LTM4627EV
High Efficiency PolyPhase Step-Down Power Supply

DESCRIPTION

Demonstration circuit 1668B-C is a PolyPhase® power supply featuring four LTM®4627 high efficiency synchronous buck µModule® regulators. The DC1668B-C input voltage range is between 4.5V to 20V with a jumper programmable output voltage from 0.6V to 3.3V. The demo circuit can deliver up to 50A of load with excellent current-sharing. Current derating may be necessary under certain operating conditions.

The LTM4627 can be synchronized to an external clock between 250kHz to 770kHz. The default switching frequency for the DC1668B-C is set to 500kHz through the onboard LTC6902 clock generator. The external clock interleaves the paralleled phases to minimize input and output ripple.

DC1668B-C demonstrates that paralleling LTM4627 modules is easy and reliable. These features and the availability of the LTM4627 in a compact thermally enhanced 15mm × 15mm × 4.32mm LGA package make the circuit ideal for use in high density point of load regulation applications.

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

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PERFORMANCE SUMMARY

Specifications are at T_A = 25°C

PARAMETER	CONDITIONS/NOTES	VALUE
Maximum Input Voltage		20V
Minimum Input Voltage		4.5V
Output Voltage V_{OUT}	Remove V_{OUT} SEL Jumper for V_{OUT} = 0.6V_{DC}	0.6V_{DC}, 1V_{DC}, 1.2V_{DC}, 1.5V_{DC}, 1.8V_{DC}, 2.5V_{DC}, 3.3V_{DC}
Maximum Continuous Output Current $I_{OUT(MAX)}$	Current Derating May Be Necessary for Certain V_{IN}, V_{OUT}, Frequency and Thermal Conditions	50A_{DC}
Default Operating Frequency		500kHz
External Clock Synchronous Frequency Range		250kHz to 770kHz
Output Voltage Ripple (Typical)	V_{IN} = 12V, V_{OUT} = 1.8V, 500kHz (20MHz BW)	< 10mV_{P-P} at I_{OUT} = 50A, See Figure 6
Efficiency	V_{IN} = 12V, V_{OUT} = 1.8V, 500kHz	87.7% at I_{OUT} = 50A, See Figure 3
Load Transient	V_{IN} = 12V, V_{OUT} = 1.8V	See Figure 5

BOARD PHOTO

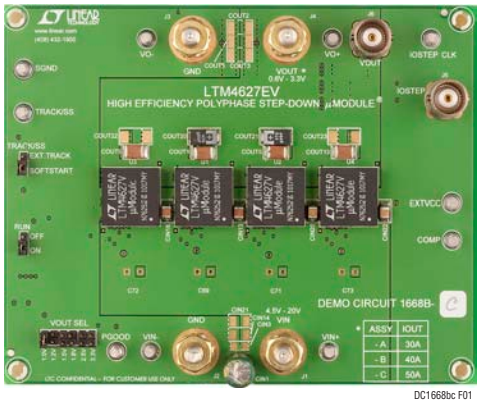


Figure 1. LTM4627/DC1668B-C Demo Board

QUICK START PROCEDURE

Demonstration circuit 1668B-C is easy to set up to evaluate the performance of paralleled LTM4627 modules. Please refer to Figure 2 for proper measurement equipment setup and follow the procedure below:

1. With power off, connect the input power supply, load, meters, and V_{OUT} BNC cable as shown in Figure 2. Preset the load to 0A and V_{IN} supply to be 0V. Place jumpers in the following positions for a typical 1.8V_{OUT} application:

