LTC3875EUJ
High Efficiency, Dual-Output Synchronous Buck Converter with Very Low DCR Inductor

DESCRIPTION

Demonstration circuit 2000A is a high efficiency, high density, synchronous buck converter with a 4.5V to 14V input range. It can supply 30A maximum load current at a 1.0V output and at a 1.5V output separately. The demo board includes a LTC®3875EUJ controller. The LTC3875 is a feature-rich dual phase synchronous buck controller with very low DCR current sensing capability, on-chip drivers and remote output voltage sensing. This board is set up with a 0.32mΩ DCR inductor. The temperature compensation function can guarantee accurate current limit over a wide temperature range with DCR sensing.

The LTC3875 is suitable for inputs from 4.5V to 38V and outputs up to 3.5V. It can provide a high efficiency, high power density and versatile power solution for telecom and datacom systems, industrial and medical instruments, DC power distribution systems and computer systems. The LTC3875 is available in a 40-pin 6mm × 6mm QFN package.

To shut down the converter, set the RUN1/RUN2 pin voltage below 1.2V (SW1: OFF; SW2: OFF). Use the JP1 jumper to select burst mode, pulse-skipping mode or forced continuous mode operation at light load. Switching frequency is pre-set at about 400kHz, and it can be easily modified from 250kHz to 770kHz. An on-board dynamic circuit is also available for the transient test. Please see the LTC3875 data sheet for more detailed information.

Design files for this circuit board are available at http://www.linear.com/demo/DC2000A

PERFORMANCE SUMMARY

Specifications are at T_A = 25°C

PARAMETER	CONDITIONS	VALUE
Input Voltage Range		4.5V to 14V
Output Voltage, V_{OUT1}	V_{IN} = 4.5V to 14V, I_{OUT1} = 0A to 30A	1.0V ±2%
Maximum Output Current, I_{OUT1}	V_{IN} = 4.5V to 14V, V_{OUT1} = 1.0V	30A
Typical Efficiency, V_{OUT1}	V_{IN} = 12V, V_{OUT1} = 1.0 V, I_{OUT1} = 30A	86.9%
Output Voltage, V_{OUT2}	V_{IN} = 4.5V to 14V, I_{OUT2} = 0A to 30A	1.5V ±2%
Maximum Output Current, I_{OUT2}	V_{IN} = 4.5V to 14V, V_{OUT2} = 1.5V	30A
Typical Efficiency, V_{OUT2}	V_{IN} = 12V, V_{OUT2} = 1.5V, I_{OUT2} = 30A	89.6%
Typical Switching Frequency		400kHz

QUICK START PROCEDURE

Demonstration circuit 2000A is easy to set up to evaluate the performance of the LTC3875EUJ. Refer to Figure 1 for the proper measurement equipment setup and follow the procedure below:

1. With power off, connect the input power supply to V_{IN} (4.5V to 14V) and GND (input return).
2. Connect the 1.0V output load between V_{OUT1} and GND (Initial load: no load).
3. Connect the 1.5V output load between V_{OUT2} and GND (Initial load: no load).
4. Connect the DVMs to the input and outputs. Set default jumper position: JP1: CCM; SW1: ON; SW2: ON.
5. Turn on the input power supply and check for the proper output voltages. V_{OUT1} should be 1.0V ±2%. And V_{OUT2} should be 1.5V ±2%
6. Once the proper output voltages are established, adjust the loads within the operating range and observe the output voltage regulation, ripple voltage and other parameters.

Note: When measuring the output or input voltage ripple, do not use the long ground lead on the oscilloscope probe. See Figure 2 for the proper scope probe technique. Short, stiff leads need to be soldered to the (+) and (–) terminals of an output capacitor. The probe's ground ring needs to touch the (–) lead and the probe tip needs to touch the (+) lead.

