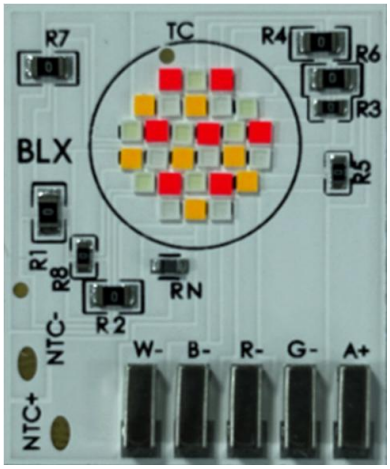
Introduction

The purpose of this document is to provide useful and important guidance to ensure the best outcomes using Bridgelux Vesta Series RGBW Array. The target audience for this Application Note is designers, engineers, and specifiers who contribute to the success of a product's design and launch. This document is principally focused on:

- Product General Information
- Handling
- Connector Wiring
- Selection
- Assembly
- ESD Prevention
- Chemical Compatibility



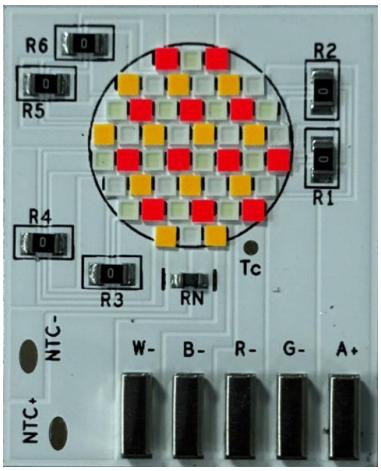


Table of Contents

Bridgelux Vesta Series RGBW Array Product Family

Table 1: Vesta Series RGBW Array Product family information

RGBW D10 Series (Tj=Tc=25°C)

Part Number	Channel	Typical Drive Current[1] (mA)	Dominant Wavelength(nM)			Peak Wavelength(nM)			Forward Voltage[1] (V)			Purity	Typical Pulsed Flux[2,3] T_c=25°C[4] (lm)	Typical Power T_c=25°C[4] (W)
			Min	Typical	Max	Min	Typi-cal	Max	Min	Typ-ical	Max			
BXRV-D10-RGBW2000-B3	Red	300	610	616	623	625	632	640	18.6	19.7	20.9	0.949	271	5.9
	Green	350	515	521	530	505	514	520	18.2	19.3	20.5	0.783	1014	6.8
	Blue	350	455	/	460	450	/	456	19.6	20.9	22.1	0.975	171	7.3

Part Number	Channel	Typical Drive Current[1] (mA)	Forward Voltage[1] (V)			Typical Pulsed Flux[2,3] T_c=25°C[4] (lm)	Typical Power T_c=25°C[4] (W)	Typical Efficacy T_c=25°C[4] (lm/W)
			Min	Typical	Max			
BXRV-D10-RGBW2000-B3	White	350	19.6	20.8	22.1	1055	7.3	145

RGBW D10 Series (Tj=Tc=65°C)

Part Number	Channel	Typical Drive Current[1] (mA)	Dominant Wavelength(nM)			Peak Wavelength(nM)			Forward Voltage[1] (V)			Purity	Typical Pulsed Flux[2,3] T_c=65°C[4] (lm)	Typical Power T_c=65°C[4] (W)
			Min	Typical	Max	Min	Typi-cal	Max	Min	Typ-ical	Max			
BXRV-D10-RGBW2000-B3	Red	300	610	615	623	625	632	640	18.1	19.2	20.4	0.941	230	5.8
	Green	350	515	524	533	505	518	523	17.2	18.3	19.4	0.768	933	6.4
	Blue	350	455	/	462	450	/	458	19.0	20.2	21.4	0.971	175	7.1

Part Number	Channel	Typical Drive Current[1] (mA)	Forward Voltage[1] (V)			Typical Pulsed Flux[2,3] T_c=65°C[4] (lm)	Typical Power T_c=65°C[4] (W)	Typical Efficacy T_c=65°C[4] (lm/W)
			Min	Typical	Max			
BXRV-D10-RGBW2000-B3	White	350	18.9	20.1	21.3	975	7.0	139

RGBW D13 Series (Tj=Tc=25°C)

