LTC3829
High Efficiency, 6-Phase, Single Output, Synchronous Buck Converter

DESCRIPTION

Demonstration circuit 1675A is a high efficiency, 6-phase, synchronous buck converter with a 7V to 14V input range that utilizes two LTC®3829 controllers. It can supply 120A maximum load current with a 1.5V output voltage. The LTC3829 is a feature-rich single-output 3-phase synchronous buck controller with on-chip drivers and remote output voltage sensing. This board is set up with a sense resistor configuration for current sensing. Optional inductor DCR current sensing is possible. The temperature compensation function can guarantee accurate current limit over a wide temperature range with DCR sensing.

The Stage Shedding™ function allows the controller to decrease the number of phases to one during a light load condition to save switching losses. Nonlinear control and active voltage positioning (AVP) can improve the transient response. The LTC3829 is suitable for an input voltage ranging from 4.5V to 38V and an output voltage up to 5V. It can provide high efficiency, high power density and versatile power solutions for telecom and datacom systems, industrial and medical instruments, DC power distribution systems and computer systems. The LTC3829 is available in 38-pin 5mm × 7mm QFN and 38-pin TSSOP packages.

To shut down the converter, set the RUN pin voltage below 1.2V (JP1: Off). Use the JP4 jumper to select Burst Mode® operation, stage shedding mode or forced continuous mode operation at light load. The nonlinear control function is set by JP5 and JP6. The switching frequency is pre-set at about 400kHz, and can be easily modified from 250kHz to 770kHz. An on-board dynamic circuit is also available for a transient test. Please see LTC3829 data sheet for more detailed information.

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

PERFORMANCE SUMMARY (T_A = 25°C)

PARAMETER	CONDITION	VALUE
Input Voltage Range		7V to 14V
Output Voltage, V_{OUT}	V_{IN} = 7V to 14V, I_{OUT} = 0A to 120A	1.5V ±2%
Maximum Output Current, I_{OUT}	V_{IN} = 7V to 14V, V_{OUT} = 1.5V	120A
Typical Efficiency	V_{IN} = 12V, V_{OUT} = 1.5V, I_{OUT} = 120A	87.6%
Typical Switching Frequency		400kHz

QUICK START PROCEDURE

Demonstration circuit 1675A is easy to set up to evaluate the performance of the LTC3829. 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 (7V-14V) and GND (input return).
2. Connect the 1.5V output load between VOUT and GND (Initial load: no load).
3. Connect the DVMs to the input and outputs. Set default jumper position: JP1: ON; JP2: OFF; JP3: OFF; JP4: FORCE CONTINUOUS; JP5: OFF; JP6: OFF
4. Turn on the input power supply and check for the proper output voltages. VOUT should be 1.5V ±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.

