Low Voltage, Buck Boost, High Brightness LED Driver Demo Board

Introduction

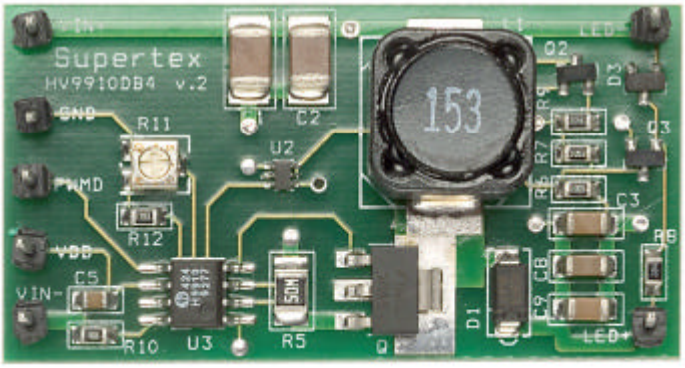
The Supertex HV9910DB4v.2 demo board is a complete high current, high brightness (HB) LED power driver to supply a string of LEDs using the HV9910 IC from a low DC voltage. The demo board can be used to test the performance of the HV9910 as a constant current driver to power LEDs. HV9910DB4v.2 can drive LED strings whose voltage is less or more than the input voltage.

HV9910DB4v.2 can supply a maximum output current of 620mA (adjustable using the on-board potentiometer) to drive LED strings having a maximum string voltage of 22V. HV9910DB4v.2 is ideally suited to drive a string of 5 or 6 high brightness LEDs at high efficiencies (typically greater than 85%). This demo board is an improved version of the HV9910DB4 v.2 with over-voltage protection and output voltage feedback to maintain a constant LED current (see Application note AN-H49 for details).

The power conversion stage of HV9910DB4v.2 consists of a current-controlled buck-boost converter operating at a variable switching frequency. The nominal output current of the demo board can be adjusted to any value less than 780mA 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.

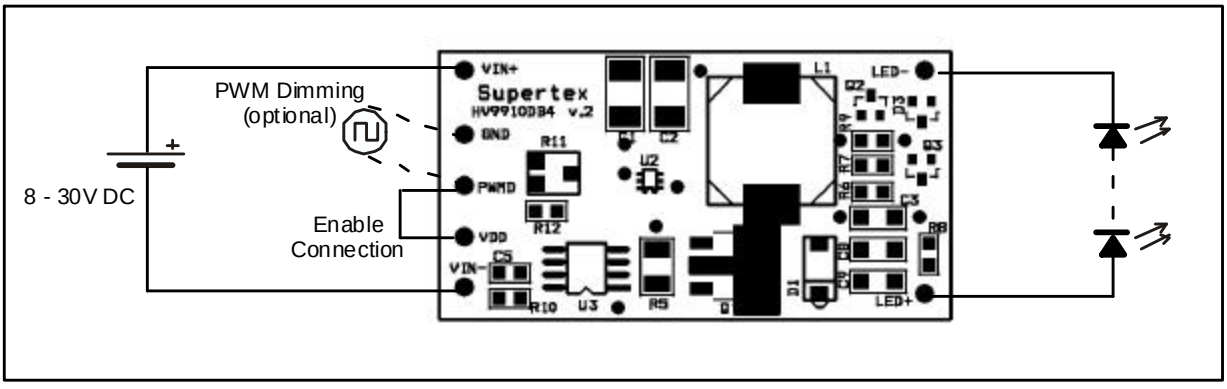
Specifications

Input	9VDC – 30VDC
Load Current	780mA maximum
LED String Voltage	10V minimum 22V maximum
Switching Frequency	Variable, depends on output voltage
Overall Set Point	26V
Efficiency	>85% (typ.)



Actual Size: 53.5mm x 26.75mm

Board Layout and Connections



Instructions

VIN+: Connect the positive terminal of the DC input source to this pin.

VIN-: Connect the negative terminal of the DC input source to this pin.

LED+: Connect the Anode of the LED string to this pin.

LED-: Connect the Cathode of the LED string to this pin.

VDD: This pin is connected to the VDD 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 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 on and off the converter 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!

Setting the Output Current

The output current of a peak-current-controlled buck-boost converter is given by:

$$I_o \approx 12.5 \times V_{LD}^2$$

where:

I_o: output current

V_{LD}: voltage at the dimming pin

Testing HV9910DB4v.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 VDD. 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 Condition:

This power stage can be run under open LED condition. When there are no LEDs connected at the output, the converter will switch at a frequency of about 2.5kHz and draw about 0.2 to 0.3W of power from the input.

