Light is OSRAM

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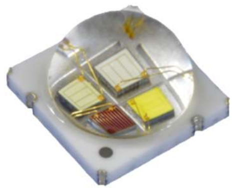
Our Brand
LED ENGIN

LuxiGen™ Multi-Color Emitter Series

RGBW Pin Aligned LED Emitter

LZ4-00MD09



Key Features

- High Luminous Efficacy 4-die RGBW LED
- Individually addressable Red, Green, Blue and Daylight White die
- Anodes and Cathodes are aligned for easy connection of multiple emitters
- Electrically neutral thermal path
- Ultra-small foot print – 7.0mm x 7.0mm
- Surface mount ceramic package with integrated glass lens
- Low Thermal Resistance (2.8°C/W)
- Very high Luminous Flux density
- JEDEC Level 1 for Moisture Sensitivity Level
- Lead (Pb) free and RoHS compliant
- Reflow solderable (up to 6 cycles)

Typical Applications

- Architectural Lighting
- Retail Spot and Display Lighting
- Stage and Studio Lighting
- Hospitality Lighting
- Museum Lighting
- Video Walls and Full Color Displays

Part number options

Base part number

Part number	Description
LZ4-00MD09-xxxx	LZ4 RGBW emitter pin aligned
LZ4-60MD09-xxxx[1]	LZ4 RGBW emitter pin aligned on 4 channel Star MCPCB

Note:

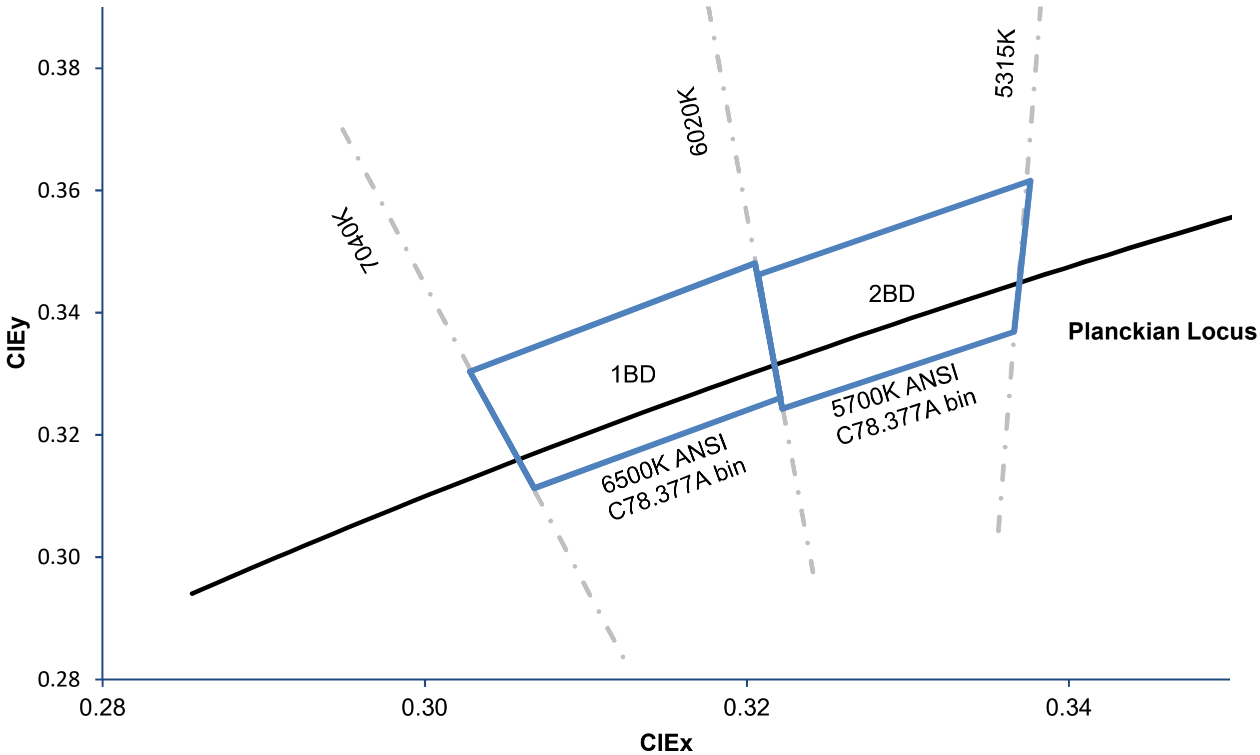
1. Emitter on MCPCB option is only offered through catalog distributors.

Bin kit option codes

MD, RGB – Cool White

Kit number suffix	Min flus bin	Color bin range	Description
0000	17R	R2	Red, full distribution flux; full distribution wavelength
	12G	G2 – G3	Green, full distribution flux; full distribution wavelength
	17B	B01 – B02	Blue, full distribution flux; full distribution wavelength
	PQ	1BD, 2BD	White full distribution flux and CCT

Daylight White Chromaticity Groups



Standard Chromaticity Groups plotted on excerpt from the CIE 1931 (2°) x-y Chromaticity Diagram.

Coordinates are listed below

Cool White Bin Coordinates

Bin Code	CIEx	CIEy	Bin Code	CIEx	CIEy
1BD	0.3068	0.3113	2BD	0.3222	0.3243
	0.3028	0.3304		0.3207	0.3462
	0.3205	0.3481		0.3376	0.3616
	0.3221	0.3261		0.3366	0.3369
	0.3068	0.3113		0.3222	0.3243

Luminous Flux Bins

Table 1:

Bin Code	Minimum Luminous Flux (Φ_V) @ I_F = 700mA [1] (lm)				Maximum Luminous Flux (Φ_V) @ I_F = 700mA [1] (lm)			
	1 Red	1 Green	1 Blue	1 White	1 Red	1 Green	1 Blue	1 White
17R	105				160			
12G		125				195		
17B			19				30	
18B			30				47	
PQ				182				285

Note for Table 1:

1. Flux performance is measured at 10ms pulse, T_C = 25°C. LED Engin maintains a tolerance of ±10% on flux measurements.

Dominant Wavelength Bins

Table 2:

Bin Code	Minimum Dominant Wavelength (λ_D) @ I_F = 700mA [1] (nm)			Maximum Dominant Wavelength (λ_D) @ I_F = 700mA [1] (nm)		
	1 Red	1 Green	1 Blue	1 Red	1 Green	1 Blue
R2	618			630		
G2		520			525	
G3		525			530	
B01			452			457
B02			457			462

Note for Table 2:

1. Dominant wavelength is measured at 10ms pulse, T_C = 25°C. LED Engin maintains a tolerance of ± 1.0nm on dominant wavelength measurements.

Forward Voltage Bins

Table 3:

Bin Code	Minimum Forward Voltage (V_F) @ I_F = 700mA [1] (V)				Maximum Forward Voltage (V_F) @ I_F = 700mA [1] (V)			
	1 Red	1 Green	1 Blue	1 White	1 Red	1 Green	1 Blue	1 White
0	2.10	3.20	2.80	2.80	2.90	4.20	3.80	3.80

Note for Table 3:

1. Forward voltage is measured at 10ms pulse, T_C = 25°C. LED Engin maintains a tolerance of ± 0.04V on forward voltage measurements.

Absolute Maximum Ratings

Table 4:

Parameter	Symbol	Value	Unit
DC Forward Current [1]	I_F	1000	mA
Peak Pulsed Forward Current [2]	I_{FP}	1500	mA
Reverse Voltage	V_R	See Note 3	V
Storage Temperature	T_{stg}	-40 ~ +125	°C
Junction Temperature	T_J	125	°C
Soldering Temperature [4]	T_{sol}	260	°C
Allowable Reflow Cycles		6	
ESD Sensitivity [5]		ESD Sensitive Device Class 0 ANSI/ ESDA/ JEDEC JS-001 HBM	

Notes for Table 4:

1. Maximum DC forward current is determined by thermal resistance and case temperature. Follow Figure 12 for current derating.
2. Pulse forward current conditions: Pulse Width ≤ 10msec and Duty Cycle ≤ 10%.
3. LEDs are not designed to be reverse biased.
4. Solder conditions per JEDEC 020D. See Reflow Soldering Profile Figure 4.
5. LED Engin recommends taking reasonable precautions towards possible ESD damages and handling the emitter in an electrostatic protected area (EPA). An EPA may be adequately protected by ESD controls as outlined in ANSI/ESD S6.1.

