Off-Line, High Brightness, 1.4A LED Driver Demo Board

General Description

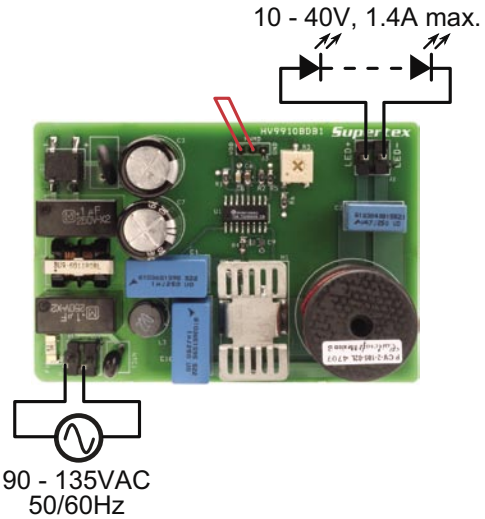
The HV9910BDB1 demoboard is an offline, high current LED driver designed to drive a 40V LED string at 1.4A from a 110V input. The demoboard uses Supertex's HV9910B LED driver IC to drive a buck converter.

The HV9910BDB1 has a typical full load efficiency of 88%, with the buck converter efficiency (excluding the diode bridge rectifier and EMI filter) at 93%. The demoboard also meets CISPR-15 conducted EMI standards.

The output current can be adjusted in two ways - either with linear dimming using the onboard potentiometer or with PWM dimming by applying a TTL-compatible square wave signal at the PWMD terminal. Using linear dimming, the output current of the HV9910DB1 can be lowered to about 0.1A (note: zero output current can be obtained only by PWM dimming).

Specifications	
Input voltage	90 - 135Vrms, 50/60Hz
Output voltage	10 - 40V
Output current	1.4A max
Output current ripple (typ)	40% (peak-peak)
Full load efficiency (@110V)	88%
Power factor (@110V)	0.64
Input current (@110V)	0.83A rms
Input current THD (@110V)	117%
Switching frequency (typ)	50kHz
Minimum output current (@110V)	0.1A
Conducted EMI	Meets CISPR-15
Temperature rise of heatsink (@110V input and full load)	50°C
Open LED protection	yes
Output short circuit protection	no
Dimensions	86.4mm X 58.4mm

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 HV9910BDB1. Use floating high voltage differential probes or isolate the demoboard by using an isolating transformer.

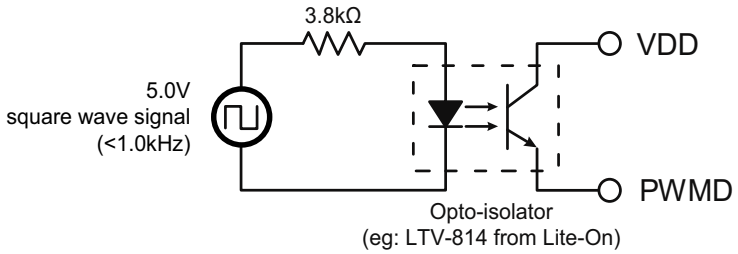
There is no galvanic isolation. Dangerous voltages are present when connected to the AC line.

Connections

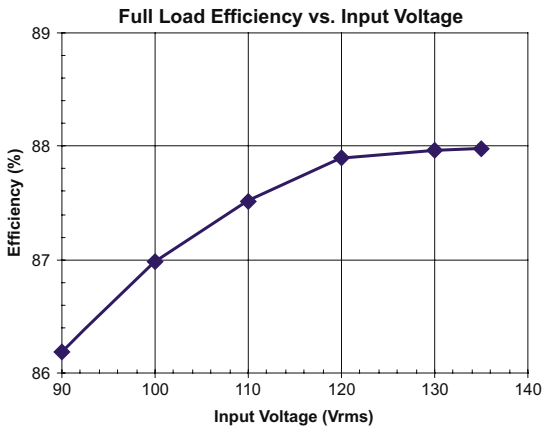
1. Connect the input AC voltage between the AC IN terminals as shown in the connection diagram.
2. Connect the LED string between LED+ (anode of LED string) and LED- (cathode of LED string).
3. Connect the PWMD terminal to the VDD terminal using the jumper provided to enable the LED driver.
4. The current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

