

Vertical integrated **Light source provider**

from **Component** to **Engine**, from **LEDs** to **Smart light**



Samsung COB Application note

Application note-COB-ver1.4
Release date : Apr. 2022

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0. Introduction

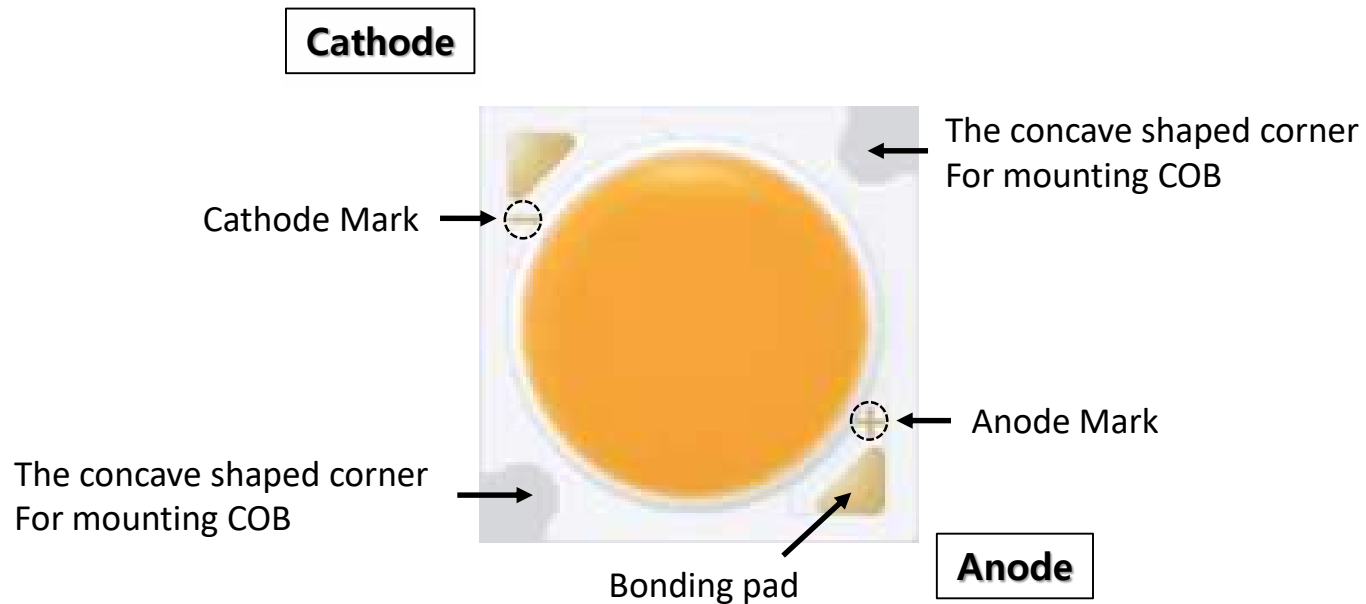
■ General Information

Model	LC010C	LC003D LC006D LC009D LC013D	LC020C	LC030C LC040C	LC016D LC019D LC026D LC033D	LC040D LC060D LC080D
Shape						
Remark	13.5 x 13.5 mm Ø6.0 mm	13.5 x 13.5 mm Ø9.8 mm	19.0 x 19.0 mm Ø8.5 mm	19.0 x 19.0 mm Ø11.5 mm	19.0 x 19.0 mm Ø14.5 mm	28.0 x 28.0 mm Ø22.0 mm
Bulbs /MR /PAR	○	○				
Down /Spot Light		○	○	○	○	
High /Low bay				○	○	○

1. Component

■ Appearance Features

- Efficient LES area over product size
 - Uniform Chip arrangement
 - Concave shaped corner for Screw fixation
 - Aluminum metal substrate
- : Metal substrate basically make the low thermal resistance



1.1 Package information

■ Samsung COB Line-up : D-series

- D series is targeting main stream in general lighting and it has leading efficacy.

COB D-series Platform	Model	Wattage											Performance (LC026D)
		3W	6W	9W	13W	16W	19W	26W	33W	40W	60W	80W	
		LES 9.8mm (13.5x13.5mm)				14.5mm (19x19mm)				22.0mm (28x28mm)			
Gen.4	CRI 70+			●	●	●	●	●	●	●	●	●	D4 rank : 170lm/W
	CRI 80+	●	●	●	●	●	●	●	●	●	●	●	
	CRI 90+	●	●	●	●	●	●	●	●	●	●	●	
Gen.3 Gen.3+	CRI 70+			●	●	●	●	●	●	●	●	●	D3 rank : 161lm/W D3+ rank:164lm/W
	CRI 80+	●	●	●	●	●	●	●	●	●	●	●	
	CRI 90+	●	●	●	●	●	●	●	●	●	●	●	
Gen.2 Gen.2+	CRI 70+			●	●	●	●	●	●	●	●	●	D2 rank : 151lm/W D2+ rank:154lm/W
	CRI 80+	●	●	●	●	●	●	●	●	●	●	●	
	CRI 90+	●	●	●	●	●	●	●	●	●	●	●	

● : MP

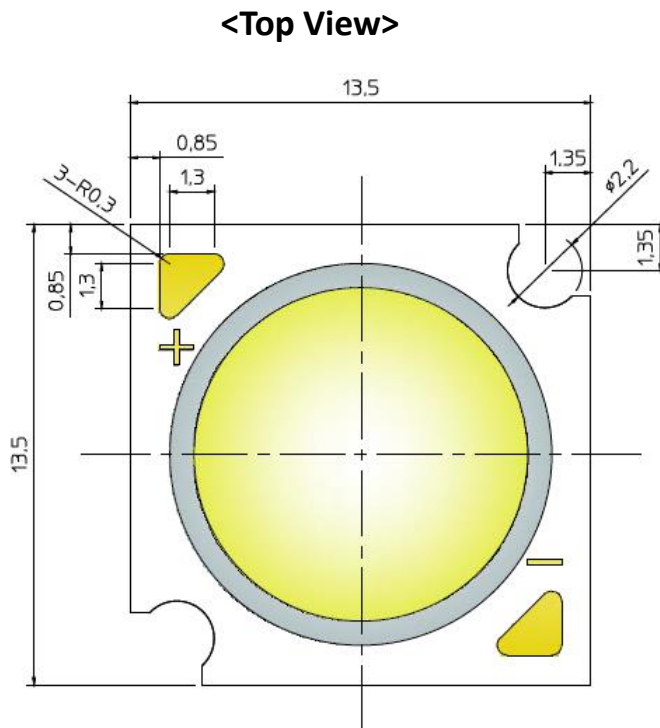
1.1 Package information

■ Samsung COB Line-up : C-series

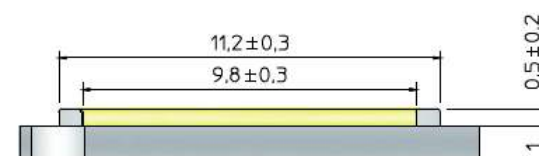
- Samsung COB C-series Gen.2 provide high efficacy & CBCP for narrow beam lighting.

Platform	Model		Wattage				Key Features
			10W (LC010C)	20W (LC020C)	30W (LC030C)	40W (LC040C)	
Small LES COB (C-series Gen.2)	CRI 80+		●	●	●	●	• Providing Full CCT & CRI • Best Efficacy • Low thermal resistance by Metal Substrate
	CRI 90+		●	●	●	●	
	Size [mm]	LES-In (LES-Out)	6.0 (7.5)	8.5 (10.0)	11.5 (13.5)		• Outline of C-series Gen.2 is same with D-series. → To Use D-series holder
		Package	13.5 x 13.5	19.0 x 19.0			

● : MP

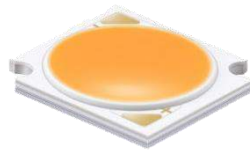


12S x 1P

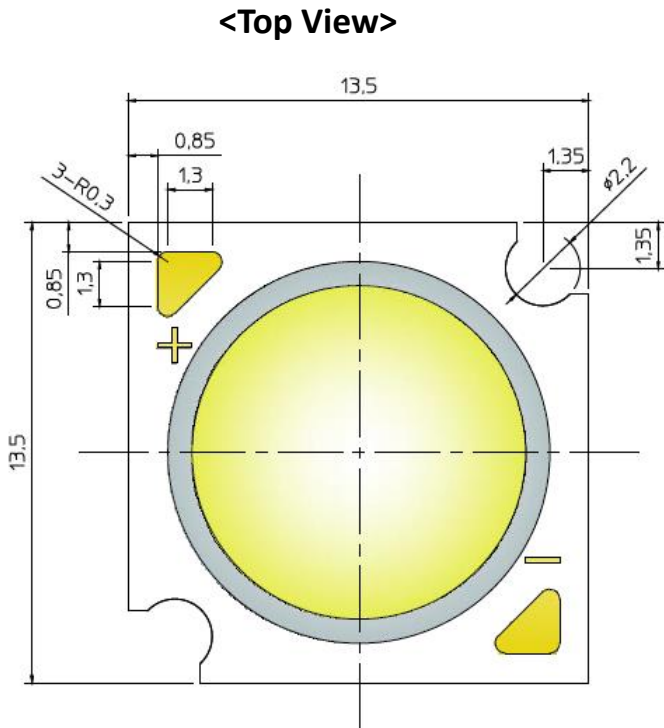


1.1.1 Package Circuit & Dimension_LC006D

■ Package



■ Dimension

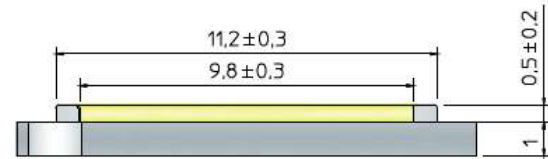


■ Circuit Array



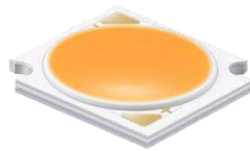
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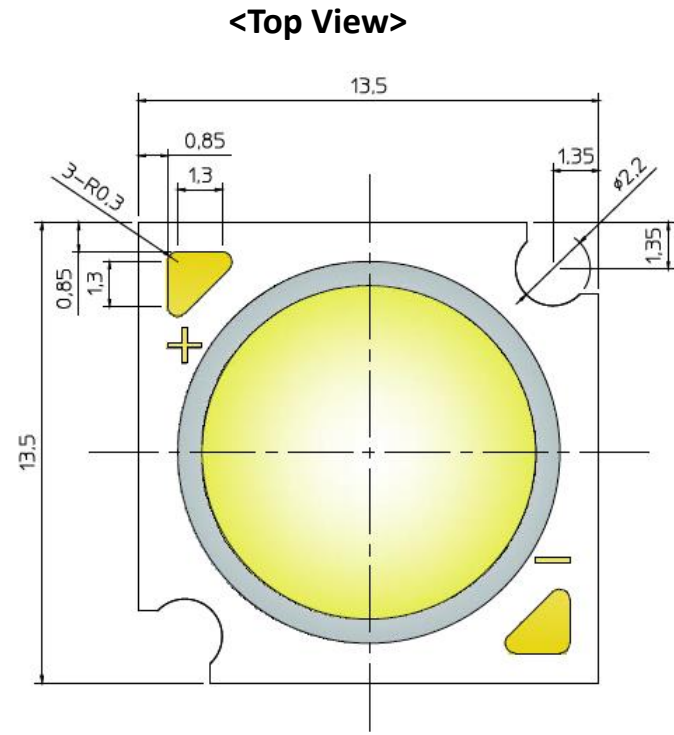


