NEC/TOKIN

Devices thru Material Innovation

Vol. 02 Super Capacitors (ELECTRIC DOUBLE-LAYER CAPACITORS)



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 Caapacitors 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.

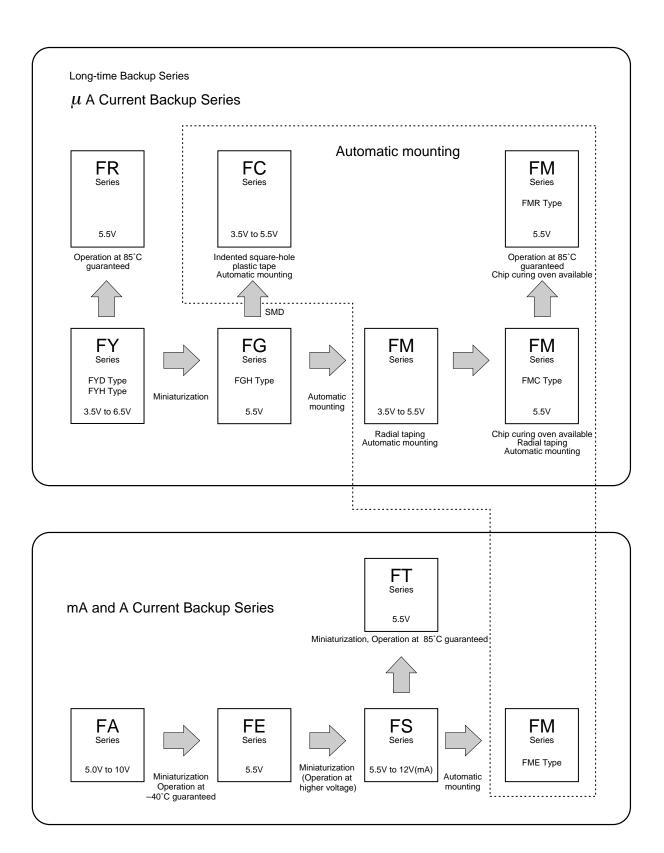
3. Please read 'Notes on Using the Super Capacitor' on page 56 when you design the circuits using the Super Capacitors.

ISO 9001 QS 9000	ISO 14001
JQA	JQA

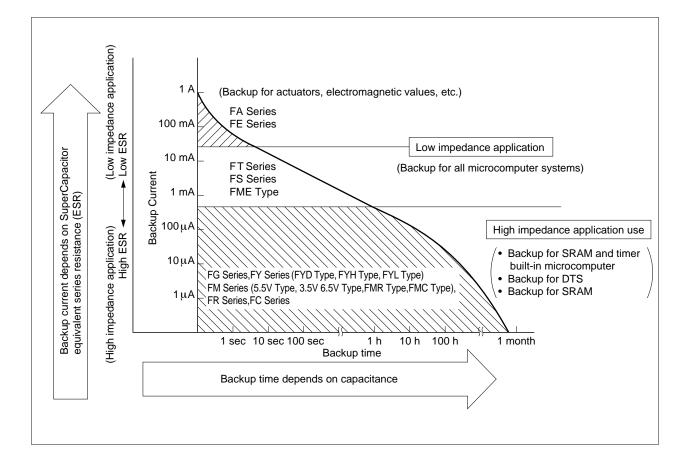
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Organization of Super Capacitor Series



Backup Performance For Selection



Description

The Super Capacitor is the most outstanding capacitor concept to appear in the past decade. The large capacitance, slow rate of discharge and small package make it useful as a non-battery reserve power source that can provide currents (1-100 mA) and protect microcomputers from power shutdowns lasting several seconds.

It is also useful for maintaining the contents of low dissipation volatile memories (i.e. CMOS) for several months. (For more detailed applications, refer to the table shown below.)

The operating principle of the Super Capacitor is based on an electric double layer appearing at the interface between activated carbon particles and sulfuric acid solution as electrolyte. The two electrodes are separated by an ionically conducting but electrically insulating porous membrane. Conductive rubber membranes contain the electrode and electrolyte material and make contact to the cell. Several cells are stacked in series to achieve the 5.5 V and 11 V rated voltages.

Since the Super Capacitor exhibit relatively high ESR, it is not recommended for ripple absorption in DC power supply applications.

In some manufacturing operations it has been polarized with the following voltage direction.

Shorter lead: Positive Longer lead (connected to case): N egative Therefore, the use of the Super Capacitor in that direction is recommended in actual usage.

Typical Applications

The following table shows typical applications categorized by the functions and the magnitude of back-up current required.

FUNCTIONS	BACKUP CURRENT	APPLICATIONS	EQUIPMENT	ADEOUATE SERIES
Large current supply	Up to 1 A	Actuator applications (Large current in a short period) Primary power supply for LED displays, toys,	Actuators Relay/Solenoid starter Igniters Handheld toys Displays, Smoke detectors, Alarm	FA and FE series
Medium capacity power supply	Up to 50 mA	electric buzzers, etc. Secondary power source for undesirable voltage drops	devices, Emergency display Car radio back-up at the engine start, etc.	FT series FS series 3.5 V•6.5 V series
		Motor Start	VCR, Video disk Record player	(FSH) FME type
Power backup for primary power outages	500 µA	CMOS Microcomputers	Phones (Memory dial, Auto-answering) Electric cash registers Electric typewriters Computer terminals Automatic measuring instruments, etc.	FC series FY series FYD Type FYH Type FYL Type
		CMOS RAMs ICs for Clocks	Digital tuning audio system (LW-MW-FM Radio, Car Radio, Stereo, etc.) Programmable consumer electronic products (VCR, Microwave overun, Games, etc.)	3.5 V•6.5 V Series (FYD) FM series FG series
		 CMOS RAMs ICs for Clocks High operating temperature (85°C) 	Measuring instruments Automatic control Communications Car	FR series

Other Applications

Programmable Thermostat, Copiers, Vending Machines, Automatic Electricity Counters, Traffic Signals, Taxi Meters, Fuel Management Systems, Process Monitoring or Control, Satellite Communications, Portable "Battery" Operated Equipment, Fare Collection System, POS Terminals, Mail Sorters, Scale, Flow Metering, Electronic Slot Machines, Water Heat Controllers.

FC Series

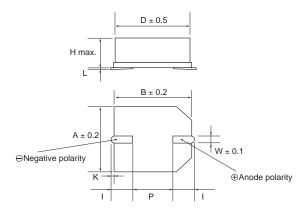
Features

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

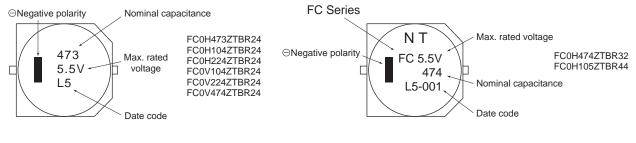
Applications

Subsidiary power supply.
 Buck up power supply line.
 Memory backup during battery exchange.

Dimensions



<u>Markings</u>



Standard Rating

Part Number	Max. Rated Voltage	Nominal Capacitance Discharge	Max. ESR (at 1kHz)	at 20 minutos	Voltage Holding				[Dimension	(Unit:r	nm)		
T dit Number	(Vdc)	system (F)	(Ω)	(mA)	Characteristic Min. (V)	D	Н	A	В	I	W	Ρ	к	L
FC0H473ZTBR24	5.5	0.047	50	0.071	4.2	10.5	5.5	10.8	10.8	3.6±0.5	1.2	5.0	0.7±0.2	0 +0.3
FC0H104ZTBR24	5.5	0.10	25	0.15	4.2	10.5	5.5	10.8	10.8	3.6±0.5	1.2	5.0	0.7±0.2	0 +0.3
FC0H224ZTBR24	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±0.2	0 +0.3
FC0H474ZTBR32	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±0.35	0 +0.5
FC0H105ZTBR44	5.5	1.00	7	1.50	4.2	21.0	10.5	21.6	21.6	7.0±1.0	1.4	10.0	1.2±0.35	0 +0.5
FC0V104ZTBR24	3.5	0.10	50	0.090	-	10.5	5.5	10.8	10.8	3.6±0.5	1.2	5.0	0.7±0.2	0 +0.3
FC0V224ZTBR24	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±0.2	0 +0.3
FC0V474ZTBR24	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±0.2	0 +0.3

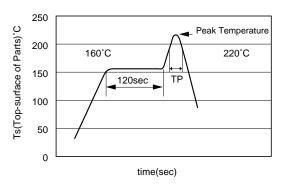
Precautions for use

 This capacitor is exclusive use of reflow soldering. It's designed for thermal conduction system such as infrared ray (IR) or heat blow.

For applying other methods, Please consult with us first.

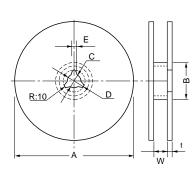
- Graph attheleft, "Reflow Condition" indicares the surface temperature at the top of capacitor.
- Reflow Condition

Reflow Profile



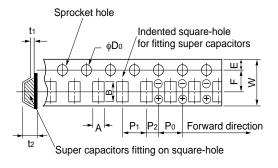
Tape and Reel Dimensions

[Reel Dimensions]



				(mm)
Mark	TBR24		TBR32	TBR44
А	380±2		330±2	380±2
В	Product height 5.5mm	80±1	400.4	400.4
	Product height 8.5mm	100±1	100±1	100±1
С	13±0.5		13±0.5	13±0.5
D	21±0.8		21±0.8	21±0.8
E	2±0.5		2±0.5	2±0.5
W	25.5±0.5		32.5±0.5	44.5±0.5
t	Product height 5.5mm	3.0	2.8	2.8
	Product height 8.5mm	2.8	2.0	2.0

Dimensions of indented [square-hole plastic tape]



			(mm)
Mark	TBR24	TBR32	TBR44
W	24.0	32.0	44.0
A	11.4	18.0	23.0
В	13.0	20.0	25.0
P0	4.0	4.0	4.0
P1	16.0	24.0	32.0
P2	2.0	2.0	2.0
F	11.5	14.2	20.2
φDo	1.55	1.55	1.55
t1	0.4	0.5	0.5
E	1.75	1.75	1.75
t2	5.8	10.0	12.0

Number of pachaged Super capacitors

Part Number	Packaging
FC0H473ZTBR24	1000pcs./reel
FC0H104ZTBR24	1000pcs./reel
FC0H224ZTBR24	500pcs./reel
FC0H474ZTBR32	200pcs./reel
FC0H105ZTBR44	150pcs./reel
FC0V104ZTBR24	1000pcs./reel
FC0V224ZTBR24	1000pcs./reel
FC0V474ZTBR24	500pcs./reel

Specifications 5.5V Type

ltem			Standard	Test Condition	s conforming to JIS C 5102-1994	
Operating Temperation	ture Range	–25°C to +70°C				
Maximum Operating Voltage		5.5 VDC				
Nominal Capacitance Range		0.047 to 1.0F		See character	istics measuring method.	
Capacitance Allow	ance	+80%, -20%		See character	istics measuring method.	
Equivalent Series	Resistance	See standard list		See character	istics measuring method.	
Current (30-minute	es value)	See standard list		See character	istics measuring method.	
		Capacitance	More than 90% of initial requirement	Conforms to	7.14	
		Equivalent series resistance	Not to exceed 120% of initial requirement	Surge Voltag	e: 6.3 V(5.5V products)	
		Current (30-minute value)	Not to exceed 120% of initial requirement	Temperature	: 70 ± 2°C	
				Charge:	30 sec.	
Surge Voltage20				Discharge:	9 min. 30 sec.	
		Appearance	No obvious abnormality	Number of cy	cles 1000 cycles.	
				Charge resis	tance: 0.047F 300 Ω	
				Discharge re	sistance: 0 Ω	
		Capacitance	50% or higher of initial value	Conforms to	7.12	
	Phase 2	Equivalent series resistance	4 or less times initial value	Phase 1: +2	5 ± 2°C	
* Temperature		Capacitance	200% or below of initial value	 Phase 2: –2	5 ± 2°C	
Variation of	Phase 5	Equivalent series resistance	Satisty initial standard value	 Phase 3: -4	0 ± 2°C	
Characteristics		Current (30-minute value)	1.5 CV (mA) or below	Phase 4: +25 ± 2°C Phase 5: +70 ± 2°C		
	Phase 6	Capacitance	Within ±20% of initial value			
		Equivalent series resistance	Satisty initial standard value	Phase 6: +25 ± 2°C		
		Current (30-minute value)	Satisty initial standard value	-		
		Capacitance		Conforms to 8.2.3		
*		Equivalent series resistance	Satisty initial standard value	Frequency : 10 to 55 Hz		
Vibration Resistan	ce	Current (30-minute value)		Test duration	: 6 hours	
		Appearance	No obvious abnormality	-		
		Capacitance		Conforms to 8.5 Solder temperature: 260 ± 10°C		
*		Equivalent series resistance	Satisty initial standard value			
Soldering Heat Re	sistance	Current (30-minute value)		Dipping duration: 10 ± 1 sec. Dipped up to 1.6 mm from the lower end		
		Appearance	No obvious able abnormality	of the capacitor.		
		Capacitance		Conforms to		
*		Equivalent series resistance	Satisty initial standard value	Temperature condition:		
Temperature Cycle	9	Current (30-minute value)		-25°C →	normal temperature	
		Appearance	No obvious abnormality	→ +70°C	→ normal temperature	
		Capacitance	Within 20% of initial value	Number of cy	cles: 5 cycles	
*		Equivalent series resistance	1.2 or less times initial standard value	Conforms to	9.5	
Humidity Resistand	ce	Current (30-minute value)	1.2 or less times initial standard value	Temperature Relative hum		
		Appearance	No obuious abnormality	Test duration		
*		Capacitance	Within 30% of initial value	Conforms to	9.10	
		Equivalent series resistance	Twice or less times initial standard value	Temperature		
High Temperature	Load	Current (30-minute value)	Twice or less times initial standard value	 Voltage appli Series protection 		
		Appearance	No obvious abnormality	Series protection resistance: 0Ω Test duration: 1000^{+48}_{0} hours		
* Voltage Holding			-	condition	Voltage applied: 5.0 VDCSeries resistance: 0Ω Charging time:24hours	
			/oltage between terminal leads higher than 4.2 V		Time:24hoursTemperature:Lower than25°C	

* The characteristics above must be satisfied for asterisked items after the end of reflow soldering (according to the reflow condition shown on page).

