SEOUL SEMICONDUCTOR

Integrated AC LED Solution

Acrich2 – 10W

SMJD-HEXV10W#

MacAdam 3-Step | RoHS
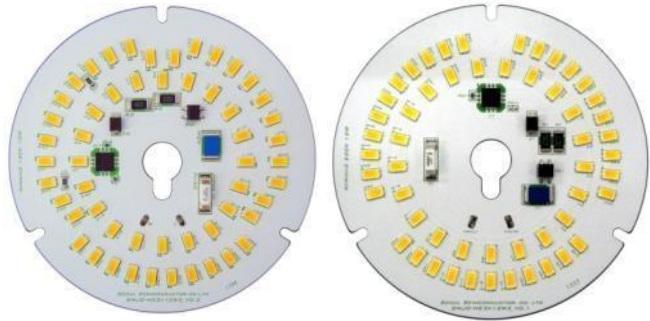
Product Brief

Description

- The Acrich2 series of products are designed to be driven directly off of AC line voltage, therefore they do not need the standard converter essential for conventional general lighting products.
- The converter or driver found in most general lighting products can limit the overall life of the product, but with the Acrich2 series of products the life of the product can more closely be estimated from the LED itself. This will also allow for a much smaller form factor from an overall fixture design allowing for higher creativity in the fixture.
- The modules have a high power factor which can contribute to a higher energy savings in the end application.

Features and Benefits

- Connects directly to AC line voltage
- High Power Factor
- Low THD
- Long Life Time
- Simple BOM
- Lead Free Product
- RoHS Compliant
- High Efficacy up to 140 lm/W

Key Applications

- Ceiling light
- Flush mount
- Down light

Table 1. Product Selection

| Part No. | Vin [Vac] | P [W] | CCT [K] | Flux [lm] | | CRI |
				Min.	Typ.	Min.
SMJD-HE2V10W3	120	10	4700-5300	1250	1350	80
			3700-4200	1100	1200	
			2600-3200			
SMJD-HE3V10W3	220	10	4700-5300	1250	1350	80
			3700-4200	1100	1200	
			2600-3200			
SMJD-HE2V10W8	120	10	4700-5300	1100	1200	90
			3700-4200			
			2600-3200			
SMJD-HE3V10W8	220	10	4700-5300	1100	1200	90
			3700-4200			
			2600-3200			

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Performance Characteristics

Table 2. Electro Optical Characteristics, T_a = 25ºC

Parameter	Symbol	Value			Unit	Mark
		Min.	Typ.	Max.		
Luminous Flux	Φ_V [2]	1250	1350	1450	lm	See detail
		1100	1200	1300		See detail
Correlated Color Temperature [3]	CCT	4700	5000	5300	K	C
		3700	4000	4200		E
		2900	3000	3200		G
		2600	2700	2900		H
CRI	Ra	80	-	-	-	3
		90	-	-	-	8
Input Voltage [4]	V_{in}		120		Vac	2V
			220			3V
Power Consumption	P	9	10	11	W	10W
Operating Frequency	f		50 / 60		Hz	
Power Factor	PF		Over 0.97		-	
Viewing Angle	$2\Theta_{1/2}$		120		deg.	
Tolerance of Surge [5]	V_s	500	-	-	V	

Notes :

(1) At 120Vac/220Vac, T_a = 25ºC

(2) Φ_V is the total luminous flux output measured with an integrated sphere.

　　※ At CCT C rank, luminous flux mark 10b

　　　At CCT E,G,H rank, luminous flux mark 10a

(3) Correlated Color Temperature is derived from the CIE 1931 Chromaticity diagram.

(4) Operating Voltage doesn't indicate the maximum voltage which customers use but means tolerable voltage according to each country's voltage variation rate. It is recommended that the solder pad temperature should be below 70℃.

(5) Surge withstand in accordance with IEC61000-4-5

Performance Characteristics

Table 3. Absolute Maximum Ratings, $T_a = 25^oC$

Parameter	Symbol	Unit	Value
Maximum Input Voltage @120Vac	V_{in}	Vac	140
Maximum Input Voltage @220Vac			260
Power Consumption	P	W	14
Operating Temperature	T_{opr}	^oC	-30 ~ 85
Storage Temperature	T_{stg}	^oC	-40 ~ 100
ESD Sensitivity	-	-	±4,000V HBM

Thermal Resistance

Part	Package Power Dissipation [W]	Maximum Junction Temperature [℃]	$R\theta_{j\text{-}s}$ [℃/W]
Acrich2 LED	SAWZKG0B Max 0.58	125	27

Notes :

(1) Z = 8 : CRI 80 PKG, Z=9 : CRI 90 PKG

The Acrich2 LED has a thermal resistance of 27℃/W from junction of the LED to the

LED lead.

The maximum junction temperature of the Acrich2 LED package is 125℃, therefore the maximum

lead temperature T_{s_max} is

$T_{s\_max} = T_{j\_max} - (R\theta_{j\text{-}s} * P_d)$

   $= 125℃ - (27℃/W * 0.58W) = 109.34℃$

Although this is the maximum lead temperature, it is recommended to keep the lead temperature

under 70℃.

Characteristics Graph

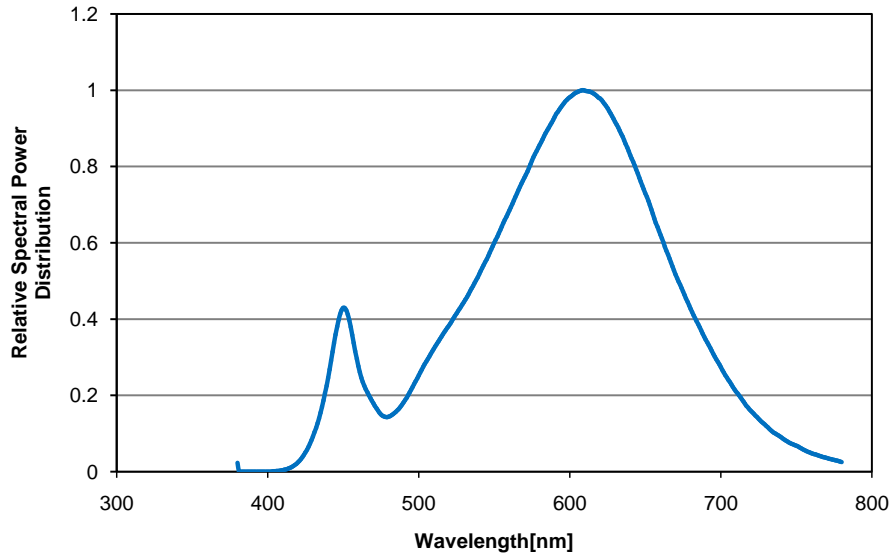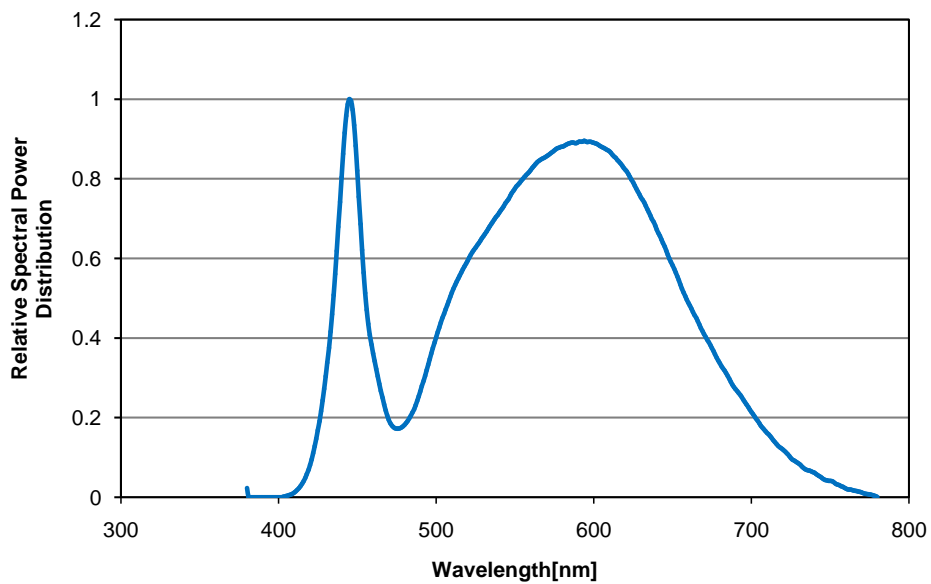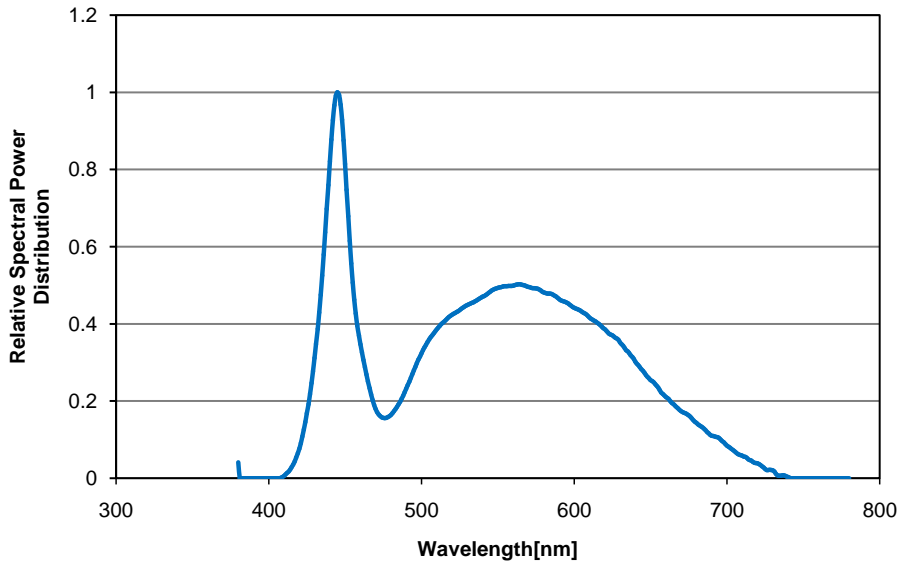**Fig 1. Relative Spectral Distribution vs. Wavelength Characteristic – G, H**

