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# Bridgelux ES Array Series

## Data Sheet DS17

**BXRA – W1800, - N2000, - C2500**

### Introduction

The Bridgelux family of LED Array products delivers high performance, compact and cost-effective solid-state lighting solutions to serve the general lighting market. These products combine the higher efficacy, lifetime, and reliability benefits of LEDs with the light output levels of many conventional lighting sources. The Bridgelux ES Array Series has been specified to enable lamp and luminaire designs surpassing efficacy and quality of light requirements driven by regulatory standards with reasonable system design margins, enabling lighting product compliance to Energy Star, Title 24, Part L and other global standards.

The Bridgelux ES Array products provide a high performance alternative to conventional solid state solutions, delivering between 1800 and 2500 lumens under application conditions in warm, neutral and cool white color temperatures. These compact high flux density light sources deliver uniform high quality illumination without pixilation or the multiple shadow effect caused by LED component based solutions. To simplify system design for appropriate light output, Bridgelux LED Arrays are specified to deliver performance under typical use conditions.

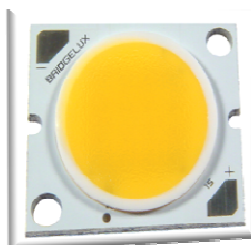
These integrated plug and play solutions reduce system complexity and enable miniaturized cost-effective lamp and luminaire designs. Lighting system designs incorporating these LED Arrays deliver comparable performance to that of 20-100 Watt incandescent and halogen, 7-42 Watt compact fluorescent, and 18-50 Watt HID based luminaires and feature increased system level efficacy and service life. Typical applications include replacement lamps, task, accent, spot, retail, track, down light, low bay, wide area, security, wall pack and street lighting.

### Features

- Compact high flux density light source
- Uniform high quality illumination
- Streamlined thermal path
- Energy Star / ANSI compliant binning structure
- More energy efficient than incandescent, halogen and fluorescent lamps
- Low voltage DC operation
- Instant light with unlimited dimming
- 5-year warranty
- RoHS compliant and Pb free

### Benefits

- Enhanced optical control
- Clean white light without pixilation
- Significantly reduced thermal resistance and increased operating temperatures
- Uniform consistent white light
- Lower operating costs
- Increased safety
- Easy to use with daylight and motion detectors to enable increased energy savings
- Reduced maintenance costs
- Environmentally friendly, no disposal issue



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## Product Nomenclature

The part number designation for Bridgelux LED Arrays is explained as follows:

B X R A – A B C D E – R R R R R

Where:

B X R A – designates product family

A – designates color, C for Cool White, N for Neutral White and W for Warm White

B C D – designates LED Array product flux, 18 for a 1800 lumen array, and 20 for a 2000 lumen array, etc

E – designates product family

R R R R R – used to designate product options, 00000 by default

The base product part number (BXRA-ABCDE) is indicated on each individual unit, printed on the bottom of the LED Array.

## Average Lumen Maintenance Characteristics

Bridgelux projects that its family of LED Array products will deliver, on average, greater than 70% lumen maintenance after 50,000 hours of operation at the rated forward test current. This performance assumes constant current operation with case temperature maintained at or below 70°C. For use beyond these typical operating conditions please consult your Bridgelux sales representative for further assistance.

These projections are based on a combination of package test data, semiconductor chip reliability data, a fundamental understanding of package related degradation mechanisms, and performance observed from products installed in the field using Bridgelux die technology. Bridgelux conducts lumen maintenance tests per LM80. Observation of design limits is required in order to achieve this projected lumen maintenance.

## Environmental Compliance

Bridgelux is committed to providing environmentally friendly products to the solid-state lighting market. Bridgelux LED Arrays are compliant to the European Union directives on the restriction of hazardous substances in electronic equipment, namely the RoHS directive. Bridgelux will not intentionally add the following restricted materials to LED Array products: lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBB) or polybrominated diphenyl ethers (PBDE).

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## UL Recognition

Bridgelux has UL Recognition for all the LED Array products listed in this data sheet. Please refer to the UL file E333389 for the latest list of UL Recognized Arrays. Bridgelux uses UL Recognized materials with suitable flammability ratings in the LED Array to streamline the process for customers to secure UL listing of the final luminaire product. Bridgelux recommends that luminaires are designed with a Class 2 Driver to facilitate the UL listing process.

## Minor Product Change Policy

The rigorous qualification testing on products offered by Bridgelux provides performance assurance. Slight cosmetic changes that do not affect form, fit, or function may occur as Bridgelux continues product optimization.

## Cautionary Statements

### CAUTION: CONTACT WITH OPTICAL AREA

Do not touch the optical area of the LED Array. Avoid any contact with the optical area. Applying stress to the yellow phosphor resin area can result in damage to the LED Array.

Optics and reflectors must not be mounted in contact with the white phosphor resin area or the white ring that surrounds the yellow phosphor area. Using the white ring to secure optics can result in damage to the LED Array as the ring is not designed to act as a mechanical locating feature. Optical devices may be mounted on the top surface of the LED Array substrate outside of the white ring maximum OD as specified in the product data sheet. Use the mechanical features of the LED Array substrate edges and/or mounting holes to locate and secure the optical device as needed.

### CAUTION: EYE SAFETY

Eye safety classification for the use of Bridgelux LED Arrays is in accordance with IEC specification EN62471: Photobiological Safety of Lamps and Lamp Systems. Bridgelux LED Arrays are classified as Risk Group 1 (Low Risk) when operated at or below their rated test current. Please use appropriate precautions. It is important that employees working with LEDs are trained to use them safely.

### CAUTION: RISK OF BURN

Do not touch the LED Array or resin area during operation. Allow the LED Array to cool for a sufficient period of time before handling. The LED Array may reach elevated temperatures such that it can burn skin when touched.

### CAUTION: CHEMICAL EXPOSURE HAZARD

Exposure to some chemicals commonly used in luminaire manufacturing and assembly can cause damage to the LED Array. Please consult Application Note AN11 for additional information.

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## Case Temperature Measurement Point

A case temperature measurement point location is included on the top surface of the Bridgelux LED Arrays. The location of this measurement point is indicated in the mechanical dimensions section of this data sheet.

The purpose of this measurement point is to allow the user access to a measurement point closely linked to the true case temperature on the back surface of the LED Array. Once the LED Array is installed, it is challenging to measure the back surface of the array, or true case temperature. Measuring the top surface of the product can lead to inaccurate results due to the poor thermal conductivity of the top layers of the array such as the solder mask and other materials.

Bridgelux has provided the case temperature measurement location in a manner which closely ties it to the true case temperature of the LED Array under steady state operation. Deviations between thermal measurements taken at the point indicated and the back of the LED Array differ by less than 1 °C, providing a robust method to testing thermal operation once the product is installed.

