

### Surface Mount Type

Series: **FP** Type: **V**

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



#### ■ Features

- Low ESR (30 % to 50 % less than FK series)
- Endurance: 2000 h at 105 °C
- Vibration-proof product is available upon request. ( $\phi 8 \leq$ )
- RoHS directive compliant

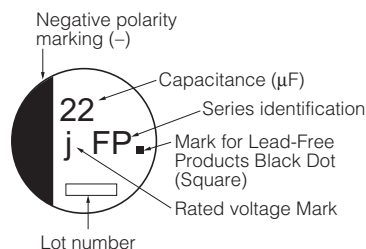
#### ■ Specifications

|                                    |                                                                                                                                                                                             |                                    |    |    |    |    |    |                             |
|------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|----|----|----|----|----|-----------------------------|
| Category Temp. Range               | -55 °C to +105 °C                                                                                                                                                                           |                                    |    |    |    |    |    |                             |
| Rated W.V. Range                   | 6.3 V.DC to 50 V.DC                                                                                                                                                                         |                                    |    |    |    |    |    |                             |
| Nominal Cap. Range                 | 10 µF to 1800 µF                                                                                                                                                                            |                                    |    |    |    |    |    |                             |
| Capacitance Tolerance              | ±20 % (120 Hz/+20 °C)                                                                                                                                                                       |                                    |    |    |    |    |    |                             |
| DC Leakage Current                 | I ≤ 0.01 CV or 3 (µA) After 2 minutes (whichever is greater)                                                                                                                                |                                    |    |    |    |    |    |                             |
| tan δ                              | Please see the attached standard products list                                                                                                                                              |                                    |    |    |    |    |    |                             |
| Characteristics at Low Temperature | W.V. (V)                                                                                                                                                                                    | 6.3                                | 10 | 16 | 25 | 35 | 50 | (Impedance ratio at 120 Hz) |
|                                    | Z(-25 °C)/Z(+20 °C)                                                                                                                                                                         | 2                                  | 2  | 2  | 2  | 2  | 2  |                             |
|                                    | Z(-40°C)/Z(+20 °C)                                                                                                                                                                          | 3                                  | 3  | 3  | 3  | 3  | 3  |                             |
|                                    | Z(-55°C)/Z(+20 °C)                                                                                                                                                                          | 4                                  | 4  | 4  | 3  | 3  | 3  |                             |
| Endurance                          | After applying rated working voltage at +105 °C ±2 °C for 2000 hours the capacitors shall meet the limits specified below. Post-test requirement at +20 °C                                  |                                    |    |    |    |    |    |                             |
|                                    | Capacitance change                                                                                                                                                                          | ±30 % of initial measured value    |    |    |    |    |    |                             |
|                                    | tan δ                                                                                                                                                                                       | ≤ 200 % of initial specified value |    |    |    |    |    |                             |
|                                    | DC leakage current                                                                                                                                                                          | ≤ initial specified value          |    |    |    |    |    |                             |
| Shelf Life                         | After storage for 1000 hours at +105 °C±2 °C with no voltage applied and then being stabilized at +20 °C, capacitors shall meet the limits specified in Endurance. (With voltage treatment) |                                    |    |    |    |    |    |                             |
| Resistance to Soldering Heat       | After reflow soldering and then being stabilized at +20 °C, capacitors shall meet the following limits.                                                                                     |                                    |    |    |    |    |    |                             |
|                                    | Capacitance change                                                                                                                                                                          | ±10 % of initial measured value    |    |    |    |    |    |                             |
|                                    | tan δ                                                                                                                                                                                       | ≤ initial specified value          |    |    |    |    |    |                             |
|                                    | DC leakage current                                                                                                                                                                          | ≤ initial specified value          |    |    |    |    |    |                             |

#### ■ Marking

Example: 6.3 V 22  $\mu$ F

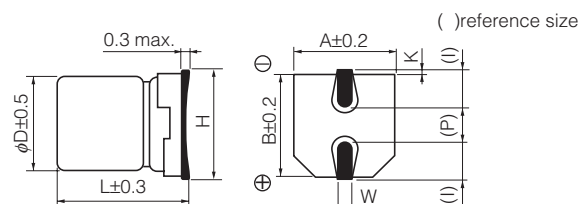
Marking color: BLACK



##### Rated Voltage Mark

|   |       |
|---|-------|
| j | 6.3 V |
| A | 10 V  |
| C | 16 V  |
| E | 25 V  |
| V | 35 V  |
| H | 50 V  |

#### ■ Dimensions in mm(not to scale)



(mm)

