

NeoCapacitor[®]

Conductive Polymer Chip Tantalum Capacitor



Vol. 03



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For Correct Use of NeoCapacitor®

Be sure to read following Notes before using NeoCapacitor®.

[Notes]

- Be sure to read "Direction for using NeoCapacitor®" (p.33 - p.39) and "Cautions" (p.41) before commencing circuit design or using the capacitor.
- Confirm the using conditions and rated performance of the capacitor prior to actual use.
- Main failure reason of NeoCapacitor® is increase in leakage current or short-circuit. Therefore it's important to take sufficient margin for redundant circuit design.

[Quality Grades]

TOKIN's devices are classified into the following three quality grades in accordance with their application (for details of the applications, see p.41). 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 the products in this document for applications other than "standard" quality grade must contact TOKIN sales representative in advance. As for sales branch, see the back cover.

- **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 as specific industrial fields. Devices with a "special" quality grade are designed, manufactured, and tested using 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 bring 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 bring serious problems in the wider community. Customers who use TOKIN's products for these "specific" applications must conclude an individual quality agreement and/or development agreement with TOKIN. A quality assurance program designated by the customer must also be determined in advance.



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Outline of conductive polymer chip tantalum capacitor “NeoCapacitor®”

TOKIN the inventor of chip tantalum capacitor succeeded in applying conductive polymer as cathode material and launched the product “NeoCapacitor®” at the head of the world capacitor history in 1994. “NeoCapacitor®” provide lower ESR (Equivalent Series Resistance) than conventional MnO₂ type tantalum capacitors due to high conductivity of the conductive polymer. As a result of it, NeoCapacitor® can handle higher ripple current so that it can provide excellent performance for voltage smoothing and noise absorption in high speed operation circuit and has been expanding various area in multi media instruments. TOKIN’s wide product line up based upon our cutting edge technology, e.g. miniaturized, thinner, higher capacitance and lower ESR respond to customer’s request rapidly.

Moreover TOKIN is the first runner of the world wide environment protection activity and addressing elimination of environmental load substances from product planning and design stage. All series and all part number of NeoCapacitor® conform to Lead free (JEITA PHASE3), RoHS2 directive (2011/65/EU + 2015/863/EU) and Halogen free. Furthermore NeoCapacitor® employ Antimony free and Red phosphorous free materials for mold resin.

Feature of “NeoCapacitor®”

■ Excellent noise absorption performance

Because of higher conductivity of conductive polymer, “NeoCapacitor®” provide lower ESR than conventional MnO₂ type tantalum capacitor and provide excellent performance for noise absorption in higher performance portable instruments. TOKIN has been making effort for achievement of lower ESR continuously.

■ Wide line up

Wide case size of products from miniaturized to large ones are available. TOKIN is the first runner of miniaturization of tantalum capacitor especially in B2-case (3528 foot print) or smaller. These are suitable for portable instruments e.g. smart phone, tablet computer etc.

■ Higher volumetric efficiency (Higher capacitance and smaller case size)

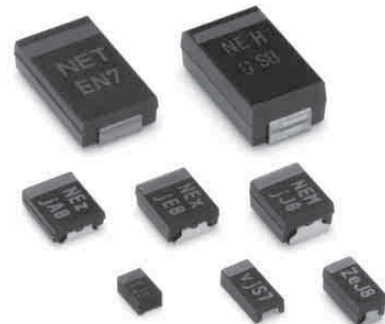
“NeoCapacitor®” has higher volumetric efficiency compare to multi layer ceramic capacitor, aluminum electrolytic capacitor. So it contributes down sizing and lightweight of various portable instruments.

■ Lead free and RoHS conformance

NeoCapacitor® conform to Lead free (JEITA PHASE3) and RoHS2 directive (2011/65/EU + 2015/863/EU)

■ Higher safety

When micro precursors of failure occur, leakage current flow through them so that insulation of conductive polymer can occur and failures can be avoided



Suitable applications of “NeoCapacitor®”

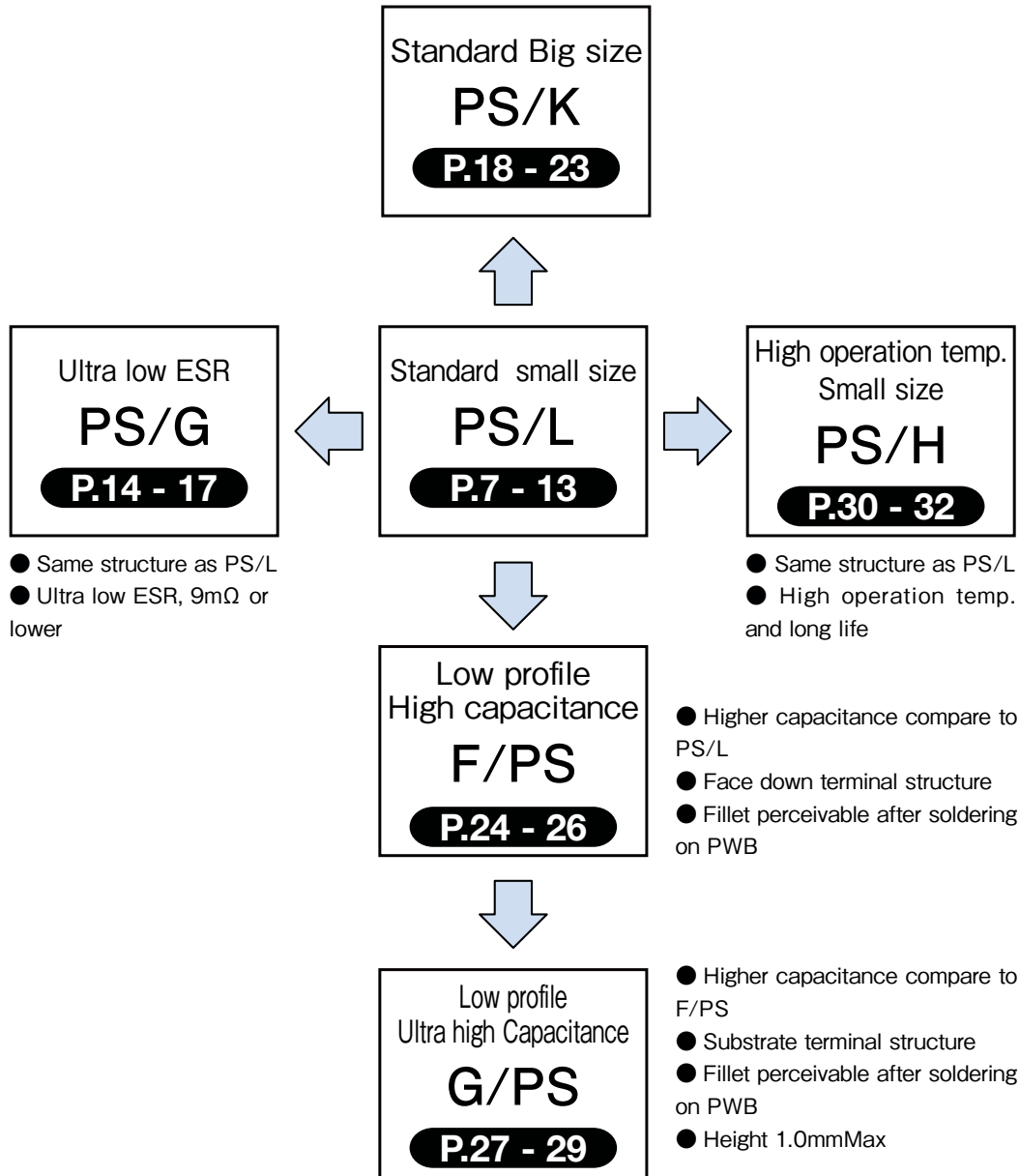
- PC (Voltage smoothing and noise absorption of CPU, memory and various LSI)
- Smartphone, mobile phone (Stabilization of battery voltage, stabilization for display)
- LCD TV (Stabilization of LCD driver and timing controller)
- Others (Tablet PC, portable audio player, DSC, DVC, HDD, SSD, communication card)

NeoCapacitor® is manufactured in the factory certified international standard “ISO 9001” , “ISO 14001” and “IATF 16949” .



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Series illustration of NeoCapacitor®



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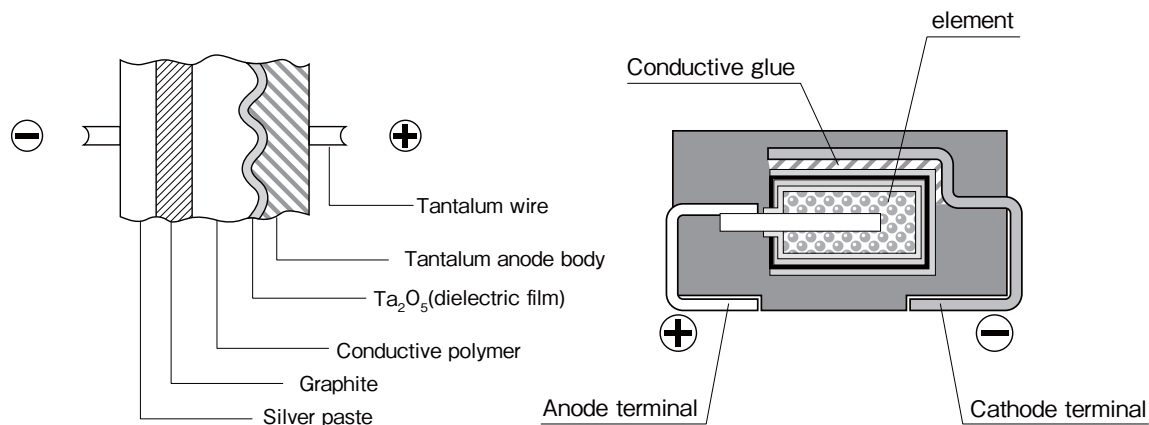
Structure of *NeoCapacitor*[®]

Fundamental structure of NeoCapacitor[®] is same as conventional MnO₂ chip tantalum capacitor.

Conductive polymer is used for cathode on behalf of MnO₂.

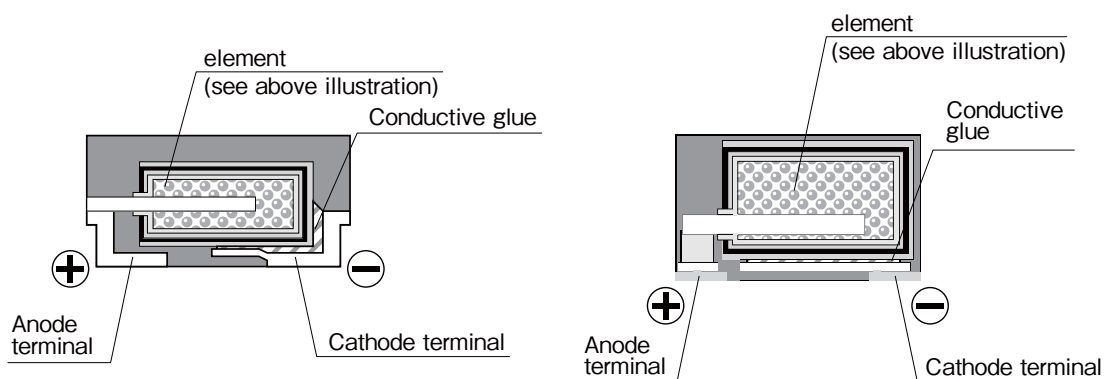
Anode terminal is connected with tantalum wire embedded in anode body of capacitor element. Cathode terminal is connected with cathode layer of the element together with conductive glue. Anode and cathode terminal are taken out of the mold resin.

As for F/PS and G/PS, terminal structure is rather different from PS/L due to improvement of volumetric efficiency.



