QUICK START GUIDE FOR DEMONSTRATION CIRCUIT 1225

HIGH EFFICIENCY SEPIC

LTC1871-1

DESCRIPTION

Demonstration circuit 1225 is high efficiency non-isolated SEPIC (Single Ended Primary Inductor Converter) converter featuring the LTC1871-1 switching controller. The DC1225 converts 5V to 20V input to 12V output and provides over 3A of output current. The converter operates at 300kHz with efficiency over 94%. With proper amount of airflow, the DC1225 converter can generate over 3A of output current. The DC1225 can be easily modified to generate output voltages in the range from 1.23V to 48V.

Also, the DC1225 can be modified for other input voltages like 5V-36V, 9V-36V, 36V-72V, and so on. The wider input voltage range will decrease the converter efficiency. Therefore, narrow input voltage range will be more desirable.

The LTC1871-1 can be synchronized to an external clock of up to 400kHz. Please refer to LTC1871-1 data sheet for design details and applications information.

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

Table 1. Performance Summary

PARAMETER	CONDITION	VALUE
Minimum Input Voltage	I_{OUT} = 0A to 3A	5V
Maximum Input Voltage	I_{OUT} = 0A to 3A	20V
V_{OUT}	V_{IN} = 5V to 20V, I_{OUT} = 0A to 3A	12V ±3%
Typical Output Ripple V_{OUT}	V_{IN} = 5V to 20V, I_{OUT} = 0A to 3A	100mV_{P-P}
Nominal Switching Frequency		300kHz

QUICK START PROCEDURE

Demonstration circuit 1225 is easy to set up to evaluate the performance of LTC1871-1 circuit. **Refer to Figure 1 for proper measurement equipment setup** and follow the procedure below:

NOTE: 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 2. for proper scope probe technique.

1. With power off, connect the input power supply to Vin and GND. Make sure that the input power supply has sufficient current rating at minimum input voltage for the required output load.
2. Turn on the power at the input.

   NOTE: Make sure that the input voltage does not exceed 20V.
3. Check for the proper output voltage.
   Vout = 12V, +/-3%.

   If there is no output, temporarily disconnect the load to make sure that the load is not set too high.
4. Once the proper output voltage is established, adjust the load within the operating range and observe the output voltage regulation, ripple voltage, efficiency and other parameters.

5. The DC1225 is equipped with an output capacitor CSYS (150uF) that approximates typical system rail capacitance. If system board already has capacitance of similar value CSYS can be removed.

6. The input capacitor Cin4 is optional and is used to help with filtering when board is connected to lab supply with long leads. The capacitor Cin4 can be removed if the input power source is close and has low source impedance.