QUICK START PROCEDURE

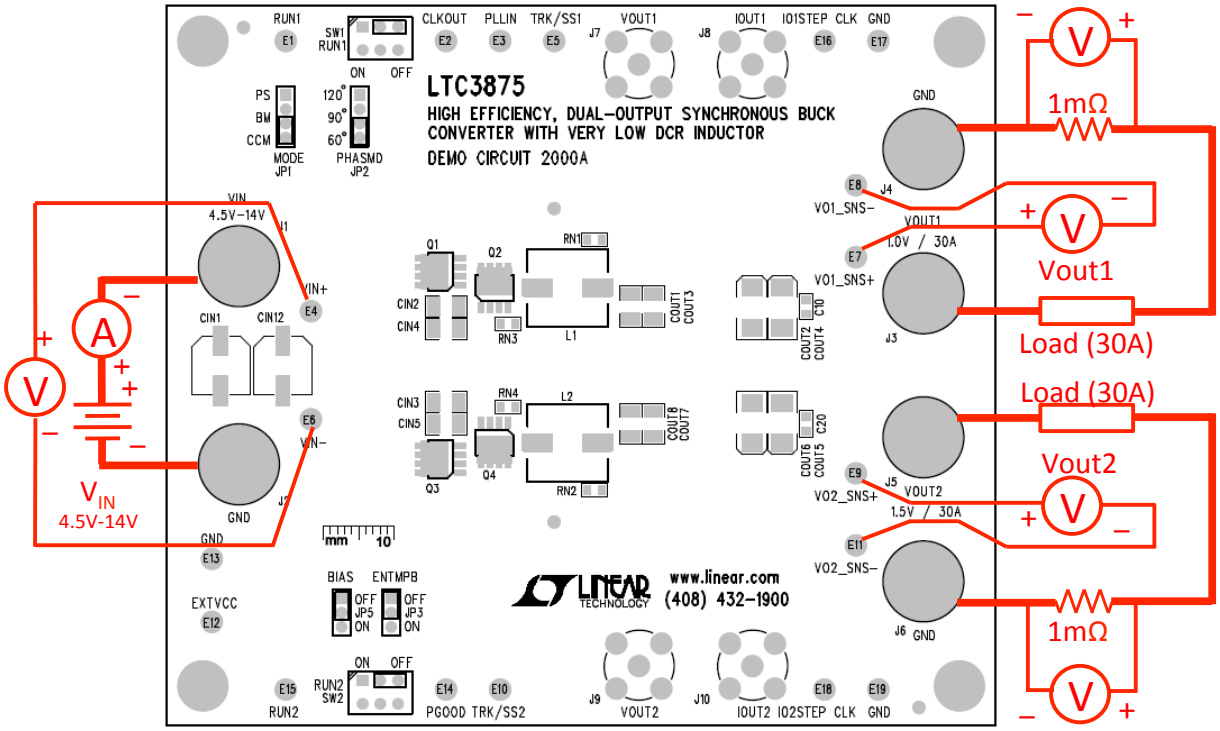


Figure 1. Proper Measurement Equipment Setup

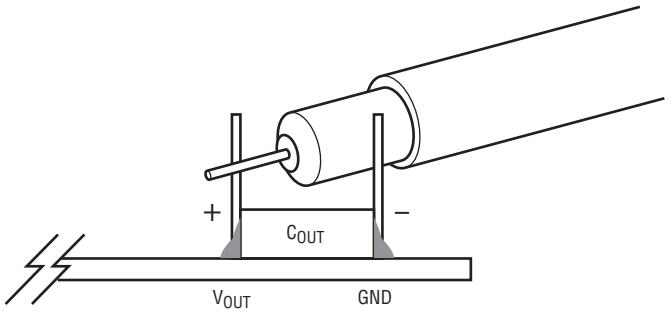


Figure 2. Measuring Output Voltage Ripple

QUICK START PROCEDURE

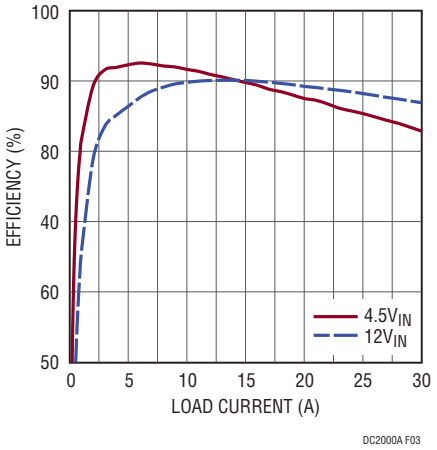


Figure 3. Efficiency vs Load Current at V_{OUT1} = 1V

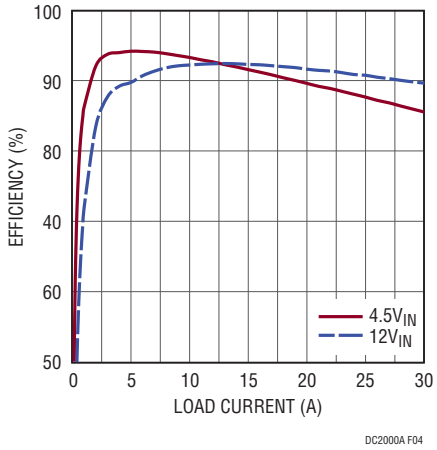