Specifications 3.5V Type

-				
Item			Standard	Test Conditions conforming to JIS C 5012 ⁻¹⁹⁹⁴
Operating Tempera	ture Range	–25°C to +70°C		
Maximum Operatir	ig Voltage	3.5 VDC		
Nominal Capacitance Range		0.010 to 0.47F		See characteristics measuring method.
Capacitance Allow	ance	+80%, -20%		See characteristics measuring method.
Equivalent Series	Resistance	See standard list		See characteristics measuring method.
Current (30-minute	es value)	See standard list		See characteristics measuring method.
	,	Capacitance	More than 90% of initial requirement	Conforms to 7.14
		Equivalent series resistance	Not to exceed 120% of initial requirement	Surge Voltage: $4.0 V(3.5V \text{ products})$ Temperature: $70 \pm 2^{\circ}C$
		Current (30-minute value)	Not to exceed 120% of initial requirement	Charge: 30 sec.
*Surge Voltage		Appearance	No obvious abnormality	$\begin{array}{cccc} - & \text{Discharge:} & 9 \text{ min. 30 sec.} \\ \text{Number of cycles } 1000 \text{ cycles.} \\ \text{Charge resistance :} 0.10\text{F} & 150 \Omega \\ & : 0.22\text{F} & 56 \Omega \\ & : 0.47\text{F} & 30 \Omega \\ & : 1.0\text{F} & 15 \Omega \\ \end{array}$
		Capacitance	50% or higher of initial value	Conforms to 7.12
	Phase 2	Equivalent series resistance	4 or less times initial value	Phase 1: +25 ± 2°C
* Temperature		Capacitance	200% or below of initial value	Phase 2: –25 ± 2°C
Variation of	Phase 5	Equivalent series resistance	Satisty initial standard value	Phase 3: -40 ± 2°C
Characteristics		Current (30-minute value)	1.5 CV (mA) or below	Phase 4: +25 ± 2°C
		Capacitance	Within ±20% of initial value	Phase 5: +70 ± 2°C
	Phase 6	Equivalent series resistance	Satisty initial standard value	Phase 6: +25 ± 2°C
		Current (30-minute value)	Satisty initial standard value	-
		Capacitance		Conforms to 8.2.3
*		Equivalent series resistance	Satisty initial standard value	Frequency : 10 to 55 Hz
Vibration Resistan	се	Current (30-minute value)		Test duration : 6 hours
		Appearance	No obvious abnormality	
		Capacitance		Conforms to 8.5
*		Equivalent series resistance	Satisty initial standard value	Solder temperature: 260 ± 10°C
Soldering Heat Re	sistance	Current (30-minute value)		Dipping duration: 10 ± 1 sec.
		Appearance	No obvious able abnormality	Dipped up to 1.6 mm from the lower end of the capacitor.
		Capacitance		Conforms to 9.3
*		Equivalent series resistance	Satisty initial standard value	Temperature condition:
Temperature Cycle	e	Current (30-minute value)		$-25^{\circ}C \rightarrow \text{normal temperature}$
		Appearance	No obvious abnormality	\rightarrow +70°C \rightarrow normal temperature Number of cycles: 5 cycles
		Capacitance	Within 20% of initial value	Conforms to 9.5
		Equivalent series resistance	1.2 or less times initial standard value	Temperature: $40 \pm 2^{\circ}C$
*Humidity Resistan	се	Current (30-minute value)	1.2 or less times initial standard value	Relative humidity: 90 to 95% RH
		Appearance		Test duration: 240 ± 8 hours
			No obuious abnormality Within 30% of initial value	Conforms to 9.10
		Capacitance		Temperature: $70 \pm 2^{\circ}C$
*High Temperature	Load	Equivalent series resistance	Twice or less times initial standard value	Voltage applied: 3.5 Vdc
		Current (30-minute value)	Twice or less times initial standard value	Series protection resistance: 0Ω
		Appearance	No obvious abnormality	Test duration: 1000^{+48}_{0} hours

* The characteristics above must be satisfied for asterisked items after the end of reflow soldering (according to the reflow condition shown on page).

FT Series

The FT series Super Capacitors are ideal as short-time (30 minutes max.) backup devices in small and lightweight systems. 5.5 VDC (0.10 F to 5.6 F)

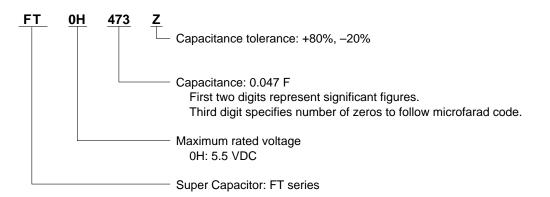
Features

• Ideal for supplying current of several hundred μA to several mA for short time

Applications

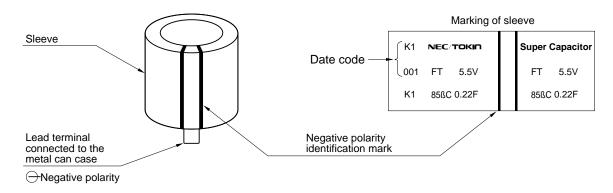
· Backup source for microcomputers and buffer for momentary high-current loads (for example, motors)

Part Number System

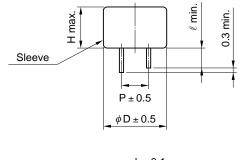


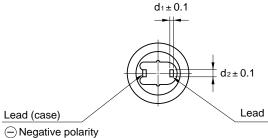
Markings

Markings are made with black ink on the green sleeve.



Dimensions and Standard Ratings





	D 11.5	Н	Р	4			(g)
	11.5	0.5		d1	d2	l	(oz)
(0		8.5	5.08	0.4	1.2	2.7	1.6
).453)	(0.335)	(0.2)	(0.016)	(0.047)	(0.106)	(0.057)
FT0H224Z	14.5	12.0	5.08	0.4	1.2	2.2	4.1
((0.57)	(0.47)	(0.2)	(0.016)	(0.047)	(0.087)	(0.145)
FT0H474Z	16.5	13.0	5.08	0.4	1.2	2.7	5.3
((0.65)	(0.512)	(0.2)	(0.016)	(0.047)	(0.106)	(0.187)
FT0H105Z	21.5	13.0	7.62	0.6	1.2	3.0	10.0
((0.85)	(0.512)	(0.3)	(0.024)	(0.047)	(0.118)	(0.353)
FT0H225Z	28.5	14.0	10.16	0.6	1.4	6.1	18.0
(*	1.12)	(0.55)	(0.4)	(0.024)	(0.055)	(0.240)	(0.635)
FT0H335Z 3	36.5	15.0	15.00	0.6	1.7	6.1	38.0
(*	1.44)	(0.588)	(0.59)	(0.024)	(0.067)	(0.240)	(1.34)
FT0H565Z	44.5	17.0	20.00	1.0	1.4	6.1	72.0
(*	1.75)	(0.67)	(0.79)	(0.039)	(0.055)	(0.240)	(2.54)

Note: Weight is typical.

Part Number	Max. Rated Voltage (V)	Nomial Capacitance Charge System (F)	Discharge System (F)	Max. ESR (at 1 kHz) (Ω)	Max. Current at 30 minutes (mA)
FT0H104Z	5.5	0.10	0.14	less than 16	less than 0.15
FT0H224Z	5.5	0.22	0.28	less than 10	less than 0.33
FT0H474Z	5.5	0.47	0.60	less than 6.5	less than 0.71
FT0H105Z	5.5	1.0	1.3	less than 3.5	less than 1.5
FT0H225Z	5.5	2.2	2.8	less than 1.8	less than 3.3
FT0H335Z	5.5	3.3	4.2	less than 1.0	less than 5.0
FT0H565Z	5.5	5.6	7.2	less than 0.6	less than 8.4

Specifications

•				Test Conditions
Item			conforming to JIS C 5102 ⁻¹⁹⁹⁴	
Operating Temperatu	ire Range	–40°C to +85°C		
Maximum Operating Voltage		5.5 Vdc		
Nominal Capacitan	ce Range	0.1 to 5.6 F (Refer to s	tandard ratings)	
Capacitance Allowa	ance	+80 %, -20 %		See characteristics measuring conditions
Equivalent Series R	esistance	See standard list		See characteristics measuring conditions
Current (30-minute	value)	See standard list		See characteristics measuring conditions
		Capacitance	More than 90 % of initial requirement	At 85°C Surge voltage 6.3 V Charge: 30 sec. Discharge: 9 min. 30 sec. 1000 cycles Charge resistance:
Surge Voltage		Equivalent Series Resistance	Not to exceed 120 % of initial requirement	0.10 F 150 Ω 0.22 F 56 Ω 0.47 F 30 Ω 1.0 F 15 Ω 2.2 F 10 Ω
		Current at 30 minutes	Not to exceed 120 % of initial requirement	$\begin{array}{cccccccccccccccccccccccccccccccccccc$
	Dhana 2	Capacitance	More than 50 % of initial value	Conforms to 7.12
	Phase 2	Equivalent Series Resistance	Not to exceed 3 times initial value	Phase 1: +25±2°C
	Phase 3	Capacitance	More than 30 % of initial value	Phase 2: -25 ±2°C
Temperature	Flidse 5	Equivalent Series Resistance	Not to exceed 7 times initial value	Phase 3: -40 ±2°C
Variation of	Phase 5	Capacitance	Not to exceed 150 % of initial value	Phase 4: +25±2°C
Characteristics		Equivalent Series Resistance	Not to exceed initial requirement	Phase 5: +85 ±2°C
		Current at 30 minutes	Not to exceed 1.5 CV (mA)	Phase 6: +25 ±2°C
	Phase 6	ΔC/C	Within ±20 % of initial value	
		Equivalent Series Resistance	Not to exceed initial requirement	_
		Current at 30 minutes	Not to exceed initial requirement	
Lead Strength (Ten	sile)	No loosening nor perm	anent damage of the leads	Conforms to 8.1.2(1) 0.022 to 0.47 F: 1 kg, 10 sec. 1 F: 2.5 kg, 10 sec.
		Capacitance	Meet initial requirement	Conforms to 8.2.3
Vibration Resistance	e	Equivalent Series Resistance	Meet initial requirement	Frequency: 10 to 55 Hz
		Current at 30 minutes	Meet initial requirement	Test duration: 6 hours
Solderability		3/4 or more of the pin s	surface should be covered with new solder	Conforms to 8.4 230 ± 5°C 5 ± 0.5 sec. 1.6 mm from body
		Capacitance	Meet initial requirement	Conforms to 8.5
Soldering Heat Resistance		Equivalent Series Resistance	Meet initial requirement	260 ±10°C, 10 ±1 sec. Immersion depth:
Roolotanoo		Current at 30 minutes	Meet initial requirement	1.6 mm from body
		Capacitance	Meet initial requirement	Conforms to 9.3 Temperatuve condition:
Temperature Cycle		Equivalent Series Resistance	Meet initial requirement	$-40^{\circ}C \rightarrow Normal temperature \rightarrow +85^{\circ}C \rightarrow Normal temperature$
		Current at 30 minutes	Meet initial requirement	Number of cycles : 5 cycles
		Capacitance	Within $\pm 20\%$ of initial value	Conforms to 9.5
Humidity Resistance	e	Equivalent Series Resistance	Not to exceed120 % of initial requirement	40 ± 2°C, 90 to 95% RH
		Current at 30 minutes	Not to exceed120 % of initial requirement	240 ± 8 hours
		Capacitance change	Within ±30% of initial value	Conforms to 9.10
High temperature L	oad	Equivalent Series Resistance	Not to exceed 200% of initial requirement	- Temperature: $85 \pm 2^{\circ}C$ Series resistance: $\underset{1}{0}$
		Current at 30 minutes	Not to exceed 200% of initial requirement	Applied voltage: 5.5 VDC Time of test: 1000 hours

FG Series

The FG series includes small-size electric double-layer capacitors with excellent voltage holding characteristics. The FG series are ideal as long-time backup devices for minute-current loads in small and lightweight systems.

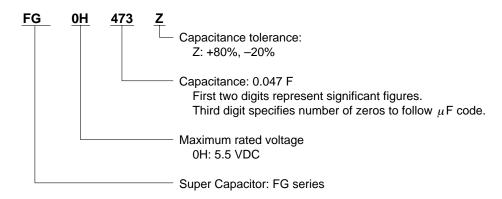
Features

- The volume of the products is approx. 1/2 that of the FYD type products. (0.22F~2.2F)
- Added 4.7F/5.5V to series.
- Miniaturized 0.047F/5.5V and 0.10F/5.5V

Applications

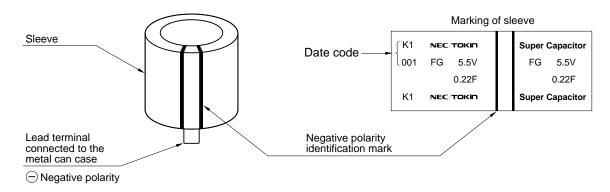
- · Backup of CMOS microprocessors, static RAMs, DTSs (digital tuning systems)
- Memory backup of remote controllers and handy cassette player during battery exchange

Part Number System

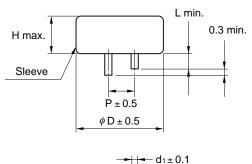


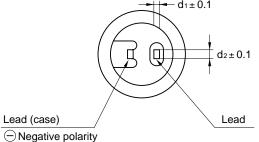
Markings

Markings are made with black ink on the green sleeve.



Dimensions and Standard Ratings





Part No.		Dim	nensions	s mm (ir	nch)		Weight
Fall NO.	D	Н	Р	d₁	d2	L	g (oz)
FG0H103Z	11.0	5.5	5.08	0.2	1.2	2.7	0.9
	(0.43)	(0.215)	(0.200)	(0.016)	(0.047)	(0.106)	(0.032)
FG0H223Z	11.0	5.5	5.08	0.2	1.2	2.7	1.0
	(0.43)	(0.215)	(0.200)	(0.016)	(0.047)	(0.106)	(0.035)
FG0H473Z	11.0	5.5	5.08	0.2	1.2	2.7	1.0
	(0.43)	(0.215)	(0.200)	(0.016)	(0.047)	(0.106)	(0.035)
FG0H104Z	11.0	6.5	5.08	0.2	1.2	2.7	1.3
	(0.43)	(0.256)	(0.200)	(0.016)	(0.047)	(0.106)	(0.046)
FG0H224Z	13.0	9.0	5.08	0.4	1.2	2.2	2.5
	(0.512)	(0.355)	(0.200)	(0.016)	(0.047)	(0.087)	(0.088)
FG0H474Z	14.5	18.0	5.08	0.4	1.2	2.4	5.1
	(0.571)	(0.709)	(0.200)	(0.016)	(0.047)	(0.095)	(0.180)
FG0H105Z	16.5	19.0	5.08	0.4	1.2	2.7	7.0
	(0.65)	(0.749)	(0.200)	(0.016)	(0.047)	(0.106)	(0.247)
FG0H225Z	21.5	19.0	7.62	0.6	1.2	3.0	12.1
	(0.85)	(0.749)	(0.300)	(0.024)	(0.047)	(0.118)	(0.427)
FG0H475Z	28.5	22.0	10.16	0.6	1.4	6.1	27.3
	(1.122)	(0.867)	(0.400)	(0.024)	(0.055)	(0.240)	(0.964)

Note: Weight is typical.

