Bridgelux ES Star Array Series

Product Data Sheet DS23

BXRA-27x0540, BXRA-27x0740, BXRA-30x0540, BXRA-30x0740

BXRA-40E0600, BXRA-40E0810,

BXRA 50C0700-B, BXRA-50C1000, BXRA-56C0700, BXRA-56C1000

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 450 and 1000 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 40-60 Watt incandescent and halogen and 7-13 Watt compact fluorescent based luminaires and feature increased system level efficacy and service life. Typical applications include replacement lamps, task, accent, spot, track, down light, wide area, security, and wall pack.

Features

- Compact high flux density light source
- Uniform high quality illumination
- Minimum 70, 80 and 90 CRI options
- Streamlined thermal path
- Energy Star / ANSI compliant color binning structure with 3SDCM options
- 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
- High quality true color reproduction
- 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:

BXRA – AB C DEFG – H – IJ

Where:

BXRA – Designates product family

AB – Designates the nominal ANSI color temperature; 27 = 2700K; 30 = 3000K, etc.

C - Designates minimum CRI; C = 70, E = 80, G = 90

DEFG - Designates Nominal Flux; 0540 = 540lm, 0740 = 740lm, 1000=1000lm, etc.

H – Designates configuration

IJ – Designates CCT Bin options
3000K as an example:
00 = Full ANSI: Q3, Q4, R3, R4
03 = 3 SDCM

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 85°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 does not intentionally add the following restricted materials to LED Array products: lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBB) or polybrominated diphenyl ethers (PBDE).

UL Recognition

Bridgelux secures UL Recognition for all the LED Array products. We continue to add arrays as they are recognized by UL. 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.

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.

Selection Guide

The following configurations are available:

Table 1: Selection Guide for ES Star Arrays

Base Part Number	**CCT** (Nominal)	**CRI** (min)	**Typical Pulsed Flux T_j 25ºC** (lm)	**Typical DC Flux T_{case} 70ºC** (lm)	**Test Current** (mA)	**Vf** (Typ) (V)	**Power** (Typ) (W)	**Efficacy** (Typ at T_j 25ºC) (lm/W)
BXRA-27E0540-A-00	2700	80	560	500	350	18.8	6.6	85
BXRA-27G0540-A-00	2700	90	480	430	350	18.8	6.6	73
BXRA-27E0740-A-00	2700	80	810	725	350	28.1	9.8	82
BXRA-27G0740-A-00	2700	90	690	615	350	28.1	9.8	70
BXRA-30E0540-A-00	3000	80	600	525	350	18.8	6.6	91
BXRA-30G0540-A-00	3000	90	530	465	350	18.8	6.6	81
BXRA-30E0740-A-00	3000	80	860	770	350	28.1	9.8	88
BXRA-30G0740-A-00	3000	90	760	680	350	28.1	9.8	77
BXRA-40E0600-A-00	4000	80	650	560	350	18.8	6.6	98
BXRA-40E0810-A-00	4000	80	980	860	350	28.1	9.8	100
BXRA-50C0700-B-00	5000	70	780	685	700	9.4	6.6	118
BXRA-50C1000-A-00	5000	70	1120	1000	350	28.1	9.8	114
BXRA-56C0700-A-00	5600	70	780	685	350	18.8	6.6	118
BXRA-56C1000-A-00	5600	70	1120	1000	350	28.1	9.8	114

Color Control Options

ES LED Series Arrays are available in the following color control options.

Table 2: Color Control Options

Product	CCT	CRI	7SDCM Part Number	3SDCM Part Number
ES Star	2700K	80	BXRA-27E0540-A-00	BXRA-27E0540-A-03
ES Star	2700K	90	BXRA-27G0540-A-00	BXRA-27G0540-A-03
ES Star	2700K	80	BXRA-27E0740-A-00	BXRA-27E0740-A-03
ES Star	2700K	90	BXRA-27G0740-A-00	BXRA-27G0740-A-03
ES Star	3000K	80	BXRA-30E0540-A-00	BXRA-30E0540-A-03
ES Star	3000K	90	BXRA-30G0540-A-00	BXRA-30G0540-A-03
ES Star	3000K	80	BXRA-30E0740-A-00	BXRA-30E0740-A-03
ES Star	3000K	90	BXRA-30G0740-A-00	BXRA-30G0740-A-03
ES Star	4000K	80	BXRA-40E0600-A-00	Not Available
ES Star	4000K	80	BXRA-40E0810-A-00	BXRA-40E0810-A-03
ES Star	5000k	70	BXRA-56C0700-B-00	Not Available
ES Star	5000K	70	BXRA-56C1000-A-00	Not Available
ES Star	5600K	70	BXRA-56C0700-A-00	Not Available
ES Star	5600K	70	BXRA-56C1000-A-00	Not Available

Flux Characteristics

Table 3: Flux Characteristics

Color	ANSI CCT (K)	Base Part Number	CRI (min)[4]	Typical DC Flux T_{case} = 70ºC (lm)[3]	Minimum Pulsed Flux T_j = 25ºC (lm)[1]	Typical Pulsed Flux T_j = 25ºC (lm)	Test Current (mA)[2]
Warm White	2700	BXRA-27E0540-A-00	80	500	500	560	350
		BXRA-27G0540-A-00	90	430	430	480	350
		BXRA-27E0740-A-00	80	725	730	810	350
		BXRA-27G0740-A-00	90	615	620	690	350
	3000	BXRA-30E0540-A-00	80	525	540	600	350
		BXRA-30G0540-A-00	90	465	480	530	350
		BXRA-30E0740-A-00	80	770	770	860	350
		BXRA-30G0740-A-00	90	680	680	760	350
Neutral White	4000	BXRA-40E0600-A-00	80	560	580	650	350
		BXRA-40E0810-A-00	80	860	880	980	350
Cool White	5000	BXRA-50C0700-B-00	70	685	700	780	700
		BXRA-50C1000-A-00	70	1000	1000	1120	350
	5600	BXRA-56C0700-A-00	70	685	700	780	350
		BXRA-56C1000-A-00	70	1000	1010	1120	350

Notes for Table 3:

1. Bridgelux maintains a ± 7% tolerance of flux measurements.
2. Parts are tested in pulsed conditions, T_j = 25°C. Pulse width is 10 ms at rated test current.
3. Typical performance when driven at DC (direct current) test current with LED Array case temperature maintained at 70°C, mounted to heat sink with thermal interface material. Please contact a Bridgelux sales representative for additional details.
4. Typical R9 value for 90 CRI product options is 50.
5. Reference Table 7 and 8 for typical performance at other driver currents (including those commonly available in the market).

