



# Application Note

**Samsung Electronics**  
**CR35H(3535)**

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# 1. Introduction

## 1.1 System Overview

### 1.1.1 Product Description

CR35H is designed for indoor and outdoor lightings such as bulb, distributed lighting, ambient lighting, flood lighting etc.

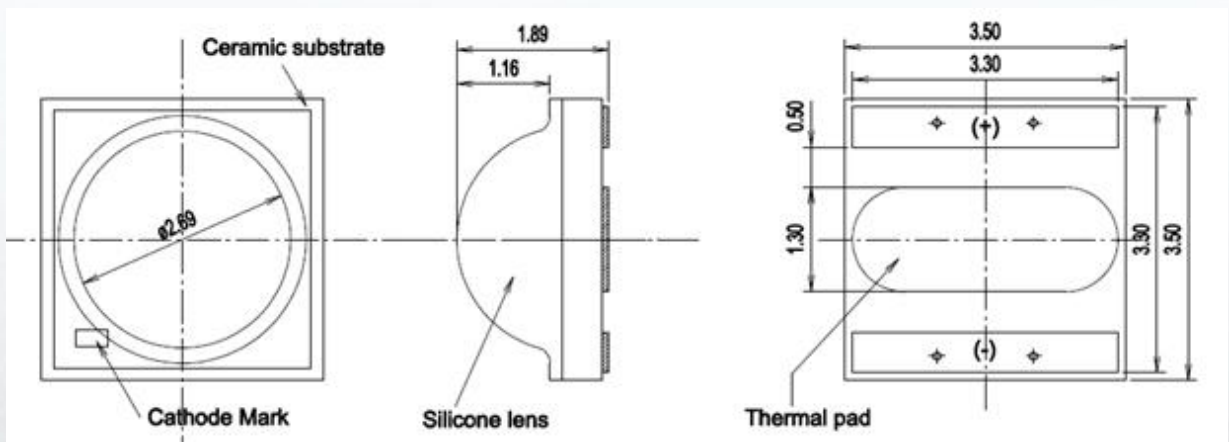
And it can provide stable performance and long lifetime for lighting products.

#### < Outline of CR35H >

Top View

Side View

Bottom View

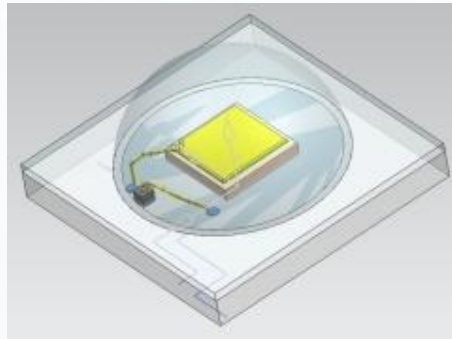


Unit : mm / Tolerance :  $\pm 0.13$

## 1.1 System Overview

### 1.1.2 Benefits and Features

CR35H provides benefits to customers. The key features are explained in detail as given below



- Reliable high power LED at high current operation
- Ceramic Package(3.5 x 3.5 x 1.89t mm)
- Small footprint with isolated thermal pad(3.5mm x 3.5mm)
- Leverage on strong semiconductor technology
- Wide viewing angle(  $\Delta\theta : 125^\circ \times 125^\circ$  ) for uniform illuminance
- Eco-friendly : RoHS compliant

# 1. Introduction

## 1.2 Application

CR35H product and applied module can be use at various applications, as shown below.

Application	Image
<ul style="list-style-type: none"><li>- Directional Lamp<ul style="list-style-type: none"><li>· MR &amp; PAR Lamp</li><li>· Down light</li><li>· Track light</li></ul></li></ul>	
<ul style="list-style-type: none"><li>- Low &amp; High Bay Solution<ul style="list-style-type: none"><li>· Warehouse, Industrial</li></ul></li></ul>	
<ul style="list-style-type: none"><li>- Outdoor Lighting<ul style="list-style-type: none"><li>· Street, Tunnel, Garage</li></ul></li></ul>	
<ul style="list-style-type: none"><li>- High End Solution<ul style="list-style-type: none"><li>· Torch</li></ul></li></ul>	

## 1.3 Package Information

### 1.3.1 Absolute Maximum Rating

CR35H's absolute maximum ratings are shown in below table. When you design an application by using CR35H, you should refer to parameter's rating not to exceed a permitted limit.

If any parameter is designed out of limit, it may cause a short CR35H's lifetime or unexpected breakdown .

**Table. Absolute Maximum Rating**

Item	Maximum Rating
Operation Forward Current ( $T_a = 25\text{ }^\circ\text{C}$ )	1500 mA
Thermal Resistance ( $R_{th,j-s}$ )	6.1 $^\circ\text{C/W}$
LED Junction Temperature ( $T_j$ )	150 $^\circ\text{C}$
Operating Temperature Range ( $T_{opr}$ )	-40 $^\circ\text{C}$ ~ 85 $^\circ\text{C}$
Storage Temperature Range ( $T_{stg}$ )	-40 $^\circ\text{C}$ ~ 100 $^\circ\text{C}$
Reverse Voltage	0.7 ~ 1.2 V
ESD	HB $\pm 5$ kV

## 2.1 Warnings

Please follow below guideline for efficient and safe usage of CR35H.

- 1) For over-current-proof, customers are recommended to apply resistors to prevent sudden change of the input current caused by slight shift of the voltage.
- 2) This device should not be used in any type of fluid such as water, oil, organic solvent, etc. If decontamination is required, IPA could be recommended to use.
- 3) When LEDs illuminate, operating current should be decided after considering the ambient maximum temperature (Refer to the maximum rating table).
- 4) LEDs must be stored in a clean environment. If the LEDs are to be stored for 3 months or more after being shipped from Samsung, they should be packed in a container sealed with nitrogen gas.  
(Shelf life of sealed bags: 12 months, temp. 0~40 °C, 20~70 % RH)
- 5) After bag is opened, device subjected to soldering, solder reflow, or other high temperature processes must be :
  - a. Mounted within 168 hours (7 days) at an assembly line with a condition of no more than 30 °C/60 % RH,
  - b. Stored at <10 % RH.

## 2.1 Warnings

Please follow below guideline for efficient and safe usage of CR35H.

- 6) Repack unused products with anti-moisture pack, seal pack to close any opening and then store in a dry place.
- 7) Devices require baking before mounting, if humidity card reading is  $>60\%$  at  $23\pm 5\text{ }^{\circ}\text{C}$ .
- 8) If baking is required, devices must be baked for 24 hours at  $65\pm 5\text{ }^{\circ}\text{C}$ .
- 9) The LEDs are sensitive to the static electricity and surge current. It is recommended to use a wrist band or anti-electrostatic glove when handling the LEDs.

If voltage exceeding the absolute maximum rating is applied to LEDs, it may cause damage or even destruction to LED devices. Damaged LEDs may show some unusual characteristics such as increase in leak current, lowered turn-on voltage, or abnormal lighting of LEDs at low current.


# 3. Product & Technology Description

## 3.1 Optical Considerations

### 3.1.1 Basic Performance

- The optical characteristics are shown in below tables.

**Table. Luminous efficacy (@ If=350mA , 25 °C)**

Model		Size(mm)	If(mA)	Vf(V) Typ.	Flux(lm) Typ.	Lm/W Typ.	CRI
	CR35H (Ceramic) 3535)	3.5x3.5x 1.89t	350 (Max. 1500)	3.00	CW 130	124	70+
					WW110	105	80+

**Table. Luminous flux with CCT (@ If=350mA, 25 °C)**

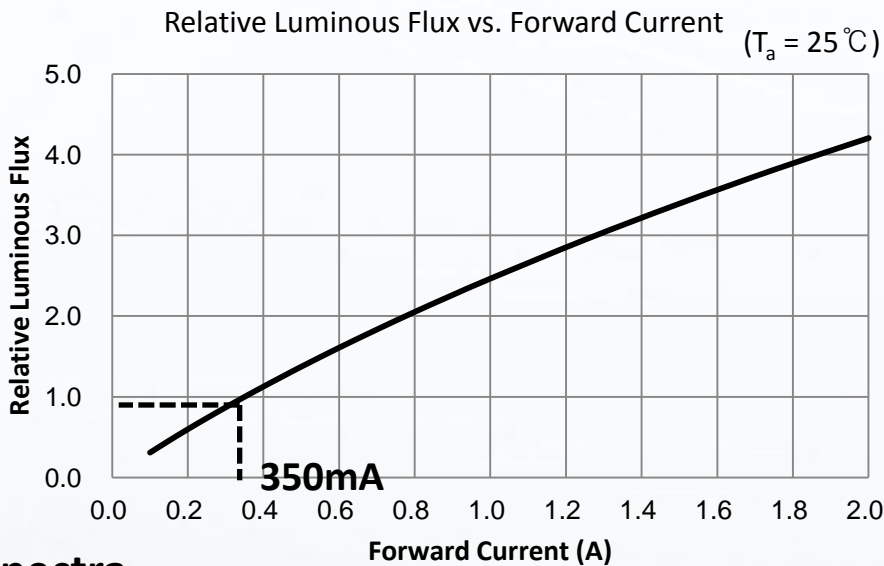
CCT(K)	Item	Unit	Rank	Min.	Typ.	Max.
Warm White (2700, 3000, 3500, 4000K)	Luminous Flux	lm	F5	90	-	140
	Forward Voltage	V	E6	2.7	-	3.3
	CRI	-	-	80	-	-
	Viewing Angle	°	-	-	125	-
Cool White (5000, 5700K)	Luminous Flux	lm	H5	110	-	160
	Forward Voltage	V	E6	2.7	-	3.3
	CRI	-	-	70	-	-
	Viewing Angle	°	-	-	125	-

## 3.1 Optical Considerations

### 3.1.1 Basic Performance

#### - Relative Flux vs. Forward Current

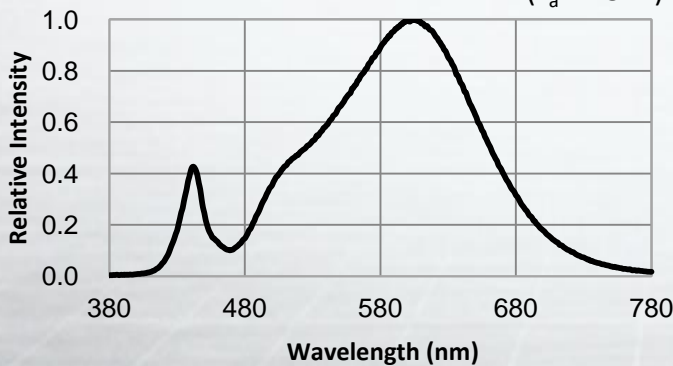
- The below graph shows the variation of relative luminous flux with forward current up to 2000mA.
- Relative luminous flux of 100% is the total luminous flux of CR35H at the forward current of 350mA.



