XLamp® CXB3590 LED



PRODUCT DESCRIPTION

The XLamp® CXB3590 LED Array is the brightest member of the second generation of the CXA family that delivers up to 30% higher efficacy and up to 20% higher lumens than the first generation in the same LES. The higher performance second generation CXA LED Arrays provide a drop-in performance upgrade to existing CXA LED designs to shorten product development time. Available in 2-step, 3-step and 5-step EasyWhite® bins, the CXB3590 LED delivers high lumen output and high efficacy in a single, easy-to-use package that eliminates the need for reflow soldering.

The CX Family LED Design Guide provides basic information on the requirements to use the CXB3590 LED successfully in luminaire designs.

FEATURES

- 30-mm optical source
- Mechanical and optical design consistent with CXA35 LED
- Available in 70-, 80- and 90-minimum CRI options
- EasyWhite® 2-, 3- and 5-step binning
- Forward voltage options: 36-V class & 72-V class
- 85 °C binning and characterization
- Extremely uniform color over viewing angle
- Top-side solder connections
- Thermocouple attach point
- NEMA SSL-3 2011 standard flux bins
- RoHS and REACh compliant
- UL® recognized component (E349212)

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CHARACTERISTICS

Characteristics	Unit	Minimum	Typical	Maximum
Viewing angle (FWHM)	degrees		115	
ESD withstand voltage (HBM per Mil-Std-883D)	V			8000
DC forward current (36 V)	mA			3600*
DC forward current (72 V)	mA			1800*
Reverse current (36 V, 72 V)	mA			0.1
Forward voltage (36 V, @ 2400 mA, Tj = 85 °C)	V		36	39
Forward voltage (72 V, @ 1200 mA, Tj = 85 °C)	V		72	78

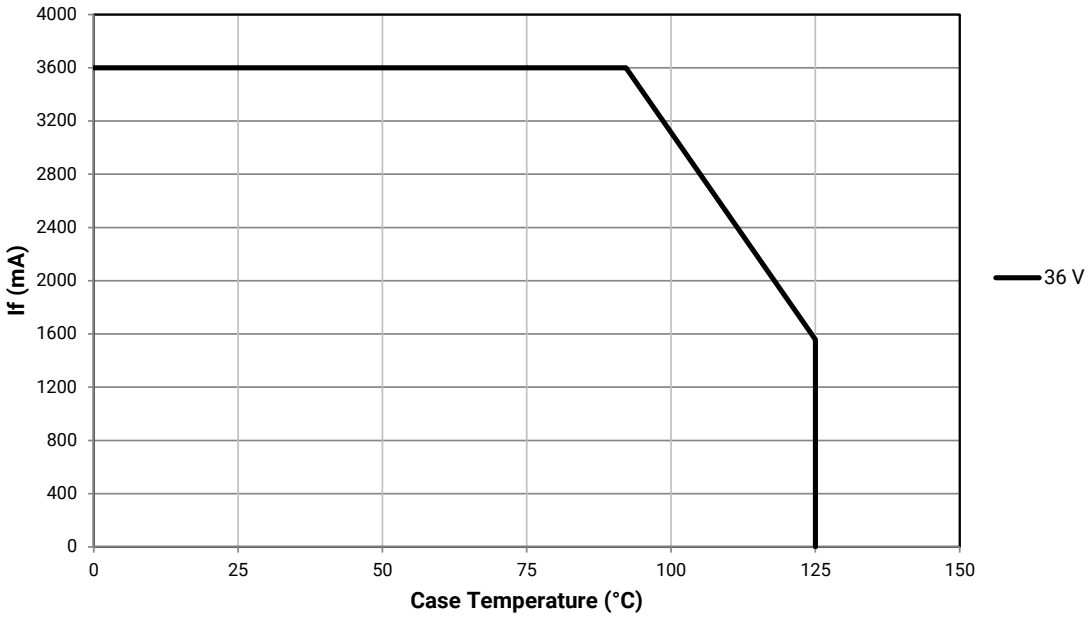
* Refer to the Operating Limits section.

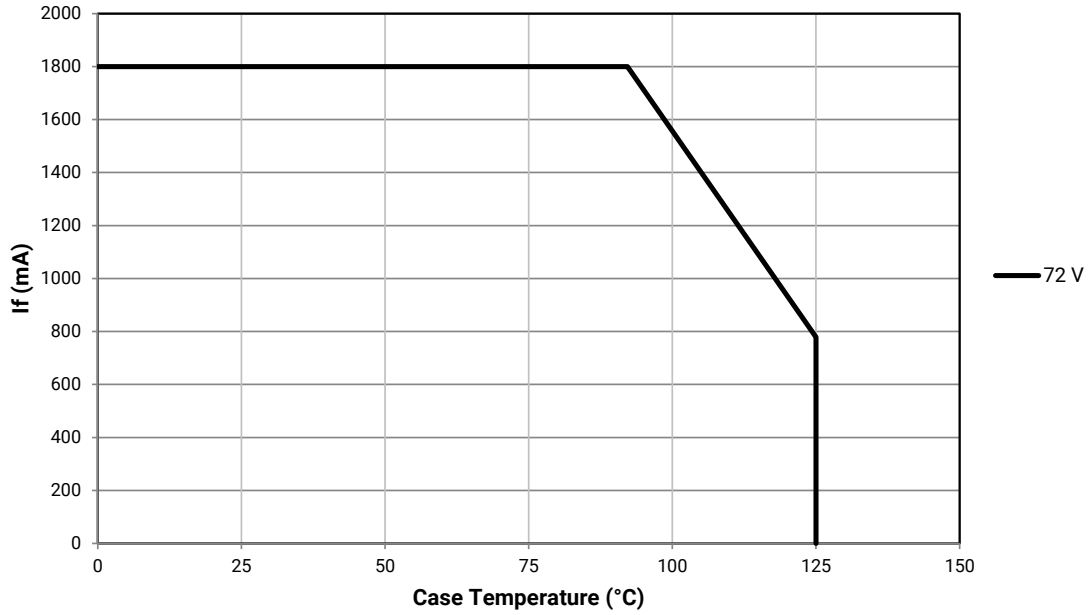
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OPERATING LIMITS

The maximum current rating of the CXB3590 depends on the case temperature (Tc) when the LED has reached thermal equilibrium under steady-state operation. The graphs shown below assume that the system design employs good thermal management (thermal interface material and heat sink) and may vary when poor thermal management is employed. Please refer to the Mechanical Dimensions section on page 17 for the location of the Tc measurement point.

Another important factor in good thermal management is the temperature of the Light Emitting Surface (LES). Cree LED recommends a maximum LES temperature of 135 °C to ensure optimal LED lifetime. Please refer to the Thermal Design section on page 18 for more information on LES temperature measurement.





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FLUX CHARACTERISTICS, EASYWHITE® ORDER CODES AND BINS - 36 V (I_F = 2400 mA, T_J = 85 °C)

The following table provides order codes for XLamp CXB3590 LEDs. For a complete description of the order code nomenclature, please see the Bin and Order Code Formats section (page 17).

