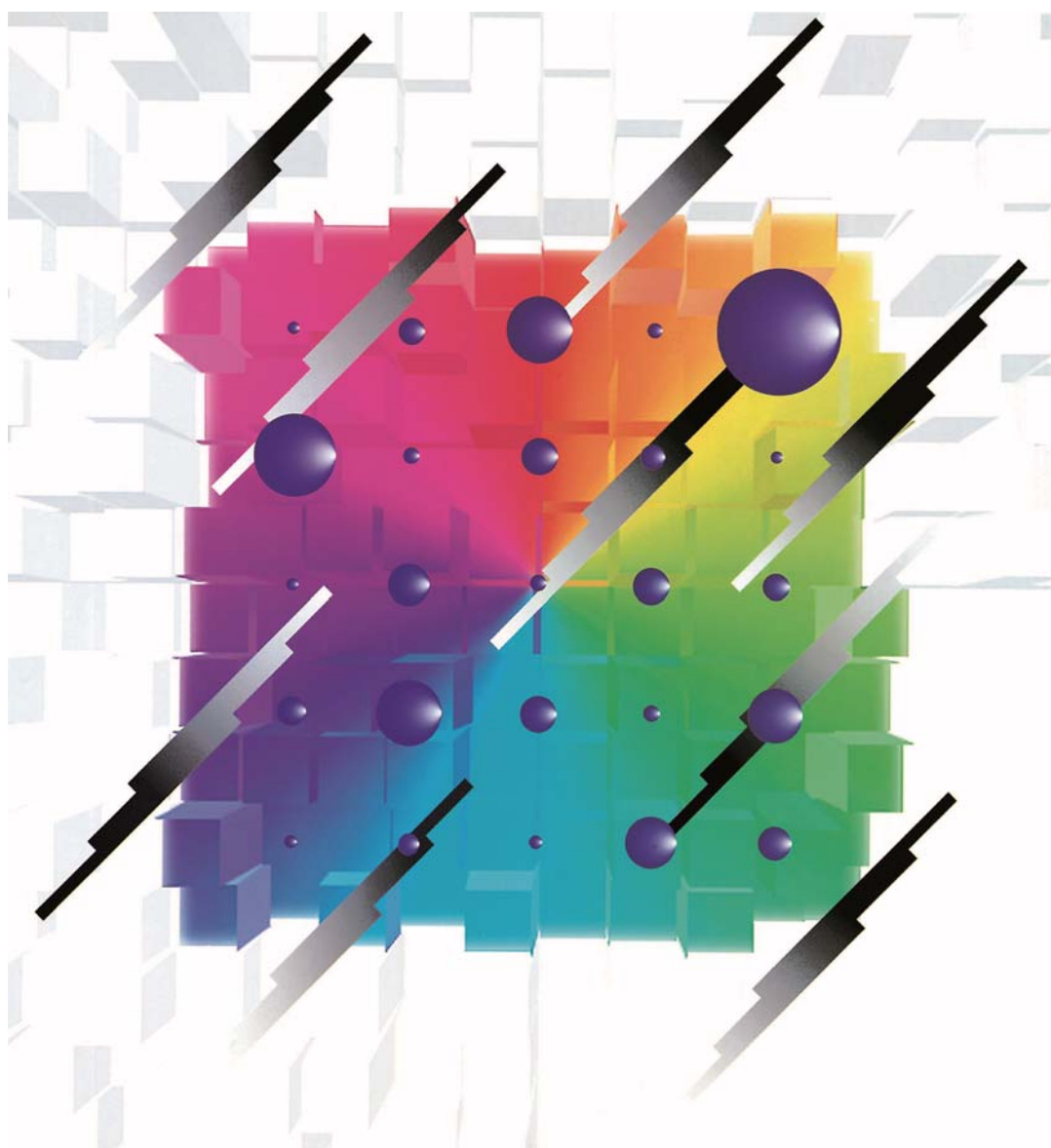


### SP-Cap

Conductive Polymer Aluminum Electrolytic Capacitors



## 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<sub>2</sub>, H<sub>2</sub>S, NH<sub>3</sub>, SO<sub>2</sub>, or NO<sub>x</sub>.
  - (4) In an environment where strong static electricity or electromagnetic waves exist.
  - (5) Mounting or placing heat-generating components or inflammables, such as vinyl-coated wires, near these products.
  - (6) Sealing or coating of these products or a printed circuit board on which these products are mounted, with resin and other material.
  - (7) Using solvent, water or water-soluble cleaner for flux cleaning agent after soldering. (In particular, when using water or a water-soluble cleaning agent, be careful not to leave water residues)
  - (8) Using in the atmosphere 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.

## ⚠ Application Guidelines (SP-Cap)

### 1. Circuit design

#### 1.1 Prohibited circuits for use

Do not use the SP-Cap with the following circuit.

- (1) Time-constant circuit
- (2) Coupling circuits
- (3) 2 or more SP-Cap connected serially
- (4) Circuit which are greatly affected by leakage current
- (5) High-impedance voltage retention circuits

#### 1.2 Voltage and polarity

The application of over-voltage and reverse voltage described below can cause increases in leakage current and short circuits. Applied voltage, refers to the voltage value including the peak value of the transitional Instantaneous voltage and the peak value of ripple voltage, not just steady line voltage.

Design your circuit so that the peak voltage does not exceed the stipulated voltage.

[Over-Voltage]

Do not apply over-voltage in excess of the rated voltage. Do not apply voltage, which exceeds the full rated voltage when the SP-Cap receive impulse voltage, instantaneous high voltage, high pulse voltage etc.

[Reverse-Voltage]

Do not apply reverse-voltage

#### 1.3 Ripple current

Use the SP-Cap within the stipulated permitted ripple current.

When excessive ripple current is applied to the SP-Cap, it causes increases in leakage current and short circuits due to self-heating.

Even when using the SP-Cap under the permissible ripple current, reverse voltage may occur if the DC bias voltage is low.

#### 1.4 Leakage current

There is a risk of leakage current characteristics increasing even if the following use environments are within the stipulated range. However, even if the leakage current increases, the SP-Cap self-repairing function will reduce the leakage current in most cases when a voltage is applied.

- (1) After re-flow
- (2) Shelf conditions such as high temperature with no load, high temperature high humidity with no load and sudden temperature changes.

#### 1.5 Temperature

- (1) Use at or under the rated (guaranteed) temperature.

Operation at temperatures exceeding specifications causes large changes in the SP-Cap electrical properties, and deterioration than can potentially lead to failure.

When calculating the operating temperature of the SP-Cap, be sure to include not only the ambient temperature and internal temperature of the unit, but also radiation from heat generating elements inside the unit (power transistors, resistors, etc.), and self-heating due to ripple current.

- (2) Specified ESR is a value at the time of shipping from factory. ESR may change upon use conditions.

#### 1.6 Failure rate

The majority of failure modes are short circuits or increases in leakage current.

The main factors of failure are mechanical stress, heat stress and electric stress due to re-flow and heat from the use temperature environment.

Even within the stipulated limits, it is possible to lower the failure rate by reducing use conditions such as temperature and voltage. Please be sure to have ample margin in your design.

[Expected Failure Rate]

- (1) Data based on our reliability tests: 8.2 Fit or less (Based on applied rated voltage at 105 °C)
- (2) Market failure rate: 0.13 Fit or less (Based on c=0, Reliability standard : 60 %)

#### 1.7 Mounting area consideration

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

## 2. Mounting

### 2.1 When mounting

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

### 2.2 Soldering

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

### 2.3 Land size

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

### 2.4 Mechanical stress

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

### 2.5 Circuit board cleaning

SP-Cap should be cleaned after soldering in accordance with the following conditions.

Temperature : Less than 60 °C

Time : Within 5min

Be sure to sufficiently wash and dry (20 min at 100 °C) the board afterward.

[Recommended Cleaning Solvents]

Pine Alpha ST-100S, Clean-thru 750H / 750L / 710M, Aqua Cleaner 210SEP, Sunelec B-12

DK Beclear CW-5790, Techno Cleaner 219, Cold Cleaner P3-375, Telpene Cleaner EC-7R

Technocare FRW-17 / FRW-1 / FRV-1, AXREL 32, IPA (Isopropyl alcohol)

- (1) Consult our factory when performing processes with cleaning solvents other than those listed above or deionized water.
- (2) The use of ozone depleting cleaning agents are not recommended in the interest of protecting the environment.
- (3) In the case of using ultrasonic cleaning, the terminals may be broken. Therefore, please test before using in mass production.

## 3. Usage environment of equipment

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

- (1) In liquid, such as Water, Oil, Chemicals, or Organic solvent.
- (2) In direct sunlight, outdoors, or in dust.
- (3) In vapor, such as dew condensation water of resistive element, or water leakage, salty air, or air with a high concentration corrosive gas, such as Cl<sub>2</sub>, H<sub>2</sub>S, NH<sub>3</sub>, SO<sub>2</sub>, or NO<sub>2</sub>.
- (4) In an environment where strong static electricity or electromagnetic waves exist.
- (5) Mounting or placing heat-generating components or inflammables, such as vinyl-coated wires, near these SP-Cap.
- (6) Sealing or coating of these SP-Cap or a printed circuit board on which these SP-Cap are mounted, with resin and other material.
- (7) Acid or alkaline environments.
- (8) Environment subject to excessive vibration and shock.

## 4. Storage

SP-Cap should be stored in a moisture proof environment. Storage conditions before and after opening the moisture proof packaging as follows.

(If these conditions are exceeded, the package may absorb moisture and there is a risk of damage to the exterior due to heat stress during mounting.)

[Environment of Storage]

Temperature: 5 °C to 30 °C without direct sunlight

Humidity : Less than 70 %

Maximum storage term before opening the package (2 years after manufactured)

Maximum storage condition after opening the package (7 days after opening)

SP-Cap should be all used within the storage term after opening the package.

## 5. Transportation

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

## 6. Emergency procedures

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

## 7. Discarding

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

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

## ◇ Intellectual property right

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

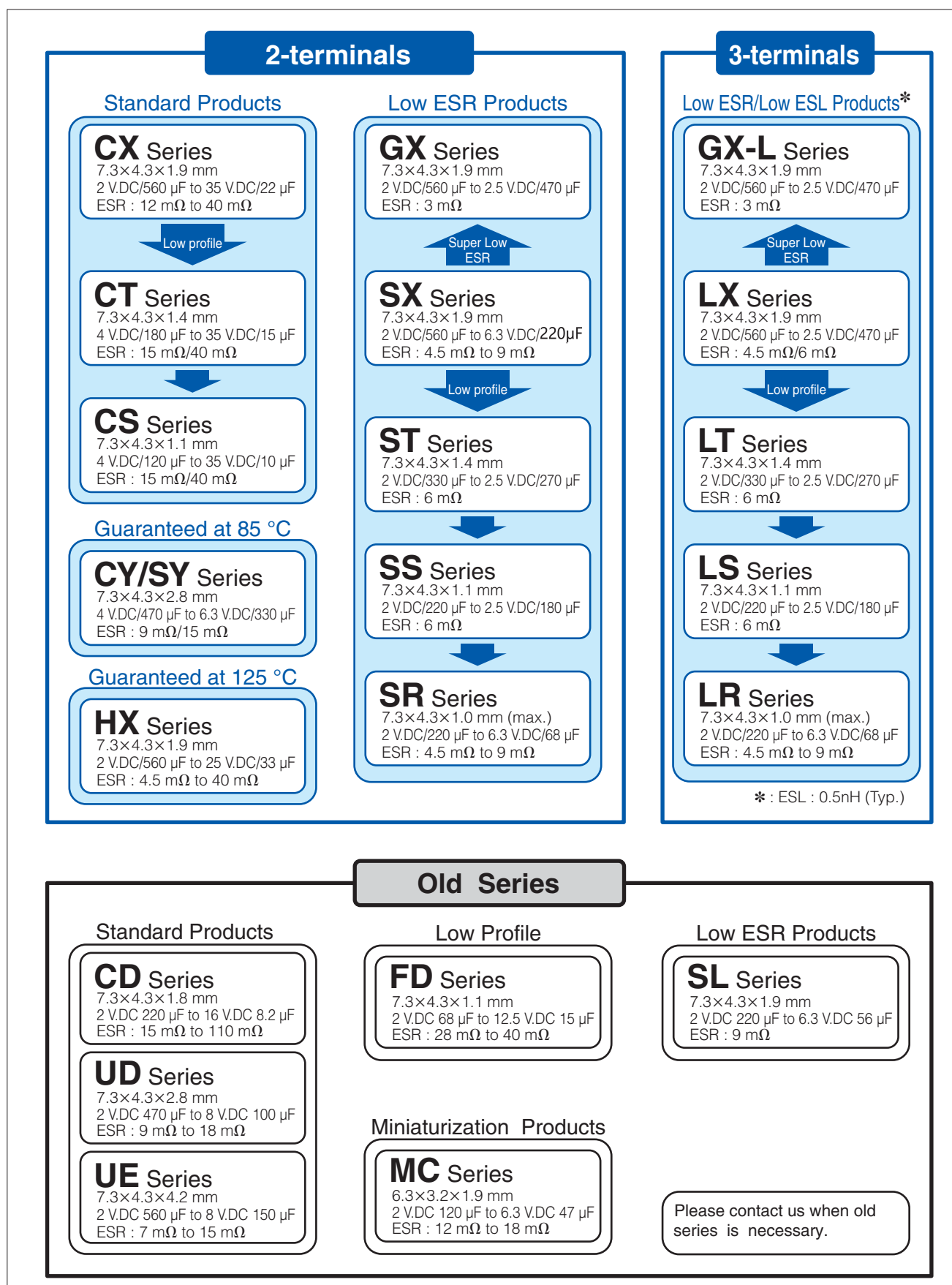
Representative patents relating to SP-Cap are as follows :

US Patent No. 7136276

### Line up

| Series | Part No.  | Features                                 | Low profile | Low ESR | Low ESL | High voltage | High Temperature | Category temperature range (°C) | Rated voltage (V.DC) | ESR (mΩ)  | Capacitance (μF) |
|--------|-----------|------------------------------------------|-------------|---------|---------|--------------|------------------|---------------------------------|----------------------|-----------|------------------|
| CX     | EEFCX---- | Standard                                 |             |         |         | ●            |                  | -55 to 105                      | 2 to 35              | 12 to 40  | 15 to 560        |
| CT     | EEFCF---- |                                          | ●           |         |         | ●            |                  | -55 to 105                      | 4 to 35              | 15 to 40  | 15 to 180        |
| CS     | EEFCS---- |                                          | ●           |         |         | ●            |                  | -55 to 105                      | 4 to 35              | 15 to 40  | 10 to 120        |
| SX     | EEFSX---- | Low ESR                                  |             | ●       |         |              |                  | -55 to 105                      | 2 to 6.3             | 4.5 to 9  | 82 to 560        |
| GX     | EEFGX---- | Super low ESR/High ripple current        |             | ●       | ●       |              |                  | -55 to 105                      | 2 to 2.5             | 3         | 330 to 560       |
| LX     | EEFLX---- | Low ESR/Low ESL                          |             | ●       | ●       |              |                  | -55 to 105                      | 2 to 2.5             | 4.5 to 6  | 330 to 560       |
| ST     | EEFST---- | Low profile/Low ESR                      | ●           | ●       |         |              |                  | -55 to 105                      | 2 to 2.5             | 6         | 270 to 330       |
| LT     | EEFLT---- | Low profile/Low ESR/Low ESL              | ●           | ●       | ●       |              |                  | -55 to 105                      | 2 to 2.5             | 6         | 270 to 330       |
| SS     | EEFSS---- | Low profile/Low ESR                      | ●           | ●       |         |              |                  | -55 to 105                      | 2 to 2.5             | 6         | 180 to 220       |
| LS     | EEFLS---- | Low profile/Low ESR/Low ESL              | ●           | ●       | ●       |              |                  | -55 to 105                      | 2 to 2.5             | 6         | 180 to 220       |
| SR     | EEFSR---- | Low profile(1 mm max.)                   | ●           | ●       |         |              |                  | -55 to 105                      | 2 to 6.3             | 4.5 to 9  | 68 to 220        |
| LR     | EEFLR---- | Low profile(1 mm max.)/Low ESL           | ●           | ●       | ●       |              |                  | -55 to 105                      | 2 to 6.3             | 4.5 to 9  | 68 to 220        |
| CY     | ECGCY---- | Guaranteed at 85°C<br>Height 3.0 mm max. |             | ●       |         |              |                  | -55 to 85                       | 4, 6.3               | 15        | 330 to 470       |
| SY     | ECGSY---- |                                          |             |         |         |              |                  | -55 to 85                       | 4, 6.3               | 9         | 330 to 470       |
| HX     | EEFHX---- | Guaranteed at 125 °C                     |             | ●       |         | ●            | ●                | -55 to 125                      | 2 to 25              | 4.5 to 40 | 15 to 560        |

