FUJITSU MEDIA DEVICE
DATA SHEET

DS01-41101-1E

CAPACITORS

Functional Polymer Capacitors (FPCAP)

CS Series

■ DESCRIPTIONS

Recent trends in development of digital, high-frequency electronic devices have led to increasing demand for capacitors with reduced ripple and noise characteristics, plus compact size, high capacitance, and low ESR. The FPCAP capacitor utilizes a revolutionary new proprietary cathode formation process for greatly reducing ESR and improving efficiency with a variety of power supplies, as well as ripple and noise reduction.

The FUJITSU CS series FPCAP uses a functional conductive polymer cathode layer material to greatly reduce ESR in comparison with previous processes using manganese dioxide. This capacitor is ideal for use in applications demanding higher efficiency, low noise, reduced size, and high performance such as notebook PC power supply smoothing and CPU backup.

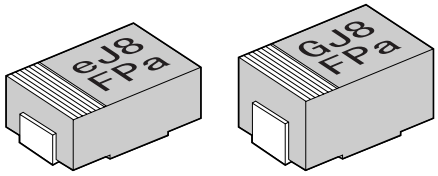
■ FEATURES

- Low ESR
- High ripple effect
- High reliability, long life

■ PRODUCT LINEUP

Part Number	Rated voltage	Rated static capacitance (µF)	Loss angle tangent	Leak current (µA)	ESR 100 kHz (mΩ)	Ripple current at maximum capacitance (mA rms)	Case size
FP-2R5CS221M-E0R	2.5	220	0.10	55.00	45	1700	E0
FP-2R5CS331M-ER	2.5	330	0.08	82.50	65	1500	E
FP-4R0CS151M-E0R	4.0	150	0.10	60.00	45	1700	E0
FP-4R0CS221M-ER	4.0	220	0.08	88.00	65	1500	E
FP-6R3CS101M-E0R	6.3	100	0.10	63.00	45	1700	E0
FP-6R3CS151M-ER	6.3	150	0.08	94.50	55	1900	E
FP-010CS101M-ER	10	100	0.08	100.00	55	1900	E

■ PACKAGES



■ PRINCIPAL CHARACTERISTICS

Parameter		Conditions	Value		Unit
			Min.	Max.	
Category temperature range		—	–55	105	°C
Maximum temperature at rated voltage		—	—	105	°C
Rated voltage range		Test method (JIS C 5101-3-1998) : at 105 °C	2.5	10	V
Static capacitance range		Test method (JIS C 5101-3-1998) : at 105 °C	100	330	µF
Static capacitance tolerance		Test method (JIS C 5101-3-1998) : Measurement frequency : 120 Hz ±20% at 20 °C Measurement voltage : 0.5 Vrms +1.5–2 Vdc Measurement circuit : Equivalent series circuit	–20	+20	%
Loss angle tangent	FP-2R5CS221M-E0R	Test method (JIS C 5101-3-1998) : Measurement frequency : 120 Hz ±20% at 20 °C Measurement voltage : 0.5 Vrms +1.5–2 Vdc Measurement circuit : Equivalent series circuit	—	0.10	—
	FP-2R5CS331M-ER		—	0.08	
	FP-4R0CS151M-E0R		—	0.10	
	FP-4R0CS221M-ER		—	0.08	
	FP-6R3CS101M-E0R		—	0.10	
	FP-6R3CS151M-ER		—	0.08	
	FP-010CS101M-ER		—	0.08	
Leak current	FP-2R5CS221M-E0R	Test method (JIS C 5101-3-1998) : Apply rated voltage through serial protective resistance of approx. 1000 Ω or less	—	55.00	µA
	FP-2R5CS331M-ER		—	82.50	
	FP-4R0CS151M-E0R		—	60.00	
	FP-4R0CS221M-ER		—	88.00	
	FP-6R3CS101M-E0R		—	63.00	
	FP-6R3CS151M-ER		—	94.50	
	FP-010CS101M-ER		—	100.00	
Equivalent series resistance (ESR)	FP-2R5CS221M-E0R	Test method (JIS C 5101-3-1998) : Measurement frequency : 100 kHz ±10% Measurement voltage : 0.5 Vrms +1.5–2 Vdc Measurement circuit : Equivalent series circuit Measurement temperature: 20 °C ±2 °C	—	45	mΩ
	FP-2R5CS331M-ER		—	65	
	FP-4R0CS151M-E0R		—	45	
	FP-4R0CS221M-ER		—	65	
	FP-6R3CS101M-E0R		—	45	
	FP-6R3CS151M-ER		—	55	
	FP-010CS101M-ER		—	55	
Maximum allowable ripple current	FP-2R5CS221M-E0R	100 kHz	—	1700	mA rms
	FP-2R5CS331M-ER		—	1500	
	FP-4R0CS151M-E0R		—	1700	
	FP-4R0CS221M-ER		—	1500	
	FP-6R3CS101M-E0R		—	1700	
	FP-6R3CS151M-ER		—	1900	
	FP-010CS101M-ER		—	1900	

