Approval Sheet for SMD LED

Reference No : T1608-122
Version No : Rev 5.0
Customer Name : Standard
Model Name : LPAWW-NC10
Color : White white color
Issued Date : 26 April. 2011

Customer					

CTL					
Eng'ring	Develop.	Prod.	QA	Sales	Approved

Remarks:

CTL
Clean Technology Leader

358-1. Sin-Dong, Yungtong-Gu, Suwon-Si, Gyeonggi-Do, 442-390
http://www.ctlinc.co.kr Tel : (031) 205-0450.,Fax : (031) 205-5315

1. Features and Applications

- ❑ Package : SMD Package
- ❑ Resin : colorless clear type
- ❑ Dimensions in mm : 1.6 x 0.8 x 0.4 (L x W x H)
- ❑ Approx Weight : 0.88 mg
- ❑ Technology : InGaN Blue Color
- ❑ Viewing Angle : wide (120º)
- ❑ Assembly methods : suitable for all SMT assembly methods
- ❑ Soldering methods : IR reflow soldering
- ❑ MSL : Qualified according to JEDEC moisture sensitivity Level 3.
- ❑ ROHS : Environmental friendly, RoHS compliance.
- ❑ Taping : 8mm conductive black carrier tape & antistatic clear cover tape 4,000pcs/reel, Φ180mm wheel

Applications:

- Outdoor displays
- Backlighting (LCD, switches, keys, displays, illuminated advertising, general lighting)
- Interior automotive lighting (e.g. dashboard backlighting, etc.)
- Indicator

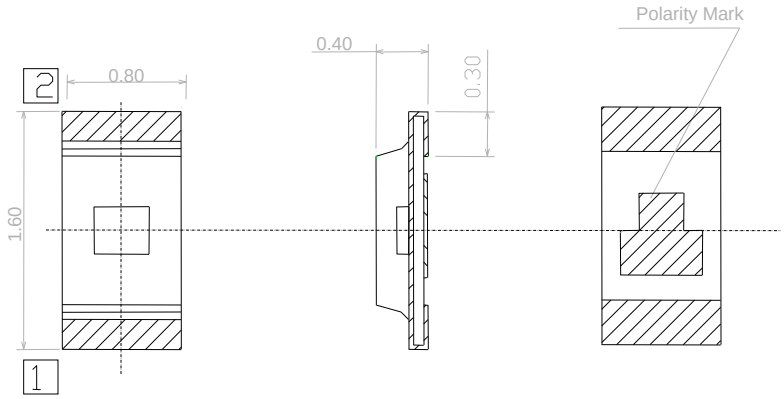
2. Part Name Description

L P A WW – NC 10

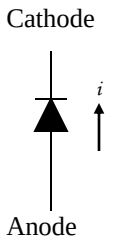
- 0 0 : **Rev. No. (Optional)**
- xx : Rank **Name (Optional)**
- WW : **White** color
- A : **1.6mm x 0.8mm** Series
- P : PCB Type SMD LED
- L : **L**ED

3. Outline Dimensions and Materials

1) Outline Dimensions



(TOP) (SIDE) (BOTTOM)

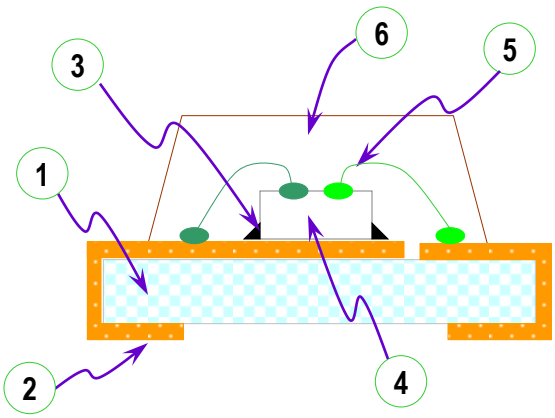


Circuit Diagram

- MODEL : LPAWW
- TYPE : 1.6 x 0.8 x 0.4 (t)
- TOLERANCE : ± 0.10 mm

2) Materials

- **Package : Epoxy Resin , Clear (Optional : Diffuser type)**
- **Paste : Silver filled Epoxy**
- **Electrode : Au Plating** Surface Treatment of Terminals : Au Plating



Number	Item	Material
1	PCB	BT Resin
2	Lead	Cu / Au
3	Paste	Ag Paste
4	LED Chip	InGaN / Al_2O_3
5	Wire	Gold Wire
6	Compound	Clear Compound

4. Specifications

1) Absolute Maximum Ratings

Items	Symbol	Maximum Rating	Unit
Forward Current	I_F	20	mA
Pulse Forward Current*	I_{FP}	100	mA
Reverse Voltage	V_R	5	V
Power Dissipation	P_D	70	mW
Operating Temperature	T_{opr}	- 30 ~ 80	℃
Storage Temperature	T_{stg}	- 40 ~ 85	℃

