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Date: August 2009

Sub: **AEC-Q200** Testing Data

**Automotive Electronics Council**  
Stress Test Qualification For Passive Components

Table 3 - Test Methods Referenced Aluminum Electrolytic Capacitors  
Grade 1: -40°C to +125°C

Component: ALUMINUM ELECTROLYTIC CAPACITOR

NIC Components PN: NATK301M35V10X10.8LSYF

DESC: 300uF @ 35VDC, 10mm X 10.8mm Size

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**Aluminum Electrolytic Capacitors**  
For automotive equipment

### Environmental Test Summary

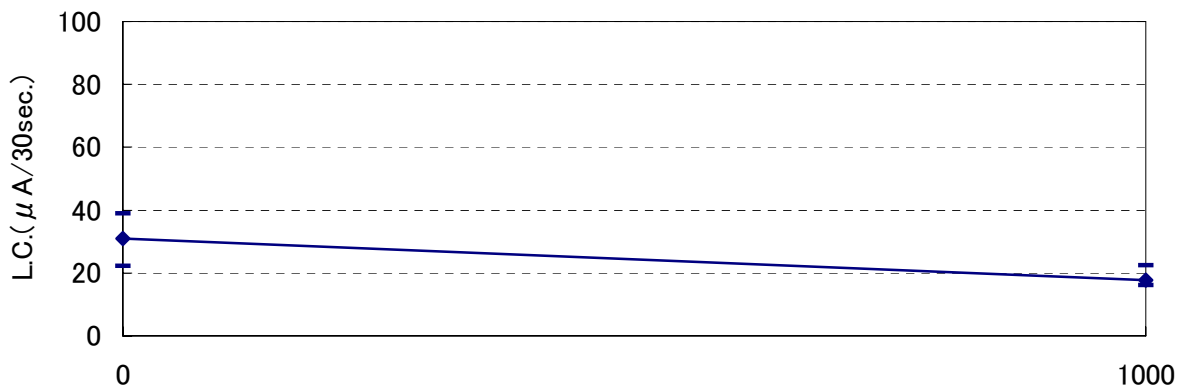
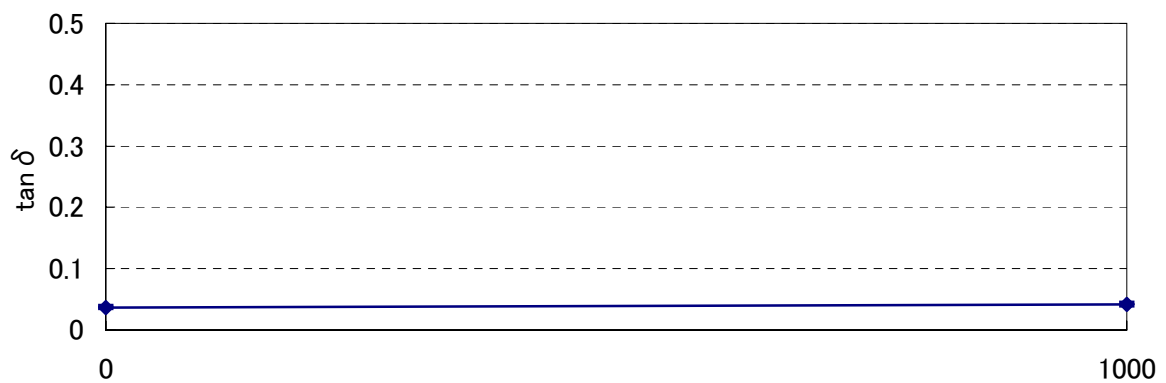
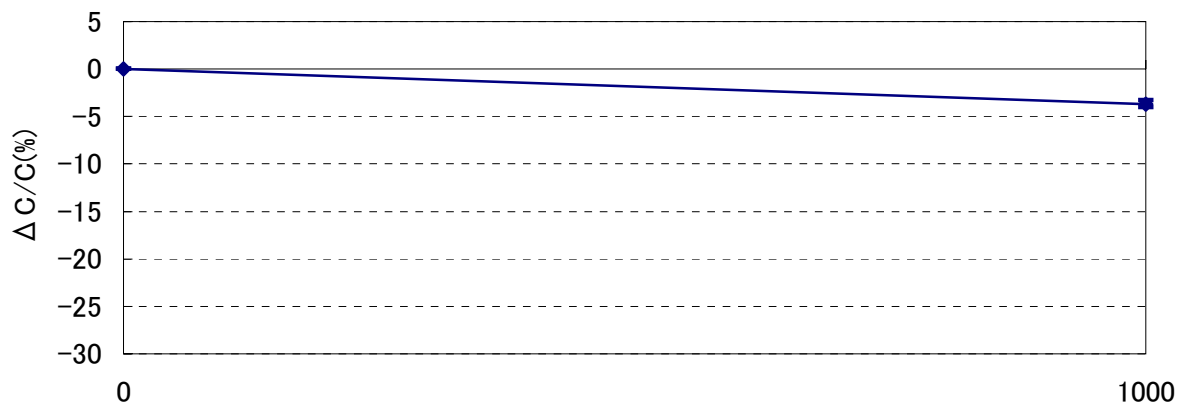
SUPPLIER ; Nippon Industries Co., Ltd.		USER PART NUMBER ;			
NAME OF LABORATORY ; Nippon Industries Co., Ltd.		PART NAME / SUPPLIER PART NUMBER ; ALUMINUM ELECTROLYTIC CAPACITOR / NATK301M35V10X10.8LSYF			
AEC Q200 Test No.	Description	Test Condition	# Lots Tested	Q'ty Tested	Number Failed
3	High Temperature Exposure (Storage)	1000hrs. at 125°C	1	80	0
4	Temperature Cycling	-40°C × 30min ← → +125°C × 30min 1000 cycles	1	80	0
6	Moisture Resistance	MIL-STD-202 Method 202	1	80	0
7	Biased Humidity	1000hrs. at 85°C/85%RH Rated voltage	1	80	0
8	Operational Life	2000hrs. at 125°C Rated voltage	1	80	0
10	Physical Dimension	Per spec.	1	30	0
12	Resistance to Solvents	MIL-STD-202 Method 215	1	5	0
13	Mechanical Shock	MIL-STD-202 Method 213	1	30	0
14	Vibration	5G 20min 12 cycles, 3 directions (X, Y, Z)	1	30	0
15	Resistance to Soldering Heat	MIL-STD-202 Method 210	1	30	0
16	Thermal Shock	-40°C × 15min ← → +125°C × 15min. 300 cycles	1	30	0
17	ESD	AEC-Q200-002	1	15	0
18	Solderability	Per spec.	1	15	0
19	Electrical Characterization	Per spec.	3	90	0
20	Flammability	UL-94-V-0	-	-	-
21	Board Flex	AEC-Q200-005	1	30	0
22	Terminal Strength (SMD)	AEC-Q200-006	1	30	0
27	Surge Voltage	AEC-Q200-007	1	30	0

## TEST CONDITION

1000 hours at 125°C with no voltage applied.

The rated voltage applied for 1 hour after the test.

MODEL No. : NATK301M35V10X10.8LSYF n = 80 pcs.