Fig 2. Relative Spectral Distribution vs. Wavelength Characteristic – E

Characteristics Graph

Fig 3. Relative Spectral Distribution vs. Wavelength Characteristic – C

Characteristics Graph

Fig 4. Relative Power Distribution vs. Voltage, T$_a$=25℃, 120V

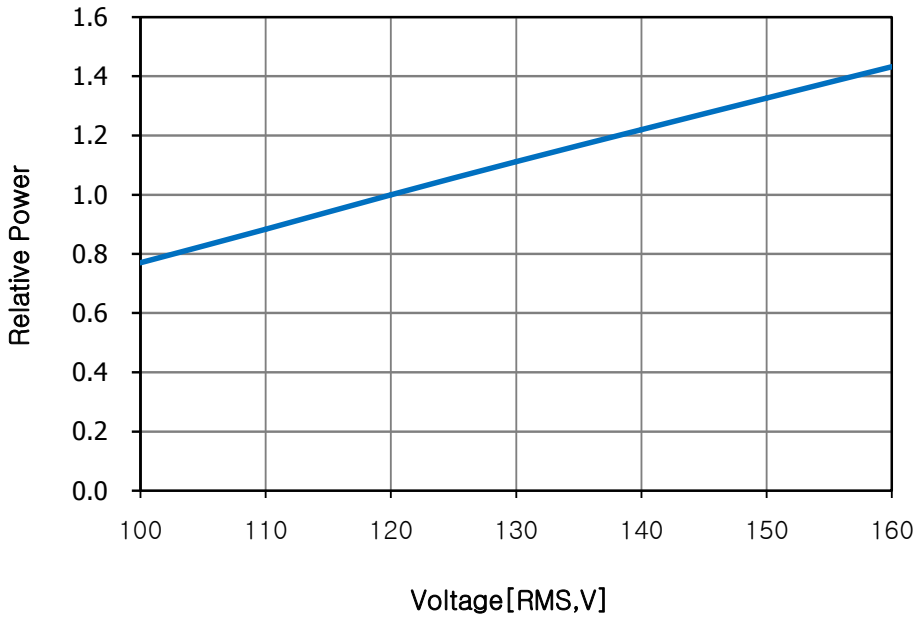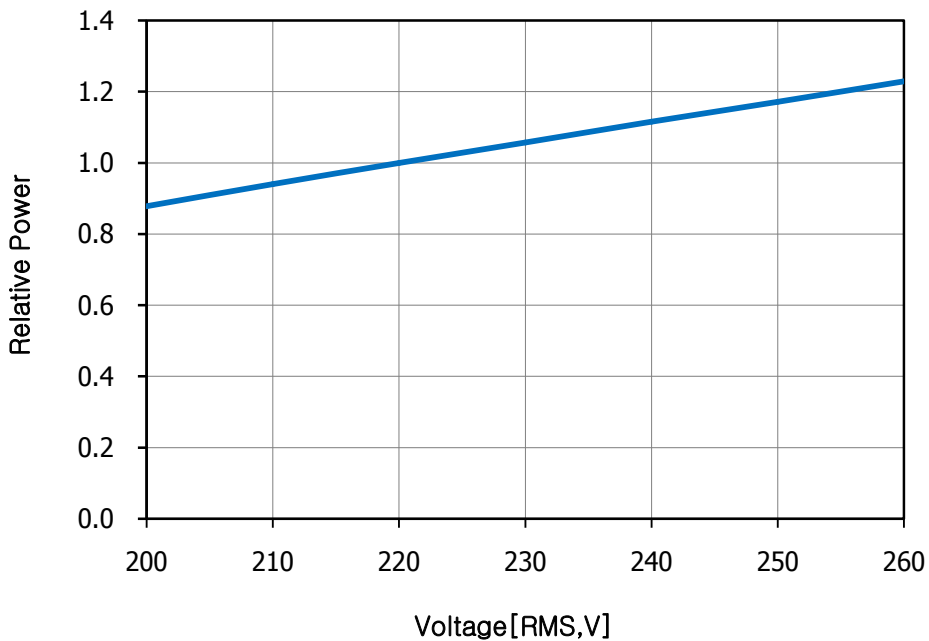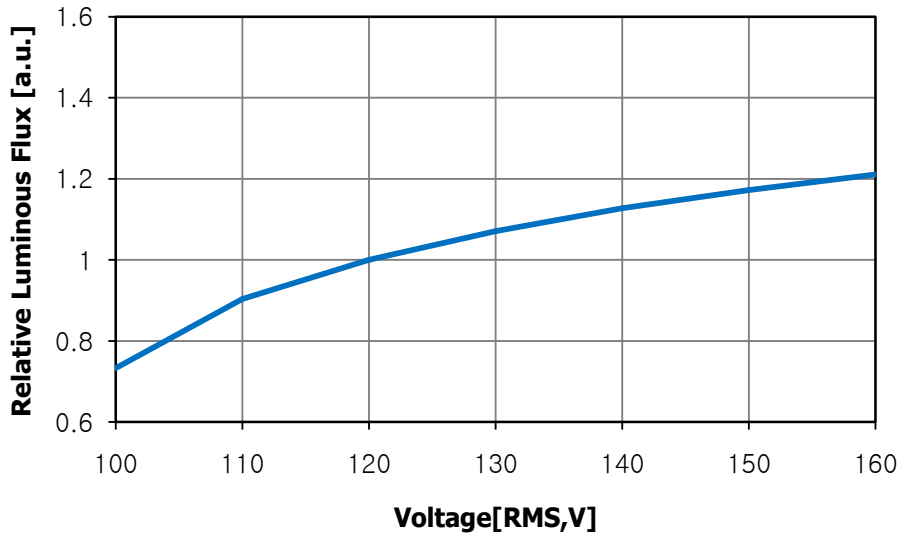**Fig 5. Relative Power Distribution vs. Voltage, T$_a$=25℃, 220V**

