

XLamp® CMB3090 LED



PRODUCT DESCRIPTION

The XLamp® CMB family delivers industry-leading lumen density and efficacy in Cree LED's package and LES sizes. Leveraging the latest COB technology platform, the CMB family provides a no-compromise performance upgrade to existing CXA, CXB and CMA product families while retaining mechanical and optical compatibility with them.

XLamp CMB LEDs are optimized for premium indoor lighting applications, including track, spot and downlight, as well as outdoor lighting.

FEATURES

- 23-mm optical source
- Mechanical and optical design consistent with CXA3070, CXB3070, and CMA3090 LEDs
- Available in 70, 80, 90, and 95 CRI minimum options
- EasyWhite® 2-, 3- and 5-step binning
- Premium Color 2- and 3-step binning
- Forward voltage options: 48-V class, 72-V class
- 85 °C binning and characterization
- Maximum drive current: 3600 mA (48 V), 2400 mA (72 V)
- 115° viewing angle, uniform chromaticity profile
- Top-side solder connections

TABLE OF CONTENTS

Characteristics	2
Operating Limits.....	3
Flux Characteristics, Order Codes & Bins - Standard LEDs - 48 V	4
Flux Characteristics, Order Codes & Bins - Standard LEDs, Premium Color - 48 V	5
Flux Characteristics, Order Codes & Bins - Standard LEDs - 72 V	6
Flux Characteristics, Order Codes & Bins - Standard LEDs, Premium Color- 72 V	7
Relative Spectral Power Distribution, Standard LEDs.....	8
Relative Spectral Power Distribution, Premium Color LEDs.....	9
Electrical Characteristics.....	11
Relative Luminous Flux.....	12
Typical Spatial Distribution.....	13
Performance Groups - Chromaticity	14
Premium Color Performance Groups - Chromaticity	15
EasyWhite® Bins Plotted on the 1931 CIE Color Space	16
Premium Color Bins Plotted on the 1931 CIE Color Space.....	17
Bin and Order Code Formats.....	19
Mechanical Dimensions	20
Thermal Design	21
Notes	23
Packaging.....	24

CHARACTERISTICS

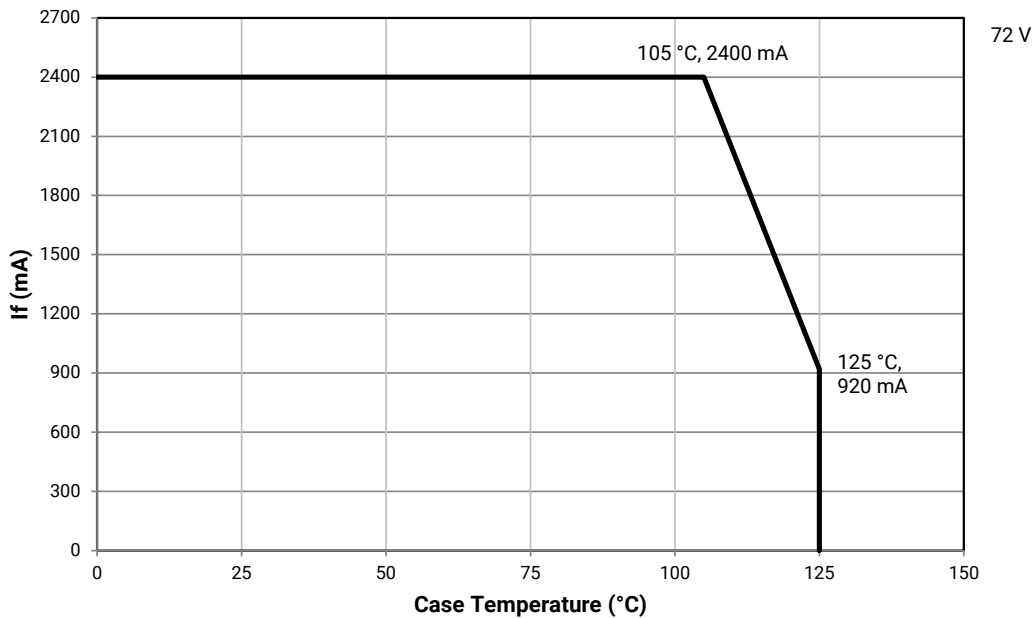
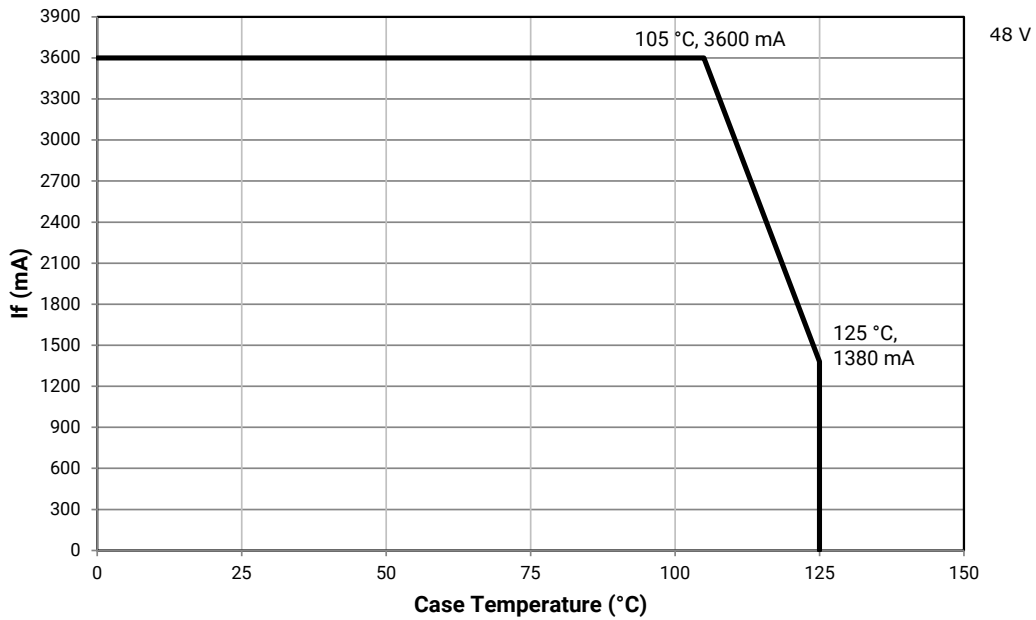
Characteristics	Unit	Minimum	Typical	Maximum
Viewing angle (FWHM)	degrees		115	
ESD withstand voltage (JEDEC JS-001-2012)	V		Class 3A	
DC forward current (48 V)	mA			3600*
DC forward current (72 V)	mA			2400*
Reverse current (48 V, 72 V)	mA			0.1
Forward voltage (48 V, @ 1800 mA, T _j = 85 °C)	V		45.4	48
Forward voltage (72 V, @ 1200 mA, T _j = 85 °C)	V		68.1	72

* Refer to the Operating Limits section.

OPERATING LIMITS

The maximum current rating of the CMB3090 LED depends on the case temperature (T_c) 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. Either solder pad shown in the Mechanical Dimensions section on page 20 can be used as the T_c 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 140 °C to ensure optimal LED lifetime. Please refer to the Thermal Design section on page 21 for more information on LES temperature measurement.



FLUX CHARACTERISTICS, ORDER CODES & BINS - STANDARD LEDS - 48 V (I_F = 1800 mA, T_J = 85 °C)

The following tables provide order codes for XLamp CMB3090 LEDs. For a complete description of the order code nomenclature, please see the Bin and Order Code Formats section (page 19).

Nominal CCT	CRI		Minimum Luminous Flux (lm)	Typical Luminous Flux (lm)	2-Step		3-Step		5-Step	
	Min.	Typ			Group	Order Code	Group	Order Code	Group	Order Code
6500 K	70	73	13,263	13,968					65E	CMB3090-0000-000Q0B0A65E
	80	82	12,094	12,736					65E	CMB3090-0000-000Q0H0A65E
5700 K	70	73	13,159	13,858					57E	CMB3090-0000-000Q0B0A57E
	80	82	11,999	12,636					57E	CMB3090-0000-000Q0H0A57E
	90	92	10,559	11,120			57G	CMB3090-0000-000Q0U0A57G		
5000 K	70	73	13,158	13,857					50E	CMB3090-0000-000Q0B0A50E
	80	82	11,997	12,635			50G	CMB3090-0000-000Q0H0A50G		
	90	92	10,262	10,807			50G	CMB3090-0000-000Q0U0A50G		
4000 K	70	73	13,005	13,696					40E	CMB3090-0000-000Q0B0A40E
	80	82	11,858	12,488	40H	CMB3090-0000-000Q0H0A40H	40G	CMB3090-0000-000Q0H0A40G		
	90	92	10,206	10,748	40H	CMB3090-0000-000Q0U0A40H	40G	CMB3090-0000-000Q0U0A40G		
3500 K	80	82	11,761	12,386	35H	CMB3090-0000-000Q0H0A35H	35G	CMB3090-0000-000Q0H0A35G		
	90	92	10,186	10,727	35H	CMB3090-0000-000Q0U0A35H	35G	CMB3090-0000-000Q0U0A35G		
3000 K	70	73	12,684	13,358					30E	CMB3090-0000-000Q0B0A30E
	80	82	11,567	12,180	30H	CMB3090-0000-000Q0H0A30H	30G	CMB3090-0000-000Q0H0A30G		
	90	92	10,052	10,586	30H	CMB3090-0000-000Q0U0A30H	30G	CMB3090-0000-000Q0U0A30G		
2700 K	80	82	11,086	11,675	27H	CMB3090-0000-000Q0H0A27H	27G	CMB3090-0000-000Q0H0A27G		
	90	92	9,662	10,175	27H	CMB3090-0000-000Q0U0A27H	27G	CMB3090-0000-000Q0U0A27G		
2200 K	80	82	9,755	10,274			22G	CMB3090-0000-000Q0H0A22G		

- 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 23).
 - For 80 CRI minimum LEDs, CRI R9 minimum is 0 with a ±2 tolerance. For 90 CRI minimum LEDs, CRI R9 typical is 60.

