HIGH BRIGHTNESS LED DRIVER

GENERAL DESCRIPTION

The M1910B/C is a PWM high-efficiency LED driver control IC. It allows efficient operation of High Brightness (HB) LEDs. The M1910B/C controls an external MOSFET at fixed switching frequency up to 300 kHz. The frequency can be programmed using a single resistor. The LED string is driven at constant current rather than constant voltage, thus providing constant light output and enhanced reliability. The M1910C provide a constant voltage loop compensation for compensation voltage loop gain.

The output current can be programmed between a few milliamps and up to more than 10A. Output current to an LED string can be programmed to any value between zero and its maximum value by applying an external control voltage at the linear dimming control input of the M1910B. The M1910B provides a low-frequency PWM dimming input that can accept an external control signal with a duty ratio of 0-100% and a frequency of up to a few kilohertz.

FEATURES

- >85% Efficiency
- 2.5V to 450V input range
- Constant-current LED driver
- Constant voltage loop compensation
- Applications from a few mA to more than 1A Output
- LED string from one to hundreds of diodes
- PWM Low-Frequency Dimming via PWM pin

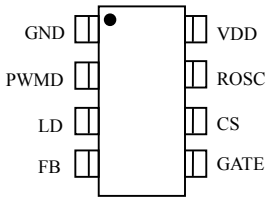
APPLICATIONS

- DC/DC or AC/DC LED Driver applications
- RGB Backlighting LED Driver
- Back Lighting of Flat Panel Displays
- General purpose constant current source
- Signage and Decorative LED Lighting
- Chargers

HIGH BRIGHTNESS LED DRIVER

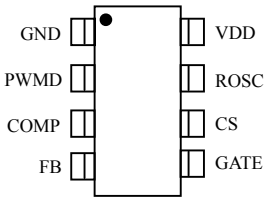
PIN ASSIGNMENT

M1910B



(Buck converter)

M1910C

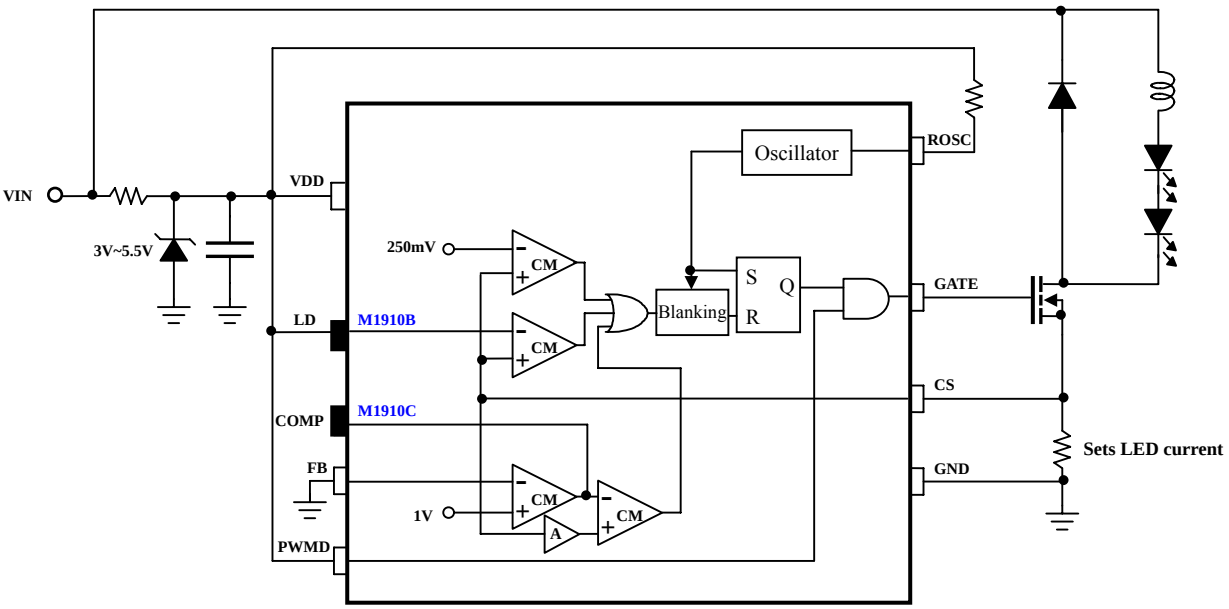


(Buck, Boost converter)

