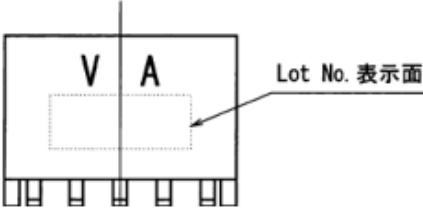
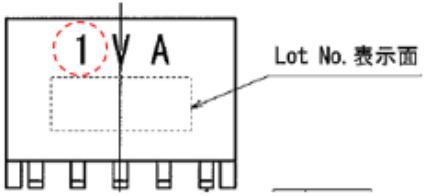
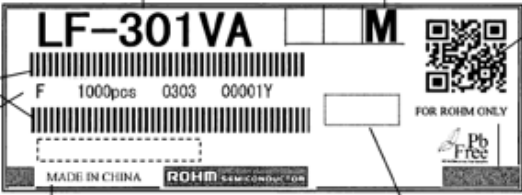



- | | | |
|---|--|--------------|
| ① | Content for Change | (P.2) |
| ② | Specification Change of Wire Bonding | (P.3) |
| ③ | Specification of Silicon Resin Coating | (P.4) |
| ④ | Improvement Effect Verification
(Repetition Test of Reflow + Reliability Test) | (P.5) |
| ⑤ | Evaluation of Circuit Board Mounting
(Circuit Board Mounting+ Reliability Test) | (P.6) |
| ⑥ | Changes in Process Flow | (P.7) |
| ⑦ | Electrical and Optical Characteristics | (P.8) |
| ⑧ | Reliability Test | (P.9) |

① Content for Change

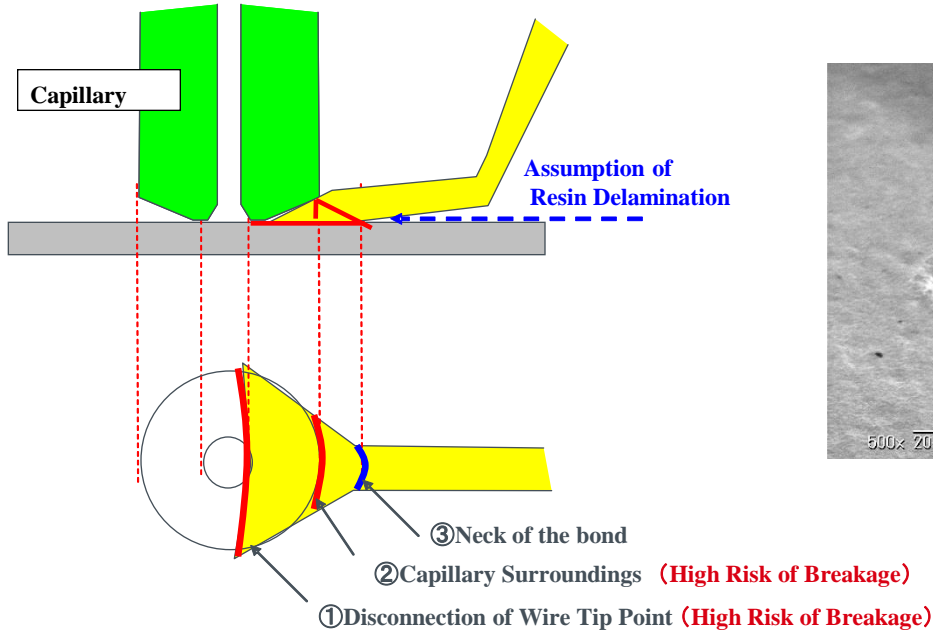
【Change Content】

No.	Item	Before	After
1	Objective of Change	In reflow process, to level up the resistance of temperature load.	
2	Device Name	LF-301**	LF-3011**
3	Product Structure	—	Changed the 2nd bonding as double wire bonding Silicon Resin Coating of LED and 2nd wire
4	Changes on its appearance (Example on the right)		
5	Electrical Characteristics	No change of the Specifications and capability	
6	Optical Characteristics	No change of the Specifications and capability	
7	Reliability Test	No problems before and after the change	
8	SOC: Substance Of Concern	—	Added Silicon Resin
9	Changes in Process	—	Wire Bonding Process (Double Bonding) Add Silicon Resin Coating
10	Specification	—	Record double wire bonding in the outline drawing of specification and add silicon resin.
11	Change in Label (Example on the right)		
12	Classification	Classified by the stock number	

