

QUICK START GUIDE FOR DEMONSTRATION CIRCUIT 1031A-C

36V-72VIN, SYNCHRONOUS FORWARD CONVERTER

LTC3725 / LTC3726

DESCRIPTION

Demonstration circuit 1031A-C is a 36V-72Vin, synchronous forward converter featuring the LTC3725/LTC3726. This circuit was designed specifically to attain a high current, low ripple, synchronously rectified forward to efficiently power 5.0V loads at up to 20A from a typical telecom input voltage range. This circuit features secondary-side con-

trol of the supply eliminating the need for an optocoupler, self-starting architecture, input undervoltage lockout, and output overvoltage protection.

**Design files for this circuit board are available.
Call the LTC factory.**

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Table 1. Performance Summary ($T_A = 25^\circ\text{C}$)

PARAMETER	CONDITION	VALUE
Minimum Input Voltage		36V
Maximum Input Voltage		72V
Output Voltage V_{OUT}	$V_{\text{IN}} = 36\text{V to } 72\text{V}, I_{\text{OUT}} = 0\text{A to } 20\text{A}$	5.0V
Maximum Output Current	200LFM Airflow	20A
Typical Output Ripple V_{OUT}	$V_{\text{IN}} = 72\text{V}, I_{\text{OUT}} = 20\text{A}$	100mV _{P-P}
Size	Component Area x Top Component Height	2.3" x 0.9" x 0.394"
Load Transient Response	Peak Deviation with Load Step of 10A to 20A (10A/us)	±200mV
	Settling Time	40us
Nominal Switching Frequency		300kHz
Efficiency	$V_{\text{IN}} = 48\text{V}, I_{\text{OUT}} = 20\text{A}$	91.5% Typical

OPERATING PRINCIPLES

The LTC3726 controller is used on the secondary and the LTC3725 driver with self-starting capability is used on the primary. When an input voltage is applied, the LTC3725 begins a controlled soft-start of the output voltage. As this voltage begins to rise, the LTC3726 secondary controller is quickly powered up via T1, D1, and Q27. The LTC3726 then assumes control of the output voltage by sending encoded PWM gate pulses to the LTC3725 primary driver via the small signal transformer, T2. The LTC3725 then operates as a simple driver receiving both input signals and bias power through T2.

The transition from primary to secondary control occurs seamlessly at a fraction of the output voltage. From that point on, operation and design simplifies to that of a simple buck converter. Secondary sensing eliminates delays, tames large-signal overshoot and reduces output capacitance while utilizing off-the-shelf magnetics and attaining high efficiency.

For large values of input inductance, a 100V, 47uF electrolytic capacitor can be added across the input terminals to damp the input filter and provide adequate stability. See Linear Technology Application Note AN19 for a discussion on input filter stability analysis. A recommended part is the Sanyo 100MV39AX.

QUICK START PROCEDURE

Demonstration circuit 1031A-C is easy to set up to evaluate the performance of the LTC3725/LTC3726. Refer to Figure 1 for proper measurement equipment setup and follow the procedure below:

NOTE: When measuring the input or output voltage ripple, care must be taken to avoid a long ground lead on the oscilloscope probe. Measure the output (or input) voltage ripple by touching the probe tip and probe ground directly across the input or output capacitor. See Figure 2 for proper scope probe technique.

1. Set an input power supply that is capable of 36V to 72V at a current of at least 3.5A to a voltage of 36V. Then, turn off the supply.
2. With power off, connect the supply to the input terminals +Vin and -Vin.
 - a. Input voltages lower than 36V can keep the converter from turning on due to the undervoltage lockout feature of the LTC3725/LTC3726.
 - b. If efficiency measurements are desired, an ammeter capable of measuring 3.5Adc can be put in series with the input supply in order to measure the DC1031A-C's input current.
 - c. A voltmeter with a capability of measuring at least 72V can be placed across the input terminals in order to get an accurate input voltage measurement.

3. Turn on the power at the input.

NOTE: Make sure that the input voltage never exceeds 72V.

4. Check for the proper output voltage of 5.0V
 5. Turn off the power at the input.
 6. Once the proper output voltages are established, connect a variable load capable of sinking 20A at 5.0V to the output terminals +Vout and -Vout. Set the current for 0A.
 - a. If efficiency measurements are desired, an ammeter or a resistor current shunt that is capable of handling at least 20Adc can be put in series with the output load in order to measure the DC1031A-C's output current.
 - b. A voltmeter with a capability of measuring at least 5.0V can be placed across the output terminals in order to get an accurate output voltage measurement.
 7. Turn on the power at the input.
- NOTE:** If there is no output, temporarily disconnect the load to make sure that the load is not set too high.
8. Once the proper output voltage is established, adjust the load within the operating range and observe the output voltage regulation, ripple voltage, efficiency and other desired parameters.

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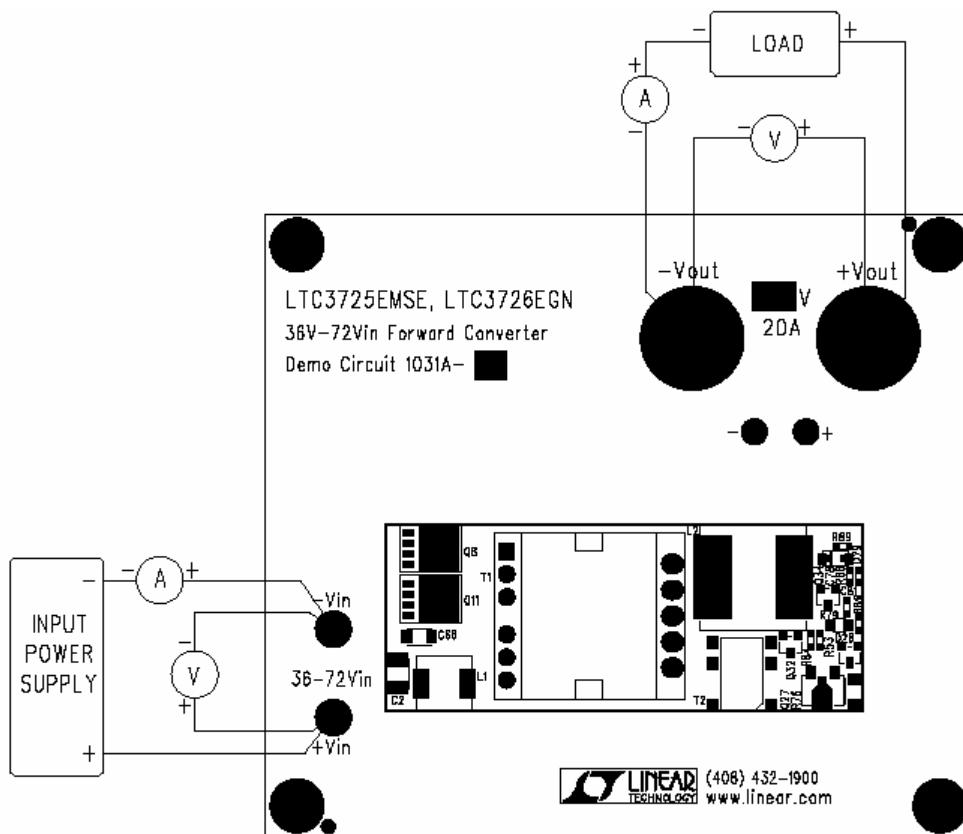