Nominal CCT	CRI*		Minimum Luminous Flux			2-Step		3-Step		5-Step	
	Min	Typ	Group	Flux (lm) @ 85 °C	Flux (lm) @ 25 °C**	Group	Order Code	Group	Order Code	Group	Order Code
6500 K	70	---	CD	12,000	13,237					65E	CXB3590-0000-000N0BCD65E
			DB	13,000	14,340						CXB3590-0000-000N0BDB65E
			DD	14,000	15,443						CXB3590-0000-000N0BDD65E
	80	---	CB	11,000	12,134					65E	CXB3590-0000-000N0HCB65E
			CD	12,000	13,237						CXB3590-0000-000N0HCD65E
			DB	13,000	14,340						CXB3590-0000-000N0HDB65E
5700 K	70	---	CD	12,000	13,237					57E	CXB3590-0000-000N0BCD57E
			DB	13,000	14,340						CXB3590-0000-000N0BDB57E
			DD	14,000	15,443						CXB3590-0000-000N0BDD57E
	80	---	CB	11,000	12,134					57E	CXB3590-0000-000N0HCB57E
			CD	12,000	13,237						CXB3590-0000-000N0HCD57E
			DB	13,000	14,340						CXB3590-0000-000N0HDB57E
	90	92	BD	10,000	11,031			57G	CXB3590-0000-000N0UBD57G		
			CB	11,000	12,134				CXB3590-0000-000N0UCB57G		
			CD	12,000	13,237				CXB3590-0000-000N0UCD57G		

Notes

- Cree LED maintains a tolerance of ±7% on flux and power measurements, ±0.005 on chromaticity (CCx, CCy) measurements and a tolerance of ±2 on CRI measurements. See the Measurements section (page 20).
- CXB3590 LED order codes specify only a minimum flux bin and not a maximum. Cree LED may ship reels in flux bins higher than the minimum specified by the order code without advance notice. Shipments will always adhere to the chromaticity bin restrictions specified by the order code.

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FLUX CHARACTERISTICS, EASYWHITE® ORDER CODES AND BINS - 36 V (I_F = 2400 mA, T_J = 85 °C) - CONTINUED

Nominal CCT	CRI*		Minimum Luminous Flux			2-Step		3-Step		5-Step	
	Min	Typ	Group	Flux (lm) @ 85 °C	Flux (lm) @ 25 °C**	Group	Order Code	Group	Order Code	Group	Order Code
5000 K	70	---	CD	12,000	13,237					50E	CXB3590-0000-000N0BCD50E
			DB	13,000	14,340						CXB3590-0000-000N0BDB50E
			DD	14,000	15,443						CXB3590-0000-000N0BDD50E
	80	---	CB	11,000	12,134			50G	CXB3590-0000-000N0HCB50G	50E	CXB3590-0000-000N0HCB50E
			CD	12,000	13,237				CXB3590-0000-000N0HCD50G		CXB3590-0000-000N0HCD50E
			DB	13,000	14,340				CXB3590-0000-000N0HDB50G		
	90	92	BD	10,000	11,031			50G	CXB3590-0000-000N0UBD50G		
			CB	11,000	12,134				CXB3590-0000-000N0UCB50G		
			CD	12,000	13,237				CXB3590-0000-000N0UCD50G		
4000 K	70	---	CD	12,000	13,237					40E	CXB3590-0000-000N0BCD40E
			DB	13,000	14,340						CXB3590-0000-000N0BDB40E
			DD	14,000	15,443						CXB3590-0000-000N0BDD40E
	80	---	CB	11,000	12,134	40H	CXB3590-0000-000N0HCB40H	40G	CXB3590-0000-000N0HCB40G		
			CD	12,000	13,237		CXB3590-0000-000N0HCD40H		CXB3590-0000-000N0HCD40G		
			DB	13,000	14,340		CXB3590-0000-000N0HDB40H		CXB3590-0000-000N0HDB40G		
	90	92	BB	9,500	10,479	40H	CXB3590-0000-000N0UBB40H	40G	CXB3590-0000-000N0UBB40G		
			BD	10,000	11,031		CXB3590-0000-000N0UBD40H		CXB3590-0000-000N0UBD40G		
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FLUX CHARACTERISTICS, EASYWHITE® ORDER CODES AND BINS - 36 V (I_F = 2400 mA, T_J = 85 °C) - CONTINUED

Nominal CCT	CRI*		Minimum Luminous Flux			2-Step		3-Step		5-Step	
	Min	Typ	Group	Flux (lm) @ 85 °C	Flux (lm) @ 25 °C**	Group	Order Code	Group	Order Code	Group	Order Code
3500 K	80	---	CB	11,000	12,134	35H	CXB3590-0000-000N0HCB35H	35G	CXB3590-0000-000N0HCB35G		
			CD	12,000	13,237		CXB3590-0000-000N0HCD35H		CXB3590-0000-000N0HCD35G		
	90	92	BB	9,500	10,479	35H	CXB3590-0000-000N0UBB35H	35G	CXB3590-0000-000N0UBB35G		
			BD	10,000	11,031		CXB3590-0000-000N0UBD35H		CXB3590-0000-000N0UBD35G		
			CB	11,000	12,134		CXB3590-0000-000N0UCB35H		CXB3590-0000-000N0UCB35G		
3000 K	80	---	BD	10,000	11,031	30H	CXB3590-0000-000N0HBD30H	30G	CXB3590-0000-000N0HBD30G		
			CB	11,000	12,134		CXB3590-0000-000N0HCB30H		CXB3590-0000-000N0HCB30G		
			CD	12,000	13,237		CXB3590-0000-000N0HCD30H		CXB3590-0000-000N0HCD30G		
	90	92	BB	9,500	10,479	30H	CXB3590-0000-000N0UBB30H	30G	CXB3590-0000-000N0UBB30G		
			BD	10,000	11,031		CXB3590-0000-000N0UBD30H		CXB3590-0000-000N0UBD30G		
2700 K	80	---	BD	10,000	11,031	27H	CXB3590-0000-000N0HBD27H	27G	CXB3590-0000-000N0HBD27G		
			CB	11,000	12,134		CXB3590-0000-000N0HCB27H		CXB3590-0000-000N0HCB27G		
	90	92	AD	9,000	9,928	27H	CXB3590-0000-000N0UAD27H	27G	CXB3590-0000-000N0UAD27G		
			BB	9,500	10,479		CXB3590-0000-000N0UBB27H		CXB3590-0000-000N0UBB27G		
			BD	10,000	11,031		CXB3590-0000-000N0UBD27H		CXB3590-0000-000N0UBD27G		

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FLUX CHARACTERISTICS, EASYWHITE® ORDER CODES AND BINS - 72 V (I_F = 1200 mA, T_J = 85 °C)

The following table provides order codes for XLamp CXB3590 LEDs. For a complete description of the order code nomenclature, please see the Bin and Order Code Formats section (page 17).