Part Number	Channel	Typical Drive Current[1] (mA)	Dominant Wavelength(nM)			Peak Wavelength(nM)			Forward Voltage[1] (V)			Purity	Typical Pulsed Flux[2,3] T_c=25°C[4] (lm)	Typical Power T_c=25°C[4] (W)
			Min	Typical	Max	Min	Typi-cal	Max	Min	Typ-ical	Max			
BXRV-D13-RGBW3000-B3	Red	300	610	616	623	625	632	640	31.8	33.9	35.9	0.95	465	10.2
	Green	350	515	521	530	505	514	520	31.1	33.1	35.1	0.78	1738	11.6
	Blue	350	455	/	460	450	/	456	33.7	35.8	38.0	0.98	292	12.5

Part Number	Channel	Typical Drive Current[1] (mA)	Forward Voltage[1] (V)			Typical Pulsed Flux[2,3] T_c=25°C[4] (lm)	Typical Power T_c=25°C[4] (W)	Typical Efficacy T_c=25°C[4] (lm/W)
			Min	Typical	Max			
BXRV-D13-RGBW3000-B3	White	350	33.5	35.7	37.8	1808	12.5	145

RGBW D13 Series (Tj=Tc=65°C)

Part Number	Channel	Typical Drive Current[1] (mA)	Dominant Wavelength(nM)			Peak Wavelength(nM)			Forward Voltage[1] (V)			Purity	Typical Pulsed Flux[2,3] T_c=65°C[4] (lm)	Typical Power T_c=65°C[4] (W)
			Min	Typical	Max	Min	Typi-cal	Max	Min	Typ-ical	Max			
BXRV-D13-RGBW3000-B3	Red	300	610	615	623	625	632	640	31.0	33.0	35.0	0.941	395	9.9
	Green	350	515	524	533	505	518	523	29.5	31.4	33.3	0.768	1600	11.0
	Blue	350	455	/	462	450	/	458	32.6	34.7	36.7	0.971	299	12.1

Part Number	Channel	Typical Drive Current[1] (mA)	Forward Voltage[1] (V)			Typical Pulsed Flux[2,3] T_c=65°C[4] (lm)	Typical Power T_c=65°C[4] (W)	Typical Efficacy T_c=65°C[4] (lm/W)
			Min	Typical	Max			
BXRV-D13-RGBW3000-B3	White	350	32.4	34.4	36.5	1671	12.1	139

