



Cree LED Horticulture LEDs



Agenda

- Horticulture Overview
- XLamp® Horizon LEDs
- XLamp® S Line LEDs
- Photophyll™ Select LEDs
- J Series® White and Color LEDs

Application Overview: Horticulture

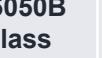
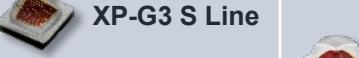
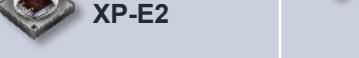
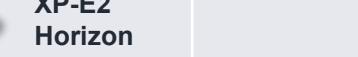
Horticulture and other forms of agricultural lighting require application-tuned ratios of spectral content, high efficacy and long lifetimes. Since these systems are designed to maximize yields for plants and animals, they require different metrics than lighting products designed around the human visual system.

Latest Innovations

XLamp® Horizon LEDs	<ul style="list-style-type: none">▪ Two horticulture beam shapes▪ Can be placed up to 40% closer to plants than standard LEDs, with up to 10% higher light levels and similar uniformity▪ Available on 5 LED colors	 <p>XP-G3 White & Photophyll™ Select XP-G3 Royal Blue XP-G3 Photo Red XP-E2 Far Red</p>
XLamp® Horticulture LED Upgrades	<ul style="list-style-type: none">▪ XLamp XP-G3 Photo Red S Line LED upgraded with up to 14% higher efficiency▪ Flagship XLamp LEDs are now available in S Line versions for best-in-class sulfur and corrosion resistance	 <p>XP-G3 Photo Red S Line XP-G3 Royal S Line XP-G3 Photophyll™ Select S Line XP-E2 Far Red S Line</p>



Cree LED Portfolio Overview: Horticulture

LED	XLamp® XP	XLamp® XP Horizon	J Series® 5050	J Series 3030	J Series 2835
Footprint (mm)	3.45 x 3.45	3.45 x 3.45	5.0 x 5.0	3.0 x 3.0	2.8 x 3.5
Max Power (W)	6	6	5	1	1
Photophyll™ Select	 XP-G3 S Line	 XP-G3 Horizon			 JB2835B G Class
White	 XP-G3 S Line	 XP-G3 Horizon	 JR5050C E Class  JR5050B K Class	 JB3030C E Class	 JB2835B G Class
450 nm Royal Blue	 XP-G3 S Line	 XP-G3 Horizon			 JE2835 N Class
PC Mint					 JE2835 N Class
660 nm Photo Red	 XP-G3 S Line  XP-E2	 XP-G3 Horizon			 JE2835 N Class
730 nm Far Red	 XP-E2 S Line	 XP-E2 Horizon			 JE2835 N Class
PC Purple					 JE2835 N Class

Cree LED Advantages

Horizon LEDs that improve lighting uniformity & decrease mounting height

Expanded S Line portfolio for best-in-class sulfur and corrosion resistance

Photophyll™ Select: new phosphor-converted LEDs with blue & green spectral output tuned for horticulture

XLamp® Horizon LEDs: Horticulture Beam Shapes



LED	Color	Beam Shape	Max Current	Max Power	Footprint	
XLamp XP-G3	White	Horizon70 Horizon90	2.000A	6W	3.45 x 3.45 mm	
	Photophyll™ Select					
	Royal Blue		1.500A	4W		
	Photo Red					
XLamp XP-E2	Far Red		1.500A	4W		

Two beam shapes that improve lighting uniformity & decrease mounting height

Increases plant density for vertical farms

- More plants can be grown in a rack footprint
- Lower costs, higher revenues

Increases uniformity & efficiency for greenhouses

- Square illuminance pattern
- Allows use of more efficient optics

Includes S Line sulfur resistance

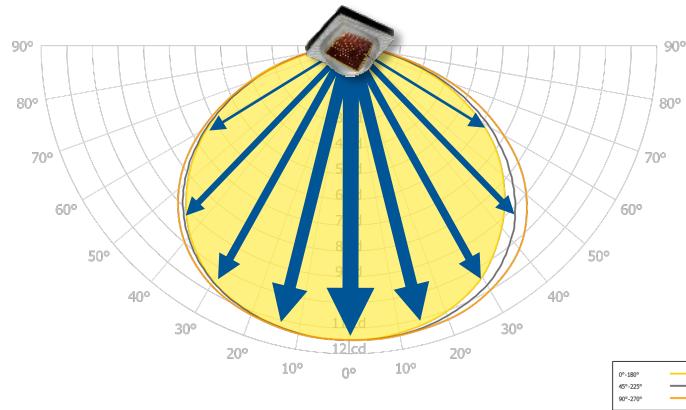
- Highest possible level of LED corrosion resistance
- Increases system reliability