Optical Characteristics @ T_C = 25°C

Table 5:

Parameter	Symbol	Typical				Unit
		Red	Green	Blue [1]	White	
Luminous Flux (@ I_F = 700mA)	Φ_V	130	165	39	240	lm
Luminous Flux (@ I_F = 1000mA)	Φ_V	180	215	50	315	lm
Dominant Wavelength		623	523	457		
Correlated Color Temperature	CCT				6500	K
Color Rendering Index (CRI)	R_a				75	
Viewing Angle [2]	$2\Theta_{½}$	95				
Total Included Angle [3]	$\Theta_{0.9}$	115				Degrees

Notes for Table 5:

1. When operating the Blue LED, observe IEC 62471 Risk Group 2. Do not stare into the beam.
2. Viewing Angle is the off axis angle from emitter centerline where the luminous intensity is ½ of the peak value.
3. Total Included Angle is the total angle that includes 90% of the total luminous flux.

Electrical Characteristics @ T_C = 25°C

Table 6:

Parameter	Symbol	Typical				Unit
		Red	Green	Blue	White	
Forward Voltage (@ I_F = 700mA)	V_F	2.5	3.6	3.2	3.2	V
Temperature Coefficient of Forward Voltage	$\Delta V_F/\Delta T_J$	-1.9	-2.9	-2.0	-2.0	mV/°C
Thermal Resistance, electrical (Junction to Case)	$R\Theta_{J\text{-}C,\ el}$	2.8				°C/W

IPC/JEDEC Moisture Sensitivity Level

Table 7 - IPC/JEDEC J-STD-20D.1 MSL Classification :

	Floor Life		Soak Requirements			
			Standard		Accelerated	
Level	Time	Conditions	Time (hrs)	Conditions	Time (hrs)	Conditions
1	Unlimited	≤ 30°C/ 85% RH	168 +5/-0	85°C/ 85% RH	n/a	n/a

Note for Table 7:

1. The standard soak time includes a default value of 24 hours for semiconductor manufacturer's exposure time (MET) between bake and bag and includes the maximum time allowed out of the bag at the distributor's facility.

Mechanical Dimensions (mm)

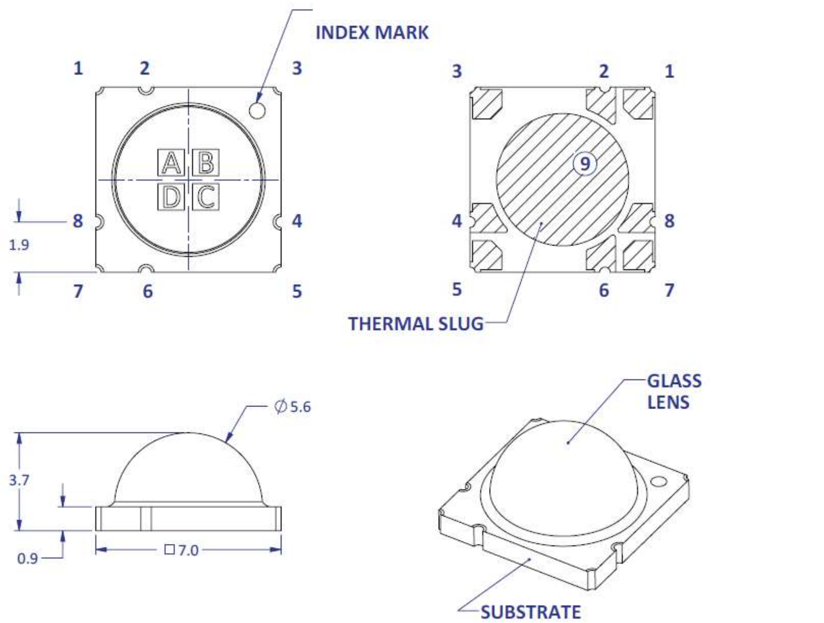
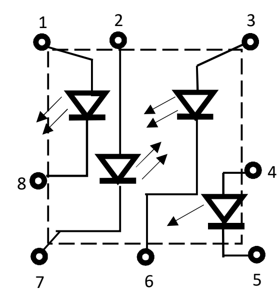


Figure 1: Package outline drawing

Pin Out			
Pad	Die	Color	Function
1	A	Green	Anode
2	D	Blue	Anode
3	B	Red	Anode
4	C	White	Anode
5	C	White	Cathode
6	B	Red	Cathode
7	D	Blue	Cathode
8	A	Green	Cathode
9 [2]	n/a	n/a	Thermal



Notes for Figure 1:

1. Unless otherwise noted, the tolerance = ± 0.20 mm.
2. Thermal contact, Pad 9, is electrically neutral.
3. Tc (case temperature) point is Pad 9. Because it is not easily accessible, the recommended temperature measurement point is side of the substrate

Recommended Solder Pad Layout (mm)

Non-pedestal MCPCB Design | **Pedestal MCPCB Design**

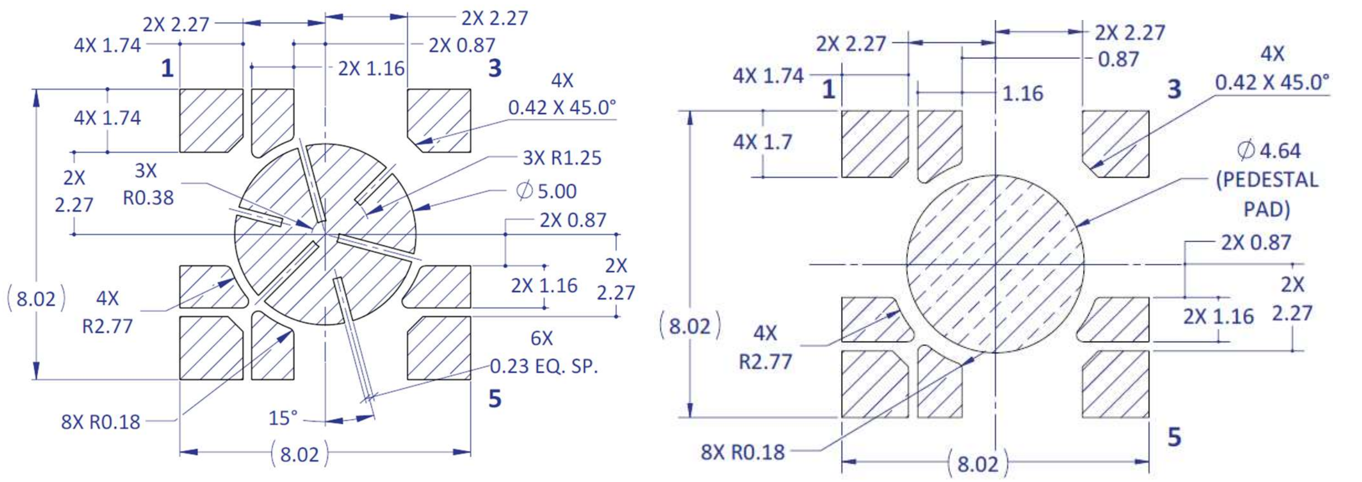


Figure 2a: Recommended solder pad layout for anode, cathode, and thermal pad for non-pedestal and pedestal design

Notes for Figure 2a:

1. Unless otherwise noted, the tolerance = ± 0.20 mm.
2. Pedestal MCPCB allows the emitter thermal slug to be soldered directly to the metal core of the MCPCB. Such MCPCB eliminate the high thermal resistance dielectric layer that standard MCPCB technologies use in between the emitter thermal slug and the metal core of the MCPCB, thus lowering the overall system thermal resistance.
3. LED Engin recommends x-ray sample monitoring for solder voids underneath the emitter thermal slug. The total area covered by solder voids should be less than 20% of the total emitter thermal slug area. Excessive solder voids will increase the emitter to MCPCB thermal resistance and may lead to higher failure rates due to thermal over stress.