Optical Characteristics

Table 4: Optical Characteristics

Color	ANSI CCT (K)	Base Part Number	Color Temperature (CCT) [1], [2], [3]			CRI (min)	Typical Viewing Angle (Degrees) $2\theta^{1/2}$ [4]	Typical Center Beam Candle Power (cd) [5]
			Min	Typ	Max			
Warm White	2700	BXRA-27E0540-A-00	2580 K	2725 K	2870 K	80	120	175
		BXRA-27G0540-A-00	2580 K	2725 K	2870 K	90	120	155
		BXRA-27E0740-A-00	2580 K	2725 K	2870 K	80	120	235
		BXRA-27G0740-A-00	2580 K	2725 K	2870 K	90	120	215
	3000	BXRA-30E0540-A-00	2870 K	3045 K	3220 K	80	120	190
		BXRA-30G0540-A-00	2870 K	3045 K	3220 K	90	120	170
		BXRA-30E0740-A-00	2870 K	3045 K	3220 K	80	120	260
		BXRA-30G0740-A-00	2870 K	3045 K	3220 K	90	120	235
Neutral White	4000	BXRA-40E0600-A-00	3700K	4000 K	4250K	80	120	180
		BXRA-40E0810-A-00	3700K	4000 K	4250K	80	120	285
Cool White	5000	BXRA-50C0700-B-00	4745 K	5100 K	5310 K	70	120	245
		BXRA-50C1000-A-00	4745 K	5100 K	5310 K	70	120	340
	5600	BXRA-56C0700-A-00	5310 K	5665 K	6020 K	70	120	245
		BXRA-56C1000-A-00	5310 K	5665 K	6020 K	70	120	340

Notes for Table 4:

1. Parts are tested in pulsed conditions, T_j = 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. Viewing angle is the off axis angle from the centerline where Iv is ½ of the peak value.
5. Center beam candle power is a calculated value based on lambertian radiation pattern at nominal test current.

Electrical Characteristics

Table 5: Electrical Characteristics

Color	Base Part Number	Forward Voltage Vf (V)[2]			Test Current (mA)[1]	Typical Coefficient of Forward Voltage (mV/ºC) $\Delta Vf/\Delta Tj$	Typical Thermal Resistance Junction to Case (ºC/W) $R\theta_{j-c}$
		Min	Typ	Max			
Warm White	BXRA-27E0540-A-00	16.9	18.1	20.7	350	-6 to -18	2.60
	BXRA-27G0540-A-00	16.9	18.1	20.7	350	-6 to -18	2.60
	BXRA-27E0740-A-00	25.3	28.1	30.9	350	-9 to -27	1.75
	BXRA-27G0740-A-00	25.3	28.1	30.9	350	-9 to -27	1.75
	BXRA-30E0540-A-00	16.9	18.1	20.7	350	-6 to -18	2.60
	BXRA-30G0540-A-00	16.9	18.1	20.7	350	-6 to -18	2.60
	BXRA-30E0740-A-00	25.3	28.1	30.9	350	-9 to -27	1.75
	BXRA-30G0740-A-00	25.3	28.1	30.9	350	-9 to -27	1.75
Neutral White	BXRA-40E0600-A-00	16.9	18.1	20.7	350	-6 to -18	2.60
	BXRA-40E0810-A-00	25.3	28.1	30.9	350	-9 to -27	1.75
Cool White	BXRA-50C0700-B-00	8.4	9.4	10.3	700	-3 to -9	2.60
	BXRA-50C1000-A-00	25.3	28.1	30.9	350	-9 to -27	1.75
	BXRA-56C0700-A-00	16.9	18.1	20.7	350	-6 to -18	2.60
	BXRA-56C1000-A-00	25.3	28.1	30.9	350	-9 to -27	1.75

Notes for Table 5:

1. Parts are tested in pulsed conditions, T_j = 25°C. Pulse width is 10 ms at rated test current.
2. Bridgelux maintains a tester tolerance of ± 0.10 V on forward voltage measurements.

Absolute Minimum and Maximum Ratings

Table 6: Maximum Current and Reverse Voltage Ratings

Color	Base Part Number	Maximum DC Forward Current (mA)	Maximum Peak Pulsed Current (mA)[1]	Maximum Reverse Voltage (Vr)[2]
Warm White	BXRA-27E0540-A-00	500	700	-30 V
	BXRA-27G0540-A-00	500	700	-30 V
	BXRA-27E0740-A-00	500	700	-45 V
	BXRA-27G0740-A-00	500	700	-45 V
	BXRA-30E0540-A-00	500	700	-30 V
	BXRA-30G0540-A-00	500	700	-30 V
	BXRA-30E0740-A-00	500	700	-45 V
	BXRA-30G0740-A-00	500	700	-45 V
Neutral White	BXRA-40E0600-A-00	500	700	-30 V
	BXRA-40E0810-A-00	500	700	-45 V
Cool White	BXRA-50C0700-B-00	750	1000	-15 V
	BXRA-50C1000-A-00	500	700	-45 V
	BXRA-56C0700-A-00	500	700	-30 V
	BXRA-56C1000-A-00	500	700	-45 V

Notes for Table 6:

1. Bridgelux recommends a maximum duty cycle of 10% when operating LED Arrays at the maximum peak pulsed current specified.
2. Light emitting diodes are not designed to be driven in reverse voltage.

Table 7: Maximum Ratings

Parameter	Maximum Rating
LED Junction Temperature	150℃
Storage Temperature	-40℃ to +105℃
Operating Case Temperature	105℃
Soldering Temperature*	350℃ or lower for a maximum of 3.5 seconds

*See Bridgelux Application Note AN15: Reflow Soldering of Bridgelux LED Arrays for solder procedure (www.Bridgelux.com)

Typical Performance at Alternative Drive Currents

The Bridgelux LED Arrays are tested and binned against the specifications shown in Tables 2, 3 and 4. 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 5 and 6 and from the current vs. voltage characteristics shown in Figures 10 and 11. The typical performance at common drive currents is also summarized in Tables 8 and 9.

Table 8: Typical Product Performance at Alternative Drive Currents

Color	ANSI CCT (K)	Part Number	CRI	Typical DC Luminous Flux ϕv (lm), T_{case}=70℃	Typical Pulsed Luminous Flux ϕv (lm), T_j=25℃	Typical Forward Voltage V_f (V)	Forward Current (mA)[2]
Warm White	2700	BXRA-27E0540-A-00	80	385	410	17.8	250
				682	**560**	**18.8**	**350** [1]
		BXRA-27G0540-A-00	90	317	353	17.8	250
				430	**480**	**18.8**	**350** [1]
		BXRA-27E0740-A-00	80	585	650	18.4	250
				725	**810**	**28.1**	**350** [1]
		BXRA-27G0740-A-00	90	450	505	26.7	250
				615	**690**	**28.1**	**350** [1]
	3000	BXRA-30E0540-A-00	80	385	440	17.8	250
				525	**600**	**18.8**	**350** [1]
		BXRA-30G0540-A-00	90	340	390	17.8	250
				465	**530**	**18.8**	**350** [1]
		BXRA-30E0740-A-00	80	565	630	17.8	250
				770	**860**	**28.1**	**350** [1]
		BXRA-30G0740-A-00	90	500	570	26.7	250
				680	**760**	**28.1**	**350** [1]

Typical Performance at Alternative Drive Currents (continued)