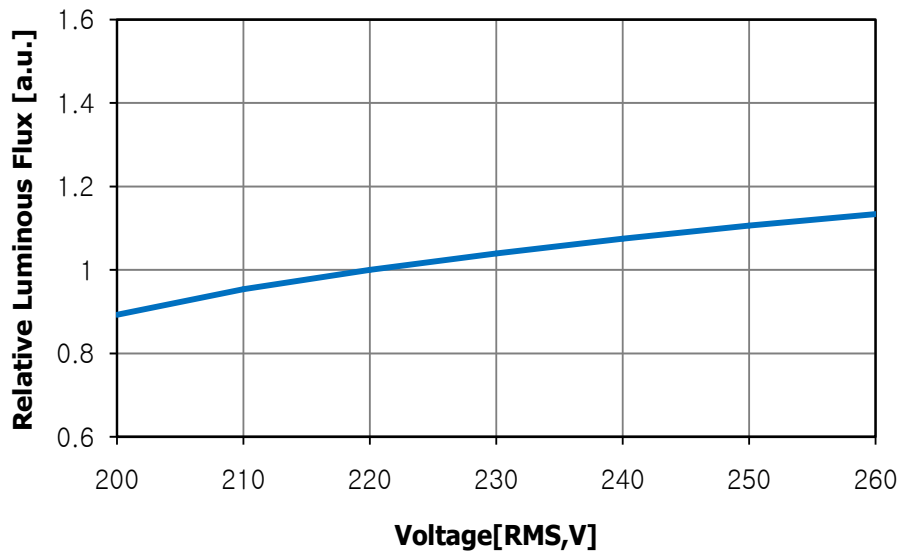# Characteristics Graph

Fig 6. Relative Luminous Flux vs. Voltage, T$_a$=25℃, 120V

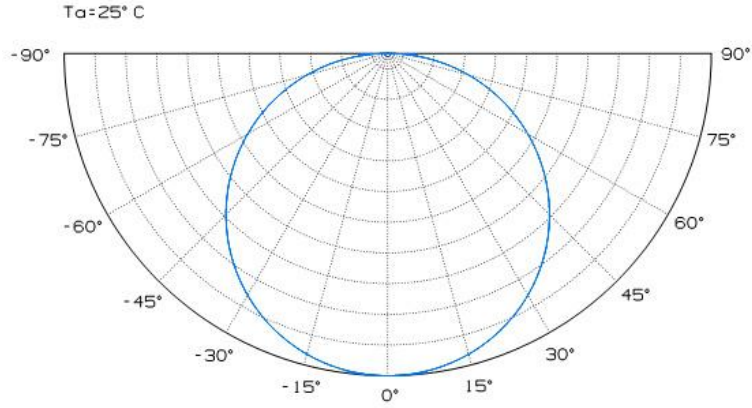**Fig 7. Relative Luminous Flux vs. Voltage, T$_a$=25℃, 220V**

Characteristics Graph

Fig 8. Radiant Pattern, T_a =25℃

Color Bin Structure

CIE Chromaticity Diagram
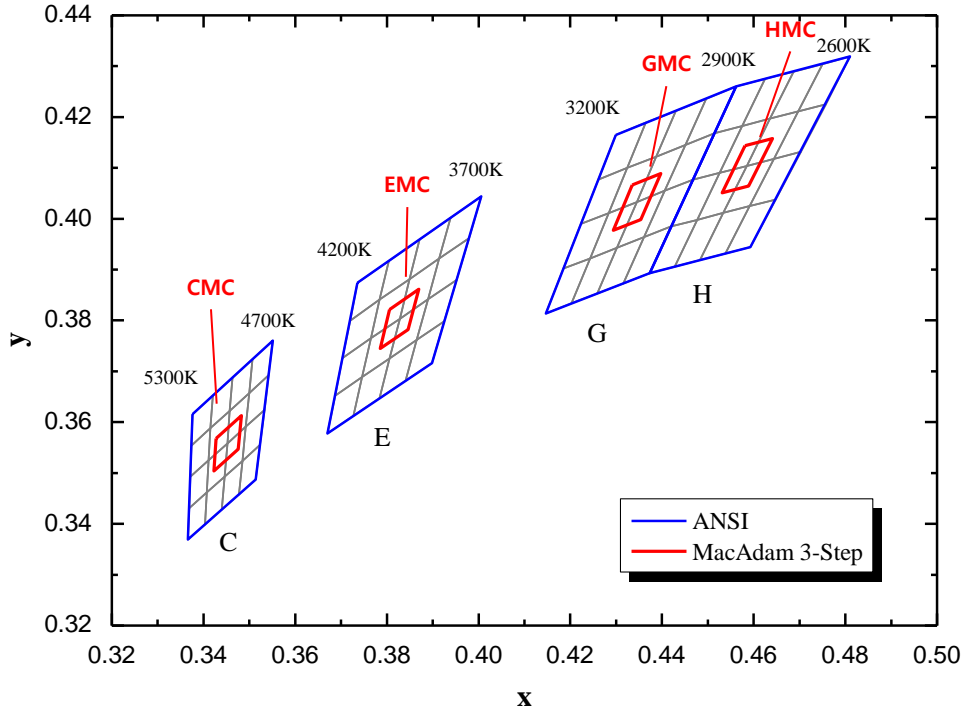
Bin	x	y	Bin	x	y
CMC	0.3427	0.3568	EMC	0.3806	0.3822
	0.3423	0.3504		0.3786	0.3745
	0.3476	0.3547		0.3846	0.3782
	0.3482	0.3613		0.3870	0.3861
GMC	0.4336	0.4067	HMC	0.4581	0.4143
	0.4294	0.3977		0.4531	0.4051
	0.4354	0.3999		0.4589	0.4065
	0.4398	0.4089		0.4641	0.4157
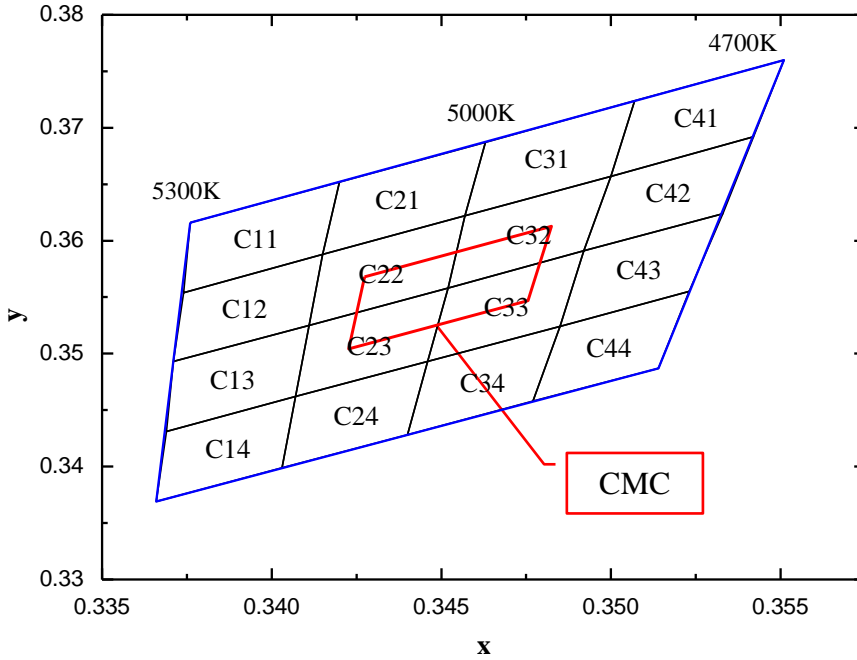
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Color Bin Structure