Recommended Solder Mask Layout (mm)

Non-pedestal MCPCB Design | **Pedestal MCPCB Design**

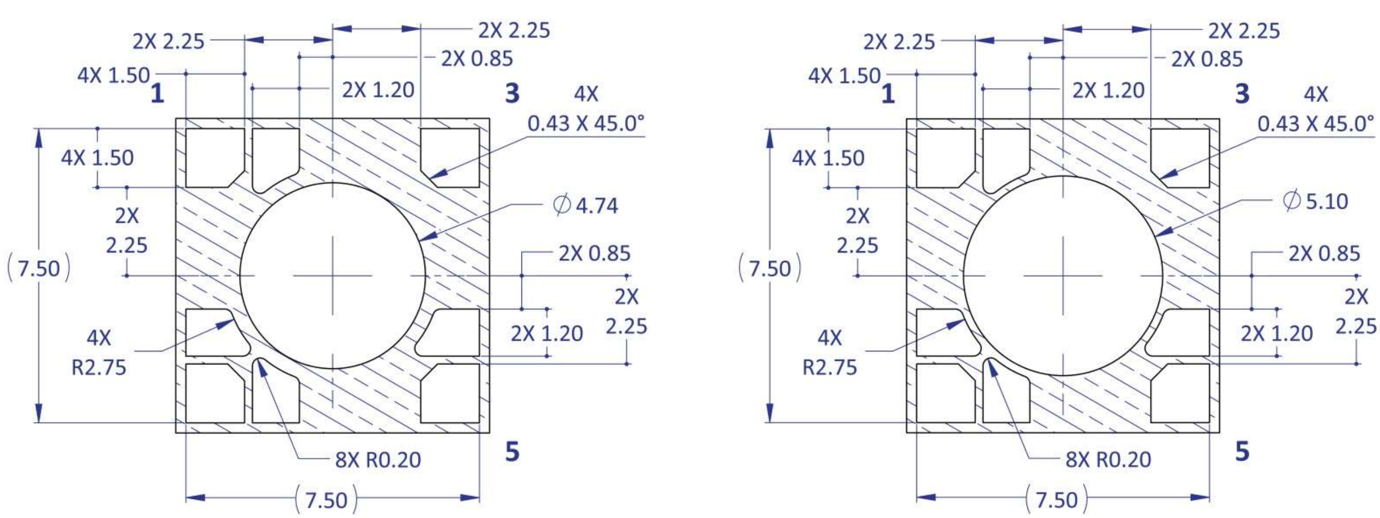
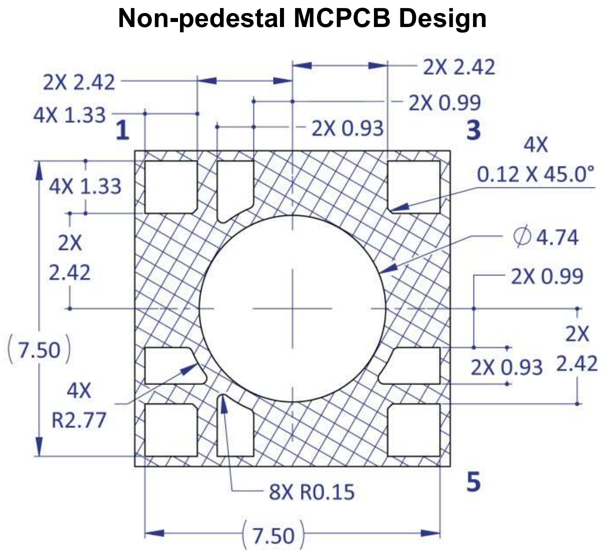


Figure 2b: Recommended solder mask opening for anode, cathode, and thermal pad for non-pedestal and pedestal design

Note for Figure 2b:

1. Unless otherwise noted, the tolerance = ± 0.20 mm.

Recommended 8 mil Stencil Apertures Layout (mm)



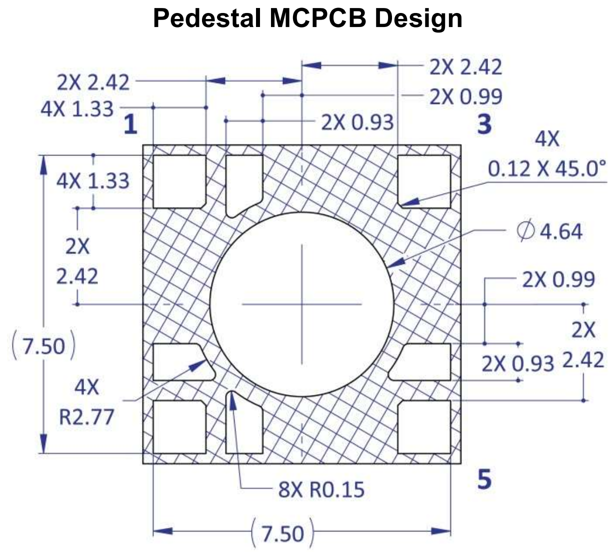


Figure 2c: Recommended 8mil stencil apertures for anode, cathode, and thermal pad for non-pedestal and pedestal design

Note for Figure 2c:

