Bridgelux® Vero® SE 29 Array

Product Data Sheet DS123

10 TEN YEAR Warranty™

BXRC-27x10K0 | 30x10K0 | 35x10K0 | 40x10K0 | 50x10K1 | 57x10K1 | 65x10K1

Introduction

Vero SE

Vero® SE Series represents a state of the art COB solution with revolutionary advancements in LED integration technology. Vero SE's innovative light source system integrates Bridgelux's seventh generation COB technology with poke-in connectivity that enables solder free installation. Vero SE LED light sources streamline assembly processes, lower manufacturing cost, simplify luminaire design, improve light quality and increase design flexibility.

Vero SE poke-in connectivity simplifies manufacturing and assembly processes by eliminating the need to solder. Secondary connector and holder components are not required, allowing for rapid integration of arrays into fixtures and an efficient field replaceable solution.

Vero SE is available in four different light emitting surface (LES) configurations and has been engineered to reliably operate over a broad current range, enabling new degrees of flexibility in luminaire design optimization. Vero SE arrays deliver increased lumen density for improved beam control and precision lighting with 2 and 3 SDCM color control standards for clean and consistent uniform lighting.

Features

- Poke-in connectivity
- Efficacy of 155 lm/W typical
- Vero SE 29 lumen output performance ranges from 5,368 to 37,173 lumens
- Broad range of CCT options from 2700K to 6500K
- CRI options: minimum 70, 80, and 90
- Color control: 2 and 3 SDCM for 2700K-4000K CCT
- Reliable operation at up to 2X nominal drive current
- Radial die pattern and improved lumen density
- Top side part number markings
- No exposed solder pads or electrical connections

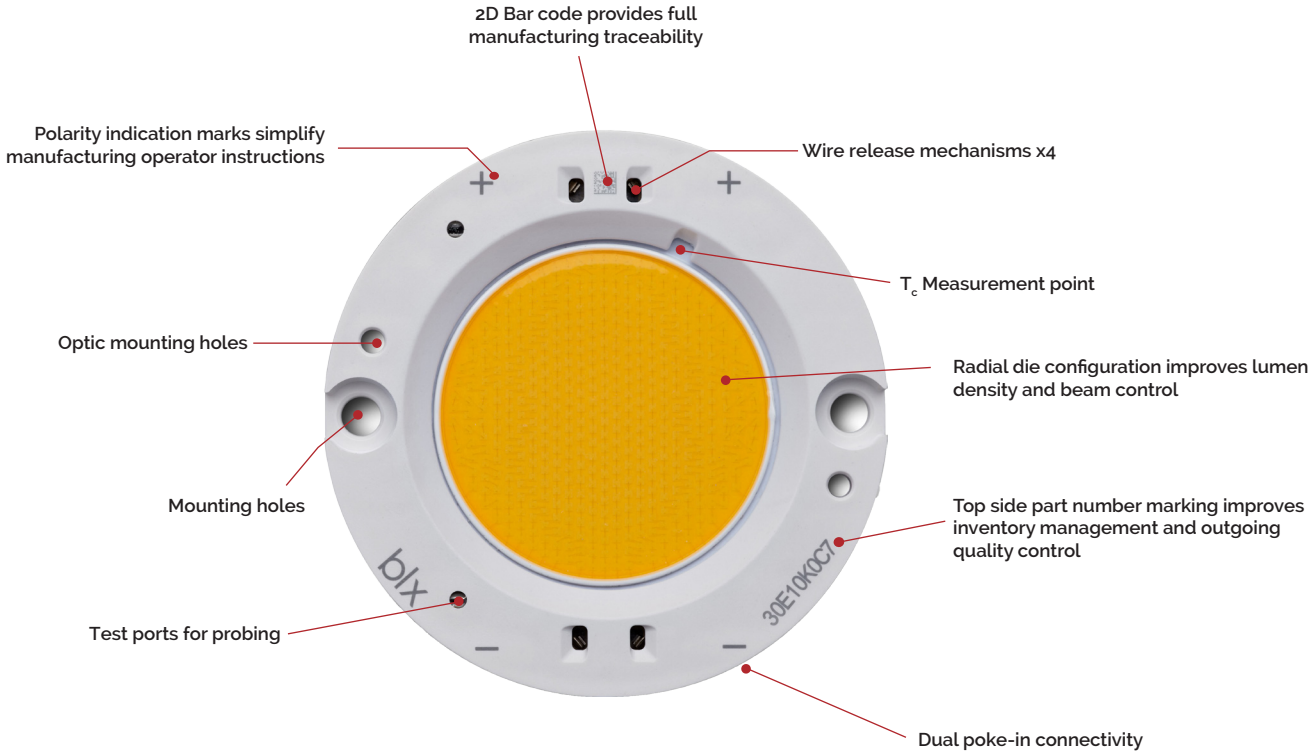
Benefits

- Poke-in connectivity enables solderless, connector free installation
- Broad application coverage for interior and exterior lighting
- Flexibility for application driven lighting design requirements
- High quality, true color reproduction
- Uniform consistent white light
- Flexibility in design optimization
- Enhanced ease of use and assembly
- Ability to configure multiple arrays in series and parallel reduces customer driver cost
- Improved inventory management and quality control

Contents

Product Feature Map

Vero SE 29 is the largest form factor in the product family of next generation solid state light sources. In addition to delivering the performance and light quality required for many lighting applications, Vero SE incorporates several features to simplify the design integration and manufacturing process, accelerate time to market and reduce system costs. Please visit www.bridgelux.com for more information on the Vero SE Series family of products.



Product Nomenclature

The part number designation for Bridgelux Vero SE 29 LED arrays is explained as follows:

1 2 3 4 – 5 6 7 8 9 10 11 – 12 – 13 14 - 15 16

BXRC – 30 E 10K⓪ – C – 7 3 - SE

Product Family

Nominal CCT
27 = 2,700K
30 = 3,000K
35 = 3,500K
40 = 4,000K
50 = 5,000K
57 = 5,700K
65 = 6,500K

Minimum CRI
C = 70 CRI
E = 80 CRI
G = 90 CRI

Flux Indicator
10Kx = 10,000lm

Color Targeting Designator
0 = Cold Targeted (2700K - 4000K)
1 = Hot Targeted (5000K - 6500K)

Array Configuration

Gen. 7

CCT Bin Options
2 = 2 SDCM
3 = 3 SDCM
4 = 4 SDCM

Special Edition

Product Selection Guide

The following product configurations are available:

Table 1: Selection Guide, Pulsed Measurement Data (T_j = T_c = 25˚C)

Part Number	Nominal CCT[1] (K)	CRI[2]	Drive Current[3] (mA)	Typical Pulsed Flux[4,5,6] T_c = 25°C (lm)	Minimum Pulsed Flux[6,7] T_c = 25°C (lm)	Typical V_f (V)	Typical Power (W)	Typical Efficacy (lm/W)
BXRC-27E10K0-B-7X-SE	2700	80	1800	13899	12509	52.0	93.6	148
BXRC-27E10K0-C-7X-SE	2700	80	1710	17605	15844	69.4	118.7	148
BXRC-27E10K0-D-7X-SE	2700	80	2100	11711	10540	37.6	79.0	148
BXRC-27G10K0-B-7X-SE	2700	90	1800	11582	10424	52.0	93.6	124
BXRC-27G10K0-C-7X-SE	2700	90	1710	14671	13204	69.4	118.7	124
BXRC-27G10K0-D-7X-SE	2700	90	2100	9759	8783	37.6	79.0	124
BXRC-30E10K0-B-7X-SE	3000	80	1800	14478	13030	52.0	93.6	155
BXRC-30E10K0-C-7X-SE	3000	80	1710	18339	16505	69.4	118.7	155
BXRC-30E10K0-D-7X-SE	3000	80	2100	12565	10979	37.6	79.0	159
BXRC-30G10K0-B-7X-SE	3000	90	1800	12017	10815	52.0	93.6	128
BXRC-30G10K0-C-7X-SE	3000	90	1710	15221	13699	69.4	118.7	128
BXRC-30G10K0-D-7X-SE	3000	90	2100	10125	9112	37.6	79.0	128
BXRC-35E10K0-B-7X-SE	3500	80	1800	14912	13421	52.0	93.6	159
BXRC-35E10K0-C-7X-SE	3500	80	1710	18889	16999	69.4	118.7	159
BXRC-35E10K0-D-7X-SE	3500	80	2100	12565	11309	37.6	79.0	159
BXRC-35G10K0-B-7X-SE	3500	90	1800	12451	11206	52.0	93.6	133
BXRC-35G10K0-C-7X-SE	3500	90	1710	15771	14194	69.4	118.7	133
BXRC-35G10K0-D-7X-SE	3500	90	2100	10491	9442	37.6	79.0	133
BXRC-40E10K0-B-7X-SE	4000	80	1800	15057	13551	52.0	93.6	161
BXRC-40E10K0-C-7X-SE	4000	80	1710	19072	17165	69.4	118.7	161
BXRC-40E10K0-D-7X-SE	4000	80	2100	12687	11418	37.6	79.0	161
BXRC-40G10K0-B-7X-SE	4000	90	1800	12885	11597	52.0	93.6	138
BXRC-40G10K0-C-7X-SE	4000	90	1710	16321	14689	69.4	118.7	138
BXRC-40G10K0-D-7X-SE	4000	90	2100	10857	9772	37.6	79.0	138
BXRC-50C10K1-B-74-SE	5000	70	1800	16505	14855	52.0	93.6	176
BXRC-50C10K1-C-74-SE	5000	70	1710	20906	18816	69.4	118.7	176
BXRC-50C10K1-D-74-SE	5000	70	2100	13907	12516	37.6	79.0	176
BXRC-50E10K1-B-74-SE	5000	80	1800	15515	13963	52.0	93.6	166
BXRC-50E10K1-C-74-SE	5000	80	1710	19652	17687	69.4	118.7	166
BXRC-50E10K1-D-74-SE	5000	80	2100	13072	11766	37.6	79.0	166

Notes for Table 1:

1. Nominal CCT as defined by ANSI C78.377-2011. Products with CCTs 5000K-6500K are hot targeted to T_c = 85˚C.
2. CRI values are minimums. Minimum R9 value for 80 CRI products is 0, the minimum R9 values for 90 CRI products is 50.
3. Drive current is referred to as nominal drive current.
4. Products tested under pulsed condition (10ms pulse width) at nominal test current where T_j (junction temperature) = T_c (case temperature) = 25˚C.
5. Typical performance values are provided as a reference only and not a guarantee of performance.
6. Bridgelux maintains a ±7% tolerance on flux measurements.
7. Minimum flux values at the nominal test current are guaranteed by 100% test.

