

## Universal, Off-Line, High Brightness, 350mA LED Driver Demo Board

### General Description

The Supertex HV9910BDB2 demo board is a High-Brightness LED power driver to supply a string of LEDs using the HV9910B IC from a universal AC input voltage. The HV9910BDB2 can supply a maximum output current of 350mA to drive 10 - 40V LED strings from a wide input voltage - 90 to 265VAC, 50/60Hz.

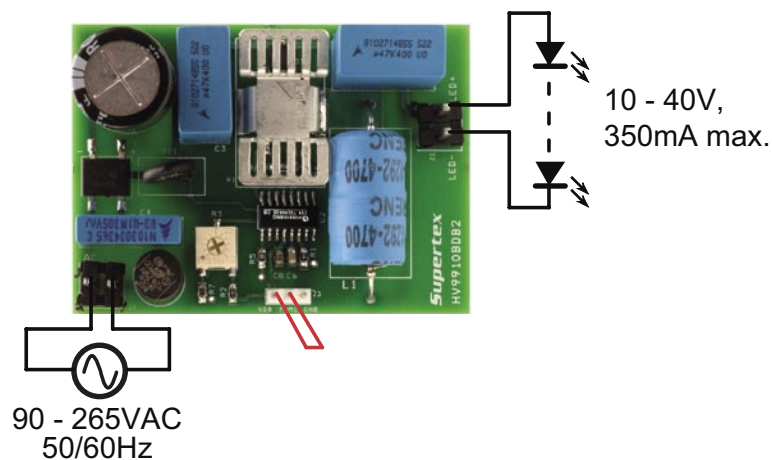
The power conversion stage of the HV9910BDB2 consists of a diode bridge rectifier followed by a current-controlled buck converter operating at a switching frequency of 50kHz. The nominal output current of the demo board can be adjusted to any value between 30 and 350mA using the on-board trimming potentiometer. PWM dimming can be achieved by applying a pulse-width-modulated square wave signal between the PWMD and GND pins. Zero output current can be obtained only by PWM dimming.

The HV9910BDB2 is not CISPR-15 compliant. Additional filtering is required to make the board meet CISPR-15 limits.

### Specifications

Parameter	Value
Input voltage	90 - 265Vrms, 50/60Hz
Output voltage	10 - 40V
Output current	350mA max
Output current ripple (typ) @110V input	25% (peak-peak) @40V output, 350mA
Full load efficiency	88% @110VAC
	86% @230VAC
Power factor	0.70 @110VAC
	0.48 @230VAC
Input current (rms)	0.20A @110VAC
	0.14A @230VAC
Input current THD	94% @110VAC
	95% @230VAC
Switching frequency (typ)	50kHz
Minimum output current	20mA @110VAC
	30mA @230VAC
Open LED protection	yes
Output short circuit protection	no
Dimensions	68.6mm X 49.6mm

### Connection Diagram



### **WARNING!!!**

**Do not connect earth-grounded test instruments. Doing so will short the AC line, resulting in damage to the instrument and/or the HV9910BDB2. Use floating high voltage differential probes or isolate the demoboard by using an isolating transformer.**

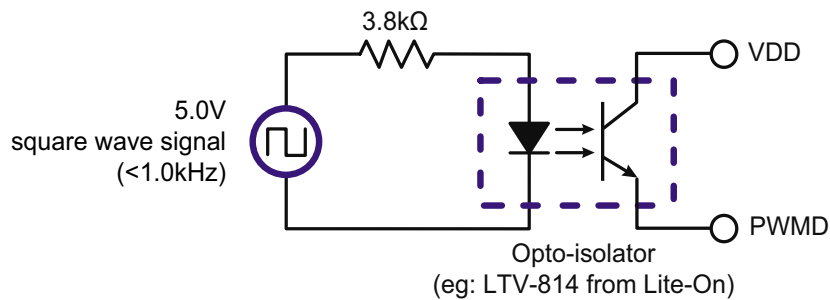
**There is no galvanic isolation. Dangerous voltages are present when connected to the AC line.**

