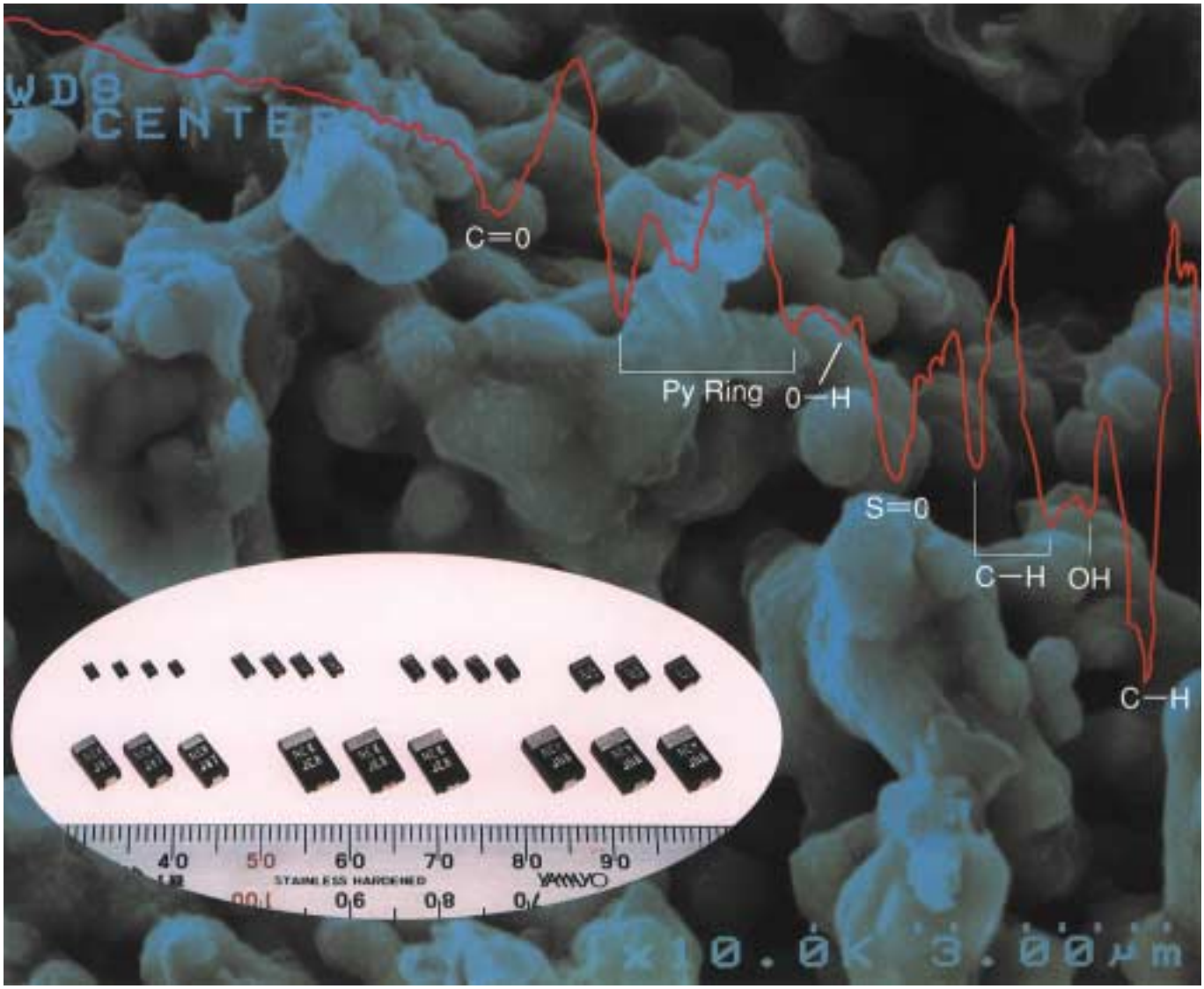
imagination. Solutions.

NEC

Conductive Polymer Tantalum Capacitor

NeoCapacitor



6th edition

Usage OF NeoCapacitor

Most NeoCapacitor failures are the result of leakage current or short circuits.
Please refer to the 'Notes on using the NeoCapacitor on pages 39 to 42 of this brochure before designing NeoCapacitor into your system.

CONTENTS

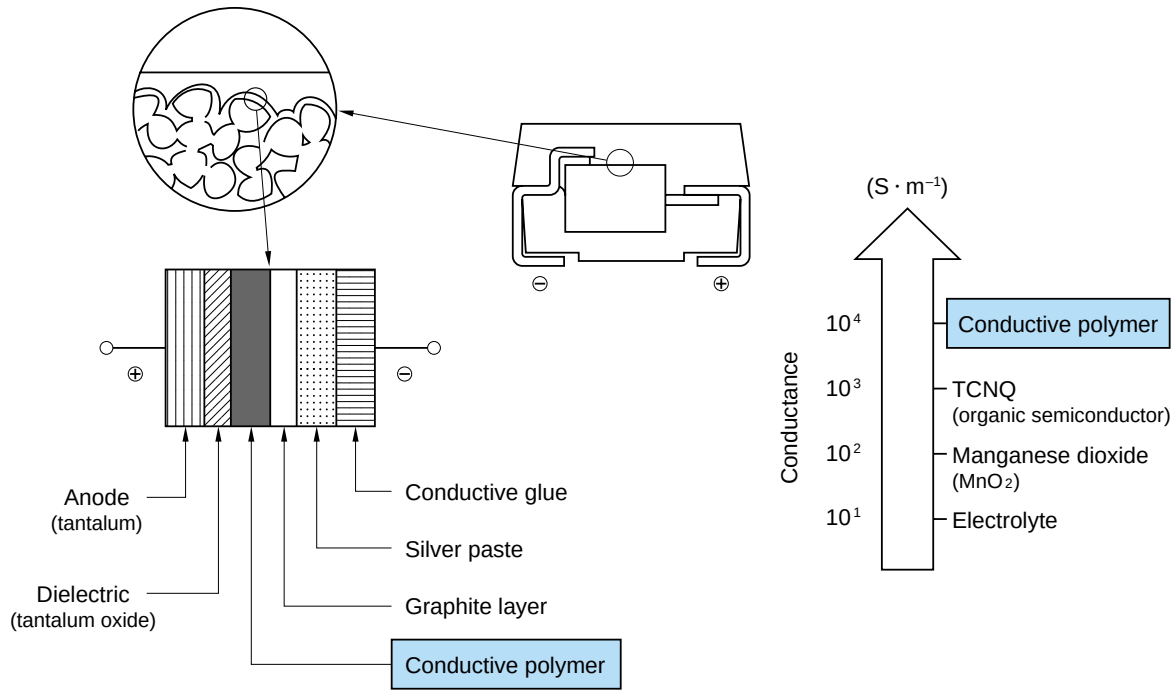
What's NeoCapacitor

NeoCapacitor has the same structure as a conventional chip tantalum capacitor.

It has a low-resistance cathode of conductive polymer as a substitute for manganese dioxide of a conventional capacitor.

It features high permissible ripple current and effective noise reduction in a high frequency application with its ultra low ESR (equivalent series resistance).

NeoCapacitor is manufactured in the factories certified by the International standards, the ISO9001 and the QS-9000.



NeoCapacitor's Structure

Features

- Small size (the same as conventional chip)
- Ultra Low ESR/low impedance
- Suitability for surface mounting
- High permissible ripple current

Applications

- DC / DC converter
- Suppression of oscillation for general purpose regulator
- Video camera
- Portable cassette / CD player
- Personal handy phone
- Game machine

Line Up of NeoCapacitor

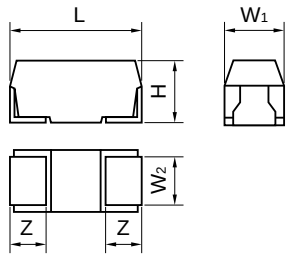
PS/N series of the highest operating temperature 85˚C, and PS/L series of the highest operating temperature 125˚C which was developed to become lower ESR further are provided.

Series	Operating Temperature Range (˚C)	DC Rated Voltage Range (V)	Capacitance Range (μF)	Capacitance Tolerance (%)	DC Leakage Current (μF)	Tangent of Loss Angle	Features
PS/L	–55 to +105	4 to 10	3.3 to 330	±20	0.1 CV or 3, whicherer greater	0.09 to 0.5	Ultra-low ESR
PS/N	–55 to +85	4 to 16	3.3 to 220	±20	0.1 CV or 3, whicherer greater	0.09 to 0.5	Low ESR

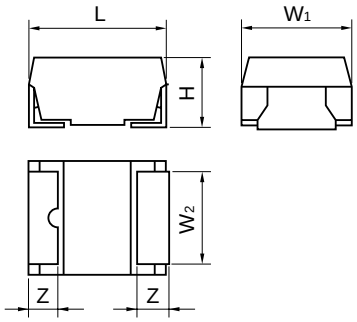
Specifications (PS/L Series)

Dimensions

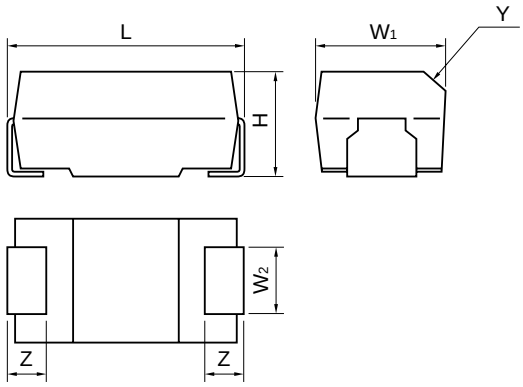
P, A2 and A case



B2 and V case



C and D case



Unit : mm (inch)

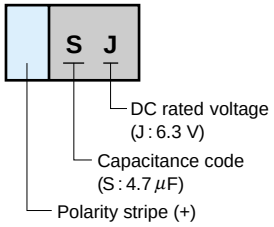
Case code	EIA code	L	W1	W2	H	Z	Y
P	2012	2.0 ± 0.2 (0.079±0.008)	1.25 ± 0.2 (0.049±0.008)	0.9 ± 0.1 (0.035±0.004)	1.1 ± 0.1 (0.043±0.004)	0.5 ± 0.1 (0.020±0.004)	—
A2	3216L	3.2 ± 0.2 (0.126±0.008)	1.6 ± 0.2 (0.063±0.008)	1.2 ± 0.1 (0.047±0.004)	1.1 ± 0.1 (0.043±0.004)	0.8 ± 0.2 (0.031±0.008)	—
A	3216	3.2 ± 0.2 (0.126±0.008)	1.6 ± 0.2 (0.063±0.008)	1.2 ± 0.1 (0.047±0.004)	1.6 ± 0.2 (0.061±0.008)	0.8 ± 0.2 (0.031±0.008)	—
B2	3528	3.5 ± 0.2 (0.138±0.008)	2.8 ± 0.2 (0.110±0.008)	2.3 ± 0.1 (0.091±0.004)	1.9 ± 0.2 (0.075±0.008)	0.8 ± 0.2 (0.031±0.008)	—
C	6032	6.0 ± 0.2 (0.236±0.008)	3.2 ± 0.2 (0.126±0.008)	2.2 ± 0.1 (0.087±0.004)	2.5 ± 0.2 (0.098±0.008)	1.3 ± 0.2 (0.051±0.008)	0.4 C (0.016)
V	7343L	7.3 ± 0.2 (0.287±0.008)	4.3 ± 0.2 (0.169±0.008)	2.4 ± 0.1 (0.094±0.004)	1.9 ± 0.1 (0.075±0.004)	1.3 ± 0.2 (0.051±0.008)	—
D	7343	7.3 ± 0.2 (0.287±0.008)	4.3 ± 0.2 (0.169±0.008)	2.4 ± 0.1 (0.094±0.004)	2.8 ± 0.2 (0.110±0.008)	1.3 ± 0.2 (0.051±0.008)	0.5 C (0.020)

C–V Value Reference by Case Code

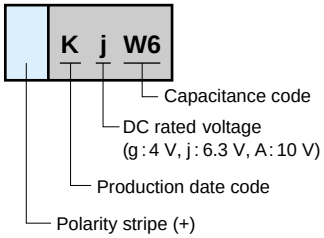
Capacitance (μF) \ Rated voltage (V)	4	6.3	10
3.3			A
4.7		P	A2, A
6.8		A	A, B2
10	P, A	A2, A	B2
15		A, B2	B2, C
22	B2	A, B2	B2, C
33		B2	B2, C
47		B2, C	C, V, D
68	C	C	D
100	B2		D
150		V, D	
220	V, D	D	
330	D	D	

Markings

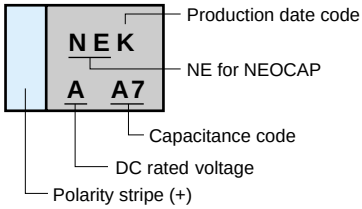
P case



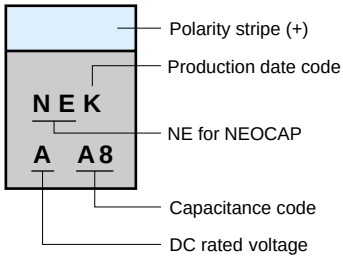
A2 and A case



B2 case



C, V and D case



Capacitance code

Code	A	E	J	N	S	W	Code	6	7	8
Number	1	1.5	2.2	3.3	4.7	6.8	Multiplier	10^6	10^7	10^8

Example) A7 = $1 \times 10^7 = 10^7$ (pF) = 10 (μF)

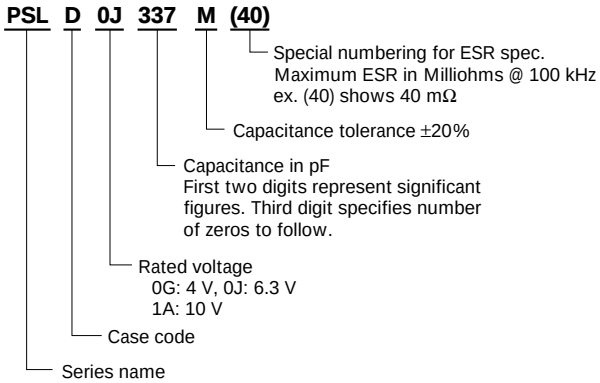
Procuction date code

Year \ Month	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1999	a	b	c	d	e	f	g	h	j	k	l	m
2000	n	p	q	r	s	t	u	v	w	x	y	z
2001	A	B	C	D	E	F	G	H	J	K	L	M
2002	N	P	Q	R	S	T	U	V	W	X	Y	Z

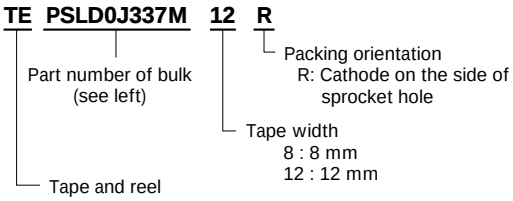
(NOTE) Date code will resume beginning in 2003.

PART NUMBER SYSTEM

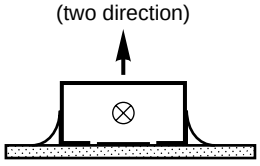
[Bulk]



[TAPE & REEL]



Performance Characteristics

No.	Item		Performance			Test Condition
1	Operating temperature		–55 to +105˚C			
2	Rated voltage (V.dc)		4	6.3	10	Temperature : 85˚C
3	Category voltage (V.dc)		3.3	5	8	Temperature : 105˚C
4	Surge voltage (V.dc)		5.2	8	13	Temperature : 85˚C
5	Capacitance		3.3 to 330 μF			Frequency : 1 kHz
6	Capacitance tolerance		±20%			Frequency : 1 kHz
7	Tangent of loss angle (tan δ)		Refer to rating on page 9			Same measuring condition as No.5
8	Leakage current (L. C)		0.1 CV (μF × volts) or 3 μA, whichever is greater			Voltage : Rated voltage for 5 min.
9	Equivalent series resistance (ESR)		Refer to rating on page 9			Frequency : 100 kHz
19	Dimensions		Mechanical dimensions shall meet the requirements specified on Page 4			
11	Resistance to solvents	Visual	Marking shall be legible.			Exposure to the following detergent for the duration of 30 ± 5 sec. • Isopropyl alcohol
12	Vibration	Cap.	Shall be stable for period of measurement.			Frequency : 10 to 55 Hz Sweep : 1 minute Amplitude of vibration : 1.5 mm Vibration time : Each plane shall be 2 hours for a total 4 hours. Within last 30 minutes, capacitance shall be measured several times.
		Visual	There shall be no evidence of mechanical damage.			
13	Shock	ΔC/C	± 20%			100 G, Saw-tooth wave
		tan δ	Shall not exceed the value in No.7			
		L.C	Shall not exceed the value in No.8			
		Visual	There shall be no evidence of mechanical damage.			
14	Terminal strength	Visual	There shall be no evidence of mechanical damage.			Strength : 4.9 N Time : 10 ± 0.5 sec. (two direction) 
15	Surge voltage	ΔC/C	± 20%			Temperature : 85 ± 2˚C Applied voltage : No. 3 Series resistance : 1000 Ω Duration of surge : 30 ± 5 sec. Time between surge : 5.5 min. Number of cycles : 1,000
		tan δ	Shall not exceed the value in No.7			
		L.C	Shall not exceed the value in No.8			
		Visual	There shall be no evidence of mechanical damage.			

