

# LIGHT EMITTING DIODE SPECIFICATION

## Revise History

Rev.	Descriptions	Date	Page
1.0	-	23-10-2017	-
2.0	Renew form	15-12-2018	-
2.1	Renew form	10-11-2020	-
2.2	Renew form	27-12-2023	-



## Features:

- Long operating life
- Low Power Consumption
- Low voltage DC operated
- RoHS Compliant
- Anti-ultraviolet Packaging

## Application:

- Status indicator, Industrial control panel, Sensor status indication.
- Wearable and portable devices, Traffic light, barricade light, brake light, warning sign.

Part Number	Dice Material	Emitted Color	Lens Color
IE-3528WC-SB-LUV-CE-06	InGaN	White	Water Clear

## Electro-Optical Characteristics (T<sub>a</sub>=25°C)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test Condition
Luminous Intensity <sup>*1</sup>	IV	6000	-	10000	mcd	IF=20mA
Luminous Flux	Φ	-	-	-	Lm	
Forward Voltage	VF	2.70	2.90	3.30	V	
Color Rendering index	CRI	70	-	-	%	
CIE Coordinates	x,y	-	-	-	-	
Color Temperature	CCT	4500	5000	5500	k	
Viewing Angle <sup>*2</sup>	2θ <sub>1/2</sub>	-	60	-	deg	VR=5V
Reverse Current	IR	-	-	10	uA	

Notes:

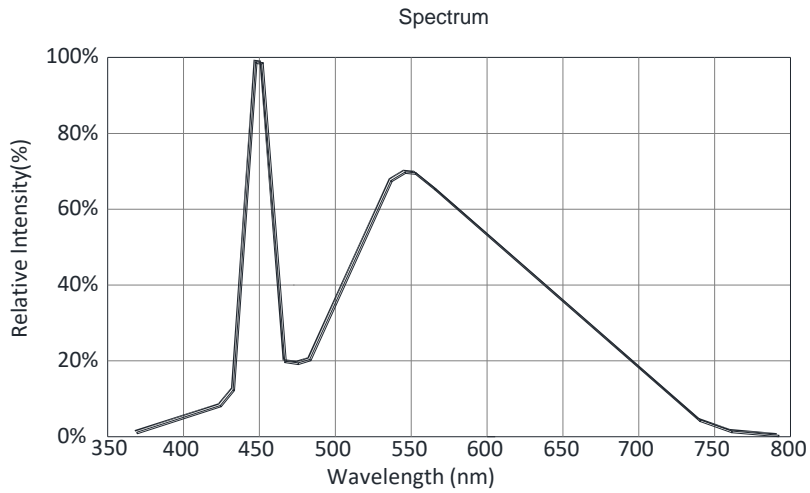
1. A Luminous intensity is measured with a light sensor and filter combination that approximates the CIE eye-response curve.
2. 2θ<sub>1/2</sub> is the  $\theta$ -axis angle where the luminous intensity is 1/2 the peak intensity

## Absolute Maximum Ratings (T<sub>a</sub>=25°C)

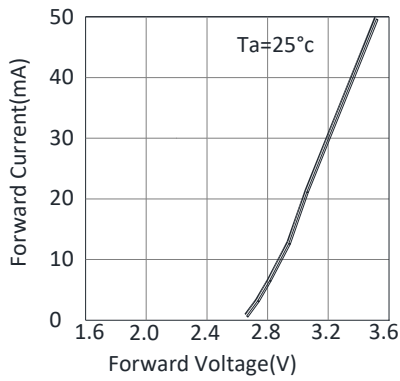
Parameter	Symbol	Max.	Unit
Power Dissipation	P <sub>d</sub>	102	mW
Peak Forward Current <sup>*1</sup>	IFP	100	mA
Forward Current	IF	30	mA
Reverse Voltage	VR	5	v
Junction Temperature	T <sub>j</sub>	125	°C
Electrostatic Discharge	ESD	2000	v
Operating Temperature Range	Topr	-40to+85	°C
Storage Temperature Range	Tstg	-40to+85	°C
Reflow Soldering	Tsld	260°C for 5 secs	

