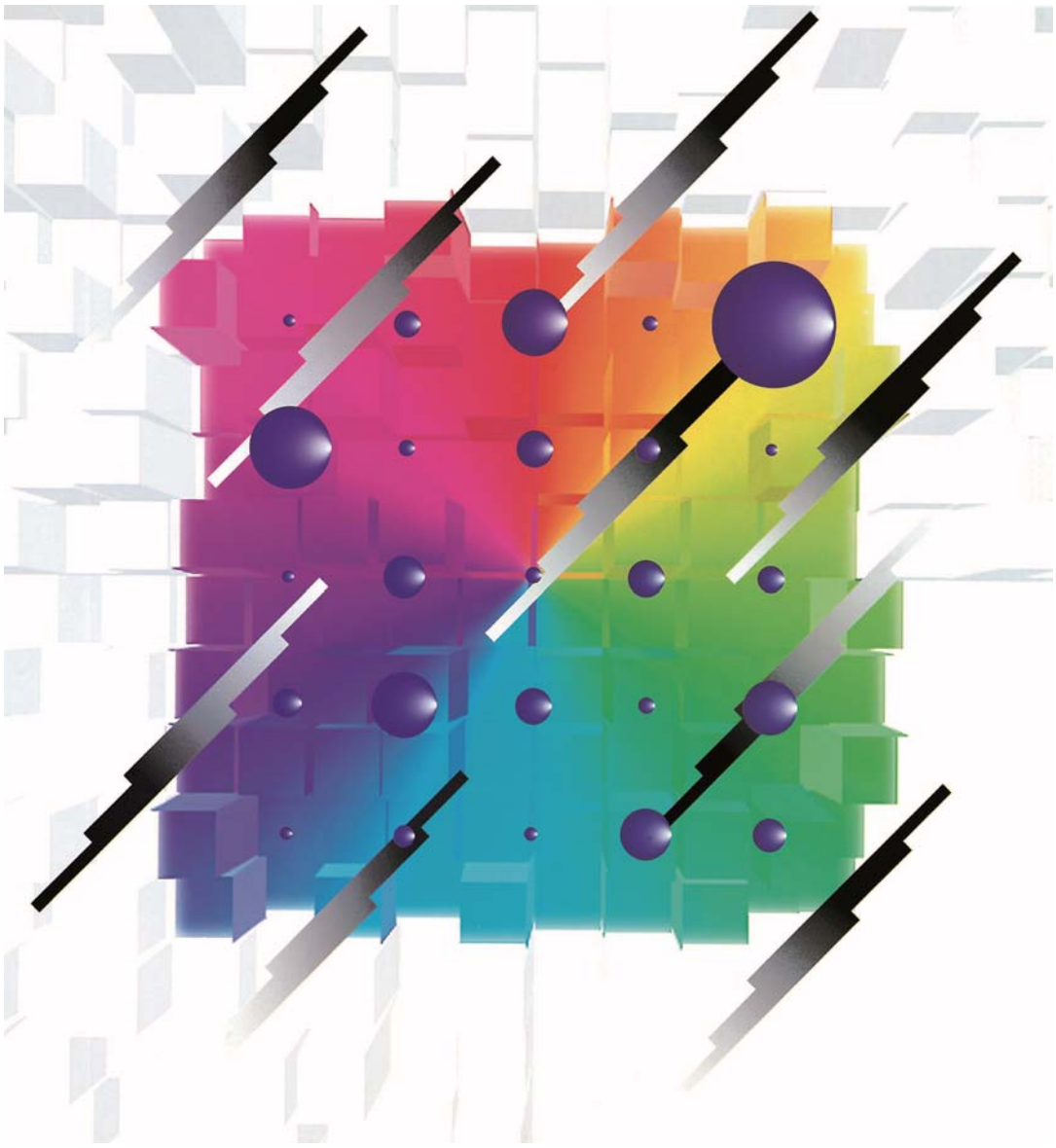
Panasonic

2017

Products Catalog

# Aluminum Electrolytic Capacitors

Surface mount type



2017.04 | http://industrial.panasonic.com/ww/products/capacitors/aluminum-capacitors/aluminum-cap-smd

# Notices

## ■ Applicable Laws and Regulations

- This product complies with the RoHS Directive (Restriction of the use of certain Hazardous substances in electrical and electronic equipment (DIRECTIVE 2011/65/EU).
- No Ozone Depleting Chemicals(ODC's), controlled under the Montreal Protocol Agreement, are used in producing this product.
- We do not 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.

## ■ Limited applications

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

# Items to be observed

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

## ■ For specifications

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

## ■ Conditions of use

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

## 1. Circuit design

### 1.1 Operating Temperature and Frequency

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

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

(2) Effects of frequency on electrical parameters
   (a) At higher frequencies, capacitance and impedance decrease while tan d increases.
   (b) 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.
   Check for the maximum capacitor operating temperatures including ambient temperature, internal capacitor temperature rise due to ripple current, and the effects of radiated heat from power transistors, IC's or resistors.
   Avoid placing components, which could conduct heat to the capacitor from the back side of the circuit board.

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

$$L_2 = L_1 \times 2^{\left(\frac{T_1 - T_2}{10}\right)}$$

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

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

### 1.3 Common Application Conditions to Avoid

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

(1) Reverse Voltage
   DC capacitors have polarity. Therefore, please do not apply the reverse voltage. Verify correct polarity before insertion.
   For circuits with changing or uncertain polarity, use DC bipolar capacitors. DC bipolar capacitors are not suitable for use in AC circuits.

(2) Charge / Discharge Applications
   Standard capacitors are not suitable for use in repeating charge/discharge applications. For charge/discharge applications, consult us with your actual application condition.
   For rush current, please to not exceed 100 A.

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

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

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

### 1.4 Using Two or More Capacitors in Series or Parallel

(1) Capacitors Connected in Parallel
The circuit resistance can closely approximate the series resistance of the capacitor, causing an imbalance of ripple current loads within the capacitors. Careful wiring methods can minimize the possible application of an excessive ripple current to a capacitor.
(2) Capacitors Connected in Series
Differences in normal DC leakage current among capacitors can cause voltage imbalances.
The use of voltage divider shunt resistors with consideration to leakage currents can prevent capacitor voltage imbalances.

NOTE : Please do not use in the series in the case of conductive polymer hybrid aluminum electrolytic capacitor.

### 1.5 Capacitor Mounting Considerations

(1) Double-Sided Circuit Boards
Avoid wiring pattern runs, which pass between the mounted capacitor and the circuit board.
(2) Clearance for Case Mounted Pressure Relief (≧ $\phi$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.
(Dia 10 mm to Dia 16 mm : 2 mm minimum, Dia 18 mm : 3 mm minimum)
(3) Wiring Near the Pressure Relief (≧ $\phi$10 mm)
Avoid locating high voltage or high current wiring or circuit board paths above the pressure relief. Flammable, high temperature gas that exceeds 100 °C may be released which could dissolve the wire insulation and ignite.
(4) Circuit Board Patterns Under the Capacitor
Avoid circuit board runs under the capacitor, as an electrical short can occur due to an electrolyte leakage.

### 1.6 Electrical Isolation of the Capacitor

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

### 1.7 Capacitor 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 kΩ.
(3) Capacitors stored for a long period of time may exhibit an increase in leakage current.
This can be corrected by gradually applying rated voltage in series with a resistor of approximately 1 kΩ.
(4) If capacitors are dropped, they can be damaged mechanically or electrically. Avoid using dropped capacitors.
(5) Dented or crushed capacitors should not be used. The seal integrity can be damaged and loss of electrolyte/ shortened life can result.

### 2.2 Capacitor Insertion

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

## 2.3 Reflow Soldering

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

## 2.4 Manual Soldering

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

## 2.5 Capacitor Handling after Soldering

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

## 2.6 Circuit Board Cleaning

(1) Circuit boards can be immersed or ultrasonically cleaned using suitable cleaning solvents for up to 5 minutes and up to 60 °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.
(2) Avoid using the following solvent groups unless specifically allowed in the specification ;
(a) Halogenated cleaning solvents: except for solvent resistant capacitor types, halogenated solvents can permeate the seal and cause internal capacitor corrosion and failure.
For solvent resistant capacitors, carefully follow the temperature and time requirements based on the specification.
1,1,1-trichloroethane should never be used on any aluminum electrolytic capacitor.
(b) Alkaline solvents : could react and dissolve the aluminum case.
(c) Petroleum based solvents : deterioration of the rubber seal could result.
(d) Xylene : deterioration of the rubber seal could result.
(e) Acetone : removal of the ink markings on the vinyl sleeve could result.
(3) A thorough drying after cleaning is required to remove residual cleaning solvents that may be trapped between the capacitor and the circuit board. Avoid drying temperatures, which exceed the Upper category temperature of the capacitor.
4) Monitor the contamination levels of the cleaning solvents during use in terms of electrical conductivity, pH, specific gravity, or water content. Chlorine levels can rise with contamination and adversely affect the performance of the capacitor.
5) Depending on the cleaning method, the marking on a capacitor may be erased or blurred.
Please consult us if you are not certain about acceptable cleaning solvents or cleaning methods.

## 2.7 Mounting Adhesives and Coating Agents

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

## 2.8 Fumigation

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

## 3. Precautions for using capacitors

### 3.1 Environmental Conditions

Capacitors should not be used in the following environments.

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

### 3.2 Electrical Precautions

(1) Avoid touching the terminals of a capacitor as a possible electric shock could result. The exposed aluminum case is not insulated and could also cause electric shock if touched.
(2) Avoid short circuiting the area between the capacitor terminals with conductive materials including liquids such as acids or alkaline solutions.
(3) A low-molecular-weight-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

Leakage current of a capacitor increases with long storage times. The aluminum oxide film deteriorates as a function of temperature and time.
If used without reconditioning, an abnormally high current will be required to restore the oxide film.
This surge current could cause the circuit or the capacitor to fail.
Expiration date is 42 months from outgoing inspection date.
However, expiration date for series which are not listed below is 12 months from outgoing inspection date.

| Series | Expiration date |
|---|---|
| **S** (only High temperature reflow)<br>**HA** (only High temperature reflow)<br>**HB** (only High temperature reflow and 5.4 mm height)<br>**HC, HD, FCA, FC, FKA, FK, FKS, FP, FT, TG, TK, TP, TC, TCU, TQ** | 42 months from outgoing inspection date |

For storage condition, keep room temperature (5 °C to 35 °C) and humidity (45 % to 85 %) where direct sunshine doesn't reach.

### 5.1 Environmental Conditions

Do not store under condition outside the area described in the specification, and also under conditions listed below.

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

## 6. Capacitor Disposal

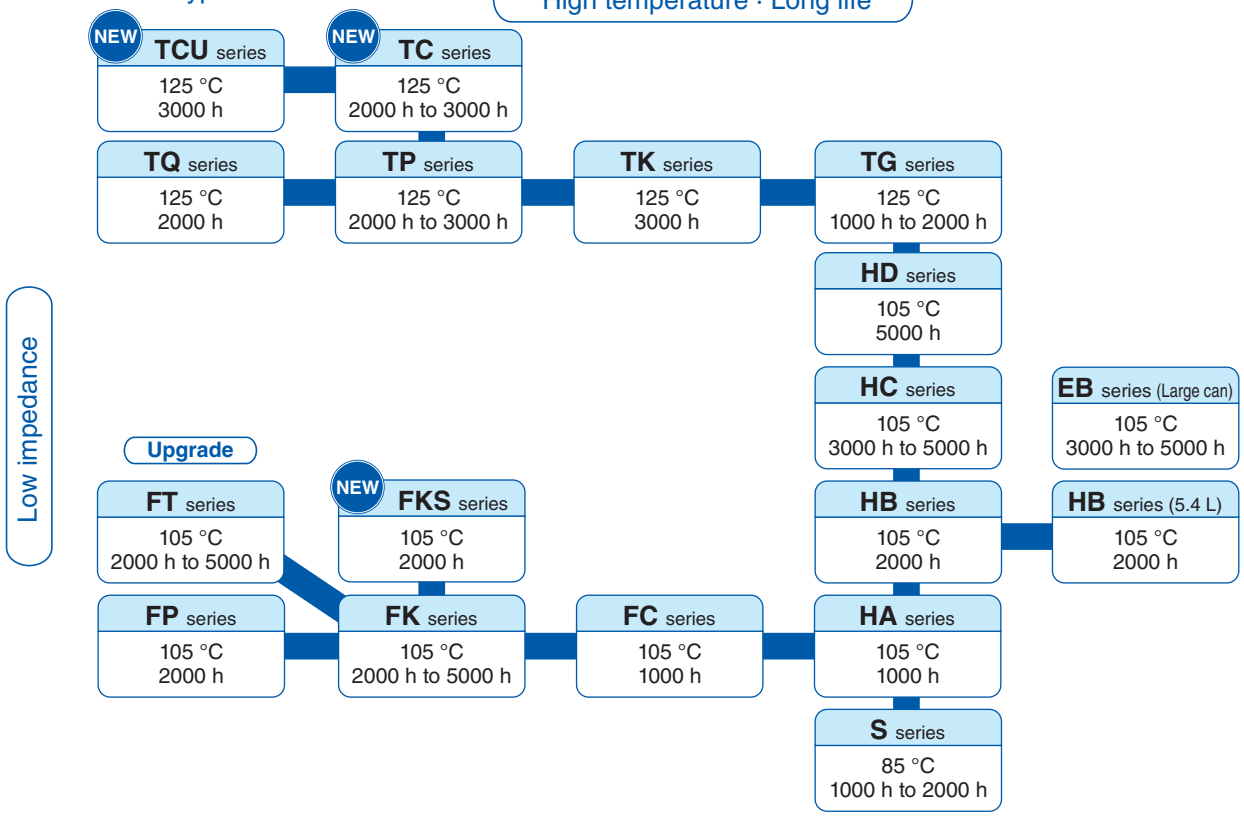
When disposing capacitors, use one of the following methods.

(1) Incinerate after crushing the capacitor or puncturing the can wall (to prevent explosion due to internal pressure rise).
(2) Dispose as solid waste.

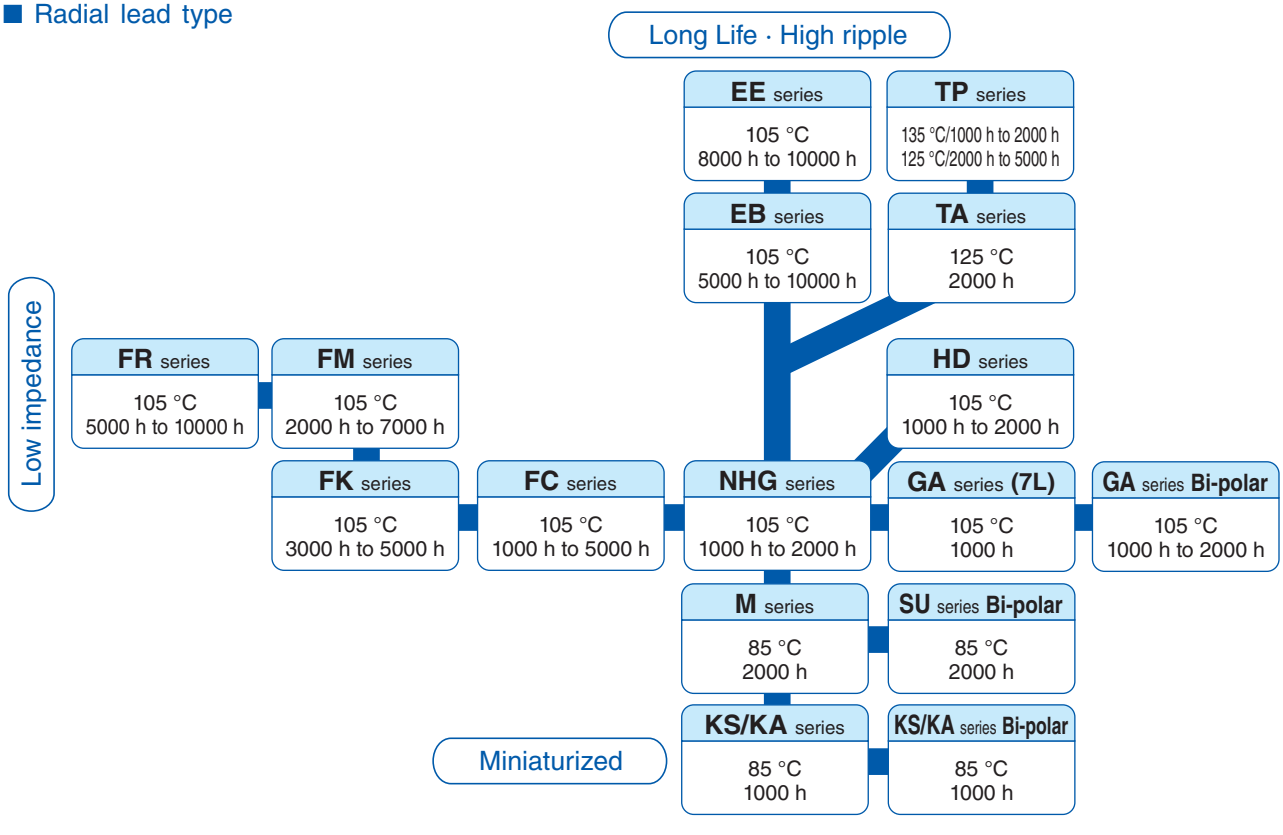
NOTE : Local laws may have specific disposal requirements which must be followed.

# Diagram

## ■ Surface mount type

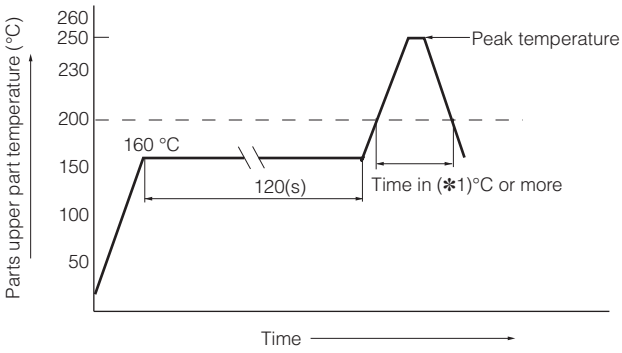



## ■ Radial lead type



## Recommendable reflow soldering

● RoHS compliant




## Lead-Free reflow

| Reflow No. | Fig. (1) | Fig. (2) | Fig. (3) | Fig. (4) |
|---|---|---|---|---|
| Category | $\phi$4 to $\phi$6.3 | $\phi$8 to $\phi$10 | $\phi$12.5 to $\phi$18 | EB series ($\phi$10 to $\phi$18) |
| Peak temperature | 250 °C | 235 °C | 230 °C (220 °C) | 230 °C |
| Time in peak temperature | 5 s | 5 s | 5 s (5 s) | 5 s |
| Time in (✻1) °C or more | ≧200 °C 60 s | ≧200 °C 60 s | ≧200 °C 20 s (30 s) | ≧200 °C 20 s |
| Time of reflow | 1 time | 1 time | 1 time | 1 time |

## High temperature Lead-Free reflow

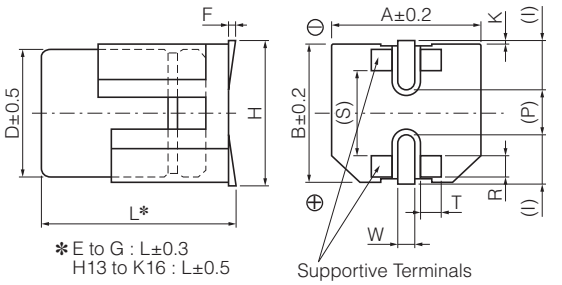
| Reflow No. | Fig. (5) | Fig. (6) | | Fig. (7) | | Fig. (8) | |
|---|---|---|---|---|---|---|---|
| Category | $\phi$4 to $\phi$6.3 | $\phi$8 to $\phi$10 | | $\phi$8 to $\phi$10 | | $\phi$6.3 to $\phi$10 (TK・TP series) | |
| Peak temperature | 260 °C (255 °C) | 245 °C | 260 °C | 250 °C | 260 °C | 255 °C | 260 °C |
| Time in peak temperature | ≧250 °C 5 s (10 s) | ≧240 °C 10 s | ≧250 °C 5 s | ≧240 °C 10 s | ≧250 °C 5 s | ≧250 °C 30 s | ≧250 °C 20 s |
| Time in (✻1) °C or more | ≧230 °C 30 s | ≧230 °C 30 s | ≧230 °C 30 s | ≧230 °C 30 s | ≧230 °C 30 s | ≧230 °C 40 s | ≧230 °C 30 s |
| | ≧217 °C 40 s | ≧217 °C 40 s | ≧217 °C 40 s | ≧217 °C 40 s | ≧217 °C 40 s | ≧217 °C 65 s | ≧217 °C 65 s |
| | ≧200 °C 70 s | ≧200 °C 70 s | ≧200 °C 70 s | ≧200 °C 70 s | ≧200 °C 70 s | ≧200 °C 90 s | ≧200 °C 70 s |
| Time of reflow | 2 times | 2 times | 1 time | 2 times | 1 time | 2 times | 2 times |

| Reflow No. | Fig. (9) | Fig. (10) | Fig. (11) |
|---|---|---|---|
| Category | $\phi$12.5 to $\phi$18 (FK, TK, HD series) 6.3 V.DC to 35 V.DC | $\phi$12.5 to $\phi$18 (FK series) 50 V.DC to 63 V.DC (TK series) 50 V.DC | $\phi$12.5 to $\phi$18 (FK series) 80 V.DC to 100 V.DC (TK series) 63 V.DC to 100 V.DC |
| Peak temperature | 245 °C | 245 °C | 245 °C |
| Time in peak temperature | ≧240 °C 30 s | ≧240 °C 5 s | ≧240 °C 5 s |
| Time in (✻1) °C or more | ≧217 °C 90 s | ≧217 °C 30 s | ≧217 °C 30 s |
| Time of reflow | 2 times | 2 times | 1 time |

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

## Dimensions (Vibration-proof products)

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




( ) Reference size

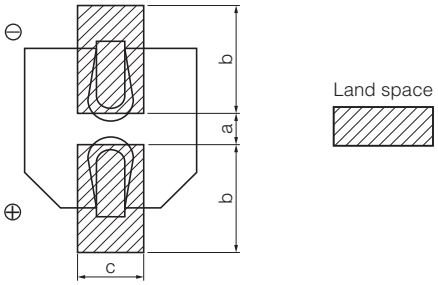
(Unit : mm)

| Size code | φD | L | A, B | H max. | F | I | W | P | K | R | S | T |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| E | 8.0 | 6.5 | 8.3 | 9.5 | 0 to +0.15 | 3.4 | 0.7±0.1 | 2.2 | $0.35^{+0.15}_{-0.20}$ | 0.70±0.2 | 5.3±0.2 | 1.7±0.2 |
| F | 8.0 | 10.5 | 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±0.2 | 1.3±0.2 |
| G | 10.0 | 10.5 | 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±0.2 | 1.3±0.2 |
| H13 | 12.5 | 13.8 | 13.5 | 15.0 | –0.1 to +0.15 | 4.7 | 1.2±0.2 | 4.4 | 0.70±0.3 | 2.2±0.2 | 7.1±0.2 | 2.4±0.2 |
| J16 | 16.0 | 16.8 | 17.0 | 19.0 | –0.1 to +0.15 | 5.5 | 1.4±0.2 | 6.7 | 0.70±0.3 | 3.0±0.2 | 9.0±0.2 | 1.9±0.2 |
| K16 | 18.0 | 16.8 | 19.0 | 21.0 | –0.1 to +0.15 | 6.7 | 1.4±0.2 | 6.7 | 0.70±0.3 | 3.0±0.2 | 11.0±0.2 | 1.9±0.2 |

## Land/Pad pattern

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

● Standard products



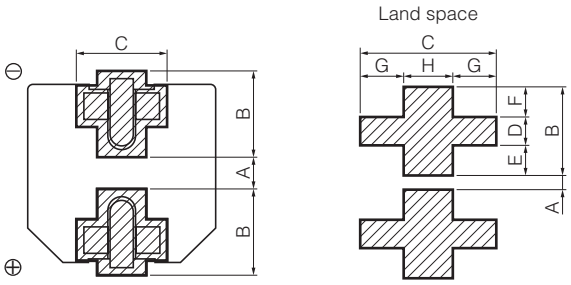

[Table of board land size vs. capacitor size]

(Unit : mm)

| Size code (Dimensions) | a | b | c |
|---|---|---|---|
| B (φ4) | 1.0 | 2.5 | 1.6 |
| C (φ5) | 1.5 | 2.8 | 1.6 |
| D (φ6.3) | 1.8 | 3.2 | 1.6 |
| E (φ8 × 6.2L) | 2.2 | 4.0 | 1.6 |
| F (φ8 × 10.2L) | 3.1 | 4.0 | 2.0 |
| G (φ10 × 10.2L) | 4.6 | 4.1 | 2.0 |
| H (φ12.5) | 4.0 | 5.7 | 2.0 |
| J (φ16) | 6.0 | 6.5 | 2.5 |
| K (φ18) | 6.0 | 7.5 | 2.5 |

✻ When size “a” is wide, back fillet can be made, decreasing fitting strength.

● Vibration-proof products




[Table of board land size vs. capacitor size]

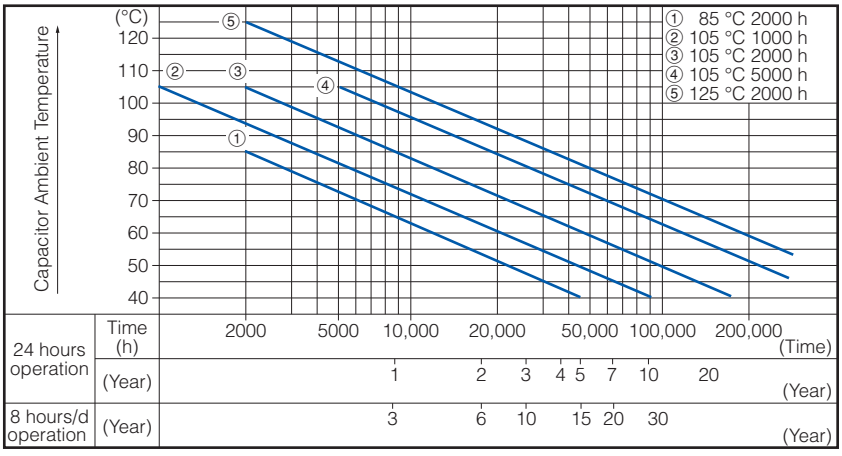
(Unit : mm)

| Size code (Dimensions) | A | B | C | D | E | F | G | H |
|---|---|---|---|---|---|---|---|---|
| E (φ8 × 6.5L) | 1.8 | 4.2 | 5.0 | 1.3 | 1.5 | 1.4 | 1.5 | 2.0 |
| F (φ8 × 10.5L) | 2.7 | 4.0 | 4.7 | 1.3 | 1.0 | 1.7 | 1.1 | 2.5 |
| G (φ10) | 3.9 | 4.4 | 4.7 | 1.3 | 1.2 | 1.9 | 1.1 | 2.5 |
| H (φ12.5) | 3.9 | 6.0 | 6.9 | 2.8 | 1.3 | 1.9 | 2.2 | 2.5 |
| J (φ16) | 5.8 | 6.8 | 6.2 | 3.6 | 1.3 | 1.9 | 1.7 | 2.8 |
| K (φ18) | 5.8 | 7.3 | 6.2 | 3.6 | 1.8 | 1.9 | 1.7 | 2.8 |

✻ When size “A” is wide, back fillet can be made, decreasing fitting strength.

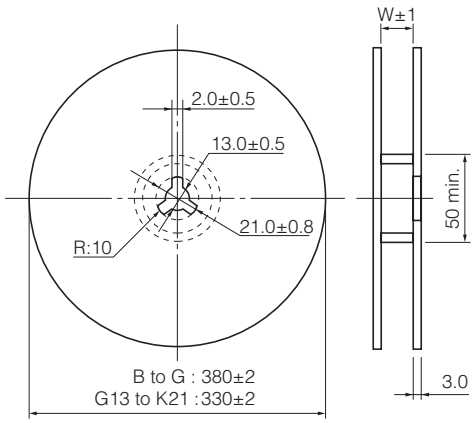
✻ Take mounting conditions, solderability and fitting strength into consideration when selecting parts for your company’s design.

## Expected life estimate quick reference guide



## Packaging specifications

● Reel dimensions

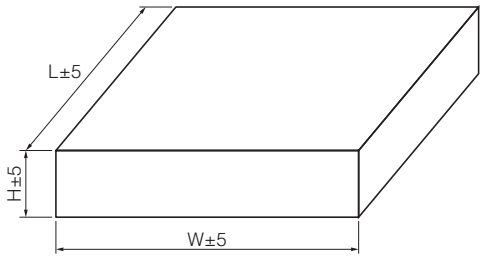



Unit : mm

| Size code | W |
|---|---|
| B, C | 14 |
| D, E, D8 | 18 |
| F, G | 26 |

| Size code | W |
|---|---|
| G13, G17 | 34 |
| H13, H16 | |
| J16, J21 | 46 |
| K16, K21 | |

● Dimensions of outer carton box




Unit : mm

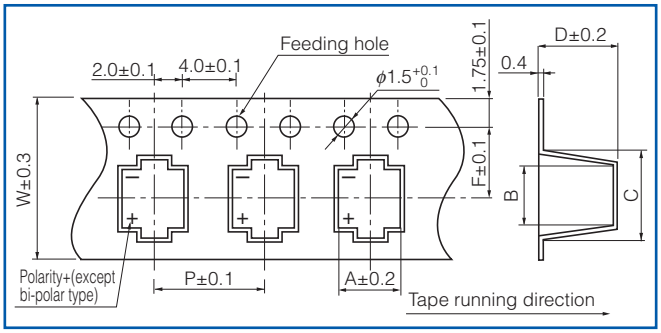
| Size code | H | W, L |
|---|---|---|
| B, C | 220 | 395 |
| D, D8, E | 250 | 395 |
| F, G | 220 | 395 |
| G13, G17 | 210 | 350 |
| H13, H16 | | |
| J16, J21 | 230 | 350 |
| K16, K21 | | |

● Min.packing quantity

| Size code | Height | Min.packing quantity pcs. 380 mm reel |
|---|---|---|
| B | L=5.4 mm | 2000 |
| | L=5.8 mm | 2000 |
| C, D | L=5.4 mm | 1000 |
| | L=5.8 mm | 1000 |
| E | – | 1000 |
| D8 | – | 900 |
| F, G | – | 500 |

| Size code | Min.packing quantity pcs. 330 mm reel |
|---|---|
| G13 | 250 |
| G17, H13 | 200 |
| H16 | 150 |
| J16, K16 | 125 |
| J21, K21 | 75 |

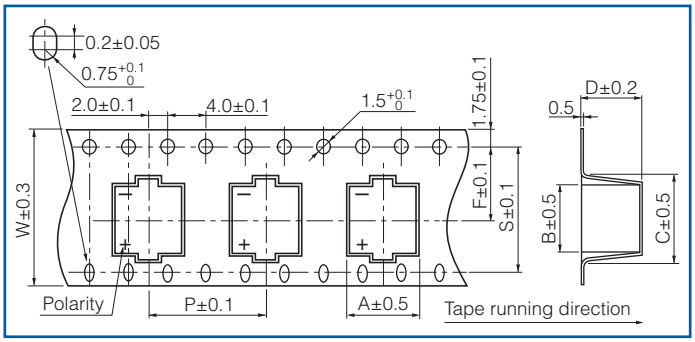
● Taping dimensions (size B to G)




Ask factory for technical specifications.

| Size code | W | A | B | C | P | F | D Height | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | L=5.4 mm | L=5.8 mm |
| B | 12.0 | 4.7 | 4.6 +0.2 −0.1 | 6.5±0.3 | 8.0 | 5.5 | 5.8 | 6.2 |
| C | 12.0 | 5.7 | 5.7 +0.3 −0.2 | 8.0±0.5 | 12.0 | 5.5 | 5.8 | 6.4 |
| D | 16.0 | 7.0 | 7.0 +0.3 −0.2 | 9.0±0.5 | 12.0 | 7.5 | 5.8 | 6.4 |
| D8 | 16.0 | 7.0 | 7.0 +0.3 −0.2 | 9.0±0.5 | 12.0 | 7.5 | 8.4 | |
| E | 16.0 | 8.7 | 8.7 +0.3 −0.2 | 11.4±0.5 | 12.0 | 7.5 | 6.8 | |
| F | 24.0 | 8.7 | 8.7 +0.3 −0.2 | 12.5±0.5 | 16.0 | 11.5 | 11.0 | |
| G | 24.0 | 10.7 | 10.7 +0.3 −0.2 | 14.5±0.5 | 16.0 | 11.5 | 11.0 | |

● Taping dimensions (size G13 to K21)




Ask factory for technical specifications.

| Size code | Taping size | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | F | P | S | W |
| G13 | 10.7 | 10.7 | 14.5 | 14.5 | 14.2 | 20.0 | 28.4 | 32.0 |
| G17 | 10.7 | 10.7 | 14.5 | 17.5 | 14.2 | 20.0 | 28.4 | 32.0 |
| H13 | 14.0 | 14.0 | 18.0 | 14.5 | 14.2 | 24.0 | 28.4 | 32.0 |
| H16 | 14.0 | 14.0 | 18.0 | 17.5 | 14.2 | 24.0 | 28.4 | 32.0 |
| J16 | 17.5 | 17.5 | 23.0 | 17.5 | 20.2 | 28.0 | 40.4 | 44.0 |
| J21 | 17.5 | 17.5 | 23.0 | 22.5 | 20.2 | 28.0 | 40.4 | 44.0 |
| K16 | 19.5 | 19.5 | 26.0 | 17.5 | 20.2 | 32.0 | 40.4 | 44.0 |
| K21 | 19.5 | 19.5 | 26.0 | 22.5 | 20.2 | 32.0 | 40.4 | 44.0 |

# Surface Mount Type

Series : **S** Type : **V**

**High temperature Lead-Free reflow (suffix : A*)**

## Features

- Endurance : 85 °C 2000 h
- Vibration-proof product is available upon request. (φ8 mm and larger)
- RoHS compliant

## Specifications

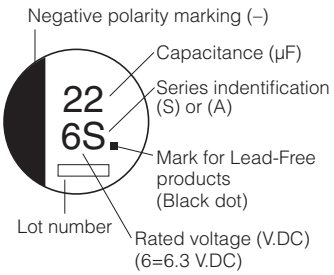
| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Category temperature range | –40 °C to +85 °C | | | | | | | |
| Rated voltage range | 6.3 V.DC to 50 V.DC | | | | | | | |
| Capacitance range | 1 µF to 1500 µF | | | | | | | |
| Capacitance tolerance | ±20 % (120 Hz/+20 °C) | | | | | | | |
| 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 | | | | | | | |
| Characteristics at low temperature | V.DC | 6.3 | 10 | 16 | 25 | 35 | 50 | (Impedance ratio at 120 Hz) |
| | Z(–25 °C)/Z(+20 °C) | 4 | 3 | 2 | 2 | 2 | 2 | |
| | Z(–40 °C)/Z(+20 °C) | 8 | 6 | 4 | 4 | 3 | 3 | |
| Endurance | After applying rated working voltage for 2000 hours (Miniaturization product type 1000 hours) at +85 °C±2 °C and then being stabilized at +20 °C, Capacitors shall meer the following limits. | | | | | | | |
| | Capacitance change | Within ±20 % of the initial value | | | | | | |
| | | Size code | Cap. change | | | | | |
| | | D8 (φ6.3×7.7) | 2000 hours ±25 % | | | | | |
| | | ≦ D (φ6.3) Miniature | 1000 hours ±30 % | | | | | |
| | tan δ | ≦ 200 % of the initial limit | | | | | | |
| | DC leakege current | Within the initial limit | | | | | | |
| Shelf life | After storage for 1000 hours at +85 °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) | | | | | | | |
| 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 | | | | | | |
| | tan δ | Within the initial limit | | | | | | |
| | DC leakage current | Within the initial limit | | | | | | |
| AEC-Q200 | AEC-Q200 compliant | | | | | | | |

## Frequency correction factor for ripple current

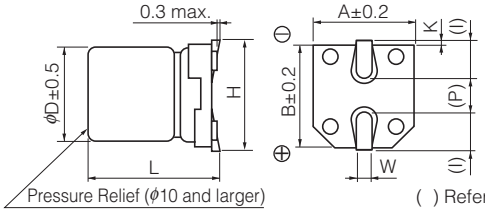
| Frequency (Hz) | 50, 60 | 120 | 1 k | 10 k to |
|---|---|---|---|---|
| Correction factor | 0.70 | 1.00 | 1.30 | 1.70 |

## Marking

Example : 6.3 V.DC 22 µF
Marking color : BLACK




## Dimensions




(Unit : mm)

| Size code | φD | L | A, B | H. | I | W | P | K |
|---|---|---|---|---|---|---|---|---|
| B | 4.0 | $5.4^{+0.1}_{-0.2}$ | 4.3 | 5.5 max | 1.8 | 0.65±0.1 | 1.0 | $0.35^{+0.15}_{-0.20}$ |
| C | 5.0 | $5.4^{+0.1}_{-0.2}$ | 5.3 | 6.5 max | 2.2 | 0.65±0.1 | 1.5 | $0.35^{+0.15}_{-0.20}$ |
| D | 6.3 | $5.4^{+0.1}_{-0.2}$ | 6.6 | 7.8 max | 2.6 | 0.65±0.1 | 1.8 | $0.35^{+0.15}_{-0.20}$ |
| D8 | 6.3 | 7.7±0.3 | 6.6 | 7.8 max | 2.6 | 0.65±0.1 | 1.8 | $0.35^{+0.15}_{-0.20}$ |
| E | 8.0 | 6.2±0.3 | 8.3 | 9.5 max | 3.4 | 0.65±0.1 | 2.2 | $0.35^{+0.15}_{-0.20}$ |
| F | 8.0 | 10.2±0.3 | 8.3 | 10.0 max | 3.4 | 0.90±0.2 | 3.1 | 0.70±0.20 |
| G | 10.0 | 10.2±0.3 | 10.3 | 12.0 max | 3.5 | 0.90±0.2 | 4.6 | 0.70±0.20 |

## Characteristics list

| Rated voltage (V.DC) | Cap. (±20 %) (μF) | Case size (mm) | | Size* code | Specification | | | Part No. | Reflow | Min. Packaging Q'ty |
|---|---|---|---|---|---|---|---|---|---|---|
| | | φD | L | | Ripple current (120 Hz) (+85 °C) (mA r.m.s.) | tan δ (120 Hz) (+20 °C) | Endurance (hours) | | | Taping (pcs) |
| 6.3 | 22 | 4 | 5.4 | B | 29 | 0.30 | 2000 | EEE0JA220AR | (5) | 2000 |
| | 33 | 4 | 5.4 | (B) | 22 | 0.35 | 1000 | EEE0JA330WAR | (5) | 2000 |
| | 47 | 5 | 5.4 | C | 46 | 0.30 | 2000 | EEE0JA470AR | (5) | 1000 |
| | 100 | 5 | 5.4 | (C) | 47 | 0.40 | 1000 | EEE0JA101WAR | (5) | 1000 |
| | | 6.3 | 5.4 | D | 71 | 0.30 | 2000 | EEE0JA101AP | (5) | 1000 |
| | 330 | 6.3 | 7.7 | D8 | 188 | 0.30 | 2000 | EEE0JA331XAP | (5) | 900 |
| | | 8 | 6.2 | E | 300 | 0.35 | 2000 | EEE0JA331AP | (7) | 1000 |
| | 470 | 8 | 10.2 | (F) | 380 | 0.35 | 1000 | EEE0JA471UAP | (7) | 500 |
| | 1000 | 10 | 10.2 | G | 700 | 0.35 | 2000 | EEE0JA102AP | (7) | 500 |
| | 1500 | 10 | 10.2 | (G) | 750 | 0.50 | 1000 | EEE0JA152UAP | (7) | 500 |
| 10 | 22 | 4 | 5.4 | (B) | 28 | 0.30 | 1000 | EEE1AA220WAR | (5) | 2000 |
| | 33 | 4 | 5.4 | (B) | 29 | 0.30 | 1000 | EEE1AA330WAR | (5) | 2000 |
| | | 5 | 5.4 | C | 43 | 0.22 | 2000 | EEE1AA330AR | (5) | 1000 |
| | 47 | 5 | 5.4 | (C) | 47 | 0.30 | 1000 | EEE1AA470WAR | (5) | 1000 |
| | 100 | 5 | 5.4 | (C) | 50 | 0.30 | 1000 | EEE1AA101WAR | (5) | 1000 |
| | | 6.3 | 5.4 | D | 70 | 0.26 | 2000 | EEE1AA101AP | (5) | 1000 |
| | 220 | 6.3 | 7.7 | D8 | 173 | 0.22 | 2000 | EEE1AA221XAP | (5) | 900 |
| | | 8 | 6.2 | E | 250 | 0.26 | 2000 | EEE1AA221AP | (7) | 1000 |
| | 330 | 8 | 10.2 | F | 390 | 0.26 | 2000 | EEE1AA331AP | (7) | 500 |
| | 470 | 8 | 10.2 | (F) | 390 | 0.26 | 1000 | EEE1AA471UAP | (7) | 500 |
| | | 10 | 10.2 | G | 400 | 0.26 | 2000 | EEE1AA471AP | (7) | 500 |
| | 1000 | 10 | 10.2 | (G) | 580 | 0.35 | 1000 | EEE1AA102UAP | (7) | 500 |
| 16 | 10 | 4 | 5.4 | B | 28 | 0.16 | 2000 | EEE1CA100AR | (5) | 2000 |
| | 22 | 4 | 5.4 | (B) | 28 | 0.26 | 1000 | EEE1CA220WAR | (5) | 2000 |
| | | 5 | 5.4 | C | 39 | 0.16 | 2000 | EEE1CA220AR | (5) | 1000 |
| | 33 | 5 | 5.4 | (C) | 35 | 0.26 | 1000 | EEE1CA330WAR | (5) | 1000 |
| | 47 | 5 | 5.4 | (C) | 39 | 0.26 | 1000 | EEE1CA470WAR | (5) | 1000 |
| | | 6.3 | 5.4 | D | 70 | 0.16 | 2000 | EEE1CA470AP | (5) | 1000 |
| | 100 | 6.3 | 5.4 | (D) | 70 | 0.26 | 1000 | EEE1CA101WAP | (5) | 1000 |
| | | 8 | 6.2 | E | 200 | 0.20 | 2000 | EEE1CA101AP | (7) | 1000 |
| | 220 | 6.3 | 7.7 | D8 | 162 | 0.20 | 2000 | EEE1CA221XAP | (5) | 900 |
| | | 8 | 10.2 | (F) | 280 | 0.20 | 1000 | EEE1CA221UAP | (7) | 500 |
| | 330 | 8 | 10.2 | (F) | 320 | 0.20 | 1000 | EEE1CA331UAP | (7) | 500 |
| | | 10 | 10.2 | G | 380 | 0.20 | 2000 | EEE1CA331AP | (7) | 500 |
| | 470 | 8 | 10.2 | (F) | 350 | 0.26 | 1000 | EEE1CA471UAP | (7) | 500 |
| | | 10 | 10.2 | G | 420 | 0.20 | 2000 | EEE1CA471AP | (7) | 500 |
| 25 | 4.7 | 4 | 5.4 | B | 22 | 0.14 | 2000 | EEE1EA4R7AR | (5) | 2000 |
| | 10 | 4 | 5.4 | (B) | 22 | 0.20 | 1000 | EEE1EA100WAR | (5) | 2000 |
| | | 5 | 5.4 | C | 28 | 0.14 | 2000 | EEE1EA100AR | (5) | 1000 |
| | 22 | 5 | 5.4 | (C) | 35 | 0.20 | 1000 | EEE1EA220WAR | (5) | 1000 |
| | | 6.3 | 5.4 | D | 55 | 0.14 | 2000 | EEE1EA220AP | (5) | 1000 |
| | 33 | 5 | 5.4 | (C) | 42 | 0.20 | 1000 | EEE1EA330WAR | (5) | 1000 |
| | | 6.3 | 5.4 | D | 65 | 0.14 | 2000 | EEE1EA330AP | (5) | 1000 |
| | 47 | 6.3 | 5.4 | (D) | 70 | 0.20 | 1000 | EEE1EA470WAP | (5) | 1000 |
| | 100 | 8 | 6.2 | (E) | 91 | 0.16 | 1000 | EEE1EA101UAP | (7) | 1000 |
| | | 6.3 | 7.7 | D8 | 143 | 0.16 | 2000 | EEE1EA101XAP | (5) | 900 |
| | | 8 | 10.2 | F | 180 | 0.16 | 2000 | EEE1EA101AP | (7) | 500 |
| | 220 | 8 | 10.2 | (F) | 230 | 0.20 | 1000 | EEE1EA221UAP | (7) | 500 |
| | | 10 | 10.2 | G | 310 | 0.16 | 2000 | EEE1EA221AP | (7) | 500 |
| | 330 | 8 | 10.2 | (F) | 270 | 0.20 | 1000 | EEE1EA331UAP | (7) | 500 |
| | | 10 | 10.2 | G | 340 | 0.16 | 2000 | EEE1EA331AP | (7) | 500 |
| | 470 | 10 | 10.2 | (G) | 380 | 0.25 | 1000 | EEE1EA471UAP | (7) | 500 |

✻ Size code( ) : Miniaturization product

· Please refer to the page of "Reflow Profile" and "The Taping Dimensions".