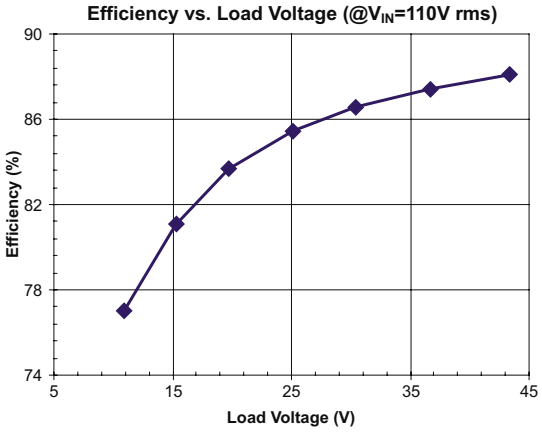
PWM Dimming

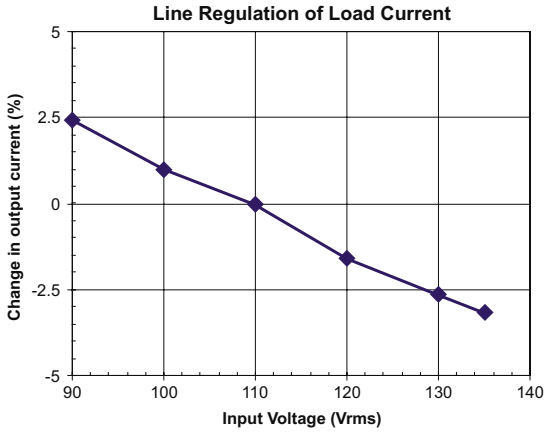
The HV9910BDB1 is capable of being PWM dimmed by applying a square wave TTL compatible signal between PWMD and GND terminals. However, since there is no galvanic isolation on the board, care must be taken to prevent damage to the PWM dimming source and/or the HV9910BDB1. One simple way is to isolate the LED driver from the AC line using an isolation transformer. Another approach is to use an opto-isolator to drive the PWMD pin as shown in the figure below.

