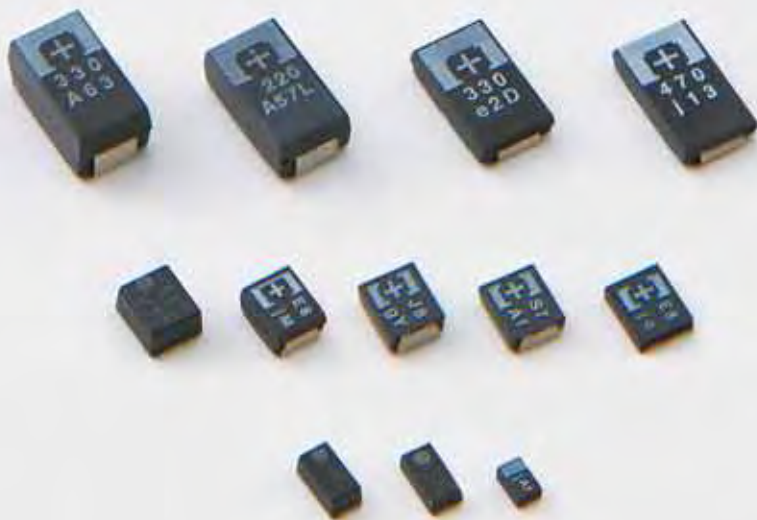


Conductive Polymer Tantalum Solid Capacitors

POSCAP



OS-CON

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※ Yellow letters : Update



Guidelines and precautions for use

About capacitors

Please take note of the following points in order to make the best use of capacitor's performance.

Please use capacitors within the range of specified performance after confirming each capacitor's usage environment and circuit condition.

Please choose capacitors that match the lifetime of the intended circuit design.

The performance of capacitors is changed by the temperature or frequency. Therefore, please consider these variations when designing the circuit.

Please buy capacitors from our official distributors. Otherwise there is no warranty.

Line-up

Conductive Polymer Aluminum Solid Capacitors **OS-CON**
Conductive Polymer Tantalum Solid Capacitors **POSCAP**

Considerations when using in industrial equipment

To when capacitors are used in industrial equipment, allow wider margin of capacitance, impedance and other characteristics.

Polarity

OS-CON and **POSCAP** have polarity.

Please confirm the polarity prior to use. If it is used with the reverse polarities, leakage current, shorter lifetime or a short circuit may result.

There is no bi-polar model of the **OS-CON** and **POSCAP**.

Rating and category

The definition of rating and category is as follows.

- ☐ Rated temperature:
The maximum ambient temperature at which rated voltage may be continuously applied.
- ☐ Rated voltage:
The maximum direct voltage or peak value of pulse voltage which may be applied continuously to a capacitor at any temperature between the lower category temperature and the rated temperature.
- ☐ Category temperature range:
The range of ambient temperatures for which a capacitor has been designed to operate continuously; this is given by the lower and upper category temperature.
- ☐ Category voltage:
The maximum voltage which may be applied continuously to a capacitor at its upper limit of category temperature.

Operating temperature and ripple current

- ☐ Set the operating temperature so that it falls within the range stipulated in this delivery specification.
- ☐ Do not apply current that exceeds the allowable ripple current. When excessive ripple current is applied, internal heat increases and reduces the lifetime.

In case capacitors are used under the condition out of the specified frequency, ripple current shall not exceed the value revised by the frequency coefficient.

Parallel connection

Ripple current may be flowed to a capacitor that has lower impedance when a different kind of capacitor is used in parallel.

Please be very careful of choosing models.

Please consider the balance of electric current when more than two capacitors are connected in parallel.

Applied voltage for designing

Do not apply voltages exceeding the full rated voltage. If such voltage is applied, it may cause short circuit even though it is just a moment.

- ☐ 90% and below of the rated voltage or category voltage of the **POSCAP** is recommended. If the rated voltage is 10V or over except for TQC series, 80% and below of the rated voltage or category voltage is recommended.
- ☐ The sum of the DC voltage plus the peak AC voltage shall not exceed the rated voltage or category voltage.
- ☐ The sum of the DC voltage plus the negative peak AC voltage shall not allow reverse voltage.
- ☐ Do not apply reverse voltage.

Please contact us when there is a concern that circuit operation may cause reverse voltage.

Operating environment restrictions

Do not use the capacitor in the following environments

- ☐ Places where water, salt water or oil can directly fall on it and places where dew condensation may form
- ☐ Places with noxious gas (hydrogen sulfide, sulfurous acid, nitrous acid, chlorine, ammonia, etc)
- ☐ Places susceptible to ozone, ultraviolet rays and radiation
- ☐ Places where vibration or shock exceeds the allowable value as specified in the catalog or specification sheet
- ☐ Places under direct sunlight

Land pattern

Please design hole space and hole diameter of circuit board for capacitor radial lead type, or land patterns for capacitor SMD type with consideration of the product dimension specified in the catalog or specification sheet and the size tolerance. Avoid locating heat-generating components around the capacitor and on the underside of the PC board. When a capacitor is mounted to the double sided circuit board, avoid placing through holes under the capacitor. Avoid having the printed wire under the capacitor.

Soldering

- ☐ The soldering conditions as soldering iron, flow soldering, reflow soldering should be under the range prescribed in specifications.
- ☐ If the specifications are not followed, there is a possibility of the cosmetic defection, the intensive increase of leakage current or the capacitance reduction.
- ☐ Soldering heat stress to capacitor varies depending on temperature, duration time, mounting condition such as size, material and component quantity of PC board. Please check the heat durability in your actual soldering condition.

Guidelines and precautions for use

About capacitors

Things to be noted before mounting

- ☐ Do not reuse capacitors that have been assembled in a set and energized.
- ☐ Leakage current may increase when capacitors are stored for long term. In this case, we recommend you to apply the rated voltage for 1 hour at 60°C to 70°C with a resistor load of 1kΩ.
- ☐ In case the capacitor has re-striking-voltage, please apply the rated voltage to the capacitor through a resistor load of 1kΩ.

Mounting 1

- ☐ Please mount capacitors after confirming the polarity.
- ☐ Please mount capacitors after confirming its rated capacitance and rated voltage.
- ☐ When mounting capacitors to the circuit board, please use capacitors with the lead space matching the hole space of the circuit board.
- ☐ Do not drop capacitors or use capacitors dropped beforehand.
- ☐ Be careful not to deform the capacitor during installation.

Mounting 2

- ☐ When an automatic inserter is used to clinch the capacitor lead terminal, make sure it is not set too strongly.
- ☐ Be careful of the shock force that can be produced by absorbers, product chckers and centers on automatic inserters and installers.
- ☐ Do not apply excessive external force to the lead terminal or the capacitor itself.

Storage conditions

It is necessary to maintain a good storage environment in order to prevent the problem when soldering due to the degradation of solderability or moisturization of molding resin.

- ☐ When storing the reel in the storage bag, please ensure that the storage bag is fully sealed.*
- ☐ Do not store in high temperature and high humidity environment.
- ☐ For duration of storage, refer to the respective "Guidelines and precautions for use" of each capacitor.
- ☐ Do not store in damp conditions such as with water, salt water, or oil, and dew condensation.
- ☐ Do not store in places filled with noxious gas (hydrogen sulfide, sulfurous acid, nitrous acid, chlorine, ammonia, etc).
- ☐ Do not store in places susceptible to ozone, ultraviolet rays and radiation.
- ☐ Please unseal storage bag just before mounting and be conscious that the capacitors are used up. Refer to the respective "Guidelines and precautions for use" of each capacitor when some remain by necessity.

*Only for capacitors packed by laminate bag.

Disposal of capacitors

Capacitors comprise solid organic compounds, various metals, resin, rubber, etc. Treat them as industrial waste when disposing of it.

In case of disposing of a large amount of capacitor, we can dispose on your behalf.

OS-CON

OS-CON Line-up

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Classification	Series	Page	Features	Small size · Low profile	Large capacitance	Low ESR	For automotive	High voltage	Size code	Category temperature range (°C)	Rated voltage range (V.DC)	Capacitance range (μF)	L×W (mm)	H (mm)
SMD type	TPU	81	Small size Low profile Face down terminal	●					S09	−55 to +85	2.5 to 10	4.7 to 100	2.0×1.25	0.9
									B09	−55 to +85	6.3	150	3.5×2.8	0.9
	TPH	82	Small size Low ESR Face down terminal	●		●			A09	−55 to +85	2.5 to 10	33 to 100	3.2×1.6	0.9
								A14	−55 to +85	2.5 to 6.3	100 to 220	3.2×1.6	1.4	
	TPG	83	Small size Low profile Large capacitance	●	●				B1G	−55 to +105	2.5 to 12.5	33 to 220	3.5×2.8	1.1
								B15G	−55 to +105	4.0 to 6.3	150 to 220	3.5×2.8	1.4	
	TPSF	84	Low ESR · Small size Large capacitance Face down terminal	●	●	●			B1S	−55 to +105	2.5	200	3.5×2.8	1.1
								B2S	−55 to +105	2.0 to 2.5	270	3.5×2.8	1.9	
	TPE	85 to 88	Low ESR				●		B2	−55 to +105	2.0 to 10	47 to 470	3.5×2.8	1.9
									D15E	−55 to +105	6.3	470	7.3×4.3	1.4
									D2E	−55 to +105	2.5 to 10	68 to 470	7.3×4.3	1.8
									D3L	−55 to +105	2.5 to 10	220 to 680	7.3×4.3	2.8
									D4	−55 to +105	2.5 to 10	330 to 1,500	7.3×4.3	3.8
	TPB	89 to 90	Standard						B2	−55 to +105	4.0 to 10	33 to 68	3.5×2.8	1.9
									D3L	−55 to +105	4.0 to 10	150 to 330	7.3×4.3	2.8
									D4	−55 to +105	6.3 to 10	220 to 470	7.3×4.3	3.8
	TPC	91 to 92	Low profile	●					B1	−55 to +105	6.3 to 12.5	10 to 47	3.5×2.8	1.1
									D2	−55 to +105	6.3 to 10	68 to 330	7.3×4.3	1.9

Classification	Series	Page	Features	Small size - Low profile	Large capacitance	Low ESR	For automotive	High voltage	Size code	Category temperature range (°C)	Rated voltage range (V. DC)	Capacitance range (μF)	L×W (mm)	H (mm)
SMD type	TPF	93 to 94	Low ESR Large capacitance		●	●			D2E	-55 to +105	2.0	220 to 330	7.3×4.3	1.8
									D3L	-55 to +105	2.5 to 10	150 to 680	7.3×4.3	2.8
									D4	-55 to +105	2.5 to 6.3	470 to 1,000	7.3×4.3	3.8
	TA	95	High reliability (for the car electronics)					●	B2	-55 to +105	4.0 to 10	47 to 100	3.5×2.8	1.9
									D2E	-55 to +105	2.5 to 10	68 to 470	7.3×4.3	1.8
									D3L	-55 to +105	2.5 to 10	150 to 680	7.3×4.3	2.8
	TV	96	High reliability Guaranteed at 125°C (for the car electronics)					●	D2E	-55 to +125	6.3 to 10	68 to 150	7.3×4.3	1.8
									D3L	-55 to +125	10	150	7.3×4.3	2.8
	TH	97 to 98	Guaranteed at 125°C						D2E	-55 to +125	2.5 to 6.3	150 to 330	7.3×4.3	1.8
									D2	-55 to +125	2.5 to 10	68 to 220	7.3×4.3	1.9
									D3L	-55 to +125	4.0 to 6.3	220 to 330	7.3×4.3	2.8
									D4	-55 to +125	4.0 to 10	220 to 470	7.3×4.3	3.8
	TQC	99 to 100	High voltage					●	B15	-55 to +105	35	2.7	3.5×2.8	1.4
									B2	-55 to +105	16 to 35	3.9 to 22	3.5×2.8	1.9
									D12	-55 to +105	16	33	7.3×4.3	1.15
									D15	-55 to +105	16 to 25	22 to 47	7.3×4.3	1.4
									D2	-55 to +105	16 to 35	10 to 100	7.3×4.3	1.9
									D3L	-55 to +105	16 to 20	100 to 150	7.3×4.3	2.8

- (2) It may take a few seconds to a few minutes before POSCAP emits smoke by the situation. Increase safety by using a protective circuit.
- (3) If the smoke comes into eyes, rinse immediately. If the smoke is inhaled, gargle immediately.
- (4) In case a large current continues to flow after a short circuit, in the worst case, the shorted-out section may ignite. For safety, install a redundant circuit or a protective circuit, etc.

7-2. Wear-out failure (lifetime)

When lifetime exceeded the specified guarantee time of Endurance and Damp heat, electrolyte might insulate and cause electric characteristic changed. This is called an open circuit. The electric characteristics of capacitance and ESR may possibly change within the specified range in specifications when it is used under the condition of the rated voltage, electric and mechanical performance. Please note it when design.

8.Reduction of failure stress

When POSCAP is used within the rated voltage, it shows a stable characteristic, but it may be damaged in a short circuit when an overvoltage, for instance, is applied. The time to reach the failure mode can be extended by using POSCAP with reduced environment temperature, ripple current and applied voltage.

Failure rate

In the case of the endurance which is 105°C 2,000h. 0.5%/1,000h (Environment temp. : 105°C, Rated voltage or Category voltage applied)

In the case of the endurance which is 105°C 1,000h or 125°C 1,000h.

1.0%/1,000h (Environment temp. : 105°C, Rated voltage or Category voltage applied)

In the case of the endurance which is 85°C 1,000h.

1.0%/1,000h (Environment temp. : 85°C, Rated voltage applied)

9.Considerations when soldering

The soldering conditions are to be within the range prescribed in this delivery specification. If the specifications are not followed, there is the possibility of degradation of electric characteristic and lifetime when soldering is conducted under conditions that are harsher than those stipulated.

10.Others

POSCAP's Electrical characteristics are affected by temperature and frequency fluctuations. Design circuits after checking the amount of fluctuation.

Storage conditions

It is necessary to set an environment to prevent a trouble at the time of soldering by the degradation of solder ability or moisture's getting into the molding resin when POSCAP are stored. (Please refer to page 6. about the general storage conditions) The storage period is 18 months or shorter after shipment from factories, under the condition that the storage bag is unopened. Please unseal storage bag just before mounting and be conscious that POSCAP in the storage bag is used up.

