Panasonic

Conductive Polymer Capacitors Full Line Product Guide

Conductive Polymer Capacitors
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Conductive polymer Aluminum Electrolytic Capacitors

SP-Cap

Conductive Polymer Tantalum Solid Capacitors

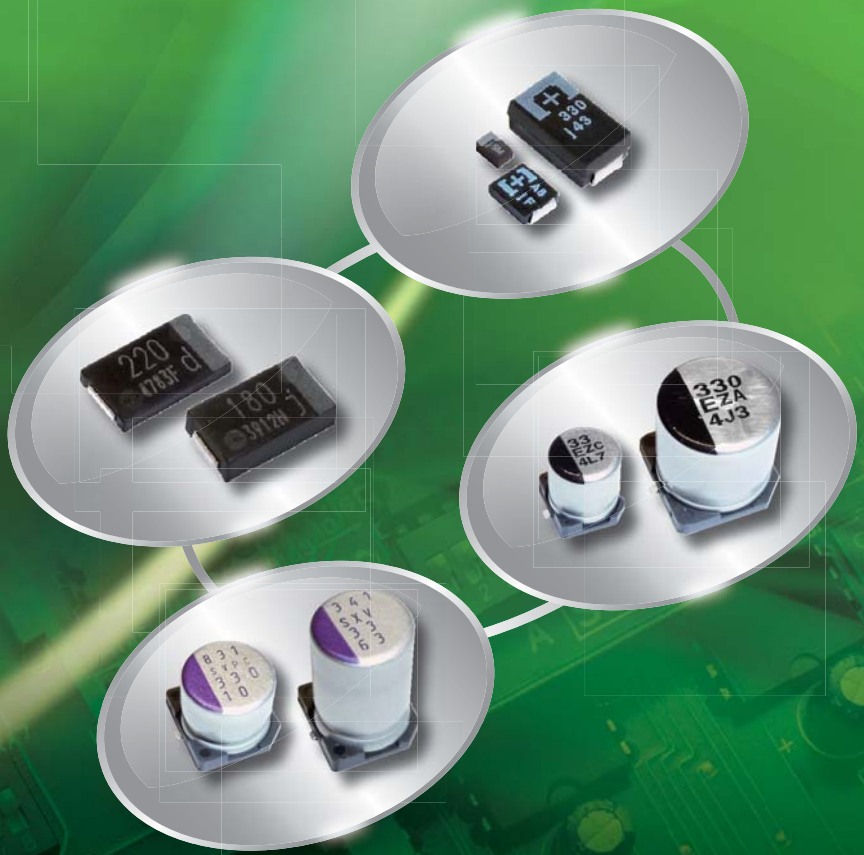
POSCAP™

Conductive Polymer Aluminum Solid Capacitors

OS-CON™

Conductive Polymer Hybrid Aluminum Electrolytic Capacitors

Hybrid



2015.12 industrial.panasonic.com/ww/

Electrolytic capacitors with conductive polymer to meet the needs of all electronic equipments in the world

SP-Cap, **POSCAP**, **OS-CON**, **Hybrid** use high conductive polymer to achieve low Equivalent Series Resistance(ESR), excellent noise reduction capability and ideal frequency. Each capacitor has long service lifetime, high reliability and high heat resistance.

Features

Low ESR by using conductive polymer

- Suitable as a decoupling capacitor to remove noises, because its impedance has ideal frequency characteristics.
- Suitable as a smoothing capacitor for switching power supply or a backup capacitor for CPU because it allows large ripple current.
- Suitable as a backup capacitor for the circuits that consumes large current at a high speed.

Long lifetime

- **SP-Cap** / **POSCAP** 105 ℃ 2000 h, **Hybrid** 125 ℃ 4000 h
- (**OS-CON**) Special series includes 1000 h guarantee at 85 ℃ 85 %RH, and is suitable for industrial equipment.

Super low ESR

- **SP-Cap** 3 mΩ max. • **POSCAP** 5 mΩ max.

Small size / Low profile

- **SP-Cap** Height1.0 mm max.
  POSCAP L2.0xW1.25xH0.9 mm
  Contribute to the miniaturization of the equipment

Superior temperature characteristics

- ESR has stable characteristics at when operating between -55 ℃ and 105 ℃ (some up to 125 ℃), suitable for applications used at low temperatures (under 0 ℃).

Rush current resistance characteristics

- (**POSCAP**)The rush current is guaranteed at 20 A.

Wide capacitance range

- **SP-Cap** <10 μF to 560 μF>
- **POSCAP** <2.7 μF to 1500 μF>
- **OS-CON** <3.3 μF to 2700 μF>
- **Hybrid** <10 μF to 330 μF>

High voltage / High reliability

- **SP-Cap** (35 V.DC)、**POSCAP** (35 V.DC)、**OS-CON** (100 V.DC)、**Hybrid** (80 V.DC) High voltage and high reliability products which are available for special purpose such as industrial equipment etc.

Environmental responsibility

- All models are PVC-free, compliant with RoHS and ELV directives, easy to use in environmental view point.

Applications

Noise removing, backup and bypass capacitors for digital equipment, cellular phone, personal computers, home appliance, automotive electric equipment, industrial equipment, etc.

PRECAUTIONS

- The contents of this catalog are current as of December 2015. They may change without prior notice. When ordering products, please be sure to request a delivery specifications form and read it carefully.
- Products described herein are not intended for applications requiring extremely high reliability (for example, those in which extensive human injury or property damage may occur such as life-support systems and automotive or aircraft control systems).
- The performance, characteristics, and features of the products described in this catalog are based on the products working alone under prescribed conditions. Data listed here is not intended as a guarantee of performance when working as part of any other product or device. In order to detect problems and situations that cannot be predicted beforehand by evaluation of supplied data, please always perform necessary performance evaluations with these devices as part of the product that they will be used in.
- When using the products listed in this catalog, please always be sure to try to prevent any possible accidents or injury by designing products in a careful and safe manner. If you have any questions concerning the use of these products, please contact any of our sales representatives.
- For any products listed in this catalog that may constitute restricted trade goods under overseas exchange or service trade laws, permission to deliver according to law may be required before importing.
- The unauthorized duplication from this catalog is forbidden firmly.
- Please understand that we cannot be held responsible for any damages to the industrial properties of any third party that arise from the use or application of the products listed in this catalog, with the exception of those items directly related to method of construction.

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SP-Cap

POSCAP

OS-CON

Hybrid

※OS-CON series, we are publishing our recommended products only.
For more details, please refer to our web site.

Environmental responsibility

Automotive & Industrial Systems Company, Panasonic Corporation

Principle

The Automotive & Industrial Systems Company Group, Panasonic Corporation, Fulfills both environmental contribution and business growth, takes care of biodiversity, and contributes to create harmonization of environment, economy and society and to achieve a sustainable society.

RoHS compliance

All capacitors comply with RoHS directive (2011/65/EU).

Restricted Substance

Restricted substances of RoHS directive
Cadmium(Cd) and it's compounds
Lead(Pb) and it's compounds
Mercury(Hg) and it's compounds
Hexavalent chromium(Cr^{+6})
Polybrominated biphenyls(PBBs)
Polybromineted diphenyl ethers(PBDEs)

Lead-free stance

All complete parts and homogenous materials of capacitors are lead-free.(JEITA, PHASE3)

ISO/TS Certified

(1) Quality Approval

Factory	Site	Applicable standard	Organization	Certificate number	Acquisition years
Uji factory	Kyoto	ISO9001:2008	JQA	JQA-2524	1998.7.31
Yamaguchi factory	Yamaguchi	ISO9001:2008	JQA	JQA-2524	1998.7.31
		ISO/TS16949:2009	JQA	JQA-AU0162-1	2007.2.23
SAGA SANYO Industries Co., Ltd.	Saga	ISO9001:2008	JQA	JQA-2524	1998.7.31
		ISO/TS16949:2009	JQA	JQA-AU0162-10	2006.7.31
PIDSG	Singapore	ISO9001:2008	BSI	FM 612824	1994.12.8
SJC	Indonesia	ISO9001:2008	DNV	01706-1995-AQ-KOB-JAQB	2006.3.24
		ISO/TS16949:2009	DNV	14795CC2-2011-AQ-JPN-IATF	2011.3.1

(2) Environment Approval

Factory	Site	Applicable standard	Organization	Certificate number	Acquisition years
Uji factory	Kyoto	ISO14001:2004	JACO	EC10J0027	1996.12.26
Yamaguchi factory	Yamaguchi	ISO14001:2004	JACO	EC10J0027	1997.12.22
SAGA SANYO Industries Co., Ltd.	Saga	ISO14001:2004	JACO	EC10J0027	1998.3.10
PIDSG	Singapore	ISO14001:2004	AJA	AJA98/1151	1998.4.9
SJC	Indonesia	ISO14001:2004	TUV NORD	08 104 0078	2010.2.15
		ISO14001:2004	TUV NORD	08 104 0182	2011.11.4

Notices / Items to be observed

Notices

Applicable laws and regulations

- This product complies with the RoHS Directive (Restriction of the use of certain Hazardous substances in electrical and electronic equipment (DIRECTIVE 2011/65/EU).
- No Ozone Depleting Chemicals(ODC's), controlled under the Montreal Protocol Agreement, are used in producing this product.
- We do not PBBs or PBDEs as brominated flame retardants.
- Export procedure which followed export related regulations, such as foreign exchange and a foreign trade method, on the occasion of export of this product Thank you for your consideration.

Limited applications

- This capacitor is designed to be used for electronics circuits such as audio/visual equipment, home appliances, computers and other office equipment, optical equipment, measuring equipment.
  High reliability and safety are required [be / a possibility that incorrect operation of this product may do harm to a human life or property] more. When use is considered by the use, the delivery specifications which suited the use separately need to be exchanged.

Items to be observed

- This specification guarantees the quality and performance of the product as individual components.
  Before use, check and evaluate their compatibility with installed in your products.
- Do not use the products beyond the specifications described in this document.

When using this capacitor in a product where safety is critical

- Install the following systems for a failsafe design to ensure safety if these products are to be used in equipment where a defect in these products may cause the loss of human life or other signification damage, such as damage to vehicles (automobile, train, vessel), traffic lights, medical equipment, aerospace equipment, electric heating appliances, combustion/gas equipment, rotating rotating equipment, and disaster/crime prevention equipment.
  ・The system is equipped with a protection circuit and protection device.
  ・The system is equipped with a redundant circuit or other system to prevent an unsafe status in the event of a single fault.

Conditions of use

- Before using the products, carefully check the effects on their quality and performance, and determined whether or not they can be used. These products are designed and manufactured for general-purpose and standard use in general electronic equipment. These products are not intended for use in the following special conditions.
  (1) In liquid, such as Water, Oil, Chemicals, or Organic solvent.
  (2) In direct sunlight, outdoors, or in dust.
  (3) In vapor, such as dew condensation water of resistive element, or water leakage, salty air, or air with a high concentration corrosive gas, such as Cl_2, H_2S, NH_3, SO_2, or NOx.
  (4) In an environment where strong static electricity or electromagnetic waves exist.
  (5) Mounting or placing heat-generating components or inflammables, such as vinyl-coated wires, near these products.
  (6) Sealing or coating of these products or a printed circuit board on which these products are mounted, with resin and other material.
  (7) Using resolvent, water or water-soluble cleaner for flux cleaning agent after soldering.
  (In particular, when using water or a water-soluble cleaning agent, be careful not to leave water residues)
  (8) Using in the atmosphere which strays Acid or alkaline.
  (9) Using in the atmosphere which there are excessive vibration and shock.
- Please arrange circuit design for preventing impulse or transitional voltage.
  Do not apply voltage, which exceeds the full rated voltage when the capacitors receive impulse voltage, instantaneous high voltage, high pulse voltage etc.
- Electrolyte is used in the products. Therefore, misuse can result in rapid deterioration of characteristics and functions of each product. Electrolyte leakage damages printed circuit and affects performance, characteristics, and functions of customer system.

Total Solutions

Features

SP-Cap
Conductive Polymer Aluminum Electrolytic Capacitors (Stack Type)
Super Low ESR | Low profile | Large capacitance

POSCAP
Conductive Polymer Tantalum Solid Capacitors (Sintered type)
Super small size | Low ESR | Large capacitance

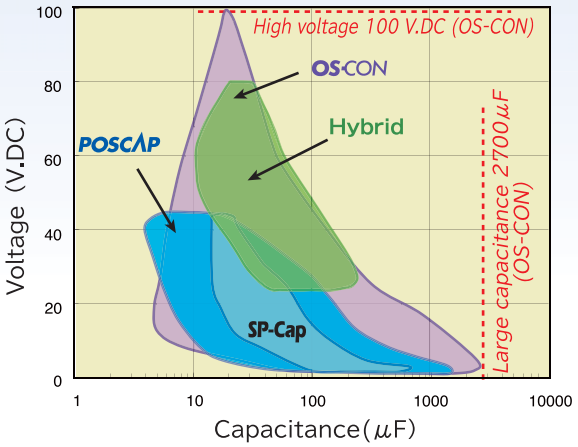
OS-CON
Conductive Polymer Alunimum Solid Capacitors (Wounf Type)
Low ESR | High voltage | Large capacitance

Hybrid
Conductive Polymer Hybrid Aluminum Electrolytic Capacitors
(Wounf Type)Conductive Polymer+Electrolyte
Low ESR | High voltage | High reliability

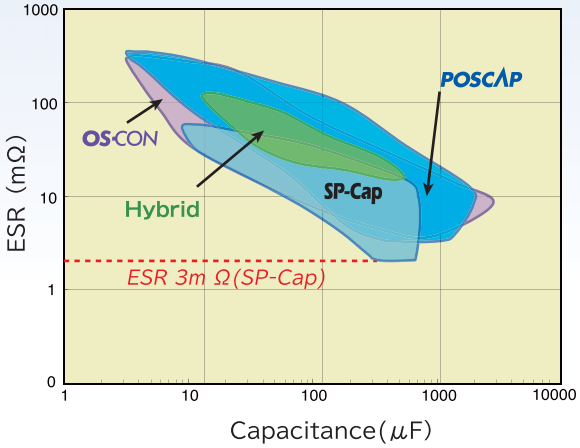
Characteristics Portfolio

Full coverage of the capacitor conductive market

voltage vs. capacitance

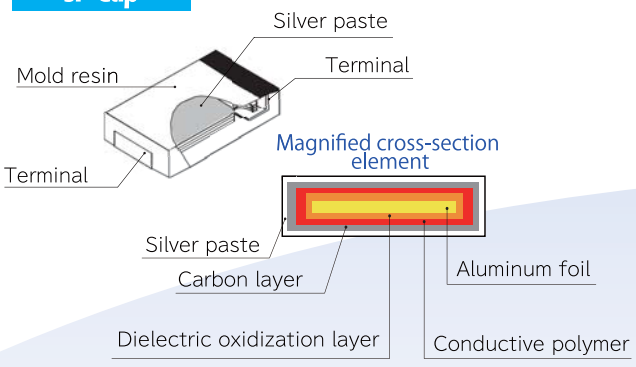


capacitance vs. ESR

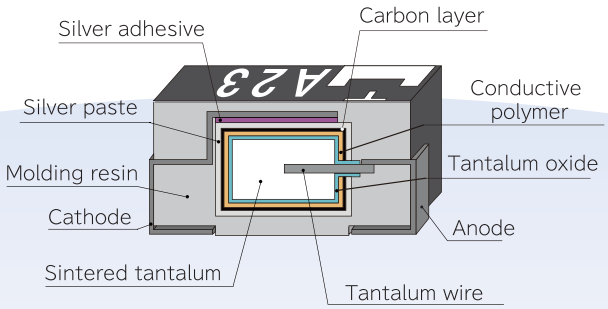


Basic structure

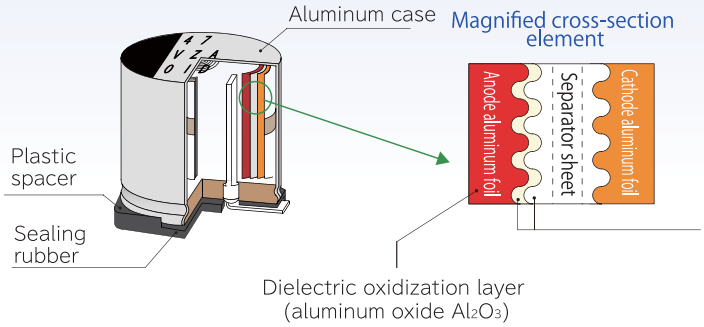
SP-Cap



POSCAP



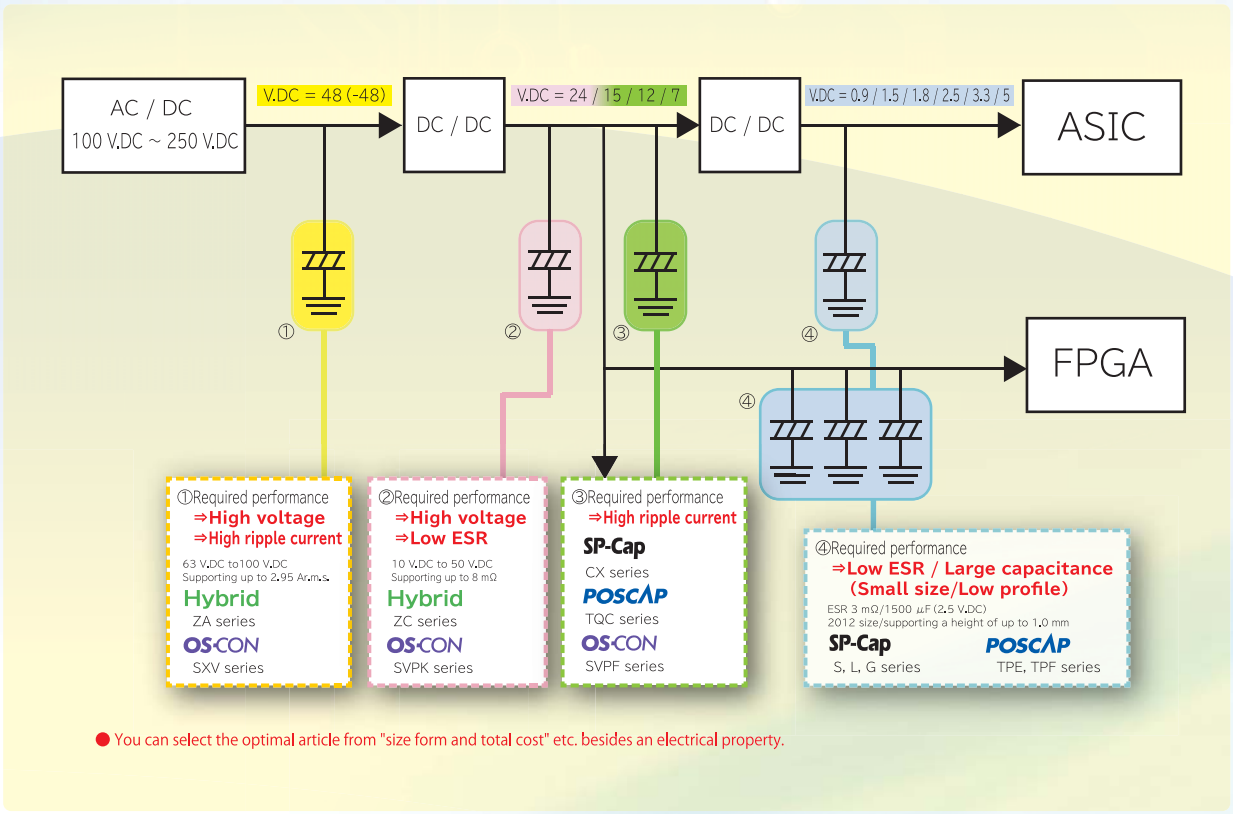
OS-CON / Hybrid



Hybrid electrolyte(Conductive polymer + Electrolyte) impregnating separator sheet[Hybrid]

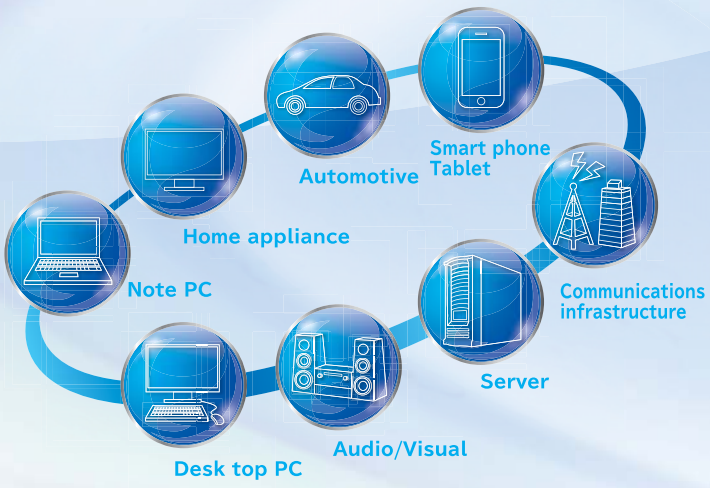
Electrolyte(Conductive polymer) impregnating separator sheet[OS-CON]

Examples of common use case four conductive products



Application

●Main market	SP-Cap	POSCAP	OS-CON	Hybrid
Note PC	●	●		
Desk top PC			●	●
Audio/Visual	●	●	●	●
Server	●	●	●	●
Communications infrastructure	●	●	●	●
Smart phone Tablet	●	●		
Automotive		●	●	●
Home appliance			●	●



Voltage & Capacitance ■SP-Cap ■POSCAP

Series (ESR mΩ) <Size> (Ripple Ar.m.s.)

V.DC \ μF	2.7	3.9	4.7	5.6	8.2	10	15	22	33	47	56	68	82
2.0													
2.5										TPU [S09] (150) (0.51)			
4.0												TPU [S09] (150) (0.51) TPH [A09] (150) (0.51) TPB [B2] (70) (1.1)	SX [D] (9) (6.3)
6.3						TPU [S09] (250) (0.4)		TPU [S09] (150) (0.51)		TPU [S09] (150) (0.51) TPH [A09] (150) (0.51) TA [B2] (70) (1.1) TPC [B1] (55/70) (1.1/1.0)		CS [D] (15) (5.1) SR [D] (9) (6.3) LR [D] (9) (6.3) TA [B2] (70) (1.1) TPB [B2] (70) (1.1)	
8.0								TPC [B1] (70) (1.0)		TPG [B1G] (70) (1)			
10			TPU [S09] (300) (0.36)						TPH [A09] (150) (0.51) TPB [B2] (70) (1.1)	CS [D] (40) (3.2) CX [D] (40) (3.2) TPG [B1G] (70) (1.0) TPE [B2] (35) (1.4) TA [B2] (70) (1.1) HX [D] (40) (3.2) TPB [B2] (70) (1.1)		CT [D] (40) (3.2) CX [D] (40) (3.2) TPE [D2E] (25) (2.4) TV [D2E] (25) (2.4) TA [D2E] (25) (2.4) HX [D] (40) (3.2) TPC [D2] (45) (1.7) THC [D2] (45) (1.7)	
12.5						TPC [B1] (80) (0.8)	TPC [B1] (80) (0.8)		TPG [B1G] (70) (1)				
16						TQC [B2] (100) (0.8)	CS [D] (40) (3.2) CX [D] (40) (3.2) TQC [B2] (90) (1.0) HX [D] (40) (3.2)	CS [D] (40) (3.2) CX [D] (40) (3.2) HX [D] (40) (3.2)	CS [D] (40) (3.2) CX [D] (40) (3.2) TQC [B2] (90) (1.0) TQC [D12] (40) (1.8) TQC [D2] (70) (1.4) HX [D] (40) (3.2)	CT [D] (40) (3.2) CX [D] (40) (3.2) TQC [D15] (55) (1.5) TQC [D2] (55/40) (1.45/1.8)		CX [D] (40) (3.2) TQC [D2] (50) (1.5) HX [D] (40) (3.2)	
20					TQC [B2] (100) (0.8)	CS [D] (40) (3.2)	CS [D] (40) (3.2)	CS [D] (40) (3.2) CX [D] (40) (3.2) TQC [B2] (90) (1.0) TQC [D2] (80) (1.3) HX [D] (40) (3.2)	CT [D] (40) (3.2) CX [D] (40) (3.2) TQC [D2] (60) (1.4) HX [D] (40) (3.2)	CT [D] (40) (3.2) CX [D] (40) (3.2) TQC [D15] (55) (1.5) TQC [D2] (55) (1.45) HX [D] (40) (3.2)	CX [D] (40) (3.2) HX [D] (40) (3.2)		
25				TQC [B2] (100) (0.8)		CS [D] (40) (3.2)	CS [D] (40) (3.2) CX [D] (40) (3.2) TQC [B2] (100) (0.9) TQC [D2] (90/45) (1.0/1.5) HX [D] (40) (3.2)	CT [D] (40) (3.2) CX [D] (40) (3.2) TQC [D15] (70) (1.4) TQC [D2] (60/45) (1.4/1.5) HX [D] (40) (3.2)	CX [D] (40) (3.2) TQC [D2] (60) (1.4) HX [D] (40) (3.2)			TQC [D3L] (70) (1.4)	
35	TQC [B15] (300) (0.8)	TQC [B2] (400) (0.5)				TQC [D2] (120) (1.0) CS [D] (40) (3.2)	TQC [D2] (150) (0.9) CT [D] (40) (3.2) CX [D] (40) (3.2)	CX [D] (40) (3.2)					

Size code

SP-Cap DxWxH (unit : mm)

D	7.3×4.3×1.0 max.	SR、LR
	7.3×4.3×1.1	CS、SS、LS
	7.3×4.3×1.4	CT、ST、LT
	7.3×4.3×1.9	CX、SX、GX、LX、GX-L

POSCAP DxWxH

S09	2.0×1.25×0.9
A09	3.2×1.6×0.9
A14	3.2×1.6×1.4

V.DC \ μF	100	120	150	180	220	270	330	390	470	560	680	1000	1500
2.0				SX [D] (9) (6.3)	CX [D] (15) (5.1) SS [D] (6) (7.5) LS [D] (6) (7.5) SR [D] (4.5/6) (8.5/7.5) LR [D] (4.5/6) (8.5/7.5) SX [D] (9) (6.3) TPF [D2E] (6) (4.7)	CX [D] (12) (5.6) SX [D] (4.5/6/9) (8.5/7.5/6.3) TPSF [B2S] (9/6) (2.4/3.2)	CX [D] (15/12) (5.1/5.6) ST [D] (6) (7.5) SX [D] (4.5/6/9) (8.5/7.5/6.3) GX [D] (3) (10.2) LT [D] (6) (7.5) LX [D] (6/4.5) (7.5/8.5) TPE [B2] (15/13) (2.0/2.0)	CX [D] (15) (5.1) SX [D] (4.5/6/9) (8.5/7.5/6.3)	CX [D] (15) (5.1) SX [D] (4.5/6/9) (8.5/7.5/6.3) LX [D] (6/4.5) (7.5/8.5) GX [D] (3) (10.2) GX-L [D] (3) (10.2) TPE [B2] (15/11) (2.3/2.3) HX [D] (4.5/6/9/15) (8.5/7.5/6.3/5.1)	CX [D] (15) (5.1) SX [D] (4.5) (8.5) LX [D] (6/4.5) (7.5/8.5) GX [D] (3) (10.2) GX-L [D] (3) (10.2) HX [D] (4.5/15) (8.5/5.1)			
2.5	TPU [S09] (150) (0.51) TPH [A09] (150) (0.51)		SX [D] (9) (6.3)	SS [D] (6) (7.5) SX [D] (9) (6.3) LS [D] (6) (7.5) SR [D] (4.5/6) (8.5/7.5) LR [D] (4.5/6) (8.5/7.5)	CX [D] (15) (5.1) SX [D] (9/7) (6.3/7.0) TPH [A14] (70) (0.74) TPG [B1G] (70) (1.0) TPG [B15G] (30) (1.4) TPE [B2] (35/25/21/15) (1.4/1.6/1.7/2.0) TPE [D2E] (25/18/15/9) (2.4/2.8/3.1/3.9) TA [D2E] (25/15/9) (2.4/3.1/3.9) TPE [D2E] (25/18/15) (2.4/2.8/3.1) THC [D2] (45) (1.7)	SX [D] (7) (7.0) ST [D] (6) (7.5) LT [D] (6) (7.5) TPSF [B2S] (6) (3.2)	CX [D] (15) (5.1) SX [D] (4.5/6/9) (8.5/7.5/6.3) LX [D] (6/4.5) (7.5/8.5) TPE [B2] (35) (1.4) TPE [D2E] (25/18/15) (2.4/2.8/3.1) TA [D2E] (25/18/15) (2.4/2.8/3.1) TPF [D3L] (7) (4.4) HX [D] (4.5/6/9/15) (8.5/7.5/6.3/5.1) THE [D2E] (15/18/25) (3.1/2.8/2.4)	CX [D] (15) (5.1) SX [D] (4.5/6/9) (8.5/7.5/6.3)	CX [D] (15) (5.1) SX [D] (4.5/6/9) (8.5/7.5/6.3) LX [D] (6/4.5) (7.5/8.5) GX [D] (3) (10.2) GX-L [D] (3) (10.2) TPE [D2E] (25/18/15/9/7) (2.4/2.8/3.1/3.5/3.9/4.4) TA [D2E] (25/15) (2.4/3.1) TPF [D3L] (10/7/6) (4.4/4.4/4.4) TPF [D4] (5) (6.1) HX [D] (4.5/6/9/15) (8.5/7.5/6.3/5.1)		TPE [D3L] (15/12) (3.1/3.5) TPF [D3L] (10/7/6) (4.4/4.4/4.4) TPF [D4] (5) (6.1) TA [D3L] (25/15) (2.4/3.1)	TPE [D4] (15) (3.9) TPF [D4] (6/5) (5.6/6.1)	TPE [D4] (15/12) (3.9/4.4)
4.0	SX [D] (9) (6.3) TPE [B2] (35) (1.4) TA [B2] (70) (1.1)	SR [D] (9) (6.3) LR [D] (9) (6.3) CS [D] (15) (5.1)	SX [D] (9/7) (6.3/7.0) TPH [A14] (70) (0.74) TPE [D2E] (18) (2.8) CX [D] (15) (5.1)	CT [D] (15) (5.1) CX [D] (15/12) (5.1/5.6) SX [D] (9) (6.3)	CX [D] (15/12) (5.1/5.6) SX [D] (9) (6.3) TPE [B2] (35) (1.4) TPE [D2E] (25/18/15) (2.4/2.8/3.1) TA [D2E] (25/18) (2.4/2.8) THE [D2E] (15/18/25) (3.1/2.8/2.4)	CX [D] (15) (5.1)	TPE [D2E] (25/18) (2.4/2.8) TPF [D3L] (12) (4.0) THB [D3L] (40) (2.0) TPB [D3L] (40) (2.0)		TPE [D3L] (10) (2.4) TPF [D3L] (10) (4.4) TA [D3L] (25/18) (2.4/2.8)		TPF [D4] (10) (4.4)		
6.3	CT [D] (15) (5.1) CX [D] (15) (5.1) TPH [A09] (100) (0.67) TPH [A09] (70) (0.74) TPG [B1G] (70/55) (1.0/1.1) TPE [B2] (35/25) (1.4/1.6) TPE [D2E] (25/18) (2.4/2.8) TPC [D2] (45) (1.7)	CX [D] (40) (3.2) SX [D] (7) (7.0) TPE [B2] (35) (1.4) TPE [D2E] (25/18/15) (2.4/2.8/3.1) TA [D2E] (25) (2.4) TV [D2E] (25) (2.4)	CX [D] (15/12) (5.1/5.6) SX [D] (9) (6.3) TPU [B09] (100) (0.67) TPG [B15G] (70/35) (1.0/1.2) TPE [B2] (35/25) (1.4/1.6) TA [D2E] (25) (2.4) TV [D2E] (25) (2.4) TPE [D2E] (25/18/15) (2.4/2.8/3.1) TPC [D2] (40) (1.9) THC [D2] (40) (1.9) THE [D2E] (18/25) (2.8/2.4)	CX [D] (15) (5.1)	TPE [B2] (35) (1.4) TPE [D3L] (25/18) (2.4/2.8) TPF [D3L] (12/9/5) (4.0/4.6/6.1) TA [D2E] (25/18) (2.4/2.8) THB [D3L] (40) (2.0) THB [D4] (40) (3.0) TPB [D3L] (40) (2.0)		TPE [D2E] (25) (2.4) TPE [D3L] (25/18/15/9) (2.4/2.8/3.1/3.9) TPF [D3L] (9) (3.9) TPE [D4] (10) (4.4) TA [D3L] (25) (2.4) TPC [D2] (40) (1.9) THB [D4] (40) (3.0) TPB [D3L] (40) (2.0) TPB [D4] (40) (3.0)		TPE [D15E] (35) (1.7) TPF [D4] (10) (4.4) TPE [D4] (25/18) (3.3/3.5) THB [D4] (35) (3.0)		TPE [D4] (25/18) (3.0/3.5)		
8.0	TPE [B2] (35) (1.4)		TPC [D2] (40) (1.9)										
10	CX [D] (40) (3.2) HX [D] (40) (3.2) TPC [D2] (45) (1.7)		TPF [D3L] (15) (3.6) TA [D3L] (25) (2.4) TV [D3L] (25) (2.4) TPB [D3L] (40) (2.0)		TPE [D3L] (25/18) (2.4/2.8) TA [D3L] (25) (2.4) TPB [D3L] (40) (2.0) TPB [D4] (40) (3.0)		TPE [D4] (25) (3.0) THB [D4] (35) (3.0) TPB [D4] (35) (3.0)						
12.5													
16	TQC [D2] (50) (1.8)		TQC [D3L] (50) (1.8)										
20	TQC [D3L] (55) (1.7)												
25													
35													

(unit : mm)

B09	3.5×2.8×0.9
B1, B1G	3.5×2.8×1.1
B15, B15G	3.5×2.8×1.4
B2, B2S	3.5×2.8×1.9

D12	7.3×4.3×1.15
D15, D15E	7.3×4.3×1.4
D2E	7.3×4.3×1.8
D2	7.3×4.3×1.9

D3L	7.3×4.3×2.8
D4	7.3×4.3×3.8

Voltage (More than 16V.DC) & Capacitance

SMD Type

Series (ESR mΩ)	<Size> (Ripple Ar.m.s.)

Product of 105 ℃

■OS-CON ■Hybrid

V.DC \ μF	3.3	10	15	18	22	27	33	39	47	56	68	82
16									SVPG [B45] (25) (32)		SVPC [C6] (25) (2.44)	
												SVPF [B6] (27) (3.0)
20							SVPG [B45] (27) (3.0)			SVPF [B6] (30) (2.8)		
25		SVPS [E7] (60) (1.5)	SVPG [B45] (30) (2.8)			SVPF [B6] (40) (2.45)	ZA [C] (80) (0.9)		SVPF [C6] (30) (2.8)	SVPF [C6] (30) (2.8)		SVPF [E7] (28) (3.0)
										ZA [D] (50) (1.3)		
35					ZA [C] (100) (0.9)	ZA [D] (60) (1.3)		SVPF [E7] (30) (2.8)	ZA [D] (60) (1.3)		ZA [D8] (35) (2.0)	SVPF [E12] (20) (4.0)
					SVPF [C6] (35) (2.6)							
50		ZA [C] (120) (0.75)		SVPF [E7] (35) (2.7)	ZA [D] (80) (1.1)		ZA [D8] (40) (1.6)	SVPF [E12] (25) (3.8)			ZA [F] (30) (1.8)	
		SVPF C6 (40) (2.5)			SVPK [C6] (35/2.6)						SVPF [F12] (18) (4.4)	
63		ZA [D] (120) (1.0)			ZA [D8] (80) (1.5)		ZA [F] (40) (1.7)			ZA [G] (30) (1.8)		
							SXV [E12] (25) (2.95)					
80					ZA [F] (45) (1.55)		ZA [G] (36) (1.7)					
100			SXV [E12] (40) (2.35)									

Product of 125 ℃

V.DC \ μF	8.2	10	18	22	33	39	47	56	68	82	100	120
16										SVPD [E7] E7 (40) (0.67)		
20												
25		SVPD [C6] (65) (0.474)		SVPD [E7] (48) (0.58)	ZC [C] (80) (0.55)	SVPD [F8] (45) (0.664)	SVPD [E12] (30) (0.943)	ZC [D] (50) (0.9)		SVPD [F12] (28) (1.202)	ZC [D8] (30) (1.4)	
35	SVPD [E7] (70) (0.4)		SVPD [F8] (60) (0.55)	ZC [C] (10) (0.55)			ZC [D] (60) (0.9)		ZC [D8] (35) (1.4)			
				SVPD [E12] (50) (0.7)			SVPD [F12] (30) (1.15)					
50		ZC [C] (120) (0.5)		ZC [D] (80) (0.75)	ZC [D8] (40) (1.1)				ZC [F] (30) (1.25)		ZC [G] (28) (1.6)	ZC [G] (28) (1.6)
63		ZC [D] (120) (0.7)		ZC [D8] (80) (0.9)	ZC [F] (40) (1.1)			ZC [G] (30) (1.4)	ZC [G] (30) (1.4)			
80				ZC [F] (45) (1.05)	ZC [G] (36) (1.36)		ZC [G] (36) (1.36)					

Size code

OS-CON

(unit : mm)

B45	ϕ 5×L4.5
B6	ϕ 5×L6.0

C6	ϕ 6.3×L6.0
C10	ϕ 6.3×L10.0

E7	ϕ 8×L7.0
E12	ϕ 8×L12.0

F8	ϕ 10×L8.0
F12	ϕ 10×L12.7

V.DC \ μF	100	120	150	180	220	270	330	390	470	560	1000
16	SVPC [C6] (24) (2.49)	SVPC [E7] (27) (2.9)	SVPC [E7] (22) (3.22)	SVPF [C6] (22) (3.3) SVPE [C10] (11) (4.46)		SVPG [C10] (8) (5.8) SVPF [E7] (22) (3.3) SVPC [12] (18) (4.07)			SVPE [F12] (10) (6.1)	SVPF [E12] (14) (4.95)	SVPF [F12] (12) (5.4)
20		SVPF [C6] (25) (3.2)		SVPF [E7] (25) (3.2)				SVPF [E12] (14) (4.95)		SVPF [F12] (12) (5.4)	
25	SVPF [E7] (24) (3.2) ZA [D8] (30) (2.0)			SVPF [E12] (12) (4.65)	ZA [F] (27) (2.3)		SVPF [F12] (14) (5.0) ZA [G] (20) (2.5)				
35		SVPF [F12] (20) (4.3)	ZA [F] (27) (2.3)			ZA [G] (20) (2.5)	SVPK [F12] (18) (4.4)				
50	ZA [G] (28) (2.0)										
63											
80											
100											

V.DC \ μF	150	220	270	330
16				
20				
25		ZC [F] (27) (1.6)		ZC [G] (20) (2.0)
35	ZC [F] (27) (1.6)		ZC [G] (20) (2.0)	
50				
63				

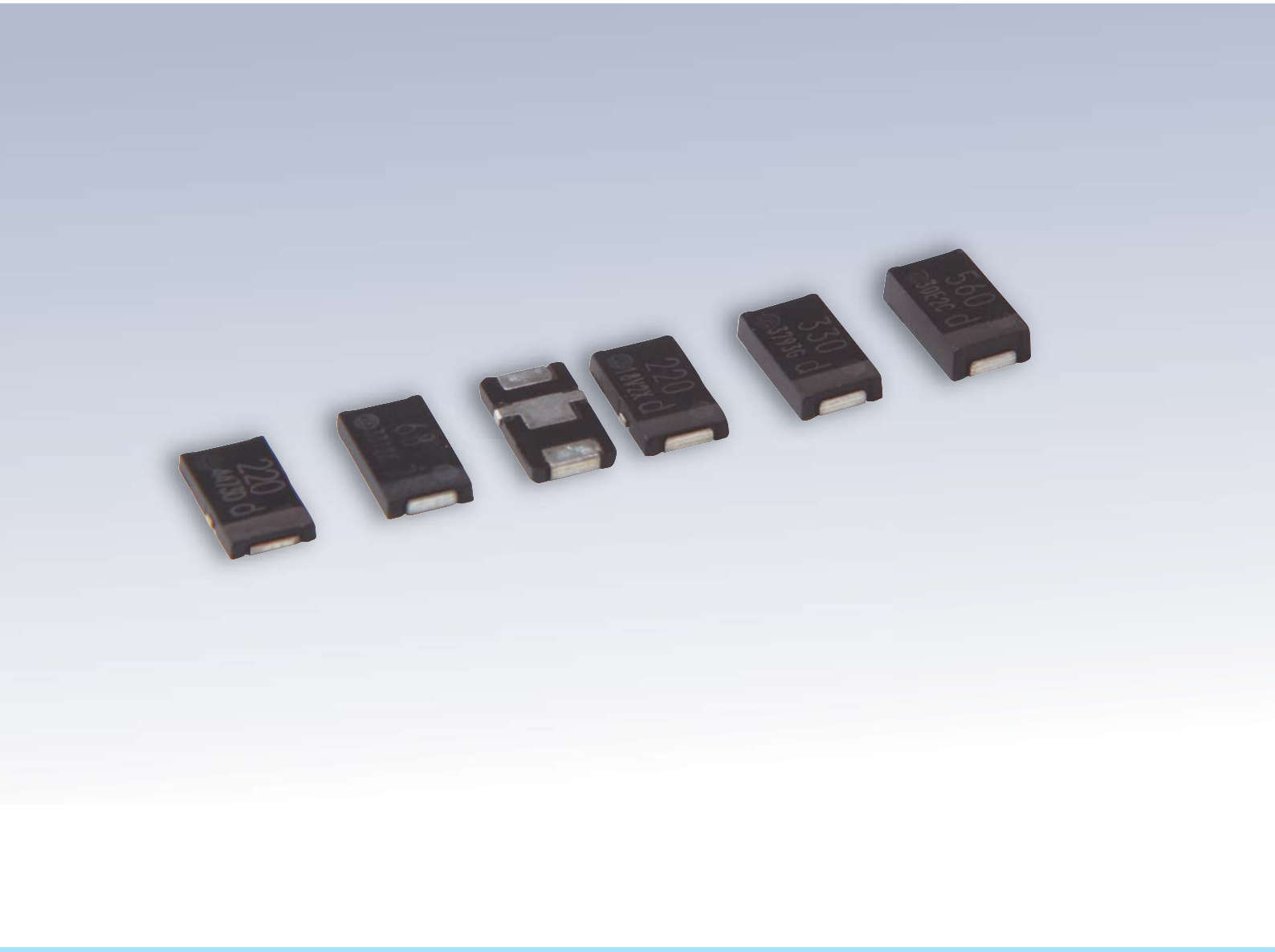
Hybrid

(unit : mm)

C	ϕ 5×L5.8
D	ϕ 6.3×L5.8
D8	ϕ 6.3×L7.7
F	ϕ 8×L10.2
G	ϕ 10×L10.2

Conductive polymer Aluminum
Electrolytic Capacitors

SP-Cap



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Conductive polymer Aluminum Electrolytic Capacitors

POSCAP

OS-CON

Hybrid

Guidelines and precautions

⚠ Application Guidelines

1.Circuit design

1-1 Prohibited circuits for use

Do not use the SP-Cap with the following circuit.
(1) Time constant circuits (2) Coupling circuits (3) 2 or more SP-Cap connected serially
(4) Circuit which are greatly affected by leakage current (5) High-impedance voltage retention circuits

1-2 Voltage & polarity

The application of over- voltage and reverse voltage described below can cause increases in leakage current and short circuits.
Applied voltage, refers to the voltage value including the peak value of the transitional Instantaneous voltage and the peak value of ripple voltage, not just steady line voltage.
Design your circuit so than the peak voltage does not exceed the stipulated voltage.
[Over-Voltage]
Do not apply over-voltage in excess of the rated voltage. Do not apply voltage, which exceeds the full rated voltage when the SP-Cap receive impulse voltage, instantaneous high voltage, high pulse voltage etc.
[Reverse-Voltage]
Do not apply reverse-voltage

1-3 Ripple current

Use the SP-Cap within the stipulated permitted ripple current.
When excessive ripple current is applied to the SP-Cap, if causes increases in leakage current and short circuits due to self-heating.
Even when using the SP-Cap under the permissible ripple current, reverse voltage may occur if the DC bias voltage is low.

