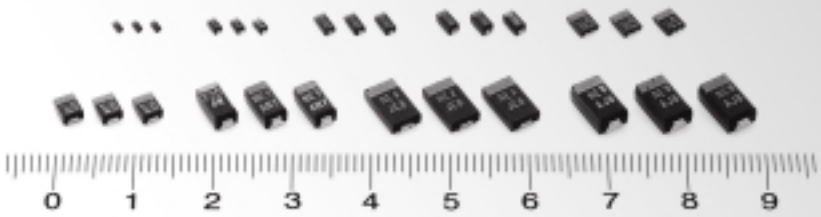
Devices thru Material Innovation

NEC/TOKIN

Vol.02

Conductive Polymer Tantalum Capacitor
NeoCapacitor

Conductive Polymer Tantalum Capacitor NeoCapacitor



Correct Use of NeoCapacitor (Please Read)

[Notes]

- Be sure to read "Notes on Using The NeoCapacitor" (p29 - p32) and "Cautions" (p35) before commencing circuit design or using the capacitor.
- Confirm the usage conditions and rated performance of the capacitor before use.
- Ninety percent of the failure that occurs in this capacitor is caused by an increase in leakage current or short-circuiting. It is therefore important to make sufficient allowances for redundant wiring in the circuit design.

[Quality Grades]

NEC TOKIN devices are classified into the following quality grades in accordance with their application (for details of the applications, see p35). The quality grade of all devices in this document is "standard"; the devices in this document cannot be used for "special" or "specific" quality grade applications. Customers who intend to use a product or products in this document for applications other than those specified under the "standard" quality grade must contact an NEC TOKIN sales representative in advance (see the reverse side of the cover for contact details).

- Standard: This quality grade is intended for applications in which failure or malfunction of the device is highly unlikely to cause harm to persons or damage to property, or be the source of any negative effects or problems in the wider community.
- Special: This quality grade is intended for special applications that have common requirements, such specific industrial fields. Devices with a "special" quality grade are designed, manufactured, and tested using a more stringent quality assurance program than that used for "standard" grade devices. There is a high possibility that failure or malfunction of the device when being used for applications in this category will cause harm to persons or damage to property, or create negative effects or problems in the wider community.
- Specific: Devices with a "specific" quality grade are designed, manufactured, and tested using a quality assurance program that is designated by the customer or that is created in accordance with the customer's specifications. There is an extremely high possibility that failure or malfunction of the device when being used for applications in this category will cause harm to persons or damage to property, or create serious problems in the wider community. Customers who use NEC TOKIN's products for these "specific" applications must conclude an individual quality agreement and/or development agreement with NEC TOKIN. A quality assurance program designated by the customer must also be determined in advance.

CONTENTS

What's NeoCapacitor

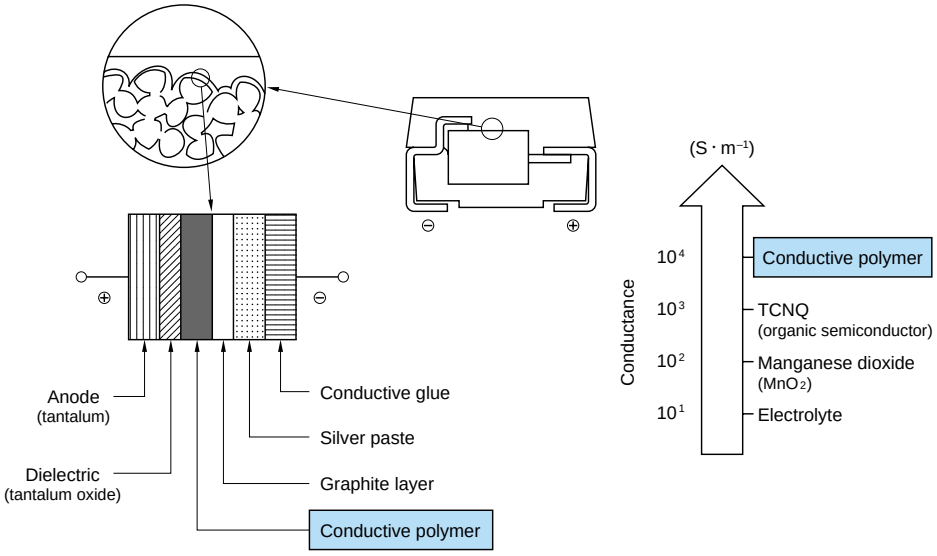
Lead-free / Conform to RoHS

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. Conformity to RoHs is available by Lead-free plating.



NeoCapacitor's Structure

Features

Rich product line-up

Small size (the same as conventional chip)

Ultra Low ESR/low impedance

Suitability for surface mounting

High permissible ripple current

Lead-free Type/In conformity to RoHs

Self healing phenomenon when failed

(Conductive polymer used for electrolyte is superior in insulating the damaged portion in comparison with the manganese oxide (used in conventional tantalum capacitor)

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

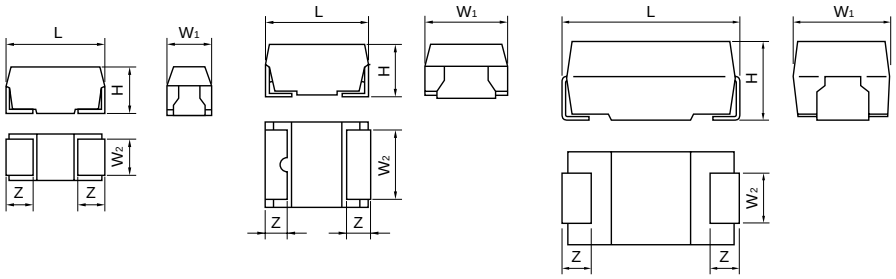
Series	Operating Temperature Range (˚C)	DC Rated Voltage Range (V)	Capacitance Range (μF)	Capacitance Tolerance (%)	DC Leakage Current (μA)	Dissipation Factor (%)	Features
PS/L	–55 to +105	2.5 to 16	2.2 to 1000	±20	0.1 CV or 3, (J case, 10 μA) whichever greater	4 to 10	Ultra-low ESR
PS/G	–55 to +105	2.5	330 to 680	±20	0.1 CV or 3, whichever greater	10	Ultra-low ESR (Single digit ESR)

Specifications (PS/L Series)

Lead-free / Conform to RoHS

Dimensions

J, P, A2 and A case　B3, B2 and V case　C2, C and D case



Unit : mm (inch)

Case code	EIA code	L	W_1	W_2	H	Z
J	–	1.6 ± 0.1 (0.061±0.004)	0.8 ± 0.1 (0.031±0.004)	0.6 ± 0.1 (0.024±0.004)	0.8 ± 0.1 (0.031±0.004)	0.3 ± 0.15 (0.012±0.006)
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	3216H	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)
B3	–	3.5 ± 0.2 (0.138±0.008)	2.8 ± 0.2 (0.110±0.008)	2.2 ± 0.1 (0.087±0.004)	1.1 ± 0.1 (0.043±0.004)	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)	2.2 ± 0.1 (0.087±0.004)	1.9 ± 0.2 (0.075±0.008)	0.8 ± 0.2 (0.031±0.008)
C2	–	6.0 ± 0.2 (0.138±0.008)	3.2 ± 0.2 (0.126±0.008)	2.2 ± 0.1 (0.087±0.004)	1.4 ± 0.1 (0.055±0.004)	1.3 ± 0.2 (0.051±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)
V	–	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)

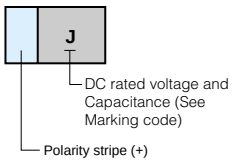
C–V Value Reference by Case Code

Capacitance (μF) \ Ralated voltage (V)		2.5V	4V	6.3V	10V	16V	20V
		0E	0G	0J	1A	1C	1D
2.2	225			J	J		
3.3	335			J, P	A	A	
4.7	475			J, P	A2, A	B2	
6.8	685			P, A	A, B2	B2	
10	106		J, P, A	P, A2, A	A2, A, B2	B2	
15	156			A2, A, B2	B2, C		
22	226	P	P, A2, B2	A2, A, B3, B2	B3, B2, C	[C2(70)]	[V(80)]
33	336		A	A, B3, B2	B3, B2, C2, C	[V(70)]	[V(80)]
47	476		A, B3	B3, B2, C2, C	B2, C2, C, V, D	D, [V(70)]	
68	686		C2, C	B2, C2, C	V, D, [C(100/55)]		
100	107	B3	B3, B2, C2	B2, C, [C2(70)]	V, D, [C(100/55)]		
150	157		B2, C	C, V, D, [C(18)]	D		
220	227	B2	C, V, D, [B2(45)]	V, D	D		
330	337	C, V, [B2(45)], [C(18)]	C, V, D	D			
470	477	V	D				
680	687	D	D				
1000	108	D					

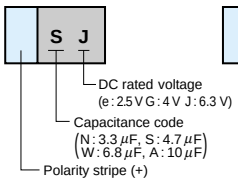
[ ]:Under development-specification to be determined. Numeral:ESR (mΩ) at 100kHz.

Markings

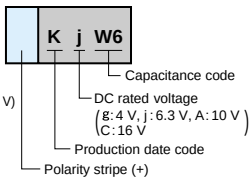
J case



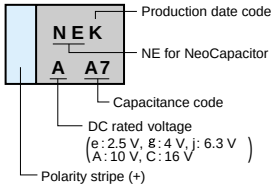
P case



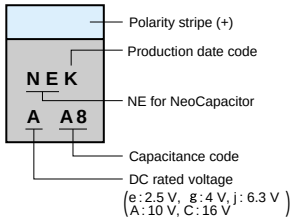
A2 and A case



B3 and B2 case



C2, C, V and D case



[J case Marking code]

μF \ UR	4 V	6.3 V	10 V
2.2		ſ	∀
3.3		ɔ	
4.7		J	
6.8			
10	ↄ		

[P case Marking code]

μF \ UR	2.5 V	4 V	6.3 V	10 V
3.3			NJ	
4.7			SJ	
6.8			WJ	
10		ĀG	ĀJ	
15				
22	J̄e	J̄G		

Capacitance code

Code	A	E	J	N	S	W	Code	6	7	8	9
Number	1	1.5	2.2	3.3	4.7	6.8	Multiplier	10^6	10^7	10^8	10^9

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

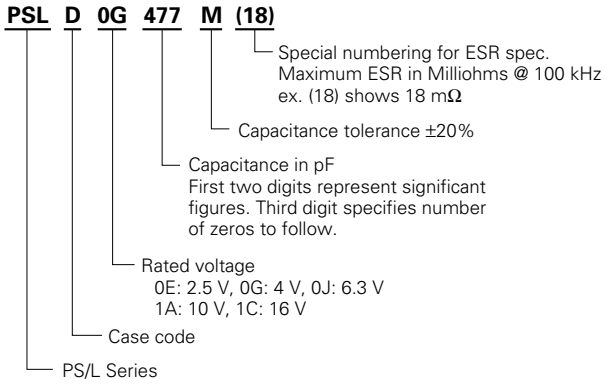
Procuction date code

Year \ Month	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
2003	a	b	c	d	e	f	g	h	j	k	l	m
2004	n	p	q	r	s	t	u	v	w	x	y	z
2005	A	B	C	D	E	F	G	H	J	K	L	M
2006	N	P	Q	R	S	T	U	V	W	X	Y	Z

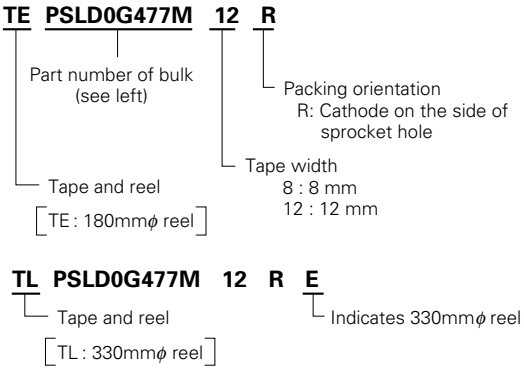
(NOTE) Production date code will resume for beginning in 2007.

PART NUMBER SYSTEM

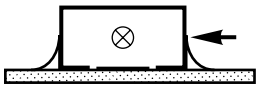
[Bulk]



[TAPE & REEL]



