

# LTM4620EV: High Efficiency, PolyPhase 50A Step-Down Power $\mu$ Module<sup>®</sup> Regulator

## DESCRIPTION

Demonstration circuit 1780A-A features PolyPhase<sup>®</sup> design using the LTM<sup>®</sup>4620EV, the high efficiency, high density, dual 13A, switch mode step-down power module regulator. The input voltage is from 4.5V to 16V. The output voltage is jumper selectable from 1.0V to 2.5V. DC1780A-A can deliver nominal 50A output current with 2 $\times$  LTM4620s in parallel. As explained in the data sheet, output current derating is necessary for certain  $V_{IN}$ ,  $V_{OUT}$ , and thermal conditions. The LTM4620 on DC1780A-A always operate 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\_CONTROL pin. The output

voltage is tightly regulated between “ $V_{OUT}^{+}$ ” and “ $V_{OUT}^{-}$ ” through remote output voltage sensing which improves output voltage regulation at heavy loads. These features and the availability of the LTM4620EV in a compact 15mm  $\times$  15mm  $\times$  4.41mm LGA package make it ideal for use in many high-density point-of-load regulation applications. The LTM4620 data sheet must be read in conjunction with this demo manual prior to working on or modifying the demo circuit DC1780A-A.

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

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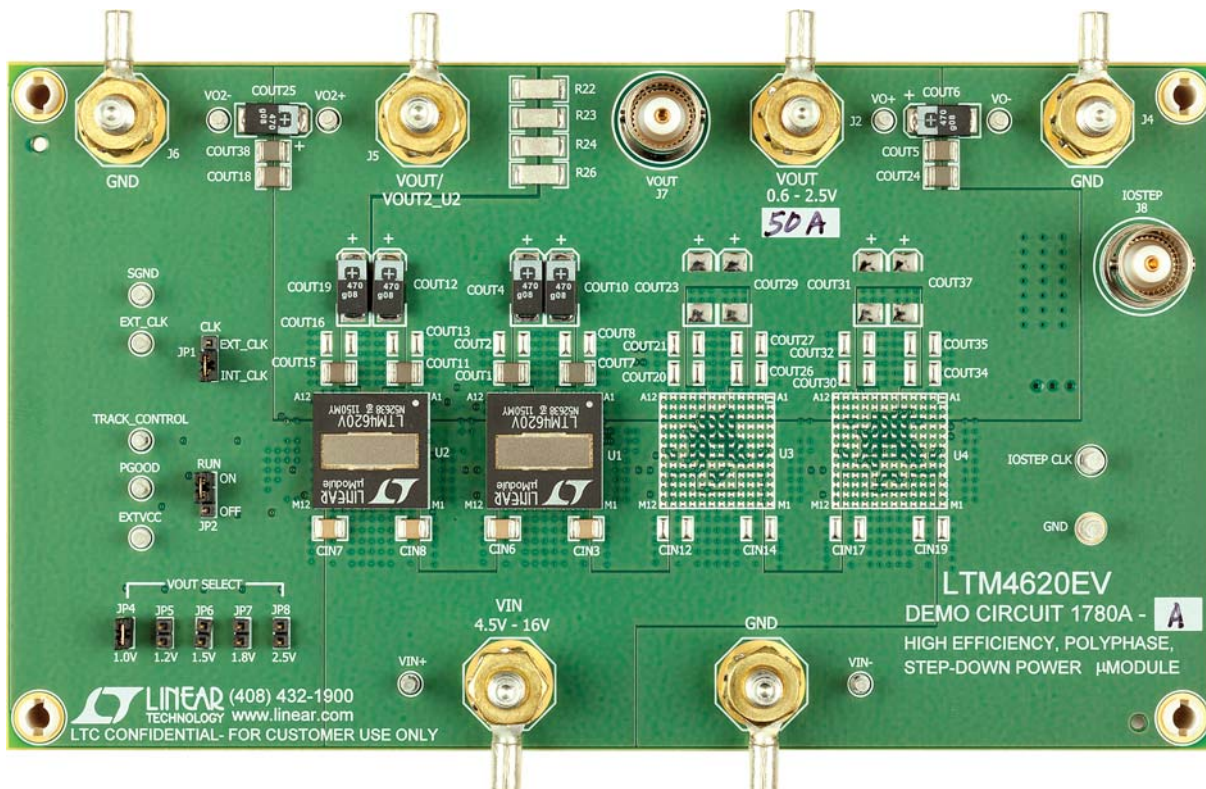


Figure 1. 50A PolyPhase LTM4620/DC1780A-A Demo Board

# DEMO MANUAL DC1780A-A

## PERFORMANCE SUMMARY Specifications are at $T_A = 25^\circ\text{C}$

PARAMETER	CONDITIONS/NOTES	VALUE
Input Voltage Range		4.5V to 16V
Output Voltage $V_{OUT}$	$V_{IN} = 4.5\text{V to }16\text{V}$ , $I_{OUT} = 0\text{A to }50\text{A}$ , JP4: 1.0V	$1.0\text{V} \pm 1.5\%$ (0.985V to 1.015V)
Maximum Continuous Output Current	Derating is necessary for certain $V_{IN}$ , $V_{OUT}$ and thermal conditions, see data sheet for detail.	50A
Default Operating Frequency		500kHz
Resistor Programmable Frequency Range		400kHz to 780kHz
External Clock Sync. Frequency Range		400kHz to 780kHz
Efficiency	$V_{IN} = 12\text{V}$ , $V_{OUT} = 1.0\text{V}$ , $I_{OUT} = 50\text{A}$ , $f_{SW} = 500\text{kHz}$	82.4% See Figure 4
Load Transient	$V_{IN} = 12\text{V}$ , $V_{OUT} = 1.0\text{V}$ , $I_{SETP} = 25\text{A to }50\text{A}$	<138mV, See Figure 5
Output Voltage Ripple	$V_{IN} = 12\text{V}$ , $V_{OUT} = 1.0\text{V}$ , $I_{OUT} = 50\text{A}$	<10mV, See Figure 6