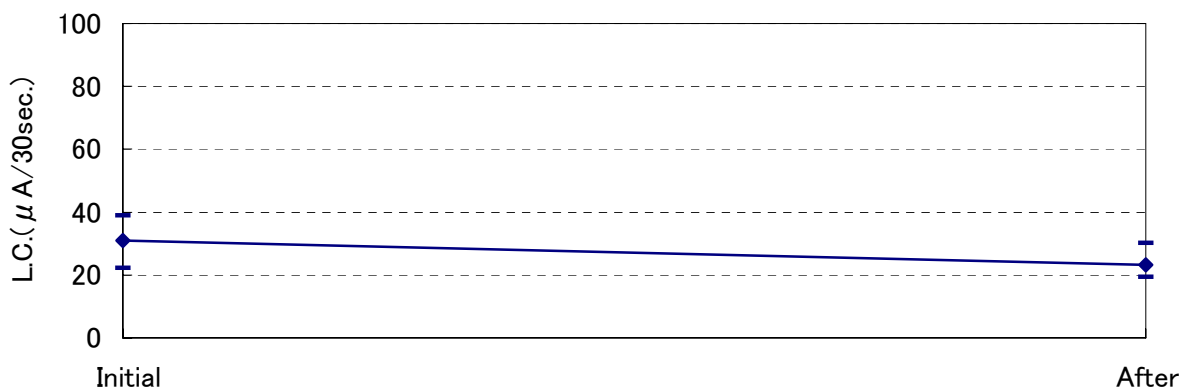
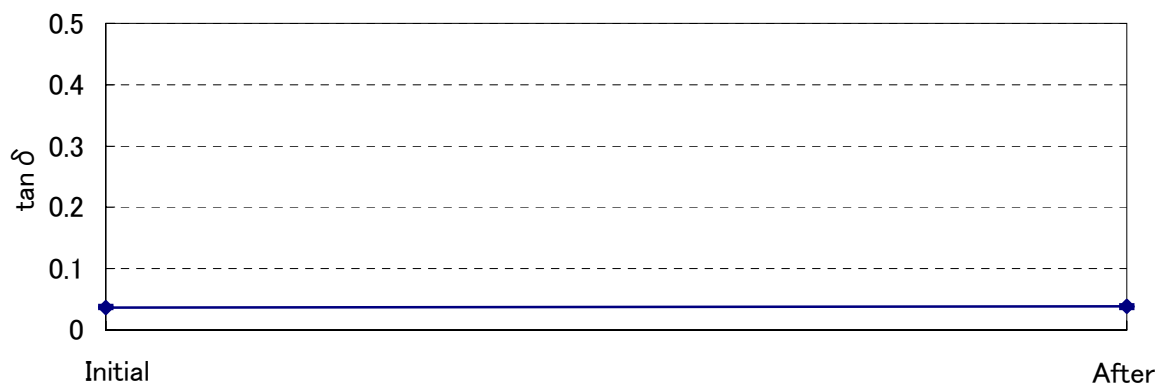
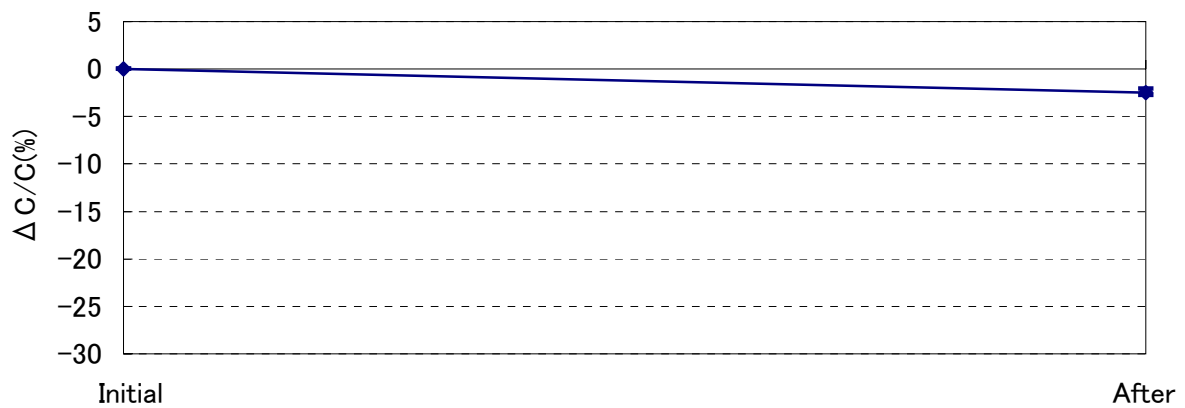
Appearance : No remarkable abnormality.  
Judgment : Passed.

## TEST CONDITION

 $-40^{\circ}\text{C} \times 30\text{min} \leftrightarrow +125^{\circ}\text{C} \times 30\text{min}$ 

Number of cycles : 1000 cycles

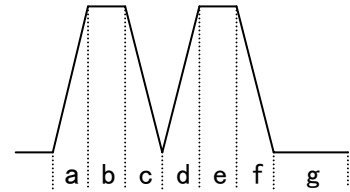
MODEL No. : NATK301M35V10X10.8LSYF n = 80 pcs.



Appearance : No remarkable abnormality.  
Judgment : Passed.

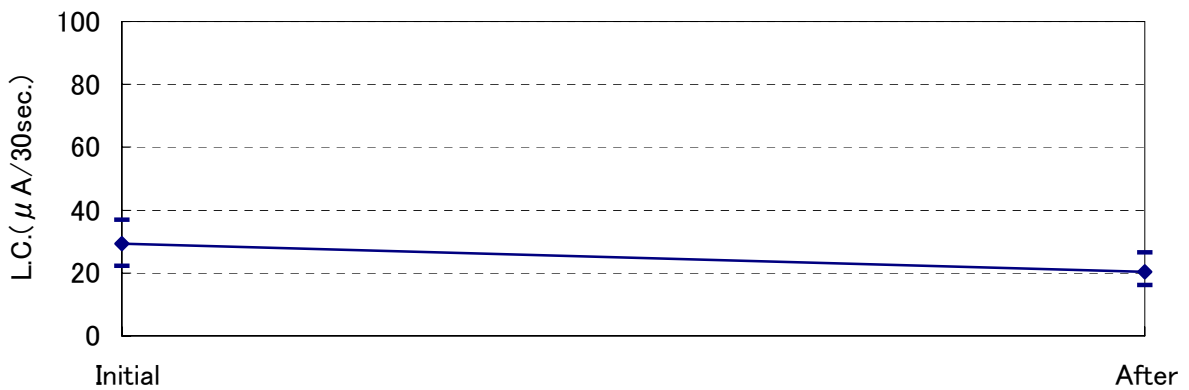
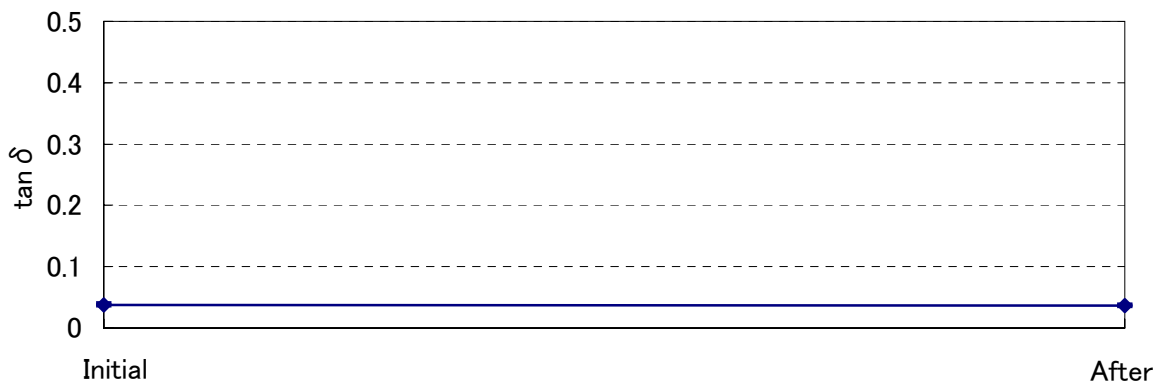
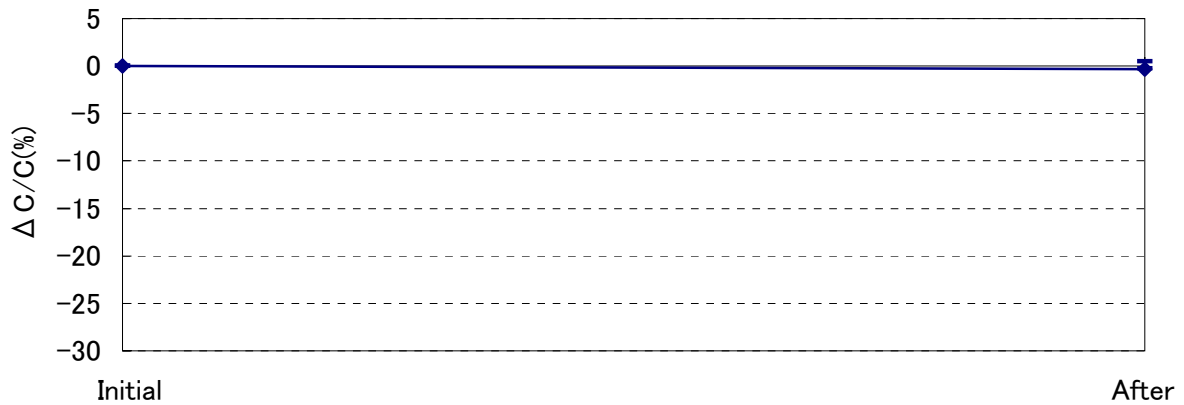
TEST CONDITION

Step	Temp.(°C)	Humidity (%)	Time (hrs)
a, d	25 → 65	95	2.5
b, e	65	95	3
c, f	65 → 25	95	2.5
g	25	95	8



Number of cycles : 10 cycles

MODEL No. : NATK301M35V10X10.8LSYF n = 80 pcs.



