LTC3129-1
15V, 200mA Synchronous Buck-Boost DC/DC Converter with 1.3µA Quiescent Current

DESCRIPTION

Demonstration circuit 1923A features the LTC3129-1, a high efficiency 200mA buck-boost DC/DC converter with a wide V_{IN} and V_{OUT} range.

The DC1923A 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 LTC3129-1 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 LTC3129-1 also features fixed output voltages with eight user-selectable settings (JP4, JP5, JP6). This allows the user to eliminate the output voltage divider and the associated bias current.

The DC1923A operates with a 2.42V to 15V input voltage range, and has been designed with the output voltage set to 5V. The demo board can be programmed to any of the eight voltage settings by using jumpers JP4, JP5, and JP6.

Once the converter is started the LTC3129-1 can operate with V_{IN} as low as 1.92V provided V_{CC} is back-fed. Consult the data sheet for more information on these options.

The DC1923A 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 LTC3129-1 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	TYPICAL
Input Voltage Range	2.42V to 15V
VOUT	5V; 8 User Selectable Voltages
IOUT (see Note 1)	200mA, for VIN > V_{OUT}
Efficiency	See Figure 1

Note 1: The demo board output current is a function of VIN. Please refer to the data sheet for more information.

DESCRIPTION

DC1923A Efficiency vs Load, V_{OUT} = 5V

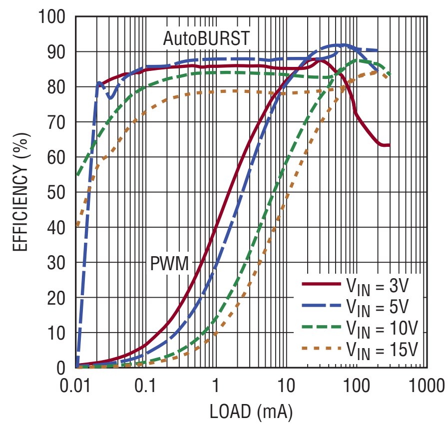


Figure 1. DC1923A Efficiency

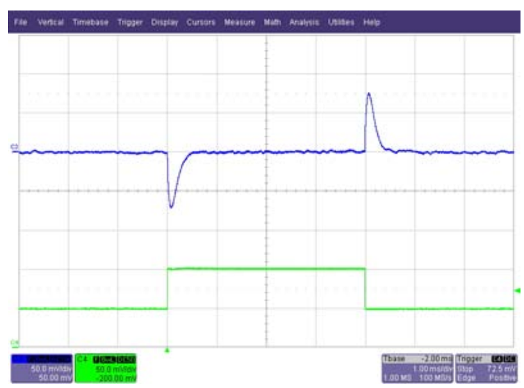


Figure 2. DC1923A 50mA to 100mA Output Step Response

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 VIN or VOUT 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
JP7:	DUST PWR	NC

To set VOUT = 5V

JP4:	VS1	VCC
JP5:	VS2	VCC
JP6:	VS3	GND

QUICK START PROCEDURE

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 VOUT as shown in Figure 3 (100Ω for VOUT = 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 VIN is 4V.
5. Verify VOUT is ~5V.
6. VIN can now be varied between 2.42V and 15V. VOUT should remain in regulation.
7. Load current (IOUT) can also be varied. The maximum IOUT is a function of VIN and the current limit. Consult the data sheet for more information on IOUT vs VIN. In general for VIN > VOUT IOUT can be increased to 200mA. For VIN < VOUT IOUT 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 VOUT drops out of regulation, check to be sure that VIN 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 R6 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. VOUT should be in regulation. As the load is increased VIN will drop until it reaches the MPPC set voltage. As the load is increased further, VOUT will drop out of regulation, but VIN 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.

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 VOUT regulation setting. In general the Dust Networks mote will operate with VOUT set to 3.3V. However, care should be taken to not overvoltage the mote. Newer motes may require a different VOUT. The DC1923A demo board can be configured for different VOUT voltages by simply changing jumpers JP4, JP5 and JP6. To configure the board for 3.3V set the jumpers as follows:

JP4:	VS1	VCC
JP5:	VS2	GND
JP6:	VS3	GND

16. Once the output voltage has been set to the proper voltage and with the power supply OFF connect DC1923A to the Dust Networks mote demo board using J1. See Figures 5 and 6 for the proper connections and orientation. Move jumper JP7 to VOUT.
17. Once the boards have been connected, turn on PS1 and increase the voltage to approximately 3V. VOUT should now be in regulation. VIN can now be varied over the operating range and VOUT should remain in regulation.