FLUX CHARACTERISTICS, ORDER CODES & BINS - STANDARD LEDS, PREMIUM COLOR - 48 V ($I_f = 1800$ mA, $T_j = 85$ °C)

Fidelity

Nominal CCT	CRI*		Minimum Luminous Flux (lm)	Typical Luminous Flux (lm)	2-Step	
	Min.	Typ			Group	Order Code
4000 K	95	98	9,220	9,709	40H	CMB3090-0000-000Q0Z0A40H
3500 K	95	98	9,175	9,662	35H	CMB3090-0000-000Q0Z0A35H
3000 K	95	98	8,908	9,381	30H	CMB3090-0000-000Q0Z0A30H
2700 K	95	98	8,476	8,927	27H	CMB3090-0000-000Q0Z0A27H

Specialty

Nominal CCT	CRI		Minimum Luminous Flux (lm)	Typical Luminous Flux (lm)	2-Step		3-Step			
	Min.	Typ			Group	Order Code	Group	Order Code	Group	Order Code
3100 K	90	92	9,600	10,110			31Q	CMB3090-0000-000Q0U0A31Q		
3000 K	90	92	9,449	9,951					30U	CMB3090-0000-000Q0U0A30U
	90	92	9,851	10,374			30Q	CMB3090-0000-000Q0U0A30Q		
	95	98	8,393	8,839	L7C	CMB3090-0000-000Q0Z0AL7C				

Notes

- Cree LED maintains a tolerance of $\pm 7\%$ 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 23).
- For 80 CRI minimum LEDs, CRI R9 minimum is 0 with a ± 2 tolerance. For 90 CRI minimum LEDs, CRI R9 typical is 60.

FLUX CHARACTERISTICS, ORDER CODES & BINS - STANDARD LEDS - 72 V (I_F = 1200 mA, T_J = 85 °C)

The following tables provide order codes for XLamp CMB3090 LEDs. For a complete description of the order code nomenclature, please see the Bin and Order Code Formats section (page 19).

Nominal CCT	CRI		Minimum Luminous Flux (lm)	Typical Luminous Flux (lm)	2-Step		3-Step		5-Step	
	Min.	Typ			Group	Order Code	Group	Order Code	Group	Order Code
6500 K	70	73	13,263	13,968					65E	CMB3090-0000-000R0B0A65E
	80	82	12,094	12,736					65E	CMB3090-0000-000R0H0A65E
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	80	82	11,997	12,635			50G	CMB3090-0000-000R0H0A50G		
	90	92	10,262	10,807			50G	CMB3090-0000-000R0U0A50G		
4000 K	70	73	13,005	13,696					40E	CMB3090-0000-000R0B0A40E
	80	82	11,858	12,488	40H	CMB3090-0000-000R0H0A40H	40G	CMB3090-0000-000R0H0A40G		
	90	92	10,206	10,748	40H	CMB3090-0000-000R0U0A40H	40G	CMB3090-0000-000R0U0A40G		
3500 K	80	82	11,761	12,386	35H	CMB3090-0000-000R0H0A35H	35G	CMB3090-0000-000R0H0A35G		
	90	92	10,186	10,727	35H	CMB3090-0000-000R0U0A35H	35G	CMB3090-0000-000R0U0A35G		
3000 K	70	73	12,684	13,358					30E	CMB3090-0000-000R0B0A30E
	80	82	11,567	12,180	30H	CMB3090-0000-000R0H0A30H	30G	CMB3090-0000-000R0H0A30G		
	90	92	10,052	10,586	30H	CMB3090-0000-000R0U0A30H	30G	CMB3090-0000-000R0U0A30G		
2700 K	80	82	11,086	11,675	27H	CMB3090-0000-000R0H0A27H	27G	CMB3090-0000-000R0H0A27G		
	90	92	9,662	10,175	27H	CMB3090-0000-000R0U0A27H	27G	CMB3090-0000-000R0U0A27G		
2200 K	80	82	9,755	10,274			22G	CMB3090-0000-000R0H0A22G		

- 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 23).
 - For 80 CRI minimum LEDs, CRI R9 minimum is 0 with a ±2 tolerance. For 90 CRI minimum LEDs, CRI R9 typical is 60.

FLUX CHARACTERISTICS, ORDER CODES & BINS - STANDARD LEDS, PREMIUM COLOR- 72 V (I_F = 1200 mA, T_J = 85 °C)

Fidelity

Nominal CCT	CRI*		Minimum Luminous Flux (lm)	Typical Luminous Flux (lm)	2-Step	
	Min.	Typ			Group	Order Code
4000 K	95	98	9,220	9,709	40H	CMB3090-0000-000R0Z0A40H
3500 K	95	98	9,175	9,662	35H	CMB3090-0000-000R0Z0A35H
3000 K	95	98	8,908	9,381	30H	CMB3090-0000-000R0Z0A30H
2700 K	95	98	8,476	8,927	27H	CMB3090-0000-000R0Z0A27H

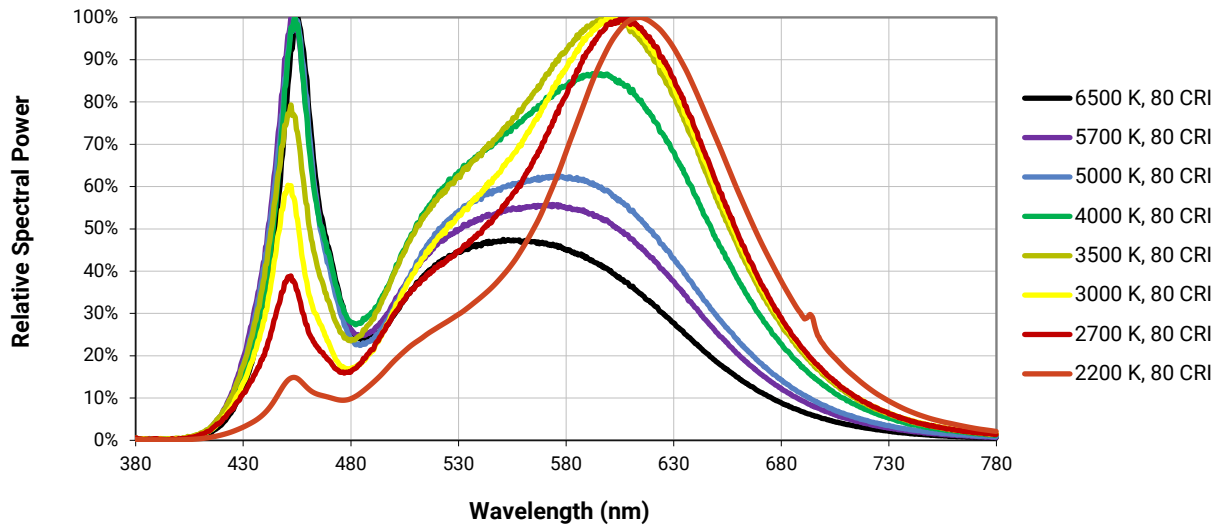
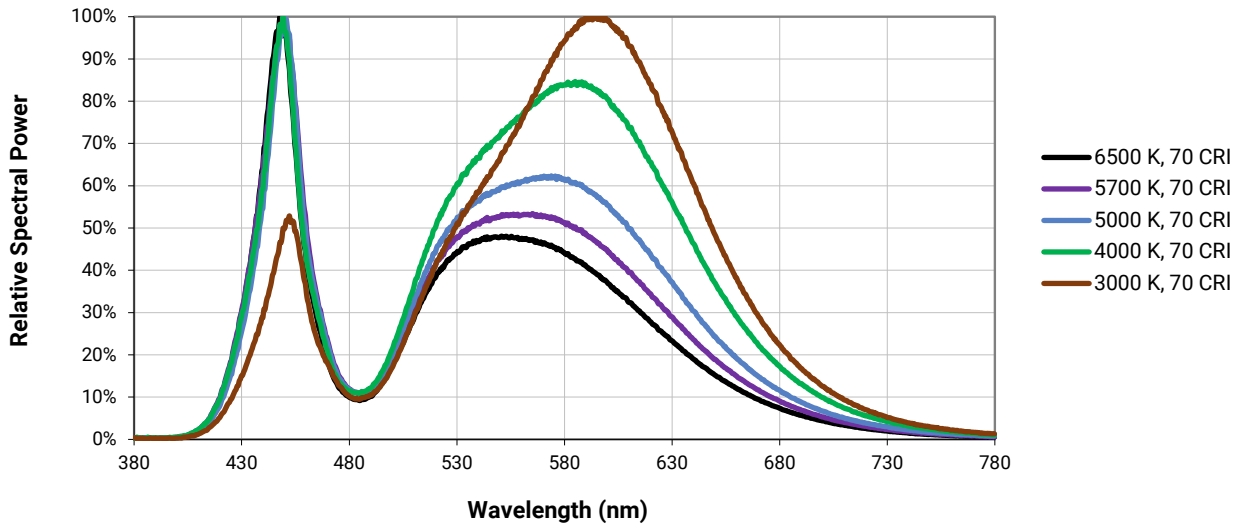
Specialty