1-4 Leakage current

There is a risk of leakage current characteristics increasing even if the following use environments are within the stipulated range.
However, even if the leakage current increases, the SP-Cap self-repairing function will reduce the leakage current in most cases when a voltage is applied.
(1) After re-flow
(2) Shelf conditions such as high temperature with no load, high temperature high humidity with no load and sudden temperature changes.

1-5 Temperature

Use at or under the rated (guaranteed) temperature.
Operation at temperatures exceeding specifications causes large changes in the SP-Cap electrical properties, and deterioration than can potentially lead to failure.
When calculating the operating temperature of the SP-Cap, be sure to include not only the ambient temperature and internal temperature of the unit, but also radiation from heat generating elements inside the unit (power transistors, resistors, etc.), and self-heating due to ripple current.

1-6 Calculation of the expected life time

Expected life is affected by operating temperature.
Generally, the expected life time will be 10 times by each 20 ℃ reduction in temperature.
As below can be calculated the formula for expected life time Lx(h) of SP-Cap at Tx (℃).
Not guaranteed is the life time which is obtained by this formula as well as upper limit of valid expected life time is 20 years.

$$L_X = L_0 \times 10^{\frac{T_0 - T_X}{20}}$$

T_0 Upper category temperature
T_x Temperature in actual use (Temperature of SP-Cap)
L_0 Guaranteed life at (T_0)
L_x Life expectance in actual use (T_x)

1-7 Failure rate

The majority of failure modes are short circuits or increases in leakage current.
The main factors of failure are mechanical stress, heat stress and electric stress due to re-flow and heat from the use temperature environment.
Even within the stipulated limits, it is possible to lower the failure rate by reducing use conditions such as temperature and voltage. Please be sure to have ample margin in your design.
[Expected Failure Rate]
(1) Date based on our reliability tests: 8.2 Fit or less (Based on applied rated voltage at 105 ℃)
(2) Market failure rate: 0.13 Fit or less (Based on c=0, Reliability standard : 60 %)

1-8 Mounting area considerration

Isolate the surface of PCB under the mounted SP-Cap.

2. Mounting

2-1 When mounting

(1) Check the SP-Cap ratings (capacitance and voltage) before mounting.
(2) Check the SP-Cap polarity before mounting.
(3) Check the land size for the SP-Cap before mounting.
(4) When using a mounter, if the pressure for mounting is too high, then the current leak may increase, short-circuiting may occur, or the SP-Cap may break down or come off.

2-2 Soldering

(1) Reflow soldering
Be performed by one of following methods.
(a) Ambient heat conduction reflow (IR / Hot-air) Please refer to the page of "Mounting Specifications".
(b) Vapor phase reflow (but only allowable for CX, CT, SX, ST, GX, LX, LT and HX series).
Please contact Panasonic for details of allowable vapor phase reflow condition.
(2) Wave soldering and dip soldering
Please remind SP-Cap is NOT compatible.
(3) Hand soldering
Excessive force stress to the SP-Cap should be avoided Conditions :
Tip temperature of soldering iron : 350 °C max.
Exposure time : 10 s max.
※Once removed from the printed circuit board for any reason, please do not use the SP-Cap again.

2-3 Land size

Refer to the land size of "Mounting specifications" for appropriate design dimensions.
Circuit board design requires examination of the most suitable dimensions taking conditions such as circuit board, parts and reflow into consideration.

2-4 Mechanical stress

Do not apply excessive force to the SP-Cap this can damage the electrodes and badly affect the SP-Cap mount ability.
It can also cause the increase of leakage current, separation of the lead wire and element, and damage to the SP-Cap body, all of which can badly affect the electrical performance of the SP-Cap.

2-5 Circuit board cleaning

SP-Cap should be cleaned after soldering in accordance with the following conditions.
Temperature : Less than 60 °C
Time : Within 5 min
Be sure to sufficiently wash and dry (20 min at 100 °C) the board afterward.
[Recommended Cleaning Solvents]
Pine Alpha ST-100S, Clean-thru 750H / 750L / 710M, Aqua Cleaner 210SEP, Sunelec B-12
DK Beclear CW-5790, Techno Cleaner 219, Cold Cleaner P3-375, Telpene Cleaner EC-7R
Technocare FRW-17 / FRW-1 / FRV-1, AXREL 32, IPA (Isopropyl alcohol)
(1) Consult our factory when performing processes with cleaning solvents other than those listed above or deionized water.
(2) The use of ozone depleting cleaning agents are not recommended in the interest of protecting the environment.
(3) In the case of using ultrasonic cleaning, the terminals may be broken. Therefore, please test before using in mass production.

3.Usage environment of equipment

Avoid using equipment to which SP-Cap are fi ted in the following environments.

1. In liquid, such as Water, Oil, Chemicals, or Organic solvent.
2. In direct sunlight, outdoors, or in dust.
3. In vapor, such as dew condensation water of resistive element, or water leakage, salty air, or air with a high concentration corrosive gas, such as Cl2, H2S, NH3, SO2 or NO2.
4. In an environment where strong static electricity or electromagnetic waves exist.
5. Mounting or placing heat-generating components or inflammables, such as vinyl-coated wires, near these SP-Cap.
6. Sealing or coating of these SP-Cap or a printed circuit board on which these SP-Cap are mounted, with resin and other material.
7. Acid or alkaline environments.
8. Environment subject to excessive vibration and shock.

Guidelines and precautions

4.Storage

SP-Cap should be stored in a moisture proof environment. Storage conditions before and after opening the moisture proof packaging as follows.
(If these conditions are exceeded, the package may absorb moisture and there is a risk of damage to the exterior due to heat stress during mounting.)
[Environment of Storage]

Temperature: 5 °C to 30 °C without direct sunlight
Humidity : Less than 70 %
Maximum storage term before opening the package (2 years after manufactured)
Maximum storage condition after opening the package (7 days after opening)
SP-Cap should be all used within the storage term after opening the package.

5.Transportation

Take sufficient care during handling because excessive vibration, or shock can cause the reliability of the SP-Cap to decrease.

6.Emergency procedures

If the SP-Cap is overheated, the resin case may emit smoke. If this occurs, immediately switch off the unit's main power supply to stop operation. Keep your face and hands away from the SP-Cap the temperature may be high enough to cause the SP-Cap to ignite and burn.

7.Discarding

Since SP-Cap are composed of various metals and resins, treat them as industrial waste when arranging for their disposal.

The precautions for the use of functional polymer aluminum electrolytic capacitors follow the "Precautionary guidelines for the use of fixed aluminum electrolytic capacitors for electronic equipment", RCR-2367B issued by EIAJ in March 2002. Please refer to the above guidelines for details.

Intellectual property right

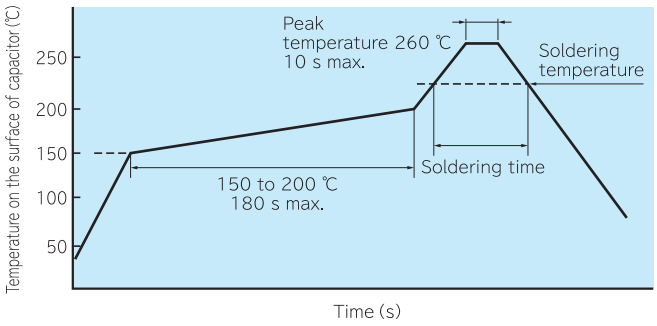
We, Panasonic Group are providing the product and service that customers can use without anxiety, and are working positively on the protection of our products under intellectual property rights.
Representative patents relating to SP-Cap are as follows:

US Patent No. 7136276

Mounting specifications / Packing specifications

Recommendable reflow soldaring

■Recommendable reflow soldering



Reflow cycle : 3 max.

Soldering temperature and Soldering time

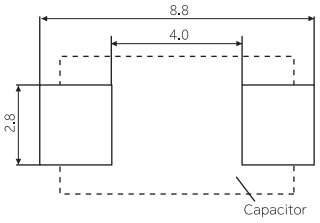
Temperature	Time
≧ 255 ℃	30 s max.
≧ 230 ℃	130 s max.
≧ 217 ℃	150 s max.

Sp-Cap recommended profile condition of the IPC/J-STD-020D standard

Land Pattern

■Typical land pattern : 2-Terminals

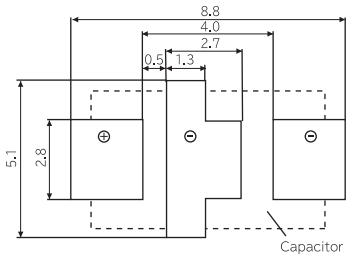
For standard terminal (C∗, S∗, G∗ Series)



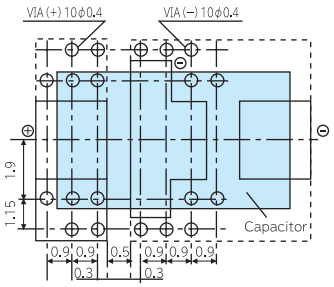
(unit : mm)

■Typical land pattern : 3-Terminals

For Low ESL terminal (L∗, GX-L Series)

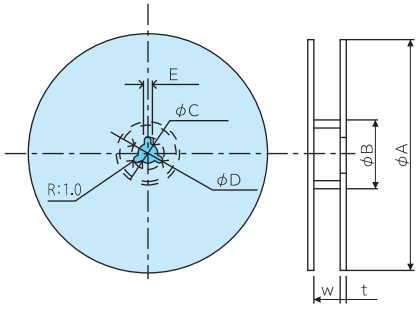


For Low ESL terminal (L∗, GX-L Series)



Packaging Specifications

■Reel Dimensions

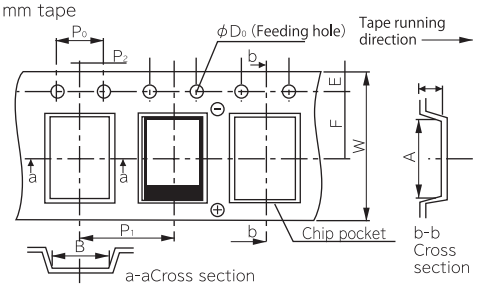


(unit : mm)

Reel	φA	φB	φC	φD	φE	W	t
φ330	330	80	13±0.5	21±0.8	2±0.5	14	3

■Embossed Taping

12 mm tape

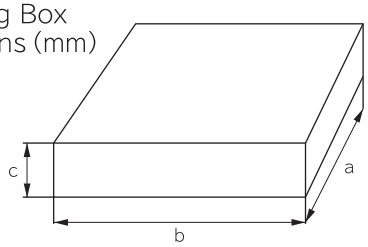


(unit : mm)

A±0.2	B±0.2	W±0.3	F±0.1	E±0.1	P1±0.1
7.6	4.5	12.0	5.5	1.75	8.0

P2±0.1	P0±0.1	φD0±0.1	t±0.2 (Series)	
			∗R/∗S	∗T/∗X
2.0	4.0	1.5	1.5	2.4

■Packaging Box Dimensions (mm)



(unit : mm)

Reel	a	b	c
φ330	400 max.	400 max.	135 max.

Line-up

Series	Page	Part No.	Features	Low profile	Low ESR	Low ESL	High voltage	High Temperature	Category temperature range (℃)	Rated voltage (V.DC)	ESR (mΩ)	Capacitance (μF)
CX	21 to 22	EEFCX----	Standard				●		-55 to 105	2 to 35	12 to 40	15 to 560
CT	21 to 22	EEFCT----		●			●		-55 to 105	4 to 35	15 to 40	15 to 180
CS	21 to 22	EEFCS----		●			●		-55 to 105	4 to 35	15 to 40	10 to 120
SX	23 to 24	EEFSX----	Low ESR		●				-55 to 105	2 to 6.3	4.5 to 9	82 to 560
GX	25 to 26	EEFGX----	Super low ESR/High ripple current		●	●			-55 to 105	2 to 2.5	3	330 to 560
LX	27 to 28	EEFLX----	Low ESR/Low ESL		●	●			-55 to 105	2 to 2.5	4.5 to 6	330 to 560
ST	29 to 30	EEFST----	Low profile/Low ESR	●	●				-55 to 105	2 to 2.5	6	270 to 330
LT	29 to 30	EEFLT----	Low profile/Low ESR/Low ESL	●	●	●			-55 to 105	2 to 2.5	6	270 to 330
SS	29 to 30	EEFSS----	Low profile/Low ESR	●	●				-55 to 105	2 to 2.5	6	180 to 220
LS	29 to 30	EEFLS----	Low profile/Low ESR/Low ESL	●	●	●			-55 to 105	2 to 2.5	6	180 to 220
SR	29 to 30	EEFSR----	Low profile(1 mm max.)	●	●				-55 to 105	2 to 6.3	4.5 to 9	68 to 220
LR	29 to 30	EEFLR----	Low profile(1 mm max.)/Low ESL	●	●	●			-55 to 105	2 to 6.3	4.5 to 9	68 to 220
HX	31 to 32	EEFHX----	Guaranteed at 125 ℃		●		●	●	-55 to 125	2 to 25	4.5 to 40	15 to 560

Series system diagram

2 terminals

Standard / High Voltage

P.21 to 22

CX series
7.3×4.3×1.9 mm
2 V.DC / 560 μF to
35 V.DC / 22 μF
ESR:12 mΩ to 40 mΩ

Low profile

P.21 to 22

CT series
7.3 x 4.3 x1.4 mm
4 V.DC / 180 μF to
35 V.DC / 15 μF
ESR:15 mΩ / 40 mΩ

P.21 to 22

CS series
7.3 x 4.3 x 1.1 mm
4 V.DC / 120 μF to
35 V.DC / 10 μF
ESR:15 mΩ / 40 mΩ

Guaranteed at 125 ℃

P.31 to 32

HX series
7.3x4.3x1.9mm
2 V.DC / 560 μF to
25 V.DC / 33 μF
ESR:4.5 mΩ to 40 mΩ

Low ESR

P.25 to 26

GX series
7.3 x 4.3 x1.9 mm
2 V.DC / 560 μF to
2.5 V.DC / 470 μF
ESR:3 mΩ

SUPER LOW ESR

P.23 to 24

SX series
7.3 x 4.3 x1.9 mm
2 V.DC / 560 μF to
6.3 V.DC / 180 μF
ESR:4.5 mΩ to 9 mΩ

Low profile

P.29 to 30

ST series
7.3 x 4.3 x1.4 mm
2 V.DC / 330 μF to
2.5 V.DC / 270 μF
ESR:6 mΩ

P.29 to 30

SS series
7.3 x 4.3 x 1.1 mm
2 V.DC / 220 μF to
2.5 V.DC / 180 μF
ESR:6 mΩ

P.29 to 30

SR series
7.3 x 4.3 x 1.0 mm (max.)
2 V.DC / 220 μF to
6.3 V.DC / 68 μF
ESR:4.5 mΩ to 9 mΩ

3 terminals

Low ESR / Low ESL※

P.25 to 26

GX-L series
7.3 x 4.3 x 1.9 mm
2 V.DC / 560 μF to
2.5 V.DC / 470 μF
ESR:3 mΩ

SUPER LOW ESR

P.27 to 28

LX series
7.3 x 4.3 x 1.9mm
2 V.DC / 560 μF to
2.5 V.DC / 470 μF
ESR:4.5 mΩ / 6 mΩ

Low profile

P.29 to 30

LT series
7.3 x 4.3 x 1.4 mm
2 V.DC / 330 μF to
2.5 V.DC / 270 μF
ESR:6 mΩ

P.29 to 30

LS series
7.3 x 4.3 x 1.1 mm
2 V.DC / 220 μF to
2.5 V.DC / 180 μF
ESR:6 mΩ

P.29 to 30

LR series
7.3 x 4.3 x 1.0mm (max.)
2 V.DC / 220 μF to
6.3 V.DC / 68 μF
ESR:4.5 mΩ to 9 mΩ

※:ESL:0.5 nH (Typ.)

Products list

Size・ESR Matrix list

Size code (ESR mΩ)

μF / V.DC	10	15	22	33	47	56	68	82	100
2.0									
2.5									
4.0								SX(9)	SX(9)
6.3							SR(9)		CT(15)
							LR(9)		CX(15)
							CS(15)		
10					CS(40)		CT(40)		CX(40)
					CX(40)		CX(40)		HX(40)
							HX(40)		
16		CS(40)	CS(40)	CS(40)	CT(40)		CX(40)		
		CX(40)	CX(40)	CX(40)	CX(40)		HX(40)		
		HX(40)	HX(40)	HX(40)	HX(40)				
20	CS(40)	CS(40)	CS(40)	CT(40)	CT(40)	CX(40)			
			CX(40)	CX(40)	CX(40)	HX(40)			
			HX(40)	HX(40)	HX(40)				
25	CS(40)	CS(40)	CT(40)	CX(40)					
		CX(40)	CX(40)	HX(40)					
		HX(40)	HX(40)						
35	CS(40)	CT(40)	CX(40)						
		CX(40)							

μF / V.DC	120	150	180	220	270	330	390	470	560
2.0			SX(9)	SX(9)	SX(9/6/4.5)	SX(9/6/4.5)	SX(9/6/4.5)	SX(9/6/4.5)	SX(4.5)
				SR(6/4.5)	CX(12)	ST(6)	CX(15)	CX(15)	CX(15)
				LR(6/4.5)		LT(6)		GX-L(3)	GX-L(3)
				SS(6)		CX (15/12)		GX(3)	GX(3)
				LS(6)		GX(3)		LX(6/4.5)	LX(6/4.5)
				CX(15)		LX(6/4.5)		HX(15/9/6/4.5)	HX(15/4.5)
2.5		SX(9)	SX(9)	SX(9/7)	SX(7)	SX(9/6/4.5)	SX(9/6/4.5)	SX(9/6/4.5)	
			SR(6/4.5)	CX(15)	ST(6)	CX(15)	CX(15)	CX(15)	
			LR(6/4.5)		LT(6)	LX(6/4.5)		GX(3)	
			SS(6)			HX(15/9/6/4.5)		LX(6/4.5)	
			LS(6)					GX-L(3)	
								HX(15/9/6/4.5)	
4.0	SR(9)	SX(9/7)	SX(9)	SX(9)	CX(15)				
	LR(9)	CX(15)	CT(15)	CX (15/12)					
	CS(15)		CX (15/12)						
6.3	CX(15)	CX (15/12)	CX(15)						
	SX(7)	SX(9)							
10									
16									
20									
25									
35									

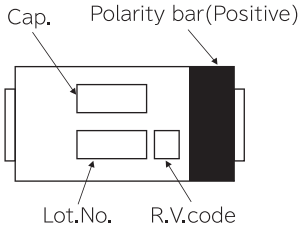
Surface mount type CS/CT/CX Series

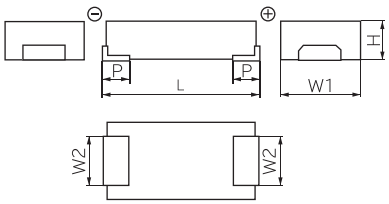
- High voltage (35 V.DC max.)
- Low profile (Height 1.1 mm)
- High ripple current (5600 mAr.m.s. max.)
- RoHS compliance, Halogen free

Specifications

Items	Specifications		
Series	CS	CT	CX
Category temperature range	-55 ℃ to 105 ℃		
Rated voltage range	4 V.DC to 35 V.DC		2 V.DC to 35 V.DC
Rated capacitance range	10 μF to 120 μF	15 μF to 180 μF	15 μF to 560 μF
Capacitance tolerance	±20 %(120 Hz/20 ℃)		
Leakage current	I ≦ 0.1 CV(μA)[2 V.DC to 6.3 V.DC, 2 minutes], I ≦ 0.3 CV(μA)[10 V.DC to 35 V.DC, 2 minutes]		
Dissipation factor(tan δ)	≦ 0.06(120 Hz/20 ℃)		
Surge voltage(V.DC)	Rated voltage ×1.25[2 V.DC to 16 V.DC], ×1.15[20 V.DC to 35 V.DC] (15 ℃ to 35 ℃)		
Endurance	+105℃, 2000 h, rated voltage applied		
	Capacitance change	Within ±20% of the initial value	
	tan δ	≦ 2 times of the initial limit	
	DC leakage current	≦ 3 times of the initial limit[2 V.DC to 6.3 V.DC], ≦Within the initial limit[10 V.DC to 35 V.DC]	
Damp heat (Steady state)	+60℃, 90%, 500h, No-applied voltage		
	Capacitance change of initial measurd value	2 V.DC to 2.5 V.DC	4 V.DC, 10 V.DC to 35 V.DC / 6.3 V.DC
		+70 %, -20 %	+60 %, -20 % / +50 %, -20 %
	tan δ	≦ 2 times of the initial limit	
	DC leakage current	Within the initial limit[2 V.DC to 6.3 V.DC], ≦ 3 times of the initial limit[10 V.DC to 35 V.DC]	

Marking and dimensions





Rated voltage(V.DC)	2	2.5	4	6.3	10
code	d	e	g	j	A

Rated voltage(V.DC)	16	20	25	35
code	C	D	E	V

(Unit : mm)

Series	L ±0.2	W1 ±0.2	W2 ±0.1	H ±0.1	P ±0.3
CS	7.3	4.3	2.4	1.1	1.3
CT	7.3	4.3	2.4	1.4	1.3
CX	7.3	4.3	2.4	1.9	1.3

Characteristics list

Series	Rated voltage (V.DC)	Capacitance (μF)	Case size (mm)			Specifications		Part number	Min. Packaging Q'ty ※3 (pcs)
			L	W	H	Ripple current ※1 (mArm.s.)	ESR ※2 (mΩ max.)		
CS	4	120	7.3	4.3	1.1	5100	15	EEFCS0G121R	3500
	6.3	68	7.3	4.3	1.1	5100	15	EEFCS0J680R	3500
	10	47	7.3	4.3	1.1	3200	40	EEFCS1A470R	3500
	16	15	7.3	4.3	1.1	3200	40	EEFCS1C150R	3500
		22	7.3	4.3	1.1	3200	40	EEFCS1C220R	3500
		33	7.3	4.3	1.1	3200	40	EEFCS1C330R	3500
	20	10	7.3	4.3	1.1	3200	40	EEFCS1D100R	3500
		15	7.3	4.3	1.1	3200	40	EEFCS1D150R	3500
		22	7.3	4.3	1.1	3200	40	EEFCS1D220R	3500
	25	10	7.3	4.3	1.1	3200	40	EEFCS1E100R	3500
		15	7.3	4.3	1.1	3200	40	EEFCS1E150R	3500
	35	10	7.3	4.3	1.1	3200	40	EEFCS1V100R	3500
CT	4	180	7.3	4.3	1.4	5100	15	EEFCT0G181R	3500
	6.3	100	7.3	4.3	1.4	5100	15	EEFCT0J101R	3500
	10	68	7.3	4.3	1.4	3200	40	EEFCT1A680R	3500
	16	47	7.3	4.3	1.4	3200	40	EEFCT1C470R	3500
	20	33	7.3	4.3	1.4	3200	40	EEFCT1D330R	3500
		47	7.3	4.3	1.4	3200	40	EEFCT1D470R	3500
	25	22	7.3	4.3	1.4	3200	40	EEFCT1E220R	3500
	35	15	7.3	4.3	1.4	3200	40	EEFCT1V150R	3500
CX	2	220	7.3	4.3	1.9	5100	15	EEFCX0D221R	3500
		270	7.3	4.3	1.9	5600	12	EEFCX0D271XR	3500
		330	7.3	4.3	1.9	5100	15	EEFCX0D331R	3500
			7.3	4.3	1.9	5600	12	EEFCX0D331XR	3500
		390	7.3	4.3	1.9	5100	15	EEFCX0D391R	3500
		470	7.3	4.3	1.9	5100	15	EEFCX0D471R	3500
		560	7.3	4.3	1.9	5100	15	EEFCX0D561R	3500
	2.5	220	7.3	4.3	1.9	5100	15	EEFCX0E221R	3500
		330	7.3	4.3	1.9	5100	15	EEFCX0E331R	3500
		390	7.3	4.3	1.9	5100	15	EEFCX0E391R	3500
		470	7.3	4.3	1.9	5100	15	EEFCX0E471R	3500
	4	150	7.3	4.3	1.9	5100	15	EEFCX0G151R	3500
		180	7.3	4.3	1.9	5100	15	EEFCX0G181R	3500
			7.3	4.3	1.9	5600	12	EEFCX0G181XR	3500
		220	7.3	4.3	1.9	5100	15	EEFCX0G221R	3500
			7.3	4.3	1.9	5600	12	EEFCX0G221XR	3500
		270	7.3	4.3	1.9	5100	15	EEFCX0G271R	3500
		330	7.3	4.3	1.9	5100	15	EEFCX0G331R	3500
	6.3	100	7.3	4.3	1.9	5100	15	EEFCX0J101R	3500
		120	7.3	4.3	1.9	5100	15	EEFCX0J121R	3500
		150	7.3	4.3	1.9	5100	15	EEFCX0J151R	3500
			7.3	4.3	1.9	5600	12	EEFCX0J151XR	3500
		180	7.3	4.3	1.9	5100	15	EEFCX0J181R	3500
		220	7.3	4.3	1.9	5100	15	EEFCX0J221R	3500
	10	47	7.3	4.3	1.9	3200	40	EEFCX1A470R	3500
		68	7.3	4.3	1.9	3200	40	EEFCX1A680R	3500
		100	7.3	4.3	1.9	3200	40	EEFCX1A101R	3500
	16	15	7.3	4.3	1.9	3200	40	EEFCX1C150R	3500
		22	7.3	4.3	1.9	3200	40	EEFCX1C220R	3500
		33	7.3	4.3	1.9	3200	40	EEFCX1C330R	3500
		47	7.3	4.3	1.9	3200	40	EEFCX1C470R	3500
		68	7.3	4.3	1.9	3200	40	EEFCX1C680R	3500
	20	22	7.3	4.3	1.9	3200	40	EEFCX1D220R	3500
		33	7.3	4.3	1.9	3200	40	EEFCX1D330R	3500
		47	7.3	4.3	1.9	3200	40	EEFCX1D470R	3500
		56	7.3	4.3	1.9	3200	40	EEFCX1D560R	3500
	25	15	7.3	4.3	1.9	3200	40	EEFCX1E150R	3500
		22	7.3	4.3	1.9	3200	40	EEFCX1E220R	3500
		33	7.3	4.3	1.9	3200	40	EEFCX1E330R	3500
	35	15	7.3	4.3	1.9	3200	40	EEFCX1V150R	3500
		22	7.3	4.3	1.9	3200	40	EEFCX1V220R	3500

※1：Ripple current (100 kHz/ +45 ℃), ※2：ESR (100 kHz/+20 ℃) ※3：Please contact us when 500 pcs packing is necessary

◆Please refer to the P16 in this catalog for "Reflow conditions" and "Taping specifications".

Temperature coefficient of Ripple current

	Temp.	T ≦ 45 ℃	45 ℃ < T≦85 ℃	85 ℃ < T ≦ 105 ℃
2 V.DC to 6.3 V.DC	Coefficient	1.0	0.7	0.25
10 V.DC to 35 V.DC		1.0	0.8	0.5

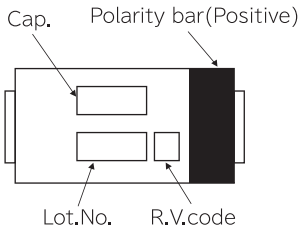
Surface mount type SX Series

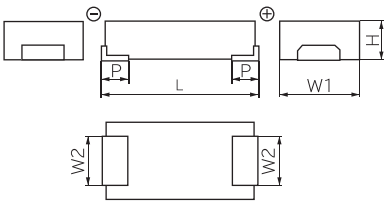
- Large capacitance (560 μF max.)
- High ripple current (8500 mAr.m.s. max.)
- Low ESR (4.5 mΩ to 9 mΩ max.)
- RoHS compliance, Halogen free

Specifications

Items	Specifications			
Series	SX			
Category temperature range	-55 ℃ to 105 ℃			
Rated voltage range	2 V.DC to 6.3 V.DC			
Rated capacitance range	82 μF to 560 μF			
Capacitance tolerance	±20 %(120 Hz/20 ℃)			
Leakage current	I ≦ 0.1 CV(μA)[2 minutes]			
Dissipation factor(tan δ)	≦ 0.06(120 Hz/20 ℃)			
Surge voltage(V.DC)	Rated voltage ×1.25(15 ℃ to 35 ℃)			
Endurance	+105 ℃, 2000 h, rated voltage applied			
	Capacitance change	Within ±20 % of the initial value		
	tan δ	≦ 2 times of the initial limit		
	DC leakage current	≦ 3 times of the initial limit		
Damp heat (Steady state)	+60 ℃, 90 %, 500 h, No-applied voltage			
	Capacitance change of initial measurd value	2 V.DC to 2.5 V.DC	4 V.DC	6.3 V.DC
		+70 %, −20 %	+60 %, −20 %	+50 %, −20 %
	tan δ	≦ 2 times of the initial limit		
	DC leakage current	Within the initial limit		

Marking and dimensions





Rated voltage(V.DC)	2	2.5	4	6.3
code	d	e	g	j

(Unit : mm)

Series	L ±0.2	W1 ±0.2	W2 ±0.1	H ±0.1	P ±0.3
SX	7.3	4.3	2.4	1.9	1.3

Characteristics list

Series	Rated voltage (V.DC)	Capacitance (μF)	Case size (mm)			Specifications		Part number	Min. Packaging Q'ty ※3 (pcs)
			L	W	H	Ripple current ※1 (mArm.s.)	ESR ※2 (mΩ max.)		
SX	2	180	7.3	4.3	1.9	6300	9	EEFSX0D181ER	3500
		220	7.3	4.3	1.9	6300	9	EEFSX0D221ER	3500
		270	7.3	4.3	1.9	6300	9	EEFSX0D271ER	3500
			7.3	4.3	1.9	7500	6	EEFSX0D271XE	3500
			7.3	4.3	1.9	8500	4.5	EEFSX0D271E4	3500
		330	7.3	4.3	1.9	6300	9	EEFSX0D331ER	3500
			7.3	4.3	1.9	7500	6	EEFSX0D331XE	3500
			7.3	4.3	1.9	8500	4.5	EEFSX0D331E4	3500
		390	7.3	4.3	1.9	6300	9	EEFSX0D391ER	3500
			7.3	4.3	1.9	7500	6	EEFSX0D391XE	3500
			7.3	4.3	1.9	8500	4.5	EEFSX0D391E4	3500
		470	7.3	4.3	1.9	6300	9	EEFSX0D471ER	3500
			7.3	4.3	1.9	7500	6	EEFSX0D471XE	3500
			7.3	4.3	1.9	8500	4.5	EEFSX0D471E4	3500
		560	7.3	4.3	1.9	8500	4.5	EEFSX0D561E4	3500
	2.5	150	7.3	4.3	1.9	6300	9	EEFSX0E151ER	3500
		180	7.3	4.3	1.9	6300	9	EEFSX0E181ER	3500
		220	7.3	4.3	1.9	6300	9	EEFSX0E221ER	3500
			7.3	4.3	1.9	7000	7	EEFSX0E221E7	3500
		270	7.3	4.3	1.9	7000	7	EEFSX0E271E7	3500
		330	7.3	4.3	1.9	6300	9	EEFSX0E331ER	3500
			7.3	4.3	1.9	7500	6	EEFSX0E331XE	3500
			7.3	4.3	1.9	8500	4.5	EEFSX0E331E4	3500
		390	7.3	4.3	1.9	6300	9	EEFSX0E391ER	3500
			7.3	4.3	1.9	7500	6	EEFSX0E391XE	3500
			7.3	4.3	1.9	8500	4.5	EEFSX0E391E4	3500
		470	7.3	4.3	1.9	6300	9	EEFSX0E471ER	3500
			7.3	4.3	1.9	7500	6	EEFSX0E471XE	3500
			7.3	4.3	1.9	8500	4.5	EEFSX0E471E4	3500
	4	82	7.3	4.3	1.9	6300	9	EEFSX0G820ER	3500
		100	7.3	4.3	1.9	6300	9	EEFSX0G101ER	3500
		150	7.3	4.3	1.9	6300	9	EEFSX0G151ER	3500
			7.3	4.3	1.9	7000	7	EEFSX0G151E7	3500
		180	7.3	4.3	1.9	6300	9	EEFSX0G181ER	3500
		220	7.3	4.3	1.9	6300	9	EEFSX0G221ER	3500
		270	7.3	4.3	1.9	6300	9	EEFSX0G271ER	3500
	6.3	120	7.3	4.3	1.9	7000	7	EEFSX0J121E7	3500
		150	7.3	4.3	1.9	6300	9	EEFSX0J151ER	3500
		180	7.3	4.3	1.9	6300	9	EEFSX0J181ER	3500

※1：Ripple current (100 kHz/ +45 ℃), ※2：ESR (100 kHz/+20 ℃) ※3：Please contact us when 500 pcs packing is necessary

◆Please refer to the P16 in this catalog for "Reflow conditions" and "Taping specifications".

Temperature coefficient of Ripple current

Temp.	≦ 45 ℃	45 ℃ < T ≦ 85 ℃	85 ℃ < T ≦ 105 ℃
Coefficient	1.0	0.7	0.25

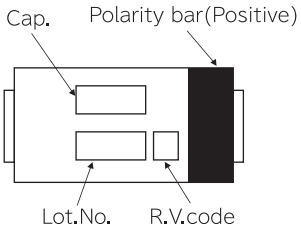
Surface mount type GX Series

- Large capacitance (560 μF max.)
- Low ESL (3 terminals : 50% less than 2-terminals) [Suffix : L]
- RoHS compliance, Halogen free
- Super low ESR (3 mΩ max.)
- High ripple current (10200 mAr.m.s. max.)

Specifications

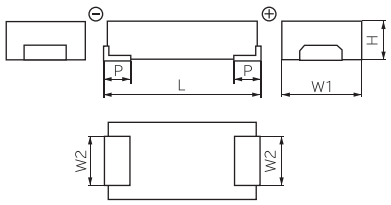
Items	Specifications	
Series	GX	
Category temperature range	-55 ℃ to 105 ℃	
Rated voltage range	2 V.DC to 2.5 V.DC	
Rated capacitance range	330 μF to 560 μF	
Capacitance tolerance	±20 %(120 Hz/+20 ℃)	
Leakage current	I ≦ 0.1 CV(μA)[2 minutes]	
Dissipation factor(tan δ)	≦ 0.06(120 Hz/+20 ℃)	
Surge voltage(V.DC)	Rated voltage ×1.25(15 ℃ to 35 ℃)	
Endurance	+105 ℃, 2000 h, rated voltage applied	
	Capacitance change	Within ±20 % of the initial value
	tan δ	≦ 2 times of the initial limit
	DC leakage current	≦ 3 times of the initial limit
Damp heat (Steady state)	+60 ℃, 90 %, 500 h, No-applied voltage	
	Capacitance change of initial measurd value	2 V.DC to 2.5 V.DC
		+70 %, −20 %
	tan δ	≦ 2 times of the initial limit
	DC leakage current	Within the initial limit

Marking and dimensions



Rated voltage(V.DC)	2	2.5
code	d	e

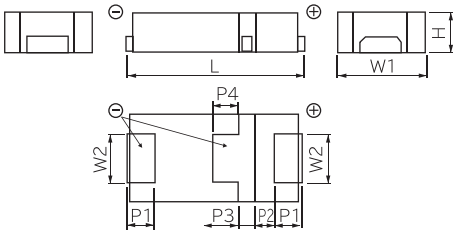
2 terminals



(Unit : mm)

Series	L ±0.2	W1 ±0.2	W2 ±0.1	H ±0.1	P ±0.3
GX	7.3	4.3	2.4	1.9	1.3

3 terminals



(Unit : mm)

Series	L ±0.2	W1 ±0.2	W2 ±0.1	H ±0.1	P1 ±0.3	P2 ±0.1	P3 ±0.2	P4 ±0.2
GX	7.3	4.3	2.4	1.9	1.3	1.1	0.7	1.4

Characteristics list

Series	Rated voltage (V.DC)	Capacitance (μF)	Case size (mm)			Specifications		The number of terminals		Part number	Min. Packaging Q'ty ※3 (pcs)
			L	W	H	Ripple current ※1 (mAr.m.s.)	ESR ※2 (mΩ max.)	2	3		
GX	2	330	7.3	4.3	1.9	10200	3	○		EEFGX0D331R	3500
		470	7.3	4.3	1.9	10200	3	○		EEFGX0D471R	3500
			7.3	4.3	1.9	10200	3		○	EEFGX0D471L	3500
		560	7.3	4.3	1.9	10200	3	○		EEFGX0D561R	3500
			7.3	4.3	1.9	10200	3		○	EEFGX0D561L	3500
	2.5	470	7.3	4.3	1.9	10200	3	○		EEFGX0E471R	3500
			7.3	4.3	1.9	10200	3		○	EEFGX0E471L	3500

※1：Ripple current (100 kHz/ +45 ℃), ※2：ESR (100 kHz/+20 ℃) ※3：Please contact us when 500 pcs packing is necessary
◆Please refer to the P16 in this catalog for "Reflow conditions" and "Taping specifications".

Temperature coefficient of Ripple current

Temp.	≦ 45 ℃	45 ℃ < T ≦ 85 ℃	85 ℃ < T ≦ 105 ℃
Coefficient	1.0	0.7	0.25

Design and specifications are each subject to change without notice. Ask factory for the current technical specifications before purchase and/or use.
Should a safety concern arise regarding this product, please be sure to contact us immediately.

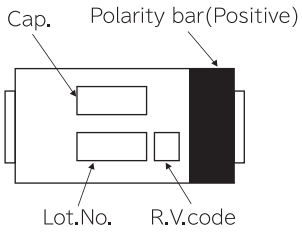
Surface mount type LX Series

- Large capacitance (560 μF max.)
- Low ESR (4.5 mΩ、6 mΩ max.)
- Low ESL (3 terminals : 50% less than 2 terminals)
- High ripple current (8500 mAr.m.s. max.)
- RoHS compliance, Halogen free

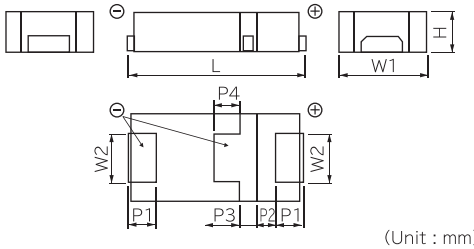
Specifications

Items	Specifications	
Series	LX	
Category temperature range	-55 ℃ to 105 ℃	
Rated voltage range	2 V.DC to 2.5 V.DC	
Rated capacitance range	330 μF to 560 μF	
Capacitance tolerance	±20 %(120 Hz/+20 ℃)	
Leakage current	I ≦ 0.1 CV(μA)[2 minutes]	
Dissipation factor(tan δ)	≦ 0.06(120 Hz/+20 ℃)	
Surge voltage(V.DC)	Rated voltage ×1.25(15 ℃ to 35 ℃)	
Endurance	+105 ℃, 2000 h, rated voltage applied	
	Capacitance change	Within ±20 % of the initial value
	tan δ	≦ 2 times of the initial limit
	DC leakage current	≦ 3 times of the initial limit
Damp heat (Steady state)	+60 ℃, 90 %, 500 h, No-applied voltage	
	Capacitance change of initial measurd value	2 V.DC to 2.5 V.DC
		+70 %, −20 %
	tan δ	≦ 2 times of the initial limit
	DC leakage current	Within the initial limit

Marking and dimensions



Rated voltage(V.DC)	2	2.5
code	d	e



(Unit : mm)

Series	L ±0.2	W1 ±0.2	W2 ±0.1	H ±0.1	P1 ±0.3	P2 ±0.1	P3 ±0.2	P4 ±0.2
LX	7.3	4.3	2.4	1.9	1.3	1.1	0.7	1.4

Characteristics list

Series	Rated voltage (V.DC)	Capacitance (μF)	Case size (mm)			Specifications		Part number	Min. Packaging Q'ty ※3 (pcs)
			L	W	H	Ripple current ※1 (mAr.m.s.)	ESR ※2 (mΩ max.)		
LX	2	330	7.3	4.3	1.9	7500	6	EEFLX0D331R	3500
			7.3	4.3	1.9	8500	4.5	EEFLX0D331R4	3500
		470	7.3	4.3	1.9	7500	6	EEFLX0D471R	3500
			7.3	4.3	1.9	8500	4.5	EEFLX0D471R4	3500
		560	7.3	4.3	1.9	7500	6	EEFLX0D561R	3500
			7.3	4.3	1.9	8500	4.5	EEFLX0D561R4	3500
	2.5	330	7.3	4.3	1.9	7500	6	EEFLX0E331R	3500
			7.3	4.3	1.9	8500	4.5	EEFLX0E331R4	3500
		470	7.3	4.3	1.9	7500	6	EEFLX0E471R	3500
			7.3	4.3	1.9	8500	4.5	EEFLX0E471R4	3500

※1:Ripple current (100 kHz/ +45 ℃), ※2:ESR (100 kHz/+20 ℃) ※3:Please contact us when 500 pcs packing is necessary
◆Please refer to the P16 in this catalog for "Reflow conditions" and "Taping specifications".