—— continued ——

<table>
<tr><th>No.</th><th colspan="2">Item</th><th>Performance</th><th colspan="2">Test Condition</th></tr>
<tr><td rowspan="5">16</td><td rowspan="5">Characteris-tics at high and low Temperature</td><td>⊿C/C</td><td>$^{0}_{-20}$ %</td><td>Step 2</td><td rowspan="5"><table><tr><th>Step</th><th>Temperature</th></tr><tr><td>1</td><td>25 ± 2˚C</td></tr><tr><td>2</td><td>–55 $^{0}_{-3}$˚C</td></tr><tr><td>3</td><td>25 ± 2˚C</td></tr><tr><td>4</td><td>105 $^{+3}_{0}$˚C</td></tr></table></td></tr>
<tr><td>tan δ</td><td>Shall not exceed the value in No.7</td><td></td></tr>
<tr><td>⊿C/C</td><td>$^{+50}_{0}$ %</td><td rowspan="3">Step 4</td></tr>
<tr><td>tan δ</td><td>Shall not exceed 150% of initial requirements</td></tr>
<tr><td>L.C</td><td>1.0 CV (μF × volts) or 30 μA, whichever is greater</td></tr>
<tr><td rowspan="4">17</td><td rowspan="4">Resistance to Soldering</td><td>⊿C/C</td><td>± 20%</td><td colspan="2" rowspan="4">Reflow soldering method
240˚C, 10 sec. max.
(peak 260˚C)</td></tr>
<tr><td>tan δ</td><td>Shall not exceed the value in No.7</td></tr>
<tr><td>L.C</td><td>Shall not exceed 130% of initial requirements</td></tr>
<tr><td>Visual</td><td>There shall be no evidence of mechanical damage.</td></tr>
<tr><td>18</td><td colspan="2">Solderability</td><td>Over 95% of the terminal surface shall be covered by a continuous new solder coating after immersion.</td><td colspan="2">The flux shall be a solution containing 25% by weight of water white rosin and 75% by weight of methyl alcohol.
Solder temp. : 210 ± 5˚C
Immersion time : 5 ± 0.5 sec.</td></tr>
<tr><td rowspan="4">19</td><td rowspan="4">Damp heat, steady state</td><td>Cap.</td><td>+30% to –20% of rated capacitance</td><td colspan="2" rowspan="4">Temperature : 40 ± 2˚C
Moisture : 90 to 95% R.H.
Duration : 500 $^{+24}_{0}$ Hr.</td></tr>
<tr><td>tan δ</td><td>Shall not exceed 150% of initial requirements</td></tr>
<tr><td>L.C</td><td>Shall not exceed the value in No.8</td></tr>
<tr><td>Visual</td><td>There shall be no evidence of mechanical damage.</td></tr>
<tr><td rowspan="4">20</td><td rowspan="4">Rapid chage of temperature</td><td>⊿C/C</td><td>± 20%</td><td colspan="2" rowspan="4">Parts shall be temperature cycled over a temperature range of –55 to +105˚C, five times continuously as follows.<table><tr><th>Step</th><th>Temperature</th><th>Time</th></tr><tr><td>1</td><td>–55 $^{0}_{-3}$˚C</td><td>30 ± 3 min.</td></tr><tr><td>2</td><td>room temp.</td><td>10 to 15 min.</td></tr><tr><td>3</td><td>105 $^{+3}_{0}$˚C</td><td>30 ± 3 min.</td></tr><tr><td>4</td><td>room temp.</td><td>10 to 15 min.</td></tr></table></td></tr>
<tr><td>tan δ</td><td>Shall not exceed the value in No.7</td></tr>
<tr><td>L.C</td><td>Shall not exceed the value in No.8</td></tr>
<tr><td>Visual</td><td>There shall be no evidence of mechanical damage.</td></tr>
<tr><td rowspan="4">21</td><td rowspan="4">Endurance I</td><td>⊿C/C</td><td>± 20%</td><td colspan="2" rowspan="4">Temperature : 85 ± 2˚C
Duration : 1000 $^{+48}_{0}$ Hr.
Applied voltage : No. 2
Series resistance : 3 Ω</td></tr>
<tr><td>tan δ</td><td>Shall not exceed 150% of initial requirements.</td></tr>
<tr><td>L.C</td><td>Shall not exceed the value in No.8</td></tr>
<tr><td>Visual</td><td>There shall be no evidence of mechanical damage.</td></tr>
<tr><td rowspan="4">22</td><td rowspan="4">Endurance II</td><td>⊿C/C</td><td>± 20%</td><td colspan="2" rowspan="4">Temperature : 105 ± 2˚C
Duration : 1000 $^{+48}_{0}$ Hr.
Applied voltage : No. 3
Series resistance : 3 Ω</td></tr>
<tr><td>tan δ</td><td>Shall not exceed 300% of initial requirements.</td></tr>
<tr><td>L.C</td><td>Shall not exceed the value in No.8</td></tr>
<tr><td>Visual</td><td>There shall be no evidence of mechanical damage.</td></tr>
<tr><td>23</td><td colspan="2">Maximum permissible ripple current</td><td>0.5 Arms, 0.7 A_{P-P} (P case)
0.7 Arms, 1.0 A_{P-P} (A2, A case)
0.9 Arms, 1.5 A_{P-P} (B2 case)
1.5 Arms, 2.0 A_{P-P} (C case)
1.7 Arms, 2.5 A_{P-P} (V case)
1.5 Arms, 2.5 A_{P-P} (D case)</td><td colspan="2">Frequency : 1 MHz</td></tr>
</table>

Ratings

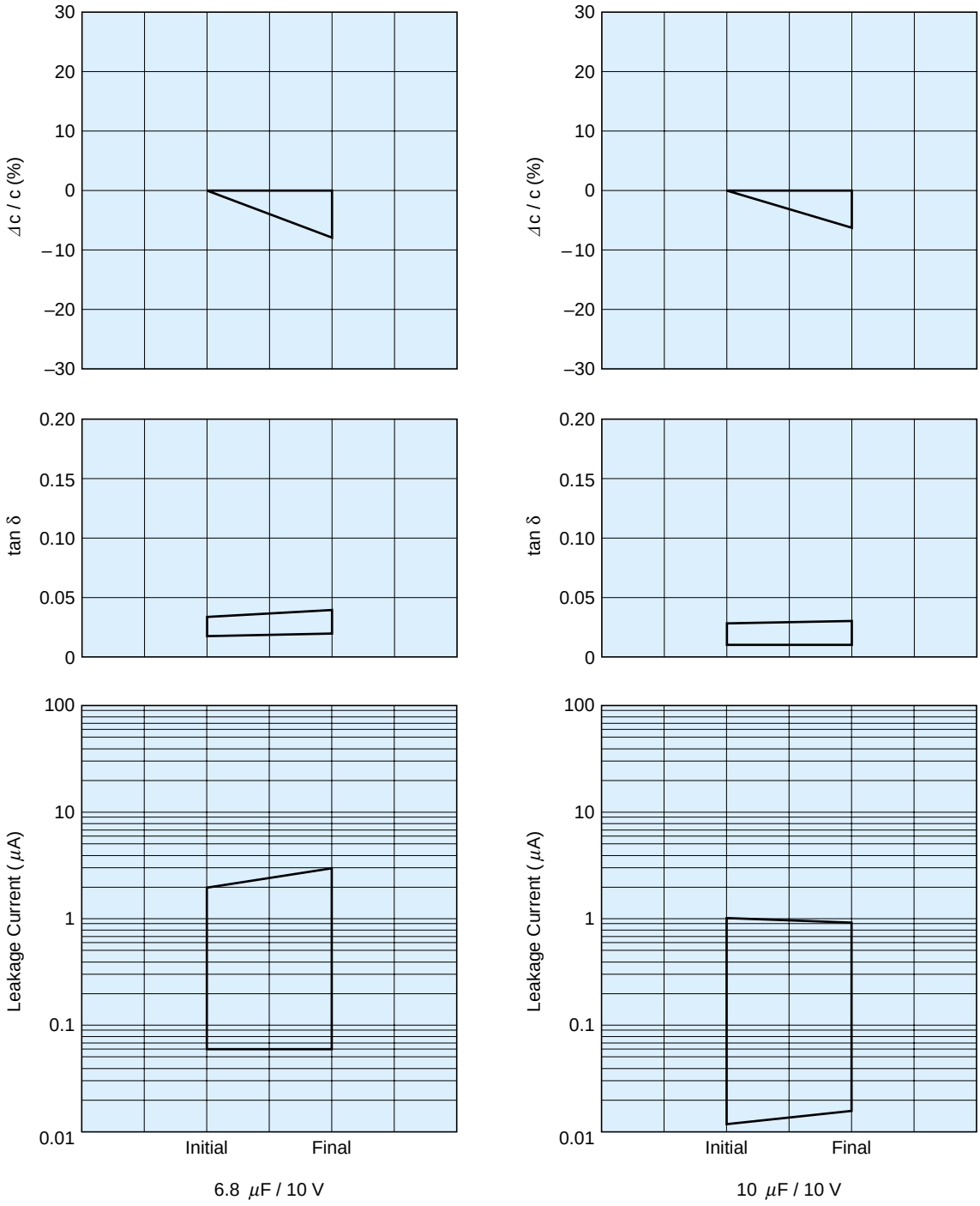
DC Rated Voltage @85°C (105°C) Vdc	Capacitance @20°C, 1 kHz μF	Case Code	Part Number	Leakage Current @20°C μA Max.	tan δ @20°C, 1 kHz % Max.	ESR @20°C, 100 kHz mΩ Max.	Ripple Current @20°C, 1 MHz A_{P-P} Max.
4 (3.3)	10	P	PSLP0G106M	4	15	500	0.7
	10	A	PSLA0G106M	4	15	500	1.0
	22	B2	PSLB20G226M	8.8	15	300	1.5
	68	C	PSLC0G686M	27.2	25	100	2.0
	100	B2	PSLB20G107M	40	25	80	1.5
	220	V	PSLV0G227M	88	50	45	2.5
	220	D	PSLD0G227M	88	50	80	2.5
	220	D	PSLD0G227M(60)	88	50	60	2.5
	220	D	PSLD0G227M(55)	88	50	55	2.5
	220	D	PSLD0G227M(40)	88	50	40	2.5
	330	D	PSLD0G337M	132	50	55	2.5
	330	D	PSLD0G337M(40)	132	50	40	2.5
6.3 (5)	4.7	P	PSLP0J475M	2.9	9	500	0.7
	6.8	A	PSLA0J685M	4.2	9	800	1.0
	10	A2	PSLA20J106M	6.3	15	500	1.0
	10	A	PSLA0J106M	6.3	15	500	1.0
	15	A	PSLA0J156M	9.45	15	500	1.0
	15	B2	PSLB20J156M	9.4	15	300	1.5
	22	A	PSLA0J226M	13.8	15	500	1.0
	22	B2	PSLB20J226M	13.8	15	300	1.5
	33	B2	PSLB20J336M	20.7	15	300	1.5
	47	B2	PSLB20J476M	29.6	25	200	1.5
	47	C	PSLC0J476M	29.6	25	100	2.0
	68	C	PSLC0J686M	42.8	25	100	2.0
	150	V	PSLV0J157M	94.5	30	45	2.5
	150	D	PSLD0J157M	94.5	30	80	2.5
	150	D	PSLD0J157M(60)	94.5	30	60	2.5
	150	D	PSLD0J157M(55)	94.5	30	55	2.5
	150	D	PSLD0J157M(40)	94.5	30	40	2.5
	220	D	PSLD0J227M	138.6	50	80	2.5
	220	D	PSLD0J227M(55)	138.6	50	55	2.5
	220	D	PSLD0J227M(40)	138.6	50	40	2.5
	330	D	PSLD0J337M	207.9	50	55	2.5
	330	D	PSLD0J337M(40)	207.9	50	40	2.5
	330	D	PSLD0J337M(25)	207.9	50	25	2.5

DC Rated Voltage @85°C (105°C) Vdc	Capacitance @20°C, 1 kHz μF	Case Code	Part Number	Leakage Current @20°C μA Max.	tan δ @20°C, 1 kHz % Max.	ESR @20°C, 100 kHz mΩ Max.	Ripple Current @20°C, 1 MHz A_{P-P} Max.
10 (8)	3.3	A	PSLA1A335M	3.3	9	800	1.0
	4.7	A2	PSLA21A475M	4.7	9	500	1.0
	4.7	A	PSLA1A475M	4.7	9	800	1.0
	6.8	A	PSLA1A685M	6.8	15	800	1.0
	6.8	B2	PSLB21A685M	6.8	15	500	1.5
	10	B2	PSLB21A106M	10	25	300	1.5
	15	B2	PSLB21A156M	9.5	15	300	1.5
	15	C	PSLC1A156M	15	25	200	2.0
	22	B2	PSLB21A226M	13.8	15	300	1.5
	22	C	PSLC1A226M	22	25	150	2.0
	33	B2	PSLB21A336M	20.7	15	300	1.5
	33	C	PSLC1A336M	33	25	100	2.0
	47	C	PSLC1A476M	47	25	100	2.0
	47	V	PSLV1A476M	47	30	60	2.5
	47	D	PSLD1A476M	47	30	100	2.5
	68	D	PSLD1A686M	68	30	100	2.5
	100	D	PSLD1A107M	100	30	80	2.5
	100	D	PSLD1A107M(55)	100	30	55	2.5

Typical Performance Characteristics

○ PS/L Series

Resistance to soldering (240˚C, 10 sec. reflow)



6.8 μF / 10 V

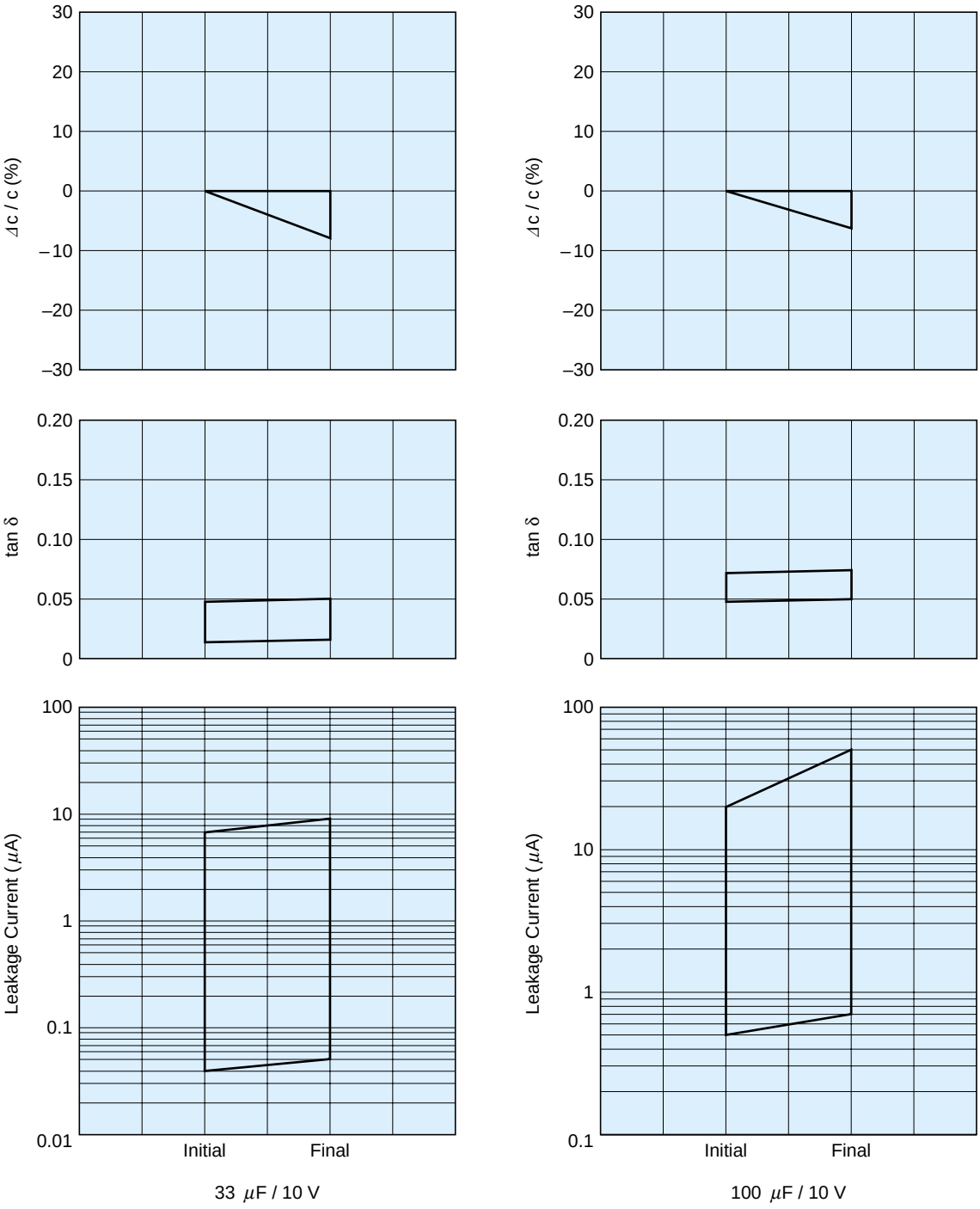
A Case

10 μF / 10 V

B2 Case

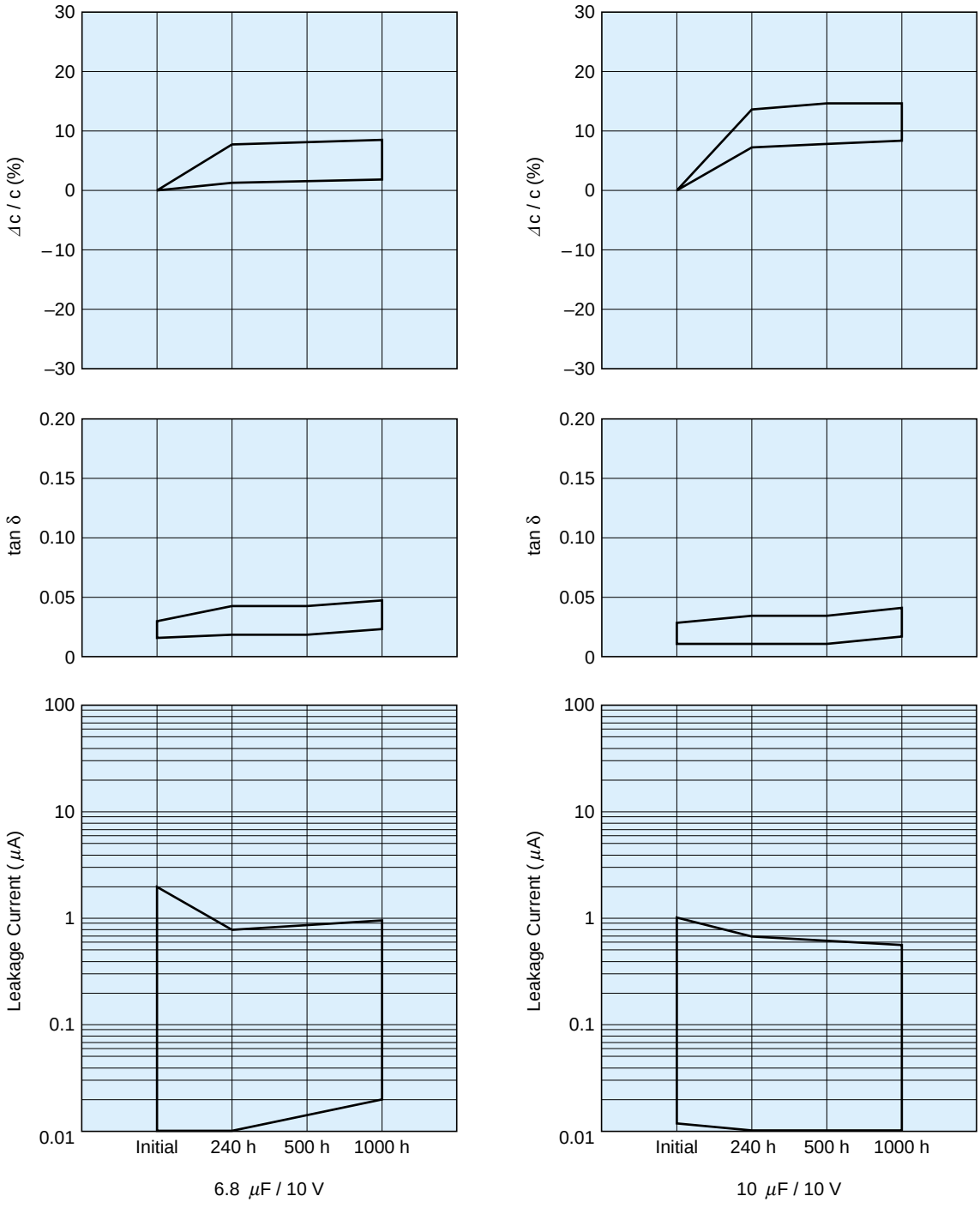
○ PS/L Series

Resistance to soldering (240˚C, 10 sec. reflow)