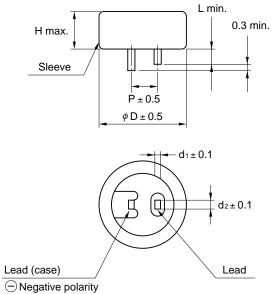
Part Number	Max. Rated Voltage (V)	Nomial Capacitance Charge System (F)	Discharge System (F)	Max. ESR (at 1 kHz) (Ω)	Max. Current at 30 minutes (mA)	Voltage Holding Characteristic Min.(V)
FG0H103Z	5.5	0.01	0.013	300	0.015	4.2
FG0H223Z	5.5	0.022	0.028	200	0.033	4.2
FG0H473Z	5.5	0.047	0.060	200	0.071	4.2
FG0H104Z	5.5	0.10	0.13	100	0.15	4.2
FG0H224Z	5.5	0.22	0.28	100	0.33	4.2
FG0H474Z	5.5	0.47	0.60	120	0.71	4.2
FG0H105Z	5.5	1.0	1.3	65	1.5	4.2
FG0H225Z	5.5	2.2	2.8	35	3.3	4.2
FG0H475Z	5.5	4.7	6.0	35	7.1	4.2

Specifications

				Тос	t Conditions		
Items	;		Standard		g to JIS C 5102 ⁻¹⁹⁹⁴		
Operating Tempera	ature Range	–25°C to +70°C		00.101	9 10 010 0 0101		
Maximum Operati	-	5.5 Vdc					
Nominal Capacita		0.010 to 4.7 F		See characteris	stics measuring method		
Capacitance Allow		+80 %, -20 %			stics measuring method		
Equivalent Series		See standard list		See characteristics measuring method			
Current (30-minut		See standard list			stics measuring method		
		Capacitance	More than 90% of initial requirement	Conforms to 7.			
		Equivalent series resistance	Not to exceed 120% of initial requirement	Surge voltage:	6.3V		
		Current at 30 min.	Not to exceed 120% of initial requirement	Temperature: 7 Charge: 30 sec			
Surge Voltage		Appearance No obvious abnormality		Discharge: 9 min 30 sec. Number of cycles: 1000 cycles Series resistance: $0.010F: 1500 \Omega 0.47F: 30 \Omega$ $0.022F: 560 \Omega 1.0F: 15 \Omega$ $0.047F: 300 \Omega 2.2F: 10 \Omega$ $0.10F: 150 \Omega 4.7F: 10 \Omega$ $0.22F: 56 \Omega$ Discharge resistance: 0 Ω			
		Capacitance	50% or higher of initial value	Conforms to 7.	12		
	Phase 2	Equivalent series resistance	4 or less times initial value	Phase 1: +25	±2°C		
Temperature		Capacitance	200% or below of initial value	Phase 2: -25	±2°C		
Variation of	Phase 5	Equivalent series resistance	Satisfy initial standard value	Phase 3: -40	±2°C		
Characteristics		Current at 30 min.	1.5 CV (mA) or below	Phase 4: +25	±2°C		
		Capacitance	Within ±20% of initial value	Phase 5: +70	±2°C		
	Phase 6	Equivalent series resistance	Phase 6: +25	±2°C			
		Current at 30 min.	Satisfy initial standard value Satisfy initial standard value				
Lead Strength (Te	ensile)		anent damage of the leads	Conforms to 8.	1 2 (1)		
g		Capacitance					
Vibration Resista	nce	Equivalent series resistance	Meet initial standard value	Conforms to 8.2.3 (1)			
		Current at 30 min.		Frequency: 10	to 55 Hz		
		Appearance	No obvious abnormality	Test duration: 6	6 hours		
Solderability		3 / 4 or more of the pin	surface should be covered with new solder		ature: 230±5°C		
Soldering Heat R	esistance	Capacitance Equivalent series resistance Current at 30 min.	Should satisfy initial standard value	Dipping duration	ature: 260±10°C		
		Appearance	No obvious abnormality		of the capacitor		
Temperature Cyc	le	Capacitance Equivalent series resistance Current at 30 min.	Satisfy initial standard value	' →+7($\hat{C} \rightarrow \text{normal temperature}$ $\hat{C} \rightarrow \text{normal temperature}$		
		Appearance	No obvious abnormality	Number of cyc	-		
		Capacitance	Within ±20% of initial value	Conforms to 9.	5		
Humidity Resistar	nce	Equivalent series resistance	1.2 or less times initial standard value	Temperature: 4			
		Current at 30 min.	1.2 or less times initial standard value	Relative humic	lity: 90 to 95% RH		
		Appearance	No obvious abnormality	Test duration: 2			
		Capacitance	Within ±30% of initial value	Conforms to 9.	-		
High Temperature Load		Equivalent series resistance	Twice or less times initial standard value	Temperature: 70±2°C Voltage applied: 5.5Vdc			
		Current at 30 min.	Twice or less times initial standard value		on resistance: 0Ω		
		Appearance	No obvious abnormality	Test duration:	1000 ⁺⁴⁸ hours		
Voltage Holding C (Self Discharge)	haracteristics	Voltage between termin	al leads higher than 4.2V	Charging Condition	Voltage applied: 5.0VDC (with case side terminal negative) Series resistance: 0Ω Charging time: 24 hours Time: 24 hours		
				Storage	Temperature: Lower than 25°C Humidity: Lower than 70%RH		

• FGH Type

Dimensions and Standard Ratings



Dert Me		Weight					
Part No.	D	Н	Р	d₁	d2	L	g
FGH0H104Z	11.0	5.5	5.08	0.2	1.2	2.7	1.0
FGH0H224Z	11.0	7.0	5.08	0.2	1.2	2.7	1.3
FGH0H474Z	16.5	8.0	5.08	0.4	1.2	2.7	4.1
FGH0H105Z	21.5	9.5	7.62	0.6	1.2	3.0	7.2

Note: Weight is typical.

Part Number	Max. Rated Voltage (V)	Nomial Capacitance Charge System (F)	Discharge System (F)	Max. ESR (at 1 kHz) (Ω)	Max. Current at 30 minutes (mA)	Voltage Holding Characteristic Min.(V)
FGH0H104Z	5.5	-	0.10	100	0.15	4.2
FGH0H224Z	5.5	-	0.22	100	0.33	4.2
FGH0H474Z	5.5	-	0.47	65	0.71	4.2
FGH0H105Z	5.5	-	1.0	35	1.5	4.2

Specifications FGH Type

Items			Standard		t Conditions g to JIS C 5102 ⁻¹⁹⁹⁴		
Operating Tempera	ature Range	–25°C to +70°C		Comonitian	9 10 010 0 0102		
Maximum Operati		5.5 Vdc					
Nominal Capacita		0.10 to 1.0 F		See characteris	stics measuring method		
Capacitance Allov	-	+80 %, -20 %			stics measuring method		
Equivalent Series		See standard list			stics measuring method		
Current (30-minut		See standard list			stics measuring method		
Current (30-minu	le value)	Capacitance	More than 90% of initial requirement	Conforms to 7.	V		
		Equivalent series resistance	Not to exceed 120% of initial requirement	Surge voltage:			
		Current at 30 min.	Not to exceed 120% of initial requirement	Temperature: 70±2°C Charge: 30 sec.			
Surge Voltage		Appearance No obvious abnormality		Discharge: 9 m	iin 30 sec. les: 1000 cycles ce: 0 Ω 0.47F: 30 Ω Ω 1.0F: 15 Ω Ω 2.2F: 10 Ω		
				Discharge resis	stance: 0 Ω		
	Dhoos 0	Capacitance	50% or higher of initial value	Conforms to 7.	12		
	Phase 2	Equivalent series resistance	4 or less times initial value	Phase 1: +25	±2°C		
Temperature		Capacitance	200% or below of initial value	Phase 2: -25	±2°C		
Variation of	Phase 5	Equivalent series resistance	Satisfy initial standard value	Phase 3: -40	±2°C		
Characteristics		Current at 30 min.	1.5 CV (mA) or below	Phase 4: +25:	±2°C		
		Capacitance	Within ±20% of initial value	Phase 5: +70:	±2°C		
	Phase 6	Equivalent series resistance	Satisfy initial standard value	Phase 6: +25:	±2°C		
		Current at 30 min.	Satisfy initial standard value				
Lead Strength (Te	ensile)	No loosening nor perm	anent damage of the leads	Conforms to 8.	1.2 (1)		
		Capacitance					
Vibration Resista	nce	Equivalent series resistance	Meet initial standard value	Conforms to 8.2.3			
		Current at 30 min.		Frequency: 10			
		Appearance	No obvious abnormality	Test duration: 6	3 hours		
Solderability			surface should be covered with new solder		ature: 230±5°C		
Solder Heat Resis	stance	Capacitance Equivalent series resistance Current at 30 min.	Should satisfy initial standard value	Dipping duration	ature: 260±10°C		
		Appearance	No obvious abnormality		of the capacitor		
Temperature Cyc	le	Capacitance Equivalent series resistance Current at 30 min.	Satisfy initial standard value	Conforms to 9. Temperature: -25 $\rightarrow +70$	3 °C → normal temperature)°C → normal temperature		
		Appearance	No obvious abnormality	Number of cyc	es: 5 cycles		
		Capacitance	Within ±20% of initial value	Conforms to 9.	5		
Humidity Resistar	nce	Equivalent series resistance	1.2 or less times initial standard value	Temperature: 4	0±2°C		
		Current at 30 min.	1.2 or less times initial standard value	Relative humid	ity: 90 to 95% RH		
		Appearance	No obvious abnormality	Test duration: 2			
		Capacitance	Within ±30% of initial value	Conforms to 9.			
High Temperature Load		Equivalent series resistance	Twice or less times initial standard value	Temperature: 7			
J		Current at 30 min.	Twice or less times initial standard value	Voltage applied	1: 5.5Vdc on resistance: 0Ω		
		Appearance	No obvious abnormality	Test duration:			
Voltage Holding Cl (Self Discharge)	haracteristics		al leads higher than 4.2V	Charging Condition	Voltage applied: 5.0VDC (with case side terminal negative) Series resistance: 0Ω Charging time: 24 hours Time: 24 hours		
(Storage	Temperature: Lower than 25°C Humidity: Lower than 70%RH		

FM Series for Automatic Assembly

The FM series includes small, resin-molded electric double-layer capacitors suitable for automatic assembly. These capacitors are ideal as long-time backup devices for minute-current loads in VCRs, audio systems, cordless telephones, and compact electronic systems. (FME types are backup devices adaptable to current consumption mA level.)

Features

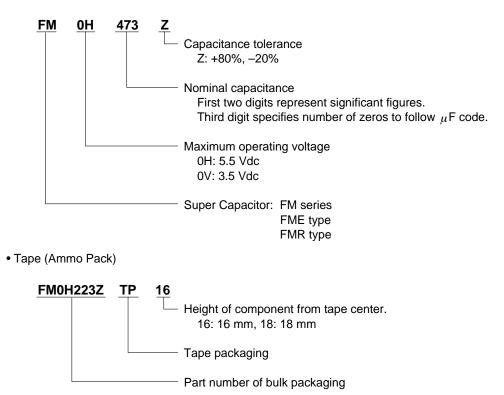
- · High adaptability to automatic assembly
- Can be cleaned
- Excellent voltage holding characteristics ideal for long-time supply of 1 μA to several hundred μA (Except 3.5 V type, FME type)
- Space saving

Applications

Backup of CMOS microcomputers, static RAMs, and DTSs

Part Number System

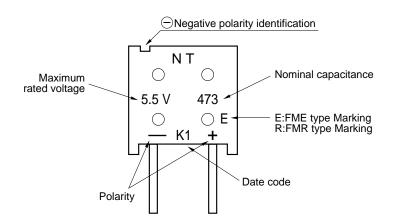
Bulk



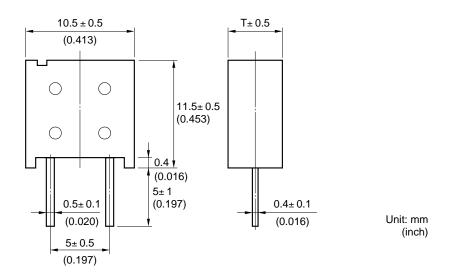
NUMBER OF PACKED CAPACITORS

Tape: 1000 pcs./box

Markings



Dimensions And Standard Ratings



• 5.5 V Type

Part	t Number Ammo pack	Max. Rated Voltage (VDC)	Nomial Capacitance Charge System (F)	Discharge System	Max. ESR (at 1 kHz) (Ω)	Max. Current at 30 minutes (mA)	Voltage Holding Characteristic min. (V)	T mm (inch)	Weight g (oz)
FM0H103Z	FM0H103ZTP()	5.5	0.01	0.014	300	0.015	4.2	5.0 (0.197)	1.3 (0.046)
FM0H223Z	FM0H223ZTP()	5.5	0.022	0.028	200	0.033	4.2	5.0 (0.197)	1.3 (0.046)
FM0H473Z	FM0H473ZTP()	5.5	0.047	0.06	200	0.071	4.2	5.0 (0.197)	1.3 (0.046)
FM0H104Z	FM0H104ZTP()	5.5	0.10	0.13	100	0.15	4.2	6.5 (0.256)	1.6 (0.056)
FM0H224Z	FM0H224ZTP()	5.5	-	0.22	100	0.33	4.2	6.5 (0.256)	1.6 (0.056)

Note: To complete part number, insert lead length H. (16 or 18 mm: Refer to Taping Specification on page 31.)

• 3.5 V Type

Part	Number	Max. Rated Voltage	Nominal Capacitance		Max. ESR (at 1 kHz)	Max. Current at 30 minutes	T mm	Weight g
	Ammo pack	(VDC)	(F)	Discharge System (F)	(Ω)	(mA)	(inch)	(oz)
FM0V473Z	FM0V473ZTP()	3.5	0.047	0.06	200	0.042	5.0 (0.197)	1.3 (0.046)
FM0V104Z	FM0V104ZTP()	3.5	0.10	0.13	100	0.090	5.0 (0.197)	1.3 (0.046)
FM0V224Z	FM0V224ZTP()	3.5	0.22	0.30	100	0.20	6.5 (0.256)	1.6 (0.056)

Note: To complete part number, insert lead length H. (16 or 18 mm: Refer to Taping Specification on page 31.)

• FME Type (Backup Large Current, mA Order)

Part	t Number	Max. Rated Voltage	Nominal Capacitance	Discharge System	Max. ESR (at 1 kHz)	Max. Current at 30 minutes	T mm	Weight g
	Ammo pack	(VDC)	(F)	(F)	(Ω)	(mA)	(inch)	(oz)
FME0H223Z	FME0H223ZTP()	5.5	0.022	0.028	40	0.033	5.0 (0.197)	1.3 (0.046)
FME0H473Z	FME0H473ZTP()	5.5	0.047	0.06	20	0.071	5.0 (0.197)	1.3 (0.046)

Note: To complete part number, insert lead length H. (16 or 18 mm: Refer to Taping Specification on page 31.)

• FMR Type (Extended Operating Temperature range)

Part	t Number	Max. Rated Voltage	Nominal Capacitance	Discharge System	Max. ESR (at 1 kHz)	Max. Current at 30 minutes	Voltage Holding Characteristic	T mm	Weight g
	Ammo pack	(VDC)	(F)	(F)	(Ω)	(mA)	min.(V)	(inch)	(oz)
FMR0H473Z	FMR0H473ZTP()	5.5	0.047	0.062	200	0.071	4.2	6.5	1.6

Note: To complete part number, insert lead length H. (16 or 18 mm: Refer to Taping Specification on page 31.)

• FM 6.5V Type

Par	Number	Max. Rated Voltage	Nominal Capacitance	e Discharge System	Max. ESR (at 1 kHz)	Max. Current at 30 minutes	T mm	Weight g
	Ammo pack	(VDC)	(F)	(F)	(Ω)	(mA)	(inch)	(oz)
FM0J473Z	FM0J473ZTP()	6.5	0.047	0.062	200	0.071	6.5	1.6

Note: To complete part number, insert lead length H. (16 or 18 mm: Refer to Taping Specification on page 31.)