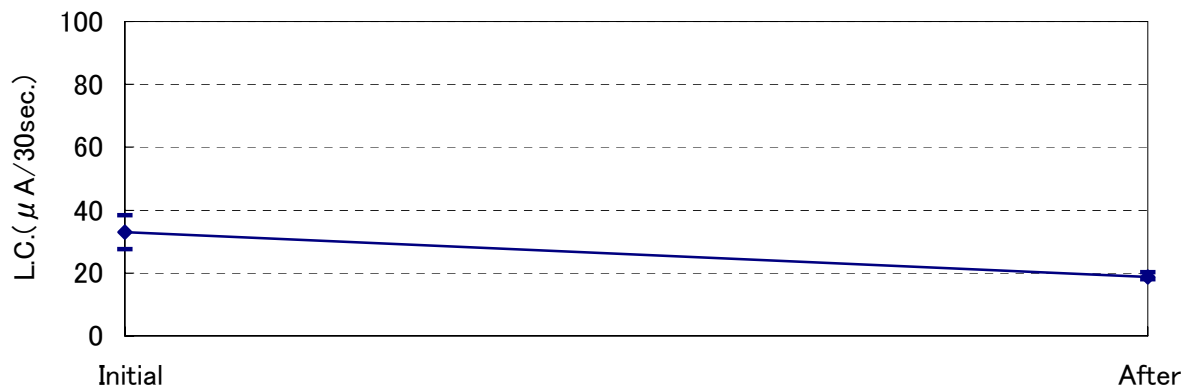
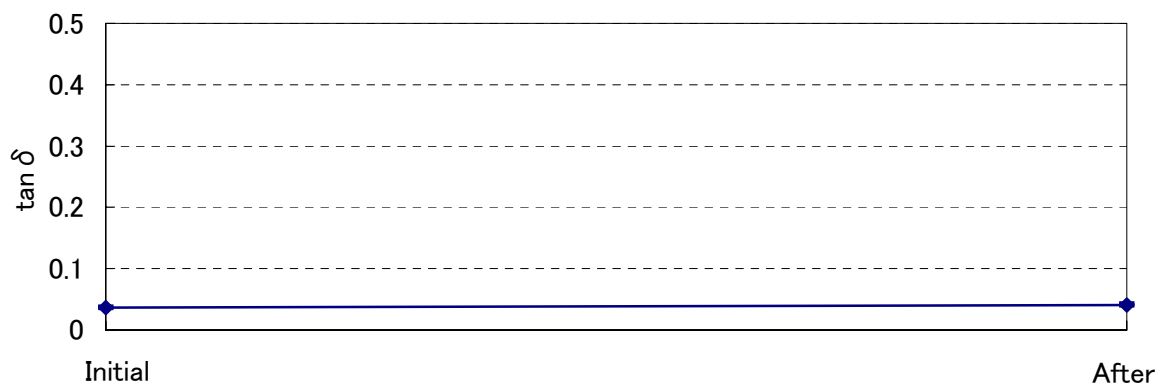
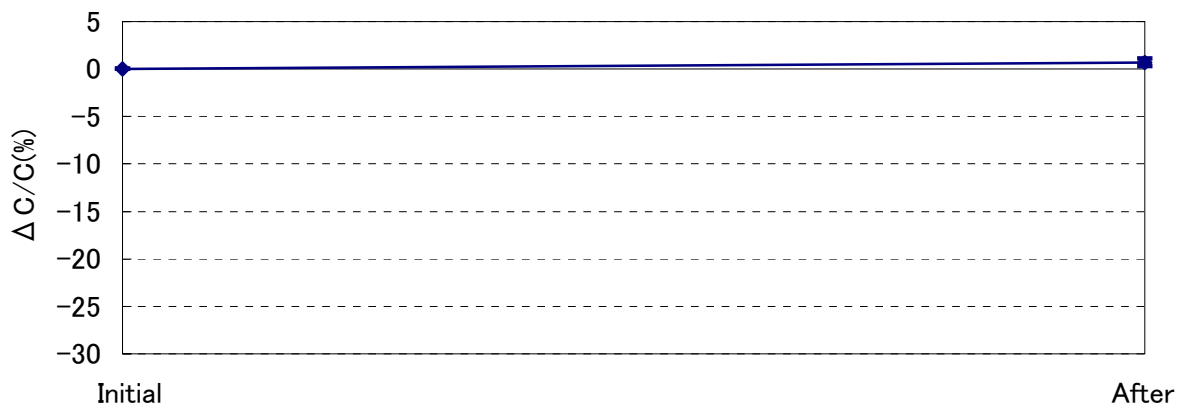
Appearance : No remarkable abnormality.  
Judgment : Passed.

## TEST CONDITION

1000 hours at 85°C with the rated voltage applied.

Humidity ; 85% RH

MODEL No. : NATK301M35V10X10.8LSYF n = 80 pcs.

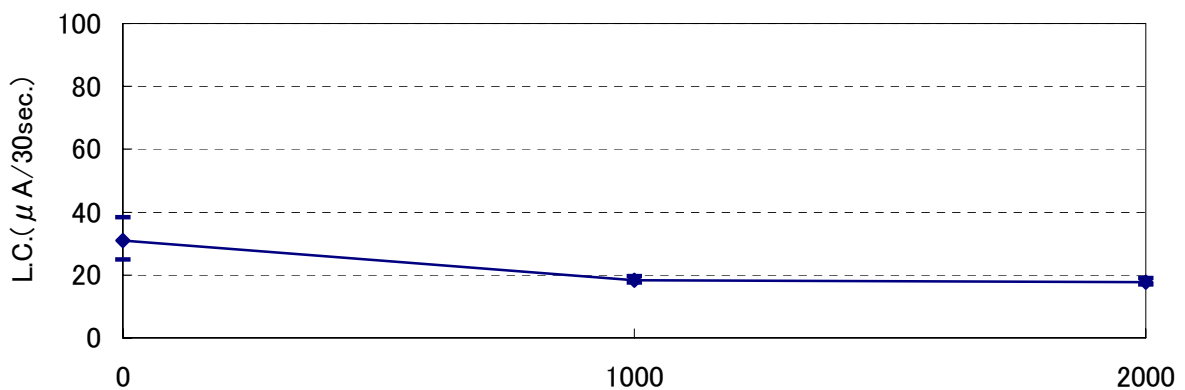
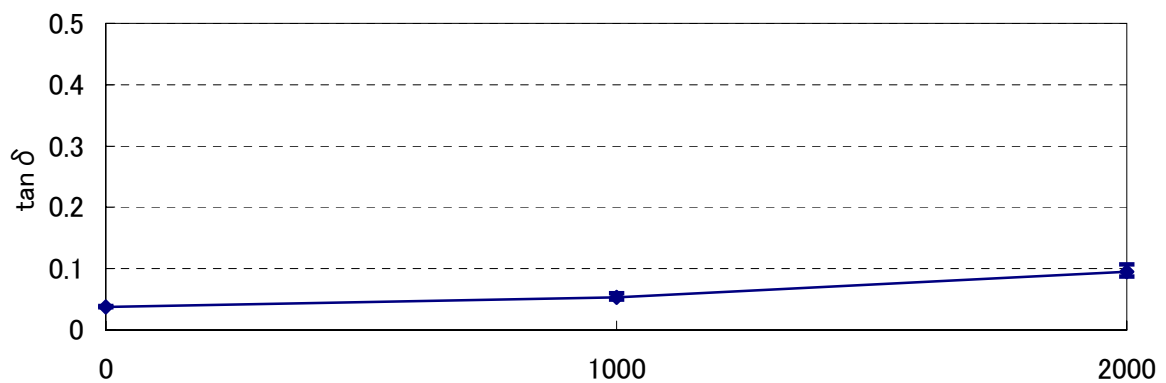
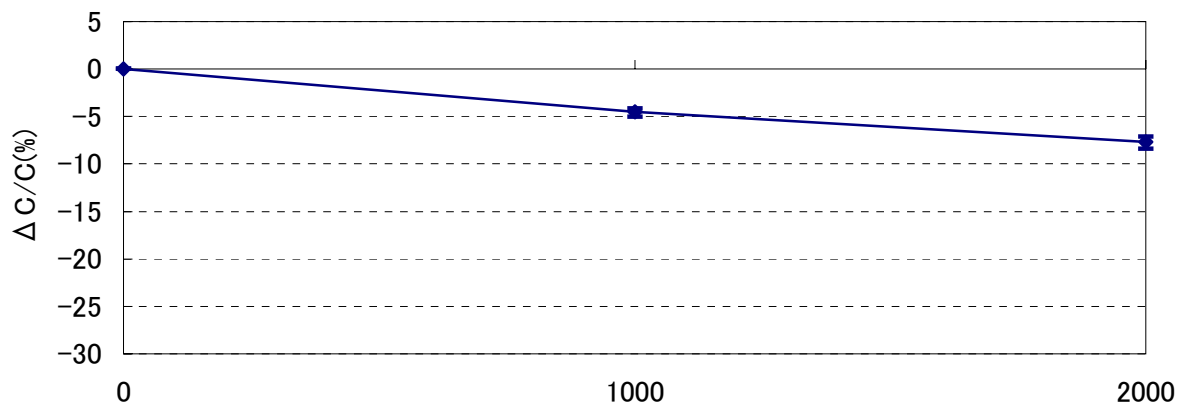
Appearance : No remarkable abnormality.  
Judgment : Passed.

## TEST CONDITION

2000 hours at 125°C with the rated voltage applied.

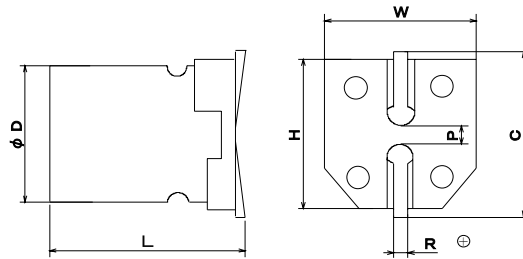
Ripple current : 500mA/100kHz

MODEL No. : NATK301M35V10X10.8LSYF n = 80 pcs.



