



## LED Driver Demo Board

### Input 85-265VAC // Output 150mA, 21V (3W)

#### General Description

The AN9910BDB8 demo board is a High Brightness LED power driver to supply a string of LEDs using the An9910B IC from a universal AC input voltage.

The An9910B is an open loop current mode control LED driver IC. It is ideally suited for buck LED drivers. Since the An9910B operates in open loop current mode control, the controller achieves good output current regulation without the need for any loop compensation.

This demo board can supply a maximum output current of 150mA to drive 18 - 21V LED strings from a wide input voltage - 85 to 265VAC, 50Hz.

The power conversion stage of the board consists of a diode bridge rectifier followed by a current-controlled buck converter operating at a switching frequency of 60kHz.

The circuits featured are output current soft start and protections from, load overvoltage and open circuit. The driver is inherently short circuit proof by virtue of the peak current regulation method.

Specifications	
Input AC voltage	85 to 265V, 50Hz
Output voltage	18 to 21V
Output current	150mA +/-10%
Power factor	> 55%
Full load efficiency	80% (220VAC input)
100 Hz Output Current Ripple	< 18%
Output short circuit protection	Yes
Output overvoltage, open circuit protection	Yes
Constant off-time	15 us
Switching frequency	About 60kHz ( depends on the input and output voltage)
Operating Temperature	-25 ... +60 °C
Dimensions	40 x 25 x 20 mm

#### Warning!

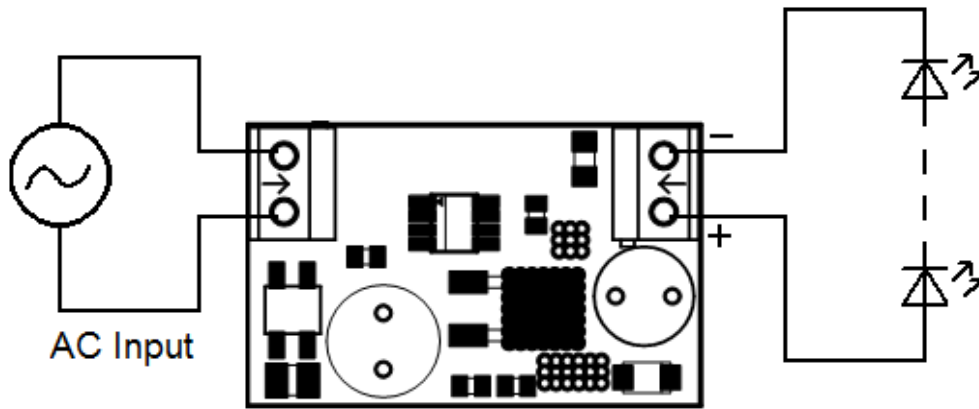
*Working with this board can cause serious bodily harm or death. Connecting the board to a source of line voltage will result in the presence of hazardous voltage throughout the system including the LED load.*

*The board should only be handled by persons well aware of the dangers involved with working on live electrical equipment. Extreme care should be taken to protect against electric shock. Disconnect the board before attempting to make any changes to the system configuration. Always work with another person nearby who can offer assistance in case of an emergency. Wear safety glasses for eye protection.*

*The electrolytic capacitor carries a hazardous voltage for an extended time after the board is disconnected. Check the capacitor voltage before handling the board.*