JP2	JP7	JP6
V_{OUT} Select	RUN	TRACK/SS
1.8V	OFF	SOFT-START

2. Turn on the power at the input. Increase V_{IN} to 12V (Do not hot-plug the input supply or apply more than the rated maximum voltage of 20V to the board or the modules may be damaged).
3. Set the run pin jumper (JP7) to the ON position. The output voltage should be regulated. The output voltage meter should read 1.8V ±2% (1.76V to 1.84V).
4. Vary the input voltage from 5V to 20V and adjust the load current from 0A to 50A. V_{OUT} should remain regulated at 1.8V±2%. Observe the load regulation, output voltage ripple, efficiency and other parameters. Output voltage ripple should be measured at J6 with a BNC cable and oscilloscope. The probe channel for V_{OUT} should be set at 50Ω termination resistance to match the BNC cable.
5. For optional load transient testing apply an adjustable positive pulse signal between IOSTEP CLK and GND pins. The pulse amplitude sets the load step current amplitude. The pulse width should be short (< 1ms) and pulse duty cycle should be low (< 15%) to limit the thermal stress on the load transient circuit. The load step current can be monitored with a BNC connected to J5 (5mV/A).

QUICK START PROCEDURE

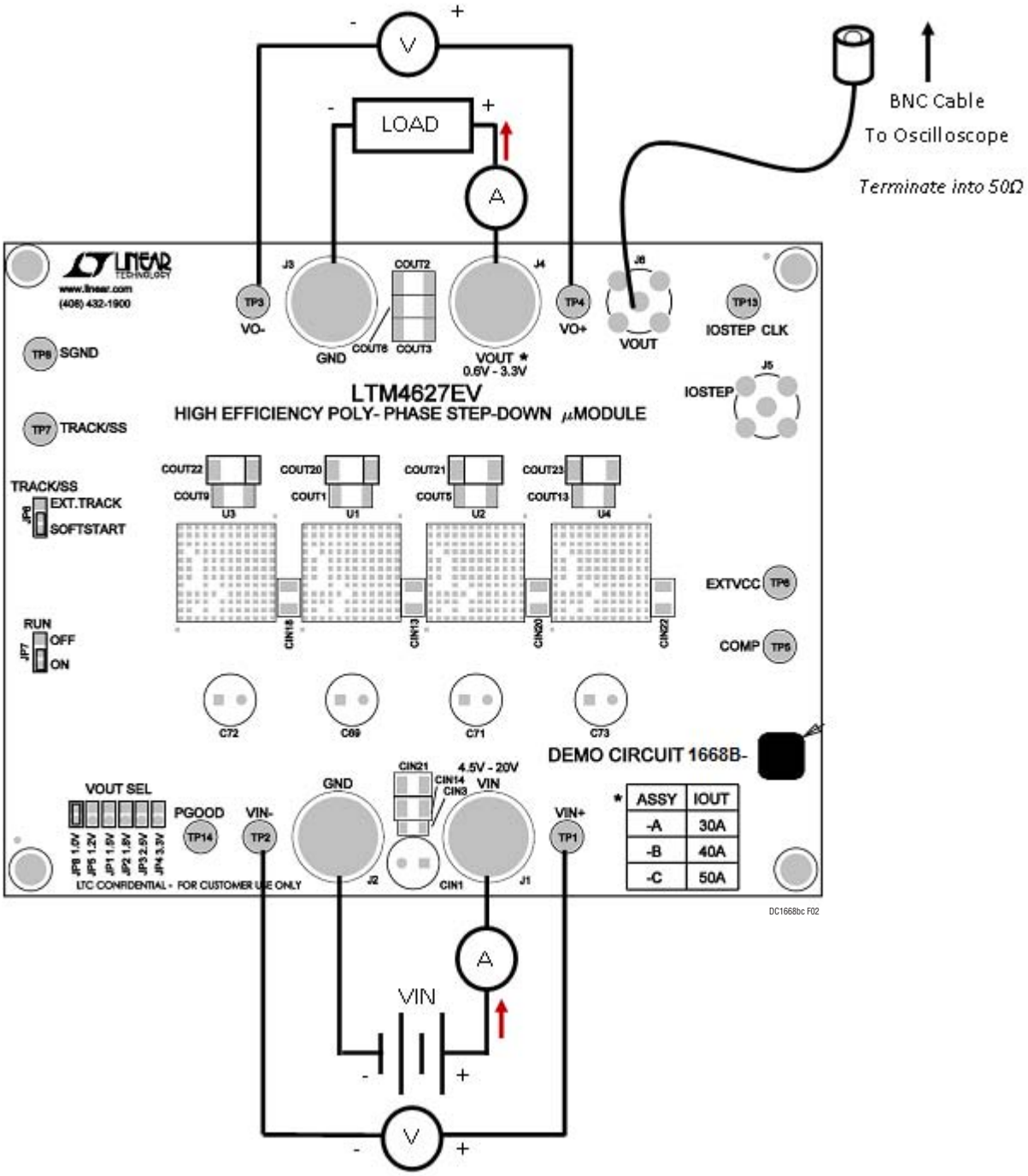


Figure 2. Test Setup of DC1668B (All Versions)

QUICK START PROCEDURE

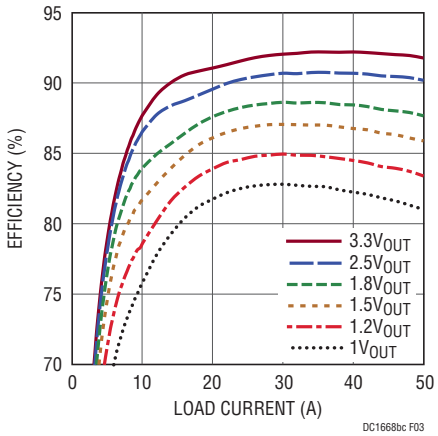


Figure 3. Measured Efficiency at $12V_{IN}$, 500kHz

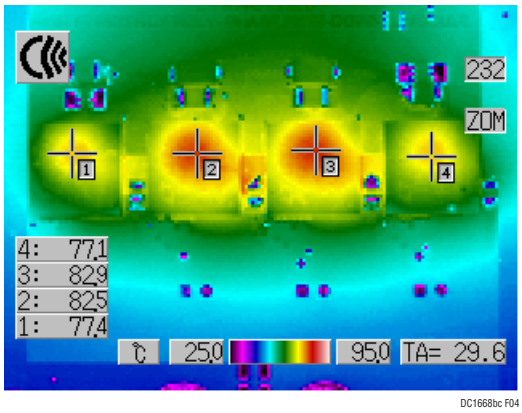
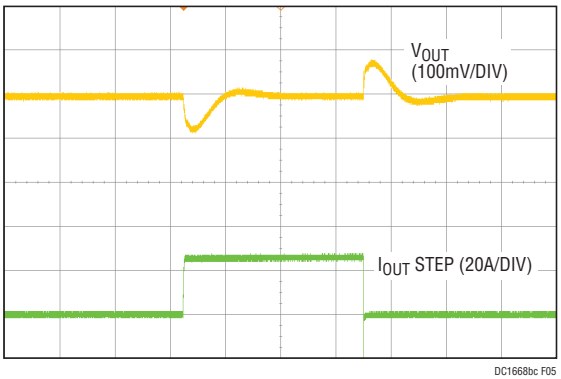
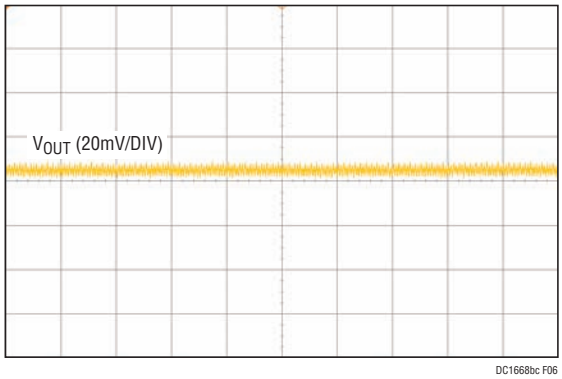


Figure 4. Thermal Capture at $12V_{IN}$, $1.8V_{OUT}$, 50A, 500kHz No Forced Airflow (Convection). T_A = 29°C.