CIE Chromaticity Diagram

Bin	x	y	Bin	x	y	Bin	x	y	Bin	x	y
	0.3376	0.3616		0.3420	0.3652		0.3463	0.3687		0.3507	0.3724
C11	0.3374	0.3554	C21	0.3415	0.3588	C31	0.3457	0.3622	C41	0.3500	0.3657
	0.3415	0.3588		0.3457	0.3622		0.3500	0.3657		0.3542	0.3692
	0.3420	0.3652		0.3463	0.3687		0.3507	0.3724		0.3551	0.3760
	0.3374	0.3554		0.3415	0.3588		0.3457	0.3622		0.3500	0.3657
C12	0.3371	0.3493	C22	0.3411	0.3525	C32	0.3452	0.3558	C42	0.3492	0.3591
	0.3411	0.3525		0.3452	0.3558		0.3492	0.3591		0.3533	0.3624
	0.3415	0.3588		0.3457	0.3622		0.3500	0.3657		0.3542	0.3692
	0.3371	0.3493		0.3411	0.3525		0.3452	0.3558		0.3492	0.3591
C13	0.3369	0.3431	C23	0.3407	0.3462	C33	0.3446	0.3493	C43	0.3485	0.3524
	0.3407	0.3462		0.3446	0.3493		0.3485	0.3524		0.3523	0.3555
	0.3411	0.3525		0.3452	0.3558		0.3492	0.3591		0.3533	0.3624
	0.3369	0.3431		0.3407	0.3462		0.3446	0.3493		0.3485	0.3524
C14	0.3366	0.3369	C24	0.3403	0.3399	C34	0.3440	0.3428	C44	0.3477	0.3458
	0.3403	0.3399		0.3440	0.3428		0.3477	0.3458		0.3514	0.3487
	0.3407	0.3462		0.3446	0.3493		0.3485	0.3524		0.3523	0.3555

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Color Bin Structure

CIE Chromaticity Diagram
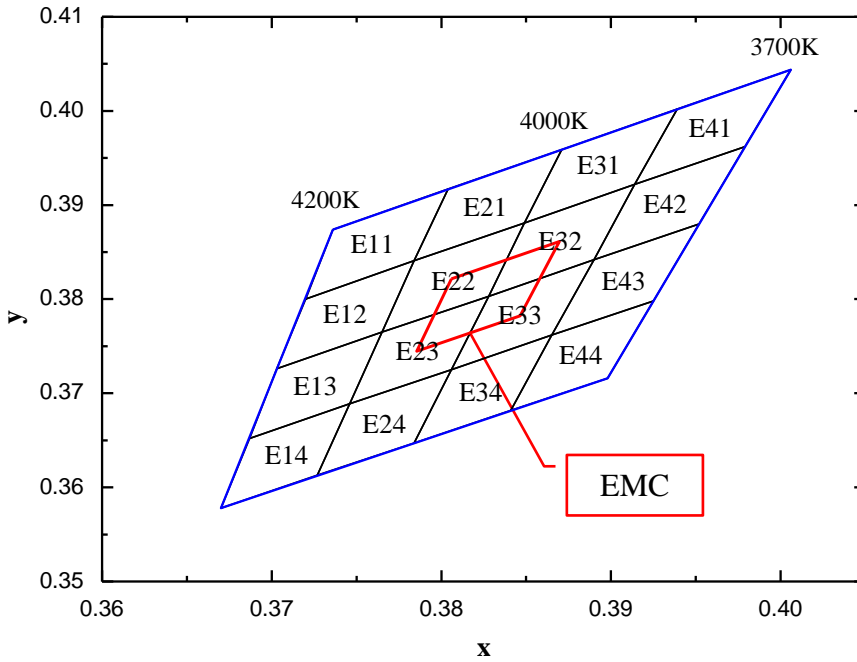
Bin	x	y	Bin	x	y	Bin	x	y	Bin	x	y
	0.3736	0.3874		0.3804	0.3917		0.3871	0.3959		0.3939	0.4002
E11	0.3720	0.3800	E21	0.3784	0.3841	E31	0.3849	0.3881	E41	0.3914	0.3922
	0.3784	0.3841		0.3849	0.3881		0.3914	0.3922		0.3979	0.3962
	0.3804	0.3917		0.3871	0.3959		0.3939	0.4002		0.4006	0.4044
	0.3720	0.3800		0.3784	0.3841		0.3849	0.3881		0.3914	0.3922
E12	0.3703	0.3726	E22	0.3765	0.3765	E32	0.3828	0.3803	E42	0.3890	0.3842
	0.3765	0.3765		0.3828	0.3803		0.3890	0.3842		0.3952	0.3880
	0.3784	0.3841		0.3849	0.3881		0.3914	0.3922		0.3979	0.3962
	0.3703	0.3726		0.3765	0.3765		0.3828	0.3803		0.3890	0.3842
E13	0.3687	0.3652	E23	0.3746	0.3689	E33	0.3806	0.3725	E43	0.3865	0.3762
	0.3746	0.3689		0.3806	0.3725		0.3865	0.3762		0.3925	0.3798
	0.3765	0.3765		0.3828	0.3803		0.3890	0.3842		0.3952	0.3880
	0.3687	0.3652		0.3746	0.3689		0.3806	0.3725		0.3865	0.3762
E14	0.3670	0.3578	E24	0.3727	0.3613	E34	0.3784	0.3647	E44	0.3841	0.3682
	0.3727	0.3613		0.3784	0.3647		0.3841	0.3682		0.3898	0.3716
	0.3746	0.3689		0.3806	0.3725		0.3865	0.3762		0.3925	0.3798