#### - Spectra

<Warm White>

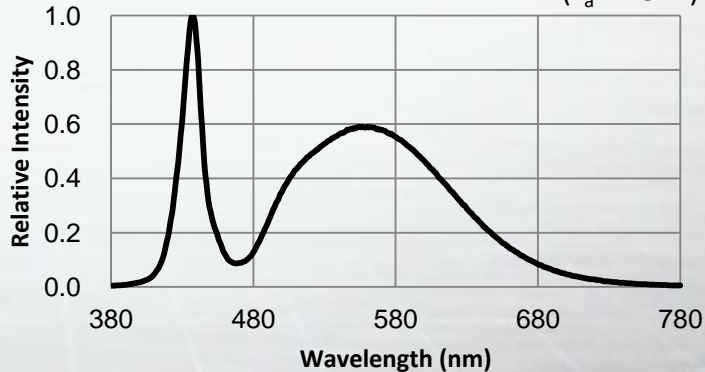
Relative intensity vs. Wavelength ( $T_a = 25^\circ\text{C}$ )



Chromaticity Coordinate :  
(x, y) = (0.447, 0.422)

<Cool White>

Relative Intensity vs. Wavelength ( $T_a = 25^\circ\text{C}$ )



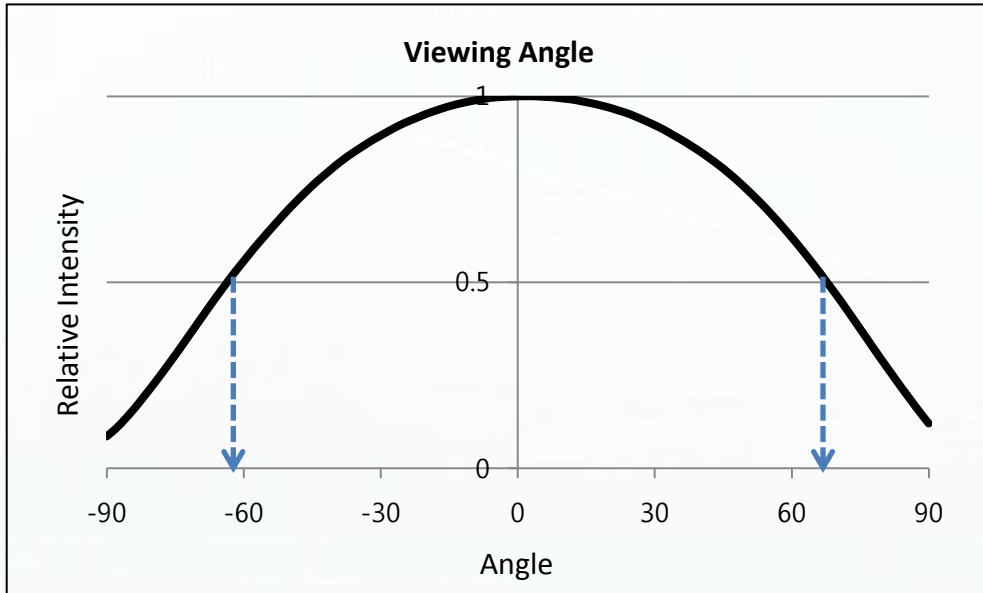
Chromaticity Coordinate :  
(x, y) = (0.340, 0.379)

## 3.1 Optical Considerations

### 3.1.1 Basic Performance

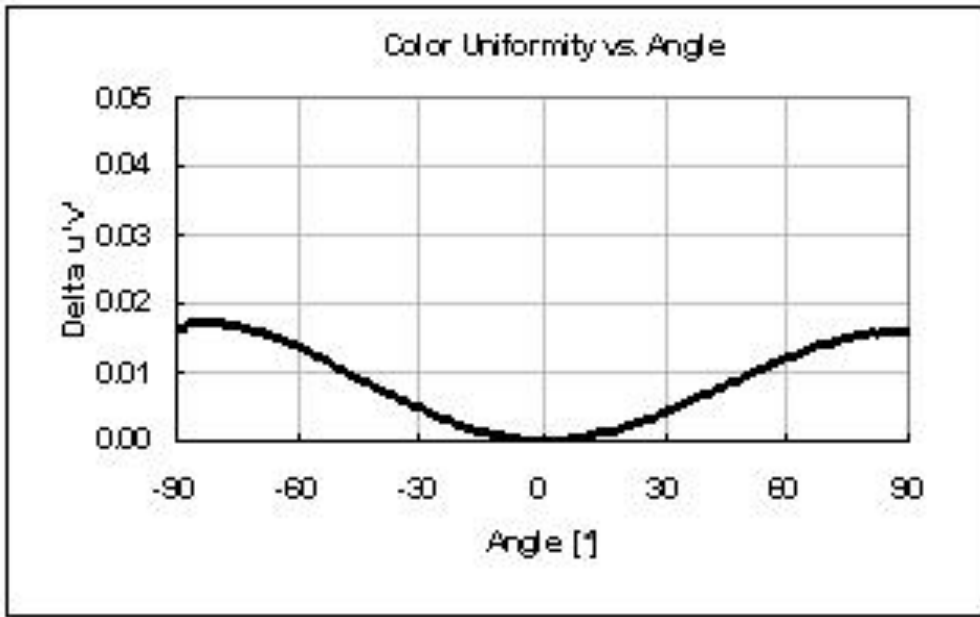
#### - Viewing Angle

- CR35H's beam angle : 125° (FWHM). ( $T_a = 25^\circ\text{C}$ )



#### - Viewing Angle vs. Color Value

( $T_a = 25^\circ\text{C}$ )

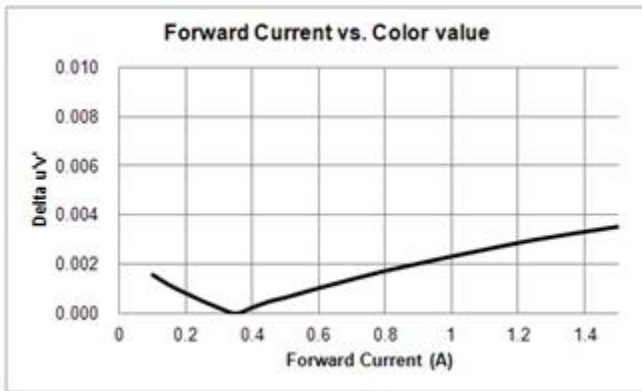


## 3.1 Optical Considerations

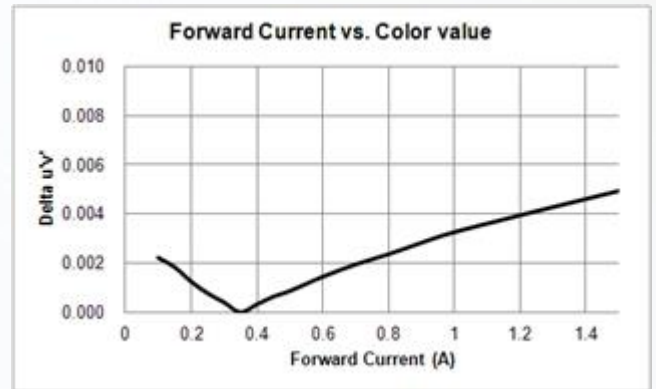
### 3.1.1 Basic Performance

#### - Forward Current vs. Color X, Y

<Warm White> ( $T_a = 25^\circ\text{C}$ )



<Cool White> ( $T_a = 25^\circ\text{C}$ )

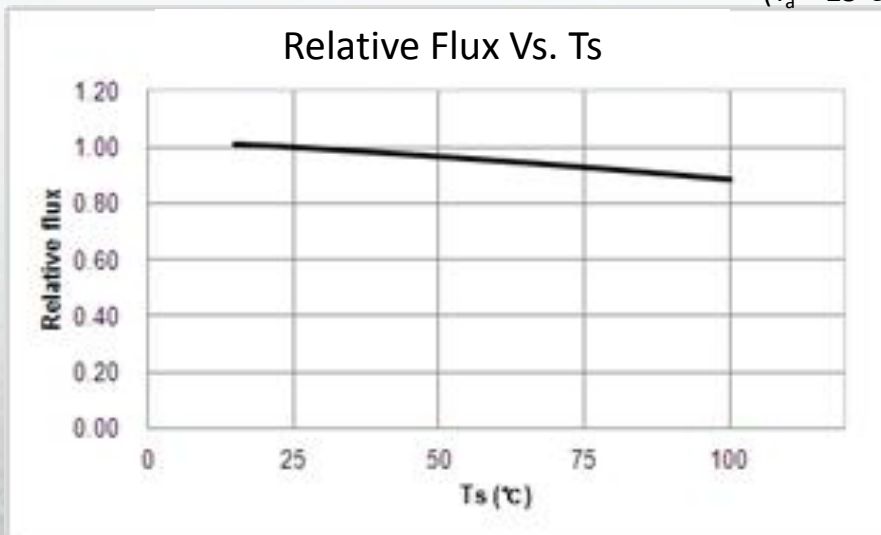


Chromaticity Coordinate(at 350mA) :  
 $(x, y) = (0.447, 0.422)$   
 $(u', v') = (0.249, 0.530)$

Chromaticity Coordinate(at 350mA) :  
 $(x, y) = (0.340, 0.379)$   
 $(u', v') = (0.198, 0.497)$

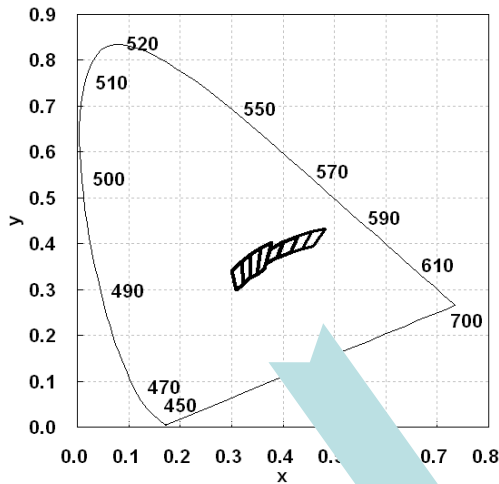
#### - Relative Flux vs. $T_s$ (solder point temp.)