Nominal CCT	CRI*		Minimum Luminous Flux			2-Step		3-Step		5-Step	
	Min	Typ	Group	Flux (lm) @ 85 °C	Flux (lm) @ 25 °C**	Group	Order Code	Group	Order Code	Group	Order Code
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			DB	13,000	14,340						CXB3590-0000-000R0BDB65E
			DD	14,000	15,443						CXB3590-0000-000R0BDD65E
	80	---	CB	11,000	12,134					65E	CXB3590-0000-000R0HCB65E
			CD	12,000	13,237						CXB3590-0000-000R0HCD65E
			DB	13,000	14,340						CXB3590-0000-000R0HDB65E
5700 K	70	---	CD	12,000	13,237					57E	CXB3590-0000-000R0BCD57E
			DB	13,000	14,340						CXB3590-0000-000R0BDB57E
			DD	14,000	15,443						CXB3590-0000-000R0BDD57E
	80	---	CB	11,000	12,134					57E	CXB3590-0000-000R0HCB57E
			CD	12,000	13,237						CXB3590-0000-000R0HCD57E
			DB	13,000	14,340						CXB3590-0000-000R0HDB57E
	90	92	BD	10,000	11,031			57G	CXB3590-0000-000R0UBD57G		
			CB	11,000	12,134				CXB3590-0000-000R0UCB57G		
			CD	12,000	13,237				CXB3590-0000-000R0UCD57G		

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FLUX CHARACTERISTICS, EASYWHITE® ORDER CODES AND BINS - 72 V (I_F = 1200 mA, T_J = 85 °C) - CONTINUED

Nominal CCT	CRI*		Minimum Luminous Flux			2-Step		3-Step		5-Step	
	Min	Typ	Group	Flux (lm) @ 85 °C	Flux (lm) @ 25 °C**	Group	Order Code	Group	Order Code	Group	Order Code
5000 K	70	---	CD	12,000	13,237					50E	CXB3590-0000-000R0BCD50E
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	90	92	BD	10,000	11,031			50G	CXB3590-0000-000R0UBD50G		
			CB	11,000	12,134				CXB3590-0000-000R0UCB50G		
			CD	12,000	13,237				CXB3590-0000-000R0UCD50G		
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			DD	14,000	15,443						CXB3590-0000-000R0BDD40E
	80	---	CB	11,000	12,134	40H	CXB3590-0000-000R0HCB40H	40G	CXB3590-0000-000R0HCB40G		
			CD	12,000	13,237		CXB3590-0000-000R0HCD40H		CXB3590-0000-000R0HCD40G		
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	90	92	BB	9,500	10,479	40H	CXB3590-0000-000R0UBB40H	40G	CXB3590-0000-000R0UBB40G		
			BD	10,000	11,031		CXB3590-0000-000R0UBD40H		CXB3590-0000-000R0UBD40G		
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FLUX CHARACTERISTICS, EASYWHITE® ORDER CODES AND BINS - 72 V (I_F = 1200 mA, T_J = 85 °C) - CONTINUED

Nominal CCT	CRI*		Minimum Luminous Flux			2-Step		3-Step		5-Step	
	Min	Typ	Group	Flux (lm) @ 85 °C	Flux (lm) @ 25 °C**	Group	Order Code	Group	Order Code	Group	Order Code
3500 K	80	---	CB	11,000	12,134	35H	CXB3590-0000-000R0HCB35H	35G	CXB3590-0000-000R0HCB35G		
			CD	12,000	13,237		CXB3590-0000-000R0HCD35H		CXB3590-0000-000R0HCD35G		
	90	92	BB	9,500	10,479	35H	CXB3590-0000-000R0UBB35H	35G	CXB3590-0000-000R0UBB35G		
			BD	10,000	11,031		CXB3590-0000-000R0UBD35H		CXB3590-0000-000R0UBD35G		
			CB	11,000	12,134		CXB3590-0000-000R0UCB35H		CXB3590-0000-000R0UCB35G		
3000 K	80	---	BD	10,000	11,031	30H	CXB3590-0000-000R0HBD30H	30G	CXB3590-0000-000R0HBD30G		
			CB	11,000	12,134		CXB3590-0000-000R0HCB30H		CXB3590-0000-000R0HCB30G		
			CD	12,000	13,237		CXB3590-0000-000R0HCD30H		CXB3590-0000-000R0HCD30G		
	90	92	BB	9,500	10,479	30H	CXB3590-0000-000R0UBB30H	30G	CXB3590-0000-000R0UBB30G		
			BD	10,000	11,031		CXB3590-0000-000R0UBD30H		CXB3590-0000-000R0UBD30G		
2700 K	80	---	BD	10,000	11,031	27H	CXB3590-0000-000R0HBD27H	27G	CXB3590-0000-000R0HBD27G		
			CB	11,000	12,134		CXB3590-0000-000R0HCB27H		CXB3590-0000-000R0HCB27G		
	90	92	AD	9,000	9,928	27H	CXB3590-0000-000R0UAD27H	27G	CXB3590-0000-000R0UAD27G		
			BB	9,500	10,479		CXB3590-0000-000R0UBB27H		CXB3590-0000-000R0UBB27G		
			BD	10,000	11,031		CXB3590-0000-000R0UBD27H		CXB3590-0000-000R0UBD27G		

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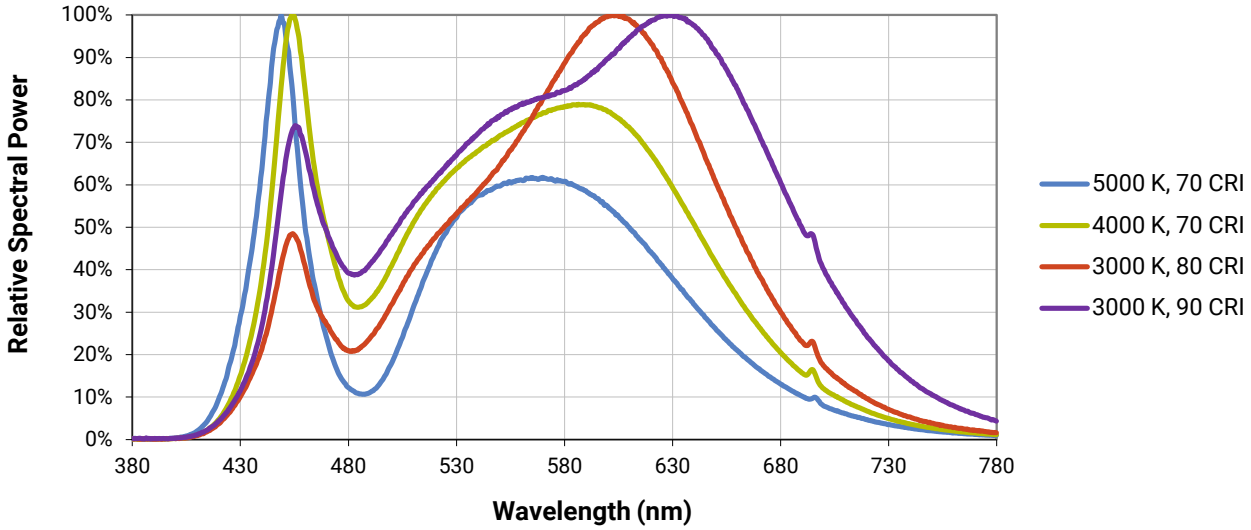
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RELATIVE SPECTRAL POWER DISTRIBUTION

