LT3799-1
Offline Isolated Flyback LED Driver with PFC

DESCRIPTION

Demonstration circuit 1816B is an off-line isolated flyback LED driver featuring LT®3799-1. The demo board provides a single constant current output of 3A over an LED string voltage from 22V to 38V. It is optimized to operate over a wide AC input voltage range (90VAC to 305VAC, 47Hz to 63Hz). LED current typically stays within ±5% over the whole input voltage range. It provides a high power factor (>0.9) enabling a single design to be used worldwide. It is also designed to comply with the IEC 61000-3-2 Class C harmonics standard and the EN55015B conducted EMI standard.

The LT3799-1 controls an isolated flyback converter in boundary mode. Its novel current sensing scheme delivers a well-regulated output current to the secondary side without using an opto-coupler. Open- and shorted-LED protection ensures long term reliability.

The LT3799-1 is available in a low profile, thermally-enhanced 16-lead MSOP package.

The LT3799-1 data sheet gives a complete description of the device, operation and application information. The data sheet must be read in conjunction with this quick start guide for demo circuit 1816B.

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

PERFORMANCE SUMMARY (T_A = 25°C)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Input Voltage Range	Line Frequency, 47Hz to 63Hz	90	277	305	VAC
Output Current I_{OUT}	V_{IN} = 120VAC, V_{LED} = 36V		3		A
Output Voltage		22	36	38	V
Open LED Voltage	(Note 1)	45			V

Note 1: For applications with low LED string voltage, FB pin divider resistor R4 and output clamp Z3 can be adjusted to reduce the open voltage limit. See “Protection from Open LED and Shorted LED Faults” section in the data sheet for detail.

QUICK START PROCEDURE

IMPORTANT NOTE TO CUSTOMERS

HIGH VOLTAGES ARE PRESENTED 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.

Demonstration circuit 1816B is easy to set up to evaluate the performance of the LT3799-1. Refer to Figure 1 for proper measurement equipment setup and follow the procedure below:

1. Connect a 3A LED string with forward voltage less than 38V, but greater than 22V, between LED^+ and LED^- 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 (305VAC).