☐ Ta = 25 ℃
☐ I_{FP} Conditions : Pulse Width ≤ 0.1 msec. And Duty ≤ 1/10

2) Initial Electrical / Optical Characteristics

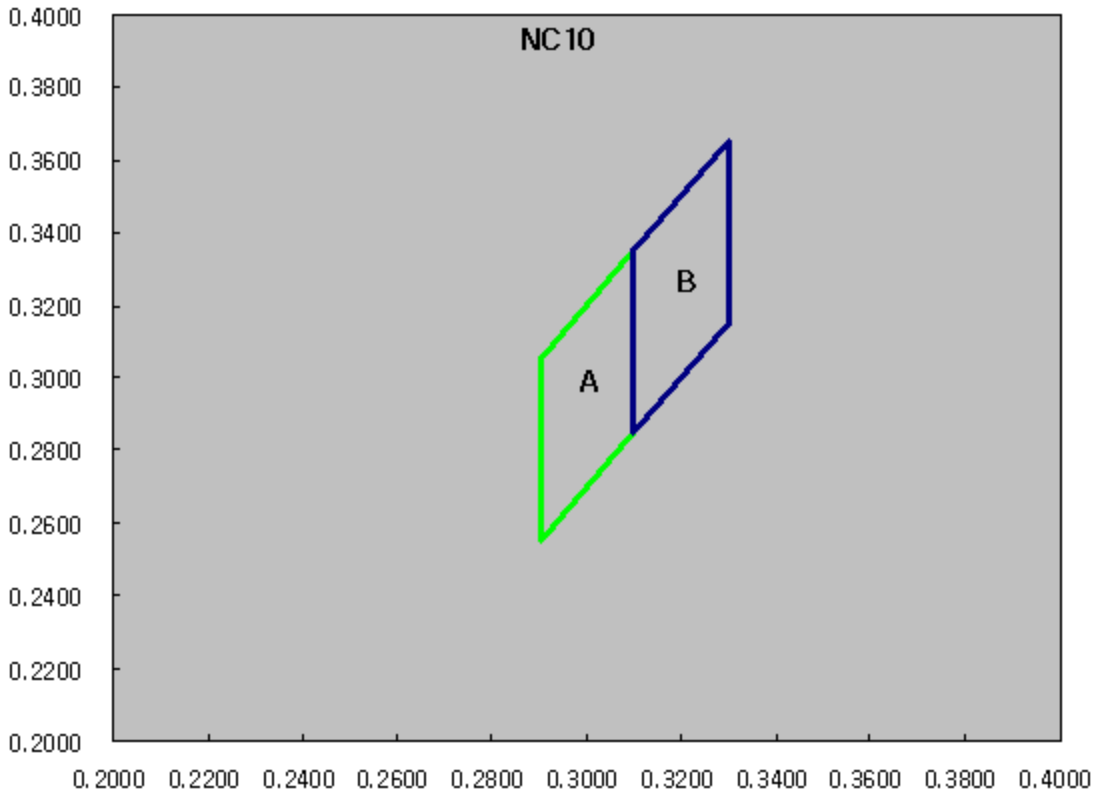
Items	Symbol	Min.	Typ.	Max.	Unit	Condition
Forward Voltage	V_F	2.7	-	3.2	V	I_F = 5 mA
Reverse Current	I_R	-	-	10	uA	V_R = 5 V
Luminous Intensity	I_V	60	-	120	mcd	I_F = 5 mA
Chromaticity Coordinates	Cx	0.30	-	0.32	-	I_F = 5 mA
	Cy	0.27	-	0.35	-	
Full Width at Half Maximum	Δλ	-	25	-	nm	I_F = 20 mA

☐ Luminous Intensity Measuring Equipment : LX4560A (Teknologue, JAPAN)
☐ Voltages are tested at a current pulse duration 1ms and an accuracy of ±0.1V
☐ Luminous Intensity is tested at a current pulse duration 5ms and an accuracy of ±10%
☐ Dominant Wavelength is tested at a current pulse duration 5ms and an accuracy of ± 1nm

5. Grouping parameter

1) Chromaticity Coordinates Ranks **(Ta = 25 ℃)**

Rank	Color Coordinates					Test Condition
A	X	0.290	0.290	0.310	0.310	I_F =5 mA
	Y	0.255	0.305	0.335	0.285	
B	X	0.310	0.310	0.330	0.330	
	Y	0.285	0.335	0.365	0.315	



❑ 0.01 tolerance for Color Coordinates may be caused by measurement inaccuracy.

5. Grouping parameter (Continue)

2) Forward Voltage

(Ta = 25 ℃)

V_F Rank	Min	Typ	Max	Unit	Test Condition
A	**2.7**	**-**	**2.8**	**V**	**I_F = 5 mA**
B	**2.8**	**-**	**2.9**		
C	**2.9**	**-**	**3.0**		
D	**3.0**	**-**	**3.1**		
E	**3.1**	**-**	**3.2**		

☐ Voltages are tested at a current pulse duration 1ms and an accuracy of ±0.1V

3) Luminous Intensity Ranks △5

(Ta = 25 ℃)

I_V Rank	Min	Typ	Max	Unit	Test Condition
A	**60**	**-**	**90**	**mcd**	**I_F = 5 mA**
B	**90**	**-**	**120**		
C	**120**	**-**	**150**		
D	**150**	**-**	**180**		
E	**180**	**-**	**220**		
F	**220**	**-**	**270**		

☐ Luminous Intensity is tested at a current pulse duration 5ms and an accuracy of ±10%

