

# LINEAR TECHNOLOGY LTC3851EGN Demonstration Circuit 1171A Synchronous Buck Converter User Guide

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## QUICK START GUIDE FOR DEMONSTRATION CIRCUIT 1171A SYNCHRONOUS BUCK CONVERTER LTC3851EGN

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## DESCRIPTION

Demonstration circuit 1171A is a single output synchronous buck converter featuring the LTC3851EGN. The circuit is designed with all components on the top side. The package style for the LTC3851EGN is a 16-lead narrow SSOP.

Two versions of the board are available. DC1171A-A has an on-board sense resistor for current feedback, while the DC1171A-B is configured with a DCR sense circuit that allows the converter to use the inductor's DCR as the sense element instead of the on-board sense resistor to save cost, board space while improving full load efficiency over 2%.

The main features of the board include an internal 5V linear regulator for bias and a Mode selector that allows the converter to run in CCM, pulse skip or Burst Mode operation (requires some minor modification). Synchronization to an external clock is also possible.

The input voltage range is 4.5V to 14V. The LTC3851 datasheet gives a complete description of the part, operation and application information and must be read in conjunction with this quick start guide for demo circuit 1171A.

**Design files for this circuit board are available.**

**Call the LTC factory.**

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**Table 1. Performance Summary (T = 25°C)**

PARAMETER	CONDITION	VALUE
Input Voltage Range		4.5V – 14V
Output Voltage VOUT	V = 4.5V to 14V, I = 0A to 15A	1.5V $\pm$ 2%
Nominal Switching Frequency		400kHz
Efficiency	VOUT = 1.5V, IOU1 = 15A; VIN = 12V	87.3% Typical (A-A) 90.0% Typical (A-B)

## QUICK START PROCEDURE

Demonstration circuit 1171A is easy to set up to evaluate the performance of the LTC3851EGN.

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. Place jumpers in the following positions:

JP1	400k
JP2	On
JP3	CCM

2. With power off, connect the input power supply to Vin and GND.

3. Turn on the power at the input.

**NOTE:** Make sure that the input voltage does not exceed 14V.

4. Check for the proper output voltage.

Vout = 1.470V to 1.530V

NOTE: 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 voltages are established, adjust the loads within the operating range and observe the output voltage regulation, ripple voltage, efficiency and other parameters.
6. Different operating modes can be evaluated by changing the position of jumper JP3 and are discussed in the next section.

