LTM4630EV
High Efficiency, PolyPhase 70A Step-Down Power µModule Regulator

DESCRIPTION

Demonstration Circuit 2007A-A features a PolyPhase® design using the LTM®4630EV, the high efficiency, high density, dual 18A, switch mode step-down power µModule® regulator. The input voltage is from 4.5V to 15V. The output voltage is jumper selectable from 0.9V to 1.8V. The DC2007A-A can deliver a nominal 70A output current. As explained in the data sheet, output current derating is necessary for certain V_{IN}, V_{OUT}, and thermal conditions. The LTM4630 on the DC2007A-A always operates in continuous conduction mode. The switching frequency can be programmed through a resistor or can be synchronized to an external clock signal. The board allows the user to program how its output voltage ramps up and down through the TRACK pin. The output voltage is tightly regulated between "VO+" and "VO-" through remote output voltage sensing which improves output voltage regulation at heavy loads. These features and the availability of the LTM4630EV in a compact 16mm × 16mm × 4.41mm LGA package make it ideal for use in many high density point-of-load regulation applications. The LTM4630 data sheet must be read in conjunction with this demo manual for working on or modifying the demo circuit DC2007A-A.

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

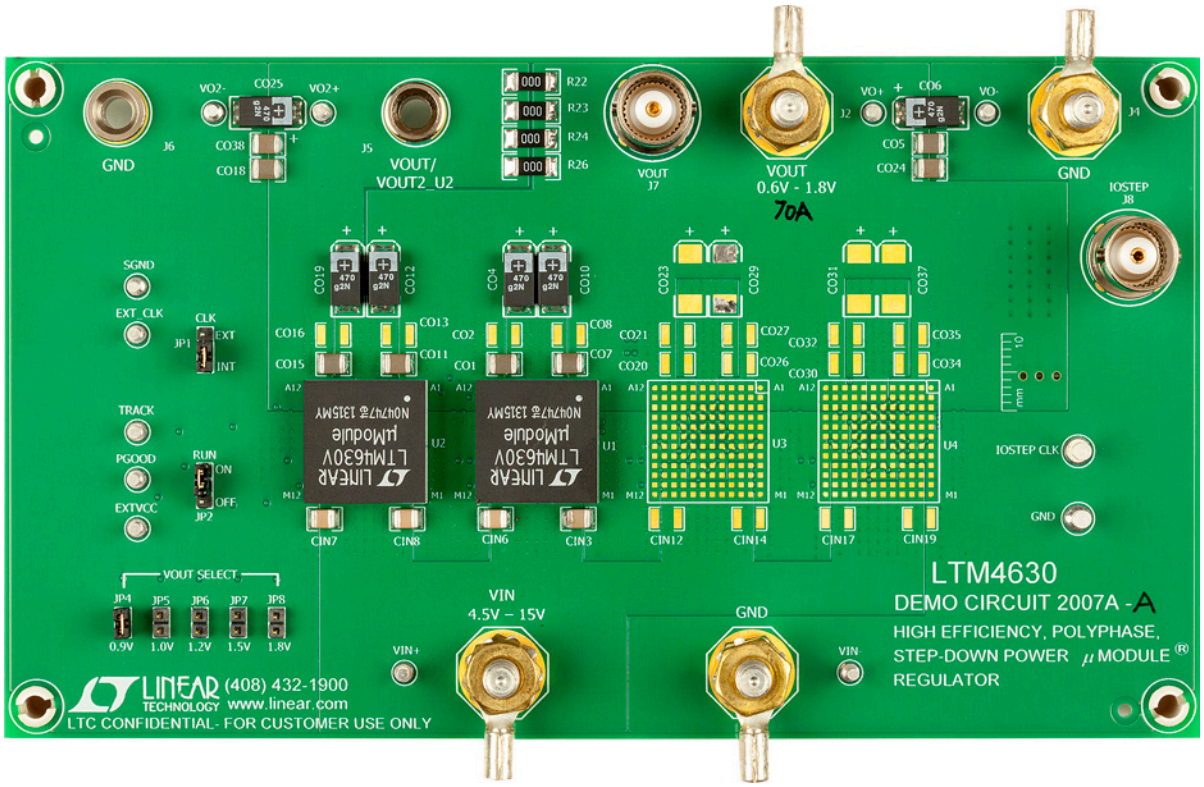


Figure 1. 70A PolyPhase LTM4630/DC2007A-A Demo Board

PERFORMANCE SUMMARY

Specifications are at T_A = 25°C

PARAMETER	CONDITIONS / NOTES	VALUE
Input Voltage Range		4.5V ~ 15V
Output Voltage V_{OUT}	V_{IN} = 4.5A ~ 15V, I_{OUT} = 0A ~ 70A, JP5: 1.0V	1.0V ±1.5% (0.985V ~ 1.015V)
Maximum Continuous Output Current	Derating Is Necessary for Certain V_{IN}, V_{OUT} and Thermal Conditions, See Data Sheet for Details.	70A
Default Operating Frequency		400kHz
Resistor Programmable Frequency Range		400kHz to 780kHz
External Clock Sync. Frequency Range		400kHz to 780kHz
Efficiency	V_{IN} = 12V, V_{OUT} = 1.0V, I_{OUT} = 70A, f_{SW} = 400kHz	83.5% See Figure 3
Load Transient	V_{IN} = 12V, V_{OUT} = 1.0V, I_{STEP} = 0A ~ 17.5A	<80mV, See Figure 4
Output Voltage Ripple	V_{IN} = 12V, V_{OUT} = 1.0V, I_{OUT} = 70A	<5mV, See Figure 5

QUICK START PROCEDURE