Appearance : No remarkable abnormality.

Judgment : Passed.



MODEL No. :

NATK301M35V10X10.8LSYF

unit : mm

	$\phi D$	L	W	H	C	R	P
1	10.00	10.45	10.30	10.32	11.07	1.18	4.63
2	9.99	10.45	10.29	10.30	11.11	1.19	4.61
3	9.97	10.43	10.29	10.32	11.10	1.17	4.58
4	9.99	10.45	10.29	10.32	11.11	1.18	4.58
5	9.99	10.41	10.29	10.28	11.11	1.17	4.61
6	9.98	10.46	10.29	10.29	11.09	1.18	4.55
7	9.98	10.47	10.29	10.31	11.12	1.18	4.59
8	9.99	10.42	10.30	10.30	11.13	1.19	4.61
9	9.98	10.41	10.29	10.31	11.11	1.18	4.61
10	9.98	10.45	10.29	10.32	11.12	1.17	4.55
11	9.98	10.46	10.30	10.31	11.06	1.18	4.56
12	9.98	10.45	10.29	10.32	11.13	1.17	4.59
13	10.00	10.44	10.30	10.30	11.13	1.17	4.57
14	9.99	10.44	10.30	10.31	11.11	1.17	4.58
15	10.00	10.46	10.30	10.29	11.13	1.18	4.52
16	9.99	10.43	10.29	10.28	11.12	1.16	4.63
17	9.98	10.38	10.30	10.29	11.10	1.18	4.58
18	9.99	10.43	10.28	10.30	11.11	1.18	4.64
19	9.98	10.47	10.30	10.30	11.11	1.18	4.59
20	9.99	10.47	10.30	10.30	11.10	1.19	4.53
21	9.98	10.41	10.29	10.32	11.11	1.19	4.53
22	9.98	10.39	10.30	10.30	11.10	1.17	4.57
23	9.99	10.43	10.29	10.30	11.07	1.16	4.54
24	10.00	10.40	10.30	10.30	11.08	1.17	4.54
25	9.98	10.42	10.30	10.30	11.10	1.18	4.59
26	9.99	10.43	10.30	10.31	11.09	1.17	4.54
27	9.99	10.47	10.30	10.31	11.11	1.19	4.62
28	10.00	10.40	10.29	10.29	11.11	1.18	4.61
29	9.98	10.44	10.30	10.31	11.09	1.15	4.56
30	9.98	10.43	10.30	10.30	11.11	1.16	4.64
$\bar{X}$	9.99	10.43	10.30	10.30	11.10	1.18	4.58
MAX	10.00	10.47	10.30	10.32	11.13	1.19	4.64
MIN	9.97	10.38	10.28	10.28	11.06	1.15	4.52
$3\sigma$	0.02	0.07	0.02	0.03	0.05	0.03	0.10
USL	10.50	10.80	10.50	10.50	11.20	1.40	4.80
LSL	-	10.20	10.10	10.10	10.80	1.00	4.40
CP	-	4.01	11.85	5.85	3.78	6.74	1.96
CPK	21.69	3.14	11.55	5.74	1.80	5.92	1.78

## TEST CONDITION :

Dipped in the solvent at 20 to 25°C.

Solvent ; Isopropyl alcohol

Dipping time ; 3 min.

## APPERANCE :

No significant change observed. The marking was legible.

## TEST MODEL :

NATK301M35V10X10.8LSYF      n = 5pcs.

## RESULT :

All samples met the specified standard.

## TEST CONDITION

Peak acceleration ;  $1000 \text{ m/s}^2$  (100G)

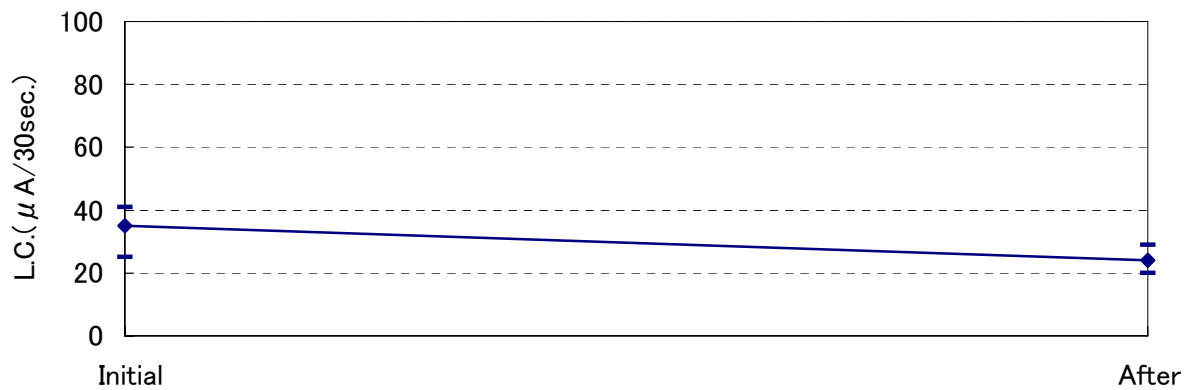
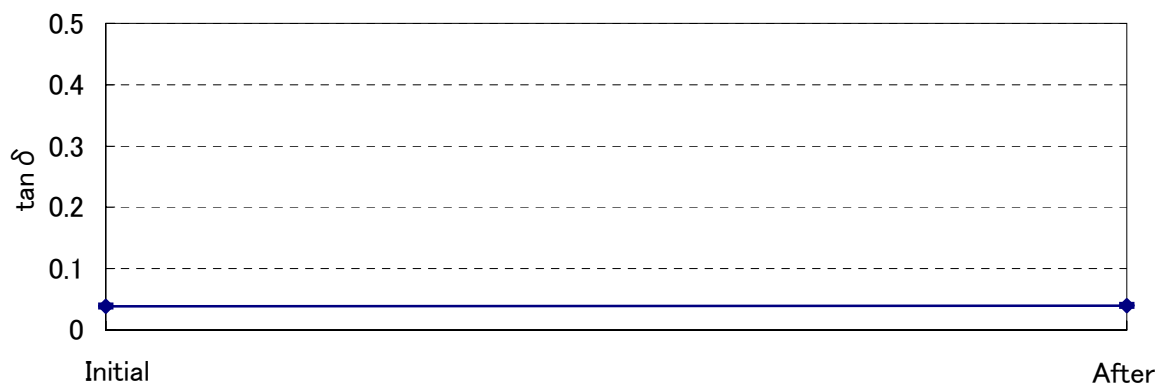
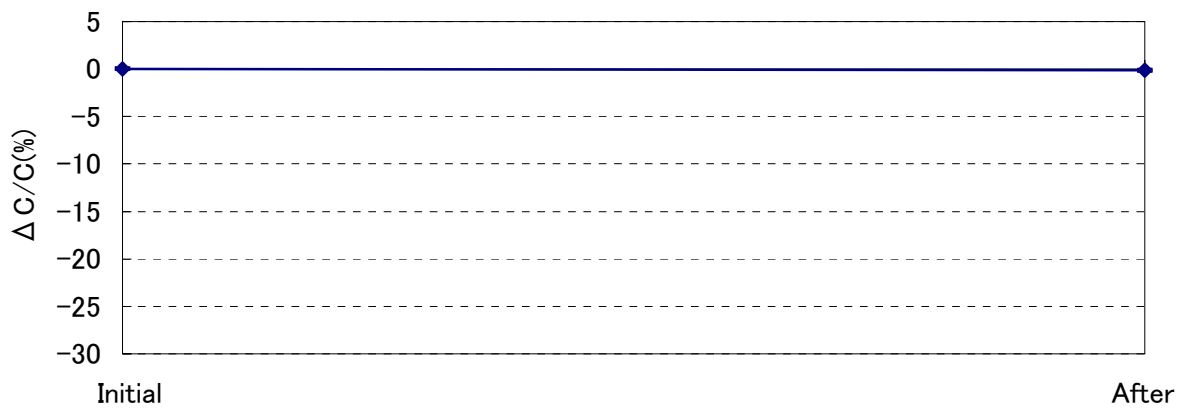
Duration of a pulse ; 6 ms

Pulse shape ; half-sine

Number of shocks ; X-X', Y-Y', Z-Z' 6 directions  $\times$  3 times

→ Total 18 times

MODEL No. : NATK301M35V10X10.8LSYF n = 30 pcs.

Appearance : No remarkable abnormality.  
Judgment : Passed.

