LTC3129
15V, 200mA Synchronous Buck-Boost DC/DC Converter with 1.3µA Quiescent Current

DESCRIPTION

Demonstration Circuit 1922A features the LTC®3129, a high efficiency 200mA buck-boost DC/DC converter with a wide V_{IN} and V_{OUT} range.

The DC1922A demo board has two user selectable operating modes: Burst Mode® Operation and Fixed Frequency PWM (JP3). There is also an accurate programmable RUN pin which is used to ENABLE the converter (JP1). The LTC3129 also incorporates a maximum power point control function which can be enabled (JP2) for applications where the input source is a solar cell or is high impedance, such as intrinsically safe applications or high Z_{OUT} thermal electric generators (TEGs).

The DC1922A operates with a 2.42V to 15V input voltage range, and has been designed with the output voltage set to 5.0V. Once the converter is started the LTC3129 can operate with V_{IN} as low as 1.92V provided V_{CC} is backfed. The demo board has optional provisions to backfeed V_{CC} (D1) in order to increase efficiency in some 5V output applications, or to allow operation with V_{IN} down to 1.92V. Consult the data sheet for more information on these options.

The DC1922A demo board also incorporates a connector (J1) which can be used to connect to a Dust Networks Mote demo board.

Figure 1 shows typical demo board efficiency and Figure 2 shows typical step response.

The LTC3129 data sheet has detailed information about the operation, specification, 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

PERFORMANCE SUMMARY

Specifications are at T_A = 25°C

PARAMETER	VALUE
Input Voltage Range	2.42V to 15V
V_{OUT}	5.0V
I_{OUT} (See Note 1)	200mA, for $V_{IN} > V_{OUT}$
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

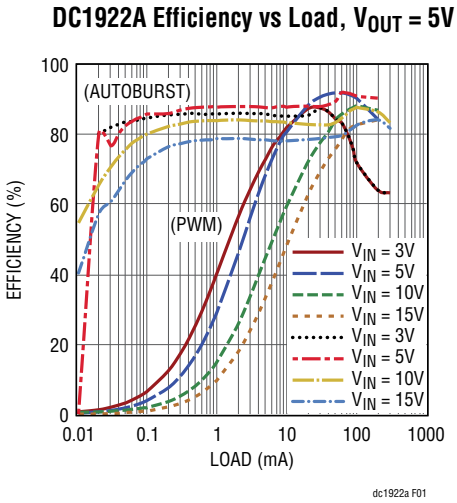


Figure 1. DC1922A Efficiency in AUTOBURST MODE

Figure 2. DC1922A Step Response

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 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, PS1 and LOAD settings to start:

   PS1 = OFF

   JP1 (RUN) = ON

   JP2 (MPPC) = OFF

   JP3 (PWM) = BURST MODE OPERATION

   JP4 (DUST PWR) = NC

2. With power OFF connect the power supply (PS1) as shown in Figure 3. If accurate current measurements are desired (for efficiency calculations for example) then connect an ammeter (AM1) in series with the supply as shown. The ammeter is not required however.
3. Connect a 50mA load to V_{OUT} as shown in Figure 3 (100Ω for V_{OUT} = 5V). Connect an ammeter (AM2) 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 2.42V and 15.0V. 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 $V_{IN} > V_{OUT}$ I_{OUT} can be increased to 200mA. For $V_{IN} < V_{OUT}$ I_{OUT} capability will be reduced.
8. For operation in fixed frequency (PWM) mode move Jumper JP3 to FIXED FREQ. See the data sheet for more information on Burst Mode operation.
9. NOTE: If V_{OUT} drops out of regulation, check to be sure that V_{IN} is not below the minimum value for regulation (see data sheet).

For USE with a Solar Cells/MPPC:

10. With power OFF move jumper MPPC (JP2) to ON.
11. If using a power supply as the source, place a minimum of 10Ω, 10W resistor in series with the input to simulate the source resistance. If using a solar cell (s) or high impedance source, no additional resistance should be needed.
12. Set resistor R9 to a value which will set the MPPC pin to the desired voltage. See the data sheet section “Programming the MPPC Voltage” for more information.
13. With no load and the MPPC voltage set, increase the source voltage above the MPPC set point. V_{OUT} should be in regulation. As the load is increased V_{IN} will drop until it reaches the MPPC set voltage. As the load is increased further, V_{OUT} will drop out of regulation, but V_{IN} will be regulated to the set point voltage. This is to prevent the input source from collapsing and to allow the maximum power to be extracted from the source.
14. Consult the data sheet for more information on maximum power point control (MPPC) operation.