Demonstration circuit DC2007A-A is easy to set up to evaluate the performance of PolyPhase operation of the LTM4630EV. Due to the high input/output current, the user should select the proper input supply/load/cable which can sustain the full load operation. It's recommended to pull the load current from J2 and J4. The load current pulled from J5 and J6 shouldn't exceed 18A. Please refer to Figure 2 for proper measurement setup and follow the procedure below:

1. Place jumpers in the following positions for a typical 1.0V_{OUT} application:

JP1	*JP2*	*JP4 ~ JP8*
CLK	**RUN**	**VOUT SELECT**
INT	OFF	ON JP5/1.0V

2. With power off, connect the input power supply, load and meters as shown in Figure 2. Preset the load to 0A and V_{IN} supply to 12V.
3. Turn on the power supply at the input. Place JP2 to the ON position. The output voltage between "VO+" and "VO-" should be 1.0V ±1.5% (0.985V ~ 1.015V).
4. Once the proper output voltage is established, adjust the load within the operating range and observe the output voltage regulation, output voltage ripple, efficiency and other parameters. Output voltage ripple should be measured at J7 with BNC cables. 50Ω termination should be set on the oscilloscope or BNC cables.
5. (Optional) For an optional load transient test, apply an adjustable pulse signal between "IOSTEP CLK" and the "GND" test point. Pulse amplitude (3V ~ 3.5V) sets the load step current amplitude. The output transient current can be monitored at the BNC connector, J8 (5mV/A). The pulse signal should be a very small duty cycle (<10%) to limit the thermal stress on the transient load circuit.
6. (Optional) The LTM4630 can be synchronized to an external clock signal. Place the JP1 jumper on EXT and apply a clock signal (0V ~ 5V, square wave) on the "EXT_CLK" test point.
7. (Optional) The outputs of LTM4630 can track another supply. The output voltage tracks the voltage on TRACK when a valid signal is applied on the test point.
8. (Optional) The DC2007A-A can be configured to a dual output configuration with VO at 52.5A load current and VO2 at 18A load current. Stuff a 0Ω resistor on R61 and a 0.1µF on C14. Remove R22, R23, R24, R26, R27, R28, R32, R33, R35. Output voltage, VO2, is set by R37 based on the equation VO2 = 0.6V(1 + 60.4k/R37).