When remainder unfortunately occurs, return them to the storage bag once again and, please seal the unsealed part by adhesive tape etc., including desiccants. Moreover, once and use it in time the storage bag is opened, store POSCAP according to the table's Floor Life "Time" and "conditions"

MSL	Floor life		Applicable models
	Time	Conditions	
2a	4 weeks	≤30°C/60%RH	See characteristics list in Page 81 to 100
3	168 hours	≤30°C/60%RH	
5	48 hours	≤30°C/60%RH	

(Conform to IPC/JEDEC J-STD-020D)

Intellectual property right

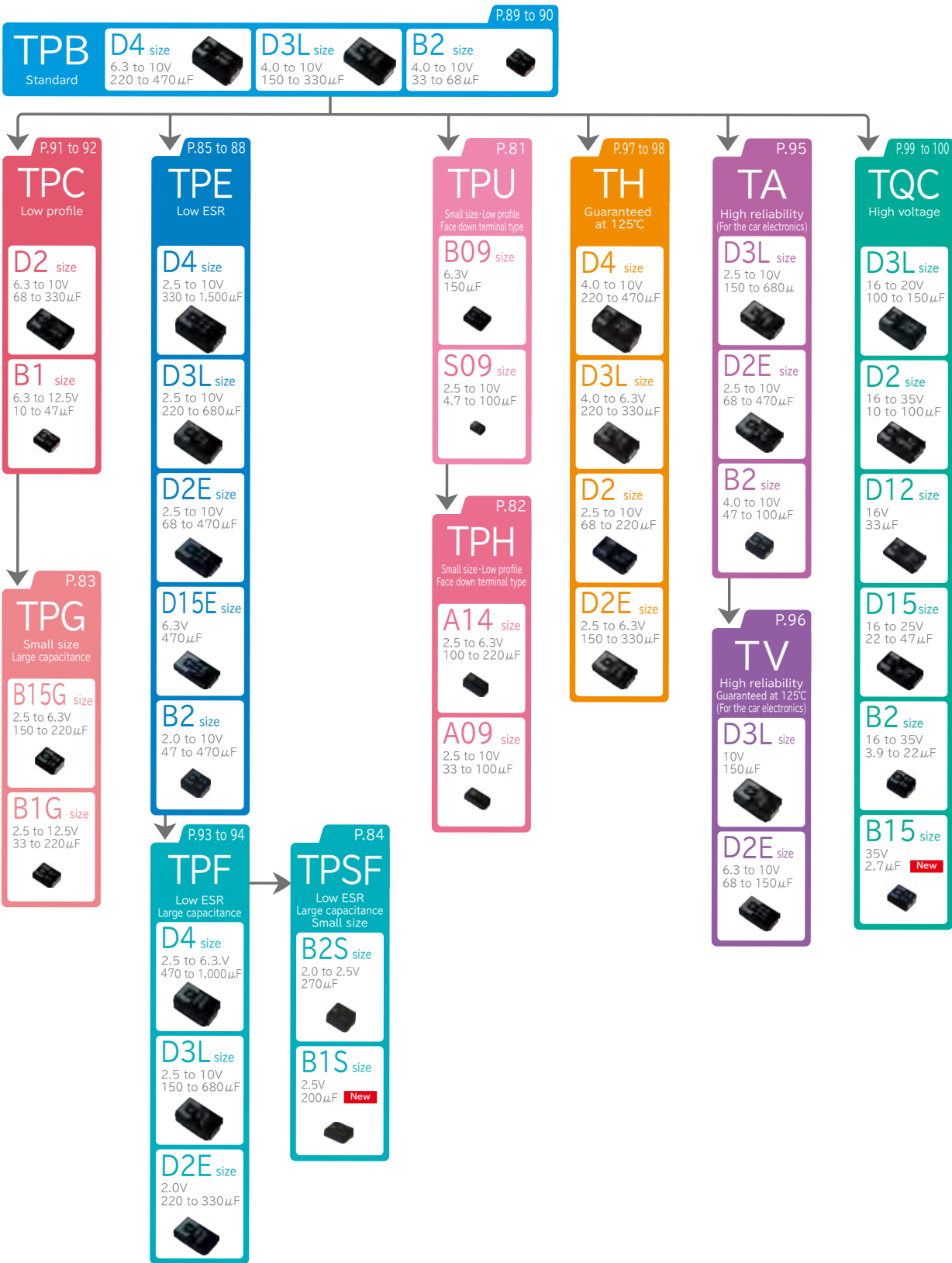
We, Panasonic are providing the product and service that customers can use without anxiety, and are working positively on the protection of our products under intellectual property rights.

Representative patents relating to POSCAP are as follows:

(TPB, TPC, TPD, TPE, TPF, TPG, TPH, TPSF, TPU, TA, TV, TH series)

U.S. Patent Nos. 6168639 and 6313979

Series system
diagram



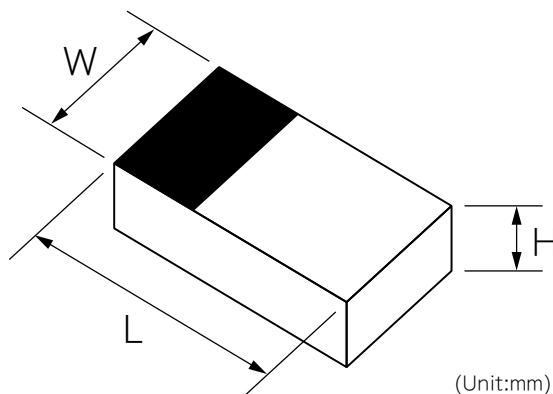
Case size

	S09	A09	A14	B09	B1	B1S	B1G	B15	B15G	B2	B2S	D12	D15	D15E	D2E	D2	D3L	D4
L	2.0	3.2	3.2	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	7.3	7.3	7.3	7.3	7.3	7.3	7.3
W	1.25	1.6	1.6	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	4.3	4.3	4.3	4.3	4.3	4.3	4.3
H	0.9	0.9	1.4	0.9	1.1	1.1	1.1	1.4	1.4	1.9	1.9	1.15	1.4	1.4	1.8	1.9	2.8	3.8

(Unit:mm)

The size of each photo is nearly to full scale.

Image of case size



S09 size	A09 size	A14 size	B09 size	B1 size	B1S size	B1G size	B15 size	B15G size
L2.0×W1.25×H0.9	L3.2×W1.6×H0.9	L3.2×W1.6×H1.4	L3.5×W2.8×H0.9	L3.5×W2.8×H1.1	L3.5×W2.8×H1.1	L3.5×W2.8×H1.1	L3.5×W2.8×H1.4	L3.5×W2.8×H1.4
P.81	P.82	P.82	P.81	P.91 to 92	P.84	P.83	P.99 to 100	P.83
TPU	TPH	TPH	TPU	TPC	TPSF	TPG	TQC	TPG
2.5 to 10V 4.7 to 100μF	2.5 to 10V 33 to 100μF	2.5 to 6.3V 100 to 220μF	6.3V 150μF	6.3 to 12.5V 10 to 47μF	2.5V 200μF New	2.5 to 12.5V 33 to 220μF	35V 2.7μF New	2.5 to 6.3V 150 to 220μF

B2 size	B2S size	D12 size	D15 size	D15E size	D2E size	D2 size	D3L size	D4 size
L3.5×W2.8×H1.9	L3.5×W2.8×H1.9	L7.3×W4.3×H1.15	L7.3×W4.3×H1.4	L7.3×W4.3×H1.4	L7.3×W4.3×H1.8	L7.3×W4.3×H1.9	L7.3×W4.3×H2.8	L7.3×W4.3×H3.8
P.85	P.84	P.99 to 100	P.99 to 100	P.85	P.85	P.91	P.85	P.85
TPE	TPSF	TQC	TQC	TPE	TPE	TPC	TPE	TPE
2.0 to 10V 47 to 470μF	2.0 to 2.5V 270μF	16V 33μF	16 to 25V 22 to 47μF	6.3V 470μF	2.5 to 10V 68 to 470μF	6.3 to 10V 68 to 330μF	2.5 to 10V 220 to 680μF	2.5 to 10V 330 to 1,500μF
P.89 to 90					P.93 to 94	P.97 to 98	P.89 to 90	P.89 to 90
TPB					TPF	TH	TPB	TPB
4.0 to 10V 33 to 68μF					2.0V 220 to 330μF	2.5 to 10V 68 to 220μF	4.0 to 10V 150 to 330μF	6.3 to 10V 220 to 470μF
P.95					P.95	P.99 to 100	P.93 to 94	P.93 to 94
TA					TA	TQC	TPF	TPF
4.0 to 10V 47 to 100μF					2.5 to 10V 68 to 470μF	16 to 35V 10 to 100μF	2.5 to 10V 150 to 680μF	2.5 to 6.3V 470 to 1,000μF
P.99 to 100					P.96		P.95	P.97 to 98
TQC					TV		TA	TH
16 to 35V 3.9 to 22μF					6.3 to 10V 68 to 150μF P.97 to 98		2.5 to 10V 150 to 680μF	4.0 to 10V 220 to 470μF

The size of each photo is nearly to full scale.

Products list

Size・ESR Matrix list

V	Series	μ F										
		2.7	3.9	4.7	5.6	8.2	10	15	22	33	47	68
2.0	TPE											
	TPF											
	TPSF											
2.5	TPB											
	TPE											
	TPF											
	TPG											
	TPH											
	TPSF											
	TPU										S09 (150)	
4.0	TPB											B2 (70)
	TPE											
	TPF											
	TPG											
	TPH											A09 (150)
	TPU											S09 (150)
6.3	TPB											B2 (70)
	TPC										B1 (70,55)	
	TPE											
	TPF											
	TPG											
	TPH										A09 (150)	
8.0	TPU						S09 (250)		S09 (150)		S09 (150)	
	TPC								B1 (70)			
	TPE											
	TPG										B1G (70)	
10	TPB									B2 (70)	B2 (70)	
	TPC											D2 (45)
	TPE										B2 (35)	D2E (25)
	TPF											
	TPG										B1G (70)	
	TPH									A09 (150)		
	TPU			S09 (300)								
12.5	TPC						B1 (80)	B1 (80)				
	TPG									B1G (70)		
16	TQC						B2 (100)	B2 (90)		D2 (70)	D2 (55,40)	D2 (50)
										D12 (40)	D15 (55)	
20	TQC					B2 (100)			D2 (80)	D2 (60)	D15 (55)	
									B2 (90)		D2 (55)	
25	TQC				B2 (100)			D2 (90,45)	D2 (60,45)	D2 (60)		
							B2 (100)	D15 (70)				
35	TQC	B15 (300)	B2 (400)				D2 (120)					

Case size

(Unit:mm)

	S09	A09	A14	B09	B1	B1S	B1G	B15	B15G	B2	B2S	D12	D15	D15E	D2E	D2	D3L	D4
L	2.0	3.2	3.2	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	7.3	7.3	7.3	7.3	7.3	7.3	7.3
W	1.25	1.6	1.6	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	4.3	4.3	4.3	4.3	4.3	4.3	4.3
H	0.9	0.9	1.4	0.9	1.1	1.1	1.1	1.4	1.4	1.9	1.9	1.15	1.4	1.4	1.8	1.9	2.8	3.8

V	Series	100	120	150	200	220	270	330	470	680	1,000	1,500
2.0	TPE							B2 (15,13)	B2 (11)			
	TPF					D2E (6)		D2E (6)				
	TPSF						B2S (9,6)					
2.5	TPB	B2 (70)										
	TPE			B2 (35)		D2E (9,*2) B2 (35,25,21,15)		D2E (*3) D2E (18,15,12,9,7)		D3L (15,12)	D4 (15)	D4 (15,12)
	TPF							D3L (7)	D3L (10,7,6)	D3L (10,7,6)	D4 (6,5)	
	TPG					B1G (70) B15G (30)			D4 (5)	D4 (5)		
	TPH	A09 (150)				A14 (70)						
	TPSF				B1S (9★)		B2S (6★)					
	TPU	S09 (150)										
4.0	TPB							D3L (40)				
	TPE	B2 (35)		D2E (18) B2 (35)		D2E (*1) B2 (35)		D2E (25,18)	D3L (10,*2)			
	TPF							D3L (12)	D3L (10,5★)	D4 (10)		
	TPG					B15G (70)						
	TPH			A14 (70)								
	TPU											
6.3	TPB							D3L (40) D4 (40)	D4 (35)			
	TPC	D2 (45)		D2 (40)				D2 (40)				
	TPE	D2E (25,18) B2 (35,25)	B2 (35)	D2E (*1) B2 (35,25)		D2E (25,18) B2 (25★) B2 (35)		D2E (25) D3L (9,*1) D4 (10)	D4 (25,18) D15E (35)	D4 (25,18)		
	TPF							D3L (12,9,5)	D3L (9,5★) D4 (10)			
	TPG	B1G (70,55,35★)		B15G (70,35)		B15G (35★)						
	TPH	A09 (100) A14 (70)										
	TPU			B09 (100)								
8.0	TPC			D2 (40)								
	TPE	B2 (35)										
	TPG											
10	TPB			D3L (40)		D4 (40) D3L (40)		D4 (35)				
	TPC	D2 (45)										
	TPE					D3L (25,18)		D4 (25)				
	TPF			D3L (15)								
	TPG											
	TPH											
	TPU											
12.5	TPC											
16	TQC	D2 (50)		D3L (50)								
20	TQC	D3L (55)										
25	TQC											
35	TQC											

★Under development *1 (F:15, I:18, M:25) *2 (C:12, F:15, I:18, M:25) *3 (7, 9, C:12, F:15, I:18, M:25)

 ・Symbols in table: Case size
 ・(): ESR specification (mΩmax.)