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

## ■ Standard Products

Endurance : 105 °C 2000 h

| W.V. | Cap.<br>(±20 %) | Case size |        |               | Specification                                              |                                        |                               | Part No.<br>(RoHS:compliant) | Reflow | Min.<br>Packaging Q'ty |
|------|-----------------|-----------|--------|---------------|------------------------------------------------------------|----------------------------------------|-------------------------------|------------------------------|--------|------------------------|
|      |                 | Dia.      | Length | *Size<br>Code | Ripple<br>Current<br>(100 kHz)<br>(+105 °C)<br>(mA r.m.s.) | E.S.R.<br>(100 kHz)<br>(+20 °C)<br>(Ω) | tan δ<br>(120 Hz)<br>(+20 °C) |                              |        | Taping                 |
| (V)  | (μF)            | (mm)      | (mm)   |               |                                                            |                                        |                               |                              |        | (pcs)                  |
| 6.3  | 22              | 4         | 5.8    | B             | 160                                                        | 0.85                                   | 0.26                          | EEEF0J220AR                  | (5)    | 2000                   |
|      | 47              | 4         | 5.8    | (B)           | 160                                                        | 0.85                                   | 0.26                          | EEEF0J470UAR                 | (5)    | 2000                   |
|      |                 | 5         | 5.8    | C             | 240                                                        | 0.36                                   | 0.26                          | EEEF0J470AR                  | (5)    | 1000                   |
|      | 100             | 5         | 5.8    | (C)           | 240                                                        | 0.36                                   | 0.26                          | EEEF0J101UAR                 | (5)    | 1000                   |
|      |                 | 6.3       | 5.8    | D             | 300                                                        | 0.26                                   | 0.26                          | EEEF0J101AP                  | (5)    | 1000                   |
|      | 220             | 6.3       | 5.8    | D             | 300                                                        | 0.26                                   | 0.26                          | EEEF0J221AP                  | (5)    | 1000                   |
|      | 330             | 6.3       | 7.7    | D8            | 600                                                        | 0.16                                   | 0.26                          | EEEF0J331XAP                 | (5)    | 900                    |
|      |                 | 8         | 6.2    | E             | 500                                                        | 0.18                                   | 0.26                          | EEEF0J331AP                  | (6)    | 1000                   |
|      | 470             | 8         | 10.2   | F             | 850                                                        | 0.08                                   | 0.26                          | EEEF0J471AP                  | (6)    | 500                    |
|      | 1000            | 8         | 10.2   | F             | 850                                                        | 0.08                                   | 0.26                          | EEEF0J102AP                  | (6)    | 500                    |
| 1500 | 10              | 10.2      | G      | 1190          | 0.06                                                       | 0.26                                   | EEEF0J152AP                   | (6)                          | 500    |                        |
| 1800 | 10              | 10.2      | (G)    | 850           | 0.08                                                       | 0.26                                   | EEEF0J182UAP                  | (6)                          | 500    |                        |
| 10   | 22              | 4         | 5.8    | B             | 160                                                        | 0.85                                   | 0.19                          | EEEF1A220AR                  | (5)    | 2000                   |
|      | 33              | 4         | 5.8    | (B)           | 160                                                        | 0.85                                   | 0.19                          | EEEF1A330UAR                 | (5)    | 2000                   |
|      |                 | 5         | 5.8    | C             | 240                                                        | 0.36                                   | 0.19                          | EEEF1A330AR                  | (5)    | 1000                   |
|      | 150             | 6.3       | 5.8    | D             | 300                                                        | 0.26                                   | 0.19                          | EEEF1A151AP                  | (5)    | 1000                   |
|      | 220             | 6.3       | 7.7    | D8            | 600                                                        | 0.16                                   | 0.19                          | EEEF1A221XAP                 | (5)    | 900                    |
|      |                 | 8         | 6.2    | E             | 500                                                        | 0.18                                   | 0.19                          | EEEF1A221AP                  | (6)    | 1000                   |
|      | 330             | 8         | 10.2   | F             | 850                                                        | 0.08                                   | 0.19                          | EEEF1A331AP                  | (6)    | 500                    |
|      | 470             | 8         | 10.2   | F             | 850                                                        | 0.08                                   | 0.19                          | EEEF1A471AP                  | (6)    | 500                    |
|      | 680             | 8         | 10.2   | F             | 850                                                        | 0.08                                   | 0.19                          | EEEF1A681AP                  | (6)    | 500                    |
|      | 1000            | 10        | 10.2   | G             | 1190                                                       | 0.06                                   | 0.19                          | EEEF1A102AP                  | (6)    | 500                    |
| 1200 | 10              | 10.2      | (G)    | 850           | 0.08                                                       | 0.19                                   | EEEF1A122UAP                  | (6)                          | 500    |                        |