6. Rank table 5

Rank	VF(V)	IV(mcd)	CIE
1	2.7 – 2.8	60 - 90	A
2	2.7 – 2.8	60 - 90	B
3	2.8 – 2.9	60 - 90	A
4	2.8 – 2.9	60 - 90	B
5	2.9 – 3.0	60 - 90	A
6	2.9 – 3.0	60 - 90	B
7	3.0 – 3.1	60 - 90	A
8	3.0 – 3.1	60 – 90	B
9	3.1 – 3.2	60 - 90	A
10	3.1 – 3.2	60 – 90	B
11	2.7 – 2.8	90 - 120	A
12	2.7 – 2.8	90 - 120	B
13	2.8 – 2.9	90 - 120	A
14	2.8 – 2.9	90 - 120	B
15	2.9 – 3.0	90 - 120	A
16	2.9 – 3.0	90 - 120	B
17	3.0 – 3.1	90 - 120	A
18	3.0 – 3.1	90 - 120	B
19	3.1 – 3.2	90 - 120	A
20	3.1 – 3.2	90 - 120	B
21	2.7 – 2.8	120 - 150	A
22	2.7 – 2.8	120 - 150	B
23	2.8 – 2.9	120 - 150	A
24	2.8 – 2.9	120 - 150	B
25	2.9 – 3.0	120 - 150	A
26	2.9 – 3.0	120 - 150	B
27	3.0 – 3.1	120 - 150	A
28	3.0 – 3.1	120 - 150	B
29	3.1 – 3.2	120 - 150	A
30	3.1 – 3.2	120 - 150	B

6. Rank table (Continue) 5

Rank	VF(V)	IV(mcd)	CIE
31	2.7 – 2.8	150 - 180	A
32	2.7 – 2.8	150 - 180	B
33	2.8 – 2.9	150 - 180	A
34	2.8 – 2.9	150 - 180	B
35	2.9 – 3.0	150 - 180	A
36	2.9 – 3.0	150 - 180	B
37	3.0 – 3.1	150 - 180	A
38	3.0 – 3.1	150 - 180	B
39	3.1 – 3.2	150 - 180	A
40	3.1 – 3.2	150 - 180	B
41	2.7 – 2.8	180 - 220	A
42	2.7 – 2.8	180 - 220	B
43	2.8 – 2.9	180 - 220	A
44	2.8 – 2.9	180 - 220	B
45	2.9 – 3.0	180 - 220	A
46	2.9 – 3.0	180 - 220	B
47	3.0 – 3.1	180 - 220	A
48	3.0 – 3.1	180 - 220	B
49	3.1 – 3.2	180 - 220	A
50	3.1 – 3.2	180 - 220	B
51	2.7 – 2.8	220 - 270	A
52	2.7 – 2.8	220 - 270	B
53	2.8 – 2.9	220 - 270	A
54	2.8 – 2.9	220 - 270	B
55	2.9 – 3.0	220 - 270	A
56	2.9 – 3.0	220 - 270	B
57	3.0 – 3.1	220 - 270	A
58	3.0 – 3.1	220 - 270	B
59	3.1 – 3.2	220 - 270	A
60	3.1 – 3.2	220 - 270	B

