

LTM4627EV High Efficiency 50A PolyPhase Step-Down Power Supply

DESCRIPTION

Demonstration circuit 1668A-C is a PolyPhase® power supply featuring four LTM®4627 high efficiency synchronous buck μ Module® regulators. The DC1668A-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 DC1668A-C is set to 500kHz through the onboard

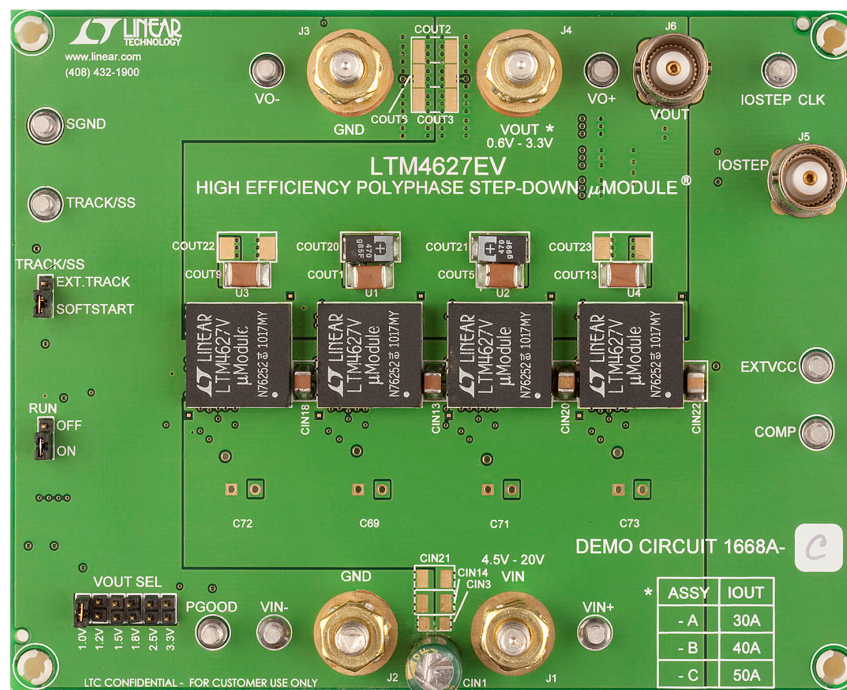
LTC6902 clock generator. The external clock interleaves the paralleled phases to minimize input and output ripple.

DC1668A-C demonstrates that paralleling LTM4627 modules is easy and reliable. These features and the availability of the LTM4627 in a compact thermally enhanced 15mm \times 15mm \times 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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BOARD PHOTO



PERFORMANCE SUMMARY

PARAMETER	CONDITION	VALUE
Input Voltage Range		4.5V to 20V
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 5
Efficiency	$V_{IN} = 12V$, $V_{OUT} = 1.8V$ 500kHz	87.7% at $I_{OUT} = 50A$, See Figure 2
Load Transient	$V_{IN} = 12V$, $V_{OUT} = 1.8V$	See Figure 4

QUICK START PROCEDURE

Demonstration circuit 1668A-C is easy to set up to evaluate the performance of paralleled LTM4627 modules. Please refer to Figure 1 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 1. 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 $1.8V \pm 2\%$ (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 $1.8V \pm 2\%$. 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