1. Unless otherwise noted, the tolerance = ± 0.20 mm.

Reflow Soldering Profile

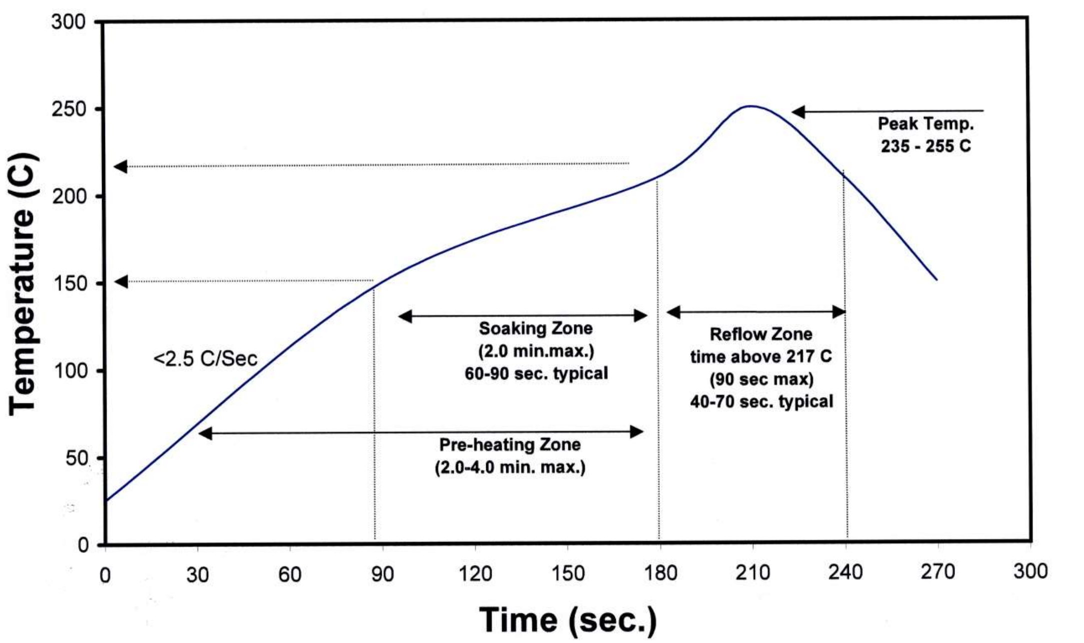


Figure 3: Reflow soldering profile for lead free soldering

Typical Radiation Pattern

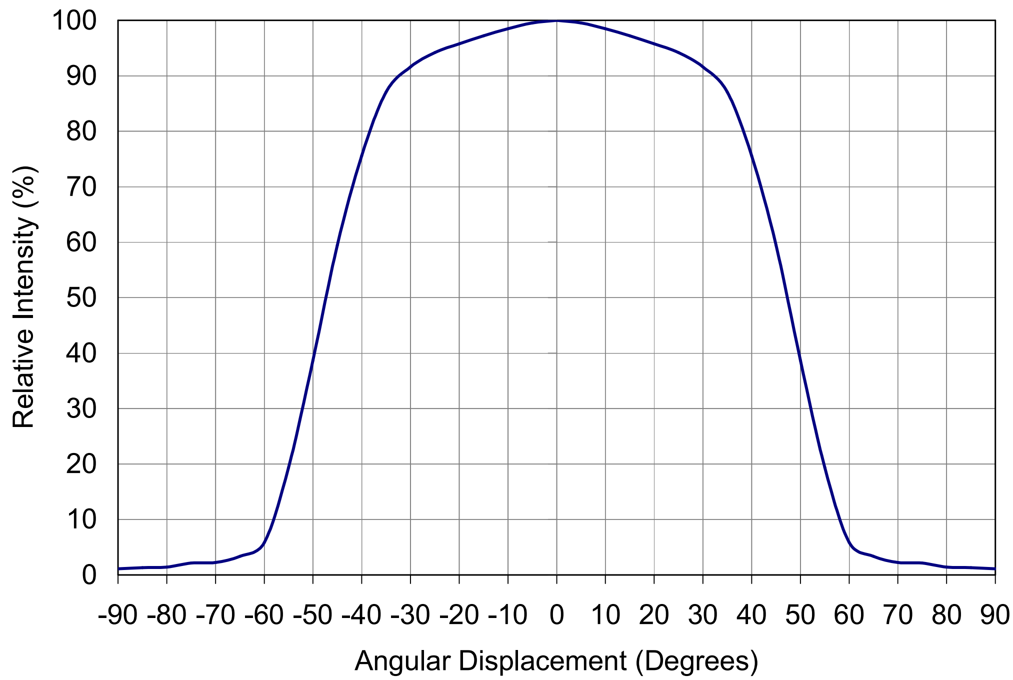


Figure 4: Typical representative spatial radiation pattern

Typical Relative Spectral Power Distribution

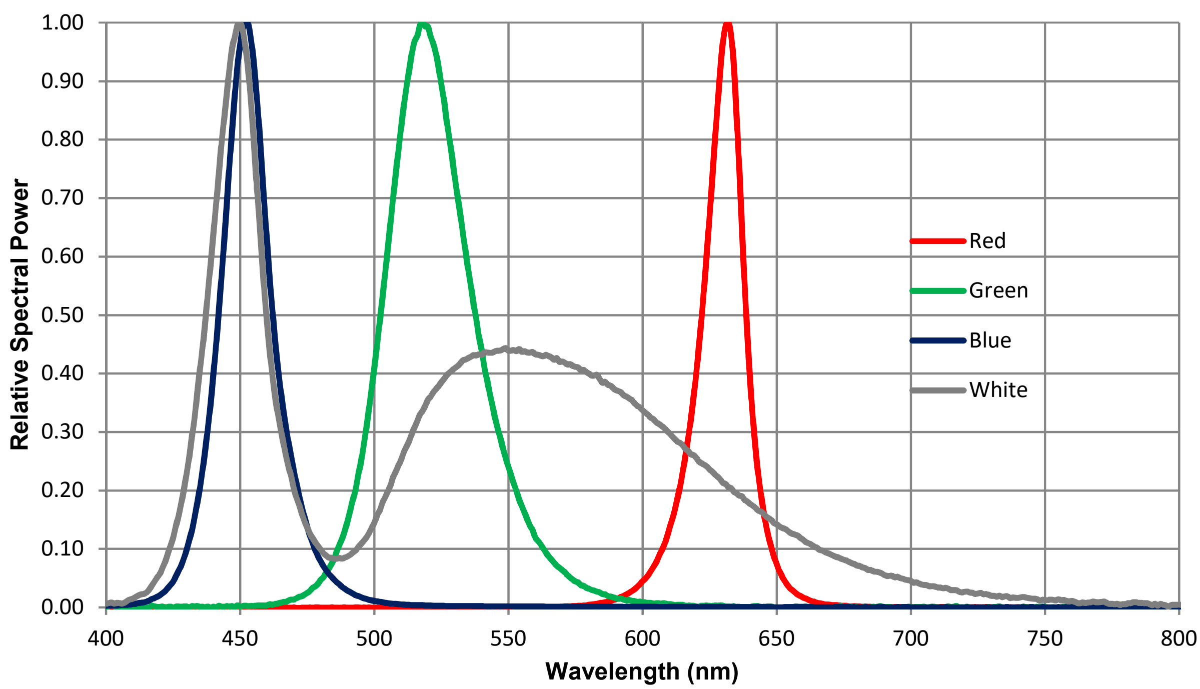