② Specification Change of Wire Bonding

【 Summary 】 Reinforcement of Wire 2nd Bond

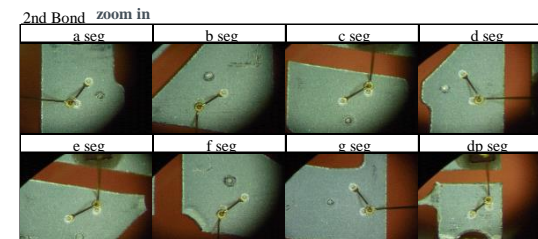
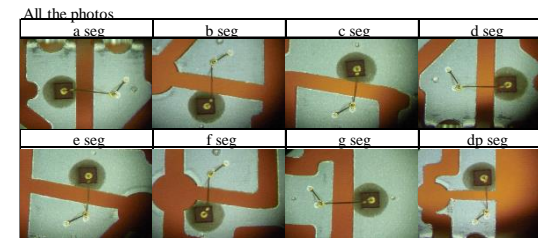
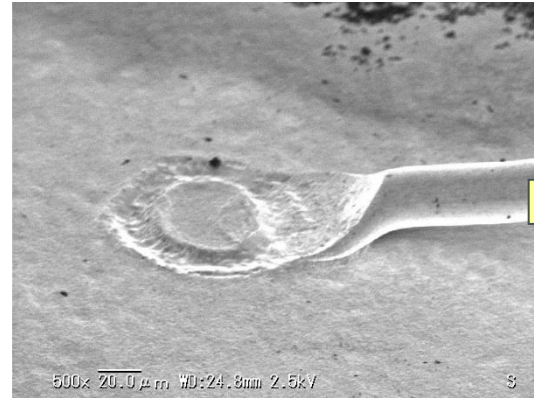
【Cross-section Image】



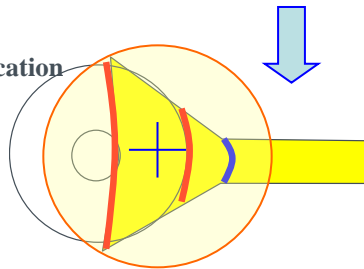
<Photos of 2nd Wire Bonding>

Before (LF-301Series)

After (LF-3011Series)



Improved Specification



(Reinforcement)

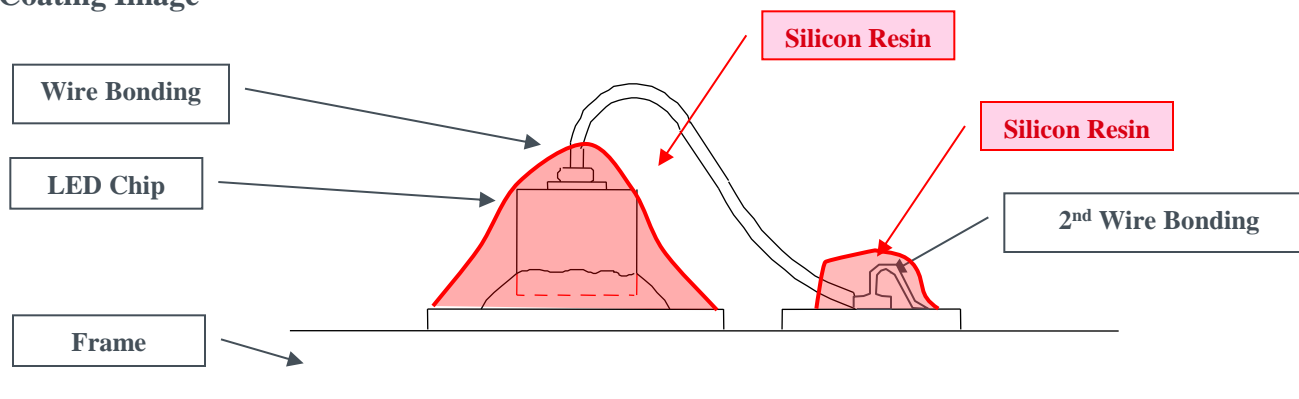
Bond again at the weak points of the wire which has high risk of breakage.