V_{OUT} = 1.8V
I_{OUT} DC = 25A
I_{OUT} STEP = 25A
f_{SW} = 500kHz

Figure 5. Measured Load Step Response



V_{OUT} = 1.8V
I_{OUT} = 50A
f_{SW} = 500kHz

Figure 6. Measured Output Voltage Ripple (20MHz BW)

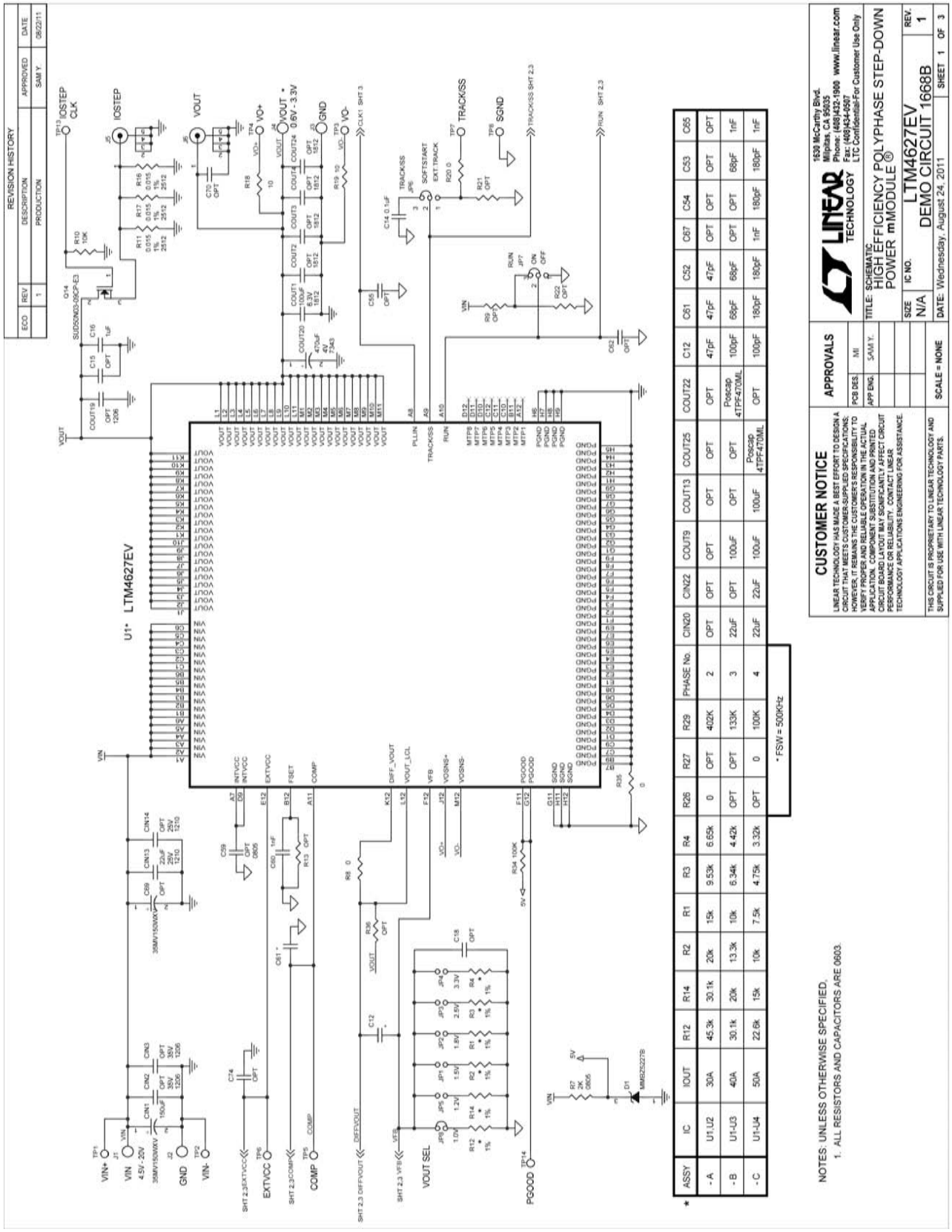
PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	1	CIN1	CAP, 150µF 20% 35V ALUM	SANYO 35MV150WXV
2	2	CIN13, CIN18, CIN20, CIN22	CAP, 1210 22µF 20% 25V X5R	AVX 12103D226MAT2A
3	2	COUT1, COUT5, COUT9, COUT13	CAP, 1812 100µF 20% 6.3V X5R	TDK C4532X5R0J107MZ
4	2	COUT20, COUT21, COUT25	CAP, 470µF 20% 4V POSCAP	SANYO POSCAP 4TPF470ML
5	2	R8	RES, 0603 0Ω JUMPER	VISHAY CRCW06030000Z0EA
6	2	R18, R19	RES, 0603 10Ω 5% 1/10W	AAC CR16-100JM
7	4	R30, R31, R32, R33	RES, 0603 100Ω 5% 1/10W	KOA RK73B1JTTD101J
8	1	R34	RES, 0603 100k 5% 1/10W	VISHAY CRCW0603100KJNEA
9	1	R35	RES, 0805 0Ω JUMPER	VISHAY CRCW08050000Z0EA
10	1	U5	IC, LTC6902CMS	LINEAR TECHNOLOGY LTC6902CMS
11	1	C12	CAP, 0603 100pF 10% 50V NP0	AVX 06035A101KAT2A
12	4	C52, C53, C54, C61	CAP, 0603 180pF 5% 50V NP0	AVX 06035A181JAT
13	1	C61	CAP, 0603 180pF 5% 50V NP0	AVX 06035A181JAT
14	2	C65, C67	CAP, 0603 1000pF 10% 50V NP0	AVX 06035A102KAT2A
15	1	R1	RES, 0603 7.5k 1% 1/10W	VISHAY CRCW06037K50FKEA
16	1	R2	RES, 0603 10k 1% 1/10W	VISHAY CRCW060310K0FKEA