Table 9: Typical Product Performance at Alternative Drive Currents

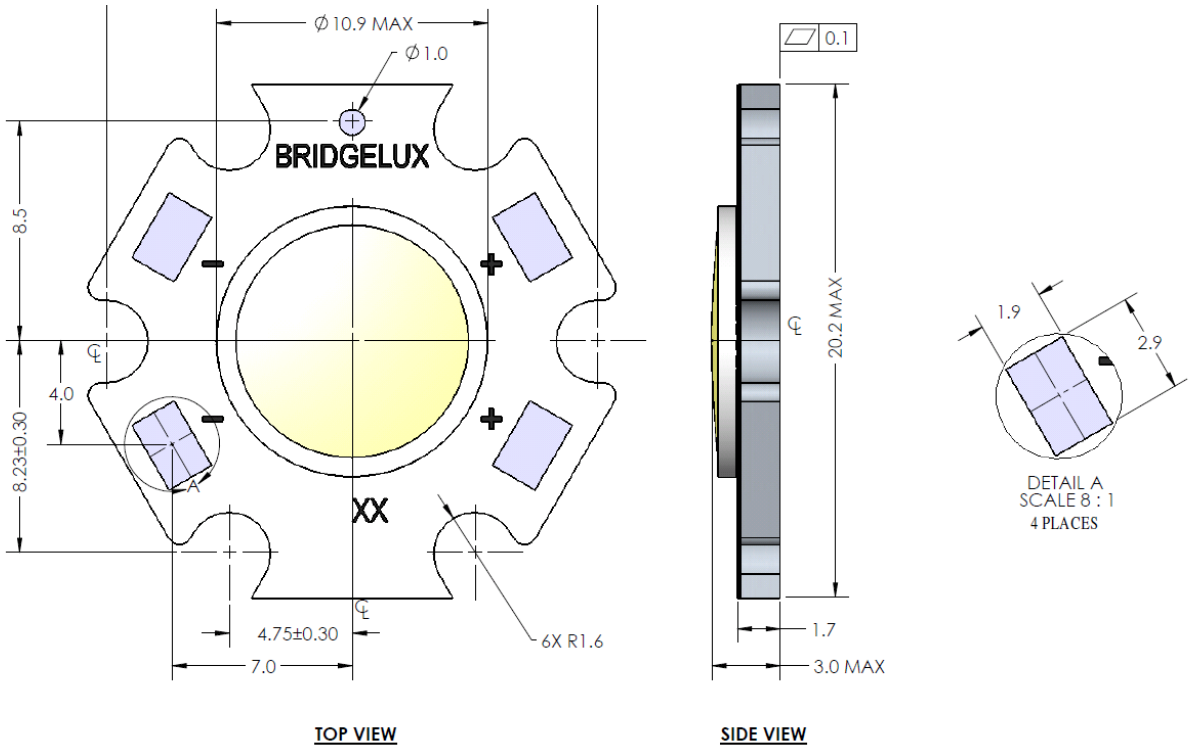
Color	ANSI CCT (K)	BXRA Part Number	CRI	Typ. Flux T_{case} = 70ºC (lm) [3]	Typ. Flux Tj = 25ºC (lm)	Typical Forward Voltage V_f	Forward Current (mA) [2]
Neutral White	400	BXRA-40E0600-A-00	80	**560**	**650**	**28.1**	**350[1]**
		BXRA-40E0810-A-00		634	723	26.7	250
				860	**980**	**28.1**	**350[1]**
Cool White	5000	BXRA-50C0700-B-00	70	500	575	8.9	500
				685	**780**	**9.4**	**700[1]**
		BXRA-50C1000-A-00		736	825	26.7	250
				1000	**1120**	**28.1**	**350[1]**
	5600	BXRA-56C0700-A-00	70	735	575	17.8	250
				685	**780**	**18.8**	**350[1]**
				930	1063	19.4	500
		BXRA-56C1000-A-00	70	735	825	26.7	250
				1000	**1120**	**28.1**	**350[1]**

Notes for Tables 8 and 9:

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 7 and 8, 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 ES Star Arrays



Notes for Figure 1:

1. Slots are for M2.5 or #4 screws.
2. Solder pads are labeled "+" and "-" to denote positive and negative, respectively.
3. It is not necessary to provide electrical connections to both sets of solder pads. Either set my be used depending on application specific design requirements.
4. Drawings are not to scale.
5. Drawing dimensions are in millimeters.
6. Unless otherwise specified, tolerances are ± 0.20mm.
7. Refer to product Application Notes AN10 and AN11 for product handling, mounting and heat sink recommendations.
8. The optical center of the LED Array is defined by the mechanical center of the array.
9. 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