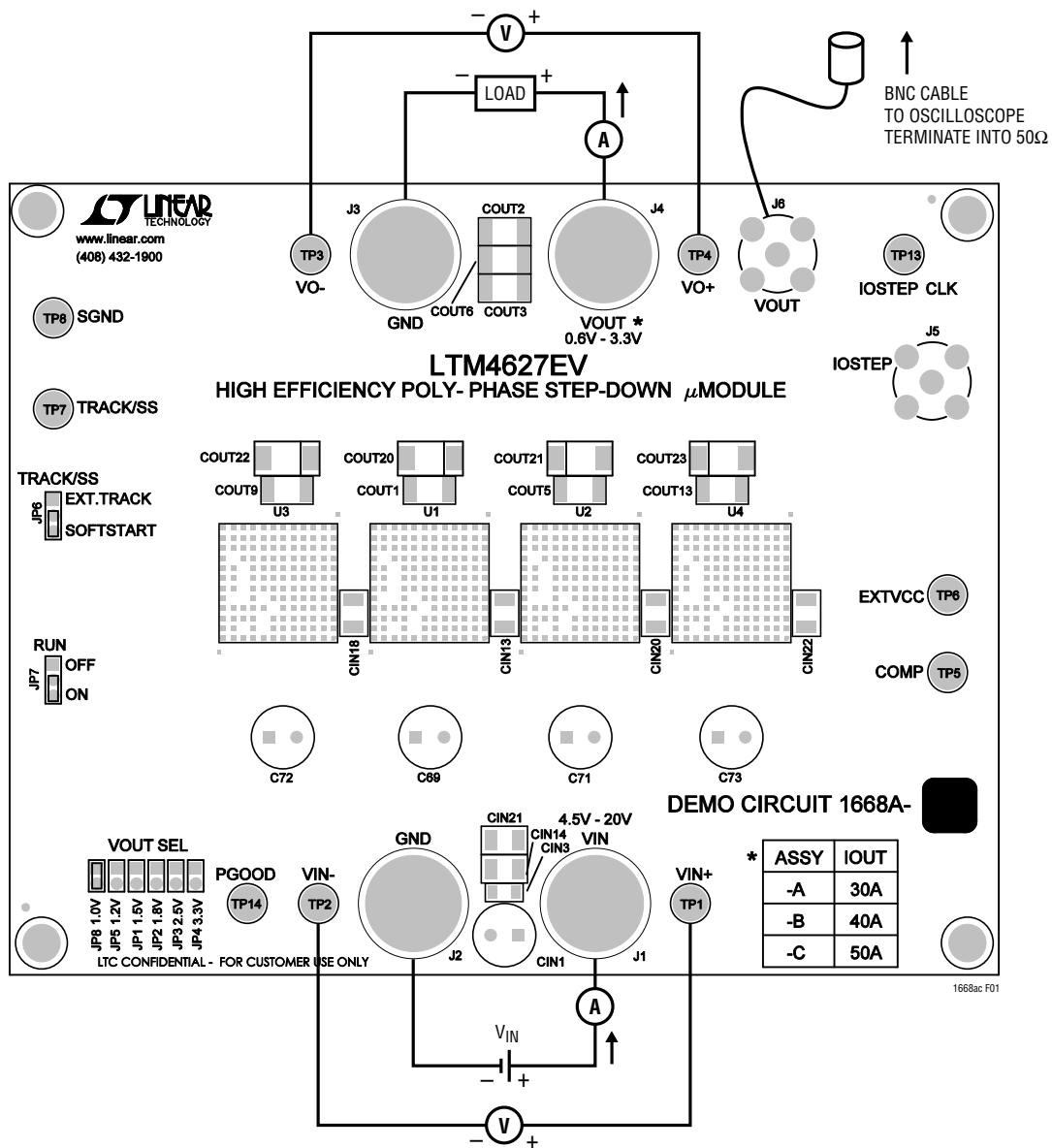


Figure 1. Test Setup of DC1668A-C

QUICK START PROCEDURE

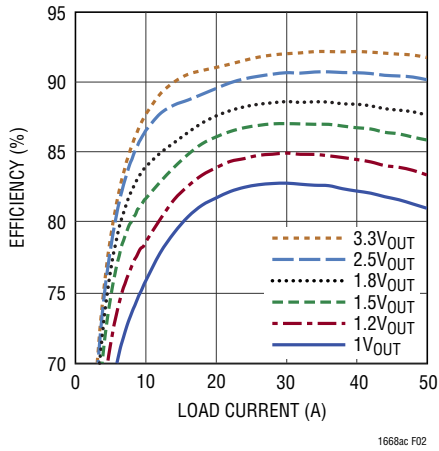


Figure 2. Measured Efficiency at 12V_{IN}, 500kHz

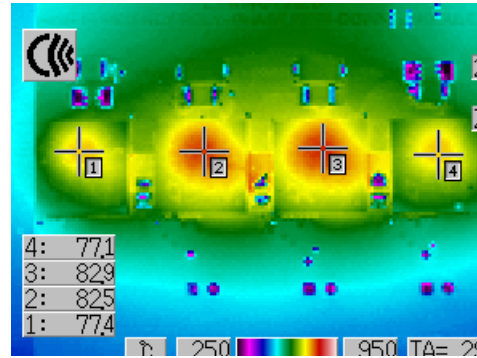


Figure 3. Thermal Capture at 12V_{IN}, 1.8V_{OUT}, 50A, 500kHz
No Forced Airflow (Convection). T_A = 29°C

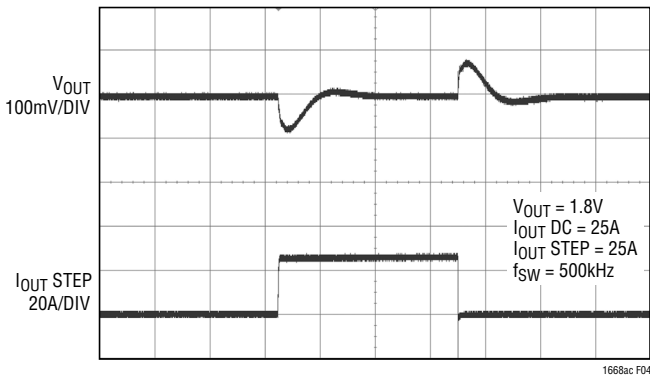


Figure 4. Measured Load Step Response

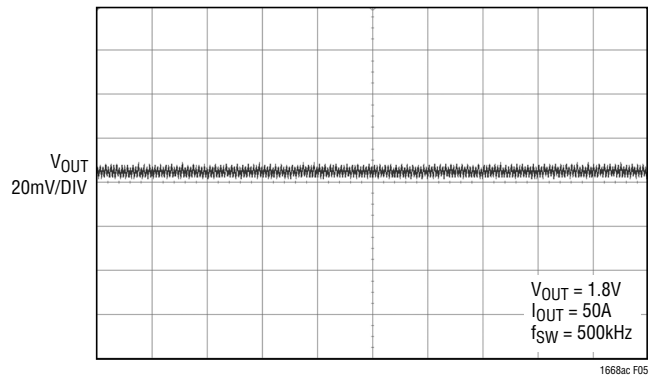


Figure 5. Measured Output Voltage Ripple (20MHz BW)

PARTS LIST

ITEM	QUANTITY	REFERENCE-DESCRIPTION	DESCRIPTION	MANUFACTURER'S PART NUMBER
Required Circuit Components:				
1	1	CIN1	Cap, 150µF 20% 35V Alum	Sanyo 35MV150WXV
2	4	CIN13, CIN18, CIN20, CIN22	Cap, 1210 22µF 20% 25V X5R	AVX 12103D226MAT2A
3	4	COU1, COU5, COU9, COU13	Cap, 1812 100µF 20% 6.3V X5R	TDK C4532X5R0J107MZ
4	3	COU20, COU21, COU25	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 RK73B1JTDD101J
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 Multiphase Oscillator	Linear Technology LTC6902CMS
11	1	C12	Cap, 0603 100pF 10% 50V NPO	AVX 06035A101KAT2A
12	4	C52, C53, C54, C61	Cap, 0603 180pF 5% 50V NPO	AVX 06035A181JAT
13	1	C61	Cap, 0603 180pF 5% 50V NPO	AVX 06035A181JAT
14	2	C65, C67	Cap, 0603 1000pF 10% 50V NPO	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, µModule Regulator	Linear Technology LTM4627EV
Additional Demo Board Circuit Components:				
1	2	C14, C28	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 NPO	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	COU2, COU3, COU6	Cap, 1812 100µF 20% 6.3V X5R Option	TDK C4532X5R0J107MZ Option
13	0	COU4, COU7, COU11	Cap, 1812 Option	Taiyo Yuden JMK432BJ107MU-T Option
14		COU15		
15	0	COU10, COU14	Cap, 1812 100µF 20% 6.3V X5R Option	TDK C4532X5R0J107MZ Option