17	1	R3	RES, 0603 4.75k 1% 1/10W	VISHAY CRCW06034K75FKED
18	1	R4	RES, 0603 3.32k 1% 1/10W	VISHAY CRCW0603K32FKEA
19	1	R12	RES, 0603 22.6k 1% 1/10W	VISHAY CRCW060322K6FKEA
20	1	R14	RES, 0603 15k 1% 1/10W	VISHAY CRCW060315K0FKEA
21	1	R27	RES, 0603 0Ω JUMPER	VISHAY CRCW06030000Z0EA
22	1	R29	RES, 0603 100k 1% 1/10W	VISHAY CRCW0603100KFKEA
23	4	U1, U2, U3, U4	IC, MICRO MODULE	LINEAR TECHNOLOGY LTM4627EV
Additional Demo Board Circuit Components				
1	2	C14, C38	CAP, 0603 0.1µF 20% 16V X7R	TAIYO YUDEN EMK107BJ104MA-T
2	1	C16	CAP, 0603 1µF 20% 10V X5R	TAIYO YUDEN LMK107BJ105MA-T
3	1	C60	CAP, 0603 1000pF 10% 50V NP0	AVX 06035A102KAT2A
4	1	D1	DIODE, ZENER 350mW	DIODES INC. MMBZ5227B
5	1	R7	RES, 0805 2k 5% 1/10W	AAC CR10-202JM
6	1	Q14	XSTR,SUD50N03-10CP MOSFET	SILICONIX SUD50N03-10CP
7	1	R10	RES, 0603 10k 5% 1/10W	AAC CR16-103JM
8	2	R20	RES, 0603 0Ω JUMPER	VISHAY CRCW06030000Z0EA
9	3	R11, R16, R17	RES, 2512 0.015Ω 1% 1W	PANASONIC ERJM1WSF15MU
10	0	CIN2, CIN3	CAP, 1206 10µF 20% 35V X5R OPTION	TAIYO YUDEN GMK316BJ106ML-T OPTION
11	0	CIN14, CIN19, CIN21, CIN23	CAP, 1210 22µF 20% 25V X5R OPTION	AVX 12103D226MAT2A OPTION
12	0	COUT2, COUT3, COUT6	CAP, 1812 100µF 20% 6.3V X5R OPTION	TDK C4532X5R0J107MZ OPTION
13	0	COUT4, COUT7, COUT11, COUT15	CAP, 1812 OPTION	TAIYO YUDEN JMK432BJ107MU-T OPTION