Figure 1. Proper Measurement Equipment Setup

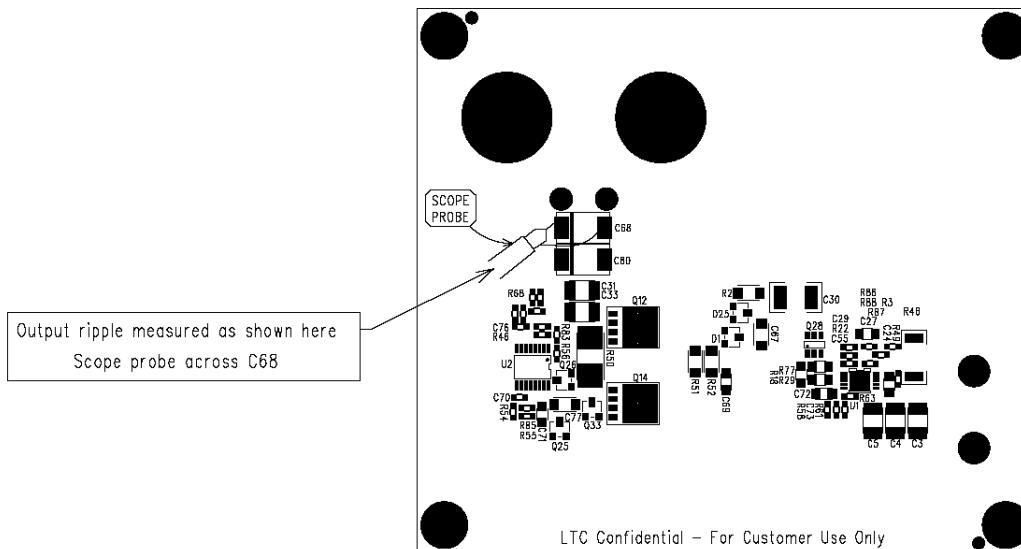


Figure 2. Measuring Input or Output Ripple

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MEASURED DATA

Figures 3 through 11 are measured data for a typical DC1031A-C. Figures 12 through 21 are schematics, bill of materials and layout.

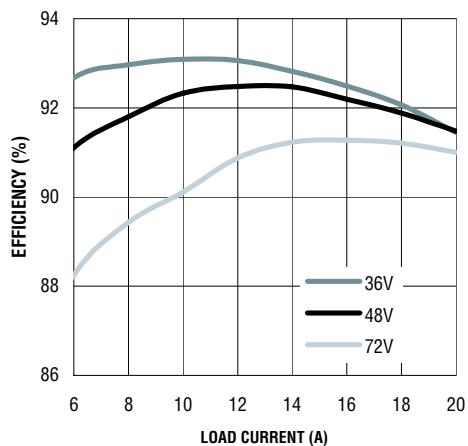


Figure 3. Efficiency (200lfm airflow)

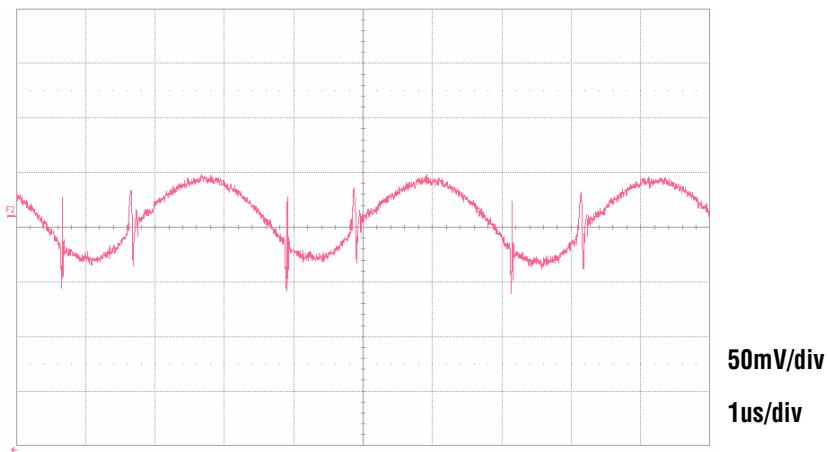


Figure 4. Output Ripple Voltage (72Vin, 20Aout)

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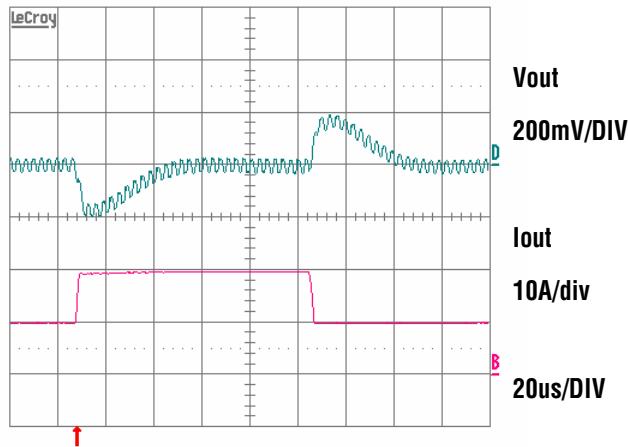