7. Typical Characteristic Curve

Fig.1 Maximum forward current vs. temperature

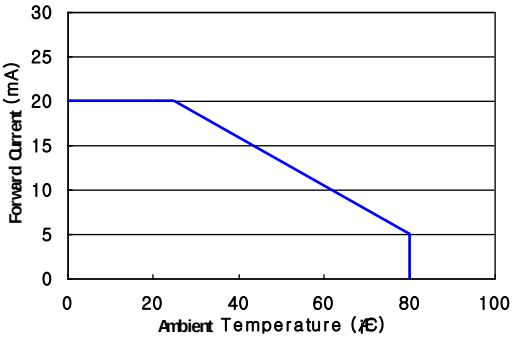


Fig.2 Forward current vs. Luminous Intensity

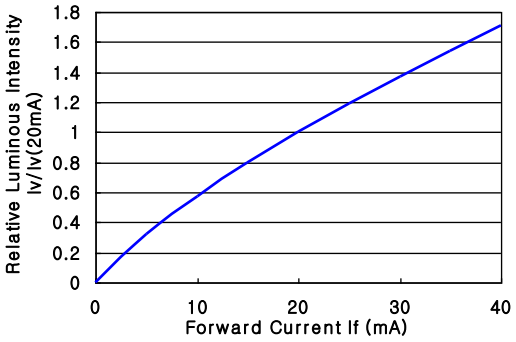


Fig. 3 Wavelength Distribution

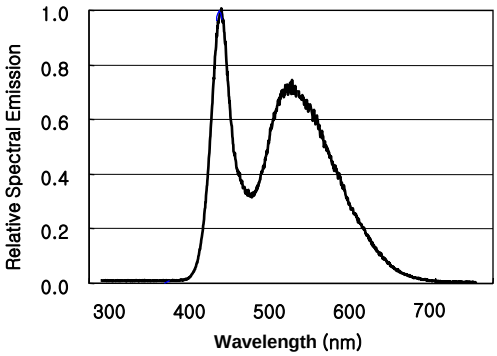


Fig.4 Forward voltage vs. Forward current

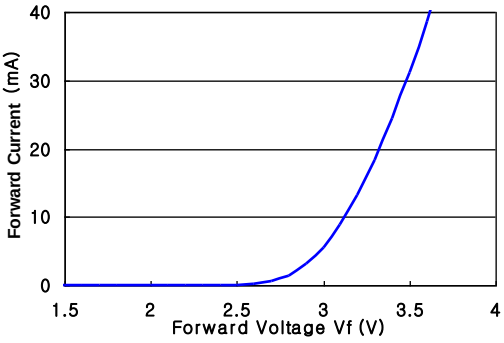
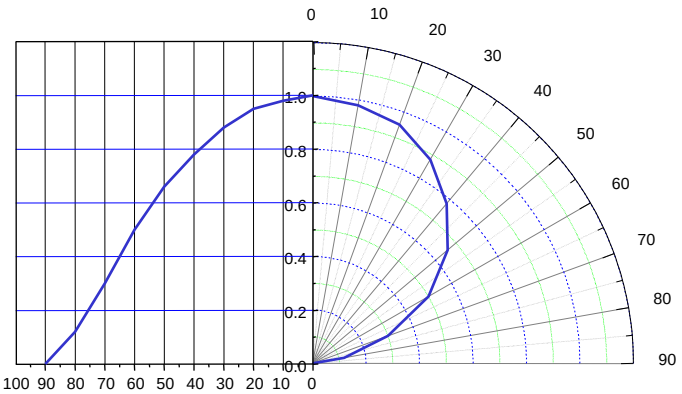


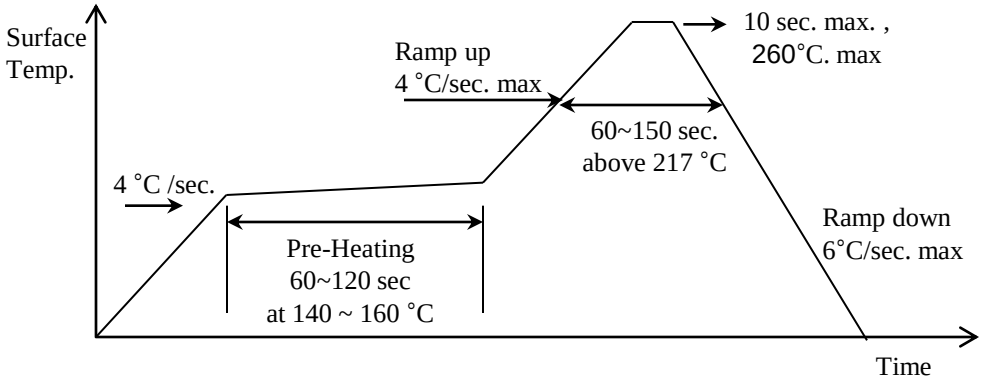
Fig.5 Radiation Diagram



8. Soldering Conditions

Reflow soldering is recommended , and soldering should not be done more than two times.
When repairing is done , a double-headed soldering iron should be used.

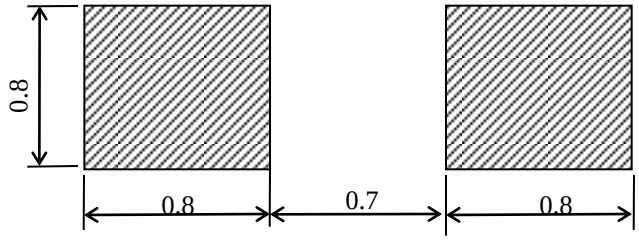
1) Lead-free Solder Re-flow Profile (JEDEC J-STD-020C).



2) For manual solder

Not more than 5sec @max 300°C, under soldering iron.

3) Recommendable Soldering Pattern

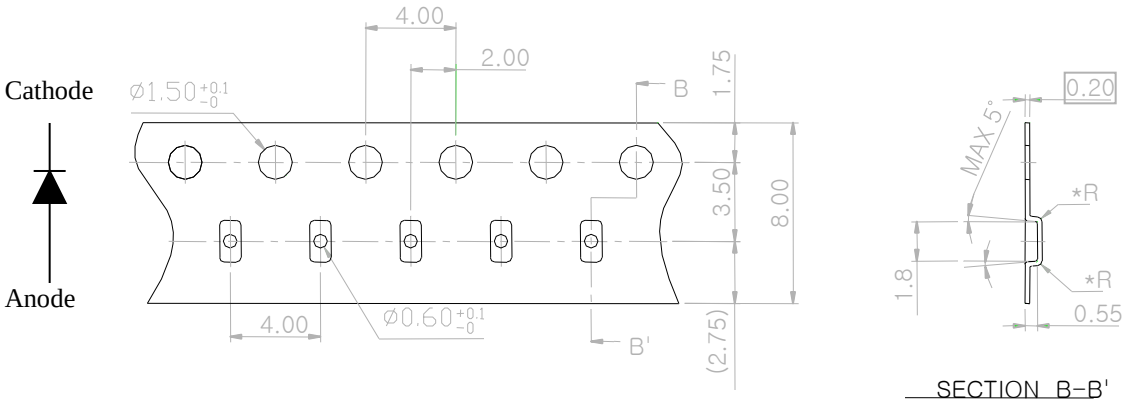


4) Precaution When Mounting

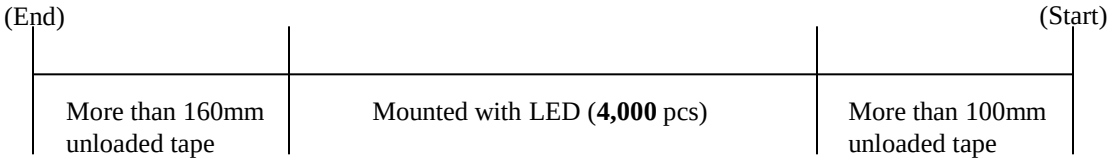
Do not apply force to the plastic part of the LED under high-temperature conditions.
To avoid damaging the LED plastic do not apply friction using hard materials.
When installing the PCB in product, ensure that the device does not came into contact with other components