## Flux Characteristics

Table 1: Flux Characteristics

Color	ANSI CCT (K)	Part Number	CRI	Typical Luminous Flux $\phi_v$ (lm), $T_{case}=60^\circ\text{C}$ [3]	Minimum Luminous Flux $\phi_v$ (lm), $T_j=25^\circ\text{C}$ [1]	Typical Luminous Flux $\phi_v$ (lm), $T_j=25^\circ\text{C}$	Test Current (mA) [2]
Warm White	2700K	BXRA-W1800-00S0E	80	1650	1650	1840	700
	2700K	BXRA-W1800-00S0G	90	1500	1500	1665	700
	3000K	BXRA-W1800-00Q0E	80	1800	1800	2000	700
	3000K	BXRA-W1800-00Q0G	90	1600	1600	1800	700
Neutral White	4000K	BXRA-N2000-00L0E	80	2000	2000	2200	700
Cool White	5700K	BXRA-C2500-00E0C	70	2400	2400	2650	700

Notes for Table 1:

1. Bridgelux maintains a  $\pm 7\%$  tolerance of flux measurements.
2. Parts are tested in pulsed conditions,  $T_j = 25^\circ\text{C}$ . Pulse width is 10 ms at rated test current.
3. Typical performance when driven with direct current using Bridgelux test set-up. Please contact a Bridgelux sales representative for additional details

## Optical Characteristics

Table 2: Optical Characteristics

Color	ANSI CCT (K)	Part Number	Color Temperature (CCT) <sup>[1],[2],[3]</sup>			Minimum Color Rendering Index <sup>[4]</sup>	Typical Viewing Angle (Degrees) <sup>[6]</sup> 2 θ½	Typical Center Beam Candle Power (cd) <sup>[5]</sup>
			Min	Typ	Max			
Warm White	2700K	BXRA-W1800-00S0E	2580 K	2725 K	2870 K	80	120	585
	2700K	BXRA-W1800-00S0G	2580 K	2725 K	2870 K	90	120	530
	3000K	BXRA-W1800-00Q0E	2870 K	3045 K	3220 K	80	120	635
	3000K	BXRA-W1800-00Q0G	2870 K	3045 K	3220 K	90	120	575
Neutral White	4000K	BXRA-N2000-00L0E	3700 K	4000 K	4250 K	80	120	700
Cool White	5700K	BXRA-C2500-00E0C	5310 K	5665 K	6020 K	70	120	845

Notes for Table 2:

1. Parts are tested in pulsed conditions, T<sub>j</sub> = 25°C. Pulse width is 10 ms at rated test current.
2. Refer to Flux Characteristic Table for test current data.
3. Product is binned for color in x y coordinates.
4. Higher CRI options available upon request.
5. Center beam candle power is a calculated value based on lambertian radiation pattern at nominal test current.
6. Viewing angle is the off axis angle from the centerline where I<sub>v</sub> is ½ of the peak value.



## Electrical Characteristics

Table 3: Electrical Characteristics

Color	Base Part Number <sup>[1]</sup>	Forward Voltage $V_f$ (V) <sup>[2]</sup>			Test Current (mA) <sup>[3]</sup>	Typical Temperature Coefficient of Forward Voltage (mV/°C) $\Delta V_f/\Delta T_j$	Typical Thermal Resistance Junction to Case (°C/W) $R_{\theta_{j-c}}$
		Min	Typ	Max			
Warm White	BXRA-W1800-XXXXX	33.7	38.1	41.9	700	-12 to -36	0.75
Neutral White	BXRA-N2000-XXXXX	33.7	38.1	41.9	700	-12 to -36	0.75
Cool White	BXRA-C2500-XXXXX	33.7	38.1	41.9	700	-12 to -36	0.75

Notes for Table 3:

1. XXXXX indicates specification applies for all versions with base number.
2. Parts are tested in pulsed conditions,  $T_j = 25^\circ\text{C}$ . Pulse width is 10 ms at rated test current.
3. Bridgelux maintains a tester tolerance of  $\pm 0.10$  V on forward voltage measurements.

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## Absolute Minimum and Maximum Ratings

Table 4: Minimum and Maximum Current and Reverse Voltage Ratings

Part Number	Maximum DC Forward Current (mA)	Minimum DC Forward Current (mA) <sup>[2]</sup>	Maximum Peak Pulsed Current (mA) <sup>[3]</sup>	Maximum Reverse Voltage (Vr) <sup>[1]</sup>
BXRA-W1800-XXXXX	1000	300	1400	-60 Volts
BXRA-N2000-XXXXX	1000	300	1400	-60 Volts
BXRA-C2500-XXXXX	1000	300	1400	-60 Volts

Notes for Table 4:

1. Light emitting diodes are not designed to be driven in reverse voltage.
2. Driving these high current devices at low currents can result in variations in performance. For low current operation pulse width modulation is recommended.
3. Bridgelux recommends a maximum duty cycle of 10% when operating LED Arrays at the maximum peak pulsed current specified.

Table 5: Maximum Ratings

Parameter	Maximum Rating
LED Junction Temperature	150 °C
Storage Temperature	-40 °C to +105 °C
Operating Case Temperature	105 °C
Soldering Temperature	3.5 seconds, 350 °C or lower

## Typical Performance at Alternative Drive Currents

The Bridgelux LED Arrays are tested and binned against the specifications shown in Tables 1, 2 and 3. Customers also have options to drive the LED Arrays at alternative drive currents dependent on the specific application. The typical performance at any drive current can be derived from the flux vs. current characteristics shown in Figure 7 and from the current vs. voltage characteristics shown in Figure 11. The typical performance at common drive currents is also summarized in Table 6.

Table 6: Typical Product Performance at Alternative Drive Currents

Color	ANSI CCT (K)	Part Number	Typical Luminous Flux $\phi_v$ (lm), $T_{case}=60^\circ\text{C}$	Typical Luminous Flux $\phi_v$ (lm), $T_j=25^\circ\text{C}$	Typical Forward Voltage $V_f$ (V)	Forward Current (mA) <sup>[2]</sup>
Warm White	2700K	BXRA-W1800-00S0E	900	1000	35.5	350
			1260	1375	36.7	500
			<b>1650</b>	<b>1840</b>	<b>38.1</b>	<b>700</b> <sup>[1]</sup>
	2700K	BXRA-W1800-00S0G	810	900	35.5	350
			1125	1250	36.7	500
			<b>1475</b>	<b>1650</b>	<b>38.1</b>	<b>700</b> <sup>[1]</sup>
	3000K	BXRA-W1800-00Q0E	1000	1100	35.5	350
			1350	1500	36.7	500
			<b>1800</b>	<b>2000</b>	<b>38.1</b>	<b>700</b> <sup>[1]</sup>
	3000K	BXRA-W1800-00Q0G	875	975	35.5	350
			1225	1350	36.7	500
			<b>1625</b>	<b>1800</b>	<b>38.1</b>	<b>700</b> <sup>[1]</sup>

## Typical Performance at Alternative Drive Currents (continued)

Table 7: Typical Product Performance at Alternative Drive Currents

Color	ANSI CCT (K)	Part Number	Typical Luminous Flux $\phi_v$ (lm), $T_{case}=60^{\circ}C$	Typical Luminous Flux $\phi_v$ (lm), $T_j=25^{\circ}C$	Typical Forward Voltage $V_f$ (V)	Forward Current (mA) <sup>[2]</sup>
Neutral White	4000K	BXRA-N2000-00L0E	1075	1200	35.5	350
			1475	1650	36.7	500
			<b>1975</b>	<b>2200</b>	<b>38.1</b>	<b>700</b> <sup>[1]</sup>

