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Super Capacitors



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FOR CORRECT USE OF SUPER CAPACITORS

- 1. Please confirm the operating conditions and the specifications of the Super Capacitors befor using them.
- 2. The electrolyte of these Super Capacitors is sealed with material such as rubber. When you use the capacitors for a long time at high temperature, the moisture of the electrolyte evaporates and the equivalent series resistance (E.S.R.) increases. The fundamental failure mode is the open mode depending on E.S.R. increase.

When using a capacitor, please introduce a safe design assuming unexpected capacitor failure, such as redundancy in design and protection from fire and erroneous operation.

3. Please read 'Notes on Using the Super Capacitor' on page 60 when you design the circuits using the Super Capacitors.

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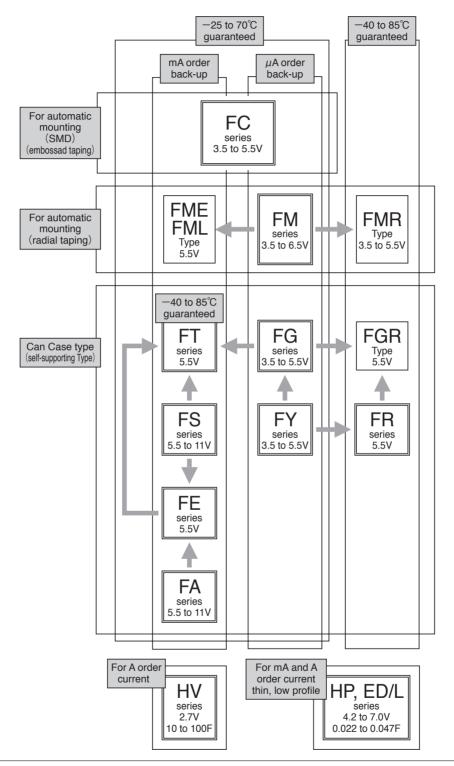
•Before using the product in this catalog, please read "Precautions" and other safety precautions listed in the printed version catalog.

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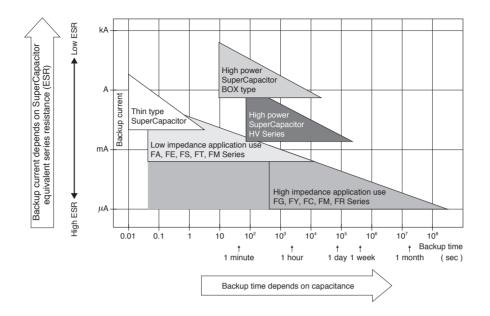
1. Organization of Super Capacitor Series



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2. Performance for Selection



3. Characteristics of Super Capacitor

Super Capacitor can not be used for applications in AC circuit such as ripple absorption because it has high internal resistance (several hundred $m\Omega$ to a hundred Ω) compared to aluminum electrolysis capacitor. Thus its main use would be similar to that of secondary battery such as power back-up in DC circuit. The following list shows the characteristics of Super Capacitors as compared to aluminum electrolyses capacitors for power back-up and secondary batteries.

	Seconda	ry battery	Capa	acitor
	NiCd battery	Lithium ion battery	Aluminum electrolysis capacito	Super Capacitor
Back-up ability	O	0		0
Eco-hazard	Cd			
Operating temperature range	−20 to 60 °C	−20 to 50 °C	−55 to 105 °C	-40 to 85 °C (FR, FT)
Charge time	few hours	few hours	few minutes	few minutes
Charge/discharge life time	approx. 500 times	approx. 500 to 1000 times	limitless (*1)	limitless (*1)
Restrictions on charge/discharge	yes	yes	none	none
Flow soldering	not applicable	not applicable	applicable	applicable
Automatic mounting	not applicable	not applicable	applicable	applicable (FM and FC series)
Safety risks	leakage, explosion	leakage, combustion, explosion, ignition	heat-up, explosion	gas emission (*2)

(*1) Aluminum electrolysis capacitor and Super Capacitor has limited lifetime. However, when used under proper conditions, both can operate sufficiently within the designed lifetime of the set they are built in.

(*2) There is no harm as it is a mere leak of water vapor which transitioned from water contained in the electrolyte (diluted sulfuric acid). However, application of abnormal voltage surge exceeding maximum operating voltage may result in leakage and explosion.

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4. Typical Applications

As in the characteristics remarked previously, Super Capacitor has characteristics intermediate between general capacitors and batteries. Because of this, Super Capacitor can be used like a secondary battery when applied to DC circuit. The best suited applications of Super Capacitor are back-up device for the power shut-down of micro computers and RAM's. The list below shows main application examples.

Intended use (guideline)	Power supply (guideline)	Application	Examples of equipments	Series	
		CMOS RAM, IC for clocks	Measuring device, Control equipment, Communication device, Automotive power source	 FR series (85 °C guaranteed) 	
Long time back-up	500 μ A and below	CMOS micro computer, IC for clocks	CMOS micro computer Static RAM/DTS (digital tuning system)	 FC series FG series FY series FM series 	
		Micro computer, RAM	 VCR, Microwave oven, Micro computer Memory equipped device 		
Back-up for 1 hour or less	50 mA and below	Driving motor	 VCR, Printer, Projector Video disk 	FT seriesFS series	
		Subsidiary power supply for driving motor during voltage drop	• Camera		
Back-up for		Power source of toys, LED, buzzer	Toys, Display device, Alarm device	• FA series	
10 seconds or less	1 A and below	High current supply for a short amount of time	Actuator, Relay solenoid, Gas igniter	FE series	
Peak assist	100 mA to several A	 High speed charge/discharge, high current supply in ampere order Subsidiary power supply for driving motor during voltage drop 	 Mobile equipment, Mobile communication device, Wireless card, DSC, Mobile terminal 	HP seriesED/L series	
Power assist	Up to several A	Power supply, Subsidiary power supply	• Street sign, Display light , UPS	HV series	

Application Examples of Super Capacitor

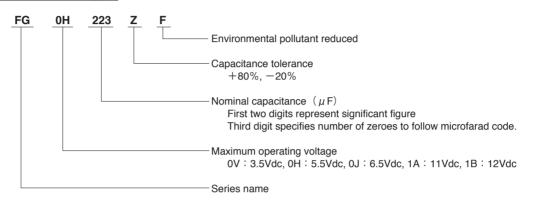
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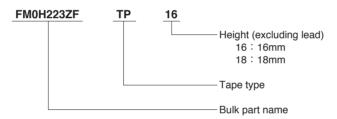
5. Part Number System

FM, FC, FT, FG, FS, FR, FY, FE, FA Series

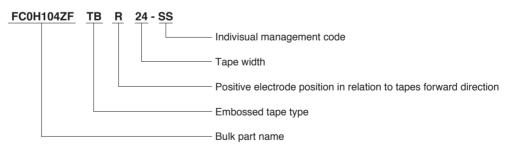
FG Series bulk type



FM Series tape type (Ammo pack)



FC Series tape type (Embossed tape)

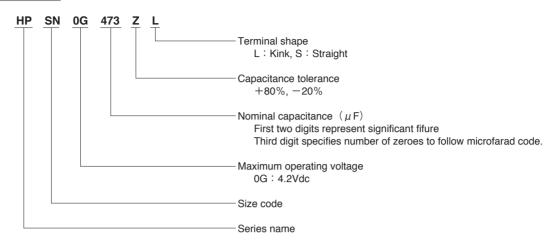


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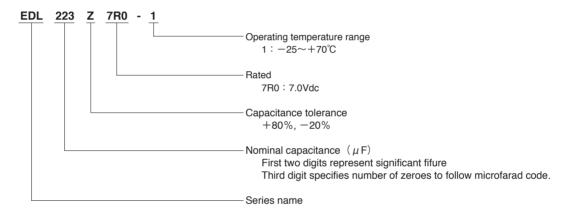
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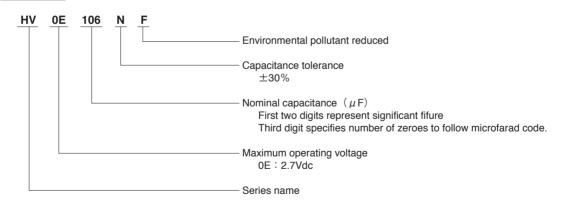
HP Series



ED/L Series



HV Series



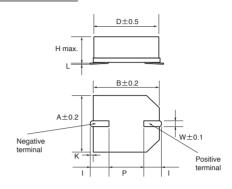
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6. Rated Specifications6.1 FC Series

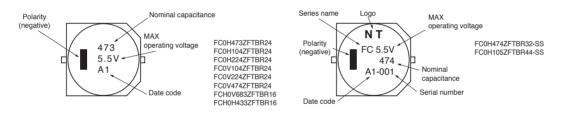
Features

- · Enables surface mounting.
- High rated voltage of 5.5V.
- · High leakage reliability.



Markings

Displays nominal capacitance, MAX operating voltage serial number, polarity and etc.



Dimensions

Standard models

Part Number	Max. Operating	Nominal Capacitance	Max. ESR	Max. current at	Voltage Holding				Din	nension (Ui	nit:mm)				Weight
Part Number	Voltage (Vdc)	Discharge system (F)	(at 1kHz) (Ω)	30 minutes (mA)	Characteristic Min. (V)	D	н	A	в	I	w	Р	к	L	(g)
FCS0H473ZFTBR24	5.5	0.047	100	0.071	4.2	10.5	5.5	10.8	10.8	3.9±0.5	1.2	5.0	0.7±0.3	$0 {}^{+0.3}_{-0.1}$	1.0
FCS0H104ZFTBR24	5.5	0.10	50	0.15	4.2	10.5	5.5	10.8	10.8	3.9±0.5	1.2	5.0	0.7±0.3	$0 {}^{+0.3}_{-0.1}$	1.0
FC0H224ZFTBR24	5.5	0.22	25	0.33	4.2	10.5	8.5	10.8	10.8	3.6±0.5	1.2	5.0	0.7±0.3	$0 {}^{+0.3}_{-0.1}$	1.4
FC0H474ZFTBR32-SS	5.5	0.47	13	0.71	4.2	16.0	9.5	16.3	16.3	6.8±1.0	1.2	5.0	1.2±0.5	$0 {}^{+0.3}_{-0.1}$	4.0
FC0H105ZFTBR44-SS	5.5	1.0	7	1.50	4.2	21.0	10.5	21.6	21.6	7.0±1.0	1.4	10.0	1.2±0.5	$0 {}^{+0.3}_{-0.1}$	6.7
FC0V104ZFTBR24	3.5	0.10	50	0.09	-	10.5	5.5	10.8	10.8	3.6±0.5	1.2	5.0	0.7±0.3	$0 {}^{+0.3}_{-0.1}$	1.0
FC0V224ZFTBR24	3.5	0.22	25	0.20	-	10.5	5.5	10.8	10.8	3.6±0.5	1.2	5.0	0.7±0.3	$0 {}^{+0.3}_{-0.1}$	1.0
FC0V474ZFTBR24	3.5	0.47	25	0.42	-	10.5	8.5	10.8	10.8	3.6±0.5	1.2	5.0	0.7±0.3	$0 {}^{+0.3}_{-0.1}$	1.4
FCH0V683ZFTBR16	3.6	0.068	40	0.062	-	6.8	3.7	6.8	6.8	2.9±0.5	0.7	2.5	0.7±0.3	$0 {}^{+0.3}_{-0.1}$	0.3
FCH0H433ZFTBR16	5.5	0.043	50	0.065	-	6.8	5.0	6.8	6.8	2.9±0.5	0.7	2.5	0.7±0.3	$0 {}^{+0.3}_{-0.1}$	0.4

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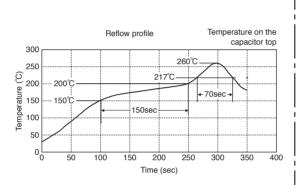
NEC/TOKIN

Precautions for use

- This series is exclusively for reflow soldering. It is designed for thermal conduction system such as combination use of infrared ray and heat blow. Consult with NEC TOKIN before applying other methods.
- The reflow condition must be kept within reflow profile graphs shown below.
- Applying reflow soldering is limited to 2 times. After the first reflow, cool down the capacitor thoroughly to 5-35 °C before the second reflow.

Always consult with NEC TOKIN when applying reflow soldering in a more severe condition than the condition described here.

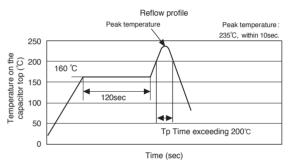
Other FC Series



FCS0H473ZFTBR24 and FCS0H104ZFTBR24

Above "Reflow Profile" graph indicates temperature at the terminals and capacitor top.

Peak temperature	Below 260 °C
Over 255 °C	Within 10sec.
Over 230 °C	Within 45sec.
Over 220 °C	Within 60sec.
Over 217 °C	Within 70sec.
Time between $150^{\circ}C$ to 200°C (temperature zone over $170^{\circ}C$ =within 50sec.)	150sec.



