

APPROVAL SHEET

MODEL NAME SMD LED, TOP VIEW

PART NUMBER A0A1CEBHAMPY

CUSTOMER NAME

DATE 2012. 05. 15

[CUSTOMER APPROVAL]

APPROVAL NO.		
APPROVAL DATE		
APPROVAL	CHECK	APPROVAL
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[LUMENS APPROVAL]

ISSUED DEPT. APPR'D (R&D)	ISSUE	REVIEW	REVIEW	APPR'D
	2012. .	2012. .	2012. .	2012. .
DEPT. APPR'D	R&D	SALES	MANUFACTURE	QA/QC
	2012. .	2012. .	2012. .	2012. .

Lumens semiconductor lighting CO., LTD.

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Revision note

[illegible]

DATA SHEET

MODEL NAME	SMD LED
PART NUMBER	A0A1CEBHAMPY
PACKAGE	PLCC 2 type
COLOR	Yellow (AlGaInP)

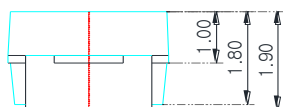
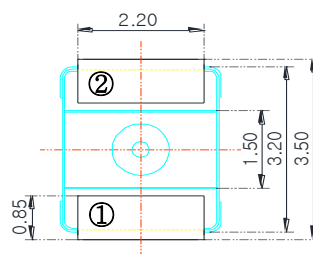
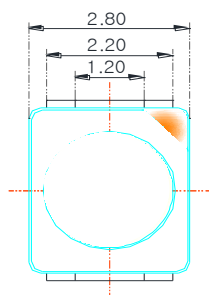
- Application
 - Display module lighting
 - Automotive backlighting
 - Traffic lighting
 - Marker lighting
 - Signal & symbol luminaire

Dimension

Type : 3528 PLCC 2

Unit : mm

- High brightness Yellow-color surface mount LED.
 - 120° viewing angle.
 - Small package outline (LxWxH) of 3.5 x 2.8 x 1.9 mm.
 - Qualified according to JEDEC moisture sensitivity Level 2.
 - Compatible to both IR reflow soldering and TTV soldering.
 - Unit : mm
- General Tolerance : ± 0.10



Material

	Material
LED Chip	AlGaInP Base
Wire	Au Gold wire 1.2mil.
Lead-frame.	Cu Alloy With Ag Plating.
Encapsulation	Silicone
Package Polymer	PPA

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Absolute Maximum Ratings.

Parameters	Symbol	Maximum Value Yellow	Unit	Test condition
DC forward current	IF	70	mA	
Pulse current; (tp ≤ 10 ms, Duty cycle = 1/10)	IFP	200	mA	
Power dissipation (at room temperature)	PDL	210	mW	
Reverse current (Vr = 10V)	IR	5	uA	
Operating temperature.	TOPR	-40 ~ +100	°C	
Storage temperature.	TSTG	-40 ~ +100	°C	
Soldering Temperature	TSOL	Reflow Soldering :260°C /10s Hand Soldering : 350°C /3s	°C	
Chip junction temperature.	Tj	125	°C	

*IFP Conditions : Pulse Width ≤10msec, and duty ≤1/10

Thermal Characteristics

(Ta=25°C)

Item	Symbol	Typical	Unit
Heat resistance	Rjs	45	K/W
	Rja	100	K/W

*Rjs = Heat resistance from Junction to Slug temperature (Ts)

*Rja = Heat resistance from Junction to ambient temperature (Ta)

* Using Lumens standard circuit board Al-PCB (2.0x2.0mm), T=1.6mm (T3Ster)

Electrical & Optical Characteristics at Ta=25°C.

Item	Symbol	Chip	Min.	Typ.	Max.	Condition	Unit
Intensity	IV	ALL	2.1		4.5	IF=50 mA	cd
Dominant Wavelength	λd	E	586		588	IF=50 mA	nm
		F	588		590		
		G	590		592		
Forward Voltage	VF	1	1.8		2.0	IF=50 mA	V
		2	2.0		2.2		
		3	2.2		2.4		
		4	2.4		2.6		
Viewing Angle	2θ 1/2	ALL	---	120	---	IF=50 mA	deg

1. Intensity is measured by **CAS-140** of Instrument System Co.

2. Intensity is measured with an accuracy of +0 ~7%.

3. Forward voltage, Vf is measured with an accuracy of ± 0.05 V

Rank of full color LED

Luminous Intensity Rank

RANK	Unit	If = 50mA	
		MIN	MAX
a	cd	2.1	2.4
b		2.4	2.7
c		2.7	3.0
d		3.0	3.3
e		3.6	3.9
f		3.9	4.2
g		4.2	4.5

Wavelength Groups

RANK	Unit	If = 50mA	
		MIN	MAX
A	nm	586	588
B		588	590
C		590	592

* If color binning is required, only one color group is allowed for each chip within a reel.

* Wavelength groups are measured with an accuracy of $\pm 1\text{nm}$.

Forward Voltage Rank

RANK	Unit	If = 50mA	
		MIN	MAX
1	V	1.8	2.0
2		2.0	2.2
3		2.2	2.4
4		2.4	2.6

*Voltages are tested at a current pulse duration of 1 ms and accuracy of 0.05V.

IPOC/JEDEC Moisture Sensitivity LevelTable 2.5 **IPC/JEDEC J-STD MSL Classification**

Level	Floor Life		Soak Requirements			
			Standard		Accelerated	
	Time	Conditions	Time (hrs)	Conditions	Time (hrs)	Conditions
2	1 Year	$\leq 30^{\circ}\text{C}/$ 60% RH	168 +5/-0	$30^{\circ}\text{C}/$ 60% RH	n/a	n/a

Notes : The standard soak time is the sum of the default value of 24 hours for the semiconductor manufacturer's exposure time (MET) between bake and bag and the floor life of maximum time allowed out of the bag at the end user of distributor's facility

Wire pull force test data

Wire Diameter : 30um,

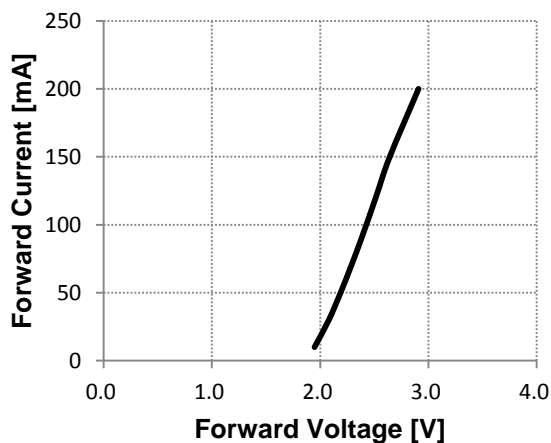
Spec : Min. 8gr

Wire Dia	30	30	30	30
D1	22.1	22.3	19.2	21.0
D2	19.7	21.3	19.7	20.3
D3	19.2	18.3	18.5	18.1
D4	20.1	19.6	18.9	21.4
D5	21.3	19.7	19.0	19.7

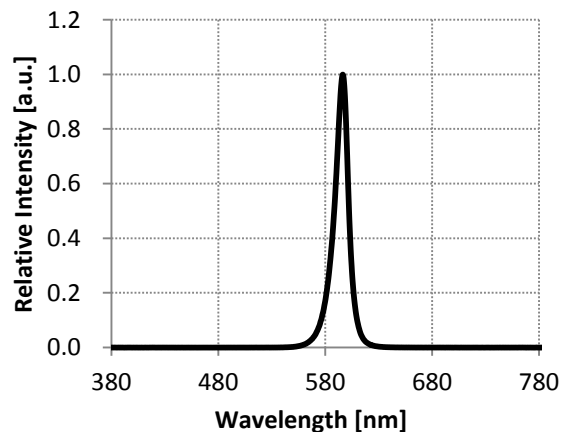
Average	19.97
Min	18.1
Max	22.3
Std Dev	1.11982
CPK (LSL=8)	3.56

Optical and Electrical Characteristics @25°C

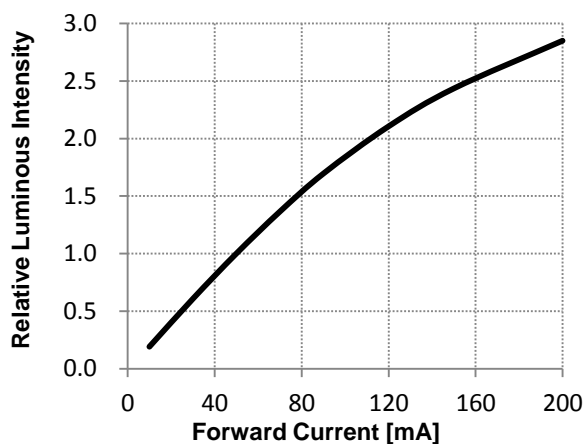
Forward Current vs Forward Voltage



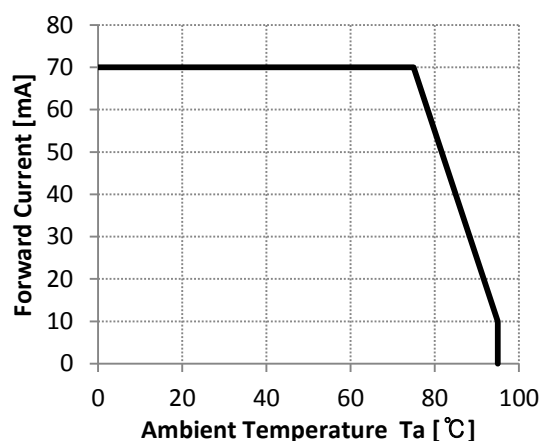
Relative Intensity vs. Wavelength



Relative Luminous Intensity vs. Forward Current

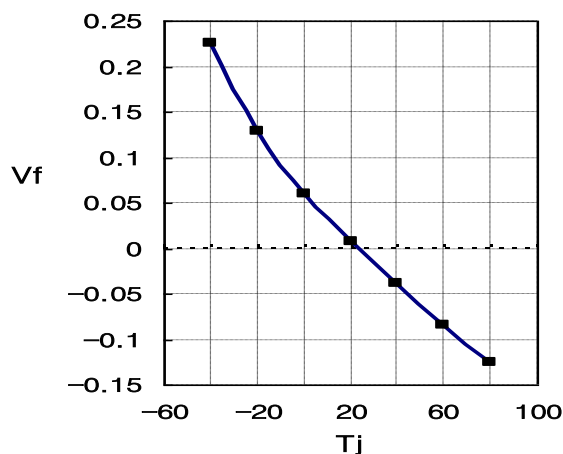


Relative Forward Current Vs. Ambient Temperature



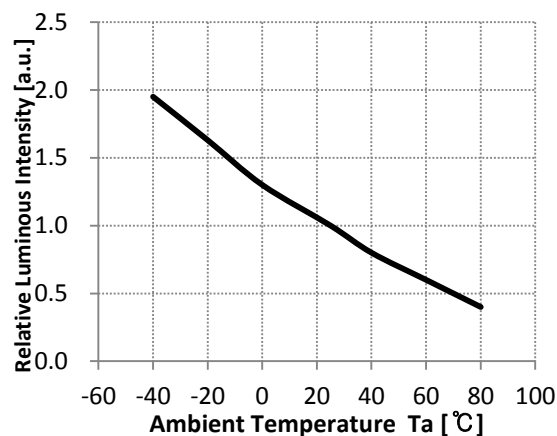
Relative Forward Voltage

$$V_F = V_F - V_{F(25^\circ\text{C})} = \beta(T_j); I_F = 50 \text{ mA}$$

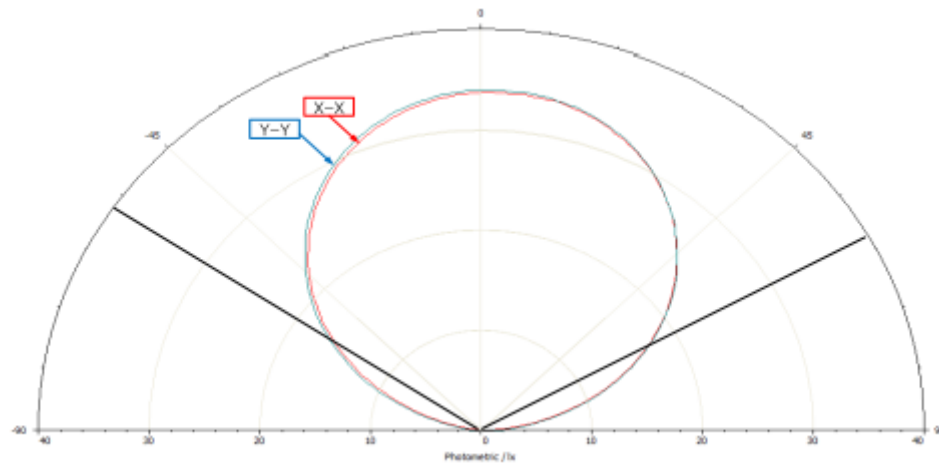


Relative Luminous Intensity

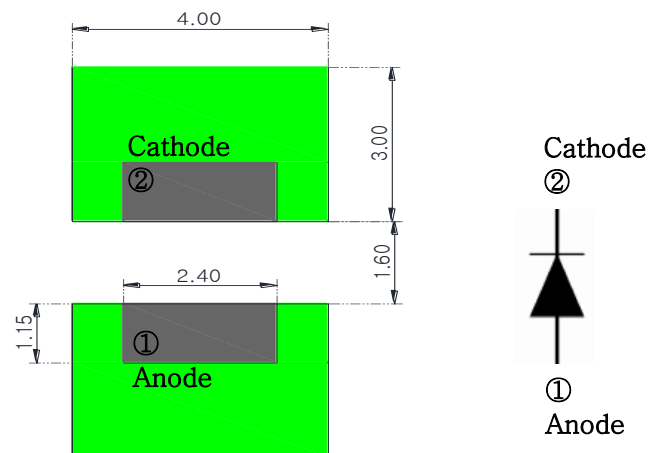
$$I_v = I_{v(25^\circ\text{C})} = \gamma(T_j); I_F = 50 \text{ mA}$$



Radiation Characteristic @25 °C (50mA)



Recommended Solder Pad

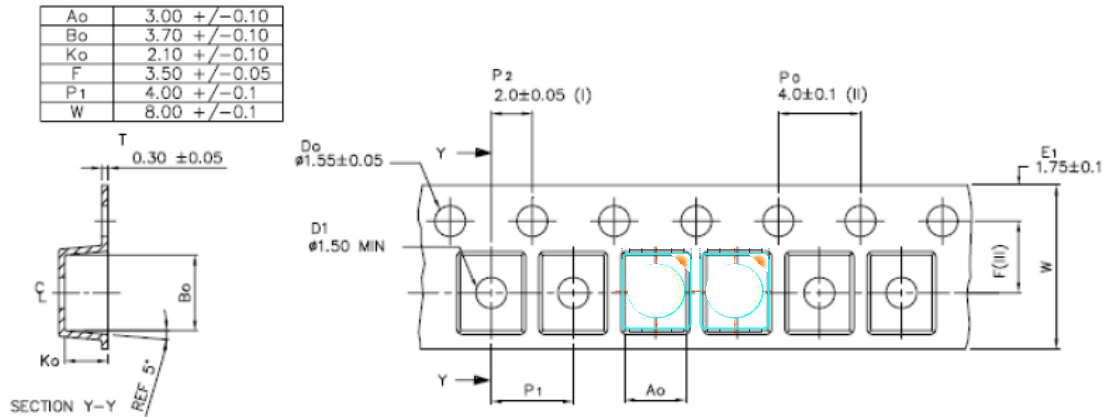


Shown is recommended pad geometry only. Customer PCB design shall include adequate thermal heat sink design & thermal analysis.

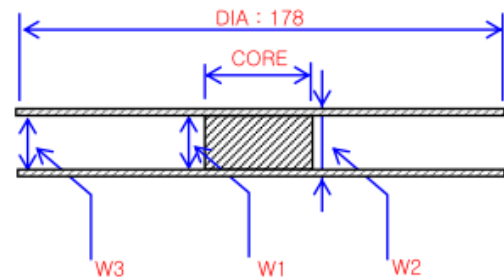
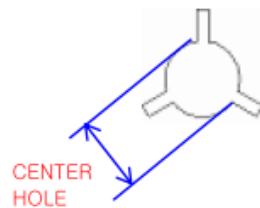
Tape And Orientation.

Reels come in quantity of
2,000 units. Reel diameter is 180 mm.