Product Selection Guide

The following product configurations are available:

Table 1: Selection Guide, Pulsed Measurement Data (T_j = T_c = 25˚C) (continued)

Part Number	Nominal CCT[1] (K)	CRI[2]	Drive Current[3] (mA)	Typical Pulsed Flux[4,5,6] T_c = 25°C (lm)	Minimum Pulsed Flux[6,7] T_c = 25°C (lm)	Typical V_f (V)	Typical Power (W)	Typical Efficacy (lm/W)
BXRC-50G10K1-B-74-SE	5000	90	1800	13204	11883	52.0	93.6	141
BXRC-50G10K1-C-74-SE	5000	90	1710	16725	15052	69.4	118.7	141
BXRC-50G10K1-D-74-SE	5000	90	2100	11125	10013	37.6	79.0	141
BXRC-57C10K1-B-74-SE	5700	70	1800	15926	14333	52.0	93.6	170
BXRC-57C10K1-C-74-SE	5700	70	1710	20172	18155	69.4	118.7	170
BXRC-57C10K1-D-74-SE	5700	70	2100	13419	12077	37.6	79.0	170
BXRC-57E10K1-B-74-SE	5700	80	1800	15781	14202	52.0	93.6	169
BXRC-57E10K1-C-74-SE	5700	80	1710	19989	17990	69.4	118.7	168
BXRC-57E10K1-D-74-SE	5700	80	2100	13297	11967	37.6	79.0	168
BXRC-65C10K1-B-74-SE	6500	70	1800	16215	14593	52.0	93.6	173
BXRC-65C10K1-C-74-SE	6500	70	1710	20539	18486	69.4	118.7	173
BXRC-65C10K1-D-74-SE	6500	70	2100	13663	12296	37.6	79.0	173
BXRC-65E10K1-B-74-SE	6500	80	1800	16070	14464	52.0	93.6	172
BXRC-65E10K1-C-74-SE	6500	80	1710	20356	18320	69.4	118.7	172
BXRC-65E10K1-D-74-SE	6500	80	2100	13541	12186	37.6	79.0	171

Notes for Table 1:

1. Nominal CCT as defined by ANSI C78.377-2011. Products with a CCT of 5000K-6500K are hot targeted to T_c = 85˚C.
2. CRI values are minimums. Minimum R9 value for 80 CRI products is 0, the minimum R9 values for 90 CRI products is 50.
3. Drive current is referred to as nominal drive current.
4. Products tested under pulsed condition (10ms pulse width) at nominal test current where T_j (junction temperature) = T_c (case temperature) = 25˚C.
5. Typical performance values are provided as a reference only and not a guarantee of performance.
6. Bridgelux maintains a ±7% tolerance on flux measurements.
7. Minimum flux values at the nominal test current are guaranteed by 100% test.

Product Selection Guide

The following product configurations are available:

Table 2: Selection Guide, Stabilized DC Performance (T_c = 85°C) [4,5]

Part Number	Nominal CCT[1] (K)	CRI[2]	Drive Current[3] (mA)	Typical DC Flux T_c = 85°C (lm)	Minimum DC Flux[6] T_c = 85°C (lm)	Typical V_f (V)	Typical Power (W)	Typical Efficacy (lm/W)
BXRC-27E10K0-B-7X-SE	2700	80	1800	12509	11258	50.7	91.2	137
BXRC-27E10K0-C-7X-SE	2700	80	1710	15845	14260	68.1	116.4	136
BXRC-27E10K0-D-7X-SE	2700	80	2100	10540	9486	36.6	76.8	137
BXRC-27G10K0-B-7X-SE	2700	90	1800	10424	9381	50.7	91.2	114
BXRC-27G10K0-C-7X-SE	2700	90	1710	13204	11884	68.1	116.4	113
BXRC-27G10K0-D-7X-SE	2700	90	2100	8783	7905	36.6	76.8	114
BXRC-30E10K0-B-7X-SE	3000	80	1800	13030	11727	50.7	91.2	143
BXRC-30E10K0-C-7X-SE	3000	80	1710	16505	14854	68.1	116.4	142
BXRC-30E10K0-D-7X-SE	3000	80	2100	11309	9882	36.6	76.8	147
BXRC-30G10K0-B-7X-SE	3000	90	1800	10815	9733	50.7	91.2	119
BXRC-30G10K0-C-7X-SE	3000	90	1710	13699	12329	68.1	116.4	118
BXRC-30G10K0-D-7X-SE	3000	90	2100	9113	8201	36.6	76.8	119
BXRC-35E10K0-B-7X-SE	3500	80	1800	13421	12079	50.7	91.2	147
BXRC-35E10K0-C-7X-SE	3500	80	1710	17000	15299	68.1	116.4	146
BXRC-35E10K0-D-7X-SE	3500	80	2100	11308	10178	36.6	76.8	147
BXRC-35G10K0-B-7X-SE	3500	90	1800	11206	10085	50.7	91.2	123
BXRC-35G10K0-C-7X-SE	3500	90	1710	14194	12775	68.1	116.4	122
BXRC-35G10K0-D-7X-SE	3500	90	2100	9442	8498	36.6	76.8	123
BXRC-40E10K0-B-7X-SE	4000	80	1800	13551	12196	50.7	91.2	149
BXRC-40E10K0-C-7X-SE	4000	80	1710	17165	15448	68.1	116.4	147
BXRC-40E10K0-D-7X-SE	4000	80	2100	11418	10277	36.6	76.8	149
BXRC-40G10K0-B-7X-SE	4000	90	1800	11597	10437	50.7	91.2	127
BXRC-40G10K0-C-7X-SE	4000	90	1710	14689	13220	68.1	116.4	126
BXRC-40G10K0-D-7X-SE	4000	90	2100	9771	8794	36.6	76.8	127
BXRC-50C10K1-B-74-SE	5000	70	1800	14854	13369	50.7	91.2	163
BXRC-50C10K1-C-74-SE	5000	70	1710	18815	16934	68.1	116.4	162
BXRC-50C10K1-D-74-SE	5000	70	2100	12516	11264	36.6	76.8	163
BXRC-50E10K1-B-74-SE	5000	80	1800	13963	12567	50.7	91.2	153
BXRC-50E10K1-C-74-SE	5000	80	1710	17686	15918	68.1	116.4	152
BXRC-50E10K1-D-74-SE	5000	80	2100	11765	10589	36.6	76.8	153

Notes for Tables 2:

1. Nominal CCT as defined by ANSI C78.377-2011. Products with a CCT of 5000K-6500K are hot targeted to T_c = 85°C.
2. CRI values are minimums. Minimum R9 value for 80 CRI products is 0, the minimum R9 values for 90 CRI products is 50.
3. Drive current is referred to as nominal drive current.
4. Typical stabilized DC performance values are provided as reference only and not a guarantee of performance.
5. Typical performance is estimated based on operation under DC (direct current) with LED array mounted onto a heat sink with thermal interface material and the case temperature maintained at 85°C. Based on Bridgelux test setup, values may vary depending on the thermal design of the luminaire and/or the exposed environment to which the product is subjected.
6. Minimum flux values at elevated temperatures are provided for reference only and are not guaranteed by 100% production testing. Based on Bridgelux test setup, values may vary depending on the thermal design of the luminaire and/or the exposed environment to which the product is subjected.

Product Selection Guide

The following product configurations are available:

Table 2: Selection Guide, Stabilized DC Performance (T_c = 85˚C) [4,5] (continued)

Part Number	Nominal CCT[1] (K)	CRI[2]	Nominal Drive Current[3] (mA)	Typical DC Flux T_c = 85°C (lm)	Minimum DC Flux[6] T_c = 85°C (lm)	Typical V_f (V)	Typical Power (W)	Typical Efficacy (lm/W)
BXRC-50G10K1-B-74-SE	5000	90	1800	11883	10695	50.7	91.2	130
BXRC-50G10K1-C-74-SE	5000	90	1710	15052	13547	68.1	116.4	129
BXRC-50G10K1-D-74-SE	5000	90	2100	10013	9012	36.6	76.8	130
BXRC-57C10K1-B-74-SE	5700	70	1800	14333	12900	50.7	91.2	157
BXRC-57C10K1-C-74-SE	5700	70	1710	18155	16340	68.1	116.4	156
BXRC-57C10K1-D-74-SE	5700	70	2100	12077	10869	36.6	76.8	157
BXRC-57E10K1-B-74-SE	5700	80	1800	14203	12782	50.7	91.2	156
BXRC-57E10K1-C-74-SE	5700	80	1710	17990	16191	68.1	116.4	155
BXRC-57E10K1-D-74-SE	5700	80	2100	11967	10770	36.6	76.8	156
BXRC-65C10K1-B-74-SE	6500	70	1800	14594	13134	50.7	91.2	160
BXRC-65C10K1-C-74-SE	6500	70	1710	18485	16637	68.1	116.4	159
BXRC-65C10K1-D-74-SE	6500	70	2100	12297	11067	36.6	76.8	160
BXRC-65E10K1-B-74-SE	6500	80	1800	14463	13017	50.7	91.2	159
BXRC-65E10K1-C-74-SE	6500	80	1710	18320	16488	68.1	116.4	157
BXRC-65E10K1-D-74-SE	6500	80	2100	12187	10968	36.6	76.8	159

Notes for Tables 2:

1. Nominal CCT as defined by ANSI C78.377-2011. Products with a CCT of 5000K-6500K are hot targeted to T_c = 85˚C.
2. CRI values are minimums. Minimum R9 value for 80 CRI products is 0, the minimum R9 values for 90 CRI products is 50.
3. Drive current is referred to as nominal drive current.
4. Typical stabilized DC performance values are provided as reference only and not a guarantee of performance.
5. Typical performance is estimated based on operation under DC (direct current) with LED array mounted onto a heat sink with thermal interface material and the case temperature maintained at 85˚C. Based on Bridgelux test setup, values may vary depending on the thermal design of the luminaire and/or the exposed environment to which the product is subjected.
6. Minimum flux values at elevated temperatures are provided for reference only and are not guaranteed by 100% production testing. Based on Bridgelux test setup, values may vary depending on the thermal design of the luminaire and/or the exposed environment to which the product is subjected.

Performance at Commonly Used Drive Currents

Vero SE LED arrays are tested to the specifications shown using the nominal drive currents in Table 1. Vero SE may also be driven at other drive currents dependent on specific application design requirements. The performance at any drive current can be derived from the current vs. voltage characteristics shown in Figures 1, 2 & 3 and the flux vs. current characteristics shown in Figures 4, 5 & 6. The performance at commonly used drive currents is summarized in Table 3.

Table 3: Product Performance at Commonly Used Drive Currents

Part Number	CRI	Drive Current[1] (mA)	Typical V_f T_c = 25°C (V)	Typical Power T_c = 25°C (W)	Typical Flux[2] T_c = 25°C (lm)	Typical DC Flux[3] T_c = 85°C (lm)	Typical Efficacy T_c = 25°C (lm/W)
BXRC-27E10K0-B-7X-SE	80	900	49.6	44.7	7215	6586	162
		1200	50.5	60.6	9500	8636	157
		1800	**52.0**	**93.6**	**13899**	**12509**	**148**
		2700	54.1	146.1	20035	17867	137
		3600	55.8	201.0	25642	22593	128
BXRC-27E10K0-C-7X-SE	80	855	66.2	56.6	10001	9517	177
		1140	67.3	76.7	12711	11725	166
		1710	**69.4**	**118.7**	**17605**	**15845**	**148**
		2565	72.1	185.0	24975	21480	135
		3420	74.4	254.6	31304	26304	123
BXRC-27E10K0-D-7X-SE	80	1050	35.4	37.2	6442	6276	173
		1400	36.2	50.6	8290	7715	164
		2100	**37.6**	**79.0**	**11711**	**10540**	**148**
		3150	39.5	124.4	16672	14048	134
		4200	41.2	172.9	21013	17159	122
BXRC-27G10K0-B-7X-SE	90	900	49.6	44.7	6013	5488	135
		1200	50.5	60.6	7917	7197	131
		1800	**52.0**	**93.6**	**11582**	**10424**	**124**
		2700	54.1	146.1	16696	14890	114
		3600	55.8	201.0	21369	18827	106
BXRC-27G10K0-C-7X-SE	90	855	66.2	56.6	8334	7931	147
		1140	67.3	76.7	10593	9771	138
		1710	**69.4**	**118.7**	**14671**	**13204**	**124**
		2565	72.1	185.0	20812	17900	113
		3420	74.4	254.6	26086	21920	102
BXRC-27G10K0-D-7X-SE	90	1050	35.4	37.2	5368	5230	144
		1400	36.2	50.6	6908	6429	136
		2100	**37.6**	**79.0**	**9759**	**8783**	**124**
		3150	39.5	124.4	13894	11707	112
		4200	41.2	172.9	17511	14299	101

Notes for Table 3:

1. Alternate drive currents in Table 3 are provided for reference only and are not a guarantee of performance.
2. Bridgelux maintains a ± 7% tolerance on flux measurements.
3. Typical stabilized DC performance values are provided as reference only and not a guarantee of performance.

