Technical Datasheet DS46

LUMILEDS

power light source

Luxeon III Star

Introduction

Luxeon® III is a revolutionary, energy efficient and ultra compact new light source, combining the lifetime and reliability advantages of Light Emitting Diodes with the brightness of conventional lighting.

Luxeon III is rated for up to 1400mA operation, delivering increased lumens per package.

Luxeon Power Light Sources give you total design freedom and unmatched brightness, creating a new world of light.

For high volume applications, custom Luxeon power light source designs are available upon request, to meet your specific needs.

Features

- Highest flux per LED family in the world
- Very long operating life (up to 100k hours)
- Available in 5500K white, green, blue, royal blue, cyan
- Lambertian and side emitting radiation patterns
- More energy efficient than incandescent and most halogen lamps
- Low voltage DC operated
- Cool beam, safe to the touch
- Instant light (less than 100 ns)
- Fully dimmable
- No UV
- Superior ESD protection

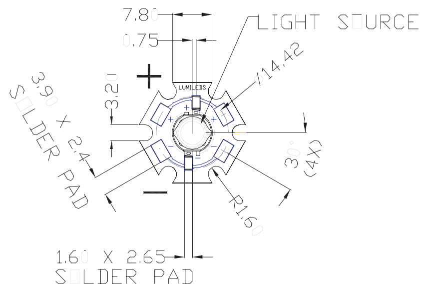
Typical Applications

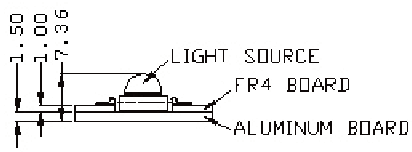
- Reading lights (car, bus, aircraft)
- Portable (flashlight, bicycle)
- Mini-accent/Uplighters/ Downlighters/Orientation
- Fiber optic alternative/ Decorative/Entertainment
- Bollards/Security/Garden
- Cove/Undershelf/Task
- Automotive rear combination lamps
- Traffic signaling/Beacons/ Rail crossing and Wayside
- Indoor/Outdoor Commercial and Residential Architectural
- Edge-lit signs (Exit, point of sale)
- LCD Backlights/Light Guides

LUXEON®

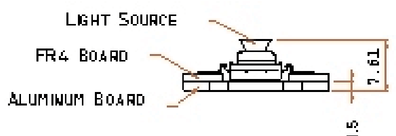
Mechanical Dimensions

Luxeon III Star





Side Emitting



Notes:

1. Slots in aluminum-core PCB for M3 or #4 mounting screw.
2. Electrical interconnection pads labeled on the aluminum-core PCB with "+" and "-" to denote positive and negative, respectively. All positive pads are interconnected, as are all negative pads, allowing for flexibility in array interconnection.
3. Electrical insulation between neighboring Stars is required —aluminum board is not electrically neutral.
4. Drawings not to scale.
5. All dimensions are in millimeters.

Flux Characteristics at 700mA, Junction Temperature, T_J = 25ºC

Table 1.

Color	Luxeon Emitter	Minimum Luminous Flux (lm) or Radiometric Power (mW) Φ_V [1,2]	Typical Luminous Flux (lm) or Radiometric Power (mW) Φ_V [2]	Radiation Pattern
White	LXHL-LW3C	60.0	65	Lambertian
Green	LXHL-LM3C	51.7	64	
Cyan	LXHL-LE3C	51.7	64	
Blue[3]	LXHL-LB3C	13.9	23	
Royal Blue[4]	LXHL-LR3C	275 mW	340 mW	
White	LXHL-FW3C	51.7	58	Side Emitting
Green	LXHL-FM3C	51.7	58	
Blue[3]	LXHL-FB3C	13.9	21	

Flux Characteristics at 1000mA, Junction Temperature, T_J = 25ºC

Table 2.