(unit : mm)



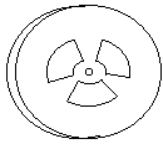
w1	9.0 ± 0.5
w2	11.5 ± 0.5
w3	9.0 ± 0.5
center	13.3 ± 0.3
core	60.0 ± 0.5



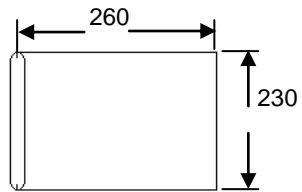
Materials and Characteristics

Carrier Tape			Cover Tape		
Description	Typical Value	Unit	Description	Typical Value	Unit
Material	Polycarbonate		Thickness	0.061+-0.013	mm
Tensile Strength(yield)	63	Mpa	Tensile Strength(break)	70	Mpa
Impact strength(notched)	10.2	Kg-cm/cm	Elongation(length)	150	%
Elongation	105	%	Elongation(lateral)	145	%
Shrinkage	<1.0	%	Tear Strength(length)	0.20	N
Surface resistivity	10E4-10E6	Ohm/sq	Tear Strength(lateral)	0.19	N
Volume resistivity	<10E6	Ohm-cm	Surface resistivity (surface)	<2.0E+09	Ohm/sq
			Surface resistivity (sealing)	<2.0E+09	Ohm/sq

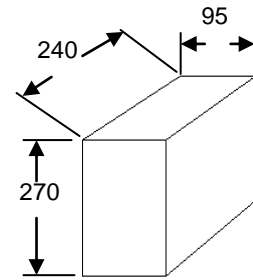
Packing Formation



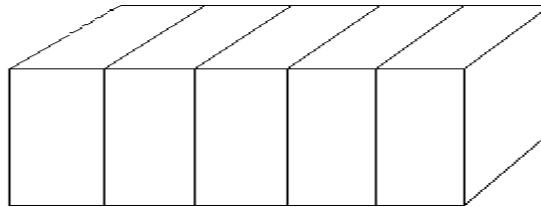
Diameter : 178 mm
Width : 17 mm
3528 \Rightarrow 2000 pcs/Reel
Anti-Static Shielding
Black Reel



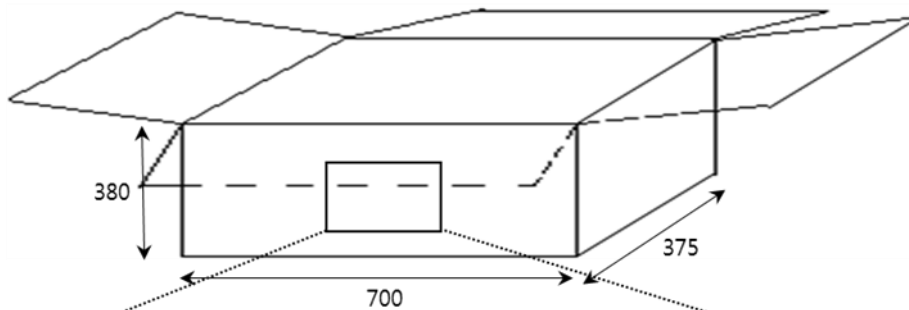
Anti-Static Shielding
1 Reel / Bag (T = 0.1 mm)



5 Bags / 1 Inner Box
3528 \Rightarrow 10000 pcs/ 1 Inner Box



5 Inner Box/1 Carton
3528 \Rightarrow 50000 pcs/ 1 Carton



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Customer	
Part No	
Quantity	
Date	
Carton No	

Label Format and Serial Number

Part Number	: GGG
Lot No.	: AAA
VF / IV / CIE	: BBB / CCC / DDD
Quantity	: EEE ea
Serial No	: FFF yymddxxxx

AAA : Lot. number

BBB : Forward voltage(V)

CCC : Brightness of LED

DDD : CIE Rank(CIE-P)

EEE : Quantity of LED

FFF : yymddxxxx (yy:year, mm:month, dd:day, xxxx:real no)

GGG : A0A1CEBHAMPY

Automotive Electronics Council (AEC-Q101)**Pre-and Post-Stress Electrical Test**

Abrv	Data Type	Note	Sample Size per lot	# of lots	Accept on # failed	reference	Additional Requirements
Test	1	NG	All qualification parts tested per the appropriate device specification		0	User specification or supplier's standard specification	Test is performed as specified in the applicable stress reference at room temperature

Test condition: Electrical Characterization @ 25C

Item	Symbol	Chip	Min.	Typ.	Max.	Condition	Unit
Intensity	IV	ALL	2.1		4.5	IF=50 mA	cd
Dominant Wavelength	λ_d	E	586		588	IF=50 mA	nm
		F	588		590		
		G	590		592		
Forward Voltage	VF	1	1.8		2.0	IF=50 mA	V
		2	2.0		2.2		
		3	2.2		2.4		
		4	2.4		2.6		
Viewing Angle	2θ 1/2	ALL	---	120	---	IF=50 mA	deg

Pre-Conditioning

Abrv	Data Type	Note	Sample Size per lot	# of lots	Accept on # failed	reference	Additional Requirements
PC	1	GS	SMD qualification parts for TC, AC, H3TRB & IOL/PTC		0	JESD22 A-113	Performed on surface mount devices(SMDs) prior to TC, AC, H3TRB & IOL/PTC stress only, use A113 Sensitivity parts must be reported

Step	Item	Details	Section
1	Initial Electrical Test	- Replace any failing devices - Optional for testing by Supplier	4.1
2	Visual Inspection	- Replace any failing devices - Optional for testing by Supplier	4.2
3	Temperature Cycling	- 5 cycles -40 °C to 60 °C - Optional shipping simulation based on product requirements	4.3
4	Bake	- 24 h at 125 °C - Optional for testing by Supplier	4.4
5	Moisture Soak	- Soak time and conditions per IPC/JEDEC J-STD-020 based on device MSL level	4.5
6	Reflow	- 3 reflow cycles using profiles per IPC/JEDEC J-STD-020, document rev of J-STD-020 used - SnPb or Pb-free profile based on device end use process	4.6
7	Flux Application	- 10 s full immersion dip in activated water soluble flux - Optional for testing by User or second level configuration - Not required for BGA, CGA and LGA packages	4.7
8	Cleaning	- DI water rinse - Remove all flux residual - Optional for testing by User or second level configuration - Not required for BGA, CGA and LGA packages	4.8
9	Drying	- Room ambient drying - Optional for testing by User or second level configuration - Not required for BGA, CGA and LGA packages	4.9
10	Final Electrical Test	- If all devices pass then ready for Reliability Testing - If valid failures are found then devices may have been tested to the wrong MSL level or something is substandard with the devices - Optional for testing by Supplier	4.10

This test method establishes an industry standard preconditioning flow for SMDs that is representative of a typical industry multiple solder reflow operation. It is performed prior to being submitted to specific in-house reliability testing to evaluate long term reliability and it could be also classifying Moisture sensitive level.

MSL level identify classification level of nonhermetic solid state surface mount devices

LEVEL	FLOOR LIFE		SOAK REQUIREMENTS			
			Standard		Accelerated Equivalent ¹	
	TIME	CONDITIONS	TIME (hours)	CONDITIONS	TIME (hours)	CONDITIONS
1	Unlimited	≤30 °C/85% RH	168 +5/-0	85 °C/85% RH		
2	1 year	≤30 °C/60% RH	168 +5/-0	85 °C/60% RH		
2a	4 weeks	≤30 °C/60% RH	696 ² +5/-0	30 °C/60% RH	120 +1/-0	60 °C/60% RH
3	168 hours	≤30 °C/60% RH	192 ² +5/-0	30 °C/60% RH	40 +1/-0	60 °C/60% RH
4	72 hours	≤30 °C/60% RH	96 ² +2/-0	30 °C/60% RH	20 +0.5/-0	60 °C/60% RH
5	48 hours	≤30 °C/60% RH	72 ² +2/-0	30 °C/60% RH	15 +0.5/-0	60 °C/60% RH
5a	24 hours	≤30 °C/60% RH	48 ² +2/-0	30 °C/60% RH	10 +0.5/-0	60 °C/60% RH
6	Time on Label (TOL)	≤30 °C/60% RH	TOL	30 °C/60% RH		

Mostly, Lumens 3528 LED has classification MSL II, 1 year floor life time under 30°C / 60% RH

External Visual

Abrv	Data Type	Note	Sample Size per lot	# of lots	Accept on # failed	reference	Additional Requirements
EV	1	NG	All qualification parts submitted for testing		0	JESD22 B-101	Inspect device construction, marking and workmanship

Failure Criteria

1. Any dimension which is non-conforming to an applicable drawing or specification.
2. Any physical feature (type, material, color, finish, etc.) that is non-conforming to an applicable drawing or specification.
3. Any flaw or defect that renders the part cosmetically unacceptable or mechanically unfit for use, as defined by an applicable drawing or specification.
4. Contamination that renders the part cosmetically unacceptable or mechanically unfit for use, as defined by an applicable drawing or specification.
5. Any specific condition that is inspected for separately by specialized equipment (for example certain physical dimensions) may be excluded from the external visual inspection.
6. No more than 5% maximum exposure of the base material that is intended to be covered by the Lead Finish Design (i.e. dam bar trim area, lead tip trim area, and/or .254mm (10 mils) maximum mold resin bleed area from peripheral leaded package body are not intended by design to be covered by lead finish)
7. Failures caused by handling damage during the course of the inspection are not to be counted.

▪ IQC Raw Data

모델명 : A0A1CEBHAMPY/R

검사일	입고 수량	Lot No.	n	Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	특이 사항
				2.80 ±0.1	3.20 ±0.1	3.50 ±0.1	2.30 ±0.1	1.90 ±0.1	0.90 ±0.1	1.30 ±0.1	
4 월 28 일	164,000		#1	2.839	3.244	3.481	2.267	1.874	0.88	1.305	
			#2	2.857	3.229	3.468	2.264	1.856	0.886	1.303	
			#3	2.853	3.243	3.464	2.28	1.866	0.888	1.292	
			#4	2.838	3.24	3.462	2.266	1.862	0.882	1.297	
			#5	2.821	3.23	3.469	2.275	1.869	0.885	1.307	

순번	자재명	규격	주요항목	Sampling	기준	검사 방법	비고
1	Chip	ES-SEYLPX14	외관검사, Dimension	외관 20, Dimension 5	Ac 0, Re 1	샘플링	검사 기준 서
		ES-SEHRPX14					
2	Lead Fframe	3528 2P 1.9T	외관검사, Dimension	외관 20, Dimension 5	Ac 0, Re 1	샘플링	검사 기준 서
3	Epoxy	ECCOBOND C-850-6L	Viscosity at 25℃ at 5rpm	cP	60,000	성적서 검사	기준
			Specific Gravity at 25℃		3.2		
			Volume Resistivity	(ohm-cm)	≤ 0.001		
			Die Shear Strength	(2.5x2.5 mm die)	≥ 2000(psi)		
4	Gold Bonding Wire	HS-L	Breaking Load	(gf)	min 11.5	성적서 검사	기준
			Elongation	(%)	2.0 ~ 8.0		
			Diameter	(μm)	29 ~ 31		
			Au	-	≥ 99.99%		
			Ag	ppm	< 5		
			Be	ppm	< 8		
5	Cover Tape	Cover Tape	W	(mm)	5.3 ±0.2	성적서 검사	기준
			T	(μm)	62 ±0.7		
			Tensile Breaking Elongation	(%)	110		
			Tensile Breaking Strenght	(MPa)	60		
			Surface Resistance	(Ω/sq)	10 ⁹ ±2		

Parametric Verification

Abrv	Data Type	Note	Sample Size per lot	# of lots	Accept on # failed	reference	Additional Requirements
PV	1	N	25	3 note A	0	Individual AEC user specification	Test all parameters according to user specification over the device temperature range to insure specification compliance

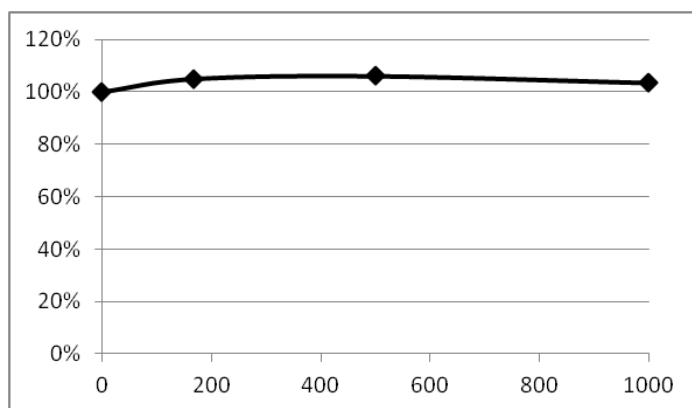
Characterization @ -55, 25, & 150C

Operating temperature.	TOPR	-40 ~ +100	°C	
Storage temperature.	TSTG	-40 ~ +100	°C	

High temperature gate bias

Abrv	Data Type	Note	Sample Size per lot	# of lots	Accept on # failed	reference	Additional Requirements
High Temperature Gate (forward) Bias	1	DGMUP	77	1 Note B	0	JESD22 A-108	1000 hours at junction temperature $T_J = 150^{\circ}\text{C}$, or specified $T_J(\text{max})$ rating, with gate biased at 100% of maximum gate voltage rating indicated in the detail specification with device biased OFF. The ambient temperature T_A is to be adjusted to compensate for current leakage. Can reduce duration to 500 hours through increasing T_J by 25°C , adjusting T_A to compensate for current leakage. TEST before and after HTGB as a minimum.

Test Item	LUMENS	Test Conditions		Test time	Number of Damaged
		Ref	LUMENS		
High Temperature Forward Bias	O	JESD22-A108	$T_a = 85^{\circ}\text{C}$ @ 50mA	1,000hrs	0/50



Test Result

No.	0	168	H	500	H	1000	H
1	2.98	3.16	6.0%	3.21	7.7%	3.13	5.0%
2	2.93	3.07	4.8%	3.08	5.1%	2.98	1.7%
3	2.81	2.93	4.3%	2.98	6.0%	2.92	3.9%
4	2.79	2.91	4.3%	2.93	5.0%	2.87	2.9%
5	2.83	2.98	5.3%	3.05	7.8%	2.99	5.7%
6	3.38	3.56	5.3%	3.58	5.9%	3.49	3.3%
7	2.94	3.11	5.8%	3.11	5.8%	3.01	2.4%
8	3.39	3.53	4.1%	3.53	4.1%	3.45	1.8%
9	2.75	2.86	4.0%	2.85	3.6%	2.82	2.5%
10	2.73	2.86	4.8%	2.88	5.5%	2.79	2.2%
11	2.99	3.15	5.4%	3.21	7.4%	3.17	6.0%
12	3.35	3.53	5.4%	3.57	6.6%	3.48	3.9%
13	3.27	3.42	4.6%	3.48	6.4%	3.42	4.6%
14	3.14	3.30	5.1%	3.37	7.3%	3.32	5.7%
15	3.33	3.52	5.7%	3.55	6.6%	3.43	3.0%
16	3.18	3.31	4.1%	3.33	4.7%	3.29	3.5%
17	2.77	2.87	3.6%	2.93	5.8%	2.87	3.6%
18	3.33	3.50	5.1%	3.56	6.9%	3.48	4.5%
19	3.02	3.18	5.3%	3.17	5.0%	3.07	1.7%
20	2.84	2.98	4.9%	3.02	6.3%	2.93	3.2%
21	3.01	3.16	5.0%	3.18	5.6%	3.10	3.0%
22	3.37	3.56	5.6%	3.59	6.5%	3.46	2.7%
23	3.07	3.19	3.9%	3.24	5.5%	3.16	2.9%
24	3.20	3.37	5.3%	3.41	6.6%	3.32	3.7%
25	3.05	3.20	4.9%	3.19	4.6%	3.08	1.0%
26	3.00	3.16	5.3%	3.19	6.3%	3.11	3.7%
27	3.27	3.42	4.6%	3.45	5.5%	3.38	3.4%
28	3.18	3.36	5.7%	3.36	5.7%	3.28	3.1%
29	3.36	3.57	6.3%	3.58	6.5%	3.53	5.1%
30	2.74	2.88	5.1%	2.87	4.7%	2.81	2.6%
31	3.05	3.17	3.9%	3.21	5.2%	3.16	3.6%
32	3.29	3.46	5.2%	3.53	7.3%	3.41	3.6%
33	3.28	3.43	4.6%	3.51	7.0%	3.46	5.5%
34	3.25	3.40	4.6%	3.43	5.5%	3.34	2.8%
35	2.89	3.03	4.8%	3.06	5.9%	3.00	3.8%
36	2.79	2.97	6.5%	3.02	8.2%	2.93	5.0%
37	2.71	2.81	3.7%	2.85	5.2%	2.77	2.2%
38	2.99	3.13	4.7%	3.17	6.0%	3.08	3.0%
39	3.21	3.36	4.7%	3.37	5.0%	3.29	2.5%
40	2.75	2.87	4.4%	2.86	4.0%	2.76	0.4%
41	3.22	3.40	5.6%	3.42	6.2%	3.30	2.5%
42	3.07	3.25	5.9%	3.27	6.5%	3.21	4.6%
43	3.16	3.33	5.4%	3.41	7.9%	3.33	5.4%
44	2.97	3.09	4.0%	3.12	5.1%	3.06	3.0%
45	2.70	2.83	4.8%	2.85	5.6%	2.78	3.0%
46	3.28	3.45	5.2%	3.51	7.0%	3.43	4.6%
47	3.15	3.29	4.4%	3.30	4.8%	3.18	1.0%
48	3.37	3.55	5.3%	3.60	6.8%	3.49	3.6%
49	3.03	3.20	5.6%	3.23	6.6%	3.16	4.3%
50	3.14	3.32	5.7%	3.37	7.3%	3.29	4.8%
Min.	2.70	2.81	3.6%	2.85	3.6%	2.76	0.4%
Max.	3.39	3.57	6.5%	3.60	8.2%	3.53	6.0%
Average	3.07	3.22	5.0%	3.25	6.0%	3.17	3.4%
std	0.22	0.23	0.7%	0.24	1.1%	0.23	1.3%

Temperature cycling

Abrv	Data Type	Note	Sample Size per lot	# of lots	Accept on # failed	reference	Additional Requirements
TC	1	DGU	77	1 note B	0	JESD22A-104	1000cycle (Ta=minimum range of -55℃ to maximum rated junction temperature, not to exceed 150℃). Can reduce duration to 400 cycle using Ta(max)=25℃ over device maximum rated junction temperature. TEST before and after TC as a minimum.

Failure Criteria

Failure criteria shall include, but not be limited to, hermeticity for hermetic devices, parametric limits functional limits, mechanical damage and waarpge. Parametric and functional limits shall be defined by the applicable procurement document. Mechanical damage shall not include damage induced by fixturing or handling or the damage is not critical to the package performance in the specific application.

