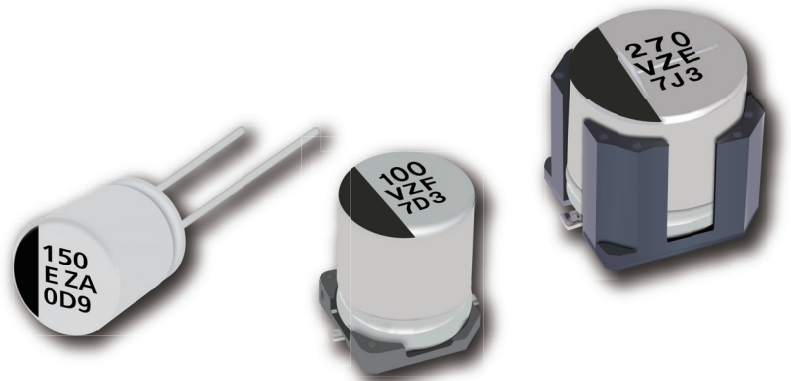


Products Catalog

**Conductive Polymer Hybrid Aluminum  
Electrolytic Capacitors**  
**Hybrid**



**IN Your  
Future**



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**Guidelines and precautions regarding the technical information and use of our products described in this online catalog.**

- If you want to use our products described in this online catalog for applications requiring special qualities or reliability, or for applications where the failure or malfunction of the products may directly jeopardize human life or potentially cause personal injury (e.g. aircraft and aerospace equipment, traffic and transportation equipment, combustion equipment, medical equipment, accident prevention, anti-crime equipment, and/or safety equipment), it is necessary to verify whether the specifications of our products fit to such applications. Please ensure that you will ask and check with our inquiry desk as to whether the specifications of our products fit to such applications use before you use our products.
- The quality and performance of our products as described in this online catalog only apply to our products when used in isolation. Therefore, please ensure you evaluate and verify our products under the specific circumstances in which our products are assembled in your own products and in which our products will actually be used.
- If you use our products in equipment that requires a high degree of reliability, regardless of the application, it is recommended that you set up protection circuits and redundancy circuits in order to ensure safety of your equipment.
- The products and product specifications described in this online catalog are subject to change for improvement without prior notice. Therefore, please be sure to request and confirm the latest product specifications which explain the specifications of our products in detail, before you finalize the design of your applications, purchase, or use our products.
- The technical information in this online catalog provides examples of our products' typical operations and application circuits. We do not guarantee the non-infringement of third party's intellectual property rights and we do not grant any license, right, or interest in our intellectual property.
- If any of our products, product specifications and/or technical information in this online catalog is to be exported or provided to non-residents, the laws and regulations of the exporting country, especially with regard to security and export control, shall be observed.

**<Regarding the Certificate of Compliance with the EU RoHS Directive/REACH Regulations>**

- The switchover date for compliance with the RoHS Directive/REACH Regulations varies depending on the part number or series of our products.
- When you use the inventory of our products for which it is unclear whether those products are compliant with the RoHS Directive/REACH Regulation, please select "Sales Inquiry" in the website inquiry form and contact us.

**We do not take any responsibility for the use of our products outside the scope of the specifications, descriptions, guidelines and precautions described in this online catalog.**

## 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 and (EU)2015/863)).
- No Ozone Depleting Chemicals(ODC's), controlled under the Montreal Protocol Agreement, are used in producing this product.  
We do not use 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.
- These products are not dangerous goods on the transportation as identified by UN(United Nations) numbers or UN classification.

### ■ 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.
- An advanced specification must be signed individually for high-reliability use that might threaten human life or property due to a malfunction of the capacitor.

### ■ Intellectual property rights and licenses

- The technical information in this specification provides examples of our products' typical operations and application circuits. We do not guarantee the non-infringement of third party's intellectual property rights and we do not grant any license, right, or interest in our intellectual property.

## Items to be observed

### ■ For specification

- This specification guarantees the quality and performance of the product as individual components. The durability differs depending on the environment and the conditions of usage. Before use, check and evaluate their compatibility with actual conditions when installed in the products. When safety requirements cannot be satisfied in your technical examination, inform us immediately.
- Do not use the products beyond the specifications described in this document.

### ■ Upon application to products where safety is regarded as important

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 significant 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.

- (1) The system is equipped with a protection circuit and protection device.
- (2) 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<sub>2</sub>, H<sub>2</sub>S, NH<sub>3</sub>, SO<sub>2</sub>, or NO<sub>x</sub>.
  - (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 solvent, 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 where strays acid or alkaline.
  - (9) Using in the atmosphere where there are excessive vibration and shock.
  - (10) Using in the atmosphere where there are low pressure or decompression.
- 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.
- Our products there is a product are using an electrolyte solution. 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.

## ⚠ Application guidelines (Hybrid)

### 1. Circuit design

#### 1.1 Operating temperature and frequency

Electrical characteristics of the capacitor are likely to change due to variation in temperature and/or frequency. Circuit designers should take these changes into consideration.

(1) Effects of operating temperature on electrical parameters

At higher temperatures : leakage current and capacitance increase while equivalent series resistance (ESR) decreases.

At lower temperatures : leakage current and capacitance decrease while equivalent series resistance (ESR) increases.

(2) Effects of frequency on electrical parameters

At higher frequencies : capacitance and impedance decrease while  $\tan \delta$  increases.

At lower frequencies : 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 °C 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.

Measure not only the ambient temperature but also the surface temperature of the capacitor's case top, which has effects of ripple current and radiated heat from power transistors, IC's, and/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 is as follows ;

$$L_2 = L_1 \times 2^{\frac{T_1 - T_2}{10}} \quad \text{where } T_1 \geq T_2$$

$L_1$  : Guaranteed life (h) at temperature,  $T_1$  °C

$L_2$  : Expected life (h) at temperature,  $T_2$  °C

$T_1$  : Upper category temperature + temperature rise due to rated ripple current (°C)

$T_2$  : Actual operating temperature, ambient temperature + temperature rise due to ripple current (°C)

(4) Using the capacitor beyond the rated lifetime will result in short circuit, electrolyte leak, vent open, and large deterioration of characteristics. The lifetime cannot exceed 15 years due to aging of sealing rubber.

#### 1.3 Load conditions to avoid

The following load conditions will cause rapid deterioration of capacitor's electrical characteristics.

In addition, instantaneous heating and gas generation within the capacitor may cause an operation of pressure relief vent, and that results in electrolyte leaks, explosion and/or fire ignition.

The leaked electrolyte is combustible and electrically conductive.

(1) Reverse voltage

DC capacitors have polarity. Therefore, do not apply the reverse voltage. Find the correct polarity before insertion.

(2) Charge / Discharge applications

General purpose capacitors are not suitable for use in repeating charge/discharge applications. For such applications, consult a sales representative with actual application condition. Rush current must not exceed 100 A.

(3) ON-OFF circuit

When using capacitors in circuit where ON-OFF switching is repeated more than 10,000 times a day, consult a sales representative with actual application condition for an appropriate choice of capacitors.

(4) Over voltage

Do not apply a voltage exceeding the rated voltage. The rated surge voltage can be applied only for a short time. Make sure that a 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 rated value.

Make sure that rated ripple currents superimposed on low DC bias voltages do not cause reverse voltage conditions. Even if the current is below the rated ripple current, using the capacitor for longer than the rated lifetime will cause ESR increase and internal generation of heat, which may eventually lead to vent open, bulging of case/rubber, electrolyte leak, short circuit, explosion, or ignition in the worst case.

### 1.4 Connections in parallel

Because the impedance of the capacitor and PCB's wiring are very close, various impedance values may cause unbalanced ripple current loads among parallel capacitors. Combine the same part number and wire them carefully to minimize the potential risk of an excessive ripple current concentrating to one capacitor of the smallest impedance. The capacitors cannot be used in series.

### 1.5 Capacitor mounting considerations

- (1) For double sided circuit boards, avoid wiring patterns passing between the mounted capacitor and the circuit board. When a radial lead type capacitor is dipped into a solder bath, an excess solder may deposit under the capacitor by capillary action, causing short circuit between anode and cathode terminals. Also, lead holes must be placed with special care for radial lead type capacitors because laminate on capacitor's surface may become damaged during flow process.
- (2) The pitch between circuit board holes should match the lead wire pitch of the radial lead type capacitors within the specified tolerances. Unmatched pitch may cause an excessive stress on lead wires during the insertion process and result in short/open circuit, increased leakage current, or electrolyte leak.
- (3) Clearance for case mounted pressure relief ( $\geq \varnothing 10$  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.  
\*  $\geq \varnothing 10$  mm : 2 mm minimum
- (4) Wiring near the pressure relief ( $\geq \varnothing 10$  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.
- (5) Circuit board patterns under the capacitor  
Avoid circuit board runs under the capacitor, as an electrical short can occur due to an electrolyte leakage.
- (6) Resonant vibration after circuit board's production may make a heavy load on the capacitor and cause rapid change in characteristics and/or capacitor's break.

### 1.6 Electrical isolation

Electrically isolate the capacitor's case from cathode terminals, as well as circuit patterns.

### 1.7 Capacitor coating

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 k $\Omega$ .
- (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 k $\Omega$ .
- (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 dimension and land pattern size for surface mount type, or holes' pitch for radial lead type before mount to avoid short circuit, stress on terminals, and/or lack of terminal strength.
- (4) Excessive mounting pressure can cause high leakage current, short circuit, or disconnection.
- (5) When using a mounter for radial lead type, avoid cutter wear and acute angle of lead-bending with respect to circuit board. That may create excessive stress and pull the lead to damage the capacitor.

### 2.3 Reflow soldering (for surface mount type)

- (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.  
If the peak temperature is high or if the heating time is long, it may cause deterioration of the electrical characteristics and life characteristics.  
Recommended soldering condition is a guideline for ensuring the basic characteristics of the components, but not for the stable soldering conditions. Conditions for proper soldering should be set up according to individual conditions.  
\* 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 °C / sec. Please contact Panasonic for detailed conditions.
- (7) The vibration-proof capacitors of size ø6.3 has support terminals extending from the bottom side to the lead edge. Then, make sure to find appropriate soldering conditions to form fillet on the support terminals if required for appearance inspection. However, even if sufficient solder fillets are not observed, the reliability of vibration-proof will not be lowered because the support terminals on the bottom side enhance the solder joint to PCB.

### 2.4 Flow soldering (for radial type)

- (1) Radial lead type capacitors cannot apply to reflow soldering.
- (2) Do not immerse the capacitor body into the solder bath as excessive internal pressure could result.
- (3) Apply proper soldering conditions (temperature, time, etc.). Do not exceed the specified limits.
- (4) Do not allow other parts or components to touch the capacitor during soldering.
- (5) When mounting the radial type being touched to PCB, be sure to check the appearance of solder under the sealing rubber, which does not have an airflow structure.

### 2.5 Manual soldering

- (1) Apply soldering conditions (temperature and time) based on the specification, or do not exceed temperature of 350 °C for 3 seconds.
- (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.
- (4) When bending lead wires of radial type capacitors to match the hole pitch on PCB, avoid applying excessive stress to the capacitor body.

### 2.6 Capacitor handling after soldering

- (1) Avoid moving the capacitor after soldering to prevent excessive stress on the lead wires where they enter the seal. The capacitor may break from element portion due to a torque at outer rim, causing a large stress to terminals.
- (2) Do not use the capacitor as a handle when moving the circuit board assembly. The total weight of the board would apply to element portion through terminals, and the capacitor may break.
- (3) Avoid striking the capacitor after assembly to prevent failure due to excessive shock. The capacitor may break due to excessive shock or load above specified range.

## 2.7 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 °C 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.  
【Target solvent】  
Pine Alpha ST-100S, Aqua Cleaner 210SEP, Clean-thru 750H / 750L / 710M, Sunelec B-12, Sunelec B-12, Cold Cleaner P3-375, Techno Cleaner 219, DK Be-clear CW-5790, Telpene Cleaner EC-7R, Technocare FRW-17 / FRW-1 / FRV-1
- (2) Avoid using the following solvent groups unless specifically allowed in the specification ;
  - (a) Halogenated based solvents : may permeate the seal and cause internal corrosion.  
Especially, 1-1-1 trichloroethane must not be used on any aluminum electrolytic capacitors.
  - (b) Alkaline based solvents : may dissolve and react to the aluminum case.
  - (c) Petroleum based solvents : may deteriorate the sealing rubber
  - (d) Xylene : may deteriorate the sealing rubber
  - (e) Acetone : may erase the markings on the capacitor top
- (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 cleaning solvents during use in terms of electrical conductivity, pH, specific gravity, and water content. Inside the capacitor may corrode with high density of chlorine. Control the flux density in the cleaning agent to be less than 2 mass%.
- (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.

## 2.8 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.

Cure or dry out the coating agents thoroughly, and do not leave any solvents. Make sure to dry out cleaning agents completely immediately after washing the circuit board if the capacitors are mounted afterward, so that the solvents are not left under the capacitor body. Also, leave more than 1/3 of the sealing portion open, and do not cover that portion with any adhesives or coating.

## 2.9 Potting and molding

Potting and molding processes cannot be recommended. They have potential risks to change the capacitor's performance and reliability due to injection pressure, diffused material into the capacitor, as well as heat accumulation by covered resin. Also, evaporated electrolyte may remain inside the resin, then turn to liquid, and possibly short circuit PCB patterns.

## 2.10 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.

## 2.11 Flux

If you use a halogen type (Chlorine type, Bromine type, etc.) high-activity flux, please use it after confirmation in advance, as it may have an impact on performance and reliability of this product due to the residue of the flux.

## 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.

Even within the specified requirements, a large vibration acceleration may be applied due to resonance, so be sure to evaluate and confirm with the actual product.



### 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-shiroxane 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 °C 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

- (1) Leakage current of a capacitor tends to increase after a long-term storage due to dielectric dissolution, and very high current may flow at the first voltage load. However, applying voltage will form the dielectric, and the leakage current will decrease. Expiration date is 42 months from the outgoing inspection date. Storage condition is to keep in room temperature (5 °C to 35 °C) and humidity (45 % to 85 %) with no direct sunshine.
- (2) Environmental conditions  
Do not store under condition outside the area described in the specification, and also under conditions listed below.
  - (a) Exposure to temperatures above the upper category or below the lower category temperature of the capacitor.
  - (b) Direct contact with water, salt water, or oil.
  - (c) High humidity conditions where water could condense on the capacitor.
  - (d) Exposure to toxic gases such as hydrogen sulfide, sulfuric acid, chlorine, Chlorine compound, Bromine, Bromine compound or ammonia.
  - (e) Exposure to ozone, radiation, or ultraviolet rays.
  - (f) 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 "Safety application guide for the use in fixed aluminum electrolytic capacitors for electronic equipment", RCR-2367D issued by JEITA in October 2017.  
Please refer to the above application guide for details.

### ■ AEC-Q200 compliant

The products are tested based on all or part of the test conditions and methods defined in AEC-Q200. Please consult with Panasonic for the details of the product specification and specific evaluation test results, etc., and please review and approve Panasonic's product specification before ordering.

#### \* 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 are as follows:

US Patent No.7497879, No.7621970, No.9208954, No.9595396, No.9966200, No.10453618,  
No.10559432, No.10679800, No.10685788, No.10790095  
JP Patent No.5360250  
EP Patent No.1808875, No.2698802

**Line-up**

**Surface mount type**

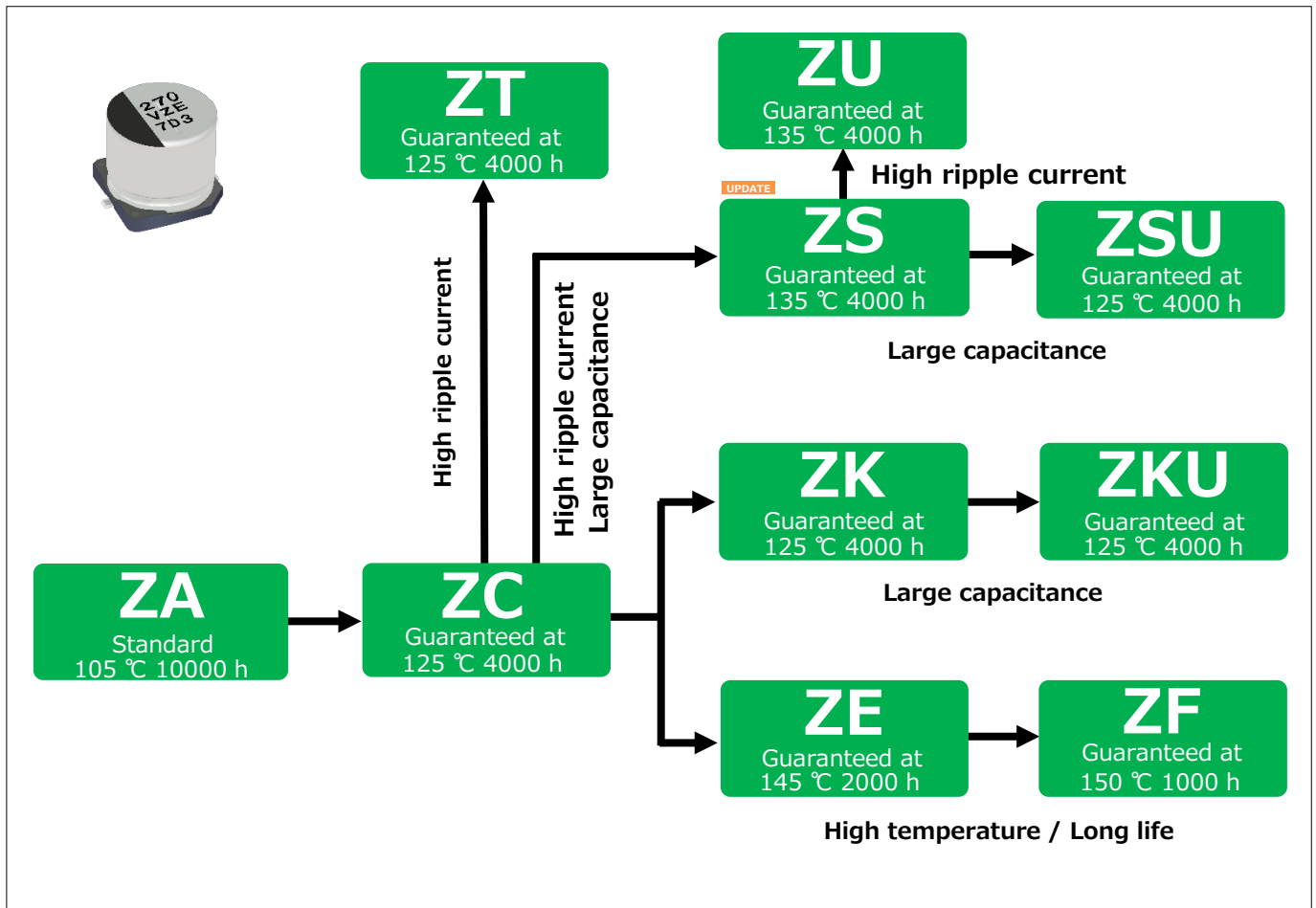
Series	Part No.	Features	Small size	Large cap.	High ripple	High temp.	Long life	Category temperature range (°C)	Rated voltage range (V)	ESR (mΩ)	Capacitance range (μF)	Size code	Size (mm)	
													øD	L
ZA	EEHZA---	Low ESR High ripple current Long life 105 °C 10000 h	●					-55 to 105	25 to 50	80 to 120	10 to 33	C	5.0	5.8
									25 to 63	50 to 120	10 to 56	D	6.3	5.8
									25 to 80	30 to 80	22 to 100	D8	6.3	7.7
										27 to 45	22 to 220	F	8.0	10.2
ZC	EEHZC---	Low ESR High ripple current Long life 125 °C 4000 h	●				-55 to 125	25 to 50	80 to 120	10 to 33	C	5.0	5.8	
								25 to 63	50 to 120	10 to 56	D	6.3	5.8	
								25 to 80	30 to 80	22 to 100	D8	6.3	7.7	
									27 to 45	22 to 220	F	8.0	10.2	
ZK	EEHZK---	Large capacitance High ripple current Long life 125 °C 4000 h	●	●	●	●	-55 to 125	25 to 35	80 to 100	33 to 47	C	5.0	5.8	
									50 to 60	56 to 82	D	6.3	5.8	
									30 to 35	100 to 150	D8	6.3	7.7	
									27	180 to 270	F	8.0	10.2	
									20	330 to 470	G	10.0	10.2	
ZKU	EEHZK--U-	Large capacitance Long life 125 °C 4000 h	●	●	●	●	-55 to 125	25 to 35	80 to 100	39 to 56	C	5.0	5.8	
									50 to 60	68 to 100	D	6.3	5.8	
									30 to 35	120 to 180	D8	6.3	7.7	
									27	220 to 330	F	8.0	10.2	
ZT	EEHZT---	125 °C 4000 h	●	●	●	●	-55 to 125	25 to 63	22 to 32	33 to 220	F	8.0	10.2	
									16 to 25	56 to 330	G	10.0	10.2	
UPDATE ZS	EEHZS---	125 °C 4000 h 135 °C 4000 h	●	●	●	●	-55 to 135	25 to 63	14 to 19	100 to 470	G12	10.0	12.5	
									11 to 15	150 to 560	G16	10.0	16.5	
ZSU	EEHZS--U-	125 °C 4000 h	●	●	●	●	-55 to 125	25 to 63	14 to 19	120 to 680	G12	10.0	12.5	
									11 to 15	180 to 1000	G16	10.0	16.5	
ZU	EEHZU---	125 °C 4000 h 135 °C 4000 h	●	●	●	●	-55 to 135	25 to 63	10 to 12	100 to 470	G12	10.0	12.5	
									8 to 10	150 to 560	G16	10.0	16.5	
ZE	EEHZE---	145 °C 2000 h 135 °C 4000 h				●	●	-55 to 145	27 to 40	33 to 220	F	8.0	10.2	
									20 to 30	56 to 330	G	10.0	10.2	
ZF	EEHZF---	150 °C 1000 h				●	●	-55 to 150	27 to 40	33 to 150	F	8.0	10.2	
									20 to 30	56 to 270	G	10.0	10.2	