## QUICK START PROCEDURE

Table 1. LTM4620 Demo Cards for up to 100A Point-of-Load Regulation

MAXIMUM OUTPUT CURRENT	NUMBER OF OUTPUT VOLTAGES	NUMBER OF LTM4620 $\mu$ MODULE REGULATORS ON THE BOARD	DEMO CARD NUMBER
13A, 13A	2	1	DC1498A
50A	1	2	DC1780A-A
75A	1	3	DC1780A-B
100A	1	4	DC1780A-C

Demonstration circuit DC1780A-A is easy to set up to evaluate the performance of PolyPhase operation of the LTM4620EV. Due to the high input/output current, select a proper input supply/load/cable which can sustain the full load operation. Please refer to Figure 2 for proper measurement setup and follow the procedure below:

- Place jumpers in the following positions for a typical  $1.0\text{V}_{OUT}$  application:

JP1	JP2	JP4-JP8
CLK	RUN	$V_{OUT}$ SELECT
INT_CLK	OFF	ON JP4/1.0V

- 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.

- Turn on the power supply at the input. Place JP2 to ON position. The output voltage between  $V_{OUT}^+$  and  $V_{OUT}^-$  should be  $1.0\text{V} \pm 1.5\%$  (0.985V to 1.015V).
- 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.  $50\Omega$  termination should be set on the oscilloscope or BNC cables.
- (Optional) For optional load transient test, apply an adjustable pulse signal between IOSTEP CLK and GND test point. The pulse amplitude (3V to 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 very small duty cycle (< 10%) to limit the thermal stress on the transient load circuit.

**QUICK START PROCEDURE**

- 6. (Optional) LTM4620 can be synchronized to an external clock signal. Place the JP1 jumper on EXT\_CLK and apply a clock signal (0V to 5V, square wave) on the EXT\_CLK test point.
- 7. (Optional) The outputs of LTM4620 can track another supply. The output voltage tracks the voltage on TRACK\_CONTROL when a valid signal is applied on the test point.
- 8. (Optional) DC1780A-A can be configured to a dual outputs configuration with  $V_{OUT}$  at 37A load current and  $V_{OUT2}$  at 13A load current. Stuff  $0\Omega$  resistor on R61 and  $0.1\mu F$  on C14. Remove R22, R23, R24, R26, R27, R28, R32, R33, R35. Output voltage  $V_{OUT2}$  is set by R37 based on the equation  $V_{OUT2} = 0.6V(1 + 60.4k/R37)$ .