Table 8: Typical Product Performance at Alternative Drive Currents

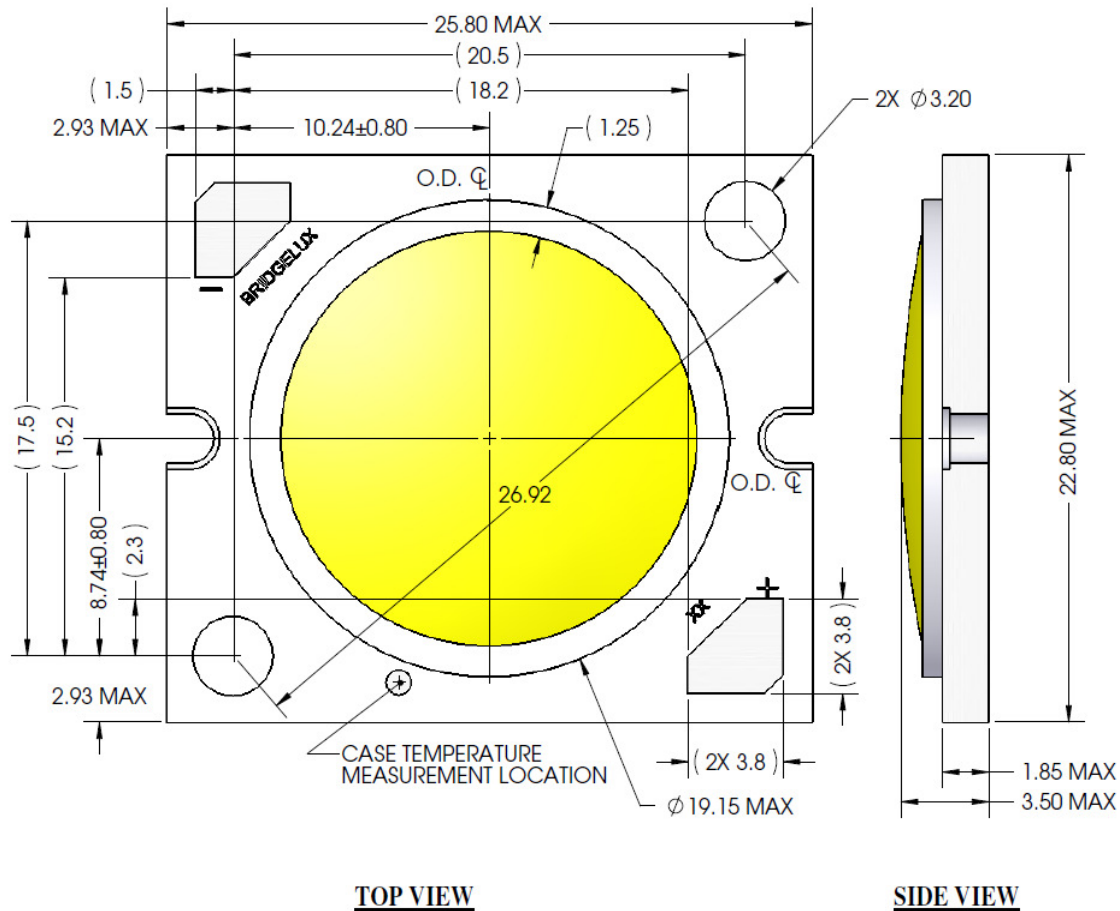
Color	ANSI CCT (K)	Part Number	Typical Luminous Flux $\phi_v$ (lm), $T_{case}=60^{\circ}C$	Typical Luminous Flux $\phi_v$ (lm), $T_j=25^{\circ}C$	Typical Forward Voltage $V_f$ (V)	Forward Current (mA) <sup>[2]</sup>
Cool White	5700K	BXRA-C2500-00E0C	1300	1450	35.5	350
			1800	2000	36.7	500
			<b>2400</b>	<b>2650</b>	<b>38.1</b>	<b>700</b> <sup>[1]</sup>

Notes for Table 6, 7 and 8:

1. Product is tested and binned at the specified drive current.
2. Operating these LED Arrays at or below the drive currents listed in Table 6, with a case temperature maintained at or below 70°C, will enable the average lumen maintenance projection outlined earlier in this Product Data Sheet.

## Mechanical Dimensions

Figure 1: Drawing for 2000 lumen product options (part numbers BXRA-C2500, BXRA-N2000, BXRA-W1800)

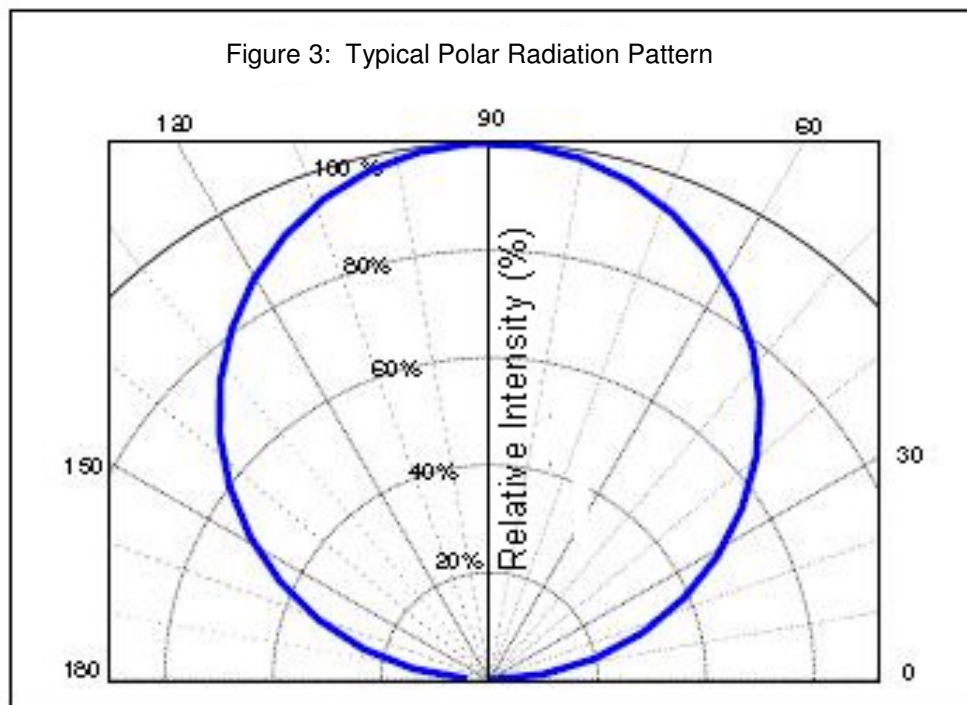
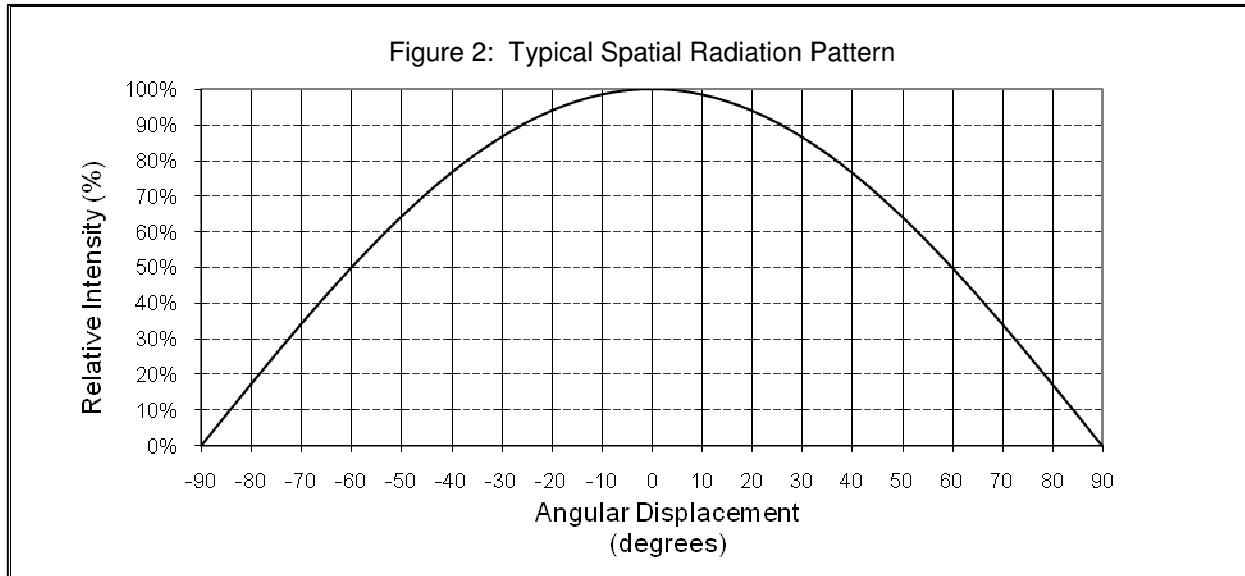