PIN DESCRIPTION

Pin No		I/O	Pin Name	Description
M1910B	M1910C			
1	1		GND	Device ground
2	2	I	PWMD	Low Frequency PWM Dimming pin, also Enable input.
3		I	LD	Linear Dimming by changing the current limit threshold at current sense comparator
	3	I	COMP	Constant Voltage Loop Compensation. This pin connects a capacitor between COMP and GND for compensation voltage loop gain.
4	4	I	FB	Reference voltage. Internal threshold set to 1.0V. Connect external resistor to program LED current
5	5	O	GATE	Drives the gate of the external MOSFET
6	6	I	CS	Inductor current sense input. Internal threshold voltage set to 250mV. Connect external sense resistor .
7	7	I	ROSC	Oscillator control. A resistor connected between his pin and VDD sets the PWM frequency.
8	8		VDD	Positive power

BLOCK DIAGRAM



HIGH BRIGHTNESS LED DRIVER

ABSOLUTE MAXIMUM RATING

(TA=25℃)

Parameter	Rating	Unit
Power Supply V_{DD} With Respect to V_{SS}	6.0	V
CS, LD, PWMD, GATE,FB,ROSC to GND	-0.3 to Vdd + 0.3	V
Operating Temperature	-40 to +85	℃
Storage Temperature	-65 to 150	℃

ELECTRICAL CHARACTERISTICS

Characteristics	Sym.	Min.	Typ.	Max.	Unit	Conditions
Supply Voltage	VDDmax	2.5		5.5	V	
Pin PWMD input low voltage	$V_{EN(lo)}$			1.0	V	V_{DD}= 5V
Pin PWMD input high voltage	$V_{EN(hi)}$	2.4			V	V_{DD}= 5V
Current sense threshold voltage	$V_{CS(hi)}$	242	250	258	mV	
Feedback threshold voltage	V_{FB}	970	1000	1030	mV	
GATE high output voltage	$V_{GATE(hi)}$	VDD-0.3		VDD	V	I_{OUT} = 10mA
GATE low output voltage	$V_{GATE(lo)}$	0		0.3	V	I_{OUT} = -10mA
Oscillator frequency	Fosc	80	100	120	KHz	R_{OSC} = 240KΩ
		20	25	30	KHz	R_{OSC} = 1.0MΩ
Maximum Oscillator PWM Duty Cycle	D_{MAXhf}			99	%	F_{PWMhf} = 100KHz, at GATE, CS to GND.
Linear Dimming pin voltage range	V_{LD}	0		250	mV	V_{DD}= 5V
Current sense blanking interval	T_{BLANK}	150	215	280	ns	V_{CS} = 0.55V_{LD}, V_{LD} = VDD
GATE output rise time	T_{RISE}		30	50	ns	C_{GATE} = 500pF
GATE output fall time	T_{FALL}		30	50	ns	C_{GATE} = 500pF

APPLICATION INFORMATION

LED Driver Operation

The M1910B/C can control all basic types of converters. When the gate via the external power MOSFET, the LED driver stores the input energy in an inductor or delivers the energy directly to LEDs (depending on the application circuit). The sampling resistor that connects to CS pin controls the maximum value of LED current. When the voltage at CS pin exceeds the internally set, 250mV threshold, the power MOSFET turns off. It can be programmed externally by applying voltage to the LD pin that will be limited the LED maximum current. When soft start is required, a capacitor can be connected to the LD pin to allow the voltage to ramp at a desired rate.