Bridgelux Vesta Series RGBW Array Product Dimension

RGBW D10 Series

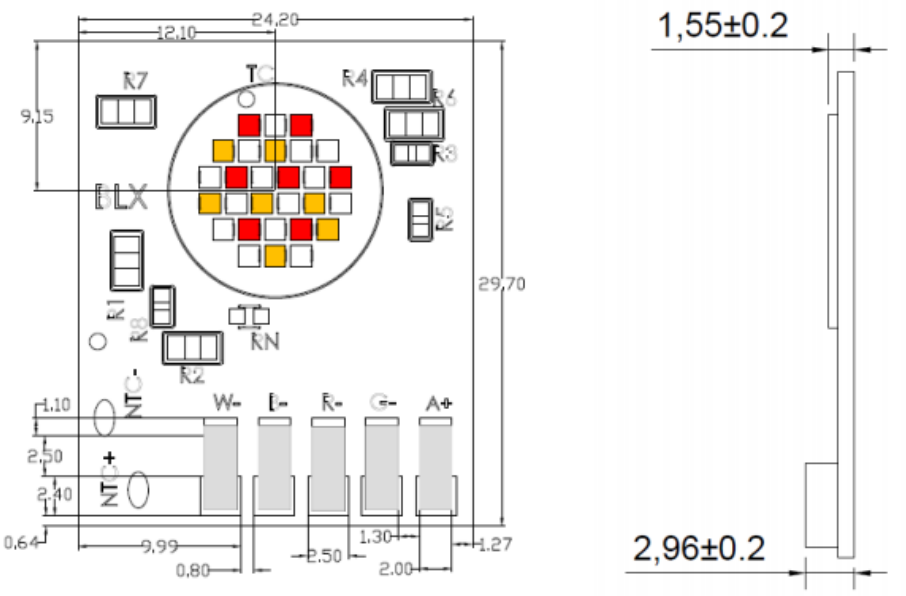


Figure 1: RGBW D10 Series Dimension in millimeter

RGBW D13 Series

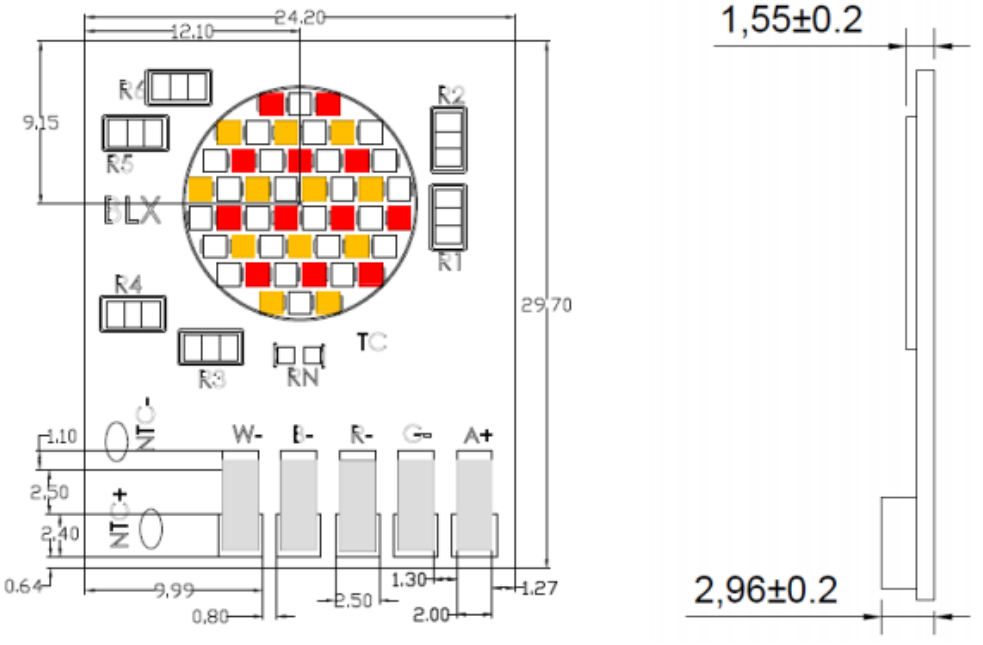


Figure 2: RGBW D13 Series Dimension in millimeter

Handling Guide

CAUTION: CONTACT WITH OPTICAL AREA

Avoid any contact with the optical area. Do not touch the optical area of the LED array or apply stress to the CSP area. Contact may cause damage to the LED array.

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

Bridgelux LED Arrays are packaged for volume shipment in trays of various sizes. Low volume sample shipments may be packaged using other methods. To manually remove the LED Arrays simply lift the LED Arrays from the tray by gripping the white plastic portion of the LED Arrays module. The trays come with notched areas around the array that accommodate fingers for grabbing the arrays from the sides. Figure 3 illustrates a suitable method of removing the Bridgelux LED Arrays modules from the shipping tray.

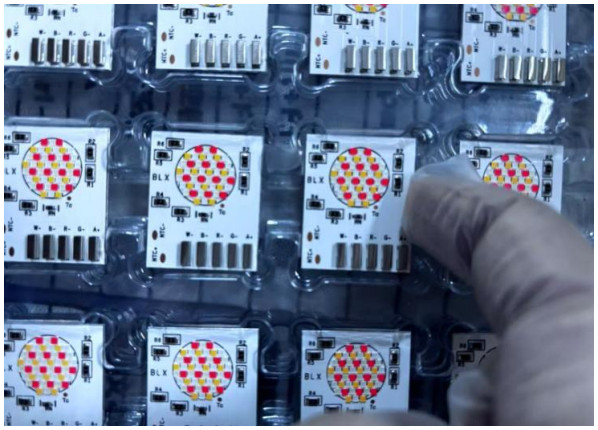


Figure 3: Removal of a LED Arrays from a tray

Handle the parts with care. It is recommended to wear finger cots or plastic gloves to prevent dirt or other contaminants from adhering to the LED Arrays (see Figure 4). Bridgelux LED Arrays modules are optical devices. Please ensure that nothing comes into contact with CSP area, as this may adversely affect performance. Although use of a clean room is not required, the environment in which the LED Arrays modules are assembled should be clean, avoiding dust and particles, which may adhere to the resin area of the LED Arrays module.

Bridgelux LED Arrays modules have passed ESD testing to levels which do not require special handling for most assembly processes. However, to prevent inadvertent damage, Bridgelux recommends using appropriate ESD grounding procedures while handling the LED Arrays modules.