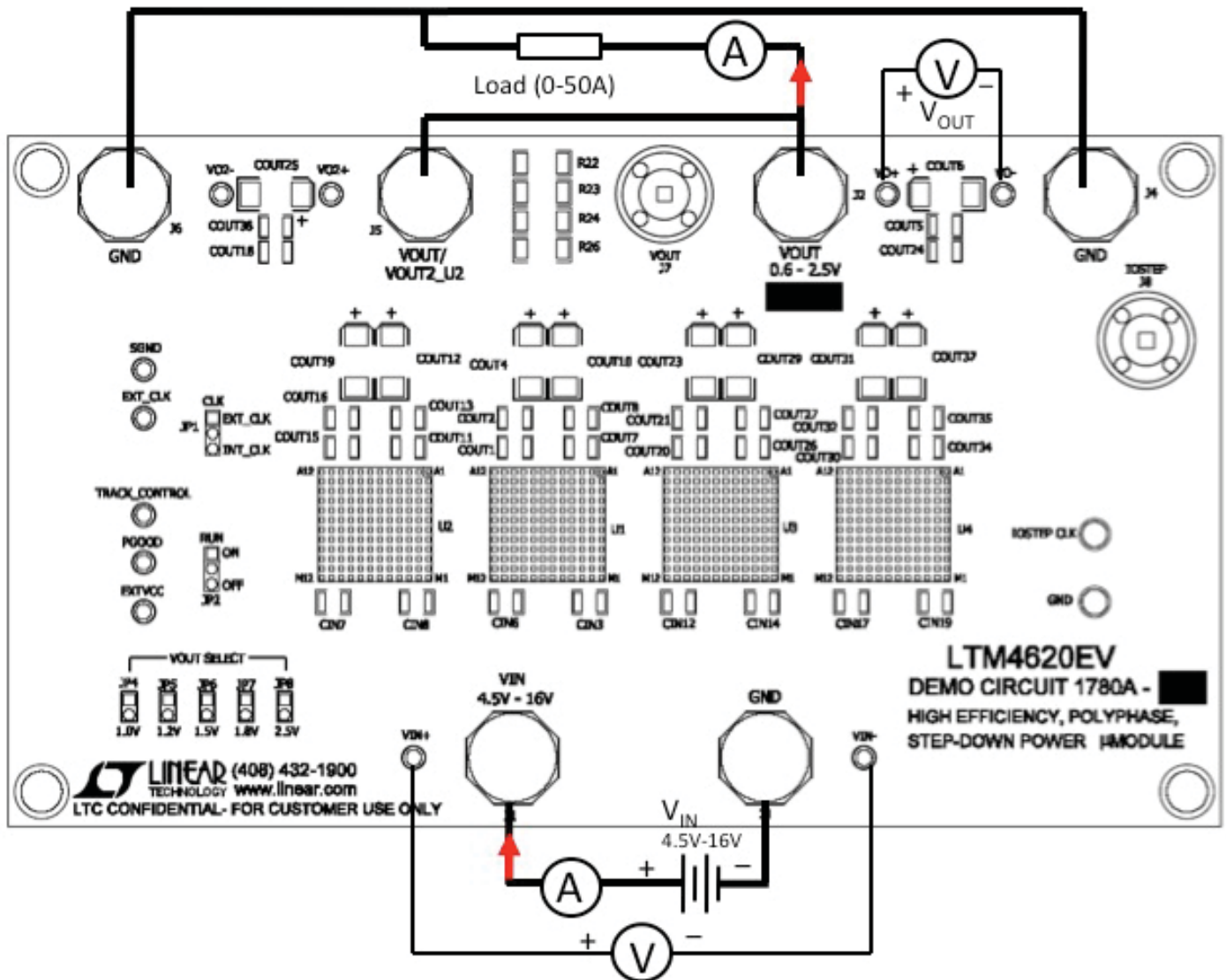


Figure 2. Test Setup of DC1780A-A

\* Note: The output current is measured with a mV-voltage meter across a 1% accurate shunt resistor.

## QUICK START PROCEDURE

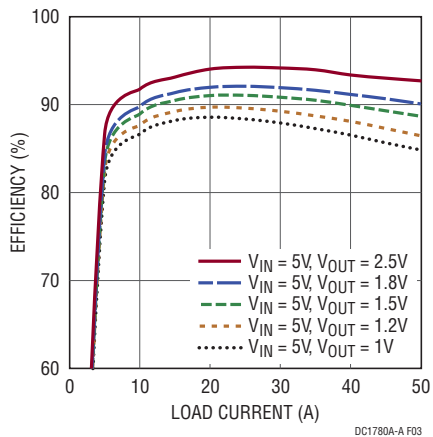


Figure 3. Measured Efficiency  $V_{IN} = 5V$ ,  $f_{SW} = 500kHz$

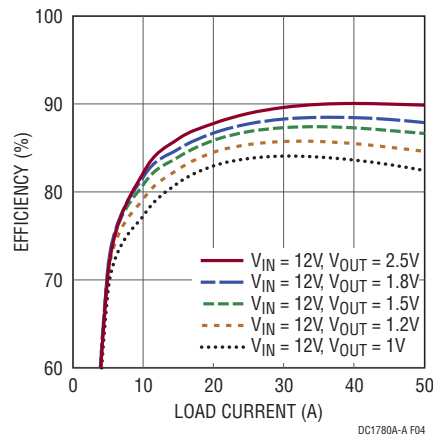


Figure 4. Measured Efficiency  $V_{IN} = 12V$ ,  $f_{SW} = 500kHz$

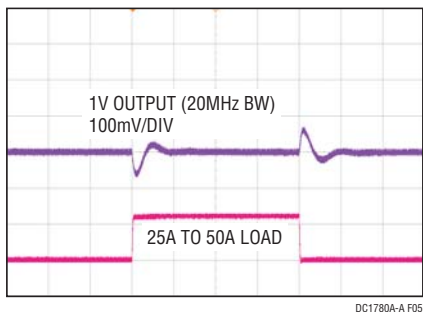


Figure 5. Load Transient 25A to 50A ( $V_{IN} = 12V$ ,  $V_{OUT} = 1V$ )

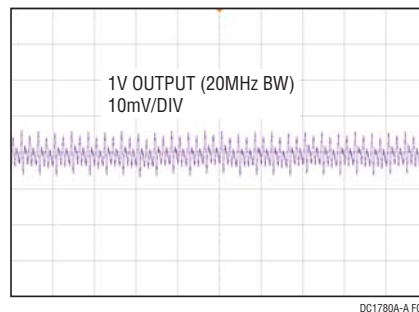


Figure 6. Measured Output Voltage Ripple at  $12V_{IN}$ ,  $1V_{OUT}$ , 50A on J7 with Standard Demo Circuit Default Setup

**QUICK START PROCEDURE**

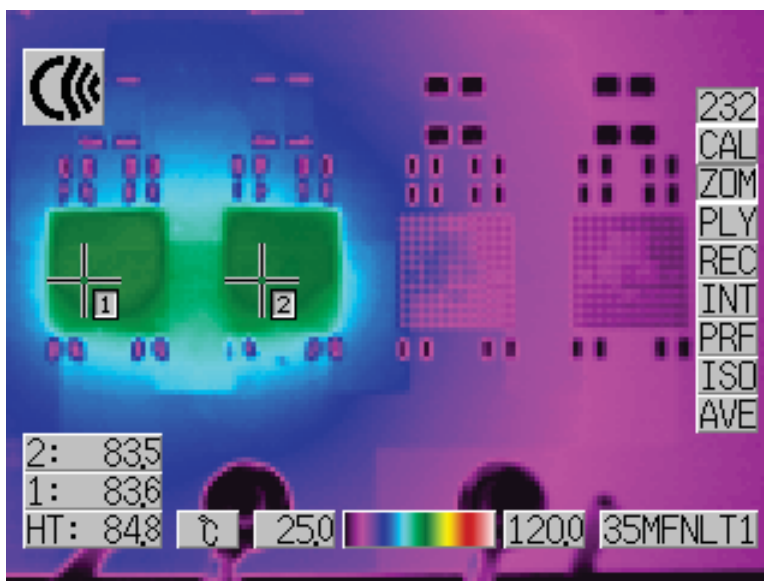


Figure 7. Thermal Capture at 12V<sub>IN</sub>, 1.0V<sub>OUT</sub> at 50A (Ambient Temperature = 23.3°C, No Airflow and No Heat Sink)