Tp Time exceeding 200°C ට ²⁵⁰ 240 Я 1 Tati 230 ame 220 ^Deak 210 200 0 10 20 30 40 50 60 Tp (sec)

Above "Reflow Profile" graph indicates temperature at the terminals and capacitor top.

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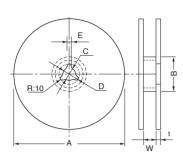
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Tape and Reel Dimensions

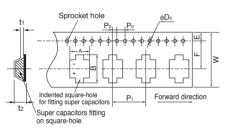
[Reel Dimensions]

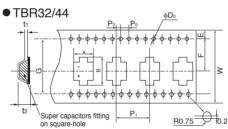


TBR16	TBR24		TBR32	TBR44
380±2	380±2	330±2	380±2	
	Product height 5.5mm	80±1		
80±1	Product height 8.5mm	100±1	100±1	100±1
13±0.5	13±0.5		13±0.5	13±0.5
21±0.8	21±0.8		21±0.8	21±0.8
2±0.5	2±0.5		2±0.5	2±0.5
17 5 1 0	Product height 5.5mm	25.5±0.5	00 5 ± 1 0	45.5±1.0
17.5±1.0	Product height 8.5mm 25.5±1.0		33.5 - 1.0	45.5±1.0
2.0	2.0		2.0	2.0
	380±2 80±1 13±0.5 21±0.8 2±0.5 17.5±1.0	380±2 380±2 380±1 Product height 5.5mm 80±1 Product height 8.5mm 13±0.5 13±0.5 21±0.8 21±0.8 2±0.5 2±0.5 17.5±1.0 Product height 8.5mm Product height 8.5mm Product height 8.5mm	380±2 380±2 380±2 80±1 Product height 5.5mm 80±1 Product height 8.5mm 100±1 13±0.5 13±0.5 21±0.8 21±0.8 2±0.5 2±0.5 17.5±1.0 Product height 8.5mm Product height 8.5mm 25.5±0.5	$\begin{array}{ccc} 380 \pm 2 & 380 \pm 2 & 330 \pm 2 \\ \hline 80 \pm 1 & 80 \pm 1 & 80 \pm 1 \\ \hline 80 \pm 1 & 80 \pm 1 & 100 \pm 1 \\ \hline \end{tabular} & 100 \pm 1 & 100 \pm 1 \\ \hline \end{tabular} & 100 \pm 1 & 100 \pm 1 \\ \hline \end{tabular} & 100 \pm 1 & 100 \pm 1 \\ \hline \end{tabular} & 100 \pm 1 & 13 \pm 0.5 \\ \hline \end{tabular} & 13 \pm 0.5 & 13 \pm 0.5 \\ \hline \end{tabular} & 21 \pm 0.8 & 21 \pm 0.8 \\ \hline \end{tabular} & 21 \pm 0.8 & 21 \pm 0$

Dimensions of indented [square-hole plastic tape]

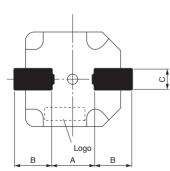
• TBR16/24





					(mm)
Mark	TBR16	TBR24		TBR32	TBR44
W	16.0	24.0		32.0	44.0
Α	7.2	11.4		18.0	23.0
В	9.0	13.0		20.0	25.0
Po	4.0	4.0		4.0	4.0
P1	12.0	16.0	24.0	32.0	
P2	2.0	2.0	2.0	2.0	
F	7.5	11.5		14.2	20.2
φDo	1.55	1.55		1.55	1.55
t1	0.4	0.4		0.5	0.5
E	1.75	1.75		1.75	1.75
	5.0	Product height 5.5mm	6.0	10.0	10.0
t2	5.0	Product height 8.5mm	8.4	10.0	12.0
G	-	-		28.4	40.4

Recommended land pattern



Land pattern

			(mm
Part Number	A	В	С
FCSOH473ZFTBR24	5.0	4.9	2.5
FCSOH104ZFTBR24	5.0	4.9	2.5
FCOH224ZFTBR24	5.0	4.6	2.5
FCOH474ZFTBR32	5.0	10.0	2.5
FCOH105ZFTBR44	10.0	10.5	3.5
FCOVH104ZFTBR24	5.0	4.6	2.5
FCOV224ZFTBR24	5.0	4.6	2.5
FCOV474ZFTBR24	5.0	4.6	2.5
FCHOV683ZFTBR16	2.5	4.0	1.4
FCHOH433ZFTBR16	2.5	4.0	1.4

Lead terminal

			(mm)
Part Number	А	В	С
FCSOH473ZFTBR24	5.0	3.9	1.2
FCSOH104ZFTBR24	5.0	3.9	1.2
FCOH224ZFTBR24	5.0	3.6	1.2
FCOH474ZFTBR32	5.0	6.8	1.2
FCOH105ZFTBR44	10.0	7.0	1.4
FCOV104ZFTBR24	5.0	3.6	1.2
FCOV224ZFTBR24	5.0	3.6	1.2
FCOV474ZFTBR24	5.0	3.6	1.2
FCHOV683ZFTBR16	2.5	2.9	0.7
FCHOH433ZFTBR16	2.5	2.9	0.7

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	Series name		FC				
Item			5.5V type, 3.5V type	Test conc	ditions (conforming to JIS C 5101-1)		
Category temperature ra	nge	-25°C to -	+70℃				
MAX operating voltage	•	5.5Vdc, 3.5	Vdc				
Capacitance			indard ratings	Refer to "Me	easurement Conditions"		
Capacitance allowance		+80%, -2	-	Refer to "Measurement Conditions"			
ESR			indard ratings		t 1kHz, 10mA ; See also "Measurement		
Current (30-minutes valu	e)	Refer to sta	indard ratings		asurement Conditions"		
	Capacitance		90% of initial ratings	Conforms to			
	ESR		ed 120% of initial ratings	Surge voltag	ge : 4.0V (3.5V type)		
	Current (30 minutes value)		ed 120% of initial ratings	Charge : 30	: 6.3V (5.5V type)		
* Surge	Appearance		abnormality	Discharge : Number of c Series resist	9min 30sec. ycles : 1000 iance : 0.043F, 0.047F 300 Ω : 0.068F 240 Ω : 0.10F 150 Ω : 0.22F 56 Ω : 0.47F 30 Ω : 1.0F 15Ω esistance : 0 Ω		
	Capacitance		50% higher than initial value	Temperature			
	ESR	Phase 2	400% or less than initial value				
	Capacitance	Phase 3		Conforms to	4.29		
*	ESR			Phase1 : +:			
Characteristics in	Capacitance ESR	Phase 5	200% or less than initial value Satisfy initial ratings	Phase2 : −25±2℃ Phase4 : +25±2℃			
different temperature	Current (30 minutes value)	1 11030 5	1.5CV (mA) or below	Phase5 : +			
	Capacitance		Within ±20% of initial value	Phase6 : +:	25±2℃		
	ESR	Phase 6	Satisfy initial ratings				
	Current (30 minutes value)		Satisfy initial ratings				
	Capacitance ESR	Satisfy initia	al ratings	Conforms to	4.17		
* Vibration resistance	Current (30 minutes value)		a raingo	Frequency : 10 to 55 Hz Testing time : 6 hours			
	Appearance	No obvious	abnormality				
	Capacitance						
*	ESR	Satisfy initia	al ratings		Cooled down to ambient temperature after reflow soldering, then the product must fulfill the condition		
Solder heat resistance	Current (30 minutes value)			stated left. (See page 10 for reflow condition)			
	Appearance	No obvious	abnormality				
	Capacitance ESR	Satisfy initia	al ratings	Conforms to 4.16			
* Temperature cycle	Current (30 minutes value)		a raungs	Temperature	condition : −25 °C → Room temperature→ +70 °C → Room temperature		
	Appearance	No obvious	abnormality	Number of c	ycles : 5 Cycles		
	Capacitance	Within ±20	% of initial value				
*	ESR		ed 120% of initial ratings	 Conforms to Temperature 			
High temp. and high humidity resistance	Current (30 minutes value)		ed 120% of initial ratings		nidity : 90 to 95 % RH		
numery resistance	Appearance		abnormality	Testing time	: 240±8 hours		
	Capacitance		1% of initial value				
	ESR		% of initial ratings	Conforms to			
* High temperature load			-		lied : MAX operating voltage ction resistance : 0Ω		
	Current (30 minutes value) Appearance		% of initial ratings		: 1000 ⁺⁴⁸ ₀ Hours		
* Self discharge characteristics (voltage holding characteristics)		5.5V type: V	abnormality /oltage between terminal leads higher than 4.2V Not specified	Charging condition Storage	Voltage applied : 5.0Vdc (Terminal at the case's side be negative) Series resistance : 0Ω Charging time : 24 hours Let stand for 24 hours in condition described below with terminals opened.		
				Storage			

As for items with "*", it must fulfill the above condition after the reflow soldering. (See page 10 for reflow conditions)

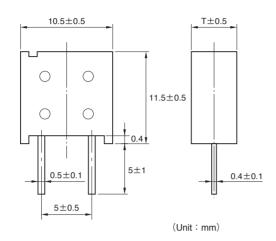
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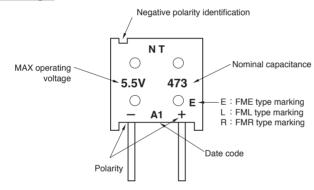
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6.2 FM Series

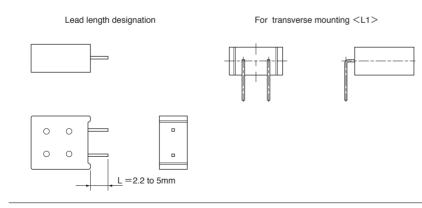
Dimensions



Markings



Lead terminal forming example



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• 5.5V Type

Part Number		MAX operating		ninal sitance	MAX ESR (at 1 kHz)	MAX current at 30 min.	Voltage holding	т	Weight
Bulk	Ammo pack	voltage (Vdc)	Charge system(F)	Discharge system(F)	(Ω)	(mA)	characteristics (V)	(mm)	(g)
FM0H103ZF	FM0H103ZFTP ()	5.5	0.01	0.014	300	0.015	4.2	5.0	1.3
FM0H223ZF	FM0H223ZFTP ()	5.5	0.022	0.028	200	0.033	4.2	5.0	1.3
FM0H473ZF	FM0H473ZFTP ()	5.5	0.047	0.06	200	0.071	4.2	5.0	1.3
FM0H104ZF	FM0H104ZFTP ()	5.5	0.10	0.13	100	0.15	4.2	6.5	1.6
FM0H224ZF	FM0H224ZFTP ()	5.5	-	0.22	100	0.33	4.2	6.5	1.6

To complete the part number, insert lead length (16mm or 18mm) in to the "()"

• 3.5V Type

Part Number		MAX operating voltage	-	ninal itance	MAX ESR (at 1 kHz)	MAX current at 30 min.	т	Weight
Bulk	Ammo pack	(Vdc)	Charge Discharge (αt 1 KHZ) system(F) system(F) (Ω)		,,	(mA)	(mm)	(g)
FM0V473ZF	FM0V473ZFTP ()	3.5	0.047	0.06	200	0.042	5.0	1.3
FM0V104ZF	FM0V104ZFTP ()	3.5	0.10	0.13	100	0.090	5.0	1.3
FM0V224ZF	FM0V224ZFTP ()	3.5	0.22	0.30	100	0.20	6.5	1.6

To complete the part number, insert lead length (16mm or 18mm) in to the "($\)$ "

• 6.5V Type

Pa	art Number	MAX operating Voltage			MAX ESR (at 1 kHz)	MAX current at 30 min.	т	Weight
Bulk	Ammo pack	(Vdc)	Charge system(F)	Discharge system(F)	(Ω)	(mA)	(mm)	(g)
FM0J473ZF	FM0J473ZFTP ()	6.5	0.047	0.062	200	0.071	6.5	1.6

To complete the part number, insert lead length (16mm or 18mm) in to the "()"

• FME, FML Type (Buckup Large Current, mA Order)

Pa	Part Number			ninal itance	MAX ESR (at 1 kHz)	MAX current at 30 min.	т	Weight
Bulk	Ammo pack	voltage (Vdc)	Charge system(F)	Discharge system(F)	(Ω)	(mA)	(mm)	(g)
FME0H223ZF	FME0H223ZFTP ()	5.5	0.022	0.028	40	0.033	5.0	1.3
FME0H473ZF	FME0H473ZFTP ()	5.5	0.047	0.06	20	0.071	5.0	1.3
FML0H333ZF	FML0H333ZFTP ()	5.5	0.033		6.5	0.050	5.0	1.3

To complete the part number, insert lead length (16mm or 18mm) in to the "()"

● FMR Type (MAX Operating Temperature 85 °C Type)

Pa	art Number	MAX operating	-	ninal itance	MAX ESR (at 1 kHz)	MAX current at 30 min.	Voltage holding	т	Weight
Bulk	Ammo pack	voltage (Vdc)	Charge system(F)	Discharge system(F)	(Ω)	(mA)	characteristics (V)	(mm)	(g)
FMR0H473ZF	FMR0H473ZFTP ()	5.5	0.047	0.062	200	0.071	4.2	6.5	1.6
FMR0H104ZF	FMR0H104ZFTP ()	5.5	0.10		50	0.15	4.2	6.5	1.6
FMR0V104ZF	FMR0V104ZFTP ()	3.5	0.10		50	0.090	_	6.5	1.6