Performance Characteristics

<table>
<tr><th>No.</th><th colspan="2">Item</th><th colspan="5">Performance</th><th>Test Condition : Conform to IEC60384-1</th></tr>
<tr><td>1</td><td colspan="2">Operating temperature</td><td colspan="5">–55 to +105˚C</td><td></td></tr>
<tr><td>2</td><td colspan="2">Rated voltage (V.dc)</td><td>2.5</td><td>4</td><td>6.3</td><td>10</td><td>16</td><td>Temperature : 85˚C</td></tr>
<tr><td>3</td><td colspan="2">Derated voltage (V.dc)</td><td>2</td><td>3.3</td><td>5</td><td>8</td><td>12.8</td><td>Temperature : 105˚C</td></tr>
<tr><td>4</td><td colspan="2">Surge voltage (V.dc)</td><td>3.3</td><td>5.2</td><td>8</td><td>13</td><td>20</td><td>Temperature : 85˚C</td></tr>
<tr><td>5</td><td colspan="2">Capacitance</td><td colspan="5">2.2 to 1000 μF</td><td>Frequency : 120 Hz</td></tr>
<tr><td>6</td><td colspan="2">Capacitance tolerance</td><td colspan="5">±20%</td><td>Frequency : 120 Hz</td></tr>
<tr><td>7</td><td colspan="2">Dissipation Factor (DF)</td><td colspan="5">Refer to rating on page 7</td><td>Same measuring condition as No.5</td></tr>
<tr><td>8</td><td colspan="2">Leakage current (L. C)</td><td colspan="5">0.1 CV (μF × volts) or 3 μA (J case, 10 μA), whichever is greater</td><td>Voltage : Rated voltage for 5 min.</td></tr>
<tr><td>9</td><td colspan="2">Equivalent series resistance (ESR)</td><td colspan="5">Refer to rating on page 7</td><td>Frequency : 100 kHz
Temperature : 25˚C</td></tr>
<tr><td>10</td><td>Terminal strength</td><td>Visual</td><td colspan="5">There shall be no evidence of mechanical damage.</td><td>Strength : 4.9 N
Time : 10 ± 0.5 sec.
(two direction)
  </td></tr>
<tr><td rowspan="4">11</td><td rowspan="4">Surge voltage</td><td>⊿C/C</td><td colspan="5">Refer to rating on page 7</td><td rowspan="4">Temperature : 85 ± 2˚C
Applied voltage : No. 4
Series resistance : 33 Ω
Duration of surge : 30 ± 5 sec.
Time between surge : 5.5 min.
Number of cycles : 1,000</td></tr>
<tr><td>DF</td><td colspan="5">Shall not exceed the value in No.7</td></tr>
<tr><td>L.C</td><td colspan="5">Shall not exceed the value in No.8</td></tr>
<tr><td>Visual</td><td colspan="5">There shall be no evidence of mechanical damage.</td></tr>
<tr><td rowspan="5">12</td><td rowspan="5">Characteris-tics at high and low Temperature</td><td>⊿C/C</td><td colspan="5">$^{0}_{-20}$ %</td><td rowspan="5">Step 2
Step 4
<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>DF</td><td colspan="5">Shall not exceed the value in No.7</td></tr>
<tr><td>⊿C/C</td><td colspan="5">$^{+50}_{0}$ %</td></tr>
<tr><td>DF</td><td colspan="5">Shall not exceed 150% of initial requirements</td></tr>
<tr><td>L.C</td><td colspan="5">1.0 CV (μF × volts) or 30 μA, whichever is greater</td></tr>
<tr><td rowspan="4">13</td><td rowspan="4">Resistance to Soldering</td><td>⊿C/C</td><td colspan="5">Refer to rating on page 7</td><td rowspan="4">Reflow soldering method
240˚C, 10 sec. max.</td></tr>
<tr><td>DF</td><td colspan="5">Shall not exceed 130% of the value in No.7</td></tr>
<tr><td>L.C</td><td colspan="5">Shall not exceed the value in No.8</td></tr>
<tr><td>Visual</td><td colspan="5">There shall be no evidence of mechanical damage.</td></tr>
<tr><td rowspan="4">14</td><td rowspan="4">Damp heat, steady state</td><td>Cap.</td><td colspan="5">+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>DF</td><td colspan="5">Shall not exceed 150% of initial requirements</td></tr>
<tr><td>L.C</td><td colspan="5">Shall not exceed the value in No.8</td></tr>
<tr><td>Visual</td><td colspan="5">There shall be no evidence of mechanical damage.</td></tr>
<tr><td rowspan="4">15</td><td rowspan="4">Rapid change of temperature</td><td>⊿C/C</td><td colspan="5">Refer to rating on page 7</td><td 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>DF</td><td colspan="5">Shall not exceed the value in No.7</td></tr>
<tr><td>L.C</td><td colspan="5">Shall not exceed the value in No.8</td></tr>
<tr><td>Visual</td><td colspan="5">There shall be no evidence of mechanical damage.</td></tr>
<tr><td rowspan="4">16</td><td rowspan="4">Endurance I</td><td>⊿C/C</td><td colspan="5">Refer to rating on page 7</td><td rowspan="4">Temperature : 85 ± 2˚C
Duration : 1000 $^{+48}_{0}$ Hr.
Applied voltage : No. 2</td></tr>
<tr><td>DF</td><td colspan="5">Shall not exceed 150% of initial requirements.</td></tr>
<tr><td>L.C</td><td colspan="5">Shall not exceed the value in No.8</td></tr>
<tr><td>Visual</td><td colspan="5">There shall be no evidence of mechanical damage.</td></tr>
<tr><td rowspan="4">17</td><td rowspan="4">Endurance II</td><td>⊿C/C</td><td colspan="5">Refer to rating on page 7</td><td rowspan="4">Temperature : 105 ± 2˚C
Duration : 1000 $^{+48}_{0}$ Hr.
Applied voltage : No. 3</td></tr>
<tr><td>DF</td><td colspan="5">Shall not exceed 300% of initial requirements.</td></tr>
<tr><td>L.C</td><td colspan="5">Shall not exceed the value in No.8</td></tr>
<tr><td>Visual</td><td colspan="5">There shall be no evidence of mechanical damage.</td></tr>
<tr><td>18</td><td colspan="2">Maximum permissible ripple current</td><td colspan="5">Refer to rating on page 7</td><td>Frequency : 100 kHz</td></tr>
</table>

Ratings

Rated Voltage	Capacitance (μF)	Case Code	Part Number (Bulk)	Leakage Current (μA)	DF (%)	ESR (mΩ)	Permissible Ripple Current (mA rms.)	DF (%)		Capacitance	
								–55˚C	+105˚C	Change1	Change2
2.5	22	P	PSLP0E226M	5.5	6	200	354	6	9	±20%	±20%
	100	B3	PSLB30E107M	25	8	70	1035	8	12	±20%	±20%
	220	B2	PSLB20E227M	55	8	45	1374	8	12	±20%	±20%
	220	B2	PSLB20E227M(35)	55	8	35	1558	8	12	±20%	±20%
	330	C	PSLC0E337M(25)	82.5	10	25	2345	10	15	±20%	±20%
	330	V	PSLV0E337M	82.5	10	25	2236	10	15	±20%	±20%
	330	V	PSLV0E337M(15)	82.5	10	15	2887	10	15	±20%	±20%
	330	V	PSLV0E337M(12)	82.5	10	12	3227	10	15	±20%	±20%
	470	V	PSLV0E477M(15)	117.5	10	15	2887	10	15	±20%	±20%
	470	V	PSLV0E477M(12)	117.5	10	12	3227	10	15	±20%	±20%
	680	D	PSLD0E687M	170	10	25	2449	10	15	±20%	±20%
	680	D	PSLD0E687M(15)	170	10	15	3162	10	15	±20%	±20%
	680	D	PSLD0E687M(12)	170	10	12	3536	10	15	±20%	±20%
	1000	D	PSLD0E108M	250	10	25	2449	10	15	±20%	±20%
	1000	D	PSLD0E108M(15)	250	10	15	3162	10	15	±20%	±20%
4	10	J	PSLJ0G106M	10	4	300	183	4	6	±20%	±20%
	10	P	PSLP0G106M	4	6	200	354	6	9	±20%	±20%
	10	A	PSLA0G106M	4	6	200	612	6	9	±20%	±20%
	22	P	PSLP0G226M	8.8	6	200	354	6	9	±20%	±20%
	22	A2	PSLA20G226M	8.8	6	200	548	6	9	±20%	±20%
	22	B2	PSLB20G226M	8.8	8	150	753	8	12	±20%	±20%
	33	A	PSLA0G336M	13.2	6	180	645	6	9	±20%	±20%
	47	A	PSLA0G476M	18.8	6	180	645	6	9	±20%	±20%
	47	B3	PSLB30G476M	18.8	8	70	1035	8	12	±20%	±20%
	68	C2	PSLC20G686M	27.2	8	55	1279	8	12	±20%	±20%
	68	C	PSLC0G686M	27.2	9	100	1049	9	14	±20%	±20%
	100	B3	PSLB30G107M	40	8	70	1035	8	12	±20%	±20%
	100	B2	PSLB20G107M	40	8	70	1102	8	12	±20%	±20%
	100	B2	PSLB20G107M(45)	40	8	45	1374	8	12	±20%	±20%
	100	C2	PSLC20G107M	40	9	55	1279	9	14	±20%	±20%
	150	B2	PSLB20G157M	60	8	45	1374	8	12	±20%	±20%
	150	B2	PSLB20G157M(35)	60	8	35	1558	8	12	±20%	±20%
	150	C	PSLC0G157M	60	9	100	1049	9	14	±20%	±20%
	220	C	PSLC0G227M	88	9	55	1414	9	14	±20%	±20%
	220	C	PSLC0G227M(45)	88	9	45	1563	9	14	±20%	±20%
	220	C	PSLC0G227M(25)	88	9	25	2098	9	14	±20%	±20%
	220	V	PSLV0G227M	88	10	45	1667	10	15	±20%	±20%
	220	V	PSLV0G227M(25)	88	10	25	2236	10	15	±20%	±20%
	220	V	PSLV0G227M(18)	88	10	18	2635	10	15	±20%	±20%
	220	V	PSLV0G227M(15)	88	10	15	2887	10	15	±20%	±20%
	220	V	PSLV0G227M(12)	88	10	12	3227	10	15	±20%	±20%
	220	D	PSLD0G227M	88	10	55	1651	10	15	±20%	±20%
	220	D	PSLD0G227M(40)	88	10	40	1936	10	15	±20%	±20%
	220	D	PSLD0G227M(25)	88	10	25	2449	10	15	±20%	±20%
	220	D	PSLD0G227M(15)	88	10	15	3162	10	15	±20%	±20%
	220	D	PSLD0G227M(12)	88	10	12	3536	10	15	±20%	±20%
	330	C	PSLC0G337M	132	10	55	1414	10	15	±20%	±20%
	330	V	PSLV0G337M	132	10	45	1667	10	15	±20%	±20%
	330	V	PSLV0G337M(25)	132	10	25	2887	10	15	±20%	±20%
	330	V	PSLV0G337M(12)	132	10	12	3227	10	15	±20%	±20%
	330	D	PSLD0G337M	132	10	40	1936	10	15	±20%	±20%
	330	D	PSLD0G337M(25)	132	10	25	2449	10	15	±20%	±20%
	330	D	PSLD0G337M(15)	132	10	15	3162	10	15	±20%	±20%
	470	D	PSLD0G477M	188	10	25	2449	10	15	±20%	±20%

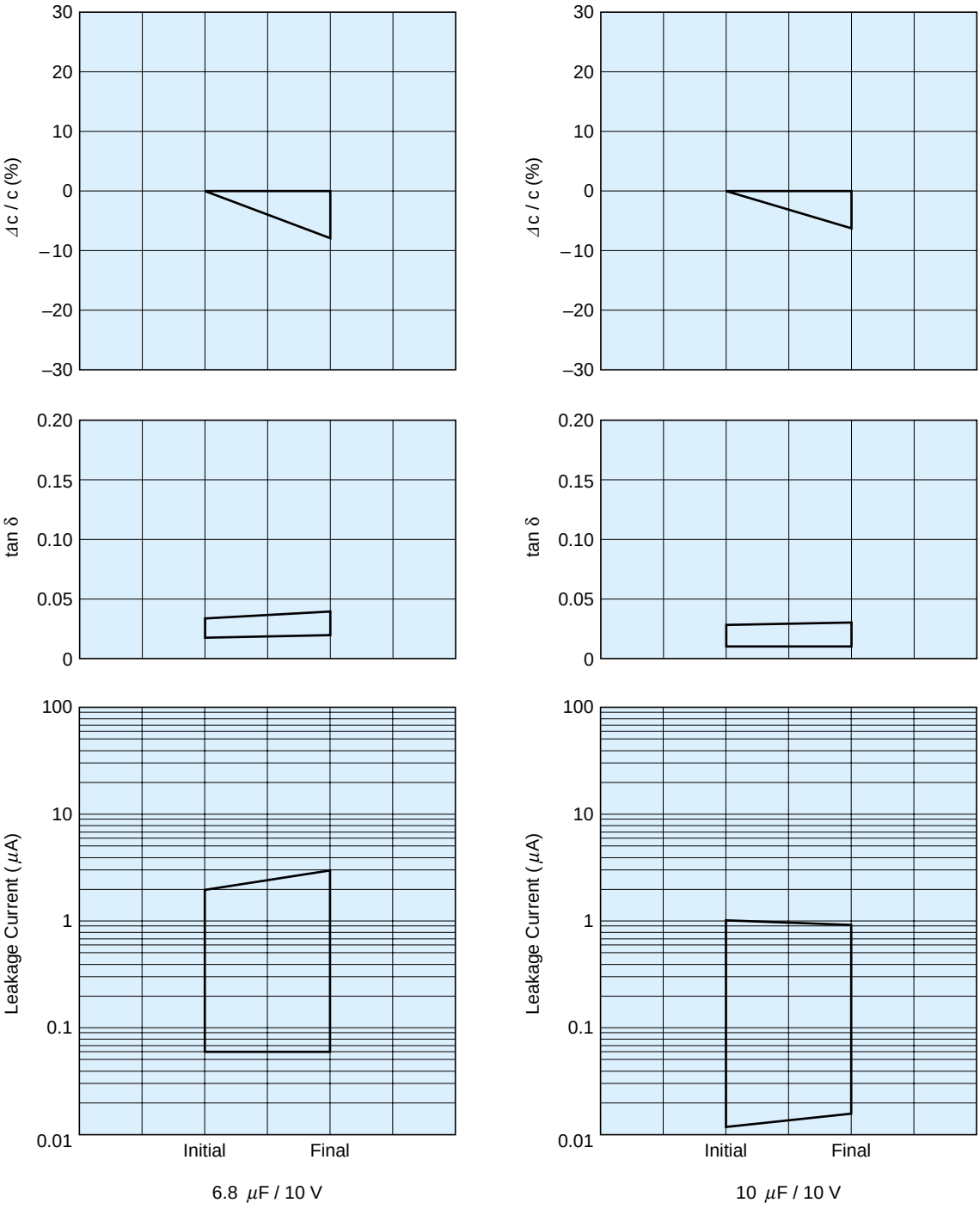
Rated Voltage	Capacitance (μF)	Case Code	Part Number (Bulk)	DC Leakage Current (μA)	DF (%)	ESR (mΩ)	Permissible Ripple Current (mA rms.)	DF (%)		Capacitance Change	
								–55˚C	+105˚C	Change1	Change2
4	470	D	PSLD0G477M(18)	188	10	18	2887	10	15	±20%	±20%
	470	D	PSLD0G477M(15)	188	10	15	3162	10	15	±20%	±20%
	470	D	PSLD0G477M(12)	188	10	12	3536	10	15	±20%	±20%
	680	D	PSLD0G687M	272	10	25	2449	10	15	±20%	±20%
	680	D	PSLD0G687M(15)	272	10	15	3162	10	15	±20%	±20%
	680	D	PSLD0G687M(12)	272	10	12	3536	10	15	±20%	±20%
6.3	2.2	J	PSLJ0J225M	10	4	500	141	4	6	±20%	±20%
	3.3	J	PSLJ0J335M	10	4	500	141	4	6	±20%	±20%
	3.3	P	PSLP0J335M	3	6	300	289	6	9	±20%	±20%
	4.7	J	PSLJ0J475M	10	4	500	141	4	6	±20%	±20%
	4.7	P	PSLP0J475M	3	6	300	289	6	9	±20%	±20%
	6.8	P	PSLP0J685M	4.2	6	300	289	6	9	±20%	±20%
	6.8	A	PSLA0J685M	4.2	6	300	500	6	9	±20%	±20%
	10	P	PSLP0J106M	6.3	6	200	354	6	9	±20%	±20%
	10	A2	PSLA20J106M	6.3	6	200	548	6	9	±20%	±20%
	10	A	PSLA0J106M	6.3	6	200	612	6	9	±20%	±20%
	15	A2	PSLA20J156M	9.4	6	200	548	6	9	±20%	±20%
	15	A	PSLA0J156M	9.4	6	200	612	6	9	±20%	±20%
	15	B2	PSLB20J156M	9.4	8	150	753	8	12	±20%	±20%
	22	A2	PSLA20J226M	13.8	6	200	548	6	9	±20%	±20%
	22	A	PSLA0J226M	13.8	6	180	645	6	9	±20%	±20%
	22	B3	PSLB30J226M	13.8	8	70	1035	8	12	±20%	±20%
	22	B2	PSLB20J226M	13.8	8	150	753	8	12	±20%	±20%
	33	A	PSLA0J336M	20.7	6	180	645	6	9	±20%	±20%
	33	B3	PSLB30J336M	20.7	8	70	1035	8	12	±20%	±20%
	33	B2	PSLB20J336M	20.7	8	150	753	8	12	±20%	±20%
	47	B3	PSLB30J476M	29.6	8	70	1035	8	12	±20%	±20%
	47	B2	PSLB20J476M	29.6	8	150	753	8	12	±20%	±20%
	47	B2	PSLB20J476M(70)	29.6	8	70	1102	8	12	±20%	±20%
	47	C2	PSLC20J476M	29.6	9	70	1134	9	14	±20%	±20%
	47	C	PSLC0J476M	29.6	9	100	1049	9	14	±20%	±20%
	68	B2	PSLB20J686M	42.8	8	70	1102	8	12	±20%	±20%
	68	B2	PSLB20J686M(55)	42.8	8	55	1243	8	12	±20%	±20%
	68	C2	PSLC20J686M	42.8	9	55	1279	9	14	±20%	±20%
	68	C	PSLC0J686M	42.8	9	100	1049	9	14	±20%	±20%
	100	B2	PSLB20J107M	63	8	70	1102	8	12	±20%	±20%
	100	B2	PSLB20J107M(45)	63	8	45	1374	8	12	±20%	±20%
	100	B2	PSLB20J107M(35)	63	8	35	1558	8	12	±20%	±20%
	100	C	PSLC0J107M	63	9	100	1049	9	14	±20%	±20%
	150	C	PSLC0J157M	94.5	9	100	1049	9	14	±20%	±20%
	150	C	PSLC0J157M(55)	94.5	9	55	1414	9	14	±20%	±20%
	150	C	PSLC0J157M(45)	94.5	9	45	1563	9	14	±20%	±20%
	150	C	PSLC0J157M(25)	94.5	9	25	2098	9	14	±20%	±20%
	150	V	PSLV0J157M	94.5	10	45	1667	10	15	±20%	±20%
	150	V	PSLV0J157M(25)	94.5	10	25	2236	10	15	±20%	±20%
	150	V	PSLV0J157M(18)	94.5	10	18	2635	10	15	±20%	±20%
	150	D	PSLD0J157M	94.5	10	55	1651	10	15	±20%	±20%
	150	D	PSLD0J157M(40)	94.5	10	40	1936	10	15	±20%	±20%
	150	D	PSLD0J157M(25)	94.5	10	25	2449	10	15	±20%	±20%
	220	V	PSLV0J227M	138.6	10	45	1667	10	15	±20%	±20%
	220	V	PSLV0J227M(15)	138.6	10	15	2887	10	15	±20%	±20%
	220	V	PSLV0J227M(12)	138.6	10	12	3227	10	15	±20%	±20%
	220	D	PSLD0J227M	138.6	10	55	1651	10	15	±20%	±20%
	220	D	PSLD0J227M(40)	138.6	10	40	1936	10	15	±20%	±20%