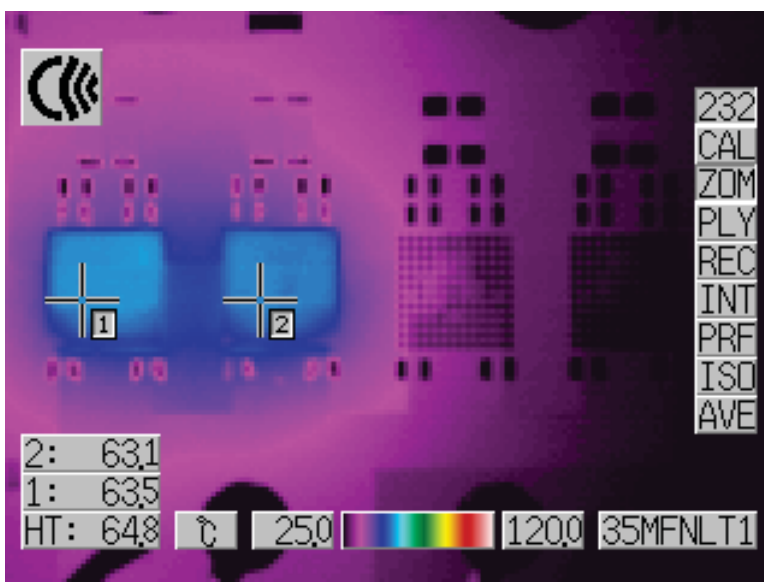


Figure 8, Thermal Capture at 12V<sub>IN</sub>, 1.0V<sub>OUT</sub> at 50A (Ambient Temperature = 23.3°C, 200LFM Airflow and No Heat Sink)



