

LT3799-1

Offline Isolated Flyback LED Driver with PFC

DESCRIPTION

Demonstration circuit 1947A is an off-line isolated flyback LED driver featuring [LTC®3799-1](#). The demo board provides a single constant current output of 1A over an LED string voltage from 30V to 50V. It is optimized to operate over a wide AC input voltage range (90VAC to 277VAC, 47Hz to 63Hz). 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 1947A.

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

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PERFORMANCE SUMMARY (T_A = 25°C)

| PARAMETER | CONDITIONS | MIN | TYP | MAX | UNITS |
|---------------------------------|--|-----|-----|-----|-------|
| Input Voltage Range | Line Frequency, 47Hz to 63Hz | 90 | 230 | 277 | VAC |
| Output Current I _{OUT} | V _{IN} = 120VAC, V _{LED} = 48V | | 1 | | A |
| Output Voltage | | 30 | 48 | 50 | V |
| Open LED Voltage | (Note 1) | 54 | | | V |

Note 1: For applications with low LED string voltage, FB pin divider resistor R4 and output clamp D9 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 1947A is easy to set up to evaluate the performance of the LT3799-1.

for proper measurement equipment setup and follow the procedure below:

1. Connect a 1A LED string with forward voltage less than 50V, but greater than 30V, 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 (277VAC).

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.