Test Item	LUMENS	Ref		Test Conditions		Test time		Number of Damaged	
		LUMENS		LUMENS		LUMENS		LUMENS	
Temperature Cycle	O	JESD22-A104		(-)40℃ ~ (+)100℃ ~ (+)100℃ ~ (-)40℃ each 15min		1,000cycle		0/50	

TC

condition

TC : -40℃ to 100℃ and 100℃ to -40℃

Cycle : 65min

Test Sample Q'ty : 50 pcs

Test Device : A0A1CEBHAMPY

Test Item : Intensity(IV) Decay

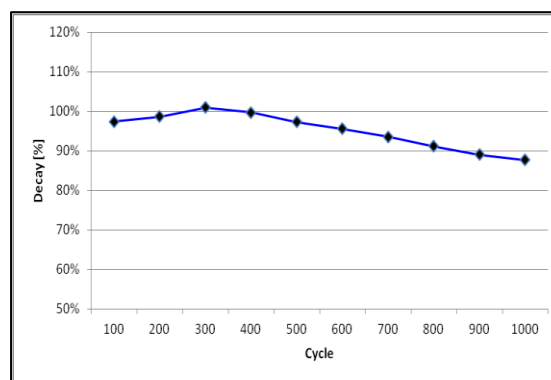
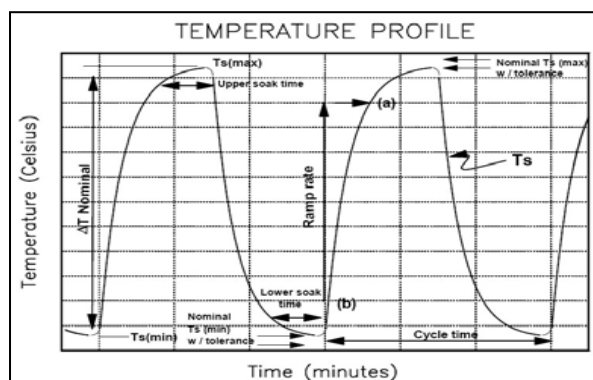
Remark

Test Start : 2012. 03. 02 09:00

작성	검토	승인
결재		

Reliability TEST

Test Sample #	Initial	100 Cycle		200 Cycle		300 Cycle		400 Cycle		500 Cycle		600 Cycle		700 Cycle		800 Cycle		900 Cycle		1000 Cycle	
		2012-03-07 5:40		2012-03-12 2:20		2012-03-16 23:00		2012-03-21 19:40		2012-03-26 16:20		2012-03-31 13:00		2012-04-05 9:40		2012-04-10 6:20		2012-04-15 3:00		2012-04-19 23:40	
		IV(cd)	%	IV(cd)	%	IV(cd)	%	IV(cd)	%	IV(cd)	%	IV(cd)	%	IV(cd)	%	IV(cd)	%	IV(cd)	%	IV(cd)	%
Min	2.36	2.30		2.34		2.39		2.37		2.30		2.26		2.21		2.15		2.10		2.07	
Max	2.47	2.41		2.45		2.50		2.45		2.40		2.36		2.31		2.25		2.20		2.17	
Average	2.42	2.35	-2.6%	2.39	-1.3%	2.44	0.9%	2.41	-0.3%	2.35	-2.8%	2.31	-4.4%	2.26	-6.5%	2.20	-8.9%	2.15	-11.0%	2.12	-12.3%



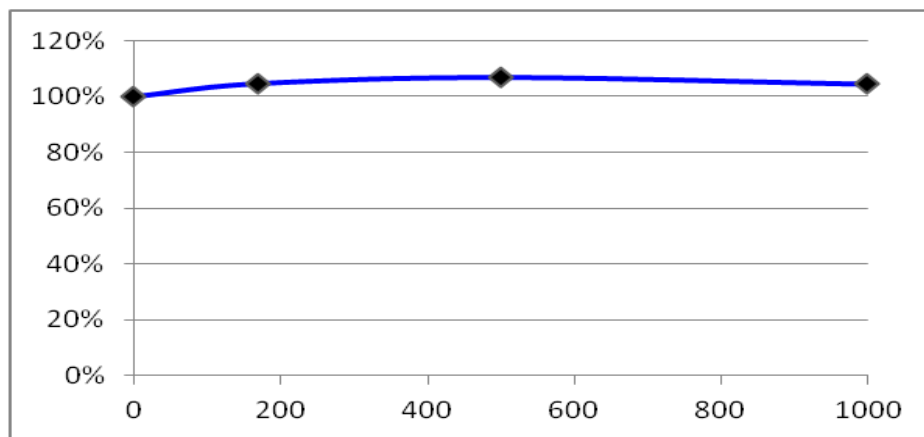
High humidity high temp bias

Abrv	Data Type	Note	Sample Size per lot	# of lots	Accept on # failed	reference	Additional Requirements
H ³ TRB	1	DGUV	77	1 note B	0	JESD22A-101	1000 hours at Ta=85°C/85% RH with device reverse biased at 80% of rated breakdown voltage up to a maximum of 100V or limit of chamber. Test before and after H3TRB as a minimum.

Test Item	LUMENS		Test Conditions	Test time	Number of Damaged
		Ref	LUMENS	LUMENS	LUMENS
High Temperature High Humidity Forward Bias	O	JESD22-A101	Ta=85°C/85% @ 50mA	1,000hrs	0/50

* High Temperature High Humidity TEST

▶ Device Name	A0A1CEBHAMPY
▶ Test Purpose	Package 신뢰성 시험
▶ Test Performed	H3ST
▶ Elec. Parameter	Flux [lm]
▶ Tested Term	2012.02.20 ~ 2012.04.01



Time	0	168	500	1000
Min.	4.71	4.89	4.91	4.75
Max.	5.00	5.28	5.41	5.33
Average	4.85	5.07	5.17	5.06
std	0.08	0.10	0.13	0.14

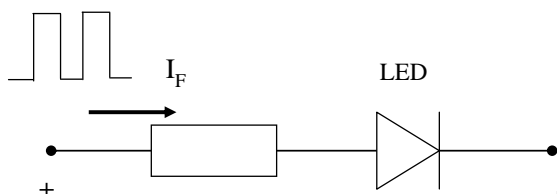
Device Name	측정항목	측정 조건	불량 판정 기준			
			초기 판정		최종 판정	
			min	max	min	max
A0A1CEBHAMPY	V _F	I _F = 50mA	-	-	-	U * 1.1
	I _R	V _R =10V	-	5 μ A	-	U * 2.0
	I _V	I _F = 50mA	-	-	L * 0.7	-

Power Temperature cycling

Abv	Data Type	Note	Sample Size per lot	# of lots	Accept on # failed	reference	Additional Requirements
PTC	1	DGTUW	77	1 note A	0	JESD22A-105	Perform PTC if $\Delta T_J \geq 100^\circ\text{C}$ cannot be achieved with IOL. Tested per duration indicated for Timing Requirements in Table 2A. Devices powered and chamber cycled to insure $\Delta T_J \geq 100^\circ\text{C}$ (not to exceed absolute maximum ratings). TEST before and after PTC as a minimum.




Test Item	Lumens		Test Conditions	Test time	Number of Damaged
		Ref	Lumens	Lumens	Lumens
Power Temperature Cycle	O	JESD22A-105B	-40/+85°C IF=[max. derating] T on/off=5min	1000hr	0/50

Power & t/c condition (acc. to JESD22-A105)

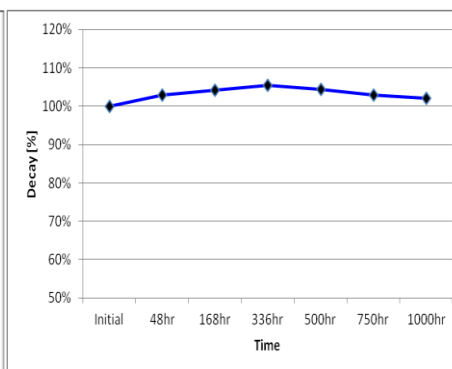
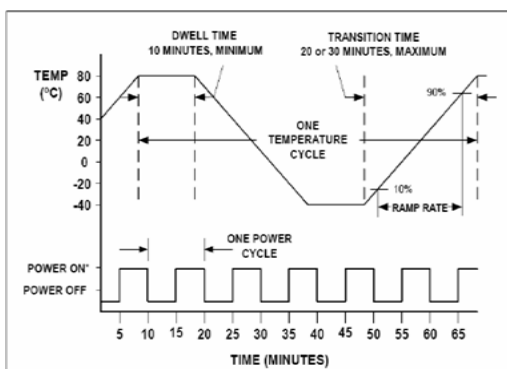


PTC

condition													
TC	: ON/OFF = 5MIN												
Cycle	: 65min												
Test Sample Q'ty	: 50 pcs												
Test Device	: A0A1CEBHAMPY												
Test Item	: Total Flux (lm) Decay												
Remark													
Test Start	: 2012. 02. 20 09:00												
Reliability TEST													
Test Sample #	Initial	48hr		168hr		336hr		500hr		750hr		1000hr	
		2012-02-22		2012-02-27		2012-03-05		2012-03-11		2012-03-22		2012-04-01	
	IV(cd)	IV(cd)	%	IV(cd)	%	IV(cd)	%	IV(cd)	%	IV(cd)	%	IV(cd)	%
Min	4.60	4.73	1.79%	4.76	2.11%	4.81	2.38%	4.76	1.79%	4.72	0.20%	4.69	-0.99%
Max	5.19	5.40	4.31%	5.48	6.54%	5.57	8.44%	5.47	8.23%	5.43	7.38%	5.35	6.33%
Average	4.89	5.03	2.95%	5.09	4.11%	5.16	5.43%	5.10	4.35%	5.03	2.91%	4.99	2.14%

결 재	작성	검토	승인
			

작성	검토	승인
결재		



>> Resistance to extremes of high/low temperature under biasing and to the effect of alternative exposure to these extremes during LED on & off operation

ESD Characterization

Attr	Data Type	Note	Sample Size per lot	# of lots	Accept on # failed	reference
ESD	1 (HBM,MM) 2(CDM)	D	30 ea CDM/ HBM/MM	1	0	AEC Q101-001,002 and 005

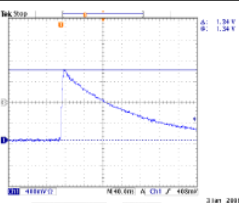
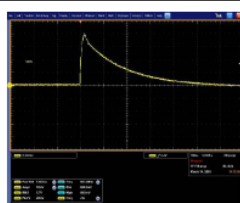
Additional Requirements

Supplier must perform at least two of the referenced ESD models through the end of 2005. CDM will be required as one of the two selected models as of 2006. For CDM, small packages may not be able to hold enough charge to meet the specified discharge voltage. For these packages, perform the test once and, if there is insufficient charge, the supplier must instead perform HBM and MM. The supplier must document that the package could not hold sufficient charge to perform the test. See attached procedure for details on how to perform the test. Test before and after ESD.

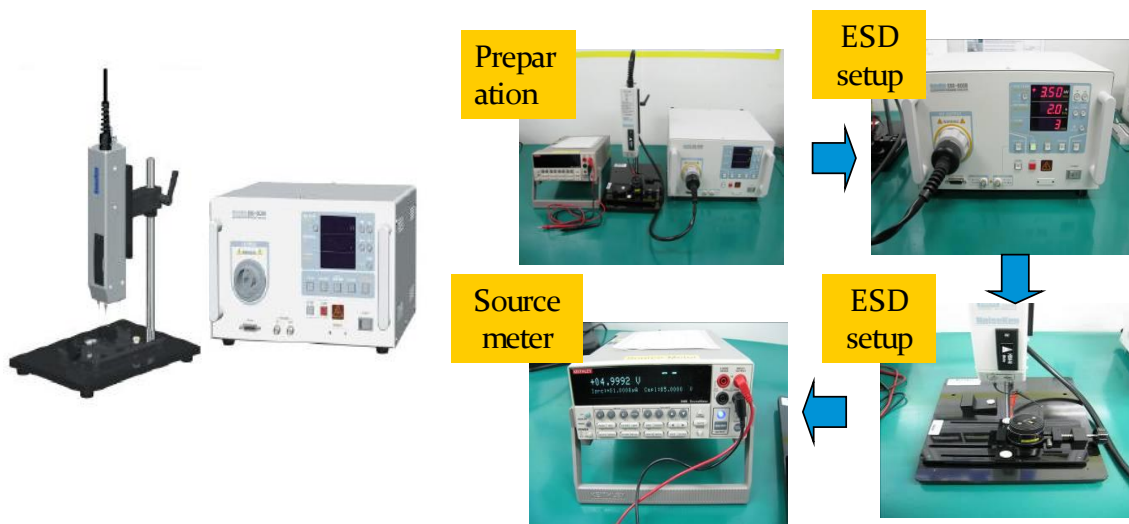
HBM Test Condition						
Voltage Level (V)	I _{peak} for short, I _{ps} (A)	I _{peak} for 500 Ohm* I _{pr} (A)	Rise Time for short Tr (ns)	Rise Time for 500 Ohm* Tr _r (ns)	Decay Time for Short, T _d (ns)	Ringing Current I _r (a)
1000	0.6~0.74	.375-.55	2.0 - 10	5.0 - 25	130 - 170	15% of I _{ps} and I _{pr}
2000	1.2 – 1.46	Not Applicable	2.0 - 10	Not Applicable	130 – 170	15% of I _{ps} and I _{pr}
4000	2.40 – 2.94	Not Applicable	2.0 - 10	Not Applicable	130 – 170	15% of I _{ps} and I _{pr}
8000	4.8 – 5.86	Not Applicable	2.0 - 10	Not Applicable	130 – 170	15% of I _{ps} and I _{pr}

How to judge			
Ho	≤250 V	H ₂	>2000 V to ≤4000 V
Hi A	>250V to ≤ 500 V	H _{3A}	>4000 V to ≤8000 V
Hi B	>500V to 1000V	H _{3B}	>8000 V
Hi C	>1000V to ≤ 2000V		

- Chip상태에서의 ESD Level TEST 결과는 하기와 같음.
 1. TEST 장비
 - A. TSE Chip TESTER
 2. TEST 방법
 - A. HBM +/-3,000V 인가 후 저전류 특성TEST 진행,
 3. TEST sample Q'ty : Forepi 600ea / Epivalley 600ea

NoisKen Ess-6008 HBM 측정 파형 	TSE Chip Tester ESD HBM 측정 파형 
NoisKen Ess-6008 HBM 준거 규격 AEC-Q100-002-Rew.D Jul2003 ESDA ANSI/EOS/ESD-STM5.1-2001 IEC 61340-3-1 Ed.1.0 2002 IEC 60749-26 Ed.1.0 2003 JEDEC JESD22-A114C Jan.2005 JEITA EIAJ ED-4701/300 Aug.2001 Test Method304 MIL-STD-883F 3015.7 Mar.1989	TSE Chip Tester HBM 준거 규격 MIL-STD-883F 3015.7 Mar.1989

ESD Characterization



인체 MODEL 시험(HBM)

AEC-Q100-002-Rev.D Jul2003
 ESDA ANSI/ESD/ESD-STM5.1-2001
 IEC 61340-3-Ed1.0 2002
 IEC 60749-26 Ed1.0 2003
 JEDEC JESD22-A114C Jan.2005
 JEITA EIAJ ED-4701/300 Aug2001 Test Method304
 MIL-STD-883F 3015.7 Mar.1989

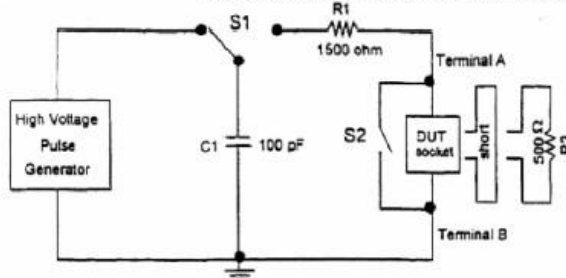
인체 MODEL (HBM) PROBE

항 목	사 양
충방전 CONDENSER 용량치	100pF±10%
방전 저항치	1500Ω±1%

HBM ESD TEST

A. Human Body Model (HBM, JESD22-A114)

- ✓ Tester model : ESS- 6008 (NoiseKen)
- ✓ Condition
 - Input voltage : 100V- 8kV ± 10%
 - Distance : contact
 - Input direction : Anode → Cathode ,Cathode → Anode
 - measuring environment : Ta=24°C , RH = 55%, wearing earth band



V : Input Voltage, C : Discharge Condenser , R : Discharge Resistance
 DUT : Device Under Test

Typical equivalent HBM ESD circuit

Class	Voltage Range
Class 0	< 250V
Class 1A	250 V to < 500V
Class 1B	500V to < 1kV
Class 1C	1kV to < 2kV
Class 2	2kV to < 4kV
Class 3A	4kV to < 8kV
Class 3B	≥ 8kV

HBM ESD Level

Test Result

Device	Chip LED			Model No.	A0A1CEBHAMPY			Date	2012.02. 15	
Lor No.	DPLE-120205S-S01			Lot Size	80 pcs		Inspector	MIR		
Test Item		ESD(Electro Static Discharge) : VR(>10V) Check								
Test Mode		Human Body Model								
Test Device		A0A1CEBHAMPY Package								
Electro-optical		Measuring Equipment : Source Meter, CHARGEMASTER CH 20								
Characteristics										
Specification		VR > 10V at IR=5uA								
Test Condition		0.5 KV		1.0 KV		1.5 KV		2.0 KV		
	1	3.00	Pass	2.91	Pass	2.84	Pass	2.83	Pass	
	2	2.77	Pass	2.73	Pass	2.71	Pass	2.63	Pass	
	3	2.66	Pass	2.59	Pass	2.60	Pass	2.55	Pass	
	4	2.79	Pass	2.74	Pass	2.72	Pass	2.71	Pass	
	5	2.70	Pass	2.66	Pass	2.63	Pass	2.62	Pass	
	6	2.68	Pass	2.62	Pass	2.60	Pass	2.57	Pass	
	7	2.96	Pass	2.89	Pass	2.85	Pass	2.79	Pass	
	8	2.96	Pass	2.88	Pass	2.87	Pass	2.84	Pass	
	9	2.83	Pass	2.78	Pass	2.74	Pass	2.72	Pass	
	10	3.07	Pass	2.99	Pass	2.94	Pass	2.87	Pass	
Result		Pass		Pass		Pass		Pass		
Test Condition		2.5 KV		3.0 KV		3.5 KV		4.0 KV		
	1	2.78	Pass	2.67	Pass	2.53	Pass	2.41	Pass	
	2	2.59	Pass	2.50	Pass	2.39	Pass	2.26	Pass	
	3	2.51	Pass	2.46	Pass	2.40	Pass	2.30	Pass	
	4	2.69	Pass	2.59	Pass	2.52	Pass	2.42	Pass	
	5	2.53	Pass	2.42	Pass	2.33	Pass	2.23	Pass	
	6	2.49	Pass	2.39	Pass	2.31	Pass	2.23	Pass	
	7	2.76	Pass	2.66	Pass	2.55	Pass	2.46	Pass	
	8	2.80	Pass	2.67	Pass	2.56	Pass	2.43	Pass	
	9	2.65	Pass	2.54	Pass	2.41	Pass	2.35	Pass	
	10	2.81	Pass	2.68	Pass	2.60	Pass	2.49	Pass	
Result		Pass		Pass		Pass		Pass		
TEST RESULT			ESD LEVEL = CLASS 3A 이상 (>4,000V) H3A Rank							

ESD Characterization

Avrv	Data Type	Note	Sample Size per lot	# of lots	Accept on # failed	reference
ESD	1 (HBM,MM) 2(CDM)	D	30 ea CDM/ HBM/MM	1	0	AEC Q1 01-001,002 and 005

Additional Requirements

Supplier must perform at least two of the referenced ESD models through the end of 2005. CDM will be required as one of the two selected models as of 2006. for CDM, small packages may not be able to hold enough charge to meet the specified discharge voltage. For these packages, perform the test once and, if there is insufficient charge, the supplier must instead perform HBM and MM. The supplier must document that the package could not hold sufficient charge to perform the test. See attached procedure for details on how to perform the test. Test before and after ESD.

