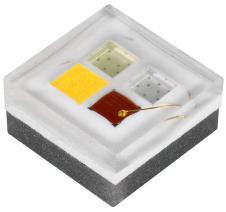
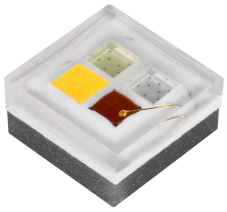
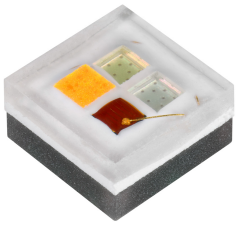
XLamp® X21A Multi-Color LEDs



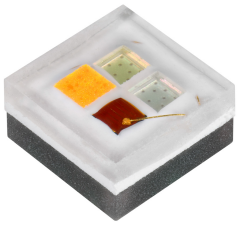
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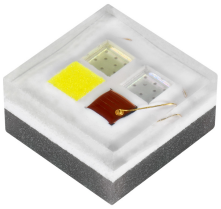
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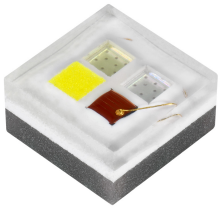
X21APA



X21ABA



X21APL



X21ABL

PRODUCT DESCRIPTION

XLamp® X21 Color LEDs are multi-color (RGBW or RGB+PC Amber or RGB+PC Lime LEDs) that deliver the combination of high lumen output and great color mixing in a small 2.1 x 2.1 mm package. The XLamp X21 Color LEDs feature the smallest possible distance between LED die, creating a small optical source for excellent optical control and efficient color mixing. XLamp X21 Color LEDs are optimized for all high-performance multi- color lighting applications, including color-changing, stage, architectural and entertainment

FEATURES

- Available in RGB + color configurations in a single package
- Maximum drive current per LED die: 350mA
- Individually addressable LEDs
- Reflow solderable – JEDEC J-STD-020
- RoHS and REACH compliant
- UL® recognized component (E349212)

Cree LED / 4001 E. Hwy. 54, Suite 2000 / Durham, NC 27713 USA / +1.919.313.5330 / www.cree-led.com

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CHARACTERISTICS — X21ACL COMPLETE PACKAGE

The following table lists the product characteristics for the XLamp X21 Multi-Color LED package, measured with all LED dies on simultaneously and each LED die connected to independent drive circuits at 175 mA.

Characteristics	Unit	Minimum	Typical	Maximum
Thermal resistance, junction to solder point $R_{\theta\text{-}S}$◊	°C/W	-	7.0	-
Viewing angle (FWHM) — High Intensity	degrees	-	120	-
LED junction temperature	°C	-	-	150

◊ $R_{\theta\text{-}S}$ Thermal resistance measurement was performed per the JEDEC JESD51-14 standard. See the Thermal Resistance Measurement application note for more details.

CHARACTERISTICS — PER LED DIE

The following table lists the product characteristics for each LED die within the XLamp X21 Multi-Color LED package.

Characteristics	Unit	Minimum	Typical	Maximum
Temperature coefficient of voltage — red	mV/°C	-	-1.5	-
Temperature coefficient of voltage — green	mV/°C	-	-1.0	-
Temperature coefficient of voltage — royal	mV/°C	-	-1.1	-
Temperature coefficient of voltage — white	mV/°C	-	-1.1	-
DC forward current — red, green, royal, white	mA	-	-	350
Forward voltage (@ 175 mA, 25 °C) — red	V	-	2.5	2.7
Forward voltage (@ 175 mA, 25 °C) — green	V	-	2.8	3.0
Forward voltage (@ 175 mA, 25 °C) — royal, white	V	-	3.0	3.2

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FLUX CHARACTERISTICS — HIGH INTENSITY (T_J = 25 °C)

The following table lists the minimum and typical luminous flux for each LED die within the XLamp package at 175 mA per die, measured at T_j = 25 °C.

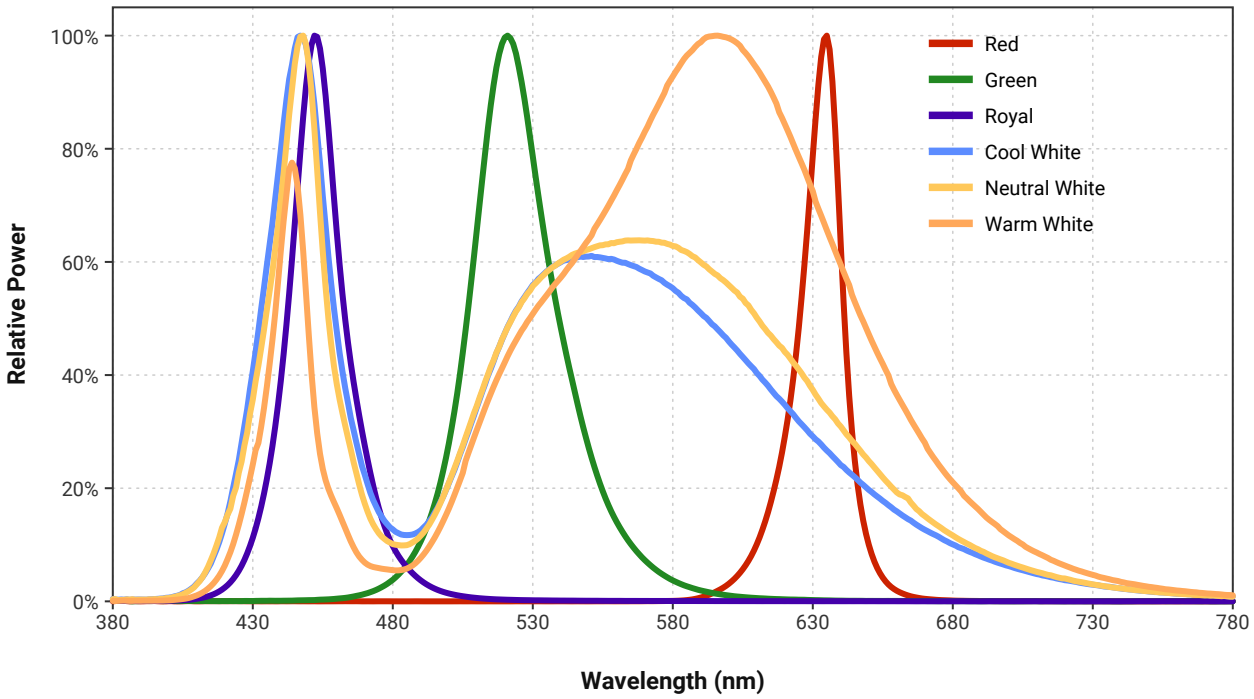
Color		Chromaticity Bins / Dominant Wavelength Range		Minimum Luminous Flux @ 175 mA		Typical Luminous Flux @ 175 mA	Order Code
		Minimum	Maximum	Group	Flux (lm)	Flux (lm)	
Color + White	Red	620 nm	630 nm	A2	20	30	X21ACL-H0-0000-0000BA2AAA1E
	Green	520 nm	535 nm		40	55	
	Royal Blue	450 nm	465 nm		5	10	
	Cool White 70CRI	6500K			40	60	
Color + White	Red	620 nm	630 nm	A2	20	30	X21ACL-H0-0000-0000BA2AAA2E
	Green	520 nm	535 nm		40	55	
	Royal Blue	450 nm	465 nm		5	10	
	Cool White 70CRI	5700K			40	65	
Color + White	Red	620 nm	630 nm	A2	20	30	X21ACL-H0-0000-0000HA2AAA3G
	Green	520 nm	535 nm		40	55	
	Royal Blue	450 nm	465 nm		5	10	
	Neutral White 80CRI	5000K			40	60	
Color + White	Red	620 nm	630 nm	A2	20	30	X21ACL-H0-0000-0000HA2AAA5G
	Green	520 nm	535 nm		40	55	
	Royal Blue	450 nm	465 nm		5	10	
	Neutral White 80CRI	4000K			40	58	
Color + White	Red	620 nm	630 nm	A2	20	30	X21ACL-H0-0000-0000HA2AAA7G
	Green	520 nm	535 nm		40	55	
	Royal Blue	450 nm	465 nm		5	10	
	Warm White 80CRI	3000K			40	55	

Notes

- Cree LED maintains a tolerance of ±7% on flux and power measurements, ±0.005 on chromaticity measurements and ±2 on CRI measurements.
- XLamp X21ACL 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 without advance notice.

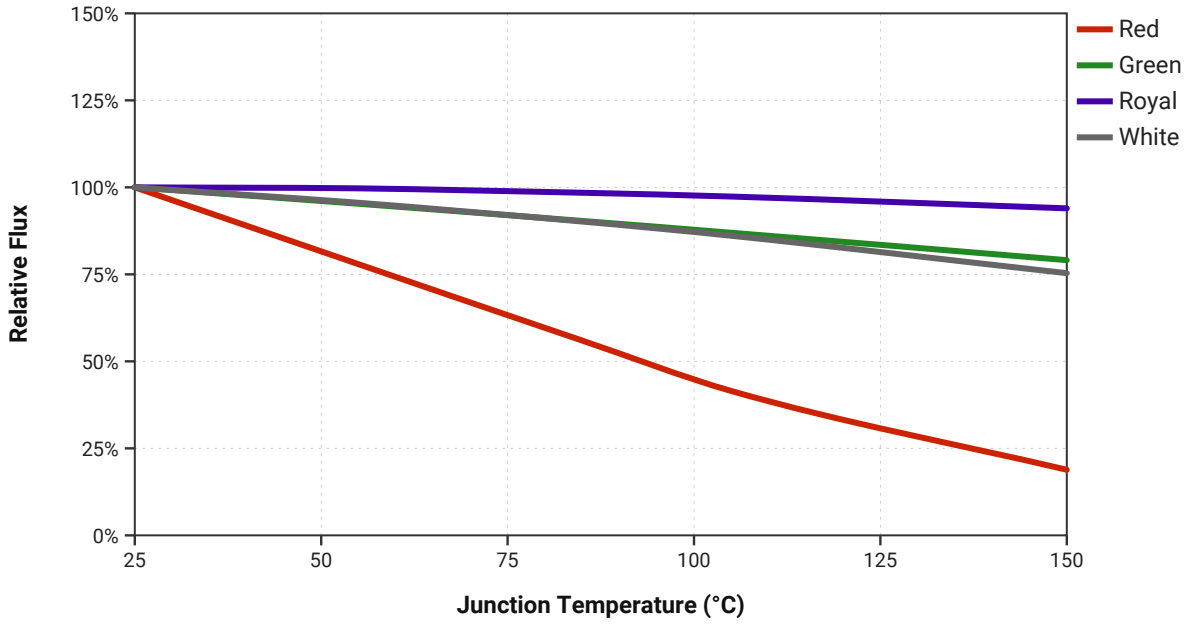
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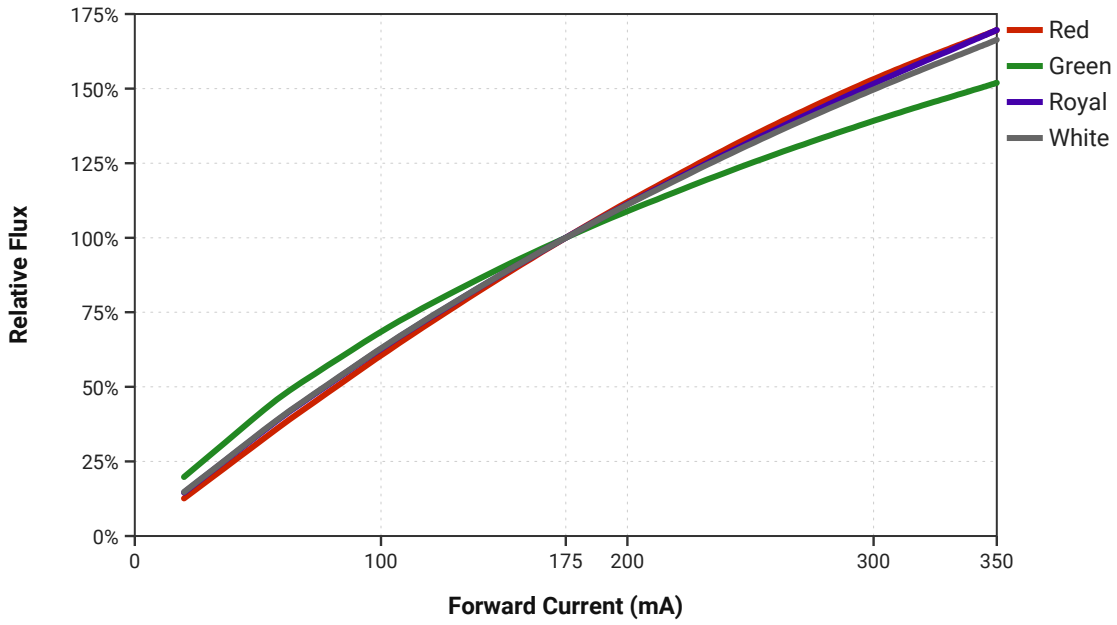


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RELATIVE FLUX VS. JUNCTION TEMPERATURE — X21ACL (I_F = 175 mA)

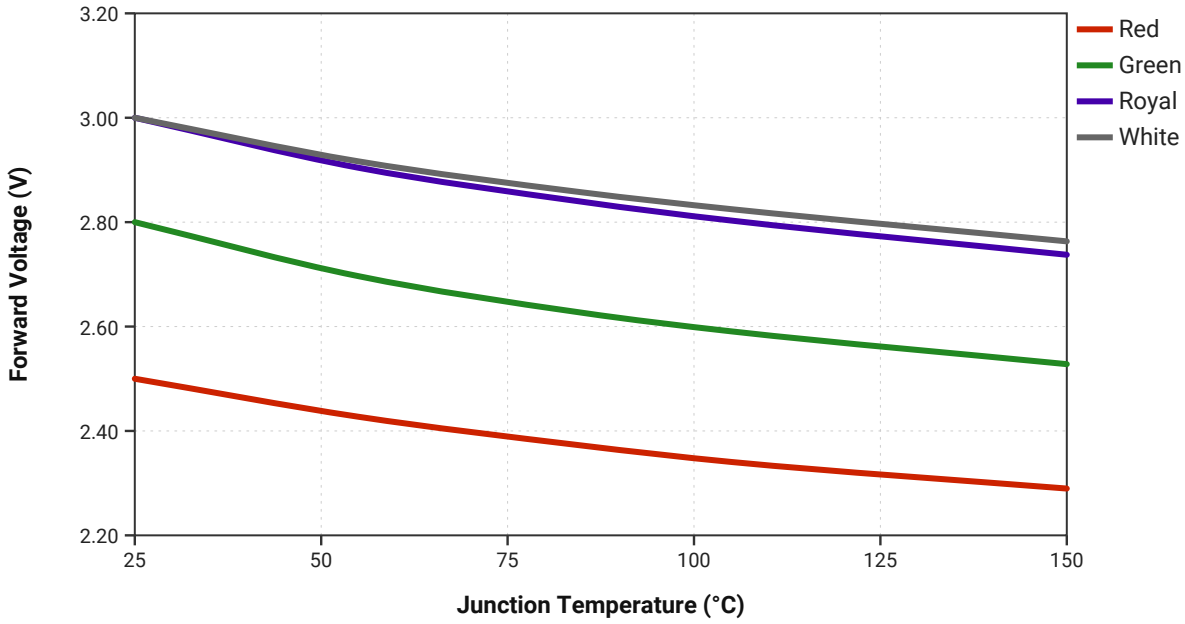


RELATIVE FLUX VS. FORWARD CURRENT — X21ACL (T_J = 25 °C)

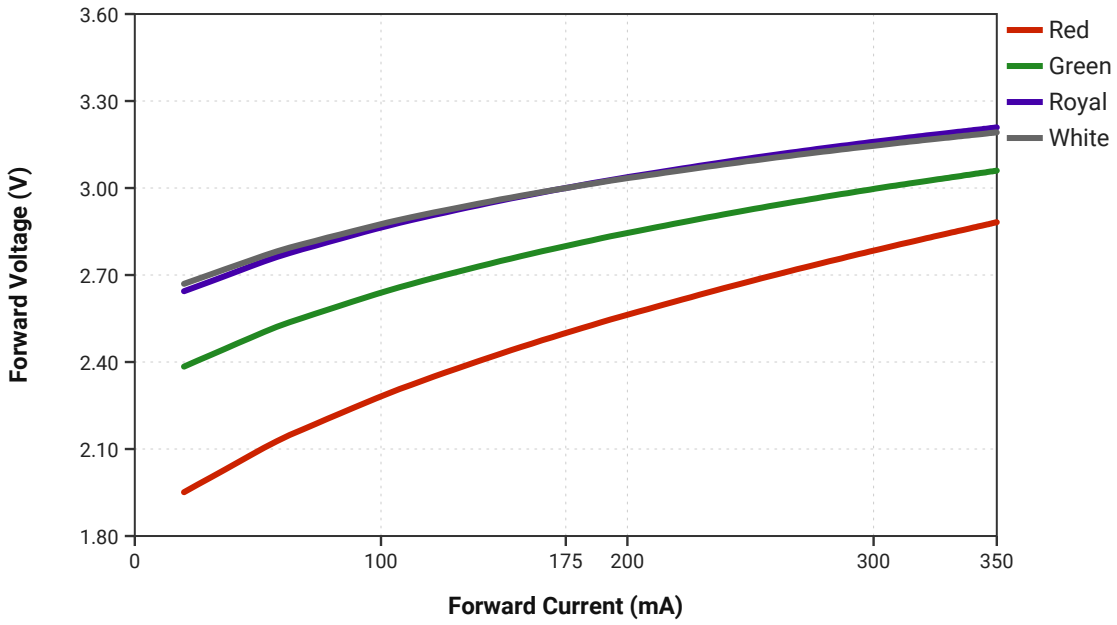


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FORWARD VOLTAGE VS. JUNCTION TEMPERATURE — X21ACL (I_F = 175 mA)

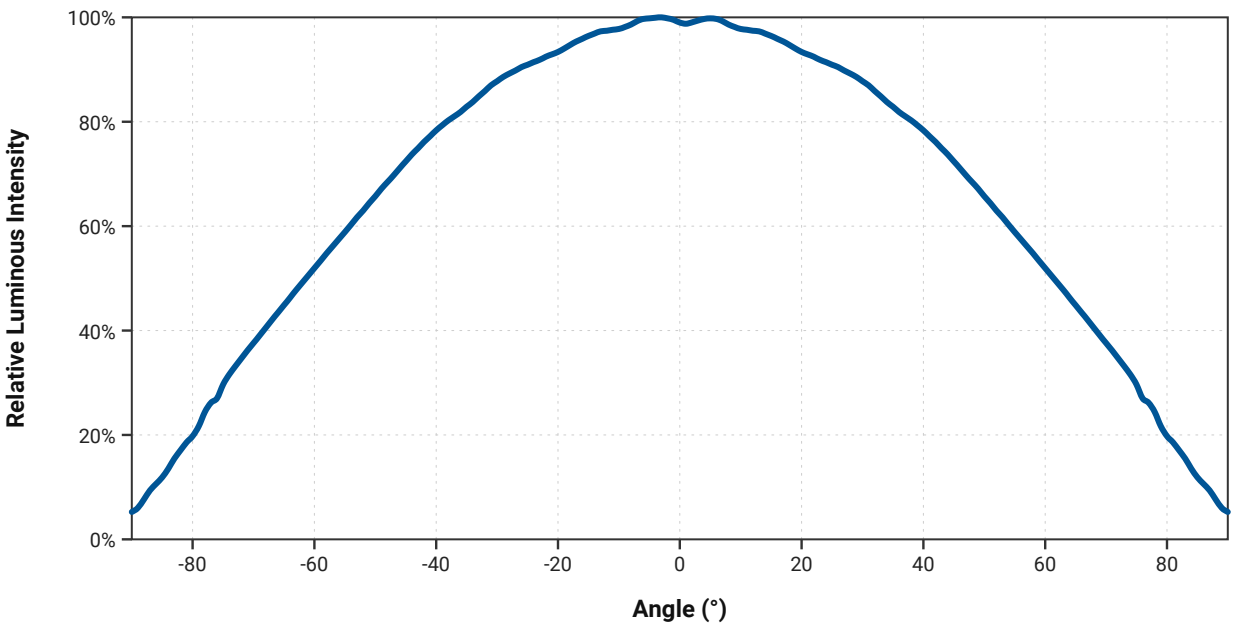


FORWARD VOLTAGE VS. FORWARD CURRENT — X21ACL (T_J = 25 °C)



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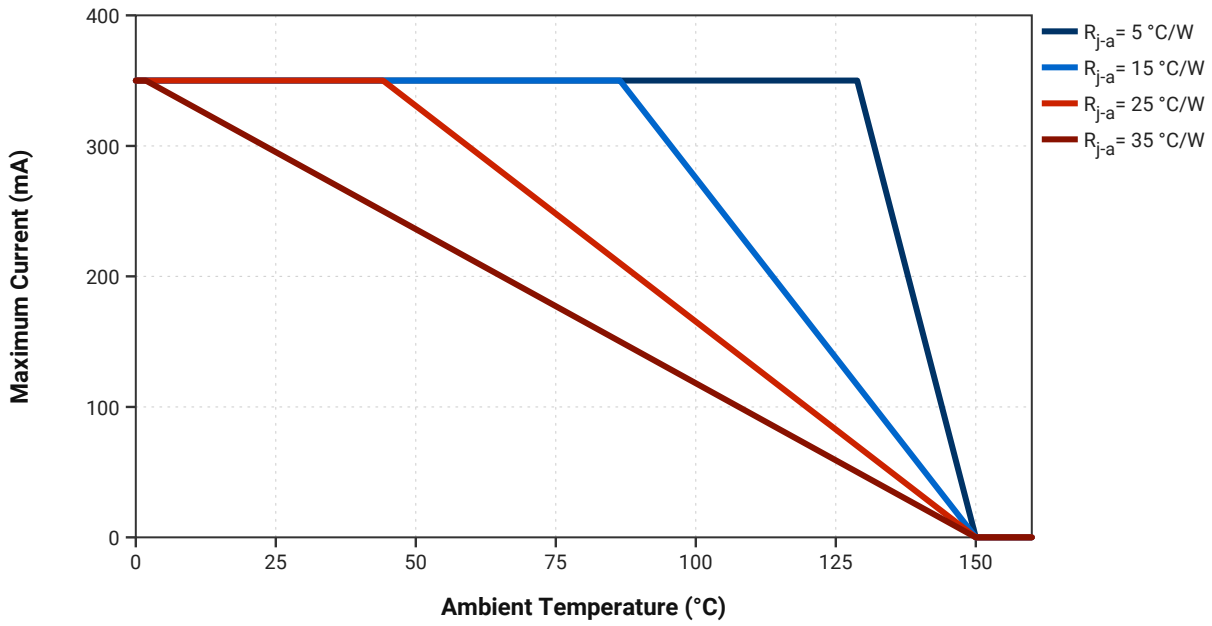