Color	Luxeon Emitter	Typical Luminous Flux (lm) or Radiometric Power (mW) Φ_V [1,2] 1000 mA	Radiation Pattern
White	LXHL-LW3C	80	Lambertian
Green	LXHL-LM3C	80	
Cyan	LXHL-LE3C	80	
Blue[3]	LXHL-LB3C	30	
Royal Blue[4]	LXHL-LR3C	450 mW	
White	LXHL-FW3C	70	Side Emitting
Green	LXHL-FM3C	70	
Blue[3]	LXHL-FB3C	27	

Notes for Tables 1 & 2:

1. Minimum luminous flux or radiometric power performance guaranteed within published operating conditions. Lumileds maintains a tolerance of ± 10% on flux and power measurements.
2. Luxeon types with even higher luminous flux levels will become available in the future. Please consult your Lumileds Authorized Distributor or Lumileds sales representative for more information.
3. Typical flux value for 470 nm devices. Due to the CIE eye response curve in the short blue wavelength range, the minimum luminous flux will vary over the Lumileds blue color range. Luminous flux will vary from a typical of 17 lm for the 460-465nm bin to a typical of 30 lm for the 475-480 nm bin due to this effect. Although the luminous power efficiency is lower in the short blue wavelength range, radiometric power efficiency increases as wavelength decreases. For more information, consult the Luxeon Design Guide, available upon request.
4. Royal Blue product is binned by radiometric power and peak wavelength rather than photometric lumens and dominant wavelength.

Flux Characteristics at 1400mA, Junction Temperature, T_J = 25ºC

Table 3.

Color	**Luxeon Emitter**	**Minimum Luminous Flux (lm) Φ_V [1,2]**	**Typical Luminous Flux (lm) Φ_V [2]**	**Radiation Pattern**
Red	LXHL-LD3C	90	140	Lambertian
Red-Orange	LXHL-LH3C	120	190	
Amber	LXHL-LL3C	70	110	
Red	LXHL-FD3C	90	125	Side Emitting
Red-Orange	LXHL-FH3C	120	170	
Amber	LXHL-FL3C	70	100	

Notes for Table 3:

1. Minimum luminous flux performance guaranteed within published operating conditions. Lumileds maintains a tolerance of ± 10% on flux measurements.
2. Luxeon types with even higher luminous flux levels will become available in the future. Please consult your Lumileds Authorized Distributor or Lumileds sales representative for more information.

Optical Characteristics at 700mA, Junction Temperature, T_J = 25ºC

Table 4.

Radiation Pattern	Color	Dominant Wavelength[1] λD, Peak Wavelength[2] λP, or Color Temperature[3] CCT Min.	Typ.	Max.	Spectral Half-width[4] (nm) $\Delta\lambda_{1/2}$	Temperature Coefficient of Dominant Wavelength (nm/°C) $\Delta\lambda_D / \Delta T_J$	Total Included Angle[5] (degrees) $\theta_{0.90V}$	Viewing Angle[6] (degrees) 2θ 1/2
Lambertian	White	4500K	5500K	10000K	—	—		
	Green	520nm	530nm	550nm	35	0.04	160	140
	Cyan	490nm	505nm	520nm	30	0.04	160	140
	Blue	460nm	470nm	490nm	25	0.04	160	140
	Royal Blue[2]	440nm	455nm	460nm	20	0.04	160	140

Optical Characteristics at 700mA, Junction Temperature, T_J = 25ºC Continued

Table 5.

Radiation Pattern	Color	Dominant Wavelength[1] λD, or Color Temperature[3] CCT Min.	Typ.	Max.	Spectral Half-width[4] (nm) Cum $\Phi_{45°}$	Temperature Coefficient of Dominant Wavelength (nm/°C) $\Delta\lambda_D / \Delta T_J$	Typical Total Flux Percent within first 45° [7] Cum $\Phi_{45°}$	Typical Angle of Peak Intensity [8] θ_{Peak}
Side Emitting	White	4500K	5500K	10000K	—	—	<15%	75° - 85°
	Green	520nm	530nm	550nm	35	0.04	<15%	75° - 85°
	Blue	460nm	470nm	490nm	20	0.04	<15%	75° - 85°

Notes: (for Tables 4 & 5)

1. Dominant wavelength is derived from the CIE 1931 Chromaticity diagram and represents the perceived color. Lumileds maintains a tolerance of ± 0.5nm for dominant wavelength measurements.
2. Royal Blue product is binned by radiometric power and peak wavelength rather than photometric lumens and dominant wavelength. Lumileds maintains a tolerance of ± 2nm for peak wavelength measurements.
3. CRI (Color Rendering Index) for White product types is 70. CRI for Warm White product type is 90 with typical Rg value of 70. CCT ±5% tester tolerance.
4. Spectral width at ½ of the peak intensity.
5. Total angle at which 90% of total luminous flux is captured.
6. θ½ is the off axis angle from lamp centerline where the luminous intensity is ½ of the peak value.
7. Cumulative flux percent within ± 45° from optical axis.
8. Off axis angle from lamp centerline where the luminous intensity reaches the peak value.
9. All white, green, cyan, blue and royal blue products built with Indium Gallium Nitride (InGaN). All red, red-orange and abmer products built with Aluminum Indium Gallium Phosphide (AlInGaP).
10. Blue and Royal Blue power light sources represented here are IEC825 Class 2 for eye safety.

