LT8312 Boundary Mode PFC Controller

DESCRIPTION

Demonstration Circuit 2104A is an off-line boundary conduction mode power factor correction (PFC) boost converter featuring the LT®8312. Boundary conduction mode offers inherent MOSFET valley switching to reduce the switching loss and the boost diode zero current switching to remove the diode reverse-recovery loss. The demo board provides a 400V/150W single constant-voltage output suitable for applications requiring regulated input voltage.

The DC2104A is optimized to operate over a wide AC input voltage range (90VAC to 265VAC, 47Hz to 63Hz). Output voltage accuracy stays within ±5% over the whole input voltage and load range. It provides a high power factor (>0.95) enabling the design to be used worldwide. It is also designed to comply with the IEC61000-3-2 Class-D harmonics standard and the EN55022 conducted EMI standard.

This DC 2104A evaluation board uses a two-layer printed circuit board (PCB) designed for 150W (400V/0.375A) rated power. It can also be changed for other power level applications. Please refer to the Typical Applications section in the data sheet for more information.

The LT8312 is available in a low profile, thermally enhanced 16-lead MSOP package.

The LT8312 data sheet gives a complete description of the part, operation and application information. The data sheet must be read in conjunction with this demo manual.

Design files for this circuit board are available at http://www.linear.com/demo/DC2104A

PERFORMANCE SUMMARY

Specifications are at T_A = 25°C

SYMBOL	PARAMETER	CONDITIONS		MIN	TYP	MAX	UNITS
V_{IN}	Input Voltage Range	Line Frequency, 47Hz to 63Hz		90	115	265	VAC
V_{OUT}	Output Voltage			380	400	420	V
I_{OUT}	Maximum Output Current			0.375			A
EFE	Efficiency	I_{OUT} = 0.375A	115VAC 230VAC		96 97.5		%
PF	Power Factor	I_{OUT} = 0.375A	115VAC 230VAC		0.99 0.98		%

QUICK START PROCEDURE

IMPORTANT NOTE TO CUSTOMERS:

HIGH VOLTAGES ARE PRESENT ON THE DEMO CIRCUIT, AND CAN LEAD TO LETHAL INJURIES TO HUMAN BODY. ONLY QUALIFIED PERSONNEL SHOULD OPERATE IT. IT IS STRONGLY RECOMMENDED TO USE SAFETY GLASSES AND AN ISOLATION TRANSFORMER.

NOTE: Improper components replacement on the demo circuit can cause performance deteriorations, circuit malfunction, property damage, and even life threatening injuries. Contact Linear Technology applications engineers for proper component replacement.

DC2104A is easy to set up to evaluate the performance of the LT8312. Refer to Figure 1 for proper measurement equipment setup and follow the procedure below:

1. Connect an adjustable load between + and – output terminals.
2. With power off, connect the input power supply to Line (L) input and Neutral (N) input.
3. Turn on the power at the input.

   NOTE: Make sure that the input voltage does not exceed the maximum input voltage (265VAC).
4. Check for the proper output voltage.

Once the proper output voltage is established, adjust the input voltage and/or the load and observe the output voltage regulation, efficiency, power factor and other parameters.