Structure of element
(Common for all series)

Structure of PS/L, PS/G, PS/H and
PS/K series



Structure of F/PS series

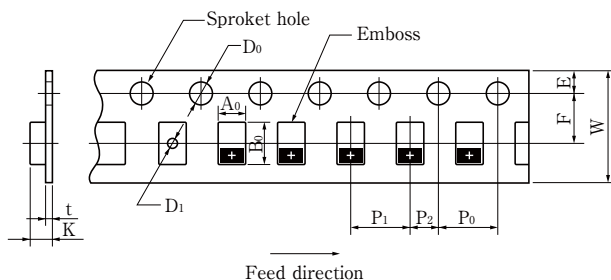
Structure of G/PS series



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Tape and reel specification

Dimension of Carrier Tape and Standard Packing Quantity



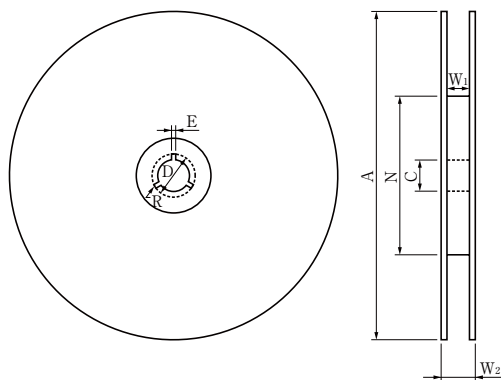
Note) Standard taping orientation is R.
R indicates cathode is located to sprocket hole.

(Unit : mm)

Dimension code Case code	A_0 ± 0.2	B_0 ± 0.2	W ± 0.3	F ± 0.05	E ± 0.1	P_1 ± 0.1	P_2 ± 0.05	P_0 ± 0.1	D_0 $+0.1/-0$	D_1 min.	K ± 0.2	t	Standard packing quantity	
													ϕ 180mm reel	ϕ 330mm reel
P2 *	1.55	2.3	8.0	3.5	1.75	4.0	2.0	4.0	ϕ 1.5	—	1.3	0.25	3000p	—
A3 **	1.9	3.5	8.0	3.5	1.75	4.0	2.0	4.0	ϕ 1.5	—	1.1	0.25	3000p	—
A	1.9	3.5	8.0	3.5	1.75	4.0	2.0	4.0	ϕ 1.5	ϕ 1.0	1.9	0.2	2000p	—
B3	3.2	3.8	8.0	3.5	1.75	4.0	2.0	4.0	ϕ 1.5	ϕ 1.0	1.4	0.2	3000p	—
B15	3.25	3.8	8.0	3.5	1.75	4.0	2.0	4.0	ϕ 1.5	ϕ 1.0	1.7	0.25	2500p	—
B2	3.3	3.8	8.0	3.5	1.75	4.0	2.0	4.0	ϕ 1.5	ϕ 1.0	2.1	0.2	2000p	—
V15	4.6	7.7	12.0	5.5	1.75	8.0	2.0	4.0	ϕ 1.5	ϕ 1.5	2.2	0.6	—	3000p
V	4.6	7.8	12.0	5.5	1.75	8.0	2.0	4.0	ϕ 1.5	ϕ 1.5	2.2	0.6	—	3000p
D	4.6	7.6	12.0	5.5	1.75	8.0	2.0	4.0	ϕ 1.5	ϕ 1.5	3.1	0.6	500p	—

(*) G/PS series (**) F/PS series

Dimension of Reel



(Unit : mm)

Reel	Tape width	A	N	C	D	E	W_1	W_2	R
ϕ 180mm	8	ϕ 180 $^{+0}_{-3}$	ϕ 50 min.	ϕ 13 ± 0.5	ϕ 21 ± 0.5	2.0 ± 0.5	9.0 ± 1.0	11.4 ± 1.0	1
ϕ 180mm	12	ϕ 178 ± 0.2	ϕ 50 min.	ϕ 13.0 $^{+0.5}_{-0.2}$	20.2 min	1.5 min.	ϕ 12.4 $^{+2.0}_{-0.0}$	18.4 max	-
ϕ 330mm	12	ϕ 330 ± 0.2	ϕ 50 min.	ϕ 13.0 $^{+0.5}_{-0.2}$	20.2 min	1.5 min.	ϕ 12.4 $^{+2.0}_{-0.0}$	18.4 max	-



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PS/L series is the standard product of NeoCapacitor®.
PS/L series can provide space-saving solution and low ESR.



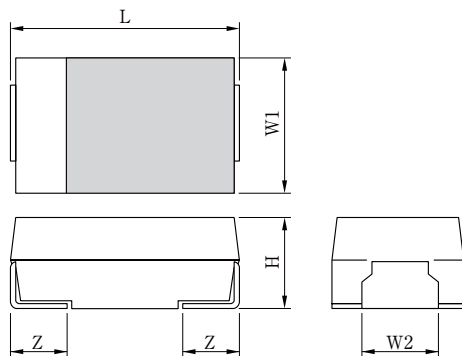
■ Performance Characteristics

Item		Performance							Test condition (IEC 60384-1, 24)
Operating temperature		- 55°C ~ + 105°C							—
Rated temperature		+ 105°C							—
Rated voltage (V)		2.5	4	6.3	10	16	20	25	Temp. : 105°C
Surge voltage (V)		3.3	5.2	8	13	20	23	29	Temp. : 105°C
Nominal Capacitance	Range	3.3 μ F ~ 330 μ F							Measurement freq. : 120Hz Measurement volt. : 0.5Vrms+1.5V DC
	Tolerance	$\pm$ 20%							Measurement freq. : 120Hz Measurement volt. : 0.5Vrms+1.5V DC
Dissipation Factor (tan δ)		Refer to Standard Ratings							Measurement freq. : 120Hz Measurement volt. : 0.5Vrms+1.5V DC
Leakage Current (LC)		Refer to Standard Ratings							Rated voltage after 5 minuets
Equivalent Series Resistance (ESR)		Refer to Standard Ratings							Measurement freq. : 100kHz (Note: 300kHz ~ 500kHz for limited part number)
Permissible Ripple Current		Refer to Standard Ratings							Measurement freq. : 100kHz, sine wave (Note: 300kHz ~ 500kHz for limited part number)
		Δ C/C		tan δ		LC			
Surge voltage test		+20% ~ - 20% of the initial value		Within IL		Within IL		Temp. : 105°C, Surge voltage apply, 1000ohm series resistance, 1000cycles	
Characteristics at high and low temperature	+ 25°C	—		Within IL		Within IL		—	
	- 55°C	0% ~ - 20% compare with +25° C		Within IL		—		—	
	+ 105°C	+50% ~ 0% compare with +25° C		Within 1.5 $\times$ IL		Within 10 $\times$ IL		—	
Endurance		+20% ~ - 20% of the initial value		Within 1.5 $\times$ IL		Within IL		Temp. : 105°C, Rated voltage apply, 2000hours	
Damp heat		+30% ~ - 20% of the initial value		Within 1.5 $\times$ IL		Within IL		Temp. : 60°C, Humidity: 90 ~ 95%RH, 500hours	

IL = Initial limit

Unless otherwise specified, the measurement of electrical property is performed under the room temperature (25°C)

■ Dimensions



(Unit : mm)

Dimension code Case code	L	W1	W2	H	Z
A	3.2 $\pm$ 0.2	1.6 $\pm$ 0.2	1.2 $\pm$ 0.1	1.6 $\pm$ 0.2	0.8 $\pm$ 0.2
B3	3.5 $\pm$ 0.2	2.8 $\pm$ 0.2	2.2 $\pm$ 0.1	1.1 $\pm$ 0.1	0.8 $\pm$ 0.2
B15	3.5 $\pm$ 0.2	2.8 $\pm$ 0.2	2.2 $\pm$ 0.1	1.4 $\pm$ 0.1	0.8 $\pm$ 0.2
B2	3.5 $\pm$ 0.2	2.8 $\pm$ 0.2	2.2 $\pm$ 0.1	1.9 $\pm$ 0.1	0.8 $\pm$ 0.2



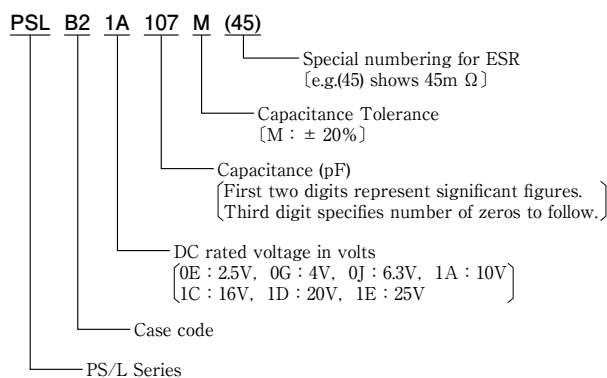
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Standard C-V Value Reference by Case Code

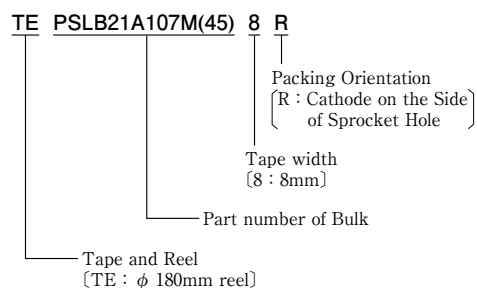
Rated voltage Capacitance	2.5V	4V	6.3V	10V	16V	20V	25V
	0E	0G	0J	1A	1C	1D	1E
3.3 μ F				A	A		
4.7 μ F				A	B2		
6.8 μ F			A	A,B2	B2		B3,B2
10 μ F		A	A	A,B2	B2		B15
15 μ F			A,B2	A,B2			B2
22 μ F		B2	A,B3,B2	A,B3,B2		B2	B2
33 μ F		A	A,B3,B2	A,B3,B2	B2, B3	B2	
47 μ F		A,B3	A,B3,B2	A,B3,B2			
68 μ F		A	A,B3,B2				
100 μ F	A,B3	A,B3,B2	A,B3,B2	B2			
150 μ F		B2	B15,B2				
220 μ F	A,B3,B2	B2	B2				
330 μ F	B2		B2				

Part Number System

[Bulk]



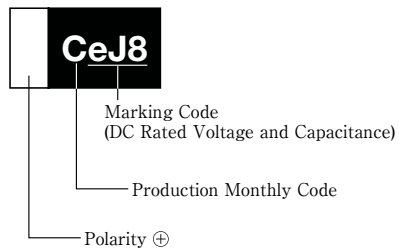
[Tape and reel]



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■ Marking

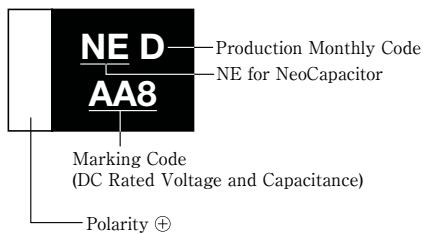
【A case】 (e.g. 2.5V/220 μ F)



《DC rated voltage and capacitance》

Capacitance	Rated voltage		2.5V	4V	6.3V	10V	16V	20V	25V
			e	g	j	A	C	D	E
3.3 μ F	N6					AN6	CN6		
4.7 μ F	S6					AS6	CS6		
6.8 μ F	W6				jW6	AW6	CW6		EW6
10 μ F	A7			gA7	jA7	AA7	CA7		EA7
15 μ F	E7				jE7	AE7	CE7		EE7
22 μ F	J7			gJ7	jJ7	AJ7		DJ7	EJ7
33 μ F	N7			gN7	jN7	AN7	CN7	DN7	
47 μ F	S7			gS7	jS7	AS7			
68 μ F	W7			gW7	jW7	AW7			
100 μ F	A8	eA8	gA8	jA8	AA8				
150 μ F	E8		gE8	jE8					
220 μ F	J8	eJ8	gJ8	jJ8					
330 μ F	N8	eN8	gN8	jN8					

【B2, B15, B3 case】 (e.g. 10V/100 μ F)



《Production monthly code》

Y \ M	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
2017	A	B	C	D	E	F	G	H	J	K	L	M
2018	N	P	Q	R	S	T	U	V	W	X	Y	Z
2019	a	b	c	d	e	f	g	h	j	k	l	m
2020	n	p	q	r	s	t	u	v	w	x	y	z

NOTE: Production monthly code will resume beginning in 2021.