Figure 5: Typical relative spectral power vs. wavelength @ T_C = 25°C

Typical Forward Current Characteristics

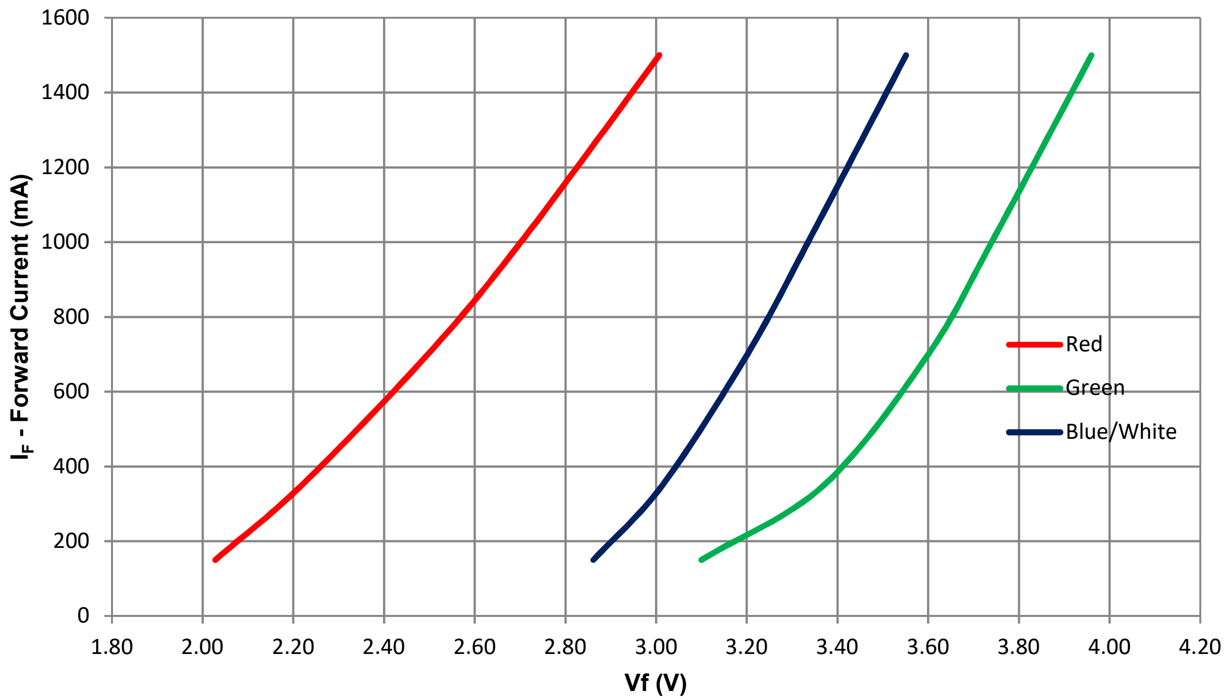


Figure 6: Typical forward current vs. forward voltage @ T_C = 25°C

Typical Relative Light Output over Current

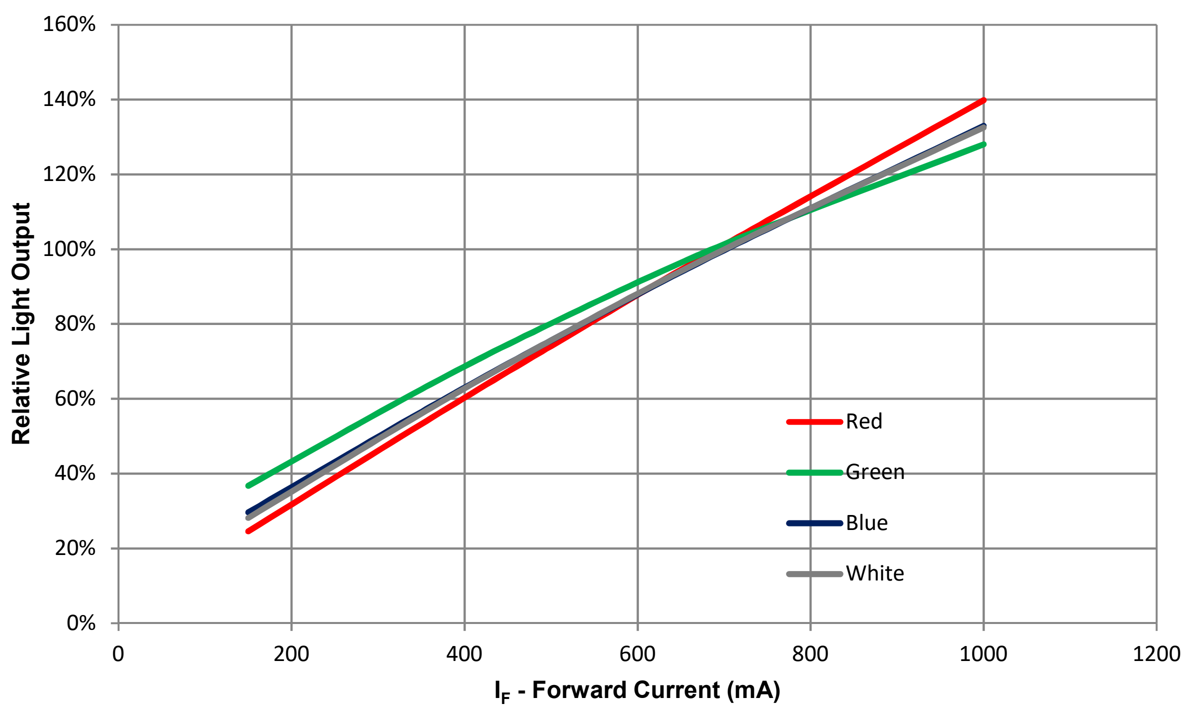


Figure 7: Typical relative light output vs. forward current @ T_C = 25°C

Typical Relative Light Output over Temperature