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THERMAL DESIGN

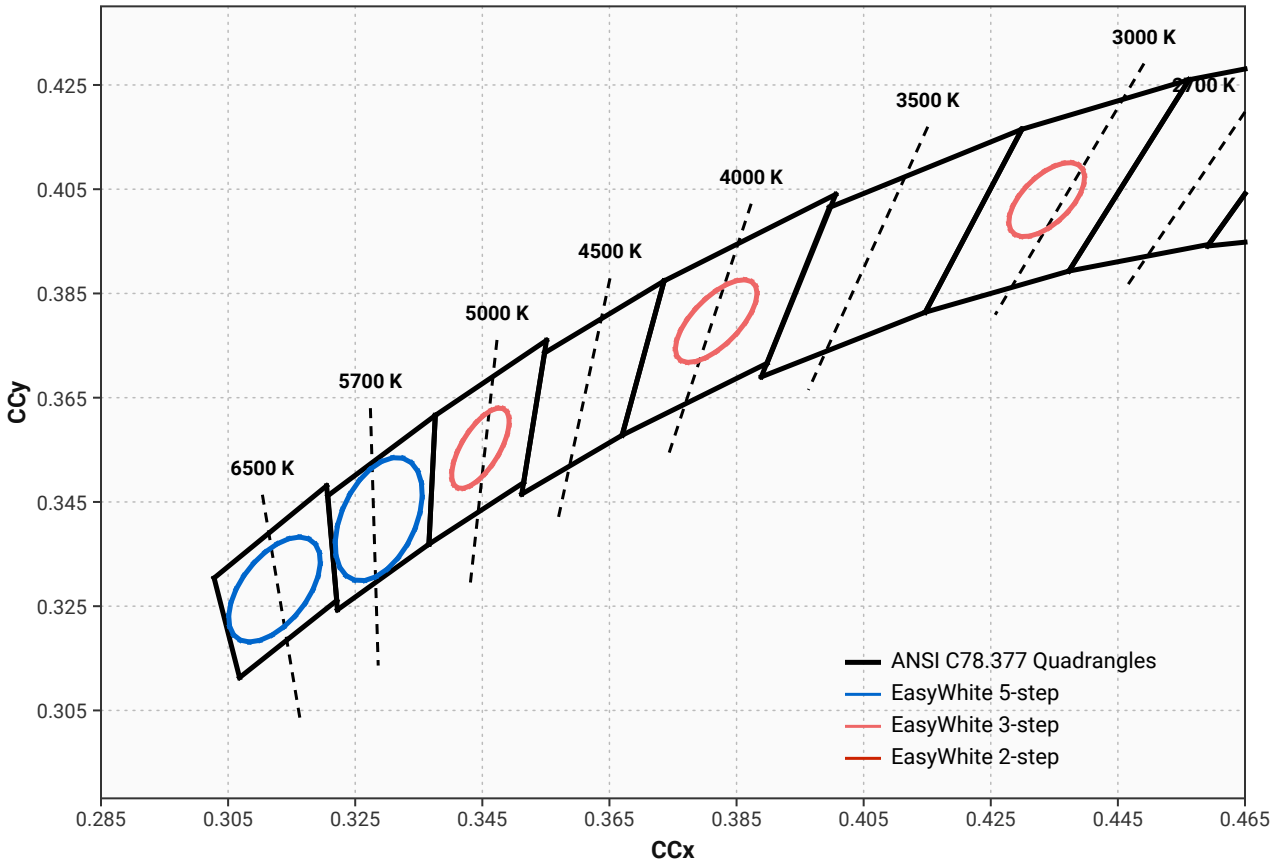
The maximum forward current is determined by the thermal resistance between the LED junction and ambient. It is crucial for the end product to be designed in a manner that minimizes the thermal resistance from the solder point to ambient in order to optimize lamp life and optical characteristics.

Please refer to the Characteristics table on page 3 for this product's thermal resistance and maximum junction temperature.



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CHROMATICITY BINS — EASYWHITE BINS



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PERFORMANCE GROUPS

XLamp X21A LEDs are tested for chromaticity and placed into one of the regions defined by the following bounding coordinates.

Color Bin (3-Step MacAdam Ellipses)						
Bin Code	CCT (K)	Center x	Center y	Major Axis (a)	Minor Axis (b)	Rotation (°)
3G	5000	0.3447	0.3553	0.0084	0.0031	65.00
5G	4000	0.3818	0.3797	0.0094	0.0040	53.70
7G	3000	0.4338	0.4030	0.0083	0.0041	53.20

Color Bin (5-Step MacAdam Ellipses)						
Bin Code	CCT (K)	Center x	Center y	Major Axis (a)	Minor Axis (b)	Rotation (°)
1E	6500	0.3123	0.3282	0.0111	0.0055	61.00
2E	5700	0.3287	0.3417	0.0123	0.0060	72.00

XLamp X21A White LEDs tested for luminous flux are placed into one of the following luminous flux groups.

Group Code	Min Luminous Flux (lm)	Max Luminous Flux (lm)
1	20	40
2	40	60
3	60	80
4	80	100
5	100	120

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CHARACTERISTICS — X21ACB COMPLETE PACKAGE

The following table lists the product characteristics for the XLamp X21 Multi-Color LED package, measured with all LED dies on simultaneously and each LED die connected to independent drive circuits at 175 mA.

Characteristics	Unit	Minimum	Typical	Maximum
Thermal resistance, junction to solder point $R_{\theta\text{-}S}$◊	°C/W	-	7.0	-
Viewing angle (FWHM) — High Intensity	degrees	-	120	-
LED junction temperature	°C	-	-	150

◊ $R_{\theta\text{-}S}$ Thermal resistance measurement was performed per the JEDEC JESD51-14 standard. See the Thermal Resistance Measurement application note for more details.

CHARACTERISTICS — PER LED DIE

The following table lists the product characteristics for each LED die within the XLamp X21 Multi-Color LED package.

Characteristics	Unit	Minimum	Typical	Maximum
Temperature coefficient of voltage — red	mV/°C	-	-1.5	-
Temperature coefficient of voltage — green	mV/°C	-	-1.0	-
Temperature coefficient of voltage — blue	mV/°C	-	-1.1	-
Temperature coefficient of voltage — white	mV/°C	-	-1.1	-
DC forward current — red, green, blue, white	mA	-	-	350
Forward voltage (@ 175 mA, 25 °C) — red	V	-	2.5	2.7
Forward voltage (@ 175 mA, 25 °C) — green	V	-	2.8	3.0
Forward voltage (@ 175 mA, 25 °C) — blue, white	V	-	3.0	3.2

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FLUX CHARACTERISTICS — HIGH INTENSITY (T_J = 25 °C)

The following table lists the minimum and typical luminous flux for each LED die within the XLamp package at 175 mA per die, measured at T_j = 25 °C.

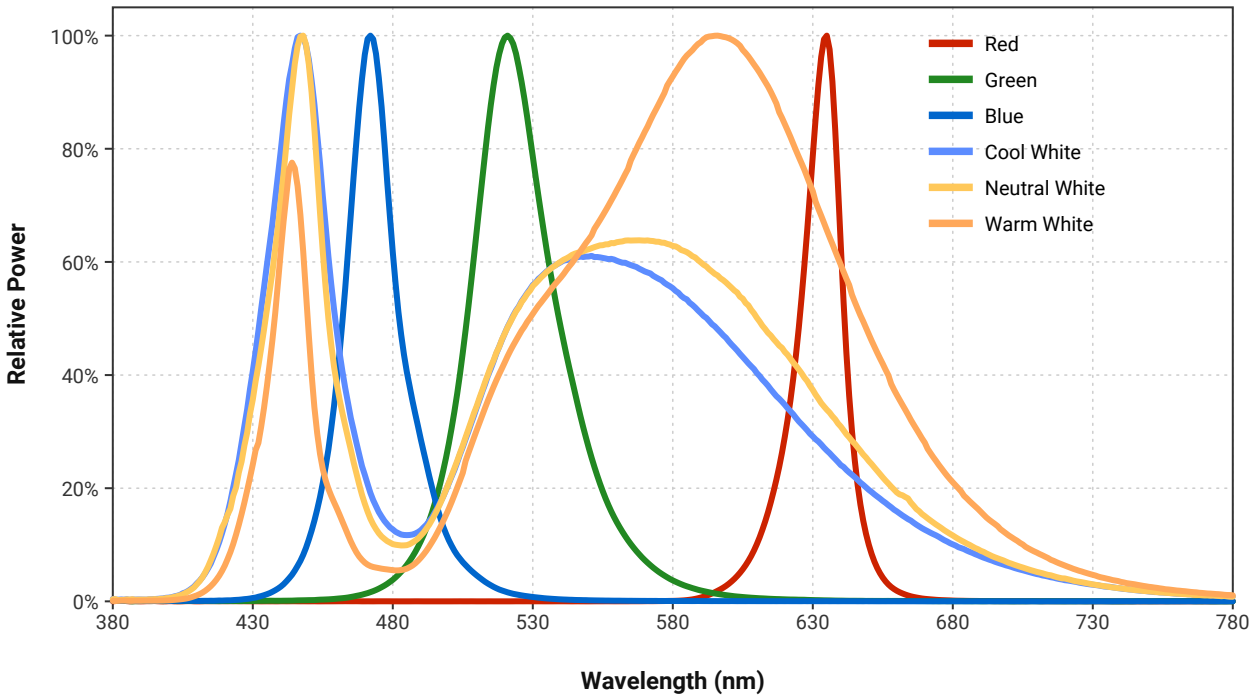
Color		Chromaticity Bins / Dominant Wavelength Range		Minimum Luminous Flux @ 175 mA		Typical Luminous Flux @ 175 mA	Order Code
		Minimum	Maximum	Group	Flux (lm)	Flux (lm)	
Color + White	Red	620 nm	630 nm	A2	20	30	X21ACB-H0-0000-0000BA2AAA1E
	Green	520 nm	535 nm		40	55	
	Blue	465 nm	480 nm		10	15	
	Cool White 70CRI	6500K			40	60	
Color + White	Red	620 nm	630 nm	A2	20	30	X21ACB-H0-0000-0000BA2AAA2E
	Green	520 nm	535 nm		40	55	
	Blue	465 nm	480 nm		10	15	
	Cool White 70CRI	5700K			40	65	
Color + White	Red	620 nm	630 nm	A2	20	30	X21ACB-H0-0000-0000HA2AAA3G
	Green	520 nm	535 nm		40	55	
	Blue	465 nm	480 nm		10	15	
	Neutral White 80CRI	5000K			40	60	
Color + White	Red	620 nm	630 nm	A2	20	30	X21ACB-H0-0000-0000HA2AAA5G
	Green	520 nm	535 nm		40	55	
	Blue	465 nm	480 nm		10	15	
	Neutral White 80CRI	4000K			40	58	
Color + White	Red	620 nm	630 nm	A2	20	30	X21ACB-H0-0000-0000HA2AAA7G
	Green	520 nm	535 nm		40	55	
	Blue	465 nm	480 nm		10	15	
	Warm White 80CRI	3000K			40	55	

Notes

- Cree LED maintains a tolerance of ±7% on flux and power measurements, ±0.005 on chromaticity measurements and ±2 on CRI measurements.
- XLamp X21ACB 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 without advance notice.

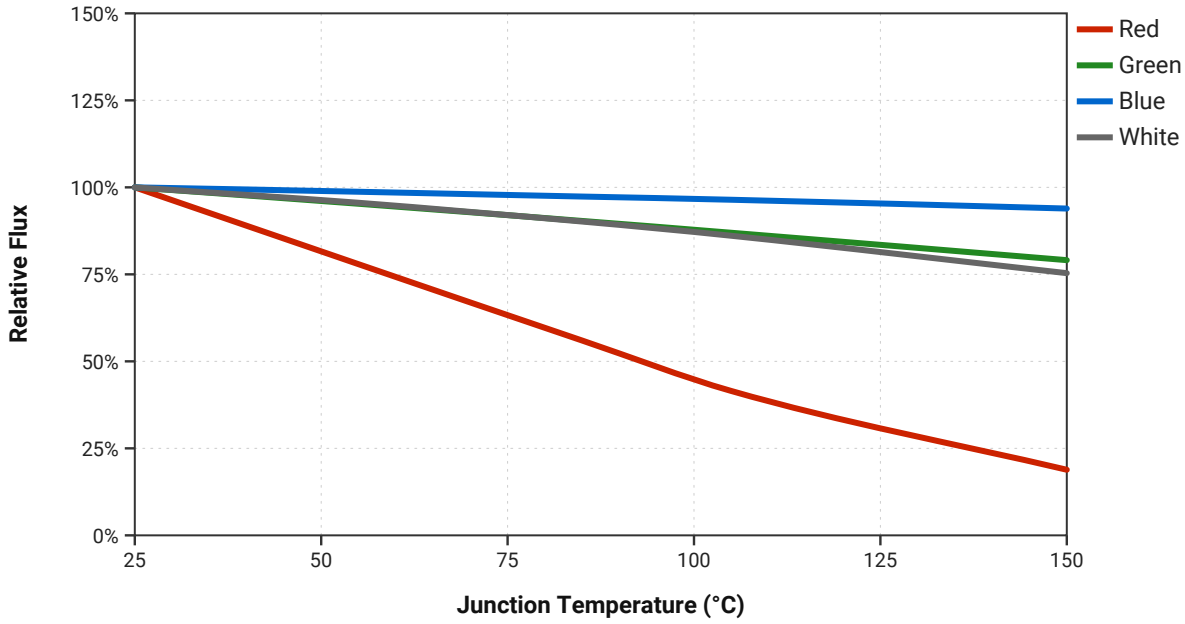
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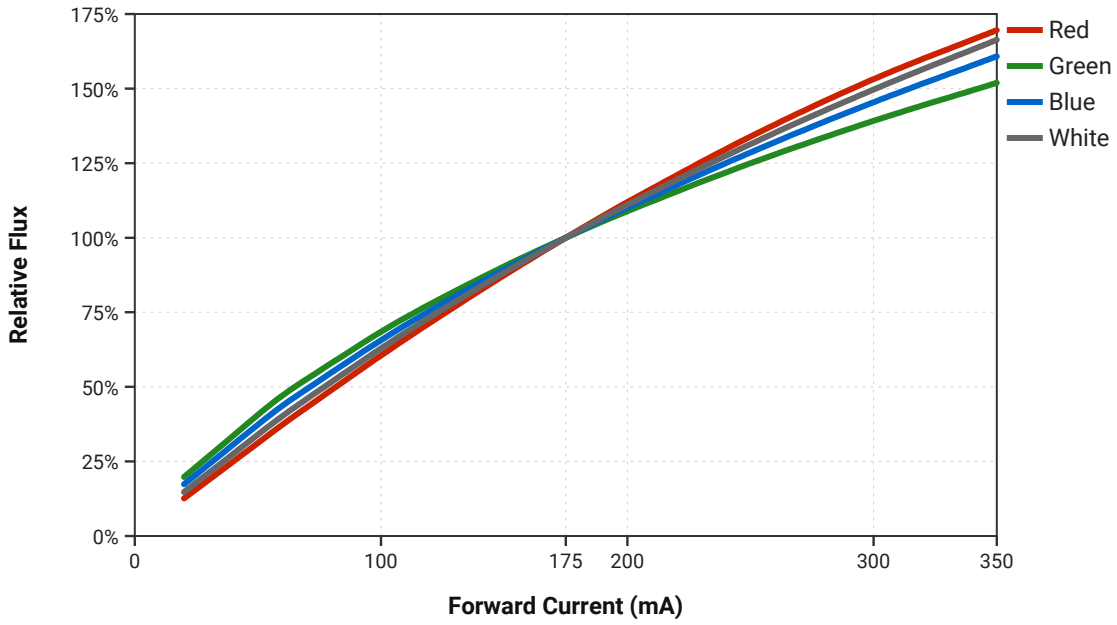


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RELATIVE FLUX VS. JUNCTION TEMPERATURE — X21ACB (I_F = 175 mA)

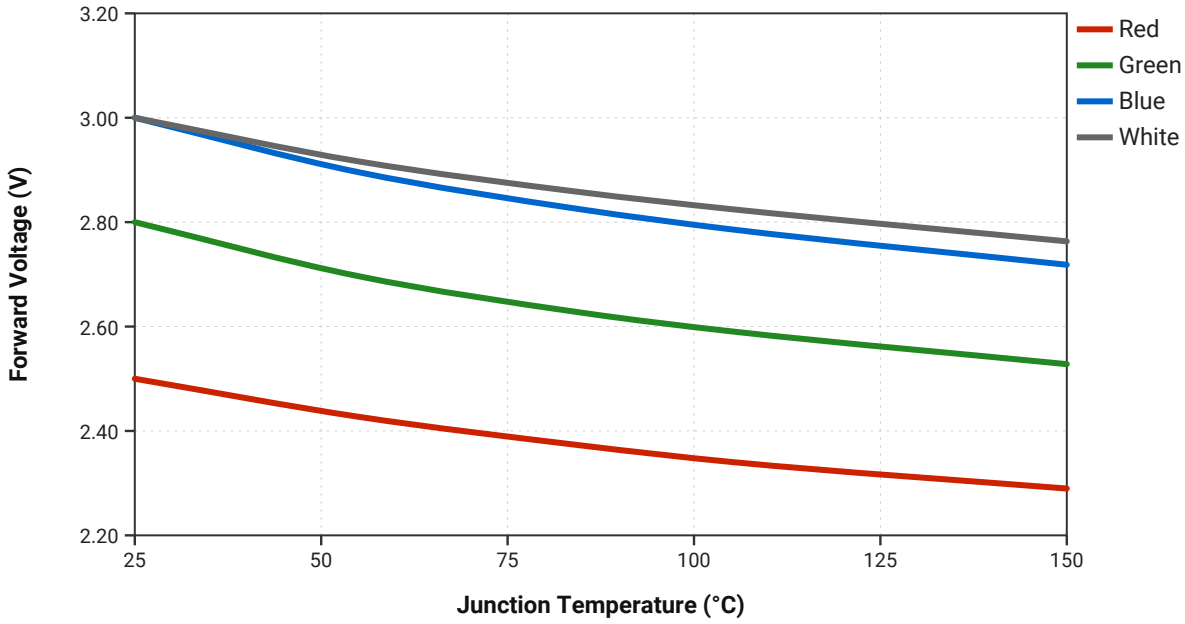


RELATIVE FLUX VS. FORWARD CURRENT — X21ACB (T_J = 25 °C)

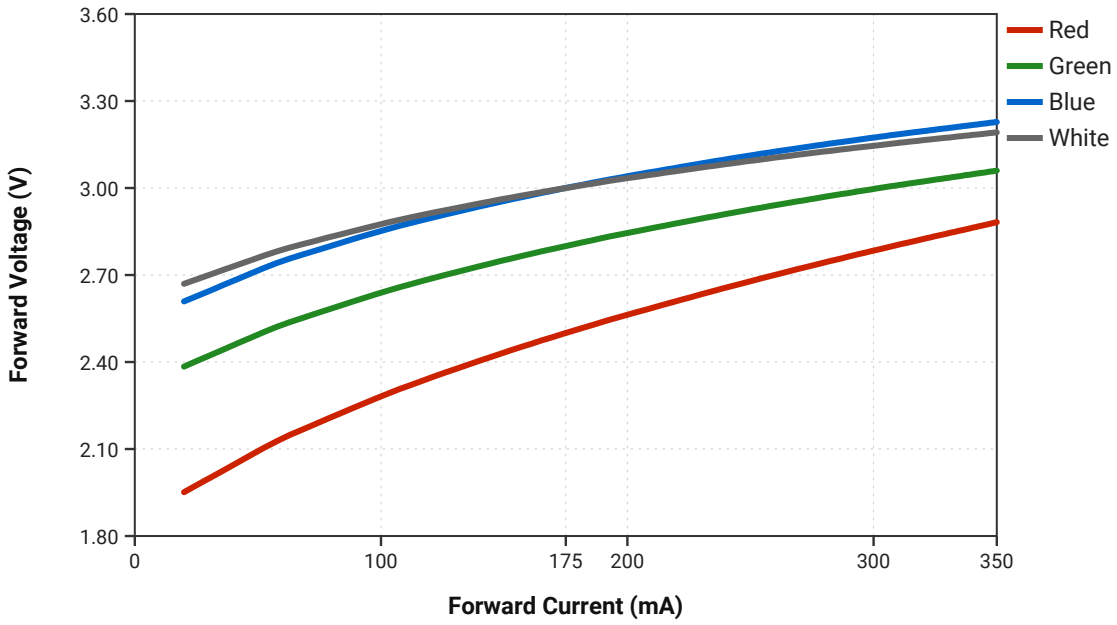


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FORWARD VOLTAGE VS. JUNCTION TEMPERATURE — X21ACB (I_F = 175 mA)