Performance at Commonly Used Drive Currents

Table 3: Product Performance at Commonly Used Drive Currents (Continued)

Part Number	CRI	Drive Current[1] (mA)	Typical V_f T_c = 25°C (V)	Typical Power T_c = 25°C (W)	Typical Flux[2] T_c = 25°C (lm)	Typical DC Flux[3] T_c = 85°C (lm)	Typical Efficacy T_c = 25°C (lm/W)
BXRC-30E10K0-B-7X-SE	80	900	49.6	44.7	7516	6861	168
		1200	50.5	60.6	9896	8996	163
		1800	**52.0**	**93.6**	**14478**	**13030**	**155**
		2700	54.1	146.1	20870	18612	143
		3600	55.8	201.0	26711	23534	133
BXRC-30E10K0-C-7X-SE	80	855	66.2	56.6	10418	9913	184
		1140	67.3	76.7	13241	12214	173
		1710	**69.4**	**118.7**	**18339**	**16505**	**155**
		2565	72.1	185.0	26016	22375	141
		3420	74.4	254.6	32608	27400	128
BXRC-30E10K0-D-7X-SE	80	1050	35.4	37.2	6912	6734	186
		1400	36.2	50.6	8895	8278	176
		2100	**37.6**	**79.0**	**12565**	**11309**	**159**
		3150	39.5	124.4	17889	15073	144
		4200	41.2	172.9	22546	18411	130
BXRC-30G10K0-B-7X-SE	90	900	49.6	44.7	6238	5694	140
		1200	50.5	60.6	8214	7466	136
		1800	**52.0**	**93.6**	**12017**	**10815**	**128**
		2700	54.1	146.1	17322	15448	119
		3600	55.8	201.0	22170	19533	110
BXRC-30G10K0-C-7X-SE	90	855	66.2	56.6	8647	8228	153
		1140	67.3	76.7	10990	10137	143
		1710	**69.4**	**118.7**	**15221**	**13699**	**128**
		2565	72.1	185.0	21593	18572	117
		3420	74.4	254.6	27065	22742	106
BXRC-30G10K0-D-7X-SE	90	1050	35.4	37.2	5569	5427	150
		1400	36.2	50.6	7168	6670	142
		2100	**37.6**	**79.0**	**10125**	**9113**	**128**
		3150	39.5	124.4	14415	12146	116
		4200	41.2	172.9	18167	14835	105
BXRC-35E10K0-B-7X-SE	80	900	49.6	44.7	7741	7066	173
		1200	50.5	60.6	10193	9266	168
		1800	**52.0**	**93.6**	**14912**	**13421**	**159**
		2700	54.1	146.1	21496	19170	147
		3600	55.8	201.0	27512	24240	137
BXRC-35E10K0-C-7X-SE	80	855	66.2	56.6	10730	10211	190
		1140	67.3	76.7	13638	12580	178
		1710	**69.4**	**118.7**	**18889**	**17000**	**159**
		2565	72.1	185.0	26796	23047	145
		3420	74.4	254.6	33586	28222	132
BXRC-35E10K0-D-7X-SE	80	1050	35.4	37.2	6911	6734	186
		1400	36.2	50.6	8895	8278	176
		2100	**37.6**	**79.0**	**12565**	**11308**	**159**
		3150	39.5	124.4	17888	15072	144
		4200	41.2	172.9	22545	18410	130

Notes for Table 3:

1. Alternate drive currents in Table 3 are provided for reference only and are not a guarantee of performance.
2. Bridgelux maintains a ± 7% tolerance on flux measurements.
3. Typical stabilized DC performance values are provided as reference only and not a guarantee of performance.

Performance at Commonly Used Drive Currents

Table 3: Product Performance at Commonly Used Drive Currents (Continued)

Part Number	CRI	Drive Current[1] (mA)	Typical V_f T_c = 25°C (V)	Typical Power T_c = 25°C (W)	Typical Flux[2] T_c = 25°C (lm)	Typical DC Flux[3] T_c = 85°C (lm)	Typical Efficacy T_c = 25°C (lm/W)
BXRC-35G10K0-B-7X-SE	90	900	49.6	44.7	6464	5900	145
		1200	50.5	60.6	8511	7736	141
		1800	**52.0**	**93.6**	**12451**	**11206**	**133**
		2700	54.1	146.1	17948	16006	123
		3600	55.8	201.0	22971	20239	114
BXRC-35G10K0-C-7X-SE	90	855	66.2	56.6	8959	8525	158
		1140	67.3	76.7	11387	10504	148
		1710	**69.4**	**118.7**	**15771**	**14194**	**133**
		2565	72.1	185.0	22373	19243	121
		3420	74.4	254.6	28043	23564	110
BXRC-35G10K0-D-7X-SE	90	1050	35.4	37.2	5771	5623	155
		1400	36.2	50.6	7427	6912	147
		2100	**37.6**	**79.0**	**10491**	**9442**	**133**
		3150	39.5	124.4	14936	12585	120
		4200	41.2	172.9	18824	15372	109
BXRC-40E10K0-B-7X-SE	80	900	49.6	44.7	7816	7135	175
		1200	50.5	60.6	10292	9356	170
		1800	**52.0**	**93.6**	**15057**	**13551**	**161**
		2700	54.1	146.1	21704	19356	149
		3600	55.8	201.0	27779	24476	138
BXRC-40E10K0-C-7X-SE	80	855	66.2	56.6	10834	10310	191
		1140	67.3	76.7	13770	12702	180
		1710	**69.4**	**118.7**	**19072**	**17165**	**161**
		2565	72.1	185.0	27056	23270	146
		3420	74.4	254.6	33912	28496	133
BXRC-40E10K0-D-7X-SE	80	1050	35.4	37.2	6978	6800	188
		1400	36.2	50.6	8981	8358	177
		2100	**37.6**	**79.0**	**12687**	**11418**	**161**
		3150	39.5	124.4	18062	15219	145
		4200	41.2	172.9	22764	18589	132
BXRC-40G10K0-B-7X-SE	90	900	49.6	44.7	6689	6106	150
		1200	50.5	60.6	8808	8006	145
		1800	**52.0**	**93.6**	**12885**	**11597**	**138**
		2700	54.1	146.1	18574	16565	127
		3600	55.8	201.0	23773	20945	118
BXRC-40G10K0-C-7X-SE	90	855	66.2	56.6	9272	8823	164
		1140	67.3	76.7	11784	10870	154
		1710	**69.4**	**118.7**	**16321**	**14689**	**138**
		2565	72.1	185.0	23154	19914	125
		3420	74.4	254.6	29021	24386	114
BXRC-40G10K0-D-7X-SE	90	1050	35.4	37.2	5972	5819	160
		1400	36.2	50.6	7686	7153	152
		2100	**37.6**	**79.0**	**10857**	**9771**	**138**
		3150	39.5	124.4	15457	13024	124
		4200	41.2	172.9	19481	15908	113

Notes for Table 3:

1. Alternate drive currents in Table 3 are provided for reference only and are not a guarantee of performance.
2. Bridgelux maintains a ± 7% tolerance on flux measurements.
3. Typical stabilized DC performance values are provided as reference only and not a guarantee of performance.

Performance at Commonly Used Drive Currents

Table 3: Product Performance at Commonly Used Drive Currents (Continued)

Part Number	CRI	Drive Current[1] (mA)	Typical V_f T_c = 25°C (V)	Typical Power T_c = 25°C (W)	Typical Flux[2] T_c = 25°C (lm)	Typical DC Flux[3] T_c = 85°C (lm)	Typical Efficacy T_c = 25°C (lm/W)
BXRC-50C10K1-B-74-SE	70	900	49.6	44.7	8568	7821	192
		1200	50.5	60.6	11282	10255	186
		1800	**52.0**	**93.6**	**16505**	**14854**	**176**
		2700	54.1	146.1	23791	21218	163
		3600	55.8	201.0	30450	26829	151
BXRC-50C10K1-C-74-SE	70	855	66.2	56.6	11876	11301	210
		1140	67.3	76.7	15094	13924	197
		1710	**69.4**	**118.7**	**20906**	**18815**	**176**
		2565	72.1	185.0	29658	25508	160
		3420	74.4	254.6	37173	31236	146
BXRC-50C10K1-D-74-SE	70	1050	35.4	37.2	7649	7453	206
		1400	36.2	50.6	9845	9162	194
		2100	**37.6**	**79.0**	**13907**	**12516**	**176**
		3150	39.5	124.4	19798	16682	159
		4200	41.2	172.9	24953	20376	144
BXRC-50E10K1-B-74-SE	80	900	49.6	44.7	8054	7352	180
		1200	50.5	60.6	10605	9640	175
		1800	**52.0**	**93.6**	**15515**	**13963**	**166**
		2700	54.1	146.1	22364	19945	153
		3600	55.8	201.0	28623	25219	142
BXRC-50E10K1-C-74-SE	80	855	66.2	56.6	11163	10623	197
		1140	67.3	76.7	14189	13088	185
		1710	**69.4**	**118.7**	**19652**	**17686**	**166**
		2565	72.1	185.0	27878	23977	151
		3420	74.4	254.6	34943	29362	137
BXRC-50E10K1-D-74-SE	80	1050	35.4	37.2	7190	7006	193
		1400	36.2	50.6	9254	8612	183
		2100	**37.6**	**79.0**	**13072**	**11765**	**166**
		3150	39.5	124.4	18610	15681	150
		4200	41.2	172.9	23456	19154	136
BXRC-50G10K1-B-74-SE	90	900	49.6	44.7	6854	6257	153
		1200	50.5	60.6	9025	8204	149
		1800	**52.0**	**93.6**	**13204**	**11883**	**141**
		2700	54.1	146.1	19033	16974	130
		3600	55.8	201.0	24360	21463	121
BXRC-50G10K1-C-74-SE	90	855	66.2	56.6	9501	9041	168
		1140	67.3	76.7	12076	11139	157
		1710	**69.4**	**118.7**	**16725**	**15052**	**141**
		2565	72.1	185.0	23726	20406	128
		3420	74.4	254.6	29738	24989	117
BXRC-50G10K1-D-74-SE	90	1050	35.4	37.2	6120	5963	164
		1400	36.2	50.6	7876	7329	156
		2100	**37.6**	**79.0**	**11125**	**10013**	**141**
		3150	39.5	124.4	15839	13345	127
		4200	41.2	172.9	19962	16301	115

Notes for Table 3:

1. Alternate drive currents in Table 3 are provided for reference only and are not a guarantee of performance.
2. Bridgelux maintains a ± 7% tolerance on flux measurements.
3. Typical stabilized DC performance values are provided as reference only and not a guarantee of performance.