Color Bin Structure

CIE Chromaticity Diagram
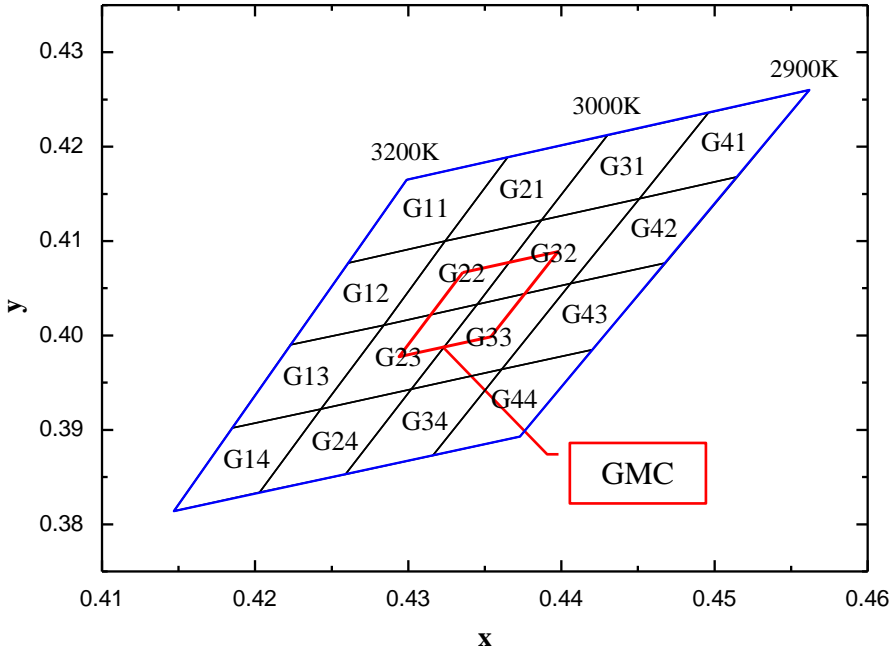
Bin	x	y	Bin	x	y	Bin	x	y	Bin	x	y
G11	0.4299	0.4165	**G21**	0.4364	0.4188	**G31**	0.4430	0.4212	**G41**	0.4496	0.4236
	0.4261	0.4077		0.4324	0.4099		0.4387	0.4122		0.4451	0.4145
	0.4324	0.4100		0.4387	0.4122		0.4451	0.4145		0.4514	0.4168
	0.4365	0.4189		0.4430	0.4212		0.4496	0.4236		0.4562	0.4260
G12	0.4261	0.4077	**G22**	0.4324	0.4100	**G32**	0.4387	0.4122	**G42**	0.4451	0.4145
	0.4223	0.3990		0.4284	0.4011		0.4345	0.4033		0.4406	0.4055
	0.4284	0.4011		0.4345	0.4033		0.4406	0.4055		0.4468	0.4077
	0.4324	0.4100		0.4387	0.4122		0.4451	0.4145		0.4515	0.4168
G13	0.4223	0.3990	**G23**	0.4284	0.4011	**G33**	0.4345	0.4033	**G43**	0.4406	0.4055
	0.4185	0.3902		0.4243	0.3922		0.4302	0.3943		0.4361	0.3964
	0.4243	0.3922		0.4302	0.3943		0.4361	0.3964		0.4420	0.3985
	0.4284	0.4011		0.4345	0.4033		0.4406	0.4055		0.4468	0.4077
G14	0.4243	0.3922	**G24**	0.4302	0.3943	**G34**	0.4302	0.3943	**G44**	0.4361	0.3964
	0.4203	0.3834		0.4259	0.3853		0.4259	0.3853		0.4316	0.3873
	0.4147	0.3814		0.4203	0.3834		0.4316	0.3873		0.4373	0.3893
	0.4185	0.3902		0.4243	0.3922		0.4361	0.3964		0.4420	0.3985

Part List

Table 4. Part List

No	Part	Reference	Specification	Quantity	Mark
1	PCB	-	SMJD-HE2V10W# @120Vac Al, Φ=100, T=1.6, 1 layer / Cu 1oz / White PSR	1	120V
			SMJD-HE3V10W# @220Vac Al, Φ=100, T=1.6, 1 layer / Cu 1oz / White PSR	1	220V
2	LED	D1~D54	SAW8KG0B	54	3
			SAW9KG0B	54	8
3	IC	U1	DT3001B @120Vac	1	
			DT3001A @220Vac	1	
4	Fuse	F1	250V, 1A	1	
5	Varistor	V1	275Vac	1	
6	Bridge Diode	BD1	600V, 1A	1	
7	TVS	Z1	440V, 600W, 5%, Unidirectional	1	
8		R1, R2	R6432, 22Ω, 5%(J)	2	
9		R_{SET}	R1608, 2kΩ, 1%(F) @120Vac	1	
	Resistor		R1608, 1kΩ, 1%(F) @220Vac	1	
10		R_{BLD}	R1608, 1kΩ, 5%(J)	1	
11		J1, J2	R3216, 0Ω, 5%(J) @120Vac	2	
			R3216, 0Ω, 5%(J) @220Vac	-	

Notes :

(1) The above specification is subject to change without further notice for the improvement of products.

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Mechanical Dimensions
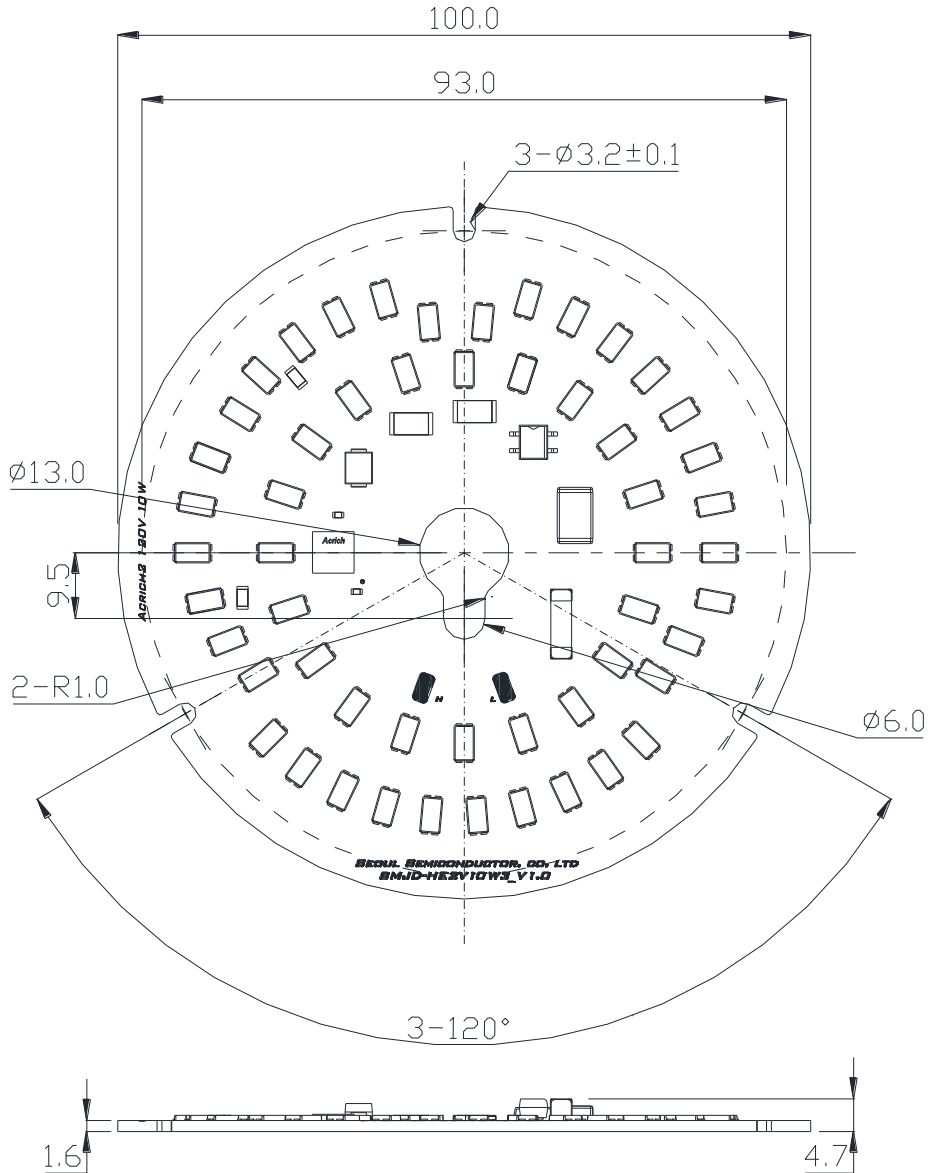
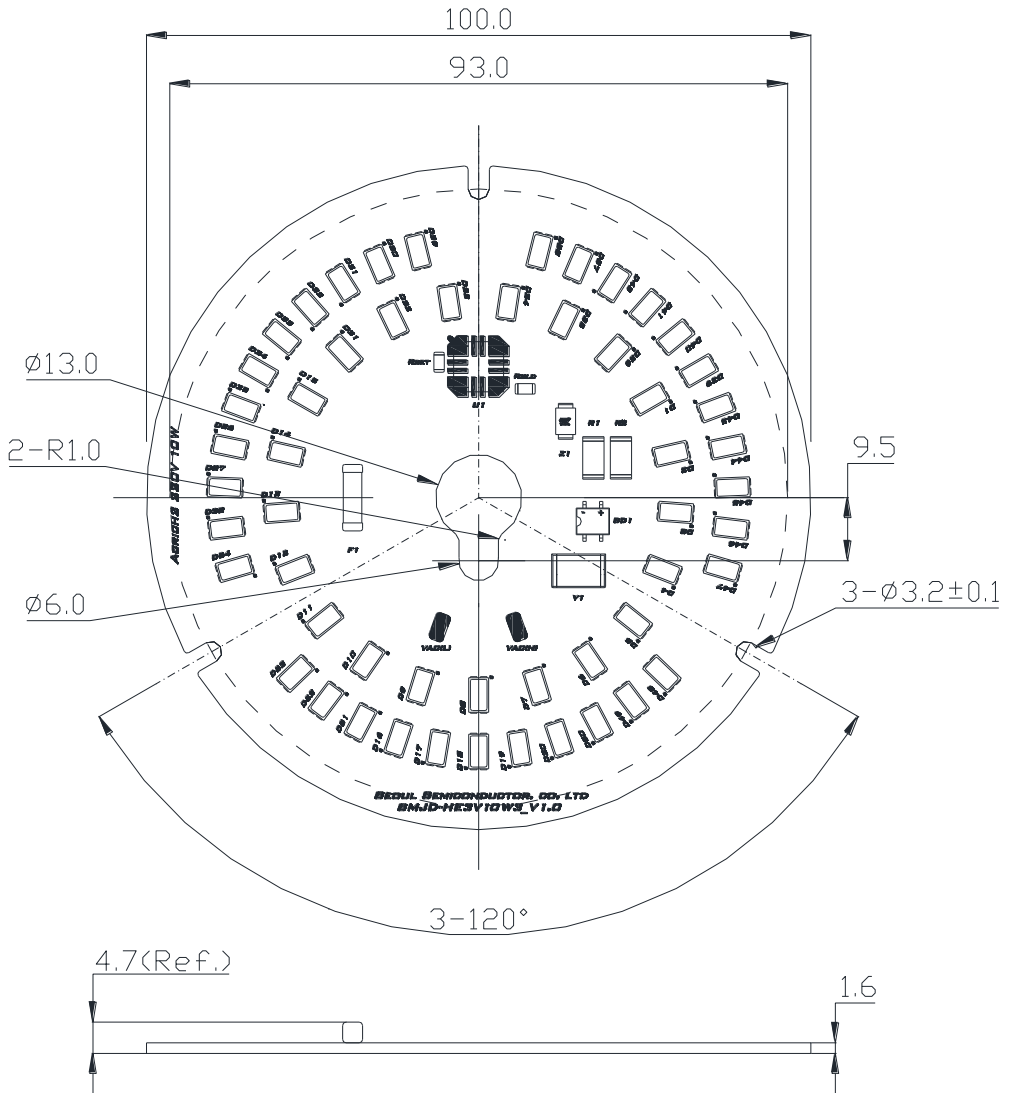

