

# LTC3108EDE/ LTC3108EDE-1 Ultralow Voltage Step-Up Converter and Power Manager

## DESCRIPTION

Demonstration Circuit 1582B featuring the LTC3108 is a highly integrated DC/DC converter optimized for harvesting and managing energy from extremely low input voltage sources such as thermoelectric generators (TEG). The step-up topology operates from input voltages as low as 20mV.

The DC 1582B Demonstration Circuit has been optimized for low start-up voltage with a 100:1 turns ratio transformer. For application where it is desirable to trade-off a higher start-up voltage for higher current, a lower turns ratio transformer can be used. Refer to the LTC3108 datasheet for more information.

The LTC3108 is designed to accumulate and manage energy over a long period of time to enable short bursts of power to be used to acquire and transmit data. The burst must occur at a low enough duty cycle such that the total output energy during the burst does not exceed the average source power integrated over the accumulation time between bursts.

The Demonstration Circuit has been set up with a storage capacitor that makes it easy to evaluate the general functionality of the circuit. The lower value capacitor allows for a fast charge time but limits the pulsed energy that can be drawn from it. Space is provided, and alternate part footprints have been built into the PCB to allow experimentation with larger capacitors for more energy storage. In a typical application, the larger output capacitors may be used. Refer to the datasheet for more information including equations to properly size the output capacitors for a given application.

The LTC3108 is available in two versions, the only difference being the VOUT and VOUT2 output voltages. Refer to the datasheets for more information.

**Design files for this circuit board are available. Call the LTC factory.**

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TABLE 1. Typical Specifications (25°C)

|                     |                                              |
|---------------------|----------------------------------------------|
| Input Voltage Range | 50mV-400mV (Typical no load start-up = 20mV) |
| VLDO                | 2.2V                                         |
| VOUT                | Jumper Selectable from 2.35 to 5.0V          |
| VOUT2               | Switched Output, VOUT2=VOUT                  |
| VSTORE              | 5.25V                                        |

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## QUICK START PROCEDURE

Using short twisted pair leads for any power connections and with all loads and power supplies off, refer to Figure 1 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.

Two versions of the demo board are available. Assembly build –A uses the LTC3108EDE while Assembly build –B uses the LTC3108EDE-1. The only difference is the VOUT and VOUT2 voltages.

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 VCC or VOUT and GND terminals. See Figure 2 for proper scope probe technique.

1. Jumper, Power Supply and LOAD Settings to start:  
PS1= OFF  
LOADS = OFF  
JP1 (VOUT2) = ON  
JP2= VAUX  
JP3 = VAUX
2. Turn on PS1 and slowly increase voltage until the voltage at VIN is 50mV. Monitor input current. If input current exceeds 50 mA turn off PS1 and look for shorts.
3. Confirm VLDO = 2.2V
4. Increase Vin = 100mV
5. Set LOAD on VLDO to 50 $\mu$ A. Set LOAD on VOUT = 25  $\mu$ A. Set LOAD on VOUT2 = 25  $\mu$ A.
6. For the –A version: Verify VLDO = 2.2V, VOUT  $\approx$  5.0V, VOUT2 $\approx$  5.0V, and VSTORE  $\approx$  5.2V
7. For the –B version: Verify VLDO = 2.2V, VOUT  $\approx$  4.5V, VOUT2 $\approx$  4.5V, and VSTORE  $\approx$  5.2V

The board is now ready for operation. The voltage on VOUT and VOUT2 can be modified by changing jumpers JP2 and JP3. The jumper combinations are shown on the demo board.

Several variations of this design are possible, including increasing the energy storage by populating C7, or C9. Please refer to the datasheet for design equations.

