Off-Line, High Brightness, LED Driver Demo Board

General Description

The Supertex HV9910DB2v2 demo board is a complete high current, high brightness (HB) LED power driver to supply a string of LEDs using the HV9910B IC from a universal AC input voltage. The demo board can be used to test the performance of HV9910B as a constant current driver to power a string or multiple strings of LEDs.

HV9910DB2v2 can supply a maximum output current of 350mA to drive LED strings from a wide input voltage – 90 to 265VAC, 50/60Hz. This wide input voltage range makes this demo board usable all over the world.

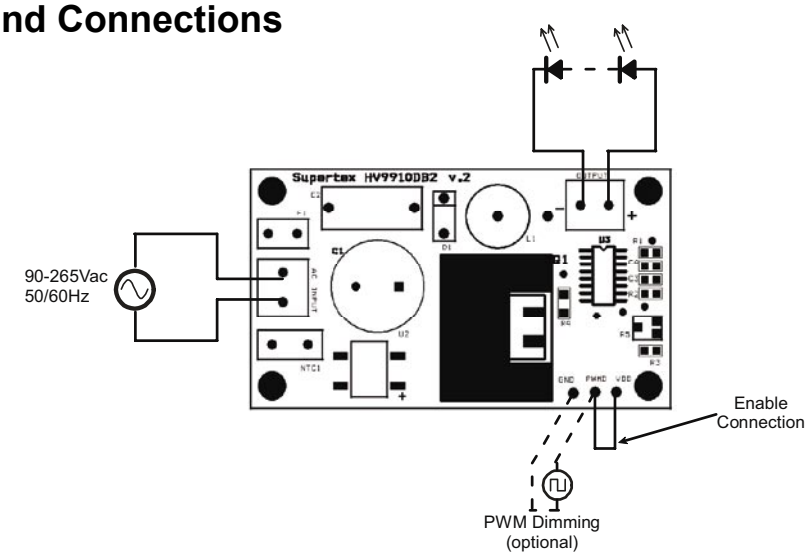
For driving LED strings whose voltage is greater than one-half of the input voltage, see the HV9910DB3v3 datasheet.

The power conversion stage of HV9910DB2v2 consists of a diode bridge rectifier followed by a current-controlled buck converter operating at a switching frequency of 50kHz. The nominal output current of the demo board can be adjusted to any value between 35mA and 350mA using the on-board trimming potentiometer. PWM dimming can be achieved by applying a pulse-width-modulated square wave signal between the PWMD and GND pins.

Actual Dimensions: 74.5mm x 42.5mm

Specifications		
Input voltage:	90VAC – 265VAC	
Load current:	350mA maximum (adjustable down to 50mA)	
Output voltage:		
Input voltage	LED string voltage	
	Min (V)	Max (V)
110VAC	10	40
220VAC	20	50

Board Layout and Connections



Instructions

AC Input: Connect these pins to a standard line voltage outlet (or a DC voltage between 100 – 375V). Use a two-wire cable without ground connection.

Note: Apply AC line voltage as a last step to power up the LED string, after you connect the LED to the demo board! Disconnecting the LED string will not damage the board, however it is not advisable.

ATTENTION: The LED demo board and connected LEDs are not isolated from line voltage. None of the demo board terminals are galvanic isolated from the AC line voltage. All measuring instruments, as scopes and meters must be isolated from ground (floating) using isolating transformers.

OUTPUT: These two terminals are the output terminals of the converter and must be connected to the LED string. The Positive-Marked end is to be connected to the positive (anode) terminal of LED string, the Negative-Marked end is to be connected to the negative (cathode) terminal.

Note: Both terminals will have active live voltage when input AC line is applied!

VDD: This pin is connected to the VDD pin of the HV9910B. The typical voltage on the pin is 7.6V. This voltage can be used to drive any additional circuitry required. Please see the datasheet regarding the output current capability at the VDD pin.

GND: This pin is connected to the Ground connection of the buck converter.

PWMD: This terminal can be used to either enable/disable the converter or to apply a PWM dimming signal.

To just enable the converter, connect the PWMD pin to the VDD pin. Disconnecting the PWMD pin will cause the circuit to stop.

PWM dimming of the LED light can be achieved by turning the converter on and off with a low frequency 50Hz to 1000Hz TTL logic level signal. Changing the Duty Ratio of the signal changes the effective average current via the LEDs, changing the light emission.

Note: In the case of PWM dimming, the PWMD pin should not be connected to the VDD pin! Also, the signal generator or the device applying the signal to PWMD pin must be isolated from the input mains.

