

QUICK START GUIDE FOR DEMONSTRATION CIRCUIT 774

HIGH EFFICIENCY, HIGH POWER BUCK CONVERTER WITH MARGINING AND TRACKING

LTC3770EUH

DESCRIPTION

Demonstration circuit 774 is a high efficiency synchronous step-down DC/DC converter with 5V to 28V input range. It can provide 2.5V output with 10A maximum current. The demo board features the LTC3770EUH controller. The LTC3770 has a high accuracy $\pm 0.67\%$ 0.6V reference voltage and provides many advanced functions including output tracking, programmable voltage margining, programmable current limit, output over voltage protection and input under voltage lockout, power good

monitor, programmable soft start, selectable discontinuous operation mode or forced continuous mode at light load, and adjustable dead time between the top gate and bottom gate signals to optimize the efficiency.

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

Table 1. Performance Summary ($T_A = 25^\circ\text{C}$)

| PARAMETER | CONDITION | VALUE |
|-----------------------------|--|-----------------------|
| Input Voltage Range | | 5V to 28V |
| Output Voltage | $V_{IN} = 5\text{-}28\text{V}$, $I_{OUT} = 0\text{A to }10\text{A}$, | $2.5\text{V} \pm 2\%$ |
| Maximum load current | $V_{IN} = 5\text{-}28\text{V}$ | 10A |
| Typical Output Ripple | $V_{IN} = 12\text{V}$, $I_{OUT} = 10\text{A}$ (20MHz BW) | 60mV _{p-p} |
| Typical Switching Frequency | $V_{IN} = 12\text{V}$, $I_{OUT} = 10\text{A}$ | 250kHz |

OPERATING PRINCIPLES

The LTC3770 uses a constant on-time, valley current mode control architecture able to deliver very low duty cycles with fast transient response without requiring a sense resistor. The switching frequency of the converter can be selected by an external resistor R_{on} and is compensated for variations on input supply voltage. An internal phase-lock loop allows the controller to be synchronized to an external clock. Figure 3 gives the efficiency curves (JP1: DCM).

The LTC3770 has the output voltage up and down tracking capability. Using the TRACK/SS pin, the converter output can track another supply's output voltage. To select tracking function, place JP2 at TRACK, take off the soft start cap C_{ss} and connect a resistor divider to the

external voltage to be tracked. The tracking can be coincident or ratiometric, as shown in figure 4.

Voltage margining is the dynamic adjustment of the output voltage to its worst case operating range during test to screen the components, verify some control/protection functionality of the board and improve the system reliability. The LTC3770 has two logic control pins, MARGIN1 and MARGIN0, to enable and set up margin up (higher output voltage) or margin down (lower output voltage). Table 2 is a summary of the configurations.

When the margining function is enabled, the error amplifier reference voltage will be adjusted to: $V_{REFIN} = 0.6\text{V} \pm 1.18\text{V} \times R5/R6$

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By selecting the ratio of R5 to R6, the margin voltage is programmable and the converter output can be set to a desirable testing range.

QUICK START PROCEDURE

Demonstration circuit 774 is easy to set up to evaluate the performance of LTC3770. 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. Initial jumper positions:

JP2: SS; JP1: FC

2. With power off, connect the input power supply to VIN (5V-28V) and GND (input return).
3. Connect the 2.5V load between VOUT and GND. (Initial load: 0 A)
4. Connect the DVMs to the input and output.
5. Turn on the input power supply and check for the proper output voltages. VOUT should be 2.5V \pm 2%.
6. Once the proper output voltage is established, adjust the load within the operating range and observe the output voltage regulation, ripple voltage and other parameters.

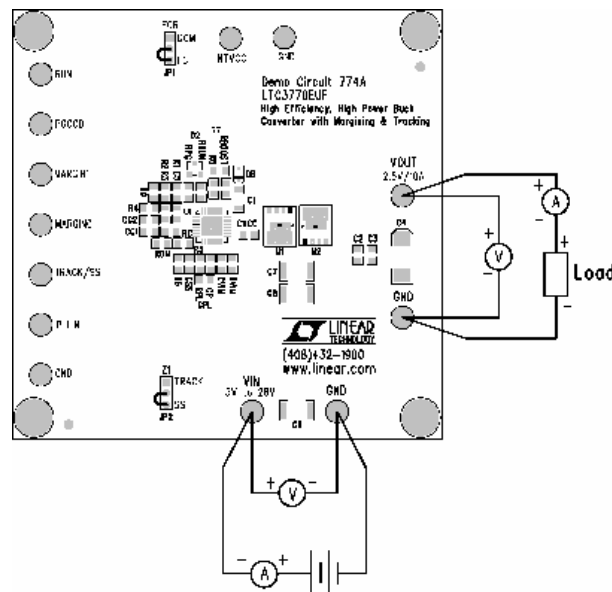


Figure 1. Proper Measurement Equipment Setup

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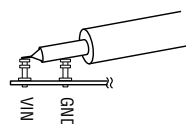