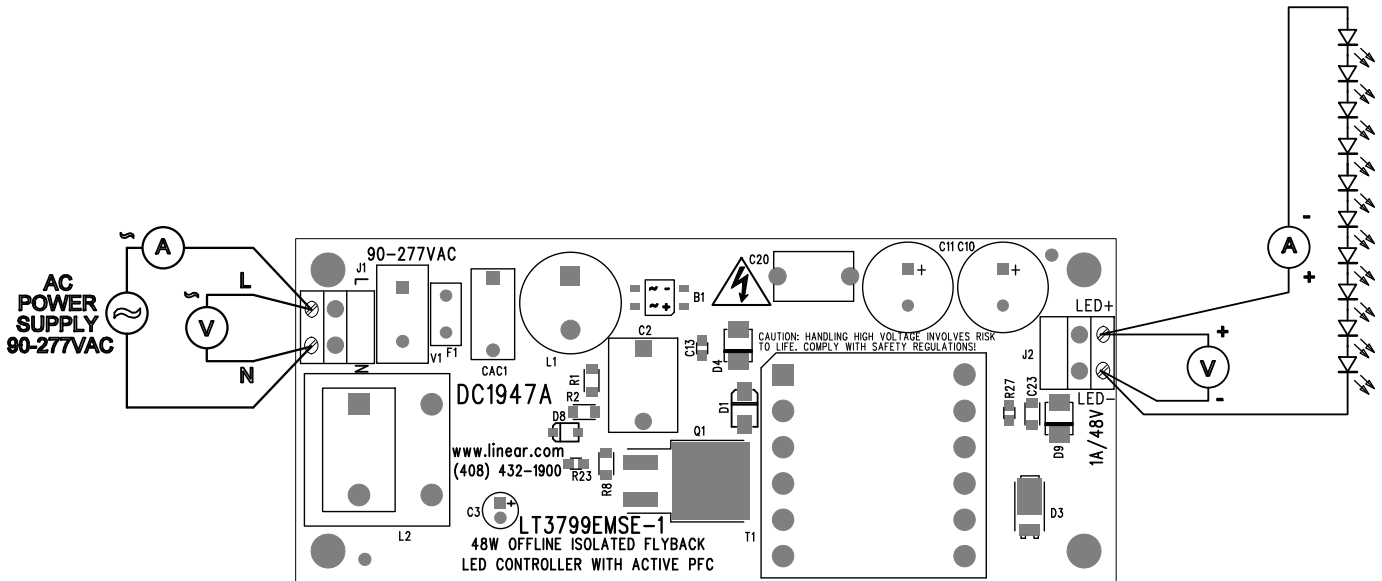


Figure 1. Proper Measurement Equipment Setup

QUICK START PROCEDURE

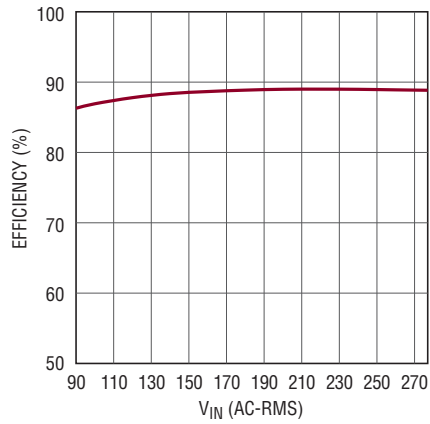


Figure 2. Efficiency vs Input Voltage

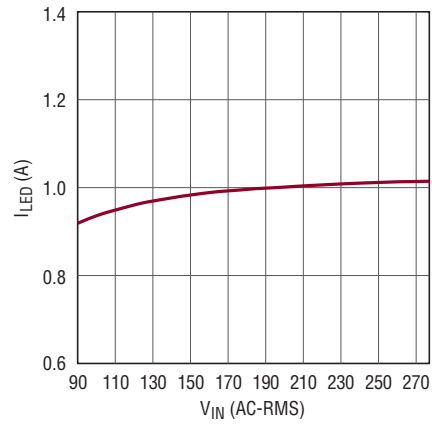


Figure 3. I_{LED} vs Input Voltage

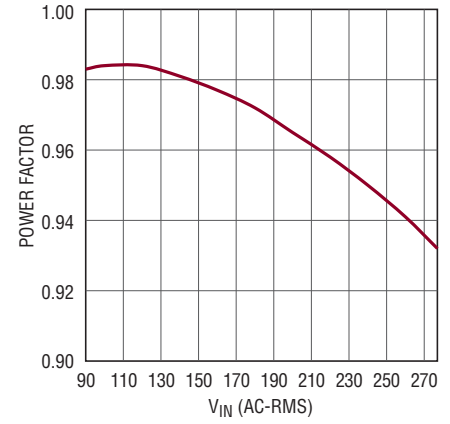


Figure 4. Power Factor vs Input Voltage

Input Line Voltage and Current

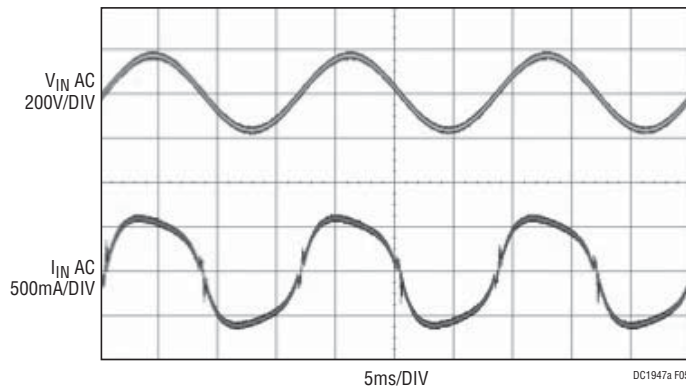


Figure 5. $V_{IN} = 120VAC$

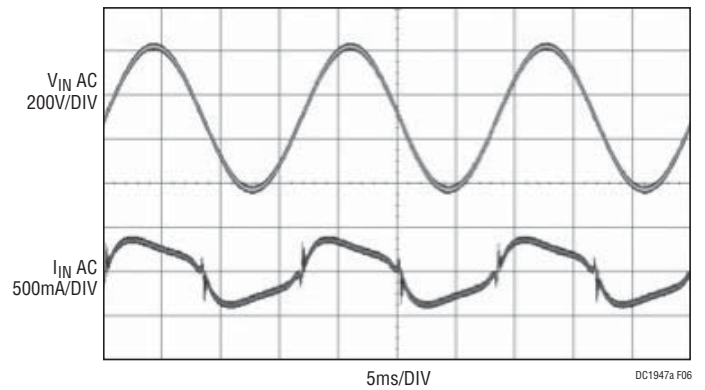


Figure 6. $V_{IN} = 230VAC$

Switch Node Voltage

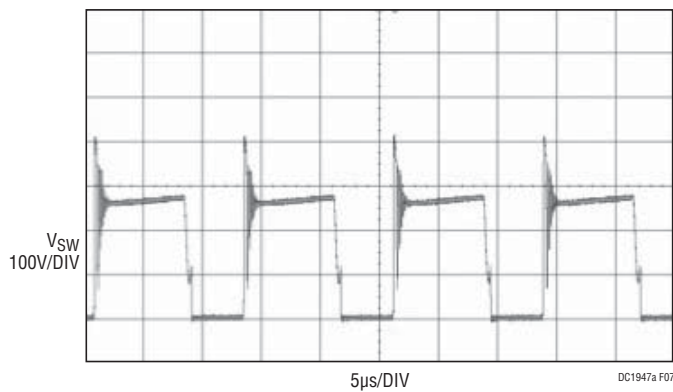


Figure 7. $V_{IN} = 120VAC$

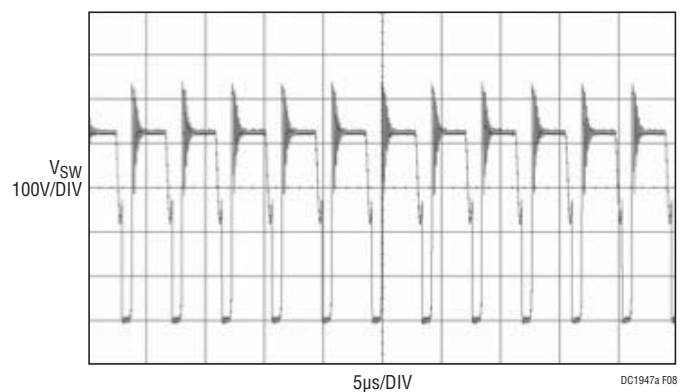


Figure 8. $V_{IN} = 230VAC$

QUICK START PROCEDURE

Output Voltage and Switch Node Voltage During Output Open

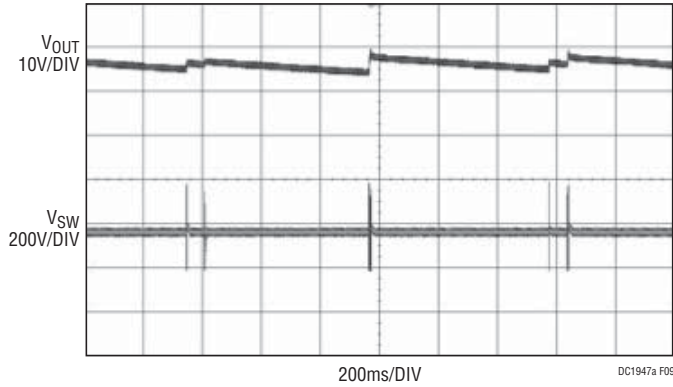


Figure 9. $V_{IN} = 120VAC$

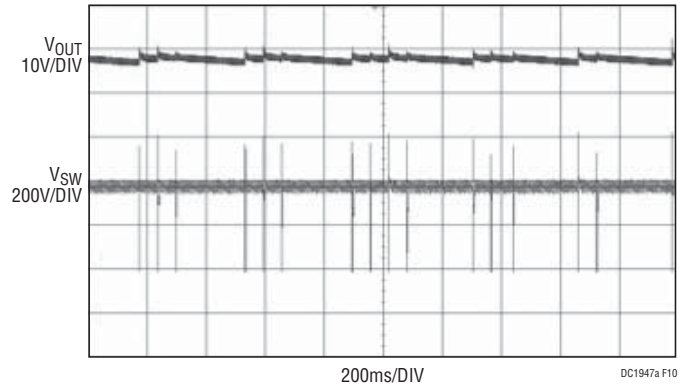


Figure 10. $V_{IN} = 230VAC$

Output Current and Switch Node Voltage During Output Short

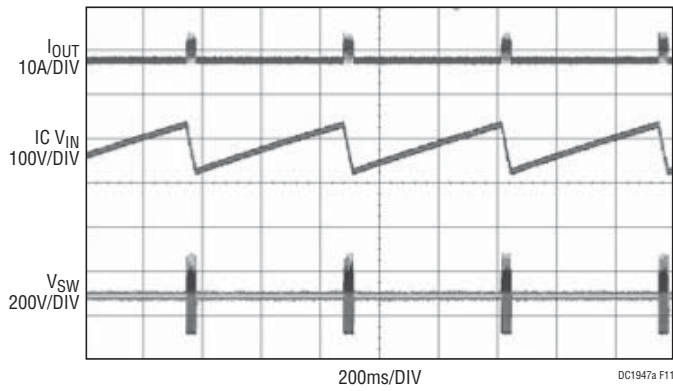


Figure 11. $V_{IN} = 120VAC$