MM Test Condition

Voltage Level (V)	Positive First Peak Current for short, I _{ps1}	Positive Second Peak Current for short, I _{ps1}	Major Pulse Period for short, T _{pm} (ns)	Positive First Peak current for 500 Ohm*, I _{pr} (A)	Current at 100ns for 600 Ohm*, I _{pr} (A)
1000	1.5 – 2.0	67% to 90% of I _{ps1}	66 – 90	Not Applicable	Not Applicable
2000	3.0 – 4.0	67% to 90% of I _{ps1}	66 – 90	Not Applicable	Not Applicable
4000	6.0 – 8.1	67% to 90% of I _{ps1}	66 – 90	0.85 to 1.2	0.29 ± 10%
8000	11.9 – 16.1	67% to 90% of I _{ps1}	66 – 90	Not Applicable	Not Applicable

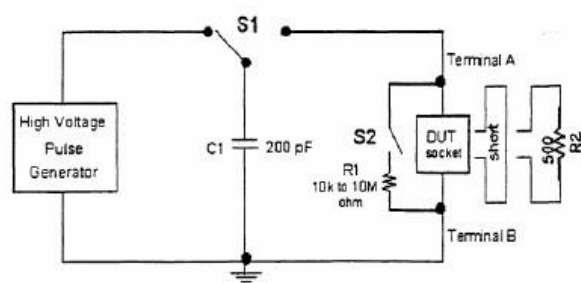
How to judge

Mo	≤ 25 V	M2	>100 V to ≤ 200 V
M1 A	>25 V to ≤ 50 V	M3	>200 V to ≤ 400 V
M1 B	>50 V to ≤ 100 V	M4	>400 V

MM ESD TEST

B. Machine Model (MM, JESD22-A115)

- ✓ Tester model : ESS- 6008 (NoiseKen)
- ✓ Condition
 - Input voltage : 100V- 800V ± 10%
 - Distance : contact
 - Input direction : Anode → Cathode ,Cathode → Anode
 - measuring environment : Ta=24°C , RH = 55%, wearing earth band



Typical equivalent MM ESD circuit

Class	Voltage Range
Class M1	< 100V
Class M2	100 V to < 200V
Class M3	200V to < 400V
Class M4	≥ 400V

MM ESD Level

Test Result

Device	Chip LED			Model No.	A0A1CEBHAMPY		Date	2012.02. 15	
Lor No.	DPLE-120205S-S01			Lot Size	80 pcs		Inspector	MIR	
Test Item		ESD(Electro Static Discharge) : VR(>10V) Check							
Test Mode		Machine Model							
Test Device		A0A1CEBHAMPY Package							
Electro-optical		Measuring Equipment : Source Meter, Chargemaster CH 20							
Characteristics									
Specification		VR > 10V at IR=5uA							
Test Condition		50 V		100 V		150 V		200 V	
	1	3.03	Pass	2.94	Pass	2.90	Pass	2.81	Pass
	2	2.68	Pass	2.63	Pass	2.57	Pass	2.49	Pass
	3	2.98	Pass	2.94	Pass	2.84	Pass	2.79	Pass
	4	2.64	Pass	2.62	Pass	2.58	Pass	2.48	Pass
	5	2.86	Pass	2.81	Pass	2.74	Pass	2.66	Pass
	6	2.62	Pass	2.58	Pass	2.55	Pass	2.48	Pass
	7	2.61	Pass	2.54	Pass	2.51	Pass	2.46	Pass
	8	3.00	Pass	2.90	Pass	2.80	Pass	2.75	Pass
	9	2.61	Pass	2.54	Pass	2.46	Pass	2.42	Pass
	10	3.08	Pass	3.05	Pass	2.97	Pass	2.86	Pass
Result		Pass		Pass		Pass		Pass	
Test Condition		250 V		300 V		350 V		400 V	
	1	2.74	Pass	2.67	Pass	2.51	Pass	2.47	Pass
	2	2.44	Pass	2.38	Pass	2.29	Pass	2.25	Pass
	3	2.67	Pass	2.54	Pass	2.41	Pass	2.39	Pass
	4	2.37	Pass	2.30	Pass	2.21	Pass	2.18	Pass
	5	2.59	Pass	2.49	Pass	2.36	Pass	2.27	Pass
	6	2.41	Pass	2.31	Pass	2.20	Pass	2.14	Pass
	7	2.38	Pass	2.26	Pass	2.17	Pass	2.07	Pass
	8	2.66	Pass	2.58	Pass	2.43	Pass	2.36	Pass
	9	2.37	Pass	2.31	Pass	2.18	Pass	2.13	Pass
	10	2.78	Pass	2.70	Pass	2.53	Pass	2.44	Pass
Result		Pass		Pass		Pass		Pass	
TEST RESULT			ESD LEVEL = CLASS M4						

ESD Characterization

Avrv	Data Type	Note	Sample Size per lot	# of lots	Accept on # failed	reference
ESD	1 (HBM,MM) 2(CDM)	D	30 ea CDM/ HBM/MM	1	0	AEC Q1 01 -001,002 and 005

Additional Requirements

Supplier must perform at least two of the referenced ESD models through the end of 2005. CDM will be required as one of the two selected models as of 2006. for CDM, small packages may not be able to hold enough charge to meet the specified discharge voltage. Fore these packages, perform the test once and, if there is insufficient charge, the supplier must instead perform HBM and MM. The supplier must document that the package could not hold sufficient charge to perform the test. See attached procedure for details on how to perform the test. Test before and after ESD.

CDM Test Condition

Voltage Level (V)	1 st Peak current for 4pF Ip1 (A) (±20%)	2 nd Peak current for 4pF Ip2 (A)	3 rd Peak current for 4pF Ip3 (A)	Rise Time Tr (ps)	Full width at half height for 4pF FWHH (ps)
250	2.25	<50% of LP1	<25% of LP1	<400	<600
500	4.5	<50% of LP1	<25% of LP1	<400	<600
1000	9.00	<50% of LP1	<25% of LP1	<400	<600
2000	18.00	<50% of LP1	<25% of LP1	<400	<600

How to judge

C0	≤ 125 V	C3	> 500 V to ≤ 750 V
C1	> 125 V to ≤ 250V	C4	> 750 V to ≤ 1000 V
C2	> 250 V to ≤ 500 V	C5	> 1000 V

Test Result

Device	Chip LED			Model No.	A0A1CEBHAMPY		Date	2012.02. 15	
Lor No.	DPLE-120205S-S01			Lot Size	80 pcs		Inspector	MIR	
Test Item		ESD(Electro Static Discharge) : VR(>10V) Check							
Test Mode		CDM (150 pF/330Ω, 9Point, 10Times/point)							
Test Device		A0A1CEBHAMPY Package							
Electro-optical		Measuring Equipment : Source Meter, Chargemaster CH 20							
Characteristics									
Specification		VR > 10V at IR=5uA							
Test Condition		0.2 KV		0.4 KV		0.6 KV		0.8 KV	
	1	2.68	Pass	2.64	Pass	2.60	Pass	2.55	Pass
	2	3.09	Pass	3.03	Pass	2.95	Pass	2.90	Pass
	3	2.71	Pass	2.66	Pass	2.57	Pass	2.51	Pass
	4	3.04	Pass	3.00	Pass	2.93	Pass	2.83	Pass
	5	2.79	Pass	2.76	Pass	2.69	Pass	2.62	Pass
	6	2.97	Pass	2.92	Pass	2.81	Pass	2.76	Pass
	7	2.96	Pass	2.93	Pass	2.87	Pass	2.82	Pass
	8	3.09	Pass	3.04	Pass	2.99	Pass	2.93	Pass
	9	2.85	Pass	2.83	Pass	2.74	Pass	2.67	Pass
	10	2.60	Pass	2.57	Pass	2.50	Pass	2.46	Pass
Result		Pass		Pass		Pass		Pass	
Test Condition		1.0 KV		1.2 KV		1.4 KV		1.6 KV	
	1	2.46	Pass	2.39	Pass	2.27	Pass	2.20	Pass
	2	2.82	Pass	2.74	Pass	2.62	Pass	2.52	Pass
	3	2.45	Pass	2.39	Pass	2.29	Pass	2.22	Pass
	4	2.75	Pass	2.68	Pass	2.60	Pass	2.55	Pass
	5	2.57	Pass	2.46	Pass	2.36	Pass	2.31	Pass
	6	2.67	Pass	2.54	Pass	2.43	Pass	2.34	Pass
	7	2.75	Pass	2.63	Pass	2.55	Pass	2.50	Pass
	8	2.83	Pass	2.75	Pass	2.60	Pass	2.54	Pass
	9	2.61	Pass	2.55	Pass	2.45	Pass	2.38	Pass
	10	2.39	Pass	2.33	Pass	2.24	Pass	2.16	Pass
Result		Pass		Pass		Pass		Pass	
TEST RESULT			ESD LEVEL = C5						

DPA

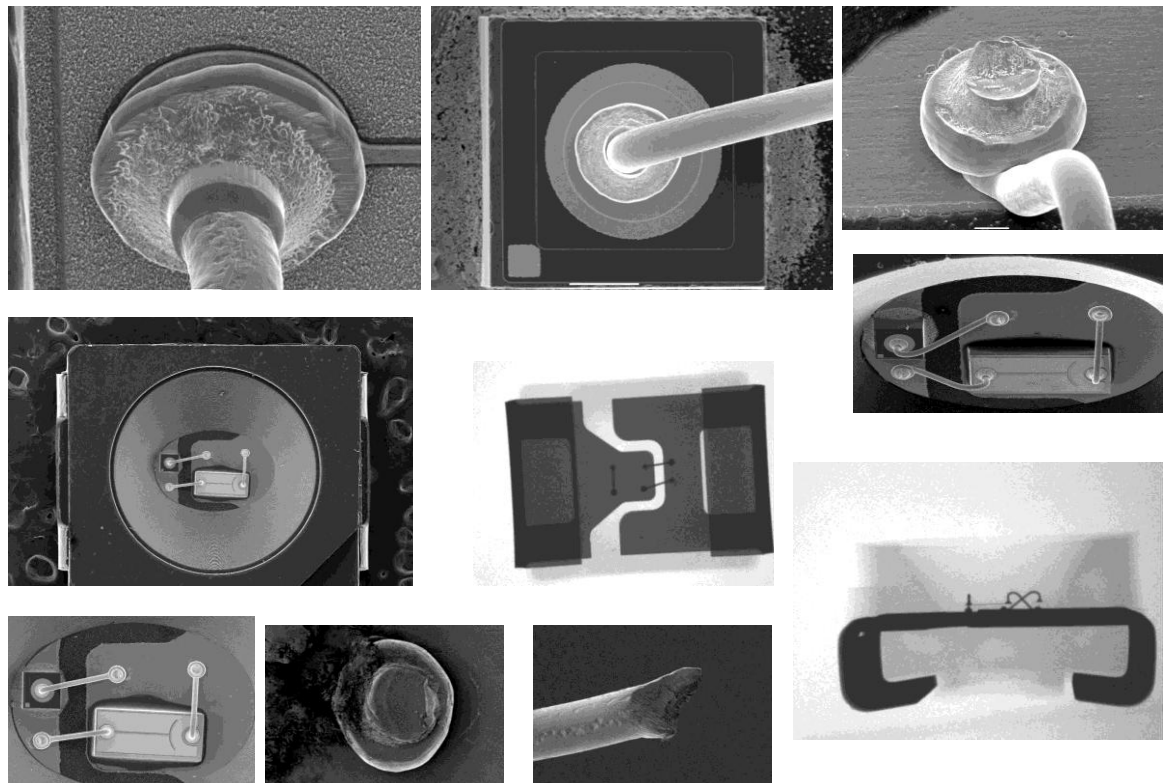
Avrv	Data Type	Note	Sample Size per lot	# of lots	Accept on # failed	reference
DPA	1	DG	Random	1	0	AEC-Q101-004 Section 4

Additional Requirements


- Parts selected for this test must have successfully completed environmental testing as defined in Table 2 (Process Change Guidelines for the Selection of Tests) of AEC-Q101.
- The parts shall be opened or de-capsulated in order to expose the internal die/substrate and determine the extent of any mechanical damage. The process used to de-capsulate the device must insure that it does not cause degradation of the leads and bonds. The internal die or substrate must be completely exposed and free of packaging material.
- The devices shall be examined under a magnification of up to 50X to the criteria listed in section 4.4, herein.
- Failed devices shall be analyzed to determine the cause of the failure. A Failure Analysis Report documenting this analysis shall be prepared on all failures. If the analysis shows that the failure was caused by the package opening process, the test shall be repeated on a second group of parts.



3528 Package DPA 분석



Physical dimension


Avrv	Data Type	Note	Sample Size per lot	# of lots	Accept on # failed	reference	Additional Requirements
PD	2	NG	30	1	0	JESD22 B-1 00 	Verify physical dimensions to the applicable user device packaging specification for dimensions and tolerances

Failure Criteria

Any device that exhibits a dimension or dimensions not in conformance with specified tolerances or limits of applicable drawings shall constitute a failure.

Time	n	Ball Thickness	Gold Wire's Diameter
		20 ± 5 μm	30 ± 5 μm
1Time	#1	20.29	28.29
	#2	23.16	28.41
	#3	21.58	27.61
	#4	22.23	30.38
	#5	21.58	34.52
2Time	#1	22.83	28.37
	#2	19.63	28.36
	#3	18.72	28.99
	#4	23.72	27.61
	#5	17.26	27.61
1Time	#1	18.36	28.29
	#2	18.27	29.41
	#3	18.36	28.39
	#4	18.27	34.52
	#5	21.58	30.38
2Time	#1	17.26	28.37
	#2	18.36	28.24
	#3	18.72	28.24
	#4	17.31	27.61
	#5	23.72	34.52

Vibration Variable Frequency

Avrv	Data Type	Note	Sample Size per lot	# of lots	Accept on # failed	reference	Additional Requirements
VVF	2	DGH (2)	Items 1 6 through 1 9 are sequential tests fore hermetic packages. (see note H on Legend page)			JESD22 B-1 03 	Use a constant displacement of 0.06 inches (double amplitude) over the range of 20Hz to 1 00 Hz and a 50g constant peak acceleration over the range of 1 00Hz to 200KHz. Test before and After VVF

Failure Criteria

A component shall be defined as a failure if hermeticity requirements cannot be demonstrated, if parametric limits are exceeded or if functionality cannot be demonstrated under the conditions specified in the applicable procurement document. Mechanical damage, such as cracking, chipping or breaking of the package will also be considered a failure provided such damage was not caused by fixturing or handling and the damage is critical to component performance in the specific application.