Figure 5. Output Voltage Transient Response (48Vin, 10A to 20A step)

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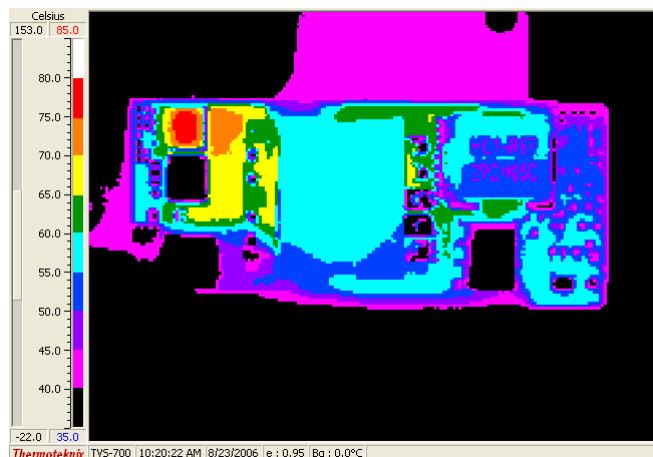


Figure 6. Temp Data (48Vin, 20A, 25°C, 200LFM airflow – front)

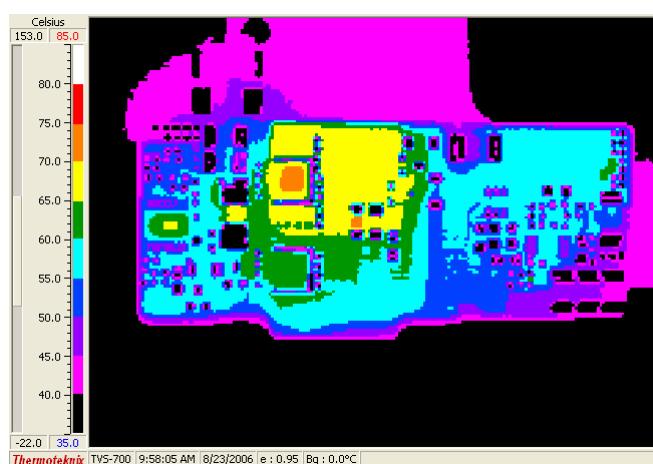


Figure 7. Temp Data (48Vin, 20A, 25°C, 200LFM airflow – back)

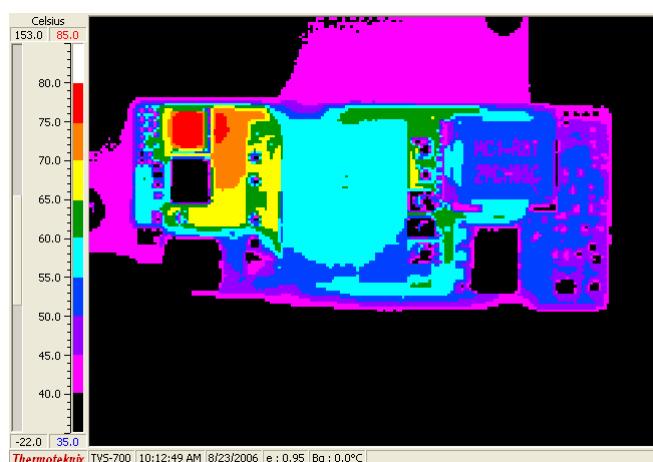


Figure 8. Temp Data (36Vin, 20A, 25°C, 200LFM airflow – front)

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Figure 9. Temp Data (36Vin, 20A, 25°C, 200LFM airflow – back)



Figure 10. Temp Data (72Vin, 20A, 25°C, 200LFM airflow – front)



Figure 11. Temp Data (72Vin, 20A, 25°C, 200LFM airflow – back)

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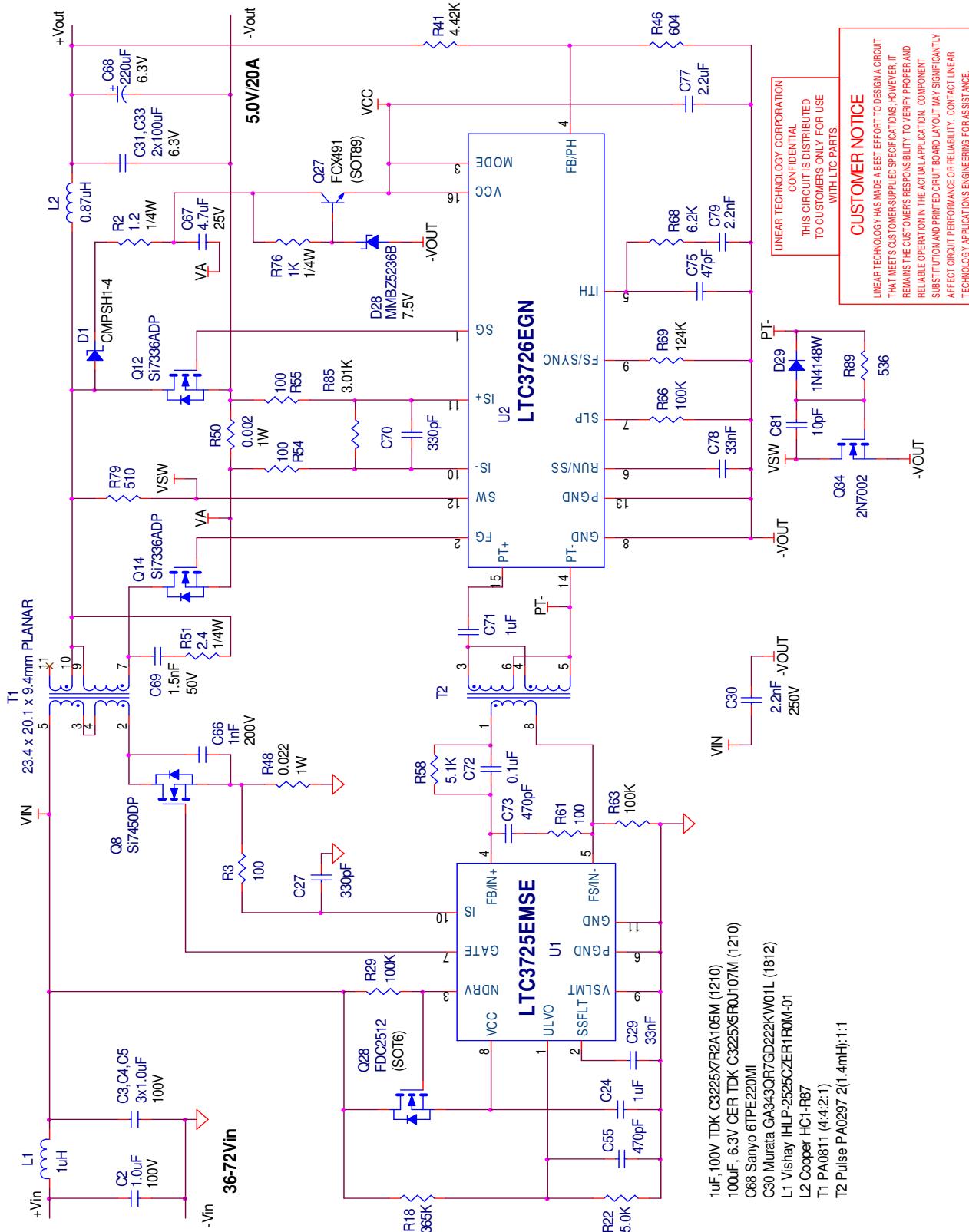