1.1.1 Package Circuit & Dimension_LC009D

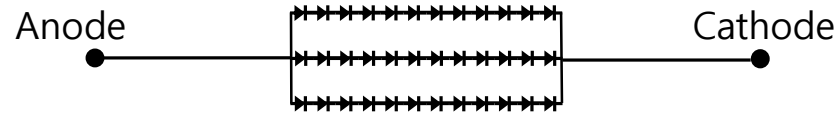
Package



Dimension

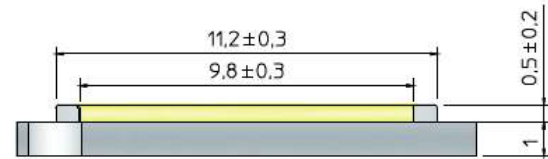


Circuit Array



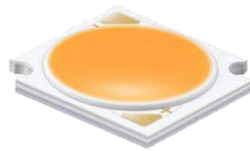
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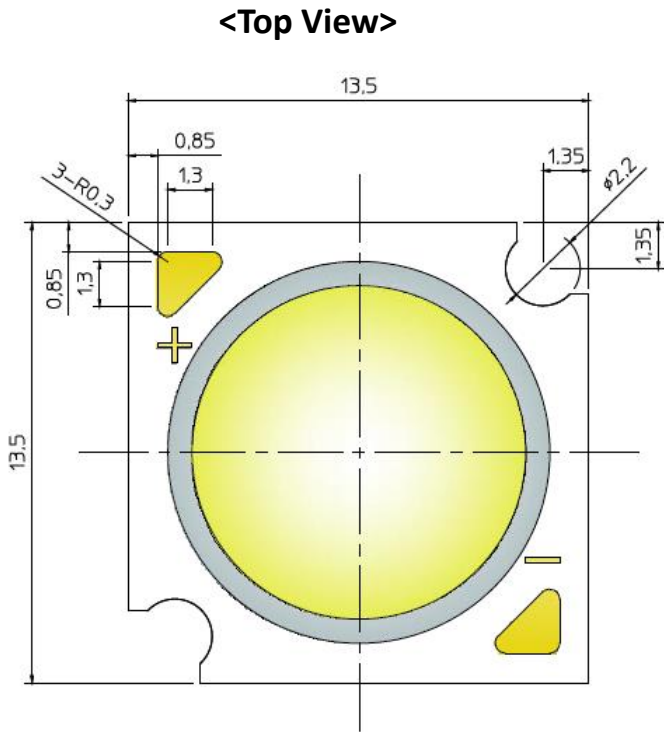


1.1.1 Package Circuit & Dimension_LC013D

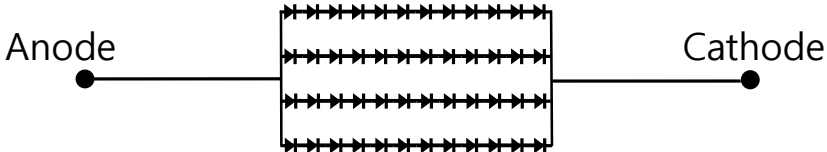
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Dimension

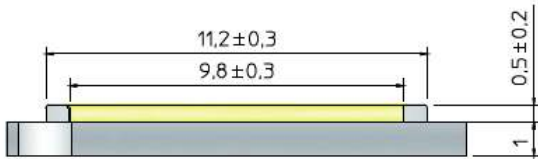


Circuit Array



12S x 4P

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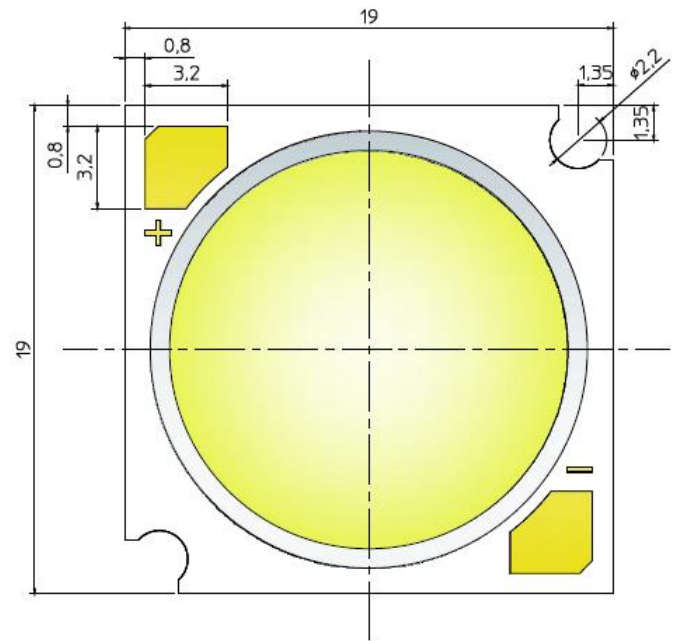
1.1.1 Package Circuit & Dimension_LC016D

Package

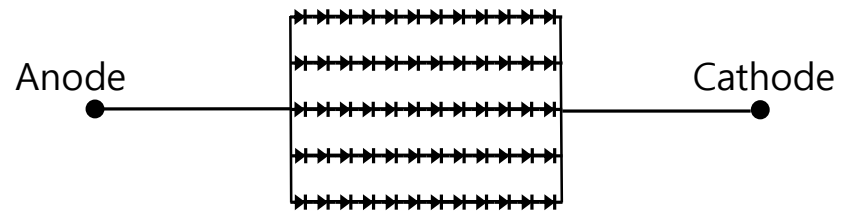


Dimension

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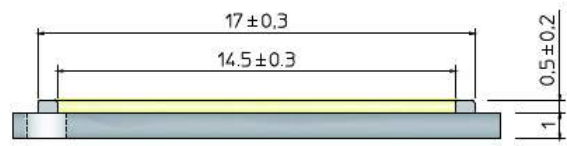


Circuit Array



12S x 5P

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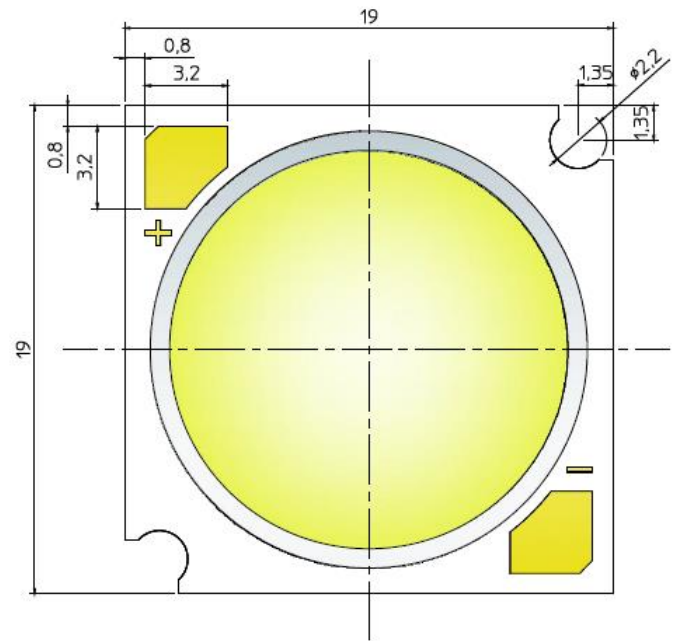
1.1.1 Package Circuit & Dimension_LC019D

■ Package

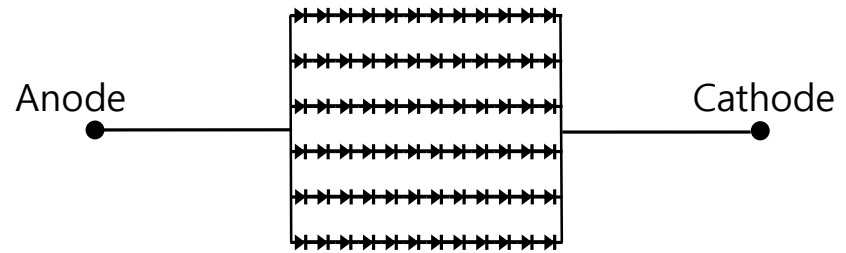


■ Dimension

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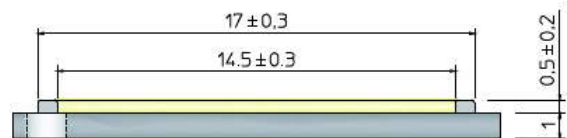


■ Circuit Array



12S x 6P

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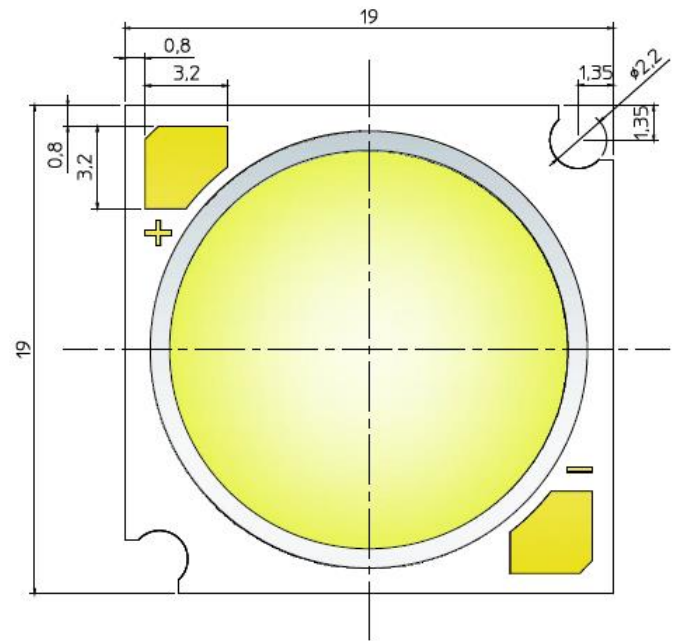
1.1.1 Package Circuit & Dimension_LC026D