③ Specification of Silicon Resin Coating

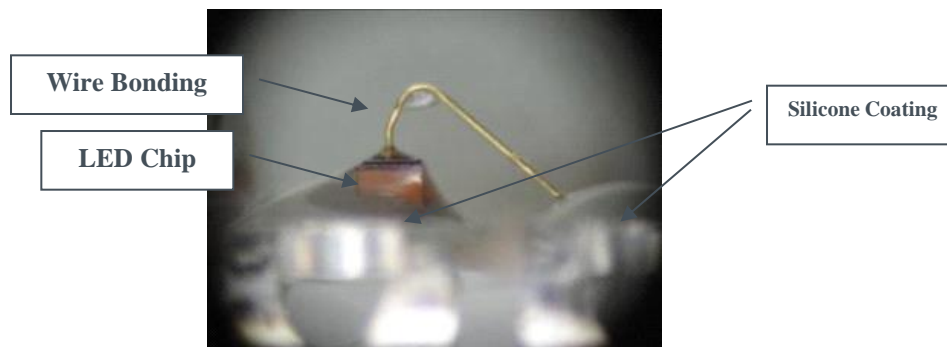
【Silicon Resin Coating Specification】

- Coating around the LED chip and 2nd wire bonding with silicon resin

—Silicone Coating Image—



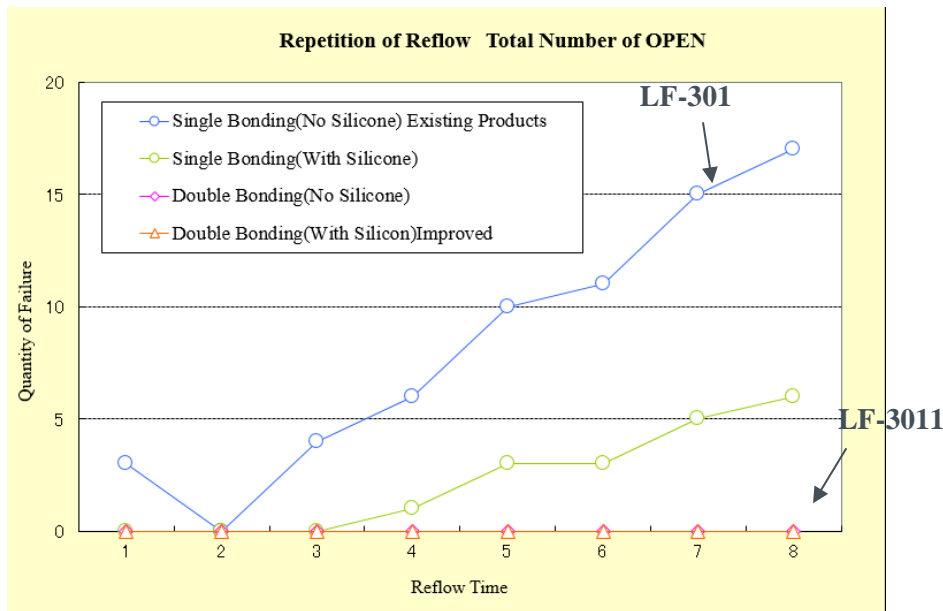
—Silicone Coating Photo—



④ Improvement Effect Verification (Repetition Test of Reflow + Reliability Test)

① (Repetition Test of Reflow Implementation)

Implement under the following conditions
 Verification of the products with
 Silicon Resin (Yes or No), 2nd Wire Bonding (Double/ Single)
 ※Reflow: 250°C Peak



② Temperature Cycling Test for single article -40°C~85°C 30 minutes each.
 No failure after Temperature Cycling Test (Level 4 for evaluation, including the available products) for 500 cycles

Wire Bonding	Si	Quantity	50cyc	100cyc	200cyc	300cyc	500cyc	
Single Bonding	No	22	0/22	0/22	0/22	0/22	0/22	LF-301 Series
	Yes	22	0/22	0/22	0/22	0/22	0/22	
2nd Double Bonding	No	22	0/22	0/22	0/22	0/22	0/22	LF-3011Series
	Yes	22	0/22	0/22	0/22	0/22	0/22	

WB	Silicone Coating	Peak Temperature	N	1	2	3	4	5	6	7	8
2nd Single Bonding	No	250°C	20	3	0	4	6	10	11	15	17
	Yes	250°C	20	0	0	0	1	3	3	5	6
2nd Double Bonding	No	250°C	20	0	0	0	0	0	0	0	0
	Yes	250°C	20	0	0	0	0	0	0	0	0

(Result) The effect of Silicone is confirmed. Furthermore, with 2nd double wire bonding, it is confirmed its improvement effect of failure prevention.
 (Silicon Coating for prevention of LED die bonding delamination)
 And no failure after 500 cycles of Temperature Cycling Test.