**Optimized for:
Specialty Lighting**

Horticulture

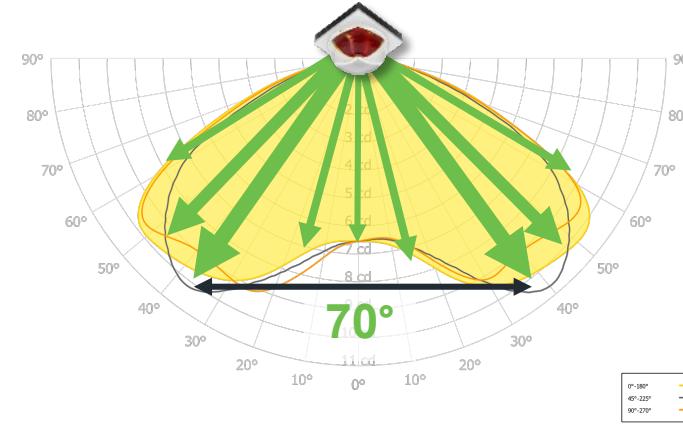


XLamp® Horizon LEDs: Horticulture Beam Shapes



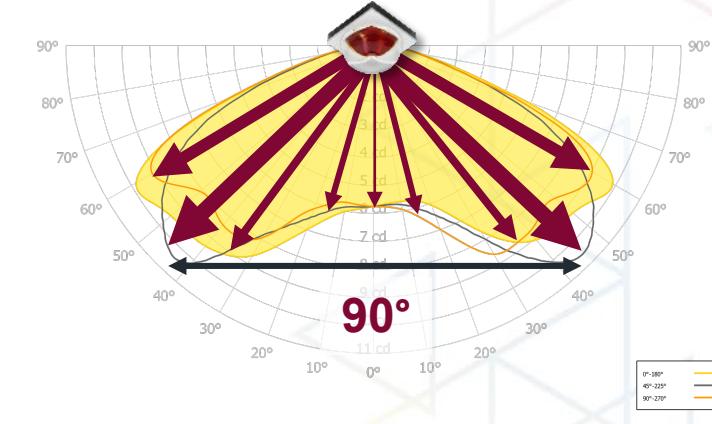
Standard

- Sends most light straight down
- Can cause over-lighting of plants underneath luminaires and under-lighting everywhere else



Horizon70

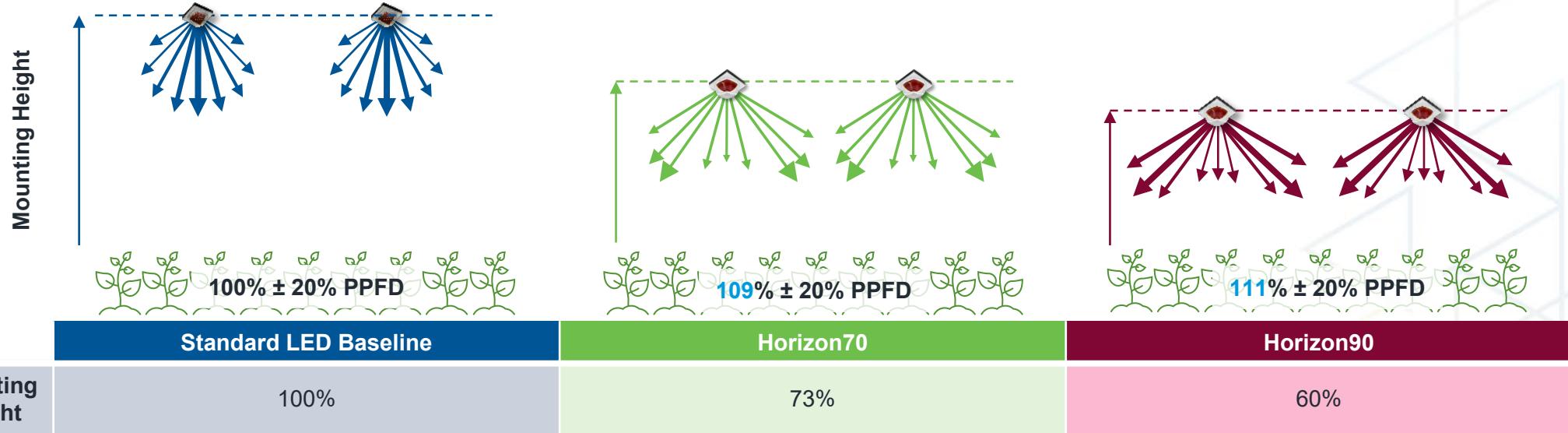
- Light output optimized to peaks spaced 70° apart
- Distributes light uniformly across the plants below
- Compatible with existing “batwing” optic profiles