4. Check for the proper output current.

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

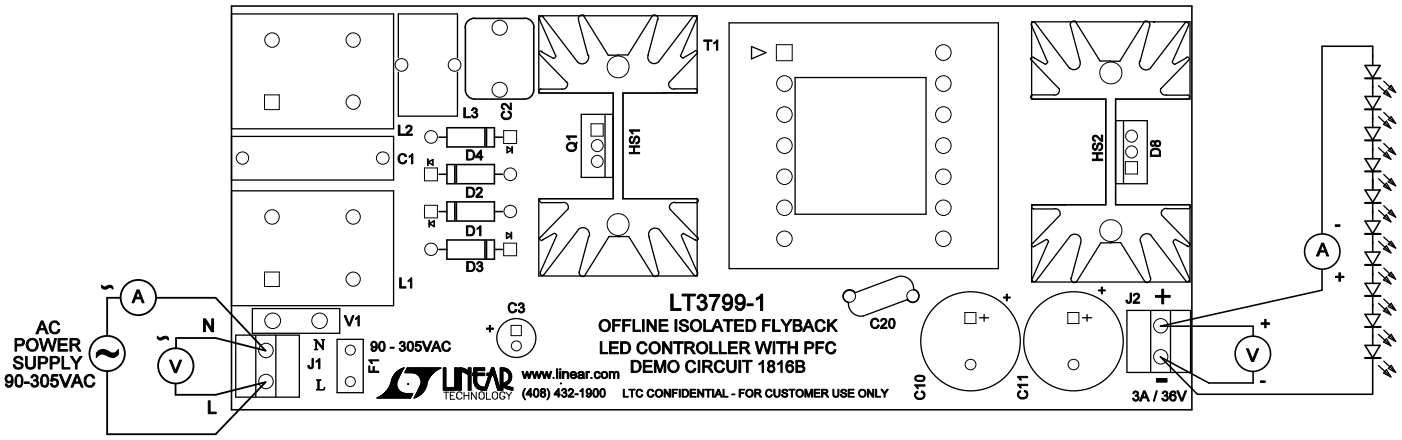


Figure 1. Proper Measurement Equipment Setup

QUICK START PROCEDURE

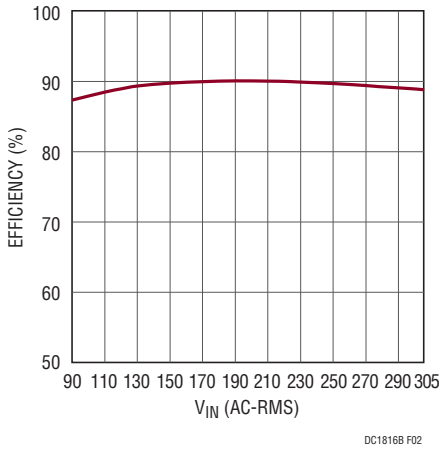


Figure 2. Efficiency vs Input Voltage

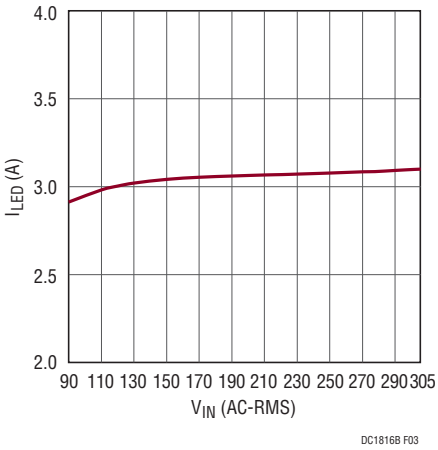


Figure 3. I_{OUT} vs Input Voltage

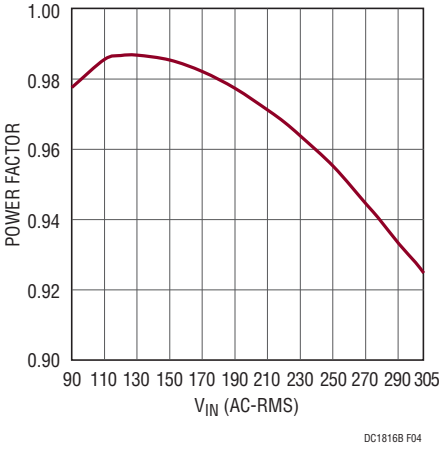


Figure 4. Power Factor vs Input Voltage

Input Line Voltage and Current

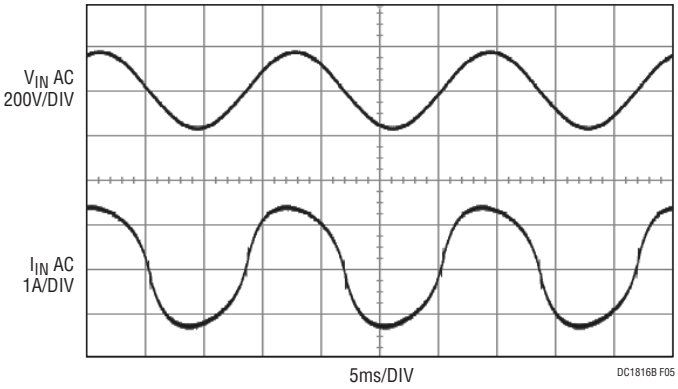


Figure 5. V_{IN} = 120VAC

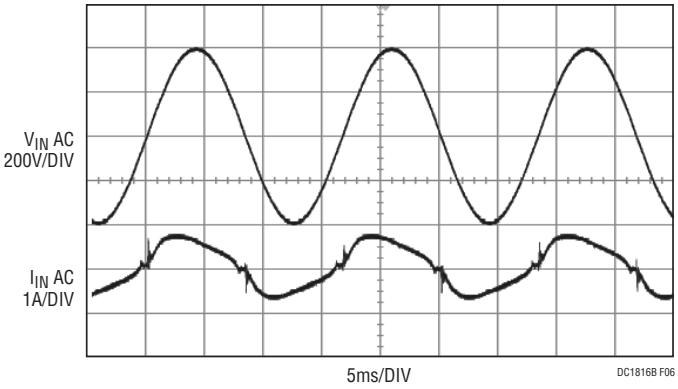


Figure 6. V_{IN} = 277VAC

Switch Node Voltage

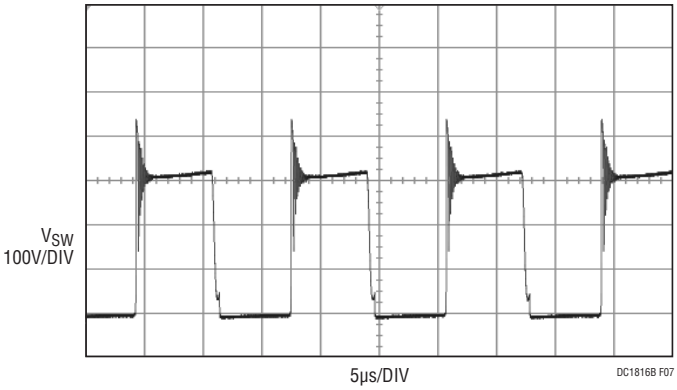


Figure 7. V_{IN} = 120VAC

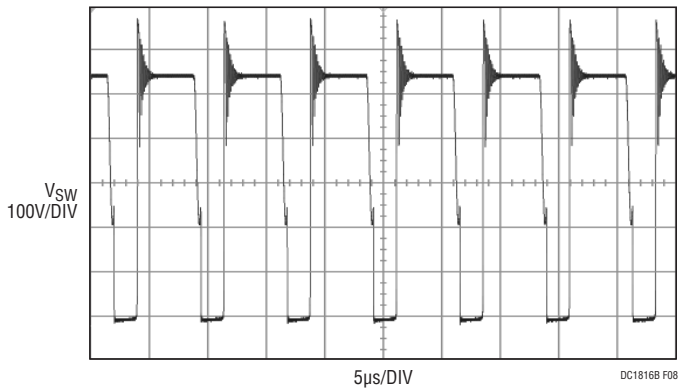


Figure 8. V_{IN} = 277VAC

QUICK START PROCEDURE

Output Voltage and Switch Node Voltage During Output Open

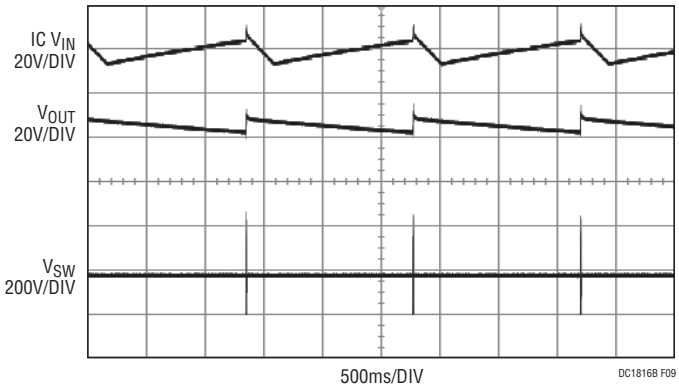