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■ Standard Ratings

Rated Voltage (V)	Capacitance (μF)	Case Code	Part Number (Bulk)	Leakage Current (μA, +25°C) Maximum	tan δ (+25°C, 120Hz) Maximum	ESR *1 (mΩ, +25°C, 100kHz) Maximum	Permissible Ripple Current *2 (mA, +25°C, 100kHz) Maximum
2.5	47	A / 3216-16	PSLA0E476M	11.7	0.06	180	645
	100	A / 3216-16	PSLA0E107M	25	0.08	100	866
	100	A / 3216-16	PSLA0E107M(45)	25	0.08	45	1291
	100	A / 3216-16	PSLA0E107M(35)	25	0.08	35	1464
	100	B3 / 3528-11	PSLB30E107M	25	0.08	70	1035
	220	A / 3216-16	PSLA0E227M(45)	55	0.08	45 ●	1291 ●
	220	A / 3216-16	PSLA0E227M(35)	55	0.08	35 ●	1464 ●
	220	A / 3216-16	PSLA0E227M(25)	55	0.08	25 ●	1732 ●
	220	B3 / 3528-11	PSLB30E227M	55	0.08	70	1035
	220	B3 / 3528-11	PSLB30E227M(35)	55	0.08	35	1463
	220	B2 / 3528-19	PSLB20E227M	55	0.08	45	1374
	220	B2 / 3528-19	PSLB20E227M(35)	55	0.08	35	1558
	220	B2 / 3528-19	PSLB20E227M(25)	55	0.08	25	1844
	220	B2 / 3528-19	PSLB20E227M(21)	55	0.08	21	2012
	220	B2 / 3528-19	PSLB20E227M(15)	55	0.08	15 ●	2380 ●
	330	B2 / 3528-19	PSLB20E337M(45)	82.5	0.08	45	1374
	330	B2 / 3528-19	PSLB20E337M(35)	82.5	0.08	35	1558
	330	B2 / 3528-19	PSLB20E337M(21)	82.5	0.08	21	2012
	330	B2 / 3528-19	PSLB20E337M(15)	82.5	0.08	15 ●	2380 ●
4	10	A / 3216-16	PSLA0G106M	4	0.06	200	612
	22	B2 / 3528-19	PSLB20G226M	8.8	0.08	150	753
	33	A / 3216-16	PSLA0G336M	13.2	0.06	180	645
	47	A / 3216-16	PSLA0G476M	18.8	0.06	180	645
	47	B3 / 3528-11	PSLB30G476M	18.8	0.08	70	1035
	68	A / 3216-16	PSLA0G686M	27.2	0.06	180	645
	100	A / 3216-16	PSLA0G107M	40	0.08	100	866
	100	A / 3216-16	PSLA0G107M(45)	40	0.08	45	1291
	100	A / 3216-16	PSLA0G107M(35)	40	0.08	35	1464
	100	A / 3216-16	PSLA0G107M(25)	40	0.08	25	1732
	100	B3 / 3528-11	PSLB30G107M	40	0.08	70	1035
	100	B2 / 3528-19	PSLB20G107M	40	0.08	70	1102
	100	B2 / 3528-19	PSLB20G107M(45)	40	0.08	45	1374
	100	B2 / 3528-19	PSLB20G107M(35)	40	0.08	35	1558
	150	B2 / 3528-19	PSLB20G157M	60	0.08	45	1374

* 1 : ESR measurement frequency ● : 300 ~ 500kHz
 * 2 : Permissible Ripple Current condition ★ : Product temperature 105°C, 100kHz
 ● : +25°C, 300 ~ 500kHz



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Rated Voltage (V)	Capacitance (μF)	Case Code	Part Number (Bulk)	Leakage Current (μA, +25°C) Maximum	tan δ (+25°C, 120Hz) Maximum	ESR *1 (mΩ, +25°C, 100kHz) Maximum	Permissible Ripple Current *2 (mA rms, +25°C, 100kHz) Maximum
4	150	B2 / 3528-19	PSLB20G157M(35)	60	0.08	35	1558
	150	B2 / 3528-19	PSLB20G157M(25)	60	0.08	25	1844
	220	B2 / 3528-19	PSLB20G227M	88	0.08	45	1374
	220	B2 / 3528-19	PSLB20G227M(35)	88	0.08	35	1558
	220	B2 / 3528-19	PSLB20G227M(25)	88	0.08	25	1844
	220	B2 / 3528-19	PSLB20G227M(15)	88	0.08	15	2380
6.3	6.8	A / 3216-16	PSLA0J685M	4.2	0.06	300	500
	10	A / 3216-16	PSLA0J106M	6.3	0.06	200	612
	15	A / 3216-16	PSLA0J156M	9.4	0.06	200	612
	15	B2 / 3528-19	PSLB20J156M	9.4	0.08	150	753
	22	A / 3216-16	PSLA0J226M	13.8	0.06	180	645
	22	B3 / 3528-11	PSLB30J226M	13.8	0.08	70	1035
	22	B2 / 3528-19	PSLB20J226M	13.8	0.08	150	753
	33	A / 3216-16	PSLA0J336M	20.7	0.06	180	645
	33	B3 / 3528-11	PSLB30J336M	20.7	0.08	70	1035
	33	B2 / 3528-19	PSLB20J336M	20.7	0.08	150	753
	47	A / 3216-16	PSLA0J476M	29.6	0.06	150	645
	47	A / 3216-16	PSLA0J476M(70)	29.6	0.06	70	1035
	47	B3 / 3528-11	PSLB30J476M	29.6	0.08	70	1035
	47	B3 / 3528-11	PSLB30J476M(55)	29.6	0.08	55	1168
	47	B2 / 3528-19	PSLB20J476M	29.6	0.08	150	753
	47	B2 / 3528-19	PSLB20J476M(70)	29.6	0.08	70	1102
	68	A / 3216-16	PSLA0J686M(70)	43	0.08	70	1035
	68	B3 / 3528-11	PSLB30J686M	42.8	0.08	70	1035
	68	B2 / 3528-19	PSLB20J686M	42.8	0.08	70	1102
	68	B2 / 3528-19	PSLB20J686M(55)	42.8	0.08	55	1243
	100	A / 3216-16	PSLA0J107M(70)	63	0.08	70	1035
	100	A / 3216-16	PSLA0J107M(45)	63	0.08	45	1300
	100	A / 3216-16	PSLA0J107M(35)	63	0.08	35	1500
	100	A / 3216-16	PSLA0J107M(25)	63	0.08	25	1732
	100	B3 / 3528-11	PSLB30J107M	63	0.08	70	1035
	100	B3 / 3528-11	PSLB30J107M(45)	63	0.08	45	1291
	100	B2 / 3528-19	PSLB20J107M	63	0.08	70	1102
	100	B2 / 3528-19	PSLB20J107M(45)	63	0.08	45	1374

* 1 : ESR measurement frequency

● : 300 ~ 500kHz

* 2 : Permissible Ripple Current condition

★ : Product temperature 105°C, 100kHz

● : +25°C, 300 ~ 500kHz



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Rated Voltage (V)	Capacitance (μF)	Case Code	Part Number (Bulk)	Leakage Current (μA, +25°C) Maximum	tan δ (+25°C, 120Hz) Maximum	ESR *1 (mΩ, +25°C, 100kHz) Maximum	Permissible Ripple Current *2 (mA, +25°C, 100kHz) Maximum
6.3	100	B2 / 3528-19	PSLB20J107M(35)	63	0.08	35	1558
	100	B2 / 3528-19	PSLB20J107M(25)	63	0.08	25	1844
	150	B3 / 3528-11	PSLB30J157M(35)	94.5	0.08	35	1464
	150	B15 / 3528-14	PSLB150J157M(70)	94.5	0.1	70	1069
	150	B15 / 3528-14	PSLB150J157M(35)	94.5	0.1	35	1512
	150	B2 / 3528-19	PSLB20J157M(45)	94.5	0.08	45	1374
	150	B2 / 3528-19	PSLB20J157M(35)	94.5	0.08	35	1558
	150	B2 / 3528-19	PSLB20J157M(25)	94.5	0.08	25	1844
	220	B2 / 3528-19	PSLB20J227M(45)	138.6	0.08	45	1374
	220	B2 / 3528-19	PSLB20J227M(35)	138.6	0.08	35	1558
	220	B2 / 3528-19	PSLB20J227M(25)	138.6	0.08	25	1844
	330	B2 / 3528-19	PSLB20J337M(45)	415.8	0.08	45	1374
10	3.3	A / 3216-16	PSLA1A335M	3.3	0.06	300	500
	4.7	A / 3216-16	PSLA1A475M	4.7	0.06	300	500
	6.8	A / 3216-16	PSLA1A685M	6.8	0.06	300	500
	6.8	B2 / 3528-19	PSLB21A685M	6.8	0.08	200	652
	10	A / 3216-16	PSLA1A106M	10	0.06	200	612
	10	B2 / 3528-19	PSLB21A106M	10	0.08	200	652
	15	A / 3216-16	PSLA1A156M	15	0.06	180	645
	15	B2 / 3528-19	PSLB21A156M	15	0.08	150	753
	22	A / 3216-16	PSLA1A226M	22	0.06	180	645
	22	B3 / 3528-11	PSLB31A226M	22	0.08	70	1035
	22	B2 / 3528-19	PSLB21A226M	22	0.08	150	753
	33	A / 3216-16	PSLA1A336M	33	0.08	200	612
	33	B3 / 3528-11	PSLB31A336M	33	0.08	70	1035
	33	B2 / 3528-19	PSLB21A336M	33	0.08	150	753
	47	A / 3216-16	PSLA1A476M	47	0.08	180	645
	47	A / 3216-16	PSLA1A476M(45)	47	0.08	45	1291
	47	B3 / 3528-11	PSLB31A476M	47	0.08	70	1035
	47	B3 / 3528-11	PSLB31A476M(45)	47	0.08	45	1291
	47	B2 / 3528-19	PSLB21A476M	47	0.08	70	1102
	47	B2 / 3528-19	PSLB21A476M(35)	47	0.08	35	1558
	100	B2 / 3528-19	PSLB21A107M(45)	100	0.1	45	1374
16	3.3	A / 3216-16	PSLA1C335M	5.2	0.06	800	306 ★

* 1 : ESR measurement frequency ● : 300 ~ 500kHz
 * 2 : Permissible Ripple Current condition ★ : Product temperature 105°C, 100kHz
 ● : +25°C, 300 ~ 500kHz



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Rated Voltage (V)	Capacitance (μF)	Case Code	Part Number (Bulk)	Leakage Current (μA, +25°C) Maximum	tan δ (+25°C, 120Hz) Maximum	ESR *1 (mΩ, +25°C, 100kHz) Maximum	Permissible Ripple Current *2 (mA rms, +25°C, 100kHz) Maximum
16	4.7	B2 / 3528-19	PSLB21C475M	7.5	0.08	200	652 ★
	6.8	B2 / 3528-19	PSLB21C685M	10.8	0.08	200	652 ★
	10	B2 / 3528-19	PSLB21C106M	16	0.08	100	922 ★
	15	B2 / 3528-19	PSLB21C156M(90)	16	0.1	90	972 ★
	33	B3 / 3528-11	PSLB31C336M	105.6	0.08	70	1035 ★
	33	B2 / 3528-19	PSLB21C336M	52.8	0.08	70	1102 ★
20	33	B2 / 3528-19	PSLB21D336M	132	0.1	90	972 ★
25	6.8	B3 / 3528-11	PSLB31E685M	34	0.08	100	866 ★
	6.8	B2 / 3528-19	PSLB21E685M	17	0.08	100	922 ★
	10	B15 / 3528-14	PSLB151E106M	50	0.1	100	922 ★
	15	B2 / 3528-19	PSLB21E156M	75	0.1	100	922 ★
	22	B2 / 3528-19	PSLB21E226M	55	0.1	90	972 ★

* 1 : ESR measurement frequency

● : 300 ~ 500kHz

* 2 : Permissible Ripple Current condition

★ : Product temperature 105°C, 100kHz

● : +25°C, 300 ~ 500kHz



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PS/G series is lower ESR series of NeoCapacitor®.

PS/G series has same case size and same structure as PS/L series.



