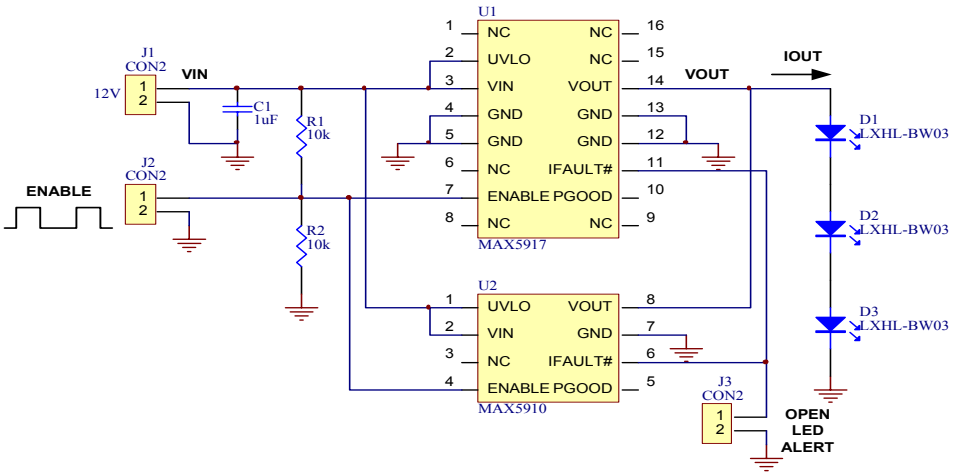
HIGH BRIGHTNESS LED (HBLED) DRIVER

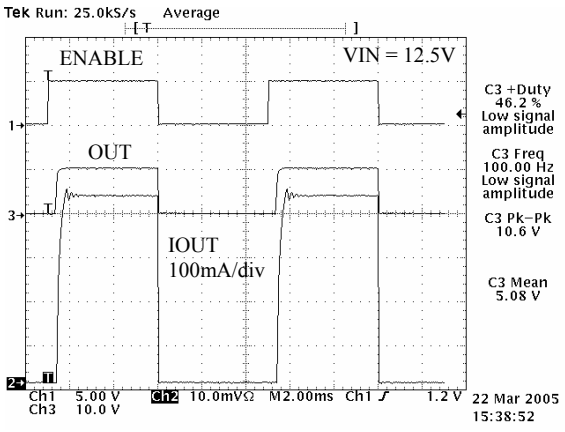
MAX5910/MAX5917 make HBLED driver task simple by integrating the power MOSFET on board. The devices offer dimming capability, open LED detection and over temperature protection. The following circuit illustrates a complete HBLED driver circuit. The circuit limits the current drawn by the LED's with a preset limits. The circuit can drive one or multiple HBLED in series. The circuit uses either MAX5917A, MAX5917B or MAX5910 for different current limit level. The devices can work in parallel to deliver higher current if needed. The circuit also detects an open LED string and asserts the IFAULT# signal.

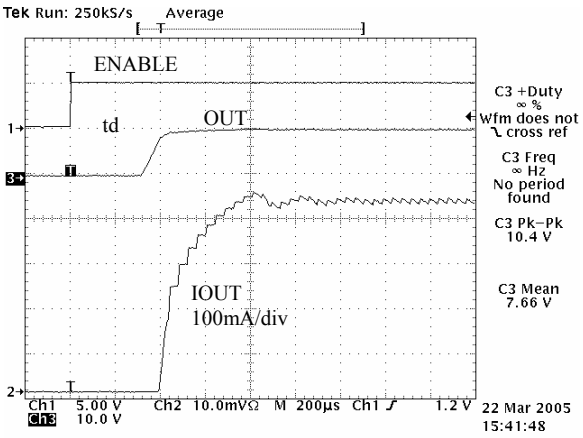


The circuit has the following features:

- 10V – 65V Input Power
- Drives One or Multiple HBLED in Series. Drives Three HBLED for 12V input.
- Constant Current Limit with Integrated Power MOSFET
  - MAX5917A: 510mA – 623mA
  - MAX5917B: 370mA – 470mA
  - MAX5910: 250mA – 310mA
- High Power Packages:
  - MAX5917A/B: 1039mW SO-16
  - MAX5910: 470mW SO-8
- Higher Current Option with Parallel IC
- Dimmable Through Enable Input (J2)
- Over Temperature Protection
- Open LED Alert Signal

The following plots show output voltage and current and the signal driving the ENABLE pin with input voltage at 12.5V





The circuit works as a constant current limiter, delivering a constant current (Ilim) to the LED as long as the LED forward voltage is less than the input voltage (VIN) minus the voltage drop across the integrated power MOSFET. The voltage drop can be calculated as follow:

Vdrop = Ilim*RDS(on)

Ex. For MAX5917B, Ilim = 420mA (typ) and RDS(on)=2.2 Ohm (typ) → Vdrop = 420mA*2.2 Ohm = 0.924V (typ).

To drive a series of HBLED, make sure their forward voltage drop is less than VIN minus Vdrop, considering all worst case conditions.

To dim the LED, drive the ENABLE pin with pulses. Pulse magnitude must be between 2.4V and 12V. Adjust the pulse duty cycle for different brightness. Lower duty cycle give less light output and at the same time reducing the integrated MOSFET power dissipation. There is a turn on time delay (td) from the valid on condition at the ENABLE to when the output turn on. This td (typically 400us) does affect the output duty cycle and must be taken into account. The output effective duty cycle (De) can be calculated as follow:

De = (D*Ts – td)/Ts ; Where Ts is the pulse period and D is the duty cycle at the ENABLE pin.

