



CIRCADIAN® Zirc™ LED Technology

Breakthrough energy efficient Zirc™ Day-Night 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 85-fold day-night contrast between blue emission at the peak effective 475nm Circadian Potency wavelength. Not only does ZircLight™ provide a robust circadian entraining light solution, but with 128 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 475nm blue the peak circadian wavelength?

Billions of years ago when life first began, the only light that penetrated the ocean depths was 475nm blue. All other spectral colors in sunlight are absorbed by sea water, so days were blue and nights black. Circadian clocks evolved using 475nm blue as the signal for day and night. New research now shows that our eyes, like the primitive oceans, use blue light with a peak wavelength of 475nm 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 475nm 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™ Night LEDs deliver only 1% of blue content, easily meeting the UL verification mark of "Less than 2% blue light at Night" And during the day Zirc™ LEDs deliver more than 20% 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™ night 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™ White Light Day and Night LEDs

- Each 128 lumens/watt
- Each between 3200 – 4000 K CCT
- Both CRI >80

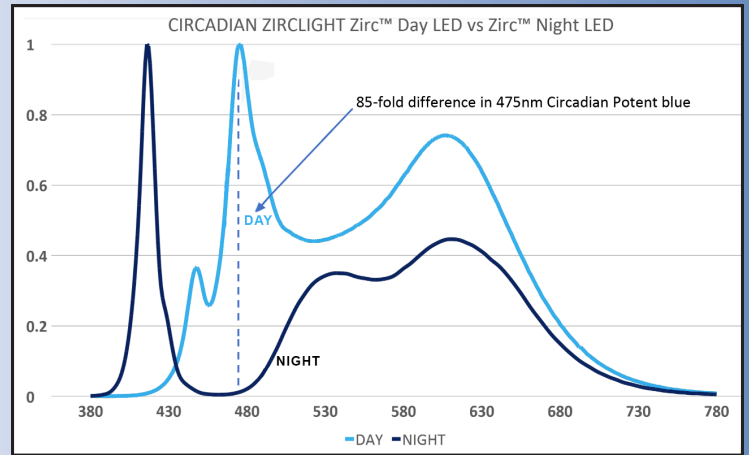
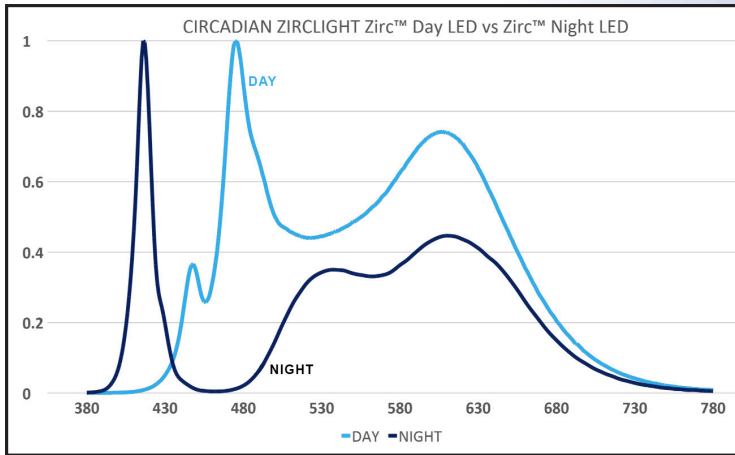
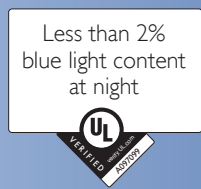
With a record-breaking contrast in Circadian Potency

- Zirc™ Day emits 85 times more Circadian Potent 475nm blue than Zirc™ Night LED
- More than 20 fold difference in total 440-490nm blue emission
- Zirc™ Night LED emits only 1% of visible energy in 440-490nm blue Circadian potency band
- Exceeds the UL verification spec of <2% blue content at night

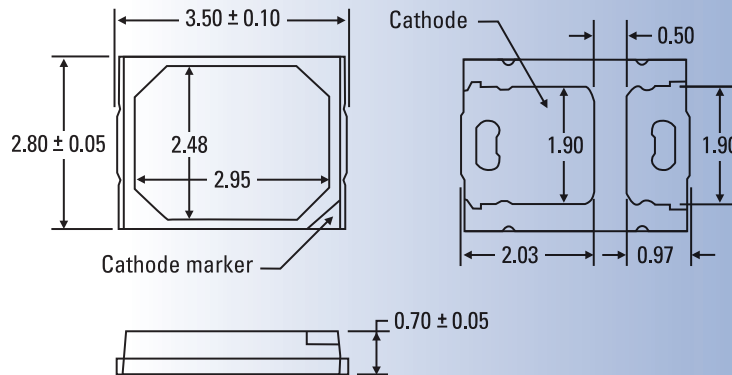


CIRCADIAN® ZircLight™

DynamicBlu™ Spectrum Control
with Zirc™ NightSafe™ Technology



CIRCADIAN® Zirc™ LED Technology



SPECIFICATIONS (25°C, Nominal Current)	Zirc™ NIGHT Typical	Zirc™ DAY Typical	UNIQUE BENEFITS
Forward Voltage	3.16V	5.98V	Maximizing Robust Circadian Entrainment and Energy Efficacy
Current (Nominal)	120mA	65mA	
CCT	3200K	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	85x contrast Day vs Night at 475nm peak Circadian Potency
CPPR	0.11	0.429	Circadian Potency/Photopic Ratio - no need to dim at night
Blue content of visible light	1.04%	20.4%	20x contrast Day vs Night 440-490nm blue/380-780nm
CRI	82.3	82.6	Both >80
R9	44.3	63.1	Good color rendering
COI	1.8	2.5	A COI less than 3.0 aids in accurately detecting skin color in healthcare settings
Luminous flux	48.7lm	49.4lm	Low glare mid-power output
Luminous efficacy	128lm/W	127.3 lm/W	Record breaking matched day-night energy efficacy
ESD sensitivity	Class 2	Class 2	ANSI/ESDA/JEDEC JS-001-2012
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

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