QUICK START PROCEDURE

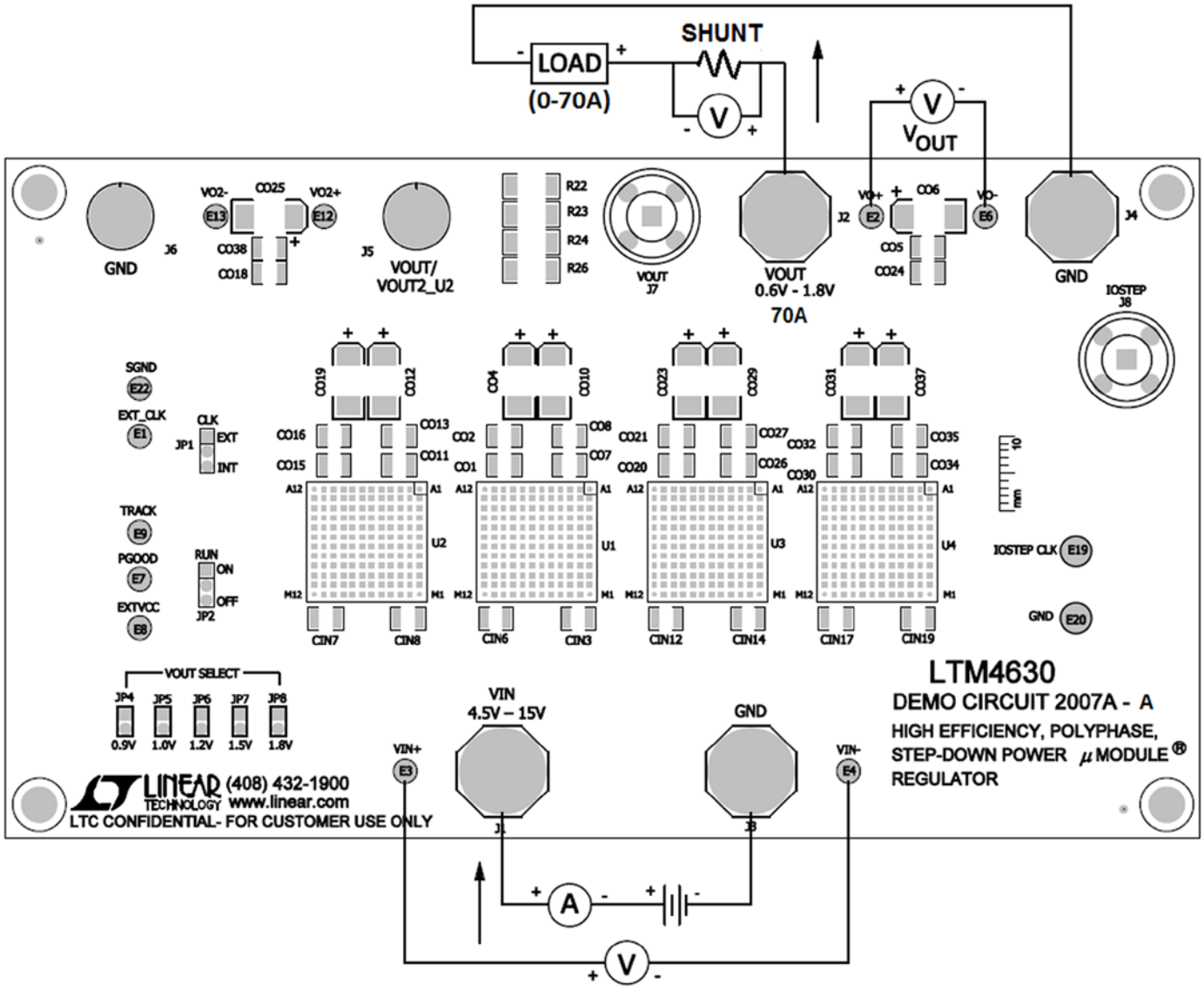


Figure 2. Test Setup of DC2007A-A

QUICK START PROCEDURE

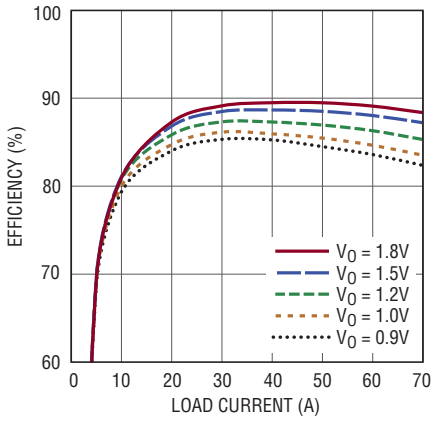


Figure 3. Measured Efficiency V_{IN} = 12V, f_{SW} = 400kHz

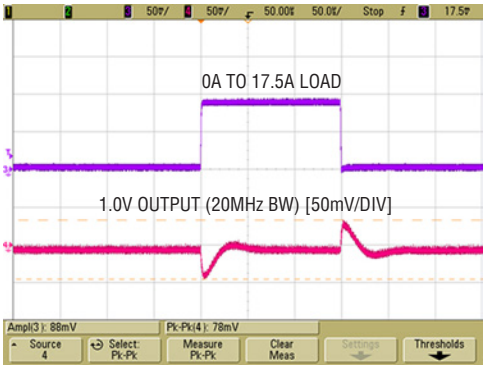


Figure 4. Load Transient 0A to 17.5A (V_{IN} = 12V, V_{OUT} = 1.0V)