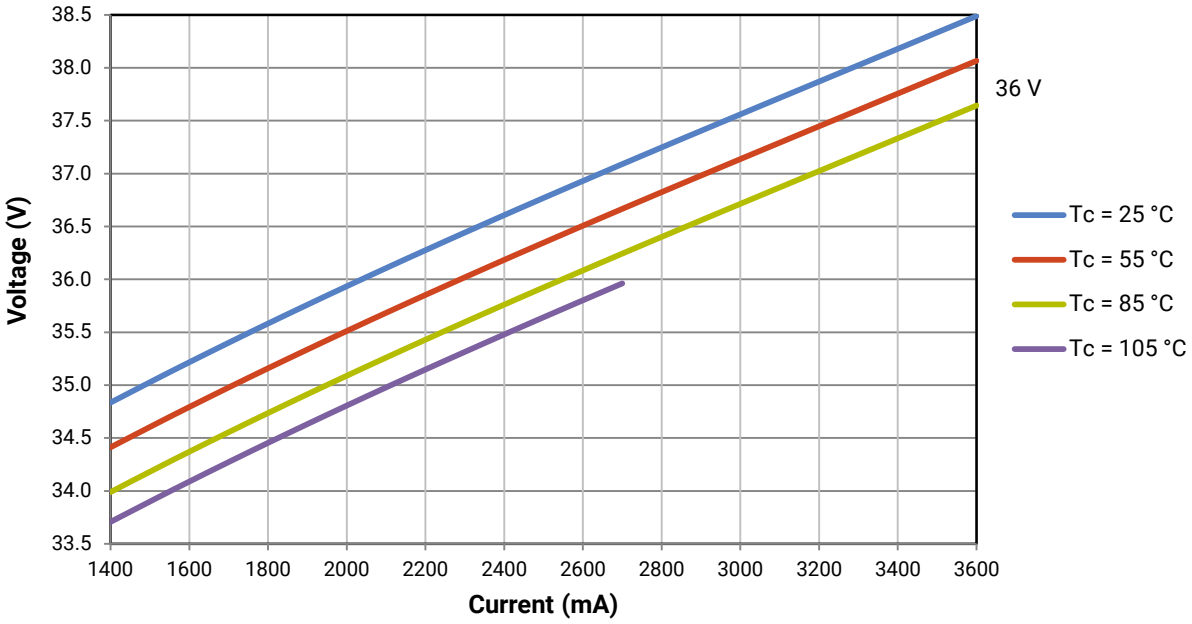
The following graph is the result of a series of pulsed measurements at 2400 mA for the 36-V CXB3590 and 1200 mA for the 72-V CXB3590 and T_J = 85 °C.

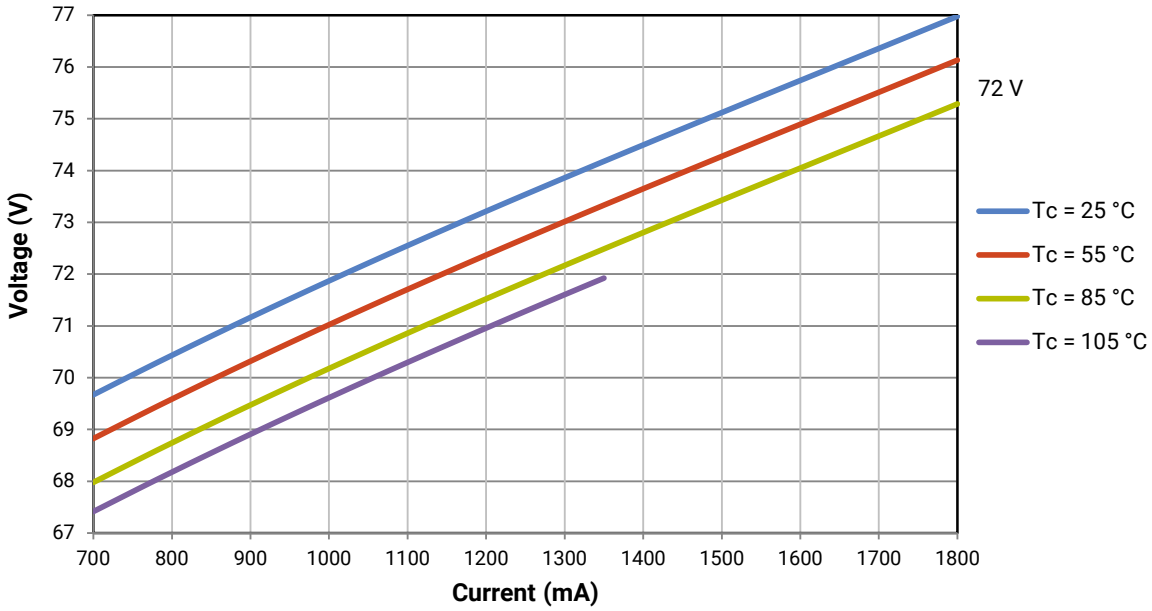


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ELECTRICAL CHARACTERISTICS

The following graphs are the result of a series of steady-state measurements.





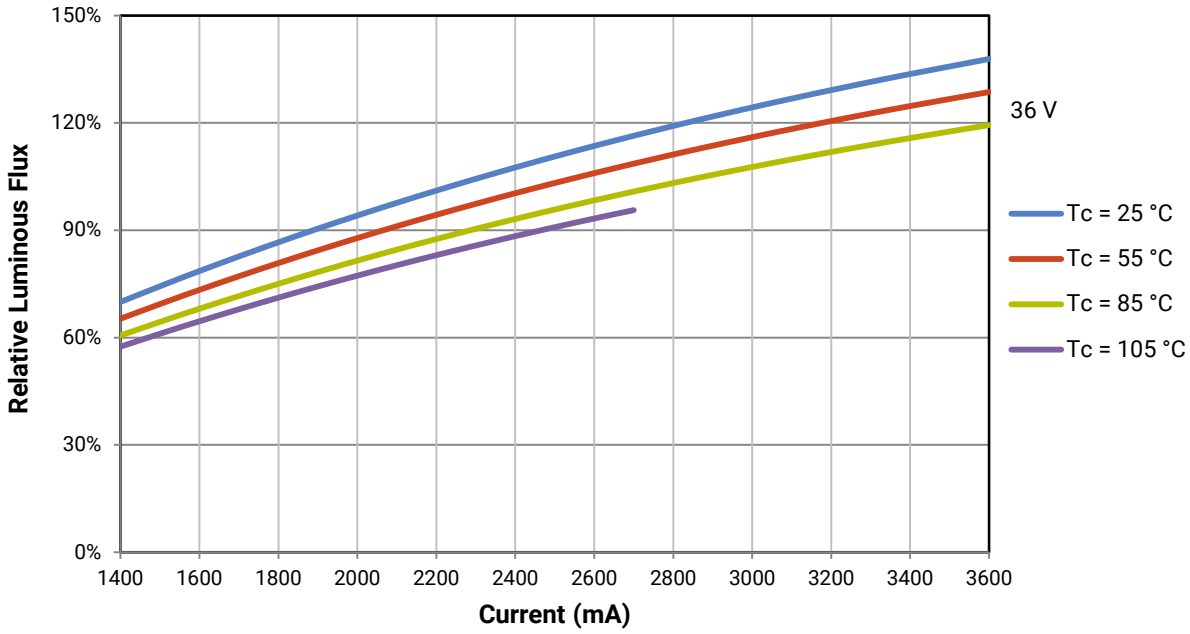
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RELATIVE LUMINOUS FLUX

The relative luminous flux values provided below are the ratio of:

- Measurements of CXB3590 at steady-state operation at the given conditions, divided by
- Flux measured during binning, which is a pulsed measurement at 2400 mA at T_J = 85 °C for the 36-V CXB3590.