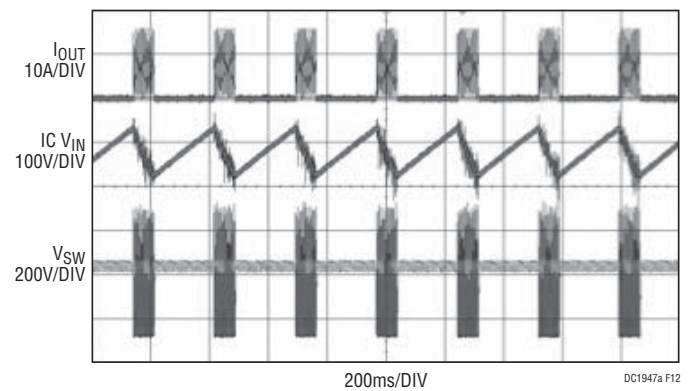


Figure 12. $V_{IN} = 230VAC$

PARTS LIST

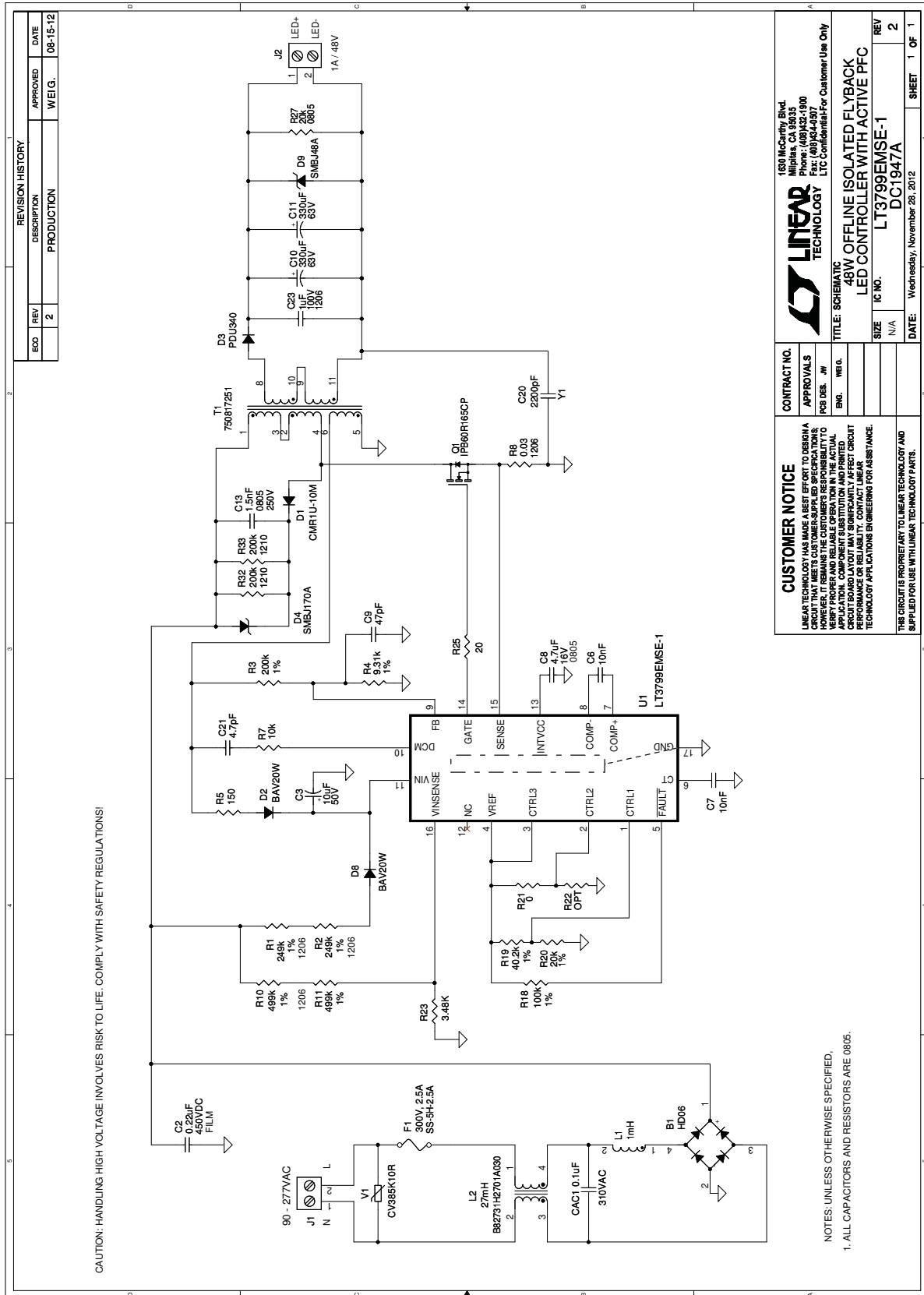
| ITEM | QTY | REFERENCE | PART DESCRIPTION | MANUFACTURER/PART NUMBER |
|------------------------------------|-----|-----------|--|--------------------------------------|
| Required Circuit Components | | | | |
| 1 | 1 | B1 | RECTIFIER, BRIDGE 600V, 0.8A | DIODES INC., HD06-T |
| 2 | 1 | CAC1 | CAP, 0.1 μ F, 310V, 20% | VISHAY, BFC233922104 |
| 3 | 1 | C2 | CAP, FILM, 0.22 μ F, 450V, 10% | RUBYCON, 450MPH224K |
| 4 | 1 | C3 | CAP, 10 μ F, 20%, 50V, ALUM | RUBYCON, 50YXJ10M 5X11 |
| 5 | 2 | C6, C7 | CAP, X7R, 0.01 μ F, 50V, 10%, 0805 | Murata, GRM216R71H103KA01D |
| 6 | 1 | C8 | CAP, X5R, 4.7 μ F, 16V, 20%, 0805 | AVX, 0805YD475MAT2A |
| 7 | 1 | C9 | CAP, C0G, 47pF, 50V, 10%, 0805 | AVX, 08055A470KAT |
| 8 | 1 | C10, C11 | CAP, ELEC., 330 μ F, 63V, 20% | RUBYCON, 63ZL330MEF |
| 9 | 1 | C13 | CAP, U2J, 1.5nF, 250V, 5%, 0805 | Murata, GRM21A7U2E152JW31D |
| 10 | 1 | C20 | CAP, 2.2nF, 10%, TYPE "Y1" | VISHAY, 440LD22-R |