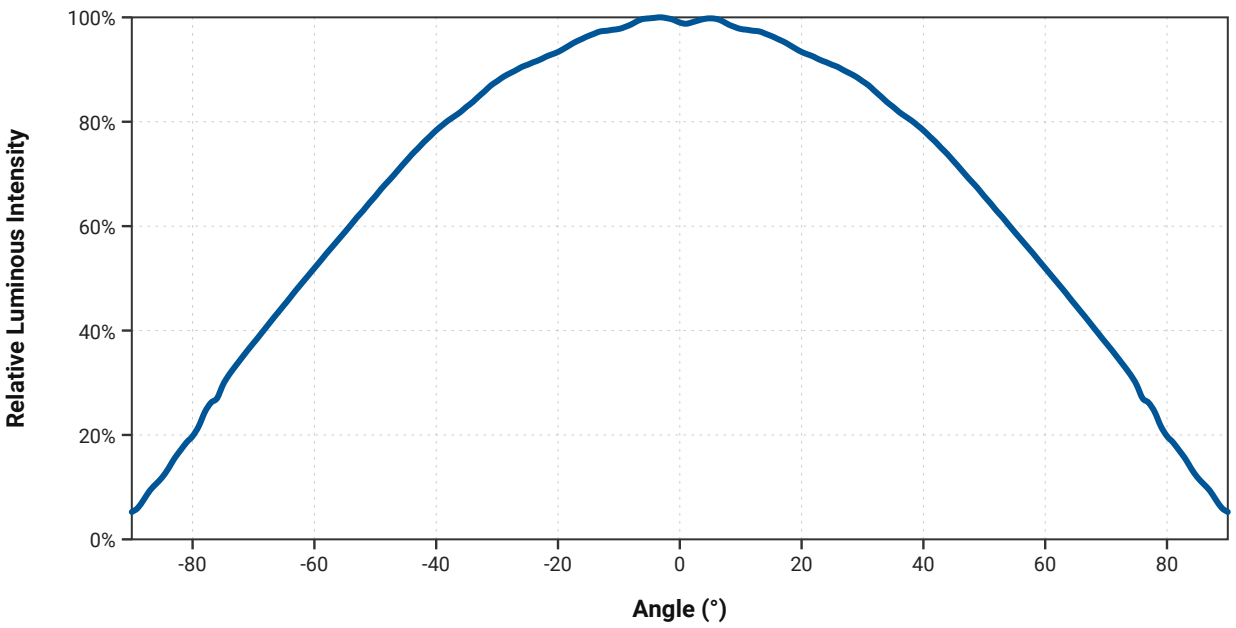


FORWARD VOLTAGE VS. FORWARD CURRENT — X21ACB (T_J = 25 °C)



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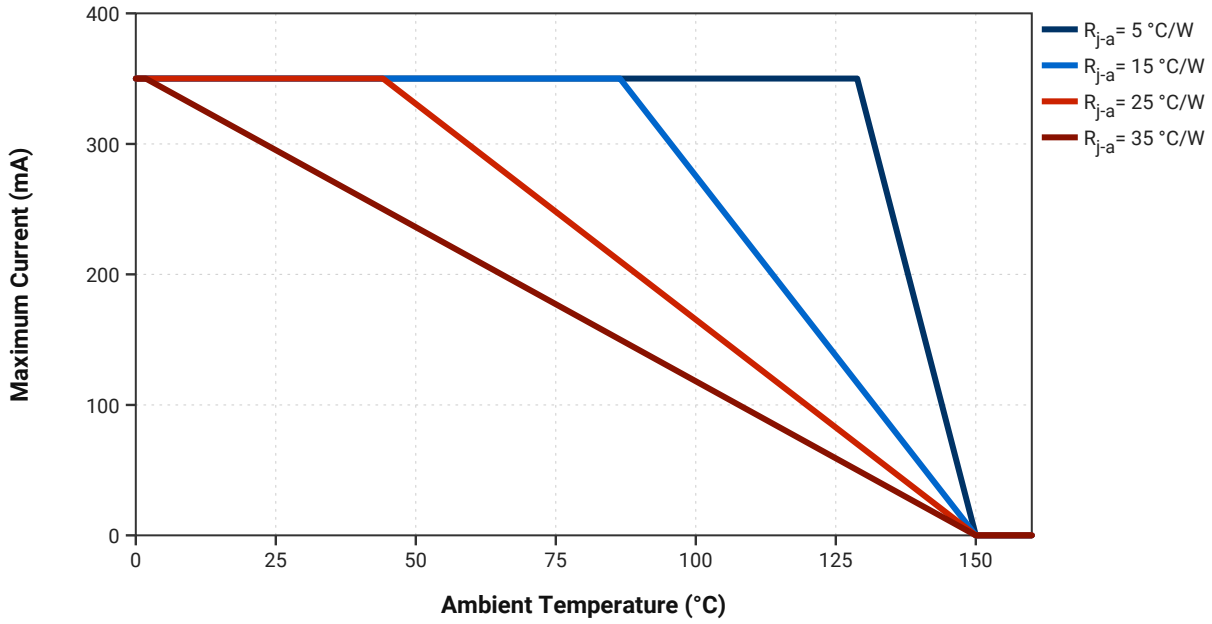


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THERMAL DESIGN

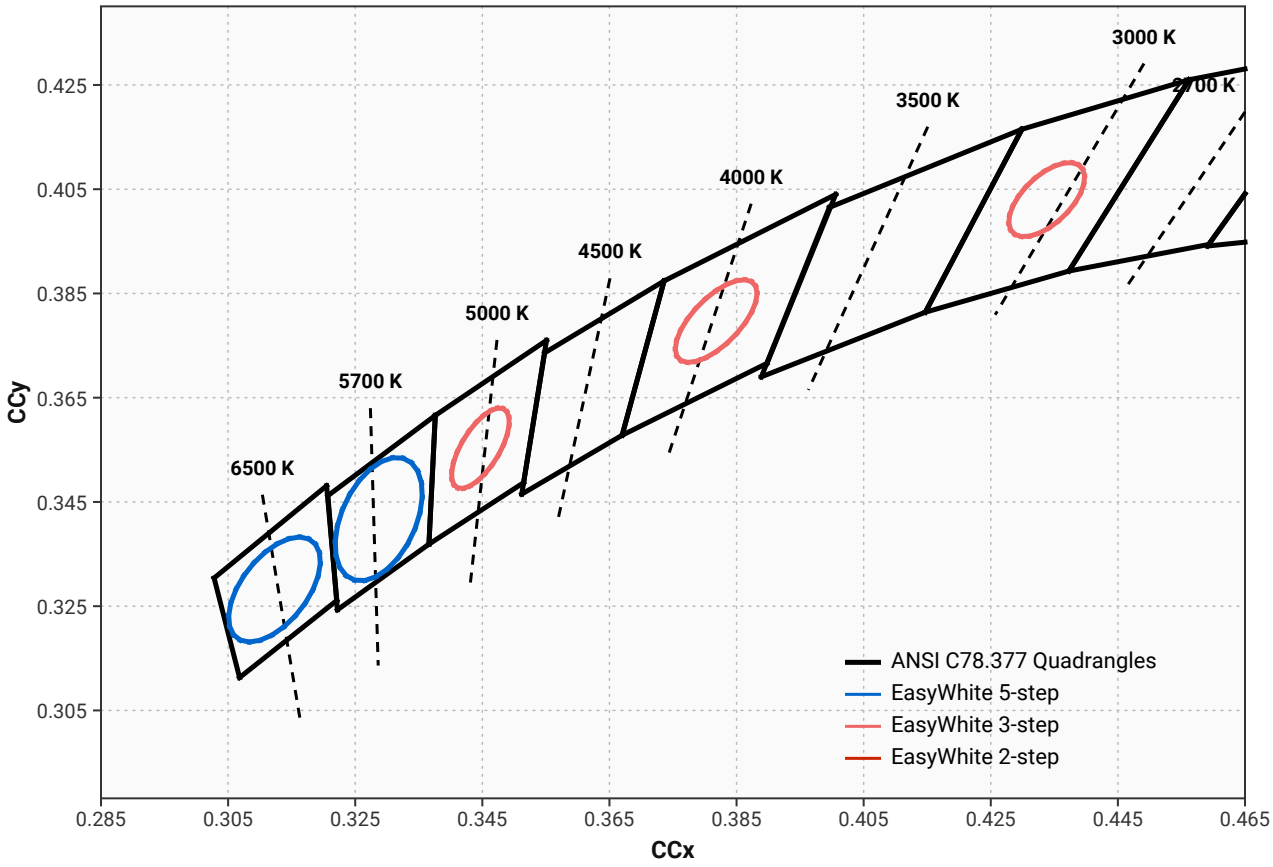
The maximum forward current is determined by the thermal resistance between the LED junction and ambient. It is crucial for the end product to be designed in a manner that minimizes the thermal resistance from the solder point to ambient in order to optimize lamp life and optical characteristics.

Please refer to the Characteristics table on page 12 for this product's thermal resistance and maximum junction temperature.



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CHROMATICITY BINS — EASYWHITE BINS



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PERFORMANCE GROUPS

XLamp X21A LEDs are tested for chromaticity and placed into one of the regions defined by the following bounding coordinates.

Color Bin (3-Step MacAdam Ellipses)						
Bin Code	CCT (K)	Center x	Center y	Major Axis (a)	Minor Axis (b)	Rotation (°)
3G	5000	0.3447	0.3553	0.0084	0.0031	65.00
5G	4000	0.3818	0.3797	0.0094	0.0040	53.70
7G	3000	0.4338	0.4030	0.0083	0.0041	53.20

Color Bin (5-Step MacAdam Ellipses)						
Bin Code	CCT (K)	Center x	Center y	Major Axis (a)	Minor Axis (b)	Rotation (°)
1E	6500	0.3123	0.3282	0.0111	0.0055	61.00
2E	5700	0.3287	0.3417	0.0123	0.0060	72.00

XLamp X21A White LEDs tested for luminous flux are placed into one of the following luminous flux groups.

Group Code	Min Luminous Flux (lm)	Max Luminous Flux (lm)
1	20	40
2	40	60
3	60	80
4	80	100
5	100	120

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CHARACTERISTICS — X21APA COMPLETE PACKAGE

The following table lists the product characteristics for the XLamp X21 Multi-Color LED package, measured with all LED dies on simultaneously and each LED die connected to independent drive circuits at 175 mA.

Characteristics	Unit	Minimum	Typical	Maximum
Thermal resistance, junction to solder point $R_{\theta\text{-}S}$◊	°C/W	-	7.0	-
Viewing angle (FWHM) — High Intensity	degrees	-	120	-
LED junction temperature	°C	-	-	150

◊ $R_{\theta\text{-}S}$ Thermal resistance measurement was performed per the JEDEC JESD51-14 standard. See the Thermal Resistance Measurement application note for more details.

CHARACTERISTICS — PER LED DIE

The following table lists the product characteristics for each LED die within the XLamp X21 Multi-Color LED package.

Characteristics	Unit	Minimum	Typical	Maximum
Temperature coefficient of voltage — red	mV/°C	-	-1.5	-
Temperature coefficient of voltage — green	mV/°C	-	-1.0	-
Temperature coefficient of voltage — royal	mV/°C	-	-1.1	-
Temperature coefficient of voltage — PC Amber	mV/°C	-	-1.1	-
DC forward current — red, green, royal, PC Amber	mA	-	-	350
Forward voltage (@ 175 mA, 25 °C) — red	V	-	2.5	2.7
Forward voltage (@ 175 mA, 25 °C) — green	V	-	2.8	3.0
Forward voltage (@ 175 mA, 25 °C) — royal, PC Amber	V	-	3.0	3.2

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FLUX CHARACTERISTICS — HIGH INTENSITY (T_J = 25 °C)

The following table lists the minimum and typical luminous flux for each LED die within the XLamp package at 175 mA per die, measured at T_j = 25 °C.

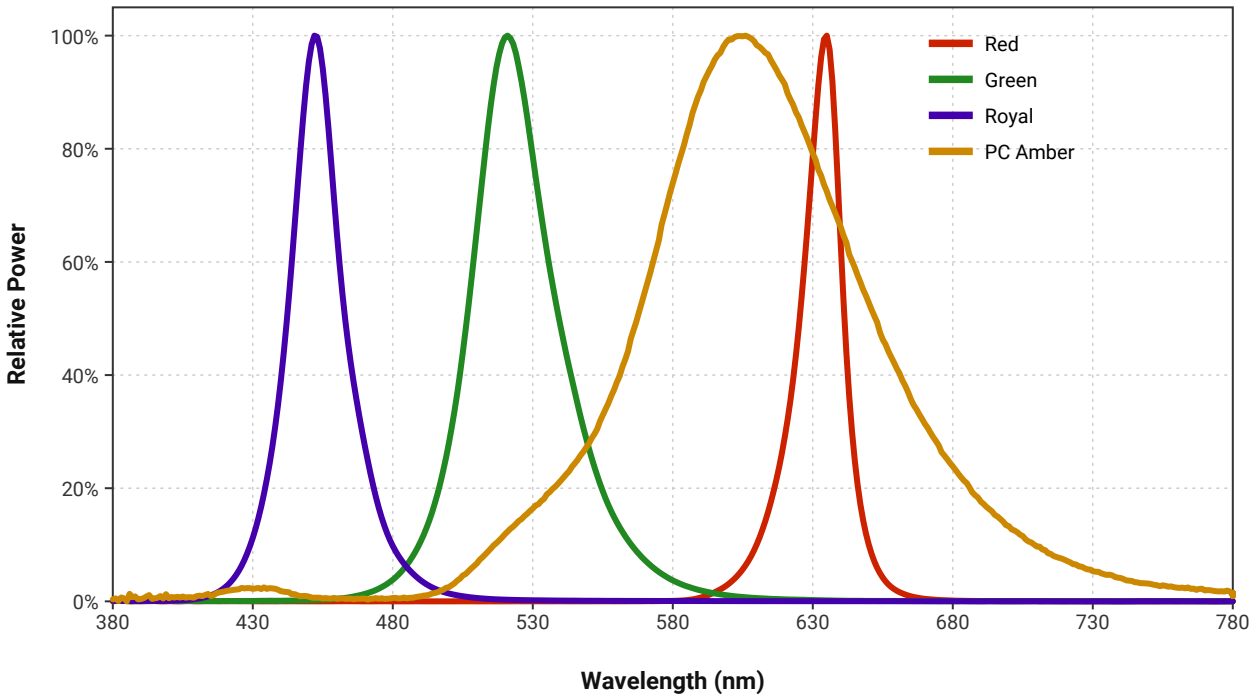
Color		Chromaticity Bins / Dominant Wavelength Range		Minimum Luminous Flux @ 175 mA		Typical Luminous Flux @ 175 mA	Order Code
		Minimum	Maximum	Group	Flux (lm)	Flux (lm)	
Color + PC Amber	Red	620 nm	630 nm	A2	20	30	X21APA-H0-0000-00000A2AAAYS
	Green	520 nm	535 nm		40	55	
	Royal Blue	450 nm	465 nm		5	10	
	PC Amber	YS			20	35	

Notes

- Cree LED maintains a tolerance of ±7% on flux and power measurements, ±0.005 on chromaticity measurements and ±2 on CRI measurements.
- XLamp X21APA 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 without advance notice.

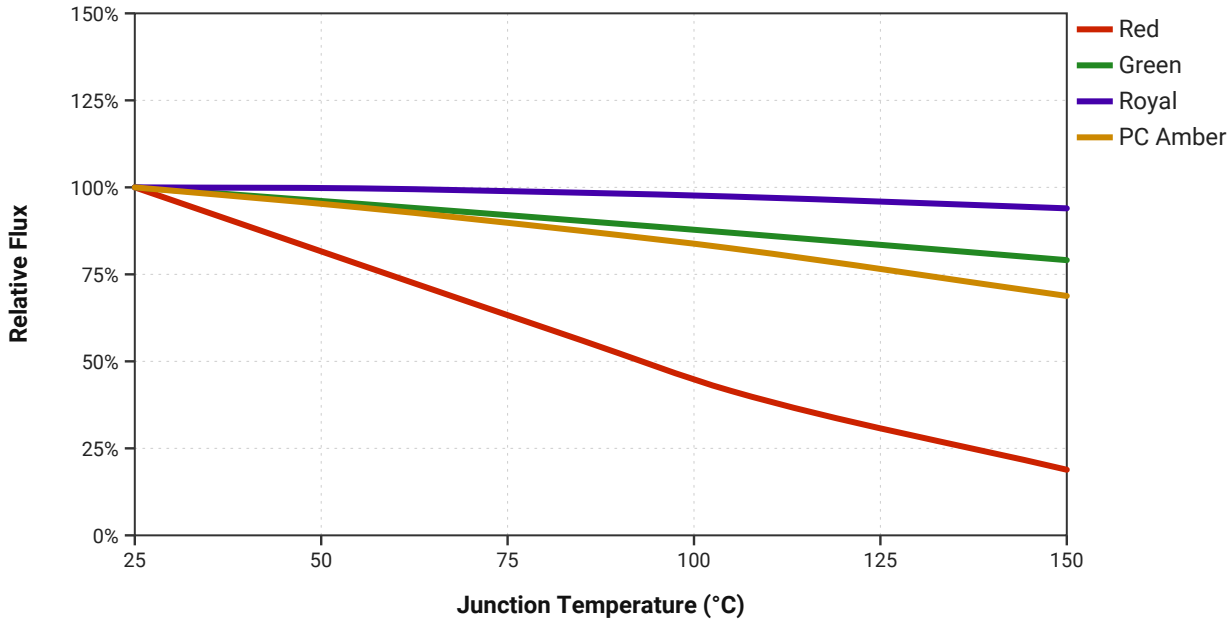
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RELATIVE SPECTRAL POWER DISTRIBUTION

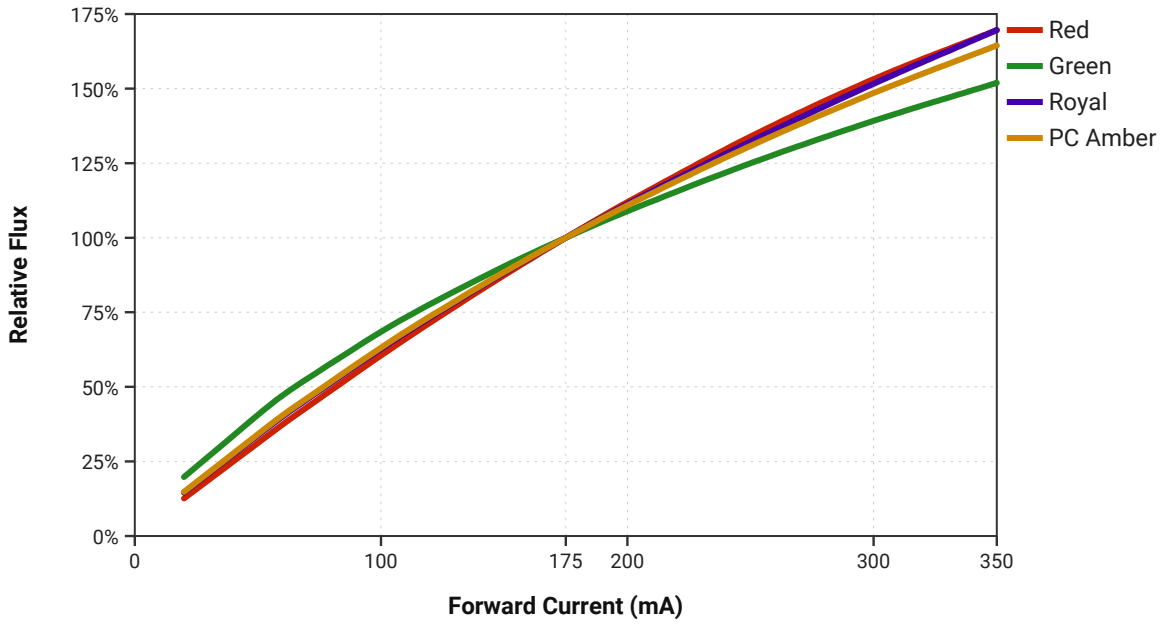


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RELATIVE FLUX VS. JUNCTION TEMPERATURE — X21APA (I_F = 175 mA)

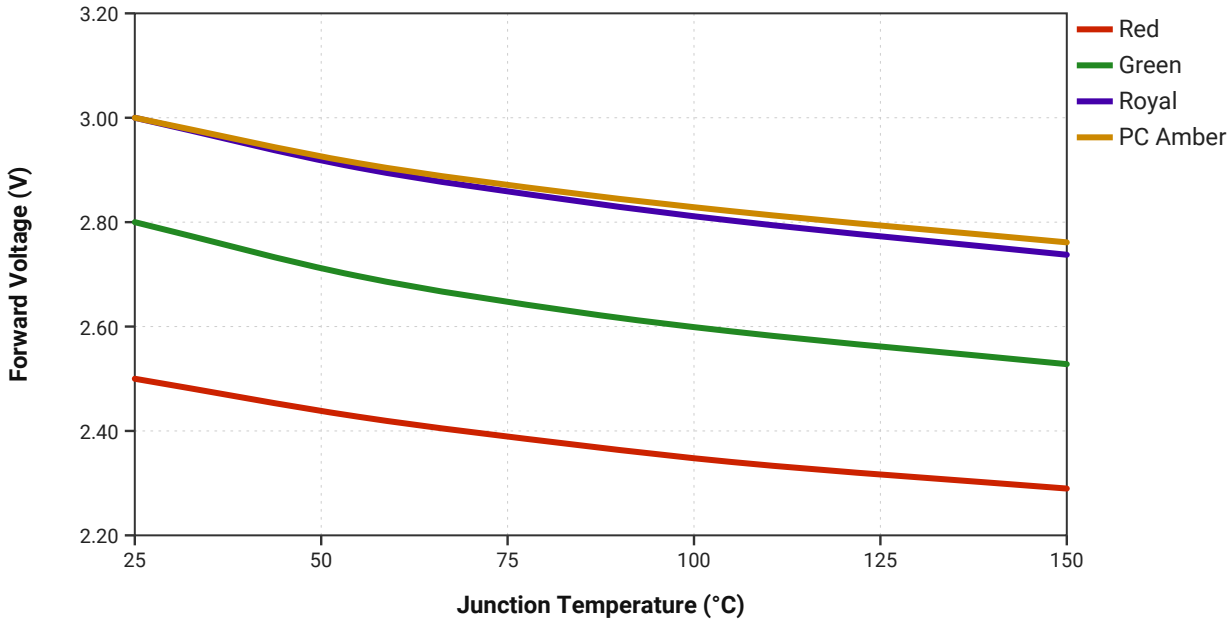


RELATIVE FLUX VS. FORWARD CURRENT — X21APA (T_J = 25 °C)