Using the 36-V CXB3590 LED as an example, at steady-state operation of Tc = 25 °C, I_F = 2800 mA, the relative luminous flux ratio is 120% in the chart below. A CXB3590 LED that measures 11,000 lm during binning will deliver 13,200 lm (11,000 * 1.2) at steady-state operation of Tc = 25 °C, I_F = 2800 mA.



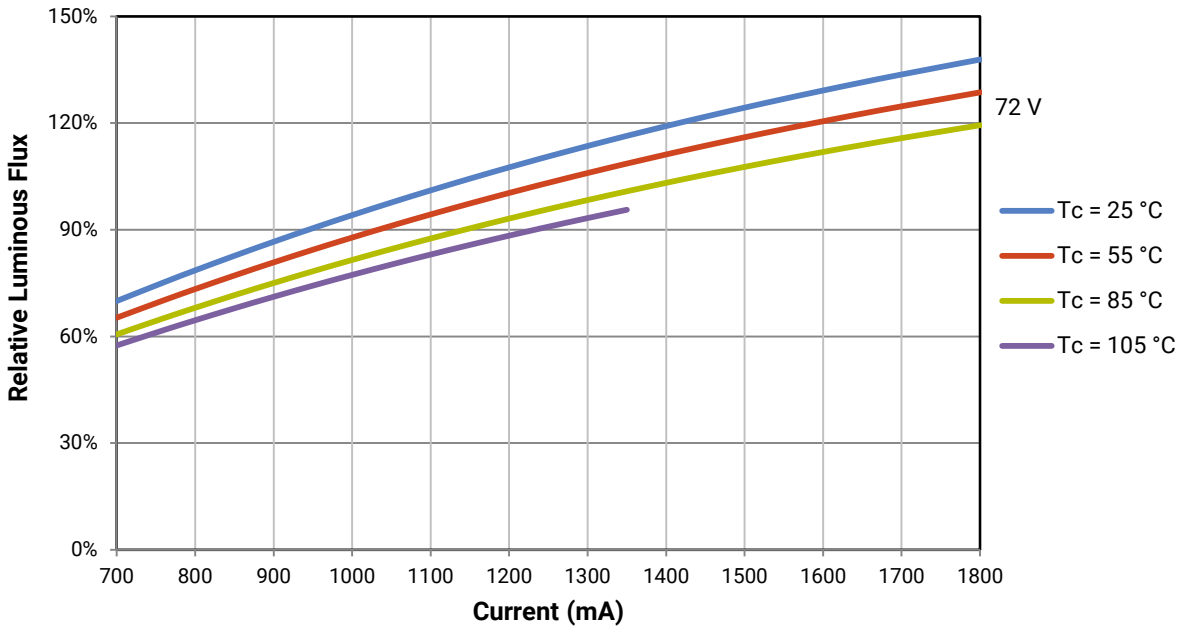
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RELATIVE LUMINOUS FLUX - CONTINUED

The relative luminous flux values provided below are the ratio of:

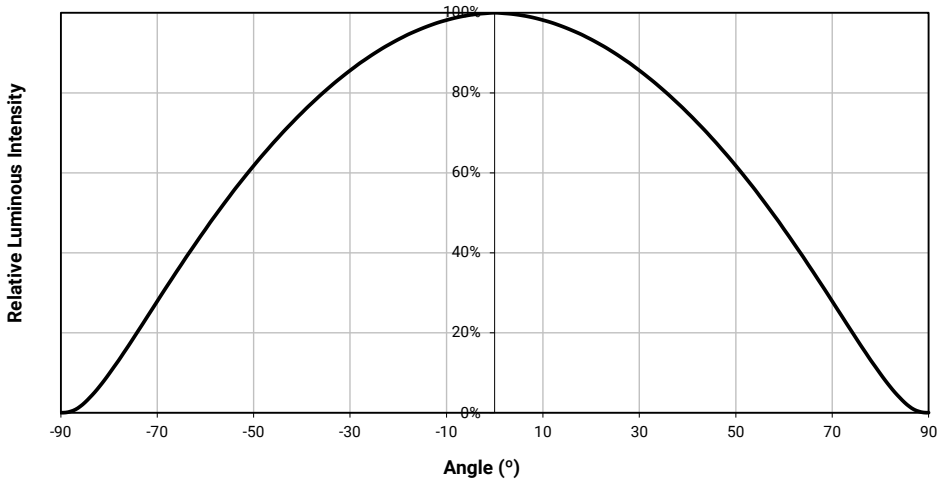
- Measurements of CXB3590 at steady-state operation at the given conditions, divided by
- Flux measured during binning, which is a pulsed measurement at 1200 mA at T_J = 85 °C for the 72-V CXB3590.

Using the 72-V CXB3590 LED as an example, at steady-state operation of Tc = 25 °C, I_F = 1400 mA, the relative luminous flux ratio is 120% in the chart below. A CXB3590 LED that measures 11,000 lm during binning will deliver 13,200 lm (11,000 * 1.2) at steady-state operation of Tc = 25 °C, I_F = 1400 mA.



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TYPICAL SPATIAL DISTRIBUTION



PERFORMANCE GROUPS - BRIGHTNESS (36 V, I_F = 2400 mA; 72 V, I_F = 1200 mA, T_J = 85 °C)

XLamp CXB3590 LEDs are tested for luminous flux and placed into one of the following bins.

Group Code	Minimum Luminous Flux	Maximum Luminous Flux
AD	9,000	9,500
BB	9,500	10,000
BD	10,000	11,000
CB	11,000	12,000
CD	12,000	13,000
DB	13,000	14,000
DD	14,000	15,000
EB	15,000	16,000

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PERFORMANCE GROUPS - CHROMATICITY (T_J = 85 °C)

XLamp CXB3590 LEDs are tested for chromaticity and placed into one of the regions defined by the following bounding coordinates.