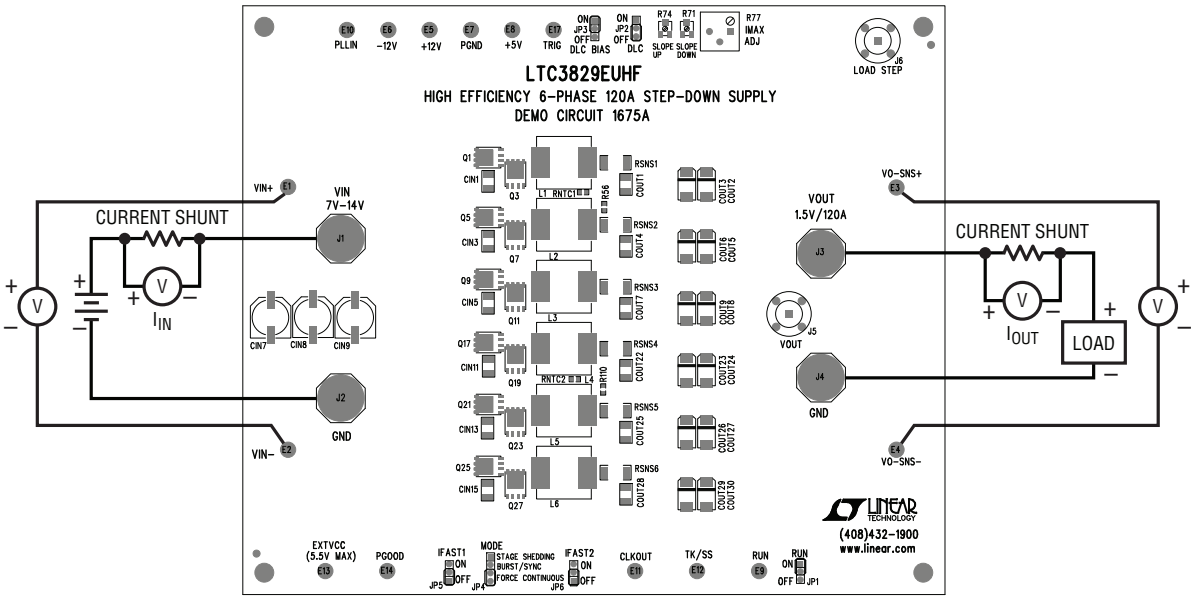


Figure 1. Proper Measurement Equipment Setup

QUICK START PROCEDURE

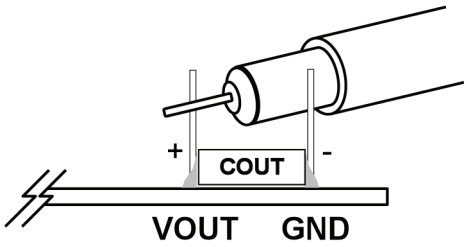


Figure 2. Measuring Output Voltage Ripple

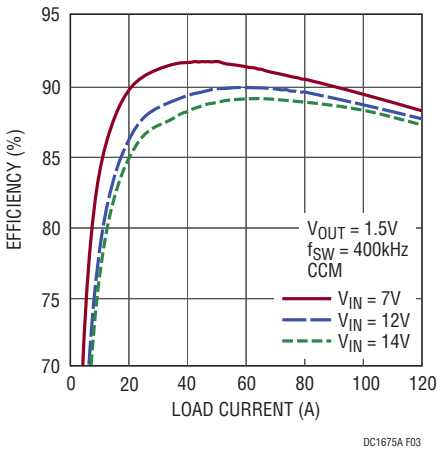


Figure 3. Efficiency vs Load Current

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	12	CIN1, CIN2, CIN3, CIN4, CIN5, CIN6, CIN11, CIN12, CIN13, CIN14, CIN15, CIN16	Cap., X5R 10µF 16V 10%,1210	AVX, 1210YD106KAT2A
2	3	CIN7, CIN8, CIN9	Cap., OSCON 180µF 16V 20%	SANYO 16SVP180MX
3	6	COUT1, COUT4, COUT7, COUT22, COUT25, COUT28	Cap., X5R 100µF 6.3V 10%,1210	AVX, 12106D107KAT2A
4	12	COUT2, COUT3, COUT5, COUT6, COUT8, COUT9, COUT23, COUT24, COUT26, COUT27, COUT29, COUT30	Cap., POSCAP 330µF 2.5V 20%	SANYO 2R5TPE330M9
5	3	COUT10, COUT11, C63	Cap., X7R 1µF 25V 10%,0805	AVX, 08053C105KAT9A
6	1	C1	Cap., NPO 100pF 16V 10%,0603	AVX, 0603YA101KAT2A
7	2	C3, C67	Cap., X7R 1µF 16V 10%,0603	AVX, 0603YC105KAT
8	2	C4, C78	CAP., NPO 22pF 16V 10% 0603	AVX, 0603YA220KAT
9	1	C5	Cap., X7R 0.0022µF 50V 10%,0603	AVX, 06035C222KAT2A
10	15	C10, C24, C25, C26, C40, C53, C55, C56, C62, C69, C73, C77, C79, C80, C86	Cap., X5R 0.1µF 25V 5%,0603	AVX 06033D104JAT2A
11	2	C11, C74	Cap., X5R 4.7µF 10V 10%,0805	AVX, 0805ZD475KAT
12	6	C21, C22, C23, C81, C82, C83	Cap., NPO 1000pF 25V 5%,0603	AVX, 06033A102JAT2A
13	3	C44, C57, C58	Cap., X7R 0.01µF 50V 10%,0603	AVX, 06035C103KAT2A