Temperature coefficient of Ripple current

Temp.	≦ 45 ℃	45 ℃ < T ≦ 85 ℃	85 ℃ < T ≦ 105 ℃
Coefficient	1.0	0.7	0.25

Design and specifications are each subject to change without notice. Ask factory for the current technical specifications before purchase and/or use.
Should a safety concern arise regarding this product, please be sure to contact us immediately.

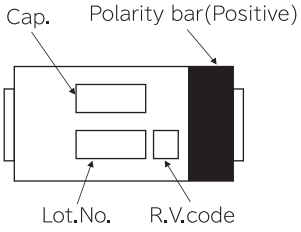
Surface mount type SR/LR/SS LS/ST/LT Series

- Low profile (Height 1.0 mm max.)
- Low ESL (3 terminals : 50% less than 2 terminals)
- RoHS compliance, Halogen free
- Low ESR (4.5 mΩ to 9 mΩ)
- High ripple current (8500 mArm.s. max.)

Specifications

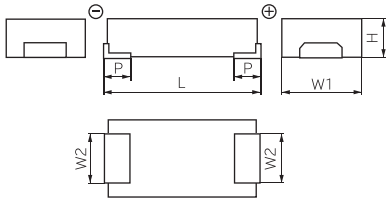
Items	Specifications					
Series	SR	LR	SS	LS	ST	LT
Category temperature range	-55 ℃ to 105 ℃					
Rated voltage range	2 V.DC to 6.3 V.DC		2 V.DC to 2.5 V.DC			
Rated capacitance range	68 μF to 220 μF		180 μF to 220 μF		270 μF to 330 μF	
Capacitance tolerance	±20 %(120 Hz/+20 ℃)					
Leakage current	I ≦ 0.1 CV(μA)[2 minutes]					
Dissipation factor(tan δ)	≦ 0.06(120 Hz/+20 ℃)					
Surge voltage(V.DC)	Rated voltage ×1.25(15 ℃ to 35 ℃)					
Endurance	+105 ℃, 2000 h, rated voltage applied					
	Capacitance change	Within ±20 % of the initial value				
	tan δ	≦ 2 times of the initial limit				
	DC leakage current	≦ 3 times of the initial limit				
Damp heat (Steady state)	+60 ℃, 90 %, 500 h, No-applied voltage					
	Capacitance change of initial measurd value	2 V.DC to 2.5 V.DC	4 V.DC	6.3 V.DC		
		+70 %, −20 %	+60 %, −20 %	+50 %, −20 %		
	tan δ	≦ 2 times of the initial limit				
	DC leakage current	Within the initial limit				

Marking and dimensions



Rated voltage(V.DC)	2	2.5	4	6.3
code	d	e	g	j

2 terminals

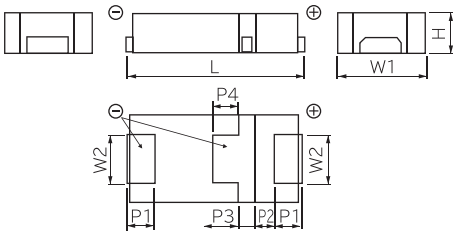


(Unit : mm)

Series	L ±0.2	W1 ±0.2	W2 ±0.1	H ±0.1	P ±0.3
SR	7.3	4.3	2.4	1.0※1	1.3
SS	7.3	4.3	2.4	1.1	1.3
ST	7.3	4.3	2.4	1.4	1.3

※1 Maximum

3 terminals



(Unit : mm)

Series	L ±0.2	W1 ±0.2	W2 ±0.1	H ±0.1	P1 ±0.3	P2 ±0.1	P3 ±0.2	P4 ±0.2
LR	7.3	4.3	2.4	1.0※1	1.3	1.1	0.7	1.4
LS	7.3	4.3	2.4	1.1	1.3	1.1	0.7	1.4
LT	7.3	4.3	2.4	1.4	1.3	1.1	0.7	1.4

※1 Maximum

Characteristics list

Series	Rated voltage (V.DC)	Capacitance (μF)	Case size (mm)			Specifications		The number of terminals		Part number	Min. Packaging Q'ty ※3 (pcs)
			L	W	H	Ripple current ※1 (mAr.m.s.)	ESR ※2 (mΩ max.)	2	3		
SR	2	220	7.3	4.3	1.0 max.	7500	6	○		EEFSR0D221R	3500
			7.3	4.3	1.0 max.	8500	4.5	○		EEFSR0D221R4	3500
	2.5	180	7.3	4.3	1.0 max.	7500	6	○		EEFSR0E181R	3500
			7.3	4.3	1.0 max.	8500	4.5	○		EEFSR0E181R4	3500
	4	120	7.3	4.3	1.0 max.	6300	9	○		EEFSR0G121R	3500
	6.3	68	7.3	4.3	1.0 max.	6300	9	○		EEFSR0J680R	3500
LR	2	220	7.3	4.3	1.0 max.	7500	6		○	EEFLR0D221R	3500
			7.3	4.3	1.0 max.	8500	4.5		○	EEFLR0D221R4	3500
	2.5	180	7.3	4.3	1.0 max.	7500	6		○	EEFLR0E181R	3500
			7.3	4.3	1.0 max.	8500	4.5		○	EEFLR0E181R4	3500
	4	120	7.3	4.3	1.0 max.	6300	9		○	EEFLR0G121R	3500
	6.3	68	7.3	4.3	1.0 max.	6300	9		○	EEFLR0J680R	3500
SS	2	220	7.3	4.3	1.1	7500	6	○		EEFSS0D221R	3500
	2.5	180	7.3	4.3	1.1	7500	6	○		EEFSS0E181R	3500
LS	2	220	7.3	4.3	1.1	7500	6		○	EEFLS0D221R	3500
	2.5	180	7.3	4.3	1.1	7500	6		○	EEFLS0E181R	3500
ST	2	330	7.3	4.3	1.4	7500	6	○		EEFST0D331R	3500
	2.5	270	7.3	4.3	1.4	7500	6	○		EEFST0E271R	3500
LT	2	330	7.3	4.3	1.4	7500	6		○	EEFLT0D331R	3500
	2.5	270	7.3	4.3	1.4	7500	6		○	EEFLT0E271R	3500

※1:Ripple current (100 kHz/ +45 ℃), ※2:ESR (100 kHz/+20 ℃) ※3:Please contact us when 500 pcs packing is necessary
◆Please refer to the P16 in this catalog for "Reflow conditions" and "Taping specifications".

Temperature coefficient of Ripple current

Temp.	≦ 45 ℃	45 ℃ < T ≦ 85 ℃	85 ℃ < T ≦ 105 ℃
Coefficient	1.0	0.7	0.25

Design and specifications are each subject to change without notice. Ask factory for the current technical specifications before purchase and/or use.
Should a safety concern arise regarding this product, please be sure to contact us immediately.

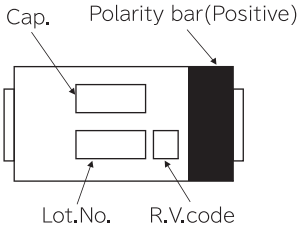
Surface mount type HX Series

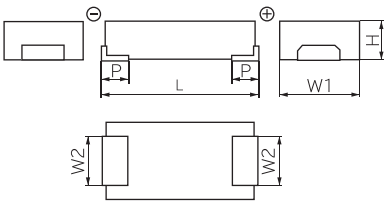
- Endurance 125 ℃ 1000 h
- High voltage & Large capacitance (2 V.DC / 560 μF to 25 V.DC / 33 μF)
- Low ESR(4.5 mΩ max.)
- RoHS compliance, Halogen free

Specifications

Items	Specifications		
Series	HX		
Category temperature range	-55 ℃ to 125 ℃		
Rated voltage range	2 V.DC to 2.5 V.DC, 10 V.DC to 25 V.DC		
Category voltage range	1.6 V.DC to 2 V.DC, 8 V.DC to 20 V.DC		
Rated capacitance range	15 μF to 560 μF		
Capacitance tolerance	±20 % (120 Hz/20 ℃)		
Leakage current	I ≦ 0.1 CV(μA)[2 V.DC,2.5 V.DC, 2 minutes], I ≦ 0.3 CV(μA)[10 V.DC to 25 V.DC, 2 minutes]		
Dissipation factor(tan δ)	≦ 0.1 (120 Hz/20 ℃)		
Surge voltage(V.DC)	Rated voltage ×1.25[2 V.DC to 16 V.DC], ×1.15[20 V.DC to 25 V.DC] (15 ℃ to 35 ℃)		
Endurance	+125 ℃, 1000 h, rated voltage applied		
	Capacitance change	Within ±20 % of the initial value	
	tan δ	≦ 2 times of the initial limit	
	DC leakage current	Within the initial limit	
Damp heat (Steady state)	+60 ℃, 90 %, 500 h, No-applied voltage		
	Capacitance change of initial measurd value	2 V.DC to 2.5 V.DC	10 V.DC to 25 V.DC
		+70 %, −20 %	+60 %, −20 %
	tan δ	≦ 2 times of the initial limit	
	DC leakage current	Within the initial limit[2 V.DC,2.5 V.DC], ≦ 300 % of the initial limit[10 V.DC to 25 V.DC]	

Marking and dimensions





Rated voltage(V.DC)	2	2.5	10	16	20	25
code	d	e	A	C	D	E

(Unit : mm)

Series	L ±0.2	W1 ±0.2	W2 ±0.1	H ±0.1	P ±0.3
HX	7.3	4.3	2.4	1.9	1.3

Characteristics list

Series	Rated voltage [105 ℃] (V.DC)	Category voltage [125 ℃] (V.DC)	Capacitance (μF)	Case size (mm)			Specifications		Part number	Min. Packaging Q'ty ※3 (pcs)
				L	W	H	Ripple current ※1 (mAr.m.s.)	ESR ※2 (mΩ max.)		
HX	2	1.6	470	7.3	4.3	1.9	5100	15	EEFHX0D471R	3500
				7.3	4.3	1.9	6300	9	EEFHX0D471R9	3500
				7.3	4.3	1.9	7500	6	EEFHX0D471R6	3500
				7.3	4.3	1.9	8500	4.5	EEFHX0D471R4	3500
			560	7.3	4.3	1.9	5100	15	EEFHX0D561R	3500
				7.3	4.3	1.9	8500	4.5	EEFHX0D561R4	3500
	2.5	2	330	7.3	4.3	1.9	5100	15	EEFHX0E331R	3500
				7.3	4.3	1.9	6300	9	EEFHX0E331R9	3500
				7.3	4.3	1.9	7500	6	EEFHX0E331R6	3500
				7.3	4.3	1.9	8500	4.5	EEFHX0E331R4	3500
			470	7.3	4.3	1.9	5100	15	EEFHX0E471R	3500
				7.3	4.3	1.9	6300	9	EEFHX0E471R9	3500
				7.3	4.3	1.9	7500	6	EEFHX0E471R6	3500
				7.3	4.3	1.9	8500	4.5	EEFHX0E471R4	3500
	10	8	47	7.3	4.3	1.9	3200	40	EEFHX1A470R	3500
			68	7.3	4.3	1.9	3200	40	EEFHX1A680R	3500
			100	7.3	4.3	1.9	3200	40	EEFHX1A101R	3500
	16	12.8	15	7.3	4.3	1.9	3200	40	EEFHX1C150R	3500
			22	7.3	4.3	1.9	3200	40	EEFHX1C220R	3500
			33	7.3	4.3	1.9	3200	40	EEFHX1C330R	3500
			47	7.3	4.3	1.9	3200	40	EEFHX1C470R	3500
			68	7.3	4.3	1.9	3200	40	EEFHX1C680R	3500
	20	16	22	7.3	4.3	1.9	3200	40	EEFHX1D220R	3500
			33	7.3	4.3	1.9	3200	40	EEFHX1D330R	3500
			47	7.3	4.3	1.9	3200	40	EEFHX1D470R	3500
			56	7.3	4.3	1.9	3200	40	EEFHX1D560R	3500
	25	20	15	7.3	4.3	1.9	3200	40	EEFHX1E150R	3500
			22	7.3	4.3	1.9	3200	40	EEFHX1E220R	3500
			33	7.3	4.3	1.9	3200	40	EEFHX1E330R	3500

※1：Ripple current (100 kHz/ +45 ℃), ※2：ESR (100 kHz/+20 ℃) ※3：Please contact us when 500 pcs packing is necessary
◆Please refer to the P16 in this catalog for "Reflow conditions" and "Taping specifications".

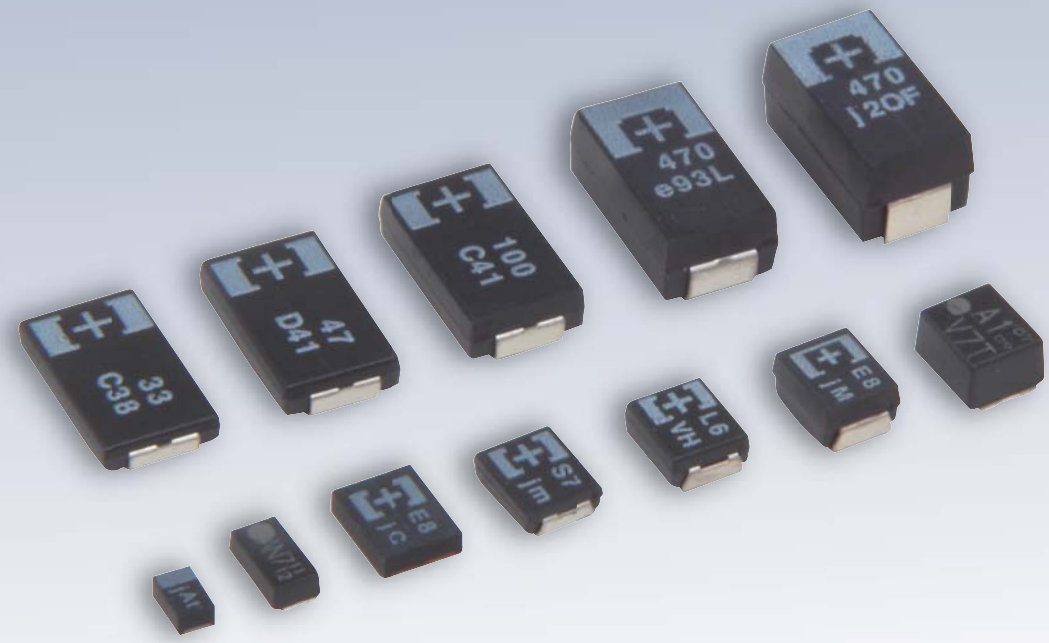
Temperature coefficient of Ripple current

	Temp.	T ≦ 45 ℃	45 ℃ < T ≦ 85 ℃	85 ℃ < T ≦ 105 ℃	125 ℃ < T
2 V.DC to 2.5 V.DC	Coefficient	1.0	0.7	0.25	0.25
10 V.DC to 25 V.DC		1.0	0.8	0.5	0.25

Ripple current should be controlled so that surface temperature of capacitor does not exceed the category temperature.

Conductive Polymer Tantalum
Solid Capacitors

POSCAP



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SP-Cap

Conductive Polymer Tantalum Solid Capacitors

OS-CON

Hybrid

Guidelines and precautions

⚠ Application Guidelines

1.Circuit design

1-1 Prohibited circuits

Since problems can be expected, **POSCAP** cannot be used on the following circuits
(1) High impedance voltage retention circuits (2) Time constant circuits
(3) Circuits greatly affected by leakage current
(4) The circuit in which two or more **POSCAP** are connected in a series so as to raise the endurance voltage.

1-2 Failure and life-span

The failure rate is 0.5 %※ / 1000 h (Confidence level : 60 %) based on JIS C 5003.
The mainly failure modes are as follows.
※B2 size or less : 1.0 %

1-2-1 Contingency failure

The main causes of failure are thermal stresses cause by the soldering or thermal use environment, along with heat stresses, electrical stresses or mechanical stresses. The most common failure mode is a short circuit. In case a short circuit occurs, ensure safety by fully considering the followings.
(1) If **POSCAP** emit smoke, turn off the main power of the equipment. In this case, keep your face and hands away from the area.
(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.

1-2-2 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.

1-3 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 2000 h.
0.5 %/1000 h (Environment temp. : 105 °C, Rated voltage or Category voltage applied)
In the case of the endurance which is 105 °C 1000 h or 125 °C 1000 h.
1.0 %/1000 h (Environment temp. : 105 °C, Rated voltage or Category voltage applied)
In the case of the endurance which is 85 °C 1000 h.
1.0 %/1000 h (Environment temp. : 85 °C, Rated voltage applied)

1-4 Check the rated performance

After checking the operation and installation environments, design the circuit so that it falls within the rated performance range stipulated in this delivery specification.

1-5 Operating temperature and ripple current

(a) Set the operating temperature so that it falls within the range stipulated in this delivery specification.
(b) Do not apply current that exceeds the allowable ripple current. Ripple current should be controlled so that surface temperature of a capacitor do not exceed the rated temperature.
(For questions regarding TQC series, please contact us.)

1-6 Leakage current

Even when the soldering conditions fall within the range of this delivery specifications, leakage current increases a little on occasion. It also increases a little during high temperature storage, high humidity storage and temperature cycling with no voltage applied. In cases such as these, leakage current will decrease by applying voltage under the condition of below the **POSCAP**'s maximum operating temperature.
The speed at which the leakage current is restored is increased by applying voltage when the **POSCAP**'s temperature is close to the maximum operating temperature.

1-7 Rapid charge and discharge limitation

Rapid charge and discharge are restricted (for maintainance of high-proof reliability).
A protective circuit is recommended for when a rapid charge or discharge causes excessive rush current since this is main cause of short circuit and large leakage current. Use a protective circuits in case the rush current value exceeds 20 A※
Be sure to insert a protection resistor of about 1 kΩ for charge and discharge when measuring the leakage current.
※TPU series : 10 A

2. Mounting

2-1 Protect circuit

The failure mode of **POSCAP** is the short mode. When it breaks down, short electric current flows to it.
POSCAP gives off heat by this short current.
Do the following consideration in design fully for the safety because it has a bad influence on the part around **POSCAP** due to this heat.

· A protective circuit and a protective device are set up, so as to make the system safer.
· A diffuse circuit and so on is set up, so as to make the system safer such as that a machine may not break down as to the single trouble.

2-2 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 that those stipulated.

2-3 Others

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

3.Storage

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 make storage of **POSCAP** sealing up in the reel and storage bag at the time of delivery in the following environment. Also, set storage period as 18 months or shorter.
Room temperature and room humidity (generally : 15 to 35 ℃, 45 to 75 % RH) are desirable.
Place where **POSCAP** is not exposed by direct sunshine.
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	
	Time	Conditions
2a	4 weeks	≦ 30 ℃/60 %Rh
3	168 hours	≦ 30 ℃/60 %Rh
5	48 hours	≦ 30 ℃/60 %Rh

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

Intellectual property right

We, Panasonic Group 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:

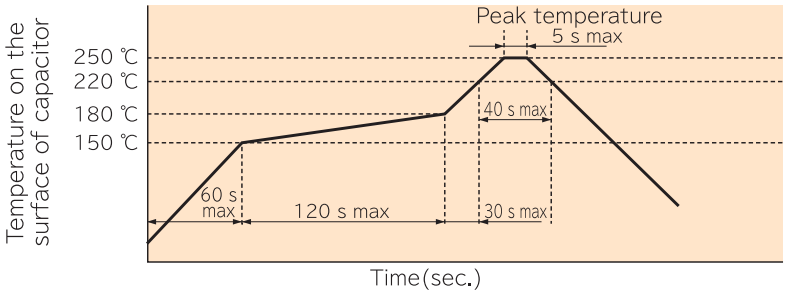
US Patent Nos. 6168639 and 6313979

Mounting specifications

Recommended soldering condition

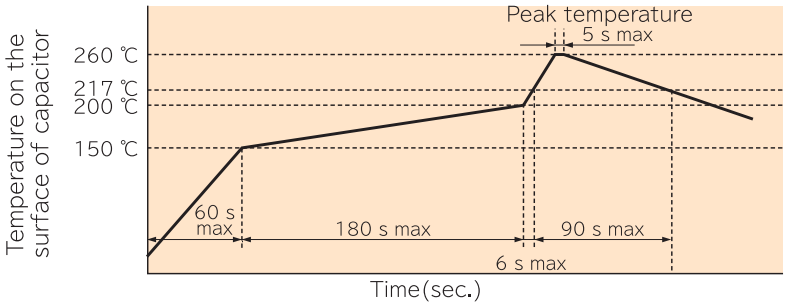
Peak temperature 250 ℃ lead free reflow soldering profile

The cycles of reflow soldering: Twice (max)



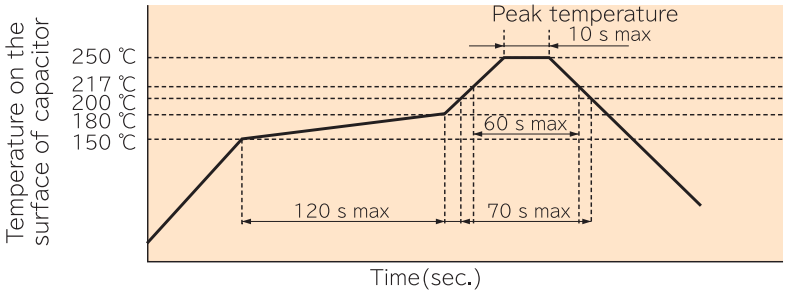
Peak temperature 260 ℃ lead free reflow soldering profile

This reflow is limited at moisture sensitive level.
Please contact us separately concerning about detail.
The cycles of reflow soldering: Twice (max)



TQC series

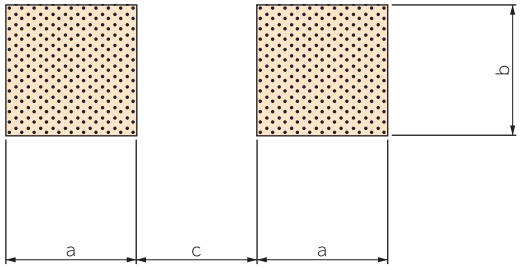
The cycles of reflow soldering: Twice (max)



Soldering with a soldering iron

Tip of a soldering iron: 350 ℃ max (TQC serise: 400 ℃ max)　Power of a soldering iron: 30 W max
Working time: 3 sec. max (TQC serise: 5 sec max)
(Do not let the tip of soldering iron touch the POSCAP itself. Do not subject the POSCAP itself to excessive stress when soldering

Land/Pad Pattern



(unit:mm)

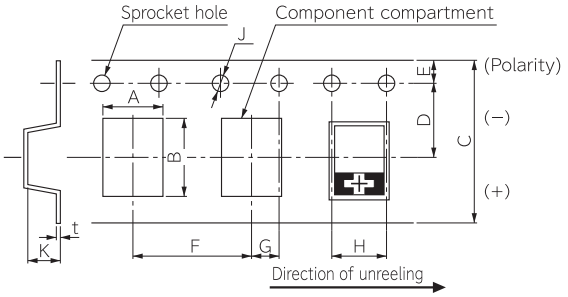
Size code	a	b	c	Size code	a	b	c
S09	1.0	0.9	0.6	D12	2.4	2.9	3.7
A09	1.6	1.4	1.0	D15	2.4	2.9	3.7
A14	1.6	1.4	1.0	D15E	2.4	2.9	3.7
B09	1.6	2.7	1.4	D2E	2.4	2.9	3.7
B1	1.6	2.7	1.4	D2	2.4	2.9	3.7
B1G	1.6	2.7	1.4	D3L	2.4	2.9	3.7
B15	1.6	2.7	1.4	D4	2.4	2.9	3.7
B15G	1.6	2.7	1.4				
B2	1.6	2.7	1.4				
B2S	1.6	2.7	1.4				

Packing specifications

*We supply only embossed taping type

Packing specifications

Dimension of carrier tape

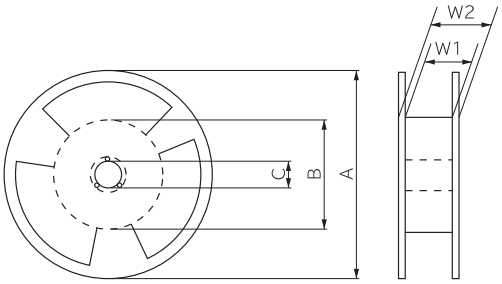


(unit:mm)

Size code	A ±0.1	B ±0.1	C ±0.3	D ±0.05	E ±0.1	F ±0.1	G ±0.05	H ±0.1	J $^{+0.1}_{-0}$	K ±0.1	t ±0.05
S09	1.65	2.4	8.0	3.5	1.75	4.0	2.0	4.0	ϕ 1.5	1.3	0.25
A09	2.05	3.65	8.0	3.5	1.75	4.0	2.0	4.0	ϕ 1.5	1.3	0.25
A14	2.05	3.65	8.0	3.5	1.75	4.0	2.0	4.0	ϕ 1.5	1.7	0.25
B09	3.2	3.8	8.0	3.5	1.75	4.0	2.0	4.0	ϕ 1.5	1.4	0.25
B1	3.2	3.8	8.0	3.5	1.75	4.0	2.0	4.0	ϕ 1.5	1.4	0.25
B1G	3.25	3.9	8.0	3.5	1.75	4.0	2.0	4.0	ϕ 1.5	1.7	0.25
B15	3.3	3.8	8.0	3.5	1.75	4.0	2.0	4.0	ϕ 1.5	2.1	0.25
B15G	3.25	3.9	8.0	3.5	1.75	4.0	2.0	4.0	ϕ 1.5	1.7	0.25
B2	3.3	3.8	8.0	3.5	1.75	4.0	2.0	4.0	ϕ 1.5	2.1	0.25
B2S	3.25	4.0	8.0	3.5	1.75	4.0	2.0	4.0	ϕ 1.5	2.1	0.25
D12	4.5	7.5	12.0	5.5	1.75	8.0	2.0	4.0	ϕ 1.5	1.7	0.3
D15	4.5	7.5	12.0	5.5	1.75	8.0	2.0	4.0	ϕ 1.5	2.4	0.3
D15E	4.7	7.8	12.0	5.5	1.75	8.0	2.0	4.0	ϕ 1.5	1.7	0.3
D2E	4.5	7.5	12.0	5.5	1.75	8.0	2.0	4.0	ϕ 1.5	2.4	0.3
D2	4.5	7.5	12.0	5.5	1.75	8.0	2.0	4.0	ϕ 1.5	2.4	0.3
D3L	4.5	7.7	12.0	5.5	1.75	8.0	2.0	4.0	ϕ 1.5	3.2	0.3
D4	4.5	7.7	12.0	5.5	1.75	8.0	2.0	4.0	ϕ 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±10 μm Width of cover tape: 9.5±0.2 mm 5.5±0.2 mm (ϕ 180reel)

Reel dimension



(unit:mm)

A	B	C	W1	W2
ϕ 330±2	ϕ 80±2	ϕ 13±0.2	13.5±0.5	17.5±1.0
ϕ 180$^{+0}_{-3}$	ϕ 60±2	ϕ 13±0.2	9±0.5	11.4±1.0

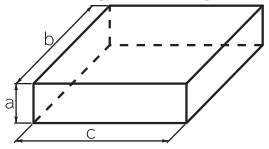
Minimum packing quantity and weight

Size code	Quantity(pcs./Reel, ϕ 180)	Typical weight(g)
S09	3000	200
A09	3000	200
A14	2500	200
B09	3000	200
B1	3000	200
B1G	2500	200
B15	2000	160
B15G	2500	200
B2	2000	200
B2S	2000	200

Size code	Quantity(pcs./Reel, ϕ 330)	Typical weight(g)
D12	4500	1200
D15	3000	1000
D15E	4000	1000
D2E	3000	1000
D2	3000	1000
D3L	2500	1100
D4	2000	1200

※Small order quantity (500 pcs/reel) is available with TPE, TPF and TQC series. Please contact our sales representative if you prefer it.

Dimension of packing case



(unit:mm)

Reel size	ϕ 180	ϕ 330
a	90	120
b	240	360
c	240	360

Units per packing case

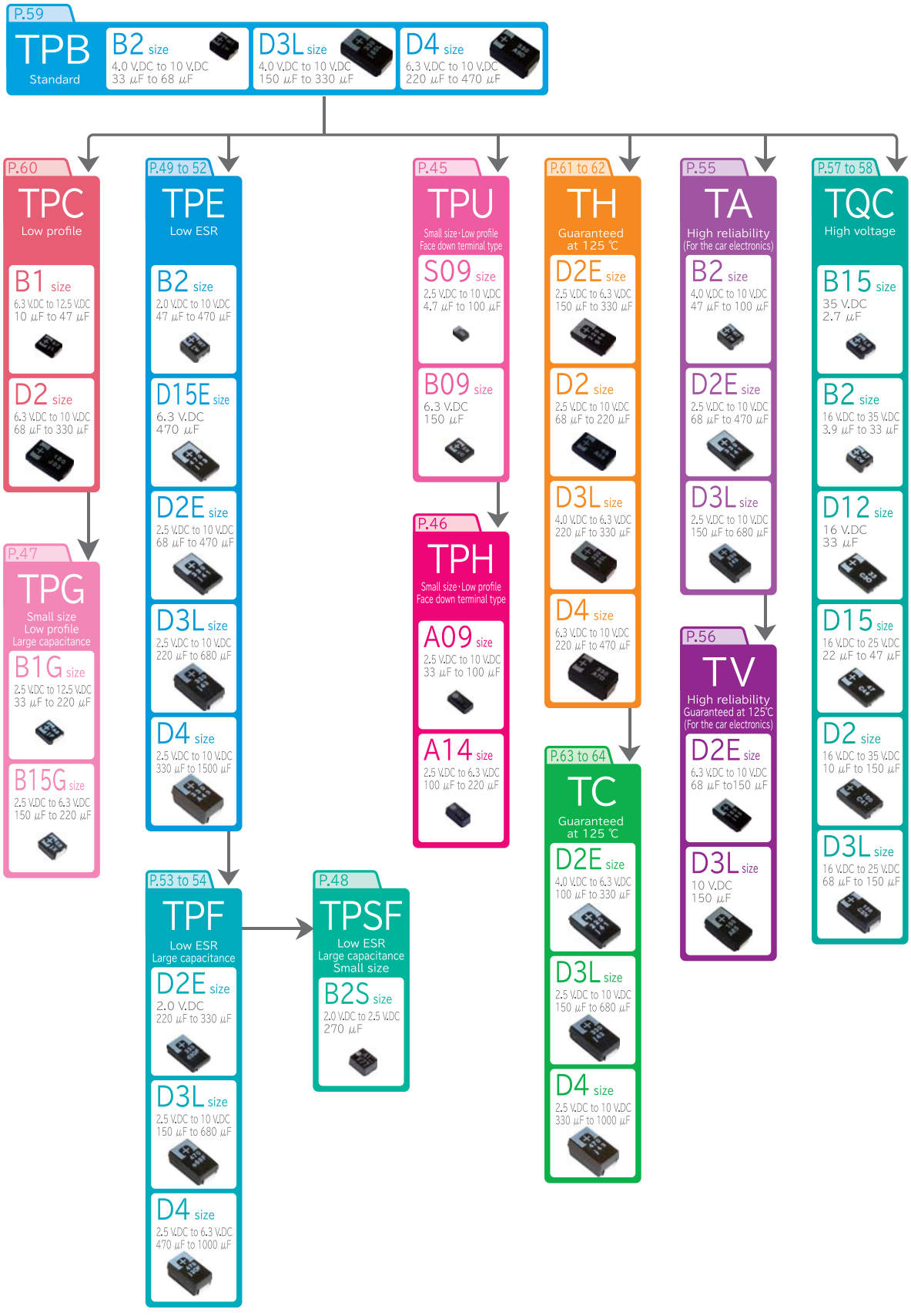
Size code	Pieces/case	Size code	Pieces/case
S09	15000	D12	22500
A09	15000	D15	15000
A14	12500	D15E	20000
B09	15000	D2E	15000
B1	15000	D2	15000
B1G	12500	D3L	12500
B15	10000	D4	10000
B15G	12500		
B2	10000		
B2S	10000		

Line-up

Series	Page	Features	Small size/Low profile	Large capacitance	Low ESR	For automotive	High voltage	Guaranteed at 125 ℃	Category temperature range (℃)	Rated voltage (V.DC)	ESR (mΩ)	Capacitance (μF)	Size code	Size (mm) L	W	H
TPU	45	Small size Low profile Face down terminal	●						-55 to 85	2.5 to 10	150 to 300	4.7 to 100	S09	2.0	1.25	0.9
									-55 to 85	6.3	100	150	B09	3.5	2.8	0.9
TPH	46	Small size Low profile Face down terminal	●		●				-55 to 85	6.3 to 10	100 to 150	33 to 100	A09	3.2	1.6	0.9
									-55 to 105	2.5 to 6.3	150	47 to 100	A09	3.2	1.6	0.9
									-55 to 85	2.5 to 6.3	70	100 to 220	A14	3.2	1.6	1.4
TPG	47	Small size Low profile Large capacitance	●	●					-55 to 105	2.5 to 12.5	35 to 70	33 to 220	B1G	3.5	2.8	1.1
									-55 to 105	2.5 to 6.3	30 to 70	150 to 220	B15G	3.5	2.8	1.4
TPSF	48	Low ESR / Small size Large capacitance Face down terminal	●	●	●				-55 to 105	2.0 to 2.5	6 to 9	270	B2S	3.5	2.8	1.9
TPE	49 to 52	Low ESR			●				-55 to 105	2.0 to 10	11 to 35	47 to 470	B2	3.5	2.8	1.9
									-55 to 105	6.3	35	470	D15E	7.3	4.3	1.4
									-55 to 105	2.5 to 10	7 to 25	68 to 470	D2E	7.3	4.3	1.8
									-55 to 105	2.5 to 10	9 to 25	220 to 680	D3L	7.3	4.3	2.8
									-55 to 105	2.5 to 10	10 to 25	330 to 1500	D4	7.3	4.3	3.8
TPF	53 to 54	Low ESR Large capacitance		●	●				-55 to 105	2.0	6	220 to 330	D2E	7.3	4.3	1.8
									-55 to 105	2.5 to 10	5 to 15	150 to 680	D3L	7.3	4.3	2.8
									-55 to 105	2.5 to 6.3	5 to 10	470 to 1000	D4	7.3	4.3	3.8
TA	55	High reliability (for the car erectronics)				●			-55 to 105	4.0 to 10	70	47 to 100	B2	3.5	2.8	1.9
									-55 to 105	2.5 to 10	9 to 25	68 to 470	D2E	7.3	4.3	1.8
									-55 to 105	2.5 to 10	15 to 25	150 to 680	D3L	7.3	4.3	2.8
TV	56	High reliability Guaranteed at 125 ℃ (for the car erectronics)				●		●	-55 to 125	6.3 to 10	25	6 to 150	D2E	7.3	4.3	1.8
									-55 to 125	10	25	150	D3L	7.3	4.3	2.8

Series	Page	Features	Small size/Low profile	Large capacitance	Low ESR	For automotive	High voltage	Guaranteed at 125 ℃	Category temperature range (℃)	Rated voltage (V.DC)	ESR (mΩ)	Capacitance (μF)	Size code	Size (mm) L	W	H
TQC	57 to 58	High voltage					●		-55 to 105	35	300	2.7	B15	3.5	2.8	1.4
									-55 to 105	16 to 35	90 to 400	3.9 to 33	B2	3.5	2.8	1.9
									-55 to 105	16	40	33	D12	7.3	4.3	1.15
									-55 to 105	16 to 25	55 to 70	22 to 47	D15	7.3	4.3	1.4
									-55 to 105	16 to 35	40 to 150	10 to 150	D2	7.3	4.3	1.9
									-55 to 105	16 to 25	50 to 70	68 to 150	D3L	7.3	4.3	2.8
TPB	59	Standard							-55 to 105	4.0 to 10	70	33 to 68	B2	3.5	2.8	1.9
									-55 to 105	4.0 to 10	40	150 to 330	D3L	7.3	4.3	2.8
									-55 to 105	6.3 to 10	35 to 40	220 to 470	D4	7.3	4.3	3.8
TPC	60	Low profile	●						-55 to 105	6.3 to 12.5	55 to 80	10 to 47	B1	3.5	2.8	1.1
									-55 to 105	6.3 to 10	40 to 45	68 to 330	D2	7.3	4.3	1.9
TH	61 to 62	Guaranteed at 125 ℃						●	-55 to 125	2.5 to 6.3	15 to 25	150 to 330	D2E	7.3	4.3	1.8
									-55 to 125	2.5 to 10	40 to 45	68 to 220	D2	7.3	4.3	1.9
									-55 to 125	4.0 to 6.3	40	220 to 330	D3L	7.3	4.3	2.8
									-55 to 125	6.3 to 10	35 to 40	220 to 470	D4	7.3	4.3	3.8
TC	63 to 64	Guaranteed at 125 ℃						●	-55 to 125	4.0 to 6.3	15 to 25	100 to 330	D2E	7.3	4.3	1.8
									-55 to 125	2.5 to 10	5 to 25	150 to 680	D3L	7.3	4.3	2.8
									-55 to 125	2.5 to 10	5 to 25	330 to 1000	D4	7.3	4.3	3.8

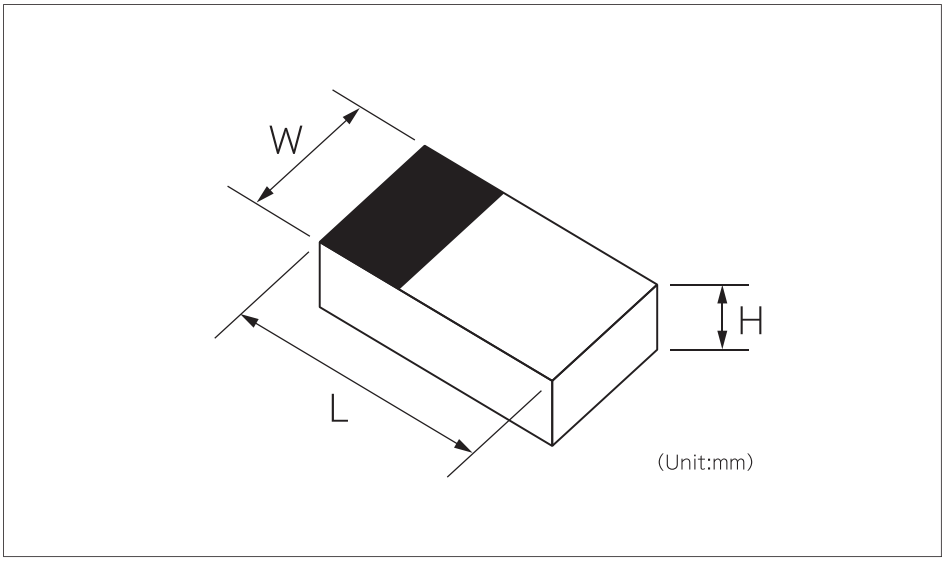
Series system diagram



Case size (Unit:mm)

	S09	A09	A14	B09	B1	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	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	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	1.4	1.4	1.9	1.9	1.15	1.4	1.4	1.8	1.9	2.8	3.8

The size of each photo is nearly to full scale.