(Continued)

Parameter			Conditions	Value		Unit
				Min.	Max.	
Solder thermal resistance	Static capacitance variability (ΔC/C)		Test method (JIS C 5101-3-1998) : Solder type : H60A, H60S, H63A Flux : Rosin ethanol solution (25 wt%) Preheat : 150 °C to 160 °C, 120 s : 200 °C or more, 20 s Peak temperature : 240 °C, 10 s Testing method : Reflow	Value before testing − 10	Value before testing + 10	%
	Loss angle tangent	FP-2R5CS221M-E0R		—	0.20	—
		FP-2R5CS331M-ER		—	0.16	
		FP-4R0CS151M-E0R		—	0.20	
		FP-4R0CS221M-ER		—	0.16	
		FP-6R3CS101M-E0R		—	0.20	
		FP-6R3CS151M-ER		—	0.16	
		FP-010CS101M-ER		—	0.16	
	Leak current	FP-2R5CS221M-E0R		—	165.00	μA
		FP-2R5CS331M-ER		—	247.50	
		FP-4R0CS151M-E0R		—	180.00	
		FP-4R0CS221M-ER		—	264.00	
		FP-6R3CS101M-E0R		—	189.00	
		FP-6R3CS151M-ER		—	283.50	
		FP-010CS101M-ER		—	300.00	
High temperature, high humidity	Static capacitance variability (ΔC/C)		Test method (JIS C 5101-3-1998) : Measurement temperature : 60 °C ± 2 °C Test time : 1000 h ± 48 h Relative humidity : 90% to 95% Measurement conditions : Recovery to room temperature	− 20	+ 40	%
	Loss angle tangent	FP-2R5CS221M-E0R		—	0.20	—
		FP-2R5CS331M-ER		—	0.16	
		FP-4R0CS151M-E0R		—	0.20	
		FP-4R0CS221M-ER		—	0.16	
		FP-6R3CS101M-E0R		—	0.20	
		FP-6R3CS151M-ER		—	0.16	
		FP-010CS101M-ER		—	0.16	
	Leak current	FP-2R5CS221M-E0R		—	165.00	μA
		FP-2R5CS331M-ER		—	247.50	
		FP-4R0CS151M-E0R		—	180.00	
		FP-4R0CS221M-ER		—	264.00	
		FP-6R3CS101M-E0R		—	189.00	
		FP-6R3CS151M-ER		—	283.50	
		FP-010CS101M-ER		—	300.00	