Figure 4. Efficiency vs Load Current at V_{OUT2} = 1.5V

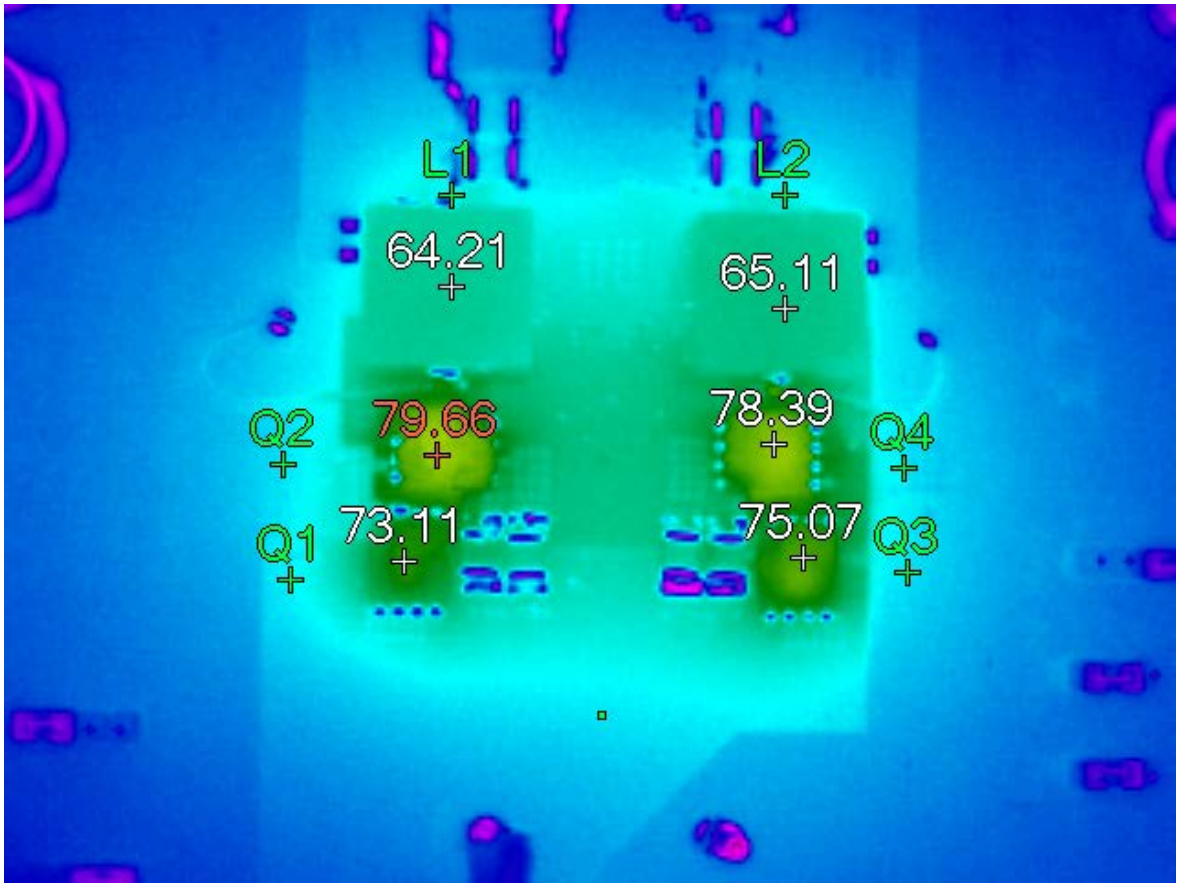


Figure 5. Thermal Performance at V_{IN} = 12V, V_{OUT1} = 1V, I_{OUT1} = 30A, V_{OUT2} = 1.5V, I_{OUT2} = 30A, No Forced Air

QUICK START PROCEDURE

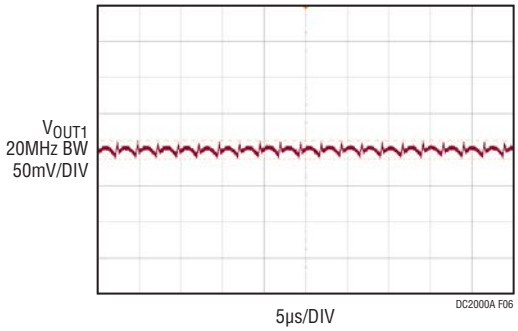


Figure 6. Output Voltage Ripple at V_{IN} = 12V, V_{OUT1} = 1V, I_{OUT1} = 30A