# LTC3108EDE

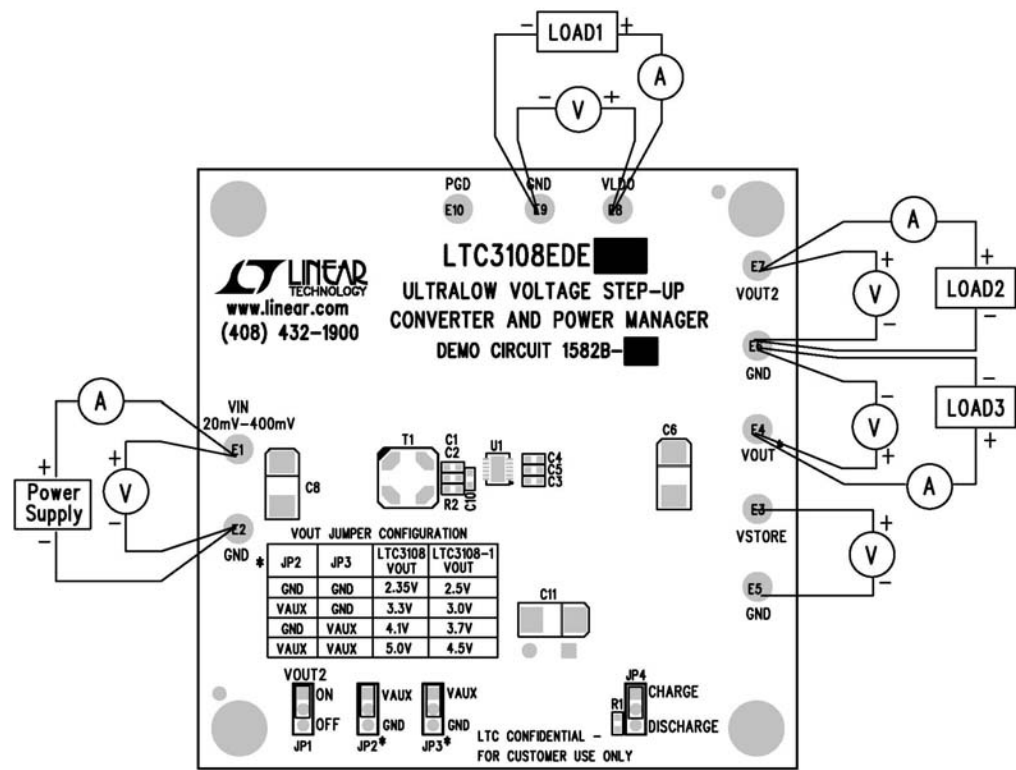


Figure 1. Connection Diagram

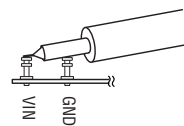


Figure 2. Measuring Input or Output Ripple

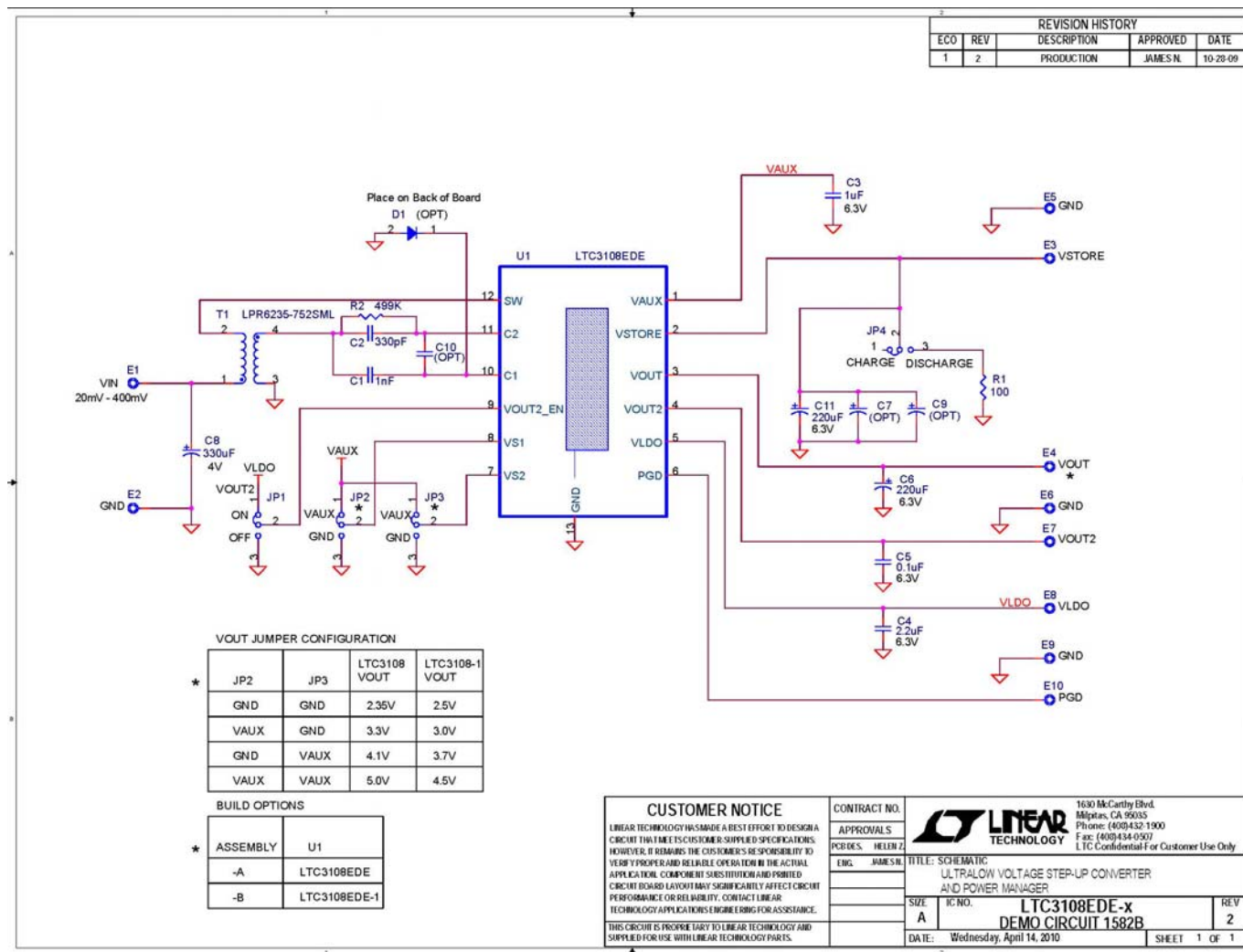


Figure 3. Circuit Schematic

|                                    |    |           |                                      |                                   |
|------------------------------------|----|-----------|--------------------------------------|-----------------------------------|
| 1                                  | 1  | C8        | CAP., POLYMER SMD, 330uF, 4V, 20%    | PANASONIC, EEFUE0G331ER           |
| 2                                  | 1  | C1        | CAP CER, X7R, 1000pF, 50V, 10%, 0603 | PANASONIC, ECJ-1VB1H102K          |
| 3                                  | 1  | C2        | CAP CER, X7R, 330pF, 50V, 10%, 0603  | PANASONIC, ECJ-1VC1H331J          |
| 4                                  | 1  | C3        | CAP CER, X5R, 1uF, 6.3V, 10%, 0603   | PANASONIC, ECJ-1VB0J105K          |
| 5                                  | 1  | C4        | CAP CER, X5R, 2.2uF, 6.3V, 20%, 0603 | PANASONIC, ECJ-1VB0J225K          |
| 6                                  | 1  | C5        | CAP CER, X7R, 0.1uF, 16V, 10%, 0603  | PANASONIC, ECJ-1VB1C104K          |
| 7                                  | 2  | C6,C11    | CAP., POLYMER SMD, 220uF, 6.3V, 20%  | PANASONIC, EEFUE0J221ER           |
| 8                                  | 1  | R1        | RES., CHIP, 100, 1/10W, 0603         | PANASONIC, ERJ-3EKF1000V          |
| 9                                  | 1  | R2        | RES., CHIP, 499K, 1/10W, 0603        | PANASONIC, ERJ-3EKF4993V          |