Rated Voltage	Capacitance (μF)	Case Code	Part Number (Bulk)	DC Leakage Current (μA)	DF (%)	ESR (mΩ)	Permissible Ripple Current (mA rms.)	DF (%)		Capacitance Change	
								–55˚C	+105˚C	Change1	Change2
6.3	330	D	PSLD0J337M	207.9	10	40	1936	10	15	±20%	±20%
	330	D	PSLD0J337M(25)	207.9	10	25	2449	10	15	±20%	±20%
10	2.2	J	PSLJ1A225M	10	4	500	141	4	6	±20%	±20%
	3.3	A	PSLA1A335M	3.3	6	300	500	6	9	±20%	±20%
	4.7	A2	PSLA21A475M	4.7	6	300	447	6	9	±20%	±20%
	4.7	A	PSLA1A475M	4.7	6	300	500	6	9	±20%	±20%
	6.8	A	PSLA1A685M	6.8	6	300	500	6	9	±20%	±20%
	6.8	B2	PSLB21A685M	6.8	8	200	652	8	12	±20%	±20%
	10	A2	PSLA21A106M	10	6	200	548	6	9	±20%	±20%
	10	A	PSLA1A106M	10	6	200	612	6	9	±20%	±20%
	10	B2	PSLB21A106M	10	8	200	652	8	12	±20%	±20%
	15	B2	PSLB21A156M	15	8	150	753	8	12	±20%	±20%
	15	C	PSLC1A156M	15	9	200	742	9	14	±20%	±20%
	22	B3	PSLB31A226M	22	8	70	1035	8	12	±20%	±20%
	22	B2	PSLB21A226M	22	8	150	753	8	12	±20%	±20%
	22	C	PSLC1A226M	22	9	150	856	9	14	±20%	±20%
	33	B3	PSLB31A336M	33	8	70	1035	8	12	±20%	±20%
	33	B2	PSLB21A336M	33	8	150	753	8	12	±20%	±20%
	33	C2	PSLC21A336M	33	9	70	1134	9	14	±20%	±20%
	33	C	PSLC1A336M	33	9	100	1049	9	14	±20%	±20%
	47	B2	PSLB21A476M	47	8	70	1102	8	12	±20%	±20%
	47	C2	PSLC21A476M	47	9	70	1134	9	14	±20%	±20%
	47	C	PSLC1A476M	47	9	100	1049	9	14	±20%	±20%
	47	C	PSLC1A476M(55)	47	9	55	1414	9	14	±20%	±20%
	47	V	PSLV1A476M	47	10	60	1443	10	15	±20%	±20%
	47	D	PSLD1A476M	47	10	100	1225	10	15	±20%	±20%
	68	V	PSLV1A686M	68	10	60	1443	10	15	±20%	±20%
	68	D	PSLD1A686M	68	10	100	1225	10	15	±20%	±20%
	100	V	PSLV1A107M	100	10	45	1667	10	15	±20%	±20%
	100	V	PSLV1A107M(25)	100	10	25	2236	10	15	±20%	±20%
	100	D	PSLD1A107M	100	10	55	1651	10	15	±20%	±20%
	150	D	PSLD1A157M	150	10	55	1651	10	15	±20%	±20%
	150	D	PSLD1A157M(40)	150	10	40	1936	10	15	±20%	±20%
	220	D	PSLD1A227M	220	10	55	1651	10	15	±20%	±20%
	220	D	PSLD1A227M(40)	220	10	40	1936	10	15	±20%	±20%
	220	D	PSLD1A227M(25)	220	10	25	2449	10	15	±20%	±20%
16	3.3	A	PSLA1C335M	5.2	6	800	306	6	9	±20%	±20%
	4.7	B2	PSLB21C475M	7.5	8	200	652	8	12	±20%	±20%
	6.8	B2	PSLB21C685M	10.8	8	200	652	8	12	±20%	±20%
	10	B2	PSLB21C106M	16	8	100	922	8	12	±20%	±20%
	47	D	PSLD1C476M	75.2	10	70	1464	10	15	±20%	±20%

Typical Performance Characteristics

○PS/L Series

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



6.8 μF / 10 V

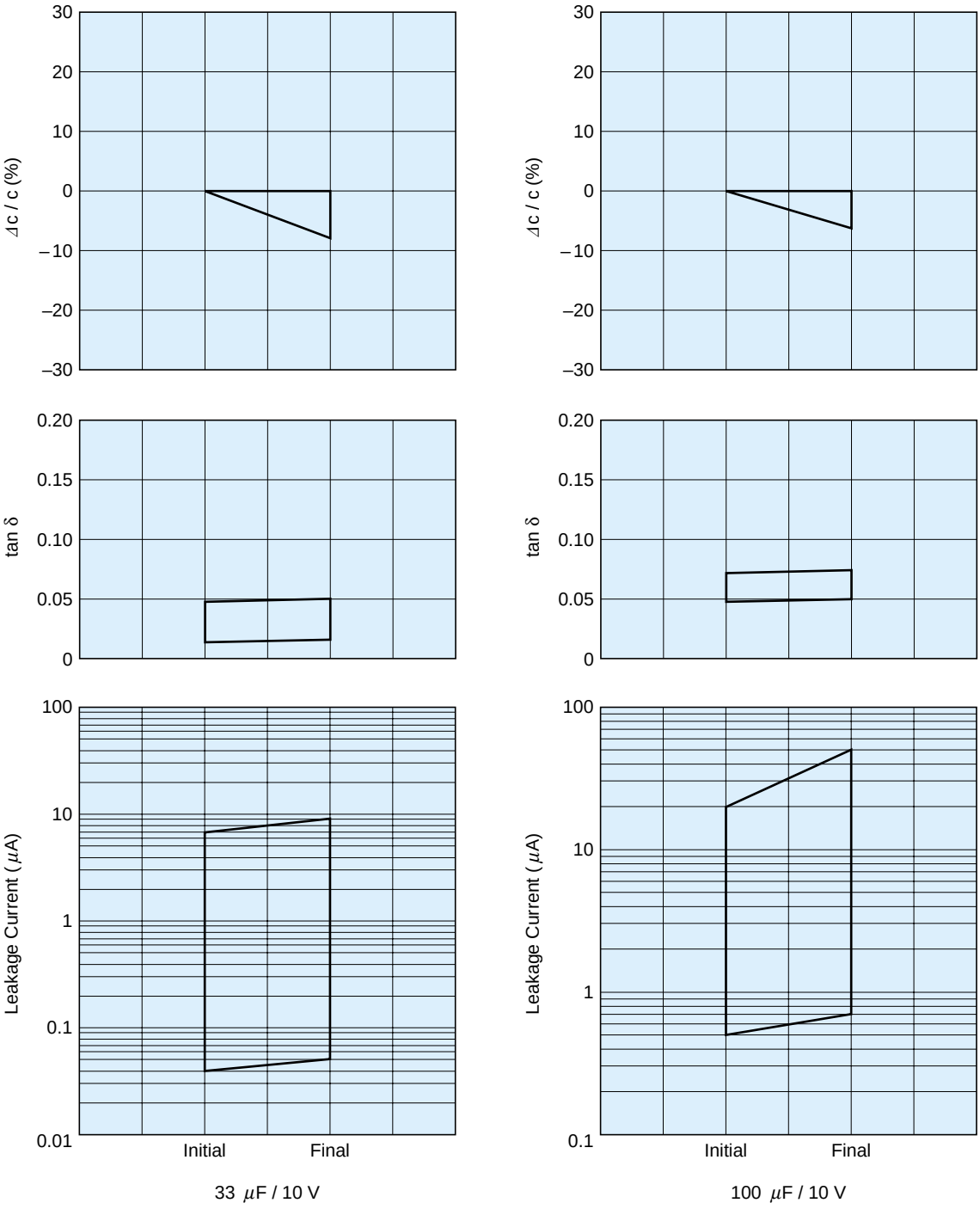
A Case

10 μF / 10 V

B2 Case

○PS/L Series

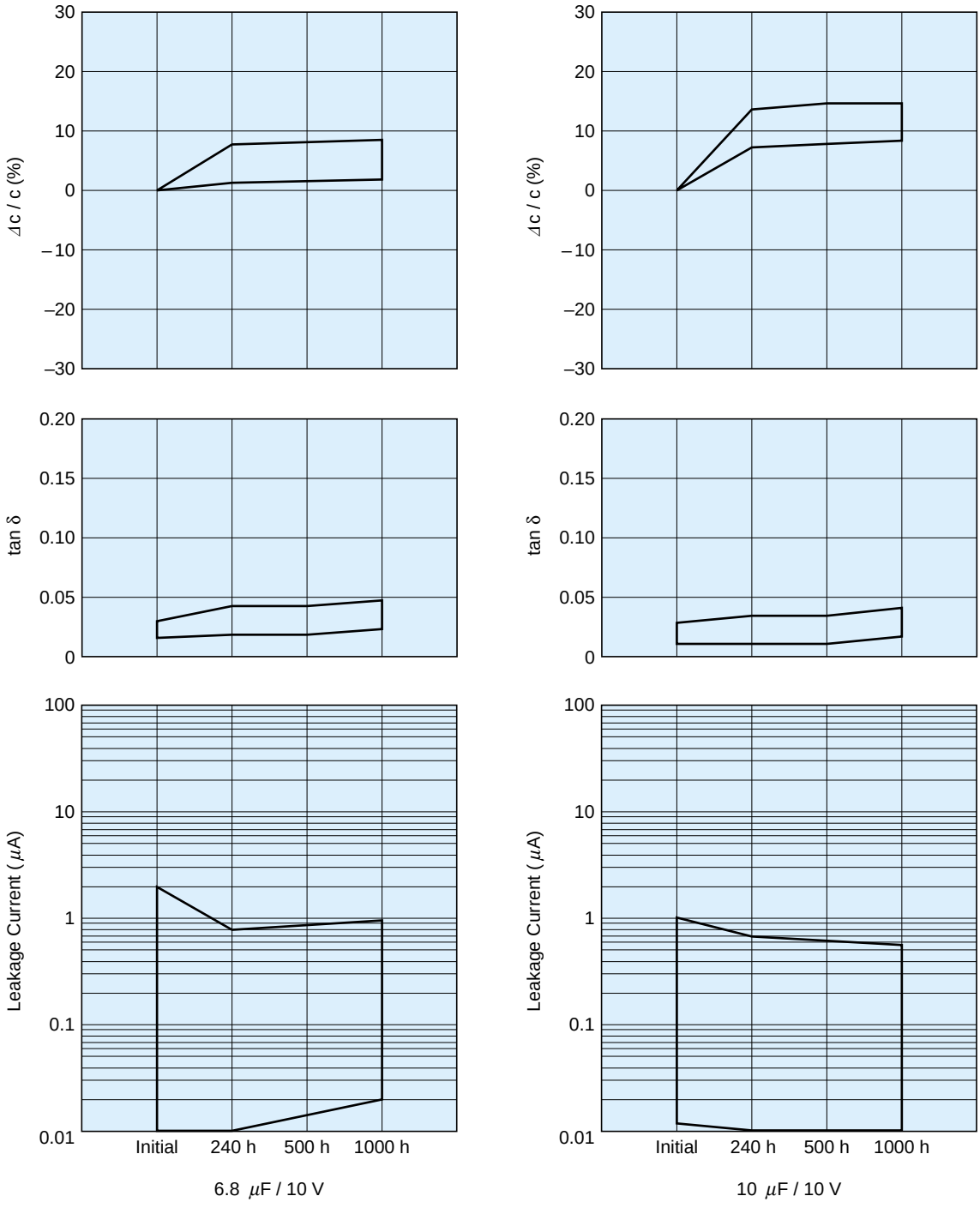
Resistance to soldering (240˚C, 10 sec. reflow)