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

## Characteristics list

| Rated voltage (V.DC) | Cap. (±20 %) (μF) | Case size (mm) | | Size* code | Specification | | | Part No. | Reflow | Min. Packaging Q'ty |
|---|---|---|---|---|---|---|---|---|---|---|
| | | φD | L | | Ripple current (120 Hz) (+85 °C) (mA r.m.s.) | tan δ (120 Hz) (+20 °C) | Endurance (hours) | | | Taping (pcs) |
| 35 | 4.7 | 4 | 5.4 | B | 22 | 0.12 | 2000 | EEE1VA4R7AR | (5) | 2000 |
| | 10 | 4 | 5.4 | (B) | 22 | 0.16 | 1000 | EEE1VA100WAR | (5) | 2000 |
| | | 5 | 5.4 | C | 30 | 0.12 | 2000 | EEE1VA100AR | (5) | 1000 |
| | 22 | 5 | 5.4 | (C) | 36 | 0.16 | 1000 | EEE1VA220WAR | (5) | 1000 |
| | | 6.3 | 5.4 | D | 60 | 0.12 | 2000 | EEE1VA220AP | (5) | 1000 |
| | 33 | 6.3 | 5.4 | (D) | 60 | 0.16 | 1000 | EEE1VA330WAP | (5) | 1000 |
| | | 8 | 6.2 | E | 130 | 0.14 | 2000 | EEE1VA330AP | (7) | 1000 |
| | 47 | 6.3 | 5.4 | (D) | 70 | 0.16 | 1000 | EEE1VA470WAP | (5) | 1000 |
| | | 8 | 6.2 | E | 165 | 0.14 | 2000 | EEE1VA470AP | (7) | 1000 |
| | 100 | 6.3 | 7.7 | D8 | 132 | 0.14 | 2000 | EEE1VA101XAP | (5) | 900 |
| | | 8 | 10.2 | (F) | 140 | 0.14 | 1000 | EEE1VA101UAP | (7) | 500 |
| | | 10 | 10.2 | G | 210 | 0.14 | 2000 | EEE1VA101AP | (7) | 500 |
| | 220 | 8 | 10.2 | (F) | 200 | 0.14 | 1000 | EEE1VA221UAP | (7) | 500 |
| | | 10 | 10.2 | G | 310 | 0.14 | 2000 | EEE1VA221AP | (7) | 500 |
| | 330 | 10 | 10.2 | (G) | 350 | 0.30 | 1000 | EEE1VA331UAP | (7) | 500 |
| 50 | 1 | 4 | 5.4 | B | 10 | 0.12 | 2000 | EEE1HA1R0AR | (5) | 2000 |
| | 2.2 | 4 | 5.4 | B | 16 | 0.12 | 2000 | EEE1HA2R2AR | (5) | 2000 |
| | 3.3 | 4 | 5.4 | B | 16 | 0.12 | 2000 | EEE1HA3R3AR | (5) | 2000 |
| | 4.7 | 4 | 5.4 | (B) | 18 | 0.14 | 1000 | EEE1HA4R7WAR | (5) | 2000 |
| | | 5 | 5.4 | C | 23 | 0.12 | 2000 | EEE1HA4R7AR | (5) | 1000 |
| | 10 | 5 | 5.4 | (C) | 27 | 0.14 | 1000 | EEE1HA100WAR | (5) | 1000 |
| | | 6.3 | 5.4 | D | 35 | 0.12 | 2000 | EEE1HA100AP | (5) | 1000 |
| | 22 | 6.3 | 5.4 | (D) | 40 | 0.14 | 1000 | EEE1HA220WAP | (5) | 1000 |
| | | 8 | 6.2 | E | 120 | 0.12 | 2000 | EEE1HA220AP | (7) | 1000 |
| | 33 | 8 | 6.2 | (E) | 65 | 0.12 | 1000 | EEE1HA330UAP | (7) | 1000 |
| | | 6.3 | 7.7 | D8 | 65 | 0.14 | 2000 | EEE1HA330XAP | (5) | 900 |
| | | 8 | 10.2 | F | 110 | 0.12 | 2000 | EEE1HA330AP | (7) | 500 |
| | 47 | 6.3 | 7.7 | D8 | 105 | 0.14 | 2000 | EEE1HA470XAP | (5) | 900 |
| | | 8 | 10.2 | (F) | 110 | 0.12 | 1000 | EEE1HA470UAP | (7) | 500 |
| | | 10 | 10.2 | G | 130 | 0.12 | 2000 | EEE1HA470AP | (7) | 500 |
| | 100 | 8 | 10.2 | (F) | 200 | 0.18 | 1000 | EEE1HA101UAP | (7) | 500 |
| | | 10 | 10.2 | G | 250 | 0.12 | 2000 | EEE1HA101AP | (7) | 500 |
| | 220 | 10 | 10.2 | (G) | 300 | 0.18 | 1000 | EEE1HA221UAP | (7) | 500 |

✻ Size code( ) : Miniaturization product

· Please refer to the page of "Reflow Profile" and "The Taping Dimensions".

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

# Surface Mount Type

Series : **S** Type : **V**

## Features

- Endurance : 85 °C 2000 h
- Vibration-proof product is available upon request. (φ8 mm and larger)
- RoHS compliant

## Specifications

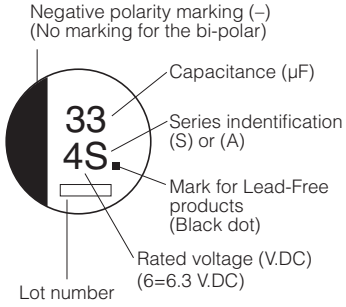
| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Category temperature range | –40 °C to +85 °C | | | | | | | | | | |
| Rated voltage range | 4 V.DC to 100 V.DC | | | | | | | | | | |
| Capacitance range | 1 µF to 1500 µF | | | | | | | | | | |
| Capacitance tolerance | ±20 % (120 Hz/+20 °C) | | | | | | | | | | |
| Leakage current | I ≦ 0.01 CV or 3 (µA) (Bi-Polar I ≦ 0.02 CV or 6 (µA) After 2 minutes (Whichever is greater) | | | | | | | | | | |
| Dissipation factor (tan δ) | Please see the attached characteristics list | | | | | | | | | | |
| Characteristics at low temperature | V.DC | 4 | 6.3 | 10 | 16 | 25 | 35 | 50 | 63 | 100 | (Impedance ratio at 120 Hz) |
| | Z(–25 °C)/Z(+20 °C) | 7 | 4 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | |
| | Z(–40 °C)/Z(+20 °C) | 15 | 8 | 6 | 4 | 4 | 3 | 3 | 4 | 4 | |
| Endurance | After applying rated working voltage for 2000 hours (Bi-polar:1000 hours for each polarity) at +85 °C±2 °C and then being stabilized at +20 °C, Capacitors shall meet the following limits. | | | | | | | | | | |
| | Capacitance change | Within ±20 % of the initial value | | | | | | | | | |
| | | Size code | Rated voltage | Cap. change | | | | | | | |
| | | B(φ4) to D, D8(φ6.3) | 4 V.DC | 1000 hours ±30 % | | | | | | | |
| | | ≦ D(φ6.3) Miniature | 6.3 V.DC | 1000 hours ±30 % | | | | | | | |
| | | | ≧ 10 V.DC | 1000 hours ±20 % | | | | | | | |
| | tan δ | ≦ 200 % of the initial limit | | | | | | | | | |
| | DC leakage current | Within the initial limit | | | | | | | | | |
| Shelf life | After storage for 1000 hours at +85 °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) | | | | | | | | | | |
| 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 | | | | | | | | | |
| | tan δ | Within the initial limit | | | | | | | | | |
| | DC leakage current | Within the initial limit | | | | | | | | | |
| AEC-Q200 | AEC-Q200 compliant | | | | | | | | | | |

## Frequency correction factor for ripple current

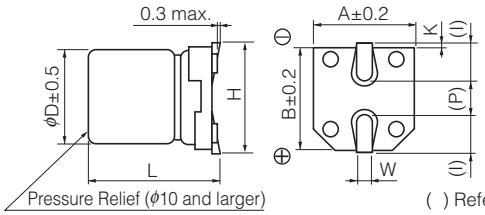
| Frequency (Hz) | 50, 60 | 120 | 1 k | 10 k to |
|---|---|---|---|---|
| Correction factor | 0.70 | 1.00 | 1.30 | 1.70 |

## Marking

Example : 4 V.DC 33 µF
Marking color : BLACK




## Dimensions




(Unit : mm)

| Size code | φD | L | A, B | H | I | W | P | K |
|---|---|---|---|---|---|---|---|---|
| B | 4.0 | $5.4^{+0.1}_{-0.2}$ | 4.3 | 5.5 max. | 1.8 | 0.65±0.1 | 1.0 | $0.35^{+0.15}_{-0.20}$ |
| C | 5.0 | $5.4^{+0.1}_{-0.2}$ | 5.3 | 6.5 max. | 2.2 | 0.65±0.1 | 1.5 | $0.35^{+0.15}_{-0.20}$ |
| D | 6.3 | $5.4^{+0.1}_{-0.2}$ | 6.6 | 7.8 max. | 2.6 | 0.65±0.1 | 1.8 | $0.35^{+0.15}_{-0.20}$ |
| D8 | 6.3 | 7.7±0.3 | 6.6 | 7.8 max. | 2.6 | 0.65±0.1 | 1.8 | $0.35^{+0.15}_{-0.20}$ |
| E | 8.0 | 6.2±0.3 | 8.3 | 9.5 max. | 3.4 | 0.65±0.1 | 2.2 | $0.35^{+0.15}_{-0.20}$ |
| F | 8.0 | 10.2±0.3 | 8.3 | 10.0 max. | 3.4 | 0.90±0.2 | 3.1 | 0.70±0.20 |
| G | 10.0 | 10.2±0.3 | 10.3 | 12.0 max. | 3.5 | 0.90±0.2 | 4.6 | 0.70±0.20 |

## Characteristics list

| Rated voltage (V.DC) | Cap. (±20 %) (μF) | Case size (mm) | | Size* code | Specification | | | Part No. | Reflow | Min. Packaging Q'ty |
|---|---|---|---|---|---|---|---|---|---|---|
| | | φD | L | | Ripple current (120 Hz) (+85 °C) (mA r.m.s.) | tan δ (120 Hz) (+20 °C) | Endurance (hours) | | | Taping (pcs) |
| 4 | 33 | 4 | 5.4 | B | 26 | 0.35 | 1000 | EEE0GA330SR | (1) | 2000 |
| | 47 | 4 | 5.4 | B | 34 | 0.35 | 1000 | EEE0GA470SR | (1) | 2000 |
| | 100 | 5 | 5.4 | C | 61 | 0.35 | 1000 | EEE0GA101SR | (1) | 1000 |
| | 220 | 6.3 | 5.4 | D | 82 | 0.35 | 1000 | EEE0GA221SP | (1) | 1000 |
| | 330 | 6.3 | 5.4 | (D) | 80 | 0.50 | 1000 | EEE0GA331WP | (1) | 1000 |
| | 470 | 6.3 | 7.7 | D8 | 200 | 0.35 | 1000 | EEE0GA471XP | (1) | 900 |
| 6.3 | 22 | 4 | 5.4 | B | 29 | 0.26 | 2000 | EEE0JA220SR | (1) | 2000 |
| | 33 | 4 | 5.4 | (B) | 22 | 0.35 | 1000 | EEE0JA330WR | (1) | 2000 |
| | 47 | 4 | 5.4 | (B) | 36 | 0.35 | 1000 | EEE0JA470WR | (1) | 2000 |
| | | 5 | 5.4 | C | 46 | 0.26 | 2000 | EEE0JA470SR | (1) | 1000 |
| | 100 | 5 | 5.4 | (C) | 47 | 0.35 | 1000 | EEE0JA101WR | (1) | 1000 |
| | | 6.3 | 5.4 | D | 71 | 0.26 | 2000 | EEE0JA101SP | (1) | 1000 |
| | 220 | 6.3 | 5.4 | (D) | 74 | 0.35 | 1000 | EEE0JA221WP | (1) | 1000 |
| | 330 | 6.3 | 7.7 | D8 | 188 | 0.26 | 2000 | EEE0JA331XP | (1) | 900 |
| | | 8 | 6.2 | E | 300 | 0.35 | 2000 | EEE0JA331P | (2) | 1000 |
| | 470 | 8 | 10.2 | F | 380 | 0.35 | 2000 | EEE0JA471P | (2) | 500 |
| | 1000 | 8 | 10.2 | (F) | 500 | 0.35 | 2000 | EEE0JA102UP | (2) | 500 |
| | | 10 | 10.2 | G | 700 | 0.35 | 2000 | EEE0JA102P | (2) | 500 |
| | 1500 | 10 | 10.2 | G | 750 | 0.35 | 2000 | EEE0JA152P | (2) | 500 |
| 10 | 22 | 4 | 5.4 | (B) | 28 | 0.30 | 1000 | EEE1AA220WR | (1) | 2000 |
| | 33 | 4 | 5.4 | (B) | 29 | 0.30 | 1000 | EEE1AA330WR | (1) | 2000 |
| | | 5 | 5.4 | C | 43 | 0.20 | 2000 | EEE1AA330SR | (1) | 1000 |
| | 47 | 5 | 5.4 | (C) | 43 | 0.30 | 1000 | EEE1AA470WR | (1) | 1000 |
| | 100 | 5 | 5.4 | (C) | 50 | 0.30 | 1000 | EEE1AA101WR | (1) | 1000 |
| | | 6.3 | 5.4 | D | 70 | 0.26 | 2000 | EEE1AA101SP | (1) | 1000 |
| | 220 | 6.3 | 7.7 | D8 | 173 | 0.20 | 2000 | EEE1AA221XP | (1) | 900 |
| | | 8 | 6.2 | E | 250 | 0.26 | 2000 | EEE1AA221P | (2) | 1000 |
| | 330 | 8 | 10.2 | F | 390 | 0.26 | 2000 | EEE1AA331P | (2) | 500 |
| | 470 | 8 | 10.2 | (F) | 390 | 0.26 | 2000 | EEE1AA471UP | (2) | 500 |
| | | 10 | 10.2 | G | 400 | 0.26 | 2000 | EEE1AA471P | (2) | 500 |
| | 1000 | 10 | 10.2 | G | 580 | 0.26 | 2000 | EEE1AA102P | (2) | 500 |
| 16 | 10 | 4 | 5.4 | B | 28 | 0.16 | 2000 | EEE1CA100SR | (1) | 2000 |
| | 22 | 4 | 5.4 | (B) | 28 | 0.26 | 1000 | EEE1CA220WR | (1) | 2000 |
| | | 5 | 5.4 | C | 39 | 0.16 | 2000 | EEE1CA220SR | (1) | 1000 |
| | 33 | 5 | 5.4 | (C) | 35 | 0.26 | 1000 | EEE1CA330WR | (1) | 1000 |
| | 47 | 5 | 5.4 | (C) | 39 | 0.26 | 1000 | EEE1CA470WR | (1) | 1000 |
| | | 6.3 | 5.4 | D | 70 | 0.16 | 2000 | EEE1CA470SP | (1) | 1000 |
| | 100 | 6.3 | 5.4 | (D) | 70 | 0.26 | 1000 | EEE1CA101WP | (1) | 1000 |
| | | 8 | 6.2 | E | 200 | 0.20 | 2000 | EEE1CA101P | (2) | 1000 |
| | 220 | 6.3 | 7.7 | D8 | 162 | 0.16 | 2000 | EEE1CA221XP | (1) | 900 |
| | | 8 | 10.2 | F | 280 | 0.20 | 2000 | EEE1CA221P | (2) | 500 |
| | 330 | 8 | 10.2 | (F) | 320 | 0.20 | 2000 | EEE1CA331UP | (2) | 500 |
| | | 10 | 10.2 | G | 380 | 0.20 | 2000 | EEE1CA331P | (2) | 500 |
| | 470 | 8 | 10.2 | (F) | 350 | 0.20 | 2000 | EEE1CA471UP | (2) | 500 |
| | | 10 | 10.2 | G | 420 | 0.20 | 2000 | EEE1CA471P | (2) | 500 |

✻ Size code( ) : Miniaturization product

· Please refer to the page of "Reflow Profile" and "The Taping Dimensions".

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

## Characteristics list

| Rated voltage (V.DC) | Cap. (±20 %) (μF) | Case size (mm) | | Size* code | Specification | | | Part No. | Reflow | Min. Packaging Q'ty |
|---|---|---|---|---|---|---|---|---|---|---|
| | | φD | L | | Ripple current (120 Hz) (+85 °C) (mA r.m.s.) | tan δ (120 Hz) (+20 °C) | Endurance (hours) | | | Taping (pcs) |
| 25 | 4.7 | 4 | 5.4 | B | 22 | 0.14 | 2000 | EEE1EA4R7SR | (1) | 2000 |
| | 10 | 4 | 5.4 | (B) | 22 | 0.20 | 1000 | EEE1EA100WR | (1) | 2000 |
| | | 5 | 5.4 | C | 28 | 0.14 | 2000 | EEE1EA100SR | (1) | 1000 |
| | 22 | 5 | 5.4 | (C) | 35 | 0.20 | 1000 | EEE1EA220WR | (1) | 1000 |
| | | 6.3 | 5.4 | D | 55 | 0.14 | 2000 | EEE1EA220SP | (1) | 1000 |
| | 33 | 5 | 5.4 | (C) | 42 | 0.20 | 1000 | EEE1EA330WR | (1) | 1000 |
| | | 6.3 | 5.4 | D | 65 | 0.14 | 2000 | EEE1EA330SP | (1) | 1000 |
| | 47 | 6.3 | 5.4 | (D) | 70 | 0.20 | 1000 | EEE1EA470WP | (1) | 1000 |
| | 100 | 6.3 | 7.7 | D8 | 143 | 0.14 | 2000 | EEE1EA101XP | (1) | 900 |
| | | 8 | 6.2 | (E) | 91 | 0.16 | 2000 | EEE1EA101UP | (2) | 1000 |
| | | 8 | 10.2 | F | 180 | 0.16 | 2000 | EEE1EA101P | (2) | 500 |
| | 220 | 8 | 10.2 | (F) | 230 | 0.16 | 2000 | EEE1EA221UP | (2) | 500 |
| | | 10 | 10.2 | G | 310 | 0.16 | 2000 | EEE1EA221P | (2) | 500 |
| | 330 | 8 | 10.2 | (F) | 270 | 0.16 | 2000 | EEE1EA331UP | (2) | 500 |
| | | 10 | 10.2 | G | 340 | 0.16 | 2000 | EEE1EA331P | (2) | 500 |
| | 470 | 10 | 10.2 | G | 380 | 0.16 | 2000 | EEE1EA471P | (2) | 500 |
| 35 | 4.7 | 4 | 5.4 | B | 22 | 0.12 | 2000 | EEE1VA4R7SR | (1) | 2000 |
| | 10 | 4 | 5.4 | (B) | 22 | 0.16 | 1000 | EEE1VA100WR | (1) | 2000 |
| | | 5 | 5.4 | C | 30 | 0.12 | 2000 | EEE1VA100SR | (1) | 1000 |
| | 22 | 5 | 5.4 | (C) | 36 | 0.16 | 1000 | EEE1VA220WR | (1) | 1000 |
| | | 6.3 | 5.4 | D | 60 | 0.12 | 2000 | EEE1VA220SP | (1) | 1000 |
| | 33 | 6.3 | 5.4 | (D) | 60 | 0.16 | 1000 | EEE1VA330WP | (1) | 1000 |
| | | 8 | 6.2 | E | 130 | 0.14 | 2000 | EEE1VA330P | (2) | 1000 |
| | 47 | 6.3 | 5.4 | (D) | 70 | 0.16 | 1000 | EEE1VA470WP | (1) | 1000 |
| | | 8 | 6.2 | E | 165 | 0.14 | 2000 | EEE1VA470P | (2) | 1000 |
| | 100 | 6.3 | 7.7 | D8 | 132 | 0.12 | 2000 | EEE1VA101XP | (1) | 900 |
| | | 8 | 10.2 | (F) | 140 | 0.14 | 2000 | EEE1VA101UP | (2) | 500 |
| | | 10 | 10.2 | G | 210 | 0.14 | 2000 | EEE1VA101P | (2) | 500 |
| | 220 | 8 | 10.2 | (F) | 200 | 0.14 | 2000 | EEE1VA221UP | (2) | 500 |
| | | 10 | 10.2 | G | 310 | 0.14 | 2000 | EEE1VA221P | (2) | 500 |
| | 330 | 10 | 10.2 | G | 350 | 0.14 | 2000 | EEE1VA331P | (2) | 500 |

✻ Size code( ) : Miniaturization product
· Please refer to the page of "Reflow Profile" and "The Taping Dimensions".
· When requesting vibration-proof product, please put the last "V" instead to "P"

## Characteristics list

| Rated voltage (V.DC) | Cap. (±20 %) (μF) | Case size (mm) | | Size* code | Specification | | | Part No. | Reflow | Min. Packaging Q'ty |
|---|---|---|---|---|---|---|---|---|---|---|
| | | φD | L | | Ripple current (120 Hz) (+85 °C) (mA r.m.s.) | tan δ (120 Hz) (+20 °C) | Endurance (hours) | | | Taping (pcs) |
| 50 | 1 | 4 | 5.4 | B | 10 | 0.12 | 2000 | EEE1HA010SR | (1) | 2000 |
| | 2.2 | 4 | 5.4 | B | 16 | 0.12 | 2000 | EEE1HA2R2SR | (1) | 2000 |
| | 3.3 | 4 | 5.4 | B | 16 | 0.12 | 2000 | EEE1HA3R3SR | (1) | 2000 |
| | 4.7 | 4 | 5.4 | (B) | 18 | 0.14 | 1000 | EEE1HA4R7WR | (1) | 2000 |
| | | 5 | 5.4 | C | 23 | 0.12 | 2000 | EEE1HA4R7SR | (1) | 1000 |
| | 10 | 5 | 5.4 | (C) | 27 | 0.14 | 1000 | EEE1HA100WR | (1) | 1000 |
| | | 6.3 | 5.4 | D | 35 | 0.12 | 2000 | EEE1HA100SP | (1) | 1000 |
| | 22 | 6.3 | 5.4 | (D) | 40 | 0.14 | 1000 | EEE1HA220WP | (1) | 1000 |
| | | 8 | 6.2 | E | 120 | 0.12 | 2000 | EEE1HA220P | (2) | 1000 |
| | 33 | 6.3 | 7.7 | D8 | 85 | 0.12 | 2000 | EEE1HA330XP | (1) | 900 |
| | | 8 | 6.2 | (E) | 65 | 0.12 | 2000 | EEE1HA330UP | (2) | 1000 |
| | | 8 | 10.2 | F | 110 | 0.12 | 2000 | EEE1HA330P | (2) | 500 |
| | 47 | 6.3 | 7.7 | D8 | 105 | 0.12 | 2000 | EEE1HA470XP | (1) | 900 |
| | | 8 | 10.2 | (F) | 110 | 0.12 | 2000 | EEE1HA470UP | (2) | 500 |
| | | 10 | 10.2 | G | 130 | 0.12 | 2000 | EEE1HA470P | (2) | 500 |
| | 100 | 8 | 10.2 | (F) | 200 | 0.12 | 2000 | EEE1HA101UP | (2) | 500 |
| | | 10 | 10.2 | G | 250 | 0.12 | 2000 | EEE1HA101P | (2) | 500 |
| | 220 | 10 | 10.2 | G | 300 | 0.12 | 2000 | EEE1HA221P | (2) | 500 |
| 63 | 22 | 8 | 6.2 | (E) | 40 | 0.18 | 2000 | EEE1JA220UP | (2) | 1000 |
| | | 8 | 10.2 | F | 40 | 0.18 | 2000 | EEE1JA220P | (2) | 500 |
| | 33 | 8 | 10.2 | F | 45 | 0.18 | 2000 | EEE1JA330P | (2) | 500 |
| | 47 | 8 | 10.2 | (F) | 45 | 0.18 | 2000 | EEE1JA470UP | (2) | 500 |
| | | 10 | 10.2 | G | 45 | 0.18 | 2000 | EEE1JA470P | (2) | 500 |
| | 100 | 10 | 10.2 | G | 60 | 0.18 | 2000 | EEE1JA101P | (2) | 500 |
| 100 | 4.7 | 8 | 6.2 | (E) | 50 | 0.18 | 2000 | EEE2AA4R7UP | (2) | 1000 |
| | 10 | 8 | 6.2 | (E) | 50 | 0.18 | 2000 | EEE2AA100UP | (2) | 1000 |
| | | 8 | 10.2 | F | 85 | 0.18 | 2000 | EEE2AA100P | (2) | 500 |
| | 22 | 8 | 10.2 | (F) | 55 | 0.18 | 2000 | EEE2AA220UP | (2) | 500 |
| | | 10 | 10.2 | G | 85 | 0.18 | 2000 | EEE2AA220P | (2) | 500 |
| | 33 | 10 | 10.2 | G | 90 | 0.18 | 2000 | EEE2AA330P | (2) | 500 |

✻ Size code( ) : Miniaturization product

· Please refer to the page of "Reflow Profile" and "The Taping Dimensions".

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

## Characteristics list (Bi-polar)

Endurance : 85 °C 2000 h

| Rated voltage (V.DC) | Cap. (±20 %) (μF) | Case size (mm) | | Size code | Specification | | | Part No. | Reflow | Min. Packaging Q'ty |
|---|---|---|---|---|---|---|---|---|---|---|
| | | φD | L | | Ripple current (120 Hz) (+85 °C) (mA r.m.s.) | tan δ (120 Hz) (+20 °C) | Endurance (hours) | | | Taping (pcs) |
| 6.3 | 22 | 5 | 5.4 | C | 29 | 0.52 | 2000 | EEE0JA220NR | (1) | 1000 |
| | 47 | 6.3 | 5.4 | D | 46 | 0.52 | 2000 | EEE0JA470NP | (1) | 1000 |
| 10 | 10 | 4 | 5.4 | B | 25 | 0.40 | 2000 | EEE1AA100NR | (1) | 2000 |
| | 33 | 6.3 | 5.4 | D | 43 | 0.40 | 2000 | EEE1AA330NP | (1) | 1000 |
| 16 | 4.7 | 4 | 5.4 | B | 20 | 0.32 | 2000 | EEE1CA4R7NR | (1) | 2000 |
| | 10 | 5 | 5.4 | C | 25 | 0.32 | 2000 | EEE1CA100NR | (1) | 1000 |
| | 22 | 6.3 | 5.4 | D | 39 | 0.32 | 2000 | EEE1CA220NP | (1) | 1000 |
| 25 | 3.3 | 4 | 5.4 | B | 12 | 0.28 | 2000 | EEE1EA3R3NR | (1) | 2000 |
| | 4.7 | 5 | 5.4 | C | 21 | 0.28 | 2000 | EEE1EA4R7NR | (1) | 1000 |
| | 10 | 6.3 | 5.4 | D | 28 | 0.28 | 2000 | EEE1EA100NP | (1) | 1000 |
| 35 | 2.2 | 4 | 5.4 | B | 12 | 0.24 | 2000 | EEE1VA2R2NR | (1) | 2000 |
| | 4.7 | 5 | 5.4 | C | 22 | 0.24 | 2000 | EEE1VA4R7NR | (1) | 1000 |
| | 10 | 6.3 | 5.4 | D | 30 | 0.24 | 2000 | EEE1VA100NP | (1) | 1000 |
| 50 | 1 | 4 | 5.4 | B | 10 | 0.24 | 2000 | EEE1HA010NR | (1) | 2000 |
| | 2.2 | 5 | 5.4 | C | 16 | 0.24 | 2000 | EEE1HA2R2NR | (1) | 1000 |
| | 3.3 | 5 | 5.4 | C | 21 | 0.24 | 2000 | EEENZ1H3R3R | (1) | 1000 |
| | 4.7 | 6.3 | 5.4 | D | 31 | 0.24 | 2000 | EEE1HA4R7NP | (1) | 1000 |

· Please refer to the page of “Reflow Profile” and “The Taping Dimensions”.
· When requesting vibration-proof product, please put the last “V” instead to “P”

# Surface Mount Type

Series : **HA** Type : **V**
**High temperature**
**Lead-Free reflow (suffix : A*)**

Hight-temperature assuranceize

HA
↑
S

## Features

- Endurance : 105 °C 1000 h
- Vibration-proof product is available upon request. (φ8 mm and larger)
- RoHS compliant

## Specifications

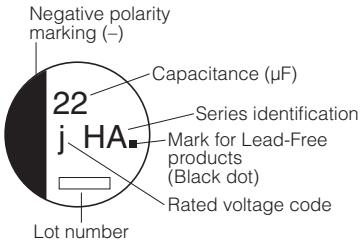
| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Category temperature range | –40 °C to +105 °C | | | | | | | |
| Rated voltage range | 6.3 V.DC to 50 V.DC | | | | | | | |
| Capacitance range | 1 µF to 1500 µF | | | | | | | |
| Capacitance tolerance | ±20 % (120 Hz/+20 °C) | | | | | | | |
| 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 | | | | | | | |
| Characteristics at low temperature | V.DC | 6.3 | 10 | 16 | 25 | 35 | 50 | (Impedance ratio at 120 Hz) |
| | Z(–25 °C)/Z(+20 °C) | 4 | 3 | 2 | 2 | 2 | 2 | |
| | Z(–40 °C)/Z(+20 °C) | 8 | 6 | 4 | 4 | 3 | 3 | |
| Endurance | After applying rated working voltage for 1000 hours at +105 °C±2 °C and then being stabilized at +20 °C, capacitors shall meet the following limits. | | | | | | | |
| | Capacitance change | Within ±30 % of the initial value | | | | | | |
| | tan δ | ≦200 % of the initial limit | | | | | | |
| | DC leakage current | Within the initial limit | | | | | | |
| 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) | | | | | | | |
| 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 | | | | | | |
| | tan δ | Within the initial limit | | | | | | |
| | DC leakage current | Within the initial limit | | | | | | |
| AEC-Q200 | AEC-Q200 compliant | | | | | | | |

## Frequency correction factor for ripple current

| Frequency (Hz) | 50, 60 | 120 | 1 k | 10 k to |
|---|---|---|---|---|
| Correction factor | 0.70 | 1.00 | 1.30 | 1.70 |

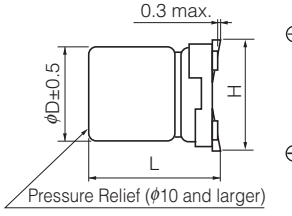
## Marking

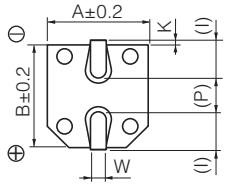
Example : 6.3 V.DC 22 µF
Marking color : BLACK




| R. Voltage (V.DC) | 6.3 | 10 | 16 | 25 | 35 | 50 |
|---|---|---|---|---|---|---|
| Code | j | A | C | E | V | H |

## Dimensions




( ) Reference size

(Unit : mm)

| Size code | φD | L | A, B | H | I | W | P | K |
|---|---|---|---|---|---|---|---|---|
| B | 4.0 | $5.4^{+0.1}_{-0.2}$ | 4.3 | 5.5 max. | 1.8 | 0.65±0.1 | 1.0 | $0.35^{+0.15}_{-0.20}$ |
| C | 5.0 | $5.4^{+0.1}_{-0.2}$ | 5.3 | 6.5 max. | 2.2 | 0.65±0.1 | 1.5 | $0.35^{+0.15}_{-0.20}$ |
| D | 6.3 | $5.4^{+0.1}_{-0.2}$ | 6.6 | 7.8 max. | 2.6 | 0.65±0.1 | 1.8 | $0.35^{+0.15}_{-0.20}$ |
| D8 | 6.3 | 7.7±0.3 | 6.6 | 7.8 max. | 2.6 | 0.65±0.1 | 1.8 | $0.35^{+0.15}_{-0.20}$ |
| E | 8.0 | 6.2±0.3 | 8.3 | 9.5 max. | 3.4 | 0.65±0.1 | 2.2 | $0.35^{+0.15}_{-0.20}$ |
| F | 8.0 | 10.2±0.3 | 8.3 | 10.0 max. | 3.4 | 0.90±0.2 | 3.1 | 0.70±0.20 |
| G | 10.0 | 10.2±0.3 | 10.3 | 12.0 max. | 3.5 | 0.90±0.2 | 4.6 | 0.70±0.20 |

## Characteristics list

Endurance : 105 °C 1000 h

| Rated voltage (V.DC) | Cap. (±20 %) (μF) | Case size (mm) | | Size* code | Specification | | Part No. | Reflow | Min. Packaging Q'ty |
|---|---|---|---|---|---|---|---|---|---|
| | | φD | L | | Ripple current (120 Hz) (+105 °C) (mA r.m.s.) | tan δ (120 Hz) (+20 °C) | | | Taping (pcs) |
| 6.3 | 22 | 4 | 5.4 | B | 29 | 0.30 | EEEHA0J220AR | (5) | 2000 |
| | 33 | 4 | 5.4 | (B) | 29 | 0.35 | EEEHAJ330WAR | (5) | 2000 |
| | 47 | 5 | 5.4 | C | 46 | 0.30 | EEEHA0J470AR | (5) | 1000 |
| | 100 | 5 | 5.4 | (C) | 47 | 0.40 | EEEHAJ101WAR | (5) | 1000 |
| | | 6.3 | 5.4 | D | 71 | 0.30 | EEEHA0J101AP | (5) | 1000 |
| | 330 | 6.3 | 7.7 | D8 | 105 | 0.30 | EEEHAJ331XAP | (5) | 900 |
| | | 8 | 6.2 | (E) | 18 0 | 0.35 | EEEHAJ331UAP | (7) | 500 |
| | | 8 | 10.2 | F | 230 | 0.35 | EEEHA0J331AP | (7) | 500 |
| | 470 | 8 | 10.2 | (F) | 300 | 0.35 | EEEHAJ471UAP | (7) | 500 |
| | 1000 | 10 | 10.2 | G | 400 | 0.35 | EEEHA0J102AP | (7) | 500 |
| | 1500 | 10 | 10.2 | (G) | 480 | 0.50 | EEEHAJ152UAP | (7) | 500 |
| 10 | 22 | 4 | 5.4 | (B) | 28 | 0.30 | EEEHAA220WAR | (5) | 2000 |
| | 33 | 4 | 5.4 | (B) | 29 | 0.30 | EEEHAA330WAR | (5) | 2000 |
| | | 5 | 5.4 | C | 43 | 0.22 | EEEHA1A330AR | (5) | 1000 |
| | 47 | 5 | 5.4 | (C) | 43 | 0.30 | EEEHAA470WAR | (5) | 1000 |
| | 100 | 6.3 | 5.4 | (D) | 71 | 0.30 | EEEHAA101WAP | (5) | 1000 |
| | | 8 | 6.2 | E | 110 | 0.26 | EEEHA1A101AP | (7) | 1000 |
| | 220 | 6.3 | 7.7 | D8 | 105 | 0.22 | EEEHAA221XAP | (5) | 900 |
| | | 8 | 10.2 | F | 160 | 0.26 | EEEHA1A221AP | (7) | 500 |
| | 470 | 8 | 10.2 | (F) | 200 | 0.26 | EEEHAA471UAP | (7) | 500 |
| | | 10 | 10.2 | G | 270 | 0.26 | EEEHA1A471AP | (7) | 500 |
| | 1000 | 10 | 10.2 | (G) | 400 | 0.35 | EEEHAA102UAP | (7) | 500 |
| 16 | 10 | 4 | 5.4 | B | 28 | 0.16 | EEEHA1C100AR | (5) | 2000 |
| | 22 | 4 | 5.4 | (B) | 28 | 0.26 | EEEHAC220WAR | (5) | 2000 |
| | | 5 | 5.4 | C | 39 | 0.16 | EEEHA1C220AR | (5) | 1000 |
| | 33 | 5 | 5.4 | (C) | 35 | 0.26 | EEEHAC330WAR | (5) | 1000 |
| | 47 | 5 | 5.4 | (C) | 39 | 0.26 | EEEHAC470WAR | (5) | 1000 |
| | | 6.3 | 5.4 | D | 70 | 0.16 | EEEHA1C470AP | (5) | 1000 |
| | 100 | 6.3 | 5.4 | (D) | 70 | 0.26 | EEEHAC101WAP | (5) | 1000 |
| | 220 | 6.3 | 7.7 | D8 | 105 | 0.20 | EEEHAC221XAP | (5) | 900 |
| | | 8 | 10.2 | (F) | 150 | 0.20 | EEEHAC221UAP | (7) | 500 |
| | | 10 | 10.2 | G | 210 | 0.20 | EEEHA1C221AP | (7) | 500 |
| | 330 | 8 | 10.2 | (F) | 170 | 0.20 | EEEHAC331UAP | (7) | 500 |
| | | 10 | 10.2 | G | 230 | 0.20 | EEEHA1C331AP | (7) | 500 |
| | 470 | 8 | 10.2 | (F) | 340 | 0.26 | EEEHAC471UAP | (7) | 500 |
| | | 10 | 10.2 | G | 340 | 0.20 | EEEHA1C471AP | (7) | 500 |
| | 680 | 10 | 10.2 | (G) | 380 | 0.26 | EEEHAC681UAP | (7) | 500 |

✻ Size code( ) : Miniaturization product

If Part number exceeds 12 digits, voltage code is abbreviated as follows; 0J → J, 1A → A, 1C → C, 1E → E, 1V → V, 1H → H

· Please refer to the page of "Reflow Profile" and "The Taping Dimensions".