Figure 2. Measuring Input or Output Ripple

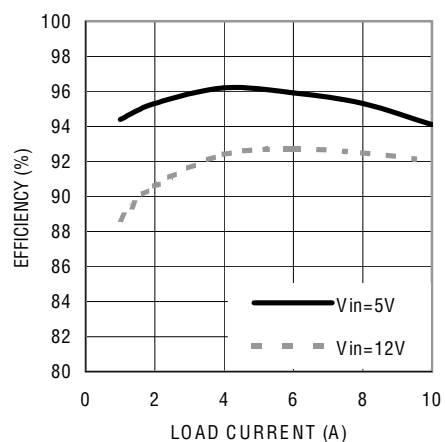
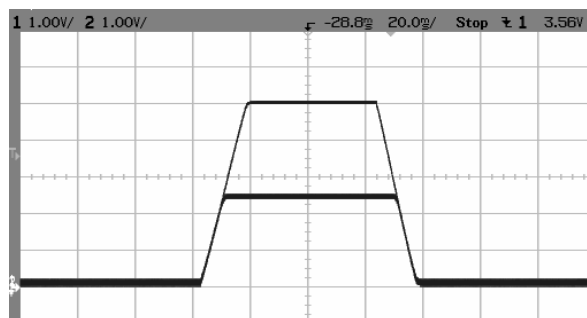


Figure 3. Efficiency vs load current

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(a) Coincident tracking



(b) Ratiometric tracking

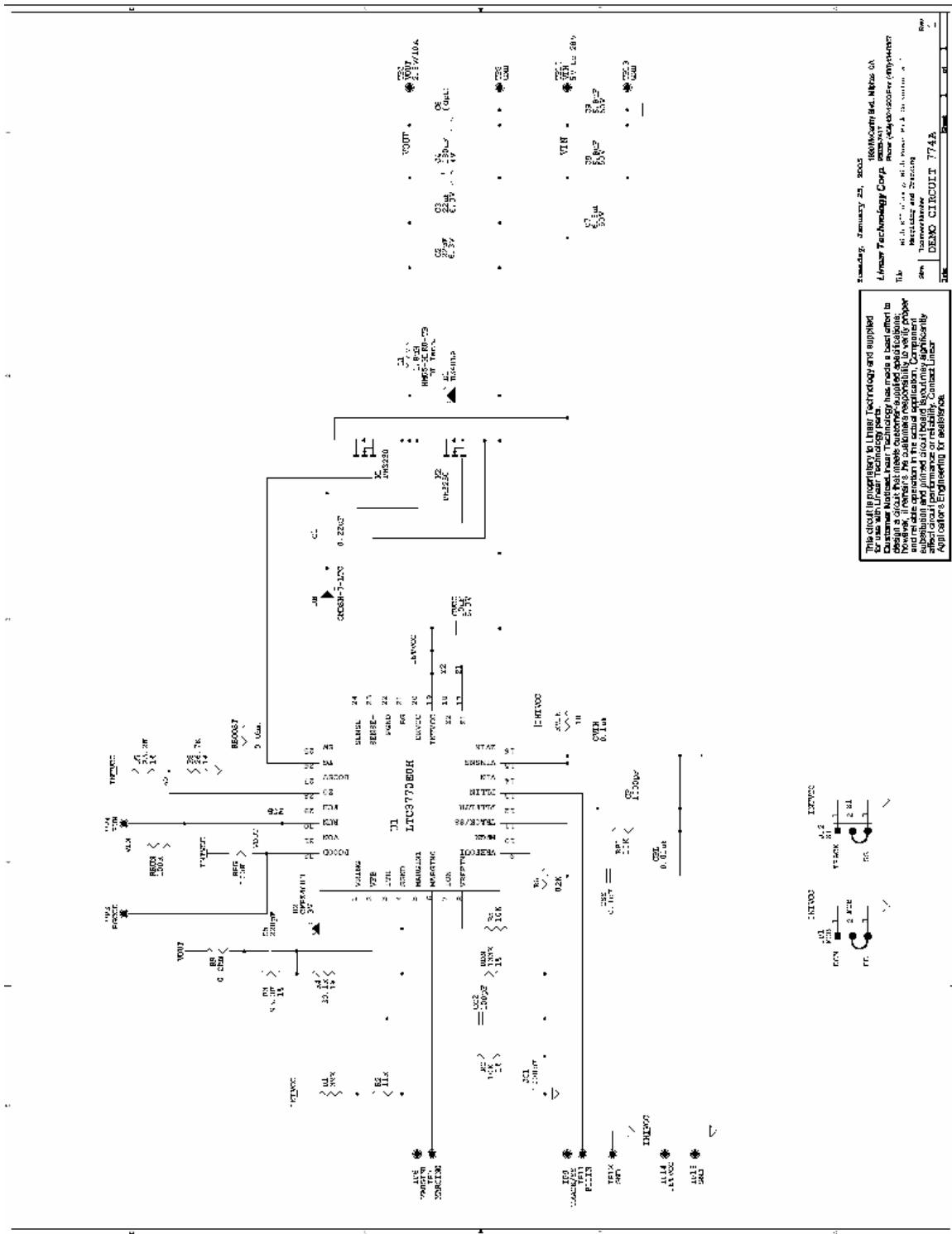
Figure 4. (a)(b) Up/down output tracking. Upper waveform: external voltage; lower waveform: output voltage of the LTC3770 converter

Table 2. Margining Function

| MARGIN1 | MARGINO | MODE |
|---------|---------|----------------|
| Low | Low | No margining |
| Low | High | Margining up |
| High | Low | Margining down |
| High | High | No margining |

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This circuit is proprietary to Linear Technology and supplied to customers under a non-disclosure agreement. Linear Technology Corp. has made a best effort to design a circuit that meets customer-specified specifications. However, the user must verify the circuit's performance and reliability in the actual application. Components are not guaranteed to be available in the quantities specified in this document. Applications Engineering is available at applications@linear.com.

Monday, January 21, 2003
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 DEMO CIRCUIT 774A