Specifications 5.5 V Type

					Test Conditions			
Item			Standard	Confo	rming to JIS C 5102 ⁻¹⁹⁹⁴			
Operating Tempera	ture Range	–25°C to +70°C						
Maximum Operatin	g Voltage	5.5 VDC						
Nominal Capacitar	0	See standard list						
Capacitance Allow	ance	+80%, -20%		See charac	teristics measuring method.			
Equivalent Series	Resistance	See standard list			teristics measuring method.			
Current (30-minute	es value)	See standard list		See charac	teristics measuring method.			
		Capacitance	More than 90% of initial requirement	Conforms Surge Volt				
		Equivalent series resistance	Not to exceed 120% of initial requirement	- Temperatu				
		Current (30-minute value)	Not to exceed 120% of initial requirement	Charge: 30 sec.				
Surge Voltage		Appearance	Appearance No obvious abnormality.		9 min. 30 sec. cycles 1000 cycles. stance: 1500 Ω 0.22F: 56 Ω 560 Ω 300 Ω 150 Ω resistance: 0 Ω			
	Phase 2	Capacitance	50% or higher of initial value	Conforms	to 7.12			
- .	FildSe Z	Equivalent series resistance	4 or less times initial value	Phase 1:				
Temperature Variation of		Capacitance	200% or below of initial value	Phase 2: · Phase 3: ·				
Characteristics Phase 5		Equivalent series resistance	Satisty initial standard value	Phase 3:				
		Current (30-minute value)	1.5 CV (mA) or below	Phase 5:				
		Capacitance	Within ±20% of initial value	Phase 6:	+25 ± 2°C			
	Phase 6	Equivalent series resistance	Satisty initial standard value	_				
		Current (30-minute value)	Satisty initial standard value					
Lead Strengh (Ten	sile)	No loosening nor perma	nent damage of the leads	Conforms 1 kg 10sec	to 8.1.2 (1) 2.			
		Capacitance		Conforms to 8.2.3 Frequency : 10 to 55 Hz				
Vibration Resistan	re	Equivalent series resistance	Satisty initial standard value					
vibration resistan		Current (30-minute value)		Test durati	on : 6 hours			
		Appearance	No obvious abnormality					
Solderability		3/4 or more of the pin su	rface should be covered with new solder	Dipping du	perature: $230 \pm 5^{\circ}$ C rration: 5 ± 0.5 sec. to 1.6 mm from the lower end			
		Capacitance		Conforms to 8.5				
		Equivalent series resistance	Satisty initial standard value	Solder tem Dipping du	perature: $260 \pm 10^{\circ}$ C ration: 10 ± 1 sec.			
Soldering Heat Re	sistance	Current (30-minute value)			to 1.6 mm from the lower end			
		Appearance	No obvious able abnormality	of the capa				
		Capacitance		Conforms				
Temperature Cycle	`	Equivalent series resistance	Satisty initial standard value		re condition: → normal temperature			
Temperature Oyoic	•	Current (30-minute value)		$\rightarrow +70^{\circ}$	$C \rightarrow normal temperature$			
		Appearance	No obvious abnormality		cycles: 5 cycles			
		Capacitance	Within 20% of initial value	Conforms	to 9.5			
Humidity Resistan	2	Equivalent series resistance	1.2 or less times initial standard value	Temperatu	re: $40 \pm 2^{\circ}C$			
Turniary Resistan		Current (30-minute value)	1.2 or less times initial standard value	Relative h	umidity: 90 to 95% RH			
		Appearance	No obuious abnormality	Test durati	on: 240 ± 8 hours			
		Capacitance	Within 30% of initial value	Conforms				
High Temperature Load		Equivalent series resistance	Twice or less times initial standard value	 Temperatu Voltage ap 				
gir remperature		Current (30-minute value)	Twice or less times initial standard value		tection resistance: 0Ω			
		Appearance	No obvious abnormality	Test durati				
Voltage Holding Characteristics		Voltage between termina	al leads higher than 4.2 V	Charging condition	Voltage applied: 5.0 VDC Series resistance: 0Ω Charging time: 24hours			
(Self Discharge)				Storage	Time: 24hours Temperature:Lower than 25°C Humidity:Lower than 70%RH			

Specifications 3.5 V Type

				Test Conditions			
Item			Standard	Conforming to JIS C 5102 ⁻¹⁹⁹⁴			
Operating Temperature Range		–25°C to +70°C					
Maximum Operating Voltage		3.5 VDC					
Nominal Capacitar	nce Range	See standard list					
Capacitance Allow	ance	+80%, -20%		See characteristics measuring method.			
Equivalent Series	Resistance	See standard list		See characteristics measuring method.			
Current (30-minute	es value)	See standard list		See characteristics measuring method.			
		Capacitance	More than 90% of initial requirement	Conforms to 7.14			
		Equivalent series resistance	Not to exceed 120% of initial requirement	Surge voltage: 4.0 V Temperature: 70±2°C			
		Current (30-minute value)	Not to exceed 120% of initial requirement	Charge: 30 sec.			
Surge Voltage		Appearance	No obvious abnormality	Discharge: 9 min. 30 sec. Number of cycles 1000 cycles. Series resistance: 0.047 F: 300Ω 0.10 F: 150Ω 0.22 F: 56Ω Discharge resistance: 0Ω			
	Dharan	Capacitance	50% or higher of initial value	Conforms to 7.12			
	Phase 2	Equivalent series resistance	4 or less times initial value	Phase 1: +25 ± 2°C			
-		Capacitance	200% or below of initial value	Phase 2: -25 ± 2°C			
Temperature Variation of	Phase 5	Equivalent series resistance	Satisty initial standard value	 Phase 3: -40 ± 2°C Phase 4: +25 ± 2°C 			
Characteristics		Current (30-minute value)	1.5 CV (mA) or below	Phase 4: $\pm 25 \pm 2$ C Phase 5: $\pm 70 \pm 2^{\circ}$ C			
enalationolio	Phase 6	Capacitance	Within ±20% of initial value	Phase 6: $+25 \pm 2^{\circ}C$			
		Equivalent series resistance	Satisty initial standard value				
		Current (30-minute value)	Satisty initial standard value	_			
Lead Strengh (Ten	sile)	No loosening nor perma	anent damage of the leads	Conforms to 8.1.2 (1) 1 kg 10 sec			
		Capacitance Equivalent series resistance Current (30-minute value)		Conforms to 8.2.3			
Vibration Resistan	~~			Frequency: 10 to 55 Hz Test duration: 6 hours			
VIDIALION RESISTAN	ce						
		Appearance	No considerable abnormality				
Solderability		3/4 or more of the pin surface should be covered with new solder		Conforms to 8.4 Solder temperature: $230 \pm 5^{\circ}$ C Dipping duration: 5 ± 0.5 sec. Dipped up to 1.6 mm from for the lower end of the capacitor.			
		Capacitance		Conforms to 8.5			
0 I I I I I		Equivalent series resistance	Satisty initial standard value	Solder temperature: $260 \pm 10^{\circ}$ C Dipping duration: 10 ± 1 sec.			
Soldering Heat Re	sistance	Current (30-minute value)		Dipping duration: 10 ± 1 sec. Dipped up to 1.6 mm from for the lower			
		Appearance	No obvious abnormality	end of the capacitor.			
		Capacitance		Conforms to 9.3			
To an a section of the		Equivalent series resistance	Satisty initial standard value	Temperature condition:			
Temperature Cycle	9	Current (30-minute value)		$-25^{\circ}C \rightarrow \text{normal temperature}$ $\rightarrow +70^{\circ}C \rightarrow \text{normal temperature}$			
		Appearance	No obvious abnormality	Number of cycles: 5 cycles			
		Capacitance	Within ±20% of initial value	Conforms to 9.5			
	~~	Equivalent series resistance	1.2 or less times initial standard value	Temperature: $40 \pm 2^{\circ}C$			
Humidity Resistan	Ce	Current (30-minute value)	1.2 or less times initial standard value	Relative humidity: 90 to 95% RH Test duration: 240 ± 8 hours			
		Appearance	No obvious abnormality				
		Capacitance	Within 30% of initial value	Conforms to 9.10			
Link Terr	Land	Equivalent series resistance	Twice or less times initial standard value	Temperature: $70 \pm 2^{\circ}C$			
High Temperature	Load	Current (30-minute value)	Twice or less times initial standard value	- Voltage applied: 3.5 Vdc Series protection resistance: 0 Ω			
		Appearance	No obvious abnormality	Test duration: 1000 ⁺⁴⁸ ₀ hours			

Specifications FME Type

Item			Standard	Test Conditions Conforming JIS C 5102 ⁻¹⁹⁹⁴			
Operating Temperature Range		-25°C to +70°C					
Maximum Operating Voltage		5.5 VDC					
Nominal Capacitar	<u> </u>	See standard list					
Capacitance Allow	-	+80%, -20%		See characteristics measuring method.			
Equivalent Series		See standard list		See characteristics measuring method.			
Current (30-minute		See standard list		See characteristics measuring method.			
		Capacitance	More than 90% of initial requirement	Conforms to 7.14			
		Equivalent series resistance	Not to exceed 120% of initial requirement	Surge Voltage: 7.4 V			
		Current (30-minute value)	Not to exceed 120% of initial requirement	Temperature: $70 \pm 2^{\circ}C$ Chargs: 30 sec.			
Surge Voltage		Appearance	No obvious abnormality	Dischargs: 9 min. 30 sec. Number of cycles 1000 cycles. Series resistance: 0.022 F: 560 Ω 0.047 F: 300 Ω Discharge resistance: 0 Ω			
	Phase 2	Capacitance	50% or higher of initial value	Conforms to 7.12			
	- FIId58 Z	Equivalent series resistance	3 or less times initial value	Phase 1: +25 ± 2°C Phase 2: -25 ± 2°C			
Temperature		Capacitance	150% or below of initial value	 Phase 2: −25 ± 2°C Phase 3: −40 ± 2°C 			
Variation of	Phase 5	Equivalent series resistance	Satisty initial standard value	Phase 4: $+25 \pm 2^{\circ}C$			
Characteristics		Current (30-minute value)	1.5 CV (mA) or below	Phase 5: +70 ± 2°C			
		Capacitance	Within ±20% of initial value	Phase 6: +25 ± 2°C			
	Phase 6	Equivalent series resistance	Satisty initial standard value	_			
		Current (30-minute value)	Satisty initial standard value				
Lead Strengh (Ten	sile)	No loosening nor perma	nent damage of the leads	Conforms to 8.1.2 (1) 1 kg 10 sec			
		Capacitance Equivalent series resistance Should satisty initial standard value		Conforms to 8.2.3 Frequency: 10 to 55 Hz			
Vibration Resistan	~~						
VIDIATION RESISTAN	ce	Current (30-minute value)		Test duration: 6 hours			
		Appearance	There should be no considerable abnormality				
Solderability		3/4 or more of the pin su	urface should be covered with new solder	Conforms to 8.4 Solder temperature: $230 \pm 5^{\circ}$ C Dipping duration: 5 ± 0.5 sec. Dipped up to 1.6 mm from the lower end of the capacitor.			
		Capacitance		Conforms to 8.5			
Soldaring Hoat Do	sistanco	Equivalent series resistance	Satisty initial standard value	Solder temperature: $260 \pm 10^{\circ}C$ Dipping duration: 10 ± 1 sec.			
Soldering Heat Re	SISIGNUE	Current (30-minute value)		Dipped up to 1.6 mm from the lower end			
		Appearance	No obvious abnormality	of the capacitor.			
		Capacitance		Conforms to 9.3			
Temperature Cycle	`	Equivalent series resistance	Satisty initial standard value	Temperature condition: $-25^{\circ}C \rightarrow \text{normal temperature}$			
Temperature Cycle	5	Current (30-minute value)		\rightarrow +70°C \rightarrow normal temperature			
		Appearance	No obvious abnormality	Number of cycles: 5 cycles			
		Capacitance	Within ±20% of initial value	Conforms to 9.5			
Humidity Resistan	<u>ce</u>	Equivalent series resistance	1.2 or less times initial standard value	Temperature: $40 \pm 2^{\circ}C$			
Tranniary INCOISIGIT		Current (30-minute value)	1.2 or less times initial standard value	Relative humidity: 90 to 95% RH			
		Appearance	No obvious abnormality	Test duration: 240 ± 8 hours			
		Capacitance	Within 30% of initial value	Conforms to 9.10			
High Temperature	Load	Equivalent series resistance	Twice or less times initial standard value	Temperature: 70 ± 2°C Voltage applied: 5.5 Vdc			
ingii ieiipeiatule	2000	Current (30-minute value)	Twice or less times initial standard value	Series protection resistance: 0Ω			
		Appearance	No obvious abnormality	Test duration: 1000 ⁺⁴⁸ ₀ hours			

NEC/TOKIN

Specifications FMR Type

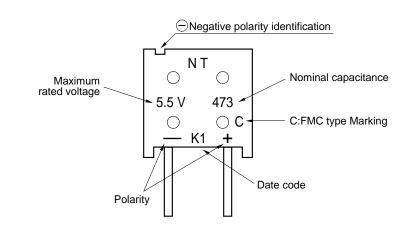
Item			Standard	Confo	Test Conditions rming to JIS C 5102 ⁻¹⁹⁹⁴		
Operating Temperature Range		-40°C to +85°C					
Maximum Operatir		5.5 VDC					
Nominal Capacitar		See standard list					
Capacitance Allow	-	+80%, -20%		See charact	teristics measuring method.		
Equivalent Series		See standard list		See characteristics measuring method			
Current (30-minute		See standard list			teristics measuring method.		
		Capacitance	More than 90% of initial requirement	Conforms to 7.14			
		Equivalent series resistance	Not to exceed 120% of initial requirement	Surge Volta			
		Current (30-minute value)	Not to exceed 120% of initial requirement	Temperatu			
Surge Voltage		Appearance			$\begin{array}{c} 30 \ \text{sec.} \\ 9 \ \text{min. } 30 \ \text{sec.} \\ \text{cycles } 1000 \ \text{cycles.} \\ \text{stance:} \\ 300 \ \Omega \\ \text{resistance: } 0 \ \Omega \end{array}$		
	Dhoop 2	Capacitance	50% or higher initial value	Conforms t	to 7.12		
	Phase 2	Equivalent series resistance	4 or less times initial value	Phase 1: -			
		Capacitance	30% or higher initial value	Phase 2: -	-25 ± 2°C		
-	Phase 3	Equivalent series resistance	7 or less times initial value	Phase 3: -	–40 ± 2°C		
Temperature		Capacitance	200% or higher initial value	Phase 4: -	+25 ± 2°C		
Variation of	Phase 5	Equivalent series resistance	Satisfy initial standard value	Phase 5: -			
Characteristics		Current (30-minute value)	1.5 CV (mA) or below	Phase 6: -	+25 ± 2°C		
		Capacitance	Within ±20% of initial standard value	-			
	Phase 6	Equivalent series resistance	Satisfy initial standard value	-			
Phase 6		Current (30-minute value)	Satisfy initial standard value	-			
			Satisfy Initial standard value	Conforms to 8.1.2 (1)			
Lead Strengh (Ten	sile)	No loosening nor perma	nent damage of the leads	1 kg 10sec.			
		Capacitance		Conforms	to 8.2.3		
Vibration Resistan	Ce	Equivalent series resistance	Satisty initial standard value	Frequency	: 10 to 55 Hz		
VIDIATION RESISTAN	00	Current (30-minute value)			on : 6 hours		
		Appearance	No obvious abnormality]			
Solderability		3/4 or more of the pin su Capacitance	rface should be covered with new solder.	Solder temperature: $230 \pm 5^{\circ}$ C Dipping duration: 5 ± 0.5 sec. Dipped up to 1.6 mm from the lower e of the capacitor.			
Soldering Heat Re	sistance ①	Equivalent series resistance Satisty initial standard value Current (30-minute value)		Conforms to 8.5 Solder temperature: $260 \pm 10^{\circ}$ C Dipping duration: 10 ± 1 sec. Dipped up to 1.6 mm from the lower en			
		Appearance	No obvious able abnormality	of the capa			
		Capacitance		After refle			
Soldering Heat Re	eistanaa 🕥	Equivalent series resistance	Satisty initial standard value	After reflow pre-heating $(160^{\circ}C \pm 5^{\circ}C \ 120 \pm 10 \text{ sec.})$			
Soluening Heat Re	SISTALICE	Current (30-minute value)		$\begin{bmatrix} 100 \text{ C} \pm 5 \end{bmatrix}$	\bigcirc 120 ± 10 Sec.)		
		Appearance	No obvious able abnormality]			
		Capacitance		Conforms			
Tomporature Or I		Equivalent series resistance	Satisty initial standard value		re condition:		
Temperature Cycle	;	Current (30-minute value)		-40°C -	\rightarrow normal temperature C \rightarrow normal temperature		
		Appearance	No obvious abnormality		cycles: 5 cycles		
		Capacitance	Within 20% of initial value	Conforms			
		Equivalent series resistance	1.2 or less times initial standard value	Temperatu			
Humidity Resistan	се	Current (30-minute value)	1.2 or less times initial standard value		$40 \pm 2 \text{ C}$ umidity: 90 to 95% RH		
		Appearance	No obuious abnormality	-			
			Within 30% of initial value	Test duration			
		Capacitance	Twice or less times initial standard value	Temperatu			
High Temperature	Load	Equivalent series resistance		Voltage ap	plied: 5.5 Vdc		
5 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 -		Current (30-minute value)	Twice or less times initial standard value	Series protection resistance: 0Ω			
Voltage Holding Characteristics (Self Discharge)		Appearance No obvious abnormality Voltage between terminal leads higher than 4.2 V			on: 1000_{0}^{+48} hours Voltage applied: 5.0 VE Series resistance: 0 Ω Charging time: 24hou Time: 24hour		
				Storage	Temperature:Lower than 25 Humidity:Lower than 70%R		