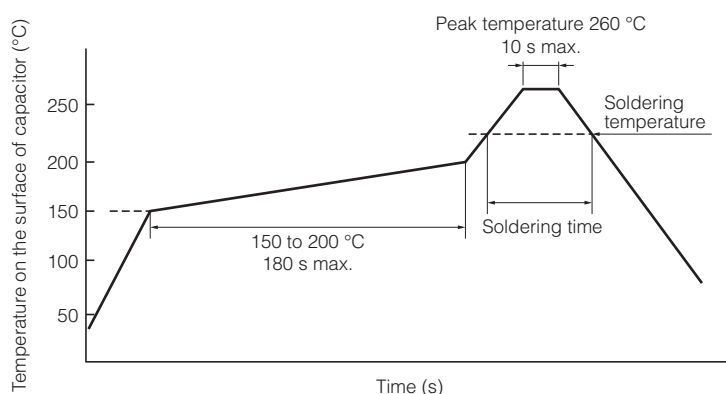
## Diagram



## Mounting Specifications

### ● Recommendable reflow soldering

<Standard>



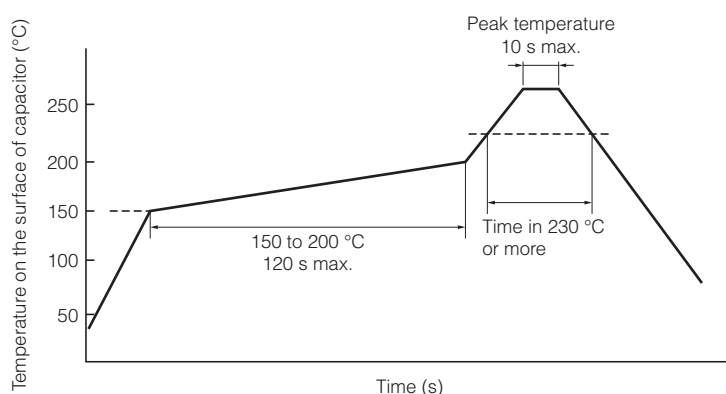
Reflow cycle : 3 max.

Soldering temperature and Soldering time

| Temperature                | Time       |
|----------------------------|------------|
| $\geq 255^{\circ}\text{C}$ | 30 s max.  |
| $\geq 230^{\circ}\text{C}$ | 130 s max. |
| $\geq 217^{\circ}\text{C}$ | 150 s max. |

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

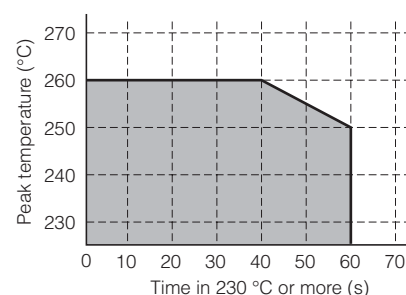
<260 °C>



Reflow cycle : 2 max.

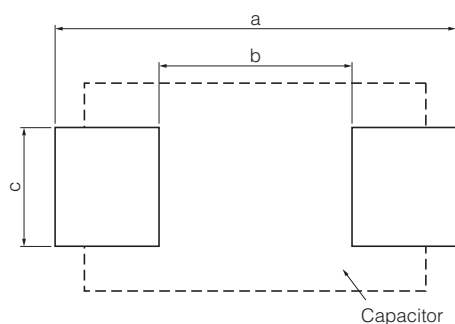
EX.)

| Peak temperature  | Time in 230 °C or more |
|-------------------|------------------------|
| 260 °C, 10 s max. | 40 s max.              |
| 250 °C, 10 s max. | 60 s max.              |



### ● Typical land pattern

For standard terminal (2-terminals)

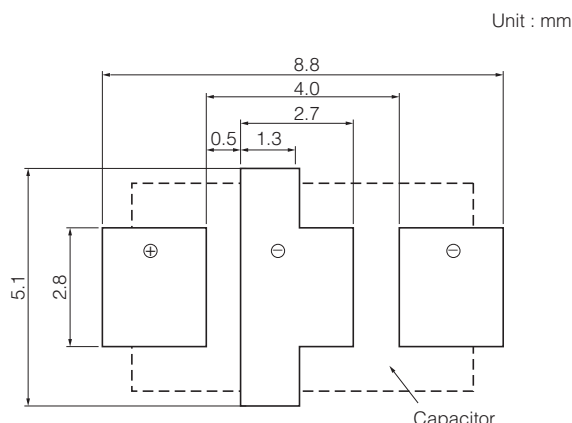


Unit : mm

| Series               | a   | b   | c   |
|----------------------|-----|-----|-----|
| Standard (Except MC) | 8.8 | 4.0 | 2.8 |
| (MC)                 | 7.2 | 2.6 | 2.2 |

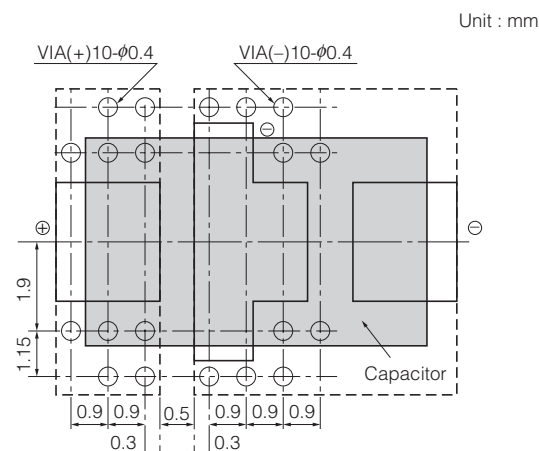
## ● Typical land pattern

For Low ESL terminal (3-terminals)  
(LR, LS, LT, LX, GX-L series)



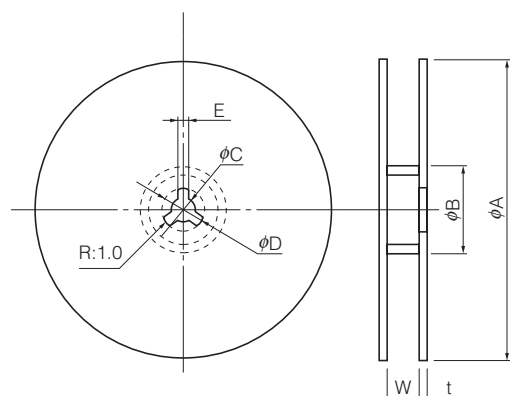
## ● VIA

For Low ESL terminal (3-terminals)  
(LR, LS, LT, LX, GX-L series)



## Packaging Specifications

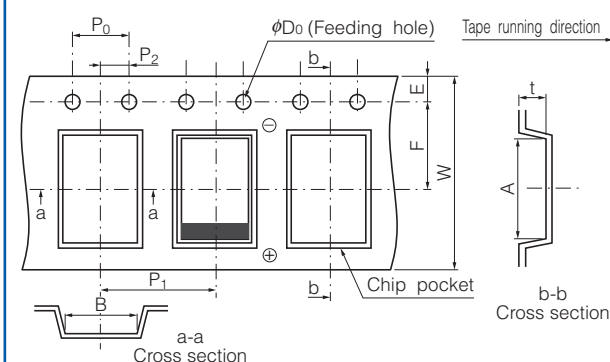
### ● Reel Dimensions



Unit : mm

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

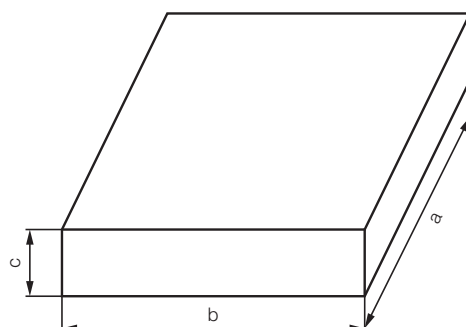
### ● Embossed Taping



Unit : mm

| A              |                | B                                   |                                                   | W           | F       | E         | P <sub>1</sub> |
|----------------|----------------|-------------------------------------|---------------------------------------------------|-------------|---------|-----------|----------------|
| Standard       | (MC series)    | Standard                            | (MC series)                                       |             |         |           |                |
| 7.6±0.2        | 6.3±0.3        | 4.5±0.2                             | 3.6±0.3                                           | 12.0±0.3    | 5.5±0.1 | 1.75±0.10 | 8.0±0.1        |
| P <sub>2</sub> | P <sub>0</sub> | φD <sub>0</sub>                     | Upper row : Product height (mm) / Lower berth : t |             |         |           |                |
| to 1.1         | 1.4 to 1.9     | 2.8                                 | 4.2                                               | (MC series) |         |           |                |
| 2.0±0.1        | 4.0±0.1        | 1.5 <sup>+0.1</sup> <sub>-0.1</sub> | 1.5±0.2                                           | 2.4±0.2     | 3.5±0.2 | 4.3±0.2   | 2.8±0.3        |

## Packaging Box Dimensions



Unit : mm

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

## Surface Mount Type

## SP-Cap

Series : **CS, CT, CX**



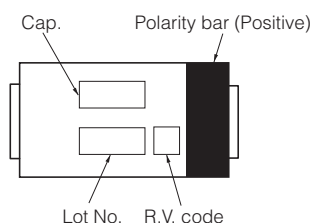
### Features

- High voltage (35 V.DC max.)
- Low profile (Height 1.0 mm max.)
- High ripple current (5600 mAr.m.s. max.)
- RoHS compliance, Halogen free

### Specifications

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

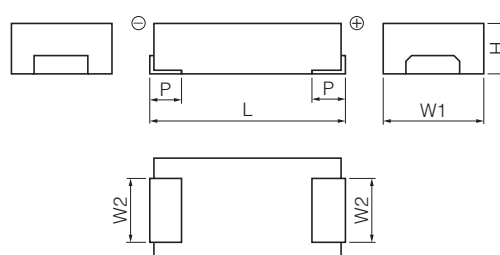
### Marking



Rated voltage mark

|   |          |   |          |   |         |
|---|----------|---|----------|---|---------|
| d | 2 V.DC   | j | 6.3 V.DC | D | 20 V.DC |
| e | 2.5 V.DC | A | 10 V.DC  | E | 25 V.DC |
| g | 4 V.DC   | C | 16 V.DC  | V | 35 V.DC |

### Dimensions (not to scale)



Unit : mm

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

\* Externals of figure are the reference.

## Characteristics list

Reflow \*3

&lt;Standard&gt;

| Series | Rated voltage (V.DC) | Capacitance (±20 %) (μF) | Case size (mm) |     |     | Specification                    |                     | Part number | Min.*4 Packaging Q'ty (pcs) |
|--------|----------------------|--------------------------|----------------|-----|-----|----------------------------------|---------------------|-------------|-----------------------------|
|        |                      |                          | L              | W   | H   | *1<br>Ripple current (mA r.m.s.) | *2<br>ESR (mΩ max.) |             |                             |
| CS     | 4                    | 120                      | 7.3            | 4.3 | 1.1 | 5100                             | 15                  | EEFCS0G121R | 3500                        |
|        | 6.3                  | 68                       | 7.3            | 4.3 | 1.1 | 5100                             | 15                  | EEFCS0J680R | 3500                        |
|        | 10                   | 47                       | 7.3            | 4.3 | 1.1 | 3200                             | 40                  | EEFCS1A470R | 3500                        |
|        | 16                   | 15                       | 7.3            | 4.3 | 1.1 | 3200                             | 40                  | EEFCS1C150R | 3500                        |
|        |                      | 22                       | 7.3            | 4.3 | 1.1 | 3200                             | 40                  | EEFCS1C220R | 3500                        |
|        |                      | 33                       | 7.3            | 4.3 | 1.1 | 3200                             | 40                  | EEFCS1C330R | 3500                        |
|        | 20                   | 10                       | 7.3            | 4.3 | 1.1 | 3200                             | 40                  | EEFCS1D100R | 3500                        |
|        |                      | 15                       | 7.3            | 4.3 | 1.1 | 3200                             | 40                  | EEFCS1D150R | 3500                        |
|        |                      | 22                       | 7.3            | 4.3 | 1.1 | 3200                             | 40                  | EEFCS1D220R | 3500                        |
|        | 25                   | 10                       | 7.3            | 4.3 | 1.1 | 3200                             | 40                  | EEFCS1E100R | 3500                        |
|        |                      | 15                       | 7.3            | 4.3 | 1.1 | 3200                             | 40                  | EEFCS1E150R | 3500                        |
| CT     | 35                   | 10                       | 7.3            | 4.3 | 1.1 | 3200                             | 40                  | EEFCS1V100R | 3500                        |
|        | 4                    | 180                      | 7.3            | 4.3 | 1.4 | 5100                             | 15                  | EEFCT0G181R | 3500                        |
|        | 6.3                  | 100                      | 7.3            | 4.3 | 1.4 | 5100                             | 15                  | EEFCT0J101R | 3500                        |
|        | 10                   | 68                       | 7.3            | 4.3 | 1.4 | 3200                             | 40                  | EEFCT1A680R | 3500                        |
|        | 16                   | 47                       | 7.3            | 4.3 | 1.4 | 3200                             | 40                  | EEFCT1C470R | 3500                        |
|        | 20                   | 33                       | 7.3            | 4.3 | 1.4 | 3200                             | 40                  | EEFCT1D330R | 3500                        |
|        |                      | 47                       | 7.3            | 4.3 | 1.4 | 3200                             | 40                  | EEFCT1D470R | 3500                        |
|        | 25                   | 22                       | 7.3            | 4.3 | 1.4 | 3200                             | 40                  | EEFCT1E220R | 3500                        |
|        | 35                   | 15                       | 7.3            | 4.3 | 1.4 | 3200                             | 40                  | EEFCT1V150R | 3500                        |

\*1: Ripple current (100 kHz/ +45°C ), \*2: ESR (100 kHz/+20 °C)

\*3: Please refer to the page of "Mounting Specifications".

\*4: Please contact us when 500 pcs packing is necessary.