QUICK START PROCEDURE

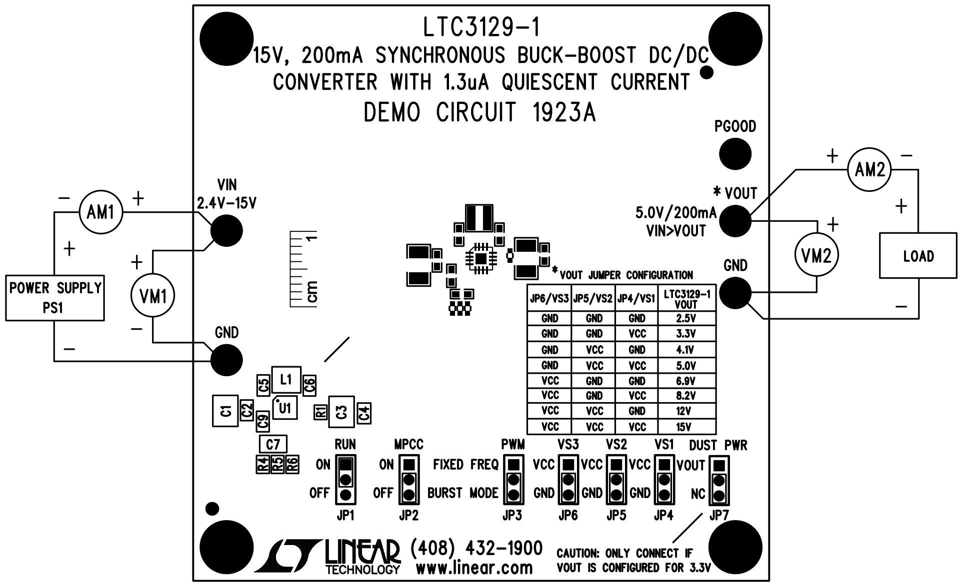


Figure 3. Proper Measurement Equipment Setup

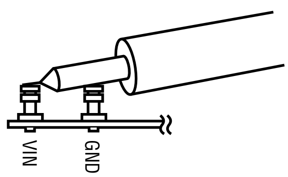


Figure 4. Measuring Input or Output Ripple

Figure 5. DC1923A Connected to DC9003A Dust Mote (Top View)