Figure 9. V_{IN} = 120VAC

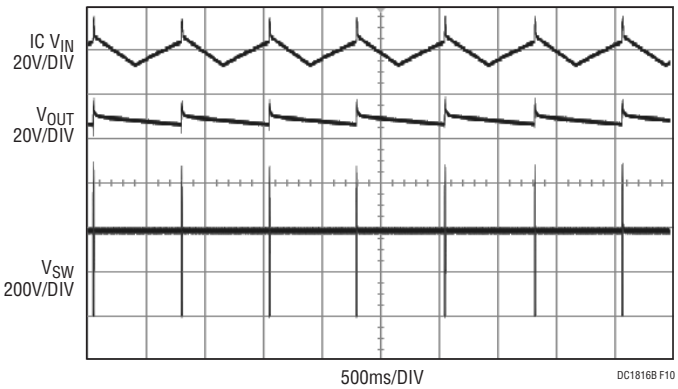


Figure 10. V_{IN} = 277VAC

Output Current and Switch Node Voltage During Output Short

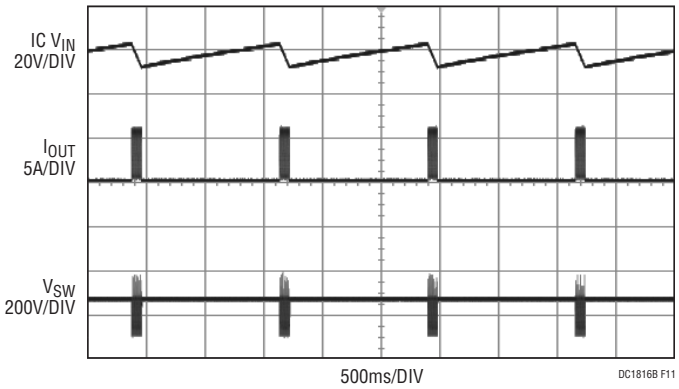


Figure 11. V_{IN} = 120VAC

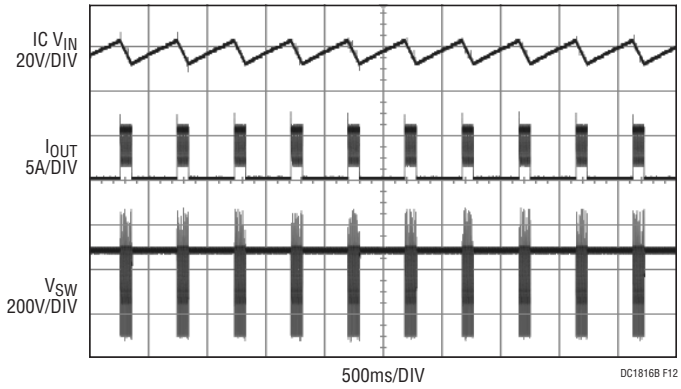


Figure 12. V_{IN} = 277VAC

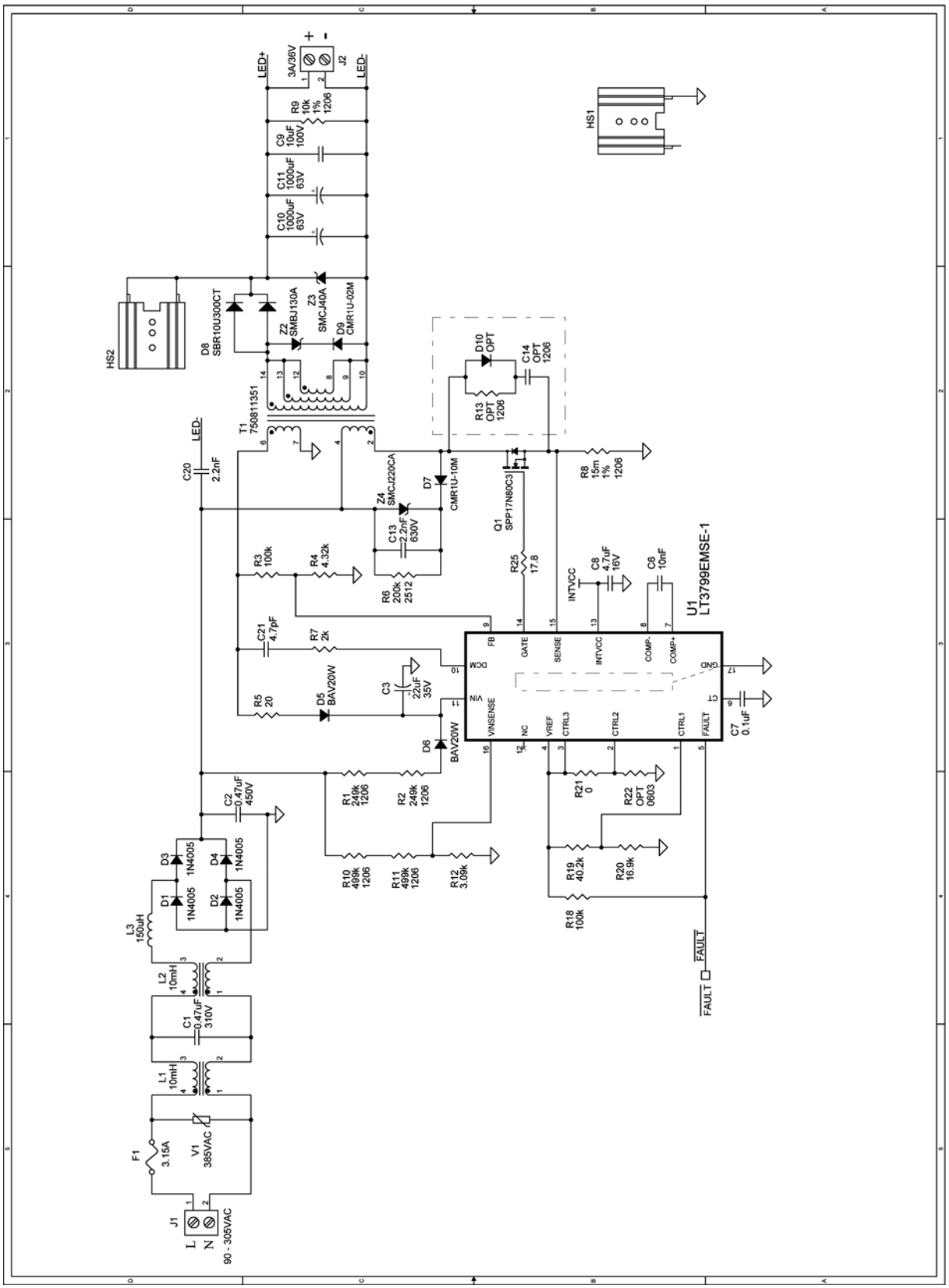
PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	1	C1	CAP, 0.47µF 20% 310V POLYPROPYLENE	VISHAY BFC33820474
2	1	C2	CAP, 0.47µF 20% 450V FILM	RUBYCON 450MMK474K
3	1	C3	CAP, 22µF 20% 35V ALUM	NIC NRSZ220M35V5X11F
4	1	C6	CAP, 0603 10nF 10% 50V X7R	AVX 06035C103KAT2A
5	1	C7	CAP, 0603 0.1µF 10% 50V X7R	AVX 06035C104KAT2A
6	1	C8	CAP, 0805 4.7µF 20% 16V X5R	AVX 0805YD475MAT2A
7	1	C9	CAP, 2220 10µF 20% 100V X7S	TDK C5750X7S2A106M
8	2	C10, C11	CAP, 1000µF 20% 63V ELEC	PANASONIC EEU-FC1J102
9	1	C13	CAP, 1210 2.2nF 5% 630V U2J	MURATA GRM32A7U2J222JW31D