PARTS LIST

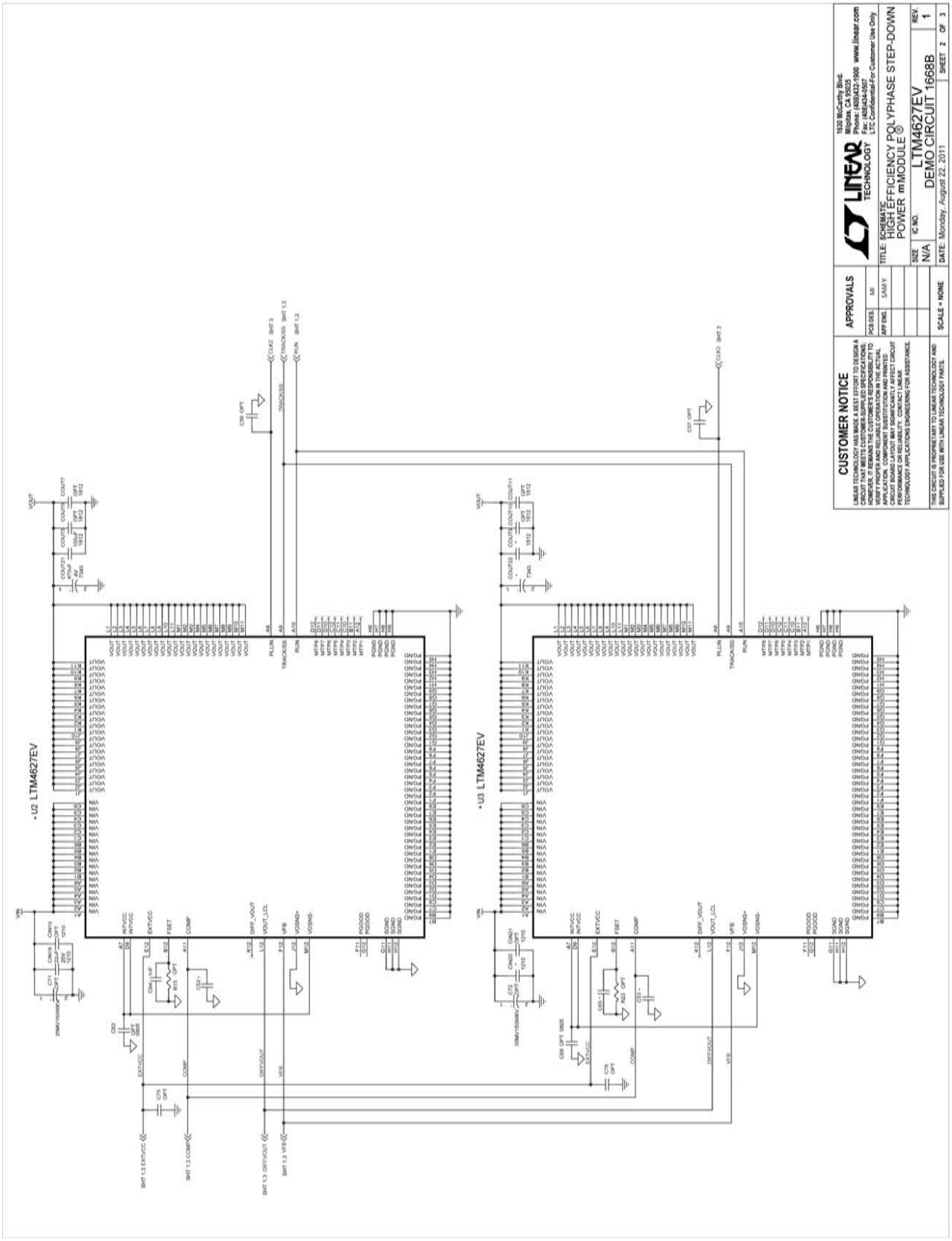
ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
14	0	COUT10, COUT14	CAP, 1812 100µF 20% 6.3V X5R OPTION	TDK C4532X5R0J107MZ OPTION
15	0	COUT19	CAP, 1206 OPTION	TAIYO YUDEN EMK316BJ475ML-T OPTION
16	0	COUT23, COUT26, COUT27	CAP, 470µF 20% 4V POSCAP OPTION	SANYO POSCAP 4TPF470ML OPTION
17	0	COUT24	CAP, 1812 OPTION	TAIYO YUDEN JMK316BJ226ML-T
18	0	C15	CAP, 0603 1µF 20% 10V X5R OPTION	TAIYO YUDEN LMK107BJ105MA-T OPTION
19	0	C18, C55, C56, C57, C58, C62, C74 TO C77	CAP, 0603 OPTION	OPTION
20	0	C59, C63, C66, C68	CAP, 0805 OPTION	OPTION
21	0	C64	CAP, 0603 1000pF 10% 50V NP0 OPTION	AVX 06035A102KAT2A OPTION
22	0	C69, C71, C72, C73	CAP, 150µF 20% 35V ALUM OPTION	SANYO 35MV150WXV OPTION
23	1	C70	CAP, 0603 0.22µF 20% 10V X5R OPTION	TAIYO YUDEN LMK107BJ224MA-T OPTION