To complete the part number, insert lead length (16mm or 18mm) in to the "()"

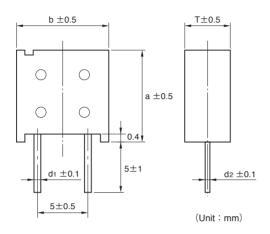
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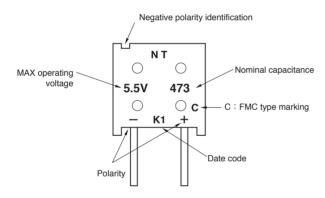
• FMC Type

Chip parts applicable to treatment in bond hardening furnace (160 $\pm5\,^\circ\!\!C$ for 120 ±10 seonds)

Dimensions



Markings



Specifications

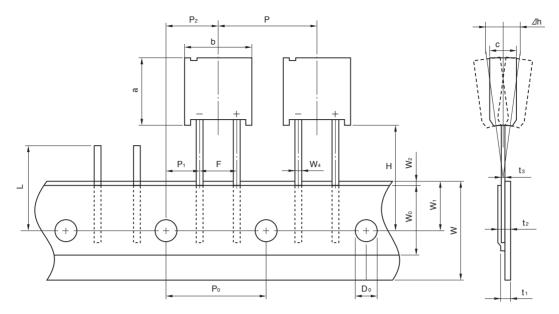
Pa	Part Number		Non capac	ninal itance	MAX ESR (at 1 kHz)	MAX current at	Voltage holding	а	b	Т	d1	d2	Weight
Bulk	Ammo pack	voltage (Vdc)	Charge system(F)	Discharge system(F)	(Ω)	30 min. (mA)	characteristics (V)	(mm)	(mm)	(mm)	(mm)	(mm)	(g)
FMC0H473ZF	FMC0H473ZFTP ()	5.5	0.047	0.06	100	0.071	4.2	11.5	10.5	5.0	0.5	0.4	1.3
FMC0H104ZF	FMC0H104ZFTP ()	5.5	0.10	0.13	50	0.15	4.2	11.5	10.5	6.5	0.5	0.4	1.6
FMC0H334ZF	FMC0H334ZFTP ()	5.5	-	0.33	25	0.50	4.2	15.0	14.0	9.0	0.6	0.6	3.5

To complete the part number, insert lead length (16mm or 18mm) in to the "($\)$ "

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Taping Specification [except FMC0H334ZFTP()]



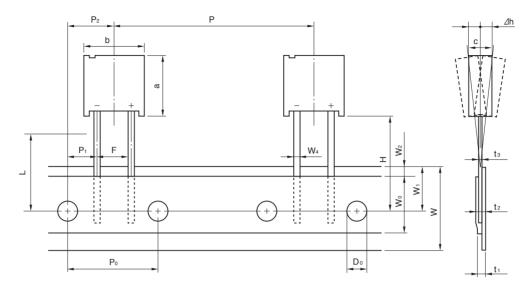
(Unit:mm)

Item	Symbol	Value	Tolerance	Remarks
Component Height	а	11.5	±0.5	
Component Width	b	10.5	±0.5	
Component Thickness	С	_	±0.5	5.5 V type : 5.0/0.010F to 0.047F, 6.5/0.047F 3.5 V type : 5.0/0.047F to 0.10F, 6.5/0.22F FME type : 5.0/0.022F to 0.047F FML type : 5.0/0.033F 6.5 V type : 6.5/0.047F, 0.10F FMR type : 6.5/0.047F FMC type : 5.0/0.047F, 6.5/0.10F
Lead-wire Width	W4	0.5	±0.1	
Lead-wire Thickness	t3	0.4	±0.1	
Pitch between Component	Р	12.7	±1.0	
Sprocket Hole Pitch	P ₀	12.7	±0.3	
Sprocket Hole to Lead	P1	3.85	±0.7	
"	P ₂	6.35	±1.3	
Lead Spacing	F	5.0	±0.5	
Component Alignment	⊿h	2.0 Max.	-	Including tilting caused by bending lead wire.
Tape Width	w	18.0	+1.0 -0.5	
Hold-down tape Width	Wo	12.5 Min.	-	
Sprocket Hole Position	W ₁	9.0	±0.5	
Hold-down Tape Position	W ₂	3.0 Max.	-	No protrusion of tape.
Component's Bottom Line Position	Н	16.0	±0.5	
"	п	18.0	±0.5	
Sprocket Hole Diameter	D ₀	φ4.0	±0.2	
Total tape Thickness	t1	0.7	±0.2	
"	t2	1.5 Max.	_	
Defect Component Cut-off Position	L	11.0 Max.	-	

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Taping Specification [except FMC0H334ZFTP ()]



(Unit:mm)

Item	Symbol	Value	Tolerance	Remarks
Component Height	а	15.0	±0.5	
Component Width	b	14.0	±0.5	
Component Thickness	С	9.0	±0.5	
Lead-wire Width	W4	0.6	±0.1	
Lead-wire Thickness	t3	0.6	±0.1	
Pitch between Component	Р	25.4	±1.0	
Sprocket Hole Pitch	P ₀	12.7	±0.3	
Sprocket Hole to Lead	P1	3.85	±0.7	
"	P ₂	6.35	±1.3	
Lead Spacing	F	5.0	±0.5	
Component Alignment	⊿h	2.0 Max.	-	Including tilting caused by bending lead wire
Tape Width	w	18.0	+1.0 -0.5	
Hold-down tape Width	Wo	12.5 Min.	-	
Sprocket Hole Position	W1	9.0	±0.5	
Hold-down Tape Position	W2	3.0 Max.	-	No protrusion of tape
Component's Bottom Line Position	н	16.0	±0.5	
//		18.0	±0.5	
Sprocket Hole Diameter	D ₀	φ4.0	±0.2	
Total tape Thickness	t1	0.67	±0.2	
"	t2	1.7 Max.	-	
Defect Component Cut-off Position	L	11.0 Max.	-	

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- •Before using the product in this catalog, please read "Precautions" and other safety precautions listed in the printed version catalog.

No	Series name	5.5V ty	/pe, 3.5V type, 6.5V type		FME type		Test conditions	
Item		05°C	FMC, FML type to +70°C	05 °C		(0	conforming to JIS C 5101-1)	
Category tempera MAX operating vo	-		, 3.5Vdc, 6.5Vdc	-25 C	to +70 °C			
Capacitance	inage	5.5V:0 3.5V:0	0.010F to 0.33F 0.047F to 0.22F	0.22F, (Refer to	"Measurement Conditions"	
Capacitance allow	vance	6.5V : 0 +80 %	, —20 %	+80 %	, -20 %	Refer to	"Measurement Conditions"	
ESR		Refer to	o standard ratings	Refer to	o standard ratings		ed at 1kHz, 10mA ; See also rement Conditions"	
Current (30-minut	tes value)	Refer to	o standard ratings	Refer to	o standard ratings		"Measurement Conditions"	
	Capacitance	More th	an 90% of initial ratings	More th	nan 90% of initial ratings		ns to 4.26	
	ESR	Not to e	xceed 120% of initial ratings	Not to e	xceed 120% of initial ratings	Surge v	oltage : 4.0V (3.5V type) : 6.3V (5.5V type)	
	Current (30 minutes value		xceed 120% of initial ratings	Not to e	xceed 120% of initial ratings	Dischar	: 7.4V (6.5V type) : 30 sec. ge : 9min 30sec. of cycles : 1000 sistance : 0.010F 1500Ω	
Surge	Appearance	No obv	ious abnormality	No obv	ious abnormality	Dischar	$\begin{array}{cccc} : 0.022F & 560\Omega\\ : 0.043F, 0.047F & 300\Omega\\ : 0.068F & 240\Omega\\ : 0.10F & 150\Omega\\ : 0.22F & 56\Omega\\ : 0.33F & 51\Omega\\ ge resistance : 0\Omega\\ ature : 70\pm2^{\circ}C \end{array}$	
	Capacitance		50% or higher than initial value	Phase	50% or higher than initial value			
	ESR		400% or less than initial value	2	400% or less than initial value	-		
	Capacitance ESR	Phase 3		Phase 3			ns to 4.29 ∶+25±2℃	
Characteristics in different	Capacitance	Phase	200% or less than initial value	Phase	200% or less than initial value	Phase2	:−25±2°C	
temperature	mperature ESR		5 Sausiy milai raungs		5 Satisty initial ratings		: +25±2℃ : +70±2℃	
	Current (30 minutes value)		1.5CV (mA) or below		1.5CV (mA) or below		: +25±2℃	
	Capacitance ESR	Phase	Within ±20% of initial value Satisfy initial ratings	Phase	Within ±20% of initial value Satisfy initial ratings	-		
	Current (30 minutes value)	6 Satisfy initial ratings		6	Satisfy initial ratings	-		
Lead strength (ter		No tern	ninal damage	No tern	ninal damage	Conform	ns to 4.13.1	
Vibration	Capacitance ESR	Satisfy	initial ratings	Satisfy	initial ratings		ns to 4.17 ncy:10 to 55 Hz	
resistance	Current (30 minutes value)	Nie obri		NIh	· · · · · · · · · · · · · · · · · · ·		time : 6 hours	
Solderability	Appearance	Over 3/	ious abnormality 4 of the terminal should ered by the new solder	Over 3/	ious abnormality /4 of the terminal should ered by the new solder	Conforms to 4.15 Solder temp : 245±5°C Dipping time : 5±0.5 sec. 1.6mm from the bottom should be dipp		
Solder heat	Capacitance ESR	Satisfy	initial ratings	Satisfy	initial ratings	Conforms to 4.14 Solder temp : 260±10℃		
resistance	Current (30 minutes value)						time : 10 ± 1 sec. from the bottom should be dipped.	
	Appearance	No obv	ious abnormality	No obv	ious abnormality	1.011111	form the bottom should be upped.	
Temperature cycle	Capacitance ESR Current (30 minutes value)	Satisfy	initial ratings	Satisfy	initial ratings		ns to 4.16 e condition : -25°C →Room temperature→ +70°C →Room temperature	
-	Appearance	No obv	ious abnormality	No obv	ious abnormality	Number	of cycles : 5 Cycles	
	Capacitance	Within	±20% of initial value	Within	\pm 20% of initial value			
High temp. and	ESR	-	xceed 120% of initial ratings	-	xceed 120% of initial ratings		is to 4.22 $(40+2)^{\circ}$	
high humidity resistance	Current (30 minutes value)		xceed 120% of initial ratings		xceed 120% of initial ratings	Relative	ature:40±2℃ humidity:90 to 95%RH	
1001010100	Appearance		ious abnormality		ious abnormality	Testing	time: 240±8 hours	
	Capacitance		±30% of initial value		\pm 30% of initial value	Carte	a to 1.00	
High	ESR		200% of initial ratings		200% of initial ratings		ns to 4.23 ature∶70±2℃	
emperature	Current (30 minutes value)		200% of initial ratings		200% of initial ratings	Voltage	applied : MAX operating voltage	
load	Appearance		ious abnormality		ious abnormality		protection resistance ÷ 0 Ω time ÷ 1000 ⁺⁴⁸ Hours	
Self discharge ch (voltage holding c	aracteristics	5.5V ty	pe: Voltage between terminal leads higher than 4.2V	140 000	is a contributive	Charging condition	Voltage applied : 5.0Vdc (Terminal at the case's side be negative) Series resistance : 0.0 Charging time : 24 hours Let stand for 24 hours in condition	
	····· ····,		pe: Not specified pe: Not specified			Storage	described below with terminals opened. Ambient temperature : Lower than 25°C Relative humidity : Lower than 70%RH	