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

## Characteristics list

Endurance : 105 °C 1000 h

| Rated voltage (V.DC) | Cap. (±20 %) (μF) | Case size (mm) | | Size* code | Specification | | Part No. | Reflow | Min. Packaging Q'ty |
|---|---|---|---|---|---|---|---|---|---|
| | | φD | L | | Ripple current (120 Hz) (+105 °C) (mA r.m.s.) | tan δ (120 Hz) (+20 °C) | | | Taping (pcs) |
| 25 | 4.7 | 4 | 5.4 | B | 22 | 0.14 | EEEHA1E4R7AR | (5) | 2000 |
| | 10 | 4 | 5.4 | (B) | 22 | 0.20 | EEEHAE100WAR | (5) | 2000 |
| | | 5 | 5.4 | C | 28 | 0.14 | EEEHA1E100AR | (5) | 1000 |
| | 22 | 5 | 5.4 | (C) | 35 | 0.20 | EEEHAE220WAR | (5) | 1000 |
| | | 6.3 | 5.4 | D | 55 | 0.14 | EEEHA1E220AP | (5) | 1000 |
| | 33 | 5 | 5.4 | (C) | 45 | 0.20 | EEEHAE330WAR | (5) | 1000 |
| | | 6.3 | 5.4 | D | 65 | 0.14 | EEEHA1E330AP | (5) | 1000 |
| | 47 | 6.3 | 5.4 | (D) | 70 | 0.20 | EEEHAE470WAP | (5) | 1000 |
| | | 8 | 6.2 | E | 91 | 0.16 | EEEHA1E470AP | (7) | 1000 |
| | 100 | 8 | 6.2 | (E) | 91 | 0.16 | EEEHAE101UAP | (7) | 1000 |
| | | 6.3 | 7.7 | D8 | 91 | 0.16 | EEEHAE101XAP | (5) | 900 |
| | | 8 | 10.2 | F | 130 | 0.16 | EEEHA1E101AP | (7) | 500 |
| | 220 | 8 | 10.2 | (F) | 160 | 0.20 | EEEHAE221UAP | (7) | 500 |
| | | 10 | 10.2 | G | 190 | 0.16 | EEEHA1E221AP | (7) | 500 |
| | 330 | 8 | 10.2 | (F) | 180 | 0.20 | EEEHAE331UAP | (7) | 500 |
| | | 10 | 10.2 | G | 340 | 0.16 | EEEHA1E331AP | (7) | 500 |
| | 470 | 10 | 10.2 | (G) | 360 | 0.25 | EEEHAE471UAP | (7) | 500 |
| 35 | 4.7 | 4 | 5.4 | B | 22 | 0.12 | EEEHA1V4R7AR | (5) | 2000 |
| | 10 | 4 | 5.4 | (B) | 22 | 0.16 | EEEHAV100WAR | (5) | 2000 |
| | | 5 | 5.4 | C | 30 | 0.12 | EEEHA1V100AR | (5) | 1000 |
| | 22 | 5 | 5.4 | (C) | 35 | 0.16 | EEEHAV220WAR | (5) | 1000 |
| | | 6.3 | 5.4 | D | 60 | 0.12 | EEEHA1V220AP | (5) | 1000 |
| | 33 | 6.3 | 5.4 | (D) | 42 | 0.16 | EEEHAV330WAP | (5) | 1000 |
| | | 8 | 6.2 | E | 84 | 0.14 | EEEHA1V330AP | (7) | 1000 |
| | 47 | 8 | 6.2 | (E) | 84 | 0.14 | EEEHAV470UAP | (7) | 1000 |
| | | 8 | 10.2 | F | 98 | 0.14 | EEEHA1V470AP | (7) | 500 |
| | 100 | 6.3 | 7.7 | D8 | 84 | 0.14 | EEEHAV101XAP | (5) | 900 |
| | | 8 | 10.2 | (F) | 120 | 0.14 | EEEHAV101UAP | (7) | 500 |
| | | 10 | 10.2 | G | 160 | 0.14 | EEEHA1V101AP | (7) | 500 |
| | 220 | 8 | 10.2 | (F) | 170 | 0.14 | EEEHAV221UAP | (7) | 500 |
| | | 10 | 10.2 | G | 210 | 0.14 | EEEHA1V221AP | (7) | 500 |
| | 330 | 10 | 10.2 | (G) | 250 | 0.30 | EEEHAV331UAP | (7) | 500 |
| 50 | 1 | 4 | 5.4 | B | 10 | 0.12 | EEEHA1H1R0AR | (5) | 2000 |
| | 2.2 | 4 | 5.4 | B | 16 | 0.12 | EEEHA1H2R2AR | (5) | 2000 |
| | 3.3 | 4 | 5.4 | B | 16 | 0.12 | EEEHA1H3R3AR | (5) | 2000 |
| | 4.7 | 5 | 5.4 | C | 23 | 0.12 | EEEHA1H4R7AR | (5) | 1000 |
| | 10 | 6.3 | 5.4 | D | 35 | 0.12 | EEEHA1H100AP | (5) | 1000 |
| | 22 | 8 | 6.2 | E | 70 | 0.12 | EEEHA1H220AP | (7) | 1000 |
| | 33 | 6.3 | 7.7 | D8 | 70 | 0.14 | EEEHAH330XAP | (5) | 900 |
| | | 8 | 6.2 | (E) | 70 | 0.12 | EEEHAH330UAP | (7) | 1000 |
| | | 8 | 10.2 | F | 91 | 0.12 | EEEHA1H330AP | (7) | 500 |
| | 47 | 6.3 | 7.7 | D8 | 63 | 0.14 | EEEHAH470XAP | (5) | 900 |
| | | 8 | 10.2 | (F) | 95 | 0.12 | EEEHAH470UAP | (7) | 500 |
| | | 10 | 10.2 | G | 100 | 0.12 | EEEHA1H470AP | (7) | 500 |
| | 100 | 8 | 10.2 | (F) | 110 | 0.18 | EEEHAH101UAP | (7) | 500 |
| | | 10 | 10.2 | G | 120 | 0.12 | EEEHA1H101AP | (7) | 500 |
| | 220 | 10 | 10.2 | (G) | 150 | 0.18 | EEEHAH221UAP | (7) | 500 |

✻ Size code( ) : Miniaturization product

If Part number exceeds 12 digits, voltage code is abbreviated as follows; 0J → J, 1A → A, 1C → C, 1E → E, 1V → V, 1H → H

· Please refer to the page of "Reflow Profile" and "The Taping Dimensions".

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

# Surface Mount Type

Series : **HA** Type : **V**

Hight-temperature assuranceize

HA
↑
S

## Features

- Endurance : 105 °C 1000 h
- Vibration-proof product is available upon request. (φ8 mm and larger)
- RoHS compliant

## Specifications

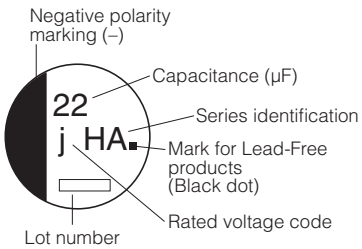
| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Category temperature range | –40 °C to +105 °C | | | | | | | | | |
| Rated voltage range | 6.3 V.DC to 100 V.DC | | | | | | | | | |
| Capacitance range | 1 µF to 1500 µF | | | | | | | | | |
| Capacitance tolerance | ±20 % (120 Hz/+20 °C) | | | | | | | | | |
| 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 | | | | | | | | | |
| Characteristics at low temperature | V.DC | 6.3 | 10 | 16 | 25 | 35 | 50 | 63 | 100 | (Impedance ratio at 120 Hz) |
| | Z(–25 °C)/Z(+20 °C) | 4 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | |
| | Z(–40 °C)/Z(+20 °C) | 8 | 6 | 4 | 4 | 3 | 3 | 4 | 4 | |
| Endurance | After applying rated working voltage for 1000 hours at +105 °C±2 °C and then being stabilized at +20 °C, capacitors shall meet the following limits. | | | | | | | | | |
| | Capacitance change | Within ±20 % of the initial value (6.3 V.DC of miniature : ±30 %) | | | | | | | | |
| | tan δ | ≦ 200 % of the initial limit | | | | | | | | |
| | DC leakage current | Within the initial limit | | | | | | | | |
| 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) | | | | | | | | | |
| Resistance to soldering heat | After reflow soldering and then being stabilized at +20 °C, capacitor shall meet the following limits. | | | | | | | | | |
| | Capacitance change | Within ±10 % of the initial value | | | | | | | | |
| | tan δ | Within the initial limit | | | | | | | | |
| | DC leakage current | Within the initial limit | | | | | | | | |
| AEC-Q200 | AEC-Q200 compliant | | | | | | | | | |

## Frequency correction factor for ripple current

| Frequency (Hz) | 50, 60 | 120 | 1 k | 10 k to |
|---|---|---|---|---|
| Correction factor | 0.70 | 1.00 | 1.30 | 1.70 |

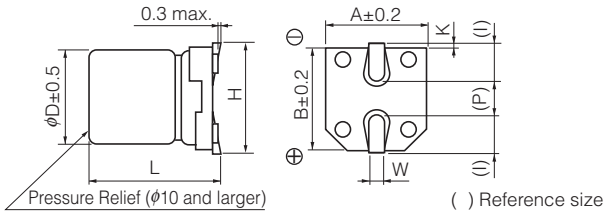
## Marking

Example : 6.3 V.DC 22 µF
Marking color : BLACK




| R. Voltage (V.DC) | 6.3 | 10 | 16 | 25 | 35 | 50 | 63 | 100 |
|---|---|---|---|---|---|---|---|---|
| Code | j | A | C | E | V | H | J | 2A |

## Dimensions




(Unit : mm)

| Size code | φD | L | A, B | H | I | W | P | K |
|---|---|---|---|---|---|---|---|---|
| B | 4.0 | $5.4^{+0.1}_{-0.2}$ | 4.3 | 5.5 max. | 1.8 | 0.65±0.1 | 1.0 | $0.35^{+0.15}_{-0.20}$ |
| C | 5.0 | $5.4^{+0.1}_{-0.2}$ | 5.3 | 6.5 max. | 2.2 | 0.65±0.1 | 1.5 | $0.35^{+0.15}_{-0.20}$ |
| D | 6.3 | $5.4^{+0.1}_{-0.2}$ | 6.6 | 7.8 max. | 2.6 | 0.65±0.1 | 1.8 | $0.35^{+0.15}_{-0.20}$ |
| D8 | 6.3 | 7.7±0.3 | 6.6 | 7.8 max. | 2.6 | 0.65±0.1 | 1.8 | $0.35^{+0.15}_{-0.20}$ |
| E | 8.0 | 6.2±0.3 | 8.3 | 9.5 max. | 3.4 | 0.65±0.1 | 2.2 | $0.35^{+0.15}_{-0.20}$ |
| F | 8.0 | 10.2±0.3 | 8.3 | 10.0 max. | 3.4 | 0.90±0.2 | 3.1 | 0.70±0.20 |
| G | 10.0 | 10.2±0.3 | 10.3 | 12.0 max. | 3.5 | 0.90±0.2 | 4.6 | 0.70±0.20 |

## Characteristics list

Endurance : 105 °C 1000 h

| Rated voltage (V.DC) | Cap. (±20 %) (μF) | Case size (mm) | | Size* code | Specification | | Part No. | Reflow | Min. Packaging Q'ty |
|---|---|---|---|---|---|---|---|---|---|
| | | φD | L | | Ripple current (120 Hz) (+105 °C) (mA r.m.s.) | tan δ (120 Hz) (+20 °C) | | | Taping (pcs) |
| 6.3 | 22 | 4 | 5.4 | B | 29 | 0.30 | EEEHA0J220R | (1) | 2000 |
| | 33 | 4 | 5.4 | (B) | 29 | 0.35 | EEEHA0J330WR | (1) | 2000 |
| | 47 | 4 | 5.4 | (B) | 36 | 0.35 | EEEHA0J470WR | (1) | 2000 |
| | | 5 | 5.4 | C | 46 | 0.30 | EEEHA0J470R | (1) | 1000 |
| | 100 | 5 | 5.4 | (C) | 47 | 0.35 | EEEHA0J101WR | (1) | 1000 |
| | | 6.3 | 5.4 | D | 71 | 0.30 | EEEHA0J101P | (1) | 1000 |
| | 220 | 6.3 | 5.4 | (D) | 74 | 0.35 | EEEHA0J221WP | (1) | 1000 |
| | 330 | 6.3 | 7.7 | D8 | 105 | 0.30 | EEEHA0J331XP | (1) | 900 |
| | | 8 | 10.2 | F | 230 | 0.35 | EEEHA0J331P | (2) | 500 |
| | 470 | 8 | 10.2 | (F) | 300 | 0.35 | EEEHA0J471UP | (2) | 500 |
| | 1000 | 8 | 10.2 | (F) | 300 | 0.35 | EEEHA0J102UP | (2) | 500 |
| | | 10 | 10.2 | G | 400 | 0.35 | EEEHA0J102P | (2) | 500 |
| | 1500 | 10 | 10.2 | G | 480 | 0.35 | EEEHA0J152P | (2) | 500 |
| 10 | 22 | 4 | 5.4 | (B) | 28 | 0.30 | EEEHA1A220WR | (1) | 2000 |
| | 33 | 4 | 5.4 | (B) | 29 | 0.30 | EEEHA1A330WR | (1) | 2000 |
| | | 5 | 5.4 | C | 43 | 0.22 | EEEHA1A330R | (1) | 1000 |
| | 47 | 5 | 5.4 | (C) | 43 | 0.30 | EEEHA1A470WR | (1) | 1000 |
| | 100 | 6.3 | 5.4 | (D) | 71 | 0.30 | EEEHA1A101WP | (1) | 1000 |
| | | 8 | 6.2 | E | 110 | 0.26 | EEEHA1A101P | (2) | 1000 |
| | 220 | 6.3 | 7.7 | D8 | 105 | 0.22 | EEEHA1A221XP | (1) | 900 |
| | | 8 | 10.2 | F | 160 | 0.26 | EEEHA1A221P | (2) | 500 |
| | 470 | 8 | 10.2 | (F) | 200 | 0.26 | EEEHA1A471UP | (2) | 500 |
| | | 10 | 10.2 | G | 270 | 0.26 | EEEHA1A471P | (2) | 500 |
| | 1000 | 10 | 10.2 | G | 400 | 0.26 | EEEHA1A102P | (2) | 500 |
| 16 | 10 | 4 | 5.4 | B | 28 | 0.16 | EEEHA1C100R | (1) | 2000 |
| | 22 | 4 | 5.4 | (B) | 28 | 0.26 | EEEHA1C220WR | (1) | 2000 |
| | | 5 | 5.4 | C | 39 | 0.16 | EEEHA1C220R | (1) | 1000 |
| | 33 | 5 | 5.4 | (C) | 35 | 0.26 | EEEHA1C330WR | (1) | 1000 |
| | 47 | 5 | 5.4 | (C) | 39 | 0.26 | EEEHA1C470WR | (1) | 1000 |
| | | 6.3 | 5.4 | D | 70 | 0.16 | EEEHA1C470P | (1) | 1000 |
| | 100 | 6.3 | 5.4 | (D) | 70 | 0.26 | EEEHA1C101WP | (1) | 1000 |
| | 220 | 6.3 | 7.7 | D8 | 105 | 0.16 | EEEHA1C221XP | (1) | 900 |
| | | 8 | 10.2 | (F) | 150 | 0.20 | EEEHA1C221UP | (2) | 500 |
| | | 10 | 10.2 | G | 210 | 0.20 | EEEHA1C221P | (2) | 500 |
| | 330 | 8 | 10.2 | (F) | 170 | 0.20 | EEEHA1C331UP | (2) | 500 |
| | | 10 | 10.2 | G | 230 | 0.20 | EEEHA1C331P | (2) | 500 |
| | 470 | 8 | 10.2 | (F) | 340 | 0.20 | EEEHA1C471UP | (2) | 500 |
| | | 10 | 10.2 | G | 340 | 0.20 | EEEHA1C471P | (2) | 500 |
| | 680 | 10 | 10.2 | G | 380 | 0.20 | EEEHA1C681P | (2) | 500 |

✻ Size code( ) : Miniaturization product

· Please refer to the page of “Reflow Profile” and “The Taping Dimensions”.

· When requesting vibration-proof product, please put the last “V” instead to “P”

## Characteristics list

Endurance : 105 °C 1000 h

| Rated voltage (V.DC) | Cap. (±20 %) (μF) | Case size (mm) | | Size* code | Specification | | Part No. | Reflow | Min. Packaging Q'ty |
|---|---|---|---|---|---|---|---|---|---|
| | | φD | L | | Ripple current (120 Hz) (+105 °C) (mA r.m.s.) | tan δ (120 Hz) (+20 °C) | | | Taping (pcs) |
| 25 | 4.7 | 4 | 5.4 | B | 22 | 0.14 | EEEHA1E4R7R | (1) | 2000 |
| | 10 | 4 | 5.4 | (B) | 22 | 0.20 | EEEHA1E100WR | (1) | 2000 |
| | | 5 | 5.4 | C | 28 | 0.14 | EEEHA1E100R | (1) | 1000 |
| | 22 | 5 | 5.4 | (C) | 35 | 0.20 | EEEHA1E220WR | (1) | 1000 |
| | | 6.3 | 5.4 | D | 55 | 0.14 | EEEHA1E220P | (1) | 1000 |
| | 33 | 5 | 5.4 | (C) | 45 | 0.20 | EEEHA1E330WR | (1) | 1000 |
| | | 6.3 | 5.4 | D | 65 | 0.14 | EEEHA1E330P | (1) | 1000 |
| | 47 | 6.3 | 5.4 | (D) | 70 | 0.20 | EEEHA1E470WP | (1) | 1000 |
| | | 8 | 6.2 | E | 91 | 0.16 | EEEHA1E470P | (2) | 1000 |
| | 100 | 6.3 | 7.7 | D8 | 91 | 0.14 | EEEHA1E101XP | (1) | 900 |
| | | 8 | 6.2 | (E) | 91 | 0.16 | EEEHA1E101UP | (2) | 1000 |
| | | 8 | 10.2 | F | 130 | 0.16 | EEEHA1E101P | (2) | 500 |
| | 220 | 8 | 10.2 | (F) | 160 | 0.16 | EEEHA1E221UP | (2) | 500 |
| | | 10 | 10.2 | G | 190 | 0.16 | EEEHA1E221P | (2) | 500 |
| | 330 | 8 | 10.2 | (F) | 180 | 0.16 | EEEHA1E331UP | (2) | 500 |
| | | 10 | 10.2 | G | 340 | 0.16 | EEEHA1E331P | (2) | 500 |
| | 470 | 10 | 10.2 | G | 360 | 0.16 | EEEHA1E471P | (2) | 500 |
| 35 | 4.7 | 4 | 5.4 | B | 22 | 0.12 | EEEHA1V4R7R | (1) | 2000 |
| | 10 | 4 | 5.4 | (B) | 22 | 0.16 | EEEHA1V100WR | (1) | 2000 |
| | | 5 | 5.4 | C | 30 | 0.12 | EEEHA1V100R | (1) | 1000 |
| | 22 | 5 | 5.4 | (C) | 35 | 0.16 | EEEHA1V220WR | (1) | 1000 |
| | | 6.3 | 5.4 | D | 60 | 0.12 | EEEHA1V220P | (1) | 1000 |
| | 33 | 6.3 | 5.4 | (D) | 42 | 0.16 | EEEHA1V330WP | (1) | 1000 |
| | | 8 | 6.2 | E | 84 | 0.14 | EEEHA1V330P | (2) | 1000 |
| | 47 | 8 | 6.2 | (E) | 84 | 0.14 | EEEHA1V470UP | (2) | 1000 |
| | | 8 | 10.2 | F | 98 | 0.14 | EEEHA1V470P | (2) | 500 |
| | 100 | 6.3 | 7.7 | D8 | 84 | 0.12 | EEEHA1V101XP | (1) | 900 |
| | | 8 | 10.2 | (F) | 120 | 0.14 | EEEHA1V101UP | (2) | 500 |
| | | 10 | 10.2 | G | 160 | 0.14 | EEEHA1V101P | (2) | 500 |
| | 220 | 8 | 10.2 | (F) | 170 | 0.14 | EEEHA1V221UP | (2) | 500 |
| | | 10 | 10.2 | G | 210 | 0.14 | EEEHA1V221P | (2) | 500 |
| | 330 | 10 | 10.2 | G | 250 | 0.14 | EEEHA1V331P | (2) | 500 |
| 50 | 1 | 4 | 5.4 | B | 10 | 0.12 | EEEHA1H1R0R | (1) | 2000 |
| | 2.2 | 4 | 5.4 | B | 16 | 0.12 | EEEHA1H2R2R | (1) | 2000 |
| | 3.3 | 4 | 5.4 | B | 16 | 0.12 | EEEHA1H3R3R | (1) | 2000 |
| | 4.7 | 5 | 5.4 | C | 23 | 0.12 | EEEHA1H4R7R | (1) | 1000 |
| | 10 | 6.3 | 5.4 | D | 35 | 0.12 | EEEHA1H100P | (1) | 1000 |
| | 22 | 8 | 6.2 | E | 70 | 0.12 | EEEHA1H220P | (2) | 1000 |
| | 33 | 6.3 | 7.7 | D8 | 70 | 0.12 | EEEHA1H330XP | (1) | 900 |
| | | 8 | 6.2 | (E) | 70 | 0.12 | EEEHA1H330UP | (2) | 1000 |
| | | 8 | 10.2 | F | 91 | 0.12 | EEEHA1H330P | (2) | 500 |
| | 47 | 6.3 | 7.7 | D8 | 63 | 0.12 | EEEHA1H470XP | (1) | 900 |
| | | 8 | 10.2 | (F) | 95 | 0.12 | EEEHA1H470UP | (2) | 500 |
| | | 10 | 10.2 | G | 100 | 0.12 | EEEHA1H470P | (2) | 500 |
| | 100 | 8 | 10.2 | (F) | 110 | 0.12 | EEEHA1H101UP | (2) | 500 |
| | | 10 | 10.2 | G | 120 | 0.12 | EEEHA1H101P | (2) | 500 |
| | 220 | 10 | 10.2 | G | 150 | 0.12 | EEEHA1H221P | (2) | 500 |

✻ Size code( ) : Miniaturization product

· Please refer to the page of "Reflow Profile" and "The Taping Dimensions".

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

## Characteristics list

Endurance : 105 °C 1000 h

| Rated voltage (V.DC) | Cap. (±20 %) (μF) | Case size (mm) | | Size* code | Specification | | Part No. | Reflow | Min. Packaging Q'ty |
|---|---|---|---|---|---|---|---|---|---|
| | | φD | L | | Ripple current (120 Hz) (+105 °C) (mA r.m.s.) | tan δ (120 Hz) (+20 °C) | | | Taping (pcs) |
| 63 | 10 | 8 | 6.2 | E | 25 | 0.18 | EEEHA1J100P | (2) | 1000 |
| | 22 | 8 | 6.2 | (E) | 25 | 0.18 | EEEHA1J220UP | (2) | 1000 |
| | | 8 | 10.2 | F | 30 | 0.18 | EEEHA1J220P | (2) | 500 |
| | 33 | 10 | 10.2 | G | 45 | 0.18 | EEEHA1J330P | (2) | 500 |
| | 47 | 8 | 10.2 | (F) | 45 | 0.18 | EEEHA1J470UP | (2) | 500 |
| | | 10 | 10.2 | G | 50 | 0.18 | EEEHA1J470P | (2) | 500 |
| 100 | 4.7 | 8 | 6.2 | (E) | 30 | 0.18 | EEEHA2A4R7UP | (2) | 1000 |
| | 10 | 8 | 10.2 | F | 55 | 0.18 | EEEHA2A100P | (2) | 500 |
| | 22 | 8 | 10.2 | (F) | 55 | 0.18 | EEEHA2A220UP | (2) | 500 |
| | | 10 | 10.2 | G | 60 | 0.18 | EEEHA2A220P | (2) | 500 |
| | 33 | 10 | 10.2 | G | 65 | 0.18 | EEEHA2A330P | (2) | 500 |
| | 47 | 10 | 10.2 | (G) | 65 | 0.18 | EEEHA2A470UP | (2) | 500 |

✻ Size code( ) : Miniaturization product

· Please refer to the page of “Reflow Profile” and “The Taping Dimensions”.

· When requesting vibration-proof product, please put the last “V” instead to “P”

# Surface Mount Type

Series : **HB** Type : **V**
**High temperature**
**Lead-Free reflow (suffix : A*)**

## Features

- Endurance : 105 °C 2000 h
- Vibration-proof product is available upon request. (φ8 mm and larger)
- RoHS compliant

## Specifications

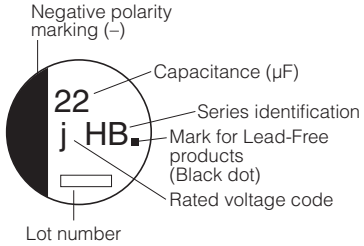
| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Category temperature range | –40 °C to +105 °C | | | | | | | | |
| Rated voltage range | 6.3 V.DC to 50 V.DC | | | | | | | | |
| Capacitance range | 1 µF to 1500 µF | | | | | | | | |
| Capacitance tolerance | ±20 % (120 Hz/ +20 °C) | | | | | | | | |
| 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 | | | | | | | | |
| Characteristics at low temperature | Standard | V.DC | 6.3 | 10 | 16 | 25 | 35 | 50 | (Impedance ratio at 120 Hz) |
| | | Z(–25 °C)/Z(+20 °C) | 4 | 3 | 2 | 2 | 2 | 2 | |
| | | Z(–40 °C)/Z(+20 °C) | 8 | 6 | 4 | 4 | 3 | 3 | |
| | Miniaturization product | Z(–25 °C)/Z(+20 °C) | 4 | 3 | 2 | 2 | 2 | 2 | |
| | | Z(–40 °C)/Z(+20 °C) | 10 | 8 | 6 | 6 | 4 | 4 | |
| Endurance | After applying rated working voltage for 2000 hours at +105 °C±2 °C and then being stabilized at +20 °C, capacitors shall meet the following limits. | | | | | | | | |
| | Capacitance change | Within ±20 % of the initial value (16 V.DC or less : Within ±25 %, Miniaturization product : Within ±35 %) | | | | | | | |
| | tan δ | ≦ 200 % of the initial limit | | | | | | | |
| | DC leakage current | Within the initial limit | | | | | | | |
| 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) | | | | | | | | |
| 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 | | | | | | | |
| | tan δ | Within the initial limit | | | | | | | |
| | DC leakage current | Within the initial limit | | | | | | | |
| AEC-Q200 | AEC-Q200 compliant | | | | | | | | |

## Frequency correction factor for ripple current

| Frequency (Hz) | 50, 60 | 120 | 1 k | 10 k to |
|---|---|---|---|---|
| Correction factor | 0.70 | 1.00 | 1.30 | 1.70 |

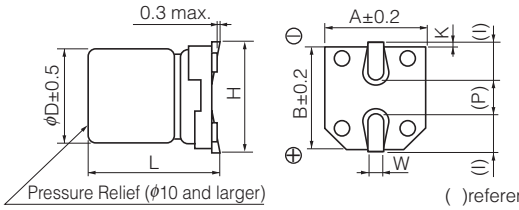
## Marking

Example : 6.3 V.DC 22 µF
Marking color : BLACK




| R. Voltage (V.DC) | 6.3 | 10 | 16 | 25 | 35 | 50 |
|---|---|---|---|---|---|---|
| Code | j | A | C | E | V | H |

## Dimensions




(Unit : mm)

| Size code | φD | L | A, B | H | I | W | P | K |
|---|---|---|---|---|---|---|---|---|
| B | 4.0 | 5.8±0.3 | 4.3 | 5.5 max. | 1.8 | 0.65±0.1 | 1.0 | $0.35^{+0.15}_{-0.20}$ |
| C | 5.0 | 5.8±0.3 | 5.3 | 6.5 max. | 2.2 | 0.65±0.1 | 1.5 | $0.35^{+0.15}_{-0.20}$ |
| D | 6.3 | 5.8±0.3 | 6.6 | 7.8 max. | 2.6 | 0.65±0.1 | 1.8 | $0.35^{+0.15}_{-0.20}$ |
| D8 | 6.3 | 7.7±0.3 | 6.6 | 7.8 max. | 2.6 | 0.65±0.1 | 1.8 | $0.35^{+0.15}_{-0.20}$ |
| E | 8.0 | 6.2±0.3 | 8.3 | 9.5 max. | 3.4 | 0.65±0.1 | 2.2 | $0.35^{+0.15}_{-0.20}$ |
| F | 8.0 | 10.2±0.3 | 8.3 | 10.0 max. | 3.4 | 0.90±0.2 | 3.1 | 0.70±0.20 |
| G | 10.0 | 10.2±0.3 | 10.3 | 12.0 max. | 3.5 | 0.90±0.2 | 4.6 | 0.70±0.20 |

## Characteristics list

Endurance : 105 °C 2000 h

| Rated voltage (V.DC) | Cap. (±20 %) (μF) | Case size (mm) | | Size* code | Specification | | Part No. | Reflow | Min. Packaging Q'ty |
|---|---|---|---|---|---|---|---|---|---|
| | | φD | L | | Ripple current (120 Hz) (+105 °C) (mA r.m.s.) | tan δ (120 Hz) (+20 °C) | | | Taping (pcs) |
| 6.3 | 22 | 4 | 5.8 | B | 26 | 0.30 | EEEHB0J220AR | (5) | 2000 |
| | 33 | 4 | 5.8 | B | 29 | 0.30 | EEEHB0J330AR | (5) | 2000 |
| | 47 | 4 | 5.8 | (B) | 26 | 0.50 | EEEHBJ470UAR | (5) | 2000 |
| | | 5 | 5.8 | C | 46 | 0.30 | EEEHB0J470AR | (5) | 1000 |
| | 100 | 5 | 5.8 | (C) | 42 | 0.50 | EEEHBJ101UAR | (5) | 1000 |
| | | 6.3 | 5.8 | D | 71 | 0.30 | EEEHB0J101AP | (5) | 1000 |
| | 220 | 6.3 | 5.8 | (D) | 80 | 0.50 | EEEHBJ221UAP | (5) | 1000 |
| | | 8 | 10.2 | F | 150 | 0.35 | EEEHB0J221AP | (7) | 500 |
| | 330 | 8 | 6.2 | (E) | 180 | 0.50 | EEEHBJ331UAP | (7) | 1000 |
| | | 8 | 10.2 | F | 230 | 0.35 | EEEHB0J331AP | (7) | 500 |
| | 470 | 8 | 10.2 | (F) | 230 | 0.50 | EEEHBJ471UAP | (7) | 500 |
| | 1500 | 10 | 10.2 | (G) | 290 | 0.50 | EEEHBJ152UAP | (7) | 500 |
| 10 | 33 | 4 | 5.8 | (B) | 23 | 0.30 | EEEHBA330UAR | (5) | 2000 |
| | | 5 | 5.8 | C | 43 | 0.26 | EEEHB1A330AR | (5) | 1000 |
| | 68 | 6.3 | 5.8 | D | 70 | 0.22 | EEEHB1A680AP | (5) | 1000 |
| | 100 | 6.3 | 5.8 | (D) | 71 | 0.30 | EEEHBA101UAP | (5) | 1000 |
| | | 8 | 6.2 | E | 110 | 0.26 | EEEHB1A101AP | (7) | 1000 |
| | 150 | 6.3 | 5.8 | (D) | 64 | 0.50 | EEEHBA151UAP | (5) | 1000 |
| | 220 | 8 | 6.2 | (E) | 110 | 0.30 | EEEHBA221UAP | (7) | 1000 |
| | | 8 | 10.2 | F | 160 | 0.26 | EEEHB1A221AP | (7) | 500 |
| | 470 | 8 | 10.2 | (F) | 220 | 0.35 | EEEHBA471UAP | (7) | 500 |
| | | 10 | 10.2 | G | 270 | 0.26 | EEEHB1A471AP | (7) | 500 |
| 16 | 10 | 4 | 5.8 | B | 28 | 0.16 | EEEHB1C100AR | (5) | 2000 |
| | 22 | 4 | 5.8 | (B) | 29.5 | 0.26 | EEEHBC220UAR | (5) | 2000 |
| | | 5 | 5.8 | C | 39 | 0.16 | EEEHB1C220AR | (5) | 1000 |
| | 33 | 6.3 | 5.8 | D | 65 | 0.16 | EEEHB1C330AP | (5) | 1000 |
| | 47 | 5 | 5.8 | (C) | 39 | 0.26 | EEEHBC470UAR | (5) | 1000 |
| | | 6.3 | 5.8 | D | 70 | 0.16 | EEEHB1C470AP | (5) | 1000 |
| | | 6.3 | 7.7 | D8 | 84 | 0.16 | EEEHBC470XAP | (5) | 900 |
| | 100 | 6.3 | 5.8 | (D) | 70 | 0.26 | EEEHBC101UAP | (5) | 1000 |
| | | 8 | 10.2 | F | 120 | 0.20 | EEEHB1C101AP | (7) | 500 |
| | 220 | 8 | 10.2 | (F) | 150 | 0.20 | EEEHBC221UAP | (7) | 500 |
| | | 10 | 10.2 | G | 210 | 0.20 | EEEHB1C221AP | (7) | 500 |
| | 330 | 10 | 10.2 | G | 230 | 0.20 | EEEHB1C331AP | (7) | 500 |
| | 470 | 8 | 10.2 | (F) | 240 | 0.40 | EEEHBC471UAP | (7) | 500 |
| | | 10 | 10.2 | G | 340 | 0.20 | EEEHB1C471AP | (7) | 500 |
| 25 | 4.7 | 4 | 5.8 | B | 22 | 0.14 | EEEHB1E4R7AR | (5) | 2000 |
| | 6.8 | 4 | 5.8 | B | 25 | 0.14 | EEEHB1E6R8AR | (5) | 2000 |
| | 10 | 4 | 5.8 | (B) | 28 | 0.16 | EEEHBE100UAR | (5) | 2000 |
| | | 5 | 5.8 | C | 28 | 0.14 | EEEHB1E100AR | (5) | 1000 |
| | 22 | 6.3 | 5.8 | D | 55 | 0.14 | EEEHB1E220AP | (5) | 1000 |
| | 33 | 5 | 5.8 | (C) | 50 | 0.20 | EEEHBE330UAR | (5) | 1000 |
| | | 6.3 | 5.8 | D | 65 | 0.14 | EEEHB1E330AP | (5) | 1000 |
| | 47 | 6.3 | 5.8 | (D) | 65 | 0.20 | EEEHBE470UAP | (5) | 1000 |
| | | 8 | 6.2 | E | 91 | 0.16 | EEEHB1E470AP | (7) | 1000 |
| | 100 | 8 | 6.2 | (E) | 100 | 0.16 | EEEHBE101UAP | (7) | 1000 |
| | | 8 | 10.2 | F | 130 | 0.16 | EEEHB1E101AP | (7) | 500 |
| | 220 | 8 | 10.2 | (F) | 130 | 0.30 | EEEHBE221UAP | (7) | 500 |
| | | 10 | 10.2 | G | 190 | 0.16 | EEEHB1E221AP | (7) | 500 |
| | 330 | 8 | 10.2 | (F) | 130 | 0.30 | EEEHBE331UAP | (7) | 500 |
| | | 10 | 10.2 | G | 220 | 0.16 | EEEHB1E331AP | (7) | 500 |
| | 470 | 10 | 10.2 | (G) | 230 | 0.30 | EEEHBE471UAP | (7) | 500 |

✻ Size code( ) : Miniaturization product

If Part number exceeds 12 digits, voltage code is abbreviated as follows; 0J → J, 1A → A, 1C → C, 1E → E, 1V → V

· Please refer to the page of "Reflow Profile" and "The Taping Dimensions".

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

## Characteristics list

Endurance : 105 °C 2000 h

| Rated voltage (V.DC) | Cap. (±20 %) (μF) | Case size (mm) | | Size* code | Specification | | Part No. | Reflow | Min. Packaging Q'ty |
|---|---|---|---|---|---|---|---|---|---|
| | | φD | L | | Ripple current (120 Hz) (+105 °C) (mA r.m.s.) | tan δ (120 Hz) (+20 °C) | | | Taping (pcs) |
| 35 | 4.7 | 4 | 5.8 | B | 21 | 0.12 | EEEHB1V4R7AR | (5) | 2000 |
| | 6.8 | 4 | 5.8 | (B) | 25 | 0.12 | EEEHBV6R8UAR | (5) | 2000 |
| | 10 | 5 | 5.8 | C | 28 | 0.12 | EEEHB1V100AR | (5) | 1000 |
| | 22 | 6.3 | 5.8 | D | 55 | 0.12 | EEEHB1V220AP | (5) | 1000 |
| | 33 | 8 | 6.2 | E | 84 | 0.14 | EEEHB1V330AP | (7) | 1000 |
| | 47 | 6.3 | 7.7 | D8 | 98 | 0.20 | EEEHBV470YAP | (5) | 900 |
| | | 8 | 6.2 | (E) | 91 | 0.18 | EEEHBV470UAP | (7) | 1000 |
| | | 8 | 10.2 | F | 98 | 0.14 | EEEHB1V470AP | (7) | 500 |
| | 100 | 8 | 10.2 | (F) | 98 | 0.20 | EEEHBV101UAP | (7) | 500 |
| | | 10 | 10.2 | G | 160 | 0.14 | EEEHB1V101AP | (7) | 500 |
| | 220 | 10 | 10.2 | (G) | 180 | 0.14 | EEEHBV221UAP | (7) | 500 |
| 50 | 1 | 4 | 5.8 | B | 10 | 0.12 | EEEHB1H1R0AR | (5) | 2000 |
| | 2.2 | 4 | 5.8 | B | 16 | 0.12 | EEEHB1H2R2AR | (5) | 2000 |
| | 3.3 | 4 | 5.8 | B | 16 | 0.12 | EEEHB1H3R3AR | (5) | 2000 |
| | 4.7 | 5 | 5.8 | C | 23 | 0.12 | EEEHB1H4R7AR | (5) | 1000 |
| | 6.8 | 5 | 5.8 | C | 23 | 0.12 | EEEHB1H6R8AR | (5) | 1000 |
| | 10 | 6.3 | 5.8 | D | 35 | 0.12 | EEEHB1H100AP | (5) | 1000 |
| | 22 | 6.3 | 5.8 | (D) | 35 | 0.14 | EEEHBH220UAP | (5) | 1000 |
| | | 8 | 6.2 | E | 70 | 0.12 | EEEHB1H220AP | (7) | 1000 |
| | 33 | 8 | 10.2 | F | 91 | 0.12 | EEEHB1H330AP | (7) | 500 |
| | 47 | 6.3 | 7.7 | D8 | 63 | 0.12 | EEEHBH470YAP | (5) | 900 |
| | | 8 | 10.2 | (F) | 95 | 0.12 | EEEHBH470UAP | (7) | 500 |
| | | 10 | 10.2 | G | 100 | 0.12 | EEEHB1H470AP | (7) | 500 |
| | 100 | 10 | 10.2 | (G) | 250 | 0.12 | EEEHBH101UAP | (7) | 500 |
| | 220 | 10 | 10.2 | (G) | 270 | 0.18 | EEEHBH221UAP | (7) | 500 |

✻ Size code( ) : Miniaturization product

If Part number exceeds 12 digits, voltage code is abbreviated as follows; 0J → J, 1A → A, 1C → C, 1E → E, 1V → V

· Please refer to the page of “Reflow Profile” and “The Taping Dimensions”.