14	1	C52	Cap., NPO 100pF 50V 5%,1206	AVX, 12065A101JAT2A
15	5	C54, C61, C65, C66, C68	Cap., X7R 4.7µF 25V 10%,1206	AVX, 12063C475KAT
16	1	C60	Cap., X5R 0.47µF 16V 10%,0603	AVX 0603YD474KAT2A
17	1	C64	Cap., NPO 10pF 25V 5%,0603	AVX, 06033A100JAT
18	2	C70, C71	Cap., X7R 10µF 16V 10%,1206	AVX, 1206YC105KAT
19	6	D1, D2, D3, D8, D9, D10	Schottky Diode, 30V	Central Semi. CMDSH-3
20	1	D4	Zener Diode, 5.1V	On Semi. MMBZ5231BLT1G
21	1	D5	Schottky Diode	Diodes Inc. BAT54S
22	2	D6,D7	Diode Schotkky, 40V	Diodes Inc. B0540W-7
23	6	L1, L2, L3, L4, L5, L6	Inductor, 0.33µH	Wurth, 744308033
24	1	L7	Inductor, 10µH	Sumida,CLS62RC-100
25	1	L8	Inductor, 10µH, CMD series	SUMIDA, CMD4D08NP-100MC
26	6	Q1, Q5, Q9, Q17, Q21, Q25	N-Chanel Pwr MOSFET	RENESAS, RJK0305DPB
27	12	Q3, Q4, Q7, Q8, Q11, Q12, Q19 Q20, Q23, Q24, Q27, Q28	N-Chanel Pwr MOSFET	RENESAS, RJK0330DPB
28	1	Q13	NPN Transistors, SOT23	Zetex, FMMT619TA
29	2	Q14, Q15	MOSFET, N-Channel 30V	Siliconix, SUD50N03-09P
30	1	Q16	PNP Transistors, SOT23	Zetex, FMMT718TA
31	6	RSNS1, RSNS2, RSNS3, RSNS4, RSNS5, RSNS6	Res., Chip, 0.001Ω, 1%, 2010_Kelvin	VISHAY, WSL20101L000FEA
32	1	R1	Res., Chip, 30.1k, 1%, 0603	VISHAY, CRCW060330K1FKEA
33	1	R2	Res., Chip, 20.0k, 1%, 0603	VISHAY, CRCW060320K0FKEA
34	20	R3, R13, R27, R28, R29, R35, R45, R87, R90, R96, R104, R107, R108, R121, R123, R125, R131, R132, R133, R134	Res., Chip, 0Ω, 0603	VISHAY, CRCW06030000Z0EA