## Characteristics list

Reflow <sup>\*3</sup>

&lt;Standard&gt;

| Series | Rated voltage (V.DC) | Capacitance (±20 %) (μF) | Case size (mm) |     |     | Specification                              |                                | Part number  | Min.*4 Packaging Q'ty (pcs) |
|--------|----------------------|--------------------------|----------------|-----|-----|--------------------------------------------|--------------------------------|--------------|-----------------------------|
|        |                      |                          | L              | W   | H   | <sup>*1</sup><br>Ripple current (mAr.m.s.) | <sup>*2</sup><br>ESR (mΩ max.) |              |                             |
| CX     | 2                    | 220                      | 7.3            | 4.3 | 1.9 | 5100                                       | 15                             | EEFCX0D221R  | 3500                        |
|        |                      | 270                      | 7.3            | 4.3 | 1.9 | 5600                                       | 12                             | EEFCX0D271XR | 3500                        |
|        |                      | 330                      | 7.3            | 4.3 | 1.9 | 5100                                       | 15                             | EEFCX0D331R  | 3500                        |
|        |                      |                          | 7.3            | 4.3 | 1.9 | 5600                                       | 12                             | EEFCX0D331XR | 3500                        |
|        |                      | 390                      | 7.3            | 4.3 | 1.9 | 5100                                       | 15                             | EEFCX0D391R  | 3500                        |
|        |                      | 470                      | 7.3            | 4.3 | 1.9 | 5100                                       | 15                             | EEFCX0D471R  | 3500                        |
|        | 2.5                  | 560                      | 7.3            | 4.3 | 1.9 | 5100                                       | 15                             | EEFCX0D561R  | 3500                        |
|        |                      | 220                      | 7.3            | 4.3 | 1.9 | 5100                                       | 15                             | EEFCX0E221R  | 3500                        |
|        |                      | 330                      | 7.3            | 4.3 | 1.9 | 5100                                       | 15                             | EEFCX0E331R  | 3500                        |
|        |                      | 390                      | 7.3            | 4.3 | 1.9 | 5100                                       | 15                             | EEFCX0E391R  | 3500                        |
|        |                      | 470                      | 7.3            | 4.3 | 1.9 | 5100                                       | 15                             | EEFCX0E471R  | 3500                        |
|        | 4                    | 150                      | 7.3            | 4.3 | 1.9 | 5100                                       | 15                             | EEFCX0G151R  | 3500                        |
|        |                      | 180                      | 7.3            | 4.3 | 1.9 | 5100                                       | 15                             | EEFCX0G181R  | 3500                        |
|        |                      |                          | 7.3            | 4.3 | 1.9 | 5600                                       | 12                             | EEFCX0G181XR | 3500                        |
|        |                      | 220                      | 7.3            | 4.3 | 1.9 | 5100                                       | 15                             | EEFCX0G221R  | 3500                        |
|        |                      |                          | 7.3            | 4.3 | 1.9 | 5600                                       | 12                             | EEFCX0G221XR | 3500                        |
|        |                      | 270                      | 7.3            | 4.3 | 1.9 | 5100                                       | 15                             | EEFCX0G271R  | 3500                        |
|        |                      | 330                      | 7.3            | 4.3 | 1.9 | 5100                                       | 15                             | EEFCX0G331R  | 3500                        |
|        |                      | 100                      | 7.3            | 4.3 | 1.9 | 5100                                       | 15                             | EEFCX0J101R  | 3500                        |
|        | 6.3                  | 120                      | 7.3            | 4.3 | 1.9 | 5100                                       | 15                             | EEFCX0J121R  | 3500                        |
|        |                      | 150                      | 7.3            | 4.3 | 1.9 | 5100                                       | 15                             | EEFCX0J151R  | 3500                        |
|        |                      |                          | 7.3            | 4.3 | 1.9 | 5600                                       | 12                             | EEFCX0J151XR | 3500                        |
|        |                      | 180                      | 7.3            | 4.3 | 1.9 | 5100                                       | 15                             | EEFCX0J181R  | 3500                        |
|        |                      | 220                      | 7.3            | 4.3 | 1.9 | 5100                                       | 15                             | EEFCX0J221R  | 3500                        |
|        | 10                   | 47                       | 7.3            | 4.3 | 1.9 | 3200                                       | 40                             | EEFCX1A470R  | 3500                        |
|        |                      | 68                       | 7.3            | 4.3 | 1.9 | 3200                                       | 40                             | EEFCX1A680R  | 3500                        |
|        |                      | 100                      | 7.3            | 4.3 | 1.9 | 3200                                       | 40                             | EEFCX1A101R  | 3500                        |
|        | 16                   | 15                       | 7.3            | 4.3 | 1.9 | 3200                                       | 40                             | EEFCX1C150R  | 3500                        |
|        |                      | 22                       | 7.3            | 4.3 | 1.9 | 3200                                       | 40                             | EEFCX1C220R  | 3500                        |
|        |                      | 33                       | 7.3            | 4.3 | 1.9 | 3200                                       | 40                             | EEFCX1C330R  | 3500                        |
|        |                      | 47                       | 7.3            | 4.3 | 1.9 | 3200                                       | 40                             | EEFCX1C470R  | 3500                        |
|        |                      | 68                       | 7.3            | 4.3 | 1.9 | 3200                                       | 40                             | EEFCX1C680R  | 3500                        |
|        | 20                   | 22                       | 7.3            | 4.3 | 1.9 | 3200                                       | 40                             | EEFCX1D220R  | 3500                        |
|        |                      | 33                       | 7.3            | 4.3 | 1.9 | 3200                                       | 40                             | EEFCX1D330R  | 3500                        |
|        |                      | 47                       | 7.3            | 4.3 | 1.9 | 3200                                       | 40                             | EEFCX1D470R  | 3500                        |
|        |                      | 56                       | 7.3            | 4.3 | 1.9 | 3200                                       | 40                             | EEFCX1D560R  | 3500                        |
|        | 25                   | 15                       | 7.3            | 4.3 | 1.9 | 3200                                       | 40                             | EEFCX1E150R  | 3500                        |
|        |                      | 22                       | 7.3            | 4.3 | 1.9 | 3200                                       | 40                             | EEFCX1E220R  | 3500                        |
|        |                      | 33                       | 7.3            | 4.3 | 1.9 | 3200                                       | 40                             | EEFCX1E330R  | 3500                        |
|        | 35                   | 15                       | 7.3            | 4.3 | 1.9 | 3200                                       | 40                             | EEFCX1V150R  | 3500                        |
|        |                      | 22                       | 7.3            | 4.3 | 1.9 | 3200                                       | 40                             | EEFCX1V220R  | 3500                        |

\*1: Ripple current (100 kHz/ +45°C ), \*2: ESR (100 kHz/+20 °C)

\*3: Please refer to the page of "Mounting Specifications".

\*4: Please contact us when 500 pcs packing is necessary.

## Temperature compensation multipliers for ripple current

|                    | Temp.       | T ≤ 45 °C | 45 °C < T ≤ 85 °C | 85 °C < T ≤ 105 °C |
|--------------------|-------------|-----------|-------------------|--------------------|
| 2 V.DC to 6.3 V.DC | Coefficient | 1.0       | 0.7               | 0.25               |
| 10 V.DC to 35 V.DC |             | 1.0       | 0.8               | 0.5                |

## Surface Mount Type SP-Cap

Series : **SX (Low ESR Products)**



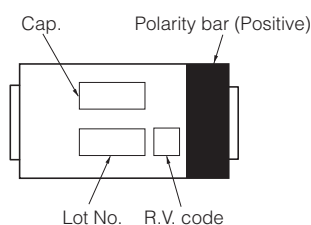
### Features

- Large capacitance (560  $\mu\text{F}$  max.)
- Low ESR (4.5  $\text{m}\Omega$  to 9  $\text{m}\Omega$ )
- High ripple current (8500  $\text{mA}_{\text{R.M.S.}}$  max.)
- RoHS compliance, Halogen free

### Specifications

|                             |                                                |                                   |              |              |
|-----------------------------|------------------------------------------------|-----------------------------------|--------------|--------------|
| Series                      | SX                                             |                                   |              |              |
| Category temp. range        | -55 °C to +105 °C                              |                                   |              |              |
| Rated voltage range         | 2 V.DC to 6.3 V.DC                             |                                   |              |              |
| Nominal cap.range           | 82 μF to 560 μF                                |                                   |              |              |
| Capacitance tolerance       | ±20 % (120 Hz/+20 °C)                          |                                   |              |              |
| DC leakage current          | I ≤ 0.1 CV (μA) 2 minutes                      |                                   |              |              |
| Dissipation factor (tan δ)  | ≤ 0.06 (120 Hz/+20 °C)                         |                                   |              |              |
| Surge voltage (V.DC)        | Rated voltage × 1.25 (15 °C to 35 °C)          |                                   |              |              |
| Endurance                   | +105 °C, 2000 h, rated voltage applied         |                                   |              |              |
|                             | Capacitance change                             | Within ±20 % of the initial value |              |              |
|                             | tan δ                                          | ≤ 2 times of the initial limit    |              |              |
|                             | DC leakage current                             | ≤ 3 times of the initial limit    |              |              |
| Damp heat<br>(Steady state) | +60 °C, 90 %, 500 h, No-applied voltage        |                                   |              |              |
|                             | Capacitance change of<br>initial measurd value | 2 to 2.5 V.DC                     | 4 V.DC       | 6.3 V.DC     |
|                             |                                                | +70 %, -20 %                      | +60 %, -20 % | +50 %, -20 % |
|                             | tan δ                                          | ≤ 2 times of the initial limit    |              |              |
|                             | DC leakage current                             | Within the initial limit          |              |              |

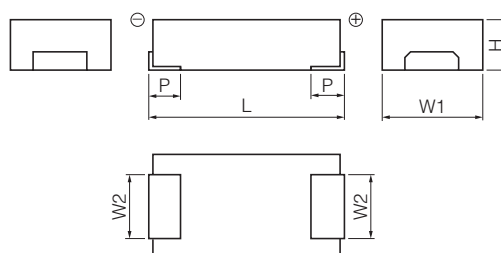
### Marking



Rated voltage mark

|   |          |
|---|----------|
| d | 2 V.DC   |
| e | 2.5 V.DC |
| g | 4 V.DC   |
| j | 6.3 V.DC |

### Dimensions (not to scale)



Unit : mm

| Series | $L \pm 0.2$ | $W1 \pm 0.2$ | $W2 \pm 0.1$ | $H \pm 0.1$ | $P \pm 0.3$ |
|--------|-------------|--------------|--------------|-------------|-------------|
| SX     | 7.3         | 4.3          | 2.4          | 1.9         | 1.3         |

\* Externals of figure are the reference.

## Characteristics list

|        |                      |                          |                |     |     |                                 |                     | Reflow *3    | <Standard>                  |      |
|--------|----------------------|--------------------------|----------------|-----|-----|---------------------------------|---------------------|--------------|-----------------------------|------|
| Series | Rated voltage (V.DC) | Capacitance (±20 %) (μF) | Case size (mm) |     |     | Specification                   |                     | Part number  | Min.*4 Packaging Q'ty (pcs) |      |
|        |                      |                          | L              | W   | H   | *1<br>Ripple current (mAr.m.s.) | *2<br>ESR (mΩ max.) |              |                             |      |
| SX     | 2                    | 180                      | 7.3            | 4.3 | 1.9 | 6300                            | 9                   | EEFSX0D181ER | 3500                        |      |
|        |                      | 220                      | 7.3            | 4.3 | 1.9 | 6300                            | 9                   | EEFSX0D221ER | 3500                        |      |
|        |                      | 270                      | 7.3            | 4.3 | 1.9 | 6300                            | 9                   | EEFSX0D271ER | 3500                        |      |
|        |                      |                          | 7.3            | 4.3 | 1.9 | 7500                            | 6                   | EEFSX0D271XE | 3500                        |      |
|        |                      |                          | 7.3            | 4.3 | 1.9 | 8500                            | 4.5                 | EEFSX0D271E4 | 3500                        |      |
|        |                      | 330                      | 7.3            | 4.3 | 1.9 | 6300                            | 9                   | EEFSX0D331ER | 3500                        |      |
|        |                      |                          | 7.3            | 4.3 | 1.9 | 7500                            | 6                   | EEFSX0D331XE | 3500                        |      |
|        |                      |                          | 7.3            | 4.3 | 1.9 | 8500                            | 4.5                 | EEFSX0D331E4 | 3500                        |      |
|        |                      | 390                      | 7.3            | 4.3 | 1.9 | 6300                            | 9                   | EEFSX0D391ER | 3500                        |      |
|        |                      |                          | 7.3            | 4.3 | 1.9 | 7500                            | 6                   | EEFSX0D391XE | 3500                        |      |
|        |                      |                          | 7.3            | 4.3 | 1.9 | 8500                            | 4.5                 | EEFSX0D391E4 | 3500                        |      |
|        |                      | 470                      | 7.3            | 4.3 | 1.9 | 6300                            | 9                   | EEFSX0D471ER | 3500                        |      |
|        |                      |                          | 7.3            | 4.3 | 1.9 | 7500                            | 6                   | EEFSX0D471XE | 3500                        |      |
|        |                      |                          | 7.3            | 4.3 | 1.9 | 8500                            | 4.5                 | EEFSX0D471E4 | 3500                        |      |
|        |                      | 560                      | 7.3            | 4.3 | 1.9 | 8500                            | 4.5                 | EEFSX0D561E4 | 3500                        |      |
|        | 2.5                  | 150                      | 7.3            | 4.3 | 1.9 | 6300                            | 9                   | EEFSX0E151ER | 3500                        |      |
|        |                      | 180                      | 7.3            | 4.3 | 1.9 | 6300                            | 9                   | EEFSX0E181ER | 3500                        |      |
|        |                      | 220                      | 7.3            | 4.3 | 1.9 | 6300                            | 9                   | EEFSX0E221ER | 3500                        |      |
|        |                      |                          | 7.3            | 4.3 | 1.9 | 7000                            | 7                   | EEFSX0E221E7 | 3500                        |      |
|        |                      | 270                      | 7.3            | 4.3 | 1.9 | 7000                            | 7                   | EEFSX0E271E7 | 3500                        |      |
|        |                      | 330                      | 7.3            | 4.3 | 1.9 | 6300                            | 9                   | EEFSX0E331ER | 3500                        |      |
|        |                      |                          | 7.3            | 4.3 | 1.9 | 7500                            | 6                   | EEFSX0E331XE | 3500                        |      |
|        |                      |                          | 7.3            | 4.3 | 1.9 | 8500                            | 4.5                 | EEFSX0E331E4 | 3500                        |      |
|        |                      | 390                      | 7.3            | 4.3 | 1.9 | 6300                            | 9                   | EEFSX0E391ER | 3500                        |      |
|        |                      |                          | 7.3            | 4.3 | 1.9 | 7500                            | 6                   | EEFSX0E391XE | 3500                        |      |
|        |                      |                          | 7.3            | 4.3 | 1.9 | 8500                            | 4.5                 | EEFSX0E391E4 | 3500                        |      |
|        |                      | 470                      | 7.3            | 4.3 | 1.9 | 6300                            | 9                   | EEFSX0E471ER | 3500                        |      |
|        |                      |                          | 7.3            | 4.3 | 1.9 | 7500                            | 6                   | EEFSX0E471XE | 3500                        |      |
|        |                      |                          | 7.3            | 4.3 | 1.9 | 8500                            | 4.5                 | EEFSX0E471E4 | 3500                        |      |
|        |                      | 4                        | 82             | 7.3 | 4.3 | 1.9                             | 6300                | 9            | EEFSX0G820ER                | 3500 |
|        | 100                  |                          | 7.3            | 4.3 | 1.9 | 6300                            | 9                   | EEFSX0G101ER | 3500                        |      |
|        | 150                  |                          | 7.3            | 4.3 | 1.9 | 6300                            | 9                   | EEFSX0G151ER | 3500                        |      |
|        |                      |                          | 7.3            | 4.3 | 1.9 | 7000                            | 7                   | EEFSX0G151E7 | 3500                        |      |
|        | 180                  |                          | 7.3            | 4.3 | 1.9 | 6300                            | 9                   | EEFSX0G181ER | 3500                        |      |
|        | 220                  |                          | 7.3            | 4.3 | 1.9 | 6300                            | 9                   | EEFSX0G221ER | 3500                        |      |
|        | 270                  |                          | 7.3            | 4.3 | 1.9 | 6300                            | 9                   | EEFSX0G271ER | 3500                        |      |
|        | NEW                  |                          | 330            | 7.3 | 4.3 | 1.9                             | 6300                | 9            | EEFSX0G331ER                | 3500 |
|        | 7.3                  |                          |                | 4.3 | 1.9 | 7500                            | 6                   | EEFSX0G331XE | 3500                        |      |
|        | 6.3                  |                          | 120            | 7.3 | 4.3 | 1.9                             | 7000                | 7            | EEFSX0J121E7                | 3500 |
|        |                      | 150                      | 7.3            | 4.3 | 1.9 | 6300                            | 9                   | EEFSX0J151ER | 3500                        |      |
|        |                      | 180                      | 7.3            | 4.3 | 1.9 | 6300                            | 9                   | EEFSX0J181ER | 3500                        |      |
|        |                      | NEW                      | 220            | 7.3 | 4.3 | 1.9                             | 6300                | 9            | EEFSX0J221ER                | 3500 |

\*1: Ripple current (100 kHz/ +45°C ), \*2: ESR (100 kHz/+20 °C)

\*3: Please refer to the page of "Mounting Specifications".