○ PS/L Series

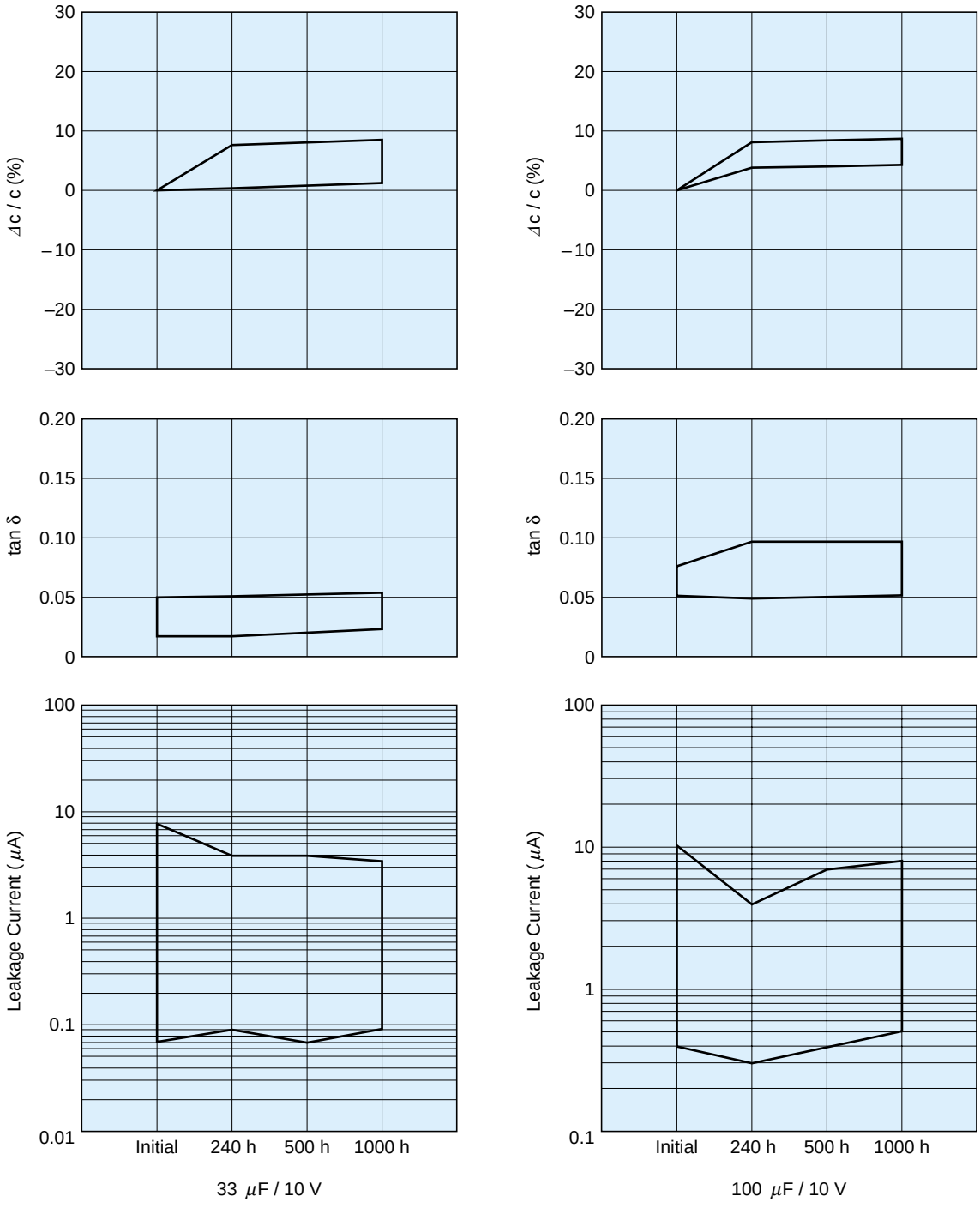
Damp heat, steady state (40˚C, 90 to 95% R.H.)



A Case **B2 Case**

○ PS/L Series

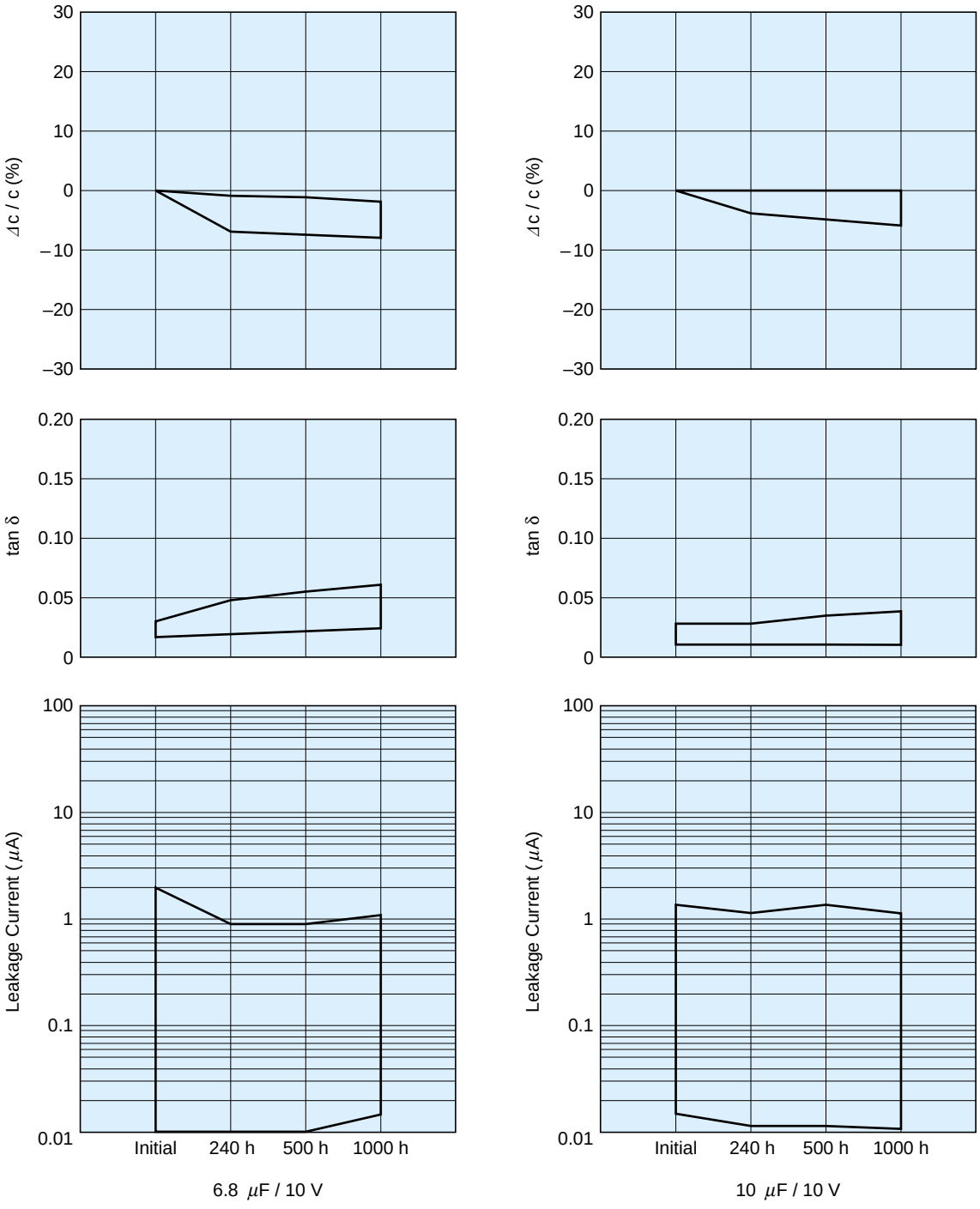
Damp heat, steady state (40˚C, 90 to 95% R.H.)



C Case **D Case**

○ PS/L Series

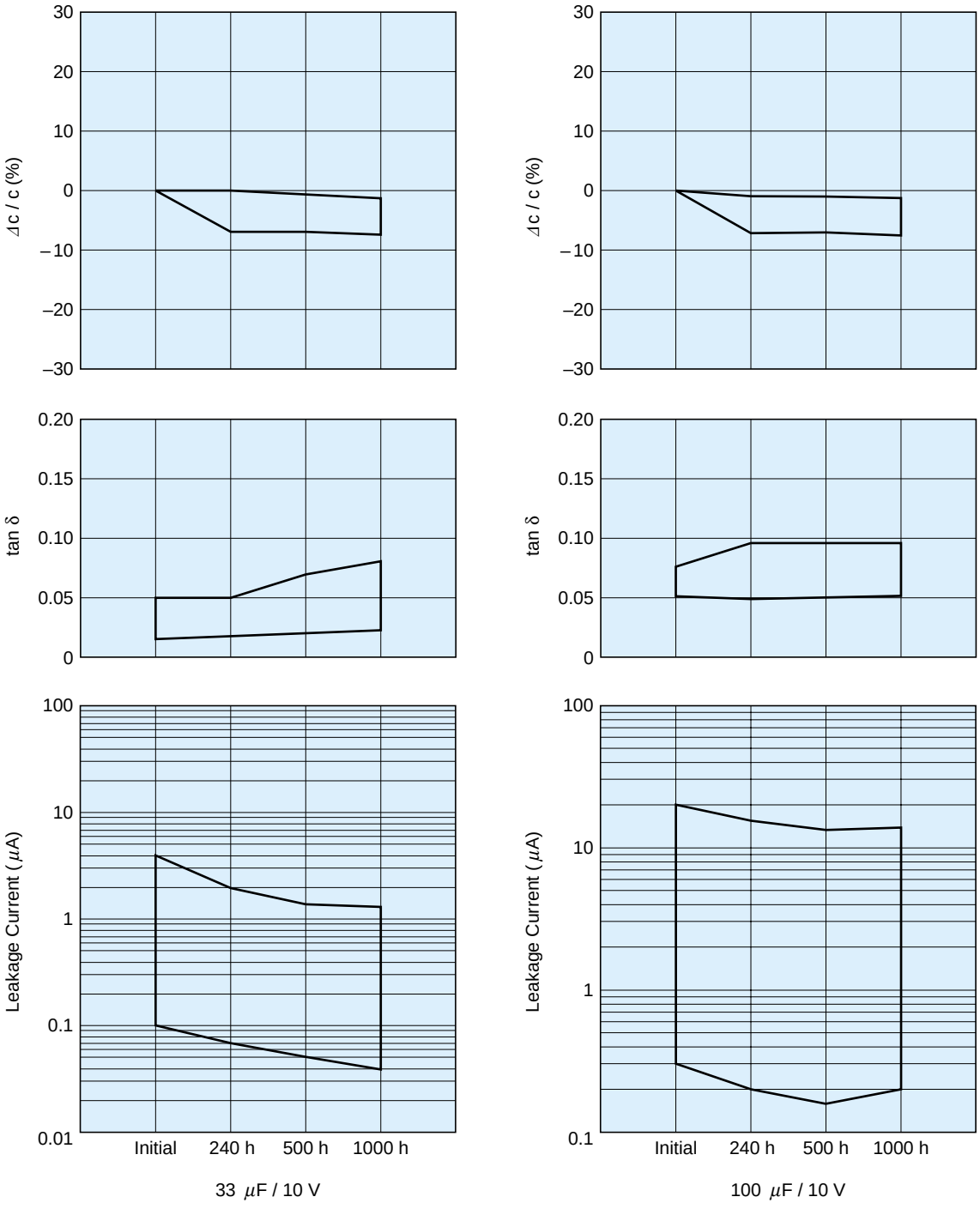
Endurance (105˚C, Rated Voltage)



A Case **B2 Case**

○ PS/L Series

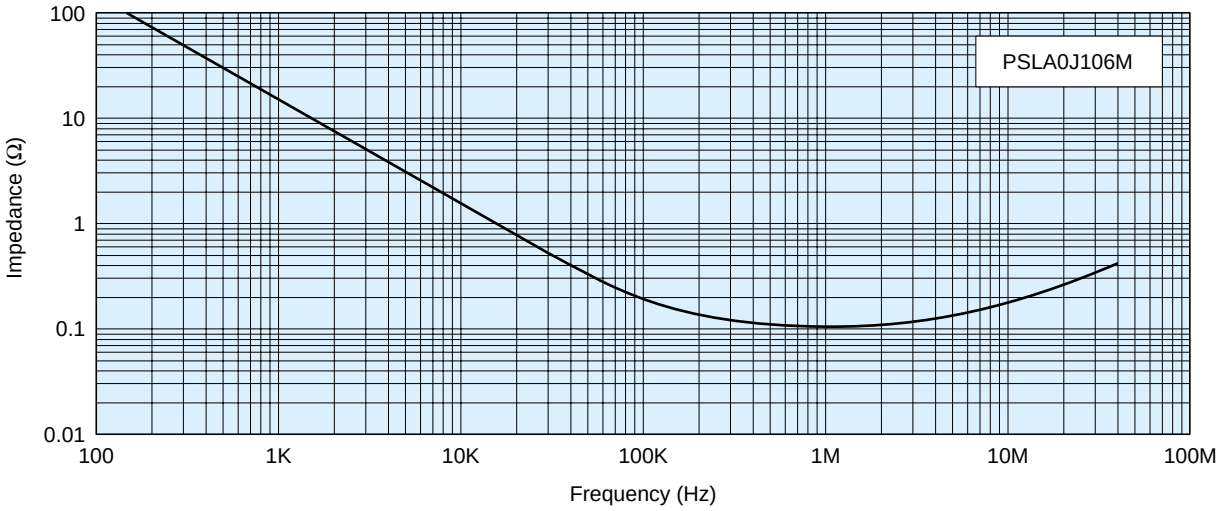
Endurance (105˚C, Rated Voltage)