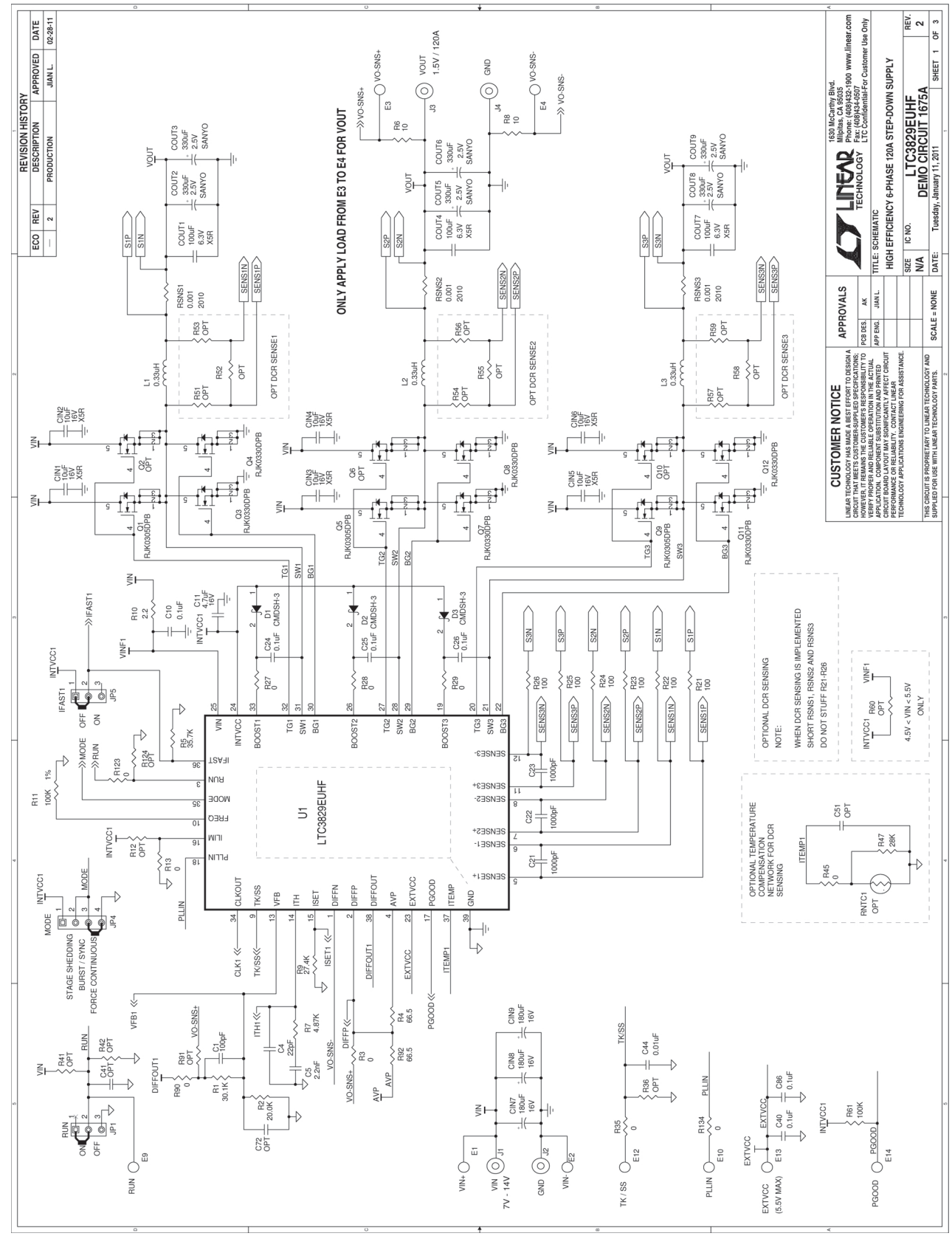
PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
35	2	R4, R92	Res., Chip, 66.5Ω, 1%, 0603	VISHAY,CRCW060366R5FKEA
36	1	R5	Res., Chip, 35.7k, 1%, 0603	VISHAY, CRCW060335K7FKEA
37	2	R6,R8	Res., Chip, 10Ω, 1%, 0603	VISHAY, CRCW060310RFKEA
38	1	R7	Res., Chip, 4.87k, 1%, 0603	VISHAY, CRCW06034K87FKEA
39	2	R9, R106	Res., Chip, 27.4k, 1%,0603	VISHAY, CRCW060327K4FKEA
40	2	R10, R95	Res., Chip, 2.2Ω, 1%, 0603	VISHAY, CRCW06032R20FNEA
41	3	R11, R61, R93	Res., Chip, 100k, 1%, 0603	VISHAY, CRCW0603100KFKEA
42	12	R21, R22, R23, R24, R25, R26, R112, R113, R114, R115, R116, R117	Res., Chip, 100Ω, 1%, 0603	VISHAY, CRCW0603100RFKEA
43	2	R47, R122	Res., Chip, 28k, 1%, 0603	VISHAY, CRCW060328KFKEA
44	1	R69	Res., Chip, 390k, 1%, 0603	VISHAY, CRCW0603390K0FKEA
45	1	R70	Res., Chip, 110k, 1%, 0603	VISHAY, CRCW0603110K0FKEA
46	2	R71, R74	Pot. 11 Turns 50k	Bourns 3313J-1-503E
47	1	R77	Pot. 3386-3/8 Square	Bourns 3386P-1-503LF
48	1	R72	Res., Chip, 1.5k, 1%, 0603	VISHAY, CRCW06031K50FKEA
49	1	R75	Res., Chip, 7.5k, 1%, 0603	VISHAY, CRCW06037K50FKEA
50	1	R76	Res., Chip, 1k, 1%, 0603	VISHAY, CRCW06031K0FKEA
51	1	R78	Res., Chip, 2k, 1%, 0603	VISHAY, CRCW06032K00FKEA
52	4	R79, R80, R81, R82	Res., Chip, 0.010Ω, 0.5W 1%	VISHAY, WSL2010R0100FEA