\*4: Please contact us when 500 pcs packing is necessary.

## Temperature compensation multipliers for ripple current

| Temp.       | T ≤ 45 °C | 45 °C < T ≤ 85 °C | 85 °C < T ≤ 105 °C |
|-------------|-----------|-------------------|--------------------|
| Coefficient | 1.0       | 0.7               | 0.25               |

## Surface Mount Type SP-Cap

Series : **GX (Super Low ESR Products)**



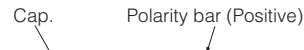
### Features

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

### Specifications

| Series                             | GX                                           |                                        |
|------------------------------------|----------------------------------------------|----------------------------------------|
| Category temp. range               | -55 °C to +105 °C                            |                                        |
| Rated voltage range                | 2 V.DC to 2.5 V.DC                           |                                        |
| Nominal cap.range                  | 330 $\mu$ F to 560 $\mu$ F                   |                                        |
| Capacitance tolerance              | $\pm 20$ % (120 Hz/+20 °C)                   |                                        |
| DC leakage current                 | $I \leq 0.1$ CV ( $\mu$ A) 2 minutes         |                                        |
| Dissipation factor (tan $\delta$ ) | $\leq 0.06$ (120 Hz/+20 °C)                  |                                        |
| Surge voltage (V.DC)               | Rated voltage $\times$ 1.25 (15 °C to 35 °C) |                                        |
| Endurance                          | +105 °C, 2000 h, rated voltage applied       |                                        |
|                                    | Capacitance change                           | Within $\pm 20$ % of the initial value |
|                                    | tan $\delta$                                 | $\leq 2$ times of the initial limit    |
|                                    | DC leakage current                           | $\leq 3$ times of the initial limit    |
| Damp heat (Steady state)           | +60 °C, 90 %, 500 h, No-applied voltage      |                                        |
|                                    | Capacitance change of initial measurd value  | 2 V.DC to 2.5 V.DC<br>+70 %, -20 %     |
|                                    | tan $\delta$                                 | $\leq 2$ times of the initial limit    |
|                                    | DC leakage current                           | Within the initial limit               |

### Marking

|  |          | <table><tr><th colspan="2">Rated voltage mark</th></tr><tr><td>d</td><td>2 V.DC</td></tr><tr><td>e</td><td>2.5 V.DC</td></tr></table> | Rated voltage mark |  | d | 2 V.DC | e | 2.5 V.DC |
|-------------------------------------------------------------------------------------|----------|---------------------------------------------------------------------------------------------------------------------------------------|--------------------|--|---|--------|---|----------|
| Rated voltage mark                                                                  |          |                                                                                                                                       |                    |  |   |        |   |          |
| d                                                                                   | 2 V.DC   |                                                                                                                                       |                    |  |   |        |   |          |
| e                                                                                   | 2.5 V.DC |                                                                                                                                       |                    |  |   |        |   |          |

### Dimensions (not to scale)

2 terminals

Technical drawing of a 2-terminal capacitor. The top view shows a rectangular body with a central notch, with dimensions L (length), W1 (width), and P (notch width). The side view shows the height H. The front view shows the width W2.

Unit : mm

| Series | L $\pm 0.2$ | W1 $\pm 0.2$ | W2 $\pm 0.1$ | H $\pm 0.1$ | P $\pm 0.3$ |
|--------|-------------|--------------|--------------|-------------|-------------|
| GX     | 7.3         | 4.3          | 2.4          | 1.9         | 1.3         |

\* Externals of figure are the reference.

3 terminals

Technical drawing of a 3-terminal capacitor. The top view shows a rectangular body with a central notch, with dimensions L (length), W1 (width), and P (notch width). The side view shows the height H. The front view shows the width W2 and the terminal positions P1, P2, P3, and P4.

Unit : mm

| Series | L $\pm 0.2$ | W1 $\pm 0.2$ | W2 $\pm 0.1$ | H $\pm 0.1$ | P1 $\pm 0.3$ | P2 $\pm 0.1$ | P3 $\pm 0.2$ | P4 $\pm 0.2$ |
|--------|-------------|--------------|--------------|-------------|--------------|--------------|--------------|--------------|
| GX     | 7.3         | 4.3          | 2.4          | 1.9         | 1.3          | 1.1          | 0.7          | 1.4          |

\* Externals of figure are the reference.

## Characteristics list

| Reflow *3 |                      |                          |                |     |     |                                 |                     |                         |   | <Standard>  |                             |
|-----------|----------------------|--------------------------|----------------|-----|-----|---------------------------------|---------------------|-------------------------|---|-------------|-----------------------------|
| Series    | Rated voltage (V.DC) | Capacitance (±20 %) (μF) | Case size (mm) |     |     | Specification                   |                     | The number of terminals |   | Part number | Min.*4 Packaging Q'ty (pcs) |
|           |                      |                          | L              | W   | H   | *1<br>Ripple current (mAr.m.s.) | *2<br>ESR (mΩ max.) | 2                       | 3 |             |                             |
| GX        | 2                    | 330                      | 7.3            | 4.3 | 1.9 | 10200                           | 3                   | ○                       |   | EEFGX0D331R | 3500                        |
|           |                      | 470                      | 7.3            | 4.3 | 1.9 | 10200                           | 3                   | ○                       |   | EEFGX0D471R | 3500                        |
|           |                      |                          | 7.3            | 4.3 | 1.9 | 10200                           | 3                   |                         | ○ | EEFGX0D471L | 3500                        |
|           |                      | 560                      | 7.3            | 4.3 | 1.9 | 10200                           | 3                   | ○                       |   | EEFGX0D561R | 3500                        |
|           |                      |                          | 7.3            | 4.3 | 1.9 | 10200                           | 3                   |                         | ○ | EEFGX0D561L | 3500                        |
|           | 2.5                  | NEW 330                  | 7.3            | 4.3 | 1.9 | 10200                           | 3                   | ○                       |   | EEFGX0E331R | 3500                        |
|           |                      | 470                      | 7.3            | 4.3 | 1.9 | 10200                           | 3                   | ○                       |   | EEFGX0E471R | 3500                        |
|           |                      |                          | 7.3            | 4.3 | 1.9 | 10200                           | 3                   |                         | ○ | EEFGX0E471L | 3500                        |

\*1: Ripple current (100 kHz/ +45°C ), \*2: ESR (100 kHz/+20 °C)

\*3: Please refer to the page of "Mounting Specifications".

\*4: Please contact us when 500 pcs packing is necessary.

## Temperature compensation multipliers for ripple current

| Temp.       | T ≤ 45 °C | 45 °C < T ≤ 85 °C | 85 °C < T ≤ 105 °C |
|-------------|-----------|-------------------|--------------------|
| Coefficient | 1.0       | 0.7               | 0.25               |

## Surface Mount Type SP-Cap

Series : **LX (Low ESR / Low ESL Products)**



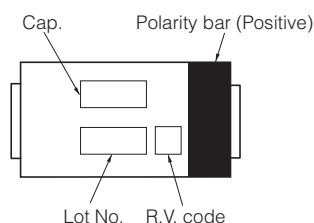
### Features

- Large capacitance (560  $\mu\text{F}$  max.)
- Low ESR (4.5  $\text{m}\Omega$ , 6  $\text{m}\Omega$ )
- Low ESL (3-terminals : 50 % less than 2-terminals)
- High ripple current (8500  $\text{mA}_{\text{r.m.s.}}$  max.)
- RoHS compliance, Halogen free

### Specifications

| Series                               | LX                                                  |                                        |
|--------------------------------------|-----------------------------------------------------|----------------------------------------|
| Category temp. range                 | -55 °C to +105 °C                                   |                                        |
| Rated voltage range                  | 2 V.DC to 2.5 V.DC                                  |                                        |
| Nominal cap.range                    | 330 $\mu\text{F}$ to 560 $\mu\text{F}$              |                                        |
| Capacitance tolerance                | $\pm 20\%$ (120 Hz/+20 °C)                          |                                        |
| DC leakage current                   | $I \leq 0.1 \text{ CV}$ ( $\mu\text{A}$ ) 2 minutes |                                        |
| Dissipation factor ( $\tan \delta$ ) | $\leq 0.06$ (120 Hz/+20 °C)                         |                                        |
| Surge voltage (V.DC)                 | Rated voltage $\times 1.25$ (15 °C to 35 °C)        |                                        |
| Endurance                            | +105 °C, 2000 h, rated voltage applied              |                                        |
|                                      | Capacitance change                                  | Within $\pm 20\%$ of the initial value |
|                                      | $\tan \delta$                                       | $\leq 2$ times of the initial limit    |
|                                      | DC leakage current                                  | $\leq 3$ times of the initial limit    |
| Damp heat (Steady state)             | +60 °C, 90 %, 500 h, No-applied voltage             |                                        |
|                                      | Capacitance change of initial measurd value         | 2 V.DC to 2.5 V.DC<br>+70 %, -20 %     |
|                                      | $\tan \delta$                                       | $\leq 2$ times of the initial limit    |
|                                      | DC leakage current                                  | Within the initial limit               |

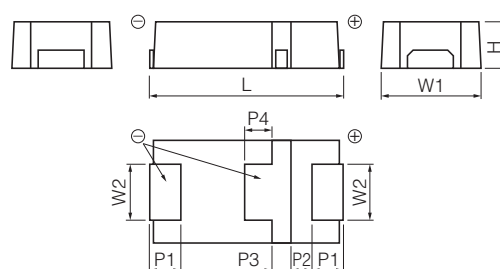
### Marking



Rated voltage mark

|   |          |
|---|----------|
| d | 2 V.DC   |
| e | 2.5 V.DC |

### Dimensions (not to scale)



Unit : mm

| Series | L $\pm 0.2$ | W1 $\pm 0.2$ | W2 $\pm 0.1$ | H $\pm 0.1$ | P1 $\pm 0.3$ | P2 $\pm 0.1$ | P3 $\pm 0.2$ | P4 $\pm 0.2$ |
|--------|-------------|--------------|--------------|-------------|--------------|--------------|--------------|--------------|
| LX     | 7.3         | 4.3          | 2.4          | 1.9         | 1.3          | 1.1          | 0.7          | 1.4          |

\* Externals of figure are the reference.

## Characteristics list

| Reflow *3 <Standard> |                      |                          |                |     |     |                                 |                     |              |                             |
|----------------------|----------------------|--------------------------|----------------|-----|-----|---------------------------------|---------------------|--------------|-----------------------------|
| Series               | Rated voltage (V.DC) | Capacitance (±20 %) (μF) | Case size (mm) |     |     | Specification                   |                     | Part number  | Min.*4 Packaging Q'ty (pcs) |
|                      |                      |                          | L              | W   | H   | *1<br>Ripple current (mAr.m.s.) | *2<br>ESR (mΩ max.) |              |                             |
| LX                   | 2                    | 330                      | 7.3            | 4.3 | 1.9 | 7500                            | 6                   | EEFLX0D331R  | 3500                        |
|                      |                      |                          | 7.3            | 4.3 | 1.9 | 8500                            | 4.5                 | EEFLX0D331R4 | 3500                        |
|                      |                      | 470                      | 7.3            | 4.3 | 1.9 | 7500                            | 6                   | EEFLX0D471R  | 3500                        |
|                      |                      |                          | 7.3            | 4.3 | 1.9 | 8500                            | 4.5                 | EEFLX0D471R4 | 3500                        |
|                      |                      | 560                      | 7.3            | 4.3 | 1.9 | 7500                            | 6                   | EEFLX0D561R  | 3500                        |
|                      |                      |                          | 7.3            | 4.3 | 1.9 | 8500                            | 4.5                 | EEFLX0D561R4 | 3500                        |
|                      | 2.5                  | 330                      | 7.3            | 4.3 | 1.9 | 7500                            | 6                   | EEFLX0E331R  | 3500                        |
|                      |                      |                          | 7.3            | 4.3 | 1.9 | 8500                            | 4.5                 | EEFLX0E331R4 | 3500                        |
|                      |                      | 470                      | 7.3            | 4.3 | 1.9 | 7500                            | 6                   | EEFLX0E471R  | 3500                        |
|                      |                      |                          | 7.3            | 4.3 | 1.9 | 8500                            | 4.5                 | EEFLX0E471R4 | 3500                        |

\*1: Ripple current (100 kHz/ +45°C), \*2: ESR (100 kHz/+20 °C)

\*3: Please refer to the page of "Mounting Specifications".

\*4: Please contact us when 500 pcs packing is necessary.

## Temperature compensation multipliers for ripple current

| Temp.       | $T \leq 45\text{ }^{\circ}\text{C}$ | $45\text{ }^{\circ}\text{C} < T \leq 85\text{ }^{\circ}\text{C}$ | $85\text{ }^{\circ}\text{C} < T \leq 105\text{ }^{\circ}\text{C}$ |
|-------------|-------------------------------------|------------------------------------------------------------------|-------------------------------------------------------------------|
| Coefficient | 1.0                                 | 0.7                                                              | 0.25                                                              |

## Surface Mount Type SP-Cap

Series : **SR, LR, SS, LS, ST, LT**



### Features

- Low profile (Height 1.0 mm max.)
- Low ESR (4.5 mΩ to 9 mΩ)
- Low ESL (3-terminals : 50% less than 2-terminals) [LR, LS, LT series]
- High ripple current (8500 mA.r.m.s. max.)
- RoHS compliance, Halogen free

### Specifications

| Series                      | SR                                             | LR | SS                                | LS | ST               | LT |              |  |
|-----------------------------|------------------------------------------------|----|-----------------------------------|----|------------------|----|--------------|--|
| Category temp. Range        | -55 °C to +105 °C                              |    |                                   |    |                  |    |              |  |
| Rated voltage range         | 2 V.DC to 6.3 V.DC                             |    | 2 V.DC to 2.5 V.DC                |    |                  |    |              |  |
| Nominal cap.Range           | 68 μF to 220μF                                 |    | 180 μF to 220μF                   |    | 270 μF to 330 μF |    |              |  |
| Capacitance tolerance       | ±20 % (120 Hz / + 20 °C)                       |    |                                   |    |                  |    |              |  |
| DC leakage current          | I ≤ 0.1 CV (μA) 2 minutes                      |    |                                   |    |                  |    |              |  |
| Dissipation factor (tan δ)  | ≤ 0.06 (120 Hz/+20 °C)                         |    |                                   |    |                  |    |              |  |
| Surge voltage (V.DC)        | Rated voltage × 1.25 (15 °C to 35 °C)          |    |                                   |    |                  |    |              |  |
| Endurance                   | +105 °C, 2000 h, rated voltage applied         |    |                                   |    |                  |    |              |  |
|                             | Capacitance change                             |    | Within ±20 % of the initial value |    |                  |    |              |  |
|                             | tan δ                                          |    | ≤ 2 times of the initial limit    |    |                  |    |              |  |
|                             | DC leakage current                             |    | ≤ 3 times of the initial limit    |    |                  |    |              |  |
| Damp heat<br>(Steady state) | +60 °C, 90 %, 500 h, No-applied voltage        |    |                                   |    |                  |    |              |  |
|                             | Capacitance change of<br>initial measurd value |    | 2 V.DC to 2.5 V.DC                |    | 4 V.DC           |    | 6.3 V.DC     |  |
|                             |                                                |    | +70 %, -20 %                      |    | +60 %, -20 %     |    | +50 %, -20 % |  |
|                             | tan δ                                          |    | ≤ 2 times of the initial limit    |    |                  |    |              |  |
|                             | DC leakage current                             |    | Within the initial limit          |    |                  |    |              |  |