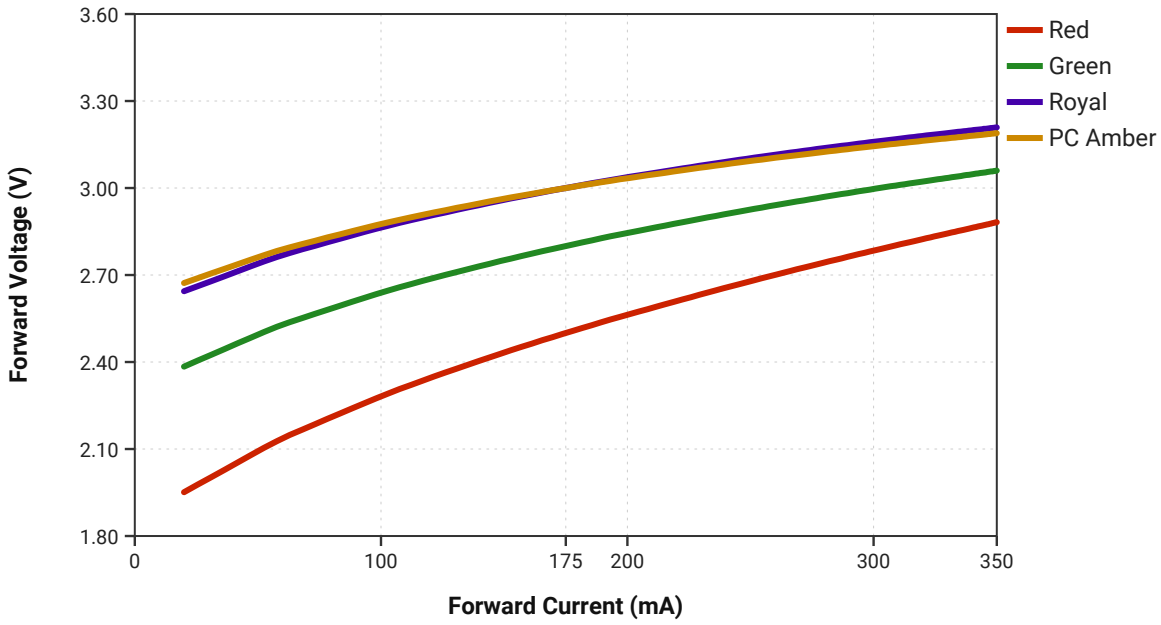


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FORWARD VOLTAGE VS. JUNCTION TEMPERATURE — X21APA (I_F = 175 mA)

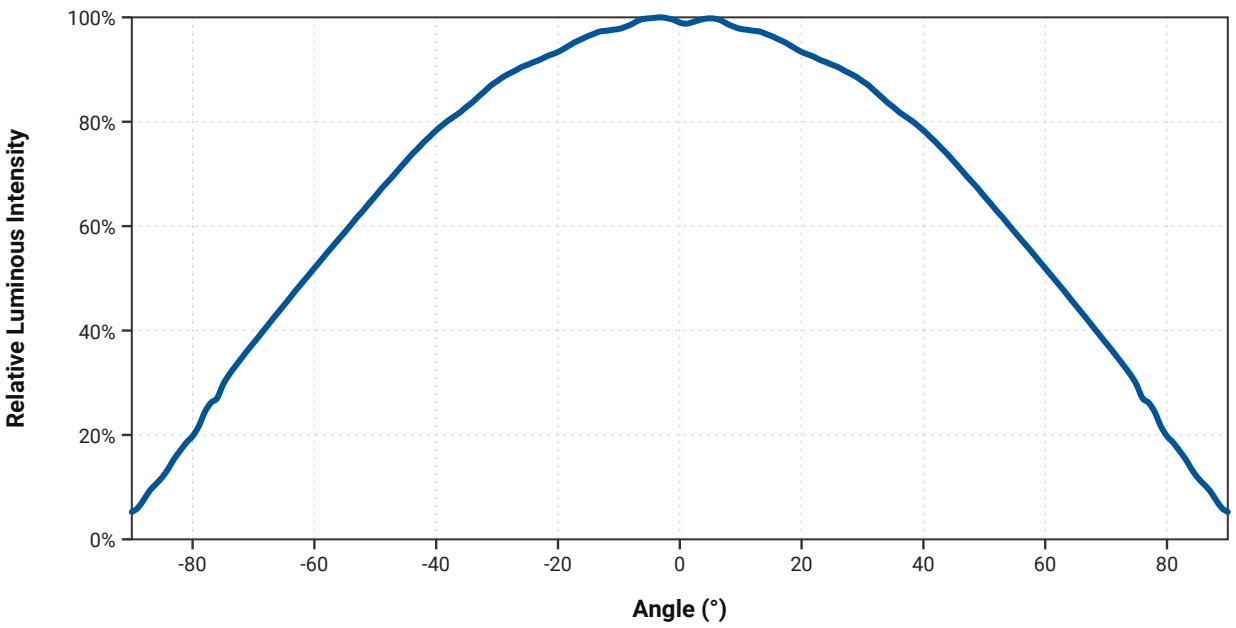


FORWARD VOLTAGE VS. FORWARD CURRENT — X21APA (T_J = 25 °C)



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TYPICAL SPATIAL DISTRIBUTION

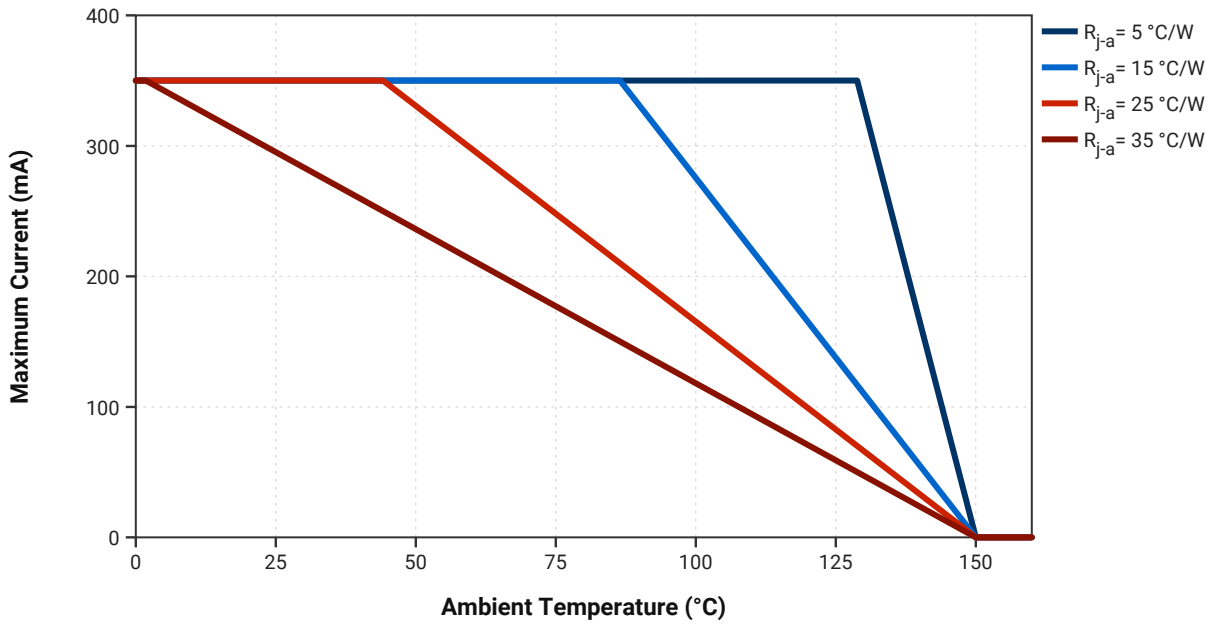


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THERMAL DESIGN

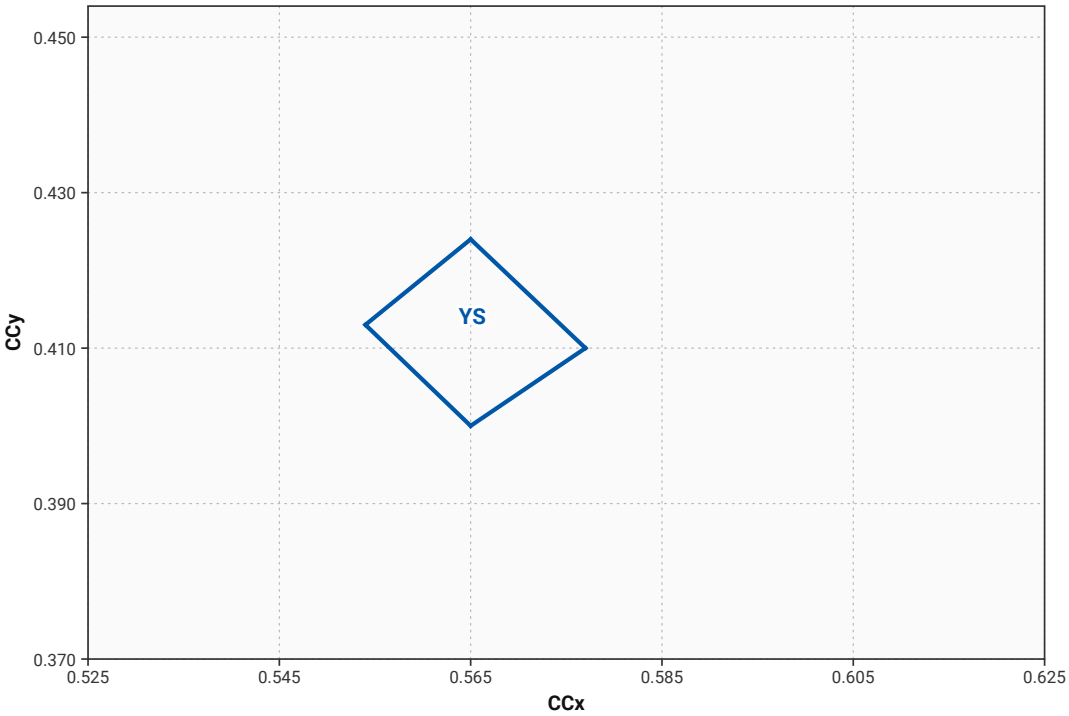
The maximum forward current is determined by the thermal resistance between the LED junction and ambient. It is crucial for the end product to be designed in a manner that minimizes the thermal resistance from the solder point to ambient in order to optimize lamp life and optical characteristics.

Please refer to the Characteristics table on page 21 for this product's thermal resistance and maximum junction temperature.



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CHROMATICITY BINS — PC AMBER



Bin	x	y
YS	0.5650	0.4240
	0.5770	0.4100
	0.5650	0.4000
	0.5540	0.4130

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PERFORMANCE GROUPS

XLamp X21A PC Amber LEDs tested for luminous flux are placed into one of the following luminous flux groups.

Group Code	Min Luminous Flux (lm)	Max Luminous Flux (lm)
2	20	40
3	40	60
4	60	80
5	80	100

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CHARACTERISTICS — X21ABA COMPLETE PACKAGE

The following table lists the product characteristics for the XLamp X21 Multi-Color LED package, measured with all LED dies on simultaneously and each LED die connected to independent drive circuits at 175 mA.

Characteristics	Unit	Minimum	Typical	Maximum
Thermal resistance, junction to solder point $R_{\theta\text{-}S}$◊	°C/W	-	7.0	-
Viewing angle (FWHM) — High Intensity	degrees	-	120	-
LED junction temperature	°C	-	-	150

◊ $R_{\theta\text{-}S}$ Thermal resistance measurement was performed per the JEDEC JESD51-14 standard. See the Thermal Resistance Measurement application note for more details.

CHARACTERISTICS — PER LED DIE

The following table lists the product characteristics for each LED die within the XLamp X21 Multi-Color LED package.

Characteristics	Unit	Minimum	Typical	Maximum
Temperature coefficient of voltage — red	mV/°C	-	-1.5	-
Temperature coefficient of voltage — green	mV/°C	-	-1.0	-
Temperature coefficient of voltage — blue	mV/°C	-	-1.1	-
Temperature coefficient of voltage — PC Amber	mV/°C	-	-1.1	-
DC forward current — red, green, blue, PC Amber	mA	-	-	350
Forward voltage (@ 175 mA, 25 °C) — red	V	-	2.5	2.7
Forward voltage (@ 175 mA, 25 °C) — green	V	-	2.8	3.0
Forward voltage (@ 175 mA, 25 °C) — blue, PC Amber	V	-	3.0	3.2

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FLUX CHARACTERISTICS — HIGH INTENSITY (T_J = 25 °C)

The following table lists the minimum and typical luminous flux for each LED die within the XLamp package at 175 mA per die, measured at T_j = 25 °C.

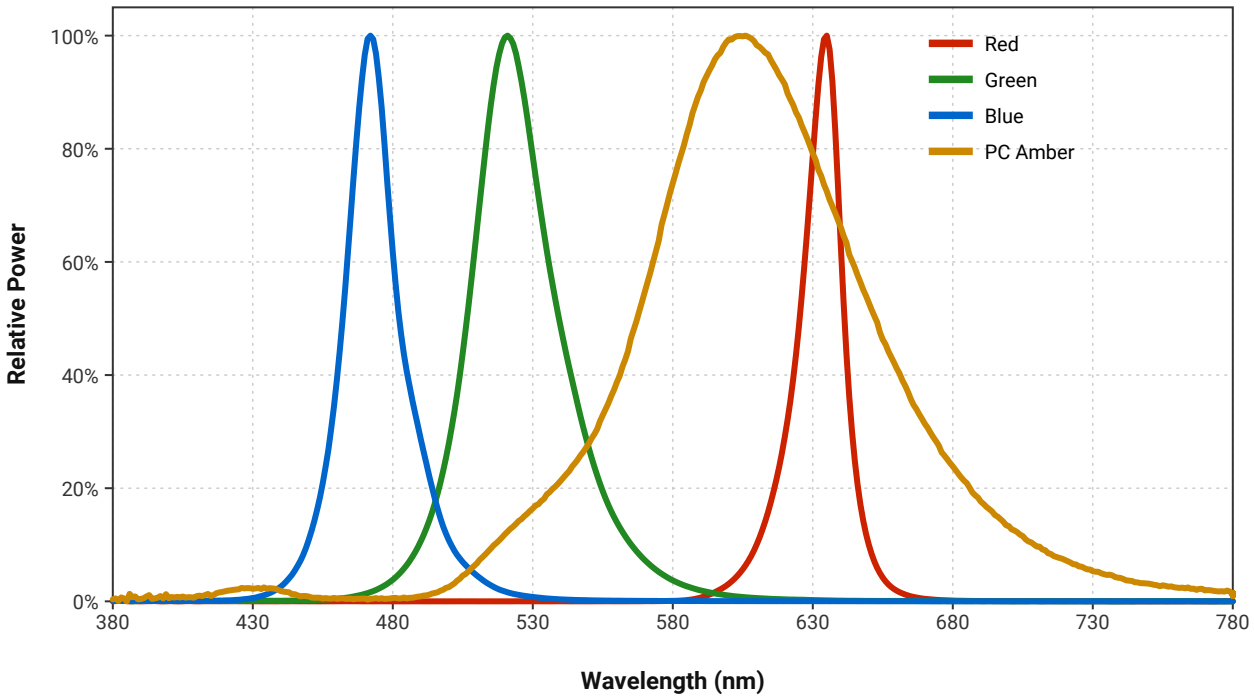
Color		Chromaticity Bins / Dominant Wavelength Range		Minimum Luminous Flux @ 175 mA		Typical Luminous Flux @ 175 mA	Order Code
		Minimum	Maximum	Group	Flux (lm)	Flux (lm)	
Color + PC Amber	Red	620 nm	630 nm	A2	20	30	X21ABA-H0-0000-00000A2AAAYS
	Green	520 nm	535 nm		40	55	
	Blue	465 nm	480 nm		10	15	
	PC Amber	YS			20	35	

Notes

- Cree LED maintains a tolerance of ±7% on flux and power measurements, ±0.005 on chromaticity measurements and ±2 on CRI measurements.
- XLamp X21ABA 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 without advance notice.

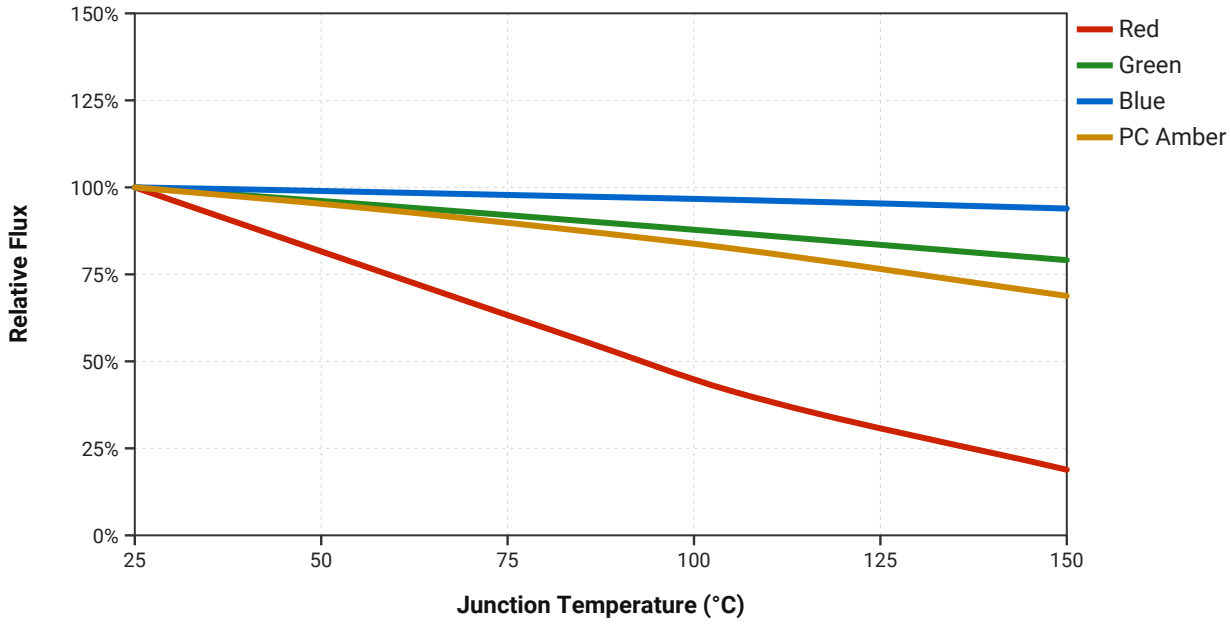
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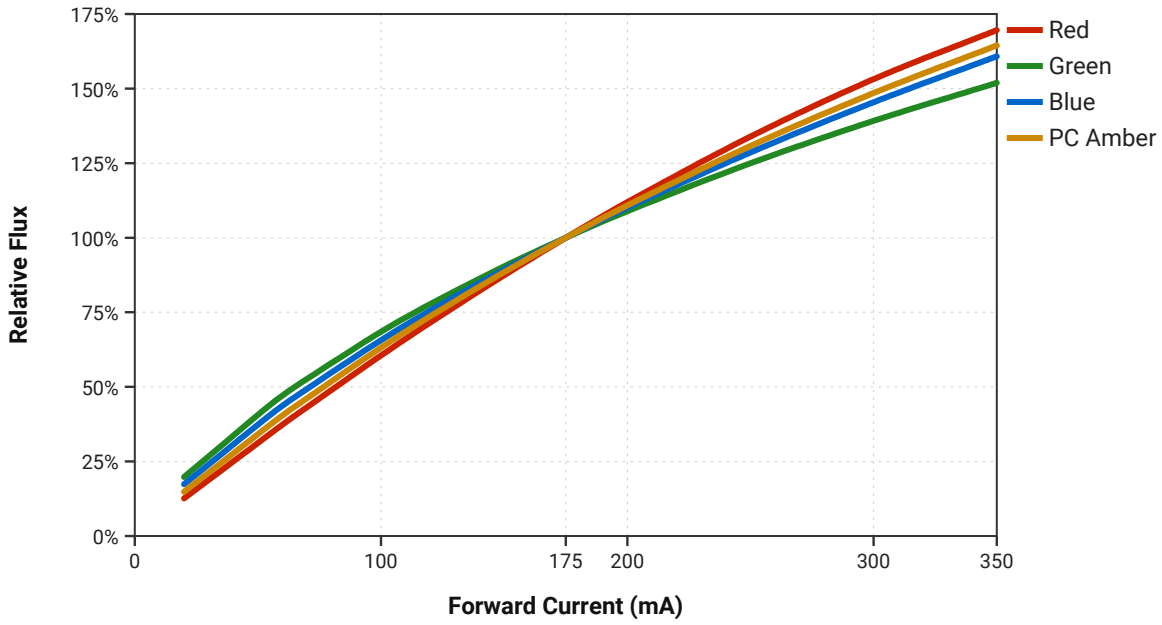


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RELATIVE FLUX VS. JUNCTION TEMPERATURE — X21ABA (I_F = 175 mA)