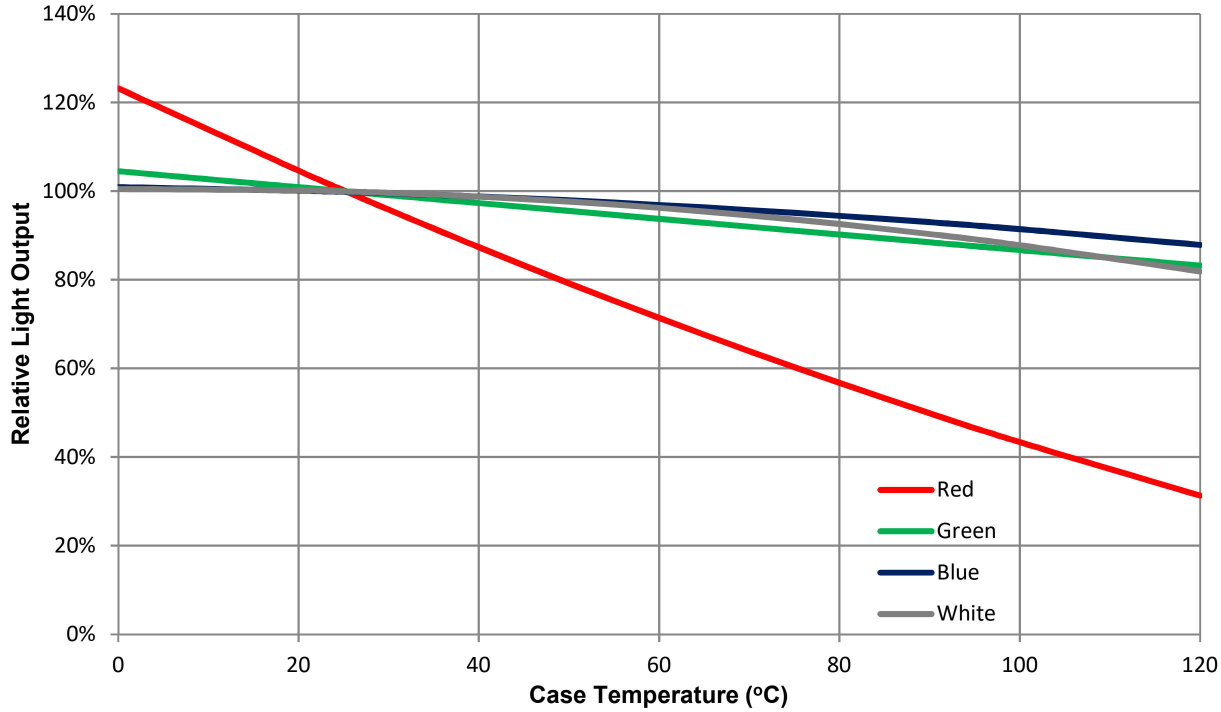


Figure 8: Typical relative light output vs. case temperature

Typical Dominant Wavelength/Chromaticity Coordinate Shift over Current

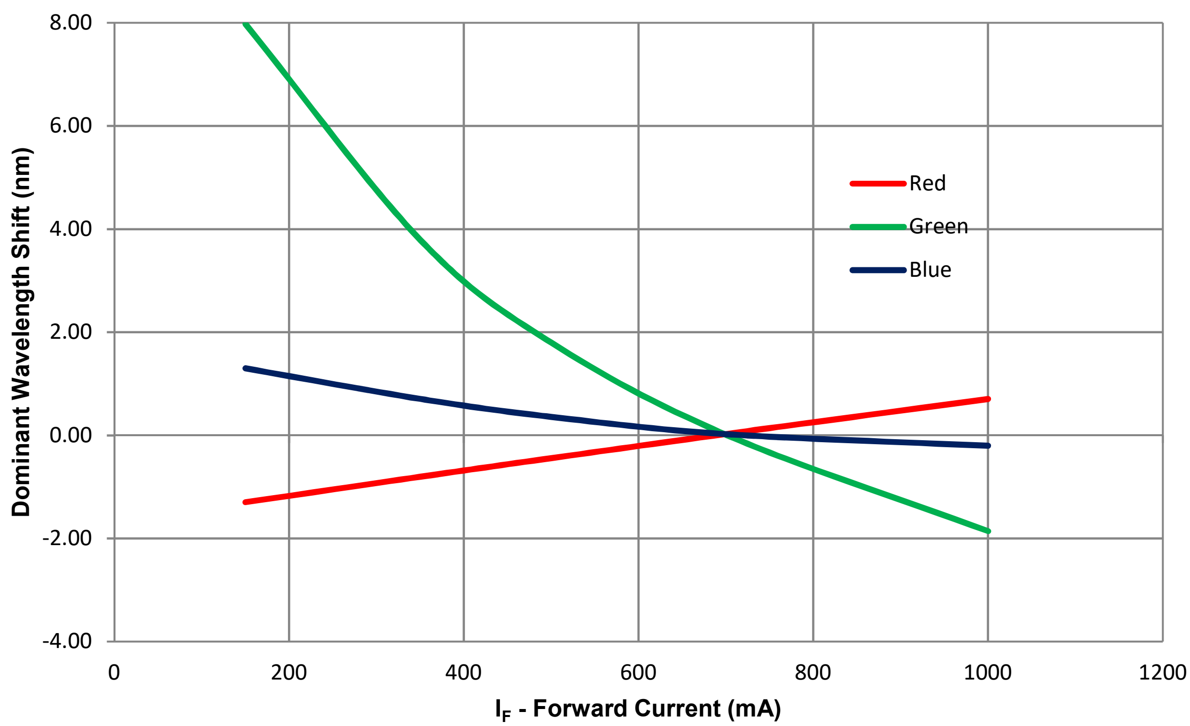


Figure 9a: Typical dominant wavelength shift vs. forward current @ T_C = 25°C

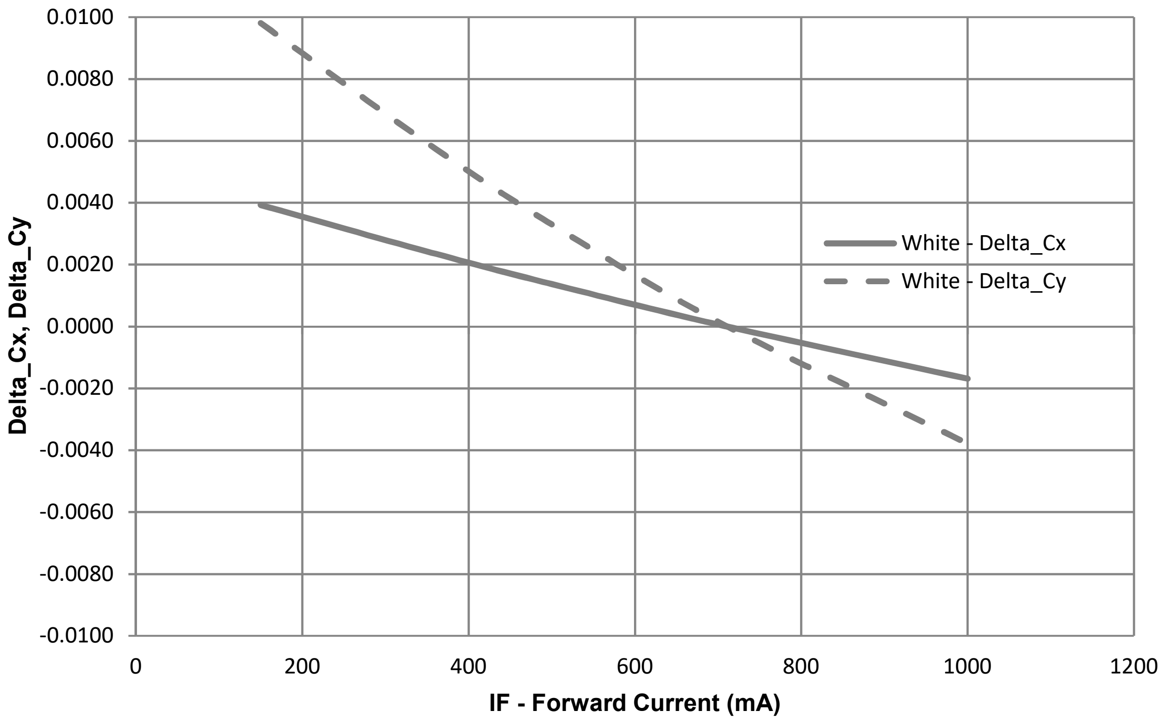


Figure 9b: Typical chromaticity coordinate shift vs. forward current @ T_C = 25°C

