

4W LED Driver Demoboard with Accurate Average-Mode Constant Current Control

General Description

The HV9967BDB1 demoboard is a high-brightness LED driver designed to drive 4 LEDs in series at currents up to 350mA from a 20 - 60V DC input. The demoboard uses the Supertex's HV9967B in a buck configuration in a constant off-time mode.

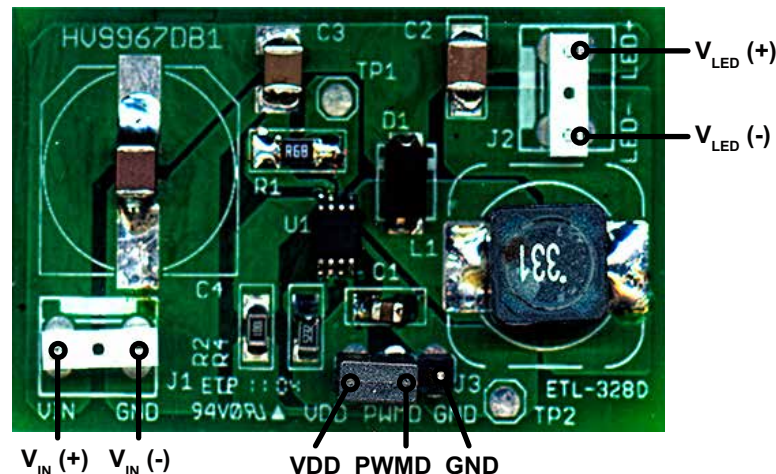
The HV9967BDB1 LED driver features tight regulation of the LED current within a few milliamps over the entire range of the input voltage (i.e. 20 - 60VDC). The LED current accuracy is almost insensitive to the passive component tolerances, such as the inductance or the timing resistor.

PWM dimming can be achieved by applying a pulse-width-modulated square wave signal between the PWMD and GND pins.

Specifications

Parameter	Specification
Input voltage	20 - 60 VDC
Output voltage	10 -15VDC (4 x LEDs)
Output current	350mA $\pm$ 5%
Output current ripple	20% pk-pk (Typical, depending on the type of LED)
Switching frequency	Variable with constant $T_{OFF} = 5\mu s \pm 20\%$
Full load efficiency	Typical 80% minimum
Output short circuit protection	Included, hiccup mode