Optical Characteristics at 1400mA, Junction Temperature, T_J = 25ºC

Table 6.

Radiation Pattern	Color	Dominant Wavelength[1] λD Min.	Typ.	Max.	Spectral Half-width[2] (nm) $\Delta\lambda_{1/2}$	Temperature Coefficient of Dominant Wavelength (nm/ºC) $\Delta\lambda_D / \Delta T_J$	Total Included Angle[3] (degrees) $\theta_{0.90V}$	Viewing Angle[4] (degrees) 2θ 1/2
Lambertian	Red	620.5nm	627nm	645nm	20	0.05	170	130
	Red-Orange	613.5nm	617nm	620.5nm	18	0.06	170	130
	Amber	584.5nm	590nm	597nm	17	0.09	170	130

Optical Characteristics at 1400mA, Junction Temperature, T_J = 25ºC, Continued

Table 7.

Radiation Pattern	Color	Dominant Wavelength[1] λD Min.	Typ.	Max.	Spectral Half-width[2] (nm) $\Delta\lambda_{1/2}$	Temperature Coefficient of Dominant Wavelength (nm/ºC) $\Delta\lambda_D / \Delta T_J$	Typical Total Flux Percent within first 45° [5] Cum $\Phi_{45°}$	Typical Angle of Peak Intensity [6] θ_{Peak}
Side Emitting	Red	620.5nm	627nm	645nm	20	0.05	<30%	75° - 85°
	Red-Orange	613.5nm	617nm	620.5nm	18	0.06	<30%	75° - 85°
	Amber	584.5nm	590nm	597nm	17	0.09	<30%	75° - 85°

Notes: (for Tables 6 & 7)

1. Dominant wavelength is derived from the CIE 1931 Chromaticity diagram and represents the perceived color. Lumileds maintains a tolerance of ± 0.5nm for dominant wavelength measurements.
2. Spectral width at ½ of the peak intensity.
3. Total angle at which 90% of total luminous flux is captured.
4. θ½ is the off axis angle from lamp centerline where the luminous intensity is ½ of the peak value.
5. Cumulative flux percent within ± 45° from optical axis.
6. Off axis angle from lamp centerline where the luminous intensity reaches the peak value.
7. All red, red-orange and amber products built with Aluminum Indium Gallium Phosphide (AlInGaP).

Electrical Characteristics at 700mA, Junction Temperature, T_J = 25ºC

Table 8.

Color	Forward Voltage V_F [1] (V) Min.	Typ.	Max.	Dynamic Resistance[2] (Ω) R_D	Temperature Coefficient of Forward Voltage[3] (mV/°C) $\Delta V_F / \Delta T_J$	Thermal Resistance, Junction to Board (°C/W) $R\theta_{J-B}$
White	3.03	3.70	4.47	0.8	-2.0	17
Green	3.03	3.70	4.47	0.8	-2.0	17
Cyan	3.03	3.70	4.47	0.8	-2.0	17
Blue	3.03	3.70	4.47	0.8	-2.0	17
Royal Blue	3.03	3.70	4.47	0.8	-2.0	17

Notes for Table 8:

1. Lumileds maintains a tolerance of ± 0.06V on forward voltage measurements.
2. Dynamic resistance is the inverse of the slope in linear forward voltage model for LEDs. See Figures 3a and 3b.
3. Measured between 25°C ≤ T_J ≤ 110°C at I_F = 700mA.

Electrical Characteristics at 1000mA, Junction Temperature, TJ = 25ºC

Table 9.

Color	Typical Forward Voltage V_F (V)[1] 1000 mA
White	3.90
Green	3.90
Cyan	3.90
Blue	3.90
Royal Blue	3.90

Notes for Table 9:

1. Proper current derating must be observed to maintain junction temperature below the maximum. For more information, consult the Luxeon Design Guide, available upon request.
2. Allowable board temperature to avoid exceeding maximum junction temperature at maximum Vf limit at 700 mA based on thermal resistance of Star assembly.
3. LEDs are not designed to be driven in reverse bias. Please consult Lumileds' Application Brief AB11 for further information.

Electrical Characteristics at 1400mA, Junction Temperature, T_J = 25ºC

Table 10.