Notes: 1. Duty Factor = 10%, Frequency = 1 kHz

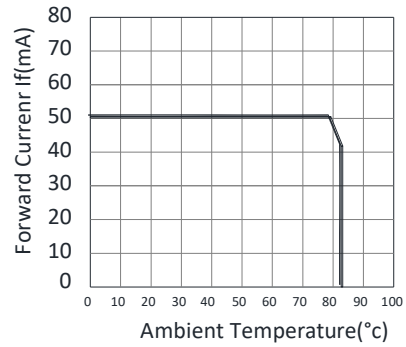
## Optical & Electrical Characteristics



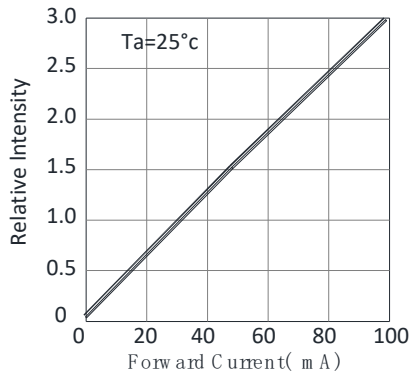
Forward Current vs. Forward Voltage



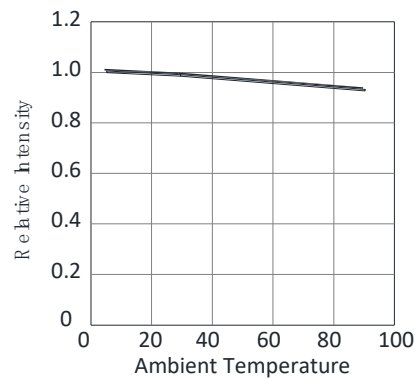
Maximum Driving Forward DC Current vs. Ambient Temperature



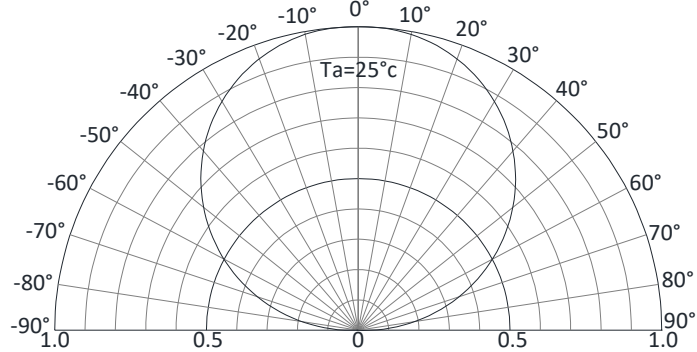
Relative Intensity vs. Forward Current



Relative Intensity vs. Ambient Temperature



Radiation Pattern



**Bin Limits****Bin Range Of Luminous Intensity (Unit:mcd)**

Bin Code	Min	Max	Condition
L1	6000	8000	IF=20mA
L2	8000	10000	
L3	-	-	
L4	-	-	
L5	-	-	
L6	-	-	