The below graph shows the variation of relative luminous flux with a solder point temperature up to  $100^\circ\text{C}$ . ( $T_a = 25^\circ\text{C}$ )

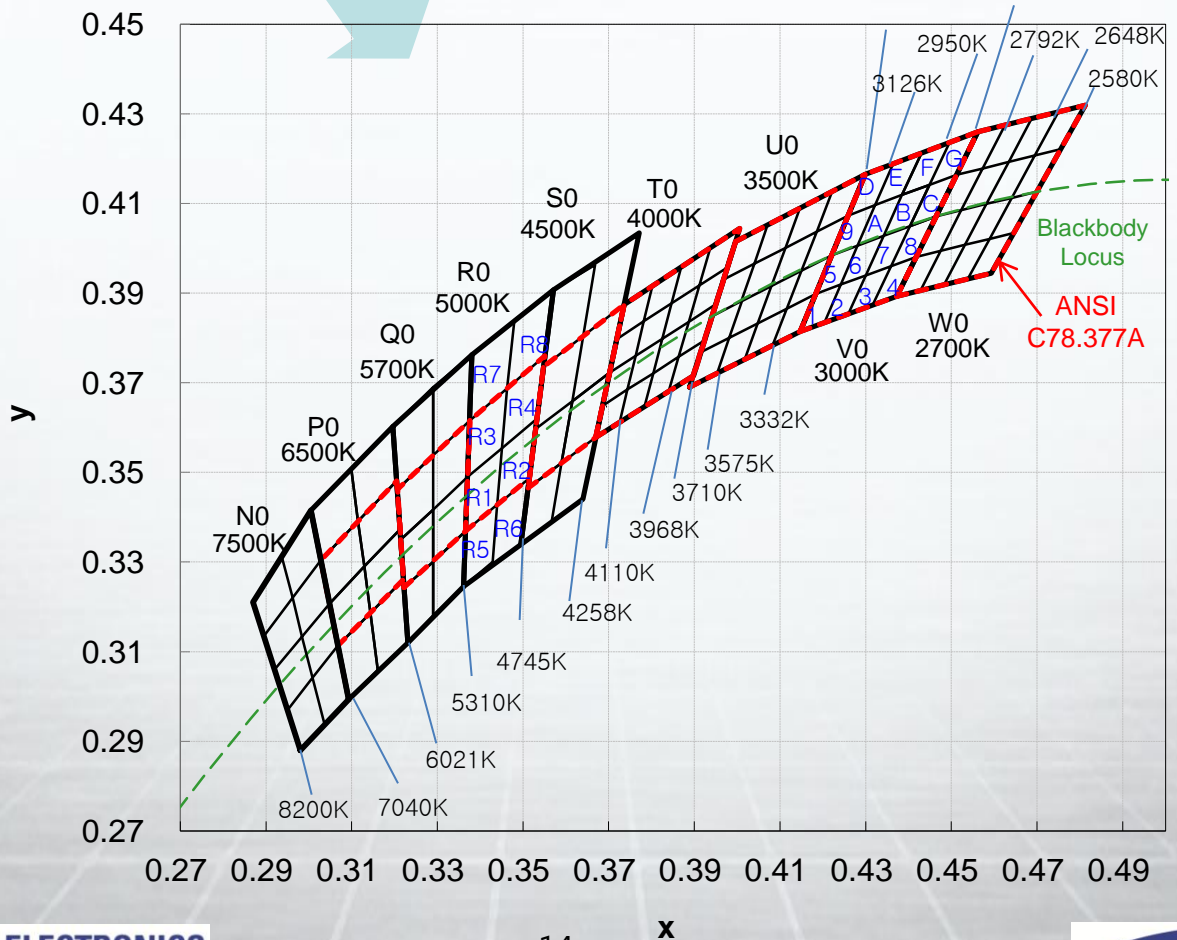


## 3.1 Optical Considerations

### 3.1.2 Color Binning Information



- CR35H are supplied by ANSI standard



## 3.1 Optical Considerations

### 3.1.2 Color Binning Information

LEDs are provided in three color domain by customers' request. The domain size mainly affect the color quality (uniformity) in luminaires. For the tight control of color quality, the LEDs in the small color domain have to be used in luminaires.

#### 1) Whole Bin (16 Sub Bin)

D	E	F	G
9	A	B	C
5	6	7	8
1	2	3	4

	<b>Item Code(W : CCT 2700K)</b>
Whole Bin	SPHWHTL3D303E6W0F5

#### 2) Half Bin (8 Sub Bin)

9	A	B	C
5	6	7	8

	<b>Item Code(W : CCT 2700K)</b>
Half Bin	SPHWHTL3D303E6WUF5

#### 3) Quarter Bin (4 Sub Bin)

	A	B	
	6	7	

	<b>Item Code(W : CCT 2700K)</b>
Quarter Bin	SPHWHTL3D303E6WPF5

## 3.1 Optical Considerations

### 3.1.2 Color Binning Information

LEDs are provided in two color domain by customers' request. The domain size mainly affect the color quality (uniformity) in luminaires. For the tight control of color quality, the LEDs in the small color domain have to be used in luminaires.

#### 1) Whole Bin (8 Sub Bin)

7	8
3	4
1	2
5	6

	<b>Item Code(R : CCT 5000K)</b>
Whole Bin	SPHWHTL3D303E6R0H5

#### 2) Half Bin (4 Sub Bin)

3	4
1	2

	<b>Item Code(R : CCT 5000K)</b>
Half Bin	SPHWHTL3D303E6RTH5

## 3.1 Optical Considerations

### 3.1.3 Luminous Flux Binning Information

Luminous flux is critical factor to design lighting product. LEDs are supplied 3 groups of luminous flux in each CCT .

Warm white products are provided in three flux bins ( bin code name: F5,G4,H3) and cool white products are also provided in flux bin(code name : H5, J4, H3).

First digit means the lowest flux bin name and second digit means the total number of flux sub bin.

For example, In bin 'F5' 'F' means a F1 bin as the lowest flux bin and '5' means that this bin has five flux sub bins(F1, G1, H1, J1, K1).

Luminous flux @ 350mA (lm)

Min. Flux Bin		5700K	5000K	4000K	3500K	3000K	2700K
		Q	R	T	U	V	W
D1	70-80						
E1	80-90			F5			
F1	90-100			G4			
G1	100-110	H5			H3		
H1	110-120	J4					
J1	120-130	K3					
K1	130-140				↓	↓	↓
M1	140-150						
N1	150-160	↓	↓	↓			

## 3.1 Optical Considerations

### 3.1.4 Solutions for MacAdam 3-Step

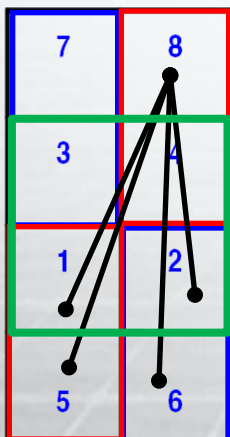
- Kitting-Bin is purposed to maximize effective utilization in the production of lighting applications. And, It is convenient to assemble LED modules in according to kitting binning guide line.

- **Basic Array Methods on PCB of LEDs**

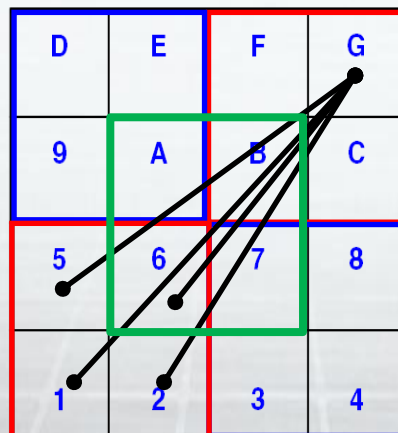
For target bin(green line)

- Cool white : one LED in 4 upper bins(3,4,7,8) could be paired with any LED in 4 lower bins(1,2,5,6)
- Warm white : one LED in 4 bins(B,C,F,G) could be paired with any LEDs in diagonal 4 bins(1,2,5,6)

[Cool White]



[Warm White]



[Pairing]



## 3.1 Optical Considerations

### 3.1.4 Solutions for MacAdam 3-Step

- **Chromaticity Binning Method**  
: The kitting bins are also grouped as the same way as production bin
- **Number of Chromaticity Bin Group**  
: Cool white : 8 groups, Warm white : 16 groups
- **CR35H Kitting Bin Code**  
: Products for kitting bin should be noticed in different nomenclature as shown in below table

CCT	Lm Rank	Product Code
W(2700K)	F5	SPHWHTL3D303E6WKF5
	G4	SPHWHTL3D303E6WKG4
	H3	SPHWHTL3D303E6WKH3
V(3000K)	F5	SPHWHTL3D303E6VKF5
	G4	SPHWHTL3D303E6VKG4
	H3	SPHWHTL3D303E6VKH3
U(3500K)	F5	SPHWHTL3D303E6UKF5
	G4	SPHWHTL3D303E6UKG4
	H3	SPHWHTL3D303E6UKH3
T(4000K)	G4	SPHWHTL3D303E6TKG4
	H3	SPHWHTL3D303E6TKH3
	J2	SPHWHTL3D303E6TKJ2
R(5000K)	H5	SPHWHTL3D303E6RKH5
	J4	SPHWHTL3D303E6RKJ4
	K3	SPHWHTL3D303E6RKK3
Q(5700K)	H5	SPHWHTL3D303E6QKH5
	J4	SPHWHTL3D303E6QKJ4
	K3	SPHWHTL3D303E6QKK3

※ Product color code 'K' means kitting product.

