Off-Line Current Source Controller

Introduction

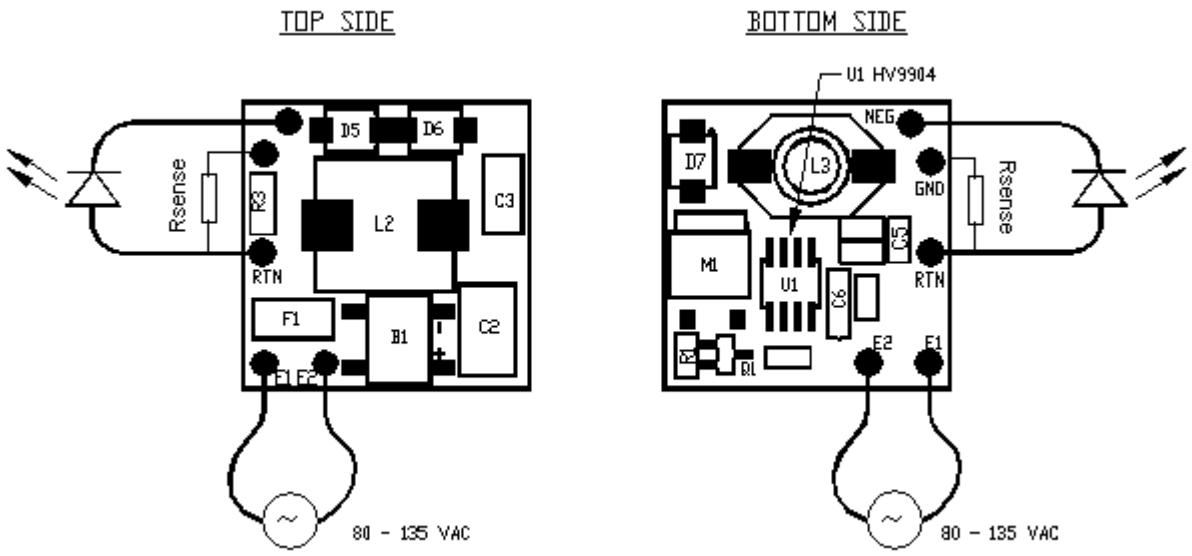
The Supertex HV9904DB1 demo board is an LED driver circuit using the HV9904. A power converter of the demo board consists of an input buck-boost stage and an output buck stage. The output voltage polarity is negative. Due to its double down conversion topology, the converter can operate directly off of AC line to produce low-voltage output without use of a transformer. The converter does not require any electrolytic capacitors and maintains output current with low peak-to-average ratio.

The circuit is practical for up to 2W of output power. It features low cost and very high reliability

Specification

Input Voltage	80 to 135VAC, 60Hz
Output Voltage	20V max
Output Power	2W max
Efficiency	62% at Io=500mA, Vin=100VAC

Board Layout and Connections



WARNING!!!
Do not connect to scope ground or to the ground of other earth-grounded instruments. Doing so will short the AC line, resulting in damage to the circuit and/or instruments. Either use an isolation transformer on the AC line, use a differential probe, or use a floating, battery-powered instrument to make measurements.

WARNING!!!
No galvanic isolation. Dangerous voltages are present when connected to the AC mains.

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NEG, RTN

Connect your LED to these terminals: negative to NEG, positive to RTN.

E1, E2

Connect 80 to 135VAC, 60Hz line source to these terminals: line to E1, neutral to E2. The input is protected with a 0.5A fuse. *IMPORTANT: Make sure that your LED is connected to NEG and RTN terminals. There is no open circuit protection available in this demo board. Contact Supertex, Inc. for the application circuit if protection is required*.

GND

This is circuit common.

Note that since galvanic isolation is not provided, connecting this point to an earth-grounded instrument (such as an oscilloscope) will short the AC line, resulting in circuit and/or instrument damage.

Also note that GND may be at higher potential with respect to earth ground, even if the AC is switched off. Use caution!

Do not connect to earth-ground.

Setting Output Current

$$Iout = \frac{2.5V}{R_3}$$

R_3 should be larger than 3.57Ω to have the output current less than 700mA.

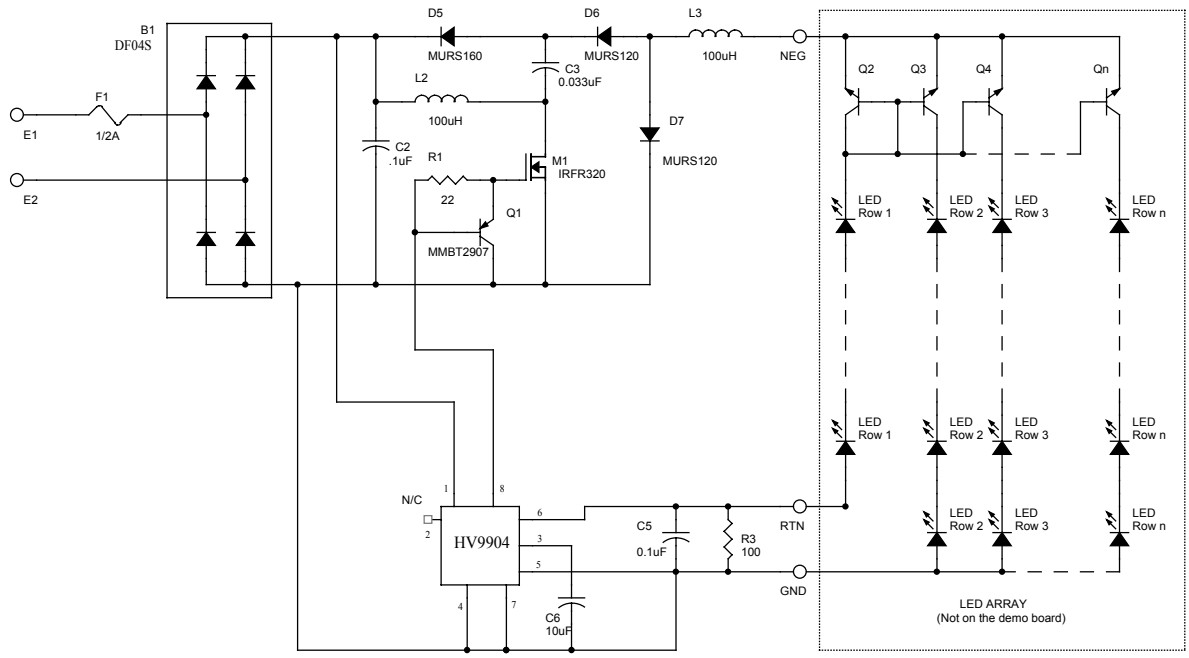
Also if there is a current mirror setup in the load as shown in the schematic below, then