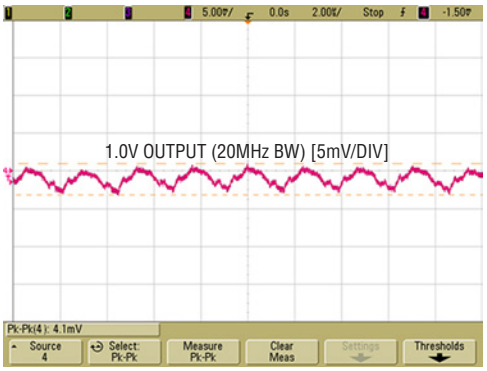


Figure 5. Measured Output Voltage Ripple at 12V_{IN}, 1.0V_{OUT}, 70A with Standard Demo Circuit Default Setup

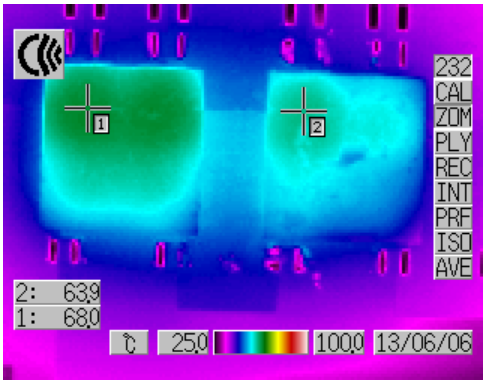


Figure 6. Thermal Capture at 12V_{IN}, 1.0V_{OUT}, 70A (T_A = 25°C, 400 LFM Airflow and No Heat Sink)

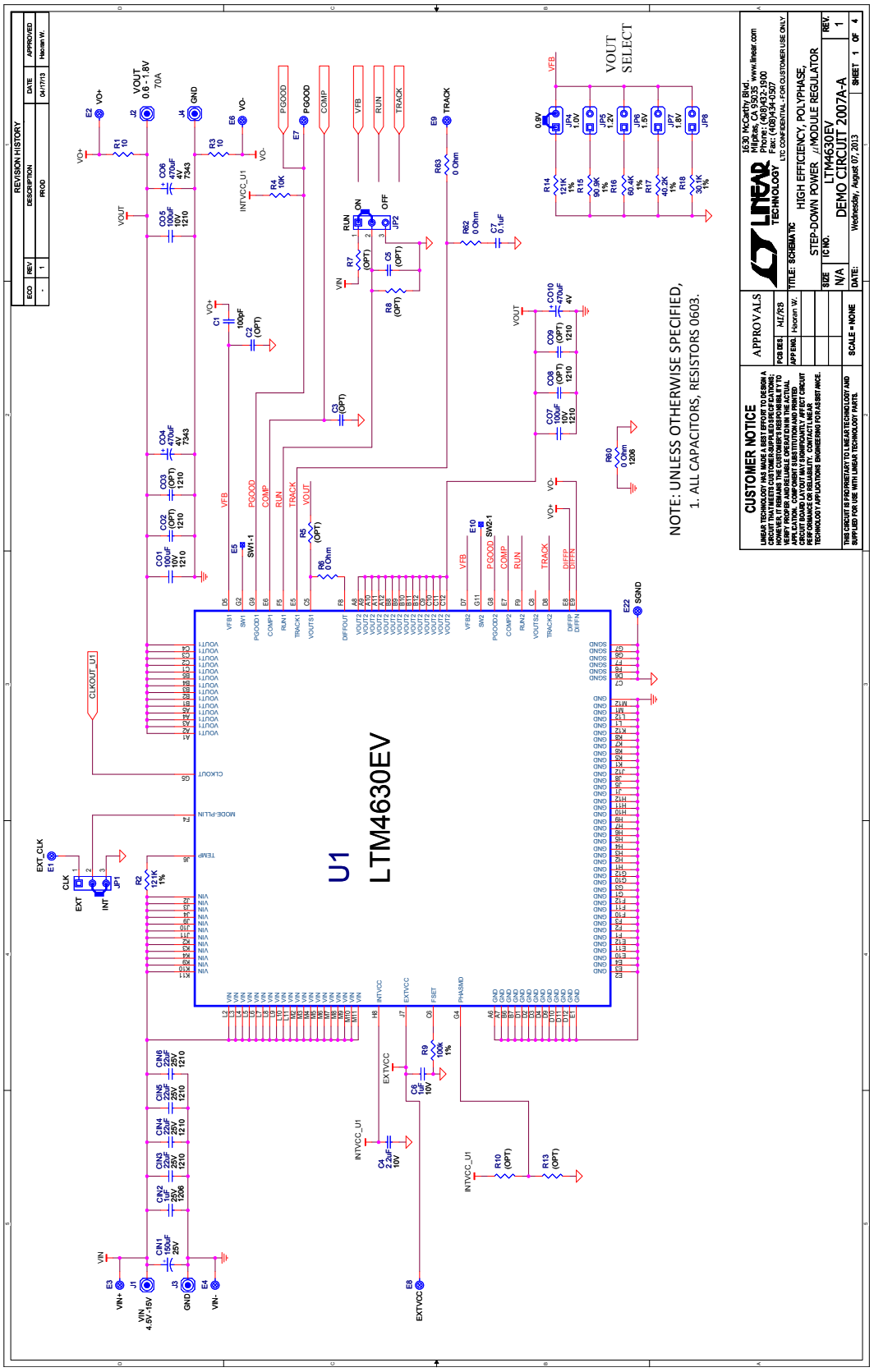
PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	8	CIN3, CIN4, CIN5, CIN6, CIN7, CIN8, CIN9, CIN10,	CAP, 1210 22µF 10% 25V X5R	AVX, 12103D226KAT2A
2	8	CO1, CO5, CO7, CO11, CO15, CO18, CO24, CO38	CAP, 1210 100µF 20% 10V X5R	TAIYO YUDEN, LMK325BJ107MM-T
3	6	CO4, CO6, CO10, CO12, CO19, CO25	CAP, 7343 470µF 20% 4V POSCAP	SANYO, 4TPE470MCL
4	13	R6, R19, R20, R27, R28, R32, R33, R35, R40, R45, R46, R62, R63	RES, 0603 0Ω JUMPER	VISHAY, CRCW06030000Z0EA
5	2	U1, U2	IC, VOLTAGE REGULATOR, LGA	LINEAR TECH., LTM4630EV#PBF
Additional Demo Board Circuit Components				
1	1	CIN1	CAP, 150µF 25% 25V ALUM	SUN ELECT., 25CE150AX
2	2	CIN2, CIN11	CAP, 1206 1µF 10% 25V X5R	TAIYO YUDEN, TMK316BJ105KD-T
3	1	C1	CAP, 0603 100pF 10% 25V XNPO	AVX, 06033A101KAT2A
4	0	C2, C3, C5, C8, C9, C12, C13, C14, C15, C16, C17, C20, C21, C26, C29, C30	CAP, 0603 OPTION	OPTION