Figure 2: Typical Spacial Radiation Pattern

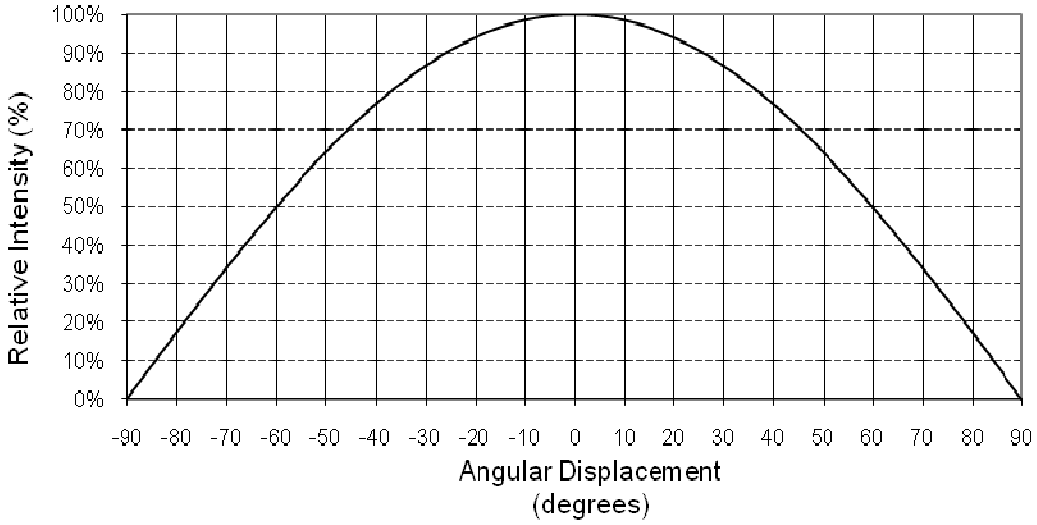
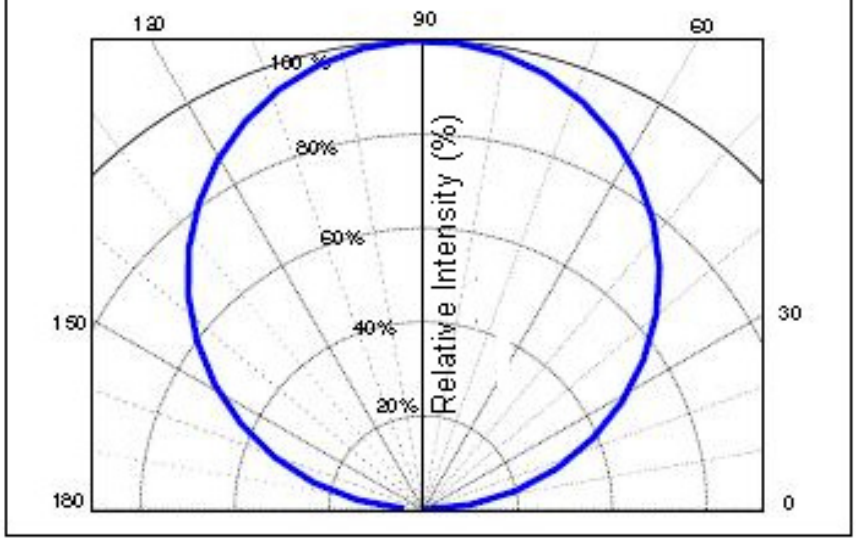
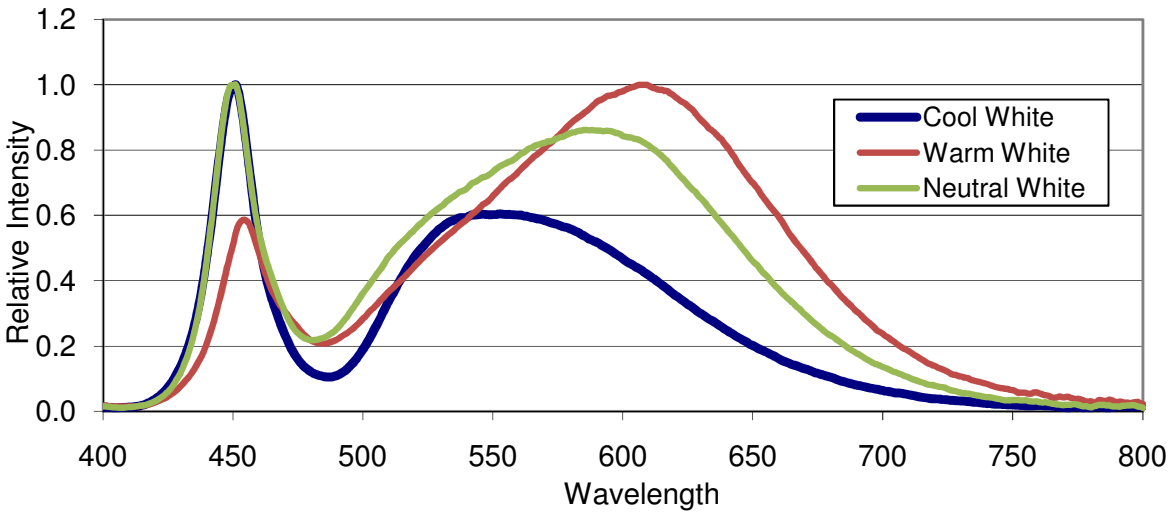


Figure 3: Typical Polar Radiation Pattern



Wavelength Characteristics at Rated Test Current, Tj=25℃

Figure 4: Typical Color Spectrum



Typical Relative Luminous Flux vs. Current, Tj=25℃

Figure 5: Typical Flux vs. Current
BXRA-xxE0540-A, BXRA-xxE0600-A, BXRA-XXC0700-A

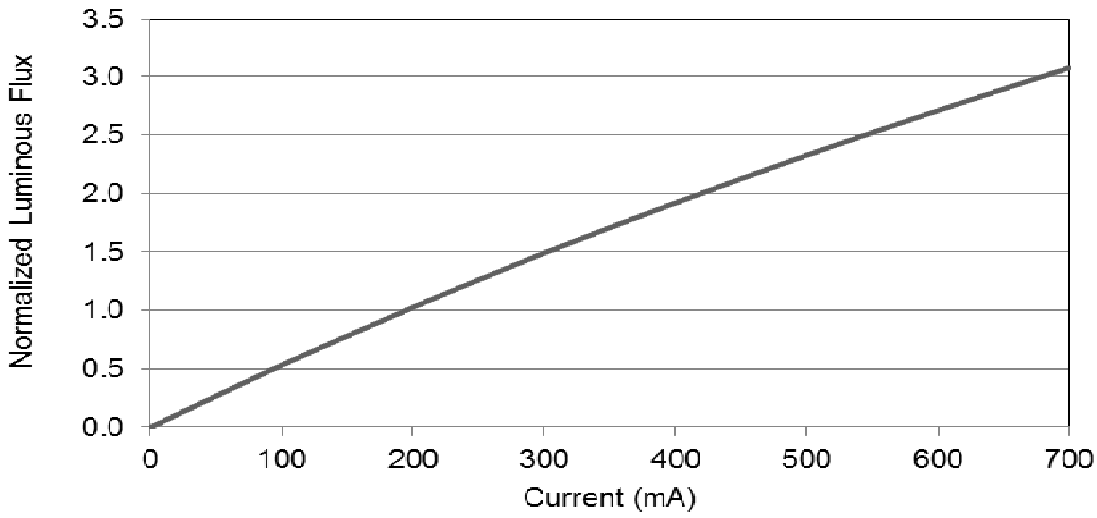
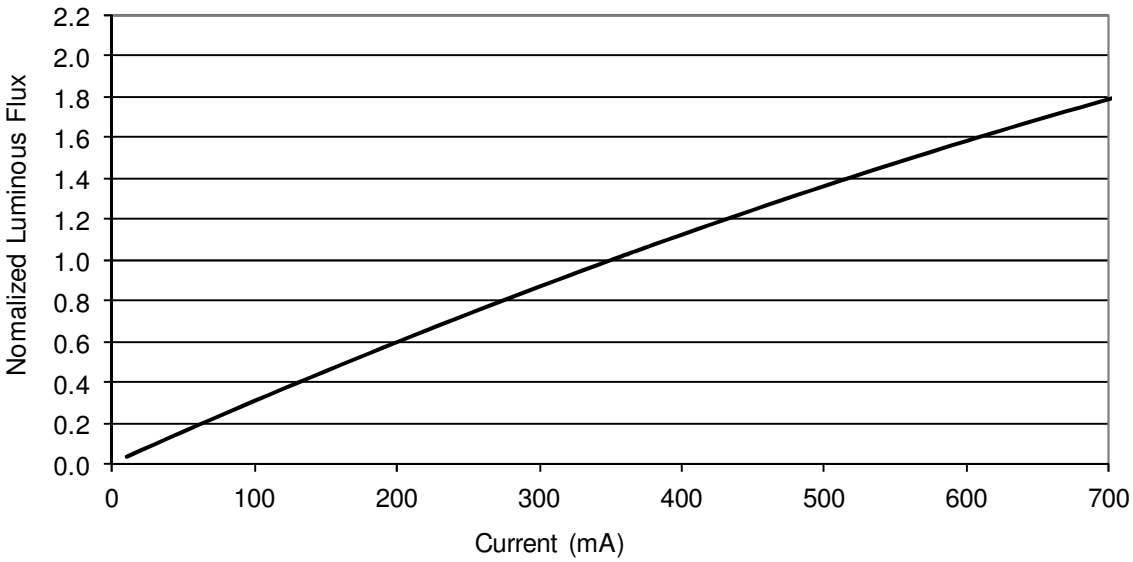
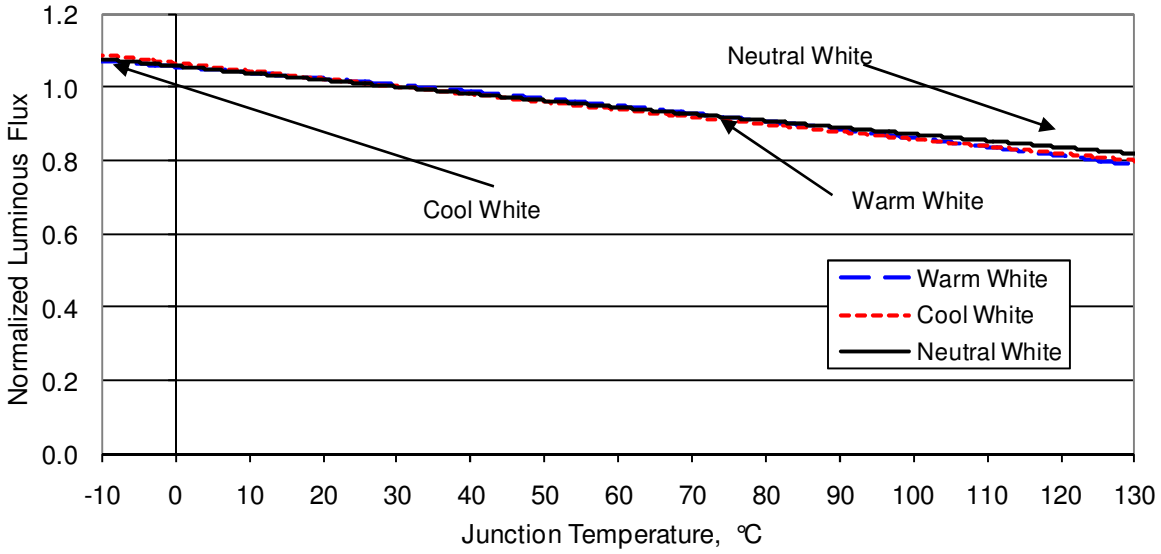