Performance at Commonly Used Drive Currents

Table 3: Product Performance at Commonly Used Drive Currents (Continued)

Part Number	CRI	Drive Current[1] (mA)	Typical V_f T_c = 25°C (V)	Typical Power T_c = 25°C (W)	Typical Flux[2] T_c = 25°C (lm)	Typical DC Flux[3] T_c = 85°C (lm)	Typical Efficacy T_c = 25°C (lm/W)
BXRC-57C10K1-B-74-SE	70	900	49.6	44.7	8267	7547	185
		1200	50.5	60.6	10886	9895	180
		1800	**52.0**	**93.6**	**15926**	**14333**	**170**
		2700	54.1	146.1	22957	20473	157
		3600	55.8	201.0	29382	25888	146
BXRC-57C10K1-C-74-SE	70	855	66.2	56.6	11459	10905	203
		1140	67.3	76.7	14565	13435	190
		1710	**69.4**	**118.7**	**20172**	**18155**	**170**
		2565	72.1	185.0	28617	24613	155
		3420	74.4	254.6	35869	30140	141
BXRC-57C10K1-D-74-SE	70	1050	35.4	37.2	7381	7192	198
		1400	36.2	50.6	9499	8840	188
		2100	**37.6**	**79.0**	**13419**	**12077**	**170**
		3150	39.5	124.4	19104	16097	154
		4200	41.2	172.9	24077	19661	139
BXRC-57E10K1-B-74-SE	80	900	49.6	44.7	8192	7478	183
		1200	50.5	60.6	10787	9805	178
		1800	**52.0**	**93.6**	**15781**	**14203**	**169**
		2700	54.1	146.1	22748	20287	156
		3600	55.8	201.0	29115	25652	145
BXRC-57E10K1-C-74-SE	80	855	66.2	56.6	11355	10805	201
		1140	67.3	76.7	14432	13313	188
		1710	**69.4**	**118.7**	**19989**	**17990**	**168**
		2565	72.1	185.0	28357	24389	153
		3420	74.4	254.6	35543	29866	140
BXRC-57E10K1-D-74-SE	80	1050	35.4	37.2	7314	7126	197
		1400	36.2	50.6	9413	8760	186
		2100	**37.6**	**79.0**	**13297**	**11967**	**168**
		3150	39.5	124.4	18930	15950	152
		4200	41.2	172.9	23859	19483	138
BXRC-65C10K1-B-74-SE	70	900	49.6	44.7	8418	7684	188
		1200	50.5	60.6	11084	10075	183
		1800	**52.0**	**93.6**	**16215**	**14594**	**173**
		2700	54.1	146.1	23374	20845	160
		3600	55.8	201.0	29916	26358	149
BXRC-65C10K1-C-74-SE	70	855	66.2	56.6	11668	11103	206
		1140	67.3	76.7	14830	13679	193
		1710	**69.4**	**118.7**	**20539**	**18485**	**173**
		2565	72.1	185.0	29137	25060	158
		3420	74.4	254.6	36521	30688	143
BXRC-65C10K1-D-74-SE	70	1050	35.4	37.2	7515	7323	202
		1400	36.2	50.6	9672	9001	191
		2100	**37.6**	**79.0**	**13663**	**12297**	**173**
		3150	39.5	124.4	19451	16389	156
		4200	41.2	172.9	24515	20019	142

Notes for Table 3:

1. Alternate drive currents in Table 3 are provided for reference only and are not a guarantee of performance.
2. Bridgelux maintains a ± 7% tolerance on flux measurements.
3. Typical stabilized DC performance values are provided as reference only and not a guarantee of performance.

Performance at Commonly Used Drive Currents

Table 3: Product Performance at Commonly Used Drive Currents (Continued)

Part Number	CRI	Drive Current[1] (mA)	Typical V_f T_c = 25°C (V)	Typical Power T_c = 25°C (W)	Typical Flux[2] T_c = 25°C (lm)	Typical DC Flux[3] T_c = 85°C (lm)	Typical Efficacy T_c = 25°C (lm/W)
BXRC-65E10K1-B-74-SE	80	900	49.6	44.7	8343	7615	187
		1200	50.5	60.6	10985	9985	181
		1800	**52.0**	**93.6**	**16070**	**14463**	**172**
		2700	54.1	146.1	23165	20659	159
		3600	55.8	201.0	29649	26123	147
BXRC-65E10K1-C-74-SE	80	855	66.2	56.6	11564	11004	204
		1140	67.3	76.7	14697	13557	192
		1710	**69.4**	**118.7**	**20356**	**18320**	**172**
		2565	72.1	185.0	28877	24837	156
		3420	74.4	254.6	36195	30414	142
BXRC-65E10K1-D-74-SE	80	1050	35.4	37.2	7448	7257	200
		1400	36.2	50.6	9586	8921	189
		2100	**37.6**	**79.0**	**13541**	**12187**	**171**
		3150	39.5	124.4	19277	16243	155
		4200	41.2	172.9	24296	19840	140

Notes for Table 3:

1. Alternate drive currents in Table 3 are provided for reference only and are not a guarantee of performance.
2. Bridgelux maintains a ± 7% tolerance on flux measurements.
3. Typical stabilized DC performance values are provided as reference only and not a guarantee of performance.

Electrical Characteristics

Table 4: Electrical Characteristics

Part Number	Drive Current (mA)	Forward Voltage Pulsed, T_c = 25°C (V) [1, 2, 3, 8]			Typical Coefficient of Forward Voltage[4] $\Delta V_f/\Delta T_c$ (mV/°C)	Typical Thermal Resistance Junction to Case[5,6] R_{j-c} (°C/W)	Driver Selection Voltages[7] (V)	
		Minimum	Typical	Maximum			V_f Min. Hot T_c = 105°C (V)	V_f Max. Cold T_c = -40°C (V)
BXRC-xxx10Kx-B-7x-SE	1800	48.1	52.0	55.9	-24.9	0.06	46.1	57.5
	3600	51.7	55.8	60.0	-24.9	0.07	49.7	61.6
BXRC-xxx10Kx-C-7x-SE	1710	64.2	69.4	74.6	-33.2	0.04	61.5	76.8
	3420	68.8	74.4	80.0	-33.2	0.05	66.2	82.2
BXRC-xxx10Kx-D-7x-SE	2100	34.8	37.6	40.4	-17.4	0.06	33.4	41.6
	4200	38.1	41.2	44.3	-17.4	0.07	36.7	45.4

Notes for Table 4:

1. Parts are tested in pulsed conditions, T_c = 25°C. Pulse width is 10ms.
2. Voltage minimum and maximum are provided for reference only and are not a guarantee of performance.
3. Bridgelux maintains a tester tolerance of ± 0.10V on forward voltage measurements.
4. Typical coefficient of forward voltage tolerance is ± 0.1mV for nominal current.
5. Thermal resistance values are based from test data of a 3000K 80 CRI product.
6. Thermal resistance value was calculated using total electrical input power; optical power was not subtracted from input power. The thermal interface material used during testing is not included in the thermal resistance value.
7. V_f min hot and max cold values are provided as reference only and are not guaranteed by test. These values are provided to aid in driver design and selection over the operating range of the product.
8. This product has been designed and manufactured per IEC 62031:2014. This product has passed dielectric withstand voltage testing at 1160 V. The working voltage designated for the insulation is 80V d.c. The maximum allowable voltage across the array must be determined in the end product application.

Eye Safety

Table 5: Eye Safety Risk Group (RG) Classifications

Part Number	Drive Current [5] (mA)	CCT[1,5]			
		2700K/3000K	4000K[2]	5000K[3]	6500K[4]
BXRC-xxx10Kx-B-7x-SE	1800	RG1	RG1	RG1	RG1
	2700	RG1	RG1	-	RG2
	3600	RG1	RG1	-	RG2
BXRC-xxx10Kx-C-7x-SE	1710	RG1	RG1	-	-
	2565	RG1	RG1	-	-
	3420	RG1	RG2	-	-
BXRC-xxx10Kx-D-7x-SE	2100	RG1	RG1	RG1	RG1
	3150	RG1	RG1	RG1	RG2
	4200	RG1	RG1	RG2	RG2

Notes for Table 5:

1. Eye safety classification for the use of Bridgelux Vero SE Series LED arrays is in accordance with specification IEC/TR 62778: Application of IEC 62471 for the assessment of blue light hazard to light sources and luminaires.
2. For products classified as RG2 at 4000K, E_{thr} = 1847.5 lx.
3. For products classified as RG2 at 5000K, E_{thr} = 1315.8 lx.
4. For products classified as RG2 at 6500K, E_{thr} = 1124.5 lx.
5. Please contact your Bridgelux sales representative for E_{thr} values at specific drive currents and CCTs not listed.

Absolute Maximum Ratings

Table 6: Maximum Ratings

Parameter	Maximum Rating		
LED Junction Temperature (T_j)	125˚C		
Storage Temperature	-40˚C to +105˚C		
Operating Case Temperature[1] (T_c)	105˚C		
	BXRC-xxx10Kx-B-7x-SE	BXRC-xxx10Kx-C-7x-SE	BXRC-xxx10Kx-D-7x-SE
Maximum Drive Current[2]	3600mA	3420mA	4200mA
Maximum Peak Pulsed Drive Current[3]	5140mA	4890mA	6000mA
Maximum Reverse Voltage[4]	-90V	-120V	-65V

Notes for Table 6:

1. For IEC 62717 requirement, please consult your Bridgelux sales representative.
2. Arrays may be driven at higher currents however lumen maintenance may be reduced.
3. Bridgelux recommends a maximum duty cycle of 10% and pulse width of 20 ms when operating LED Arrays at maximum peak pulsed current specified. Maximum peak pulsed currents indicate values where LED Arrays can be driven without catastrophic failures.
4. Light emitting diodes are not designed to be driven in reverse voltage and will not produce light under this condition. Maximum rating provided for reference only.

Performance Curves

Figure 1: Vero SE 29B Drive Current vs. Voltage ($T_j = T_c = 25^{\circ}C$)