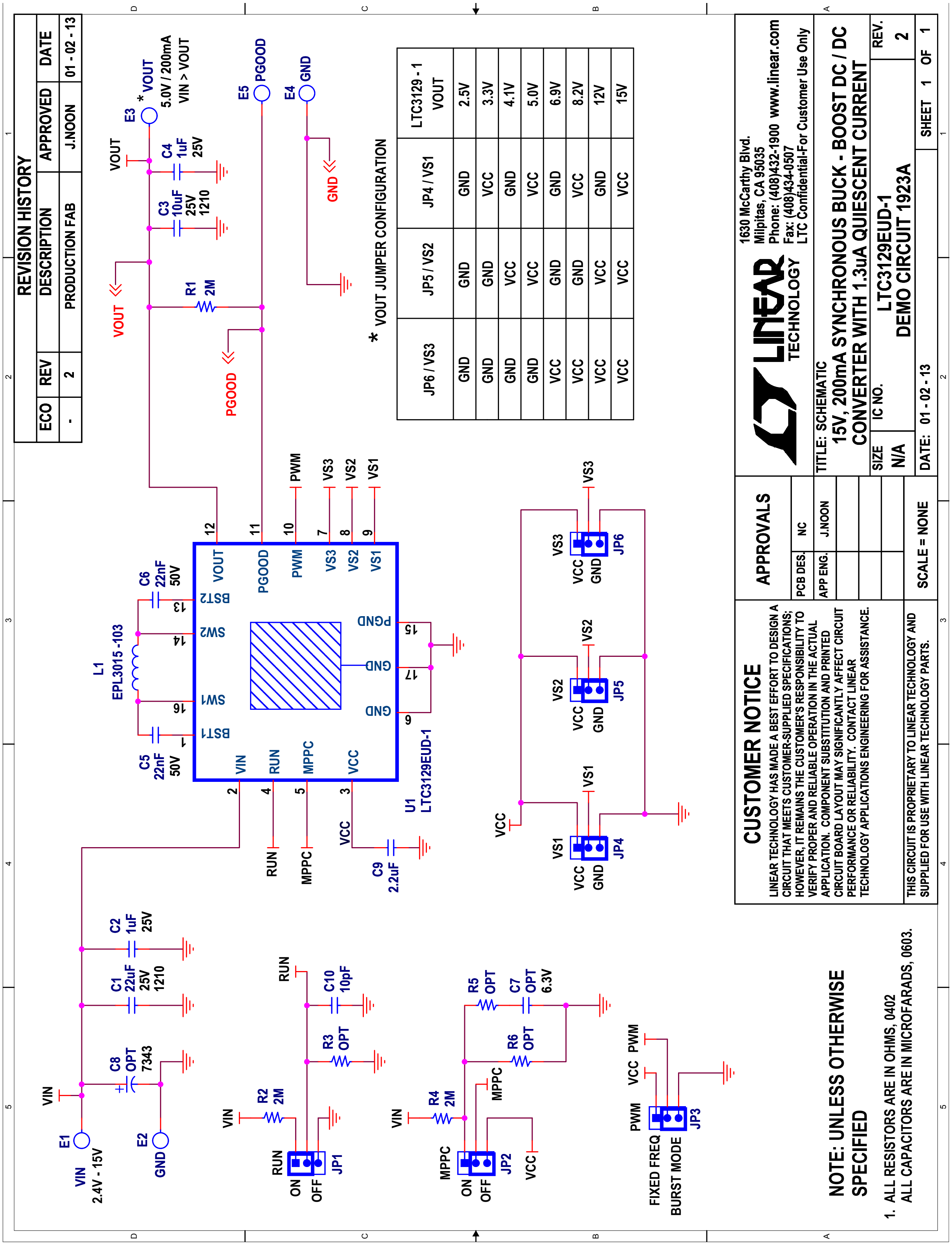
QUICK START PROCEDURE

Figure 6. DC1923A Connected to DC9003A 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 1µF 25V X5R 0603	TDK, C1608X5R1E105M
3	1	C3	CAP CER 10µF 25V X5R 1210	TDK, C3225X5R1E106M
4	2	C5, C6	CAP CER 22000pF 50V X7R 10% 0603	TDK, C1608X7R1H223K
5	1	C9	CAP CER 2.2µF 10V X7R 20% 0603	TDK, C1608X7R1A225M
6	1	C10	CAP CER 10pF 50V NP0 ±0.25pF 0603	TDK, C1608C0G1H100C
7	1	L1	INDUCTOR, 10µH	COILCRAFT, EPL3015-103
8	1	Q1	N-CHANNEL MOSFET, 20V, SOT23	DIODES/ZETEX, ZXMN2F30FHTA
9	3	R1, R2, R4	RES, CHIP, 2M, 1/16W, 1%, 0402	VISHAY, CRCW04022M00FKED
10	1	U1	15V, 200mA SYNCHRONOUS BUCK-BOOST DC/DC CONVERTER WITH 1.3µA QUIESCENT CURRENT	LINEAR TECHNOLOGY, LTC3129EUD-1
Additional Demo Board Circuit Components				
1	0	C7 (OPT)	CAP CER 0603	OPT
2	0	C8 (OPT)	CAP TANT 68µF 20V 10% SMD 7343	OPT
3	0	R3, R5, R6 (OPT)	RES 1/10W 1% 0402 SMD	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, 2X6, 12-PIN, SMT HORIZONTAL SOCKET w/KEY, 0.100"	SAMTEC, SMH-106-02-L-D-05
3	7	JP1-JP7	JMP, 0.079" SINGLE ROW HEADER, 3 PIN	SAMTEC, TMM-103-02-L-S
4	7	XJP1-XPJP7	SHUNT, 0.079" CENTER	SAMTEC, 2SN-BK-G
5	4	(STAND-OFFS)	STAND-OFF, NYLON 0.625" TALL	KEYSTONE, 8834(SNAP ON)