Specifications FM 6.5V Type

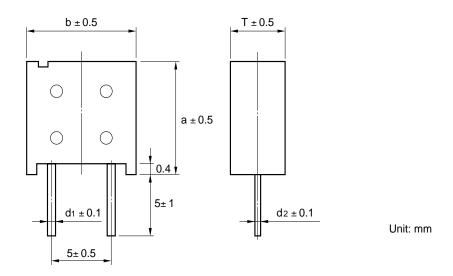
-				Test Conditions			
Item			Standard	Conforming to JIS C 5102 ⁻¹⁹⁹⁴			
Operating Temperature Range		-25°C to +70°C					
Maximum Operating Voltage		6.5 VDC					
Nominal Capacitance Range		See standard list					
Capacitance Allow	ance	+80%, -20%		See characteristics measuring method.			
Equivalent Series	Resistance	See standard list		See characteristics measuring method.			
Current (30-minute	es value)	See standard list		See characteristics measuring method.			
		Capacitance	More than 90% of initial requirement	Conforms to 7.14			
		Equivalent series resistance	Not to exceed 120% of initial requirement	Surge Voltage: 7.4 V			
Surge Voltage		Current (30-minute value) Appearance	Not to exceed 120% of initial requirement No obvious abnormality	Temperature: $70 \pm 2^{\circ}C$ Charge: $30 \sec C$ Discharge: $9 \min .30 \sec C$ Number of cycles 1000 cycles . Series resistance: $0.047 \text{ F}: 300 \Omega$ Discharge resistance: 0Ω			
	DI O	Capacitance	50% or higher of initial value	Conforms to 7.12			
	Phase 2	Equivalent series resistance	4 or less times initial value	Phase 1: +25 ± 2°C			
Tomporatura		Capacitance	200% or below of initial value	Phase 2: $-25 \pm 2^{\circ}C$			
Temperature Variation of	Phase 5	Equivalent series resistance	Satisty initial standard value	 Phase 3: −40 ± 2°C Phase 4: +25 ± 2°C 			
Characteristics		Current (30-minute value)	1.5 CV (mA) or below	Phase 5: $+70 \pm 2^{\circ}C$			
		Capacitance	Within ±20% of initial value	Phase 6: +25 ± 2°C			
	Phase 6	Equivalent series resistance	Satisty initial standard value				
		Current (30-minute value)	Satisty initial standard value				
Lead Strengh (Ten	sile)	No loosening nor perma	anent damage of the leads	Conforms to 8.1.2 (1) 1 kg 10sec.			
		Capacitance		Conforms to 8.2.3			
Vikastisa Desister		Equivalent series resistance	Satisty initial standard value	Frequency : 10 to 55 Hz			
Vibration Resistan	ce	Current (30-minute value)	-	Test duration : 6 hours			
		Appearance	No obvious abnormality				
Solderability		3/4 or more of the pin surface should be covered with new solder		Conforms to 8.4Solder temperature: $230 \pm 5^{\circ}$ CDipping duration: 5 ± 0.5 sec.Dipped up to 1.6 mm from the lower endof the capacitor.			
		Capacitance		Conforms to 8.5			
Soldaring Heat De	rictores	Equivalent series resistance	Satisty initial standard value	Solder temperature: $260 \pm 10^{\circ}$ C Dipping duration: 10 ± 1 sec.			
Soldering Heat Re	SISTALICE	Current (30-minute value)		Dipped up to 1.6 mm from the lower end			
		Appearance	No obvious able abnormality	of the capacitor.			
		Capacitance		Conforms to 9.3			
Temperature Cycle	۰ ۱	Equivalent series resistance	Satisty initial standard value	Temperature condition: −25°C → normal temperature			
Temperature Oyoic	•	Current (30-minute value)		\rightarrow +70°C \rightarrow normal temperature			
		Appearance	No obvious abnormality	Number of cycles: 5 cycles			
		Capacitance	Within 20% of initial value	Conforms to 9.5			
Humidity Resistan	ce	Equivalent series resistance	1.2 or less times initial standard value	Temperature: $40 \pm 2^{\circ}C$			
		Current (30-minute value)	1.2 or less times initial standard value	Relative humidity: 90 to 95% RH Test duration: 240 ± 8 hours			
		Appearance	No obuious abnormality				
		Capacitance	Within 30% of initial value	Conforms to 9.10			
High Temperature	Load	Equivalent series resistance	Twice or less times initial standard value	Temperature: $70 \pm 2^{\circ}C$ Voltage applied: 6.5 Vdc			
. <u></u>		Current (30-minute value)	Twice or less times initial standard value	Series protection resistance: 0Ω Test duration: 1000_{0}^{+48} hours			

• FMC Type

Markings



Dimensions And Standard Ratings



Part	Number	Max. Rated Voltage	Nomial Capacitance Charge System		Wax. LOR	Max. Current at 30 minutes	Voltage Holding Characteristic	а	b	Т	d1	d2	Weight
	Ammo pack	(VDC)	(F)	(F)	`(Ω)΄	(mA)		(mm)	(mm)	(mm)	(mm)	(mm)	(g)
FMC0H473Z	FMC0H473ZTP()	5.5	0.047	0.062	less than 100	less than 0.071	more than 4.2V	11.5	10.5	5.0	0.5	0.4	1.3
FMC0H104Z	FMC0H104ZTP()	5.5	0.10	0.13	less than 50	less than 0.15	more than 4.2V	11.5	10.5	6.5	0.5	0.4	1.6
FMC0H334Z	FMC0H334ZTP()	5.5	-	0.33	less than 30	less than 0.50	more than 4.2V	15.0	14.0	9.0	0.6	0.6	3.5

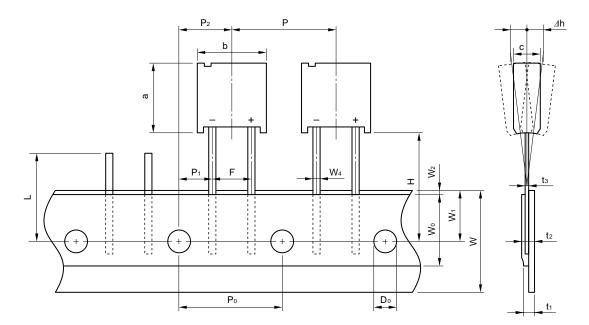
Chip parts applicable to treatment in bond hardening furnace (160 \pm 5°C for 120 \pm 10 seconds)

Specifications FMC Type

-					Test Conditions		
Item			Standard	Confo	prming to JIS C 5102-1994		
Operating Tempera	ture Range	–25°C to +70°C		Como			
Maximum Operating Voltage		5.5 VDC					
Nominal Capacitar	0 0	0.047F , 0.10F , 0.33F					
Capacitance Allow	-	+80%, -20%		See charac	teristics measuring method.		
Equivalent Series		See standard list		See characteristics measuring method.			
Current (30-minute		See standard list			teristics measuring method.		
		Capacitance	More than 90% of initial requirement	Conforms			
		Equivalent series resistance	Not to exceed 120% of initial requirement	Surge Voltage: 6.3 V			
		Current (30-minute value)	Not to exceed 120% of initial requirement	 Temperatu Chargs: 			
Surge Voltage		Appearance	pearance No obvious abnormality.		30 sec. 9 min. 30 sec. cycles 1000 cycles. istance: 150 Ω 51 Ω 300 Ω resistance: 0 Ω		
	Phase 2	Capacitance	50% or higher of initial value	Conforms			
	1 11030 2	Equivalent series resistance	3 or less times initial value	Phase 1:			
Temperature		Capacitance	150% or below of initial value	Phase 2:			
Variation of	Phase 5	Equivalent series resistance	Satisty initial standard value	Phase 3:			
Characteristics		Current (30-minute value)	1.5 CV (mA) or below	Phase 4: · Phase 5: ·			
		Capacitance	Within ±20% of initial value	Phase 5. Phase 6:			
	Phase 6	Equivalent series resistance	Satisty initial standard value	1 11836 0.	+23 ± 2 6		
	Current (30-minute value) Satisty initial standard value		Satisty initial standard value	-			
Lead Strengh (Ten	ile)	No loosening nor perma	nent damage of the leads	Conforms to 8.1.2 (1) 1 kg 10 sec			
		Capacitance	quivalent series resistance Should satisty initial standard value		to 8.2.3		
		Equivalent series resistance			2: 10 to 55 Hz		
Vibration Resistan	ce	Current (30-minute value)			on: 6 hours		
		Appearance	There should be no considerable abnormality	1			
Solderability		3/4 or more of the pin surface should be covered with new solder		Dipping du	nperature: $230 \pm 5^{\circ}$ C rration: 5 ± 0.5 sec. to 1.6 mm from the lower end		
		Capacitance		Conforms to 8.5			
		Equivalent series resistance	Satisty initial standard value		nperature: $260 \pm 10^{\circ}$ C		
Soldering Heat Re	sistance	Current (30-minute value)		Dipping duration: 10 ± 1 sec. Dipped up to 1.6 mm from the lower end			
		Appearance	No obvious abnormality	of the capa	acitor.		
		Capacitance		Conforms			
Tomporature Out		Equivalent series resistance	Satisty initial standard value	Temperatu	re condition: → normal temperature		
Temperature Cycle	;	Current (30-minute value)		-25 C → +70°	\rightarrow normal temperature $^{\circ}C \rightarrow$ normal temperature		
		Appearance	No obvious abnormality		cycles: 5 cycles		
		Capacitance	Within ±20% of initial value	Conforms	to 9.5		
Humidity Resistan	<u></u>	Equivalent series resistance	1.2 or less times initial standard value	Temperatu			
Turniuity Itesistalli		Current (30-minute value)	1.2 or less times initial standard value		umidity: 90 to 95% RH		
		Appearance	No obvious abnormality	Test durati	on: 240 ± 8 hours		
		Capacitance	Within 30% of initial value	Conforms			
Link Tears and	الممط	Equivalent series resistance	Twice or less times initial standard value	 Temperatu Voltage ap 			
High Temperature	LUAU	Current (30-minute value)	Twice or less times initial standard value	Series pro	tection resistance: 0 Ω		
		Appearance	No obvious abnormality	Test durati	on: 1000 ⁺⁴⁸ hours		
*Voltage Holding Characteristics		Voltage between terminal le	ads higher then 4.2V	Charging condition	Voltage applied: 5.0 VDC Series resistance: 0 Ω Charging time: 24hours		
(Self Dischage)				Storage	Time:24hoursTemperature:Lower than 25°CHumidity:Lower than 70%RH		

*The characteristics above must be satisfied for asterisked items after the end of reflow soldering (according to the reflow condition shown on page).

Taping Specification (Ammo pack) (except FMC0H334ZTP())



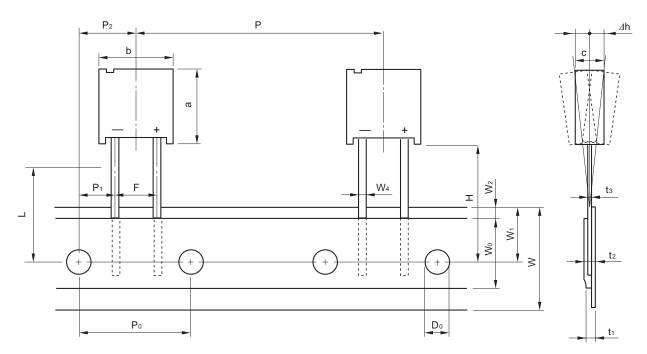
U	Init	÷	mm

Item	Symbol	Value	Tolerance	Remarks
Component Height	а	11.5	±0.5	
Component Width	b	1 0.5	±0.5	
Component Thickness	С	-	±0.5	5.5 V Type: 5.0/0.010 F~0.047 F, 6.5/0.10 F~0.22 F 3.5 V Type: 5.0/0.047 F~0.10 F, 6.5/0.22 F FME Type: 5.0/0.022 F~0.047 F 6.5 Type: 6.5/0.022 F FMR Type: 6.5/0.047 F FMC Type: 5.0/0.047 F, 6.5/0.10 F
Lead-wire Width	W4	0.5	±0.1	
Lead-wire Thicknesst3	t3	0.4	±0.1	
Pitch of Component	Р	12.7	±1.0	
Sprocket Pitch	Po	12.7	±0.3	
Sprocket Hole Center to Lead	P1	3.85	±0.7	
Sprocket Hole to Component Center	P ₂	6.35	±1.3	
Lead Spacing	F	5.0	±0.5	
Component Alignment	⊿h	2.0 max.	_	Including tiltiing caused by bending of 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
Height of Component from Tape Center	Н	16.0	±0.5	
		18.0	±0.5	
Sprocket Hole Diameter	Do	<i>φ</i> 4.0	±0.2	
Total Tape Thickness	t1	0.7	±0.2	
	t2	1.5 max.	-	
Length of Shipped Lead	L	11.0 max.	_	

Packing Quantity

1000 pcs. / box

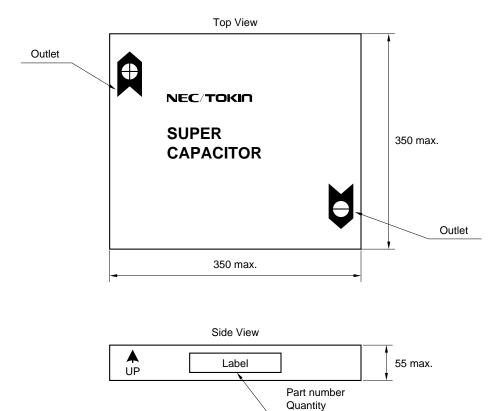




L	Init	·	mm
<u> </u>	/I II C		

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 of Component	Р	25.4	±1.0	
Sprocket Pitch	Po	12.7	±0.3	
Sprocket Hole Center to Lead	P1	3.85	±0.7	
Sprocket Hole to Component Center	P ₂	6.35	±1.3	
Lead Spacing	F	5.0	±0.5	
Component Alignment	⊿h	2.0 max.	_	Including tiltiing caused by bending of 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
Height of Component from Tape Center	н	16.0	±0.5	
height of component norm tape center		18.0	±0.5	
Sprocket Hole Diameter	Do	<i>φ</i> 4.0	±0.2	
Total tape thickness	t1	0.67	±0.2	
	t2	1.7 max.	_	
Length of Shipped Lead	L	11.0 max.	_	

Packing dimensions



Date code

Marking of Box

Marking shows the following items.

- (a) Terminal direction
- (b) Part number
- (c) Quantity
- (d) Date code
- (e) Company logo

Packing Quantity : 1000 pcs. / box (Except FMC0H334ZTP())

400 pcs. / box (Except FMC0H3342TP(), 400 pcs. / box (FMC0H334ZTP())

FA Series for Large Backup Current Capacitors

The FA series is suitable for supplying a large current in a short time.

These capacitors are ideal for momentarily backing up a high-current, short-time load in an electronic system (in the event of momentary power failure).

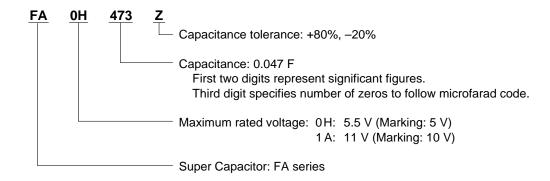
Features

- Extremely low equivalent series resistance (ESR) ideal for supplying backup current of 10 mA to 1 A for a short time
- High breakdown voltage (maximum operating voltage: 11 V) that can drive microcomputers and actuators

Applications

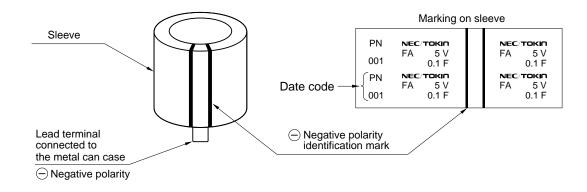
Momentary backup of microcomputers and DRAMs and auxiliary power supply of mechanical systems (motors, relays, electromagnetic valves)

Part Number System

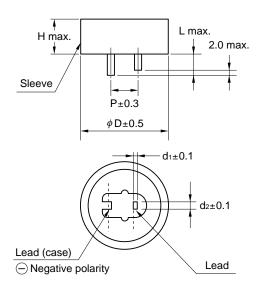


Markings

Markings are made with black ink on the green sleeve.