QUICK START PROCEDURE

For USE with a DUST Networks MOTE demo board:

15. Connector J1 is designed to interface with a Dust Networks Mote demo board. Consult the Dust documentation for optimal V_{OUT} regulation setting. In general the Dust Networks Mote will operate with V_{OUT} set to 3.3V. However, care should be taken to not overvoltage the Mote. Newer Motes may require a different V_{OUT}. The DC1922A demo board can be configured for different V_{OUT} voltages by simply changing R2.
16. The DC1922A demo board can be configured for V_{OUT} = 3.3V by changing resistor R2 to 1.1M for R1 = 2M.
17. Once the output voltage has been set to the proper voltage and with the power supply OFF connect DC1922A to the Dust Networks Mote demo board using J1. See Figure 5 and 6 for the proper connections and orientation. Move jumper JP4 to V_{OUT}.
18. Once the boards have been connected, turn on PS1 and increase the voltage to approximately 3V. V_{OUT} should now be in regulation. V_{IN} can now be varied over the operating range and V_{OUT} should remain in regulation.

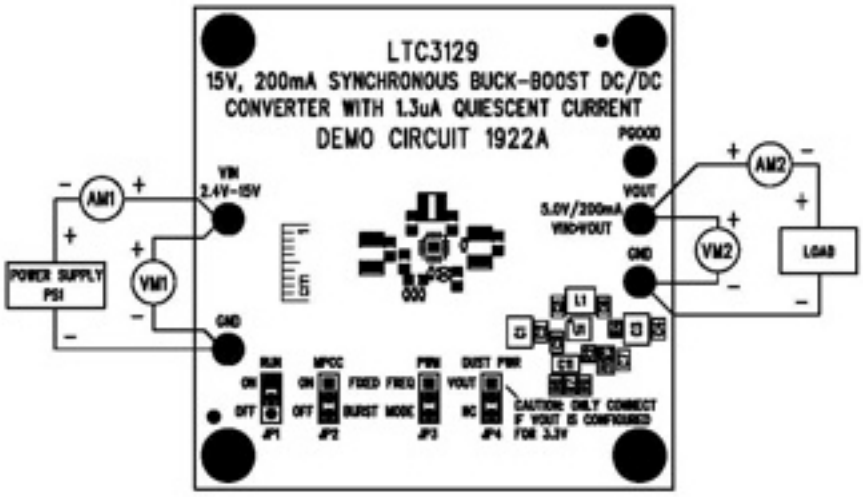


Figure 3. Proper Measurement Equipment Setup

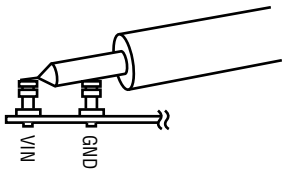


Figure 4. Measuring Input or Output Ripple

QUICK START PROCEDURE

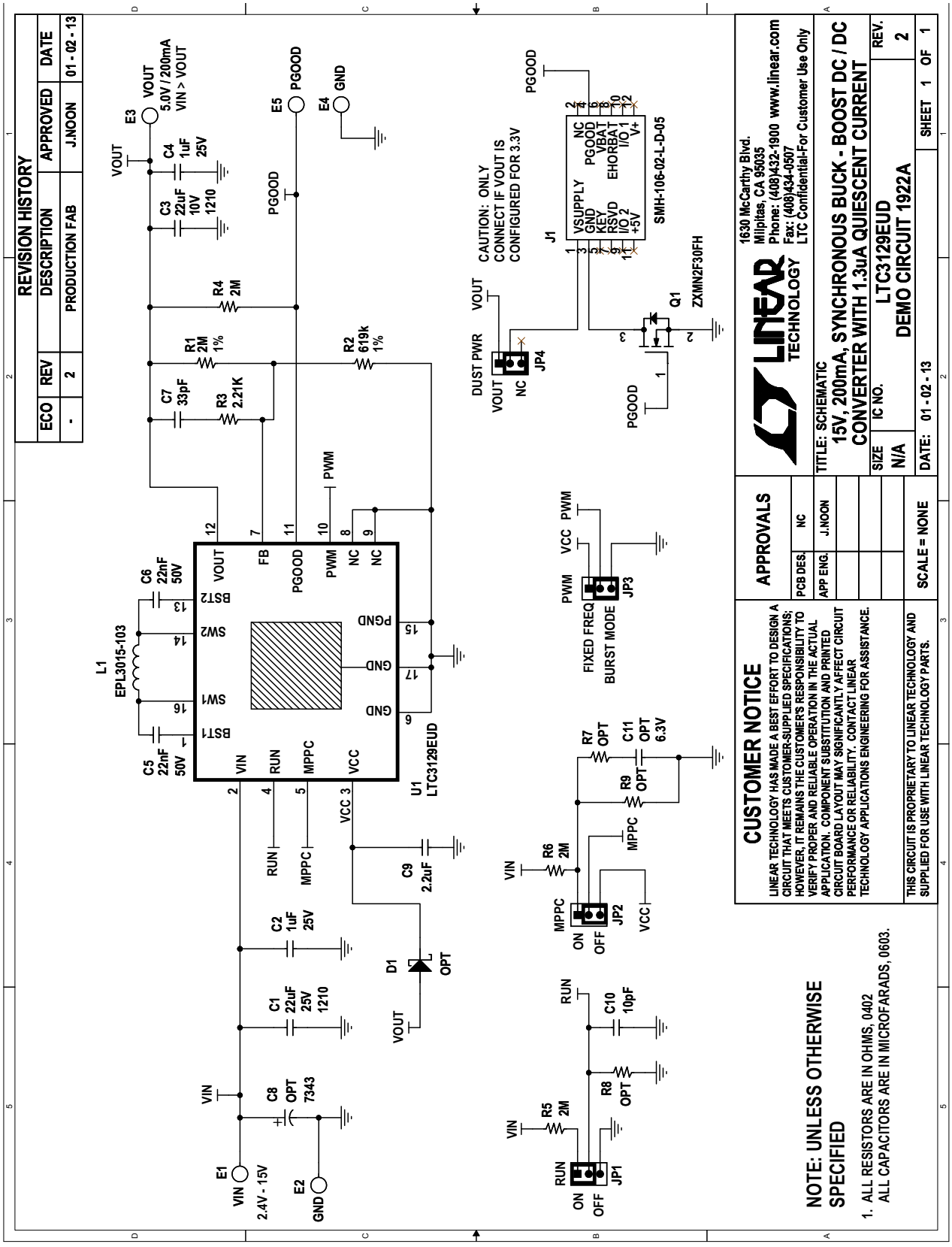
Figure 5. DC1922A Connected to DC9003 Dust Mote (Top View)

