DESCRIPTION

Demonstration circuit DC702 is a 2.25 MHz step-down converter, using the LTC3406B monolithic synchronous buck regulator. The DC702 has an input voltage range of 2.5V to 5.5V, and is capable of delivering up to 600 mA of output current at a minimum input voltage of 3V. The DC702 is made for noise sensitive applications, due to the LTC3406B-2 operating in pulse-skipping mode at low load currents. The DC702 is a high efficiency circuit - up to 90%, and during shutdown, the DC702 consumes less than 1 uA. These features, plus the LTC3406B coming in a tiny 5-Pin ThinSOT package and having an operating frequency of 2.25 MHz (allowing the exclusive use of low profile surface mount components), make the DC702 an ideal circuit for use in battery-powered, hand-held applications.

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

Table 1.

Performance Summary (T_A = 25°C)

PARAMETER	CONDITION	VALUE
Minimum Input Voltage		2.5V
Maximum Input Voltage		5.5V
Output Voltage V_{OUT}	V_{IN} = 2.5V to 5.5V, I_{OUT} = 0A to 600 mA	1.8V ±2%
Typical Output Ripple V_{OUT}	V_{IN} = 5V, I_{OUT} = 600 mA (20 MHz BW)	20mV_{P-P}
Output Regulation	Line	±1%
	Load	±1%
Nominal Switching Frequency		2.25 MHz

QUICK START PROCEDURE

The DC702 demonstration circuit is easy to set up to evaluate the performance of the LTC3406B-2. One word of caution: when the board is right-side up (the title is legible at the top of the board), the output voltage turret is on the left side of the board, and the input voltage turret is on the right side of the board. Set up the circuit appropriately. Before proceeding to test, insert jumper JP1 into the upper position, connecting the RUN pin to ground (GND), which shuts down the 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. Connect the input power supply to the Vin and GND terminals on the right-side of the board. Do not hot-plug Vin or increase Vin over the rated maximum supply voltage of 5.5V, or the part may be damaged.
2. Connect the load between the Vout and GND terminals on the left-side of the board.
3. Apply 3.3V at Vin. Measure Vout; it should read 0V. If desired, one can measure the shutdown supply current at this point. The supply current will be approximately 1 uA in shutdown.
4. Turn on the circuit by connecting the RUN pin to Vin or inserting the JP1 jumper into the ON (lower) position. Measure Vout - it will measure approximately 1.8V.
5. Vary the input voltage from 2.5V to 5.5V and adjust the load current from 0 to 600mA. The output voltage should be regulating. Measure the output ripple voltage at any output current level; it should measure less than 20 mVAC.
6. Observe the voltage waveform at the switch node (pin 3). Verify the switching frequency is between 1.8 MHz and 2.7 MHz (T = 0.555 us and 0.370 us), and that the switch node waveform is rectangular in shape.

When finished, turn off the circuit (connecting the RUN pin to ground) by inserting the JP1 jumper into the OFF (upper) position.

Warning - if long leads are used to power the demo circuit, the input voltage at the part could “ring”. To eliminate this, insert a small tantalum capacitor (for instance, an AVX part # TAJW226M010R) on the pads between the input power and return terminals on the bottom of the demo board. The (greater) ESR of the tantalum will dampen the (possible) ringing voltage due to the use of long input leads. On a normal, typical PCB, with short traces, the capacitor is not needed.

If more efficiency is desired from the demo circuit, replace the stock inductor, a Taiyo Yuden part # LQLBC2518M2R2M, with a Murata inductor, # LQH32CN2R2M11. Due to its larger size, the Murata inductor has lower DCR than the Taiyo Yuden inductor, thus has less power dissipation.