9. Packing Process and Materials

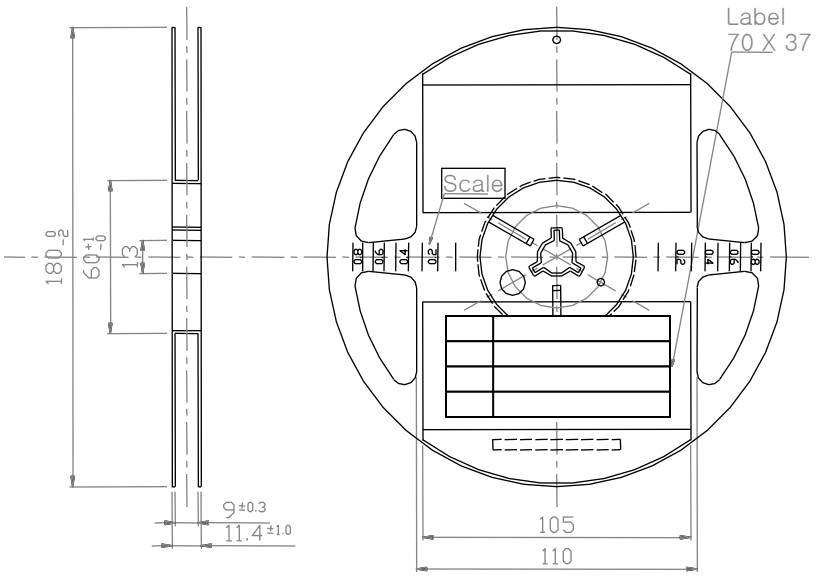
1) Dimension of tape(Material : PS Conductive, 10E4~5Ω)