Color	Forward Voltage V_F (V)[1] Min.	Typ.	Max.	Dynamic Resistance[2] (Ω) R_D	Temperature Coefficient of Forward Voltage[3] (mV/ºC) $\Delta V_F / \Delta T_J$	Thermal Resistance, Junction to Board (ºC/W) $R\theta_{J-B}$
Red	2.31	2.95	3.51	0.7	-2.0	10
Red-Orange	2.31	2.95	3.51	0.7	-2.0	10
Amber	2.31	2.95	3.51	0.7	-2.0	10

Notes for Table 10:

1. Lumileds maintains a tolerance of ± 0.06V on forward voltage measurements.
2. Dynamic resistance is the inverse of the slope in linear forward voltage model for LEDs. See Figure 3.
3. Measured between 25ºC ≤ T_J ≤ 110ºC at I_F = 1400mA.

Absolute Maximum Ratings

Table 11.

Parameter	White/Green/ Cyan/Blue/ Royal Blue	Red/ Red-Orange/ Amber
DC Forward Current (mA)[1]	1000	1540
Peak Pulsed Forward Current (mA)	1000	2200
Average Forward Current (mA)	1000	1400
LED Junction Temperature (ºC)	135	135
Storage Operating Temperature (ºC)	-40 to +120	-40 to +120
ESD Sensitivity [2]	±16,000V HBM	±16,000V HBM

Notes for Table 11:

1. Proper current derating must be observed to maintain junction temperature below the maximum. For more information, consult the Luxeon Design Guide, available upon request.
2. LEDs are not designed to be driven in reverse bias. Please consult Lumileds' Application Brief AB11 for further information.

Wavelength Characteristics, T_J = 25ºC

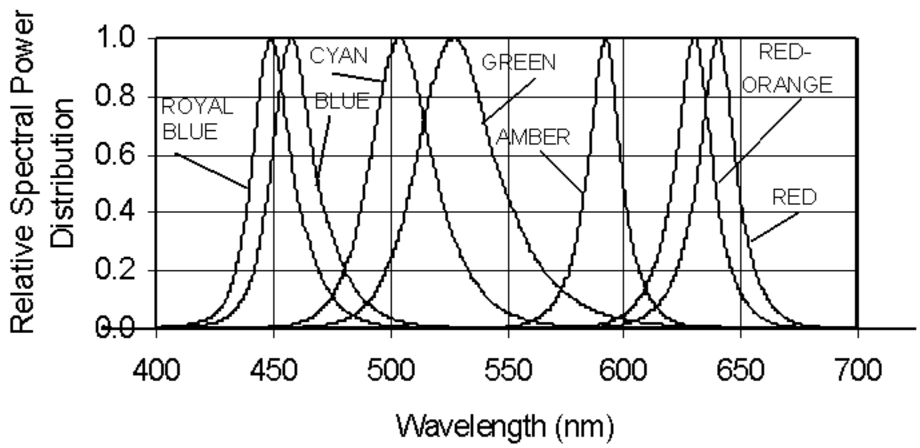


Figure 1a. Relative Intensity vs. Wavelength

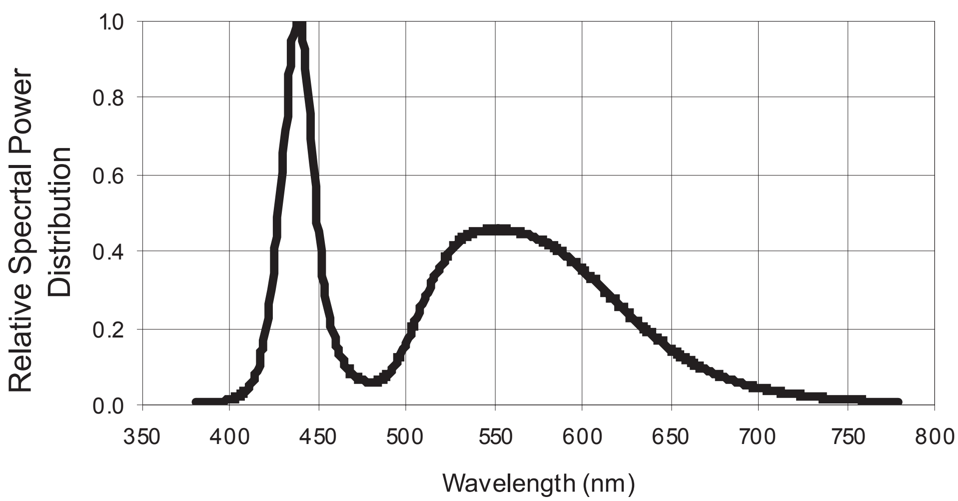


Figure 1b. White Color Spectrum of Typical 5500K CCT Part, Integrated Measurement.