· When requesting vibration-proof product, please put the last “V” instead to “P”

# Surface Mount Type

Series : **HB** Type : **V**

Long life
HB (5.5 mm max.)
↑ Low profile
HA

## Features

- Endurance: 105 °C 2000 h
- 5.8 mm height (≦ φ6.3), 5.5 mm height max.
- Vibration-proof product is available upon request. (φ8 mm and larger)
- RoHS compliant

## Specifications

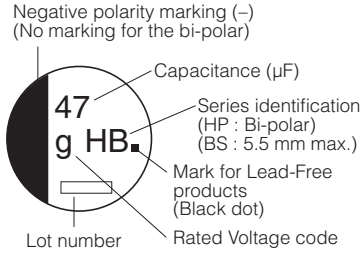
| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Category temperature range | –40 °C to +105 °C | | | | | | | | |
| Rated voltage range | 4 V.DC to 50 V.DC | | | | | | | | |
| Capacitance range | 1 μF to 470 μF | | | | | | | | |
| Capacitance tolerance | ±20 % (120 Hz/+20 °C) | | | | | | | | |
| Leakage current | I ≦ 0.01 CV or 3 (μA) After 2 minutes (Bi-polar I ≦ 0.02 CV or 6 (μA) after 2 minutes) (Whichever is greater) | | | | | | | | |
| Dissipation factor (tan δ) | Please see the attached characteristics list | | | | | | | | |
| Characteristics at low temperature | V.DC | 4 | 6.3 | 10 | 16 | 25 | 35 | 50 | (Impedance ratio at 120 Hz) |
| | Z(–25 °C)/Z(+20 °C) | 7 | 4 | 3 | 2 | 2 | 2 | 2 | |
| | Z(–40 °C)/Z(+20 °C) | 15 | 8 | 6 | 4 | 4 | 3 | 3 | |
| Endurance | After applying rated working voltage for 2000 hours (Bi-polar : 1000 hours for each polarity) at +105 °C±2 °C and then being stabilized at +20 °C, Capacitors shall meet the following limits. | | | | | | | | |
| | Capacitance change | Within ±20 % of the initial value (4 V.DC : ±35 % 6.3 V.DC : ±25 % φ4 to φ6.3), 5.5 mm max. : ±25 % | | | | | | | |
| | tan δ | ≦ 200 % of the initial limit | | | | | | | |
| | DC leakage current | Within the initial limit | | | | | | | |
| 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) | | | | | | | | |
| 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 | | | | | | | |
| | tan δ | Within the initial limit | | | | | | | |
| | DC leakage current | Within the initial limit | | | | | | | |
| AEC-Q200 | AEC-Q200 compliant | | | | | | | | |

## Frequency correction factor for ripple current

| Frequency (Hz) | 50, 60 | 120 | 1 k | 10 k to |
|---|---|---|---|---|
| Correction factor | 0.70 | 1.00 | 1.30 | 1.70 |

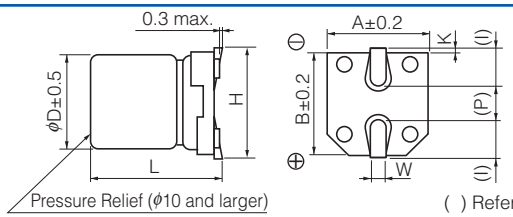
## Marking

Example : 4 V.DC 47 μF
Marking color : BLACK




| R. Voltage (V.DC) | 4 | 6.3 | 10 | 16 | 25 | 35 | 50 |
|---|---|---|---|---|---|---|---|
| Code | g | j | A | C | E | V | H |

## Dimensions




( ) Reference size

(Unit : mm)

| Size code | φD | L | A, B | H | I | W | P | K |
|---|---|---|---|---|---|---|---|---|
| B | 4.0 | 5.8±0.3 | 4.3 | 5.5 max. | 1.8 | 0.65±0.1 | 1.0 | $0.35^{+0.15}_{-0.20}$ |
| C | 5.0 | 5.8±0.3 | 5.3 | 6.5 max. | 2.2 | 0.65±0.1 | 1.5 | $0.35^{+0.15}_{-0.20}$ |
| D | 6.3 | 5.8±0.3 | 6.6 | 7.8 max. | 2.6 | 0.65±0.1 | 1.8 | $0.35^{+0.15}_{-0.20}$ |
| E | 8.0 | 6.2±0.3 | 8.3 | 9.5 max. | 3.4 | 0.65±0.1 | 2.2 | $0.35^{+0.15}_{-0.20}$ |
| F | 8.0 | 10.2±0.3 | 8.3 | 10.0 max. | 3.4 | 0.90±0.2 | 3.1 | 0.70±0.20 |
| G | 10.0 | 10.2±0.3 | 10.3 | 12.0 max. | 3.5 | 0.90±0.2 | 4.6 | 0.70±0.20 |

● 5.5 mm height max.

| Size code | φD | L | A, B | H | I | W | P | K |
|---|---|---|---|---|---|---|---|---|
| B | 4.0 | $5.4^{+0.1}_{-0.2}$ | 4.3 | 5.5 max. | 1.8 | 0.65±0.1 | 1.0 | $0.35^{+0.15}_{-0.20}$ |
| C | 5.0 | $5.4^{+0.1}_{-0.2}$ | 5.3 | 6.5 max. | 2.2 | 0.65±0.1 | 1.5 | $0.35^{+0.15}_{-0.20}$ |
| D | 6.3 | $5.4^{+0.1}_{-0.2}$ | 6.6 | 7.8 max. | 2.6 | 0.65±0.1 | 1.8 | $0.35^{+0.15}_{-0.20}$ |

## Characteristics list

Endurance : 105 °C 2000 h

| Rated voltage (V.DC) | Cap. (±20 %) (μF) | Case size (mm) | | Size code | Specification | | Part No. | Reflow | Min. Packaging Q'ty |
|---|---|---|---|---|---|---|---|---|---|
| | | φD | L | | Ripple current (120 Hz) (+105 °C) (mA r.m.s.) | tan δ (120 Hz) (+20 °C) | | | Taping (pcs) |
| 4 | 47 | 4 | 5.8 | B | 34 | 0.50 | EEEHB0G470R | (1) | 2000 |
| | 100 | 5 | 5.8 | C | 61 | 0.50 | EEEHB0G101R | (1) | 1000 |
| | 150 | 6.3 | 5.8 | D | 82 | 0.50 | EEEHB0G151P | (1) | 1000 |
| | 220 | 6.3 | 5.8 | D | 82 | 0.50 | EEEHB0G221P | (1) | 1000 |
| 6.3 | 22 | 4 | 5.8 | B | 26 | 0.30 | EEEHB0J220R | (1) | 2000 |
| | 33 | 4 | 5.8 | B | 29 | 0.30 | EEEHB0J330R | (1) | 2000 |
| | 47 | 5 | 5.8 | C | 46 | 0.30 | EEEHB0J470R | (1) | 1000 |
| | 100 | 6.3 | 5.8 | D | 71 | 0.30 | EEEHB0J101P | (1) | 1000 |
| | 220 | 8 | 10.2 | F | 150 | 0.35 | EEEHB0J221P | (2) | 500 |
| | 330 | 8 | 10.2 | F | 230 | 0.35 | EEEHB0J331P | (2) | 500 |
| 10 | 33 | 5 | 5.8 | C | 43 | 0.22 | EEEHB1A330R | (1) | 1000 |
| | 100 | 8 | 6.2 | E | 110 | 0.26 | EEEHB1A101P | (2) | 1000 |
| | 220 | 8 | 10.2 | F | 160 | 0.26 | EEEHB1A221P | (2) | 500 |
| | 470 | 10 | 10.2 | G | 270 | 0.26 | EEEHB1A471P | (2) | 500 |
| 16 | 10 | 4 | 5.8 | B | 28 | 0.16 | EEEHB1C100R | (1) | 2000 |
| | 22 | 5 | 5.8 | C | 39 | 0.16 | EEEHB1C220R | (1) | 1000 |
| | 47 | 6.3 | 5.8 | D | 70 | 0.16 | EEEHB1C470P | (1) | 1000 |
| | 100 | 8 | 10.2 | F | 120 | 0.20 | EEEHB1C101P | (2) | 500 |
| | 220 | 10 | 10.2 | G | 210 | 0.20 | EEEHB1C221P | (2) | 500 |
| | 330 | 10 | 10.2 | G | 230 | 0.20 | EEEHB1C331P | (2) | 500 |
| 25 | 4.7 | 4 | 5.8 | B | 22 | 0.14 | EEEHB1E4R7R | (1) | 2000 |
| | 6.8 | 4 | 5.8 | B | 25 | 0.14 | EEEHB1E6R8R | (1) | 2000 |
| | 33 | 6.3 | 5.8 | D | 65 | 0.14 | EEEHB1E330P | (1) | 1000 |
| | 47 | 8 | 6.2 | E | 91 | 0.16 | EEEHB1E470P | (2) | 1000 |
| | 100 | 8 | 10.2 | F | 130 | 0.16 | EEEHB1E101P | (2) | 500 |
| | 220 | 10 | 10.2 | G | 190 | 0.16 | EEEHB1E221P | (2) | 500 |
| 35 | 10 | 5 | 5.8 | C | 28 | 0.12 | EEEHB1V100R | (1) | 1000 |
| | 22 | 6.3 | 5.8 | D | 55 | 0.12 | EEEHB1V220P | (1) | 1000 |
| | 33 | 8 | 6.2 | E | 84 | 0.14 | EEEHB1V330P | (2) | 1000 |
| | 47 | 8 | 10.2 | F | 98 | 0.14 | EEEHB1V470P | (2) | 500 |
| | 100 | 10 | 10.2 | G | 160 | 0.14 | EEEHB1V101P | (2) | 500 |
| 50 | 1 | 4 | 5.8 | B | 10 | 0.12 | EEEHB1H1R0R | (1) | 2000 |
| | 2.2 | 4 | 5.8 | B | 16 | 0.12 | EEEHB1H2R2R | (1) | 2000 |
| | 3.3 | 4 | 5.8 | B | 16 | 0.12 | EEEHB1H3R3R | (1) | 2000 |
| | 4.7 | 5 | 5.8 | C | 23 | 0.12 | EEEHB1H4R7R | (1) | 1000 |
| | 6.8 | 5 | 5.8 | C | 23 | 0.12 | EEEHB1H6R8R | (1) | 1000 |
| | 10 | 6.3 | 5.8 | D | 35 | 0.12 | EEEHB1H100P | (1) | 1000 |
| | 22 | 8 | 6.2 | E | 70 | 0.12 | EEEHB1H220P | (2) | 1000 |
| | 33 | 8 | 10.2 | F | 91 | 0.12 | EEEHB1H330P | (2) | 500 |
| | 47 | 10 | 10.2 | G | 100 | 0.12 | EEEHB1H470P | (2) | 500 |

· Please refer to the page of “Reflow Profile” and “The Taping Dimensions”.
· When requesting vibration-proof product, please put the last “V” instead to “P”

## Characteristics list (Bi-polar)

Endurance : 105 °C 2000 h

| Rated voltage (V.DC) | Cap. (±20 %) (μF) | Case size (mm) | | Size code | Specification | | Part No. | Reflow | Min. Packaging Q'ty |
|---|---|---|---|---|---|---|---|---|---|
| | | φD | L | | Ripple current (120 Hz) (+105 °C) (mA r.m.s.) | tan δ (120 Hz) (+20 °C) | | | Taping (pcs) |
| 6.3 | 47 | 6.3 | 5.8 | D | 35 | 0.60 | EEEHP0J470P | (1) | 1000 |
| 10 | 10 | 4 | 5.8 | B | 20 | 0.44 | EEEHP1A100R | (1) | 2000 |
| | 33 | 6.3 | 5.8 | D | 26 | 0.44 | EEEHP1A330P | (1) | 1000 |
| 16 | 10 | 5 | 5.8 | C | 25 | 0.32 | EEEHP1C100R | (1) | 1000 |
| 25 | 3.3 | 4 | 5.8 | B | 12 | 0.28 | EEEHP1E3R3R | (1) | 2000 |
| | 4.7 | 4 | 5.8 | B | 12 | 0.28 | EEEHP1E4R7R | (1) | 2000 |
| | 10 | 6.3 | 5.8 | D | 28 | 0.28 | EEEHP1E100P | (1) | 1000 |
| | 22 | 6.3 | 5.8 | D | 55 | 0.28 | EEEHP1E220P | (1) | 1000 |
| 35 | 2.2 | 4 | 5.8 | B | 10 | 0.24 | EEEHP1V2R2R | (1) | 2000 |
| 50 | 1 | 4 | 5.8 | B | 10 | 0.24 | EEEHP1H1R0R | (1) | 2000 |
| | 3.3 | 6.3 | 5.8 | D | 16 | 0.24 | EEEHP1H3R3P | (1) | 1000 |
| | 4.7 | 6.3 | 5.8 | D | 23 | 0.24 | EEEHP1H4R7P | (1) | 1000 |

## Characteristics list (5.5 mm max.)

Endurance : 105 °C 2000 h

| Rated voltage (V.DC) | Cap. (±20 %) (μF) | Case size (mm) | | Size code | Specification | | Part No. | Reflow | Min. Packaging Q'ty |
|---|---|---|---|---|---|---|---|---|---|
| | | φD | L | | Ripple current (120 Hz) (+105 °C) (mA r.m.s.) | tan δ (120 Hz) (+20 °C) | | | Taping (pcs) |
| 6.3 | 22 | 4 | 5.4 | B | 26 | 0.30 | EEEHB0J220SR | (1) | 2000 |
| | 47 | 5 | 5.4 | C | 46 | 0.30 | EEEHB0J470SR | (1) | 1000 |
| | 100 | 6.3 | 5.4 | D | 71 | 0.30 | EEEHB0J101SP | (1) | 1000 |
| 10 | 33 | 5 | 5.4 | C | 43 | 0.22 | EEEHB1A330SR | (1) | 1000 |
| 16 | 10 | 4 | 5.4 | B | 28 | 0.16 | EEEHB1C100SR | (1) | 2000 |
| | 22 | 5 | 5.4 | C | 39 | 0.16 | EEEHB1C220SR | (1) | 1000 |
| | 47 | 6.3 | 5.4 | D | 70 | 0.16 | EEEHB1C470SP | (1) | 1000 |
| 25 | 4.7 | 4 | 5.4 | B | 22 | 0.14 | EEEHB1E4R7SR | (1) | 2000 |
| | 6.8 | 4 | 5.4 | B | 25 | 0.14 | EEEHB1E6R8SR | (1) | 2000 |
| | 33 | 6.3 | 5.4 | D | 65 | 0.14 | EEEHB1E330SP | (1) | 1000 |
| 35 | 10 | 5 | 5.4 | C | 28 | 0.12 | EEEHB1V100SR | (1) | 1000 |
| | 22 | 6.3 | 5.4 | D | 55 | 0.12 | EEEHB1V220SP | (1) | 1000 |
| 50 | 1 | 4 | 5.4 | B | 10 | 0.12 | EEEHB1H1R0SR | (1) | 2000 |
| | 2.2 | 4 | 5.4 | B | 16 | 0.12 | EEEHB1H2R2SR | (1) | 2000 |
| | 3.3 | 4 | 5.4 | B | 16 | 0.12 | EEEHB1H3R3SR | (1) | 2000 |
| | 4.7 | 5 | 5.4 | C | 23 | 0.12 | EEEHB1H4R7SR | (1) | 1000 |
| | 6.8 | 5 | 5.4 | C | 23 | 0.12 | EEEHB1H6R8SR | (1) | 1000 |
| | 10 | 6.3 | 5.4 | D | 35 | 0.12 | EEEHB1H100SP | (1) | 1000 |

· Please refer to the page of “Reflow Profile” and “The Taping Dimensions”.
· When requesting vibration-proof product, please put the last “V” instead to “P”

# Surface Mount Type

Series : **HC** Type : **V**

Long life

HC

↑

HB


## Features

- Endurance : 105 °C 3000 h to 5000 h
- Vibration-proof product is available upon request. ($\phi$8 mm and larger)
- RoHS compliant

## Specifications

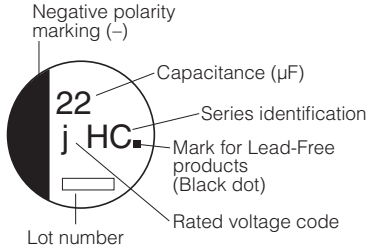
| | | |
|---|---|---|
| Category temperature range | –40 °C to +105 °C | |
| Rated voltage range | 6.3 V.DC to 50 V.DC | |
| Capacitance range | 1 μF to 1000 μF | |
| Capacitance tolerance | ±20 % (120 Hz/+20 °C) | |
| Leakage current | I ≦ 0.01 CV or 3 (μA) After 2 minutes (Whichever is greater) | |
| Dissipation factor (tan $\delta$) | Please see the attached characteristics list | |
| Endurance | After applying rated working voltage for +105 °C±2 °C and then being stabilized at +20 °C, Capacitors shall meet the following limits.<br>$\phi$4 to $\phi$6.3 (3000 hours After applying rated working voltage)<br>$\phi$8 to $\phi$10 (5000 hours After applying rated working voltage) | |
| | Capacitance change | Within ±30 % of the initial value |
| | tan $\delta$ | ≦300 % of the initial limit |
| | DC leakage current | Within the initial limit |
| 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) | |
| Resistance to soldering heat | Capacitance change | Within ±10 % of the initial value |
| | tan $\delta$ | Within the initial limit |
| | DC leakage current | Within the initial limit |
| AEC-Q200 | AEC-Q200 compliant | |

## Frequency correction factor for ripple current

| Frequency (Hz) | 50, 60 | 120 | 1 k | 10 k to |
|---|---|---|---|---|
| Correction factor | 0.70 | 1.00 | 1.30 | 1.70 |

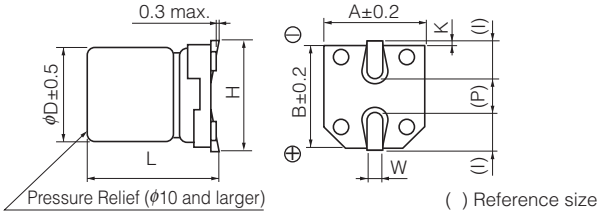
## Marking

Example : 6.3 V.DC 22 μF
Marking color : BLACK




| R. Voltage (V.DC) | 6.3 | 10 | 16 | 25 | 35 | 50 |
|---|---|---|---|---|---|---|
| Code | j | A | C | E | V | H |

## Dimensions




(Unit : mm)

| Size code | ϕD | L | A, B | H | I | W | P | K |
|---|---|---|---|---|---|---|---|---|
| B | 4.0 | 5.8±0.3 | 4.3 | 5.5 max. | 1.8 | 0.65±0.1 | 1.0 | $0.35^{+0.15}_{-0.20}$ |
| C | 5.0 | 5.8±0.3 | 5.3 | 6.5 max. | 2.2 | 0.65±0.1 | 1.5 | $0.35^{+0.15}_{-0.20}$ |
| D | 6.3 | 5.8±0.3 | 6.6 | 7.8 max. | 2.6 | 0.65±0.1 | 1.8 | $0.35^{+0.15}_{-0.20}$ |
| D8 | 6.3 | 7.7±0.3 | 6.6 | 7.8 max. | 2.6 | 0.65±0.1 | 1.8 | $0.35^{+0.15}_{-0.20}$ |
| F | 8.0 | 10.2±0.3 | 8.3 | 10.0 max. | 3.4 | 0.90±0.2 | 3.1 | 0.70±0.2 |
| G | 10.0 | 10.2±0.3 | 10.3 | 12.0 max. | 3.5 | 0.90±0.2 | 4.6 | 0.70±0.2 |

## Characteristics list

Endurance : 105 °C 3000 h (φ8, φ10 : 5000 h)

| Rated voltage (V.DC) | Cap. (±20 %) (μF) | Case size (mm) | | Size code | Specification | | Part No. | Reflow | Min. Packaging Q'ty |
|---|---|---|---|---|---|---|---|---|---|
| | | φD | L | | Ripple current (120 Hz) (+105 °C) (mA r.m.s.) | tan δ (120 Hz) (+20 °C) | | | Taping (pcs) |
| 6.3 | 22 | 4 | 5.8 | B | 26 | 0.30 | EEEHC0J220R | (1) | 2000 |
| | 47 | 5 | 5.8 | C | 46 | 0.30 | EEEHC0J470R | (1) | 1000 |
| | 100 | 6.3 | 5.8 | D | 71 | 0.30 | EEEHC0J101P | (1) | 1000 |
| | 220 | 6.3 | 7.7 | D8 | 101 | 0.30 | EEEHC0J221XP | (1) | 900 |
| | 330 | 8 | 10.2 | F | 230 | 0.30 | EEEHC0J331P | (2) | 500 |
| | 1000 | 10 | 10.2 | G | 313 | 0.50 | EEEHC0J102P | (2) | 500 |
| 10 | 33 | 5 | 5.8 | C | 43 | 0.26 | EEEHC1A330R | (1) | 1000 |
| | 220 | 8 | 10.2 | F | 160 | 0.26 | EEEHC1A221P | (2) | 500 |
| 16 | 10 | 4 | 5.8 | B | 28 | 0.20 | EEEHC1C100R | (1) | 2000 |
| | 22 | 5 | 5.8 | C | 39 | 0.20 | EEEHC1C220R | (1) | 1000 |
| | 47 | 6.3 | 5.8 | D | 70 | 0.20 | EEEHC1C470P | (1) | 1000 |
| | 100 | 6.3 | 7.7 | D8 | 81 | 0.20 | EEEHC1C101XP | (1) | 900 |
| | 470 | 10 | 10.2 | G | 340 | 0.20 | EEEHC1C471P | (2) | 500 |
| 25 | 33 | 6.3 | 5.8 | D | 65 | 0.16 | EEEHC1E330P | (1) | 1000 |
| | 47 | 6.3 | 7.7 | D8 | 65 | 0.16 | EEEHC1E470XP | (1) | 900 |
| | 100 | 8 | 10.2 | F | 130 | 0.16 | EEEHC1E101P | (2) | 500 |
| | 330 | 10 | 10.2 | G | 238 | 0.16 | EEEHC1E331P | (2) | 500 |
| 35 | 4.7 | 4 | 5.8 | B | 15 | 0.14 | EEEHC1V4R7R | (1) | 2000 |
| | 10 | 5 | 5.8 | C | 28 | 0.14 | EEEHC1V100R | (1) | 1000 |
| | 22 | 6.3 | 5.8 | D | 55 | 0.14 | EEEHC1V220P | (1) | 1000 |
| | 33 | 6.3 | 7.7 | D8 | 57 | 0.14 | EEEHC1V330XP | (1) | 900 |
| | 220 | 10 | 10.2 | G | 220 | 0.14 | EEEHC1V221P | (2) | 500 |
| 50 | 1 | 4 | 5.8 | B | 10 | 0.12 | EEEHC1H1R0R | (1) | 2000 |
| | 2.2 | 4 | 5.8 | B | 16 | 0.12 | EEEHC1H2R2R | (1) | 2000 |
| | 3.3 | 4 | 5.8 | B | 16 | 0.12 | EEEHC1H3R3R | (1) | 2000 |
| | 4.7 | 5 | 5.8 | C | 23 | 0.12 | EEEHC1H4R7R | (1) | 1000 |
| | 10 | 6.3 | 5.8 | D | 35 | 0.12 | EEEHC1H100P | (1) | 1000 |
| | 22 | 6.3 | 7.7 | D8 | 49 | 0.12 | EEEHC1H220XP | (1) | 900 |
| | 33 | 8 | 10.2 | F | 91 | 0.12 | EEEHC1H330P | (2) | 500 |
| | 47 | 8 | 10.2 | F | 100 | 0.12 | EEEHC1H470P | (2) | 500 |
| | 100 | 10 | 10.2 | G | 160 | 0.12 | EEEHC1H101P | (2) | 500 |

· Please refer to the page of “Reflow Profile” and “The Taping Dimensions”.
· When requesting vibration-proof product, please put the last “V” instead to “P”

# Surface Mount Type

Series : **HD** Type : **V**

❊ **6.3 V.DC to 35 V.DC : High temperature Lead-Free reflow (suffix : A*)**
**50 V.DC to 100 V.DC : Standard Lead-Free reflow**

## Features

- Endurance : 105 °C 5000 h
- Vibration-proof product is available upon request. (φ8 mm and larger)
- RoHS compliant

## Specifications

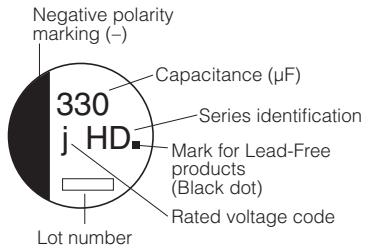
| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Category temperature range | –40 °C to +105 °C | | | | | | | | |
| Rated voltage range | 6.3 V.DC to 100 V.DC | | | | | | | | |
| Capacitance range | 1 μF to 1000 μF | | | | | | | | |
| Capacitance tolerance | ±20 % (120 Hz/+20 °C) | | | | | | | | |
| 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 | | | | | | | | |
| Characteristics at low temperature | V.DC | 6.3 | 10 | 16 | 25 | 35 | 50 | 63 | 100 | (Impedance ratio at 120 Hz) |
| | Z(–25 °C)/Z(+20 °C) | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | |
| | Z(–40 °C)/Z(+20 °C) | 4 | 4 | 3 | 3 | 3 | 3 | 3 | 3 | |
| Endurance | After applying rated working voltage for 5000 hours at +105 °C±2 °C and then being stabilized at +20 °C, capacitors shall meet the following limits. | | | | | | | | |
| | Capacitance change | Within ±30 % of the initial value | | | | | | | |
| | tan δ | ≦ 300 % of the initial limit | | | | | | | |
| | DC leakage current | ≦ initial specified value | | | | | | | |
| 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) | | | | | | | | |
| | Capacitance change | Within ±20 % of the initial value | | | | | | | |
| | 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 | | | | | | | |
| | tan δ | Within the initial limit | | | | | | | |
| | DC leakage current | Within the initial limit | | | | | | | |
| AEC-Q200 | AEC-Q200 compliant | | | | | | | | |

## Frequency correction factor for ripple current

| Frequency (Hz) | 50, 60 | 120 | 1 k | 10 k to |
|---|---|---|---|---|
| Correction factor | 0.70 | 1.00 | 1.30 | 1.70 |

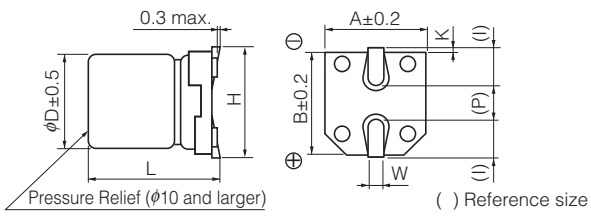
## Marking

Example : 6.3 V.DC 330 μF
Marking color : BLACK




| R. Voltage (V.DC) | 6.3 | 10 | 16 | 25 | 35 | 50 | 63 | 100 |
|---|---|---|---|---|---|---|---|---|
| Code | j | A | C | E | V | H | J | 2A |

## Dimensions




(Unit : mm)

| Size code | φD | L | A, B | H | I | W | P | K |
|---|---|---|---|---|---|---|---|---|
| B | 4.0 | 5.8±0.3 | 4.3 | 5.5 max. | 1.8 | 0.65±0.1 | 1.0 | $0.35^{+0.15}_{-0.20}$ |
| C | 5.0 | 5.8±0.3 | 5.3 | 6.5 max. | 2.2 | 0.65±0.1 | 1.5 | $0.35^{+0.15}_{-0.20}$ |
| D | 6.3 | 5.8±0.3 | 6.6 | 7.8 max. | 2.6 | 0.65±0.1 | 1.8 | $0.35^{+0.15}_{-0.20}$ |
| D8 | 6.3 | 7.7±0.3 | 6.6 | 7.8 max. | 2.6 | 0.65±0.1 | 1.8 | $0.35^{+0.15}_{-0.20}$ |
| E | 8.0 | 6.2±0.3 | 8.3 | 9.5 max. | 3.4 | 0.65±0.1 | 2.2 | $0.35^{+0.15}_{-0.20}$ |
| F | 8.0 | 10.2±0.3 | 8.3 | 10.0 max. | 3.4 | 0.90±0.2 | 3.1 | 0.70±0.20 |
| G | 10.0 | 10.2±0.3 | 10.3 | 12.0 max. | 3.5 | 0.90±0.2 | 4.6 | 0.70±0.20 |

## Characteristics list (6.3 V.DC to 35 V.DC)

Endurance : 105 °C 5000 h

| Rated voltage (V.DC) | Cap. (±20 %) (μF) | Case size (mm) | | Size code | Specification | | | Part No. | Reflow | Min. Packaging Q'ty |
|---|---|---|---|---|---|---|---|---|---|---|
| | | φD | L | | Ripple current (120 Hz) (+105 °C) (mA r.m.s.) | Impedance (100 kHz) (+20 °C) (Ω) | tan δ (120 Hz) (+20 °C) | | | Taping (pcs) |
| 6.3 | 330 | 8 | 10.2 | F | 230 | 1.5 | 0.30 | EEEHD0J331AP | (7) | 500 |
| | 1000 | 10 | 10.2 | G | 313 | 0.8 | 0.50 | EEEHD0J102AP | (7) | 500 |
| 10 | 100 | 8 | 6.2 | E | 62 | 2.0 | 0.30 | EEEHD1A101AP | (7) | 1000 |
| | 220 | 8 | 10.2 | F | 160 | 1.5 | 0.30 | EEEHD1A221AP | (7) | 500 |
| | 330 | 8 | 10.2 | F | 160 | 1.5 | 0.30 | EEEHD1A331AP | (7) | 500 |
| 16 | 10 | 4.0 | 5.8 | B | 28 | 12.0 | 0.20 | EEEHD1C100AR | (5) | 2000 |
| | 22 | 5.0 | 5.8 | C | 39 | 7.2 | 0.20 | EEEHD1C220AR | (5) | 1000 |
| | 47 | 6.3 | 5.8 | D | 70 | 4.0 | 0.20 | EEEHD1C470AP | (5) | 1000 |
| | 100 | 8 | 10.2 | F | 130 | 1.5 | 0.20 | EEEHD1C101AP | (7) | 500 |
| | 220 | 10 | 10.2 | G | 220 | 0.8 | 0.20 | EEEHD1C221AP | (7) | 500 |
| | 470 | 10 | 10.2 | G | 340 | 0.8 | 0.20 | EEEHD1C471AP | (7) | 500 |
| 25 | 4.7 | 4 | 5.8 | B | 17 | 12.0 | 0.16 | EEEHD1E4R7AR | (5) | 2000 |
| | 10 | 5 | 5.8 | C | 28 | 7.2 | 0.16 | EEEHD1E100AR | (5) | 1000 |
| | 22 | 6.3 | 5.8 | D | 55 | 4.0 | 0.16 | EEEHD1E220AP | (5) | 1000 |
| | 33 | 6.3 | 5.8 | D | 55 | 4.0 | 0.16 | EEEHD1E330AP | (5) | 1000 |
| | 47 | 8 | 6.2 | E | 56 | 2.0 | 0.18 | EEEHD1E470AP | (7) | 1000 |
| | 100 | 8 | 10.2 | F | 130 | 1.5 | 0.16 | EEEHD1E101AP | (7) | 500 |
| | 330 | 10 | 10.2 | G | 238 | 0.8 | 0.16 | EEEHD1E331AP | (7) | 500 |
| 35 | 4.7 | 4 | 5.8 | B | 17 | 12.0 | 0.13 | EEEHD1V4R7AR | (5) | 2000 |
| | 10 | 5 | 5.8 | C | 28 | 7.2 | 0.13 | EEEHD1V100AR | (5) | 1000 |
| | 22 | 6.3 | 5.8 | D | 55 | 4.0 | 0.13 | EEEHD1V220AP | (5) | 1000 |
| | 33 | 8 | 6.2 | E | 53 | 2.0 | 0.16 | EEEHD1V330AP | (7) | 1000 |
| | | 6.3 | 7.7 | D8 | 57 | 2.0 | 0.13 | EEEHDV330XAP | (5) | 900 |
| | 47 | 6.3 | 7.7 | D8 | 57 | 2.0 | 0.14 | EEEHDV470XAP | (5) | 900 |
| | | 8 | 10.2 | F | 79 | 1.5 | 0.14 | EEEHD1V470AP | (7) | 500 |
| | 100 | 10 | 10.2 | G | 101 | 0.8 | 0.14 | EEEHD1V101AP | (7) | 500 |
| | 220 | 10 | 10.2 | G | 220 | 0.8 | 0.14 | EEEHD1V221AP | (7) | 500 |

## Characteristics list (50 V.DC to 100 V.DC)

Endurance : 105 °C 5000 h

| Rated voltage (V.DC) | Cap. (±20 %) (μF) | Case size (mm) | | Size code | Specification | | | Part No. | Reflow | Min. Packaging Q'ty |
|---|---|---|---|---|---|---|---|---|---|---|
| | | φD | L | | Ripple current (120 Hz) (+105 °C) (mA r.m.s.) | Impedance (100 kHz) (+20 °C) (Ω) | tan δ (120 Hz) (+20 °C) | | | Taping (pcs) |
| 50 | 1 | 4 | 5.8 | B | 7 | 12.0 | 0.12 | EEEHD1H1R0R | (1) | 2000 |
| | 2.2 | 4 | 5.8 | B | 12 | 12.0 | 0.12 | EEEHD1H2R2R | (1) | 2000 |
| | 3.3 | 4 | 5.8 | B | 16 | 12.0 | 0.12 | EEEHD1H3R3R | (1) | 2000 |
| | 4.7 | 5 | 5.8 | C | 21 | 7.2 | 0.12 | EEEHD1H4R7R | (1) | 1000 |
| | 10 | 6.3 | 5.8 | D | 33 | 4.0 | 0.12 | EEEHD1H100P | (1) | 1000 |
| | 22 | 8 | 6.2 | E | 50 | 2.0 | 0.14 | EEEHD1H220P | (2) | 1000 |
| | 33 | 8 | 10.2 | F | 74 | 1.5 | 0.14 | EEEHD1H330P | (2) | 500 |
| | 47 | 10 | 10.2 | G | 94 | 0.8 | 0.14 | EEEHD1H470P | (2) | 500 |
| | 100 | 10 | 10.2 | G | 94 | 0.8 | 0.14 | EEEHD1H101P | (2) | 500 |
| 63 | 10 | 8 | 6.2 | E | 45 | 2.0 | 0.18 | EEEHD1J100P | (2) | 1000 |
| | 22 | 8 | 10.2 | F | 65 | 1.5 | 0.18 | EEEHD1J220P | (2) | 500 |
| | 33 | 10 | 10.2 | G | 80 | 0.8 | 0.18 | EEEHD1J330P | (2) | 500 |
| 100 | 10 | 8 | 10.2 | F | 55 | 1.5 | 0.18 | EEEHD2A100P | (2) | 500 |
| | 22 | 10 | 10.2 | G | 70 | 0.8 | 0.18 | EEEHD2A220P | (2) | 500 |

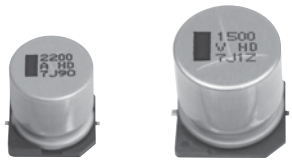
If Part number exceeds 12 digits, voltage code is abbrevi ated as follows; 0J → J, 1A → A, 1C → C, 1E → E, 1V → V,

· Please refer to the page of “Reflow Profile” and “The Taping Dimensions”.

· When requesting vibration-proof product, please put the last “V” instead to “P”

# Surface Mount Type

Series : Medium-size **HD** Type : **V**
**High temperature**
**Lead-Free reflow (suffix : A*)**



## Features

- Endurance : 105 °C 5000 h
- Vibration-proof product is available upon request.
- RoHS compliant

## Specifications

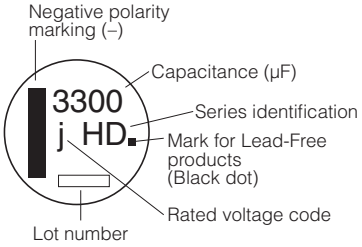
| | | |
|---|---|---|
| Category temperature range | –55 °C to +105 °C | |
| Rated voltage range | 6.3 V.DC to 35 V.DC | |
| Capacitance range | 680 µF to 7500 µF | |
| Capacitance tolerance | ±20 % (120 Hz/+20 °C) | |
| Leakage current | I ≦ 0.01 CV (µA) After 2 minutes | |
| Dissipation factor (tan $\delta$) | Please see the attached characteristics list | |
| Endurance | After applying rated working voltage for 5000 hours at +105 °C±2 °C and then being stabilized at +20 °C, Capacitors shall meet the following limits. | |
| | Capacitance change | Within ±30 % of the initial value |
| | tan $\delta$ | ≦200 % of the initial limit |
| | DC leakage current | Within the initial limit |
| 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) | |
| 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 |
| | tan $\delta$ | Within the initial limit |
| | DC leakage current | Within the initial limit |
| AEC-Q200 | AEC-Q200 compliant | |

## Frequency correction factor for ripple current

| Capacitance (µF) \ Frequency (Hz) | 60 | 120 | 1 k | 10 k | 100 k to |
|---|---|---|---|---|---|
| 680 to 1000 | 0.93 | 1.00 | 1.20 | 1.27 | 1.33 |
| 1200 to 2200 | 0.94 | 1.00 | 1.13 | 1.19 | 1.25 |
| 2700 to 7500 | 0.94 | 1.00 | 1.12 | 1.18 | 1.18 |

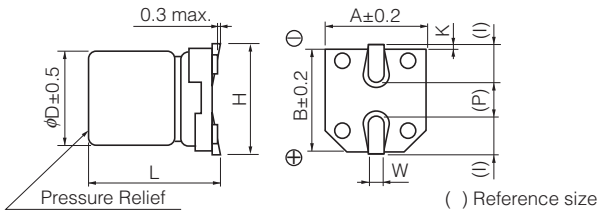
## Marking

Example : 6.3 V.DC 3300 µF
Marking color : BLACK




| R. Voltage (V.DC) | 6.3 | 10 | 16 | 25 | 35 |
|---|---|---|---|---|---|
| Code | j | A | C | E | V |

## Dimensions




(Unit : mm)

| Size code | φD | L | A,B | H | I | W | P | K |
|---|---|---|---|---|---|---|---|---|
| H13 | 12.5 | 13.5±0.5 | 13.5 | 15.0 max. | 4.7 | 0.90±0.3 | 4.4 | 0.70±0.3 |
| J16 | 16.0 | 16.5±0.5 | 17.0 | 19.0 max | 5.5 | 1.20±0.3 | 6.7 | 0.70±0.3 |
| K16 | 18.0 | 16.5±0.5 | 19.0 | 21.0 max | 6.7 | 1.20±0.3 | 6.7 | 0.70±0.3 |

## Characteristics list

Endurance : 105 °C 5000 h

| Rated voltage (V.DC) | Cap. (±20 %) (μF) | Case size (mm) | | Size code | Specification | | Part No. | Reflow | Min. Packaging Q'ty |
|---|---|---|---|---|---|---|---|---|---|
| | | φD | L | | Ripple current (120 Hz) (+105 °C) (mA r.m.s.) | tan δ (120 Hz) (+20 °C) | | | Taping (pcs) |
| 6.3 | 3300 | 12.5 | 13.5 | H13 | 680 | 0.32 | EEEHD0J332AQ | (9) | 200 |
| | 6800 | 16 | 16.5 | J16 | 1280 | 0.38 | EEEHD0J682AM | (9) | 125 |
| | 7500 | 18 | 16.5 | K16 | 1540 | 0.40 | EEEHD0J752AM | (9) | 125 |
| 10 | 2200 | 12.5 | 13.5 | H13 | 620 | 0.24 | EEEHD1A222AQ | (9) | 200 |
| | 4700 | 16 | 16.5 | J16 | 1280 | 0.28 | EEEHD1A472AM | (9) | 125 |
| | 6800 | 18 | 16.5 | K16 | 1540 | 0.32 | EEEHD1A682AM | (9) | 125 |
| 16 | 1500 | 12.5 | 13.5 | H13 | 620 | 0.18 | EEEHD1C152AQ | (9) | 200 |
| | 3300 | 16 | 16.5 | J16 | 1280 | 0.22 | EEEHD1C332AM | (9) | 125 |
| | 4700 | 18 | 16.5 | K16 | 1540 | 0.24 | EEEHD1C472AM | (9) | 125 |
| 25 | 1000 | 12.5 | 13.5 | H13 | 580 | 0.16 | EEEHD1E102AQ | (9) | 200 |
| | 2200 | 16 | 16.5 | J16 | 1200 | 0.18 | EEEHD1E222AM | (9) | 125 |
| | 3300 | 18 | 16.5 | K16 | 1540 | 0.20 | EEEHD1E332AM | (9) | 125 |
| 35 | 680 | 12.5 | 13.5 | H13 | 580 | 0.14 | EEEHD1V681AQ | (9) | 200 |
| | 1500 | 16 | 16.5 | J16 | 1200 | 0.16 | EEEHD1V152AM | (9) | 125 |
| | 1800 | 18 | 16.5 | K16 | 1450 | 0.16 | EEEHD1V182AM | (9) | 125 |

· Please refer to the page of “Reflow Profile” and “The Taping Dimensions”.
· When requesting vibration-proof product, please put the last “V” instead to “P” or “M”

# Surface Mount Type

Series : **FC** Type : **V**
**High temperature**
**Lead-Free reflow (suffix : A*)**

Low impedance

FC
↑
HA

## Features

- Endurance : 105 °C 1000 h
- Low impedance (1/2 for HA series)
- Vibration-proof product is available upon request. (φ8 mm and larger)
- RoHS compliant

## Specifications

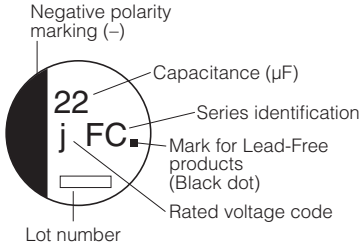
| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Category temperature range | –40 °C to +105 °C | | | | | | |
| Rated voltage range | 6.3 V.DC to 35 V.DC | | | | | | |
| Capacitance range | 1 μF to 1500 μF | | | | | | |
| Capacitance tolerance | ±20 % (120 Hz/+20 °C) | | | | | | |
| Leakage current | I ≦ 0.01 CV or 3 (μA) After 2 minutes (Whichever is greater) | | | | | | |
| Dissipation factor (tan δ) | Please see the attached characteristics list | | | | | | |
| Characteristics at low temperature | V.DC | 6.3 | 10 | 16 | 25 | 35 | (Impedance ratio at 120 Hz) |
| | Z(–25 °C) / Z(+20 °C) | 2 | 2 | 2 | 2 | 2 | |
| | Z(–40 °C) / Z(+20 °C) | 3 | 3 | 3 | 3 | 3 | |
| Endurance | After applying rated working voltage for 1000 hours at +105 °C±2 °C and then being stabilized at +20 °C, Capacitors shall meet the following limits. | | | | | | |
| | Capacitance change | Within ±20 % of the initial value | | | | | |
| | tan δ | ≦200 % of the initial limit | | | | | |
| | DC leakage current | Within the initial limit | | | | | |
| 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) | | | | | | |
| 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 | | | | | |
| | tan δ | Within the initial limit | | | | | |
| | DC leakage current | Within the initial limit | | | | | |
| AEC-Q200 | AEC-Q200 compliant | | | | | | |

## Frequency correction factor for ripple current

| Frequency (Hz) | 50, 60 | 120 | 1 k | 10 k | 100 k to |
|---|---|---|---|---|---|
| Correction factor | 0.70 | 0.75 | 0.90 | 0.95 | 1.00 |

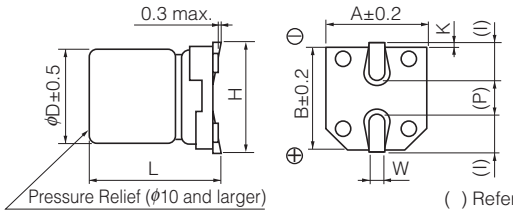
## Marking

Example : 6.3 V.DC 22 μF
Marking color : BLACK




| R. Voltage (V.DC) | 6.3 | 10 | 16 | 25 | 35 |
|---|---|---|---|---|---|
| Code | j | A | C | E | V |

## Dimensions




(Unit : mm)

| Size code | φD | L | A, B | H | I | W | P | K |
|---|---|---|---|---|---|---|---|---|
| B | 4.0 | $5.4^{+0.1}_{-0.2}$ | 4.3 | 5.5 max. | 1.8 | 0.65±0.1 | 1.0 | $0.35^{+0.15}_{-0.20}$ |
| C | 5.0 | $5.4^{+0.1}_{-0.2}$ | 5.3 | 6.5 max. | 2.2 | 0.65±0.1 | 1.5 | $0.35^{+0.15}_{-0.20}$ |
| D | 6.3 | $5.4^{+0.1}_{-0.2}$ | 6.6 | 7.8 max. | 2.6 | 0.65±0.1 | 1.8 | $0.35^{+0.15}_{-0.20}$ |
| E | 8.0 | 6.2±0.3 | 8.3 | 9.5 max. | 3.4 | 0.65±0.1 | 2.2 | $0.35^{+0.15}_{-0.20}$ |
| F | 8.0 | 10.2±0.3 | 8.3 | 10.0 max. | 3.4 | 0.90±0.2 | 3.1 | 0.70±0.2 |
| G | 10.0 | 10.2±0.3 | 10.3 | 12.0 max. | 3.5 | 0.90±0.2 | 4.6 | 0.70±0.2 |