## Connections

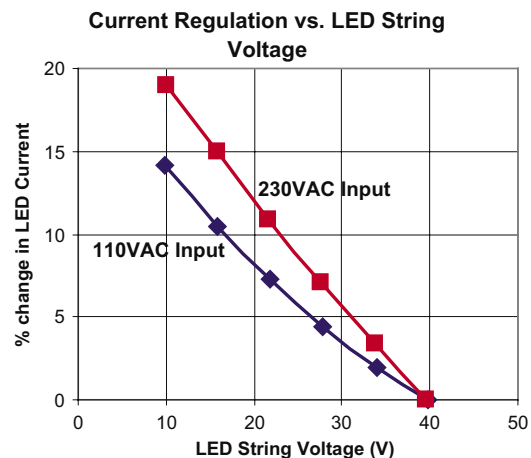
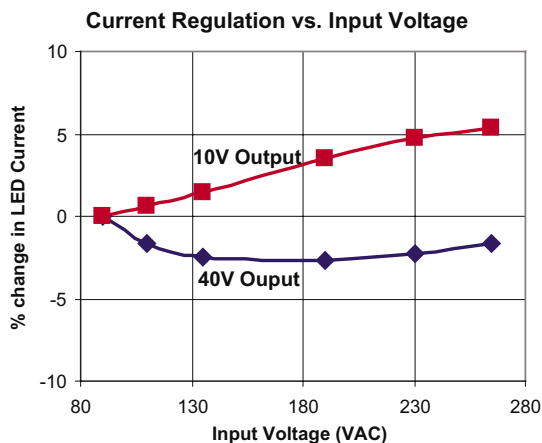
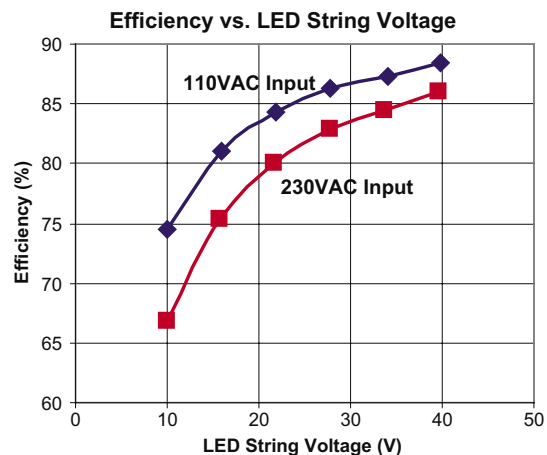
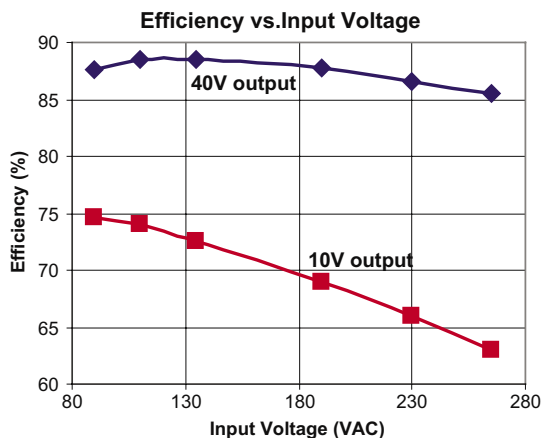
1. Connect the input AC voltage between the AC IN terminals as shown in the connection diagram.
2. Connect the LED string between LED+ (anode of LED string) and LED- (cathode of LED string).
3. Connect the PWM terminal to the VDD terminal using the jumper provided to enable the LED driver.
4. The current level can be adjusted using the on-board potentiometer.

## PWM Dimming

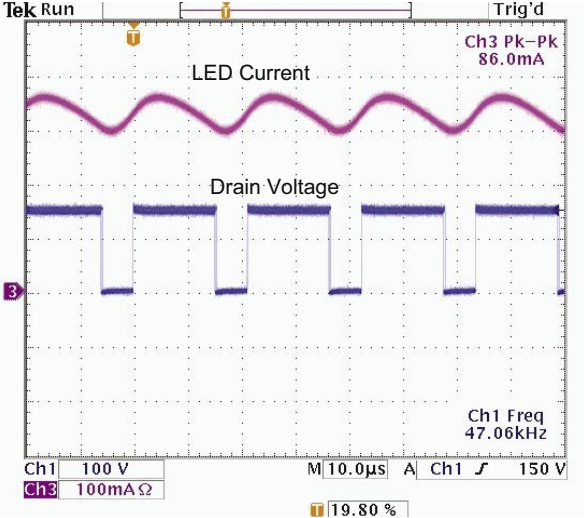
The HV9910BDB2 is capable of being PWM dimmed by applying a square wave TTL compatible signal between PWM and GND terminals. However, since there is no galvanic isolation on the board, care must be taken to prevent damage to the PWM dimming source and/or the HV9910BDB2. One simple way is to isolate the LED driver from the AC line using an isolation transformer. Another approach is to use an opto-isolator to drive the PWM pin as shown in the figure below.