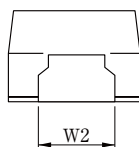
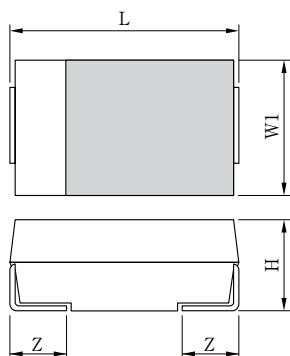
■ Performance Characteristics

Item		Performance			Test condition (IEC 60384-1, 24)
Operating temperature		- 55°C ~ + 105°C			—
Rated temperature		+ 105°C			—
Rated voltage (V)		2.5			Temp. : 105°C
Surge voltage (V)		3.3			Temp. : 85°C
Nominal Capacitance	Range	330 μ F			Measurement freq. : 120Hz Measurement volt. : 0.5Vrms+1.5V DC
	Tolerance	$\pm$ 20%			Measurement freq. : 120Hz Measurement volt. : 0.5Vrms+1.5V DC
Dissipation Factor (tan δ)		Refer to Standard Ratings			Measurement freq. : 120Hz Measurement volt. : 0.5Vrms+1.5V DC
Leakage Current (LC)		Refer to Standard Ratings			Rated voltage after 5 minutes
Equivalent Series Resistance (ESR)		Refer to Standard Ratings			Measurement freq. : 300kHz-500kHz
Permissible Ripple Current		Refer to Standard Ratings			Measurement freq. : 300kHz-500kHz, sine wave
		Δ C/C	tan δ	LC	
Surge voltage test		+20% ~ - 20% of the initial value	Within IL	Within IL	Temp. : 85°C, Surge voltage apply, 1000ohm series resistance, 1000cycles
Characteristics at high and low temperature	+ 25°C	—	Within IL	Within IL	—
	- 55°C	0% ~ - 20% compare with +25° C	Within IL	—	—
	+ 105°C	+50% ~ 0% compare with +25° C	Within 1.5 $\times$ IL	Within 10 $\times$ IL	—
Endurance		+20% ~ - 20% of the initial value	Within 1.5 $\times$ IL	Within IL	Temp. : 105°C, Rated voltage apply, 1000hours
Damp heat		+30% ~ - 20% of the initial value	Within 1.5 $\times$ IL	Within IL	Temp. : 60°C, Humidity: 90~95%R.H., 500hours

IL = Initial limit

Unless otherwise specified, the measurement of electrical property is performed under the room temperature (25°C)

■ Dimensions



(Unit : mm)

Dimension code	L	W1	W2	H	Z
Case code B2	3.5 $\pm$ 0.2	2.8 $\pm$ 0.2	2.2 $\pm$ 0.1	1.9 $\pm$ 0.1	0.8 $\pm$ 0.2



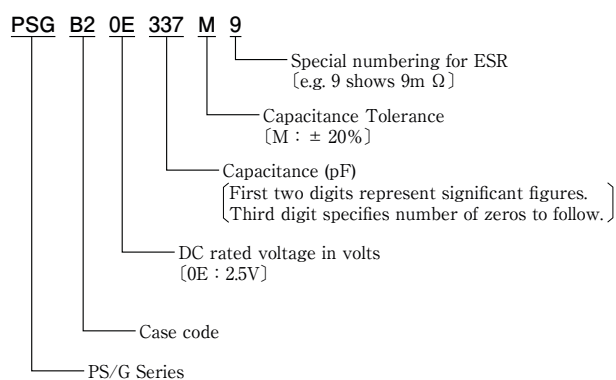
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■ Standard C-V Value Reference by Case Code

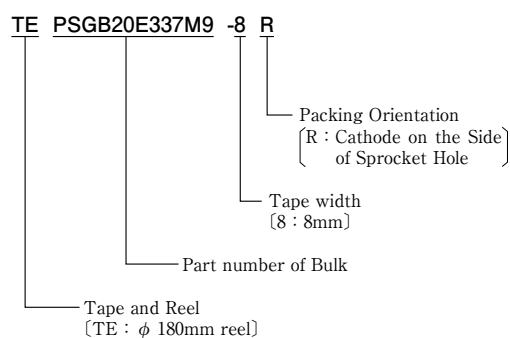
Rated Voltage	2.5V
Capacitance	0E
330 μ F	B2 9

※ Number : ESR initial spec. (m Ω)

[Bulk]



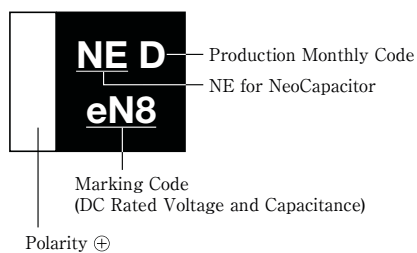
[Tape and reel]



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■ Marking

[B2 case] (e.g. 2.5V/330 μ F)



《DC rated voltage and capacitance》

Rated voltage		2.5V
Capacitance		e
330 μ F	N8	eN8

《Production monthly code》

Y \ M	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
2017	A	B	C	D	E	F	G	H	J	K	L	M
2018	N	P	Q	R	S	T	U	V	W	X	Y	Z
2019	a	b	c	d	e	f	g	h	j	k	l	m
2020	n	p	q	r	s	t	u	v	w	x	y	z

NOTE: Production monthly code will resume beginning in 2021.



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Standard Ratings

Rated Voltage (V)	Capacitance (μF)	Case Code	Part Number (Bulk)	Leakage Current (μA, +25°C) Maximum	tan δ (+25°C, 120Hz) Maximum	ESR * ¹ (mΩ, +25°C) Maximum	Permissible Ripple Current * ² (mA _{rms} , +25°C) Maximum
2.5	330	B2 / 3528-19	PSGB20E337M9	82.5	0.08	9 ●	3073 ●

* 1 : ESR measurement frequency ● : 300 ~ 500kHz

* 2 : Permissible Ripple Current ● : 300 ~ 500kHz



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PS/K Series is the standard products of NeoCapacitor® and can provide space saving solution and excellent noise absorption performance due to low ESR.



■ Performance characteristics

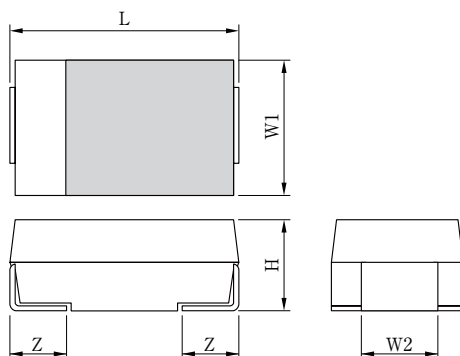
Item		Performance						Test condition	
Operating temperature		-55°C ~ +105°C						—	
Rated temperature		+105°C						—	
Rated voltage (V)		2.5	4	6.3	10	16	20	25	Temp. : 105°C
Surge voltage (V)		3.3	5.2	8	13	20	26	32	Temp. : 105°C
Nominal Capacitance	Range	15μF ~ 1,000μF						Measurement freq. : 120Hz Measurement volt. : 0.5Vrms+1.5V DC	
	Tolerance	±20%						Measurement freq. : 120Hz Measurement volt. : 0.5Vrms+1.5V DC	
Dissipation Factor (tanδ)		Refer to Standard Ratings						Measurement freq. : 120Hz Measurement volt. : 0.5Vrms+1.5V DC	
Leakage Current (LC)		Refer to Standard Ratings						Rated voltage after 5 minutes	
Equivalent Series Resistance (ESR)		Refer to Standard Ratings						Measurement freq. : 100kHz	
Permissible Ripple Current		Refer to Standard Ratings						Measurement freq. : 100kHz, sine wave	
		ΔC/C		tanδ		LC			
Surge Voltage Test		Within -20%/+10% of the initial value		Within IL		Within IL		Temp. : 105°C, Surge voltage apply, 1,000cycles	
Characteristics at high and low temperature	+25°C	—		Within IL		Within IL		—	
	-55°C	Within -20%/+20% compare with +25°C		Within IL		—		—	
	+105°C	Within -30%/+30% compare with +25°C		Within 1.5 × IL		Within 10 × IL		—	
Endurance		Within -20%/+10% of the initial value		Within IL		Within 1.25 × IL		Temp. : 105°C, Rated voltage apply, 2,000hours	
Damp heat		Within -5%/+35% of the initial value		Within IL		Within 3 × IL		Temp. : 60°C, Humidity: 90%R.H., 500hours	

IL=Initial limit

Unless otherwise specified, the measurement of electrical property is performed under the room temperature (25°C)

■ Dimensions

(Unit : mm)



Dimension code Case code	L	W1	W2	H	Z
V15	7.3 ± 0.3	4.3 ± 0.3	2.4 ± 0.1	1.4 ± 0.1	1.3 ± 0.2
V	7.3 ± 0.3	4.3 ± 0.3	2.4 ± 0.1	1.9 ± 0.1	1.3 ± 0.2
D	7.3 ± 0.3	4.3 ± 0.3	2.4 ± 0.1	2.8 ± 0.3	1.3 ± 0.2



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■ Products line up

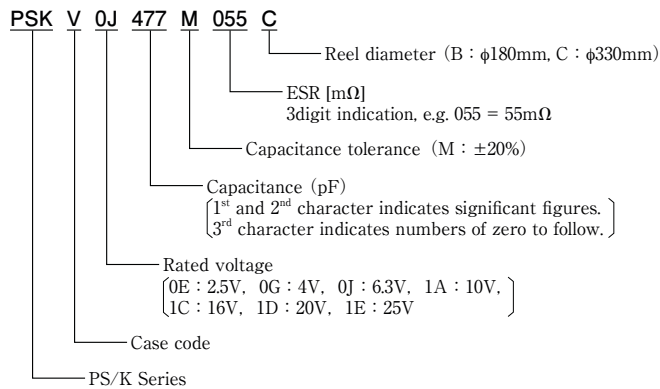
Nominal capacitance vs. Case size at each rated voltage

$V_R [V_{ac}]$ Cap. [μF]	2.5	4	6.3	10	16	20	25
10							
15							V
22						V	V
33							V D
47					V D	V15 V D	
68				V D	V		
100			V	V D	V		
150			V D	V D	D		
220		V D	V D	V D			
330	V	V D	V D				
470	V		D	V D			
680		D	D				
1000		D					



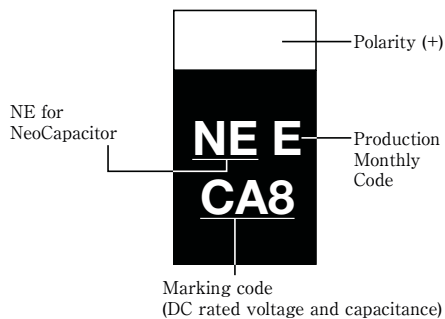
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Part number system (tape and reel only)



Marking [Common for V15, V, and D-case]

(e.g. : 16V, 100μF)



Note) Roughness of marking plane may vary to improve visibility of marking.

《DC rated voltage and capacitance》

Rated voltage		2.5V	4V	6.3V	10V	16V	20V	25V
Capacitance		e	g	j	A	C	D	E
10μF	A7							
15μF	E7							EE7
22μF	J7						DJ7	EJ7
33μF	N7				AN7			EN7
47μF	S7				AS7	CS7	DS7	
68μF	W7		gW7	jW7	AW7	CW7		
100μF	A8		gA8	jA8	AA8	CA8		
150μF	E8		gE8	jE8	AE8			
220μF	J8		gJ8	jJ8	AJ8			
330μF	N8	eN8	gN8	jN8				
470μF	S8	eS8	gS8					
680μF	W8	eW8	gW8					
1000μF	A9	eA9						

《Production monthly code》

Y \ M	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
2017	A	B	C	D	E	F	G	H	J	K	L	M
2018	N	P	Q	R	S	T	U	V	W	X	Y	Z
2019	a	b	c	d	e	f	g	h	j	k	l	m
2020	n	p	q	r	s	t	u	v	w	x	y	z

NOTE: Production monthly code will resume beginning in 2021.