## Characteristics list

Endurance : 105 °C 1000 h

| Rated voltage (V.DC) | Cap. (±20 %) (μF) | Case size (mm) | | Size code | Specification | | | Part No. | Reflow | Min. Packaging Q'ty |
|---|---|---|---|---|---|---|---|---|---|---|
| | | φD | L | | Ripple current (100 kHz) (+105 °C) (mA r.m.s.) | Impedance (100 kHz) (+20 °C) (Ω) | tan δ (120 Hz) (+20 °C) | | | Taping (pcs) |
| 6.3 | 22 | 4 | 5.4 | B | 60 | 3.00 | 0.26 | EEEFC0J220AR | (5) | 2000 |
| | 47 | 5 | 5.4 | C | 95 | 1.80 | 0.26 | EEEFC0J470AR | (5) | 1000 |
| | 68 | 6.3 | 5.4 | D | 140 | 1.00 | 0.26 | EEEFC0J680AP | (5) | 1000 |
| | 100 | 6.3 | 5.4 | D | 140 | 1.00 | 0.26 | EEEFC0J101AP | (5) | 1000 |
| | 220 | 8 | 6.2 | E | 230 | 0.40 | 0.26 | EEEFC0J221AP | (6) | 1000 |
| | 330 | 8 | 10.2 | F | 450 | 0.30 | 0.26 | EEEFC0J331AP | (6) | 500 |
| | 1000 | 10 | 10.2 | G | 670 | 0.15 | 0.26 | EEEFC0J102AP | (6) | 500 |
| | 1500 | 10 | 10.2 | G | 670 | 0.15 | 0.26 | EEEFC0J152AP | (6) | 500 |
| 10 | 33 | 5 | 5.4 | C | 95 | 1.80 | 0.19 | EEEFC1A330AR | (5) | 1000 |
| | 100 | 8 | 6.2 | E | 230 | 0.40 | 0.19 | EEEFC1A101AP | (6) | 1000 |
| | 150 | 8 | 6.2 | E | 230 | 0.40 | 0.19 | EEEFC1A151AP | (6) | 1000 |
| | 220 | 8 | 10.2 | F | 450 | 0.30 | 0.19 | EEEFC1A221AP | (6) | 500 |
| | 470 | 10 | 10.2 | G | 670 | 0.15 | 0.19 | EEEFC1A471AP | (6) | 500 |
| | 1000 | 10 | 10.2 | G | 670 | 0.15 | 0.19 | EEEFC1A102AP | (6) | 500 |
| 16 | 10 | 4 | 5.4 | B | 60 | 3.00 | 0.16 | EEEFC1C100AR | (5) | 2000 |
| | 22 | 5 | 5.4 | C | 95 | 1.80 | 0.16 | EEEFC1C220AR | (5) | 1000 |
| | 47 | 6.3 | 5.4 | D | 140 | 1.00 | 0.16 | EEEFC1C470AP | (5) | 1000 |
| | 68 | 8 | 6.2 | E | 230 | 0.40 | 0.16 | EEEFC1C680AP | (6) | 1000 |
| | 100 | 8 | 6.2 | E | 230 | 0.40 | 0.16 | EEEFC1C101AP | (6) | 1000 |
| | 220 | 10 | 10.2 | G | 670 | 0.15 | 0.16 | EEEFC1C221AP | (6) | 500 |
| | 330 | 10 | 10.2 | G | 670 | 0.15 | 0.16 | EEEFC1C331AP | (6) | 500 |
| | 470 | 10 | 10.2 | G | 670 | 0.15 | 0.16 | EEEFC1C471AP | (6) | 500 |
| | 680 | 10 | 10.2 | G | 670 | 0.15 | 0.16 | EEEFC1C681AP | (6) | 500 |
| 25 | 6.8 | 4 | 5.4 | B | 60 | 3.00 | 0.14 | EEEFC1E6R8AR | (5) | 2000 |
| | 22 | 6.3 | 5.4 | D | 140 | 1.00 | 0.14 | EEEFC1E220AP | (5) | 1000 |
| | 33 | 6.3 | 5.4 | D | 140 | 1.00 | 0.14 | EEEFC1E330AP | (5) | 1000 |
| | 47 | 8 | 6.2 | E | 230 | 0.40 | 0.14 | EEEFC1E470AP | (6) | 1000 |
| | 68 | 8 | 10.2 | F | 450 | 0.30 | 0.14 | EEEFC1E680AP | (6) | 500 |
| | 100 | 8 | 10.2 | F | 450 | 0.30 | 0.14 | EEEFC1E101AP | (6) | 500 |
| | 220 | 10 | 10.2 | G | 670 | 0.15 | 0.14 | EEEFC1E221AP | (6) | 500 |
| | 330 | 10 | 10.2 | G | 670 | 0.15 | 0.14 | EEEFC1E331AP | (6) | 500 |
| | 470 | 10 | 10.2 | G | 670 | 0.15 | 0.14 | EEEFC1E471AP | (6) | 500 |
| 35 | 1 | 4 | 5.4 | B | 60 | 3.00 | 0.12 | EEEFC1V1R0AR | (5) | 2000 |
| | 2.2 | 4 | 5.4 | B | 60 | 3.00 | 0.12 | EEEFC1V2R2AR | (5) | 2000 |
| | 3.3 | 4 | 5.4 | B | 60 | 3.00 | 0.12 | EEEFC1V3R3AR | (5) | 2000 |
| | 4.7 | 4 | 5.4 | B | 60 | 3.00 | 0.12 | EEEFC1V4R7AR | (5) | 2000 |
| | 6.8 | 5 | 5.4 | C | 95 | 1.80 | 0.12 | EEEFC1V6R8AR | (5) | 1000 |
| | 10 | 5 | 5.4 | C | 95 | 1.80 | 0.12 | EEEFC1V100AR | (5) | 1000 |
| | 22 | 6.3 | 5.4 | D | 140 | 1.00 | 0.12 | EEEFC1V220AP | (5) | 1000 |
| | 33 | 8 | 6.2 | E | 230 | 0.40 | 0.12 | EEEFC1V330AP | (6) | 1000 |
| | 47 | 8 | 6.2 | E | 230 | 0.40 | 0.12 | EEEFC1V470AP | (6) | 1000 |
| | 100 | 10 | 10.2 | G | 670 | 0.15 | 0.12 | EEEFC1V101AP | (6) | 500 |
| | 220 | 10 | 10.2 | G | 670 | 0.15 | 0.12 | EEEFC1V221AP | (6) | 500 |
| | 330 | 10 | 10.2 | G | 670 | 0.15 | 0.12 | EEEFC1V331AP | (6) | 500 |

· Please refer to the page of “Reflow Profile” and “The Taping Dimensions”.
· When requesting vibration-proof product, please put the last “V” instead to “P”

# Surface Mount Type

Series : **FC** Type : **V**

Low impedance

FC

↑

HA

## Features

- Endurance : 105 °C 1000 h
- Low impedance (1/2 for HA series)
- Vibration-proof product is available upon request. (φ8 mm and larger)
- RoHS compliant

## Specifications

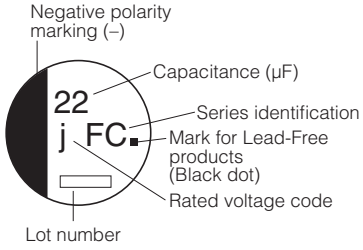
| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Category temperature range | –40 °C to +105 °C | | | | | | | |
| Rated voltage range | 6.3 V.DC to 50 V.DC | | | | | | | |
| Capacitance range | 1 μF to 1500 μF | | | | | | | |
| Capacitance tolerance | ±20 % (120 Hz/+20 °C) | | | | | | | |
| 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 | | | | | | | |
| Characteristics at low temperature | V.DC | 6.3 | 10 | 16 | 25 | 35 | 50 | (Impedance ratio at 120 Hz) |
| | Z(–25 °C) / Z(+20 °C) | 2 | 2 | 2 | 2 | 2 | 2 | |
| | Z(–40 °C) / Z(+20 °C) | 3 | 3 | 3 | 3 | 3 | 3 | |
| Endurance | After applying rated working voltage for 1000 hours at +105 °C±2 °C and then being stabilized at +20 °C, Capacitors shall meet the following limits. | | | | | | | |
| | Capacitance change | Within ±20 % of the initial value | | | | | | |
| | tan δ | ≦200 % of the initial limit | | | | | | |
| | DC leakage current | Within the initial limit | | | | | | |
| 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) | | | | | | | |
| Resistance to soldering heat | After reflow soldering and then being stabilized at +20 °C, capacitor shall meet the following limits. | | | | | | | |
| | Capacitance change | Within ±10 % of the initial value | | | | | | |
| | tan δ | Within the initial limit | | | | | | |
| | DC leakage current | Within the initial limit | | | | | | |
| AEC-Q200 | AEC-Q200 compliant | | | | | | | |

## Frequency correction factor for ripple current

| Frequency (Hz) | 50, 60 | 120 | 1 k | 10 k | 100 k to |
|---|---|---|---|---|---|
| Correction factor | 0.70 | 0.75 | 0.90 | 0.95 | 1.00 |

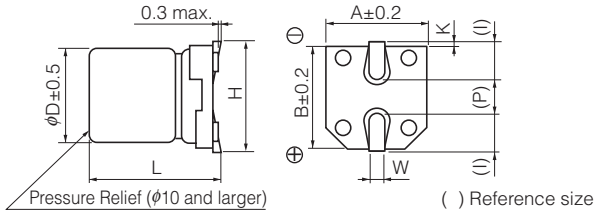
## Marking

Example : 6.3 V.DC 22 μF
Marking color : BLACK




| R. Voltage (V.DC) | 6.3 | 10 | 16 | 25 | 35 | 50 |
|---|---|---|---|---|---|---|
| Code | j | A | C | E | V | H |

## Dimensions




(Unit : mm)

| Size code | φD | L | A, B | H | I | W | P | K |
|---|---|---|---|---|---|---|---|---|
| B | 4.0 | $5.4^{+0.1}_{-0.2}$ | 4.3 | 5.5 max. | 1.8 | 0.65±0.1 | 1.0 | $0.35^{+0.15}_{-0.20}$ |
| C | 5.0 | $5.4^{+0.1}_{-0.2}$ | 5.3 | 6.5 max. | 2.2 | 0.65±0.1 | 1.5 | $0.35^{+0.15}_{-0.20}$ |
| D | 6.3 | $5.4^{+0.1}_{-0.2}$ | 6.6 | 7.8 max. | 2.6 | 0.65±0.1 | 1.8 | $0.35^{+0.15}_{-0.20}$ |
| E | 8.0 | 6.2±0.3 | 8.3 | 9.5 max. | 3.4 | 0.65±0.1 | 2.2 | $0.35^{+0.15}_{-0.20}$ |
| F | 8.0 | 10.2±0.3 | 8.3 | 10.0 max. | 3.4 | 0.90±0.2 | 3.1 | 0.70±0.2 |
| G | 10.0 | 10.2±0.3 | 10.3 | 12.0 max. | 3.5 | 0.90±0.2 | 4.6 | 0.70±0.2 |

## Characteristics list

Endurance : 105 °C 1000 h

| Rated voltage (V.DC) | Cap. (±20 %) (μF) | Case size (mm) | | Size code | Specification | | | Part No. | Reflow | Min. Packaging Q'ty |
|---|---|---|---|---|---|---|---|---|---|---|
| | | φD | L | | Ripple current (100 kHz) (+105 °C) (mA r.m.s.) | Impedance (100 kHz) (+20 °C) (Ω) | tan δ (120 Hz) (+20 °C) | | | Taping (pcs) |
| 6.3 | 22 | 4 | 5.4 | B | 60 | 3.00 | 0.26 | EEEFC0J220R | (1) | 2000 |
| | 47 | 5 | 5.4 | C | 95 | 1.80 | 0.26 | EEEFC0J470R | (1) | 1000 |
| | 68 | 6.3 | 5.4 | D | 140 | 1.00 | 0.26 | EEEFC0J680P | (1) | 1000 |
| | 100 | 6.3 | 5.4 | D | 140 | 1.00 | 0.26 | EEEFC0J101P | (1) | 1000 |
| | 220 | 8 | 6.2 | E | 230 | 0.40 | 0.26 | EEEFC0J221P | (2) | 1000 |
| | 330 | 8 | 10.2 | F | 450 | 0.30 | 0.26 | EEEFC0J331P | (2) | 500 |
| | 1000 | 10 | 10.2 | G | 670 | 0.15 | 0.26 | EEEFC0J102P | (2) | 500 |
| | 1500 | 10 | 10.2 | G | 670 | 0.15 | 0.26 | EEEFC0J152P | (2) | 500 |
| 10 | 33 | 5 | 5.4 | C | 95 | 1.80 | 0.19 | EEEFC1A330R | (1) | 1000 |
| | 100 | 8 | 6.2 | E | 230 | 0.40 | 0.19 | EEEFC1A101P | (2) | 1000 |
| | 150 | 8 | 6.2 | E | 230 | 0.40 | 0.19 | EEEFC1A151P | (2) | 1000 |
| | 220 | 8 | 10.2 | F | 450 | 0.30 | 0.19 | EEEFC1A221P | (2) | 500 |
| | 470 | 10 | 10.2 | G | 670 | 0.15 | 0.19 | EEEFC1A471P | (2) | 500 |
| | 1000 | 10 | 10.2 | G | 670 | 0.15 | 0.19 | EEEFC1A102P | (2) | 500 |
| 16 | 10 | 4 | 5.4 | B | 60 | 3.00 | 0.16 | EEEFC1C100R | (1) | 2000 |
| | 22 | 5 | 5.4 | C | 95 | 1.80 | 0.16 | EEEFC1C220R | (1) | 1000 |
| | 47 | 6.3 | 5.4 | D | 140 | 1.00 | 0.16 | EEEFC1C470P | (1) | 1000 |
| | 68 | 8 | 6.2 | E | 230 | 0.40 | 0.16 | EEEFC1C680P | (2) | 1000 |
| | 100 | 8 | 6.2 | E | 230 | 0.40 | 0.16 | EEEFC1C101P | (2) | 1000 |
| | 220 | 10 | 10.2 | G | 670 | 0.15 | 0.16 | EEEFC1C221P | (2) | 500 |
| | 330 | 10 | 10.2 | G | 670 | 0.15 | 0.16 | EEEFC1C331P | (2) | 500 |
| | 470 | 10 | 10.2 | G | 670 | 0.15 | 0.16 | EEEFC1C471P | (2) | 500 |
| | 680 | 10 | 10.2 | G | 670 | 0.15 | 0.16 | EEEFC1C681P | (2) | 500 |
| 25 | 6.8 | 4 | 5.4 | B | 60 | 3.00 | 0.14 | EEEFC1E6R8R | (1) | 2000 |
| | 22 | 6.3 | 5.4 | D | 140 | 1.00 | 0.14 | EEEFC1E220P | (1) | 1000 |
| | 33 | 6.3 | 5.4 | D | 140 | 1.00 | 0.14 | EEEFC1E330P | (1) | 1000 |
| | 47 | 8 | 6.2 | E | 230 | 0.40 | 0.14 | EEEFC1E470P | (2) | 1000 |
| | 68 | 8 | 10.2 | F | 450 | 0.30 | 0.14 | EEEFC1E680P | (2) | 500 |
| | 100 | 8 | 10.2 | F | 450 | 0.30 | 0.14 | EEEFC1E101P | (2) | 500 |
| | 220 | 10 | 10.2 | G | 670 | 0.15 | 0.14 | EEEFC1E221P | (2) | 500 |
| | 330 | 10 | 10.2 | G | 670 | 0.15 | 0.14 | EEEFC1E331P | (2) | 500 |
| | 470 | 10 | 10.2 | G | 670 | 0.15 | 0.14 | EEEFC1E471P | (2) | 500 |
| 35 | 1 | 4 | 5.4 | B | 60 | 3.00 | 0.12 | EEEFC1V1R0R | (1) | 2000 |
| | 2.2 | 4 | 5.4 | B | 60 | 3.00 | 0.12 | EEEFC1V2R2R | (1) | 2000 |
| | 3.3 | 4 | 5.4 | B | 60 | 3.00 | 0.12 | EEEFC1V3R3R | (1) | 2000 |
| | 4.7 | 4 | 5.4 | B | 60 | 3.00 | 0.12 | EEEFC1V4R7R | (1) | 2000 |
| | 6.8 | 5 | 5.4 | C | 95 | 1.80 | 0.12 | EEEFC1V6R8R | (1) | 1000 |
| | 10 | 5 | 5.4 | C | 95 | 1.80 | 0.12 | EEEFC1V100R | (1) | 1000 |
| | 22 | 6.3 | 5.4 | D | 140 | 1.00 | 0.12 | EEEFC1V220P | (1) | 1000 |
| | 33 | 8 | 6.2 | E | 230 | 0.40 | 0.12 | EEEFC1V330P | (2) | 1000 |
| | 47 | 8 | 6.2 | E | 230 | 0.40 | 0.12 | EEEFC1V470P | (2) | 1000 |
| | 100 | 10 | 10.2 | G | 670 | 0.15 | 0.12 | EEEFC1V101P | (2) | 500 |
| | 220 | 10 | 10.2 | G | 670 | 0.15 | 0.12 | EEEFC1V221P | (2) | 500 |
| | 330 | 10 | 10.2 | G | 670 | 0.15 | 0.12 | EEEFC1V331P | (2) | 500 |
| 50 | 1 | 4 | 5.4 | B | 30 | 5.00 | 0.12 | EEEFC1H1R0R | (1) | 2000 |
| | 2.2 | 4 | 5.4 | B | 30 | 5.00 | 0.12 | EEEFC1H2R2R | (1) | 2000 |
| | 3.3 | 4 | 5.4 | B | 30 | 5.00 | 0.12 | EEEFC1H3R3R | (1) | 2000 |
| | 4.7 | 5 | 5.4 | C | 50 | 3.00 | 0.12 | EEEFC1H4R7R | (1) | 1000 |
| | 10 | 6.3 | 5.4 | D | 70 | 2.00 | 0.12 | EEEFC1H100P | (1) | 1000 |
| | 22 | 8 | 6.2 | E | 120 | 0.70 | 0.12 | EEEFC1H220P | (2) | 1000 |
| | 33 | 8 | 10.2 | F | 300 | 0.60 | 0.12 | EEEFC1H330P | (2) | 500 |
| | 47 | 10 | 10.2 | G | 500 | 0.30 | 0.12 | EEEFC1H470P | (2) | 500 |
| | 100 | 10 | 10.2 | G | 500 | 0.30 | 0.12 | EEEFC1H101P | (2) | 500 |
| | 220 | 10 | 10.2 | G | 500 | 0.30 | 0.12 | EEEFC1H221P | (2) | 500 |

· Please refer to the page of “Reflow Profile” and “The Taping Dimensions”.
· When requesting vibration-proof product, please put the last “V” instead to “P”

# Surface Mount Type

Series : **FK** Type : **V**
**High temperature**
**Lead-Free reflow (suffix : A*)**

## Features

- Endurance : 105 °C 2000 h
- Low impedance (40 % to 60 % less than FC series)
  Miniaturized (30 % to 50 % less than FC series)
- Vibration-proof product is available upon request. (φ8 mm and larger)
- RoHS compliant

## Specifications

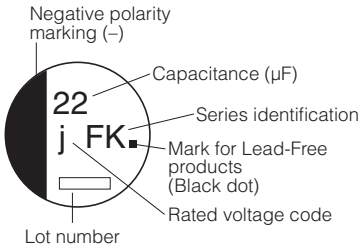
| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Category temperature range | –55 °C to +105 °C | | | | | | |
| Rated voltage range | 6.3 V.DC to 35 V.DC | | | | | | |
| Capacitance range | 4.7 μF to 1500 μF | | | | | | |
| Capacitance tolerance | ±20 % (120 Hz/+20 °C) | | | | | | |
| Leakage current | I ≦ 0.01 CV or 3 (μA) After 2 minutes (Whichever is greater) | | | | | | |
| Dissipation factor (tan δ) | Please see the attached characteristics list | | | | | | |
| Characteristics at low temperature | V.DC | 6.3 | 10 | 16 | 25 | 35 | (Impedance ratio at 120 Hz) |
| | Z(–25 °C)/Z(+20 °C) | 2 | 2 | 2 | 2 | 2 | |
| | Z(–40 °C)/Z(+20 °C) | 3 | 3 | 3 | 3 | 3 | |
| | Z(–55 °C)/Z(+20 °C) | 4 | 4 | 4 | 3 | 3 | |
| Endurance | After applying rated working voltage for 2000 hours at +105 °C±2 °C and then being stabilized at +20 °C, Capacitors shall meet the following limits. | | | | | | |
| | Capacitance change | Within ±30 % of the initial value | | | | | |
| | tan δ | ≦200 % of the initial limit | | | | | |
| | DC leakage current | Within the initial limit | | | | | |
| 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) | | | | | | |
| Resistance to soldering heat | After reflow soldering and then being stabilized at +20 °C, capacitor shall meet the following limits. | | | | | | |
| | Capacitance change | Within ±10 % of the initial value | | | | | |
| | tan δ | Within the initial limit | | | | | |
| | DC leakage current | Within the initial limit | | | | | |
| AEC-Q200 | AEC-Q200 compliant | | | | | | |

## Frequency correction factor for ripple current

| Capacitance (μF) \ Frequency (Hz) | 120 | 1 k | 10 k | 100 k to |
|---|---|---|---|---|
| 4.7 to 470 | 0.65 | 0.85 | 0.95 | 1.00 |
| 680 to 1500 | 0.70 | 0.90 | 0.95 | 1.00 |

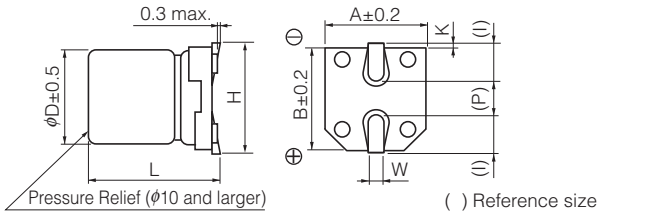
## Marking

Example : 6.3 V.DC 22 μF
Marking color : BLACK




| R. Voltage (V.DC) | 6.3 | 10 | 16 | 25 | 35 |
|---|---|---|---|---|---|
| Code | j | A | C | E | V |

## Dimensions




( ) Reference size

(Unit : mm)

| Size code | φD | L | A, B | H | I | W | P | K |
|---|---|---|---|---|---|---|---|---|
| B | 4.0 | 5.8±0.3 | 4.3 | 5.5 max. | 1.8 | 0.65±0.1 | 1.0 | $0.35^{+0.15}_{-0.20}$ |
| C | 5.0 | 5.8±0.3 | 5.3 | 6.5 max. | 2.2 | 0.65±0.1 | 1.5 | $0.35^{+0.15}_{-0.20}$ |
| D | 6.3 | 5.8±0.3 | 6.6 | 7.8 max. | 2.6 | 0.65±0.1 | 1.8 | $0.35^{+0.15}_{-0.20}$ |
| D8 | 6.3 | 7.7±0.3 | 6.6 | 7.8 max. | 2.6 | 0.65±0.1 | 1.8 | $0.35^{+0.15}_{-0.20}$ |
| E | 8.0 | 6.2±0.3 | 8.3 | 9.5 max. | 3.4 | 0.65±0.1 | 2.2 | $0.35^{+0.15}_{-0.20}$ |
| F | 8.0 | 10.2±0.3 | 8.3 | 10.0 max. | 3.4 | 0.90±0.2 | 3.1 | 0.70±0.20 |
| G | 10.0 | 10.2±0.3 | 10.3 | 12.0 max. | 3.5 | 0.90±0.2 | 4.6 | 0.70±0.20 |

## Characteristics list

Endurance : 105 °C 2000 h

| Rated voltage (V.DC) | Cap. (±20 %) (μF) | Case size (mm) | | Size* code | Specification | | | Part No. | Reflow | Min. Packaging Q'ty |
|---|---|---|---|---|---|---|---|---|---|---|
| | | φD | L | | Ripple current (100 kHz) (+105 °C) (mA r.m.s.) | Impedance (100 kHz) (+20 °C) (Ω) | tan δ (120 Hz) (+20 °C) | | | Taping (pcs) |
| 6.3 | 22 | 4 | 5.8 | B | 90 | 1.35 | 0.26 | EEEFK0J220AR | (5) | 2000 |
| | 47 | 4 | 5.8 | (B) | 90 | 1.35 | 0.26 | EEEFKJ470UAR | (5) | 2000 |
| | | 5 | 5.8 | C | 160 | 0.70 | 0.26 | EEEFK0J470AR | (5) | 1000 |
| | 100 | 5 | 5.8 | (C) | 160 | 0.70 | 0.26 | EEEFKJ101UAR | (5) | 1000 |
| | | 6.3 | 5.8 | D | 240 | 0.36 | 0.26 | EEEFK0J101AP | (5) | 1000 |
| | 220 | 6.3 | 5.8 | D | 240 | 0.36 | 0.26 | EEEFK0J221AP | (5) | 1000 |
| | 330 | 6.3 | 7.7 | D8 | 280 | 0.34 | 0.26 | EEEFKJ331XAP | (5) | 900 |
| | | 8 | 6.2 | E | 300 | 0.26 | 0.26 | EEEFK0J331AP | (6) | 1000 |
| | 470 | 8 | 10.2 | F | 600 | 0.16 | 0.26 | EEEFK0J471AP | (6) | 500 |
| | 1000 | 8 | 10.2 | F | 600 | 0.16 | 0.26 | EEEFK0J102AP | (6) | 500 |
| | 1500 | 10 | 10.2 | G | 850 | 0.08 | 0.26 | EEEFK0J152AP | (6) | 500 |
| 10 | 22 | 4 | 5.8 | B | 90 | 1.35 | 0.19 | EEEFK1A220AR | (5) | 2000 |
| | 33 | 4 | 5.8 | (B) | 90 | 1.35 | 0.19 | EEEFKA330UAR | (5) | 2000 |
| | | 5 | 5.8 | C | 160 | 0.70 | 0.19 | EEEFK1A330AR | (5) | 1000 |
| | 150 | 6.3 | 5.8 | D | 240 | 0.36 | 0.19 | EEEFK1A151AP | (5) | 1000 |
| | 220 | 6.3 | 7.7 | D8 | 280 | 0.34 | 0.19 | EEEFKA221XAP | (5) | 900 |
| | | 8 | 6.2 | E | 300 | 0.26 | 0.19 | EEEFK1A221AP | (6) | 1000 |
| | 330 | 8 | 10.2 | F | 600 | 0.16 | 0.19 | EEEFK1A331AP | (6) | 500 |
| | 470 | 8 | 10.2 | F | 600 | 0.16 | 0.19 | EEEFK1A471AP | (6) | 500 |
| | 680 | 8 | 10.2 | F | 600 | 0.16 | 0.19 | EEEFK1A681AP | (6) | 500 |
| | 1000 | 10 | 10.2 | G | 850 | 0.08 | 0.19 | EEEFK1A102AP | (6) | 500 |
| 16 | 10 | 4 | 5.8 | B | 90 | 1.35 | 0.16 | EEEFK1C100AR | (5) | 2000 |
| | 22 | 4 | 5.8 | (B) | 90 | 1.35 | 0.16 | EEEFKC220UAR | (5) | 2000 |
| | | 5 | 5.8 | C | 160 | 0.70 | 0.16 | EEEFK1C220AR | (5) | 1000 |
| | 47 | 5 | 5.8 | (C) | 160 | 0.70 | 0.16 | EEEFKC470UAR | (5) | 1000 |
| | | 6.3 | 5.8 | D | 240 | 0.36 | 0.16 | EEEFK1C470AP | (5) | 1000 |
| | 68 | 6.3 | 5.8 | D | 240 | 0.36 | 0.16 | EEEFK1C680AP | (5) | 1000 |
| | 100 | 6.3 | 5.8 | D | 240 | 0.36 | 0.16 | EEEFK1C101AP | (5) | 1000 |
| | 150 | 6.3 | 7.7 | D8 | 280 | 0.34 | 0.16 | EEEFKC151XAP | (5) | 900 |
| | 220 | 6.3 | 7.7 | D8 | 280 | 0.34 | 0.16 | EEEFKC221XAP | (5) | 900 |
| | | 8 | 6.2 | E | 300 | 0.26 | 0.16 | EEEFK1C221AP | (6) | 1000 |
| | 330 | 8 | 10.2 | F | 600 | 0.16 | 0.16 | EEEFK1C331AP | (6) | 500 |
| | 470 | 8 | 10.2 | F | 600 | 0.16 | 0.16 | EEEFK1C471AP | (6) | 500 |
| | 680 | 10 | 10.2 | G | 850 | 0.08 | 0.16 | EEEFK1C681AP | (6) | 500 |
| 25 | 10 | 4 | 5.8 | B | 90 | 1.35 | 0.14 | EEEFK1E100AR | (5) | 2000 |
| | 22 | 5 | 5.8 | C | 160 | 0.70 | 0.14 | EEEFK1E220AR | (5) | 1000 |
| | 33 | 5 | 5.8 | (C) | 160 | 0.70 | 0.14 | EEEFKE330UAR | (5) | 1000 |
| | | 6.3 | 5.8 | D | 240 | 0.36 | 0.14 | EEEFK1E330AP | (5) | 1000 |
| | 47 | 6.3 | 5.8 | D | 240 | 0.36 | 0.14 | EEEFK1E470AP | (5) | 1000 |
| | 68 | 6.3 | 5.8 | D | 240 | 0.36 | 0.14 | EEEFK1E680AP | (5) | 1000 |
| | 100 | 6.3 | 7.7 | D8 | 280 | 0.34 | 0.14 | EEEFKE101XAP | (5) | 900 |
| | | 8 | 6.2 | E | 300 | 0.26 | 0.14 | EEEFK1E101AP | (6) | 1000 |
| | 150 | 8 | 10.2 | F | 600 | 0.16 | 0.14 | EEEFK1E151AP | (6) | 500 |
| | 220 | 8 | 10.2 | F | 600 | 0.16 | 0.14 | EEEFK1E221AP | (6) | 500 |
| | 330 | 8 | 10.2 | F | 600 | 0.16 | 0.14 | EEEFK1E331AP | (6) | 500 |
| | 470 | 10 | 10.2 | G | 850 | 0.08 | 0.14 | EEEFK1E471AP | (6) | 500 |
| 35 | 4.7 | 4 | 5.8 | B | 90 | 1.35 | 0.12 | EEEFK1V4R7AR | (5) | 2000 |
| | 10 | 4 | 5.8 | (B) | 90 | 1.35 | 0.12 | EEEFKV100UAR | (5) | 2000 |
| | | 5 | 5.8 | C | 160 | 0.70 | 0.12 | EEEFK1V100AR | (5) | 1000 |
| | 22 | 5 | 5.8 | C | 160 | 0.70 | 0.12 | EEEFK1V220AR | (5) | 1000 |
| | 33 | 6.3 | 5.8 | D | 240 | 0.36 | 0.12 | EEEFK1V330AP | (5) | 1000 |
| | 47 | 6.3 | 5.8 | D | 240 | 0.36 | 0.12 | EEEFK1V470AP | (5) | 1000 |
| | 68 | 6.3 | 7.7 | D8 | 280 | 0.34 | 0.12 | EEEFKV680XAP | (5) | 900 |
| | 100 | 6.3 | 7.7 | D8 | 280 | 0.34 | 0.12 | EEEFKV101XAP | (5) | 900 |
| | | 8 | 10.2 | F | 600 | 0.16 | 0.12 | EEEFK1V101AP | (6) | 500 |
| | 150 | 8 | 10.2 | F | 600 | 0.16 | 0.12 | EEEFK1V151AP | (6) | 500 |
| | 220 | 8 | 10.2 | F | 600 | 0.16 | 0.12 | EEEFK1V221AP | (6) | 500 |
| | 330 | 10 | 10.2 | G | 850 | 0.08 | 0.12 | EEEFK1V331AP | (6) | 500 |

✻ Size code( ) : Miniaturization product

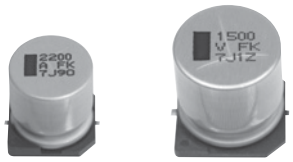
If Part number exceeds 12 digits, voltage code is abbreviated as follows; 0J → J, 1A → A, 1C → C, 1E → E, 1V → V

· Please refer to the page of "Reflow Profile" and "The Taping Dimensions".

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

# Surface Mount Type

Series : Medium-size **FK** Type : **V**
**High temperature**
**Lead-Free reflow (suffix : A*)**



## Features

- Endurance : 105 °C 5000 h
- Vibration-proof product is available upon request.
- RoHS compliant

## Specifications

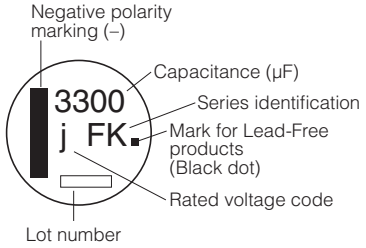
| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Category temperature range | –55 °C to +105 °C | | | | | | | | | | |
| Rated voltage range | 6.3 V.DC to 100 V.DC | | | | | | | | | | |
| Capacitance range | 47 µF to 6800 µF | | | | | | | | | | |
| Capacitance tolerance | ±20 % (120 Hz/+20 °C) | | | | | | | | | | |
| Leakage current | I ≦ 0.01 CV (µA) After 2 minutes | | | | | | | | | | |
| Dissipation factor (tan $\delta$) | Please see the attached characteristics list | | | | | | | | | | |
| Characteristics at low temperature | V.DC | 6.3 | 10 | 16 | 25 | 35 | 50 | 63 | 80 | 100 | (Impedance ratio at 120 Hz) |
| | Z(–25 °C)/Z(+20 °C) | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | |
| | Z(–40 °C)/Z(+20 °C) | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | |
| | Z(–55 °C)/Z(+20 °C) | 4 | 4 | 4 | 3 | 3 | 3 | 3 | 3 | 3 | |
| Endurance | After applying rated working voltage for 5000 hours at +105 °C±2 °C and then being stabilized at +20 °C, Capacitors shall meet the following limits. | | | | | | | | | | |
| | Capacitance change | Within ±30 % of the initial value | | | | | | | | | |
| | tan $\delta$ | ≦200 % of the initial limit | | | | | | | | | |
| | DC leakage current | Within the initial limit | | | | | | | | | |
| 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) | | | | | | | | | | |
| 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 | | | | | | | | | |
| | tan $\delta$ | Within the initial limit | | | | | | | | | |
| | DC leakage current | Within the initial limit | | | | | | | | | |
| AEC-Q200 | AEC-Q200 compliant | | | | | | | | | | |

## Frequency correction factor for ripple current

| Frequency (Hz) | 120 | 1 k | 10 k | 100 k to |
|---|---|---|---|---|
| Correction factor | 0.75 | 0.90 | 0.95 | 1.00 |

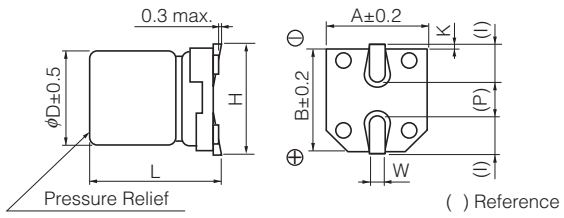
## Marking

Example : 6.3 V.DC 3300 µF
Marking color : BLACK




| R. Voltage (V.DC) | 6.3 | 10 | 16 | 25 | 35 | 50 | 63 | 80 | 100 |
|---|---|---|---|---|---|---|---|---|---|
| Code | j | A | C | E | V | H | J | K | 2A |

## Dimensions




(Unit : mm)

| Size code | φD | L | A, B | H | I | W | P | K |
|---|---|---|---|---|---|---|---|---|
| H13 | 12.5 | 13.5±0.5 | 13.5 | 15.0 max. | 4.7 | 0.90±0.3 | 4.4 | 0.70±0.30 |
| J16 | 16.0 | 16.5±0.5 | 17.0 | 19.0 max. | 5.5 | 1.20±0.3 | 6.7 | 0.70±0.30 |
| K16 | 18.0 | 16.5±0.5 | 19.0 | 21.0 max. | 6.7 | 1.20±0.3 | 6.7 | 0.70±0.30 |

## Characteristics list

Endurance : 105 °C 5000 h

| Rated voltage (V.DC) | Cap. (±20 %) (μF) | Case size (mm) | | Size code | Specification | | | Part No. | Reflow | Min. Packaging Q'ty |
|---|---|---|---|---|---|---|---|---|---|---|
| | | φD | L | | Ripple current (100 kHz) (+105 °C) (mA r.m.s.) | Impedance (100 kHz) (+20 °C) (Ω) | tan δ (120 Hz) (+20 °C) | | | Taping (pcs) |
| 6.3 | 3300 | 12.5 | 13.5 | H13 | 1100 | 0.06 | 0.30 | EEEFK0J332AQ | (9) | 200 |
| | 6800 | 16 | 16.5 | J16 | 1800 | 0.035 | 0.36 | EEEFK0J682AM | (9) | 125 |
| 10 | 2200 | 12.5 | 13.5 | H13 | 1100 | 0.06 | 0.21 | EEEFK1A222AQ | (9) | 200 |
| | 4700 | 16 | 16.5 | J16 | 1800 | 0.035 | 0.25 | EEEFK1A472AM | (9) | 125 |
| | 6800 | 18 | 16.5 | K16 | 2060 | 0.033 | 0.29 | EEEFK1A682AM | (9) | 125 |
| 16 | 1500 | 12.5 | 13.5 | H13 | 1100 | 0.06 | 0.16 | EEEFK1C152AQ | (9) | 200 |
| | 3300 | 16 | 16.5 | J16 | 1800 | 0.035 | 0.20 | EEEFK1C332AM | (9) | 125 |
| | 4700 | 18 | 16.5 | K16 | 2060 | 0.033 | 0.22 | EEEFK1C472AM | (9) | 125 |
| 25 | 1000 | 12.5 | 13.5 | H13 | 1100 | 0.06 | 0.14 | EEEFK1E102AQ | (9) | 200 |
| | 1500 | 16 | 16.5 | J16 | 1800 | 0.035 | 0.16 | EEEFK1E152AM | (9) | 125 |
| | 2200 | 16 | 16.5 | J16 | 1800 | 0.035 | 0.16 | EEEFK1E222AM | (9) | 125 |
| | 3300 | 18 | 16.5 | K16 | 2060 | 0.033 | 0.18 | EEEFK1E332AM | (9) | 125 |
| 35 | 470 | 12.5 | 13.5 | H13 | 1100 | 0.06 | 0.12 | EEEFK1V471AQ | (9) | 200 |
| | 680 | 12.5 | 13.5 | H13 | 1100 | 0.06 | 0.12 | EEEFK1V681AQ | (9) | 200 |
| | 1000 | 16 | 16.5 | J16 | 1800 | 0.035 | 0.12 | EEEFK1V102AM | (9) | 125 |
| | 1500 | 16 | 16.5 | J16 | 1800 | 0.035 | 0.12 | EEEFK1V152AM | (9) | 125 |
| 50 | 330 | 12.5 | 13.5 | H13 | 900 | 0.12 | 0.12 | EEEFK1H331AQ | (10) | 200 |
| | 390 | 12.5 | 13.5 | H13 | 900 | 0.12 | 0.12 | EEEFK1H391AQ | (10) | 200 |
| | 470 | 16 | 16.5 | J16 | 1610 | 0.073 | 0.12 | EEEFK1H471AM | (10) | 125 |
| | 560 | 16 | 16.5 | J16 | 1610 | 0.073 | 0.12 | EEEFK1H561AM | (10) | 125 |
| | 680 | 16 | 16.5 | J16 | 1610 | 0.073 | 0.12 | EEEFK1H681AM | (10) | 125 |
| | 1000 | 16 | 16.5 | J16 | 1610 | 0.073 | 0.12 | EEEFK1H102AM | (10) | 125 |
| 63 | 150 | 12.5 | 13.5 | H13 | 800 | 0.16 | 0.10 | EEEFK1J151AQ | (10) | 200 |
| | 220 | 12.5 | 13.5 | H13 | 800 | 0.16 | 0.10 | EEEFK1J221AQ | (10) | 200 |
| | 470 | 16 | 16.5 | J16 | 1410 | 0.082 | 0.10 | EEEFK1J471AM | (10) | 125 |
| | 680 | 18 | 16.5 | K16 | 1690 | 0.08 | 0.10 | EEEFK1J681AM | (10) | 125 |
| 80 | 68 | 12.5 | 13.5 | H13 | 500 | 0.32 | 0.08 | EEEFK1K680AQ | (11) | 200 |
| | 100 | 12.5 | 13.5 | H13 | 500 | 0.32 | 0.08 | EEEFK1K101AQ | (11) | 200 |
| | 150 | 12.5 | 13.5 | H13 | 500 | 0.32 | 0.08 | EEEFK1K151AQ | (11) | 200 |
| | 330 | 16 | 16.5 | J16 | 793 | 0.17 | 0.08 | EEEFK1K331AM | (11) | 125 |
| | 470 | 18 | 16.5 | K16 | 917 | 0.153 | 0.08 | EEEFK1K471AM | (11) | 125 |
| 100 | 47 | 12.5 | 13.5 | H13 | 500 | 0.32 | 0.07 | EEEFK2A470AQ | (11) | 200 |
| | 68 | 12.5 | 13.5 | H13 | 500 | 0.32 | 0.07 | EEEFK2A680AQ | (11) | 200 |
| | 100 | 16 | 16.5 | J16 | 793 | 0.17 | 0.07 | EEEFK2A101AM | (11) | 125 |
| | 150 | 16 | 16.5 | J16 | 793 | 0.17 | 0.07 | EEEFK2A151AM | (11) | 125 |
| | 220 | 18 | 16.5 | K16 | 917 | 0.153 | 0.07 | EEEFK2A221AM | (11) | 125 |
| | 330 | 18 | 16.5 | K16 | 917 | 0.153 | 0.07 | EEEFK2A331AM | (11) | 125 |

· Please refer to the page of “Reflow Profile” and “The Taping Dimensions”.
· When requesting vibration-proof product, please put the last “V” instead to “Q” or “M”

# Surface Mount Type

Series : **FK** Type : **V**

## Features

- Endurance : 105 °C 2000 h to 5000 h
- Low impedance (40 % to 60 % less than FC series)
  Miniaturized (30 % to 50 % less than FC series)
- Vibration-proof product is available upon request. (φ8 mm and larger)
- RoHS compliant

## Specifications

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Category temperature range | –55 °C to +105 °C | | | | | | | | | | |
| Rated voltage range | 6.3 V.DC to 100 V.DC | | | | | | | | | | |
| Capacitance range | 3.3 μF to 6800 μF | | | | | | | | | | |
| Capacitance tolerance | ±20 % (120 Hz/+20 °C) | | | | | | | | | | |
| 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 | | | | | | | | | | |
| Characteristics at low temperature | V.DC | 6.3 | 10 | 16 | 25 | 35 | 50 | 63 | 80 | 100 | (Impedance ratio at 120 Hz) |
| | Z(–25 °C)/Z(+20 °C) | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | |
| | Z(–40 °C)/Z(+20 °C) | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | |
| | Z(–55 °C)/Z(+20 °C) | 4 | 4 | 4 | 3 | 3 | 3 | 3 | 3 | 3 | |
| Endurance | After applying rated working voltage for 2000 hours at +105 °C±2 °C and then being stabilized at +20 °C, Capacitors shall meet the following limits. (≧φ12.5 and suffix "G" in φ8×10.2, φ10×10.2 are 5000 hours) | | | | | | | | | | |
| | Capacitance change | Within ±30 % of the initial value (Suffix "G" is 35 %) | | | | | | | | | |
| | tan δ | ≦ 200 % of the initial limit (Suffix "G" is 300 %) | | | | | | | | | |
| | DC leakage current | Within the initial limit | | | | | | | | | |
| 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) | | | | | | | | | | |
| 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 | | | | | | | | | |
| | tan δ | Within the initial limit | | | | | | | | | |
| | DC leakage current | Within the initial limit | | | | | | | | | |
| AEC-Q200 | AEC-Q200 compliant | | | | | | | | | | |

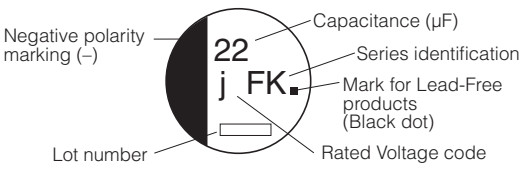
## Frequency correction factor for ripple current

| Frequency (Hz) | 50, 60 | 120 | 1 k | 10 k | 100 k to |
|---|---|---|---|---|---|
| Correction factor | 0.70 | 0.75 | 0.90 | 0.95 | 1.00 |

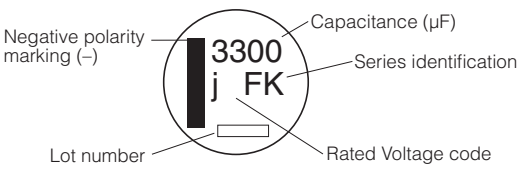
## Marking

Example : 6.3 V.DC 22 μF, 6.3 V.DC 3300 μF
Marking color : BLACK

≦ φ10

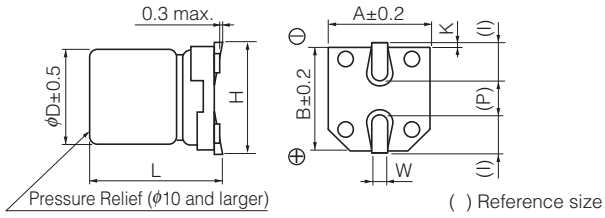



≧ φ12.5




| R. Voltage (V.DC) | 6.3 | 10 | 16 | 25 | 35 | 50 | 63 | 80 | 100 |
|---|---|---|---|---|---|---|---|---|---|
| Code | j | A | C | E | V | H | J | K | 2A |