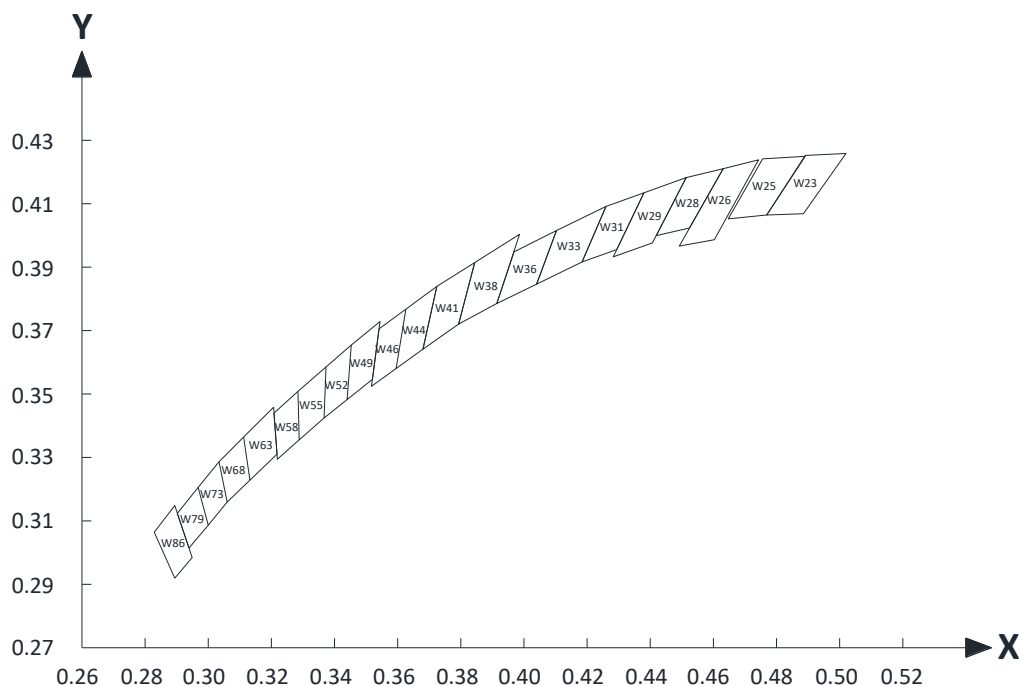
**Bin Range Of Forward Voltage (Unit:V)**

Bin Code	Min	Max	Condition
V1	2.7	2.8	IF=20mA
V2	2.8	2.9	
V3	2.9	3.0	
V4	3.0	3.1	
V5	3.1	3.2	
V6	3.2	3.3	

Notes:

- 1.Tolerance of Luminous Intensity  $\pm 10\%$
- 2.Tolerance of Forward Voltage  $\pm 0.1V$

### CIE Chromaticity Diagram CIE Chromaticity Diagram



Bin Code	CCT(K)	X1	Y1	X2	Y2	X3	Y3	X4	Y4
<b>W23</b>	2363±62	0.4770	0.4050	0.4892	0.4238	0.5021	0.4244	0.4886	0.4054
<b>W25</b>	2503±77	0.4648	0.4038	0.4757	0.4227	0.4892	0.4235	0.4770	0.4050
<b>W26</b>	2653±72	0.4632	0.4196	0.4744	0.4224	0.4604	0.3972	0.4493	0.3952
<b>W28</b>	2798±72	0.4420	0.3985	0.4515	0.4168	0.4632	0.4196	0.4525	0.4009
<b>W29</b>	2958±87	0.4381	0.4120	0.4515	0.4168	0.4408	0.3962	0.4284	0.3918
<b>W31</b>	3133±87	0.4185	0.3902	0.4261	0.4077	0.4381	0.4120	0.4295	0.3941
<b>W33</b>	3343±122	0.4041	0.3832	0.4104	0.4001	0.4261	0.4077	0.4185	0.3902
<b>W36</b>	3588±122	0.3915	0.3771	0.3970	0.3934	0.4104	0.4001	0.4041	0.3832
<b>W38</b>	3848±137	0.3794	0.3706	0.3845	0.3900	0.3987	0.3989	0.3915	0.3771
<b>W41</b>	4123±137	0.3681	0.3627	0.3725	0.3825	0.3845	0.3900	0.3794	0.3706
<b>W44</b>	4382±121	0.3596	0.3566	0.3627	0.3753	0.3725	0.3825	0.3681	0.3627
<b>W46</b>	4624±121	0.3518	0.3510	0.3542	0.3691	0.3627	0.3753	0.3596	0.3566
<b>W49</b>	4887±141	0.3441	0.3468	0.3454	0.3640	0.3545	0.3714	0.3521	0.3532
<b>W52</b>	5169±141	0.3368	0.3410	0.3374	0.3571	0.3454	0.3640	0.3441	0.3468
<b>W55</b>	5488±177	0.3289	0.3341	0.3285	0.3494	0.3374	0.3571	0.3368	0.3410
<b>W58</b>	5843±177	0.3220	0.3280	0.3209	0.3425	0.3285	0.3494	0.3289	0.3341
<b>W63</b>	6275±255	0.3133	0.3214	0.3113	0.3350	0.3208	0.3444	0.3219	0.3296
<b>W68</b>	6785±255	0.3061	0.3145	0.3035	0.3272	0.3113	0.3350	0.3133	0.3214
<b>W73</b>	7320±280	0.3001	0.3072	0.2969	0.3191	0.3035	0.3272	0.3061	0.3145
<b>W79</b>	7900±300	0.2940	0.3000	0.29.3	0.3109	0.2969	0.3191	0.3001	0.3072
<b>W86</b>	8600±400	0.2895	0.2905	0.2830	0.3050	0.2895	0.3134	0.2950	0.2970