L×W×H (Unit:mm)

S09 size	A09 size	A14 size	B09 size	B1 size	B1G size	B15 size	B15G size
2.0×1.25×0.9	3.2×1.6×0.9	3.2×1.6×1.4	3.5×2.8×0.9	3.5×2.8×1.1	3.5×2.8×1.1	3.5×2.8×1.4	3.5×2.8×1.4
P.45	P.46	P.46	P.45	P.60	P.47	P.57	P.47
TPU	TPH	TPH	TPU	TPC	TPG	TQC	TPG
2.5 V.DC to 10 V.DC 4.7 µF to 100 µF	2.5 V.DC to 10 V.DC 33 µF to 100 µF	2.5 V.DC to 6.3 V.DC 100 µF to 220 µF	6.3 V.DC 150 µF	6.3 V.DC to 12.5 V.DC 10 µF to 47 µF	2.5 V.DC to 12.5 V.DC 33 µF to 220 µF	35 V.DC 2.7 µF	2.5 V.DC to 6.3 V.DC 150 µF to 220 µF

L×W×H (Unit:mm)

B2 size	B2S size	D12 size	D15 size	D15E size	D2E size	D2 size	D3L size		D4 size
3.5×2.8×1.9	3.5×2.8×1.9	7.3×4.3×1.15	7.3×4.3×1.4	7.3×4.3×1.4	7.3×4.3×1.8	7.3×4.3×1.9	7.3×4.3×2.8		7.3×4.3×3.8
P.49-50	P.48	P.58	P.58	P.51-52	P.51-52	P.58	P.51-52	P.56	P.51-52
TPE	TPSF	TQC	TQC	TPE	TPE	TQC	TPE	TV	TPE
2.0 V.DC to 10 V.DC 47 µF to 470 µF	2.0 V.DC to 2.5 V.DC 270 µF	16 V.DC 33 µF	16 V.DC to 25 V.DC 22 µF to 47 µF	6.3 V.DC 470 µF	2.5 V.DC to 10 V.DC 68 µF to 470 µF	16 V.DC to 35 V.DC 10 µF to 150 µF	2.5 V.DC to 10 V.DC 220 µF to 680 µF	10 V.DC 150 µF	2.5 V.DC to 10 V.DC 330 µF to 1500 µF
P.55					P.53-54	P.60	P.53-54	P.58	P.53-54
TA					TPF	TPC	TPF	TQC	TPF
4.0 V.DC to 10 V.DC 47 µF to 100 µF					2.0 V.DC 220 µF to 330 µF	6.3 V.DC to 10 V.DC 68 µF to 330 µF	2.5 V.DC to 10 V.DC 150 µF to 680 µF	16 V.DC to 25 V.DC 68 µF to 150 µF	2.5 V.DC to 6.3 V.DC 470 µF to 1000 µF
P.57					P.55	P.61-62	P.55	P.59	P.59
TQC					TA	TH	TA	TPB	TPB
16 V.DC to 35 V.DC 3.9 µF to 33 µF					2.5 V.DC to 10 V.DC 68 µF to 470 µF	2.5 V.DC to 10 V.DC 68 µF to 220 µF	2.5 V.DC to 10 V.DC 150 µF to 680 µF	4.0 V.DC to 10 V.DC 150 µF to 330 µF	6.3 V.DC to 10 V.DC 220 µF to 470 µF
P.59					P.56		P.61-62	P.63-64	P.61-62
TPB					TV		TH	TC	TH
4.0 V.DC to 10 V.DC 33 µF to 68 µF					6.3 V.DC to 10 V.DC 68 µF to 150 µF		4.0 V.DC to 6.3 V.DC 220 µF to 330 µF	2.5 V.DC to 10 V.DC 150 µF to 680 µF	6.3 V.DC to 10 V.DC 220 µF to 470 µF
					P.61-62				P.63-64
					TH				TC
					2.5 V.DC to 6.3 V.DC 150 µF to 330 µF				2.5 V.DC to 10 V.DC 330 µF to 1000 µF
					P.63-64				
					TC				
					4.0 V.DC to 6.3 V.DC 100 µF to 330 µF				

The size of each photo is nearly to full scale.

Products list

Size・ESR Matrix list

Size code (ESR mΩ)

V.DC	Series \ μF	2.7	3.9	4.7	5.6	8.2	10	15	22	33	47	68
2.0	TPSF											
	TPE											
	TPF											
2.5	TPU										S09 (150)	
	TPH											
	TPG											
	TPSF											
	TPE											
	TPF											
	TA											
	TH											
	TC											
4.0	TPU											S09 (150)
	TPH											A09 (150)
	TPG											
	TPE											
	TPF											
	TA											
	TPB											B2 (70)
	TH											
	TC											
6.3	TPU						S09 (250)		S09 (150)		S09 (150)	
	TPH										A09 (150)	
	TPG											
	TPE											
	TPF											
	TA										B2 (70)	B2 (70)
	TV											
	TPB											B2 (70)
	TPC										B1 (70,55)	
	TH											
	TC											
8.0	TPG										B1G (70)	
	TPE											
	TPC								B1 (70)			
10	TPU			S09 (300)								
	TPH									A09 (150)		
	TPG										B1G (70)	
	TPE										B2 (35)	D2E (25)
	TPF											
	TA										B2 (70)	D2E (25)
	TV											D2E (25)
	TPB									B2 (70)	B2 (70)	
	TPC											D2 (45)
	TH											D2 (45)
	TC											
12.5	TPG									B1G (70)		
	TPC						B1 (80)	B1 (80)				
16	TQC						B2 (100)	B2 (90)		B2 (90)	D15 (55)	D2 (50)
										D12 (40)	D2 (55,40)	
										D2 (70)		
20	TQC					B2 (100)			B2 (90)	D2 (60)	D15 (55)	
											D2 (55)	
25	TQC				B2 (100)			B2 (100)	D15 (70)	D2 (60)		D3L (70)
								D2 (90,45)	D2 (60,45)			
35	TQC	B15 (300)	B2 (400)				D2 (120)	D2 (150)				

Case size

(Unit:mm)

	S09	A09	A14	B09	B1	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	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	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	1.4	1.4	1.9	1.9	1.15	1.4	1.4	1.8	1.9	2.8	3.8

V.DC	Series \ μF	100	120	150	220	270	330	470	680	1000	1500
2.0	TPSF					B2S (9 / 6)					
	TPE						B2 (15,13)	B2 (15,11)			
	TPF				D2E (6)		D2E (6)				
2.5	TPU	S09 (150)									
	TPH	A09 (150)			A14 (70)						
	TPG				B1G (70)						
					B15G (30)						
	TPSF					B2S (6)					
	TPE				B2 (35,25,21,15)		B2 (35)	D2E (18,15,12,9,7)	D3L (15,12)	D4 (15)	D4 (15,12)
					D2E (25,18,15,9)		D2E (25,18,15,12,9,7)				
	TPF						D3L (7)	D3L (10,7,6)	D3L (10,7,6)	D4 (6,5)	
								D4 (5)	D4 (5)		
	TA				D2E (25,15,9)		D2E (25,18,15)	D2E (25,15)	D3L (25,15)		
	TH				D2 (45)		D2E (25,18,15)				
	TC								D3L (15,12,10,	D4 (15,6,5)	
									D4 (5)		
4.0	TPU										
	TPH			A14 (70)							
	TPG				B15G (70)						
	TPE	B2 (35)		B2 (35)	B2 (35)		D2E (25,18)	D3L (25,18,15,12)			
				D2E (18)	D2E (25,18,15)						
	TPF						D3L (12)	D3L (10)	D4 (10)		
	TA	B2 (70)			D2E (25,18)			D3L (25,18)			
	TPB						D3L (40)				
	TH				D2E (25,18,15)		D3L (40)				
	TC			D2E (18)	D2E (25,18,15)		D2E (25,18)	D3L (25,18,15,12,10)	D4 (10)		
							D3L (12)				
6.3	TPU			B09 (100)							
	TPH	A09 (100)									
		A14 (70)									
	TPG	B1G (70,55,35)		B15G (70,35)							
	TPE	B2 (35,25)	B2 (35)	B2 (35,25)	B2 (35)		D2E (25)	D15E (35)	D4 (25,18)		
		D2E (25,18)		D2E (25,18,15)	D2E (25,18)		D3L (25,18,15,9)	D4 (25,18)			
							D4 (10)				
	TPF				D3L (12,9,5)		D3L (9)	D4 (10)			
	TA			D2E (25)	D2E (25,18)		D3L (25)				
	TV			D2E (25)							
	TPB				D3L (40)		D3L (40)	D4 (35)			
							D4 (40)				
	TPC	D2 (45)		D2 (40)			D2 (40)				
	TH			D2E (25,18)	D3L (40)		D4 (40)	D4 (35)			
				D2 (40)							
	TC	D2E (25,18)		D2E (25,18,15)	D2E (25,18)		D3L (25,18,15,9)	D4 (25,18,10)	D4 (25,18)		
					D3L (12,9,5)						
8.0	TPG										
	TPE	B2 (35)									
	TPC			D2 (40)							
10	TPU										
	TPH										
	TPG										
	TPE				D3L (25,18)		D4 (25)				
	TPF			D3L (15)							
	TA			D3L (25)	D3L (25)						
	TV			D3L (25)							
	TPB			D3L (40)	D3L (40)		D4 (35)				
					D4 (40)						
	TPC	D2 (45)									
	TH				D4 (40)		D4 (35)				
	TC			D3L (15)	D3L (25,18)		D4 (25)				
12.5	TPG										
	TPC										
16	TQC	D2 (50)		D3L (50)							
				D2 (70)							
20	TQC	D3L (55)									
25	TQC										
35	TQC										

Surface mount type TPU Series

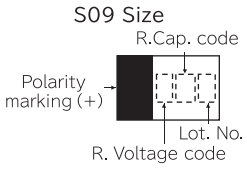
- Small size, Low profile (L2.0xW1.25xH0.9 mm)
- Face down terminal type
- RoHS compliance, Halogen free

Specifications

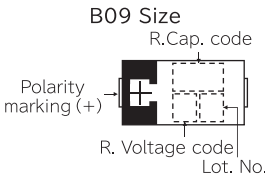
Items	Specifications	
Size code	S09	B09
Category temperature range	−55 ℃ to +85 ℃	
Rated voltage range	2.5 V.DC to 10 V.DC	6.3 V.DC
Category voltage range	2.5 V.DC to 10 V.DC	6.3 V.DC
Rated capacitance range	4.7 μF to 100 μF	150 μF
Capacitance tolerance	±20 %(120 Hz /+20 ℃)	
Leakage current	Please see the attached characteristics list	
Dissipation factor(tanδ)	Please see the attached characteristics list	
Surge voltage(V.DC)	Rated voltage x1.15	
Endurance	+85 ℃, 1000 h, rated voltage applied	
	Capacitance change	Within±20 % of the initial value
	tanδ	≦ 1.5 times of the initial limit
	DC leakage current	Within the initial limit
Damp heat (Steady state)	+60 ℃, 90 % to 95 %, 500 h, No-applied voltage	
	Capacitance change	Within+40 %,−20 % of the initial value
	tanδ	≦ 1.5 times of the initial limit
	DC leakage current	≦ 3 times of the initial limit

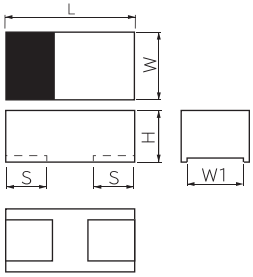
Marking and dimensions

S09 Size



B09 Size





(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

R. Voltage (V.DC)	2.5	4.0	6.3	10.0
Code	e	g	j	A

S09 size

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

B09 size

R. Cap. (μF)	150
Code	E8

Characteristics list

Series	Rated voltage (V.DC)	Rated temp. (℃)	Category voltage (V.DC)	Category temp. (℃)	Rated capacitance (μF)	Case size (mm) L	W	H	Size code	Specifications Ripple current ※1 (mArm.s.)	ESR ※2 (mΩ max.)	tan δ ※3	LC ※4 (μA)	Standard Part number	Min. Packaging Q'ty (pcs)
TPU	2.5	85	2.5	85	47	2.0	1.25	0.9	S09	510	150	0.10	23.5	2R5TPU47MSI	3000
		85	2.5	85	100	2.0	1.25	0.9		510	150	0.10	50.0	ETPU100MSI	3000
	4	85	4	85	68	2.0	1.25	0.9		510	150	0.10	54.4	4TPU68MSI	3000
	6.3	85	6.3	85	10	2.0	1.25	0.9		400	250	0.10	6.3	6TPU10MSI	3000
		85	6.3	85	22	2.0	1.25	0.9		510	150	0.10	27.7	6TPU22MSI	3000
		85	6.3	85	47	2.0	1.25	0.9		510	150	0.10	59.2	6TPU47MSI	3000
		85	6.3	85	150	3.5	2.8	0.9	B09	670	100	0.10	94.5	6TPU150MBI	3000
	10	85	10	85	4.7	2.0	1.25	0.9	S09	360	300	0.10	4.7	10TPU4R7MSI	3000

※1 : Ripple current (100 kHz/ +45 ℃), ※2 : ESR (100 kHz/+20 ℃) ※3 : tanδ (120 Hz/+20 ℃) ※4 : After 5 minutes

◆Please refer to the P37 to 38 in this catalog for "Reflow conditions" and "Taping specifications".

Surface mount type TPH Series

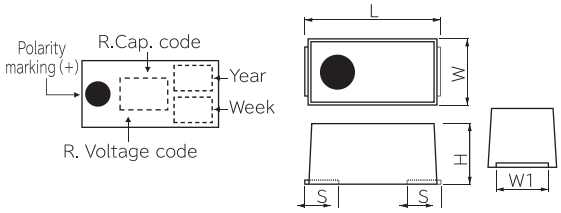
- Small size, Low profile (L3.2xW1.6xH0.9 mm)
- Face down terminal type
- RoHS compliance, Halogen free

Specifications

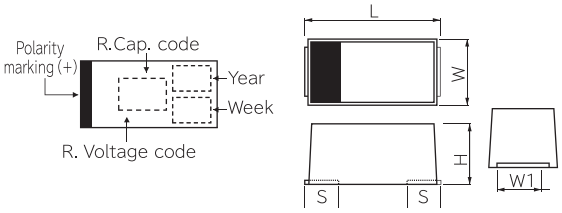
Items	Specifications	
Size code	A09	A14
Category temperature range	–55 ℃ to +105 ℃ / –55 ℃ to +85 ℃ (Rated temp. 85 ℃)	
Rated voltage range	2.5 V.DC to 10 V.DC	2.5 V.DC to 6.3 V.DC
Category voltage range	2.5 V.DC to 10 V.DC	2.5 V.DC to 6.3 V.DC
Rated capacitance range	33 μF to 100 μF	100 μF to 220 μF
Capacitance tolerance	±20 %(120 Hz/+20 ℃)	
Leakage current	Please see the attached characteristics list	
Dissipation factor(tanδ)	Please see the attached characteristics list	
Surge voltage(V.DC)	Rated voltage x1.15	
Endurance	+105 ℃, 1000 h rated voltage applied ※Rated temp, 85 ℃ Products:85 ℃, 1000 h, rated voltage applied	
	Capacitance change	Within±20 % of the initial value
	tanδ	≦ 1.5 times of the initial limit
	DC leakage current	Within the initial limit
Damp heat (Steady state)	+60 ℃, 90 % to 95 %, 500 h, No-applied voltage	
	Capacitance change	Within+50 %, −20 % of the initial value (ETPH220MABC)
		Within+40 %, −20 % of the initial value (Except for above model)
	tanδ	≦ 1.5 times of the initial limit
	DC leakage current	≦ 3 times of the initial limit

Marking and dimensions

A09／A14 Size



A09 Size (6TPH100MAEA)



(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

R. Voltage (V.DC)	2.5	4.0	6.3	10
Code	e	g	j	A

R. Cap. (μF)	33	47	68	100	150	220
Code	N7	S7	W7	A8	E8	J8

Characteristics list

Series	Rated voltage (V.DC)	Rated temp. (℃)	Category voltage (V.DC)	Category temp. (℃)	Rated capacitance (μF)	Case size (mm) L	W	H	Size code	Specifications Ripple current ※1 (mArms.)	ESR ※2 (mΩ max.)	tan δ ※3	LC ※4 (μA)	Standard Part number	Min. Packaging Q'ty (pcs)
TPH	2.5	105	2.5	105	100	3.2	1.6	0.9	A09	510	150	0.10	25.0	ETPH100MHA	3000
		85	2.5	85	220	3.2	1.6	1.4	A14	740	70	0.10	110.0	ETPH220MABC	2500
	4	105	4	105	68	3.2	1.6	0.9	A09	510	150	0.10	27.2	4TPH68MHA	3000
		85	4	85	150	3.2	1.6	1.4	A14	740	70	0.10	120.0	4TPH150MABC	2500
	6.3	105	6.3	105	47	3.2	1.6	0.9	A09	510	150	0.10	29.6	6TPH47MHA	3000
		85	6.3	85	100	3.2	1.6	0.9		670	100	0.10	63.0	6TPH100MAEA	3000
		85	6.3	85	100	3.2	1.6	1.4	A14	740	70	0.10	126.0	6TPH100MABC	2500
	10	85	10	85	33	3.2	1.6	0.9	A09	510	150	0.10	33.0	ATPH33MAHA	3000

※1:Ripple current (100 kHz/ +45 ℃), ※2:ESR (100 kHz/+20 ℃) ※3:tanδ (120 Hz/+20 ℃) ※4:After 5 minutes

◆Please refer to the P37 to 38 in this catalog for "Reflow conditions" and "Taping specifications".

Design and specifications are each subject to change without notice. Ask factory for the current technical specifications before purchase and/or use.
Should a safety concern arise regarding this product, please be sure to contact us immediately.

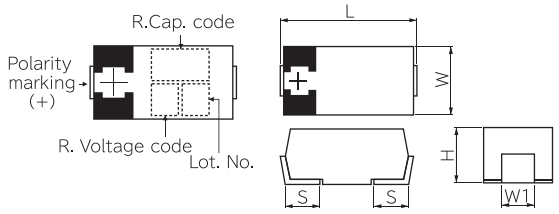
Surface mount type TPG Series

- Small size, Low profile (L3.5xW2.8xH1.1 mm)
- Large capacitance (220 μF max.)
- RoHS compliance, Halogen free

Specifications

Items	Specifications	
Size code	B1G	B15G
Category temperature range	−55 ℃ to +105 ℃	
Rated voltage range	2.5 V.DC to 12.5 V.DC	2.5 V.DC to 6.3 V.DC
Category voltage range	2 V.DC to 10 V.DC	2.5 V.DC to 5 V.DC
Rated capacitance range	33 μF to 220 μF	150 μF to 220 μF
Capacitance tolerance	±20 %(120 Hz/+20 ℃)	
Leakage current	Please see the attached characteristics list	
Dissipation factor(tanδ)	Please see the attached characteristics list	
Surge voltage(V.DC)	Rated voltage x1.15	
Endurance	+85 ℃, 1000 h, rated voltage applied	
	Capacitance change	Within±20 % of the initial value
	tanδ	≦ 1.5 times of the initial limit
	DC leakage current	Within the initial limit
Damp heat (Steady state)	+60 ℃, 90 % to 95 %, 500 h, No-applied voltage	
	Capacitance change	Within+40 %, −20 % of the initial value
	tanδ	≦ 1.5 times of the initial limit
	DC leakage current	≦ 3 times of the initial limit

Marking and dimensions



(unit : mm)

Size code	L +0.3/-0.1	W +0.3/-0.1	H ±0.1	S ±0.2	W1 ±0.1
B1G	3.5	2.8	1.1	0.8	2.2
B15G	3.5	2.8	1.4	0.8	2.2

R. Voltage (V.DC)	2.5	4.0	6.3	8.0	10.0	12.5
Code	e	g	j	k	A	B

R. Cap. (μF)	33	47	100	150	220
Code	N7	S7	A8	E8	J8

Characteristics list

Series	Rated voltage (V.DC)	Rated temp. (℃)	Category voltage (V.DC)	Category temp. (℃)	Rated capacitance (μF)	Case size (mm) L	W	H	Size code	Specifications Ripple current ※1 (mArm.s.)	ESR ※2 (mΩ max.)	tan δ ※3	LC ※4 (μA)	Standard Part number	Min. Packaging Q'ty (pcs)
TPG	2.5	85	2	105	220	3.5	2.8	1.1	B1G	1000	70	0.10	55.0	2R5TPG220M	2500
		85	2	105		3.5	2.8	1.4	B15G	1400	30/300kHz	0.10	110.0	2R5TPG220MUG	2500
	4	85	3.2	105		3.5	2.8	1.4		1000	70	0.10	88.0	4TPG220M	2500
	6.3	85	5	105	100	3.5	2.8	1.1	B1G	1000	70	0.10	63.0	6TPG100M	2500
		85	5	105		3.5	2.8	1.1		1100	55	0.10	63.0	6TPG100MG	2500
		85	5	105		3.5	2.8	1.1		1200	35/300kHz	0.10	126.0	6TPG100MZGD	2500
		85	5	105	150	3.5	2.8	1.4	B15G	1000	70	0.10	94.5	6TPG150M	2500
		85	5	105		3.5	2.8	1.4		1200	35/300kHz	0.10	189.0	6TPG150MZG	2500
	8	85	6.3	105	47	3.5	2.8	1.1	B1G	1000	70	0.10	37.6	8TPG47M	2500
	10	85	8	105		3.5	2.8	1.1		1000	70	0.10	47.0	10TPG47M	2500
	12.5	85	10	105	33	3.5	2.8	1.1		1000	70	0.10	41.3	12TPG33M	2500

※1 : Ripple current (100 kHz/ +45 ℃). ※2 : ESR (100 kHz/+20 ℃) ※3 : tanδ (120 Hz/+20 ℃) ※4 : After 5 minutes

◆Please refer to the P37 to 38 in this catalog for "Reflow conditions" and "Taping specifications".

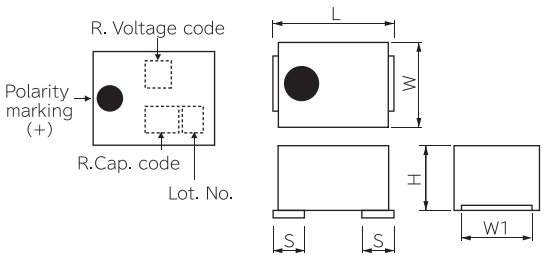
Surface mount type TPSF Series

- Super low ESR (6 mΩ max.)
- Super low ESL (0.7 nH)
- Face down terminal type
- RoHS compliance, Halogen free

Specifications

Items	Specifications	
Size code	B2S	
Category temperature range	−55 ℃ to +105 ℃	
Rated voltage range	2 V.DC to 2.5 V.DC	
Category voltage range	2 V.DC to 2.5 V.DC	
Rated capacitance range	270 μF	
Capacitance tolerance	±20 %(120 Hz/+20 ℃)	
Leakage current	Please see the attached characteristics list	
Dissipation factor(tanδ)	Please see the attached characteristics list	
Surge voltage(V.DC)	Rated voltage x1.15	
Endurance	+105 ℃, 1000 h rated voltage applied	
	Capacitance change	Within±20 % of the initial value
	tanδ	≦ 1.5 times of the initial limit
	DC leakage current	Within the initial limit
Damp heat (Steady state)	+60 ℃, 90 % to 95 %, 500 h, No-applied voltage	
	Capacitance change	Within+40 %, −20 % of the initial value
	tanδ	≦ 1.5 times of the initial limit
	DC leakage current	≦ 3 times of the initial limit

Marking and dimensions



(unit : mm)

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

R. Voltage (V.DC)	2.0	2.5
Code	d	e

R. Cap. (μF)	270
Code	L8

Characteristics list

Series	Rated voltage (V.DC)	Rated temp. (℃)	Category voltage (V.DC)	Category temp. (℃)	Rated capacitance (μF)	Case size (mm) L	W	H	Size code	Specifications Ripple current ※1 (mArm.s.)	ESR ※2 (mΩ max.)	tan δ ※3	LC ※4 (μA)	Standard Part number	Min. Packaging Q'ty (pcs)
TPSF	2	105	2	105	270	3.5	2.8	1.9	B2S	3200	6/500kHz	0.08	108.0	2TPSF270M6E	2000
		105	2	105		3.5	2.8	1.9		2400	9/300kHz	0.08	108.0	2TPSF270M9G	2000
	2.5	105	2.5	105		3.5	2.8	1.9		3200	6/500kHz	0.08	135.0	ETPSF270M6E	2000

※1 : Ripple current (100 kHz/ +45 ℃), ※2 : ESR (100 kHz/+20 ℃) ※3 : tanδ (120 Hz/+20 ℃) ※4 : After 5 minutes

◆Please refer to the P37 to 38 in this catalog for "Reflow conditions" and "Taping specifications".

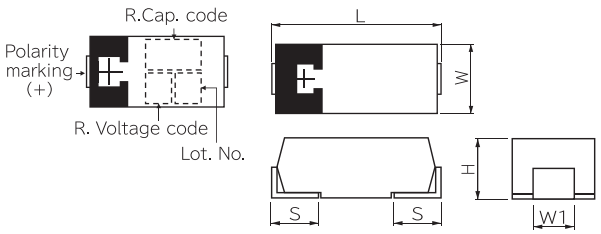
Surface mount type TPE Series B size

■ Small size (L3.5xW2.8xH1.9 mm) ■ RoHS compliance, Halogen free
■ Low ESR (15 mΩ)

Specifications

Items	Specifications	
Size code	B2	
Category temperature range	–55 ℃ to +105 ℃	
Rated voltage range	2 V.DC to 10 V.DC	
Category voltage range	1.8 V.DC to 8 V.DC	
Rated capacitance range	47 μF to 470 μF	
Capacitance tolerance	±20 %(120 Hz/+20 ℃)	
Leakage current	Please see the attached characteristics list	
Dissipation factor(tanδ)	Please see the attached characteristics list	
Surge voltage(V.DC)	Rated voltage x1.15	
Endurance	+105 ℃, 1000 h rated voltage applied ※Rated temp, 85 ℃ Products：85 ℃, 1000 h, rated voltage applied	
	Capacitance change	Within±20 % of the initial value
	tanδ	≦ 1.5 times of the initial limit
	DC leakage current	Within the initial limit
Damp heat (Steady state)	+60 ℃, 90 % to 95 %, 500 h, No-applied voltage	
	Capacitance change	Within+50 %, –20 %(2R5TPE220MAZB(MAPB,MAFB), 2R5TPE330MAZB, 2TPE330MAFB(MADGB), 2TPE470MAJGB(MAFB), 2TPE330MFB)
		Within+40 %, –20 % of the initial value (Except for above model)
	tanδ	≦ 1.5 times of the initial limit
	DC leakage current	≦ 3 times of the initial limit

Marking and dimensions



(unit : mm)

Size code	L ±0.2	W ±0.2	H ±0.1	S ±0.2	W1 ±0.1
B2	3.5	2.8	1.9	0.8	2.2

R. Voltage (V.DC)	2.0	2.5	4.0	6.3	8.0	10.0
Code	d	e	g	j	k	A

R. Cap. (μF)	47	100	120	150	220	330	470
Code	S7	A8	C8	E8	J8	N8	S8

Characteristics list

Series	Rated voltage (V.DC)	Rated temp. (℃)	Category voltage (V.DC)	Category temp. (℃)	Rated capacitance (μF)	Case size (mm) L	W	H	Size code	Specifications Ripple current ※1 (mArms)	ESR ※2 (mΩ max.)	tan δ ※3	LC ※4 (μA)	Standard Part number	Min. Packaging Q'ty (pcs)
TPE	2	105	2	105	330	3.5	2.8	1.9	B2	2000	15	0.08	132.0	2TPE330MFB	2000
		85	1.8	105		3.5	2.8	1.9		2000	15	0.08	132.0	2TPE330MAFB	2000
		85	1.8	105		3.5	2.8	1.9		2000	13/300 kHz	0.08	132.0	2TPE330MADGB	2000
		85	1.8	105	470	3.5	2.8	1.9		2300	15	0.10	188.0	2TPE470MAFB	2000
		85	1.8	105		3.5	2.8	1.9		2300	11/300 kHz	0.10	188.0	2TPE470MAJGB	2000
	2.5	85	2	105	220	3.5	2.8	1.9		2000	15	0.08	110.0	2R5TPE220MAFB	2000
		105	2.5	105		3.5	2.8	1.9		1800	15/300 kHz	0.08	110.0	2R5TPE220MFGB	2000
		105	2.5	105		3.5	2.8	1.9		1700	21	0.08	55.0	2R5TPE220MLB	2000
		85	2	105		3.5	2.8	1.9		1600	25	0.08	55.0	2R5TPE220MAPB	2000
		105	2.5	105		3.5	2.8	1.9		1400	35	0.08	55.0	2R5TPE220MZB	2000
		85	2	105		3.5	2.8	1.9		1400	35	0.08	55.0	2R5TPE220MAZB	2000
		85	2	105	330	3.5	2.8	1.9		1400	35	0.08	82.5	2R5TPE330MAZB	2000
	4	105	4	105	100	3.5	2.8	1.9		1400	35	0.08	40.0	4TPE100MZB	2000
		85	3.2	105	150	3.5	2.8	1.9		1400	35	0.08	60.0	4TPE150MAZB	2000
		85	3.2	105	220	3.5	2.8	1.9		1400	35	0.08	88.0	4TPE220MAZB	2000
	6.3	105	6.3	105	100	3.5	2.8	1.9		1600	25	0.08	63.0	6TPE100MPB	2000
		85	5	105		3.5	2.8	1.9		1400	35	0.08	63.0	6TPE100MAZB	2000
		85	5	105	120	3.5	2.8	1.9		1400	35	0.08	75.6	6TPE120MAZB	2000
		85	5	105	150	3.5	2.8	1.9		1600	25	0.08	94.5	6TPE150MAPB	2000
		85	5	105		3.5	2.8	1.9		1400	35	0.08	94.5	6TPE150MAZB	2000
		85	5	105	220	3.5	2.8	1.9		1400	35	0.10	138.6	6TPE220MAZB	2000
	8	85	6.3	105	100	3.5	2.8	1.9		1400	35	0.08	80.0	8TPE100MAZB	2000
	10	85	8	105	47	3.5	2.8	1.9		1400	35	0.08	47.0	10TPE47MAZB	2000

※1：Ripple current (100 kHz/ +45 ℃), ※2：ESR (100 kHz/+20 ℃)　※3：tanδ (120 Hz/+20 ℃)　※4：After 5 minutes

◆Please refer to the P37 to 38 in this catalog for "Reflow conditions" and "Taping specifications".

※：Small order quantity (500 pcs/reel) is available with TPE series. Please contact our sales representative if you prefer it.

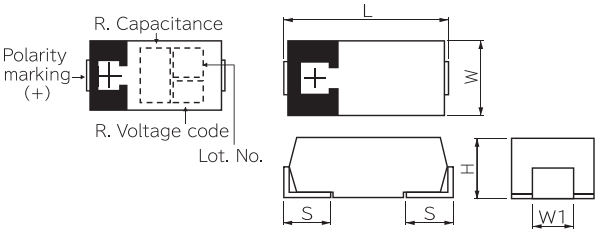
Surface mount type TPE Series D size

- Low profile (Height 1.5 mm)
- Low ESR(7 mΩ)
- Large capacitance(1500 μF max.)
- RoHS compliance, Halogen free

Specifications

Items	Specifications			
Size code	D15E	D2E	D3L	D4
Category temperature range	−55 ℃ to +105 ℃			
Rated voltage range	6.3 V.DC	2.5 V.DC to 10 V.DC		
Category voltage range	5 V.DC	2.5 V.DC to 10 V.DC		
Rated capacitance range	470 μF	68 μF to 470 μF	220 μF to 680 μF	330 μF to 1500 μF
Capacitance tolerance	±20(120 Hz/+20 ℃)			
Leakage current	Please see the attached characteristics list			
Dissipation factor(tanδ)	Please see the attached characteristics list			
Surge voltage(V.DC)	Rated voltage x1.15			
Endurance	+105 ℃, 2000 h, rated voltage applied ※Rated temp, 85 ℃ products:85 ℃, 1000 h, rated voltage applied6TPE330MAP, 6TPE470MAZU:85 ℃, 2000 h			
	Capacitance change	Within±20 % of the initial value		
	tanδ	≦ 1.5 times of the initial limit		
	DC leakage current	Within the initial limit		
Damp heat (Steady state)	+60 ℃, 90 % to 95 %, 500 h, No-applied voltage			
	Capacitance change	Within+50 %, −20 %(2R5TPE220M(I, F, 9), 2R5TPE330M (I, F, C, 9, 7), 2R5TPE470M(I, F, C, 9, 7), 2R5TPE1000M(F, C)		
		Within+40 %, −20 % of the initial value (Except for above model)		
	tanδ	≦ 1.5 times of the initial limit		
	DC leakage current	≦ 3 times of the initial limit		

Marking and dimensions



(unit : mm)

Size code	L ±0.3	W ±0.2	H ±0.2※1	S ±0.2	W1 ±0.1
D15E	7.3	4.3	1.4	1.1	2.4
D2E	7.3	4.3	1.8	1.3	2.4
D3L	7.3	4.3	2.8	1.3	2.4
D4	7.3	4.3	3.8	1.3	2.4

※1 ±0.1 : D2E,D15E

R. Voltage (V.DC)	2.5	4.0	6.3	10.0
Code	e	g	j	A

Characteristics list

Series	Rated voltage (V.DC)	Rated temp. (℃)	Category voltage (V.DC)	Category temp. (℃)	Rated capacitance (μF)	Case size (mm) L	W	H	Size code	Specifications Ripple current ※1 (mArms.)	ESR ※2 (mΩ max.)	tan δ ※3	LC ※4 (μA)	Standard Part number	Min. Packaging Q'ty (pcs)
TPE	2.5	105	2.5	105	220	7.3	4.3	1.8	D2E	3900	9	0.10	55.0	2R5TPE220M9	3000
		105	2.5	105		7.3	4.3	1.8		3100	15	0.10	55.0	2R5TPE220MF	3000
		105	2.5	105		7.3	4.3	1.8		2800	18	0.10	55.0	2R5TPE220MI	3000
		105	2.5	105		7.3	4.3	1.8		2400	25	0.10	55.0	2R5TPE220M	3000
		105	2.5	105	330	7.3	4.3	1.8		4400	7	0.10	82.5	2R5TPE330M7	3000
		105	2.5	105		7.3	4.3	1.8		3900	9	0.10	82.5	2R5TPE330M9	3000
		105	2.5	105		7.3	4.3	1.8		3500	12	0.10	82.5	2R5TPE330MC	3000
		105	2.5	105		7.3	4.3	1.8		3100	15	0.10	82.5	2R5TPE330MF	3000
		105	2.5	105		7.3	4.3	1.8		2800	18	0.10	82.5	2R5TPE330MI	3000
		105	2.5	105		7.3	4.3	1.8		2400	25	0.10	82.5	2R5TPE330M	3000
		105	2.5	105	470	7.3	4.3	1.8		4400	7	0.10	117.5	2R5TPE470M7	3000
		105	2.5	105		7.3	4.3	1.8		3900	9	0.10	117.5	2R5TPE470M9	3000
		105	2.5	105		7.3	4.3	1.8		3500	12	0.10	117.5	2R5TPE470MC	3000
		105	2.5	105		7.3	4.3	1.8		3100	15	0.10	117.5	2R5TPE470MF	3000
		105	2.5	105		7.3	4.3	1.8		2800	18	0.10	117.5	2R5TPE470MI	3000
		105	2.5	105	680	7.3	4.3	2.8	D3L	3500	12	0.10	170.0	2R5TPE680MCL	2500
		105	2.5	105		7.3	4.3	2.8		3100	15	0.10	170.0	2R5TPE680MFL	2500
		105	2.5	105	1000	7.3	4.3	3.8	D4	3900	15	0.15	250.0	2R5TPE1000MF	2000
		105	2.5	105	1500	7.3	4.3	3.8		4400	12	0.15	375.0	2R5TPE1500MC	2000
		105	2.5	105		7.3	4.3	3.8		3900	15	0.15	375.0	2R5TPE1500MF	2000
	4	105	4	105	150	7.3	4.3	1.8	D2E	2800	18	0.10	60.0	4TPE150MI	3000
		105	4	105	220	7.3	4.3	1.8		3100	15	0.10	88.0	4TPE220MF	3000
		105	4	105		7.3	4.3	1.8		2800	18	0.10	88.0	4TPE220MI	3000
		105	4	105		7.3	4.3	1.8		2400	25	0.10	88.0	4TPE220M	3000
		105	4	105	330	7.3	4.3	1.8		2800	18	0.10	132.0	4TPE330MI	3000
		105	4	105		7.3	4.3	1.8		2400	25	0.10	132.0	4TPE330M	3000
		105	4	105	470	7.3	4.3	2.8	D3L	3500	12	0.10	188.0	4TPE470MCL	2500
		105	4	105		7.3	4.3	2.8		3100	15	0.10	188.0	4TPE470MFL	2500
		105	4	105		7.3	4.3	2.8		2800	18	0.10	188.0	4TPE470MIL	2500
		105	4	105		7.3	4.3	2.8		2400	25	0.10	188.0	4TPE470ML	2500
	6.3	105	6.3	105	100	7.3	4.3	1.8	D2E	2800	18	0.10	63.0	6TPE100MI	3000
		105	6.3	105		7.3	4.3	1.8		2400	25	0.10	63.0	6TPE100M	3000
		105	6.3	105	150	7.3	4.3	1.8		3100	15	0.10	94.5	6TPE150MF	3000
		105	6.3	105		7.3	4.3	1.8		2800	18	0.10	94.5	6TPE150MI	3000
		105	6.3	105		7.3	4.3	1.8		2400	25	0.10	94.5	6TPE150M	3000
		105	6.3	105	220	7.3	4.3	1.8		2800	18	0.10	138.6	6TPE220MI	3000
		105	6.3	105		7.3	4.3	1.8		2400	25	0.10	138.6	6TPE220M	3000
		85	5	105		7.3	4.3	1.8		2400	25	0.10	138.6	6TPE220MAP	3000
		85	5	105	330	7.3	4.3	1.8		2400	25	0.10	207.9	6TPE330MAP	3000
		85	5	105		7.3	4.3	2.8	D3L	2400	25	0.10	207.9	6TPE330MAL	2500
		85	5	105		7.3	4.3	2.8		3900	9/500 kHz	0.10	207.9	6TPE330MA9EL	2500
		105	6.3	105		7.3	4.3	2.8		3100	15	0.10	207.9	6TPE330MFL	2500
		105	6.3	105		7.3	4.3	2.8		2800	18	0.10	207.9	6TPE330MIL	2500
		105	6.3	105		7.3	4.3	2.8		2400	25	0.10	207.9	6TPE330ML	2500
		85	5	105		7.3	4.3	3.8	D4	4400	10	0.10	207.9	6TPE330MAA	2000
		85	5	105	470	7.3	4.3	1.4	D15E	1700	35	0.10	296.1	6TPE470MAZU	4000
		105	6.3	105		7.3	4.3	3.8	D4	3500	18	0.15	296.1	6TPE470MI	2000
		105	6.3	105		7.3	4.3	3.8		3000	25	0.15	296.1	6TPE470M	2000
		105	6.3	105	680	7.3	4.3	3.8		3500	18	0.15	428.4	6TPE680MI	2000
		105	6.3	105		7.3	4.3	3.8		3000	25	0.15	428.4	6TPE680M	2000
	10	105	10	105	68	7.3	4.3	1.8	D2E	2400	25	0.10	68.0	10TPE68M	3000
		105	10	105	220	7.3	4.3	2.8	D3L	2800	18	0.10	220.0	10TPE220MIL	2500
		105	10	105		7.3	4.3	2.8		2400	25	0.10	220.0	10TPE220ML	2500
		105	10	105	330	7.3	4.3	3.8	D4	3000	25	0.10	330.0	10TPE330M	2000

※1：Ripple current (100 kHz/ +45 ℃), ※2：ESR (100 kHz/+20 ℃)　※3：tanδ (120 Hz/+20 ℃)　※4：After 5 minutes

◆Please refer to each page in this catarog for "Reflow conditions" and "Taping specifications".

※：Small order quantity (500 pcs/reel) is available with TPE series. Please contact our sales representative if you prefer it.