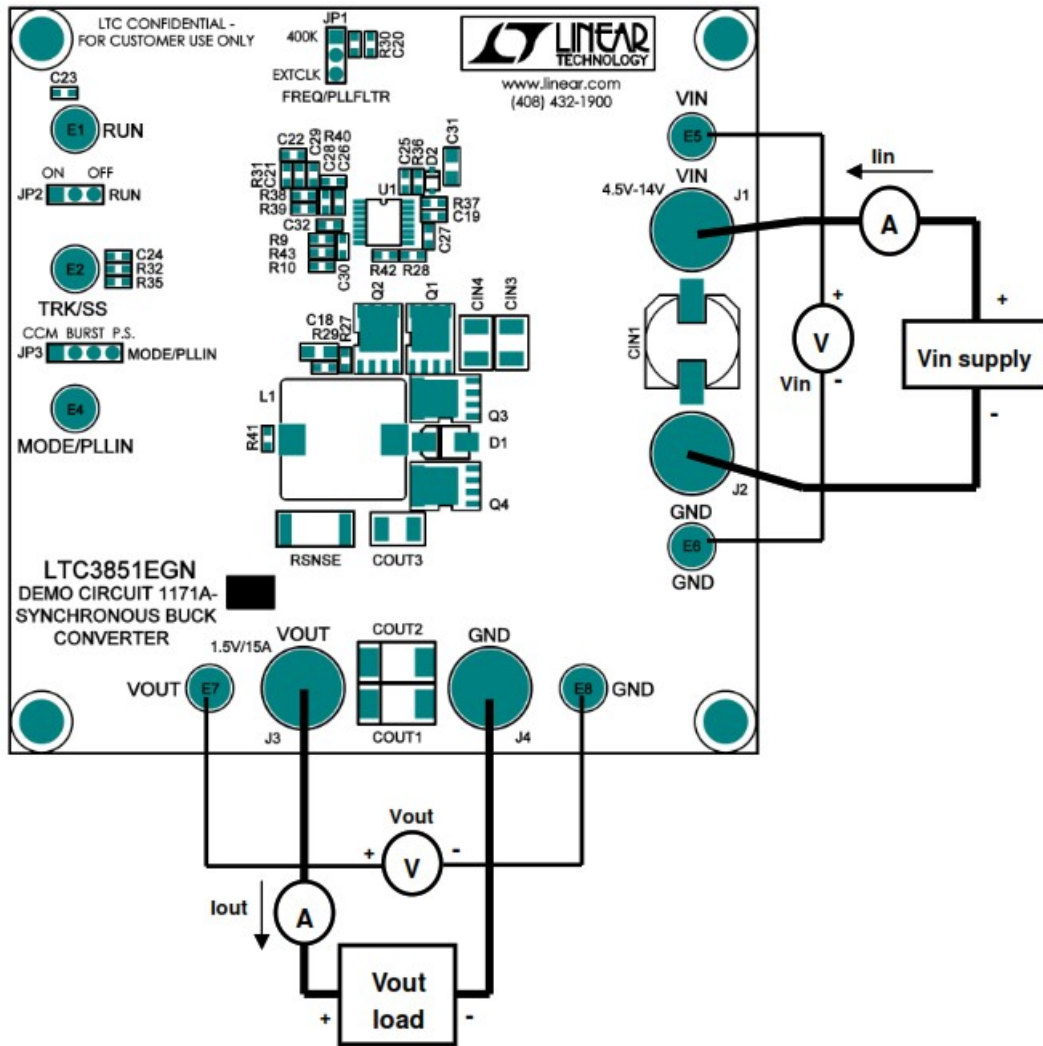


Figure 1. Proper Measurement Equipment Setup

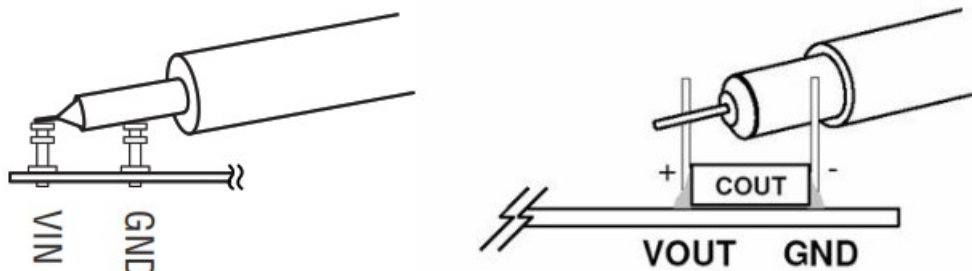


Figure 2. Measuring Input or Output Ripple Across Terminals or Directly Across Bulk Capacitor

## FREQUENCY SYNCHRONIZATION AND MODE SELECTION

Demonstration circuit 1171A's Mode selector allows the converter to run in CCM or pulse skip operation by changing position of jumper JP3. For synchronizing to an external clock source both JP1 and JP3 needs to be adjusted, while for Burst Mode operation some bench modification is needed.

Refer to Table 2 and to the data sheet for more details.

**Table 2. Mode Selection and Synchronized Operation Options**

	BOARD MODIFICATION		MODE SELECTOR
CONFIGURATION		JP1	JP4
CCM operation	–	‘400K’	‘CCM’
Pulse skip operation	–	‘400K’	‘P.S.’
Burst Mode operation	100k resistor between JP4 pin1 and pin2	‘400K’	Remove Jumper
Synchronized to ext. clock applied to MODE/PLLIN pin	–	‘EXTCLK’	‘BURST’

## RAIL TRACKING

Demonstration circuit 1171A is configured for an on board soft start circuit. The soft start ramp rate can be adjusted by changing the value of C24. Demonstration circuit 1171A can also be modified to track an external reference. Refer to Table 3 for tracking options and to the data sheet for more details.

**Table 3. Output Tracking Options**

	TRK/SS RESISTORS AND CAPACITOR			RAIL TRACKING
CONFIGURATION	R32	R35	C24	TRK/SS PIN
Soft Start Without Tracking (Default)	0.Q	Open	0.1 pF	Open
Vout equals External Ramp	0.Q	Open	Open	External reference applied
Vout tracking scaled external ramp	Resistor divider		Open	External reference applied