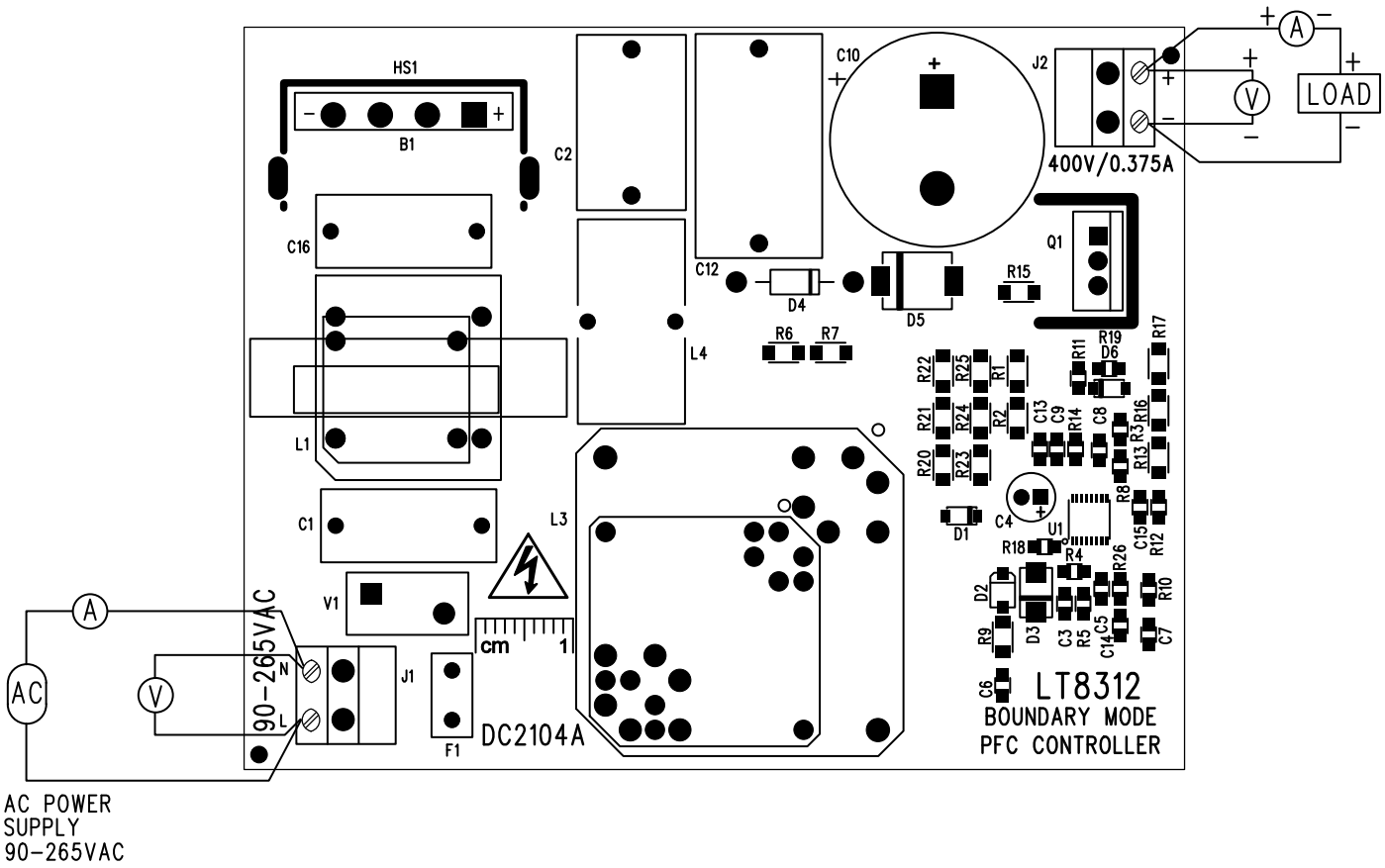


Figure 1. Proper Measurement Equipment Setup

QUICK START PROCEDURE

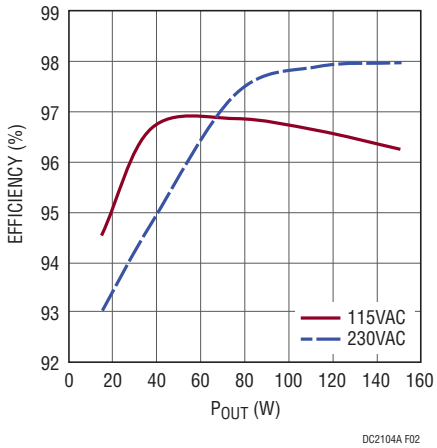


Figure 2. Efficiency vs Load

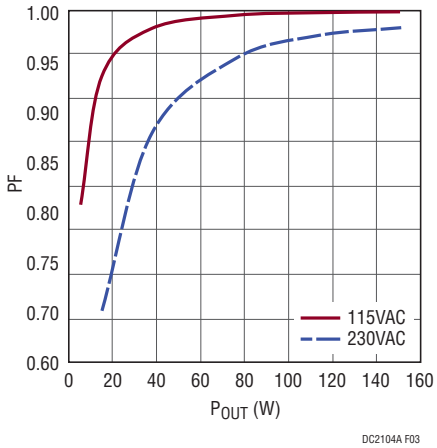


Figure 3. Power Factor vs Load

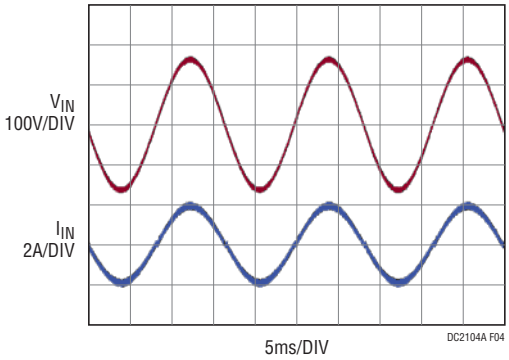


Figure 4. 115VAC Input Voltage and Current

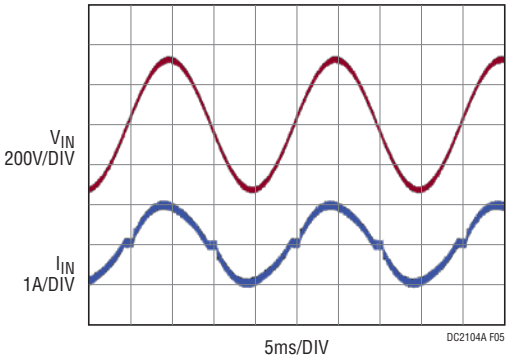


Figure 5. 230VAC Input Voltage and Current

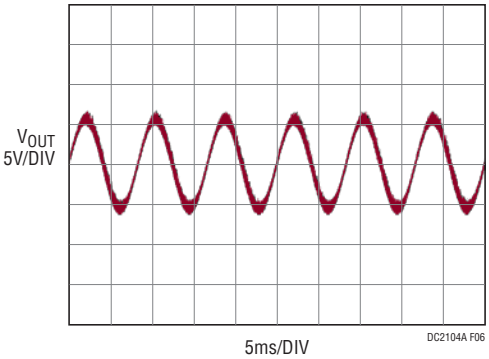


Figure 6. Output Ripple (AC-Coupled), V_{IN} = 115VAC

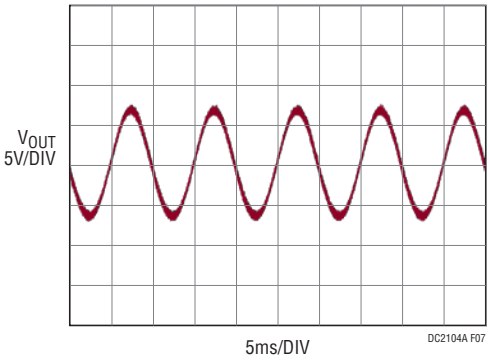


Figure 7. Output Ripple (AC-Coupled), V_{IN} = 230VAC

QUICK START PROCEDURE

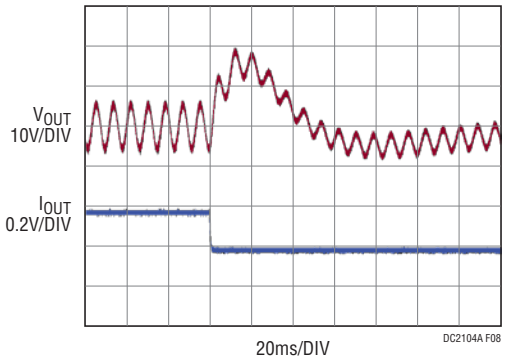


Figure 8. V_{IN} = 115VAC, Full Load to Half Load Transient

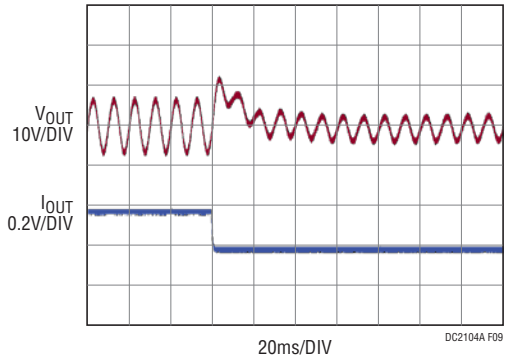