10	1	C20	CAP, 2.2nF 10% Y5B TYPE “Y1”	VISHAY 440LD22-R
11	1	C21	CAP, 0603 4.7pF ±0.1pF 50V NP0	AVX 06035A4R7CAT2A
12	4	D1, D2, D3, D4	DIODES, RECTIFIER 1.0A	DIODES INC. 1N4005-T
13	2	D5, D6	DIODE, FAST SWITCHING	DIODES INC. BAV20W-7-F
14	1	D7	DIODE, ULTRA FAST RECOVERY SILICON RECTIFIER	CENTRAL SEMI.CMR1U-10M
15	1	D8	DIODE, SUPER BARRIER RECTIFIER 10A	DIODES INC. SBR10U300CT
16	1	D9	DIODE, RECOVERY RECTIFIER	CENTRAL SEMI.CMR1U-02M
17	1	F1	FUSE, FAST ACTING 3.15A	BUSSMAN SS-5H-3.15A-APH
18	2	L1,L2	IND, 10mH COMMON MODE CHOKE	SUMIDA LF2628NP-103
19	1	L3	IND, 150µH LINE CHOKE	WÜRTH ELECTRONIK 7447018
20	1	Q1	XSTR, COOL MOS POWER TRANSISTOR	INFINEON SPP17N80C3
21	2	R1, R2	RES, 1206 249k 1% 1/4W	VISHAY CRCW1206249KFKEA
22	2	R3, R18	RES, 0603 100k 5% 1/10W	VISHAY CRCW0603100KJNEA
23	1	R4	RES, 0603 4.32k 1% 1/10W	VISHAY CRCW06034K32FKEA
24	1	R5	RES, 0603 20Ω 5% 1/10W	VISHAY CRCW060320R0JNEA
25	1	R6	RES, 2512 200k 5% 1W	VISHAY CRCW2512200KJNEG