Table 1 — Component test levels


Service condition	Peak acceleration (G)	Displacement pk-pk (in / mm)	Cross-over frequency (Hz)	Min. / Max. frequency (Hz)	Vibration	20~100Hz/50G/10min SR, XYZ, 30min/axis	90Min	20EA
1	20	0.060 / 1.5	80	20 / 2000				
2	10	0.040 / 1.0	70	10 / 1000				
3	3	0.030 / 0.75	45	5 / 500				
4	1	0.020 / 0.5	31	5 / 500				
5	0.3	0.010 / 0.25	24	5 / 500				
6	0.1	0.005 / 0.125	20	5 / 500				
7	0.01	0.001 / 0.039	14	5 / 500				
8	0.001	0.0005 / 0.0127	6.2	5 / 500				

Result (Optical Characteristics and Visual inspection)

Vibration		20~100Hz/50G/10min			90 min	20 ea
		SR, XYZ, 30min/axis				

No	VF (V)		Intensity (cd)		Visual Inspection (x50)	
	Before	After	Before	After	Before	After
1	2.26	2.28	2.94	2.77	x	x
2	2.17	2.17	2.69	2.52	x	x
3	2.18	2.19	2.74	2.55	x	x
4	2.12	2.13	3.04	2.90	x	x
5	2.06	2.07	2.87	2.69	x	x
6	2.19	2.21	2.60	2.49	x	x
7	2.31	2.33	3.09	2.89	x	x
8	2.41	2.42	2.86	2.72	x	x
9	2.48	2.50	2.68	2.54	x	x
10	2.11	2.13	2.86	2.66	x	x
11	2.31	2.32	2.84	2.68	x	x
12	2.05	2.05	3.06	2.91	x	x
13	2.02	2.02	2.80	2.68	x	x
14	2.43	2.43	2.83	2.66	x	x
15	2.15	2.16	3.04	2.88	x	x
16	2.24	2.26	2.77	2.63	x	x
17	2.39	2.40	2.65	2.49	x	x
18	2.29	2.29	2.97	2.84	x	x
19	2.40	2.40	2.76	2.61	x	x
20	2.37	2.39	2.84	2.68	x	x

Mechanical Shock

Avrv	Data Type	Note	Sample Size per lot	# of lots	Accept on # failed	reference	Additional Requirements
MS	2	DGH (3)			0	JESD22 B-104 	1500g's for 0.5mS, 5blows, 3orientations. Test before and after MS.

Failure Criteria

Failure criteria shall include, but not be limited to, hermeticity for hermetic devices, parametric limits, functional limits, mechanical damage and warpage. Parametric and functional limits shall be defined by the applicable procurement document. Mechanical damage shall not include damage induced by fixturing or handling or the damage is not critical to the package performance in the specific application.

Table 1 — Component test levels

Table 1 — Component test levels					LED Drop	50cm, 2Edge(Front, Back), 1Face(Bottom)		1time	1 LOT
Service condition	Equivalent drop height (inches) / (cm)	Velocity change (in/s) / (cm/s)	Acceleration peak (G)	Pulse duration (ms)	Item	Initial		Result	
						MIN	MAX	MIN	MAX
H	59 / 150	214 / 543	2900	0.3	V _F	—	—	L * 0.9	U * 1.1
G	51 / 130	199 / 505	2000	0.4					
B	44 / 112	184 / 467	1500	0.5	CIE	X	—	± 0.008	
F	30 / 76.2	152 / 386	900	0.7		Y		± 0.015	
A	20 / 50.8	124 / 316	500	1.0					
E	13 / 33.0	100 / 254	340	1.2	nit		—	L * 0.7	—
D	7 / 17.8	73.6 / 187	200	1.5			—		
C	3 / 7.62	48.1 / 122	100	2.0					

Result (Optical Characteristics and Visual inspection)

No	VF (V)		Intensity (cd)		Visual Inspection (x50)	
	Before	After	Before	After	Crack	Destruction
1	2.32	2.33	2.98	2.97	x	x
2	2.27	2.28	2.67	2.70	x	x
3	2.26	2.26	3.08	3.08	x	x
4	2.42	2.42	2.91	2.91	x	x
5	2.39	2.39	2.72	2.76	x	x
6	2.13	2.14	2.69	2.69	x	x
7	2.13	2.14	2.83	2.83	x	x
8	2.03	2.03	2.69	2.72	x	x
9	2.28	2.30	2.83	2.85	x	x
10	2.47	2.49	2.64	2.67	x	x
11	2.06	2.07	2.96	2.95	x	x
12	2.10	2.11	3.08	3.09	x	x
13	2.25	2.26	2.69	2.68	x	x
14	2.14	2.14	2.76	2.77	x	x
15	2.13	2.14	2.79	2.80	x	x
16	2.03	2.05	2.91	2.93	x	x
17	2.34	2.35	2.98	2.99	x	x
18	2.07	2.07	3.07	3.06	x	x
19	2.17	2.18	3.02	3.06	x	x
20	2.29	2.30	2.61	2.60	x	x

Resistance to Solder Heat

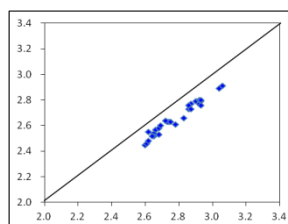
Avrv	Data Type	Note	Sample Size per lot	# of lots	Accept on # failed	reference	Additional Requirements
RSH	2	DG	30	1	0	JESD22 B-106	Test before and after RSH. SMD devices shall be fully submerged during test unless justified by the supplier and agreed to by the user(e.g., submerge SOT223, not D2PAK)
Failure Criteria							
A device shall be defined as a failure if hermeticity for hermetic devices cannot be demonstrated, if parametric limits are exceeded, or if functionality cannot be demonstrated under nominal and worst case conditions specified in the applicable procurement document. Mechanical damage such as cracking, chipping, or breaking of the package, (10 - 20X magnification), will also be considered a failure provided such damage was not induced by fixturing or handling.							

Pb-Free Wave

Company	solder pot temperature	dwelt time	board thickness	preheat temperature, board and/or component temp.	preheat duration	Other comments
A	265 +/-5C	3 to 4 seconds	2.0 mm (79 mils), 6 layer	120C comp. lead		0.7 m/min conveyor
	265 +/-5C	5 seconds	2.2 mm (87 mils), 14 layer	110C comp. lead		0.6 m/min conveyor
B	265 +/-5C	2-3 seconds	1.6 to 2.0mm (63 to 79 mils)	140C, board max.		1 m/min conveyor,
C	265 +/-5C	3 to 6.5 seconds	thick (>90 mils)	140C, comp. body		
	260 +/-5C	2 to 4 seconds	thin (62 mils)	125C, comp body		single wave
D	265-270C	2-5 sec., single wave	62 mils	110-140C comp. body	< 2 minutes	
E	260-265C	3-8 sec	63 to 135 mils	110-130C PWB topside	2-3 minutes	

* Solder Heating TEST

- ▶ Device Name A0A1CEBHAMPY
- ▶ Test Purpose Package 신뢰성 시험
- ▶ Test Performed SHT
- ▶ Elec. Parameter Intensity [cd]
- ▶ Tested Term 2012.02.14 ~ 2012.02.17



	Before	After	Decay[%]
min	2.60	2.45	-6.1%
max	3.06	2.91	-2.7%
avg	2.78	2.65	-4.5%
std	0.14	0.13	0.01

Solderability

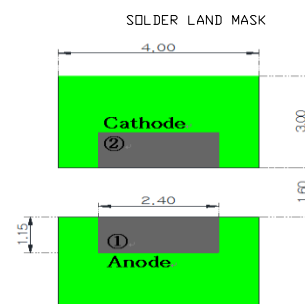
Avrv	Data Type	Note	Sample Size per lot	# of lots	Accept on # failed	reference	Additional Requirements
SD	2	DG	10	1 Note B	0	J-STD-002	Magnification 50x, reference solder conditions in Table 2B. Test Method A for through-hole, Both B Test Methods and test method B for SMD

Solder Conditions table (test#21) Requirements

Type	Test Method	Solder Temperature	Steam Age Category	Exception for Dry Heat
Leaded Through-Hole	A	235 °C	3	--
SMD Standard Process	B	235 °C	3	--
SMD Low Temperature Solder	B	215 °C	--	4hrs @ 155 °C (in Lieu of steam age)
SMD Dissolutions for Metals Test	D	260 °C	3	---

Soldering Reflow

- Soldering of the SMD LEDs shall conform to the soldering condition in the individual specifications.
- SMD LEDs are designed for Reflow Soldering.
- In the reflow soldering, too high temperature and too large temperature gradient such as rapid heating/cooling may cause electrical & optical failures and damages of the devices.
- Lumens cannot guarantee the LED after they have been assembled using the solder dipping method.

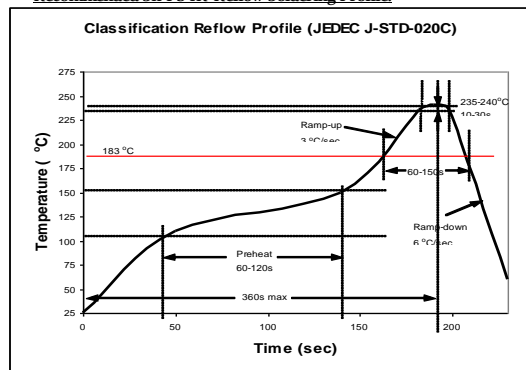


3X IR reflow through IR reflow under IR soldering condition (acc. to J-STD-020B)

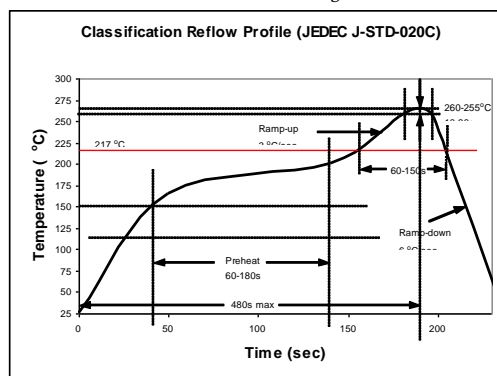


Through RTSH, endurance of package under 3X repeated-high temperature can be confirmed Based on RTSH result, limit reflow-rework times for IR-reflow

Recommended Sn-Pb IR-Reflow Soldering Profile



Recommended Pb Free IR-Reflow Soldering Profile



Solderability test

Spectrum processing :

No peaks omitted

Processing option : All elements analyzed (Normalised)

Number of iterations = 4

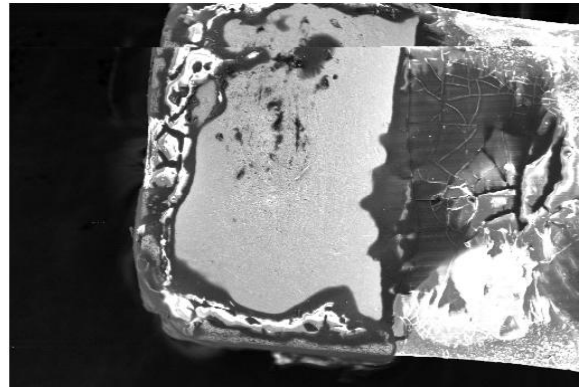
Standard :

C CaCO3 1-Feb-2012 12:00 AM

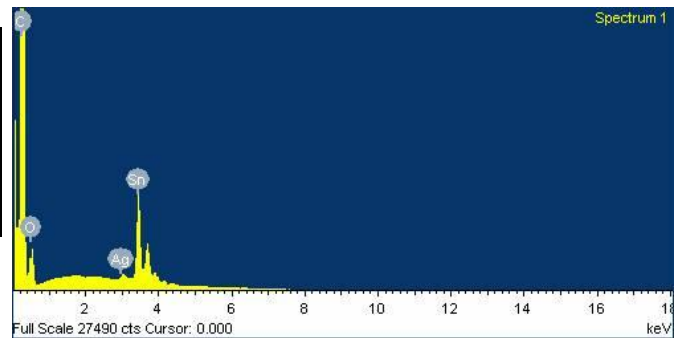
O SiO2 1-Feb-2012 12:00 AM

Ag Ag 1-Feb-2012 12:00 AM

Sn Sn 1-Feb-2012 12:00 AM



Element	Weight%	Atomic%
C K	49.25	80.78
O K	10.12	12.46
Ag L	0.95	0.17
Sn L	39.68	6.59
Totals	100	



Thermal Resistance

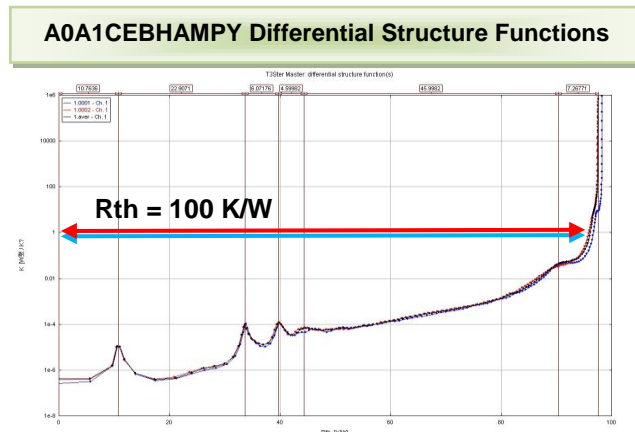
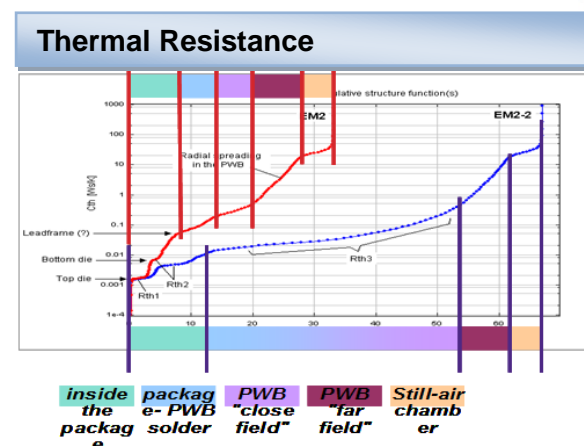
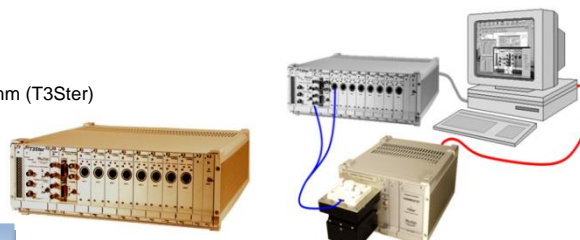
Abrv	Data Type	Note	Sample Size per lot	# of lots	Accept on # failed	reference	Additional Requirements
TC	1	DGU	77	1 note B	0	JESD24-3, 24-4, 24-6 as appropriate	Measure TR to assure specification compliance and provide process change comparison data.

ITEM	Symbol	Typical	Unit
Heat Resistance	Rjs	45	K/W
	Rja	100	K/W

Thermal Characteristics

(Ta=25°C)

- * Rjs = Heat Resistance from junction to Slug temperature (Ts)
- * Rja = Heat Resistance from junction to ambient temperature (Ta)
- * Using Lumens standard circuit board AI-PCB (2.0x2.0mm), T=1.6mm (T3Ster)



Wire Bond Strength

Abrv	Data Type	Note	Sample Size per lot	# of lots	Accept on # failed	reference	Additional Requirements
WBS	3	DGE	10 bonds for min of 5device	1	0	MIL-STD-750 Method 2037	Pre & Post process change comparison to evaluate process change robustness

Time	n	Wire Pull Force ≥ 8.0g (1.2mil)
1 Time	#1	18.2
	#2	17.1
	#3	15.9
	#4	15.9
	#5	16.7
2 Time	#1	18.7
	#2	18.8
	#3	17.5
	#4	16.8
	#5	15.7
3 Time	#1	17.6
	#2	16.8
	#3	14.5
	#4	14.7
	#5	15.5
4 Time	#1	22.1
	#2	21.5
	#3	21.7
	#4	21.1
	#5	21.3

Bond Shear

Abrv	Data Type	Note	Sample Size per lot	# of lots	Accept on # failed	reference	Additional Requirements
BS	3	DGE	10 bonds from min of 5device	1	0	AEC-Q101-003	See attached procedure for details on acceptance criteria and how to perform the test.

Time	n	Ball Share Strength	
		≥ 30g	
1 Time	#1	72.8	
	#2	88	
	#3	81	
	#4	86.7	
	#5	73.9	
2 Time	#1	85.1	
	#2	90.6	
	#3	86.7	
	#4	83.8	
	#5	93.9	
3 Time	#1	80.4	
	#2	72.8	
	#3	84.6	
	#4	73.6	
	#5	79.2	
4 Time	#1	86.8	
	#2	82.1	
	#3	79.9	
	#4	82.3	
	#5	79.8	

Die Shear

Abrv	Data Type	Note	Sample Size per lot	# of lots	Accept on # failed	reference	Additional Requirements
DS	3	DG	5	1	0	MIL-STD-750 Method 2017	Pre & Post process change comparison to evaluate process change robustness

Time	n	Die Share Strength	
		≥ 200g	
1 Time	#1	301.8	
	#2	405.5	
	#3	497.0	
	#4	504.5	
	#5	365.1	
2 Time	#1	269.7	
	#2	307.0	
	#3	381.6	
	#4	338.1	
	#5	342.8	
3 Time	#1	264.6	
	#2	375.0	
	#3	311.6	
	#4	313.0	
	#5	299.4	
4 Time	#1	273.0	
	#2	299.6	
	#3	317.4	
	#4	311.8	
	#5	305.2	

가혹 신뢰성 결과에 따른 3528 SLUG LED MTTF

Test Result

MTTF=(신뢰성 x 신뢰성 시간) / 불량 수량 (0 은 1 개)

No	Test Item	Condition	시료수	불량내용		MTTF
				Limit 불량	완전 불량	예상 수명
1	상온 동작	Ta=25℃ IF=50mA T=1000hrs	50	0	0	50x1000/1=50,000 시간
2	저온 동작	Ta=-30℃ IF=50mA T=1000hrs	50	0	0	50,000 hrs
3	고온 동작	Ta=85℃ IF=50mA T=1000hrs	50	0	0	
4	고온 고습 보존	Ta=85℃ RH=85% T=1000hrs	50	0	0	
5	온도 순환	Ta=-40~25~100~25℃ (30min~5min~30min~5min) TC=100cycle	50	0	0	
6	증기압	Ta=120℃ RH=100% P=2atm T=4hrs	50	0	0	
7	Solder Heat	Ta=260℃ T=10sec	50	0	0	

Mean Time To Failure (Lift time)

LED단품 신뢰성기준은 LED단품을 일정시간동안 TEST한후 만족할 만한 성능으로 동작할 확률로 정의된다.
즉 가용 수명 기간동안 고장 발생률은 일정하며 신뢰도는 아래 식으로 정의 된다.