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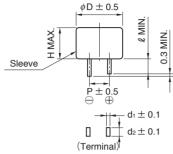
Item	Series name		FMR type	Test cond	ditions (conforming to JIS C 5101-1)				
Category temperature ra	nge	-40°C to -	+85℃	1					
MAX operating voltage	0	5.5Vdc, 3.5	Vdc						
Capacitance		0.047F, 0.1		Refer to "Me	asurement Conditions"				
Capacitance allowance		+80 %, -2			asurement Conditions"				
					: 1kHz, 10mA ; See also "Measuremen				
ESR		Refer to sta	andard ratings	Conditions"	Conditions"				
Current (30-minutes valu	e)	Refer to sta	indard ratings	-	asurement Conditions"				
	Capacitance	More than 9	90% of initial ratings	Conforms to Surge voltag					
	ESR	Not to exce	ed 120% of initial ratings	Charge : 30					
Surge	Current (30 minutes value)	Not to exce	ed 120% of initial ratings	Discharge :					
	Appearance	No obvious	abnormality	Number of cycles : 1000 Series resistance : 300 Ω Discharge resistance : 0Ω Temperature : 85±2°C					
	Capacitance	Phase 2	50% or higher than initial value						
	ESR	400% or less than initial value		0	4.00				
	Capacitance	Phase 3	30% or higher than initial value	Conforms to					
	ESR	1 11030 0	Below 700% of the initial value	Phase1 : +: Phase2 : -:					
Characteristics in	Capacitance		200% or less than initial value	Phase3 : -					
different temperature	ESR	Phase 5	Satisfy initial ratings	Phase4 : +:					
	Current (30 minutes value)		1.5CV (mA) or below	Phase5 : +					
	Capacitance		Within ±20% of initial value	Phase6 : +:	25±2℃				
	ESR	Phase 6	Satisfy initial ratings	_					
Current (30 minutes value)			Satisfy initial ratings						
Lead strength (tensile)		No terminal	damage	Conforms to	4.13.1				
	Capacitance			Conformata	4.17				
Vibration resistance	ESR	Satisfy initia	al ratings	Conforms to Frequency :					
VIDIALION TESISLANCE	Current (30 minutes value)			Testing time					
	Appearance	No obvious	abnormality	roomig unio					
Solderability		Over 3/4 of the new sol	the terminal should be covered by der	Conforms to 4.15 Solder temp : 245±5℃ Dipping time : 5±0.5 sec. 1.6mm from the bottom should be dipped.					
	Capacitance			Conforms to	4.14				
Solder heat resistance	ESR	Satisfy initia	al ratings	Conforms to 4.14 Solder temp : 260±10°C					
	Current (30 minutes value)				: 10±1 sec. the bottom should be dipped.				
	Appearance	No obvious	abnormality	1.01111110111	the bottom should be dipped.				
	Capacitance	Catiof civitic	al votin co	Conforms to					
Temperature cycle	ESR Current (30 minutes value)	Satisfy initia	arraungs	Temperature	condition : -40 °C → Room temperature				
	Appearance	No obvious	abnormality	Number of c	+85 °C →Room temperature ycles : 5 Cycles				
	Capacitance		0% of initial value						
Link to one and black	ESR		ed 120% of initial ratings	Conforms to					
High temp. and high humidity resistance	Current (30 minutes value)		ed 120% of initial ratings	Temperature Relative hun	a : 40±2 C nidity : 90 to 95 %RH				
	Appearance		abnormality		: 240±8 hours				
	Capacitance		% of initial value	Conference	4.00				
	ESR		% of initial ratings	Conforms to Temperature					
High temperature load				Voltage appl	ied : MAX operating voltage				
	Current (30 minutes value)		% of initial ratings		ction resistance∶0Ω ∶1000 ⁺⁴⁸ Hours				
	Appearance	INO ODVIOUS	abnormality	resurig unie					
Self discharge characteristics			Voltage between terminal leads higher than 4.2V	Charging condition	Voltage applied : 5.0Vdc (Terminal at the case's side be negative) Series resistance : 0Ω Charging time : 24 hours Let stand for 24 hours in condition				
(voltage holding characteristics)		Not specified	Storage	described below with terminals opened. Ambient temperature : Lower than 25°C Relative humidity : Lower than 70%RH					

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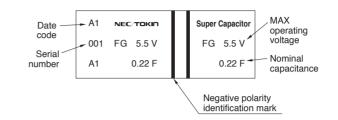
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6.3 FG Series

Dimensions



Markings on sleeve



FG Type

Specifications

	MAX	Nominal c	apacitance	MAX ESR	MAX	Voltage		Di	mension	(unit:m	m)		Weight
Part Number	operating voltage (Vdc)	Charge system (F)	Discharge system (F)	(at 1 kHz) (Ω)	current at 30 min. (mA)	holding characteristics (V)	φD	Н	Р	l	dı	d2	(g)
FG0H103ZF	5.5	0.010	0.013	300	0.015	4.2	11.0	5.5	5.08	2.7	0.2	1.2	0.9
FG0H223ZF	5.5	0.022	0.028	200	0.033	4.2	11.0	5.5	5.08	2.7	0.2	1.2	1.0
FG0H473ZF	5.5	0.047	0.060	200	0.071	4.2	11.0	5.5	5.08	2.7	0.2	1.2	1.0
FG0H104ZF	5.5	0.10	0.13	100	0.15	4.2	11.0	6.5	5.08	2.7	0.2	1.2	1.3
FG0H224ZF	5.5	0.22	0.28	100	0.33	4.2	13.0	9.0	5.08	2.2	0.4	1.2	2.5
FG0H474ZF	5.5	0.47	0.60	120	0.71	4.2	14.5	18.0	5.08	2.4	0.4	1.2	5.1
FG0H105ZF	5.5	1.0	1.3	65	1.5	4.2	16.5	19.0	5.08	2.7	0.4	1.2	7.0
FG0H225ZF	5.5	2.2	2.8	35	3.3	4.2	21.5	19.0	7.62	3.0	0.6	1.2	12.1
FG0H475ZF	5.5	4.7	6.0	35	7.1	4.2	28.5	22.0	10.16	6.1	0.6	1.4	27.3
FG0V155ZF	3.5	1.5	2.2	65	1.5	-	16.5	14.0	5.08	3.1	0.4	1.2	5.2

• FGH Type

Specifications

	MAX		Nominal capacitance		MAX ESR MAX Voltage Dimension (unit:mm)								Weight
Part Number	operating voltage (Vdc)	Charge system (F)	Discharge system (F)	(at 1 kHz) (Ω)	current at 30 min. (mA)	holding characteristics (V)	φD	Н	Р	l	dı	d2	(g)
FGH0H104ZF	5.5	-	0.10	100	0.15	4.2	11.0	5.5	5.08	2.7	0.2	1.2	1.0
FGH0H224ZF	5.5	-	0.22	100	0.33	4.2	11.0	7.0	5.08	2.7	0.2	1.2	1.3
FGH0H474ZF	5.5	-	0.47	65	0.71	4.2	16.5	8.0	5.08	2.7	0.4	1.2	4.1
FGH0V105ZF	5.5	-	1.0	35	1.5	4.2	21.5	9.5	7.62	3.0	0.6	1.2	7.2

• FGR Type

Specifications

		Nominal capacitance		MAX ESR	MAX	Voltage			Weight				
Part Number	operating voltage (Vdc)	Charge system (F)	Discharge system (F)	(at 1 kHz) (Ω)	current at 30 min. (mA)	holding characteristics (V)	φD	Н	Р	l	d1	d2	(g)
FGR0H474ZF	5.5	0.47	0.60	120	0.71	4.2	14.5	18.0	5.08	2.4	0.4	1.2	5.1
FGR0H105ZF	5.5	1.0	1.3	65	1.5	4.2	16.5	19.0	5.08	2.7	0.4	1.2	7.0
FGR0H225ZF	5.5	2.2	2.8	35	3.3	4.2	21.5	19.0	7.62	3.0	0.6	1.2	12.1

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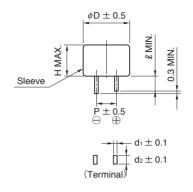
Item	Series name		FG, FGH type		FGR type	(c	Test conditions conforming to JIS C 5101-1)			
Category tempera	ature range	_25℃	to +70 °C	-40 ℃	to +85 °C					
MAX operating vo	oltage	5.5Vdc	, 3.5Vdc	5.5Vdc						
Capacitance			010F to 4.7F 0.10F to 1.0F	0.47F t	o 2.2F	Refer to	"Measurement Conditions"			
Capacitance allow	wance	+80 %	, -20 %	+80 %	, -20 %	Refer to	"Measurement Conditions"			
ESR		Refer to	o standard ratings	Refer to	o standard ratings		ed at 1kHz, 10mA ; See also rement Conditions"			
Current (30-minu	tes value)	Refer to	o standard ratings	Refer to	o standard ratings	Refer to	"Measurement Conditions"			
	Capacitance	More th	nan 90% of initial ratings	More th	an 90% of initial ratings		is to 4.26			
	ESR	Not to e	xceed 120% of initial ratings	Not to e	xceed 120% of initial ratings	Surge voltage : 6.3V (5.5V type) Charge : 30 sec.				
	Current (30 minutes value)	Not to e	exceed 120% of initial ratings	Not to e	xceed 120% of initial ratings		ge:9min 30sec. of cycles:1000			
Surge	Appearance	No obv	ious abnormality	No obv	ious abnormality	Series re Discharg	$ \begin{array}{c} \text{isstance : 0.022F} & 560\Omega\\ & : 0.047F & 300\Omega\\ & : 0.10F & 150\Omega\\ & : 0.22F & 56\Omega\\ & : 0.47F & 30\Omega\\ & : 1.0F & 15\Omega\\ \text{ge resistance : } 0\Omega\\ \text{ature : } 85\pm2^{\circ}\text{C} \end{array} $			
	Capacitance	Phase	50% or higher than initial value	Phase	50% or higher than initial value					
	ESR	2	400% or less than initial value	2	400% or less than initial value	Conform	ns to 4.29			
	Capacitance ESR	Phase 3		Phase 3	30% or higher than initial value 700% or less than initial value	Phase1	: +25±2℃			
Characteristics	haracteristics Canacitance		200% or less than initial value		200% or less than initial value		: −25±2°C : −40+2°C			
in different temperature	ESR	Phase 5	Satisfy initial ratings	Phase 5	Satisfy initial ratings	Phase4 : +25±2°C				
	Current (30 minutes value)		1.5CV (mA) or below		1.5CV (mA) or below		: +70±2℃ (FG, FGH) : +85±2℃ (FGR)			
	Capacitance ESR	Phase	Within ±20% of initial value Satisfy initial ratings	Phase	Within ±20% of initial value Satisfy initial ratings		: +25±2℃			
ESR Current (30 minutes value)		6	Satisfy initial ratings	6	Satisfy initial ratings	1				
Lead strength (tensile)		No tern	ninal damage	No tern	ninal damage	Conform	ns to 4.13.1			
	Capacitance					Conforma to 4.17				
Vibration	ESR	Satisfy	initial ratings	Satisfy initial ratings		Conforms to 4.17 Frequency : 10 to 55 Hz				
resistance	Current (30 minutes value)					Testing time : 6 hours				
	Appearance		ious abnormality	INO ODV	ious abnormality	Conform	ns to 4.15			
Solderability			/4 of the terminal should ered by the new solder	Over 3/4 of the terminal should be covered by the new solder		Solder te Dipping	time : 5 ± 0.5 sec. rom the bottom should be dipped			
	Capacitance					Conform	ns to 4.14			
Solder heat	ESR	Satisfy	initial ratings	Satisfy	initial ratings	Solder to	emp∶260±10°C			
resistance	Current (30 minutes value)	No obv	ique obnormality	No obv	ique obsermelity		time: 10±1 sec. rom the bottom should be dipped			
	Appearance Capacitance		ious abnormality		ious abnormality					
Temperature	ESR	Satisfy	initial ratings	Satisfy	initial ratings		is to 4.16 e condition : Category MIN temp→Room temp			
cycle	Current (30 minutes value)		-		-		Category MAX temp→Room ten			
	Appearance	No obv	ious abnormality	No obv	ious abnormality	Number	of cycles : 5 Cycles			
	Capacitance	Within	\pm 20% of initial value	Within	\pm 20% of initial value					
High temp. and	ESR	Not to e ratings	exceed 120% of initial	Not to e ratings	exceed 120% of initial		is to 4.22			
high humidity resistance	Current (30 minutes value)		exceed 120% of initial		exceed 120% of initial	Relative	ature : 40±2℃ humidity : 90 to 95 %RH :ime : 240±8 hours			
	Appearance	No obv	ious abnormality		ious abnormality	1				
	Capacitance	Within	\pm 30% of initial value	Within	\pm 30% of initial value	Conform	ns to 4.23			
High ESR	ESR	Below	200% of initial ratings	Below 2	200% of initial ratings	Temp : (Category MAX temp ±2℃			
temperature –	Current (30 minutes value)	Below 2	200% of initial ratings	Below 2	200% of initial ratings		applied : MAX operating voltage rotection resistance : 0Ω			
Appearance			ious abnormality		ious abnormality		time: 1000 ⁺⁴⁸ Hours			
	Self discharge characteristics		pe: Voltage between terminal leads higher	Voltage between terminal leads higher than 4.2V		Charging condition	Voltage applied : 5.0Vdc (Terminal at the case's side be negative) Series resistance : 0.0 Charging time : 24 hours			
(voltage holding characteristics)		than 4.2V 3.5V type: Not specified		Inglief	undin T.∠ V	Storage Let stand for 24 hours in cond described below with terminals Ambient temperature : Lower Relative humidity : Lower tha				

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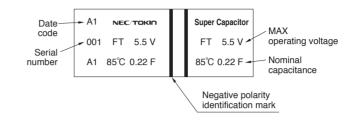
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6.4 FT Series