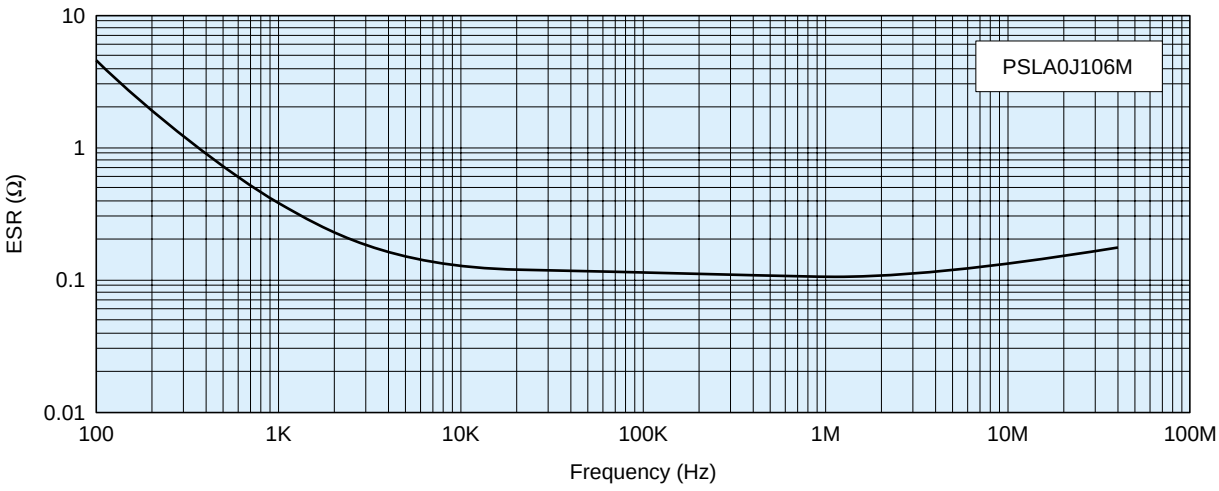
C Case **D Case**

○ PS/L Series

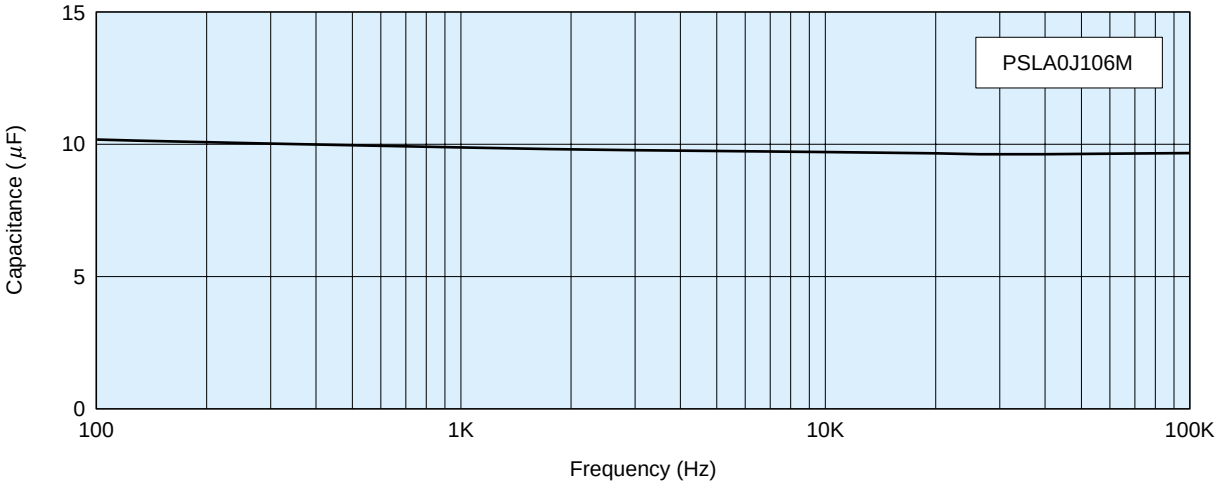
● **Impedance-frequency characteristics (Reference data)**



● **ESR-frequency characteristics (Reference data)**

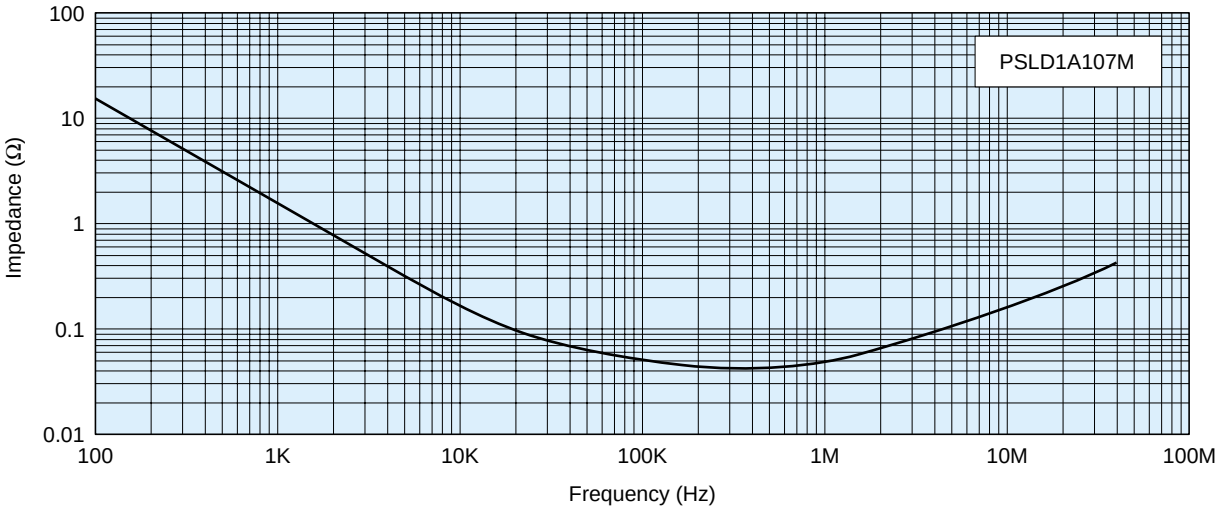


● **Capacitance-frequency characteristics (Reference data)**

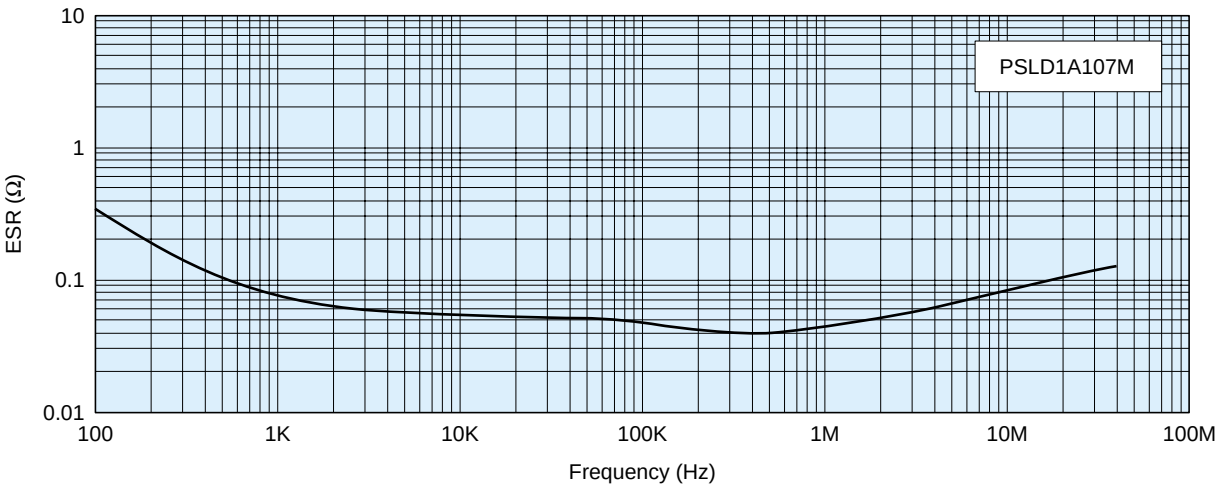


○ PS/L Series

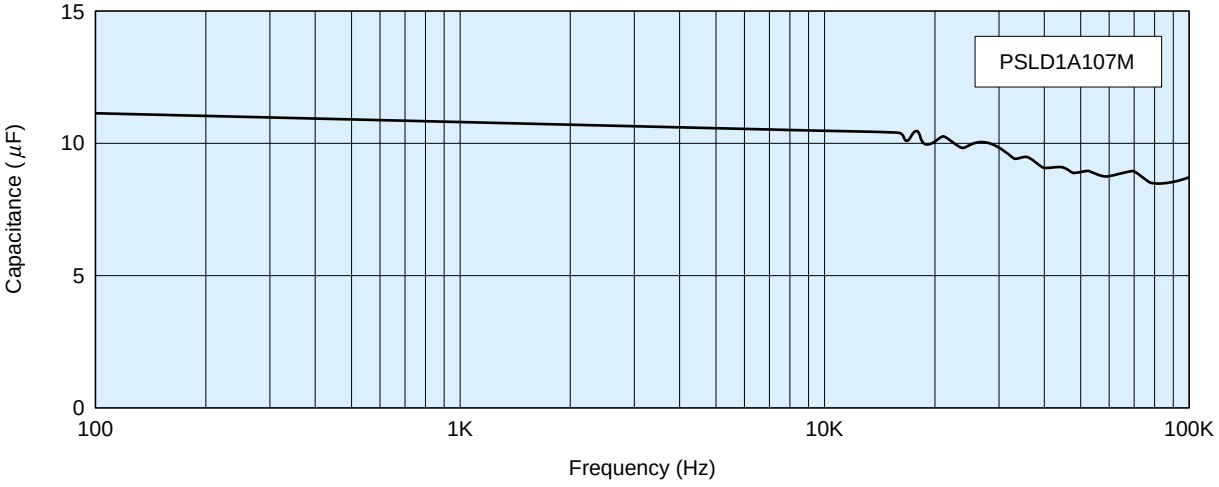
● Impedance-frequency characteristics (Reference data)



● ESR-frequency characteristics (Reference data)

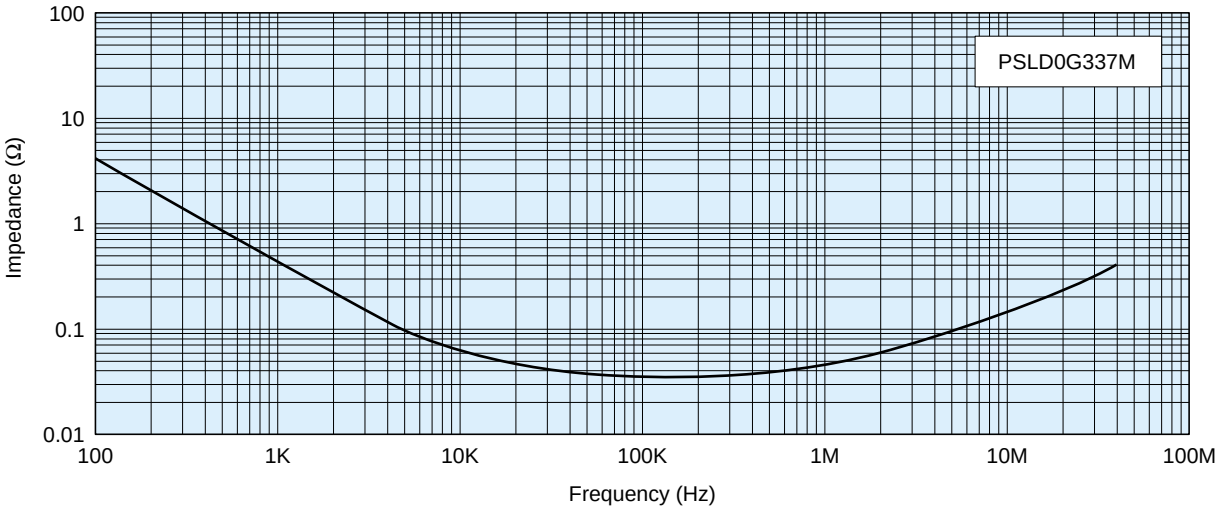


● Capacitance-frequency characteristics (Reference data)



○ PS/L Series

● Impedance-frequency characteristics (Reference data)



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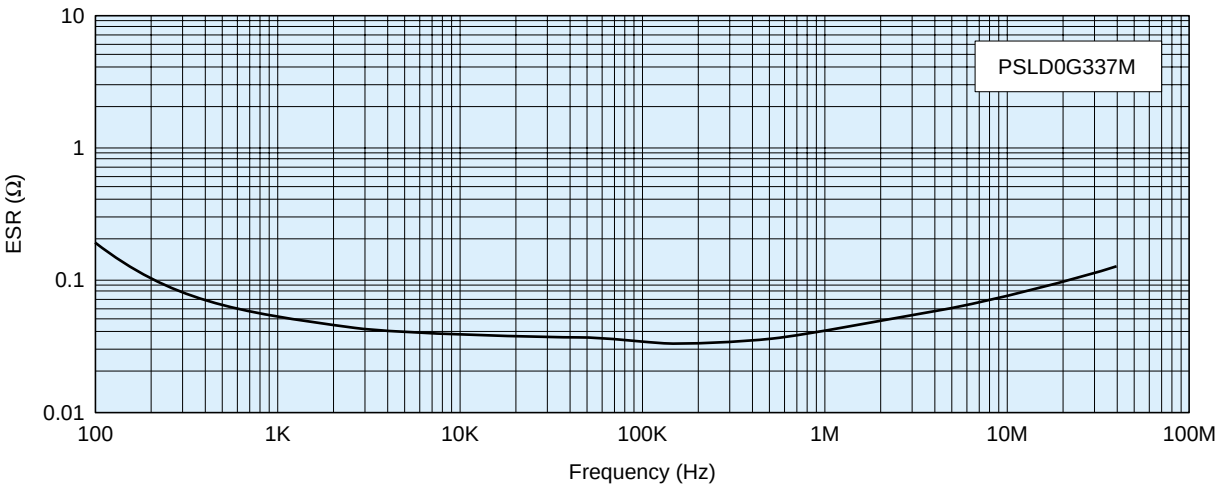
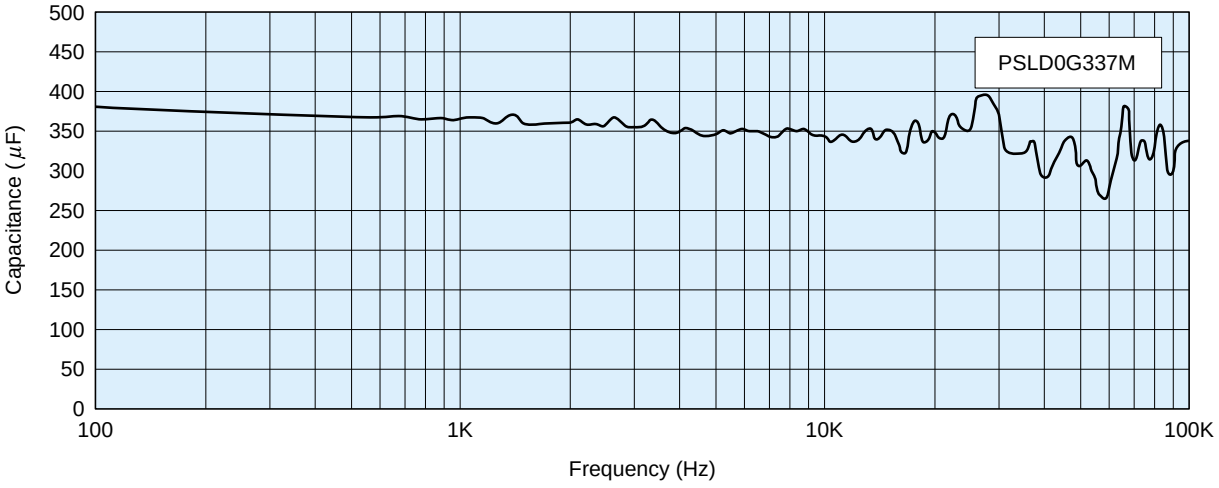


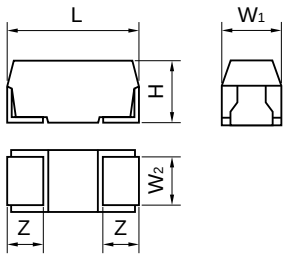
● Capacitance-frequency characteristics (Reference data)



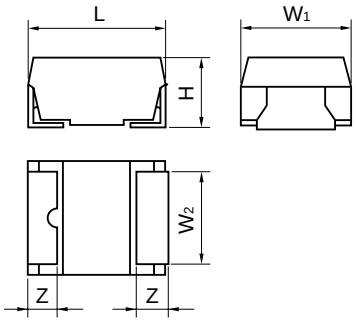
Specifications (PS/N Series)

Dimensions

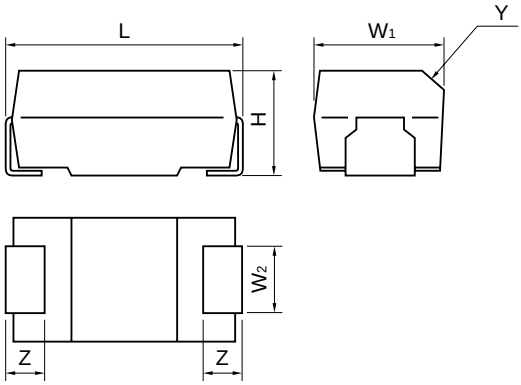
A case



B2 case



C and D case



Unit : mm (inch)

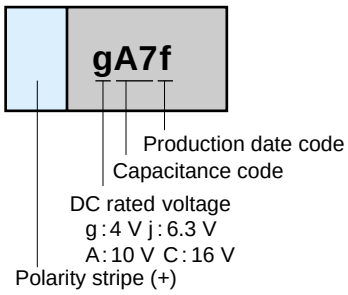
Case code	EIA code	L	W_1	W_2	H	Z	Y
A	3216	3.2 ± 0.2 (0.126±0.008)	1.6 ± 0.2 (0.063±0.008)	1.2 ± 0.1 (0.047±0.004)	1.6 ± 0.2 (0.061±0.008)	0.8 ± 0.2 (0.031±0.008)	—
B2	3528	3.5 ± 0.2 (0.138±0.008)	2.8 ± 0.2 (0.110±0.008)	2.3 ± 0.1 (0.091±0.004)	1.9 ± 0.2 (0.075±0.008)	0.8 ± 0.2 (0.031±0.008)	—
C	6032	6.0 ± 0.2 (0.236±0.008)	3.2 ± 0.2 (0.126±0.008)	2.2 ± 0.1 (0.087±0.004)	2.5 ± 0.2 (0.098±0.008)	1.3 ± 0.2 (0.051±0.008)	0.4 C (0.016)
D	7343	7.3 ± 0.2 (0.287±0.008)	4.3 ± 0.2 (0.169±0.008)	2.4 ± 0.1 (0.094±0.004)	2.8 ± 0.2 (0.110±0.008)	1.3 ± 0.2 (0.051±0.008)	0.5 C (0.020)

C–V Value Reference by Case Code

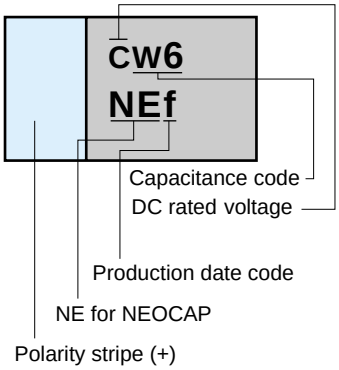
Capacitance (μF) \ Rated voltage (V)	4	6.3	10	16
3.3			A	A
4.7			A	B2
6.8		A	B2	B2
10	A	A	B2	
15		B2	C	
22	B2		C	
33			C	
47		C	D	
68	C		D	
100			D	
150		D		
220	D			

Markings

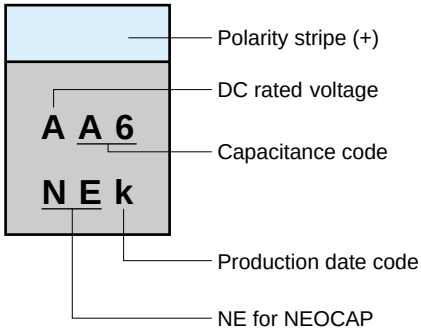
A case



B2 case



C and D case



Capacitance code

Code	A	E	J	N	S	W	Code	6	7	8
Number	1	1.5	2.2	3.3	4.7	6.8	Multiplier	10^6	10^7	10^8

Example) A7 = $1 \times 10^7 = 10^7$ (pF) = 10 (μF)

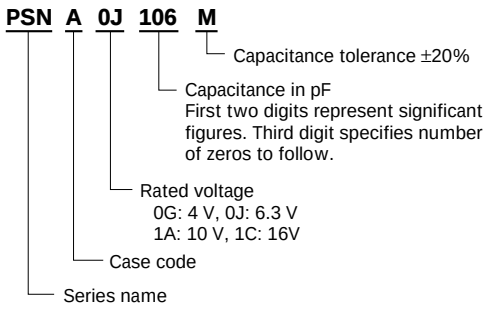
Procuction date code

Year \ Month	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1999	a	b	c	d	e	f	g	h	j	k	l	m
2000	n	p	q	r	s	t	u	v	w	x	y	z
2001	A	B	C	D	E	F	G	H	J	K	L	M
2002	N	P	Q	R	S	T	U	V	W	X	Y	Z

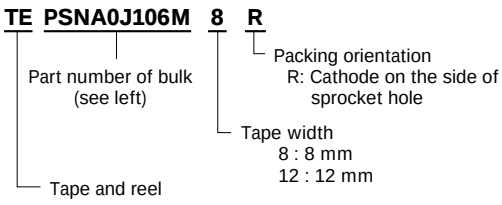
(NOTE) Date code will resume beginning in 2003.