⑤ Evaluation of Circuit Board Mounting (Circuit Board Mounting+ Reliability Test)

③Circuit Mounting Reflow+ Temperature Cycling Test

Sample : Improved Product LF-3011VK (Coated with Silicone + 2nd Double Bonding)

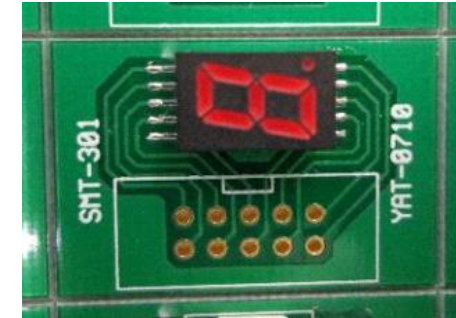
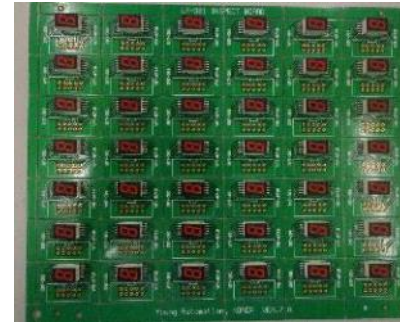
Quantity : 42pcs × 5 Circuit

Test Condition : Reflow 250°C Peak

Mounted Circuit Board (Refer to photo on the right)

Temperature Cycling Test

(-40°C/85°C30min each 50cyc,100cyc,200cyc)



Board Thickness t=1.6mm Grass Epoxy Board

Judgment : Light confirmation at high temperature (about 85°C)

(Result) Light confirmation results of each tests are showed bellow, it is observed no failure of no light after 200cyc of Temperature Cycling Test (mounted).

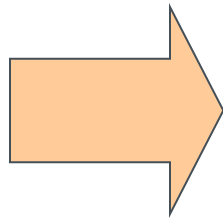
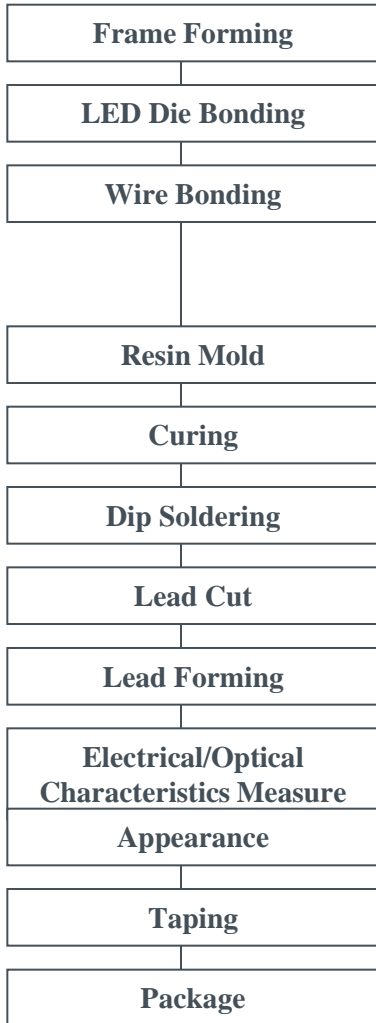
Sample	Quantity	Circuit Board Mounted	Temperature Cycling Test (-40°C/85°C 30min each)		
			50cyc	100cyc	200cyc
Improved Product(Coated with Silicone + 2 nd Double Bonding)	210pcs	Pn/n = 0/210pcs	Pn/n = 0/210pcs	Pn/n = 0/210pcs	Pn/n = 0/210pcs

【Consideration】

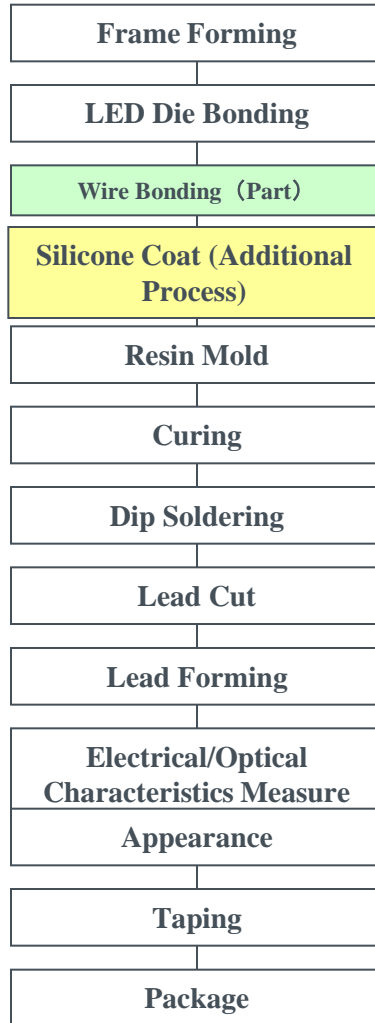
Confirmed no problem with the product mounted.