Light Output Characteristics

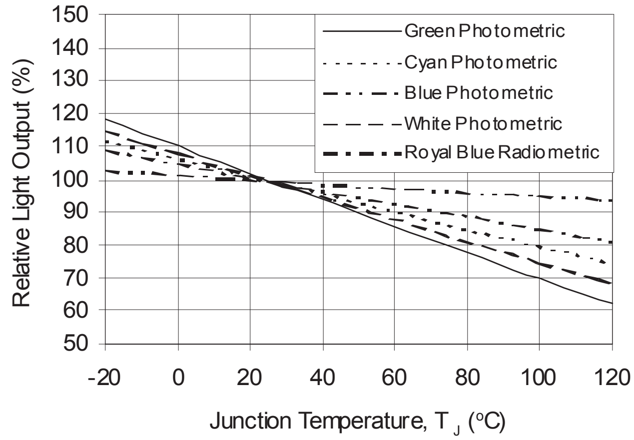


Figure 2. Relative Light Output vs. Junction Temperature for White, Green, Cyan, Blue and Royal Blue.

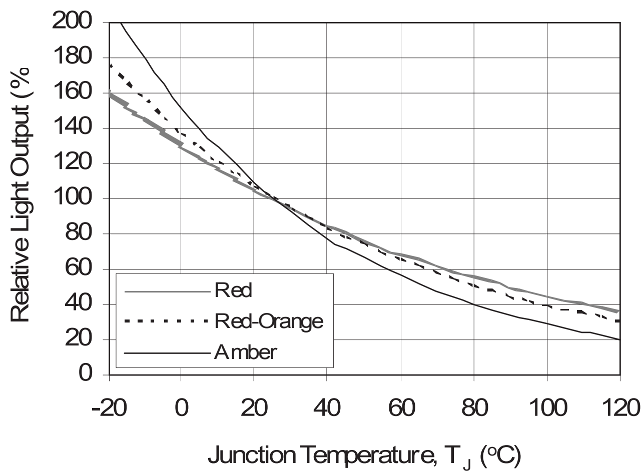


Figure 3. Relative Light Output vs. Junction Temperature or Red, Red-Orange and Amber.

Forward Current Characteristics, T_J = 25ºC

Note:

Driving these high power devices at currents less than the test conditions may produce unpredictable results and may be subject to variation in performance. Pulse width modulation (PWM) is recommended for dimming effects.

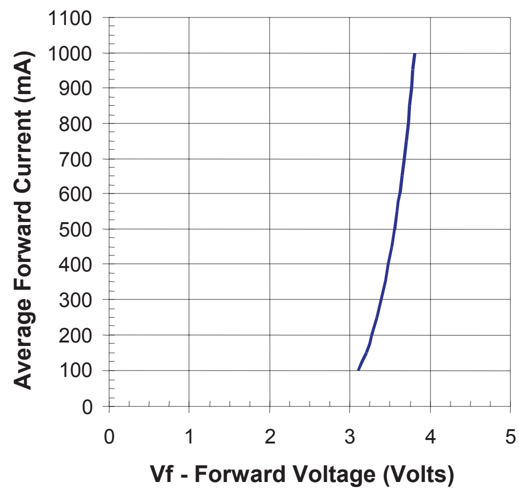


Figure 4. Forward Current vs. Forward Voltage for White, Green, Cyan, Blue, and Royal Blue.

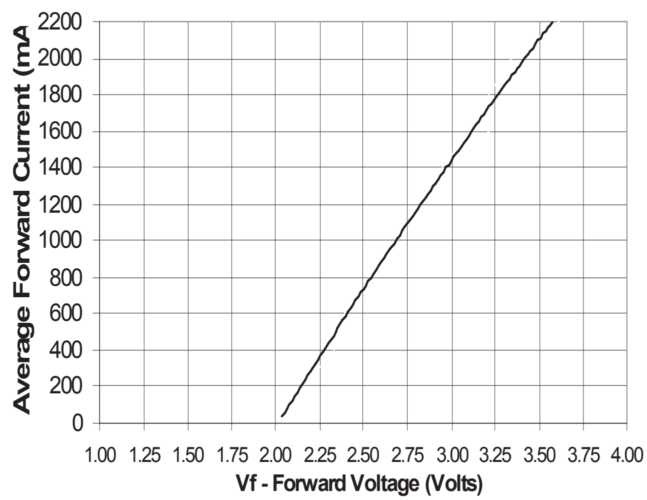


Figure 5. Forward Current vs. Forward Voltage for Red, Red-Orange and Amber.