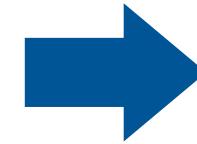
Horizon90

- Light output optimized to peaks spaced 90° apart
- Distributes light uniformly to the plants below with minimal luminaire height

Value in Vertical Farm Applications

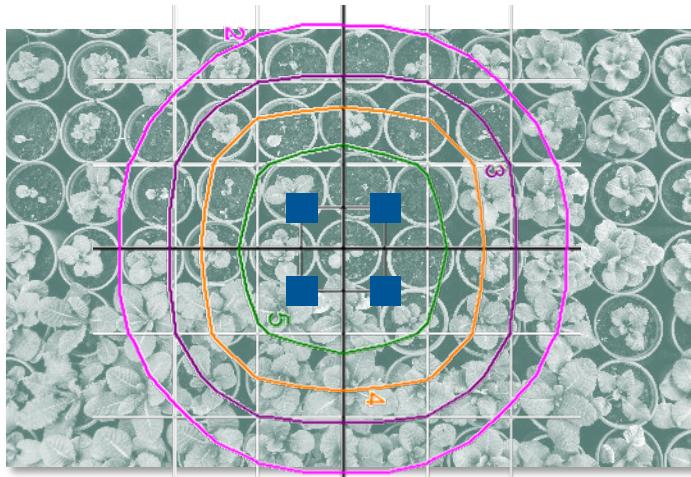
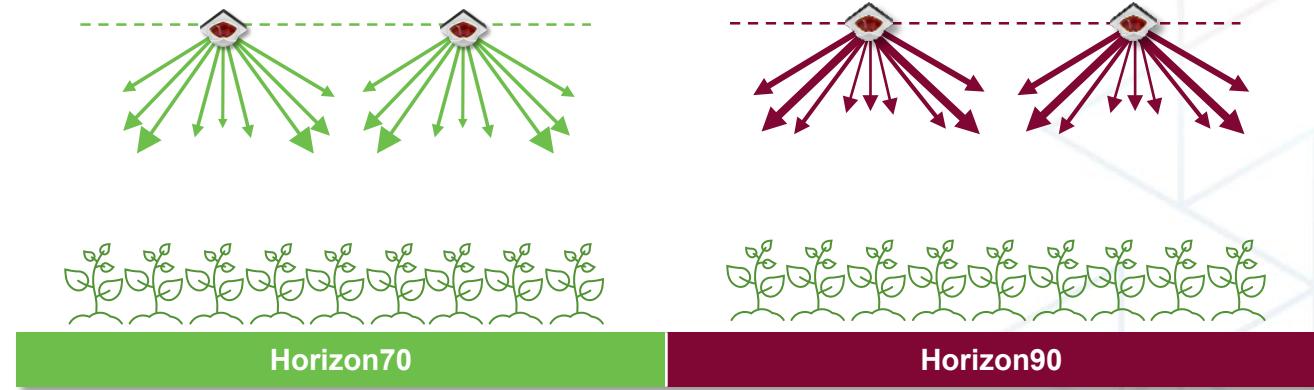