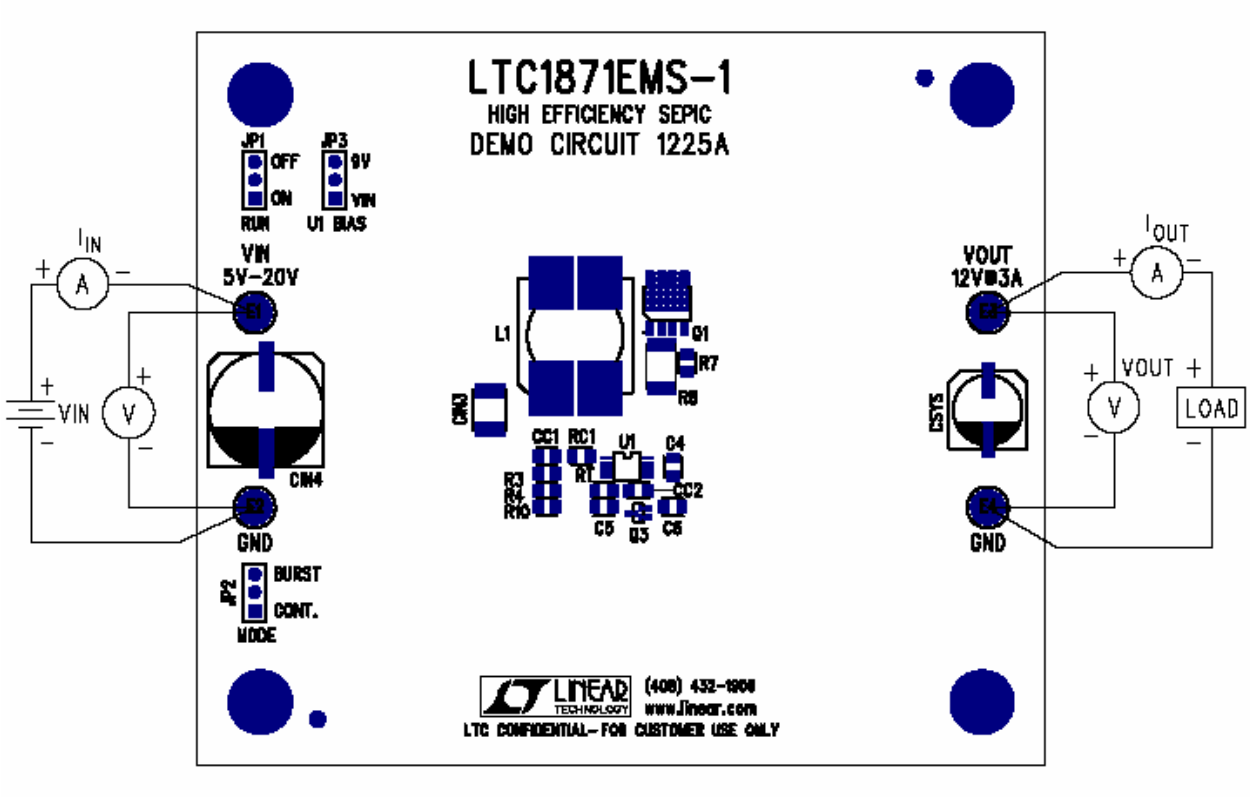


Figure 1. Proper Measurement Equipment Setup

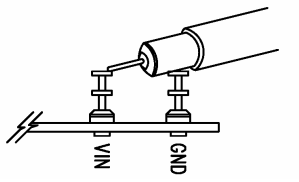


Figure 2. Scope Probe Placement for Measuring Input or Output Ripple

CHANGING THE OUTPUT VOLTAGE

To set the output voltage lower than 12V, change the bottom voltage divider resistor connected to FB pin of U1 (see the schematic on page 5). For example, to get 9V output, change R3 resistor value to 17.4k. However, keep in mind that changing the transformer as well may increase the efficiency.

To operate at higher input voltages the optional preregulator circuit Q2 can be used. Also, if the output voltage is in the range from 5V-36 the bias power for U1 can be diode-ORed from the output and input. Please contact LTC factory for details.

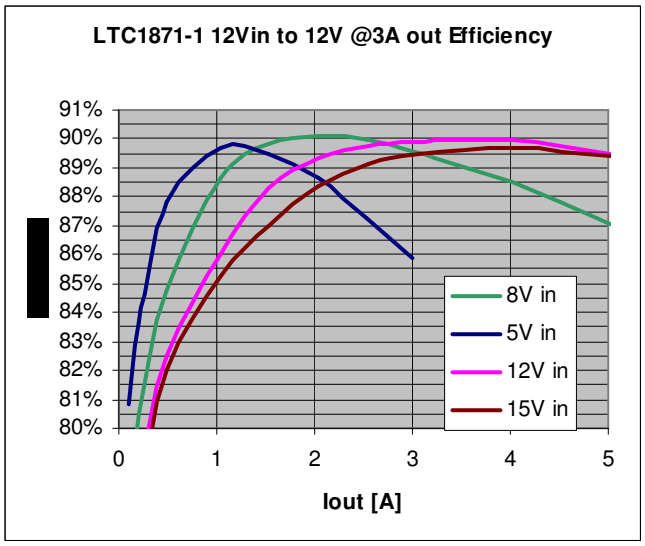


Figure 3. High efficiency of DC1225 allows the board to be used in thermally critical applications with outputs over 3A.

OUTPUT LOAD STEP RESPONSE

The load step response of DC1225 is very fast even though relatively small amount of output capacitance is present (120uF ceramic and 150uF electrolytic). The load step transients are shown in Figure 4.