Programming Operating Frequency

The operating frequency of the oscillator is programmed between 25 and 300kHz using an external resistor connected to the ROSC pin :

$$Fosc = \frac{25500}{Rosc[K\Omega] + 18}[KHz]$$

Inductor Design

Referring to the typical application circuit below the value can be calculated from the desired peak-to-peak LED ripple current in the inductor. Typically, such ripple current is selected to be 30% of the nominal LED current. In the example given here, the nominal current ILED is 350mA.

The next step is determining the total voltage drop across the LED string. For example, when the string consists of 10 High - Brightness LEDs and each diode has a forward voltage drop of 3.0V at its nominal current; the total LED voltage VLEDS is 30V. Knowing the nominal rectified input voltage VIN=120V*1.41=169V, the switching duty ratio can be determined, as:

$$D = \frac{Vleds}{Vin} = \frac{9.6}{169} = 0.056$$

Then, given the switching frequency, in this example fosc=50 KHz, the required on-time of the MOSFET transistor can be calculated:

$$Ton = \frac{D}{Fosc} = \frac{0.056}{16\,KHz} = 3.5\mu\,\mathrm{sec}$$

The required value of the inductor is given by:

$$L = \frac{(Vin - Vleds) * Ton}{0.3 * Ileds} = \frac{(169v - 9.6V) * 3.5\mu\,\mathrm{sec}}{0.3 * 350mA} = 4.6mH$$

Setting Light Output

When the buck converter topology of Figure 1 is selected, the peak CS voltage is a good representation of the average current in the LED. However, there is a certain error associated with this current sensing method that needs to be accounted for. This error is introduced by the difference between the peak and the average current in the inductor.

For example if the peak-to-peak ripple current in the inductor is 150mA, to get a 500mA LED current, the sense resistor should be

$$Rcs = \frac{250mV}{Il + 0.5\Delta Il} = \frac{250mV}{350mA + 0.5 * 150mA} = 0.58\Omega$$

Dimming

1. Linear

The Linear Dimming pin is used to control the LED current. An external 0-250mV voltage can be connected to the LD pin to adjust the LED current during operation.

To disable Linear dimming and enable the M1910B/C permanently, connect the PWMD pin to VDD

2. PWM

PWM Dimming can be achieved by driving the PWMD pin with a low frequency square wave signal. When the PWM signal is zero, the GATE driver is turned off and when the PWMD signal if high, the GATE driver is enabled.

To disable PWM dimming and enable the M1910B/C permanently, connect the PWMD pin to VDD.

APPLICATIONS

Buck Converter

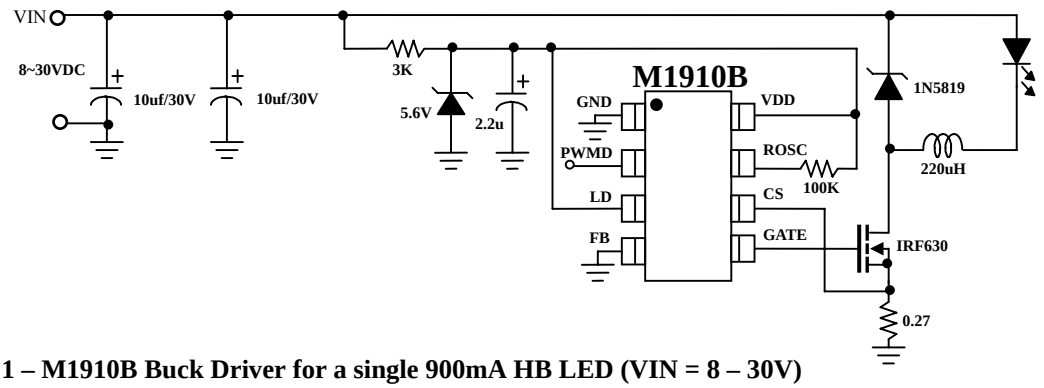


Figure 1 – M1910B Buck Driver for a single 900mA HB LED (VIN = 8 – 30V)