### Marking

| Rated voltage mark |          |
|--------------------|----------|
| d                  | 2 V.DC   |
| e                  | 2.5 V.DC |
| g                  | 4 V.DC   |
| j                  | 6.3 V.DC |

### Dimensions (not to scale)

| SR, SS, ST series                                     |       |        |        |       |       |
|-------------------------------------------------------|-------|--------|--------|-------|-------|
|                                                       |       |        |        |       |       |
| Unit : mm                                             |       |        |        |       |       |
| Series                                                | L±0.2 | W1±0.2 | W2±0.1 | H±0.1 | P±0.3 |
| SR                                                    | 7.3   | 4.3    | 2.4    | 1.0*1 | 1.3   |
| SS                                                    | 7.3   | 4.3    | 2.4    | 1.1   | 1.3   |
| ST                                                    | 7.3   | 4.3    | 2.4    | 1.4   | 1.3   |
| * Externals of figure are the reference. *1 : Maximum |       |        |        |       |       |

| LR, LS, LT series                                     |       |        |        |       |        |        |        |        |
|-------------------------------------------------------|-------|--------|--------|-------|--------|--------|--------|--------|
|                                                       |       |        |        |       |        |        |        |        |
| Unit : mm                                             |       |        |        |       |        |        |        |        |
| Series                                                | L±0.2 | W1±0.2 | W2±0.1 | H±0.1 | P1±0.3 | P2±0.1 | P3±0.2 | P4±0.2 |
| LR                                                    | 7.3   | 4.3    | 2.4    | 1.0*1 | 1.3    | 1.1    | 0.7    | 1.4    |
| LS                                                    | 7.3   | 4.3    | 2.4    | 1.1   | 1.3    | 1.1    | 0.7    | 1.4    |
| LT                                                    | 7.3   | 4.3    | 2.4    | 1.4   | 1.3    | 1.1    | 0.7    | 1.4    |
| * Externals of figure are the reference. *1 : Maximum |       |        |        |       |        |        |        |        |

## Characteristics list

| Reflow *3 |                      |                          |                |     |          |                           |               |                         |   | <Standard>   |                             |
|-----------|----------------------|--------------------------|----------------|-----|----------|---------------------------|---------------|-------------------------|---|--------------|-----------------------------|
| Series    | Rated voltage (V.DC) | Capacitance (±20 %) (μF) | Case size (mm) |     |          | Specification             |               | The number of terminals |   | Part number  | Min.*4 Packaging Q'ty (pcs) |
|           |                      |                          | L              | W   | H        | *1                        | *2            |                         |   |              |                             |
|           |                      |                          |                |     |          | Ripple current (mAr.m.s.) | ESR (mΩ max.) | 2                       | 3 |              |                             |
| SR        | 2                    | 220                      | 7.3            | 4.3 | 1.0 max. | 7500                      | 6             | ○                       |   | EEFSR0D221R  | 3500                        |
|           |                      |                          | 7.3            | 4.3 | 1.0 max. | 8500                      | 4.5           | ○                       |   | EEFSR0D221R4 | 3500                        |
|           | 2.5                  | 180                      | 7.3            | 4.3 | 1.0 max. | 7500                      | 6             | ○                       |   | EEFSR0E181R  | 3500                        |
|           |                      |                          | 7.3            | 4.3 | 1.0 max. | 8500                      | 4.5           | ○                       |   | EEFSR0E181R4 | 3500                        |
|           | 4                    | 120                      | 7.3            | 4.3 | 1.0 max. | 6300                      | 9             | ○                       |   | EEFSR0G121R  | 3500                        |
|           | 6.3                  | 68                       | 7.3            | 4.3 | 1.0 max. | 6300                      | 9             | ○                       |   | EEFSR0J680R  | 3500                        |
| LR        | 2                    | 220                      | 7.3            | 4.3 | 1.0 max. | 7500                      | 6             |                         | ○ | EEFLR0D221R  | 3500                        |
|           |                      |                          | 7.3            | 4.3 | 1.0 max. | 8500                      | 4.5           |                         | ○ | EEFLR0D221R4 | 3500                        |
|           | 2.5                  | 180                      | 7.3            | 4.3 | 1.0 max. | 7500                      | 6             |                         | ○ | EEFLR0E181R  | 3500                        |
|           |                      |                          | 7.3            | 4.3 | 1.0 max. | 8500                      | 4.5           |                         | ○ | EEFLR0E181R4 | 3500                        |
|           | 4                    | 120                      | 7.3            | 4.3 | 1.0 max. | 6300                      | 9             |                         | ○ | EEFLR0G121R  | 3500                        |
|           | 6.3                  | 68                       | 7.3            | 4.3 | 1.0 max. | 6300                      | 9             |                         | ○ | EEFLR0J680R  | 3500                        |
| SS        | 2                    | 220                      | 7.3            | 4.3 | 1.1      | 7500                      | 6             | ○                       |   | EEFSS0D221R  | 3500                        |
|           | 2.5                  | 180                      | 7.3            | 4.3 | 1.1      | 7500                      | 6             | ○                       |   | EEFSS0E181R  | 3500                        |
| LS        | 2                    | 220                      | 7.3            | 4.3 | 1.1      | 7500                      | 6             |                         | ○ | EEFLS0D221R  | 3500                        |
|           | 2.5                  | 180                      | 7.3            | 4.3 | 1.1      | 7500                      | 6             |                         | ○ | EEFLS0E181R  | 3500                        |
| ST        | 2                    | 330                      | 7.3            | 4.3 | 1.4      | 7500                      | 6             | ○                       |   | EEFST0D331R  | 3500                        |
|           | 2.5                  | 270                      | 7.3            | 4.3 | 1.4      | 7500                      | 6             | ○                       |   | EEFST0E271R  | 3500                        |
| LT        | 2                    | 330                      | 7.3            | 4.3 | 1.4      | 7500                      | 6             |                         | ○ | EEFLT0D331R  | 3500                        |
|           | 2.5                  | 270                      | 7.3            | 4.3 | 1.4      | 7500                      | 6             |                         | ○ | EEFLT0E271R  | 3500                        |

\*1: Ripple current (100 kHz/ +45°C ), \*2: ESR (100 kHz/+20 °C)

\*3: Please refer to the page of "Mounting Specifications".

\*4: Please contact us when 500 pcs packing is necessary.

## Temperature compensation multipliers for ripple current

| Temp.       | $T \leq 45\text{ }^{\circ}\text{C}$ | $45\text{ }^{\circ}\text{C} < T \leq 85\text{ }^{\circ}\text{C}$ | $85\text{ }^{\circ}\text{C} < T \leq 105\text{ }^{\circ}\text{C}$ |
|-------------|-------------------------------------|------------------------------------------------------------------|-------------------------------------------------------------------|
| Coefficient | 1.0                                 | 0.7                                                              | 0.25                                                              |

## Surface Mount Type SP-Cap

Series : **CY, SY (Guaranteed at 85 °C)**



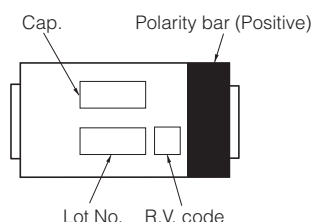
### Features

- Endurance 85 °C 2000 h
- Product height (3.0 mm max.)
- High ripple current (5100 mAr.m.s. to 6300 mAr.m.s. max.)
- RoHS compliance, Halogen free

### Specifications

| Series                      | CY / SY                                                  |                                   |              |
|-----------------------------|----------------------------------------------------------|-----------------------------------|--------------|
| Category temp. range        | -55 °C to +85 °C                                         |                                   |              |
| Rated voltage range         | 4 V.DC, 6.3 V.DC                                         |                                   |              |
| Nominal cap.range           | 330 µF to 470 µF                                         |                                   |              |
| Capacitance tolerance       | ±20 % (120 Hz / + 20 °C)                                 |                                   |              |
| DC leakage current          | I ≤ 0.1 CV (µA) [4 V.DC, 6.3 V.DC, 2 minutes]            |                                   |              |
| Dissipation factor (tan δ)  | ≤ 0.06 (120 Hz / + 20 °C)                                |                                   |              |
| Surge voltage (V.DC)        | Rated voltage × 1.25 [4 V.DC, 6.3 V.DC] (15 °C to 35 °C) |                                   |              |
| Endurance                   | +85 °C, 2000 h, rated voltage applied                    |                                   |              |
|                             | Capacitance change                                       | Within ±20 % of the initial value |              |
|                             | tan δ                                                    | ≤ 2 times of the initial limit    |              |
|                             | DC leakage current                                       | ≤ 3 times of the initial limit    |              |
| Damp heat<br>(Steady state) | +60 °C, 90 %, 500 h, No-applied voltage                  |                                   |              |
|                             | Capacitance change<br>of initial measurd value           | 4 V.DC                            | 6.3 V.DC     |
|                             |                                                          | +60 %, -20 %                      | +50 %, -20 % |
|                             | tan δ                                                    | ≤ 2 times of the initial limit    |              |
|                             | DC leakage current                                       | Within the initial limit          |              |

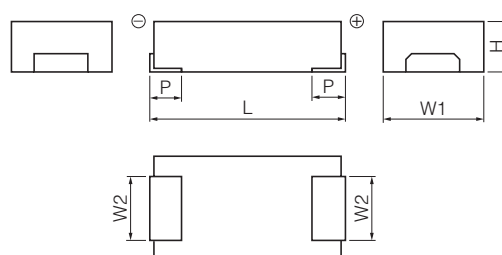
### Marking



Rated voltage mark

|   |          |
|---|----------|
| g | 4 V.DC   |
| j | 6.3 V.DC |

### Dimensions (not to scale)



Unit : mm

| Series | L±0.2 | W1±0.2 | W2±0.1 | H±0.2 | P±0.3 |
|--------|-------|--------|--------|-------|-------|
| CY/SY  | 7.3   | 4.3    | 2.4    | 2.8   | 1.3   |

\* Externals of figure are the reference.

## Characteristics list

|        |                      |                          |                |     |     |                                 |                     | Reflow *3   | <Standard>                  |
|--------|----------------------|--------------------------|----------------|-----|-----|---------------------------------|---------------------|-------------|-----------------------------|
| Series | Rated voltage (V.DC) | Capacitance (±20 %) (μF) | Case size (mm) |     |     | Specification                   |                     | Part number | Min.*4 Packaging Q'ty (pcs) |
|        |                      |                          | L              | W   | H   | *1<br>Ripple current (mAr.m.s.) | *2<br>ESR (mΩ max.) |             |                             |
| CY     | 4                    | 470                      | 7.3            | 4.3 | 2.8 | 5100                            | 15                  | ECGCY0G471R | 2000                        |
|        | 6.3                  | 330                      | 7.3            | 4.3 | 2.8 | 5100                            | 15                  | ECGCY0J331R | 2000                        |
| SY     | 4                    | 470                      | 7.3            | 4.3 | 2.8 | 6300                            | 9                   | ECGSY0G471R | 2000                        |
|        | 6.3                  | 330                      | 7.3            | 4.3 | 2.8 | 6300                            | 9                   | ECGSY0J331R | 2000                        |

<sup>\*1</sup>: Ripple current (100 kHz/ +45°C )

<sup>\*2</sup>: ESR (100 kHz/+20 °C)

<sup>\*3</sup>: Please refer to the page of "Mounting Specifications".

<sup>\*4</sup>: Please contact us when 500 pcs packing is necessary.

## Temperature compensation multipliers for ripple current

| Temp.       | T ≤ 45 °C | 45 °C < T ≤ 65 °C | 65 °C < T ≤ 85 °C |
|-------------|-----------|-------------------|-------------------|
| Coefficient | 1.0       | 0.7               | 0.25              |

## Surface Mount Type SP-Cap

Series : HX (Guaranteed at 125 °C)



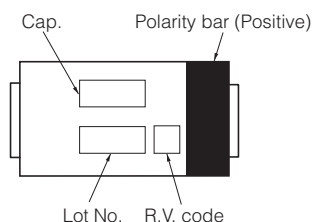
### Features

- Endurance 125 °C 1000 h
- High voltage & Large capacitance (2 V.DC 560  $\mu$ F to 25 V.DC 33  $\mu$ F)
- Low ESR (4.5 m $\Omega$  max.)
- RoHS compliance, Halogen free

### Specifications

| Series                             | HX                                                                                                                   |                                                                                                          |
|------------------------------------|----------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|
| Category temp. range               | -55 °C to +125 °C                                                                                                    |                                                                                                          |
| Rated voltage range                | 2 V.DC to 2.5 V.DC, 10 V.DC to 25 V.DC                                                                               |                                                                                                          |
| Category voltage range             | 1.6 V.DC to 2 V.DC, 8 V.DC to 20 V.DC                                                                                |                                                                                                          |
| Nominal cap.range                  | 15 $\mu$ F to 560 $\mu$ F                                                                                            |                                                                                                          |
| Capacitance tolerance              | $\pm 20$ % (120 Hz/+20 °C)                                                                                           |                                                                                                          |
| DC leakage current                 | 2 V.DC to 2.5 V.DC : $I \leq 0.1$ CV ( $\mu$ A) 2 minutes, 10 V.DC to 25 V.DC : $I \leq 0.3$ CV ( $\mu$ A) 2 minutes |                                                                                                          |
| Dissipation factor (tan $\delta$ ) | $\leq 0.1$ (120 Hz/+20 °C)                                                                                           |                                                                                                          |
| Surge voltage (V.DC)               | Rated voltage $\times 1.25$ [2 V.DC to 16 V.DC], $\times 1.15$ [20 V.DC to 25 V.DC](15 °C to 35 °C)                  |                                                                                                          |
| Endurance                          | +125 °C, 1000 h, Category voltage applied                                                                            |                                                                                                          |
|                                    | Capacitance change                                                                                                   | Within $\pm 20$ % of the initial value                                                                   |
|                                    | tan $\delta$                                                                                                         | $\leq 2$ times of the initial limit                                                                      |
|                                    | DC leakage current                                                                                                   | Within the initial limit                                                                                 |
| Damp heat (Steady state)           | After storing for 500 hours at +60 °C, 90 %                                                                          |                                                                                                          |
|                                    | Capacitance change of initial measurd value                                                                          | 2 V.DC to 2.5 V.DC                                                                                       |
|                                    |                                                                                                                      | +70 %, -20 %                                                                                             |
|                                    | tan $\delta$                                                                                                         | 10 V.DC to 25 V.DC                                                                                       |
|                                    |                                                                                                                      | +60 %, -20 %                                                                                             |
|                                    | DC leakage current                                                                                                   | 2 V.DC to 2.5 V.DC : Within the initial limit<br>10 V.DC to 25V DC : $\leq 3$ times of the initial limit |

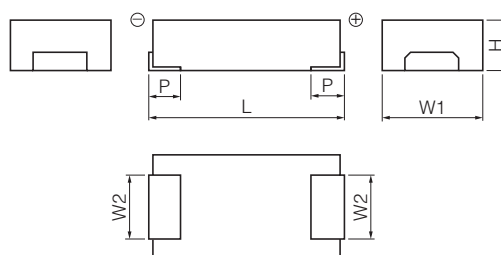
### Marking



Rated voltage mark

|   |          |   |         |
|---|----------|---|---------|
| d | 2 V.DC   | C | 16 V.DC |
| e | 2.5 V.DC | D | 20 V.DC |
| A | 10 V.DC  | E | 25 V.DC |

### Dimensions (not to scale)



Unit : mm

| Series | L $\pm 0.2$ | W1 $\pm 0.2$ | W2 $\pm 0.1$ | H $\pm 0.1$ | P $\pm 0.3$ |
|--------|-------------|--------------|--------------|-------------|-------------|
| HX     | 7.3         | 4.3          | 2.4          | 1.9         | 1.3         |

\* Externals of figure are the reference.

