LTC3875EUJ
High Efficient, Single Output Synchronous Buck Converter with Very Low DCR Inductor

DESCRIPTION

Demonstration circuit 2055A is a high efficiency, high density, 4-phase synchronous buck converter with a 4.5V to 14V input voltage range. It can supply up to 120A of load current with a 1.0V output. This demo board has two each LTC®3875EUJ feature-rich dual-phase synchronous current mode buck controllers with very low DCR current sensing capability, on-chip drivers and remote output voltage sensing. This board is set up with 0.32mΩ DCR output inductors. 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, medical instruments, and DC power distribution. The LTC3875 is available in a 40-lead 6mm × 6mm QFN package.

To shut down the converter, set the RUN pin voltage below 1.0V (SW1 and SW2: both OFF). Use JP1 jumper to select Burst Mode® operation, pulse-skipping mode or forced continuous mode operation at light load. The switching frequency is pre-set at about 400kHz, and it can be easily modified from 250kHz to 720kHz. An onboard dynamic circuit is also available for a load transient test. Please see LTC3875 data sheet for more detailed information.

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

PERFORMANCE SUMMARY

Specifications are at T_A = 25°C

PARAMETER	CONDITION	VALUE
Input Voltage Range		4.5V to 14V
Output Voltage, V_{OUT}	V_{IN} = 4.5 to 14V, I_{OUT} = 0A to 120A	1.0V ±2%
Maximum Output Current, I_{OUT}	V_{IN} = 4.5 to 14V, V_{OUT} = 1.0V	120A
Typical Efficiency, V_{OUT}	V_{IN} = 12V, V_{OUT} = 1.0 V, I_{OUT} = 120A	87.1%, See Figure 3
Typical Switching Frequency		400kHz

QUICK START PROCEDURE

Demonstration circuit 2055A 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 VIN (4.5V-14V) and GND (input return).
2. Connect the 1.0V output load between VOUT1 and GND (Initial load: no load).
3. Connect the DVMs to the input and outputs. Set default jumper position:
4. Turn on the input power supply and check for the proper output voltages. V_{OUT1} should be 1.0V ±2%.
5. 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.

JP1	*JP2*	*JP3*	*JP4*	*JP5*	*JP6*	*SW1*	*SW2*
MODE	**PHASMD1**	**ENTMPB1**	**ENTMPB1**	**BIAS**	**PHASMD1**	**RUN1**	**RUN2**
CCM	90°	OFF	OFF	OFF	90°	ON	ON