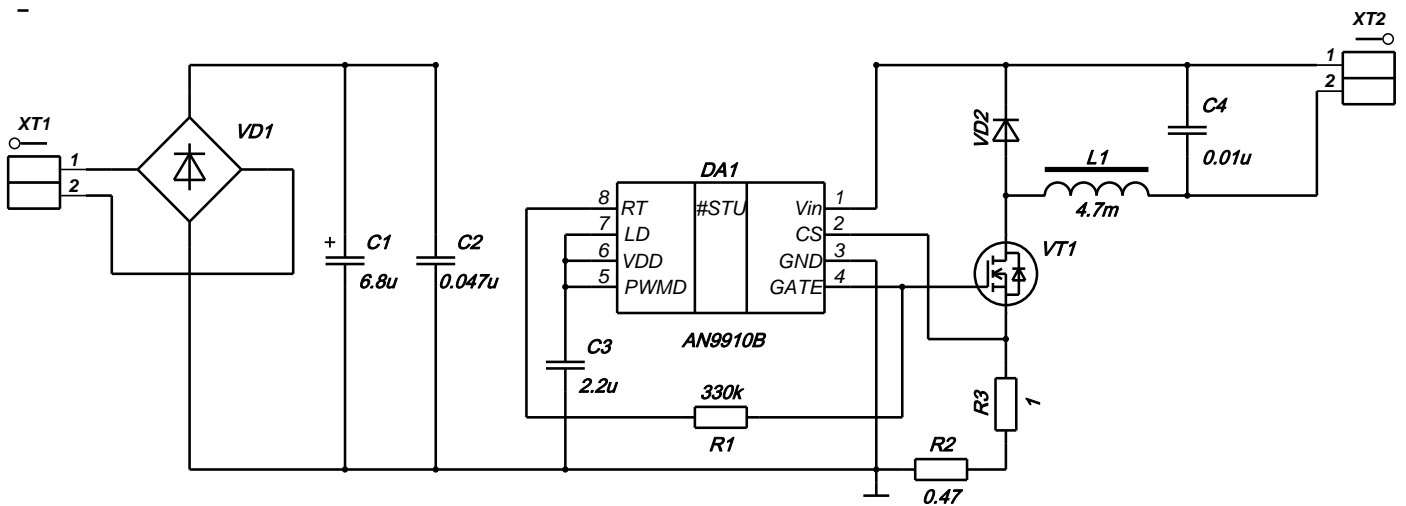
### Board Connections



### Connection Instructions

1. Carefully inspect the board for shipping damage, loose components, etc, before making connections.
2. Connect the board to the line and load as shown in the diagram. Be sure to check for correct polarity when connecting the LED string to avoid damage to the string. The LED string voltage can be anything between 18 and 21V.
3. Energize the mains supply.

### Schematic Diagram





## Principles of Operation

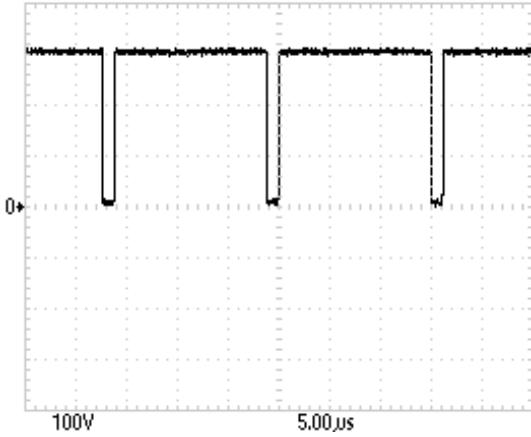
The HV9910B is optimized to drive buck LED drivers using open-loop peak current mode control. This method of control enables fairly accurate LED current control without the need for high side current sensing or the design of any closed loop controllers.

The oscillator in the HV9910B is controlled by a single resistor connected at the RT pin. The resistor R1 is connected between RT and GATE, and the circuit operates in a constant off-time mode and the above equation determines the off-time. The oscillator produces pulses at regular intervals. These pulses set the SR flip-flop in the An9910B which causes the GATE driver to turn on. The same pulses also start the blanking timer which inhibits the reset input of the SR flip flop and prevent false turn-offs due to the turn-on spike. When the FET turns on, the current through the inductor starts ramping up. This current flows through the external sense resistor  $R_{cs}$  (R2, R3) and produces a ramp voltage at the CS pin.