Nominal CCT	CRI		Minimum Luminous Flux (lm)	Typical Luminous Flux (lm)	2-Step		3-Step			
	Min.	Typ			Group	Order Code	Group	Order Code	Group	Order Code
3100 K	90	92	9,600	10,110			31Q	CMB3090-0000-000R0U0A31Q		
3000 K	90	92	9,449	9,951					30U	CMB3090-0000-000R0U0A30U
	90	92	9,851	10,374			30Q	CMB3090-0000-000R0U0A30Q		
	95	98	8,393	8,839	L7C	CMB3090-0000-000R0Z0AL7C				

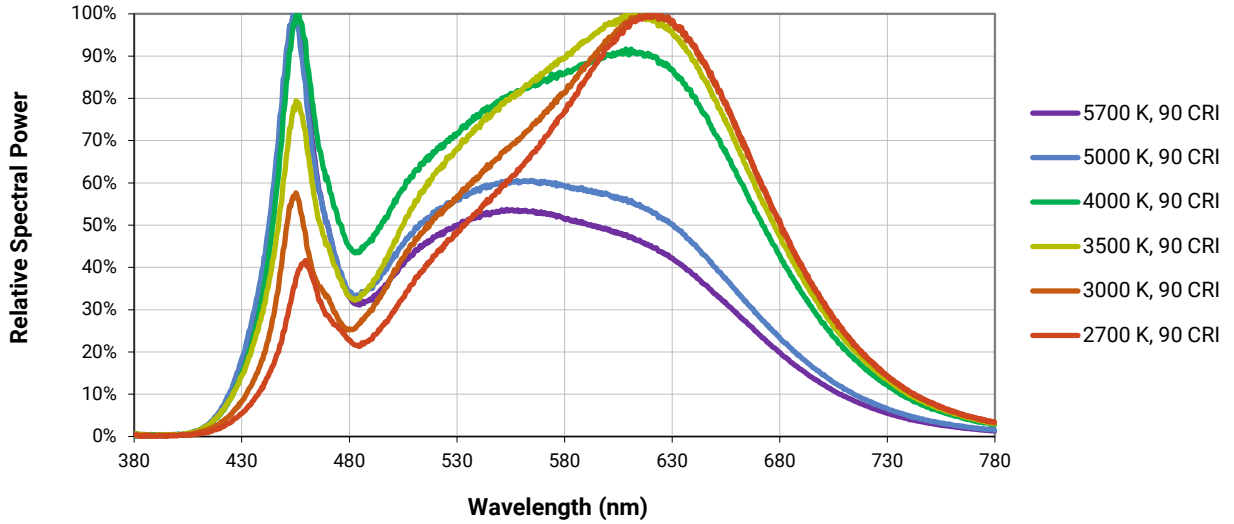
- Notes**
- Cree LED maintains a tolerance of ±7% on flux and power measurements, ±0.005 on chromaticity (CCx, CCy) measurements and a tolerance of ±2 on CRI measurements. See the Measurements section (page 23).
 - For 80 CRI minimum LEDs, CRI R9 minimum is 0 with a ±2 tolerance. For 90 CRI minimum LEDs, CRI R9 typical is 60.

RELATIVE SPECTRAL POWER DISTRIBUTION, STANDARD LEDs

The following graphs are the result of a series of pulsed measurements at 1800 mA for the 48-V CMB3090, 1200 mA for the 72-V CMB3090 and $T_j = 85\text{ }^\circ\text{C}$.



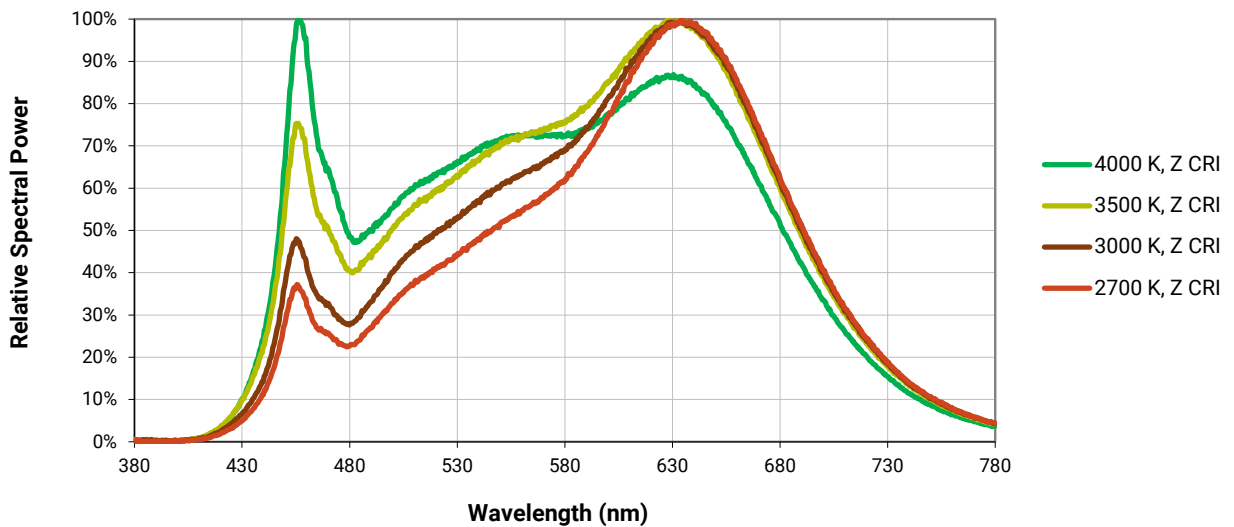
RELATIVE SPECTRAL POWER DISTRIBUTION, STANDARD LEDs - CONTINUED