26	1	R7	RES, 0603 2k 5% 1/10W	VISHAY CRCW06032K00JNEA
27	1	R8	RES, 1206 0.015Ω 1% 1/4W	VISHAY WSL1206R0150FEA
28	1	R9	RES, 1206 10k 1% 1/4W	VISHAY CRCW120610K0FKEA
29	2	R10, R11	RES, 1206 499k 1% 1/4W	VISHAY CRCW1206499KFKEA
30	1	R12	RES, 0603 3.09k 1% 1/10W	VISHAY CRCW06033K09FKEA
31	1	R19	RES, 0603 40.2k 1% 1/10W	NIC NRC06F4222TRF
32	1	R20	RES, 0603 16.9k 1% 1/10W	VISHAY CRCW060316K9FKEA
33	1	R21	RES, 0603 0Ω JUMPER	VISHAY CRCW06030000Z0EA
34	1	R25	RES, 0603 17.8Ω 1% 1/10W	VISHAY CRCW060317R8FKEA
35	1	T1	XFMR, FLYBACK	WÜRTH ELECTONIK 750811351
36	1	U1	IC, OFFLINE ISOLATED LED CONTROLLER	LINEAR TECH. LT3799EMSE-1
37	1	V1	VARISTOR, 385V RMS 13.5MM RADIAL	SEI CV385K10B
38	1	Z2	DIODE, TRANSIENT VOLTAGE SUPPRESSOR	DIODES INC. SMBJ130(C)A-13-F
39	1	Z3	DIODE, TRANSIENT VOLTAGE SUPPRESSOR	DIODES INC. SMCJ40(C)A-13-F
40	1	Z4	DIODE, TRANSIENT VOLTAGE SUPPRESSOR	LITTELFUSE INC. SMCJ220CA