| 16   | 10              | 4         | 5.8    | B             | 160                                                        | 0.85                                   | 0.16                          | EEEF1C100AR                  | (5)    | 2000                   |
|      | 22              | 4         | 5.8    | (B)           | 160                                                        | 0.85                                   | 0.16                          | EEEF1C220UAR                 | (5)    | 2000                   |
|      |                 | 5         | 5.8    | C             | 240                                                        | 0.36                                   | 0.16                          | EEEF1C220AR                  | (5)    | 1000                   |
|      | 47              | 5         | 5.8    | (C)           | 240                                                        | 0.36                                   | 0.16                          | EEEF1C470UAR                 | (5)    | 1000                   |
|      |                 | 6.3       | 5.8    | D             | 300                                                        | 0.26                                   | 0.16                          | EEEF1C470AP                  | (5)    | 1000                   |
|      | 68              | 6.3       | 5.8    | D             | 300                                                        | 0.26                                   | 0.16                          | EEEF1C680AP                  | (5)    | 1000                   |
|      | 100             | 6.3       | 5.8    | D             | 300                                                        | 0.26                                   | 0.16                          | EEEF1C101AP                  | (5)    | 1000                   |
|      |                 | 6.3       | 7.7    | D8            | 600                                                        | 0.16                                   | 0.16                          | EEEF1C101XAP                 | (5)    | 900                    |
|      | 150             | 6.3       | 7.7    | D8            | 600                                                        | 0.16                                   | 0.16                          | EEEF1C151XAP                 | (5)    | 900                    |
|      | 220             | 6.3       | 7.7    | D8            | 600                                                        | 0.16                                   | 0.16                          | EEEF1C221XAP                 | (5)    | 900                    |
|      |                 | 8         | 6.2    | E             | 500                                                        | 0.18                                   | 0.16                          | EEEF1C221AP                  | (6)    | 1000                   |
|      | 330             | 8         | 10.2   | F             | 850                                                        | 0.08                                   | 0.16                          | EEEF1C331AP                  | (6)    | 500                    |
|      | 470             | 8         | 10.2   | F             | 850                                                        | 0.08                                   | 0.16                          | EEEF1C471AP                  | (6)    | 500                    |
|      | 680             | 10        | 10.2   | G             | 1190                                                       | 0.06                                   | 0.16                          | EEEF1C681AP                  | (6)    | 500                    |
| 820  | 10              | 10.2      | (G)    | 850           | 0.08                                                       | 0.16                                   | EEEF1C821UAP                  | (6)                          | 500    |                        |
| 25   | 10              | 4         | 5.8    | B             | 160                                                        | 0.85                                   | 0.14                          | EEEF1E100AR                  | (5)    | 2000                   |
|      | 22              | 5         | 5.8    | C             | 240                                                        | 0.36                                   | 0.14                          | EEEF1E220AR                  | (5)    | 1000                   |
|      | 33              | 5         | 5.8    | (C)           | 240                                                        | 0.36                                   | 0.14                          | EEEF1E330UAR                 | (5)    | 1000                   |
|      |                 | 6.3       | 5.8    | D             | 300                                                        | 0.26                                   | 0.14                          | EEEF1E330AP                  | (5)    | 1000                   |
|      | 47              | 6.3       | 5.8    | D             | 300                                                        | 0.26                                   | 0.14                          | EEEF1E470AP                  | (5)    | 1000                   |
|      | 68              | 6.3       | 5.8    | D             | 300                                                        | 0.26                                   | 0.14                          | EEEF1E680AP                  | (5)    | 1000                   |
|      | 100             | 6.3       | 7.7    | D8            | 600                                                        | 0.16                                   | 0.14                          | EEEF1E101XAP                 | (5)    | 900                    |
|      |                 | 8         | 6.2    | E             | 500                                                        | 0.18                                   | 0.14                          | EEEF1E101AP                  | (6)    | 1000                   |
|      | 150             | 8         | 10.2   | F             | 850                                                        | 0.08                                   | 0.14                          | EEEF1E151AP                  | (6)    | 500                    |
|      | 220             | 8         | 10.2   | F             | 850                                                        | 0.08                                   | 0.14                          | EEEF1E221AP                  | (6)    | 500                    |
|      | 330             | 8         | 10.2   | F             | 850                                                        | 0.08                                   | 0.14                          | EEEF1E331AP                  | (6)    | 500                    |
|      | 470             | 10        | 10.2   | G             | 1190                                                       | 0.06                                   | 0.14                          | EEEF1E471AP                  | (6)    | 500                    |
| 560  | 10              | 10.2      | (G)    | 850           | 0.08                                                       | 0.14                                   | EEEF1E561UAP                  | (6)                          | 500    |                        |

