DEMO CIRCUIT 1411A
QUICK START GUIDE

LTC3787
High Efficiency PolyPhase Synchronous Boost Converter

DESCRIPTION

Demonstration circuit DC1411 is DC/DC boost converter featuring the LTC3787 constant frequency current mode boost controller. The DC1411A operates over 5V to 24V input and provides 6A to 16A of output current as shown in figure 3. The 350kHz constant frequency operation results in small and efficient circuit. The converter provides high output voltage accuracy (typically ±3%) over wide load range with no minimum load requirement. The demonstration circuit can be easily modified to generate different output voltages. Please consult LTC factory for details.

The DC1411 has small circuit footprint. It is a high performance and cost effective solution for Telecom, Automotive and Power Over Ethernet applications.

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

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Table 1. Performance Summary

PARAMETER	CONDITION	VALUE
Minimum Input Voltage	I_{OUT} = 0A to 6A	5V
Maximum Input Voltage	I_{OUT} = 0A to 16A	24V
V_{OUT}	V_{IN} = 5V to 24V, I_{OUT} = 0A to 6A	24V ±3%
Typical Output Ripple V_{OUT}	V_{IN} = 5V to 24V, I_{OUT} = 6A	200mV_{P-P}
Nominal Switching Frequency		350kHz

QUICK START PROCEDURE

Demonstration circuit DC1411 is easy to set up to evaluate the performance of the LTC3787. For proper measurement equipment setup refer to Figure 1 and follow the procedure below:

NOTE: When measuring the input or output voltage ripple, care must be taken to minimize the length of oscilloscope probe ground lead. Measure the input or output voltage ripple by connecting the probe tip directly across the VIN or VOUT and GND terminals as shown in Figure 2.

1. With power off, connect the input power supply to Vin and GND.
2. Check the Vcc Bias voltage-setting jumper JP5. Move it into Vin position if required.
3. Turn the input power source on and slowly increase the input voltage. Be careful not to exceed 24V.

   NOTE: Make sure that the input voltage Vin does not exceed 24V. If higher operating voltage is required, power components with higher voltage ratings should be used.
4. Set the input voltage to 6V and check for the proper output voltage of 24V. If there is no output, temporarily disconnect the load to make sure that the load is not set too high.
5. Once the proper output voltage is established, adjust the load and observe the output voltage regulation, ripple voltage, efficiency and other parameters.

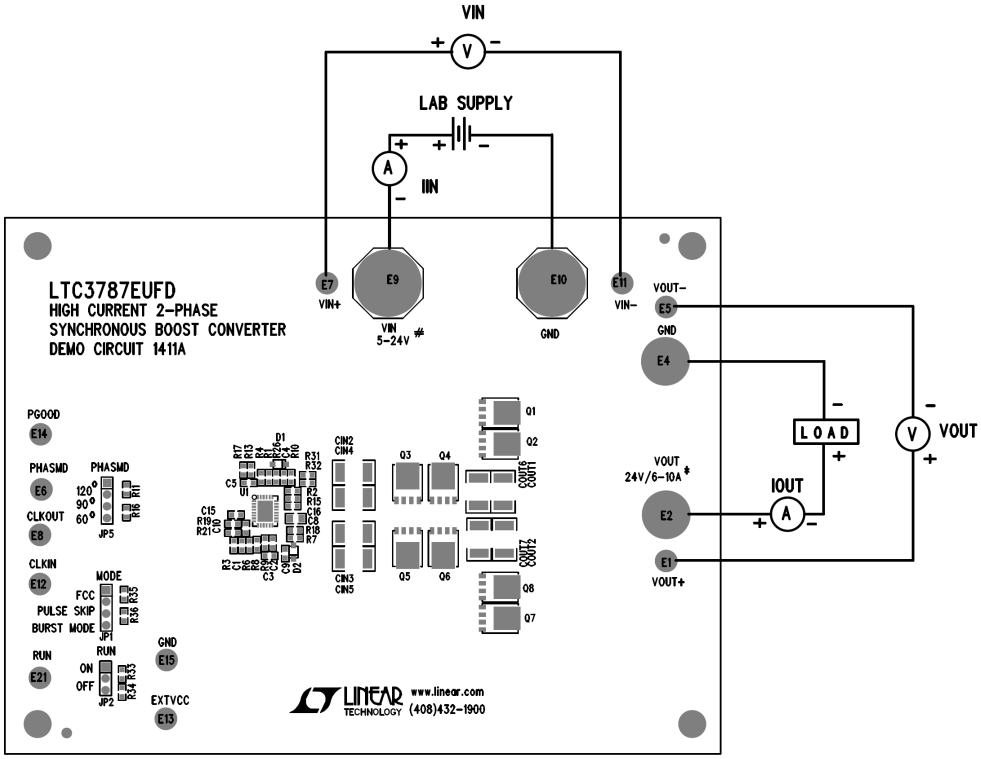


Figure 1. Proper Measurement Equipment Setup

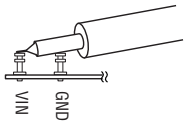


Figure 2. Measuring Input or Output Ripple

CHANGING THE OUTPUT VOLTAGE

To set the output voltage lower than 24V, change the bottom voltage divider resistors connected to LTC3787 FB pin (see the schematic on page 4). To get higher than 24V output voltage MOSFETs and capacitors with higher voltage ratings may be required. Please contact LTC factory for details.