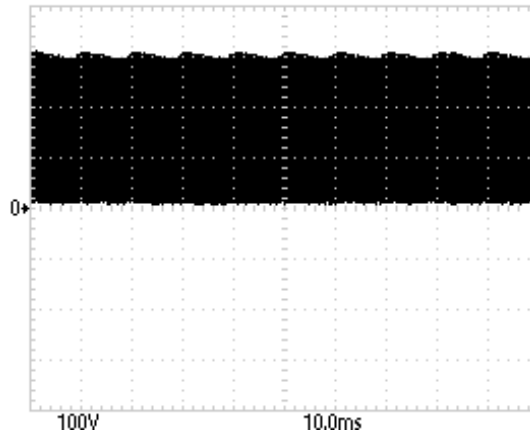


Waveforms

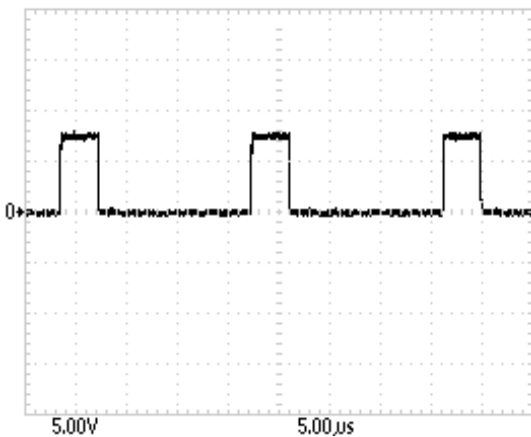
Drain voltage



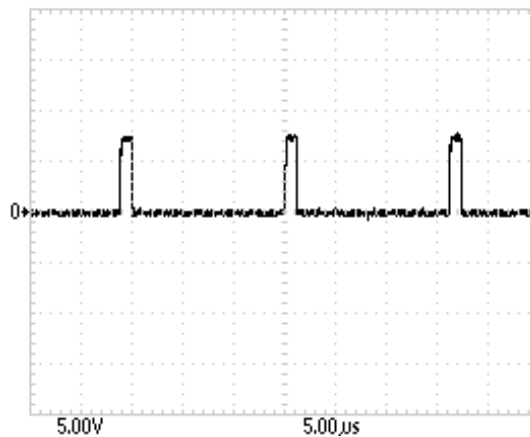
Drain voltage (overview)



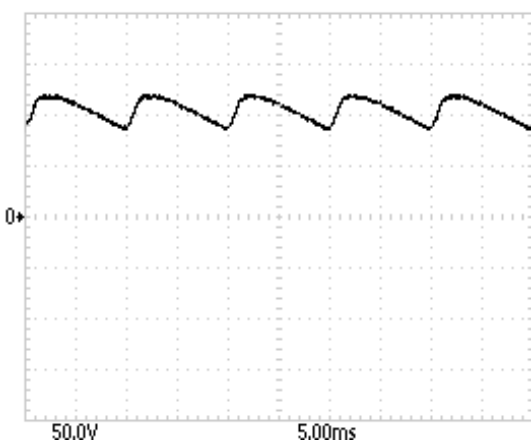
GATE (low input voltage)



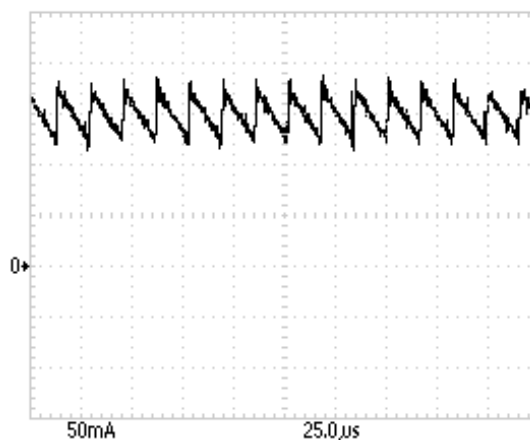
GATE (high input voltage)