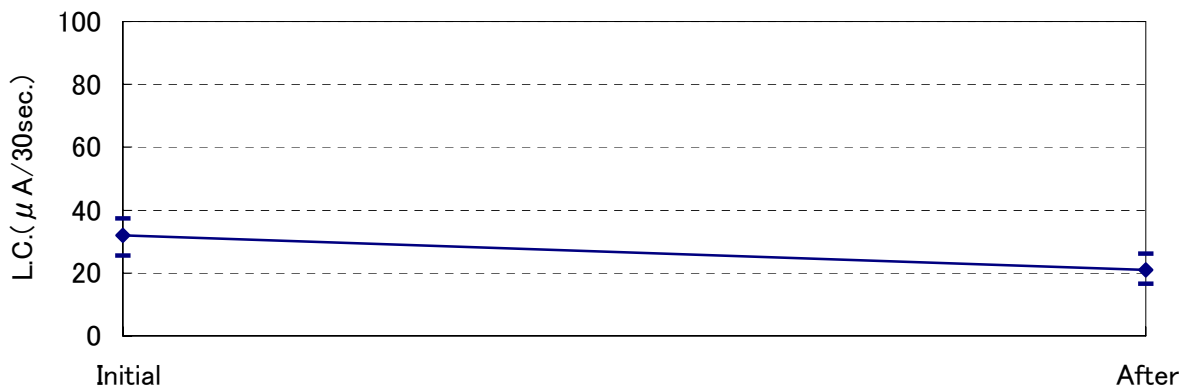
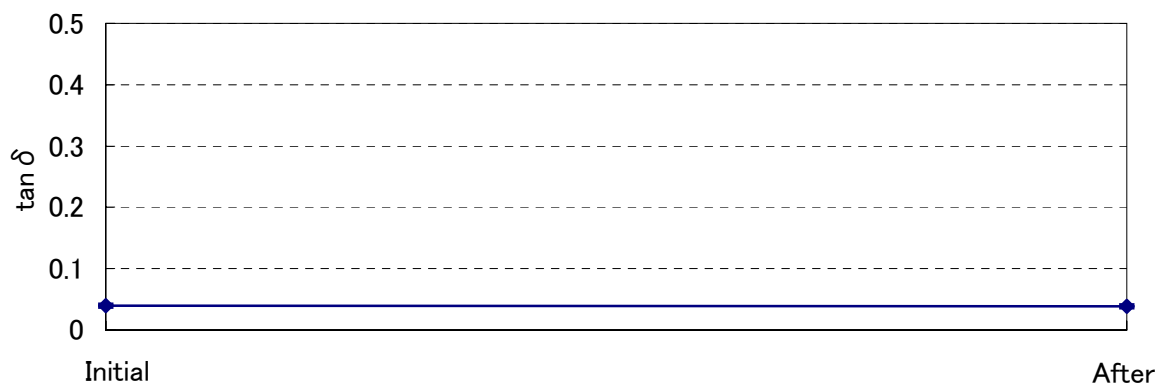
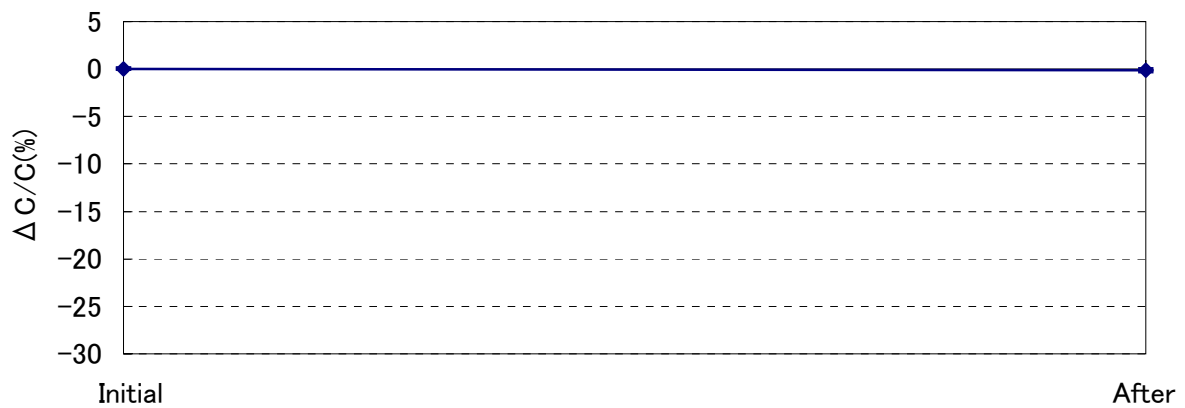
## TEST CONDITION

Direction and duration of vibration ; 3 orthogonal directions mutually  
each for 4h. Total 12h.

Frequency ; 10 to 2000 Hz

Acceleration ; 5G

MODEL No. : NATK301M35V10X10.8LSYF n = 30 pcs.

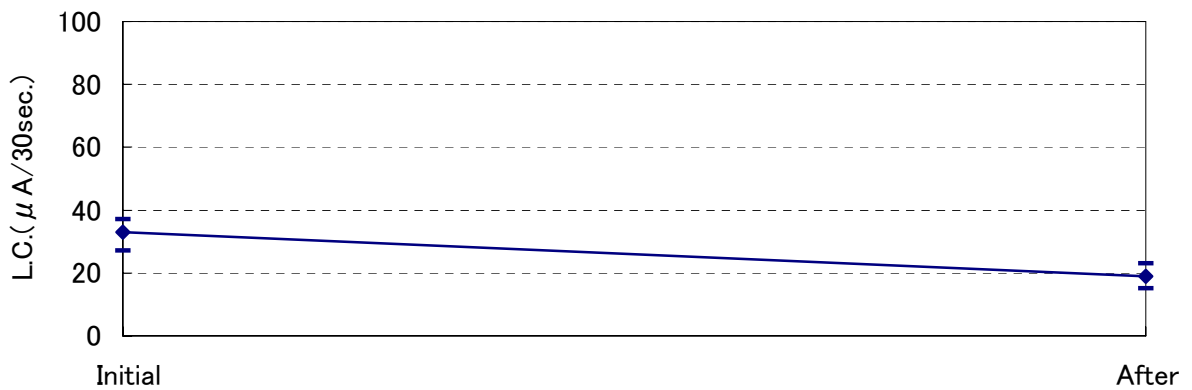
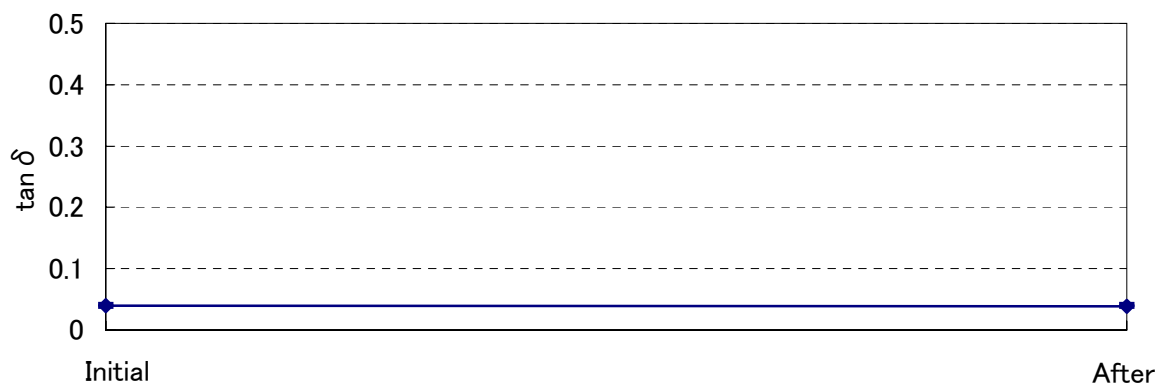
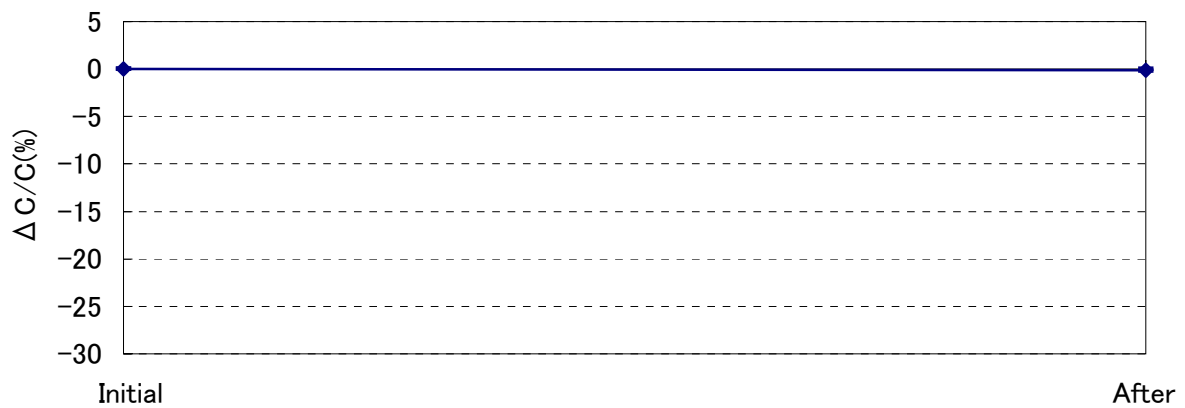


Appearance : No remarkable abnormality.  
Judgment : Passed.