■ Package

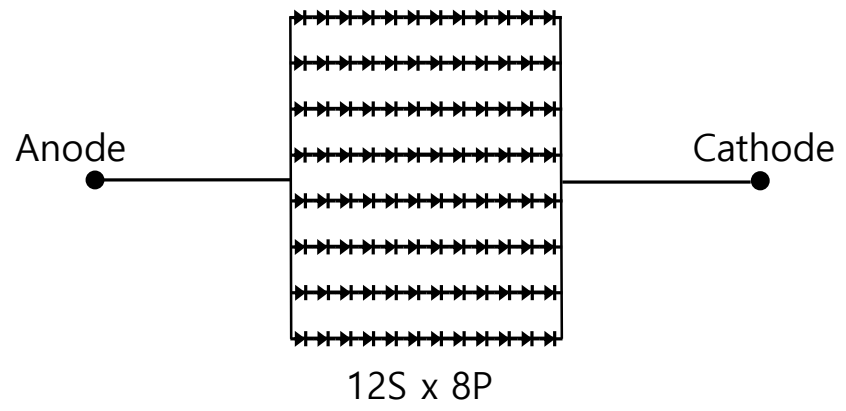


■ Dimension

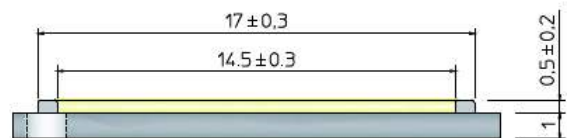
<Top View>



■ Circuit Array



<Side View>



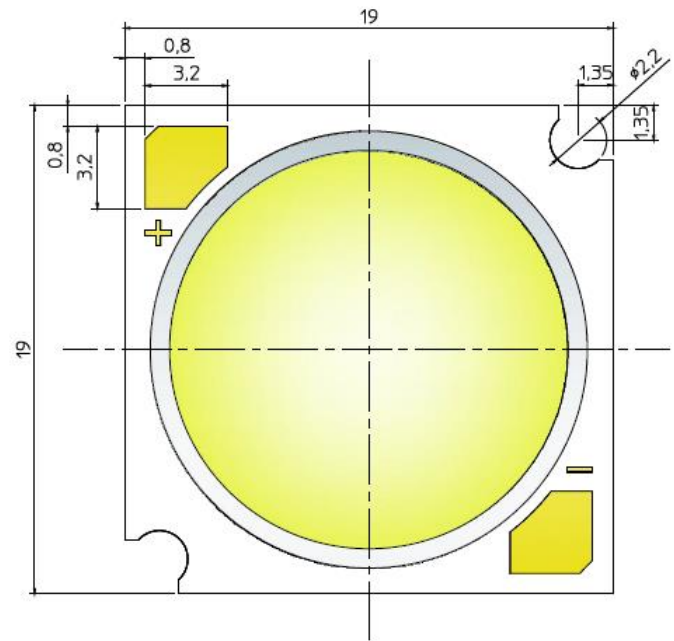
1.1.1 Package Circuit & Dimension_LC033D

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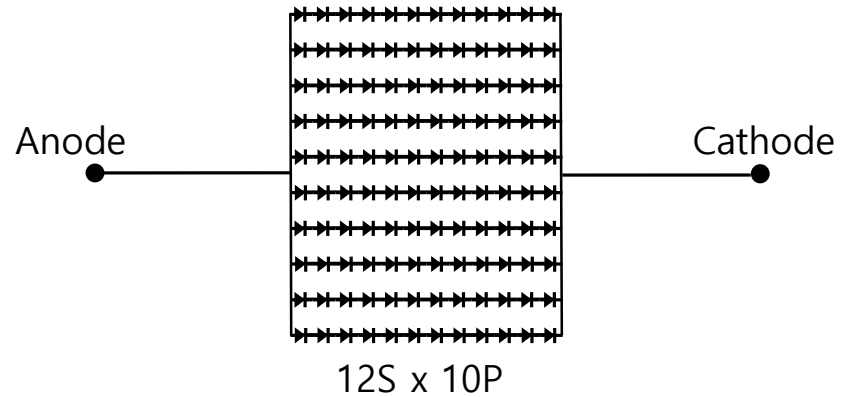


Dimension

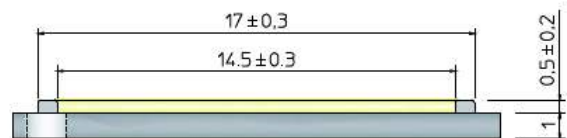
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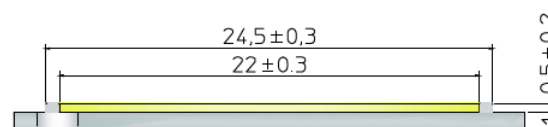
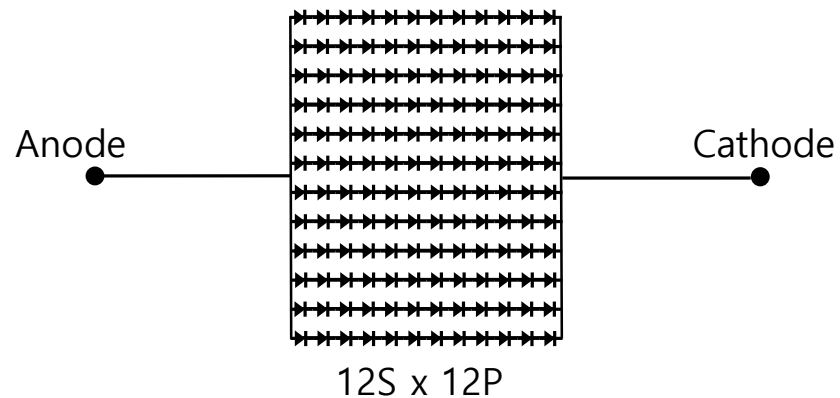
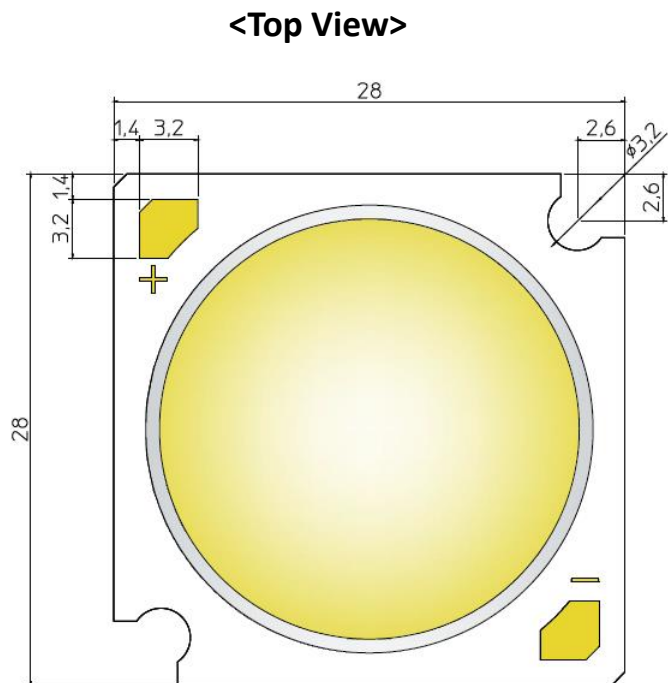


Circuit Array



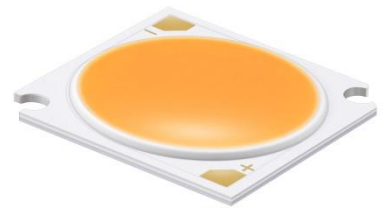
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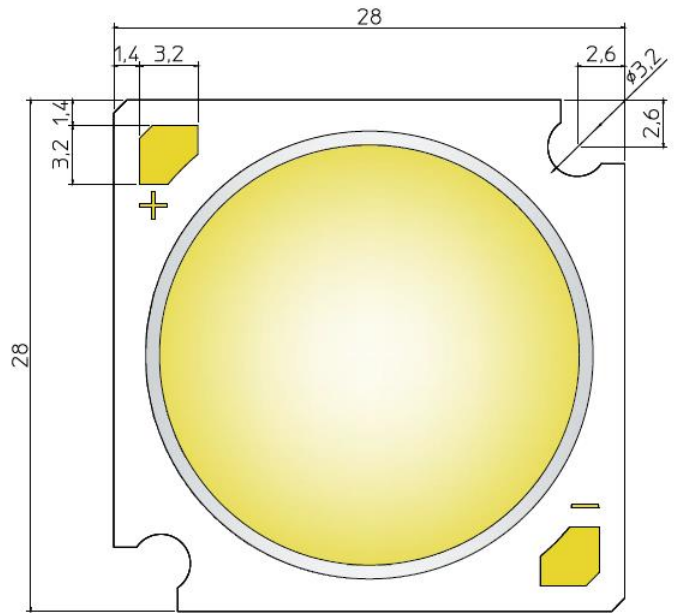
1.1.1 Package Circuit & Dimension_LC060D

■ Package

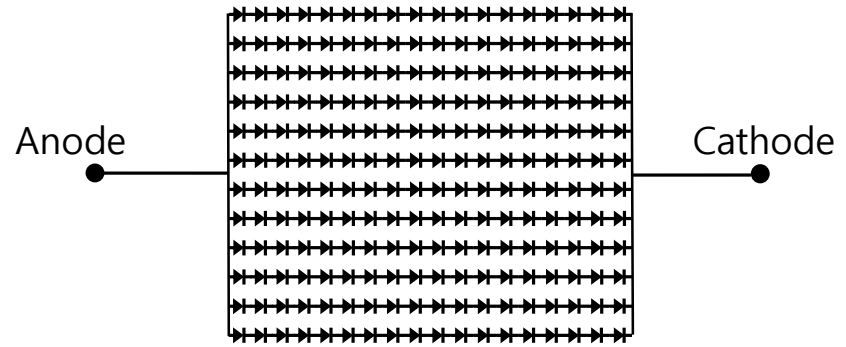


■ Dimension

<Top View>

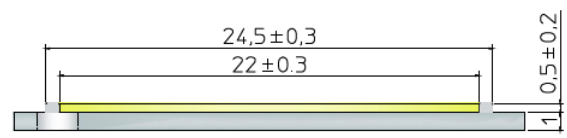


■ Circuit Array



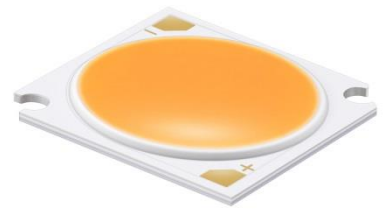
18S x 12P

<Side View>



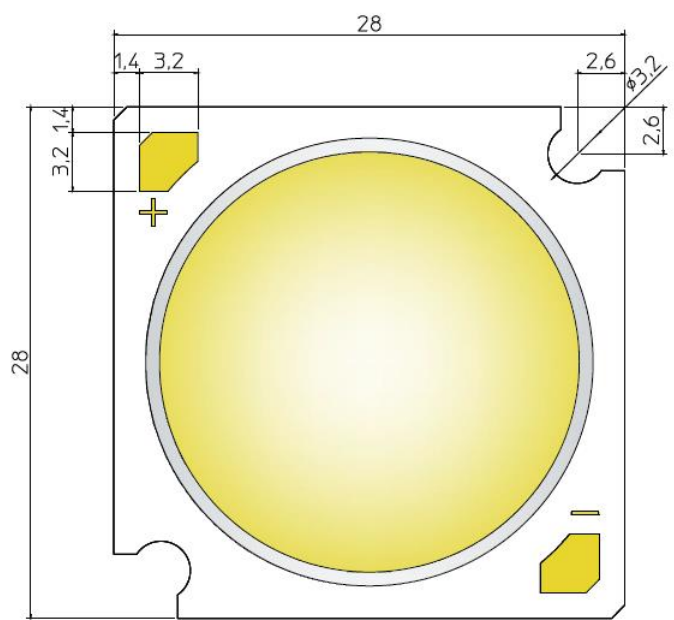
1.1.1 Package Circuit & Dimension_LC080D