QUICK START PROCEDURE

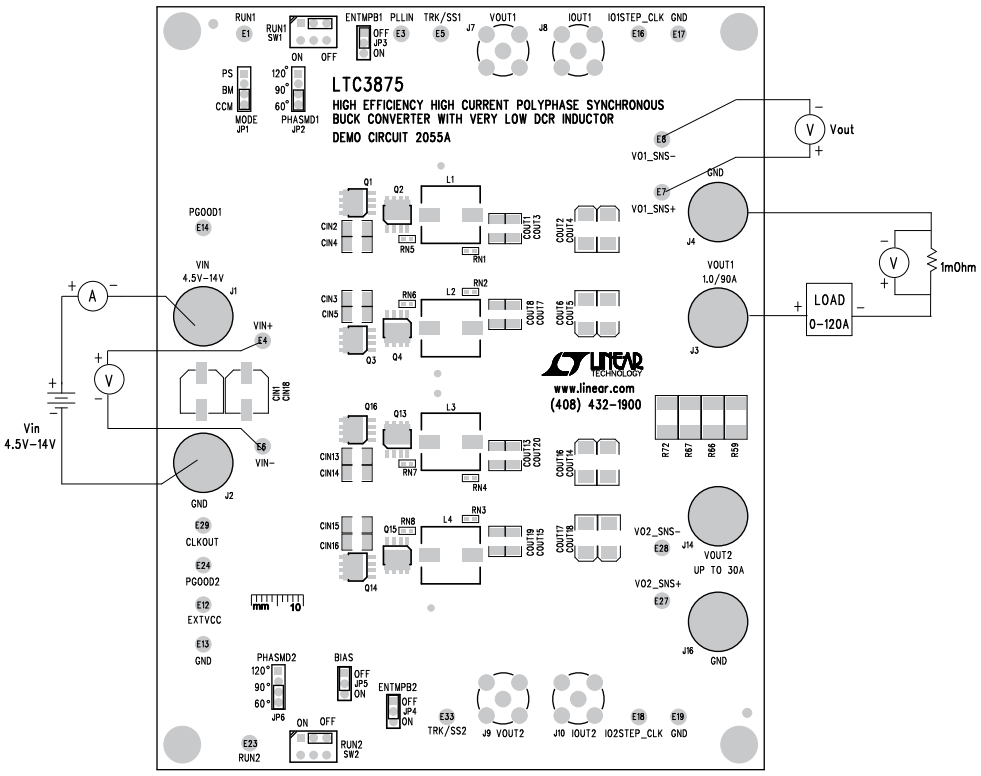


Figure 1. Proper Measurement Equipment Setup

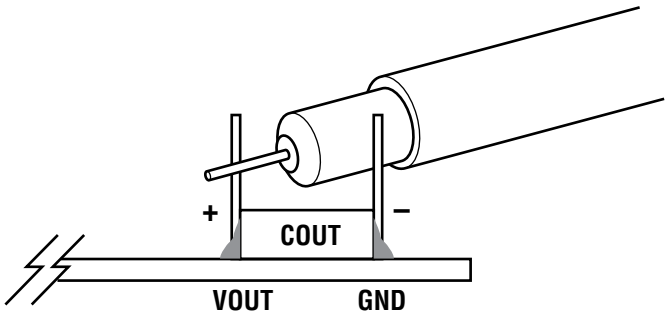


Figure 2. Measuring Output Voltage Ripple

QUICK START PROCEDURE

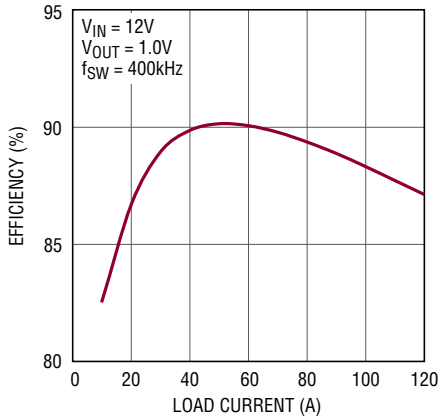


Figure 3. Efficiency vs Load Current

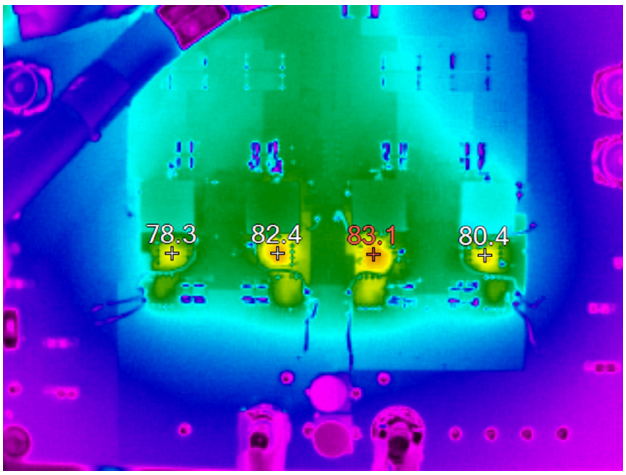


Figure 4. Thermal Performance at V_{IN} = 12V, V_{OUT} = 1.0V, I_{OUT} = 120A, 200LFM Forced Air Flow