SMJD-HE2V10W# (120V)

Notes :

(1) All dimensions are in millimeters. (Tolerance unless noted : ±0.2)
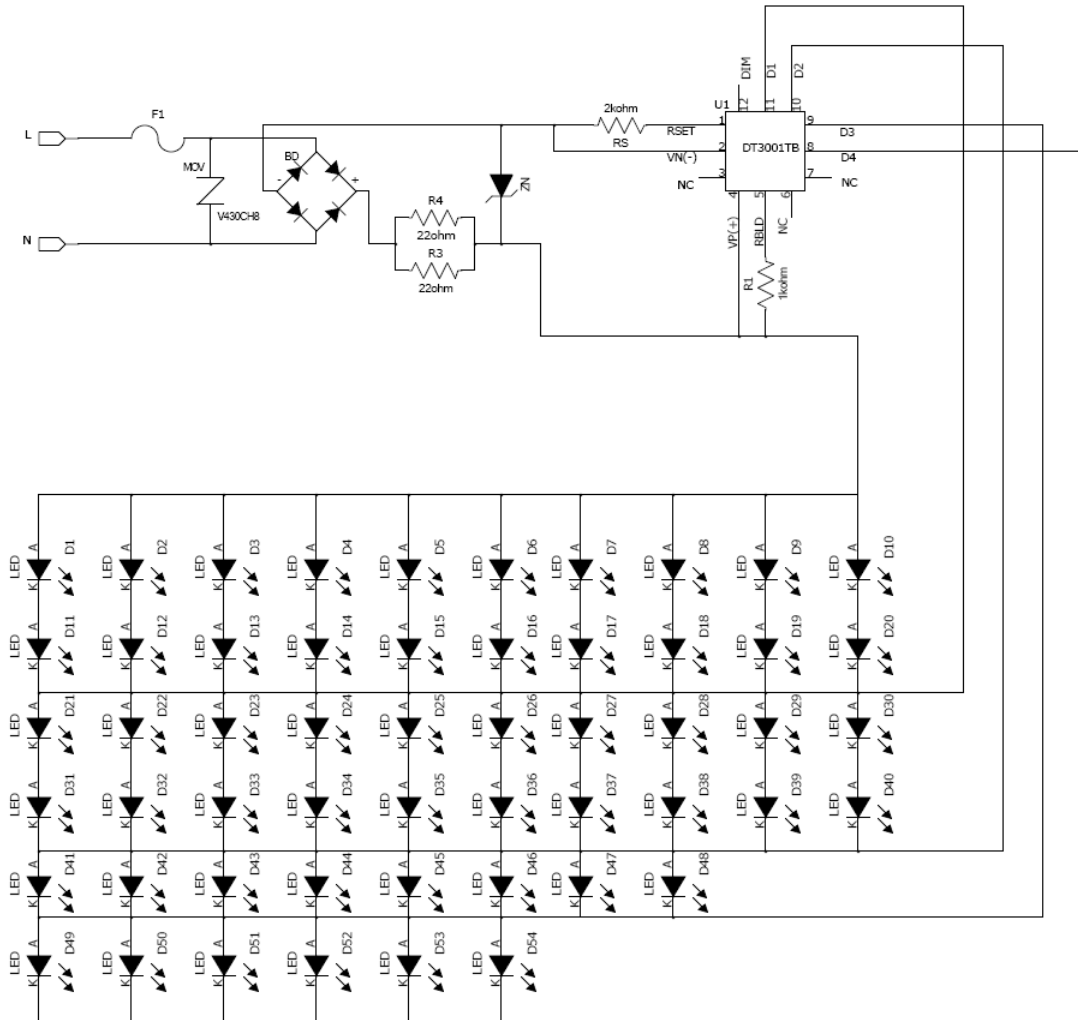
(2) Scale : None