Figure 6. DC1922A Connected to DC9003 Dust Mote (Bottom View)

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	1	C1	CAP CER 22µF, 25V, X5R, 20%,1210	TDK, C3225X5R1E226M
2	2	C2, C4	CAP CER 1.0µF, 25V, X5R, 20%, 0603	TDK, C1608X5R1E105M
3	1	C3	CAP CER 22µF, 10V, X5R, 20%, 1210	TDK, C3225X5R1A226M
4	2	C5,C6	CAP CER 22000pF, 50V, X7R, 10%, 0603	TDK, C1608X7R1H223K
5	1	C7	CAP CER 33pF, 50V, 5%, NP0 0603	TDK, C1608C0G1H330J
6	1	C9	CAP CER 2.2µF, 10V, X7R, 20%, 0603	TDK, C1608X7R1A225M
7	1	C10	CAP CER 10pF, 50V, NP0, ±0.25pF 0603	TDK, C1608C0G1H100C
8	1	L1	INDUCTOR, 10µH	COILCRAFT, EPL3015-103
9	1	Q1	N-CHANNEL MOSFET, 20V, SOT23	DIODES/ZETEX, ZXMN2F30FHTA
10	4	R1, R4, R5, R6	RES,CHIP, 2.0M, 1/16W, 1%, 0402	VISHAY, CRCW04022M00FKED
11	1	R2	RES, CHIP, 619k, 1/16W,1%, 0402	VISHAY, CRCW0402619KFKED
12	1	R3	RES, CHIP, 2.21k, 1/16W, 1%, 0402	VISHAY, CRCW04022K21FKED
13	1	U1	15V, 200mA SYNCHRONOUS BUCK - BOOST DC / DC CONVERTER WITH 1.3µA QUIESCENT CURRENT	LINEAR TECHNOLOGY, LTC3129EUD
Additional Demo Board Circuit Components				
1	0	C8	CAP TANT 68µF, 20V, 10%, SMD 7343 (OPT)	OPT
2	0	C11	CAP CER 6.3V, 0603 (OPT)	OPT
3	0	D1	DIODE SCHOTTKY (OPT)	OPT
4	0	R7, R8, R9	RES 1/10W, 1%, 0402 SMD (OPT)	OPT
Hardware: For Demo Board Only				
1	5	E1, E2, E3, E4, E5	TESTPOINT, TURRET 0.094"	MILLMAX 2501-2-00-80-00-00-07-0
2	1	J1	HEADER, 2 × 6, 12-PIN, SMT HORIZONTAL SOCKET W/KEY, 0.100"	SAMTEC, SMH-106-02-L-D-05
3	4	JP1, JP2, JP3, JP4	JMP, 0.079 SINGLE ROW HEADER, 3 PIN	SAMTEC, TMM-103-02-L-S
4	4	XJP1, XJP2, XJP3, XJP4	SHUNT, .079" CENTER	SAMTEC, 2SN-BK-G
5	4	(STAND-OFFS)	STAND-OFF, NYLON 0.625" Tall	KEYSTONE, 8834(SNAP ON)

SCHEMATIC DIAGRAM



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