| 11 | 1 | C21 | CAP, C0G, 4.7pF, 50V, 0805 | AVX, 08055A4R7BAQ2A |
| 12 | 1 | C23 | CAP, X7R, 1 μ F, 100V, 10%, 1206 | AVX 12061C105KAT2A |
| 13 | 1 | D1 | DIODE, ULTRA FAST RECTIFIER | CENTRAL SEMI.CMR1U-10M |
| 14 | 2 | D2, D8 | DIODE, FAST SWITCHING | DIODES INC., BAV20W-7-F |
| 15 | 1 | D3 | DIODE, 3A Ultra-Fast REC., Power-DI-5 | DIODES INC., PDU340-13 |
| 16 | 1 | D4 | DIODE, TVS, 600W, 170V, SMB | DIODES INC., SMBJ170A-13-F |
| 17 | 1 | D9 | DIODE, TVS, 600W, 48V, SMB | DIODES INC. SMBJ48A-13-F |
| 18 | 1 | F1 | FUSE, 2.5A | BUSSMAN, SS-5H-2.5A |
| 19 | 1 | L1 | INDUCTOR, 1mH, | TDK, TSL1315RA-102JR78-PF |
| 20 | 1 | L2 | CHOKE, D Code Double Choke | EPCOS, B82731H2701A030 |
| 21 | 1 | Q1 | XSTR, MOSFET, N-CHANNEL 650V | INFINEON, IPB60R165CP |
| 22 | 2 | R1, R2 | RES, CHIP, 249k, 1%, 1/4W, 1206 | VISHAY, CRCW0805249KFKEA |
| 23 | 1 | R3 | RES, CHIP, 200k, 1%, 1/8W, 0805 | VISHAY, CRCW0805200KFKEA |
| 24 | 1 | R4 | RES, CHIP, 9.31k, 1%, 1/8W, 0805 | VISHAY, CRCW08059K31FKEA |
| 25 | 1 | R5 | RES, CHIP, 150, 1%, 1/8W, 0805 | VISHAY, CRCW0805150RFKEA |