Testing the HV9910DB2v2

Connect the LED string to the output terminals. Check the polarity of the LED connection, anode end of the string should be connected to the positive output, cathode should be connected to the negative output. Connect the AC input to the input terminals (there is no polarity to be considered). Short the PWMD pin to VDD. Apply an AC voltage at the input terminals and the LED string should start to glow.

An ammeter can be connected in series with the LEDs to measure the output current. The current level can then be changed by adjusting the trimming potentiometer.

Note: Make sure the LED string is fully functional. One way is to use a DC current limited source to test the string. A 40V/300mA power supply should be a good solution.

Open LED Test

After the initial test of functionality, the demo board can be tested at open LED string. The test is non-destructive and not time restricted. Disconnect one end of the LEDs and power up the demo. There will be no light emission and the AC current withdrawn from the line will be very low. There is no switching at the switching node.

Linear Dimming Test

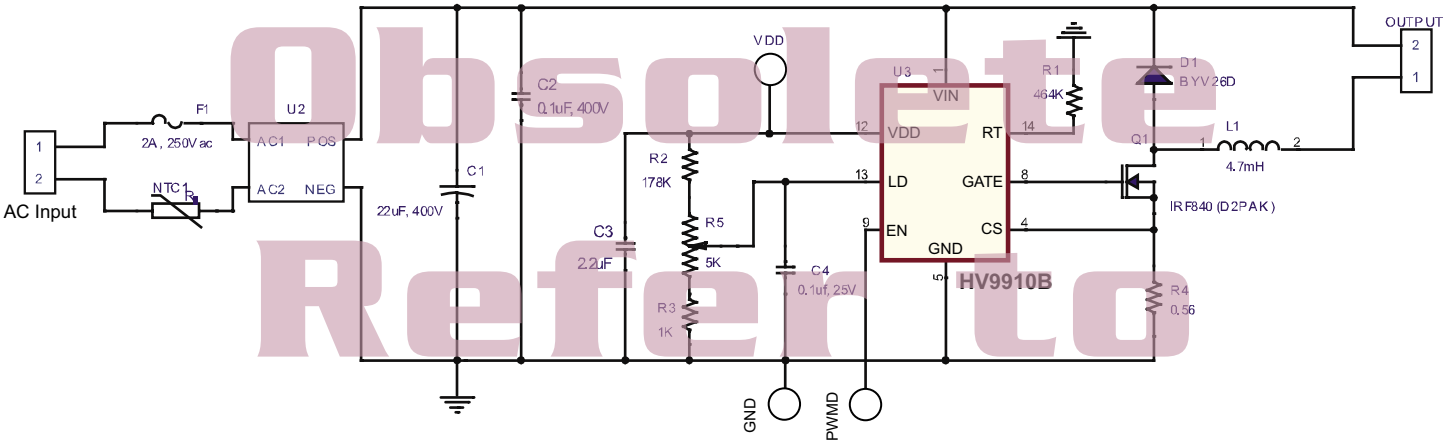
Gradual change of current via LEDs is possible by using the trimming potentiometer R5 placed on the demo board. The HV9910B has a preset voltage reference level of 250mV when the voltage at the LD pin of the IC is above 250mV. The external resistor divider consisting of R2, R3 and potentiometer R5 can change that level by pulling down the pin LD below 250mV, reducing the LED string current in linear fashion.

The maximum output current of the HV9910DB2v2 is 350mA. It can be reduced to 50mA using R5.

PWM Dimming Test

During normal demo board operation, by applying a PWM TTL level signal to pin PWMD, the output current through the LEDs can be changed in PWM fashion in a 0 to 100% range. In this dimming mode, the output current has normally two levels – zero and nominal current, except at very low duty ratios where inductor current cannot ramp up to the nominal value within the short time.