⑥ Changes in Process Flow

(Before : LF-301A/K Series)

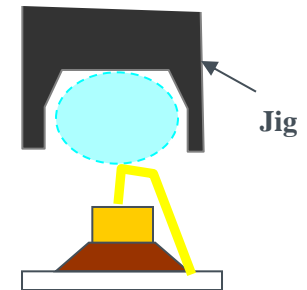
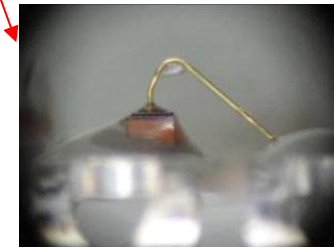


(After : LF-3011A/K Series)



Item	2 nd Double Wire Bonding
Machine	No change
Remark	Actual achievement in series of LA-401D/N, LA-501D/N, LA-601A/K, LB-602A/K2 (Double Wire Bonding)

Silicon Coating : Design a jig which won't hit the chip/wire when printing.



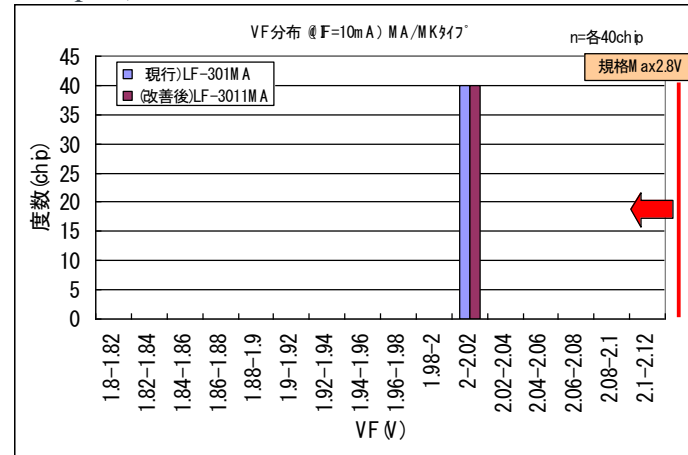
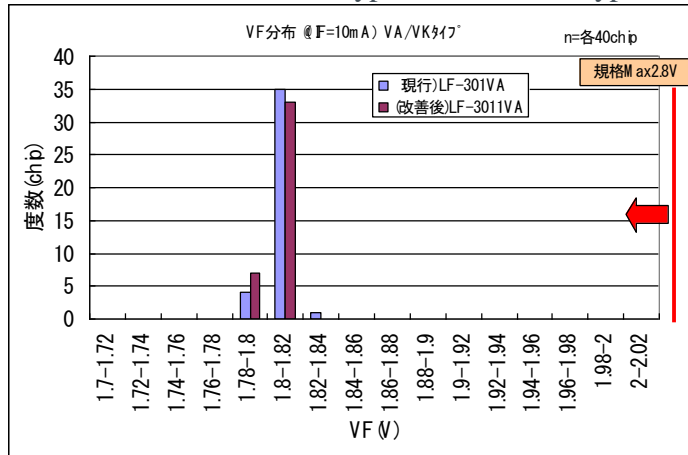
Item	Silicone Coating
Machine	Improved (with devices below)
Remark	Actual achievement in the green chip of LA, LB types (LA-301MB and others)

⑦ Electrical and Optical Characteristics

【Electrical Characteristics (Voltage Characteristics of Forward Direction)】

The following is the confirmation result of electrical characteristics (VF Value, IF=10mA)

(※Common Anode of Red V type and Green M type as the examples)



(Result)

- VF Value : No significant difference after the resin change
There's merit to standard value of specification.

【Optical Characteristics】

- Luminous Intensity Rank : No change (Specification)
- Luminance value : No significant difference
- Emission Wavelength : No significant difference

⑧ Reliability Test

【Reliability Test】

Reliability Test Results of LF-3011A/K Series are showed below

1. TEST RESULT			
TEST ITEM	TEST CONDITION	n [PCS] (Sample QTY.)	P n (NG QTY.)
Temperature cycle	-30°C (30min) ~ 85°C (30min) 100cycle	22	0
High temperature storage	Ta = 85°C 1000hrs	22	0
Low temperature storage	Ta = -30°C 1000hrs	22	0
Load life	I _F = IFMAX Ta = 25°C 1000hrs	22	0

2. FAILURE CRITERIA		
ITEM	CONDITION	CRITERIA
Luminous intensity	I _F = 10mA/Segment	Within 60% of the initial value
Forward voltage	I _F = 10mA	Changing rate within ±10% of initial value.
Reverse Current	V _R = 3V	Within maximum of specification.

3.JUDGMENT
Failure doesn't occur with each test item.