Dimensions



Markings on sleeve



Specifications

	MAX	Nominal ca	apacitance	MAX ESR	MAX current		Di	mension	(unit:m	m)		Weight
Part Number	operating voltage (Vdc)	Charge system (F)	Discharge system (F)	(at 1 kHz) (Ω)	at 30 min. (mA)	φD	Н	Р	d₁	d2	l	(g)
FT0H104ZF	5.5	0.10	0.14	16	0.15	11.5	8.5	5.08	0.4	1.2	2.7	1.6
FT0H224ZF	5.5	0.22	0.28	10	0.33	14.5	12.0	5.08	0.4	1.2	2.2	4.1
FT0H474ZF	5.5	0.47	0.60	6.5	0.71	16.5	13.0	5.08	0.4	1.2	2.7	5.3
FT0H105ZF	5.5	1.0	1.3	3.5	1.5	21.5	13.0	7.62	0.6	1.2	3.0	10.0
FT0H225ZF	5.5	2.2	2.8	1.8	3.3	28.5	14.0	10.16	0.6	1.4	6.1	18.0
FT0H335ZF	5.5	3.3	4.2	1.0	5.0	36.5	15.0	15.00	0.6	1.7	6.1	38.0
FT0H565ZF	5.5	5.6	7.2	0.6	8.4	44.5	17.0	20.00	1.0	1.4	6.1	72.0

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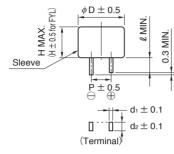
Item	Series name		FT type	Test conditions (conforming to JIS C 5101-1)
Category temperature ra	nge	-40 ℃ to -	⊦85°C	
MAX operating voltage		5.5Vdc		
Capacitance		0.1F to 5.6F	=	Refer to "Measurement Conditions"
Capacitance allowance		+80 %, -2	20 %	Refer to "Measurement Conditions"
ESR		Refer to sta	ndard ratings	Measured at 1kHz, 10mA ; See also "Measurement Conditions"
Current (30-minutes valu	e)	Refer to sta	ndard ratings	Refer to "Measurement Conditions"
	Capacitance	More than 9	00% of initial ratings	Conforms to 4.26
	ESR	Not to exce	ed 120% of initial ratings	Surge voltage : 6.3V
	Current (30 minutes value)	Not to exce	ed 120% of initial ratings	Charge : 30 sec. Discharge : 9min 30sec.
Surge	Appearance		abnormality	Number of cycles : 1000 Series resistance : 0.10F 150Ω : 0.22F 56Ω : 0.47F 30Ω : 1.0F 15Ω : 2.2F 10Ω : 3.3F 10Ω : 5.6F 10Ω Discharge resistance : 0Ω Temperature : 85±2°C
	Capacitance	Phase 2	50% or higher than initial value	_
	ESR	111030 2	400% or less than initial value	Conforms to 4.29
	Capacitance ESR	Phase 3	30% or higher than initial value 700% or less than initial value	Phase1 : +25±2℃
Characteristics in	Capacitance		200% or less than initial value	Phase2∶−25±2℃
different temperature	ESR	Phase 5	Satisfy initial ratings	Phase3 : −40±2℃
	Current (30 minutes value)		1.5CV (mA) or below	Phase4 : +25±2℃ Phase5 : +70±2℃
	Capacitance	Within ±20% of initial value Phase 6 Satisfy initial ratings		Phase6 : $+25\pm2^{\circ}$
	ESR			-
	Current (30 minutes value)		Satisfy initial ratings	
Lead strength (tensile)	Ormeritener	No terminal	damage	Conforms to 4.13.1
	Capacitance ESR	Satisfy initia	al ratings	Conforms to 4.17
Vibration resistance	Current (30 minutes value)	Oationy mille	a ratings	Frequency : 10 to 55 Hz
	Appearance	No obvious	abnormality	Testing time : 6 hours
Solderability			the terminal should be covered by	Conforms to 4.15 Solder temp : 245±5°C Dipping time : 5±0.5 sec. 1.6mm from the bottom should be dipped.
	Capacitance			Conforms to 4.14
Solder heat resistance	ESR	Satisfy initia	al ratings	Solder temp : 260±10 ℃
	Current (30 minutes value)	No obvides	alan avmality	Dipping time : 10±1 sec. 1.6mm from the bottom should be dipped.
	Appearance Capacitance ESR		abnormality	Conforms to 4.16
Temperature cycle	Current (30 minutes value)	Satisfy initia	araunys	Temperature condition : −40 °C → Room temperature→ +85 °C → Room temperature
	Appearance	No obvious	abnormality	Number of cycles : 5 Cycles
	Capacitance		% of initial value	
High terror (1111)	ESR		ed 120% of initial ratings	Conforms to 4.22
High temp. and high humidity resistance	Current (30 minutes value)			Temperature : 40±2℃ Relative humidity : 90 to 95 %RH
internet in the second s	· · · · · · · · · · · · · · · · · · ·		ed 120% of initial ratings	Testing time : 240±8 hours
	Appearance		abnormality	
	Capacitance		% of initial value	Conforms to 4.23
High temperature load	ESR	Below 2009	6 of initial ratings	Temperature : 85±2℃ Voltage applied : MAX operating voltage
J	Current (30 minutes value)	Below 200%	6 of initial ratings	Series protection resistance : 0Ω
	Appearance	No obvious	abnormality	Testing time : 1000 ⁺⁴⁸ Hours

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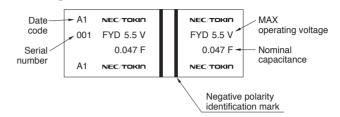
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6.5 FY Series

Dimensions



Markings on sleeve



• FYD Type

Specifications

	MAX	Nominal ca	apacitance	MAX ESR	MAX	Voltage		Di	mension	(unit:m	m)		Weight
Part Number	operating voltage (Vdc)	Charge system (F)	Discharge system (F)	(at 1 kHz) (Ω)	current at 30 min. (mA)	holding characteristics (V)	φD	Н	Р	l	dı	d2	(g)
FYD0H223ZF	5.5	0.022	0.033	220	0.033	4.2	11.5	8.5	5.08	2.7	0.4	1.2	1.6
FYD0H473ZF	5.5	0.047	0.070	220	0.071	4.2	11.5	8.5	5.08	2.7	0.4	1.2	1.7
FYD0H104ZF	5.5	0.10	0.14	100	0.15	4.2	13.0	8.5	5.08	2.2	0.4	1.2	2.4
FYD0H224ZF	5.5	0.22	0.35	120	0.33	4.2	14.5	15.0	5.08	2.4	0.4	1.2	4.3
FYD0H474ZF	5.5	0.47	0.75	65	0.71	4.2	16.5	15.0	5.08	2.7	0.4	1.2	6.0
FYD0H105ZF	5.5	1.0	1.6	35	1.5	4.2	21.5	16.0	7.62	3.0	0.6	1.2	11.0
FYD0H145ZF	5.5	1.4	2.1	45	2.1	4.2	21.5	19.0	7.62	3.0	0.6	1.2	12.0
FYD0H225ZF	5.5	2.2	3.3	35	3.3	4.2	28.5	22.0	10.16	6.1	0.6	1.4	22.9

• FYH Type

Specifications

	MAX	Nominal c	apacitance	MAX ESR	MAX	Voltage		Di	mension	(unit:m	m)		Weight
Part Number	operating voltage (Vdc)	Charge system (F)	Discharge system (F)	(at 1 kHz) (Ω)	current at 30 min. (mA)	holding characteristics (V)	φD	Н	Р	l	d1	d2	(g)
FYH0H223ZF	5.5	0.022	0.033	200	0.033	4.2	11.5	7.0	5.08	2.7	0.4	1.2	1.5
FYH0H473ZF	5.5	0.047	0.075	100	0.071	4.2	13.0	7.0	5.08	2.2	0.4	1.2	2.2
FYH0H104ZF	5.5	0.10	0.16	50	0.15	4.2	16.5	7.5	5.08	2.7	0.4	1.2	3.4
FYH0H224ZF	5.5	0.22	0.30	60	0.33	4.2	16.5	9.5	5.08	2.7	0.4	1.2	3.6
FYH0H474ZF	5.5	0.47	0.70	35	0.71	4.2	21.5	10.0	7.62	3.0	0.6	1.2	7.2
FYH0H105ZF	5.5	1.0	1.5	20	1.5	4.2	28.5	11.0	10.16	6.1	0.6	1.4	13.9

• FGL Type

Specifications

	MAX	Nominal c	apacitance	MAX ESR		Voltage		Di	mension	(unit:m	m)		Weight
Part Number	operating voltage (Vdc)	Charge system (F)	Discharge system (F)	(at 1 kHz) (Ω)	current at 30 min. (mA)	holding characteristics (V)	φD	Н	Р	l	d1	d2	(g)
FYL0H103ZF	5.5	0.01	0.013	300	0.015	4.2	11.0	5.0	5.08	2.7	0.2	1.2	0.9
FYL0H223ZF	5.5	0.022	0.028	200	0.033	4.2	11.0	5.0	5.08	2.7	0.2	1.2	1.0
FYL0H473ZF	5.5	0.047	0.061	200	0.071	4.2	12.0	5.0	5.08	2.7	0.2	1.2	1.2

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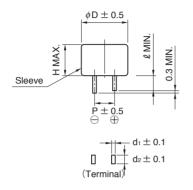
Item	Series name	F	FY type (FYD, FYH, FYL)	Test conc	litions (conforming to JIS C 5101-1)			
Category temperature ra	nge	-25℃ to -	+70 ℃					
MAX operating voltage	-	5.5Vdc						
Capacitance			andard ratings	Refer to "Me	asurement Conditions"			
Capacitance allowance		+80 %, -2			asurement Conditions"			
		FYD: 0.02		Mossured at	1kHz, 10mA ; See also "Measuremen			
ESR		FYH : 0.02 FYL : 0.01	2F to 1.0F DF to 0.047F	Conditions"	TREZ, TOTTA, See also measuremen			
Current (30-minutes valu	e)	Refer to sta	andard ratings		asurement Conditions"			
	Capacitance	More than 9	90% of initial ratings	Conforms to Surge voltag				
	ESR	Not to exce	ed 120% of initial ratings	Charge : 30	sec.			
	Current (30 minutes value)	Not to exce	ed 120% of initial ratings	Discharge : Number of c				
Surge	Appearance	No obvious	abnormality	Series resist	ance : 0.010F 1500 Ω : 0.022F 560 Ω : 0.047F 300 Ω : 0.068F 240 Ω : 0.10F 150 Ω : 0.22F 56 Ω : 0.47F 30 Ω : 1.0F, 1.4F 15 Ω : 2.2F 10 Ω sistance : 0 Ω			
	Capacitance ESR	Phase 2	50% or higher than initial value 400% or less than initial value					
	Capacitance	Phase 3		Conforms to	4.29			
o	ESR		2000/ or loss than initial value	Phase1 : +2				
Characteristics in different temperature	Capacitance ESR	Phase 5	200% or less than initial value Satisfy initial ratings	Phase2 : -2 Phase4 : +2				
	Current (30 minutes value)		1.5CV (mA) or below	Phase5 : +1				
	Capacitance		Within ±20% of initial value	Phase6 : +2	25±20			
	ESR	Phase 6	Satisfy initial ratings	-				
Lead strength (tensile)	Current (30 minutes value)	No termina	Satisfy initial ratings	Conforms to 4.13.1				
Lead strength (tensile)	Capacitance	NO termina	damage	Comonitis to	7.10.1			
	ESR	Satisfy initia	al ratings	Conforms to				
Vibration resistance	Current (30 minutes value)			Frequency : Testing time				
	Appearance	No obvious	abnormality					
Solderability		Over 3/4 of the new sol	the terminal should be covered by der					
Solder heat resistance	Capacitance ESR Current (30 minutes value)	Satisfy initia	al ratings		4.14 : 260±10℃ : 10±1 sec.			
	Appearance	No obvious	abnormality		the bottom should be dipped.			
	Capacitance			Conforms to	4.16			
Temperature cycle	ESR	Satisfy initia	al ratings		condition : -25 °C →Room temperature-			
iomperature cycle	Current (30 minutes value)			Number of a	+70 °C →Room temperatur ycles : 5 Cycles			
	Appearance		abnormality		yulea · J Uyulea			
	Capacitance		0% of initial value	Conforms to	4.22			
High temp. and high	ESR		ed 120% of initial ratings	Temperature	:40±2℃			
humidity resistance	Current (30 minutes value)		ed 120% of initial ratings		nidity:90 to 95 %RH :240±8 hours			
	Appearance		abnormality					
	Capacitance	Within ±30	0% of initial value	Conforms to				
High temperature load		Below 2009	% of initial ratings	Temperature Voltage appl	ied : MAX operating voltage			
	Current (30 minutes value)		% of initial ratings	Series protect	ction resistance : 0Ω			
	Appearance	No obvious	abnormality	resting time	: 1000 ⁺⁴⁸ Hours			
Self discharge characteri		Voltage bet	ween terminal leads higher than 4.2V	Charging condition Voltage applied : 5.0Vdc (Termi at the case's side be negative) Series resistance : 0.0 Charging time : 24 hours				
(voitage noiding chafacte	สารแรง)		-	Storage	Let stand for 24 hours in condition described below with terminals opened Ambient temperature : Lower than 25% Relative humidity : Lower than 70%R			

