

Low Voltage, High Brightness LED Driver Demo Board

Introduction

The Supertex HV9910DB3 v.2 demo board is a complete high current, high brightness (HB) LED power driver to supply a string of LED(s) using the HV9910 IC from a low DC voltage. The demo board can be used to test the performance of HV9910 as a constant current driver to power LEDs.

HV9910DB3 v.2 can supply a maximum output current of 900mA to drive LED strings from an 8VDC to 30VDC input. It achieves an overall efficiency above 85%. HV9910DB3 v.2 is ideally suited to drive one or two 1W LEDs from a 12V or 24V input voltage.

The power conversion stage of HV9910DB3 v.2 consists of a current-controlled buck converter operating at a switching frequency of 80kHz. The nominal output current of the demo board can be adjusted to any value less than 900mA using the on-board trimming potentiometer. The output current can be set using the jumper connection (see Instructions section). PWM dimming can be achieved by applying a pulse-width-modulated square wave signal between the PWMD and GND pins.

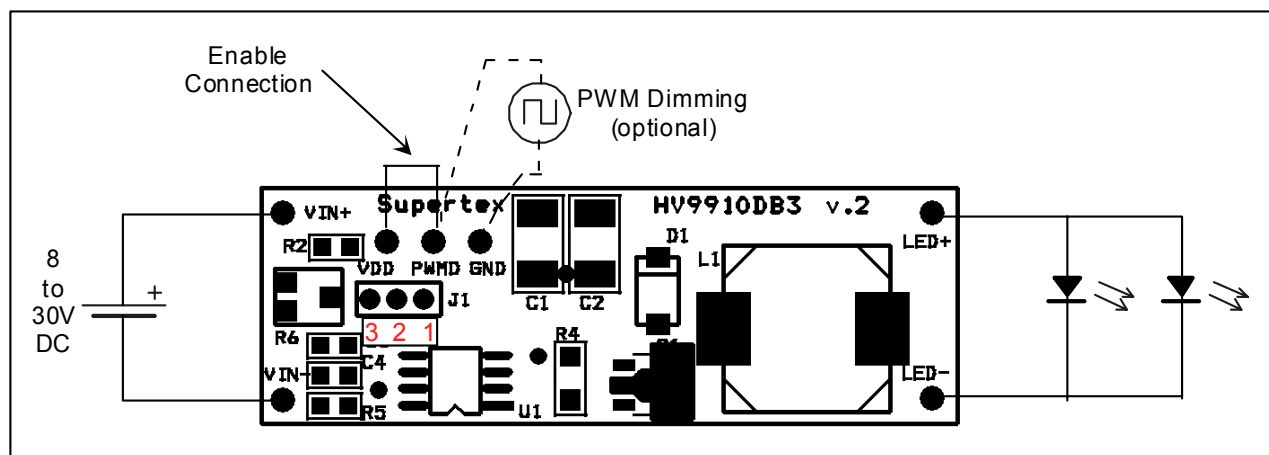
Specifications

Input	8VDC – 30VDC
Load Current	900mA maximum
LED String Voltage	$V_{input}/2$ (see instructions)
Switching Frequency	80kHz
Efficiency	>85% (typ.)



Actual Size: 53mm x 18mm

Board Layout and Connections



Instructions

V_{IN+}: Connect the positive terminal of the DC input source to this pin.

V_{IN-}: Connect the negative terminal of the DC input source to this pin.

LED+: Connect the Anode of the LED(s) to this pin.

LED-: Connect the Cathode of the LED(s) to this pin.

V_{DD}: 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!

J1: The three pins in J1 are used to set the current level of the output. The HV9910DB3 v.2 has 2 settings:

Pin 2 connected to Pin 1: Output Current is 900mA

Pin 2 connected to Pin 3: Output current can be adjusted using the potentiometer

Note: The maximum output voltage of the HV9910DB3 v.2 depends on the input voltage. The condition to be satisfied is that the maximum output voltage is not more than half of the minimum input voltage.

$$V_{o,max} \leq \frac{V_{in,min}}{2}$$

Thus, when using a 24V supply, the maximum output voltage can be 12V.

Testing HV9910DB3 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 DC input to the input terminals (check the polarity). Short the PWMD pin to V_{DD}. Apply a DC voltage at the input terminals and the LED string should start to glow.

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

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 LED(s) is possible by using the trimming potentiometer 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 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.

