

### 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)							
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)

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

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.

**NEW**

■ Standard Products

Endurance : 105 °C 2000 h

W.V.	Cap. (±20 %)	Case size			Specification			Part No. (RoHS:compliant)	Reflow	Min. Packaging Q'ty
		Dia.	Length	*Size Code	Ripple Current (100 kHz) (+105 °C) (mA r.m.s.)	E.S.R. (100 kHz) (+20 °C) (Ω)	tan δ (120 Hz) (+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)
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.

■ Standard Products

Endurance : 105 °C 2000 h

W.V.	Cap. (±20 %)	Case size			Specification			Part No. (RoHS:compliant)	Reflow	Min. Packaging Q'ty
		Dia.	Length	*Size Code	Ripple Current (100 kHz (+105 °C) (mA r.m.s.))	E.S.R. (100 kHz) (+20 °C) (Ω)	tan δ (120 Hz) (+20 °C)			Taping  (pcs)
(V)	(μF)	(mm)	(mm)							
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
390	10	10.2	(G)	850	0.08	0.12	EEEFV391UAP	(6)	500	
50	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

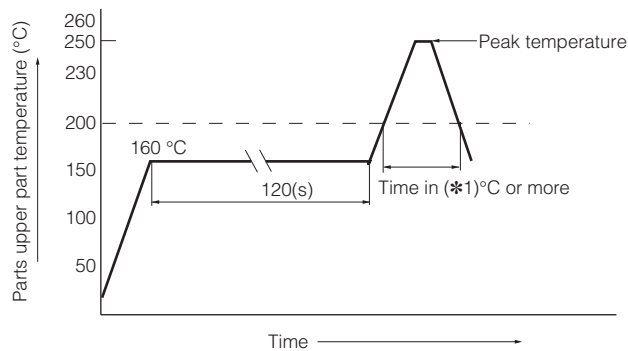
\* Size code( ):Miniaturization product

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.

- Reflow guaranteed condition
- RoHS compliant



### ■ Lead-Free reflow

Reflow No.	Fig. (1)	Fig. (2)	Fig. (3)	Fig. (4)
Category	φ3 to φ6.3	φ8 to φ10	φ12.5 to φ18	EB series (φ10 to φ18)
Peak temperature	250 °C	235 °C	230 °C (220 °C)	230 °C
Time in peak temperature	5 s	5 s	5 s (5 s)	5 s
Time in (*1) °C or more	≥200 °C 60 s	≥200 °C 60 s	≥200 °C 20 s (30 s)	≥200 °C 20 s
Time of reflow	1 time	1 time	1 time	1 time

### ■ High temperature Lead-Free reflow

Reflow No.	Fig. (5)	Fig. (6)		Fig. (7)		Fig. (8)	
Category	φ4 to φ6.3	φ8 to φ10		φ8 to φ10		φ8 to φ10 (TK · TP series)	
Peak temperature	260 °C (255 °C)	245 °C	260 °C	250 °C	260 °C	255 °C	260 °C
Time in peak temperature	≥250 °C 5 s (10 s)	≥240 °C 10 s	≥250 °C 5 s	≥240 °C 10 s	≥250 °C 5 s	≥250 °C 30 s	≥250 °C 20 s
Time in (*1) °C or more	≥230 °C 30 s	≥230 °C 30 s	≥230 °C 30 s	≥230 °C 30 s	≥230 °C 30 s	≥230 °C 40 s	≥230 °C 30 s
	≥217 °C 40 s	≥217 °C 40 s	≥217 °C 40 s	≥217 °C 40 s	≥217 °C 40 s	≥217 °C 65 s	≥217 °C 65 s
	≥200 °C 70 s	≥200 °C 70 s	≥200 °C 70 s	≥200 °C 70 s	≥200 °C 70 s	≥200 °C 90 s	≥200 °C 70 s
Time of reflow	2 times	2 times	1 time	2 times	1 time	2 times	2 times

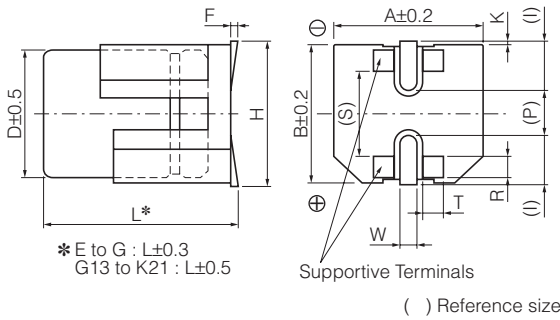
Reflow No.	Fig. (9)	Fig. (10)	Fig. (11)
Category	φ12.5 to φ18 (FK, TK, HD series) 6.3 V to 35 V	φ12.5 to φ18 (FK series) 50 V to 63 V (TK series) 50 V	φ12.5 to φ18 (FK series) 80 V to 100 V (TK series) 63 V to 100 V
Peak temperature	245 °C	245 °C	245 °C
Time in peak temperature	≤240 °C 30 s	≤240 °C 5 s	≤240 °C 5 s
Time in (*1) °C or more	≤217 °C 90 s	≤217 °C 30 s	≤217 °C 30 s
Time of reflow	2 times	2 times	1 time

- \* For reflow, use a thermal condition system such as infrared radiation (IR) or hot blast.
- \* Vapor heat transfer systems (VPS) are not recommended.
- \* Panasonic have several series available for pure Tin terminal and ZVEI reflow based on J-STD-020D (JEDEC). (Please contact sales for details.)