Forward Current Characteristics, T_J = 25ºC, Continued

Note:
Driving these high power devices at currents less than the test conditions may produce unpredictable results and may be subject to variation in performance. Pulse width modulation (PWM) is recommended for dimming effects.

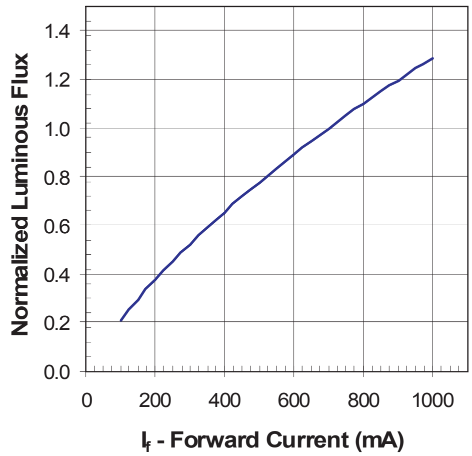


Figure 6. Relative Luminous Flux vs. Forward Current for White, Green, Cyan, Blue, and Royal Blue at T_J = 25ºC maintained.

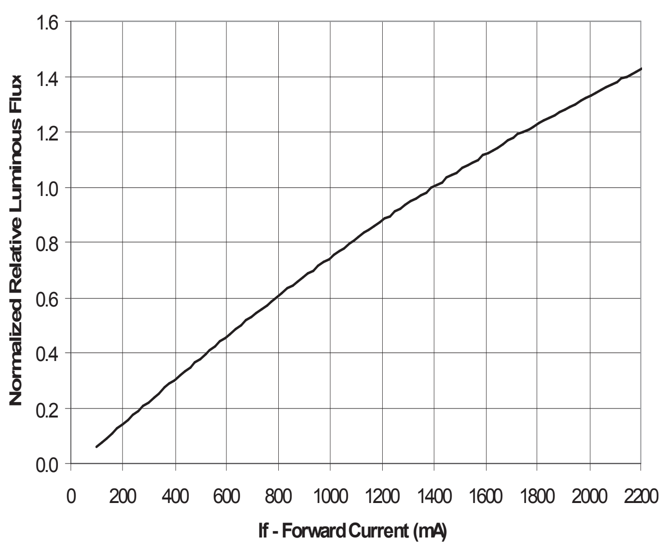


Figure 7. Relative Luminous Flux vs. Forward Current for Red, Red-Orange and Amber at T_J = 25ºC maintained.

Current Derating Curves

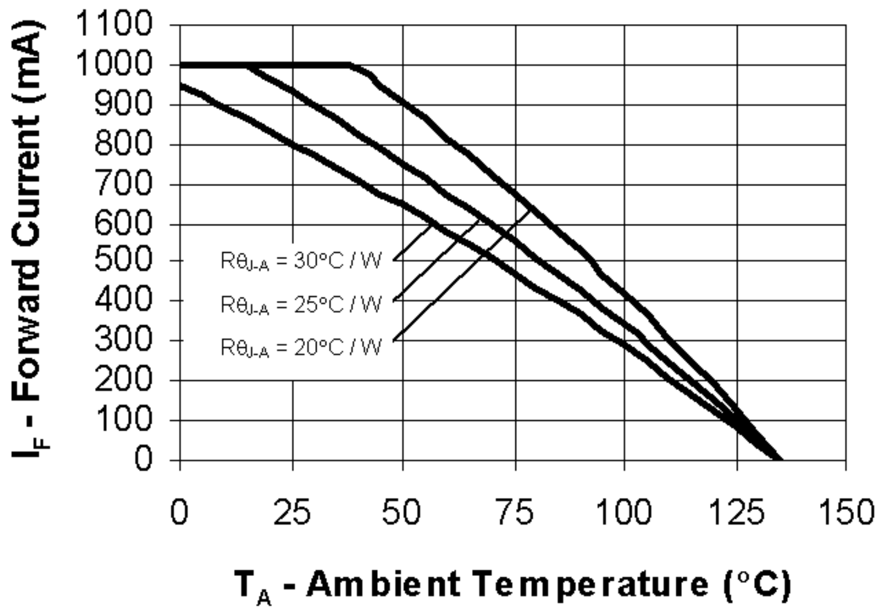


Figure 8. Maximum Forward Current vs. Ambient Temperature.
Derating based on T_{JMAX} = 135°C for White, Green, Cyan, Blue, and Royal Blue. Since Luxeon III may be driven at up to 1000mA, derating curves may not be applicable for all operating conditions.