DEMO MANUAL DC1668A-C

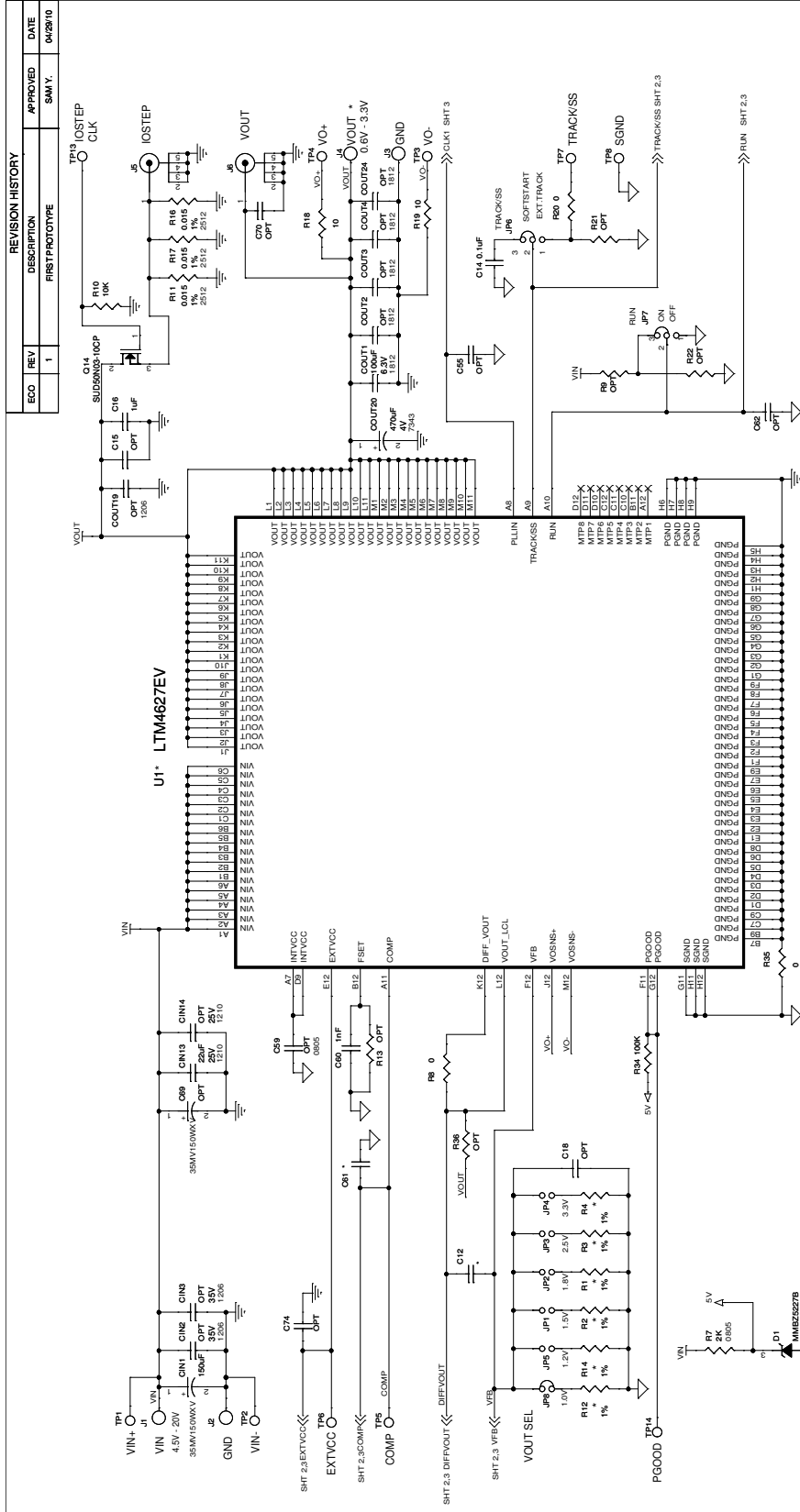
PARTS LIST

ITEM	QUANTITY	REFERENCE-DESCRIPTION	DESCRIPTION	MANUFACTURER'S PART NUMBER
16	0	COU19	Cap, 1206 Option	Taiyo Yuden EMK316BJ475ML-T Option
17	0	COU23, COU26, COU27	Cap, 470 μ F 20% 4V POSCAP Option	Sanyo POSCAP 4TPF470ML Option
18	0	COU24	Cap, 1812 Option	Taiyo Yuden JMK316BJ226ML-T
19	0	C15	Cap, 0603 1 μ F 20% 10V X5R Option	Taiyo Yuden LMK107BJ105MA-T Option
20	0	C18, C55, C56, C57, C58, C62	Cap, 0603 Option	Option
21		C74 to C77		
22	0	C59, C63, C66, C68	Cap, 0805 Option	Option
23	0	C64	Cap, 0603 1000pF 10% 50V NPO Option	AVX 06035A102KAT2A Option
24	0	C69, C71, C72, C73	Cap, 150 μ F 20% 35V Alum Option	Sanyo 35MV150WVX Option
25	1	C70	Cap, 0603 0.22 μ F 20% 10V X5R Option	Taiyo Yuden LMK107BJ224MA-T Option
26	0	R9, R13, R15, R23, R24	Res, 0603 51k 5% 1/10W Option	AAC CR16-513JM Option
27	0	R21, R22, R36	Res, 0603 Option	Option
28	0	COU22	Cap, 470 μ F 20% 4V POSCAP Option	Sanyo POSCAP 4TPF470ML Option