## 3.1 Optical Considerations

### 3.1.4 Solutions for MacAdam 3-Step

#### → Kitting-Bin example (R0 rank)

: Customers could be supplied with 12 bin combinations

- Inner box may contain one combination of the below 12 combinations.
- Customers have only to use a pair of 2 reels in SMT.
- Please refer to packing information before SMT.

No.	Box contains	No.	Box contains	No.	Box contains
1	R5 n reel + R8 n reel	5	R1 n reel + R7 n reel	9	R3 n reel + R5 n reel
2	R5 n reel + R7 n reel	6	R1 n reel + R8 n reel	10	R3 n reel + R6 n reel
3	R6 n reel + R7 n reel	7	R2 n reel + R7 n reel	11	R4 n reel + R5 n reel
4	R6 n reel + R8 n reel	8	R2 n reel + R8 n reel	12	R4 n reel + R6 n reel

※ n= 1~5

## 3.1 Optical Considerations

### 3.1.4 Solutions for MacAdam 3-Step

#### → Kitting-Bin example (V0 rank)

: Products is provided as below bin combinations

- Any one Inner Box may contain any one of the below 42 combinations.
- Customers can mount 2 reels (which have been packed for suitable binning) in SMT process to achieve tighter color quality in system level.

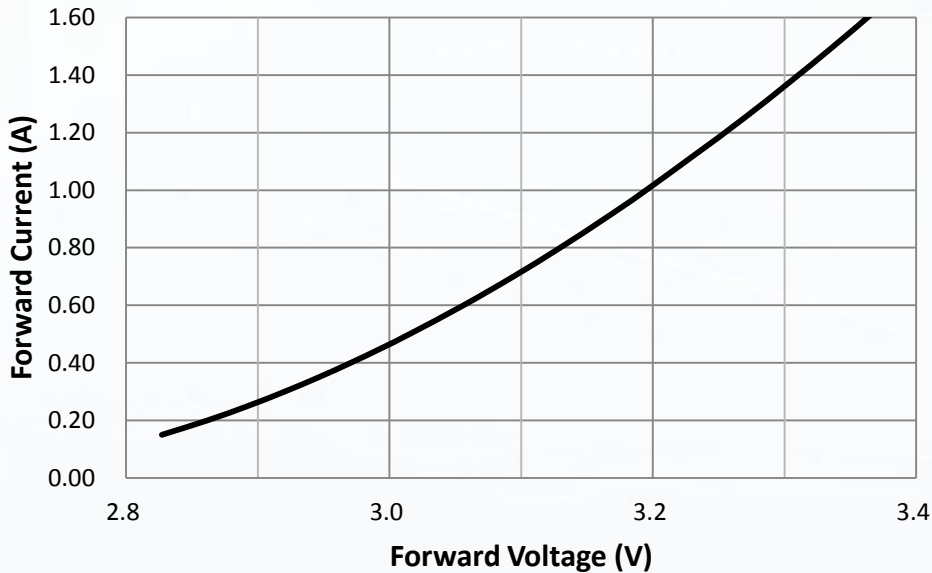
No.	Box contains	No.	Box contains	No.	Box contains
1	V1 n reel+ VC n reel	15	V5 n reel+ V8 n reel	29	V7 n reel+ V9 n reel
2	V1 n reel+ VF n reel	16	V5 n reel+ VC n reel	30	V7 n reel+ VD n reel
3	V1 n reel+ VG n reel	17	V5 n reel+ VF n reel	31	V7 n reel+ VE n reel
4	V2 n reel+ VC n reel	18	V5 n reel+ VG n reel	32	V7 n reel+ VF n reel
5	V2 n reel+ VE n reel	19	V8 n reel+ V9 n reel	33	VA n reel+ V2 n reel
6	V2 n reel+ VF n reel	20	V8 n reel+ VD n reel	34	VA n reel+ V3 n reel
7	V2 n reel+ VG n reel	21	V8 n reel+ VE n reel	35	VA n reel+ V4 n reel
8	V3 n reel+ V9 n reel	22	V9 n reel+ VC n reel	36	VA n reel+ V8 n reel
9	V3 n reel+ VD n reel	23	V6 n reel+ V8 n reel	37	VA n reel+ VC n reel
10	V3 n reel+ VE n reel	24	V6 n reel+ VC n reel	38	VB n reel+ V1 n reel
11	V3 n reel+ VF n reel	25	V6 n reel+ VE n reel	39	VB n reel+ V2 n reel
12	V4 n reel+ V9 n reel	26	V6 n reel+ VF n reel	40	VB n reel+ V3 n reel
13	V4 n reel+ VD n reel	27	V6 n reel+ VG n reel	41	VB n reel+ V5 n reel
14	V4 n reel+ VE n reel	28	V7 n reel+ V5 n reel	42	VB n reel+ V9 n reel

※ n= 1~5

## 3.2 Electrical Considerations

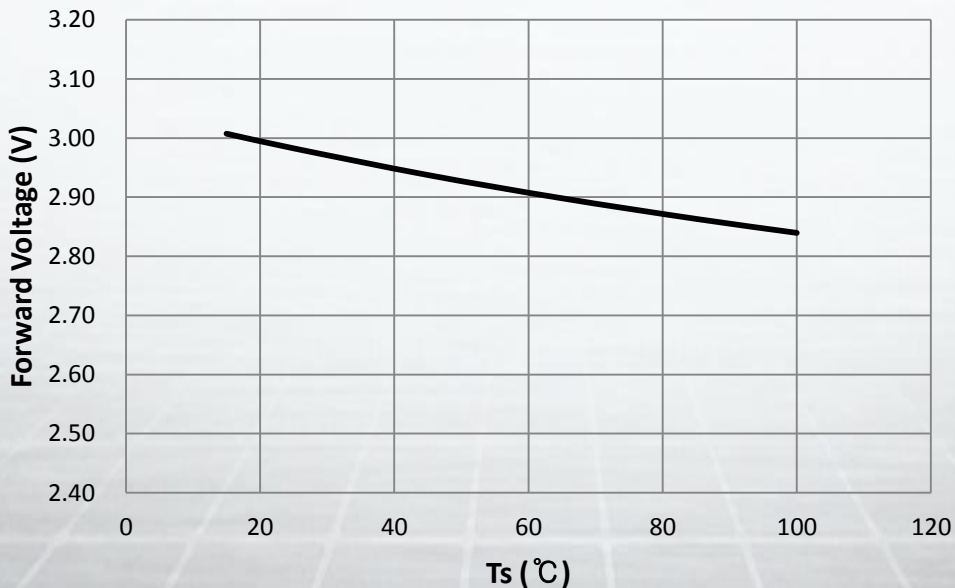
### 3.2.1 Electrical Characteristic Graph

#### - Forward Voltage vs. Forward Current



#### - $T_s$ (solder point temp.) vs. Forward Voltage

:  $V_f$  of LEDs gradually decrease with the ramping up of soldering point temperature



## 3.3 Thermal Considerations

### 3.3.1 Thermal measurement

Thermal management is important to ensure sufficient lifetime and performance. The thermal resistance is  $6.1^{\circ}\text{C}/\text{W}(\text{Max.})$

Please apply suitable thermal design referring to guideline as shown below.

**1)  $R_{\text{th } j-s}$  (Thermal Resistance Junction to Solder) :  $6.1^{\circ}\text{C}/\text{W}(\text{Max.})$**

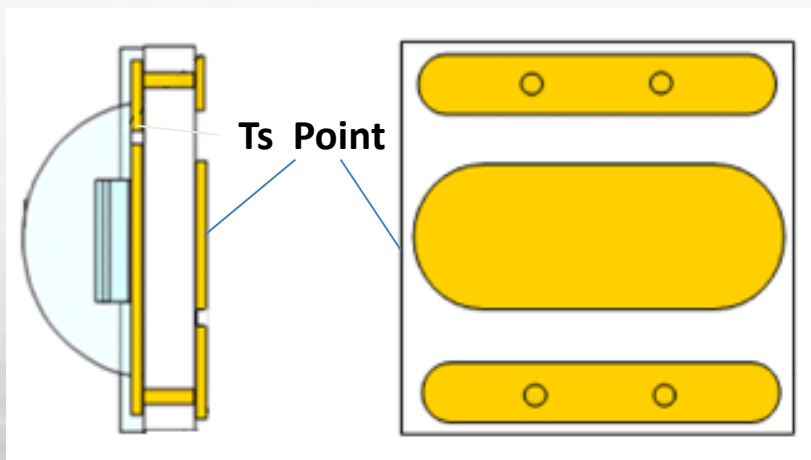
**2) How to calculate junction temperature**

:  $T_j$  (Junction Temperature) =  $T_s + R_{\text{th}} \times P_d$  ( $P_d = I_F \times V_F$ )

**3) Measuring  $T_s$  Point**

Measure the nearest point to the thermal pad as shown below.  
If necessary, remove PSR of PCB to reach  $T_s$  point.