# DEMO MANUAL DC1780A-A

## PARTS LIST

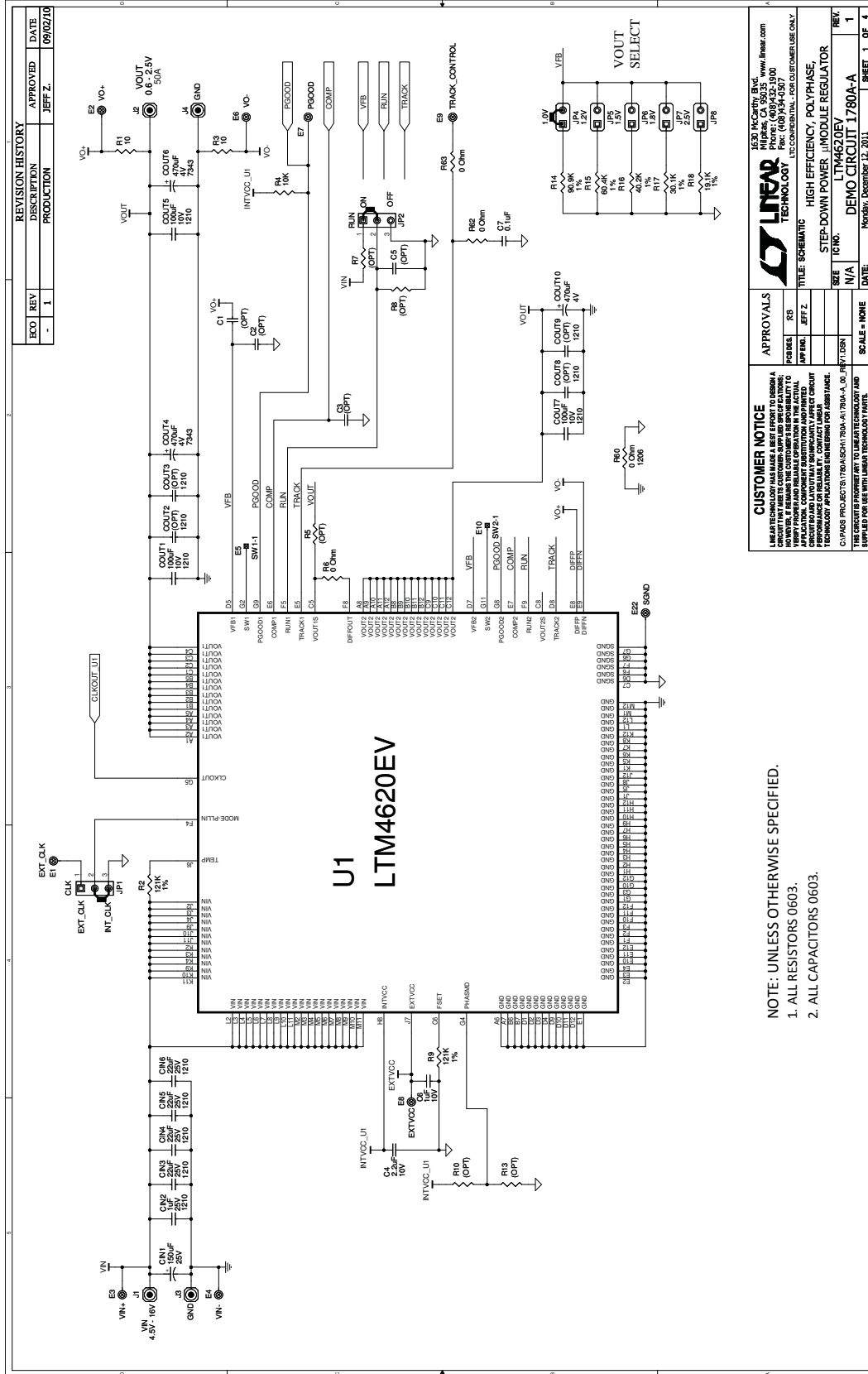
ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
<b>Required Circuit Components</b>				
1	8	CIN3, CIN4, CIN5, CIN6, CIN7, CIN8, CIN9, CIN10	Cap., X5R 22 $\mu$ F 25V 10% 1210	Murata GRM32ER61226KE15
2	4	COUT1, COUT7, COUT11, COUT15,	Cap., X5R 100 $\mu$ F 10V 20% 1210	Taiyo Yuden LMK325BJ107MN-T
3	4	COUT4, COUT10, COUT12, COUT19	Cap., POSCAP 470 $\mu$ F 4V 20% 7343	SANYO 4TPE470MCL
4	1	R14	Res., Chip 90.9k 0.06W 1% 0603	Vishay CRCW060390K9FKEA
5	2	R9, R31	Res., Chip 121k 0.06W 1% 0603	Vishay CRCW0603121KFKEA
6	2	R1, R3	Res., Chip 10 0.06W 5% 0603	Vishay CRCW060310R0JNEA
7	2	C4, C10	Cap., X5R 2.2 $\mu$ F 10V 20% 0603	Taiyo Yuden LMK107BJ225MA
8	1	C7	Cap., X7R 0.1 $\mu$ F 25V 10% 0603	AVX 06033C104KAT2A
9	2	U1, U2	I.C., Volt. Reg. LGA(144) 15MMX15MMX4.41MM(1873-REV0)	Linear Technology Corp. LTM4620EV
<b>Additional Demo Board Circuit Components</b>				
10	1	C25	Cap., X7R 0.1 $\mu$ F 25V 10% 0603	AVX 06033C104KAT2A
11	2	COUT5, COUT18, COUT24, COUT38	Cap., X5R 100 $\mu$ F 10V 20% 1210	Taiyo Yuden LMK325BJ107MN-T
12	2	COUT6, COUT25	Cap., POSCAP 470 $\mu$ F 4V 20% 7343	SANYO 4TPE470MCL
13	1	R15	Res., Chip 60.4k 0.06W 1% 0603	Vishay CRCW060360K4FKEA
14	1	R16	Res., Chip 40.2k 0.06W 1% 0603	Vishay CRCW060340K2FKEA
15	1	R17	Res., Chip 30.1k 0.06W 1% 0603	Vishay CRCW060330K1FKEA
16	1	R18	Res., Chip 19.1k 0.06W 1% 0603	Vishay CRCW060319K1FKEA
17	6	R2, R21, R39, R43, R47, R51	Res., Chip 121k 0.06W 1% 0603	Vishay CRCW0603121KFKEA
18	2	R25, R29	Res., Chip 10 $\Omega$ 0.06W 5% 0603	Vishay CRCW060310R0JNEA
19	2	C18, C22	Cap., X5R 2.2 $\mu$ F 10V 20% 0603	Taiyo Yuden LMK107BJ225MA
20	1	CIN1	Cap., Alum 150 $\mu$ F 25V 25% SUNCON-8	SUNCON 25CE150AX
21	2	CIN2, CIN11	Cap., X5R 1 $\mu$ F 25V 10% 1210	Taiyo Yuden TMK325BJ105KM
22	4	R22, R23, R24, R26	Res., 0 $\Omega$ 2010	TEPRO(NAKOMA) RNH6083
23	2	R56, R57	Res., 0.010 2W 1% 2512	Vishay WSL-2512-R01000-F-EA
24	0	R58, R59 (OPT)	Res., 2512	
25	1	R60	Res/Jumper, Chip 0 $\Omega$ 1/4W 1A 1206	Vishay CRCW12060000Z0EA
26	4	R4, R36, R41, R54	Res., Chip 10k 0.06W 5% 0603	Vishay CRCW060310K0JNEA
27	0	R5, R7, R8, R10, R13, R30, R34, R37, R38, R42, R44, R48, R49, R50, R52, R53, R55, R61 (OPT)	Res., 0603	
28	13	R6, R19, R20, R27, R28, R32, R33, R35, R40, R45, R46, R62, R63,	Res/Jumper, Chip 0 $\Omega$ 1/16W 1A 0603	Vishay CRCW06030000Z0EA
29	0	COUT23, COUT29, COUT31, COUT37 (OPT)	Cap., "D" Case 7343	
30	0	C1, C2, C3, C5, C8, C9, C12, C13, C14, C15, C16, C17, C20, C21, C26, C29, C30 (OPT)	Cap., 0603	
31	6	C6, C11, C19, C23, C27, C28	Cap., X7R 1 $\mu$ F 10V 10% 0603	Taiyo Yuden LMK107BJ105KA
32	1	C24	Cap., X7R 0.01 $\mu$ F 100V 10% 0603	AVX 06031C103KAT2A
33	2	Q1, Q2	Mosfet N-channel, 30V DPAK(TO-252)	Vishay Siliconix SUD50N03-09P

## PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
34	0	COUT2, COUT3, COUT8, COUT9, CIN12, COUT13, CIN13, COUT14, CIN14, CIN15, COUT16, CIN16, COUT17, CIN17, CIN18, CIN19, COUT20, COUT21, COUT22, COUT26, COUT27, COUT28, COUT30, COUT32, COUT33, COUT34, COUT35, COUT36 (OPT)	Cap., 1210	
<b>Hardware for Demo Board only</b>				
35	3	XJP1, XJP2, XJP4	Shunt, 2mm Ctrs.	Samtec 2SN-BK-G
36	4	MH1-MH4	STAND-OFF, NYLON 0.5" Tall	KEYSTONE, 8833 (SNAP ON)
37	2	J7, J8	BNC Connector	Connex 112404
38	2	JP1, JP2	Headers, 3 Pins 2mm Ctrs.	Samtec TMM-103-02-L-S
39	5	JP4, JP5, JP6, JP7, JP8	Jumper, 2 Pins 2mm Ctrs.	Samtec TMM-102-02-L-S
40	6	J1, J2, J3, J4, J5, J6	Stud, Test Pin	PEM KFH-032-10
41	11	E1, E2, E3, E4, E6, E7, E8, E9, E12, E13, E22	Turret, Test Point	Mill Max 2308-2-00-80-00-00-07-0
42	0	E5, E10, E11, E14, E15, E16, E17, E18 (Opt)	Test Point	
43	2	E19, E20	Turret, Test Point	Mill Max 2501-2-00-80-00-00-07-0
44	12		NUT, BRASS NUTS #10-32	ANY, #10-32
45	6		RING, LUG RING # 10	KEYSTONE, 8205
46	6		WASHER, #10, Tin Plated Brass	ANY, #10 EXT BZ TN

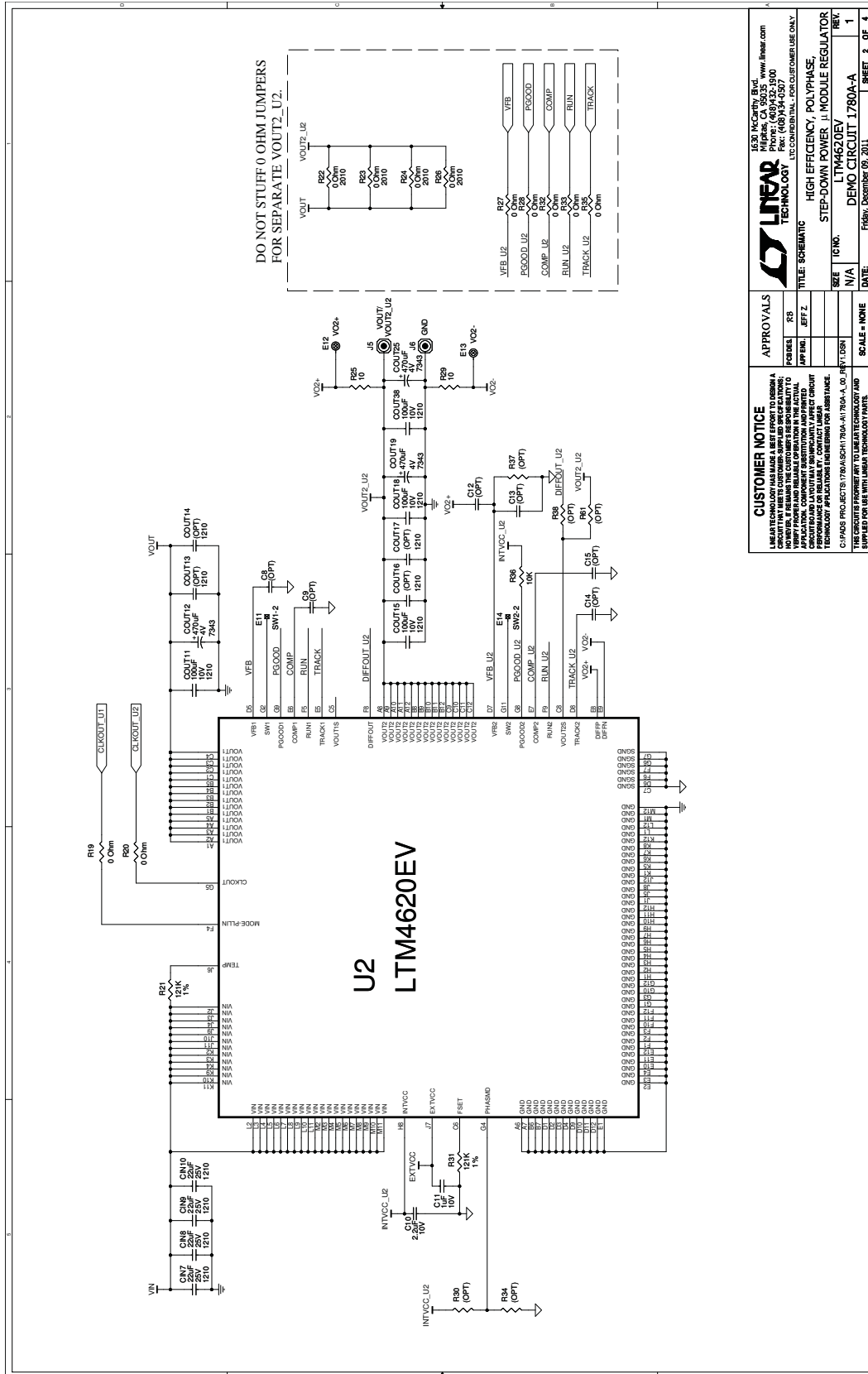
# DEMO MANUAL DC1780A-A

## SCHEMATIC DIAGRAM





SCHEMATIC DIAGRAM



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DESIGNER	RB
APPROVER	EFFZ
DATE	