29	1	COU25	Cap, 470 μ F 20% 4V POSCAP Option	Sanyo POSCAP 4TPF470ML
30	1	R26	Res, 0603 Option	Option

Hardware

1	6	JP1, JP2, JP3, JP4, JP5, JP8	Header, 2 Pin, 2mm	Samtec TMM 102-02-L-S
2	2	JP6, JP7	Header, 3 Pin, 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 DIAGRAMS



ASSY	IC	IOUT	R12	R14	R1	R2	R11	R3	R4	R27	R29	PHASE No.	CIN20	CIN22	COUT19	COUT13	COUT25	COUT22	C12	C61	C52	C67	C54	C63	C65
- A	U1,U2	30A	453k	30.1k	20k	20k	15k	9.53k	6.65k	0	402k	2	OPT	OPT	OPT	OPT	OPT	OPT	OPT	47pF	47pF	OPT	OPT	OPT	OPT
- B	U1-U3	40A	30.1k	20k	13.3k	10k	6.94k	4.42k	4.42k	0	133k	3	22uF	OPT	OPT	OPT	Passcap 4TTP-470ML	OPT	OPT	88pF	88pF	OPT	OPT	OPT	OPT
- C	U1-U4	50A	226k	15k	10k	7.5k	4.75k	3.32k	3.32k	0	100k	4	22uF	22uF	100uF	100uF	4TTP-470ML	OPT	OPT	180pF	180pF	180pF	180pF	180pF	

* FSW = 500KHZ

NOTES: UNLESS OTHERWISE SPECIFIED,
1. ALL RESISTORS AND CAPACITORS ARE 0603.

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APPROVALS

DESIGNER	MI
APP ENGR	SAM.Y.