## Characteristics list

|        |                                     |                                        |                             |                |     |     |                                               |                                   | Reflow <sup>*3</sup> | <Standard>                                       |
|--------|-------------------------------------|----------------------------------------|-----------------------------|----------------|-----|-----|-----------------------------------------------|-----------------------------------|----------------------|--------------------------------------------------|
| Series | Rated voltage<br>[105 °C]<br>(V.DC) | Category voltage<br>[125 °C]<br>(V.DC) | Capacitance<br>(±20 %) (μF) | Case size (mm) |     |     | Specification                                 |                                   | Part number          | Min. <sup>*4</sup><br>Packaging<br>Q'ty<br>(pcs) |
|        |                                     |                                        |                             | L              | W   | H   | <sup>*1</sup><br>Ripple current<br>(mAr.m.s.) | <sup>*2</sup><br>ESR<br>(mΩ max.) |                      |                                                  |
| HX     | 2                                   | 1.6                                    | 470                         | 7.3            | 4.3 | 1.9 | 5100                                          | 15                                | EEFHX0D471R          | 3500                                             |
|        |                                     |                                        |                             | 7.3            | 4.3 | 1.9 | 6300                                          | 9                                 | EEFHX0D471R9         | 3500                                             |
|        |                                     |                                        |                             | 7.3            | 4.3 | 1.9 | 7500                                          | 6                                 | EEFHX0D471R6         | 3500                                             |
|        |                                     |                                        |                             | 7.3            | 4.3 | 1.9 | 8500                                          | 4.5                               | EEFHX0D471R4         | 3500                                             |
|        |                                     |                                        | 560                         | 7.3            | 4.3 | 1.9 | 5100                                          | 15                                | EEFHX0D561R          | 3500                                             |
|        |                                     |                                        |                             | 7.3            | 4.3 | 1.9 | 8500                                          | 4.5                               | EEFHX0D561R4         | 3500                                             |
|        | 2.5                                 | 2                                      | 330                         | 7.3            | 4.3 | 1.9 | 5100                                          | 15                                | EEFHX0E331R          | 3500                                             |
|        |                                     |                                        |                             | 7.3            | 4.3 | 1.9 | 6300                                          | 9                                 | EEFHX0E331R9         | 3500                                             |
|        |                                     |                                        |                             | 7.3            | 4.3 | 1.9 | 7500                                          | 6                                 | EEFHX0E331R6         | 3500                                             |
|        |                                     |                                        |                             | 7.3            | 4.3 | 1.9 | 8500                                          | 4.5                               | EEFHX0E331R4         | 3500                                             |
|        |                                     |                                        | 470                         | 7.3            | 4.3 | 1.9 | 5100                                          | 15                                | EEFHX0E471R          | 3500                                             |
|        |                                     |                                        |                             | 7.3            | 4.3 | 1.9 | 6300                                          | 9                                 | EEFHX0E471R9         | 3500                                             |
|        |                                     |                                        |                             | 7.3            | 4.3 | 1.9 | 7500                                          | 6                                 | EEFHX0E471R6         | 3500                                             |
|        |                                     |                                        |                             | 7.3            | 4.3 | 1.9 | 8500                                          | 4.5                               | EEFHX0E471R4         | 3500                                             |
|        | 10                                  | 8                                      | 47                          | 7.3            | 4.3 | 1.9 | 3200                                          | 40                                | EEFHX1A470R          | 3500                                             |
|        |                                     |                                        | 68                          | 7.3            | 4.3 | 1.9 | 3200                                          | 40                                | EEFHX1A680R          | 3500                                             |
|        |                                     |                                        | 100                         | 7.3            | 4.3 | 1.9 | 3200                                          | 40                                | EEFHX1A101R          | 3500                                             |
|        | 16                                  | 12.8                                   | 15                          | 7.3            | 4.3 | 1.9 | 3200                                          | 40                                | EEFHX1C150R          | 3500                                             |
|        |                                     |                                        | 22                          | 7.3            | 4.3 | 1.9 | 3200                                          | 40                                | EEFHX1C220R          | 3500                                             |
|        |                                     |                                        | 33                          | 7.3            | 4.3 | 1.9 | 3200                                          | 40                                | EEFHX1C330R          | 3500                                             |
|        |                                     |                                        | 47                          | 7.3            | 4.3 | 1.9 | 3200                                          | 40                                | EEFHX1C470R          | 3500                                             |
|        |                                     |                                        | 68                          | 7.3            | 4.3 | 1.9 | 3200                                          | 40                                | EEFHX1C680R          | 3500                                             |
|        | 20                                  | 16                                     | 22                          | 7.3            | 4.3 | 1.9 | 3200                                          | 40                                | EEFHX1D220R          | 3500                                             |
|        |                                     |                                        | 33                          | 7.3            | 4.3 | 1.9 | 3200                                          | 40                                | EEFHX1D330R          | 3500                                             |
|        |                                     |                                        | 47                          | 7.3            | 4.3 | 1.9 | 3200                                          | 40                                | EEFHX1D470R          | 3500                                             |
|        |                                     |                                        | 56                          | 7.3            | 4.3 | 1.9 | 3200                                          | 40                                | EEFHX1D560R          | 3500                                             |
|        | 25                                  | 20                                     | 15                          | 7.3            | 4.3 | 1.9 | 3200                                          | 40                                | EEFHX1E150R          | 3500                                             |
|        |                                     |                                        | 22                          | 7.3            | 4.3 | 1.9 | 3200                                          | 40                                | EEFHX1E220R          | 3500                                             |
|        |                                     |                                        | 33                          | 7.3            | 4.3 | 1.9 | 3200                                          | 40                                | EEFHX1E330R          | 3500                                             |

<sup>\*1</sup>: Ripple current (100 kHz/ +45°C ), <sup>\*2</sup>: ESR (100 kHz/+20 °C)

<sup>\*3</sup>: Please refer to the page of "Mounting Specifications".

<sup>\*4</sup>: Please contact us when 500 pcs packing is necessary.

## Temperature compensation multipliers for ripple current

|                    | Temp.       | T ≤ 45 °C | 45 °C < T ≤ 85 °C | 85 °C < T ≤ 105 °C | 105 °C < T ≤ 125 °C |
|--------------------|-------------|-----------|-------------------|--------------------|---------------------|
| 2 V.DC to 2.5 V.DC | Coefficient | 1.0       | 0.7               | 0.25               | 0.25                |
| 10 V.DC to 25 V.DC |             | 1.0       | 0.8               | 0.5                | 0.25                |

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

### Surface Mount Type

### SP-Cap

Series: **FD, CD, UD, UE**

**Old series**

#### [Our Requests]

Since this series is old, we don't recommend you to adopt it but CX & SX series for your new design.



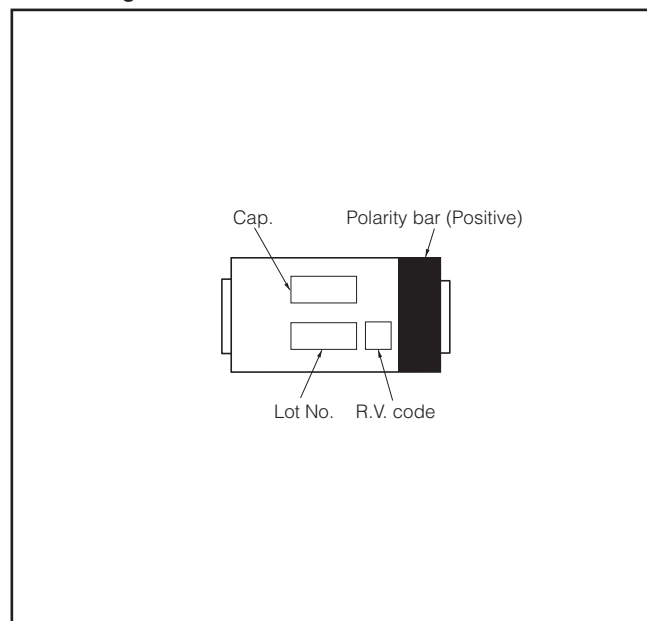
#### ■ Features

- Low ESR
- Excellent Noise-absorbent Characteristics
- RoHS directive compliant

#### ■ Specifications

| Series & Size Code    | FD                                                                                                                                                                                        | CD                                 | UD                     | UE               |                   |
|-----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|------------------------|------------------|-------------------|
| Category Temp. Range  | -40 °C to +105 °C                                                                                                                                                                         |                                    |                        |                  |                   |
| Rated Voltage Range   | 2 V.DC to 12.5 V.DC                                                                                                                                                                       | 2 V.DC to 16 V.DC                  | 2 V.DC to 8 V.DC       | 2 V.DC to 8 V.DC |                   |
| Nominal Cap.Range     | 15 μF to 68 μF                                                                                                                                                                            | 2.2 μF to 220 μF                   | 68 μF to 470 μF        | 100 μF to 560 μF |                   |
| Capacitance Tolerance | ±20 %                                                                                                                                                                                     |                                    |                        |                  |                   |
| DC Leakage Current    | Reflow 240 °C : I ≤ 0.06 CV (μA) 2minutes (2 V.DC to 4 V.DC)<br>I ≤ 0.04 CV or 3 (μA) 2 minutes (6.3 V.DC to 16 V.DC) (Whichever is greater)<br>Reflow 260 °C : I ≤ 0.1 CV (μA) 2 minutes |                                    |                        |                  |                   |
| tan δ                 | ≤ 0.06 (120 Hz/+20 °C)                                                                                                                                                                    |                                    | ≤ 0.10 (120 Hz/+20 °C) |                  |                   |
| Surge Voltage         | Rated Voltage × 1.25 (15 °C to 35 °C)                                                                                                                                                     |                                    |                        |                  |                   |
| Endurance             | After applying rated voltage for 1000 hours at 105 °C±2 °C, and then being stabilized at +20 °C, capacitor shall meet the following limits.                                               |                                    |                        |                  |                   |
|                       | Capacitance change                                                                                                                                                                        | ±10% of initial measured value     |                        |                  |                   |
|                       | tan δ                                                                                                                                                                                     | ≤ Initial specified value          |                        |                  |                   |
|                       | DC leakage current                                                                                                                                                                        | ≤ Initial specified value          |                        |                  |                   |
| Moisture resistance   | After storing for 500 hours at 60 °C, 90 %                                                                                                                                                |                                    |                        |                  |                   |
|                       | Capacitance change of initial measurd value                                                                                                                                               | 2, 2.5 V.DC                        | 4 V.DC                 | 6.3 V.DC         | 8 V.DC to 16 V.DC |
|                       |                                                                                                                                                                                           | +70, -20 %                         | +60, -20 %             | +50, -20 %       | +40, -20 %        |
|                       | tan δ                                                                                                                                                                                     | ≤ 200 % of initial specified value |                        |                  |                   |
| DC leakage current    | ≤ Initial specified value                                                                                                                                                                 |                                    |                        |                  |                   |

#### ■ Marking



#### ■ Dimensions in mm(not to scale)

(Unit : mm)

| Series & Size Code | L $\pm 0.2$ | W1 $\pm 0.2$ | W2 $\pm 0.1$ | H             | P $\pm 0.3$ |
|--------------------|-------------|--------------|--------------|---------------|-------------|
| FD                 | 7.3         | 4.3          | 2.4          | 1.1 $\pm 0.1$ | 1.3         |
| CD                 | 7.3         | 4.3          | 2.4          | 1.8 $\pm 0.1$ | 1.3         |
| UD                 | 7.3         | 4.3          | 2.4          | 2.8 $\pm 0.2$ | 1.3         |
| UE                 | 7.3         | 4.3          | 2.4          | 4.2 $\pm 0.1$ | 1.3         |

\* Externals of figure are the reference.

## ■ Standard Products

Reflow \*3

&lt;260 °C&gt;