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
5	4	C4, C10, C18, C22	CAP, 0603 2.2µF 20% 10V X5R	TAIYO YUDEN, LMK107BJ225MA-T
6	6	C6, C11, C19, C23, C27, C28	CAP, 0603 1µF 10% 10V X7R	TAIYO YUDEN, LMK107BJ105KA-T
7	2	C7, C25	CAP, 0603 0.1µF 10% 25V X7R	AVX, 06033C104KAT2A
8	1	C24	CAP, 0603 0.01µF 10% 100V X7R	AVX, 06031C103KAT2A
9	0	CO2, CO3, CO8, CO9, CO13, CO14, CO16, CO17, CO20, CO21, CO22, CO26, CO27, CO28, CO30, CO32, CO33, CO34, CO35, CO36	CAP, 1210 OPTION	OPTION
10	0	CO23, CO29, CO31, CO37	CAP, 7343 OPTION	OPTION
11	0	CIN12, CIN13, CIN14, CIN15, CIN16, CIN17, CIN18, CIN19	CAP, 1210 OPTION	OPTION
12	2	Q1, Q2	MOSFET, N-CH D-S 30V TO252	VISHAY, SUD50N04-8M8P-4GE3
13	4	R1, R3, R25, R29	RES, 0603 10Ω 5% 1/10W	VISHAY, CRCW060310R0JNEA
14	5	R2, R14, R21, R39, R47	RES, 0603 121k 1% 1/10W	VISHAY, CRCW0603121KFKEA
15	4	R4, R36, R41, R54	RES, 0603 10k 5% 1/10W	VISHAY, CRCW060310K0JNEA
16	0	R5, R7, R8, R10, R30, R37, R38, R42, R44, R48, R49, R50, R52, R53, R55, R61	RES, 0603 OPTION	OPTION
17	4	R9, R31, R43, R51	RES, 0603 100k 1% 1/10W	VISHAY, CRCW0603100KFKEA
18	1	R15	RES, 0603 90.9k 1% 1/10W	VISHAY, CRCW060390K9FKEA
19	1	R16	RES, 0603 60.4k 1% 1/10W	VISHAY, CRCW060360K4FKEA
20	1	R17	RES, 0603 40.2k 1% 1/10W	VISHAY, CRCW060340K2FKEA
21	1	R18	RES, 0603 30.1k 1% 1/10W	VISHAY, CRCW060330K1FKEA
22	4	R22, R23, R24, R26	RES, 2010 0Ω JUMPER	VISHAY, CRCW20100000Z0EF
23	2	R56, R57	RES, 2512 0.010Ω 1% 1W	VISHAY, WSL2512R01000FEA
24	0	R58, R59	RES, 2512 OPTION	OPTION
25	1	R60	RES, 1206 0Ω JUMPER	VISHAY, CRCW12060000ZOEA
26	0	U3, U4		OPTION
27	0	R13, R34	RES, 0603 OPTION	OPTION
Hardware				
1	11	E1, E2, E3, E4, E6, E7, E8, E9, E12, E13, E22	TURRET	MILL MAX 2308-2-00-80-00-00-07-0
2	2	E19, E20	TURRET	MILL MAX 2501-2-00-80-00-00-07-0
3	2	JP1, JP2	HEADER, 3-PIN 2mm	SAMTEC TMM-103-02-L-S
4	5	JP4, JP5, JP6, JP7, JP8	HEADER, 2-PIN 2mm	SAMTEC TMM-102-02-L-S
5	4	J1, J2, J3, J4	STUD	PEM KFH-032-10
6	2	J5, J6	JACK, BANANA	KEYSTONE 575-4
7	8		NUT, BRASS 10-32	ANY
8	4		LUG RING #10	KEYSTONE 8205
9	4		WASHER, TIN PLATED BRASS #10	ANY
10	2	J7, J8	CON, BNC	CONNEX 112404
11	3	JP1, JP2, JP4	SHUNT	SAMTEC 2SN-BK-G
12	4		STAND-OFF, NYLON	KEYSTONE 8833