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Additional Demo Board Circuit Components				
1	0	C14	CAP, 1206 100pF 5% 1000V U2J	MURATA GRM31A7U3A101JW31D
2	0	D10	DIODE, ULTRA FAST RECOVERY SILICON RECTIFIER	CENTRAL SEMI. CMR1U-10M
3	0	R13	RES, 1206 10k 1% 1/2W	VISHAY CRCW120610K0JNEAHP
4	0	R22	RES, 0603	
Hardware—For Demo Board Only				
1	2	HS1, HS2	HEAT SINK, TO-220	AAVID THERMALLOY 529802B02500G
2	2	J1, J2	TERMINAL BLOCK, 2 POSITION	WEIDMULLER 1715250000
3	1		NUT, TIN PLATE#4-40	ANY, #4-40
4	1		WASHER, #4, FLAT WASHER	ANY
5	1		SCREW, 4/40 X 3/8	ANY, 4/40 X 3/8, PHILIPS SCREW
6	1		NUT, TIN PLATE# 2-56	ANY, #2-56
7	1		WASHER, #2, FLAT WASHER	ANY
8	1		SPACER, NYLON SHOULDER	KEYSTONE, 3051
9	1		SCREW, 2-56 X 3/8	ANY, 2-56 X 3/8 PHILIPS SCREW
10	1		THERMAL PAD	BERGQUIST, SP600-58
11	1		SILICONE HEAT SINK	RAWN
12	1		FAB, PRINTED CIRCUIT BOARD	DEMO CIRCUIT 1816B
13	1		STENCIL	STENCIL DC1816B

SCHEMATIC DIAGRAM



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