■ Package

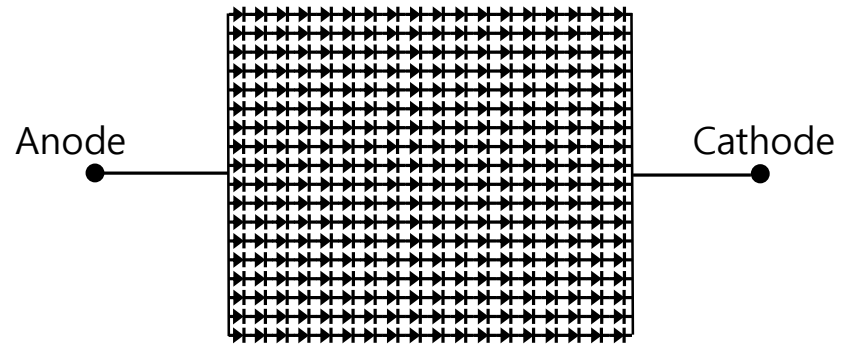


■ Dimension

<Top View>

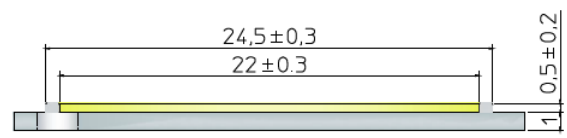


■ Circuit Array



18S x 18P

<Side View>

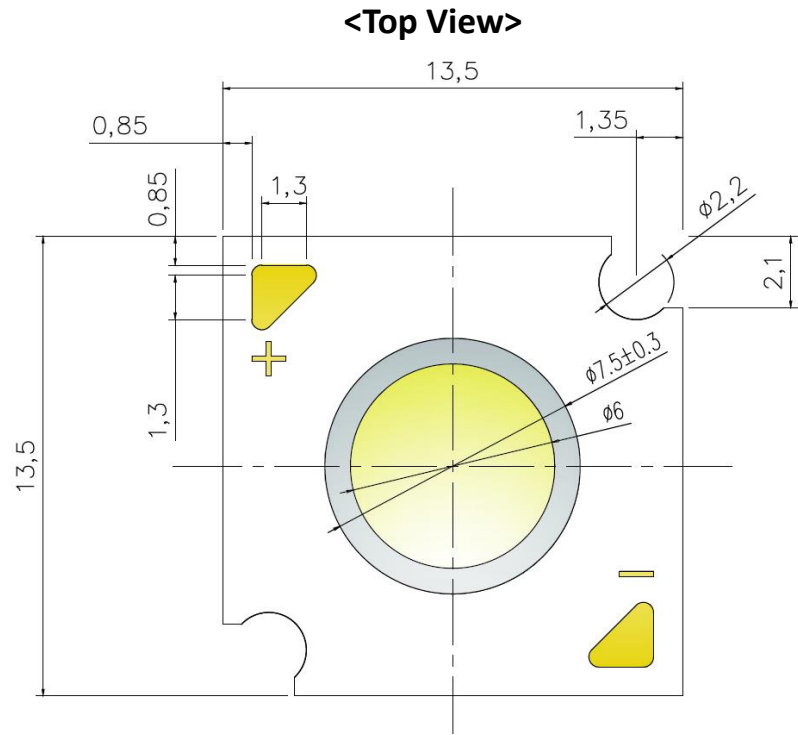


1.1.1 Package Circuit & Dimension_LC010C

Package



Dimension

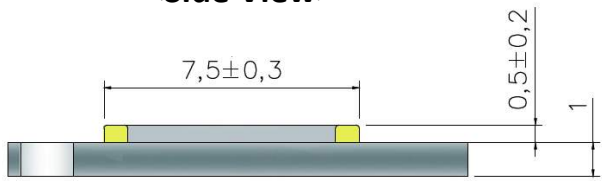


Circuit Array



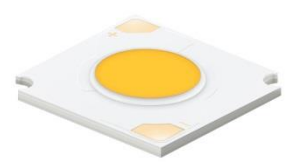
12S x 2P

<Side View>

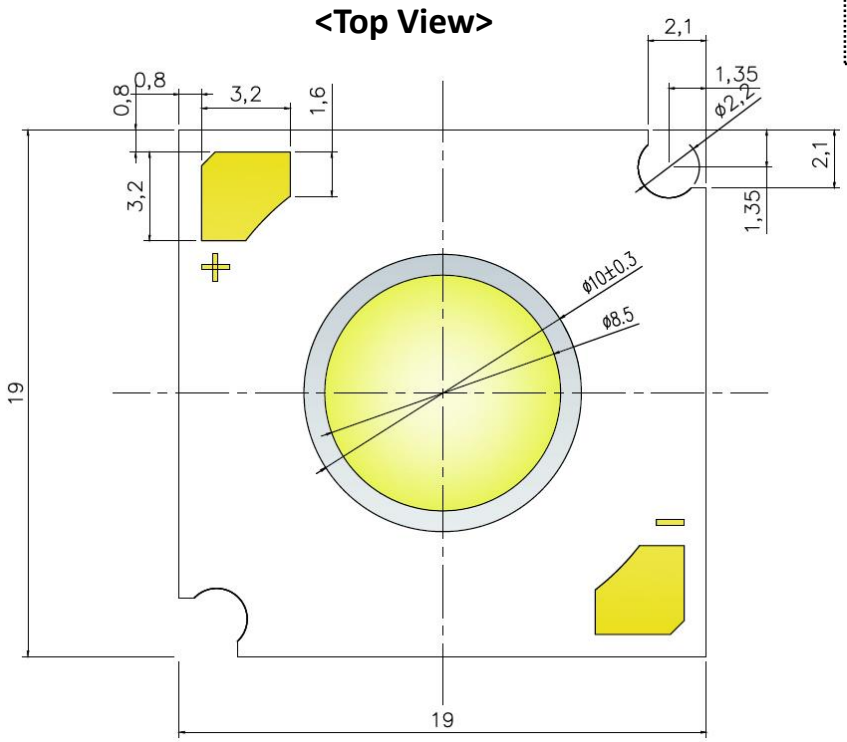


1.1.1 Package Circuit & Dimension_LC020C

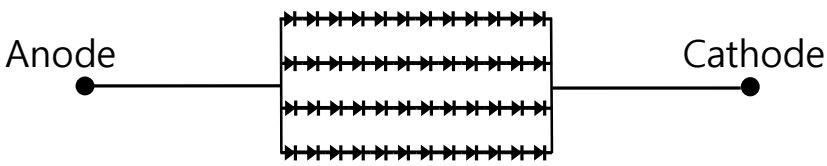
Package



Dimension

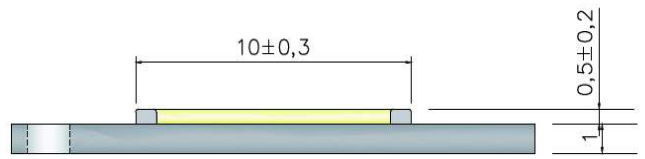


Circuit Array



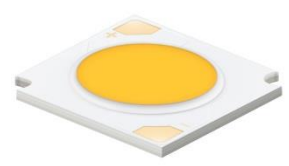
12S x 4P

<Side View>

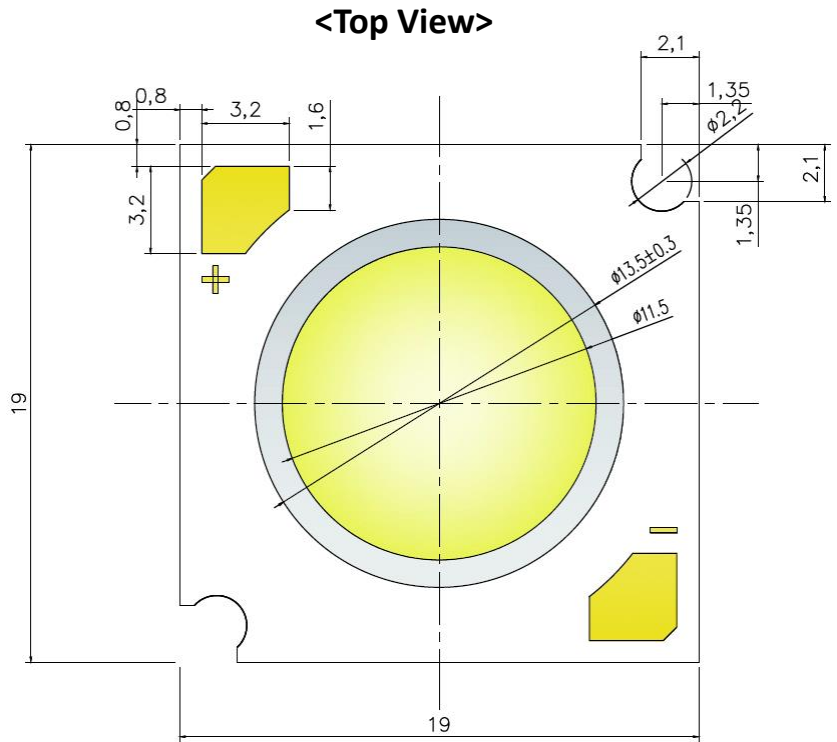


1.1.1 Package Circuit & Dimension_LC030C

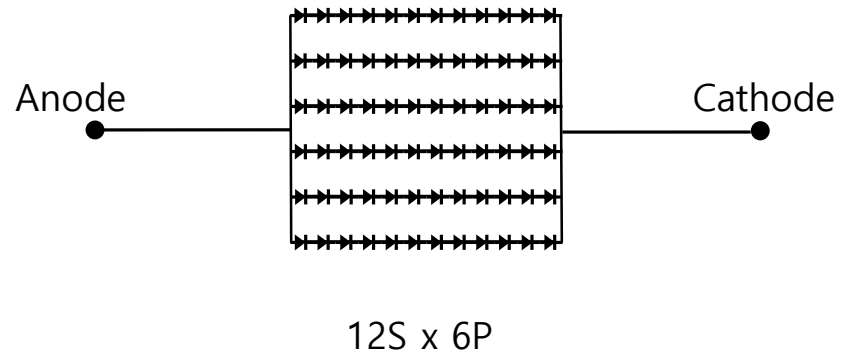
■ Package



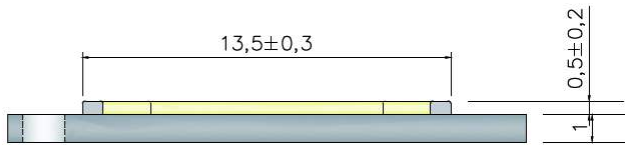
■ Dimension



■ Circuit Array

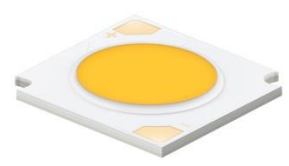


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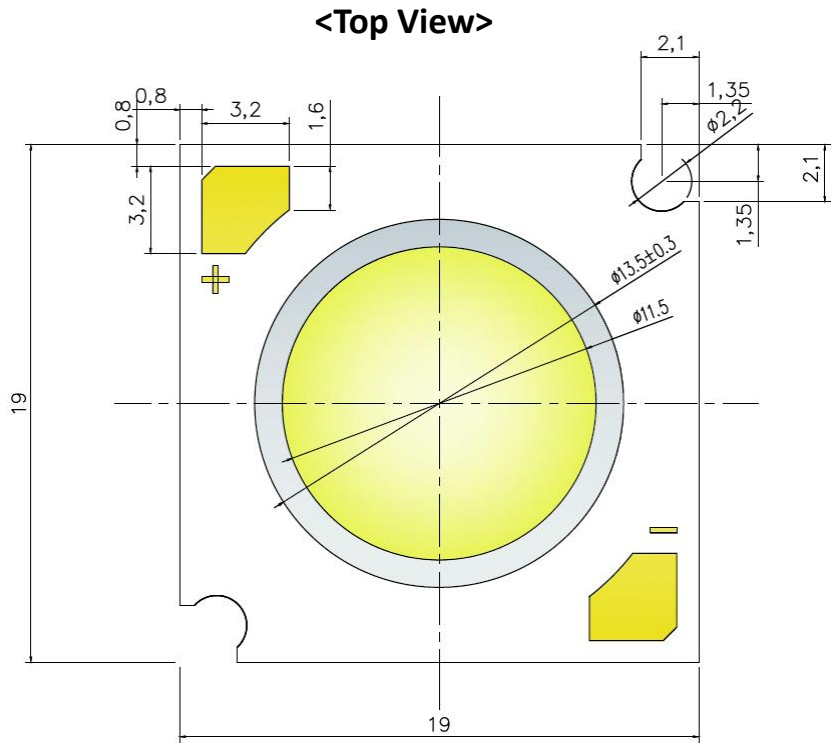


1.1.1 Package Circuit & Dimension_LC040C

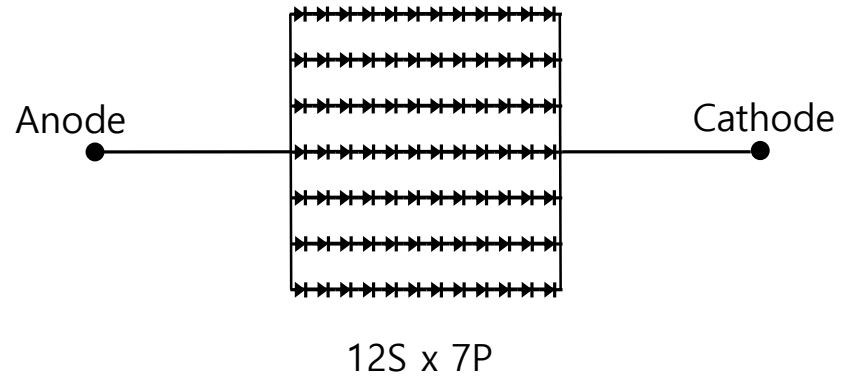
Package



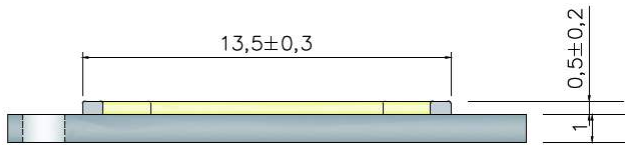
Dimension



Circuit Array



<Side View>

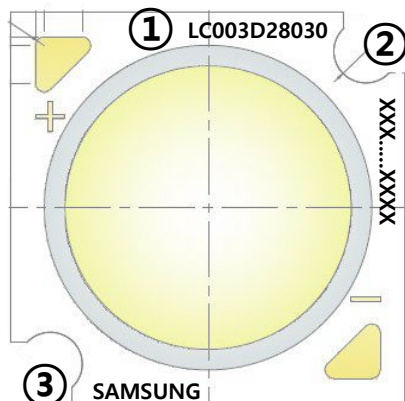


1.1.2 Laser-marking guide_D-series Gen.1

Format _ D-series Gen.1

1313 Size	1919 Size	2828 Size
ex) 3W Ra80 3000K	ex) 26W Ra80 3000K	ex) 40W Ra80 3000K

Information _ D-series Gen.1



① LC003D 1 80 30