**Radial lead type**

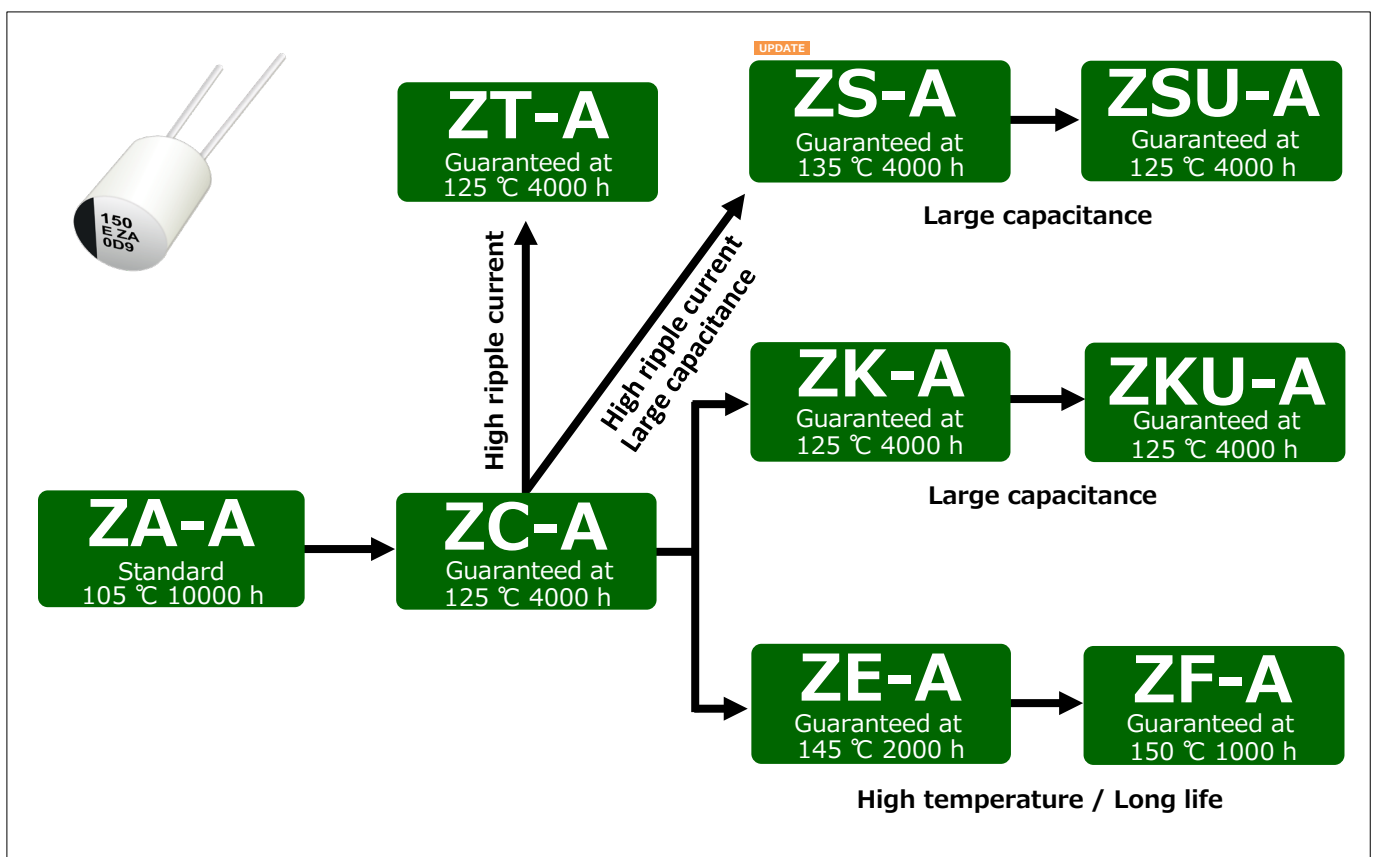
Series	Part No.	Features	Small size	Large cap.	High ripple	High temp.	Long life	Category temperature range (°C)	Rated voltage range (V)	ESR (mΩ)	Capacitance range (μF)	Size code	Size (mm)	
													øD	L
ZA-A	EEHAZA---B	105 °C 10000 h						-55 to 105	25 to 80	27 to 45	22 to 220	F	8.0	9.5
										20 to 36	33 to 330	G	10.0	9.5
ZC-A	EEHAZC---B	125 °C 4000 h					●	-55 to 125	25 to 80	27 to 45	22 to 220	F	8.0	9.5
										20 to 36	33 to 330	G	10.0	9.5
ZK-A	EEHAZK---B	125 °C 4000 h	●	●			●	-55 to 125	25 to 35	27	180 to 270	F	8.0	9.5
										20	330 to 470	G	10.0	9.5
ZKU -A	EEHAZK--UB	125 °C 4000 h	●	●			●	-55 to 125	25 to 35	27	220 to 330	F	8.0	9.5
										20	390 to 560	G	10.0	9.5
ZT-A	EEHAZT---B	125 °C 4000 h	●	●			●	-55 to 125	25 to 63	22 to 32	33 to 220	F	8.0	9.5
										16 to 25	56 to 330	G	10.0	9.5
UPDATE ZS-A	EEHAZS---B	125 °C 4000 h 135 °C 4000 h	●	●			●	-55 to 135	25 to 63	14 to 19	100 to 470	G12	10.0	11.7
										11 to 15	150 to 560	G16	10.0	15.7
ZSU-A	EEHAZS--UB	125 °C 4000 h	●	●			●	-55 to 125	25 to 63	14 to 19	120 to 680	G12	10.0	11.7
										11 to 15	180 to 1000	G16	10.0	15.7
ZE-A	EEHAZE---B	145 °C 2000 h 135 °C 4000 h				●	●	-55 to 145	25 to 63	27 to 40	33 to 220	F	8.0	9.5
										20 to 30	56 to 330	G	10.0	9.5
ZF-A	EEHAZF---B	150 °C 1000 h				●	●	-55 to 150	25 to 63	27 to 40	33 to 150	F	8.0	9.5
										20 to 30	56 to 270	G	10.0	9.5

**Diagram**

**Surface mount type**



**Radial lead type**



Size · ESR Matrix list

Surface mount type

V	series	µF																					
		10	22	27	33	39	47	56	68	82	100	120	150	180	220	270	330	390	470	560	680	1000	
25	ZA		C(80)		C(80)		D(50)	D(50)	D8(30)		D8(30)		F(27)		F(27)		G(20)						
	ZC		C(80)		C(80)		D(50)	D(50)	D8(30)		D8(30)		F(27)		F(27)		G(20)						
	ZK						C(80)		D(50)	D(50)			D8(30)			F(27)			G(20)				
	ZKU							C(80)			D(50)			D8(30)				F(27)			G(20)		
	ZT															F(22)		G(16)					
	ZS																			G(12)(14)	G(16)(11)		
	ZSU																					G(12)(14)	G(16)(11)
	ZU																			G(12)(10)	G(16)(8)		
	ZE															F(27)		G(20)					
	ZF																	G(20)					
35	ZA	C(100)	C(100)	D(60)	D(60)		D(60)		D8(35)		F(27)		F(27)		G(20)	G(20)							
	ZC	C(100)	C(100)		D(60)		D(60)		D8(35)		F(27)		F(27)		G(20)	G(20)							
	ZK				C(100)			D(60)		D8(35)			F(27)				G(20)						
	ZKU					C(100)			D(60)		D8(35)			F(27)				G(20)					
	ZT												F(22)				G(16)			G(12)(14)	G(16)(11)		
	ZS																				G(12)(14)	G(16)(11)	
	ZSU																					G(12)(14)	G(16)(11)
	ZU																						G(16)(11)
	ZE													F(27)				G(20)					
	ZF																						
50	ZA	C(120)	D(80)		D8(40)		F(30)		F(30)			G(28)											
	ZC	C(120)	D(80)		D8(40)		F(30)		F(30)			G(28)	G(28)										
	ZT								F(25)			G(23)	G(23)										
	ZS													G(12)(17)			G(16)(13)						
	ZSU													G(12)(17)			G(16)(13)						
	ZU													G(12)(12)			G(16)(10)						
	ZE								F(30)														
	ZF													G(28)									
	ZA	D(120)	D8(80)		F(40)		F(40)	G(30)	G(30)	G(30)													
	ZC	D(120)	D8(80)		F(40)		F(40)	G(30)	G(30)	G(30)													
ZT				F(32)		F(32)	G(25)	G(25)	G(25)														
ZS										G(12)(19)						G(16)(15)							
ZSU										G(12)(12)		G(12)(19)			G(16)(15)								
ZU																G(16)(10)							
ZE				F(40)																			
ZF							G(30)		G(30)														
80	ZA		F(45)		G(36)																		
	ZC		F(45)		G(36)		G(36)																

Size code (ESR mΩ)

Size code

Unit : mm

New

C	ø5.0 x L5.8	D8	ø6.3 x L7.7	G	ø10.0 x L10.2	G16	ø10.0 x L16.5
D	ø6.3 x L5.8	F	ø8.0 x L10.2	G12	ø10.0 x L12.5		

Radial lead type

V	series	µF																					
		10	22	27	33	39	47	56	68	82	100	120	150	180	220	270	330	390	470	560	680	1000	
25	ZA												F(27)		F(27)		G(20)						
	ZC												F(27)		F(27)		G(20)						
	ZK															F(27)			G(20)				
	ZKU																F(27)			G(20)			
	ZT															F(22)		G(16)					
	ZS																			G(12)(14)	G(16)(11)		
	ZSU																					G(12)(14)	G(16)(11)
	ZE															F(27)		G(20)					
	ZF																						
	35	ZA									F(27)		F(27)		G(20)	G(20)							
ZC										F(27)		F(27)		G(20)	G(20)								
ZK													F(27)				G(20)						
ZKU														F(27)				G(20)					
ZT													F(22)				G(16)						
ZS																				G(12)(14)	G(16)(11)		
ZSU																						G(12)(14)	G(16)(11)
ZE														F(27)				G(20)					
ZF																							
50		ZA						F(30)		F(30)			G(28)										
	ZC						F(30)		F(30)			G(28)	G(28)										
	ZT								F(25)			G(23)	G(23)										
	ZS													G(12)(17)			G(16)(13)						
	ZSU														G(12)(17)		G(16)(13)						
	ZE								F(30)														
	ZF													G(28)									
	ZA				F(40)		F(40)	G(30)	G(30)	G(30)													
	ZC				F(40)		F(40)	G(30)	G(30)	G(30)													
	ZT				F(32)		F(32)	G(25)	G(25)	G(25)													
ZS										G(12)(19)						G(16)(15)							
ZSU												G(12)(19)			G(16)(15)								
ZE				F(40)				G(30)		G(30)													
ZF								G(30)															
80	ZA		F(45)		G(36)																		
	ZC		F(45)		G(36)		G(36)																

Size code (ESR mΩ)

Size code

Unit : mm

New

F	ø8.0 x L9.5	G	ø10.0 x L9.5	G12	ø10.0 x L11.7	G16	ø10.0 x L15.7
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**Explanation of part numbers**

◇ Part number system

• Surface mount type

<b>EEH</b> Product classification 3 figures	<b>ZC</b> Series 2 figures	<b>1E</b> Voltage code 1 to 2 figures	<b>101</b> Capacitance code 3 figures	<b>X</b> Size code 0 to 1 figure	<b>*</b> Special code 0 to 1 figure	<b>P</b> Taping code 1 figure
	Series	Rated voltage (V)	Cap. (μF)	øD x L	Dia øD	Tape width (mm)
	Code	Code	Code	Code	Code	Code
	ZA, ZC, ZK, ZKU, ZT, ZS, ZSU, ZU, ZE, ZF	25, 35, 50, 63, 80	10, 22, 27, 33, 39, 47, 56, 68, 82, 100, 120, 150, 180, 220, 270, 330, 390, 470, 560, 680, 1000	6.3 x 7.7 (D8)	Miniaturization product	12, 16 ~ 24, Vibration-proof
				X	U	R, P, V

\* Only D8 is marked with X

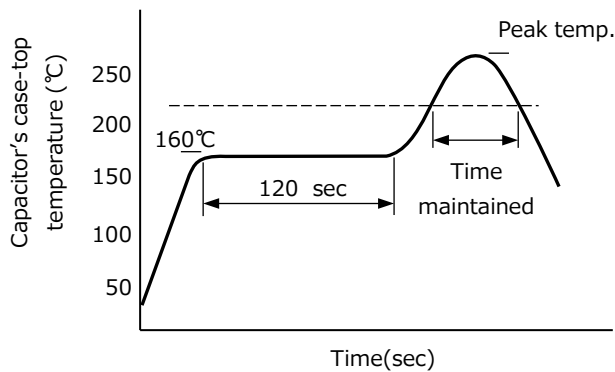
\* If the total figures number of the part number exceeds 12 figures, "1" is omitted.  
e.g.) 1E → E

• Radial lead type

<b>EEHA</b> Product classification 4 figures	<b>ZC</b> Series 2 figures	<b>1E</b> Voltage code 1 to 2 figure	<b>151</b> Capacitance code 3 figures	<b>*</b> Special code 0 to 1 figure	<b>B</b> Taping code 1 figure
	Series	Rated voltage (V)	Cap. (μF)	Dia øD	Lead space (mm)
	Code	Code	Code	Code	Code
	ZA, ZC, ZK, ZKU, ZT, ZS, ZSU, ZU, ZE, ZF	25, 35, 50, 63, 80	22, 33, 47, 56, 68, 82, 100, 120, 150, 180, 220, 270, 330, 390, 470, 560, 680, 1000	Miniaturization product	3.5, 5.0
				U	B

\* If the total figures number of the part number exceeds 12 figures, "1" is omitted.  
e.g.) 1E → E

**Recommended reflow soldering**



Size code	C, D, D8	F, G, G12, G16	
Peak temp.	260°C (255°C)	245°C	260°C
Time in peak temperature	≥ 250°C 5 s (10 s)	≥ 240°C 10 s	≥ 250°C 5 s
Time maintained	≥ 230°C 30 s	≥ 230°C 30 s	≥ 230°C 30 s
	≥ 217°C 40 s	≥ 217°C 40 s	≥ 217°C 40 s
	≥ 200°C 70 s	≥ 200°C 70 s	≥ 200°C 70 s
Reflow cycles	2 times	2 times	1 time

\* For reflow, use a thermal condition system such as infrared and radiation (IR) or hot blas.

\* Reflow temperature is measured on capacitor's case top.

**Specifications for radial lead type**

● Flow soldering condition

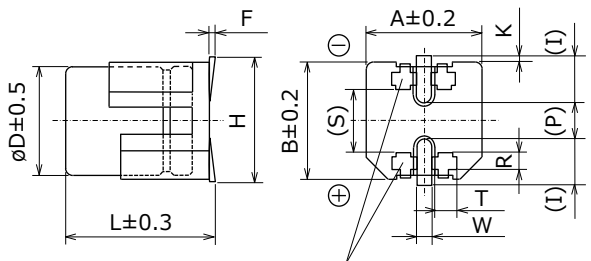
< RoHS compliant >

	Temperature	Time	Flow number
Soldering condition	260°C + 5°C or less	10 sec +1 sec or less	1 time

**Vibration-proof products**

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

< Size code : D, D8 >



Supportive terminals

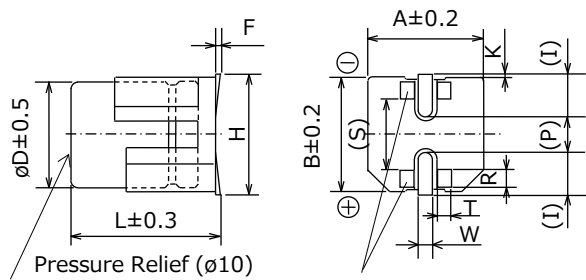
( ) Reference size

Unit : mm

Size code	øD	L	A, B	H max.	F	I	W
D	6.3	6.1	6.6	7.8	0 to +0.15	2.4	0.65±0.1
D8	6.3	8.0	6.6	7.8	0 to +0.15	2.4	0.65±0.1

Size code	P	K	R	S	T
D	2.2	0.35 <sup>+0.15</sup> <sub>-0.20</sub>	1.1±0.2	3.3	1.05±0.2
D8	2.2	0.35 <sup>+0.15</sup> <sub>-0.20</sub>	1.1±0.2	3.3	1.05±0.2

< Size code : F, G, G12, G16 >



Supportive terminals

( ) Reference size

Unit : mm

Size code	øD	L	A, B	H max.	F	I	W
F	8.0	10.5	8.3	10.0	0 to +0.15	3.4	1.2±0.2
G	10.0	10.5	10.3	12.0	0 to +0.15	3.5	1.2±0.2
G12	10.0	12.8	10.3	11.0 <sup>*1</sup>	0 to +0.15	3.2	1.2±0.2
G16	10.0	16.8	10.3	11.0 <sup>*1</sup>	0 to +0.15	3.2	1.2±0.2

\*1:±0.2

Size code	P	K	R	S	T
F	3.1	0.70±0.2	0.70±0.2	5.3	1.3±0.2
G	4.6	0.70±0.2	0.70±0.2	6.9	1.3±0.2
G12	4.6	—	0.70±0.2	6.9	1.3±0.2
G16	4.6	—	0.70±0.2	6.9	1.3±0.2

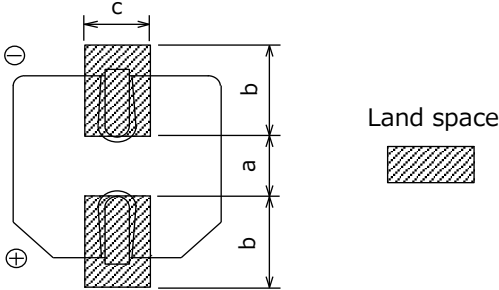
**Mounting specification**

**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.

Unit : mm

● Standard products



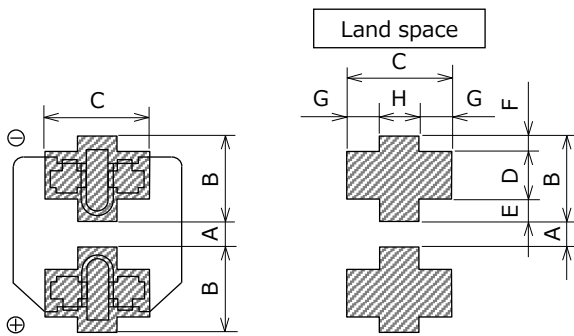
Size code	a	b	c
C : $\phi 5 \times L5.8$	1.5	2.8	1.6
D : $\phi 6.3 \times L5.8$	1.8	3.2	1.6
D8 : $\phi 6.3 \times L7.7$	1.8	3.2	1.6
F : $\phi 8 \times L10.2$	3.1	4.0	2.0
G : $\phi 10 \times L10.2$	4.6	4.1	2.0
G12 : $\phi 10 \times L12.5$	4.6	4.1	2.0
G16 : $\phi 10 \times L16.5$	4.6	4.1	2.0

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

\* Take mounting conditions, solderability and fitting strength into consideration when selecting parts for your design.

● Vibration-proof products

< Size code : D, D8 >



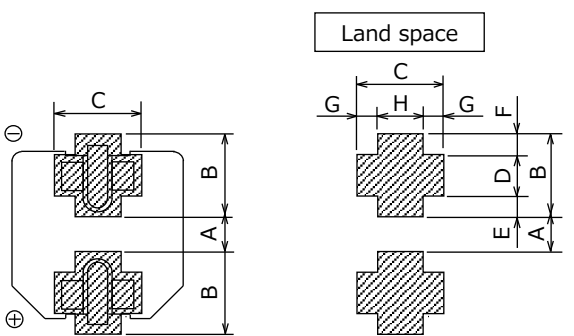
Unit : mm

Size code	A	B	C	D
D : $\phi 6.3 \times L6.1$	1.2	3.6	3.2	2.0
D8 : $\phi 6.3 \times L8.0$	1.2	3.6	3.2	2.0

Size code	E	F	G	H
D : $\phi 6.3 \times L6.1$	0.95	0.65	1.0	1.2
D8 : $\phi 6.3 \times L8.0$	0.95	0.65	1.0	1.2

Larger dimension of "A" may prevent back fillet from being formed adequately to obtain required solder strength.

< Size code : F, G, G12, G16 >



Unit : mm

Size code	A	B	C	D
F : $\phi 8 \times L10.5$	2.7	4.0	4.7	1.3
G : $\phi 10 \times L10.5$	3.9	4.4	4.7	1.3
G12 : $\phi 10 \times L12.8$	3.9	4.4	4.7	1.3
G16 : $\phi 10 \times L16.8$	3.9	4.4	4.7	1.3

Size code	E	F	G	H
F : $\phi 8 \times L10.5$	1.0	1.7	1.1	2.5
G : $\phi 10 \times L10.5$	1.2	1.9	1.1	2.5
G12 : $\phi 10 \times L12.8$	1.2	1.9	1.1	2.5
G16 : $\phi 10 \times L16.8$	1.2	1.9	1.1	2.5

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

\* Take mounting conditions, solderability and fitting strength into consideration when selecting parts for your design.

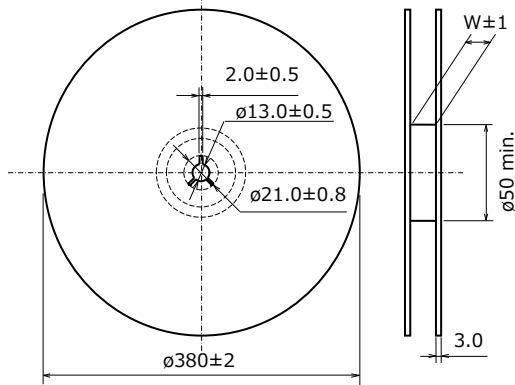
\* The vibration-proof capacitors of size  $\phi 6.3$  has support terminals extending from the bottom side to the lead edge.

Then, make sure to find appropriate soldering conditions to form fillet on the support terminals if required for appearance inspection.