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<table>
<tr><th colspan="3" rowspan="2">Parameter</th><th rowspan="2">Conditions</th><th colspan="2">Value</th><th rowspan="2">Unit</th></tr>
<tr><th>Min.</th><th>Max.</th></tr>
<tr><td rowspan="17">Durability</td><td colspan="2">Static capacitance variability (ΔC/C)</td><td rowspan="17">Test method (JIS C 5101-3-1998) :
Testing temperature : 105 °C ± 2 °C
Testing voltage : Rated voltage
Series resistance : 3 Ω
Test time : 1000 h ± 12 h
Measurement conditions : After discharge following 2 or more hours at room temperature</td><td>Value before testing − 20</td><td>Value before testing + 20</td><td>%</td></tr>
<tr><td rowspan="8">Loss angle tangent</td><td>FP-2R5CS221M-E0R</td><td>—</td><td>0.15</td><td rowspan="8">—</td></tr>
<tr><td>FP-2R5CS331M-ER</td><td>—</td><td>0.12</td></tr>
<tr><td>FP-4R0CS151M-E0R</td><td>—</td><td>0.15</td></tr>
<tr><td>FP-4R0CS221M-ER</td><td>—</td><td>0.12</td></tr>
<tr><td>FP-6R3CS101M-E0R</td><td>—</td><td>0.15</td></tr>
<tr><td>FP-6R3CS151M-ER</td><td>—</td><td>0.12</td></tr>
<tr><td>FP-010CS101M-ER</td><td>—</td><td>0.12</td></tr>
<tr><td rowspan="8">Leak current</td><td>FP-2R5CS221M-E0R</td><td>—</td><td>55.00</td><td rowspan="8">μA</td></tr>
<tr><td>FP-2R5CS331M-ER</td><td>—</td><td>82.50</td></tr>
<tr><td>FP-4R0CS151M-E0R</td><td>—</td><td>60.00</td></tr>
<tr><td>FP-4R0CS221M-ER</td><td>—</td><td>88.00</td></tr>
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<tr><td>FP-6R3CS151M-ER</td><td>—</td><td>94.50</td></tr>
<tr><td>FP-010CS101M-ER</td><td>—</td><td>100.00</td></tr>
<tr><td rowspan="17">Rapid temperature change</td><td colspan="2">Static capacitance</td><td rowspan="17">Test method (JIS C 5101-3-1998) :
Repeat 5 cycles of steps 1 to 4 in each cycle
<table><tr><th>Step</th><th>Temp. (°C)</th></tr><tr><td>1</td><td>20 ± 2</td></tr><tr><td>2</td><td>–55 ± 2</td></tr><tr><td>3</td><td>20 ± 2</td></tr><tr><td>4</td><td>+105 ± 2</td></tr><tr><td>5</td><td>20 ± 2</td></tr></table></td><td>Value before testing − 10</td><td>Value before testing + 10</td><td>%</td></tr>
<tr><td rowspan="8">Loss angle tangent</td><td>FP-2R5CS221M-E0R</td><td>—</td><td>0.15</td><td rowspan="8">—</td></tr>
<tr><td>FP-2R5CS331M-ER</td><td>—</td><td>0.12</td></tr>
<tr><td>FP-4R0CS151M-E0R</td><td>—</td><td>0.15</td></tr>
<tr><td>FP-4R0CS221M-ER</td><td>—</td><td>0.12</td></tr>
<tr><td>FP-6R3CS101M-E0R</td><td>—</td><td>0.15</td></tr>
<tr><td>FP-6R3CS151M-ER</td><td>—</td><td>0.12</td></tr>
<tr><td>FP-010CS101M-ER</td><td>—</td><td>0.12</td></tr>
<tr><td rowspan="8">Leak current</td><td>FP-2R5CS221M-E0R</td><td>—</td><td>165.00</td><td rowspan="8">μA</td></tr>
<tr><td>FP-2R5CS331M-ER</td><td>—</td><td>247.50</td></tr>
<tr><td>FP-4R0CS151M-E0R</td><td>—</td><td>180.00</td></tr>
<tr><td>FP-4R0CS221M-ER</td><td>—</td><td>264.00</td></tr>
<tr><td>FP-6R3CS101M-E0R</td><td>—</td><td>189.00</td></tr>
<tr><td>FP-6R3CS151M-ER</td><td>—</td><td>283.50</td></tr>
<tr><td>FP-010CS101M-ER</td><td>—</td><td>300.00</td></tr>
</table>

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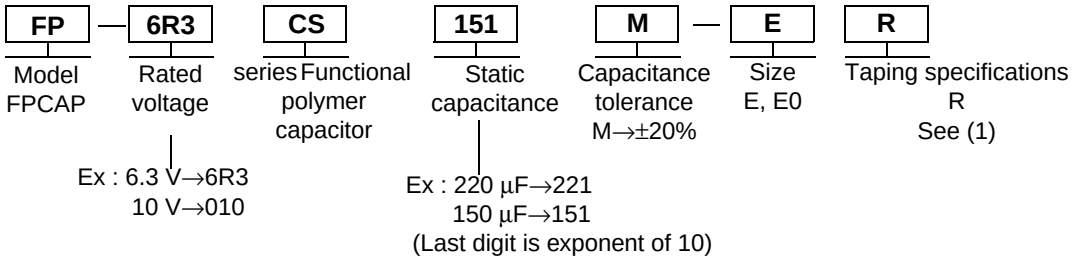
Parameter			Conditions	Value		Unit
				Min.	Max.	
Failure rate after solder heat resistance test	Static capacitance		Test method (JIS C 5101-3-1998) : Testing temperature : 105 °C ± 2 °C Rated voltage to be applied Reliability standard : 60% Failure criterion : 0.1%/1000 hours	Value before testing − 30	Value before testing + 30	%
	Loss angle tangent	FP-2R5CS221M-E0R		—	0.30	—
		FP-2R5CS331M-ER		—	0.24	
		FP-4R0CS151M-E0R		—	0.30	
		FP-4R0CS221M-ER		—	0.24	
		FP-6R3CS101M-E0R		—	0.30	
		FP-6R3CS151M-ER		—	0.24	
		FP-010CS101M-ER		—	0.24	
	Leak current	FP-2R5CS221M-E0R		—	165.00	μA
		FP-2R5CS331M-ER		—	247.50	
		FP-4R0CS151M-E0R		—	180.00	
		FP-4R0CS221M-ER		—	264.00	
		FP-6R3CS101M-E0R		—	189.00	
		FP-6R3CS151M-ER		—	283.50	
		FP-010CS101M-ER		—	300.00	