 3W COB Gen1 Ra80 3000K

② LOT No. of Inner-code

③ “SAMSUNG” should be printed by Samsung One Font

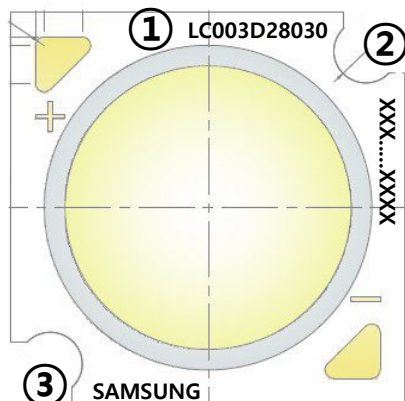
※ The detail dimension of font position and size are not exactly defined.

1.1.2 Laser-marking guide_D-series Gen.2

Format _ D-series Gen.2

1313 Size	1919 Size	2828 Size
ex) 3W Ra80 3000K	ex) 26W Ra80 3000K	ex) 40W Ra80 3000K

Information _ D-series Gen.2



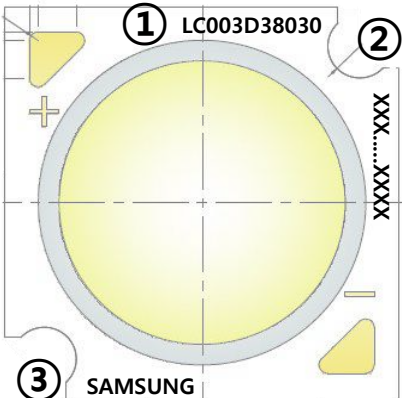
① LC003D 2 80 30
 3W COB Gen2 Ra80 3000K

② LOT No. of Inner-code

③ “SAMSUNG” should be printed by Samsung One Font

※ The detail dimension of font position and size are not exactly defined.

1313 Size	1919 Size	2828 Size
ex) 3W Ra80 3000K	ex) 26W Ra80 3000K	ex) 40W Ra80 3000K



- ① LC003D 3 80 30
3W COB Gen3 Ra80 3000K

- ② LOT No. of Inner-code

- ③ “SAMSUNG” should be printed by Samsung One Font

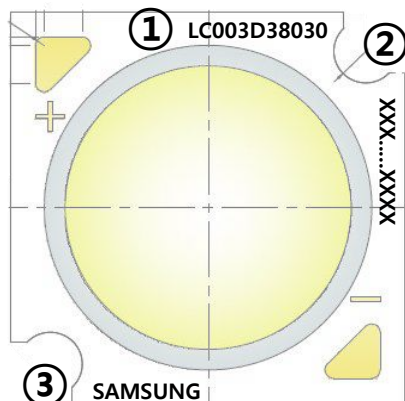
※ The detail dimension of font position and size are not exactly defined.

1.1.2 Laser-marking guide_D-series Gen.4

Format _ D-series Gen.3

1313 Size	1919 Size	2828 Size
ex) 3W Ra80 3000K	ex) 26W Ra80 3000K	ex) 40W Ra80 3000K

Information _ D-series Gen.4

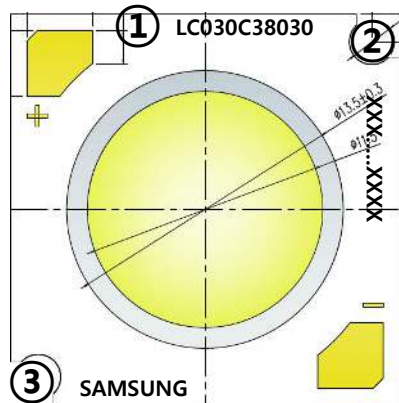
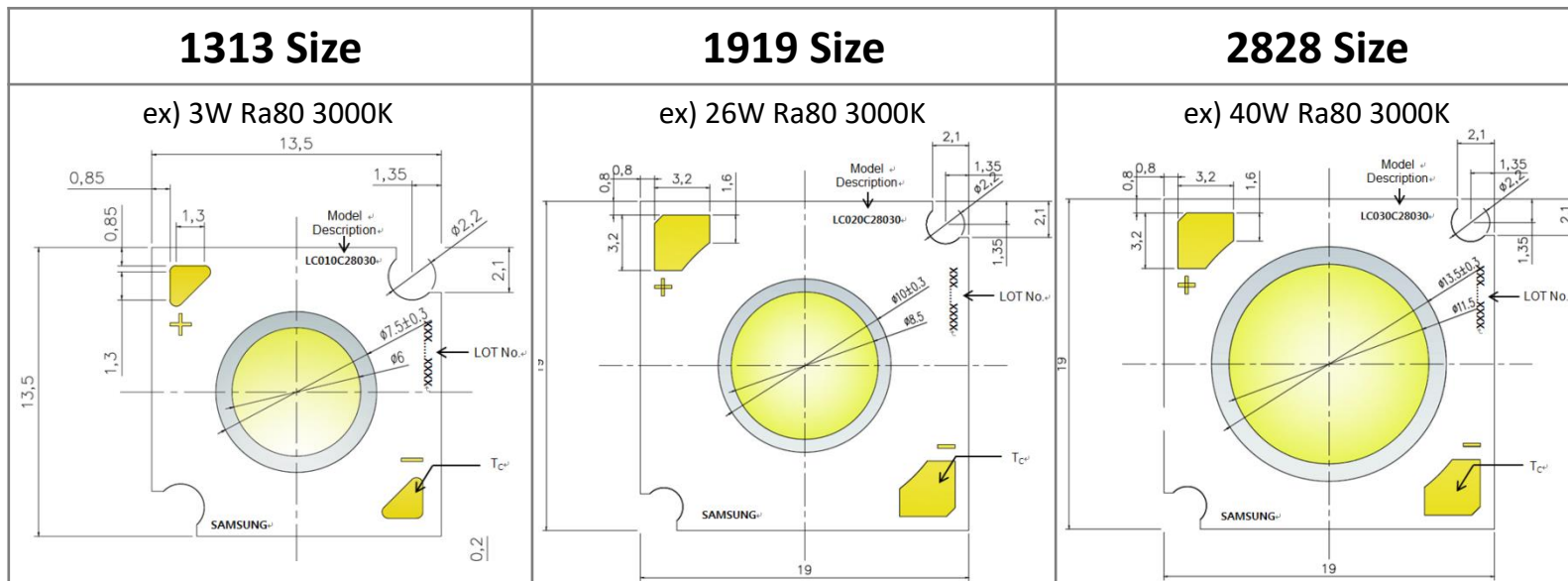


① LC003D 4 80 30
3W COB Gen4 Ra80 3000K

② LOT No. of Inner-code

③ “SAMSUNG” should be printed by Samsung One Font

※ The detail dimension of font position and size are not exactly defined.