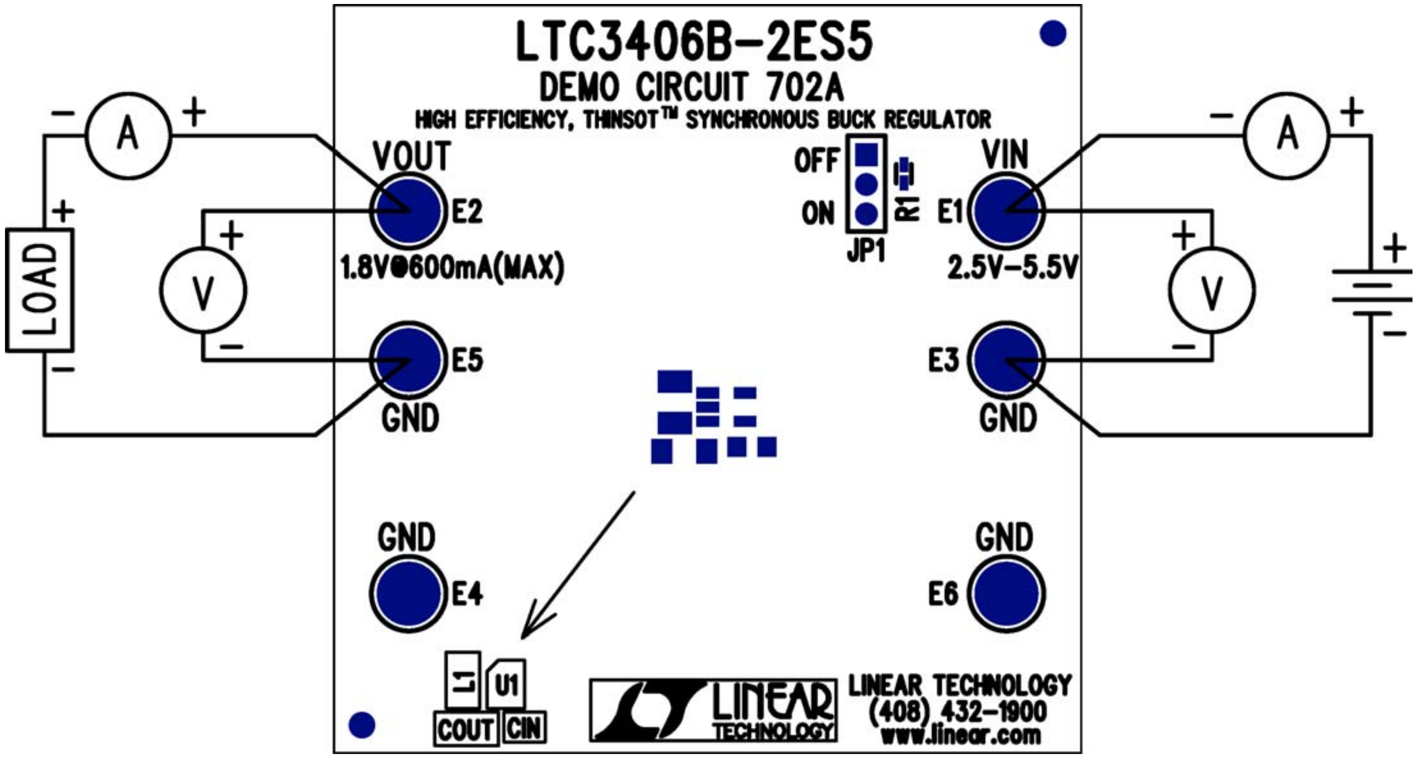


Figure 1. Proper Measurement Equipment Setup

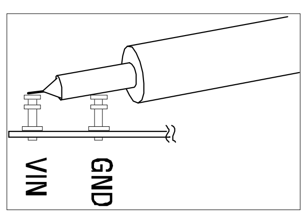
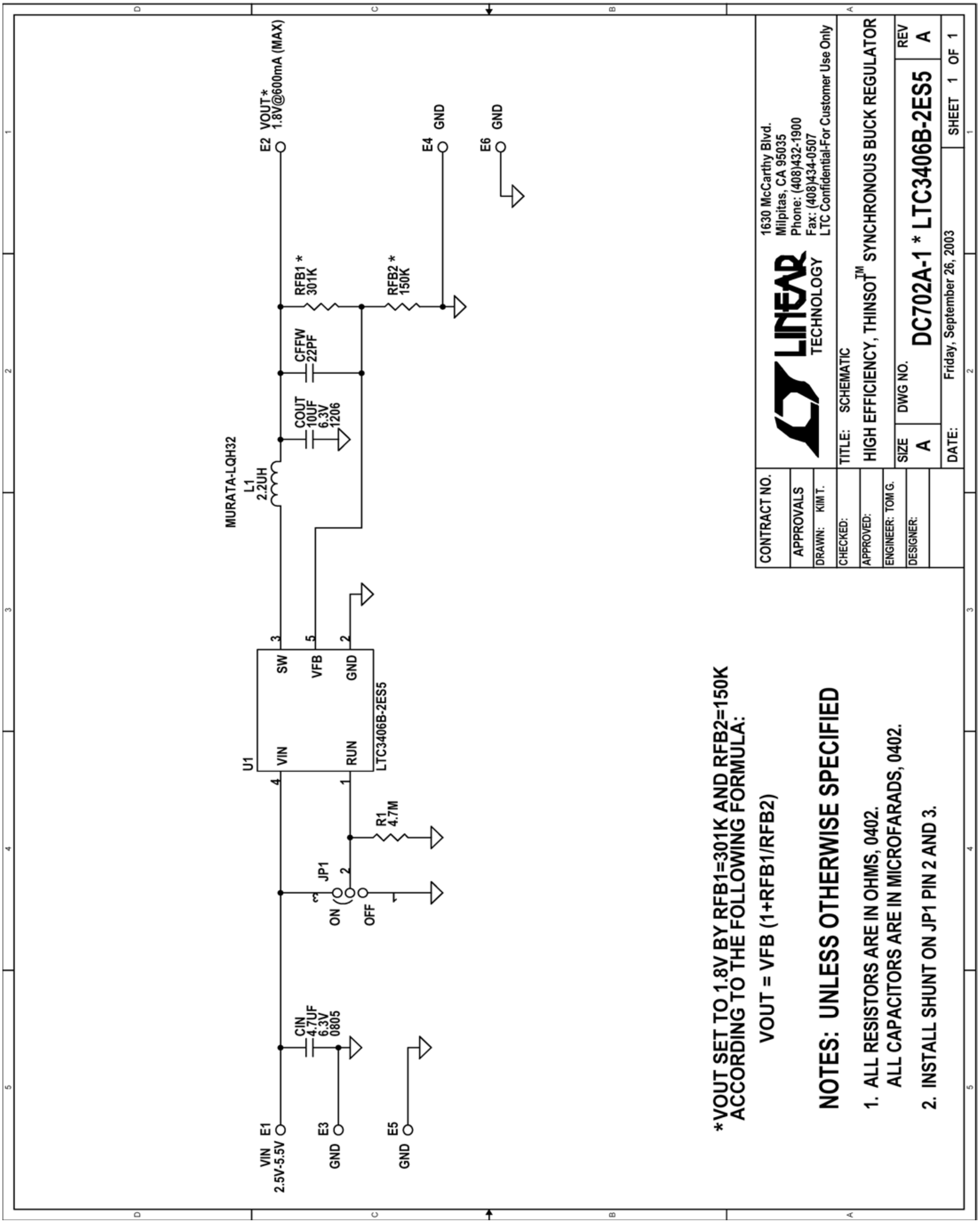


Figure 2. Measuring Input or Output Ripple


E2 VOUT*
1.8V@600mA (MAX)
E4 GND
E6 GND
RFB1 *
301K
RFB2 *
150K
CFFW
22PF
COUT
10UF
6.3V
1206
MURATA-LQH32
L1
2.2UH
U1
SW
VFB
GND
VIN
RUN
LTC3406B-2ES5
R1
4.7M
JP1
ON
OFF
CIN
4.7UF
6.3V
0805
VIN E1
2.5V-5.5V
E3 GND
E5 GND
*VOUT SET TO 1.8V BY RFB1=301K AND RFB2=150K
ACCORDING TO THE FOLLOWING FORMULA:
VOUT = VFB (1+RFB1/RFB2)
NOTES: UNLESS OTHERWISE SPECIFIED
1. ALL RESISTORS ARE IN OHMS, 0402.
ALL CAPACITORS ARE IN MICROFARADS, 0402.
2. INSTALL SHUNT ON JP1 PIN 2 AND 3.
CONTRACT NO.
APPROVALS
DRAWN: KIM T.
CHECKED:
APPROVED:
ENGINEER: TOM G.
DESIGNER:
LINEAR TECHNOLOGY
1630 McCarthy Blvd.
Milpitas, CA 95035
Phone: (408)432-1900
Fax: (408)434-0507
LTC Confidential-For Customer Use Only
TITLE: SCHEMATIC
HIGH EFFICIENCY, THINSOT™ SYNCHRONOUS BUCK REGULATOR
SIZE A
DWG NO.
DC702A-1 * LTC3406B-2ES5
REV A
DATE: Friday, September 26, 2003
SHEET 1 OF 1