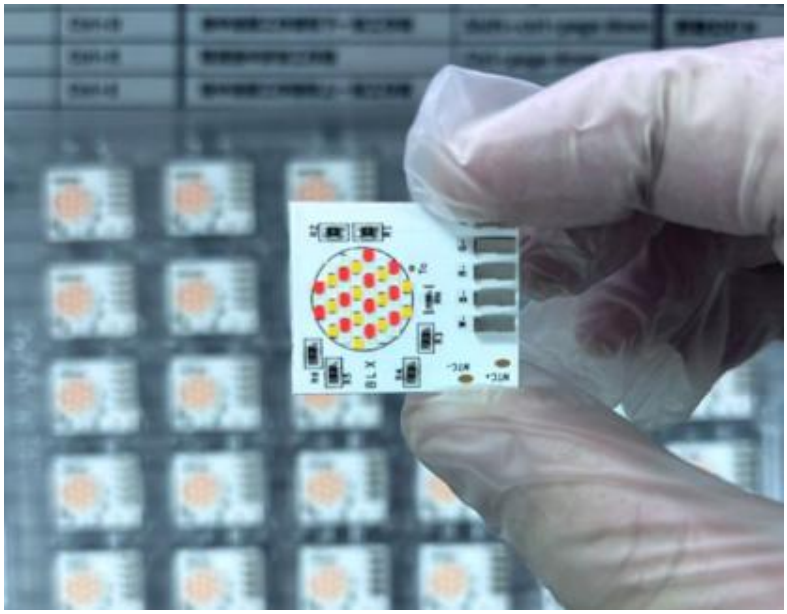


Figure 4: Wear gloves or finger cots when handling LED Arrays modules from the plastic portion of the module

If debris contacts the resin, gently remove it by rinsing it with isopropyl alcohol (commonly called rubbing alcohol).

If pick-and-place equipment is used for automated assembly, the vacuum collet should be designed so as to avoid contact on the CSP area. Contact with the outer plastic is acceptable

Pick up Tools

Sharp tools are strictly prohibited from being used on the CSP in the light-emitting area, and strong external force must not be applied to it.

Handling

Handle the parts with care. It is recommended to wear finger cots or gloves to prevent dirt or other contaminants from adhering to the LED array (see Figure 3). LED array are optical devices. Please ensure that nothing comes into contact with the Light Source Area, as this may adversely affect performance.

Although use of a clean room is not required, the environment in which the LED array are assembled should be clean, avoiding dust and particles which may adhere to the resin area of the Vesta Series RGBW Array With CSP.

LED array have passed ESD testing to levels which do not require special handling for most assembly processes. However, to prevent inadvertent damage, Bridgelux recommends using appropriate ESD grounding procedures while handling the Vesta Series RGBW Array With CSP.

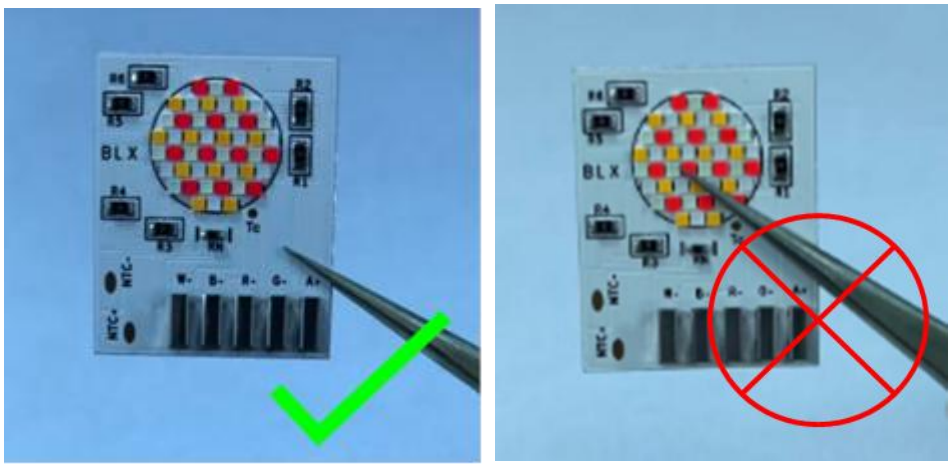
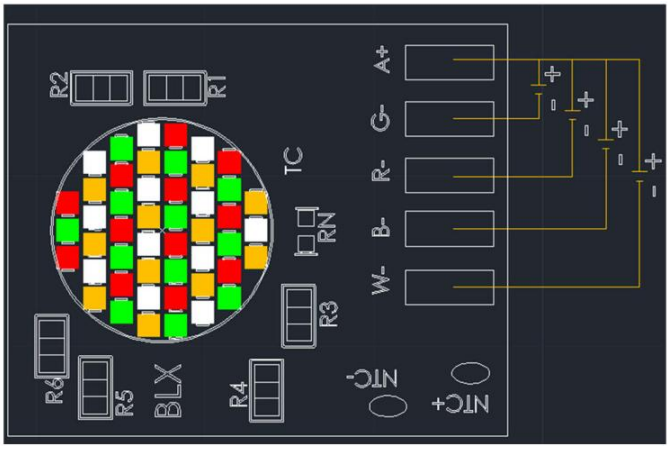