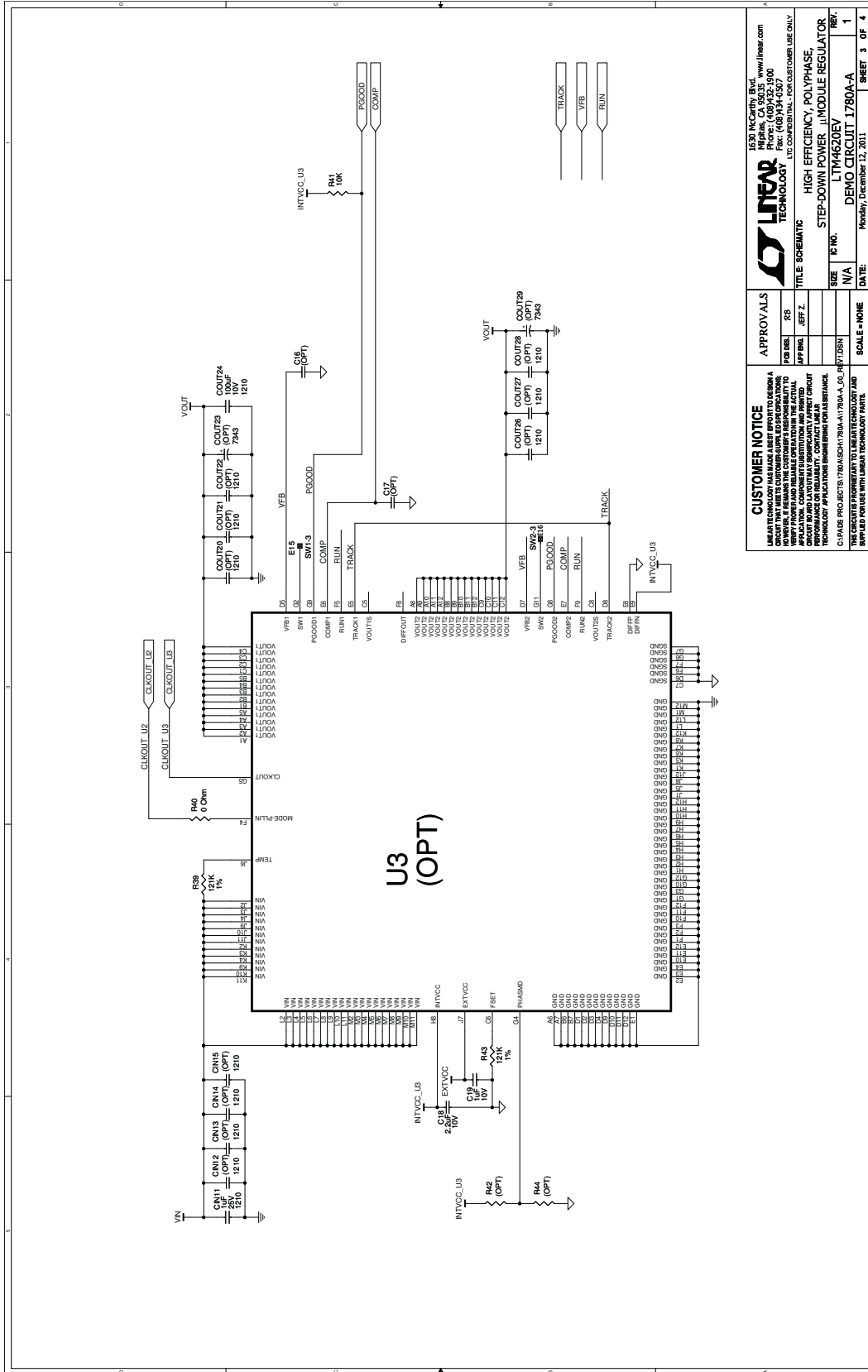
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**HIGH EFFICIENCY, POLYPHASE STEP-DOWN POWER MODULE REGULATOR**

SIZE	IC NO.	REV.
N/A	LTM4620EV	1
DATE	DEMO CIRCUIT	1780A-A
Friday, December 09, 2011		SHEET 2 OF 4

# DEMO MANUAL DC1780A-A

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DESIGNED BY:	RS
CHECKED BY:	JEFF Z
DATE:	