53	1	R83	Res., Chip, 115k, 1%, 0603	VISHAY, CRCW0603115KFKEA
54	1	R84	Res., Chip, 13.3k, 1%, 0603	VISHAY, CRCW060313K3FKEA
55	1	R86	Res., Chip, 30.1k, 1%, 0603	VISHAY, CRCW060330K1FKEA
56	1	R89	Res., Chip, 10k, 1%, 0603	VISHAY, CRCW060310K0FKEA
57	1	R98	Res., Chip, 30.9k, 1%, 0603	VISHAY, CRCW060330K9FKEA
58	2	U2, U1	I.C.,Volt. Reg., 38-Pin 7mm × 5mm QFN	Linear Tech., LTC3829EUHF
59	1	U3	I.C., Low Pwr Timer	TI, TLC555ID (4 tubes@75)
60	1	U4	I.C., Volt. Reg.	Linear Tech. Corp. LT1930ES5
61	1	U5	I.C., Dual Op Amp	Linear Technology Corp. LT1361CS8
62	1	U6	I.C., LT1761ES5, SOT23	Linear Tech. Corp. LT1761ES5-SD
63	1	U7	I.C., Feedback Amp	Linear Tech. Corp. LT1210CR
64	1	VR1	I.C., Volt. Ref.	Linear Tech. Corp. LT1004CS8-1.2
Additional Demo Board Circuit Components				
1	0	COUT16, COUT17, COUT18, COUT19, COUT20, COUT21	Cap., 1210 OPT	
2	0	RNTC1, C1, RNTC2, R12, R36, R41, C41, R42, R51, C51, R52, R53, R54, R55, R56, R57, R58, R59, R60, C72, R73, C75, C76, C84, R85, C85, R88, R91, R94, R97, R99, R100, R101, R102, R103, R105, R109, R110, R111, R118, R119, R120, R124, R126, R127, R128, R129, R130, R133, R135	OPT	
3	0	COUT12, COUT13, COUT14, COUT15, COUT31, COUT32, COUT33, COUT34	Cap., 7343, OPT	
4	0	C59	Cap., 1206, OPT	
5	0	Q2, Q6, Q10, Q18, Q22, Q26	OPT	