SCHEMATIC DIAGRAM



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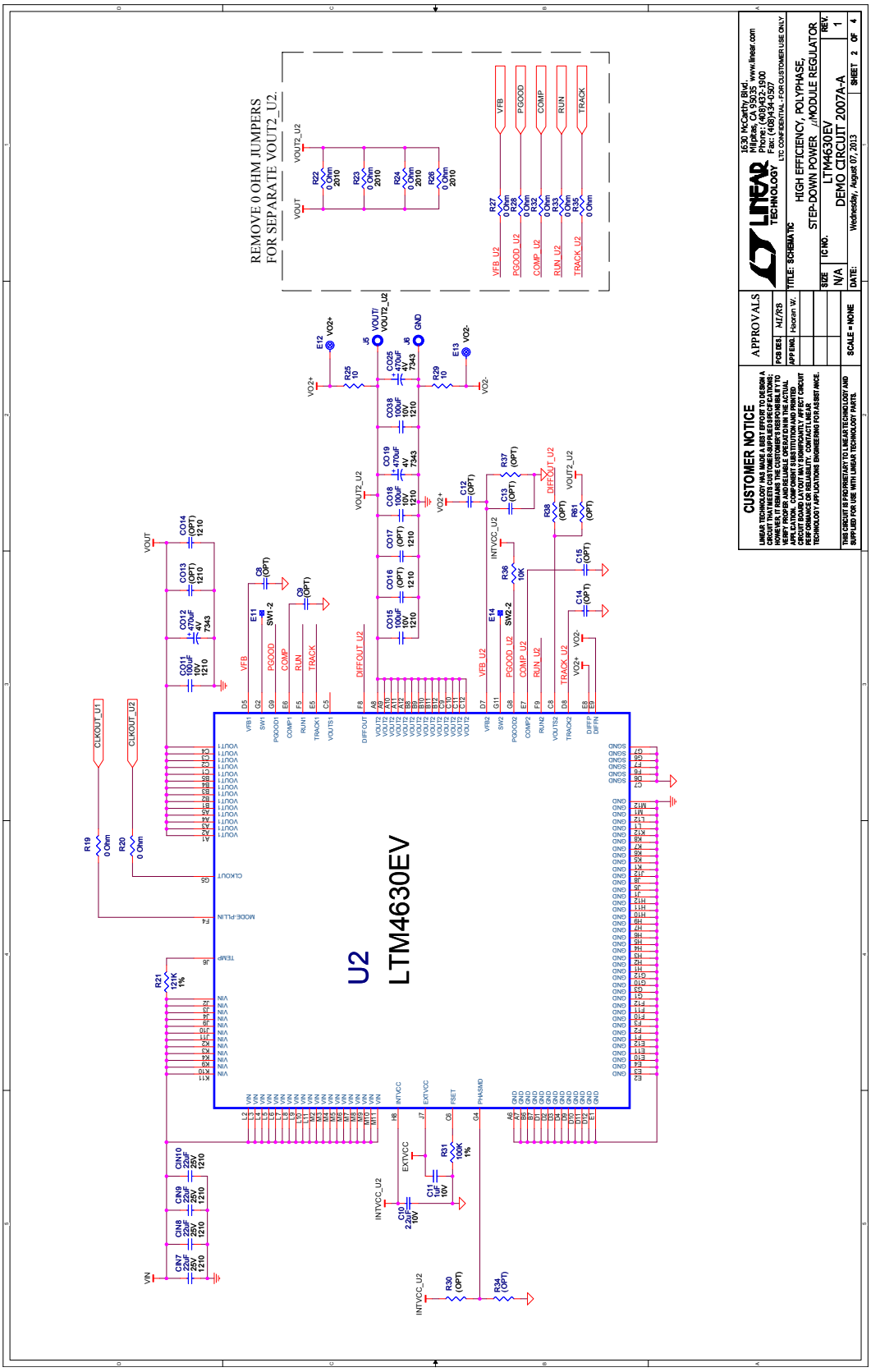