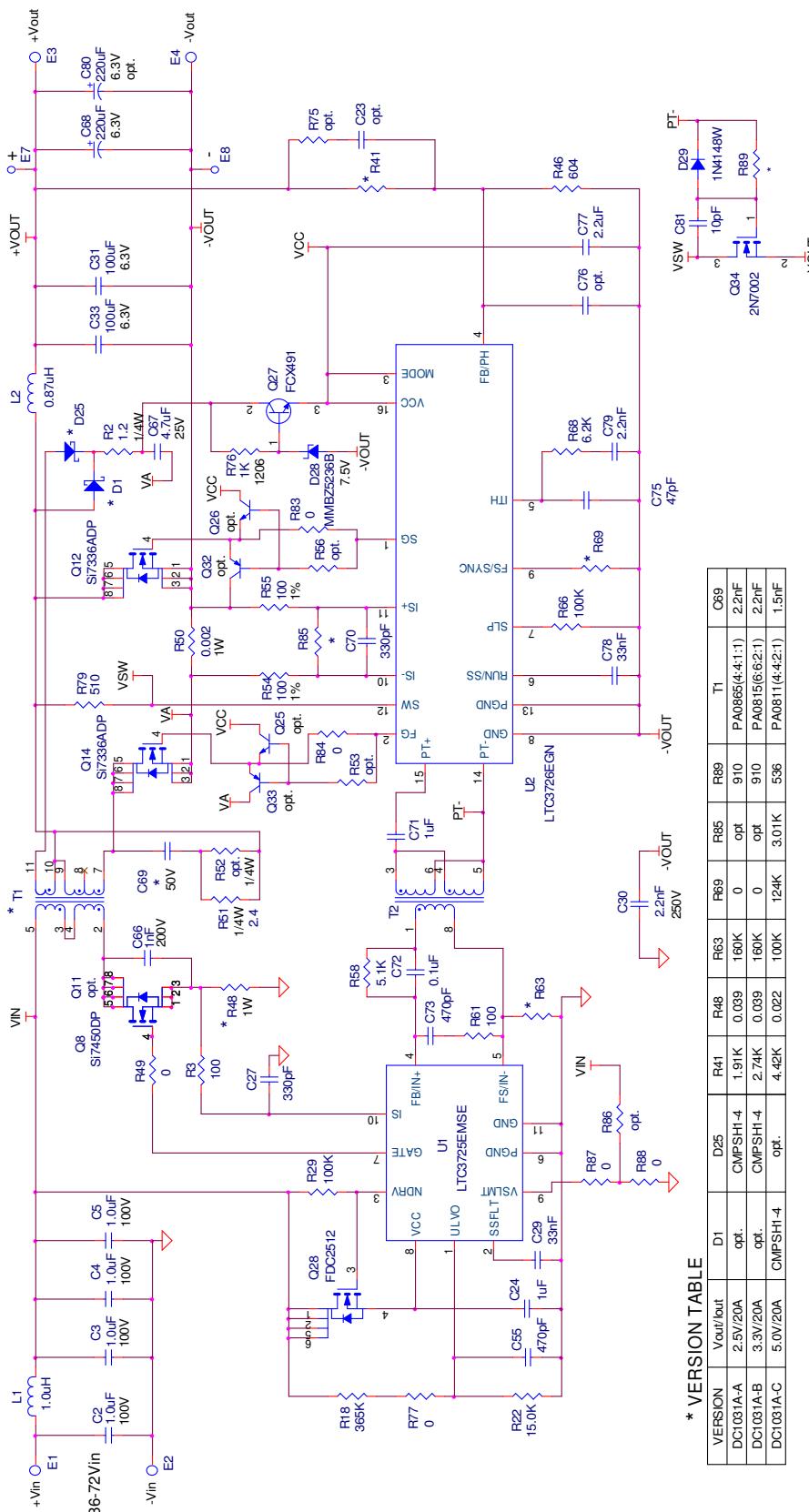
Figure 12. Simplified Schematic

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LINEAR TECHNOLOGY HAS MADE A BEST EFFORT TO DESIGN A CIRCUIT THAT MEETS CUSTOMERS' SUPPLIED SPECIFICATIONS; HOWEVER, IT REMAINS THE CUSTOMER'S RESPONSIBILITY TO VERIFY PROPER AND RELIABLE OPERATION IN THE ACTUAL APPLICATION. COMPONENT SUBSTITUTION AND PRINTED CIRUIT BOARD LAYOUT MAY SIGNIFICANTLY AFFECT CIRCUIT PERFORMANCE OR RELIABILITY. CONTACT LINEAR TECHNOLOGY APPLICATIONS ENGINEERING FOR ASSISTANCE.