RELATIVE SPECTRAL POWER DISTRIBUTION, PREMIUM COLOR LEDs

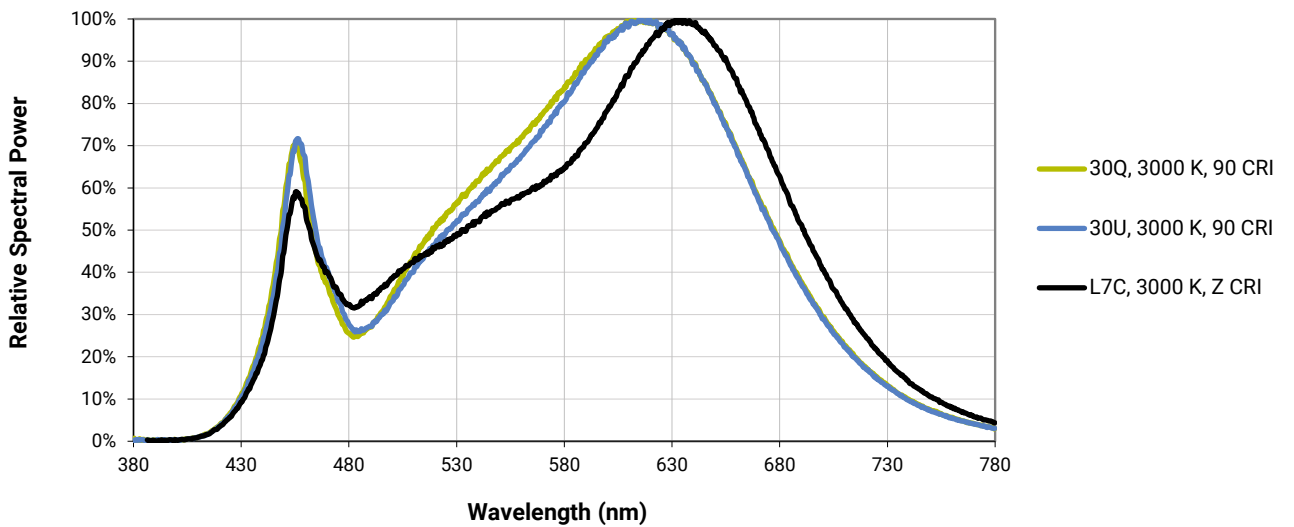
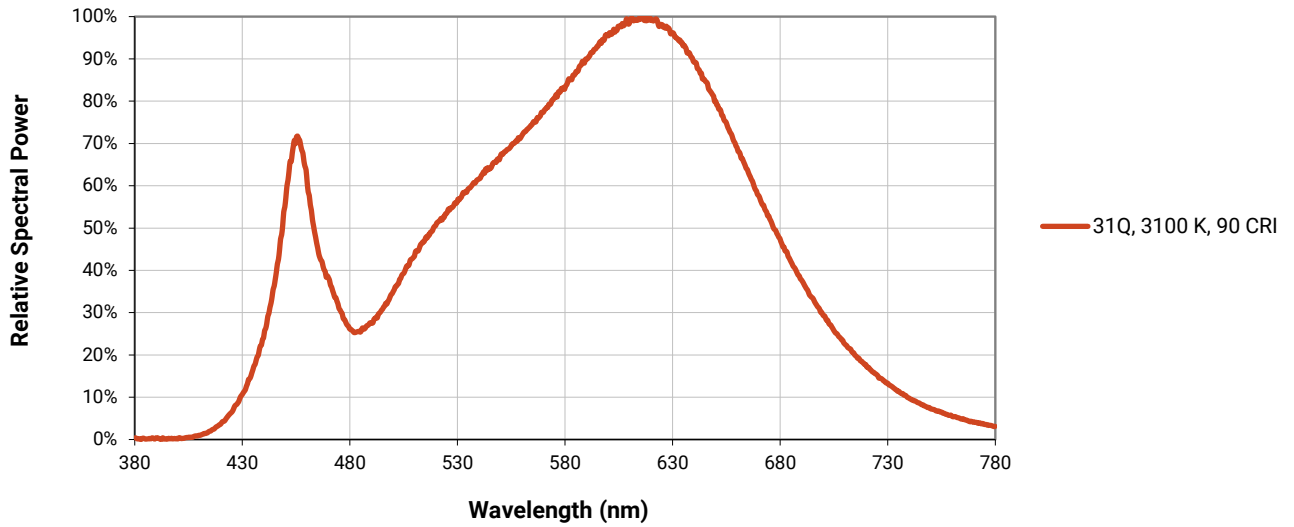
The following graphs are the result of a series of pulsed measurements at 1800 mA for the 48-V CMB3090, 1200 mA for the 72-V CMB3090 and $T_j = 85^\circ\text{C}$.

Fidelity



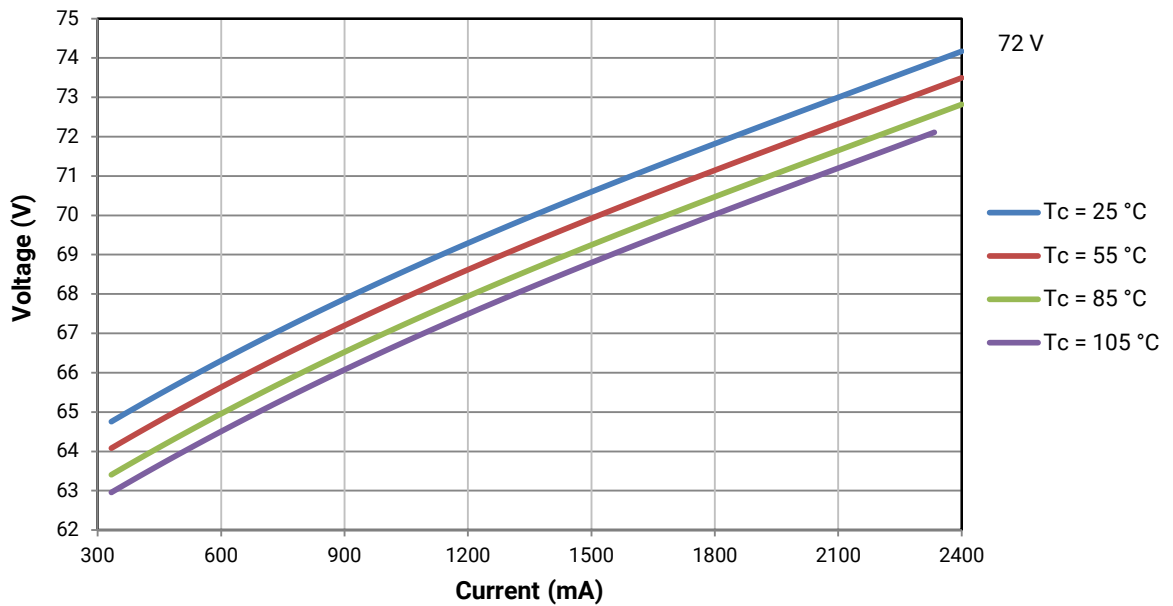
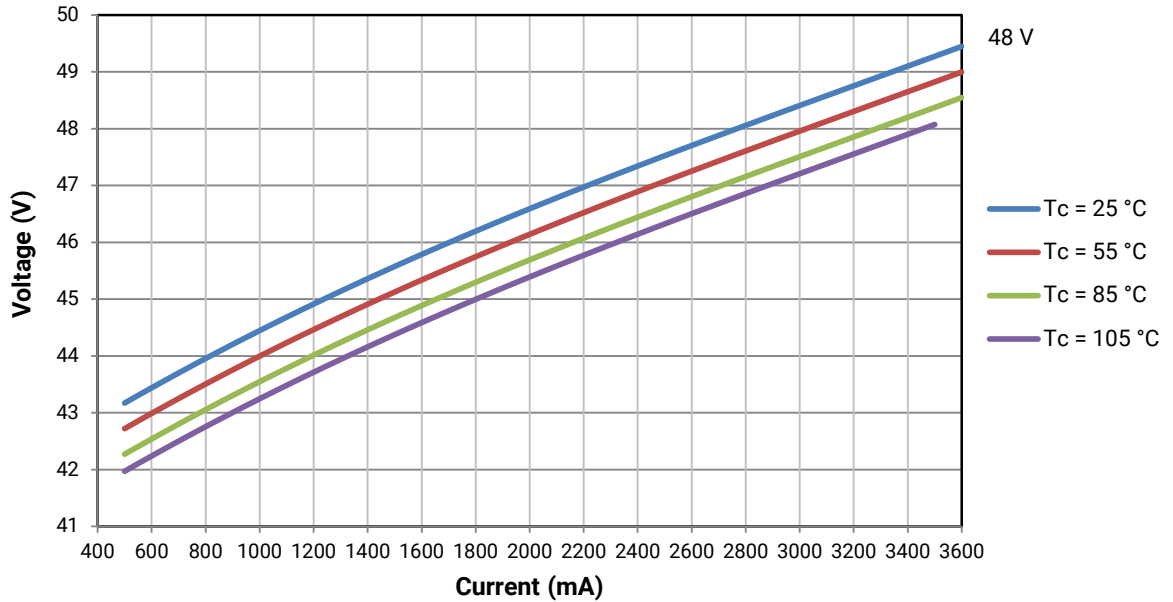
RELATIVE SPECTRAL POWER DISTRIBUTION, PREMIUM COLOR LEDS - CONTINUED