| 26 | 1 | R7 | RES, CHIP, 10k, 1%, 1/8W, 0805 | VISHAY, CRCW080510KFKEA |
| 27 | 1 | R8 | RES, CHIP, 0.03, 1/4W, 1%, 1206 | VISHAY, WSL1206R0300FEA |
| 28 | 2 | R10, R11 | RES, CHIP, 499k, 1%, 1/4W, 1206 | VISHAY, CRCW1206499KFKEA |
| 29 | 1 | R18 | RES, CHIP, 100k, 1%, 1/8W, 0805 | VISHAY, CRCW0805100KFKEA |
| 30 | 1 | R19 | RES, CHIP, 40.2k, 1%, 1/8W, 0805 | VISHAY, CRCW080540K2FKEA |
| 31 | 2 | R20, R27 | RES, CHIP, 20k, 1%, 1/8W, 0805 | VISHAY, CRCW080520KFKEA |
| 32 | 1 | R21 | RES, CHIP, 0, 1/8W, 0805 | VISHAY, CRCW08050000Z0EA |
| 33 | 1 | R23 | RES, CHIP, 3.48k, 1%, 1/8W, 0805 | VISHAY, CRCW08053K48FKEA |
| 34 | 1 | R25 | RES, CHIP, 20, 5%, 1/8W, 0805 | VISHAY, CRCW080520R0JKEA |
| 35 | 2 | R32, R33 | RES, CHIP, 200k, 1%, 1/2W, 1210 | VISHAY, CRCW1210200KFKEA |
| 36 | 1 | T1 | XFMR, FLYBACK | WÜRTH ELECTRONIK, 750817251 |
| 37 | 1 | U1 | IC., Isolated Flyback Controller | LINEAR TECH. LT3799EMSE-1#PBF |
| 38 | 1 | V1 | VARISTOR, 385V | Stackpole Electronic, Inc. CV385K10R |

DEMO MANUAL DC1947A

PARTS LIST

| ITEM | QTY | REFERENCE | PART DESCRIPTION | MANUFACTURER/PART NUMBER |
|---|-----|------------|----------------------------|--------------------------|
| Additional Demo Board Circuit Components | | | | |
| 1 | 0 | R22(OPT) | RES, CHIP, 0805 | |
| Hardware—For Demo Board Only | | | | |
| 1 | 2 | J1, J2 | TERMINAL BLOCK, 2 POSITION | WEIDMULLER, 1715250000 |
| 2 | 4 | MH1 to MH4 | STAND-OFF, NYLON,0.25" | KEYSTONE, 8831(SNAP ON) |

SCHEMATIC DIAGRAM



DEMO MANUAL DC1947A

DEMONSTRATION BOARD IMPORTANT NOTICE

Linear Technology Corporation (LTC) provides the enclosed product(s) under the following **AS IS** conditions:

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Please read the DEMO BOARD manual prior to handling the product. Persons handling this product must have electronics training and observe good laboratory practice standards. **Common sense is encouraged.**

This notice contains important safety information about temperatures and voltages. For further safety concerns, please contact a LTC application engineer.

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