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RESDAM Corp., Inc. Milpitas, CA 95035 Phone: (408) 435-1900 Fax: (408) 341-0207		J. Wu	12/5/05
TITLE		LTC3726EMSE, LTC3726EGN, 36V - 72V/in Forward Converter	
SIZE	CAGE CODE	DWG NO.	REV
125x155		DC1031A	A
SHEET	FILENAME	SCALE	CF
1		1	1

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Item	Qty	Reference	Part Description	Manufacture / Part #
REQUIRED CIRCUIT COMPONENTS¹				
1	4	C2,C3,C4,C5	CAP., X7R, 1.0uF, 100V, 20%, 1210	TDK, C3225X7R2A105M
2	2	C71,C24	CAP., X7R, 1uF, 16V 10%, 0805	TAIYO YUDEN, EMK212BJ105KG
3	2	C27,C70	CAP., X7R, 330pF, 25V, 10%, 0603	AVX, 06033C331KAT2A
4	2	C29,C78	CAP., X7R, 33nF, 25V, 10%, 0603	AVX, 06033C333KAT2A
5	1	C30	CAP., X7R, 2.2nF, 250V, 10%, 1812	MURATA, GA343QR7GD222KW01L
6	2	C31,C33	CAP., X5R, 100uF, 6.3V, 20%, 1210	TDK, C3225X5R0J107M
7	2	C73,C55	CAP., COG, 470pF, 25V, 10%, 0603	AVX, 06033A471KAT2A
8	1	C66	CAP., COG, 1nF, 200V, 10%, 1206	AVX, 12062A102KAT2A
9	1	C67	CAP., X7R, 4.7uF, 25V, 20%, 1206	TDK, C3216X7R1E475M
10	1	C68	CAP., POSCAP, 220uF, 6.3V, 20% 7343	SANYO, 6TPE220MI
11	1	C69	CAP., NPO, 1.5nF, 50V, 10%, 0805	AVX, 08055A152KAT2A
12	1	C72	CAP., X7R, 0.1uF, 25V, 10%, 0805	AVX, 08053C104KAT2A
13	1	C75	CAP., NPO, 47pF, 25V, 10%, 0603	AVX, 06033A470KAT2A
14	1	C77	CAP., X7R, 2.2uF, 16V, 20%, 1206	TDK, C3216X7R1C225M
15	1	C79	CAP., X7R, 2.2nF, 25V, 10%, 0603	AVX, 06033C222KAT2A
16	1	C81	CAP., COG, 10pF, 50V, 5%, 0603	AVX, 06035A100JAT2A
17	1	D1	DIODE, Schottky, CMPSH1-4, 40V, SOT23	CENTRAL SEMI., CMPSH1-4-LTC
18	1	D28	Diode, MMBZ5236B, SOT23	DIODES INC., MMBZ5236B-7
19	1	D29	Diode, 1N4148W SOD-123	DIODES INC., 1N4148W-7-F
20	1	L1	INDUCTOR, 1.0uH	VISHAY DALE, IHLP2525CZER1R0M01
	0	L1 (second source)	INDUCTOR, 1.0uH	COOPER, HCP0703-1R0-R
21	1	L2	INDUCTOR, 0.87uH	COOPER, HC1-R87
22	1	Q8	FET, N-CH., Si7450DP, POWERPAK SO-8	VISHAY, Si7450DP
23	2	Q12,Q14	FET, N-CH., Si7336ADP, POWERPAK SO-8	VISHAY, Si7336ADP
24	1	Q34	N-CH., Transistor. 2N7002 SOT23	DIODES INC., 2N7002-7-F
25	1	Q27	NPN TRANSISTOR, FCX491	ZETEX, FCX491
26	1	Q28	N-CH FET, 150V, FDC2512, Super SOT-6	FAIRCHILD, FDC2512
27	1	R2	RES., CHIP, 1.2, 1/4W, 5%, 1206	AAC, CR18-1R2JM
28	2	R54,R55	RES., CHIP, 100, 1/16W, 1%, 0603	VISHAY, CRCW06031000FRT6
29	1	R18	RES., CHIP, 365K, 1/8W, 1%, 0805	VISHAY, CRCW0805365KFKEB
30	1	R22	RES., CHIP, 15.0K, 1/16W, 1%, 0603	AAC, CR16-1502FM
31	1	R29	RES., CHIP, 100K, 1/8W, 5%, 0805	AAC, CR10-104JM
32	1	R41	RES., CHIP, 4.42K, 1/16W, 1%, 0603	AAC, CR16-4421FM
33	1	R46	RES., CHIP, 604, 1/16W, 1%, 0603	AAC, CR16-6040FM
34	1	R48	RES., CHIP, 0.022, 1W, 2%, 2010	IRC, LRC-LRF2010-01-R022-G
35	1	R50	RES., CHIP, 0.002, 1W, 1%, 2512	PANASONIC, ERJM1WTF2M0U
36	1	R51	RES., CHIP, 2.4, 1/4W, 5%, 1206	AAC, CR18-2R4JM
37	1	R58	RES., CHIP, 5.1K, 1/16W, 5%, 0603	AAC, CR16-512JM
38	2	R3,R61	RES., CHIP, 100, 1/16W, 5%, 0603	AAC, CR16-101JM
39	2	R63,R66	RES., CHIP, 100K, 1/16W, 5%, 0603	AAC, CR16-104JM
40	1	R68	RES., CHIP, 6.2K, 1/16W, 5%, 0603	AAC, CR16-622JM
41	1	R69	RES., CHIP, 124K, 1/16W, 1%, 0603	AAC, CR16-1243FM
42	1	R76	RES., CHIP, 1K, 1/4W, 5%, 1206	AAC, CR18-102JM
43	1	R79	RES., CHIP, 510, 1/8W, 5%, 0805 e3	AAC, CR10-511JM
44	1	R85	RES., CHIP, 3.01K, 1/16W, 1%, 0603	AAC, CR16-3011FM