Figure 3: Proper handling of the LED array using fingers and tweezers

Wiring Guideline



Connector Wiring Guideline

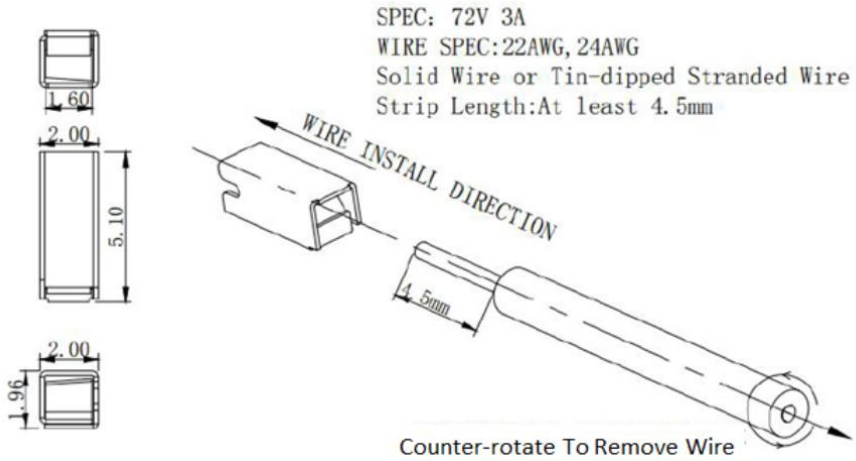


Figure 4: Connector Wiring Guideline

Selection Guide

Table 2: Vesta Series RGBW Array Product family Tunable White information

RGBW D10 Series (Tj=Tc=25°C)

Part Number	Nominal CCT[1] (K)	CRI[2]	Nominal Drive Current[3] Per Channel (mA)				Forward Voltage[3] (V)				Typical Pulsed Flux[3,4] T_c=25°C (lm)	Typical Power T_c=25°C (W)	Typical Efficacy T_c=25°C (lm/W)
			Blue	Green	Red	White	Blue	Green	Red	White			
BXRV-D10-RGBW2000-B3	1800K	92	0	2	300	137	18.2	18.2	19.7	19.1	717	9	84
	2200K	95	5	0	300	310	18.2	18.2	19.7	19.8	1169	12	96
	2400K	96	10	7	286	367	18.3	18.3	19.7	20.0	1368	13	103
	2700K	96	18	20	238	395	18.3	18.4	19.5	20.0	1436	13	109
	3000K	96	27	33	198	412	18.4	18.5	19.3	20.1	1523	13	115
	3500K	96	42	55	159	414	18.5	18.6	19.1	20.1	1598	13	122
	4000K	96	57	69	134	410	18.6	18.7	19.0	20.1	1627	13	124
	5000K	96	79	103	87	401	18.7	18.9	18.7	20.0	1679	13	128
	5700K	95	95	112	69	393	18.8	18.9	18.6	20.0	1690	13	129
	6500K	95	110	125	51	385	18.9	19.0	18.5	20.0	1662	13	127
	8000K	94	135	141	44	350	19.0	19.1	18.5	19.9	1662	13	127
	10000K	93	154	151	34	330	19.1	19.2	18.4	19.9	1637	13	126

RGBW D10 Series (Tj=Tc=65°C)

Part Number	Nominal CCT[1] (K)	CRI[2]	Nominal Drive Current[3] Per Channel (mA)				Forward Voltage[3] (V)				Typical Pulsed Flux[3,4] T_c=65°C[7] (lm)	Typical Power T_c=65°C (W)	Typical Efficacy T_c=65°C (lm/W)
			Blue	Green	Red	White	Blue	Green	Red	White			
BXRV-D10-RGBW2000-B3	1800K	91	0	2	300	137	17.9	17.9	19.4	18.7	677	8.4	80
	2200K	94	5	0	300	310	17.9	17.9	19.4	19.4	1095	11.9	92
	2400K	95	10	7	286	367	18.0	17.9	19.4	19.6	1283	13.0	98
	2700K	95	18	20	238	395	18.0	18.0	19.2	19.7	1348	13.0	104
	3000K	96	27	33	198	412	18.1	18.1	19.0	19.7	1430	13.0	110
	3500K	96	42	55	159	414	18.2	18.2	18.8	19.7	1505	12.9	117
	4000K	96	57	69	134	410	18.3	18.3	18.7	19.7	1536	12.9	119
	5000K	95	79	103	87	401	18.4	18.5	18.4	19.7	1588	12.8	124
	5700K	95	95	112	69	393	18.5	18.6	18.3	19.7	1591	12.8	124
	6500K	95	110	125	51	385	18.6	18.7	18.2	19.6	1574	12.8	123
	8000K	94	135	141	44	350	18.7	18.7	18.2	19.6	1573	12.8	123
	10000K	94	154	151	34	330	18.8	18.8	18.1	19.5	1553	12.8	121