**Lower Luminaire
Mounting Height
+
Same Uniformity
+
More PPFD**



- More plants per rack
- Higher yields
- Lower energy costs

Value in Greenhouse Applications



Square Light Distribution on Plants
+
Light Spreading with no Secondary Optic



- Improved uniformity vs standard LEDs
- Higher efficiency (less optical loss)
- Lower total system cost

Horticulture Product Details: XLamp® Horizon LEDs



Color	Red PPF %	Green/Blue Ratio	XLamp® LED	Test Current (mA)	Min PPF (μmol/s)	Typ PPF (μmol/s)	PPF/W (μmol/J)	Order Code
White 4000K, 70 CRI	~40%	~2.5	XP-G3 Horizon70	350	2.54	---	2.61	XPGDWT-BW-0000-00ME5
			XP-G3 Horizon90	350	2.54	---	2.61	XPGDWT-BF-0000-00ME5
Photophyll™ Select	20%	2.0	XP-G3 Horizon70	350	2.50	2.60	2.62	XPGDWT-NW-0000-00XPP
			XP-G3 Horizon90	350	2.50	2.60	2.62	XPGDWT-NF-0000-00XPP
		2.5	XP-G3 Horizon70	350	2.50	2.60	2.62	XPGDWT-QW-0000-00XPP
			XP-G3 Horizon90	350	2.50	2.60	2.62	XPGDWT-QF-0000-00XPP
		3.0	XP-G3 Horizon70	350	2.50	2.60	2.62	XPGDWT-XW-0000-00XPP
			XP-G3 Horizon90	350	2.50	2.60	2.62	XPGDWT-XF-0000-00XPP
Royal Blue	-	-	XP-G3 Horizon70	350	2.77	—	2.83	XPGDRY-LW-0000-00601
			XP-G3 Horizon90	350	2.58	—	2.64	XPGDRY-LF-0000-00501
Photo Red	~99%	-	XP-G3 Horizon70	350	2.99	3.01	4.60	XPGDPR-LW-0000-00H01
			XP-G3 Horizon90	350	2.85	---	4.36	XPGDPR-LF-0000-00G01
Far Red	-	-	XP-E2 Horizon70	350	2.49*	2.52*	3.83*	XPEBFR-LW-0000-00C01
			XP-E2 Horizon90	350	2.34*	---	3.56*	XPEBFR-LF-0000-00B01

730 nm LED flux values shown are photon flux (PF) for the range 380-780 nm

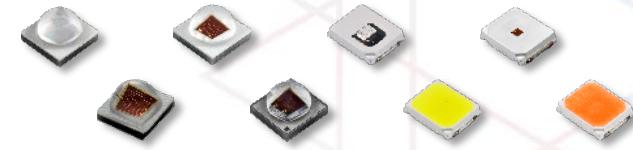
All performance figures shown for $T_j = 25^\circ\text{C}$

XLamp® S Line Horticulture LEDs

- Cree LED has expanded its portfolio of XLamp horticulture LEDs with new S Line options
- Engineered with industry-leading sulfur and corrosion resistance, these LEDs thrive in demanding greenhouse environments, ensuring longevity and reliability
- Derived from proven technology used in outdoor lighting applications, S Line LEDs now extend to horticulture, promising extended operational lifespans and heightened system reliability.
- These LEDs offer a higher return on investment with reduced replacement and repair costs, making them ideal for maximizing yields and profits in greenhouse settings