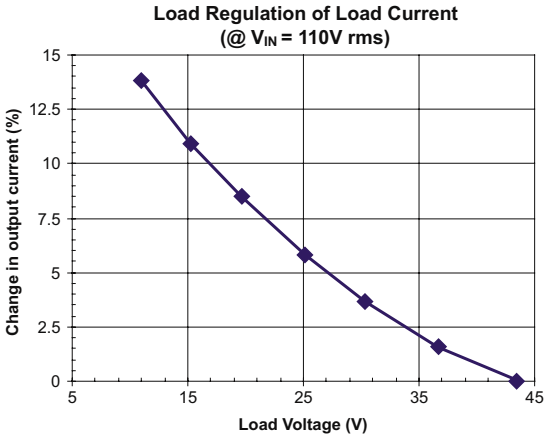


Typical Results

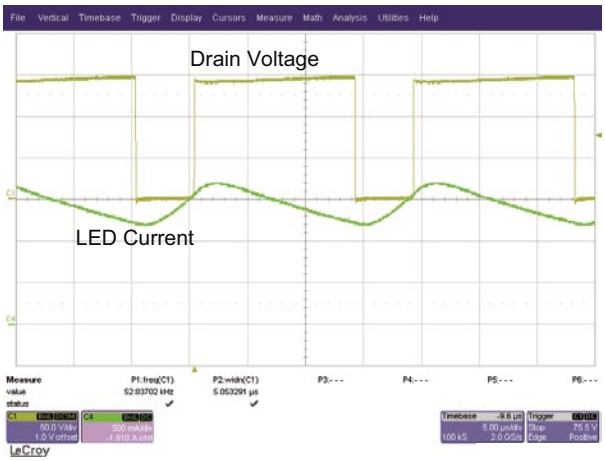




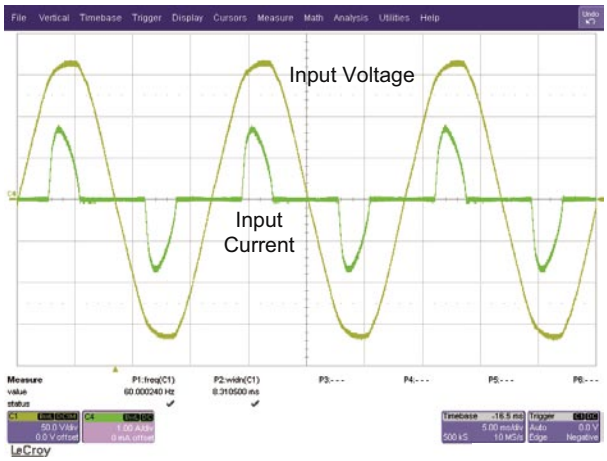




Waveforms



Steady State waveforms at 150Vdc input and full load output



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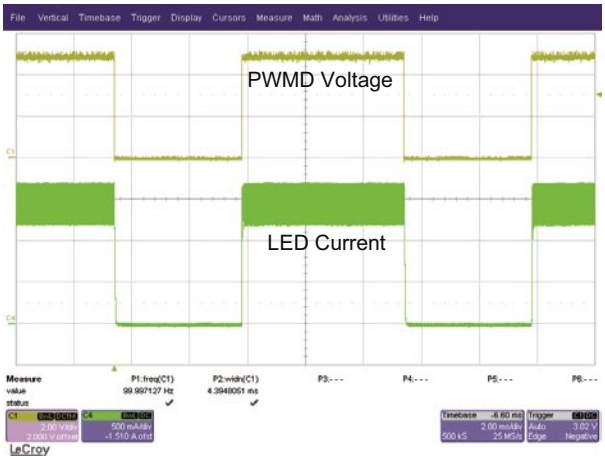
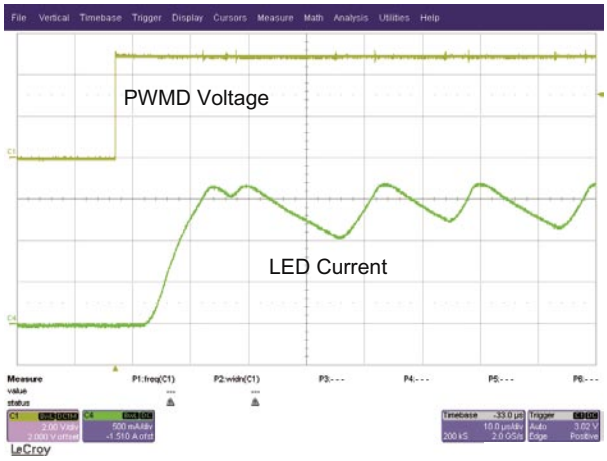
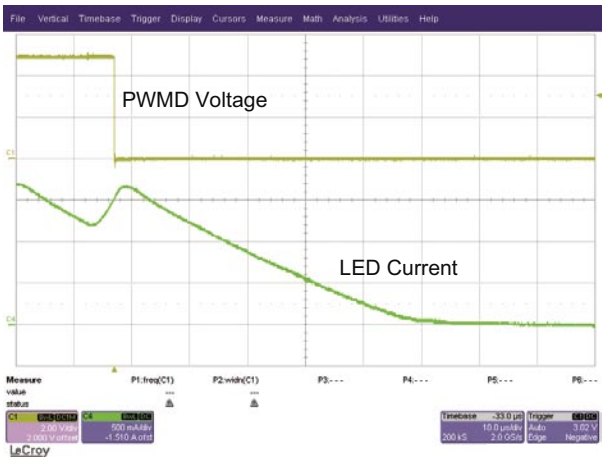