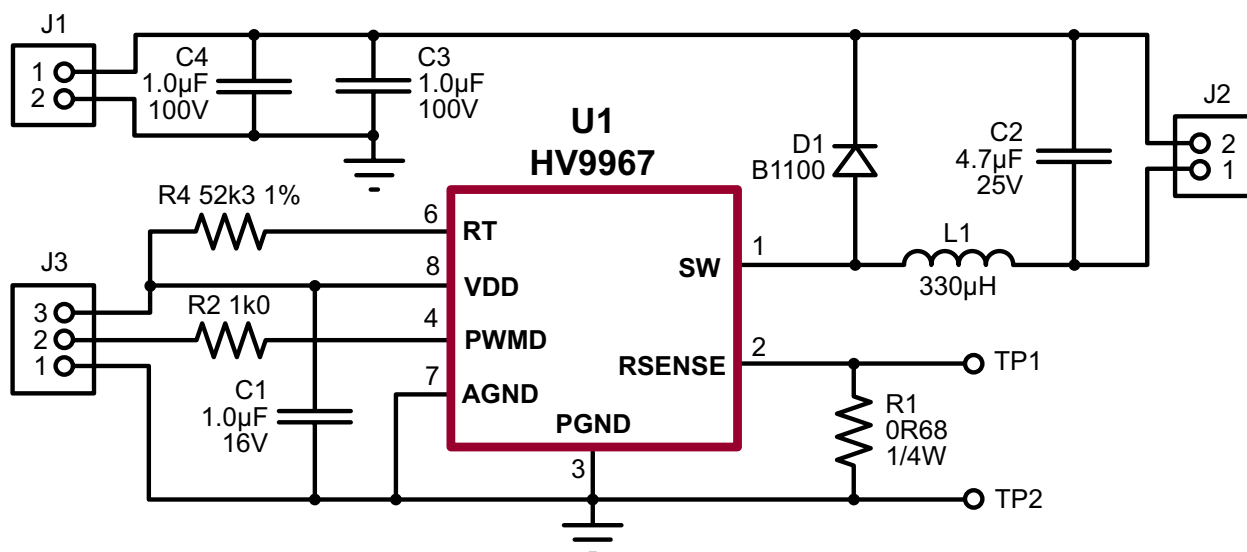
Connection Diagram



Connections

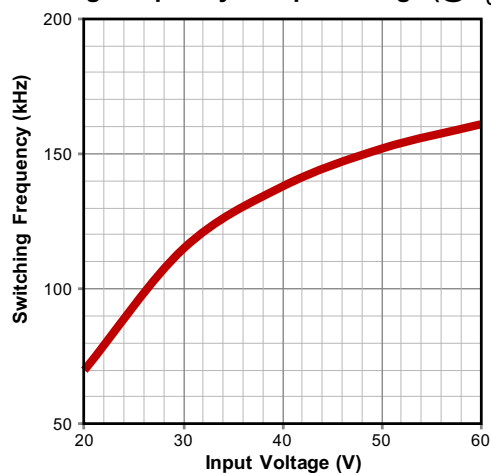
1. Connect the LED string between LED+ (Anode of LED string) and LED- (Cathode of LED string).
2. Connect the PWMD terminal to the VDD terminal to enable the LED driver if PWM dimming is not required.
3. Connect the input DC voltage between the VIN+ and VIN- terminals.

Circuit Schematic

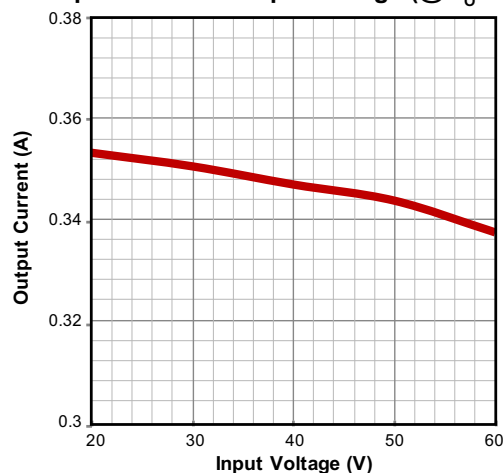


Typical Characteristics

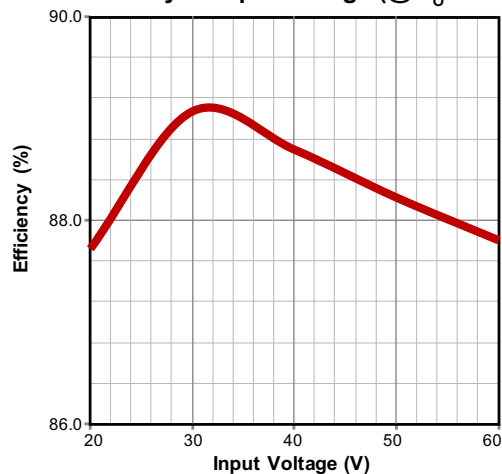
Switching Frequency vs Input Voltage (@ $V_o = 12V$)



Output Current vs Input Voltage (@ $V_o = 12V$)



Efficiency vs Input Voltage (@ $V_o = 12V$)



Normal Operation:

Figures 1-4 show the waveforms during normal operation at loading of 4 x LED in series at different input.

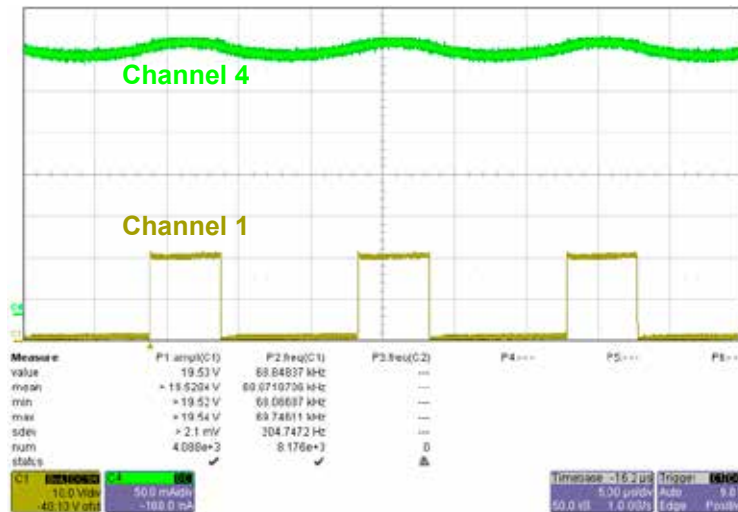


Figure 1: 20V Output

Channel 1 (Brown) : Drain-Source Voltage (10V/div)
 Channel 4 (Green) : Output LED Current (50mA/div)
 Time Scale : 5μs/div