Specialty



ELECTRICAL CHARACTERISTICS

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

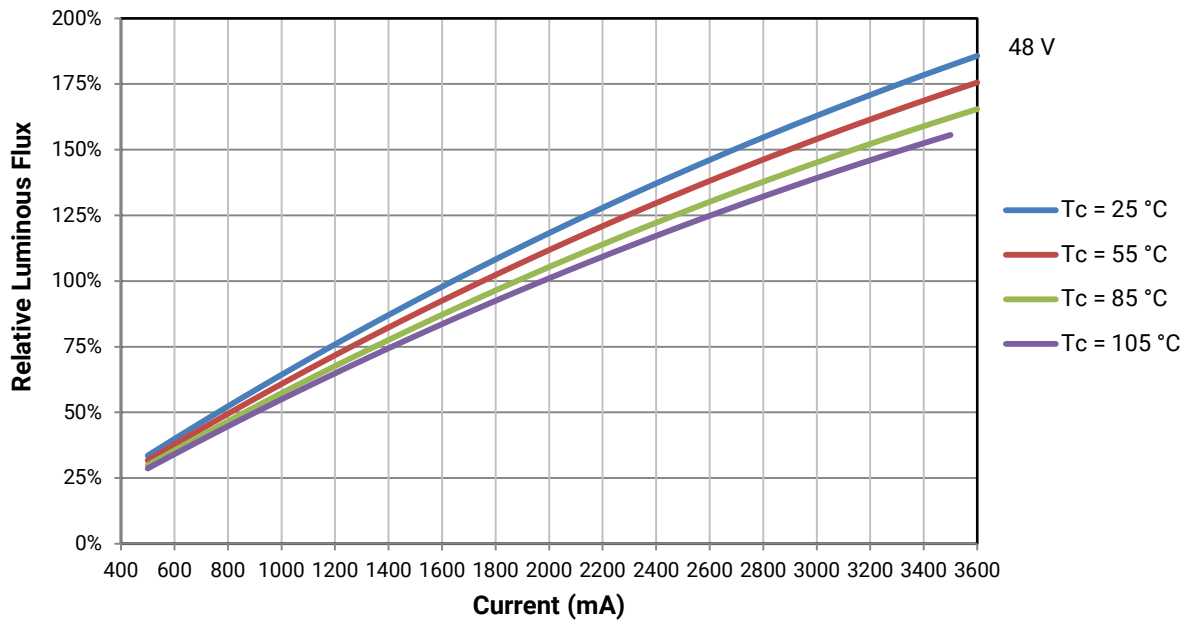


RELATIVE LUMINOUS FLUX

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

- Measurements of CMB3090 at steady-state operation at the given conditions, divided by
- Flux measured during binning, which is a pulsed measurement at 1800 mA at $T_j = 85^\circ\text{C}$ for the 48-V CMB3090.

Using the 48-V CMB3090 LED as an example,, at steady-state operation of $T_c = 25^\circ\text{C}$, $I_f = 1200\text{ mA}$, the relative luminous flux ratio is 75% in the chart below. A 48-V CMB3090 LED that measures 9755 lm during binning will deliver 7316 lm ($9755 \cdot .75$) at steady-state operation of $T_c = 25^\circ\text{C}$, $I_f = 1200\text{ mA}$.

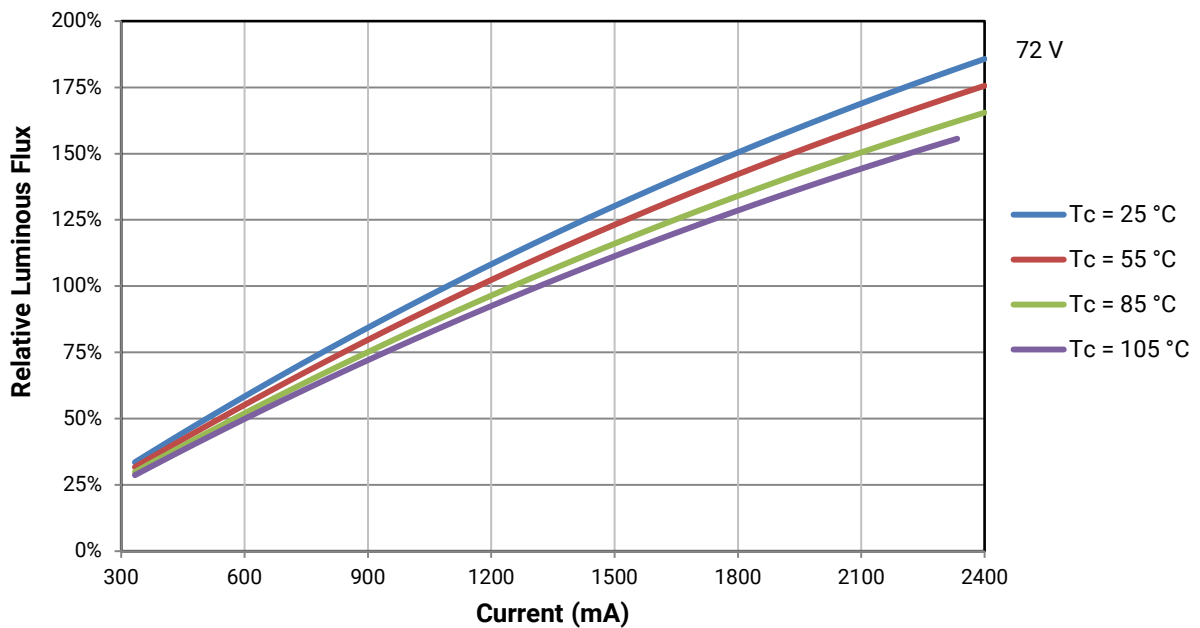


RELATIVE LUMINOUS FLUX - CONTINUED

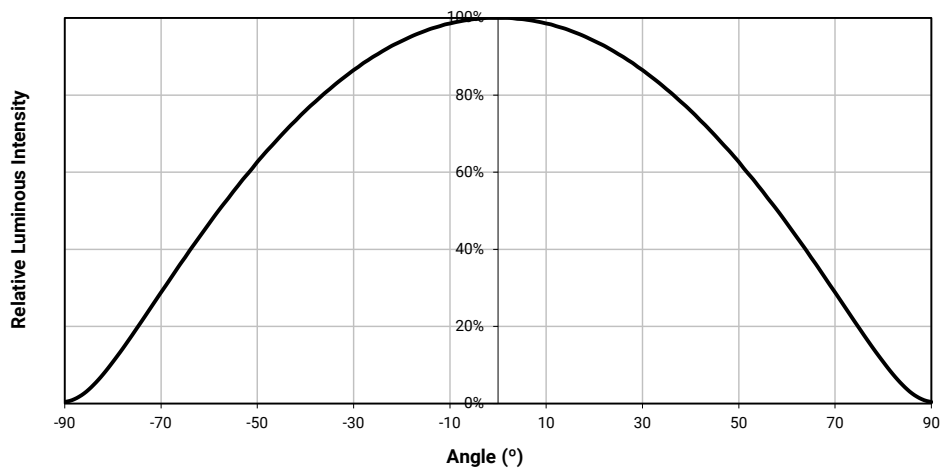
The relative luminous flux values provided below are the ratio of:

- Measurements of CMB3090 at steady-state operation at the given conditions, divided by
- Flux measured during binning, which is a pulsed measurement at 1200 mA at $T_j = 85\text{ °C}$ for the 72-V CMB3090.

Using the 72-V CMB3090 LED as an example,, at steady-state operation of $T_c = 25\text{ °C}$, $I_f = 1800\text{ mA}$, the relative luminous flux ratio is 150% in the chart below. A 72-V CMB3090 LED that measures 9755 lm during binning will deliver 14,633 lm (9755×1.5) at steady-state operation of $T_c = 25\text{ °C}$, $I_f = 1800\text{ mA}$.



TYPICAL SPATIAL DISTRIBUTION



PERFORMANCE GROUPS - CHROMATICITY ($T_j = 85\text{ }^\circ\text{C}$)

XLamp CMB3090 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	0.3764	0.3711
		0.3784	0.3787
		0.3847	0.3826
		0.3825	0.3748
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	
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
22G	2200 K	0.5066	0.4158	0.00980	0.00480	45.5

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
30E	3000 K	0.4338	0.4030	0.01390	0.00680	53.2

PREMIUM COLOR PERFORMANCE GROUPS - CHROMATICITY ($T_j = 85\text{ }^\circ\text{C}$)

XLamp CMB3090 LEDs are tested for chromaticity and placed into one of the regions defined by the following bounding coordinates.