**Packaging specifications**

**Specifications for surface mount type**

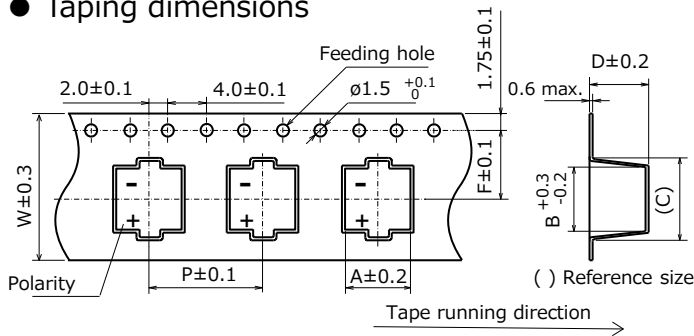
- Reel dimensions (not to scale)



Unit : mm

Size code	W
C	14.0
D, D8	18.0
F, G, G12, G16	26.0

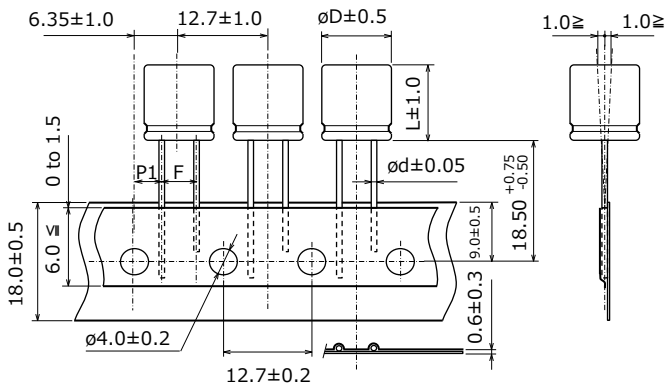
- Taping dimensions



※Ask factory for technical specifications

**Radial lead type**

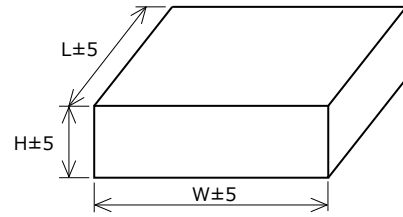
- Taping dimensions



Unit : mm

Size code	$\phi D$	L	$\phi d$	F	P1
F	8.0	9.5	0.6	$3.5 \pm 0.5$	$4.60 \pm 0.50$
G	10.0	9.5	0.6	$5.0 + 0.8 / - 0.2$	$3.85 \pm 0.50$
G12	10.0	11.7	0.8	$5.0 + 0.8 / - 0.2$	$3.85 \pm 0.50$
G16	10.0	15.7	0.8	$5.0 + 0.8 / - 0.2$	$3.85 \pm 0.50$

- Dimensions of outer carton box



Unit : mm

Size code	H	W, L
C	220	395
D, D8	250	395
F, G, G12, G16	220	395

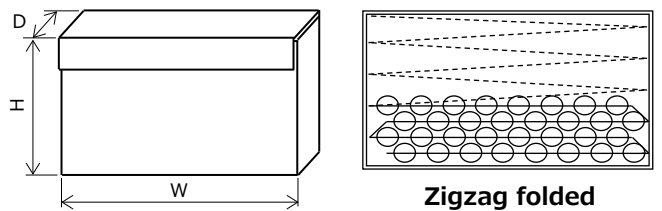
- Min.packing quantity

Size code	Min.packing quantity (pcs.)
C, D	1000
D8	900
F, G	500
G12	400
G16	250

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
G12	10.7	10.7	14.5	13.7	16.0	11.5	24.0
G16	10.7	10.7	14.5	17.5	20.0	11.5	24.0

- Dimensions of outer carton box / Packaging method



Unit : mm

Size code	W	H	D
F	340 max.	230 max.	55 max.
G	340 max.	170 max.	55 max.
G12	340 max.	170 max.	55 max.
G16	340 max.	170 max.	55 max.

- Min.packing quantity

Size code	Min.packing quantity (pcs.)
F	1000
G	500
G12	500
G16	500



## Surface Mount Type

**ZA** series

High temperature lead-free reflow



**Hybrid**

### Features

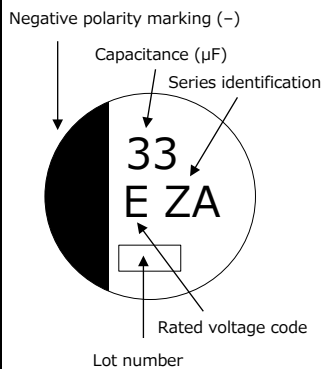
- Endurance : 10000 h at 105 °C
- Low ESR and high ripple current (70 % over, Lower ESR than current V-FP)
- High voltage (to 80 V)
- Equivalent to conductive polymer type aluminum electrolytic capacitor (There are little characteristics change by temperature and frequency)
- Vibration-proof product is available upon request. New lineup of ø6.3 product. (ø6.3, ø8, ø10)
- AEC-Q200 compliant
- RoHS compliant

### Specifications

Size code	C	D	D8	F	G
Category temp. range	-55 °C to +105 °C				
Rated voltage range	25 V to 50 V	25 V to 63 V		25 V to 80 V	
Nominal cap.range	10 µF to 33 µF	10 µF to 56 µF	22 µF to 100 µF	22 µF to 220 µF	33 µF to 330 µF
Capacitance tolerance	±20 % (120 Hz / +20 °C)				
DC 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)	Rated voltage × 1.25 (15 °C to 35 °C)				
Endurance	+105 °C ± 2 °C, 10000 h, apply the rated ripple current without exceeding the rated voltage.				
	Capacitance change	Within ±30% of the initial value			
	Dissipation factor (tan δ)	≤ 200 % of the initial limit			
	ESR	≤ 200 % of the initial limit			
	DC leakage current	Within the initial limit			
ESR after endurance (Ω / 100 kHz)(-40 °C)	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 °C ± 2 °C with no voltage applied and then being stabilized at +20 °C, capacitors shall meet the limits specified in endurance. (With voltage treatment)				
Damp heat (Load)	+85 °C ± 2 °C, 85 % to 90 %RH, 2000 h, rated voltage applied				
	Capacitance change	Within ±30% of the initial value			
	Dissipation factor (tan δ)	≤ 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 °C, capacitors shall meet the following limits.				
	Capacitance change	Within ±10% of the initial value			
	DC leakage current	Within the initial limit			

### Marking

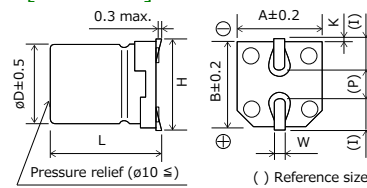
Example : 25 V 33 µF  
Marking color : BLACK



R. voltage code	Unit : V
E	25
V	35
H	50
J	63
K	80

### Dimensions (not to scale)

#### [Standard]

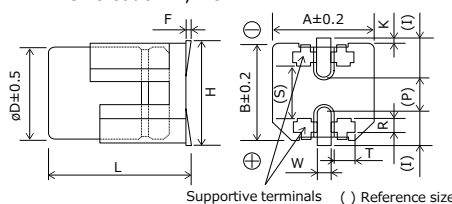


Size code	øD	L	A, B	H max.	I	W	P	K
C	5.0	5.8±0.3	5.3	6.5	2.2	0.65±0.1	1.5	0.35 <sup>+0.15</sup> <sub>-0.20</sub>
D	6.3	5.8±0.3	6.6	7.8	2.6	0.65±0.1	1.8	0.35 <sup>+0.15</sup> <sub>-0.20</sub>
D8	6.3	7.7±0.3	6.6	7.8	2.6	0.65±0.1	1.8	0.35 <sup>+0.15</sup> <sub>-0.20</sub>
F	8.0	10.2±0.3	8.3	10	3.4	0.90±0.2	3.1	0.70±0.2
G	10.0	10.2±0.3	10.3	12.0	3.5	0.90±0.2	4.6	0.70±0.2

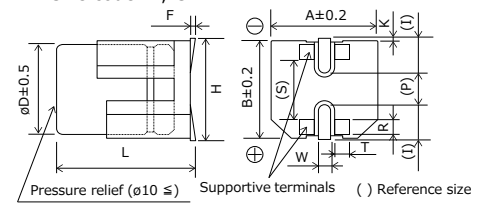
Unit : mm

#### [Vibration-proof product]

< Size code : D, D8 >



< Size code : F, G >



Size code	øD	L	A, B	H max.	F	I	W	P	K	R	S	T
D	6.3	6.1±0.3	6.6	7.8	0 to +0.15	2.4	0.65±0.1	2.2	0.35 <sup>+0.15</sup> <sub>-0.20</sub>	1.1±0.2	3.3	1.05±0.2
D8	6.3	8.0±0.3	6.6	7.8	0 to +0.15	2.4	0.65±0.1	2.2	0.35 <sup>+0.15</sup> <sub>-0.20</sub>	1.1±0.2	3.3	1.05±0.2
F	8.0	10.5±0.3	8.3	10.0	0 to +0.15	3.4	1.2±0.2	3.1	0.70±0.2	0.70±0.2	5.3	1.3±0.2
G	10.0	10.5±0.3	10.3	12.0	0 to +0.15	3.5	1.2±0.2	4.6	0.70±0.2	0.70±0.2	6.9	1.3±0.2

Unit : mm

**Characteristics list**

Endurance : 105 °C 10000 h

Rated voltage (V)	Capacitance (±20 %) (µF)	Case size (mm)			Size code	Specification			Part number		Min. packaging q'ty (pcs)
		øD	L			Ripple current*1 (mA rms)	ESR*2 (mΩ)	tan δ*3	Standard product	Vibration-proof product	Taping
			Standard	Vibration-proof							
25	22	5.0	5.8	-	C	900	80	0.14	EEHZA1E220R	-	1000
	33	5.0	5.8	-	C	900	80	0.14	EEHZA1E330R	-	1000
	47	6.3	5.8	6.1	D	1300	50	0.14	EEHZA1E470P	EEHZA1E470V	1000
	56	6.3	5.8	6.1	D	1300	50	0.14	EEHZA1E560P	EEHZA1E560V	1000
	68	6.3	7.7	8.0	D8	2000	30	0.14	EEHZA1E680XP	EEHZA1E680XV	900
	100	6.3	7.7	8.0	D8	2000	30	0.14	EEHZA1E101XP	EEHZA1E101XV	900
	150	8.0	10.2	10.5	F	2300	27	0.14	EEHZA1E151P	EEHZA1E151V	500
	220	8.0	10.2	10.5	F	2300	27	0.14	EEHZA1E221P	EEHZA1E221V	500
35	330	10.0	10.2	10.5	G	2500	20	0.14	EEHZA1E331P	EEHZA1E331V	500
	10	5.0	5.8	-	C	900	100	0.12	EEHZA1V100R	-	1000
	22	5.0	5.8	-	C	900	100	0.12	EEHZA1V220R	-	1000
	27	6.3	5.8	6.1	D	1300	60	0.12	EEHZA1V270P	EEHZA1V270V	1000
	33	6.3	5.8	6.1	D	1300	60	0.12	EEHZA1V330P	EEHZA1V330V	1000
	47	6.3	5.8	6.1	D	1300	60	0.12	EEHZA1V470P	EEHZA1V470V	1000
	68	6.3	7.7	8.0	D8	2000	35	0.12	EEHZA1V680XP	EEHZA1V680XV	900
	100	8.0	10.2	10.5	F	2300	27	0.12	EEHZA1V101P	EEHZA1V101V	500
50	150	8.0	10.2	10.5	F	2300	27	0.12	EEHZA1V151P	EEHZA1V151V	500
	220	10.0	10.2	10.5	G	2500	20	0.12	EEHZA1V221P	EEHZA1V221V	500
	270	10.0	10.2	10.5	G	2500	20	0.12	EEHZA1V271P	EEHZA1V271V	500
	10	5.0	5.8	-	C	750	120	0.10	EEHZA1H100R	-	1000
	22	6.3	5.8	6.1	D	1100	80	0.10	EEHZA1H220P	EEHZA1H220V	1000
	33	6.3	7.7	8.0	D8	1600	40	0.10	EEHZA1H330XP	EEHZA1H330XV	900
	47	8.0	10.2	10.5	F	1800	30	0.10	EEHZA1H470P	EEHZA1H470V	500
	68	8.0	10.2	10.5	F	1800	30	0.10	EEHZA1H680P	EEHZA1H680V	500
63	100	10.0	10.2	10.5	G	2000	28	0.10	EEHZA1H101P	EEHZA1H101V	500
	10	6.3	5.8	6.1	D	1000	120	0.08	EEHZA1J100P	EEHZA1J100V	1000
	22	6.3	7.7	8.0	D8	1500	80	0.08	EEHZA1J220XP	EEHZA1J220XV	900
	33	8.0	10.2	10.5	F	1700	40	0.08	EEHZA1J330P	EEHZA1J330V	500
	47	8.0	10.2	10.5	F	1700	40	0.08	EEHZA1J470P	EEHZA1J470V	500
	56	10.0	10.2	10.5	G	1800	30	0.08	EEHZA1J560P	EEHZA1J560V	500
	68	10.0	10.2	10.5	G	1800	30	0.08	EEHZA1J680P	EEHZA1J680V	500
	82	10.0	10.2	10.5	G	1800	30	0.08	EEHZA1J820P	EEHZA1J820V	500
80	22	8.0	10.2	10.5	F	1550	45	0.08	EEHZA1K220P	EEHZA1K220V	500
	33	10.0	10.2	10.5	G	1700	36	0.08	EEHZA1K330P	EEHZA1K330V	500
	47	10.0	10.2	10.5	G	1700	36	0.08	EEHZA1K470P	EEHZA1K470V	500

\*1: Ripple current (100 kHz / +105 °C)      \*2: ESR (100 kHz / +20 °C)      \*3: tan δ (120 Hz / +20 °C)

◆ Please refer to the page of "Reflow profile" and "The taping dimensions".

◆ The dimensions of the vibration-proof products, please refer to the page of the mounting specification.

**Frequency correction factor for ripple current**

Rated capacitance (C)	Frequency (f)	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 (C)	Frequency (f)	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 (C)	Frequency (f)	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 (C)	Frequency (f)	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

## Surface Mount Type

**ZC** series

**High temperature lead-free reflow**



**Hybrid**

### Features

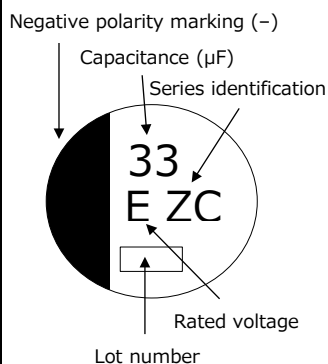
- Endurance: 4000 h at 125 °C (High temperature / Long life)
- Low ESR and high ripple current (85 % over, Lower ESR than current V-TP)
- High-withstand voltage ( to 80 V), Low LC (0.01 CV or 3 μA)
- Equivalent to conductive polymer type aluminum electrolytic capacitor (There are little characteristics change by temperature and frequency)
- Vibration-proof product is available upon request. New lineup of ø6.3 product. (ø6.3, ø8, ø10)
- AEC-Q200 compliant
- RoHS compliant

### Specifications

Size code	C	D	D8	F	G
Category temp. range	-55 °C to +125 °C				
Rated voltage range	25 V to 50 V	25 V to 63 V		25 V to 80 V	
Nominal cap.range	10 μF to 33 μF	10 μF to 56 μF	22 μF to 100 μF	22 μF to 220 μF	33 μF to 330 μF
Capacitance tolerance	±20 % (120 Hz / +20 °C)				
DC 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)	Rated voltage × 1.25 (15 °C to 35 °C)				
Endurance 1	+125 °C ± 2 °C, 4000 h, apply the rated ripple current without exceeding the rated voltage.				
	Capacitance change	Within ±30% of the initial value			
	Dissipation factor (tan δ)	≤ 200 % of the initial limit			
	ESR	≤ 200 % of the initial limit			
Endurance 2	+125 °C ± 2 °C, 3000 h, apply the rated ripple current without exceeding the rated voltage.				
	Capacitance change	Within ±30% of the initial value			
	Dissipation factor (tan δ)	≤ 200 % of the initial limit			
	ESR	≤ 300 % of the initial limit			
Shelf life	After storage for 1000 hours at +125 °C ± 2 °C with no voltage applied and then being stabilized at +20 °C, capacitors shall meet the limits specified in endurance. (With voltage treatment)				
	DC leakage current	Within the initial limit			
Damp heat (Load)	+85 °C ± 2 °C, 85 % to 90 %RH, 2000 h, rated voltage applied				
	Capacitance change	Within ±30% of the initial value			
	Dissipation factor (tan δ)	≤ 200 % of the initial limit			
	ESR	≤ 200 % of the initial limit			
Resistance to soldering heat	After reflow soldering and then being stabilized at +20 °C, capacitors shall meet the following limits.				
	Capacitance change	Within ±10% of the initial value			
	Dissipation factor (tan δ)	Within the initial limit			
	DC leakage current	Within the initial limit			

### Marking

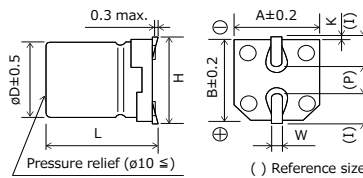
Example : 25 V 33 μF  
Marking color : BLACK



R. voltage code	Unit : V
E	25
V	35
H	50
J	63
K	80

### Dimensions (not to scale)

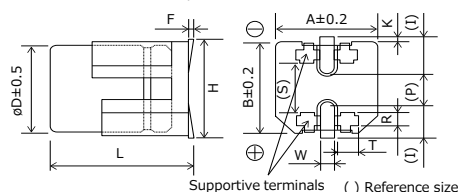
[Standard]



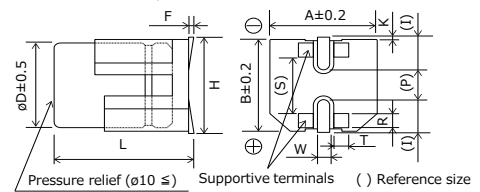
Size code	øD	L	A, B	H max.	I	W	P	K	Unit : mm
C	5.0	5.8±0.3	5.3	6.5	2.2	0.65±0.1	1.5	0.35 <sup>+0.15</sup> <sub>-0.20</sub>	
D	6.3	5.8±0.3	6.6	7.8	2.6	0.65±0.1	1.8	0.35 <sup>+0.15</sup> <sub>-0.20</sub>	
D8	6.3	7.7±0.3	6.6	7.8	2.6	0.65±0.1	1.8	0.35 <sup>+0.15</sup> <sub>-0.20</sub>	
F	8.0	10.2±0.3	8.3	10	3.4	0.90±0.2	3.1	0.70±0.2	
G	10.0	10.2±0.3	10.3	12.0	3.5	0.90±0.2	4.6	0.70±0.2	

[Vibration-proof product]

< Size code : D, D8 >



< Size code : F, G >



Size code	øD	L	A, B	H max.	F	I	W	P	K	R	S	T	Unit : mm
D	6.3	6.1±0.3	6.6	7.8	0 to +0.15	2.4	0.65±0.1	2.2	0.35 <sup>+0.15</sup> <sub>-0.20</sub>	1.1±0.2	3.3	1.05±0.2	
D8	6.3	8.0±0.3	6.6	7.8	0 to +0.15	2.4	0.65±0.1	2.2	0.35 <sup>+0.15</sup> <sub>-0.20</sub>	1.1±0.2	3.3	1.05±0.2	
F	8.0	10.5±0.3	8.3	10.0	0 to +0.15	3.4	1.2±0.2	3.1	0.70±0.2	0.70±0.2	5.3	1.3±0.2	
G	10.0	10.5±0.3	10.3	12.0	0 to +0.15	3.5	1.2±0.2	4.6	0.70±0.2	0.70±0.2	6.9	1.3±0.2	

**Characteristics list**

Endurance 1 : 125 °C 4000 h

Endurance 2 : 125 °C 3000 h

Rated voltage (V)	Capacitance (±20 %) (μF)	Case size (mm)			Size code	Specification				Part number		Min. packaging qty (pcs)
		øD	L			Ripple current *1 (mA rms)	ESR *2 (mΩ)	tan δ *3	Standard product	Vibration-proof product		
			Standard	Vibration-proof							Endurance 1	Endurance 2
25	22	5.0	5.8	-	C	550	-	80	0.14	EEHZC1E220R	-	1000
	33	5.0	5.8	-	C	550	-	80	0.14	EEHZC1E330R	-	1000
	47	6.3	5.8	6.1	D	900	-	50	0.14	EEHZC1E470P	EEHZC1E470V	1000
	56	6.3	5.8	6.1	D	900	-	50	0.14	EEHZC1E560P	EEHZC1E560V	1000
	68	6.3	7.7	8.0	D8	1400	-	30	0.14	EEHZC1E680XP	EEHZC1E680XV	900
	100	6.3	7.7	8.0	D8	1400	-	30	0.14	EEHZC1E101XP	EEHZC1E101XV	900
	150	8.0	10.2	10.5	F	1600	1900	27	0.14	EEHZC1E151P	EEHZC1E151V	500
	220	8.0	10.2	10.5	F	1600	1900	27	0.14	EEHZC1E221P	EEHZC1E221V	500
	330	10.0	10.2	10.5	G	2000	2900	20	0.14	EEHZC1E331P	EEHZC1E331V	500
35	10	5.0	5.8	-	C	550	-	100	0.12	EEHZC1V100R	-	1000
	22	5.0	5.8	-	C	550	-	100	0.12	EEHZC1V220R	-	1000
	33	6.3	5.8	6.1	D	900	-	60	0.12	EEHZC1V330P	EEHZC1V330V	1000
	47	6.3	5.8	6.1	D	900	-	60	0.12	EEHZC1V470P	EEHZC1V470V	1000
	68	6.3	7.7	8.0	D8	1400	-	35	0.12	EEHZC1V680XP	EEHZC1V680XV	900
	100	8.0	10.2	10.5	F	1600	1900	27	0.12	EEHZC1V101P	EEHZC1V101V	500
	150	8.0	10.2	10.5	F	1600	1900	27	0.12	EEHZC1V151P	EEHZC1V151V	500
	220	10.0	10.2	10.5	G	2000	2800	20	0.12	EEHZC1V221P	EEHZC1V221V	500
	270	10.0	10.2	10.5	G	2000	2800	20	0.12	EEHZC1V271P	EEHZC1V271V	500
50	10	5.0	5.8	-	C	500	-	120	0.10	EEHZC1H100R	-	1000
	22	6.3	5.8	6.1	D	750	-	80	0.10	EEHZC1H220P	EEHZC1H220V	1000
	33	6.3	7.7	8.0	D8	1100	-	40	0.10	EEHZC1H330XP	EEHZC1H330XV	900
	47	8.0	10.2	10.5	F	1250	-	30	0.10	EEHZC1H470P	EEHZC1H470V	500
	68	8.0	10.2	10.5	F	1250	-	30	0.10	EEHZC1H680P	EEHZC1H680V	500
	100	10.0	10.2	10.5	G	1600	-	28	0.10	EEHZC1H101P	EEHZC1H101V	500
	120	10.0	10.2	10.5	G	1600	-	28	0.10	EEHZC1H121P	EEHZC1H121V	500
63	10	6.3	5.8	6.1	D	700	-	120	0.08	EEHZC1J100P	EEHZC1J100V	1000
	22	6.3	7.7	8.0	D8	900	-	80	0.08	EEHZC1J220XP	EEHZC1J220XV	900
	33	8.0	10.2	10.5	F	1100	-	40	0.08	EEHZC1J330P	EEHZC1J330V	500
	47	8.0	10.2	10.5	F	1100	-	40	0.08	EEHZC1J470P	EEHZC1J470V	500
	56	10.0	10.2	10.5	G	1400	-	30	0.08	EEHZC1J560P	EEHZC1J560V	500
	68	10.0	10.2	10.5	G	1400	-	30	0.08	EEHZC1J680P	EEHZC1J680V	500
	82	10.0	10.2	10.5	G	1400	-	30	0.08	EEHZC1J820P	EEHZC1J820V	500
80	22	8.0	10.2	10.5	F	1050	-	45	0.08	EEHZC1K220P	EEHZC1K220V	500
	33	10.0	10.2	10.5	G	1360	-	36	0.08	EEHZC1K330P	EEHZC1K330V	500
	47	10.0	10.2	10.5	G	1360	-	36	0.08	EEHZC1K470P	EEHZC1K470V	500

\*1: Ripple current (100 kHz / +125 °C)

\*2: ESR (100 kHz / +20 °C)

\*3: tan δ (120 Hz / +20 °C)

◆ Please refer to the page of "Reflow profile" and "The taping dimensions".