24	0	R9, R13, R15, R23, R24	RES, 0603 51k 5% 1/10W OPTION	AAC CR16-513JM OPTION
25	0	R21, R22, R36	RES, 0603 OPTION	OPTION
26	0	COUT22	CAP, 470µF 20% 4V POSCAP OPTION	SANYO POSCAP 4TPF470ML OPTION
27	1	COUT25	CAP, 470µF 20% 4V POSCAP	SANYO POSCAP 4TPF470ML
28	1	R26	RES, 0603 OPTION	OPTION
Hardware				
1	6	JP1, JP2, JP3, JP4, JP5, JP8	HEADER, 2PIN, 2mm	SAMTEC TMM 102-02-L-S
2	2	JP6, JP7	HEADER, 3PIN, 2mm	SAMTEC TMM-103-02-L-S
3	4	J1, J2, J3, J4	STUD, PRESS-FIT	PEM KFH-032-10
4	2	J5, J6	CONN, BNC, 5 PINS	CONNEX 112404
5	10	TP1 TO TP8, TP13, TP14	TURRET	MILL MAX 2501-2-00-80-00-00-07-0
6	3	JP1, JP6, JP7	SHUNT, 2mm	SAMTEC 2SN-BK-G
7	4		STANDOFF, SNAP ON	KEYSTONE_8834
8	8	J1, J2, J3, J4	NUT, BRASS #10-32	ANY
9	4	J1, J2, J3, J4	WASHER, BRASS #10	ANY
10	4	J1, J2, J3, J4	LUG, RING	KEYSTONE 310 PbF