The following equation calculates the power dissipation in the integrated MOSFET:

P = (VIN – Vd)*Ilim*De ; Where Vd is the forward voltage drop of the LED.

Example: Luxeon XHL-BW03 forward voltage drop is 3.42V (typ) each. Pulse is 50%, 100Hz at the ENABLE pin, VIN = 12.5V, and MAX5917B is used.

P = (12.5V – 3*3.42V)*0.420A*((0.5/100Hz-400us)*100Hz) = 0.43W

MAX5910's SO-8 package has junction to ambient thermal coefficient Tja = 170°C/W. The device over-temperature shutdown (Tsd) threshold is 140°C. At the given ambient temperature (Ta), the maximum power the package can take before going into thermal shut down is:

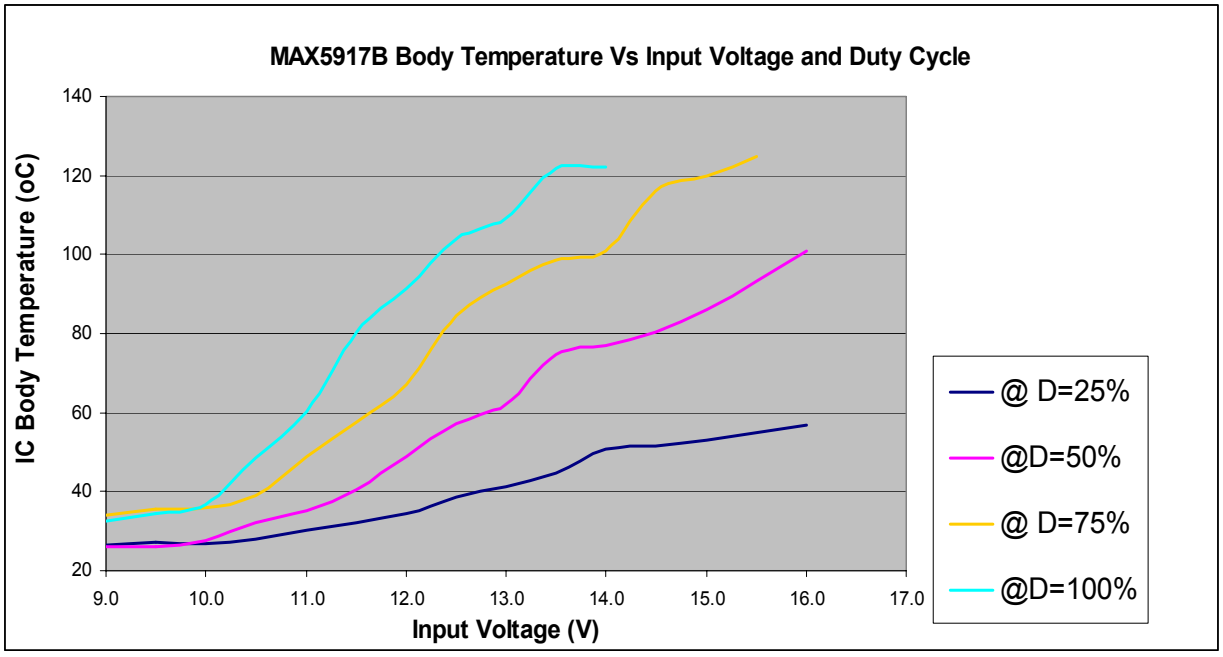
P = (Tsd-Ta)/Tja

Example: Ta = 25°C, P = (140oC-25°C)/170°C/W = 0.676W

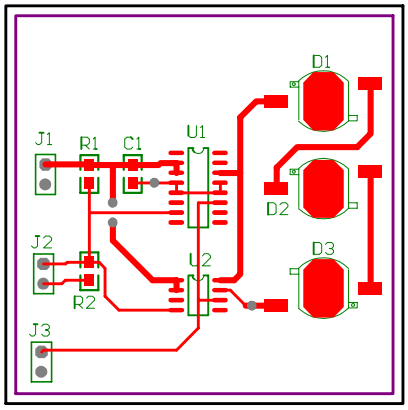
MAX5917's SO-16 package has Tja = 115°C/W which increases the power capability to 1W for the same condition.

MAX5910 and MAX5917 detect an open LED string and assert the IFAULT# signal. This signal can be used to alert the system of the fault.

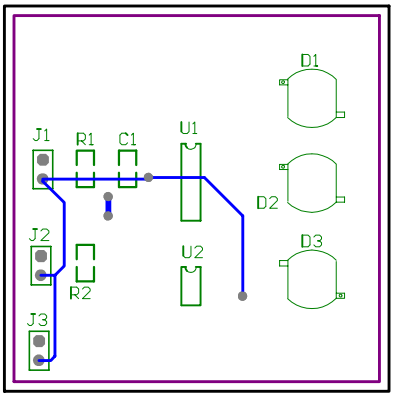
The following chart shows test result of the circuit using MAX5917B and three Luxeon XHL-BW01:



Circuit PCB layout information:



Component Side



Back Side

Circuit Bill of Material:

Comment	Footprint	Quantity	Designators
10k	0805	2	R1,R2
1uF	0805	1	C1
CON2	hdr1x2	3	J1,J2,J3
LXHL-BW03	emitter	3	D1,D2,D3
MAX5910	SO-8	1	U2
MAX5917	SO-16	1	U1