Universal Voltage Off-Line High Brightness LED Driver Demo Board

Introduction

The Supertex HV9910DB2 v.2 demo board is a complete high current, high brightness (HB) LED power driver to supply a string of LEDs using the HV9910 IC from a universal AC input voltage. The demo board can be used to test the performance of HV9910 as a constant current driver to power a string or multiple strings of LEDs.

HV9910DB2v.2 can supply a maximum output current of 350mA to drive LED strings from a wide input voltage – 90VAC to 265VAC, 50/60Hz. This wide input voltage range makes this demo board usable all over the world.

The power conversion stage of HV9910DB2v.2 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.

Specifications

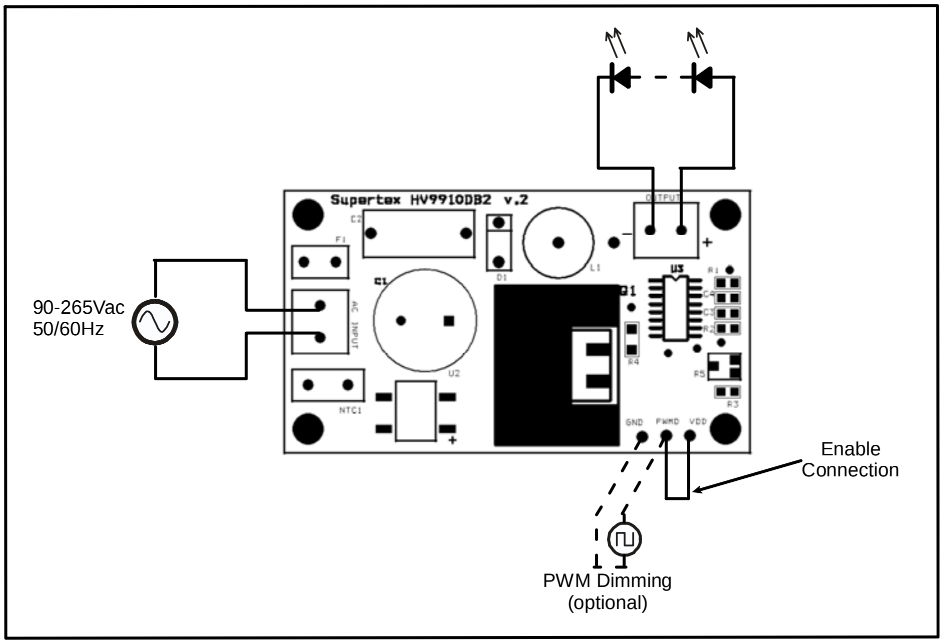
Input	90VAC – 265VAC
Load Current	350mA maximum (adjustable down to 50mA)

Output Voltage

Input Voltage	LED String Voltage	
	Min (V)	Max (V)
110V AC	10	40
220V AC	20	50

Actual Size: 74.5mm x 42.5mm

Board Layout and Connections



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Instructions

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

Note: Apply AC line voltage as a last step to power up LED string, after you connect LED to demo board! Disconnected LED string would 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. Positive-Marked end is to be connected to positive (anode) terminal of LED string, Negative-Marked 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 V_{DD} pin of the HV9910. 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 V_{DD} 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 V_{DD} pin. Disconnecting the PWMD pin will cause the circuit to stop.

PWM dimming of the LED light can be achieved by turning on and off the converter with 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 V_{DD} pin! Also, the signal generator or the device applying the signal to PWMD pin must be isolated from the input mains.

Testing HV9910DB2 v.2

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 V_{DD}. 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 R_5 placed on the demo board. The HV9910 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 R_2, R_3 and potentiometer R_5 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 HV9910DB2 is 350mA. It can be reduced using R_5.

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.