■ PART NUMBER DESIGNATION

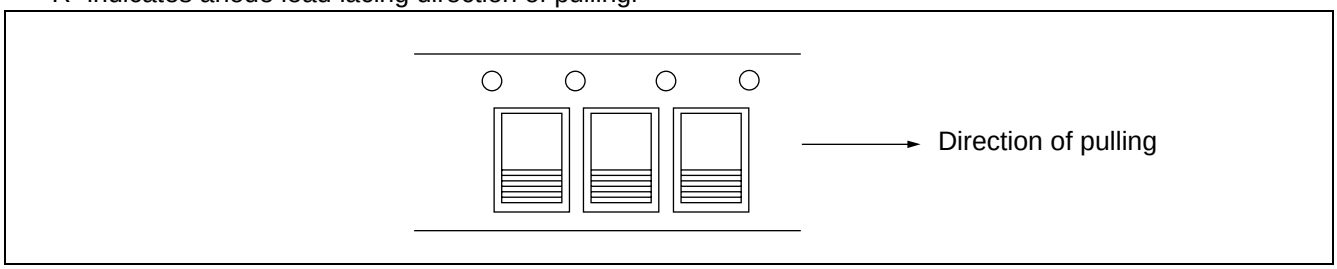
Example illustrated : E case, 6.3 V/150 µF



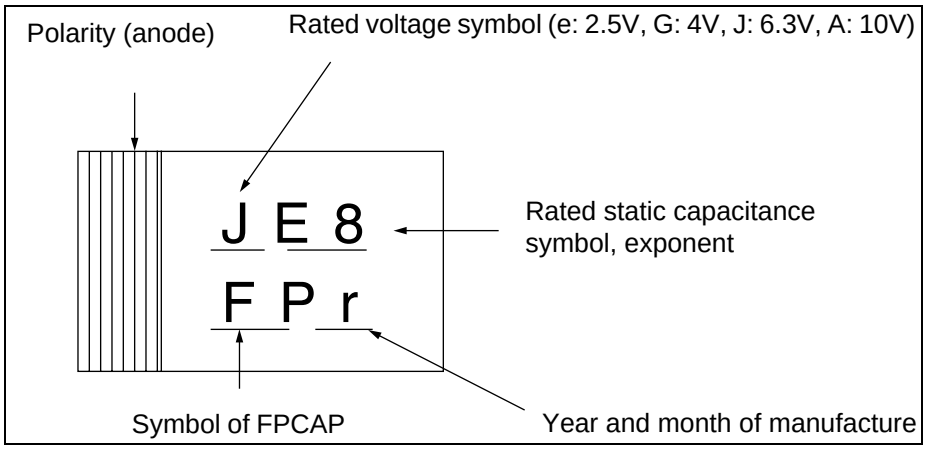
Delivery format indication

- Carrier tape format:

"R" indicates anode lead facing direction of pullingl



■ MARKING AND POLARITY INDICATOR



Rated capacitance symbols

Symbol	Value (pF)
A	**1.0**
E	**1.5**
J	**2.2**
N	**3.3**

Year and date of manufacture

	1	2	3	4	5	6	7	8	9	10	11	12
2001	A	B	C	D	E	F	G	H	J	K	L	M
2002	N	P	Q	R	S	T	U	V	W	X	Y	Z
2003	a	b	c	d	e	f	g	h	j	k	l	m
2004	n	p	q	r	s	t	u	v	w	x	y	z