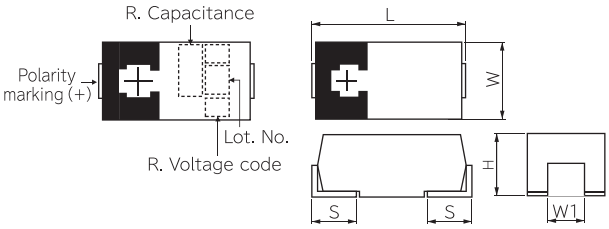
Surface mount type TPF Series

- Low ESR (5 mΩ)
- Large capacitance (1000 μF max.)
- RoHS compliance, Halogen free

Specifications

Items	Specifications		
Size code	D2E	D3L	D4
Category temperature range	−55 ℃ to +105 ℃		
Rated voltage range	2 V.DC	2.5 V.DC to 10 V.DC	2.5 V.DC to 6.3 V.DC
Category voltage range	2 V.DC	2.5 V.DC to 10 V.DC	2.5 V.DC to 6.3 V.DC
Rated capacitance range	220 μF to 330 μF	150 μF to 680 μF	470 μF to 1000 μF
Capacitance tolerance	±20 %(120 Hz/+20 ℃)		
Leakage current	Please see the attached characteristics list		
Dissipation factor(tan δ)	Please see the attached characteristics list		
Surge voltage(V.DC)	Rated voltage x1.15		
Endurance	+105 ℃, 2000 h, rated voltage applied		
	Capacitance change	Within±20 % of the initial value	
	tan δ	≦ 1.5 times of the initial limit	
	DC leakage current	Within the initial limit	
Damp heat (Steady state)	+60 ℃, 90 % to 95 %, 500 h, No-applied voltage		
	Capacitance change	Within+50 %,−20 % of the initial value(2TPF220M6, 2TPF330M6, ETPF1000M6H (5H)	
		Within+40 %, −20 % of the initial value (Except for above model)	
	tan δ	≦ 1.5 times of the initial limit	
	DC leakage current	≦ 3 times of the initial limit	

Marking and dimensions



(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
D4	7.3	4.3	3.8	1.3	2.4

※1 ±0.1 : D2E

R. Voltage (V.DC)	2.0	2.5	4.0	6.3	10.0
Code	d	e	g	j	A

Characteristics list

Series	Rated voltage (V.DC)	Rated temp. (℃)	Category voltage (V.DC)	Category temp. (℃)	Rated capacitance (μF)	Case size (mm) L	W	H	Size code	Specifications Ripple current ※1 (mArms.)	ESR ※2 (mΩ max.)	tan δ ※3	LC ※4 (μA)	Standard Part number	Min. Packaging Q'ty (pcs)
TPF	2	105	2	105	220	7.3	4.3	1.8	D2E	4700	6	0.10	88.0	2TPF220M6	3000
		105	2	105	330	7.3	4.3	1.8		4700	6	0.10	132.0	2TPF330M6	3000
	2.5	105	2.5	105	330	7.3	4.3	2.8	D3L	4400	7	0.10	82.5	2R5TPF330M7L	2500
		105	2.5	105	470	7.3	4.3	2.8		4400	6	0.10	117.5	2R5TPF470M6L	2500
		105	2.5	105		7.3	4.3	2.8		4400	7	0.10	117.5	2R5TPF470M7L	2500
		105	2.5	105		7.3	4.3	2.8		4400	10	0.10	117.5	2R5TPF470ML	2500
		105	2.5	105		7.3	4.3	3.8	D4	6100	5	0.10	117.5	ETPF470M5H	2000
		105	2.5	105	680	7.3	4.3	2.8	D3L	4400	6	0.10	170.0	2R5TPF680M6L	2500
		105	2.5	105		7.3	4.3	2.8		4400	7	0.10	170.0	2R5TPF680M7L	2500
		105	2.5	105		7.3	4.3	2.8		4400	10	0.10	170.0	2R5TPF680ML	2500
		105	2.5	105		7.3	4.3	3.8	D4	6100	5	0.10	170.0	ETPF680M5H	2000
		105	2.5	105	1000	7.3	4.3	3.8		6100	5	0.10	250.0	ETPF1000M5H	2000
		105	2.5	105		7.3	4.3	3.8		5600	6	0.10	250.0	ETPF1000M6H	2000
	4	105	4	105	330	7.3	4.3	2.8	D3L	4000	12	0.10	132.0	4TPF330ML	2500
		105	4	105	470	7.3	4.3	2.8		4400	10	0.10	188.0	4TPF470ML	2500
		105	4	105	680	7.3	4.3	3.8	D4	4400	10	0.10	272.0	4TPF680MAH	2000
	6.3	105	6.3	105	220	7.3	4.3	2.8	D3L	6100	5	0.10	138.6	6TPF220M5L	2500
		105	6.3	105		7.3	4.3	2.8		4600	9	0.10	138.6	6TPF220M9L	2500
		105	6.3	105		7.3	4.3	2.8		4000	12	0.10	138.6	6TPF220ML	2500
		105	6.3	105	330	7.3	4.3	2.8		3900	9	0.10	207.9	6TPF330M9L	2500
		105	6.3	105	470	7.3	4.3	3.8	D4	4400	10	0.10	296.1	6TPF470MAH	2000
	10	105	10	105	150	7.3	4.3	2.8	D3L	3600	15	0.10	150.0	10TPF150ML	2500

※1：Ripple current (100 kHz/ +45 ℃), ※2：ESR (100 kHz/+20 ℃)　※3：tanδ (120 Hz/+20 ℃)　※4：After 5 minutes

◆Please refer to the P37 to 38 in this catalog for "Reflow conditions" and "Taping specifications".

※：Small order quantity (500 pcs/reel) is available with TPF series. Please contact our sales representative if you prefer it.

Design and specifications are each subject to change without notice. Ask factory for the current technical specifications before purchase and/or use.
Should a safety concern arise regarding this product, please be sure to contact us immediately.

Surface mount type TA Series

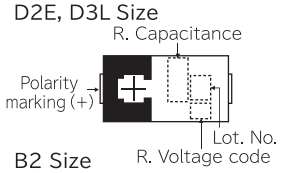
- Guaranteed at 85 ℃85 %RH
- RoHS compliance, Halogen free

Specifications

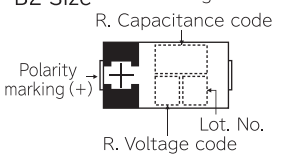
Items	Specifications		
Size code	B2	D2E	D3L
Category temperature range	−55 ℃ to +105 ℃		
Rated voltage range	4 V.DC to 10 V.DC	2.5 V.DC to 10 V.DC	
Category voltage range	4 V.DC to 10 V.DC	2.5 V.DC to 10 V.DC	
Rated capacitance range	47 μF to 100 μF	68 μF to 470 μF	150 μF to 680 μF
Capacitance tolerance	±20 %(120 Hz/+20 ℃)		
Leakage current	Please see the attached characteristics list		
Dissipation factor(tanδ)	Please see the attached characteristics list		
Surge voltage(V.DC)	Rated voltage x1.15		
Endurance	+105 ℃, 2000 h, (B2 size : 1000 h)rated voltage applied		
	Capacitance change	Within±20 % of the initial value	
	tanδ	≦ 1.5 times of the initial limit	
	DC leakage current	Within the initial limit	
Damp heat (Steady state)	+85 ℃, 85 to 90 %RH, 500 h, rated voltage applied		
	Capacitance change	Within +50 %, −20 % of the initial value(2R5TAE470M(F), 2R5TAE330M(F, I), 2R5TAE220M(F, 9))	
		Within+40 %, −20 % of the initial value (Except for above model)	
	tanδ	≦ 1.5 times of the initial limit	
	DC leakage current	Within the initial limit	

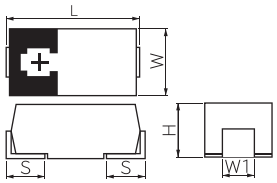
Marking and dimensions

D2E, D3L Size



B2 Size





(unit : mm)

Size code	L ±0.3 ※1	W ±0.2	H ±0.2 ※2	S ±0.2	W1 ±0.1
B2	3.5	2.8	1.9	0.8	2.2
D2E	7.3	4.3	1.8	1.3	2.4
D3L	7.3	4.3	2.8	1.3	2.4

※1 ±0.2:B2 ※2 ±0.1:B2,D2E

R. Voltage (V.DC)	2.5	4.0	6.3	10.0
Code	e	g	j	A

B2 size

R. Cap. (μF)	47	68	100
Code	S7	W7	A8

Characteristics list

Series	Rated voltage (V.DC)	Rated temp. (℃)	Category voltage (V.DC)	Category temp. (℃)	Rated capacitance (μF)	Case size (mm) L	W	H	Size code	Specifications Ripple current ※1 (mArm.s.)	ESR ※2 (mΩ max.)	tan δ ※3	LC ※4 (μA)	Standard Part number	Min. Packaging Q'ty (pcs)
TA	2.5	105	2.5	105	220	7.3	4.3	1.8	D2E	3900	9	0.10	110.0	2R5TAE220M9	3000
		105	2.5	105		7.3	4.3	1.8		3100	15	0.10	55.0	2R5TAE220MF	3000
		105	2.5	105		7.3	4.3	1.8		2400	25	0.10	55.0	2R5TAE220M	3000
		105	2.5	105	330	7.3	4.3	1.8		3100	15	0.10	82.5	2R5TAE330MF	3000
		105	2.5	105		7.3	4.3	1.8		2800	18	0.10	82.5	2R5TAE330MI	3000
		105	2.5	105		7.3	4.3	1.8		2400	25	0.10	82.5	2R5TAE330M	3000
		105	2.5	105	470	7.3	4.3	1.8		3100	15	0.10	117.5	2R5TAE470MF	3000
		105	2.5	105		7.3	4.3	1.8		2400	25	0.10	117.5	2R5TAE470M	3000
		105	2.5	105	680	7.3	4.3	2.8	D3L	3100	15	0.10	170.0	2R5TAE680MFL	2500
		105	2.5	105		7.3	4.3	2.8		2400	25	0.10	170.0	2R5TAE680ML	2500
	4	105	4	105	100	3.5	2.8	1.9	B2	1100	70	0.08	40.0	4TAB100M	2000
		105	4	105	220	7.3	4.3	1.8	D2E	2800	18	0.10	88.0	4TAE220MI	3000
		105	4	105		7.3	4.3	1.8		2400	25	0.10	88.0	4TAE220M	3000
		105	4	105	470	7.3	4.3	2.8	D3L	2800	18	0.10	188.0	4TAE470MIL	2500
		105	4	105		7.3	4.3	2.8		2400	25	0.10	188.0	4TAE470ML	2500
	6.3	105	6.3	105	47	3.5	2.8	1.9	B2	1100	70	0.08	29.6	6TAB47M	2000
		105	6.3	105	68	3.5	2.8	1.9		1100	70	0.08	42.8	6TAB68M	2000
		105	6.3	105	150	7.3	4.3	1.8	D2E	2400	25	0.10	94.5	6TAE150M	3000
		105	6.3	105	220	7.3	4.3	1.8		2800	18	0.10	138.6	6TAE220MI	3000
		105	6.3	105		7.3	4.3	1.8		2400	25	0.10	138.6	6TAE220M	3000
		105	6.3	105	330	7.3	4.3	2.8	D3L	2400	25	0.10	207.9	6TAE330ML	2500
	10	105	10	105	47	3.5	2.8	1.9	B2	1100	70	0.08	47.0	10TAB47M	2000
		105	10	105	68	7.3	4.3	1.8	D2E	2400	25	0.10	68.0	10TAE68M	3000
		105	10	105	150	7.3	4.3	2.8	D3L	2400	25	0.10	150.0	10TAE150ML	2500
		105	10	105	220	7.3	4.3	2.8		2400	25	0.10	220.0	10TAE220ML	2500

※1:Ripple current (100 kHz/ +45 ℃), ※2:ESR (100 kHz/+20 ℃) ※3:tanδ (120 Hz/+20 ℃) ※4:After 5 minutes

◆Please refer to the P37 to 38 in this catalog for "Reflow conditions" and "Taping specifications".

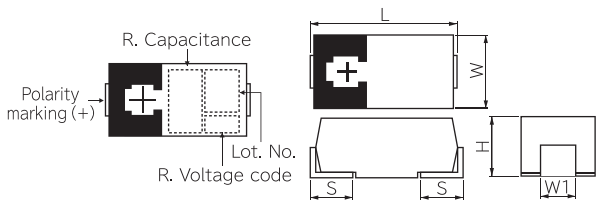
Surface mount type TV Series

- Guaranteed at 85 ℃85 %RH
- Guaranteed at 125 ℃
- RoHS compliance, Halogen free

Specifications

Items	Specifications		
Size code	D2E		D3L
Category temperature range	−55 ℃ to +125 ℃		
Rated voltage range	6.3 V.DC to 10 V.DC		10 V.DC
Category voltage range	4 V.DC to 6.3 V.DC		6.3 V.DC
Rated capacitance range	68 μF to 150 μF		150 μF
Capacitance tolerance	±20 %(120 Hz/+20 ℃)		
Leakage current	Please see the attached characteristics list		
Dissipation factor(tanδ)	Please see the attached characteristics list		
Surge voltage(V.DC)	Rated voltage x1.15		
Endurance	+125 ℃, 1000 h, category voltage applied (105 ℃ 2000 h, rated voltage applied)		
	temp	125 ℃	105 ℃
	Capacitance change	Within±20 % of the initial value	Within±20 % of the initial value
	tanδ	≦ 2 times of the initial limit	≦ 1.5 times of the initial limit
	DC leakage current	≦ 2 times of the initial limit	Within the initial limit
Damp heat (Steady state)	+85 ℃, 85 % to 90 %, 500 h, rated voltage applied		
	Capacitance change	Within+40 %, −20 % of the initial value	
	tanδ	≦ 1.5 times of the initial limit	
	DC leakage current	Within the initial limit	

Marking and dimensions



(unit : mm)

Size code	L ±0.3	W ±0.2※1	H ±0.2	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

R. Voltage (V.DC)	6.3	10.0
Code	j	A

Characteristics list

Series	Rated voltage (V.DC)	Rated temp. (℃)	Category voltage (V.DC)	Category temp. (℃)	Rated capacitance (μF)	Case size (mm)			Size code	Specifications				Standard	
						L	W	H		Ripple current ※1 (mArms)	ESR ※2 (mΩ max.)	tan δ ※3	LC ※4 (μA)	Part number	Min. Packaging Q'ty (pcs)
TV	6.3	105	4	125	150	7.3	4.3	1.8	D2E	2400	25	0.10	94.5	6TVE150M	3000
	10	105	6.3	125	68	7.3	4.3	1.8	D2E	2400	25	0.10	68.0	10TVE68M	3000
		105	6.3	125	150	7.3	4.3	2.8	D3L	2400	25	0.10	150.0	10TVE150ML	2500

※1 : Ripple current (100 kHz/ +45 ℃), ※2 : ESR (100 kHz/+20 ℃) ※3 : tanδ (120 Hz/+20 ℃) ※4 : After 5 minutes

◆Please refer to the P37 to 38 in this catalog for "Reflow conditions" and "Taping specifications".

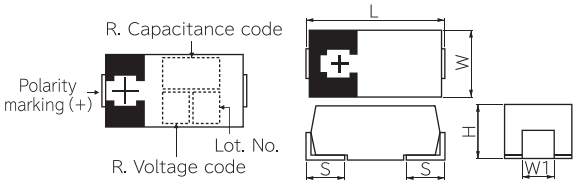
Surface mount type TQC Series B size

- High voltage (35 V.DC max.)
- RoHS compliance, Halogen free

Specifications

Items	Specifications	
Size code	B15	B2
Category temperature range	–55 ℃ to +105 ℃	
Rated voltage range	35 V.DC	16 V.DC to 35 V.DC
Category voltage range	35 V.DC	16 V.DC to 35 V.DC
Rated capacitance range	2.7 μF	3.9 μF to 33 μF
Capacitance tolerance	±20 % (120 Hz/+20 ℃)	
Leakage current	Please see the attached characteristics list	
Dissipation factor(tanδ)	Please see the attached characteristics list	
Surge voltage(V.DC)	Rated voltage x1.15	
Endurance	+105 ℃, 2000 h(16TQC33MYFB: 1000 h), rated voltage applied	
	Capacitance change	Within±20 % of the initial value
	tanδ	≦ 1.5 times of the initial limit
	DC leakage current	Within the initial limit
Damp heat (Steady state)	+60 ℃, 90 % to 95 %, 500 h, No-applied voltage	
	Capacitance change	Within+40 %, −20 % of the initial value
	tanδ	≦ 1.5 times of the initial limit
	DC leakage current	≦ 3 times of the initial limit

Marking and dimensions



(unit : mm)

Size code	L ±0.2	W ±0.2	H ±0.1	S ±0.2	W1 ±0.1
B15	3.5	2.8	1.4	0.8	2.2
B2	3.5	2.8	1.9	0.8	2.2

R. Voltage (V.DC)	16	20	25	35
Code	C	D	E	V

R. Cap. (μF)	2.7	3.9	5.6	8.2	10	15	22	33
Code	L6	Q6	U6	Y6	A7	E7	J7	N7

Characteristics list

Series	Rated voltage (V.DC)	Rated temp. (℃)	Category voltage (V.DC)	Category temp. (℃)	Rated capacitance (μF)	Case size (mm) L	W	H	Size code	Specifications Ripple current ※1 (mArm.s.)	ESR ※2 (mΩ max.)	tan δ ※3	LC ※4 (μA)	Standard Part number	Min. Packaging Q'ty (pcs)
TQC	16	105	16	105	10	3.5	2.8	1.9	B2	800	100	0.10	48.0	16TQC10M	2000
		105	16	105	15	3.5	2.8	1.9		1000	90	0.10	72.0	16TQC15M	2000
		105	16	105	33	3.5	2.8	1.9		1000	90	0.10	158.4	16TQC33MYFB	2000
	20	105	20	105	8.2	3.5	2.8	1.9		800	100	0.10	49.2	20TQC8R2M	2000
		105	20	105	22	3.5	2.8	1.9		1000	90	0.10	132.0	20TQC22MYFB	2000
	25	105	25	105	5.6	3.5	2.8	1.9		800	100	0.10	42.0	25TQC5R6M	2000
		105	25	105	15	3.5	2.8	1.9		900	100	0.10	112.5	25TQC15MYFB	2000
	35	105	35	105	2.7	3.5	2.8	1.4	B15	800	300	0.10	47.3	35TQC2R7MYF	2000
		105	35	105	3.9	3.5	2.8	1.9	B2	500	400	0.10	40.9	35TQC3R9MYF	2000

※1 : Ripple current (100 kHz/ +105 ℃), ※2 : ESR (100 kHz/+20 ℃) ※3 : tanδ (120 Hz/+20 ℃) ※4 : After 5 minutes

◆Please refer to each page in this catarog for "Reflow conditions" and "Taping specifications".

※ : Small order quantity (500 pcs/reel) is available with TQC series. Please contact our sales representative if you prefer it.

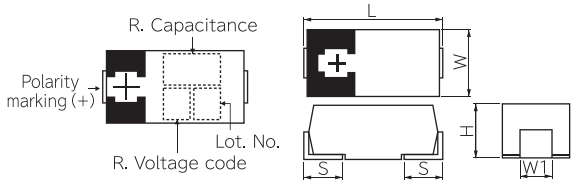
TQC Series D size

- High voltage (35 V.DC max.)
- RoHS compliance, Halogen free

Specifications

Items	Specifications			
Size code	D12	D15	D2	D3L
Category temperature range	−55 ℃ to +105 ℃			
Rated voltage range	16 V.DC	16 V.DC to 25 V.DC	16 V.DC to 35 V.DC	16 V.DC to 25 V.DC
Category voltage range	16 V.DC	16 V.DC to 25 V.DC	16 V.DC to 35 V.DC	16 V.DC to 25 V.DC
Rated capacitance range	33 μF	22 μF to 47 μF	10 μF to 100 μF	68 μF to 150 μF
Capacitance tolerance	±20 %(120 Hz/+20 ℃)			
Leakage current	Please see the attached characteristics list			
Dissipation factor(tanδ)	Please see the attached characteristics list			
Surge voltage(V.DC)	Rated voltage x1.15			
Endurance	+105 ℃, 2000 h, rated voltage applied			
	Capacitance change	Within±20 % of the initial value		
	tanδ	≦ 1.5 times of the initial limit		
	DC leakage current	Within the initial limit		
Damp heat (Steady state)	+60 ℃, 90 % to 95 %, 500 h, No-applied voltage			
	Capacitance change	Within+40 %, −20 % of the initial value		
	tanδ	≦ 1.5 times of the initial limit		
	DC leakage current	≦ 3 times of the initial limit		

Marking and dimensions



(unit : mm)

Size code	L ±0.2 ※1	W ±0.2	H ±0.1 ※2	S ±0.2	W1 ±0.1
D12	7.3	4.3	1.15	1.3	2.4
D15	7.3	4.3	1.4	1.3	2.4
D2	7.3	4.3	1.9	1.3	2.4
D3L	7.3	4.3	2.8	1.3	2.4

※1 D3L size (±0.3)　※2 D12 size (±0.05)、D3L size (±0.2)

R. Voltage (V.DC)	16	20	25	35
Code	C	D	1E	V

Characteristics list

Series	Rated voltage (V.DC)	Rated temp. (℃)	Category voltage (V.DC)	Category temp. (℃)	Rated capacitance (μF)	Case size (mm) L	W	H	Size code	Specifications Ripple current ※1 (mArms.)	ESR ※2 (mΩ max.)	tan δ ※3	LC ※4 (μA)	Standard Part number	Min. Packaging Q'ty (pcs)
TQC	16	105	16	105	33	7.3	4.3	1.15	D12	1800	40	0.10	52.8	16TQC33MYFS	4500
		105	16	105		7.3	4.3	1.9	D2	1400	70	0.10	52.8	16TQC33MYFD	3000
		105	16	105	47	7.3	4.3	1.4	D15	1500	55	0.10	75.2	16TQC47MYFT	3000
		105	16	105		7.3	4.3	1.9	D2	1800	40	0.10	75.2	16TQC47MW	3000
		105	16	105		7.3	4.3	1.9		1450	55	0.10	75.2	16TQC47MYFD	3000
		105	16	105	68	7.3	4.3	1.9		1500	50	0.10	108.8	16TQC68MYF	3000
		105	16	105	100	7.3	4.3	1.9		1800	50	0.10	160.0	16TQC100MYF	3000
		105	16	105	150	7.3	4.3	2.8	D3L	1800	50	0.10	240.0	16TQC150MYF	2500
		105	16	105		7.3	4.3	1.9	D2	1500	70	0.15	240.0	1CTQC15173F1	3000
	20	105	20	105	33	7.3	4.3	1.9		1400	60	0.10	66.0	20TQC33MYFD	3000
		105	20	105	47	7.3	4.3	1.9		1450	55	0.10	94.0	20TQC47MYF	3000
		105	20	105		7.3	4.3	1.4	D15	1500	55	0.10	94.0	20TQC47MYFT	3000
		105	20	105	100	7.3	4.3	2.8	D3L	1700	55	0.10	200.0	20TQC100MYF	2500
	25	105	25	105	15	7.3	4.3	1.9	D2	1500	45	0.10	38.0	25TQC15MV	3000
		105	25	105		7.3	4.3	1.9		1000	90	0.10	38.0	25TQC15MYFD	3000
		105	25	105	22	7.3	4.3	1.9		1500	45	0.10	55.0	25TQC22MV	3000
		105	25	105		7.3	4.3	1.9		1400	60	0.10	55.0	25TQC22MYFD	3000
		105	25	105		7.3	4.3	1.4	D15	1400	70	0.10	55.0	25TQC22MYFT	3000
		105	25	105	33	7.3	4.3	1.9	D2	1400	60	0.10	82.5	25TQC33MYF	3000
		105	25	105	68	7.3	4.3	2.8	D3L	1400	70	0.10	170.0	25TQC68MYF	2500
	35	105	35	105	10	7.3	4.3	1.9	D2	1000	120	0.10	35.0	35TQC10M	3000
		105	35	105		7.3	4.3	1.9		1000	120	0.10	35.0	35TQC10MYF	3000
		105	35	105	15	7.3	4.3	1.9		900	150	0.10	52.5	35TQC15MYF	3000

※1:Ripple current (100 kHz/ +105 ℃), ※2:ESR (100 kHz/+20 ℃)　※3:tanδ (120 Hz/+20 ℃)　※4:After 5 minutes

◆Please refer to each page in this catarog for "Reflow conditions" and "Taping specifications".

※:Small order quantity (500 pcs/reel) is available with TQC series. Please contact our sales representative if you prefer it.

Surface mount type TPB Series

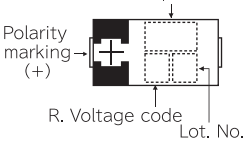
- Standard
- RoHS compliance, Halogen free

Specifications

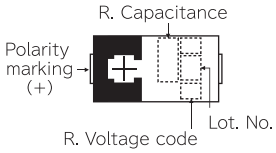
Items	Specifications		
Size code	B2	D3L	D4
Category temperature range	−55 ℃ to +105 ℃		
Rated voltage range	4 V.DC to 10 V.DC		6.3 V.DC to 10 V.DC
Category voltage range	4 V.DC to 10 V.DC		6.3 V.DC to 10 V.DC
Rated capacitance range	33 μF to 68 μF	150 μF to 330 μF	220 μF to 470 μF
Capacitance tolerance	±20 % (120 Hz/+20 ℃)		
Leakage current	Please see the attached characteristics list		
Dissipation factor(tanδ)	Please see the attached characteristics list		
Surge voltage(V.DC)	Rated voltage x1.15		
Endurance	+105 ℃ 2000 h, (B2 size:1000 h) rated voltage appled ＊Rated temp. 85 ℃ 1000 h rated voltage applied		
	Capacitance change	Within±20 % of the initial value	
	tanδ	≦ 1.5 times of the initial limit	
	DC leakage current	Within the initial limit	
Damp heat (Steady state)	+60 ℃, 90 % to 95 %, 500 h, No-applied voltage		
	Capacitance change	Within+40 %, −20 % of the initial value	
	tanδ	≦ 1.5 times of the initial limit	
	DC leakage current	≦ 3 times of the initial limit	

Marking and dimensions

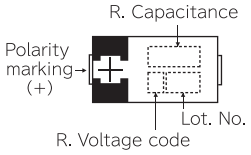
B2 Size

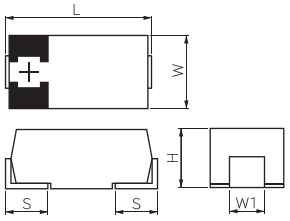


D3L Size



D4 Size





(unit : mm)

Size code	L ±0.2	W ±0.2	H ±0.1	S ±0.2	W1 ±0.1
B2	3.5	2.8	1.9	0.8	2.2
D3L	7.3	4.3	2.8	1.3	2.4
D4	7.3	4.3	3.8	1.3	2.4

R. Voltage (V.DC)	4.0	6.3	10
Code	g	j	A

B2 size

R. Cap. (μF)	33	47	68
Code	N7	S7	W7

Characteristics list

Series	Rated voltage (V.DC)	Rated temp. (℃)	Category voltage (V.DC)	Category temp. (℃)	Rated capacitance (μF)	Case size (mm) L	W	H	Size code	Specifications Ripple current ※1 (mArms.)	ESR ※2 (mΩ max.)	tan δ ※3	LC ※4 (μA)	Standard Part number	Min. Packaging Q'ty (pcs)
TPB	4	105	4	105	68	3.5	2.8	1.9	B2	1100	70	0.08	27.2	4TPB68M	2000
		105	4	105	330	7.3	4.3	2.8	D3L	2000	40	0.10	132.0	4TPB330ML	2500
	6.3	105	6.3	105	68	3.5	2.8	1.9	B2	1100	70	0.08	42.8	6TPB68M	2000
		105	6.3	105	220	7.3	4.3	2.8	D3L	2000	40	0.10	138.6	6TPB220ML	2500
		85	5	105	330	7.3	4.3	2.8		2000	40	0.10	207.9	6TPB330MAL	2500
		105	6.3	105		7.3	4.3	2.8		2000	40	0.10	207.9	6TPB330ML	2500
		105	6.3	105		7.3	4.3	3.8	D4	3000	40	0.10	207.9	6TPB330M	2000
		105	6.3	105	470	7.3	4.3	3.8		3000	35	0.15	296.1	6TPB470M	2000
	10	105	10	105	33	3.5	2.8	1.9	B2	1100	70	0.08	33.0	10TPB33M	2000
		105	10	105	47	3.5	2.8	1.9		1100	70	0.08	47.0	10TPB47M	2000
		105	10	105	150	7.3	4.3	2.8	D3L	2000	40	0.10	150.0	10TPB150ML	2500
		105	10	105	220	7.3	4.3	2.8		2000	40	0.10	220.0	10TPB220ML	2500
		105	10	105		7.3	4.3	3.8	D4	3000	40	0.10	220.0	10TPB220M	2000
		105	10	105	330	7.3	4.3	3.8		3000	35	0.10	330.0	10TPB330M	2000

※1：Ripple current (100 kHz/ +45 ℃), ※2：ESR (100 kHz/+20 ℃)　※3：tanδ (120 Hz/+20 ℃)　※4：After 5 minutes

◆Please refer to each page in this catarog for "Reflow conditions" and "Taping specifications".

Design and specifications are each subject to change without notice. Ask factory for the current technical specifications before purchase and/or use.
Should a safety concern arise regarding this product, please be sure to contact us immediately.

Surface mount type TPC Series

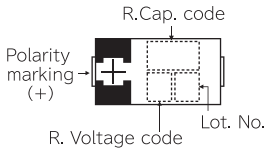
- Low profile (Heght 1.1mm)
- RoHS compliance, Halogen free

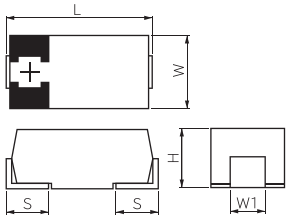
Specifications

Items	Specifications	
Size code	B1	D2
Category temperature range	−55 ℃ to +105 ℃	
Rated voltage range	6.3 V.DC to 12.5 V.DC	6.3 V.DC to 10 V.DC
Category voltage range	5 V.DC to 10 V.DC	6.3 V.DC to 10 V.DC
Rated capacitance range	10 μF to 47 μF	68 μF to 330 μF
Capacitance tolerance	±20 % (120 Hz/+20 ℃)	
Leakage current	Please see the attached characteristics list	
Dissipation factor(tanδ)	Please see the attached characteristics list	
Surge voltage(V.DC)	Rated voltage x1.15	
Endurance	+105 ℃ 2000 h, (B1 size:1000 h) rated voltage appled ＊Rated temp. 85 ℃ 1000 h rated voltage applied	
	Capacitance change	Within±20 % of the initial value
	tanδ	≦ 1.5 times of the initial limit
	DC leakage current	Within the initial limit
Damp heat (Steady state)	+60 ℃, 90 % to 95 %, 500 h, No-applied voltage	
	Capacitance change	Within+40 %, −20 % of the initial value
	tanδ	≦ 1.5 times of the initial limit
	DC leakage current	≦ 3 times of the initial limit

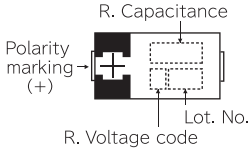
Marking and dimensions

B1 Size





D2 Size



(unit : mm)

Size code	L ±0.2 ※1	W ±0.2	H ±0.1 ※2	S ±0.2	W1 ±0.1
B1	3.5	2.8	1.1	0.8	2.2
D2	7.3	4.3	1.9	1.3	2.4

R. Voltage (V.DC)	6.3	8.0	10	12.5
Code	j	k	A	B

B1size

R. Cap. (μF)	10	15	22	33	47
Code	A7	E7	J7	N7	S7

Characteristics list

Series	Rated voltage (V.DC)	Rated temp. (℃)	Category voltage (V.DC)	Category temp. (℃)	Rated capacitance (μF)	Case size (mm) L	W	H	Size code	Specifications Ripple current ※1 (mArm.s.)	ESR ※2 (mΩ max.)	tan δ ※3	LC ※4 (μA)	Standard Part number	Min. Packaging Q'ty (pcs)
TPC	6.3	85	5	105	47	3.5	2.8	1.1	B1	1100	55	0.10	29.6	6TPC47M	3000
		85	5	105		3.5	2.8	1.1		1000	70	0.10	29.6	6TPC47MB	3000
		105	6.3	105	100	7.3	4.3	1.9	D2	1700	45	0.10	63.0	6TPC100M	3000
		105	6.3	105	150	7.3	4.3	1.9		1900	40	0.10	94.5	6TPC150M	3000
		85	5	105	330	7.3	4.3	1.9		1900	40	0.10	207.9	6TPC330MA	3000
	8	85	6.3	105	22	3.5	2.8	1.1	B1	1000	70	0.10	17.6	8TPC22M	3000
		105	8	105	150	7.3	4.3	1.9	D2	1900	40	0.10	120.0	8TPC150M	3000
	10	105	10	105	68	7.3	4.3	1.9		1700	45	0.10	68.0	10TPC68M	3000
		105	10	105	100	7.3	4.3	1.9		1700	45	0.10	100	10TPC100M	3000
	12.5	85	10	105	10	3.5	2.8	1.1	B1	800	80	0.10	12.5	12TPC10M	3000
		85	10	105	15	3.5	2.8	1.1		800	80	0.10	18.8	12TPC15M	3000

※1:Ripple current (100 kHz/ +45 ℃), ※2:ESR (100 kHz/+20 ℃) ※3:tanδ (120 Hz/+20 ℃) ※4:After 5 minutes

◆Please refer to each page in this catarog for "Reflow conditions" and "Taping specifications".

Surface mount type TH Series

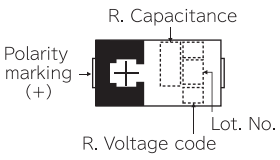
- Guaranteed at 125 ℃1000 h
- RoHS compliance, Halogen free

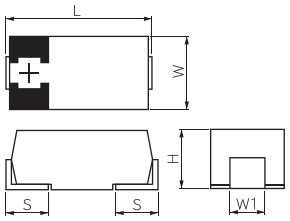
Specifications

Items	Specifications			
Size code	D2E	D2	D3L	D4
Category temperature range	−55 ℃ to +125 ℃			
Rated voltage range	2.5 V.DC to 6.3 V.DC	2.5 V.DC to 10 V.DC	4 V.DC to 6.3 V.DC	6.3 V.DC to 10 V.DC
Category voltage range	1.6 V.DC ~ 4 V.DC	1.6 V.DC to 6.3 V.DC	2.5 V.DC to 4 V.DC	4 V.DC to 6.3 V.DC
Rated capacitance range	150 μF to 330 μF	68 μF to 220 μF	220 μF to 330 μF	220 μF to 470 μF
Capacitance tolerance	±20 % (120 Hz/+20 ℃)			
Leakage current	Please see the attached characteristics list			
Dissipation factor(tanδ)	Please see the attached characteristics list			
Surge voltage(V.DC)	Rated voltage x1.15			
Endurance	+125 ℃ 1000 h, category voltage appled			
	Capacitance change	Within±20 % of the initial value		
	tanδ	≦ 2 times of the initial limit		
	DC leakage current	≦ 2 times of the initial limit		
Damp heat (Steady state)	+60 ℃, 90 % to 95 %, 500 h, No-applied voltage			
	Capacitance change	Within+40 %, −20 % of the initial value		
	tanδ	≦ 1.5 times of the initial limit		
	DC leakage current	≦ 3 times of the initial limit		

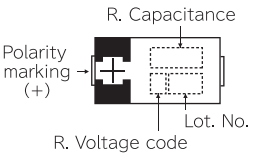
Marking and dimensions

D2E, D3L Size





D2, D4 Size



(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
D2	7.3	4.3	1.9	1.3	2.4
D3L	7.3	4.3	2.8	1.3	2.4
D4	7.3	4.3	3.8	1.3	2.4

※1 ±0.2:D2 ※2 ±0.2:D3L,D4

R. Voltage (V.DC)	2.5	4.0	6.3	10.0
Code	e	g	j	A

Characteristics list

Series	Rated voltage (V.DC)	Rated temp. (℃)	Category voltage (V.DC)	Category temp. (℃)	Rated capacitance (μF)	Case size (mm) L	W	H	Size code	Specifications Ripple current ※1 (mArms)	ESR ※2 (mΩ max.)	tan δ ※3	LC ※4 (μA)	Standard Part number	Min. Packaging Q'ty (pcs)
THB	4	105	2.5	125	330	7.3	4.3	2.8	D3L	2000	40	0.10	132.0	4THB330ML	2500
	6.3	105	4	125	220	7.3	4.3	2.8		2000	40	0.10	138.6	6THB220ML	2500
		105	4	125	330	7.3	4.3	3.8	D4	3000	40	0.10	207.9	6THB330M	2000
		105	4	125	470	7.3	4.3	3.8		3000	35	0.15	296.1	6THB470M	2000
	10	105	6.3	125	220	7.3	4.3	3.8		3000	40	0.10	220.0	10THB220M	2000
		105	6.3	125	330	7.3	4.3	3.8		3000	35	0.10	330.0	10THB330M	2000
THC	2.5	105	1.6	125	220	7.3	4.3	1.9	D2	1700	45	0.10	55.0	2R5THC220M	3000
	6.3	105	4	125	150	7.3	4.3	1.9		1900	40	0.10	94.5	6THC150M	3000
	10	105	6.3	125	68	7.3	4.3	1.9		1700	45	0.10	68.0	10THC68M	3000
THE	2.5	105	1.6	125	330	7.3	4.3	1.8	D2E	3100	15	0.10	82.5	2R5THE330MF	3000
		105	1.6	125		7.3	4.3	1.8		2800	18	0.10	82.5	2R5THE330MI	3000
		105	1.6	125		7.3	4.3	1.8		2400	25	0.10	82.5	2R5THE330M	3000
	4	105	2.5	125	220	7.3	4.3	1.8		3100	15	0.10	88.0	4THE220MF	3000
		105	2.5	125		7.3	4.3	1.8		2800	18	0.10	88.0	4THE 220MI	3000
		105	2.5	125		7.3	4.3	1.8		2400	25	0.10	88.0	4THE220M	3000
	6.3	105	4	125	150	7.3	4.3	1.8		2800	18	0.10	94.5	6THE150MI	3000
		105	4	125		7.3	4.3	1.8		2400	25	0.10	94.5	6THE150M	3000

※1：Ripple current (100 kHz/ +45 ℃), ※2：ESR (100 kHz/+20 ℃)　※3：tanδ (120 Hz/+20 ℃)　※4：After 5 minutes
◆Please refer to each page in this catarog for "Reflow conditions" and "Taping specifications".

Design and specifications are each subject to change without notice. Ask factory for the current technical specifications before purchase and/or use.
Should a safety concern arise regarding this product, please be sure to contact us immediately.

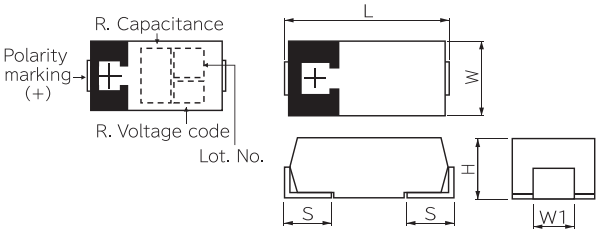
Surface mount type TC Series

- Guaranteed at 125℃
- RoHS compliance, Halogen free

Specifications

Items	Specifications		
Size code	D2E	D3L	D4
Category temperature range	–55 ℃ to +125 ℃		
Rated voltage range	4 V.DC to 6.3 V.DC	2.5 V.DC to 10 V.DC	
Category voltage range	3.2 V.DC to 5 V.DC	2 V.DC to 8 V.DC	
Rated capacitance range	100 μF to 330 μF	150 μF to 680 μF	330 μF to 1000 μF
Capacitance tolerance	±20 % (120 Hz/+20 ℃)		
Leakage current	Please see the attached characteristics list		
Dissipation factor(tanδ)	Please see the attached characteristics list		
Surge voltage(V.DC)	Rated voltage x1.15		
Endurance	+125 ℃, 1000 h, Category temperature range voltage applied		
	Capacitance change	Within±20 % of the initial value	
	tanδ	≦ 2 times of the initial limit	
	DC leakage current	≦ 2 times of the initial limit	
Damp heat (Steady state)	+60 ℃, 90 % to 95 %, 500 h, No-applied voltage		
	Capacitance change	Within+50 %, -20 % of the initial value (ETCF1000M6H (5H))	
		Within+40 %, -20 % of the initial value	
	tanδ	≦ 1.5 times of the initial limit	
	DC leakage current	≦ 3 times of the initial limit	

Marking and dimensions



(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
D4	7.3	4.3	3.8	1.3	2.4

※1 ±0.1 : D2E

R. Voltage (V.DC)	2.5	4.0	6.3	10.0
Code	e	g	j	A

Characteristics list

Series	Rated voltage (V.DC)	Rated temp. (℃)	Category voltage (V.DC)	Category temp. (℃)	Rated capacitance (μF)	Case size (mm) L	W	H	Size code	Specifications Ripple current ※1 (mArms)	ESR ※2 (mΩ max.)	tan δ ※3	LC ※4 (μA)	Standard Part number	Min. Packaging Q'ty (pcs)
TCE	2.5	105	2	125	680	7.3	4.3	2.8	D3L	3500	12	0.10	170.0	ETCE680MCL	2500
		105	2	125		7.3	4.3	2.8		3100	15	0.10	170.0	ETCE680MFL	2500
		105	2	125	1000	7.3	4.3	3.8	D4	3900	15	0.15	250.0	ETCE1000MF	2000
	4	105	3.2	125	150	7.3	4.3	1.8	D2E	2800	18	0.10	60.0	4TCE150MI	3000
		105	3.2	125	220	7.3	4.3	1.8		3100	15	0.10	88.0	4TCE220MF	3000
		105	3.2	125		7.3	4.3	1.8		2800	18	0.10	88.0	4TCE220MI	3000
		105	3.2	125		7.3	4.3	1.8		2400	25	0.10	88.0	4TCE220M	3000
		105	3.2	125	330	7.3	4.3	1.8		2800	18	0.10	132.0	4TCE330MI	3000
		105	3.2	125		7.3	4.3	1.8		2400	25	0.10	132.0	4TCE330M	3000
		105	3.2	125	470	7.3	4.3	2.8	D3L	3500	12	0.10	188.0	4TCE470MCL	2500
		105	3.2	125		7.3	4.3	2.8		3100	15	0.10	188.0	4TCE470MFL	2500
		105	3.2	125		7.3	4.3	2.8		2800	18	0.10	188.0	4TCE470MIL	2500
		105	3.2	125		7.3	4.3	2.8		2400	25	0.10	188.0	4TCE470ML	2500
	6.3	105	5	125	100	7.3	4.3	1.8	D2E	2800	18	0.10	63.0	6TCE100MI	3000
		105	5	125		7.3	4.3	1.8		2400	25	0.10	63.0	6TCE100M	3000
		105	5	125	150	7.3	4.3	1.8		3100	15	0.10	94.5	6TCE150MF	3000
		105	5	125		7.3	4.3	1.8		2800	18	0.10	94.5	6TCE150MI	3000
		105	5	125		7.3	4.3	1.8		2400	25	0.10	94.5	6TCE150M	3000
		105	5	125	220	7.3	4.3	1.8		2800	18	0.10	138.6	6TCE220MI	3000
		105	5	125		7.3	4.3	1.8		2400	25	0.10	138.6	6TCE220M	3000
		105	5	125	330	7.3	4.3	2.8	D3L	3100	15	0.10	207.9	6TCE330MFL	2500
		105	5	125		7.3	4.3	2.8		2800	18	0.10	207.9	6TCE330MIL	2500
		105	5	125		7.3	4.3	2.8		2400	25	0.10	207.9	6TCE330ML	2500
		105	5	125	470	7.3	4.3	3.8	D4	3500	18	0.15	296.1	6TCE470MI	2000
		105	5	125		7.3	4.3	3.8		3000	25	0.15	296.1	6TCE470M	2000
		105	5	125	680	7.3	4.3	3.8		3500	18	0.15	428.4	6TCE680MI	2000
		105	5	125		7.3	4.3	3.8		3000	25	0.15	428.4	6TCE680M	2000
	10	105	8	125	220	7.3	4.3	2.8	D3L	2800	18	0.10	220.0	10TCE220MIL	2500
		105	8	125		7.3	4.3	2.8		2400	25	0.10	220.0	10TCE220ML	2500
		105	8	125	330	7.3	4.3	3.8	D4	3000	25	0.10	330.0	10TCE330M	2000
TCF	2.5	105	2	125	680	7.3	4.3	2.8	D3L	4400	6	0.10	170.0	ETCF680M6L	2500
		105	2	125		7.3	4.3	2.8		4400	7	0.10	170.0	ETCF680M7L	2500
		105	2	125		7.3	4.3	2.8		4400	10	0.10	170.0	ETCF680ML	2500
		105	2	125		7.3	4.3	3.8	D4	6100	5	0.10	170.0	ETCF680M5H	2000
		105	2	125	1000	7.3	4.3	3.8		6100	5	0.10	250.0	ETCF1000M5H	2000
		105	2	125		7.3	4.3	3.8		5600	6	0.10	250.0	ETCF1000M6H	2000
	4	105	3.2	125	330	7.3	4.3	2.8	D3L	4000	12	0.10	132.0	4TCF330ML	2500
		105	3.2	125	470	7.3	4.3	2.8		4400	10	0.10	188.0	4TCF470ML	2500
		105	3.2	125	680	7.3	4.3	3.8	D4	4400	10	0.10	272.0	4TCF680MAH	2000
	6.3	105	5	125	220	7.3	4.3	2.8	D3L	6100	5	0.10	138.6	6TCF220M5L	2500
		105	5	125		7.3	4.3	2.8		4600	9	0.10	138.6	6TCF220M9L	2500
		105	5	125		7.3	4.3	2.8		4000	12	0.10	138.6	6TCF220ML	2500
		105	5	125	330	7.3	4.3	2.8		3900	9	0.10	207.9	6TCF330M9L	2500
		105	5	125	470	7.3	4.3	3.8	D4	4400	10	0.10	296.1	6TCF470MAH	2000
	10	105	10	125	150	7.3	4.3	2.8	D3L	3600	15	0.10	150.0	10TCF150ML	2500

※1：Ripple current (100 kHz/ +45 ℃), ※2：ESR (100 kHz/+20 ℃)　※3：tanδ (120 Hz/+20 ℃)　※4：After 5 minutes

◆Please refer to each page in this catarog for "Reflow conditions" and "Taping specifications".