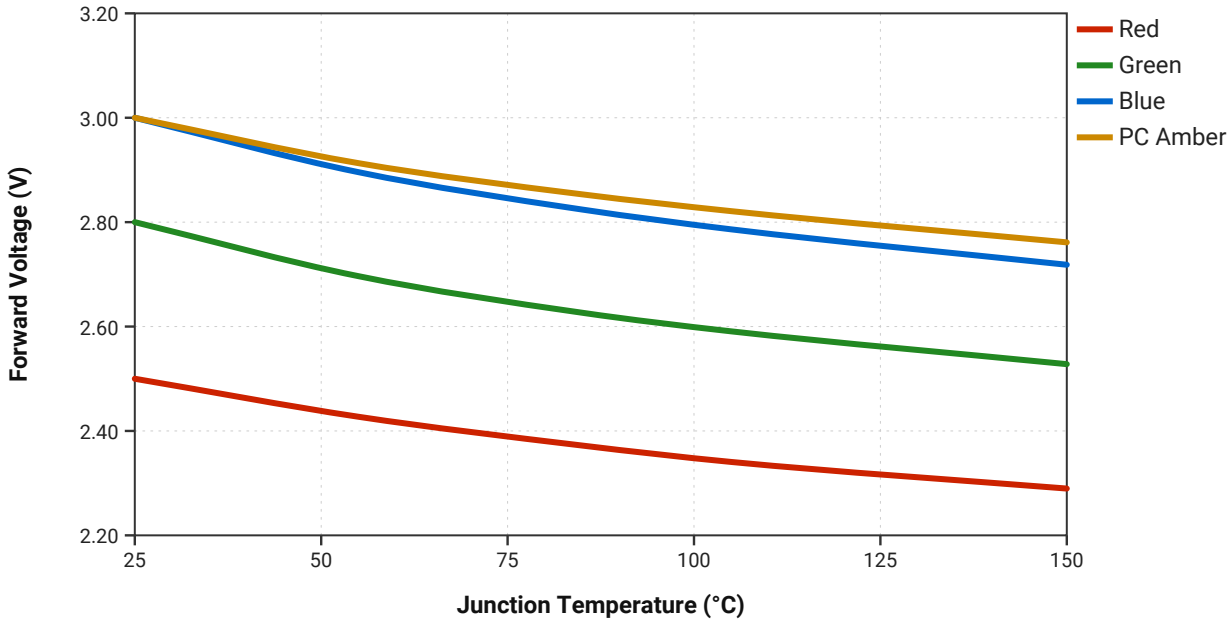


RELATIVE FLUX VS. FORWARD CURRENT — X21ABA (T_J = 25 °C)

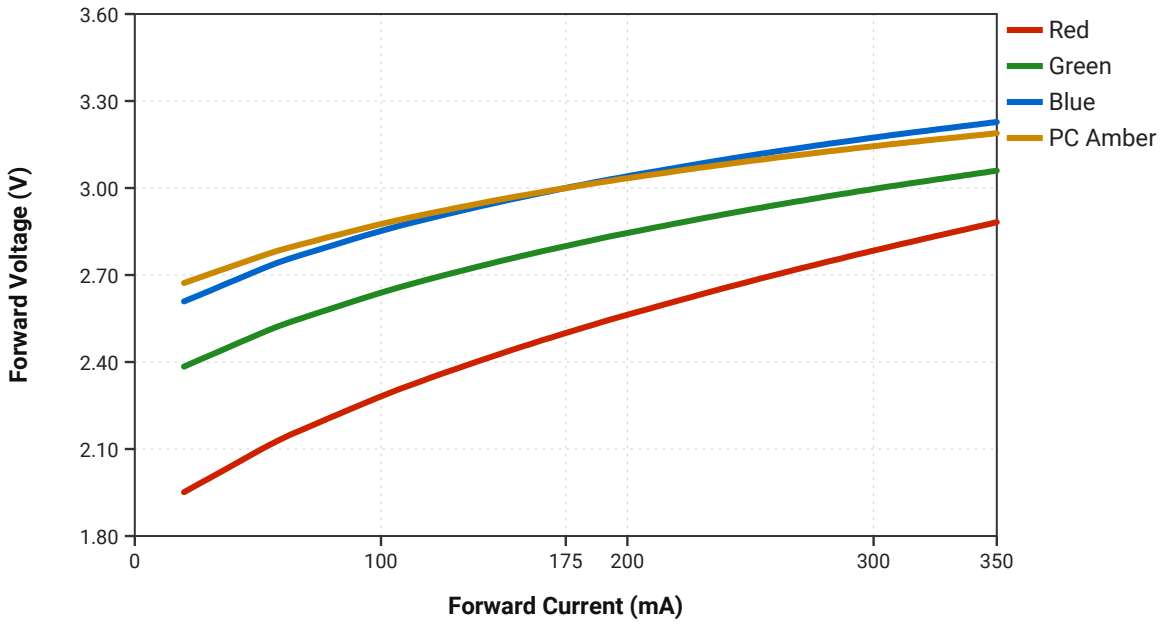


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FORWARD VOLTAGE VS. JUNCTION TEMPERATURE — X21ABA (I_F = 175 mA)

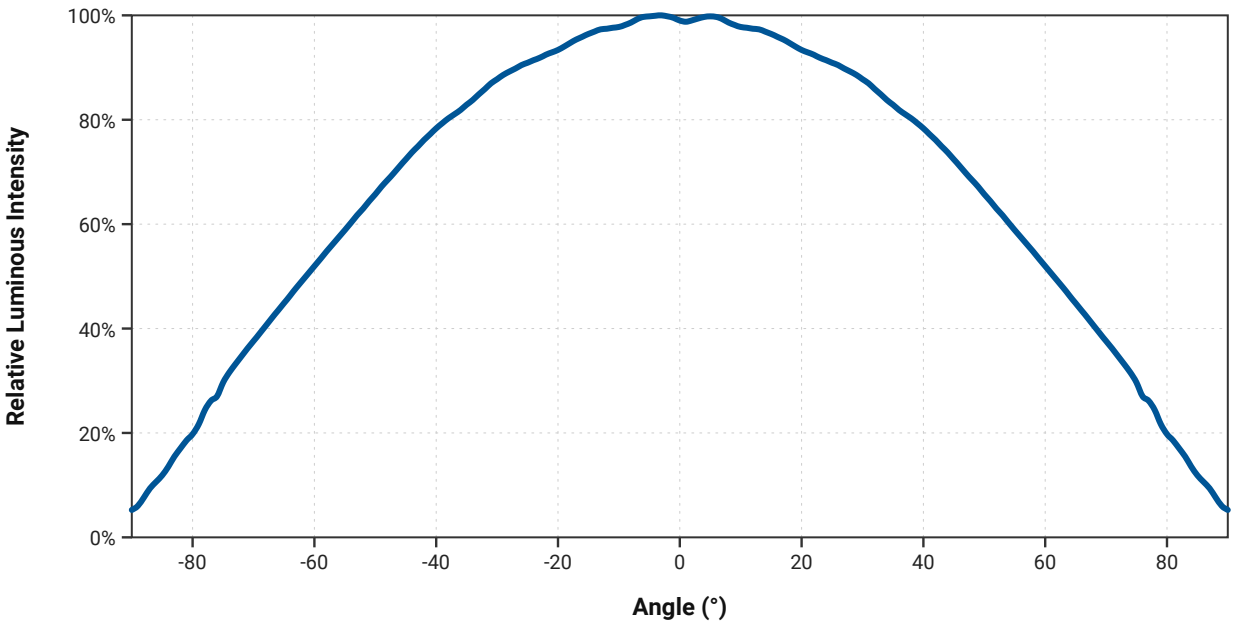


FORWARD VOLTAGE VS. FORWARD CURRENT — X21ABA (T_J = 25 °C)



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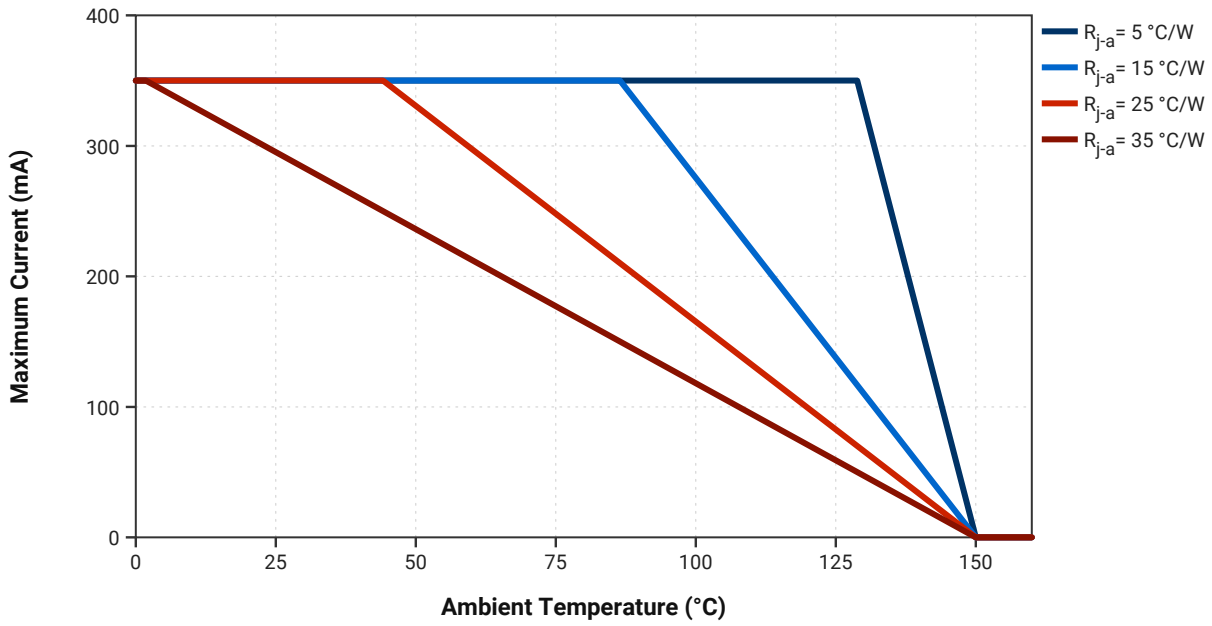


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THERMAL DESIGN

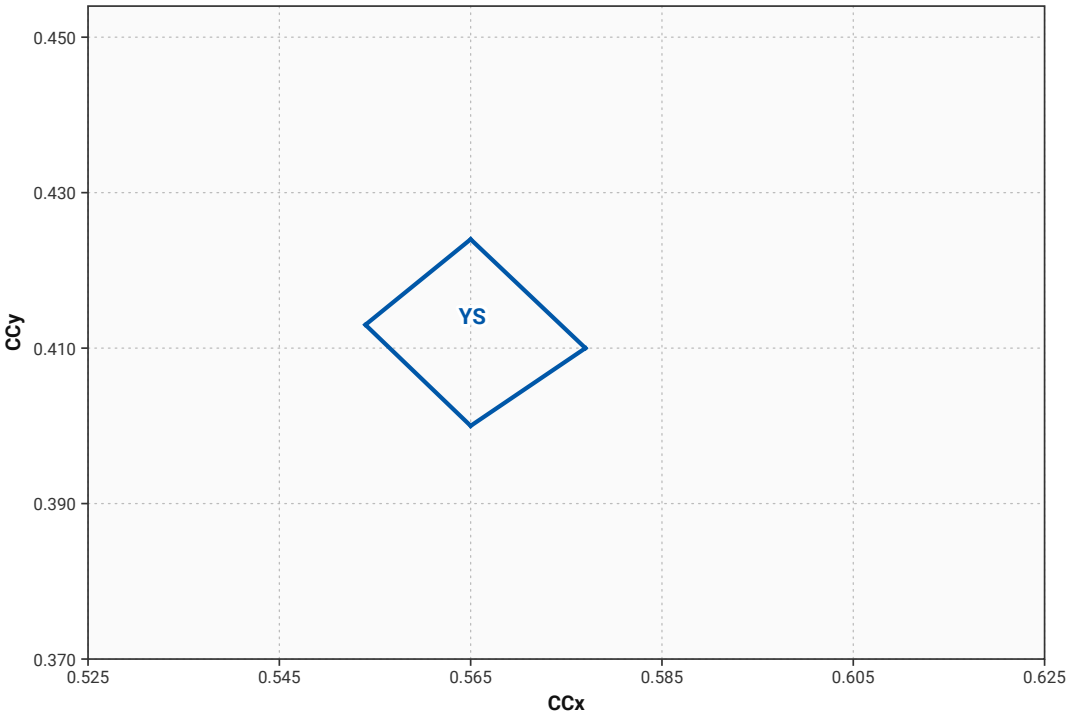
The maximum forward current is determined by the thermal resistance between the LED junction and ambient. It is crucial for the end product to be designed in a manner that minimizes the thermal resistance from the solder point to ambient in order to optimize lamp life and optical characteristics.

Please refer to the Characteristics table on page 30 for this product's thermal resistance and maximum junction temperature.



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CHROMATICITY BINS — PC AMBER



Bin	x	y
YS	0.5650	0.4240
	0.5770	0.4100
	0.5650	0.4000
	0.5540	0.4130

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PERFORMANCE GROUPS

XLamp X21A PC Amber LEDs tested for luminous flux are placed into one of the following luminous flux groups.

Group Code	Min Luminous Flux (lm)	Max Luminous Flux (lm)
2	20	40
3	40	60
4	60	80
5	80	100

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CHARACTERISTICS — X21APL COMPLETE PACKAGE

The following table lists the product characteristics for the XLamp X21 Multi-Color LED package, measured with all LED dies on simultaneously and each LED die connected to independent drive circuits at 175 mA.

Characteristics	Unit	Minimum	Typical	Maximum
Thermal resistance, junction to solder point $R_{\theta\text{-}S}$◊	°C/W	-	7.0	-
Viewing angle (FWHM) — High Intensity	degrees	-	120	-
LED junction temperature	°C	-	-	150

◊ $R_{\theta\text{-}S}$ Thermal resistance measurement was performed per the JEDEC JESD51-14 standard. See the Thermal Resistance Measurement application note for more details.

CHARACTERISTICS — PER LED DIE

The following table lists the product characteristics for each LED die within the XLamp X21 Multi-Color LED package.

Characteristics	Unit	Minimum	Typical	Maximum
Temperature coefficient of voltage — red	mV/°C	-	-1.5	-
Temperature coefficient of voltage — green	mV/°C	-	-1.0	-
Temperature coefficient of voltage — royal	mV/°C	-	-1.1	-
Temperature coefficient of voltage — PC Lime	mV/°C	-	-1.1	-
DC forward current — red, green, royal, PC Lime	mA	-	-	350
Forward voltage (@ 175 mA, 25 °C) — red	V	-	2.5	2.7
Forward voltage (@ 175 mA, 25 °C) — green	V	-	2.8	3.0
Forward voltage (@ 175 mA, 25 °C) — royal, PC Lime	V	-	3.0	3.2

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FLUX CHARACTERISTICS — HIGH INTENSITY (T_J = 25 °C)

The following table lists the minimum and typical luminous flux for each LED die within the XLamp package at 175 mA per die, measured at T_j = 25 °C.

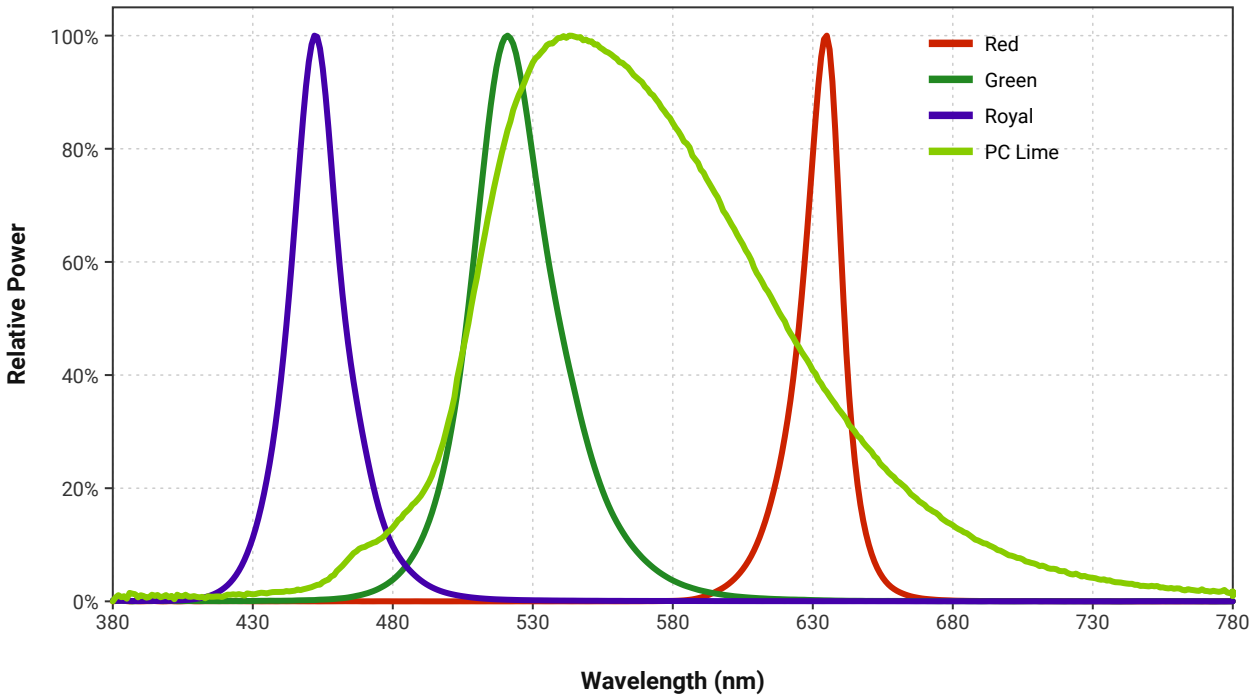
Color		Chromaticity Bins / Dominant Wavelength Range		Minimum Luminous Flux @ 175 mA		Typical Luminous Flux @ 175 mA	Order Code
		Minimum	Maximum	Group	Flux (lm)	Flux (lm)	
Color + PC Lime	Red	620 nm	630 nm	A2	20	30	X21APL-H0-0000-00000A2AAALA
	Green	520 nm	535 nm		40	55	
	Royal Blue	450 nm	465 nm		5	10	
	PC Lime	PL3, PL4			50	65	

Notes

- Cree LED maintains a tolerance of ±7% on flux and power measurements, ±0.005 on chromaticity measurements and ±2 on CRI measurements.
- XLamp X21APL 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 without advance notice.

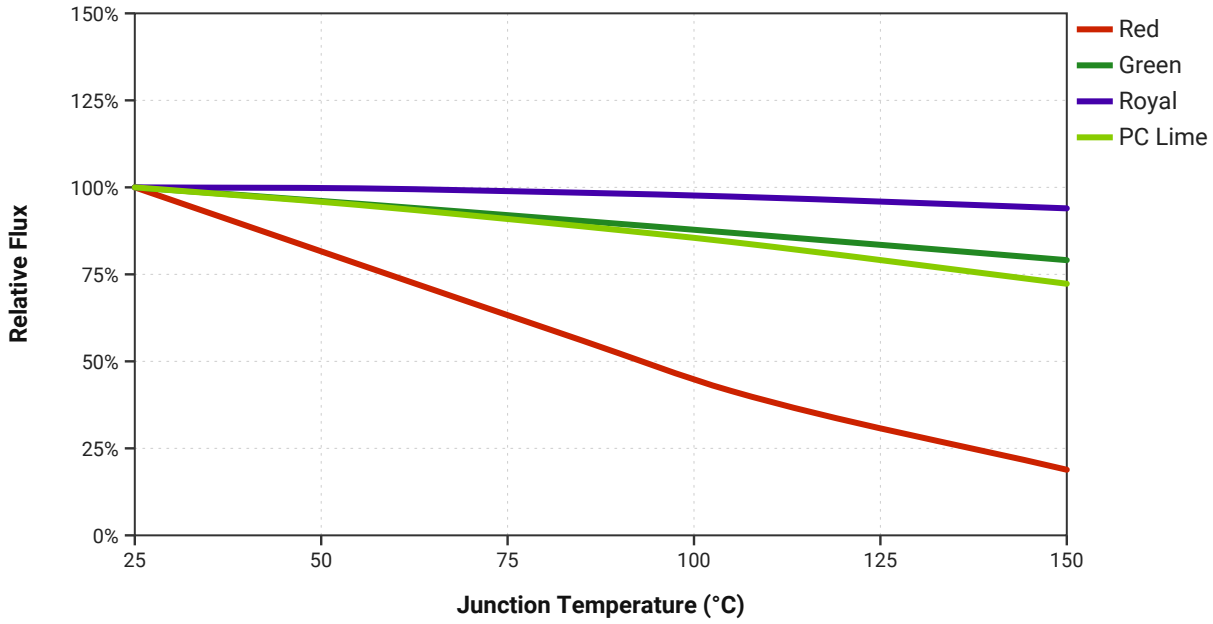
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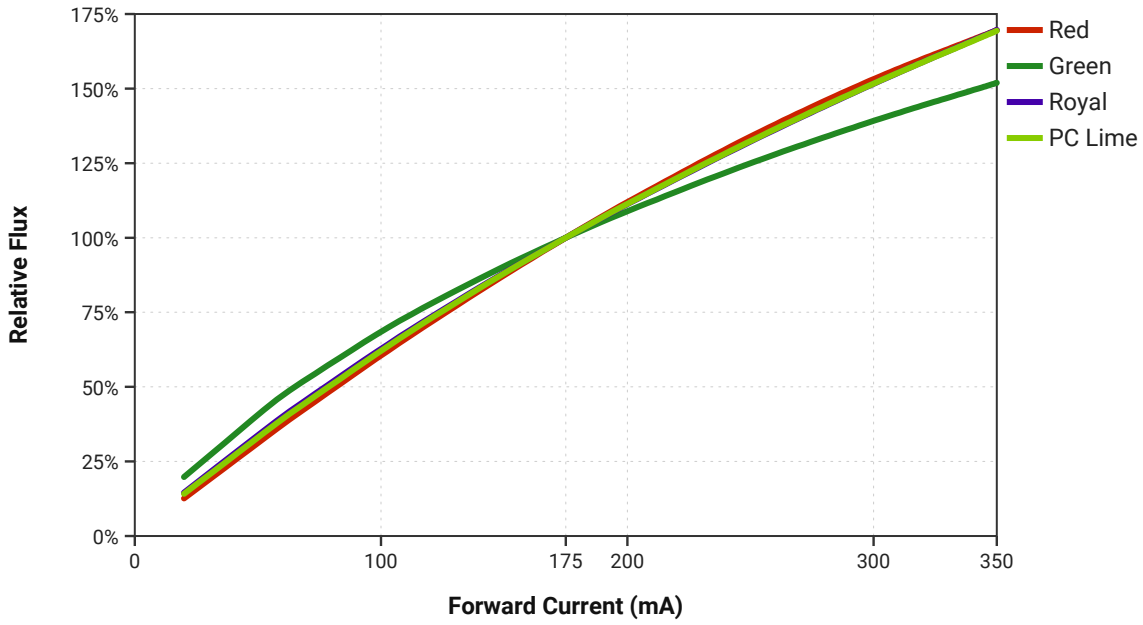