PWM Dimming at 100Hz

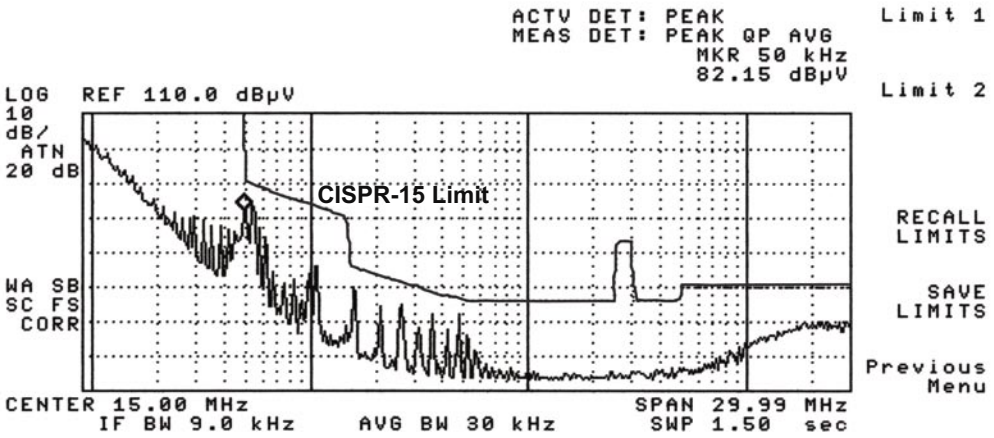


Rising Edge of LED Current during PWM Dimming

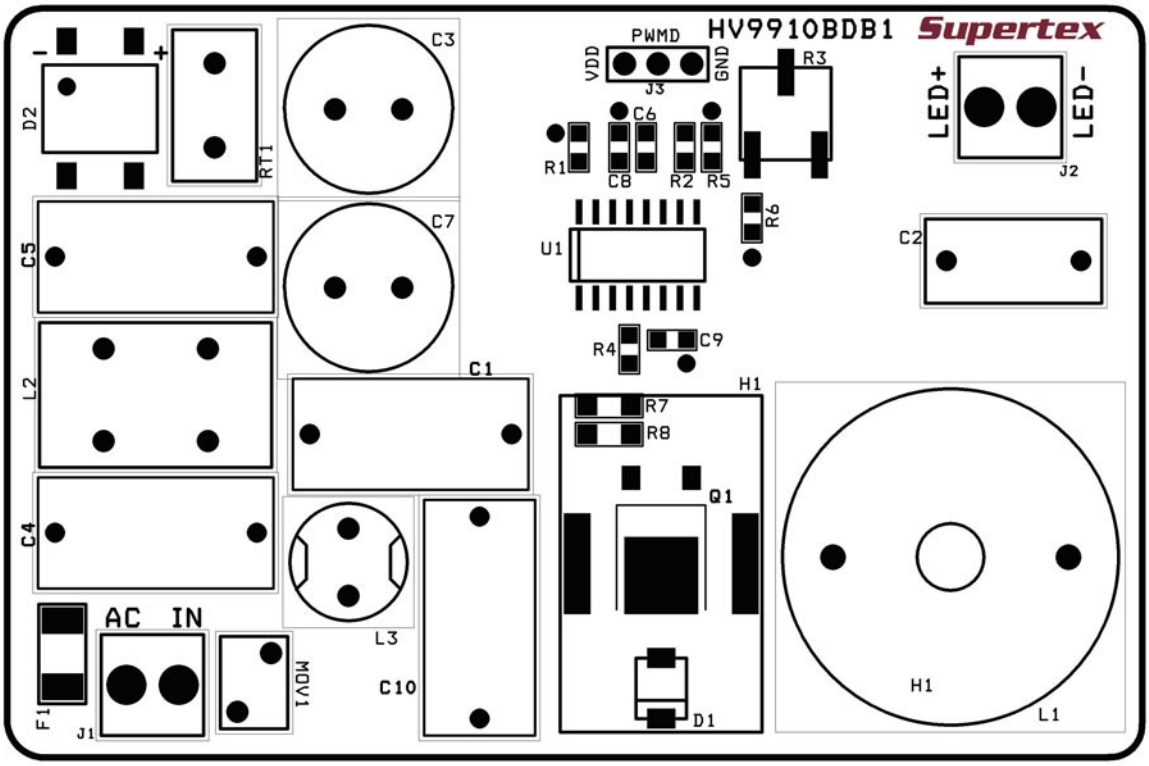


Falling Edge of LED Current during PWM Dimming

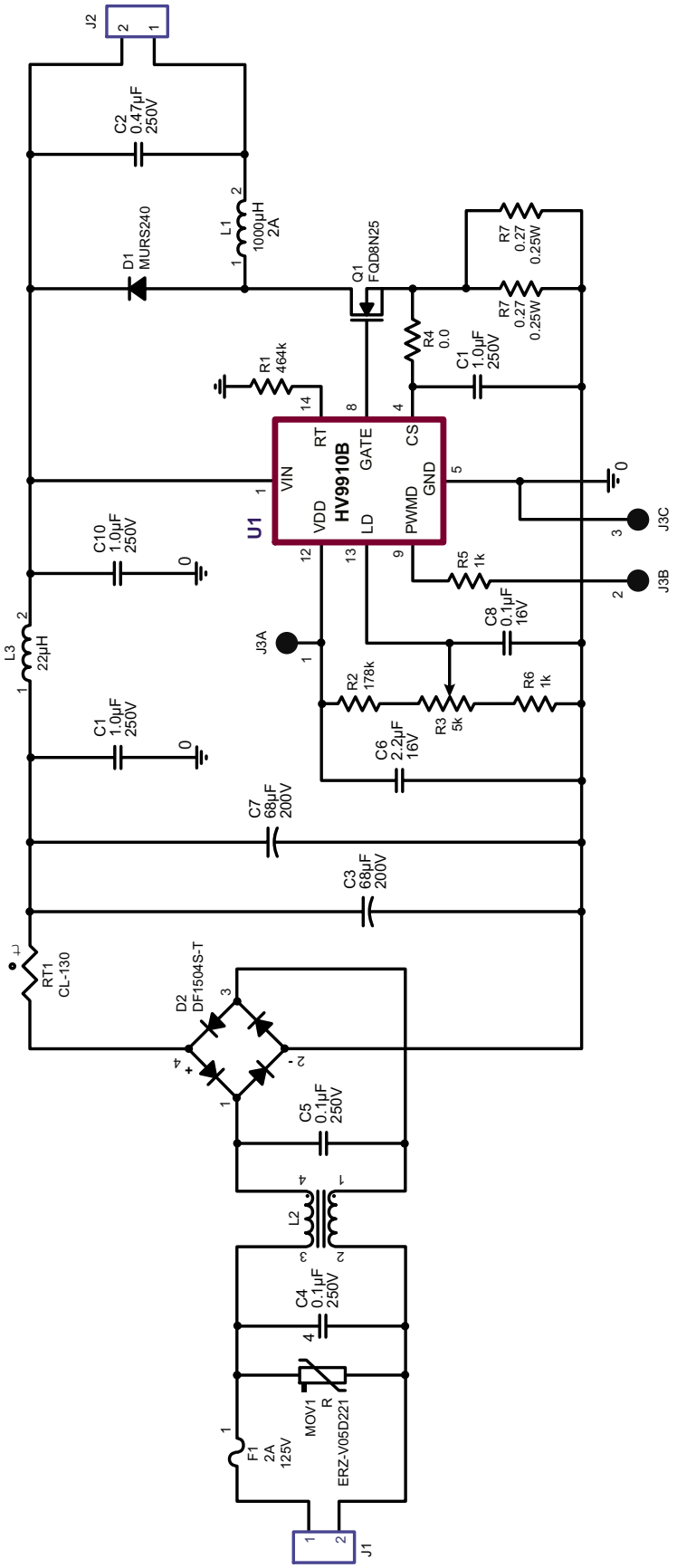
Conducted EMI Measurements at Full Load and 110V AC input