- ① LC030C 2 80 30
30W COB Gen2 Ra80 3000K

② LOT No. of Inner-code

③ “SAMSUNG” should be printed by Samsung One Font

※ The detail dimension of font position and size are not exactly defined.

1.1.3 Packing information

■ Packing of Samsung COB D-series Gen.2

PCB size	Wattage	(pcs)				
		Tray	Aluminum Bag	Inner Box	Outer Box	MOQ
13.5 x 13.5	LC003D,LC006D LC009D,LC013D	50	250	500	2000	500
19.0 x 19.0	LC016D,LC019D LC026D,LC033D	25	125	250	1000	250
28.0 x 28.0	LC040D,LC060D LC080D	16	80	160	640	160

■ Packing of Samsung COB D-series Gen.3

PCB size	Wattage	(pcs)				
		Tray	Aluminum Bag	Inner Box	Outer Box	MOQ
13.5 x 13.5	LC003D,LC006D LC009D,LC013D	50	250	500	2000	500
19.0 x 19.0	LC016D,LC019D LC026D,LC033D	25	125	250	1000	250
28.0 x 28.0	LC040D,LC060D LC080D	16	80	160	640	160

1.1.3 Packing information

■ Packing of Samsung COB D-series Gen.4

PCB size	Wattage	(pcs)				
		Tray	Aluminum Bag	Inner Box	Outer Box	MOQ
13.5 x 13.5	LC003D,LC006D LC009D,LC013D	50	250	500	2000	500
19.0 x 19.0	LC016D,LC019D LC026D,LC033D	25	125	250	1000	250
28.0 x 28.0	LC040D,LC060D LC080D	16	80	160	640	160

■ Packing of Samsung COB C-series Gen.2

PCB size	Wattage	(pcs)				
		Tray	Aluminum Bag	Inner Box	Outer Box	MOQ
13.5 x 13.5	LC010C	50	250	500	2000	500
19.0 x 19.0	LC020C,LC030C LC040C	25	125	250	1000	250

1.2 Package Measuring Guide

■ Consideration for T_s & T_j between LED and Lighting

LED Measurement



Integrating Sphere



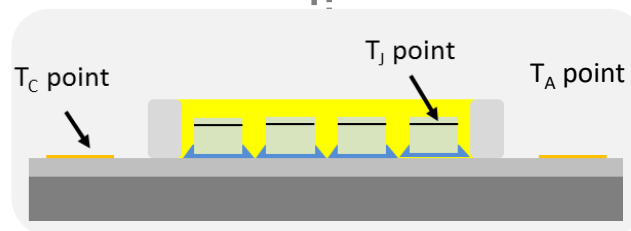
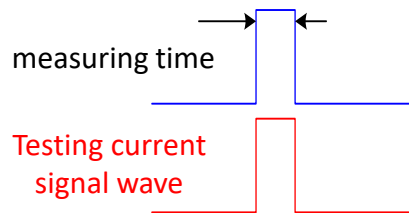
Test Handler

[Pulse Current Driving]

→ Same Temp. : $T_A \cong T_C \cong T_j$

$$(T_j = T_C + R_{TH(J-C)} \times \text{Power}(\cong 0))$$

[By Pulse current driving]



Lighting Measurement

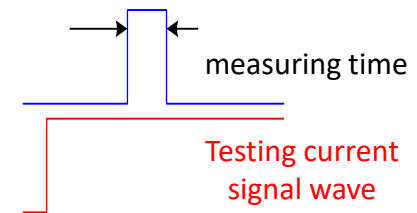


[Continuous DC current Driving]

→ Different Temp. : $T_A \ll T_s < T_j$

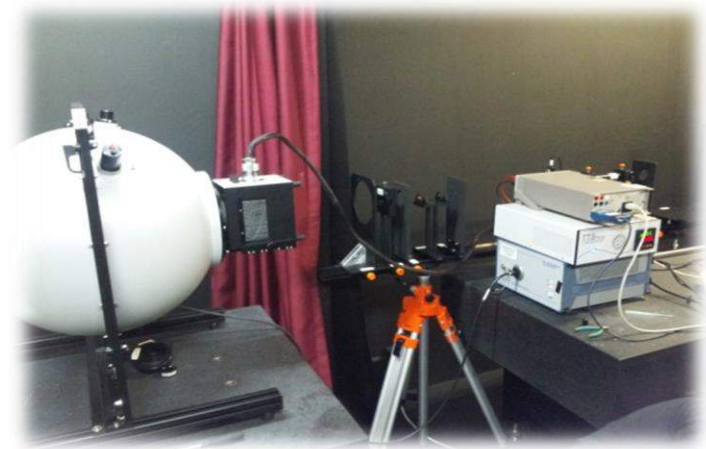
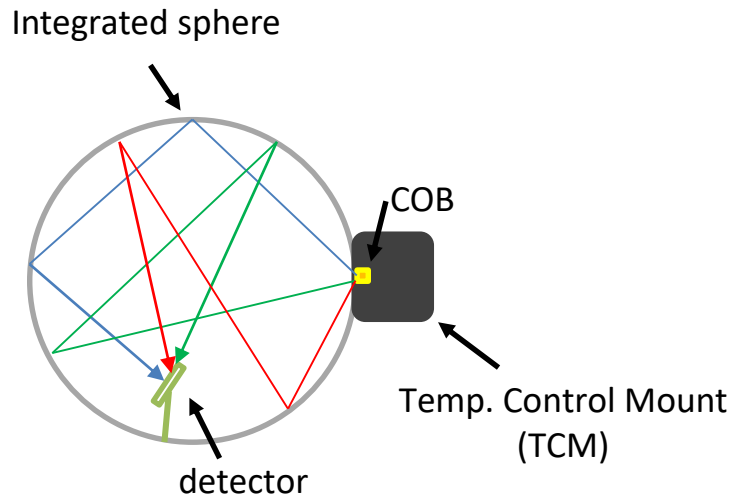
$$(T_j = T_C + R_{TH(J-C)} \times \text{Power})$$

[By Continuous DC current driving]



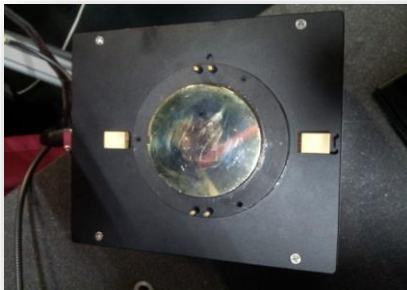
1.2.1 Optical Measuring

■ Measurement Component by Samsung

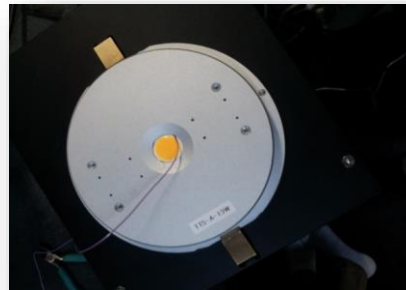


A – instrument (PKG) Pulse current measuring

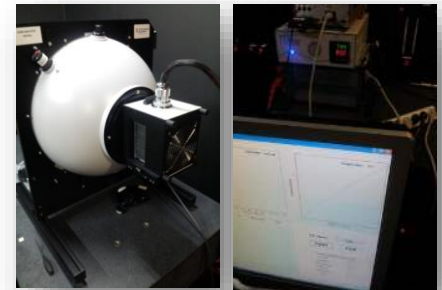
■ Measuring method



Set-up COB on the TCM



Put white cover on the TCM



Attach TCM
With integrated sphere

1.2.2 Thermal Measuring Guide

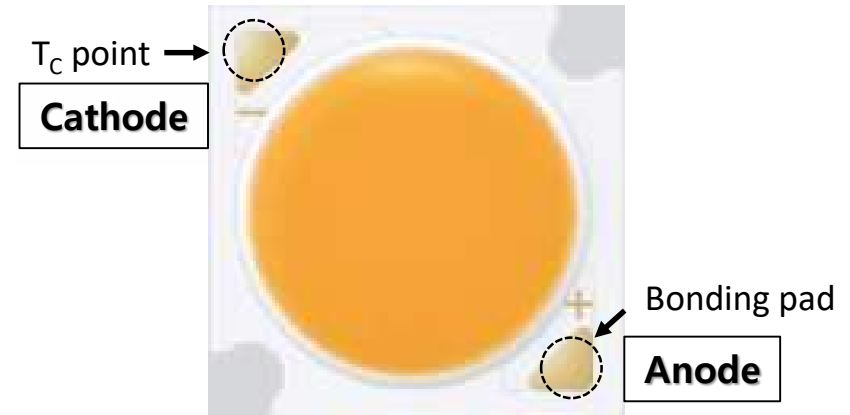
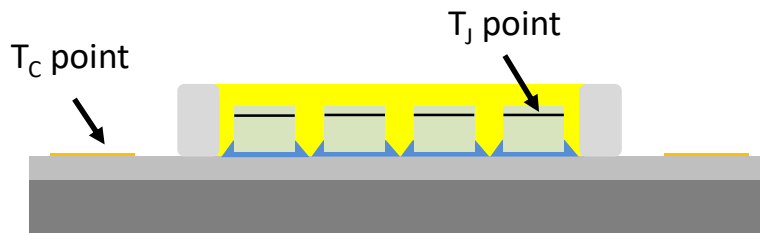
■ Thermal Point

▪ T_J & T_C point

- T_J point : Junction Temp. of chip(Chip)
: Generally, this Temp. couldn't measure.
- T_C point : Case Temp. of PCB(COB package).
: Generally, this Temp. could measure by thermocouple.

▪ Recommended T_C point

- T_C point : One of both pad in the COB package(below image).
※ T_S point is soldering point under SMT PKG. However, COB isn't SMT structure.
So, T_S and T_C is same meaning in COB.



2. Handling Guide

■ Handling Guide

- User have not to touch the lighting Emitting Surface(LES) in any cases.

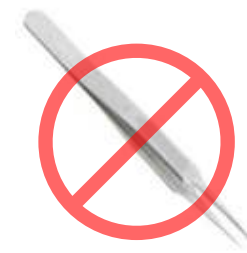
► Tools



White Ceramic tweezer

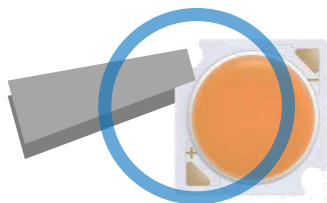


Vacuum tweezer



Sharped-tip Tweezer

► Pick-up



Softly handling when use
white Ceramic tweezer



Use vacuum tweezer case
(have to keep clean vacuum pad side)



DO NOT allow @ LES side



※ This recommended is provided for informational purpose only and is not a warranty or a specification.

2. Handling Guide

■ Particle on COB



Samsung's management for "Particle"

→ Samsung COB is managed below target for quality.

- Point particle : Diameter $\geq 1\text{mm}$
- Line particle : Length $\geq 1\text{mm}$, Width $\geq 0.15\text{mm}$

▪ Recommended method for particle removal



If user want to remove "Particle",

→ User should use blower.