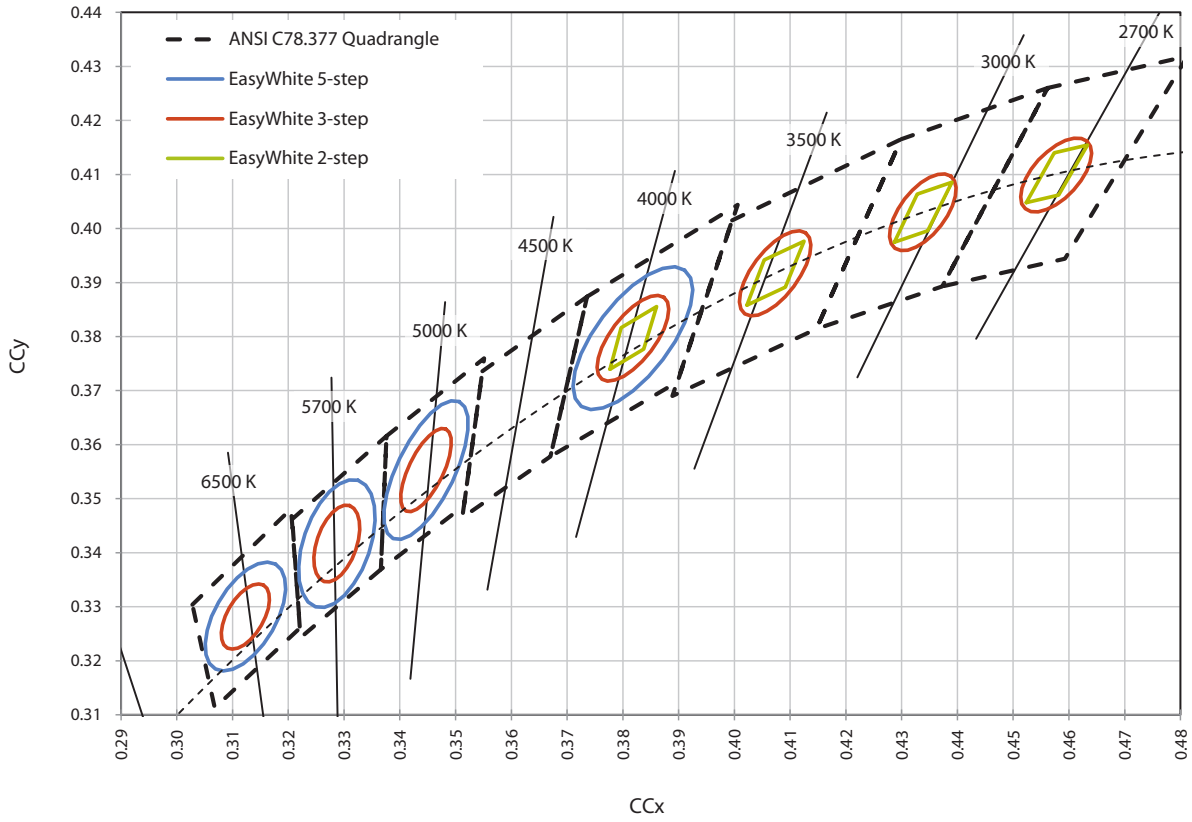
EasyWhite Color Temperatures – 2-Step			
Code	**CCT**	**x**	**y**
40H	4000 K	0.3777	0.3739
		0.3797	0.3816
		0.3861	0.3855
		0.3838	0.3777
35H	3500 K	0.4022	0.3858
		0.4053	0.3942
		0.4125	0.3977
		0.4091	0.3891
30H	3000 K	0.4287	0.3975
		0.4328	0.4064
		0.4390	0.4086
		0.4347	0.3996
27H	2700 K	0.4524	0.4048
		0.4574	0.4140
		0.4633	0.4154
		0.4581	0.4062

EasyWhite Color Temperatures – 3-Step Ellipse						
Bin Code	**CCT**	**Center Point**		**Major Axis**	**Minor Axis**	**Rotation Angle (°)**
		x	**y**	**a**	**b**	
65G	6500 K	0.3123	0.3282	0.00666	0.00330	61.0
57G	5700 K	0.3287	0.3417	0.00738	0.00360	72.0
50G	5000 K	0.3447	0.3553	0.00840	0.00312	65.0
40G	4000 K	0.3818	0.3797	0.00939	0.00402	53.7
35G	3500 K	0.4073	0.3917	0.00927	0.00414	54.0
30G	3000 K	0.4338	0.4030	0.00834	0.00408	53.2
27G	2700 K	0.4577	0.4099	0.00834	0.00420	48.5

EasyWhite Color Temperatures – 5-Step Ellipse						
Bin Code	**CCT**	**Center Point**		**Major Axis**	**Minor Axis**	**Rotation Angle (°)**
		x	**y**	**a**	**b**	
65E	6500 K	0.3123	0.3282	0.01110	0.00550	61.0
57E	5700 K	0.3287	0.3417	0.01230	0.00600	72.0
50E	5000 K	0.3447	0.3553	0.01400	0.00520	65.0
40E	4000 K	0.3818	0.3797	0.01565	0.00670	53.7

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EASYWHITE® BINS PLOTTED ON THE 1931 CIE CURVE



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BIN AND ORDER CODE FORMATS

Bin codes and order codes are configured as follows:

Order Code

SSSSSCC-HHHH-HHHGGRNNNNN

- Series = CXA35
- Internal code
- CRI Specification
  - 0 = Standard CRI
  - H = 80 CRI minimum
  - U = 90 CRI minimum
  - Y = 93 CRI minimum
- Kit code
- Vf class
  - N0 = 36-V class
  - R0 = 72-V class
- Performance class

Bin Code

SSSSSCC-WWW-FF-GGR-AAAAA

- Series = CXA35
- Chromaticity bin
- Vf class
  - N0 = 36-V class
  - R0 = 72-V class
- Internal code
- CRI Specification
  - B = 70 CRI minimum
  - H = 80 CRI minimum
  - U = 90 CRI minimum
  - Y = 93 CRI minimum
- Flux bin
- Performance class

MECHANICAL DIMENSIONS

Dimensions are in mm.

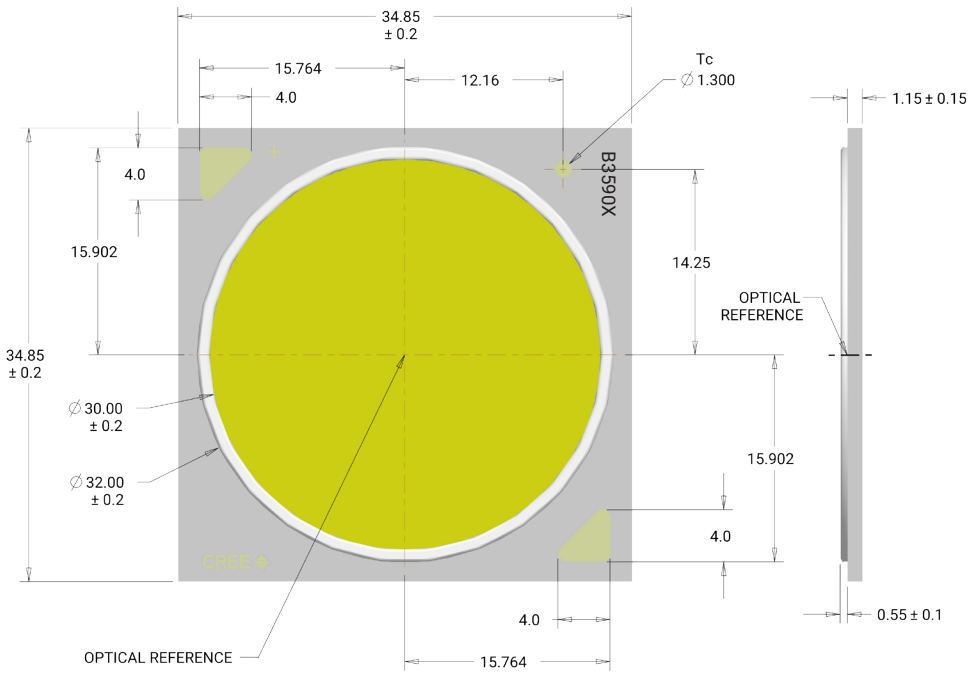
Tolerances unless otherwise specified: ±.13

x° ±1°

Meaning of B3590X

B3590N = 36-V CXB3590

B3590R = 72-V CXB3590



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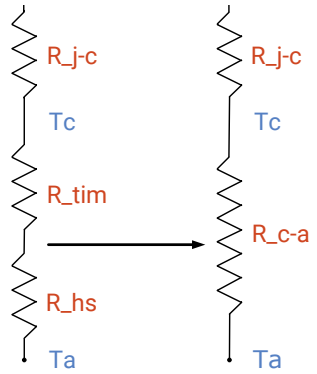
THERMAL DESIGN