## Dimensions




(Unit : mm)

| Size code | φD | L | A,B | H | I | W | P | K |
|---|---|---|---|---|---|---|---|---|
| B | 4.0 | 5.8±0.3 | 4.3 | 5.5 max. | 1.8 | 0.65±0.1 | 1.0 | $0.35^{+1.5}_{-0.2}$ |
| C | 5.0 | 5.8±0.3 | 5.3 | 6.5 max. | 2.2 | 0.65±0.1 | 1.5 | $0.35^{+1.5}_{-0.2}$ |
| D | 6.3 | 5.8±0.3 | 6.6 | 7.8 max. | 2.6 | 0.65±0.1 | 1.8 | $0.35^{+1.5}_{-0.2}$ |
| D8 | 6.3 | 7.7±0.3 | 6.6 | 7.8 max. | 2.6 | 0.65±0.1 | 1.8 | $0.35^{+1.5}_{-0.2}$ |
| E | 8.0 | 6.2±0.3 | 8.3 | 9.5 max. | 3.4 | 0.65±0.1 | 2.2 | $0.35^{+1.5}_{-0.2}$ |
| F | 8.0 | 10.2±0.3 | 8.3 | 10.0 max. | 3.4 | 0.90±0.2 | 3.1 | 0.70±0.2 |
| G | 10.0 | 10.2±0.3 | 10.3 | 12.0 max. | 3.5 | 0.90±0.2 | 4.6 | 0.70±0.2 |
| H13 | 12.5 | 13.5±0.5 | 13.5 | 15.0 max. | 4.7 | 0.90±0.3 | 4.4 | 0.70±0.3 |
| J16 | 16.0 | 16.5±0.5 | 17.0 | 19.0 max. | 5.5 | 1.20±0.3 | 6.7 | 0.70±0.3 |
| K16 | 18.0 | 16.5±0.5 | 19.0 | 21.0 max. | 6.7 | 1.20±0.3 | 6.7 | 0.70±0.3 |

## Characteristics list

Endurance : 105 °C 2000 h (≧ φ12.5 : 5000 h)

| Rated voltage (V.DC) | Cap. (±20 %) (μF) | Case size (mm) φD | Case size (mm) L | Size* code | Specification: Ripple current (100 kHz) (+105 °C) (mA r.m.s.) | Specification: Impedance (100 kHz) (+20 °C) (Ω) | Specification: tan δ (120 Hz) (+20 °C) | Part No. | Reflow | Min. Packaging Q'ty Taping (pcs) |
|---|---|---|---|---|---|---|---|---|---|---|
| 6.3 | 22 | 4 | 5.8 | B | 90 | 1.35 | 0.26 | EEEFK0J220R | (1) | 2000 |
| | 47 | 4 | 5.8 | (B) | 90 | 1.35 | 0.26 | EEEFK0J470UR | (1) | 2000 |
| | | 5 | 5.8 | C | 160 | 0.70 | 0.26 | EEEFK0J470R | (1) | 1000 |
| | 100 | 5 | 5.8 | (C) | 160 | 0.70 | 0.26 | EEEFK0J101UR | (1) | 1000 |
| | | 6.3 | 5.8 | D | 240 | 0.36 | 0.26 | EEEFK0J101P | (1) | 1000 |
| | 220 | 6.3 | 5.8 | D | 240 | 0.36 | 0.26 | EEEFK0J221P | (1) | 1000 |
| | 330 | 6.3 | 7.7 | D8 | 280 | 0.34 | 0.26 | EEEFK0J331XP | (1) | 900 |
| | | 8 | 6.2 | E | 300 | 0.26 | 0.26 | EEEFK0J331P | (2) | 1000 |
| | 470 | 8 | 10.2 | F | 600 | 0.16 | 0.26 | EEEFK0J471P | (2) | 500 |
| | 1000 | 8 | 10.2 | F | 600 | 0.16 | 0.26 | EEEFK0J102P | (2) | 500 |
| | 1500 | 10 | 10.2 | G | 850 | 0.08 | 0.26 | EEEFK0J152P | (2) | 500 |
| | 3300 | 12.5 | 13.5 | H13 | 1100 | 0.06 | 0.30 | EEVFK0J332Q | (3) | 200 |
| | 6800 | 16 | 16.5 | J16 | 1800 | 0.035 | 0.36 | EEVFK0J682M | (3) | 125 |
| 10 | 22 | 4 | 5.8 | B | 90 | 1.35 | 0.19 | EEEFK1A220R | (1) | 2000 |
| | 33 | 4 | 5.8 | (B) | 90 | 1.35 | 0.19 | EEEFK1A330UR | (1) | 2000 |
| | | 5 | 5.8 | C | 160 | 0.70 | 0.19 | EEEFK1A330R | (1) | 1000 |
| | 150 | 6.3 | 5.8 | D | 240 | 0.36 | 0.19 | EEEFK1A151P | (1) | 1000 |
| | 220 | 6.3 | 7.7 | D8 | 280 | 0.34 | 0.19 | EEEFK1A221XP | (1) | 900 |
| | | 8 | 6.2 | E | 300 | 0.26 | 0.19 | EEEFK1A221P | (2) | 1000 |
| | 330 | 8 | 10.2 | F | 600 | 0.16 | 0.19 | EEEFK1A331P | (2) | 500 |
| | 470 | 8 | 10.2 | F | 600 | 0.16 | 0.19 | EEEFK1A471P | (2) | 500 |
| | 680 | 8 | 10.2 | F | 600 | 0.16 | 0.19 | EEEFK1A681P | (2) | 500 |
| | 1000 | 10 | 10.2 | G | 850 | 0.08 | 0.19 | EEEFK1A102P | (2) | 500 |
| | 2200 | 12.5 | 13.5 | H13 | 1100 | 0.06 | 0.21 | EEVFK1A222Q | (3) | 200 |
| | 4700 | 16 | 16.5 | J16 | 1800 | 0.035 | 0.25 | EEVFK1A472M | (3) | 125 |
| | 6800 | 18 | 16.5 | K16 | 2060 | 0.033 | 0.29 | EEVFK1A682M | (3) | 125 |
| 16 | 10 | 4 | 5.8 | B | 90 | 1.35 | 0.16 | EEEFK1C100R | (1) | 2000 |
| | 22 | 4 | 5.8 | (B) | 90 | 1.35 | 0.16 | EEEFK1C220UR | (1) | 2000 |
| | | 5 | 5.8 | C | 160 | 0.70 | 0.16 | EEEFK1C220R | (1) | 1000 |
| | 47 | 5 | 5.8 | (C) | 160 | 0.70 | 0.16 | EEEFK1C470UR | (1) | 1000 |
| | | 6.3 | 5.8 | D | 240 | 0.36 | 0.16 | EEEFK1C470P | (1) | 1000 |
| | 68 | 6.3 | 5.8 | D | 240 | 0.36 | 0.16 | EEEFK1C680P | (1) | 1000 |
| | 100 | 6.3 | 5.8 | D | 240 | 0.36 | 0.16 | EEEFK1C101P | (1) | 1000 |
| | 150 | 6.3 | 7.7 | D8 | 280 | 0.34 | 0.16 | EEEFK1C151XP | (1) | 900 |
| | 220 | 6.3 | 7.7 | D8 | 280 | 0.34 | 0.16 | EEEFK1C221XP | (1) | 900 |
| | | 8 | 6.2 | E | 300 | 0.26 | 0.16 | EEEFK1C221P | (2) | 1000 |
| | 330 | 8 | 10.2 | F | 600 | 0.16 | 0.16 | EEEFK1C331P | (2) | 500 |
| | 470 | 8 | 10.2 | F | 600 | 0.16 | 0.16 | EEEFK1C471P | (2) | 500 |
| | 680 | 10 | 10.2 | G | 850 | 0.08 | 0.16 | EEEFK1C681P | (2) | 500 |
| | 1500 | 12.5 | 13.5 | H13 | 1100 | 0.06 | 0.16 | EEVFK1C152Q | (3) | 200 |
| | 3300 | 16 | 16.5 | J16 | 1800 | 0.035 | 0.20 | EEVFK1C332M | (3) | 125 |
| | 4700 | 18 | 16.5 | K16 | 2060 | 0.033 | 0.22 | EEVFK1C472M | (3) | 125 |
| 25 | 10 | 4 | 5.8 | B | 90 | 1.35 | 0.14 | EEEFK1E100R | (1) | 2000 |
| | 22 | 5 | 5.8 | C | 160 | 0.70 | 0.14 | EEEFK1E220R | (1) | 1000 |
| | 33 | 5 | 5.8 | (C) | 160 | 0.70 | 0.14 | EEEFK1E330UR | (1) | 1000 |
| | | 6.3 | 5.8 | D | 240 | 0.36 | 0.14 | EEEFK1E330P | (1) | 1000 |
| | 47 | 6.3 | 5.8 | D | 240 | 0.36 | 0.14 | EEEFK1E470P | (1) | 1000 |
| | 68 | 6.3 | 5.8 | D | 240 | 0.36 | 0.14 | EEEFK1E680P | (1) | 1000 |
| | 100 | 6.3 | 7.7 | D8 | 280 | 0.34 | 0.14 | EEEFK1E101XP | (1) | 900 |
| | | 8 | 6.2 | E | 300 | 0.26 | 0.14 | EEEFK1E101P | (2) | 1000 |
| | 150 | 8 | 10.2 | F | 600 | 0.16 | 0.14 | EEEFK1E151P | (2) | 500 |
| | 220 | 8 | 10.2 | F | 600 | 0.16 | 0.14 | EEEFK1E221P | (2) | 500 |
| | 330 | 8 | 10.2 | F | 600 | 0.16 | 0.14 | EEEFK1E331P | (2) | 500 |
| | 470 | 10 | 10.2 | G | 850 | 0.08 | 0.14 | EEEFK1E471P | (2) | 500 |
| | 1000 | 12.5 | 13.5 | H13 | 1100 | 0.06 | 0.14 | EEVFK1E102Q | (3) | 200 |
| | 1500 | 16 | 16.5 | J16 | 1800 | 0.035 | 0.14 | EEVFK1E152M | (3) | 125 |
| | 2200 | 16 | 16.5 | J16 | 1800 | 0.035 | 0.16 | EEVFK1E222M | (3) | 125 |
| | 3300 | 18 | 16.5 | K16 | 2060 | 0.033 | 0.18 | EEVFK1E332M | (3) | 125 |

✻ Size code( ) : Miniaturization product
· Please refer to the page of "Reflow Profile" and "The Taping Dimensions".
· When requesting vibration-proof product, please put the last "V" instead to "P"

## Characteristics list

Endurance : 105 °C 2000 h (≧ φ12.5 : 5000 h)

| Rated voltage (V.DC) | Cap. (±20 %) (μF) | Case size (mm) φD | Case size (mm) L | Size* code | Specification: Ripple current (100 kHz) (+105 °C) (mA r.m.s.) | Specification: Impedance (100 kHz) (+20 °C) (Ω) | Specification: tan δ (120 Hz) (+20 °C) | Part No. | Reflow | Min. Packaging Q'ty Taping (pcs) |
|---|---|---|---|---|---|---|---|---|---|---|
| 35 | 4.7 | 4 | 5.8 | B | 90 | 1.35 | 0.12 | EEEFK1V4R7R | (1) | 2000 |
| | 10 | 4 | 5.8 | (B) | 90 | 1.35 | 0.12 | EEEFK1V100UR | (1) | 2000 |
| | | 5 | 5.8 | C | 160 | 0.70 | 0.12 | EEEFK1V100R | (1) | 1000 |
| | 22 | 5 | 5.8 | C | 160 | 0.70 | 0.12 | EEEFK1V220R | (1) | 1000 |
| | 33 | 6.3 | 5.8 | D | 240 | 0.36 | 0.12 | EEEFK1V330P | (1) | 1000 |
| | 47 | 6.3 | 5.8 | D | 240 | 0.36 | 0.12 | EEEFK1V470P | (1) | 1000 |
| | 68 | 6.3 | 7.7 | D8 | 280 | 0.34 | 0.12 | EEEFK1V680XP | (1) | 900 |
| | 100 | 6.3 | 7.7 | D8 | 280 | 0.34 | 0.12 | EEEFK1V101XP | (1) | 900 |
| | | 8 | 10.2 | F | 600 | 0.16 | 0.12 | EEEFK1V101P | (2) | 500 |
| | 150 | 8 | 10.2 | F | 600 | 0.16 | 0.12 | EEEFK1V151P | (2) | 500 |
| | 220 | 8 | 10.2 | F | 600 | 0.16 | 0.12 | EEEFK1V221P | (2) | 500 |
| | 330 | 10 | 10.2 | G | 850 | 0.08 | 0.12 | EEEFK1V331P | (2) | 500 |
| | 470 | 12.5 | 13.5 | H13 | 1100 | 0.06 | 0.12 | EEVFK1V471Q | (3) | 200 |
| | 680 | 12.5 | 13.5 | H13 | 1100 | 0.06 | 0.12 | EEVFK1V681Q | (3) | 200 |
| | 1000 | 16 | 16.5 | J16 | 1800 | 0.035 | 0.12 | EEVFK1V102M | (3) | 125 |
| | 1500 | 16 | 16.5 | J16 | 1800 | 0.035 | 0.12 | EEVFK1V152M | (3) | 125 |
| 50 | 4.7 | 4 | 5.8 | B | 60 | 2.90 | 0.10 | EEEFK1H4R7R | (1) | 2000 |
| | 10 | 5 | 5.8 | (C) | 85 | 1.52 | 0.10 | EEEFK1H100UR | (1) | 1000 |
| | | 6.3 | 5.8 | D | 165 | 0.88 | 0.10 | EEEFK1H100P | (1) | 1000 |
| | 22 | 6.3 | 5.8 | D | 165 | 0.88 | 0.10 | EEEFK1H220P | (1) | 1000 |
| | 33 | 6.3 | 7.7 | D8 | 195 | 0.68 | 0.10 | EEEFK1H330XP | (1) | 900 |
| | | 8 | 6.2 | E | 195 | 0.68 | 0.10 | EEEFK1H330P | (2) | 1000 |
| | 47 | 6.3 | 7.7 | D8 | 195 | 0.68 | 0.10 | EEEFK1H470XP | (1) | 900 |
| | | 8 | 6.2 | E | 195 | 0.68 | 0.10 | EEEFK1H470P | (2) | 1000 |
| | 100 | 8 | 10.2 | F | 350 | 0.34 | 0.10 | EEEFK1H101P | (2) | 500 |
| | 150 | 10 | 10.2 | G | 670 | 0.18 | 0.10 | EEEFK1H151P | (2) | 500 |
| | 220 | 10 | 10.2 | G | 670 | 0.18 | 0.10 | EEEFK1H221P | (2) | 500 |
| | 330 | 12.5 | 13.5 | H13 | 900 | 0.12 | 0.10 | EEVFK1H331Q | (3) | 200 |
| | 390 | 12.5 | 13.5 | H13 | 900 | 0.12 | 0.10 | EEVFK1H391Q | (3) | 200 |
| | 470 | 16 | 16.5 | J16 | 1610 | 0.073 | 0.10 | EEVFK1H471M | (3) | 125 |
| | 560 | 16 | 16.5 | J16 | 1610 | 0.073 | 0.10 | EEVFK1H561M | (3) | 125 |
| | 680 | 16 | 16.5 | J16 | 1610 | 0.073 | 0.10 | EEVFK1H681M | (3) | 125 |
| | 1000 | 16 | 16.5 | J16 | 1610 | 0.073 | 0.10 | EEVFK1H102M | (3) | 125 |
| 63 | 4.7 | 5 | 5.8 | C | 50 | 3.00 | 0.08 | EEEFK1J4R7R | (1) | 1000 |
| | 10 | 6.3 | 5.8 | D | 80 | 1.50 | 0.08 | EEEFK1J100P | (1) | 1000 |
| | 22 | 6.3 | 7.7 | D8 | 120 | 1.20 | 0.08 | EEEFK1J220XP | (1) | 900 |
| | | 8 | 6.2 | E | 120 | 1.20 | 0.08 | EEEFK1J220P | (2) | 1000 |
| | 33 | 8 | 10.2 | F | 250 | 0.65 | 0.08 | EEEFK1J330P | (2) | 500 |
| | 47 | 8 | 10.2 | F | 250 | 0.65 | 0.08 | EEEFK1J470P | (2) | 500 |
| | 68 | 8 | 10.2 | (F) | 250 | 0.65 | 0.08 | EEEFK1J680UP | (2) | 500 |
| | 100 | 10 | 10.2 | G | 400 | 0.35 | 0.08 | EEEFK1J101P | (2) | 500 |
| | 150 | 12.5 | 13.5 | H13 | 800 | 0.16 | 0.08 | EEVFK1J151Q | (3) | 200 |
| | 220 | 12.5 | 13.5 | H13 | 800 | 0.16 | 0.08 | EEVFK1J221Q | (3) | 200 |
| | 470 | 16 | 16.5 | J16 | 1410 | 0.082 | 0.08 | EEVFK1J471M | (3) | 125 |
| | 680 | 18 | 16.5 | K16 | 1690 | 0.08 | 0.08 | EEVFK1J681M | (3) | 125 |
| 80 | 3.3 | 5 | 5.8 | C | 25 | 5.00 | 0.08 | EEEFK1K3R3R | (1) | 1000 |
| | 4.7 | 6.3 | 5.8 | D | 40 | 3.00 | 0.08 | EEEFK1K4R7P | (1) | 1000 |
| | 10 | 6.3 | 7.7 | D8 | 60 | 2.40 | 0.08 | EEEFK1K100XP | (1) | 900 |
| | | 8 | 6.2 | E | 60 | 2.40 | 0.08 | EEEFK1K100P | (2) | 1000 |
| | 22 | 8 | 10.2 | F | 130 | 1.30 | 0.08 | EEEFK1K220P | (2) | 500 |
| | 33 | 8 | 10.2 | F | 130 | 1.30 | 0.08 | EEEFK1K330P | (2) | 500 |
| | 47 | 10 | 10.2 | G | 200 | 0.70 | 0.08 | EEEFK1K470P | (2) | 500 |
| | 68 | 12.5 | 13.5 | H13 | 500 | 0.32 | 0.08 | EEVFK1K680Q | (3) | 200 |
| | 100 | 12.5 | 13.5 | H13 | 500 | 0.32 | 0.08 | EEVFK1K101Q | (3) | 200 |
| | 150 | 12.5 | 13.5 | H13 | 500 | 0.32 | 0.08 | EEVFK1K151Q | (3) | 200 |
| | 330 | 16 | 16.5 | J16 | 793 | 0.17 | 0.08 | EEVFK1K331M | (3) | 125 |
| | 470 | 18 | 16.5 | K16 | 917 | 0.153 | 0.08 | EEVFK1K471M | (3) | 125 |

✻ Size code( ) : Miniaturization product
· Please refer to the page of "Reflow Profile" and "The Taping Dimensions".
· When requesting vibration-proof product, please put the last "V" instead to "P"

## Characteristics list

Endurance : 105 °C 2000 h (≧ φ12.5 : 5000 h)

| Rated voltage (V.DC) | Cap. (±20 %) (μF) | Case size (mm) φD | Case size (mm) L | Size* code | Specification: Ripple current (100 kHz) (+105 °C) (mA r.m.s.) | Specification: Impedance (100 kHz) (+20 °C) (Ω) | Specification: tan δ (120 Hz) (+20 °C) | Part No. | Reflow | Min. Packaging Q'ty Taping (pcs) |
|---|---|---|---|---|---|---|---|---|---|---|
| 100 | 22 | 8 | 10.2 | F | 130 | 1.30 | 0.07 | EEEFK2A220P | (2) | 500 |
| | 33 | 10 | 10.2 | G | 200 | 0.70 | 0.07 | EEEFK2A330P | (2) | 500 |
| | 47 | 12.5 | 13.5 | H13 | 500 | 0.32 | 0.07 | EEVFK2A470Q | (3) | 200 |
| | 68 | 12.5 | 13.5 | H13 | 500 | 0.32 | 0.07 | EEVFK2A680Q | (3) | 200 |
| | 100 | 16 | 16.5 | J16 | 793 | 0.17 | 0.07 | EEVFK2A101M | (3) | 125 |
| | 150 | 16 | 16.5 | J16 | 793 | 0.17 | 0.07 | EEVFK2A151M | (3) | 125 |
| | 220 | 18 | 16.5 | K16 | 917 | 0.153 | 0.07 | EEVFK2A221M | (3) | 125 |
| | 330 | 18 | 16.5 | K16 | 917 | 0.153 | 0.07 | EEVFK2A331M | (3) | 125 |

✻ Size code( ) : Miniaturization product
· Please refer to the page of "Reflow Profile" and "The Taping Dimensions".

## Characteristics list

Endurance : 105 °C 5000 h

| Rated voltage (V.DC) | Cap. (±20 %) (μF) | Case size (mm) φD | Case size (mm) L | Size* code | Specification: Ripple current (100 kHz) (+105 °C) (mA r.m.s.) | Specification: Impedance (100 kHz) (+20 °C) (Ω) | Specification: tan δ (120 Hz) (+20 °C) | Part No. | Reflow | Min. Packaging Q'ty Taping (pcs) |
|---|---|---|---|---|---|---|---|---|---|---|
| 6.3 | 470 | 8 | 10.2 | F | 600 | 0.16 | 0.26 | EEEFK0J471GP | (2) | 500 |
| | 1000 | 8 | 10.2 | F | 600 | 0.16 | 0.26 | EEEFK0J102GP | (2) | 500 |
| | 1500 | 10 | 10.2 | G | 850 | 0.08 | 0.26 | EEEFK0J152GP | (2) | 500 |
| 10 | 330 | 8 | 10.2 | F | 600 | 0.16 | 0.19 | EEEFK1A331GP | (2) | 500 |
| | 470 | 8 | 10.2 | F | 600 | 0.16 | 0.19 | EEEFK1A471GP | (2) | 500 |
| | 680 | 8 | 10.2 | F | 600 | 0.16 | 0.19 | EEEFK1A681GP | (2) | 500 |
| | 1000 | 10 | 10.2 | G | 850 | 0.08 | 0.19 | EEEFK1A102GP | (2) | 500 |
| 16 | 330 | 8 | 10.2 | F | 600 | 0.16 | 0.16 | EEEFK1C331GP | (2) | 500 |
| | 470 | 8 | 10.2 | F | 600 | 0.16 | 0.16 | EEEFK1C471GP | (2) | 500 |
| | 680 | 10 | 10.2 | G | 850 | 0.08 | 0.16 | EEEFK1C681GP | (2) | 500 |
| 25 | 150 | 8 | 10.2 | F | 600 | 0.16 | 0.14 | EEEFK1E151GP | (2) | 500 |
| | 220 | 8 | 10.2 | F | 600 | 0.16 | 0.14 | EEEFK1E221GP | (2) | 500 |
| | 330 | 8 | 10.2 | F | 600 | 0.16 | 0.14 | EEEFK1E331GP | (2) | 500 |
| | 470 | 10 | 10.2 | G | 850 | 0.08 | 0.14 | EEEFK1E471GP | (2) | 500 |
| 35 | 100 | 8 | 10.2 | F | 600 | 0.16 | 0.12 | EEEFK1V101GP | (2) | 500 |
| | 150 | 8 | 10.2 | F | 600 | 0.16 | 0.12 | EEEFK1V151GP | (2) | 500 |
| | 220 | 8 | 10.2 | F | 600 | 0.16 | 0.12 | EEEFK1V221GP | (2) | 500 |
| | 330 | 10 | 10.2 | G | 850 | 0.08 | 0.12 | EEEFK1V331GP | (2) | 500 |
| 50 | 100 | 8 | 10.2 | F | 350 | 0.34 | 0.10 | EEEFK1H101GP | (2) | 500 |
| | 150 | 10 | 10.2 | G | 670 | 0.18 | 0.10 | EEEFK1H151GP | (2) | 500 |
| | 220 | 10 | 10.2 | G | 670 | 0.18 | 0.10 | EEEFK1H221GP | (2) | 500 |

· Please refer to the page of "Reflow Profile" and "The Taping Dimensions".
· When requesting vibration-proof product, please put the last "V" instead to "P"

# Surface Mount Type NEW

Series : **FKS** Type : **V**

**High temperature Lead-Free reflow**

## Features

- Endurance : 105 °C 2000 h
- 1 size smaller than series FK
- Vibration-proof product is available upon request. (ϕ8 mm and larger)
- RoHS compliant

## Specifications

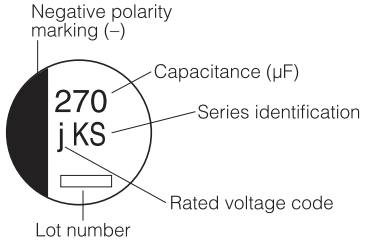
| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Category temperature range | –55 °C to +105 °C | | | | | | | |
| Rated voltage range | 6.3 V.DC to 50 V.DC | | | | | | | |
| Rated capacitance range | 39 µF to 1800 µF | | | | | | | |
| Capacitance tolerance | ±20 % (120 Hz/+20 °C) | | | | | | | |
| 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 | | | | | | | |
| Characteristics at low temperature | V.DC | 6.3 | 10 | 16 | 25 | 35 | 50 | (Impedance ratio at 120 Hz) |
| | Z(–25 °C)/Z(+20 °C) | 2 | 2 | 2 | 2 | 2 | 2 | |
| | Z(–40 °C)/Z(+20 °C) | 3 | 3 | 3 | 3 | 3 | 3 | |
| | Z(–55 °C)/Z(+20 °C) | 4 | 4 | 4 | 3 | 3 | 3 | |
| Endurance | After applying rated working voltage for 2000 hours at +105 °C±2 °C and then being stabilized at +20 °C, capacitors shall meet the following limits. | | | | | | | |
| | Capacitance change | Within ±30 % of the initial value | | | | | | |
| | tan δ | ≦ 200 % of the initial limit | | | | | | |
| | DC leakege current | Within the initial limit | | | | | | |
| 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) | | | | | | | |
| 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 | | | | | | |
| | tan δ | Within the initial limit | | | | | | |
| | DC leakage current | Within the initial limit | | | | | | |
| AEC-Q200 | AEC-Q200 compliant | | | | | | | |

## Frequency correction factor for ripple current

| Frequency (Hz) | 120 | 1 k | 10 k | 100 k to |
|---|---|---|---|---|
| Correction factor | 0.65 | 0.85 | 0.95 | 1.00 |

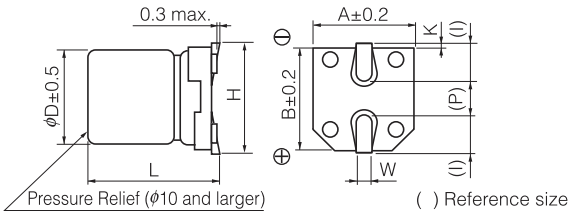
## Marking

Example : 6.3 V.DC 270 µF
Marking color : BLACK




| R. Voltage (V.DC) | 6.3 | 10 | 16 | 25 | 35 | 50 |
|---|---|---|---|---|---|---|
| Code | j | A | C | E | V | H |

## Dimensions




(Unit : mm)

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

## Characteristics list

Endurance : 105 °C 2000 h

| Rated voltage (V.DC) | Cap. (±20 %) (μF) | Case size (mm) | | Size Code | Specification | | | Part No. | Reflow | Min. Packaging Q'ty |
|---|---|---|---|---|---|---|---|---|---|---|
| | | φD | L | | Ripple current (100 kHz) (+105 °C) (mA r.m.s.) | ESR (100 kHz) (+20 °C) (Ω) | tan δ (120 Hz) (+20 °C) | | | Taping (pcs) |
| 6.3 | 270 | 6.3 | 5.8 | D | 240 | 0.36 | 0.26 | EEEFK0J271SP | (5) | 1000 |
| | 470 | 6.3 | 7.7 | D8 | 280 | 0.34 | 0.26 | EEEFKJ471XSP | (5) | 900 |
| | 1800 | 10 | 10.2 | G | 850 | 0.08 | 0.26 | EEEFK0J182SP | (6) | 500 |
| 10 | 220 | 6.3 | 5.8 | D | 240 | 0.36 | 0.19 | EEEFK1A221SP | (5) | 1000 |
| | 330 | 6.3 | 7.7 | D8 | 280 | 0.34 | 0.19 | EEEFKA331XSP | (5) | 900 |
| | 820 | 8 | 10.2 | F | 600 | 0.16 | 0.19 | EEEFK1A821SP | (6) | 500 |
| | 1200 | 10 | 10.2 | G | 850 | 0.08 | 0.19 | EEEFK1A122SP | (6) | 500 |
| 16 | 150 | 6.3 | 5.8 | D | 240 | 0.36 | 0.16 | EEEFK1C151SP | (5) | 1000 |
| | 270 | 6.3 | 7.7 | D8 | 280 | 0.34 | 0.16 | EEEFKC271XSP | (5) | 900 |
| | 560 | 8 | 10.2 | F | 600 | 0.16 | 0.16 | EEEFK1C561SP | (6) | 500 |
| | 1000 | 10 | 10.2 | G | 850 | 0.08 | 0.16 | EEEFK1C102SP | (6) | 500 |
| 25 | 100 | 6.3 | 5.8 | D | 240 | 0.36 | 0.14 | EEEFK1E101SP | (5) | 1000 |
| | 150 | 6.3 | 7.7 | D8 | 280 | 0.34 | 0.14 | EEEFKE151XSP | (5) | 900 |
| | 180 | 6.3 | 7.7 | D8 | 280 | 0.34 | 0.14 | EEEFKE181XSP | (5) | 900 |
| | 390 | 8 | 10.2 | F | 600 | 0.16 | 0.14 | EEEFK1E391SP | (6) | 500 |
| | 680 | 10 | 10.2 | G | 850 | 0.08 | 0.14 | EEEFK1E681SP | (6) | 500 |
| 35 | 68 | 6.3 | 5.8 | D | 240 | 0.36 | 0.12 | EEEFK1V680SP | (5) | 1000 |
| | 82 | 6.3 | 5.8 | D | 240 | 0.36 | 0.12 | EEEFK1V820SP | (5) | 1000 |
| | 120 | 6.3 | 7.7 | D8 | 280 | 0.34 | 0.12 | EEEFKV121XSP | (5) | 900 |
| | 270 | 8 | 10.2 | F | 600 | 0.16 | 0.12 | EEEFK1V271SP | (6) | 500 |
| | 470 | 10 | 10.2 | G | 850 | 0.08 | 0.12 | EEEFK1V471SP | (6) | 500 |
| 50 | 39 | 6.3 | 5.8 | D | 165 | 0.88 | 0.10 | EEEFK1H390SP | (5) | 1000 |
| | 82 | 6.3 | 7.7 | D8 | 195 | 0.68 | 0.10 | EEEFKH820XSP | (5) | 900 |
| | 180 | 8 | 10.2 | F | 350 | 0.34 | 0.10 | EEEFK1H181SP | (6) | 500 |
| | 270 | 10 | 10.2 | G | 670 | 0.18 | 0.10 | EEEFK1H271SP | (6) | 500 |

If Part number exceeds 12 digits, voltage code is abbreviated as follows; 0J → J, 1A → A, 1C → C, 1E → E, 1V → V, 1H → H

· Please refer to the page of “Reflow Profile” and “The Taping Dimensions”.

· When requesting vibration-proof product, please put the last “V” instead to “P”

# Surface Mount Type

Series : **FT** Type : **V**

**High temperature Lead-Free reflow**

## Features

- Endurance : 105 °C 2000 h to 5000 h
- Miniaturized, Low ESR (1 size smaller than series FK)
- Vibration-proof product is available upon request. (φ8 mm and larger)
- RoHS compliant

## Specifications

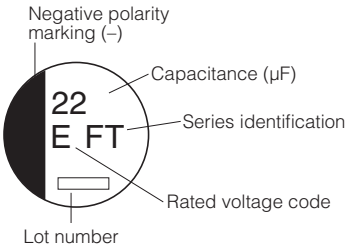
| | | |
|---|---|---|
| Category temperature range | –55 °C to +105 °C | |
| Rated voltage range | 6.3 V.DC to 50 V.DC | |
| Capacitance range | 10 µF to 2200 µF | |
| Capacitance tolerance | ±20 % (120 Hz/+20 °C) | |
| Leakage current | I ≦ 0.01 CV (µA) After 2 minutes | |
| Dissipation factor (tan δ) | Please see the attached characteristics list | |
| Endurance | After applying rated working voltage for 2000 hours at +105 °C±2 °C and then being stabilized at +20 °C, Capacitors shall meet the following limits. (Suffix "G" in 6.3 V.DC : 3000 hours, 10 V.DC to 50 V.DC : 5000 hours) | |
| | Capacitance change | Within ±30 % of the initial value (Suffix "G" is ±35 %) |
| | tan δ | ≦200 % of the initial limit (Suffix "G" is ≦300 %) |
| | DC leakage current | Within the initial limit |
| 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) | |
| Resistance to soldering heat | After reflow soldering and then being stabilized at +20 °C, capacitor shall meet the following limits. | |
| | Capacitance change | Within ±10 % of the initial value |
| | tan δ | Within the initial limit |
| | DC leakage current | Within the initial limit |
| AEC-Q200 | AEC-Q200 compliant | |

## Frequency correction factor for ripple current

| Capacitance (µF) \ Frequency (Hz) | 120 | 1 k | 10 k | 100 k to |
|---|---|---|---|---|
| 10 to 470 | 0.65 | 0.85 | 0.95 | 1.00 |
| 560 to 2200 | 0.70 | 0.90 | 0.95 | 1.00 |

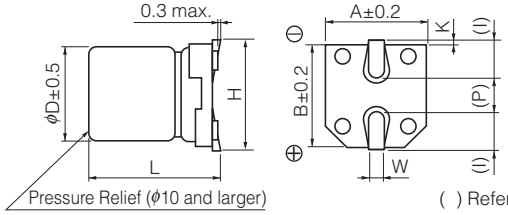
## Marking

Example : 25 V.DC 22 µF
Marking color : BLACK




| R. Voltage (V.DC) | 6.3 | 10 | 16 | 25 | 35 | 50 |
|---|---|---|---|---|---|---|
| Code | j | A | C | E | V | H |

## Dimensions




(Unit : mm)

| Size code | φD | L | A, B | H | I | W | P | K |
|---|---|---|---|---|---|---|---|---|
| B | 4.0 | 5.8±0.3 | 4.3 | 5.5 max. | 1.8 | 0.65±0.1 | 1.0 | $0.35^{+0.15}_{-0.20}$ |
| C | 5.0 | 5.8±0.3 | 5.3 | 6.5 max. | 2.2 | 0.65±0.1 | 1.5 | $0.35^{+0.15}_{-0.20}$ |
| D | 6.3 | 5.8±0.3 | 6.6 | 7.8 max. | 2.6 | 0.65±0.1 | 1.8 | $0.35^{+0.15}_{-0.20}$ |
| D8 | 6.3 | 7.7±0.3 | 6.6 | 7.8 max. | 2.6 | 0.65±0.1 | 1.8 | $0.35^{+0.15}_{-0.20}$ |
| F | 8.0 | 10.2±0.3 | 8.3 | 10.0 max. | 3.4 | 0.90±0.2 | 3.1 | 0.70±0.20 |
| G | 10.0 | 10.2±0.3 | 10.3 | 12.0 max. | 3.5 | 0.90±0.2 | 4.6 | 0.70±0.20 |

## Characteristics list

Endurance : 105 °C 2000 h

| Rated voltage (V.DC) | Cap. (±20 %) (μF) | Case size (mm) | | Size* code | Specification | | | Part No. | Reflow | Min. Packaging Q'ty |
|---|---|---|---|---|---|---|---|---|---|---|
| | | φD | L | | Ripple current (100 kHz) (+105 °C) (mA r.m.s.) | ESR (100 kHz) (+20 °C) (Ω) | tan δ (120 Hz) (+20 °C) | | | Taping (pcs) |
| 6.3 | 100 | 4 | 5.8 | B | 160 | 0.85 | 0.26 | EEEFT0J101AR | (5) | 2000 |
| | 220 | 5 | 5.8 | C | 240 | 0.36 | 0.26 | EEEFT0J221AR | (5) | 1000 |
| | 330 | 6.3 | 5.8 | D | 300 | 0.26 | 0.26 | EEEFT0J331AP | (5) | 1000 |
| | 470 | 6.3 | 7.7 | D8 | 600 | 0.16 | 0.26 | EEEFTJ471XAP | (5) | 900 |
| | 680 | 6.3 | 7.7 | D8 | 600 | 0.16 | 0.26 | EEEFTJ681XAP | (5) | 900 |
| | 1500 | 8 | 10.2 | F | 850 | 0.08 | 0.26 | EEEFT0J152AP | (6) | 500 |
| | 2200 | 10 | 10.2 | G | 1190 | 0.06 | 0.28 | EEEFT0J222AP | (6) | 500 |
| 10 | 68 | 4 | 5.8 | B | 160 | 0.85 | 0.19 | EEEFT1A680AR | (5) | 2000 |
| | 150 | 5 | 5.8 | C | 240 | 0.36 | 0.19 | EEEFT1A151AR | (5) | 1000 |
| | 220 | 6.3 | 5.8 | D | 300 | 0.26 | 0.19 | EEEFT1A221AP | (5) | 1000 |
| | 330 | 6.3 | 7.7 | D8 | 600 | 0.16 | 0.19 | EEEFTA331XAP | (5) | 900 |
| | 470 | 6.3 | 7.7 | D8 | 600 | 0.16 | 0.19 | EEEFTA471XAP | (5) | 900 |
| | 1000 | 8 | 10.2 | F | 850 | 0.08 | 0.19 | EEEFT1A102AP | (6) | 500 |
| | 1500 | 10 | 10.2 | G | 1190 | 0.06 | 0.19 | EEEFT1A152AP | (6) | 500 |
| 16 | 47 | 4 | 5.8 | B | 160 | 0.85 | 0.16 | EEEFT1C470AR | (5) | 2000 |
| | 68 | 5 | 5.8 | C | 240 | 0.36 | 0.16 | EEEFT1C680AR | (5) | 1000 |
| | 100 | 5 | 5.8 | C | 240 | 0.36 | 0.16 | EEEFT1C101AR | (5) | 1000 |
| | 150 | 6.3 | 5.8 | D | 300 | 0.26 | 0.16 | EEEFT1C151AP | (5) | 1000 |
| | 220 | 6.3 | 5.8 | D | 300 | 0.26 | 0.16 | EEEFT1C221AP | (5) | 1000 |
| | 330 | 6.3 | 7.7 | D8 | 600 | 0.16 | 0.16 | EEEFTC331XAP | (5) | 900 |
| | 680 | 8 | 10.2 | F | 850 | 0.08 | 0.16 | EEEFT1C681AP | (6) | 500 |
| NEW | 820 | 8 | 10.2 | F | 850 | 0.08 | 0.16 | EEEFT1C821UP | (6) | 500 |
| | 1000 | 10 | 10.2 | G | 1190 | 0.06 | 0.16 | EEEFT1C102AP | (6) | 500 |
| NEW | 1200 | 10 | 10.2 | G | 1190 | 0.06 | 0.16 | EEEFT1C122UP | (6) | 500 |
| 25 | 22 | 4 | 5.8 | B | 160 | 0.85 | 0.14 | EEEFT1E220AR | (5) | 2000 |
| | 33 | 4 | 5.8 | B | 160 | 0.85 | 0.14 | EEEFT1E330AR | (5) | 2000 |
| | 47 | 5 | 5.8 | C | 240 | 0.36 | 0.14 | EEEFT1E470AR | (5) | 1000 |
| | 68 | 5 | 5.8 | C | 240 | 0.36 | 0.14 | EEEFT1E680AR | (5) | 1000 |
| | 100 | 6.3 | 5.8 | D | 300 | 0.26 | 0.14 | EEEFT1E101AP | (5) | 1000 |
| | 150 | 6.3 | 7.7 | D8 | 600 | 0.16 | 0.14 | EEEFTE151XAP | (5) | 900 |
| | 220 | 6.3 | 7.7 | D8 | 600 | 0.16 | 0.14 | EEEFTE221XAP | (5) | 900 |
| | 470 | 8 | 10.2 | F | 850 | 0.08 | 0.14 | EEEFT1E471AP | (6) | 500 |
| NEW | 560 | 8 | 10.2 | F | 850 | 0.08 | 0.14 | EEEFT1E561UP | (6) | 500 |
| | 820 | 10 | 10.2 | G | 1190 | 0.06 | 0.14 | EEEFT1E821AP | (6) | 500 |
| NEW | 1000 | 10 | 10.2 | G | 1190 | 0.06 | 0.14 | EEEFT1E102UP | (6) | 500 |
| 35 | 22 | 4 | 5.8 | B | 160 | 0.85 | 0.12 | EEEFT1V220AR | (5) | 2000 |
| | 33 | 5 | 5.8 | C | 240 | 0.36 | 0.12 | EEEFT1V330AR | (5) | 1000 |
| | 47 | 5 | 5.8 | C | 240 | 0.36 | 0.12 | EEEFT1V470AR | (5) | 1000 |
| | 68 | 6.3 | 5.8 | D | 300 | 0.26 | 0.12 | EEEFT1V680AP | (5) | 1000 |
| | 100 | 6.3 | 5.8 | D | 300 | 0.26 | 0.12 | EEEFT1V101AP | (5) | 1000 |
| | 150 | 6.3 | 7.7 | D8 | 600 | 0.16 | 0.12 | EEEFTV151XAP | (5) | 900 |
| | 330 | 8 | 10.2 | F | 850 | 0.08 | 0.12 | EEEFT1V331AP | (6) | 500 |
| NEW | 390 | 8 | 10.2 | F | 850 | 0.08 | 0.12 | EEEFT1V391UP | (6) | 500 |
| | 560 | 10 | 10.2 | G | 1190 | 0.06 | 0.12 | EEEFT1V561AP | (6) | 500 |
| NEW | 680 | 10 | 10.2 | G | 1190 | 0.06 | 0.12 | EEEFT1V681UP | (6) | 500 |
| 50 | 10 | 4 | 5.8 | (B) | 85 | 2.30 | 0.10 | EEEFTH100UAR | (5) | 2000 |
| | | 5 | 5.8 | C | 165 | 0.88 | 0.10 | EEEFT1H100AR | (5) | 1000 |
| | 22 | 5 | 5.8 | C | 165 | 0.88 | 0.10 | EEEFT1H220AR | (5) | 1000 |
| | 47 | 6.3 | 5.8 | D | 195 | 0.68 | 0.10 | EEEFT1H470AP | (5) | 1000 |
| | 100 | 6.3 | 7.7 | D8 | 350 | 0.34 | 0.10 | EEEFTH101XAP | (5) | 900 |
| | 220 | 8 | 10.2 | F | 670 | 0.18 | 0.10 | EEEFT1H221AP | (6) | 500 |
| | 330 | 10 | 10.2 | G | 900 | 0.12 | 0.10 | EEEFT1H331AP | (6) | 500 |

✻ Size code( ) : Miniaturization product

If Part number exceeds 12 digits, voltage code is abbreviated as follows; 0J → J, 1A → A, 1C → C, 1E → E, 1V → V, 1H → H

· Please refer to the page of "Reflow Profile" and "The Taping Dimensions".