Horticulture Product Details: Single Color LEDs

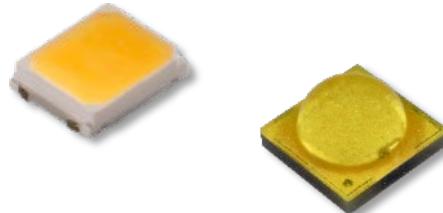


New Products & Performance Increases Q1 2024								
Color	Red PPF %	Green/Blue Ratio	LED	Test Current (mA)	Min PPF (µmol/s)	Typ PPF (µmol/s)	PPF/W (µmol/J)	Order Code
450 nm Royal Blue	---	---	XLamp® XP-G3 S Line	350	2.77	—	2.83	XPGDRY-LS-0000-00601
			XLamp XP-G3 S Line	350	2.58	—	2.64	XPGDRY-LS-0000-00501
			JE2835 3V N Class	140	—	1.01	2.43	JE2835ARY-N-0002A0000-N0000001
PC Mint			JE2835 3V N Class	140	—	1.00	2.42	JE2835APM-N-0001A0000-N0000001
660 nm Photo Red	~99%	---	XLamp XP-G3 S Line	350	2.99	3.01	4.60	XPGDPR-LS-0000-00H01
			XLamp XP-E2	350	2.71	—	3.71	XPEBPR-L1-0000-00F01
			JE2835 3V N Class	140	—	0.76	2.54	JE2835AHR-N-0001A0000-N0000001
730 nm Far Red	---	---	XLamp XP-E2 S Line	350	2.49*	2.52*	3.83*	XPEBFR-LS-0000-00C01
			XLamp XP-E2 S Line	350	2.34*	2.52*	3.83*	XPEBFR-LS-0000-00B01
			JE2835 3V N Class	140	—	0.80*	2.67*	JE2835AFR-N-0001A0000-N0000001
PC Purple	71%	0.63	JE2835 3V N Class	140	—	0.89	2.20	JE2835APP-N-0001A0000-N0000001

730 nm LED flux values shown are photon flux (PF) for the range 380-780 nm

All performance figures shown for $T_j = 25^\circ\text{C}$

Photophyll™ Select: First LEDs Fully Optimized for Horticulture



LED	Color	Voltage Class	Max Current	Max Power	Footprint
JB2835B 3V G Class	Photophyll™ Select	3	0.480A	2W	2.8 x 3.5 mm
XLamp® XP-G3 S Line		3	2.000A	6W	3.45 x 3.45 mm

New technology for the next generation of high-performance horticulture luminaires

New horticulture-specific metrics simplify design

- Avoids confusing/inaccurate translations
- Direct control over green/blue ratio

Advanced horticulture spectrum

- Maximizes green content & minimizes red vs lighting LEDs

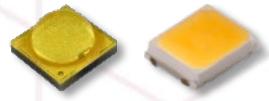
Enables high efficiency + broad spectrum with just 2 LED channels

- System efficiency up to 3.25 PPF/W
- 6% higher than standard White + Red designs