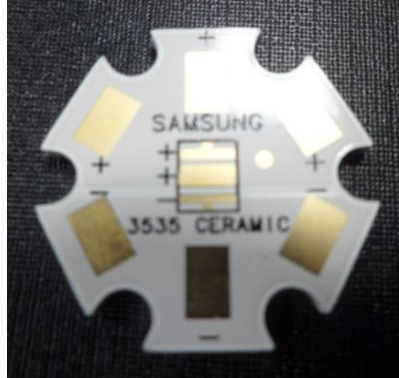
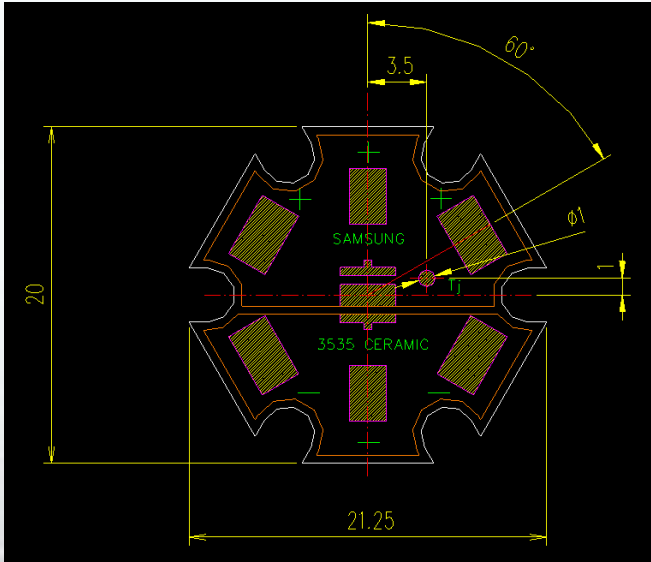
Thermal pad must be soldered to the PCB to dissipate heat properly. Otherwise, LED can be damaged.



## 3.3 Thermal Considerations

### 3.3.2 Testing PCB for Evaluation

Please use suitable testing PCB for accurate evaluation of CR35H. The Gerber file about testing PCB below will be provided through sales representative or homepage.

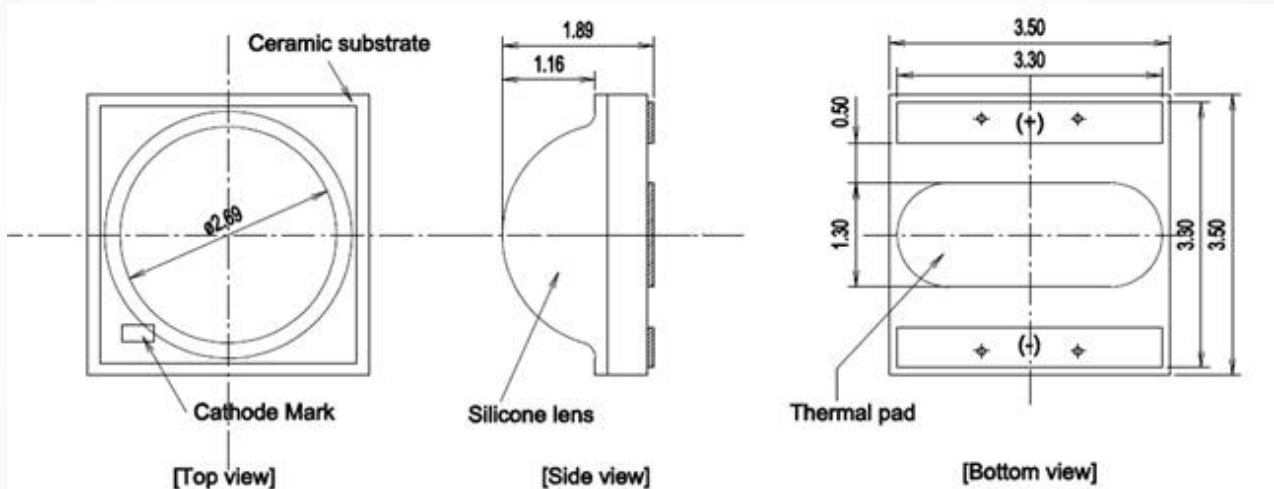
	PCB
Picture	
Drawing	

## 3.4 Mechanical Considerations

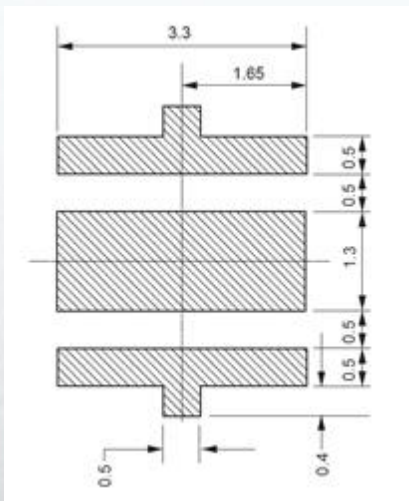
### 3.4.1 Mechanical Drawing

Drawing of CR35H

Unit : mm / Tolerance :  $\pm 0.13$



### Recommended Land Pattern

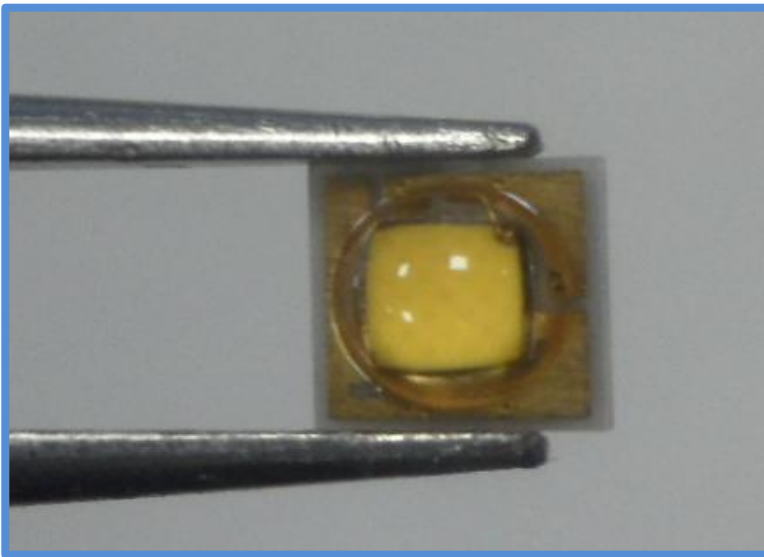


- \* This LED has built-in ESD protection device(s) connected in parallel to LED chip(s)
- \* The thermal pad is electrically isolated from the anode and cathode contact pads

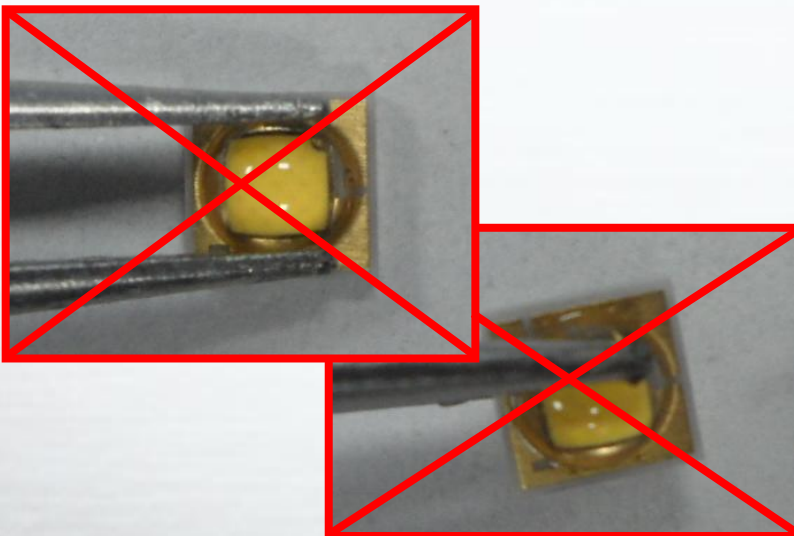
## 3.4 Mechanical Considerations

### 3.4.2 Handling Guide

Please use tweezers to grab CR35H at the base. Do not touch the lens with the tweezers or fingers and push on the lens.



Correct Handling



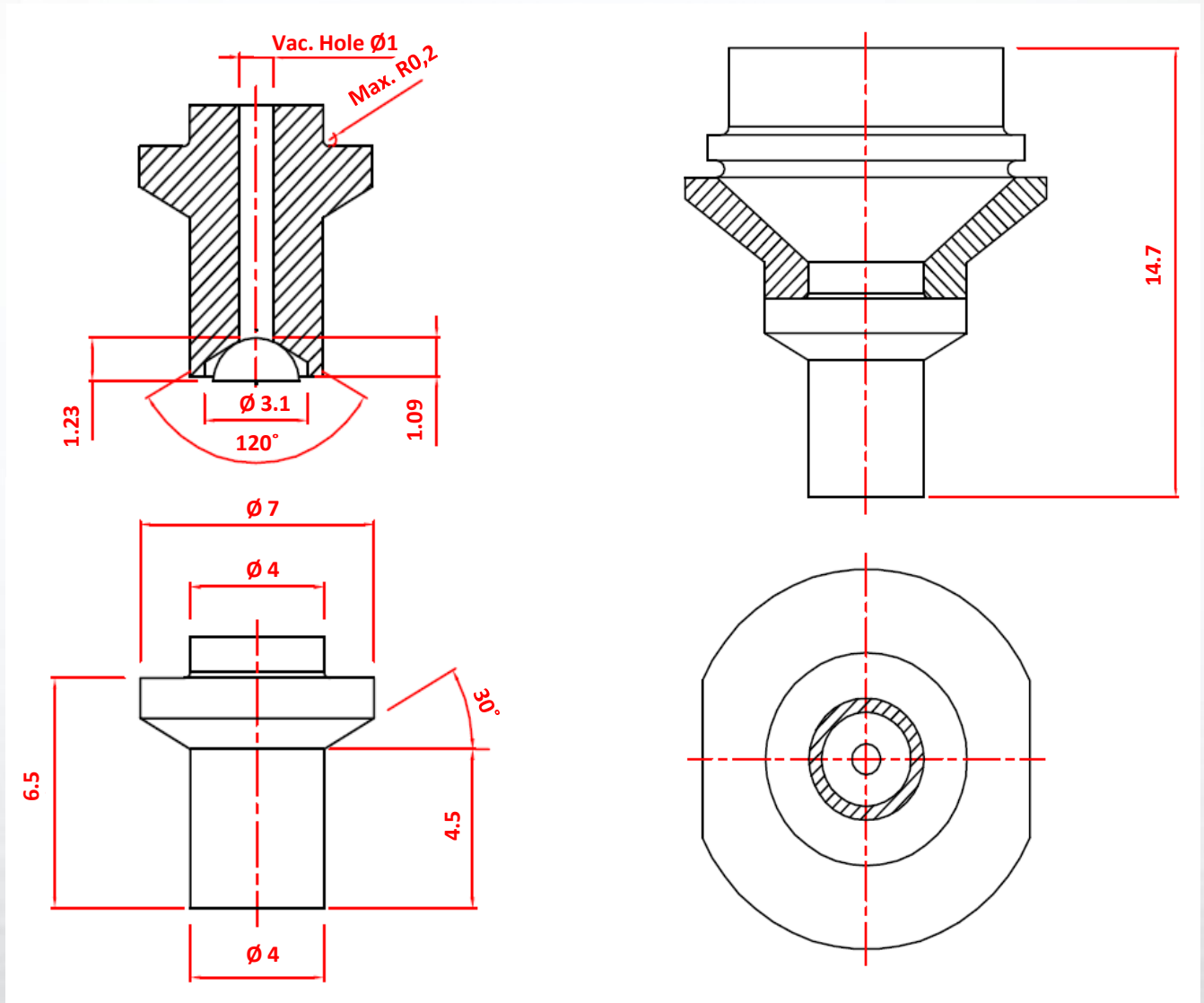
Incorrect Handling

In order to avoid any mechanical damage to the CR35H, do not apply more than **1000 gf** of shear force directly onto the lens.