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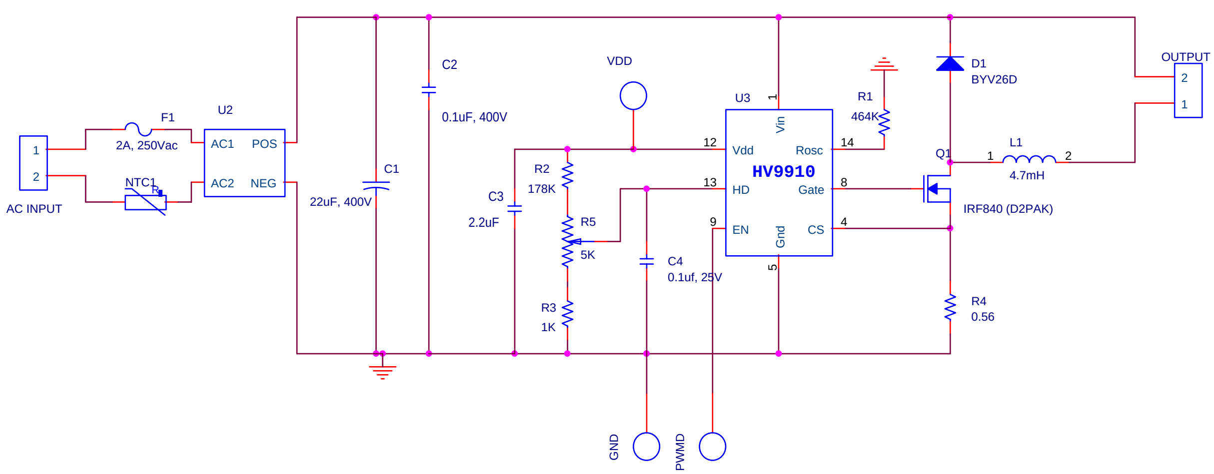
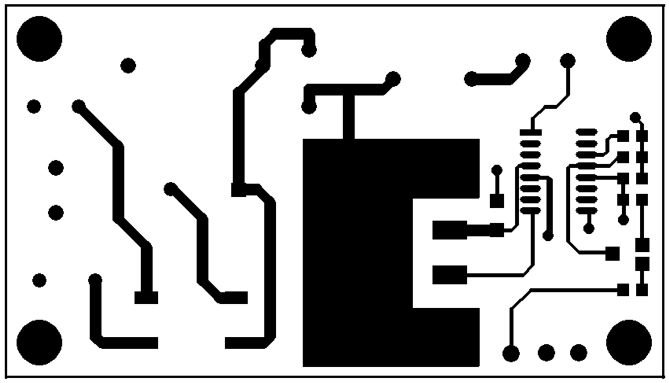
Schematic Diagram



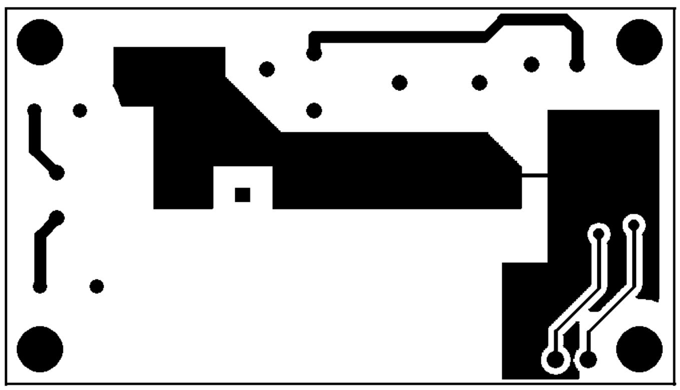
HV9910DB2 v.2 – Bill of Materials

Quantity	RefDes	Description	Manufacturer	Manufacturer's Part Number
2	OUTPUT,AC INPUT	Terminal Block	Onshore Tech.	ED350/2
1	C1	22uF, 400V Electrolytic Capacitor	Panasonic	EEU-EB2G220S
1	C2	0.1uF, 400V Metallized Polypropylene Capacitor	Panasonic	ECW-F4104JB
1	C3	2.2uF, 16V SMD 0805 ceramic capacitor	Panasonic	ECJ-2FB1C225K
1	C4	0.1uF, 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	464K, 1/8W 0805 SMD resistor	Panasonic	ERJ-6ENF4643V
1	R2	178K, 1/8W 0805 SMD resistor	Panasonic	ERJ-6ENF1783V
1	R3	1K, 1/10W 0805 SMD resistor	Panasonic	ERJ-6ENF1001V
1	R4	0.56 ohm, 1%, 1/4W SMD 1206 resistor	Panasonic	ERJ-8RQFR56V
1	POT1	Top adjust 5K trim pot	Murata	PVG3A502A01R00
1	U2	400V, 1A, DF-S, Single Phase diode bridge	Diodes, Inc.	DF04S
1	U3	Universal LED driver	Supertex	HV9910NG
1		D2PAK Heat Sink	Aavid Thermalloy	573100d00000
1	VDD,PWMD, GND	3 Position Breakaway Header	Molex/ Waldom	22-28-4030

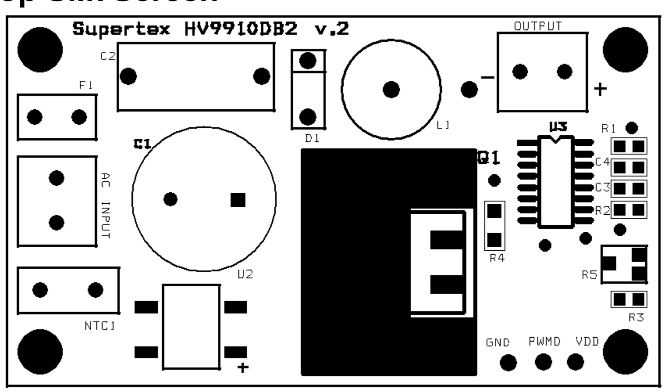
HV9910DB2 v.2 – Top Layer



HV9910DB2 v.2 – Bottom Layer



HV9910DB2 v.2 – Top Silk Screen



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