Explanation of part numbers

Part number system

2R5

Rated voltage
1 to 3 figures

Rated voltage	Code
1.8	X
2.0	2
2.5	2R5orE
4.0	4
6.3	6
8.0	8
10	10
11	11
12.5	12
16	16
20	20
25	25
35	35

TPB

Series name
3 to 4 figures

Series	Code
TPB	TPB
TPC	TPC
TPE	TPE
TPF	TPF
TPG	TPG
TPH	TPH
TPSF	TPSF
TPU	TPU
TAB	TAB
TAE	TAE
THB	THB
THC	THC
THE	THE
TQC	TQC
TVE	TVE

330

Rated capacitance
2 to 4 figures

Rated capacitance	Code
2.7	2R7
3.9	3R9
4.7	4R7
5.6	5R6
8.2	8R2
10	10
15	15
22	22
33	33
47	47
56	56
68	68
82	82
100	100
120	120
150	150
200	200
220	220
270	270
330	330
470	470
680	680
1,000	1000
1,500	1500

M

Capacitance tolerance
1 figure

Capacitance tolerance	Code
±20%	M

L

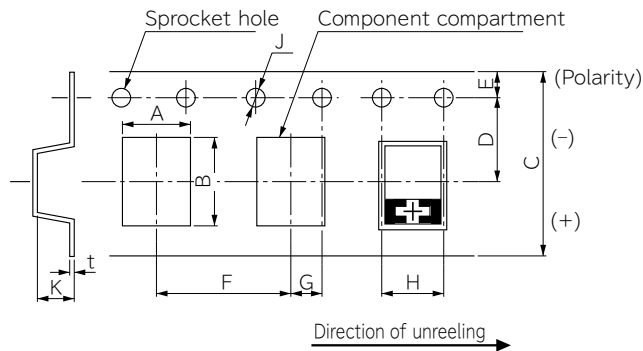
Special code
0 to 4 figures

Standard		Code
TPE series		
B2 size	ESR 35mΩ max	ZB
	ESR 30mΩ max	UB
	ESR 25mΩ max	PB
	ESR 21mΩ max	LB
	ESR 18mΩ max	IB
	ESR 15mΩ max	FB
	ESR 15mΩ/300kHz max	FGB
	ESR 35mΩ max 85°C	AZB
	ESR 30mΩ max 85°C	AUB
	ESR 25mΩ max 85°C	APB
	ESR 15mΩ max 85°C	AFB
	ESR 15mΩ/300kHz max 85°C	AFGB
	ESR 13mΩ/300kHz max 85°C	ADGB
ESR 11mΩ/300kHz max 85°C	AJGB	
D15E size	ESR 35mΩ max 85°C	AZU
D2E size	ESR 25mΩ max 85°C	AP
D3L size	ESR 25mΩ max	L
	ESR 18mΩ max	IL
	ESR 15mΩ max	FL
	ESR 12mΩ max	CL
	ESR 10mΩ max	AL
	ESR 25mΩ max 85°C	AL
	ESR 9mΩ/500kHz max 85°C	A9EL
TPG series		
B1G size	ESR 35mΩ/300kHz max.	ZGD
TPH series		
A09 size	ESR 150mΩ max	AHA
	ESR 100mΩ max	AEA
A14 size	ESR 70mΩ max	ABC
	ESR 35mΩ max	AZC
TPB series		
D3L size		L
TPC series		
85°C		A
B1 size		B

Standard		Code
TPF series		
D3L size	ESR 9mΩ max	9L
	ESR 7mΩ max	7L
	ESR 6mΩ max	6L
	ESR 5mΩ max	5L
	ESR 5mΩ/500kHz max	5EL
D4 size	ESR 10mΩ max	AH
	ESR 6mΩ max	6H
	ESR 5mΩ max	5H
TPSF series		
B2S size	ESR 18mΩ/300kHz max 85°C	AIG
TPU series		
S09 size		SI
B09 size		BI
TQC series		
Capacitance enlarged type		YF
Capacitance enlarged type(B size)		YFB
Capacitance enlarged type(D12 size)		YFS
Capacitance enlarged type(D15 size)		YFT
Capacitance enlarged type(D2 size)		YFD
All series		
ESR 55mΩ max		G
ESR 45mΩ max		V
ESR 40mΩ max		W
ESR 35mΩ max		Z
ESR 18mΩ max		I
ESR 15mΩ max		F
ESR 12mΩ max		C
ESR 9mΩ max		9
ESR 8mΩ max		8
ESR 6mΩ max		6
ESR 5mΩ max		5
ESR 35mΩ/300kHz max		ZG
ESR 30mΩ/300kHz max		UG
ESR 9mΩ/300kHz max		9G
ESR 6mΩ/500kHz max		6E
ESR 4mΩ/500kHz max		4E

*We supply only embossed tapping type

Dimension of carrier tape



(unit:mm)

Size code	A ± 0.1	B ± 0.1	C ± 0.3	D ± 0.1	E ± 0.1	F ± 0.1	G ± 0.1	H ± 0.1	J $^{+0.1}_{-0}$	K ± 0.2	t ± 0.1
S09	1.65	2.4	8.0	3.5	1.75	4.0	2.0	4.0	$\phi 1.5$	1.3	0.25
A09	2.05	3.65	8.0	3.5	1.75	4.0	2.0	4.0	$\phi 1.5$	1.3	0.25
A14	2.05	3.65	8.0	3.5	1.75	4.0	2.0	4.0	$\phi 1.5$	1.7	0.25
B09	3.2	3.8	8.0	3.5	1.75	4.0	2.0	4.0	$\phi 1.5$	1.4	0.2
B1	3.2	3.8	8.0	3.5	1.75	4.0	2.0	4.0	$\phi 1.5$	1.4	0.2
B1S	3.25	3.9	8.0	3.5	1.75	4.0	2.0	4.0	$\phi 1.5$	1.7	0.25
B1G	3.25	3.9	8.0	3.5	1.75	4.0	2.0	4.0	$\phi 1.5$	1.7	0.25
B15	3.3	3.8	8.0	3.5	1.75	4.0	2.0	4.0	$\phi 1.5$	2.1	0.2
B15G	3.25	3.9	8.0	3.5	1.75	4.0	2.0	4.0	$\phi 1.5$	1.7	0.25
B2	3.3	3.8	8.0	3.5	1.75	4.0	2.0	4.0	$\phi 1.5$	2.1	0.2
B2S	3.25	4.0	8.0	3.5	1.75	4.0	2.0	4.0	$\phi 1.5$	2.1	0.25
D12	4.5	7.5	12.0	5.5	1.75	8.0	2.0	4.0	$\phi 1.5$	1.7	0.3
D15	4.5	7.5	12.0	5.5	1.75	8.0	2.0	4.0	$\phi 1.5$	2.4	0.3
D15E	4.7	7.8	12.0	5.5	1.75	8.0	2.0	4.0	$\phi 1.5$	1.7	0.3
D2E	4.5	7.5	12.0	5.5	1.75	8.0	2.0	4.0	$\phi 1.5$	2.4	0.3
D2	4.5	7.5	12.0	5.5	1.75	8.0	2.0	4.0	$\phi 1.5$	2.4	0.3
D3L	4.5	7.7	12.0	5.5	1.75	8.0	2.0	4.0	$\phi 1.5$	3.2	0.3
D4	4.5	7.7	12.0	5.5	1.75	8.0	2.0	4.0	$\phi 1.5$	4.2	0.3

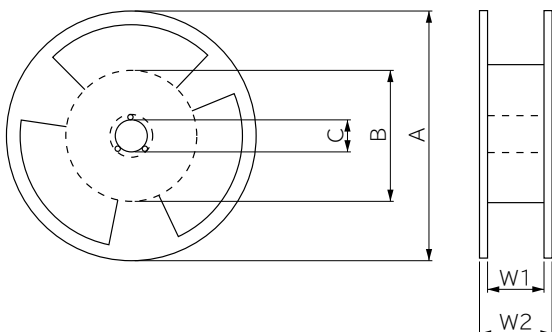
- Dimension A and B are the measure of compartment's inside bottom.
- The (+) Polarity of the chip is placed on right side towards the unreeling direction.
- Dimension of the topcover tape

Thickness of cover tape: $62 \pm 10 \mu\text{m}$

Width of cover tape: $9.5 \pm 0.2 \text{mm}$

$5.5 \pm 0.2 \text{mm}$ ($\phi 180 \text{reel}$)

Reel dimension



(unit:mm)

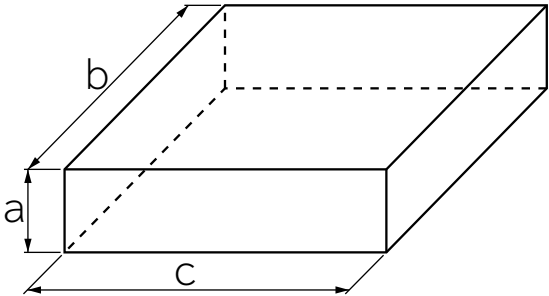
A	B	C	W1	W2
$\phi 330 \pm 2$	$\phi 80 \pm 2$	$\phi 13 \pm 0.2$	13.5 ± 0.5	17.5 ± 1.0
$\phi 180 \pm 0.3$	$\phi 60 \pm 2$	$\phi 13 \pm 0.2$	9 ± 0.5	11.4 ± 1.0

Packing
specifications

Minimum packing quantity and weight

Size code	Quantity(pcs./Reel,φ180)	Typical weight(g)	Size code	Quantity(pcs./Reel,φ330)	Typical weight(g)
S09	3,000	200	D12	4,500	1,200
A09	3,000	200	D15	3,000	1,000
A14	2,500	200	D15E	4,000	1,000
B09	3,000	200	D2E	3,000	1,000
B1	3,000	200	D2	3,000	1,000
B1S	2,500	200	D3L	2,500	1,100
B1G	2,500	200	D4	2,000	1,200
B15	2,000	160			
B15G	2,500	200			
B2	2,000	200			
B2S	2,000	200			

Dimension of packing case



(unit:mm)

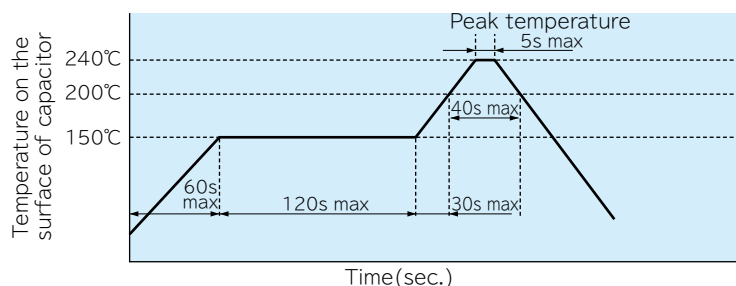
Reel size	φ180	φ330
a	90	120
b	240	360
c	240	360

Units per packing case

Size code	Pieces/case	Size code	Pieces/case
S09	15,000	D12	22,500
A09	15,000	D15	15,000
A14	12,500	D15E	20,000
B09	15,000	D2E	15,000
B1	15,000	D2	15,000
B1S	12,500	D3L	12,500
B1G	12,500	D4	10,000
B15	10,000		
B15G	12,500		
B2	10,000		
B2S	10,000		

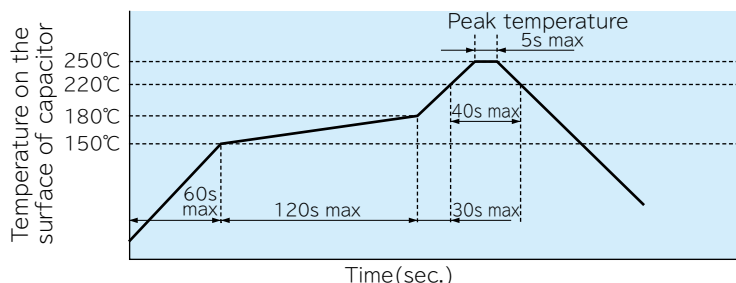
Recommended reflow soldering temperature profile

The cycles of reflow soldering: Twice (max)



Peak temperature 250°C lead free reflow soldering profile

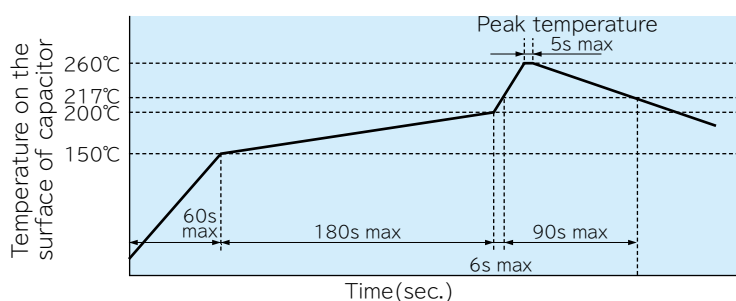
The cycles of reflow soldering: Twice (max)



Peak temperature 260°C lead free reflow soldering profile

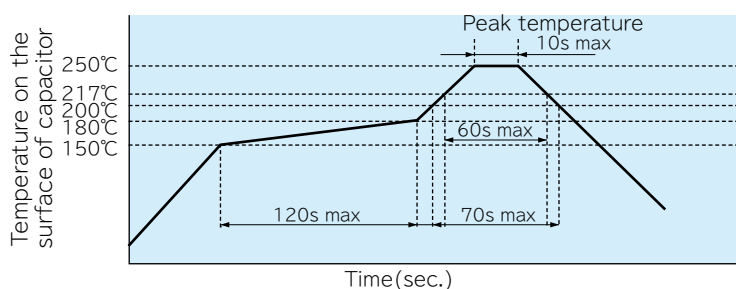
The model of MSL"2a" is changed into MSL "3" with this reflow condition.(See page 66)

The cycles of reflow soldering: Twice (max)



TQC series

The cycles of reflow soldering: Twice (max)



Soldering with a soldering iron

Tip of a soldering iron: 350°C max (TQC serie: 400°C max) Power of a soldering iron: 30W max

Working time: 3sec. max (TQC serie: 5sec max)

(Do not let the tip of soldering iron touch the POSCAP itself. Do not subject the POSCAP itself to excessive stress when soldering.)

1. Basic structure of POSCAP

The electrolytes make the difference in structure between the POSCAP and the standard tantalum capacitor.

Capacitor	Electrolyte
Tantalum capacitor	Manganese dioxide
POSCAP	Conductive polymer

(Standard model)

POSCAP uses sintered tantalum as the anode material. An oxide layer formed on the surface of the sintered tantalum is used for the dielectric, and a conductive polymer for the electrolyte.