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RELATIVE FLUX VS. JUNCTION TEMPERATURE — X21APL (I_F = 175 mA)

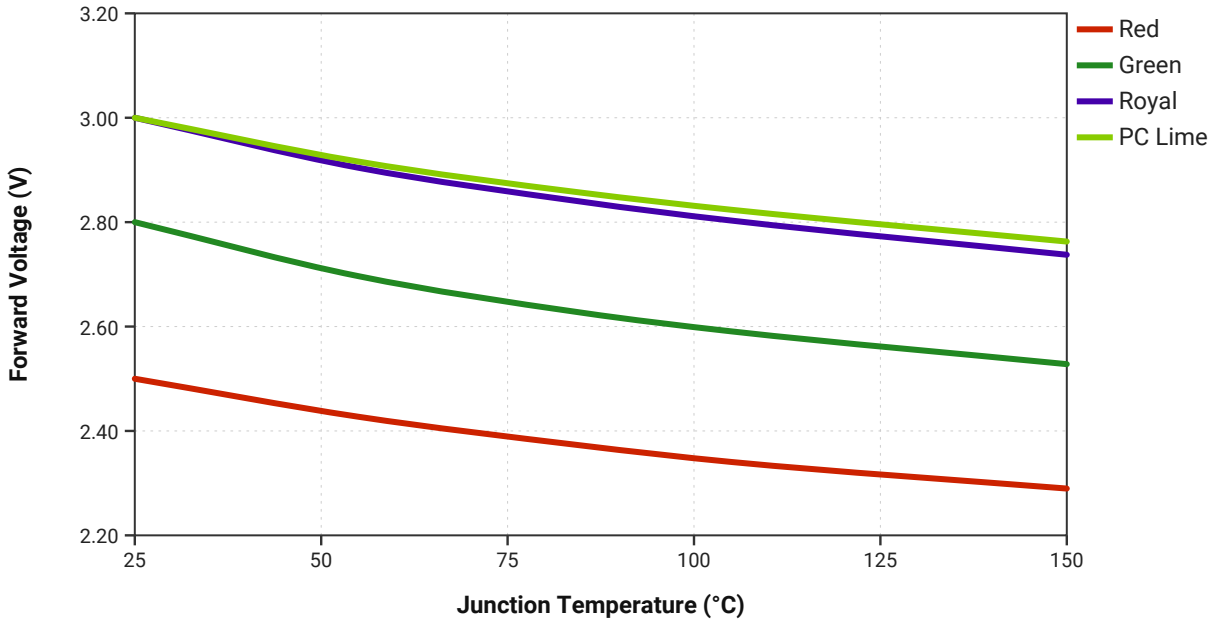


RELATIVE FLUX VS. FORWARD CURRENT — X21APL (T_J = 25 °C)

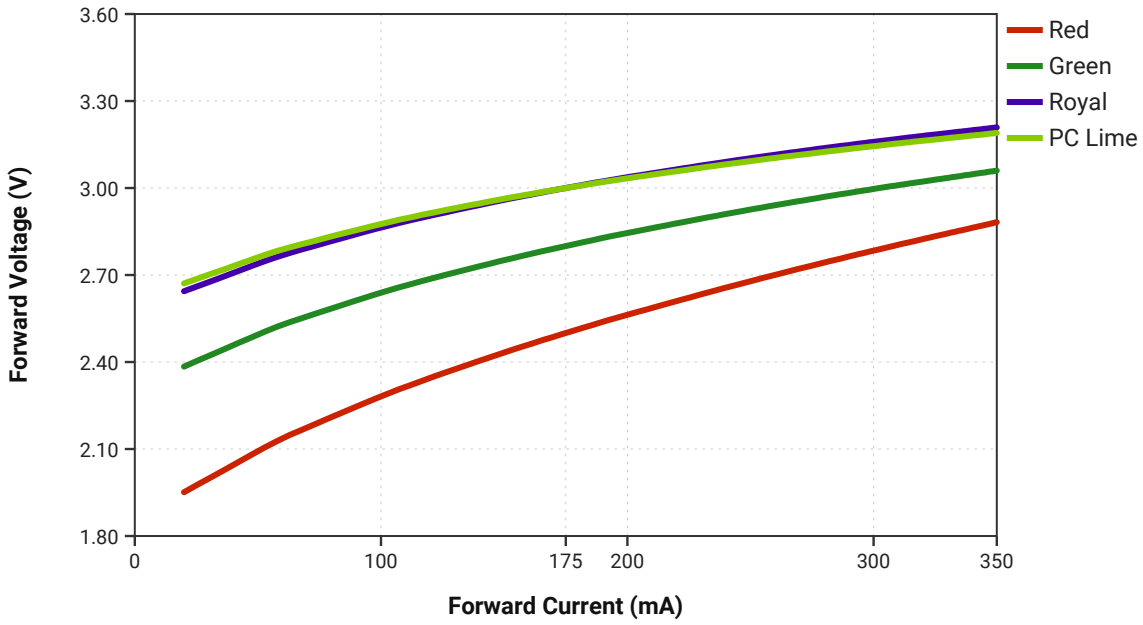


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FORWARD VOLTAGE VS. JUNCTION TEMPERATURE — X21APL (I_F = 175 mA)

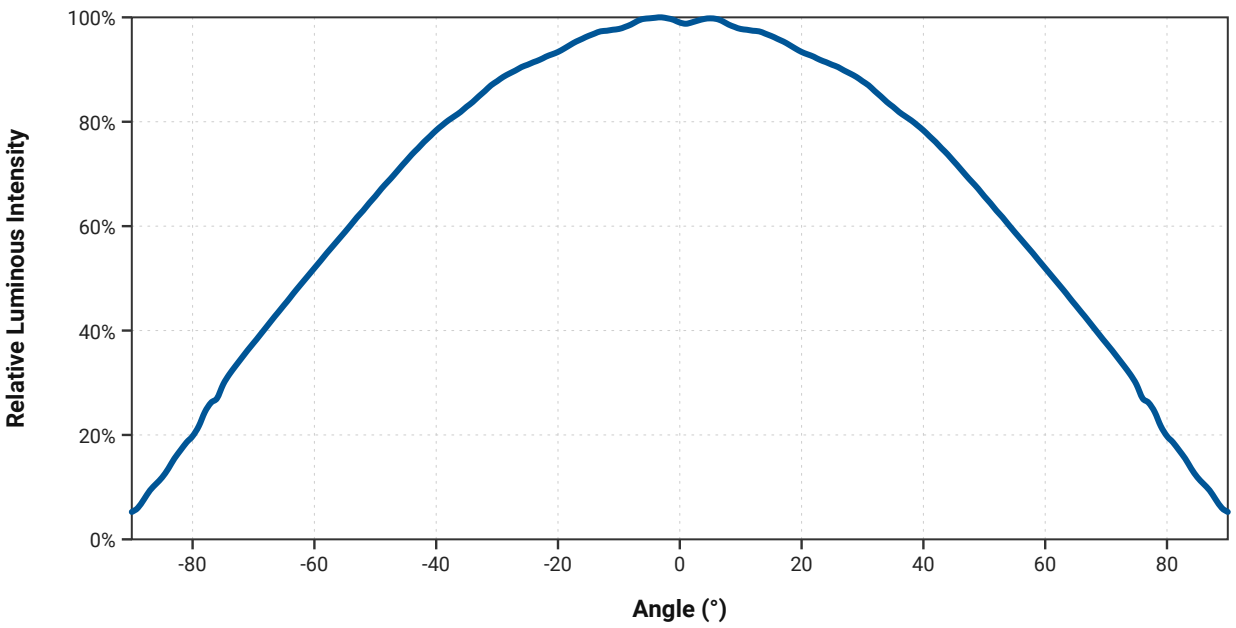


FORWARD VOLTAGE VS. FORWARD CURRENT — X21APL (T_J = 25 °C)



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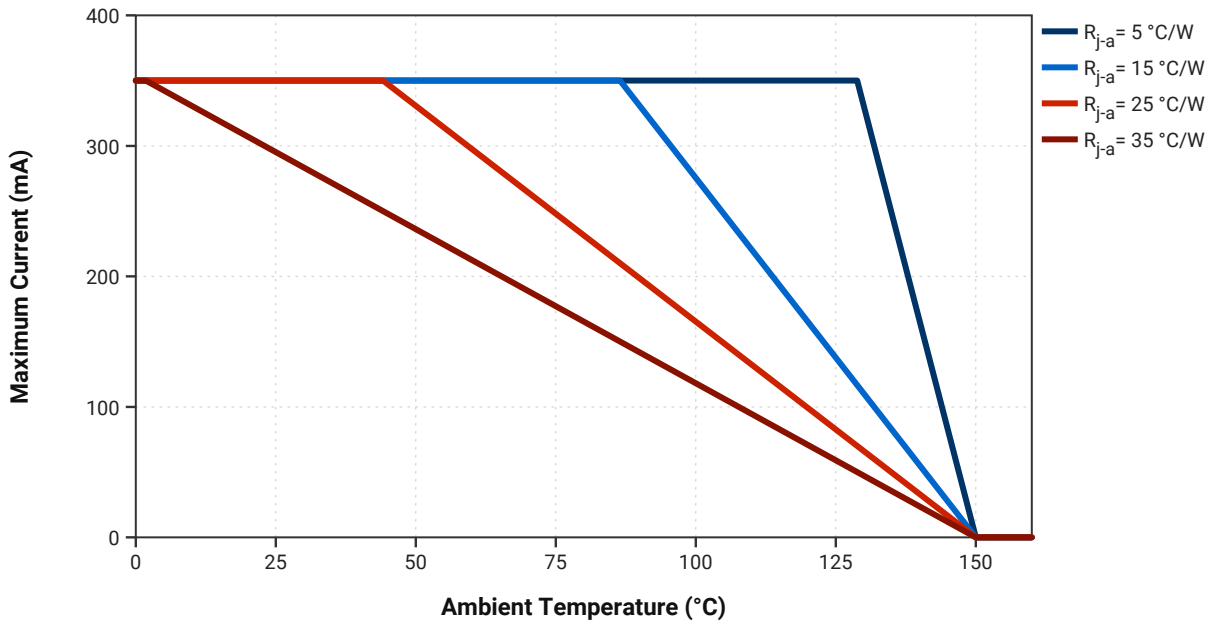


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THERMAL DESIGN

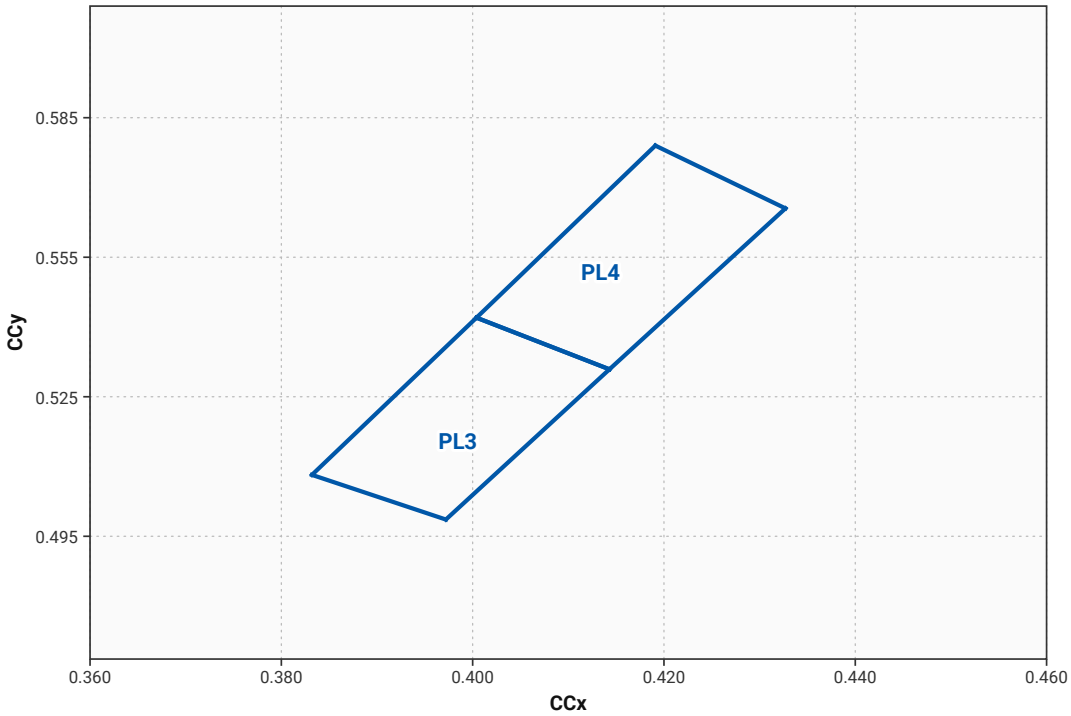
The maximum forward current is determined by the thermal resistance between the LED junction and ambient. It is crucial for the end product to be designed in a manner that minimizes the thermal resistance from the solder point to ambient in order to optimize lamp life and optical characteristics.

Please refer to the Characteristics table on page 39 for this product's thermal resistance and maximum junction temperature.



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CHROMATICITY BINS — PC LIME



Bin	x	y
PL3	0.3972	0.4986
	0.3832	0.5082
	0.4004	0.5420
	0.4143	0.5309
PL4	0.4004	0.5420
	0.4143	0.5309
	0.4327	0.5655
	0.4191	0.5790

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PERFORMANCE GROUPS

XLamp X21A PC Lime LEDs tested for luminous flux are placed into one of the following luminous flux groups.

Group Code	Min Luminous Flux (lm)	Max Luminous Flux (lm)
1	20	40
2	40	60
3	60	80
4	80	100

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CHARACTERISTICS — X21ABL COMPLETE PACKAGE

The following table lists the product characteristics for the XLamp X21 Multi-Color LED package, measured with all LED dies on simultaneously and each LED die connected to independent drive circuits at 175 mA.

Characteristics	Unit	Minimum	Typical	Maximum
Thermal resistance, junction to solder point $R_{\theta\text{-}S}$◊	°C/W	-	7.0	-
Viewing angle (FWHM) — High Intensity	degrees	-	120	-
LED junction temperature	°C	-	-	150

◊ $R_{\theta\text{-}S}$ Thermal resistance measurement was performed per the JEDEC JESD51-14 standard. See the Thermal Resistance Measurement application note for more details.

CHARACTERISTICS — PER LED DIE

The following table lists the product characteristics for each LED die within the XLamp X21 Multi-Color LED package.

Characteristics	Unit	Minimum	Typical	Maximum
Temperature coefficient of voltage — red	mV/°C	-	-1.5	-
Temperature coefficient of voltage — green	mV/°C	-	-1.0	-
Temperature coefficient of voltage — blue	mV/°C	-	-1.1	-
Temperature coefficient of voltage — PC Lime	mV/°C	-	-1.1	-
DC forward current — red, green, blue, PC Lime	mA	-	-	350
Forward voltage (@ 175 mA, 25 °C) — red	V	-	2.5	2.7
Forward voltage (@ 175 mA, 25 °C) — green	V	-	2.8	3.0
Forward voltage (@ 175 mA, 25 °C) — blue, PC Lime	V	-	3.0	3.2

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FLUX CHARACTERISTICS — HIGH INTENSITY (T_J = 25 °C)

The following table lists the minimum and typical luminous flux for each LED die within the XLamp package at 175 mA per die, measured at T_j = 25 °C.

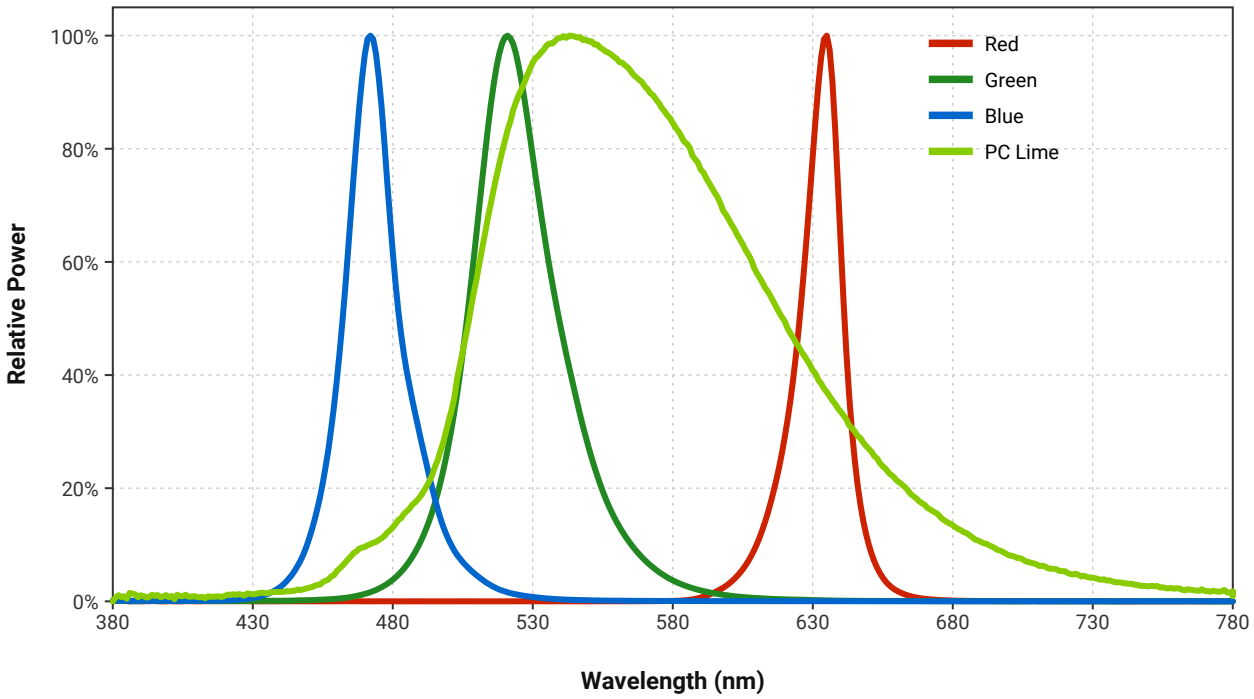
Color		Chromaticity Bins / Dominant Wavelength Range		Minimum Luminous Flux @ 175 mA		Typical Luminous Flux @ 175 mA	Order Code
		Minimum	Maximum	Group	Flux (lm)	Flux (lm)	
Color + PC Lime	Red	620 nm	630 nm	A2	20	30	X21ABL-H0-0000-00000A2AAALA
	Green	520 nm	535 nm		40	55	
	Blue	465 nm	480 nm		10	15	
	PC Lime	PL3, PL4			50	65	

Notes

- Cree LED maintains a tolerance of ±7% on flux and power measurements, ±0.005 on chromaticity measurements and ±2 on CRI measurements.
- XLamp X21ABL 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 without advance notice.