- Notes:
1. Color coordinates measurement allowance is ± 0.15.
  2. One delivery will include up to two consecutive color ranks and three luminous intensity ranks of the products the quantity-ratio of the ranks is decided by ekinglux.

**Reliability Test Items And Conditions**

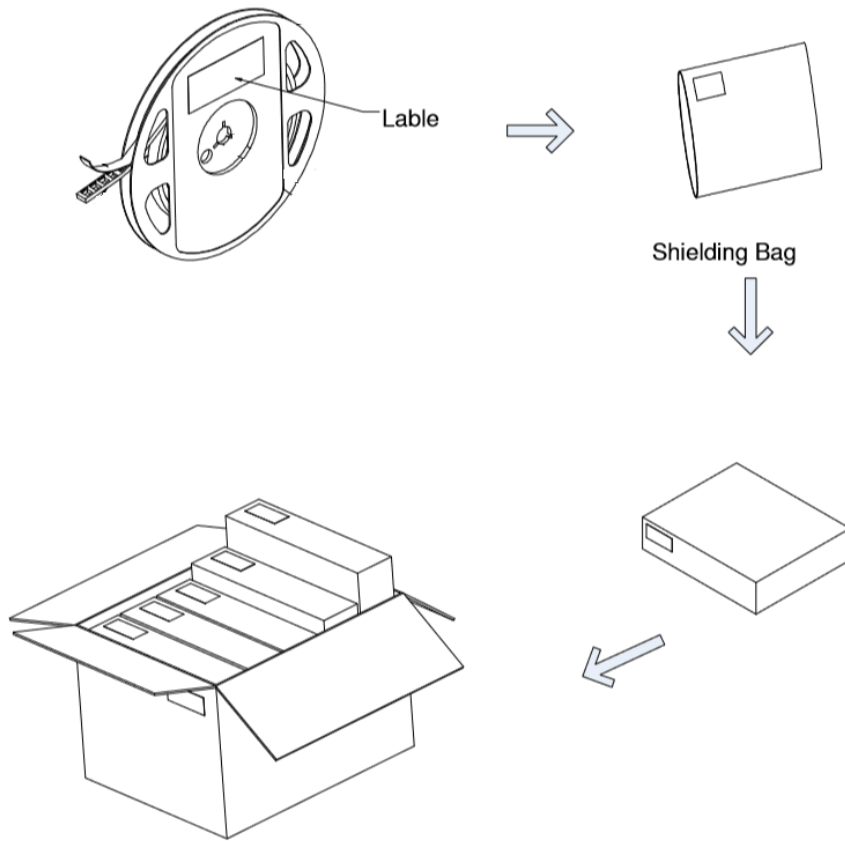
Test Items	Reference	Test Conditions	Time	Quantity	Criterion
Thermal Shock	MIL-STD-202G	-40℃ (30min) -100℃ (30min)	100 Cycles	22	0/22
Temperature And Humidity Cyclic	JEITA ED-4701 200 203	-10℃~65℃ ; 0%~90%RH	10cycles	22	0/22
High Temperature Storage	JEITA ED -4071 200 201	Ta=100℃	1000H	22	0/22
Low Temperature Storage	JEITA ED -4071 200 202	Ta=-40℃	1000H	22	0/22
High Temperature High Humidity Storage	JEITA ED -4071 100 103	Ta=85℃ ; RH=85%	1000H	22	0/22
High Temperature Life Test	JESD22-A108D	Ta=80℃	1000H	22	0/22
Life Test	JESD22-A108D	Ta=25℃ IF=20mA	1000H	22	0/22
Resistance to Sodering Heat	GB/T 4937, II , 2.2&2.3	Tsol*=(240±5) ℃10secs	2 times	22	0/22