※ This recommended is provided for informational purpose only and is not a warranty or a specification.

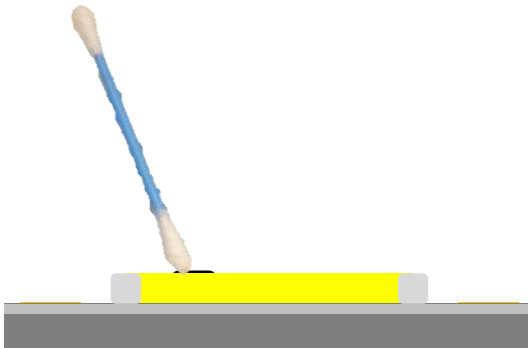
2. Handling Guide

■ Contamination and cleaning



In the production process of luminaire,
COB can be contaminated by an unexpected contaminant.

▪ Recommended method for cleaning



The organic material like as solder flux have to be cleaned out by using the tip of cotton swap soaked isopropyl alcohol(IPA).

※ This device should not be used in any type of fluid such as water, oil, organic solvent, etc.

※ This recommended is provided for informational purpose only and is not a warranty or a specification.

2. Handling Guide

■ Handling Guide (Document)

■ Environment of Working place

The working area for assembly luminaire is recommended to be maintained clean for preventing any contamination and keeping workers' safety. If all working area cannot be maintained clean, at least the space for assembly have to be kept clean and lower humidity in air.

■ Handling PKGs

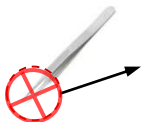
- ① Users have not to touch the lighting emitting surface(LES) in any cases.



At LES (Lighting Emitting Surface), the resin and phosphor cannot protect the bonding wire from deformation or disconnection by an external force

- ② When handling with tweezers user have to grip the thermo plastic(white mold).
③ Users have to wear the anti-static gloves or anti-static wrist band.
④ When handling COB, user have to use the anti-static tweezers.

(Especially, a sharpened-tip of the tweezers would have high possibility of giving a physical defect to CSP)



The sharp tip may physically damage the resin of Phosphor Resin or wall.

- ⑤ When switching on COB with an electrical power supplier, an unexpected or abrupt current should bring about EOS failure in COB. This may also bring about the failure in use or the decrease of life time of products. Please discharge the stored V of the power supplier.

2. Handling Guide

■ Handling Guide (Document)

■ Chemical compatibility

During manufacturing luminaire, the many chemicals could attack and contaminate packages. It is necessary to avoid the contaminants and chemicals in manufacturing process and operation. And we are providing the guideline for chemicals and relevant failure mode. (Refer to chemical guideline).

■ Storage

If the LEDs are to be stored for 3 months or more after being shipped from Samsung Electronics, they should be packed by a sealed container with nitrogen gas. (Shelf life of sealed bags: 12 months, temp. $\sim 40^{\circ}\text{C}$, $\sim 90\% \text{RH}$)

- After sealed bag is to be opened and , COB have to be followed the below guide.

- a. COB should be mounted within 672 hours(28 days) at an assembly line with a condition of no more than $30^{\circ}\text{C}/60\% \text{RH}$
- b. COB should be stored at $<10\% \text{RH}$

- Repack unused products with anti-moisture packing, fold to close any opening and then store in a dry place.

- If moisture sensitivity indicator is $>60\%$ at $23 \pm 5^{\circ}\text{C}$ the recovery work should be carried out at the proper condition. In that case, COB should be baked at $60 \pm 5^{\circ}\text{C}$

3. Assembly Guide

■ Fixation of COB

Fixing of COB is usually used in two basic method

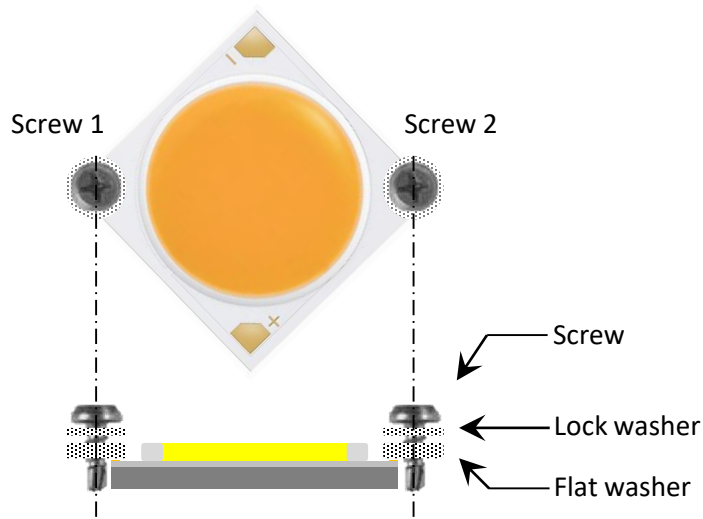
One is using the fixation screw, the other is using the holder, which are provided by holder makers.

■ Using fixation screw

This COB could be fixed by fastening 2 pairs of screw and washer.

The concaved corner is adequate shape for fixing COB with screws of M3.

The torque of fixing screw is recommended to be 0.7~1.0N·m.



The corner nearby electrode pad should not be allowed to fix screw. It is highly possible to bring about the electrical shortage.

Screw size	Washer size	Screw hole size
M2 (13.5X13.5, 19X19) M3 (28X28)	M2 (13.5X13.5, 19X19) M3 (28X28)	M2 (13.5X13.5, 19X19) M3 (28X28)

※ This recommended is provided for informational purpose only and is not a warranty or a specification.

3. Assembly Guide

▪ Using specific holder for COB

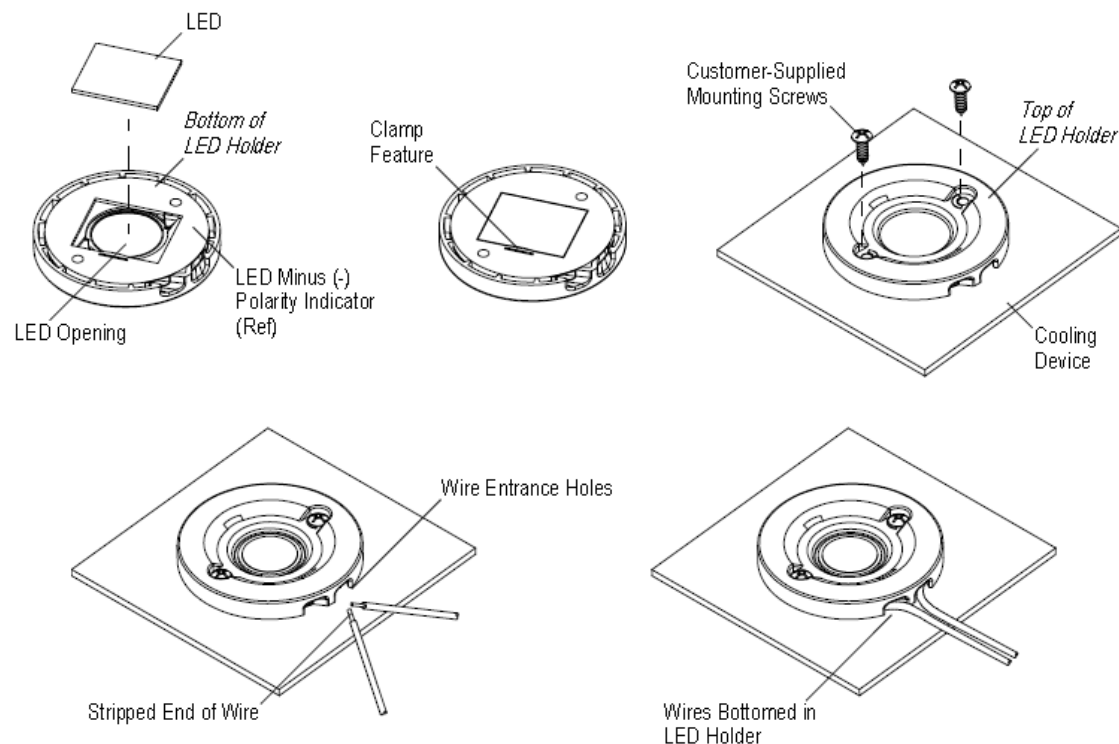
Considering holders, the luminaire is consisted of the key parts like as shown in below figures.

As described earlier, three main parts have to be well- functioned as thermal, optical and electrical.

The holder plays the role which can connect all key parts so as to properly perform the their functions.

This means that the holder is very simple and safe to fix the COB in the manufacturing luminaires.

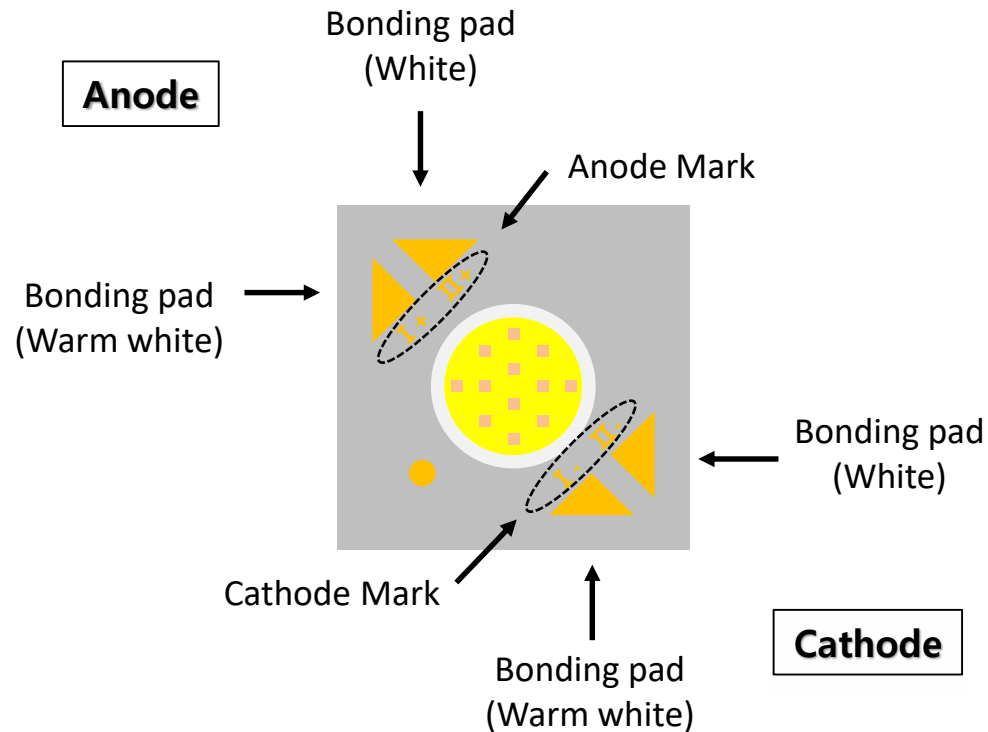
The below figure describe the assembly process by using the holder.