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■ Standard ratings

Rated voltage [V]	Capacitance [μF]	Case code	Part number	Leakage Current (μA, +25°C) Maximum	tan δ (%, +25°C, 120Hz) Maximum	ESR (mΩ, +25°C, 100kHz) Maximum	Permissible Ripple Current (mA _{rms} , +45°C, 100kHz) Maximum
2.5	330	V / 7343-19	PSKV0E337M012C	83	10	12	3900
	330	V / 7343-19	PSKV0E337M015C	83	10	15	3500
	330	V / 7343-19	PSKV0E337M025C	83	10	25	2700
	470	V / 7343-19	PSKV0E477M009C	118	10	9	4600
	470	V / 7343-19	PSKV0E477M012C	118	10	12	3900
	470	V / 7343-19	PSKV0E477M015C	118	10	15	3500
	680	D / 7343-31	PSKD0E687M015B	170	10	15	3900
	680	D / 7343-31	PSKD0E687M040B	170	10	40	2400
	1000	D / 7343-31	PSKD0E108M015B	250	10	15	3900
4	220	V / 7343-19	PSKV0G227M009C	88	10	9	4600
	220	V / 7343-19	PSKV0G227M012C	88	10	12	3900
	220	V / 7343-19	PSKV0G227M015C	88	10	15	3500
	220	V / 7343-19	PSKV0G227M018C	88	10	18	3200
	220	V / 7343-19	PSKV0G227M025C	88	10	25	2700
	220	V / 7343-19	PSKV0G227M045C	88	10	45	2000
	220	D / 7343-31	PSKD0G227M012B	88	10	12	4300
	330	V / 7343-19	PSKV0G337M012C	132	10	12	3900
	330	V / 7343-19	PSKV0G337M025C	132	10	25	2700
	330	D / 7343-31	PSKD0G337M015B	132	10	15	3900
	330	D / 7343-31	PSKD0G337M040B	132	10	40	2400
	470	D / 7343-31	PSKD0G477M010B	188	10	10	4700
	470	D / 7343-31	PSKD0G477M012B	188	10	12	4300
	470	D / 7343-31	PSKD0G477M015B	188	10	15	3900
	470	D / 7343-31	PSKD0G477M018B	188	10	18	3500
	470	D / 7343-31	PSKD0G477M025B	188	10	25	3000
	680	D / 7343-31	PSKD0G687M012B	272	10	12	4300
	680	D / 7343-31	PSKD0G687M015B	272	10	15	3900
	680	D / 7343-31	PSKD0G687M025B	272	10	25	3000
	100	V / 7343-19	PSKV0J107M015C	63	10	15	3500
6.3	150	V / 7343-19	PSKV0J157M012C	95	10	12	3900
	150	V / 7343-19	PSKV0J157M015C	95	10	15	3500
	150	V / 7343-19	PSKV0J157M018C	95	10	18	3200
	150	V / 7343-19	PSKV0J157M025C	95	10	25	2700
	150	V / 7343-19	PSKV0J157M045C	95	10	45	2000
	150	D / 7343-31	PSKD0J157M025B	95	10	25	3000
	150	D / 7343-31	PSKD0J157M055B	95	10	55	2000



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Rated voltage [V]	Capacitance [μF]	Case code	Part number	Leakage Current (μA, +25°C) Maximum	tan δ (%, +25°C, 120Hz) Maximum	ESR (mΩ, +25°C, 100kHz) Maximum	Permissible Ripple Current (mA _{rms} , +45°C, 100kHz) Maximum
6.3	220	V / 7343-19	PSKV0J227M012C	139	10	12	3900
	220	V / 7343-19	PSKV0J227M015C	139	10	15	3500
	220	V / 7343-19	PSKV0J227M025C	139	10	25	2700
	220	V / 7343-19	PSKV0J227M040C	139	10	40	2200
	220	D / 7343-31	PSKD0J227M025B	139	10	25	3000
	220	D / 7343-31	PSKD0J227M040B	139	10	40	2400
	220	D / 7343-31	PSKD0J227M050B	139	10	50	2100
	330	V / 7343-19	PSKV0J337M015C	208	10	15	3500
	330	V / 7343-19	PSKV0J337M025C	208	10	25	2700
	330	V / 7343-19	PSKV0J337M045C	208	10	45	2000
	330	D / 7343-31	PSKD0J337M009B	208	10	9	5000
	330	D / 7343-31	PSKD0J337M010B	208	10	10	4700
	330	D / 7343-31	PSKD0J337M015B	208	10	15	3900
	330	D / 7343-31	PSKD0J337M018B	208	10	18	3500
	330	D / 7343-31	PSKD0J337M025B	208	10	25	3000
	330	D / 7343-31	PSKD0J337M040B	208	10	40	2400
	470	V / 7343-19	PSKV0J477M055C	296	10	55	1800
	470	D / 7343-31	PSKD0J477M015B	296	10	15	3900
10	68	V / 7343-19	PSKV1A686M045C	68	10	45	2000
	68	V / 7343-19	PSKV1A686M060C	68	10	60	1800
	68	D / 7343-31	PSKD1A686M100B	68	10	100	1500
	100	V / 7343-19	PSKV1A107M025C	100	10	25	2700
	100	V / 7343-19	PSKV1A107M045C	100	10	45	2000
	100	D / 7343-31	PSKD1A107M055B	100	10	55	2000
	150	V / 7343-19	PSKV1A157M040C	150	10	40	2200
	150	D / 7343-31	PSKD1A157M025B	150	10	25	3000
	150	D / 7343-31	PSKD1A157M040B	150	10	40	2400
	150	D / 7343-31	PSKD1A157M055B	150	10	55	2000
	220	V / 7343-19	PSKV1A227M025C	220	10	25	2700
	220	D / 7343-31	PSKD1A227M025B	220	10	25	3000
	220	D / 7343-31	PSKD1A227M040B	220	10	40	2400
16	47	D / 7343-31	PSKD1C476M070B	75.2	10	70	1800
	47	V / 7343-19	PSKV1C476M070C	75.2	10	70	1600
	68	V / 7343-19	PSKV1C686M050C	108.8	10	50	1900
	100	V / 7343-19	PSKV1C107M050C	160	10	50	1900
	150	D / 7343-31	PSKD1C157M050B	240	10	50	2100



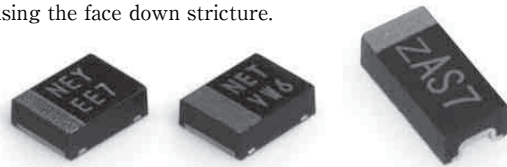
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Rated voltage [V]	Capacitance [μF]	Case code	Part number	Leakage Current (μA, +25°C) Maximum	tan δ (%, +25°C, 120Hz) Maximum	ESR (mΩ, +25°C, 100kHz) Maximum	Permissible Ripple Current (mA _{rms} , +45°C, 100kHz) Maximum
20	22	V / 7343-19	PSKV1D226M090C	44	10	90	1400
	47	V15/7343-15	PSKV151D476M045C	94	10	45	2000
	47	V / 7343-19	PSKV1D476M070C	94	10	70	1600
	47	D / 7343-31	PSKD1D476M055B	94	10	55	2000
25	15	V / 7343-19	PSKV1E156M090C	37.5	10	90	1400
	22	V / 7343-19	PSKV1E226M060C	55	10	60	1800
	22	V / 7343-19	PSKV1E226M090C	55	10	90	1400
	33	V / 7343-19	PSKV1E336M060C	82.5	10	60	1800
	33	D / 7343-31	PSKD1E336M060B	82.5	10	60	1900



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F/PS series achieved high capacitance in 1.0mm height by using the face down structure.
Best solution for smaller and thinner product.



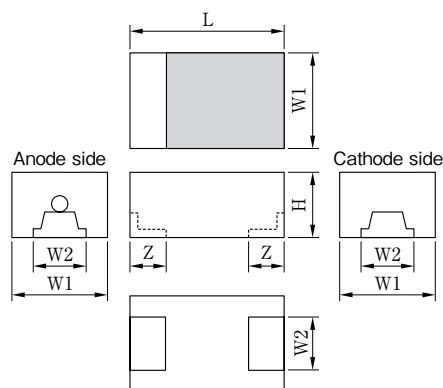
Performance Characteristics

Item		Performance					Test condition (IEC 60384-1, 24)
Operating temperature		- 55°C ~ + 105°C					—
Rated temperature		+ 105°C					—
Rated voltage (V)		4	6.3	10	25	35	Temp. : 105°C
Surge voltage (V)		5.2	8	13	29	41	Temp. : 85°C
Nominal Capacitance	Range	6.8 μ F ~ 100 μ F					Measurement freq. : 120Hz Measurement volt. : 0.5Vrms+1.5V DC
	Tolerance	$\pm$ 20%					Measurement freq. : 120Hz Measurement volt. : 0.5Vrms+1.5V DC
Dissipation Factor (tan δ)		Refer to Standard Ratings					Measurement freq. : 120Hz Measurement volt. : 0.5Vrms+1.5V DC
Leakage Current (LC)		Refer to Standard Ratings					Rated voltage after 5 minutes
Equivalent Series Resistance (ESR)		Refer to Standard Ratings					Measurement freq. : 100kHz
Permissible Ripple Current		Refer to Standard Ratings					Measurement freq. : 100kHz, sine wave
		Δ C/C	tan δ	LC			
Surge voltage test		+20% ~ - 20% of the initial value	Within IL	Within IL		Temp. : 85°C, Surge voltage apply, 1000ohm series resistance, 1000cycles	
Characteristics at high and low temperature	+ 25°C	—	Within IL	Within IL		—	
	- 55°C	0% ~ - 20% compare with +25°C	Within IL	—		—	
	+ 105°C	+50% ~ 0% compare with +25°C	Within 1.5 $\times$ IL	Within 10 $\times$ IL		—	
Endurance		+20% ~ - 20% of the initial value	Within 1.5 $\times$ IL	Within IL		Temp. : 105°C, Rated voltage apply, 1000hours	
Damp heat		+30% ~ - 20% of the initial value	Within 1.5 $\times$ IL	Within IL		Temp. : 60°C, Humidity: 90 ~ 95%R.H., 500hours	

IL = Initial limit

Unless otherwise specified, the measurement of electrical property is performed under the room temperature (25°C)

Dimensions



(Unit : mm)

Dimension code	L	W1	W2	H	Z
A3	3.2 $\pm$ 0.2	1.6 $\pm$ 0.2	1.2 $\pm$ 0.1	0.9 $\pm$ 0.1	0.8 $\pm$ 0.2
A2	3.2 $\pm$ 0.2	1.6 $\pm$ 0.2	1.2 $\pm$ 0.1	1.1 $\pm$ 0.1	0.8 $\pm$ 0.2
B3	3.5 $\pm$ 0.2	2.8 $\pm$ 0.2	2.2 $\pm$ 0.1	1.1 $\pm$ 0.1	0.8 $\pm$ 0.2



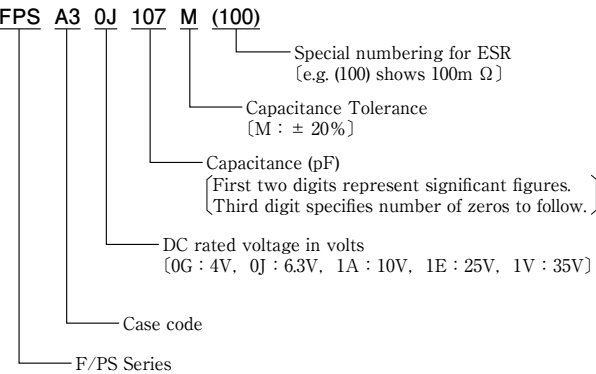
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Standard C-V Value Reference by Case Code

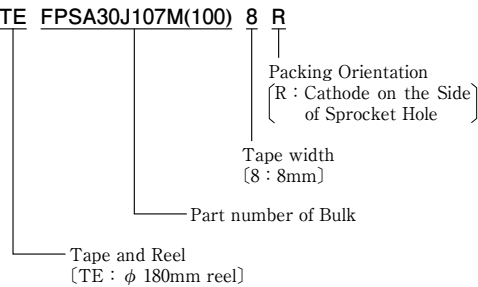
Rated voltage / Capacitance	4.0	6.3	10	25	35
	0G	0J	1A	1E	1V
6.8 μ F					B3 100
10 μ F					
15 μ F				B3 70	
22 μ F			A3 200		
33 μ F			A3 200		
47 μ F		A3 200	A3 200, 150		
68 μ F					
100 μ F	A3 200	A3 200, 100, 70, 55			

Part Number System

[Bulk]



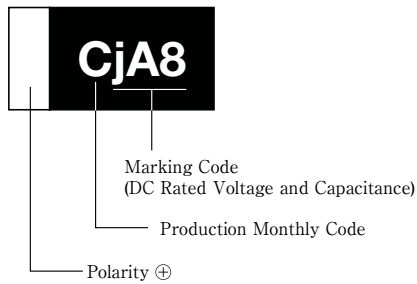
[Tape and reel]



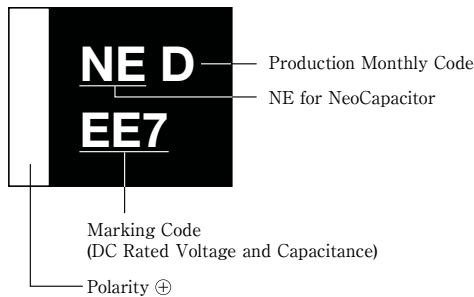
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■ Marking

【A3 case】(e.g. 6.3V/100μF)



【B3 case】(e.g. 25V/15μF)



《DC rated voltage and capacitance》

Rated voltage Capacitance		4.0	6.3	10	25	35
		g	j	A	E	V
6.8 μ F	W6					VW6
10 μ F	A7				EA7	
15 μ F	E7				EE7	
22 μ F	J7			AJ7		
33 μ F	N7			AN7		
47 μ F	S7		JS7	AS7		
68 μ F	W7					
100 μ F	A8	gA8	jA8			

《Production monthly code》

Y	M	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
2017		A	B	C	D	E	F	G	H	J	K	L	M
2018		N	P	Q	R	S	T	U	V	W	X	Y	Z
2019		a	b	c	d	e	f	g	h	j	k	l	m
2020		n	p	q	r	s	t	u	v	w	x	y	z

NOTE: Production monthly code will resume beginning in 2021.