Figure 6: Typical Flux vs. Current
BXRA-xxE0740-A, BXRA-40E0810-A, BXRA-XXC1000-A



Typical Light Output Characteristics vs. Temperature

Figure 7: Typical Flux vs. Junction Temperature



Typical Chromaticity Characteristics vs. Temperature

Figure 8: Typical ccy Shift vs. Junction Temperature

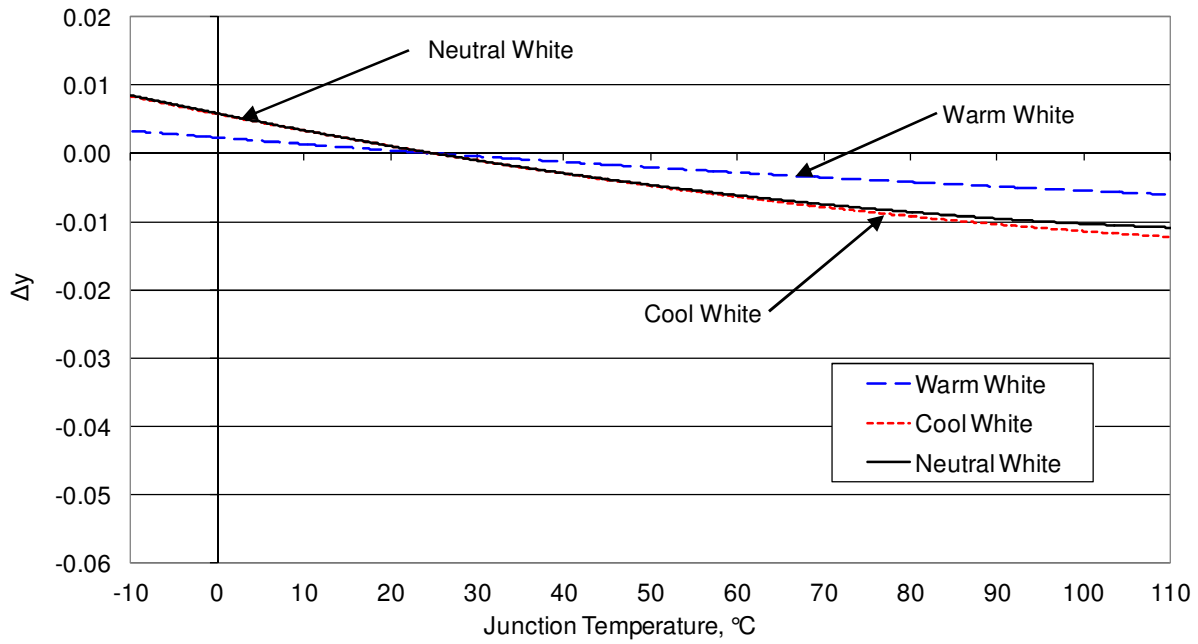
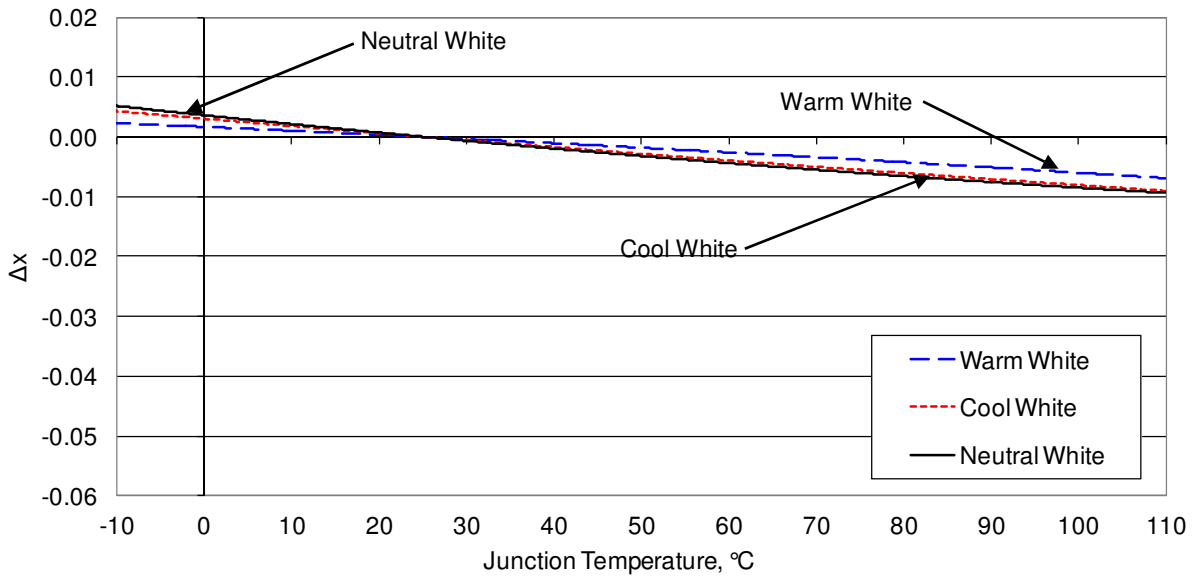