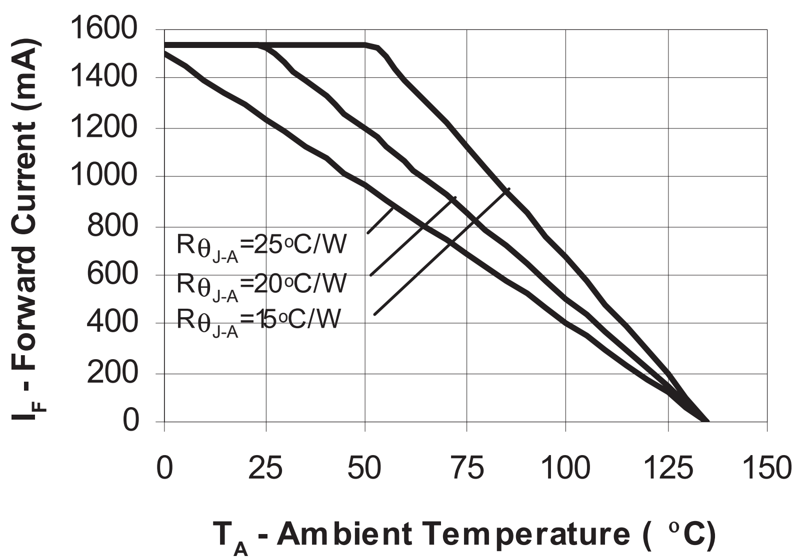


Figure 9. Maximum Forward Current vs. Ambient Temperature.
Derating based on T_{JMAX} = 135°C for Red, Red-Orange, and Amber.

Typical Lambertian Representative Spatial Radiation Pattern

Note:
For more detailed technical information regarding Luxeon radiation patterns, please consult your Lumileds Authorized Distributor or Lumileds sales representative.

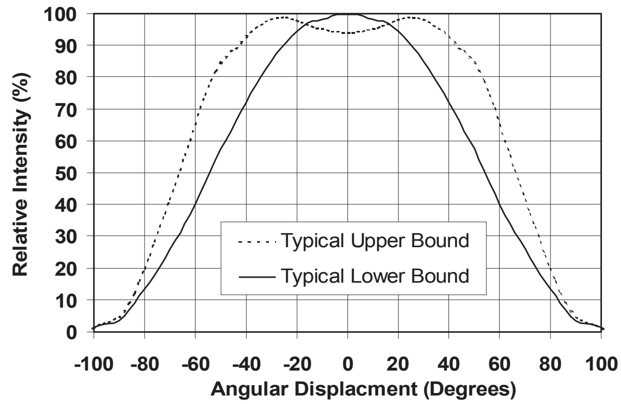


Figure 10. Typical Representative Spatial Radiation Pattern for Luxeon Emitter White, Green, Cyan, Blue and Royal Blue.

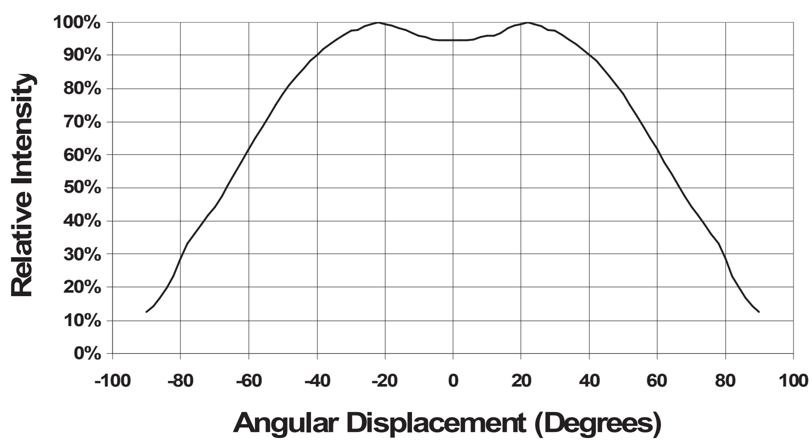


Figure 11. Typical Representative Spatial Radiation Pattern for Luxeon Lambertian Emitter Red, Red-Orange and Amber.