### Notes for Figure 1:

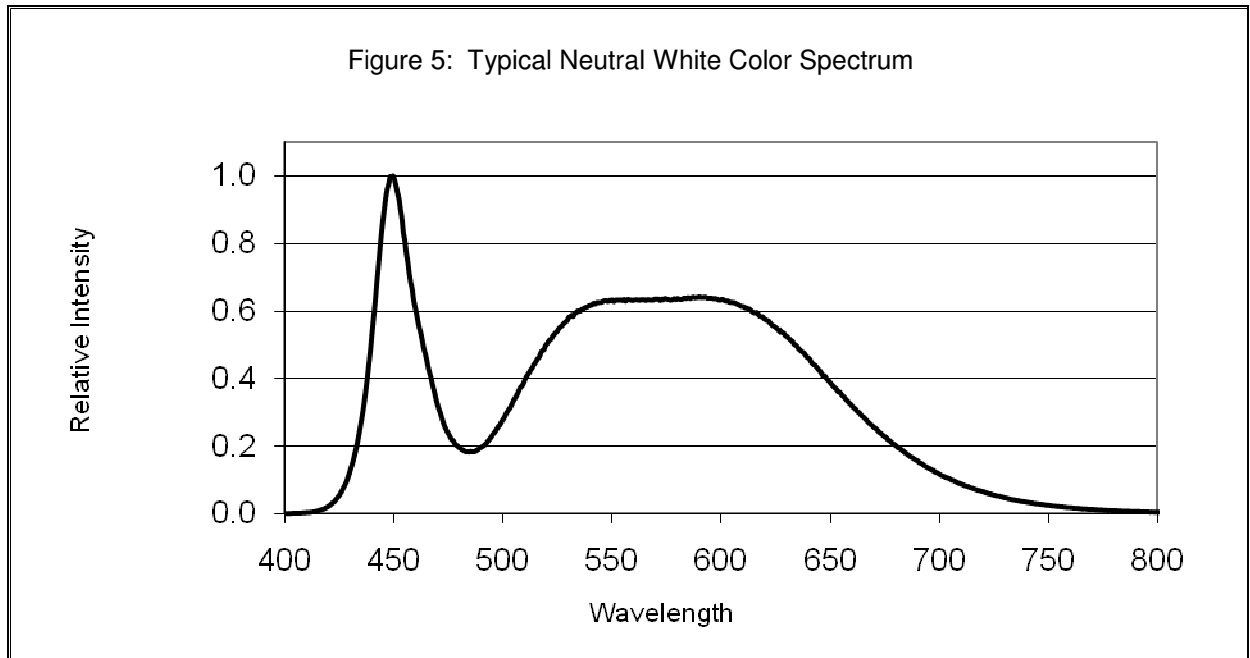
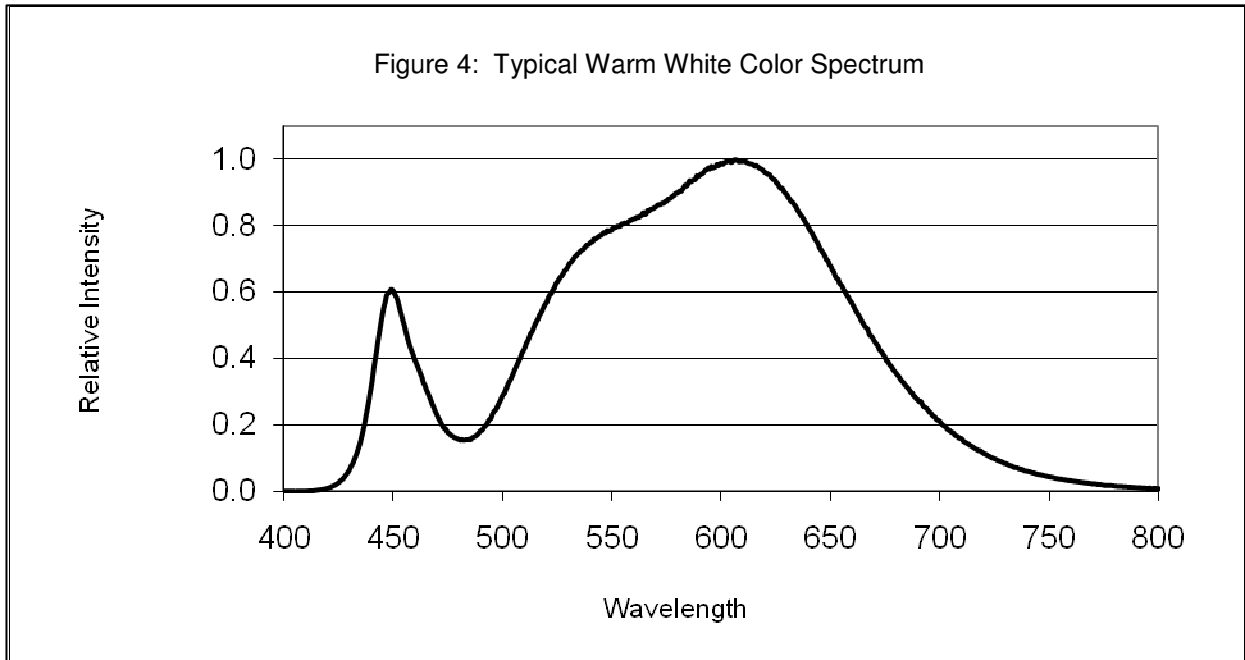
1. Mounting holes are for M2.5 or #4 screws.
2. Solder pads are labeled "+" and "-" to denote positive and negative, respectively.
3. Drawings are not to scale.
4. Drawing dimensions are in millimeters.
5. Bridgelux recommends two tapped holes for mounting screws with  $26.92 \pm 0.10$ mm center-to-center spacing.
6. Unless otherwise specified, tolerances are  $\pm 0.10$ mm.
7. Dimensions with parentheses "(" are for reference only.
8. Refer to product Application Notes AN10 and AN11 for product handling, mounting and heat sink recommendations.
9. The optical center of the LED Array is defined by the mechanical center of the array.
10. Bridgelux maintains a flatness of 0.1 mm across the mounting surface of the array. Refer to Application Notes AN10 and AN11 for product handling, mounting and heat sink recommendations.