## 3.4 Mechanical Considerations

### 3.4.3 Pick and Place Guide

Please refer pick up tool information below for SMT.



Dedicated SAMSUNG CR35H Pick-up Tool Design (All Dimensions in mm)

## 3.4 Mechanical Considerations

### 3.4.4 Soldering Guide

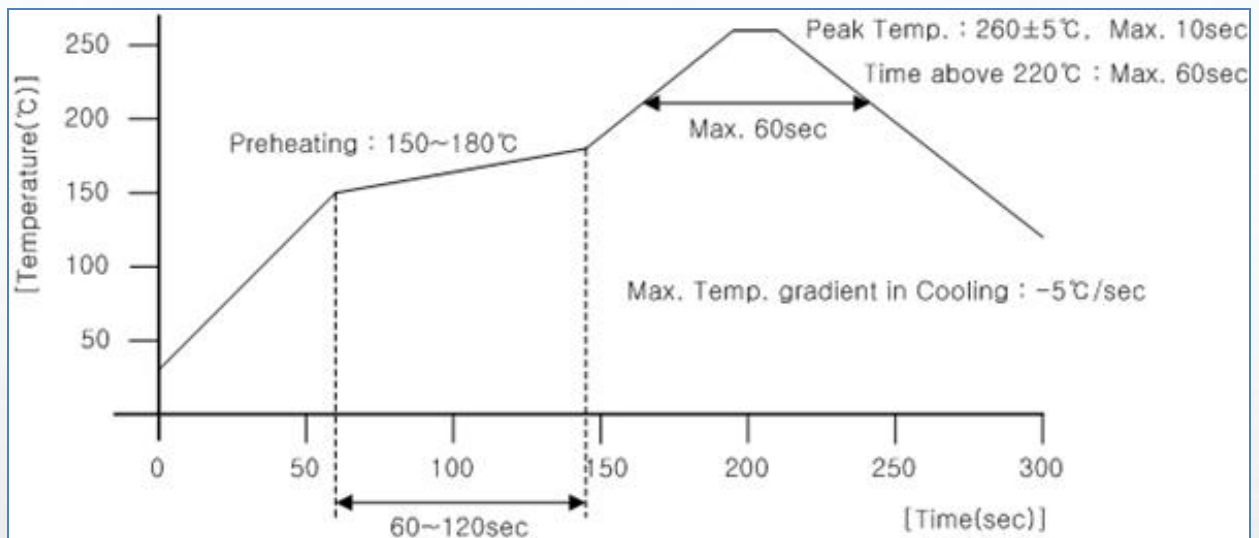
#### Reflow Condition and Work Guide

Below reflow profile is recommended for reflow soldering.

Conditions can be changed in various soldering equipment and PCB.

It is recommended that users follow the reflow guide line of a solder manufacturer .

- Reflow Frequency : 2 times max.



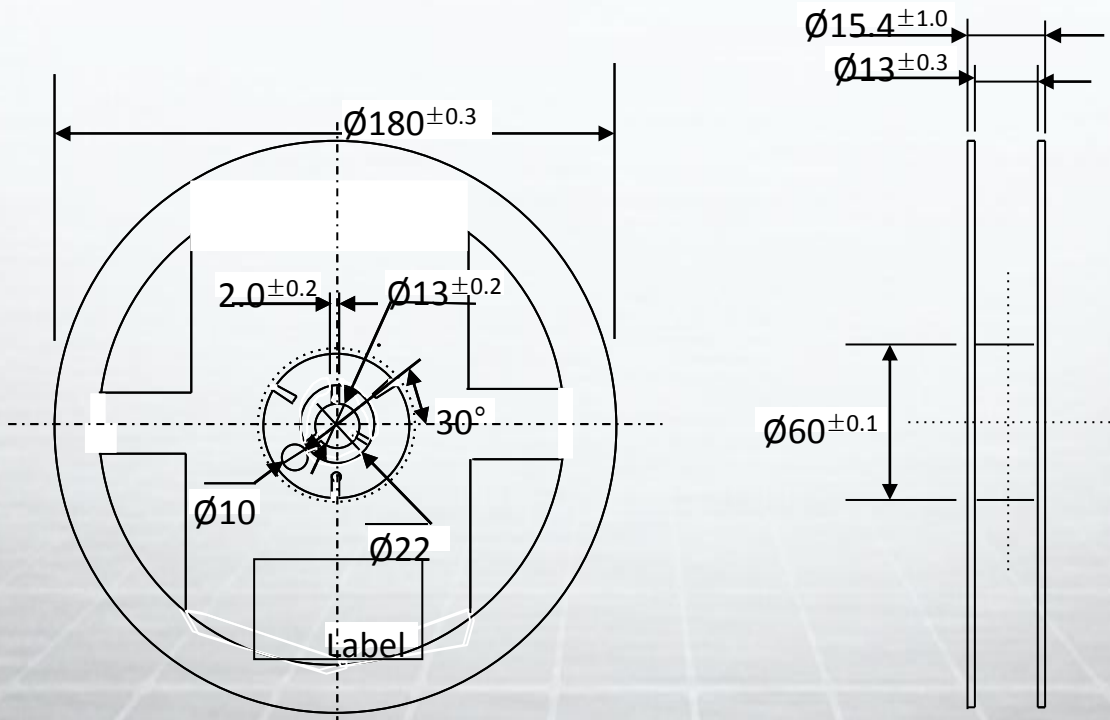
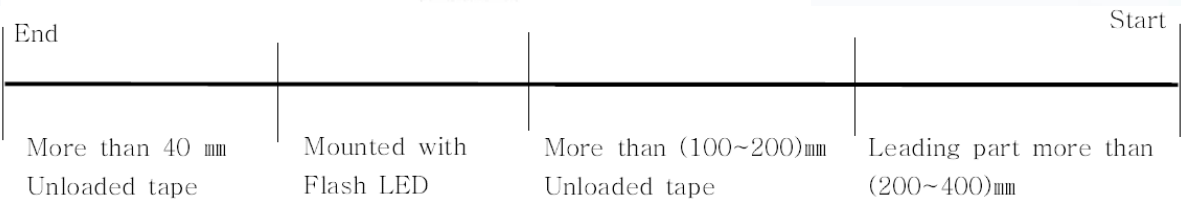
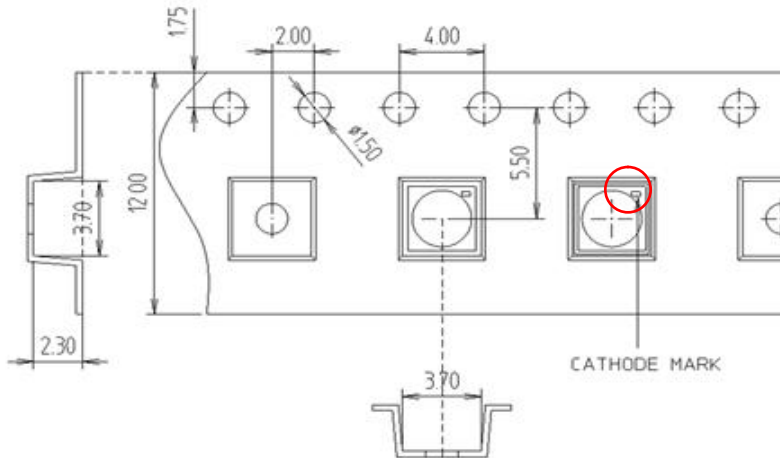
#### For Manual Soldering

Not more than 5 seconds at max. 300°C, under soldering iron

## 3.4 Mechanical Considerations

### 3.4.4 Soldering Guide

#### Tape and Reel Information



# 4. Lifetime

## 4.1 Thermal Considerations

### 4.1.1 LM80 Test Result

6000hrs test result(Relative luminous flux) for LM80

Testing Lab : Nansha

		Measured Lumen Maintenance (%)						
Ts (°C)	If (mA)	500h	1000h	2000h	3000h	4000h	5000h	6000h
55 °C	1000	100.4	100.6	99.5	98.7	97.7	97.3	97.1
75 °C	1000	100.3	100.0	99	97.3	96.1	95.5	95.5
85 °C	1000	100.4	99.9	98.7	96.8	95.9	95.1	95.3