Fidelity

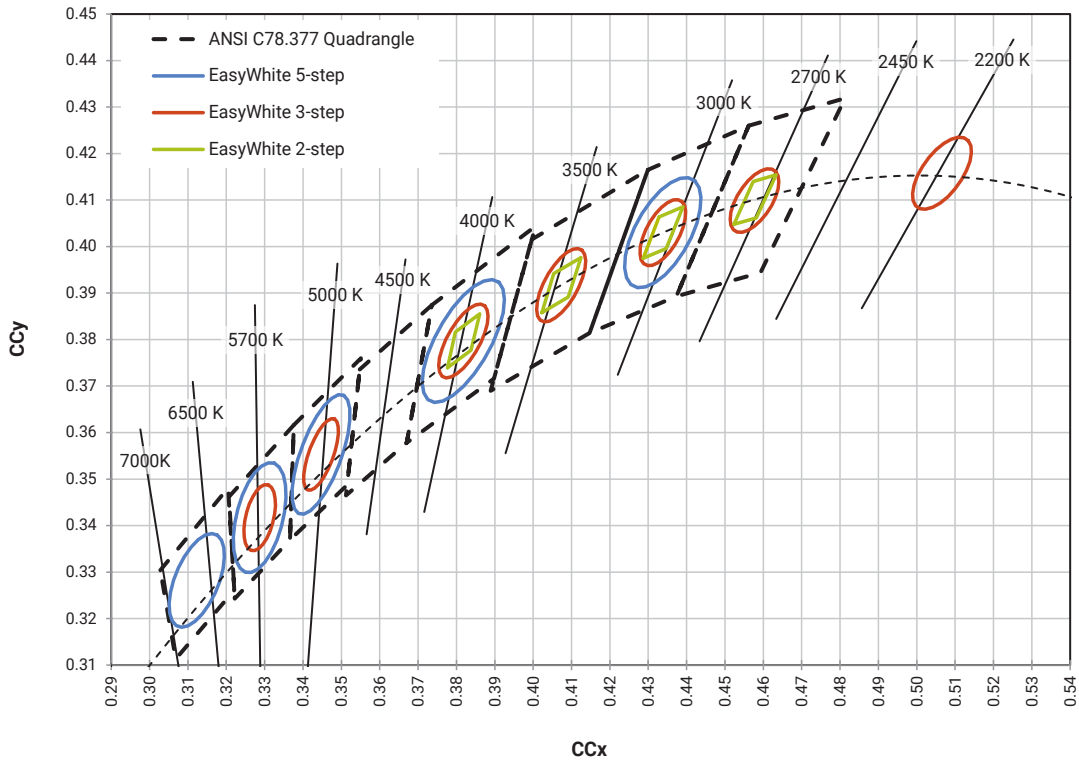
EasyWhite Color Temperatures – 2-Step			
Code	CCT	x	y
40H	4000 K	0.3764	0.3711
		0.3784	0.3787
		0.3847	0.3826
		0.3825	0.3748
35H	3500 K	0.4022	0.3858
		0.4053	0.3942
		0.4125	0.3977
		0.4091	0.3891
30H	3000 K	0.4287	0.3975
		0.4328	0.4064
		0.4390	0.4086
		0.4347	0.3996
27H	2700 K	0.4524	0.4048
		0.4574	0.4140
		0.4633	0.4154
		0.4581	0.4062

Specialty

EasyWhite Color Temperatures – 2-Step			
Code	CCT	x	y
L7C	3000 K	0.4192	0.3754
		0.4224	0.3823
		0.4291	0.3847
		0.4257	0.3777

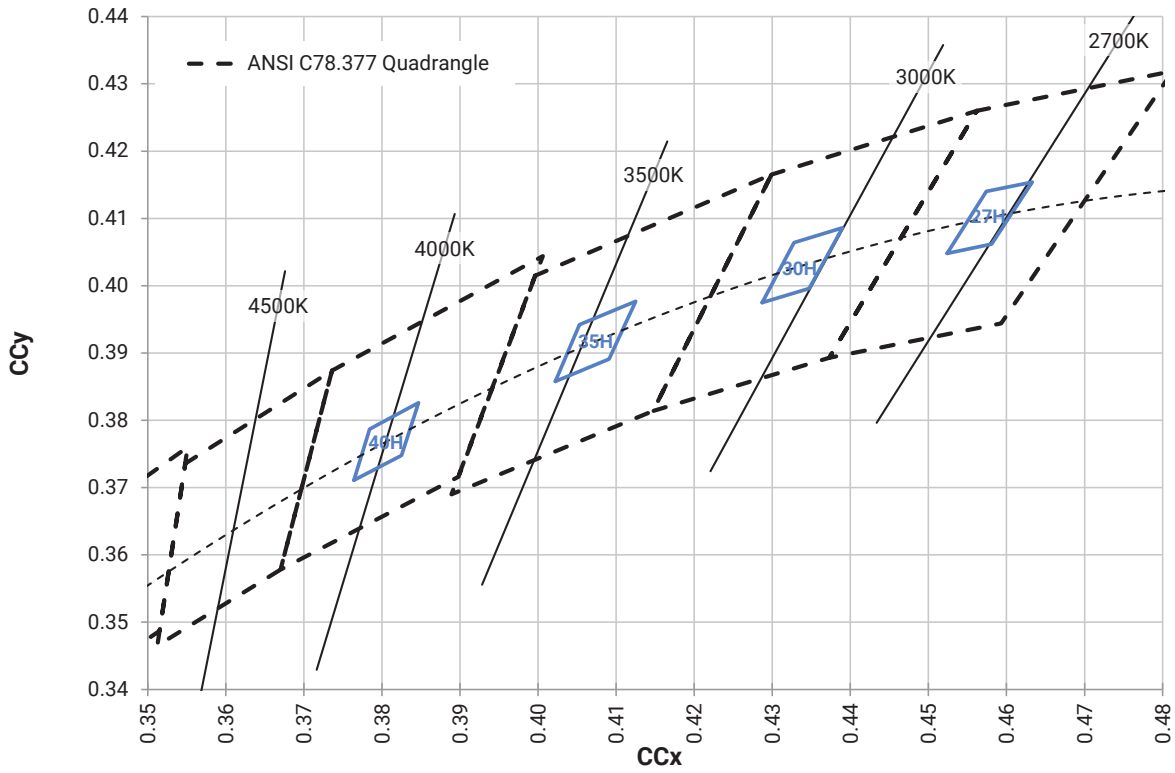
EasyWhite Color Temperatures – 3-Step Ellipse						
Bin Code	CCT	Center Point		Major Axis	Minor Axis	Rotation Angle (°)
		x	y	a	b	
31Q	3100 K	0.4236	0.3888	0.00848	0.00455	50.3
30Q	3000 K	0.4305	0.3935	0.00834	0.00408	53.2
30U	3000 K	0.4274	0.3837	0.00834	0.00408	53.2

EASYWHITE® BINS PLOTTED ON THE 1931 CIE COLOR SPACE ($T_j = 85\text{ }^\circ\text{C}$)



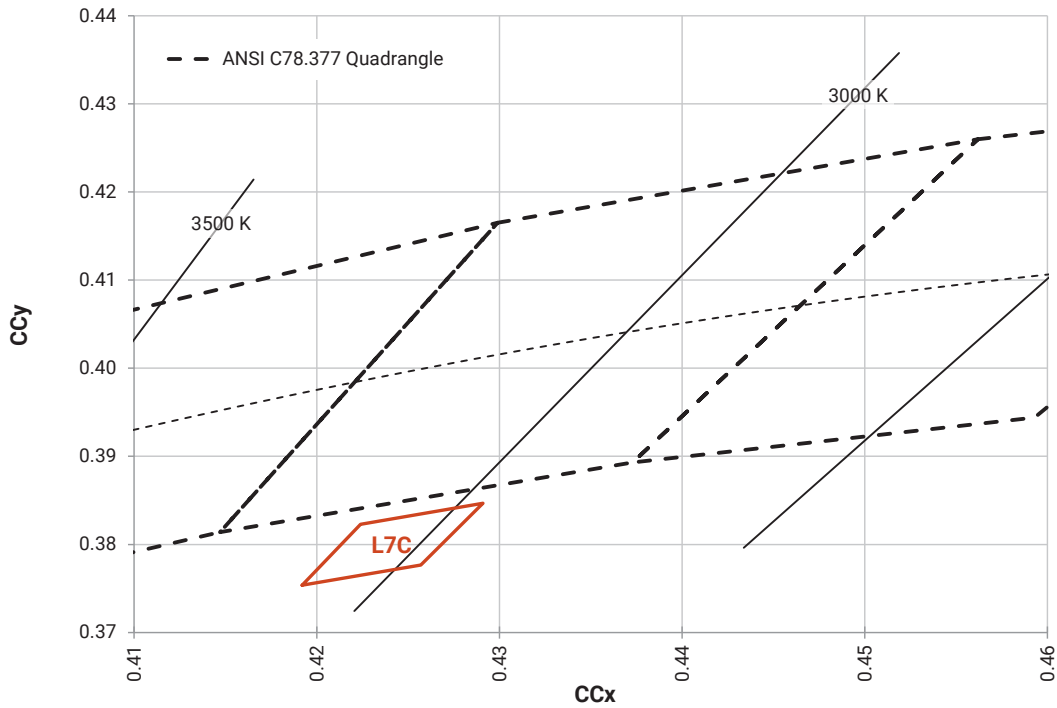
PREMIUM COLOR BINS PLOTTED ON THE 1931 CIE COLOR SPACE ($T_j = 85\text{ }^\circ\text{C}$)

Fidelity (2-step)