## TEST CONDITION

Vapor phase reflow ;  $215 \pm 5 \text{ }^\circ\text{C} \times 60 \pm 5 \text{ sec.}$ 

MODEL No. : NATK301M35V10X10.8LSYF n = 30 pcs.

Appearance : No remarkable abnormality.  
Judgment : Passed.

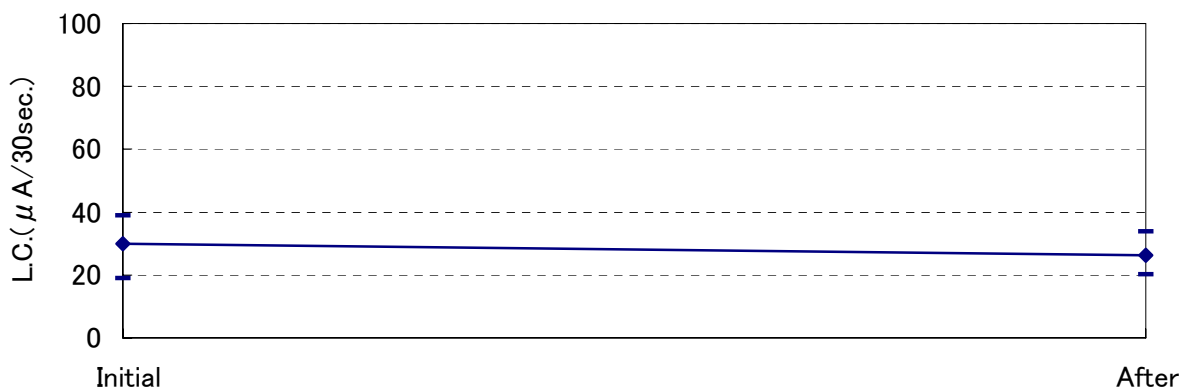
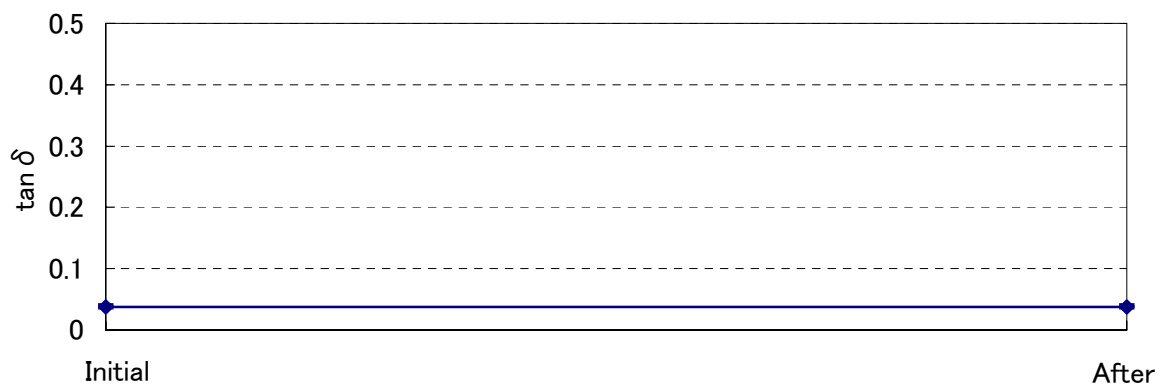
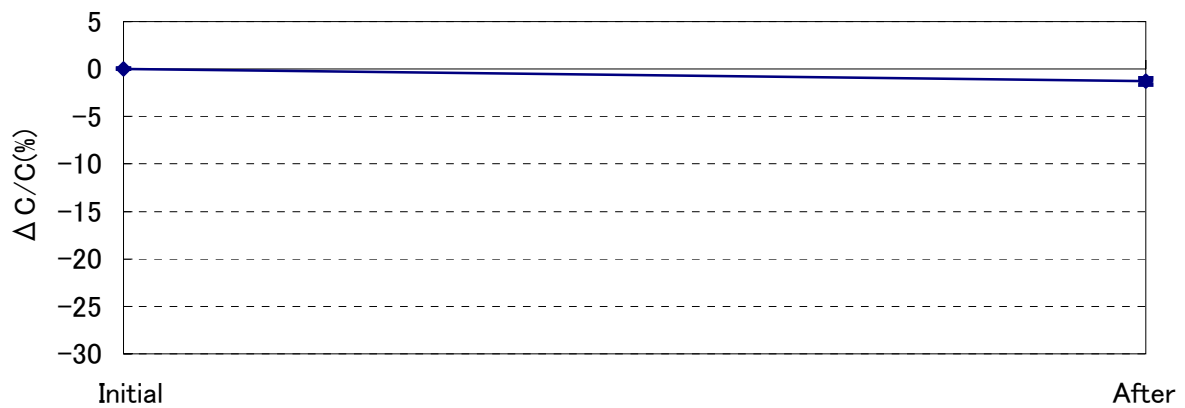
## TEST CONDITION

-40°C × 15min ← → +125°C × 15min.

Maximum transfer time : 20 seconds

Number of cycles : 300 cycles

MODEL No. : NATK301M35V10X10.8LSYF n = 30 pcs.



Appearance : No remarkable abnormality.  
Judgment : Passed.

## TEST CONDITION :

As specified in AEC-Q200 REV C

## TEST MODEL :

NATK301M35V10X10.8LSYF      n = 15pcs.

## RESULT :

±500V	±1kV	±2kV	±4kV	±6kV	±8kV	±12kV	±16kV	±25kV
OK	OK	OK	OK	OK	OK	OK	OK	OK

Appearance : No remarkable abnormality.

Judgment : Passed.

## TEST CONDITION :

- 1) Solder : ① Sn-37Pb, ② Sn-3.0Ag-0.5Cu
- 2) Flux : Ethanol solution of rosin (Rosin weight ratio : 25%)
- 3) Pretreatment : Pressure Cooker Test  
105°C 100%  $1.22 \times 10^5$ Pa 4hour
- 4) Condition of solder dip  
The terminals of capacitor are dipped in flux for 5 to 10 seconds after treatment.  
Afterwards, the capacitor is dipped in a solder bath.
  - Temperature of solder : ①  $235 \pm 5^\circ\text{C}$ , ②  $240 \pm 5^\circ\text{C}$
  - Dipping depth : 0.20 ~ 0.25 mm
  - Dipping time :  $2 \pm 0.5$  sec
  - Dipping speed and pulling up speed : 25mm/sec.

## EVALUATION CRITERIA :

95% of the surface of lead wire must be covered with the dipped solder.

## TEST MODEL :

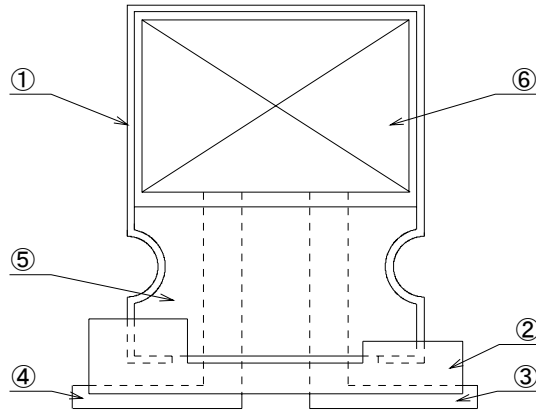
NATK301M35V10X10.8LSYF      n = 15pcs.

## RESULT :

- ① Sn-37Pb  
All samples met the specified standards.
- ② Sn-3.0Ag-0.5Cu  
All samples met the specified standards.