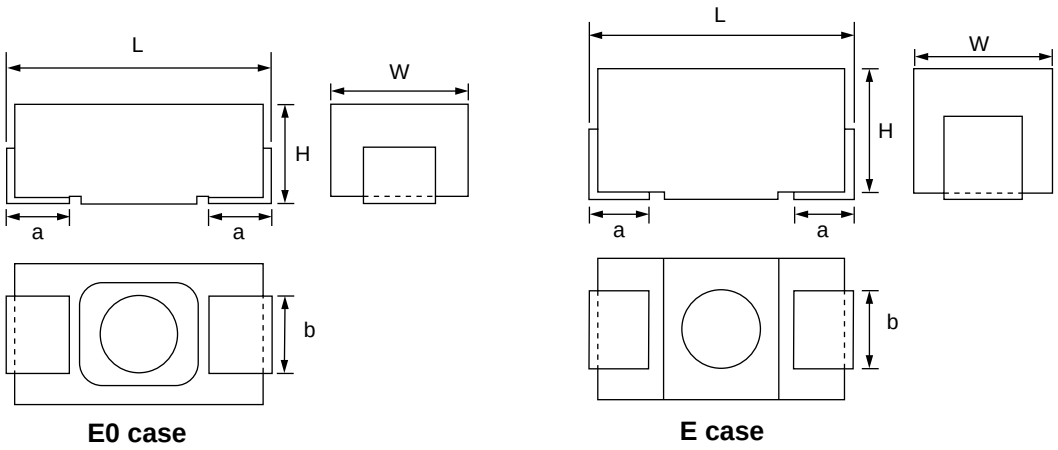
Note : After 2005, year symbols are repeated.
The next letters to be used repeat as above: c, k, l, p, u, v, w, x, y, z

Multiplier

Symbol	Value
8	10^8

Example: E8 = 1.5×10^8 pF
= 150 µF

■ PACKAGE DIMENSION



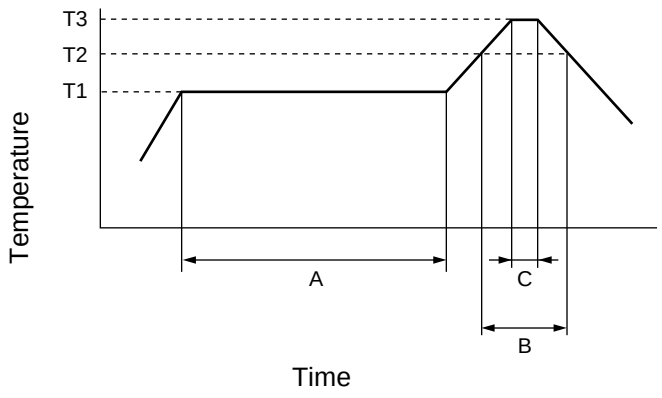
(Unit : mm)

Case Size	L	W	H	a	b
E	7.3 ± 0.2	4.3 ± 0.2	2.9 ± 0.2	1.3 ± 0.2	2.4 ± 0.2
E0	7.3 ± 0.2	4.3 ± 0.2	1.8 ± 0.2	1.3 ± 0.2	2.4 ± 0.2

■ TEMPERATURE REDUCTION COEFFICIENTS AT MAXIMUM ALLOWABLE RIPPLE CURRENT

Operating temperature (°C)	45	45 < T ≤ 85	85 < T ≤ 105
Temperature reduction coefficient	1.0	0.7	0.25

■ RECOMMENDED MOUNTING CONDITIONS



Parameter		Value		Units
		Min.	Max.	
Reflow (peak) temperature	T1	150	160	℃
	T2	—	200	℃
	T3	—	240	℃
Reflow time	A	—	120	s
	B	—	20	s
	C	—	5	s
Reflow repetitions		—	2	Time
Flux		Low-chlorine resin flux (Cl 0.2 wt% or less) recommended		—