\* Size code( ):Miniaturization product

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

The taping dimensions are explained on p.177 of our Catalog. Please use it as a reference guide.

Reflow Profile(Fig-1 to Fig-11) listed on p.175 of our Catalog.

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.

01 Feb. 2009

### ■ Standard Products

Endurance : 105 °C 2000 h

| W.V.<br>(V) | Cap.<br>(±20 %)<br>(μF) | Case size    |                |               | Specification                                              |                                        |                               | Part No.<br>(RoHS:compliant) | Reflow | Min.<br>Packaging Q'ty |
|-------------|-------------------------|--------------|----------------|---------------|------------------------------------------------------------|----------------------------------------|-------------------------------|------------------------------|--------|------------------------|
|             |                         | Dia.<br>(mm) | Length<br>(mm) | *Size<br>Code | Ripple<br>Current<br>(100 kHz)<br>(+105 °C)<br>(mA r.m.s.) | E.S.R.<br>(100 kHz)<br>(+20 °C)<br>(Ω) | tan δ<br>(120 Hz)<br>(+20 °C) |                              |        | Taping<br>(pcs)        |
| 35          | 10                      | 4            | 5.8            | (B)           | 160                                                        | 0.85                                   | 0.12                          | EEEFV100UAR                  | (5)    | 2000                   |
|             | 22                      | 5            | 5.8            | C             | 240                                                        | 0.36                                   | 0.12                          | EEEFV1V220AR                 | (5)    | 1000                   |
|             | 33                      | 6.3          | 5.8            | D             | 300                                                        | 0.26                                   | 0.12                          | EEEFV1V330AP                 | (5)    | 1000                   |
|             | 47                      | 6.3          | 5.8            | D             | 300                                                        | 0.26                                   | 0.12                          | EEEFV1V470AP                 | (5)    | 1000                   |
|             | 68                      | 6.3          | 7.7            | D8            | 600                                                        | 0.16                                   | 0.12                          | EEEFV680XAP                  | (5)    | 900                    |
|             | 100                     | 6.3          | 7.7            | D8            | 600                                                        | 0.16                                   | 0.12                          | EEEFV101XAP                  | (5)    | 900                    |
|             |                         | 8            | 10.2           | F             | 850                                                        | 0.08                                   | 0.12                          | EEEFV1V101AP                 | (6)    | 500                    |
|             | 150                     | 8            | 10.2           | F             | 850                                                        | 0.08                                   | 0.12                          | EEEFV1V151AP                 | (6)    | 500                    |
|             | 220                     | 8            | 10.2           | F             | 850                                                        | 0.08                                   | 0.12                          | EEEFV1V221AP                 | (6)    | 500                    |
|             | 330                     | 10           | 10.2           | G             | 1190                                                       | 0.06                                   | 0.12                          | EEEFV1V331AP                 | (6)    | 500                    |
| 50          | 390                     | 10           | 10.2           | (G)           | 850                                                        | 0.08                                   | 0.12                          | EEEFV391UAP                  | (6)    | 500                    |
|             | 100                     | 8            | 10.2           | F             | 670                                                        | 0.18                                   | 0.10                          | EEEFV1H101AP                 | (6)    | 500                    |
|             | 220                     | 10           | 10.2           | G             | 900                                                        | 0.12                                   | 0.10                          | EEEFV1H221AP                 | (6)    | 500                    |

\* Size code( ):Miniaturization product

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

The taping dimensions are explained on p.177 of our Catalog. Please use it as a reference guide.

Reflow Profile(Fig-1 to Fig-11) listed on p.175 of our Catalog.