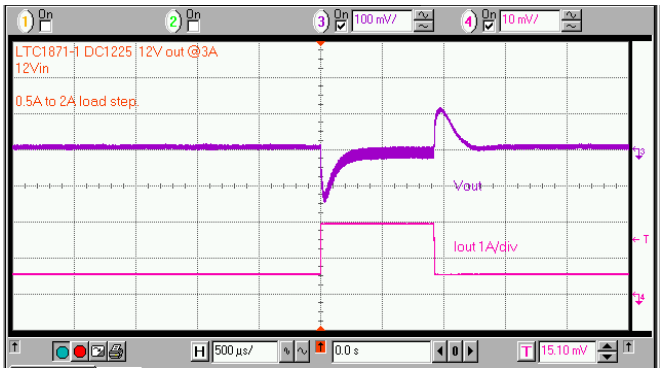


Figure 4. Fast transient response of DC1225 is achieved with a small ammount of output capacitance.

SOFT START FUNCTION

The DC1225 features Q3 soft-start circuit that controlls the inrush current and output voltage ramp at startup. The capacitor C5 controlls the startup period. The startup waveforms are shoen in figure 5.

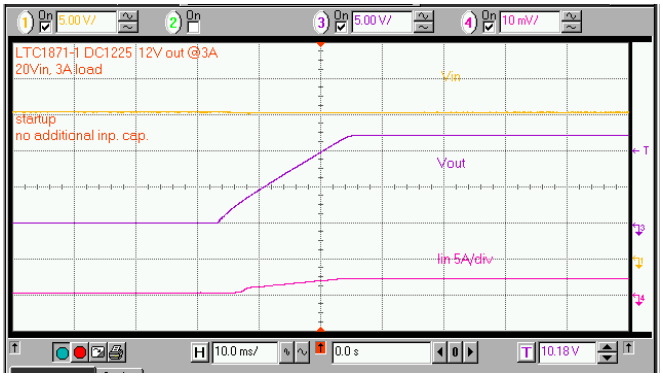
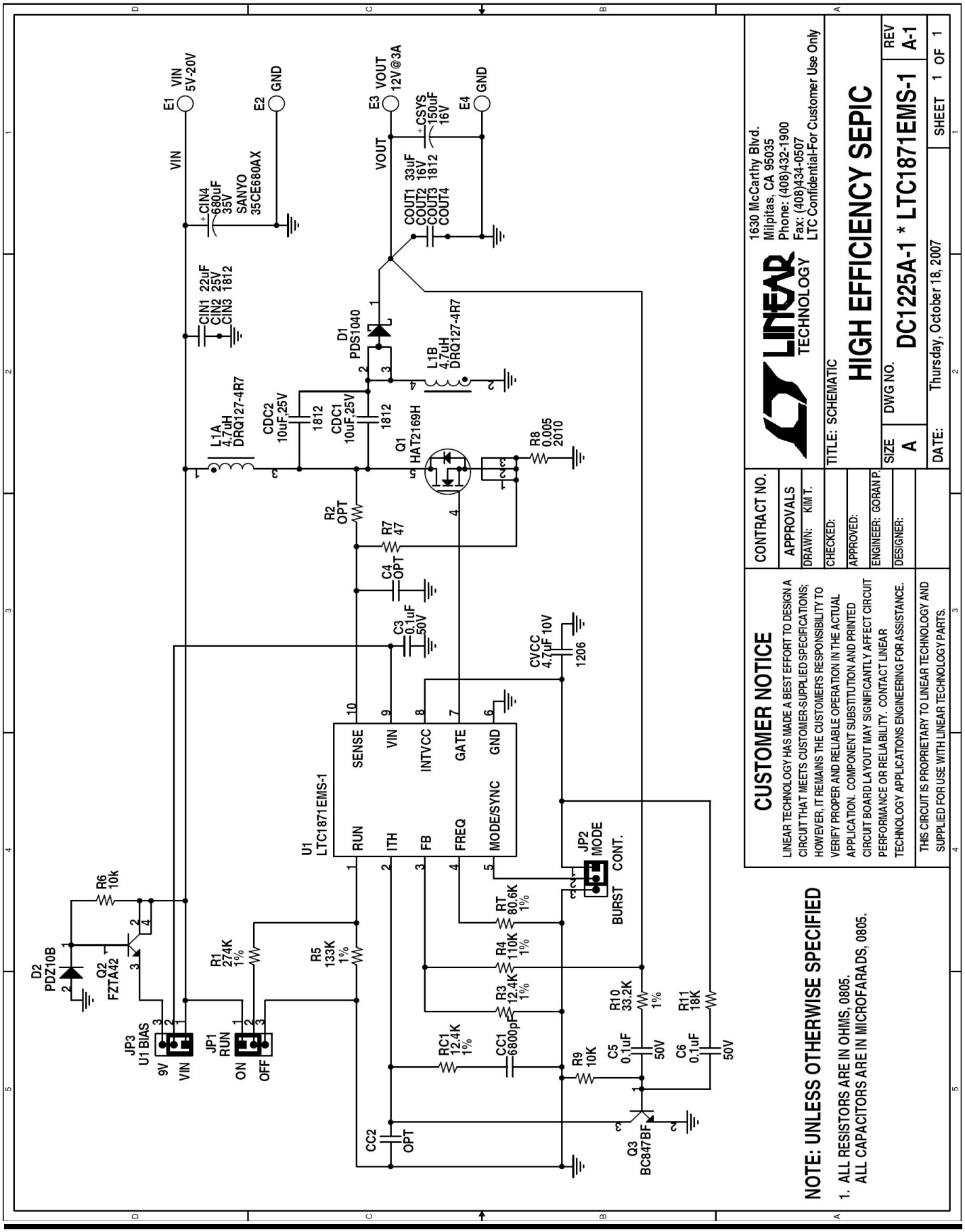