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45	1	R89	RES., CHIP, 536, 1/16W, 5%, 0603	AAC, CR16-5360FM
46	1	T1	TRANSFORMER, 1750VDC BASIC, PA0811	PULSE, PA0811
47	1	T2	TRANSFORMER, 1500VRMS BASIC, PA0297	PULSE, PA0297
48	1	U1	I.C., LTC3725EMSE, MS10E	LINEAR TECH., LTC3725EMSE
49	1	U2	I.C., LTC3726EGN, SSOP16GN	LINEAR TECH., LTC3726EGN

ADDITIONAL DEMO BOARD CIRCUIT COMPONENTS²

1	0	C23,C76 (opt.)	CAP., 0603	
2	0	C80 (opt.)	CAP., POSCAP, 220uF, 6.3V, 20% 7343	
3	0	D25 (opt.)	DIODE, Schottky, CMPSH1-4, 40V, SOT23	
4	0	Q11 (opt.)	FET, N-CH, POWERPAK SO-8	
5	0	Q25,Q26 (opt.)	NPN Transistor, FMMT619, SOT23	
6	0	Q32,Q33 (opt.)	PNP Transistor, FMMT718, SOT23	
7	5	R49,R83,R84,R87,R88	RES., CHIP, 0, 1/16W, 0603	Panasonic, ERJ3GEY0R00V
8	0	R52 (opt.)	RES., CHIP, 1206	
9	0	R53,R56,R75 (opt.)	RES., CHIP, 0603	
11	1	R77	RES., CHIP, 0, 1/8W, 0805	AAC, CJ10-000M
12	0	R86 (opt.)	RES., CHIP, 0805	

HARDWARE-FOR DEMO BOARD ONLY:

1	2	E1,E2	TESTPOINT, TURRET, .094"	MILL-MAX, 2501-2
2	2	E3,E4	STUD	PEM, KFH-032-10
3	4	E3,E4 (2 EACH)	NUT, BRASS, #10-32	ANY
4	2	E3,E4	Ring, Lug Ring # 10	KEYSTONE 8205
5	2	E3,E4	WASHER, STAR #10 BRASS NICHEL	ANY
6	2	E8,E7	TURRET,	MILL-MAX2308-2-00-44
7	4	(STAND-OFF)	STAND-OFF, NYLON 0.50"	KEYSTONE 8833 (SNAP ON)

Notes:

1. Required Circuit Components are those parts that are required to implement the circuit function
2. Additional Demo Board Circuit Components are those parts that provide added functionality for the demo board but are not required in the actual circuit.

Figure 14. Bill of Materials

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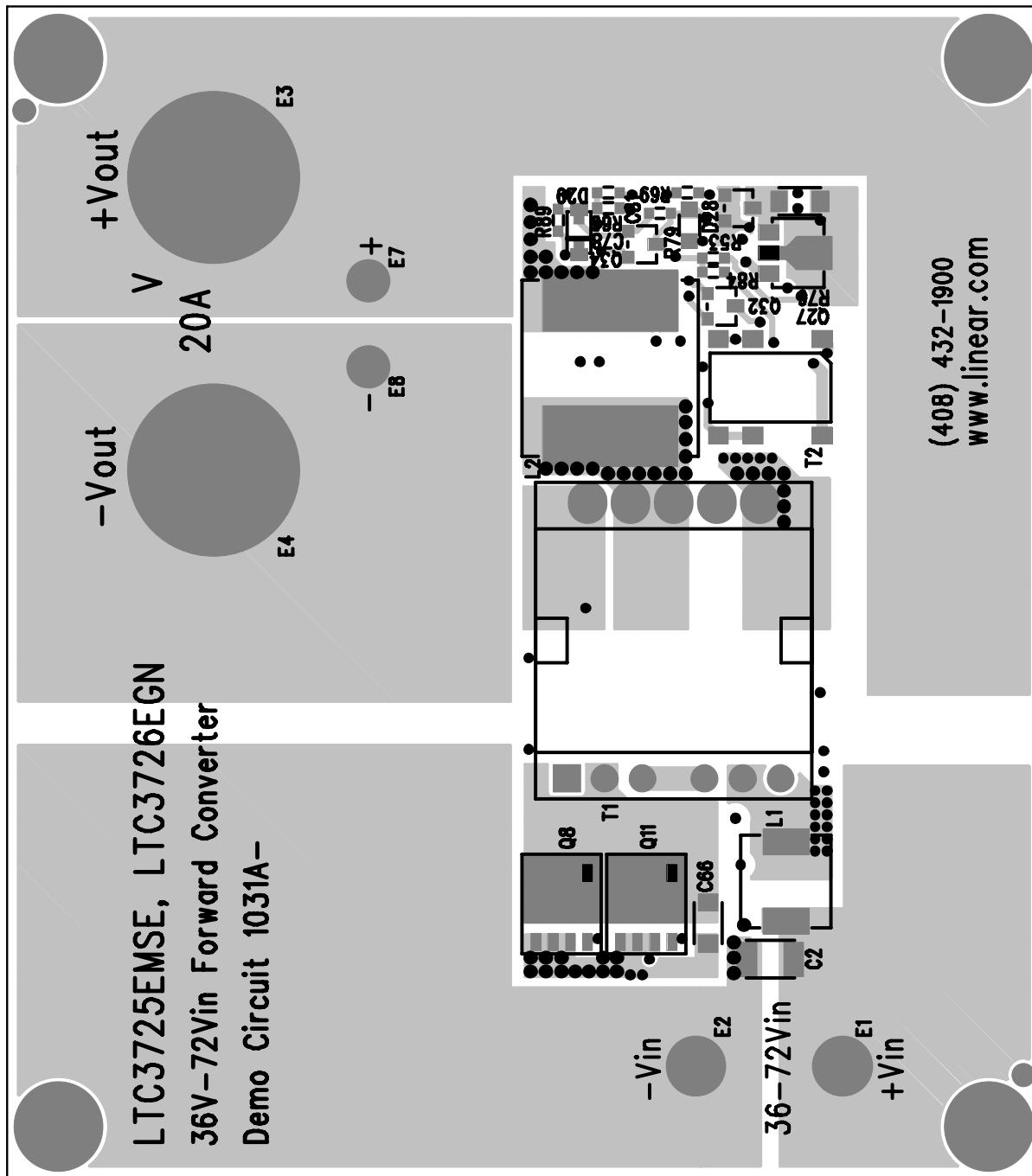