C Case **D Case**

○PS/L Series

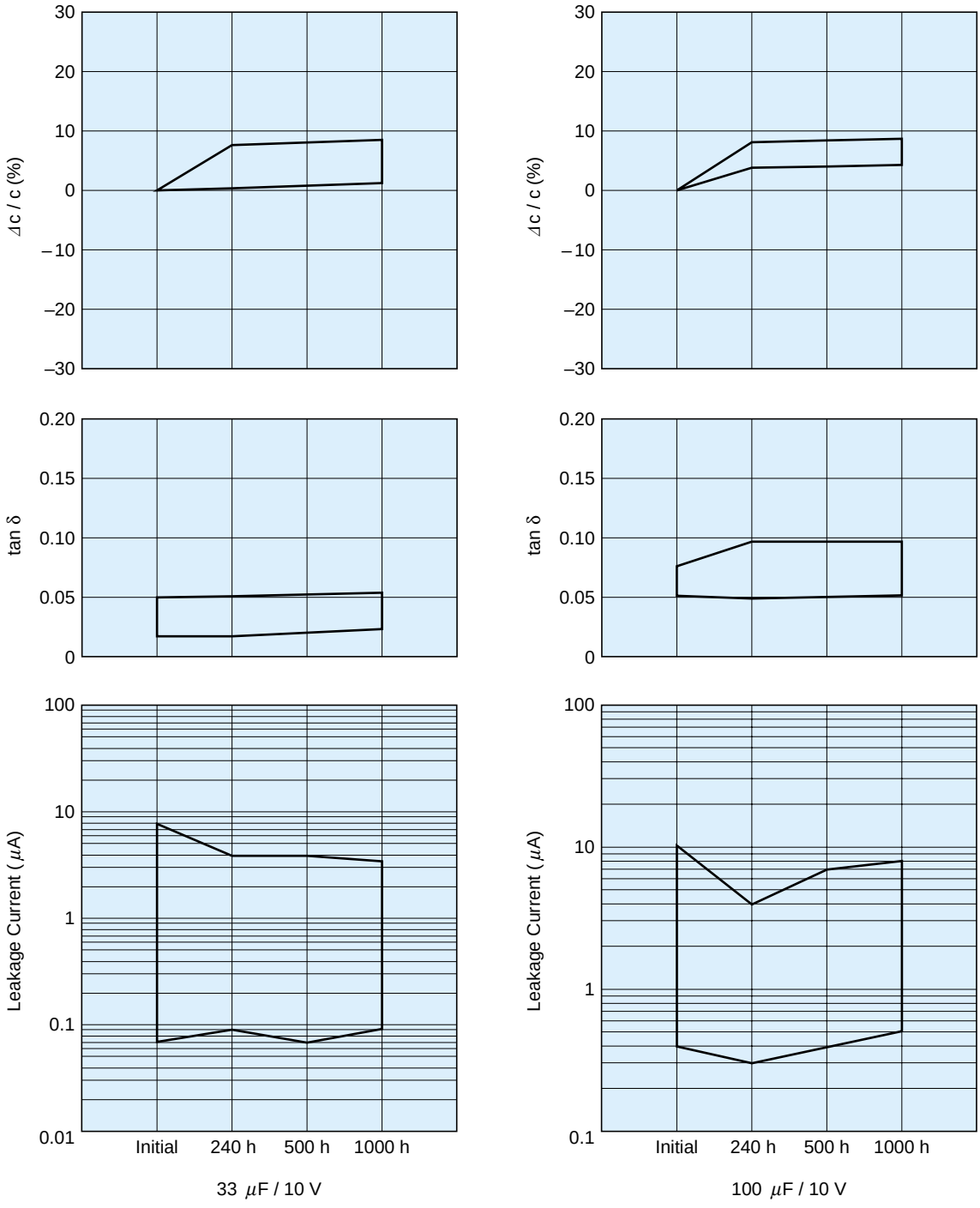
Damp heat, steady state (40˚C, 90 to 95% R.H.)



A Case **B2 Case**

○PS/L Series

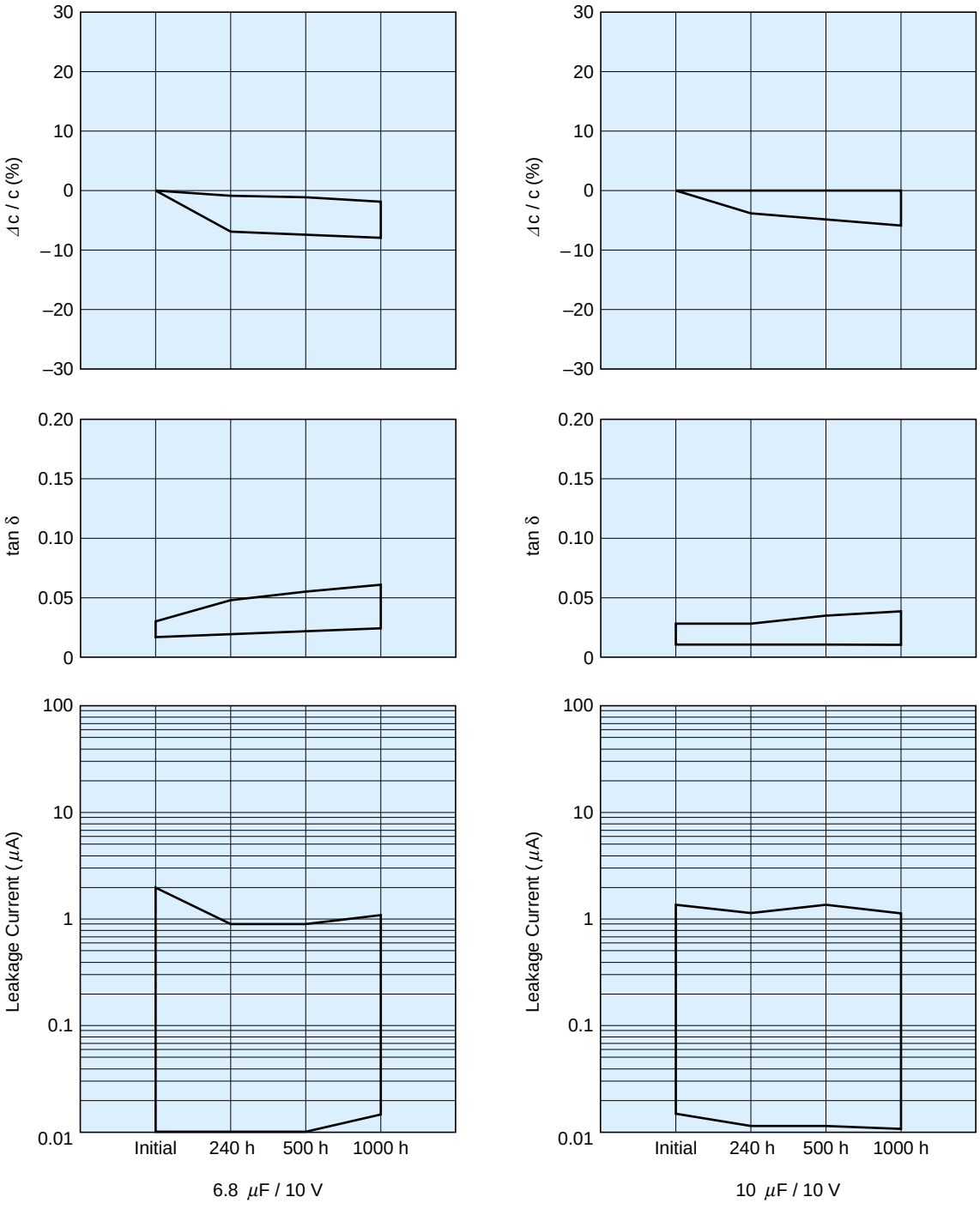
Damp heat, steady state (40˚C, 90 to 95% R.H.)



C Case **D Case**

○PS/L Series

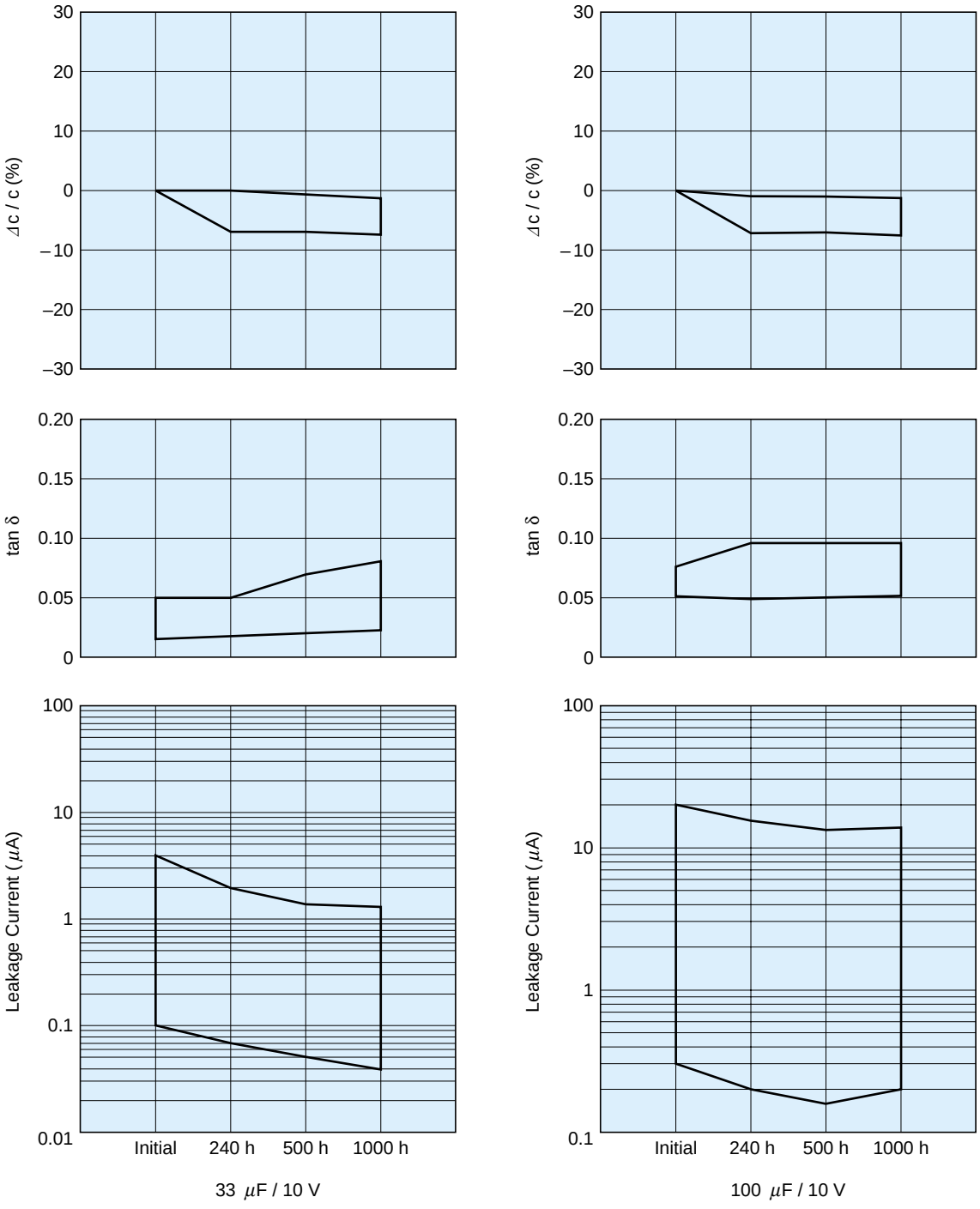
Endurance (105˚C, Rated Voltage)



A Case **B2 Case**

○PS/L Series

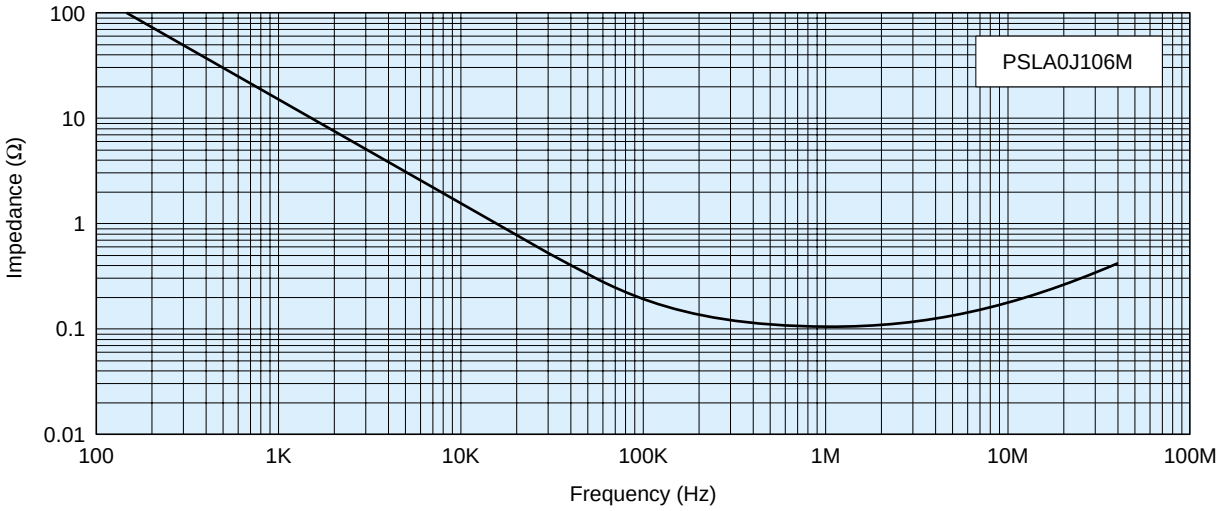
Endurance (105˚C, Rated Voltage)