Note that the output voltage will start following the input voltage when input voltage is greater than the voltage set by the voltage divider. In this mode (**wire mode**) the synchronous output rectifier MOSFET is turned continuously ON. The only losses in this mode are due to the current sense resistors, inductors and output MOSFETs DC resistance.

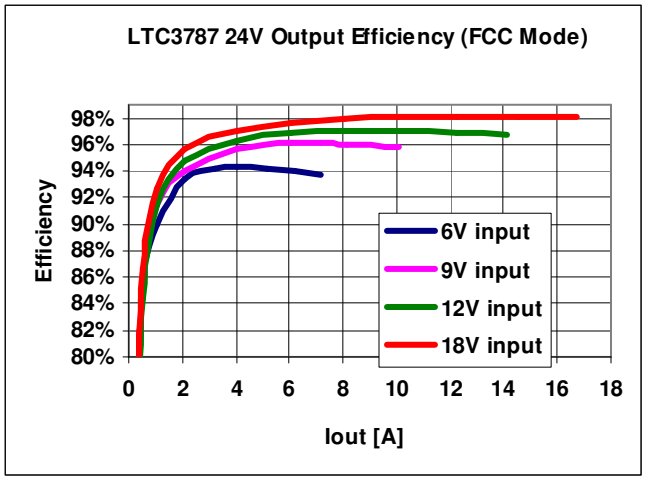


Figure 3. High efficiency of DC1411 allows the board to be used in thermally critical applications with outputs over 3A.

CONVERTER EFFICIENCY AND OUTPUT CURRENT

The DC1411 output current capability depends on the input voltage and proper cooling. Typical performance of DC1411A is shown in Figure 3. As can be seen from Figure 3, the output current capability depends on the input voltage. Also, when input voltage is equal to, or higher than the output voltage setting (wire mode) the efficiency is very high (99%) since the converter is not really running and the output MOSFET is shorting Vin to Vout.

OUTPUT LOAD STEP RESPONSE

The load step response of DC1411A is very good even though relatively small amount of output capacitance is present at the output. If higher load steps need to be handled more output capacitance can be added in order to keep the voltage transients at the desired level. The load step transients are shown in Figure 4. Also, note that the load step response even from 0% load is excellent thanks to synchronous rectification.

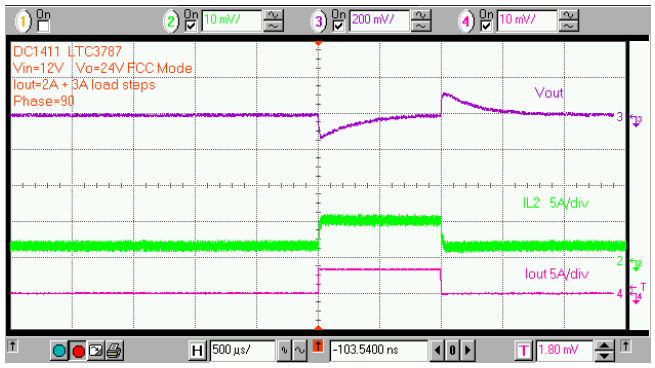


Figure 4. Fast transient response of DC1411 is achieved with a small amount of output capacitance.

SOFT START FUNCTION

The DC1411 features soft-start circuit that controls the inrush current and output voltage ramp at startup. The capacitor C_{15} (Figure 6) controls the startup period. The startup waveforms are shown in figure 5. Please note the output voltage step at about –6ms mark. The step is resulting from synchronous MOSFET being turned on. When the synchronous MOSFET is turned on the voltage drop across the synchronous MOSFET (body diode) is reduced from about 0.7V to Iout*Rdson. While the synchronous MOSFET is in off state (prior to –6ms mark) the synchronous MOSFET body diode is dissipating about 0.7V*Iout or about 4.2W with 6A load. Please refer to the LTC3787 data sheet for details about proper handling of synchronous MOSFET in your application.