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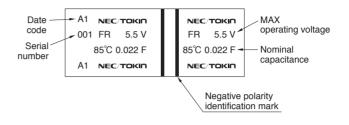
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6.6 FR Series

Dimensions







Specifications

	MAX	Nominal c	apacitance	MAX ESR	MAX	Voltage		Di	mension	(unit:m	m)		Weight
Part Number	operating voltage (Vdc)	Charge system (F)	Discharge system (F)	(at 1 kHz) (Ω)	current at 30 min. (mA)	holding characteristics (V)	φD	Н	Р	l	dı	d2	(g)
FR0H223ZF	5.5	0.022	0.028	220	0.033	4.2	11.5	14.0	5.08	2.7	0.4	1.2	2.3
FR0H473ZF	5.5	0.047	0.060	110	0.071	4.2	14.5	14.0	5.08	2.4	0.4	1.2	3.9
FR0H104ZF	5.5	0.10	0.15	150	0.15	4.2	14.5	15.5	5.08	2.4	0.4	1.2	4.3
FR0H224ZF	5.5	0.22	0.33	180	0.33	4.2	14.5	21.0	5.08	2.4	0.4	1.2	5.3
FR0H474ZF	5.5	0.47	0.75	100	0.71	4.2	16.5	21.5	5.08	2.7	0.4	1.2	7.5
FR0H105ZF	5.5	1.0	1.6	60	1.5	4.2	21.5	22.0	7.62	3.0	0.6	1.2	13.3

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Item	Series name		FR type	Test cond	litions (conforming to JIS C 5101-1)			
Category temperature ra	nge	-40 ℃ to -	⊦85 °C					
MAX operating voltage		5.5Vdc						
Capacitance		0.022F to 1	.0F	Refer to "Me	asurement Conditions"			
Capacitance allowance		+80%, -2	20 %	Refer to "Me	asurement Conditions"			
ESR			ndard ratings		1kHz, 10mA ; See also "Measuremen			
	0)		-	Conditions"	asurement Conditions"			
Current (30-minutes valu			ndard ratings	Conforms to				
	Capacitance				e : 6.3V (5.5V type)			
	ESR		ed 120% of initial ratings	Charge : 30				
Surge	Current (30 minutes value)		ed 120% of initial ratings	Discharge : s Number of cy Series resist				
				Discharge resistance : 0Ω Temperature : $70\pm2^{\circ}C$				
	Capacitance	Dha C	50% or higher than initial value					
	ESR	Phase 2	400% or less than initial value		4.00			
	Capacitance	Phase 3	30% or higher than initial value	Conforms to 4.29 Phase1 : +25±2°C				
Characteristics in	ESR Capacitance		700% or less than initial value 200% or less than initial value	Phase2 : -2	25±2℃			
different temperature	ESR	Phase 5	Satisfy initial ratings	Phase3 :4 Phase4 : +2				
	Current (30 minutes value)		1.5CV (mA) or below	Phase5 : +7				
	Capacitance	Phase 6	Within ±20% of initial value	Phase6 : +2	25±2℃			
	ESR Current (30 minutes value)	Phase 6	Satisfy initial ratings Satisfy initial ratings					
Lead strength (tensile)		No terminal		Conforms to 4.13.1				
Vibration resistance	Capacitance ESR Current (30 minutes value)	Satisfy initia		Conforms to Frequency :				
	Appearance	No obvious	abnormality	Testing time	: 6 hours			
Solderability	1	Over 3/4 of the new sol	the terminal should be covered by der	Conforms to 4.15 Solder temp : 245 ± 5 °C Dipping time : 5 ± 0.5 sec. 1.6mm from the bottom should be dipped.				
Solder heat resistance	Capacitance ESR Current (30 minutes value)	Satisfy initia	al ratings	Conforms to Solder temp Dipping time				
	Appearance	No obvious	abnormality		the bottom should be dipped.			
Temperature cycle	Capacitance ESR Current (30 minutes value)	Satisfy initia	al ratings	Conforms to Temperature of	condition : -40 °C →Room temperature-			
· ·	Appearance	No obvious	abnormality	Number of c	+85 °C →Room temperatur ycles : 5 Cycles			
	Capacitance		% of initial value		, , , , , , , , , , , , , , , , , , ,			
High temp. and high	ESR		ed 120% of initial ratings	Conforms to Temperature				
humidity resistance	Current (30 minutes value)		ed 120% of initial ratings	Relative hum	nidity: 90 to 95 % RH			
	Appearance		abnormality	Testing time	: 240±8 hours			
	Capacitance	Within ±30	% of initial value	Conforms to	4.23			
	ESR	Below 2009	6 of initial ratings	Temperature	:85±2℃			
High temperature load	Current (30 minutes value)		6 of initial ratings		ied : MAX operating voltage ction resistance : 0Ω			
	Appearance		abnormality		: 1000 ⁺⁴⁸ Hours			
Self discharge characteri (voltage holding characte			veen terminal leads higher than 4.2V	Charging condition	Voltage applied : 5.0Vdc (Terminal at the case's side be negative) Series resistance : 0Ω Charging time : 24 hours Let stand for 24 hours in condition			
	-,			 Let stand for 24 hours in condition described below with terminals op Ambient temperature : Lower than 7 Relative humidity : Lower than 7 				

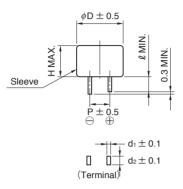
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6.7 FS Series

Dimensions



Markings on sleeve



Specifications

	MAX	Nominal ca	apacitance	MAX ESR	MAX current		Di	mension	(unit:m	m)		Weight
Part Number	operating voltage (Vdc)	Charge system (F)	Discharge system (F)	(at 1 kHz) (Ω)	at 30 min. (mA)	φD	Н	Р	l	dı	d2	(g)
FS0H223ZF	5.5	0.022	0.033	60.0	0.033	11.5	8.5	5.08	2.7	0.4	1.2	1.6
FS0H473ZF	5.5	0.047	0.072	40.0	0.071	13.0	8.5	5.08	2.2	0.4	1.2	2.6
FS0H104ZF	5.5	0.10	0.15	25.0	0.15	16.5	8.5	5.08	2.7	0.4	1.2	4.1
FS0H224ZF	5.5	0.22	0.33	25.0	0.33	16.5	13.0	5.08	2.7	0.4	1.2	5.3
FS0H474ZF	5.5	0.47	0.75	13.0	0.71	21.5	13.0	7.62	3.0	0.6	1.2	10
FS0H105ZF	5.5	1.0	1.3	7.0	1.5	28.5	14.0	10.16	6.1	0.6	1.4	18
FS1A474ZF	11.0	0.47	0.60	7.0	1.41	28.5	25.5	10.16	6.1	0.6	1.4	32
FS1A105ZF	11.0	1.0	1.3	7.0	3.0	28.5	31.5	10.16	6.1	0.6	1.4	35
FS1B105ZF	12.0	1.0	1.3	7.5	3.6	28.5	38.0	10.16	6.1	0.6	1.4	40
FS1B505ZF	12.0	5.0	6.5	4.0	18.0	44.8	60.0	20.00	9.5	1.0	1.4	160

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Item	Series name		FS type	Test conditions (conforming to JIS C 5101-1)				
Category temperature rai	nge	-25℃ to +	⊦70°C					
MAX operating voltage	•	5.5Vdc, 11V	/dc, 12Vdc					
Capacitance		5.5V ÷ 0.02 11V ÷ 0.47, 12V ÷ 1.0F,	2F to 1.0F 1.0	Refer to "Measurement Conditions"				
Capacitance allowance		+80 %, -2		Refer to "Measurement Conditions"				
ESR		5.5V ÷ 0.002 11V ÷ 0.47F 12V ÷ 1.0F,	, 1.0F	Measured at 1kHz, 10mA ; See also "Measuremen Conditions"				
Current (30-minutes value	э)		ndard ratings	Refer to "Measurement Conditions"				
	Capacitance	More than 9	00% of initial ratings	Conforms to 4.26				
	ESR	Not to exce	ed 120% of initial ratings	Surge voltage : 6.3V (5.5V type) : 12.6V (11V type)				
	Current (30 minutes value)		ed 120% of initial ratings	: 12.6V (11V type) : 13.6V (12V type)				
Surge	Appearance	No obvious	abnormality	Charge : 30 sec. Discharge : 9min 30sec. Number of cycles : 1000 Series resistance : 0.022F 560 Ω : 0.047F 300 Ω : 0.10F 150 Ω : 0.22F 56 Ω : 0.47F 30 Ω : 1.0F 15 Ω : 5.0F 10 Ω Discharge resistance : 0 Ω 7				
	minutes value)		50% or higher than initial value					
		Phase 2	300% or less than initial value					
		Phase 3		Conforms to 4.29				
Characteristics in		150% or less than initial value		Phase1: +25±2℃				
Characteristics in different temperature		Phase 5	Satisfy initial ratings	Phase2 : -25±2°C Phase4 : +25±2°C				
		1 11000 0	1.5CV (mA) or below	Phase5 : $+70\pm2^{\circ}$				
			Within $\pm 20\%$ of initial value	Phase6∶+25±2℃				
		Phase 6	Satisfy initial ratings					
	Current (30 minutes value)		Satisfy initial ratings					
Lead strength (tensile)		No terminal	damage	Conforms to 4.13.1				
Vibration resistance	ESR Current (30 minutes value)	Satisfy initia	al ratings	Conforms to 4.17 Frequency:10 to 55 Hz Testing time:6 hours				
Solderability		Over 3/4 of the new sole	the terminal should be covered by der	Conforms to 4.15 Solder temp : 245 ± 5 °C Dipping time : 5 ± 0.5 sec. 1.6mm from the bottom should be dipped.				
Solder heat resistance	ESR Current (30 minutes value)	Satisfy initia	-	Conforms to 4.14 Solder temp : 260 ± 10 °C Dipping time : 10 ± 1 sec. 1.6mm from the bottom should be dipped.				
		SDOIVGO ON	abnormality					
Temperature cycle	ESR	Satisfy initia	al ratings	Conforms to 4.16 Temperature condition : -25 °C → Room temperature- +70 °C → Room temperatur				
		No obvious	abnormality	Number of cycles : 5 Cycles				
Capacitance			f the initial value (5.5V type) % of initial value (11V type, 12Vtype)	Conforms to 4.22				
umidity resistance		Not to exce	ed 120% of initial ratings	Temperature : 40±2°C				
numbuly resistance	Current (30 minutes value)	Not to exce	ed 120% of initial ratings	Relative humidity : 90 to 95 %RH Testing time : 240±8 hours				
	Appearance	No obvious	abnormality					
	Capacitance	Over 85% o	f the initial value (5.5V type) % of initial value (11V type, 12Vtype)	Conforms to 4.23 Temperature ∶ 70±2°C				
High temperature load	ESR	Below 2009	6 of initial ratings					
J	Current (20 minutes value)	Below 200%	6 of initial ratings	Voltage applied : MAX operating voltage Series protection resistance : 0Ω				
	Current (30 minutes value)	D010W 2007	o ur ir inda radings	Series protection resistance - 012				

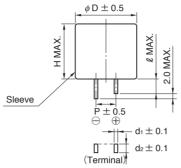
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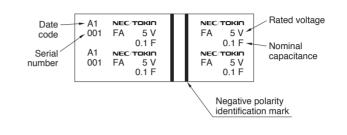
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6.8 FA Series, FE Series

• FA Series

Dimensions



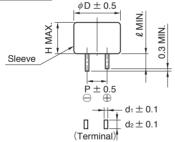


Specifications

	MAX	Rated	Nominal ca	apacitance	MAX ESR	MAX		Di	mension	ı (unit:m	m)		
Part Number	operating voltage (Vdc)	voltage (Vdc)	Charge system (F)	Discharge system (F)	(at 1 kHz) (Ω)	current at 30 min. (mA)	φD	Н	Ρ	l	d1	d ₂	Weight (g)
FA0H473ZF	5.5	5	0.047	0.075	20.0	0.071	16.0	15.5	5.1	5.0	0.4	1.2	6.2
FA0H104ZF	5.5	5	0.10	0.16	8.0	0.15	21.5	15.5	7.6	5.5	0.6	1.2	12
FA0H224ZF	5.5	5	0.22	0.35	5.0	0.33	28.5	16.5	10.2	9.5	0.6	1.4	25
FA0H474ZF	5.5	5	0.47	0.75	3.5	0.71	36.5	16.5	15.0	9.5	0.6	1.7	42
FA0H105ZF	5.5	5	1.0	1.6	2.5	1.5	44.5	18.5	20.0	9.5	1.0	1.4	65
FA1A223ZF	11.0	10	0.022	0.035	20.0	0.066	16.0	25.0	5.1	5.0	0.4	1.2	7.5
FA1A104ZF	11.0	10	0.10	0.16	8.0	0.30	28.5	25.5	10.2	9.5	0.6	1.4	32
FA1A224ZF	11.0	10	0.22	0.35	6.0	0.66	36.5	27.5	15.0	9.5	1.0	1.4	55
FA1A474ZF	11.0	10	0.47	0.75	4.0	1.41	44.5	28.5	20.0	9.5	1.0	1.4	83

