LTC3114EDHC-1
40V, 1A Synchronous Buck-Boost DC/DC Converter with Output Current Limit

DESCRIPTION

Demonstration circuit 1821B features the LTC®3114-1, a wide operating range synchronous monolithic buck-boost converter with programmable average output current.

The DC1821B demo board has two user selectable operating modes: Burst Mode® operation and Fixed Frequency PWM (JP2). There is also an accurate programmable RUN pin which is used to ENABLE the converter (JP1).

The LTC3114-1 uses average current mode control to simplify voltage loop compensation and provide good line and load transient response.

The DC1821B operates with a 2.7V to 40V input voltage range. The demo board has been designed with the output voltage set to 5V. The LTC3114-1 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.

In PWM mode, the LTC3114-1 operates at 1.2MHz to optimize small size with high efficiency operation.

The demo board also incorporates diode D1 to backfeed V_{CC} to improve efficiency in some applications. If the demo board output voltage is changed to a higher voltage, D1 should be removed. Consult the data sheet for more information.

Figure 1 shows typical demo board efficiency. Figure 2 shows the response to an input voltage step while Figure 3 shows the load step response.

The LTC3114-1 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/DC1821B

PERFORMANCE SUMMARY

Specifications are at T_A = 25°C

PARAMETER	TYP
Input Voltage Range	2.7V to 40V
V_{OUT}	5V
I_{OUT} (See Note 1)	1A for V_{IN} > 6V
Efficiency	See Figure 1

NOTE 1: The demo board output current is a function of V_{IN}. Please refer to the data sheet for more information.

DESCRIPTION

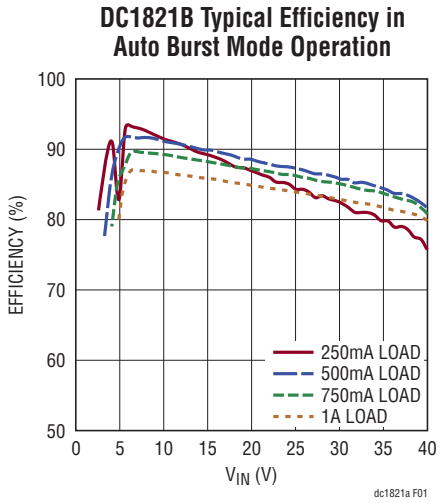


Figure 1. DC1821B Efficiency in Auto Burst Mode Operation

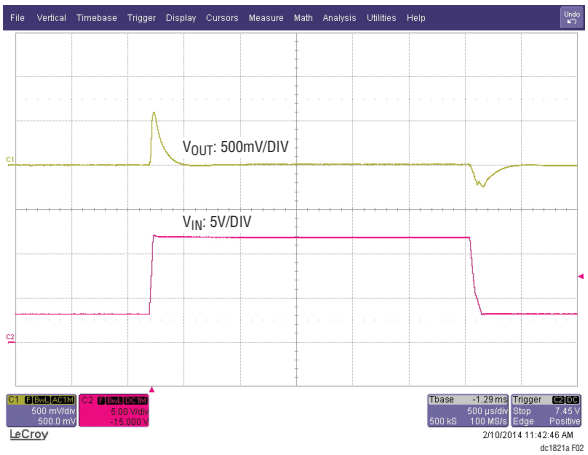


Figure 2. DC1821B Input Voltage Step Response. V_{IN} Stepped from 3.3V to 12V I_{OUT} is 500mA

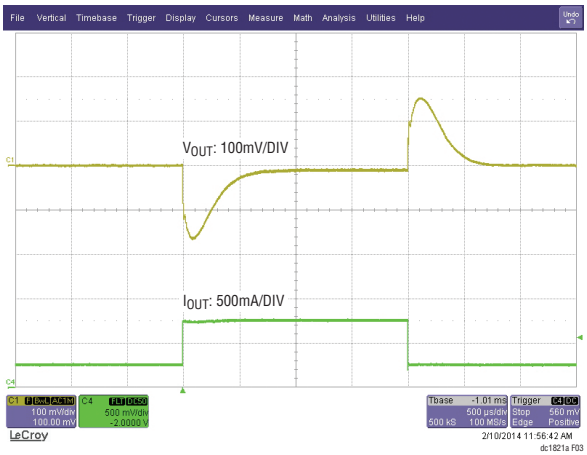


Figure 3. DC1821B Step Load Response. V_{IN} = 12V Load Step is from 250mA to 750mA

QUICK START PROCEDURE

Using short twisted pair leads for any power connections and with all loads and power supplies off, refer to Figure 4 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 5), or by using an oscilloscope probe tip jack.