Dimensions and Standard Ratings



Dort No.			Weight				
Part No.	D	Н	Р	dı	d2	L	g (oz)
FA0H473Z	16.0	15.5	5.1	0.4	1.2	5.0	6.2
	(0.630)	(0.610)	(0.2)	(0.016)	(0.047)	(0.197)	(0.219)
FA0H104Z	21.5	15.5	7.6	0.6	1.2	5.5	12
	(0.846)	(0.610)	(0.3)	(0.024)	(0.047)	(0.217)	(0.423)
FA0H224Z	28.5	16.5	10.2	0.6	1.4	9.5	25
	(1.122)	(0.650)	(0.4)	(0.024)	(0.055)	(0.374)	(0.882)
FA0H474Z	36.5	16.5	15	0.6	1.7	9.5	42
	(1.437)	(0.650)	(0.591)	(0.024)	(0.067)	(0.374)	(1.482)
FA0H105Z	44.5	18.5	20	1.0	1.4	9.5	65
	(1.752)	(0.728)	(0.787)	(0.039)	(0.055)	(0.374)	(2.293)
FA1A223Z	16.0	25.0	5.1	0.4	1.2	5.0	7.5
	(0.630)	(0.984)	(0.2)	(0.016)	(0.047)	(0.197)	(0.265)
FA1A104Z	28.5	25.5	10.2	0.6	1.4	9.5	32
	(1.122)	(1.004)	(0.4)	(0.024)	(0.055)	(0.374)	(1.129)
FA1A224Z	36.5	27.5	15	1.0	1.4	9.5	55
	(1.437)	(1.083)	(0.591)	(0.039)	(0.055)	(0.374)	(1.940)
FA1A474Z	44.5	28.5	20	1.0	1.4	9.5	83
	(1.752)	(1.122)	(0.787)	(0.039)	(0.055)	(0.374)	(2.928)

Note: Weight values are typical.

Part Number	Max. Rated Voltage (VDC)	Nominal Capacitance Charge System (F)	Discharge System (F)	Max. Current at 30 minutes (mA)	Max. ESR (at 1 kHz) (Ω)
FA0H473Z	5.5	0.047	0.075	0.071	20
FA0H104Z	5.5	0.1	0.16	0.15	8
FA0H224Z	5.5	0.22	0.35	0.33	5
FA0H474Z	5.5	0.47	0.75	0.71	3.5
FA0H105Z	5.5	1.0	1.6	1.5	2.5
FA1A223Z	11	0.022	0.035	0.066	20
FA1A104Z	11	0.1	0.16	0.33	8
FA1A224Z	11	0.22	0.35	0.66	6
FA1A474Z	11	0.47	0.75	1.41	4

Specifications

Item		Specification		Test Conditions Conforming to JIS C 5102 ⁻¹⁹⁹⁴	
Operating Temperature Range		-25°C to 70°C			
Maximun Rated Voltage		5.5 VDC, 11.0 VDC			
Nominal Capacitance Range		0.047 to 1.0 F (Refer to standard ratings)			
Capacitance Allowance		+80 %, -20 %		See characteristics measuring conditions	
Equivalent Series Resistance		See standard list		See characteristics measuring conditions	
Current (30-minute value)		See standard list		See characteristics measuring conditions	
Temperature Variation of Characteristics	At min. temp. $\begin{pmatrix} -25^{\circ}C\\ Step 2 \end{pmatrix}$	Capacitance	More than 70 % of initial value	Conforms to 7.14 Phase 1 : +25±2.0°C Phase 2 : -25±2.0°C Phase 3 : +25±2.0°C Phase 4 : +70±2.0°C Phase 5 : +25±2.0°C	
		Equivalent Series Resistance	Not to exceed 3 times initial value		
	At max. temp. (+70°C Step 4)	Capacitance	Not to exceed 150 % of initial value		
		Equivalent Series Resistance	Not to exceed initial requirement		
		Current at 30 minutes	Not to exceed 1.5 CV (mA)		
	At room temp. (+25°C Step 5)	Capacitance	Not to change more than ±20 % from initial value		
		Equivalent Series Resistance	Not to exceed initial requirement		
		Current at 30 minutes	Not to exceed initial requirement		
Lead Strength (Tensile)		No loosening or permanent damage of the leads		5.5 VDC 0.047 F to 0.22 F: 1 kg 10 sec 0.47 F to 1.0 F: 2.5 kg 10 sec 0.022 F to 0.1 F: 1 kg 10 sec 11 VDC 0.22 F to 0.47 F: 2.5 kg 10 sec	
Vibration Resistance		Capacitance	Meet initial requirement	Conforms to 8.2.3	
		Equivalent Series Resistance	Meet initial requirement	Frequency: 10 to 55 Hz	
		Current at 30 minutes	Meet initial requirement	Test duration: 6 hours	
Solderability		3/4 or more of the pin s	/4 or more of the pin surface should be covered with new solder $230 \pm 5^{\circ}C, 5 \pm 0.5$ sec. Immersion depth: 2.5 mm from body		
Soldering Heat Resistance		Capacitance	Meet initial requirement	Conforms to 8.5	
		Equivalent Series Resistance	Meet initial requirement	260 ±10°C, 10 ±1 sec. Immersion depth: 2.5 mm from body	
		Current at 30 minutes	Meet initial requirement		
Temperature Cycle		Capacitance	Meet initial requirement	Conforms to 9.3 Temperature conitiom: $-25^{\circ}C \rightarrow$ normal temperature $\rightarrow+70^{\circ}C$ normal temperature Number of cycles : 5 cycles	
		Equivalent Series Resistance	Meet initial requirement		
		Current at 30 minutes	Meet initial requirement		
Humidity Resistance		Capacitance	More than 90 % of initial requirement	Conforms to 9.5	
		Equivalent Series Resistance	Not to exceed 120 % of initial requirement	40 ± 2°C, 90 to 95 % RH	
		Current at 30 minutes	Not to exceed 120 % of initial requirement	240 ± 8 hours	
High Temperature Load		Capacitance	More than 85 % of initial requirement	Conforms to 9.10 $70 \pm 2^{\circ}C$ 5.5 V applied for 5 V type 11 V applied for 10 V type 1 000 $^{+48}_{-0}$ hours	
		Equivalent Series Resistance	Not to exceed 120 % of initial requirement		
		Current at 30 minutes	Not to exceed 200 % of initial requirement		

FE Series for Large Backup Current Capacitors

The FE series offers small, high-capacitance electric double-layer capacitors suitable for supplying a large current in a short time.

These capacitors are ideal for momentarily backing up a large-current, short-time load in an electronic system (in the event of momentary power failure)

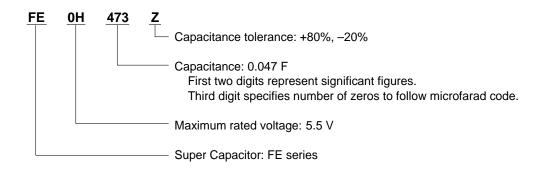
Features

- Extremely low equivalent series resistance (ESR), ideal for supplying several 10 mA to 1 A for short periods of time (about 1/2 the CV value when compared to the ESR of FA series)
- Small (about 1/4 in volume of aluminum electrolytic capacitor and 3/5 of FA series at same CV value)
- Product variety, including low-capacitance and high-capacitance models (0.047 F to 1.5 F)

Applications

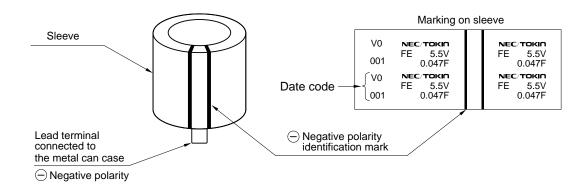
Momentary backup sources for microcomputers, SRAMs, and DRAMs, and auxiliary power source for mechanical systems (motors, relays, electromagnetic valves).

Part Number System

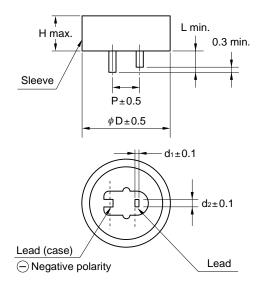


Markings

Markings are made with black ink on the green sleeve.



Dimensions And Standard Ratings



Part No.			Weight				
Part NO.	D	Н	Р	d1	d2	L	g (oz)
FE0H473Z	14.5	14.0	5.1	0.4	1.2	2.2	3.9
	(0.57)	(0.55)	(0.2)	(0.016)	(0.047)	(0.087)	(0.138)
FE0H104Z	16.5	14.0	5.1	0.4	1.2	2.7	5
	(0.65)	(0.55)	(0.2)	(0.016)	(0.047)	(0.106)	(0.177)
FE0H224Z	21.5	15.5	7.6	0.6	1.2	3.0	9.5
	(0.85)	(0.61)	(0.3)	(0.024)	(0.047)	(0.118)	(0.336)
FE0H474Z	28.5	16.5	10.2	0.6	1.4	6.1	16
	(1.12)	(0.65)	(0.4)	(0.024)	(0.055)	(0.240)	(0.565)
FE0H105Z	36.5	18.5	15.0	0.6	1.7	6.1	38
	(1.44)	(0.73)	(0.59)	(0.024)	(0.067)	(0.240)	(1.343)
FE0H155Z	44.5	18.5	20.0	1.0	1.4	6.1	72
	(1.75)	(0.73)	(0.79)	(0.039)	(0.055)	(0.240)	(2.544)

Part Number	Max. Rated Voltage (V)	Nominal Capacitance Charge System (F)	Discharge System (F)	Max. Current at 30 minutes (mA)	Max. ESR (at 1 kHz) (Ω)
FE0H473Z	5.5	0.047	0.075	0.071	14.0
FE0H104Z	5.5	0.10	0.16	0.15	6.5
FE0H224Z	5.5	0.22	0.35	0.33	3.5
FE0H474Z	5.5	0.47	0.75	0.71	1.8
FE0H105Z	5.5	1.0	1.4	1.5	1.0
FE0H155Z	5.5	1.5	2.1	2.3	0.6

Specifications

Item			Specification	Test Conditions Conforming to JIS C 5102 ⁻¹⁹⁹⁴	
Operating Temperature Range		-40°C to 70°C	·		
Operating Temperature Range Maximun Rated Voltage		5.5 VDC			
Maximun Rated Voltage Nominal Capacitance Range		0.047 to 1.5 F (Refer to	o standard ratings)		
Capacitance Allowance		+80 %, -20 %		See characteristics measuring conditions	
		See standard list		See characteristics measuring conditions	
Equivalent Series Resistance Current (30-minute value)		See standard list		See characteristics measuring conditions	
		Capacitance	More than 90 % of initial requirement	Conforms to 7.14 At 70°C Surge voltage 6.3 V Temperature : 70±2°C Charge: 30 sec.	
Surge Voltage		Equivalent Series Resistance	Not to exceed 120 % of initial requirement	Discharge: 9 min. 30 sec. 1 000 cycles Charge resistance : 0.047 F 300 Ω 0.10 F 150 Ω	
		Current at 30 minutes	Not to exceed 120 % of initial requirement	$\begin{array}{cccc} 0.22 \ F & 56 \ \Omega \\ 0.47 \ F & 30 \ \Omega \\ 1.0, 1.5 \ F & 15 \ \Omega \\ \end{array}$ Discharge resistance: Not applicable (0 Ω)	
	Phase 3	Capacitance	More than 40 % of initial value	Conforms to 7.12	
		Equivalent Series Resistance	Not to exceed 4 times initial value	Phase 1: $+25 \pm 2^{\circ}C$	
_		Capacitance	Not to exceed 200 % of initial value	Phase 2: -25 ± 2°C Phase 3: -40 ± 2°C	
Temperature	Phase 5	Equivalent Series Resistance	Not to exceed initial requirement	Phase 4: $+25 \pm 2^{\circ}$ C	
Variation of Characteristics		Current at 30 minutes	Not to exceed 1.5 CV (mA)	Phase 5: +70 ± 2°C	
Characteriotice		Capacitance	Within ±20 % of initial value	Phase 6: +25 ± 2°C	
	Phase 6	Equivalent Series Resistance	Not to exceed initial requirement		
		Current at 30 minutes Not to exceed initial requirement			
Lead Strength (T	ensile)	No loosening nor perm	Conforms to 8.1.2 (1) 0.047 to 0.47 F: 1 kg, 10 sec. 1 F, 1.5 F : 2.5 kg, 10 sec.		
		Capacitance Meet initial requirement		Conforms to 8.2.3	
Vibration Resista	ince	Equivalent Series Resistance	Meet initial requirement	Frequency: 10 to 55 Hz	
		Current at 30 minutes	Meet initial requirement	Test duration: 6 hours	
Solderability		3/4 or more of the pin s	surface should be covered with new solder	Conforms to 8.4 230 \pm 5°C Immersion depth: 5 \pm 0.5 sec. 1.6 mm from body	
		Capacitance	Meet initial requirement	Conforms to 8.5	
Soldering Heat R	lesistance	Equivalent Series Resistance	Meet initial requirement	$260 \pm 10^{\circ}$ C, 10 ± 1 sec. Immersion depth :	
		Current at 30 minutes	Meet initial requirement	1.6 mm from body	
		Capacitance	Shall meet initial requirement	Conforms to 9.3 Temperature condition:	
Temperature Cyc	le	Equivalent Series Resistance	Meet initial requirement	–40 [°] C → normal temperture	
		Current at 30 minutes	Meet initial requirement	\rightarrow +70°C \rightarrow normal temperture Number of cycles : 5 cycles	
		Capacitance change	Within ±20 % of initial value	Conforms to 9.5	
Humidity Resista	nce	Equivalent Series Resistance	Not to exceed 120 % of initial requirement	40 ± 2°C, 90 to 95 % RH 240 hours	
-		Current at 30 minutes	Not to exceed 120 % of initial requirement	240 hours 240 ± 8 hours	
		Capacitance change	Within ±30 % of initial value	Conforms to 9.10	
High Temperatur	e Load	Equivalent Series Resistance	Not to exceed 300 % of initial requirement	70 ± 2°C 5.5 V applied	
		Current at 30 minutes	Not to exceed 200 % of initial requirement	1 000 $^{+48}_{-0}$ hours	
		1	· ·		

FS Series

The FS series Super Capacitors are ideal as short-time (30 minutes max.) backup devices in small and lightweight systems. 5.5 VDC (0.022 F to 1.0 F), 11 VDC (0.47 F and 1.0 F only) and 12 VDC (1.0 F and 5.0 F only)

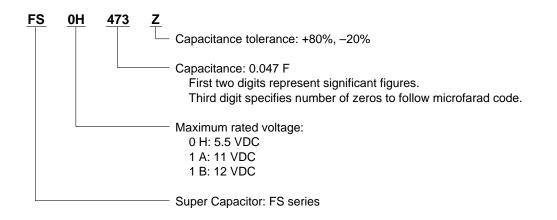
Features

- Ideal for supplying current of several hundred μA to several mA for short time

Applications

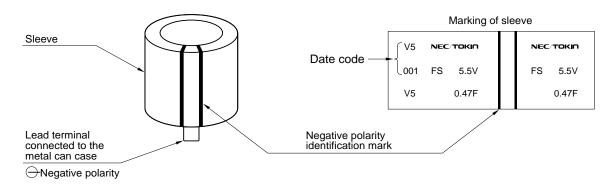
• Backup source for microcomputers and buffer for momentary high-current loads (for example, motors)

Part Number System

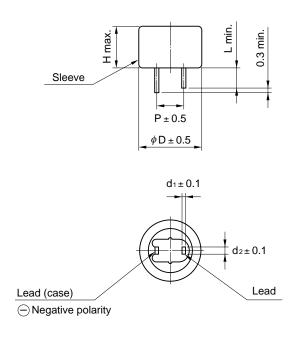


Markings

Markings are made with black ink on the green sleeve.