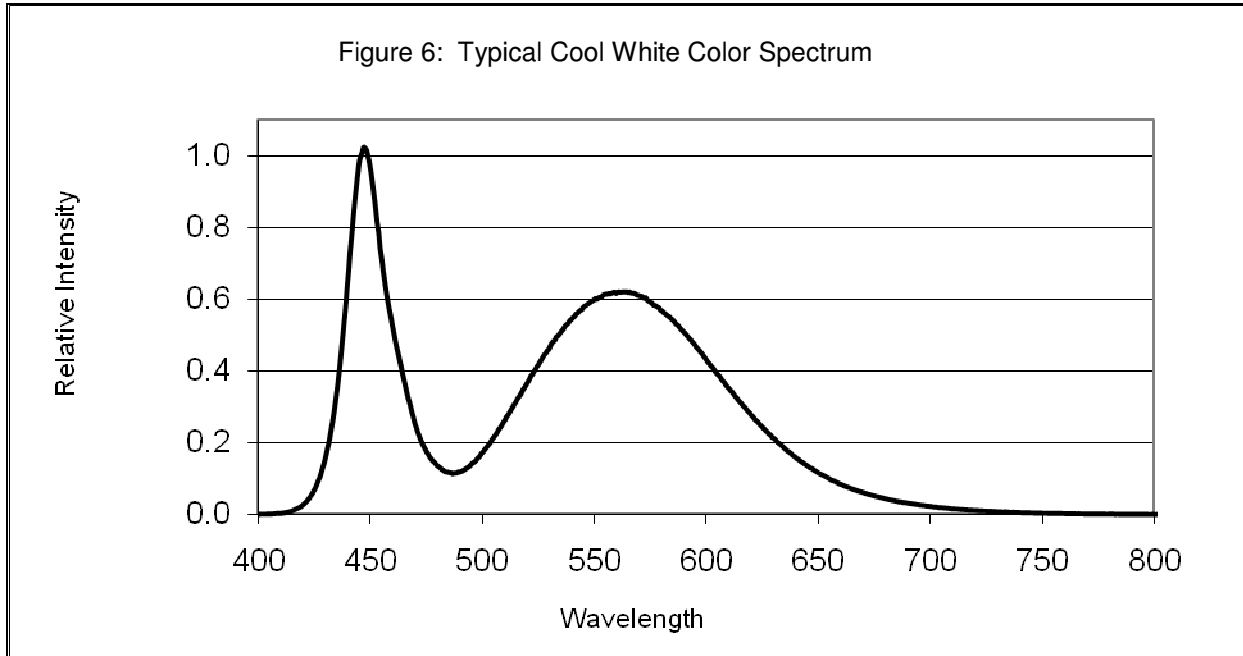
## Typical Radiation Pattern



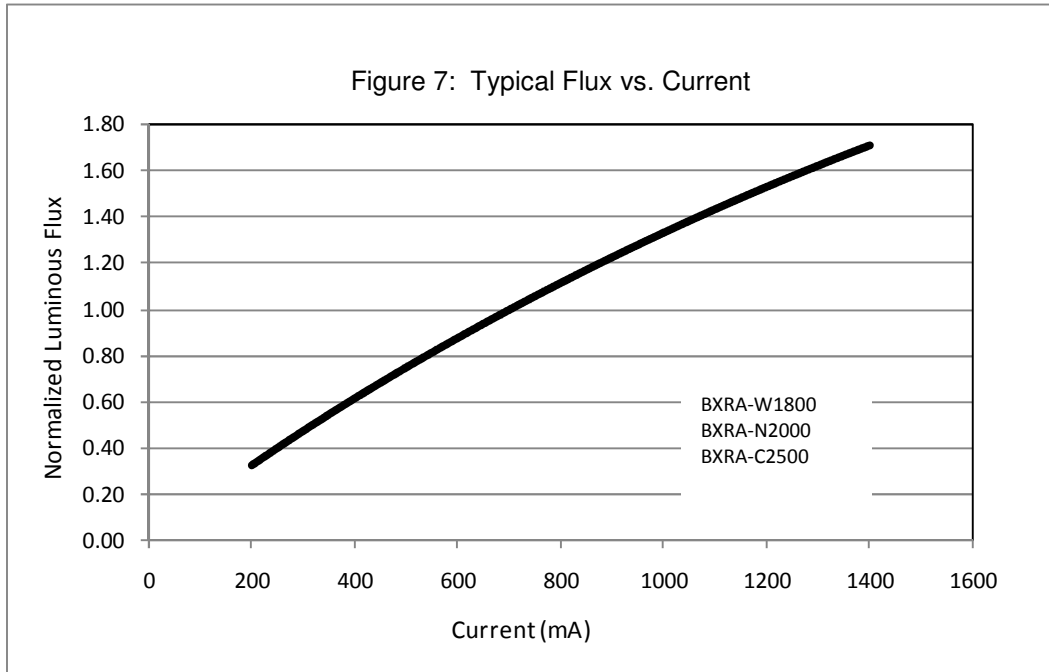
Wavelength Characteristics at Rated Test Current,  $T_j=25^\circ\text{C}$



Wavelength Characteristics at Rated Test Current,  $T_j=25^\circ\text{C}$  (Continued)