Typical Dominant Wavelength/Chromaticity Coordinate Shift over Temperature

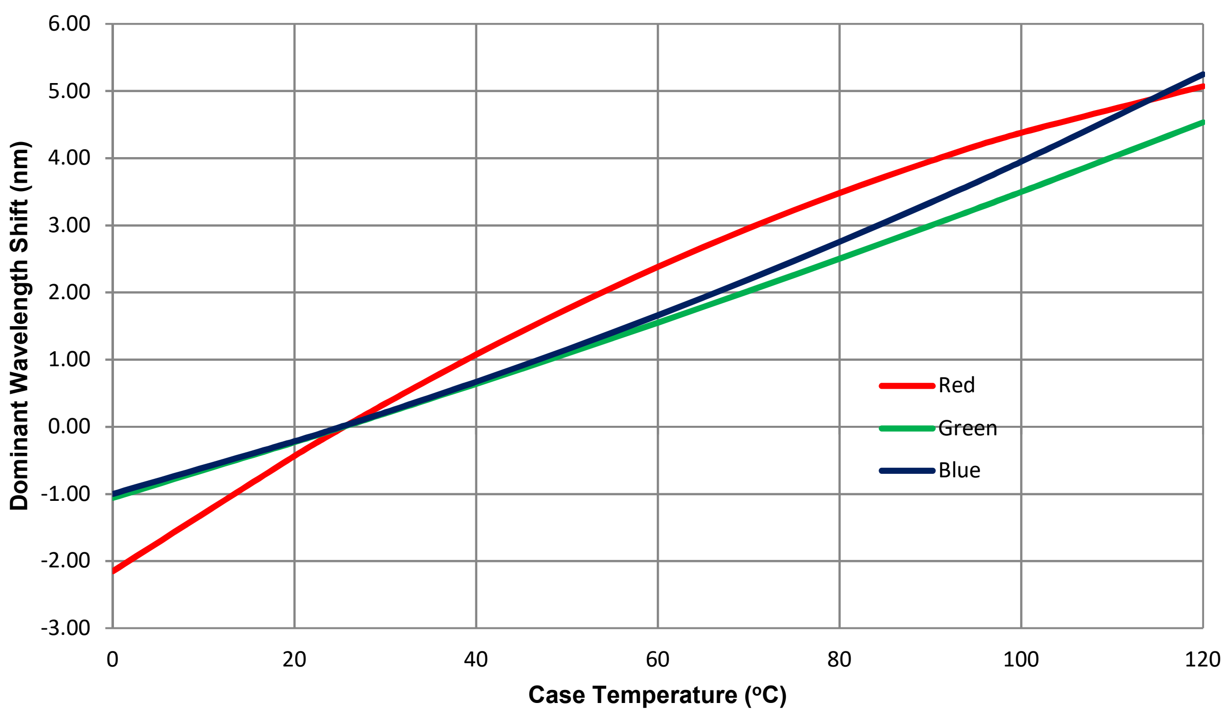


Figure 10a: Typical dominant wavelength shift vs. case temperature

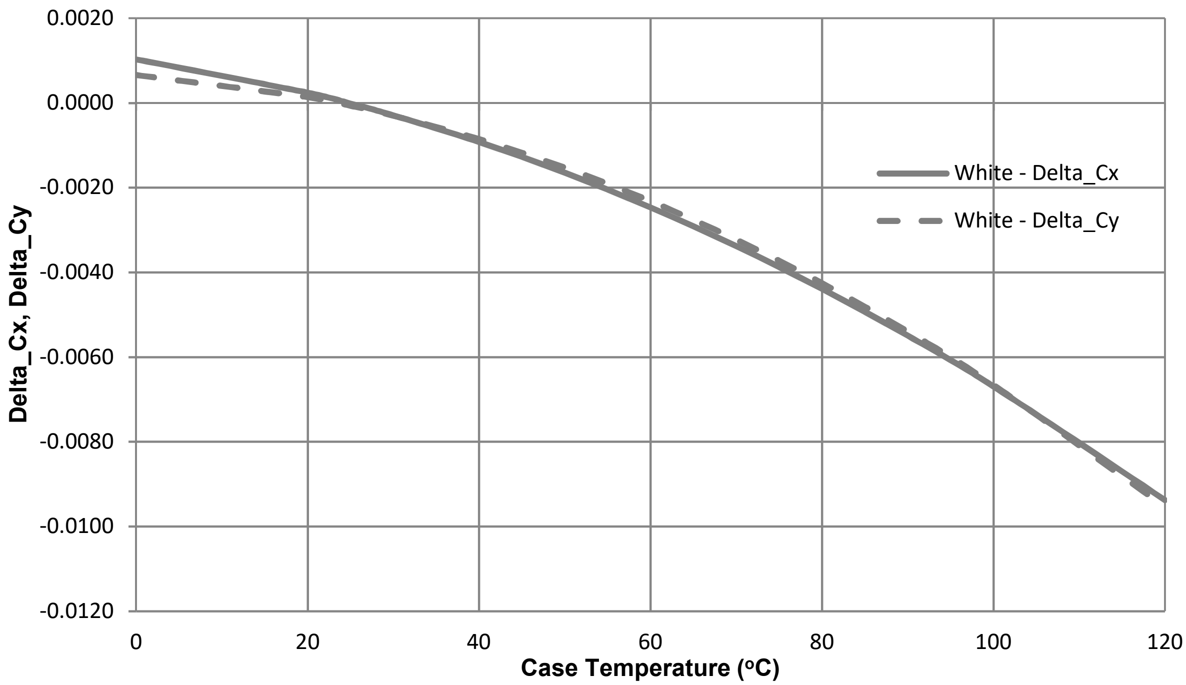


Figure 10b: Typical chromaticity coordinate shift vs. case temperature

Current De-rating

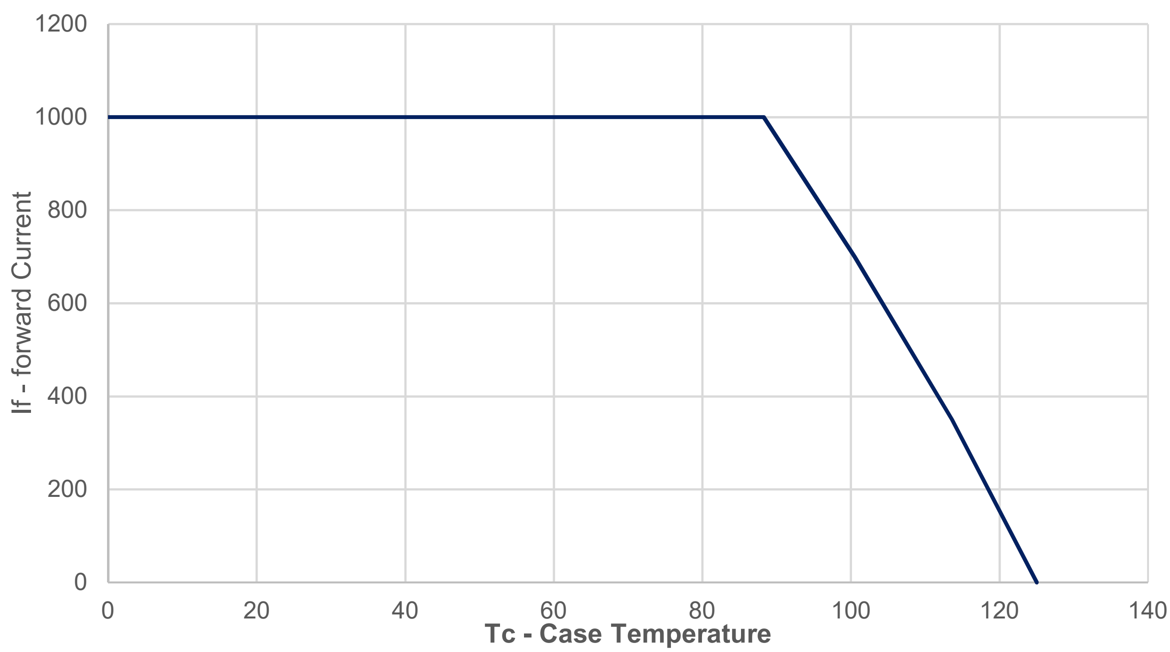
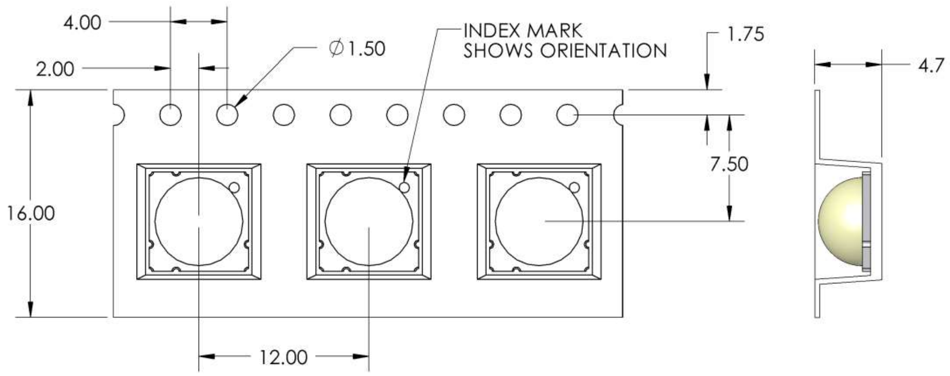


Figure 11: Maximum forward current vs. case temperature based on $T_{J(MAX)}$ = 125°C

Notes for Figure 11:

1. Maximum current assumes that all four LED dice are operating concurrently at the same current.
2. $R\Theta_{J-C}$ [Junction to Case Thermal Resistance] for LZ4-00MD09 is typically 2.8°C/W.

Emitter Tape and Reel Specifications (mm)



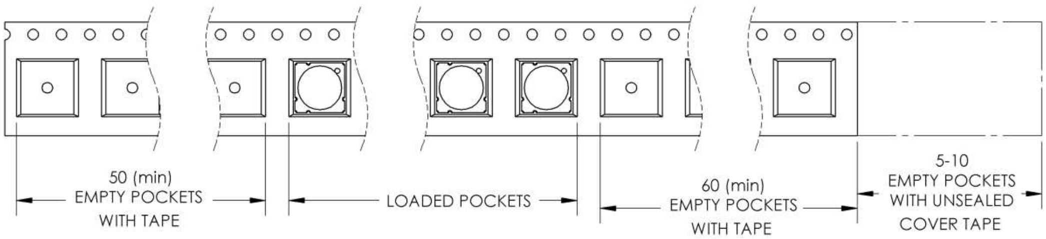


Figure 12: Emitter carrier tape specifications (mm)

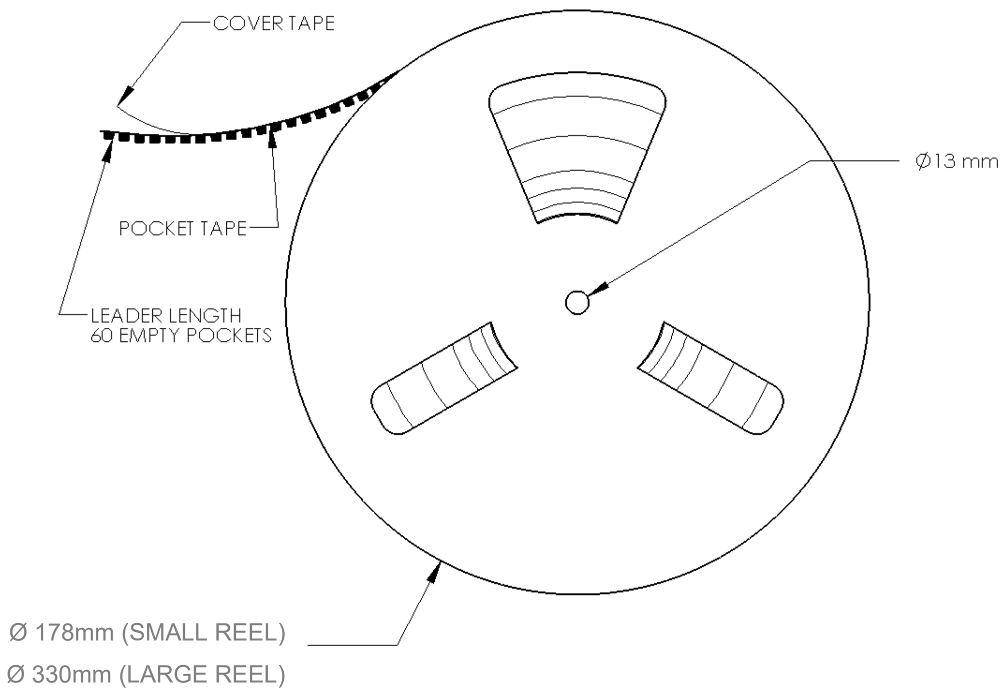


Figure 13: Emitter Reel specifications (mm)