■ Standard Ratings

Rated Voltage (V)	Capacitance (μ F)	Case Code	Part Number (Bulk)	Leakage Current (μ A, +25°C) Maximum	tan δ (+25°C, 120Hz) Maximum	ESR (mΩ, +25°C, 100kHz) Maximum	Permissible Ripple Current (mA, +25°C, 100kHz) Maximum
4	100	A3 / 3216-09	FPSA30G107M	40	0.08	200	548
6.3	47	A3 / 3216-09	FPSA30J476M	29.6	0.06	200	548
	100	A3 / 3216-09	FPSA30J107M	63	0.08	200	548
	100	A3 / 3216-09	FPSA30J107M(100)	63	0.08	100	774
	100	A3 / 3216-09	FPSA30J107M(70)	63	0.08	70	925
	100	A3 / 3216-09	FPSA30J107M(55)	63	0.08	55	1044
10	22	A3 / 3216-09	FPSA31A226M	22	0.08	200	548
	33	A3 / 3216-09	FPSA31A336M	33	0.06	200	548
	47	A3 / 3216-09	FPSA31A476M	47	0.06	200	548
	47	A3 / 3216-09	FPSA31A476M(150)	47	0.06	150	632
25	15	B3 / 3528-11	FPSB31E156M	112.5	0.1	100	886
35	6.8	B3 / 3528-11	FPSB31V685M	47.6	0.1	100	866



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G/PS series achieved high capacitance in 1.0mm height by using the substrate terminal structure.
Higher volume efficiency than F/PS series by using substrate terminal.
Best solution for smaller and thinner applications.



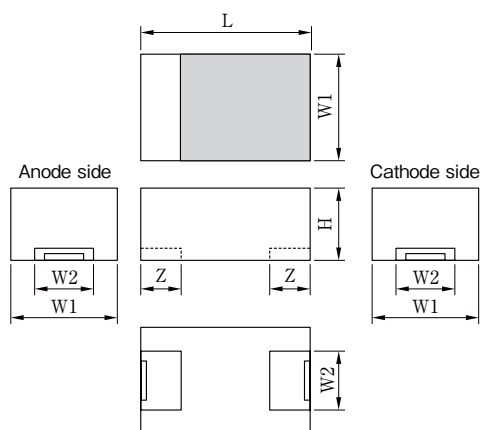
■ Performance Characteristics

Item		Performance			Test condition (IEC 60384-1, 24)
Operating temperature		- 55°C ~ +105°C			—
Rated temperature		+105°C			—
Rated voltage (V)		6.3	10	25	Temp. : 105°C
Surge voltage (V)		8	13	29	Temp. : 85°C
Nominal Capacitance	Range	4.7 μ F ~ 47 μ F			Measurement freq. : 120Hz Measurement volt. : 0.5Vrms+1.5V DC
	Tolerance	$\pm$ 20%			Measurement freq. : 120Hz Measurement volt. : 0.5Vrms+1.5V DC
Dissipation Factor (tan δ)		Refer to Standard Ratings			Measurement freq. : 120Hz Measurement volt. : 0.5Vrms+1.5V DC
Leakage Current (LC)		Refer to Standard Ratings			Rated voltage after 5 minutes
Equivalent Series Resistance (ESR)		Refer to Standard Ratings			Measurement freq. : 100kHz
Permissible Ripple Current		Refer to Standard Ratings			Measurement freq. : 100kHz, sine wave
		Δ C/C	tan δ	LC	
Surge voltage test		+20% ~ - 20% of the initial value	Within IL	Within IL	Temp. : 85°C, Surge voltage apply, 1000ohm series resistance, 1000cycles
Characteristics at high and low temperature	+ 25°C	—	Within IL	Within IL	—
	- 55°C	0% ~ - 20% compare with +25°C	Within IL	—	—
	+ 105°C	+50% ~ 0% compare with +25°C	Within 1.5 $\times$ IL	Within 10 $\times$ IL	—
Endurance		+20% ~ - 20% of the initial value	Within 1.5 $\times$ IL	Within IL	Temp. : 105°C, Rated voltage apply, 1000hours
Damp heat		+30% ~ - 20% of the initial value	Within 1.5 $\times$ IL	Within IL	Temp. : 60°C, Humidity: 90 ~ 95%RH, 500hours

IL = Initial limit

Unless otherwise specified, the measurement of electrical property is performed under the room temperature (25°C)

■ Dimensions



(Unit : mm)

Dimension code Case code	L	W1	W2	H	Z
P2	2.0 $\pm$ 0.1	1.25 $\pm$ 0.1	0.9 $\pm$ 0.1	0.9 $\pm$ 0.1	0.55 $\pm$ 0.1



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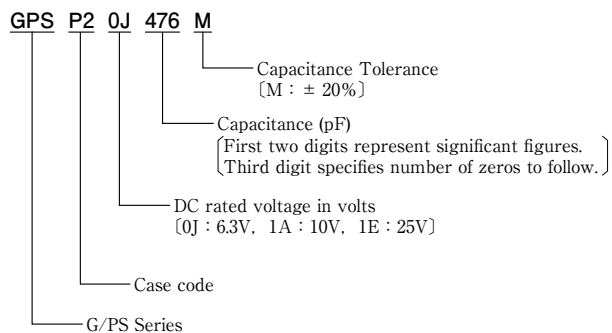
Standard C-V Value Reference by Case Code

Rated voltage Capacitance	6.3	10	25
	0J	1A	1E
4.7 μ F			P2 300
10 μ F	P2 200	P2 200	
22 μ F		P2 200	
47 μ F	P2 150		

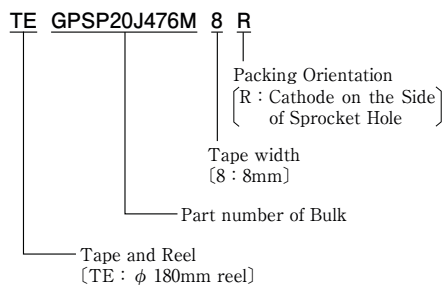
※ Number : ESR initial spec. (m Ω)

Part Number System

[Bulk]



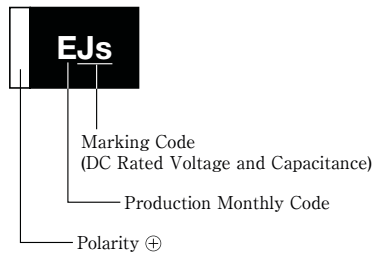
[Tape and reel]



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■ Marking

[P2 case] (e.g. 6.3V/47 μ F)



《DC rated voltage and capacitance》

Rated voltage \ Capacitance	6.3	10	25
6.3	J	A	E
10	Ja	Aa	
22		Aj	
47	Js		

《Production monthly code》

Y \ M	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
2017	A	B	C	D	E	F	G	H	J	K	L	M
2018	N	P	Q	R	S	T	U	V	W	X	Y	Z
2019	a	b	c	d	e	f	g	h	j	k	l	m
2020	n	p	q	r	s	t	u	v	w	x	y	z

NOTE: Production monthly code will resume beginning in 2021.

■ Standard Ratings

Rated Voltage (V)	Capacitance (μ F)	Case Code	Part Number (Bulk)	Leakage Current (μ A, +25°C) Maximum	$\tan \delta$ (+25°C, 120Hz) Maximum	ESR (m Ω , +25°C, 100kHz) Maximum	Permissible Ripple Current (mA rms, +25°C, 100kHz) Maximum
6.3	10	P2 / 2012-09	GPSP20J106M	18.9	0.06	200	354
	22	P2 / 2012-09	GPSP20J226M(150)	22	0.06	150	408
	47	P2 / 2012-09	GPSP20J476M	88.8	0.06	150	408
10	10	P2 / 2012-09	GPSP21A106M	30	0.06	200	354
	22	P2 / 2012-09	GPSP21A226M	66	0.06	200	354
16	10	P2 / 2012-09	GPSP21C106M	80	0.06	150	408
25	4.7	P2 / 2012-09	GPSP21E475M	35.3	0.1	300	289



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PS/H series is the high operation temperature products of NeoCapacitor®.

PS/H series can provide excellent performance under the high ambient temperature operation.



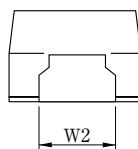
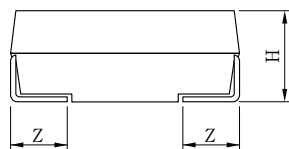
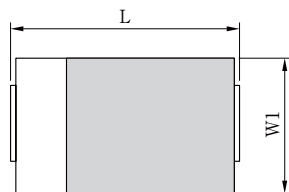
■ Performance Characteristics

Item		Performance			Test condition (IEC 60384-1, 24)
Operating temperature		- 55°C ~ + 125°C			—
Rated temperature		+ 125°C			—
Rated voltage (V)		2.5	6.3	16	Temp. : 105°C
Category voltage (V)		1.7	4.2	10.7	Temp. : 125°C
Surge voltage (V)		3.3	8	20	Temp. : 85°C
Nominal Capacitance	Range	22 μ F ~ 330 μ F			Measurement freq. : 120Hz Measurement volt. : 0.5Vrms+1.5V DC
	Tolerance	$\pm$ 20%			Measurement freq. : 120Hz Measurement volt. : 0.5Vrms+1.5V DC
Dissipation Factor (tan δ)		Refer to Standard Ratings			Measurement freq. : 120Hz Measurement volt. : 0.5Vrms+1.5V DC
Leakage Current (LC)		Refer to Standard Ratings			Rated voltage after 5 minuets
Equivalent Series Resistance (ESR)		Refer to Standard Ratings			Measurement freq. : 100kHz
Permissible Ripple Current		Refer to Standard Ratings			Measurement freq. : 100kHz, sine wave
		Δ C/C	tan δ	LC	
Surge voltage test		+20% ~ - 20% of the initial value	Within IL	Within IL	Temp. : 105°C, Surge voltage apply, 1000ohm series resistance, 1000cycles
Characteristics at high and low temperature	+ 25°C	—	Within IL	Within IL	—
	- 55°C	0% ~ - 20% compare with +25°C	Within IL	—	—
	+ 105°C	+50% ~ 0% compare with +25°C	Within 1.5 $\times$ IL	Within 10 $\times$ IL	—
Endurance		+20% ~ - 20% of the initial value	Within 1.5 $\times$ IL	125°C : No short (< 2mA) 105°C : Within IL	Temp: 125°C , 2/3*Rated voltage apply, 1,000hours 105°C , Rated voltage apply, 2,000hours
Damp heat		+40% ~ - 20% of the initial value	Within 1.5 $\times$ IL	Within IL	Temp. : 60°C, Humidity: 90 ~ 95%R.H, 500hours