**Criteria For Judging Damage**

Test Items	Symbol	Test Conditions	Criteria For Judging Damage
Forward Voltage	V <sub>F</sub>	I <sub>F</sub> =I <sub>FT</sub>	Initial Data±10%
Recerse Current	I <sub>R</sub>	V <sub>R</sub> =5V	I <sub>R</sub> ≤10uA
Luminous Intensity	I <sub>V</sub>	I <sub>F</sub> =I <sub>FT</sub>	Average I <sub>V</sub> degradation≤30% ; Single LED I <sub>V</sub> degradation≤50%
Resistance to Soldering Heat	-	-	Meterial without internal cracks,no meterial between stripped,no deaded light



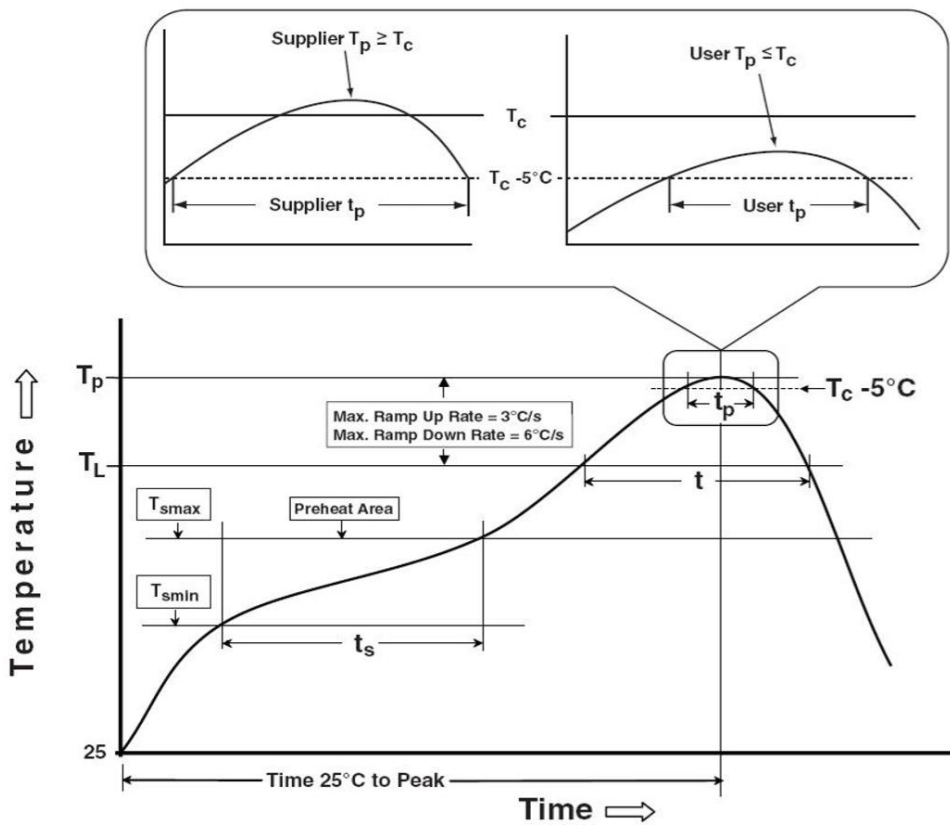
## Packaging



### Table of Classification Reflow Profiles

Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Preheat & Soak	100 °C	150 °C
Temperature min (T <sub>smin</sub> )	150°C	200 °C
Temperature max (T <sub>smax</sub> )	60-120 seconds	60-120 seconds
Time (T <sub>smin</sub> to T <sub>smax</sub> ) (t <sub>s</sub> )		
Average ramp-up rate (T <sub>smax</sub> to T <sub>p</sub> )	3 °C/second max	3 °C/second max
Liquidous temperature (T <sub>L</sub> )	183 °C	217 °C
Time at liquidous (t <sub>L</sub> )	60-150 seconds	60-150 seconds
Peak package body temperature (T <sub>p</sub> )*	230 °C ~235 °C	255 °C ~260 °C
Classification temperature (T <sub>c</sub> )	235 °C	260 °C
Time (t <sub>p</sub> ) within 5 °C of the specified Classification temperature (T <sub>c</sub> )	20 seconds	30 seconds
Average ramp-down rate (T <sub>p</sub> to T <sub>smax</sub> )	6 °C/second max	6 °C/second max
Time 25 °C to peak temperature	6 minutes max	8 minutes max

1. Tolerance for peak profile temperature (T<sub>p</sub>) is defined as a supplier minimum and a user maximum.
2. Tolerance for time at peak profile temperature (t<sub>p</sub>) is defined as a supplier minimum and a user maximum.



## Precautions

### 1. Storage:

- Moisture proof and anti-electrostatic package with moisture absorbent material is used, to keep moisture to a minimum.
- Before opening the package, the product should be kept at 30°C or less and humidity less than 60% RH, and be used within a year.