SCHEMATIC DIAGRAM

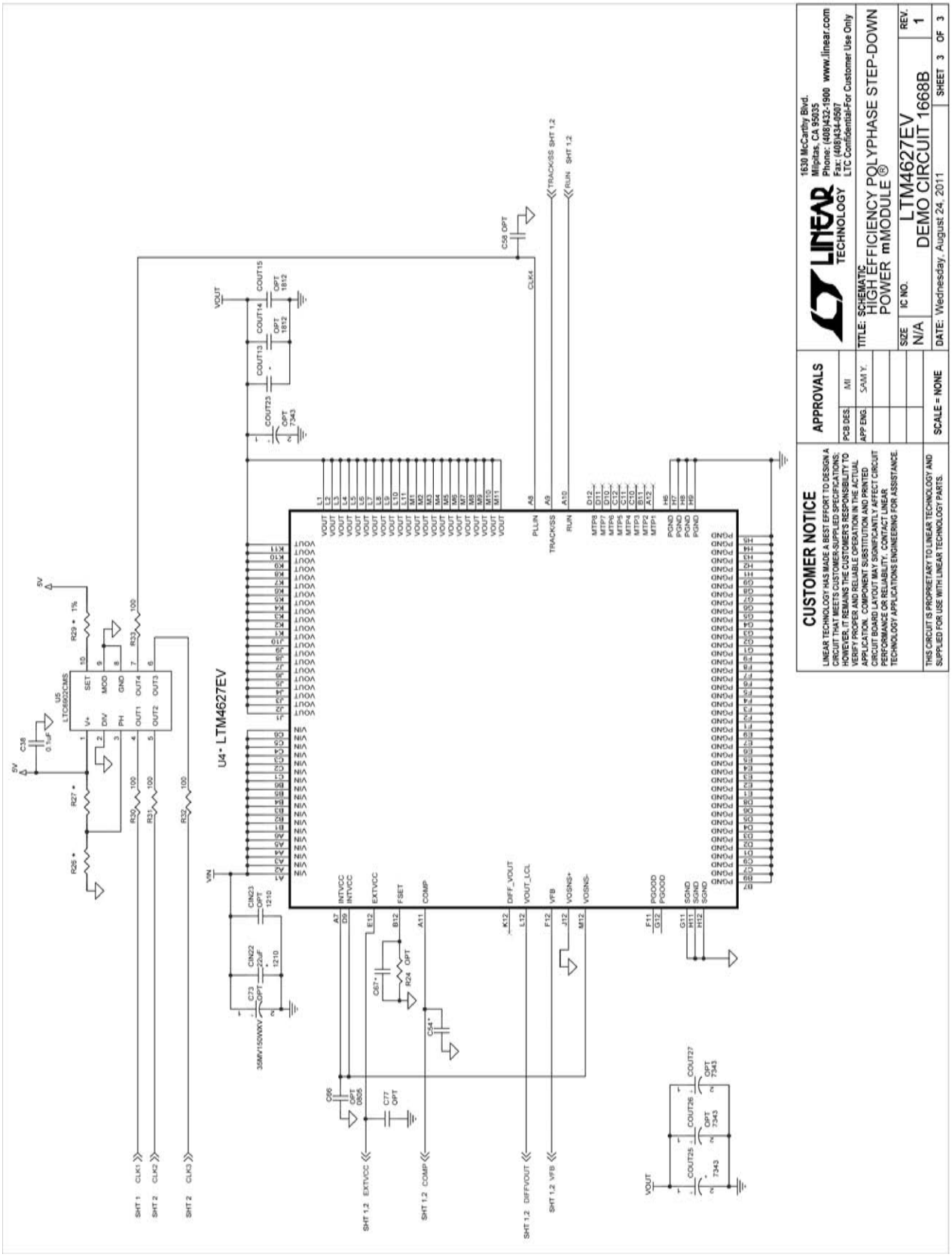


* ASSY	IC	IOUT	R12	R14	R2	R1	R3	R4	R26	R27	R29	PHASE No.	CIN20	CIN22	COUT9	COUT13	COUT25	COUT22	C12	C61	C52	C67	C54	C53	C65
- A	U1,U2	30A	45.3k	30.1k	20k	15k	9.53k	6.65k	0	OPT	402K	2	OPT	OPT	OPT	OPT	OPT	OPT	47pF	47pF	47pF	OPT	OPT	OPT	OPT
- B	U1-U3	40A	30.1k	20k	13.3k	10k	6.34k	4.42k	OPT	OPT	133K	3	22uF	OPT	100uF	OPT	OPT	Poscap 4TPF470ML	100pF	68pF	68pF	OPT	OPT	68pF	1nF
- C	U1-U4	50A	22.6k	15k	10k	7.5k	4.75k	3.32k	OPT	0	100K	4	22uF	22uF	100uF	100uF	Poscap 4TPF470ML	OPT	100pF	180pF	180pF	1nF	180pF	180pF	1nF

SCHEMATIC DIAGRAM



SCHEMATIC DIAGRAM



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