RGBW D13 Series (Tj=Tc=25°C)

Part Number	Nominal CCT[1] (K)	CRI[2]	Nominal Drive Current[3] Per Channel (mA)				Forward Voltage[3] (V)				Typical Pulsed Flux[3,4] T_c=25°C (lm)	Typical Power T_c=25°C (W)	Typical Efficacy T_c=25°C (lm/W)
			Blue	Green	Red	White	Blue	Green	Red	White			
BXRV-D13-RGBW3000-B3	1800K	92	0	2	300	137	31.2	31.3	33.8	32.7	1229	15	84
	2200K	95	5	0	300	310	31.3	31.2	33.8	34.0	2004	21	96
	2400K	96	10	7	286	367	31.3	31.3	33.7	34.2	2345	23	103
	2700K	96	18	20	238	395	31.4	31.5	33.4	34.3	2462	23	109
	3000K	96	27	33	198	412	31.5	31.6	33.1	34.4	2611	23	115
	3500K	96	42	55	159	414	31.7	31.9	32.8	34.4	2740	23	122
	4000K	96	57	69	134	410	31.8	32.0	32.6	34.4	2790	22	124
	5000K	96	79	103	87	401	32.1	32.4	32.1	34.4	2879	22	128
	5700K	95	95	112	69	393	32.3	32.5	31.9	34.3	2898	22	129
	6500K	95	110	125	51	385	32.4	32.6	31.7	34.3	2850	22	127
	8000K	94	135	141	44	350	32.6	32.7	31.6	34.1	2849	22	127
	10000K	93	154	151	34	330	32.8	32.8	31.5	34.1	2806	22	126

RGBW D13 Series (Tj=Tc=65°C)

Part Number	Nominal CCT[1] (K)	CRI[2]	Nominal Drive Current[3] Per Channel (mA)				Forward Voltage[3] (V)				Typical Pulsed Flux[3,4] T_c=65°C (lm)	Typical Power T_c=65°C (W)	Typical Efficacy T_c=65°C (lm/W)
			Blue	Green	Red	White	Blue	Green	Red	White			
BXRV-D13-RGBW3000-B3	1800K	91	0	2	300	137	30.7	30.7	33.3	32.1	1161	14	80
	2200K	94	5	0	300	310	30.7	30.7	33.3	33.3	1877	20	92
	2400K	95	10	7	286	367	30.8	30.7	33.2	33.6	2199	22	98
	2700K	95	18	20	238	395	30.9	30.9	32.9	33.7	2311	22	104
	3000K	96	27	33	198	412	31.0	31.0	32.6	33.8	2452	22	110
	3500K	96	42	55	159	414	31.1	31.3	32.3	33.8	2580	22	117
	4000K	96	57	69	134	410	31.3	31.4	32.1	33.8	2633	22	119
	5000K	95	79	103	87	401	31.5	31.8	31.6	33.7	2722	22	124
	5700K	95	95	112	69	393	31.7	31.9	31.4	33.7	2728	22	124
	6500K	95	110	125	51	385	31.8	32.0	31.2	33.7	2699	22	123
	8000K	94	135	141	44	350	32.1	32.1	31.2	33.5	2697	22	123
	10000K	94	154	151	34	330	32.3	32.2	31.1	33.4	2663	22	121

Current Ratio for Tunable White Guide

Table 3: Reference Current Ratio for Tunable White with BBL

RGBW D10 Series

CCT / Color	1800K	2200K	2400K	2700K	3000K	3500K	4000K	5000K	5700K	6500K	8000K	10000K
B	0.00%	0.81%	1.48%	2.66%	4.02%	6.26%	8.45%	11.82%	14.25%	16.36%	20.20%	23.06%
G	0.46%	0.00%	1.03%	2.95%	4.89%	8.20%	10.30%	15.36%	16.78%	18.65%	21.01%	22.55%
R	68.34%	48.78%	42.69%	35.45%	29.62%	23.70%	20.01%	13.00%	10.32%	7.55%	6.52%	5.07%
W	31.21%	50.41%	54.80%	58.94%	61.47%	61.85%	61.23%	59.82%	58.65%	57.44%	52.26%	49.32%
Total	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