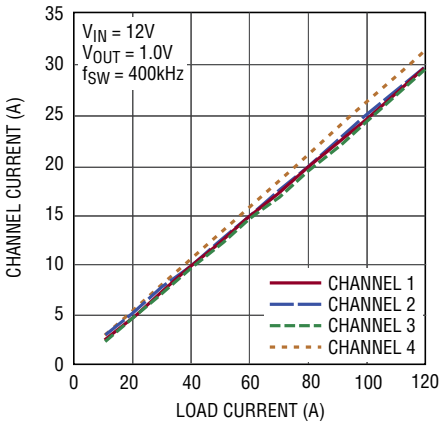


Figure 5. Current Sharing vs Load Current

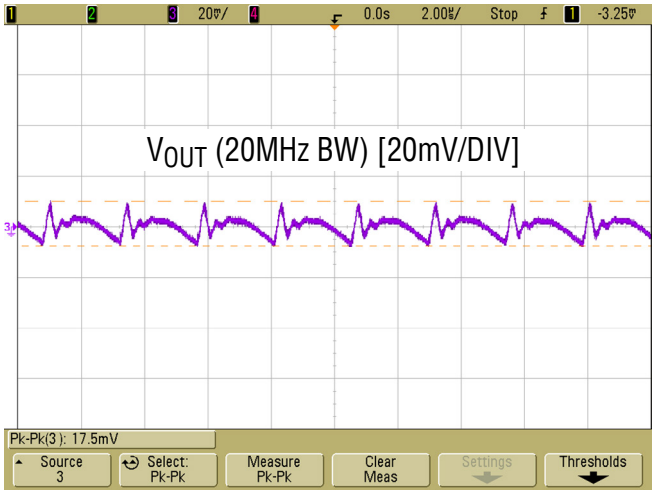


Figure 6. Output Voltage Ripple at V_{IN} = 12V, V_{OUT} = 1.0V, I_{OUT} = 120A, f_{SW} = 400kHz

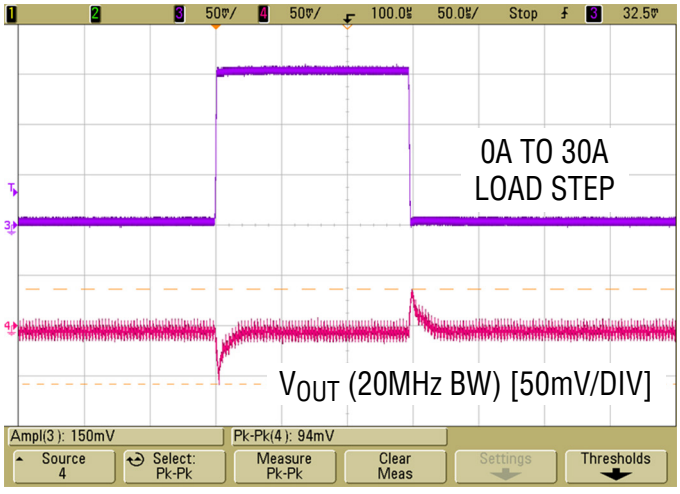


Figure 7. Transient Performance at V_{IN} = 12V, V_{OUT} = 1.0V, I_{OUT} = 0A to 30A, f_{SW} = 400kHz