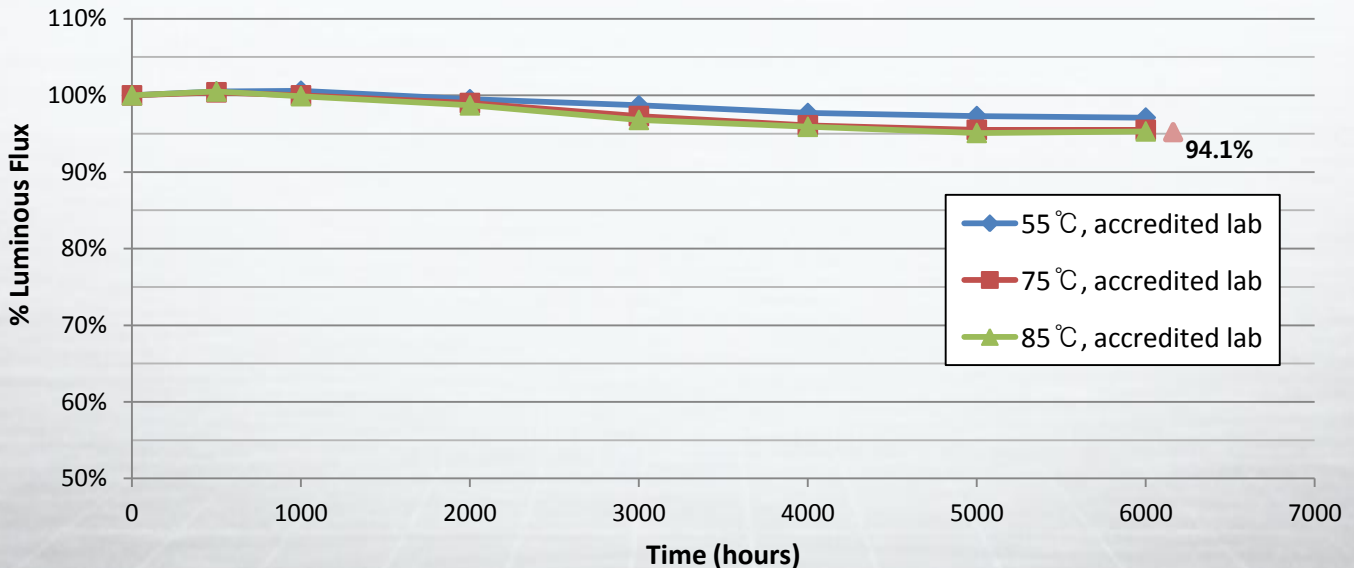
### CR35H (A) measured data

Ts : 55 °C, 75 °C, 85 °C

If : 1000mA

CCT : 2700K

R th j-s	5 °C/W
Ambient Temperature	55 °C, 75 °C, 85 °C



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## 4.1 Thermal Considerations

### 4.1.2 Estimated Lifetime

Lumen maintenance life projection

- Curve fit : perform an exponential least squares curve-fit through the averaged values
- Luminous output projection equation :  $\Phi(t) = B \exp(-\alpha t)$
- Lumen maintenance life calculation :

$$L_p = \frac{\ln\left(100 \times \frac{B}{p}\right)}{\alpha} \quad \text{in case of L70,} \quad L_{70} = \frac{\ln\left(\frac{B}{0.7}\right)}{\alpha}$$

\*  $\Phi(t)$  = averaged normalized luminous flux output at time t

\*  $\alpha$  = decay rate constant derived by the least squares curve-fit

\* B = projected initial constant derived by the least squares curve-fit

Item	55°C Case Temp.	75°C Case Temp.	85°C Case Temp.
Sample size	28		
Drive current In the test	1000 mA		
Test duration	6000 hrs		
$\alpha$	7.267E-06	9.975E-06	9.849E-06
B	1.009	1.008	1.005
Calculated L70(6k) hours	<b>50,000</b>	<b>37,000</b>	<b>37,000</b>
Reported L70(6k) hours	<b>&gt;36,000</b>	<b>&gt;36,000</b>	<b>&gt;36,000</b>

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# 5. Safety

## 5.1 Photobiological Safety(IEC 62471)

Testing Lab : KTR(Korea Testing & Research Institute)

Test Report issued under the responsibility of:



<b>TEST REPORT</b> <b>IEC 62471</b> <b>Photobiological safety of lamps and lamp systems</b>	
Report Reference No. ....	CEC2011-0117
Date of issue .....	2011.05.31
Total number of pages .....	19
<b>CB Testing Laboratory</b> .....	KTR (KOREA TESTING & RESEARCH INSTITUTE)
Address .....	66-6, Jeil-Ri, Yangji-Myun, Cheoin-Gu, Yongin, Gyeonggi-Do, Korea
<b>Applicant's name</b> .....	SAMSUNG LED CO., LTD.
Address .....	314, Maetan 3-dong, Yeongtong-gu, Suwon, Gyeonggi-do, Korea
<b>Test specification:</b>	
Standard .....	IEC 62471:2006 (First Edition) + European Group Difference and National differences
Test procedure .....	N/A
Non-standard test method.....	N/A
<b>Test Report Form No.</b> .....	IEC62471A
TRF Originator.....	VDE Testing and Certification Institute
Master TRF .....	Dated 2009-05
<b>Copyright © 2009 IEC System for Conformity Testing and Certification of Electrical Equipment (IECEE), Geneva, Switzerland. All rights reserved.</b> This publication may be reproduced in whole or in part for non-commercial purposes as long as the IECEE is acknowledged as copyright owner and source of the material. IECEE takes no responsibility for and will not assume liability for damages resulting from the reader's interpretation of the reproduced material due to its placement and context. If this Test Report Form is used by non-IECEE members, the IECEE/IEC logo and the reference to the CB Scheme procedure shall be removed.	
<b>Test item description</b> .....	LED Package
Trade Mark .....	
Manufacturer .....	SAMSUNG LED CO., LTD.
Model/Type reference .....	3535 Ceramic Cool White(SPHWHTL3)
Ratings .....	3.1 Vdc(Max), 350 mA

## 5.1 Photobiological Safety(IEC 62471)

Test item particulars .....	:	
Tested lamp .....	:	<input checked="" type="checkbox"/> continuous wave lamps <input type="checkbox"/> pulsed lamps
Tested lamp system .....	:	
Lamp classification group .....	:	<input type="checkbox"/> exempt <input checked="" type="checkbox"/> risk 1 <input type="checkbox"/> risk 2 <input type="checkbox"/> risk 3
Lamp cap .....	:	-
Bulb .....	:	LED package
Rated of the lamp .....	:	3.1 Vdc(Max), 350 mA
Furthermore marking on the lamp .....	:	-
Seasoning of lamps according IEC standard .....	:	-
Used measurement instrument .....	:	See page 15
Temperature by measurement .....	:	24.5 °C
Information for safety use .....	:	Not required

### - Measuring Instrument

Name	Maker	Model No.
Spectrometer	BENTHAM	IDR-300

### - Summary of Testing

Risk	Symbol	Risk Group Result
Actinic UV	E <sub>s</sub>	Exempt
Near UV	E <sub>UVA</sub>	Exempt
Blue light	L <sub>B</sub>	Low Risk(RG-1)
Blue light, Small Source	E <sub>B</sub>	Not Applicable
Retinal thermal	L <sub>R</sub>	Exempt
Retinal thermal Weak stimulus	L <sub>IR</sub>	Not Applicable
IR Radiation	E <sub>IR</sub>	Not Applicable

## 5.2 RoHS

CR35H complies with RoHS directive.



**Test Report No.** F690501/LF-CTSAYAA11-02162

**Issued Date:** January 21, 2011

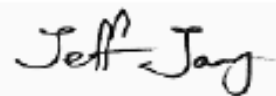
**To:** SAMSUNG LED CO., LTD.  
314, Maetan-dong  
Yeongtong-gu  
Suwon-city  
GYEONGGI-DO 443-370  
Korea

The following merchandise was submitted and identified by the client as :

SGS File No. : AYAA11-02162  
Product Name : 3535 Ceramic PKG  
Item No./Part No. : N/A  
Received Date : Jan 18, 2011  
Test Period : Jan 19, 2011 to Jan 20, 2011  
Test Performed : SGS Testing Korea tested the sample(s) selected by applicant with following results  
Test Results : For further details, please refer to following page(s)  
Comments : By the applicant's specific request, the sampling and testing was performed only for the part indicated in the photo without disassembly.

Timothy Jeon  
Jinhee Kim  
Cindy Park  
Jerry Jung/ Testing Person

SGS Testing Korea Co. Ltd.



Jeff Jang / Chemical Lab Mgr

# 5. Safety

## 5.2 RoHS



**Test Report No.** F690501/LF-CTSAYAA11-02162

**Issued Date:** January 21, 2011

**Page 2 of 5**

**Sample No.** : AYAA11-02162.001  
**Sample Description** : 3535 Ceramic PKG  
**Item No./Part No.** : N/A  
**Comments** : Materials are Ceramic, Silicone.

### Heavy Metals

Test Items	Unit	Test Method	MDL	Results
Cadmium (Cd)	mg/kg	With reference to IEC 62321:2008, ICP	0.5	N.D.
Lead (Pb)	mg/kg	With reference to IEC 62321:2008, ICP	5	N.D.
Mercury (Hg)	mg/kg	With reference to IEC 62321:2008, ICP	2	N.D.
Hexavalent Chromium (Cr VI)	mg/kg	With reference to IEC 62321:2008, UV-VIS	1	N.D.

### Flame Retardants-PBBs/PBDEs

Test Items	Unit	Test Method	MDL	Results
Monobromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Dibromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Tribromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Tetrabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Pentabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Hexabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Heptabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Octabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Nonabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Decabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Monobromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Dibromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Tribromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Tetrabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Pentabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Hexabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Heptabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Octabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Nonabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Decabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.

**NOTE:** (1) N.D. = Not detected. (<MDL)  
 (2) mg/kg = ppm  
 (3) MDL = Method Detection Limit  
 (4) - = No regulation  
 (5) \*\* = Qualitative analysis (No Unit)  
 (6) \* = Boiling-water-extraction:  
 Negative = Absence of CrVI coating  
 Positive = Presence of CrVI coating; the detected concentration in boiling-water-extraction solution is equal or greater than 0.02 mg/kg with 50 cm<sup>2</sup> sample surface area.

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 \*Some electronic analytical results document (this and report) are only to the client(s) listed and each sample(s) are prepared for 30 days only.