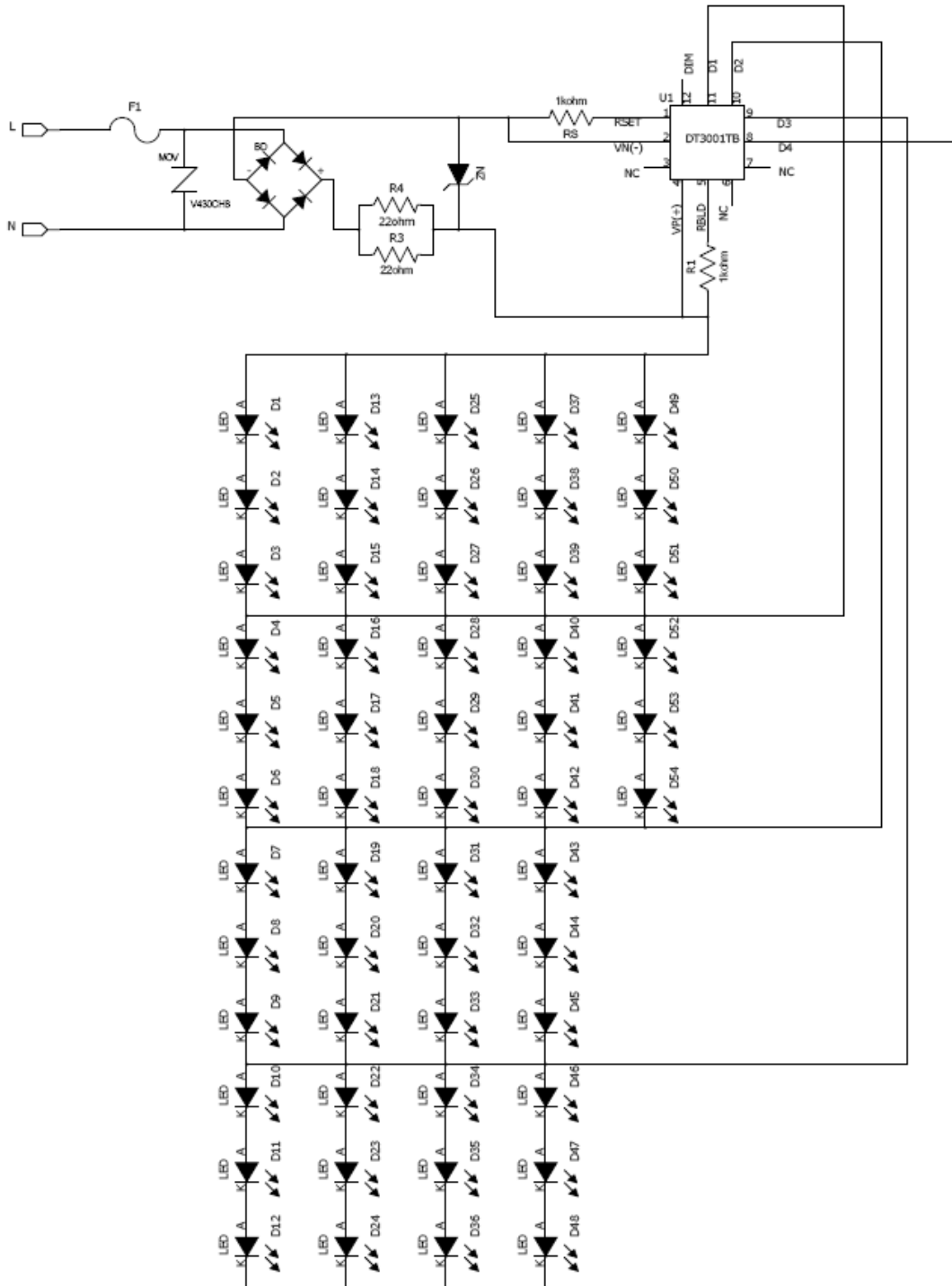# Mechanical Dimensions

SMJD-HE3V10W# (220V)

Notes :

(1) All dimensions are in millimeters. (Tolerance unless noted : ±0.2)
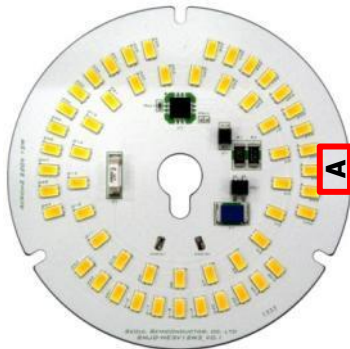
(2) Scale : None

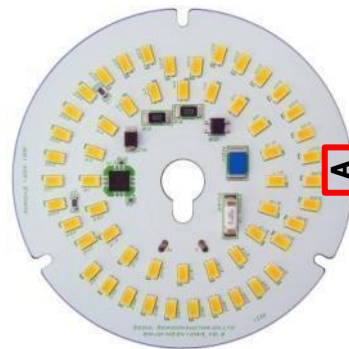# Circuit Drawing

SMJD-HE2V10W# (120V)

Circuit Drawing

SMJD-HE3V10W# (220V)

Marking Information

SMJD-HE3V10W# (220V)

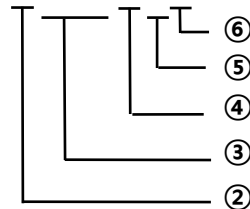SMJD-HE2V10W# (120V)

A : Marking

(2) Combination Bin

ex) 140101
3bZZG11

- Description

1 4 0 1 0 1
①
3 c Z Z G 1 1

⑥
⑤
④
③
②

① SMT Date (YYMMDD, 6 Digits)
② CRI (1 Digits)
③ Module Flux Bin (3 Digits)
④ CCT (1 Digit)
⑤ CCT Combination NO. (1 Digit)
⑥ VF Combination NO. (1 Digit)

(1) Single Bin

A :   ex) 140101
3bZG32B

- Description

1 4 0 1 0 1
①

3 c Z G 3 2 B
② ③ ④   ⑤   ⑥

① SMT Date (YYMMDD, 6 Digits)
② CRI (1 Digits)
③ LED Module Luminous Intensity
④ LED PKG. Luminous Intensity Bin (1 Digits)
⑤ LED PKG. Color Bin (3 Digits)
⑥ Vf (1 Digits)

② CRI			③ Module Flux Bin				④ CCT				⑤ CCT Combination			⑥ VF Combination		
Mark	CRI	type	Mark	Min.	Typ.	Max.	Mark	Min.	Typ.	Max.	Mark	Bin1	Bin2	Mark	Bin1	Bin2
3	80		WW				C	4700	5000	5300	0	22	33	1	A	A
8	90		WX				E	3700	4000	4200	1	23	32	2	A	B
			WY				G	2900	3000	3200	2	33	22	3	B	A
		b	XX	1100	1200	1300	H	2600	2700	2900	3	32	23	4	A	C
			XY								4	MC	MC	5	C	A
			YY								C	Inner (4bin)	Outer (12bin)	6	B	B
			ZZ											7	B	C
		c	ZJ	1250	1350	1450								8	C	B
			JJ											9	C	C

Packing

1. Tray information

- 8 PCS LED modules packed per tray

2. Tray stack and taping

10EA trays
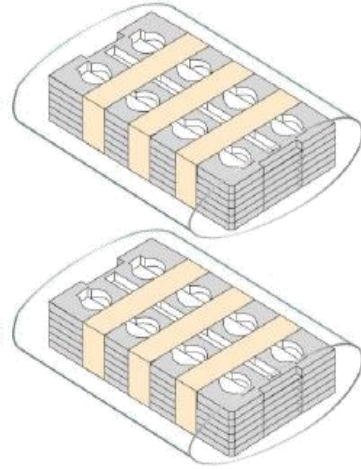with LED modules

Dummy Tray

Taping Direction
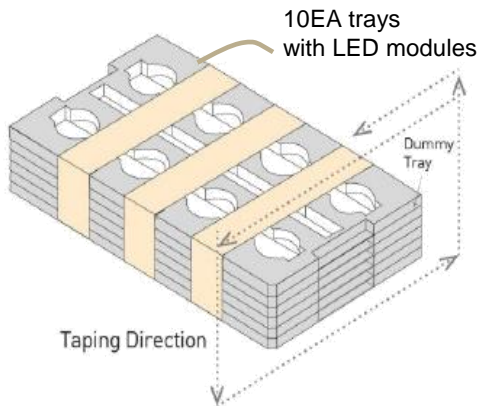
- 10 LED module trays and additional 2 dummy trays up and down of box
- Add silica gel (1EA) on top of the tray