Design and specifications are each subject to change without notice. Ask factory for the current technical specifications before purchase and/or use. Should a safety concern arise regarding this product, please be sure to contact us immediately.

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
TPB	B2	8TPB47M	2009	10TPB47M
		6TPB100MA	2009	6TPE100MAZB
		6TPB100MAV	2009	6TPE100MAZB
		6TPB47M	2009	6TPC47MB
		4TPB100M	2009	4TPE100MZB
		2R5TPB220MA	2009	2R5TPE220MZB
		2R5TPB100M	2012	4TPE100MZB
	D3L	10TPB100ML	2010	10TPC100M
		6TPB150ML	2009	6TPC150M
		4TPB470ML	2009	4TPE470ML
		4TPB220ML	2009	4TPE220M
		2R5TPB330ML	2009	2R5TPE330M
	D3	10TPB100M	2008	10TPC100M
		6TPB150M	2008	6TPC150M
		4TPB220M	2008	4TPE220M
	D4	4TPB680M	2009	6TPE680MI
		4TPB470M	2009	4TPE470ML
		2R5TPB1000M	2009	2R5TPE1000MF
		2R5TPB680M	2009	2R5TPE680MFL
TPC	B1	10TPC33MB	2013	12TPG33M
		6TPC33M	2012	6TPC47MB
		4TPC47M	2012	6TPC47MB
		2R5TPC56M	2012	6TPB68M
	D2	4TPC220M	2009	4TPE220M
		4TPC150M	2009	4TPE150MI
		2R5TPC330M	2009	2R5TPE330M
TPE	B2	6TPE100MZB	2011	6TPE100MPB
		4TPE150MUB	2013	4TPE150MAZB
		2R5TPE220MIB	2012	2R5TPE220MFGB
		2R5TPE220MDGB	2013	2R5TPE220MFGB
		2R5TPE150MZB	2011	2R5TPE220MZB
		2TPE330MIB	2011	2TPE330MFB
		2TPE330MAFGB	2011	2TPE330MAFB
	D2E	4TPE150M	2011	4TPE150MI
		2R5TPE470M	2011	2R5TPE470MI
		2TPE470M9	2011	2R5TPE470M9
		2TPE470M7	2011	2R5TPE470M7
		2TPE470M6	2011	2R5TPF470M6L
		2TPE330M9	2011	2R5TPE330M9
		2TPE330M7	2011	2R5TPE330M7
		2TPE330M6	2011	2TPF330M6
		2R5TPE220MC	2012	2R5TPE220M9
		2R5TPE220M7	2012	2R5TPE330M7

Series	Size code	Models for deletion	Year of deletion	Alternative model
TPE	D3L	2R5TPE680ML	2012	2R5TPE680MFL
		2R5TPE680MIL	2011	2R5TPE680MFL
	D4	4TPE680M	2011	6TPE680MI
		4TPE680MI	2012	6TPE680MI
		4TPE680MF	2012	4TPF680MAH
		2R5TPE1000M	2011	2R5TPE1000MF
		2R5TPE1000MI	2012	2R5TPE1000MF
TPF	D3L	6TPF330M5EL	2014	-
		4TPF470M5EL	2014	-
TPG	B1G	10TPG33M	2011	10TPC33MB
	B15G	6TPG220MZG	2014	-
TPL	D12T	All models	2013	-
	D15T	All models	2013	-
	D2T	All models	2013	-
TPLF	D2T	All models	2013	-
TPSF	B1S	ETPSF200M9ED	2014	-
	B2S	11TPSF62MAIG	2012	-
TPH	A14	ETPH220MAZC	2013	-
TPU	S09	2R5TPU22MSI	2011	6TPU22MSI
		4TPU15MSI	2011	6TPU22MSI
		4TPU33MSI	2011	6TPU47MSI
	S11	6TPU33MSK	2013	6TPU47MSI
		4TPU47MSK	2013	6TPU47MSI
		2R5TPU68MSK	2013	4TPU68MSI
	A09	10TPU33MAI	2011	ATPH33MAHA
		6TPU47MAI	2011	6TPH47MHA
		4TPU68MAI	2011	4TPH68MHA
		2R5TPU100MAI	2011	ETPH100MHA
TH	D2	4THC220M	2013	4THE220M
	D3L	10THB100ML	2010	-
		2R5THB330ML	2010	-
	D4	4THB680M	2013	-
TQC	C	25TQC10M	2011	25TQC15MYFD
		20TQC15M	2011	25TQC15MYFD
		16TQC22M	2011	25TQC22MYFD
	D2	25TQC15M	2012	25TQC15MYFD
		25TQC22M	2012	25TQC22MYFD
		20TQC22M	2012	25TQC22MYFD
		20TQC22MYFD	2015	25TQC22MYFD
		20TQC47MY	2012	20TQC47MYF
		16TQC33M	2012	16TQC33MYFD
		16TQC47M	2012	16TQC47MYFD
		16TQC68MY	2012	16TQC68MYF
	D3L	25TQC33M	2012	25TQC33MYF
		20TQC47M	2012	20TQC47MYF
		16TQC68M	2012	16TQC68MYF
	D3	16TQC100M	2012	16TQC100MYF

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	Models for deletion	Year of deletion	Alternative model
TPA	C	10TPA33M	2012/9	10TPB33M
		6TPA47M	2012/9	10TPB47M
	D3	10TPA100M	2012/9	10TPC100M
		6TPA150M	2012/9	6TPC150M
		4TPA220M	2012/9	4TPE220M
TPB	B2	8TPB33M	2012/9	10TPB33M
		4TPB150MA	2012/9	4TPE150MAZB
		4TPB100MV	2012/9	4TPE100MZB
	C	10TPB220MC	2009/10	-
		10TPB68MC	2012/9	10TPC68M
		10TPB47MC	2012/9	10TPC68M
		8TPB82MC	2012/9	8TPE100MAZB
		6TPB150MC	2012/9	6TPE150M
		6TPB100MC	2012/9	6TPG100MG
		4TPB220MC	2012/9	4TPE220MI
		4TPB150MC	2012/9	6TPE150M
		2R5TPB220MC	2012/9	4TPE220MI
	D3L	16TPB47ML	2003/6	16TQC47MYFD
		2R5TPB680ML	2012/9	2R5TPE680MFL
		2R5TPB470ML	2012/9	2R5TPE470MI
	D3	16TPB47M	2003/6	16TQC47MYFD
		2R5TPB330M	2012/9	2R5TPE330M
TPC	C1	8TPC33M	2012/9	12TPG33M
		6TPC100MC	2012/9	6TPG100MG
		6TPC68M	2012/9	6TPG100MG
		4TPC100M	2012/9	6TPG100MG
		4TPC56M	2012/9	-
		2R5TPC82M	2012/9	-
	D2	16TPC33M	2003/6	16TQC33MYFD
		2R5TPC220M	2012/9	2R5TPE220M
TPD	D4D	10TPD150M	2007/10	10TPF150ML
		6TPD470M	2012/3	6TPF470MAH
		6TPD330M	2007/10	6TPF330M9L
		6TPD220M	2007/10	6TPF220ML
		4TPD680M	2012/3	4TPF680MAH
		4TPD470M	2007/10	4TPF470ML
		4TPD330M	2007/10	4TPF330ML
		2R5TPD1000M	2012/3	ETPF1000M6H
		2R5TPD1000M8	2012/3	ETPF1000M6H
		2R5TPD1000M6	2012/3	ETPF1000M6H
		2R5TPD1000M5	2012/3	ETPF1000M5H
		2R5TPD680M	2007/10	2R5TPF680ML
		2R5TPD680M8	2007/10	2R5TPF680M7L
		2R5TPD680M6	2012/3	2R5TPF680M6L
		2R5TPD680M5	2012/3	ETPF680M5H
		2R5TPD470M	2007/10	2R5TPF470ML
		2R5TPD470M8	2007/10	2R5TPF470M7L
		2R5TPD470M6	2012/3	2R5TPF470M6L
		2R5TPD470M5	2012/3	ETPF470M5H

Series	Size code	Models for deletion	Year of deletion	Alternative model
TPE	B2	2R5TPE220MPB	2012/9	2R5TPE220MLB
	C2	8TPE100MPC2	2012/9	10TPF150ML
		6TPE150MPC2	2012/9	6TPE150M
		6TPE150MIC2	2012/9	6TPE150MI
		4TPE220MPC2	2012/9	4TPE220MI
		4TPE220MIC2	2012/9	4TPE220MI
		4TPE220MFC2	2012/9	4TPE220MF
		2R5TPE330MIC2	2012/9	2R5TPE330MF
		2R5TPE330MFC2	2012/9	2R5TPE330MF
		2R5TPE330MCC2	2012/9	2R5TPE330MC
		2R5TPE330M9C2	2012/9	2R5TPE330M9
	C3	10TPE180MGC	2012/9	10TPE220ML
		10TPE150MGC	2012/9	10TPE220ML
		6TPE220MPC	2012/9	6TPE220M
		6TPE220MIC	2012/9	6TPE220MI
		6TPE150MPC	2012/9	6TPE150M
		4TPE220MPC	2012/9	4TPE220MI
		4TPE220MIC	2012/9	4TPE220MI
		2R5TPE330MPC	2012/9	2R5TPE330MF
		2R5TPE330MIC	2012/9	2R5TPE330MF
		2R5TPE330MFC	2012/9	2R5TPE330MF
TPF	D2E	2TPF470M6	2012/9	2R5TPF470M6L
TPG	B1G	6TPG68MG	2012/9	6TPG100M
		4TPG150M	2012/9	6TPG150M
TPL	D2T	2R5TPL330M7	2011/7	-
		2R5TPL220MC	2012/9	-
TPLF	D2T	2TPLF560M6	2011/7	-
		2TPLF470M7	2012/9	-
TPSF	B2S	2TPSF270MC	2012/9	2TPSF270M9G
		2TPSF270M9	2012/9	2TPSF270M9G
TPU	S08	6TPU10M	2012/9	6TPU10MSI
		4TPU15M	2012/9	6TPU22MSI
		2R5TPU22M	2012/9	6TPU22MSI
	S11	6TPU22MSK	2012/9	6TPU22MSI
		4TPU33MSK	2012/9	6TPU47MSI
		2R5TPU47MSK	2012/9	2R5TPU47MSI
	B09	8TPU33MBI	2012/9	ATPH33MAHA
		6TPU47MBI	2012/9	6TPH47MHA
		4TPU68MBI	2012/9	4TPH68MHA
TH	D3L	2R5THB470ML	2012/9	6THB470M
	D4	2R5THB1000M	2012/9	-
		2R5THB680M	2012/9	-
	D4D	6THD330M	2012/3	6TPF330M9L
		4THD470M	2012/9	-
		2R5THD680M	2012/3	2R5TPF680M6L
TR		TR series	-	TA series
APA	D2A	APA series	2006/4	-
APB	D1	APB series	2006/4	-
APC	D2	APC series	2009/6	-
APD	D1	APD series	2009/6	-

Conductive Polymer Aluminum Solid Capacitors

OS-CON

INDEX

SP-Cap

POSCAP

Conductive Polymer Aluminum Solid Capacitors

Hybrid

Guidelines and precautions

⚠ Application Guidelines

1.Circuit design

1-1 Prohibited circuits

(a) Leakage current of the **OS-CON** may increase in the following conditions.
(1) Soldering
(2) When voltage is not applied: high temperature no-load test, high temperature and high humidityno-load test, rapidly changing temperature test, etc.
(b) Avoid the use of the **OS-CON** in the following type of circuits because leakage current may increase.
(1) High-impedance circuits
(2) Coupling circuits
(3) Time constant circuits
(4) Other circuits that are significantly affected by leakage current
※ If you plan to use 2 or more **OS-CON**s in a series connection, please contact us before use

1-2 Failure and life-span

The failure rate is 0.5 % /1000 h (Confidence level: 60 %) based on JIS C 5003.
The prospective failure is not zero. The mainly failure modes are as follows.

2-1-1 Contingency failure

The most common failure mode is a short circuit. Mainly caused by the soldering or operating temperature environment, along with heat stresses, electrical stresses or mechanical stressesas follows.
(1) Applying voltage over the rated voltage.
(2) Applying reverse voltage
(3) Excessive mechanical stress
(4) Applying rush current by sudden charge or discharge out of the specification.
(a) The following phenomenon is seen when short-current is applied to the **OS-CON**.
(1) When current is relatively low (φ 10: approx 1 A or less, φ8: approx 0.5 A or less, φ 6.3:approx 0.2 A or less)The **OS-CON** becomes heated, but no effects are visible even when the current is continously carried.
(2) When the short circuit currents exceed the mentioned value above.
After internal temperature increase, sealing rubber may be turned over.
In some cases, odorous gas may be produced.
(b) In case a short circuit occurs, ensure safety by fully considering the followings.
(1) If odorous gas is released, turn off the main power of the equipment.
In this case, keep your face and hands away from the area.
(2) Though it depends on the conditions, it takes seconds to minutes before odorant gas generates.
Protective circuit should operate in this period.
(3) If the gas comes into eyes, rinse immediately. If the gas is inhaled, gargle immediately.
(4) Do not lick the electrolyte. If the electrolyte touches skin, wash it off with soap immediately.
(5) The **OS-CON** contains combustible substances. 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.

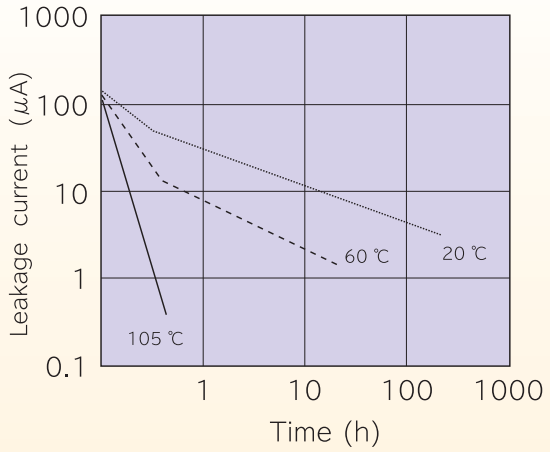
2-1-2 Wear-out failure (life time)

When life time span 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 even if it is used under the condition of the rated voltage, electric and mechanical performance. Please note it when designing.

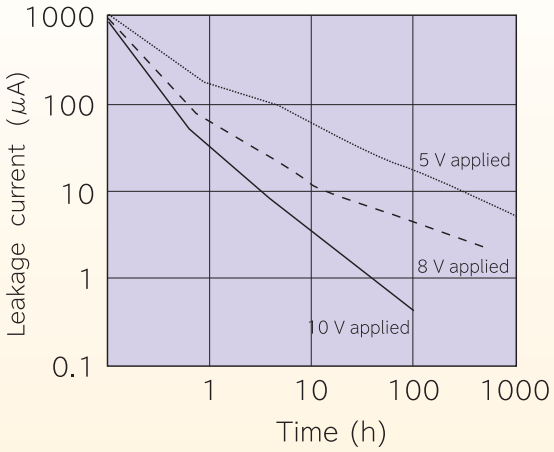
1-3 Leakage current

Mechanical stress may cause **OS-CON**' s leakage current increased.
In such a case, leakage current will gradually decrease by applying voltage (withinthe category voltage and the upper limit of category temperature).
Then, self-healing speed of leakage current is faster when it is near to the upper limit of category temperature and the category voltage.

OS-CON
leakage current restoration characteristics
16 V.DC/10 μF (16 V.DC applied)



OS-CON
leakage current restoration characteristics
10 V.DC/33 μF (Ambient temperature:65 ℃)
(Measured voltage:10 V)



※To make the recovery of LC values easy to show, samples that LC values have been increased on purpose are used in the test.

1-4 Rapid charge and discharge limitation

Allowance of a large rush current to flow due to rapid charge and discharge may result in short circuit or large leakage current. The protection circuit, to maintain high reliability, is recommended when rush current to flow to the **OS-CON** is in the following cases.

(a) Products which 10 times of allowable ripple current is less than 10 A: It is when 10 A or over of rush current is applied.
(b) Products which 10 times of allowable ripple current is 10 A or over: It is when rush current, which the figure is over 10 times of allowable ripple current, is applied.

Guidelines and precautions

2.Mounting

2-1 Soldering with a soldering iron

(a) When lead terminals for radial lead type must be processed because the lead pitch and the PCB holes do not match, process them without any stresses to the **OS-CON** before soldering.
(b) Solder without any excessive stresses to the **OS-CON** itself.
(c) When the **OS-CON** has been soldered once and needs to be removed, remove it after the solder has been completely melted.
(d) Do not let the tip of the soldering iron touch (a) the **OS-CON** itself.

2-2 Flow soldering

(a) Do not apply flow soldering to **OS-CON** SMD type.
(b) Do not solder the **OS-CON** itself by submerging it in melted solder.
(c) Solder the opposite side that the **OS-CON** is mounted on.
(d) Note that flux does not adhere to anywhere expect the lead terminal.
(e) Note that other components do not fall over and touch the **OS-CON** when soldering.

2-3 Reflow soldering

(a) Do not apply reflow soldering to **OS-CON** Radial Lead type.
(b) Please contact us for setting VPS conditions.

2-4 Capacitor handling after soldering

Do not subject the **OS-CON** to excessive stress as follows.
(a) Do not tilt, bend or twist the **OS-CON**.
(b) Do not move the PCB with holding the **OS-CON** itself.
(c) Do not hit the **OS-CON** with objects.
(d) When stacking PCBs, make sure that the **OS-CON** does not touch other PCBs or components.

2-5 Circuit board cleaning

Check the following items before washing PC board with these detergents: high quality alcohol-based cleaning fluid such as Pine-α ST-100S, clean thru 750H, 750L, 710M, 750K or Techno Care FRW 14 through 17 or detergents including substitute freon as AK-225AES or IPA.
(a) Use immersion or ultrasonic waves to clean within 2 minutes.
(b) The temperature of the cleaning fluid should be less than 60 ℃.
(c) Watch the contamination of the detergent (a) such as conductivity, pH, specific gravity, water content, etc.
(d) Do not store the **OS-CON** in a location subject to gases from the cleaning fluid or in an airtight container after cleaning.
(e) Dry the PCB or **OS-CON** with hot air that should be less than the upper category temperature.
(f) Please note that indication may disappear when rubbing print side after washing depending on a cleaner.
(g) Please contact us for details about detergents, cleaning methods and detergents other than those listed above.

2-6 Fixatives and coating materials

(a) Select the appropriate covering and sealant materials for the **OS-CON**. In particular, don't use acetone in the fixative, coating agent and diluent.
(b) Before applying the fixative or coating, completely remove any flux residue and foreign matter from the area where the board and the **OS-CON** will be jointed together.
(c) Allow any detergent to dry before applying the fixative or coating.
(d) Please contact us for the fixative and coating heat curing conditions.

2-7 Capacitor insulation

Be sure to completely separate the case, negative lead terminal, positive lead terminal and PC board patterns with each other due to the following reasons.
(a) Insulation is not guaranteed at a part of resin on the surface of a case.
(b) It offers inconstant resistance between a case and a negative lead terminal and it isn't insulated.

3.Storage

Open the bags just before mounting and use up all products once opened,
For keeping a good solderability, store the **OS-CON** as follows.

※ Due to the feature of the plating material of the lead terminal, it may rarely become dull color during the specified period as follow, but it will not affect the solderability.

		Before unsealing	After unsealing
SMD type※1		Within 24 months after shipment	Within 30 days from opening (packaged with carrier tape)
Radial lead type	Bag packing product	Within 30 months after shipment	Within 7 days from opening
	Taping product	Within 24 months after shipment	

※1 The JEDEC J-STD-020 standard is not applicable

Intellectual property right

We, Panasonic Group 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 **OS-CON** are as follows:

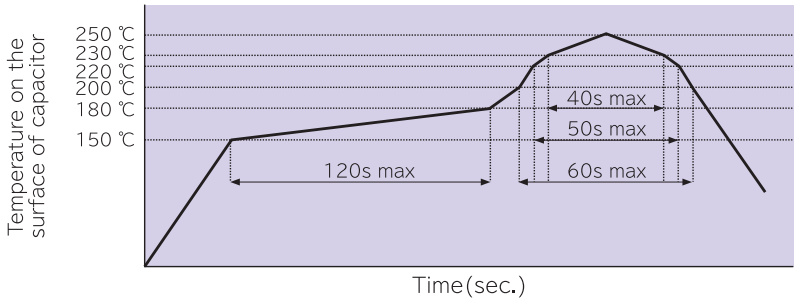
US Patent Nos. 6310765, 6508846 and 7158367

Mounting specifications

Recommendable reflow soldering

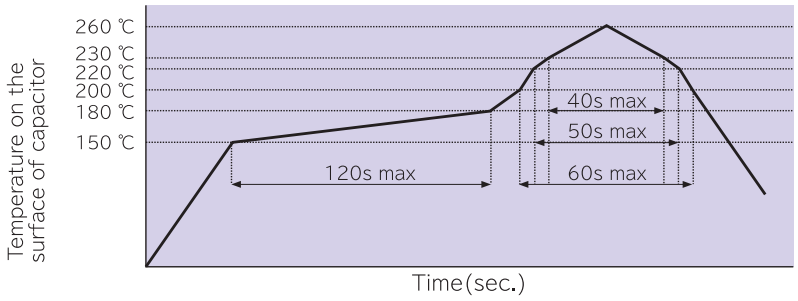
Peak temperature 250 ℃ lead free reflow soldering profile

The cycles of reflow soldering: 2 max.



Peak temperature 260 ℃ lead free reflow soldering profile

The cycles of reflow soldering: 1 max.



Soldering with a soldering iron

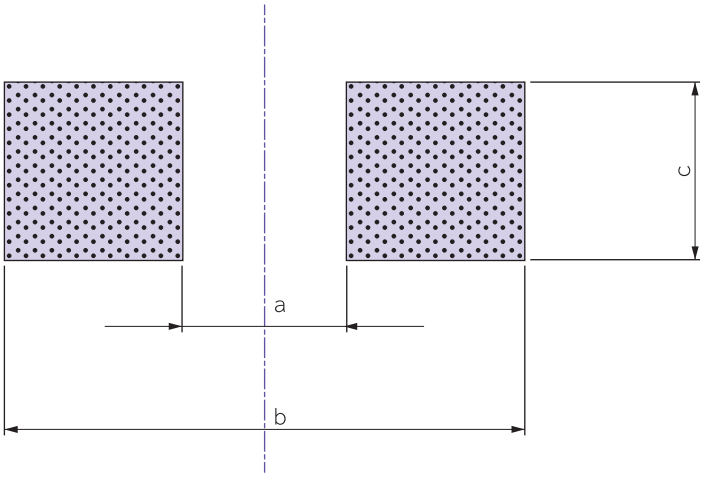
Tip of a soldering iron: 400±10 ℃
Working time: 5 sec. max

Flow soldering

	Temperature	Time	Flow number
Preheating	120 ℃ or less (ambient temperature)	120 sec. or less	1 time
Soldering condition	260 ℃ + 5 ℃ or less	10 + 1 sec. or less	2 times or less ※1

※1. When soldering 2 times, total immersion time should be 10 + 1 sec. or less.

Land/Pad Pattern



(unit : mm)

Size code	a	b	c
B45	1.4	7.4	1.6
B6	1.4	7.4	1.6
C6	2.1	9.1	1.6
C10	2.1	9.1	1.6
E7	2.8	11.1	1.9
E12	2.8	11.1	1.9
F8	4.3	13.1	1.9
F12	4.3	13.1	1.9

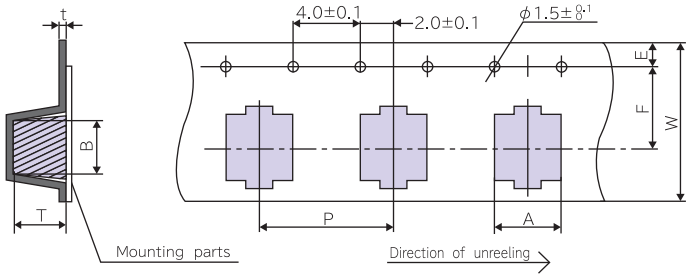
Packing specifications

Packing specifications

■Surface mount type

1. Taping

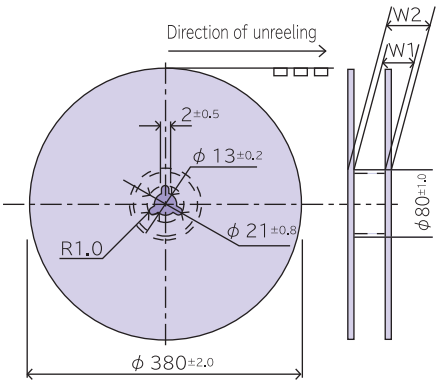
1-1. Carrier tape



(unit : mm)

Dimension / Size code	A±0.2	B±0.2	W±0.3	F±0.1	E±0.1	P±0.1	t±0.1	T±0.2
B45	5.6	5.6	16.0	7.5	1.75	8.0	0.4	4.8
B6	5.6	5.6	16.0	7.5	1.75	8.0	0.4	6.2
C6	6.9	6.9	16.0	7.5	1.75	12.0	0.4	6.2
C10	7.0	7.0	24.0	11.5	1.75	16.0	0.5	10.5
E7	8.6	8.6	24.0	11.5	1.75	12.0	0.4	7.2
E12	8.6	8.6	24.0	11.5	1.75	16.0	0.5	12.3
F8	10.7	10.7	24.0	11.5	1.75	16.0	0.4	8.2
F12	10.7	10.7	24.0	11.5	1.75	16.0	0.4	13.0

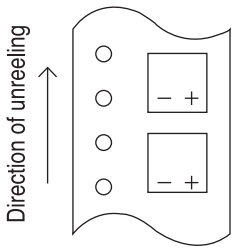
1-2. Reel



(unit : mm)

Size code	W1 ±0.5	W2 ±1.0
B45	13.0	17.5
B6, C6	17.0	21.5
C10, E7, F8, E12, F12	25.0	29.5

1-3. Polarity



2. Minimum packing quantity and weight

Size code	Quantity(pcs./Reel, φ 380)	Typical weight(g)
B45	2500	900
B6	1500	800
C6	1000	800
C10	500	700
E7	1000	1100
E12	400	800
F8	500	1000
F12	400	1000

Packing specifications

Packing specifications

■Specifications for radial lead type

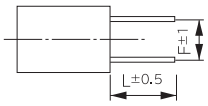
1. Lead terminal process

1-1. Applications

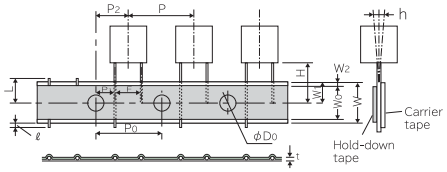
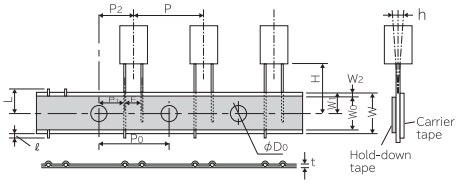
※ The following table is a standard specification. Please contact us separately concerning specifications except for that mentioned below. Because of a limit on the length of a model name, the part of process name changes to +S from +TSS, +D from +TS, +3 from +C3. Please contact us for details.

Series	Size code	Bag-packed products (lead terminal cutting)		Taping
		Not processed	Straight cut	
SEPF SXE	C55, C6, E7, E12	○	+C3	+TSS (+S)
	F13	○	+C3	+T

1-2. Lead terminal cutting

Lead terminal cutting code	Process names	Size code (φD)	Dimensions (unit : mm)
+C3 (+3)	Straight cut	C55, C6 (φ 6.3) E7, E12 (φ 8) F13 (φ 10)	 C3 L 3.5 Size code / C55, C6 / E7, E12 / F13 F / 2.5 / 3.5 / 5.0

1-3. Lead terminal taping

Taping code	F	Size code (φD)	Taping
+T	F=5.0 mm	F13 (φ 10)	
+TSS (+S)	F=2.5 mm F=3.5 mm	C55, C6 (φ 6.3) E7, E12 (φ 8)	

(unit : mm)

Code		F	P	P0	P1	P2	Δh	W	W0	W1	W2	H	φD0	t	ℓ	L
Tolerance		+0.8 −0.2	±1.0	±0.2	±0.5	±1.0	±1.0	±0.5	min.	±0.5	max	±0.75	±0.2	±0.3	max	max
+T	φ 10	5.0	12.7	12.7	3.85	6.35	0	18.0	9.5	9.0	2.5	18.5	4.0	0.6	0	11.0
+TSS (+S)	φ 5	2.0	12.7	12.7	5.35	6.35	0	18.0	9.5	9.0	2.5	17.5	4.0	0.6	0	11.0
	φ 6.3	2.5	12.7	12.7	5.10	6.35	0	18.0	9.5	9.0	2.5	17.5	4.0	0.6	0	11.0
	φ 8	3.5	12.7	12.7	4.60	6.35	0	18.0	9.5	9.0	2.5	17.5	4.0	0.6	0	11.0

2. Minimum packing quantity and weight

Size code	Case size	Processed type discrete lead terminals		Zig-zag pack taping type	
		Quantity(pcs./Bag)	Typical weight(g)	Quantity(pcs./Bag)	Typical weight(g)
C55	φ 6.3	500	150	1500	650
C6	φ 6.3	500	160	1500	700
E7	φ 8	200	110	1000	820
E12	φ 8	200	200	1000	980
F13	φ10	200	280	500	940

Line-up

SMD type

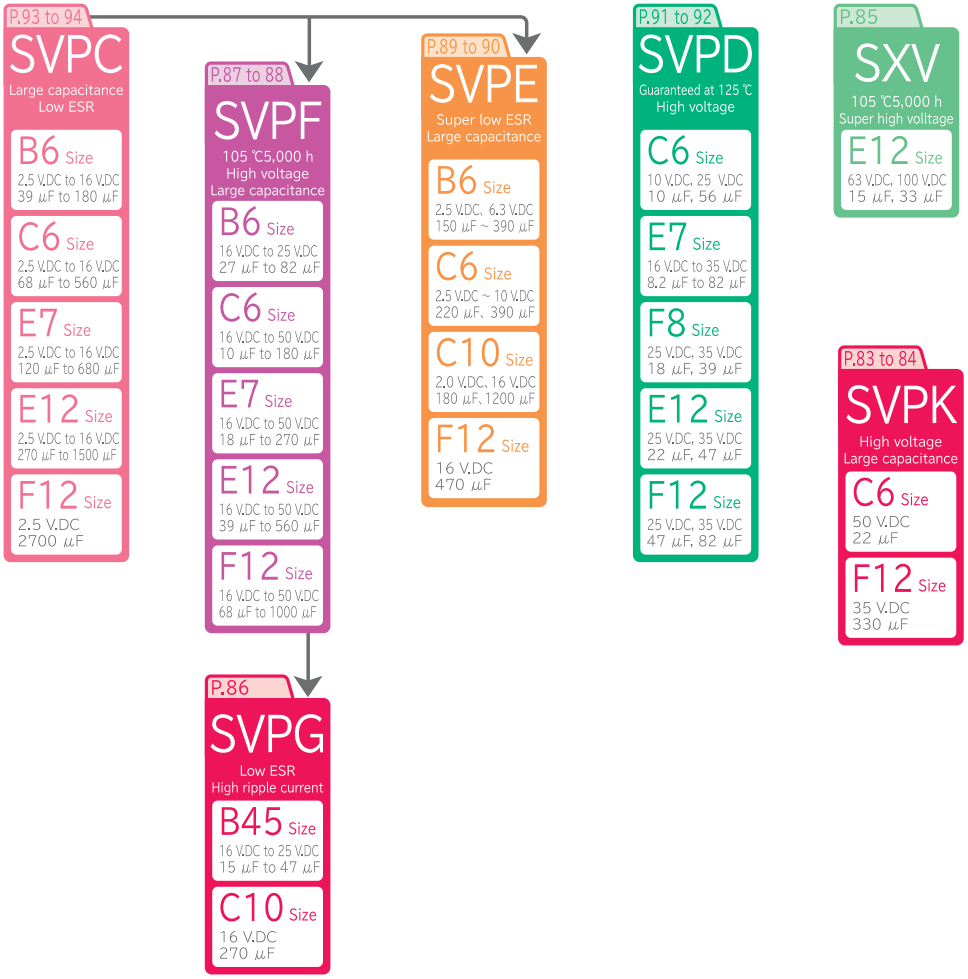
Series	Page	Features	Small size/Low profile	Large capacitance	Low ESR	High voltage	Long life/High reliability	Category temperature range (℃)	Rated voltage (V.DC)	ESR (mΩ)	Capacitance (μF)	Marking color	Size code	Size(mm) φD	Size(mm) L
SVPK	83 to 84	High voltage Large capacitance		●		●		-55 to 105	50	35	22	Purple	C6	6.3	6.0
								-55 to 105	35	18	330	Purple	F12	10.0	12.7
SXV	85	Super high voltage 105 ℃ 5000 h				●		-55 to 105	63 to 100	25 to 40	15 to 33	Purple	E12	8.0	12.0
SVPG	86	Low ESR High ripple current 105 ℃ 5000 h			●		●	-55 to 105	16 to 25	25 to 30	15 to 47	Purple	B45	5.0	4.5
								-55 to 105	16	8	270	Purple	C10	6.3	10.0
SVPF	87 to 88	High voltage Large capacitance 105 ℃ 5000 h		●		●	●	-55 to 105	16 to 25	27 to 40	27 to 82	Purple	B6	5.0	6.0
								-55 to 105	16 to 50	22 to 40	10 to 180	Purple	C6	6.3	6.0
								-55 to 105	16 to 50	22 to 35	18 to 270	Purple	E7	8.0	7.0
								-55 to 105	16 to 50	14 to 25	39 to 560	Purple	E12	8.0	12.0
								-55 to 105	16 to 50	12 to 20	68 to 1000	Purple	F12	10.0	12.7
SVPE	89 to 90	Super low ESR Large capacitance		●	●			-55 to 105	2.5 to 6.3	10 to 15	150 to 390	Purple	B6	5.0	6.0
								-55 to 105	2.5 to 10	10 to 20	220 to 390	Purple	C6	6.3	6.0
								-55 to 105	2.0 to 16	8 to 11	180 to 1200	Purple	C10	6.3	10.0
								-55 to 105	16	10	470	Purple	F12	10.0	12.7
SVPD	91 to 92	Guaranteed at 125 ℃ High voltage 85 ℃ 85 % RH				●	●	-55 to 125	10 to 25	45 to 65	10 to 56	Purple	C6	6.3	6.0
								-55 to 125	16 to 35	40 to 70	8.2 to 82	Purple	E7	8.0	7.0
								-55 to 125	25 to 35	45 to 60	18 to 39	Purple	F8	10.0	8.0
								-55 to 125	25 to 35	30 to 50	22 to 47	Purple	E12	8.0	12.0
								-55 to 125	25 to 35	28 to 30	47 to 82	Purple	F12	10.0	12.7
SVPC	93 to 94	Low ESR Large capacitance		●	●			-55 to 105	2.5 to 16	19 to 35	39 to 180	Purple	B6	5.0	6.0
								-55 to 105	2.5 to 16	15 to 30	68 to 560	Purple	C6	6.3	6.0
								-55 to 105	2.5 to 16	19 to 27	120 to 680	Purple	E7	8.0	7.0
								-55 to 105	2.5 to 16	9 to 16	270 to 1500	Purple	E12	8.0	12.0
								-55 to 105	2.5	12	2700	Purple	F12	10.0	12.7

Radial lead type

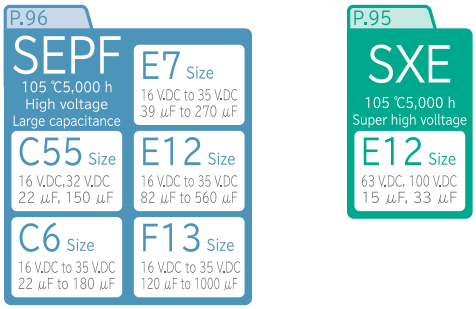
Series	Page	Features	Small size/Low profile	Large capacitance	Low ESR	High voltage	Long life/High reliability	Category temperature range (℃)	Rated voltage (V.DC)	ESR (mΩ)	Capacitance (μF)	Marking color	Size code	Size(mm) φD	Size(mm) L
SXE	95	Super high voltage 105 ℃ 5000 h				●		-55 to 105	63 to 100	25 to 40	15 to 33	Purple	E12	8.0	12.0
SEPF	96	Small size / Low profile High voltage Large capacitance 105 ℃ 5000 h	●	●		●	●	-55 to 105	16 to 32	30 to 35	22 to 150	Purple	C55	6.3	5.5
								-55 to 105	16 to 35	22 to 35	22 to 180	Purple	C6	6.3	6.0
								-55 to 105	16 to 35	22 to 30	39 to 270	Purple	E7	8.0	7.0
								-55 to 105	16 to 35	14 to 20	82 to 560	Purple	E12	8.0	12.0
								-55 to 105	16 to 35	12 to 18	120 to 1000	Purple	F13	10.0	13.0

Series system diagram

SMD type

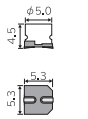
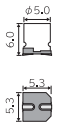
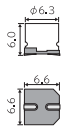
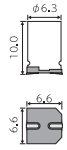
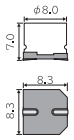
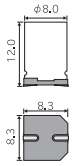
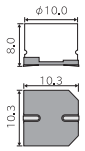
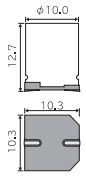


Radial lead type



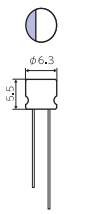
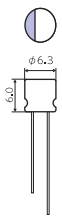
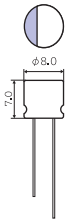
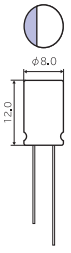
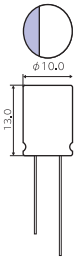
SMD type

(Unit:mm)

B45 size	B6 size	C6 size	C10 size	E7 size	E12 size	F8 size	F12 size
							
P.86 SVPG	P.87 to 88 SVPF P.89 to 90 SVPE P.93 to 94 SVPC	P.83 to 84 SVPK P.87 to 88 SVPF P.89 to 90 SVPE P.91 to 92 SVPD P.93 to 94 SVPC	P.86 SVPG P.89 to 90 SVPE	P.87 to 88 SVPF P.91 to 92 SVPD P.93 to 94 SVPC	P.85 SXV P.87 to 88 SVPF P.91 to 92 SVPD P.93 to 94 SVPC	P.91 to 92 SVPD	P.83 to 84 SVPK P.87 to 88 SVPF P.89 to 90 SVPE P.91 to 92 SVPD P.93 to 94 SVPC

※ Profile of case size are all indicated in maximum values.

Radial lead type

C55 size	C6 size	E7 size	E12 size	F13 size
				
P.96 SEPF	P.96 SEPF	P.96 SEPF	P.95 SXE P.96 SEPF	P.96 SEPF

※ Profile of case size are all indicated in maximum values.

