

### 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

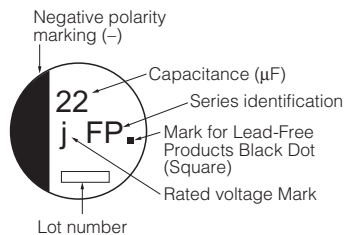
#### ■ Specifications

|                                    |   |   |    |    |    |    |    |                             |
|------------------------------------|---|---|----|----|----|----|----|-----------------------------|
| Category Temp. Range               | -55 °C to +105 °C   |   |    |    |    |    |    |                             |
| Rated W.V. Range                   | 6.3 V.DC to 50 V.DC   |   |    |    |    |    |    |                             |
| Nominal Cap. Range                 | 10 $\mu$ F to 1800 $\mu$ F  |   |    |    |    |    |    |                             |
| Capacitance Tolerance              | $\pm 20$ % (120 Hz/+20 °C)  |   |    |    |    |    |    |                             |
| DC Leakage Current                 | $I \leq 0.01$ CV or 3 ( $\mu$ A) After 2 minutes (whichever is greater)   |   |    |    |    |    |    |                             |
| tan $\delta$                       | 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 $\pm 2$ °C for 2000 hours the capacitors shall meet the limits specified below. Post-test requirement at +20 °C                                   |   |    |    |    |    |    |                             |
|                                    | Capacitance change  | $\pm 30$ % of initial measured value    |    |    |    |    |    |                             |
|                                    | tan $\delta$  | $\leq 200$ % of initial specified value |    |    |    |    |    |                             |
|                                    | DC leakage current  | $\leq$ initial specified value          |    |    |    |    |    |                             |
| Shelf Life                         | After storage for 1000 hours at +105 °C $\pm 2$ °C with no voltage applied and then being stabilized at +20 °C, capacitors shall meet the limits specified in Endurance. (With voltage treatment) |   |    |    |    |    |    |                             |
|                                    | After reflow soldering and then being stabilized at +20 °C, capacitors shall meet the following limits.   |   |    |    |    |    |    |                             |
| Resistance to Soldering Heat       | After reflow soldering and then being stabilized at +20 °C, capacitors shall meet the following limits.   |   |    |    |    |    |    |                             |
|                                    | Capacitance change  | $\pm 10$ % of initial measured value    |    |    |    |    |    |                             |
|                                    | tan $\delta$  | $\leq$ initial specified value          |    |    |    |    |    |                             |
|                                    | DC leakage current  | $\leq$ initial specified value          |    |    |    |    |    |                             |

#### ■ Marking

Example: 6.3 V 22  $\mu$ F

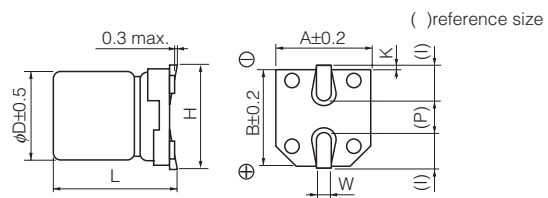
Marking color: BLACK



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

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.