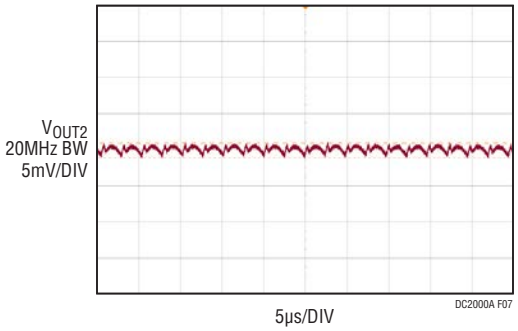


Figure 7. Output Voltage Ripple at V_{IN} = 12V, V_{OUT2} = 1.5V, I_{OUT2} = 30A

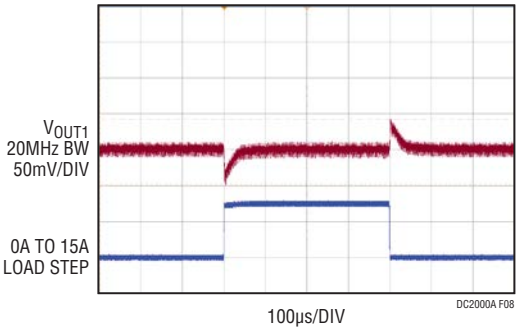


Figure 8. Transient Performance at V_{IN} = 12V, V_{OUT1} = 1V, I_{OUT1} = 0A to 15A

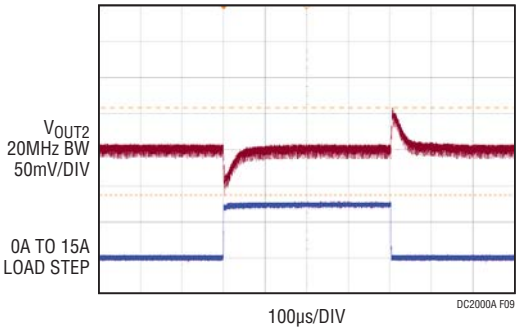


Figure 9. Transient Performance at V_{IN} = 12V, V_{OUT2} = 1V, I_{OUT2} = 0A to 15A