**STEP-DOWN POWER MODULE REGULATOR**

LT1M4620EV

DATE: Monday, December 12, 2011

SHEET 3 OF 4

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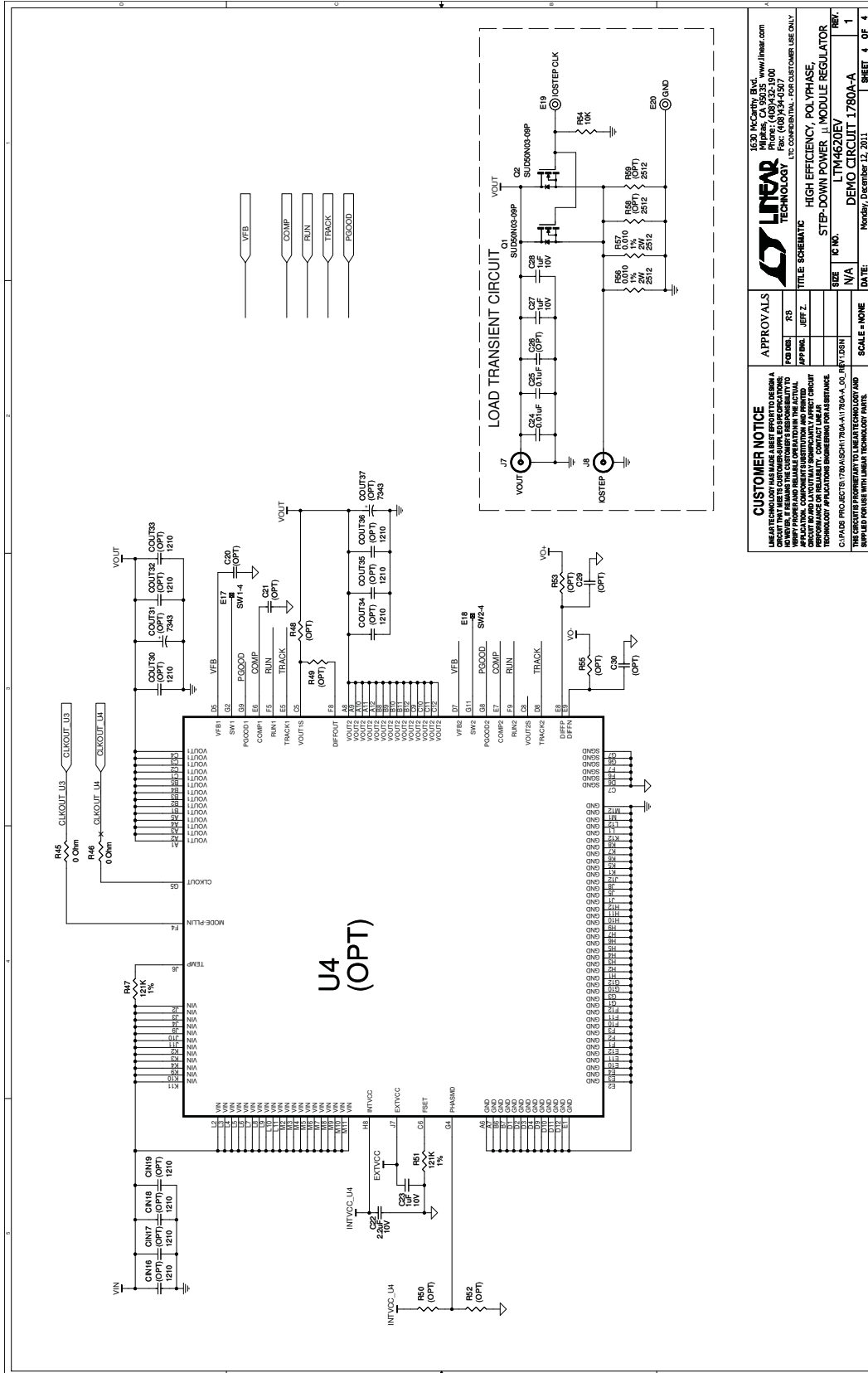
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DESIGNED BY	REV
CHECKED BY	DATE
APPROVED BY	SCALE
DATE	SCALE = NONE

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**TITLE SCHEMATIC**  
**STEP-DOWN POWER, HIGH EFFICIENCY, POLYPHASE, STEP-DOWN POWER, 11 MODULE REGULATOR**  
**LTM4620EV**  
**DEMO CIRCUIT 1780A-A**  
 Monday, December 12, 2011  
 SHEET 4 OF 4



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# DEMO MANUAL DC1780A-A

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Наши преимущества:

- Поставка оригинальных импортных электронных компонентов напрямую с производств Америки, Европы и Азии, а так же с крупнейших складов мира;
- Широкая линейка поставок активных и пассивных импортных электронных компонентов (более 30 млн. наименований);
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Помощь Конструкторского Отдела и консультации квалифицированных инженеров;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Поставка электронных компонентов под контролем ВП;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- При необходимости вся продукция военного и аэрокосмического назначения проходит испытания и сертификацию в лаборатории (по согласованию с заказчиком);
- Поставка специализированных компонентов военного и аэрокосмического уровня качества (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Actel, Aeroflex, Peregrine, VPT, Syfer, Eurofarad, Texas Instruments, MS Kennedy, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Компания «Океан Электроники» является официальным дистрибьютором и эксклюзивным представителем в России одного из крупнейших производителей разъемов военного и аэрокосмического назначения «JONHON», а так же официальным дистрибьютором и эксклюзивным представителем в России производителя высокотехнологичных и надежных решений для передачи СВЧ сигналов «FORSTAR».



## JONHON

«JONHON» (основан в 1970 г.)

Разъемы специального, военного и аэрокосмического назначения:

(Применяются в военной, авиационной, аэрокосмической, морской, железнодорожной, горно- и нефтедобывающей отраслях промышленности)

«FORSTAR» (основан в 1998 г.)

ВЧ соединители, коаксиальные кабели,  
кабельные сборки и микроволновые компоненты:

(Применяются в телекоммуникациях гражданского и специального назначения, в средствах связи, РЛС, а так же военной, авиационной и аэрокосмической отраслях промышленности).



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