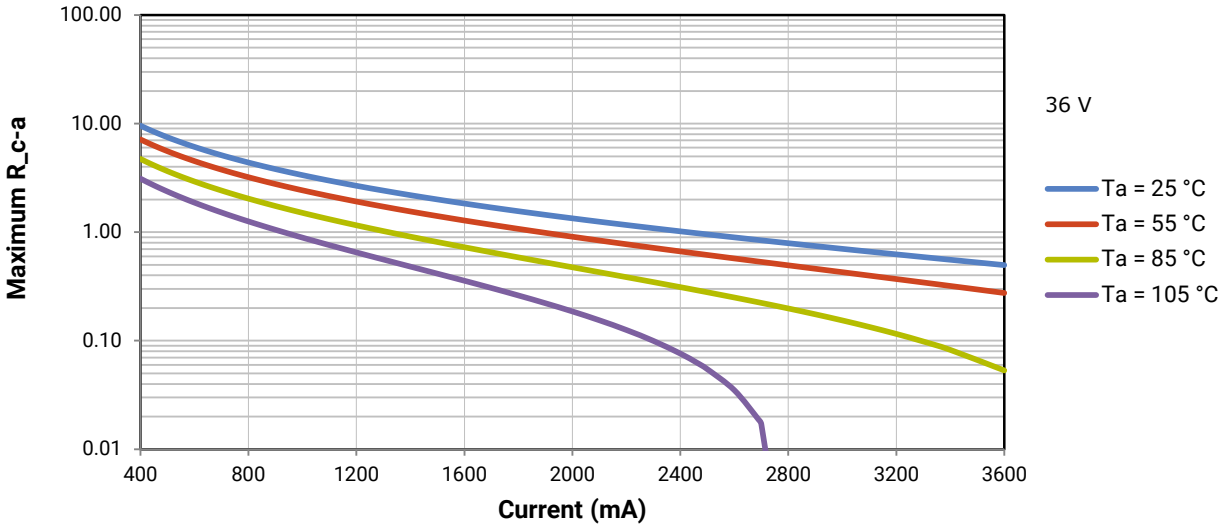
The CXB family of LED arrays can include over a hundred different LED die inside one package, and thus over a hundred different junction temperatures (T_J). Cree LED has intentionally removed junction-temperature-based operating limits and replaced the commonplace maximum T_J calculations with maximum ratings based on forward current (I_F) and case temperature (Tc). No additional calculations are required to ensure that the CXB LED is being operated within its designed limits. LES temperature measurement provides additional verification of good thermal design. Please refer to page 22 for the Operating Limit specifications.

There is no need to calculate for T_J inside the package, as the thermal management design process, specifically from T_{SP} to ambient (T_a), remains identical to any other LED component. For more information on thermal management of XLamp LEDs, please refer to the Thermal Management application note. For CXB soldering recommendations and more information on thermal interface materials (TIM), LES temperature measurement, and connection methods, please refer to the XLamp CX Family LEDs soldering and handling document. The CX Family LED Design Guide provides basic information on the requirements to use XLamp CXB LEDs successfully in luminaire designs.

To keep the CXB3590 LED at or below the maximum rated Tc, the case to ambient temperature thermal resistance (R_c-a) must be at or below the maximum R_c-a value shown on the following graph, depending on the operating environment. The y-axis in each graph is a base 10 logarithmic scale.

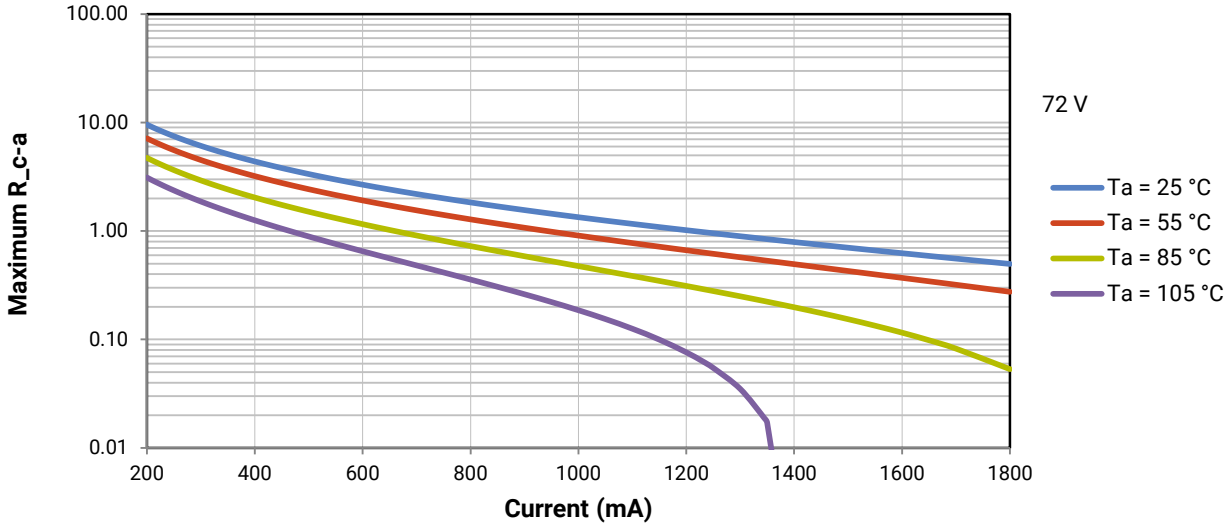
As the figure at right shows, the R_c-a value is the sum of the thermal resistance of the TIM (R_tim) plus the thermal resistance of the heat sink (R_hs).





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THERMAL DESIGN - CONTINUED



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NOTES

Measurements

The luminous flux, radiant power, chromaticity, forward voltage and CRI measurements in this document are binning specifications only and solely represent product measurements as of the date of shipment. These measurements will change over time based on a number of factors that are not within Cree LED's control and are not intended or provided as operational specifications for the products. Calculated values are provided for informational purposes only and are not intended or provided as specifications.

Pre-Release Qualification Testing

Please read the LED Reliability Overview for details of the qualification process Cree LED applies to ensure long-term reliability for XLamp LEDs and details of Cree LED's pre-release qualification testing for XLamp LEDs.