◆ The dimensions of the vibration-proof products, please refer to the page of the mounting specification.

**Frequency correction factor for ripple current**

Rated capacitance (C)	Frequency (f)	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 (C)	Frequency (f)	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 (C)	Frequency (f)	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 (C)	Frequency (f)	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°C)**

Size code	C	D	D8	F	G
ESR (Ω)	2	1.4	0.8	0.4	0.3

## Surface Mount Type

**ZK** series

High temperature lead-free reflow



**Hybrid**

### Features

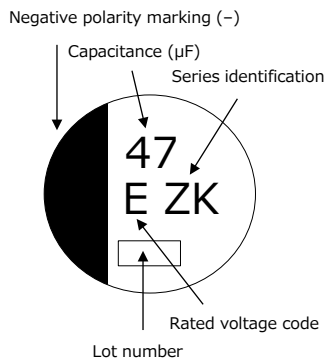
- High capacitance and High ripple current compared with ZC series
- Endurance : 4000 h at 125 °C (High temperature / Long life)
- Low ESR (85 % over, Lower ESR than Current V-TP), Low LC (0.01 CV or 3 μA)
- Equivalent to conductive polymer type Aluminum Electrolytic Capacitor (There are little characteristics change by temperature and frequency)
- Vibration-proof product is available upon request. New lineup of ø6.3 product. (ø6.3, ø8, ø10)
- AEC-Q200 compliant
- RoHS compliant

### Specifications

Size code	C	D	D8	F	G
Category temp. range	-55 °C to +125 °C				
Rated voltage range	25 V to 35 V				
Nominal cap.range	33 μF to 47 μF	56 μF to 82 μF	100 μF to 150 μF	180 μF to 270 μF	330 μF to 470 μF
Capacitance tolerance	±20 % (120 Hz / +20 °C)				
DC 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)	Rated voltage × 1.25 (15 °C to 35 °C)				
Endurance	+125 °C ± 2 °C, 4000 h, apply the rated ripple current without exceeding the rated voltage.				
	Capacitance change	Within ±30% of the initial value			
	Dissipation factor (tan δ)	≤ 200 % of the initial limit			
	ESR	≤ 200 % of the initial limit			
	DC leakage current	Within the initial limit			
ESR after endurance (Ω / 100 kHz)(-40 °C)	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 +125 °C ± 2 °C with no voltage applied and then being stabilized at +20 °C, capacitors shall meet the limits specified in endurance. (With voltage treatment)				
Damp heat (Load)	+85 °C ± 2 °C, 85 % to 90 %RH, 2000 h, rated voltage applied				
	Capacitance change	Within ±30% of the initial value			
	Dissipation factor (tan δ)	≤ 200 % of the initial limit			
	ESR	≤ 200 % of the initial limit			
Resistance to soldering heat	After reflow soldering and then being stabilized at +20 °C, capacitors shall meet the following limits.				
	Capacitance change	Within ±10% of the initial value			
	Dissipation factor (tan δ)	Within the initial limit			
	DC leakage current	Within the initial limit			

### Marking

Example : 25 V 47 μF  
Marking color : BLACK



R. voltage code	Unit : V
E	25
V	35

### Dimensions (not to scale)

**[Standard]**

Unit : mm

Size code	øD	L	A, B	H <sub>max.</sub>	I	W	P	K
C	5.0	5.8±0.3	5.3	6.5	2.2	0.65±0.1	1.5	0.35 <sup>+0.15</sup> <sub>-0.20</sub>
D	6.3	5.8±0.3	6.6	7.8	2.6	0.65±0.1	1.8	0.35 <sup>+0.15</sup> <sub>-0.20</sub>
D8	6.3	7.7±0.3	6.6	7.8	2.6	0.65±0.1	1.8	0.35 <sup>+0.15</sup> <sub>-0.20</sub>
F	8.0	10.2±0.3	8.3	10	3.4	0.90±0.2	3.1	0.70±0.2
G	10.0	10.2±0.3	10.3	12.0	3.5	0.90±0.2	4.6	0.70±0.2

**[Vibration-proof product]**  
< Size code : D, D8 >

Unit : mm

Size code	øD	L	A, B	H <sub>max.</sub>	F	I	W	P	K	R	S	T
D	6.3	6.1±0.3	6.6	7.8	0 to +0.15	2.4	0.65±0.1	2.2	0.35 <sup>+0.15</sup> <sub>-0.20</sub>	1.1±0.2	3.3	1.05±0.2
D8	6.3	8.0±0.3	6.6	7.8	0 to +0.15	2.4	0.65±0.1	2.2	0.35 <sup>+0.15</sup> <sub>-0.20</sub>	1.1±0.2	3.3	1.05±0.2
F	8.0	10.5±0.3	8.3	10.0	0 to +0.15	3.4	1.2±0.2	3.1	0.70±0.2	0.70±0.2	5.3	1.3±0.2
G	10.0	10.5±0.3	10.3	12.0	0 to +0.15	3.5	1.2±0.2	4.6	0.70±0.2	0.70±0.2	6.9	1.3±0.2

## Characteristics list

Endurance : 125 °C 4000 h

Rated voltage (V)	Capacitance (±20 %) (μF)	Case size (mm)			Size code	Specification			Part number		Min. packaging q'ty (pcs)
		øD	L			Ripple current* <sup>1</sup> (mA rms)	ESR* <sup>2</sup> (mΩ)	tan δ* <sup>3</sup>	Standard product	Vibration-proof product	Taping
			Standard	Vibration-proof							
25	47	5.0	5.8	–	C	850	80	0.14	EEHZK1E470R	–	1000
	68	6.3	5.8	6.1	D	1300	50	0.14	EEHZK1E680P	EEHZK1E680V	1000
	82	6.3	5.8	6.1	D	1300	50	0.14	EEHZK1E820P	EEHZK1E820V	1000
	150	6.3	7.7	8.0	D8	1800	30	0.14	EEHZK1E151XP	EEHZK1E151XV	900
	270	8.0	10.2	10.5	F	2000	27	0.14	EEHZK1E271P	EEHZK1E271V	500
	470	10.0	10.2	10.5	G	2800	20	0.14	EEHZK1E471P	EEHZK1E471V	500
35	33	5.0	5.8	–	C	750	100	0.12	EEHZK1V330R	–	1000
	56	6.3	5.8	6.1	D	1200	60	0.12	EEHZK1V560P	EEHZK1V560V	1000
	100	6.3	7.7	8.0	D8	1700	35	0.12	EEHZK1V101XP	EEHZK1V101XV	900
	180	8.0	10.2	10.5	F	2000	27	0.12	EEHZK1V181P	EEHZK1V181V	500
	330	10.0	10.2	10.5	G	2800	20	0.12	EEHZK1V331P	EEHZK1V331V	500

\*1: Ripple current (100 kHz / +125 °C)

\*2: ESR (100 kHz / +20 °C)

\*3: tan δ (120 Hz / +20 °C)

◆ Please refer to the page of "Reflow profile" and "The taping dimensions".

◆ The dimensions of the vibration-proof products, please refer to the page of the mounting specification.

## Frequency correction factor for ripple current

Rated capacitance (C)	Frequency (f)	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	0.15	0.20	0.25	0.35
47 μF ≤ C < 100 μF		0.15	0.25	0.30	0.40
100 μF ≤ C		0.15	0.25	0.30	0.40
Rated capacitance (C)	Frequency (f)	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	0.45	0.55	0.60	0.65
47 μF ≤ C < 100 μF		0.50	0.60	0.65	0.70
100 μF ≤ C		0.50	0.60	0.65	0.70
Rated capacitance (C)	Frequency (f)	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	0.70	0.75	0.75	0.75
47 μF ≤ C < 100 μF		0.75	0.75	0.80	0.80
100 μF ≤ C		0.75	0.80	0.85	0.85
Rated capacitance (C)	Frequency (f)	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 < 100 μF		0.85	0.90	1.00	1.00
100 μF ≤ C		0.85	0.90	1.00	1.00

## Surface Mount Type

**ZKU** series

High temperature lead-free reflow



**Hybrid**

### Features

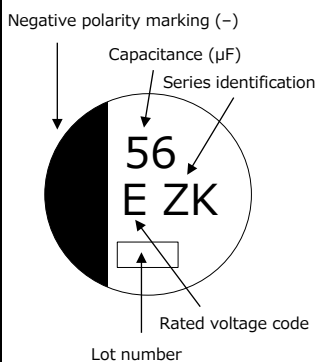
- Endurance : 4000 h at 125 °C (High temperature / Long life)
- Large capacitance compared with ZK series
- Low ESR (85 % over, Lower ESR than Current V-TP), Low LC (0.01 CV or 3 μA)
- Equivalent to conductive polymer type Aluminum Electrolytic Capacitor  
(There are little characteristics change by temperature and frequency)
- Vibration-proof product is available upon request. (ø6.3, ø8, ø10)
- AEC-Q200 compliant
- RoHS compliant

### Specifications

Size code	C	D	D8	F	G
Category temp. range	-55 °C to +125 °C				
Rated voltage range	25 V to 35 V				
Nominal cap.range	39 μF to 56 μF	68 μF to 100 μF	120 μF to 180 μF	220 μF to 330 μF	390 μF to 560 μF
Capacitance tolerance	±20 % (120 Hz / +20 °C)				
DC 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)	Rated voltage × 1.25 (15 °C to 35 °C)				
Endurance	+125 °C ± 2 °C 4000 h, apply the rated ripple current without exceeding the rated voltage.				
	Capacitance change	Within ±30% of the initial value			
	Dissipation factor (tan δ)	≤ 200 % of the initial limit			
	ESR	≤ 200 % of the initial limit			
	DC leakage current	Within the initial limit			
ESR after endurance (Ω / 100 kHz)(-40 °C)	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 +125 °C ± 2 °C with no voltage applied and then being stabilized at +20 °C, capacitors shall meet the limits specified in endurance. (With voltage treatment)				
Damp heat (Load)	+85 °C ± 2 °C, 85 % to 90 %RH, 2000 h, rated voltage applied				
	Capacitance change	Within ±30% of the initial value			
	Dissipation factor (tan δ)	≤ 200 % of the initial limit			
	ESR	≤ 200 % of the initial limit			
	DC leakage current	Within the initial limit			

### Marking

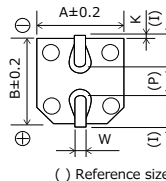
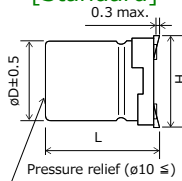
Example : 25 V 56 μF  
Marking color : BLACK



R. voltage code	Unit : V
E	25
V	35

### Dimensions (not to scale)

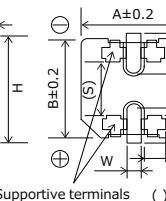
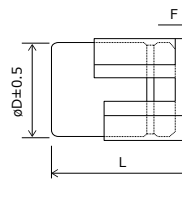
[Standard]



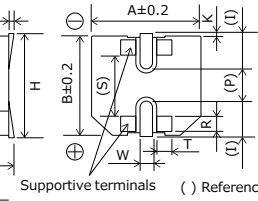
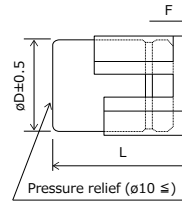
Size code	øD	L	A, B	H max.	I	W	P	K
C	5.0	5.8±0.3	5.3	6.5	2.2	0.65±0.1	1.5	0.35 <sup>+0.15</sup> <sub>-0.20</sub>
D	6.3	5.8±0.3	6.6	7.8	2.6	0.65±0.1	1.8	0.35 <sup>+0.15</sup> <sub>-0.20</sub>
D8	6.3	7.7±0.3	6.6	7.8	2.6	0.65±0.1	1.8	0.35 <sup>+0.15</sup> <sub>-0.20</sub>
F	8.0	10.2±0.3	8.3	10	3.4	0.90±0.2	3.1	0.70±0.2
G	10.0	10.2±0.3	10.3	12.0	3.5	0.90±0.2	4.6	0.70±0.2

[Vibration-proof product]

< Size code : D, D8 >



< Size code : F, G >



Size code	øD	L	A, B	H max.	F	I	W	P	K	R	S	T
D	6.3	6.1±0.3	6.6	7.8	0 to +0.15	2.4	0.65±0.1	2.2	0.35 <sup>+0.15</sup> <sub>-0.20</sub>	1.1±0.2	3.3	1.05±0.2
D8	6.3	8.0±0.3	6.6	7.8	0 to +0.15	2.4	0.65±0.1	2.2	0.35 <sup>+0.15</sup> <sub>-0.20</sub>	1.1±0.2	3.3	1.05±0.2
F	8.0	10.5±0.3	8.3	10.0	0 to +0.15	3.4	1.2±0.2	3.1	0.70±0.2	0.70±0.2	5.3	1.3±0.2
G	10.0	10.5±0.3	10.3	12.0	0 to +0.15	3.5	1.2±0.2	4.6	0.70±0.2	0.70±0.2	6.9	1.3±0.2

## Characteristics list

Endurance : 125 °C 4000 h

Rated voltage (V)	Capacitance (±20 %) (μF)	Case size (mm)			Size code	Specification			Part number		Min. packaging q'ty (pcs)
		øD	L			Ripple current* <sup>1</sup> (mA rms)	ESR* <sup>2</sup> (mΩ)	tan δ* <sup>3</sup>	Standard product	Vibration-proof product	Taping
			Standard	Vibration-proof							
25	56	5	5.8	-	C	850	80	0.14	EEHZK1E560UR	-	1000
	100	6.3	5.8	6.1	D	1300	50	0.14	EEHZK1E101UP	EEHZK1E101UV	1000
	180	6.3	7.7	8.0	D8	1800	30	0.14	EEHZKE181XUP	EEHZKE181XUV	900
	330	8	10.2	10.5	F	2000	27	0.14	EEHZK1E331UP	EEHZK1E331UV	500
	560	10	10.2	10.5	G	2800	20	0.14	EEHZK1E561UP	EEHZK1E561UV	500
35	39	5	5.8	-	C	750	100	0.12	EEHZK1V390UR	-	1000
	68	6.3	5.8	6.1	D	1200	60	0.12	EEHZK1V680UP	EEHZK1V680UV	1000
	120	6.3	7.7	8.0	D8	1700	35	0.12	EEHZKV121XUP	EEHZKV121XUV	900
	220	8	10.2	10.5	F	2000	27	0.12	EEHZK1V221UP	EEHZK1V221UV	500
	390	10	10.2	10.5	G	2800	20	0.12	EEHZK1V391UP	EEHZK1V391UV	500

\*1: Ripple current (100 kHz / +125 °C)

\*2: ESR (100 kHz / +20 °C)

\*3: tan δ (120 Hz / +20 °C)

◆ Please refer to the page of "Reflow profile" and "The taping dimensions".

◆ The dimensions of the vibration-proof products, please refer to the page of the mounting specification.

## Frequency correction factor for ripple current

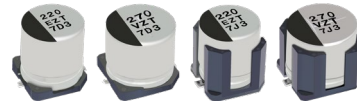
Rated capacitance (C)	Frequency(f)	100 Hz ≤ f < 200 Hz	200 Hz ≤ f < 300 Hz	300 Hz ≤ f < 500 Hz	500 Hz ≤ f < 1 kHz
C < 47 μF	Correction factor	0.15	0.20	0.25	0.35
47 μF ≤ C < 100 μF		0.15	0.25	0.30	0.40
100 μF ≤ C		0.15	0.25	0.30	0.40
Rated capacitance (C)	Frequency(f)	1 kHz ≤ f < 2 kHz	2 kHz ≤ f < 3 kHz	3 kHz ≤ f < 5 kHz	5 kHz ≤ f < 10 kHz
C < 47 μF	Correction factor	0.45	0.55	0.60	0.65
47 μF ≤ C < 100 μF		0.50	0.60	0.65	0.70
100 μF ≤ C		0.50	0.60	0.65	0.70
Rated capacitance (C)	Frequency(f)	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	0.70	0.75	0.75	0.75
47 μF ≤ C < 100 μF		0.75	0.75	0.80	0.80
100 μF ≤ C		0.75	0.80	0.85	0.85
Rated capacitance (C)	Frequency(f)	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 < 100 μF		0.85	0.90	1.00	1.00
100 μF ≤ C		0.85	0.90	1.00	1.00



## Surface Mount Type

ZT series

High temperature lead-free reflow



Hybrid

### Features

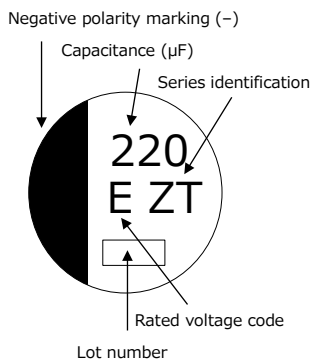
- Endurance: 4000 h at 125 °C
- Higher ripple current (75 % to 118 % higher than ZC series)
- Vibration-proof product is available upon request.
- AEC-Q200 compliant
- RoHS compliant

### Specifications

Size code	F	G
Category temp. range	-55 °C to +125 °C	
Rated voltage range	25 V to 63 V	
Nominal cap. range	33 µF to 220 µF	56 µF to 330 µF
Capacitance tolerance	±20 % (120 Hz / +20 °C)	
DC leakage current	I ≤ 0.01 CV (µA) After 2 minutes	
Dissipation factor (tan δ)	Please see the attached characteristics list	
Surge voltage (V)	Rated voltage × 1.25 (15 °C to 35 °C)	
Endurance	+125 °C ± 2 °C, 4000 h, apply the rated ripple current without exceeding the rated voltage	
	Capacitance change	Within ±30% of the initial value
	Dissipation factor (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 °C)	Size code	
	F	G
	0.4	0.3
Shelf life	After storage for 1000 hours at +125 °C ± 2 °C with no voltage applied and then being stabilized at +20 °C, capacitors shall meet the limits specified in endurance. (With voltage treatment)	
Damp heat (Load)	85 °C ± 2 °C, 85 % to 90 %RH, 2000 h, rated voltage applied	
	Capacitance change	Within ±30% of the initial value
	Dissipation factor (tan δ)	≤ 200 % of the initial limit
	E.S.R.	≤ 200 % of the initial limit
Resistance to soldering heat	After reflow soldering and then being stabilized at +20 °C, capacitors shall meet the following limits.	
	Capacitance change	Within ±10% of the initial value
	Dissipation factor (tan δ)	Within the initial limit
DC leakage current	Within the initial limit	

### Marking

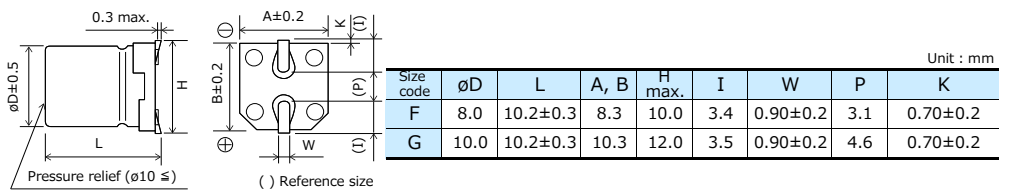
Example : 25 V 220 µF  
Marking color : BLACK



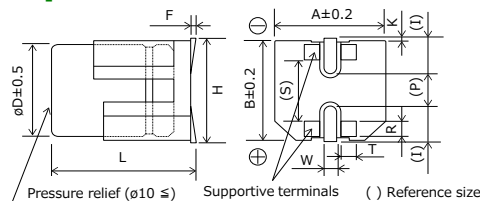
R. voltage code	Unit : V
E	25
V	35
H	50
J	63

### Dimensions (not to scale)

#### [Standard]



#### [Vibration-proof product]



## Characteristics list

Endurance : 125 °C 4000 h

Rated voltage (V)	Capacitance (±20 %) (μF)	Case size (mm)			Size code	Specification			Part number		Min. packaging q'ty (pcs)
		øD	L			Ripple current* <sup>1</sup> (mA rms)	ESR* <sup>2</sup> (mΩ)	tan δ* <sup>3</sup>	Standard product	Vibration-proof product	Taping
			Standard	Vibration-proof							
25	220	8.0	10.2	10.5	F	2900	22	0.14	EEHZT1E221P	EEHZT1E221V	500
	330	10.0	10.2	10.5	G	3500	16	0.14	EEHZT1E331P	EEHZT1E331V	500
35	150	8.0	10.2	10.5	F	2900	22	0.12	EEHZT1V151P	EEHZT1V151V	500
	270	10.0	10.2	10.5	G	3500	16	0.12	EEHZT1V271P	EEHZT1V271V	500
50	68	8.0	10.2	10.5	F	2700	25	0.10	EEHZT1H680P	EEHZT1H680V	500
	100	10.0	10.2	10.5	G	2900	23	0.10	EEHZT1H101P	EEHZT1H101V	500
	120	10.0	10.2	10.5	G	2900	23	0.10	EEHZT1H121P	EEHZT1H121V	500
63	33	8.0	10.2	10.5	F	2400	32	0.08	EEHZT1J330P	EEHZT1J330V	500
	47	8.0	10.2	10.5	F	2400	32	0.08	EEHZT1J470P	EEHZT1J470V	500
	56	10.0	10.2	10.5	G	2800	25	0.08	EEHZT1J560P	EEHZT1J560V	500
	68	10.0	10.2	10.5	G	2800	25	0.08	EEHZT1J680P	EEHZT1J680V	500
	82	10.0	10.2	10.5	G	2800	25	0.08	EEHZT1J820P	EEHZT1J820V	500

\*1: Ripple current (100 kHz / +125 °C)

\*2: ESR (100 kHz / +20 °C)

\*3: tan δ (120 Hz / +20 °C)

◆ Please refer to the page of "Reflow profile" and "The taping dimensions".