2) Details of Chip LEDs loading on tape

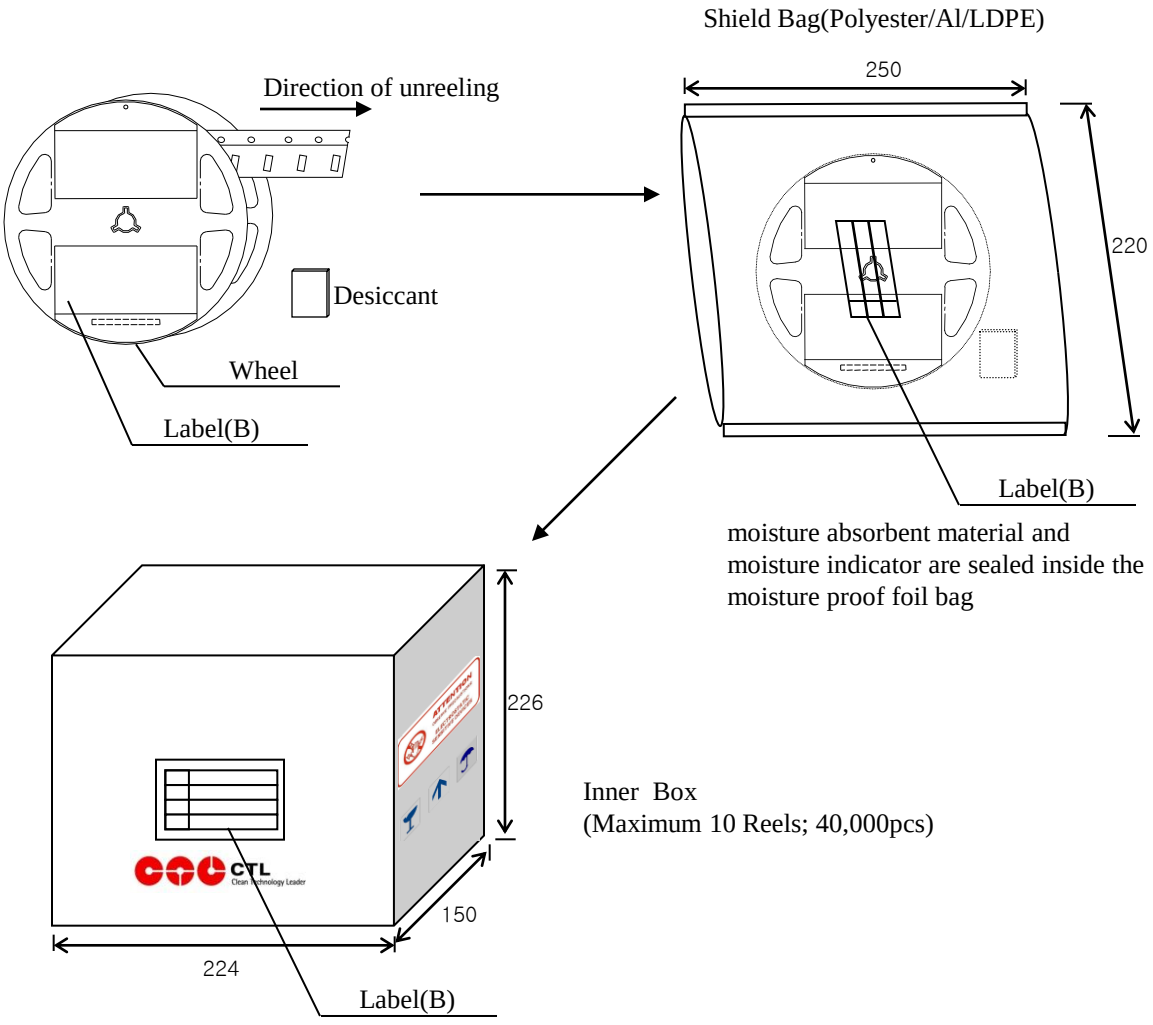


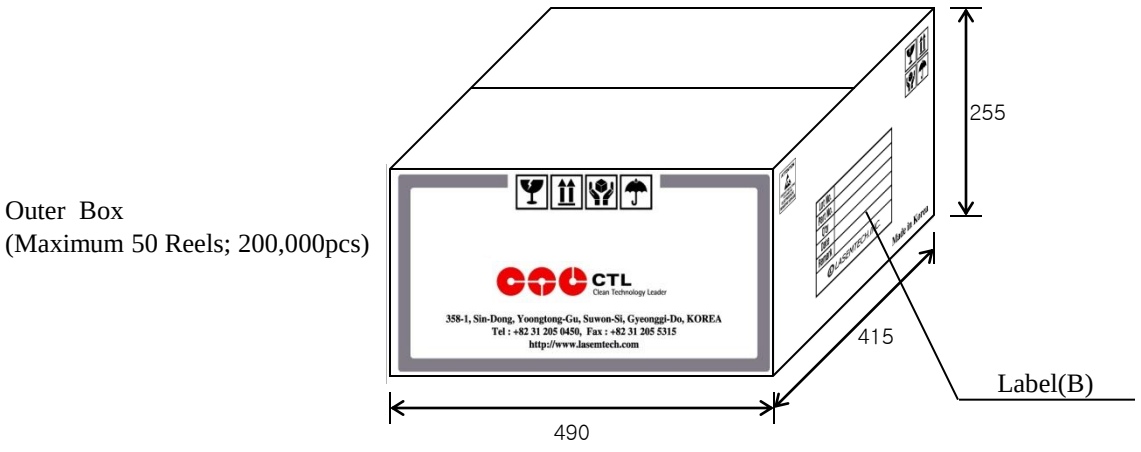
3) Dimension of Reel(Material : PS Conductive, 10E9~12Ω)



(1) Quantity : Product are packed in one taping reel of max. **4,000** pcs.
(2) Cumulative Tolerance : Cumulative Tolerance/10 pitches to be ±0.2mm
(3) Adhesion Strength of Cover Tape : Adhesion strength to be 0.1-0.7N when the cover tape is turned off from the carrier tape at 10˚ angle to be the carrier tape.
(4) Packaging : P/N, Manufacturing data Code No. and quantity to be indicated on a damp proof Package.

4) Packing Structure

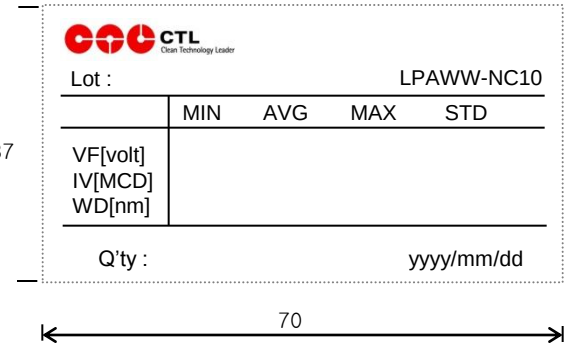




5) Labeling

→ Electrical/Optical Rank
→ Product Code (Bar Code)
→ Lot No (Bar Code)
→ Reel Serial No
→ Quantity (Bar Code)
→ Packing Date(Bar Code)
→ Customer Special (Bar Code)

→ Electrical/Optical Rank
→ Product Code (Bar Code)
→ Lot No (Bar Code)
→ Reel Serial No
→ Quantity (Bar Code)
→ Normal
Packing Date(Bar Code)



→ Property Rank Number
→ Reel No & CTL's P/N
→ Electrical/Optical property Data
→ Quantity & packing Date

10. Reliability

1) The reliability Criteria of SMD LED

Items	Symbol	Test Conditions	Criteria for Judgement	
			Min.	Max.
Forward Voltage	V_F	I_F=5mA	-	U.S.L.*)×1.2
Reverse Current	I_R	V_R = 5 V	-	20uA
Luminous Intensity	I_V	I_F=5mA	L.S.L.**)×0.5	-

❑ *) U.S.L. : Upper Standard Level **) L.S.L. : Lower Standard Level

2) Results of reliability test

Test Items	Reference	Test Conditions	Note
High Temperature Storage	JEITA ED-4701 200 201	85 ℃ / 500 hr.	0/32
Low Temperature Storage	JEITA ED-4701 200 202	-30 ℃ /500 hr.	0/32
Temp. Humidity Storage	JEITA ED-4701 100 103	60 ℃ / 90 % RH / 500 hr.	0/32
Steady State Operating Life	EIA/JESD 22-A108-B	25 ℃ / 20 mA / 500 hr.	0/32
High Temperature Operating Life	EIA/JESD 22-A108-B	80 ℃ / 5 mA / 500 hr.	0/32
Low Temperature Operating Life	EIA/JESD 22-A108-B	-30 ℃ / 5 mA / 500 hr.	0/32
Steady State Operating life of High Humidity Heat	JEITA ED-4701 100 102	60 ℃ / 90 % RH / 10 mA 500 hr.	0/32
Temperature Cycle	JEITA ED-4701 100 105	-30℃(30min) → 25(5min.) → 85℃ (30min.) / 100 cycle	0/22