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

## Characteristics list (Endurance 5000 h)

Endurance : 105 °C 5000 h (6.3 V.DC : 105 °C 3000 h)

| Rated voltage (V.DC) | Cap. (±20 %) (μF) | Case size (mm) | | Size code | Specification | | | Part No. | Reflow | Min. Packaging Q'ty |
|---|---|---|---|---|---|---|---|---|---|---|
| | | φD | L | | Ripple current (100 kHz) (+105 °C) (mA r.m.s.) | ESR (100 kHz) (+20 °C) (Ω) | tan δ (120 Hz) (+20 °C) | | | Taping (pcs) |
| 6.3 | 1500 | 8 | 10.2 | F | 850 | 0.08 | 0.26 | EEEFT0J152GP | (6) | 500 |
| | 2200 | 10 | 10.2 | G | 1190 | 0.06 | 0.28 | EEEFT0J222GP | (6) | 500 |
| 10 | 1000 | 8 | 10.2 | F | 850 | 0.08 | 0.19 | EEEFT1A102GP | (6) | 500 |
| | 1500 | 10 | 10.2 | G | 1190 | 0.06 | 0.19 | EEEFT1A152GP | (6) | 500 |
| 16 | 680 | 8 | 10.2 | F | 850 | 0.08 | 0.16 | EEEFT1C681GP | (6) | 500 |
| | 1000 | 10 | 10.2 | G | 1190 | 0.06 | 0.16 | EEEFT1C102GP | (6) | 500 |
| 25 | 470 | 8 | 10.2 | F | 850 | 0.08 | 0.14 | EEEFT1E471GP | (6) | 500 |
| | 820 | 10 | 10.2 | G | 1190 | 0.06 | 0.14 | EEEFT1E821GP | (6) | 500 |
| 35 | 330 | 8 | 10.2 | F | 850 | 0.08 | 0.12 | EEEFT1V331GP | (6) | 500 |
| | 560 | 10 | 10.2 | G | 1190 | 0.06 | 0.12 | EEEFT1V561GP | (6) | 500 |
| 50 | 220 | 8 | 10.2 | F | 670 | 0.18 | 0.10 | EEEFT1H221GP | (6) | 500 |
| | 330 | 10 | 10.2 | G | 900 | 0.12 | 0.10 | EEEFT1H331GP | (6) | 500 |

· Please refer to the page of “Reflow Profile” and “The Taping Dimensions”.
· When requesting vibration-proof product, please put the last “V” instead to “P”

# Surface Mount Type

Series : **FP** Type : **V**
**High temperature**
**Lead-Free reflow (suffix : A*)**


## Features

- Low ESR (30 % to 50 % less than FK series)
- Endurance : 105 °C 2000 h
- Vibration-proof product is available upon request. (08 mm and larger)
- RoHS compliant

## Specifications

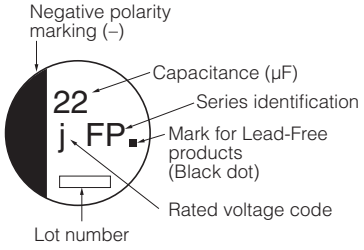
| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Category temperature range | –55 °C to +105 °C | | | | | | | |
| Rated voltage range | 6.3 V.DC to 50 V.DC | | | | | | | |
| Capacitance range | 10 µF to 1800 µF | | | | | | | |
| Capacitance tolerance | ±20 % (120 Hz/+20 °C) | | | | | | | |
| Leakage current | I ≦ 0.01 CV or 3 (µA) After 2 minutes (whichever is greater) | | | | | | | |
| Dissipation factor (tan $\delta$) | Please see the attached characteristics list | | | | | | | |
| Characteristics at low temperature | V.DC | 6.3 | 10 | 16 | 25 | 35 | 50 | (Impedance ratio at 120 Hz) |
| | Z(–25 °C)/Z(+20 °C) | 2 | 2 | 2 | 2 | 2 | 2 | |
| | Z(–40°C)/Z(+20 °C) | 3 | 3 | 3 | 3 | 3 | 3 | |
| | Z(–55°C)/Z(+20 °C) | 4 | 4 | 4 | 3 | 3 | 3 | |
| Endurance | After applying rated working voltage at +105 °C ±2 °C for 2000 hours the capacitors shall meet the limits specified below. Post-test requirement at +20 °C | | | | | | | |
| | Capacitance change | Within ±30 % of the initial value | | | | | | |
| | tan $\delta$ | ≦ 200 % of the initial limit | | | | | | |
| | DC leakege current | Within the initial limit | | | | | | |
| 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) | | | | | | | |
| 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 | | | | | | |
| | tan $\delta$ | Within the initial limit | | | | | | |
| | DC leakage current | Within the initial limit | | | | | | |
| AEC-Q200 | AEC-Q200 compliant | | | | | | | |

## Frequency correction factor for ripple current

| Capacitance (µF) \ Frequency (Hz) | 120 | 1 k | 10 k | 100 k to |
|---|---|---|---|---|
| 10 to 470 | 0.65 | 0.85 | 0.95 | 1.00 |
| 560 to 1800 | 0.75 | 0.90 | 0.95 | 1.00 |

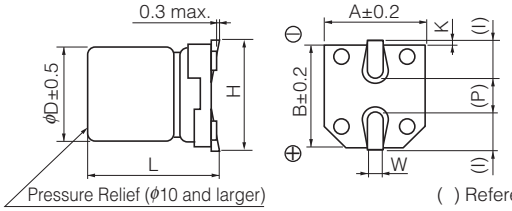
## Marking

Example : 6.3 V.DC 22 µF
Marking color : BLACK




| R. Voltage (V.DC) | 6.3 | 10 | 16 | 25 | 35 | 50 |
|---|---|---|---|---|---|---|
| Code | j | A | C | E | V | H |

## Dimensions




( ) Reference size

(Unit : mm)

| Size code | φD | L | A, B | H | I | W | P | K |
|---|---|---|---|---|---|---|---|---|
| B | 4.0 | 5.8±0.30 | 4.3 | 5.5 max. | 1.8 | 0.65±0.1 | 1.0 | $0.35^{+0.15}_{-0.20}$ |
| C | 5.0 | 5.8±0.30 | 5.3 | 6.5 max. | 2.2 | 0.65±0.1 | 1.5 | $0.35^{+0.15}_{-0.20}$ |
| D | 6.3 | 5.8±0.30 | 6.6 | 7.8 max. | 2.6 | 0.65±0.1 | 1.8 | $0.35^{+0.15}_{-0.20}$ |
| D8 | 6.3 | 7.7±0.30 | 6.6 | 7.8 max. | 2.6 | 0.65±0.1 | 1.8 | $0.35^{+0.15}_{-0.20}$ |
| E | 8.0 | 6.2±0.30 | 8.3 | 9.5 max. | 3.4 | 0.65±0.1 | 2.2 | $0.35^{+0.15}_{-0.20}$ |
| F | 8.0 | 10.2±0.30 | 8.3 | 10.0 max. | 3.4 | 0.90±0.2 | 3.1 | 0.70±0.20 |
| G | 10.0 | 10.2±0.30 | 10.3 | 12.0 max. | 3.5 | 0.90±0.2 | 4.6 | 0.70±0.20 |

## Characteristics list

Endurance : 105 °C 2000 h

| Rated voltage (V.DC) | Cap. (±20 %) (μF) | Case size (mm) | | Size* code | Specification | | | Part No. | Reflow | Min. Packaging Q'ty |
|---|---|---|---|---|---|---|---|---|---|---|
| | | φD | L | | Ripple current (100 kHz) (+105 °C) (mA r.m.s.) | ESR (100 kHz) (+20 °C) (Ω) | tan δ (120 Hz) (+20 °C) | | | Taping (pcs) |
| 6.3 | 22 | 4 | 5.8 | B | 160 | 0.85 | 0.26 | EEEFP0J220AR | (5) | 2000 |
| | 47 | 4 | 5.8 | (B) | 160 | 0.85 | 0.26 | EEEFPJ470UAR | (5) | 2000 |
| | | 5 | 5.8 | C | 240 | 0.36 | 0.26 | EEEFP0J470AR | (5) | 1000 |
| | 100 | 5 | 5.8 | (C) | 240 | 0.36 | 0.26 | EEEFPJ101UAR | (5) | 1000 |
| | | 6.3 | 5.8 | D | 300 | 0.26 | 0.26 | EEEFP0J101AP | (5) | 1000 |
| | 220 | 6.3 | 5.8 | D | 300 | 0.26 | 0.26 | EEEFP0J221AP | (5) | 1000 |
| | 330 | 6.3 | 7.7 | D8 | 600 | 0.16 | 0.26 | EEEFPJ331XAP | (5) | 900 |
| | | 8 | 6.2 | E | 500 | 0.18 | 0.26 | EEEFP0J331AP | (6) | 1000 |
| | 470 | 8 | 10.2 | F | 850 | 0.08 | 0.26 | EEEFP0J471AP | (6) | 500 |
| | 1000 | 8 | 10.2 | F | 850 | 0.08 | 0.26 | EEEFP0J102AP | (6) | 500 |
| | 1500 | 10 | 10.2 | G | 1190 | 0.06 | 0.26 | EEEFP0J152AP | (6) | 500 |
| | 1800 | 10 | 10.2 | (G) | 850 | 0.08 | 0.26 | EEEFPJ182UAP | (6) | 500 |
| 10 | 22 | 4 | 5.8 | B | 160 | 0.85 | 0.19 | EEEFP1A220AR | (5) | 2000 |
| | 33 | 4 | 5.8 | (B) | 160 | 0.85 | 0.19 | EEEFPA330UAR | (5) | 2000 |
| | | 5 | 5.8 | C | 240 | 0.36 | 0.19 | EEEFP1A330AR | (5) | 1000 |
| | 150 | 6.3 | 5.8 | D | 300 | 0.26 | 0.19 | EEEFP1A151AP | (5) | 1000 |
| | 220 | 6.3 | 7.7 | D8 | 600 | 0.16 | 0.19 | EEEFPA221XAP | (5) | 900 |
| | | 8 | 6.2 | E | 500 | 0.18 | 0.19 | EEEFP1A221AP | (6) | 1000 |
| | 330 | 8 | 10.2 | F | 850 | 0.08 | 0.19 | EEEFP1A331AP | (6) | 500 |
| | 470 | 8 | 10.2 | F | 850 | 0.08 | 0.19 | EEEFP1A471AP | (6) | 500 |
| | 680 | 8 | 10.2 | F | 850 | 0.08 | 0.19 | EEEFP1A681AP | (6) | 500 |
| | 1000 | 10 | 10.2 | G | 1190 | 0.06 | 0.19 | EEEFP1A102AP | (6) | 500 |
| | 1200 | 10 | 10.2 | (G) | 850 | 0.08 | 0.19 | EEEFPA122UAP | (6) | 500 |
| 16 | 10 | 4 | 5.8 | B | 160 | 0.85 | 0.16 | EEEFP1C100AR | (5) | 2000 |
| | 22 | 4 | 5.8 | (B) | 160 | 0.85 | 0.16 | EEEFPC220UAR | (5) | 2000 |
| | | 5 | 5.8 | C | 240 | 0.36 | 0.16 | EEEFP1C220AR | (5) | 1000 |
| | 47 | 5 | 5.8 | (C) | 240 | 0.36 | 0.16 | EEEFPC470UAR | (5) | 1000 |
| | | 6.3 | 5.8 | D | 300 | 0.26 | 0.16 | EEEFP1C470AP | (5) | 1000 |
| | 68 | 6.3 | 5.8 | D | 300 | 0.26 | 0.16 | EEEFP1C680AP | (5) | 1000 |
| | 100 | 6.3 | 5.8 | D | 300 | 0.26 | 0.16 | EEEFP1C101AP | (5) | 1000 |
| | | 6.3 | 7.7 | D8 | 600 | 0.16 | 0.16 | EEEFPC101XAP | (5) | 900 |
| | 150 | 6.3 | 7.7 | D8 | 600 | 0.16 | 0.16 | EEEFPC151XAP | (5) | 900 |
| | 220 | 6.3 | 7.7 | D8 | 600 | 0.16 | 0.16 | EEEFPC221XAP | (5) | 900 |
| | | 8 | 6.2 | E | 500 | 0.18 | 0.16 | EEEFP1C221AP | (6) | 1000 |
| | 330 | 8 | 10.2 | F | 850 | 0.08 | 0.16 | EEEFP1C331AP | (6) | 500 |
| | 470 | 8 | 10.2 | F | 850 | 0.08 | 0.16 | EEEFP1C471AP | (6) | 500 |
| | 680 | 10 | 10.2 | G | 1190 | 0.06 | 0.16 | EEEFP1C681AP | (6) | 500 |
| | 820 | 10 | 10.2 | (G) | 850 | 0.08 | 0.16 | EEEFPC821UAP | (6) | 500 |
| 25 | 10 | 4 | 5.8 | B | 160 | 0.85 | 0.14 | EEEFP1E100AR | (5) | 2000 |
| | 22 | 5 | 5.8 | C | 240 | 0.36 | 0.14 | EEEFP1E220AR | (5) | 1000 |
| | 33 | 5 | 5.8 | (C) | 240 | 0.36 | 0.14 | EEEFPE330UAR | (5) | 1000 |
| | | 6.3 | 5.8 | D | 300 | 0.26 | 0.14 | EEEFP1E330AP | (5) | 1000 |
| | 47 | 6.3 | 5.8 | D | 300 | 0.26 | 0.14 | EEEFP1E470AP | (5) | 1000 |
| | 68 | 6.3 | 5.8 | D | 300 | 0.26 | 0.14 | EEEFP1E680AP | (5) | 1000 |
| | 100 | 6.3 | 7.7 | D8 | 600 | 0.16 | 0.14 | EEEFPE101XAP | (5) | 900 |
| | | 8 | 6.2 | E | 500 | 0.18 | 0.14 | EEEFP1E101AP | (6) | 1000 |
| | 150 | 8 | 10.2 | F | 850 | 0.08 | 0.14 | EEEFP1E151AP | (6) | 500 |
| | 220 | 8 | 10.2 | F | 850 | 0.08 | 0.14 | EEEFP1E221AP | (6) | 500 |
| | 330 | 8 | 10.2 | F | 850 | 0.08 | 0.14 | EEEFP1E331AP | (6) | 500 |
| | 470 | 10 | 10.2 | G | 1190 | 0.06 | 0.14 | EEEFP1E471AP | (6) | 500 |
| | 560 | 10 | 10.2 | (G) | 850 | 0.08 | 0.14 | EEEFPE561UAP | (6) | 500 |

✻ Size code( ) : Miniaturization product

If Part number exceeds 12 digits, voltage code is abbreviated as follows; 0J → J, 1A → A, 1C → C, 1E → E, 1V → V

· Please refer to the page of "Reflow Profile" and "The Taping Dimensions".

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

## Characteristics list

Endurance : 105 °C 2000 h

| Rated voltage (V.DC) | Cap. (±20 %) (μF) | Case size (mm) | | Size* code | Specification | | | Part No. | Reflow | Min. Packaging Q'ty |
|---|---|---|---|---|---|---|---|---|---|---|
| | | φD | L | | Ripple current (100 kHz) (+105 °C) (mA r.m.s.) | ESR (100 kHz) (+20 °C) (Ω) | tan δ (120 Hz) (+20 °C) | | | Taping (pcs) |
| 35 | 10 | 4 | 5.8 | (B) | 160 | 0.85 | 0.12 | EEEFPV100UAR | (5) | 2000 |
| | 22 | 5 | 5.8 | C | 240 | 0.36 | 0.12 | EEEFP1V220AR | (5) | 1000 |
| | 33 | 6.3 | 5.8 | D | 300 | 0.26 | 0.12 | EEEFP1V330AP | (5) | 1000 |
| | 47 | 6.3 | 5.8 | D | 300 | 0.26 | 0.12 | EEEFP1V470AP | (5) | 1000 |
| | 68 | 6.3 | 7.7 | D8 | 600 | 0.16 | 0.12 | EEEFPV680XAP | (5) | 900 |
| | 100 | 6.3 | 7.7 | D8 | 600 | 0.16 | 0.12 | EEEFPV101XAP | (5) | 900 |
| | | 8 | 10.2 | F | 850 | 0.08 | 0.12 | EEEFP1V101AP | (6) | 500 |
| | 150 | 8 | 10.2 | F | 850 | 0.08 | 0.12 | EEEFP1V151AP | (6) | 500 |
| | 220 | 8 | 10.2 | F | 850 | 0.08 | 0.12 | EEEFP1V221AP | (6) | 500 |
| | 330 | 10 | 10.2 | G | 1190 | 0.06 | 0.12 | EEEFP1V331AP | (6) | 500 |
| | 390 | 10 | 10.2 | (G) | 850 | 0.08 | 0.12 | EEEFPV391UAP | (6) | 500 |
| 50 | 100 | 8 | 10.2 | F | 670 | 0.18 | 0.10 | EEEFP1H101AP | (6) | 500 |
| | 220 | 10 | 10.2 | G | 900 | 0.12 | 0.10 | EEEFP1H221AP | (6) | 500 |

✻ Size code( ) : Miniaturization product

If Part number exceeds 12 digits, voltage code is abbreviated as follows; 0J → J, 1A → A, 1C → C, 1E → E, 1V → V

· Please refer to the page of “Reflow Profile” and “The Taping Dimensions”.

· When requesting vibration-proof product, please put the last “V” instead to “P”

# Surface Mount Type

Series : **TG** Type : **V**

## Features

- Endurance : 125 °C 1000 h to 2000 h
- Miniaturization (40 % less than TA Series)
- Low ESR (Low temp)
- Vibration-proof product is available upon request. (φ8 mm and larger)
- RoHS compliant (Parts No φ8 to φ10 : EEE✻, φ12.5 to φ18 : EEV✻)

## Specifications

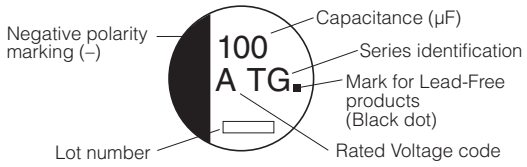
| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Category temperature range | –40 °C to +125 °C | | | | | | | | | |
| Rated voltage range | 10 V.DC to 100 V.DC | | | | | | | | | |
| Capacitance range | 10 µF to 4700 µF | | | | | | | | | |
| Capacitance tolerance | ±20 % (120 Hz/+20 °C) | | | | | | | | | |
| Leakage current | I ≦ 0.01 CV After 2 minutes | | | | | | | | | |
| Dissipation factor (tan δ) | Please see the attached characteristics list | | | | | | | | | |
| Characteristics at low temperature | V.DC | 10 | 16 | 25 | 35 | 50 | 63 | 80 | 100 | (Impedance ratio at 120 Hz) |
| | Z(–25 °C)/Z(+20 °C) | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | |
| | Z(–40 °C)/Z(+20 °C) | 6 | 4 | 4 | 3 | 3 | 3 | 3 | 3 | |
| Endurance | After applying rated working voltage for 1000 hours (φ8×6.2), 2000 hours (φ8×10.2 ≦) at +125 °C±2 °C and then being stabilized at +20 °C, capacitors shall meet the following limits. | | | | | | | | | |
| | Capacitance change | Within ±30 % of the initial value (code U : ±35 %) | | | | | | | | |
| | tan δ | ≦300 % of the initial limit (code U : ±350 %) | | | | | | | | |
| | DC leakage current | Within 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) | | | | | | | | | |
| 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 | | | | | | | | |
| | tan δ | Within the initial limit | | | | | | | | |
| | DC leakage current | Within the initial limit | | | | | | | | |
| AEC-Q200 | AEC-Q200 compliant | | | | | | | | | |

## Frequency correction factor for ripple current

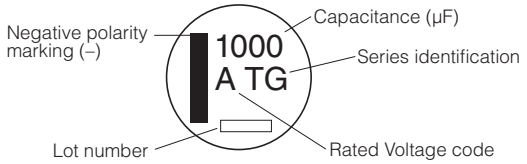
| Frequency (Hz) | 120 | 1 k | 10 k | 100 k to |
|---|---|---|---|---|
| Correction factor | 0.65 | 0.85 | 0.95 | 1.00 |

## Marking

Example : 10 V.DC 100 µF, 10 V.DC 1000 µF
Marking color : BLACK
Lead-Free products (≦ φ10)

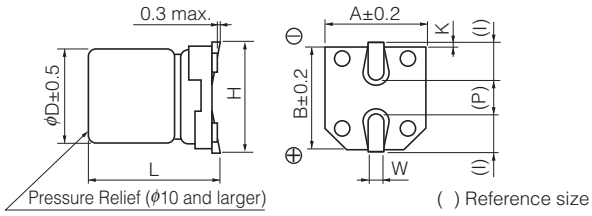



Lead-Free products (≧ φ12.5)




| R. Voltage (V.DC) | 10 | 16 | 25 | 35 | 50 | 63 | 80 | 100 |
|---|---|---|---|---|---|---|---|---|
| Code | A | C | E | V | H | J | K | 2A |

## Dimensions




(Unit : mm)

| Size code | φD | L | A, B | H | I | W | P | K |
|---|---|---|---|---|---|---|---|---|
| E | 8.0 | 6.2±0.3 | 8.3 | 9.5 max. | 3.4 | 0.65±0.1 | 2.2 | $0.35^{+0.15}_{-0.20}$ |
| F | 8.0 | 10.2±0.3 | 8.3 | 10.0 max. | 3.4 | 0.90±0.2 | 3.1 | 0.70±0.20 |
| G | 10.0 | 10.2±0.3 | 10.3 | 12.0 max. | 3.5 | 0.90±0.2 | 4.6 | 0.70±0.20 |
| H13 | 12.5 | 13.5±0.5 | 13.5 | 15.0 max. | 4.7 | 0.90±0.3 | 4.4 | 0.70±0.30 |
| J16 | 16.0 | 16.5±0.5 | 17.0 | 19.0 max. | 5.5 | 1.20±0.3 | 6.7 | 0.70±0.30 |
| K16 | 18.0 | 16.5±0.5 | 19.0 | 21.0 max. | 6.7 | 1.20±0.3 | 6.7 | 0.70±0.30 |

## Characteristics list

Endurance : 125 °C 1000 h ($\phi$8×10.2 ≦ : 2000 h)

| Rated voltage (V.DC) | Cap. (±20 %) (μF) | Case size (mm) | | Size* code | Specification | | | Part No. | Reflow | Min. Packaging Q'ty |
|---|---|---|---|---|---|---|---|---|---|---|
| | | $\phi$D | L | | Ripple current (100 kHz) (+125 °C) (mA r.m.s.) | ESR (100 kHz) (+20 °C) (Ω) | tan $\delta$ (120 Hz) (+20 °C) | | | Taping (pcs) |
| 10 | 100 | 8 | 6.2 | E | 100 | 1.00 | 0.30 | EEETG1A101P | (2) | 1000 |
| | 220 | 8 | 6.2 | (E) | 100 | 1.00 | 0.30 | EEETG1A221UP | (2) | 1000 |
| | | 8 | 10.2 | F | 197 | 0.50 | 0.30 | EEETG1A221P | (2) | 500 |
| | 330 | 8 | 10.2 | (F) | 197 | 0.50 | 0.30 | EEETG1A331UP | (2) | 500 |
| | | 10 | 10.2 | G | 270 | 0.30 | 0.30 | EEETG1A331P | (2) | 500 |
| | 470 | 10 | 10.2 | (G) | 270 | 0.30 | 0.30 | EEETG1A471UP | (2) | 500 |
| | 1000 | 12.5 | 13.5 | H13 | 800 | 0.12 | 0.30 | EEVTG1A102Q | (3) | 200 |
| | 1500 | 12.5 | 13.5 | (H13) | 800 | 0.12 | 0.30 | EEVTG1A152UQ | (3) | 200 |
| | 2200 | 16 | 16.5 | J16 | 1100 | 0.08 | 0.32 | EEVTG1A222M | (3) | 125 |
| | 3300 | 16 | 16.5 | (J16) | 1100 | 0.08 | 0.34 | EEVTG1A332UM | (3) | 125 |
| | | 18 | 16.5 | K16 | 1300 | 0.075 | 0.34 | EEVTG1A332M | (3) | 125 |
| | 4700 | 18 | 16.5 | K16 | 1300 | 0.075 | 0.36 | EEVTG1A472M | (3) | 125 |
| 16 | 100 | 8 | 10.2 | F | 197 | 0.50 | 0.23 | EEETG1C101P | (2) | 500 |
| | 220 | 8 | 10.2 | (F) | 197 | 0.50 | 0.23 | EEETG1C221UP | (2) | 500 |
| | | 10 | 10.2 | G | 270 | 0.30 | 0.23 | EEETG1C221P | (2) | 500 |
| | 330 | 10 | 10.2 | (G) | 270 | 0.30 | 0.23 | EEETG1C331UP | (2) | 500 |
| | | 12.5 | 13.5 | H13 | 800 | 0.12 | 0.23 | EEVTG1C331Q | (3) | 200 |
| | 470 | 12.5 | 13.5 | H13 | 800 | 0.12 | 0.23 | EEVTG1C471Q | (3) | 200 |
| | 680 | 12.5 | 13.5 | H13 | 800 | 0.12 | 0.23 | EEVTG1C681Q | (3) | 200 |
| | 1000 | 12.5 | 13.5 | (H13) | 800 | 0.12 | 0.23 | EEVTG1C102UQ | (3) | 200 |
| | | 16 | 16.5 | J16 | 1100 | 0.08 | 0.23 | EEVTG1C102M | (3) | 125 |
| | 2200 | 16 | 16.5 | (J16) | 1100 | 0.08 | 0.25 | EEVTG1C222UM | (3) | 125 |
| | | 18 | 16.5 | K16 | 1300 | 0.075 | 0.25 | EEVTG1C222M | (3) | 125 |
| | 3300 | 18 | 16.5 | K16 | 1300 | 0.075 | 0.27 | EEVTG1C332M | (3) | 125 |
| 25 | 47 | 8 | 6.2 | E | 100 | 1.00 | 0.18 | EEETG1E470P | (2) | 1000 |
| | 100 | 8 | 6.2 | (E) | 100 | 1.00 | 0.18 | EEETG1E101UP | (2) | 1000 |
| | | 8 | 10.2 | F | 197 | 0.50 | 0.18 | EEETG1E101P | (2) | 500 |
| | 220 | 8 | 10.2 | (F) | 197 | 0.50 | 0.18 | EEETG1E221UP | (2) | 500 |
| | | 10 | 10.2 | G | 270 | 0.30 | 0.18 | EEETG1E221P | (2) | 500 |
| | 330 | 10 | 10.2 | (G) | 270 | 0.30 | 0.18 | EEETG1E331UP | (2) | 500 |
| | | 12.5 | 13.5 | H13 | 800 | 0.12 | 0.18 | EEVTG1E331Q | (3) | 200 |
| | 470 | 12.5 | 13.5 | H13 | 800 | 0.12 | 0.18 | EEVTG1E471Q | (3) | 200 |
| | 680 | 12.5 | 13.5 | (H13) | 800 | 0.12 | 0.18 | EEVTG1E681UQ | (3) | 200 |
| | | 16 | 16.5 | J16 | 1100 | 0.08 | 0.18 | EEVTG1E681M | (3) | 125 |
| | 1000 | 16 | 16.5 | (J16) | 1100 | 0.08 | 0.18 | EEVTG1E102UM | (3) | 125 |
| | | 18 | 16.5 | K16 | 1300 | 0.075 | 0.18 | EEVTG1E102M | (3) | 125 |
| | 2200 | 18 | 16.5 | K16 | 1300 | 0.075 | 0.20 | EEVTG1E222M | (3) | 125 |
| 35 | 33 | 8 | 6.2 | E | 100 | 1.00 | 0.16 | EEETG1V330P | (2) | 1000 |
| | 47 | 8 | 6.2 | (E) | 100 | 1.00 | 0.16 | EEETG1V470UP | (2) | 1000 |
| | | 8 | 10.2 | F | 197 | 0.50 | 0.16 | EEETG1V470P | (2) | 500 |
| | 100 | 8 | 10.2 | (F) | 197 | 0.50 | 0.16 | EEETG1V101UP | (2) | 500 |
| | | 10 | 10.2 | G | 270 | 0.30 | 0.16 | EEETG1V101P | (2) | 500 |
| | 220 | 10 | 10.2 | (G) | 270 | 0.30 | 0.16 | EEETG1V221UP | (2) | 500 |
| | 330 | 12.5 | 13.5 | H13 | 800 | 0.12 | 0.16 | EEVTG1V331Q | (3) | 200 |
| | 470 | 12.5 | 13.5 | (H13) | 800 | 0.12 | 0.16 | EEVTG1V471UQ | (3) | 200 |
| | | 16 | 16.5 | J16 | 1100 | 0.08 | 0.16 | EEVTG1V471M | (3) | 125 |
| | 680 | 16 | 16.5 | (J16) | 1100 | 0.08 | 0.16 | EEVTG1V681UM | (3) | 125 |
| | | 18 | 16.5 | K16 | 1300 | 0.075 | 0.16 | EEVTG1V681M | (3) | 125 |
| | 1000 | 18 | 16.5 | K16 | 1300 | 0.075 | 0.16 | EEVTG1V102M | (3) | 125 |

✻ Size code( ) : Miniaturization product

· Please refer to the page of "Reflow Profile" and "The Taping Dimensions".

· When requesting vibration-proof product, please put the last "V" instead to "P", "Q", or "M"

## Characteristics list

Endurance : 125 °C 1000 h (φ8×10.2 ≦ : 2000 h)

| Rated voltage (V.DC) | Cap. (±20 %) (μF) | Case size (mm) φD | Case size (mm) L | Size* code | Specification: Ripple current (100 kHz) (+125 °C) (mA r.m.s.) | Specification: ESR (100 kHz) (+20 °C) (Ω) | Specification: tan δ (120 Hz) (+20 °C) | Part No. | Reflow | Min. Packaging Q'ty Taping (pcs) |
|---|---|---|---|---|---|---|---|---|---|---|
| 50 | 10 | 8 | 6.2 | E | 80 | 1.60 | 0.14 | EEETG1H100P | (2) | 1000 |
| | 22 | 8 | 6.2 | E | 80 | 1.60 | 0.14 | EEETG1H220P | (2) | 1000 |
| | 33 | 8 | 6.2 | (E) | 80 | 1.60 | 0.14 | EEETG1H330UP | (2) | 1000 |
| | | 8 | 10.2 | F | 133 | 0.75 | 0.14 | EEETG1H330P | (2) | 500 |
| | 47 | 8 | 10.2 | (F) | 133 | 0.75 | 0.14 | EEETG1H470UP | (2) | 500 |
| | | 10 | 10.2 | G | 221 | 0.50 | 0.14 | EEETG1H470P | (2) | 500 |
| | 100 | 10 | 10.2 | (G) | 221 | 0.50 | 0.14 | EEETG1H101UP | (2) | 500 |
| | 220 | 12.5 | 13.5 | H13 | 600 | 0.23 | 0.14 | EEVTG1H221Q | (3) | 200 |
| | 330 | 12.5 | 13.5 | H13 | 600 | 0.23 | 0.14 | EEVTG1H331Q | (3) | 200 |
| | 470 | 16 | 16.5 | J16 | 900 | 0.15 | 0.14 | EEVTG1H471M | (3) | 125 |
| | 680 | 16 | 16.5 | (J16) | 900 | 0.15 | 0.14 | EEVTG1H681UM | (3) | 125 |
| | | 18 | 16.5 | K16 | 950 | 0.14 | 0.14 | EEVTG1H681M | (3) | 125 |
| | 1000 | 18 | 16.5 | K16 | 950 | 0.14 | 0.14 | EEVTG1H102M | (3) | 125 |
| 63 | 10 | 8 | 6.2 | E | 55 | 2.20 | 0.12 | EEETG1J100P | (2) | 1000 |
| | 22 | 8 | 10.2 | F | 100 | 1.00 | 0.12 | EEETG1J220P | (2) | 500 |
| | 33 | 8 | 10.2 | (F) | 100 | 1.00 | 0.12 | EEETG1J330UP | (2) | 500 |
| | | 10 | 10.2 | G | 150 | 0.80 | 0.12 | EEETG1J330P | (2) | 500 |
| | 47 | 8 | 10.2 | (F) | 100 | 1.00 | 0.12 | EEETG1J470UP | (2) | 500 |
| | | 10 | 10.2 | G | 150 | 0.80 | 0.12 | EEETG1J470P | (2) | 500 |
| | 100 | 10 | 10.2 | (G) | 150 | 0.80 | 0.12 | EEETG1J101UP | (2) | 500 |
| | | 12.5 | 13.5 | H13 | 350 | 0.26 | 0.12 | EEVTG1J101Q | (3) | 200 |
| | 220 | 12.5 | 13.5 | H13 | 350 | 0.26 | 0.12 | EEVTG1J221Q | (3) | 200 |
| | 330 | 16 | 16.5 | J16 | 500 | 0.18 | 0.12 | EEVTG1J331M | (3) | 125 |
| | 470 | 16 | 16.5 | J16 | 500 | 0.18 | 0.12 | EEVTG1J471M | (3) | 125 |
| 80 | 10 | 8 | 10.2 | F | 70 | 1.30 | 0.12 | EEETG1K100P | (2) | 500 |
| | 22 | 8 | 10.2 | (F) | 70 | 1.30 | 0.12 | EEETG1K220UP | (2) | 500 |
| | | 10 | 10.2 | G | 90 | 1.00 | 0.12 | EEETG1K220P | (2) | 500 |
| | 33 | 8 | 10.2 | (F) | 70 | 1.30 | 0.12 | EEETG1K330UP | (2) | 500 |
| | | 10 | 10.2 | G | 90 | 1.00 | 0.12 | EEETG1K330P | (2) | 500 |
| | 47 | 10 | 10.2 | (G) | 90 | 1.00 | 0.12 | EEETG1K470UP | (2) | 500 |
| | | 12.5 | 13.5 | H13 | 250 | 0.42 | 0.12 | EEVTG1K470Q | (3) | 200 |
| | 100 | 12.5 | 13.5 | (H13) | 250 | 0.42 | 0.12 | EEVTG1K101UQ | (3) | 200 |
| | | 16 | 16.5 | J16 | 350 | 0.30 | 0.12 | EEVTG1K101M | (3) | 125 |
| | 220 | 16 | 16.5 | (J16) | 350 | 0.30 | 0.12 | EEVTG1K221UM | (3) | 125 |
| | | 18 | 16.5 | K16 | 400 | 0.28 | 0.12 | EEVTG1K221M | (3) | 125 |
| | 330 | 16 | 16.5 | (J16) | 350 | 0.30 | 0.12 | EEVTG1K331UM | (3) | 125 |
| | | 18 | 16.5 | K16 | 400 | 0.28 | 0.12 | EEVTG1K331M | (3) | 125 |
| | 470 | 18 | 16.5 | K16 | 400 | 0.28 | 0.12 | EEVTG1K471M | (3) | 125 |
| 100 | 10 | 8 | 10.2 | F | 70 | 1.30 | 0.10 | EEETG2A100P | (2) | 500 |
| | 22 | 8 | 10.2 | (F) | 70 | 1.30 | 0.10 | EEETG2A220UP | (2) | 500 |
| | | 10 | 10.2 | G | 90 | 1.00 | 0.10 | EEETG2A220P | (2) | 500 |
| | 33 | 10 | 10.2 | G | 90 | 1.00 | 0.10 | EEETG2A330P | (2) | 500 |
| | 47 | 12.5 | 13.5 | H13 | 250 | 0.42 | 0.10 | EEVTG2A470Q | (3) | 200 |
| | 100 | 16 | 16.5 | J16 | 350 | 0.30 | 0.10 | EEVTG2A101M | (3) | 125 |
| | 220 | 18 | 16.5 | K16 | 400 | 0.28 | 0.10 | EEVTG2A221M | (3) | 125 |
| | 330 | 18 | 16.5 | K16 | 400 | 0.28 | 0.10 | EEVTG2A331M | (3) | 125 |

✻ Size code( ) : Miniaturization product
· Please refer to the page of "Reflow Profile" and "The Taping Dimensions".
· When requesting vibration-proof product, please put the last "V" instead to "P", "Q", or "M"

# Surface Mount Type

Series : Medium-size **TK** Type : **V**
**High temperature**
**Lead-Free reflow (suffix : A*)**

## Features

- Endurance : 125 °C 2000 h
- Vibration-proof product is available upon request.
- RoHS compliant

## Specifications

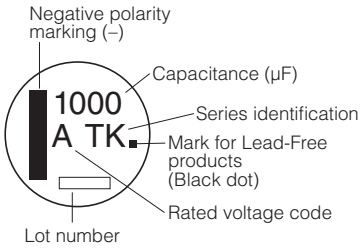
| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Category temperature range | –40 °C to +125 °C | | | | | | | | | |
| Rated voltage range | 10 V.DC to 100 V.DC | | | | | | | | | |
| Capacitance range | 47 µF to 4700 µF | | | | | | | | | |
| Capacitance tolerance | ±20 % (120 Hz/+20 °C) | | | | | | | | | |
| Leakage current | I ≦ 0.01 CV After 2 minutes | | | | | | | | | |
| Dissipation factor (tan δ) | Please see the attached characteristics list | | | | | | | | | |
| Characteristics at low temperature | V.DC | 10 | 16 | 25 | 35 | 50 | 63 | 80 | 100 | (Impedance ratio at 120 Hz) |
| | Z(–25 °C)/Z(+20 °C) | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | |
| | Z(–40 °C)/Z(+20 °C) | 6 | 4 | 4 | 3 | 3 | 3 | 3 | 3 | |
| Endurance | After applying rated working voltage for 2000 hours at +125 °C±2 °C and then being stabilized at +20 °C, Capacitors shall meet the following limits. | | | | | | | | | |
| | Capacitance change | Within ±30 % of the initial value (Miniaturization product : Within ±35 %) | | | | | | | | |
| | tan δ | ≦300 % of the initial limit (Miniaturization product : Within 350 %) | | | | | | | | |
| | DC leakage current | Within 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) | | | | | | | | | |
| 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 | | | | | | | | |
| | tan δ | Within the initial limit | | | | | | | | |
| | DC leakage current | Within the initial limit | | | | | | | | |
| AEC-Q200 | AEC-Q200 compliant | | | | | | | | | |

## Frequency correction factor for ripple current

| Frequency (Hz) | 120 | 1 k | 10 k | 100 k to |
|---|---|---|---|---|
| Correction factor | 0.75 | 0.90 | 0.95 | 1.00 |

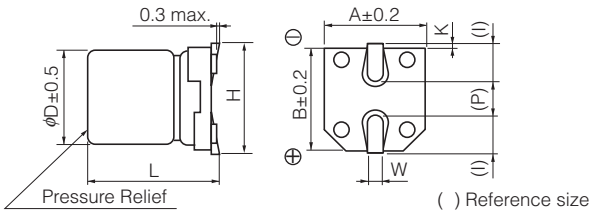
## Marking

Example : 10 V.DC 1000 µF
Marking color : BLACK




| R. Voltage (V.DC) | 10 | 16 | 25 | 35 | 50 | 63 | 80 | 100 |
|---|---|---|---|---|---|---|---|---|
| Code | A | C | E | V | H | J | K | 2A |

## Dimensions




(Unit : mm)

| Size code | φD | L | A, B | H | I | W | P | K |
|---|---|---|---|---|---|---|---|---|
| H13 | 12.5 | 13.5±0.5 | 13.5 | 15.0 max. | 4.7 | 0.90±0.3 | 4.4 | 0.70±0.3 |
| J16 | 16.0 | 16.5±0.5 | 17.0 | 19.0 max. | 5.5 | 1.20±0.3 | 6.7 | 0.70±0.3 |
| K16 | 18.0 | 16.5±0.5 | 19.0 | 21.0 max. | 6.7 | 1.20±0.3 | 6.7 | 0.70±0.3 |

## Characteristics list

Endurance : 125 °C 2000 h

| Rated voltage (V.DC) | Cap. (±20 %) (μF) | Case size (mm) | | Size* code | Specification | | | | Part No. | Reflow | Min. Packaging Q'ty |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | φD | L | | Ripple current (100 kHz) (+125 °C) (mA r.m.s.) | ESR (100 kHz) (Ω) | | tan δ (120 Hz) (+20 °C) | | | Taping (pcs) |
| | | | | | | +20 °C | –40 °C | | | | |
| 10 | 1000 | 12.5 | 13.5 | H13 | 800 | 0.120 | 1.80 | 0.30 | EEETK1A102AQ | (9) | 200 |
| | 1500 | 12.5 | 13.5 | (H13) | 800 | 0.120 | 1.80 | 0.30 | EEETKA152UAQ | (9) | 200 |
| | 2200 | 16 | 16.5 | J16 | 1100 | 0.080 | 1.20 | 0.32 | EEETK1A222AM | (9) | 125 |
| | 3300 | 16 | 16.5 | (J16) | 1100 | 0.080 | 1.20 | 0.34 | EEETKA332UAM | (9) | 125 |
| | | 18 | 16.5 | K16 | 1300 | 0.075 | 1.10 | 0.36 | EEETK1A332AM | (9) | 125 |
| | 4700 | 18 | 16.5 | K16 | 1300 | 0.075 | 1.10 | 0.38 | EEETK1A472AM | (9) | 125 |
| 16 | 330 | 12.5 | 13.5 | H13 | 800 | 0.120 | 1.80 | 0.23 | EEETK1C331AQ | (9) | 200 |
| | 470 | 12.5 | 13.5 | H13 | 800 | 0.120 | 1.80 | 0.23 | EEETK1C471AQ | (9) | 200 |
| | 680 | 12.5 | 13.5 | H13 | 800 | 0.120 | 1.80 | 0.23 | EEETK1C681AQ | (9) | 200 |
| | 1000 | 12.5 | 13.5 | (H13) | 800 | 0.120 | 1.80 | 0.23 | EEETKC102UAQ | (9) | 200 |
| | | 16 | 16.5 | J16 | 1100 | 0.080 | 1.20 | 0.25 | EEETK1C102AM | (9) | 125 |
| | 2200 | 16 | 16.5 | (J16) | 1100 | 0.080 | 1.20 | 0.27 | EEETKC222UAM | (9) | 125 |
| | | 18 | 16.5 | K16 | 1300 | 0.075 | 1.10 | 0.27 | EEETK1C222AM | (9) | 125 |
| | 3300 | 18 | 16.5 | K16 | 1300 | 0.075 | 1.10 | 0.29 | EEETK1C332AM | (9) | 125 |
| 25 | 330 | 12.5 | 13.5 | H13 | 800 | 0.120 | 1.80 | 0.18 | EEETK1E331AQ | (9) | 200 |
| | 470 | 12.5 | 13.5 | H13 | 800 | 0.120 | 1.80 | 0.18 | EEETK1E471AQ | (9) | 200 |
| | 680 | 12.5 | 13.5 | (H13) | 800 | 0.120 | 1.80 | 0.18 | EEETKE681UAQ | (9) | 200 |
| | | 16 | 16.5 | J16 | 1100 | 0.080 | 1.20 | 0.18 | EEETK1E681AM | (9) | 125 |
| | 1000 | 16 | 16.5 | (J16) | 1100 | 0.080 | 1.20 | 0.18 | EEETKE102UAM | (9) | 125 |
| | | 18 | 16.5 | K16 | 1300 | 0.075 | 1.10 | 0.18 | EEETK1E102AM | (9) | 125 |
| | 2200 | 18 | 16.5 | K16 | 1300 | 0.075 | 1.10 | 0.20 | EEETK1E222AM | (9) | 125 |
| 35 | 330 | 12.5 | 13.5 | H13 | 800 | 0.120 | 1.80 | 0.16 | EEETK1V331AQ | (9) | 200 |
| | 470 | 12.5 | 13.5 | (H13) | 800 | 0.120 | 1.80 | 0.16 | EEETKV471UAQ | (9) | 200 |
| | | 16 | 16.5 | J16 | 1100 | 0.080 | 1.20 | 0.16 | EEETK1V471AM | (9) | 125 |
| | 680 | 16 | 16.5 | (J16) | 1100 | 0.080 | 1.20 | 0.16 | EEETKV681UAM | (9) | 125 |
| | | 18 | 16.5 | K16 | 1300 | 0.075 | 1.10 | 0.16 | EEETK1V681AM | (9) | 125 |
| | 1000 | 18 | 16.5 | K16 | 1300 | 0.075 | 1.10 | 0.16 | EEETK1V102AM | (9) | 125 |
| 50 | 220 | 12.5 | 13.5 | H13 | 600 | 0.230 | 3.40 | 0.14 | EEETK1H221AQ | (10) | 200 |
| | 330 | 12.5 | 13.5 | H13 | 600 | 0.230 | 3.40 | 0.14 | EEETK1H331AQ | (10) | 200 |
| | 470 | 16 | 16.5 | J16 | 900 | 0.150 | 2.20 | 0.14 | EEETK1H471AM | (10) | 125 |
| | 680 | 16 | 16.5 | (J16) | 900 | 0.150 | 2.20 | 0.14 | EEETKH681UAM | (10) | 125 |
| | | 18 | 16.5 | K16 | 950 | 0.140 | 2.10 | 0.14 | EEETK1H681AM | (10) | 125 |
| | 1000 | 18 | 16.5 | K16 | 950 | 0.140 | 2.10 | 0.14 | EEETK1H102AM | (10) | 125 |
| 63 | 100 | 12.5 | 13.5 | H13 | 350 | 0.260 | 5.20 | 0.12 | EEETK1J101AQ | (11) | 200 |
| | 220 | 12.5 | 13.5 | H13 | 350 | 0.260 | 5.20 | 0.12 | EEETK1J221AQ | (11) | 200 |
| | 330 | 16 | 16.5 | J16 | 500 | 0.180 | 3.60 | 0.12 | EEETK1J331AM | (11) | 125 |
| | 470 | 16 | 16.5 | J16 | 500 | 0.180 | 3.60 | 0.12 | EEETK1J471AM | (11) | 125 |
| 80 | 47 | 12.5 | 13.5 | H13 | 250 | 0.420 | 8.40 | 0.12 | EEETK1K470AQ | (11) | 200 |
| | 100 | 12.5 | 13.5 | (H13) | 250 | 0.420 | 8.40 | 0.12 | EEETKK101UAQ | (11) | 200 |
| | | 16 | 16.5 | J16 | 350 | 0.300 | 6.00 | 0.12 | EEETK1K101AM | (11) | 125 |
| | 220 | 16 | 16.5 | (J16) | 350 | 0.300 | 6.00 | 0.12 | EEETKK221UAM | (11) | 125 |
| | | 18 | 16.5 | K16 | 400 | 0.280 | 5.60 | 0.12 | EEETK1K221AM | (11) | 125 |
| | 330 | 16 | 16.5 | (J16) | 350 | 0.300 | 6.00 | 0.12 | EEETKK331UAM | (11) | 125 |
| | | 18 | 16.5 | K16 | 400 | 0.280 | 5.60 | 0.12 | EEETK1K331AM | (11) | 125 |
| | 470 | 18 | 16.5 | K16 | 400 | 0.280 | 5.60 | 0.12 | EEETK1K471AM | (11) | 125 |
| 100 | 47 | 12.5 | 13.5 | H13 | 250 | 0.420 | 8.40 | 0.10 | EEETK2A470AQ | (11) | 200 |
| | 100 | 16 | 16.5 | J16 | 350 | 0.300 | 6.00 | 0.10 | EEETK2A101AM | (11) | 125 |
| | 220 | 18 | 16.5 | K16 | 400 | 0.280 | 5.60 | 0.10 | EEETK2A221AM | (11) | 125 |
| | 330 | 18 | 16.5 | K16 | 400 | 0.280 | 5.60 | 0.10 | EEETK2A331AM | (11) | 125 |

✻ Size code( ) : Miniaturization product

· Please refer to the page of "Reflow Profile" and "The Taping Dimensions".