Magnified cross-section of element

Magnified photo

(Face down terminals model)

- The sintered tantalum has a porous structure, it makes a large surface area, which enables to have large capacitance.
- The conductive polymer used for the electrolyte is high in electric conductivity and enables the low ESR.

1. POSCAP Electrical characteristics

1-1. Frequency characteristics

Fig.A Impedance frequency characteristics (POSCAP vs other type)

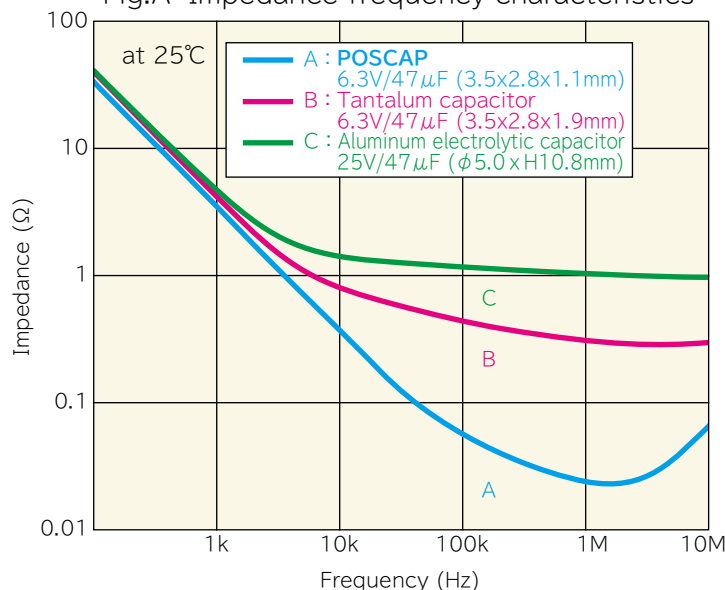
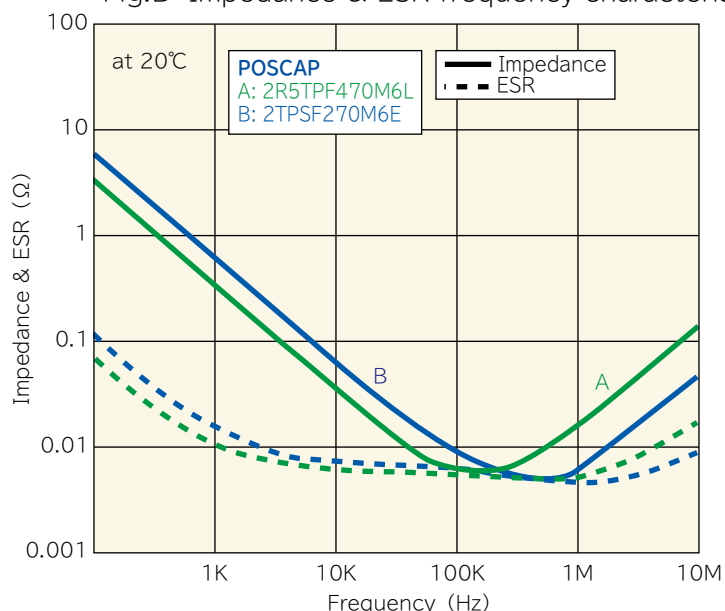


Fig.B Impedance & ESR frequency characteristics (Several POSCAP models)



The greatest characteristic of **POSCAP** is the excellent frequency characteristics.

Using a high conductive polymer for the electrolyte greatly improves the ESR characteristics and enables the **POSCAP** to perform at the higher frequency levels.

Fig. A: Compares the **POSCAP** to an aluminum electrolytic and a tantalum capacitor.

The **POSCAP**'s impedance is remarkably lower than the other capacitors at the periphery of the resonance frequency.

Fig. B: Compares the impedance and ESR frequency characteristics of three different **POSCAP** series.

The TPSF series has a low ESL characteristic which brings it to high resonance frequency, it makes impedance be much lower in the range of high - frequency wave.

1-2. Characteristics at high and low temperature

Fig.A ESR temperature characteristics
(POSCAP vs Ceramic capacitor)

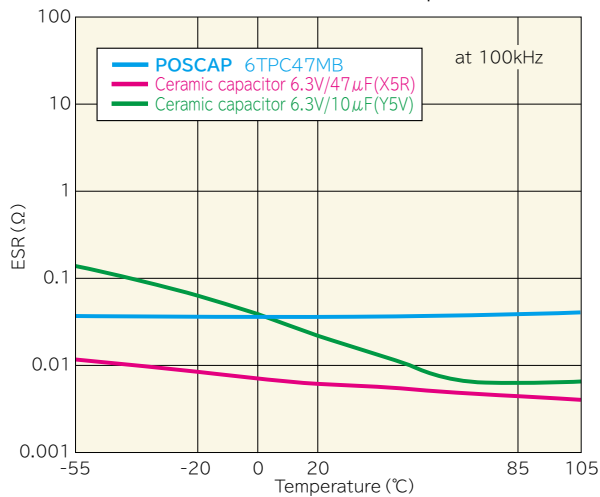
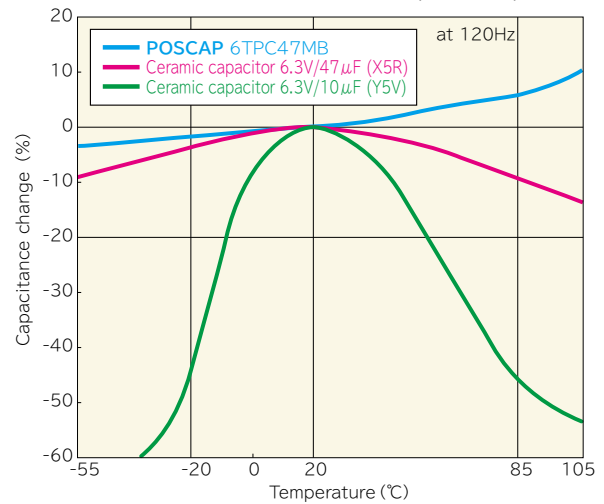


Fig.B Capacitance temperature characteristics
(POSCAP vs Ceramic capacitor)



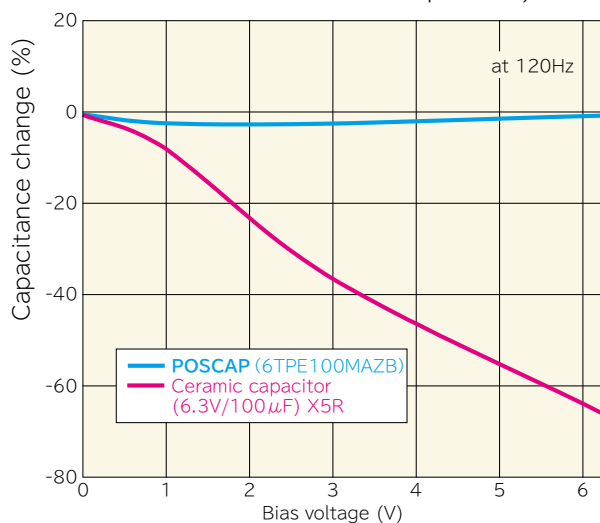
The POSCAP has a characteristics of low and high temperature, which is little change against temperature for the ESR.

The stability of ESR's temperature characteristics means the noise-clearing ability is little change against temperature.

The POSCAP is suitable for outdoor equipment which requires the temperature characteristic flexibility.

1-3. Bias characteristics

Comparison of bias characteristics
(POSCAP vs Ceramic capacitor)



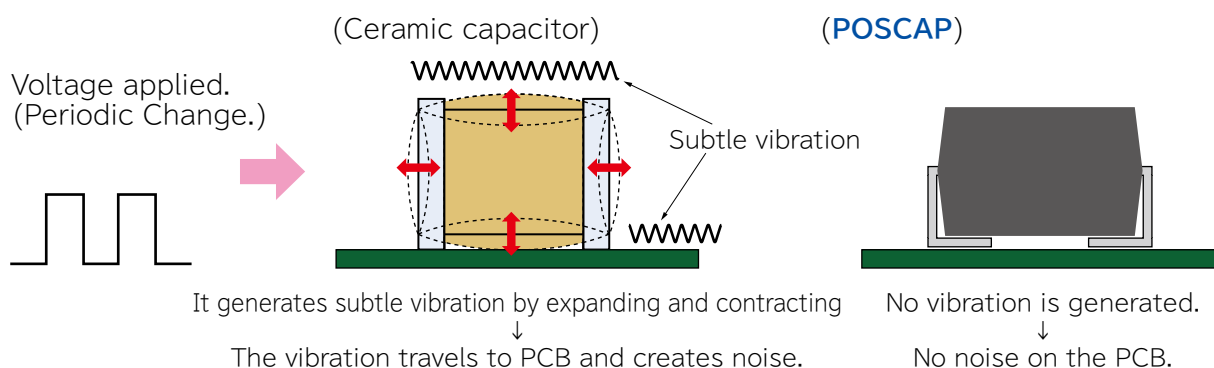
The ceramic capacitor has bias characteristics, which makes the capacitance decrease when voltage is applied to it. However, POSCAPs will show no reduction in capacitance for applied voltage, as long as the applied voltage is within its rating. Therefore, you will be able to design without worrying about capacitance changing when voltage is applied.

1-4. Piezoelectric effect of the capacitor

When variable voltage is applied to ceramic capacitors that use dielectrics with piezoelectric characteristics (e.g. barium titanate), the voltage will cause vibration due to the elasticity in the dielectric.

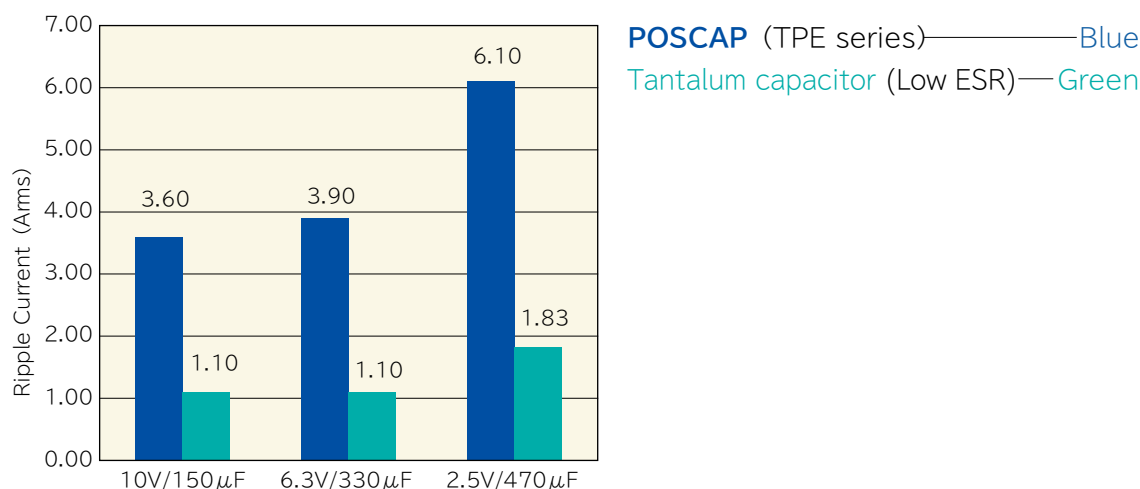
If the cyclic change is within the audio-frequency (20Hz to 20kHz), the vibration from the capacitor travels to the PCB and it could generate noise inside the equipment.

This may be an unwanted effect depending on the product you are developing. Our **POSCAP**'s dielectric layer is composed of tantalum oxide which does not have piezoelectric characteristics. Silence is thus assured by use of our product.



1-5. Allowable ripple current

Comparison of allowable ripple current
(**POSCAP** vs Tantalum capacitor)



The allowable ripple current of a capacitor is an important characteristic when selecting a smoothing capacitor for a power supply.

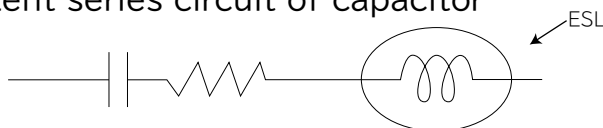
The allowable value of ripple current is decided by the generated heat of the capacitor. This generated heat is relevant to the ESR value.

Since a large ESR capacitor generates a larger value of heat, it inhibits the ripple current value. Because the ESR of the **POSCAP** is so small, it can reach a high ripple current rating compared to other electrolytic capacitors.

1-6. ESL characteristics

POSCAP is a high performing capacitor with low ESR and large capacitance. In recent circuit technologies for electronic equipment, the ESL value is important when considering performance in the high frequency range.

(a) Equivalent series circuit of capacitor



(b) Approximate ESL value of **POSCAP** (unit: nH)

Size Code	at 10 MHz	Size Code	at 10 MHz
S09	0.8	D12	1.8
A09	1.2	D15E	2.0
A14	1.1	D15	1.8
B1	1.2	D2E	1.8
B1S	0.7	D2E (TPF)	1.5
B1G	1.1	D2	2.0
B15	1.3	D3L	2.3
B15G	1.4	D3L (TPF)	2.0
B2	1.3	D4	2.6
B2S	0.7	D4 (TPF)	2.5

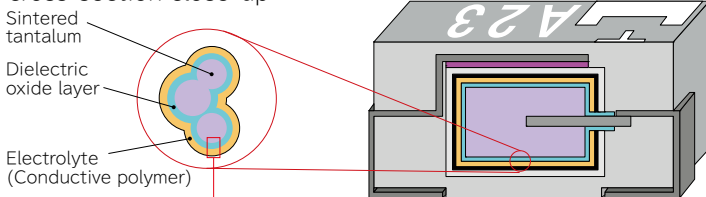
※Measuring method and position
: Based on JEITA RC-2002
※All values on the left figure are not guaranteed but reference.
Please contact SANYO for details of measurement.

1-7. Self-Healing Mechanism

Conductive polymer is used as an electrolyte in our **POSCAPs**. As an organic material, conductive polymer becomes non-conductive and acts as an insulator against leakage current at a relatively low temperature of approximately 300°C.