PART NUMBER SYSTEM

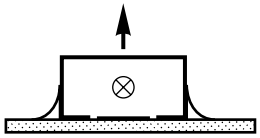
[Bulk]



[TAPE & REEL]



Performance Characteristics

No.	Item		Performance				Test Condition
1	Operating temperature		–55 to +85˚C				
2	Rated voltage (V.dc)		4	6.3	10	16	Temperature : 85˚C
3	Surge voltage (V.dc)		5.2	8	13	20	Temperature : 85˚C
4	Capacitance range		3.3 to 220 μF				Frequency : 1 kHz
5	Capacitance tolerance		±20%				Frequency : 1 kHz
6	Tangent of loss angle (tan δ)		Refer to ratings on page 24				Same measuring condition as No.4
7	Leakage current (L. C)		0.1 CV (μF $\times$ volts) or 3 μA, whichever is greater				Voltage : Rated voltage for 5 min.
8	Equivalent series resistance (ESR)		Refer to ratings on page 24				Frequency : 100 kHz
9	Dimensions		Mechanical dimensions shall meet the requirements specified on Page 19				
10	Resistance to solvents	Visual	Marking shall be legible.				Exposure to the following detergent for the duration of 30 ± 5 sec. • Isopropyl alcohol
11	Vibration	Cap.	Shall be stable for period of measurement.				Frequency : 10 to 55 Hz Sweep : 1 minute Amplitude of vibration : 1.5 mm Vibration time : Each plane shall be 2 hours for a total 4 hours. Within last 30 minutes, capacitance shall be measured several times.
		Visual	There shall be no evidence of mechanical damage.				
12	Shock	ΔC/C	± 20%				100 G, Saw-tooth wave
		tan δ	Shall not exceed the value in No.6				
		L.C	Shall not exceed the value in No.7				
		Visual	There shall be no evidence of mechanical damage.				
13	Terminal strength	Visual	There shall be no evidence of mechanical damage.				Strength : 4.9 N Time : 10 ± 0.5 sec. (two direction) 

—— continued ——

<table>
<tr><th>No.</th><th colspan="2">Item</th><th>Performance</th><th>Test Condition</th></tr>
<tr><td rowspan="4">14</td><td rowspan="4">Surge voltage</td><td>⊿C/C</td><td>± 20%</td><td rowspan="4">Temperature : 85 ± 2˚C
Applied voltage : No. 3
Series resistance : 1000 Ω
Duration of surge : 30 ± 5 sec.
Time between surge : 5.5 min.
Number of cycles : 1,000</td></tr>
<tr><td>tan δ</td><td>Shall not exceed the value in No.6</td></tr>
<tr><td>L.C</td><td>Shall not exceed the value in No.7</td></tr>
<tr><td>Visual</td><td>There shall be no evidence of mechanical damage.</td></tr>
<tr><td rowspan="5">15</td><td rowspan="5">Characteris-tics at high and low Temperature</td><td>⊿C/C</td><td>$^{0}_{-20}$%</td><td rowspan="2">Step 2</td><td rowspan="5"><table><tr><th>Step</th><th>Temperature</th></tr><tr><td>1</td><td>25 ± 2˚C</td></tr><tr><td>2</td><td>–55 $^{0}_{-3}$˚C</td></tr><tr><td>3</td><td>25 ± 2˚C</td></tr><tr><td>4</td><td>85 $^{+3}_{0}$˚C</td></tr></table></td></tr>
<tr><td>tan δ</td><td>Shall not exceed the value in No.6</td></tr>
<tr><td>⊿C/C</td><td>$^{+50}_{0}$%</td><td rowspan="3">Step 4</td></tr>
<tr><td>tan δ</td><td>Shall not exceed 150% of initial requirements</td></tr>
<tr><td>L.C</td><td>1.0 CV (μF × volts) or 30 μA, whichever is greater</td></tr>
<tr><td rowspan="4">16</td><td rowspan="4">Resistance to Soldering</td><td>⊿C/C</td><td>± 20%</td><td rowspan="4">Reflow soldering method
240˚C, 10 sec. max.
(peak 260˚C)</td></tr>
<tr><td>tan δ</td><td>Shall not exceed the value in No.6</td></tr>
<tr><td>L.C</td><td>Shall not exceed the value in No.7</td></tr>
<tr><td>Visual</td><td>There shall be no evidence of mechanical damage.</td></tr>
<tr><td>17</td><td colspan="2">Solderability</td><td>Over 95% of the terminal surface shall be covered by a continuous new solder coating after immersion.</td><td>The flux shall be a solution containing 25% by weight of water white rosin and 75% by weight of methyl alcohol.
Solder temp. : 210 ± 5˚C
Immersion time : 5 ± 0.5 sec.</td></tr>
<tr><td rowspan="4">18</td><td rowspan="4">Damp heat, steady state</td><td>Cap.</td><td>+30% to –20% of rated capacitance</td><td rowspan="4">Temperature : 40 ± 2˚C
Moisture : 90 to 95% R.H.
Duration : 500 $^{+24}_{0}$ Hr.</td></tr>
<tr><td>tan δ</td><td>Shall not exceed 150% of initial requirements</td></tr>
<tr><td>L.C</td><td>Shall not exceed the value in No.7</td></tr>
<tr><td>Visual</td><td>There shall be no evidence of mechanical damage.</td></tr>
</table>

—— continued ——

<table>
<tr><th>No.</th><th colspan="2">Item</th><th>Performance</th><th>Test Condition</th></tr>
<tr><td rowspan="4">19</td><td rowspan="4">Rapid chage
of temperature</td><td>⊿C/C</td><td>± 20%</td><td rowspan="4">Parts shall be temperature cycled over a temperature range of –55 to +85˚C, five times continuously as follows.
<table><tr><th>Step</th><th>Temperature</th><th>Time</th></tr><tr><td>1</td><td>$-55\,^{0}_{-3}$˚C</td><td>30 ± 3 min.</td></tr><tr><td>2</td><td>room temp.</td><td>10 to 15 min.</td></tr><tr><td>3</td><td>$85\,^{+3}_{0}$˚C</td><td>30 ± 3 min.</td></tr><tr><td>4</td><td>room temp.</td><td>10 to 15 min.</td></tr></table></td></tr>
<tr><td>tan δ</td><td>Shall not exceed the value in No.6</td></tr>
<tr><td>L.C</td><td>Shall not exceed the value in No.7</td></tr>
<tr><td>Visual</td><td>There shall be no evidence of mechanical damage.</td></tr>
<tr><td rowspan="4">20</td><td rowspan="4">Endurance</td><td>⊿C/C</td><td>± 20%</td><td rowspan="4">Temperature : 85 ± 2˚C
Duration : $1000\,^{+48}_{0}$ Hr.
Applied voltage : No. 2
Series resistance : 3 Ω</td></tr>
<tr><td>tan δ</td><td>Shall not exceed 150% of initial requirements.</td></tr>
<tr><td>L.C</td><td>Shall not exceed the value in No.7</td></tr>
<tr><td>Visual</td><td>There shall be no evidence of mechanical damage.</td></tr>
<tr><td>21</td><td colspan="2">Maximum permissible ripple current</td><td>0.7 Arms, 1 A_{P-P} (A case)
0.9 Arms, 1.5 A_{P-P} (B2 case)
1.5 Arms, 2.5 A_{P-P} (C, D case)</td><td>Frequency : 1 MHz</td></tr>
</table>

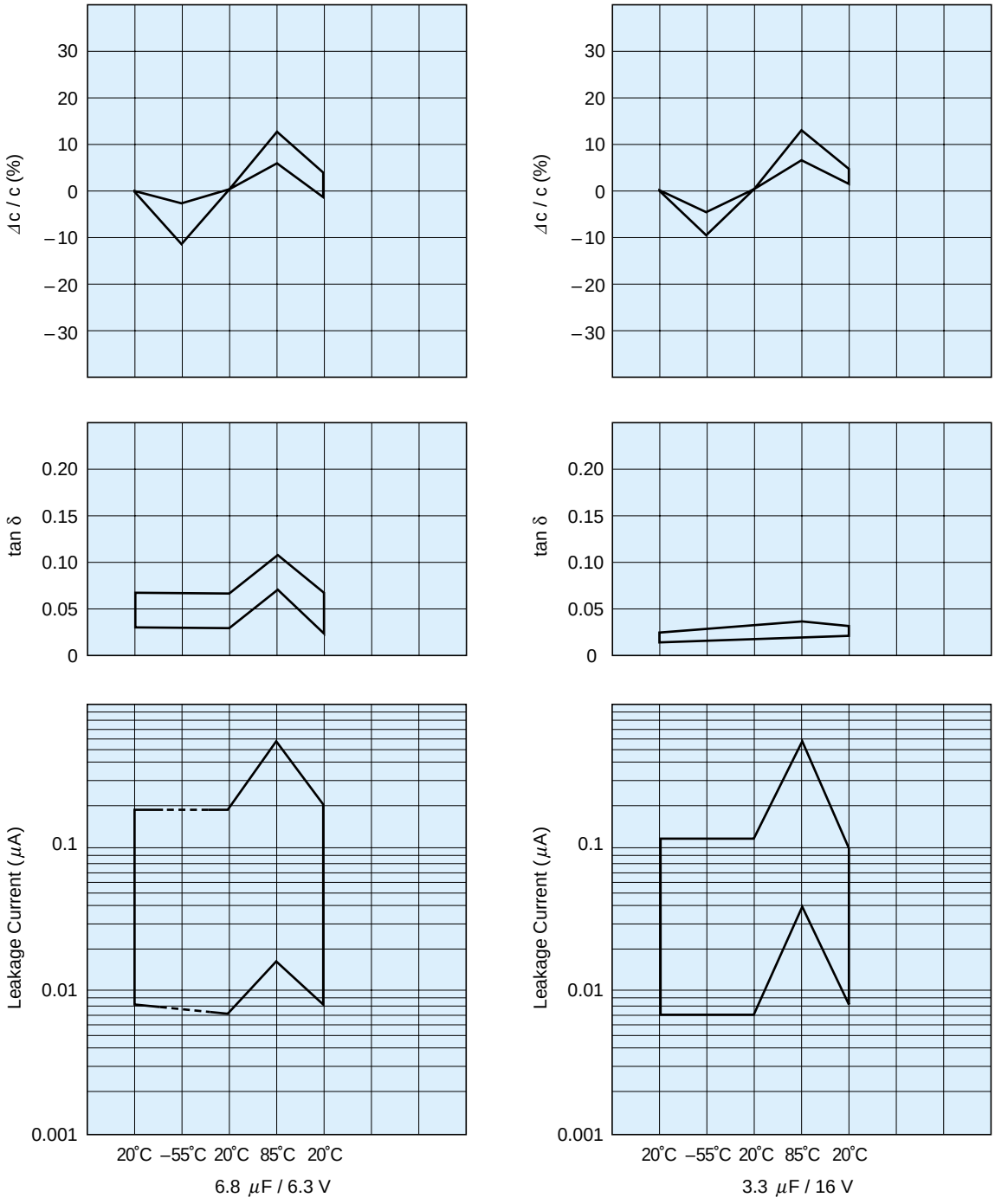
Ratings

DC Rated Voltage @85°C Vdc	Capacitance @20°C, 1 kHz μF	Case Code	Part Number	Leakage Current @20°C μA Max.	tan δ @20°C, 1 kHz % Max.	ESR @20°C, 100 kHz mΩ Max.	Ripple Current @20°C, 1 MHz A_{P-P} Max.
4	10	A	PSNA0G106M	4	15	600	1.0
	22	B2	PSNB20G226M	8.8	15	400	1.5
	68	C	PSNC0G686M	27.2	20	150	2.5
	220	D	PSND0G227M	88	50	80	2.5
6.3	6.8	A	PSNA0J685M	4.2	9	900	1.0
	10	A	PSNA0J106M	6.3	15	600	1.0
	15	B2	PSNB20J156M	9.4	15	400	1.5
	47	C	PSNC0J476M	29.6	20	150	2.5
	150	D	PSND0J157M	94.5	30	80	2.5
10	3.3	A	PSNA1A335M	3.3	9	900	1.0
	4.7	A	PSNA1A475M	4.7	9	900	1.0
	6.8	B2	PSNB21A685M	6.8	15	600	1.5
	10	B2	PSNB21A106M	10	15	400	1.5
	15	C	PSNC1A156M	15	20	250	2.5
	22	C	PSNC1A226M	22	20	200	2.5
	33	C	PSNC1A336M	33	20	150	2.5
	47	D	PSND1A476M	47	30	150	2.5
	68	D	PSND1A686M	68	30	120	2.5
	100	D	PSND1A107M	100	30	80	2.5
16	3.3	A	PSNA1C335M	5.3	9	900	1.0
	4.7	B2	PSNB21C475M	7.5	15	600	1.5
	6.8	B2	PSNB21C685M	10.9	15	600	1.5

Typical Performance Characteristics

○ PS/N Series

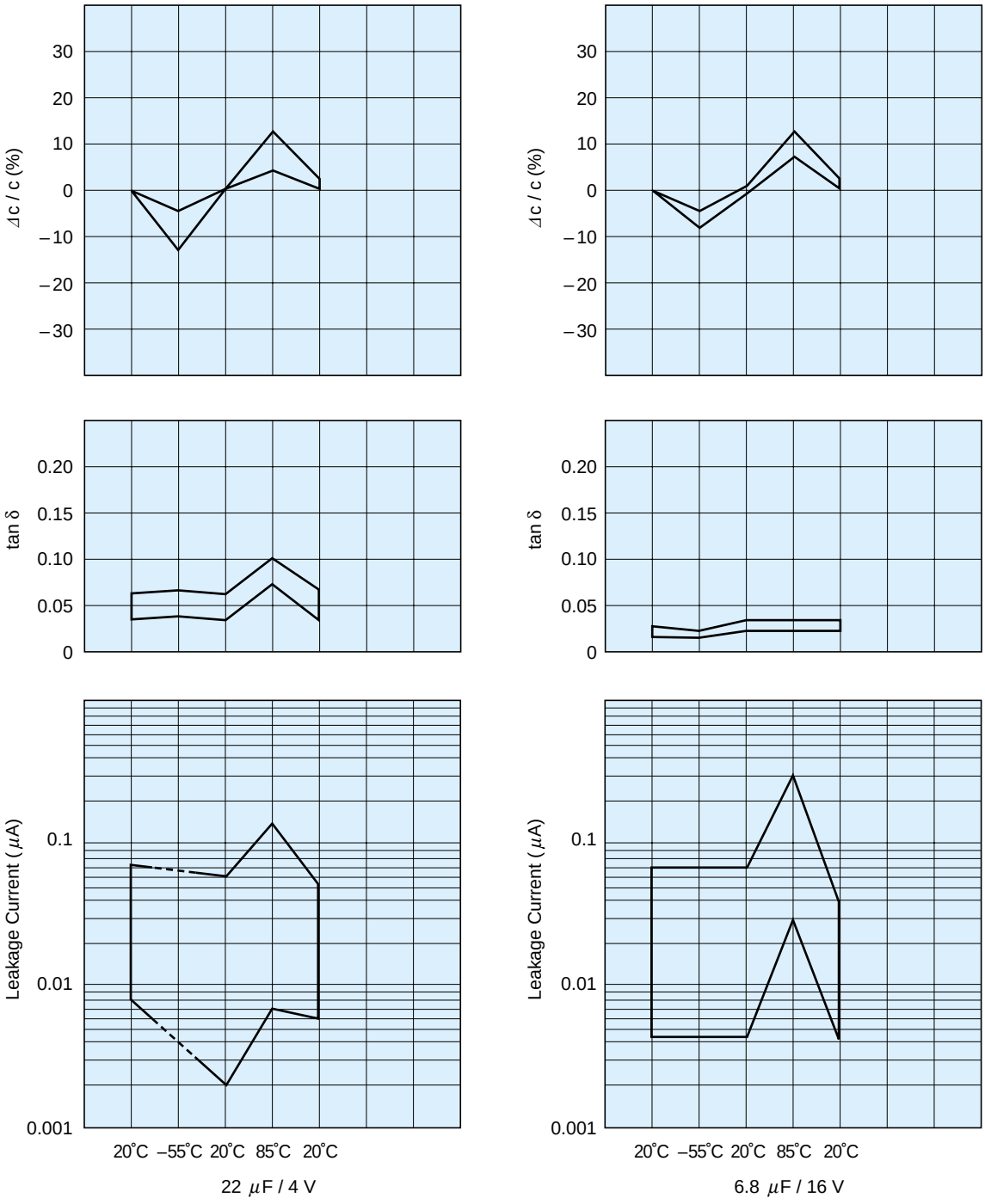
Characteristics at high and low temperature