V<sub>in</sub> pin of DA1

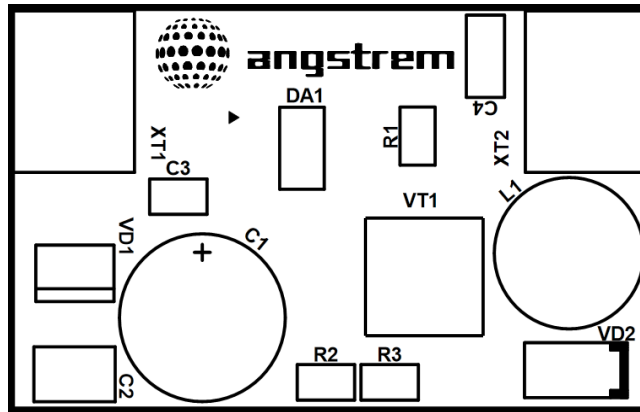
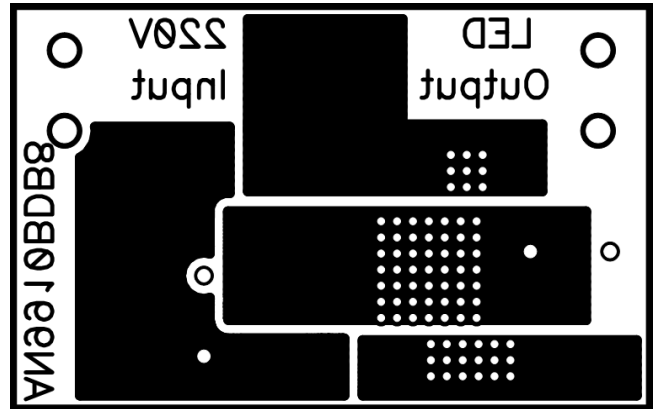
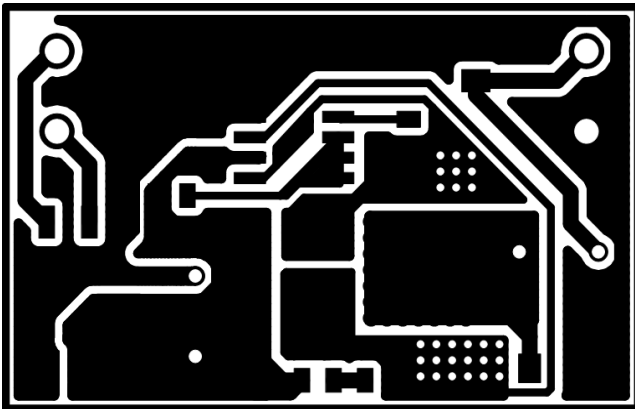


Output current





PCB Layout



Bill of Materials

Qty	REF	Description	Manufacturer	Product Number
1	C1	Cap Alu 6.8uF 400V	Rubycon	400LLE6R8MEFC10X16
1	C2	Cap X7R 1210 0.047uF 630V	-	-
1	C3	Cap X7R 0805 2.2uF 25V	-	-
1	C4	Cap X7R 1206 0.01uF 630V	-	-
1	DA1	IC LED Driver	Angstrem	AN9910B
1	L1	Inductor 4.7mH 0.20A	Würth Electronics	7447452472
1	R1	Res 0805 330kOhm 1%	-	-
1	R2	Res 0805 0.47Ohm 1%	-	-
1	R3	Res 0805 10hm 1%	-	-
1	VD1	Rect Bridge MiniDIL 600V 0.5A	Diotec	S250
1	VD2	Diode UltraFast 600V 1A	ST	STTH1R06A
1	VT1	Transistor N-MOS 650V 1.4Ohm 12 nC	Infineon	SPD03N60C3
2	X1, X2	Terminal Block 250VAC 1A	Ninqbo Xinya M&E	300-021-12