00 Sep. 2010

### 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<br><br>(pcs)    |
| (V)  | (μF)            | (mm)      | (mm)   |               |  |  |                               |                              |        |                        |
| 6.3  | 22              | 4         | 5.8    | B             | 160  | 0.85                                   | 0.26                          | EEEEFP0J220AR                | (5)    | 2000                   |
|      | 47              | 4         | 5.8    | (B)           | 160  | 0.85                                   | 0.26                          | EEEEFPJ470UAR                | (5)    | 2000                   |
|      |                 | 5         | 5.8    | C             | 240  | 0.36                                   | 0.26                          | EEEEFP0J470AR                | (5)    | 1000                   |
|      | 100             | 5         | 5.8    | (C)           | 240  | 0.36                                   | 0.26                          | EEEEFPJ101UAR                | (5)    | 1000                   |
|      |                 | 6.3       | 5.8    | D             | 300  | 0.26                                   | 0.26                          | EEEEFP0J101AP                | (5)    | 1000                   |
|      | 220             | 6.3       | 5.8    | D             | 300  | 0.26                                   | 0.26                          | EEEEFP0J221AP                | (5)    | 1000                   |
|      | 330             | 6.3       | 7.7    | D8            | 600  | 0.16                                   | 0.26                          | EEEEFPJ331XAP                | (5)    | 900                    |
|      |                 | 8         | 6.2    | E             | 500  | 0.18                                   | 0.26                          | EEEEFP0J331AP                | (6)    | 1000                   |
|      | 470             | 8         | 10.2   | F             | 850  | 0.08                                   | 0.26                          | EEEEFP0J471AP                | (6)    | 500                    |
|      | 1000            | 8         | 10.2   | F             | 850  | 0.08                                   | 0.26                          | EEEEFP0J102AP                | (6)    | 500                    |
| 1500 | 10              | 10.2      | G      | 1190          | 0.06   | 0.26                                   | EEEEFP0J152AP                 | (6)                          | 500    |                        |
| 1800 | 10              | 10.2      | (G)    | 850           | 0.08   | 0.26                                   | EEEEFPJ182UAP                 | (6)                          | 500    |                        |
| 10   | 22              | 4         | 5.8    | B             | 160  | 0.85                                   | 0.19                          | EEEEFP1A220AR                | (5)    | 2000                   |
|      | 33              | 4         | 5.8    | (B)           | 160  | 0.85                                   | 0.19                          | EEEEFPA330UAR                | (5)    | 2000                   |
|      |                 | 5         | 5.8    | C             | 240  | 0.36                                   | 0.19                          | EEEEFP1A330AR                | (5)    | 1000                   |
|      | 150             | 6.3       | 5.8    | D             | 300  | 0.26                                   | 0.19                          | EEEEFP1A151AP                | (5)    | 1000                   |
|      | 220             | 6.3       | 7.7    | D8            | 600  | 0.16                                   | 0.19                          | EEEEFPA221XAP                | (5)    | 900                    |
|      |                 | 8         | 6.2    | E             | 500  | 0.18                                   | 0.19                          | EEEEFP1A221AP                | (6)    | 1000                   |
|      | 330             | 8         | 10.2   | F             | 850  | 0.08                                   | 0.19                          | EEEEFP1A331AP                | (6)    | 500                    |
|      | 470             | 8         | 10.2   | F             | 850  | 0.08                                   | 0.19                          | EEEEFP1A471AP                | (6)    | 500                    |
|      | 680             | 8         | 10.2   | F             | 850  | 0.08                                   | 0.19                          | EEEEFP1A681AP                | (6)    | 500                    |
|      | 1000            | 10        | 10.2   | G             | 1190   | 0.06                                   | 0.19                          | EEEEFP1A102AP                | (6)    | 500                    |
| 1200 | 10              | 10.2      | (G)    | 850           | 0.08   | 0.19                                   | EEEEFPA122UAP                 | (6)                          | 500    |                        |
| 16   | 10              | 4         | 5.8    | B             | 160  | 0.85                                   | 0.16                          | EEEEFP1C100AR                | (5)    | 2000                   |
|      | 22              | 4         | 5.8    | (B)           | 160  | 0.85                                   | 0.16                          | EEEEFPC220UAR                | (5)    | 2000                   |
|      |                 | 5         | 5.8    | C             | 240  | 0.36                                   | 0.16                          | EEEEFP1C220AR                | (5)    | 1000                   |
|      | 47              | 5         | 5.8    | (C)           | 240  | 0.36                                   | 0.16                          | EEEEFPC470UAR                | (5)    | 1000                   |
|      |                 | 6.3       | 5.8    | D             | 300  | 0.26                                   | 0.16                          | EEEEFP1C470AP                | (5)    | 1000                   |
|      | 68              | 6.3       | 5.8    | D             | 300  | 0.26                                   | 0.16                          | EEEEFP1C680AP                | (5)    | 1000                   |
|      | 100             | 6.3       | 5.8    | D             | 300  | 0.26                                   | 0.16                          | EEEEFP1C101AP                | (5)    | 1000                   |
|      |                 | 6.3       | 7.7    | D8            | 600  | 0.16                                   | 0.16                          | EEEEFPC101XAP                | (5)    | 900                    |
|      | 150             | 6.3       | 7.7    | D8            | 600  | 0.16                                   | 0.16                          | EEEEFPC151XAP                | (5)    | 900                    |
|      | 220             | 6.3       | 7.7    | D8            | 600  | 0.16                                   | 0.16                          | EEEEFPC221XAP                | (5)    | 900                    |
|      |                 | 8         | 6.2    | E             | 500  | 0.18                                   | 0.16                          | EEEEFP1C221AP                | (6)    | 1000                   |
|      | 330             | 8         | 10.2   | F             | 850  | 0.08                                   | 0.16                          | EEEEFP1C331AP                | (6)    | 500                    |
|      | 470             | 8         | 10.2   | F             | 850  | 0.08                                   | 0.16                          | EEEEFP1C471AP                | (6)    | 500                    |
| 680  | 10              | 10.2      | G      | 1190          | 0.06   | 0.16                                   | EEEEFP1C681AP                 | (6)                          | 500    |                        |
| 820  | 10              | 10.2      | (G)    | 850           | 0.08   | 0.16                                   | EEEEFPC821UAP                 | (6)                          | 500    |                        |
| 25   | 10              | 4         | 5.8    | B             | 160  | 0.85                                   | 0.14                          | EEEEFP1E100AR                | (5)    | 2000                   |
|      | 22              | 5         | 5.8    | C             | 240  | 0.36                                   | 0.14                          | EEEEFP1E220AR                | (5)    | 1000                   |
|      |                 | 5         | 5.8    | (C)           | 240  | 0.36                                   | 0.14                          | EEEEFPE330UAR                | (5)    | 1000                   |
|      | 33              | 6.3       | 5.8    | D             | 300  | 0.26                                   | 0.14                          | EEEEFP1E330AP                | (5)    | 1000                   |
|      |                 | 6.3       | 5.8    | D             | 300  | 0.26                                   | 0.14                          | EEEEFP1E470AP                | (5)    | 1000                   |
|      | 68              | 6.3       | 5.8    | D             | 300  | 0.26                                   | 0.14                          | EEEEFP1E680AP                | (5)    | 1000                   |
|      | 100             | 6.3       | 7.7    | D8            | 600  | 0.16                                   | 0.14                          | EEEEFPE101XAP                | (5)    | 900                    |
|      |                 | 8         | 6.2    | E             | 500  | 0.18                                   | 0.14                          | EEEEFP1E101AP                | (6)    | 1000                   |
|      | 150             | 8         | 10.2   | F             | 850  | 0.08                                   | 0.14                          | EEEEFP1E151AP                | (6)    | 500                    |
|      | 220             | 8         | 10.2   | F             | 850  | 0.08                                   | 0.14                          | EEEEFP1E221AP                | (6)    | 500                    |
|      | 330             | 8         | 10.2   | F             | 850  | 0.08                                   | 0.14                          | EEEEFP1E331AP                | (6)    | 500                    |
|      | 470             | 10        | 10.2   | G             | 1190   | 0.06                                   | 0.14                          | EEEEFP1E471AP                | (6)    | 500                    |
|      | 560             | 10        | 10.2   | (G)           | 850  | 0.08                                   | 0.14                          | EEEEFPE561UAP                | (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 EE188 of our Catalog. Please use it as a reference guide.