고장률 지수분포 $R(t) = \exp[-\lambda t]$

R(t)= LED가 Test ON 시간에 작동할 확률

 λ = 고장 률=1/MTTF

T=Test 예상시간

신뢰성 기준의 수명test기간 동안 고장이 발생할 확률은

$$P(t)=1-R(t)$$

평균고장시간인MTTF는 LED신뢰성 불량률의 역수이며 시간으로 표시됨.

MTTF는 총 장치개수에 장치당 작동시간을 곱하고 치명적인 고장의 총 횟수로 나눔

예상 수명계산 (MTTF) = (신뢰성 수량X1,000) / 불량 갯 수 (0은 1개)

Example : LED의 MTTF가 100,000시간이라면 10시간 후 고장 없이 작동될 확률은?

작동 확률R(t) = $\exp[-(1/100,000) \times (10,000)] = \exp[-0.0001] = 99.99\%$ 고장날 확률 P(t) = $1-R(t) = 1-0.9999 = 0.01\%$ 또는 100ppm

* 참고: 고장률

MTTF(장치시간)	%/1000시간	FIT(10-E9시간당 고장횟수)
1M	0.1%	1000FIT
10M	0.01%	100FIT
100M	0.001%	10FIT

1000HR 고온동작 결과에 따른 3528 SLUG LED MTF

Junction 온도에 따른 고장률 (Arrhenius Model)

$$AF = L_u / L_a = \exp(-(E_a/k) * (1/T_a - 1/T_u))$$

$$L_u = L_a * \exp(-(E_a/k) * (1/T_a - 1/T_u))$$

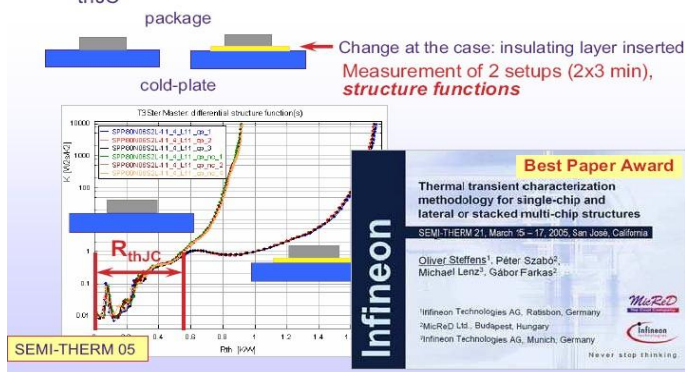
AF = Acceleration Factor
 k= Boltzmann 상수(8.617×10⁻⁵eV/OK)
 Tu = Junction Temperature at Used condition
 Ta = Junction Temperature at accelerated test condition

$$L_u (\text{life time}) = L_a \times AF$$

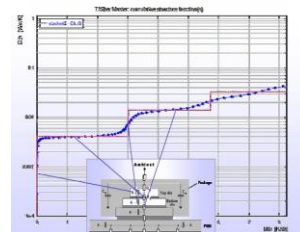
BLUE=0.43eV
 (MIL-HDBK-217C 권장
 활성화 에너지)

참고자료 :
 (Handbook of Reliability
 Engineering and
 Management, Ireson,
 Coombs, & Moss, 1996).

R_{thJC} values: dual interface method

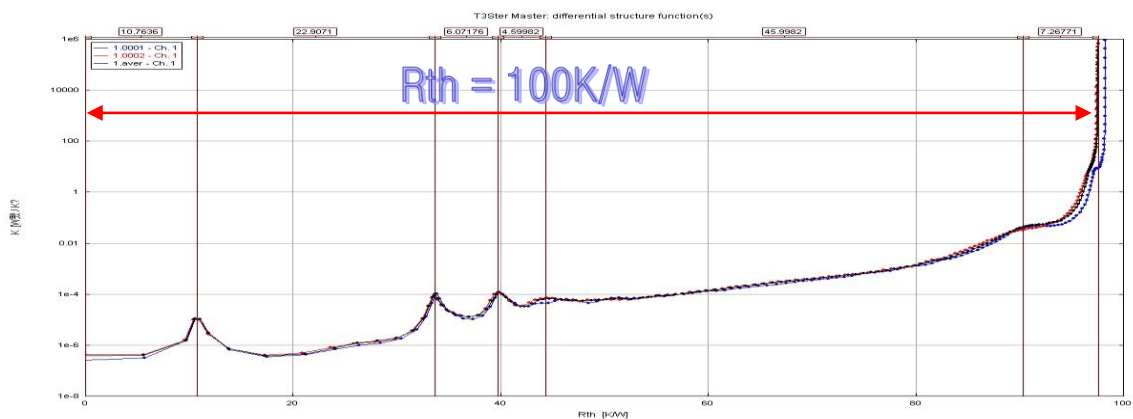


automated model generation

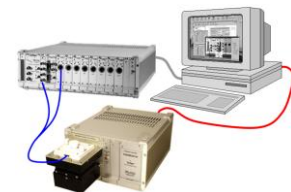


Slug type Thermal resistance (Rth)

Differential Structure functions



구분	Rth	평균 Rth
시료 #1	98	100 K/W
시료 #2	97	
시료 #3	104	
시료 #4	102	
시료 #5	101	



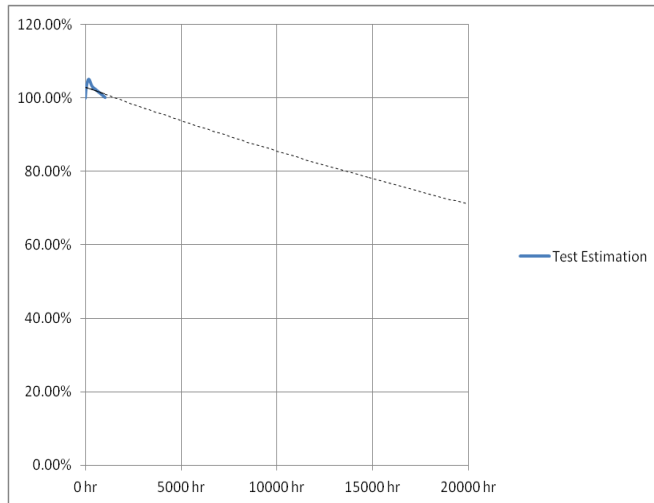
고온 동작 시험 결과

측정 조건 : $T_a=85^{\circ}\text{C}$, 시험 전류 =50mA, 계측 전류=50mA

측정 결과 : PKG junction temperature : 100.533°C

PKG lead temperature : 89.5°C

시험 결과 및 유추 결과



위 결과로부터 구해진 동작 시 Junction Temperature 에 따른 Acceleration factor 와 MTTF

$T_j [^{\circ}\text{C}]$	Acceleration factor	MTTF [hr]
50	7.041	274,720
60	4.136	161,396
70	2.507	97,805
80	1.563	60,976
90	1.00	39,018

LUMENS Reliability Standard

Test Item	Lumens	REF	Test Conditions	Test time	Number of Damaged
			Lumens	Lumens	Lumens
Resistance to Soldering Heat (Reflow Soldering)	O	JESD22-B102	Tsld=260℃, 10sec (Pre treatment 30℃, 70%, 168hrs.)	2 times	0/50
Solderability(Reflow Soldering)	O	JESD22-B102	Tsld=215±5℃, 3sec. (Lead Solder)	1 time over 95%	0/50
Thermal Shock	O	JEITA ED-4701 300 307	0℃~100℃ 15sec. 15sec.	20cycles	0/50
Temperature Cycle	O	JESD22-A 1-6	(-) 40℃~25℃~100℃~25℃ 30min. 5min. 30min. 5min.	100cycles	0/50
Moisture Resistance Cyclic	O	JEITA ED-4701 200 203	25℃ ~ 65℃ ~ -10℃ 90%RH 24hrs./1cycle	10 cycles	0/50
High Temperature Storage	O	JESD22-A103	Ta=100℃	1000hrs.	0/50
Temperature Humidity Storage	O	JESD22-A101	Ta=85℃, RH=85%	1000hrs.	0/50
Low Temperature Storage	O	Internal ref	Ta=-40℃	1000hrs.	0/50
Steady State Operating Life condition 1	O	Internal ref	Ta=25℃, IF=50mA	1000hrs.	0/50
Steady State Operating Life condition 2	O	Internal ref	Ta=25℃, IF=50mA	500hrs.	0/50
On/Off Test	O	Internal ref	1min on 1min off, IF=50mA, Ta= -25℃, 60℃, 25℃	50000 cycle	0/50
Steady State Operating Life condition 3	O	Internal ref	Ta=25℃, IF=50mA	500hrs.	0/50
Steady State Operating Life of High Temperature	O	Internal ref	Ta=85℃, IF=50mA	1000hrs	0/50
Steady State Operating Life of High Humidity Heat	O	Internal ref	85℃, RH=85%, , IF=50mA	1000hrs	0/50
Steady State Operating Life of Low temperature	O	Internal ref	Ta=-30℃, IF=50mA	1000hrs.	0/50
Vibration	O	JEITA ED-4701 400 403	100~2000~100Hz Sweep 4min. 200m/s 23direction, 4cycles	48min	0/50
Substrate Bending	O	JEITA ED-4702	3mm, 5±1sec	1time	0/50
Adhesion Strength	O	JEITA ED-4702	5N, 10±1sec	1time	0/50
Push/Pull test	O			1 time	0/50
Pressure Cooker	O	JESD22-A102B	Ta= 120℃, RH = 100% Pressure = 2atm	1time , 4hrs	0/50

Reliability Test :

Title:	A0A1CEBHAMPY LED (PLCC2) Product Qualification for flashlighting
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Purpose: To qualify the A0A1CEBHAMPY package for display applications.

Sample History: All parts are assembled and tested in Lumens

Product Reliability Qualification Plan:

All units are to be pre-conditioned before proceeding to the respective test.

	Conditions
<ul style="list-style-type: none">• Pre-conditioning as per JEDEC L 2A requirement (JESD22-A113-B)• IR re-flow soldering on FR4 board.	<ul style="list-style-type: none">- Bake @ 125°C, 24 hrs.- Moisture soak @ 60°C/60% RH, 120 hrs.- 3xIR re-flow soldering at 235°C/10 sec. min.(Jedec)

Failure criteria:

- Electrical failures:
 - Vf shift >=10%
- Light Output Degradation:
 - % Iv shift <= -30%
- Visual failures:
 - Broken or damaged package or lead
 - Solderability < 95% wetting
 - Dimension out of tolerance

Reliability Test Matrix.

3X IR/Convective Reflow Process at Peak Temperature 260°C for 10-20 sec.

Pre-conditioning @ 60°C/60% RH for 120 hours.

No	Test Item	Condition	시료수	불량내용	
				Limit 불량	완전 불량
1	상온 동작	Ta=25℃ IF=50mA T=1000hrs	50	0	0
2	저온 동작	Ta=-30℃ IF=50mA T=1000hrs	50	0	0
3	고온 동작	Ta=85℃ IF=50mA T=1000hrs	50	0	0
4	고온 고습 보존	Ta=85℃ RH=85% T=1000hrs	50	0	0
5	온도 순환	Ta=-40~25~100~25℃ (30min~5min~30min~5min) TC=100cycle	50	0	0
6	증기압	Ta=120℃ RH=100% P=2atm T=4hrs	50	0	0
7	Solder Heat	Ta=260℃ T=10sec	50	0	0

Reliability Test Result.

NO	시험항목	시료수	불량수		판정
			LIMIT 불량	완전불량	
1	OLT	50	0	0	PASS
2	HTOL	50	0	0	PASS
3	LTOL	50	0	0	PASS
4	H3ST	50	0	0	PASS
5	TC	50	0	0	PASS
6	PCT	50	0	0	PASS
7	SHT	50	0	0	PASS

Conclusions:

All qualification samples passed.

Operation Life TEST

Test Sampe #	Initial	168hr		500hr		1000hr	
	IV(lm)	IV(lm)	%	IV(lm)	%	IV(lm)	%
1	4.78	4.74	-0.84%	4.84	1.26%	4.71	-1.46%
2	5.50	5.45	-0.91%	5.60	1.82%	5.48	-0.36%
3	6.24	6.16	-1.28%	6.34	1.60%	6.24	0.00%
4	5.42	5.36	-1.11%	5.52	1.85%	5.41	-0.18%
5	4.80	4.78	-0.42%	4.95	3.13%	4.85	1.04%
6	5.21	5.18	-0.58%	5.32	2.11%	5.18	-0.58%
7	5.16	5.11	-0.97%	5.24	1.55%	5.14	-0.39%
8	6.02	5.96	-1.00%	6.08	1.00%	5.97	-0.83%
9	5.22	5.18	-0.77%	5.31	1.72%	5.20	-0.38%
10	6.20	6.16	-0.65%	6.28	1.29%	6.15	-0.81%
11	5.96	5.92	-0.67%	6.07	1.85%	5.99	0.50%
12	5.82	5.81	-0.17%	5.97	2.58%	5.90	1.37%
13	5.51	5.49	-0.36%	5.58	1.27%	5.48	-0.54%
14	5.67	5.60	-1.23%	5.73	1.06%	5.66	-0.18%
15	4.67	4.63	-0.86%	4.71	0.86%	4.63	-0.86%
16	4.70	4.68	-0.43%	4.78	1.70%	4.70	0.00%
17	4.61	4.59	-0.43%	4.67	1.30%	4.58	-0.65%
18	5.50	5.43	-1.27%	5.56	1.09%	5.49	-0.18%
19	5.42	5.38	-0.74%	5.42	0.00%	5.34	-1.48%
20	5.91	5.89	-0.34%	6.03	2.03%	5.92	0.17%
21	5.83	5.85	0.34%	6.00	2.92%	5.88	0.86%
22	4.72	4.66	-1.27%	4.76	0.85%	4.68	-0.85%
23	4.98	4.98	0.00%	5.12	2.81%	5.02	0.80%
24	6.15	6.14	-0.16%	6.27	1.95%	6.11	-0.65%
25	5.89	5.90	0.17%	6.09	3.40%	5.98	1.53%
26	6.18	6.15	-0.49%	6.32	2.27%	6.17	-0.16%
27	4.55	4.52	-0.66%	4.62	1.54%	4.54	-0.22%
28	5.12	5.09	-0.59%	5.20	1.56%	5.11	-0.20%
29	6.08	6.08	0.00%	6.17	1.48%	6.05	-0.49%
30	4.59	4.55	-0.87%	4.68	1.96%	4.61	0.44%
31	5.82	5.82	0.00%	5.96	2.41%	5.81	-0.17%
32	5.59	5.55	-0.72%	5.70	1.97%	5.63	0.72%
33	4.97	4.93	-0.80%	5.09	2.41%	5.00	0.60%
34	4.71	4.72	0.21%	4.80	1.91%	4.74	0.64%
35	6.27	6.27	0.00%	6.34	1.12%	6.23	-0.64%
36	5.82	5.78	-0.69%	5.96	2.41%	5.81	-0.17%
37	5.23	5.21	-0.38%	5.29	1.15%	5.18	-0.96%
38	6.25	6.16	-1.44%	6.37	1.92%	6.21	-0.64%
39	5.53	5.48	-0.90%	5.54	0.18%	5.43	-1.81%
40	4.73	4.71	-0.42%	4.82	1.90%	4.71	-0.42%
41	5.81	5.82	0.17%	5.95	2.41%	5.84	0.52%
42	6.10	6.08	-0.33%	6.12	0.33%	5.99	-1.80%
43	5.57	5.57	0.00%	5.68	1.97%	5.56	-0.18%
44	4.55	4.52	-0.66%	4.56	0.22%	4.46	-1.98%
45	5.57	5.57	0.00%	5.72	2.69%	5.66	1.62%
46	6.05	6.05	0.00%	6.16	1.82%	6.06	0.17%
47	6.24	6.19	-0.80%	6.29	0.80%	6.17	-1.12%
48	4.78	4.78	0.00%	4.89	2.30%	4.76	-0.42%
49	5.28	5.22	-1.14%	5.40	2.27%	5.30	0.38%
50	4.86	4.83	-0.62%	4.89	0.62%	4.81	-1.03%
Min.	4.55	4.52	-1.44%	4.56	0.00%	4.46	-1.98%
Max.	6.27	6.27	0.34%	6.37	3.40%	6.24	1.62%
Average	5.44	5.41	-0.54%	5.54	1.69%	5.43	-0.23%
std	0.56	0.56	0.00	0.57	0.01	0.56	0.01