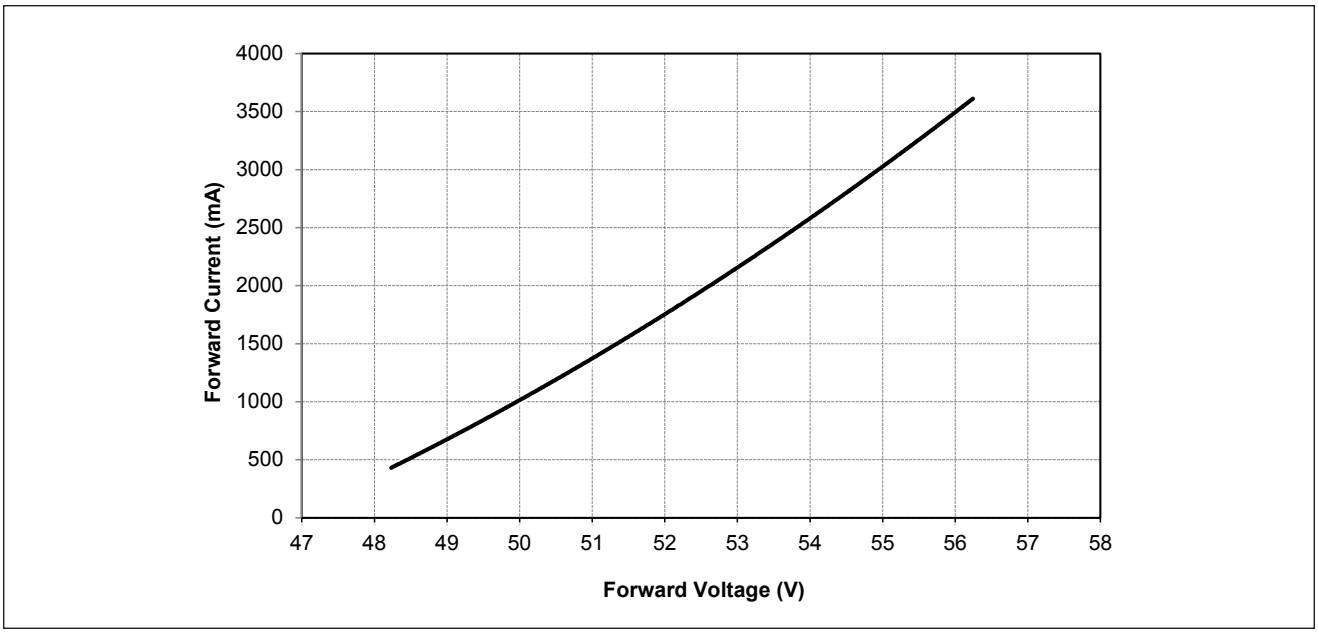
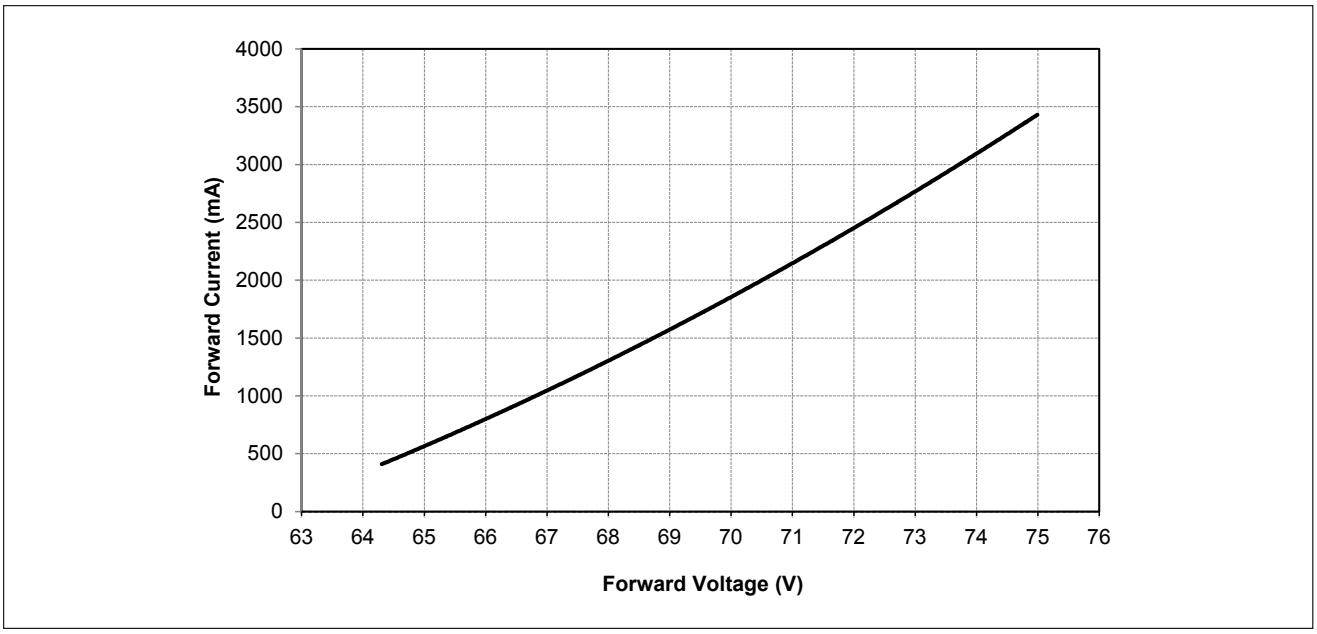


Figure 2: Vero SE 29C Drive Current vs. Voltage ($T_j = T_c = 25^{\circ}C$)



Performance Curves

Figure 3: Vero SE 29D Drive Current vs. Voltage ($T_j = T_c = 25°C$)

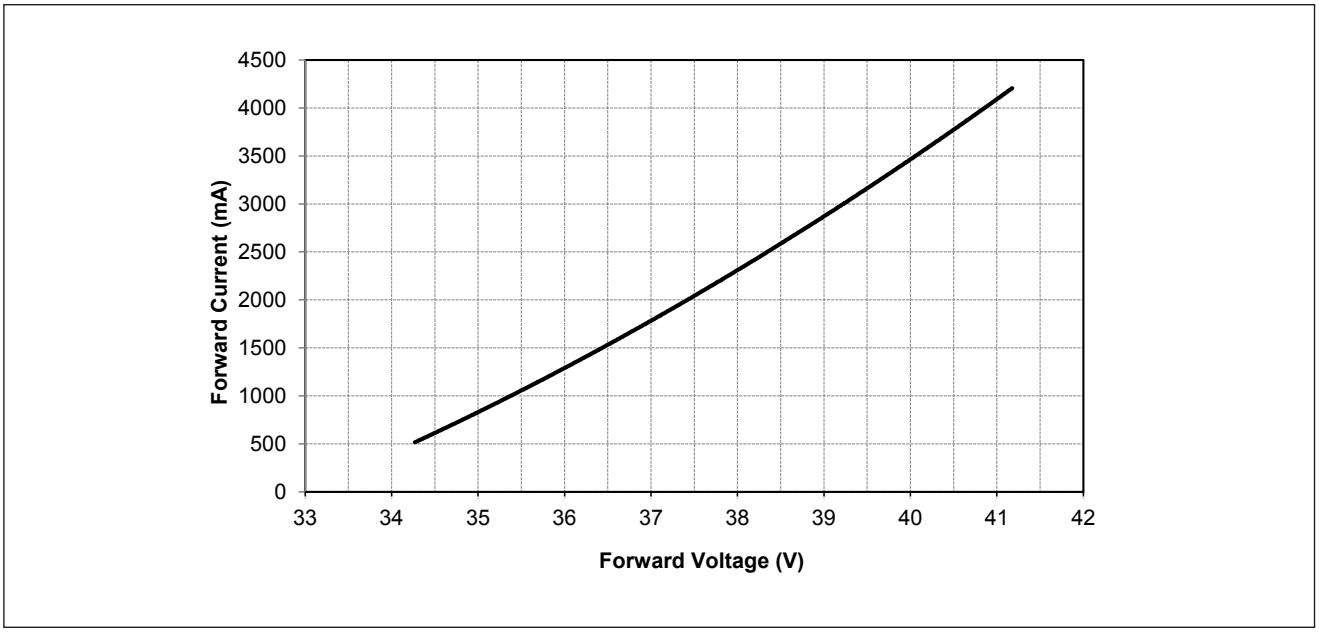
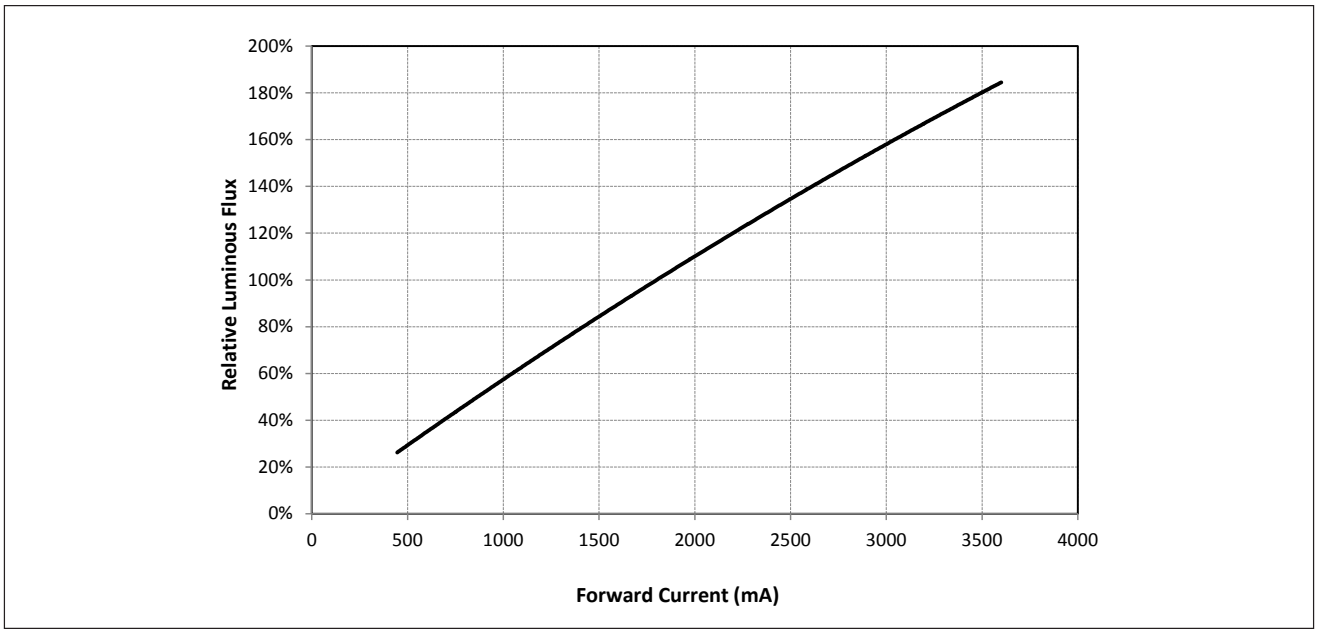


Figure 4: Vero SE 29B Typical Relative Flux vs. Current($T_j = T_c = 25°C$)



Note for Figure 4:

1. Bridgelux does not recommend driving high power LEDs at low currents. Doing so may produce unpredictable results. Pulse width modulation (PWM) is recommended for dimming effects.

Performance Curves

Figure 5: Vero SE 29C Typical Relative Flux vs. Current($T_j = T_c = 25^{\circ}C$)

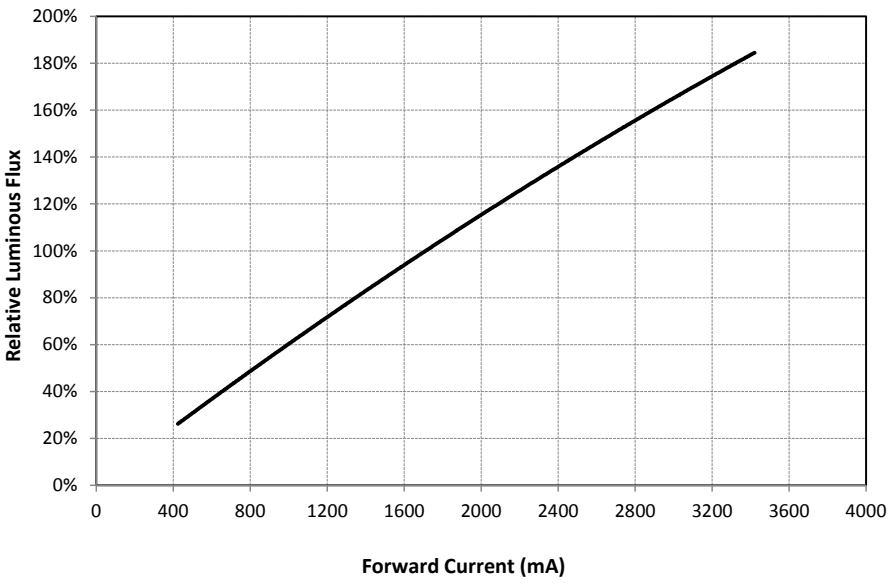
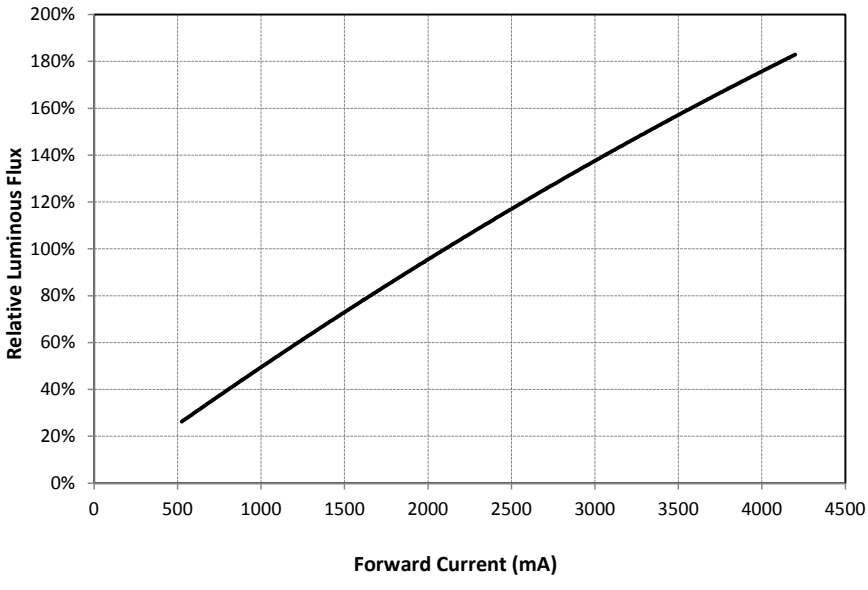


Figure 6 Vero SE 29D Typical Relative Flux vs. Current($T_j = T_c = 25^{\circ}C$)



Note for Figures 5 & 6:

1. Bridgelux does not recommend driving high power LEDs at low currents. Doing so may produce unpredictable results. Pulse width modulation (PWM) is recommended for dimming effects.