$$Iout = \frac{2.5V}{R_3} \cdot n$$

n is the number of current rows. R_3 should be larger than $3.57 \cdot n$ Ω to have the output current less than 700mA.

The average output current will come out 5-10% smaller due to power transfer interruptions during the AC line voltage cusps.

Schematic Diagram



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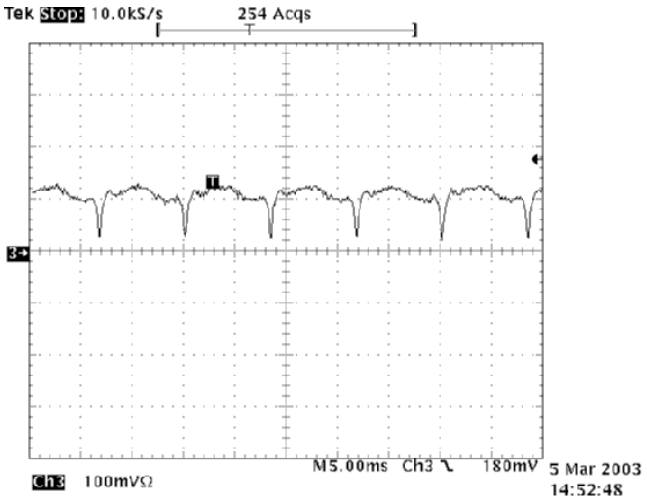
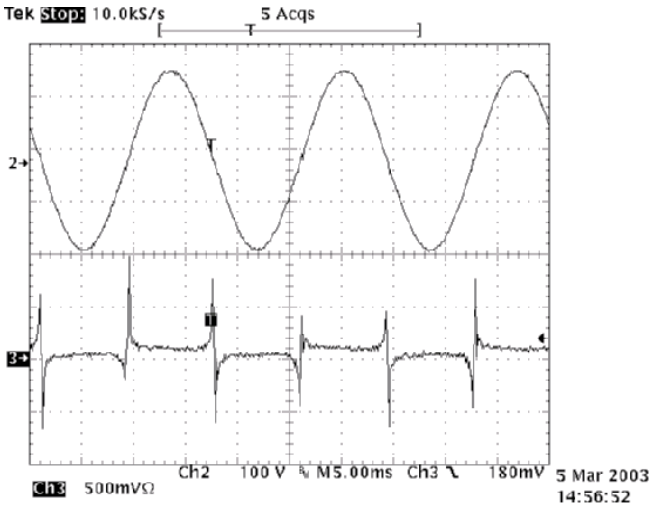
Typical Performance Characteristics

Output current
(Io = 125mA, Vo = 18V, Vin = 120VAC)



Input AC Voltage and Current
(Io = 125mA, Vo = 18V, Vin = 120VAC)



Parts List

Item	Reference	Part	Part Number	Manufacturer
1	B1	Diode Bridge	DF04S	Diodes Inc.
2	C2	Cap, PEN Film 0.1uF 250V	ECW-U2104KC9	Panasonic
3	C3	Cap, PEN Film 0.033uF 250V	ECW-U2333KC9	Panasonic
4	C5	0.1 uF, 50V, 10%		Panasonic
5	C6	10 uF, 16V Tantalum Chip		Kemet or equivalent
6	D5	Diode, Ultra Fast, 600V 1A	MURS160T3	On Semi
7	D6	Diode, Ultra Fast, 200V 1A	MURS120T3	On Semi
8	D7	Diode, Ultra Fast, 200V 1A	MURS120T3	On Semi
9	F1	Fuse, 1/2A, Slow Blow	R452.500	Littelfuse
10	L2	100uH, 1.7A	CTCDRH127-101	Central Technologies
11	L3	100uH, 1.2A	DO3316P-104	Coilcraft
12	M1	MOSFET, 400V	IRFR320	International Rectifier
13	Q1	BJT, PNP	MMBT2907	On Semi
14	R1	22 ohm, 5%, 1/8W		Panasonic or equivalent
15	R3	100 ohm, 1%, 1/8W		Panasonic or equivalent
16	R4, R5	Not used		
17	U1	PWM/PFM IC	HV9904LG	Supertex, Inc.

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