High Temperature Life TEST

No.	0	168	H	500	H	1000	H
1	2.98	3.16	6.0%	3.21	7.7%	3.13	5.0%
2	2.93	3.07	4.8%	3.08	5.1%	2.98	1.7%
3	2.81	2.93	4.3%	2.98	6.0%	2.92	3.9%
4	2.79	2.91	4.3%	2.93	5.0%	2.87	2.9%
5	2.83	2.98	5.3%	3.05	7.8%	2.99	5.7%
6	3.38	3.56	5.3%	3.58	5.9%	3.49	3.3%
7	2.94	3.11	5.8%	3.11	5.8%	3.01	2.4%
8	3.39	3.53	4.1%	3.53	4.1%	3.45	1.8%
9	2.75	2.86	4.0%	2.85	3.6%	2.82	2.5%
10	2.73	2.86	4.8%	2.88	5.5%	2.79	2.2%
11	2.99	3.15	5.4%	3.21	7.4%	3.17	6.0%
12	3.35	3.53	5.4%	3.57	6.6%	3.48	3.9%
13	3.27	3.42	4.6%	3.48	6.4%	3.42	4.6%
14	3.14	3.30	5.1%	3.37	7.3%	3.32	5.7%
15	3.33	3.52	5.7%	3.55	6.6%	3.43	3.0%
16	3.18	3.31	4.1%	3.33	4.7%	3.29	3.5%
17	2.77	2.87	3.6%	2.93	5.8%	2.87	3.6%
18	3.33	3.50	5.1%	3.56	6.9%	3.48	4.5%
19	3.02	3.18	5.3%	3.17	5.0%	3.07	1.7%
20	2.84	2.98	4.9%	3.02	6.3%	2.93	3.2%
21	3.01	3.16	5.0%	3.18	5.6%	3.10	3.0%
22	3.37	3.56	5.6%	3.59	6.5%	3.46	2.7%
23	3.07	3.19	3.9%	3.24	5.5%	3.16	2.9%
24	3.20	3.37	5.3%	3.41	6.6%	3.32	3.7%
25	3.05	3.20	4.9%	3.19	4.6%	3.08	1.0%
26	3.00	3.16	5.3%	3.19	6.3%	3.11	3.7%
27	3.27	3.42	4.6%	3.45	5.5%	3.38	3.4%
28	3.18	3.36	5.7%	3.36	5.7%	3.28	3.1%
29	3.36	3.57	6.3%	3.58	6.5%	3.53	5.1%
30	2.74	2.88	5.1%	2.87	4.7%	2.81	2.6%
31	3.05	3.17	3.9%	3.21	5.2%	3.16	3.6%
32	3.29	3.46	5.2%	3.53	7.3%	3.41	3.6%
33	3.28	3.43	4.6%	3.51	7.0%	3.46	5.5%
34	3.25	3.40	4.6%	3.43	5.5%	3.34	2.8%
35	2.89	3.03	4.8%	3.06	5.9%	3.00	3.8%
36	2.79	2.97	6.5%	3.02	8.2%	2.93	5.0%
37	2.71	2.81	3.7%	2.85	5.2%	2.77	2.2%
38	2.99	3.13	4.7%	3.17	6.0%	3.08	3.0%
39	3.21	3.36	4.7%	3.37	5.0%	3.29	2.5%
40	2.75	2.87	4.4%	2.86	4.0%	2.76	0.4%
41	3.22	3.40	5.6%	3.42	6.2%	3.30	2.5%
42	3.07	3.25	5.9%	3.27	6.5%	3.21	4.6%
43	3.16	3.33	5.4%	3.41	7.9%	3.33	5.4%
44	2.97	3.09	4.0%	3.12	5.1%	3.06	3.0%
45	2.70	2.83	4.8%	2.85	5.6%	2.78	3.0%
46	3.28	3.45	5.2%	3.51	7.0%	3.43	4.6%
47	3.15	3.29	4.4%	3.30	4.8%	3.18	1.0%
48	3.37	3.55	5.3%	3.60	6.8%	3.49	3.6%
49	3.03	3.20	5.6%	3.23	6.6%	3.16	4.3%
50	3.14	3.32	5.7%	3.37	7.3%	3.29	4.8%
Min.	2.70	2.81	3.6%	2.85	3.6%	2.76	0.4%
Max.	3.39	3.57	6.5%	3.60	8.2%	3.53	6.0%
Average	3.07	3.22	5.0%	3.25	6.0%	3.17	3.4%
std	0.22	0.23	0.7%	0.24	1.1%	0.23	1.3%

Low Temperature Life TEST

Test Sampe #	Initial	168hr		500hr		1000hr	
	IV(lm)	IV(lm)	%	IV(lm)	%	IV(lm)	%
1	4.63	4.70	1.51%	4.76	2.81%	4.71	1.73%
2	5.94	6.07	2.19%	6.15	3.54%	6.09	2.53%
3	5.28	5.39	2.08%	5.36	1.52%	5.34	1.14%
4	5.58	5.68	1.79%	5.74	2.87%	5.65	1.25%
5	5.42	5.53	2.03%	5.63	3.87%	5.56	2.58%
6	4.63	4.72	1.94%	4.74	2.38%	4.70	1.51%
7	6.04	6.14	1.66%	6.12	1.32%	5.97	-1.16%
8	4.53	4.61	1.77%	4.60	1.55%	4.55	0.44%
9	6.09	6.19	1.64%	6.24	2.46%	6.15	0.99%
10	5.47	5.54	1.28%	5.55	1.46%	5.49	0.37%
11	4.59	4.66	1.53%	4.67	1.74%	4.58	-0.22%
12	4.92	5.05	2.64%	5.05	2.64%	4.98	1.22%
13	5.89	6.01	2.04%	6.08	3.23%	6.00	1.87%
14	5.17	5.26	1.74%	5.24	1.35%	5.15	-0.39%
15	4.82	4.90	1.66%	4.94	2.49%	4.87	1.04%
16	6.29	6.43	2.23%	6.50	3.34%	6.40	1.75%
17	5.88	6.03	2.55%	6.08	3.40%	6.01	2.21%
18	5.83	5.97	2.40%	6.07	4.12%	5.97	2.40%
19	5.99	6.15	2.67%	6.21	3.67%	6.17	3.01%
20	5.45	5.57	2.20%	5.67	4.04%	5.58	2.39%
21	5.14	5.26	2.33%	5.25	2.14%	5.18	0.78%
22	5.13	5.25	2.34%	5.33	3.90%	5.21	1.56%
23	5.91	6.04	2.20%	6.19	4.74%	6.06	2.54%
24	5.78	5.89	1.90%	5.93	2.60%	5.86	1.38%
25	5.40	5.51	2.04%	5.54	2.59%	5.42	0.37%
26	4.52	4.64	2.65%	4.75	5.09%	4.68	3.54%
27	5.51	5.61	1.81%	5.66	2.72%	5.58	1.27%
28	5.20	5.28	1.54%	5.32	2.31%	5.24	0.77%
29	5.42	5.52	1.85%	5.52	1.85%	5.41	-0.18%
30	5.29	5.40	2.08%	5.51	4.16%	5.47	3.40%
31	6.08	6.22	2.30%	6.21	2.14%	6.12	0.66%
32	5.58	5.69	1.97%	5.80	3.94%	5.73	2.69%
33	6.01	6.13	2.00%	6.19	3.00%	6.11	1.66%
34	5.53	5.60	1.27%	5.63	1.81%	5.56	0.54%
35	5.88	5.98	1.70%	6.04	2.72%	5.91	0.51%
36	5.11	5.16	0.98%	5.14	0.59%	5.08	-0.59%
37	6.10	6.22	1.97%	6.20	1.64%	6.10	0.00%
38	5.41	5.52	2.03%	5.60	3.51%	5.50	1.66%
39	6.03	6.14	1.82%	6.31	4.64%	6.24	3.48%
40	6.10	6.23	2.13%	6.30	3.28%	6.24	2.30%
41	5.95	6.04	1.51%	6.09	2.35%	6.00	0.84%
42	5.06	5.20	2.77%	5.31	4.94%	5.27	4.15%
43	5.94	6.09	2.53%	6.09	2.53%	5.97	0.51%
44	5.49	5.58	1.64%	5.68	3.46%	5.60	2.00%
45	5.59	5.71	2.15%	5.71	2.15%	5.60	0.18%
46	4.93	5.04	2.23%	5.05	2.43%	5.00	1.42%
47	6.24	6.36	1.92%	6.46	3.53%	6.40	2.56%
48	4.71	4.79	1.70%	4.80	1.91%	4.75	0.85%
49	4.52	4.57	1.11%	4.64	2.65%	4.58	1.33%
50	4.96	5.06	2.02%	5.07	2.22%	5.04	1.61%
Min.	4.52	4.57	0.98%	4.60	0.59%	4.55	-1.16%
Max.	6.29	6.43	2.77%	6.50	5.09%	6.40	4.15%
Average	5.46	5.57	1.96%	5.61	2.83%	5.54	1.41%
std	0.52	0.53	0.00	0.55	0.01	0.53	0.01

High Humidity Heat Storage TEST

Test Sampe #	Initial	168hr		500hr		1000hr	
	IV(lm)	IV(lm)	%	IV(lm)	%	IV(lm)	%
1	4.87	5.02	3.08%	5.07	4.11%	5.01	2.87%
2	4.99	5.15	3.21%	5.29	6.01%	5.13	2.81%
3	4.75	4.94	4.00%	4.98	4.84%	4.86	2.32%
4	4.84	5.06	4.55%	5.20	7.44%	5.06	4.55%
5	4.88	5.17	5.94%	5.30	8.61%	5.19	6.35%
6	4.96	5.23	5.44%	5.25	5.85%	5.24	5.65%
7	4.73	4.95	4.65%	5.03	6.34%	4.94	4.44%
8	4.76	5.06	6.30%	5.08	6.72%	4.91	3.15%
9	4.86	4.98	2.47%	5.14	5.76%	4.94	1.65%
10	4.98	5.14	3.21%	5.21	4.62%	5.17	3.82%
11	4.79	4.99	4.18%	5.08	6.05%	4.94	3.13%
12	4.91	5.20	5.91%	5.39	9.78%	5.33	8.55%
13	4.88	5.13	5.12%	5.22	6.97%	5.21	6.76%
14	4.86	5.05	3.91%	5.13	5.56%	4.96	2.06%
15	4.82	5.05	4.77%	5.13	6.43%	4.99	3.53%
16	4.75	4.93	3.79%	5.00	5.26%	4.91	3.37%
17	4.83	5.12	6.00%	5.19	7.45%	5.11	5.80%
18	4.77	4.97	4.19%	5.05	5.87%	4.98	4.40%
19	4.74	4.94	4.22%	5.06	6.75%	4.99	5.27%
20	4.89	5.15	5.32%	5.32	8.79%	5.13	4.91%
21	4.75	4.91	3.37%	4.96	4.42%	4.81	1.26%
22	4.95	5.14	3.84%	5.29	6.87%	5.13	3.64%
23	5.00	5.21	4.20%	5.31	6.20%	5.14	2.80%
24	4.82	5.12	6.22%	5.25	8.92%	5.13	6.43%
25	4.94	5.17	4.66%	5.32	7.69%	5.19	5.06%
26	4.94	5.15	4.25%	5.25	6.28%	5.14	4.05%
27	4.79	4.98	3.97%	5.03	5.01%	4.91	2.51%
28	4.80	5.10	6.25%	5.14	7.08%	5.01	4.38%
29	4.95	5.28	6.67%	5.36	8.28%	5.24	5.86%
30	4.94	5.19	5.06%	5.37	8.70%	5.32	7.69%
31	4.74	4.89	3.16%	4.91	3.59%	4.75	0.21%
32	4.79	5.10	6.47%	5.26	9.81%	5.19	8.35%
33	4.88	5.07	3.89%	5.15	5.53%	5.11	4.71%
34	4.81	5.01	4.16%	5.02	4.37%	4.96	3.12%
35	4.89	5.13	4.91%	5.30	8.38%	5.15	5.32%
36	4.97	5.22	5.03%	5.35	7.65%	5.21	4.83%
37	4.91	5.05	2.85%	5.20	5.91%	5.04	2.65%
38	4.81	5.08	5.61%	5.17	7.48%	5.12	6.44%
39	4.78	5.02	5.02%	5.19	8.58%	4.98	4.18%
40	4.98	5.23	5.02%	5.41	8.63%	5.28	6.02%
41	4.81	5.00	3.95%	5.08	5.61%	4.92	2.29%
42	4.79	4.97	3.76%	5.09	6.26%	4.97	3.76%
43	4.99	5.20	4.21%	5.36	7.41%	5.27	5.61%
44	4.81	5.01	4.16%	5.12	6.44%	5.11	6.24%
45	4.82	5.01	3.94%	5.12	6.22%	5.05	4.77%
46	4.86	4.98	2.47%	5.07	4.32%	4.95	1.85%
47	4.85	5.15	6.19%	5.27	8.66%	5.09	4.95%
48	4.78	4.92	2.93%	5.04	5.44%	4.92	2.93%
49	4.94	5.09	3.04%	5.24	6.07%	5.10	3.24%
50	4.71	4.90	4.03%	4.99	5.94%	4.82	2.34%
Min.	4.71	4.89	2.47%	4.91	3.59%	4.75	0.21%
Max.	5.00	5.28	6.67%	5.41	9.81%	5.33	8.55%
Average	4.85	5.07	4.47%	5.17	6.62%	5.06	4.26%
std	0.082	0.10	0.011	0.13	0.015	0.138	0.018

Temperature Cycle TEST

Test Sample #	Initial	100 Cycle		200 Cycle	
	IV(lm)	IV(lm)	%	IV(lm)	%
1	5.62	5.56	-1.07%	5.65	0.53%
2	5.27	5.20	-1.33%	5.27	0.00%
3	5.94	5.86	-1.35%	5.97	0.51%
4	5.11	5.06	-0.98%	5.14	0.59%
5	5.57	5.53	-0.72%	5.61	0.72%
6	6.20	6.15	-0.81%	6.23	0.48%
7	5.69	5.62	-1.23%	5.70	0.18%
8	5.32	5.28	-0.75%	5.31	-0.19%
9	5.73	5.67	-1.05%	5.77	0.70%
10	5.96	5.88	-1.34%	5.96	0.00%
11	5.76	5.69	-1.22%	5.78	0.35%
12	6.16	6.10	-0.97%	6.15	-0.16%
13	5.29	5.23	-1.13%	5.32	0.57%
14	6.29	6.22	-1.11%	6.30	0.16%
15	5.57	5.51	-1.08%	5.54	-0.54%
16	4.51	4.46	-1.11%	4.51	0.00%
17	4.55	4.50	-1.10%	4.57	0.44%
18	5.47	5.39	-1.46%	5.46	-0.18%
19	5.72	5.67	-0.87%	5.75	0.52%
20	5.22	5.18	-0.77%	5.21	-0.19%
21	5.04	5.00	-0.79%	5.04	0.00%
22	5.60	5.55	-0.89%	5.60	0.00%
23	5.61	5.55	-1.07%	5.62	0.18%
24	5.67	5.62	-0.88%	5.66	-0.18%
25	5.24	5.19	-0.95%	5.26	0.38%
26	5.24	5.20	-0.76%	5.24	0.00%
27	5.20	5.17	-0.58%	5.24	0.77%
28	5.48	5.44	-0.73%	5.49	0.18%
29	5.78	5.72	-1.04%	5.82	0.69%
30	4.92	4.87	-1.02%	4.92	0.00%
31	4.94	4.91	-0.61%	4.95	0.20%
32	5.94	5.89	-0.84%	5.98	0.67%
33	6.08	6.02	-0.99%	6.10	0.33%
34	4.51	4.48	-0.67%	4.51	0.00%
35	4.89	4.85	-0.82%	4.91	0.41%
36	6.17	6.13	-0.65%	6.24	1.13%
37	5.33	5.27	-1.13%	5.33	0.00%
38	6.05	5.97	-1.32%	6.02	-0.50%
39	4.86	4.81	-1.03%	4.88	0.41%
40	5.83	5.76	-1.20%	5.84	0.17%
41	5.69	5.62	-1.23%	5.66	-0.53%
42	6.14	6.06	-1.30%	6.16	0.33%
43	4.51	4.47	-0.89%	4.55	0.89%
44	5.42	5.35	-1.29%	5.44	0.37%
45	6.11	6.06	-0.82%	6.10	-0.16%
46	5.92	5.84	-1.35%	5.93	0.17%
47	5.40	5.33	-1.30%	5.38	-0.37%
48	6.12	6.04	-1.31%	6.13	0.16%
49	4.58	4.54	-0.87%	4.58	0.00%
50	5.80	5.76	-0.69%	5.85	0.86%
Min.	4.51	4.46	-1.46%	4.51	-0.54%
Max.	6.29	6.22	-0.58%	6.30	1.13%
Average	5.50	5.44	-1.01%	5.51	0.22%
std	0.50	0.49	0.00	0.50	0.00

PRESSURE COOKER TEST

Test Sample #	Initial	PCT		Test Sample #	initial	PCT	
	IV(lm)	IV(lm)	%		IV(lm)	IV(lm)	%
1	5.52	4.76	-13.77%	26	5.13	4.62	-9.94%
2	4.93	4.22	-14.40%	27	5.94	5.33	-10.27%
3	6.02	5.27	-12.46%	28	4.85	4.20	-13.40%
4	6.18	5.33	-13.75%	29	5.11	4.49	-12.13%
5	5.08	4.45	-12.40%	30	6.06	5.22	-13.86%
6	5.12	4.56	-10.94%	31	6.04	5.24	-13.25%
7	5.99	5.29	-11.69%	32	6.26	5.49	-12.30%
8	4.95	4.24	-14.34%	33	4.65	4.02	-13.55%
9	4.81	4.30	-10.60%	34	5.35	4.71	-11.96%
10	4.84	4.26	-11.98%	35	5.52	4.75	-13.95%
11	4.51	4.00	-11.31%	36	5.70	4.97	-12.81%
12	4.76	4.20	-11.76%	37	6.09	5.50	-9.69%
13	5.84	5.26	-9.93%	38	5.98	5.16	-13.71%
14	4.75	4.14	-12.84%	39	5.11	4.67	-8.61%
15	4.74	4.15	-12.45%	40	5.91	5.35	-9.48%
16	5.24	4.73	-9.73%	41	6.27	5.37	-14.35%
17	5.10	4.42	-13.33%	42	5.80	5.07	-12.59%
18	4.86	4.44	-8.64%	43	5.77	4.99	-13.52%
19	4.67	4.06	-13.06%	44	5.88	5.29	-10.03%
20	5.94	5.22	-12.12%	45	6.01	5.39	-10.32%
21	4.82	4.37	-9.34%	46	5.41	4.72	-12.75%
22	4.92	4.44	-9.76%	47	5.53	5.04	-8.86%
23	6.24	5.69	-8.81%	48	4.82	4.37	-9.34%
24	5.56	4.95	-10.97%	49	4.87	4.30	-11.70%
25	6.12	5.58	-8.82%	50	5.99	5.41	-9.68%
min	4.00	2.01	-14.4%				
max	5.69	2.49	-8.6%				
avg	4.80	2.26	-11.6%				
std	0.50	0.15	0.02				