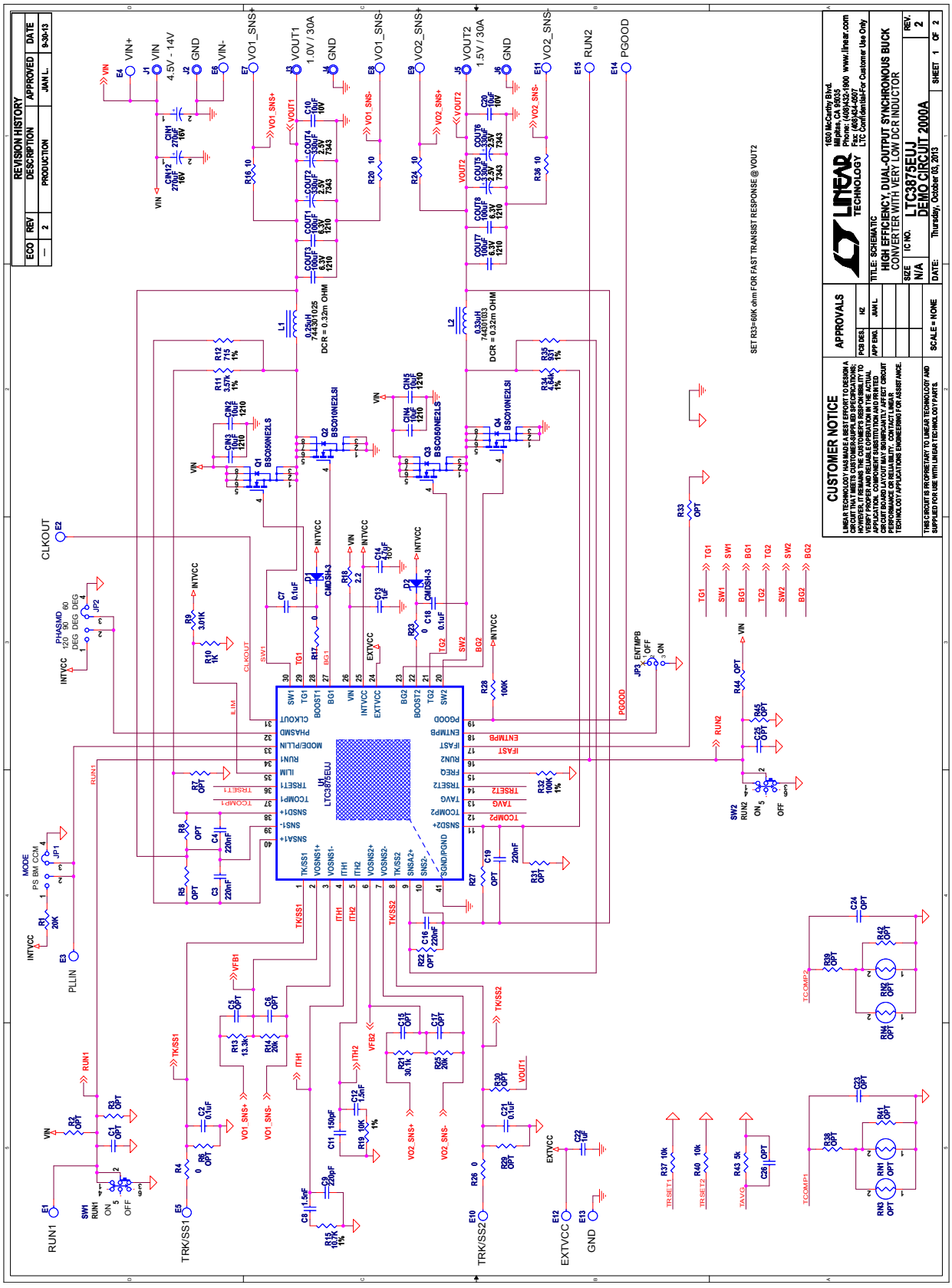
PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	1	CIN1	CAP., OS-CON, 270µF, 16V, 20%, E12	SANYO, 16SVPC270M
2	6	CIN2, CIN3, CIN4, CIN5, C27, C28	CAP., X5R, 10µF,16V, 10%, 1210	
3	2	C10, C20	CAP., X5R, 10µF,16V, 10%, 0805	
4	6	COUT1, COUT3, COUT7, COUT8, C29, C33	CAP., X5R, 100µF, 6.3V, 20%,1210	
5	7	COUT2, COUT4, COUT5, COUT6, COUT9, COUT10, COUT11	CAP., OS-CON, 330µF, 16V, 20%, 7343	SANYO, 2R5TPE330M9
6	4	C2, C7, C18, C21	CAP., X5R, 0.1µF, 16V, 10%, 0603	
7	4	C3, C4, C16, C19	CAP., X5R, 220nF, 25V, 10%, 0603	
8	2	C8, C12	CAP., X5R, 1.5nF, 25V, 10%, 0603	
9	1	C9	CAP., X5R, 220pF, 25V, 10%, 0603	
10	1	C11	CAP., X5R, 150pF, 25V, 10%, 0603	
11	2	C13, C22	CAP., X5R, 1µF, 16V, 10%, 0603	
12	1	C14	CAP., X5R, 4.7µF, 16V, 10%, 0805	
13	4	C31, C32, C35, C36	CAP., X5R, 0.22µF, 16V, 10%, 0805	
14	2	D1, D2	DIODE, SCHOTTKY, SOD-323	CENTRAL CMDSH-3TR
15	1	L1	0.25µH	WÜRTH ELECT., 744301025
16	1	L2	0.33µH	WÜRTH ELECT., 744301033