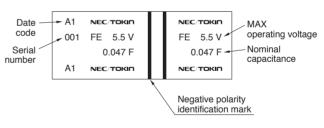
• FE Series

Dimensions



Markings on sleeve

Markings on sleeve



Specifications

	MAX	Nominal c	apacitance		MAX current							
Part Number	operating voltage (Vdc)	Charge system (F)	Discharge system (F)	ischarge (at 1 kHz)		φD	Н	Р	l	d₁	d2	Weight (g)
FE0H473ZF	5.5	0.047	0.075	14.0	0.071	14.5	14.0	5.1	2.2	0.4	1.2	3.9
FE0H104ZF	5.5	0.10	0.16	6.5	0.15	16.5	14.0	5.1	2.7	0.4	1.2	5
FE0H224ZF	5.5	0.22	0.35	3.5	0.33	21.5	15.5	7.6	3.0	0.6	1.2	9.5
FE0H474ZF	5.5	0.47	0.75	1.8	0.71	28.5	16.5	10.2	6.1	0.6	1.4	16
FE0H105ZF	5.5	1.0	1.4	1.0	1.5	36.5	18.5	15.0	6.1	0.6	1.7	38
FE0H155ZF	5.5	1.5	2.1	0.6	2.3	44.5	18.5	20.0	6.1	1.0	1.4	72

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Item	Series name		FA		FE	Test conditions (conforming to JIS C 5101-1)			
Category temper	ature range	−25°C	to +70 °C	_40°C	to +70 °C				
MAX operating v	oltage	5.5Vdc	11Vdc	5.5Vdc					
Capacitance		1	0.047F to 1.0F .022F to 0.47F	0.047F	to 1.5F	Refer to "Measurement Conditions"			
Capacitance allo	wance	+80 %	, -20 %	+80 %	, -20 %	Refer to "Measurement Conditions"			
ESR		Refer to	standard ratings	Refer to	o standard ratings	Measured at 1kHz, 10mA ; See also "Measurement Conditions"			
Current (30-minu	ites value)	Refer to	standard ratings	Refer to	o standard ratings	Refer to "Measurement Conditions"			
	Capacitance ESR				nan 90% of initial ratings xceed 120% of initial ratings	Conforms to 4.26 Surge voltage : 6.3V (5.5V type)			
	Current (30 minutes value)				xceed 120% of initial ratings	: 12.6V (11V type)			
Surge	Appearance			No obv	ious abnormality	Charge : 30 sec. Discharge : 9min 30sec. Number of cycles : 1000 Series resistance : 0.047F 300Ω : 0.10F 150Ω : 0.22F 56Ω : 0.47F 30Ω : 1.0F, 1.5F 15Ω Discharge resistance : 0Ω Temperature : 70±2°C			
	Capacitance ESR	Phase 2	70% or higher than initial value 300% or less than initial value	Phase 2					
	Capacitance	Phase Phase 40% or higher than initial value		Conforms to 4.29					
Characteristics	ESR	3		3	400% or less than initial value	Phase1 : +25±2℃ Phase2 : -25±2℃			
in different	Capacitance	Phase	150% or less than initial value	Phase	200% or less than initial value	Phase3 : -40 ± 2 °C (FE type)			
temperature	ESR	5	Satisfy initial ratings	5	Satisfy initial ratings	Phase4 : $+25\pm2^{\circ}$			
	Current (30 minutes value)		1.5CV (mA) or below		1.5CV (mA) or below	Phase5∶+70±2℃			
	Capacitance ESR	Phase	Within ±20% of initial value Satisfy initial ratings	Phase	Within ±20% of initial value Satisfy initial ratings	Phase6 : +25±2℃			
	Current (30 minutes value)	6	Satisfy initial ratings	6	Satisfy initial ratings				
Lead strength (te	nsile)	No terminal damage		No terminal damage		Conforms to 4.13.1			
	Capacitance					0			
Vibration	ESR	Satisfy	initial ratings	Satisfy	initial ratings	Conforms to 4.17			
resistance	Current (30 minutes value)					Frequency : 10 to 55 Hz Testing time : 6 hours			
	Appearance	No obv	ous abnormality	No obv	ious abnormality	-			
Solderability			4 of the terminal should ared by the new solder		4 of the terminal should ered by the new solder	Conforms to 4.15 Solder temp: 245 ± 5 °C Dipping time: 5 ± 0.5 sec. 1.6mm from the bottom should be dipped.			
Solder heat	Capacitance ESR	Satisfy	initial ratings	Satisfy	initial ratings	Conforms to 4.14 Solder temp ÷ 260±10℃			
resistance	Current (30 minutes value)					Dipping time : 10 ± 1 sec.			
	Appearance	No obv	ous abnormality	No obv	ious abnormality	1.6mm from the bottom should be dipped.			
	Capacitance	0-1-6-		Octobe	in Mart and a sec	Conforms to 4.16 Temperature condition : -25°C (-40°C for FE type)→			
Temperature	ESR Current (30 minutes value)	Satisty	initial ratings	Satisty	initial ratings	Room temperature condition : -25 C (-40 C for PE type)→			
cycle ,						+70 °C →Room temperature			
	Appearance		ous abnormality		ious abnormality	Number of cycles : 5 Cycles			
	Capacitance		0% of initial value		±20% of initial value				
High temp. and high humidity	ESR	ratings	exceed 120% of initial	ratings		Conforms to 4.22 Temperature : 40±2℃			
resistance	Current (30 minutes value)	Not to e ratings	exceed 120% of initial	Not to e ratings	exceed 120% of initial	Relative humidity : 90 to 95 %RH Testing time : 240±8 hours			
	Appearance	No obv	ous abnormality	No obv	ious abnormality				
Capacitance Ov		Over 85	5% of initial value	Within	±30% of initial value	Conforms to 4.23			
High	ESR	Below ⁻	20% of initial ratings	Below	200% of initial ratings	$\begin{array}{c} \hline \ \ \ \ \ \ \ \ \ \ \ \ \$			
temperature	Current (30 minutes value)		200% of initial ratings		200% of initial ratings				
load	Appearance		ous abnormality		ious abnormality	Series protection resistance : 0Ω Testing time : 1000 ⁺⁴⁸ Hours			
	, ppoulailos	110 000	cas abnormality	110 000		Iesting time : 1000 ⁺⁴⁸ Hours			

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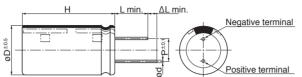
6.9 HV Series (High capacitance Type)

Dimensions



NEC/TOKIN 2.7V 10F

HV



Specifications

	MAX	Nominal	MAX ESR	MAX current		C	Dimension	ı (unit:mm)		
Part Number	operating voltage (Vdc)	capacitance (F)	(at 1 kHz) (Ω)	at 30 min. (mA)	φD	Н	Р	φd	L	⊿L	Weight (g)
HVS0E106NF	2.7	10	100	8	10.0	35±2	5.0	0.6	15.0	5.0	4.5
HVS0E226NF	2.7	22	100	18	12.5	35±2	5.0	0.6	15.0	5.0	6.5
HVS0E506NF	2.7	50	30	40	18.0	40±5	7.5	0.8	15.0	5.0	14.0
HVS0E107NF	2.7	100	30	81	22.0	50±5	10.2	1.0	15.0	5.0	24.0

Specifications

Item			Specifications	Test conditions (conforming to JIS C 5101-1)			
itom		_25°C to _	-60°C (50F, 100F),				
Category temperature ra	nge		F00 ℃ (50F, 100F), F70 ℃ (10F, 22F),				
MAX operating voltage		2.7Vdc					
Capacitance		10F, 20F, 50	DF, 100F	Refer to "Measurement Conditions"			
Capacitance allowance		±30 %		Refer to "Measurement Conditions"			
ESR		Refer to sta	ndard ratings	Measured at 1kHz, 10mA ; See also "Measurement Conditions"			
Current (30-minutes valu	e)	Refer to sta	ndard ratings	Refer to "Measurement Conditions"			
	Capacitance	Phase 2	50% higher than initial value				
	ESR	Phase 2	400% or less than initial value				
	Capacitance		150% or less than initial value	Conforms to 4.29			
Characteristics in	ESR	Phase 4	Satisfy initial ratings	Phase2 : Category MAX temp.			
different temperature	Current (30 minutes value)]	1.5×10 ⁻³ CV (A) or below	Phase4 : Category MIN temp.			
	Capacitance		Within $\pm 20\%$ of initial value	Phase5 : 20°C			
	ESR	Phase 5	Satisfy initial ratings				
	Current (30 minutes value)	1	Satisfy initial ratings				
Lead strength (tensile)	•	No terminal	damage	Conforms to 4.13.1			
	Capacitance			Conforms to 4.17			
Vibration resistance	ESR	Satisfy initia	al ratings	Frequency : 10 to 55 Hz			
VIDIATION TESIStance	Current (30 minutes value)			Testing time : 6 hours			
	Appearance	No obvious	abnormality				
Solderability		Over 3/4 of the new sol	the terminal should be covered by der	Conforms to 4.15 Solder temp : 245±5°C Dipping time : 5±0.5 sec. 1.6mm from the bottom should be dipped.			
	Capacitance			Conforms to 4.14 Solder temp : 260±10 °C			
	ESR	Satisfy initia	al ratings				
Solder heat resistance	Current (30 minutes value)	1,		Dipping time : 10 ± 1 sec.			
	Appearance	No obvious	abnormality	1.6mm from the bottom should be dipped.			
	Capacitance		· · · · · · · · · · · · · · · · · · ·	Conforms to 4.16			
	ESR	Satisfy initia	al ratings	Temperature condition : -25 °C →Room temperature→			
Temperature cycle	Current (30 minutes value)	1	0	+70°C (10F, 22F), +60°C (50F, 100F)→			
	Appearance	No obvious	abnormality	Room temperature Number of cycles : 5 Cycles			
	Capacitance	Within ±20	% of initial value	Conforms to 4.22			
High temp. and high	ESR	Not to exce	ed 120% of initial ratings	Temperature : 40±2°C (50F, 100F)			
humidity resistance	Current (30 minutes value)	Not to exce	ed 120% of initial ratings	Relative humidity : 90 to 95 %RH			
	Appearance	No obvious	abnormality	Testing time : 240±8 hours			
	Capacitance	Within ±30	% of initial value	Conforms to 4.23			
ŀ	ESR	Below 2009	6 of initial ratings	Temperature : +70 °C (10F, 22F), +60 °C (50F, 100F)			
High temperature load	Current (30 minutes value)	Below 200%	6 of initial ratings	Voltage applied : MAX operating voltage			
	Appearance	No obvious	abnormality	Series protection resistance : 0Ω Testing time : 1000 ⁺⁴⁸ Hours			

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6.10 HP · ED/L Series (Thin Type)

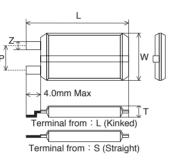
• HP, ED/L Series

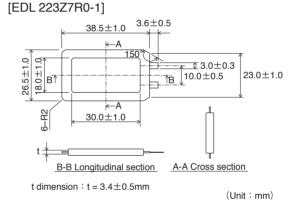
Features

- Minimized the footprint by improving packaging and cell construction method.
- Low ESR
- High speed charging/discharging enabled. Capable of high current discharge in the order of amperes (A).
- Excellent low temperature characteristics. (Can be used at -25 °C)
- Thin shape makes it suitable for mobile equipments.
- Environmentally safe as it contains no hazardous substances such as heavy metals.

Dimensions

[HP series]





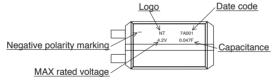
Applications

• Peak current assist for mobile equipments.

· Smoothing capacitor for power source.

Markings

[SL, SN type]



Specifications

Part Number	MAX operating voltage (Vdc)	Nominal capacitance (F)	MAX ESR (at 1 kHz) (Ω)	Size code	L MAX. (mm)	W MAX. (mm)	T MAX. (mm)	Z (mm)	P (mm)
HPSL0G223Z()	4.2	0.022	300	SL	34	14	2.3	2.5	7.5±0.5
HPSN0G473Z()	4.2	0.047	200	SN	42.5	17	2.3	3.0	10±0.5
EDL223Z7R0-1	7.8	0.022	300			Refer to abo	ove drawing		

() Lend from : L (Kinked) or S (Straight)

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- •Before using the product in this catalog, please read "Precautions" and other safety precautions listed in the printed version catalog.

7. Packing

1. FM Series

(1) Bulk

- Packing method : Pack in vinyl bags then pack them into cardboard boxes.
- Standard packing quantity : 1000pcs (100pcs / vinyl bag × 10)

However : FM0H104ZF-L1 and FM0H224ZF-L1=800pcs, FMC0H334ZF=400pcs, FMC0H334ZF-L1=300pcs

(2) Taping

• Packing method : Ammo pack

• Standard packing quantity : 1000pcs However, FMC0H334ZFTP() = 400pcs

2. FC Series

Part name	Packing unit
FCS0H473ZFTBR24	1000 PCS. / reel
FCS0H104ZFTBR24	1000 PCS. / reel
FC0H224ZFTBR24	500 PCS. / reel
FC0H474ZFTBR32	200 PCS. / reel
FC0H105ZFTBR44	150 PCS. / reel
FC0V104ZFTBR24	1000 PCS. / reel
FC0V224ZFTBR24	1000 PCS. / reel
FC0V474ZFTBR24	500 PCS. / reel
FCH0V683ZFTBR16	1500 PCS. / reel
FCH0H433ZFTBR16	1500 PCS. / reel

3. FG, FT, FS, FR, FY, FA Series

(1) Bulk (Small type)

• Packing method : Pack in vinyl bags then pack them into cardboard boxes.