Performance Curves

Figure 7: Typical DC Flux vs. Case Temperature

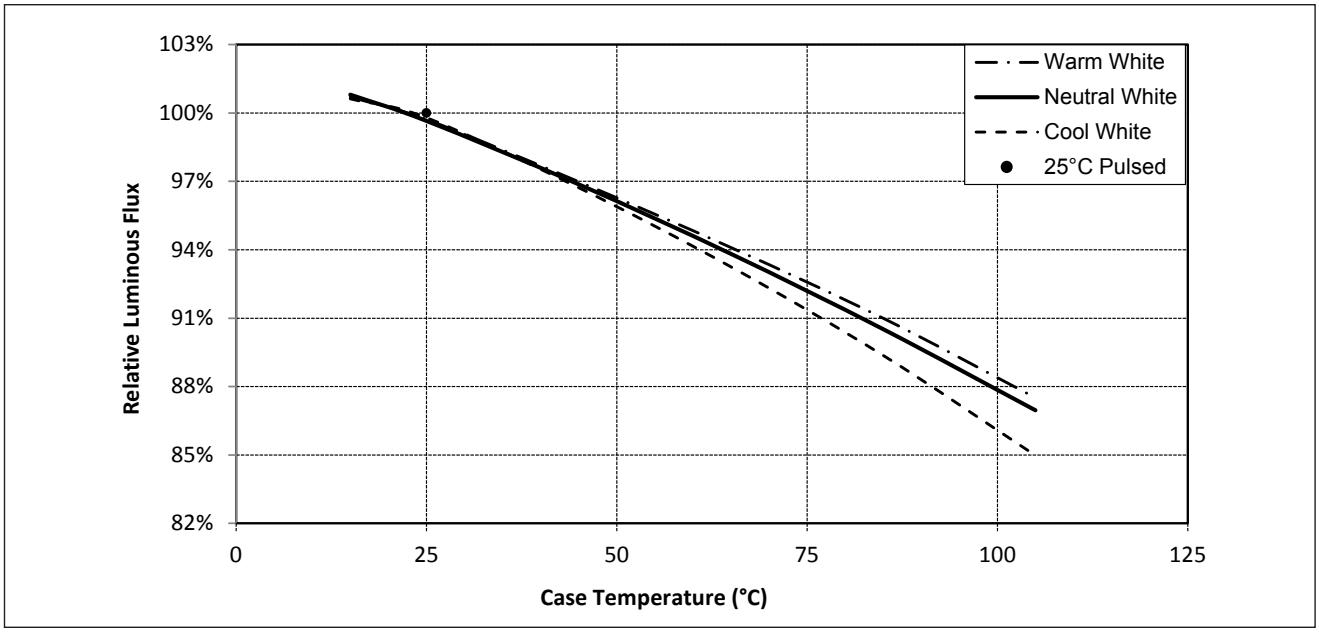
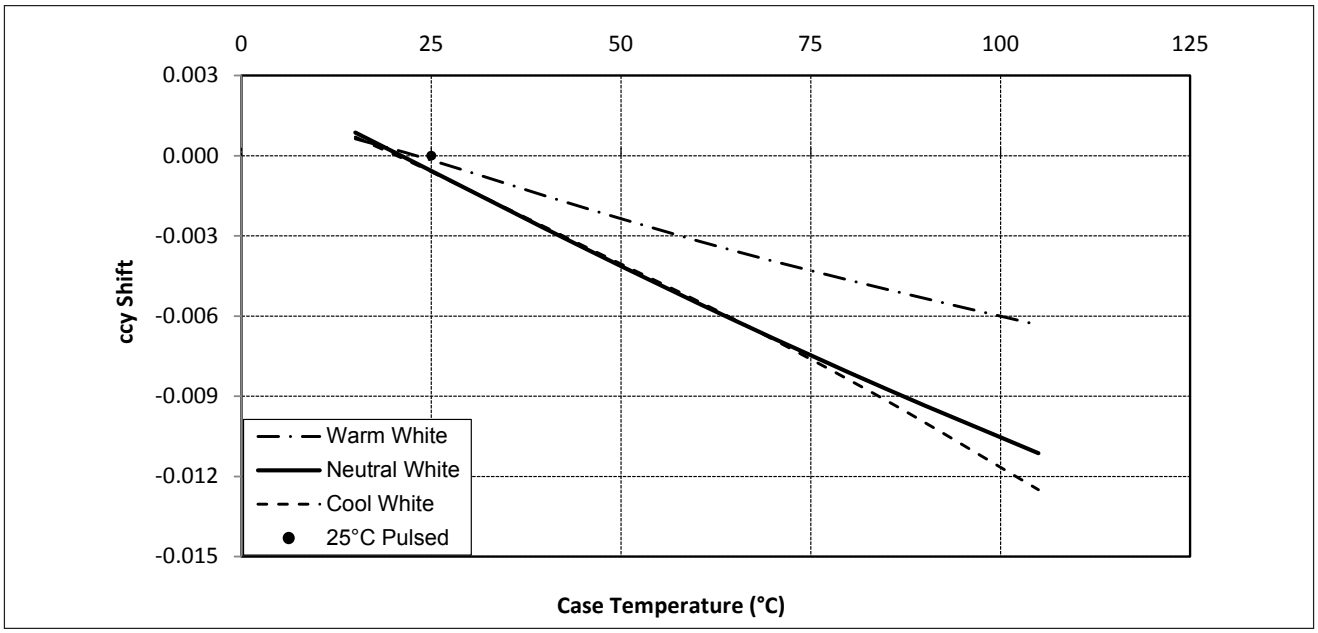


Figure 8: Typical DC ccy Shift vs. Case Temperature

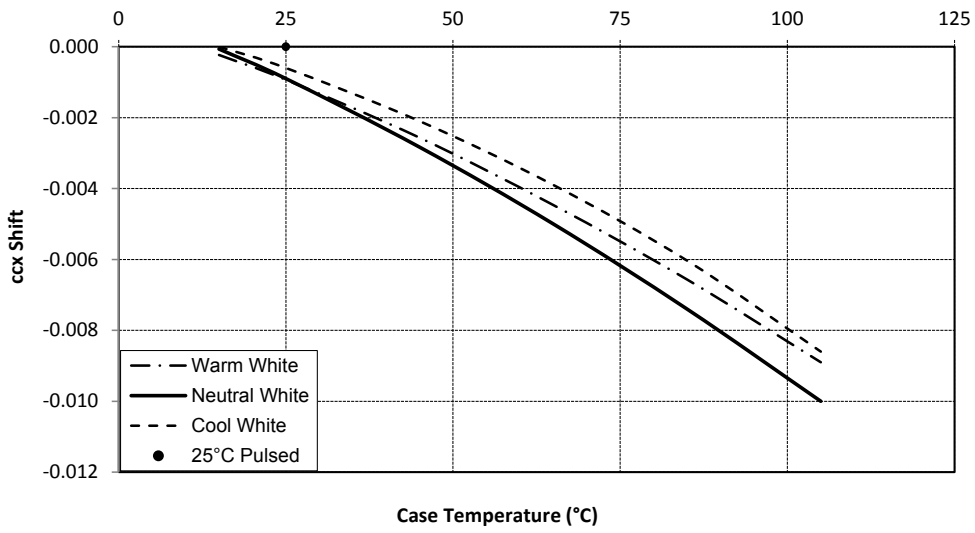


Notes for Figures 7 & 8:

1. Characteristics shown for warm white based on 3000K and 80 CRI.
2. Characteristics shown for neutral white based on 4000K and 80 CRI.
3. Characteristics shown for cool white based on 5000K and 70 CRI.
4. For other color SKUs, the shift in color will vary. Please contact your Bridgelux Sales Representative for more information.

Performance Curves

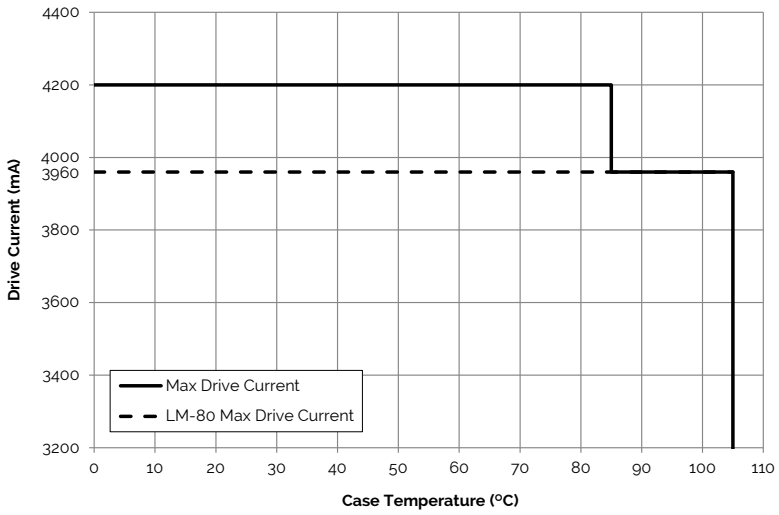
Figure 9: Typical DC ccx Shift vs. Case Temperature



Notes for Figure 9:

1. Characteristics shown for warm white based on 3000K and 80 CRI.
2. Characteristics shown for neutral white based on 4000K and 80 CRI.
3. Characteristics shown for cool white based on 5000K and 70 CRI.
4. For other color SKUs, the shift in color will vary. Please contact your Bridgelux Sales Representative for more information.