## Frequency correction factor for ripple current

Rated capacitance (C)	Frequency (f)	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 (C)	Frequency (f)	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 (C)	Frequency (f)	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 (C)	Frequency (f)	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

**Surface Mount Type**

**ZS** series

**High temperature lead-free reflow**



**Hybrid**

**Features**

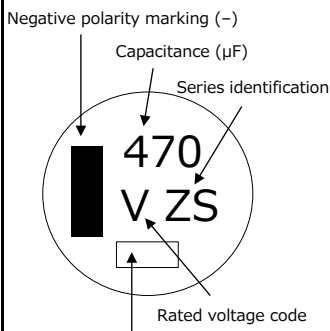
- Endurance: 4000 h at 135 °C
- High ripple current and High capacitance
- High-withstand voltage (to 63 V), Low leakage current (0.01 CV or 3 μF)
- Vibration-proof product is available upon request.
- AEC-Q200 compliant
- RoHS compliant

**Specifications**

Size code	G12	G16
Category temp. range	-55 °C to +135 °C	
Rated voltage range	25 V to 63 V	
Nominal cap.range	100 μF to 470 μF	150 μF to 560 μF
Capacitance tolerance	±20 % (120 Hz / +20 °C)	
DC 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)	Rated voltage × 1.25 (15 °C to 35 °C)	
Endurance 1	+125 °C ± 2 °C, 4000 h, apply the rated ripple current without exceeding the rated voltage.	
	Capacitance change	Within ±30% of the initial value
	Dissipation factor (tan δ)	≤ 200 % of the initial limit
	E.S.R.	≤ 200 % of the initial limit
Endurance 2	+135 °C ± 2 °C, 4000 h, apply the rated ripple current without exceeding the rated voltage.	
	Capacitance change	Within ±30% of the initial value
	Dissipation factor (tan δ)	≤ 200 % of the initial limit
	E.S.R.	≤ 200 % of the initial limit
Shelf life	After storage for 1000 hours at +135 °C ± 2 °C with no voltage applied and then being stabilized at +20°C, capacitors shall meet the limits specified in endurance. (With voltage treatment)	
	+85 °C ± 2 °C, 85 % to 90 %RH, 2000 h, rated voltage applied.	
Damp heat (Load)	+85 °C ± 2 °C, 85 % to 90 %RH, 2000 h, rated voltage applied.	
	Capacitance change	Within ±30% of the initial value
	Dissipation factor (tan δ)	≤ 200 % of the initial limit
	E.S.R.	≤ 200 % of the initial limit
Resistance to soldering heat	After reflow soldering and then being stabilized at +20°C, capacitors shall meet the following limits.	
	Capacitance change	Within ±10% of the initial value
	Dissipation factor (tan δ)	Within the initial limit
	DC leakage current	Within the initial limit

**Marking**

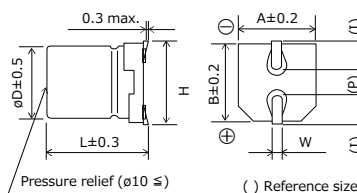
Example : 35 V 470 μF  
Marking color : BLACK



R. voltage code	Unit : V
E	25
V	35
H	50
J	63

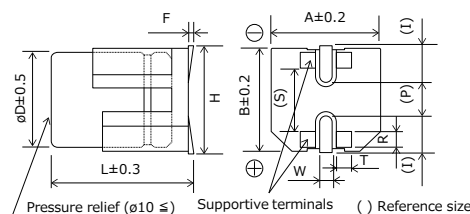
**Dimensions (not to scale)**

**[Standard]**



Size code	øD	L	A, B	H	I	W	P
G12	10.0	12.5	10.3	11.0±0.2	3.2	1.2±0.2	4.6
G16	10.0	16.5	10.3	11.0±0.2	3.2	1.2±0.2	4.6

**[Vibration-proof product]**



Size code	øD	L	A, B	H	F	I	W	P	R	S	T
G12	10.0	12.8	10.3	11.0±0.2	0 to +0.15	3.2	1.2±0.2	4.6	0.70±0.2	6.9	1.3±0.2
G16	10.0	16.8	10.3	11.0±0.2	0 to +0.15	3.2	1.2±0.2	4.6	0.70±0.2	6.9	1.3±0.2

## Characteristics list

Endurance 1 : 125 °C 4000 h

Endurance 2 : 135 °C 4000 h

Rated voltage (V)	Capacitance (±20 %) (μF)	Case size (mm)			Size code	Specification				Part number		Min. packaging q'ty (pcs)
		øD	L			Ripple current *1 (mA rms)	ESR *2 (mΩ)	tan δ *3	Standard product	Vibration-proof product		
			Standard	Vibration-proof							Endurance 1 (+125°C)	Endurance 2 (+135°C)
25	470	10.0	12.5	12.8	G12	3500	2500	14	0.14	EEHVS1E471P	EEHVS1E471V	400
	560	10.0	16.5	16.8	G16	4000	2900	11	0.14	EEHVS1E561P	EEHVS1E561V	250
35	330	10.0	12.5	12.8	G12	3500	2500	14	0.12	EEHVS1V331P	EEHVS1V331V	400
	470	10.0	16.5	16.8	G16	4000	2900	11	0.12	EEHVS1V471P	EEHVS1V471V	250
50	150	10.0	12.5	12.8	G12	3200	2250	17	0.10	EEHVS1H151P	EEHVS1H151V	400
	220	10.0	16.5	16.8	G16	3700	2600	13	0.10	EEHVS1H221P	EEHVS1H221V	250
63	100	10.0	12.5	12.8	G12	3000	2100	19	0.08	EEHVS1J101P	EEHVS1J101V	400
	150	10.0	16.5	16.8	G16	3500	2400	15	0.08	EEHVS1J151P	EEHVS1J151V	250

\*1: Ripple current (100 kHz / +125 °C or +135 °C)

\*2: ESR (100 kHz / +20 °C)

\*3: tan δ (120 Hz / +20 °C)

◆ Please refer to the page of "Reflow profile" and "The taping dimensions".

## Frequency correction factor for ripple current

Rated capacitance (C)	Frequency (f)	100 Hz ≤ f < 200 Hz	200 Hz ≤ f < 300 Hz	300 Hz ≤ f < 500 Hz	500 Hz ≤ f < 1 kHz
100 μF ≤ C < 150 μF	Correction	0.15	0.20	0.25	0.30
	factor	0.15	0.25	0.25	0.30
150 μF ≤ C					
Rated capacitance (C)	Frequency (f)	1 kHz ≤ f < 2 kHz	2 kHz ≤ f < 3 kHz	3 kHz ≤ f < 5 kHz	5 kHz ≤ f < 10 kHz
100 μF ≤ C < 150 μF	Correction	0.40	0.45	0.55	0.60
	factor	0.45	0.50	0.60	0.65
150 μF ≤ C					
Rated capacitance (C)	Frequency (f)	10 kHz ≤ f < 15 kHz	15 kHz ≤ f < 20 kHz	20 kHz ≤ f < 30 kHz	30 kHz ≤ f < 40 kHz
100 μF ≤ C < 150 μF	Correction	0.70	0.75	0.80	0.80
	factor	0.75	0.80	0.85	0.85
150 μF ≤ C					
Rated capacitance (C)	Frequency (f)	40 kHz ≤ f < 50 kHz	50 kHz ≤ f < 100 kHz	100 kHz ≤ f < 500 kHz	500 kHz ≤ f
100 μF ≤ C < 150 μF	Correction	0.85	0.90	1.00	1.00
	factor	0.85	0.90	1.00	1.00
150 μF ≤ C					

## Surface Mount Type

**ZSU** series

**High temperature lead-free reflow**



**Hybrid**

### Features

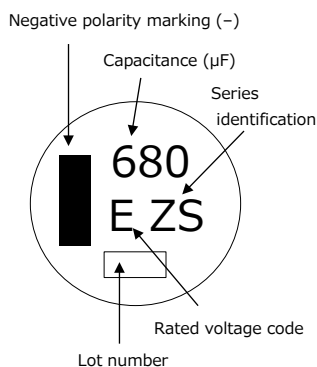
- Endurance: 4000 h at 125 °C
- Large capacitance compared with ZS series
- Vibration-proof product is available upon request.
- AEC-Q200 compliant
- RoHS compliant

### Specifications

Size code	G12		G16	
Category temp. range	-55 °C to +125 °C			
Rated voltage range	25 V to 63 V			
Nominal cap.range	120 µF to 680 µF		180 µF to 1000 µF	
Capacitance tolerance	±20 % (120 Hz / +20 °C)			
DC leakage current	I ≤ 0.01 CV (µA) After 2 minutes			
Dissipation factor (tan δ)	Please see the attached characteristics list			
Surge voltage (V)	Rated voltage × 1.25 (15 °C to 35 °C)			
Endurance	+125 °C ± 2 °C, 4000 h, apply the rated ripple current without exceeding the rated voltage.			
	Capacitance change	Within ±30% of the initial value		
	Dissipation factor (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 °C)	Size code		
	G12	G16		
	0.3	0.3		
Shelf life	After storage for 1000 hours at +125 °C ± 2 °C with no voltage applied and then being stabilized at +20°C, capacitors shall meet the limits specified in endurance. (With voltage treatment)			
Damp heat (Load)	+85 °C ± 2 °C, 85 % to 90 %RH, 2000 h, rated voltage applied.			
	Capacitance change	Within ±30% of the initial value		
	Dissipation factor (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°C, capacitors shall meet the following limits.			
	Capacitance change	Within ±10% of the initial value		
	Dissipation factor (tan δ)	Within the initial limit		
	DC leakage current	Within the initial limit		

### Marking

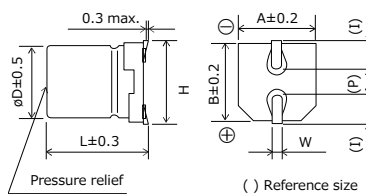
Example : 25 V 680 µF  
Marking color : BLACK



R. voltage code	Unit : V
E	25
V	35
H	50
J	63

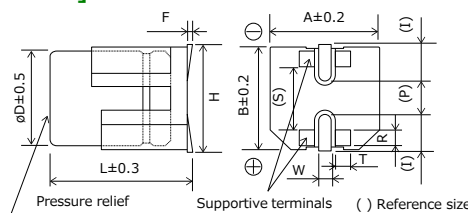
### Dimensions (not to scale)

#### [Standard]



Size code	øD	L	A, B	H	I	W	P
G12	10.0	12.5	10.3	11.0±0.2	3.2	1.2±0.2	4.6
G16	10.0	16.5	10.3	11.0±0.2	3.2	1.2±0.2	4.6

#### [Vibration-proof product]



Size code	øD	L	A, B	H	F	I	W	P	R	S	T
G12	10.0	12.8	10.3	11.0±0.2	0 to +0.15	3.2	1.2±0.2	4.6	0.70±0.2	6.9	1.3±0.2
G16	10.0	16.8	10.3	11.0±0.2	0 to +0.15	3.2	1.2±0.2	4.6	0.70±0.2	6.9	1.3±0.2

**Characteristics list**

Endurance : 125 °C 4000 h

Rated voltage (V)	Capacitance (±20 %) (μF)	Case size (mm)			Size code	Specification			Part number		Min. packaging q'ty (pcs)
		øD	L			Ripple current* <sup>1</sup> (mA rms)	ESR* <sup>2</sup> (mΩ)	tan δ* <sup>3</sup>	Standard product	Vibration-proof product	Taping
			Standard	Vibration-proof							
25	680	10.0	12.5	12.8	G12	3500	14	0.14	EEHVS1E681UP	EEHVS1E681UV	400
	1000	10.0	16.5	16.8	G16	4000	11	0.14	EEHVS1E102UP	EEHVS1E102UV	250
35	470	10.0	12.5	12.8	G12	3500	14	0.12	EEHVS1V471UP	EEHVS1V471UV	400
	680	10.0	16.5	16.8	G16	4000	11	0.12	EEHVS1V681UP	EEHVS1V681UV	250
50	180	10.0	12.5	12.8	G12	3200	17	0.10	EEHVS1H181UP	EEHVS1H181UV	400
	270	10.0	16.5	16.8	G16	3700	13	0.10	EEHVS1H271UP	EEHVS1H271UV	250
63	120	10.0	12.5	12.8	G12	3000	19	0.08	EEHVS1J121UP	EEHVS1J121UV	400
	180	10.0	16.5	16.8	G16	3500	15	0.08	EEHVS1J181UP	EEHVS1J181UV	250

\*1: Ripple current (100 kHz / +125 °C)

\*2: ESR (100 kHz / +20 °C)

\*3: tan δ (120 Hz / +20 °C)

◆ Please refer to the page of "Reflow profile" and "The taping dimensions".

**Frequency correction factor for ripple current**

Rated capacitance (C)	Frequency (f)	100 Hz ≤ f < 120 Hz	120 Hz ≤ f < 200 Hz	200 Hz ≤ f < 300 Hz	300 Hz ≤ f < 500 Hz
120 μF ≤ C	Correction factor	0.15	0.20	0.25	0.30
Rated capacitance (C)	Frequency (f)	500 Hz ≤ f < 1 kHz	1 kHz ≤ f < 2 kHz	2 kHz ≤ f < 3 kHz	3 kHz ≤ f < 5 kHz
120 μF ≤ C	Correction factor	0.40	0.50	0.60	0.65
Rated capacitance (C)	Frequency (f)	5 kHz ≤ f < 10 kHz	10 kHz ≤ f < 15 kHz	15 kHz ≤ f < 20 kHz	20 kHz ≤ f < 30 kHz
120 μF ≤ C	Correction factor	0.70	0.75	0.80	0.85
Rated capacitance (C)	Frequency (f)	30 kHz ≤ f < 50 kHz	50 kHz ≤ f < 100 kHz	100 kHz ≤ f < 500 kHz	500 kHz ≤ f < 1000 kHz
120 μF ≤ C	Correction factor	0.85	0.90	1.00	1.00

## Surface Mount Type

**ZU** series

High temperature lead-free reflow



**Hybrid**

### Features

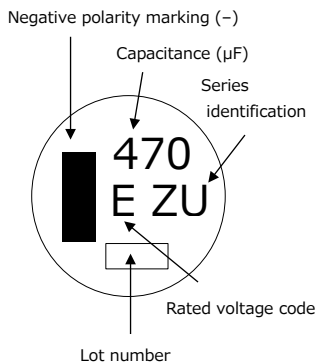
- Endurance: 4000 h at 135 °C
- High ripple current compared with ZS series
- Vibration-proof product is available upon request.
- AEC-Q200 compliant
- RoHS compliant

### Specifications

Size code	G12	G16
Category temp. range	-55 °C to +135 °C	
Rated voltage range	25 V to 63 V	
Nominal cap.range	100 µF to 470 µF	150 µF to 560 µF
Capacitance tolerance	±20 % (120 Hz / +20 °C)	
DC leakage current	I ≤ 0.01 CV (µA) After 2 minutes	
Dissipation factor (tan δ)	Please see the attached characteristics list	
Surge voltage (V)	Rated voltage × 1.25 (15 °C to 35 °C)	
Endurance 1	+125 °C ± 2 °C, 4000 h, apply the rated ripple current without exceeding the rated voltage	
	Capacitance change	Within ±30% of the initial value
	Dissipation factor (tan δ)	≤ 200 % of the initial limit
	E.S.R.	≤ 200 % of the initial limit
Endurance 2	+135 °C ± 2 °C, 4000 h, apply the rated ripple current without exceeding the rated voltage	
	Capacitance change	Within ±30% of the initial value
	Dissipation factor (tan δ)	≤ 200 % of the initial limit
	E.S.R.	≤ 200 % of the initial limit
Shelf life	After storage for 1000 hours at +135 °C ± 2 °C with no voltage applied and then being stabilized at +20 °C, capacitors shall meet the limits specified in endurance 2. (With voltage treatment)	
	85 °C ± 2 °C, 85 % to 90 %RH, 2000 h, rated voltage applied	
Damp heat (Load)	Capacitance change	
	Dissipation factor (tan δ)	
	E.S.R.	
	DC leakage current	
Resistance to soldering heat	After reflow soldering and then being stabilized at +20 °C, capacitors shall meet the following limits.	
	Capacitance change	
	Dissipation factor (tan δ)	
DC leakage current		Within the initial limit

### Marking

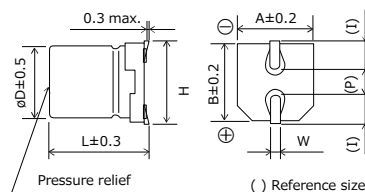
Example : 25 V 470 µF  
Marking color : BLACK



R. voltage code	Unit : V
E	25
V	35
H	50
J	63

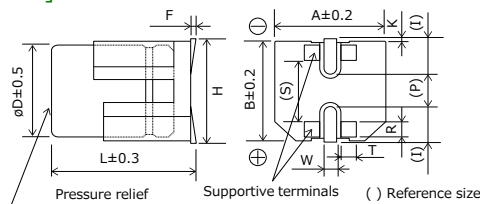
### Dimensions (not to scale)

[Standard]



Size code	øD	L	A, B	H	I	W	P
G12	10.0	12.5	10.3	11.0±0.2	3.2	1.2±0.2	4.6
G16	10.0	16.5	10.3	11.0±0.2	3.2	1.2±0.2	4.6

[Vibration-proof product]



Size code	øD	L	A, B	H	F	I	W	P	R	S	T
G12	10.0	12.8	10.3	11.0±0.2	0 to +0.15	3.2	1.2±0.2	4.6	0.70±0.2	6.9	1.3±0.2
G16	10.0	16.8	10.3	11.0±0.2	0 to +0.15	3.2	1.2±0.2	4.6	0.70±0.2	6.9	1.3±0.2

## Characteristics list

Endurance 1 : 125 °C 4000 h

Endurance 2 : 135 °C 4000 h

Rated voltage (V)	Capacitance (±20 %) (μF)	Case size (mm)			Size code	Specification				Part number		Min. packaging q'ty (pcs)
		øD	L			Ripple current *1 (mA rms)	ESR *2 (mΩ)	tan δ *3	Standard product	Vibration-proof product		
			Standard	Vibration-proof							Endurance 1 (+125°C)	Endurance 2 (+135°C)
25	470	10.0	12.5	12.8	G12	5000	3500	10	0.14	EEHZU1E471P	EEHZU1E471V	400
	560	10.0	16.5	16.8	G16	5800	4000	8	0.14	EEHZU1E561P	EEHZU1E561V	250
35	330	10.0	12.5	12.8	G12	4800	3300	11	0.12	EEHZU1V331P	EEHZU1V331V	400
	470	10.0	16.5	16.8	G16	5500	3800	9	0.12	EEHZU1V471P	EEHZU1V471V	250
50	150	10.0	12.5	12.8	G12	4600	3200	12	0.10	EEHZU1H151P	EEHZU1H151V	400
	220	10.0	16.5	16.8	G16	5200	3600	10	0.10	EEHZU1H221P	EEHZU1H221V	250
63	100	10.0	12.5	12.8	G12	4600	3200	12	0.08	EEHZU1J101P	EEHZU1J101V	400
	150	10.0	16.5	16.8	G16	5200	3600	10	0.08	EEHZU1J151P	EEHZU1J151V	250

\*1: Ripple current (100 kHz / +125 °C or +135°C)

\*2: ESR (100 kHz / +20 °C)

\*3: tan δ (120 Hz / +20 °C)

◆ Please refer to the page of "Reflow profile" and "The taping dimensions".