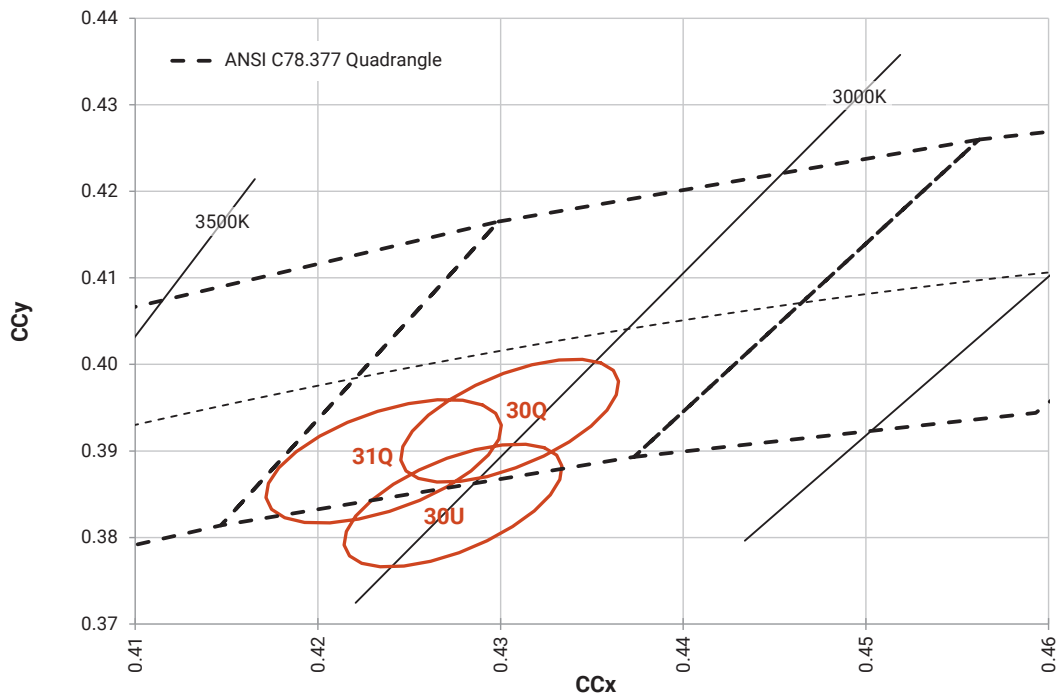


PREMIUM COLOR BINS PLOTTED ON THE 1931 CIE COLOR SPACE ($T_j = 85^\circ\text{C}$) - CONTINUED

Speciality (2-step)

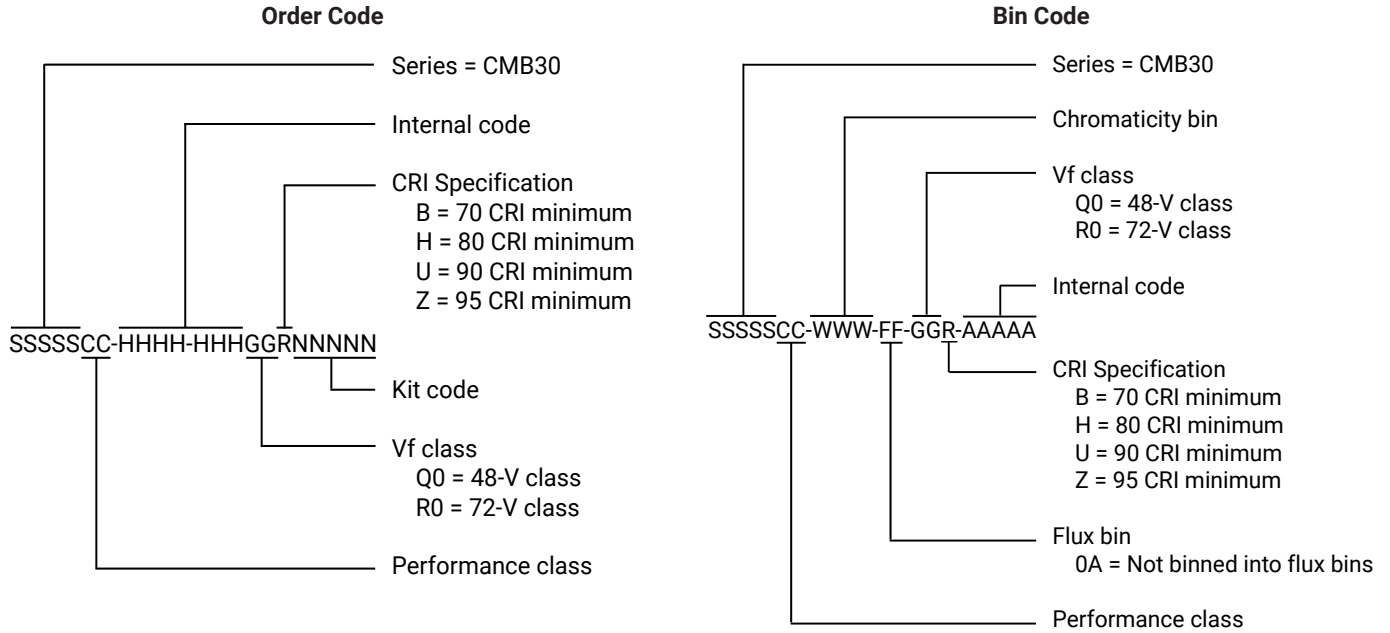


Speciality (3-step)



BIN AND ORDER CODE FORMATS

Bin codes and order codes are configured as follows:



MECHANICAL DIMENSIONS

Dimensions are in mm.

Tolerances unless otherwise specified: ± 0.13

$\alpha^\circ \pm 1^\circ$

Meaning of LED Marking

B3090Q = 48-V CMB3090

B3090R = 72-V CMB3090

X₁ X₂ X₃ X₄ X₅

X1 CCT

1 = 6500 K

2 = 5700 K

3 = 5000 K

5 = 4000 K

6 = 3500 K

7 = 3000 K

8 = 2700 K

A = 2200 K

X2

M = EasyWhite or
Fidelity LED on the
black-body line

Q = Specialty LED below
the black-body line

U = Specialty LED below
the black-body line

X3 X4 Flux bin

0A = Not binned into flux
bins

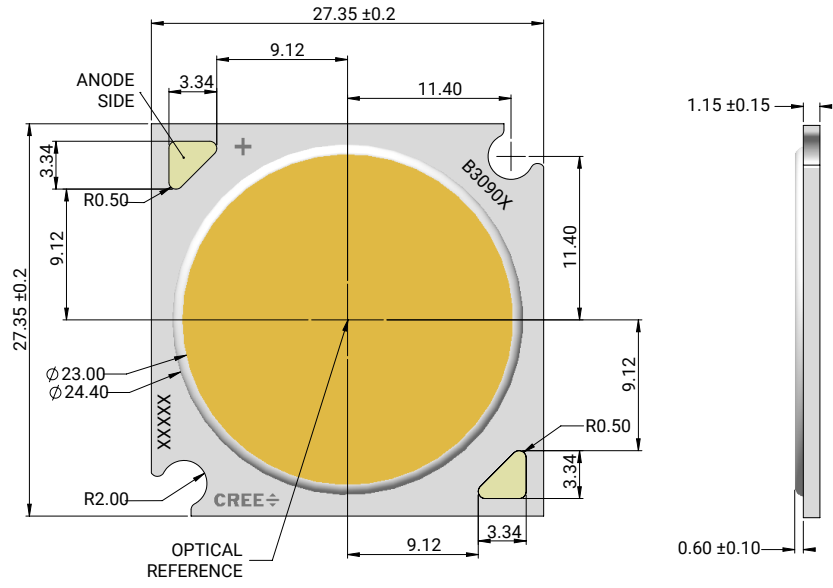
X5 CRI

B = 70 CRI min

H = 80 CRI min

U = 90 CRI min

Z = 95 CRI min



Tc measurement point: either the anode or cathode solder pad

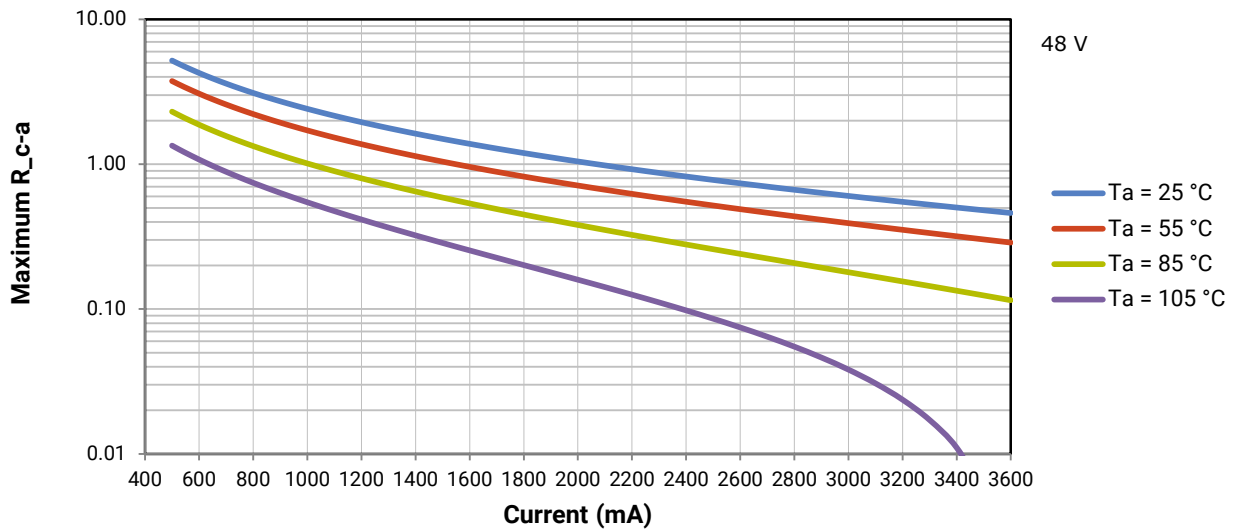
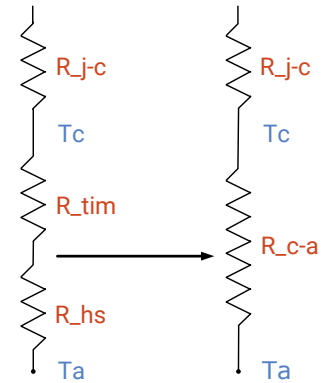
THERMAL DESIGN

The CMB 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 (T_c). No additional calculations are required to ensure that the CMB LED is being operated within its designed limits. LES temperature measurement provides additional verification of good thermal design. Please refer to page 2 for the Operating Limit specification.