Products list

Size・ESR Matrix list

SMD type

Size code (ESR mΩ)

V.DC	Series \ μF	8.2	10	15	18	22	27	33	39	47	56	68	82	100
2.0	SVPE													
2.5	SVPE													
	SVPE													
	SVPC													
4.0	SVPC													
6.3	SVPE													
	SVPE													
	SVPC													B6 (30,25)
10	SVPE													
	SVPD										C6 (45)			
	SVPC											B6 (30,23)		
16	SVPG									B45 (25)				
	SVPF												B6 (27)	
	SVPE													
	SVPD												E7 (40)	
	SVPC								B6 (35,27)			C6 (30,25)		C6 (24)
20	SVPG							B45 (27)						
	SVPF										B6 (30)			
25	SVPG			B45 (30)										
	SVPF						B6 (40)							E7 (24)
	SVPF									C6 (30)	C6 (30)		E7 (28)	
	SVPD		C6 (65)			E7 (48)			F8 (45)	E12 (30)			F12 (28)	
35	SVPK													
	SVPF					C6 (35)			E7 (30)				E12 (20)	
	SVPD	E7 (70)			F8 (60)	E12 (50)				F12 (30)				
50	SVPK					C6 (35)								
	SVPF		C6 (40)		E7 (35)				E12 (25)			F12 (20)		
63	SXV							E12 (25)						
100	SXV			E12 (40)										

Case size (unit : mm)

B45	φ5.0×L4.5	C6	φ6.3×L6.0	E7	φ8.0×L7.0	F8	φ10.0×L8.0
B6	φ5.0×L6.0	C10	φ6.3×L10.0	E12	φ8.0×L12.0	F12	φ10.0×L12.7

Radial lead type

Size code (ESR mΩ)

V.DC	Series \ μF	15	22	33	39	56	68	82	120	150
16	SEPF									C55 (30)
20	SEPF								C6 (25)	
25	SEPF					C6 (30)		E7 (28)		
32	SEPF		C55 (35)				E7 (25)			
35	SEPF		C6 (35)		E7 (30)			E12 (20)	F13 (18)	
63	SXE			E12 (25)						
100	SXE	E12 (40)								

Case size (unit : mm)

C55	φ6.3×L5.5	E7	φ8.0×L7.0	F13	φ10.0×L13.0
C6	φ6.3×L6.0	E12	φ8.0×L12.0		

V.DC	Series \ μF	120	150	180	220	270	330	390	470	560	680	820	1000	1200	1500	2700
2.0	SVPE													C10 (8)		
2.5	SVPE					B6 (10)	B6 (15,10)	C6 (10)								
	SVPE							B6 (10)								
	SVPC			B6 (30,24,19)				C6 (25,15)		C6 (16)	E7 (20)	E12 (9)			E12 (10)	F12 (12)
4.0	SVPC		B6 (30,23,20)				C6 (27,21,15)			E7 (22)				E12 (12)	E12 (12)	
										E12 (9)						
6.3	SVPE		B6 (12)	B6 (15)	C6 (10)											
	SVPE				B6 (15)											
	SVPC	B6 (21)			C6 (27,15)		C6 (17)	E7 (22)				E12 (12)				
10	SVPE				C6 (20)											
	SVPD															
	SVPC	C6 (27,22)				E7 (22)	E7 (19)									
16	SVPG					C10 (8)										
	SVPF			C6 (22)		E7 (22)				E12 (14)			F12 (12)			
	SVPE			C10 (11)					F12 (10)							
	SVPD															
	SVPC	E7 (27)	E7 (22)			E12 (16)										
20	SVPG															
	SVPF	C6 (25)		E7 (25)				E12 (14)		F12 (12)						
25	SVPG															
	SVPF															
	SVPF			E12 (16)			F12 (14)									
	SVPD															
35	SVPK						F12 (18)									
	SVPF	F12 (18)														
	SVPD															
50	SVPK															
	SVPF															
63	SXV															
100	SXV															

V.DC	Series \ μF	180	270	330	390	560	1000
16	SEPF	C6 (22)	E7 (22)			E12 (14)	F13 (12)
20	SEPF	E7 (25)			E12 (14)	F13 (12)	
25	SEPF	E12 (16)		F13 (14)			
32	SEPF						
35	SEPF						
63	SXE						
100	SXE						

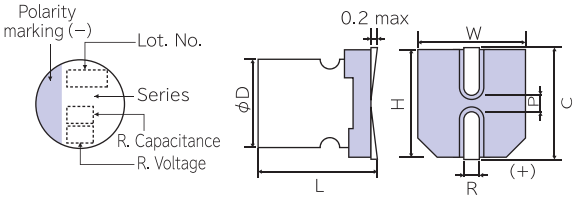
Surface mount type SVPK Series

- High voltage(50 V.DC max.)
- RoHS compliance, Halogen free

Specifications

Items	Specifications	
Size code	C6	F12
Category temperature range	–55 ℃ to +105 ℃	
Rated voltage range	50 V.DC	35 V.DC
Rated capacitance range	22 μF	330 μF
Capacitance tolerance	±20 %(120 Hz/+20 ℃)	
Leakage current	Please see the attached characteristics list	
Dissipation factor(tan δ)	Please see the attached characteristics list	
Endurance	+105 ℃, 2000 h, rated voltage applied	
	Capacitance change	Within±20 % of the initial value
	tan δ	≦ 150 % of the initial limit
	DC leakage current	Within the initial limit
Damp heat (Steady state)	+60 ℃, 90 % to 95 %, 1000 h, No-applied voltage	
	Capacitance change	Within±20 % of the initial value
	tan δ	≦ 150 % of the initial limit
	DC leakage current	Within the initial limit (after voltage processing)

Marking and dimensions



(unit : mm)

Size code	ϕD ±0.5	L +0.1 −0.4	W ±0.2	H ±0.2	C ±0.2	R	P ±0.2
C6	6.3	5.9	6.6	6.6	7.3	0.6 to 0.8	2.1
F12	10.0	12.6	10.3	10.3	11.0	0.8 to 1.1	4.6

Characteristics list

Series	Rated voltage (V.DC)	Rated capacitance (μF)	Case size (mm)		Size code	Specifications				Standard(Reel size：φ 380)	
			φD	L		Rated ripple current ※1 (mArms)	ESR ※2 (mΩ max.)	tan δ ※3	LC ※4 (μA)	Part number	Min. Packaging Q'ty (pcs)
SVPK	35	330	10.0	12.6	F12	4400	18	0.12	2310	35SVPK330M	400
	50	22	6.3	5.9	C6	2600	35	0.12	220	50SVPK22M	1000

※1：Rated ripple current (100 kHz/ +105 ℃), ※2：ESR (100 kHz to 300 kHz/+20 ℃)　※3：tanδ (120 Hz/+20 ℃)　※4：After 2 minutes

◆Please refer to the P73 to 76 in this catalog for "Reflow conditions" and "Taping specifications".

Frequency correction factor for ripple current

Frequency	120 Hz ≦ f <1 kHz	1 kHz ≦ f < 10 kHz	10 kHz ≦ f < 100 kHz	100 kHz ≦ f ≦ 500 kHz
Coefficient	0.05	0.3	0.7	1

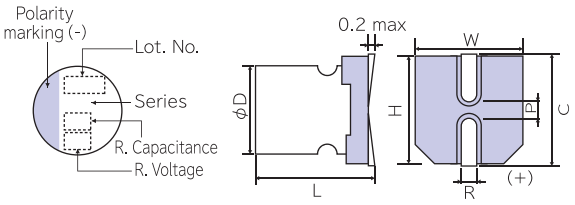
Surface mount type SXV Series

- Super high voltage(100 V.DC max.)
- RoHS compliance, Halogen free

Specifications

Items	Specifications	
Size code	E12	
Category temperature range	–55 ℃ to +105 ℃	
Rated voltage range	63 V.DC to 100 V.DC	
Rated capacitance range	15 μF to 33 μF	
Capacitance tolerance	±20 %(120 Hz/+20 ℃)	
Leakage current	Please see the attached characteristics list	
Dissipation factor(tanδ)	Please see the attached characteristics list	
Endurance	+105 ℃, 5000 h, rated voltage applied	
	Capacitance change	Within±20 % of the initial value
	tanδ	≦ 150 % of the initial limit
	DC leakage current	Within the initial limit
Damp heat (Steady state)	+60 ℃, 90 % to 95 %, 1000 h, No-applied voltage	
	Capacitance change	Within±20 % of the initial value
	tanδ	≦ 150 % of the initial limit
	DC leakage current	Within the initial limit (after voltage processing)

Marking and dimensions



(unit : mm)

Size code	ϕD ±0.5	L +0.1 −0.4	W ±0.2	H ±0.2	C ±0.2	R	P ±0.2
E12	8.0	11.9	8.3	8.3	9.0	0.8 to 1.1	3.2

Characteristics list

Series	Rated voltage (V.DC)	Rated capacitance (μF)	Case size (mm) ϕD	Case size (mm) L	Size code	Specifications: Rated ripple current ※1 (mArms.)	Specifications: ESR ※2 (mΩ max.)	Specifications: tan δ ※3	Specifications: LC ※4 (μA)	Standard(Reel size:ϕ 380): Part number	Standard(Reel size:ϕ 380): Min. Packaging Q'ty (pcs)
SXV	63	33	8.0	11.9	E12	2950	25	0.12	104	63SXV33M	400
	100	15	8.0	11.9	E12	2350	40	0.12	75	100SXV15M	400

※1:Rated ripple current (100 kHz/ +105 ℃), ※2:ESR (100 kHz to 300 kHz/+20 ℃) ※3:tanδ (120 Hz/+20 ℃) ※4:After 2 minutes

◆Please refer to the P73 to 76 in this catalog for "Reflow conditions" and "Taping specifications".

Frequency correction factor for ripple current

Frequency	120 Hz ≦ f < 1 kHz	1 kHz ≦ f < 10 kHz	10 kHz ≦ f < 100 kHz	100 kHz ≦ f ≦ 500 kHz
Coefficient	0.05	0.3	0.7	1

Design and specifications are each subject to change without notice. Ask factory for the current technical specifications before purchase and/or use.
Should a safety concern arise regarding this product, please be sure to contact us immediately.

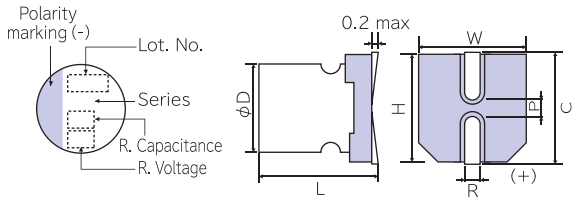
Surface mount type SVPG Series

- Low profile(Height 4.5 mm max.)
- RoHS compliance, Halogen free
- LowESR (8 to 30 mΩ)

Specifications

Items	Specifications	
Size code	B45	C10
Category temperature range	−55 ℃ to +105 ℃	
Rated voltage range	16 V.DC to 25 V.DC	16 V.DC
Rated capacitance range	15 μF to 47 μF	270 μF
Capacitance tolerance	±20 %(120 Hz/+20 ℃)	
Leakage current	Please see the attached characteristics list	
Dissipation factor(tanδ)	Please see the attached characteristics list	
Endurance	+105 ℃, 5000 h, rated voltage applied	
	Capacitance change	Within±20 % of the initial value
	tanδ	≦ 150 % of the initial limit
	DC leakage current	Within the initial limit
Damp heat (Steady state)	+60 ℃, 90 % to 95 %, 1000 h, No-applied voltage	
	Capacitance change	Within±20 % of the initial value
	tanδ	≦ 150 % of the initial limit
	DC leakage current	Within the initial limit (after voltage processing)

Marking and dimensions



(unit : mm)

Size code	ϕD ±0.5	L +0.1 −0.4	W ±0.2	H ±0.2	C ±0.2	R	P ±0.2
B45	5.0	4.4	5.3	5.3	6.0	0.6 to 0.8	1.4
C10	6.3	9.9	6.6	6.6	7.3	0.6 to 0.8	2.1

Characteristics list

Series	Rated voltage (V.DC)	Rated capacitance (μF)	Case size (mm) ϕD	Case size (mm) L	Size code	Specifications: Rated ripple current ※1 (mArms)	Specifications: ESR ※2 (mΩ max.)	Specifications: tan δ ※3	Specifications: LC ※4 (μA)	Standard(Reel size:ϕ 380): Part number	Standard(Reel size:ϕ 380): Min. Packaging Q'ty (pcs)
SVPG	16	47	5.0	4.4	B45	3200	25	0.12	150	16SVPG47M	2500
		270	6.3	9.9	C10	5800	8	0.12	864	16SVPG270M	500
	20	33	5.0	4.4	B45	3000	27	0.12	132	20SVPG33M	2500
	25	15	5.0	4.4		2800	30	0.12	75	25SVPG15M	2500

※1:Rated ripple current (100 kHz/ +105 ℃), ※2:ESR (100 kHz to 300 kHz/+20 ℃) ※3:tanδ (120 Hz/+20 ℃) ※4:After 2 minutes

◆Please refer to the P73 to 76 in this catalog for "Reflow conditions" and "Taping specifications".

Frequency correction factor for ripple current

Frequency	120 Hz ≦ f < 1 kHz	1 kHz ≦ f < 10 kHz	10 kHz ≦ f < 100 kHz	100 kHz ≦ f ≦ 500 kHz
Coefficient	0.05	0.3	0.7	1

Design and specifications are each subject to change without notice. Ask factory for the current technical specifications before purchase and/or use.
Should a safety concern arise regarding this product, please be sure to contact us immediately.

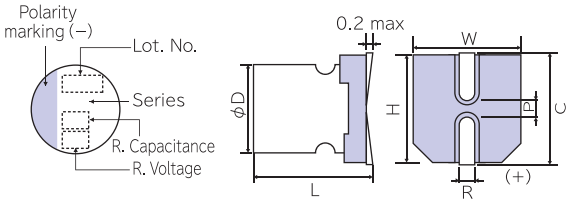
Surface mount type SVPF Series

- High voltage (50 V.DC max.)
- Large capacitance (1000 μF max.)
- 105 ℃ 5000 h
- RoHS compliance, Halogen free

Specifications

Items	Specifications				
Size code	B6	C6	E7	E12	F12
Category temperature range	−55 ℃ to +105 ℃				
Rated voltage range	16 V.DC to 25 V.DC	16 V.DC to 50 V.DC			
Rated capacitance range	27 μF to 82 μF	10 μF to 180 μF	18 μF to 270 μF	39 μF to 560 μF	68 μF to 1000 μF
Capacitance tolerance	±20 %(120 Hz/+20 ℃)				
Leakage current	Please see the attached characteristics list				
Dissipation factor(tan δ)	Please see the attached characteristics list				
Endurance	+105 ℃, 5000 h, rated voltage applied				
	Capacitance change	Within±20 % of the initial value			
	tan δ	≦ 150 % of the initial limit			
	DC leakage current	Within the initial limit			
Damp heat (Steady state)	+60 ℃, 90 % to 95 %, 1000 h, No-applied voltage				
	Capacitance change	Within±20 % of the initial value			
	tan δ	≦ 150 % of the initial limit			
	DC leakage current	Within the initial limit (after voltage processing)			

Marking and dimensions



(unit : mm)

Size code	ϕD ±0.5	L +0.1 −0.4	W ±0.2	H ±0.2	C ±0.2	R	P ±0.2
B6	5.0	5.9	5.3	5.3	6.0	0.6 to 0.8	1.4
C6	6.3	5.9	6.6	6.6	7.3	0.6 to 0.8	2.1
E7	8.0	6.9	8.3	8.3	9.0	0.6 to 0.8	3.2
E12	8.0	11.9	8.3	8.3	9.0	0.8 to 1.1	3.2
F12	10.0	12.6	10.3	10.3	11.0	0.8 to 1.1	4.6

Characteristics list

Series	Rated voltage (V.DC)	Rated capacitance (μF)	Case size (mm)		Size code	Specifications				Standard(Reel size：φ 380)	
			φD	L		Rated ripple current ※1 (mArm.s.)	ESR ※2 (mΩ max.)	tan δ ※3	LC ※4 (μA)	Part number	Min. Packaging Q'ty (pcs)
SVPF	16	82	5.0	5.9	B6	3000	27	0.12	262	16SVPF82M	1500
		180	6.3	5.9	C6	3300	22	0.12	576	16SVPF180M	1000
		270	8.0	6.9	E7	3300	22	0.12	864	16SVPF270M	1000
		560	8.0	11.9	E12	4950	14	0.12	1792	16SVPF560M	400
		1000	10.0	12.6	F12	5400	12	0.12	3200	16SVPF1000M	400
	20	56	5.0	5.9	B6	2800	30	0.12	224	20SVPF56MX	1500
		120	6.3	5.9	C6	3200	25	0.12	480	20SVPF120M	1000
		180	8.0	6.9	E7	3200	25	0.12	720	20SVPF180M	1000
		390	8.0	11.9	E12	4950	14	0.12	1560	20SVPF390M	400
		560	10.0	12.6	F12	5400	12	0.12	2240	20SVPF560M	400
	25	27	5.0	5.9	B6	2450	40	0.12	135	25SVPF27MX	1500
		47	6.3	5.9	C6	2800	30	0.12	235	25SVPF47M	1000
		56	6.3	5.9		2800	30	0.12	280	25SVPF56M	1000
		82	8.0	6.9	E7	3000	28	0.12	410	25SVPF82M	1000
		100	8.0	6.9		3200	24	0.12	500	25SVPF100M	1000
		180	8.0	11.9	E12	4650	16	0.12	900	25SVPF180M	400
		330	10.0	12.6	F12	5000	14	0.12	1650	25SVPF330M	400
	35	22	6.3	5.9	C6	2600	35	0.12	154	35SVPF22M	1000
		39	8.0	6.9	E7	2800	30	0.12	273	35SVPF39M	1000
		82	8.0	11.9	E12	4000	20	0.12	574	35SVPF82M	400
		120	10.0	12.6	F12	4400	18	0.12	840	35SVPF120M	400
	50	10	6.3	5.9	C6	2500	40	0.12	100	50SVPF10M	1000
		18	8.0	6.9	E7	2700	35	0.12	180	50SVPF18M	1000
		39	8.0	11.9	E12	3800	25	0.12	390	50SVPF39M	400
		68	10.0	12.6	F12	4300	20	0.12	680	50SVPF68M	400

※1：Rated ripple current(100 kHz/ +105 ℃), ※2：ESR (100 kHz to 300 kHz/+20 ℃)　※3：tanδ (120 Hz/+20 ℃)　※4：After 2 minutes

◆Please refer to the P73 to 76 in this catalog for "Reflow conditions" and "Taping specifications".

Frequency correction factor for ripple current

Frequency	120 Hz ≦ f < 1 kHz	1 kHz ≦ f < 10 kHz	10 kHz ≦ f < 100 kHz	100 kHz ≦ f ≦ 500 kHz
Coefficient	0.05	0.3	0.7	1

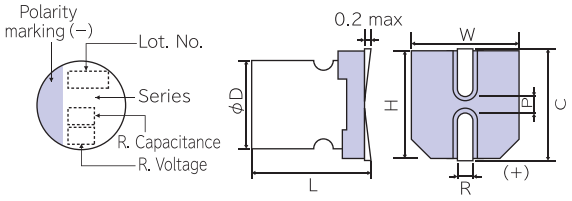
Surface mount type SVPE Series

- Super low ESR(8 mΩ to 18 mΩ)
- RoHS compliance, Halogen free
- Large capacitance (1200 μF max.)

Specifications

Items	Specifications			
Size code	B6	C6	C10	F12
Category temperature range	–55 ℃ to +105 ℃			
Rated voltage range	2.5 V.DC to 6.3 V.DC	2.5 V.DC to 10 V.DC	2 V.DC to 16 V.DC	16 V.DC
Rated capacitance range	150 μF to 390 μF	220 μF to 390 μF	180 μF to 1200 μF	470 μF
Capacitance tolerance	±20 %(120 Hz/+20 ℃)			
Leakage current	Please see the attached characteristics list			
Dissipation factor(tan δ)	Please see the attached characteristics list			
Endurance	+105 ℃, 2000 h, rated voltage applied			
	Capacitance change	Within±20 % of the initial value		
	tan δ	≦ 150 % of the initial limit		
	DC leakage current	Within the initial limit		
Damp heat (Steady state)	+60 ℃, 90 % to 95 %, 1000 h, No-applied voltage			
	Capacitance change	Within±20 % of the initial value		
	tan δ	≦ 150 % of the initial limit		
	DC leakage current	Within the initial limit (after voltage processing)		

Marking and dimensions



(unit : mm)

Size code	ϕD ±0.5	L +0.1 −0.4	W ±0.2	H ±0.2	C ±0.2	R	P ±0.2
B6	5.0	5.9	5.3	5.3	6.0	0.6 to 0.8	1.4
C6	6.3	5.9	6.6	6.6	7.3	0.6 to 0.8	2.1
C10	6.3	9.9	6.6	6.6	7.3	0.6 to 0.8	2.1
F12	10.0	12.6	10.3	10.3	11.0	0.8 to 1.1	4.6

Characteristics list

Series	Rated voltage (V.DC)	Rated capacitance (μF)	Case size (mm)		Size code	Specifications					Standard(Reel size：φ 380)	
			φD	L		Rated ripple current ※1 (mAr.m.s.)	ESR 100 kHz/20 ℃ (mΩ max.)	ESR 300 kHz/20 ℃ (mΩ max.)	tan δ ※2	LC ※3 (μA)	Part number	Min. Packaging Q'ty (pcs)
SVPE	2	1200	6.3	9.9	C10	5230	8	8	0.12	500	2SVPE1200M	500
	2.5	270	5.0	5.9	B6	3860	10	9	0.12	500	2R5SVPE270M	1500
		330	5.0	5.9		3150	15	13	0.12	500	2R5SVPE330M	1500
			5.0	5.9		3860	10	9	0.12	500	2R5SVPE330MY	1500
		390	5.0	5.9		3860	10	9	0.12	700	2R5SVPE390MX	1500
			6.3	5.9	C6	3900	10	9	0.12	500	2R5SVPE390M	1000
	6.3	150	5.0	5.9	B6	3520	12	10	0.12	500	6SVPE150M	1500
		180	5.0	5.9		3150	15	13	0.12	500	6SVPE180M	1500
		220	5.0	5.9		3150	15	13	0.12	500	6SVPE220MW	1500
			6.3	5.9	C6	3900	10	9	0.12	500	6SVPE220M	1000
	10	220	6.3	5.9		2700	20	18	0.12	500	10SVPE220M	1000
	16	180	6.3	9.9	C10	4460	11	10	0.12	576	16SVPE180M	500
		470	10.0	12.6	F12	6100	10	9	0.12	1504	16SVPE470M	400

※1：Rated ripple current (100 kHz/ +105 ℃), ※2：tanδ (120 Hz/+20 ℃)　※3：After 2 minutes

◆Please refer to the P73 to 76 in this catalog for "Reflow conditions" and "Taping specifications".

Frequency correction factor for ripple current

Frequency	120 Hz ≦ f < 1 kHz	1 kHz ≦ f < 10 kHz	10 kHz ≦ f < 100 kHz	100 kHz ≦ f ≦ 500 kHz
Coefficient	0.05	0.3	0.7	1

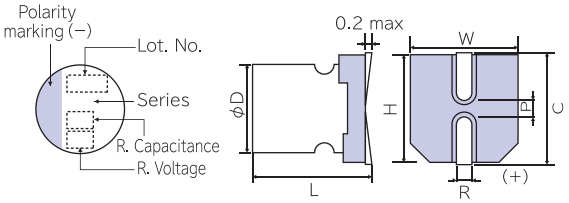
Surface mount type SVPD Series

- 125 ℃ 2000 h
- Guaranteed at 85 ℃ 85 %
- RoHS compliance, Halogen free

Specifications

Items	Specifications				
Size code	C6	E7	F8	E12	F12
Category temperature range	−55 ℃ to +125 ℃				
Rated voltage range	10 V.DC to 25 V.DC	16 V.DC to 35 V.DC	25 V.DC to 35 V.DC		
Rated capacitance range	10 μF to 56 μF	8.2 μF to 82 μF	18 μF to 39 μF	22 μF to 47 μF	47 μF to 82 μF
Capacitance tolerance	±20(120 Hz/+20 ℃)				
Leakage current	Please see the attached characteristics list				
Dissipation factor(tan δ)	Please see the attached characteristics list				
Endurance	+125 ℃, 2000 h, rated voltage applied				
	Capacitance change	Within±20 % of the initial value			
	tan δ	≦ 200 % of the initial limit			
	DC leakage current	Within the initial limit			
Damp heat (Steady state)	+85 ℃, 85 % to 90 %, 1000 h, rated voltage applied				
	Capacitance change	Within±20 % of the initial value			
	tan δ	≦ 200 % of the initial limit			
	DC leakage current	Within the initial limit (after voltage processing)			

Marking and dimensions



(unit : mm)

Size code	ϕD ±0.5	L +0.1 −0.4	W ±0.2	H ±0.2	C ±0.2	R	P ±0.2
C6	6.3	5.9	6.6	6.6	7.3	0.6 to 0.8	2.1
E7	8.0	6.9	8.3	8.3	9.0	0.6 to 0.8	3.2
F8	10.0	7.9	10.3	10.3	11.0	0.6 to 0.8	4.6
E12	8.0	11.9	8.3	8.3	9.0	0.8 to 1.1	3.2
F12	10.0	12.6	10.3	10.3	11.0	0.8 to 1.1	4.6

Characteristics list

Series	Rated voltage (V.DC)	Rated capacitance (μF)	Case size (mm)		Size code	Specifications					Standard(Reel size：φ 380)	
			φD	L		Rated ripple current ※1 (mAr.m.s.)	Allowable ripple current※1 (mAr.m.s.)	ESR ※2 (mΩ max.)	tan δ ※3	LC ※4 (μA)	Part number	Min. Packaging Q'ty (pcs)
SVPD	10	56	6.3	5.9	C6	538	1700	45	0.12	112	10SVPD56M	1000
	16	82	8.0	6.9	E7	670	2120	40	0.12	262	16SVPD82M	1000
	25	10	6.3	5.9	C6	474	1500	65	0.10	50	25SVPD10M	1000
		22	8.0	6.9	E7	580	1835	48	0.10	110	25SVPD22M	1000
		39	10.0	7.9	F8	664	2100	45	0.10	195	25SVPD39M	500
		47	8.0	11.9	E12	943	2980	30	0.12	235	25SVPD47M	400
		82	10.0	12.6	F12	1202	3800	28	0.12	410	25SVPD82M	400
	35	8.2	8.0	6.9	E7	400	1300	70	0.10	57	35SVPD8R2M	1000
		18	10.0	7.9	F8	550	1800	60	0.10	126	35SVPD18M	500
		22	8.0	11.9	E12	700	2300	50	0.12	154	35SVPD22M	400
		47	10.0	12.6	F12	1150	3650	30	0.12	329	35SVPD47M	400

※1：Rated ripple current (100 kHz/105 ℃ < Tx ≦ 125 ℃) / Allowable ripple current (100 kHz/ Tx ≦ 105 ℃)　※2：ESR (100 kHz~300 kHz/+20 ℃)
※3：tanδ (120 Hz/+20 ℃)　※4：After 2 minutes
◆Please refer to the P73 to 76 in this catalog for "Reflow conditions" and "Taping specifications".

Frequency correction factor for ripple currentt

Frequency	120 Hz ≦ f < 1 kHz	1 kHz ≦ f < 10 kHz	10 kHz ≦ f < 100 kHz	100 kHz ≦ f ≦ 500 kHz
Coefficient	0.05	0.3	0.7	1

Design and specifications are each subject to change without notice. Ask factory for the current technical specifications before purchase and/or use.
Should a safety concern arise regarding this product, please be sure to contact us immediately.

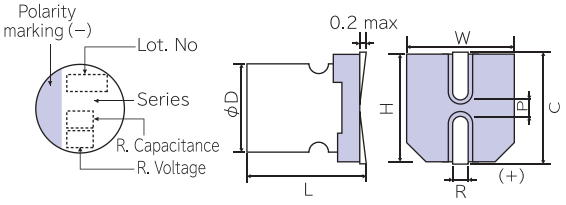
Surface mount type SVPC Series

- LowESR(9 mΩ to 30 mΩ)
- Large capacitance (2700 μF max.)
- RoHS compliance, Halogen free

Specifications

Items	Specifications				
Size code	B6	C6	E7	E12	F12
Category temperature range	−55 ℃ to +105 ℃				
Rated voltage range	2.5 V.DC to 16 V.DC				2.5 V.DC
Rated capacitance range	39 μF to 180 μF	68 μF to 560 μF	120 μF to 680 μF	270 μF to 1500 μF	2700 μF
Capacitance tolerance	±20 %(120 Hz/+20 ℃)				
Leakage current	Please see the attached characteristics list				
Dissipation factor(tan δ)	Please see the attached characteristics list				
Endurance	+105 ℃, 2000 h, rated voltage applied				
	Capacitance change	Within±20 % of the initial value			
	tan δ	≦ 150 % of the initial limit			
	DC leakage current	Within the initial limit			
Damp heat (Steady state)	+60 ℃, 90 % to 95 %, 1000 h, No-applied voltage				
	Capacitance change	Within±20 % of the initial value			
	tan δ	≦ 150 % times of the initial limit			
	DC leakage current	Within the initial limit (after voltage processing)			

Marking and dimensions



(unit : mm)

Size code	ϕD ±0.5	L +0.1 −0.4	W ±0.2	H ±0.2	C ±0.2	R	P ±0.2
B6	5.0	5.9	5.3	5.3	6.0	0.6 to 0.8	1.4
C6	6.3	5.9	6.6	6.6	7.3	0.6 to 0.8	2.1
E7	8.0	6.9	8.3	8.3	9.0	0.6 to 0.8	3.2
E12	8.0	11.9	8.3	8.3	9.0	0.8 to 1.1	3.2
F12	10.0	12.6	10.3	10.3	11.0	0.8 to 1.1	4.6

Characteristics list

Series	Rated voltage (V.DC)	Rated capacitance (μF)	Case size (mm)		Size code	Specifications					Standard(Reel size：φ 380)	
			φD	L		Rated ripple current ※1 (mArm.s.)	ESR 100 kHz/20 ℃ (mΩ max.)	ESR 300 kHz/20 ℃ (mΩ max.)	tan δ ※2	LC ※3 (μA)	Part number	Min. Packaging Q'ty (pcs)
SVPC	2.5	180	5.0	5.9	B6	1970	30	26	0.12	300	2R5SVPC180M	1500
			5.0	5.9		2200	24	20	0.12	300	2R5SVPC180MY	1500
			5.0	5.9		2800	19	16	0.12	300	2R5SVPC180MV	1500
		390	6.3	5.9	C6	2410	25	22	0.12	300	2R5SVPC390M	1000
			6.3	5.9		3160	15	13	0.12	300	2R5SVPC390MV	1000
		560	6.3	5.9		3500	16	14	0.12	300	2R5SVPC560M	1000
		680	8.0	6.9	E7	3370	20	17	0.12	500	2R5SVPC680M	1000
		820	8.0	11.9	E12	5380	9	8	0.15	500	2R5SVPC820M	400
		1500	8.0	11.9		5150	10	9	0.15	750	2R5SVPC1500M	400
		2700	10.0	12.6	F12	5070	12	10	0.15	1350	2R5SVPC2700M	400
	4.0	150	5.0	5.9	B6	1970	30	26	0.12	300	4SVPC150M	1500
			5.0	5.9		2240	23	20	0.12	300	4SVPC150MY	1500
			5.0	5.9		2730	20	17	0.12	300	4SVPC150MV	1500
		330	6.3	5.9	C6	2320	27	23	0.12	300	4SVPC330M	1000
			6.3	5.9		2630	21	18	0.12	300	4SVPC330MY	1000
			6.3	5.9		3160	15	13	0.12	300	4SVPC330MV	1000
		560	8.0	6.9	E7	3220	22	19	0.12	500	4SVPC560M	1000
			8.0	11.9	E12	5380	9	8	0.15	500	4SVPC560MX	400
		1200	8.0	11.9		4700	12	10	0.15	960	4SVPC1200M	400
		1500	8.0	11.9		4700	12	10	0.15	1200	4SVPC1500M	400
	6.3	120	5.0	5.9	B6	2660	21	18	0.12	300	6SVPC120MV	1500
		100	5.0	5.9		1970	30	26	0.12	300	6SVPC100M	1500
			5.0	5.9		2150	25	21	0.12	300	6SVPC100MY	1500
		220	6.3	5.9	C6	2320	27	23	0.12	300	6SVPC220M	1000
			6.3	5.9		3160	15	13	0.12	300	6SVPC220MV	1000
		330	6.3	5.9		3390	17	15	0.12	415	6SVPC330M	1000
		390	8.0	6.9	E7	3220	22	19	0.12	491	6SVPC390M	1000
		820	8.0	11.9	E12	4700	12	10	0.15	1033	6SVPC820M	400
	10	68	5.0	5.9	B6	1970	30	26	0.12	300	10SVPC68M	1500
			5.0	5.9		2540	23	20	0.12	300	10SVPC68MV	1500
		120	6.3	5.9	C6	2320	27	23	0.12	300	10SVPC120M	1000
			6.3	5.9		2600	22	19	0.12	300	10SVPC120MV	1000
		270	8.0	6.9	E7	3220	22	19	0.12	500	10SVPC270M	1000
		330	8.0	6.9		3460	19	17	0.12	660	10SVPC330M	1000
	16	39	5.0	5.9	B6	1820	35	30	0.12	300	16SVPC39M	1500
			5.0	5.9		2350	27	23	0.12	300	16SVPC39MV	1500
		68	6.3	5.9	C6	2200	30	26	0.12	300	16SVPC68M	1000
			6.3	5.9		2440	25	22	0.12	300	16SVPC68MV	1000
		100	6.3	5.9		2490	24	23	0.12	300	16SVPC100M	1000
		120	8.0	6.9	E7	2900	27	23	0.12	500	16SVPC120M	1000
		150	8.0	6.9		3220	22	21	0.12	500	16SVPC150M	1000
		270	8.0	11.9	E12	4070	16	14	0.15	864	16SVPC270M	400

※1：Rated ripple current (100 kHz/ +105 ℃), ※2：tanδ (120 Hz/+20 ℃)　※3：After 2 minutes

◆Please refer to the P73 to 76 in this catalog for "Reflow conditions" and "Taping specifications".

Frequency correction factor for ripple currentt

Frequency	120 Hz ≦ f < 1 kHz	1 kHz ≦ f < 10 kHz	10 kHz ≦ f < 100 kHz	100 kHz ≦ f ≦ 500 kHz
Coefficient	0.05	0.3	0.7	1

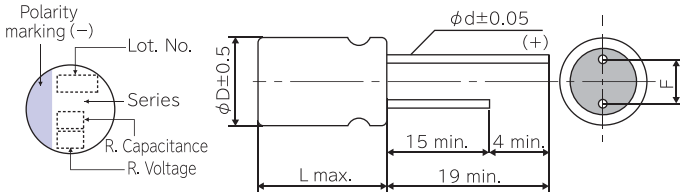
Radial lead type SXE Series

- Super high voltage(100 V.DC max.)
- RoHS compliance, Halogen free

Specifications

Items	Specifications	
Size code	E12	
Category temperature range	–55 ℃ to +105 ℃	
Rated voltage range	63 V.DC to 100 V.DC	
Rated capacitance range	15 μF to 33 μF	
Capacitance tolerance	±20 %(120 Hz/+20 ℃)	
Leakage current	Please see the attached characteristics list	
Dissipation factor(tanδ)	Please see the attached characteristics list	
Endurance	+105 ℃, 5000 h, rated voltage applied	
	Capacitance change	Within±20 % of the initial value
	tanδ	≦ 150 % of the initial limit
	DC leakage current	Within the initial limit
Damp heat (Steady state)	+60 ℃, 90 % to 95 %, 1000 h, No-applied voltage	
	Capacitance change	Within±20 % of the initial value
	tanδ	≦ 150 % of the initial limit
	DC leakage current	Within the initial limit (after voltage processing)

Marking and dimensions



(unit : mm)

Size code	ϕD ±0.5	L max	F ±0.5	ϕd ±0.05
E12	8.0	12.0	3.5	0.6

Characteristics list

Series	Rated voltage (V.DC)	Rated capacitance (μF)	Case size (mm) ϕD	Case size (mm) L	Size code	Specifications: Rated ripple current ※1 (mArms.)	Specifications: ESR ※2 (mΩ max.)	Specifications: tan δ ※3	Specifications: LC ※4 (μA)	Part number
SXE	63	33	8.0	12.0	E12	2950	25	0.12	104	63SXE33M
	100	15	8.0	12.0		2350	40	0.12	75	100SXE15M

※1:Rated ripple current (100 kHz/ +105 ℃), ※2:ESR (100 kHz to 300 kHz/+20 ℃) ※3:tanδ (120 Hz/+20 ℃) ※4:After 2 minutes

◆Please refer to the P73 to 76 in this catalog for "Flow conditions" and "Taping specifications".

Frequency correction factor for ripple currentt

Frequency	120 Hz ≦ f < 1 kHz	1 kHz ≦ f < 10 kHz	10 kHz ≦ f < 100 kHz	100 kHz ≦ f ≦ 500 kHz
Coefficient	0.05	0.3	0.7	1

Design and specifications are each subject to change without notice. Ask factory for the current technical specifications before purchase and/or use.
Should a safety concern arise regarding this product, please be sure to contact us immediately.

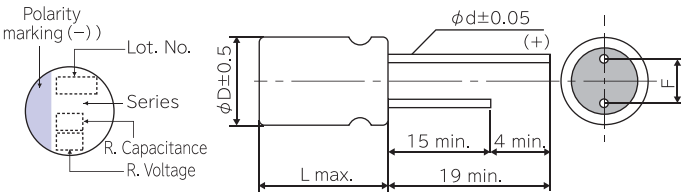
SEPF Series

- High voltage (35 V.DC max.)
- Large capacitance (1000 μF max.)
- RoHS compliance, Halogen free

Specifications

Items	Specifications				
Size code	C55	C6	E7	E12	F13
Category temperature range	−55 ℃ to +105 ℃				
Rated voltage range	16 V.DC to 32 V.DC	16 V.DC to 35 V.DC			
Rated capacitance range	22 μF to 150 μF	22 μF to 180 μF	39 μF to 270 μF	82 μF to 560 μF	120 μF to 1000 μF
Capacitance tolerance	±20 %(120 Hz/+20 ℃)				
Leakage current	Please see the attached characteristics list				
Dissipation factor(tanδ)	Please see the attached characteristics list				
Endurance	+105 ℃, 5000 h, rated voltage applied				
	Capacitance change	Within±20 % of the initial value			
	tanδ	≦ 150 % of the initial limit			
	DC leakage current	Within the initial limit			
Damp heat (Steady state)	+60 ℃, 90 % to 95 %, 1000 h, No-applied voltage				
	Capacitance change	Within±20 % of the initial value			
	tanδ	≦ 150 % of the initial limit			
	DC leakage current	Within the initial limit (after voltage processing)			

Marking and dimensions



(unit : mm)

Size code	ϕD ±0.5	L max	F ±0.5	ϕd ±0.05
C55	6.3	5.5	2.5	0.45
C6	6.3	6.0	2.5	0.5
E7	8.0	7.0	3.5	0.5※
E12	8.0	12.0	3.5	0.6
F13	10.0	13.0	5.0	0.6

※ 32SEPF68M $0.6^{\pm 0.05}$

Characteristics list

Series	Rated voltage (V.DC)	Rated capacitance (μF)	Case size (mm) ϕD	Case size (mm) L	Size code	Specifications: Rated ripple current ※1 (mArm.s.)	Specifications: ESR ※2 (mΩ max.)	Specifications: tan δ ※3	Specifications: LC ※4 (μA)	Part number
SEPF	16	150	6.3	5.5	C55	2590	30	0.12	480	16SEPF150M
		180	6.3	6.0	C6	3300	22	0.12	576	16SEPF180M
		270	8.0	7.0	E7	3300	22	0.12	864	16SEPF270M
		560	8.0	12.0	E12	4950	14	0.12	1792	16SEPF560M
		1000	10.0	13.0	F13	5400	12	0.12	3200	16SEPF1000M
	20	120	6.3	6.0	C6	3200	25	0.12	480	20SEPF120M
		180	8.0	7.0	E7	3200	25	0.12	720	20SEPF180M
		390	8.0	12.0	E12	4950	14	0.12	1560	20SEPF390M
		560	10.0	13.0	F13	5400	12	0.12	2240	20SEPF560M
	25	56	6.3	6.0	C6	2800	30	0.12	280	25SEPF56M
		82	8.0	7.0	E7	3000	28	0.12	410	25SEPF82M
		180	8.0	12.0	E12	4650	16	0.12	900	25SEPF180M
		330	10.0	13.0	F13	5000	14	0.12	1650	25SEPF330M
	32	22	6.3	5.5	C55	2400	35	0.12	140	32SEPF22M
		68	8.0	7.0	E7	3200	25	0.10	435	32SEPF68M
	35	22	6.3	6.0	C6	2600	35	0.12	154	35SEPF22M
		39	8.0	7.0	E7	2800	30	0.12	273	35SEPF39M
		82	8.0	12.0	E12	4000	20	0.12	574	35SEPF82M
		120	10.0	13.0	F13	4400	18	0.12	840	35SEPF120M

※1 : Rated ripple current (100 kHz/ +105 ℃), ※2 : ESR (100 kHz to 300 kHz/+20 ℃) ※3 : tanδ (120 Hz/+20 ℃) ※4 : After 2 minutes

◆Please refer to the P73 to 76 in this catalog for "Flow conditions" and "Taping specifications".