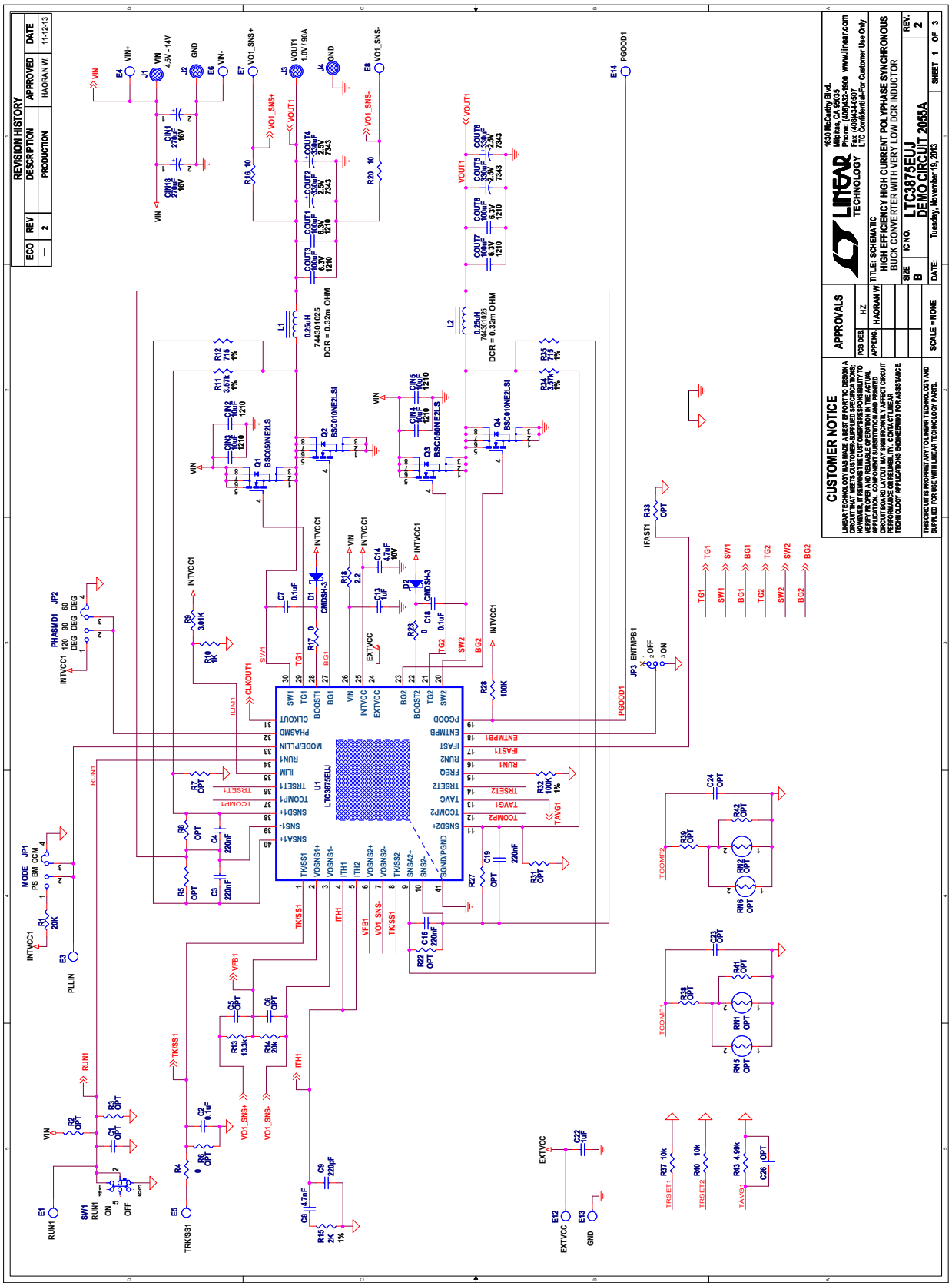
PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	2	CIN1, CIN18	CAP., OS-CON, 270µF, 16V, 20%, E12	SANYO, 16SVPC270M
2	12	COUT1, COUT3, COUT7, COUT8, COUT13, COUT15, COUT19, COUT20, C29, C30, C33, C34	CAP., X5R, 100µF, 6.3V, 20%,1210	AVX 12106D107MAT2A
3	12	COUT2, COUT4-COUT6, COUT9-COUT12, COUT14, COUT16-COUT18	CAP., OS-CON, 330µF, 2.5V, 20%, 7343	SANYO, 2R5TPE330M9
4	4	L1, L2, L3, L4	IND, 0.25µH	WURTH ELECT.,744301025
5	4	Q1, Q3, Q14, Q16	OPTIMOS POWER-TRANSISTOR, PG-TDSON-8 25V	INFINEON, BSC050NE2LS
6	4	Q2, Q4, Q13, Q15	OPTIMOS POWER-TRANSISTOR, PG-TDSON-8 25V	INFINEON, BSC010NE2LSI
7	2	U1, U3	IC, LTC3875IUJ, QFN 6mm × 6mm	LINEAR TECH., LTC3875IUJ#PBF
8	1	U2	IC, LT1763CDE, DFN 4mm × 3mm	LINEAR TECH., LT1763CDE-SD
Additional Demo Board Circuit Components				
9	10	CIN2-CIN5, CIN13-CIN16, C27, C28	CAP., X5R, 10µF,16V, 10%, 1210	AVX 1210YD106KAT2A
10	0	C1, C5, C6, CIN6-CIN12, CIN17, C23, C24, C26, C37, C48, C49, C54, C55, C58, C59, C63	CAP., OPTIONAL	
11	5	C2, C7, C18, C38, C42, C43	CAP., X5R, 0.1µF, 16V, 10%, 0603	AVX 0603YD104KAT2A
12	8	C3, C4, C16, C19, C44, C46, C52, C62	CAP., X5R, 220nF, 25V, 10%, 0603	AVX 06033D224KAT2A
13	1	C8	CAP., X7R, 4.7nF, 25V, 10%, 0603	AVX 06033C472KAT2A
14	2	C9, C57	CAP., NPO, 220pF, 25V, 10%, 0603	AVX 06033A221KAT2A
15	3	C13, C22, C56	CAP., X5R, 1µF, 25V, 10%, 0603	AVX 06033D105KAT2A
16	2	C14, C60	CAP., X5R, 4.7µF, 16V, 10%, 0805	TDK C2012X5R1E475K
17	4	C31,C32,C35,C36	CAP., X5R, 0.22µF, 16V, 10%, 0805	AVX 0805YC224KAT2A
18	4	D1, D2, D3, D4	DIODE, SCHOTTKY, SOD-323	CENTRAL CMDSH-3TR
19	0	Q5, Q6, Q9-Q12, Q17, Q18	OPTIONAL	
20	2	Q7, Q8	MOSFET SPEED SRS 30V 30A LFPAK	RENESAS RJK0305DPB
21	2	R1, R14	RES., CHIP, 20k, 1%, 0603	NIC NRC06F2002TRF
22	0	R2, R3, R5-R8, R22, R27, R31, R33, R38, R39, R41, R42, R47, R63, R65, R68, R69, RN1-RN8, R73, R74, R75, R76, R79, R83, R84, R88, R89, R90, R91, R92, R93, R94, R96, R97	RES., OPTIONAL	
23	12	R4, R17, R23, R46, R48, R51, R53, R54, R60, R61, R64, R82	RES., CHIP, 0Ω, 0603	NIC NRC06Z0TRF
24	4	R59, R66, R67, R72	RES., CHIP, 0Ω, 2512	VISHAY CRCW25120000Z0ZG
25	2	R9, R80	RES., CHIP, 3.01k, 1%, 0603	NIC NRC06F3011TRF
26	2	R10, R81	RES., CHIP, 1k, 1%, 0603	NIC NRC06F1001TRF
27	4	R11, R34, R77, R86	RES., CHIP, 3.57k, 1%, 0603	NIC NRC06F3571TRF
28	4	R12, R35, R70, R85	RES., CHIP, 715Ω, 1%, 0603	VISHAY CRCW0603715RFKEA
29	1	R13	RES., CHIP, 13.3k, 1%, 0603	VISHAY CRCW060313K3FKEA
30	8	R37, R40, R49, R52, R55, R57, R78, R101	RES., CHIP, 10k, 1%, 0603	NIC NRC06F1002TRF
31	1	R15	RES., CHIP, 2k, 1%, 0603	NIC NRC06F2001TRF
32	2	R16, R20	RES., CHIP, 10Ω, 1%, 0603	NIC NRC06F10R0TRF
33	2	R18, R62	RES., CHIP, 2.2Ω, 1%, 0603	NIC NRC06F2R20TRF