Figure 9. V_{IN} = 230VAC, Full Load to Half Load Transient

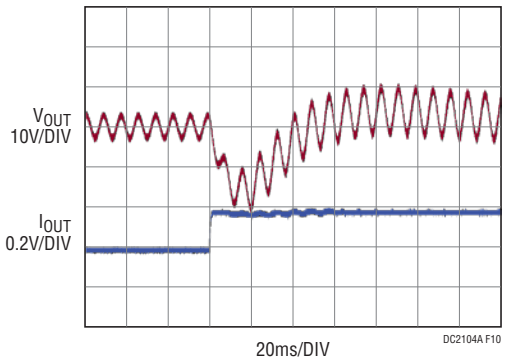


Figure 10. V_{IN} = 115VAC, Half Load to Full Load Transient

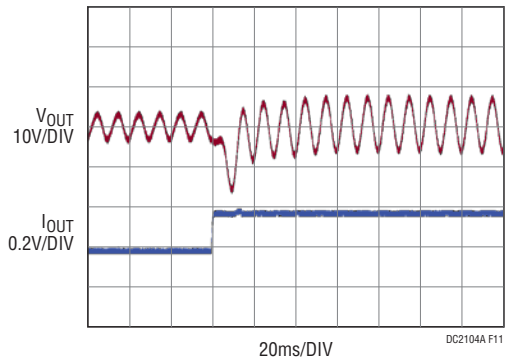


Figure 11. V_{IN} = 230VAC, Half Load to Full Load Transient

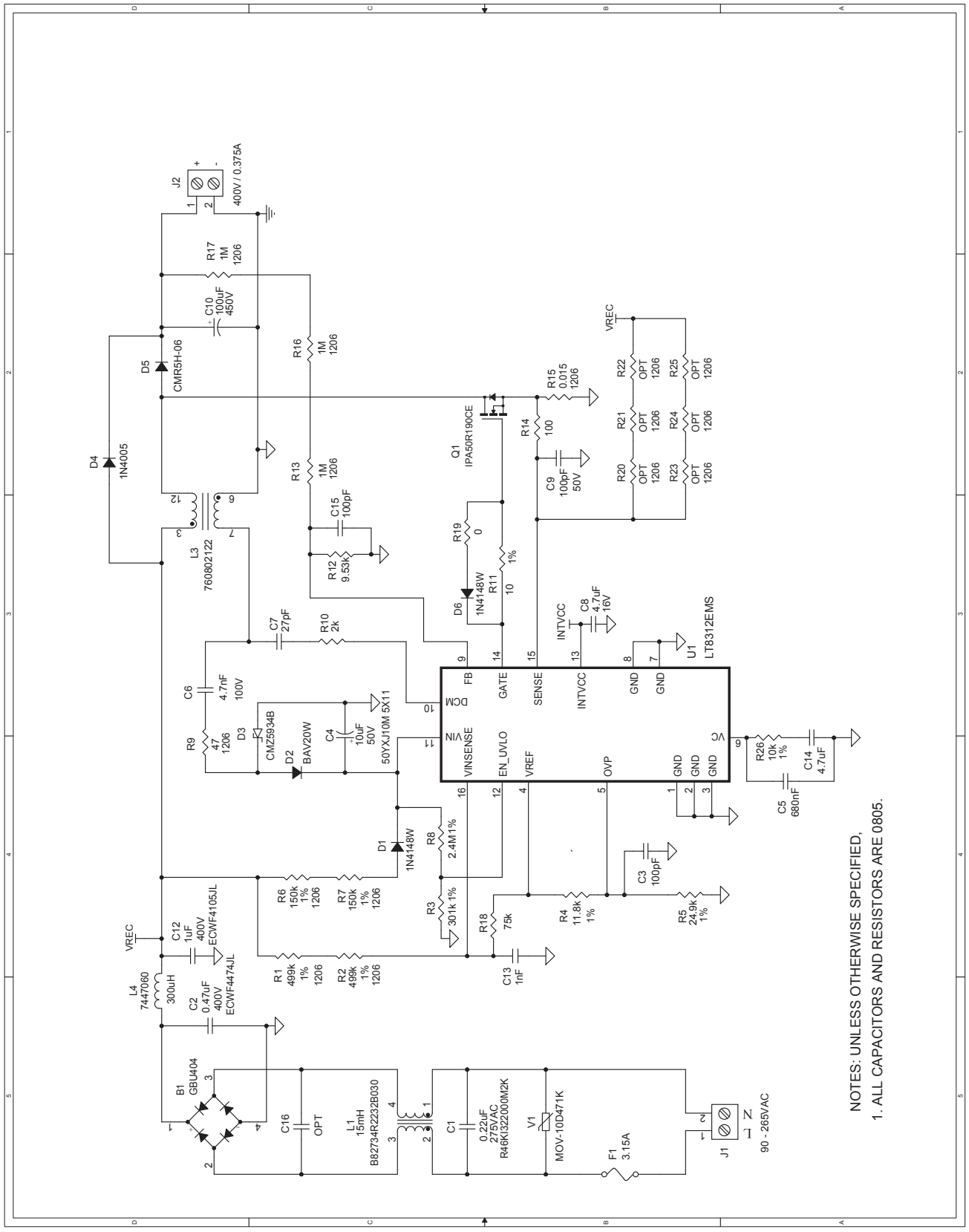
PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	1	B1	BRIDGE RECTIFIER	DIODES INC., GBU404
2	1	C1	CAP., FILM, 0.22µF, 275VAC, 10%	KEMET, R46KI322000M2K
3	1	C2	CAP., FILM, 0.47µF, 5%, 400V	PANASONIC, ECWF4474JL
4	1	C4	CAP, 10µF 20% 50V ALUM	RUBYCON, 50YXJ10M 5X11
5	1	C5	CAP., X7R, 680nF, 25V, 10%, 0805	AVX, 08053C684KAT2A
6	1	C6	Cap., C0G, 4.7nF, 100V, 5% 0805	TDK, C2012C0G2A472J125AA
7	1	C7	Cap., C0G, 27pF, 50V, 5% 0805	AVX, 08055A270JAT2A
8	2	C8, C14	CAP., X5R, 4.7µF, 20%, 16V, 0805	AVX, 0805YD475MAT2A