Dimensions and Standard Ratings



Dort No.		Dimensions mm (inch)							
Part No.	D	Н	Р	dı	d2	L	g (oz)		
FS0H223Z	11.5	8.5	5.08	0.4	1.2	2.7	1.6		
	(0.453)	(0.335)	(0.200)	(0.016)	(0.047)	(0.106)	(0.057)		
FS0H473Z	13.0	8.5	5.08	0.4	1.2	2.2	2.6		
	(0.512)	(0.335)	(0.200)	(0.016)	(0.047)	(0.087)	(0.092)		
FS0H104Z	16.5	8.5	5.08	0.4	1.2	2.7	4.1		
	(0.650)	(0.335)	(0.200)	(0.016)	(0.047)	(0.106)	(0.145)		
FS0H224Z	16.5	13.0	5.08	0.4	1.2	2.7	5.3		
	(0.650)	(0.512)	(0.200)	(0.016)	(0.047)	(0.106)	(0.187)		
FS0H474Z	21.5	13.0	7.62	0.6	1.2	3.0	10		
	(0.846)	(0.512)	(0.300)	(0.024)	(0.047)	(0.118)	(0.353)		
FS0H105Z	28.5	14.0	10.16	0.6	1.4	6.1	18		
	(1.122)	(0.551)	(0.400)	(0.024)	(0.055)	(0.240)	(0.635)		
FS1A474Z	28.5	25.5	10.16	0.6	1.4	6.1	32.0		
	(1.122)	(1.004)	(0.400)	(0.024)	(0.055)	(0.240)	(1.129)		
FS1A105Z	28.5	31.5	10.16	0.6	1.4	6.1	35.0		
	(1.122)	(1.240)	(0.400)	(0.024)	(0.055)	(0.240)	(1.235)		
FS1B105Z	28.5	38.0	10.16	0.6	1.4	6.1	40		
	(1.122)	(1.496)	(0.400)	(0.024)	(0.055)	(0.240)	(1.411)		
FS1B505Z	44.8	60.0	20.0	1.0	1.4	9.5	160		
	(1.764)	(2.361)	(0.787)	(0.040)	(0.055)	(0.240)	(5.644)		

Part Number	Max. Rated Voltage (V)	Nomial Capacitance Charge System (F)	Discharge System (F)	Max. ESR (at 1 kHz) (Ω)	Max. Current at 30 minutes (at 1 kHz) (mA)
FS0H223Z	5.5	0.022	0.033	60	0.033
FS0H473Z	5.5	0.047	0.072	40	0.071
FS0H104Z	5.5	0.10	0.15	25	0.15
FS0H224Z	5.5	0.22	0.33	25	0.33
FS0H474Z	5.5	0.47	0.75	13	0.71
FS0H105Z	5.5	1.0	1.3	7	1.5
FS1A474Z	11.0	0.47	0.60	7	1.41
FS1A105Z	11.0	1.0	1.3	7	3.0
FS1B105Z	12.0	1.0	1.3	7.5	3.6
FS1B505Z	12.0	5.0	6.5	4.0	18.0

Specifications

				Test Conditions			
Item			Standard	Conforming to JIS C 5102-1994			
Operating Temperature Range		-25°C to +70°C		Ŭ			
Maximum Operating Voltage		5.5 VDC, 11 VDC, 12 V	DC				
Nominal Capacitance Range		0.022 to 1.0 F (5.5 V products), 0	0.47 F to 1.0 F (11 V products), 1.0 F to 5.0 F (12 V products)	See characteristics measuring method.			
Capacitance Allowance		+80%, -20%					
Equivalent Series Resistance Current (30-minutes value)		See standard list		See characteristics measuring method.			
Current (30-minutes value)		See standard list		See characteristics measuring method.			
				Conforms to 7.14			
				Surge voltage: 6.3 V (5.5 V products) 12.6 V (11 V products)			
		Current (30-minute value)	Not to exceed 120% of initial requirement	13.6 V (12 V products)			
Surge Voltage		Appearance	No obvious abnormality	Temperature: $70 \pm 2^{\circ}$ C Chargs: 30 seconds Discharge: 9 min. 30 sec. Number of cycles 1000 cycles. Series resistance: 0.022 F 560 Ω 0.047 F 300 Ω 0.22 F 56 Ω 0.22 F 56 Ω 0.47 F 30 Ω 1 F 15 Ω 5 F 10 Ω Discharge resistance: 0 Ω			
	Dhara 0	Capacitance	50% or higher of initial value	Conforms to 7.12			
	Phase 2	Equivalent series resistance	3 or less times initial value	Phase 1: +25 ±2°C			
Temperature		Capacitance	150% or below of initial value	Phase 2: $-25 \pm 2^{\circ}C$			
Variation of	Phase 5	Equivalent series resistance	Satisty initial standard value	Phase 3: -40 ±2°C			
Characteristics		Current (30-minute value)	1.5 CV (mA) or below	Phase 4: +25 ±2°C Phase 5: +70 ±2°C			
		Capacitance	Within ± 20% of initial value	Phase 5: $+70 \pm 2$ C Phase 6: $+25 \pm 2^{\circ}$ C			
	Phase 6	Equivalent series resistance	Satisty initial standard value				
		Current (30-minute value)	Satisty initial standard value				
Lead Strengh (Ten	sile)	No loosening nor perma	ment damage of the leads	Conforms to 8.1.2 (1) 5.5 VDC 0.022 F to 0.22 F: 1 kg 10 sec 0.47 F to 1.0 F: 2.5 kg 10 sec 11 VDC 2.5 kg 10 sec 12 VDC 2.5 kg 10 sec			
		Capacitance		Conforms to 8.2.3			
Vikastisa Desister		Equivalent series resistance	Satisty initial standard value				
Vibration Resistan	ce	Current (30-minute value)		Frequency: 10 to 55 Hz			
		Appearance	No obvious abnormality	Test duration: 6 hours			
Solderability		3/4 or more of the pin su	urface should be covered with new solder	Conforms to 8.4 Solder temperature: $230 \pm 5^{\circ}$ C Dipping duration: 5 ± 0.5 sec. Should be dipped up to 1.6 mm from the lower end of the capacitor.			
		Capacitance		Conforms to 8.5			
Soldering Heat Re	eistanco	Equivalent series resistance	Satisty initial standard value	Solder temperature: $260 \pm 10^{\circ}$ C Dipping duration: 10 ± 1 sec.			
Soluening rieat Re	51310110E	Current (30-minute value)		Dipped up to 1.6 mm from the lower end			
		Appearance	No obvious abnormality	of the capacitor.			
Temperature Cycle	9	Capacitance Equivalent series resistance Current (30-minute value)	Satisty initial standard value	Conforms to 9.3 Temperature condition: $-25^{\circ}C \rightarrow \text{normal temperature}$ $\rightarrow +70^{\circ}C \rightarrow \text{normal temperature}$			
		Appearance	No obvious abnormality	Number of cycles: 5 cycles			
		Capacitance	90% or higher of initial standard value (5.5 V products) Within 20% of initial value (11 V, 12 V products)	Conforms to 9.5 Temperature: 40 ± 2°C			
Humidity Resistan	се	Equivalent series resistance	1.2 or less times initial standard value	Relative humidity: 90 to 95% RH			
		Current (30-minute value)	1.2 or less times initial standard value	Test duration: 240 ± 8 hours			
		Appearance	No obvious abnormality				
		Capacitance	85% or higher of initial standard value (5.5 V products) Within $\pm 30\%$ of initial value (11 V, 12 V products)	Conforms to 9.10 Temperature: $70 \pm 2^{\circ}C$ Voltage applied: Maximum operating			
High Temperature	Load	Equivalent series resistance	Twice or less times initial standard value	voltage applied. Maximum operating voltage			
		Current (30-minute value)	Twice or less times initial standard value	Series protection resistance: 0Ω			
		Appearance	No obvious abnormality	Test duration: 1000^{+48}_{0} hours			

FR Series Wide Temperature Range Capacitor [-40°C to +85°C]

The FR series Super Capacitors are small-size electric double-layer capacitors that can operate in a temperature range as wide as -40° C to $+85^{\circ}$ C.

These capacitors are ideal as long-time backup devices for minute current loads in industrial equipment such as measuring instruments, control equipment, and communications equipment.

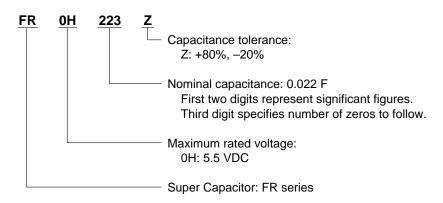
Features

- Wide operating temperature range: –40 $^\circ\text{C}$ to +85 $^\circ\text{C}$
- High reliability (load life of 85°C, 5.5 V, 1000 hours guaranteed)
- Excellent voltage holding characteristics ideal for long-time current supply of 1 µA to several hundred µA

Applications

Backup of CMOS microcomputers, static RAMs, and DTSs (digital tuning systems)

Part Number System

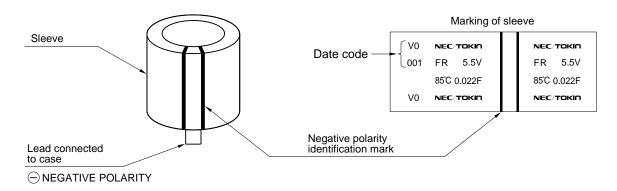


Markings

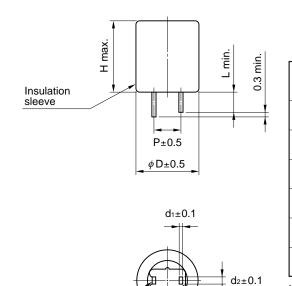
Lead connected to case

Negative polarity

Markings are made with black ink on the green sleeve.



Dimensions and Standard Ratings



Part No.			Weight				
Fait NO.	D	Н	Р	dı	d2	L	g (oz)
FR0H223Z	11.5	14.0	5.08	0.4	1.2	2.7	2.3
	(0.453)	(0.551)	(0.200)	(0.016)	(0.047)	(0.106)	(0.081)
FR0H473Z	14.5	14.0	5.08	0.4	1.2	2.4	3.9
	(0.571)	(0.551)	(0.200)	(0.016)	(0.047)	(0.095)	(0.138)
FR0H104Z	14.5	15.5	5.08	0.4	1.2	2.4	4.3
	(0.571)	(0.610)	(0.200)	(0.016)	(0.047)	(0.095)	(0.152)
FR0H224Z	14.5	21.0	5.08	0.4	1.2	2.4	5.3
	(0.571)	(0.827)	(0.200)	(0.016)	(0.047)	(0.095)	(0.187)
FR0H474Z	16.5	21.5	5.08	0.4	1.2	2.7	7.5
	(0.650)	(0.846)	(0.200)	(0.016)	(0.047)	(0.106)	(0.265)
FR0H105Z	21.5	22.0	7.62	0.6	1.2	3.0	13.3
	(0.850)	(0.866)	(0.300)	(0.024)	(0.047)	(0.118)	(0.470)

Note: Weight is typical.

LEAD

Part Number	Max. Rated Voltage (V)	Nomial Capacitance Charge System (F)	Discharge System (F)	Max. ESR (at 1 kHz) (Ω)	Max. Current at 30 minutes (mA)	Voltage Holding Characteristic Min. (V)
FR0H223Z	5.5	0.022	0.028	220	0.033	4.2
FR0H473Z	5.5	0.047	0.060	110	0.071	4.2
FR0H104Z	5.5	0.10	0.15	150	0.15	4.2
FR0H224Z	5.5	0.22	0.33	180	0.33	4.2
FR0H474Z	5.5	0.47	0.75	100	0.71	4.2
FR0H105Z	5.5	1.0	1.6	60	1.5	4.2

Specifications

			Specification	Test Conditions		
Item			Conforming to JIS C 5102 ⁻¹⁹⁹⁴			
Operating Temperature Range		–40°C to +85°C				
Maximun Working Voltage		5.5 Vdc				
Nominal Capacitance Range		0.022 to 1.0 F (Refer to	o standard ratings)			
Capacitance Allowa	ance	+80 %, -20 %		See characteristics measuring conditions		
Equivalent Series R	Resistance	See standard list		See characteristics measuring conditions		
Current (30-minute	Value)	See standard list		See characteristics measuring conditions		
		Capacitance	More than 90 % of initial requirement	Conform to 7.14 Surge voltage 6.3 V Temperature : 85±2°C Charge: 30 sec. Discharge: 9 min. 30 sec.		
Surge Voltage		Equivalent Series Resistance	Not to exceed 120 % of initial requirement	1 000 cycles Charge resistance: 0.022 F 560 Ω 0.047 F 300 Ω 0.10 F 150 Ω		
		Current at 30 minutes	Not to exceed 120 % of initial requirement	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$		
	Phase 2	Capacitance	More than 50 % of initial value	Conform to 7.12		
	FildSe Z	Equivalent Series Resistance	Not to exceed 4 times initial value	Phase 1: +25 ±2°C		
	Phase 3	Capacitance	More than 30 % of initial value	─ Phase 2: −25 ±2°C Phase 3: −40 ±2°C		
		Equivalent Series Resistance	Not to exceed 7 times initial value	Phase 4: +25 ±2°C		
Temperature Variation of	Phase 5	Capacitance	Capacitance Not to exceed 200 % of initial value Phase 5: Phase 6:			
Characteristics		Equivalent Series Resistance	Not to exceed initial requirement			
		Current at 30 minutes	Not to exceed 1.5 CV (mA)			
	Phase 6	Capacitance	Within ±20 % of initial value			
		Equivalent Series Resistance	Not to exceed initial requirement			
		Current at 30 minutes	Not to exceed initial requirement			
Lead Strength (Ten	isile)	No loosening nor permanent damage of the leads		Conform to 8.1.2 (1) 0.022 to 0.47 F: 1 kg, 10 sec. 1 F: 2.5 kg, 10 sec.		
		Capacitance	Meet initial requirement	Conform to 8.2.3		
Vibration Resietand	ce	Equivalent Series Resistance	Meet initial requirement	Frequency: 10 to 55 Hz		
		Current at 30 minutes	Meet initial requirement	 Test duration: 6 hours 		
Solderability		3/4 or more of the pin s	surface shoud be covered with new solder	Conform to 8.4 230 ± 5°C 5 ± 0.5 sec. 1.6 mm from body		
		Capacitance	Meet initial requirement	Conform to 8.5		
Soldering Heat Resistance		Equivalent Series Resistance	Meet initial requirement	$260 \pm 10^{\circ}$ C, 10 ± 1 sec.		
TCSISICIIUE		Current at 30 minutes	Meet initial requirement	 Immersion depth: 1.6 mm from body 		
		Capacitance	Meet initial requirement	Conform to 9.3 Temperature condition:		
Temperature Cycle		Equivalent Series Resistance	Meet initial requirement	$-40^{\circ}C \rightarrow normal temperature$		
		Current at 30 minutes	Meet initial requirement	→ +85°C → normal temperature Number of cycles: 5 cycles		
		Capacitance	Within $\pm 20\%$ of initial value	Conform to 9.5		
Humidity Resistand	e	Equivalent Series Resistance	Not to exceed120 % of initial requirement	40 ± 2°C, 90 to 95% RH		
		Current at 30 minutes	Not to exceed120 % of initial requirement	— 240 ± 8 hours		
•						

ltem		Specification			Test Conditions Conforming to JIS C 5102 ⁻¹⁹⁹⁴		
High	Capacitance change	Within ±30% of initial value		Conforms to 9.10 Temperature: 85 ± 2°C			
Temperature Load Equivalent Series Resistance Not to exceed 200% of initial requirement Current at 30 minutes Not to exceed 200% of initial requirement		Not to exceed 200% of initial requirement	Series res	Series resistance: 0 Ω			
		Applied voltage: 5.5 VDC Time of test: 1000 -0 hours					
Voltage Holding			Charging	(1) Applied Voltage(2) Series Resistar(3) Charging time:			
Voltage Holding Characteristics Voltage between term	nal leads higher than 4.2V	Storege	(2) Temp.:	Nothing Less than 25°C Less than 70% RH 24 h			

3.5 V, 6.5 V Rated Voltage Series FSH Type, FYD Type

These 3.5 V and, 6.5 V rated voltage are suitable for use in portable or battery-driven equipment. These capacitors are especially ideal as backup devices for cameras, remote controllers, headphone and stereos.