Figure 5. The DC1225 ramps the output slowly at startup without generating an input current surge.


E1 VIN 5V-20V
E2 GND
E3 VOUT 12V@3A
E4 GND
VIN
VOUT
+CIN4 680uF 35V SANYO 35CE680AX
CIN1 22uF 25V
CIN2 25V 1812
CIN3 1812
COUT1 33uF 16V 1812
COUT2
COUT3
COUT4
+CSYS 150uF 16V
D1 PDS1040
L1A 4.7uH DRQ127-4R7
L1B 4.7uH DRQ127-4R7
CDC2 10uF.25V 1812
CDC1 10uF.25V 1812
Q1 HAT2169H
R8 0.005 2010
R2 OPT
R7 47
C4 OPT
C3 0.1uF 50V
CVCC 4.7uF 10V 1206
U1 LTC1871EMS-1
RUN
ITH
FB
FREQ
MODE/SYNC
SENSE
VIN
INTVCC
GATE
GND
JP2 MODE BURST CONT.
RT 80.6K 1%
R4 110K 1%
R3 12.4K 1%
RC1 12.4K 1%
CC1 6800pF
R9 10K
R10 33.2K 1%
R11 18K
C5 0.1uF 50V
C6 0.1uF 50V
CC2 OPT
Q3 BC847BF
D2 PDZ10B
Q2 FZTA42
R6 10K
R1 274K 1%
R5 133K 1%
JP3 U1 BIAS 9V VIN
JP1 RUN ON OFF
CUSTOMER NOTICE
LINEAR TECHNOLOGY HAS MADE A BEST EFFORT TO DESIGN A CIRCUIT THAT MEETS CUSTOMER-SUPPLIED SPECIFICATIONS; HOWEVER, IT REMAINS THE CUSTOMER'S RESPONSIBILITY TO VERIFY PROPER AND RELIABLE OPERATION IN THE ACTUAL APPLICATION. COMPONENT SUBSTITUTION AND PRINTED CIRCUIT BOARD LAYOUT MAY SIGNIFICANTLY AFFECT CIRCUIT PERFORMANCE OR RELIABILITY. CONTACT LINEAR TECHNOLOGY APPLICATIONS ENGINEERING FOR ASSISTANCE.
THIS CIRCUIT IS PROPRIETARY TO LINEAR TECHNOLOGY AND SUPPLIED FOR USE WITH LINEAR TECHNOLOGY PARTS.
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HIGH EFFICIENCY SEPIC
SIZE A
DWG NO. DC1225A-1 * LTC1871EMS-1
REV A-1
DATE: Thursday, October 18, 2007
SHEET 1 OF 1
NOTE: UNLESS OTHERWISE SPECIFIED
1. ALL RESISTORS ARE IN OHMS, 0805.
ALL CAPACITORS ARE IN MICROFARADS, 0805.