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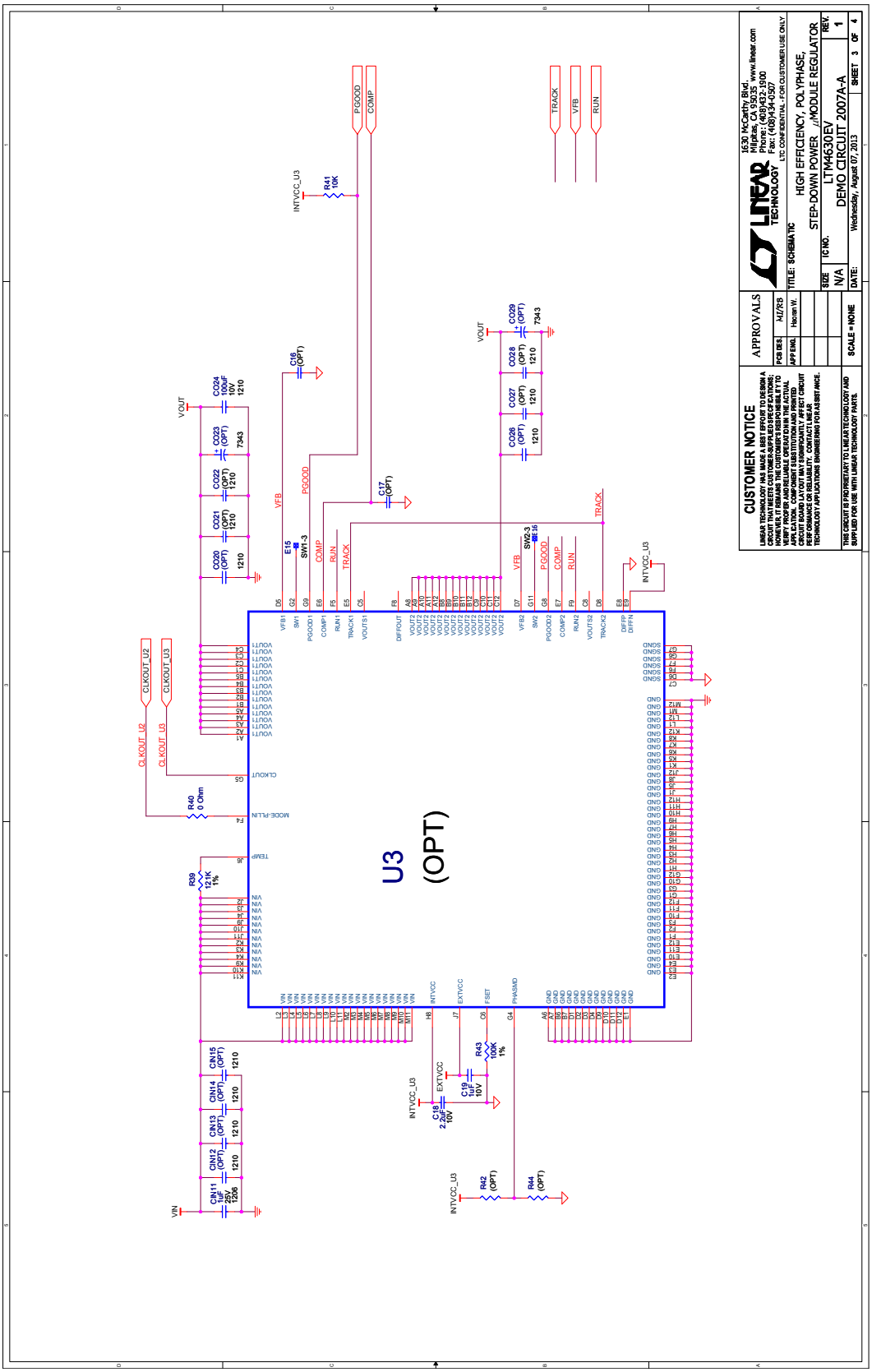