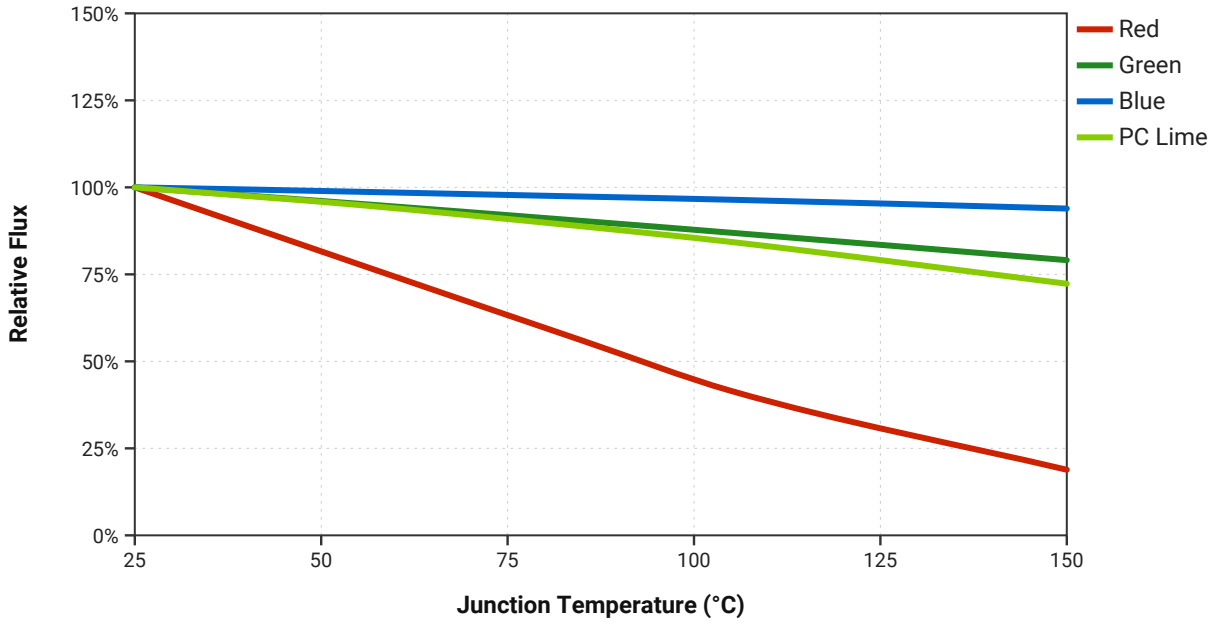
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RELATIVE SPECTRAL POWER DISTRIBUTION

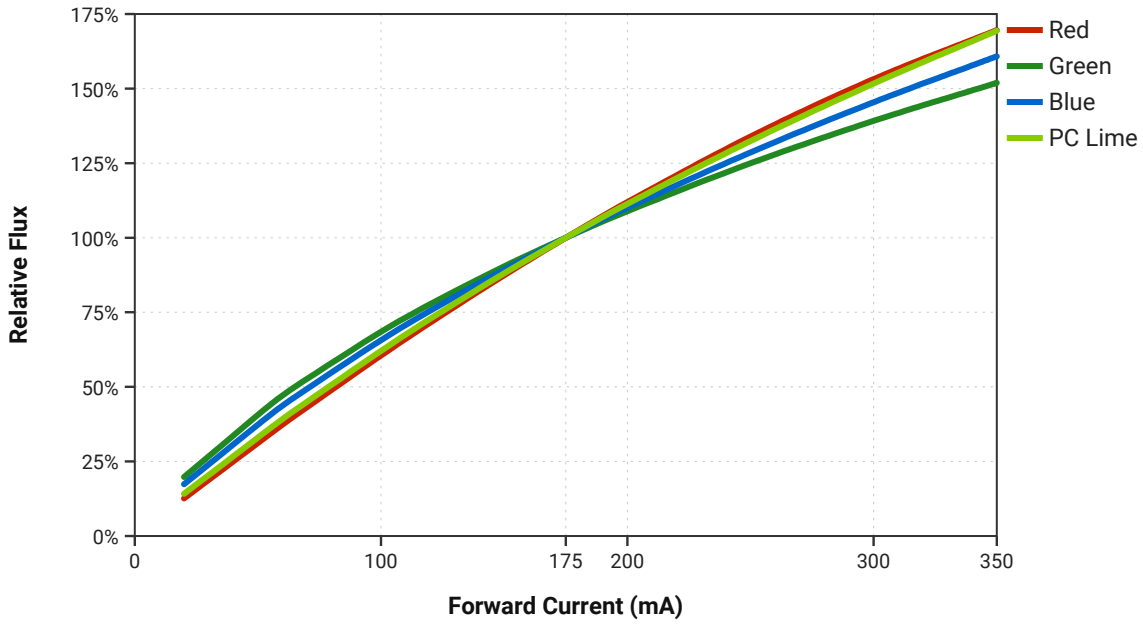


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RELATIVE FLUX VS. JUNCTION TEMPERATURE — X21ABL (I_F = 175 mA)

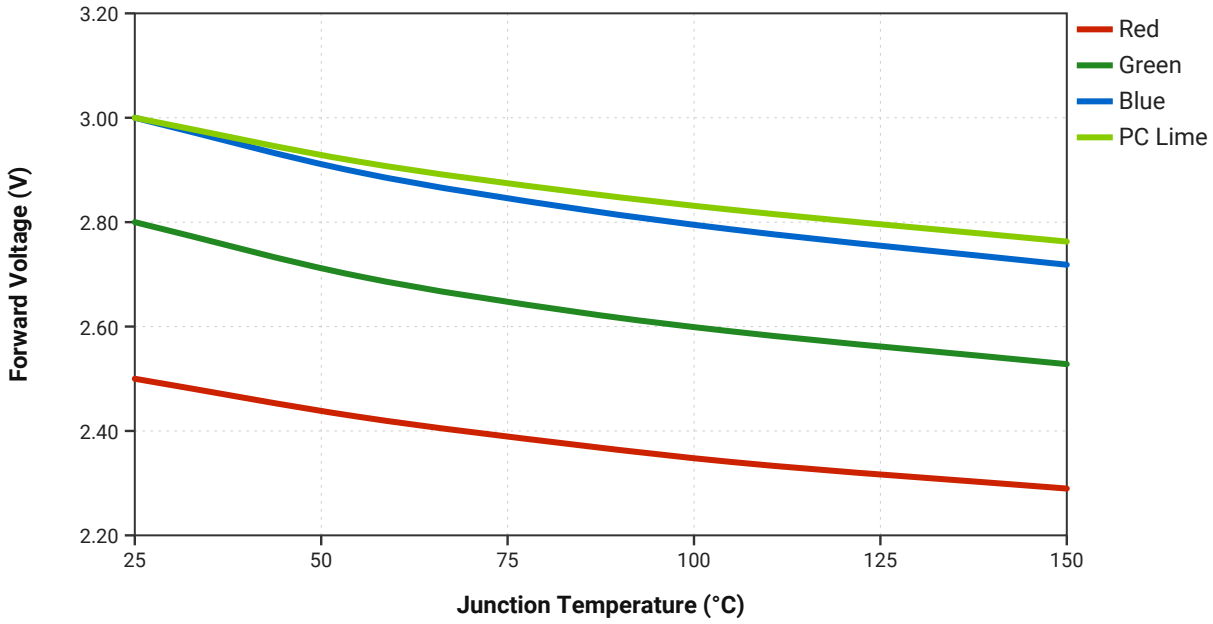


RELATIVE FLUX VS. FORWARD CURRENT — X21ABL (T_J = 25 °C)

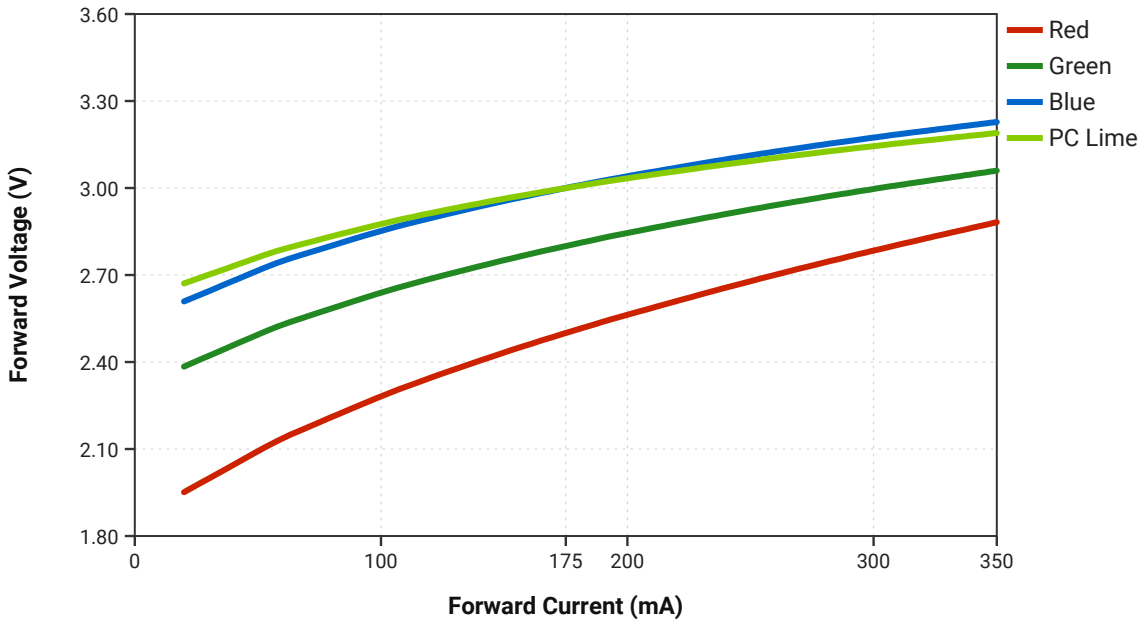


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FORWARD VOLTAGE VS. JUNCTION TEMPERATURE — X21ABL (I_F = 175 mA)

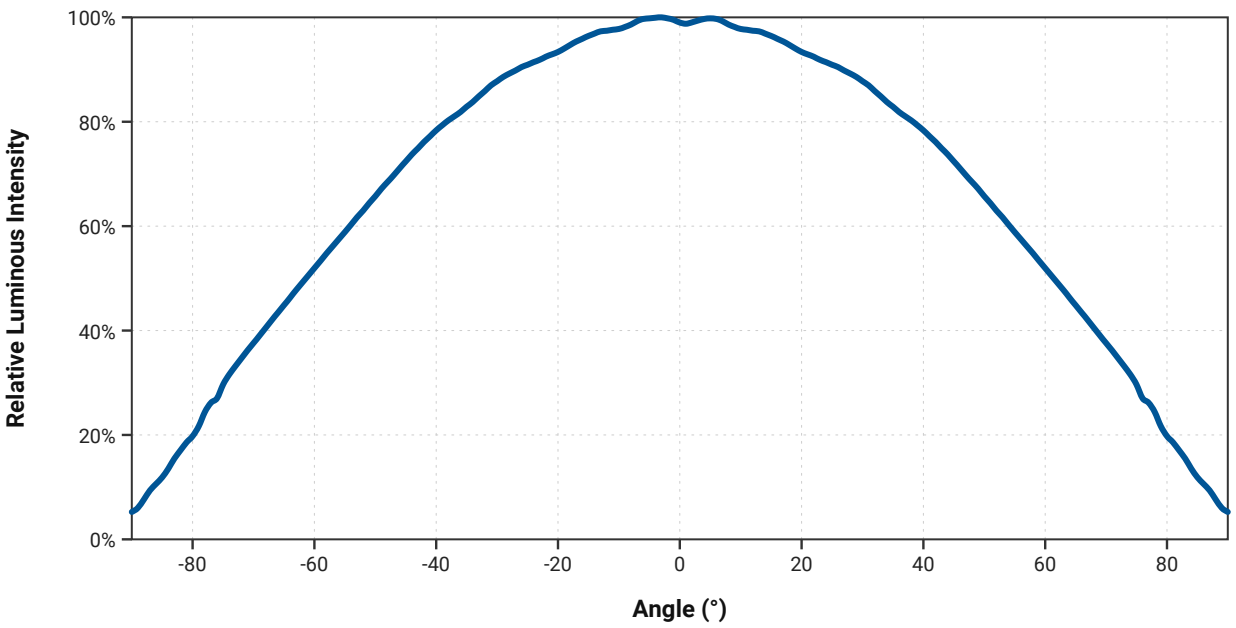


FORWARD VOLTAGE VS. FORWARD CURRENT — X21ABL (T_J = 25 °C)



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TYPICAL SPATIAL DISTRIBUTION

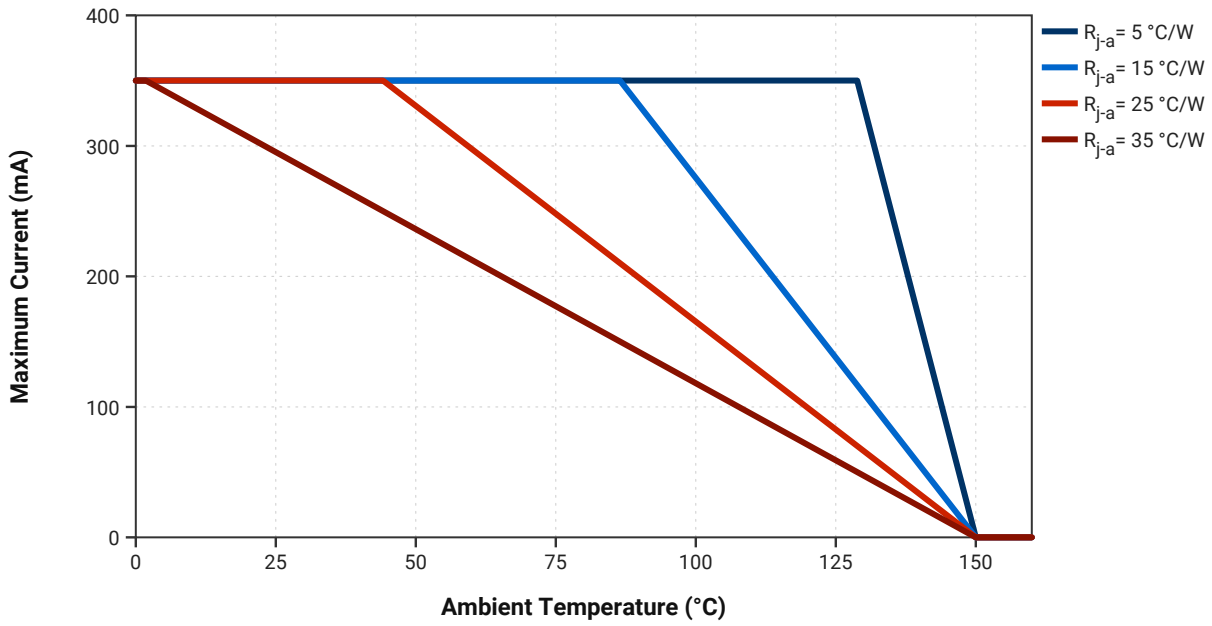


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THERMAL DESIGN

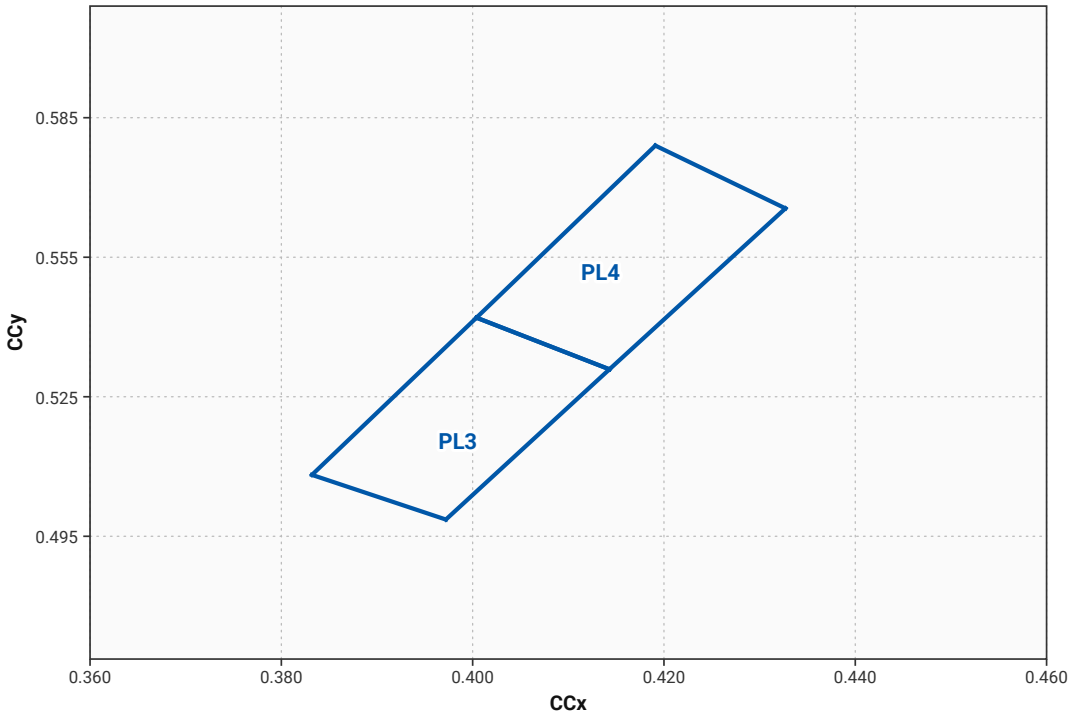
The maximum forward current is determined by the thermal resistance between the LED junction and ambient. It is crucial for the end product to be designed in a manner that minimizes the thermal resistance from the solder point to ambient in order to optimize lamp life and optical characteristics.

Please refer to the Characteristics table on page 48 for this product's thermal resistance and maximum junction temperature.



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CHROMATICITY BINS — PC LIME



Bin	x	y
PL3	0.3972	0.4986
	0.3832	0.5082
	0.4004	0.5420
	0.4143	0.5309
PL4	0.4004	0.5420
	0.4143	0.5309
	0.4327	0.5655
	0.4191	0.5790

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PERFORMANCE GROUPS

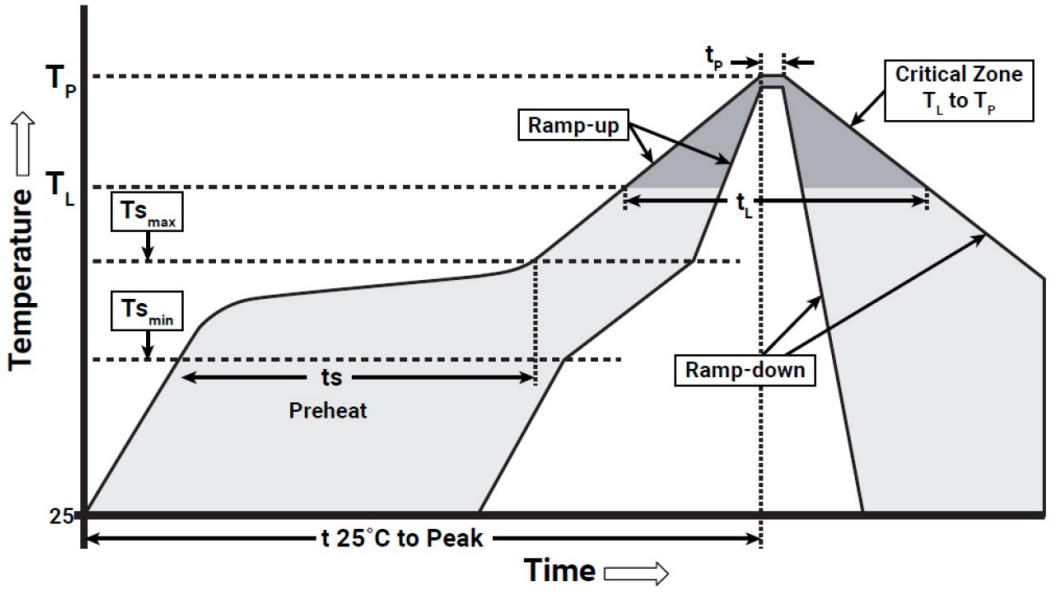
XLamp X21A PC Lime LEDs tested for luminous flux are placed into one of the following luminous flux groups.

Group Code	Min Luminous Flux (lm)	Max Luminous Flux (lm)
1	20	40
2	40	60
3	60	80
4	80	100

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REFLOW SOLDERING CHARACTERISTICS

In testing, Cree LED has found XLamp X21A LEDs to be compatible with JEDEC J-STD-020C, using the parameters listed below. As a general guideline, Cree LED recommends that users follow the recommended soldering profile provided by the manufacturer of the solder paste used, and therefore it is the lamp or luminaire manufacturer's responsibility to determine applicable soldering requirements. Note that this general guideline may not apply to all PCB designs and configurations of reflow soldering equipment.