Optimized for:
Specialty Lighting
Horticulture

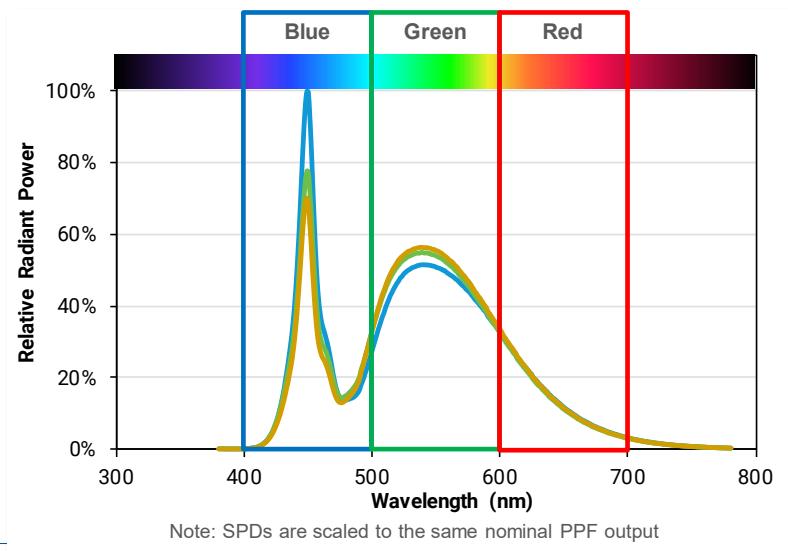


Horticulture Product Details: Photophyll™ Select LEDs



Color	Red PPF %	Green/Blue Ratio	LED	Test Current (mA)	Min PPF (μmol/s)	Typ PPF (μmol/s)	PPF/W (μmol/J)	Order Code
Photophyll™ Select	20%	2.0	XLamp® XP-G3 S Line	350	2.50	2.60	2.62	XPGDWT-NS-0000-00XPP
			JB2835B 3V G Class	55	0.41	0.44	3.00	JB2835BWT-G-N001A0000-N0000001
		2.5	XLamp XP-G3 S Line	350	2.50	2.60	2.62	XPGDWT-QS-0000-00XPP
			JB2835B 3V G Class	55	0.41	0.44	3.00	JB2835BWT-G-Q001A0000-N0000001
		3.0	XLamp XP-G3 S Line	350	2.50	2.60	2.62	XPGDWT-XS-0000-00XPP
			JB2835B 3V G Class	55	0.41	0.44	3.00	JB2835BWT-G-X001A0000-N0000001

All performance figures shown for $T_j = 25^\circ\text{C}$



Nominal GBR Target	Blue PPF%	Green PPF%	Red PPF%	Green/Blue Ratio (GBR)
2.0	26%	53%	20%	53%/26% = 2.0
2.5	22%	56%	20%	56%/22% = 2.5
3.0	19%	59%	20%	59%/19% = 3.0

Horticulture Product Details: White LEDs



Color	Red PPF %	Green/Blue Ratio	LED	Test Current (mA)	Min PPF (µmol/s)	Typ PPF (µmol/s)	PPF/W (µmol/J)	Order Code
5000K 70 CRI	~30%	~2.0	XLamp® XP-G3 S Line	350	2.78	—	2.86	XPGDWT-BS-0000-00P3E
			JR5050C 6V E Class	400	5.28	6.37	2.83	JR5050CWT-E-B50EB0000-N0000001
			JR5050B 6V K Class	400	5.28	6.04	2.66	JR5050BWT-K-B50EB0000-N0000001
			JR5050B 30V K Class	80	5.28	6.04	2.66	JR5050BWT-K-B50EK0000-N0000001
			JB3030C 3V E Class	55	0.44	0.47	3.21	JB3030CWT-E-B50EA0000-NZ000001
			JB2835B 3V G Class	55	0.41	0.45	3.05	JB2835BWT-G-B50EAHGR0-N00A0001
3500K 80 CRI	~40%	~3.4	JR5050C 6V E Class	400	4.99	6.21	2.76	JR5050CWT-E-H35EB0000-N0000001
			JR5050B 6V K Class	400	4.99	5.91	2.61	JR5050BWT-K-H35EB0000-N0000001
			JR5050B 30V K Class	80	4.99	5.91	2.61	JR5050BWT-K-H35EK0000-N0000001
			JB3030C 3V E Class	55	0.41	0.46	3.15	JB3030CWT-E-H35EA0000-NZ000001
			JB2835B 3V G Class	55	0.41	0.44	3.03	JB2835BWT-G-H35EAHGR0-N00A0001

More CCT & CRI options are available for the white LEDs. Please see the product data sheets for more detail.

All performance figures shown for $T_j = 25^\circ\text{C}$

J Series® JB3030C E Class White LEDs



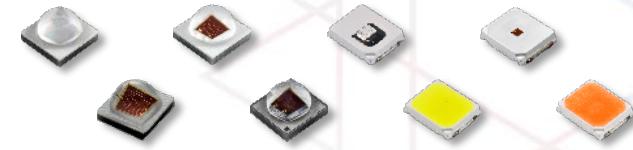
Product / Class	Test Current	V _F	4000K, 70 CRI		4000K, 80 CRI		Max Current
JB3030C 3V / E	55 mA	2.66 V	35.4 lm 0.47 µmol/s	242 LPW 3.22 µmol/J	33.4 lm 0.47 µmol/s	228 LPW 3.20 µmol/J	240 mA

Industry-leading efficiency	<ul style="list-style-type: none"> 6% higher LPW than J Series 2835 3V G Class Up to 3.33 PPF/W typical
High-reliability 3030 package	<ul style="list-style-type: none"> Flip-chip LED with no wire bonds Only ~1% LF loss after sulfur test
Easy to design in	<ul style="list-style-type: none"> Footprint compatible with 301B/H LM-80 available now with Q90 >50K hrs