17	2	Q1, Q3	OPTIMOS POWER-TRANSISTOR, PG-TDSON-8 25V	INFINEON, BSC050NE2LS
18	2	Q2, Q4	OPTIMOS POWER-TRANSISTOR, PG-TDSON-8 25V	INFINEON, BSC010NE2LSI
19	2	Q7, Q8	MOSFET SPEED SRS 30V 30A LFPAK	RENESAS RJK0305DPB
20	3	R1, R14, R25	RES., CHIP, 20k, 1%, 0603	
21	4	R4, R17, R23, R26	RES., CHIP, 0Ω, 0603	
22	1	R9	RES., CHIP, 3.01k, 1%, 0603	
23	1	R10	RES., CHIP, 1k, 1%, 0603	
24	1	R11	RES., CHIP, 3.57k, 1%, 0603	
25	1	R12	RES., CHIP, 715Ω, 1%, 0603	
26	1	R13	RES., CHIP, 13.3k, 1%, 0603	
27	7	R19, R37, R40, R49, R52, R55, R57	RES., CHIP, 10k, 1%, 0603	
28	1	R15	RES., CHIP, 10.7k, 1%, 0603	
29	4	R16, R20, R24, R36	RES., CHIP, 10Ω, 1%, 0603	
30	1	R18	RES., CHIP, 2.2Ω, 1%, 0603	
31	1	R21	RES., CHIP, 30.1k, 1%, 0603	
32	1	R50	RES., CHIP, 34.8k, 1%, 0603	
33	2	R28, R32	RES., CHIP, 100k, 1%, 0603	
34	1	R34	RES., CHIP, 4.64k, 1%, 0603	
35	1	R35	RES., CHIP, 931Ω, 1%, 0603	
36	1	R43	RES., CHIP, 4.99k, 1%, 0603	
37	2	R56, R58	RES., CHIP, 0.005Ω, 1%, 2512	IRC., LRF2512-01-R005-F