Buck-Boost Converter

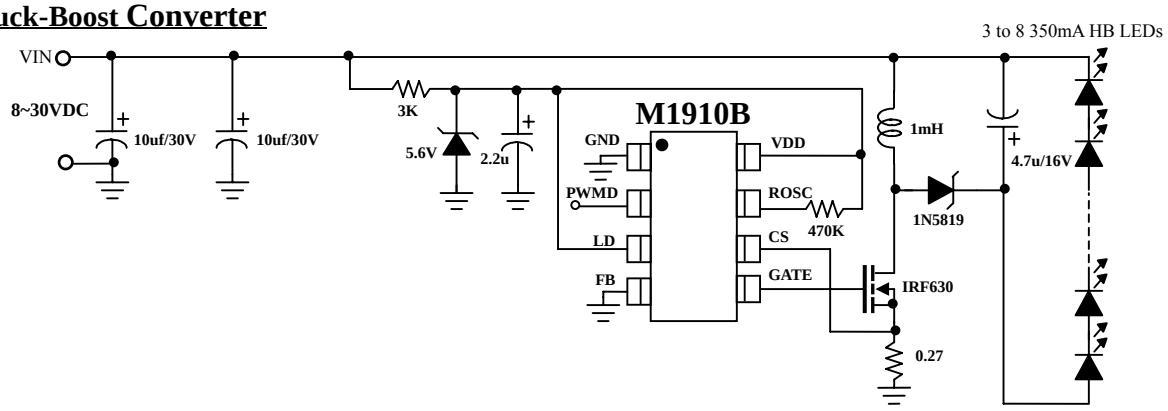


Figure 2 – M1910B Buck-Boost driver powering 3 to 8, 350mA HB LEDs (VIN = 8 – 30VIN)

Boost Converter

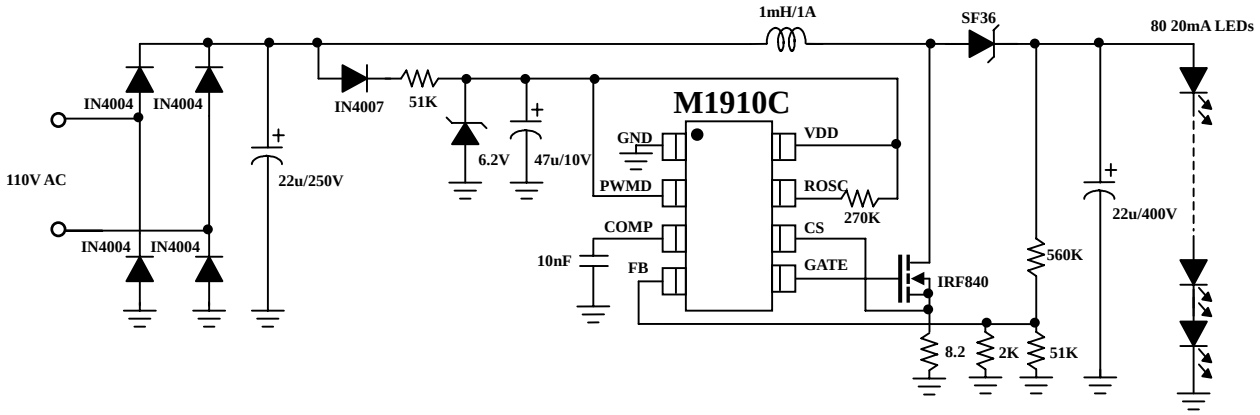


Figure3– M1910C Boost Driver powering 80 20mA LEDs, (VIN =110V AC)