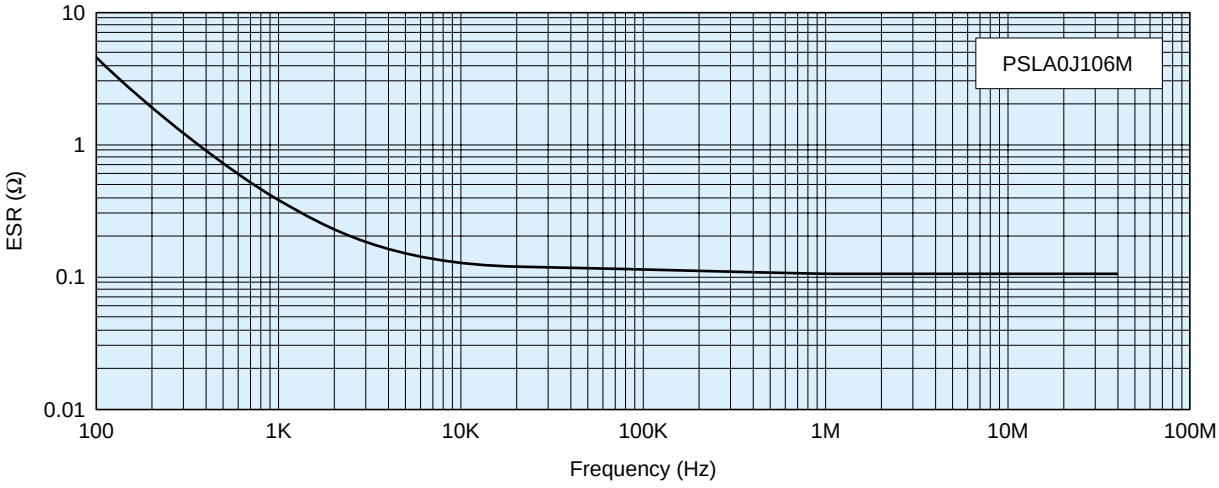
C Case **D Case**

○PS/L Series

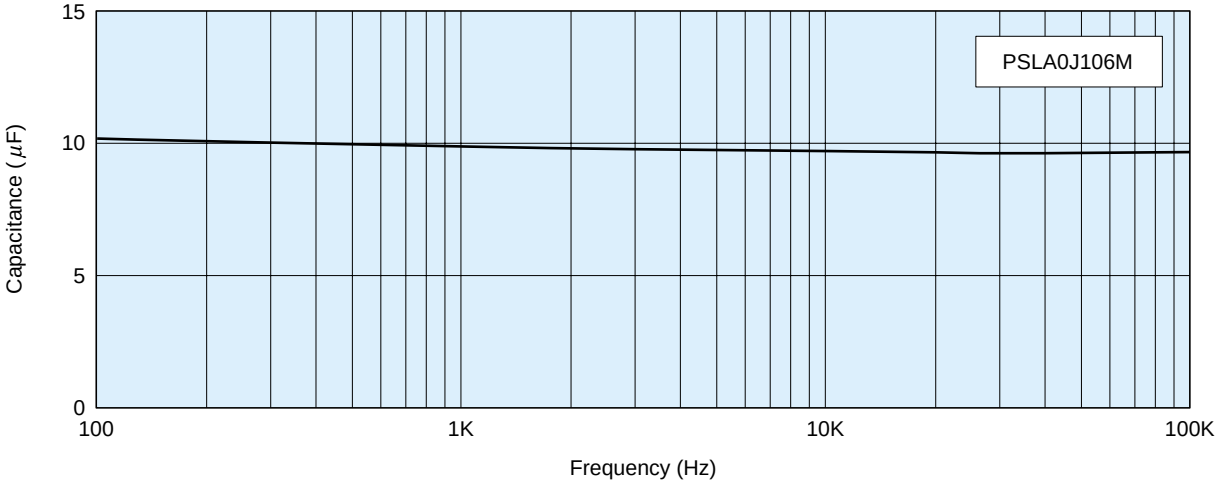
● **Impedance-frequency characteristics (Reference data)**



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

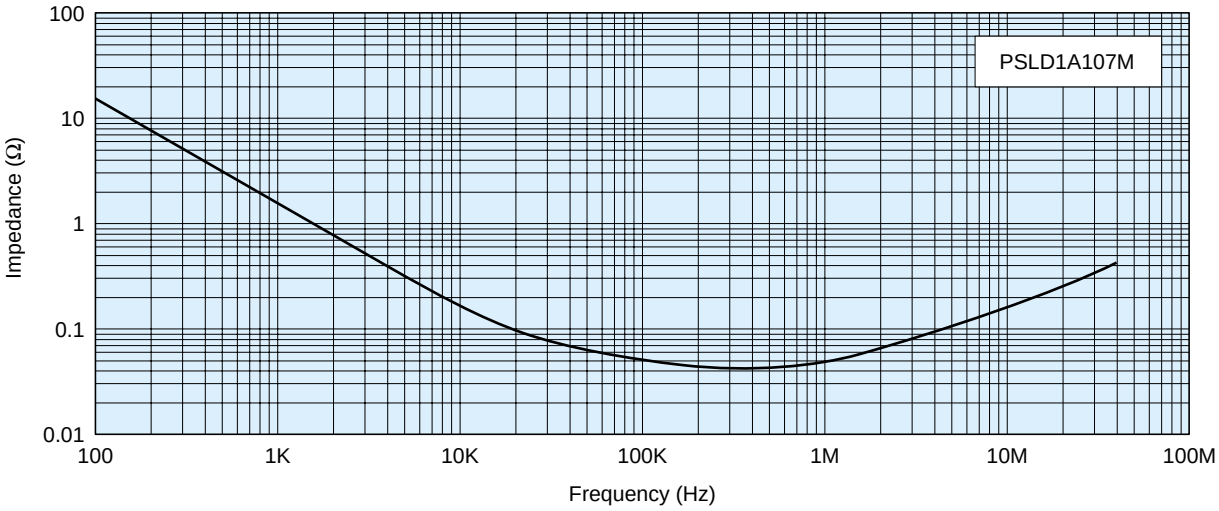


● **Capacitance-frequency characteristics (Reference data)**

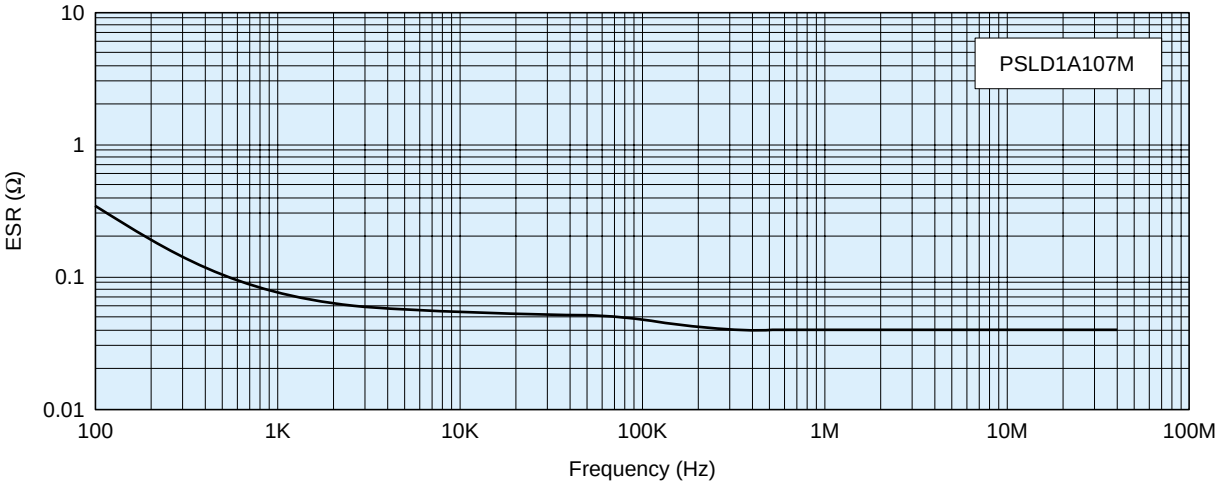


○PS/L Series

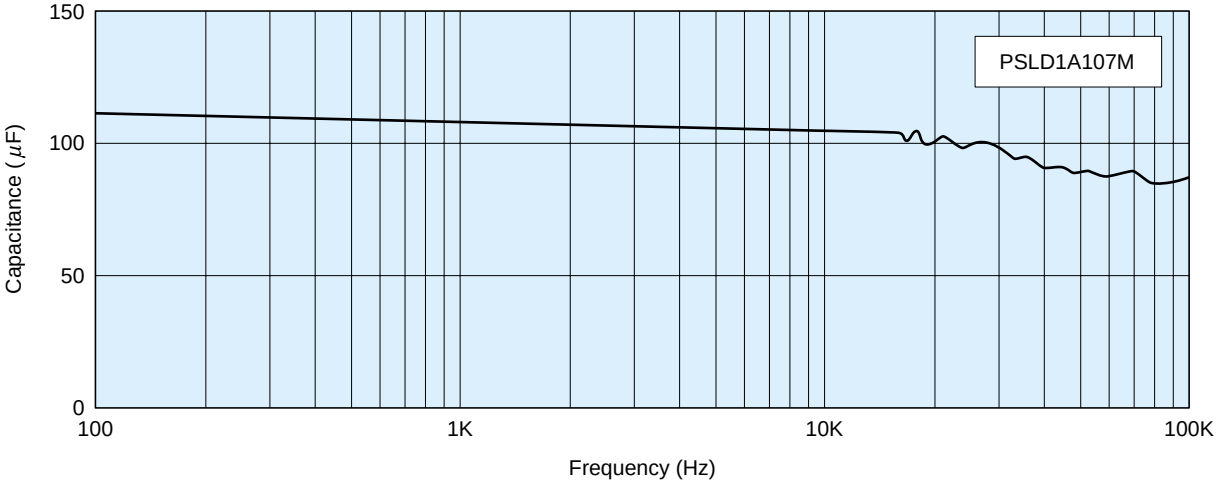
● **Impedance-frequency characteristics (Reference data)**