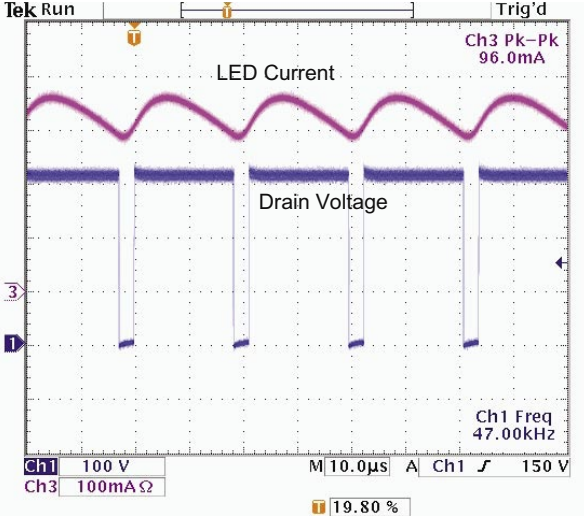
## Typical Results



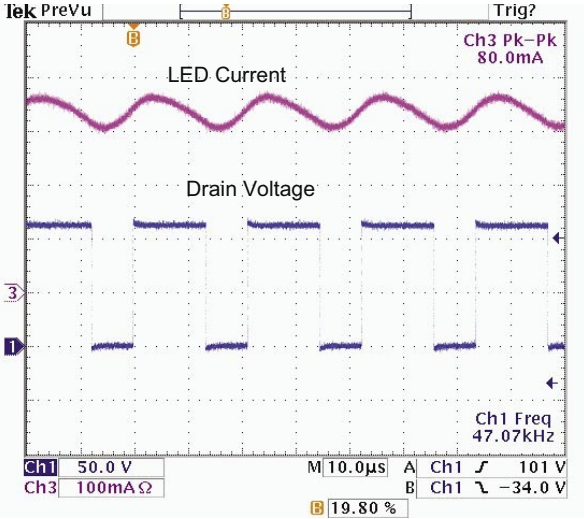
Waveforms



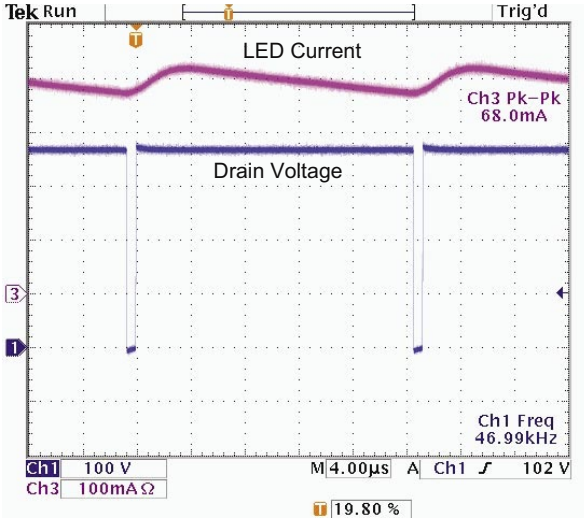
Steady State waveforms at 110VAC input and full load output