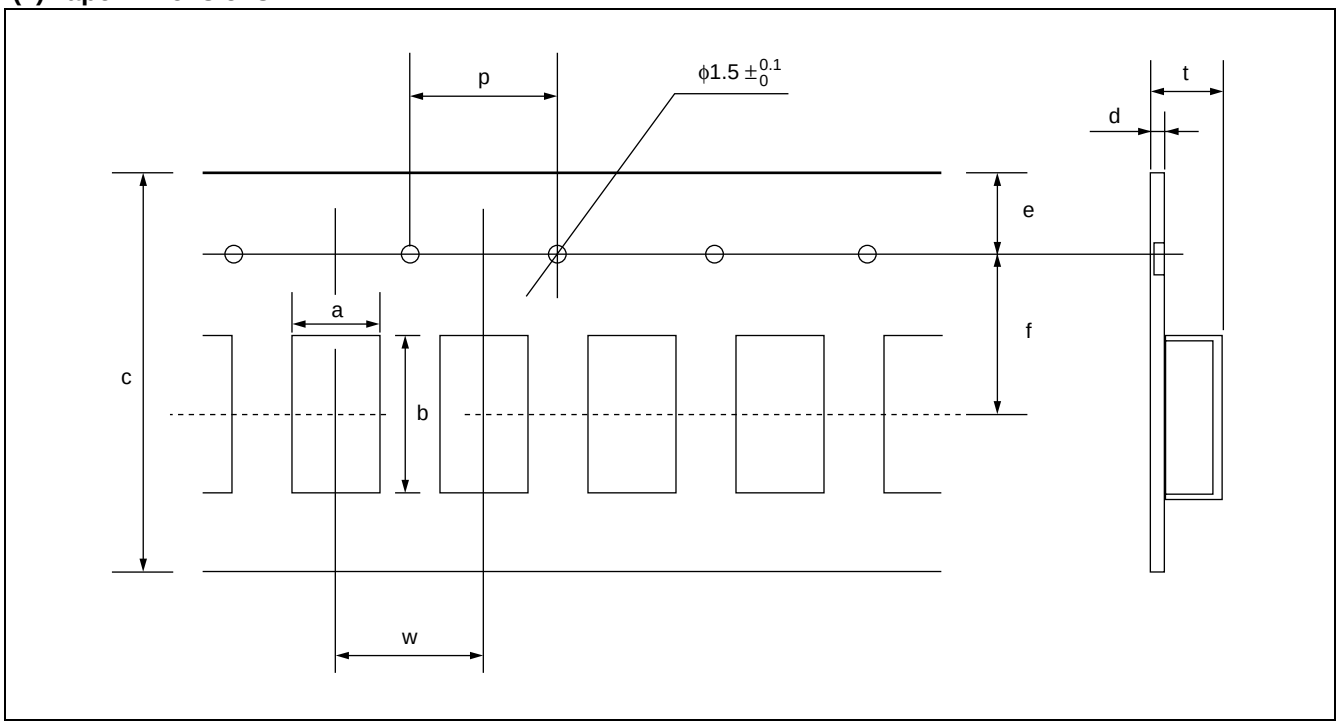
Note : Note that if capacitors absorb humidity during prolonged periods of storage, this moisture will vaporize during heating and can cause internal pressure to increase rapidly causing the external plastic to crack. In such cases, prebaking at 60 °C to 105 °C for 12 to 72 hours will eliminate the excess moisture and prevent the occurrence of cracking.

■ RECOMMENDED CLEANSING CONDITIONS

- Cleansing with ultrasonic should be avoided. The use of bubble cleaning is recommended. If ultrasonic cleansing cannot be avoided, avoid cavitation and clean for one minute or less.
- Use non-chlorinated solvents or alcohol-based organic solvents that are easy drying and leave no residue (such as isopropyl alcohol etc.).
- Cleansing solutions that may etch or dissolve exterior resin and may not be used include ester-type acetic methoxybutyl, amide N-N dimethyl formamide, polyvalent alcohol inductor diethylene glycol monobutylester, etc.