| Series & Size Code | Rated Voltage (V.DC) | Capacitance (±20 %) (μF) | Case Size |        |        | Specification                  |                     | Part number  | Reflow       |        | Min. Packaging Q'ty (pcs) |
|--------------------|----------------------|--------------------------|-----------|--------|--------|--------------------------------|---------------------|--------------|--------------|--------|---------------------------|
|                    |                      |                          | L (mm)    | W (mm) | H (mm) | *1<br>Ripple current (Ar.m.s.) | *2<br>ESR (mΩ max.) |              | *4<br>240 °C | 260 °C |                           |
| FD                 | 2                    | 68                       | 7.3       | 4.3    | 1.1    | 2.0                            | 28                  | EEFFD0D680R  | ○            | —      | 3500                      |
|                    | 2.5                  | 56                       | 7.3       | 4.3    | 1.1    | 2.0                            | 28                  | EEFFD0E560R  | ○            | —      | 3500                      |
|                    | 4                    | 39                       | 7.3       | 4.3    | 1.1    | 2.0                            | 28                  | EEFFD0G390R  | ○            | —      | 3500                      |
|                    |                      | 47                       | 7.3       | 4.3    | 1.1    | 2.0                            | 28                  | EEFFD0G470R  | ○            | —      | 3500                      |
|                    | 6.3                  | 33                       | 7.3       | 4.3    | 1.1    | 2.0                            | 28                  | EEFFD0J330R  | ○            | —      | 3500                      |
|                    | 8                    | 22                       | 7.3       | 4.3    | 1.1    | 2.0                            | 28                  | EEFFD0K220R  | ○            | —      | 3500                      |
|                    | 12.5                 | 15                       | 7.3       | 4.3    | 1.1    | 1.4                            | 40                  | EEFFD1B150R  | ○            | —      | 3500                      |
| CD                 | 2                    | 100                      | 7.3       | 4.3    | 1.8    | 2.5                            | 18                  | EEFCD0D101ER | —            | ○      | 3500                      |
|                    |                      |                          | 7.3       | 4.3    | 1.8    | 2.7                            | 15                  | EEFCD0D101XE | —            | ○      | 3500                      |
|                    |                      | 120                      | 7.3       | 4.3    | 1.8    | 2.5                            | 18                  | EEFCD0D121ER | —            | ○      | 3500                      |
|                    |                      |                          | 7.3       | 4.3    | 1.8    | 2.7                            | 15                  | EEFCD0D121XE | —            | ○      | 3500                      |
|                    |                      |                          | 7.3       | 4.3    | 1.8    | 2.5                            | 18                  | EEFCD0D151ER | —            | ○      | 3500                      |
|                    |                      |                          | 7.3       | 4.3    | 1.8    | 2.5                            | 18                  | EEFCD0D181ER | —            | ○      | 3500                      |
|                    | 2.5                  | 82                       | 7.3       | 4.3    | 1.8    | 2.5                            | 18                  | EEFCD0E820ER | —            | ○      | 3500                      |
|                    |                      |                          | 7.3       | 4.3    | 1.8    | 2.7                            | 15                  | EEFCD0E820XE | —            | ○      | 3500                      |
|                    |                      | 100                      | 7.3       | 4.3    | 1.8    | 2.5                            | 18                  | EEFCD0E101ER | —            | ○      | 3500                      |
|                    |                      |                          | 7.3       | 4.3    | 1.8    | 2.7                            | 15                  | EEFCD0E101XE | —            | ○      | 3500                      |
|                    |                      |                          | 7.3       | 4.3    | 1.8    | 2.5                            | 18                  | EEFCD0E121ER | —            | ○      | 3500                      |
|                    |                      | 120                      | 7.3       | 4.3    | 1.8    | 2.5                            | 18                  | EEFCD0E121ER | —            | ○      | 3500                      |
|                    |                      |                          | 7.3       | 4.3    | 1.8    | 2.5                            | 18                  | EEFCD0E151ER | —            | ○      | 3500                      |
|                    |                      |                          | 7.3       | 4.3    | 1.8    | 2.5                            | 18                  | EEFCD0E151ER | —            | ○      | 3500                      |
|                    | 4                    | 56                       | 7.3       | 4.3    | 1.8    | 2.5                            | 18                  | EEFCD0G560ER | —            | ○      | 3500                      |
|                    |                      |                          | 7.3       | 4.3    | 1.8    | 2.7                            | 15                  | EEFCD0G560XE | —            | ○      | 3500                      |
|                    |                      | 68                       | 7.3       | 4.3    | 1.8    | 2.5                            | 18                  | EEFCD0G680ER | —            | ○      | 3500                      |
|                    |                      |                          | 7.3       | 4.3    | 1.8    | 2.7                            | 15                  | EEFCD0G680XE | —            | ○      | 3500                      |
|                    |                      |                          | 7.3       | 4.3    | 1.8    | 2.5                            | 18                  | EEFCD0G820ER | —            | ○      | 3500                      |
|                    |                      | 82                       | 7.3       | 4.3    | 1.8    | 2.7                            | 15                  | EEFCD0G820XE | —            | ○      | 3500                      |
|                    |                      |                          | 7.3       | 4.3    | 1.8    | 2.5                            | 18                  | EEFCD0G101ER | —            | ○      | 3500                      |
|                    |                      |                          | 7.3       | 4.3    | 1.8    | 2.7                            | 15                  | EEFCD0J100ER | —            | ○      | 3500                      |
|                    | 6.3                  | 10                       | 7.3       | 4.3    | 1.8    | 1.4                            | 55                  | EEFCD0J100ER | —            | ○      | 3500                      |
|                    |                      |                          | 7.3       | 4.3    | 1.8    | 1.6                            | 40                  | EEFCD0J220ER | —            | ○      | 3500                      |
|                    |                      | 33                       | 7.3       | 4.3    | 1.8    | 2.0                            | 28                  | EEFCD0J330ER | —            | ○      | 3500                      |
|                    |                      |                          | 7.3       | 4.3    | 1.8    | 2.5                            | 18                  | EEFCD0J470ER | —            | ○      | 3500                      |
|                    |                      | 47                       | 7.3       | 4.3    | 1.8    | 2.7                            | 15                  | EEFCD0J470XE | —            | ○      | 3500                      |
|                    |                      |                          | 7.3       | 4.3    | 1.8    | 2.5                            | 18                  | EEFCD0J680ER | —            | ○      | 3500                      |
|                    | 8                    | 68                       | 7.3       | 4.3    | 1.8    | 2.7                            | 15                  | EEFCD0J680XE | —            | ○      | 3500                      |
|                    |                      |                          | 7.3       | 4.3    | 1.8    | 2.7                            | 15                  | EEFCD0K8R2ER | —            | ○      | 3500                      |
|                    |                      | 8.2                      | 7.3       | 4.3    | 1.8    | 1.4                            | 55                  | EEFCD0K8R2ER | —            | ○      | 3500                      |
|                    |                      |                          | 7.3       | 4.3    | 1.8    | 1.6                            | 40                  | EEFCD0K150ER | —            | ○      | 3500                      |
|                    |                      |                          | 7.3       | 4.3    | 1.8    | 2.0                            | 28                  | EEFCD0K220ER | —            | ○      | 3500                      |
|                    |                      | 22                       | 7.3       | 4.3    | 1.8    | 2.5                            | 18                  | EEFCD0K330ER | —            | ○      | 3500                      |
|                    |                      |                          | 7.3       | 4.3    | 1.8    | 1.8                            | 25                  | EEFCD0K470ER | —            | ○      | 3500                      |
|                    |                      |                          | 7.3       | 4.3    | 1.8    | 1.8                            | 25                  | EEFCD1A220ER | —            | ○      | 3500                      |
|                    | 10                   | 33                       | 7.3       | 4.3    | 1.8    | 1.8                            | 25                  | EEFCD1A330ER | —            | ○      | 3500                      |
|                    |                      |                          | 7.3       | 4.3    | 1.8    | 1.8                            | 25                  | EEFCD1A390ER | —            | ○      | 3500                      |
|                    |                      | 39                       | 7.3       | 4.3    | 1.8    | 1.8                            | 25                  | EEFCD1A390ER | —            | ○      | 3500                      |
|                    |                      |                          | 7.3       | 4.3    | 1.8    | 1.8                            | 25                  | EEFCD1B4R7R  | ○            | —      | 3500                      |
|                    | 12.5                 | 4.7                      | 7.3       | 4.3    | 1.8    | 1.0                            | 80                  | EEFCD1B4R7R  | ○            | —      | 3500                      |
|                    |                      |                          | 7.3       | 4.3    | 1.8    | 1.0                            | 60                  | EEFCD1B100R  | ○            | —      | 3500                      |
|                    |                      | 10                       | 7.3       | 4.3    | 1.8    | 1.0                            | 60                  | EEFCD1B100R  | ○            | —      | 3500                      |
|                    |                      |                          | 7.3       | 4.3    | 1.8    | 1.3                            | 50                  | EEFCD1B150R  | ○            | —      | 3500                      |
|                    | 16                   | 22                       | 7.3       | 4.3    | 1.8    | 1.6                            | 30                  | EEFCD1B220R  | ○            | —      | 3500                      |
|                    |                      |                          | 7.3       | 4.3    | 1.8    | 1.6                            | 30                  | EEFCD1C2R2R  | ○            | —      | 3500                      |
|                    |                      | 2.2                      | 7.3       | 4.3    | 1.8    | 1.0                            | 110                 | EEFCD1C2R2R  | ○            | —      | 3500                      |
|                    |                      |                          | 7.3       | 4.3    | 1.8    | 1.0                            | 80                  | EEFCD1C4R7R  | ○            | —      | 3500                      |
|                    |                      | 6.8                      | 7.3       | 4.3    | 1.8    | 1.0                            | 70                  | EEFCD1C6R8R  | ○            | —      | 3500                      |
|                    |                      |                          | 7.3       | 4.3    | 1.8    | 1.3                            | 45                  | EEFCD1C8R2R  | ○            | —      | 3500                      |
| UD                 | 2                    | 330                      | 7.3       | 4.3    | 2.8    | 3.0                            | 15                  | EEFUD0D331ER | —            | ○      | 2000                      |
|                    |                      |                          | 7.3       | 4.3    | 2.8    | 3.3                            | 12                  | EEFUD0D331XE | —            | ○      | 2000                      |
|                    |                      |                          | 7.3       | 4.3    | 2.8    | 3.4                            | 9                   | EEFUD0D331LE | —            | ○      | 2000                      |
|                    |                      | 390                      | 7.3       | 4.3    | 2.8    | 3.0                            | 15                  | EEFUD0D391ER | —            | ○      | 2000                      |
|                    |                      |                          | 7.3       | 4.3    | 2.8    | 3.4                            | 9                   | EEFUD0D391LE | —            | ○      | 2000                      |
|                    |                      |                          | 7.3       | 4.3    | 2.8    | 3.4                            | 9                   | EEFUD0D471LE | —            | ○      | 2000                      |
|                    | 2.5                  | 220                      | 7.3       | 4.3    | 2.8    | 3.0                            | 15                  | EEFUD0E221ER | —            | ○      | 2000                      |
|                    |                      |                          | 7.3       | 4.3    | 2.8    | 3.3                            | 12                  | EEFUD0E221XE | —            | ○      | 2000                      |
|                    |                      |                          | 7.3       | 4.3    | 2.8    | 3.4                            | 9                   | EEFUD0E221LE | —            | ○      | 2000                      |
|                    |                      | 270                      | 7.3       | 4.3    | 2.8    | 3.0                            | 15                  | EEFUD0E271ER | —            | ○      | 2000                      |
|                    |                      |                          | 7.3       | 4.3    | 2.8    | 3.4                            | 9                   | EEFUD0E271LE | —            | ○      | 2000                      |
|                    |                      |                          | 7.3       | 4.3    | 2.8    | 3.4                            | 9                   | EEFUD0E271LE | —            | ○      | 2000                      |

\*1: Ripple current (100 kHz/ +20 to +105 °C), \*2: ESR (100 kHz/+20 °C)

\*3: Please refer to the page of "Mounting Specifications".

\*4: Please contact Panasonic for details of allowable 240 °C reflow condition.

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

02 Mar. 2015

## ■ Standard Products

Reflow \*3 &lt;260 °C&gt;

| Series & Size Code | Rated Voltage (V.DC) | Capacitance (±20 %) (μF) | Case Size |        |        | Specification                  |                     | Part number  | Reflow       |        | Min. Packaging Q'ty (pcs) |
|--------------------|----------------------|--------------------------|-----------|--------|--------|--------------------------------|---------------------|--------------|--------------|--------|---------------------------|
|                    |                      |                          | L (mm)    | W (mm) | H (mm) | *1<br>Ripple current (Ar.m.s.) | *2<br>ESR (mΩ max.) |              | *4<br>240 °C | 260 °C |                           |
| UD                 | 4                    | 120                      | 7.3       | 4.3    | 2.8    | 3.0                            | 15                  | EEFUD0G121ER | —            | ○      | 2000                      |
|                    |                      |                          | 7.3       | 4.3    | 2.8    | 3.4                            | 12                  | EEFUD0G121XE | —            | ○      | 2000                      |
|                    |                      | 150                      | 7.3       | 4.3    | 2.8    | 3.0                            | 15                  | EEFUD0G151ER | —            | ○      | 2000                      |
|                    |                      |                          | 7.3       | 4.3    | 2.8    | 3.3                            | 12                  | EEFUD0G151XE | —            | ○      | 2000                      |
|                    |                      |                          | 7.3       | 4.3    | 2.8    | 3.4                            | 9                   | EEFUD0G151LE | —            | ○      | 2000                      |
|                    |                      |                          | 7.3       | 4.3    | 2.8    | 2.5                            | 18                  | EEFUD0G181ER | —            | ○      | 2000                      |
|                    | 6.3                  | 180                      | 7.3       | 4.3    | 2.8    | 3.4                            | 9                   | EEFUD0G181LE | —            | ○      | 2000                      |
|                    |                      |                          | 7.3       | 4.3    | 2.8    | 3.0                            | 15                  | EEFUD0J101ER | —            | ○      | 2000                      |
|                    |                      | 100                      | 7.3       | 4.3    | 2.8    | 3.3                            | 12                  | EEFUD0J101XE | —            | ○      | 2000                      |
|                    |                      |                          | 7.3       | 4.3    | 2.8    | 3.0                            | 15                  | EEFUD0J121ER | —            | ○      | 2000                      |
|                    |                      |                          | 7.3       | 4.3    | 2.8    | 3.3                            | 12                  | EEFUD0J121XE | —            | ○      | 2000                      |
|                    |                      |                          | 7.3       | 4.3    | 2.8    | 3.4                            | 9                   | EEFUD0J121LR | ○            | —      | 2000                      |
|                    |                      | 150                      | 7.3       | 4.3    | 2.8    | 2.5                            | 18                  | EEFUD0J151ER | —            | ○      | 2000                      |
|                    |                      |                          | 7.3       | 4.3    | 2.8    | 3.4                            | 9                   | EEFUD0J151LR | ○            | —      | 2000                      |
|                    | 8                    | 68                       | 7.3       | 4.3    | 2.8    | 3.0                            | 15                  | EEFUD0K680ER | —            | ○      | 2000                      |
|                    |                      | 100                      | 7.3       | 4.3    | 2.8    | 2.5                            | 18                  | EEFUD0K101ER | —            | ○      | 2000                      |
| UE                 | 2                    | 270                      | 7.3       | 4.3    | 4.2    | 3.3                            | 12                  | EEFUE0D271ER | —            | ○      | 2000                      |
|                    |                      |                          | 7.3       | 4.3    | 4.2    | 3.5                            | 10                  | EEFUE0D271XE | —            | ○      | 2000                      |
|                    |                      | 330                      | 7.3       | 4.3    | 4.2    | 3.3                            | 12                  | EEFUE0D331ER | —            | ○      | 2000                      |
|                    |                      |                          | 7.3       | 4.3    | 4.2    | 3.5                            | 10                  | EEFUE0D331XE | —            | ○      | 2000                      |
|                    |                      | 390                      | 7.3       | 4.3    | 4.2    | 3.3                            | 12                  | EEFUE0D391ER | —            | ○      | 2000                      |
|                    |                      |                          | 7.3       | 4.3    | 4.2    | 3.5                            | 10                  | EEFUE0D391XE | —            | ○      | 2000                      |
|                    |                      |                          | 7.3       | 4.3    | 4.2    | 3.7                            | 7                   | EEFUE0D391LE | —            | ○      | 2000                      |
|                    |                      |                          | 7.3       | 4.3    | 4.2    | 3.3                            | 12                  | EEFUE0D471ER | —            | ○      | 2000                      |
|                    |                      | 470                      | 7.3       | 4.3    | 4.2    | 3.5                            | 10                  | EEFUE0D471XE | —            | ○      | 2000                      |
|                    |                      |                          | 7.3       | 4.3    | 4.2    | 3.7                            | 7                   | EEFUE0D471LE | —            | ○      | 2000                      |
|                    |                      |                          | 7.3       | 4.3    | 4.2    | 3.3                            | 12                  | EEFUE0D561ER | —            | ○      | 2000                      |
|                    |                      |                          | 7.3       | 4.3    | 4.2    | 3.7                            | 7                   | EEFUE0D561LE | —            | ○      | 2000                      |
|                    | 2.5                  | 220                      | 7.3       | 4.3    | 4.2    | 3.3                            | 12                  | EEFUE0E221ER | —            | ○      | 2000                      |
|                    |                      |                          | 7.3       | 4.3    | 4.2    | 3.5                            | 10                  | EEFUE0E221XE | —            | ○      | 2000                      |
|                    |                      | 270                      | 7.3       | 4.3    | 4.2    | 3.3                            | 12                  | EEFUE0E271ER | —            | ○      | 2000                      |
|                    |                      |                          | 7.3       | 4.3    | 4.2    | 3.5                            | 10                  | EEFUE0E271XE | —            | ○      | 2000                      |
|                    |                      |                          | 7.3       | 4.3    | 4.2    | 3.3                            | 12                  | EEFUE0E331ER | —            | ○      | 2000                      |
|                    |                      |                          | 7.3       | 4.3    | 4.2    | 3.5                            | 10                  | EEFUE0E331XE | —            | ○      | 2000                      |
|                    |                      |                          | 7.3       | 4.3    | 4.2    | 3.7                            | 7                   | EEFUE0E331LE | —            | ○      | 2000                      |
|                    |                      | 390                      | 7.3       | 4.3    | 4.2    | 3.3                            | 12                  | EEFUE0E391ER | —            | ○      | 2000                      |
|                    |                      |                          | 7.3       | 4.3    | 4.2    | 3.7                            | 7                   | EEFUE0E391LE | —            | ○      | 2000                      |
|                    |                      |                          | 7.3       | 4.3    | 4.2    | 3.3                            | 12                  | EEFUE0E471ER | —            | ○      | 2000                      |
|                    |                      |                          | 7.3       | 4.3    | 4.2    | 3.7                            | 7                   | EEFUE0E471LE | —            | ○      | 2000                      |
|                    | 4                    | 180                      | 7.3       | 4.3    | 4.2    | 3.3                            | 12                  | EEFUE0G181ER | —            | ○      | 2000                      |
|                    |                      |                          | 7.3       | 4.3    | 4.2    | 3.5                            | 10                  | EEFUE0G181XE | —            | ○      | 2000                      |
|                    |                      | 220                      | 7.3       | 4.3    | 4.2    | 3.3                            | 12                  | EEFUE0G221ER | —            | ○      | 2000                      |
|                    |                      |                          | 7.3       | 4.3    | 4.2    | 3.5                            | 10                  | EEFUE0G221XE | —            | ○      | 2000                      |
|                    |                      |                          | 7.3       | 4.3    | 4.2    | 3.7                            | 7                   | EEFUE0G221LE | —            | ○      | 2000                      |
|                    |                      |                          | 7.3       | 4.3    | 4.2    | 3.3                            | 12                  | EEFUE0G271ER | —            | ○      | 2000                      |
|                    |                      | 270                      | 7.3       | 4.3    | 4.2    | 3.7                            | 7                   | EEFUE0G271LE | —            | ○      | 2000                      |
|                    |                      |                          | 7.3       | 4.3    | 4.2    | 3.3                            | 12                  | EEFUE0G331ER | —            | ○      | 2000                      |
|                    | 6.3                  | 150                      | 7.3       | 4.3    | 4.2    | 3.3                            | 12                  | EEFUE0J151ER | —            | ○      | 2000                      |
|                    |                      |                          | 7.3       | 4.3    | 4.2    | 3.5                            | 10                  | EEFUE0J151XE | —            | ○      | 2000                      |
|                    |                      | 180                      | 7.3       | 4.3    | 4.2    | 3.3                            | 12                  | EEFUE0J181ER | —            | ○      | 2000                      |
|                    |                      |                          | 7.3       | 4.3    | 4.2    | 3.5                            | 10                  | EEFUE0J181XE | —            | ○      | 2000                      |
|                    |                      |                          | 7.3       | 4.3    | 4.2    | 3.7                            | 7                   | EEFUE0J181LR | ○            | —      | 2000                      |
|                    |                      |                          | 7.3       | 4.3    | 4.2    | 3.0                            | 15                  | EEFUE0J221ER | —            | ○      | 2000                      |
|                    |                      | 220                      | 7.3       | 4.3    | 4.2    | 3.7                            | 7                   | EEFUE0J221LR | ○            | —      | 2000                      |
|                    |                      |                          | 7.3       | 4.3    | 4.2    | 3.3                            | 12                  | EEFUE0K101ER | —            | ○      | 2000                      |
|                    | 8                    | 100                      | 7.3       | 4.3    | 4.2    | 3.3                            | 12                  | EEFUE0K101ER | —            | ○      | 2000                      |
|                    |                      | 150                      | 7.3       | 4.3    | 4.2    | 3.0                            | 15                  | EEFUE0K151ER | —            | ○      | 2000                      |