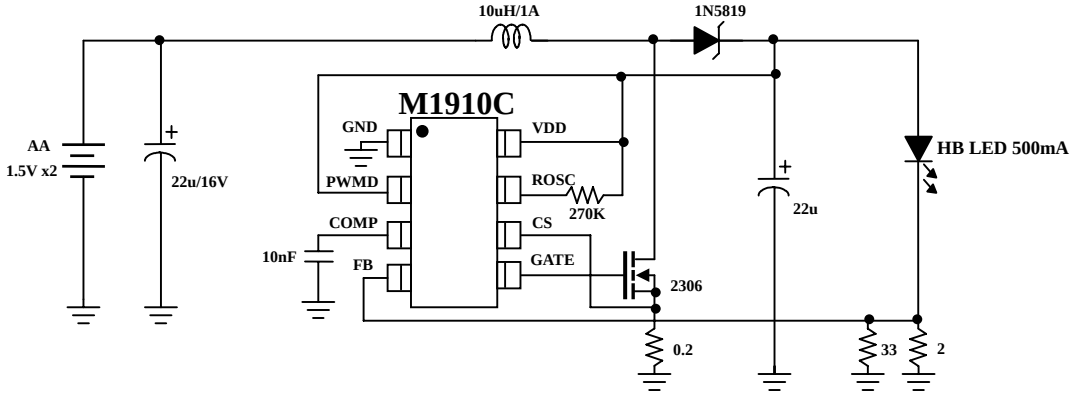
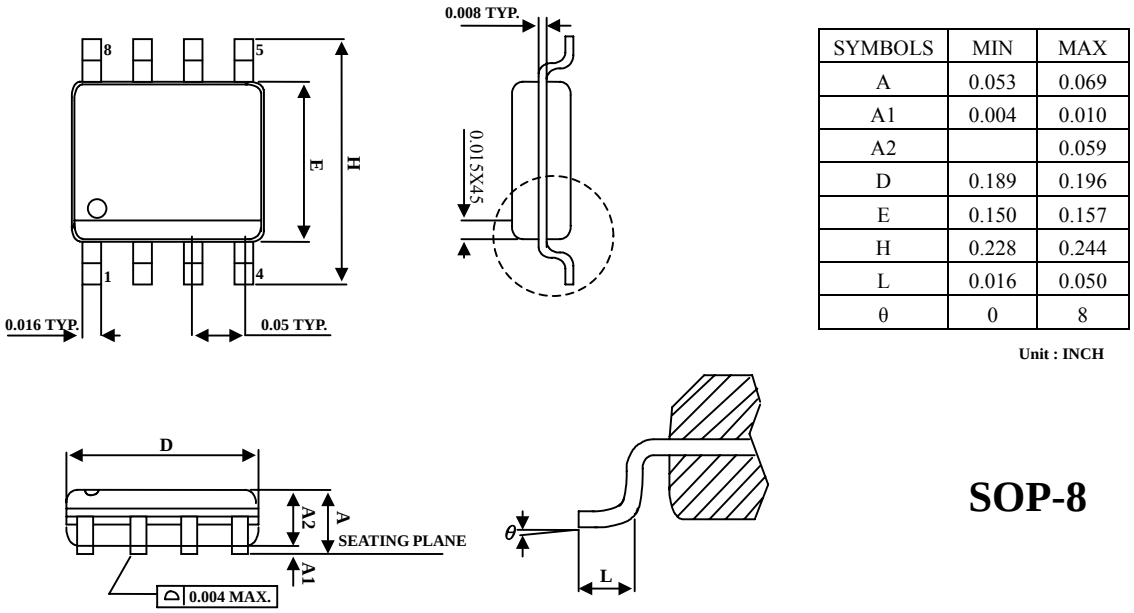


Figure 4 – M1910C Boost Driver for a single 500mA HB LED (VIN =3V, Dual AA cell)

* All specs and applications shown above subject to change without prior notice.
(以上電路及規格僅供參考,本公司得逕行修正)

PACKAGE OUTLINE

8-Pin Plastic SOP



SYMBOLS	MIN	MAX
A	0.053	0.069
A1	0.004	0.010
A2		0.059
D	0.189	0.196
E	0.150	0.157
H	0.228	0.244
L	0.016	0.050
θ	0	8

Unit : INCH

SOP-8