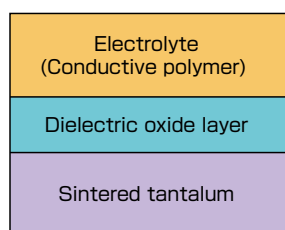
As seen in the explanation below, this characteristic is used to suppress leakage current when there is microcrack in the dielectric oxide layer. We call this capability "self-healing mechanism." In addition to this characteristic, this conductive polymer has enough heat resistance to endure reflow soldering process and it is able to retain high specific electric conductivity even after going through such process.

Tantalum pellet cross-section close-up



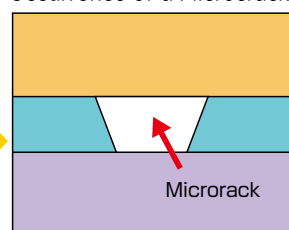
Further close-up of the layers

Initial State



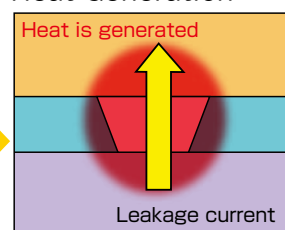
The image above represents a close-up of the cross-section of the layers within the core of a **POSCAP**, which consists of sintered tantalum, dielectric oxide layer and an electrolyte (conductive polymer).

Occurrence of a Microcrack



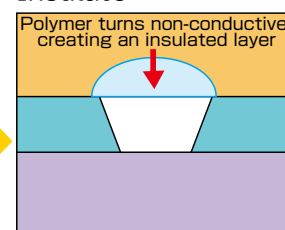
In rare cases, a microcrack could occur on the dielectric oxide layer by stress caused by rapid temperature change during the reflow soldering process or when excessive voltage is applied to the capacitor.

Heat Generation



Joule heat is generated locally when leakage current flows into the microcrack as voltage is applied.

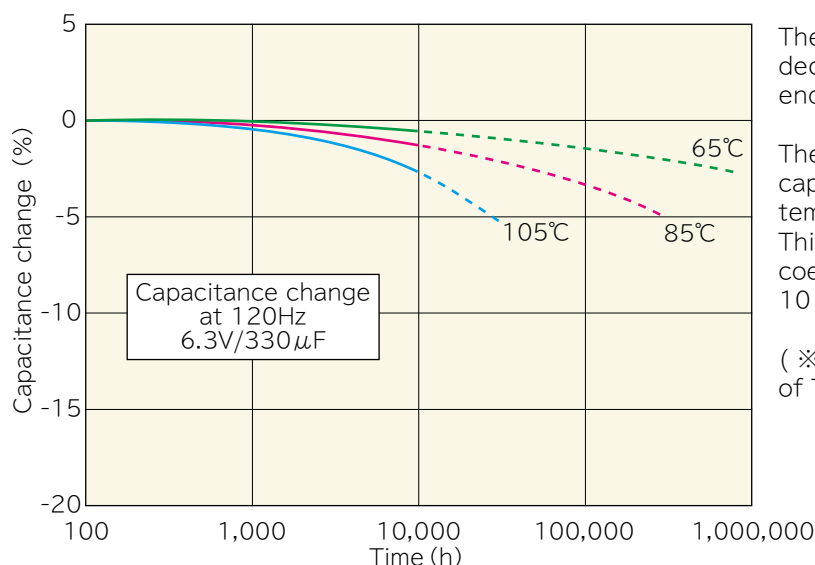
Insulate



Conductive polymer around the microcrack turns non-conductive and creates an insulated layer at a relatively-low temperature of approximately 300°C caused by Joule heat. It is at this point that the insulator suppresses the leakage current. This is called "self-healing mechanism" or "self-recovery function."

With this "self-healing mechanism" **POSCAP** is able to minimize stress induced failures and achieve high reliability.

1. Temperature acceleration test (Endurance)



The **POSCAP** capacitance level decreases during a long term endurance test.

The left figure shows time variation of capacitance decrease at each temperature.

This graph indicates that temperature coefficient of **POSCAP**'s life time is 10 times by 20°C reduction.*

(※ Please contact SANYO for details of TPU and TQC series.)

POSCAP	Aluminum electrolytic capacitor
105°C ⇒ 2,000h	105°C ⇒ 2,000h
85°C ⇒ 20,000h	85°C ⇒ 8,000h
65°C ⇒ 200,000h	65°C ⇒ 32,000h

※The following life time are not guaranteed but presumptive values.

Even if **POSCAP** and an aluminum electrolytic capacitor are guaranteed on 2,000 hours at 105°C, the life span results in big differences as temperature drops. (See left chart) POSCAP has a remarkably longer life span compared with an aluminum electrolytic capacitor.

2. Presumption of life for the POSCAP

As time increases during the endurance test, the capacitance of the **POSCAP** gets smaller. This means the eventual failure mode of **POSCAP** is open. The **POSCAP**'s cathode material is made of an organic matter (conductive polymer).

The life time is different by each operating temperature and self - heating by ripple current. The following formula outline could make it possible to estimate the presumptive lifetime of **POSCAP** at ambient temperature Tx (°C).

The result of the following calculating formula estimation is not guaranteed but presumptive value based on actual measurement.

(Please contact SANYO as to TQC series)

2-1. Calculating formula for the presumption of life

$$L_x = L_o \times 10^{\frac{T_o - T_x}{20}}$$

Lx : Life expectance in actual use (temperature Tx) (h)

Lo : Guaranteed life at maximum temperature in use (h)

To : Maximum operating temperature (°C)

Tx : Temperature in actual use (temperature of **POSCAP**) (°C)

■ Specifications

Items	Condition	Specifications			
Rated voltage (V)	—	2.5	4.0	6.3	10
Surge voltage (V)	—	2.9	4.6	7.2	12
Category temperature range (°C)	—	-55 to +85			
Capacitance tolerance (%)	120Hz/20°C	M: ±20			
Rated capacitance range (μF)	120Hz/20°C	4.7 to 150			
Dissipation Factor (DF)	120Hz/20°C	Please see the attached characteristics list			
Leakage current	Rated voltage applied, after 5 minutes	Please see the attached characteristics list			
Equivalent series resistance (ESR)	100kHz/20°C	Please see the attached characteristics list			
Characteristics of impedance ratio at high temp. and low temp.	100kHz/+20°C	-55°C	Z/Z _{20°C}	0.6 to 2.0	
		+85°C	Z/Z _{20°C}	0.6 to 2.0	
Endurance	85°C, 1,000h, rated voltage applied	ΔC/C	Within±20% of the initial value		
		DF	≤ 1.5 times of the initial limit		
		LC	Within the initial limit		
Damp heat (Steady State)	60°C, 90 to 95%RH, 500h, No-applied voltage	ΔC/C	Within+40%, -20% of the initial value		
		DF	≤ 1.5 times of the initial limit		
		LC	≤ 3 times of the initial limit		
Surge	85°C, 1,000 cycles, 1kΩ discharge resistance, surge voltage applied	ΔC/C	Within±5% of the initial value		
		DF	Within the initial limit		
		LC	< 3 times of the initial limit		

■ Marking and dimensions

S09size

Rated capacitance※4

Anode (+)

Rated voltage※1

Lot. No.※2

B09size

Rated capacitance※3

Anode (+)

Rated voltage※1

Lot. No.※2

※1 The rated voltage is as follows.

R.V.	2.5	4.0	6.3	10
Mark	e	g	j	A

※2 Lot.No.shows roughly manufacturing date.

※3 The rated capacitance is as follows.(B09)

Capacitance(μF)	150
Mark	E8

※4 The rated capacitance is as follows.(S09)

R. Cap.(μF)	4.7	10	22	47	68	100
Mark	s	A	J	S	W	A

(unit : mm)

Size code	L ±0.1※1	W ±0.1※1	H ±0.1	S ±0.1※1	W1 ±0.1
S09	2.0	1.25	0.9	0.5	0.9
B09	3.5	2.8	0.9	0.8	2.2

※1 ±0.2:B09

Recommended land pattern dimension of PWB

Diagram illustrating the dimensions of the S09 and B09 panels. The panels are shown with their respective dimensions: width (a), height (b), and spacing (c). The dimensions are given in millimeters (mm).

Size code	a	b	c
S09	1	0.9	0.6
B09	1.6	2.7	1.4

■ Size list

Size list		RV:Rated voltage			
RV μF	2.5	4.0	6.3	10	
4.7				S09	
10			S09		
22			S09		
47	S09		S09		
68		S09			
100	S09				
150			B09		

TPU series characteristics list

Size code	Part number	Rated voltage (V)	Rated temperature (°C)	Rated capacitance (μF)	Category voltage (V)	Category temperature (°C)	DF (% max)	LC (μA) max/5min.	ESR (mΩmax) 100kHz/20°C	Maximum allowable ripple current (mA)rms 100kHz※1	MSL	
											Reflow temp. ≤ 260°C	Reflow temp. ≤ 250°C
S09	10TPU4R7MSI	10	85	4.7	10	85	10	4.7	300	360	3	3
	6TPU47MSI	6.3	85	47	6.3	85	10	59.2	150	510	—	3
	6TPU22MSI	6.3	85	22	6.3	85	10	27.7	150	510	—	3
	6TPU10MSI	6.3	85	10	6.3	85	10	6.3	250	400	—	3
	4TPU68MSI	4.0	85	68	4.0	85	10	54.4	150	510	—	3
	ETPU100MSI	2.5	85	100	2.5	85	10	50.0	150	510	—	3
	R5TPU47MSI	2.5	85	47	2.5	85	10	23.5	150	510	—	3
B09	6TPU150MBI	6.3	85	150	6.3	85	10	94.5	100	670	3	3

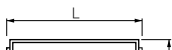
※1 100k to 500kHz, 45°C





Specifications

Items	Condition			Specifications			
Rated voltage (V)	—			2.5	4.0	6.3	10
Surge voltage (V)	—			2.9	4.6	7.2	12
Category temperature range (°C)	—			-55 to +105 / -55 to +85 (Rated temp. 85°C)			
Capacitance tolerance (%)	120Hz/20°C			M : ±20			
Rated capacitance range (μF)	120Hz/20°C			33 to 220			
Dissipation Factor (DF)	120Hz/20°C			Please see the attached characteristics list			
Leakage current	Rated voltage applied, after 5 minutes			Please see the attached characteristics list			
Equivalent series resistance (ESR)	100kHz/20°C			Please see the attached characteristics list			
Characteristics of impedance ratio at high temp. and low temp.	100kHz/+20°C	−55°C	Z/Z _{20°C}	0.6 to 2.0			
		+85°C	Z/Z _{20°C}	0.6 to 2.0			
Endurance	105°C, 1,000h rated voltage applied ※Rated temp, 85°C Products: 85°C, 1,000h, rated voltage applied	ΔC/C		Within±20% of the initial value			
		DF		≤ 1.5 times of the initial limit			
		LC		Within the initial limit			
Damp heat (Steady State)	60°C, 90 to 95%RH, 500h, No-applied voltage	ΔC/C		Within+50%, −20% of the initial value (ETPH220MABC)			
		ΔC/C		Within+40%, −20% of the initial value (Except for above model)			
		DF		≤ 1.5 times of the initial limit			
		LC		≤ 3 times of the initial limit			
Surge	105°C, 1,000 cycles, 1kΩ discharge resistance, surge voltage applied ※Rated temp, 85°C Products:85°C	ΔC/C		Within±5% of the initial value			
		DF		Within the initial limit			
		LC		≤ 3 times of the initial limit			

Marking and dimensions








Rated capacitance※2

Anode(+) →

Rated voltage※1

Year

Week




Rated capacitance※2

Anode(+) →

Rated voltage※1

Year

Week



※1 The rated voltage is as follows.

R.V.	2.5	4.0	6.3	10
Mark	e	g	j	A

※2 The rated capacitance is as follows.

Capacitance(μF)	33	47	68	100	150	220
Mark	N7	S7	W7	A8	E8	J8

(unit : mm)

Size code	L ±0.2	W ±0.2	H ±0.1	S ±0.2	W1 ±0.1
A09	3.2	1.6	0.9	0.8	1.2
A14	3.2	1.6	1.4	0.8	1.2

Recommended land pattern dimension of PWB

(unit : mm)			
Size code	a	b	c
A09	1.6	1.4	1.0
A14	1.6	1.4	1.0

Size list

RV:Rated voltage

RV	2.5	4.0	6.3	10
μF				
33				A09
47			A09	
68		A09		
100	A09		A14, A09	
150		A14		
220	A14			

TPH series characteristics list

Size code	Part number	Rated voltage (V)	Rated temperature (°C)	Rated capacitance (μF)	Category voltage (V)	Category temperature (°C)	DF (% max)	LC (μA) max/5min.	ESR (mΩmax) 100kHz/20°C	Maximum allowable ripple current (mA rms) 100kHz※1	MSL Reflow temp. ≤ 260°C Reflow temp. ≤ 250°C
A09	ATPH33MAHA	10	85	33	10	85	10	33.0	150	510	3
	6TPH100MAEA	6.3	85	100	6.3	85	10	63.0	100	670	3
	6TPH47MHA	6.3	105	47	6.3	105	10	29.6	150	510	3
	4TPH68MHA	4.0	105	68	4.0	105	10	27.2	150	510	3
	ETPH100MHA	2.5	105	100	2.5	105	10	25.0	150	510	3
A14	6TPH100MABC	6.3	85	100	6.3	85	10	126.0	70	740	3
	4TPH150MABC	4.0	85	150	4.0	85	10	120.0	70	740	3
	ETPH220MABC	2.5	85	220	2.5	85	10	110.0	70	740	3

※1 100k to 500kHz, 45°C

Surface
mount type

TPG Series

Update



RoHS compliance, Halogen free

Small size, Low profile: L3.5xW2.8xH1.1mm (B1G)

Large capacitance: 6.3V220μF (B15G)

Specifications

Items	Condition			Specifications					
Rated voltage (V)	—			2.5	4.0	6.3	8.0	10	12.5
Surge voltage (V)	—			2.9	4.6	7.2	9.2	12	14
Category temperature range (°C)	—			−55 to +105					
Capacitance tolerance (%)	120Hz/20°C			M : ±20					
Rated capacitance range (μF)	120Hz/20°C			33 to 220					
Dissipation Factor (DF)	120Hz/20°C			Please see the attached characteristics list					
Leakage current	Rated voltage applied, after 5 minutes			Please see the attached characteristics list					
Equivalent series resistance (ESR)	100kHz/20°C			Please see the attached characteristics list					
Characteristics of impedance ratio at high temp. and low temp.	100kHz/+20°C	−55°C	Z/Z _{20°C}	0.6 to 2.0					
		+105°C	Z/Z _{20°C}	0.6 to 2.0					
Endurance	85°C, 1,000h rated voltage applied	ΔC/C		Within±20% of the initial value					
		DF		≤ 1.5 times of the initial limit					
		LC		Within the initial limit					
Damp heat (Steady State)	60°C, 90 to 95RH, 500h, No-applied voltage	ΔC/C		Within+40%, −20% of the initial value					
		DF		≤ 1.5 times of the initial limit					
		LC		≤ 3 times of the initial limit					
Surge	85°C, 1,000 cycles, 1kΩ discharge resistance, surge voltage applied	ΔC/C		Within±5% of the initial value					
		DF		Within the initial limit					
		LC		≤ 3 times of the initial limit					

Marking and dimensions

Technical drawing of a capacitor. The top view shows a rectangular component with length L and width W . The side view shows a component with height H and base width S . A detail view shows the mounting tab with width $W1$.