## Frequency correction factor for ripple current

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

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

Rated capacitance (C)	Frequency (f)	10 kHz ≤ f < 15 kHz	15 kHz ≤ f < 20 kHz	20 kHz ≤ f < 30 kHz	30 kHz ≤ f < 40 kHz
100 μF ≤ C < 150 μF	Correction	0.70	0.75	0.80	0.80
150 μF ≤ C	factor	0.75	0.80	0.85	0.85

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

## After endurance ESR (100 kHz, -40°C)

Size code	G12	G16
ESR (Ω)	0.3	0.3



## Surface Mount Type

**ZE** series

**High temperature lead-free reflow**



**Hybrid**

### Features

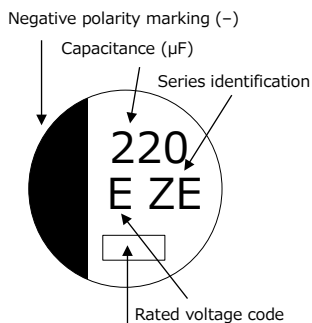
- Endurance: 2000 h at 145 °C (High temperature / Long life)
- Low ESR and high ripple current (85 % over, Lower ESR than current V-TP)
- High-withstand voltage ( to 63 V), Low LC (0.01 CV or 3 μA)
- Equivalent to conductive polymer type aluminum electrolytic capacitor (There are little characteristics change by temperature and frequency)
- Vibration-proof product is available upon request. (ø8 mm and larger)
- AEC-Q200 compliant
- RoHS compliant

### Specifications

Size code	F	G
Category temp. range	-55 °C to +145 °C	
Rated voltage range	25 V to 63 V	
Nominal cap.range	33 μF to 220 μF	56 μF to 330 μF
Capacitance tolerance	±20 % (120 Hz / +20 °C)	
DC 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)	Rated voltage × 1.25 (15 °C to 35 °C)	
Endurance 1	+145 °C ± 2 °C, 2000 h, apply the rated ripple current without exceeding the rated voltage	
	Capacitance change	Within ±30% of the initial value
	Dissipation factor (tan δ)	≤ 200 % of the initial limit
	E.S.R.	≤ 200 % of the initial limit
Endurance 2	+135 °C ± 2 °C, 4000 h, apply the rated ripple current without exceeding the rated voltage	
	Capacitance change	Within ±30% of the initial value
	Dissipation factor (tan δ)	≤ 200 % of the initial limit
	E.S.R.	≤ 200 % of the initial limit
Shelf life	After storage for 1000 hours at +145 °C ± 2 °C with no voltage applied and then being stabilized at +20 °C, capacitors shall meet the limits specified in endurance 1. (With voltage treatment)	
	85 °C ± 2 °C, 85 % to 90 %RH, 2000 h, rated voltage applied	
Damp heat (Load)	Capacitance change	
	Dissipation factor (tan δ)	
	E.S.R.	
	DC leakage current	
Resistance to soldering heat	After reflow soldering and then being stabilized at +20 °C, capacitors shall meet the following limits.	
	Capacitance change	
	Dissipation factor (tan δ)	
	DC leakage current	

### Marking

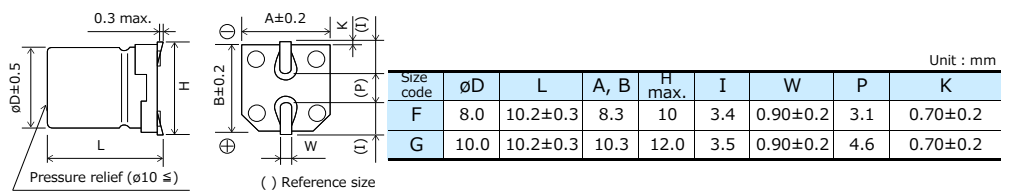
Example : 25 V 220 μF  
Marking color : BLACK



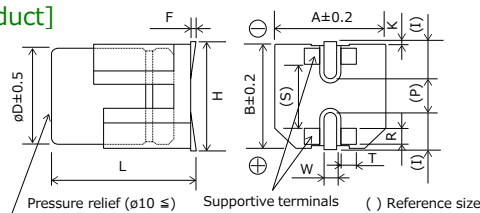
R. voltage code	Unit : V
E	25
V	35
H	50
J	63

### Dimensions (not to scale)

#### [Standard]



#### [Vibration-proof product]



## Characteristics list

Endurance 1 : 145 °C 2000 h

Endurance 2 : 135 °C 4000 h

Rated voltage (V)	Capacitance (±20 %) (μF)	Case size (mm)			Size code	Specification				Part number		Min. packaging q'ty (pcs)
		øD	L			Ripple current *1 (mA rms)	ESR *2 (mΩ)	tan δ *3	Standard product	Vibration-proof product		
			Standard	Vibration-proof							Endurance 1 (+145°C)	Endurance 2 (+135°C)
25	220	8.0	10.2	10.5	F	700	1600	27	0.14	EEHZE1E221P	EEHZE1E221V	500
	330	10.0	10.2	10.5	G	900	2000	20	0.14	EEHZE1E331P	EEHZE1E331V	500
35	150	8.0	10.2	10.5	F	700	1600	27	0.12	EEHZE1V151P	EEHZE1V151V	500
	270	10.0	10.2	10.5	G	900	2000	20	0.12	EEHZE1V271P	EEHZE1V271V	500
50	68	8.0	10.2	10.5	F	600	1250	30	0.10	EEHZE1H680P	EEHZE1H680V	500
	100	10.0	10.2	10.5	G	800	1600	28	0.10	EEHZE1H101P	EEHZE1H101V	500
63	33	8.0	10.2	10.5	F	600	1100	40	0.08	EEHZE1J330P	EEHZE1J330V	500
	56	10.0	10.2	10.5	G	800	1400	30	0.08	EEHZE1J560P	EEHZE1J560V	500
	82	10.0	10.2	10.5	G	800	1400	30	0.08	EEHZE1J820P	EEHZE1J820V	500

\*1: Ripple current (100 kHz / +145 °C or +135°C)

\*2: ESR (100 kHz / +20 °C)

\*3: tan δ (120 Hz / +20 °C)

◆ Please refer to the page of "Reflow profile" and "The taping dimensions".

◆ The dimensions of the vibration-proof products, please refer to the page of the mounting specification.

## Frequency correction factor for ripple current

Rated capacitance (C)	Frequency (f)	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 (C)	Frequency (f)	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 (C)	Frequency (f)	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 (C)	Frequency (f)	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°C)

Size code	F	G
ESR (Ω)	0.4	0.3

## Surface Mount Type

ZF series

High temperature lead-free reflow



Hybrid

### Features

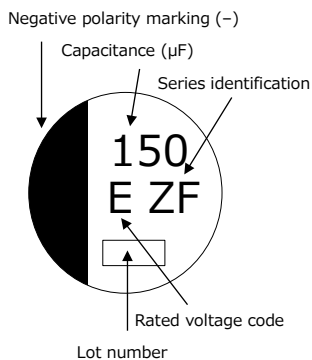
- Endurance : 1000 h at 150 °C (High temperature)
- Low ESR and high ripple current
- High-withstand voltage ( to 63 V), Low LC (0.01 CV or 3 μA)
- Vibration-proof product is available upon request
- AEC-Q200 compliant
- RoHS compliant

### Specifications

Size code	F	G
Category temp. range	-55 °C to +150 °C	
Rated voltage range	25 V to 63 V	
Nominal cap.range	33 μF to 150 μF	56 μF to 270 μF
Capacitance tolerance	±20 % (120 Hz / +20°C)	
DC 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)	Rated voltage × 1.25 (15 °C to 35 °C)	
Endurance	+150 °C ± 2 °C, 1000 h, apply the rated ripple current without exceeding the rated voltage.	
	Capacitance change	Within ±30% of the initial value
	Dissipation factor (tan δ)	≤ 200 % of the initial limit
	ESR	≤ 200 % of the initial limit
	DC leakage current	Within the initial limit
ESR after endurance (Ω / 100 kHz)(-40 °C)	Size code	
	F	G
	0.4	0.3
Shelf life	After storage for 1000 hours at +150 °C ± 2 °C with no voltage applied and then being stabilized at +20 °C, capacitors shall meet the limits specified in endurance. (With voltage treatment)	
Damp heat (Load)	+85 °C ± 2 °C, 85 % to 90 %RH, 2000 h, rated voltage applied	
	Capacitance change	Within ±30% of the initial value
	Dissipation factor (tan δ)	≤ 200 % of the initial limit
	ESR	≤ 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 °C, capacitors shall meet the following limits.	
	Capacitance change	Within ±10% of the initial value
	Dissipation factor (tan δ)	Within the initial limit
DC leakage current	Within the initial limit	

### Marking

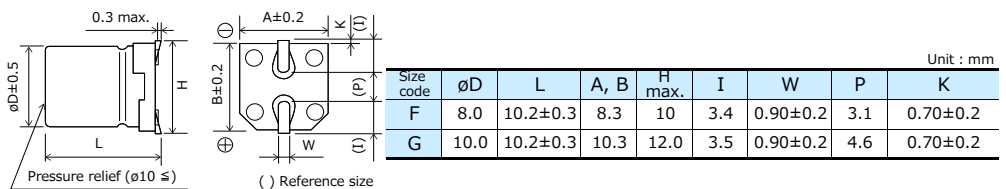
Example : 25 V 150 μF  
Marking color : BLACK



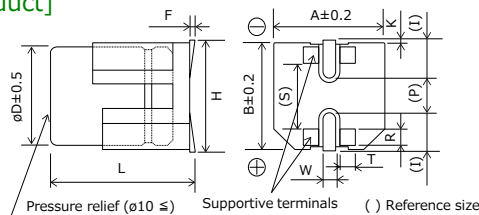
R. voltage code	Unit : V
E	25
V	35
H	50
J	63

### Dimensions (not to scale)

[Standard]



[Vibration-proof product]



**Characteristics list**

Endurance : 150 °C 1000 h

Rated voltage (V)	Capacitance (±20 %) (μF)	Case size (mm)			Size code	Specification			Part number		Min. packaging q'ty (pcs)
		øD	L			Ripple current* <sup>1</sup> (mA rms)	ESR* <sup>2</sup> (mΩ)	tan δ* <sup>3</sup>	Standard product	Vibration-proof product	Taping
			Standard	Vibration-proof							
25	150	8.0	10.2	10.5	F	800	27	0.14	EEHZF1E151P	EEHZF1E151V	500
	270	10.0	10.2	10.5	G	1000	20	0.14	EEHZF1E271P	EEHZF1E271V	500
35	100	8.0	10.2	10.5	F	770	30	0.12	EEHZF1V101P	EEHZF1V101V	500
	150	10.0	10.2	10.5	G	950	23	0.12	EEHZF1V151P	EEHZF1V151V	500
50	56	8.0	10.2	10.5	F	700	35	0.10	EEHZF1H560P	EEHZF1H560V	500
	100	10.0	10.2	10.5	G	900	28	0.10	EEHZF1H101P	EEHZF1H101V	500
63	33	8.0	10.2	10.5	F	650	40	0.08	EEHZF1J330P	EEHZF1J330V	500
	56	10.0	10.2	10.5	G	840	30	0.08	EEHZF1J560P	EEHZF1J560V	500

\*1: Ripple current (100 kHz / +150 °C)

\*2: ESR (100 kHz / +20 °C)

\*3: tan δ (120 Hz / +20 °C)

◆ Please refer to the page of "Reflow profile" and "The taping dimensions".

**Frequency correction factor for ripple current**

Rated capacitance (C)	Frequency (f)	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 (C)	Frequency (f)	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 (C)	Frequency (f)	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 (C)	Frequency (f)	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

## Radial Lead Type

ZA-A series



**Hybrid**

### Features

- Endurance : 10000 h at 105 °C (105 °C standard product)
- Taping products for automatic insertion
- AEC-Q200 compliant
- RoHS compliant

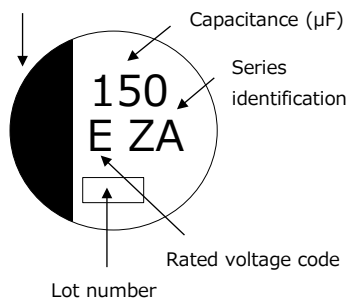
### Specifications

Size code	F		G	
Category temp. range	-55 °C to +105 °C			
Rated voltage range	25 V to 80 V			
Nominal cap.range	22 µF to 220 µF		33 µF to 330 µF	
Capacitance tolerance	±20 % (120 Hz / +20°C)			
DC leakage current	I ≤ 0.01 CV (µA) After 2 minutes			
Dissipation factor (tan δ)	Please see the attached characteristics list			
Surge voltage (V)	Rated voltage × 1.25 (15 °C to 35 °C)			
Endurance	+105 °C ± 2 °C, 10000 h, apply the rated ripple current without exceeding the rated voltage.			
	Capacitance change	Within ±30% of the initial value		
	Dissipation factor (tan δ)	≤ 200 % of the initial limit		
	ESR	≤ 200 % of the initial limit		
	DC leakage current	Within the initial limit		
	ESR after endurance (Ω / 100 kHz)(-40 °C)	Size code		
	F	G		
	0.4	0.3		
Shelf life	After storage for 1000 hours at +105 °C ± 2 °C with no voltage applied and then being stabilized at +20 °C, capacitors shall meet the limits specified in endurance. (With voltage treatment)			
Damp heat (Load)	+85 °C ± 2 °C, 85 % to 90 %RH, 2000 h, rated voltage applied			
	Capacitance change	Within ±30% of the initial value		
	Dissipation factor (tan δ)	≤ 200 % of the initial limit		
	ESR	≤ 200 % of the initial limit		
	DC leakage current	Within the initial limit		
Resistance to soldering heat	After flow soldering and then being stabilized at +20 °C, capacitors shall meet the following limits.			
	Capacitance change	Within ±10% of the initial value		
	Dissipation factor (tan δ)	Within the initial limit		
	DC leakage current	Within the initial limit		

### Marking

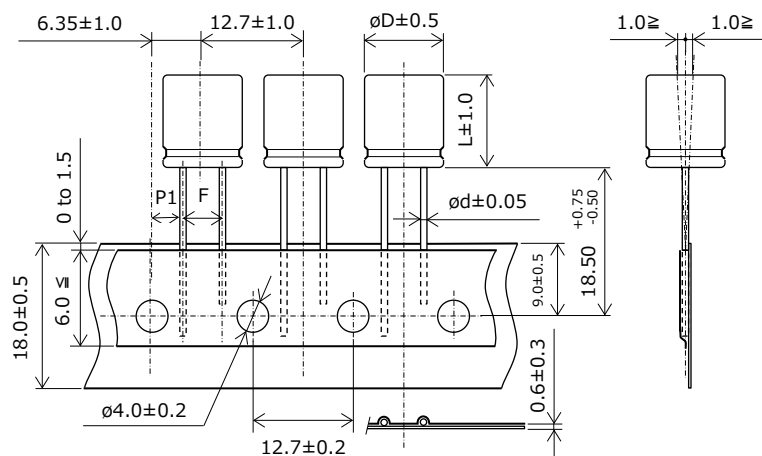
Example : 25 V 150 µF  
Marking color : BLACK

Negative polarity marking (-)



R.voltage code	Unit : V
E	25
V	35
H	50
J	63
K	80

### Shape/taping dimensions



Size code	øD	L	ød	F	P1
F	8.0	9.5	0.6	3.5±0.5	4.60±0.50
G	10.0	9.5	0.6	5.0 <sup>+0.8</sup> <sub>-0.2</sub>	3.85±0.50

Unit : mm

## Characteristics list

Endurance : 105 °C 10000 h

Rated voltage (V)	Capacitance (±20 %) (μF)	Case size (mm)			Size code	Specification			Part number	Min. packaging q'ty (pcs)
		øD	L	ød		Ripple current *1 (mA rms)	ESR *2 (mΩ)	tan δ *3		Taping
25	150	8.0	9.5	0.6	F	2300	27	0.14	EEHAZA1E151B	1000
	220	8.0	9.5	0.6	F	2300	27	0.14	EEHAZA1E221B	1000
	330	10.0	9.5	0.6	G	2500	20	0.14	EEHAZA1E331B	500
35	100	8.0	9.5	0.6	F	2300	27	0.12	EEHAZA1V101B	1000
	150	8.0	9.5	0.6	F	2300	27	0.12	EEHAZA1V151B	1000
	220	10.0	9.5	0.6	G	2500	20	0.12	EEHAZA1V221B	500
50	270	10.0	9.5	0.6	G	2500	20	0.12	EEHAZA1V271B	500
	47	8.0	9.5	0.6	F	1800	30	0.10	EEHAZA1H470B	1000
	68	8.0	9.5	0.6	F	1800	30	0.10	EEHAZA1H680B	1000
63	100	10.0	9.5	0.6	G	2000	28	0.10	EEHAZA1H101B	500
	33	8.0	9.5	0.6	F	1700	40	0.08	EEHAZA1J330B	1000
	47	8.0	9.5	0.6	F	1700	40	0.08	EEHAZA1J470B	1000
80	56	10.0	9.5	0.6	G	1800	30	0.08	EEHAZA1J560B	500
	68	10.0	9.5	0.6	G	1800	30	0.08	EEHAZA1J680B	500
	82	10.0	9.5	0.6	G	1800	30	0.08	EEHAZA1J820B	500
80	22	8.0	9.5	0.6	F	1550	45	0.08	EEHAZA1K220B	1000
	33	10.0	9.5	0.6	G	1700	36	0.08	EEHAZA1K330B	500
	47	10.0	9.5	0.6	G	1700	36	0.08	EEHAZA1K470B	500

\*1: Ripple current (100 kHz / +105 °C)

\*2: ESR (100 kHz / +20 °C)

\*3: tan δ (120 Hz / +20 °C)

◆ Please refer to the page of "Flow soldering profile" and "The taping dimensions".

## Frequency correction factor for ripple current

Rated capacitance (C)	Frequency (f)	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 (C)	Frequency (f)	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 (C)	Frequency (f)	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 (C)	Frequency (f)	40 kHz ≤ f < 50 kHz	50 kHz ≤ f < 100 kHz	100 kHz ≤ f < 500 kHz	500 kHz ≤ f < 1000 kHz
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

## Radial Lead Type

ZC-A series



**Hybrid**

### Features

- Endurance : 4000 h at 125 °C (125 °C standard product)
- Taping products for automatic insertion
- AEC-Q200 compliant
- RoHS compliant

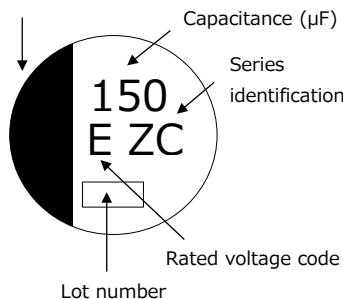
### Specifications

Size code	F	G
Category temp. range	-55 °C to +125 °C	
Rated voltage range	25 V to 80 V	
Nominal cap.range	22 μF to 220 μF	33 μF to 330 μF
Capacitance tolerance	±20 % (120 Hz / +20°C)	
DC leakage current	I ≤ 0.01 CV (μA) After 2 minutes	
Dissipation factor (tan δ)	Please see the attached characteristics list	
Surge voltage (V)	Rated voltage × 1.25 (15 °C to 35 °C)	
Endurance 1	+125 °C ± 2 °C, 4000 h, apply the rated ripple current without exceeding the rated voltage.	
	Capacitance change	Within ±30% of the initial value
	Dissipation factor (tan δ)	≤ 200 % of the initial limit
	ESR	≤ 200 % of the initial limit
Endurance 2	+125 °C ± 2 °C, 3000 h, apply the rated ripple current without exceeding the rated voltage.	
	Capacitance change	Within ±30% of the initial value
	Dissipation factor (tan δ)	≤ 200 % of the initial limit
	ESR	≤ 300 % of the initial limit
Shelf life	After storage for 1000 hours at +125 °C ± 2 °C with no voltage applied and then being stabilized at +20 °C, capacitors shall meet the limits specified in endurance 1. (With voltage treatment)	
Damp heat (Load)	+85 °C ± 2 °C, 85 % to 90 %RH, 2000 h, rated voltage applied	
	Capacitance change	Within ±30% of the initial value
	Dissipation factor (tan δ)	≤ 200 % of the initial limit
	ESR	≤ 200 % of the initial limit
Resistance to soldering heat	After flow soldering and then being stabilized at +20 °C, capacitors shall meet the following limits.	
	Capacitance change	Within ±10% of the initial value
	Dissipation factor (tan δ)	Within the initial limit
	DC leakage current	Within the initial limit

### Marking

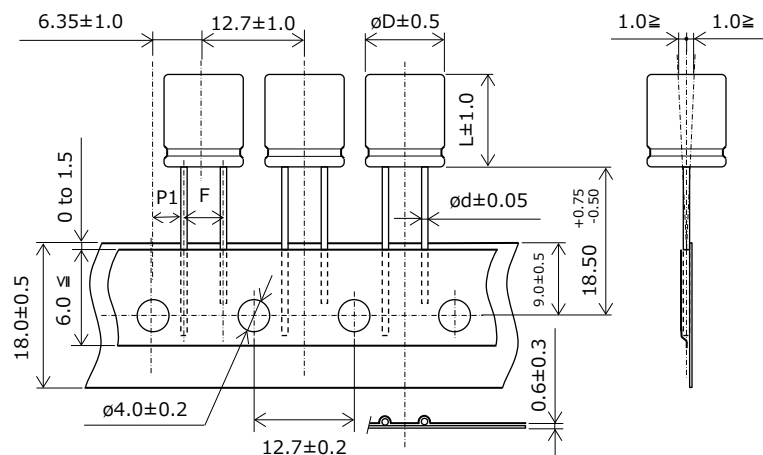
Example : 25 V 150 μF  
Marking color : BLACK

Negative polarity marking (-)



R.voltage code	Unit : V
E	25
V	35
H	50
J	63
K	80

### Shape/taping dimensions



Unit : mm

Size code	øD	L	ød	F	P1
F	8.0	9.5	0.6	3.5±0.5	4.60±0.50
G	10.0	9.5	0.6	5.0 <sup>+0.8</sup> <sub>-0.2</sub>	3.85±0.50

**Characteristics list**

Endurance 1 : 125 °C 4000 h

Endurance 2 : 125 °C 3000 h

Rated voltage (V)	Capacitance (±20 %) (μF)	Case size (mm)			Size code	Specification				Part number	Min. packaging q'ty (pcs)
		øD	L	ød		Ripple current *1 (mA rms)		ESR *2 (mΩ)	tan δ *3		Taping
						Endurance 1	Endurance 2				
25	150	8.0	9.5	0.6	F	1600	1900	27	0.14	EEHAZC1E151B	1000
	220	8.0	9.5	0.6	F	1600	1900	27	0.14	EEHAZC1E221B	1000
	330	10.0	9.5	0.6	G	2000	2900	20	0.14	EEHAZC1E331B	500
35	100	8.0	9.5	0.6	F	1600	1900	27	0.12	EEHAZC1V101B	1000
	150	8.0	9.5	0.6	F	1600	1900	27	0.12	EEHAZC1V151B	1000
	220	10.0	9.5	0.6	G	2000	2800	20	0.12	EEHAZC1V221B	500
50	270	10.0	9.5	0.6	G	2000	2800	20	0.12	EEHAZC1V271B	500
	47	8.0	9.5	0.6	F	1250	-	30	0.10	EEHAZC1H470B	1000
	68	8.0	9.5	0.6	F	1250	-	30	0.10	EEHAZC1H680B	1000
50	100	10.0	9.5	0.6	G	1600	-	28	0.10	EEHAZC1H101B	500
	120	10.0	9.5	0.6	G	1600	-	28	0.10	EEHAZC1H121B	500
	33	8.0	9.5	0.6	F	1100	-	40	0.08	EEHAZC1J330B	1000
63	47	8.0	9.5	0.6	F	1100	-	40	0.08	EEHAZC1J470B	1000
	56	10.0	9.5	0.6	G	1400	-	30	0.08	EEHAZC1J560B	500
	68	10.0	9.5	0.6	G	1400	-	30	0.08	EEHAZC1J680B	500
	82	10.0	9.5	0.6	G	1400	-	30	0.08	EEHAZC1J820B	500
	22	8.0	9.5	0.6	F	1050	-	45	0.08	EEHAZC1K220B	1000
80	33	10.0	9.5	0.6	G	1360	-	36	0.08	EEHAZC1K330B	500
	47	10.0	9.5	0.6	G	1360	-	36	0.08	EEHAZC1K470B	500

\*1: Ripple current (100 kHz / +125 °C)

\*2: ESR (100 kHz / +20 °C)

\*3: tan δ (120 Hz / +20 °C)

◆ Please refer to the page of "Flow soldering profile" and "The taping dimensions".