Typical PPF (PPF/W): E Class

	55 mA, T _j = 25°C							
CRI	6500K	5700K	5000K	4000K	3500K	3000K	2700K	
70	0.49 (3.33)	0.48 (3.26)	0.47 (3.21)	0.47 (3.22)	0.46 (3.17)	0.46 (3.14)	0.44 (2.99)	
80	0.48 (3.28)	0.47 (3.24)	0.47 (3.19)	0.47 (3.20)	0.46 (3.15)	0.46 (3.12)	0.44 (2.97)	
90	0.47 (3.18)	0.46 (3.13)	0.45 (3.09)	0.45 (3.10)	0.45 (3.04)	0.44 (3.01)	0.42 (2.86)	

Horticulture Product Details: Single Color LEDs



New Products & Performance Increases Q1 2024								
Color	Red PPF %	Green/Blue Ratio	LED	Test Current (mA)	Min PPF (µmol/s)	Typ PPF (µmol/s)	PPF/W (µmol/J)	Order Code
450 nm Royal Blue	---	---	XLamp® XP-G3 S Line	350	2.77	—	2.83	XPGDRY-LS-0000-00601
			XLamp XP-G3 S Line	350	2.58	—	2.64	XPGDRY-LS-0000-00501
			JE2835 3V N Class	140	—	1.01	2.43	JE2835ARY-N-0002A0000-N0000001
PC Mint			JE2835 3V N Class	140	—	1.00	2.42	JE2835APM-N-0001A0000-N0000001
660 nm Photo Red	~99%	---	XLamp XP-G3 S Line	350	2.99	3.01	4.60	XPGDPR-LS-0000-00H01
			XLamp XP-E2	350	2.71	—	3.71	XPEBPR-L1-0000-00F01
			JE2835 3V N Class	140	—	0.76	2.54	JE2835AHR-N-0001A0000-N0000001
730 nm Far Red	---	---	XLamp XP-E2 S Line	350	2.49*	2.52*	3.83*	XPEBFR-LS-0000-00C01
			XLamp XP-E2 S Line	350	2.34*	2.52*	3.83*	XPEBFR-LS-0000-00B01
			JE2835 3V N Class	140	—	0.80*	2.67*	JE2835AFR-N-0001A0000-N0000001
PC Purple	71%	0.63	JE2835 3V N Class	140	—	0.89	2.20	JE2835APP-N-0001A0000-N0000001

730 nm LED flux values shown are photon flux (PF) for the range 380-780 nm

All performance figures shown for $T_j = 25^\circ\text{C}$

J Series® 2835 Color LEDs



Increased flux
Q1 2024

Broadest portfolio of mid-power color LEDs	<ul style="list-style-type: none">15 available colors
Leading performance	<ul style="list-style-type: none">Leading efficacy across all colorsSingle die design for best optical control
Easy to use	<ul style="list-style-type: none">Standard 2.8 x 3.5 mm package10 colors with same polarity as J Series® 2835 Whites
Optimized for: Specialty Lighting Architectural Horticulture Transportation	

Color	WL (nm)	Typ Vf	Typ Flux	Max Current
Violet	400-420	3.28 V	218 mW	200 mA
Royal Blue	440-460	2.96 V	272 mW	240 mA
Blue	465-480	2.95 V	20.1 lm	240 mA
Cyan	490-510	3.26 V	32 lm	240 mA
Green	520-540	2.80 V	65.5 lm	240 mA
PC Lime	–	2.96 V	98 lm	240 mA
PC Mint	–	2.96 V	93 lm	240 mA
Amber	585-595	2.30 V	26 lm	250 mA
PC Amber	–	2.96 V	61 lm	240 mA
Red-Orange	610-620	2.25 V	34.0 lm	240 mA
PC Red-Orange	–	2.96 V	30.2 lm	240 mA
Red	620-630	2.25 V	27.2 lm	250 mA
Photo Red	650-670	2.15 V	138 mW	250 mA
Far Red	720-740	2.15 V	135 mW	250 mA
PC Purple	–	2.89 V	192 mW	350 mA

Binning condition: 140 mA, Tj = 25°C



www.cree-led.com