A Case

○ PS/N Series

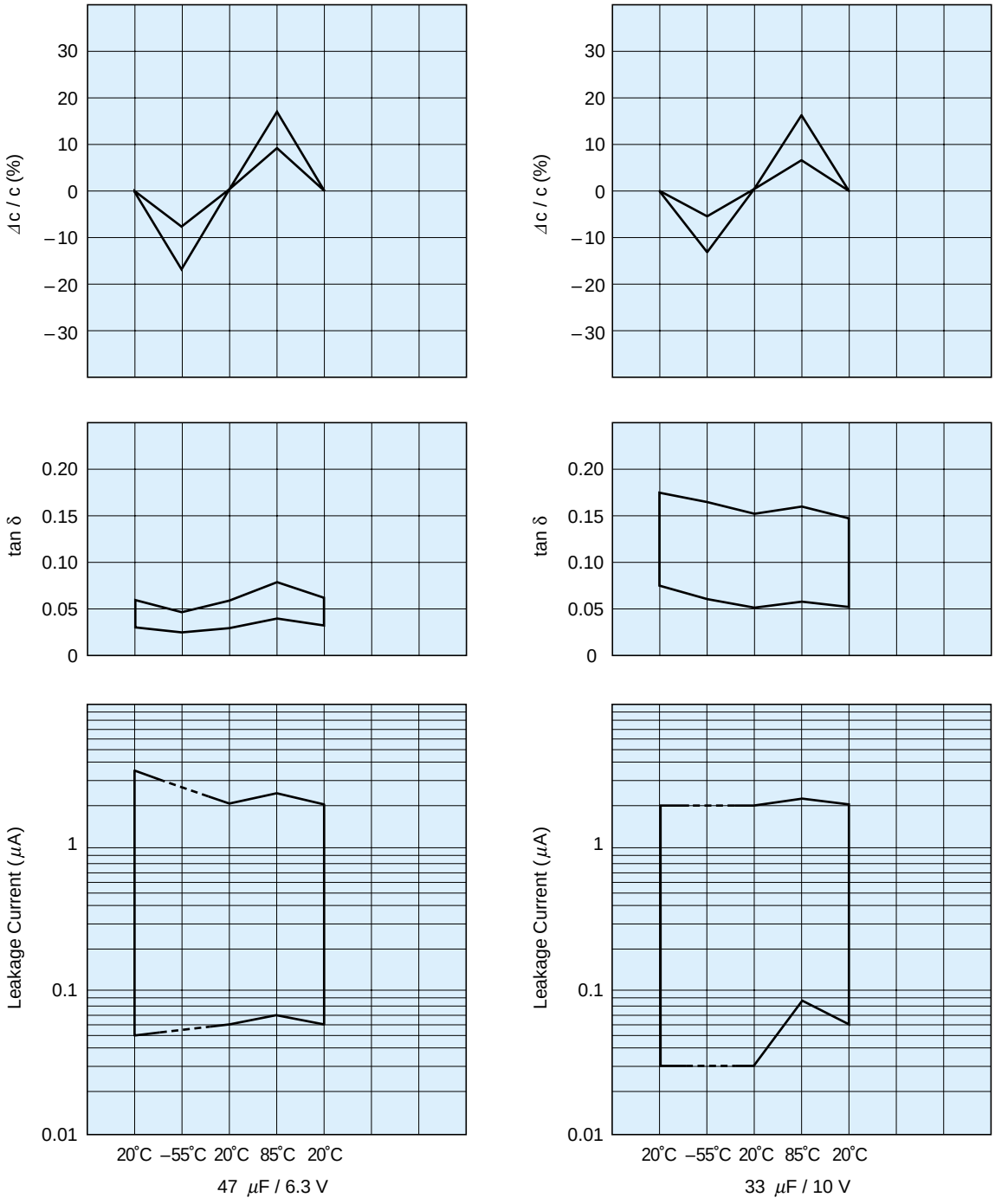
Characteristics at high and low temperature



B2 Case

○ PS/N Series

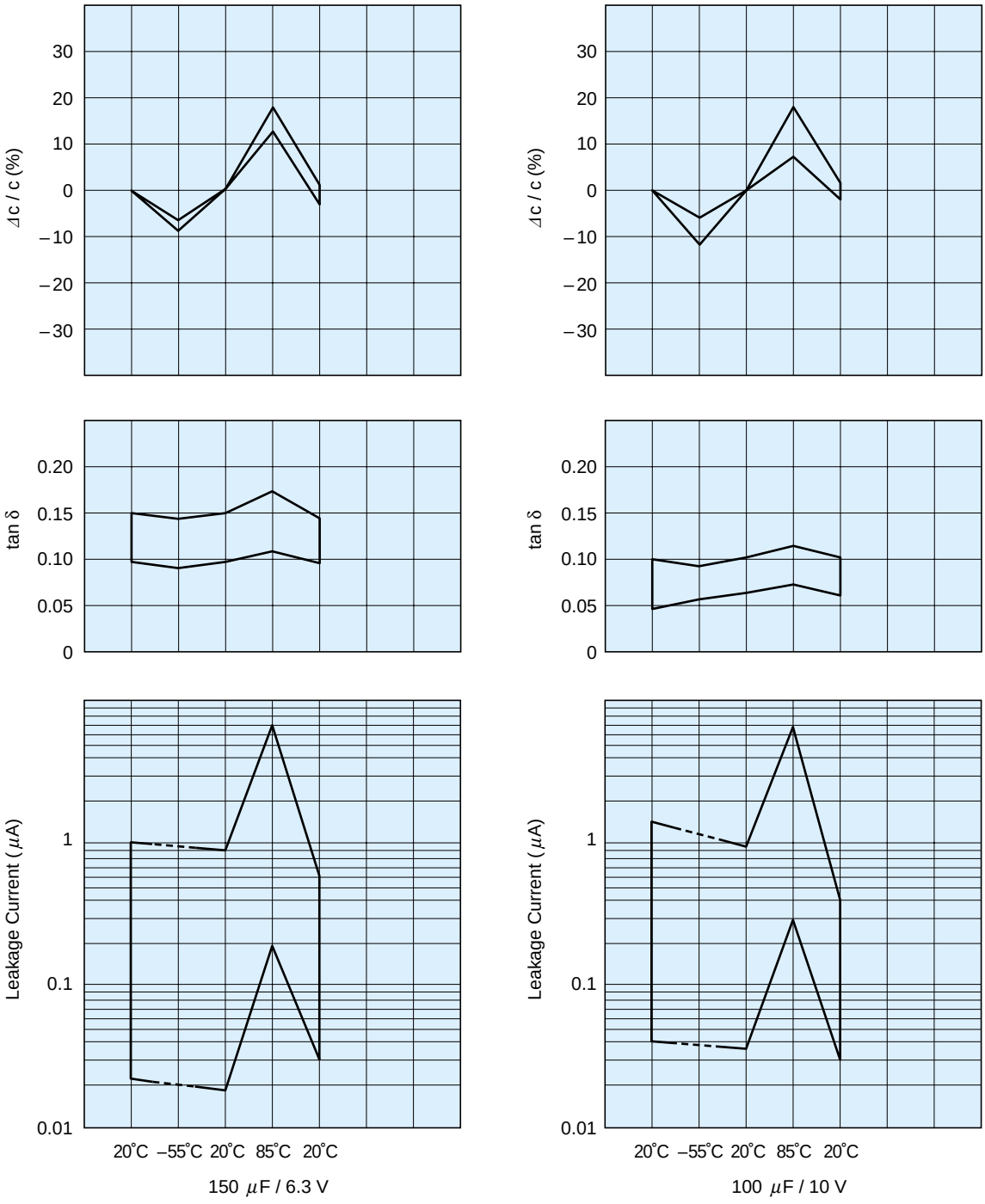
Characteristics at high and low temperature



C Case

○ PS/N Series

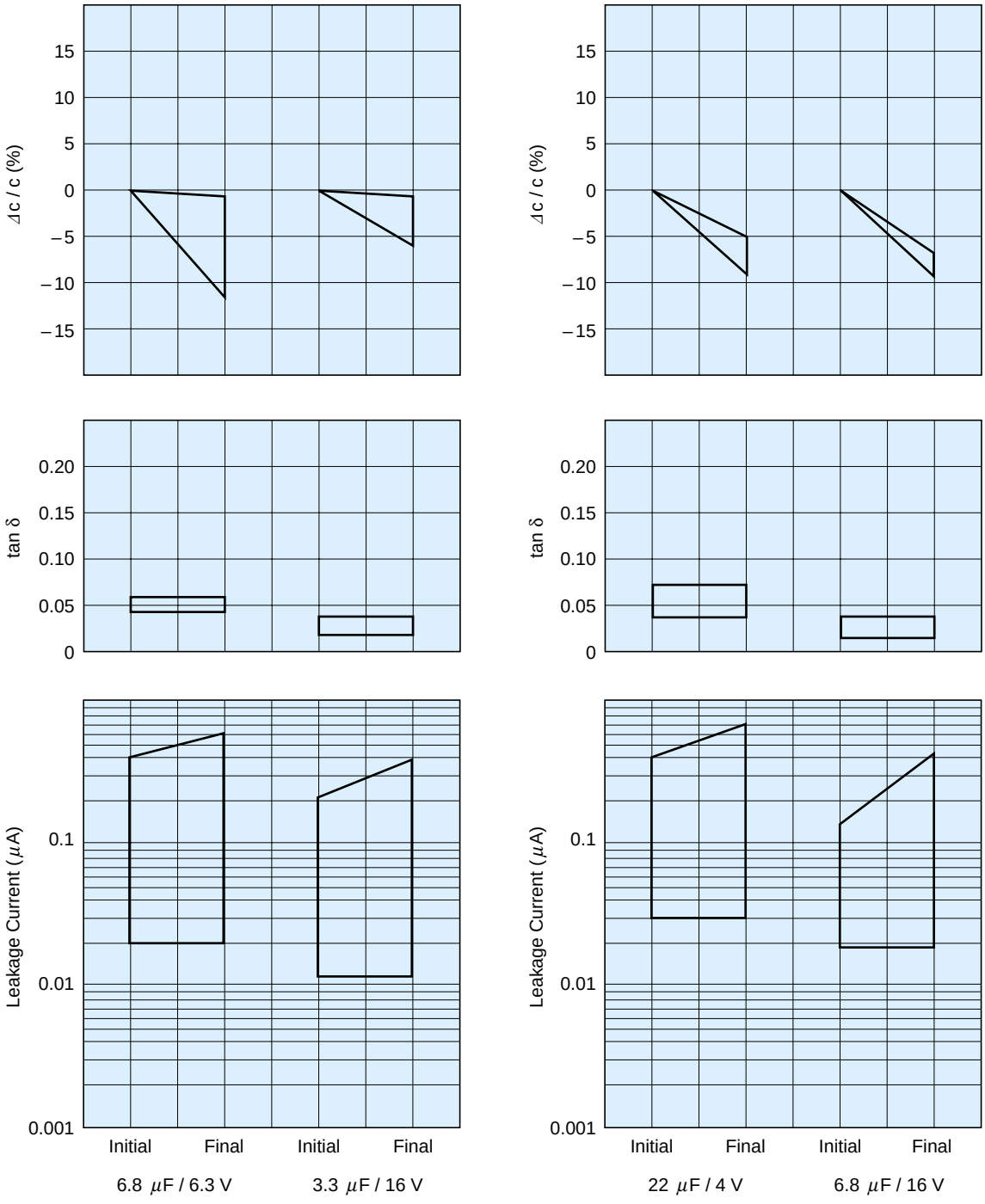
Characteristics at high and low temperature



D Case

○ PS/N Series

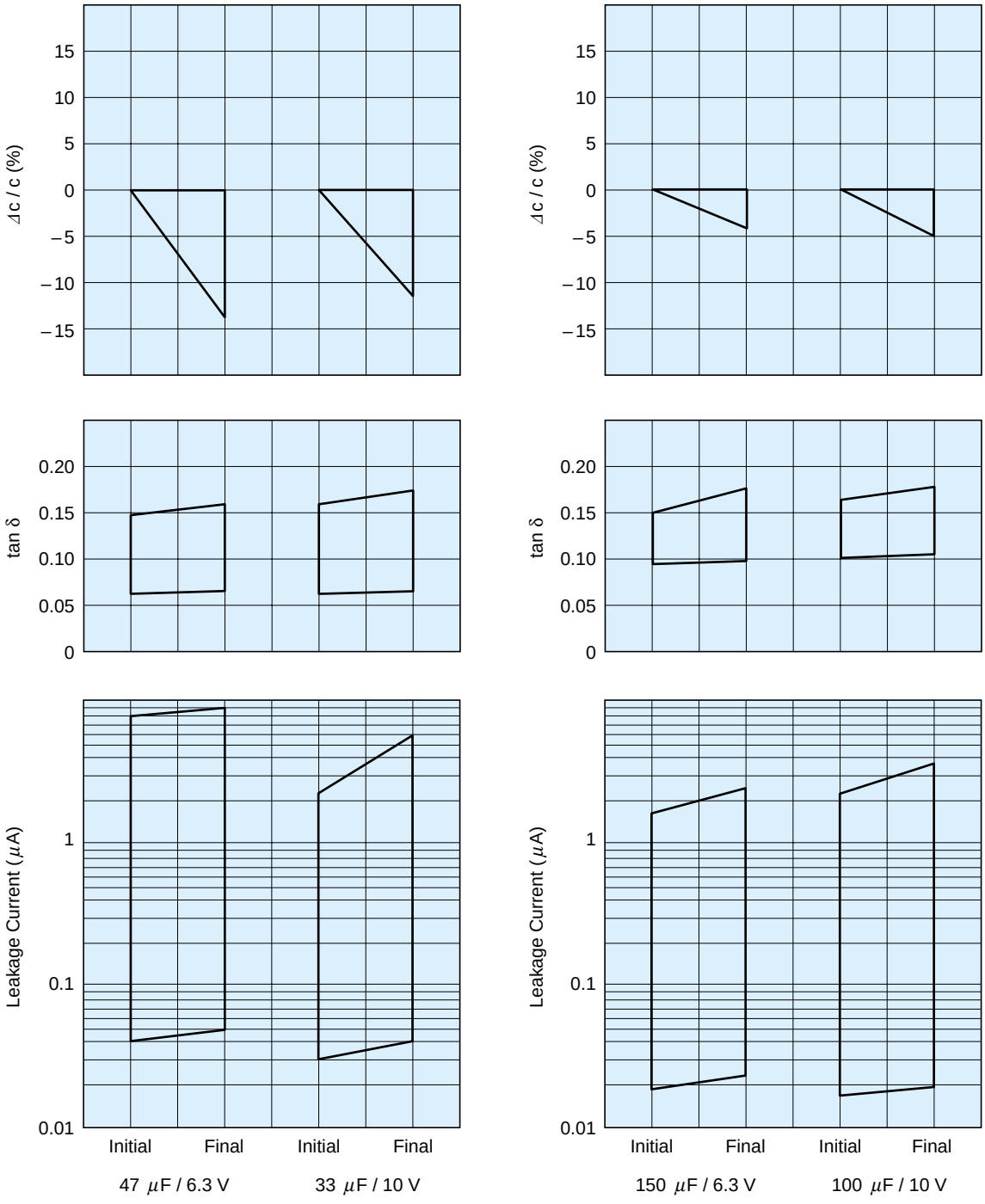
Resistance to soldering (240°C, 10 sec. reflow)