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

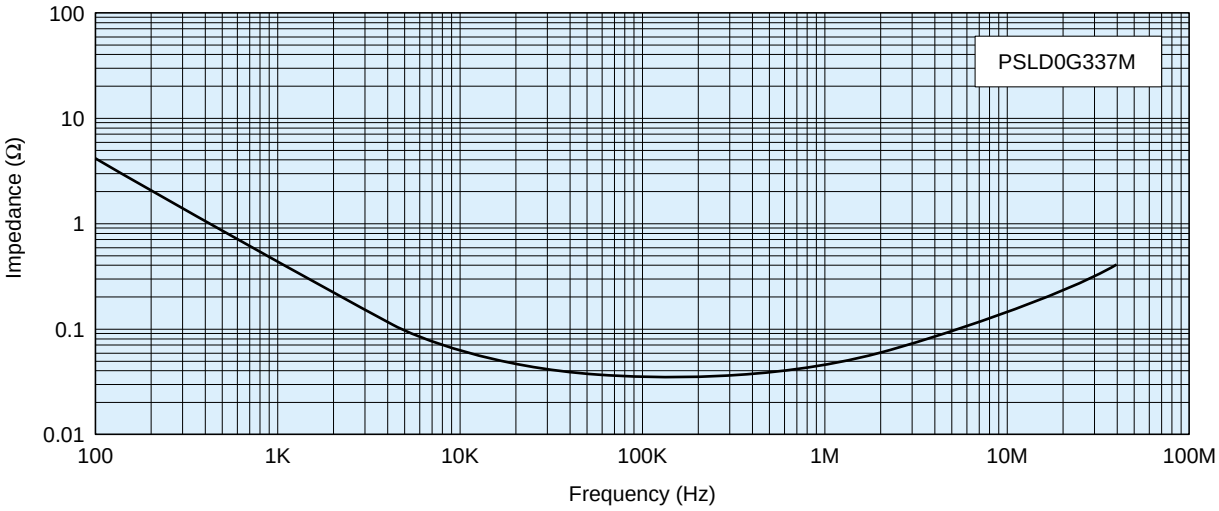


● **Capacitance-frequency characteristics (Reference data)**

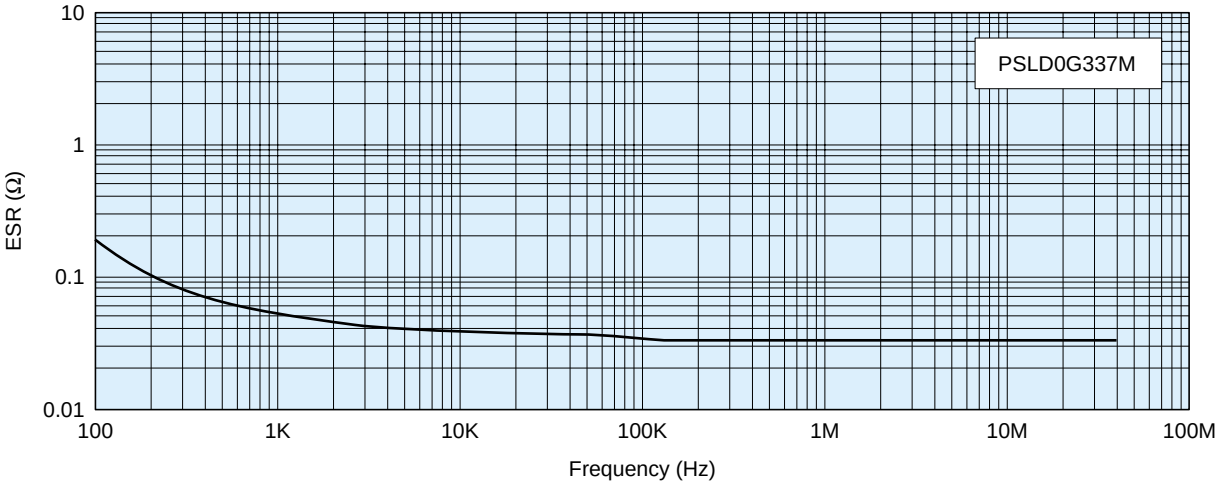


○PS/L Series

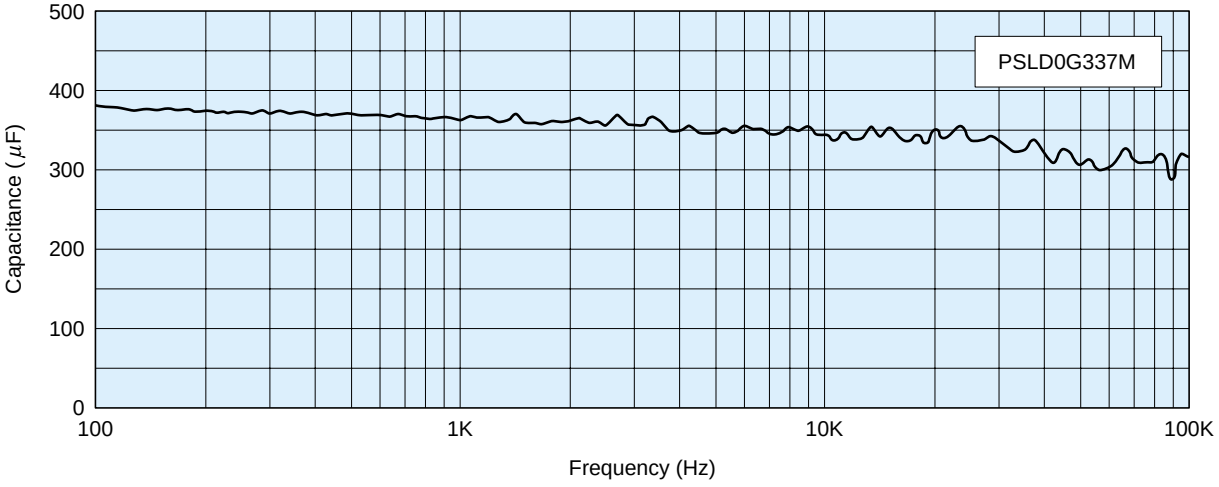
● **Impedance-frequency characteristics (Reference data)**



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



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



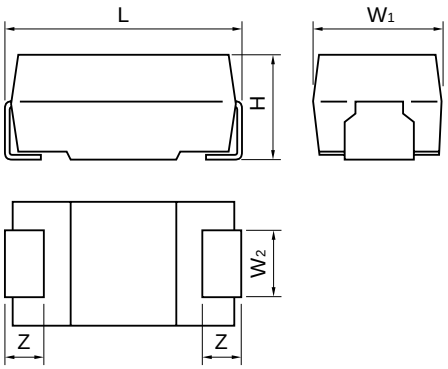
Specifications (PS/G Series)

Lead-free / Conform to RoHS

New Product

Dimensions

V, D case



Unit : mm (inch)

Case code	EIA code	L	W1	W2	H	Z
V	–	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)

C–V Value Reference by Case Code

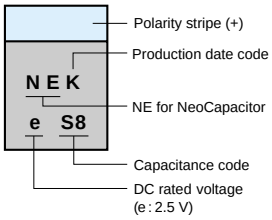
Capacitance (μF) \ Rated voltage (V)	2.5 V
220	[V 9]
330	V 9, [7] D 9, 7
470	[V 9, 7] D 9, 7, 6
680	D 9, 7

Numeral: ESR (mΩ) at 100 kHz

[ ]: Under development - specification to be determined

Markings

V, 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)

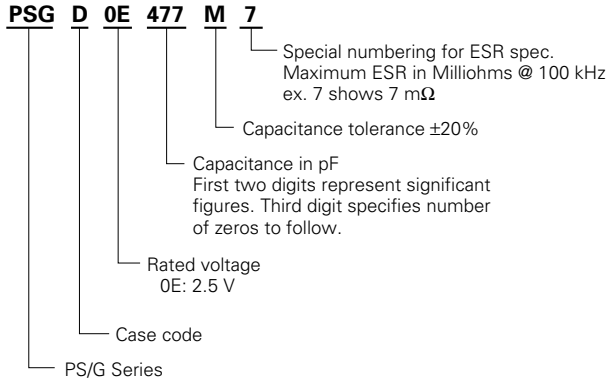
Procuction date code

Year \ Month	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
2003	a	b	c	d	e	f	g	h	j	k	l	m
2004	n	p	q	r	s	t	u	v	w	x	y	z
2005	A	B	C	D	E	F	G	H	J	K	L	M
2006	N	P	Q	R	S	T	U	V	W	X	Y	Z

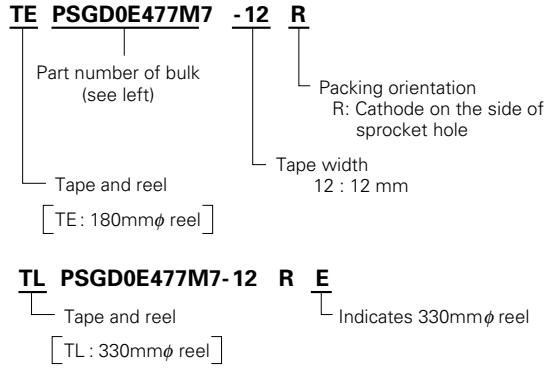
(NOTE) Production date code will resume for beginning in 2007.

PART NUMBER SYSTEM

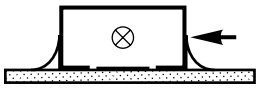
[Bulk]



[TAPE & REEL]



Performance Characteristics

No.	Item		Performance	Test Condition : Conform to IEC60384-1
1	Operating temperature		–55 to +105˚C	
2	Rated voltage (V.dc)		2.5	Temperature : 85˚C
3	Derated voltage (V.dc)		2	Temperature : 105˚C
4	Surge voltage (V.dc)		3.3	Temperature : 85˚C
5	Capacitance		330 to 680 μF	Frequency : 120 Hz
6	Capacitance tolerance		±22%	Frequency : 120 Hz
7	Dissipation Factor (DF)		Refer to rating on page 22	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 22	Frequency : 100 kHz Temperature : 25˚C
10	Terminal strength	Visual	There shall be no evidence of mechanical damage.	Strength : 4.9 N Time : 10 ± 0.5 sec. (two direction) 
11	Surge voltage	⊿C/C	Refer to rating on page 22	Temperature : 85 ± 2˚C Applied voltage : No. 4 Series resistance : 33 Ω Duration of surge : 30 ± 5 sec. Time between surge : 5.5 min. Number of cycles : 1,000
		DF	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.	
12	Characteristics at high and low Temperature	⊿C/C	$^{0}_{-20}$ %	Step 2 / Step 4
		DF	Shall not exceed the value in No.7	
		⊿C/C	$^{+50}_{0}$ %	
		DF	Shall not exceed 150% of initial requirements	
		L.C	1.0 CV (μF × volts) or 30 μA, whichever is greater	
13	Resistance to Soldering	⊿C/C	Refer to rating on page 22	Reflow soldering method 240˚C, 10 sec. max.
		DF	Shall not exceed 130% of 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	Damp heat, steady state	Cap.	+30% to -20% of rated capacitance	Temperature : 40 ± 2˚C Moisture : 90 to 95% R.H. Duration : 500 $^{+24}_{0}$ Hr.
		DF	Shall not exceed 150% of initial requirements	
		L.C	Shall not exceed the value in No.8	
		Visual	There shall be no evidence of mechanical damage.	
15	Rapid change of temperature	⊿C/C	Refer to rating on page 22	Parts shall be temperature cycled over a temperature range of –55 to +105˚C, five times continuously as follows.
		DF	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.	
16	Endurance I	⊿C/C	Refer to rating on page 22	Temperature : 85 ± 2˚C Duration : 1000 $^{+48}_{0}$ Hr. Applied voltage : No. 2
		DF	Shall not exceed 150% of initial requirements.	
		L.C	Shall not exceed the value in No.8	
		Visual	There shall be no evidence of mechanical damage.	
17	Endurance II	⊿C/C	Refer to rating on page 22	Temperature : 105 ± 2˚C Duration : 1000 $^{+48}_{0}$ Hr. Applied voltage : No. 3
		DF	Shall not exceed 300% of initial requirements.	
		L.C	Shall not exceed the value in No.8	
		Visual	There shall be no evidence of mechanical damage.	
18	Maximum permissible ripple current		Refer to rating on page 22	Frequency : 100 kHz

Step 2 / Step 4

Step	Temperature
1	25 ± 2˚C
2	–55 $^{0}_{-3}$ ˚C
3	25 ± 2˚C
4	105 $^{+3}_{0}$ ˚C

Parts shall be temperature cycled over a temperature range of –55 to +105˚C, five times continuously as follows.

Step	Temperature	Time
1	–55 $^{0}_{-3}$ ˚C	30 ± 3 min.
2	room temp.	10 to 15 min.
3	105 $^{+3}_{0}$ ˚C	30 ± 3 min.
4	room temp.	10 to 15 min.

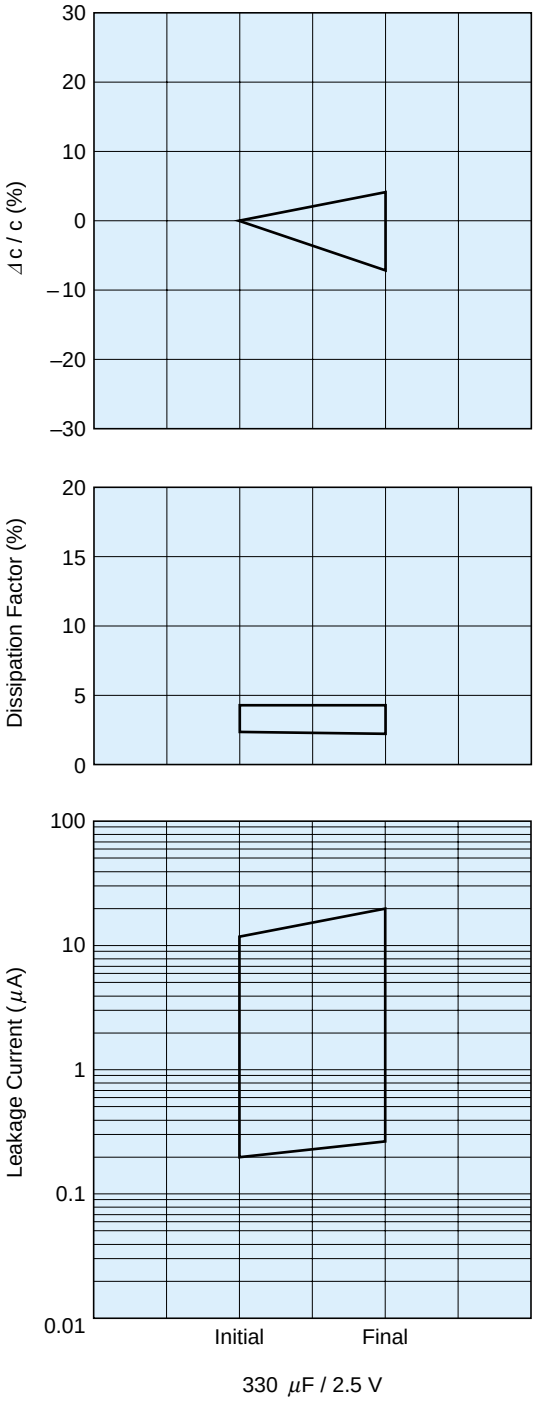
Ratings

Rated Voltage	Capacitance (μF)	Case Code	Part Number (Bulk)	DC Leakage Current (μA)	DF (%)	ESR (mΩ)	Permissible Ripple Current (mA rms.)	DF (%)		Capacitance Change	
								–55˚C	+105˚C	Change1	Change2
2.5	330	V	PSGV0E337M9	82.5	10	9	3726	10	15	±20%	±20%
	330	D	PSGD0E337M9	82.5	10	9	4082	10	15	±20%	±20%
	330	D	PSGD0E337M7	82.5	10	7	4629	10	15	±20%	±20%
	470	D	PSGD0E477M9	117.5	10	9	4082	10	15	±20%	±20%
	470	D	PSGD0E477M7	117.5	10	7	4629	10	15	±20%	±20%
	470	D	PSGD0E477M6	117.5	10	6	5000	10	15	±20%	±20%
	680	D	PSGD0E687M9	170	10	9	4082	10	15	±20%	±20%
	680	D	PSGD0E687M7	170	10	7	4629	10	15	±20%	±20%