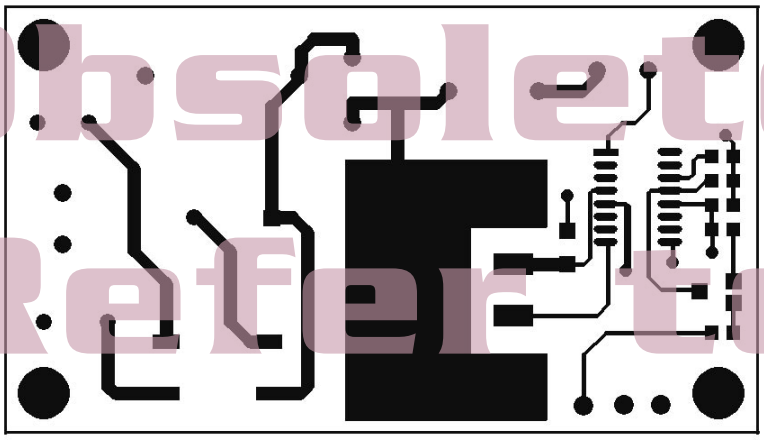
Schematic Diagram



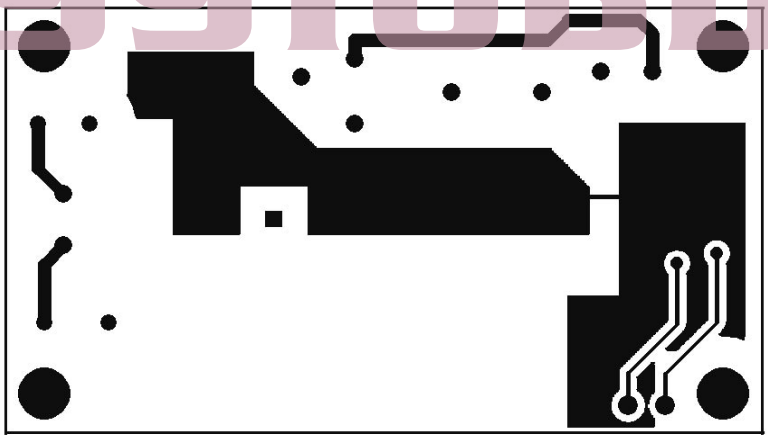
Bill of Materials

Qty	Ref	Description	Manufacturer	Manufacturer's Part Number
2	OUTPUT, AC INPUT	Terminal block	Onshore Tech.	ED350/2
1	C1	22µF, 400V electrolytic capacitor	Panasonic	EEU-EB2G220S
1	C2	0.1µF, 400V Metallized polypropylene capacitor	Panasonic	ECW-F4104JB
1	C3	2.2µF, 16V SMD 0805 ceramic capacitor	Panasonic	ECJ-2FB1C225K
1	C4	0.1µF, 25V SMD 0805 ceramic capacitor	Panasonic	ECJ-2VF1E104Z
1	D1	400V, 1.5A Fast - soft recovery diode	Philips	BYV26B
1	F1	2A, 250VAC Sub miniature fuse	Cooper Bussman	BK/PCC-2
1	L1	4.7mH, 0.4A Inductor	Coilcraft	PCH-45-475
1	NTC1	NTC inrush current limiter	Thermometrics	CL-130
1	Q1	500V, 8A D2PAK MOSFET	International Rectifier	IRF840AS
1	R1	464KΩ, 1/8W 0805 SMD resistor	Panasonic	ERJ-6ENF4643V
1	R2	178KΩ, 1/8W 0805 SMD resistor	Panasonic	ERJ-6ENF1783V
1	R3	1KΩ, 1/10W 0805 SMD resistor	Panasonic	ERJ-6ENF1001V
1	R4	0.56Ω, 1%, 1/4W SMD 1206 resistor	Panasonic	ERJ-8RQFR56V
1	POT1	Top adjust 5KΩ trim pot	Murata	PVG3A502A01R00
1	U2	400V, 1A, DF-S, Single phase diode bridge	Diodes, Inc.	DF04S
1	U3	Universal LED driver	Supertex	HV9910BNG-G
1	-	D2PAK heat sink	Aavid Thermalloy	573100d00000
1	VDD, PWMD, GND	3-Position breakaway header	Molex/Waldom	22-28-4030

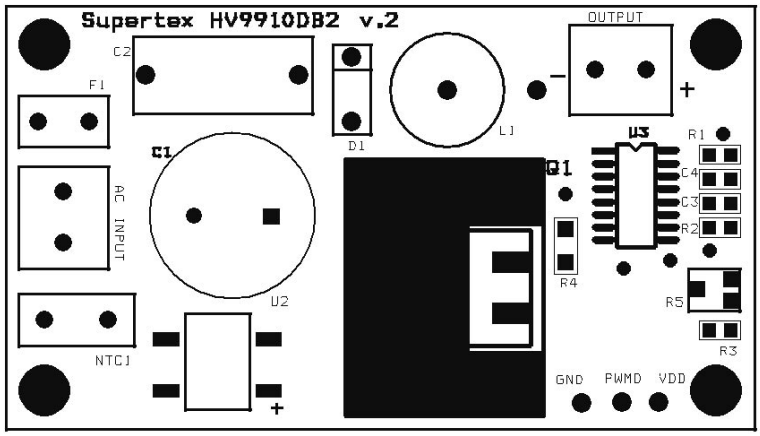
Top Layer



Bottom Layer



Top Silk Screen



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