Steady State waveforms at 230VAC input and full load output

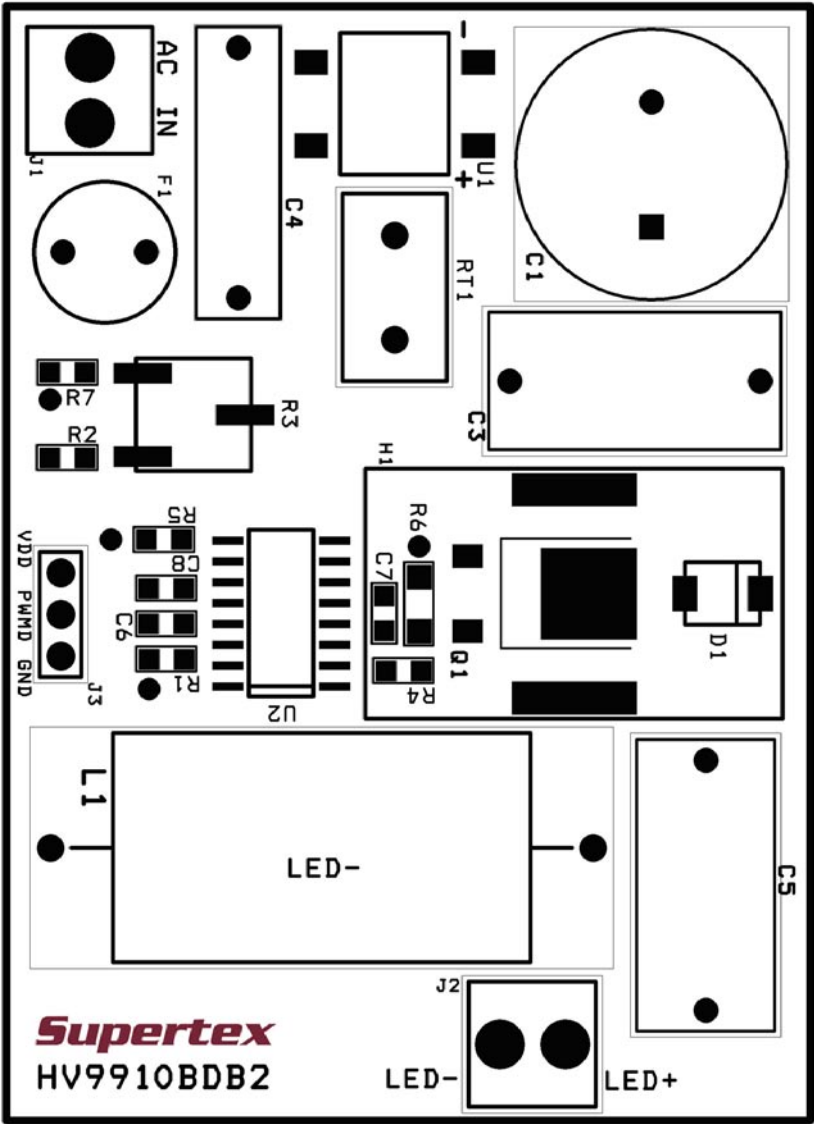


Steady State waveforms at 90VAC input and 40V, 350mA output

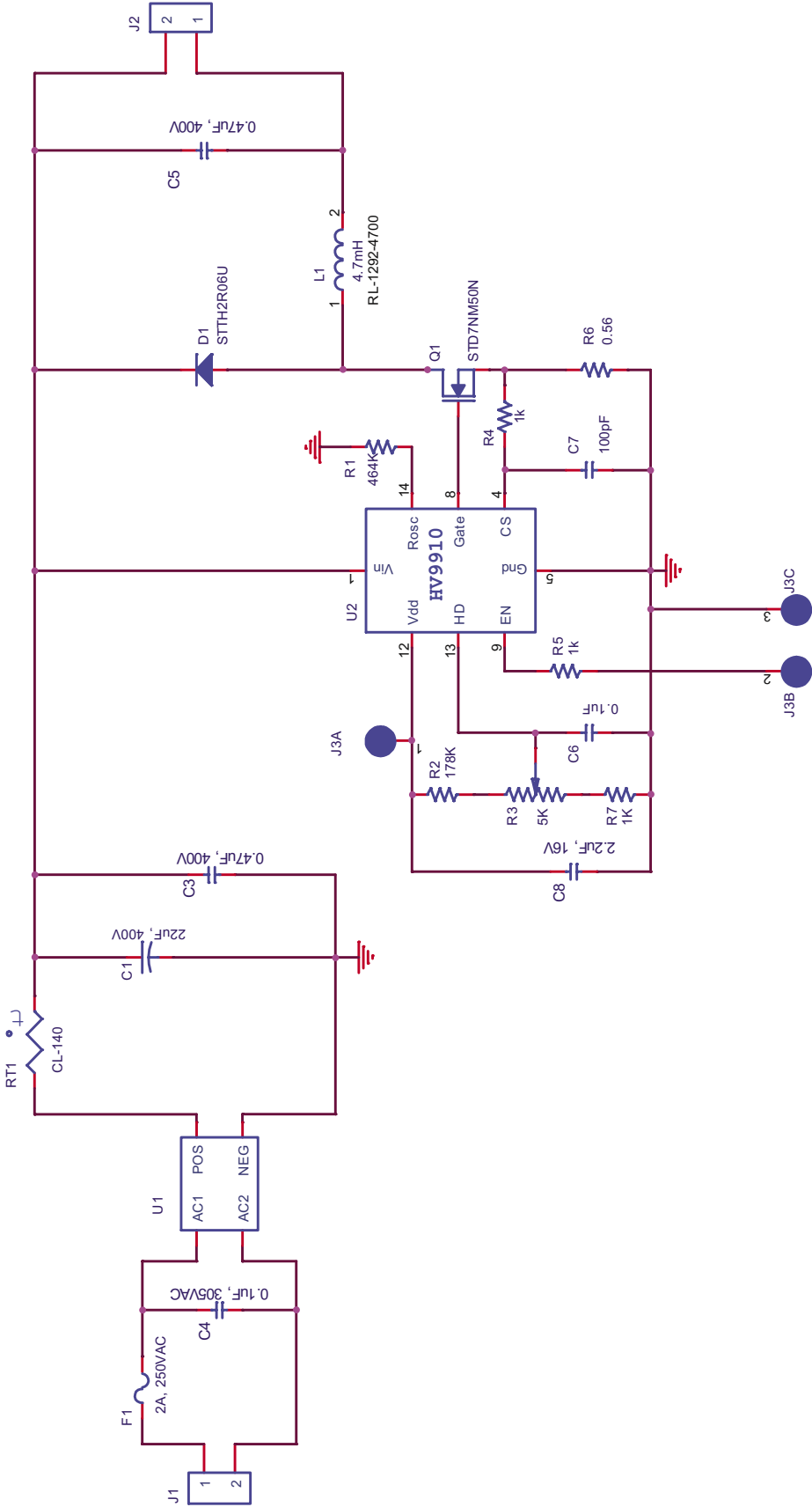


Steady State waveforms at 230VAC input and 10V, 350mA output

Silk Screen



Schematic Diagram



## Bill of Materials

Item #	Qty	RefDes	Description	Package	Manufacturer	Manufacturer's Part Number
1	1	C1	22 $\mu$ F, 400V electrolytic capacitor	Radial	Nichion	UVR2G220MHD
2	2	C3,C5	0.47 $\mu$ F, 400V metal film capacitor	Radial	EPCOS Inc	B32522C6474K
3	1	C4	0.1 $\mu$ F, 305VAC EMI suppression capacitor	Radial	EPCOS Inc	B32922C3104M
4	1	C6	0.1 $\mu$ F, 16V X7R ceramic chip capacitor	SMD0805	Panasonic	ECJ-2VB1C104K
5	1	C7	100pF, 50V C0G ceramic chip capacitor	SMD0805	TDK Corp	C2012C0G1H101J
6	1	C8	2.2 $\mu$ F, 16V X7R ceramic chip capacitor	SMD0805	TDK Corp	C2012X7R1C225K
7	1	D1	600V, 2A ultrafast diode	SMB	ST Micro	STTH2R06U