A Case **B2 Case**

○ PS/N Series

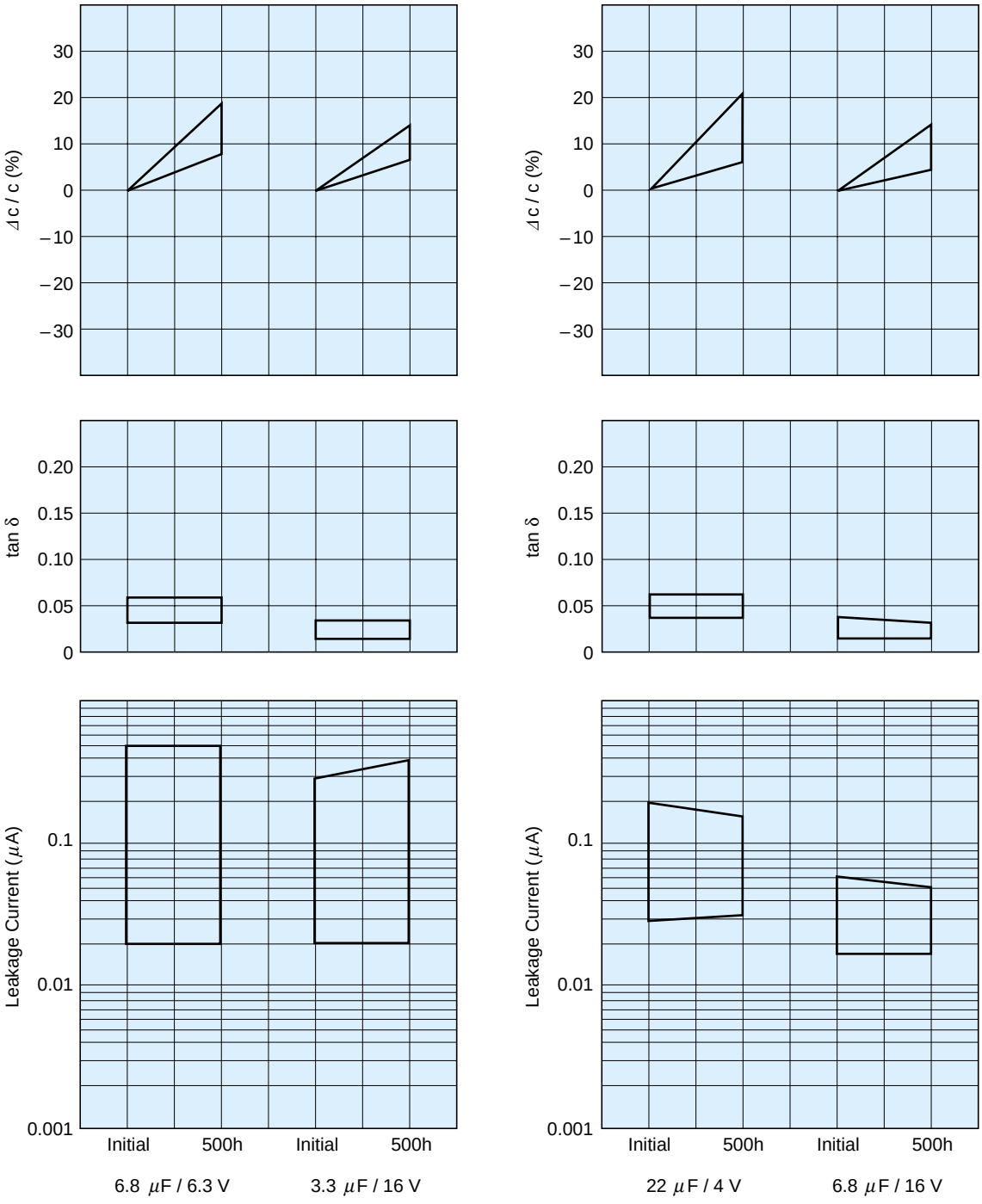
Resistance to soldering (240°C, 10 sec. reflow)



C Case **D Case**

○ PS/N Series

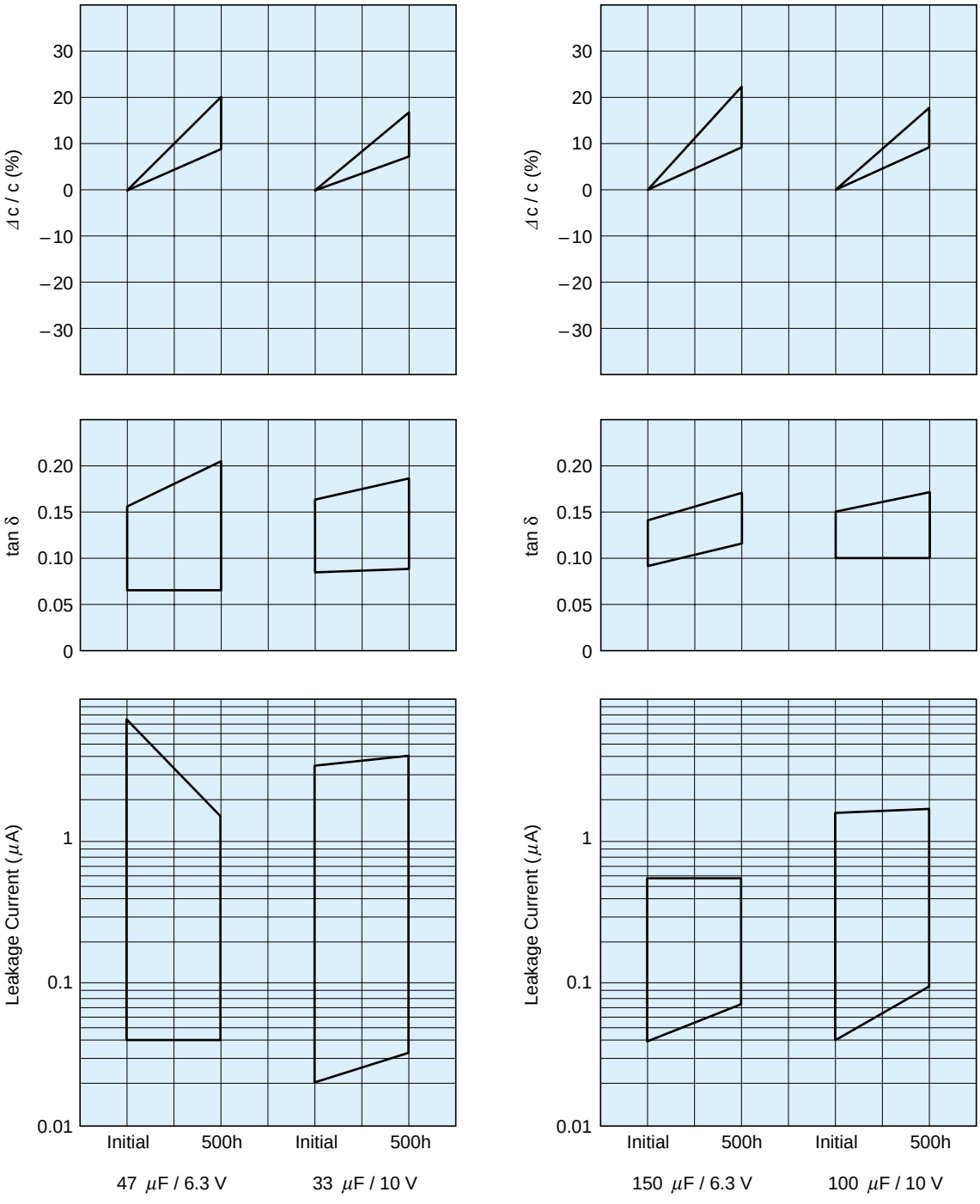
Damp heat, steady state (40˚C, 90 to 95% R.H.)



A Case **B2 Case**

○ PS/N Series

Damp heat, steady state (40˚C, 90 to 95% R.H.)

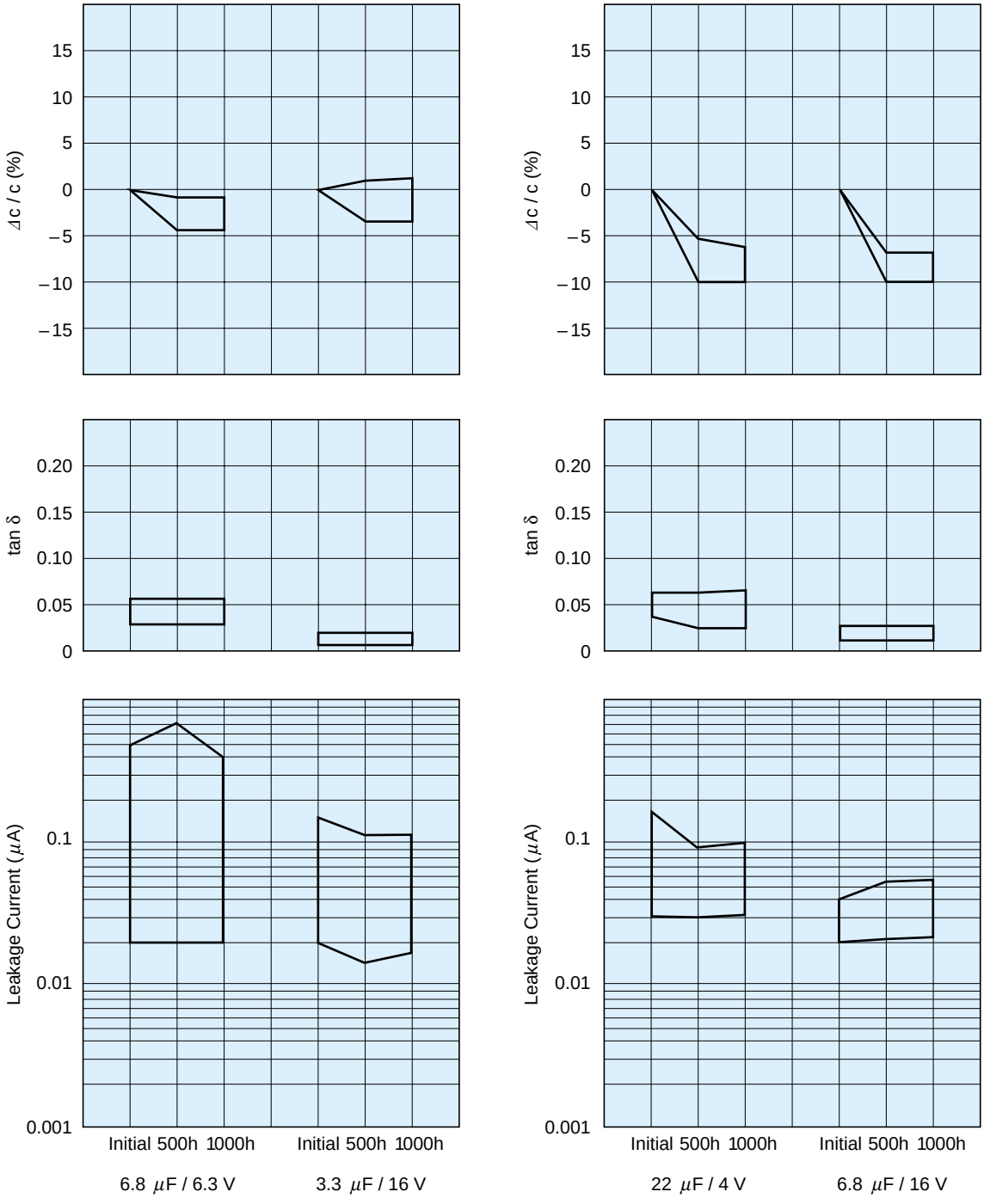


C Case **D Case**

○ PS/N Series

Endurance (85˚C, Rated Voltage × 1.3)

[reference data]

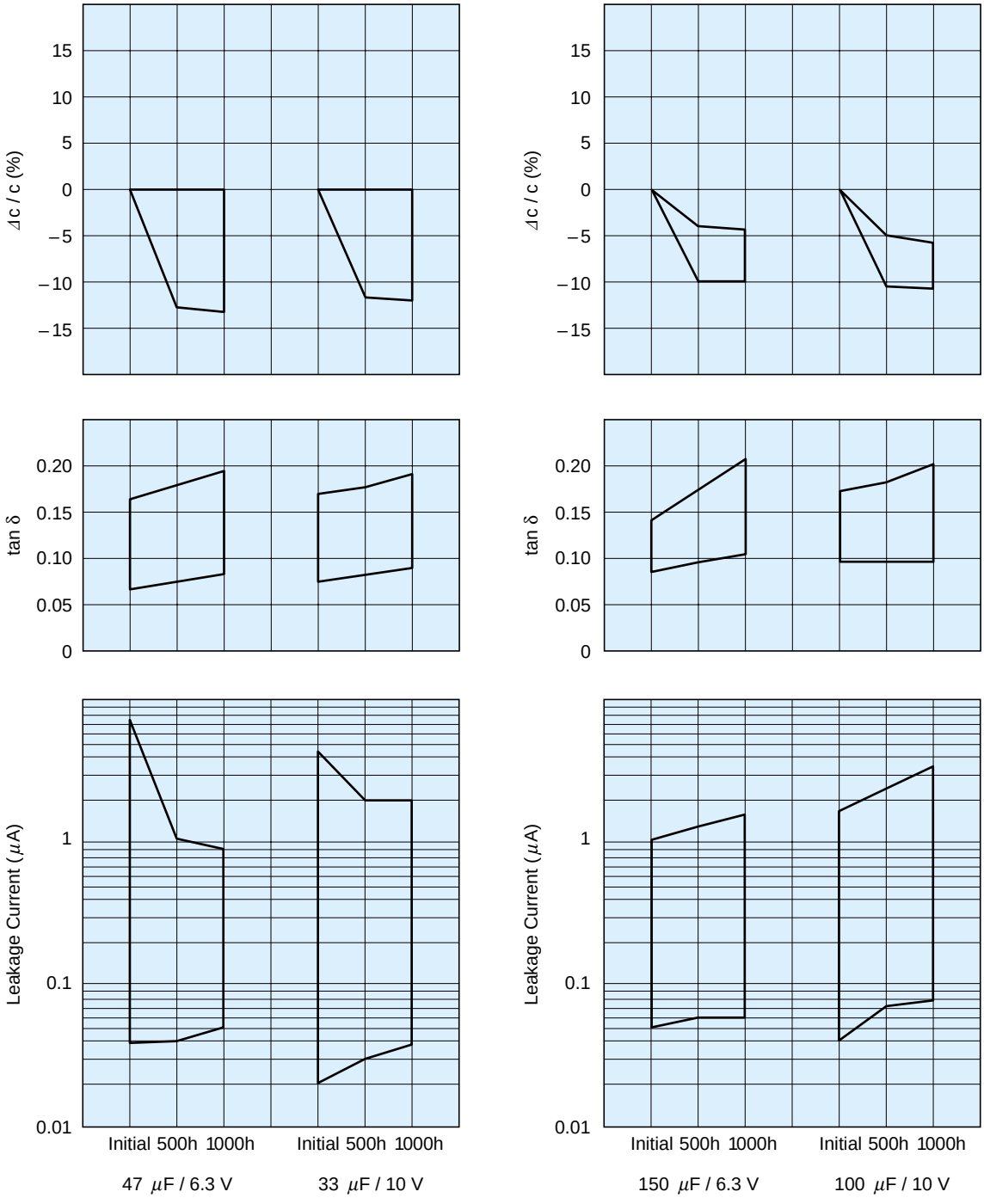


A Case **B2 Case**

○ PS/N Series

Endurance (85˚C, Rated Voltage × 1.3)

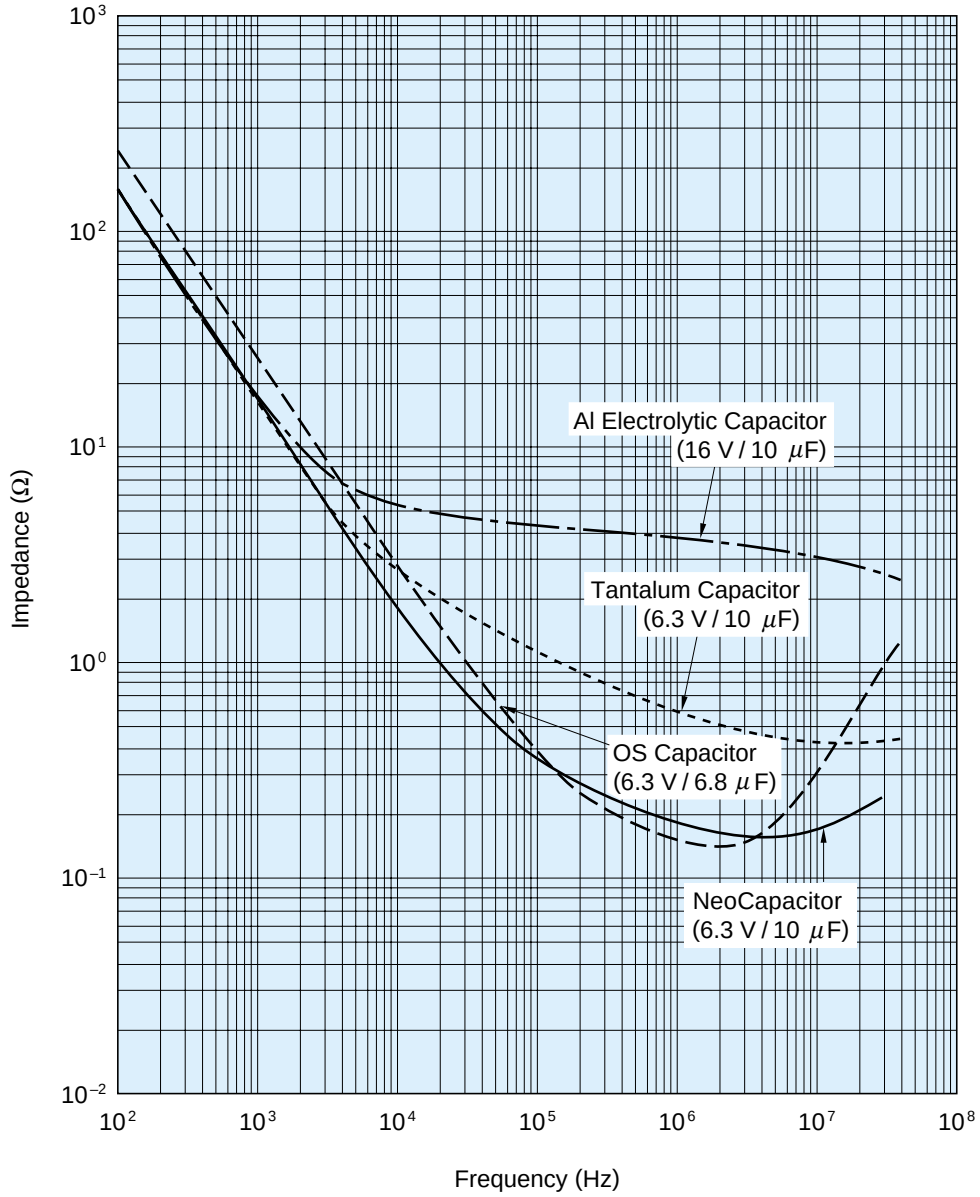
[reference data]