MODEL No. NATK301M35V10X10.8LSYF

No.	Lot.No.(63089U5)			Lot.No.(74149U4)			Lot.No.(76019U4)		
	Cap. ( $\mu$ F)	$\tan \delta$	L.C. ( $\mu$ A/30s)	Cap. ( $\mu$ F)	$\tan \delta$	L.C. ( $\mu$ A/30s)	Cap. ( $\mu$ F)	$\tan \delta$	L.C. ( $\mu$ A/30s)
1	287.4	0.037	14.87	304.9	0.036	16.43	301.3	0.037	12.93
2	292.4	0.038	14.83	305.6	0.037	18.20	293.8	0.041	12.61
3	289.4	0.037	13.42	307.1	0.039	17.91	296.9	0.039	12.07
4	289.7	0.037	15.76	307.1	0.038	17.24	298.1	0.041	13.22
5	289.3	0.038	14.71	305.1	0.037	19.19	302.9	0.037	13.15
6	292.0	0.037	13.72	306.2	0.037	15.81	300.5	0.038	13.95
7	294.2	0.038	12.26	306.0	0.038	15.97	300.3	0.039	11.68
8	290.6	0.038	13.72	302.1	0.037	13.90	299.2	0.038	10.58
9	292.1	0.038	12.99	305.0	0.037	16.42	301.5	0.038	10.96
10	289.8	0.037	12.19	309.3	0.038	15.07	301.9	0.039	11.70
11	292.1	0.038	15.31	305.5	0.036	16.30	297.3	0.038	11.71
12	293.1	0.039	15.92	303.2	0.036	17.38	296.7	0.038	10.71
13	290.8	0.039	14.42	305.4	0.037	15.62	297.9	0.039	12.01
14	291.2	0.039	14.78	302.9	0.037	14.49	295.2	0.037	12.32
15	290.3	0.039	15.95	304.5	0.037	14.76	299.3	0.038	12.72
16	292.7	0.038	15.40	310.1	0.038	14.15	304.3	0.042	11.71
17	290.7	0.039	14.30	303.9	0.036	16.16	302.5	0.038	11.04
18	290.5	0.039	14.92	307.4	0.038	16.22	303.1	0.038	12.29
19	291.0	0.038	13.65	309.5	0.037	16.95	302.1	0.038	10.88
20	292.6	0.038	14.55	304.9	0.037	15.14	300.0	0.037	15.40
21	290.8	0.039	15.26	306.1	0.037	16.10	301.6	0.042	12.32
22	290.5	0.038	14.98	307.3	0.037	15.45	297.0	0.038	12.58
23	292.1	0.038	14.31	305.4	0.037	17.56	299.4	0.038	13.36
24	291.5	0.038	14.26	306.0	0.036	15.78	303.2	0.038	11.69
25	292.7	0.038	15.18	304.8	0.036	19.50	302.0	0.041	13.03
26	291.5	0.038	14.37	304.7	0.037	17.43	302.6	0.040	12.19
27	292.2	0.039	14.47	306.7	0.037	16.44	298.6	0.040	11.77
28	290.6	0.039	14.20	301.9	0.037	15.41	304.1	0.039	11.29
29	291.2	0.039	14.52	307.7	0.037	15.76	296.6	0.037	11.67
30	290.6	0.038	14.19	301.9	0.037	15.21	299.7	0.038	11.15
$\bar{X}$	291.2	0.038	14.45	305.6	0.037	16.27	300.0	0.039	12.16
Max	294.2	0.039	15.95	310.1	0.039	19.50	304.3	0.042	15.40
Min	287.4	0.037	12.19	301.9	0.036	13.90	293.8	0.037	10.58
$3\sigma$	4.02	0.002	2.74	6.15	0.002	3.99	8.07	0.004	3.08
USL	360.0	0.140	105.0	360.0	0.140	105.0	360.0	0.140	105.0
LSL	240.0	-	-	240.0	-	-	240.0	-	-
CP	14.94	-	-	9.75	-	-	7.44	-	-
CPK	12.75	49.40	33.07	8.84	48.59	22.22	7.44	23.43	30.18



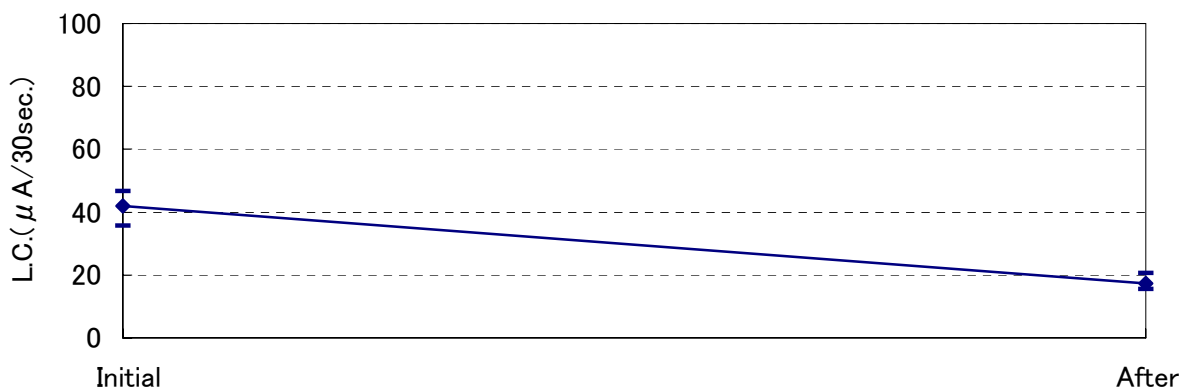
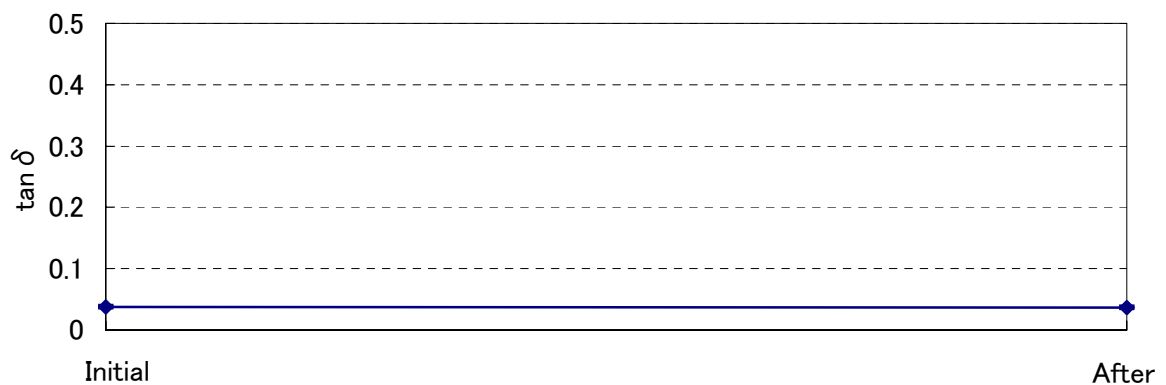
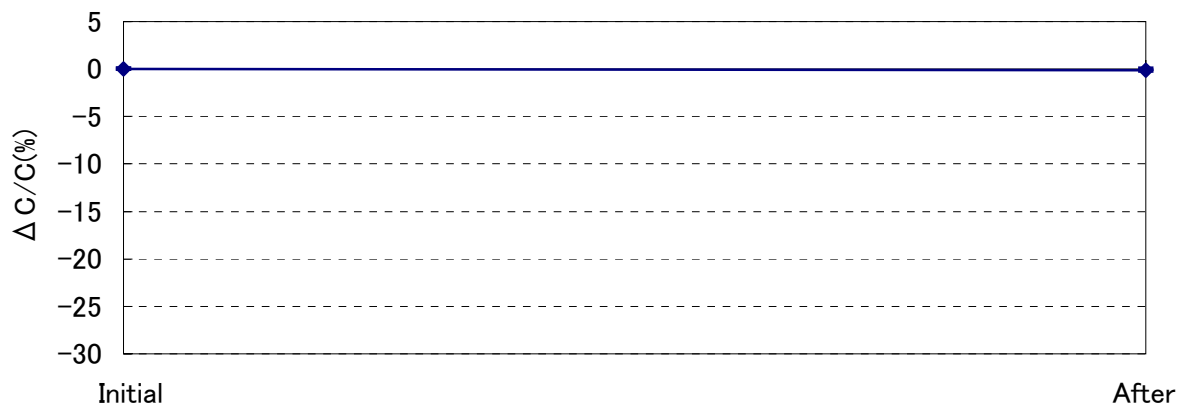
MODEL No. NATK301M35V10X10.8LSYF

No.	Components	Materials / Treatment	UL Flame Class	UL File No.
1	Case	Aluminum (Plastic coating ; nylon)	-	-
2	Spacer	Thermoplastic resin (PPS)	UL-94-V-0	E53829
3	Terminal (+)	Copper clad steel wire ( Coated with Tin 100% )	-	-
4	Terminal (-)	Copper clad steel wire ( Coated with Tin 100% )	-	-
5	Packing	Synthetic rubber	-	-
6	Element	Anode ; Aluminnum foil  Cathode ; Aluminnum foil  Capacitor paper  Electrolyte ; Organic solvents,  Amidine salt of organic acid  (non-quaternary ammonium salt)	-	-

## TEST CONDITION

The capacitor mounted on the under side of a circuit board with bending fixture.  
The capacitor must maintain for 60 seconds after the circuit board is bent  
by 2mm at 1mm/s.

MODEL No. : NATK301M35V10X10.8LSYF n = 30 pcs.