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
34	4	R28, R32, R87, R99	RES., CHIP, 100k, 1%, 0603	NIC NRC06F1003TRF
35	2	R43, R44	RES., CHIP, 4.99k, 1%, 0603	NIC NRC06F4K99TRF
36	1	R50	RES., CHIP, 34.8k, 1%, 0603	VISHAY CRCW060334K8FKEA
37	2	R56, R58	RES., CHIP, 0.005Ω, 1%, 2512	VISHAY WSL25125L000FEA
Hardware-For Demo Board Only				
38	19	E1, E3-E8, E12-E14, E16-E19, E23, E24, E27-E29, E33	TESTPOINT, TURRET, 0.062"	MILL-MAX, 2308-2-00-80-00-00-07-0
39	6	J1, J2, J3, J4, J14, J16	STUD, TESTPIN	PEM KFH-032-10
40	12	J1-J4, J14, J16 (X2)	NUT, BRASS 10-32	ANY #10-32
41	6	J1-J4, J14, J16	RING, LUG #10	KEYSTONE, 8205, #10
42	6	J1-J4, J14, J16	WASHER, TIN PLATED BRASS	ANY #10
43	3	JP1, JP2, JP6	2MM SINGLE ROW HEADER, 4-PIN	SAMTEC, TMM-104-02-L-S
44	3	JP3-JP5	HEADER 3-PIN 0.079 SINGLE ROW	SAMTEC, TMM103-02-L-S
45	6	JP1-JP6	SHUNT	SAMTEC, 2SN-BK-G
46	2	SW1, SW2	CONNECTOR, SUB MINIATURE SLIDE SWITCHES	C&K.,JS202011CQN
47	4	J7, J8, J9, J10	CONN, BNC, 5PINS	CONNEX, 112404