Linear Dimming Test:

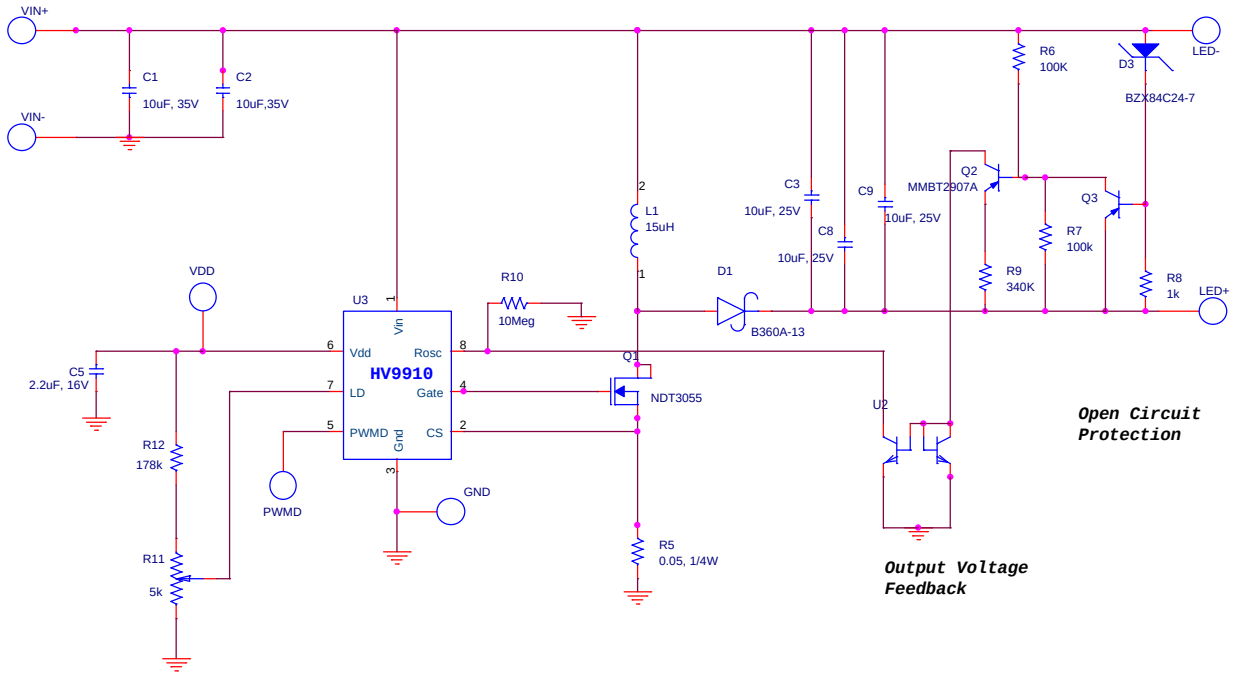
Gradual change of current via LED(s) is possible by using the trimming potentiometer placed on the demo board. The HV9910 has a preset voltage reference level of 250mV when the voltage at the LD pin of the IC is above 250mV. The external resistor divider consisting of R12 and potentiometer R11 can change that level by pulling down the pin LD below 250mV, reducing the LED string current in linear fashion.

The maximum recommended output current of the HV9910DB4 v.2 is 780mA.

PWM Dimming Test:

By applying a PWM TTL level signal between pins PWMD and GND, 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 the LED current cannot ramp up to the nominal value within the short time.