Typical Side Emitting Representative Spatial Radiation Pattern

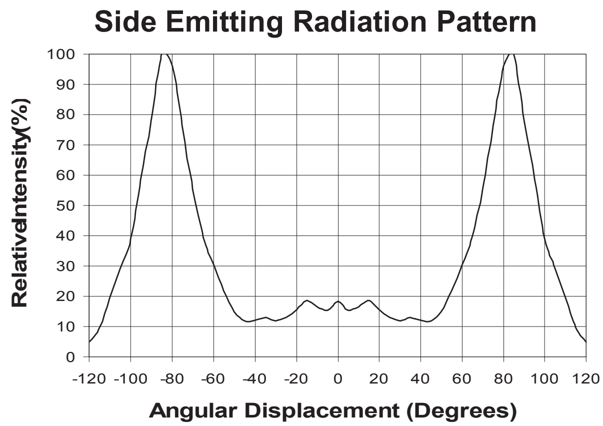


Figure 12. Typical Representative Spatial Radiation Pattern for Luxeon Emitter White, Green and Blue..

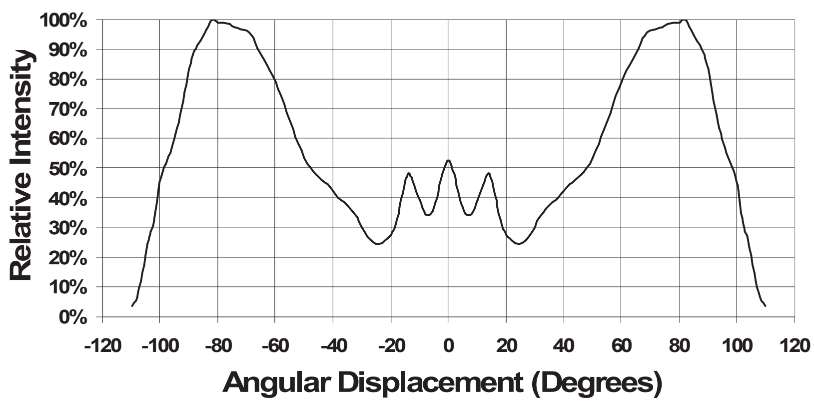


Figure 13. Typical Representative Spatial Radiation Pattern for Luxeon Side Emitting Emitter Red, Red-Orange and Amber.

Average Lumen Maintenance Characteristics

Lifetime for solid-state lighting devices (LEDs) is typically defined in terms of lumen maintenance-the percentage of initial light output remaining after a specified period of time. Lumileds projects that white, green, cyan, blue, and royal blue Luxeon III products will deliver, on average, 70% lumen maintenance at 50,000 hours of operation at a 700 mA forward current or 50% lumen maintenance at 20,000 hours of operation at a 1000 mA forward current. Lumileds projects that red, red-orange, and amber Luxeon III products will deliver, on average 50% lumen maintenance at 20,000 hours of operation at a 1400 mA forward current. This performance is based on independent test data, Lumileds historical data from tests run on similar material systems, and internal Luxeon reliability testing. This projection is based on constant current operation with junction temperature maintained at or below 90°C. Observation of design limits included in this data sheet is required in order to achieve this projected lumen maintenance.

LUMILEDS

Company Information

Luxeon is developed, manufactured and marketed by Lumileds Lighting, U.S., LLC. Lumileds is a world-class supplier of Light Emitting Diodes (LEDs) producing billions of LEDs annually. Lumileds is a fully integrated supplier, producing core LED material in all three base colors (Red, Green, Blue) and White. Lumileds has R&D development centers in San Jose, California and Best, The Netherlands and production capabilities in San Jose, California and Malaysia. Lumileds Lighting is a joint venture of Agilent Technologies and Philips Lighting and was founded in 1999. Lumileds is pioneering the high-flux LED technology and bridging the gap between solid-state LED technology and the lighting world. Lumileds is absolutely dedicated to bringing the best and brightest LED technology to enable new applications and markets in the Lighting world.

Lumileds may make process or materials changes affecting the performance or other characteristics of our products. These products supplied after such changes will continue to meet published specifications, but may not be identical to products supplied as samples or under prior orders.

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