Diagram of the capacitor marking. The marking area contains the following information: Anode (+), Rated capacitance※3 (A8), Rated voltage※1 (J), and Lot. No.※2 (G).

※1 The rated voltage is as follows.

R.V.	2.5	4.0	6.3	8.0	10	12.5
Mark	e	g	j	k	A	B

※2 Lot.No.shows roughly manufacturing date.

※3 The rated capacitance is as follows.

Capacitance(μF)	33	47	100	150	220
Mark	N7	S7	A8	E8	J8

(unit : mm)

Size code	$L \begin{smallmatrix} +0.3 \\ -0.1 \end{smallmatrix}$	$W \begin{smallmatrix} +0.3 \\ -0.1 \end{smallmatrix}$	$H \pm 0.1$	$S \pm 0.2$	$W1 \pm 0.1$
B1G	3.5	2.8	1.1	0.8	2.2
B15G	3.5	2.8	1.4	0.8	2.2

Recommended land pattern dimension of PWB

The diagram illustrates the recommended land pattern dimensions for a PWB. It consists of two identical rectangular components, each with a stippled pattern. The top view shows the width of each component as 'a' and the distance between them as 'c'. The side view shows the height of each component as 'b'.

(unit : mm)

Size code	a	b	c
B1G	1.6	2.7	1.4
B15G	1.6	2.7	1.4

Size list

RV:Rated voltage

RV	2.5	4.0	6.3	8.0	10.0	12.5
μF						
33						B1G
47				B1G	B1G	
100			B1G			
150			B15G			
220	B1G,B15G	B15G	B15G			

TPG series characteristics list

Size code	Part number	Rated voltage (V)	Rated temperature (°C)	Rated capacitance (μF)	Category voltage (V)	Category temperature (°C)	DF (% max)	LC (μA) max/5min.	ESR (mΩmax) 100kHz/20°C	Maximum allowable ripple current (mA rms) 100kHz※1	MSL Reflow temp. ≤ 260°C	Reflow temp. ≤ 250°C
B1G	12TPG33M	12.5	85	33	10	105	10	41.3	70	1000	3	3
	10TPG47M	10	85	47	8.0	105	10	47.0	70	1000	3	3
	8TPG47M	8.0	85	47	6.4	105	10	37.6	70	1000	3	3
	6TPG100M	6.3	85	100	5.0	105	10	63.0	70	1000	3	3
	6TPG100MG	6.3	85	100	5.0	105	10	63.0	55	1100	3	3
	6TPG100MZGD※2	6.3	85	100	5.0	105	10	126.0	35/300kHz	1200	3	3
	2R5TPG220M	2.5	85	220	2.0	105	10	55.0	70	1000	3	3
	6TPG220MZG※2	6.3	85	220	5.0	105	10	277.2	35/300kHz	1200	3	3
B15G	6TPG150M	6.3	85	150	5.0	105	10	94.5	70	1000	3	3
	6TPG150MZG	6.3	85	150	5.0	105	10	189.0	35/300kHz	1200	3	3
	4TPG220M	4.0	85	220	3.2	105	10	88.0	70	1000	3	3
	2R5TPG220MUG	2.5	85	220	2.0	105	10	110.0	30/300kHz	1400	3	3

※1 100k to 500kHz, 45°C ※2 Under development

※ Red letters : New models



Specifications

Items	Condition		Specifications	
Rated voltage (V)	—		2.0	2.5
Surge voltage (V)	—		2.3	2.9
Category temperature range (°C)	—		-55 to +105	
Capacitance tolerance (%)	120Hz/20°C		M : ±20	
Rated capacitance range (μF)	120Hz/20°C		200 to 270	
Dissipation Factor (DF)	120Hz/20°C		Please see the attached characteristics list	
Leakage current	Rated voltage applied, after 5 minutes		Please see the attached characteristics list	
Equivalent series resistance (ESR)	100kHz/20°C		Please see the attached characteristics list	
Characteristics of impedance ratio at high temp. and low temp.	100kHz/+20°C	-55°C	Z/Z _{20°C}	0.6 to 2.0
		+105°C	Z/Z _{20°C}	0.6 to 2.0
		ΔC/C		Within±20% of the initial value
		DF		≤ 1.5 times of the initial limit
Endurance	105°C, 1,000h, rated voltage applied ※Rated temp, 85°C Products: 85°C, 1,000h, rated voltage applied	LC		Within the initial limit
		ΔC/C		Within+40%, -20% of the initial value
		DF		≤ 1.5 times of the initial limit
Damp heat (Steady State)	60°C, 90 to 95%RH, 500h, No-applied voltage	LC		≤ 3 times of the initial limit
		ΔC/C		Within±5% of the initial value
		DF		Within the initial limit
Surge	105°C, 1,000 cycles, 1kΩ discharge resistance, surge voltage applied ※Rated temp, 85°C Products: 85°C	LC		≤ 3 times of the initial limit

Marking and dimensions

※1 The rated voltage is as follows.

R.V.	2.0	2.5
Mark	d	e

※2 Lot.No.shows roughly manufacturing date.

※3 The rated capacitance is as follows.

Capacitance(μF)	200	270
Mark	H8	L8

(unit : mm)

Size code	L ±0.2	W ±0.2	H ±0.1	S ±0.3	W1 ±0.1
B1S	3.5	2.8	1.1	0.8	2.2
B2S	3.5	2.8	1.9	0.8	2.2

Recommended land pattern dimension of PWB

The diagram illustrates the recommended land pattern dimensions for a PWB. It shows two square components, each with a side length of 'a'. The components are separated by a distance 'c'. The total width of the land pattern is 'a + c + a'. The height of the land pattern is 'b'.

(unit : mm)

Size code	a	b	c
B1S	1.6	2.7	1.4
B2S	1.6	2.7	1.4

Size list

RV:Rated voltage

RV	2.0	2.5
μF		
200		B1S
270	B2S	B2S

TPSF series characteristics list

Size code	Part number	Rated voltage (V)	Rated temperature (°C)	Rated capacitance (μF)	Category voltage (V)	Category temperature (°C)	DF (% max)	LC (μA) max/5min.	ESR (mΩmax) 100kHz/20°C	ESL (nHmax) *Typical value	Maximum allowable ripple current (mA rms) 100kHz※1	MSL Reflow temp. ≤ 260°C	Reflow temp. ≤ 250°C
B1S	ETPSF200M9ED※2	2.5	105	200	2.5	105	8.0	100	9/500kHz	0.7	2400	5	5
B2S	ETPSF270M6E※2	2.5	105	270	2.5	105	10	135	6/500kHz	0.7	3200	3	3
	2TPSF270M9G	2.0	105	270	2.0	105	8.0	108.0	9/300kHz	0.7	2400	3	3
	2TPSF270M6E	2.0	105	270	2.0	105	8.0	108.0	6/500kHz	0.7	3200	5	5

※1 100k~500kHz,45°C ※2 Under development

TPE series characteristics list

Size code	Part number	Rated voltage (V)	Rated temperature (°C)	Rated capacitance (μF)	Category voltage (V)	Category temperature (°C)	DF (% max)	LC (μA) max/5min.	ESR (mΩ max) 100kHz/20°C	Maximum allowable ripple current (mA rms) 100kHz※1	MSL Reflow temp. ≤ 260°C Reflow temp. ≤ 250°C	
B2	10TPE47MAZB	10	85	47	8.0	105	8.0	47.0	35	1400	3	3
	8TPE100MAZB	8.0	85	100	6.3	105	8.0	80.0	35	1400	3	3
	6TPE220MAZB	6.3	85	220	5.0	105	10	138.6	35	1400	3	3
	6TPE220MAPB※2	6.3	85	220	5.0	105	10	138.6	25	1400	3	3
	6TPE150MAZB	6.3	85	150	5.0	105	8.0	94.5	35	1400	3	3
	6TPE150MAPB	6.3	85	150	5.0	105	8.0	94.5	25	1600	3	3
	6TPE120MAZB	6.3	85	120	5.0	105	8.0	75.6	35	1400	3	3
	6TPE100MPB	6.3	105	100	6.3	105	8.0	63.0	25	1600	3	3
	6TPE100MAZB	6.3	85	100	5.0	105	8.0	63.0	35	1400	3	3
	4TPE220MAZB	4.0	85	220	3.2	105	8.0	88.0	35	1400	3	3
	4TPE150MAZB	4.0	85	150	3.2	105	8.0	60.0	35	1400	3	3
	4TPE100MZB	4.0	105	100	4.0	105	8.0	40.0	35	1400	3	3
	2R5TPE330MAZB	2.5	85	330	2.0	105	8.0	82.5	35	1400	3	3
	ETPE330MAFB※2	2.5	85	330	2.0	105	8.0	165.0	15	2700	3	3
	ETPE330MA9GB※2	2.5	85	330	2.0	105	8.0	165.0	9/300kHz	3200	3	3
	2R5TPE220MZB	2.5	105	220	2.5	105	8.0	55.0	35	1400	3	3
	2R5TPE220MLB	2.5	105	220	2.5	105	8.0	55.0	21	1700	3	3
	2R5TPE220MFGB	2.5	105	220	2.5	105	8.0	110.0	15/300kHz	1800	3	3
	2R5TPE220MAZB	2.5	85	220	2.0	105	8.0	55.0	35	1400	3	3
	2R5TPE220MAPB	2.5	85	220	2.0	105	8.0	55.0	25	1600	3	3
	2R5TPE220MAFB	2.5	85	220	2.0	105	8.0	110.0	15	2000	3	3
	2TPE470MAJGB	2.0	85	470	1.8	105	10	188.0	11/300kHz	2300	3	3
	2TPE330MFB	2.0	105	330	2.0	105	8.0	132.0	15	2000	3	3
	2TPE330MAFB	2.0	85	330	1.8	105	8.0	132.0	15	2000	3	3
	2TPE330MADGB	2.0	85	330	1.8	105	8.0	132.0	13/300kHz	2000	3	3

※1 100k to 500kHz, 45°C ※2 Under development

TPE series characteristics list

Size code	Part number	Rated voltage (V)	Rated temperature (°C)	Rated capacitance (μF)	Category voltage (V)	Category temperature (°C)	DF (% max)	LC (μA) max/5min.	ESR (mΩmax) 100kHz/20°C	Maximum allowable ripple current (mA rms) 100kHz※1	MSL	
											Reflow temp. ≤ 260°C	Reflow temp. ≤ 250°C
D15E	6TPE470MAZU	6.3	85	470	5.0	105	10	296.1	35	1700	3	2a
D2E	10TPE68M	10	105	68	10	105	10	68.0	25	2400	3	2a
	6TPE330MAP	6.3	85	330	5.0	105	10	207.9	25	2400	3	2a
	6TPE220MAP	6.3	85	220	5.0	105	10	138.6	25	2400	3	2a
	6TPE220M	6.3	105	220	6.3	105	10	138.6	25	2400	3	2a
	6TPE220MI	6.3	105	220	6.3	105	10	138.6	18	2800	3	2a
	6TPE150M	6.3	105	150	6.3	105	10	94.5	25	2400	3	2a
	6TPE150MI	6.3	105	150	6.3	105	10	94.5	18	2800	3	2a
	6TPE150MF	6.3	105	150	6.3	105	10	94.5	15	3100	3	2a
	6TPE100M	6.3	105	100	6.3	105	10	63.0	25	2400	3	2a
	6TPE100MI	6.3	105	100	6.3	105	10	63.0	18	2800	3	2a
	4TPE330M	4.0	105	330	4.0	105	10	132.0	25	2400	3	2a
	4TPE330MI	4.0	105	330	4.0	105	10	132.0	18	2800	3	2a
	4TPE220M	4.0	105	220	4.0	105	10	88.0	25	2400	3	2a
	4TPE220MI	4.0	105	220	4.0	105	10	88.0	18	2800	3	2a
	4TPE220MF	4.0	105	220	4.0	105	10	88.0	15	3100	3	2a
	4TPE150MI	4.0	105	150	4.0	105	10	60.0	18	2800	3	2a
	2R5TPE470MI	2.5	105	470	2.5	105	10	117.5	18	2800	3	2a
	2R5TPE470MF	2.5	105	470	2.5	105	10	117.5	15	3100	3	2a
	2R5TPE470MC	2.5	105	470	2.5	105	10	117.5	12	3500	3	2a
	2R5TPE470M9	2.5	105	470	2.5	105	10	117.5	9	3900	3	2a
	2R5TPE470M7	2.5	105	470	2.5	105	10	117.5	7	4400	3	2a
	2R5TPE330M	2.5	105	330	2.5	105	10	82.5	25	2400	3	2a
	2R5TPE330MI	2.5	105	330	2.5	105	10	82.5	18	2800	3	2a
	2R5TPE330MF	2.5	105	330	2.5	105	10	82.5	15	3100	3	2a
	2R5TPE330MC	2.5	105	330	2.5	105	10	82.5	12	3500	3	2a
	2R5TPE330M9	2.5	105	330	2.5	105	10	82.5	9	3900	3	2a
	2R5TPE330M7	2.5	105	330	2.5	105	10	82.5	7	4400	3	2a
	2R5TPE220M	2.5	105	220	2.5	105	10	55.0	25	2400	3	2a
	2R5TPE220MI	2.5	105	220	2.5	105	10	55.0	18	2800	3	2a
	2R5TPE220MF	2.5	105	220	2.5	105	10	55.0	15	3100	3	2a
	2R5TPE220M9	2.5	105	220	2.5	105	10	55.0	9	3900	3	2a
D3L	10TPE220ML	10	105	220	10	105	10	220.0	25	2400	—	2a
	10TPE220MIL	10	105	220	10	105	10	220.0	18	2800	—	2a
	6TPE330MAL	6.3	85	330	5.0	105	10	207.9	25	2400	3	2a
	6TPE330MA9EL	6.3	85	330	5.0	105	10	207.9	9/500kHz	3900	3	2a
	6TPE330ML	6.3	105	330	6.3	105	10	207.9	25	2400	3	2a
	6TPE330MIL	6.3	105	330	6.3	105	10	207.9	18	2800	3	2a
	6TPE330MFL	6.3	105	330	6.3	105	10	207.9	15	3100	3	2a
	4TPE470ML	4.0	105	470	4.0	105	10	188.0	25	2400	3	2a
	4TPE470MIL	4.0	105	470	4.0	105	10	188.0	18	2800	3	2a
	4TPE470MFL	4.0	105	470	4.0	105	10	188.0	15	3100	3	2a
	4TPE470MCL	4.0	105	470	4.0	105	10	188.0	12	3500	3	2a
	4TPE470MAL	4.0	105	470	4.0	105	10	188.0	10	4400	3	2a
D4	2R5TPE680MFL	2.5	105	680	2.5	105	10	170.0	15	3100	3	2a
	2R5TPE680MCL	2.5	105	680	2.5	105	10	170.0	12	3500	3	2a
	10TPE330M	10	105	330	10	105	10	330.0	25	3000	—	2a
	6TPE680M	6.3	105	680	6.3	105	15	428.4	25	3000	3	2a
	6TPE680MI	6.3	105	680	6.3	105	15	428.4	18	3500	3	2a
	6TPE470M	6.3	105	470	6.3	105	15	296.1	25	3000	3	2a
	6TPE470MI	6.3	105	470	6.3	105	15	296.1	18	3500	3	2a
	6TPE330MAA	6.3	85	330	5.0	105	15	207.9	10	4400	3	2a
	2R5TPE1000MF	2.5	105	1000	2.5	105	15	250.0	15	3900	3	2a
	2R5TPE1500MF	2.5	105	1500	2.5	105	15	375.0	15	3900	—	2a
	2R5TPE1500MC	2.5	105	1500	2.5	105	15	375.0	12	4400	—	2a