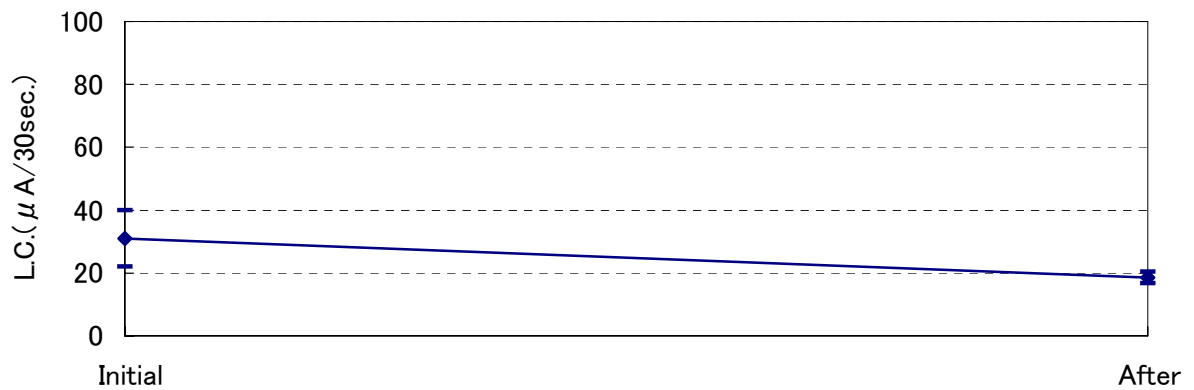
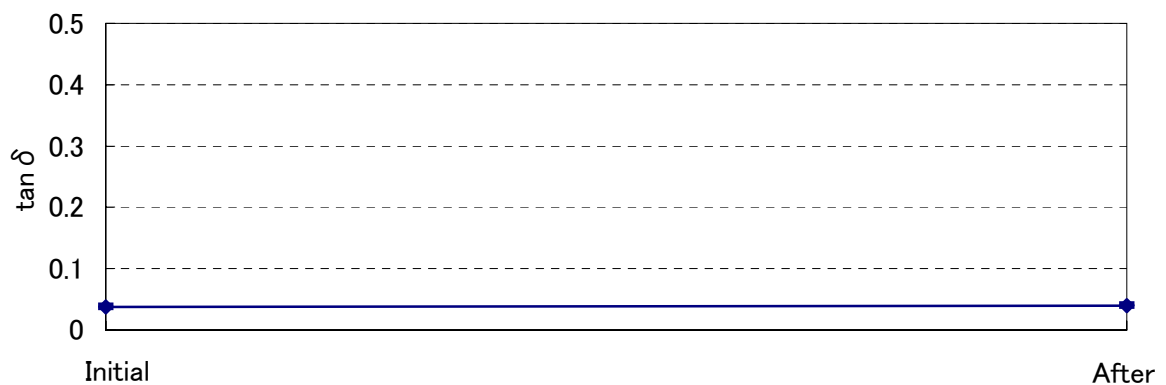
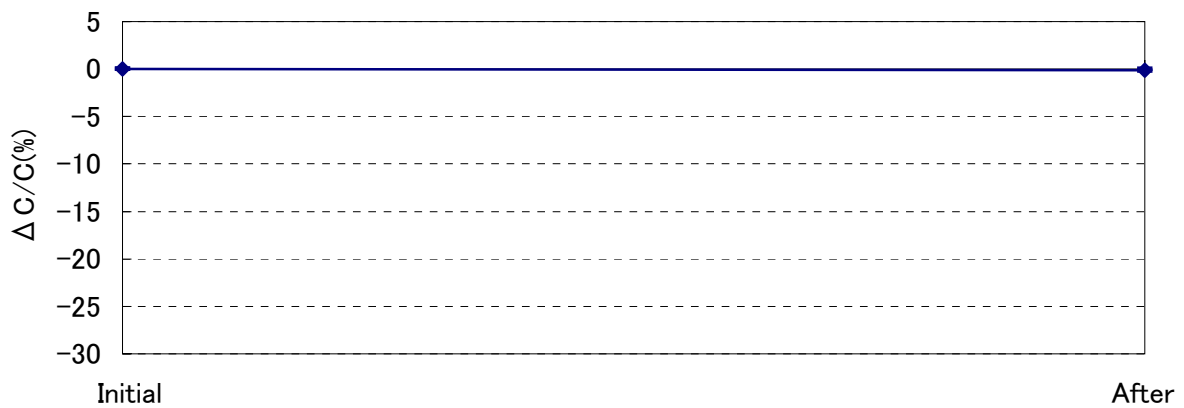


Appearance : No remarkable abnormality.  
Judgment : Passed.

## TEST CONDITION

The 18N (1.8kg) of horizontal pressure was applied for  $60 \pm 1$  seconds with a press tool.

MODEL No. : NATK301M35V10X10.8LSYF n = 30 pcs.



Appearance : No remarkable abnormality.  
Judgment : Passed.

## TEST CONDITION

Surge voltage : 44V

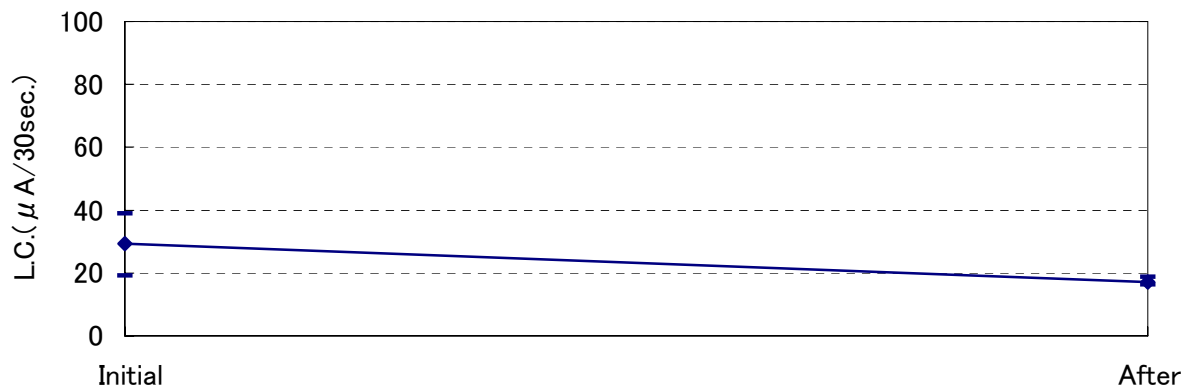
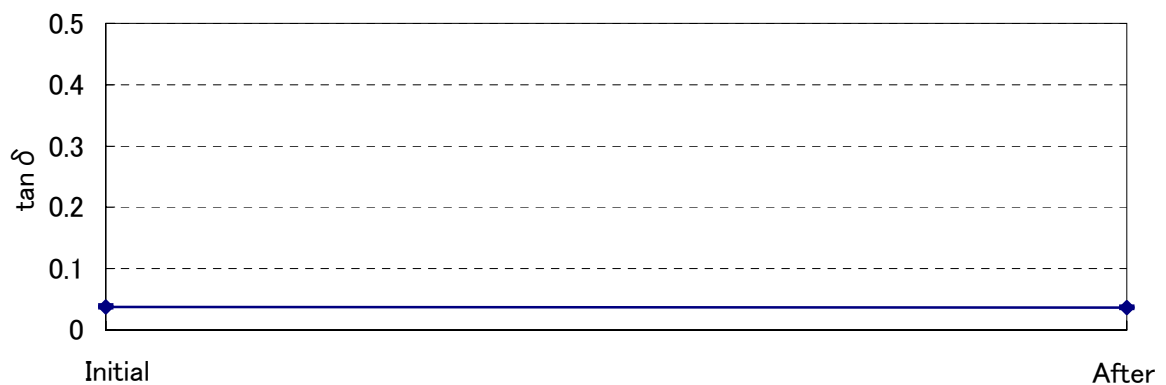
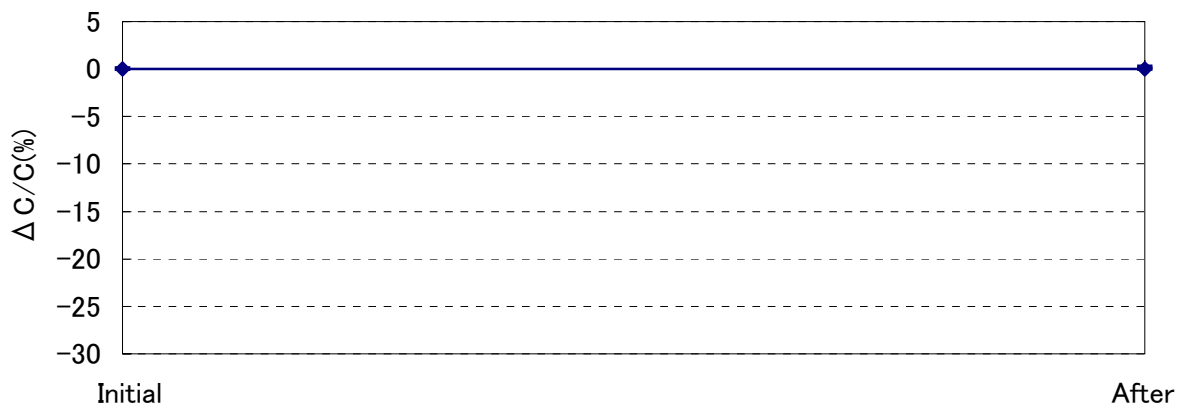
Duration: Time on  $30 \pm 5$  seconds / Time off  $6 \pm 0.5$  minutes

Number of Cycle : 1000 cycles

Test temperature : Room temperature

The discharge of surge voltage is made without any designed load.

MODEL No. : NATK301M35V10X10.8LSYF n = 30 pcs.

Appearance : No remarkable abnormality.  
Judgment : Passed.