Lumen Maintenance

Cree LED now uses standardized IES LM-80-08 and TM-21-11 methods for collecting long-term data and extrapolating LED lumen maintenance. For information on the specific LM-80 data sets available for this LED, refer to the public LM-80 results document.

Please read the Long-Term Lumen Maintenance application note for more details on Cree LED's lumen maintenance testing and forecasting. Please read the Thermal Management application note for details on how thermal design, ambient temperature, and drive current affect the LED junction temperature.

RoHS Compliance

The levels of RoHS restricted materials in this product are below the maximum concentration values (also referred to as the threshold limits) permitted for such substances, or are used in an exempted application, in accordance with EU Directive 2011/65/EC (RoHS2), as implemented January 2, 2013. RoHS Declarations for this product can be obtained from your Cree LED representative or from the Product Ecology section of the Cree LED website.

REACh Compliance

REACh substances of very high concern (SVHCs) information is available for this product. Since the European Chemical Agency (ECHA) has published notice of their intent to frequently revise the SVHC listing for the foreseeable future, please contact a Cree LED representative to insure you get the most up-to-date REACh Declaration. REACh banned substance information (REACh Article 67) is also available upon request.

UL® Recognized Component

This product meets the requirements to be considered a UL Recognized Component with Level 4 enclosure consideration. The LED package or a portion thereof has been investigated as a fire and electrical enclosure per ANSI/UL 8750.

Vision Advisory

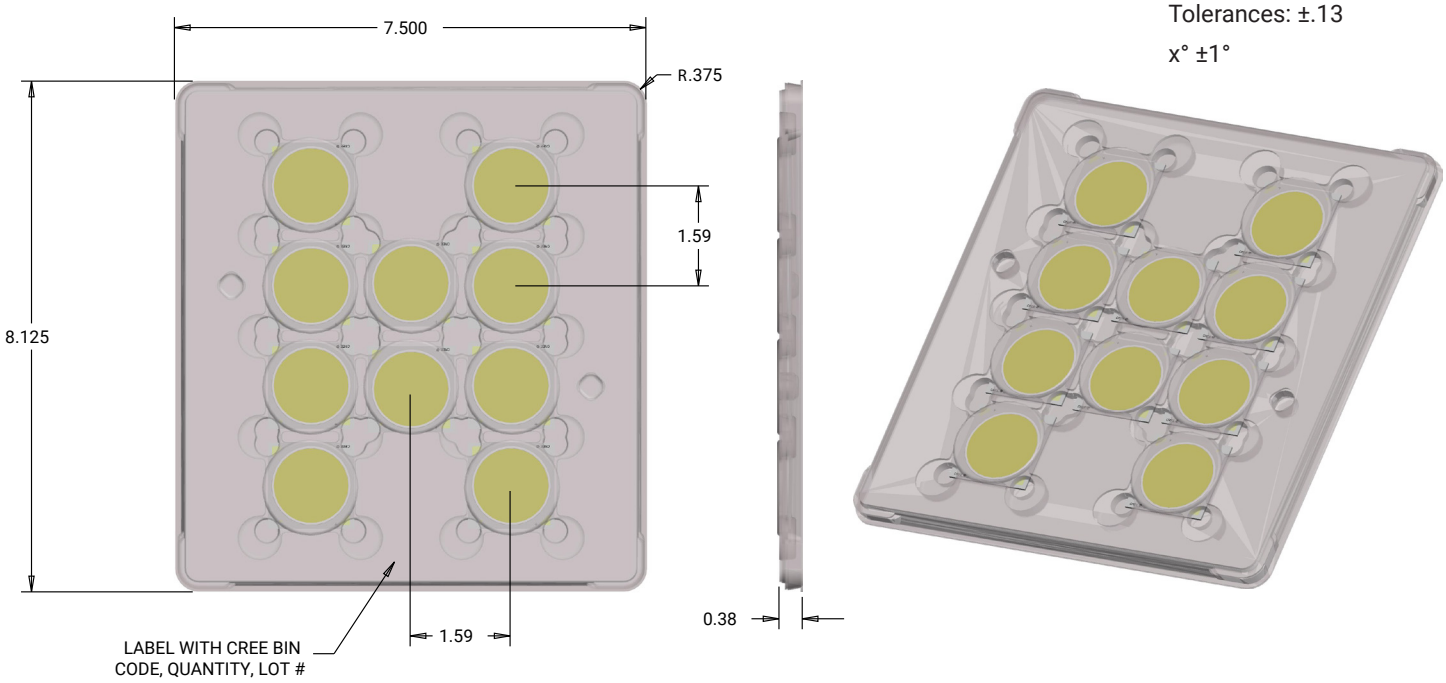
WARNING: Do not look at an exposed lamp in operation. Eye injury can result. For more information about LEDs and eye safety, please refer to the LED Eye Safety application note.

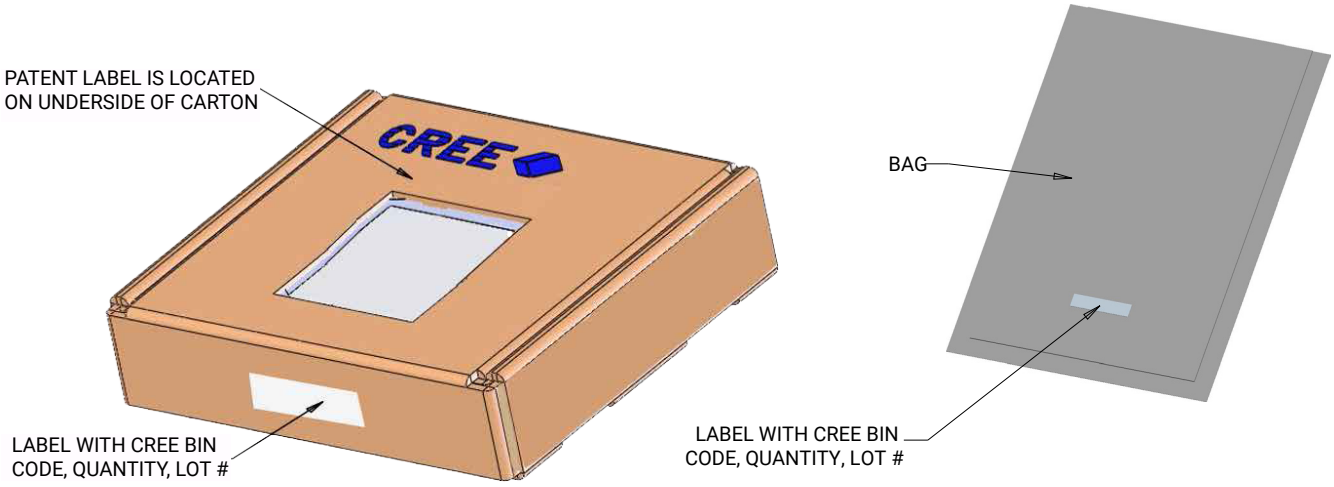
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PACKAGING

CXB3590 LEDs are packaged in trays of 10. Five trays are sealed in an anti-static bag and placed inside a carton, for a total of 50 LEDs per carton. Each carton contains 50 LEDs from the same performance bin.

Dimensions are in inches.
Tolerances: ±.13
x° ±1°





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