IL = Initial limit

Unless otherwise specified, the measurement of electrical property is performed under the room temperature (25°C)

■ Dimensions



(Unit : mm)

Dimension code	L	W1	W2	H	Z
Case code B2	3.5 $\pm$ 0.2	2.8 $\pm$ 0.2	2.2 $\pm$ 0.1	1.9 $\pm$ 0.1	0.8 $\pm$ 0.2

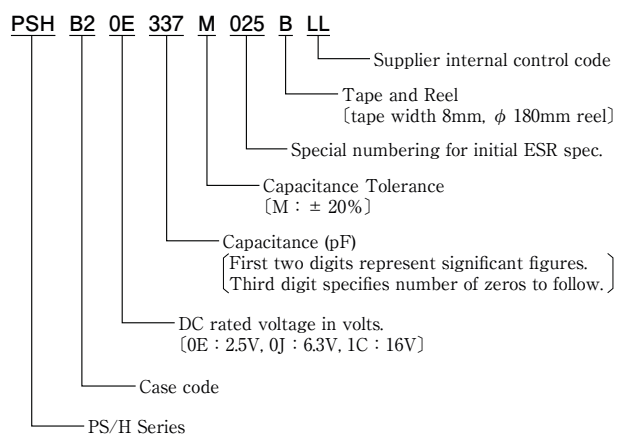


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Standard C-V Value Reference by Case Code

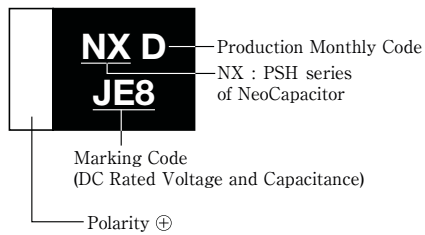
Rated voltage Capacitance	2.5V	6.3V	16V
	0E	0J	1C
22 μ F			B2 100
33 μ F			B2 70
150 μ F		B2 45	
220 μ F	B2 25	B2 45	
330 μ F	B2 25		

Part Number System



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■ Marking



《DC rated voltage and capacitance》

Rated voltage Capacitance		2.5V	6.3V	16V
		e	j	C
22 μ F	J7			CJ7
33 μ F	N7			CN7
150 μ F	E8		jE8	
220 μ F	J8	eJ8	jJ8	
330 μ F	N8	eN8		

《Production monthly code》

y \ M	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
2017	A	B	C	D	E	F	G	H	J	K	L	M
2018	N	P	Q	R	S	T	U	V	W	X	Y	Z
2019	a	b	c	d	e	f	g	h	j	k	l	m
2020	n	p	q	r	s	t	u	v	w	x	y	z

NOTE: Production monthly code will resume beginning in 2021.

■ Standard Ratings

Rated Voltage (V)	Capacitance (μ F)	Case Code	Part Number	Leakage Current (μ A, +25°C) Maximum	$\tan \delta$ (+25°C, 120Hz) Maximum	ESR (m Ω , +25°C, 100kHz) Maximum	Permissible Ripple Current (mA _{rms} , +25°C, 100kHz) Maximum
2.5	220	B2 / 3528-19	PSHB20E227M025BLL	110	0.1	25	1844
	330	B2 / 3528-19	PSHB20E337M025BLL	165	0.1	25	1844
6.3	150	B2 / 3528-19	PSHB20J157M045BLL	189	0.1	45	1374
	220	B2 / 3528-19	PSHB20J227M045BLL	277.2	0.1	45	1374
16	22	B2 / 3528-19	PSHB21C226M100BLL	70.4	0.1	100	922
	33	B2 / 3528-19	PSHB21C336M070BLL	105.6	0.1	70	1102



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Direction for using NeoCapacitor®

In order to bring out best performance of NeoCapacitor®, following direction for use would be taken into consideration.

Direction on Circuit Design

1. Confirmation of ratings

Using environment (temperature, relative humidity and applied voltage e.t.c.) would be confirmed and choice suitable product. Then please use it within determined ratings.

2. Applied voltage

The voltage exceed specified ratings shall not be applied to NeoCapacitor®. Even if the exceed voltage is applied to the capacitor instantaneously, failure may occur.

Recommended applied voltage of NeoCapacitor® is indicated as following diagram. In case of rated voltage = 100%, 90% or lower value is recommended. As for the product of which rated voltage 10V or higher, 80% or lower is recommended.

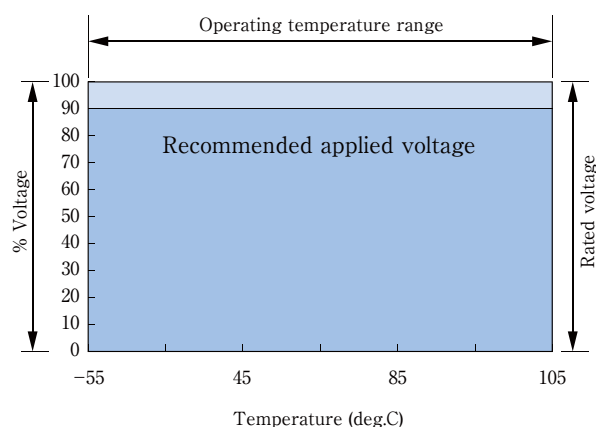


Fig.1 Explanation of recommended applied voltage

As for industrial use or other applications required higher reliability, please choice higher rated voltage product or reduce applied voltage to lower than aforementioned value so as to maintain sufficient margin.

3. Reverse voltage

NeoCapacitor® has polarity. If reverse voltage is applied to the capacitor even instantaneously, failure may occur. If failure doesn't occur in a short operation time, deterioration of reliability like a increase of leakage current or short circuit may occur with elapsing long time. Therefore reverse voltage shall not be applied to the capacitor. Especially in case of large amplitude of AC voltage is imposed to DC voltage, the DC voltage may drop suddenly and reverse voltage may be applied to the capacitor. If the reverse voltage was applied it, never use it and change it to the new one.



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4. Ripple current and ripple voltage

When a ripple current or ripple voltage is applied to NeoCapacitor®, self heat generation of capacitor element and power loss occur. Then temperature of the products rise and have a influence on reliability. Therefore ripple current exceed defined as permissible ripple current in this catalogue shall not be supplied to the capacitors. At that time, ripple current shall be decreased so that temperature on making plane of the product can be controlled lower than rating temperature.

Power loss is determined by following Formula.1

$$P = I^2 \times ESR \dots \dots \dots \text{Formula.1}$$

$$\left(\begin{array}{l} P : \text{power loss [Watt]} \\ I : \text{ripple current [A rms]} \\ ESR : [\Omega] \end{array} \right)$$

Permissible ripple current of each case size P (at 100kHz, at 25°C) is indicated in Table.1

Actual permissible ripple current I_r [A rms] is calculated by Formula.2

$$I_r = \sqrt{P/ESR} \times K \times F \dots \dots \dots \text{Formula.2}$$

$$\left(\begin{array}{l} K : \text{Temperature correction coefficient} \dots \dots \text{see Table.2} \\ F : \text{Frequency correction coefficient} \dots \dots \text{see Table.3} \end{array} \right)$$

Table.1 Permissible power loss of each case size : P [Watt]

(At frequency = 100kHz sine wave, temperature=25°C)

series case code	PS/L	PS/G	PS/H	PS/K	F/PS	G/PS
P2	—	—	—	—	—	0.025
A2, A3	—	—	—	—	0.06	—
A	0.075	—	—	—	—	—
B3	0.075	—	—	—	—	—
B15	0.08	—	—	—	—	—
B2	0.085	0.085	0.085	—	—	—
V15	—	—	—	0.180	—	—
V	—	—	—	0.187	—	—
D	—	—	—	0.225	—	—

Table.2 Temperature correction coefficient

Temperature : T	Series	T ≤ 45°C	45°C < T ≤ 85°C	85°C < T ≤ 105°C
K : Temperature correction coefficient	PS/L, PS/G, PS/H, F/PS, G/PS	1	0.9	0.4
	PS/K	1	0.7	0.25

Note) When permissible ripple current is specified at 105°C, K=1 in all operation temperature range.

Table.3 Frequency correction coefficient

Frequency : f	10kHz < f < 100kHz	100kHz ≤ f ≤ 1MHz	1MHz < f
F : Frequency correction coefficient	0.75	1	1

Ripple voltage E is calculated from impedance Z and permissible ripple current I_r as shown in following Formula.3.

$$E = Z \times I_r \dots \dots \dots \text{Formula.3}$$

As for ripple voltage E, following note shall be taken into consideration.

- Peak value in summation of DC voltage and ripple voltage shall not exceed rated voltage as shown in Fig.2.
- Sudden drop of imposed voltage, especially large drop of DC voltage shall be avoided so that reverse voltage cannot be applied to the capacitor.

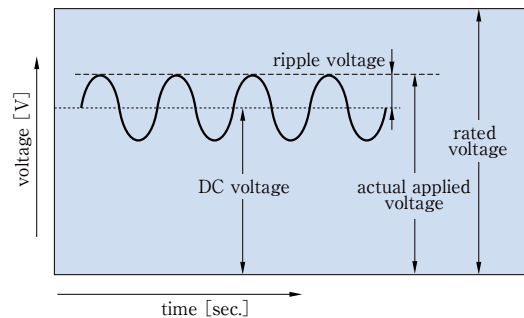


Fig.2 Explanation of rated voltage, actual applied voltage, DC voltage and ripple voltage



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5. Leakage current

Even if reflow soldering condition is within specified condition, leakage current of NeoCapacitor® may vary slightly after soldering or after various reliability test. In such cases, DC voltage equal to rated voltage or lower is continuously applied at rated temperature or lower atmosphere, leakage current decreases little by little.

Besides in case of measurement of leakage current, resistor about 1k Ω shall be certainly connected to the capacitor in series.

6. Rapid charge - discharge and protect circuit

In a peculiar application in which rapid charge -discharge is repeated and excessive inrush current generates, increase of leakage current or short circuit may occur. In such circuit, inrush current of 20A or lower is recommended. In order to decrease inrush current and enhance reliability of NeoCapacitor®, built-in of protection circuit is effective.

7. Unsuitable application of NeoCapacitor®

NeoCapacitor® used in following application or circuit, failure occurrence is expected. So following application or circuit shall be avoided.

- Sensitive to leakage current fluctuation
- Series connection in which excessive voltage higher than rated value may be applied
- High impedance circuit
- Coupling circuit
- Time constant circuit

8. Failure and lifetime of NeoCapacitor®

Failure of NeoCapacitor® is classified into random failure and wear-out failure

(1) Random failure

Major failure of NeoCapacitor® is high leakage current or short circuit caused by excessive thermal stress in soldering or excessive thermal, electrical, or mechanical stress caused by extreme change of environmental condition. These are classified as random failure. The failure rate of NeoCapacitor® shows constant value regardless of operation time. The designed value of failure rate of NeoCapacitor® is 0.5%/1,000h or 1%/1,000h (at confidence level 60%) in accordance with JIS C 5003. The value can be decreased by reducing environmental temperature, ripple current and applied voltage.

Note) Endurance is specified in 105°C, 2,000h, the value is 0.5%/1,000h (105°C, rated voltage)

Endurance is specified in 105°C, 1,000h, the value is 1%/1,000h (105°C, rated voltage)

If high leakage current or short circuit occurred, please perform following measures to maintain safety.

- Resin of the broken capacitor may thermally decompose and smoke may generate. In such cases, main power source shall be shut down and stop using the instrument.
- From several second to several minute is needed to generated the smoke from broken capacitor. It's depends on using condition. If protection circuit can be connected the capacitor, suitable time setting for starting the protection circuit is desirable.
- Broken capacitor may cause a burnt, therefore never touch or never approach face to the broken instruments.
- If smoke penetrated into eyes or larynx, perform eye cleaning or gargling immediately.
- If extremely high current flows into broken capacitor continuously, the capacitor rarely combust. So redundancy design, fire proof and other hazard proof design would be appreciated.



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(2) Wear out failure (Life time)

If the operation time of capacitor exceed the guaranteed operation time under high temperature or high temperature and high humidity atmosphere, chemical reaction of various materials used in the capacitor proceed very slowly and change of capacitance, dissipation factor and ESR will proceed during long operation term. These changes will occur even within the specified operating condition.