Figure 9: Typical ccx Shift vs. Junction Temperature



Typical Forward Current Characteristics

Figure 10: Typical Current vs. Voltage,
BXRA-xxx0540-A, BXRA-40E0600-A, BXRA-XXC0700-A

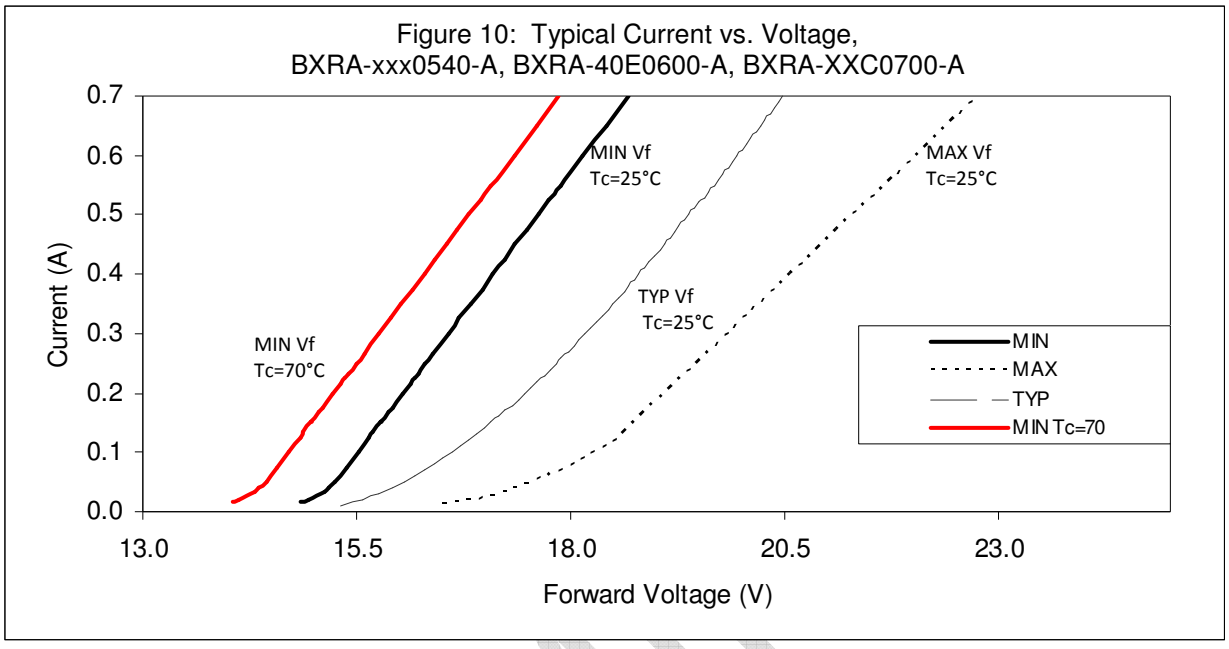
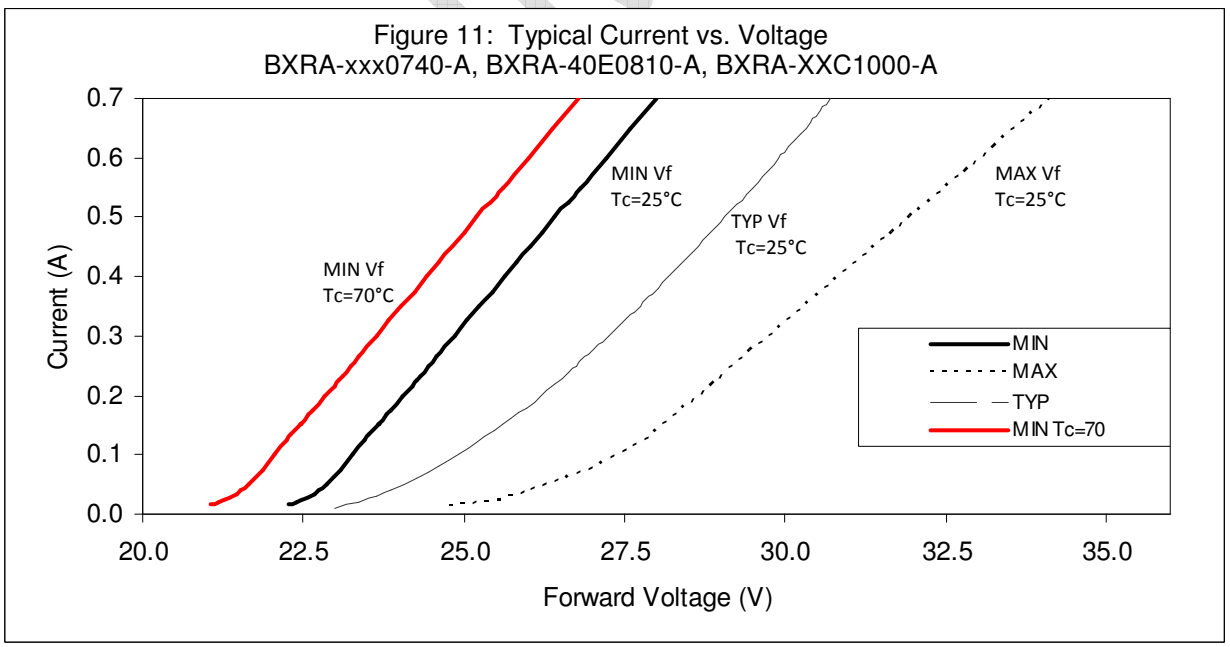
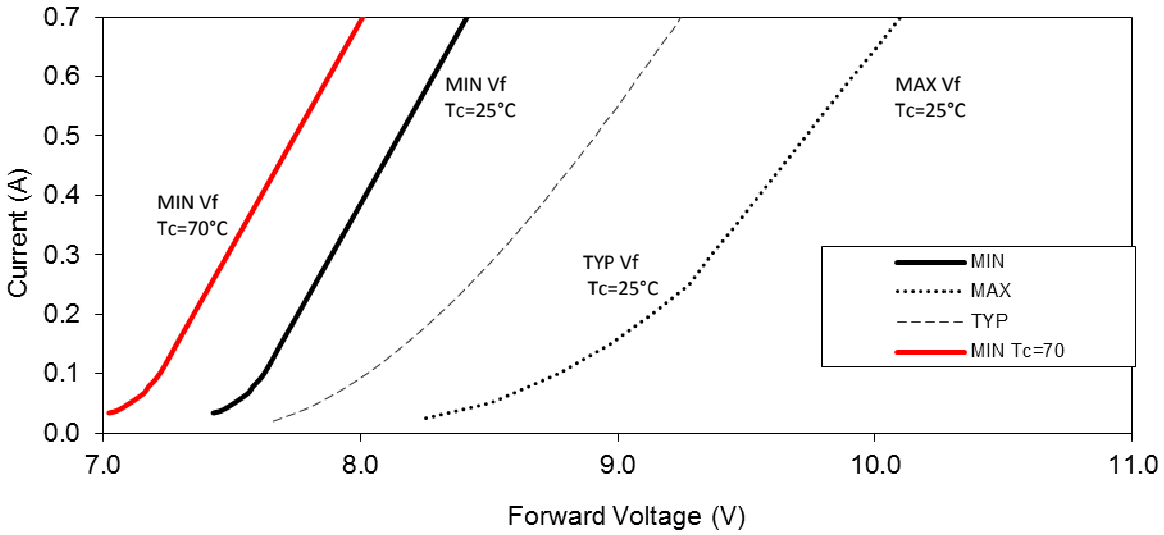