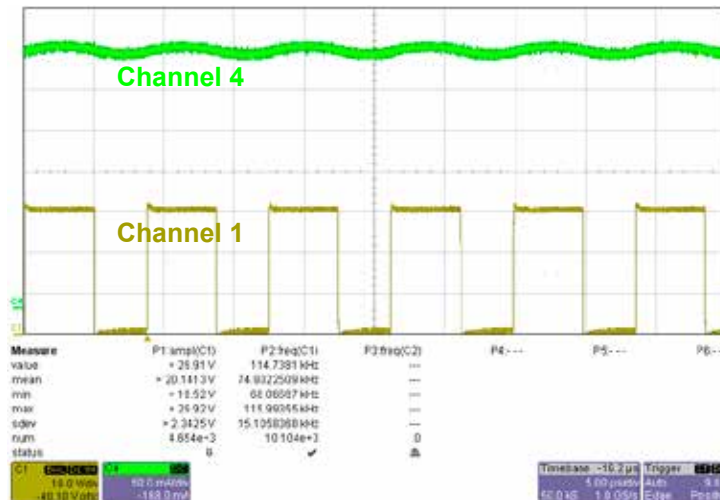


Figure 2: 30V Output

Channel 1 (Brown) : Drain-Source Voltage (10V/div)
 Channel 4 (Green) : Output LED Current (50mA/div)
 Time Scale : 5μs/div

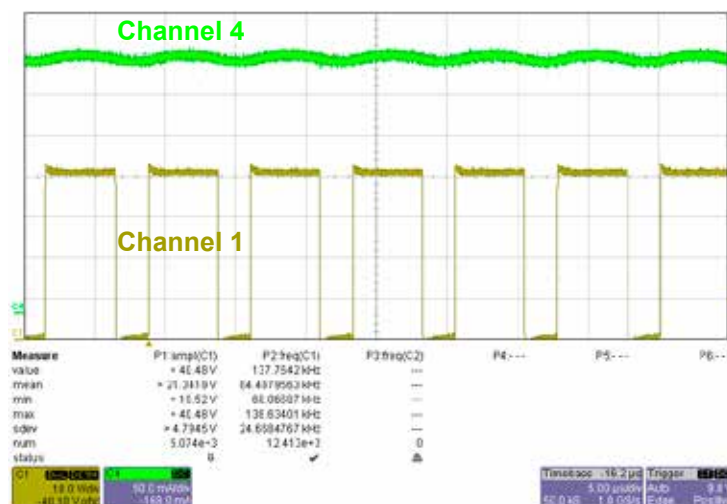


Figure 3: 40V Output

Channel 1 (Brown) : Drain-Source Voltage (10V/div)
 Channel 4 (Green) : Output LED Current (50mA/div)
 Time Scale : 5μs/div

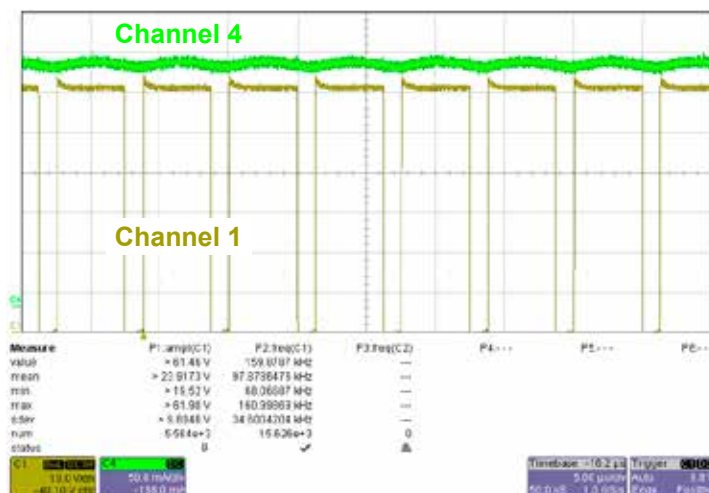


Figure 4: 60V Output

Channel 1 (Brown) : Drain-Source Voltage (10V/div)
 Channel 4 (Green) : Output LED Current (50mA/div)
 Time Scale : 5μs/div

PWM Dimming Operation:

PWM dimming operation at 4xLED in series with an external TTL square wave signal is shown in Figures 5 - 7. Figure 5 shows the overall operation of the circuit with PWM dimming input and Figures 6 and 7 show the rise and fall times of the LED current during PWM dimming.

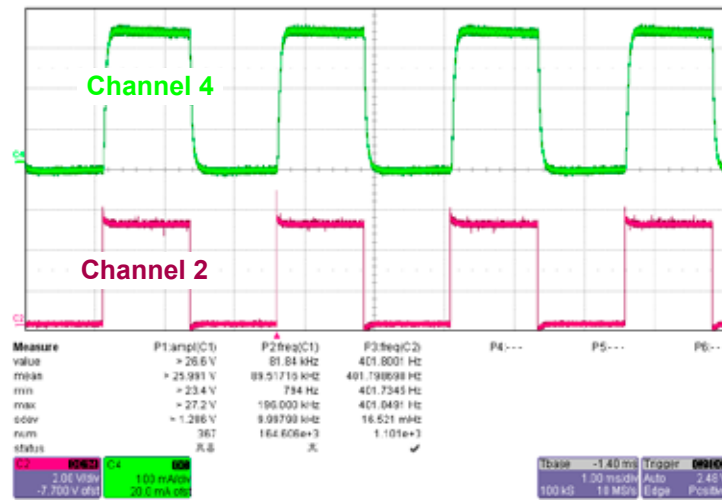


Figure 5: PWM Dimming at 24V PWM Input

Channel 2 (Pink) : Drain-Source Voltage (2V/div)
Channel 4 (Green) : Output LED Current (100mA/div)
Time Scale : 1ms/div