Reflow Profile(Fig-1 to Fig-11) listed on EE186 of our Catalog.

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Should a safety concern arise regarding this product, please be sure to contact us immediately.

00 Sep. 2010

### 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<br><br>(pcs)    |
| (V)  | (μF)            | (mm)      | (mm)   |               |  |  |                               |                              |        |                        |
| 35   | 10              | 4         | 5.8    | (B)           | 160  | 0.85                                   | 0.12                          | EEFFPV100UAR                 | (5)    | 2000                   |
|      | 22              | 5         | 5.8    | C             | 240  | 0.36                                   | 0.12                          | EEFFPV1V220AR                | (5)    | 1000                   |
|      | 33              | 6.3       | 5.8    | D             | 300  | 0.26                                   | 0.12                          | EEFFPV1V330AP                | (5)    | 1000                   |
|      | 47              | 6.3       | 5.8    | D             | 300  | 0.26                                   | 0.12                          | EEFFPV1V470AP                | (5)    | 1000                   |
|      | 68              | 6.3       | 7.7    | D8            | 600  | 0.16                                   | 0.12                          | EEFFPV680XAP                 | (5)    | 900                    |
|      | 100             | 6.3       | 7.7    | D8            | 600  | 0.16                                   | 0.12                          | EEFFPV101XAP                 | (5)    | 900                    |
|      |                 | 8         | 10.2   | F             | 850  | 0.08                                   | 0.12                          | EEFFPV1V101AP                | (6)    | 500                    |
|      | 150             | 8         | 10.2   | F             | 850  | 0.08                                   | 0.12                          | EEFFPV1V151AP                | (6)    | 500                    |
|      | 220             | 8         | 10.2   | F             | 850  | 0.08                                   | 0.12                          | EEFFPV1V221AP                | (6)    | 500                    |
|      | 330             | 10        | 10.2   | G             | 1190   | 0.06                                   | 0.12                          | EEFFPV1V331AP                | (6)    | 500                    |
| 390  | 10              | 10.2      | (G)    | 850           | 0.08   | 0.12                                   | EEFFPV391UAP                  | (6)                          | 500    |                        |
| 50   | 100             | 8         | 10.2   | F             | 670  | 0.18                                   | 0.10                          | EEFFPV1H101AP                | (6)    | 500                    |
|      | 220             | 10        | 10.2   | G             | 900  | 0.12                                   | 0.10                          | EEFFPV1H221AP                | (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 EE188 of our Catalog. Please use it as a reference guide.

Reflow Profile(Fig-1 to Fig-11) listed on EE186 of our Catalog.