Figure 10: Vero 29D Drive Current Derating Curve

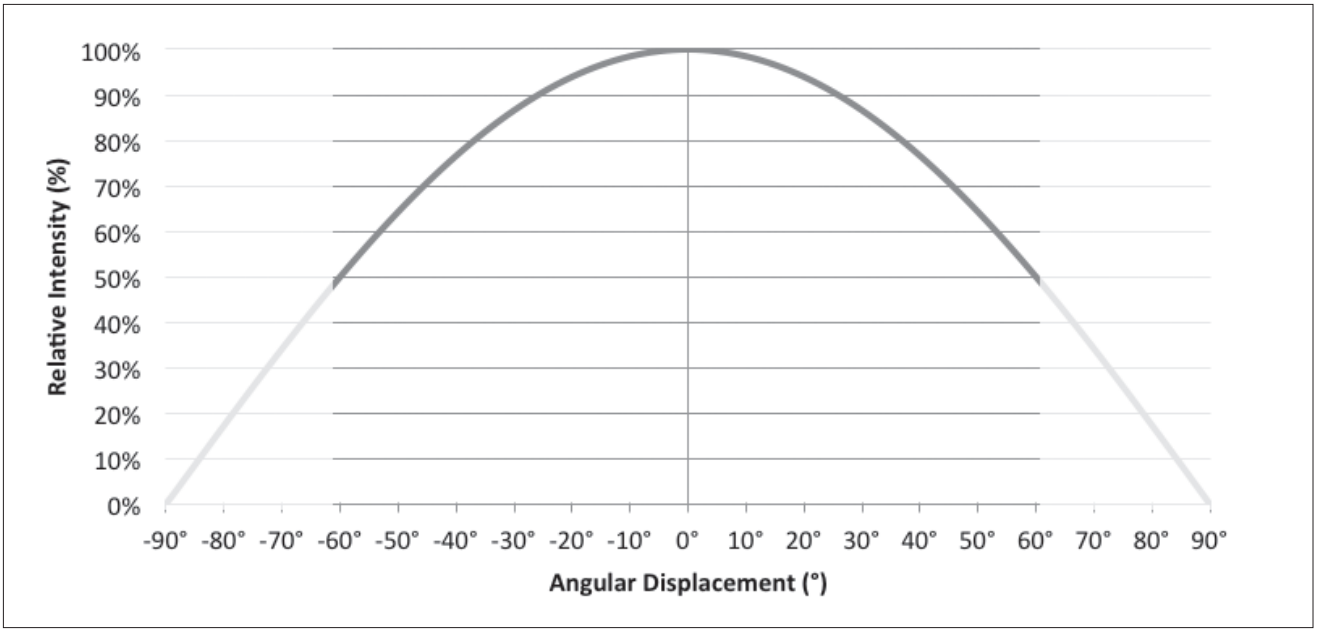


Notes for Figure 10:

1. The maximum allowable drive current for the Vero 29D product is dependent on the operating case temperature. Please refer to the Product Feature Map (page 2) for the location of the T_c Point
2. LM-80 Max Drive Current must not be exceeded in order to meet LM-80 lifetime projections.
3. Lumen maintenance (L70) and lifetime predictions are valid for drive current and case temperature conditions used for LM-80 testing as included in the applicable LM-80 test report for these products. Contact your Bridgelux sales representative for LM-80 report.

Typical Radiation Pattern

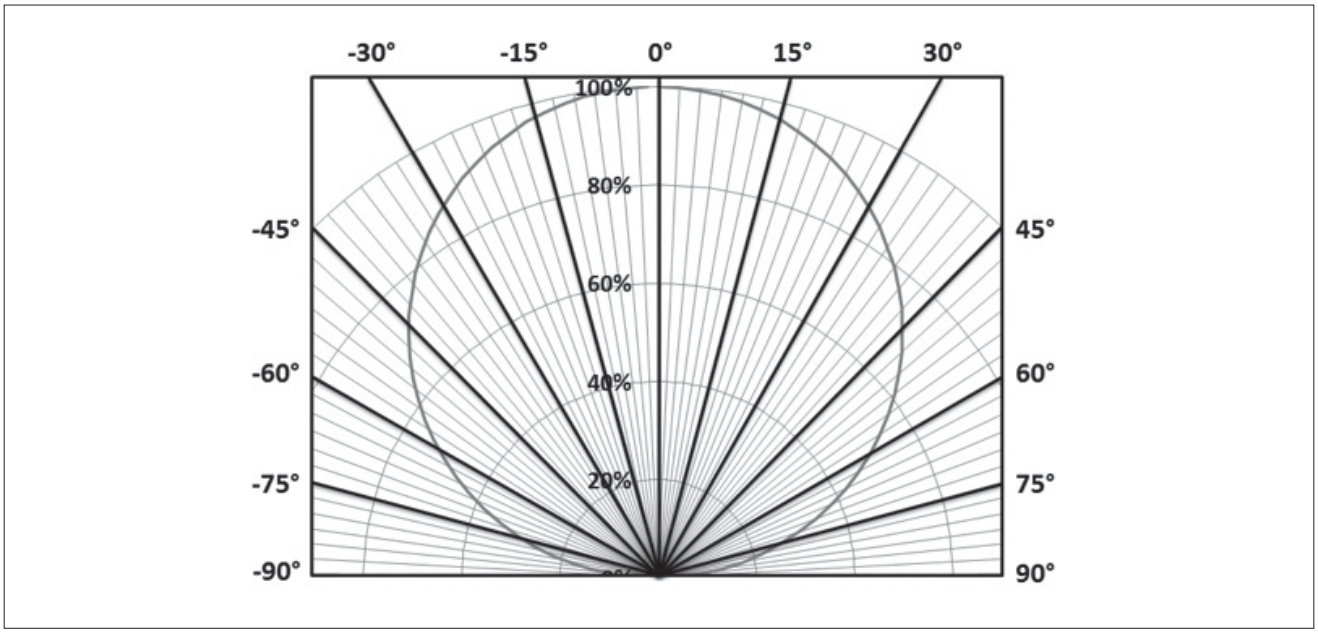
Figure 11: Typical Spatial Radiation Pattern



Note for Figure 11:

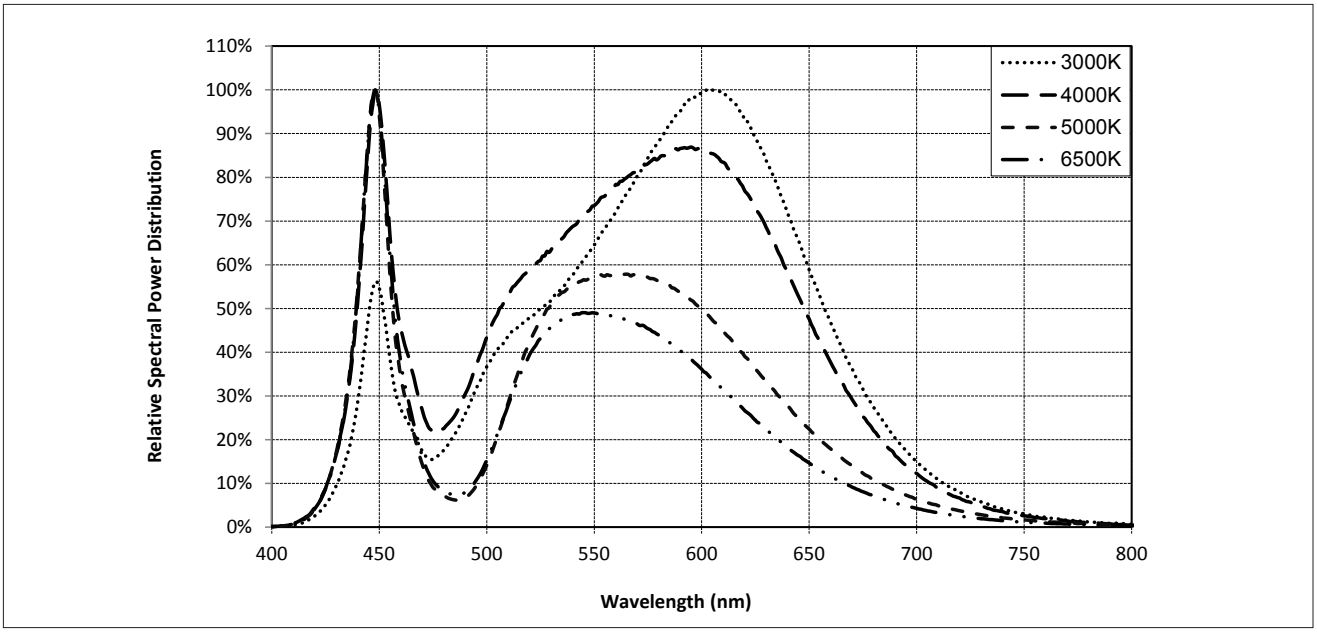
1. Typical viewing angle is 120°.
2. The viewing angle is defined as the off axis angle from the centerline where intensity is ½ of the peak value.

Figure 12: Typical Polar Radiation Pattern



Typical Color Spectrum

Figure 13: Typical Color Spectrum

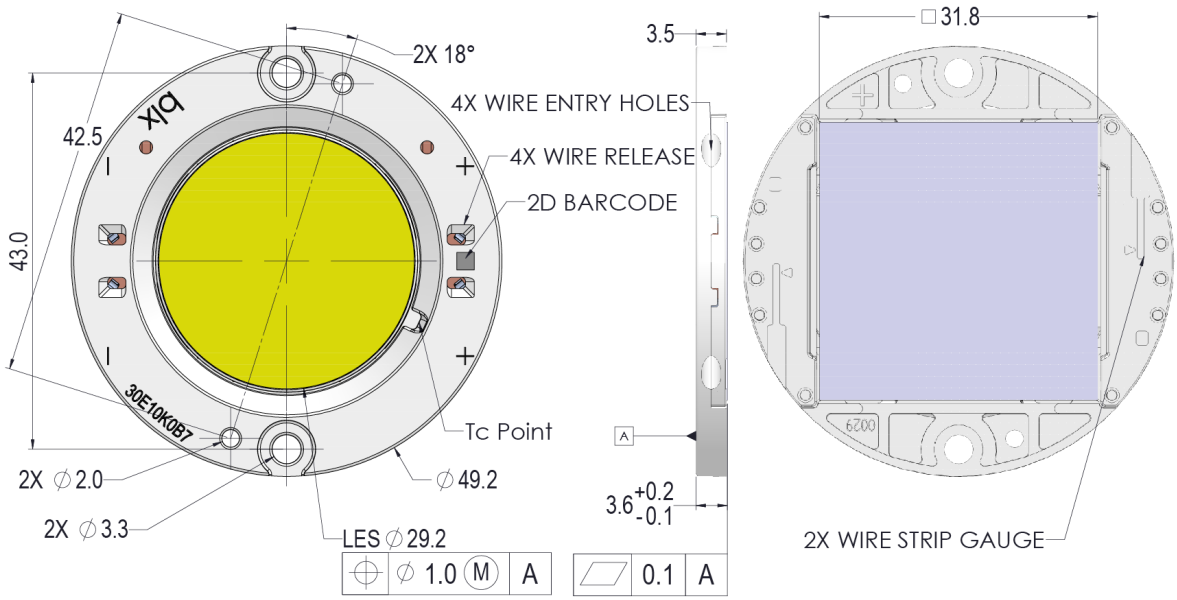


Note for Figure 13:

1. Color spectra measured at nominal current for T_j = T_c = 25°C.
2. Color spectra shown is 3000K and 80 CRI.
3. Color spectra shown is 4000K and 80 CRI.
4. Color spectra shown is 5000K and 70 CRI.
5. Color spectra shown is 6500K and 70 CRI.