4. Tunable COB Guide

■ Appearance Features

- Efficient LES area over product size
 - Uniform Chip arrangement
 - Aluminum metal substrate
- : Metal substrate basically make the low thermal resistance



4.1.1 Package information

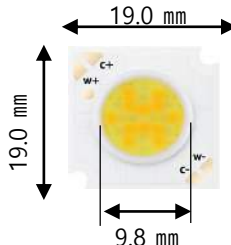
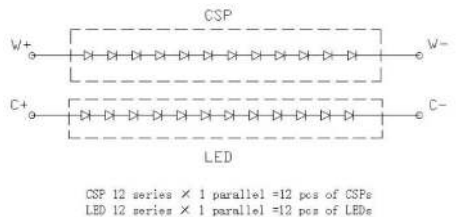
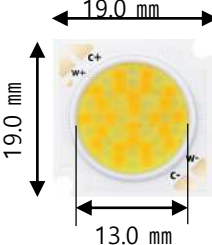
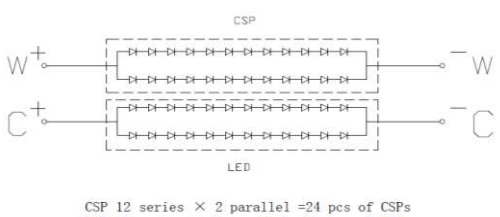
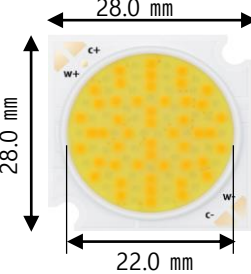
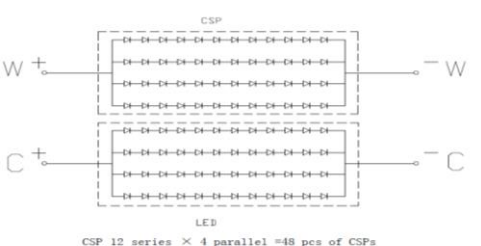
■ Samsung COB Line-up : E-series

- Samsung COB E-series Gen.1 provide tunable CCT function by each current driving.

Platform	Model		Wattage		
			10W (LC010T)	20W (LC020T)	35W (LC035T)
Tunable white COB (E-series Gen.1)	CRI 80+		●	●	●
	CRI 90+		●	●	●
	Size [mm]	LES-In (LES-Out)	9.8 (12.3)	13.0 (15.0)	22.0 (24.5)
		Package	19.0 x 19.0	19.0 x 19.0	28.0 x 28.0

● : MP

4.1.2 Package Circuit & Dimension

	PKG Dim	Circuit	Image
LC010T	19.0x19.0 LES 9.8	CW 12S1P WW 12S1P	  CSP 12 series $\times$ 1 parallel =12 pcs of CSPs LED 12 series $\times$ 1 parallel =12 pcs of LEDs
LC020T	19.0x19.0 LES 13.0	CW 12S2P WW 12S2P	  CSP 12 series $\times$ 2 parallel =24 pcs of CSPs LED 12 series $\times$ 2 parallel =24 pcs of LEDs
LC035T	28.0x28.0 LES 22.0	CW 12S4P WW 12S4P	  CSP 12 series $\times$ 4 parallel =48 pcs of CSPs LED 12 series $\times$ 4 parallel =48 pcs of LEDs

4.1.3 Tunable CCT Function

■ CCT, Color shift vs. Current ratio

Model	10W	20W	35W
If	280	560	980
Vf	35.5	35.5	35.5
W	9.94	19.88	34.79

CCT (K)	Ra 80 Model				Ra 90 Model			
	If_CW	If_WW	CIE x	CIE y	If_CW	If_WW	CIE x	CIE y
6500	100%	0%	0.3131	0.3326				
5700	87%	13%	0.3281	0.3401				
5000	71%	29%	0.3459	0.3501	100%	0%	0.3447	0.3553
4500	60%	40%	0.3594	0.3573	83%	17%	0.3606	0.3630
4000	46%	54%	0.3782	0.3673	64%	36%	0.3791	0.3720
3500	31%	69%	0.4008	0.3795	41%	59%	0.4025	0.3834
3000	12%	88%	0.4347	0.3977	15%	85%	0.4344	0.3989
2700	0%	100%	0.4613	0.4119	0%	100%	0.4578	0.4102

4.2.1 Assembly Guide

▪ Using specific holder for COB E-series

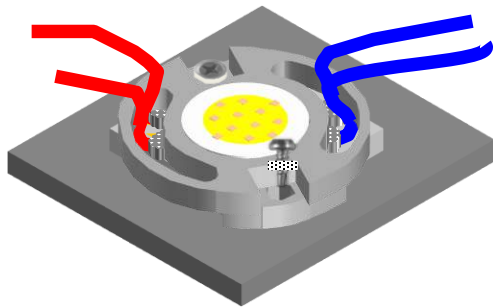
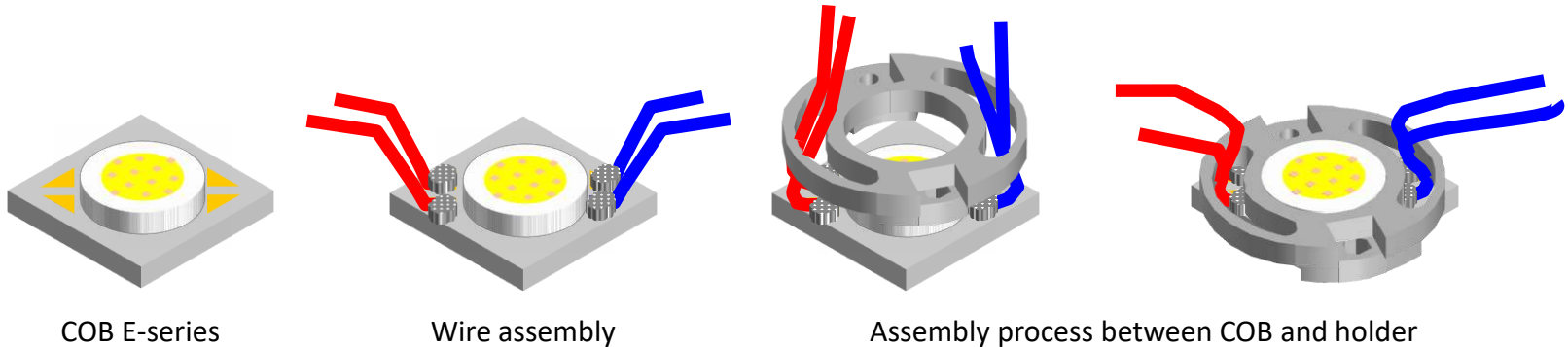
Considering holders, the luminaire is consisted of the key parts like as shown in below figures.

As described earlier, three main parts have to be well- functioned as thermal, optical and electrical.

The holder plays the role which can connect all key parts so as to properly perform the their functions.

This means that the holder is very simple and safe to fix the COB in the manufacturing luminaires.

The below figure describe the assembly process by using the holder.



Assembly of holder and heat-sink

▪ Using fixation screw

This COB could be fixed by fastening 1 pairs of screw and washer.

The concaved corner is adequate shape for fixing COB with screws of M3.

The torque of fixing screw is recommended to be 0.7~1.0N·m.

Screw size	Washer size	Screw hole size
M3	M3	M3

4.2.2 ECO system

Available Driver – Samsung COB T-Series

Item	Voltage	Current	Helvar	OSRAM	Tridonic	Samsung
LC10T	32-38V	280mA	N/A	N/A	N/A	N/A
LC20T	32-38V	562mA	LC35/2-DA-iC (D/L) LC45/2-DA-iC (D/L) LL35/2-E/DA-iC (Linear) LL60/2-E-DA Dynamic (Linear) LL60/2-E-DA-iC (Linear)	N/A	LCA 38W 350-1050mA DT8 C PRE (D/L) LCA 38W 350-1050mA DT8 SR PRE (D/L)	PMD-25AS / 25DSU (D/L)
LC35T	32-38V	980mA	LC45/2-DA-iC (D/L) LL35/2-E/DA-iC (Linear) LL60/2-E-DA Dynamic (Linear) LL60/2-E-DA-iC (Linear)	OTi50W/120-277/1A4/2CH TW L (Linear)	LCA 38W 350-1050mA DT8 C PRE (D/L) LCA 38W 350-1050mA DT8 SR PRE (D/L)	PMD-35AS (D/L)

	Vf	If	Size	Shape	P/No	Certification
Helvar	12-50V	350-700mA	123x79x30mm	Square	LC35/2-DA-iC	CE, ENEC
	25-50V	500-900mA	123x79x30mm	Square	LC45/2-DA-iC	CE
	25-100V	350-700mA	380x35x21mm	Linear	LL35/2-E-DA-iC	CE, ENEC
	25-100V	350-700mA	380x35x21mm	Linear	LL60/2-E-DA Dynamic	CE, ENEC
	25-100V	350-700mA	380x35x21mm	Linear	LL60/2-E-DA-iC	CE, ENEC
OSRAM	20-48V	400-1400mA	425x29.4x25.4mm	Linear	OTi50W/120-277/1A4/2CH TW L	CE, ENEC, CCC, RCM
Tridonic	20-50V	350-1050mA	120x70x28.3mm	Square	LCA 38W 350-1050mA DT8 C PRE	CE, ENEC, RCM, KC
	20-50V	350-1050mA	215x70x31mm	Square	LCA 38W 350-1050mA DT8 SR PRE	CE, ENEC, RCM, KC

4.2.3 ECO system

Available Holder, Lens – Samsung COB T-Series

Available Holder for Samsung T-series COB										
Manufacturer : GR Optics (http://gr100.en.alibaba.com)		LC010T			LC020T			LC035T		
Holder-Part No.		E1919GA			E1919GB			E2828GA		
		 E1919GA			 E1919GB			 E2828GA		
Lens Size	 GLK 65 69 75	Size1	Size2	Size3	Size1	Size2	Size3	Size1	Size2	Size3
Beam angle1		GLK6510	GLK6910	GLK7510	GLK6510	GLK6910	GLK7510	GLK6510	GLK6910	GLK7510
Beam angle2		GLK6523	GLK6923	GLK7523	GLK6523	GLK6923	GLK7523	GLK6523	GLK6923	GLK7523
Beam angle3		GLK6536	GLK6936	GLK7536	GLK6536	GLK6936	GLK7536	GLK6536	GLK6936	GLK7536

4.2.4 ECO system

Available Holder, Lens – Samsung COB T-Series

COB Supplier	COB Type	Holder 430	Holder 630	630 altern.
Samsung	LC 010C	434	634a	
Samsung	LC 020C / 030C / 040C	477	633c	633a
Samsung	LC 003D / 006D	434	634a	
Samsung	LC 009D / 013D	434	634a	
Samsung	LC 016D / 019D	477	633c	633a
Samsung	LC 026D / 033D	477	633c	633a
Samsung	LC 040D / 060D / 080D	431	631b	631a
Samsung	LC 010T	501		
Samsung	LC 020T	501		
Samsung	LC 030T	502		



T-COB holder

**BENDER
+ WIRTH**

<http://www.bender-wirth.com/katalog/katalog.php?lan=1&cat=40&subCat=26>