9	1	C10	CAP., ALUM, 100µF, 450V, 20%	RUBYCON, 450VXH100MEFCSN22X25
10	1	C12	CAP., FILM, 1.0µF, 5%, 400V	PANASONIC, ECWF4105JL
11	1	C13	CAP., C0G, 1nF, 10%, 25V 0805	AVX, 08053A102KAT2A
12	3	C3, C9, C15	CAP., C0G, 100pF, 5%, 25V 0805	AVX, 08055A101JAT2A
13	1	D2	DIODE, 200V, SOD123	DIODES INC., BAV20W
14	1	D3	ZENER DIODE, 24V, SMA	CENTRAL SEMI., CMZ5934B
15	1	D4	DIODE, 1A, 600V, DO-41	DIODES INC., 1N4005
16	1	D5	DIODE, 5A, 600V, SMC	CENTRAL SEMI., CMR5H-06
17	2	D1, D6	DIODE, SWITCH 100V 400mW, SOD123	DIODES INC., 1N4148W-7-F
18	1	F1	FUSE, FAST ACTING, 3.15A	BUSSMAN, SS-5H-3.15A-APH
19	1	L1	CHOKE, 15mH	EPCOS, B82734R2232B030
20	1	L3	PFC CHOKE, 450µH	WÜRTH ELECTONIK, 760802122
21	1	L4	CHOKE, 300µH	WÜRTH ELECTONIK, 7447060
22	1	Q1	N-CH MOSFET, 500V, TO-220	INFINEON, IPA50R190CE