SOLDER HEATING TEST

Test Sample #	Initial	SHT		Test Sample #	initial	SHT	
	IV(cd)	IV(cd)	%		IV(cd)	IV(cd)	%
1	2.65	2.54	-4.15%	26	2.72	2.64	-2.94%
2	2.87	2.77	-3.48%	27	2.78	2.61	-6.12%
3	2.65	2.54	-4.15%	28	2.87	2.73	-4.88%
4	2.74	2.63	-4.01%	29	2.93	2.80	-4.44%
5	2.66	2.57	-3.38%	30	2.62	2.55	-2.67%
6	2.73	2.63	-3.66%	31	3.07	2.88	-6.19%
7	2.60	2.45	-5.77%	32	3.03	2.85	-5.94%
8	2.86	2.73	-4.55%	33	2.66	2.54	-4.51%
9	2.61	2.46	-5.75%	34	2.69	2.55	-5.20%
10	2.93	2.79	-4.78%	35	3.01	2.92	-2.99%
11	2.65	2.52	-4.91%	36	2.97	2.85	-4.04%
12	3.06	2.91	-4.90%	37	2.68	2.52	-5.97%
13	2.83	2.66	-6.01%	38	2.95	2.85	-3.39%
14	2.86	2.76	-3.50%	39	3.05	2.88	-5.57%
15	2.92	2.77	-5.14%	40	2.99	2.85	-4.68%
16	2.68	2.58	-3.73%	41	2.72	2.55	-6.25%
17	2.64	2.52	-4.55%	42	2.68	2.60	-2.99%
18	2.93	2.76	-5.80%	43	2.86	2.78	-2.80%
19	2.68	2.53	-5.60%	44	2.90	2.75	-5.17%
20	2.90	2.79	-3.79%	45	2.73	2.63	-3.66%
21	2.69	2.60	-3.35%	46	2.69	2.52	-6.32%
22	3.04	2.89	-4.93%	47	3.05	2.95	-3.28%
23	2.75	2.63	-4.36%	48	3.03	2.91	-3.96%
24	2.62	2.48	-5.34%	49	2.80	2.67	-4.64%
25	2.92	2.80	-4.11%	50	2.85	2.67	-6.32%
min	2.60	2.45	-6.3%				
max	3.07	2.95	-2.7%				
avg	2.82	2.69	-4.6%				
std	0.15	0.14	0.01				

ESD-HBM Test

Product	: A0A1CEBHAMPY
Testing Item	: ESD-HBM/MM
Test Date	: 2012/02/15
Test Method	: Human Body Model : MIL-STD-883D Method 3015.7
Failure Criteria	: FOR V CHANGE AT 1 μ A \pm 30%
Test Voltage	: 100V~5000V

Test Equipment:

KEYTEK Auto ESD ZAPMASTER Tester

Environmental Condition of Laboratory:

Temperature: 25°C \pm 5°C

Humidity: 55% \pm 10% RH

Test Result:

Human Body Model, HBM+

Sample	1	2	3	4	5
	Pass	Pass	Pass	Pass	Pass

Sample	6	7	8	9	10
	Pass	Pass	Pass	Pass	Pass

Human Body Model, HBM-

Sample	1	2	3	4	5
	Pass	Pass	Pass	Pass	Pass

Sample	6	7	8	9	10
	Pass	Pass	Pass	Pass	Pass

Conclusions:

The reliability tests were designed to evaluate both package integrity as well as workability of product performance over time.

All sample has done well by completed the test required for ALT, ELT, PLT and TC test. The result shows that all sample passed the qualification criteria with ZERO failure.
From design standpoint, the package is robust enough to meets its datasheet conditions.

Matters That Require Attention

(1) Safety Reminder

Do not look squarely at the product turned on.
(Light of the product would make your eyes hurt.)

(2) Static Electricity-handle with care

As the product is sensitive to static electricity, scrupulous attention is required in handling. Especially, if overvoltage is implied to the product, such as overvoltage higher than maximum forward voltage, the product will be damaged by energy due to the overvoltage. Do not touch terminals of the product directly with bare hands.

Also, complete measures against static electricity and/or surge should be established.

Furthermore, in order to keep down a surge current generated by ON-OFF operation below maximum rated value, it is recommended to insert an appropriate protection circuit to driver circuit.

With respect to measures against static electricity and/or surge during handling, there exist several effective measures or equipments such as human body ground connection (through 1M Ω), conductive mat, conductive working clothes, conductive shoes, anti-ESD gloves, and conductive container.

In certain circumstances or facilities in which static electricity is likely to occur, using ionizer is strongly recommended.

In case the product becomes defective by static electricity, confirm certainty of the measures.

(3) Drive Condition

The product should be driven by forward current. If reverse voltage drove the product, it would be damaged by electromigration, and thus, special cautions are needed.

(4) Handling of Silicone Resin LED Products

As the product comprises silicone encapsulation material, there is a high probability that the properties and the reliability of the product are negatively influenced by an external force, circumstances, and etc. Before using the product, please be informed of below precautions:

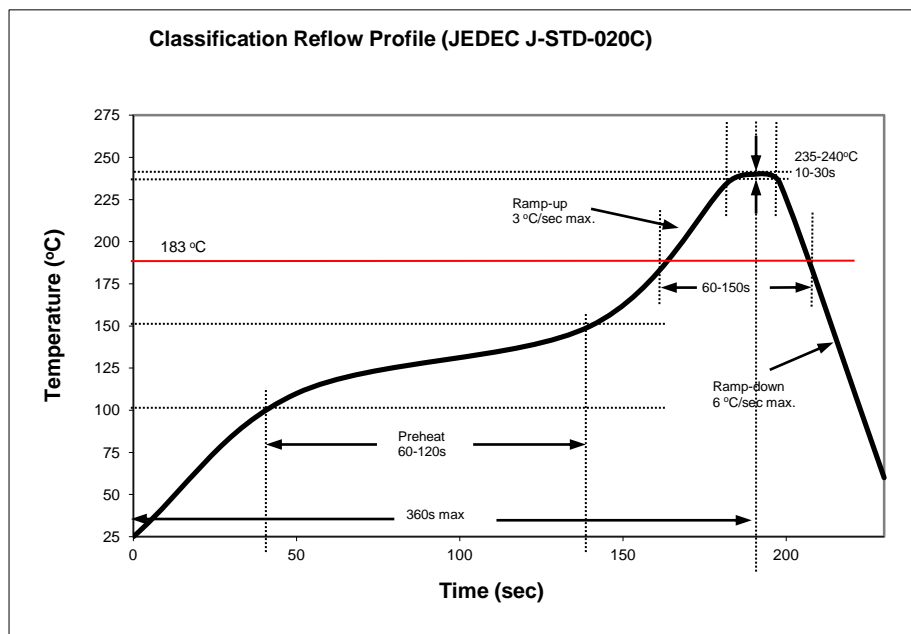
- The encapsulated material of the product is silicone resin, which is low strength material compared to epoxy resin. Therefore, the product requires special care in handling and precautions should be taken in designing other manufactures comprised of the product to avoid the strong pressure or stress on the encapsulated part. For instance, in case of employing surface mounter, it is required to use an adhesion nozzle which does not imply stress to the encapsulation material.
- Compared with epoxy encapsulation material, the silicone encapsulation material is prone to be stained with dust, which is deleterious to the optical characteristics of the product. Before using the product, therefore, it is required to check several circumstances including storage, handling, implement process, and usage circumstances.

(5) Soldering

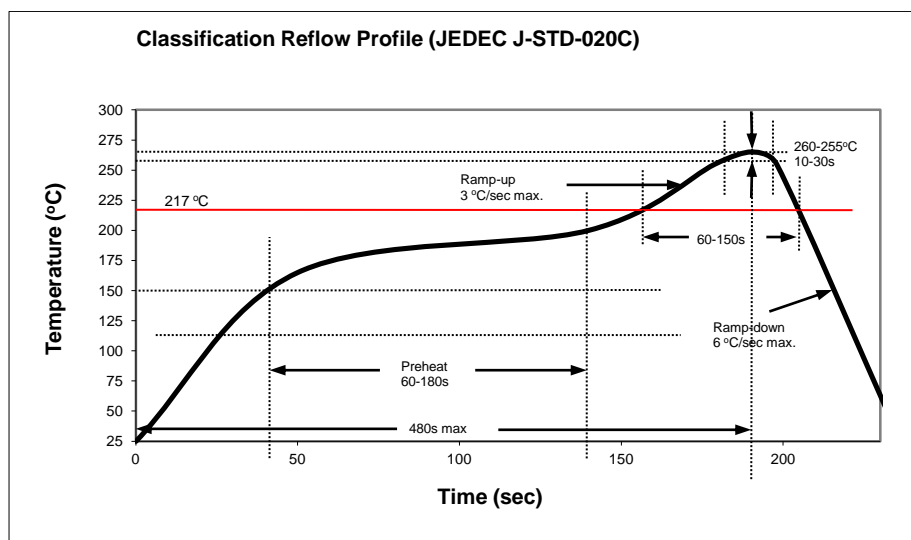
In case of soldering LED product, interface detachment can take place depending on moisture absorption status of the resin. It is well-known that vaporization expansion of the absorbed moisture due to sudden heat change causes this detachment. By this detachment, the optical characteristics of the product are changed, or the reliability of the product can be declined, and thus, special cautions are required.

- Do not imply a stress to the resin at high temperature.
- In mounting the product on board (substrate) or transporting the product, it must not be contacted with other components.
- In reflow soldering, it is required that reflow process should be taken within the scope of below "Suggested Reflow Temperature Profile."
- In case reflow soldering is executed twice, the reflow soldering process should be taken at 30°C/70% RH within 168 hours.
- Flow soldering should be prohibited.
- When modification by hand soldering is needed, use a hot plate whose temperature is set below 150°C. Also, after putting mount board on the hot plate, execute hand soldering with a soldering iron (25W, below 350°C) within 3 seconds.

Recommended Sn-Pb IR-Reflow Soldering Profile.



Recommended Pb Free IR-Reflow Soldering Profile.



(6) Dampproof Packaging

In order to prevent moisture absorption of the resin, the product is packaged by aluminum pack including silica gel. After unsealing the pack, please use the product under below conditions:

1. In case the pack is still sealed, it is required to keep the product at 5~30°C room temperature and below 90% relative humidity, and to use the product within twelve months.
2. After unsealing the pack, it is required to implement the product at 5~30°C room temperature and below 60% relative humidity within 168 hours.
3. After unsealing the pack, in case 168 hours elapsed in above circumstances, or the term of validity has already expired, bake the product 24~48 hours at 60±5°C before usage. After baking, use the product within 72 hours.
The term of validity: twelve months from the seal date (recited in NOTE of aluminum pack label)
4. If baking process were repeated several times, there would be a possibility that detachment resistance of taping becomes weak and some disturbances can take place during mounting process. In case baking process is repeated, therefore, preventive measures are required for avoiding product destruction by static electricity.
5. Do not throw or bump down the product. If laminate packing material tore, the airtightness of the product would get damaged.

6. Indicator in the dampproof packaging functions as a hygrometer. Be advised that this indicator does not represent moisture absorption of resin.

(7) Ambient

If the product were exposed to ambient including corrosiveness gas and etc, this ambient can be a bad influence on the properties of the product.

The product is not designated to be used in special circumstances. So, prior to usage, reliability test should be taken in advance, provided that the product is used under below conditions:

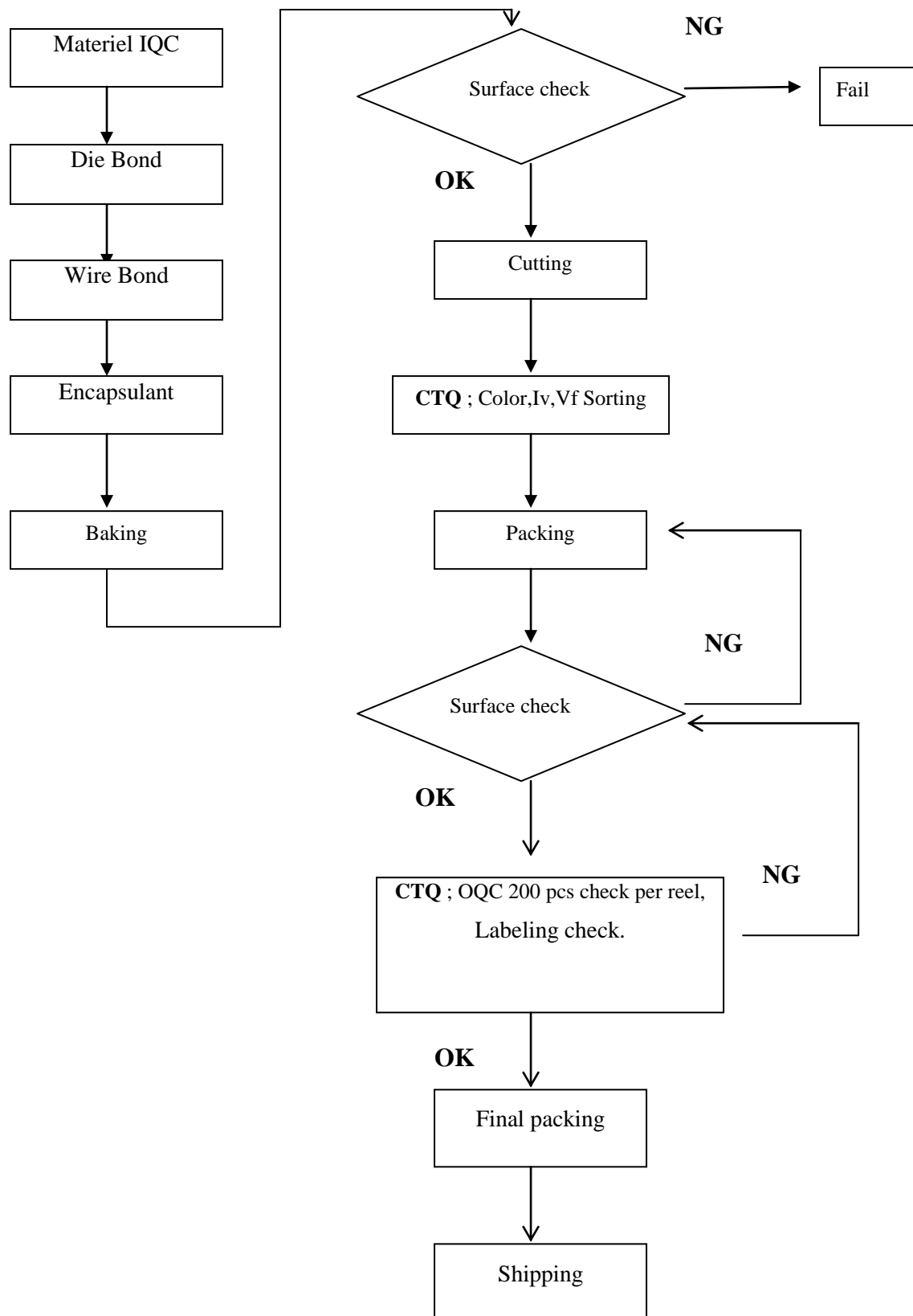
- Condensation (moisture), chloride water, corrosive gas(the gas including sulfur such as SO_x, H₂S, the gas including chlorine, NO_x, NH₃, and etc.), and etc.
- Organic solvent, oil, acidic/alkaline potion, and etc.
- Outdoor use, dust, and etc.

(8) Cleaning

In case cleaning is required after board (substrate) mounting, isopropyl alcohol must be used for cleaning. However, there is a possibility that the encapsulated resin swells according to cleaning condition, and thus, checking the condition of the product is recommended before usage. Meanwhile, since a hydrochloric solvent cause corrosion of a terminal, dissolution of the resin, and/or deterioration of the product, using the hydrochloric solvent should be avoided.

- In ultrasonic waves cleaning, prior to cleaning, make sure that the product doesn't have any problem to be cleaned.
- As brushing sometimes damage a light emitting surface, it should be prohibited.

Process Flow



Cautions:

1. After open the package, the LED should be kept at 30°C, 60%RH or less. The LED should be soldered within 4weeks after opening the package.
2. Heat generation must be taken into design consideration when using the LED.
3. Power must be applied resistors for protection, over current would be caused the optic damage to the devices and wavelength shift.
4. Manual tip solder may cause the damage to Chip devices, so advised that heat of iron should be lower than 15W with temperature control under 5 seconds at 230-260 deg. C. (The device would be got damage in re working process, recommended under 5 seconds at 230-260 deg. C)
5. All equipment and machinery must be properly grounded. It is recommended to use a wristband or anti-electrostatic glove when handing the LED.
6. Use IPA as a solvent for cleaning the LED. The other solvent may dissolve the LED package and the epoxy, Ultrasonic cleaning should not be done.
7. Damaged LED will show unusual characteristics such as leak current remarkably increase, turn-on voltage becomes lower and the LED get unlight at low current.

NOTE :

All the information published is considered to be reliable. However, Lumens does not assume any liability arising out of the application or use of any product described herein.

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