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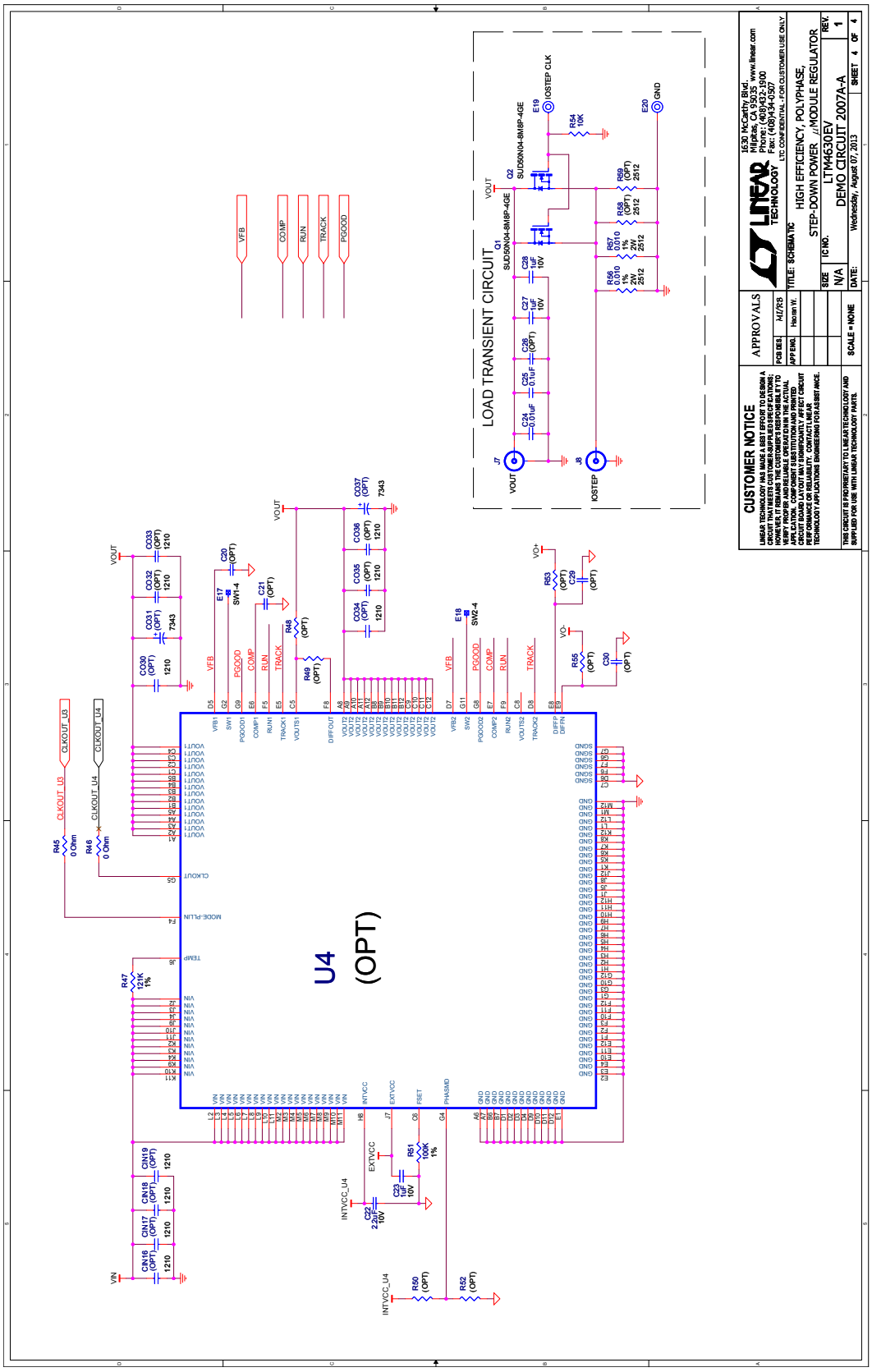

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