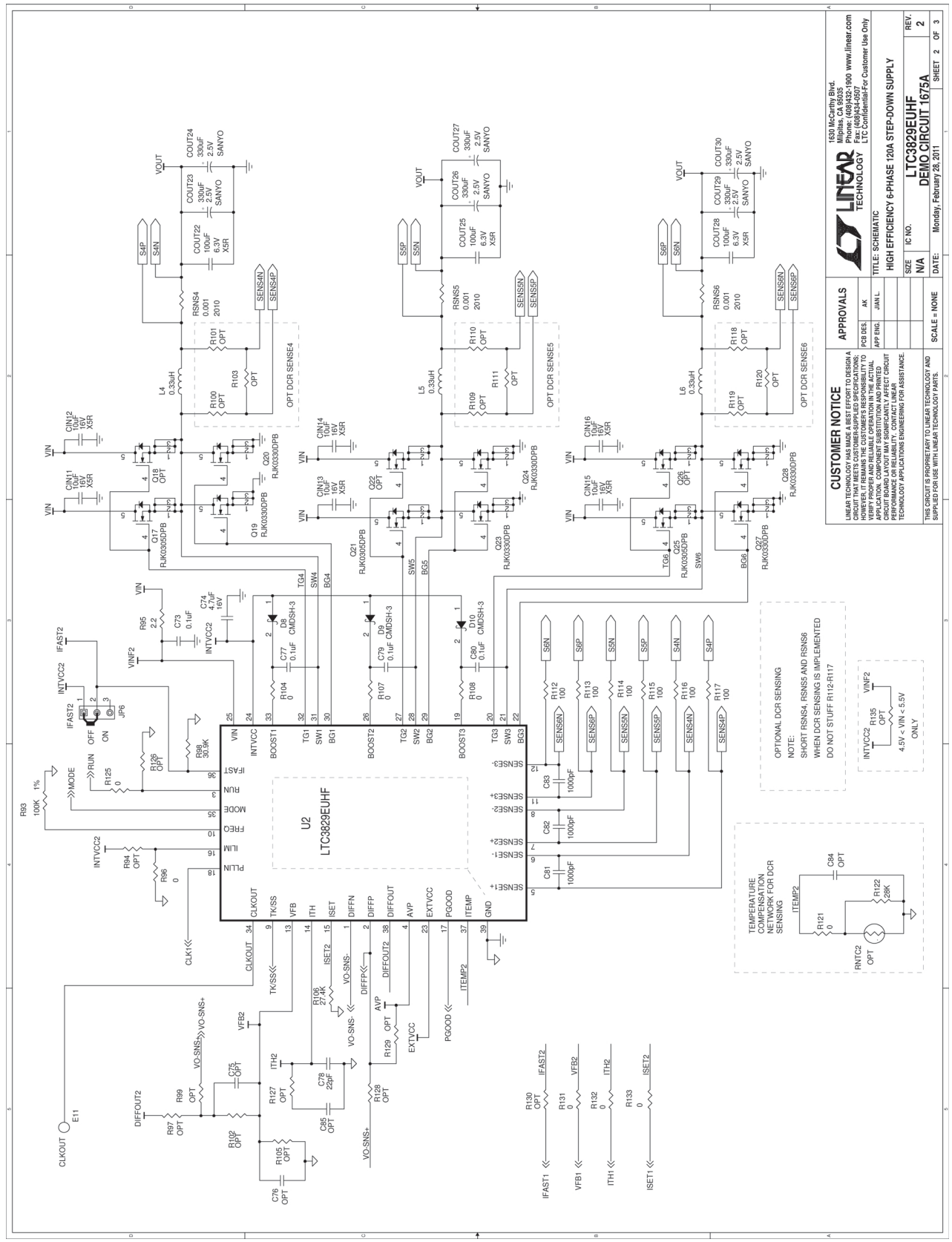
PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Hardware-For Demo Board Only				
1	4	J1, J2, J3, J4	Stud, Test Pin	PEM KFH-032-10
2	8	(J1, J2, J3, J4,) × 2	Nut, Brass Nuts #10-32	ANY #10-32
3	4	J1, J2, J3, J4	Ring, Lug Ring #10	KEYSTONE #10
4	4	J1, J2, J3, J4	Washer, Tin Plated Brass	ANY #10
5	15	E1-E14, E17	Turret, Testpoint , 091"	Mill Max 2501-2-00-80-00-00-07-0
6	5	JP1, JP2, JP3, JP5, JP6	Headers, 3 Pins 2mm Ctrs.	Samtec TMM-103-02-L-S
7	1	JP4	Headers, 4 Pins 2mm Ctrs.	Samtec TMM-104-02-L-S
8	6	XJP1, XJP2, XJP3, XJP4, XJP11, XJP12	Shunt, 2mm Ctrs.	Samtec 2SN-BK-G
9	2	J5, J6	CONN. VERT PC-MNT BNC 50Ω	CONNEX 112404
10	4		Stand-Off, Nylon 0.5" Tall	KEYSTONE, 8833(SNAP ON)

