% 1206		TDK, C3216X7R1H105M
10	1	C13	CAP CER 0.1uF 50V 20% X7R 0805		TDK, C2012X7R1H104M/0.85
11	1	C14	CAP CER 1UF 50V X5R 0402		TAIYO YUDEN, UMK105CBJ105MV-F
12	2	C15,C16	CAP CER 0.1UF 50V X7R 0402		TDK, CGA2B3X7R1H104K050BB
13	1	L1	INDUCTOR, 10uH, +/-20%		COILCRAFT, MSS1048-103MLB
14	2	R1,R6	RES, 1.00M OHM 1/16W 1% 0402 SMD		VISHAY, CRCW04021M00FKED
15	1	R2	RES, 249k OHM 1/10W 1% 0402 SMD		VISHAY, CRCW0402249KFKED
16	1	R3	RES, 15.0k OHM 1/10W 1% 0402 SMD		PANASONIC, ERJ-2RKF1502X
17	1	R4	RES, 60.4k OHM 1/10W 1% 0402 SMD		PANASONIC, ERJ-2RKF6042X
18	1	R7	RES, 47.5k OHM 1/10W 1% 0402 SMD		VISHAY, CRCW040247K5FKED
19	1	U1	40V, 2A BUCK BOOST DC/DC CONVERTER		ANALOG DEVICES, 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 150uF 50V 20% RADIAL	(OPT)	PANASONIC, EEU-FM1H151
3	0	C17	CAP CER 1210	(OPT)	
4	0	C18,C19	CAP CER 1206 4.7uF	(OPT)	
5	0	D2	DIODE SCHOTTKY 60V 3A SMA	(OPT)	DIODES INC.,B360A-13
6	1	D1	DIODE SCHOTTKY, 20V 1A SOD323	(OPT)	NXP SEMI, PMEG2010EA
7	0	R5	RES, 0402	(OPT)	
8	0	L2	INDUCTOR, 2.2uH	(OPT)	COILCRAFT XAL60XX SERIES
9	0	FB1	FERRITE BEAD	(OPT)	WURTH, 782853121
Hardware For Demo Board Only					
1	5	E1-E5	TP, TURRET, 0.094", PBF		MILL-MAX, 2501-2-00-80-00-00-07-0
2	2	JP1, JP2	JMP, 3PIN 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



ESD Caution
ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

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