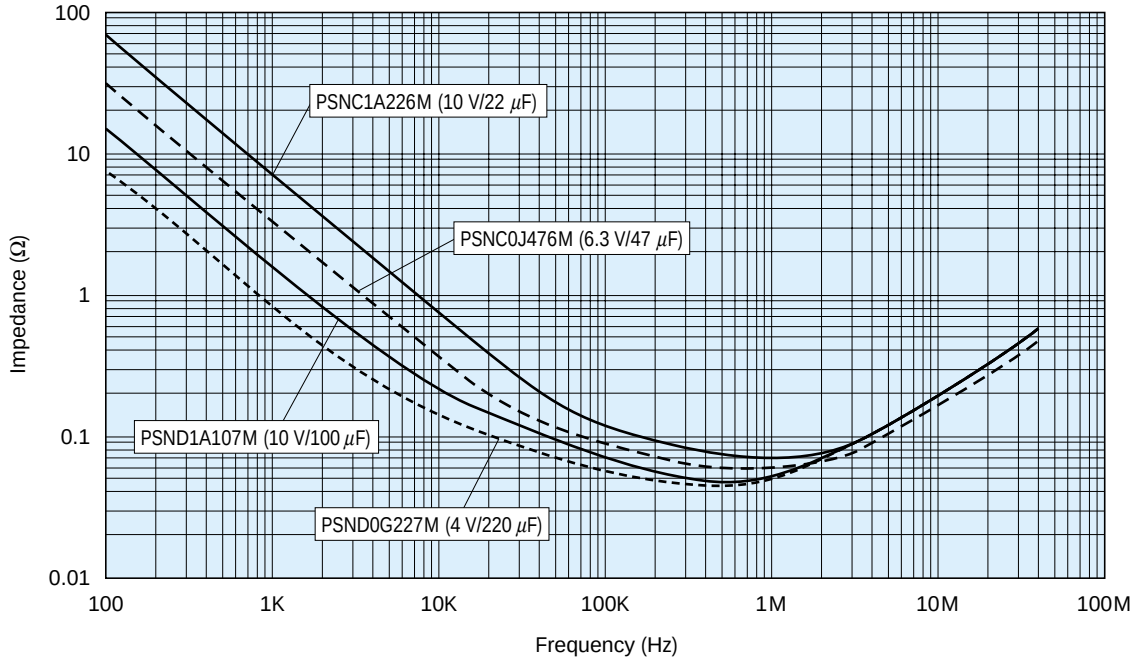
C Case **D Case**

○ PS/N Series

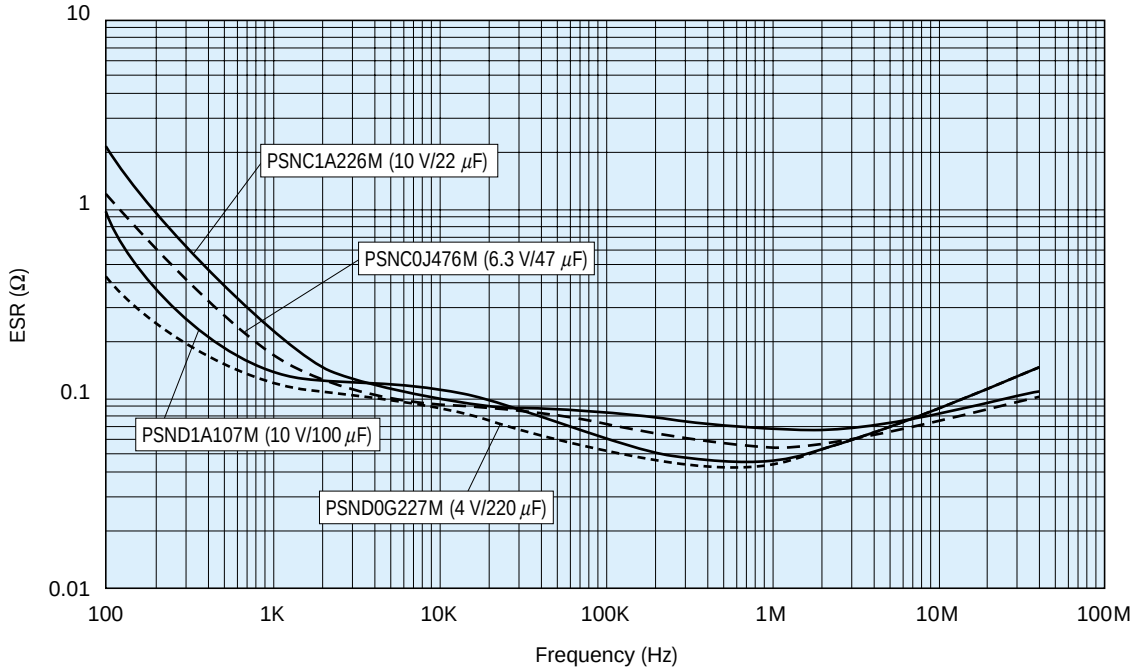
Impedance-frequency characteristics



Impedance–frequency characteristics

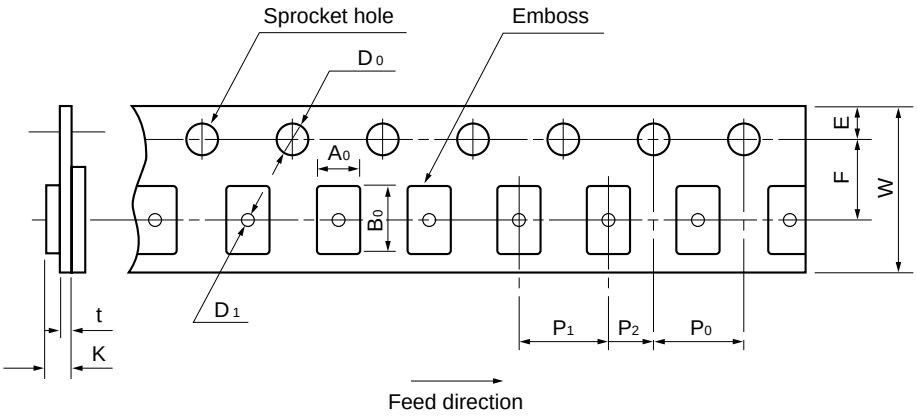


ESR–frequency characteristics



Packaging

Plastic Tape Carrier

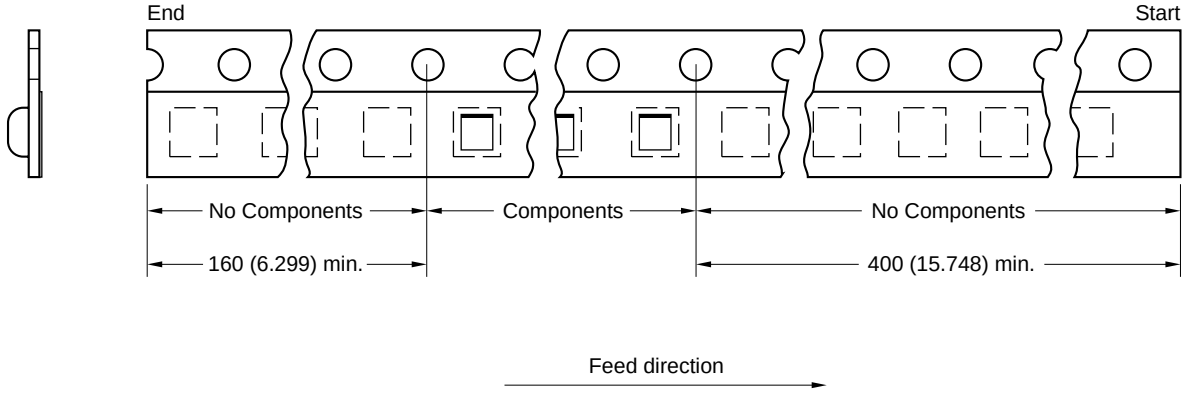


Unit : mm (inch)

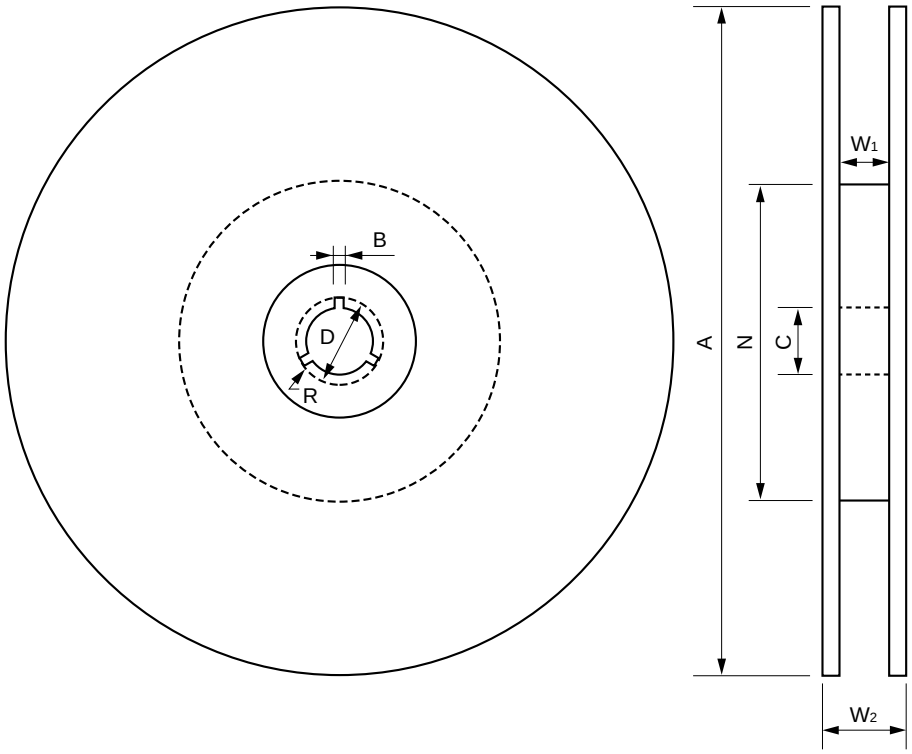
Case Code	W±0.3 (±0.012)	F±0.05 (±0.002)	E±0.1 (±0.004)	P1±0.1 (±0.004)	P2±0.05 (±0.002)	P0±0.1 (±0.004)	$D_0{}^{+0.1}_{-0}$ ($^{+0.004}_{-0}$)	$D_1{}^{+0.1}_{-0}$ ($^{+0.004}_{-0}$)	t	A0±0.2 (±0.008)	B0±0.2 (±0.008)	K±0.2 (±0.008)
P	8 (0.315)	3.5 (0.138)	1.75 (0.069)	4 (0.157)	2 (0.079)	4 (0.157)	ϕ1.5 (0.059)	—	0.2 (0.008)	1.4 (0.055)	2.2 (0.087)	1.4 (0.055)
A2								ϕ1.0		1.9 (0.075)	3.5 (0.138)	
A												1.9 (0.075)
B2										3.3 (0.130)	3.8 (0.150)	2.1 (0.083)
C	12 (0.472)	5.5 (0.217)		8 (0.315)				ϕ1.5	0.3 (0.012)	3.7 (0.146)	6.4 (0.252)	3.0 (0.118)
V									0.4 (0.016)	4.6 (0.181)	7.7 (0.303)	2.4 (0.094)
D									0.3 (0.012)	4.8 (0.189)		3.3 (0.130)

Leader and Trailer

Unit : mm (inch)



Reel



Unit : mm (inch)

Tape Width	A^{+0}_{-3} $(^{+0}_{-0.118})$	N min.	C±0.5 (±0.020)	D±0.5 (±0.020)	B±0.5 (±0.020)	W1±0.3 (±0.012)	W2±1.0 (±0.039)	R
8 mm	ϕ180 (7.09)	ϕ50 (1.969)	ϕ13 (0.512)	ϕ21 (0.827)	2 (0.079)	9 (0.354)	11.4 (0.449)	1 (0.039)
12 mm						13.0 (0.512)	15.4 (0.606)	

Case Code	Dia. 180 mm
P	3000
A2	3000
A	2000
B2	2000
C	500
V	1000
D	500

[Quantity per reel]

Notes on Using The NeoCapacitor

Most NeoCapacitor failures are the result of large leakage current or short circuit.
It is recommended the following be taken into consideration when designing the circuit.

1. Circuit design

(1) Failure rate

The failure rate of NeoCapacitor depends on applied voltage and operating temperature. Use the following formula for estimating field failure rate.

$$\lambda = \lambda_0 (V/V_0)^3 \cdot 2^{(T-T_0)/10}$$

λ : Maximum field failure rate
λ_0 : Basic failure rate (1% per 1000 h)
T : Operating temperature
V : Applied voltage of actual use
T_0 : 85˚C
V_0 : Rated voltage

(2) Permissible ripple current

Permissible ripple current shall be derated as follows

a. Temperature
–55 to +85˚C Rating value (PS/N series)
–55 to +105˚C Rating value (PS/L series)

b. Frequency

1 MHz	Rating value
500 kHz	0.9 times rating value
100 kHz	0.75 times rating value

(3) Reverse voltage

Do not apply reverse voltage since the capacitors are polarized.

(4) Derating

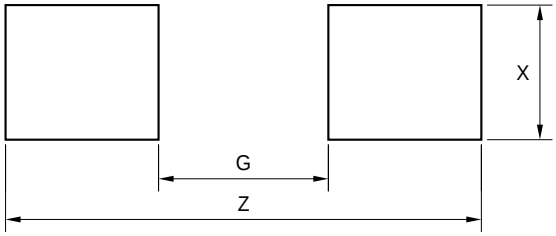
Apply appropriate voltage to the capacitors according to the failure rate estimation.
It is recommended that the applied voltage be less than 50% of the rated voltage.

2. Mounting

(1) Reflow soldering

Keep in mind the following points when soldering the capacitor in a soldering oven or with a hot plate:

(a) Pattern design (In accordance with IEC1188)



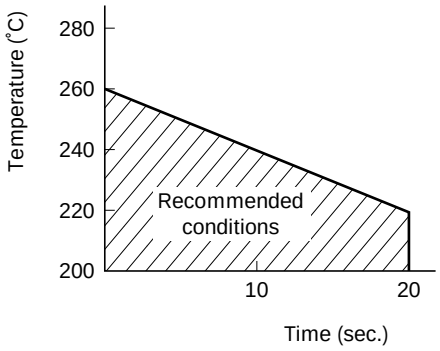
Unit : mm (inch)

Case	G max.	Z min.	X min.
P	0.5 (0.02)	2.6 (0.102)	1.2 (0.047)
A2, A	1.1 (0.043)	3.8 (0.15)	1.5 (0.059)
B2	1.4 (0.055)	4.1 (0.161)	2.7 (0.106)
C	2.9 (0.114)	6.9 (0.272)	2.7 (0.106)
V, D	4.1 (0.161)	8.2 (0.323)	2.9 (0.114)

The above dimensions are recommended. Note that if the pattern is too big, the component may not be mounted in place.

(b) Temperature and time

Keep the peak temperature and time to within the following conditions.



Whenever possible, perform preheating (at 150˚C max.) for smooth temperature profile. To maintain the reliability, mount the capacitor at a low temperature and in a short time whenever possible. The peak temperature and time shown above are applicable when the capacitor is to be soldered in a soldering oven or with a hot plate. When the capacitor is soldered by means of infrared reflow soldering, the internal temperature of the capacitor may rise beyond the surface temperature.

(2) Using soldering iron

When soldering the capacitor with a soldering iron, controlling the temperature at the tip of the soldering iron is very difficult. However, it is recommended that the following temperature and time be observed to maintain the reliability of the capacitor:

Iron temperature ... 300˚C max.
Time ..... 3 seconds max.
Iron power ..... 30 W max.

3. Cleaning

Generally, several organic solvents are used for flux cleaning of an electronic component after soldering. Many cleaning methods, such as immersion cleaning, rinse cleaning, brush cleaning, shower cleaning, vapor cleaning, and ultrasonic cleaning, are available, and one of these cleaning methods may be used alone or two or more may be used in combination. The temperature of the organic solvent may vary from room temperature to several 10˚C, depending on the desired effect. If cleaning is carried out with emphasis placed only on cleaning effect, however, the marking on the electronic component cleaned may be erased, the appearance of the component may be damaged, and in the worst case, the component may be functionally damaged. It is therefore recommended that the NeoCapacitor be cleaned under the following conditions:

[Recommended conditions of flux cleaning]

(1) Cleaning solvent..... Chlorosen, isopropyl alcohol
(2) Cleaning method ..... Shower cleaning, rinse cleaning, vapor cleaning
(3) Cleaning time ..... 5 minutes max.

* Ultrasonic cleaning

This cleaning method is extremely effective for eliminating dust that has been generated as a result of mechanical processes, but may pose a problem depending on the condition. As a result of an experiment conducted by NEC, it was confirmed that the external terminals of the capacitor were cut when it was cleaned with some ultrasonic cleaning machines. The cause of this phenomenon is considered metal fatigue of the capacitor terminals that occurred due to ultrasonic cleaning. To prevent the terminal from being cut, decreasing the output power of the ultrasonic cleaning machine or decreasing the cleaning time may be a possible solution. However, it is difficult to specify the safe cleaning conditions because there are many factors involved such as the conversion efficiency of the ultrasonic oscillator, transfer efficiency of the cleaning bath, difference in cleaning effect depending on the location in the cleaning bath, the size and quantity of the printed circuit boards to be cleaned, and the securing states of the components on the boards. It is therefore recommended that ultrasonic cleaning be avoided as much as possible.

If ultrasonic cleaning is essential, make sure through experiments that no abnormality occur as a result of the cleaning. For further information, contact NEC.

4. Others

(1) Do not apply excessive vibration and shock to the capacitor.

(2) The solderability of the capacitor may be degraded by humidity. Store the capacitor at (–5 to +40˚C) room temperature and (40 to 60% RH) humidity.

(3) Exercise care that no external force is applied to the tape packaged products (if the packaging material is deformed, the capacitor may not be automatically mounted by automatic insertion equipment).

NeoCapacitor is a trademark of NEC Corporation.

The information in this document is based on documents issued in August, 2000 at the latest. The information is subject to change without notice. For actual design-in, refer to the latest of data sheets, etc., for the most up-to-date specifications of the device.

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