Profile Feature	Lead-Free Solder
Average Ramp-Up Rate (Tsmax to Tp)	1.2 °C/second
Preheat: Temperature Min (Tsmin)	120 °C
Preheat: Temperature Max (Tsmax)	170 °C
Preheat: Time (tsmin to tsmax)	65 - 150 seconds
Time Maintained Above: Temperature (TL)	217 °C
Time Maintained Above: Time (tL)	45 - 90 seconds
Peak/Classification Temperature (Tp)	235 - 245 °C
Time Within 5 °C of Actual Peak (tp)	20 - 40 seconds
Ramp-Down Rate (max)	2 °C/second
Time 25 °C to Peak Temperature	4 minutes max
JEDEC Compatible	Yes

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ORDER CODE DESCRIPTION

SSSPPP - KL - TTTT - 0000RFGABCDD

SSS - Product Family	
X21	X21

L - Reel Size	
0	Default packaging by part

R - CRI	
B	70 minimum
H	80 minimum
0	No CRI for PC Amber, PC Lime

DD - Chromaticity Kit
See performance groups

PPP - Series	
ACL	Red, Green, Royal Blue, White
ACB	Red, Green, Blue, White
APA	Red, Green, Royal Blue, PC Amber
ABA	Red, Green, Blue, PC Amber
APL	Red, Green, Royal Blue, PC Lime
ABL	Red, Green, Blue, PC Lime

TTTT - Internal Code
Internal / product-defined

FG - Minimum Flux
Internal / product-defined

K - Configuration	
H	High Intensity

0000 - Internal Code
Internal / product-defined

ABC - Dominant Wavelength	
A	Red
B	Green
C	Blue or Royal Blue

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BIN CODE DESCRIPTION

SSSPPP - K - FGHJ - 0000 - ABCDDDRZZZZ

SSS - Product Family	
X21	X21

FGHJ - Flux Bin
See performance groups

DDD - Chromaticity Kit
See performance groups

PPP - Series	
ACL	Red, Green, Royal Blue, White
ACB	Red, Green, Blue, White
APA	Red, Green, Royal Blue, PC Amber
ABA	Red, Green, Blue, PC Amber
APL	Red, Green, Royal Blue, PC Lime
ABL	Red, Green, Blue, PC Lime

0000 - Internal Code
Internal / product-defined

R - CRI	
B	70 minimum
H	80 minimum
0	No CRI for PC Amber, PC Lime

K - Configuration	
H	High Intensity

ABC - Dominant Wavelength	
A	Red
B	Green
C	Blue or Royal Blue

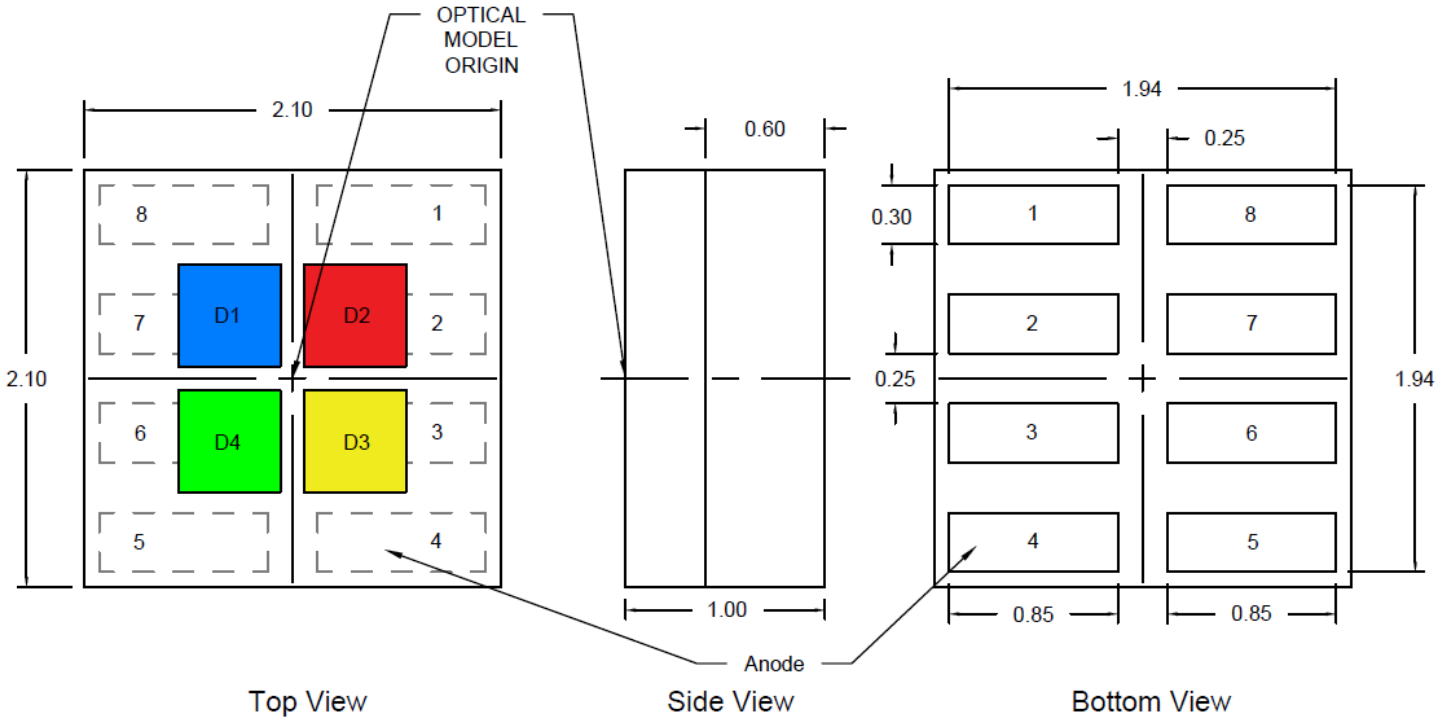
ZZZZ - Internal Code
Internal / product-defined

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MECHANICAL DIMENSIONS

The red diode (labeled D2) is used for orientation purposes when describing the mechanical dimensions and circuit diagram.

Applies to: X21ACL, X21ACB, X21APA, X21ABA, X21APL, X21ABL



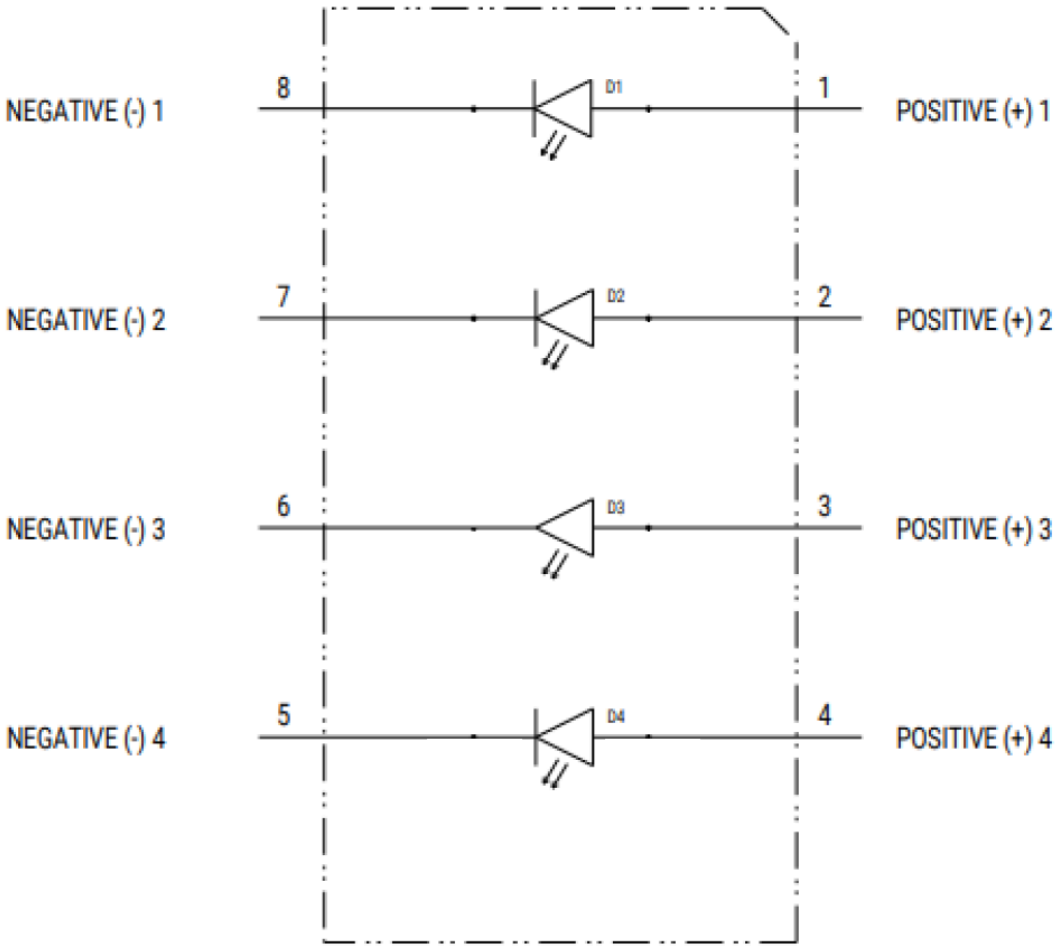
Notes

- Cree LED recommends using thermal pad kickouts to maximize component thermal performance and white solder mask to reduce system optical loss.

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CIRCUIT DIAGRAM

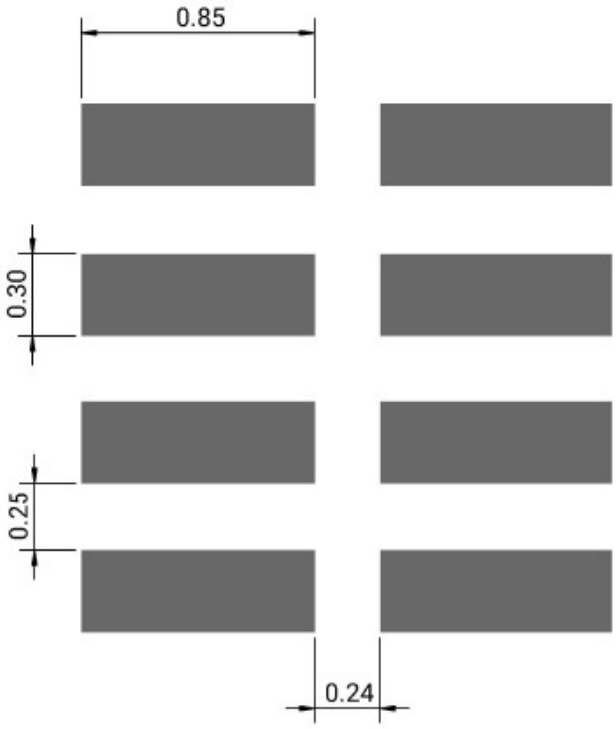
COLOR:
D1: BLUE
D2: RED
D3: WHITE
D4: GREEN



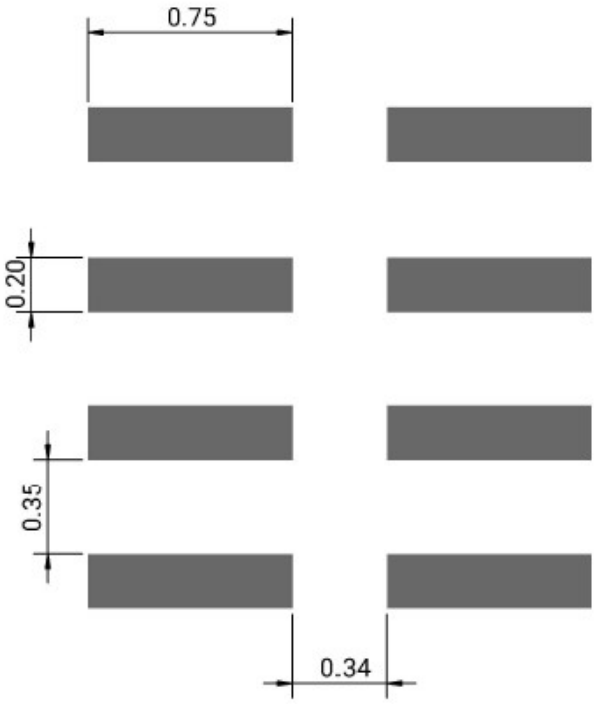
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MECHANICAL DIMENSIONS (CONTINUED)

PCB / Stencil Drawing



Recommended PCB Footprint



Recommended Stencil Openings

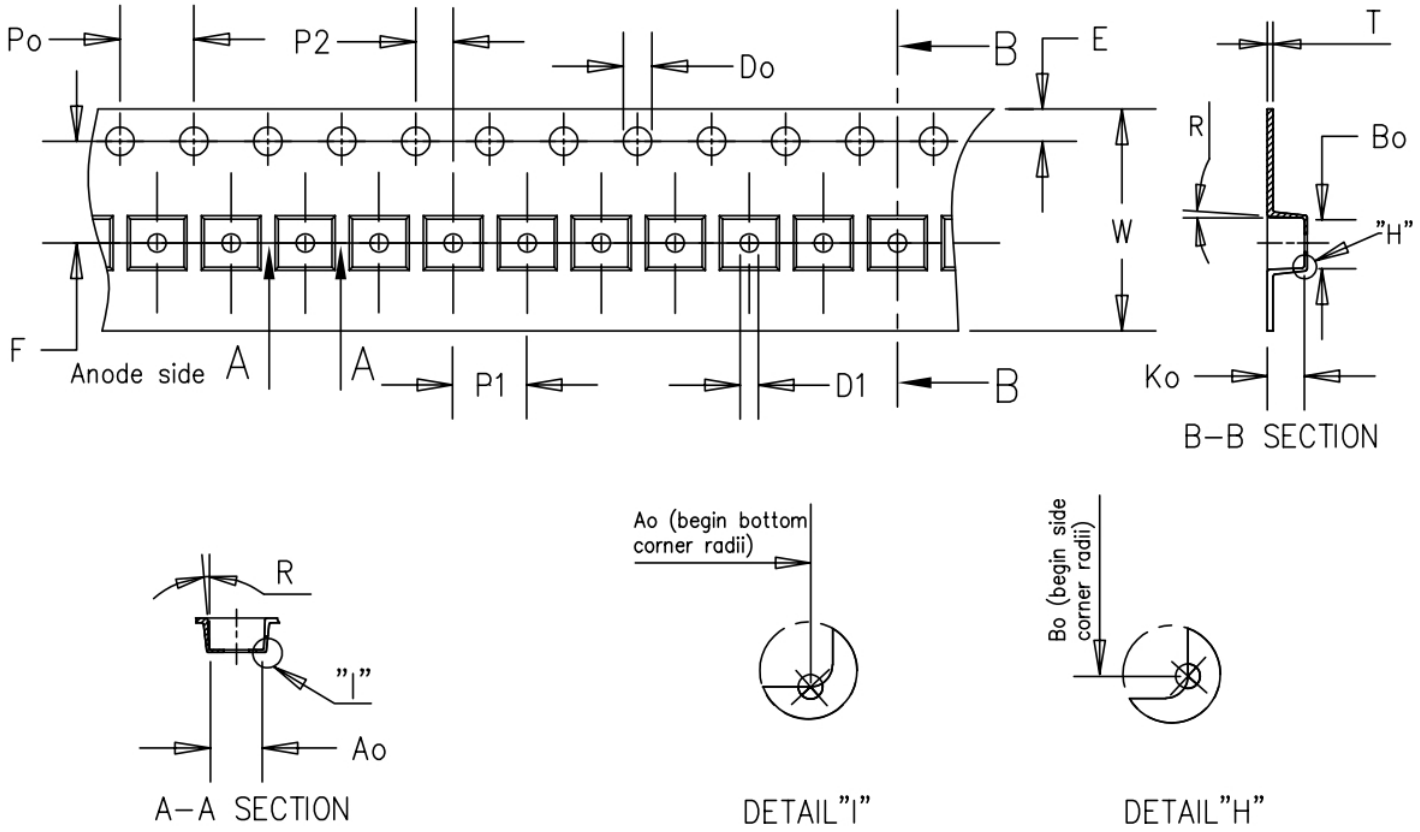
Notes

- Cree LED recommends using thermal pad kickouts to maximize component thermal performance and white solder mask to reduce system optical loss.
- This stencil has been tested and optimized for the avoidance of voiding when using ALPHA® OM-362 solder paste. For other solder pastes, a “window pane” design for the thermal pad stencil may result in a lower voiding percentage. Contact your local Cree LED representative for consultation regarding your specific application.

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TAPE AND REEL

All Cree LED carrier tapes conform to EIA-481D, Automated Component Handling Systems Standard. Except as noted, all dimensions are in mm, and measurement tolerances unless indicated otherwise: .xx = ±.15 mm.

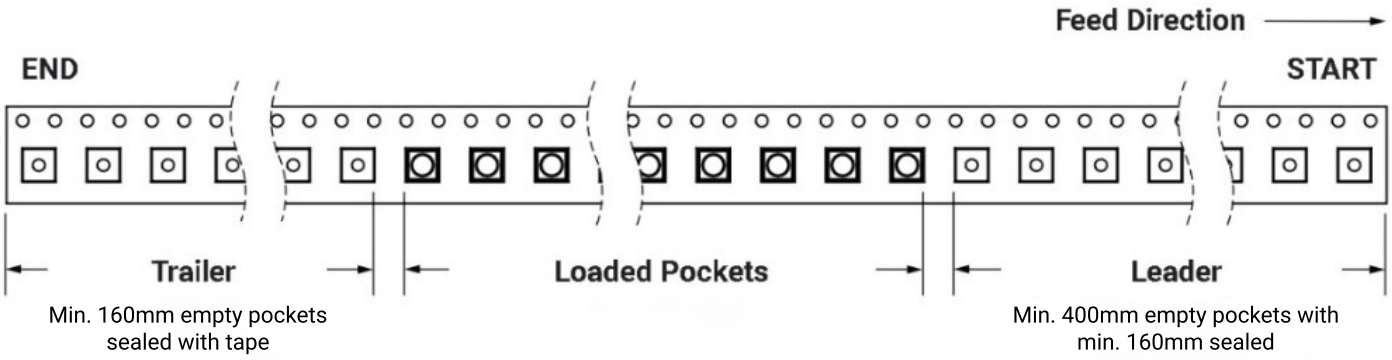


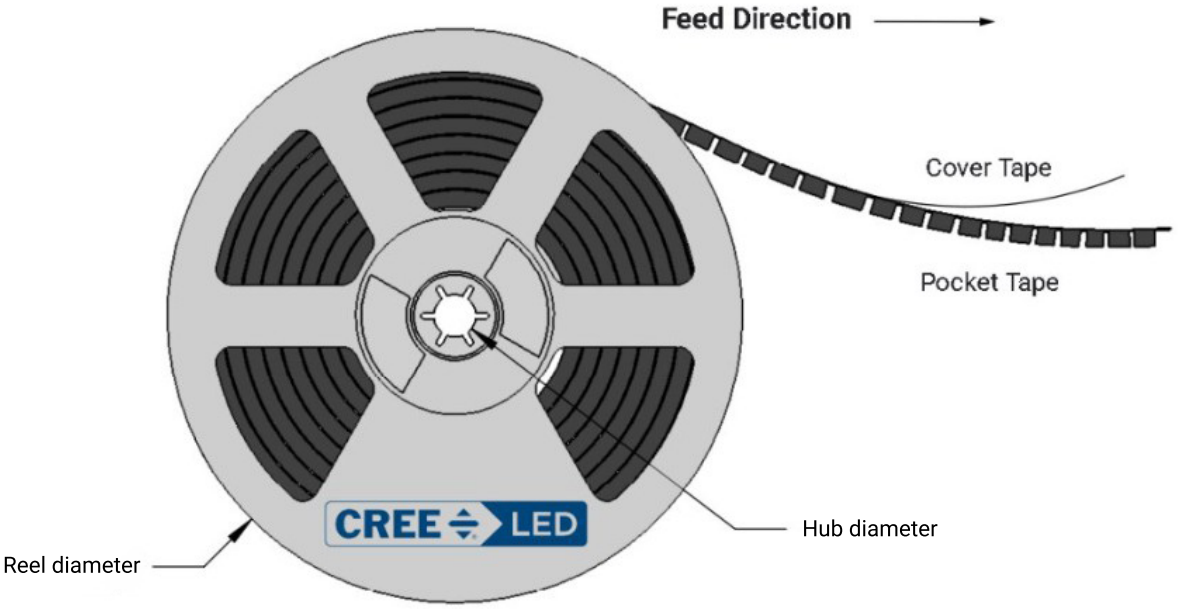
The following tape parameters apply to: X21ABA, X21ABL, X21ACB, X21ACL, X21APA, X21APL

Ao	Bo	Ko	Po	P1	P2	T	E	F	Do	D1	W	R
2.35	2.35	1.20	4.00	8.00	2.00	0.30	1.75	3.50	1.50	1.00	8.00	7°

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REEL SPECIFICATIONS





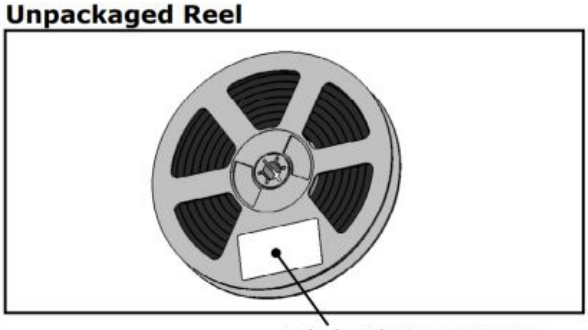
The following reel specifications apply to: X21ABA, X21ABL, X21ACB, X21ACL, X21APA, X21APL

Parameter	Value
Hub Diameter	13 mm
Reel Diameter	7 inches
Pockets per Reel (Loaded)	2000
Leader (mm)	400
Trailer (mm)	160

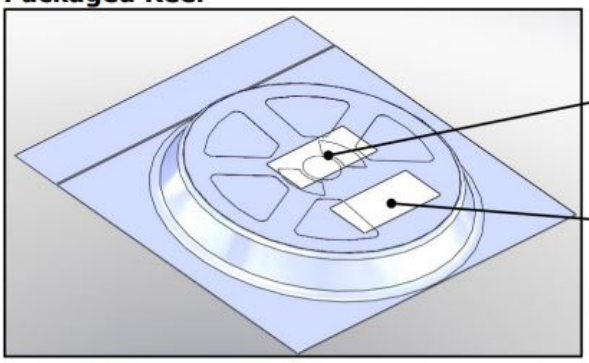
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PACKAGING

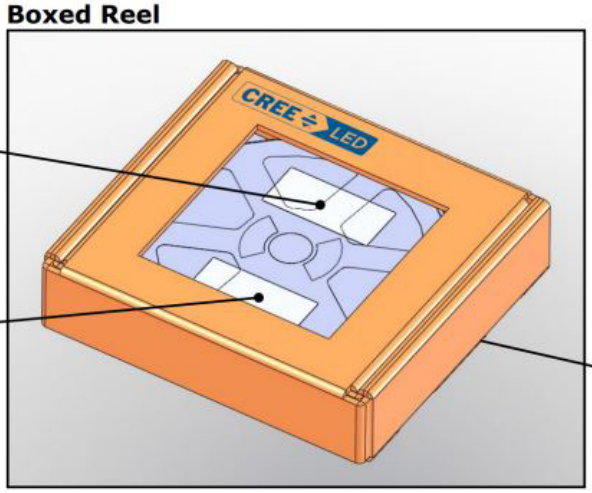
Unpackaged Reel



Packaged Reel



Boxed Reel



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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.

Moisture Sensitivity

Cree LED recommends keeping XLamp LEDs in the provided, resealable moisture-barrier packaging (MBP) until immediately prior to soldering. Unopened MBPs that contain XLamp LEDs do not need special storage for moisture sensitivity.

Once the MBP is opened, XLamp X21A LEDs may be stored as MSL 1 per JEDEC J-STD-033, meaning they have unlimited floor life in conditions of ≤ 30 °C/85% relative humidity (RH). Regardless of storage condition, Cree LED recommends sealing any unsoldered LEDs in the original MBP.

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 ensure you get the most up-to-date REACH SVHC Declaration. REACH banned substance information (REACH Article 67) is also available upon request.

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NOTES (CONTINUED)

UL® Recognized Component

This product meets the requirements to be considered a UL Recognized Component with Level 1 enclosure consideration. The LED package or a portion thereof has not been investigated as a fire enclosure or 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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