**Frequency correction factor for ripple current**

Rated capacitance (C)	Frequency (f)	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 (C)	Frequency (f)	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 (C)	Frequency (f)	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 (C)	Frequency (f)	40 kHz ≤ f < 50 kHz	50 kHz ≤ f < 100 kHz	100 kHz ≤ f < 500 kHz	500 kHz ≤ f < 1000 kHz
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 °C)**

Size code	F (ø8 x L9.5)	G (ø10 x L9.5)
ESR (Ω)	0.4	0.3



## Radial Lead Type

ZK-A series



**Hybrid**

### Features

- Endurance : 4000 h at 125 °C (Large capacitance / High ripple current)
- Taping products for automatic insertion
- AEC-Q200 compliant
- RoHS compliant

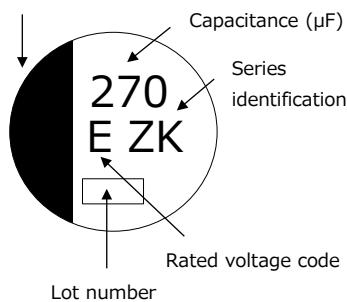
### Specifications

Size code	F	G						
Category temp. range	-55 °C to +125 °C							
Rated voltage range	25 V to 35 V							
Nominal cap.range	180 µF to 270 µF	330 µF to 470 µF						
Capacitance tolerance	±20 % (120 Hz / +20°C)							
DC leakage current	I ≤ 0.01 CV (µA) After 2 minutes							
Dissipation factor (tan δ)	Please see the attached characteristics list							
Surge voltage (V)	Rated voltage × 1.25 (15 °C to 35 °C)							
Endurance	+125 °C ± 2 °C, 4000 h, apply the rated ripple current without exceeding the rated voltage.							
	Capacitance change	Within ±30% of the initial value						
	Dissipation factor (tan δ)	≤ 200 % of the initial limit						
	ESR	≤ 200 % of the initial limit						
	DC leakage current	Within the initial limit						
	ESR after endurance (Ω / 100 kHz)(-40 °C)	<table border="1"> <tr> <th colspan="2">Size code</th> </tr> <tr> <th>F</th> <th>G</th> </tr> <tr> <td>0.4</td> <td>0.3</td> </tr> </table>		Size code		F	G	0.4
Size code								
F	G							
0.4	0.3							
Shelf life	After storage for 1000 hours at +125 °C ± 2 °C with no voltage applied and then being stabilized at +20 °C, capacitors shall meet the limits specified in endurance. (With voltage treatment)							
Damp heat (Load)	+85 °C ± 2 °C, 85 % to 90 %RH, 2000 h, rated voltage applied							
	Capacitance change	Within ±30% of the initial value						
	Dissipation factor (tan δ)	≤ 200 % of the initial limit						
	ESR	≤ 200 % of the initial limit						
	DC leakage current	Within the initial limit						
Resistance to soldering heat	After flow soldering and then being stabilized at +20 °C, capacitors shall meet the following limits.							
	Capacitance change	Within ±10% of the initial value						
	Dissipation factor (tan δ)	Within the initial limit						
	DC leakage current	Within the initial limit						

### Marking

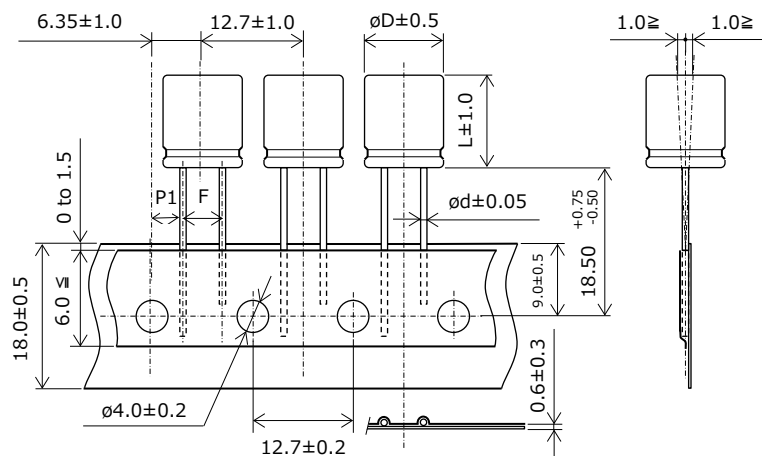
Example : 25 V 270 µF  
Marking color : BLACK

Negative polarity marking (-)



R.voltage code	Unit : V
E	25
V	35

### Shape/taping dimensions



Unit : mm

Size code	øD	L	ød	F	P1
F	8.0	9.5	0.6	3.5±0.5	4.60±0.50
G	10.0	9.5	0.6	5.0 <sup>+0.8</sup> <sub>-0.2</sub>	3.85±0.50

## Characteristics list

Endurance : 125 °C 4000 h

Rated voltage (V)	Capacitance (±20 %) (μF)	Case size (mm)			Size code	Specification			Part number	Min. packaging q'ty (pcs)
		∅D	L	∅d		Ripple current* <sup>1</sup> (mA rms)	ESR* <sup>2</sup> (mΩ)	tan δ* <sup>3</sup>		Taping
25	270	8.0	9.5	0.6	F	2000	27	0.14	EEHAZK1E271B	1000
	470	10.0	9.5	0.6	G	2800	20	0.14	EEHAZK1E471B	500
35	180	8.0	9.5	0.6	F	2000	27	0.12	EEHAZK1V181B	1000
	330	10.0	9.5	0.6	G	2800	20	0.12	EEHAZK1V331B	500

\*1: Ripple current (100 kHz / +125 °C)

\*2: ESR (100 kHz / +20 °C)

\*3: tan δ (120 Hz / +20 °C)

◆ Please refer to the page of "Flow soldering profile" and "The taping dimensions".

## Frequency correction factor for ripple current

Frequency (f)	100 Hz ≤ f < 120 Hz	120 Hz ≤ f < 200 Hz	200 Hz ≤ f < 300 Hz	300 Hz ≤ f < 500 Hz
Correction factor	0.15	0.20	0.25	0.30
Frequency (f)	500 Hz ≤ f < 1 kHz	1 kHz ≤ f < 2 kHz	2 kHz ≤ f < 3 kHz	3 kHz ≤ f < 5 kHz
Correction factor	0.40	0.50	0.60	0.65
Frequency (f)	5 kHz ≤ f < 10 kHz	10 kHz ≤ f < 15 kHz	15 kHz ≤ f < 20 kHz	20 kHz ≤ f < 30 kHz
Correction factor	0.70	0.75	0.80	0.85
Frequency (f)	30 kHz ≤ f < 40 kHz	40 kHz ≤ f < 50 kHz	50 kHz ≤ f < 100 kHz	100 kHz ≤ f < 1000 kHz
Correction factor	0.85	0.85	0.90	1.00

## Radial Lead Type

ZKU-A series



**Hybrid**

### Features

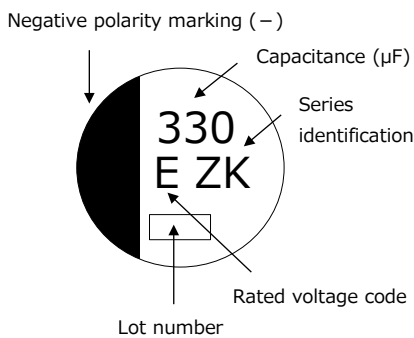
- Endurance : 4000 h at 125 °C (Large capacitance / High ripple current)
- Taping products for automatic insertion
- AEC-Q200 compliant
- RoHS compliant

### Specifications

Size code	F	G
Category temp. range	-55 °C to +125 °C	
Rated voltage range	25 V to 35 V	
Nominal cap.range	220 µF to 330 µF	390 µF to 560 µF
Capacitance tolerance	±20 % (120 Hz / +20°C)	
DC leakage current	I ≤ 0.01 CV (µA) After 2 minutes	
Dissipation factor (tan δ)	Please see the attached characteristics list	
Surge voltage (V)	Rated voltage × 1.25 (15 °C to 35 °C)	
Endurance	+125 °C ± 2 °C, 4000 h, apply the rated ripple current without exceeding the rated voltage.	
	Capacitance change	Within ±30% of the initial value
	Dissipation factor (tan δ)	≤ 200 % of the initial limit
	ESR	≤ 200 % of the initial limit
	DC leakage current	Within the initial limit
ESR after endurance (Ω / 100 kHz)(-40 °C)	Size code	
	F	G
Shelf life	After storage for 1000 hours at +125 °C ± 2 °C with no voltage applied and then being stabilized at +20 °C, capacitors shall meet the limits specified in endurance. (With voltage treatment)	
	+85 °C ± 2 °C, 85 % to 90 %RH, 2000 h, rated voltage applied	
Damp heat (Load)	Capacitance change	Within ±30% of the initial value
	Dissipation factor (tan δ)	≤ 200 % of the initial limit
	ESR	≤ 200 % of the initial limit
	DC leakage current	Within the initial limit
Resistance to soldering heat	After flow soldering and then being stabilized at +20 °C, capacitors shall meet the following limits.	
	Capacitance change	Within ±10% of the initial value
	Dissipation factor (tan δ)	Within the initial limit
	DC leakage current	Within the initial limit

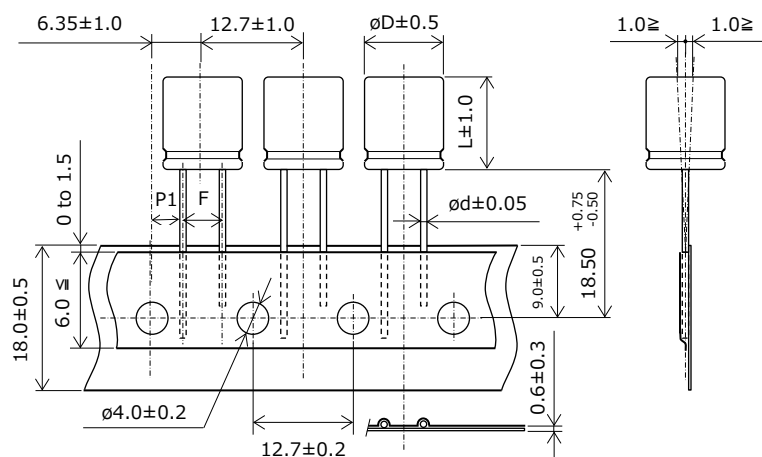
### Marking

Example : 25 V 330 µF  
Marking color : BLACK



R.voltage code	Unit : V
E	25
V	35

### Shape/taping dimensions



Unit : mm

Size code	øD	L	ød	F	P1
F	8.0	9.5	0.6	3.5±0.5	4.60±0.50
G	10.0	9.5	0.6	5.0 <sup>+0.8</sup> <sub>-0.2</sub>	3.85±0.50

**Characteristics list**

Endurance : 125 °C 4000 h

Rated voltage (V)	Capacitance (±20 %) (μF)	Case size (mm)			Size code	Specification			Part number	Min.packaging q'ty (pcs)
		øD	L	ød		Ripple current* <sup>1</sup> (mA rms)	ESR* <sup>2</sup> (mΩ)	tan δ* <sup>3</sup>		Taping
25	330	8.0	9.5	0.6	F	2000	27	0.14	EEHAZKE331UB	1000
	560	10.0	9.5	0.6	G	2800	20	0.14	EEHAZKE561UB	500
35	220	8.0	9.5	0.6	F	2000	27	0.12	EEHAZKV221UB	1000
	390	10.0	9.5	0.6	G	2800	20	0.12	EEHAZKV391UB	500

\*1: Ripple current (100 kHz / +125 °C)

\*2: ESR (100 kHz / +20 °C)

\*3: tan δ (120 Hz / +20 °C)

◆ Please refer to the page of "Flow soldering profile" and "The taping dimensions".

**Frequency correction factor for ripple current**

Frequency (f)	100 Hz ≤ f < 120 Hz	120 Hz ≤ f < 200 Hz	200 Hz ≤ f < 300 Hz	300 Hz ≤ f < 500 Hz
Correction factor	0.15	0.20	0.25	0.30
Frequency (f)	500 Hz ≤ f < 1 kHz	1 kHz ≤ f < 2 kHz	2 kHz ≤ f < 3 kHz	3 kHz ≤ f < 5 kHz
Correction factor	0.40	0.50	0.60	0.65
Frequency (f)	5 kHz ≤ f < 10 kHz	10 kHz ≤ f < 15 kHz	15 kHz ≤ f < 20 kHz	20 kHz ≤ f < 30 kHz
Correction factor	0.70	0.75	0.80	0.85
Frequency (f)	30 kHz ≤ f < 40 kHz	40 kHz ≤ f < 50 kHz	50 kHz ≤ f < 100 kHz	100 kHz ≤ f < 1000 kHz
Correction factor	0.85	0.85	0.90	1.00

## Radial Lead Type

ZT-A series



**Hybrid**

### Features

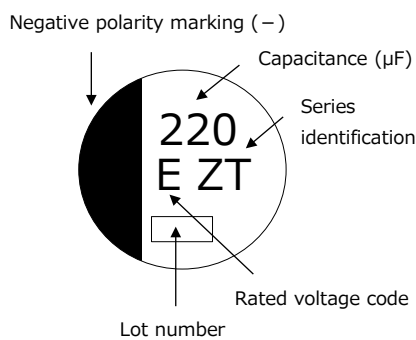
- Endurance : 4000 h at 125 °C (High ripple current)
- Taping products for automatic insertion
- AEC-Q200 compliant
- RoHS compliant

### Specifications

Size code	F	G
Category temp. range	-55 °C to +125 °C	
Rated voltage range	25 V to 63 V	
Nominal cap.range	33 µF to 220 µF	56 µF to 330 µF
Capacitance tolerance	±20 % (120 Hz / +20°C)	
DC leakage current	I ≤ 0.01 CV (µA) After 2 minutes	
Dissipation factor (tan δ)	Please see the attached characteristics list	
Surge voltage (V)	Rated voltage × 1.25 (15 °C to 35 °C)	
Endurance	+125 °C ± 2 °C, 4000 h, apply the rated ripple current without exceeding the rated voltage.	
	Capacitance change	Within ±30% of the initial value
	Dissipation factor (tan δ)	≤ 200 % of the initial limit
	ESR	≤ 200 % of the initial limit
	DC leakage current	Within the initial limit
ESR after endurance (Ω / 100 kHz)(-40 °C)	Size code	
	F	G
	0.4	0.3
Shelf life	After storage for 1000 hours at +125 °C ± 2 °C with no voltage applied and then being stabilized at +20 °C, capacitors shall meet the limits specified in endurance. (With voltage treatment)	
Damp heat (Load)	+85 °C ± 2 °C, 85 % to 90 %RH, 2000 h, rated voltage applied	
	Capacitance change	Within ±30% of the initial value
	Dissipation factor (tan δ)	≤ 200 % of the initial limit
	ESR	≤ 200 % of the initial limit
DC leakage current	Within the initial limit	
Resistance to soldering heat	After flow soldering and then being stabilized at +20 °C, capacitors shall meet the following limits.	
	Capacitance change	Within ±10% of the initial value
	Dissipation factor (tan δ)	Within the initial limit
DC leakage current	Within the initial limit	

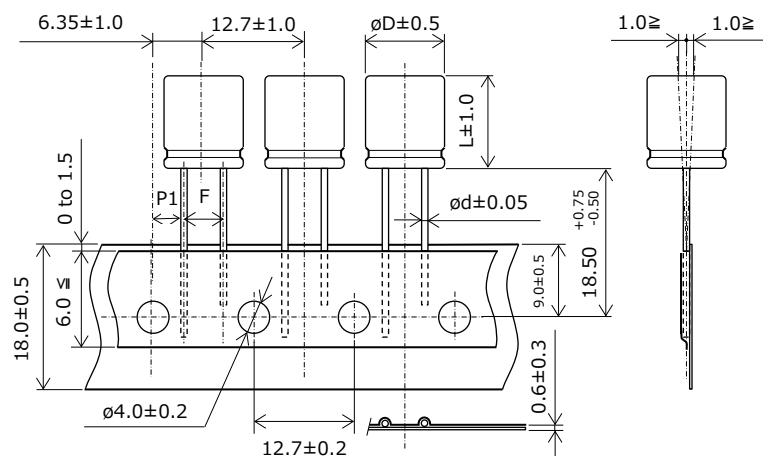
### Marking

Example : 25 V 220 µF  
Marking color : BLACK



R.voltage code	Unit : V
E	25
V	35
H	50
J	63

### Shape/taping dimensions



Size code	øD	L	ød	F	P1
F	8.0	9.5	0.6	3.5±0.5	4.60±0.50
G	10.0	9.5	0.6	5.0 <sup>+0.8</sup> <sub>-0.2</sub>	3.85±0.50

Unit : mm

**Characteristics list**

Endurance : 125 °C 4000 h

Rated voltage (V)	Capacitance (±20 %) (μF)	Case size (mm)			Size code	Specification			Part number	Min. packaging q'ty (pcs)
		øD	L	ød		Ripple current* <sup>1</sup> (mA rms)	ESR* <sup>2</sup> (mΩ)	tan δ* <sup>3</sup>		Taping
25	220	8.0	9.5	0.6	F	2900	22	0.14	EEHAZT1E221B	1000
	330	10.0	9.5	0.6	G	3500	16	0.14	EEHAZT1E331B	500
35	150	8.0	9.5	0.6	F	2900	22	0.12	EEHAZT1V151B	1000
	270	10.0	9.5	0.6	G	3500	16	0.12	EEHAZT1V271B	500
50	68	8.0	9.5	0.6	F	2700	25	0.10	EEHAZT1H680B	1000
	100	10.0	9.5	0.6	G	2900	23	0.10	EEHAZT1H101B	500
	120	10.0	9.5	0.6	G	2900	23	0.10	EEHAZT1H121B	500
63	33	8.0	9.5	0.6	F	2400	32	0.08	EEHAZT1J330B	1000
	47	8.0	9.5	0.6	F	2400	32	0.08	EEHAZT1J470B	1000
	56	10.0	9.5	0.6	G	2800	25	0.08	EEHAZT1J560B	500
	68	10.0	9.5	0.6	G	2800	25	0.08	EEHAZT1J680B	500
	82	10.0	9.5	0.6	G	2800	25	0.08	EEHAZT1J820B	500

\*1: Ripple current (100 kHz / +125 °C)

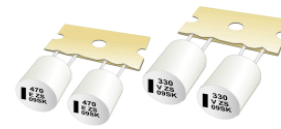
\*2: ESR (100 kHz / +20 °C)

\*3: tan δ (120 Hz / +20 °C)

◆ Please refer to the page of "Flow soldering profile" and "The taping dimensions".

**Frequency correction factor for ripple current**

Rated capacitance (C)	Frequency (f)	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 (C)	Frequency (f)	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 (C)	Frequency (f)	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 (C)	Frequency (f)	40 kHz ≤ f < 50 kHz	50 kHz ≤ f < 100 kHz	100 kHz ≤ f < 500 kHz	500 kHz ≤ f < 1000 kHz
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



**Hybrid**

**Radial Lead Type**

**ZS-A** series

**Features**

- Endurance : 4000 h at 135 °C (Large capacitance / High ripple current / Low ESR)
- Taping products for automatic insertion
- AEC-Q200 compliant
- RoHS compliant

**Specifications**

Size code	G12	G16
Category temp. range	-55 °C to +135 °C	
Rated voltage range	25 V to 63 V	
Nominal cap.range	100 µF to 470 µF	150 µF to 560 µF
Capacitance tolerance	±20 % (120 Hz / +20°C)	
DC leakage current	I ≤ 0.01 CV (µA) After 2 minutes	
Dissipation factor (tan δ)	Please see the attached characteristics list	
Surge voltage (V)	Rated voltage × 1.25 (15 °C to 35 °C)	
Endurance 1	+125 °C ± 2 °C, 4000 h, apply the rated ripple current without exceeding the rated voltage.	
	Capacitance change	Within ±30% of the initial value
	Dissipation factor (tan δ)	≤ 200 % of the initial limit
	ESR	≤ 200 % of the initial limit
Endurance 2	+135 °C ± 2 °C, 4000 h, apply the rated ripple current without exceeding the rated voltage.	
	Capacitance change	Within ±30% of the initial value
	Dissipation factor (tan δ)	≤ 200 % of the initial limit
	ESR	≤ 200 % of the initial limit
Shelf life	After storage for 1000 hours at +135 °C ± 2 °C with no voltage applied and then being stabilized at +20 °C, capacitors shall meet the limits specified in endurance. (With voltage treatment)	
Damp heat (Load)	+85 °C ± 2 °C, 85 % to 90 %RH, 2000 h, rated voltage applied	
	Capacitance change	Within ±30% of the initial value
	Dissipation factor (tan δ)	≤ 200 % of the initial limit
	ESR	≤ 200 % of the initial limit
Resistance to soldering heat	After flow soldering and then being stabilized at +20 °C, capacitors shall meet the following limits.	
	Capacitance change	Within ±10% of the initial value
	Dissipation factor (tan δ)	Within the initial limit
	DC leakage current	Within the initial limit

**Marking**

Example : 25 V 470 µF  
Marking color : BLACK

Negative polarity marking (-)  
Capacitance (µF)  
Series identification  
Rated voltage code  
Lot number

R.voltage code	Unit : V
E	25
V	35
H	50
J	63

**Shape/taping dimensions**

Size code	øD	L	ød	F	P1
G12	10.0	11.7	0.8	5.0 <sup>+0.8</sup> <sub>-0.2</sub>	3.85±0.50
G16	10.0	15.7	0.8	5.0 <sup>+0.8</sup> <sub>-0.2</sub>	3.85±0.50

Unit : mm

**Characteristics list**

Endurance 1 : 125 °C 4000 h

Endurance 2 : 135 °C 4000 h

Rated voltage (V)	Capacitance (±20 %) (μF)	Case size (mm)			Size code	Specification				Part number	Min. packaging q'ty (pcs)
		øD	L	ød		Ripple current* <sup>1</sup> (mA rms)		ESR* <sup>2</sup> (mΩ)	tan δ* <sup>3</sup>		Taping
						Endurance 1 (+125°C)	Endurance 2 (+135°C)				
25	470	10.0	11.7	0.8	G12	3500	2500	14	0.14	EEHAZS1E471B	500
	560	10.0	15.7	0.8	G16	4000	2900	11	0.14	EEHAZS1E561B	500
35	330	10.0	11.7	0.8	G12	3500	2500	14	0.12	EEHAZS1V331B	500
	470	10.0	15.7	0.8	G16	4000	2900	11	0.12	EEHAZS1V471B	500
50	150	10.0	11.7	0.8	G12	3200	2250	17	0.10	EEHAZS1H151B	500
	220	10.0	15.7	0.8	G16	3700	2600	13	0.10	EEHAZS1H221B	500
63	100	10.0	11.7	0.8	G12	3000	2100	19	0.08	EEHAZS1J101B	500
	150	10.0	15.7	0.8	G16	3500	2400	15	0.08	EEHAZS1J151B	500

\*1: Ripple current (100 kHz / +125 °C or +135 °C)

\*2: ESR (100 kHz / +20 °C)

\*3: tan δ (120 Hz / +20 °C)

◆ Please refer to the page of "Flow soldering profile" and "The taping dimensions".