SCHEMATIC DIAGRAM



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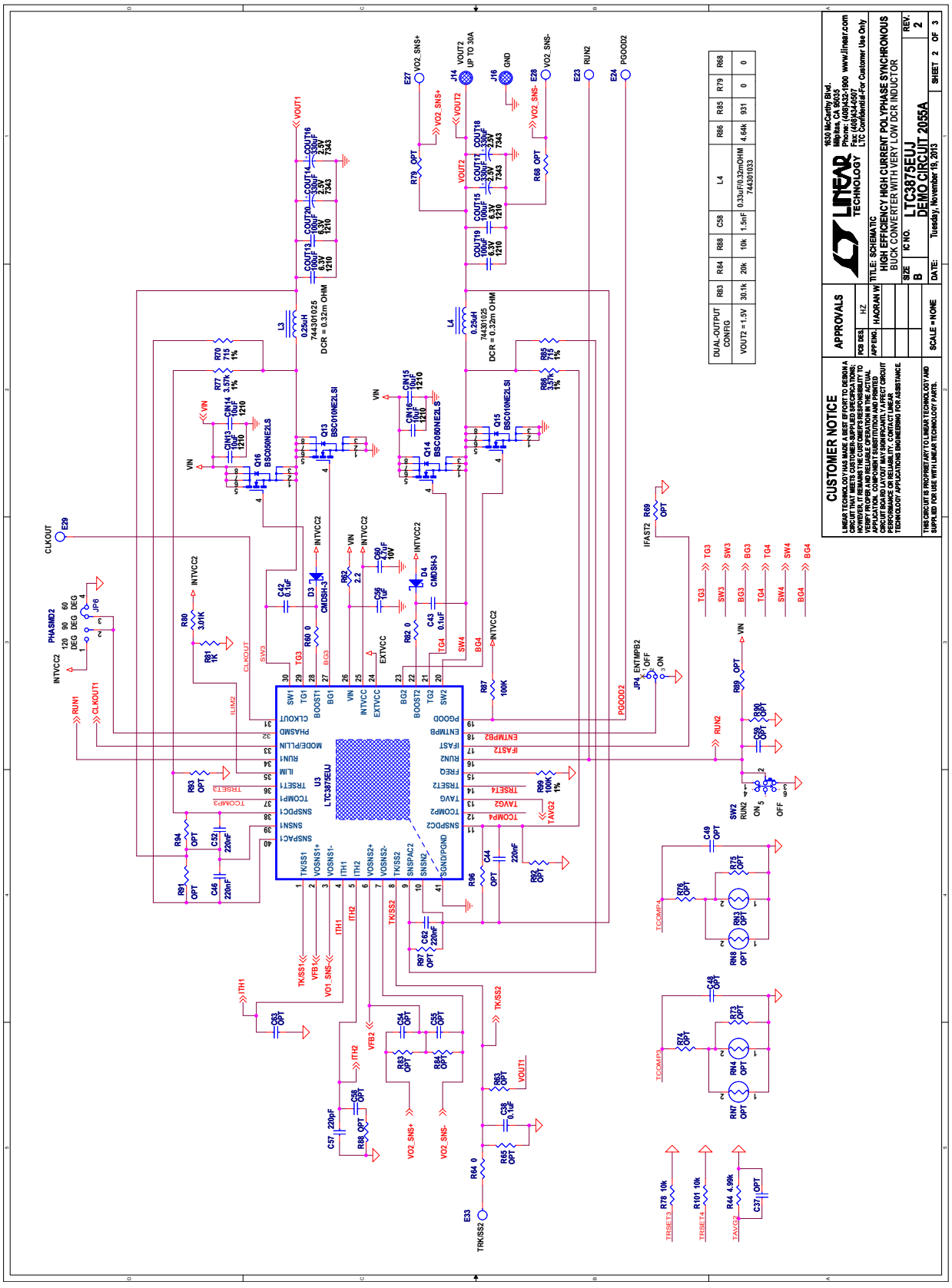