- After opening the package, the product should be stored at 30°C or less and humidity less than 10%RH. It is recommended that the product be operated at the workshop condition of 30°C or less and humidity less than 60%RH.
- If the moisture absorbent material has faded away or the LEDs have exceeded the storage time, baking treatment should be performed based on the following condition: (70±5)°C for 24 hours.

### 2. Static Electricity:

- Static electricity or surge voltage damages the LEDs. Damaged LEDs will show some unusual characteristics such as the forward voltage becoming lower, or the LEDs do not light at the low current. All devices, equipment and machinery must be properly grounded. At the same time, it is recommended that wrist bands or anti-electrostatic gloves, anti-electrostatic containers be used when dealing with the LEDs.

### 3. Vulcanization:

- LED curing is due to sulfur being in brackets and the +1 price of silver in the chemical reaction generated Ag<sub>2</sub>S in the process. It will lead to the capacity of reflecting of silver layer reducing, light color temperature drift and serious decline, seriously affecting the performance of the product. So we should take corresponding measures to avoid vulcanization, such as to avoid using sulphur volatile substances and keeping away from high sulphur content of the material.

### 4. Handling Precautions:

- Handle the component along the side surfaces by using forceps or appropriate tools.
- Do not directly touch or handle the silicone lens surface. It may damage the internal circuitry.
- Do not stack together assembled PCBs containing exposed LEDs. Impact may scratch the epoxy resin lens or damage the internal circuitry.
- Compare to epoxy encapsulant that is hard and brittle, silicone is softer and flexible. Although its characteristic significantly reduces thermal stress, it is more susceptible to damage by external mechanical force. As a result, special handling precautions need to be observed during assembly using silicone encapsulated LED products. Failure to comply might lead to damage and premature failure of the LED.