• Standard packing quantity: see chart below.

(Unit : Pises)

Series name	E.	A	FE	F	FS		FY		FR	FG	FT
Capacitance	5.5V type	11V type	FE	5.5V type	11V type, 12V type	FYD	FYH	FYL	ΓN	FG	FI
0.010F	-	-	_	-	-	_	_	2000	—	2000	-
0.022F	-	240	_	1000	—	1000	1600	2000	800	2000	-
0.047F	400	-	400	800	—	1000	800	1600	400	2000	-
0.10F	-	-	400	600	-	800	600	_	400	1600	1000
0.22F	-	-	_	400	—	400	500	—	300	800	400
0.47F	-	-	_	-	—	240	—	—	240	300	400
1.0F	-	-	_	-	_	_	_	_	_	240	-

(2) Bulk (large type)

Packing method: Pin the terminal onto a conductive mat; then pack it into individual cardboard box with insulation material.
Standard packing quantity: see chart below.

otandara paolan	ig quantity	. ooo onar	i boloti.							(Un	it : Pises)
Series name	F	A		F	S		FY		FR	FG	FT
Capacitance	5.5V type	11V type	FE	5.5V type	11V type, 12V type	FYD	FYH	FYL	FR	FG	FI
0.10F	90	50	-		-	_	-	_	-	-	_
0.22F	50	30	90	-	-	—	-	—	—	-	-
0.47F	30	20	50	90	50	_	90	_	-	_	_
1.0F	20	-	30	50	50	90	50	_	90	_	90
1.4F	-	-	-	-	-	90	-	_	_	-	-
1.5F	-	-	20	-	-	-	-	_	_	160	-
2.2F	-	-	-	-	-	50	-	_	_	90	50
3.3F	-	-	-	-	-	—	-	—	—	-	30
4.7F	-	-	-	-	-	_	-	_	—	50	-
5.0F	-	-	-	-	20	—	-	—	—	-	-
5.6F	_	_	_	_	_	_	_	_	_	_	20

4. Winded type (HV Series)

• Packing method : Pack in vinyl bags then pack them into cardboard boxes.

• Standard packing quantity : 320pcs (10F), 224pcs (22F), 120pcs (50F), 80pcs (100F)

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8. List of Plating Type and Sleeve Type

By changing the solder plating from leaded solder to lead-free solder, and the outer tube material of can-cased conventional SuperCapacitor from polyvinyl chloride to Polyethylene Terephathatate (PET), our new SuperCapacitor has now became even more friendlier to the environment.

- a. Iron + copper base + lead-free solder plating (Sn-1Cu)
- b. SUS nickel base + copper base + reflow lead-free solder plating (100% Sn, reflow processed)
- c. Copper + nickel base + lead-free solder plating (100% Sn)
- d. Iron + copper base + lead-free solder plating (100% Sn)

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	HP	All HP Series	С	No tube used
HV All HV Series d PET (Blue)	ED/L	All ED/L Series	С	No tube used
	HV	All HV Series	d	PET (Blue)

Recommended Pb-free solder : Sn / 3.5Ag / 0.75Cu

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Sn / 3.0Ag / 0.5Cu Sn / 0.7Cu Sn / 2.5Ag / 1.0Bi / 0.5Cu

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•All specifications in this catalog and production status of products are subject to change without notice. Prior to the purchase, please contact NEC TOKIN for updated product data. •Please request for a specification sheet for detailed product data prior to the purchase.

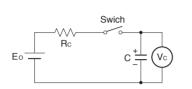
9. Measurement Conditions

(9)

(1) Capacitance (Charge System)

Capacitance: $C = \frac{\tau}{B_C}$ (F)

Capacitance is calculated from expression (9) by measuring the charge time constant (τ) of the capacitor (C). Prior to measurement, short between both pins of the capacitor for 30 minutes or more to let it discharge. In addition, follow the indication of the product when determining the polarity of the capacitor during charging.



E_o: 3.0 (V) \cdots Product with maximum operating voltage 3.5 V

5.0 (V) \cdots Product with maximum operating voltage 5.5 V

6.0 (V) \cdots Product with maximum operating voltage $$6.5~{\rm V}$$

10.0 (V) ··· Product with maximum operating voltage 11 V

12.0 (V) \cdots Product with maximum operating voltage 12 V

12

 τ : Time from start of charging until Vc becomes

0.632E₀ (V) (sec)

R_c:See table below (Ω).

	FA	FE	FS		FY		FR	FM, FME	FMC	FG	FGH	FT	FC
			13	FYD	FYH	FYL	ΓΠ	FMR, FML	TIMO	ru	run	I I	
0.010F	-	-	-	-	-	5000 Ω	-	5000 Ω	-	5000 Ω	-	-	-
0.022F	1000 Ω	-	1000 Ω	2000 Ω	-	2000 Ω	-	-	Discharge				
0.047F	1000 Ω	1000 Ω	1000 Ω	2000 Ω	1000 Ω	2000 Ω	1000 Ω	2000 Ω	1000 Ω	2000 Ω	-	-	-
0.10F	510 Ω	510 Ω	510 Ω	1000 Ω	510 Ω	-	1000 Ω	1000 Ω	1000 Ω	1000 Ω	Discharge	510 Ω	Discharge
0.22F	200 Ω	200 Ω	200 Ω	510 Ω	510 Ω	-	510 Ω	0H: Discharge 0V: 1000 Ω	-	1000 Ω	Discharge	200 Ω	Discharge
0.33F	-	-	-	-	-	-	-	-	Discharge	-	-	-	-
0.47F	100 Ω	100 Ω	100 Ω	200 Ω	200 Ω	-	200 Ω	-	-	1000 Ω	Discharge	100 Ω	Discharge
1.0F	51 Ω	51 Ω	100 Ω	100 Ω	100 Ω	-	100 Ω	-	-	510 Ω	Discharge	100 Ω	Discharge
1.4F	-	-	-	200 Ω	-	-	-	-	-	-	-	-	-
1.5F	-	51 Ω	-	-	-	-	-	-	-	510 Ω	-	-	-
2.2F	-	-	-	100 Ω	-	-	-	-	-	200 Ω	-	51 Ω	-
3.3F	-	-	-	-	-	-	-	-	-	-	-	51 Ω	-
4.7F	-	-	-	-	-	-	-	-	-	100 Ω	-	-	-
5.0F	-	-	100 Ω	-	_	-	-	-	-	_	-	-	-
5.6F	-	-	-	-	-	-	-	_	-	-	-	20 Ω	-

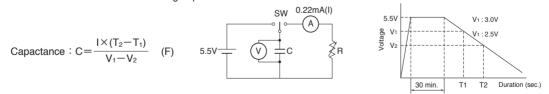
*Capacitance values according to the constant current discharge method.

Table 3 Capacitance measurement

Capacitance (Discharge System)

In the diagram below, charging is performed for a duration of 30 minutes, once the voltage of the condensor terminal reaches 5.5 V.

Then, use a constant current load device and measure the time for the terminal voltage to drop from 3.0 to 2.5 V upon discharge at 0.22 mA for 0.22 F, for example, and calculate the static capacitance according to the equation shown below. Note: The current value is 1 mA discharged per 1F.



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10. A Notes on Using Super Capacitor (Electric Double-Layer Capacitor)

1. Circuitry design

1.1 Useful life

The electrical double layered capacitor (super capacitor) uses electrolyte and is sealed with rubber etc. Water in the electrolyte can evaporate in use over long periods at high temperatures, thus reducing electrostatic capacity which in turn will create greater internal resistance. The characteristics of the super capacitor can vary greatly depending on the environment it is used in. Therefore, controlling the usage environment will ensure prolonged life of the part. Basic breakdown mode is an open mode due to increased internal resistance.

1.2 Fail rate in the field

Based on field data, the fail rate is calculated at approx. 0.006Fit. We estimate that unreported failures are ten times this amount. Therefore, we assume that the fail rate is below 0.06Fit.

1.3 Voltage application when maximum usable voltage is exceeded

Performance may be compromised, and in some cases leakage or damage may occur if applied voltage exceeds maximum working voltage.

1.4 Use of capacitor as a smoothing capacitor (ripple absorption) in electrical circuits

As super capacitors contain a high level of internal resistance, they are not recommended for use as electrical smoothing capacitors in electrical circuits.

Performance may be compromised, and in some cases leakage or damage may occur if a super capacitor is used in ripple absorption.

1.5 Series connections

As applied voltage balance to each super capacitor is lost when used in series connection, excess voltage may be applied to some super capacitors, which will not only negatively affect its performance but may also cause leakage and/or damage. Allow ample margin for maximum voltage or attach a circuit for applying equal voltage to each super capacitor (partial pressure resistor/voltage divider) when using super capacitors in series connection.

Also, arrange super capacitors so that the temperature between each capacitor will not vary.

1.6 Outer sleeve insulation

The outer sleeve wrapped around the super capacitor indicates that it is sealed, however the outer sleeve is not guaranteed for insulation purposes. Therefore, it cannot be used where insulation is necessary.

1.7 Polar characteristics

The super capacitor is manufactured so that the terminal on the outer case is negative (-). Align the (-) symbol during use. Even though discharging has been carried out prior to shipping, any residual electrical charge may negatively affect other parts.

1.8 Use next to heat emitters

Useful life of the super capacitor will be significantly affected if used near heat emitting items (coils, power transistors, and posistors etc) where the super capacitor itself may become heated.

1.9 Usage environment

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This device cannot be used in any acidic, alkaline or similar type of environment.

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1.10 Super capacitors fitted with pressure valves

HV series super capacitors are fitted with pressure valves Make an opening in the top of the pressure valve to avoid any damage to the super capacitor when the pressure valve is in use. Allow at least a 2mm opening for models with a diameter of ϕ 18mm or less, and at least a 3mm opening for models with a diameter of ϕ 22mm.

2. Mounting

2.1 Mounting onto a reflow furnace

Except for the FC series, it is not possible to mount this capacitor onto an IR / VPS reflow furnace. Do not immerse the capacitor into a soldering dip tank.

2.2 Flow soldering conditions

Keep solder under 260 °C and soldering time to within 10 seconds when using the flow automatic soldering method. (Except for the FC, HV and the HP/EDL series)

2.3 Installation using a soldering iron

Care must be taken to prevent the soldering iron from touching other parts when soldering. Keep the tip of the soldering iron under 400 $^{\circ}$ C and soldering time to within 3 seconds. For the HP/EDL series, the tip of the soldering iron must be kept at below 320 $^{\circ}$ C and soldering time to within 3 seconds. Always make sure that the temperature of the tip is controlled. Internal capacitor resistance is likely to increase if the terminals are overheated.

2.4 Lead terminal processing

Do not attempt to bend or polish the capacitor terminals with sand paper etc. Soldering may not be possible if the metallic plating is removed from the top of the terminals.

2.5 Cleaning, Coating, and Potting

Except for the FM series, cleaning, coating, and potting must not be carried out. Consult us if this type of procedure is necessary.

Terminals should be dried at less than the maximum operating temperature after cleaning.

3. Storage

3.1 Temperature and Humidity

Make sure that the super capacitor is stored according to the following conditions: Temp.: $5 \sim 35^{\circ}$ C (Standard 25), Humidity: 20 \sim 70% (Standard: 50%). Do not allow the build up of condensation through sudden temperature change.

3.2 Environment conditions

Make sure that there are no corrosive gasses like sulfur dioxide as penetration of the lead terminals is possible. Always store this item in an area with low dust and dirt levels.

Make sure that the packaging will not be deformed through heavy loading, movement and/or knocks. Keep out of direct sunlight, and away from radiation, static electricity, and magnetic fields.

3.3 Maximum storage period

This item may be stored up to one year from the date of delivery if stored at the conditions stated above. This product should be safe to use even after being stored for over a 1 year period. However, depending on the storage conditions, we recommend that the soldering is checked.

4. Dismantling

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There is a small amount of electrolyte stored within thecapacitor. Do not attempt to dismantle as direct skin contact with the electrolyte will cause burning.

This product should be treated as industrial waste and not is not to be disposed of by fire.

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		our	products,	the	following	precautions	should
be tak	en.		-		_	-	

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(2		nds of parts, and equipment in which the parts can be utilized we a standard quality level unless otherwise specified.				
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(5) Industrial property problems

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In the event any problems associated with industrial property of a third party arising as a result of the use of our products, NEC TOKIN assumes no responsibility for problems other than problems directly associated with the constitution and manufacturing method of the products.

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