Silk Screen



Schematic Diagram



Bill of Materials

Item #	Qty	RefDes	Description	Package	Manufacturer	Manufacturer's Part Number
1	2	C1, C10	1µF, 250V metallized polyester capacitor	Radial	EPCOS Inc	B32522C3105J
2	1	C2	0.47µF, 250V metallized polyester capacitor	Radial	EPCOS Inc	B32521C3474J
3	2	C3, C7	68µF, 250V electrolytic capacitor	Radial	Panasonic	EEU-EE2D680
4	2	C4, C5	0.1µF, 250V metallized polyester X2 capacitor	Radial	Panasonic	ECQ-U2A104MV
5	1	C6	2.2µF, 16V, X7R ceramic chip capacitor	SMD0805	---	---
6	1	C8	0.1µF, 50V, X7R ceramic chip capacitor	SMD0805	---	---
7	1	C9	open	---	---	---
8	1	D1	400V, 2A ultra fast recovery diode	SMB	ON Semi	MURS240T3
9	1	D2	400V, 1.5A single phase diode bridge	DF-S	Diodes Inc	DF1504S-T
10	1	F1	2A, 125V slow blow fuse	SMT	Littelfuse Inc	0452002.MRL
11	2	J1, J2	2 position 0.156" header	Thru-Hole	Molex	26-48-1021
12	1	J3	3 position, 0.1" pitch vertical header	Thru-Hole	Molex	22-28-4030
13	1	L1	1000µH, 2A rms, 2A sat inductor	Radial	Coilcraft	PCV-2-105-02L
-	-	---	Cross Reference	Radial	Coiltronics	CTX01-17784G-R
14	1	L2	0.6mH, 1A rms common mode choke	Thru-Hole	Coilcraft	BU9-6011R0BL
15	1	L3	22µH, 2.1A sat, 1.9A rms inductor	Radial	Coilcraft	RFB0807-220L
16	1	MOV1	220V, 600A surge absorber	Radial	Panasonic	ERZ-V05D221
17	1	Q1	250V, 0.55Ω, N-channel FET	DPAK	Fairchild Semi	FQD8N25
18	1	RT1	2A rms, 50Ω inrush current limiter	Radial	GE Sensing	CL-130
19	1	R1	464KΩ, 1/8W, 1% chip resistor	SMD0805	---	---
20	1	R2	178KΩ, 1/8W, 1% chip resistor	SMD0805	---	---
21	1	R3	5KΩ 6mmsq single turn potentiometer	SMT	Bourns Inc	3361P-1-502GLF
22	1	R4	0.0Ω, 1/8W chip resistor	SMD0805	---	---
23	2	R5, R6	1KΩ, 1/8W, 1% chip resistor	SMD0805	---	---
24	2	R7, R8	0.27Ω, 1/4W, 1% chip resistor	SMD1206	---	---
25	1	U1	Universal LED Driver	SO-16	Supertex	HV9910BNG-G

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