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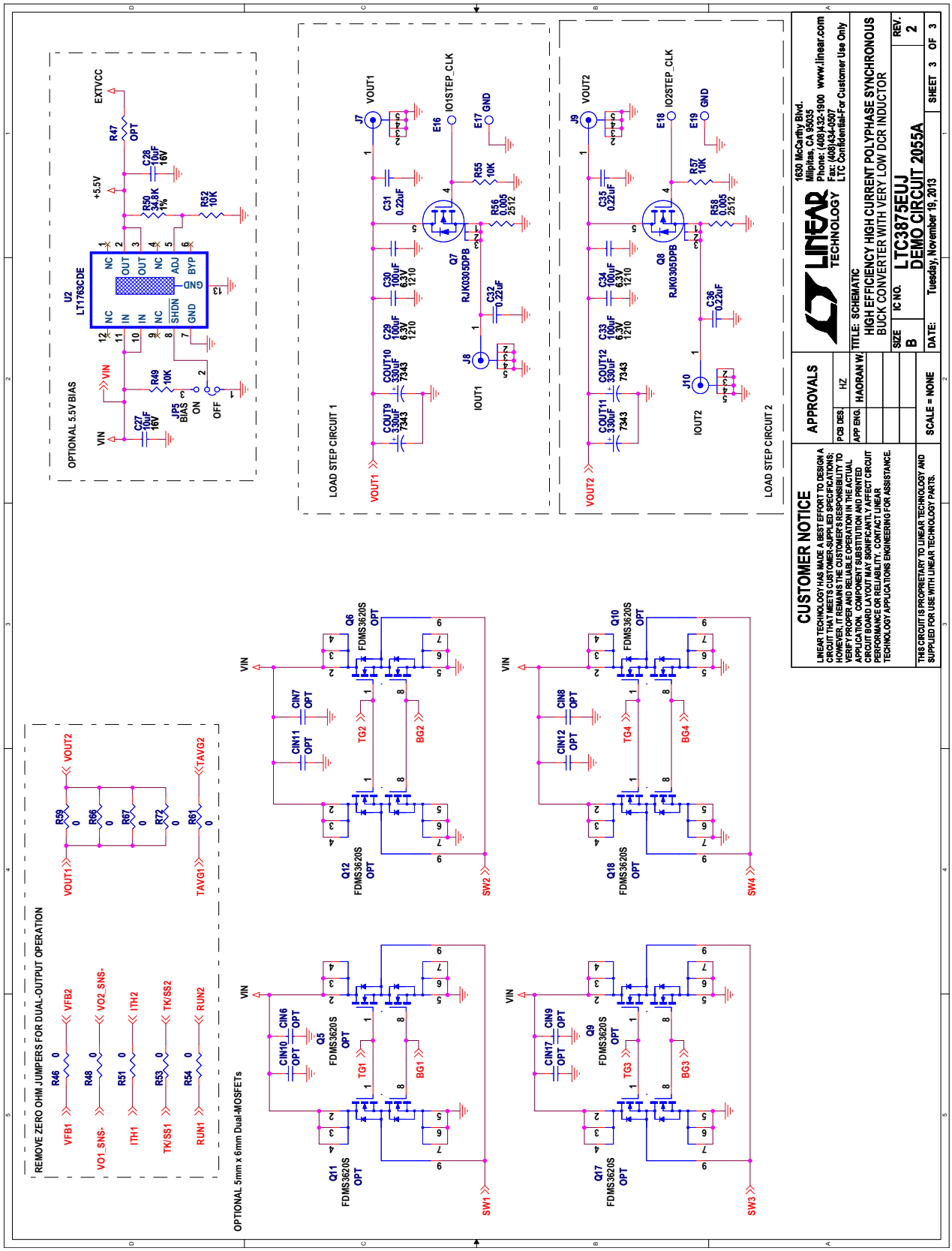

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