■ PACKING

(1) Tape Dimensions

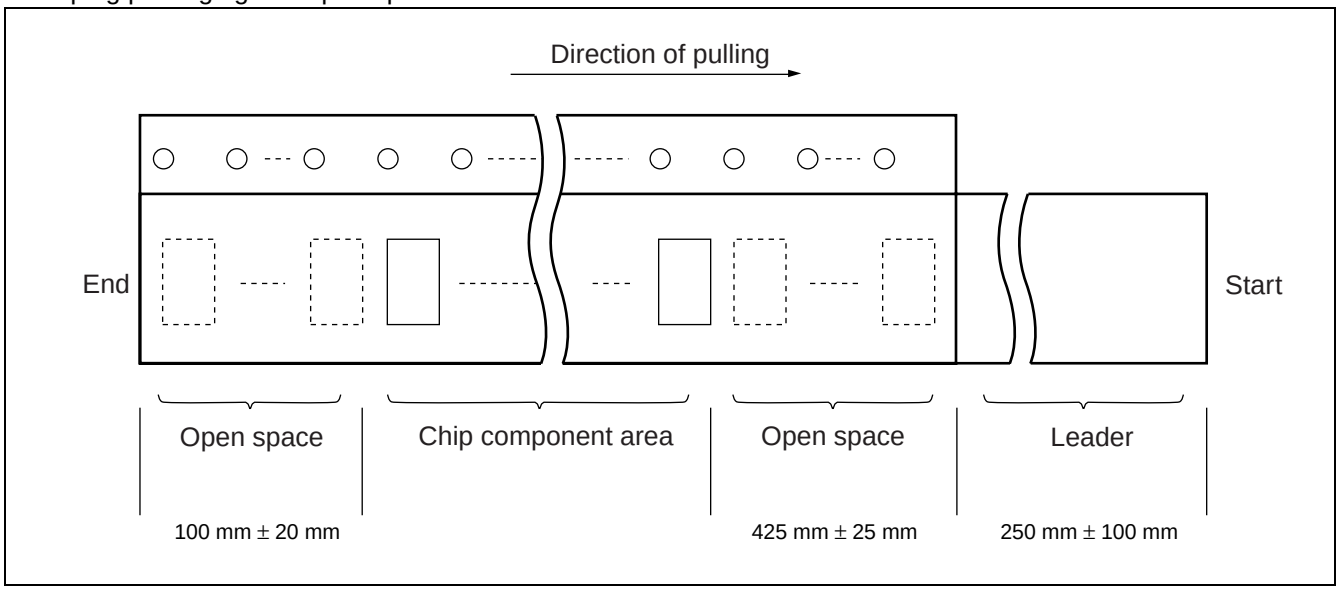


(Unit : mm)

Case size	a	b	c	e	f	t	p	w	d
E	4.6 ± 0.1	7.7 ± 0.1	12 ± 0.2	1.75 ± 0.1	5.65 ± 0.1	3.3 ± 0.1	4.0 ± 0.1	8 ± 0.1	0.3
E0	4.6 ± 0.1	7.7 ± 0.1	12 ± 0.2	1.75 ± 0.1	5.65 ± 0.1	2.2 ± 0.1	4.0 ± 0.1	8 ± 0.1	0.3

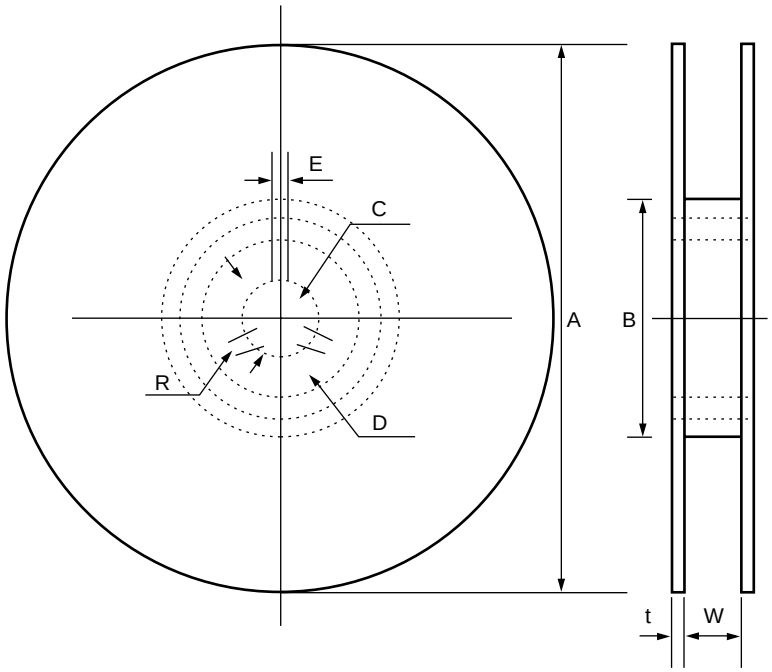
(2) Taping Packaging

Taping packaging has open spaces as shown below.



(3) Reel Dimensions

Material : Polystyrene



(Unit : mm)

A	B	C	D	E	W	t	R
$180^{+0}_{-3.0}$	$160^{+1.0}_{-0}$	13 ± 0.2	21 ± 0.8	2 ± 0.5	13 ± 0.3	2 ± 0.5	1

(4) Carrier Tape Packaging Units

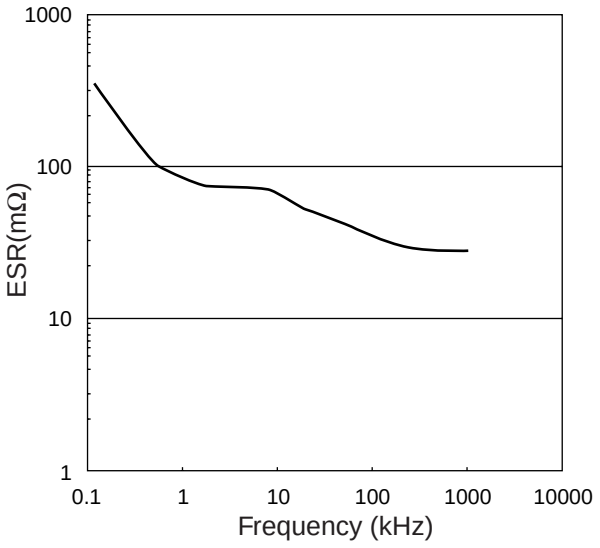
Package quantities are as follows, according to case size. The model number and quantity is marked on each reel.

