



# CIRCADIAN® Zirc™ LED Technology

Spectrally Optimized for Illumination, Human Health, Human Productivity and Energy Efficiency

## Breakthrough energy efficient Zirc™ DaySync™ - NightSafe™ LED Mid-Power pair for circadian lighting

The evidence is in. Our brains and bodies require blue-rich light during the day and absence of blue light at night to promote health and well-being. The matched pair of Zirc™ Day and Night LEDs for the first time provide an unparalleled 42-fold day-night contrast between blue emission at the peak effective 477 nm Circadian Potency wavelength. Not only does ZircLight™ provide a robust circadian entraining light solution, but with 124-143 lumens/watt delivered 24/7 there is no compromise in energy-efficiency to ensure climate change initiatives can be met.

In the natural world there is a strong circadian >100,000 fold contrast between 10,000 lux (cloudy day) and 0.1 lux (full moonlight). But unlike our ancestors we spend over 93% of our time indoors with conventional fluorescent and LED lighting which emits too little blue rich light during the day and far too much blue-rich light at night. Dozens of serious health disorders, from sleep disorders and fatigue, to obesity and diabetes, and even breast and prostate cancer have now been linked by the World Health Organization, American Medical Association and the NIH National Toxicology Program to the circadian disruption caused by the harmful effects of modern lighting.

### Why is 477nm blue the peak circadian wavelength?

Billions of years ago when life first began, the only light that penetrated the ocean depths was ~477 nm blue. All other spectral colors in sunlight are absorbed by sea water, so days were blue and nights black. Circadian clocks evolved using 477 nm blue as the signal for day and night. New research now shows that our eyes, like the primitive oceans, use blue light from 438-493 nm with a peak wavelength of 477 nm as the steady state signal for circadian entrainment. While short exposures in dark adapted laboratory volunteers may show some transient effects of violet and green, the key circadian signal is 438-493 nm blue. Circadian ZircLight™ LED's are spectrally engineered to adhere to this fundamental law of nature.

## Superior Solution

When you have to work in the evening or at night, you no longer need to dim the lights, or use ugly orange-yellow lighting, to avoid the harmful effects of blue-rich light at night. Spectrally engineered Zirc™ Day and Night light engines provide attractive energy efficient circadian healthy white light 24/7. Compared to 15-20% blue emissions of conventional LEDs, Zirc™ NightSafe™ LEDs deliver only 1.5% of blue content, easily meeting the UL verification mark of "Less than 2% blue light at Night" And during the day Zirc™ DaySync™ LEDs deliver 22% of blue content that has been critical to health since life began.

## Alertness and productivity at night safely delivered

Light is energizing especially when it contains shorter wavelengths such as blue and violet. Some have suggested using blue rich light at night to prevent fatigue, but that risks circadian disruption and ill health. Zirc™ NightSafe™ LEDs elegantly solve this problem by providing safe violet content, which is more effective than blue at promoting alertness and preventing errors, and with the advantage that it does not disrupt our circadian clocks.

## Matched Zirc™ DaySync™ and NightSafe™ LEDs

- 124 - 143 lumens/watt
- 3250 – 4000 K CCT white light
- CRI >80

## With a record-breaking contrast in Circadian Potency

- Zirc™ DaySync™ emits 42 times more Circadian Potent 477 nm blue than Zirc™ NightSafe™ LED
- More than 15-fold difference in total 438-493 nm blue emission
- Zirc™ NightSafe™ LED emits only <1.5% of visible energy in 443-493 nm blue Circadian potency band
- Exceeds the UL verification spec of <2% blue content at night



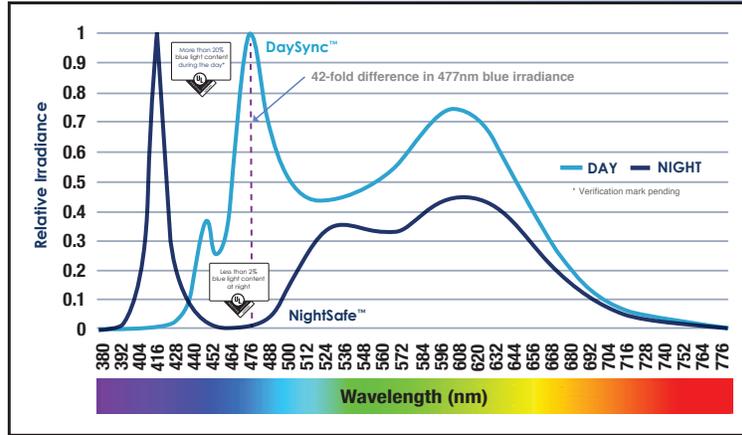
**CIRCADIAN®**  
ZircLight™

DynamicBlu™ Spectrum Control with  
Zirc™ NightSafe™ and DaySync™ LEDs

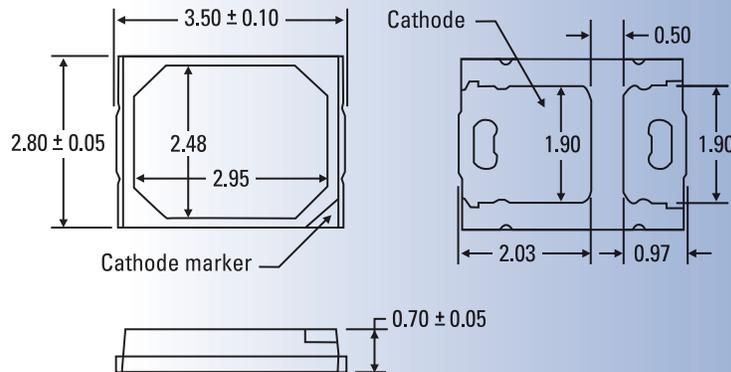
Less than 2%  
blue light content  
at night



DaySync™  
delivers over 20%  
blue content  
during the day



## CIRCADIAN® Zirc™ LED Technology



SPECIFICATIONS (25°C, Nominal Current)	Zirc™ NIGHT Typical	Zirc™ DAY Typical	UNIQUE BENEFITS Maximizing Robust Circadian Entrainment and Energy Efficacy
Forward Voltage	3.15V	5.6V	
Current (Nominal)	120mA	65mA	
CCT	3250K	4000K	Both Day and Night within 3000-4000K user comfort range
Duv	0.010	0.000	DUV optimized for maximum Circadian Potency (CIE 1960) contrast
Pump peak wavelength	416nm	475nm	42-fold contrast between Day vs Night at 477nm peak Circadian Potency
CPPR	0.11	0.429	Circadian Potency/Photopic Ratio - no need to dim at night
Blue content of visible light	1.5%	22%	15-fold contrast between Day vs Night 438-493nm blue/380-780nm
CRI	80	80	Both >80
R9	25	50	Good color rendering
COI	1.1	2.5	A COI less than 3.0 aids in accurately detecting skin color in healthcare settings
Luminous flux	47lm	52lm	Low glare mid-power output
Luminous efficacy	124lm/W	143 lm/W	Record breaking matched day-night energy efficacy
Max operating temp	85°C	85°C	To achieve projected life
Max operating current	150mA	150mA	To achieve projected life
Projected Life	>50,000h	>50,000h	L70B50, 85°C, Max Operating Current *NOTE: Testing ongoing

Healthy Light for 24-Hour Optimal Health, Safety, and Performance  
DynamicBlu™ Spectrum Control with Zirc™ DaySync™ and NightSafe™ Technology