Figure 11: Typical Current vs. Voltage
BXRA-xxx0740-A, BXRA-40E0810-A, BXRA-XXC1000-A



Typical Forward Current Characteristics (continued)

Figure 12: Typical Current vs. Voltage
BXRA-50C0700-B



Color Binning Information

Figure 13: Graph of Warm White Test Bins in xy Color Space

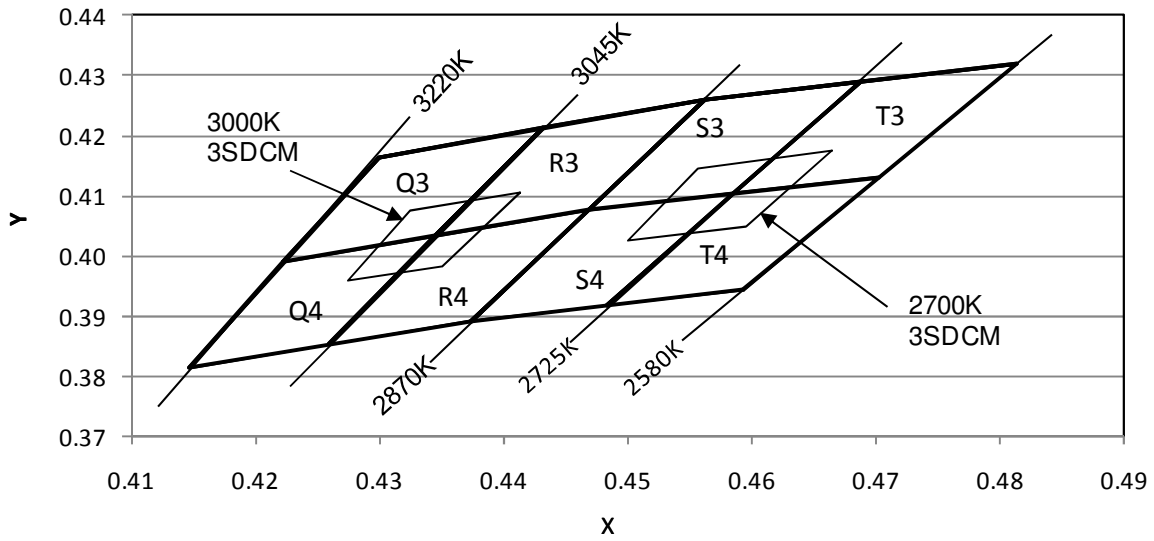


Table 10: Warm White xy Bin Coordinates and Associated Typical CCT

Bin Code	X	Y	ANSI CCT (K)
Q3	0.4223 0.4299 0.4431 0.4345	0.3990 0.4165 0.4213 0.4033	3000
Q4	0.4147 0.4223 0.4345 0.4260	0.3814 0.3990 0.4033 0.3854	3000
R3	0.4345 0.4431 0.4562 0.4468	0.4033 0.4213 0.4260 0.4077	3000
R4	0.4260 0.4345 0.4468 0.4373	0.3854 0.4033 0.4077 0.3893	3000
X3 (3SDCM)	0.4413 0.4325 0.4274 0.4350	0.4107 0.4075 0.3958 0.3984	3000

Bin Code	X	Y	ANSI CCT (K)
S3	0.4468 0.4562 0.4688 0.4585	0.4077 0.4260 0.4290 0.4104	2700
S4	0.4373 0.4468 0.4585 0.4483	0.3893 0.4077 0.4104 0.3919	2700
T4	0.4585 0.4688 0.4813 0.4703	0.4104 0.4290 0.4319 0.4132	2700
T3	0.4483 0.4585 0.4703 0.4593	0.3919 0.4104 0.4132 0.3944	2700
X3 (3SDCM)	0.4656 0.4573 0.4510 0.4583	0.4174 0.4154 0.4032 0.4049	2700

Color Binning Information (continued)

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

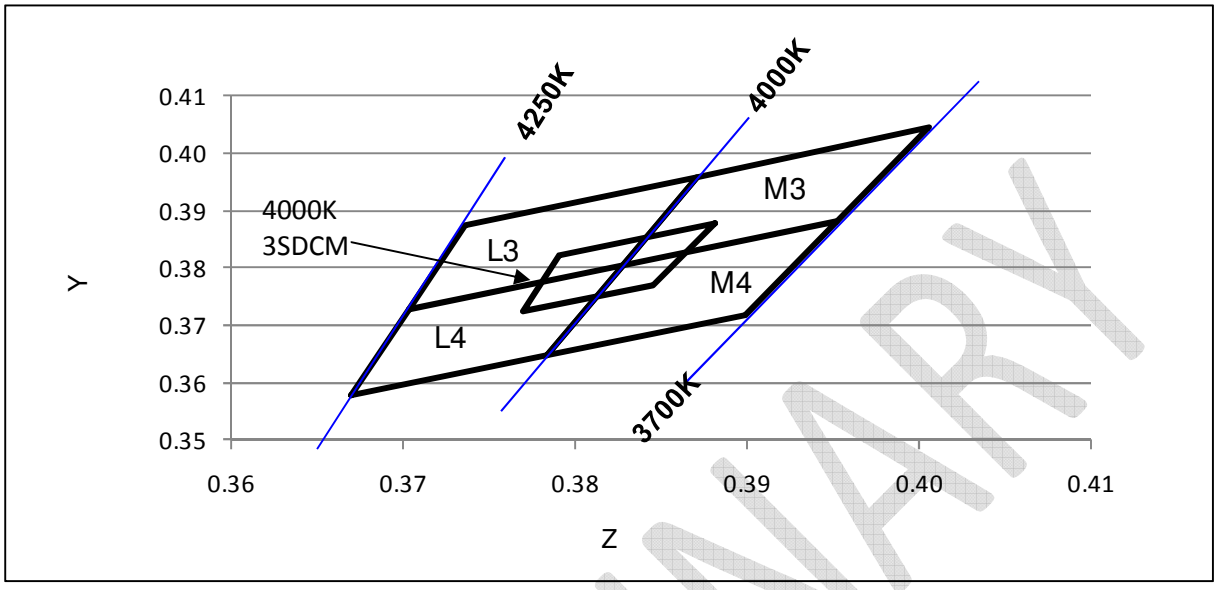


Table 11: Neutral White xy Bin Coordinates and Associated Typical CCT

Bin Code	X	Y	ANSI CCT (K)
L3	0.3703 0.3736 0.3871 0.3828	0.3726 0.3874 0.3959 0.3803	4000
L4	0.3670 0.3703 0.3828 0.3784	0.3578 0.3726 0.3803 0.3647	4000
M3	0.3828 0.3871 0.4006 0.3952	0.3803 0.3959 0.4044 0.3880	4000
M4	0.3784 0.3828 0.3952 0.3898	0.3647 0.3803 0.3880 0.3716	4000
X3 (3SDCM)	0.3881 0.3791 0.3769 0.3845	0.3879 0.3823 0.3724 0.3770	4000