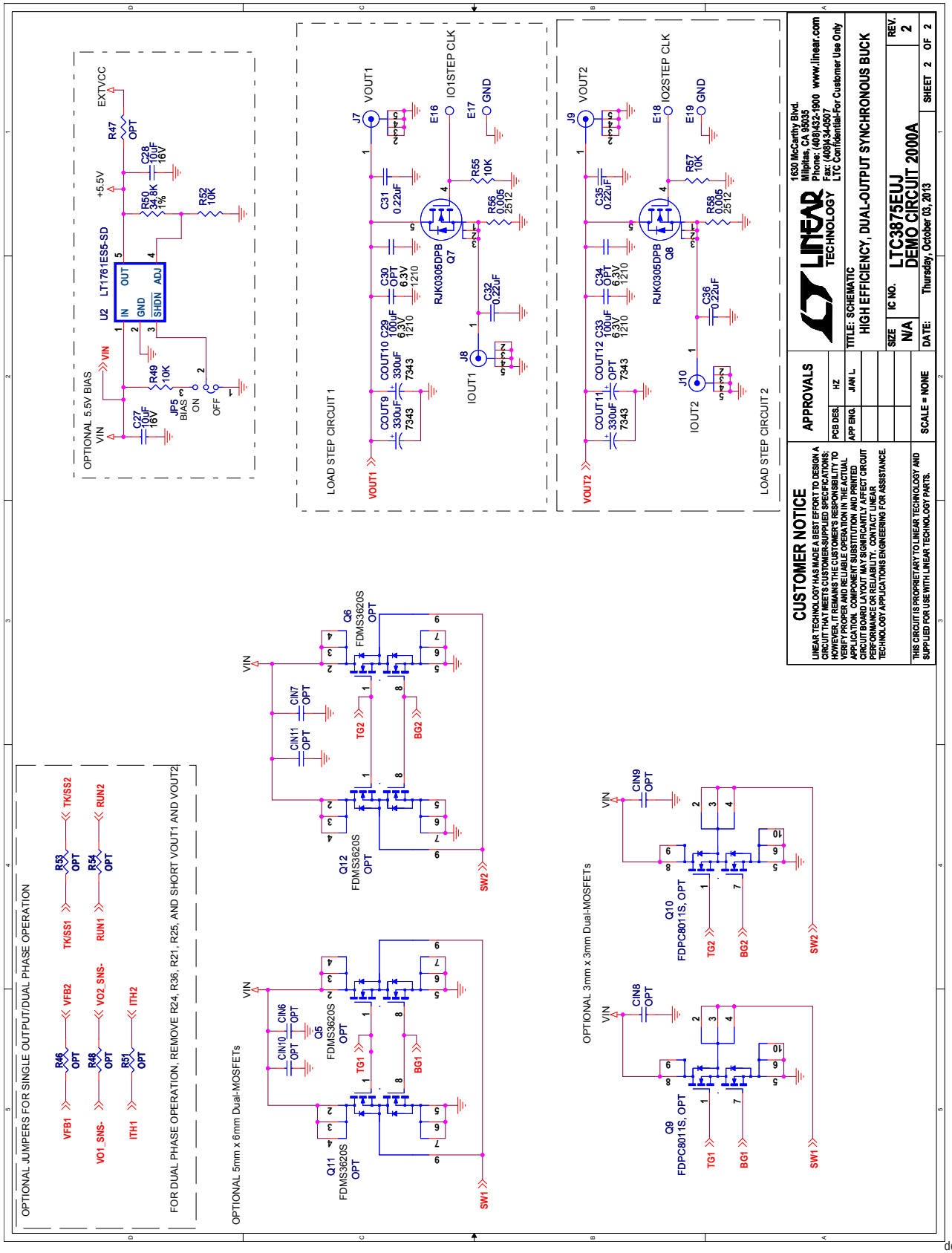
PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
38	1	U1	IC, LTC3875EUJ, QFN 6mm × 6mm	LINEAR TECH., LTC3875EUJ#010J-1PBF
39	1	U2	IC, LT1761ES5-SD, TSOT-23	LINEAR TECH., LT1761ES5-SD
Additional Demo Board Circuit Components				
1	0	C1, C5, CIN6, C6, CIN7, C30, C34, CIN8, CIN9, CIN10, CIN11, C15, C17, C23, C24, C25, C26, COUT12	CAP., OPTIONAL	
2	0	RN1-RN4, R2, R3, R5 , R6, R7, R8, R22, R27, R29, R33, R30, R31, R38, R39, R41, R42, R44, R45, R46, R47, R48, R51, R53, R54	RES., OPTIONAL	
3	0	Q5, Q6, Q11, Q12	DUAL N-CHANNEL MOSFET 25V	FAIRCHILD FDMS3620S
4	0	Q9, Q10	DUAL N-CHANNEL MOSFET 25V	FAIRCHILD FDPC8011S

SCHEMATIC DIAGRAM



SCHEMATIC DIAGRAM



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