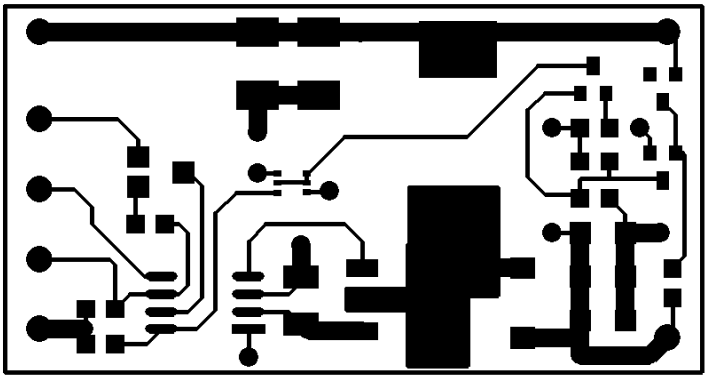
Schematic Diagram



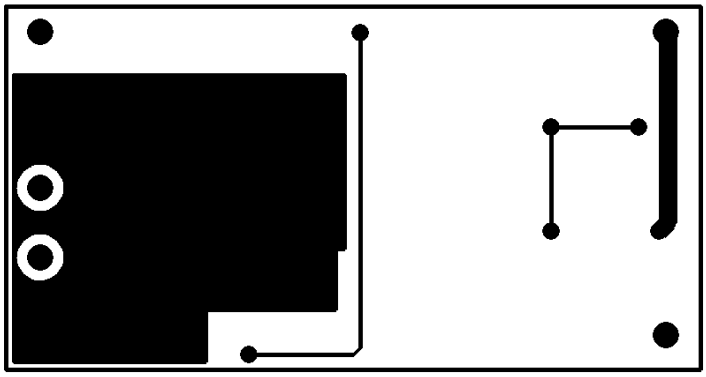
HV9910DB4 v.2 – Bill of Materials

Quantity	RefDes	Description	Manufacturer	Manufacturer's Part Number
2	C1, C2	10uF, 35V SMD 1812 Multilayer Ceramic Chip capacitors	Panasonic	ECJ-5YF1V106Z
3	C3,C8,C9	10uF, 25V SMD 1206 Multilayer Ceramic Chip capacitor	Panasonic	ECJ-3YB1E106M
1	C5	2.2uF, 25V SMD 0805 Ceramic Capacitor	Panasonic	ECJ-3YB1E106M
1	D1	60V, 3A SMA schottky diode	Diodes, Inc.	B360A-13
1	D3	24V, 350mW SOT-23 zener diode	Diodes, Inc.	BZX84C24-7
7	VIN-,VIN+,VDD,PWMD,	7 Position Breakaway Header	Molex/ Waldom	22-28-4070
	LED-,LED+,GND			
1	L1	15uH, 4.5A inductor	Coilcraft	MSS1278-153MXB
1	Q1	60V, 4A SOT-223 N-channel Mosfet	Fairchild	NDT3055
2	Q2,Q3	-60V, 0.6A SOT-23 PNP transistor	Diodes, Inc.	MMBT2907A
1	R5	0.05, 1/4W, 1% SMD1210chip resistor	Panasonic	ERJ-L14KF50MU
2	R6,R7	100k, 1/10W, 1% SMD0805 chip resistor	Panasonic	ERJ-6ENF1003V
1	R8	1k, 1/8W, 5% SMD0805 chip resistor	Panasonic	ERJ-6GEYJ102V
1	R9	340K, 1/10W, SMD0805 1% chip resistor	Panasonic	ERJ-6ENF3403V
1	R10	10Meg, 1/8W, SMD0805 5% chip resistor	Panasonic	ERJ-6GEYJ106V
1	R11	5K surface mount trim pot	Murata	PVG3A502A01R00
1	R12	178k, 1/10W, 1% SMD0805 chip resistor	Panasonic	ERJ-6ENF1783V
1	U2	40V, 600mA dual NPN transistor	Diodes, Inc.	MMDT4401-7
1	U3	Universal LED Driver	Supertex	HV9910LG

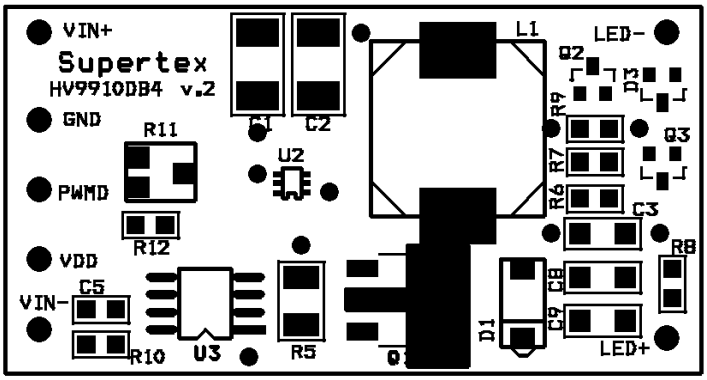
HV9910DB4 v.2 – Top Layer



HV9910DB4 v.2 – Bottom Layer



HV9910DB4 v.2 – Top Silk Screen



Supertex inc.
1235 Bordeaux Drive, Sunnyvale, CA 94089
TEL: (408) 222-8888 / FAX: (408) 222-4895
www.supertex.com