## 5.2 RoHS



**Test Report No.** F690501/LF-CTSAYAA11-02162

**Issued Date:** January 21, 2011

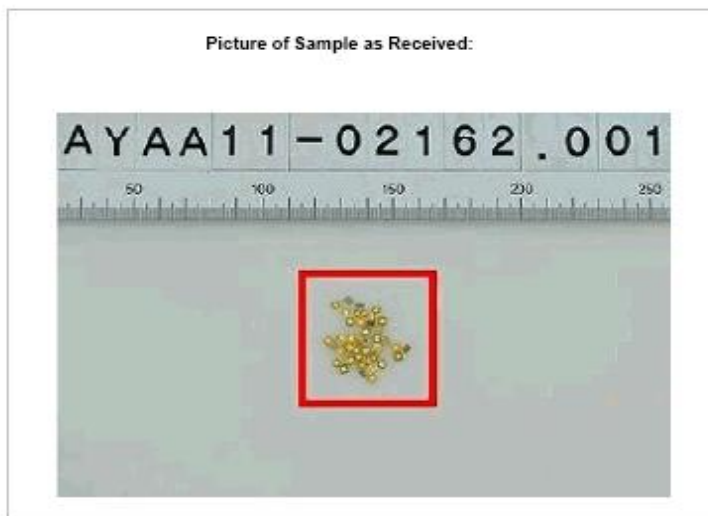
**Page 3 of 5**

**Sample No.** : AYAA11-02162.001  
**Sample Description** : 3535 Ceramic PKG  
**Item No./Part No.** : N/A  
**Comments** : Materials are Ceramic, Silicone.

### Halogen Contents

Test Items	Unit	Test Method	MDL	Results
Bromine(Br)	mg/kg	BS EN 14582:2007 , IC	30	N.D.
Chlorine(Cl)	mg/kg	BS EN 14582:2007 , IC	30	N.D.
Fluorine(F)	mg/kg	BS EN 14582:2007 , IC	30	N.D.
Iodine(I)	mg/kg	BS EN 14582:2007 , IC	50	N.D.

Picture of Sample as Received:



- NOTE:**
- (1) N.D. = Not detected.(<MDL)
  - (2) mg/kg = ppm
  - (3) MDL = Method Detection Limit
  - (4) - = No regulation
  - (5) \*\* = Qualitative analysis (No Unit)
  - (6) \* = Boiling-water-extraction:  
 Negative = Absence of CrVI coating  
 Positive = Presence of CrVI coating; the detected concentration in boiling-water-extraction solution is equal or greater than 0.02 mg/kg with 50 cm2 sample surface area.

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## 5.2 RoHS

### Testing flow chart for RoHS

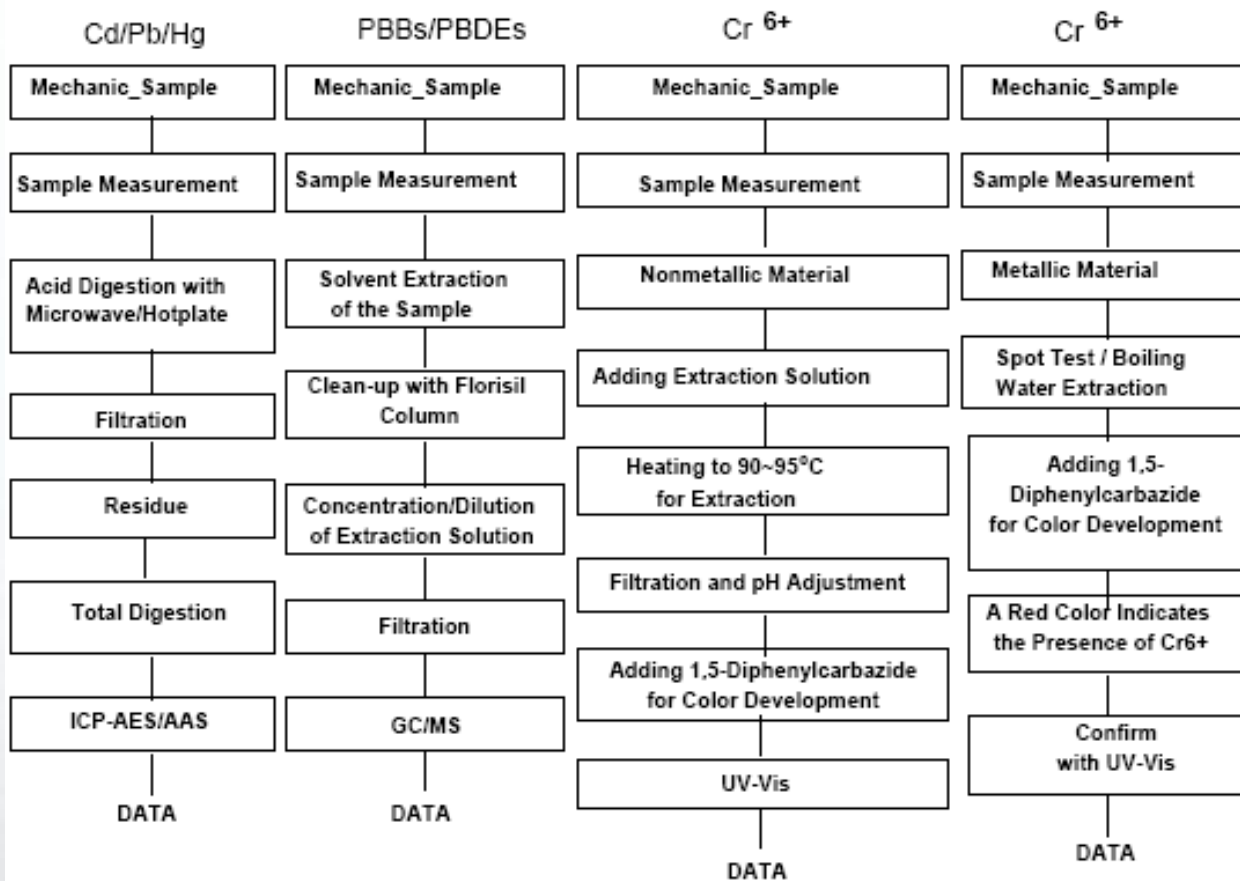


Test Report No. F690501/LF-CT&YAA11-02162

Issued Date: January 21, 2011

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#### Testing Flow Chart for RoHS: Cd/Pb/Hg/Cr<sup>6+</sup>/PBBs&PBDEs Testing



# 6. Certificate

## 6.1 UL

File E347623  
Project 11CA23063

June 02, 2011

REPORT

on

COMPONENT - Light-Emitting-Diode Package

SAMSUNG LED CO LTD  
Kyungki-Do, Korea

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### ELECTRICAL RATING:

Cat. No.	Input type	Max. Junction Temp. (°C)	Enclosure Consideration	Max. Operating Voltage	Current Rating (mA)
SPHWHTL3D30 wxxyyzz	Class 2	150	1	3.1 Vdc	300
				3.3 Vdc	700
				3.6 Vdc	1500

### Enclosure consideration codes:

- 1 - The LED package or a portion thereof has not been investigated as a fire enclosure or a fire and electrical enclosure.
- 2 - The LED package or a portion thereof has been investigated as a fire enclosure.
- 3 - The LED package or a portion thereof has been investigated as a fire and electrical enclosure.

### GENERAL:

The product is a LED package intended for only for connection to a constant current Class 2 power source.

### MODEL NOMENCLATURE:

Series	CRI (Color Rendering Index)	Forward Voltage Group	Chromaticity Coordinate	Luminous Flux
SPHWHTL3D30	w	xx	yy	zz

W = 3 (70 ≤ CRI < 80) or 5 (CRI ≥ 80)

# 6. Certificate

## 6.1 UL

### TECHNICAL CONSIDERATIONS (NOT FOR FIELD REPRESENTATIVE'S USE):

Products designated USR have been investigated using requirements contained in the Standard for Light Emitting Diode (LED) Equipment For Use In Lighting Products, UL 8750, First Edition dated 2009-11-18.

Products designated CNR have been investigated using requirements contained in the Standard for Luminaires, CSA C22.2 No. 250-08, Third Edition, dated 2010-01-01.

Conditions of Acceptability - For use only in (or with) Applicant's complete equipment where the acceptability is determined by Underwriters Laboratories Inc.

1. These products have been evaluated for connection only to a class 2 constant current source. Suitability for connection to a different source type shall be determined in the end-use application.
2. Temperature testing shall be conducted in the end-use application. The maximum temperature on the polymeric materials of the LED shall not exceed 150°C.
3. The suitability for this component for use in a damp and wet locations shall be determined in the end-use application.

## 7.1 Nomenclature Code

- Product code can be understood by below explanation.

※ 18 Digits

S	P	H	W	H	T	L	3	D	3	0	3	E	6	R	0	H	5
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18

→ Detail rank information

### 1,2,3 Digit

Samsung Package High Power

### 4,5 Digit - Color

WH : White

### 6 Digit – Product version

### 7,8 Digit – Product

L3 : 3535 Ceramic

### 9 Digit – Lens type

D : Dome Lens

### 10 Digit – Operating condition

3 : Max 3 Watt

### 11 Digit – Not defined, default “0”

### 12 Digit – CRI

3 : Min. 70+

4 : Min. 75+

5 : Min. 80+

### 13,14 Digit – Vf

E1 : 2.7~2.8V

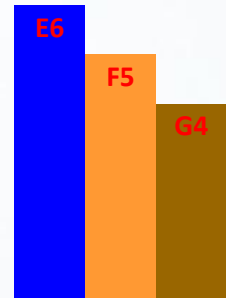
F1 : 2.8~2.9V

G1 : 2.9~3.0V

H1 : 3.0~3.1V

J1 : 3.1~3.2V

K1 : 3.2~3.3V



### 15,16 Digit – CCT

W0 : 2700K      R0 : 5000K

V0 : 3000K      Q0 : 5700K

U0 : 3500K

T0 : 4000K

### 17,18 Digit – Luminous flux

F1 : 90~100lm

G1 : 100~110

H1 : 110~120

J1 : 120~130

K1 : 130~140

L1 : 140~150