23	2	R1, R2	RES., CHIP., 499K, 1/4W, 1% 1206	VISHAY, CRCW1206499KFKEA
24	1	R3	RES., CHIP., 301K, 1/8W, 1%, 0805	VISHAY, CRCW0805301KFNEA
25	1	R4	RES., CHIP., 11.8K, 1/8W, 1%, 0805	VISHAY, CRCW080511K8FKEA
26	1	R5	RES., CHIP., 24.9K, 1/8W, 1%, 0805	VISHAY, CRCW080524K9FKEA
27	2	R6, R7	RES., CHIP., 150k, 1/4W, 1% 1206	VISHAY, CRCW1206150KFKEA
28	1	R8	RES., CHIP., 2.4M, 1/8W, 5%, 0805	VISHAY, CRCW08052M40JNEA
29	1	R9	RES., CHIP., 47, 1/4W, 5%, 1206	VISHAY, CRCW120647R0JNEA
30	1	R10	RES., CHIP., 2K, 1/8W, 5%, 0805	VISHAY, CRCW08052K00JNEA
31	1	R11	RES., CHIP., 10, 1/8W, 1% 0805	VISHAY, CRCW080510R0FNEA
32	1	R12	RES., CHIP., 9.53K, 1/8W, 1%, 0805	VISHAY, CRCW08059K53FKEA
33	3	R13, R16, R17	RES., CHIP., 1M, 1/4W, 1% 1206	VISHAY, CRCW12061M00FKEA
34	1	R14	RES., CHIP., 100, 1/8W, 1%, 0805	VISHAY, CRCW0805100RJNEA
35	1	R15	RES., CHIP., 0.015, 1W, 1% 1206	VISHAY, WSLP1206R0150FEA
36	1	R18	RES., CHIP., 75K, 1/8W, 1% 0805	VISHAY, CRCW080575K0FKEA
37	1	R19	RES., CHIP., 0, 1/8W, 0805	VISHAY, CRCW08050000Z0EA
38	1	R26	RES., CHIP., 10K, 1/8W, 1% 0805	VISHAY, CRCW080510K0FNEA
39	1	V1	VARISTOR, 300V RMS, 10mm RADIAL	BOURNS, MOV-10D471K
40	1	U1	I.C., PFC CONTROLLER MS-16	LINEAR TECH., LT8312EMS#PBF

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Additional Demo Board Circuit Components				
1	0	C16 (OPT)	CAP., FILM, 0.22µF, 275VAC, 10%	
2	0	R20-R25 (OPT)	RES., CHIP., 1206	
Hardware: For Demo Board Only				
1	2	J1, J2	CONN., TERM BLOCK PCB 5.0mm 2POS	WEIDMULLER, 1715250000
2	1	HS1	HEAT SINK FOR B1	WAKEFIELD-VETTE, 287-1ABE

SCHEMATIC DIAGRAM



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