Frequency correction factor for ripple currentt

Frequency	120 Hz ≦ f < 1 kHz	1 kHz ≦ f < 10 kHz	10 kHz ≦ f < 100 kHz	100 kHz ≦ f ≦ 500 kHz
Coefficient	0.05	0.3	0.7	1

Conductive Polymer Hybrid Aluminum Electrolytic Capacitors

Hybrid

SP-Cap

POSCAP

OS-CON

INDEX

Conductive Polymer Hybrid Aluminum Electrolytic Capacitors

Guidelines and precautions

⚠ Application Guidelines

1.Circuit Design

1-1 Operating Temperature and Frequency

Electrical parameters for electrolytic capacitors are normally specified at 20 ℃ temperature and 120 Hz frequency. These parameters vary with changes in temperature and frequency. Circuit designers should take these changes into consideration.

(1) Effects of operating temperature on electrical parameters
- (a)At higher temperatures, leakage current and capacitance increase while equivalent series resistance (ESR) decreases.
- (b)At lower temperatures, leakage current and capacitance decrease while equivalent series resistance (ESR) increases.

(2) Effects of frequency on electrical parameters
- (a)At higher frequency capacitance and impedance decrease while tanδ increases.
- (b)At lower frequency, heat generated by ripple current will rise due to an increase in equivalent series resistance (ESR).

1-2 Operating Temperature and Life Expectancy

(1) Expected life is affected by operating temperature. Generally, each 10 ℃ reduction in temperature will double the expected life. Use capacitors at the lowest possible temperature below the upper category temperature.

(2) If operating temperatures exceed the upper category limit, rapid deterioration of electrical parameter will occur and irreversible damage will result.
Check for the maximum capacitor operating temperatures including ambient temperature, internal capacitor temperature rise due to ripple current, and the effects of radiated heat from power transistors, IC's or resistors.
Avoid placing components, which could conduct heat to the capacitor from the back side of the circuit board.

(3) The formula for calculating expected life at lower operating temperatures is as follows ;

$$L_2 = L_1 \times 2^{\frac{T_1 - T_2}{10}}$$

L_1 : Guaranteed life (h) at temperature, T_1 ℃
L_2 : Expected life (h) at temperature, T_2 ℃
T_1 : Upper category temperature + temperature rise due to reted ripple current (℃)
T_2 : Actual operating temperature, ambient temperature + temperature rise due to ripple current heating(℃)

(4) Please use according to the lifetime as noted in this specification. Using products beyond end of the lifetime may change characteristics rapidly, short-circuit, operate pressure relief vent, or leak electrolyte.

1-3 Common Application Conditions to Avoid

The following misapplication load conditions will cause rapid deterioration of a capacitor's electrical parameters. In addition, rapid heating and gas generation within the capacitor can occur, causing the pressure relief vent to operate and resultant leakage of electrolyte. Under extreme conditions, explosion and fire ignition could result. The leaked electrolyte is combustible and electrically conductive.

(1) Reverse Voltage
DC capacitors have polarity. Therefore, please do not apply the reverse voltage. Verify correct polarity before insertion.

(2) Charge / Discharge Applications
Standard capacitors are not suitable for use in repeating charge/discharge applications. For charge/ discharge applications, consult us with your actual application condition.
For rush current, please to nor exceed 100 A.

(3) ON-OFF circuit
Do not use capacitors in circuit where ON-OFF switching is repeated more than 10000 times/per day.
In case of applying to the theses ON-OFF circuit, consult with us about circuit condition and so on.

(4) Over voltage
Do not apply voltages exceeding the maximum specified rated voltage. Voltages up to the surge voltage rating are acceptable for short periods of time. Ensure that the sum of the DC voltage and the superimposed AC ripple voltage does not exceed the rated voltage.

(5) Ripple Current
Do not apply ripple currents exceeding the maximum specified value. For high ripple current applications, use a capacitor designed for high ripple currents. In addition, consult us if the applied ripple current is to be higher than the maximum specified value. Ensure that rated ripple currents that superimposed on low DC bias voltages do not cause reverse voltage conditions. Even if it is within a rated ripple current, in case the practical use is over the pre described endurance life time, it causes the increase of deterioration of ESR characteristic and the internal generation heat by ripple current. Due to this, there is some possibility of vent open, bulging of sleeve and rubber, electrolyte leakage, and shot circuit, explosion and ignition in the worst case.

1-4 Using Two or More Capacitors in Parallel

The circuit resistance can closely approximate the series resistance of the capacitor, causing an imbalance of ripple current loads within the capacitors. Careful wiring methods can minimize the possible application of an excessive ripple current to a capacitor. Moreover, please do not use it in series.

1-5 Capacitor Mounting Considerations

(1) Double-Sided Circuit Boards
Avoid wiring pattern runs, which pass between the mounted capacitor and the circuit board.

(2) Clearance for Case Mounted Pressure Relief (≧ φ 10 mm)
Capacitors with case mounted pressure relief require sufficient clearance to allow for proper pressure relief operation. The minimum clearance are dependent on capacitor diameters as follows.
・≧ φ 10 mm : 2 mm minimum
(3) Wiring Near the Pressure Relief (≧ φ 10 mm)
Avoid locating high voltage or high current wiring or circuit board paths above the pressure relief . Flammable, high temperature gas that exceeds 100˚C may be released which could dissolve the wire insulation and ignite.
(4) Circuit Board Patterns Under the Capacitor
Avoid circuit board runs under the capacitor, as an electrical short can occur due to an electrolyte leakage.

1-6 Electrical Isolation of the Capacitor

Completely isolate the capacitor as follows.
・Between the cathode and the case and between the anode terminal and other circuit paths.

1-7 Capacitor Sleeve

The laminate coating is intended for marking and identification purposes and is not meant to electrically insulate the capacitor.

2.Capacitor Handling Techniques

2-1 Considerations Before Using

(1) Capacitors have a finite life. Do not reuse or recycle capacitors from used equipment.
(2) Transient recovery voltage may be generated in the capacitor due to dielectric absorption. If required, this voltage can be discharged with a resistor with a value of about 1 kΩ.
(3) Capacitors stored for a long period of time may exhibit an increase in leakage current. This can be corrected by gradually applying rated voltage in series with a resistor of approximately 1 kΩ.
(4) If capacitors are dropped, they can be damaged mechanically or electrically. Avoid using dropped capacitors.
(5) Dented or crushed capacitors should not be used. The seal integrity can be damaged and loss of electrolyte/ shortened life can result.

2-2 Capacitor Insertion

(1) Verify the correct capacitance and rated voltage of the capacitor.
(2) Verify the correct polarity of the capacitor before insertion.
(3) Verify the correct terminal dimention and land pattern size before mount to avoid stress on the terminals.
(4) Excessive mounting pressure can cause high leakage current, short circuit, or disconnection.

2-3 Reflow Soldering

(1) Surface-mount type capacitor are exclusively for reflow soldering. When reflow solder is used an ambient heat condition system such as the simultaneous use of infrared and hot-air is recommended.
(2) Observe proper soldering conditions (temperature, time, etc.). Do not exceed the specified limits.
※The Temperature on Capacitor top shall be measured by using thermal couple that is fixed firmly by epoxy glue.
(3) In case of use in 2 times reflow, 2nd reflow must be done when the capacitor' s temperature return back to normal level.
(4) In our recommended reflow condition , the case discoloration and the case swelling might be slightly generated. But please acknowledge that these two phenomena do not influence the reliability of the product.
(5) The crack on top marking might be occurred by reflow heat stress. But please acknowledge that it does not influence the reliability of the product.
(6) VPS (Vapor Phase Soldering) reflow can cause significant characteristics change and/ or mounting failure due to deformation by acute temperature rise. VPS is acceptable provided that the process does not exceed recommended reflow profile and temperature rise is less than 3 degC/sec. Please contact Panasonic for detailed conditions.

2-4 Manual Soldering

(1) Observe temperature and time soldering specifications or do not exceed temperature of 350 ℃ for 3 seconds or less.
(2) If a soldered capacitor must be removed and reinserted, avoid excessive stress on the capacitor leads.
(3) Avoid physical contacts between the tip of the soldering iron and capacitors to prevent or capacitor failure.

2-5 Capacitor Handling after Soldering

(1) Avoid moving the capacitor after soldering to prevent excessive stress on the lead wires where they enter the seal.
(2) Do not use the capacitor as a handle when moving the circuit board assembly.
(3) Avoid striking the capacitor after assembly to prevent failure due to excessive shock.

Guidelines and precautions

2-6 Circuit Board Cleaning

(1) Circuit boards can be immersed or ultrasonically cleaned using suitable cleaning solvents for up to 5 minutes and up to 60 ℃ maximum temperatures. The boards should be thoroughly rinsed and dried. The use of ozone depleting cleaning agents is not recommended for the purpose of protecting our environment.

(2) Avoid using the following solvent groups unless specifically allowed in the specification ;

(a) Halogenated cleaning solvents : except for solvent resistant capacitor types, halogenated solvents can permeate the seal and cause internal capacitor corrosion and failure.
For solvent resistant capacitors, carefully follow the temperature and time requirements based on the specification. 1-1-1 trichloroethane should never be used on any aluminum electrolytic capacitor.

(b) Alkaline solvents : could react and dissolve the aluminum case.

(c) Petroleum based solvents : deterioration of the rubber seal could result.

(d) Xylene : deterioration of the rubber seal could result.

(e) Acetone : removal of the ink markings on the vinyl sleeve could result.

(3) A thorough drying after cleaning is required to remove residual cleaning solvents that may be trapped between the capacitor and the circuit board. Avoid drying temperatures, which exceed the Upper category temperature of the capacitor.

(4) Monitor the contamination levels of the cleaning solvents during use in terms of electrical conductivity, pH, specific gravity, or water content.
Chlorine levels can rise with contamination and adversely affect the performance of the capacitor.

(5) Depending on the cleaning method, the marking on a capacitor may be erased or blurred.
Please consult us if you are not certain about acceptable cleaning solvents or cleaning methods.

2-7 Mounting Adhesives and Coating Agents

When using mounting adhesives or coating agents to control humidity, avoid using materials containing halogenated solvents.
Also, avoid the use of chloroprene based polymers.
Harden on dry adhesive or coating agents well lest the solvent should be left.
After applying adhesives or coatings, dry thoroughly to prevent residual solvents from being trapped between the capacitor and the circuit board.

2-8 Fumigation

In exporting electronic appliances with aluminum electrolytic capacitors, in some cases fumigation treatment using such halogen compound as methyl bromide is conducted for wooden boxes.
If such boxes are not dried well, the halogen left in the box is dispersed while transported and enters in the capacitors inside.
This possibly causes electrical corrosion of the capacitors. Therefore, after performing fumigation and drying make sure that no halogen is left.
Don't perform fumigation treatment to the whole electronic appliances packed in a box.

3.Precautions for using capacitors

3-1 Environmental Conditions

Capacitors should not be stored or used in the following environments.

(1) Exposure to temperatures above the upper category or below the lower category temperature of the capacitor.

(2) Direct contact with water, salt water, or oil.

(3) High humidity conditions where water could condense on the capacitor.

(4) Exposure to toxic gases such as hydrogen sulfide, sulfuric acid, nitric acid, chlorine, Chlorine compound, Bromine, Bromine compound or ammonia.

(5) Exposure to ozone, radiation, or ultraviolet rays.

(6) Vibration and shock conditions exceeding specified requirements.

3-2 Electrical Precautions

(1) Avoid touching the terminals of a capacitor as a possible electric shock could result.
The exposed aluminum case is not insulated and could also cause electric shock if touched.

(2) Avoid short circuiting the area between the capacitor terminals with conductive materials including liquids such as acids or alkaline solutions.

(3) A low-molecular-weight-siloxane which is included in a silicon material shall causes abnormal electrical characteristics.

4.Emergency Procedures

(1) If the pressure relief of the capacitor operates, immediately turn off the equipment and disconnect from the power source.
This will minimize an additional damage caused by the vaporizing electrolyte.
(2) Avoid contact with the escaping electrolyte gas, which can exceed 100 ℃ temperatures.
If electrolyte or gas enters the eye, immediately flush the eye with large amounts of water.
If electrolyte or gas is ingested by mouth, gargle with water.
If electrolyte contacts the skin, wash with soap and water.

5.Long Term Storage

Leakage current of a capacitor increases with long storage times. The aluminum oxide film deteriorates as a function of temperature and time.
If used without reconditioning, an abnormally high current will be required to restore the oxide film.
This surge current could cause the circuit or the capacitor to fail.
Storage period is one year. When storage period is over 12 months, a capacitor should be reconditioned by applying the rated voltage in series with a 1000 Ω current limiting resistor for a time period of 30 minutes.
For storage condition, keep room temperature (5 ℃ to 35 ℃) and humidity (45 % to 85 %) where direct sunshine doesn't reach.

5-1 Environmental Conditions

(1) Exposure to temperatures above the upper category or below the lower category temperature of the capacitor.
(2) Direct contact with water, salt water, or oil.
(3) High humidity conditions where water could condense on the capacitor.
(4) Exposure to toxic gases such as hydrogen sulfide, sulfuric acid, nitric acid, chlorine, Chlorine compound, Bromine, Bromine compound or ammonia.
(5) Exposure to ozone, radiation, or ultraviolet rays.
(6) Vibration and shock conditions exceeding specified requirements.

6.Capacitor Disposal

When disposing capacitors, use one of the following methods.
(1) Incinerate after crushing the capacitor or puncturing the can wall (to prevent explosion due to internal pressure rise).
(2) Dispose as solid waste.

NOTE : Local laws may have specific disposal requirements which must be followed.

The precautions in using aluminum electrolytic capacitors follow the Precautionary Guidelines for the Use of Fixed Aluminum Electrolytic Capacitors for Electronic equipment, RCR-2367B issued by EIAJ in March 2002.
Please refer to the above guidelines for details.

Intellectual property right

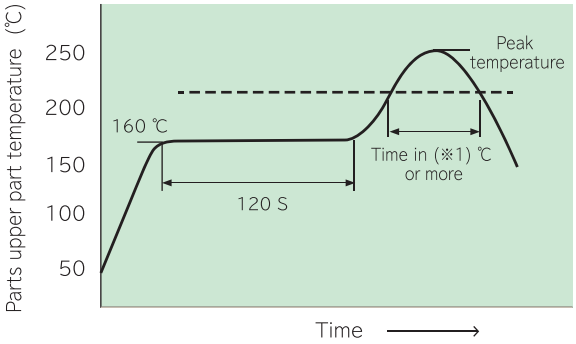
We, Panasonic Group are providing the product and service that customers can use without anxiety, and are working positively on the protection of our products under intellectual property rights.
Representative patents relating to **Conductive Polymer Hybrid Aluminum Electrolytic Capacitors** as follows:

US Patent Nos. 7497879 and 7621970 JP Patent No. 5360250

Mounting specifications

Reflow guaranteed condition

■RoHS compliant

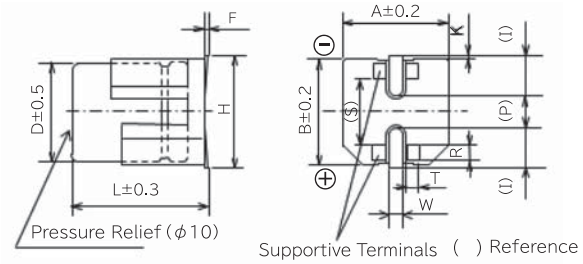


Size code	C, D, D8	F, G	
Peak temperature	260 ℃ (255 ℃)	245 ℃	260 ℃
Time in peak temperature	≧ 250 ℃ 5 s (10 s)	≧ 240 ℃ 10 s	≧ 250 ℃ 5 s
Time in (※1) ℃ or more	≧ 230 ℃ 30 s	≧ 230 ℃ 30 s	≧ 230 ℃ 30 s
	≧ 217 ℃ 40 s	≧ 217 ℃ 40 s	≧ 217 ℃ 40 s
	≧ 200 ℃ 70 s	≧ 200 ℃ 70 s	≧ 200 ℃ 70 s
Time of reflow	2 times	2 times	1 time

※For reflow, use a thermal condition system such as infrared radiation (IR) or hot blast.
※Panasonic have several series available for pure Tin terminal and ZVEI reflow based on J-STD-020D (JEDEC).(Please contact sales for details.)

Dimensions (Vibration-proof products)

The size and shape are different frome standard products. Please inquire details of our company.



(Unit : mm)

Size code	φ D	L	A,B	H max.	F	I	W
F	8.0	10.5	8.3	10.0	0~+0.15	10.5	1.2±0.2
G	10.0	10.5	10.3	12.0	0~+0.15	10.5	1.2±0.2

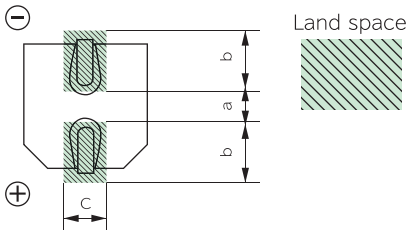
(Unit : mm)

Size code	P	K	R	S	T
F	3.1	0.7±0.2	0.7±0.2	5.3±0.2	1.3±0.2
G	4.6	0.7±0.2	0.7±0.2	6.9±0.2	1.3±0.2

Land/Pad Pattern

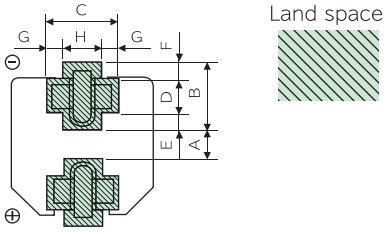
The circuit board land/pad pattern size for chip capacitors is specified in the following table.
The land pitch influences installation strength and consider it.

■Standard products



※Take mounting conditions, solderability and fitting strength into consideration when selecting parts for your company's design.

■Vibration-proof products



※Take mounting conditions, solderability and fitting strength into consideration when selecting parts for your company's design.

(Unit : mm)

Size code	a	b	c
C (φ 5×L5.8)	1.5	2.8	1.6
D (φ 6.3×L5.8)	1.8	3.2	1.6
D8 (φ 6.3×L7.7)	1.8	3.2	1.6
F (φ 8×L10.2)	3.1	4.0	2.0
G (φ 10×L10.2)	4.6	4.1	2.0

When size "a" is wide, back fillet can be made, decreasing fitting strength.

(Unit : mm)

Size code	A	B	C	D
F (φ 8×L10.5)	2.7	4.0	4.7	1.3
G (φ 10×L10.5)	3.9	4.4	4.7	1.3

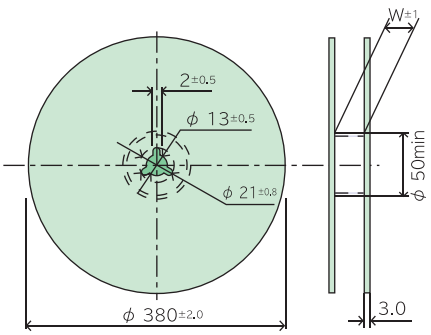
Size code	E	F	G	H
F (φ 8×L10.5)	1.0	1.7	1.1	2.5
G (φ 10×L10.5)	1.2	1.9	1.1	2.5

When size "A" is wide, back fillet can be made, decreasing fitting strength.

Packing specifications

Packaging Specifications

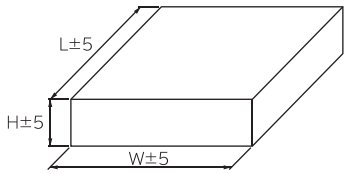
■Reel Dimensions (not to scale)



(Unit : mm)

Size code	W
C	14.0
D, D8	18.0
F, G	26.0

■Dimensions of Outer Carton Box



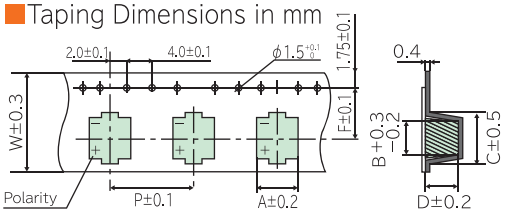
(Unit : mm)

Size code	H	W,L
C	220	395
D, D8	250	395
F, G	220	395

■Min.Packing Quantity

Size code	Min.Packing Q'ty pcs.
C, D	1000
D8	900
F, G	500

■Taping Dimensions in mm



(Unit : mm)

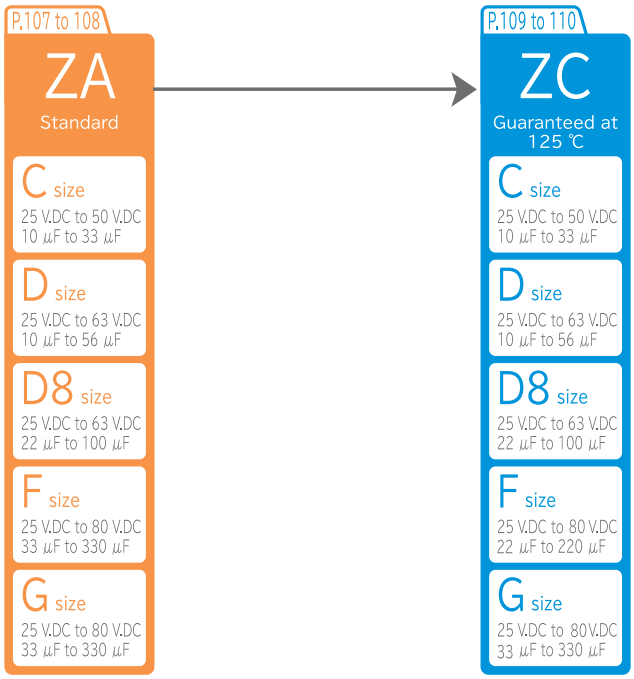
Size code	A	B	C	D	P	F	W
C	5.7	5.7	8.0	6.4	12.0	5.5	12.0
D	7.0	7.0	9.0	6.4	12.0	7.5	16.0
D8	7.0	7.0	9.0	8.4	12.0	7.5	16.0
F	8.7	8.7	12.5	11.0	16.0	11.5	24.0
G	10.7	10.7	14.5	11.0	16.0	11.5	24.0

※Ask factory for technical specifications.

Line-up

Series	Page	Part No.	Features	Small size	Low profile	Low ESR	Long life	Category temperature range (℃)
ZA	107 to 108	EEHZA---	Low ESR High ripple current Long life 105 ℃ 10,000 h	●		●	●	-55 to 105
ZC	109 to 110	EEHZC---	Low ESR High ripple current Long life 125 ℃ 4,000 h	●		●	●	-55 to 125

Series system diagram



Rated voltage (V.DC)	ESR (mΩ)	Capacitance (μF)	Size code	Size (mm)		Page	Series
				φD	L		
25 to 50	80 to 120	10 to 33	C	5	5.8	107 to 108	ZA
25 to 63	50 to 120	10 to 56	D	6.3	5.8		
25 to 63	30 to 80	22 to 100	D8	6.3	7.7		
25 to 80	27 to 45	22 to 220	F	8	10.2		
25 to 80	20 to 36	33 to 330	G	10	10.2		
25 to 50	80 to 120	10 to 33	C	5	5.8	109 to 110	ZC
25 to 63	50 to 120	10 to 56	D	6.3	5.8		
25 to 63	30 to 80	22 to 100	D8	6.3	7.7		
25 to 80	27 to 45	22 to 220	F	8	10.2		
25 to 80	20 to 36	33 to 330	G	10	10.2		

Products list

Size・ESR Matrix list

Size code (ESR mΩ)

V.DC	μF / Series	10	22	27	33	47	56	68	100	120	150	220	270	330
25	ZA				C (80)		D (50)		D8 (30)			F (27)		G (20)
	ZC				C (80)		D (50)		D8 (30)			F (27)		G (20)
35	ZA		C (100)	D (60)		D (60)		D8 (35)			F (27)		G (20)	
	ZC		C (100)			D (60)		D8 (35)			F (27)		G (20)	
50	ZA	C (120)	D (80)		D8 (40)			F (30)	G (28)					
	ZC	C (120)	D (80)		D8 (40)			F (30)	G (28)	G (28)				
63	ZA	D (120)	D8 (80)		F (40)		G (30)							
	ZC	D (120)	D8 (80)		F (40)		G (30)	G (30)						
80	ZA		F (45)		G (36)									
	ZC		F (45)		G (36)	G (36)								

Size code

(unit : mm)

C	φ 5 x L5.8	F	φ 8 x L10.2
D	φ 6.3 x L5.8	G	φ 10 x L10.2
D8	φ 6.3 x L7.7		

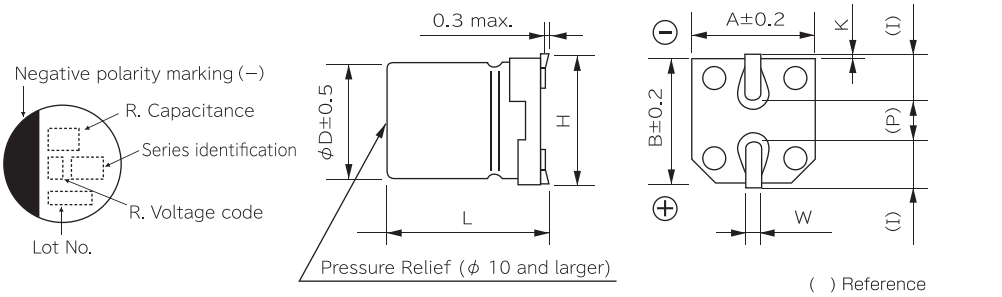
Surface mount type ZA Series

- Endurance: 10000 h at 105 ℃
- High voltage (80 V.DC max.)
- AEC-Q200 compliant
- Low ESR and High ripple current(70 % over, Lower ESR than current V-FP)
- Vibration-proof products is available upon request. (φ8 mm and larger)
- RoHS compliant

Specifications

Items	Specifications				
Size Code	C	D	D8	F	G
Category temperature range	−55 ℃ ~ +105 ℃				
Rated voltage range	25 V.DC ~ 50 V.DC	25 V.DC ~ 63 V.DC		25 V.DC ~ 80 V.DC	
Rated capacitance range	10 μF ~ 33 μF	10 μF ~ 56 μF	22 μF ~ 100 μF	22 μF ~ 220 μF	33 μF ~ 330 μF
Capacitance tolerance	±20 %(120 Hz/+20 ℃)				
Leakage current	I ≦ 0.01 CV or 3 (μA) After 2 minutes (Whichever is greater)				
Dissipation factor(tan δ)	Please see the attached characteristics list				
Surge voltage(V.DC)	Rated voltage × 1.25 (15 ℃ to 35 ℃)				
Endurance	+105 ℃, 10000 h, apply the rated ripple current without exceeding the rated voltage				
	Capacitance change	Within ±30 % of the initial value			
	tan δ	≦ 200 % of the initial limit			
	E.S.R.	≦ 200 % of the initial limit			
	DC leakage current	Within the initial limit			
	ESR after Endurance (Ω/100 kHz) (-40 ℃)	Size Code			
		C	D	D8	F	G
		2.0	1.4	0.8	0.4	0.3
Shelf Life	After storage for 1000 hours at +105 ℃±2 ℃ with no voltage applied and then being stabilized at +20 ℃, capacitors shall meet the limits specified in Endurance. (With voltage treatment)				
Damp Heat (Load)	+85 ℃, 85 % to 95 %, 2000 h, rated voltage applied				
	Capacitance change	Within ±30% of the initial value			
	tan δ	≦ 200 % of the initial limit			
	E.S.R.	≦ 200 % of the initial limit			
	DC leakage current	Within the initial limit			
Resistance to Soldering Heat	After reflow soldering and then being stabilized at +20 ℃, capacitors shall meet the following limits.				
	Capacitance chang	Within ±10 % of the initial value			
	tan δ	Within the initial limit			
	DC leakage current	Within the initial limit			

Marking and dimensions



(Unit : mm)

R. Voltage (V.DC)	25	35	50	63	80
Code	E	V	H	J	K

Size code	D	L	A,B	H	I	W	P	K
C	5.0	5.8±0.3	5.3	6.5 max.	2.2	0.65±0.1	1.5	$0.35^{+0.15}_{-0.20}$
D	6.3	5.8±0.3	6.6	7.8 max.	2.6	0.65±0.1	1.8	$0.35^{+0.15}_{-0.20}$
D8	6.3	7.7±0.3	6.6	7.8 max.	2.6	0.65±0.1	1.8	$0.35^{+0.15}_{-0.20}$
F	8.0	10.2±0.3	8.3	10.0 max.	3.4	0.90±0.2	3.1	0.70±0.2
G	10.0	10.2±0.3	10.3	12.0 max.	3.5	0.90±0.2	4.6	0.70±0.2

Characteristics list

Series	Rated voltage (V.DC)	Capacitance (±20 %) (μF)	Case size (mm)		Size code	Specifications			Standard(Reel size：φ 380)	
			φD	L		Ripple Current ※1 (mAr.m.s.)	ESR ※2 (mΩ)	tan δ ※3	Part number	Min. Packaging Q'ty (pcs)
ZA	25	33	5	5.8	C	900	80	0.14	EEHZA1E330R	1000
		56	6.3	5.8	D	1300	50	0.14	EEHZA1E560P	1000
		100	6.3	7.7	D8	2000	30	0.14	EEHZA1E101XP	900
		220	8	10.2	F	2300	27	0.14	EEHZA1E221P	500
		330	10	10.2	G	2500	20	0.14	EEHZA1E331P	500
	35	22	5	5.8	C	900	100	0.12	EEHZA1V220R	1000
		27	6.3	5.8	D	1300	60	0.12	EEHZA1V270P	1000
		47	6.3	5.8		1300	60	0.12	EEHZA1V470P	1000
		68	6.3	7.7	D8	2000	35	0.12	EEHZA1V680XP	900
		150	8	10.2	F	2300	27	0.12	EEHZA1V151P	500
		270	10	10.2	G	2500	20	0.12	EEHZA1V271P	500
	50	10	5	5.8	C	750	120	0.10	EEHZA1H100R	1000
		22	6.3	5.8	D	1100	80	0.10	EEHZA1H220P	1000
		33	6.3	7.7	D8	1600	40	0.10	EEHZA1H330XP	900
		68	8	10.2	F	1800	30	0.10	EEHZA1H680P	500
		100	10	10.2	G	2000	28	0.10	EEHZA1H101P	500
	63	10	6.3	5.8	D	1000	120	0.08	EEHZA1J100P	1000
		22	6.3	7.7	D8	1500	80	0.08	EEHZA1J220XP	900
		33	8	10.2	F	1700	40	0.08	EEHZA1J330P	500
		56	10	10.2	G	1800	30	0.08	EEHZA1J560P	500
	80	22	8	10.2	F	1550	45	0.08	EEHZA1K220P	500
		33	10	10.2	G	1700	36	0.08	EEHZA1K330P	500

※1：Ripple current (100 kHz/ +105 ℃), ※2：ESR (100 kHz/+20 ℃) ※3：tan δ (120 Hz/ +20 ℃)

◆Please refer to the P103 to 104 in this catalog for "Reflow conditions" and "Taping specifications".

◆When requesting vibration-proof product, please put the last "V" instead to "P".

Frequency correction factor for ripple current

Rated capacitance(μF)	Frequency	100 Hz ≦ f < 200 Hz	200 Hz ≦ f < 300 Hz	300 Hz ≦ f < 500 Hz	500 Hz ≦ f < 1 kHz
C < 47 μF	Correction factor	0.10	0.10	0.15	0.20
47 μF ≦ C < 150 μF		0.15	0.20	0.25	0.30
150 μF ≦ C		0.15	0.25	0.25	0.30

Rated capacitance(μF)	Frequency	1 kHz ≦ f < 2 kHz	2 kHz ≦ f < 3 kHz	3 kHz ≦ f < 5 kHz	5 kHz ≦ f < 10 kHz
C < 47 μF	Correction factor	0.30	0.40	0.45	0.50
47 μF ≦ C < 150 μF		0.40	0.45	0.55	0.60
150 μF ≦ C		0.45	0.50	0.60	0.65

Rated capacitance(μF)	Frequency	10 kHz ≦ f < 15 kHz	15 kHz ≦ f < 20 kHz	20 kHz ≦ f < 30 kHz	30 kHz ≦ f < 40 kHz
C < 47 μF	Correction factor	0.60	0.65	0.70	0.75
47 μF ≦ C < 150 μF		0.70	0.75	0.80	0.80
150 μF ≦ C		0.75	0.80	0.85	0.85

Rated capacitance(μF)	Frequency	40 kHz ≦ f < 50 kHz	50 kHz ≦ f < 100 kHz	100 kHz ≦ f < 500 kHz	500 kHz ≦ f
C < 47 μF	Correction factor	0.80	0.85	1.00	1.05
47 μF ≦ C < 150 μF		0.85	0.90	1.00	1.00
150 μF ≦ C		0.85	0.90	1.00	1.00

Design and specifications are each subject to change without notice. Ask factory for the current technical specifications before purchase and/or use.
Should a safety concern arise regarding this product, please be sure to contact us immediately.

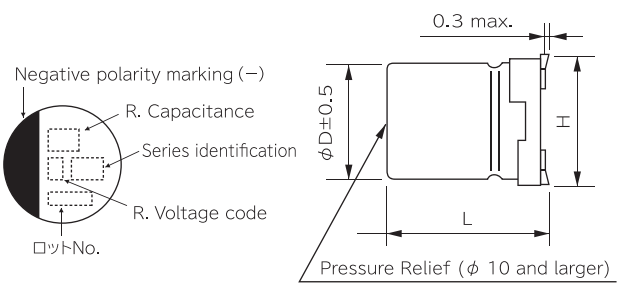
Surface mount type ZC Series

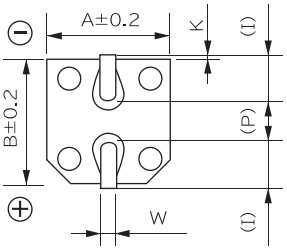
- Endurance: 4000 h at 125 ℃ (High temperature / Long life)
- High-withstand voltage (25 V.DC to 80 V.DC), Low LC (0.01 CV or 3 μA)
- AEC-Q200 compliant
- Low ESR and High ripple current (85 % over, Lower ESR than current V-TP)
- Vibration-proof products is available upon request.(φ8 mm and larger)
- RoHS compliant

Specifications

Items	Specifications				
Size Code	C	D	D8	F	G
Category temperature range	−55 ℃ ~ +125 ℃				
Rated voltage range	25 V.DC ~ 50 V.DC	25 V.DC ~ 63 V.DC		25 V.DC ~ 80 V.DC	
Rated capacitance range	10 μF ~ 33 μF	10 μF ~ 56 μF	22 μF ~ 100 μF	22 μF ~ 220 μF	33 μF ~ 330 μF
Capacitance tolerance	±20 %(120 Hz/+20 ℃)				
Leakage current	I ≦ 0.01 CV or 3 (μA) After 2 minutes (Whichever is greater)				
Dissipation factor(tan δ)	Please see the attached characteristics list				
Surge voltage(V.DC)	Rated voltage × 1.25 (15 ℃ to 35 ℃)				
Endurance 1	125 ℃, 4000 h, apply the rated ripple current without exceeding the rated voltage				
	Capacitance change	Within ±30 % of the initial value			
	tan δ	≦ 200 % of the initial limit			
	E.S.R.	≦ 200 % of the initial limit			
	DC leakage current	Within the initial limit			
Endurance 2	+125 ℃, 3000 h, apply the rated ripple current without exceeding the rated voltage				
	Capacitance change	Within ±30 % of the initial value			
	tan δ	≦ 200 % of the initial limit			
	E.S.R.	≦ 300 % of the initial limit			
	DC leakage current	Within the initial limit			
Shelf Life	After storage for 1000 hours at +125 ℃±2 ℃ with no voltage applied and then being stabilized at +20 ℃, capacitors shall meet the limits specified in Endurance. (With voltage treatment)				
Damp Heat (Load)	+85 ℃, 85 % to 95 %, 2000 h, rated voltage applied				
	Capacitance change	Within ±30 % of the initial value			
	tan δ	≦ 200 % of the initial limit			
	E.S.R.	≦ 200 % of the initial limit			
	DC leakage current	Within the initial limit			
Resistance to Soldering Heat	After reflow soldering and then being stabilized at +20 ℃, capacitors shall meet the following limits.				
	Capacitance chang	Within ±10% of the initial value			
	tan δ	Within the initial limit			
	DC leakage current	Within the initial limit			

Marking and dimensions





( ) Reference

(Unit : mm)

R. Voltage (V.DC)	25	35	50	63
Code	E	V	H	J

Size code	D	L	A,B	H	I	W	P	K
C	5.0	5.8±0.3	5.3	6.5 max.	2.2	0.65±0.1	1.5	$0.35^{+0.15}_{-0.20}$
D	6.3	5.8±0.3	6.6	7.8 max.	2.6	0.65±0.1	1.8	$0.35^{+0.15}_{-0.20}$
D8	6.3	7.7±0.3	6.6	7.8 max.	2.6	0.65±0.1	1.8	$0.35^{+0.15}_{-0.20}$
F	8.0	10.2±0.3	8.3	10.0 max.	3.4	0.90±0.2	3.1	0.70±0.2
G	10.0	10.2±0.3	10.3	12.0 max.	3.5	0.90±0.2	4.6	0.70±0.2

Characteristics list

Endurance 1 : 125 ℃ 4000 hours
Endurance 2 : 125 ℃ 3000 hours

Series	Rated voltage (V.DC)	Capacitance (±20 %) (μF)	Case size (mm)		Size code	Specifications				Standard (Reel size : φ 380)	
			φD	L		Ripple Current ※1 (mArm.s.)		ESR ※2 (mΩ)	tan δ ※3	Part number	Min. Packaging Q'ty (pcs)
						Endurance 1	Endurance 2				
ZC	25	33	5	5.8	C	550	–	80	0.14	EEHZC1E330R	1000
		56	6.3	5.8	D	900	–	50	0.14	EEHZC1E560P	1000
		100	6.3	7.7	D8	1400	–	30	0.14	EEHZC1E101XP	900
		220	8	10.2	F	1600	1900	27	0.14	EEHZC1E221P	500
		330	10	10.2	G	2000	2900	20	0.14	EEHZC1E331P	500
	35	22	5	5.8	C	550	–	100	0.12	EEHZC1V220R	1000
		47	6.3	5.8	D	900	–	60	0.12	EEHZC1V470P	1000
		68	6.3	7.7	D8	1400	–	35	0.12	EEHZC1V680XP	900
		150	8	10.2	F	1600	1900	27	0.12	EEHZC1V151P	500
		270	10	10.2	G	2000	2800	20	0.12	EEHZC1V271P	500
	50	10	5	5.8	C	500	–	120	0.10	EEHZC1H100R	1000
		22	6.3	5.8	D	750	–	80	0.10	EEHZC1H220P	1000
		33	6.3	7.7	D8	1100	–	40	0.10	EEHZC1H330XP	900
		68	8	10.2	F	1250	–	30	0.10	EEHZC1H680P	500
		100	10	10.2	G	1600	–	28	0.10	EEHZC1H101P	500
		120	10	10.2	G	1600	–	28	0.10	EEHZC1H121P	500
	63	10	6.3	5.8	D	700	–	120	0.08	EEHZC1J100P	1000
		22	6.3	7.7	D8	900	–	80	0.08	EEHZC1J220XP	900
		33	8	10.2	F	1100	–	40	0.08	EEHZC1J330P	500
		56	10	10.2	G	1400	–	30	0.08	EEHZC1J560P	500
		68	10	10.2	G	1400	–	30	0.08	EEHZC1J680P	500
	80	22	8	10.2	F	1050	–	45	0.08	EEHZC1K220P	500
		33	10	10.2	G	1360	–	36	0.08	EEHZC1K330P	500
		47	10	10.2	G	1360	–	36	0.08	EEHZC1K470P	500

※1 : Ripple current (100 kHz/ +125 ℃), ※2 : ESR (100 kHz/+20 ℃) ※3 : tan δ (120 Hz/ +20 ℃)

◆Please refer to the P103 to 104 in this catalog for "Reflow conditions" and "Taping specifications".

◆When requesting vibration-proof product, please put the last "V" instead to "P".

Frequency correction factor for ripple current

Rated capacitance (μF)	Frequency	100 Hz ≦ f < 200 Hz	200 Hz ≦ f < 300 Hz	300 Hz ≦ f < 500 Hz	500 Hz ≦ f < 1 kHz
C < 47 μF	Correction factor	0.10	0.10	0.15	0.20
47 μF ≦ C < 150 μF		0.15	0.20	0.25	0.30
150 μF ≦ C		0.15	0.25	0.25	0.30

Rated capacitance (μF)	Frequency	1 kHz ≦ f < 2 kHz	2 kHz ≦ f < 3 kHz	3 kHz ≦ f < 5 kHz	5 kHz ≦ f < 10 kHz
C < 47 μF	Correction factor	0.30	0.40	0.45	0.50
47 μF ≦ C < 150 μF		0.40	0.45	0.55	0.60
150 μF ≦ C		0.45	0.50	0.60	0.65

Rated capacitance (μF)	Frequency	10 kHz ≦ f < 15 kHz	15 kHz ≦ f < 20 kHz	20 kHz ≦ f < 30 kHz	30 kHz ≦ f < 40 kHz
C < 47 μF	Correction factor	0.60	0.65	0.70	0.75
47 μF ≦ C < 150 μF		0.70	0.75	0.80	0.80
150 μF ≦ C		0.75	0.80	0.85	0.85

Rated capacitance (μF)	Frequency	40 kHz ≦ f < 50 kHz	50 kHz ≦ f < 100 kHz	100 kHz ≦ f < 500 kHz	500 kHz ≦ f
C < 47 μF	Correction factor	0.80	0.85	1.00	1.05
47 μF ≦ C < 150 μF		0.85	0.90	1.00	1.00
150 μF ≦ C		0.85	0.90	1.00	1.00

After endurance ESR (100 kHz, -40 ℃)

Size code	C	D	D8	F	G
ESR (Ω)	2.0	1.4	0.8	0.4	0.3

⚠ Safety Precautions

When using our products, no matter what sort of equipment they might be used for,
be sure to confirm the applications and environmental conditions with our specifications in advance.

●Please contact

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VEGETABLE OIL INK

The contents of catalog are as of December 2015.