**Frequency correction factor for ripple current**

Rated capacitance (C)	Frequency (f)	100 Hz ≤ f < 200 Hz	200 Hz ≤ f < 300 Hz	300 Hz ≤ f < 500 Hz	500 Hz ≤ f < 1 kHz
100 μF ≤ C < 150 μF	Correction	0.15	0.20	0.25	0.30
	factor	0.15	0.25	0.25	0.30
150 μF ≤ C	factor	0.15	0.25	0.25	0.30
Rated capacitance (C)	Frequency (f)	1 kHz ≤ f < 2 kHz	2 kHz ≤ f < 3 kHz	3 kHz ≤ f < 5 kHz	5 kHz ≤ f < 10 kHz
100 μF ≤ C < 150 μF	Correction	0.40	0.45	0.55	0.60
	factor	0.45	0.50	0.60	0.65
150 μF ≤ C	factor	0.45	0.50	0.60	0.65
Rated capacitance (C)	Frequency (f)	10 kHz ≤ f < 15 kHz	15 kHz ≤ f < 20 kHz	20 kHz ≤ f < 30 kHz	30 kHz ≤ f < 40 kHz
100 μF ≤ C < 150 μF	Correction	0.70	0.75	0.80	0.80
	factor	0.75	0.80	0.85	0.85
150 μF ≤ C	factor	0.75	0.80	0.85	0.85
Rated capacitance (C)	Frequency (f)	40 kHz ≤ f < 50 kHz	50 kHz ≤ f < 100 kHz	100 kHz ≤ f < 500 kHz	500 kHz ≤ f < 1000 kHz
100 μF ≤ C < 150 μF	Correction	0.85	0.90	1.00	1.00
	factor	0.85	0.90	1.00	1.00
150 μF ≤ C	factor	0.85	0.90	1.00	1.00



## Radial Lead Type ZSU-A series



**Hybrid**

### Features

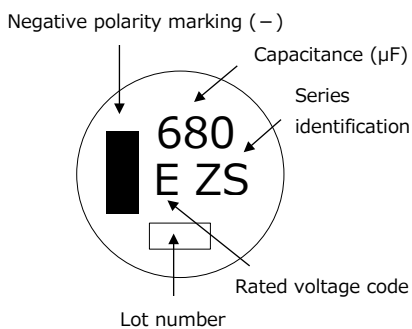
- Endurance : 4000 h at 125 °C
- Large capacitance compared with ZS series
- Taping products for automatic insertion
- AEC-Q200 compliant
- RoHS compliant

### Specifications

Size code	G12	G16
Category temp. range	-55 °C to +125 °C	
Rated voltage range	25 V to 63 V	
Nominal cap.range	120 µF to 680 µF	180 µF to 1000 µF
Capacitance tolerance	±20 % (120 Hz / +20°C)	
DC leakage current	I ≤ 0.01 CV (µA) After 2 minutes	
Dissipation factor (tan δ)	Please see the attached characteristics list	
Surge voltage (V)	Rated voltage × 1.25 (15 °C to 35 °C)	
Endurance	+125 °C ± 2 °C, 4000 h, apply the rated ripple current without exceeding the rated voltage.	
	Capacitance change	Within ±30% of the initial value
	Dissipation factor (tan δ)	≤ 200 % of the initial limit
	ESR	≤ 200 % of the initial limit
	DC leakage current	Within the initial limit
ESR after endurance (Ω / 100 kHz)(-40 °C)	Size code	
	G12	G16
	0.3	0.3
Shelf life	After storage for 1000 hours at +125 °C ± 2 °C with no voltage applied and then being stabilized at +20 °C, capacitors shall meet the limits specified in endurance. (With voltage treatment)	
Damp heat (Load)	+85 °C ± 2 °C, 85 % to 90 %RH, 2000 h, rated voltage applied	
	Capacitance change	Within ±30% of the initial value
	Dissipation factor (tan δ)	≤ 200 % of the initial limit
	ESR	≤ 200 % of the initial limit
Resistance to soldering heat	After flow soldering and then being stabilized at +20 °C, capacitors shall meet the following limits.	
	Capacitance change	Within ±10% of the initial value
	Dissipation factor (tan δ)	Within the initial limit
	DC leakage current	Within the initial limit

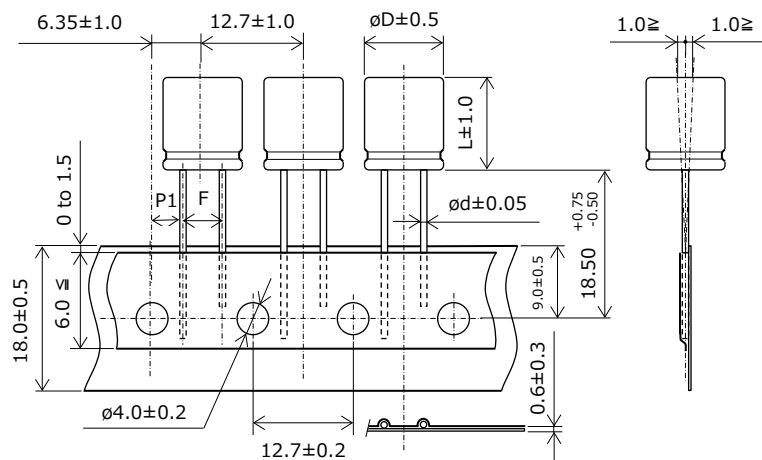
### Marking

Example : 25 V 680 µF  
Marking color : BLACK



R.voltage code	Unit : V
E	25
V	35
H	50
J	63

### Shape/taping dimensions



Size code	øD	L	ød	F	P1
G12	10.0	11.7	0.8	5.0 <sup>+0.8</sup> <sub>-0.2</sub>	3.85±0.50
G16	10.0	15.7	0.8	5.0 <sup>+0.8</sup> <sub>-0.2</sub>	3.85±0.50

**Characteristics list**

Endurance : 125 °C 4000 h

Rated voltage (V)	Capacitance (±20 %) (μF)	Case size (mm)			Size code	Specification			Part number	Min. packaging q'ty (pcs)
		øD	L	ød		Ripple current* <sup>1</sup> (mA rms)	ESR* <sup>2</sup> (mΩ)	tan δ* <sup>3</sup>		Taping
25	680	10.0	11.7	0.8	G12	3500	14	0.14	EEHAZSE681UB	500
	1000	10.0	15.7	0.8	G16	4000	11	0.14	EEHAZSE102UB	500
35	470	10.0	11.7	0.8	G12	3500	14	0.12	EEHAZSV471UB	500
	680	10.0	15.7	0.8	G16	4000	11	0.12	EEHAZSV681UB	500
50	180	10.0	11.7	0.8	G12	3200	17	0.10	EEHAZSH181UB	500
	270	10.0	15.7	0.8	G16	3700	13	0.10	EEHAZSH271UB	500
63	120	10.0	11.7	0.8	G12	3000	19	0.08	EEHAZSJ121UB	500
	180	10.0	15.7	0.8	G16	3500	15	0.08	EEHAZSJ181UB	500

\*1: Ripple current (100 kHz / +125 °C)

\*2: ESR (100 kHz / +20 °C)

\*3: tan δ (120 Hz / +20 °C)

◆ Please refer to the page of "Flow soldering profile" and "The taping dimensions".

**Frequency correction factor for ripple current**

Rated capacitance (C)	Frequency (f)	100 Hz ≤ f < 120 Hz	120 Hz ≤ f < 200 Hz	200 Hz ≤ f < 300 Hz	300 Hz ≤ f < 500 Hz
120 μF ≤ C	Correction factor	0.15	0.20	0.25	0.30
	Frequency (f)	500 Hz ≤ f < 1 kHz	1 kHz ≤ f < 2 kHz	2 kHz ≤ f < 3 kHz	3 kHz ≤ f < 5 kHz
120 μF ≤ C	Correction factor	0.40	0.50	0.60	0.65
	Frequency (f)	5 kHz ≤ f < 10 kHz	10 kHz ≤ f < 15 kHz	15 kHz ≤ f < 20 kHz	20 kHz ≤ f < 30 kHz
120 μF ≤ C	Correction factor	0.70	0.75	0.80	0.85
	Frequency (f)	30 kHz ≤ f < 50 kHz	50 kHz ≤ f < 100 kHz	100 kHz ≤ f < 500 kHz	500 kHz ≤ f < 1000 kHz
120 μF ≤ C	Correction factor	0.85	0.90	1.00	1.00

## Radial Lead Type

**ZE-A** series



**Hybrid**

### Features

- Endurance : 2000 h at 145 °C (High temperature / Long life)
- Taping products for automatic insertion
- AEC-Q200 compliant
- RoHS compliant

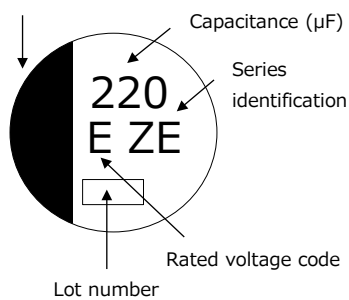
### Specifications

Size code	F	G
Category temp. range	-55 °C to +145 °C	
Rated voltage range	25 V to 63 V	
Nominal cap.range	33 µF to 220 µF	56 µF to 330 µF
Capacitance tolerance	±20 % (120 Hz / +20°C)	
DC leakage current	I ≤ 0.01 CV (µA) After 2 minutes	
Dissipation factor (tan δ)	Please see the attached characteristics list	
Surge voltage (V)	Rated voltage × 1.25 (15 °C to 35 °C)	
Endurance 1	+145 °C ± 2 °C, 2000 h, apply the rated ripple current without exceeding the rated voltage.	
	Capacitance change	Within ±30% of the initial value
	Dissipation factor (tan δ)	≤ 200 % of the initial limit
	ESR	≤ 200 % of the initial limit
Endurance 2	+135 °C ± 2 °C, 4000 h, apply the rated ripple current without exceeding the rated voltage.	
	Capacitance change	Within ±30% of the initial value
	Dissipation factor (tan δ)	≤ 200 % of the initial limit
	ESR	≤ 300 % of the initial limit
Shelf life	After storage for 1000 hours at +145 °C ± 2 °C with no voltage applied and then being stabilized at +20 °C, capacitors shall meet the limits specified in endurance 1. (With voltage treatment)	
	+85 °C ± 2 °C, 85 % to 90 %RH, 2000 h, rated voltage applied	
Damp heat (Load)	Capacitance change	Within ±30% of the initial value
	Dissipation factor (tan δ)	≤ 200 % of the initial limit
	ESR	≤ 200 % of the initial limit
	DC leakage current	Within the initial limit
Resistance to soldering heat	After flow soldering and then being stabilized at +20 °C, capacitors shall meet the following limits.	
	Capacitance change	Within ±10% of the initial value
	Dissipation factor (tan δ)	Within the initial limit
	DC leakage current	Within the initial limit

### Marking

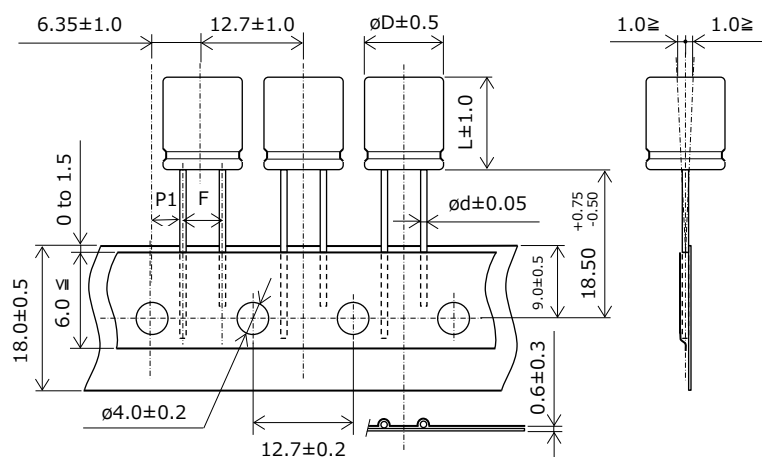
Example : 25 V 220 µF  
Marking color : BLACK

Negative polarity marking (-)



R.voltage code	Unit : V
E	25
V	35
H	50
J	63

### Shape/taping dimensions



Size code	øD	L	ød	F	P1
F	8.0	9.5	0.6	3.5±0.5	4.60±0.50
G	10.0	9.5	0.6	5.0 <sup>+0.8</sup> <sub>-0.2</sub>	3.85±0.50

Unit : mm

**Characteristics list**

Endurance 1 : 145 °C 2000 h

Endurance 2 : 135 °C 4000 h

Rated voltage (V)	Capacitance (±20 %) (μF)	Case size (mm)			Size code	Specification				Part number	Min. packaging q'ty (pcs)
		øD	L	ød		Ripple current *1 (mA rms)		ESR *2 (mΩ)	tan δ *3		Taping
						Endurance 1 (+145 °C)	Endurance 2 (+135 °C)				
25	220	8.0	9.5	0.6	F	700	1600	27	0.14	EEHAZE1E221B	1000
	330	10.0	9.5	0.6	G	900	2000	20	0.14	EEHAZE1E331B	500
35	150	8.0	9.5	0.6	F	700	1600	27	0.12	EEHAZE1V151B	1000
	270	10.0	9.5	0.6	G	900	2000	20	0.12	EEHAZE1V271B	500
50	68	8.0	9.5	0.6	F	600	1250	30	0.10	EEHAZE1H680B	1000
	100	10.0	9.5	0.6	G	800	1600	28	0.10	EEHAZE1H101B	500
63	33	8.0	9.5	0.6	F	600	1100	40	0.08	EEHAZE1J330B	1000
	56	10.0	9.5	0.6	G	800	1400	30	0.08	EEHAZE1J560B	500
	82	10.0	9.5	0.6	G	800	1400	30	0.08	EEHAZE1J820B	500

\*1: Ripple current (100 kHz / +145 °C or +135 °C)

\*2: ESR (100 kHz / +20 °C)

\*3: tan δ (120 Hz / +20 °C)

◆ Please refer to the page of "Flow soldering profile" and "The taping dimensions".

**Frequency correction factor for ripple current**

Rated capacitance (C)	Frequency (f)	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 (C)	Frequency (f)	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 (C)	Frequency (f)	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 (C)	Frequency (f)	40 kHz ≤ f < 50 kHz	50 kHz ≤ f < 100 kHz	100 kHz ≤ f < 500 kHz	500 kHz ≤ f < 1000 kHz
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 °C)**

Size code	F (ø8 x L9.5)	G (ø10 x L9.5)
ESR (Ω)	0.4	0.3

## Radial Lead Type

ZF-A series



**Hybrid**

### Features

- Endurance : 1000 h at 150 °C (High temperature)
- High temperature compared with ZC series
- High-withstand voltage (to 63 V), Low LC (0.01 CV)
- Equivalent to conductive polymer type Aluminum Electrolytic Capacitor (There are little characteristics change by temperature and frequency)
- Compatible with taping products for automatic insertion
- AEC-Q200 compliant
- RoHS compliant

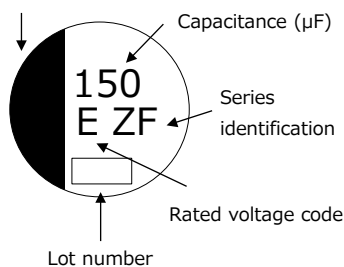
### Specifications

Size code	F	G
Category temp. range	-55 °C to +150 °C	
Rated voltage range	25 V to 63 V	
Nominal cap.range	33 μF to 150 μF	56 μF to 270 μF
Capacitance tolerance	±20 % (120 Hz / +20°C)	
DC leakage current	I ≤ 0.01 CV (μA) After 2 minutes	
Dissipation factor (tan δ)	Please see the attached characteristics list	
Surge voltage (V)	Rated voltage × 1.25 (15 °C to 35 °C)	
Endurance	+150 °C ± 2 °C, 1000 h, apply the rated ripple current without exceeding the rated voltage.	
	Capacitance change	Within ±30% of the initial value
	Dissipation factor (tan δ)	≤ 200 % of the initial limit
	ESR	≤ 200 % of the initial limit
	DC leakage current	Within the initial limit
ESR after endurance (Ω / 100 kHz)(-40 °C)	Size code	
	F	G
	0.4	0.3
Shelf life	After storage for 1000 hours at +150 °C ± 2 °C with no voltage applied and then being stabilized at +20 °C, capacitors shall meet the limits specified in endurance. (With voltage treatment)	
Damp heat (Load)	+85 °C ± 2 °C, 85 % to 90 %RH, 2000 h, rated voltage applied	
	Capacitance change	Within ±30% of the initial value
	Dissipation factor (tan δ)	≤ 200 % of the initial limit
	ESR	≤ 200 % of the initial limit
Resistance to soldering heat	After flow soldering and then being stabilized at +20 °C, capacitors shall meet the following limits.	
	Capacitance change	Within ±10% of the initial value
	Dissipation factor (tan δ)	Within the initial limit
	DC leakage current	Within the initial limit

### Marking

Example : 25 V 150 μF  
Marking color : BLACK

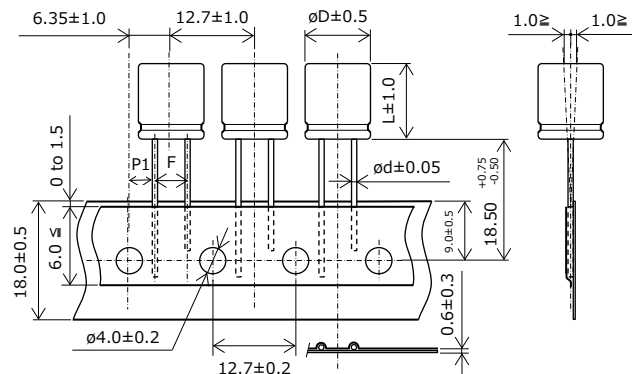
Negative polarity marking (-)



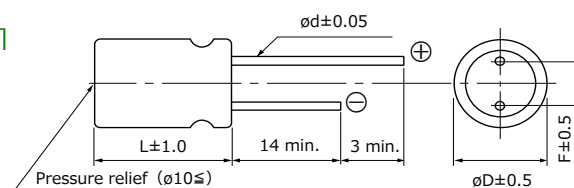
R. voltage code	Unit : V
E	25
V	35
H	50
J	63

### Shape/taping dimensions

[Taping type]



[Bulk type]



Size code	øD	L	ød	F	P1
F	8.0	9.5	0.6	3.5±0.5	4.60±0.50
G	10.0	9.5	0.6	5.0 ±0.8	3.85±0.50

Unit : mm

## Characteristics list

Endurance : 150 °C 1000 h

Rated voltage (V)	Capacitance (±20 %) (μF)	Case size (mm)			Size code	Specification			Part number		Min. packaging q'ty (pcs)	
		øD	L	ød		Ripple current*1 (mA rms)	ESR*2 (mΩ)	tan δ*3	Taping type	Bulk type	Taping	Bulk
25	150	8.0	9.5	0.6	F	800	27	0.14	EEHAZF1E151B	EEHAZF1E151	1000	200
	270	10.0	9.5	0.6	G	1000	20	0.14	EEHAZF1E271B	EEHAZF1E271	500	200
35	100	8.0	9.5	0.6	F	770	30	0.12	EEHAZF1V101B	EEHAZF1V101	1000	200
	150	10.0	9.5	0.6	G	950	23	0.12	EEHAZF1V151B	EEHAZF1V151	500	200
50	56	8.0	9.5	0.6	F	700	35	0.10	EEHAZF1H560B	EEHAZF1H560	1000	200
	100	10.0	9.5	0.6	G	900	28	0.10	EEHAZF1H101B	EEHAZF1H101	500	200
63	33	8.0	9.5	0.6	F	650	40	0.08	EEHAZF1J330B	EEHAZF1J330	1000	200
	56	10.0	9.5	0.6	G	840	30	0.08	EEHAZF1J560B	EEHAZF1J560	500	200

\*1: Ripple current (100 kHz / +150 °C)

\*2: ESR (100 kHz / +20 °C)

\*3: tan δ (120 Hz / +20 °C)

◆ Please refer to the page of "Flow soldering profile" and "The taping dimensions".

## Frequency correction factor for ripple current

Rated capacitance (C)	Frequency (f)	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 (C)	Frequency (f)	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 (C)	Frequency (f)	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 (C)	Frequency (f)	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

## 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.

**Panasonic**  
INDUSTRY

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