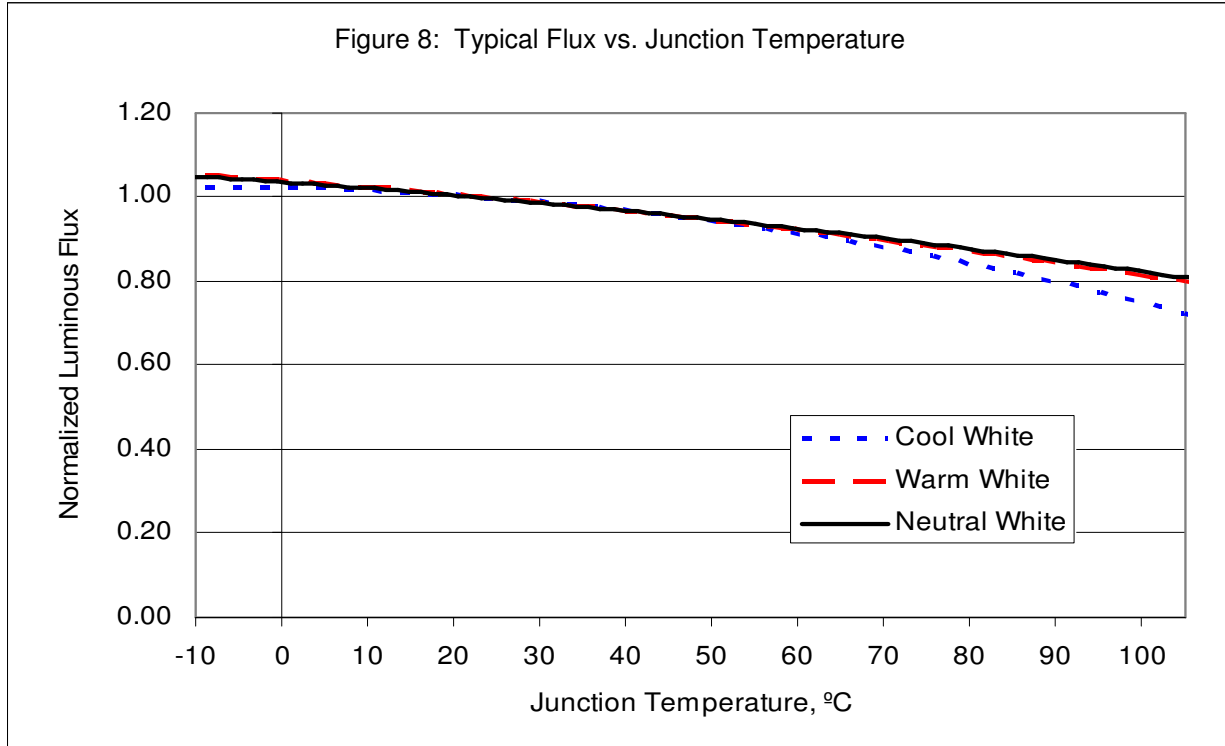


Typical Relative Luminous Flux vs. Current,  $T_j=25^\circ\text{C}$



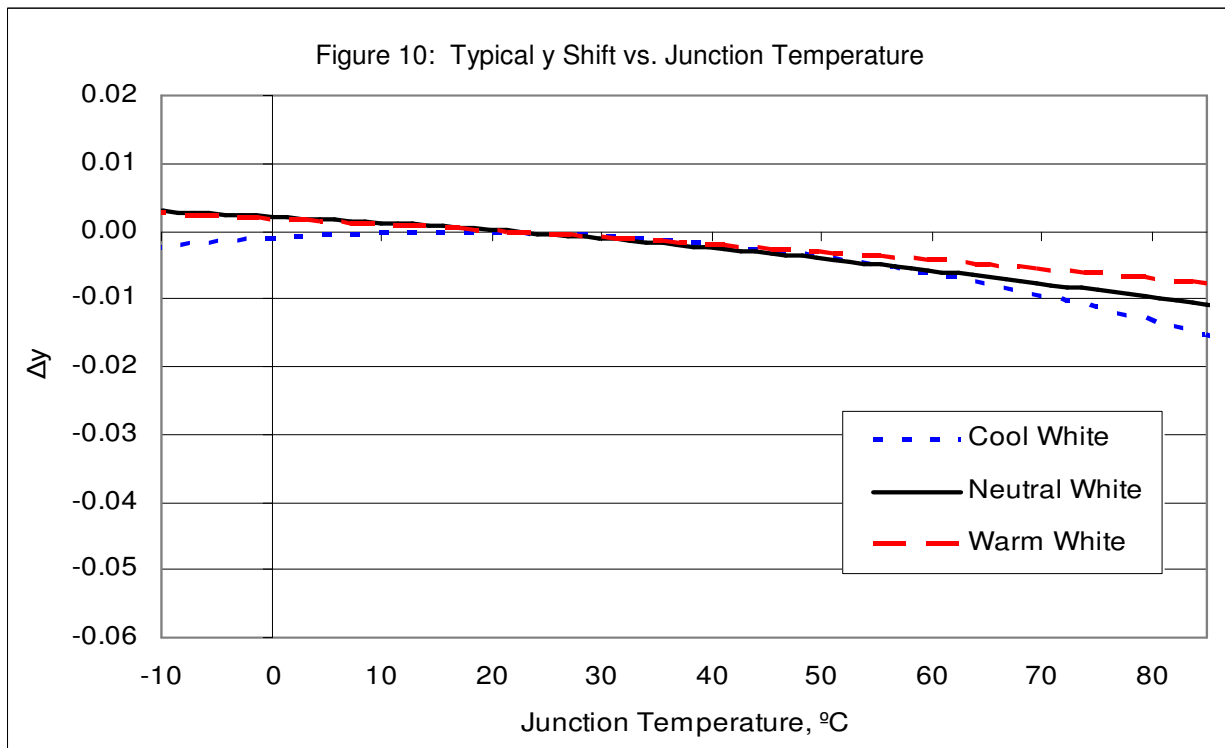
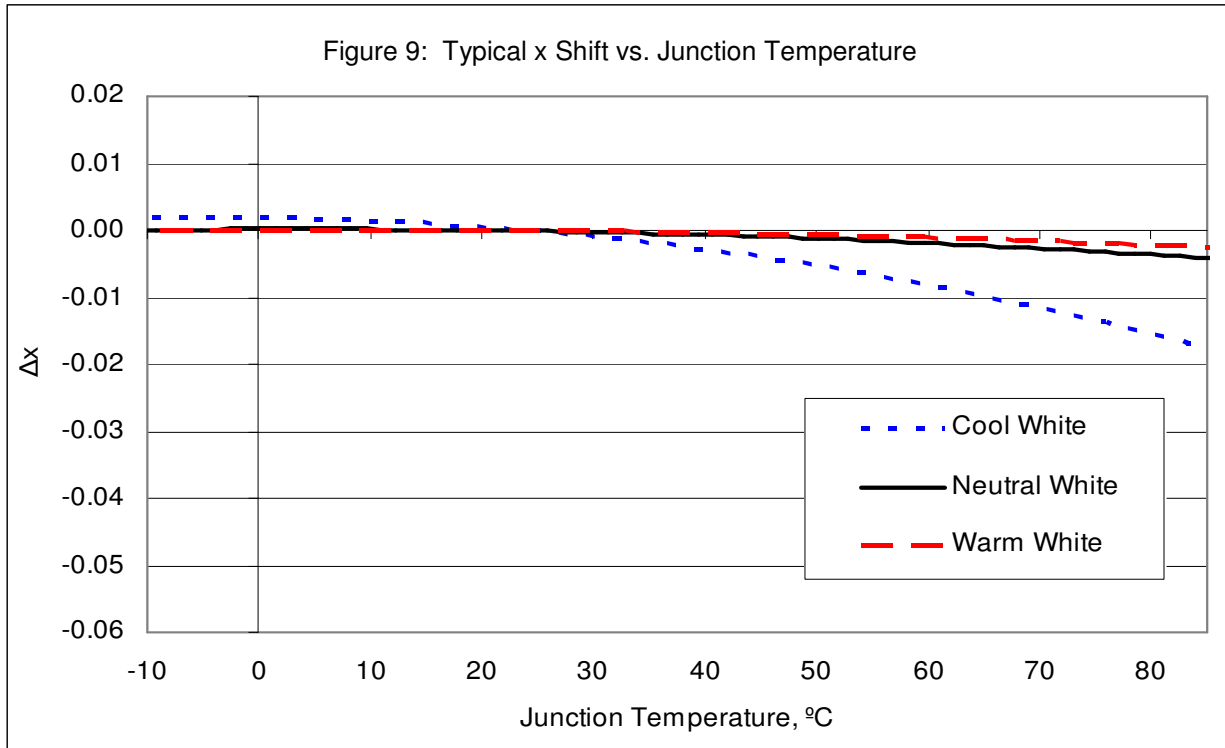
Note for Figure 7: Bridgelux does not recommend driving high power LED Arrays at low currents. Doing so may produce unpredictable results. Pulse width modulation (PWM) is recommended for dimming effects.