Figure 15. Top

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Figure 16. Layer 2

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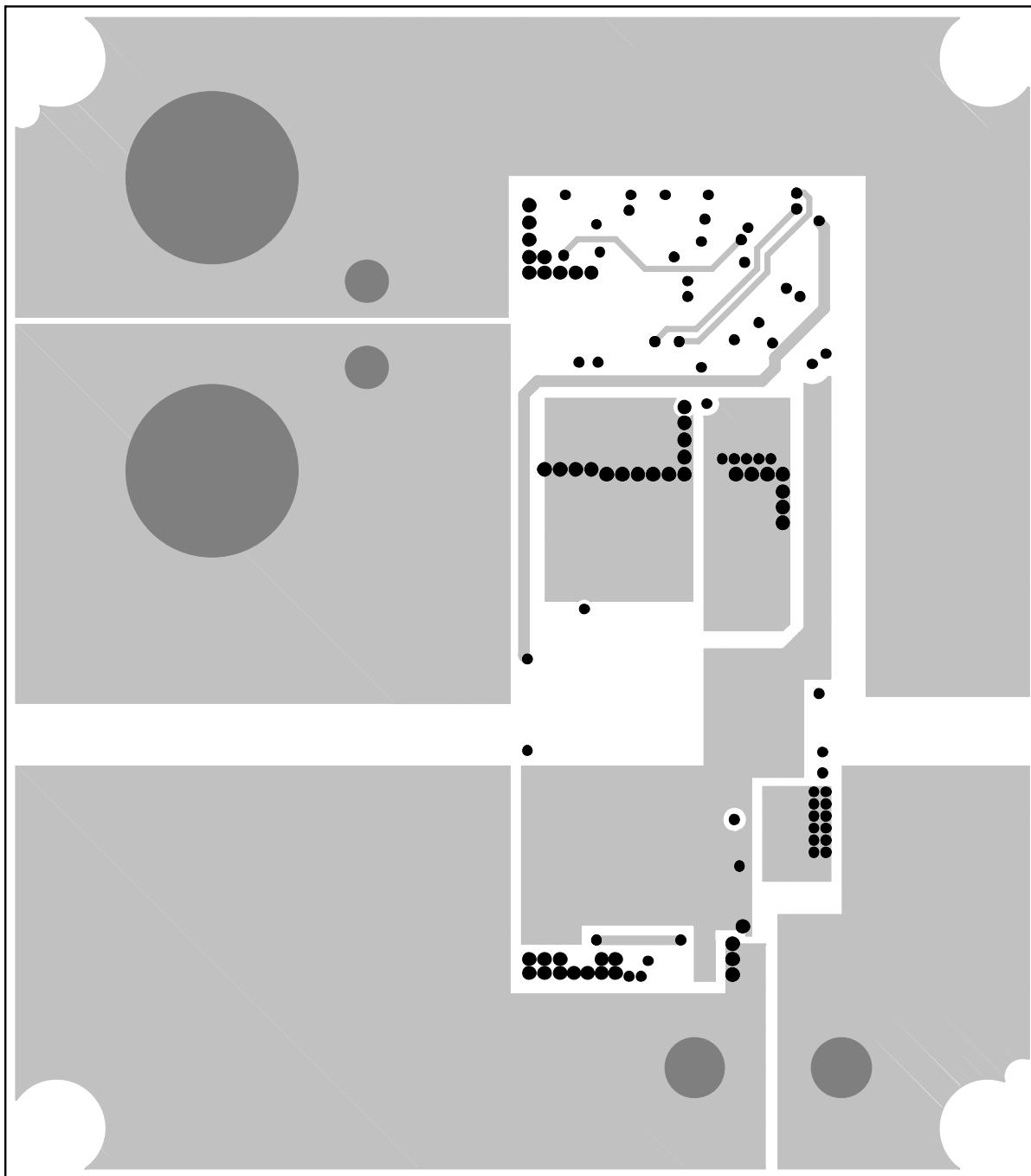


Figure 17. Layer 3

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Figure 18. Layer 4

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36V-72VIN, SYNCHRONOUS FORWARD CONVERTER