3. Sealing packing

Dielectric sealing pack (700x700)
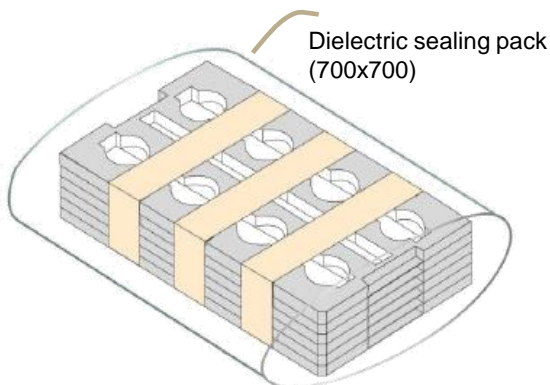
4. Box information & packing

- 160 PCS modules per BOX 1EA

** 1 Box : 8 PCS per tray x 20 trays = 160 PCS

Label Information

| Model No.	**SMJD-HEXV10W#** [(1)]
Rank	**XXXXXXX** [(2)]
Type	**STD / 3-Step** [(3)]
Quantity	**XXX**
Lot No.	**YYMDDXXXXX-XXXXXXX**
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Notes

(1) The model number designation is explained as follow
   SMJD : Seoul Semiconductor internal code
   HE : Initial of High Efficacy
   XV : (2V = 120V, 3V = 220V)
   10W : About Power Consumption
   P# : MJT PKG (P3 : SAW8KG0B, P8 : SAW9KG0B)
(2) It represents the LED module rank..(See LED Marking Detail)
(3) It represents single bin(STD) or MacAdam 3-Step(3-Step).
(4) It is attached to the top of a sealing pack & the bottom right corner of the box.

TOTAL Quantity

XXX

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Notes

(1) It is attached to the bottom right corner of the box.

Handling of Silicone Resin for LEDs
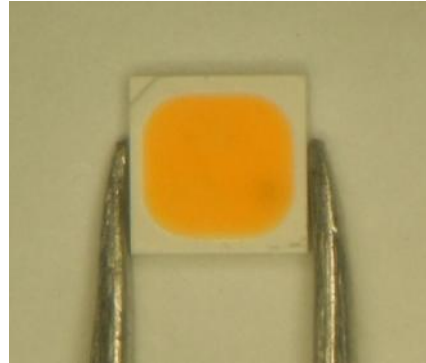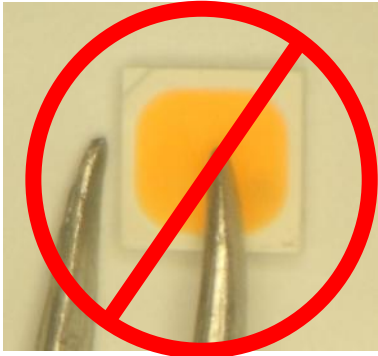
(1) Acrich2 series is encapsulated with silicone resin for high optical efficiency.

(2) Please do not touch the silicone resin area with sharp objects such as pincette(tweezers).

(3) Finger prints on silicone resin area may affect the performance.

(4) Please store LEDs in covered containers to prevent dust accumulation as this may affect performance.

(5) Excessive force more than 3000gf to the silicone lens can result in fatal or permanent damage with LEDs.

(6) Please do not cover the silicone resin area with any other resins such as epoxy, urethane, etc.

Precaution for Use

(1) Please review the Acrich2 Application Note for proper protective circuitry usage.

(2) Please note, Acrich2 products run off of high voltage, therefore caution should be taken when working near Acrich2 products.

(3) Make sure proper discharge prior to starting work.

(4) DO NOT touch any of the circuit board, components or terminals with body or metal while circuit is active.

(5) Please do not add or change wires while Acrich2 circuit is active.

(6) Long time exposure to sunlight or UV can cause the lens to discolor.

(7) Please do not use adhesives to attach the LED that outgas organic vapor.

(8) Please do not use together with the materials containing Sulfur.

(9) Please do not assemble in conditions of high moisture and/or oxidizing gas such as Cl, H_2S, NH_3, SO_2, NO_x, etc.

(10) Please do not make any modification on module.

(11) Please be cautious when soldering to board so as not to create a short between different trace patterns.

(12) Do not impact or place pressure on this product because even a small amount of pressure can damage the product. The product should also not be placed in high temperatures, high humidity or direct sunlight since the device is sensitive to these conditions.

(13) When storing devices for a long period of time before usage, please following these guidelines:
   * The devices should be stored in the anti-static bag that it was shipped in from Seoul-Semiconductor with opening.
   * If the anti-static bag has been opened, re-seal preventing air and moisture from being present in the bag.

(14) LEDs and IC are sensitive to Electro-Static Discharge (ESD) and Electrical Over Stress (EOS). The Acrich2 product should also not be installed in end equipment without ESD protection. Below is a list of suggestions that Seoul Semiconductor purposes to minimize these effects.

a. ESD (Electro Static Discharge)

Electrostatic discharge (ESD) is the defined as the release of static electricity when two objects come into contact. While most ESD events are considered harmless, it can be an expensive problem in many industrial environments during production and storage. The damage from ESD to an LEDs may cause the product to demonstrate unusual characteristics such as:

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Precaution for Use

- Increase in reverse leakage current lowered turn-on voltage
- Abnormal emissions from the LED at low current

The following recommendations are suggested to help minimize the potential for an ESD event. One or more recommended work area suggestions:

- Ionizing fan setup
- ESD table/shelf mat made of conductive materials
- ESD safe storage containers

One or more personnel suggestion options:
- Antistatic wrist-strap
- Antistatic material shoes
- Antistatic clothes

Environmental controls:
- Humidity control (ESD gets worse in a dry environment)

b. EOS (Electrical Over Stress)

Electrical Over-Stress (EOS) is defined as damage that may occur when an electronic device is subjected to a current or voltage that is beyond the maximum specification limits of the device. The effects from an EOS event can be noticed through product performance like:

- Changes to the performance of the LED package
  (If the damage is around the bond pad area and since the package is completely encapsulated the package may turn on but flicker show severe performance degradation.)
- Changes to the light output of the luminaire from component failure
- Components on the board not operating at determined drive power

Failure of performance from entire fixture due to changes in circuit voltage and current across total circuit causing trickle down failures. It is impossible to predict the failure mode of every LED exposed to electrical overstress as the failure modes have been investigated to vary, but there are some common signs that will indicate an EOS event has occurred:

- Damaged may be noticed to the bond wires (appearing similar to a blown fuse)
- Damage to the bond pads located on the emission surface of the LED package
  (shadowing can be noticed around the bond pads while viewing through a microscope)
- Anomalies noticed in the encapsulation and phosphor around the bond wires
- This damage usually appears due to the thermal stress produced during the EOS event

c. To help minimize the damage from an EOS event Seoul Semiconductor recommends utilizing:

- A surge protection circuit
- An appropriately rated over voltage protection device
- A current limiting device

Company Information

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Company Information

Seoul Semiconductor (www.SeoulSemicon.com) manufacturers and packages a wide selection of light emitting diodes (LEDs) for the automotive, general illumination/lighting, Home appliance, signage and back lighting markets. The company is the world's fifth largest LED supplier, holding more than 10,000 patents globally, while offering a wide range of LED technology and production capacity in areas such as "nPola", "Acrich", the world's first commercially produced AC LED, and "Acrich MJT - Multi-Junction Technology" a proprietary family of high-voltage LEDs.

The company's broad product portfolio includes a wide array of package and device choices such as Acrich and Acirch2, high-brightness LEDs, mid-power LEDs, side-view LEDs, and through-hole type LEDs as well as custom modules, displays, and sensors.

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