\*1: Ripple current (100 kHz/ +20 to +105 °C), \*2: ESR (100 kHz/+20 °C)

\*3: Please refer to the page of "Mounting Specifications".

\*4: Please contact Panasonic for details of allowable 240 °C reflow condition.

### Surface Mount Type

# SP-Cap

Series: **SL**

## Old series



## ■ Features

- Low-ESR (9 mΩ)
- Excellent Noise-absorbent Characteristics
- High Ripple Current
- RoHS directive compliant

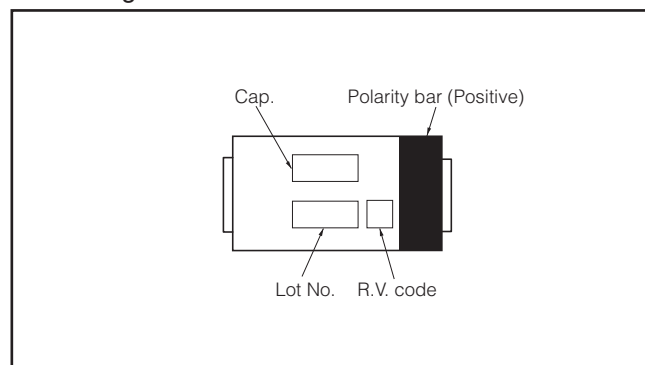
## [Our Requests]

Since this series is old, we don't recommend you to adopt it but SX series for your new design.

## ■ Specifications

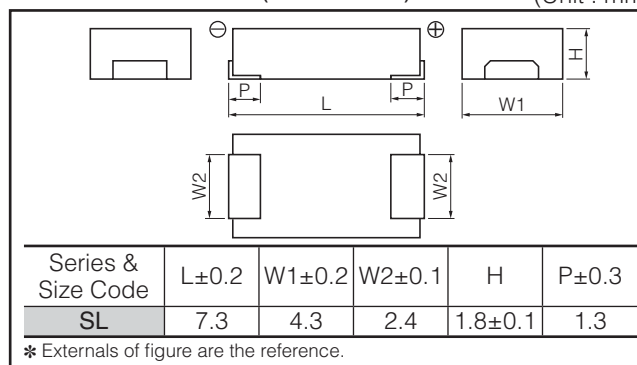
|                       |                                                                                                                                             |                                    |            |            |
|-----------------------|---------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|------------|------------|
| Series & Size Code    | SL                                                                                                                                          |                                    |            |            |
| Category Temp. Range  | -40 °C to +105 °C                                                                                                                           |                                    |            |            |
| Rated Voltage Range   | 2 V.DC to 6.3 V.DC                                                                                                                          |                                    |            |            |
| Nominal Cap.Range     | 56 μF to 220 μF                                                                                                                             |                                    |            |            |
| Capacitance Tolerance | ±20 %                                                                                                                                       |                                    |            |            |
| DC Leakage Current    | Reflow 240 °C : I ≤ 0.04 CV (μA) 2 minutes (6.3 V.DC)<br>Reflow 260 °C : I ≤ 0.1 CV (μA) 2 minutes                                          |                                    |            |            |
| tan δ                 | ≤ 0.06 (120 Hz/+20 °C)                                                                                                                      |                                    |            |            |
| Surge Voltage         | Rated Voltage × 1.25 (15 °C to 35 °C)                                                                                                       |                                    |            |            |
| Endurance             | After applying rated voltage for 1000 hours at 105 °C±2 °C, and then being stabilized at +20 °C, capacitor shall meet the following limits. |                                    |            |            |
|                       | Capacitance change                                                                                                                          | ±10% of initial measured value     |            |            |
|                       | tan δ                                                                                                                                       | ≤ Initial specified value          |            |            |
|                       | DC leakage current                                                                                                                          | ≤ Initial specified value          |            |            |
| Moisture resistance   | After storing for 500 hours at 60 °C, 90 %                                                                                                  |                                    |            |            |
|                       | Capacitance change of initial measurd value                                                                                                 | 2, 2.5 V.DC                        | 4 V.DC     | 6.3 V.DC   |
|                       |                                                                                                                                             | +70, -20 %                         | +60, -20 % | +50, -20 % |
|                       | tan δ                                                                                                                                       | ≤ 200 % of initial specified value |            |            |
| DC leakage current    | ≤ Initial specified value                                                                                                                   |                                    |            |            |

■ **Marking**



■ Dimensions in mm(not to scale)

(Unit : mm)



## ■ Low ESR Products

| ■ Low ESR Products    |                            |                                  |           |           |           |                                      |                        |              | Reflow *3    |        | <260 °C>                           |
|-----------------------|----------------------------|----------------------------------|-----------|-----------|-----------|--------------------------------------|------------------------|--------------|--------------|--------|------------------------------------|
| Series &<br>Size Code | Rated<br>Voltage<br>(V.DC) | Capaci-<br>tance<br>(±20 %) (μF) | Case Size |           |           | Specification                        |                        | Part number  | Reflow       |        | Min.<br>Packaging<br>Q'ty<br>(pcs) |
|                       |                            |                                  | L<br>(mm) | W<br>(mm) | H<br>(mm) | *1<br>Ripple<br>current<br>(Ar.m.s.) | *2<br>ESR<br>(mΩ max.) |              | *4<br>240 °C | 260 °C |                                    |
| SL                    | 2                          | 100                              | 7.3       | 4.3       | 1.8       | 3.0                                  | 9                      | EEFSL0D101ER | —            | ○      | 3500                               |
|                       |                            | 120                              | 7.3       | 4.3       | 1.8       | 3.0                                  | 9                      | EEFSL0D121ER | —            | ○      | 3500                               |
|                       |                            | 150                              | 7.3       | 4.3       | 1.8       | 3.0                                  | 9                      | EEFSL0D151ER | —            | ○      | 3500                               |
|                       |                            | 180                              | 7.3       | 4.3       | 1.8       | 3.0                                  | 9                      | EEFSL0D181ER | —            | ○      | 3500                               |
|                       |                            | 220                              | 7.3       | 4.3       | 1.8       | 3.0                                  | 9                      | EEFSL0D221ER | —            | ○      | 3500                               |
|                       | 2.5                        | 100                              | 7.3       | 4.3       | 1.8       | 3.0                                  | 9                      | EEFSL0E101ER | —            | ○      | 3500                               |
|                       |                            | 120                              | 7.3       | 4.3       | 1.8       | 3.0                                  | 9                      | EEFSL0E121ER | —            | ○      | 3500                               |
|                       |                            | 150                              | 7.3       | 4.3       | 1.8       | 3.0                                  | 9                      | EEFSL0E151ER | —            | ○      | 3500                               |
|                       | 4                          | 82                               | 7.3       | 4.3       | 1.8       | 3.0                                  | 9                      | EEFSL0G820ER | —            | ○      | 3500                               |
|                       | 6.3                        | 56                               | 7.3       | 4.3       | 1.8       | 3.0                                  | 9                      | EEFSL0J560R  | ○            | —      | 3500                               |

\*1: Ripple current (100 kHz/ +20 to +105 °C ), \*2: ESR (100 kHz/+20 °C)

\*3: Please refer to the page of "Mounting Specifications"

\*4: Please contact Panasonic for details of allowable 240 °C reflow condition.

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

03 Mar. 2015

### Surface Mount Type

### SP-Cap

Series: **MC**

**Old series**



#### ■ Features

- Achieved 40 % miniaturization on together with low ESR of SP-Cap for further design flexibility.
- RoHS directive compliant

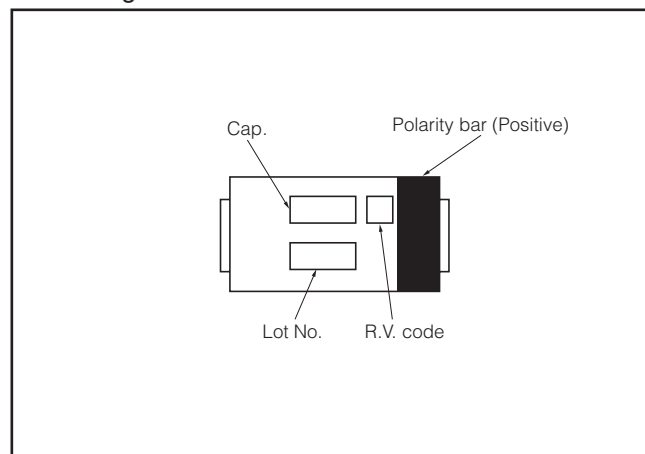
#### [Our Requests]

Since this series is old, we don't recommend you to adopt it

#### ■ Specifications

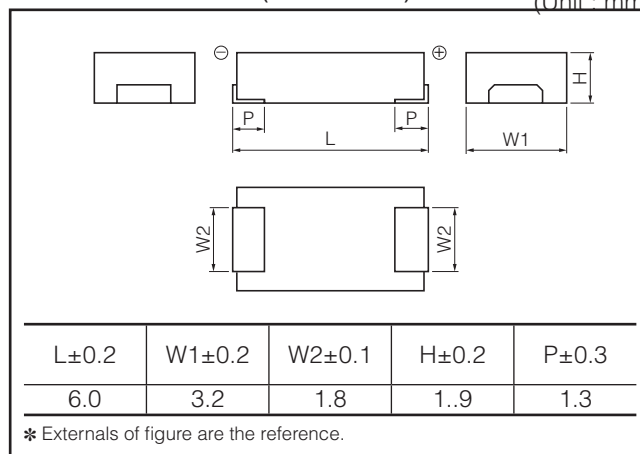
|                       |                                                                                                                 |                                    |            |            |
|-----------------------|-----------------------------------------------------------------------------------------------------------------|------------------------------------|------------|------------|
| Category Temp. Range  | -40 °C to +105 °C                                                                                               |                                    |            |            |
| Rated Voltage Range   | 2 V.DC to 6.3 V.DC                                                                                              |                                    |            |            |
| Nominal Cap.Range     | 47 μF to 120 μF                                                                                                 |                                    |            |            |
| Capacitance Tolerance | ±20 % (120 Hz/+20 °C)                                                                                           |                                    |            |            |
| DC Leakage Current    | I ≤ 0.1 CV (μA) 2 minutes                                                                                       |                                    |            |            |
| tan δ                 | ≤ 0.06 (120 Hz/+20 °C)                                                                                          |                                    |            |            |
| Surge Voltage         | Rated Voltage × 1.25 (15 °C to 35 °C)                                                                           |                                    |            |            |
| Endurance             | After applying rated voltage for 1000 hours at 105 °C±2 °C and then being atabilized at +20 °C, Capacitor shall |                                    |            |            |
|                       | Capacitance change                                                                                              | ±10% of initial measured value     |            |            |
|                       | tan δ                                                                                                           | ≤ Initial specified value          |            |            |
|                       | DC leakage current                                                                                              | ≤ Initial specified value          |            |            |
| Moisture resistance   | After storing for 500 hours at 60 °C, 90 %                                                                      |                                    |            |            |
|                       | Capacitance change of initial measurd value                                                                     | 2, 2.5 V.DC                        | 4 V.DC     | 6.3 V.DC   |
|                       |                                                                                                                 | +70, -20 %                         | +60, -20 % | +50, -20 % |
|                       | tan δ                                                                                                           | ≤ 200 % of initial specified value |            |            |
|                       | DC leakage current                                                                                              | ≤ Initial specified value          |            |            |

#### ■ Marking



#### ■ Dimensions in mm(not to scale)

(Unit : mm)



#### ■ Standard Products

Reflow \*3 <260 °C>

| Series & Size Code | Rated Voltage (V.DC) | Capacitance (±20 %) (μF) | Case Size |        |        | Specification               |                  | Part number | Min. Packaging Q'ty (pcs) |
|--------------------|----------------------|--------------------------|-----------|--------|--------|-----------------------------|------------------|-------------|---------------------------|
|                    |                      |                          | L (mm)    | W (mm) | H (mm) | Ripple current *1 (Ar.m.s.) | ESR *2 (mΩ max.) |             |                           |
| MC                 | 2                    | 120                      | 6.0       | 3.2    | 1.9    | 2.7                         | 12               | EEFMC0D121R | 3000                      |
|                    | 2.5                  | 100                      | 6.0       | 3.2    | 1.9    | 2.7                         | 12               | EEFMC0E101R | 3000                      |
|                    | 4                    | 82                       | 6.0       | 3.2    | 1.9    | 2.2                         | 18               | EEFMC0G820R | 3000                      |
|                    | 6.3                  | 47                       | 6.0       | 3.2    | 1.9    | 2.2                         | 18               | EEFMC0J470R | 3000                      |

\*1: Ripple current (100 kHz/ +20 to +105 °C ), \*2: ESR (100 kHz/+20 °C)

\*3: Please refer to the page of "Mounting Specifications".

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02 Mar. 2015

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● Factory

Device Solutions Business Division  
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**Panasonic**<sup>®</sup>

1006 Kadoma, Kadoma City, Osaka 571-8506,  
JAPAN

The information in this catalog is valid as of March 2018.