Notes for Figure 13:

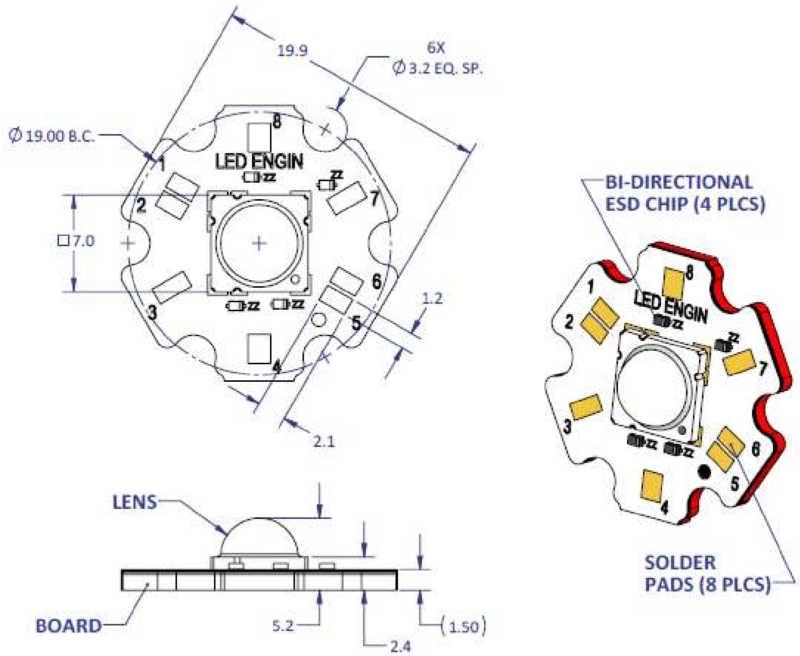
1. Small reel quantity: up to 250 emitters
2. Large reel quantity: 250-1200 emitters
3. Single flux bin and single wavelength bin per reel.

LZ4 MCPCB Option

Part number	Type of MCPCB	Dimension (mm)	Emitter + MCPCB Thermal Resistance (°C/W)	Typical V_f (V)	Typical I_f (mA)
LZ4-6xxxxx	4-channel	19.9	2.8 + 0.2 = 3.0	2.5 – 3.6	700

LZ4-6xxxxx

4 channel, Standard Star MCPCB (4x1) Dimensions (mm)



Notes:

1. Unless otherwise noted, the tolerance = ± 0.20 mm.
2. Slots in MCPCB are for M3 or #4-40 mounting screws.
3. LED Engin recommends plastic washers to electrically insulate screws from solder pads and electrical traces.
4. LED Engin recommends using thermal interface material when attaching the MCPCB to a heatsink.
5. The thermal resistance of the MCPCB is: RΘC-B 0.2°C/W.

Components used

MCPCB:	MHE-301 copper	(Rayben)
ESD chips:	BZT52C5-C10	(NXP, for 1 LED die)

Pad layout			
Ch.	**MCPCB Pad**	**String/die**	**Function**
1	8	1/A	Anode +
	1		Cathode -
2	6	2/B	Anode +
	3		Cathode -
3	5	3/C	Anode +
	4		Cathode -
4	7	4/D	Anode +
	2		Cathode -

Application Guidelines

MCPCB Assembly Recommendations

A good thermal design requires an efficient heat transfer from the MCPCB to the heat sink. In order to minimize air gaps in between the MCPCB and the heat sink, it is common practice to use thermal interface materials such as thermal pastes, thermal pads, phase change materials and thermal epoxies. Each material has its pros and cons depending on the design. Thermal interface materials are most efficient when the mating surfaces of the MCPCB and the heat sink are flat and smooth. Rough and uneven surfaces may cause gaps with higher thermal resistances, increasing the overall thermal resistance of this interface. It is critical that the thermal resistance of the interface is low, allowing for an efficient heat transfer to the heat sink and keeping MCPCB temperatures low. When optimizing the thermal performance, attention must also be paid to the amount of stress that is applied on the MCPCB. Too much stress can cause the ceramic emitter to crack. To relax some of the stress, it is advisable to use plastic washers between the screw head and the MCPCB and to follow the torque range listed below. For applications where the heat sink temperature can be above 50°C, it is recommended to use high temperature and rigid plastic washers, such as polycarbonate or glass-filled nylon.

LED Engin recommends the use of the following thermal interface materials:

- Bergquist's Gap Pad 5000S35, 0.020in thick
  - Part Number: Gap Pad® 5000S35 0.020in/0.508mm
  - Thickness: 0.020in/0.508mm
  - Thermal conductivity: 5 W/m-K
  - Continuous use max temperature: 200°C
  - Using M3 Screw (or #4 screw), with polycarbonate or glass-filled nylon washer (#4) the recommended torque range is: 20 to 25 oz-in (1.25 to 1.56 lbf-in or 0.14 to 0.18 N-m)

- 3M's Acrylic Interface Pad 5590H
  - Part number: 5590H @ 0.5mm
  - Thickness: 0.020in/0.508mm
  - Thermal conductivity: 3 W/m-K
  - Continuous use max temperature: 100°C
  - Using M3 Screw (or #4 screw), with polycarbonate or glass-filled nylon washer (#4) the recommended torque range is: 20 to 25 oz-in (1.25 to 1.56 lbf-in or 0.14 to 0.18 N-m)

Mechanical Mounting Considerations

The mounting of MCPCB assembly is a critical process step. Excessive mechanical stress build up in the MCPCB can cause the MCPCB to warp which can lead to emitter substrate cracking and subsequent cracking of the LED dies

LED Engin recommends the following steps to avoid mechanical stress build up in the MCPCB:

- Inspect MCPCB and heat sink for flatness and smoothness.
- Select appropriate torque for mounting screws. Screw torque depends on the MCPCB mounting method (thermal interface materials, screws, and washer).
- Always use three M3 or #4-40 screws with #4 washers.
- When fastening the three screws, it is recommended to tighten the screws in multiple small steps. This method avoids building stress by tilting the MCPCB when one screw is tightened in a single step.
- Always use plastic washers in combinations with the three screws. This avoids high point contact stress on the screw head to MCPCB interface, in case the screw is not seated perpendicular.
- In designs with non-tapped holes using self-tapping screws, it is common practice to follow a method of three turns tapping a hole clockwise, followed by half a turn anti-clockwise, until the appropriate torque is reached.

Wire Soldering

- To ease soldering wire to MCPCB process, it is advised to preheat the MCPCB on a hot plate of 125-150°C. Subsequently, apply the solder and additional heat from the solder iron will initiate a good solder reflow. It is recommended to use a solder iron of more than 60W.
- It is advised to use lead-free, no-clean solder. For example: SN-96.5 AG-3.0 CU 0.5 #58/275 from Kester (pn: 24-7068-7601)

About LED Engin

LED Engin, an OSRAM brand based in California's Silicon Valley, develops, manufactures, and sells advanced LED emitters, optics and light engines to create uncompromised lighting experiences for a wide range of entertainment, architectural, general lighting and specialty applications. LuxiGen™ multi-die emitter and secondary lens combinations reliably deliver industry-leading flux density, upwards of 5000 quality lumens to a target, in a wide spectrum of colors including whites, tunable whites, multi-color and UV LEDs in a unique patented compact ceramic package. Our LuxiTune™ series of tunable white lighting modules leverage our LuxiGen emitters and lenses to deliver quality, control, freedom and high density tunable white light solutions for a broad range of new recessed and downlighting applications. The small size, yet remarkably powerful beam output and superior in-source color mixing, allows for a previously unobtainable freedom of design wherever high-flux density, directional light is required. LED Engin is committed to providing products that conserve natural resources and reduce greenhouse emissions; and reserves the right to make changes to improve performance without notice.

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