SCALE = NONE

IC NO. LTM4627EV

REV. 1

DEMO CIRCUIT 1668A

DATE: Wednesday, October 20, 2010

SHEET 1 OF 3

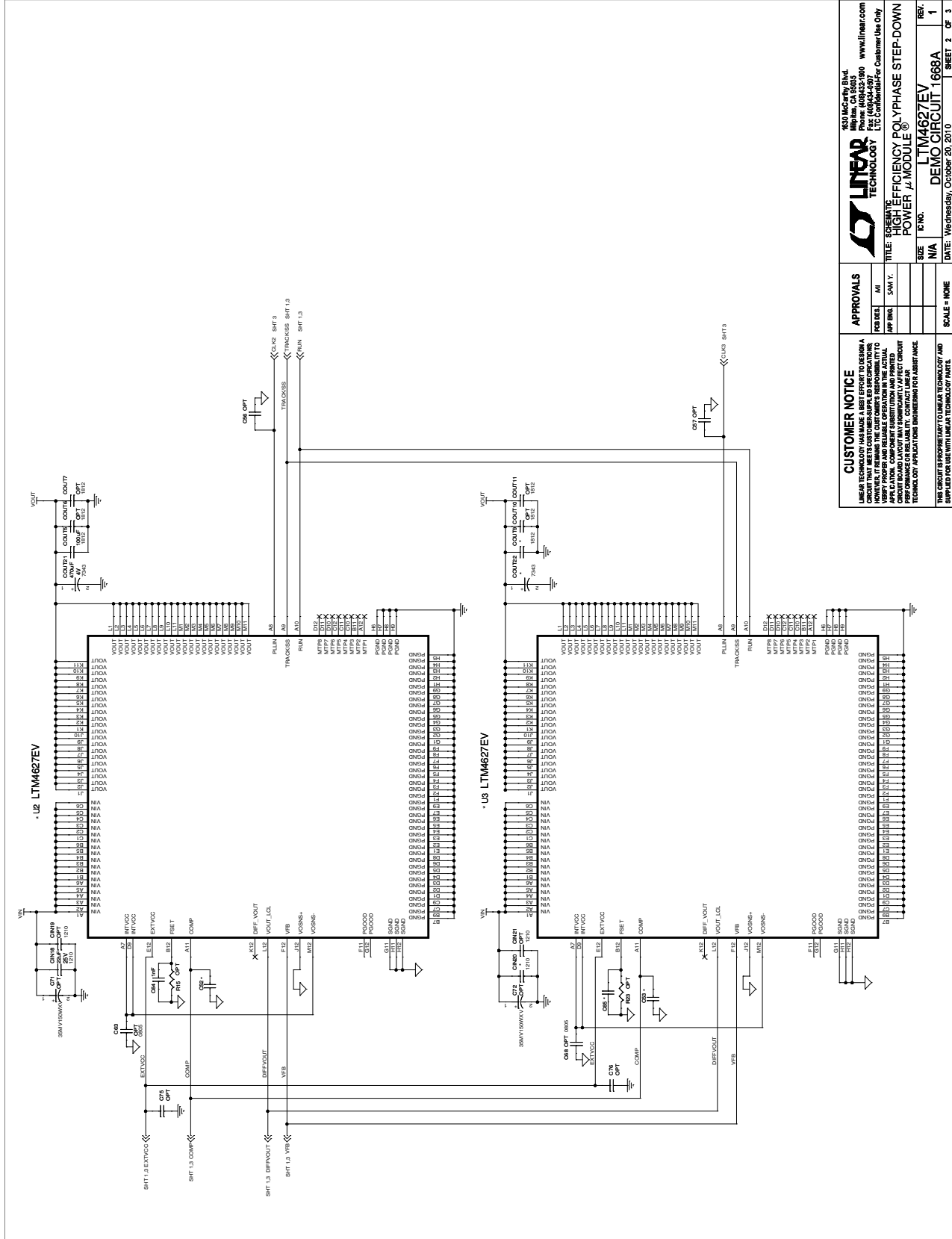
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LINEAR TECHNOLOGY