※1 100k to 500kHz, 45°C

TPB series characteristics list

Size code	Part number	Rated voltage (V)	Rated temperature (°C)	Rated capacitance (μF)	Category voltage (V)	Category temperature (°C)	DF (% max)	LC (μA) max/5min.	ESR (mΩ max) 100kHz/20°C	Maximum allowable ripple current (mA rms) 100kHz※1	MSL	
											Reflow temp. ≤ 260°C	Reflow temp. ≤ 250°C
B2	10TPB47M	10	105	47	10	105	8.0	47.0	70	1100	3	3
	10TPB33M	10	105	33	10	105	8.0	33.0	70	1100	3	3
	6TPB68M	6.3	105	68	6.3	105	8.0	42.8	70	1100	3	3
	4TPB68M	4.0	105	68	4.0	105	8.0	27.2	70	1100	3	3
D3L	10TPB220ML	10	105	220	10	105	10	220.0	40	2000	—	2a
	10TPB150ML	10	105	150	10	105	10	150.0	40	2000	3	2a
	6TPB330ML	6.3	105	330	6.3	105	10	207.9	40	2000	3	2a
	6TPB330MAL	6.3	85	330	5.0	105	10	207.9	40	2000	3	2a
	6TPB220ML	6.3	105	220	6.3	105	10	138.6	40	2000	3	2a
	4TPB330ML	4.0	105	330	4.0	105	10	132.0	40	2000	3	2a
D4	10TPB330M	10	105	330	10	105	10	330.0	35	3000	—	2a
	10TPB220M	10	105	220	10	105	10	220.0	40	3000	3	2a
	6TPB470M	6.3	105	470	6.3	105	15	296.1	35	3000	3	2a
	6TPB330M	6.3	105	330	6.3	105	10	207.9	40	3000	3	2a

※1 100k to 500kHz, 45°C

TPC series characteristics list

Size code	Part number	Rated voltage (V)	Rated temperature (°C)	Rated capacitance (μF)	Category voltage (V)	Category temperature (°C)	DF (% max)	LC (μA) max/5min.	ESR (mΩ max) 100kHz/20°C	Maximum allowable ripple current (mA rms) 100kHz※1	MSL	
											Reflow temp. ≤ 260°C	Reflow temp. ≤ 250°C
B1	12TPC15M	12.5	85	15	10	105	10	18.8	80	800	3	3
	12TPC10M	12.5	85	10	10	105	10	12.5	80	800	3	3
	8TPC22M	8.0	85	22	6.3	105	10	17.6	70	1000	3	3
	6TPC47MB	6.3	85	47	5.0	105	10	29.6	70	1000	3	3
	6TPC47M	6.3	85	47	5.0	105	10	29.6	55	1100	3	3
D2	10TPC100M	10	105	100	10	105	10	100.0	45	1700	3	2a
	10TPC68M	10	105	68	10	105	10	68.0	45	1700	3	2a
	8TPC150M	8.0	105	150	8.0	105	10	120.0	40	1900	3	2a
	6TPC330MA	6.3	85	330	5.0	105	10	207.9	40	1900	3	2a
	6TPC150M	6.3	105	150	6.3	105	10	94.5	40	1900	3	2a
	6TPC100M	6.3	105	100	6.3	105	10	63.0	45	1700	3	2a

※1 100k~500kHz,45°C

TPF series characteristics list

Size code	Part number	Rated voltage (V)	Rated temperature (°C)	Rated capacitance (μF)	Category voltage (V)	Category temperature (°C)	DF (% max)	LC (μA) max/5min.	ESR (mΩ max) 100kHz/20°C	Maximum allowable ripple current (mA rms) 100kHz※1	MSL Reflow temp. ≤ 260°C Reflow temp. ≤ 250°C	
D2E	2TPF330M6	2.0	105	330	2.0	105	10	132.0	6	4700	—	2a
	2TPF220M6	2.0	105	220	2.0	105	10	88.0	6	4700	—	2a
D3L	10TPF150ML	10	105	150	10	105	10	150.0	15	3600	—	2a
	6TPF330M9L	6.3	105	330	6.3	105	10	207.9	9	3900	3	2a
	6TPF330M5EL※2	6.3	105	330	6.3	105	10	207.9	5/500kHz	6200	3	2a
	6TPF220ML	6.3	105	220	6.3	105	10	138.6	12	4000	3	2a
	6TPF220M9L	6.3	105	220	6.3	105	10	138.6	9	4600	3	2a
	6TPF220M5L	6.3	105	220	6.3	105	10	138.6	5	6100	3	2a
	4TPF470ML	4.0	105	470	4.0	105	10	188.0	10	4400	3	2a
	4TPF470M5EL※2	4.0	105	470	4.0	105	10	188.0	5/500kHz	6200	3	2a
	4TPF330ML	4.0	105	330	4.0	105	10	132.0	12	4000	3	2a
	2R5TPF680ML	2.5	105	680	2.5	105	10	170.0	10	4400	3	2a
	2R5TPF680M7L	2.5	105	680	2.5	105	10	170.0	7	4400	3	2a
	2R5TPF680M6L	2.5	105	680	2.5	105	10	170.0	6	4400	3	2a
	2R5TPF470ML	2.5	105	470	2.5	105	10	117.5	10	4400	3	2a
	2R5TPF470M7L	2.5	105	470	2.5	105	10	117.5	7	4400	3	2a
	2R5TPF470M6L	2.5	105	470	2.5	105	10	117.5	6	4400	3	2a
	2R5TPF330M7L	2.5	105	330	2.5	105	10	82.5	7	4400	3	2a
D4	6TPF470MAH	6.3	105	470	6.3	105	10	296.1	10	4400	3	2a
	4TPF680MAH	4.0	105	680	4.0	105	10	272.0	10	4400	3	2a
	ETPF1000M6H	2.5	105	1000	2.5	105	10	250.0	6	5600	3	2a
	ETPF1000M5H	2.5	105	1000	2.5	105	10	250.0	5	6100	3	2a
	ETPF680M5H	2.5	105	680	2.5	105	10	170.0	5	6100	3	2a
	ETPF470M5H	2.5	105	470	2.5	105	10	117.5	5	6100	3	2a

※1 100k to 500kHz, 45°C ※2 Under development

Specifications

Items	Condition		Specifications	
Rated voltage (V)	—		6.3	10
Surge voltage (V)	—		7.2	12
Category temperature range (°C)	—		−55 to +125	
Capacitance tolerance (%)	120Hz/20°C		M : ±20	
Rated capacitance range (μF)	120Hz/20°C		68 to 150	
Dissipation Factor (DF)	120Hz/20°C		Please see the attached characteristics list	
Leakage current	Rated voltage applied, after 5 minutes		Please see the attached characteristics list	
Equivalent series resistance (ESR)	100kHz/20°C		Please see the attached characteristics list	
Characteristics of impedance ratio at high temp. and low temp.	100kHz/+20°C	−55°C	Z/Z _{20°C}	0.6 to 2.0
		+105°C	Z/Z _{20°C}	0.6 to 2.0
		temp	125	105
		ΔC/C	Within±20% of the initial value	Within±20% of the initial value
Endurance	125°C, 1,000h, category voltage applied (105°C 2,000h, rated voltage applied)	DF	≤ 2 times of the initial limit	≤ 1.5 times of the initial limit
		LC	≤ 2 times of the initial limit	Within the initial limit
		ΔC/C	Within+40%, −20% of the initial value	
		DF	≤ 1.5 times of the initial limit	
Damp heat (Load)	85°C, 85 to 90%RH, 500h, rated voltage applied	LC	Within the initial limit	
		ΔC/C	Within±5% of the initial value	
		DF	Within the initial limit	
Surge	105°C, 1,000 cycles, 1kΩ discharge resistance, surge voltage applied	LC	≤ 3 times of the initial limit	

Marking and dimensions

Technical drawing of the capacitor showing top, side, and end views with dimensions L, W, H, S, and W1.

D2E,D3Lsize

Diagram of the capacitor marking showing Anode (+), Rated capacitance, Lot. No. #2, and Rated voltage #1.

(unit : mm)

Size code	L ±0.3	W ±0.2	H ±0.2※1	S ±0.2	W1 ±0.1
D2E	7.3	4.3	1.8	1.3	2.4
D3L	7.3	4.3	2.8	1.3	2.4

※1 ±0.1:D2E

※1 The rated voltage is as follows.

R.V.	6.3	10
Mark	j	A

※2 Lot.No.shows roughly manufacturing date.

※3 The rated capacitance is as follows.

Capacitance(μF)	68	150
Mark	W7	E8

Recommended land pattern dimension of PWB

		(unit : mm) <table> <tr> <th>Size code</th><th>a</th><th>b</th><th>c</th></tr> <tr> <td>D2E</td><td>2.4</td><td>2.9</td><td>3.7</td></tr> <tr> <td>D3L</td><td>2.4</td><td>2.9</td><td>3.7</td></tr> </table>		Size code	a	b	c	D2E	2.4	2.9	3.7	D3L	2.4	2.9	3.7
Size code	a	b	c												
D2E	2.4	2.9	3.7												
D3L	2.4	2.9	3.7												

Size list

RV:Rated voltage		
RV	6.3	10.0
μF		
68		D2E
150	D2E	D3L

TV series characteristics list

Size code	Part number	Rated voltage (V)	Rated temperature (°C)	Rated capacitance (μF)	Category voltage (V)	Category temperature (°C)	DF (% max)	LC (μA) max/5min.	ESR (mΩmax) 100kHz/20°C	Maximum allowable ripple current (mA rms) 100kHz※1	MSL	
D2E	10TVE68M	10	105	68	6.3	125	10	68.0	25	2400	5	3
	6TVE150M	6.3	105	150	4.0	125	10	94.5	25	2400	5	3
D3L	10TVE150ML	10	105	150	6.3	125	10	150.0	25	2400	5	3

※1 100k to 500kHz,45°C

TH series characteristics list

Series	Size code	Part number	Rated voltage (V)	Rated temperature (°C)	Rated capacitance (μF)	Category voltage (V)	Category temperature (°C)	DF (% max)	LC (μA) max/5min.	ESR (mΩ max) 100kHz/20°C	Maximum allowable ripple current (mA rms) 100kHz※1	MSL	
THB	D3L	6THB220ML	6.3	105	220	4.0	125	10	138.6	40	2000	—	5
		4THB330ML	4.0	105	330	2.5	125	10	132.0	40	2000	—	5
	D4	10THB330M	10	105	330	6.3	125	10	330.0	35	3000	—	5
		10THB220M	10	105	220	6.3	125	10	220.0	40	3000	—	5
		6THB470M	6.3	105	470	4.0	125	15	296.1	35	3000	—	5
		6THB330M	6.3	105	330	4.0	125	10	207.9	40	3000	—	5
THC	D2	10THC68M	10	105	68	6.3	125	10	68.0	45	1700	—	5
		6THC150M	6.3	105	150	4.0	125	10	94.5	40	1900	—	5
		2R5THC220M	2.5	105	220	1.6	125	10	55.0	45	1700	—	5
THE	D2E	6THE150M	6.3	105	150	4.0	125	10	94.5	25	2400	—	5
		6THE150MI	6.3	105	150	4.0	125	10	94.5	18	2800	—	5
		4THE220M	4.0	105	220	2.5	125	10	88.0	25	2400	—	5
		4THE220MI	4.0	105	220	2.5	125	10	88.0	18	2800	—	5
		4THE220MF	4.0	105	220	2.5	125	10	88.0	15	3100	—	5
		2R5THE330M	2.5	105	330	1.6	125	10	82.5	25	2400	—	5
		2R5THE330MI	2.5	105	330	1.6	125	10	82.5	18	2800	—	5
		2R5THE330MF	2.5	105	330	1.6	125	10	82.5	15	3100	—	5