1. Jumper and PS1 settings to start:

   PS1: OFF

   JP1: RUN ON

   JP2: MODE FIXED FREQUENCY

2. With power OFF connect the power supply (PS1) as shown in Figure 4. If accurate current measurements are desired (for efficiency calculations for example) 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 4 (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 4V.
5. Verify V_{OUT} is ~5V.
6. V_{IN} can now be varied between 2.7V and 40V. I_{OUT} may need to be reduced for V_{IN} < 4V.
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} > 5V I_{OUT} can be increased to 1A.
8. For operation in Burst Mode operation move Jumper JP2 to BURST. 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)
10. NOTE: If V_{OUT} is changed to a voltage higher than 5V, D1 should be removed or the LTC3114-1 could be damaged.

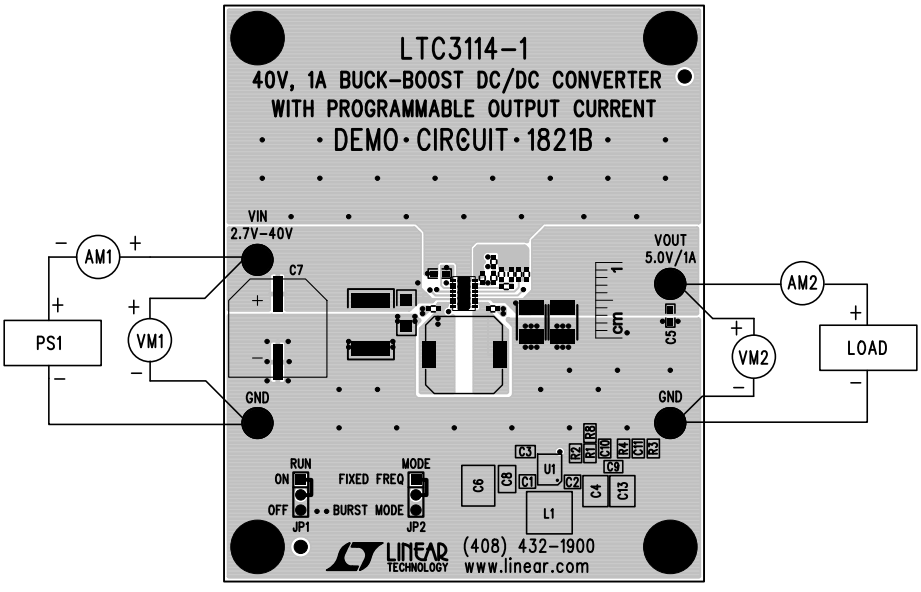


Figure 4. Proper Measurement Equipment Setup

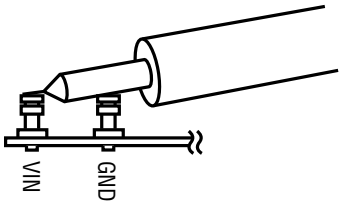
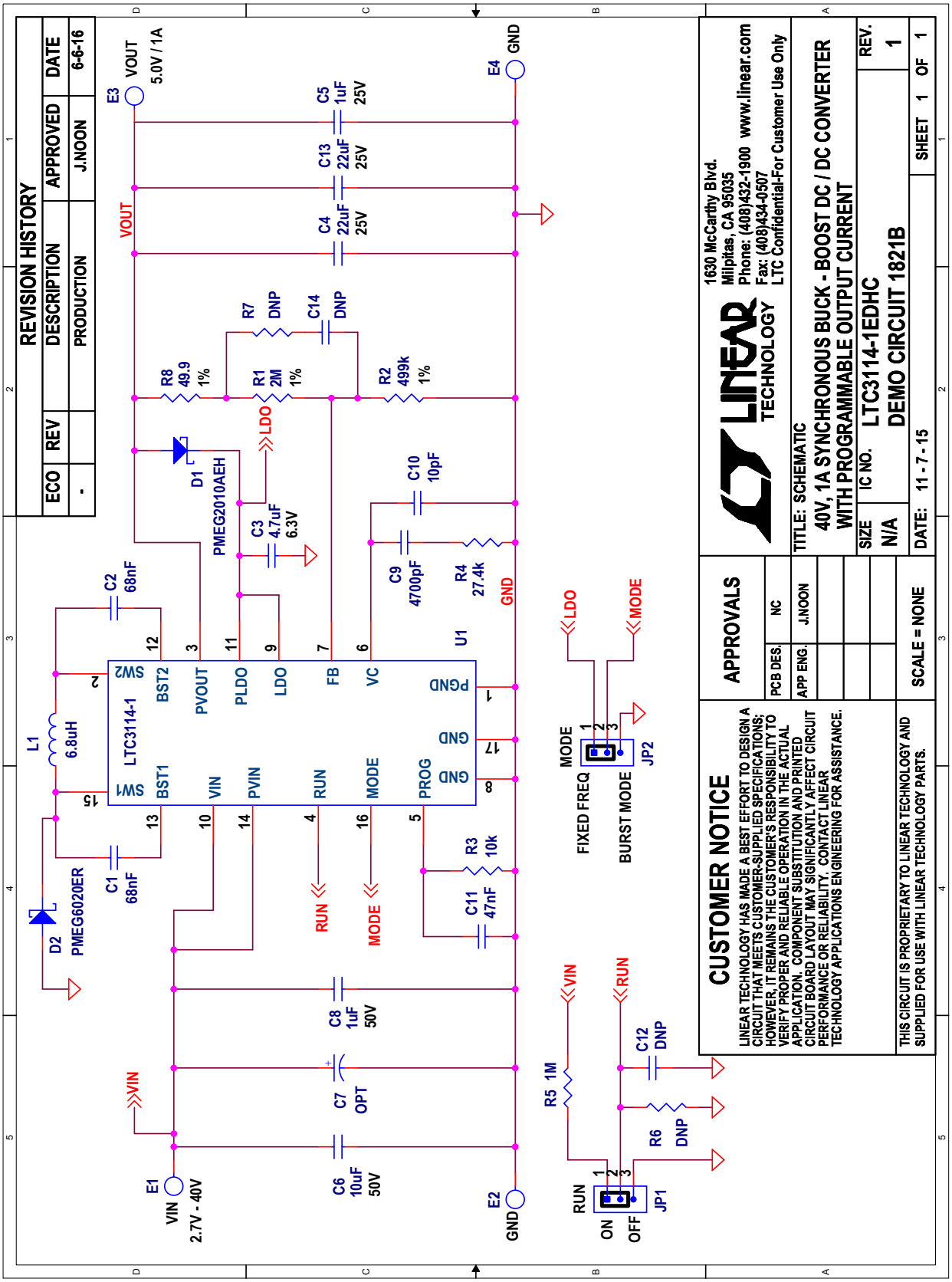