8	1	F1	2A, 250VAC time lag fuse	Radial	Cooper Bussman	SR-5-2A-BK
9	1	H1	15C/W DPAK heatsink	SMT	Aavid	7106PD
10	2	J1,J2	2 position, 0.156" pitch, vertical header	Thru-Hole	Molex	26-48-1021
11	1	J3	3 position, 0.100" pitch, vertical header	Thru-Hole	Molex	22-03-2031
12	1	L1	4.7mH, 400mA rms, 470mA sat inductor	Axial	Renco USA	RL-1292-4700
13	1	Q1	550V, 0.7 $\Omega$ N-channel FET	DPAK	ST Micro	STD5NM50
14	1	RT1	50 $\Omega$ NTC inrush limiter	Thru-Hole	GE Sensing	CL-140
15	1	R1	464K $\Omega$ , 1/8W, 1% chip resistor	SMD0805	---	---
16	1	R2	178K $\Omega$ , 1/8W, 1% chip resistor	SMD0805	---	---
17	1	R3	5K $\Omega$ top adjust trimpot	SMT	Bourns Inc	3361P-1-502G
18	3	R4,R5,R7	1K $\Omega$ , 1/8W, 1% chip resistor	SMD0805	---	---
19	1	R6	0.56 $\Omega$ , 1/4W, 1% chip resistor	SMD1206	---	---
20	1	U1	400V, 1A single phase diode bridge	DF-S	Diodes Inc	DF04S
21	1	U2	Universal LED Driver	SO-16	Supertex	HV9910BNG-G

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