## Typical Light Output Characteristics vs. Temperature

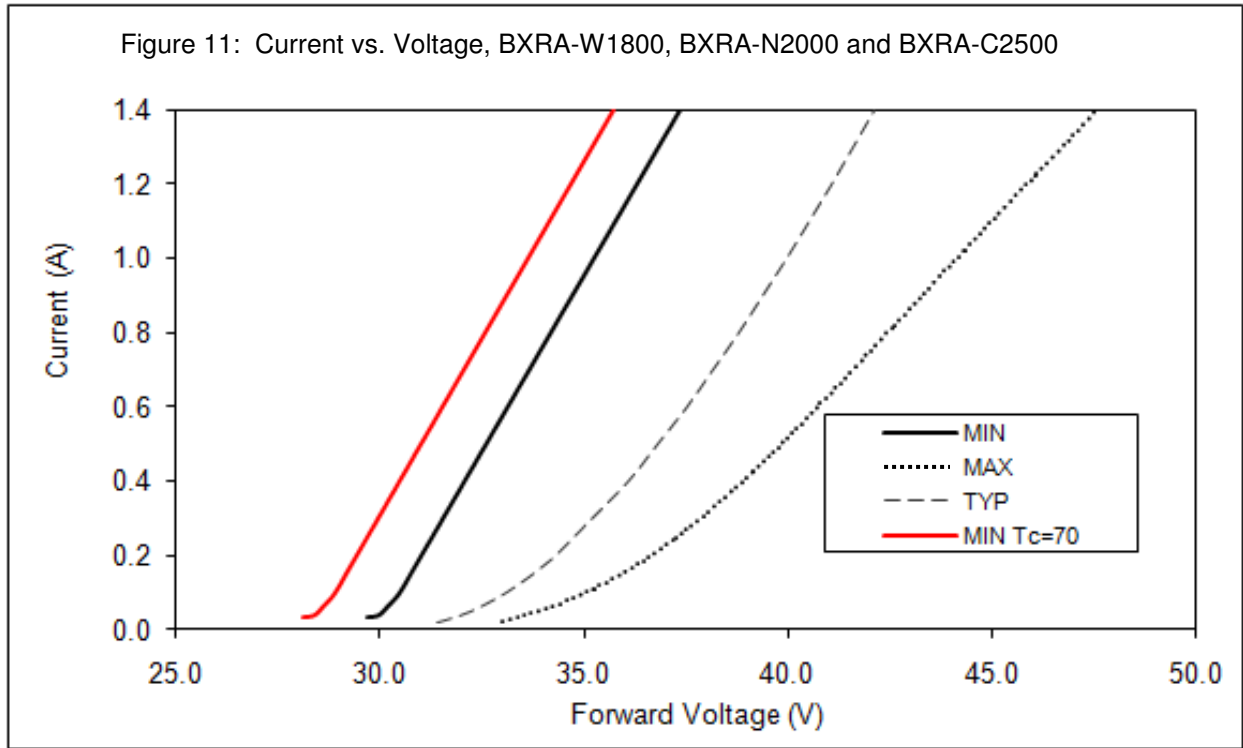




Typical Chromaticity Characteristics vs. Temperature

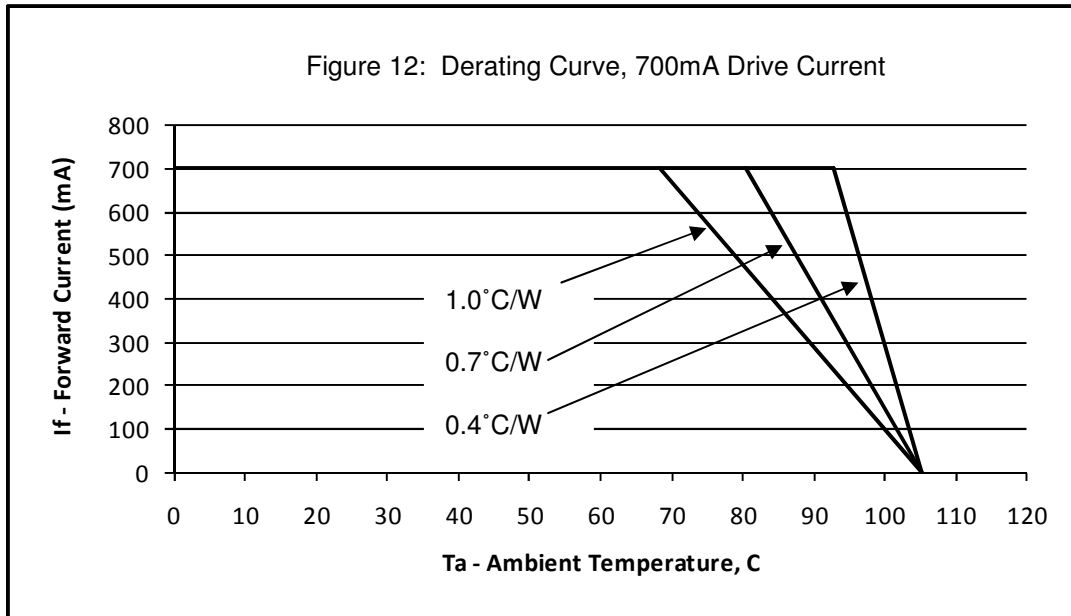


Forward Current Characteristics at  $T_j = 25^\circ\text{C}$



## Current Derating Curves

The graph below illustrates the relationship between the system thermal resistance, drive current, and ambient temperature. Please note that absolute maximum ratings requirements, including that of maximum case temperature, must be adhered to in the system design. The thermal resistance values indicated in Figure 12 are total system values (junction to ambient) including the thermal resistance of the LED Array. Individual LED Array thermal resistance values are listed in Table 3.



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## Product Binning

Typical manufacturing processes of semiconductor products result in a variation in performance surrounding the typical data sheet values. In order to minimize variation in the end product or application, Bridgelux bins its LED Arrays for color.

Bridgelux LED Arrays are labeled using a 3-digit alphanumeric bin code. This bin code is printed on the back of each LED Array in the following format:

B C D

Where:

B C – designates color bin (P3, P4, Q3, etc.)

D – designates color rendering index (0, A, B, C, etc)

All product packaged within a single tube are of the same color bin combination (or bin code). Using these codes it is possible to determine the best product utilization to deliver the consistency required in a given application.

## Color Binning Information

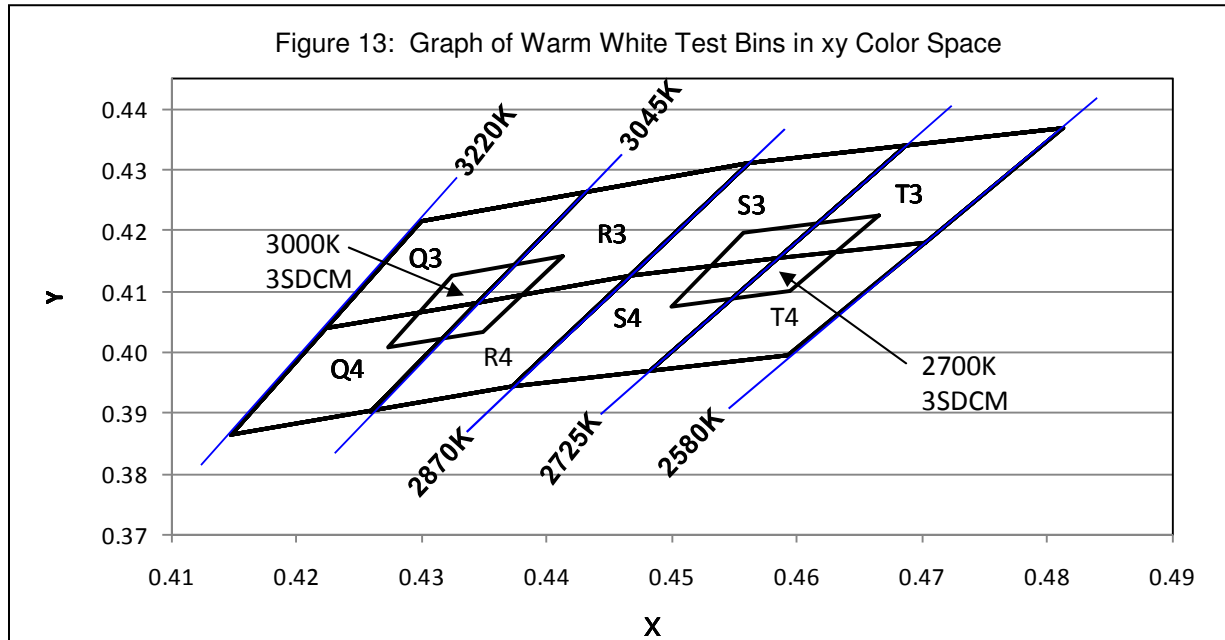


Table 9: Warm White xy Bin Coordinates and Associated Typical CCT

Bin Code	X	Y	ANSI CCT (K)
Q3	0.4223	0.3990	3000
	0.4299	0.4165	
	0.4431	0.4213	
	0.4345	0.4033	
Q4	0.4147	0.3814	3000
	0.4223	0.3990	
	0.4345	0.4033	
	0.4260	0.3854	
R3	0.4345	0.4033	3000
	0.4431	0.4213	
	0.4562	0.4260	
	0.4468	0.4077	
R4	0.4260	0.3854	3000
	0.4345	0.4033	
	0.4468	0.4077	
	0.4373	0.3893	
3SDCM	0.4413	0.4107	3000
	0.4325	0.4075	
	0.4274	0.3958	
	0.4350	0.3984	
S3	0.4468	0.4077	2700
	0.4562	0.4260	
	0.4688	0.4290	
	0.4585	0.4104	
S4	0.4373	0.3893	2700
	0.4468	0.4077	
	0.4585	0.4104	
	0.4483	0.3919	
T4	0.4585	0.4104	2700
	0.4688	0.4290	
	0.4813	0.4319	
	0.4703	0.4132	
T3	0.4483	0.3919	2700
	0.4585	0.4104	
	0.4703	0.4132	
	0.4593	0.3944	
3SDCM	0.4665	0.4175	2700
	0.4557	0.4145	
	0.4500	0.4026	
	0.4595	0.4050	