RGBW D13 Series

CCT / Color	1800K	2200K	2400K	2700K	3000K	3500K	4000K	5000K	5700K	6500K	8000K	10000K
B	0.00%	0.81%	1.48%	2.66%	4.02%	6.26%	8.45%	11.82%	14.25%	16.36%	20.20%	23.06%
G	0.46%	0.00%	1.03%	2.95%	4.89%	8.20%	10.30%	15.36%	16.78%	18.65%	21.01%	22.55%
R	68.34%	48.78%	42.69%	35.45%	29.62%	23.70%	20.01%	13.00%	10.32%	7.55%	6.52%	5.07%
W	31.21%	50.41%	54.80%	58.94%	61.47%	61.85%	61.23%	59.82%	58.65%	57.44%	52.26%	49.32%
Total	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

Bridgelux provides reference current ratio, and customer needs to fine tune& finally fixed it based on fixture actually operation condition.

Thermal Management Guidelines

This part provides general guidelines for how to characterize the junction temperature of Bridgelux Vesta Series RGBW Array With CSP in order to verify that the junction temperature in the actual application during regular operation does not exceed the maximum allowable temperature specified in the datasheet.The typical thermal resistance Rthj-sp between the junction and the solder point for Vesta Series RGBW Array With CSP is specified in Bridgelux Vesta Series RGBW Array With CSP product datasheets. The junction temperature Tj can be characterized according to the following equation:

$$T_j = T_{sp} + R_{thj\text{-}sp} \bullet P_e$$

In the equation, Pe is the electrical power operating in product component and Tsp is the temperature at the bottom of the product solder point.

In actual applications it is hard to measure the solder point temperature Tsp directly. Therefore, a practical way to characterize the product LED junction temperature is by measuring the temperature Tc

of a monitor pad on the PCB close to the product with a thermocouple. The junction temperature can then be calculated as follows:

$$T_j = T_c + R_{thj\text{-}sp} \bullet P_e$$

To ensure accurate readings of Tc, the Tc monitor pad should be set as close as possible to the product component.

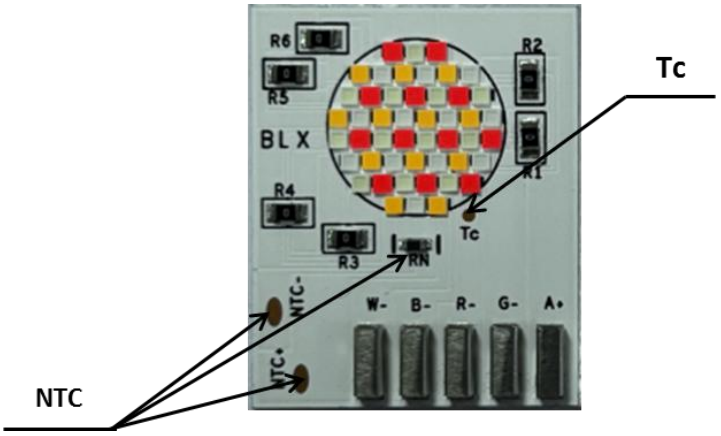


Figure 5 Tc monitor for RGBW COB

To ensure timely monitoring and get accurate readings of Tc, Bridgelux suggests integrating NTC thermal resistance for high density module application. The temperature in the emitter center area is much higher than that of emitter outer area, thus there should be reserve buffer to up-limiting Tj of Vesta Series RGBW Array With CSP for high density module design.

ESD Prevention

Bridgelux Vesta Series RGBW Array With CSP have passed ESD testing to levels which do not require special handling for most assembly processes. However, to prevent inadvertent damage, Bridgelux recommends using appropriate ESD grounding procedures while handling the modules.

According to the ESD Association out of Rome, New York, there are six basic principles in the development and implementation of effective ESD control programs:

1. Design in protection by designing products and assemblies to be as robust as reasonable from the effects of ESD.
2. Define the level of control needed in your environment.
3. Identify and define the electrostatic protected areas (EPAs), the areas in which you will be handling ESD sensitive parts (ESDS).
4. Reduce Electrostatic charge generation by reducing and eliminating static generating processes, keeping processes and materials at the same electrostatic potential, and by providing appropriate ground paths to reduce charge generation and accumulation.