If the operating condition deviates from specified area or rating or excessive ripple current application, aforementioned characteristics changes may occur before reaching the guaranteed operation time. So sufficient attention on operating condition would be taken into consideration in design stage.

In our original investigation, life time of NeoCapacitor® can be estimated by following formula.

Besides obtained lifetime is not guaranteed value but estimated one based upon our experimental data.

Note) There's some part numbers of which following formula cannot be applied. As for details, please contact TOKIN.

Lifetime estimation formula

$$L_T = L_0 \times 10^{\left(\frac{T_0 - T}{20} \right)}$$

L_T : Estimated lifetime under actual using temperature [h]
 L_0 : Guaranteed operation time under rated temperature [h]
 T_0 : Rated temperature [°C]
 T : Temperature under actual using condition [°C]

9. Others

- (1) Electrical characteristics of NeoCapacitor® change due to fluctuation of temperature or frequency. These changes would be taken into consideration on circuit design.
- (2) If several NeoCapacitor® of which different capacitance or different rated voltage are connected in parallel, or NeoCapacitor® and quite different sort of capacitors are connected in parallel, higher current flows into lower impedance capacitor. Therefore current balance on individual capacitor shall be taken into consideration in circuit design stage.
- (3) Even if the electrical characteristics of two or more NeoCapacitor® are quite same, series connection of NeoCapacitor® will cause deviation of applied voltage and over voltage will be applied to one capacitor. So the series connection of NeoCapacitor® shall not be done.
- (4) Electrical device generates high heat shall be isolated from NeoCapacitor® as far as possible. And such kind of device shall not be mounted on just opposite side of PWB in which NeoCapacitor® is mounted.
- (5) If NeoCapacitor® is used under high humidity atmosphere, moisture proof treatment shall be done after soldering.



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Direction on Soldering

1. Recommended land pattern and dimension for NeoCapacitor®

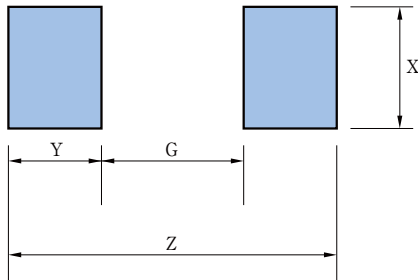


Table.4 Recommended pattern dimension (mm)

series	item	Case	G Max.	Z Min.	X Min.	Y (reference)
G/PS F/PS	P2		1.05	2.05	0.80	0.50
	A3		1.65	3.25	1.10	0.80
PS/L PS/G PS/H PS/K	A		1.10	3.80	1.50	1.35
	B3 B15 B2		1.40	4.10	2.70	1.35
	V15 V D		4.10	8.20	2.90	2.05

Note) Aforementioned dimension is recommended value. Too much large pattern cause shift of mounted capacitor or tombstone phenomenon.
(JEITA RC-2371A is also recommended for reference.)

2. Recommended reflow soldering profiles of NeoCapacitor®

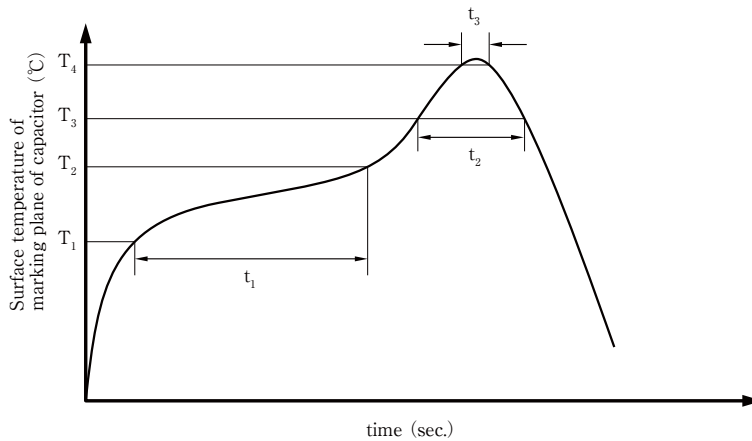


Table.5 Recommended reflow soldering profile.....Reputation of soldering is twice under following conditions.

condition	Value	T ₁ (°C)	T ₂ (°C)	t ₁ (sec.)	T ₃ (°C)	t ₂ (sec.)	T ₄ (°C)	t ₃ (sec.)	MSL
250°C reflow		150	180	120Max.	217	60Max.	250	5Max.	3
260°C reflow		150	200	180Max.	217	90Max.	260	5Max.	3

Note) As for rated voltage 16V or higher product sand D case products, 250°C reflow is recommended.



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3. For suitable soldering

- (1) NeoCapacitor® is designed for reflow soldering (infrared rays, hot blast furnace, hot plate and combination of these method), and for iron soldering. Other than aforementioned methods (flow soldering, immersion into solder bath, VPS (vapor phase soldering), laser beam soldering etc.) are not applicable.
- (2) Peculiar soldering method deviates from specified condition may cause deterioration of electrical characteristics or appearance defect. Therefore recommended soldering condition in this document shall be observed.
- (3) Thermal stress in the soldering process changes in response to location of other devices, packaging density on PWB, land pattern and so on. So prior to actual assembly, resistance to soldering shall be checked by using actual soldering condition.
- (4) Prior to soldering, polarity, rated voltage and capacitance shall be confirmed.
- (5) When automatic inserter clinches the capacitor, suitable clinching force shall be set.
- (6) When automatic inserter clinches the capacitor, excessive shock shall not be applied to the capacitor body or terminals.
- (7) Dropped capacitor shall not be used any more.
- (8) Capacitors removed from PWB after soldering shall not be used any more.
- (9) As for iron soldering, strict temperature control is very difficult due feature of tip of the soldering iron and other factors. Therefore following conditions are recommended. However the tip of the iron shall not be touched the terminal of the capacitor.
 Temperature of tip..... 350°C or lower
 Power of the iron.....30W or lower
 Working time within 3sec.
 Combination of one reflow and one iron soldering is recommended.
- (10) Rosin type of flux is recommended. Strong acid type of flux shall no be used. As for cleaning after soldering intended to remove flux, following conditions are recommended.
 Solvent for cleaning..... isopropyl alcohol or other multivalent alcohol
 Method for cleaning..... shower, rinse, vapor (ultrasonic shall not be used.)
 Time of cleaning 5 minutes or shorter
- (11) Please leave capacitor 24 +/- 2 hours at standard atmospheric condition (temperature: 15°C to 35°C, relative humidity: 45% to 75%, air pressure: 86kPa to 106kPa) after reflow soldering.

Direction on Storage

As for storage of NeoCapacitor®, control of storage atmosphere is needed to avoid deterioration of solderability or trouble on soldering caused by moisture absorption.

- (1) Outer stress shall not be added to the tape and reel product to avoid trouble of automatic insertion caused by distortion of reel and so on.
- (2) During the storage of the unopened product, direct rays shall be avoided and kept under the ambient temperature - 5°C ~ + 40°C and relative humidity 40%R.H. ~ 70%R.H.
- (3) Maximum storage time is one year or shorter from delivery.
- (4) Open the moisture proof bag just before the soldering and the capacitors shall be kept under the following atmosphere. Then they shall be mounted on PWB within following specified floor life time,

Moisture sensitive level (MSL)	Floor life	
	time	condition
3	168h	≤30°C, 60%R.H.

Note) Normative reference IPC/J-STD-020D.1

If several parts remained, the reel and desiccant shall be returned into the opened bag and sealed with craft tape. Then the sealed product shall be kept under the aforementioned environmental condition.

- (5) When the kept time exceed floor life time and the capacitors must be used reluctantly, baking shall be done. The baking may be done with tape and reel. Recommended baking condition is 50°C, 96h.



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(6) NeoCapacitor®, before and after the soldering shall not be kept in following environments.

- attacked by direct ray
- attacked by water, saltwater, oil or condensed vapor
- attacked by corrosive or toxic gas (e.g. hydrogen sulfide, sulfurous acid, nitrous acid, chlorine, ammonia and so on.)
- attacked by ozone, ultraviolet rays, radial rays and so on.
- added excessive shock or vibration deviated from specified value.

Direction on Scrap

NeoCapacitor® is consists of various organic compound or metal. If the parts are scrapped, they shall be handled as industrial waste.

Aforementioned directions is based upon JEITA technical report RCR2368B "Guideline for fixed tantalum electrolytic capacitors with solid electrolyte for use in electronic equipment" Furthermore important and useful data for using the conductive polymer capacitor are also summarized and added in this catalogue.



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Environmental Philosophy

In all domains of company activities, TOKIN promotes activities for global environmental protection by pursuing technologies and production in consideration of environment.

Response to Environmental conformance requirement

● Conformance to RoHS directive

All series and all part number of NeoCapacitor[®] conform to Lead free (JEITA PHASE3) and EU RoHS2 directive (2011/65/EU + 2015/863/EU).

RoHS restricted substances	
Cadmium and cadmium compound	Hexavalent chromium
Lead and lead compound	Polybrominated biphenyl (PBBs)
Mercury and mercury compound	Polybrominated diphenyl ether (PBDEs)

● Response to Halogen Free requirement

All series and all part number of NeoCapacitor[®] employ Halogen free materials within the component

Our definition of Halogen Free is as follows,

Of all halogen element, Chlorine(Cl) and Bromine(Br) exist within the materials as element or its compound. And content of Cl, Br and total content of Cl and Br in the homogeneous material * conforms to the values in the following table. (Fluorine(F), Iodine(I) and Astatine(At) are excluded from this declaration.)

Content of Halogen	
Chlorine (Cl) content	0.09 wt% (900 ppm) or lower at homogeneous material level
Bromine (Br) content	0.09 wt% (900 ppm) or lower at homogeneous material level
Total content of Cl and Br	0.15wt% (1500 ppm) or lower at homogeneous material level

* Homogeneous material means the material cannot be decomposed to other ones mechanically any more.
To be concrete, plastics, resin, glue, metal composite, ink, glass, paper and alloy which consist of homogeneous substances.

● Response to Antimony Free requirement

All series and all part number of NeoCapacitor[®] employ Antimony Free materials within the component.

Our definition of Antimony Free is as follows.

Content of Antimony (Sb) and Antimony trioxide (Sb₂O₃) in the homogeneous material conform to the values in the following table.

Content of Antimony and Antimony trioxide	
Antimony (Sb) content	0.1wt% (1000 ppm) or lower at homogeneous material level
Antimony trioxide (Sb ₂ O ₃) content	0.1wt% (1000 ppm) or lower at homogeneous material level

● Conformance to EU REACH

All series and all part number of NeoCapacitor[®] conform to EU REACH (2018/27th, June/EU)

As for details of aforementioned information and other environmental conformance status, please contact our sales department.



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Cautions

- The information in this catalogue is based on our newest specifications issued in January 2019.
 - The part number or specification in this catalogue may be subject to change or abolish without notice due to improvement. So prior to purchasing, please request shipment specification to us and confirm its content.
 - The content in this catalogue intend to guarantee simply characteristics or performance of electronic device itself. So prior to actual use, please mount it on actual board and carry out operation test.
 - As for failures caused by peculiar condition deviated from specified characteristics, rating and condition in this catalogue, TOKIN does not assume any liability.
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 - From the viewpoint of quality and reliability grading, TOKIN's electronic devices are classified into following three grade. "Standard", "Special" and "Specific" in which customer request quality assurance program to us for applying the devices to particular application. In each quality grade, following applications are expected.
 - Standard : Computer, office equipment, communication equipment ,testing and measurement instrument, audio and visual instrument, home electronic appliances, machine tools, personal electronic equipment and industrial robots etc..
 - Special : Transportation equipment (automotive, trains, ships etc.), traffic control systems, life support systems, anti-disaster systems, anti-crime systems, safety equipment and medical equipment (not specifically designed for life support) etc..
 - Specific : Aircraft, aerospace equipment, submersible repeaters, nuclear reactor control systems, life support systems or medical equipment for life support etc..
- Unless otherwise specified in a specific document, TOKIN's electronic devices are classifies as "Standard". If stricter and higher reliability are required, please contact sales office of TOKIN in advance.
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