### ■ Dimensions (Vibration-proof products)

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

(mm)

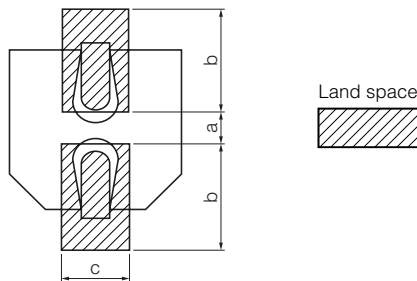


Size Code	φD	L	A, B	H max.	F	I	W	P	K	R	S	T
E	8.0	6.5	8.3	9.5	-0.1~+0.15	3.4	0.7±0.1	2.2	0.35 <sup>+0.15</sup> <sub>-0.20</sub>	0.70±0.2	5.3±0.2	1.7±0.2
F	8.0	10.5	8.3	10.0	-0.1~+0.15	3.4	1.2±0.2	3.1	0.70±0.2	0.70±0.2	5.3±0.2	1.3±0.2
G	10.0	10.5	10.3	12.0	-0.1~+0.15	3.5	1.2±0.2	4.6	0.70±0.2	0.70±0.2	6.9±0.2	1.3±0.2
G13	10.0	13.8	10.3	12.0	-0.1~+0.15	3.5	1.2±0.2	4.6	0.70±0.2	0.70±0.2	6.9±0.2	1.3±0.2
H13	12.5	13.8	13.5	15.0	-0.1~+0.15	4.7	1.2±0.3	4.4	0.70±0.3	2.2±0.2	7.1±0.2	2.4±0.2
H16	12.5	16.8	13.5	15.0	-0.1~+0.15	4.7	1.2±0.2	4.4	0.70±0.3	2.2±0.2	7.1±0.2	2.4±0.2
J16	16.0	16.8	17.0	19.0	-0.1~+0.15	5.5	1.4±0.2	6.7	0.70±0.3	3.0±0.2	9.0±0.2	1.9±0.2
J21	16.0	21.8	17.0	19.0	-0.1~+0.15	5.5	1.4±0.2	6.7	0.70±0.3	3.0±0.2	9.0±0.2	1.9±0.2
K16	18.0	16.8	19.0	21.0	-0.1~+0.15	6.7	1.4±0.2	6.7	0.70±0.3	3.0±0.2	11.0±0.2	1.9±0.2
K21	18.0	21.8	19.0	21.0	-0.1~+0.15	6.7	1.4±0.2	6.7	0.70±0.3	3.0±0.2	11.0±0.2	1.9±0.2

### ■ Land/Pad Pattern

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

#### ● Standard products

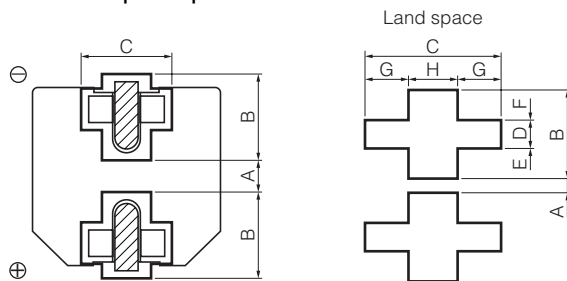


[Table of Board Land Size vs. Capacitor Size] (mm)

Size/Dimension	a	b	c
A (φ3)	0.6	2.2	1.5
B (φ4)	1.0	2.5	1.6
C (φ5)	1.5	2.8	1.6
D (φ6.3)	1.8	3.2	1.6
E (φ8 × 6.2L)	2.2	4.0	1.6
F (φ8 × 10.2L)	3.1	4.0	2.0
G (φ10 × 10.2L)	4.6	4.1	2.0
H (φ12.5)	4.0	5.7	2.0
J (φ16)	6.0	6.5	2.5
K (φ18)	6.0	7.5	2.5

\* When size "a" is wide, back fillet can be made, decreasing fitting strenght.

#### ● Vibration-proof products



[Table of Board Land Size vs. Capacitor Size] (mm)

Size/Dimension	A	B	C	D	E	F	G	H
E (φ8 × 6.5L)	1.8	4.1	5.0	1.3	1.5	1.4	1.5	2.0
F (φ8 × 10.5L)	2.7	4.0	4.7	1.3	1.0	1.7	1.1	2.5
G (φ10)	3.9	4.4	4.7	1.3	1.2	1.9	1.1	2.5
H (φ12.5)	3.9	6.0	6.9	2.8	1.3	1.9	2.2	2.5
J (φ16)	5.8	6.8	6.2	3.6	1.3	1.9	1.7	2.8
K (φ18)	5.8	7.3	6.2	3.6	1.8	1.9	1.7	2.8

\* When size "A" is wide, back fillet can be made, decreasing fitting strenght.

\* Take mounting conditions, solderability and fitting strenght into consideration when selecting parts for your company's design.

### ■ Expected Life Estimate Quick Reference Guide