※1 100k to 500kHz,45°C

TQC series characteristics list

Size code	Part number	Rated voltage (V)	Rated temperature (°C)	Rated capacitance (μF)	Category voltage (V)	Category temperature (°C)	DF (% max)	LC (μA) max/5min.	ESR (mΩ max) 100kHz/20°C	Maximum allowable ripple current (mA rms) 100kHz※1	MSL Reflow temp. ≤ 260°C	Reflow temp. ≤ 250°C
B15	35TQC2R7MYF	35	105	2.7	35	105	10	47.3	300	800	—	3
B2	35TQC3R9MYF	35	105	3.9	35	105	10	40.9	400	500	—	3
	25TQC15MYFB	25	105	15	25	105	10	112.5	100	900	—	3
	25TQC5R6M	25	105	5.6	25	105	10	42.0	100	800	—	3
	20TQC22MYFB	20	105	22	20	105	10	132.0	90	1000	—	3
	20TQC8R2M	20	105	8.2	20	105	10	49.2	100	800	—	3
	16TQC15M	16	105	15	16	105	10	72.0	90	1000	—	3
	16TQC10M	16	105	10	16	105	10	48.0	100	800	—	3
D12	16TQC33MYFS	16	105	33	16	105	10	52.8	40	1800	—	3
D15	25TQC22MYFT	25	105	22	25	105	10	55.0	70	1400	—	3
	20TQC47MYFT	20	105	47	20	105	10	94.0	55	1500	—	3
	16TQC47MYFT	16	105	47	16	105	10	75.2	55	1500	—	3
D2	35TQC10M	35	105	10	35	105	10	35.0	120	1000	—	3
	25TQC33MYF	25	105	33	25	105	10	82.5	60	1400	—	3
	25TQC22MV	25	105	22	25	105	10	55.0	45	1500※2	—	3
	25TQC22MYFD	25	105	22	25	105	10	55.0	60	1400	—	3
	25TQC15MV	25	105	15	25	105	10	38.0	45	1500※2	—	3
	25TQC15MYFD	25	105	15	25	105	10	38.0	90	1000※2	—	3
	20TQC47MYF	20	105	47	20	105	10	94.0	55	1450	—	3
	20TQC33MYFD	20	105	33	20	105	10	66.0	60	1400	—	3
	20TQC22MYFD	20	105	22	20	105	10	44.0	80	1300	—	3
	16TQC100MYF	16	105	100	16	105	10	160.0	50	1800	—	3
	16TQC68MYF	16	105	68	16	105	10	108.8	50	1500	—	3
	16TQC47MW	16	105	47	16	105	10	75.2	40	1800	—	3
	16TQC47MYFD	16	105	47	16	105	10	75.2	55	1450	—	3
	16TQC33MYFD	16	105	33	16	105	10	52.8	70	1400	—	3
D3L	20TQC100MYF	20	105	100	20	105	10	200.0	55	1700	—	3
	16TQC150MYF	16	105	150	16	105	10	240.0	50	1800	—	3

※1 100k~500kHz, 105°C ※2 100k~300kHz, 105°C

Catalog Deletion and EOL Models

Catalog Deletion and EOL Models

● Catalog Deletion Models

The following table is a list of our items which have been deleted from our catalogs.

If you are using any of the following models on the deleted list,

please substitute them with the suggested alternative model as soon as possible.

Our company continue to supply them to customers who have already used them, for the time being.

Series	Size code	Models for deletion	Year of deletion	Alternative model	Series	Size code	Models for deletion	Year of deletion	Alternative model	
TPB	B2	8TPB47M	2009	10TPB47M	TPE	D3L	2R5TPE680ML	2012	2R5TPE680MFL	
		6TPB100MA	2009	6TPE100MAZB			2R5TPE680MIL	2011	2R5TPE680MFL	
		6TPB100MAV	2009	6TPE100MAZB		D4	4TPE680M	2011	6TPE680MI	
		6TPB47M	2009	6TPC47MB			4TPE680MI	2012	6TPE680MI	
		4TPB100M	2009	4TPE100MZB			4TPF680MAH	2012		
		2R5TPB220MA	2009	2R5TPE220MZB			2R5TPE1000M	2011	2R5TPE1000MF	
		2R5TPB100M	2012	4TPE100MZB			2R5TPE1000MI	2012	2R5TPE1000MF	
	D3L	10TPB100ML	2010	10TPC100M	TPG	B1G	10TPG33M	2011	10TPC33MB	
		6TPB150ML	2009	6TPC150M	TPL	D12T	All models	2013	-	
		4TPB470ML	2009	4TPE470ML		D15T	All models	2013	-	
		4TPB220ML	2009	4TPE220M		D2T	All models	2013	-	
		2R5TPB330ML	2009	2R5TPE330M	TPLF	D2T	All models	2013	-	
	D3	10TPB100M	2008	10TPC100M	TPSF	B2S	11TPSF62MAIG	2012	-	
		6TPB150M	2008	6TPC150M	TPH	A14	ETPH220MAZC	2013	-	
		4TPB220M	2008	4TPE220M	TPU	S09	2R5TPU22MSI	2011	6TPU22MSI	
		4TPB680M	2009	6TPE680MI			4TPU15MSI	2011	6TPU22MSI	
		4TPB470M	2009	4TPE470ML			4TPU33MSI	2011	6TPU47MSI	
		D4	2R5TPB1000M	2009		2R5TPE1000MF	S11	6TPU33MSK	2013	6TPU47MSI
			2R5TPB680M	2009		2R5TPE680MFL		4TPU47MSK	2013	6TPU47MSI
	10TPC33MB		2013	12TPG33M		2R5TPU68MSK		2013	4TPU68MSI	
TPC	B1		6TPC33M	2012		6TPC47MB	A09	10TPU33MAI	2011	ATPH33MAHA
		4TPC47M	2012	6TPC47MB		6TPU47MAI		2011	6TPH47MHA	
		2R5TPC56M	2012	6TPB68M		4TPU68MAI		2011	4TPH68MHA	
		4TPC220M	2009	4TPE220M		2R5TPU100MAI		2011	ETPH100MHA	
	D2	4TPC150M	2009	4TPE150MI	TH	D2	4THC220M	2013	4THE220M	
		2R5TPC330M	2009	2R5TPE330M		D3L	10THB100ML	2010	-	
	TPE	B2	6TPE100MZB	2011		6TPE100MPB	D4	4THB680M	2013	-
			4TPE150MUB	2013	4TPE150MAZB	TQC	C	25TQC10M	2011	25TQC15MYFD
			2R5TPE220MIB	2012	2R5TPE220MFGB			20TQC15M	2011	25TQC15MYFD
			2R5TPE220MDGB	2013	2R5TPE220MFGB			16TQC22M	2011	20TQC22MYFD
			2R5TPE150MZB	2011	2R5TPE220MZB			25TQC15M	2012	25TQC15MYFD
2TPE330MIB			2011	2TPE330MFB	25TQC22M		2012	25TQC22MYFD		
2TPE330MAFGB			2011	2TPE330MAFB	20TQC22M		2012	20TQC22MYFD		
D2E		4TPE150M	2011	4TPE150MI	D2		20TQC47MY	2012	20TQC47MYF	
		2R5TPE470M	2011	2R5TPE470MI			16TQC33M	2012	16TQC33MYFD	
		2TPE470M9	2011	2R5TPE470M9			16TQC47M	2012	16TQC47MYFD	
		2TPE470M7	2011	2R5TPE470M7			16TQC68MY	2012	16TQC68MYF	
		2TPE470M6	2011	2R5TPF470M6L			D3L	25TQC33M	2012	25TQC33MYF
		2TPE330M9	2011	2R5TPE330M9				20TQC47M	2012	20TQC47MYF
		2TPE330M7	2011	2R5TPE330M7				16TQC68M	2012	16TQC68MYF
		2TPE330M6	2011	2TPF330M6	D3		16TQC100M	2012	16TQC100MYF	
		2R5TPE220MC	2012	2R5TPE220M9						
		2R5TPE220M7	2012	2R5TPE330M7						

● EOL Models

The following table is a list of the End-Of-Life (EOL) models.

Sales of these items will end as soon as we run out of its stock.

We would like to express our appreciation for your business over the years with these products and we hope the new, alternative parts will continue to serve your needs.

Thank you very much.

Series	Size code	EOL models	EOL time	Alternative model	Series	Size code	EOL models	EOL time	Alternative model
TPA	C	10TPA33M	2012/9	10TPB33M	TPE	B2	2R5TPE220MPB	2012/9	2R5TPE220MLB
		6TPA47M	2012/9	10TPB47M		C2	8TPE100MPC2	2012/9	10TPF150ML
	D3	10TPA100M	2012/9	10TPC100M			6TPE150MPC2	2012/9	6TPE150M
		6TPA150M	2012/9	6TPC150M			6TPE150MIC2	2012/9	6TPE150MI
		4TPA220M	2012/9	4TPE220M			4TPE220MPC2	2012/9	4TPE220MI
TPB	B2	8TPB33M	2012/9	10TPB33M			4TPE220MIC2	2012/9	4TPE220MI
		4TPB150MA	2012/9	4TPE150MAZB			4TPE220MFC2	2012/9	4TPE220MF
		4TPB100MV	2012/9	4TPE100MZB			2R5TPE330MIC2	2012/9	2R5TPE330MF
		10TPB220MC	2009/10	-			2R5TPE330MFC2	2012/9	2R5TPE330MF
	C	10TPB68MC	2012/9	10TPC68M			2R5TPE330MCC2	2012/9	2R5TPE330MC
		10TPB47MC	2012/9	10TPC68M			2R5TPE330M9C2	2012/9	2R5TPE330M9
		8TPB82MC	2012/9	8TPE100MAZB		C3	10TPE180MGC	2012/9	10TPE220ML
		6TPB150MC	2012/9	6TPE150M			10TPE150MGC	2012/9	10TPE220ML
		6TPB100MC	2012/9	6TPG100MG			6TPE220MPC	2012/9	6TPE220M
		4TPB220MC	2012/9	4TPE220MI			6TPE220MIC	2012/9	6TPE220MI
		4TPB150MC	2012/9	6TPE150M			6TPE150MPC	2012/9	6TPE150M
		2R5TPB220MC	2012/9	4TPE220MI			4TPE220MPC	2012/9	4TPE220MI
	D3L	16TPB47ML	2003/6	16TQC47MYFD			4TPE220MIC	2012/9	4TPE220MI
2R5TPB680ML		2012/9	2R5TPE680MFL	2R5TPE330MPC			2012/9	2R5TPE330MF	
2R5TPB470ML		2012/9	2R5TPE470MI	2R5TPE330MIC			2012/9	2R5TPE330MF	
D3	16TPB47M	2003/6	16TQC47MYFD	2R5TPE330MFC			2012/9	2R5TPE330MF	
	2R5TPB330M	2012/9	2R5TPE330M	TPF	D2E	2TPF470M6	2012/9	2R5TPF470M6L	
	TPC	C1	8TPC33M	2012/9	12TPG33M	TPG	B1G	6TPG68MG	2012/9
6TPC100MC			2012/9	6TPG100MG	TPL	D2T	4TPG150M	2012/9	6TPG150M
6TPC68M			2012/9	6TPG100MG			2R5TPL330M7	2011/7	-
4TPC100M			2012/9	6TPG100MG	2R5TPL220MC	2012/9	-		
4TPC56M			2012/9	-	TPLF	D2T	2TPLF560M6	2011/7	-
2R5TPC82M			2012/9	-			2TPLF470M7	2012/9	-
D2		16TPC33M	2003/6	16TQC33MYFD	TPSF	B2S	2TPSF270MC	2012/9	2TPSF270M9G
TPD	D4D	2R5TPC220M	2012/9	2R5TPE220M	TPU	S08	2TPSF270M9	2012/9	2TPSF270M9G
		10TPD150M	2007/10	10TPF150ML			6TPU10M	2012/9	6TPU10MSI
		6TPD470M	2012/3	6TPF470MAH			4TPU15M	2012/9	6TPU22MSI
		6TPD330M	2007/10	6TPF330M9L			2R5TPU22M	2012/9	6TPU22MSI
		6TPD220M	2007/10	6TPF220ML			6TPU22MSK	2012/9	6TPU22MSI
		4TPD680M	2012/3	4TPF680MAH		4TPU33MSK	2012/9	6TPU47MSI	
		4TPD470M	2007/10	4TPF470ML		2R5TPU47MSK	2012/9	2R5TPU47MSI	
		4TPD330M	2007/10	4TPF330ML		B09	8TPU33MBI	2012/9	ATPH33MAHA
		2R5TPD1000M	2012/3	ETPF1000M6H	6TPU47MBI		2012/9	6TPH47MHA	
		2R5TPD1000M8	2012/3	ETPF1000M6H	4TPU68MBI		2012/9	4TPH68MHA	
		2R5TPD1000M6	2012/3	ETPF1000M6H	TH	D3L	2R5THB470ML	2012/9	6THB470M
		2R5TPD1000M5	2012/3	ETPF1000M5H		D4	2R5THB1000M	2012/9	-
		2R5TPD680M	2007/10	2R5TPF680ML			2R5THB680M	2012/9	-
		2R5TPD680M8	2007/10	2R5TPF680M7L		D4D	6THD330M	2012/3	6TPF330M9L
		2R5TPD680M6	2012/3	2R5TPF680M6L			4THD470M	2012/9	-
		2R5TPD680M5	2012/3	ETPF680M5H	2R5THD680M		2012/3	2R5TPF680M6L	
		2R5TPD470M	2007/10	2R5TPF470ML	TR		TR series	-	TA series
		2R5TPD470M8	2007/10	2R5TPF470M7L	APA	D2A	APA series	2006/4	-
		2R5TPD470M6	2012/3	2R5TPF470M6L	APB	D1	APB series	2006/4	-
		2R5TPD470M5	2012/3	ETPF470M5H	APC	D2	APC series	2009/6	-
					APD	D1	APD series	2009/6	-

※ Blue letters: added or changed models at this year.