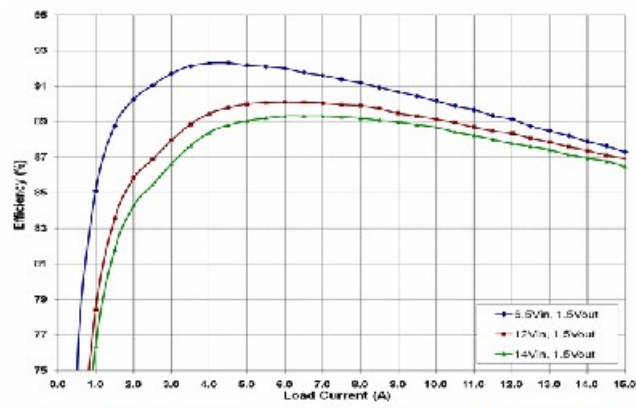


Figure 3. Typical Efficiency vs. Load Current for DC1171A-A

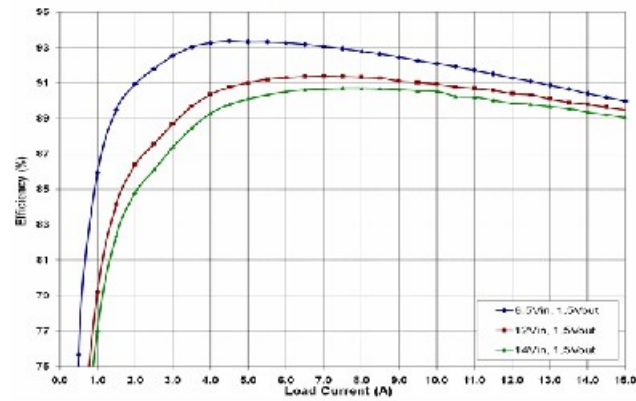


Figure 4. Typical Efficiency vs. Load Current for DC1171A-B

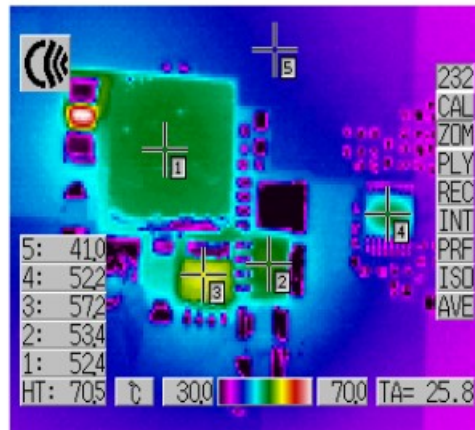


Figure 5. Thermal image of DC1171A-A, 14Vin, 1.5V@15Aout

The schematic diagram illustrates the LTC3851AEGN circuit, which is a high-frequency, high-voltage, current-mode PWM controller. The circuit is powered by a 10V supply (C20) and a 10V supply (C21). The input voltage (VIN) is connected to the BOOST pin (pin 14) and the VIN pin (pin 13). The output voltage (VOUT) is connected to the FB pin (pin 6) and the FB pin (pin 5). The feedback network consists of resistors R38, R39, R40, R41, and R42. The control logic is connected to the MODE/PLLIN pin (pin 1), the FREQ/PLLFLT pin (pin 2), the RUN pin (pin 3), the TK/SS pin (pin 4), the INTVCC pin (pin 12), the BG pin (pin 11), the GND pin (pin 9), and the ILIM pin (pin 8). The output stage consists of a MOSFET (Q1) and a diode (D2). The current sense resistor (R37) is connected between the VIN pin (pin 13) and the INTVCC pin (pin 12). The current sense amplifier (U1) is connected to the INTVCC pin (pin 12) and the ILIM pin (pin 8). The current sense amplifier (U1) is also connected to the FB pin (pin 6) and the FB pin (pin 5). The current sense amplifier (U1) is also connected to the GND pin (pin 9) and the ILIM pin (pin 8). The current sense amplifier (U1) is also connected to the MODE/PLLIN pin (pin 1) and the FREQ/PLLFLT pin (pin 2). The current sense amplifier (U1) is also connected to the RUN pin (pin 3) and the TK/SS pin (pin 4). The current sense amplifier (U1) is also connected to the INTVCC pin (pin 12) and the BG pin (pin 11). The current sense amplifier (U1) is also connected to the GND pin (pin 9) and the ILIM pin (pin 8). The current sense amplifier (U1) is also connected to the MODE/PLLIN pin (pin 1) and the FREQ/PLLFLT pin (pin 2). The current sense amplifier (U1) is also connected to the RUN pin (pin 3) and the TK/SS pin (pin 4). The current sense amplifier (U1) is also connected to the INTVCC pin (pin 12) and the BG pin (pin 11). The current sense amplifier (U1) is also connected to the GND pin (pin 9) and the ILIM pin (pin 8).

**QUICK START GUIDE FOR LINEAR TECHNOLOGY CIRCUIT 1171A**  
LINEAR TECHNOLOGY CIRCUIT 1171A

**DESCRIPTION**  
This circuit is a synchronous buck converter. It is designed to convert a 5V input to a 1.8V output. The circuit is designed to operate at a switching frequency of 1.5MHz. The circuit is designed to operate at a load current of 1A. The circuit is designed to operate at a temperature range of -40°C to 125°C. The circuit is designed to operate at a humidity range of 5% to 95%.

**QUICK START PROCEDURE**  
1. Connect the input voltage to the circuit. 2. Connect the output voltage to the load. 3. Turn on the power. 4. Measure the output voltage. 5. Adjust the output voltage to the desired value. 6. Turn off the power. 7. Disconnect the output voltage from the load. 8. Disconnect the input voltage from the circuit.

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