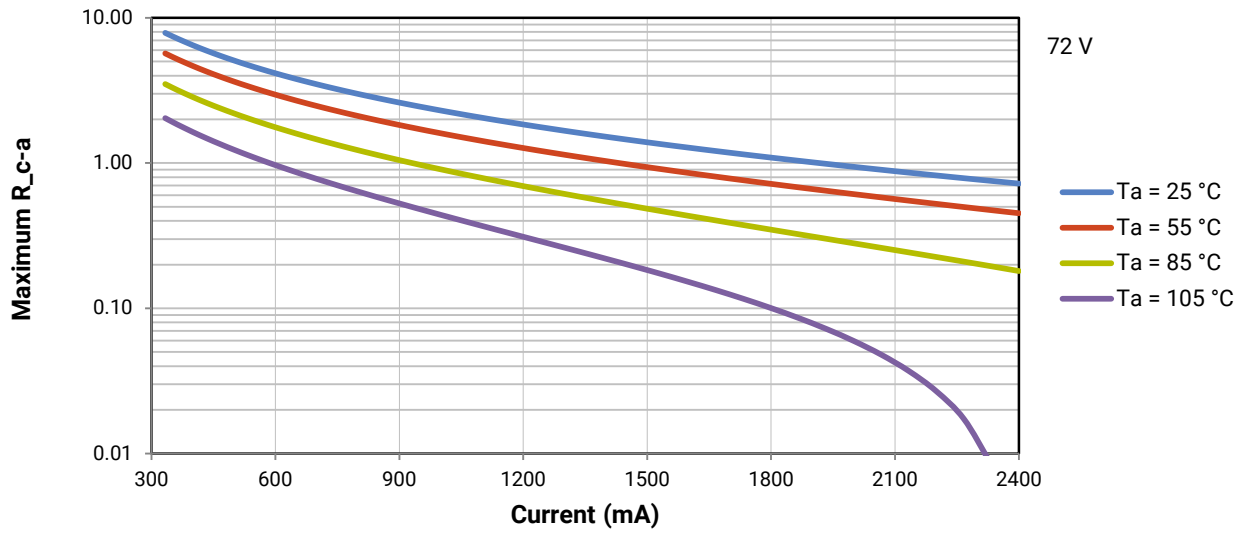
There is no need to calculate for T_j inside the package, as the thermal management design process, specifically from solder point (T_{sp}) to ambient (T_a), remains identical to any other LED component. For more information on thermal management of XLamp LEDs, please refer to the [Thermal Management application note](#). For CMU soldering recommendations and more information on thermal interface materials (TIM), LES temperature measurement, and connection methods, please refer to the [XLamp CM Family LEDs soldering and handling document](#).

To keep the CMB3090 LED at or below the maximum rated T_c , 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 graphs, depending on the operating environment. The y-axis in the graphs 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}).



THERMAL DESIGN - CONTINUED



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. Cree LED did not perform Room Temperature Operating Life (RTOL) testing on the CMB3090 LED.

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.

Vision Advisory

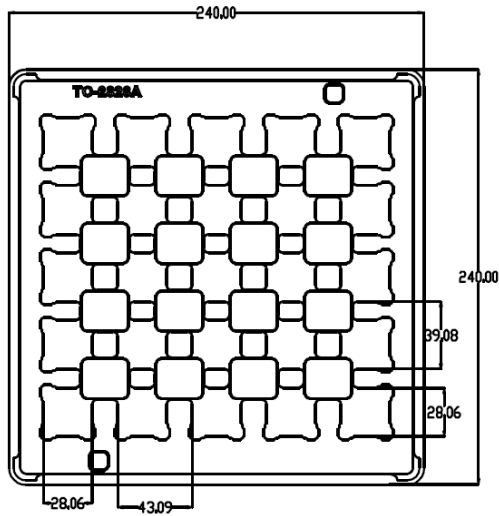
WARNING: Do not look at an exposed lamp in operation. Eye injury can result. For more information about LEDs and eye safety, please refer to the [LED Eye Safety application note](#).

PACKAGING

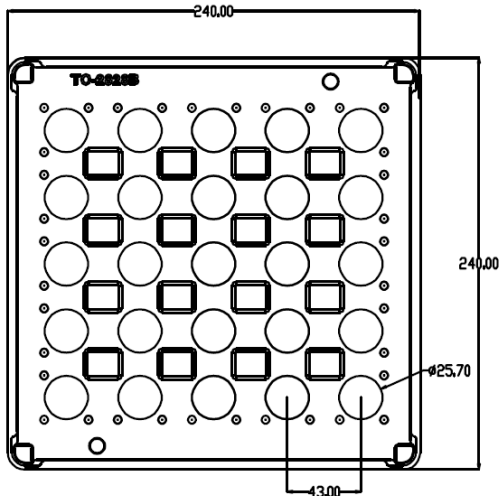
CMB3090 LEDs are packaged in trays of 25. Five trays are sealed in an anti-static bag and placed inside an inner box, for a total of 125 LEDs per box. Each box contains LEDs from the same performance bin. Eight boxes are placed inside a carton, for a total of 1,000 LEDs per carton.

Dimensions are in mm.
Tolerance: ±.5

Load Tray



Upper Tray

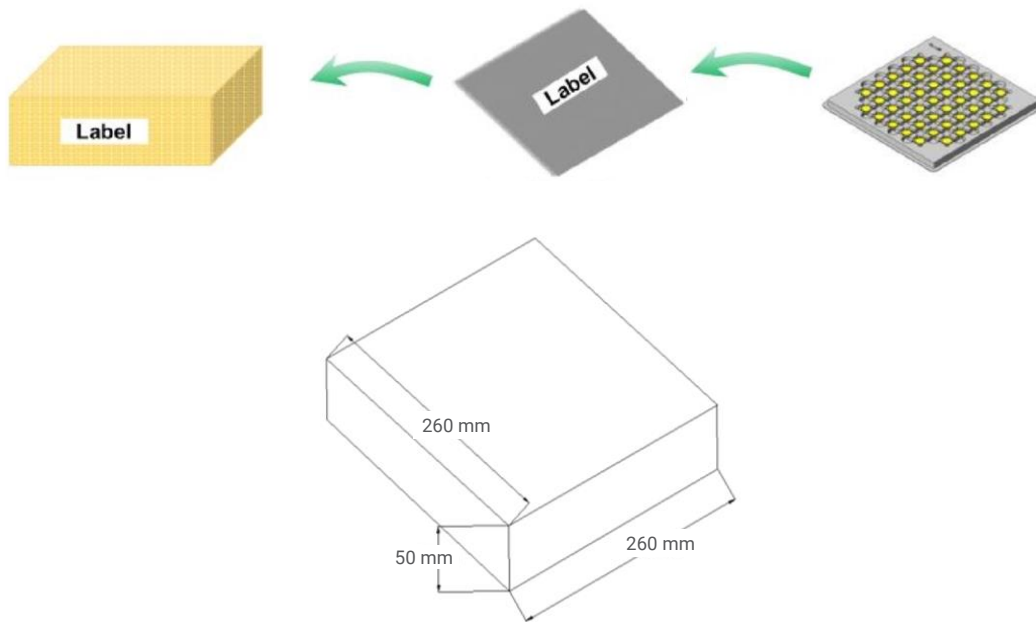


PACKAGING - CONTINUED

CMB3090 LEDs are packaged in trays of 25. Five trays are sealed in an anti-static bag and placed inside an inner box, for a total of 125 LEDs per box. Each box contains LEDs from the same performance bin. Eight boxes are placed inside a carton, for a total of 1,000 LEDs per carton.

Dimensions are in mm.
Tolerance: ± 3 mm

Inner Box



Outer Carton