Typical Performance Characteristics

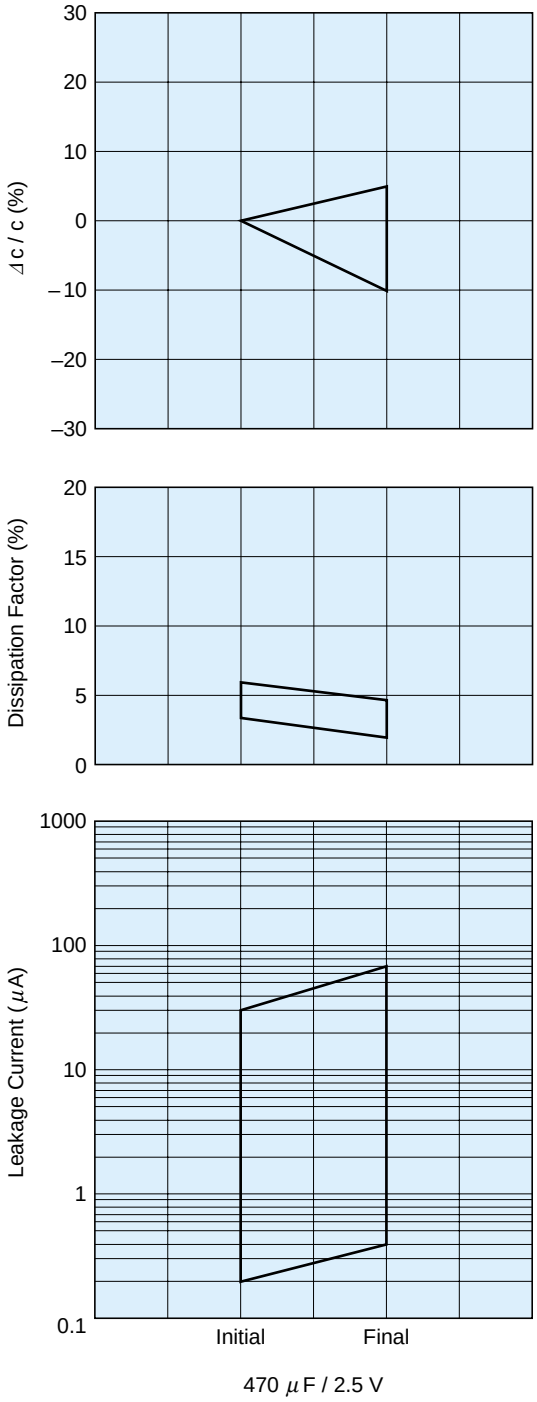
○PS/G Series

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



330 μF / 2.5 V

D Case

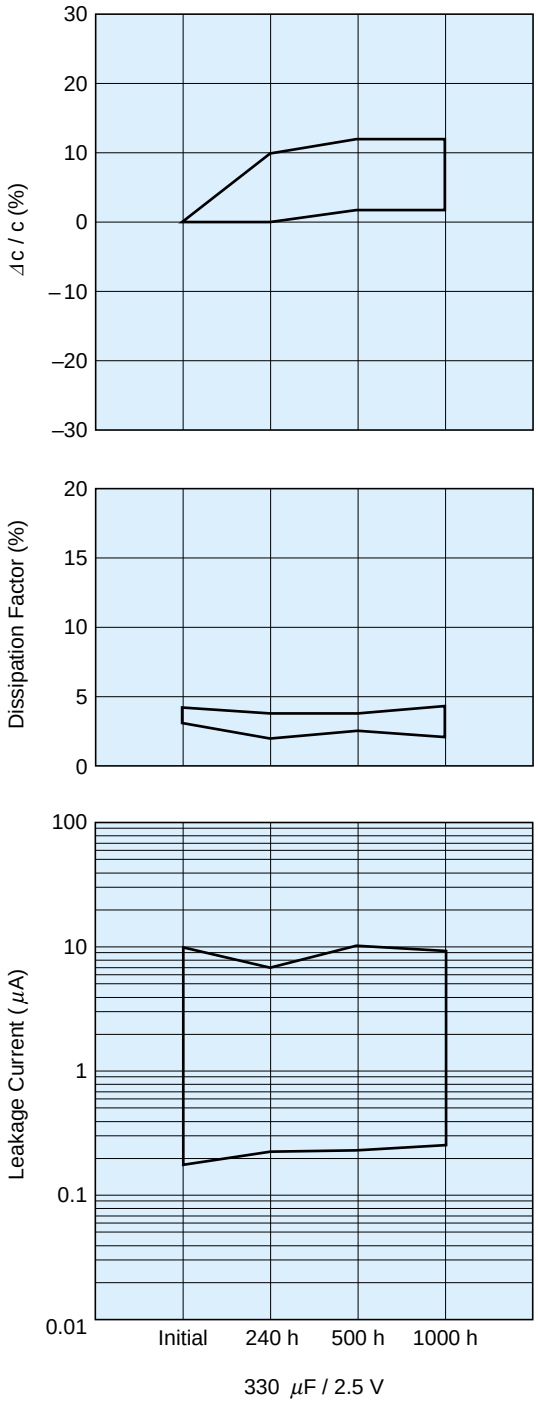


470 μF / 2.5 V

D Case

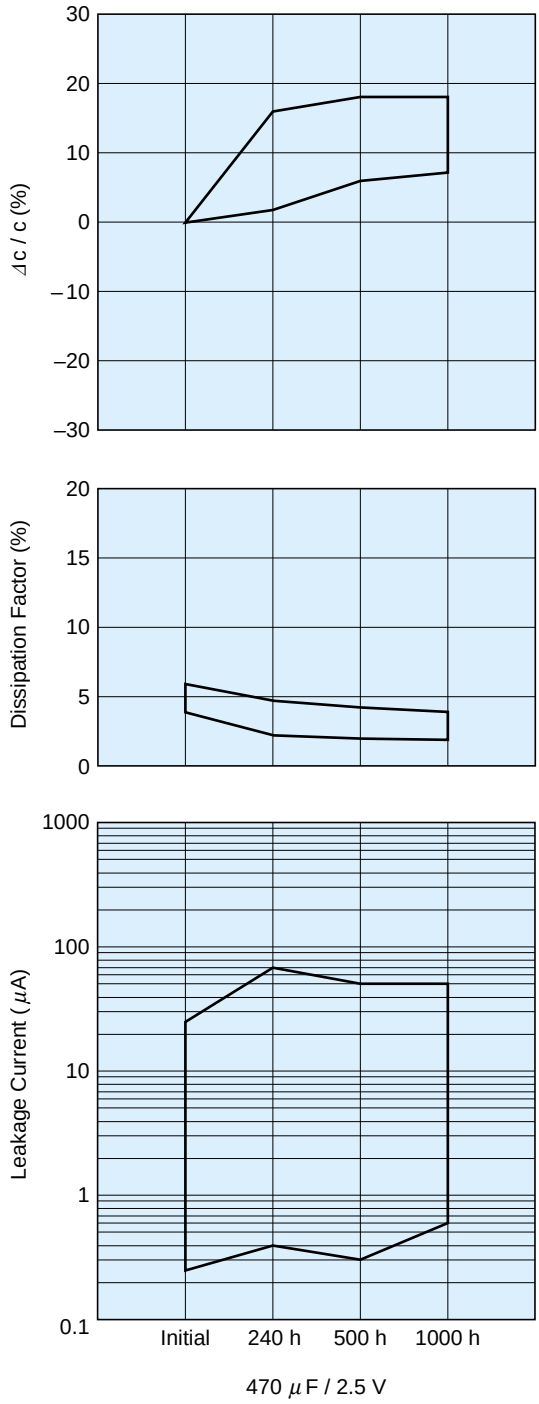
○PS/G Series

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



330 μF / 2.5 V

D Case

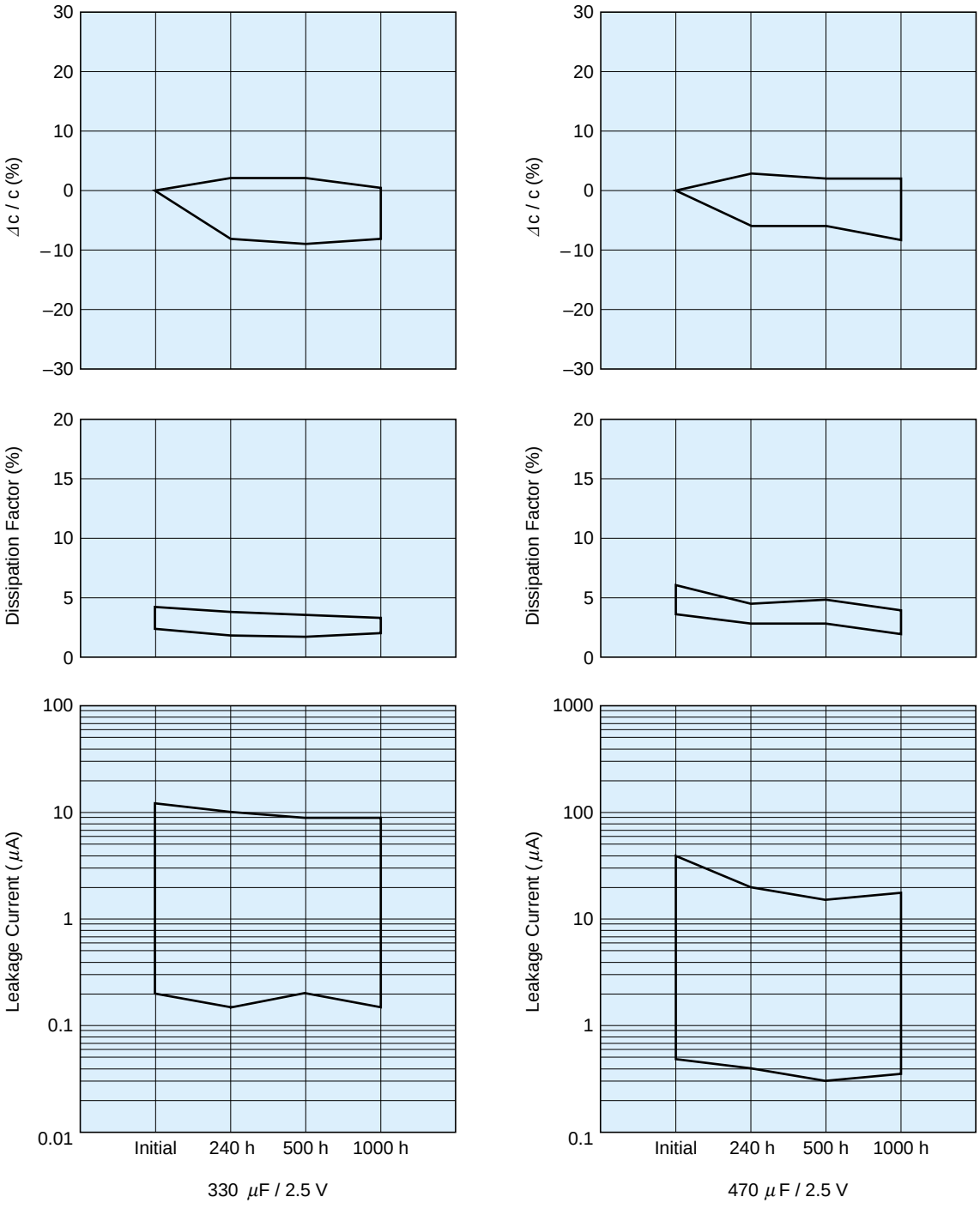


470 μF / 2.5 V

D Case

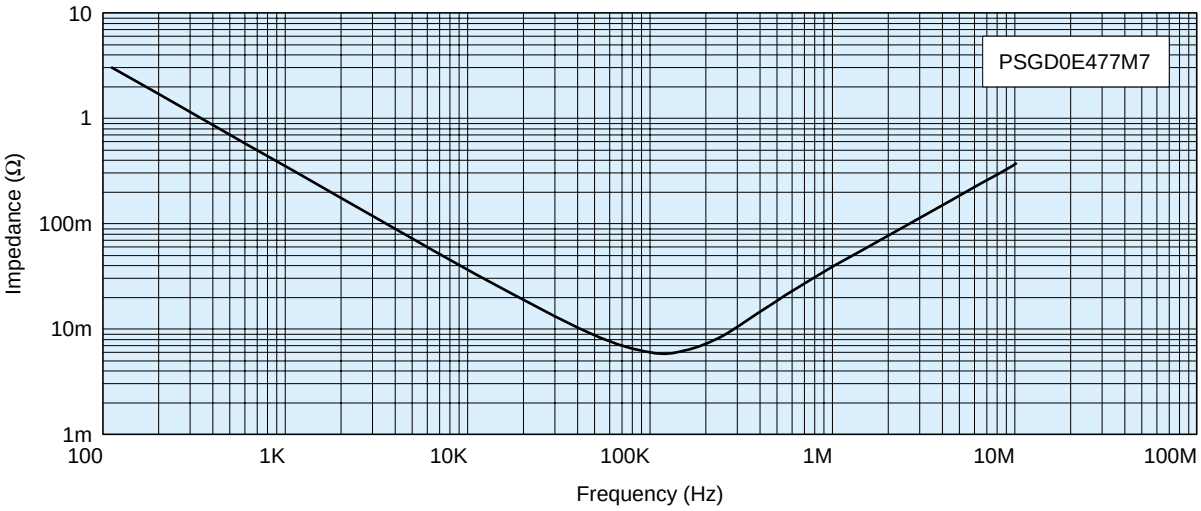
○PS/G Series

Endurance (105˚C, Rated Voltage)