11. ROHS

SGS

Test Report No. F690501/LF-CTSAYAA09-20671 Issued Date: July 21, 2009 Page 1 of 3

To: **CTL INC.**
358-1 Sin-dong
Yeongtong-gu
Suwon-city
GYEONGGI-DO
Korea

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

Product Name	: LPAWW
SGS File No.	: AYAA09-20671
Received Date	: July 16, 2009
Test Performing Date	: July 17, 2009
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)
Buyer(s)	: HYUNDAI, SAMSUNG, ETC
Comments	: By the applicant's specific request, the sampling and testing was performed only for the part indicated in the photo without disassembly.

SGS Testing Korea Co. Ltd.

Pluto Kim
Cindy Park
Jinee Song/ Testing Person

Jeff Jang / Chemical Lab Mgr

SGS Testing Korea Co.,Ltd.
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SGS

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Sample No. : AYAA09-20671.001

Sample Description : LPAWW

Item No./Part No. : N/A

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 cm2 sample surface area.

SGS Testing Korea Co.,Ltd.
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Test Report No. F690501/LF-CTSAYAA09-20671 Issued Date: July 21, 2009 Page 3 of 3

Picture of Sample as Received:

*** End ***

NOTE: (1) N.D. = Not detected.(<MDL)
(2) mg/kg = ppm
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12. Warranty

1) The term of warranty

LED comes with a one-year(12month) warranty.

2) Outgoing inspection item

Classify	Item
External appearance	Epoxy on die, Ball swerve, Missing wire, Stitch lift, Void, insertion, Attached cover-tape
Packing	Label attached, Desiccant, AL BAG sealing, Check Reel and label

3) Inspection standard

Lot size	Standard	Quantity	Judgment	Refefence
1201~3200	2,000	N =125	Badness: 0	
3201~10000	10,000	N =200	Badness: 0	
10001~35000	14,400	N =315	Badness: 0	
35001~150000	100,000	N =500	Badness: 0	
150001~500000	500,000	N=800	Badness: 0	

■ **Inspection standard : AQL 0.04% MIL-STD general inspection-II**

4) MTTF

LEDs have a MTTF of about 50,000hours.

5) Inspection Result Report

CTL Clean Technology Leader

등록 NO	개정 NO	PAGE
	0	1

검사성적서

씨티엘	입 안	심 사	결 정

입 안	심 사	결 정

공 급 처	㈜씨티엘	부 품 명		LOT SIZE	
적 용 모 델		CODE NO		LOT NO	

검사일	CTL		검사원	전수		합불	CTL	PASS	재질
	고객			출하		판정	고객		

검사항목	검사방식		검사	시료수		불량수		검사항목	검사방식		검사	시료수		불량수	
	CTL	고객	조건	CTL	고객	CTL	고객		CTL	고객	조건	CTL	고객	CTL	고객
외관검사	G-2		0/1			0									
특성검사	S-4		0/1			0									
치수검사	N=5		0/1	5		0									

측정 DATA ※ 검사항목별 검사수준에 일치된 수량을 검사하고 시료가 20개이상일경우 측정DATA는 20개만 작성한다.

검사항목	외관검사		Vf(5mA)		Iv(5mA)		CIEx		CIEy		치수A(가로)		치수B(세로)		치수C(두께)	
규 격	양호할것										1.6±0.15mm		0.8±0.15mm		0.35±0.1mm	
구 분	CTL	고객	CTL	고객	CTL	고객	CTL	고객	CTL	고객	CTL	고객	CTL	고객	CTL	고객
1																
2																
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17																
18																
19																
20																
X																
σ																
판 정	합격		합격		합격		합격		합격		합격		합격		합격	

특기사항 및 불량내용 : CIE RANK D (Certificate & Packing list첨부)
Tolerance : Vf ±0.05V, Iv±10%, Color Coordinates : ±0.01

본검사 LOT는 당사 출하검사 규정에 만족하며 품질을 보증함

품질서식등록번호 UA-110('96.06.20)

주) 부품검사파트에 검사JIG등록시 JIG검사 도장 날인 할 것

13. Flow chart

공정 흐름도
(Process Flow Diagram)

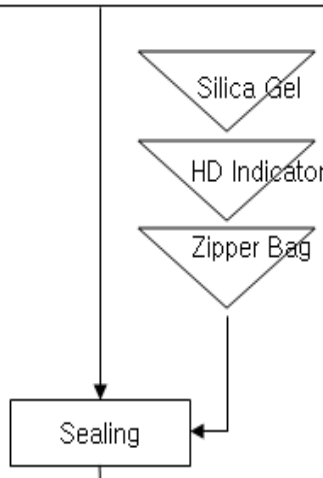
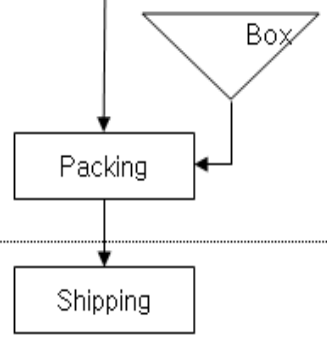
범 례 Legend	◎ : 중요 critical ○ : 보통 Normal △ : 일반 General