5. Dissipate and neutralize by grounding, ionization, and the use of conductive and dissipative static control materials.
6. Protect products from ESD with proper grounding or shunting and the use of static control packaging and material handling products.

Chemical Compatibility

Optimizing performance and reliability of a lighting system using Vesta Series RGBW Array With CSP Array standardized operating procedures shall be followed, and suitable manufacturing processes as well as materials shall be selected during the assembly of COB into the lighting systems. Careful consideration must be given to the compatibility between the involved materials and chemicals both in the processing stage and during the selection of all materials incorporated into the finished luminaires. This section provides a list of commonly used chemicals that should be avoided or strictly controlled during the processing and subsequent application of all Bridgelux COB components.

Silicone encapsulation is commonly used by most LED manufacturers, including Bridgelux. The silicone encapsulation is permeable to gas molecules. The gas molecules, including volatile organic compounds (VOC's), halogen and sulfur compounds, can interact with silicone and other components that comprise the Bridgelux Vesta Series RGBW Array With CSP and cause degradation in performance. The possibility and extent of degradation is dependent on the type of chemical, the concentration of the chemical, the temperature during exposure, and the length of time the COB exposed to the chemical. Additional considerations should be given to IP rated or "sealed" luminaires that create "air tight environments" around the module. Luminaires sealed in this fashion can trap potentially damaging gas molecules from manufacturing processes or subsequent out-gassing of materials used in the luminaire which can result in long term exposure of the COB to the contaminant.

The source of the gas molecules can be out-gassing from polymeric materials such as glues, gaskets, paints and/or under-cured materials. Materials used inside a luminaire with a potential to outgas should be characterized as part of the luminaire design to understand the environment that will be surrounding any Bridgelux COB during the luminaire lifetime. The silicone encapsulation is also vulnerable to nonpolar fluids and solvents commonly used during the manufacturing process of the luminaire such as cleaning, oil assisted drilling, and any processes that would allow the COB to come into contact with the fluids or solvents. Care should be taken such that the Vesta Series RGBW Array With CSP are protected from such chemicals to avoid ingress of small non-polar molecules into the encapsulation silicone.

Common chemicals that are known to be harmful to Bridgelux Vesta Series RGBW Array With COB are listed in Table 4. Note that the chemicals listed in Table 4 may be found in various states – liquid, gas, and/or solid. All physical states of these chemicals can be harmful to the COB, but those that are in a gaseous state, such as volatile organic compounds (VOCs), can readily permeate the lens material of the module and damage the COB internally and/or externally. Because it is impossible to determine all of the chemicals that may be detrimental to the performance of the Bridgelux Vesta Series RGBW Array With CSP, the list of chemicals may not be exhaustive. It is the responsibility of the luminaire manufacturer to ensure that any and all materials used in the luminaire design or manufacturing process does not cause damage to the subsystems.

Table 4: List of known chemical contaminants and likely sources

Classification	Chemical Name	Found In Some
Acids	Hydrochloric Acid Sulfuric Acid Nitric Acid Phosphoric acid	Cleaners, cutting fluids
Organic acids	Acetic acid	RTV silicones, cutting fluids, degreasers, adhesives
Bases	Sodium Hydroxide Potassium hydroxide Amines	Detergents, cleaners
Organic Solvents	Ethers such as glycol ether Ketones such as MEK, MIBK Aldehydes such as formaldehyde	Cleaners, mineral spirits, petroleum, paint, gasoline
Aromatic solvents	Xylene Toluene Benzene	Cleaners
Low Molecular Weight Organics Volatile Organic Compounds (VOC's)	Acetates Acrylates Aldehydes Dienes	Superglue, Loctite adhesives, threadlockers and activators, common glues, conformal coatings
Petroleum Oils	Liquid hydrocarbons	Machine oil, lubricants
Non-petroleum Oils	Siloxanes, fatty acids	Silicone oil, lard, linseed oil, castor oil
Oxidizers/Reducers	Sulfur compounds	Gaskets, paints, sealants, petroleum byproducts
Halogen compounds	Cl, F,or Br containing organic and inorganic compounds	Solder fluxes/pastes, flame retardants

Disclaimer

This application note has been prepared to provide guidance on the application of Bridgelux Vesta Series RGBW Array With CSP in customer products. Bridgelux provides this information in good faith, but does not assume any responsibility or liability for design deficiencies that might exist in the design based on the information contained in this document.
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It is the responsibility of the customer to ensure that their design meets all necessary requirements and safety certifications for its intended use.

About Bridgelux

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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