· When requesting vibration-proof product, please put the last "V" instead to "Q" or "M"

# Surface Mount Type

Series : **TK** Type : **V**

## Features

- Endurance : 125 °C 3000 h
- Low ESR at –40 °C (50 % lower than TG series)
- Added ESR specification after the endurance test
- Vibration-proof product is available upon request.
- RoHS compliant

## Specifications

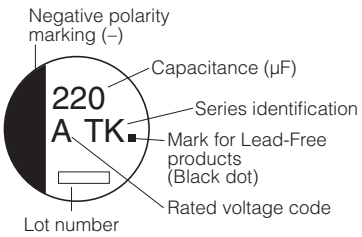
| | | | | | | |
|---|---|---|---|---|---|---|
| Category temperature range | –40 °C to +125 °C | | | | | |
| Rated voltage range | 10 V.DC to 35 V.DC | | | | | |
| Capacitance range | 47 µF to 470 µF | | | | | |
| Capacitance tolerance | ±20 % (120 Hz/+20 °C) | | | | | |
| Leakage current | I ≦ 0.01 CV After 2 minutes | | | | | |
| Dissipation factor (tan $\delta$) | Please see the attached characteristics list | | | | | |
| Characteristics at low temperature | V.DC | 10 | 16 | 25 | 35 | (Impedance ratio at 120 Hz) |
| | Z(–25 °C)/Z(+20 °C) | 3 | 2 | 2 | 2 | |
| | Z(–40 °C)/Z(+20 °C) | 4 | 3 | 3 | 3 | |
| Endurance | After the life test with DC rated woking voltage at +125 °C ±2 °C for 3000 hours, the capacitors shall meet the limits specified below. | | | | | |
| | Capacitance change | Within ±30 % of the initial value (code U : ±35 %) | | | | |
| | tan $\delta$ | ≦300 % of the initial limit (code U : ±350 %) | | | | |
| | DC leakage current | Within 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) | | | | | |
| ESR after the life test | After the life test with DC rated working voltage at +125 °C±2 °C for 3000 hours, ESR value shall meet the specified below. | | | | | |
| | After 1000 hours | 20 °C | ≦150 % of the initial limit | | | |
| | | –40 °C | ≦200 % of the initial limit | | | |
| | After 2000 hours | 20 °C | ≦300 % of the initial limit | | | |
| | | –40 °C | ≦400 % of the initial limit | | | |
| | After 3000 hours | 20 °C | ≦1000 % of the initial limit | | | |
| | | –40 °C | ≦1500 % of the initial limit | | | |
| AEC-Q200 | AEC-Q200 compliant | | | | | |

## Frequency correction factor for ripple current

| Frequency (Hz) | 120 | 1 k | 10 k | 100 k to |
|---|---|---|---|---|
| Correction factor | 0.65 | 0.85 | 0.95 | 1.00 |

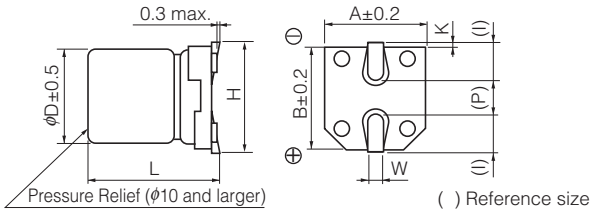
## Marking

Example : 10 V.DC 220 µF
Marking color : BLACK




| R. Voltage (V.DC) | 10 | 16 | 25 | 35 |
|---|---|---|---|---|
| Code | A | C | E | V |

## Dimensions




(Unit : mm)

| Size code | φD | L | A, B | H | I | W | P | K |
|---|---|---|---|---|---|---|---|---|
| F | 8.0 | 10.2±0.3 | 8.3 | 10.0 max. | 3.4 | 0.90±0.2 | 3.1 | 0.70±0.2 |
| G | 10.0 | 10.2±0.3 | 10.3 | 12.0 max. | 3.5 | 0.90±0.2 | 4.6 | 0.70±0.2 |

## Characteristics list

Endurance : 125 °C 3000 h

| Rated voltage (V.DC) | Cap. (±20 %) (μF) | Case size (mm) | | Size* code | Specification | | | | Part No. | Reflow | Min. Packaging Q'ty |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | φD | L | | Ripple current (100 kHz) (+125 °C) (mA r.m.s.) | ESR (100 kHz) (Ω) | | tan δ (120 Hz) (+20 °C) | | | Taping (pcs) |
| | | | | | | +20 °C | –40 °C | | | | |
| 10 | 220 | 8 | 10.2 | F | 197 | 0.3 | 5 | 0.30 | EEETK1A221P | (8) | 500 |
| | 330 | 8 | 10.2 | (F) | 197 | 0.3 | 5 | 0.30 | EEETK1A331UP | (8) | 500 |
| | | 10 | 10.2 | G | 270 | 0.2 | 3 | 0.30 | EEETK1A331P | (8) | 500 |
| | 470 | 10 | 10.2 | (G) | 270 | 0.2 | 3 | 0.30 | EEETK1A471UP | (8) | 500 |
| 16 | 100 | 8 | 10.2 | F | 197 | 0.3 | 5 | 0.23 | EEETK1C101P | (8) | 500 |
| | 220 | 8 | 10.2 | (F) | 197 | 0.3 | 5 | 0.23 | EEETK1C221UP | (8) | 500 |
| | | 10 | 10.2 | G | 270 | 0.2 | 3 | 0.23 | EEETK1C221P | (8) | 500 |
| | 330 | 10 | 10.2 | (G) | 270 | 0.2 | 3 | 0.23 | EEETK1C331UP | (8) | 500 |
| 25 | 100 | 8 | 10.2 | F | 197 | 0.3 | 5 | 0.18 | EEETK1E101P | (8) | 500 |
| | 220 | 8 | 10.2 | (F) | 197 | 0.3 | 5 | 0.18 | EEETK1E221UP | (8) | 500 |
| | | 10 | 10.2 | G | 270 | 0.2 | 3 | 0.18 | EEETK1E221P | (8) | 500 |
| | 330 | 10 | 10.2 | (G) | 270 | 0.2 | 3 | 0.18 | EEETK1E331UP | (8) | 500 |
| 35 | 47 | 8 | 10.2 | F | 197 | 0.3 | 5 | 0.16 | EEETK1V470P | (8) | 500 |
| | 100 | 8 | 10.2 | (F) | 197 | 0.3 | 5 | 0.16 | EEETK1V101UP | (8) | 500 |
| | | 10 | 10.2 | G | 270 | 0.2 | 3 | 0.16 | EEETK1V101P | (8) | 500 |
| | 220 | 10 | 10.2 | (G) | 270 | 0.2 | 3 | 0.16 | EEETK1V221UP | (8) | 500 |

✻ Size code( ) : Miniaturization product
· Please refer to the page of "Reflow Profile" and "The Taping Dimensions".
· When requesting vibration-proof product, please put the last "V" instead to "P"

# Surface Mount Type

Series : **TP** Type : **V**
**High temperature**
**Lead-Free reflow (suffix : A*)**

## Features

- Lower ESR at Low temperature after endurance
- Endurance : 125 °C 3000 h (D8 size : 2000 h)
- Automotive
- Vibration-proof product is available upon request. (φ8 mm and larger)
- RoHS compliant

## Specifications

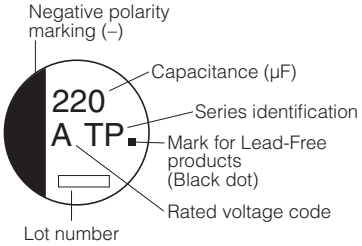
| | | | | | |
|---|---|---|---|---|---|
| Category temperature range | –40 °C to +125 °C | | | | |
| Rated voltage range | 10 V.DC to 35 V.DC | | | | |
| Capacitance range | 47 µF to 470 µF | | | | |
| Capacitance tolerance | ±20 % (120 Hz/+20 °C) | | | | |
| Leakage current | I ≦ 0.01 CV (µA) After 2 minutes | | | | |
| Dissipation factor (tan δ) | Please see the attached characteristics list | | | | |
| Endurance | After the life test with DC rated working voltage at +125 °C±2 °C for 3000 hours (D8 size : 2000 h). the capacitors shall meet the limits specified below. | | | | |
| | Capacitance change | Within ±30 % of the initial value | | | |
| | tan δ | ≦300 % of the initial limit | | | |
| | DC leakage current | Within the initial limit | | | |
| | ESR after endurance (Ω/100kHz) | | Size Code | | |
| | | | D8 | F | G |
| | | Initial (+20 °C) | 0.45 | 0.2 | 0.15 |
| | | After 2000 h (-40 °C) | 40 | 4.5 | 3.5 |
| 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) | | | | |
| 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 | | | |
| | tan δ | Within the initial limit | | | |
| | DC leakage current | Within the initial limit | | | |
| AEC-Q200 | AEC-Q200 compliant | | | | |

## Frequency correction factor for ripple current

| Frequency (Hz) | 120 | 1 k | 10 k | 100 k to |
|---|---|---|---|---|
| Correction factor | 0.65 | 0.85 | 0.95 | 1.00 |

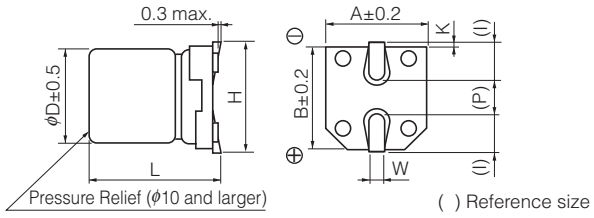
## Marking

Example : 10 V.DC 220 µF
Marking color : BLACK




| R. Voltage (V.DC) | 10 | 16 | 25 | 35 |
|---|---|---|---|---|
| Code | A | C | E | V |

## Dimensions




(Unit : mm)

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

## Characteristics list

Endurance : 125 °C 3000 h (φ6.3×7.7 : 2000 h)

| Rated voltage (V.DC) | Cap. (±20 %) (μF) | Case size (mm) φD | Case size (mm) L | Size* code | Specification: Ripple current (100 kHz) (+125 °C) (mA r.m.s.) | Specification: ESR (100 kHz) (Ω) +20 °C | Specification: ESR (100 kHz) (Ω) −40 °C | Specification: tan δ (120 Hz) (+20 °C) | Part No. | Reflow | Min. Packaging Q'ty Taping (pcs) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 10 | 220 | 8 | 10.2 | F | 270 | 0.20 | 3 | 0.30 | EEETP1A221AP | (8) | 500 |
| | 330 | 8 | 10.2 | (F) | 270 | 0.20 | 3 | 0.30 | EEETPA331UAP | (8) | 500 |
| | | 10 | 10.2 | G | 500 | 0.15 | 2 | 0.30 | EEETP1A331AP | (8) | 500 |
| | 470 | 10 | 10.2 | G | 500 | 0.15 | 2 | 0.30 | EEETP1A471AP | (8) | 500 |
| 16 | 100 | 6.3 | 7.7 | D8 | 197 | 0.45 | 5 | 0.23 | EEETPC101XAP | (8) | 900 |
| | | 8 | 10.2 | F | 270 | 0.20 | 3 | 0.23 | EEETP1C101AP | (8) | 500 |
| | 220 | 8 | 10.2 | F | 270 | 0.20 | 3 | 0.23 | EEETP1C221AP | (8) | 500 |
| | 330 | 10 | 10.2 | G | 500 | 0.15 | 2 | 0.23 | EEETP1C331AP | (8) | 500 |
| | 470 | 10 | 10.2 | G | 500 | 0.15 | 2 | 0.23 | EEETP1C471AP | (8) | 500 |
| 25 | 100 | 8 | 10.2 | F | 270 | 0.20 | 3 | 0.18 | EEETP1E101AP | (8) | 500 |
| | 220 | 10 | 10.2 | G | 500 | 0.15 | 2 | 0.18 | EEETP1E221AP | (8) | 500 |
| | 330 | 10 | 10.2 | G | 500 | 0.15 | 2 | 0.18 | EEETP1E331AP | (8) | 500 |
| 35 | 47 | 6.3 | 7.7 | D8 | 197 | 0.45 | 5 | 0.16 | EEETPV470XAP | (8) | 900 |
| | | 8 | 10.2 | F | 270 | 0.20 | 3 | 0.16 | EEETP1V470AP | (8) | 500 |
| | 100 | 8 | 10.2 | F | 270 | 0.20 | 3 | 0.16 | EEETP1V101AP | (8) | 500 |
| | 220 | 10 | 10.2 | G | 500 | 0.15 | 2 | 0.16 | EEETP1V221AP | (8) | 500 |

✻ Size code( ) : Miniaturization product
If Part number exceeds 12 digits, voltage code is abbreviated as follows; 0J → J, 1A → A, 1C → C, 1E → E, 1V → V
· Please refer to the page of “Reflow Profile” and “The Taping Dimensions”.
· When requesting vibration-proof product, please put the last “V” instead to “P”

# Surface Mount Type NEW

Series : **TC** Type : **V**

**High temperature Lead-Free reflow**

## Features

- High ripple current (50 % higher than TP series)
- Endurance: 3000 h at 125 °C (D8 size : 2000 h)
- Added ESR specification after the endurance test
- Vibration-proof product is available upon request. (ϕ8 mm and larger)
- RoHS compliant

## Specifications

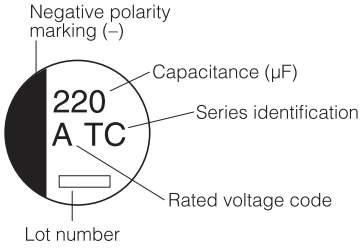
| | | | | | |
|---|---|---|---|---|---|
| Category temperature range | –40 °C to +125 °C | | | | |
| Rated voltage range | 10 V.DC to 35 V.DC | | | | |
| Rated capacitance range | 47 µF to 470 µF | | | | |
| Capacitance tolerance | ±20 % (120 Hz/+20 °C) | | | | |
| Leakage current | I ≦ 0.01 CV (µA) After 2 minutes | | | | |
| Dissipation factor (tan δ) | Please see the attached characteristics list | | | | |
| Endurance | After applying rated working voltage for 3000 hours (D8 size : 2000 h) at +125 °C±2 °C and then being stabilized at +20 °C, Capacitors shall meet the following limits. | | | | |
| | Capacitance change | Within ±30 % of the initial value | | | |
| | tan δ | ≦300 % of the initial limit | | | |
| | DC leakage current | Within the initial limit | | | |
| | ESR after endurance (Ω/100kHz) | | Size code | | |
| | | | D8 | F | G |
| | | Initial (+20 °C) | 0.45 | 0.2 | 0.15 |
| | | After 2000 h (-40 °C) | 40 | 4.5 | 3.5 |
| 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) | | | | |
| 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 | | | |
| | tan δ | Within the initial limit | | | |
| | DC leakage current | Within the initial limit | | | |
| AEC-Q200 | AEC-Q200 compliant | | | | |

## Frequency correction factor for ripple current

| Frequency (Hz) | 120 | 1 k | 10 k | 100 k to |
|---|---|---|---|---|
| Correction factor | 0.65 | 0.85 | 0.95 | 1.00 |

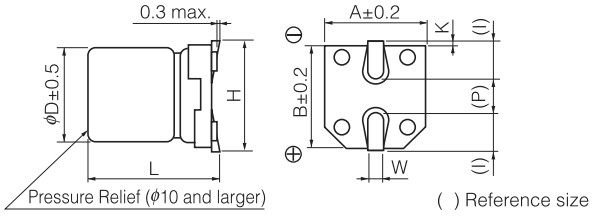
## Marking

Example : 10 V.DC 220 µF
Marking color : BLACK




| R. Voltage (V.DC) | 10 | 16 | 25 | 35 |
|---|---|---|---|---|
| Code | A | C | E | V |

## Dimensions




(Unit : mm)

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

## Characteristics list

Endurance : 125 °C 3000 h (D8 size : 2000 h)

| Rated voltage (V.DC) | Cap. (±20 %) (μF) | Case size (mm) | | Size code | Specification | | | | Part No. | Reflow | Min. Packaging Q'ty |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | φD | L | | Ripple Current (100 kHz) (+125 °C) (mA r.m.s.) | ESR (100 kHz) (Ω) | | tan δ (120 Hz) (+20 °C) | | | Taping (pcs) |
| | | | | | | +20 °C | −40 °C | | | | |
| 10 | 220 | 8 | 10.2 | F | 410 | 0.20 | 3 | 0.30 | EEETC1A221P | (8) | 500 |
| | 330 | 10 | 10.2 | G | 750 | 0.15 | 2 | 0.30 | EEETC1A331P | (8) | 500 |
| | 470 | 10 | 10.2 | G | 750 | 0.15 | 2 | 0.30 | EEETC1A471P | (8) | 500 |
| 16 | 100 | 6.3 | 7.7 | D8 | 300 | 0.45 | 5 | 0.23 | EEETC1C101XP | (8) | 900 |
| | | 8 | 10.2 | F | 410 | 0.20 | 3 | 0.23 | EEETC1C101P | (8) | 500 |
| | 220 | 8 | 10.2 | F | 410 | 0.20 | 3 | 0.23 | EEETC1C221P | (8) | 500 |
| | 330 | 10 | 10.2 | G | 750 | 0.15 | 2 | 0.23 | EEETC1C331P | (8) | 500 |
| | 470 | 10 | 10.2 | G | 750 | 0.15 | 2 | 0.23 | EEETC1C471P | (8) | 500 |
| 25 | 100 | 8 | 10.2 | F | 410 | 0.20 | 3 | 0.18 | EEETC1E101P | (8) | 500 |
| | 220 | 10 | 10.2 | G | 750 | 0.15 | 2 | 0.18 | EEETC1E221P | (8) | 500 |
| | 330 | 10 | 10.2 | G | 750 | 0.15 | 2 | 0.18 | EEETC1E331P | (8) | 500 |
| 35 | 47 | 6.3 | 7.7 | D8 | 300 | 0.45 | 5 | 0.16 | EEETC1V470XP | (8) | 900 |
| | | 8 | 10.2 | F | 410 | 0.20 | 3 | 0.16 | EEETC1V470P | (8) | 500 |
| | 100 | 8 | 10.2 | F | 410 | 0.20 | 3 | 0.16 | EEETC1V101P | (8) | 500 |
| | 220 | 10 | 10.2 | G | 750 | 0.15 | 2 | 0.16 | EEETC1V221P | (8) | 500 |

· Please refer to the page of “Reflow Profile” and “The Taping Dimensions”.
· When requesting vibration-proof product, please put the last “V” instead to “P”

# Surface Mount Type NEW

Series : **TCU** Type : **V**

**High temperature Lead-Free reflow**


## Features

- Miniaturization (20 % to 40 % less than TP series)
- Endurance : 125 °C 3000 h
- Added ESR specification after the endurance test
- Vibration-proof product is available upon request
- RoHS compliant

## Specifications

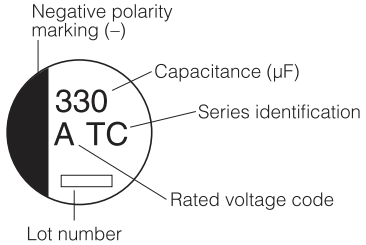
| | | | | |
|---|---|---|---|---|
| Category temperature range | –40 °C to +125 °C | | | |
| Rated voltage range | 10 V.DC to 35 V.DC | | | |
| Capacitance range | 220 µF to 680 µF | | | |
| Capacitance tolerance | ±20 % (120 Hz/+20 °C) | | | |
| Leakage current | I ≦ 0.01 CV (µA) After 2 minutes | | | |
| Dissipation factor (tan $\delta$) | Please see the attached characteristics list | | | |
| Endurance | After applying rated working voltage for 3000 hours at +125 °C±2 °C and then being stabilized at +20 °C, Capacitors shall meet the following limits. | | | |
| | Capacitance change | Within ±30 % of the initial value | | |
| | tan $\delta$ | ≦300 % of the initial limit | | |
| | DC leakage current | Within the initial limit | | |
| | ESR after endurance (Ω/100kHz) | | Size code F | Size code G |
| | | Initial (+20 °C) | 0.2 | 0.15 |
| | | After 2000 h (-40 °C) | 9 | 7 |
| 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) | | | |
| 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 | | |
| | tan $\delta$ | Within the initial limit | | |
| | DC leakage current | Within the initial limit | | |
| AEC-Q200 | AEC-Q200 compliant | | | |

## Frequency correction factor for ripple current

| Frequency (Hz) | 120 | 1 k | 10 k | 100 k to |
|---|---|---|---|---|
| Correction factor | 0.65 | 0.85 | 0.95 | 1.00 |

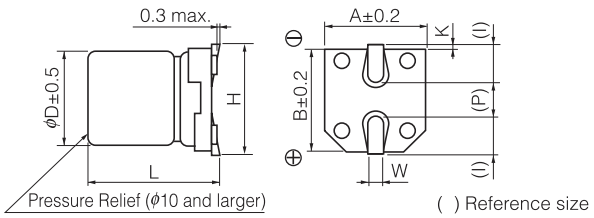
## Marking

Example : 10 V.DC 330 µF
Marking color : BLACK




| R. Voltage (V.DC) | 10 | 16 | 25 | 35 |
|---|---|---|---|---|
| Code | A | C | E | V |

## Dimensions




(Unit : mm)

| Size code | ϕD | L | A, B | H | I | W | P | K |
|---|---|---|---|---|---|---|---|---|
| F | 8.0 | 10.2±0.3 | 8.3 | 10.0max. | 3.4 | 0.90±0.2 | 3.1 | 0.70±0.20 |
| G | 10.0 | 10.2±0.3 | 10.3 | 12.0max. | 3.5 | 0.90±0.2 | 4.6 | 0.70±0.20 |

## Characteristics list

Endurance : 125 °C 3000 h

| Rated voltage (V.DC) | Cap. (±20 %) (μF) | Case size (mm) | | Size code | Specification | | | | Part No. | Reflow | Min. Packaging Q'ty |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | φD | L | | Ripple current (100 kHz) (+125 °C) (mA r.m.s.) | ESR (100 kHz) (Ω) | | tan δ (120 Hz) (+20 °C) | | | Taping (pcs) |
| | | | | | | +20 °C | −40 °C | | | | |
| 10 | 330 | 8 | 10.2 | F | 410 | 0.20 | 3 | 0.30 | EEETC1A331UP | (8) | 500 |
| | 470 | 8 | 10.2 | F | 410 | 0.20 | 3 | 0.30 | EEETC1A471UP | (8) | 500 |
| | 560 | 8 | 10.2 | F | 410 | 0.20 | 3 | 0.30 | EEETC1A561UP | (8) | 500 |
| | 680 | 10 | 10.2 | G | 750 | 0.15 | 2 | 0.30 | EEETC1A681UP | (8) | 500 |
| 16 | 330 | 8 | 10.2 | F | 410 | 0.20 | 3 | 0.23 | EEETC1C331UP | (8) | 500 |
| | 390 | 8 | 10.2 | F | 410 | 0.20 | 3 | 0.23 | EEETC1C391UP | (8) | 500 |
| | 680 | 10 | 10.2 | G | 750 | 0.15 | 2 | 0.23 | EEETC1C681UP | (8) | 500 |
| 25 | 220 | 8 | 10.2 | F | 410 | 0.20 | 3 | 0.18 | EEETC1E221UP | (8) | 500 |
| | 330 | 8 | 10.2 | F | 410 | 0.20 | 3 | 0.18 | EEETC1E331UP | (8) | 500 |
| | 470 | 10 | 10.2 | G | 750 | 0.15 | 2 | 0.18 | EEETC1E471UP | (8) | 500 |
| 35 | 220 | 8 | 10.2 | F | 410 | 0.20 | 3 | 0.16 | EEETC1V221UP | (8) | 500 |
| | 330 | 10 | 10.2 | G | 750 | 0.15 | 2 | 0.16 | EEETC1V331UP | (8) | 500 |
| | 390 | 10 | 10.2 | G | 750 | 0.15 | 2 | 0.16 | EEETC1V391UP | (8) | 500 |

· Please refer to the page of “Reflow Profile” and “The Taping Dimensions”.
· When requesting vibration-proof product, please put the last “V” instead to “P”

# Surface Mount Type

Series : **TQ** Type : **V**
**High temperature**
**Lead-Free reflow (suffix : A*)**


## Features

- 1 size smaller and same performance compare with V-TK series
- Low ESR (85 % low ESR in low temperature after endurance compare with V-TP series)
- Endurance : 125 °C 2000 h
- RoHS compliant

## Recommended applications

- Automotive

## Specifications

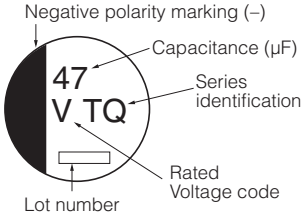
| | | | |
|---|---|---|---|
| Category temperature range | –40 °C to +125 °C | | |
| Rated voltage range | 35 V.DC | | |
| Capacitance range | 47 µF to 100 µF | | |
| Capacitance tolerance | ±20 % (120 Hz/+20 °C) | | |
| Leakage current | I ≦ 0.01 CV (µA) After 2 minutes | | |
| Dissipation factor (tan $\delta$) | Please see the attached characteristics list | | |
| Endurance | After the life test with DC rated working voltage at +125 °C±2 °C for 2000 hours, the capacitors shall meet the limits specified below. | | |
| | Capacitance change | Within ±30 % of the initial value | |
| | tan $\delta$ | ≦300 % of the initial limit | |
| | DC leakage current | Within the initial limit | |
| | ESR after endurance (Ω/100kHz) | | Size Code D8 |
| | | Initial (+20 °C) | 0.30 |
| | | After 2000 h (-40 °C) | 6 |
| 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) | | |
| 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 | |
| | tan $\delta$ | Within the initial limit | |
| | DC leakage current | Within the initial limit | |
| AEC-Q200 | AEC-Q200 compliant | | |

## Frequency correction factor for ripple current

| Frequency (Hz) | 120 | 1 k | 10 k | 100 k to |
|---|---|---|---|---|
| Correction factor | 0.65 | 0.85 | 0.95 | 1.00 |

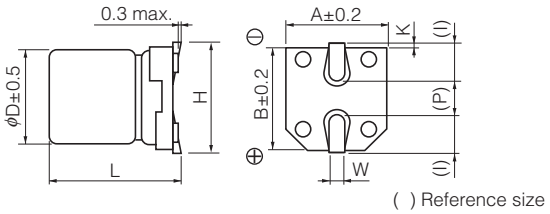
## Marking

Example : 35 V.DC 47 µF
Marking color : BLACK




| | |
|---|---|
| R. Voltage (V.DC) | 35 |
| Code | V |

## Dimensions




( ) Reference size

(Unit : mm)

| Size code | φD | L | A, B | H | I | W | P | K |
|---|---|---|---|---|---|---|---|---|
| D8 | 6.3 | 7.7±0.3 | 6.6 | 7.8 max. | 2.6 | 0.65±0.1 | 1.8 | $0.35^{+0.15}_{-0.20}$ |

## Characteristics list

Endurance : 125 °C 2000 h

| Rated voltage (V.DC) | Cap. (±20 %) (μF) | Case size (mm) | | Size code | Specification | | | Part No. | Reflow | Min. Packaging Q'ty |
|---|---|---|---|---|---|---|---|---|---|---|
| | | φD | L | | Ripple current (100 kHz) (+125 °C) (mA r.m.s.) | ESR (100 kHz) (+20 °C) (Ω) | tan δ (120 Hz) (+20 °C) | | | Taping (pcs) |
| 35 | 47 | 6.3 | 7.7 | D8 | 197 | 0.30 | 0.16 | EEETQV470XAP | (5) | 900 |
| | 100 | 6.3 | 7.7 | D8 | 197 | 0.30 | 0.16 | EEETQV101XAP | (5) | 900 |

If Part number exceeds 12 digits, voltage code is abbreviated as follows; 1V → V
· Please refer to the page of “Reflow Profile” and “The Taping Dimensions”.

# Surface Mount Type

Series : **EB** (Large Can Size) Type : **V**

## Features

- Endurance : 105 °C 3000 h to 5000 h
- RoHS compliant

## Specifications

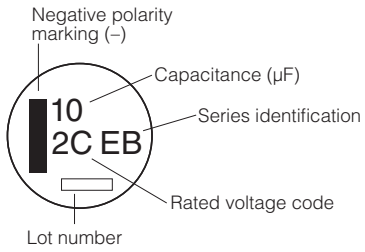
| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Category temperature range | –25 °C to +105 °C | | | | | | | |
| Rated voltage range | 160 V.DC to 450 V.DC | | | | | | | |
| Capacitance range | 2.2 µF to 100 µF | | | | | | | |
| Capacitance tolerance | ±20 % (120 Hz/+20 °C) | | | | | | | |
| Leakage current | I ≦ 0.06 CV +10 (µA) After 2 minutes | | | | | | | |
| Dissipation factor (tan δ) | Please see the attached characteristics list | | | | | | | |
| Characteristics at low temperature | V.DC | 160 | 200 | 250 | 350 | 400 | 450 | (Impedance ratio at 120 Hz) |
| | Z(–25 °C) / Z(+20 °C) | 2 | 2 | 3 | 5 | 6 | 6 | |
| Endurance | After the life test with DC rated working voltage at +105 °C±2 °C for 5000 hours, the capacitors shall meet the limits specified below. (Size code G13 : 3000 hours, G17 : 4000 hours) | | | | | | | |
| | Capacitance change | Within ±20 % of the initial value | | | | | | |
| | tan δ | ≦200 % of the initial limit | | | | | | |
| | DC leakage current | Within the initial limit | | | | | | |
| 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) | | | | | | | |
| 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 | | | | | | |
| | tan δ | Within the initial limit | | | | | | |
| | DC leakage current | Within the initial limit | | | | | | |

## Frequency correction factor for ripple current

| Rated Voltage (V.DC) \ Frequency (Hz) | 120 | 1 k | 10 k ≦ f < 30 k | 30 k ≦ f ≦ 100 k |
|---|---|---|---|---|
| 160 to 250 | 0.55 | 0.85 | 0.90 | 1.00 |
| 350 to 450 | 0.50 | 0.80 | 0.90 | 1.00 |

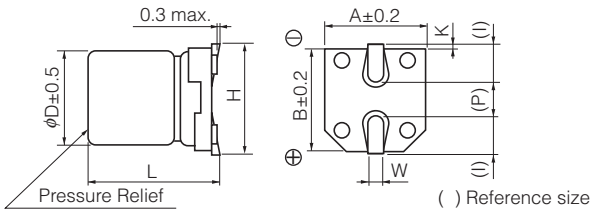
## Marking

Example : 160 V.DC 10 µF
Marking color : BLACK




| R. Voltage (V.DC) | 160 | 200 | 250 | 350 | 400 | 450 |
|---|---|---|---|---|---|---|
| Code | 2C | 2D | 2E | 2V | 2G | 2W |

## Dimensions




(Unit : mm)

| Size code | φD | L | A,B | H | I | W | P | K |
|---|---|---|---|---|---|---|---|---|
| G13 | 10.0 | 13.5±0.5 | 10.3 | 12.0 max. | 3.5 | 0.9±0.2 | 4.6 | 0.70±0.20 |
| G17 | 10.0 | 16.5±0.5 | 10.3 | 12.0 max. | 3.5 | 0.9±0.2 | 4.6 | 0.70±0.20 |
| H16 | 12.5 | 16.5±0.5 | 13.5 | 15.0 max. | 4.7 | 0.9±0.2 | 4.4 | 0.70±0.30 |
| J16 | 16.0 | 16.5±0.5 | 17.0 | 19.0 max. | 5.5 | 1.2±0.3 | 6.7 | 0.70±0.30 |
| J21 | 16.0 | 21.5±0.5 | 17.0 | 19.0 max. | 5.5 | 1.2±0.3 | 6.7 | 0.70±0.30 |
| K16 | 18.0 | 16.5±0.5 | 19.0 | 21.0 max. | 6.7 | 1.2±0.3 | 6.7 | 0.70±0.30 |
| K21 | 18.0 | 21.5±0.5 | 19.0 | 21.0 max. | 6.7 | 1.2±0.3 | 6.7 | 0.70±0.30 |

## Characteristics list

Endurance : 105 °C 5000 h (G13 : 3000 h, G17 : 4000 h)

| Rated voltage (V.DC) | Cap. (±20 %) (μF) | Case size (mm) | | Size code | Specification | | | Part No. | Reflow | Min. Packaging Q'ty |
|---|---|---|---|---|---|---|---|---|---|---|
| | | φD | L | | Ripple current (100 kHz) (+105 °C) (mA r.m.s.) | tan δ (120 Hz) (+20 °C) | Endurance (hours) | | | Taping |
| 160 | 10 | 10 | 13.5 | G13 | 70 | 0.15 | 3000 | EEVEB2C100Q | (4) | 250 |
| | 33 | 12.5 | 16.5 | H16 | 470 | 0.15 | 5000 | EEVEB2C330SQ | (4) | 150 |
| | 47 | 16 | 16.5 | J16 | 600 | 0.15 | 5000 | EEVEB2C470SM | (4) | 125 |
| | 68 | 16 | 21.5 | J21 | 750 | 0.15 | 5000 | EEVEB2C680M | (4) | 75 |
| | | 18 | 16.5 | K16 | 750 | 0.15 | 5000 | EEVEB2C680SM | (4) | 125 |
| | 100 | 18 | 21.5 | K21 | 1060 | 0.15 | 5000 | EEVEB2C101M | (4) | 75 |
| 200 | 10 | 10 | 16.5 | G17 | 80 | 0.15 | 4000 | EEVEB2D100Q | (4) | 200 |
| | 22 | 12.5 | 16.5 | H16 | 470 | 0.15 | 5000 | EEVEB2D220SQ | (4) | 150 |
| | 33 | 16 | 16.5 | J16 | 600 | 0.15 | 5000 | EEVEB2D330SM | (4) | 125 |
| | 47 | 18 | 16.5 | K16 | 600 | 0.15 | 5000 | EEVEB2D470SM | (4) | 125 |
| | 68 | 16 | 21.5 | J21 | 750 | 0.15 | 5000 | EEVEB2D680M | (4) | 75 |
| | 100 | 18 | 21.5 | K21 | 1060 | 0.15 | 5000 | EEVEB2D101M | (4) | 75 |
| 250 | 10 | 10 | 16.5 | G17 | 88 | 0.15 | 4000 | EEVEB2E100Q | (4) | 200 |
| | 22 | 16 | 16.5 | J16 | 560 | 0.15 | 5000 | EEVEB2E220SM | (4) | 125 |
| | 33 | 18 | 16.5 | K16 | 560 | 0.15 | 5000 | EEVEB2E330SM | (4) | 125 |
| | 47 | 16 | 21.5 | J21 | 710 | 0.15 | 5000 | EEVEB2E470M | (4) | 75 |
| | 68 | 18 | 21.5 | K21 | 990 | 0.15 | 5000 | EEVEB2E680M | (4) | 75 |
| 350 | 3.3 | 10 | 13.5 | G13 | 38 | 0.20 | 3000 | EEVEB2V3R3Q | (4) | 250 |
| | 4.7 | 10 | 16.5 | G17 | 50 | 0.20 | 4000 | EEVEB2V4R7Q | (4) | 200 |
| | 10 | 16 | 16.5 | J16 | 270 | 0.20 | 5000 | EEVEB2V100SM | (4) | 125 |
| | 22 | 18 | 16.5 | K16 | 350 | 0.20 | 5000 | EEVEB2V220SM | (4) | 125 |
| | 33 | 16 | 21.5 | J21 | 480 | 0.20 | 5000 | EEVEB2V330M | (4) | 75 |
| | 47 | 18 | 21.5 | K21 | 670 | 0.20 | 5000 | EEVEB2V470M | (4) | 75 |
| 400 | 3.3 | 10 | 13.5 | G13 | 40 | 0.24 | 3000 | EEVEB2G3R3Q | (4) | 250 |
| | 4.7 | 10 | 16.5 | G17 | 50 | 0.24 | 4000 | EEVEB2G4R7Q | (4) | 200 |
| | 10 | 16 | 16.5 | J16 | 250 | 0.24 | 5000 | EEVEB2G100SM | (4) | 125 |
| | 22 | 16 | 21.5 | J21 | 410 | 0.24 | 5000 | EEVEB2G220M | (4) | 75 |
| | 33 | 18 | 21.5 | K21 | 600 | 0.24 | 5000 | EEVEB2G330M | (4) | 75 |
| 450 | 2.2 | 10 | 13.5 | G13 | 29 | 0.24 | 3000 | EEVEB2W2R2Q | (4) | 250 |
| | 3.3 | 10 | 16.5 | G17 | 41 | 0.24 | 4000 | EEVEB2W3R3Q | (4) | 200 |
| | 4.7 | 12.5 | 16.5 | H16 | 49 | 0.24 | 5000 | EEVEB2W4R7SQ | (4) | 150 |
| | 10 | 18 | 16.5 | K16 | 310 | 0.24 | 5000 | EEVEB2W100SM | (4) | 125 |
| | 22 | 18 | 21.5 | K21 | 560 | 0.24 | 5000 | EEVEB2W220M | (4) | 75 |

· Please refer to the page of “Reflow Profile” and “The Taping Dimensions”.
· When requesting vibration-proof product, please put the last “V” instead to “Q or M”

## CAUTION AND WARNING

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