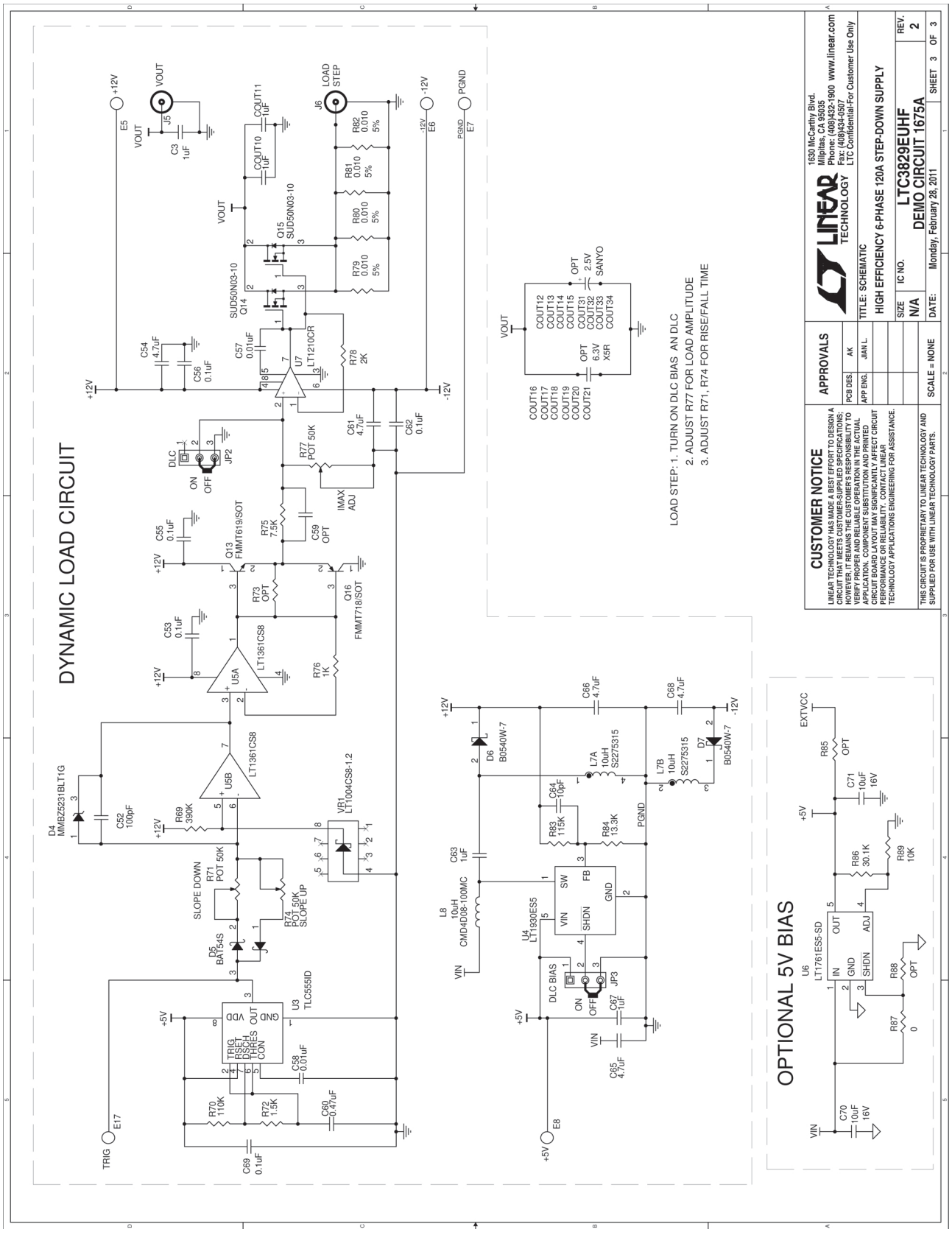
SCHEMATIC DIAGRAM



SCHEMATIC DIAGRAM



SCHEMATIC DIAGRAM



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Mailing Address:

Linear Technology
1630 McCarthy Blvd.
Milpitas, CA 95035