□	시작단계 Pre-Launch	■	양산단계 Launch	관리번호 PFD No.	F-PAWW-001

품 번 Part Number	LPAWW	작 성 일 Date	2005. 12. 08.	개정번호 Rev. No.	0
품 명 Part Name	LED	작 성 자 Drawn	김지용 J.Y Kim	페이지 Page	1/3
핵 심 팀 Core Team	제조팀, 생기팀, 개발팀, 품보팀, 자재팀				

순위	공정명	공정흐름	기호: 작업	기호: 보조작업	기호: 검사	세 부 공 정 내 역 (Operation Description)	중요제품특성: 중요도	중요제품특성: 제품/공정 특성
200	Die Attach	PCB			◆	PCB IQC	○ ◎	Appearance Dimension
		칩			◆	Chip IQC	○	Appearance
		Ag Paste			◆	Ag Paste IQC	○	Appearance
						Wafer Expanding		
		Die Attach	●			Epoxy Stamping	△	Placement / Size
						Die Attachment	○	Appearance Epoxy Coverage
		D/A Cure		◑		Epoxy Curing	△	Temp. / Time
300	Wire Bonding	Plasma		◑		Plasma Treatment	△	Power / Force
		Au Wire			◆	Au Wire IQC	○	Diameter
		Wire Bonding	●			Wire Bonding	○ ○ ○	Appearance Ball size Bondability
350	QC Gate	QC Gate			◆	Inspection	○ ☆ ☆	Appearance Ball size Bondability

순위	공정명	공정흐름	기호 내부원인	기호 표면원인	기호 외관	세부공정내역 (Operation Description)	중요제품특성 중요도	중요제품특성 제품/공정 특성
500	Mold	Plasma		◑		Plasma Treatment	△	Power / Force
		Phosphor / Compound			◆	Phosphor IQC	○	Color
					◆	Compound IQC	○	Appearance/ moisture absorption
		Encapsulation	●			Mold Bake	△	Temp. / Time / Pressure
		Bake		◑		Mold Bake	◎	Temp. / Time
700	Dicing	Saw		◑		Dicing	○	Appearance
650	P.V.I	Inspection			◆	Package Visual Inspection	◎	Appearance
800	Test	Sorting	●			Sorting	◎	OptoElectric property
900	Taping	Carrier Tape			◆	Carrier Tape IQC	○	Dimension
		Cover Tape			◆	Cover Tape IQC	○	Dimension
		Wheel			◆	Wheel IQC	○	Dimension
		Taping	●			Taping	△	Heater Temp.

순위	공정명	공정흐름	기호			세부공정내역 (Operation Description)	중요제품특성	
			수동공정	반자동공정	검사		중요도	제품/공정 특성
940	Sealing				◆	Silica Gel IQC	○	Moisture Absorption
					◆	HD Indicator IQC	○	Moisture Absorption
					◆	Zipper Bag IQC	○	Moisture Absorption
				◑		Sealing	○	Moisture Absorption
950	OQC				◆	Outgoing QC	◎ ☆ ○	Dimension OptoElectric property Peeling
990	Shipping			◑		Box Packing	○	Label / Quantity
						Shipping		

14. Precaution for use

-. This device should not be used in any type of fluid such as water, oil, organic solvent, etc. When washing is required, IPA should be used.

-. When the LEDs are illuminating, operating current should be decided after considering the ambient maximum temperature.

-. LEDs must be stored to maintain a clean atmosphere.
If the LEDs are stored for 3months or more after being shipped from CTL, a sealed container with a nitrogen atmosphere should be used for storage.

-. After opening the moisture proof packing, the LED's should be kept at 5℃~30℃, 60%RH or below. The LEDs must be soldered within seven days(168 hours) after opening the moisture-proof packing.
If the LEDs remains after soldering , it should be stored into moisture proof container.

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

-. If upon opening, the moisture indicator card shows humidity 30% or above (Color of indication changes to pink) or the expiration date has passed, the device should be baked in taping with reel using the conditions of 65±5℃, 12~24hours.
After baking, use the baked devices within 72hours, but perform baking only once.

-. Repeated baking can cause the peeling strength of the taping to change, then leads to trouble in mounting. Furthermore, prevent the devices from being destructed against static electricity for baking of it.

-. The appearance and specifications of the product may be modified for improvement without notice.

-. If the packing material of laminate would be broken, the hermeticity would deteriorate. Therefore. do not throw or drop the packed devices..

-. This LEDs is sensitive to the electrostatic and surge,
It is recommended to use a wrist band or anti-electrostatic glove when handling the LEDs.

-. If over-voltage which exceeds the absolute maximum rating is applied to LEDs, It will cause damage LEDs and result in destruction.

-. Damaged LEDs will show unusual characteristics such as leak current remarkably increase, turn-on voltage becomes lower and the LEDs get unlight at low current.

-. It is better not to use different rank LEDs.
If use mixed rank, could not attain your object for highest quality of products.