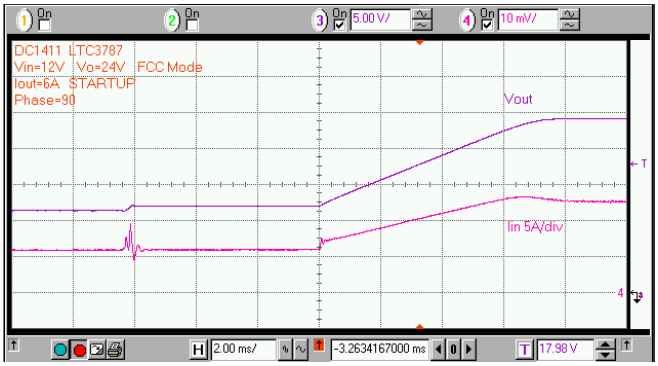
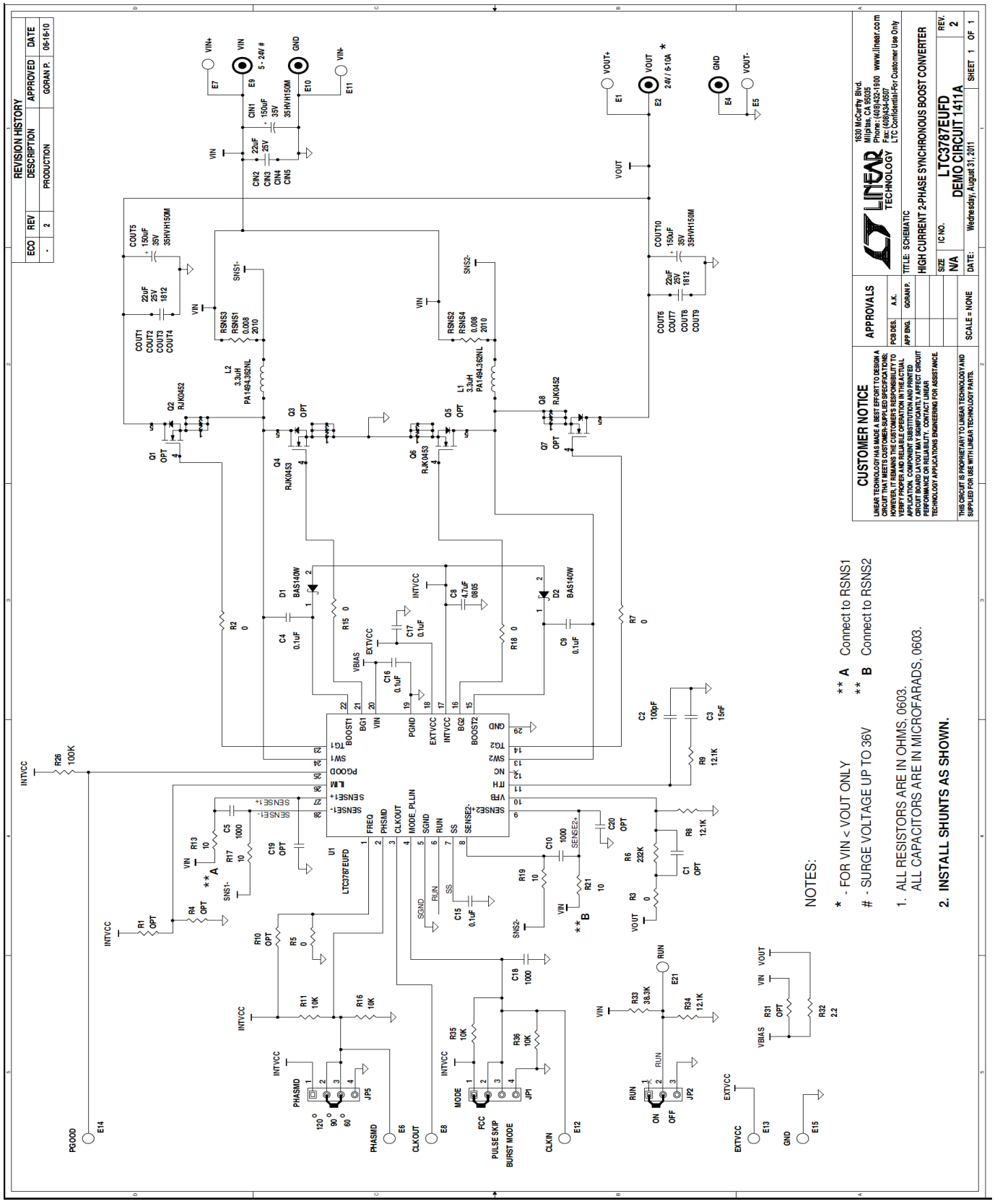


Figure 5. The DC1411 ramps the output slowly at startup without generating an input current surge.


REVISION HISTORY
ECO REV DESCRIPTION APPROVED DATE
- 2 PRODUCTION GORAN P. 06-16-10
CUSTOMER NOTICE
APPROVALS
PCB DES. A.K.
APP ENG. GORAN P.
LINEAR TECHNOLOGY
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LTC Confidential-For Customer Use Only
TITLE: SCHEMATIC
HIGH CURRENT 2-PHASE SYNCHRONOUS BOOST CONVERTER
SIZE IC NO. LTC3787EUFD REV. 2
N/A DEMO CIRCUIT 1411A
SCALE = NONE DATE: Wednesday, August 31, 2011 SHEET 1 OF 1
NOTES:
* - FOR VIN < VOUT ONLY
# - SURGE VOLTAGE UP TO 36V
** A Connect to RSNS1
** B Connect to RSNS2
1. ALL RESISTORS ARE IN OHMS, 0603.
ALL CAPACITORS ARE IN MICROFARADS, 0603.
2. INSTALL SHUNTS AS SHOWN.