Mechanical Dimensions

Figure 14: Drawing for Vero SE 29 LED Array

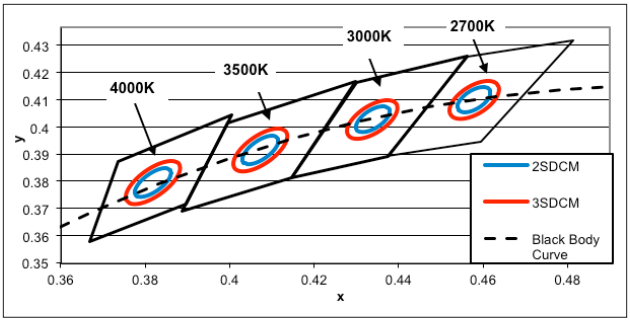


Notes for Figure 14:

1. Drawings are not to scale.
2. Drawing dimensions are in millimeters.
3. Unless otherwise specified, tolerances are ± 0.10mm.
4. Mounting holes (2X) are for M3 screws.
5. Bridgelux recommends two tapped holes for mounting screws with 43.0 ± 0.10mm center-to-center spacing.
6. Screws with flat shoulders (pan, dome, button, round, truss, mushroom) provide optimal torque control. Do NOT use flat, countersink, or raised head screws.
7. The optical center of the LED Array is nominally defined by the mechanical center of the array to a tolerance of ± 0.2mm.
8. Bridgelux maintains a flatness of 0.10mm across the mounting surface of the array.

Color Binning Information

Figure 15: Graph of Warm and Neutral White Test Bins in xy Color Space

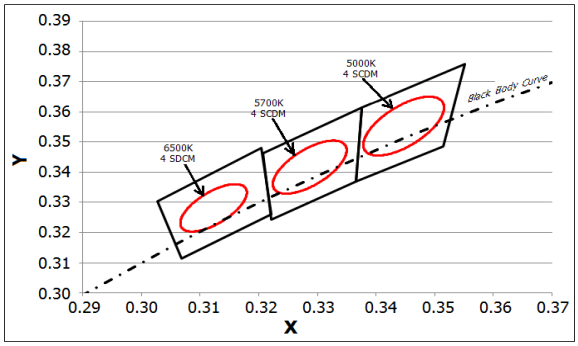


Note: Pulsed Test Conditions, T_c = 25˚C

Table 7: Warm and Neutral White xy Bin Coordinates and Associated Typical CCT

Bin Code	2700K	3000K	3500K	4000K
ANSI Bin (for reference only)	(2580K - 2870K)	(2870K - 3220K)	(3220K - 3710K)	(3710K - 4260K)
73 (3 SDCM)	(2651K - 2794K)	(2968K - 3136K)	(3369K - 3586K)	(3851K - 4130K)
72 (2 SDCM)	(2674K - 2769K)	(2995K - 3107K)	(3404K - 3548K)	(3895K - 4081K)
Center Point (x,y)	(0.4578, 0.4101)	(0.4338, 0.403)	(0.4073, 0.3917)	(0.3818, 0.3797)

Figure 16: Graph of Cool White Test Bins in xy Color Space



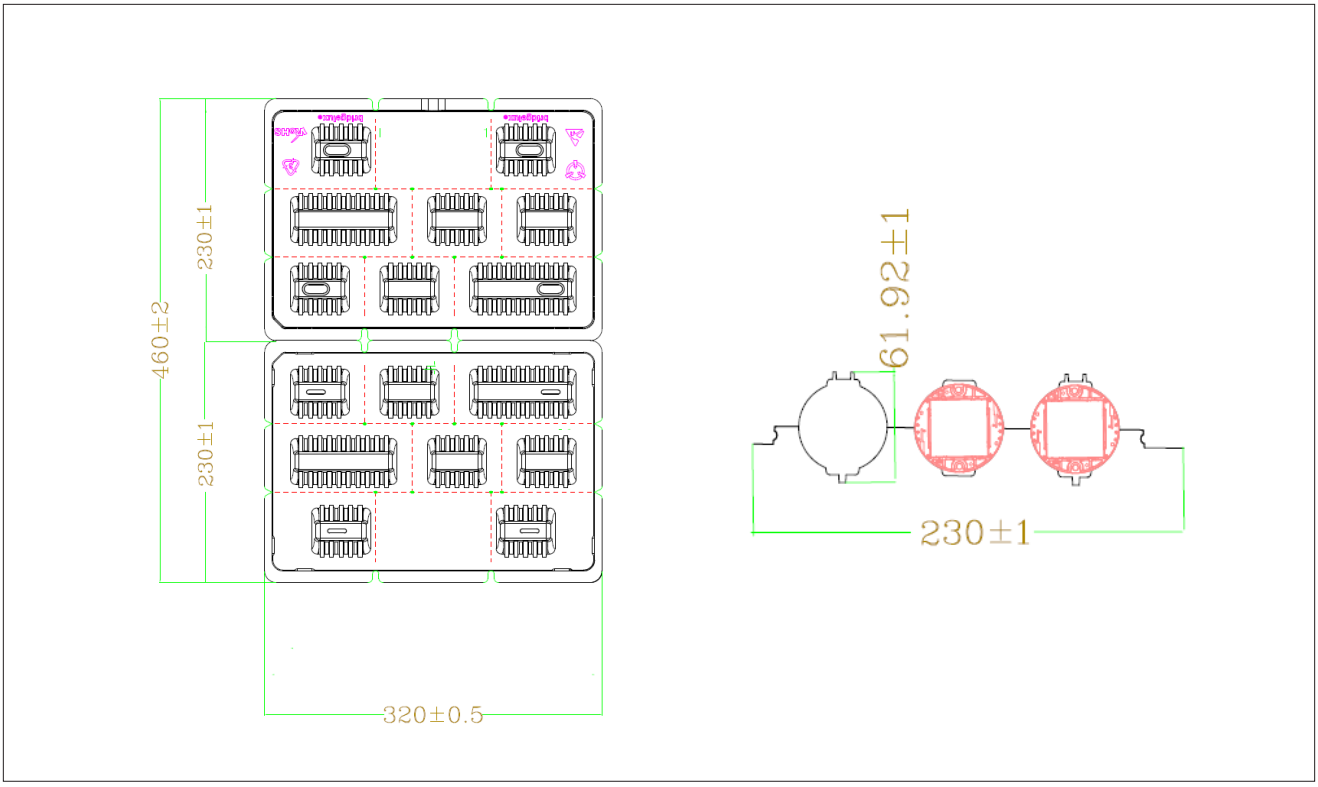
Note: Pulsed Test Conditions, T_c = 25˚C

Table 8: Cool White xy Bin Coordinates and Associated Typical CCT (product is hot targeted to T_c = 85˚C)

Bin Code	5000K	5700K	6500K
ANSI Bin (for reference only)	(4745K - 5311K)	(5312K - 6022K)	(6022K - 7042K)
74 (4 SDCM)	(4801K - 5282K)	(5829K - 5481K)	(6270K - 6765K)
Center Point (x,y)	(0.3447, 0.3553)	(0.3287, 0.3417)	(0.3123, 0.3282)

Packaging and Labeling

Figure 17: Drawing for Vero SE 29 Packaging Tray

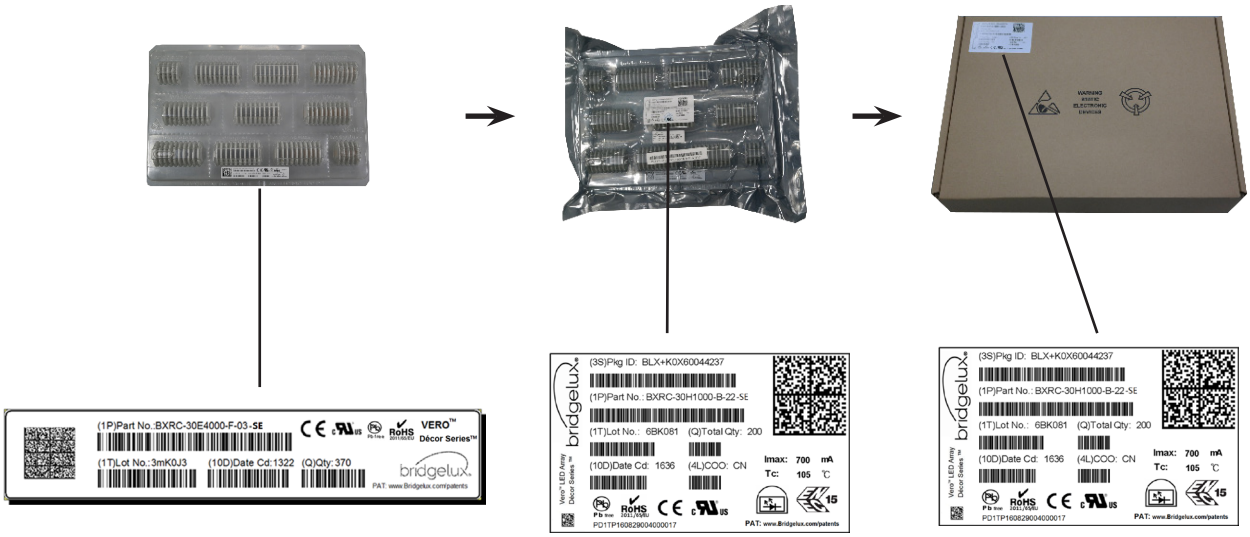


Notes for Figure 17:

1. Dimensions are in millimeters.
2. Drawings are not to scale.

Packaging and Labeling

Figure 18: Vero SE 29 Series Packaging and Labeling



Notes for Figure 18:

1. Each tray holds 50 COBs.
2. Each tray is vacuum sealed in an anti-static bag and placed in its own box.
3. Each tray, bag and box is to be labeled as shown above.

Figure 19: Vero SE Product Labeling

Bridgelux COB arrays have laser markings on the back side of the substrate to help with product identification. In addition to the product identification markings, Bridgelux COB arrays also contain markings for internal Bridgelux manufacturing use only. The image below shows which markings are for customer use and which ones are for Bridgelux internal use only. The Bridgelux internal manufacturing markings are subject to change without notice, however these will not impact the form, function or performance of the COB array.

Design Resources

Optical Source Models

Optical source models and ray set files are available for all Bridgelux products. Please contact your Bridgelux sales representative for assistance.

3D CAD Models

Three dimensional CAD models depicting the product outline of all Bridgelux Vero SE LED arrays are available in both IGS and STEP formats. Please contact your Bridgelux sales representative for assistance.

LM80

LM80 testing has been completed and the LM80 report is now available. Please contact your Bridgelux sales representative for LM-80 report.

Precautions

CAUTION: CHEMICAL EXPOSURE HAZARD

Exposure to some chemicals commonly used in luminaire manufacturing and assembly can cause damage to the LED array. Please consult Bridgelux Application Note AN31 for additional information.

CAUTION: RISK OF BURN

Do not touch the Vero SE LED array during operation. Allow the array to cool for a sufficient period of time before handling. The Vero SE LED array may reach elevated temperatures such that could burn skin when touched.

CAUTION

CONTACT WITH LIGHT EMITTING SURFACE (LES)

Avoid any contact with the LES. Do not touch the LES of the LED array or apply stress to the LES (yellow phosphor resin area). Contact may cause damage to the LED array.

Optics and reflectors must not be mounted in contact with the LES (yellow phosphor resin area). Optical devices may be mounted on the top surface of the plastic housing of the Vero SE LED array. Use the mechanical features of the LED array housing, edges and/or mounting holes to locate and secure optical devices as needed.

Disclaimers

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.

STANDARD TEST CONDITIONS

Unless otherwise stated, array testing is performed at the nominal drive current.

About Bridgelux: We Build Light That Transforms

At Bridgelux, we help companies, industries and people experience the power and possibility of light. Since 2002, we've designed LED solutions that are high performing, energy efficient, cost effective and easy to integrate. Our focus is on light's impact on human behavior, delivering products that create better environments, experiences and returns—both experiential and financial. And our patented technology drives new platforms for commercial and industrial luminaires.

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