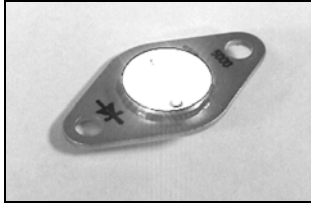


# SHARK SERIES HIGH FLUX LED ILLUMINATORS

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## FAQ'S

### FREQUENTLY ASKED QUESTIONS

**1. What are the dimensions of each LED die (L x W x H)?**

The dimensions are:

Red & Amber: nominal - 0.016 x 0.016 x 0.007" (390 x 390 x 170um)

Blue & Green: nominal - 0.0133 x 0.0133 x 0.0035" (340 x 340 x 90um)

Note: the die used may change

**2. What is the LED array pitch?**

Rows: 0.0435", Columns: 0.030", 4 center columns jogged up 0.005". The layout may change.

**3. How many LEDs are along each row and column of the array?**

The visible Shark arrays are 5 Rows and 10 columns.

**4. Do the LED's emit from their sides?**

Yes they can. The red and amber dies currently used emit from the top, but the green and blue emit on all sides.

**5. Is there an obscuring electrical contact on the top surface to which the whisker is connected? What are its dimensions?**

Yes and the dimensions are:

Red / Amber: one pad 0.0035" (90um).

Blue / Green: two pads 0.0035" round, 0.0039" square (90um, 100um).

Bond Wires: 0.001" (25um).

**6. The substrate upon which the LED dies are sitting is flat. What are its optical properties? Is it a scattering or specular surface?**

At this writing, the substrate material is bright white BeO and it is diffuse reflective. The metalization pattern is platinum silver. The optical modeling of the LED's as one lambertian plane using a 0.190" by 0.280" size seems to work well for raytrace type simulations.

**7. What is the thickness of the encapsulant that you are using (measured from the substrate)? What is its index of refraction?**

Assume 0.053" maximum thickness. Assume a refractive Index = 1.43.

**8. What is the electrical configuration of the LED die?**

The diodes are arranged electrically as 5 series diodes and 10 parallel strings of 5 each.

**9. What is the best way to drive the Shark series electrically?**

The recommended way to drive a Shark is with a constant current source. A good current source would be a power NPN transistor with adequate emitter degeneration. This configuration offers a cheaper and lower power supply voltage requirement, and lower regulator/resistor watts than using say a LM317 configured as a current regulator. The other advantage of the transistor source is the ability to gang multiple sources together to control



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multiple devices at the same current. This is not possible with a LM317 approach.

## 10. How can I easily switch the device on and off?

For ON/OFF control, a transistor based current source can be more easily controlled at the base of the transistor, without having to control the full device current directly.

## 11. How can I control the device intensity electronically?

There are several techniques. If using a microprocessor with a D/A output, that output can be utilized as a base drive reference for a transistor based current source. The most important thing when designing this circuit not to exceed the drive current of the Shark device. With proper design techniques, the resulting drive current could be made 'linear' for most general needs.

## 12. What about Pulse Width Modulation (PWM)?

Pulse width modulation is another way to control the light output by pulsing the part on and off quickly. Set the current source to the maximum desired drive current, and then cyclically turn off the current source using a PWM counter to reduce the light intensity as required. This method doesn't require a microprocessor D/A or as much interface circuitry as the other approach, and would only use one microprocessor control line per device.

## 13. What is the maximum current I can drive a Shark in pulsed-mode operation?

Because there is such variation in pulse duration and duty cycles, this is a difficult question to answer. The data sheet for the Shark Illuminators (OTLH-SHK1-10) gives a maximum peak current based on four assumptions: (1) pulse duration is  $\leq 10$  ms, (2) duty cycle is  $\leq 10\%$ , (3) adequate heat sinking, and (4) the failure mode is a blown-out wire bond. There is good reason to believe that other failure modes would come into play at lower current levels. These failure mechanisms would be manifest by a rapid degradation of light output rather than the instant catastrophic nature of a failed wire bond. Because there are so many combinations of pulse duration and duty cycles, Opto Technology has not performed life tests for pulsed mode applications and cannot therefore make performance predictions. Opto Technology recommends that customers who desire pulsed-mode operation perform their own reliability studies with the appropriate operational parameters.

## 14. How do I compensate or set LED intensity? What about temperature and uniformity i.e. unit to unit variations in brightness?

Light output vs. temperature is different for each LED color/material. Red typically has a negative output change with increases in temperature. Blue and Green materials are typically less affected by temperature, but the forward voltage is more sensitive to temperature. Some people have suggested that using a series resistor drive could offer a first order correction for this for Red LED's. That is certainly the cheapest method, but does not address part to part variations, is inexact, and does not necessarily even work with different color LED's. Where uniformity and minimum luminous output are required we suggest the following:

- a) Use conservative estimates on available flux. Measure in-situ and then de-rate the number down. Use multiple devices running at less than max current. The more safety margin you use, the more robust the resulting design will be. This may be a major factor for hard to reach areas like buoys, or lights embedded in concrete.
- b) Use a photo-detector to sample your light output. TI / Burr-Brown make some handy detectors with integrated amplifiers on board. An optical attenuator may be required.
- c) Calibrate the photo-detector and unit output using a NIST traceable standard sensor during manufacturing. Store the calibration values in the unit for periodic measure, self re-calibrate cycles. The output when under light feedback regulation will now track the photo-detector temperature and life characteristics (which should also be examined for your application) and not LED aging, temperature, etc.

By running the Shark parts at lower than max output for self calibration adjustments, three major things are accomplished:

- A. Longer life and cooler running.



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- B. Less or no concern with binning parts for matching.
- C. Built-in margin for subsequent output degradation or temperature fluctuations.



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**Revision B (12/22/03)**

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