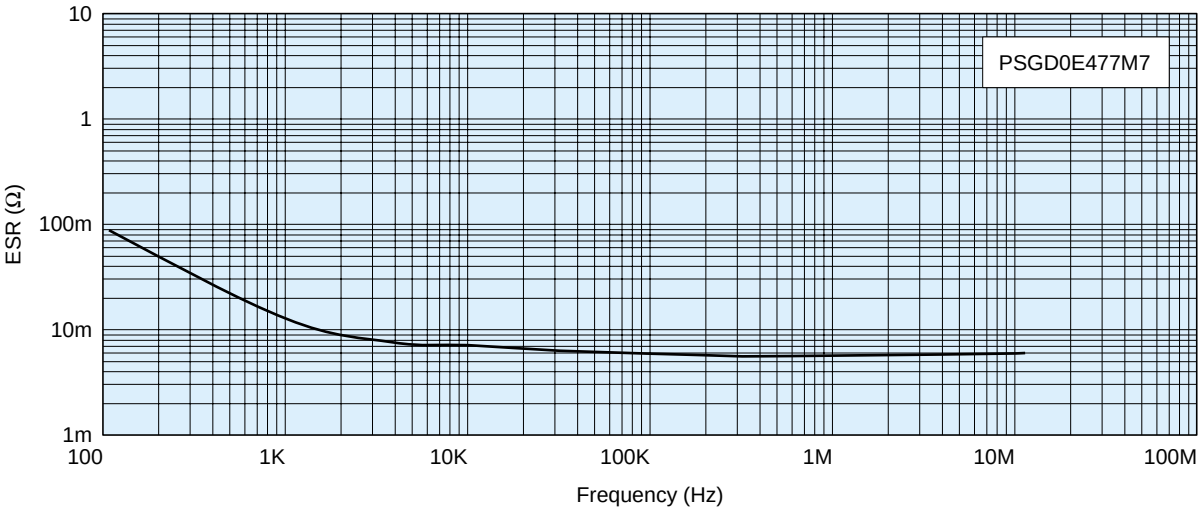


○PS/G Series

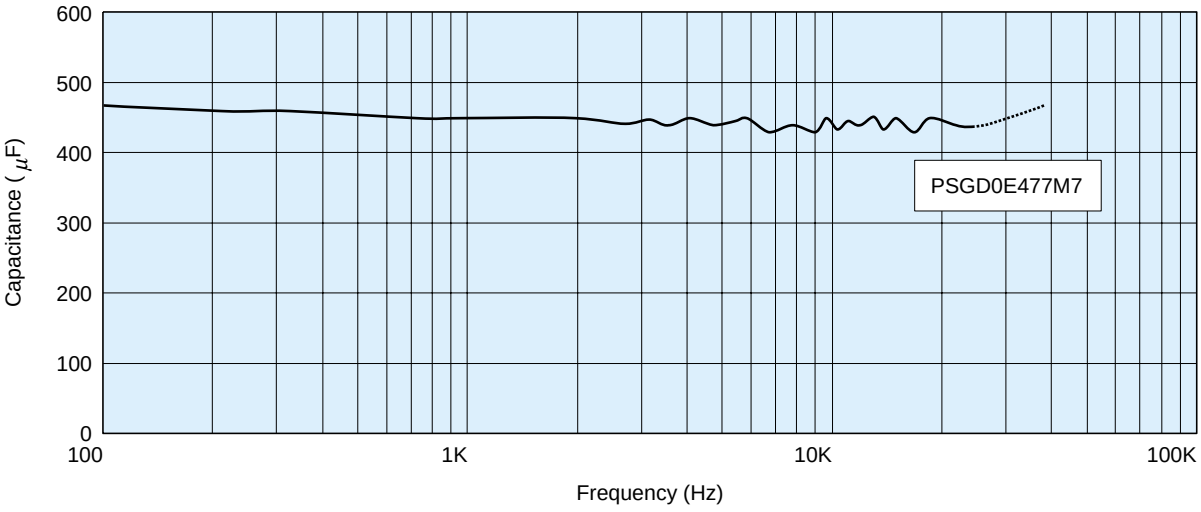
● **Impedance-frequency characteristics (Reference data)**



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

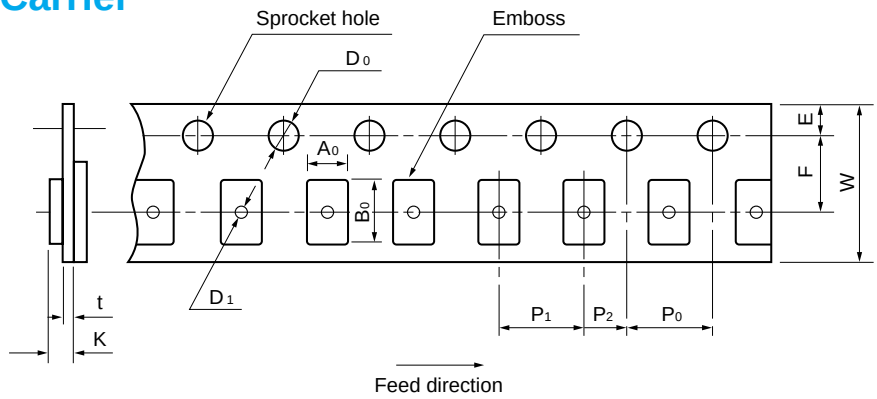


● **Capacitance-frequency characteristics (Reference data)**



Packaging

Plastic Tape Carrier

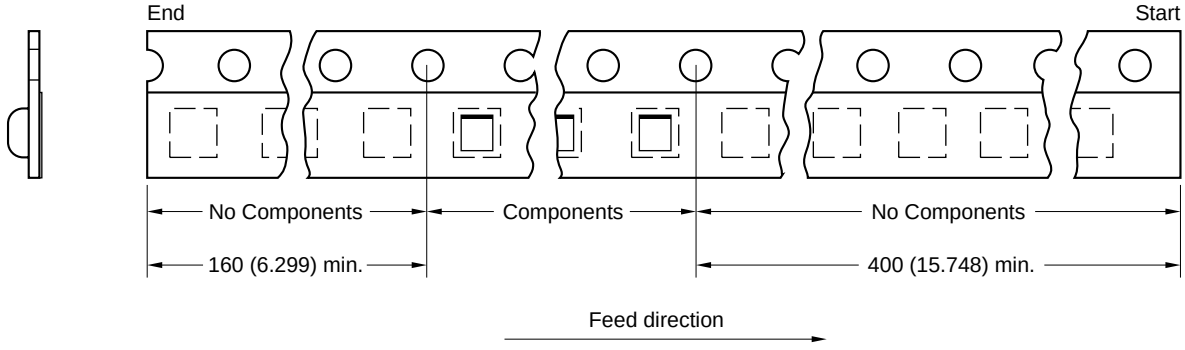


Unit : mm (inch)

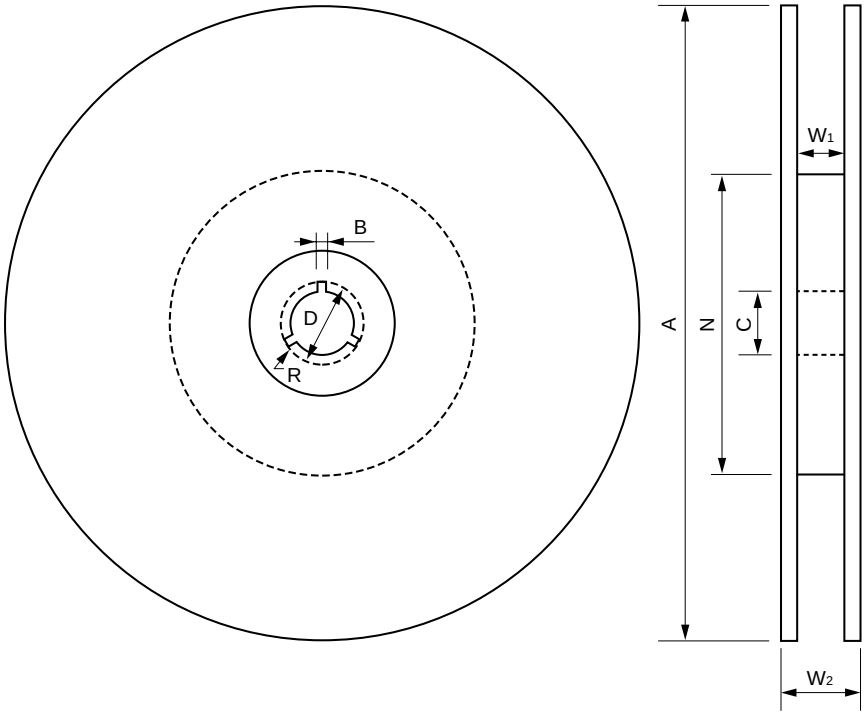
Case Code	W±0.3 (±0.012)	F±0.05 (±0.002)	E±0.1 (±0.004)	P1±0.1 (±0.004)	P2±0.05 (±0.002)	P0±0.1 (±0.004)	D0 +0.1 −0 (+0.004 −0)	D1 min.	t	A0±0.2 (±0.008)	B0±0.2 (±0.008)	K±0.2 (±0.008)
J	8 (0.315)	3.5 (0.138)	1.75 (0.069)	4 (0.157)	2 (0.079)	4 (0.157)	ϕ1.5 (0.059)	—	0.2 (0.008)	1.0 (0.039)	1.8 (0.071)	1.1 (0.043)
P								—		1.4 (0.055)	2.2 (0.087)	1.4 (0.055)
A2 (U)								ϕ1.0		1.9 (0.075)	3.5 (0.138)	
A												1.9 (0.075)
B3 (W)										3.2 (0.126)	3.8 (0.150)	1.4 (0.055)
B2 (S)										3.3 (0.130)		2.1 (0.083)
C2	12 (0.472)	5.5 (0.217)		8 (0.315)				ϕ1.5	0.3 (0.012)	3.7 (0.146)	6.4 (0.252)	1.7 (0.067)
C												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	N min.	C±0.5 (±0.020)	D	B±0.5 (±0.020)	W1	W2	R
8 mm	$\phi 180^{+0}_{-3}$ ($7.09^{+0}_{-0.118}$)	$\phi 50$ (1.969)	$\phi 13$ (0.512)	$\phi 21\pm0.5$ (0.827±0.020)	2 (0.079)	9±1.0 (0.354±0.039)	11.4±1.0 (0.449±0.039)	1 (0.039)
12 mm						13.0±1.0 (0.512±0.039)	15.4±1.0 (0.606±0.039)	
8 mm	330±2.0 (12.99±0.079)	$\phi 80$ (3.150)	$\phi 13$ (0.512)	$\phi 21\pm1.0$ (0.827±0.039)	2 (0.079)	10.0 Max. (0.394 Max.)	14.5 Max (0.571 Max)	1 (0.039)
12 mm						14.0 Max. (0.551 Max.)	18.5 Max (0.728 Max)	

Case Code	Dia. 180 mm	Dia. 330 mm
J	4000	—
P	3000	—
A2 (U)	3000	10000
A	2000	9000
B3 (W)	3000	10000
B2 (S)	2000	5000
C2	1000	4000
C	500	2500
V	1000	3000
D	500	2500

[Quantity per reel]

Notes on Using The NeoCapacitor

The most of failure mode of NeoCapacitor is Short-Circuit and large leakage current.
When you design an electric circuit, you should attend as follows.

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

25˚C	Rating value
85˚C	0.9 times rating value
105˚C	0.4 times rating value

b. Frequency

10 KHz	0.75 times rating value
100 KHz	Rating value
500 kHz	1.1 times rating value
1 MHz	1.3 times rating value

(3) Reverse voltage

Do not apply reverse voltage since the capacitors are polarized.

(4) Derating

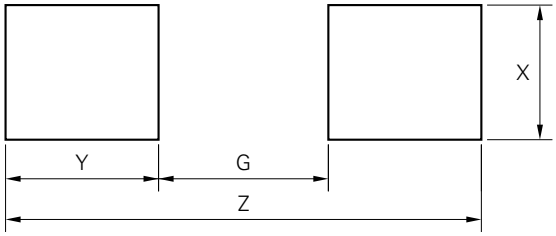
Apply appropriate voltage to the capacitors according to the failure rate estimation.
It is recommended that the applied voltage be less than 80% of the rated voltage.

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 IEC61188)



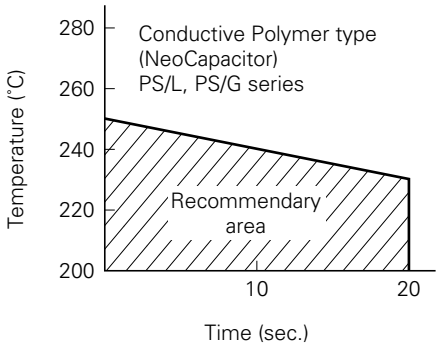
Unit : mm (inch)

Case	G max.	Z min.	X min.	Y (reference)
J	0.7 (0.028)	2.5 (0.098)	1.0 (0.039)	0.9 (0.035)
P	0.5 (0.02)	2.6 (0.102)	1.2 (0.047)	1.05 (0.041)
A2 (U), A	1.1 (0.043)	3.8 (0.15)	1.5 (0.059)	1.35 (0.053)
B3 (W), B2 (S)	1.4 (0.055)	4.1 (0.161)	2.7 (0.106)	1.35 (0.053)
C2, C	2.9 (0.114)	6.9 (0.272)	2.7 (0.106)	2.0 (0.079)
V, D	4.1 (0.161)	8.2 (0.323)	2.9 (0.114)	2.05 (0.081)

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 ... 350˚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..... 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 TOKIN, 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 TOKIN.

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).

5. In the case of Short-Circuit

The NeoCapacitor is heated and may generate smoke emission depending upon its excess current, time and other factors.

When designing the circuit, provide as much margin as possible to maintain capacitor reliability.

NeoCapacitor is a trademark of NEC TOKIN Corporation.

The information in this document is based on documents issued in April 2005 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.

No part of this document may be copied or reproduced in any form or by any means without the prior written consent of NEC TOKIN Corporation. NEC TOKIN Corporation assumes no responsibility for any errors which may appear in this document.

NEC TOKIN Corporation does not assume any liability for infringement of patents, copyrights, or other intellectual property rights of third parties by or arising from use of a device described herein or any other liability arising from use of such device. No license, either express, implied, or otherwise, is granted under any patents, copyrights, or other intellectual property rights of NEC TOKIN Corporation or others.

While NEC TOKIN Corporation has been making a continuous effort to enhance the reliability of its electronic components, the possibility of defects cannot be eliminated entirely. To minimize risks of damage or injury to persons or property arising from a defect in an NEC TOKIN electronic component, customers must incorporate sufficient safety measures in its design, such as redundancy, fire-containment, and anti-failure features. NEC TOKIN devices are classified into the following three quality grades:

"Standard," "Special," and "Specific." The Specific quality grade applies only to devices developed based on a customer-designated quality assurance program for a specific application. The recommended applications of a device depend on its quality grade, as indicated below. Customers must check the quality grade of each device before using it in a particular application.

Standard: Computers, office equipment, communications equipment, test and measurement equipment, audio and visual equipment, home electronic appliances, machine tools, personal electronic equipment, and industrial robots

Special: Transportation equipment (automobiles, trains, ships, etc.), traffic control systems, anti-disaster systems, anti-crime systems, safety equipment, and medical equipment (not specifically designed for life support)

Specific: Aircraft, aerospace equipment, submersible repeaters, nuclear reactor control systems, life support systems, or medical equipment for life support, etc.

The quality grade of NEC TOKIN devices is "Standard" unless otherwise specified in NEC TOKIN's data sheets or data books. If customers intend to use NEC TOKIN devices for applications other than those specified for Standard quality grade, they should contact an NEC TOKIN sales representative in advance.

(Note)

(1) "NEC TOKIN" as used in this statement means NEC TOKIN Corporation and also includes its majority-owned subsidiaries.

(2) "NEC TOKIN electronic component products" means any electronic component product developed or manufactured by or for NEC TOKIN (as defined above).