Color Binning Information (continued)

Figure 14: Graph of Neutral White Test Bins in xy Color Space

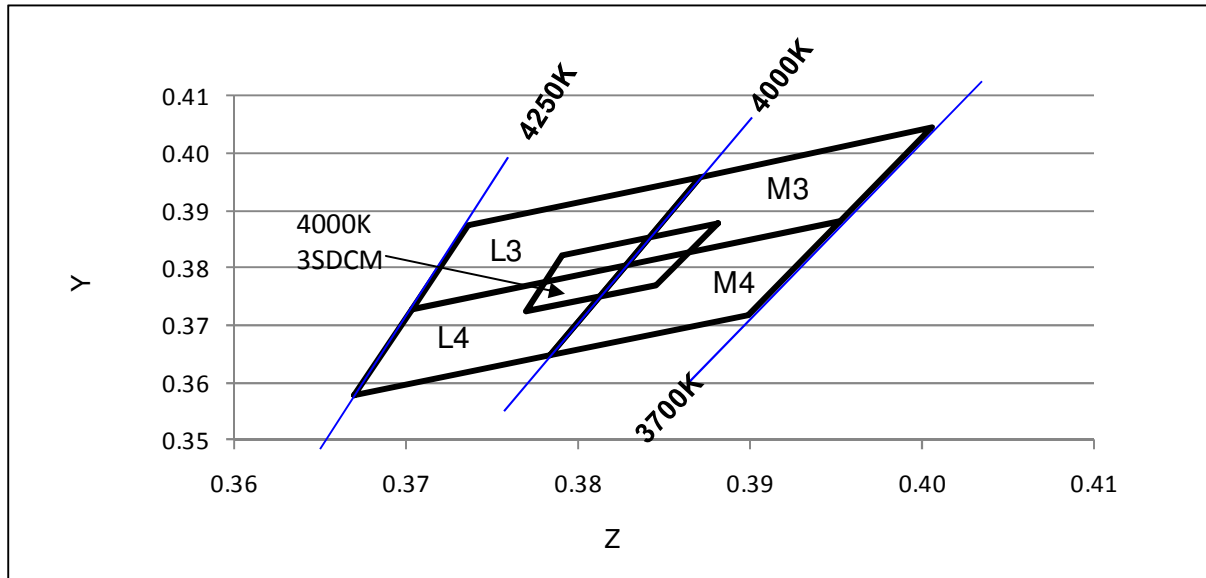


Table 10: Neutral White xy Bin Coordinates and Associated Typical CCT

Bin Code	X	Y	ANSI CCT (K)
L3	0.3703	0.3726	4000
	0.3736	0.3874	
	0.3871	0.3959	
	0.3828	0.3803	
L4	0.3670	0.3578	4000
	0.3703	0.3726	
	0.3828	0.3803	
	0.3784	0.3647	
M3	0.3828	0.3803	4000
	0.3871	0.3959	
	0.4006	0.4044	
	0.3952	0.3880	
M4	0.3784	0.3647	4000
	0.3828	0.3803	
	0.3952	0.3880	
	0.3898	0.3716	
3SDCM	0.3881	0.3879	4000
	0.3791	0.3823	
	0.3769	0.3724	
	0.3845	0.3770	

Color Binning Information (continued)

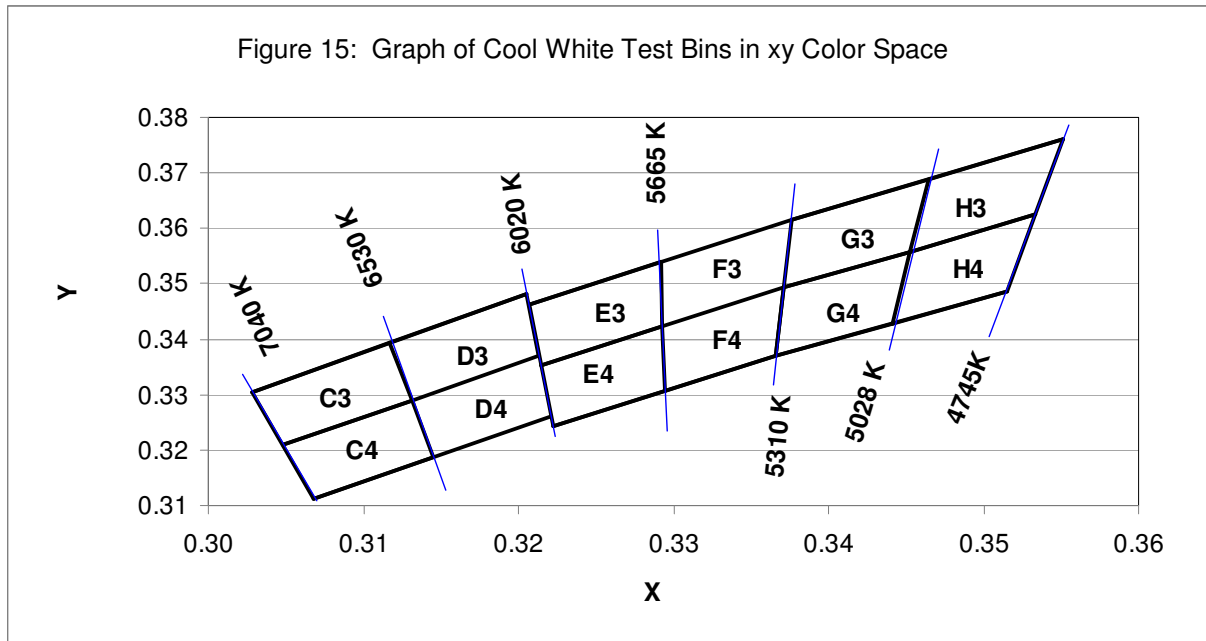


Table 11: Cool White xy Bin Coordinates and Associated Typical CCT

Bin Code	X	Y	ANSI CCT (K)
E3	0.3215	0.3353	5700
	0.3293	0.3423	
	0.3292	0.3539	
	0.3207	0.3462	
E4	0.3222	0.3243	5700
	0.3294	0.3306	
	0.3293	0.3423	
	0.3215	0.3353	
F3	0.3292	0.3539	5700
	0.3293	0.3423	
	0.3371	0.3493	
	0.3376	0.3616	
F4	0.3294	0.3306	5700
	0.3366	0.3369	
	0.3371	0.3493	
	0.3293	0.3423	

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## Mechanical Assembly and Handling

Recommended assembly is illustrated below.

When handling parts, please avoid contacting and do not apply stress to the resin area (see Figure 1, resin area is indicated in yellow).

Product should be firmly secured onto appropriate heat sink by fastening M2.5 or #4 screws on both sides of the product as illustrated in Figure 16. The recommended center-to-center spacing for these the two tapped holes for mounting screws is  $19.20 \pm 0.05\text{mm}$  for hexagonal star products and  $26.92 \pm 0.10\text{mm}$  for rectangular array products. Bridgelux recommends the use of hard non-electrically conductive flat washers with lock washers. Refer to Application Note AN11 – Handling and Assembly of Bridgelux LED Arrays, for more details.

A thin layer of thermal grease should be applied to the bottom surface of the LED Array, between the bottom of the array and the heat sink. All air gaps and voids between the heat sink and array should be eliminated. Ensure that sufficient thermal grease is used to cover the entire bottom surface of the array, but not so much that the thermal grease creeps up to the top of the array.