HIGH EFFICIENCY POLYPHASE STEP-DOWN POWER μ MODULE

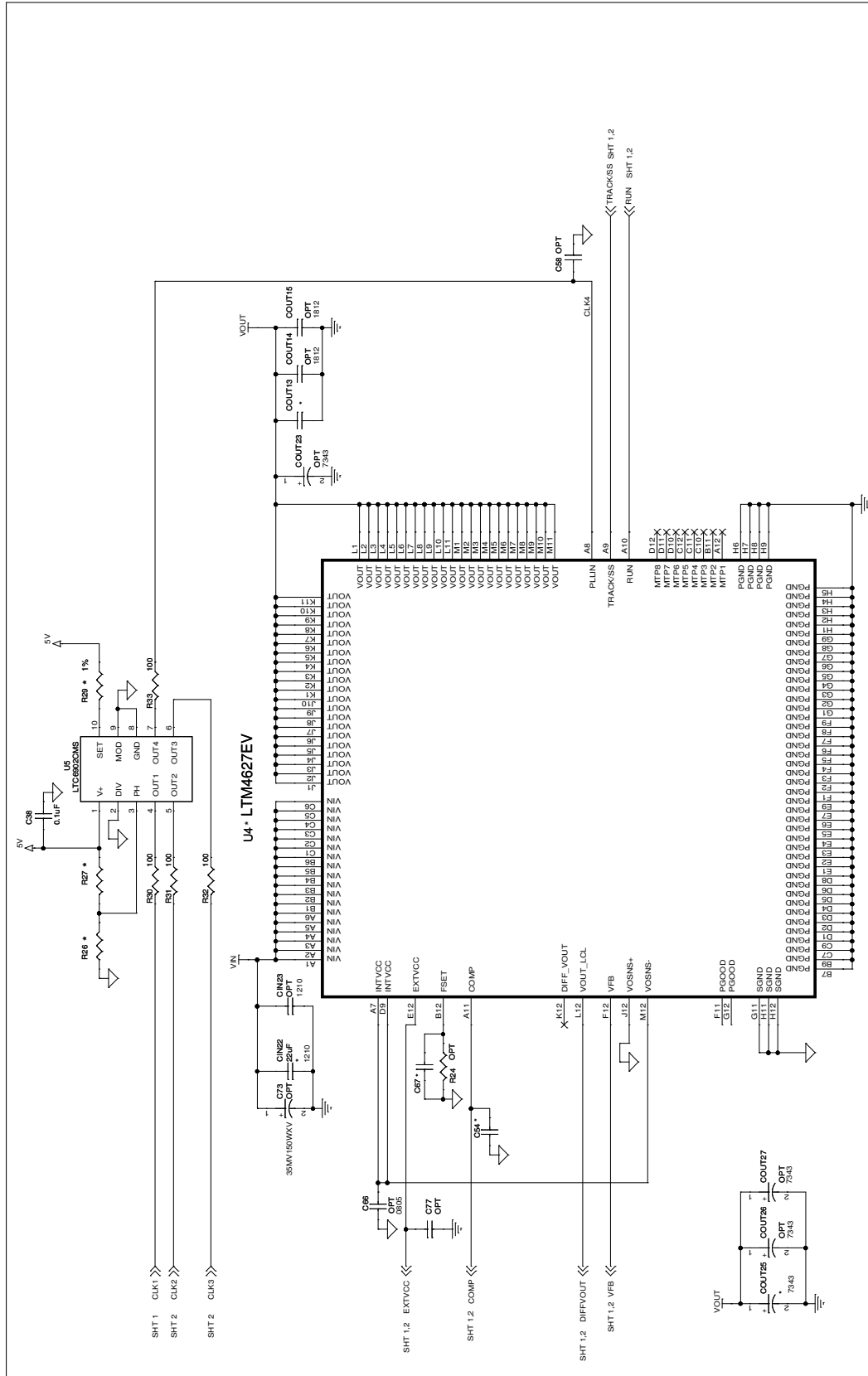
DEMO MANUAL DC1668A-C

SCHEMATIC DIAGRAMS



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TITLE: SCHEMATIC: HIGH EFFICIENCY POLYPHASE STEP-DOWN POWER μ MODULE		LTC Confidential For Customer Use Only	
IC NO.	LTM4627EV	DATE:	Wednesday, October 20, 2010
SIZE:	N/A	SCALE:	NONE
REV:	1	SHEET:	2 OF 3

SCHEMATIC DIAGRAMS



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<p>LINEAR TECHNOLOGY</p>	
<p>TITLE: SCHEMATIC HIGH EFFICIENCY POLYPHASE STEP-DOWN POWER μMODULE</p>	
IC NO.	LTM4627EV
REV.	1
SCALE	NONE
DATE	Wednesday, October 20, 2010
SHEET	3 OF 3

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APPROVALS	
PCB DES.	MI
APP ENG.	SAMY.

DEMO MANUAL DC1668A-C

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