SCHEMATIC DIAGRAM



dc1923af

SCHEMATIC DIAGRAM

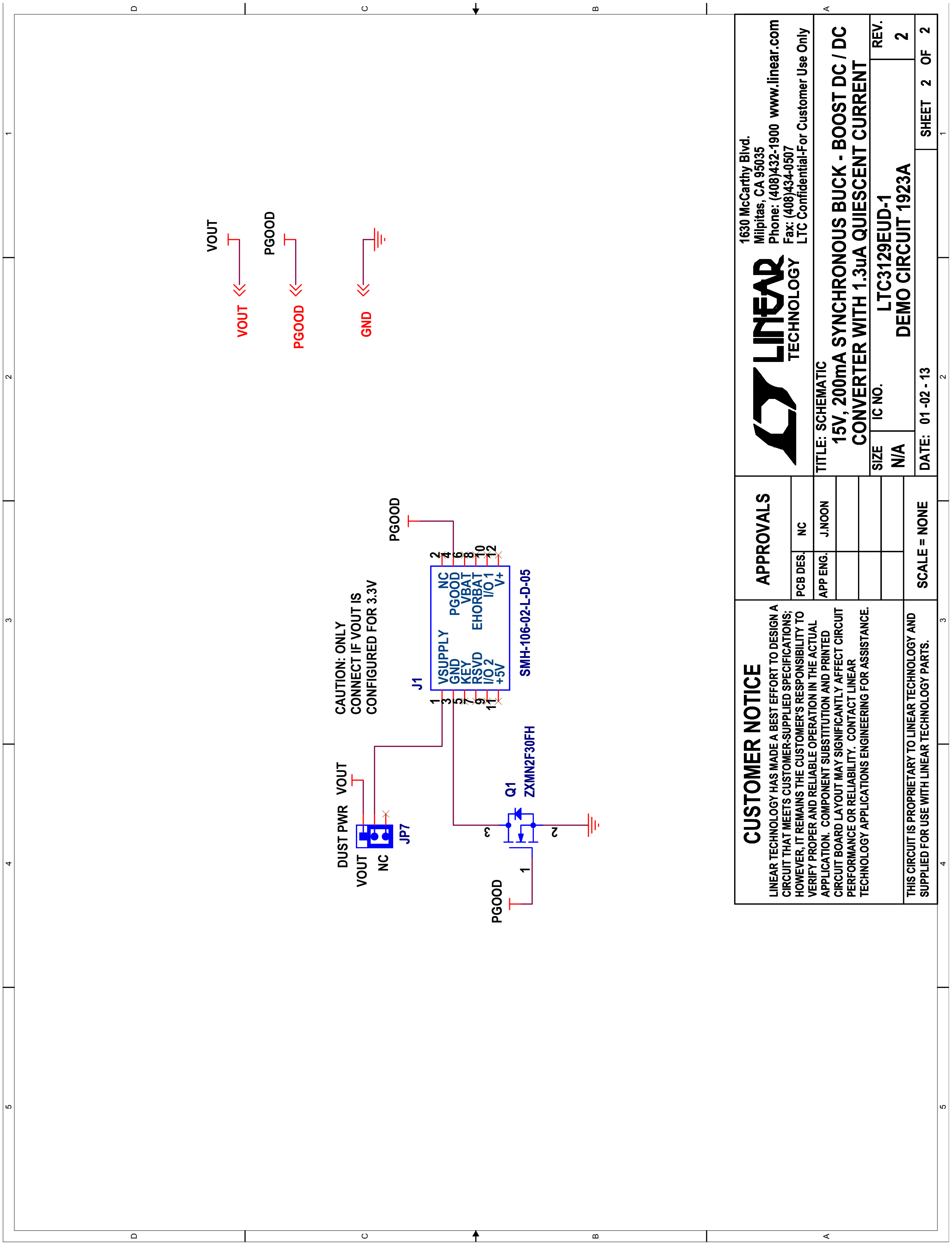


Figure 7. Circuit Schematic

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

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