| 10                                 | 1  | T1        | TRANSFORMERS, 100:1 Turns Ratio      | COILCRAFT, LPR6235-752SML         |
| 11                                 | 1  | U1        | I.C. LTC3108EDE, DFN 4mm x 3mm       | LINEAR TECH., LTC3108EDE#PBF/-1   |
| Optional Components for Demo Board |    |           |                                      |                                   |
| 12                                 | 0  | C7 (OPT)  | CAP., 0.47F, 5.5V                    | COOPER/BUSSMAN, KR-5R5C474-R      |
| 13                                 | 0  | C9 (OPT)  | CAP., TANT, 2200uF, 6.3V             | VISHAY, 592D228X06R3X2T22H        |
| 14                                 | 0  | C10 (OPT) | OPT, 0603                            |                                   |
| 15                                 | 0  | D1(OPT)   | DIODE, SWITCHING DIODE, SOD-123      | DIODES INC, 1N4148W-7             |
| Hardware for Demo Board Only       |    |           |                                      |                                   |
| 16                                 | 10 | E1-E10    | TESTPOINT, TURRET, .095"             | MILL-MAX, 2501-2-00-80-00-00-07-0 |
| 17                                 | 4  | JP1-JP4   | 3 PIN 0.079 SINGLE ROW HEADER        | SAMTEC, TMM-103-02-L-S            |
| 18                                 | 4  | JP1-JP4   | SHUNT,                               | SAMTEC, 2SN-BK-G                  |
| 19                                 | 4  | STAND OFF | STAND-OFF, NYLON 0.50" tall          | KEYSTONE, 8833 (SNAP ON)          |

Figure 4. Bill of Materials

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