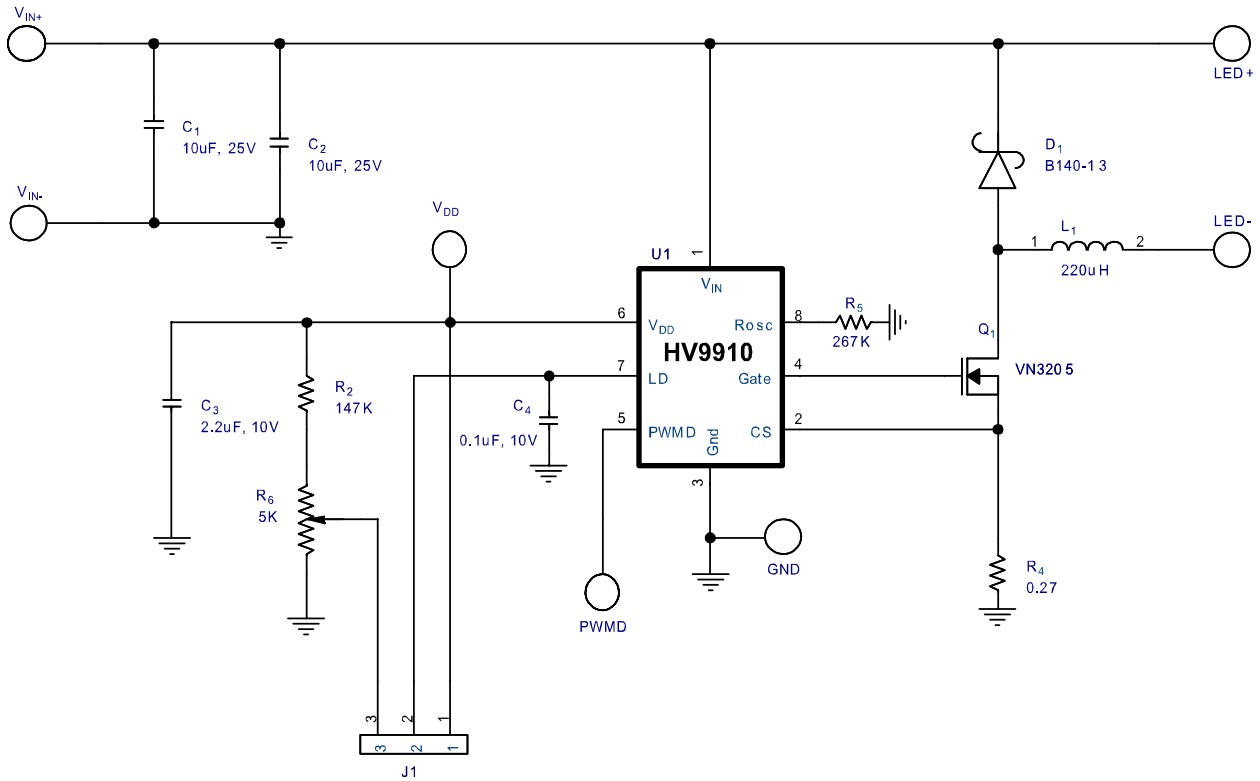
The maximum output current of the HV9910DB3 v.2 is 900mA.

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 Drawing

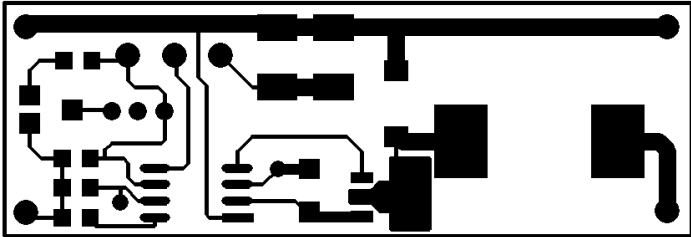
HV9910DB3 v.2



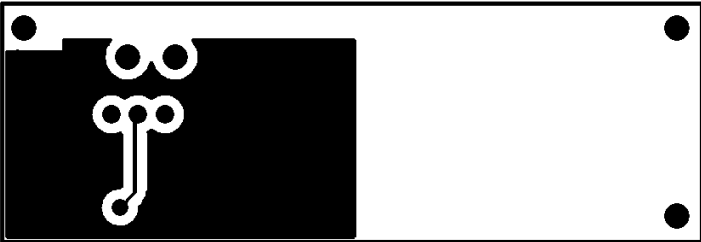
HV9910DB3 v.2 – Bill of Materials

Quantity	RefDes	Description	Manufacturer	Manufacturer's Part Number
2	C1,C2	10uF, 35V SMD 1812 Multilayer Ceramic Chip capacitors	Panasonic	ECJ-5YF1V106Z
1	C3	2.2uF, 25V SMD 0805 Ceramic Capacitor	Panasonic	ECJ-3YB1E106M
1	C4	0.1uF, 25V SMD 0805 Ceramic Capacitor	Panasonic	ECJ-2VF1E104Z
1	D1	40V, 1A SMA Schottky Diode	Diodes, Inc.	B140-13
1	J1	3 pin header, 2mm pitch	Sullins	PRPN031PAEN
1		Open Top shunt for J1	Sullins	STN02SYBN
1	L1	220uH, 1A Shielded Power Inductor	Coilcraft	MSS1278-224KXB
1	Q1	50V, 1.5A SOT-89 Power MOSFET	Supertex	VN3205N8
1	R2	147K, 1/10W, 1% SMD 0805 chip resistor	Panasonic	ERJ-6ENF1473V
1	R4	0.27 ohm, 1/4W, 1% SMD 1206 chip resistor	Panasonic	ERJ-8RQFR27V
1	R5	267K, 1/10W, 1% SMD 0805 chip resistor	Panasonic	ERJ-6ENF2673V
1	R6	5K surface mount trim pot	Murata	PVG3A502A01R00
1	U1	Universal LED Driver	Supertex	HV9910LG
1	VIN-,VIN+,VDD,PWMD ,LED-,LED+,GND	7 Position Breakaway Header	Molex/ Waldom	22-28-4070

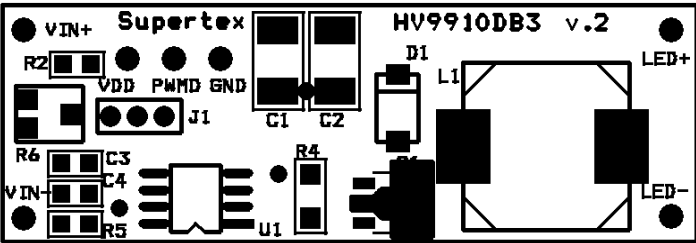
HV9910DB3 v.2 – Top Layer



HV9910DB3 v.2 – Bottom Layer



HV9910DB3 v.2 – Top Silk Screen Layer



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