Figure 19. Layer 5

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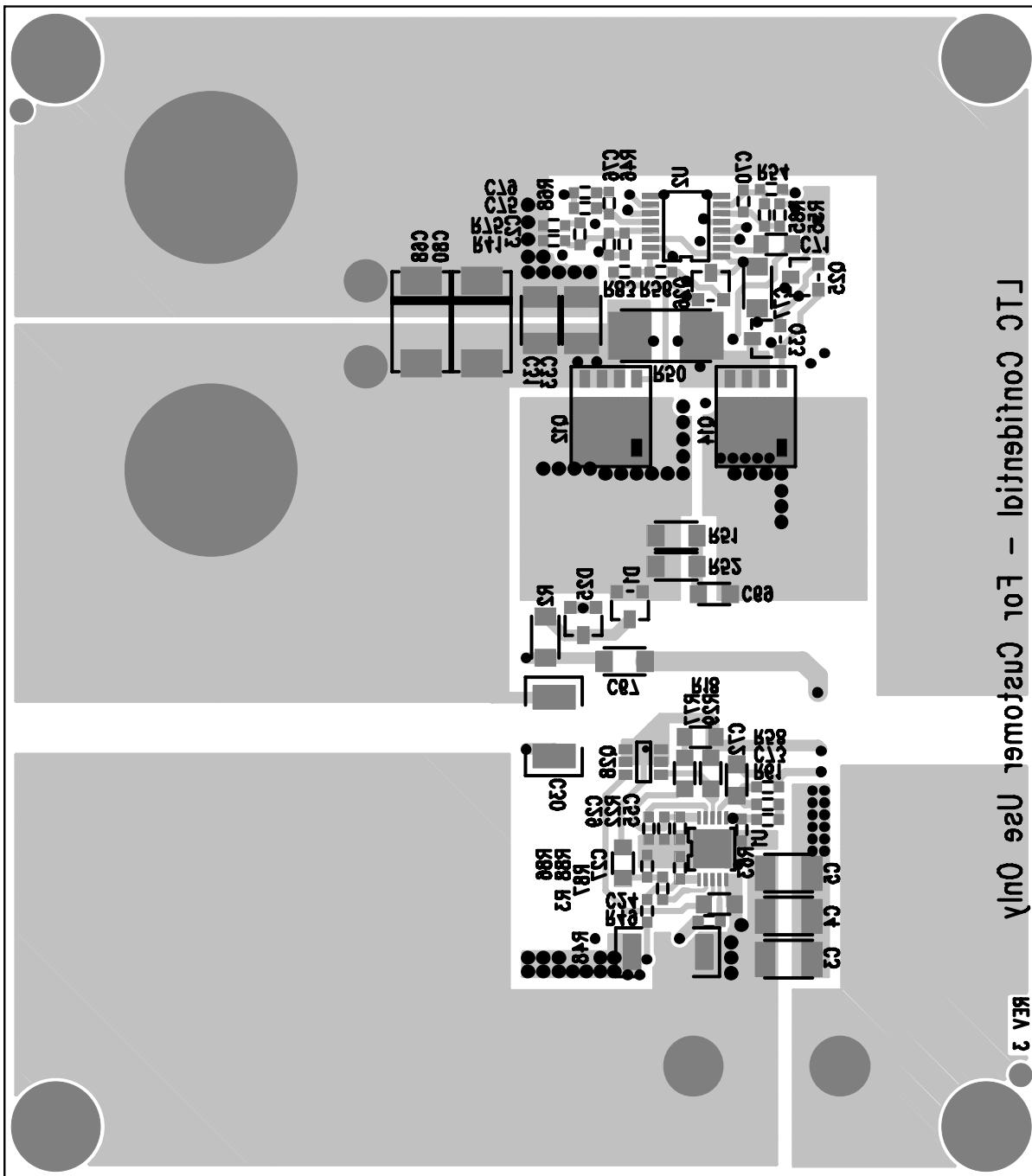


Figure 20. Bottom

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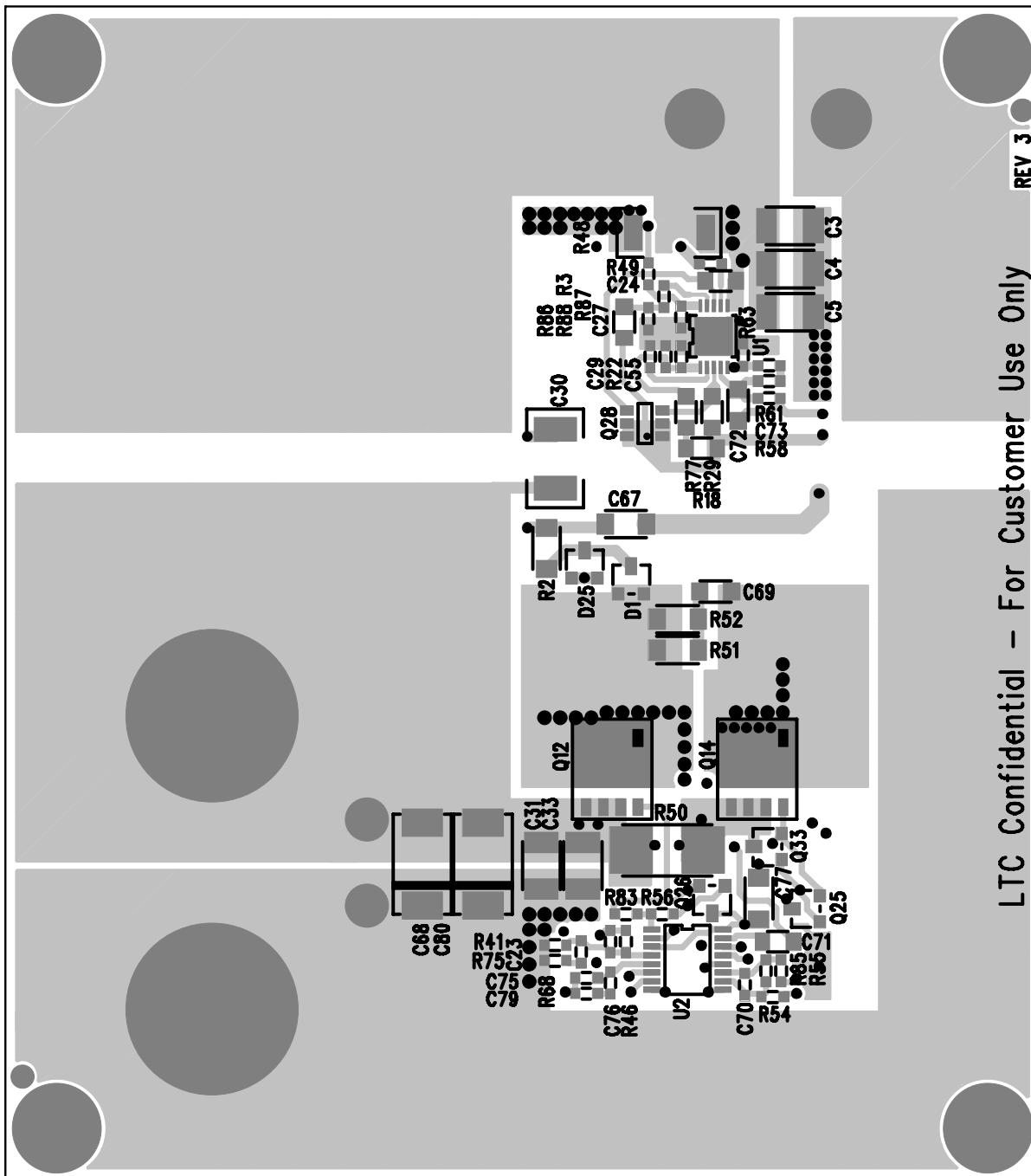


Figure 21. Bottom Mirrored



Компания «ЭлектроПласт» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

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- Поставка более 17-ти миллионов наименований электронных компонентов;
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- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Техническая поддержка проекта, помошь в подборе аналогов, поставка прототипов;
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- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

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- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



Как с нами связаться

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