Color Binning Information (continued)

Figure 15: Graph of Cool White Test Bins in xy Color Space

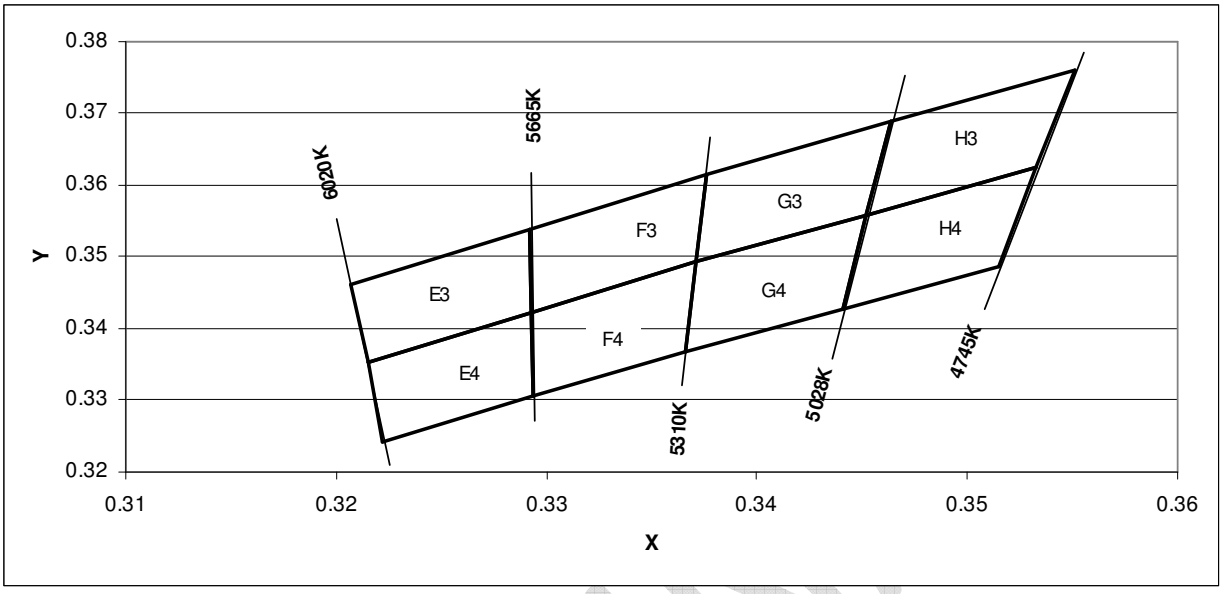


Table 12: Cool White xy Bin Coordinates and Associated Typical CCT

Bin Code	X	Y	ANSI CCT (K)
G3	0.3376	0.3616	5000
	0.3464	0.3688	
	0.3452	0.3558	
	0.3371	0.3493	
G4	0.3371	0.3493	5000
	0.3452	0.3558	
	0.3441	0.3428	
	0.3366	0.3369	
H3	0.3464	0.3688	5000
	0.3551	0.376	
	0.3533	0.3624	
	0.3452	0.3558	
H4	0.3452	0.3558	5000
	0.3533	0.3624	
	0.3515	0.3487	
	0.3441	0.3428	

Bin Code	X	Y	ANSI CCT (K)
E3	0.3215	0.3353	5600
	0.3293	0.3423	
	0.3292	0.3539	
	0.3207	0.3462	
E4	0.3222	0.3243	5600
	0.3294	0.3306	
	0.3293	0.3423	
	0.3215	0.3353	
F3	0.3292	0.3539	5600
	0.3293	0.3423	
	0.3371	0.3493	
	0.3376	0.3616	
F4	0.3294	0.3306	5600
	0.3366	0.3369	
	0.3371	0.3493	
	0.3293	0.3423	

Design Resources

Bridgelux has developed a comprehensive set of application notes and design resources to assist customers in successfully designing with Bridgelux LED Array products. Included below is a list of available resources which can be downloaded from the Bridgelux web site under the Design Resources section. These documents are updated regularly as new information becomes available, including complimentary infrastructure products such as commercially available secondary optics and electronic driver solutions.

Application Notes

- AN10: Effective Thermal Management of Bridgelux LED Arrays
- AN11: Assembly Considerations for Bridgelux LED Arrays
- AN12: Electrical Drive Considerations for Bridgelux LED Arrays
- AN14: Reliability Data Sheet for Bridgelux LED Arrays
- AN15: Reflow Soldering of Bridgelux LED Arrays
- AN16: Optical Considerations for Bridgelux LED Arrays
- DS19: Bridgelux LED Array Data Sheet for Packing and Labeling

Optical Source Models

Optical source models and ray set files are available for all Bridgelux LED Array products, and can be downloaded directly from the Bridgelux web site. The list below contains the formats currently available. If you require a specific format not included in this list, please contact your Bridgelux sales representative for assistance.

- Zemax
- ASAP
- IESNA
- LightTools
- LucidShape
- OPTIS SPEOS
- PHOTOPIA
- TracePro
- Radiant Imaging Source Model

3D CAD Models

Three dimensional CAD models depicting the product outline of all Bridgelux LED Arrays are available in both SAT and STEP formats. These CAD files can be downloaded directly from the Bridgelux web site.

About Bridgelux

Bridgelux is a leading developer and manufacturer of technologies and solutions transforming the $40 billion global lighting industry into a $100 billion market opportunity. Based in Livermore, California, Bridgelux is a pioneer in solid-state lighting (SSL), expanding the market for light-emitting diode (LED) technologies by driving down the cost of LED lighting systems. Bridgelux's patented light source technology replaces traditional technologies (such as incandescent, halogen, fluorescent and high intensity discharge lighting) with integrated, solid-state lighting solutions that enable lamp and luminaire manufacturers to provide high performance and energy-efficient white light for the rapidly growing interior and exterior lighting markets, including street lights, commercial lighting and consumer applications. With more than 550 patent applications filed or granted worldwide, Bridgelux is the only vertically integrated LED manufacturer and developer of solid-state light sources that designs its solutions specifically for the lighting industry.

For more information about the company, please visit www.bridgelux.com