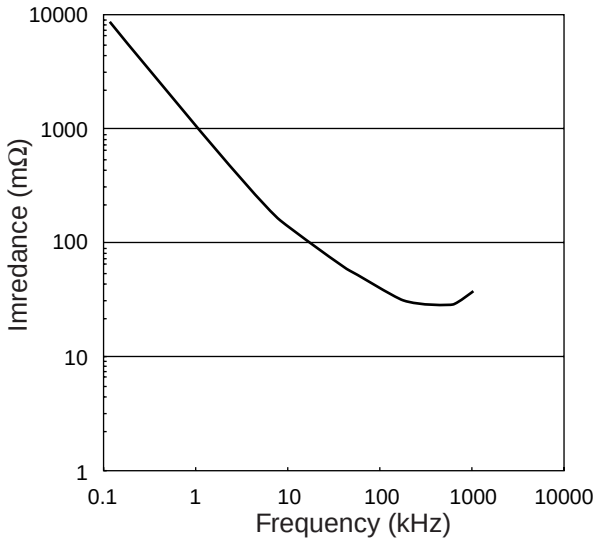
Case size	Quantity (capacitors/reel)
E	500
E0	1, 000

■ APPENDIX (Typ. values)

(1) Frequency characteristics

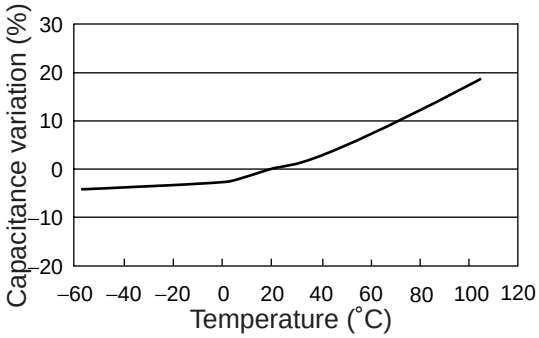
Model: FP-6R3CS151M-ER (6.3 V 150 µF ± 20%)

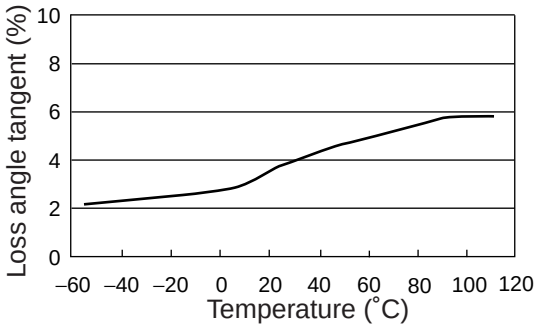


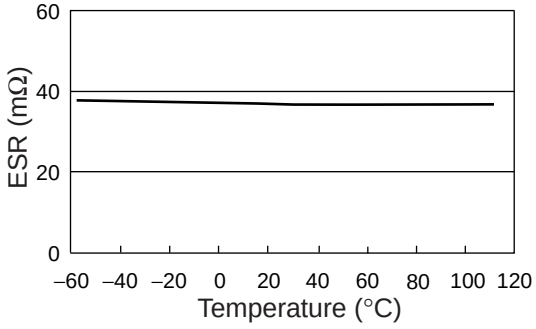


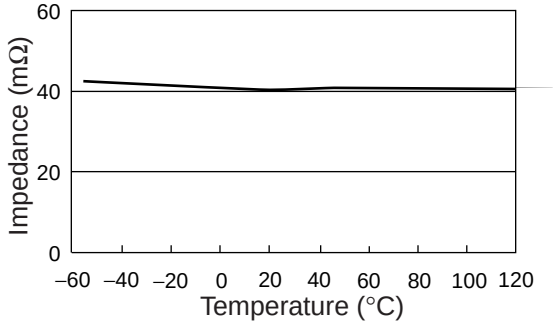
(1) Temperature characteristics

Model: FP-6R3CS151M-ER (6.3 V 150 µF ± 20%)









FUJITSU MEDIA DEVICES LIMITED

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