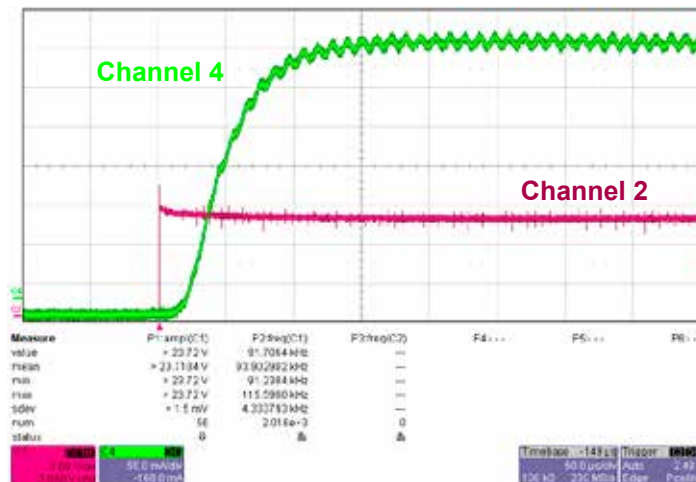


Figure 6: PWM Dimming at 24V - Rise Time

Channel 2 (Pink) : Drain-Source Voltage (2V/div)
Channel 4 (Green) : Output LED Current (50mA/div)
Time Scale : 50μs/div

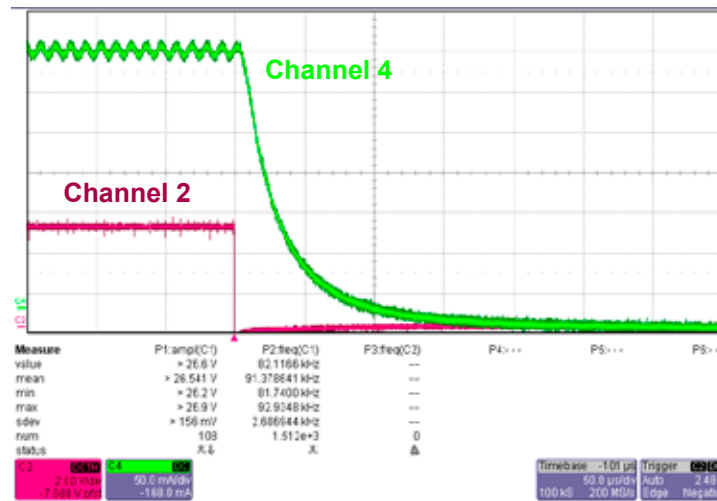


Figure 7: PWM Dimming at 24V - Fall Time

Channel 2 (Pink) : Drain-Source Voltage (2V/div)

Channel 4 (Green) : Output LED Current (50mA/div)

Time Scale : 50µs/div

Bill of Materials

Item#	Qty	Ref Des	Description	Package	Manufacturer	Manufacturer's Part Number
1	1	C1	1µF 16V X7R ceramic chip capacitor	SMD 0805	Murata	GRM21BR71C105KA88L
2	1	C2	4.7µF 25V X7R ceramic chip capacitor	SMD 1206	Murata	GRM31CR71E475KA88L
3	2	C3, C4	1µF 100V X7R ceramic chip capacitor	SMD 1210	Murata	GRM32CR72A105KA88L
4	1	D1	100V 1A Schottky rectifier	SMA	Diodes Inc	B1100-13-F
5	2	J1, J2	2 position 5.08mm pitch vertical header	Thru-hole	Molex	10-08-5021
6	1	J3	3 position 2.54mm pitch vertical header	Thru-hole	Molex	22-03-2031
7	1	L1	330µH 0.39A 0.45A sat inductor	SMT	Würth Elektronik	744 777 233
8	1	R1	0R68 1/4W 1% chip resistor	SMD 1206	-	-
9	1	R2	1K0 1/8W 1% chip resistor	SMD 0805	-	-
10	1	R4	52K3 1/8W 1% chip resistor	SMD 0805	-	-
11	1	U1	HV9967B Universal LED Driver	MSOP-8	Supertex	HV9967BMG-G

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