Figure 5. Measuring Input or Output Ripple

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	2	C1, C2	CAP CER 0.068µF 16V 10% X7R 0402	TDK, C1005X7R1C683K
2	1	C3	CAP CER 4.7µF 6.3V X5R 20% 0603	TDK, C1608X5R0J475M
3	2	C4, C13	CAP CER 22µF 25V X7R 20% 1812	TDK, C4532X7R1E226M
4	1	C5	CAP CER 1.0µF 25V X5R 0603	TDK, C1608X5R1E105M
5	1	C6	CAP CER 10µF 50V 20% X7R 2220	TDK, C5750X7R1H106M230KB
6	1	C8	CAP CER 1.0µF 50V X7R 20% 1206	TDK, C3216X7R1H105M
7	1	C9	CAP CER 4700pF 25V X7R 10% 0402	TDK, C1005X7R1E472K
8	1	C10	CAP CER 10pF 50V C0G 0402	TDK, C1005C0G1H100D
9	1	C11	CAP CER 0.047µF 25V 20% X7R 0402	TDK, C1005X7R1E473M050BC
10	1	D1	DIODE SCHOTTKY 20V	NXP, PMEG2010AEH
11	1	D2	DIODE SCHOTTKY 60V, 2A	NXP, PMEG6020ER,115
12	1	L1	INDUCTOR, 6.8µH ±30%	COILCRAFT, MSS1048-682NLB
13	1	R1	RES 2.00M 1/16W 1% 0402 SMD	VISHAY, CRCW04022M00FKED
14	1	R2	RES 499k 1/16W 1% 0402 SMD	VISHAY, CRCW0402499KFKED
15	1	R3	RES SMD 10k 1% 1/16W 0402	VISHAY,CRCW040210K0FKED
16	1	R4	RES 27.4k 1/16W 1% 0402 SMD	VISHAY, CRCW040227K4FKED
17	1	R5	RES 1.00M 1/16W 1% 0402 SMD	VISHAY, CRCW04021M00FKED
18	1	R8	RES 49.9Ω 1/16W 1% 0402 SMD	VISHAY, CRCW040249R9FKED
19	1	U1	40V, 1A BUCK-BOOST DC/DC CONVERTER WITH PROGRAMMABLE OUTPUT CURRENT	LINEAR TECHNOLOGY, LTC3114MDHC-1
Additional Demo Board Circuit Components				
20	0	C7	CAP 330µF 63V ELECT MVA SMD	UNITED CHEMI-CON EMVA630ADA331MKG5S
21	0	C12	CAP CER 1000pF 25V X7R 0402	TDK, C1005X7R1E102M
22	0	C14	DNP	
23	0	R6, R7	DNP	
Hardware for Demo Board Only				
24	4	E1, E2, E3, E4	TURRET, 0.09" DIA	MILL-MAX, 2501-2-00-80-00-00-07-0
25	2	JP2, JP1	HEADERS, 3 PINS, 2mm CTRs	SULLINS, NRPN031PAEN-RC
26	2	XJP1, XJP2	SHUNT, 2mm CTRs	SAMTEC, 2SN-BK-G
27	4	STAND OFF	STAND-OFF, NYLON 0.50" TALL	KEYSTONE, 8832 (SNAP ON)

SCHEMATIC DIAGRAM



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Mailing Address:

Linear Technology
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