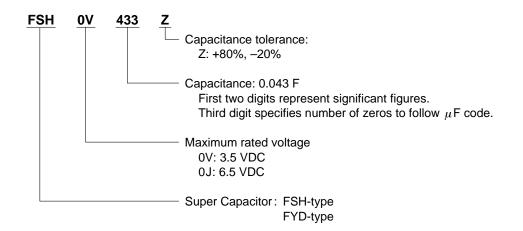
Features

- The FSH-type is ideal for supplying several hundred μA to several mA for a short time. The FYD type is ideal for backup of 1 μA to several hundred μA for a long time.
- Smaller than existing series (25% less than FS series in C•V per volume)

Applications

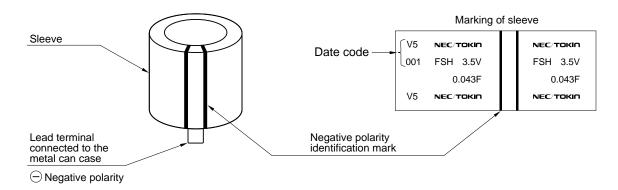
- Secondary backup power supply for cameras to charge an electronic flash (FSH type)
- Secondary backup power supply for motors (FSH-type)
- Backup of CMOS microprocessors, SRAMs, DTS ICs to charge the battery

Part Number System

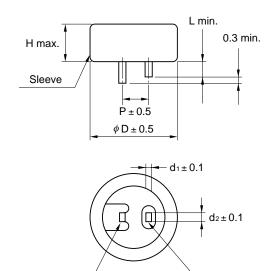


Markings

Markings are made with black ink on the green sleeve.



Dimensions and Standard Ratings



Dort No.		Dimensions mm (inch)							
Part No.	D	Н	Р	dı	d2	L	g (oz)		
FSH0V433Z	11.0	5.2	5.08	0.2	1.2	2.7	1.0		
	(0.413)	(0.205)	(0.2)	(0.008)	(0.047)	(0.106)	(0.035)		
FYD0V563Z	11.0	5.2	5.08	0.2	1.2	2.7	1.0		
	(0.413)	(0.205)	(0.2)	(0.008)	(0.047)	(0.106)	(0.035)		
FSH0J223Z	11.5	8.5	5.08	0.4	1.2	2.7	1.7		
	(0.453)	(0.355)	(0.2)	(0.016)	(0.047)	(0.106)	(0.060)		
FYD0J273Z	11.5	8.5	5.08	0.4	1.2	2.7	1.6		
	(0.453)	(0.355)	(0.2)	(0.016)	(0.047)	(0.106)	(0.056)		

Note: The weight values are typical.

Lead (case)

Part Number	Max. Rated Voltage (V)	Nomial Capacitance ChargeSystem (F)	DischargeSystem (F)	Max. ESR (at 1 kHz) (Ω)	Max. Current at 30 minutes (mA)
FSH0V433Z	3.5	0.043	0.055	50	0.039
FYD0V563Z	3.5	0.056	0.070	150	0.050
FSH0J223Z	6.5	0.022	0.033	60	0.040
FYD0J273Z	6.5	0.027	0.040	200	0.049

Lead

Specifications

Items			Specifications	Test Conditions Conforming to JIS C 5102 ⁻¹⁹⁹⁴		
Operating Tempera	ature Range	–25°C to +70°C				
Maximum Rated	0	3.5 VDC, 6.5 VDC				
Nominal Capacita	-	See standard ratings				
Capacitance Allowance		+80 %, -20 %		See characteristics measuring conditions		
Equivalent Series		See standard list		See characteristics measuring conditions		
Current (30-minut		See standard list		See characteristics measuring conditions		
		Capacitance	More than 90 % of initial requirement	Conforms to 7.14		
		Equivalent Series Resistance	Less than 200% of initial requirement	Surge voltage:		
		Current 30 minutes	Less than 120% of initial requirement	4.0 V (3.5 VDC), 7.4 V (6.5 VDC) rated part rated part		
Surge Voltage		Appearance	No significant change	Temperature: $70\pm 2^{\circ}$ C Charging for 30 seconds Discharging for 9 min 30 sec. Number of cycles: 1 000 cycles Charge resistance: 0.022 F 560 Ω 0.027 F 560 Ω 0.043 F 300 Ω 0.056 F 240 Ω No discharge resistance		
	Dhasa 0	Capacitance	More than 50 % of initial value	Conforms to 7.12		
	Phase 2	Equivalent Series Resistance	Less than 400% of initial value	Phase 1: +25 ±2°C		
		Capacitance	Less than 200% of initial value	Phase 2: –25 ±2°C		
Temperature	Phase 5	Equivalent Series Resistance	Initial requirement	Phase 3: –40 ±2°C		
Variation of		Current 30 minutes	Less than 1.5 CV (mA)	Phase 4: +25 ±2°C		
Characteristics Phas		Capacitance	Within ±20% of initial value	Phase 5: +70 ±2°C		
	Phase 6	Equivalent Series Resistance	Initial requirement	- Phase 6: +25 ±2°C		
		Current 30 minutes	Initial requirement			
	1	Capacitance		Conforms to 8.2.3		
		Equivalent Series Resistance	Shall meet initial requirements	Frequency: 10 to 55 Hz		
Vibration Resista	nce	Current 30 minutes		Time of test: 6 hours		
		Appearance	No significant change			
Solderability		3/ 4 or more of the pin s	surface should be covered with new solder	Conforms to 8.4 Temperature of solder: $230 \pm 5^{\circ}$ C Time of immersion: 5 ± 0.5 seconds To immerse capacitors up to 1.6 mm from the bottom		
		Capacitance		Conforms to 8.5		
Soldering Heat		Equivalent Series Resistance	Shall meet initial requirements	Temperature of solder: $260 \pm 10^{\circ}$ C Time of immersion: 10 ± 1 seconds		
Resistance		Current 30 minutes		To immerse capacitors up to 1.6 mm		
		Appearance	No significant change	from the bottom		
		Capacitance		Conforms to 9.3		
Temperature Cyc	le	Equivalent Series Resistance	Shall meet initial requirements	Temperature condition: −25°C → normal temperature		
		Current 30 minutes		\rightarrow +70°C \rightarrow normal temperature		
		Appearance	No significant change	Number of cycles: 5 cycles		
		Capacitance	Within ±20% of initial value	Conforms to 9.5		
Humidity Resista	nce	Equivalent Series Resistance	Less than 200% of initial requirement	Temperature: 40 ± 2°C Humidity: 90 to 95% RH		
		Current 30 minutes	Less than 120% of initial requirement	Time of test: 240 ± 8 hours		
		Appearance	No significant change			
		Capacitance	Within ±30% of initial requirement	Conforms to 9.10		
Likele Trans. (ا م م ا	Equivalent Series Resistance	Less than 300% of initial requirement	Temperature: 70 ± 2°C Series resistance: 0 Ω		
High Temperature	e Load	Current 30 minutes	Less than 200% of initial requirement	Applied voltage: 3.5 VDC, 6.5 VDC		
		Appearance	No significant change	Time of test: 1000^{+48}_{-0} hours		

FY Series

FYD TYPE: SMALL DIAMETER, EXCELLENT VOLTAGE HOLDING CHARACTERISTICS FYH, and FYL TYPE: LOW PROFILE, EXCELLENT VOLTAGE HOLDING CHARACTERISTICS

The FY series includes small-size electric double-layer capacitors with excellent voltage holding characteristics. The FYD type occupies only a small area on a printed circuit board, and the FYH and FYL types feature a low profile in height, so that they can be used in various systems.

These capacitors are ideal as long-time backup devices for minute-current loads in small and lightweight systems.

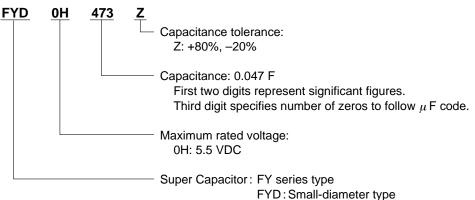
Features

- Product variety makes the FYD, FYH, and FYL types suitable for use in many types of application systems.
- Excellent voltage holding characteristics ideal for backup of 1 μ A to several hundred μ A.
- Smaller than other Super Capacitors (25% less than FS series in volume)
- Capacitance ranges from low to high (0.01 F to 2.2 F).

Applications

- · Backup of CMOS microcomputers, static RAMs, DTSs (digital tuning systems)
- Memory backup of remote controllers and handy cassette player during battery exchange

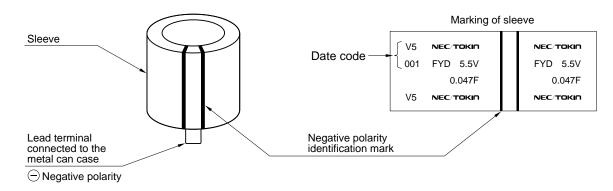
Part Number System



FYH and FYL: Low-profile type

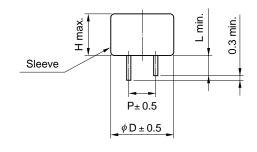
Markings

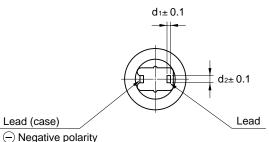
Markings are made with black ink on the green sleeve.



Dimensions and Standard Ratings

• FYD-Type





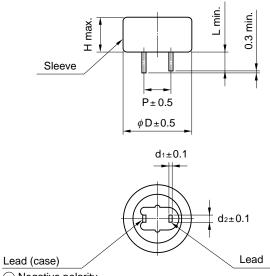
Dort No.		Dimensions mm (inch)									
Part No.	D	Н	Р	d₁	d2	L	g (oz)				
FYD0H223Z	11.5	8.5	5.08	0.4	1.2	2.7	1.6				
	(0.453)	(0.335)	(0.200)	(0.016)	(0.047)	(0.106)	(0.056)				
FYD0H473Z	11.5	8.5	5.08	0.4	1.2	2.7	1.7				
	(0.453)	(0.335)	(0.200)	(0.016)	(0.047)	(0.106)	(0.058)				
FYD0H104Z	13.0	8.5	5.08	0.4	1.2	2.2	2.4				
	(0.512)	(0.335)	(0.200)	(0.016)	(0.047)	(0.087)	(0.085)				
FYD0H224Z	14.5	15.0	5.08	0.4	1.2	2.4	4.3				
	(0.571)	(0.591)	(0.200)	(0.016)	(0.047)	(0.095)	(0.152)				
FYD0H474Z	16.5	15.0	5.08	0.4	1.2	2.7	6.0				
	(0.65)	(0.591)	(0.200)	(0.016)	(0.047)	(0.106)	(0.212)				
FYD0H105Z	21.5	16.0	7.62	0.6	1.2	3.0	11.0				
	(0.85)	(0.629)	(0.300)	(0.024)	(0.047)	(0.118)	(0.338)				
FYD0H145Z	21.5	19.0	7.62	0.6	1.2	3.0	12.0				
	(0.85)	(0.748)	(0.300)	(0.024)	(0.047)	(0.118)	(0.424)				
FYD0H225Z	28.5	22.0	10.16	0.6	1.4	6.1	22.9				
	(1.122)	(0.866)	(0.400)	(0.024)	(0.055)	(0.240)	(0.809)				

O Negative polarity

Note: Weight is typical.

Part Number	Max. Rated Voltage (V)	Nomial Capacitance Charge System (F)	Discharge System (F)	Max. ESR (at 1 kHz) (Ω)	Max. Current at 30 minutes (mA)	Voltage Holding Characteristic Min. (V)
FYD0H223Z	5.5	0.022	0.033	220	0.033	4.2
FYD0H473Z	5.5	0.047	0.070	220	0.071	4.2
FYD0H104Z	5.5	0.10	0.14	100	0.15	4.2
FYD0H224Z	5.5	0.22	0.35	120	0.33	4.2
FYD0H474Z	5.5	0.47	0.75	65	0.71	4.2
FYD0H105Z	5.5	1.0	1.6	35	1.5	4.2
FYD0H145Z	5.5	1.4	2.1	45	2.1	4.2
FYD0H225Z	5.5	2.2	3.3	35	3.3	4.2

• FYH-Type



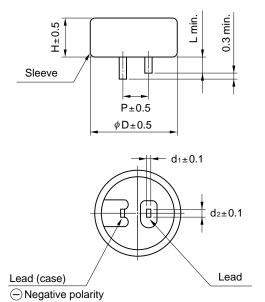
Part No.		Dimensions mm (inch)									
Part No.	D	H P		dı	d2	L	g (oz)				
FYH0H223Z	11.5	7.0	5.08	0.4	1.2	2.7	1.5				
	(0.453)	(0.276)	(0.200)	(0.016)	(0.047)	(0.106)	(0.053)				
FYH0H473Z	13.0	7.0	5.08	0.4	1.2	2.2	2.2				
	(0.512)	(0.276)	(0.200)	(0.016)	(0.047)	(0.087)	(0.078)				
FYH0H104Z	16.5	7.5	5.08	0.4	1.2	2.7	3.4				
	(0.65)	(0.295)	(0.200)	(0.016)	(0.047)	(0.106)	(0.120)				
FYH0H224Z	16.5	9.5	5.08	0.4	1.2	2.7	3.6				
	(0.65)	(0.374)	(0.200)	(0.016)	(0.047)	(0.106)	(0.127)				
FYH0H474Z	21.5	10.0	7.62	0.6	1.2	3.0	7.2				
	(0.85)	(0.394)	(0.300)	(0.024)	(0.047)	(0.118)	(0.255)				
FYH0H105Z	28.5	11.0	10.16	0.6	1.4	6.1	13.9				
	(1.122)	(0.433)	(0.400)	(0.024)	(0.055)	(0.240)	(0.491)				

Note: Weight is typical.

\odot	Negative	polarity
Θ	negative	polarity

Part Number	Max. Rated Voltage (V)	Nomial Capacitance Charge System (F)	Discharge System (F)	Max. ESR (at 1 kHz) (Ω)	Max. Current at 30 minutes (mA)	Voltage Holding Characteristic Min. (V)
FYH0H223Z	5.5	0.022	0.033	200	0.033	4.2
FYH0H473Z	5.5	0.047	0.075	100	0.071	4.2
FYH0H104Z	5.5	0.10	0.16	50	0.15	4.2
FYH0H224Z	5.5	0.22	0.30	60	0.33	4.2
FYH0H474Z	5.5	0.47	0.70	35	0.71	4.2
FYH0H105Z	5.5	1.0	0.50	20	1.5	4.2

• FYL-Type



Part No.		Weight					
Fait NO.	D	Н	Р	dı	d2	L	g (oz)
FYL0H103Z	11.0	5.0	5.08	0.2	1.2	2.7	0.9
	(0.43)	(0.197)	(0.200)	(0.016)	(0.047)	(0.106)	(0.032)
FYL0H223Z	11.0	5.0	5.08	0.2	1.2	2.7	1.0
	(0.43)	(0.197)	(0.200)	(0.016)	(0.047)	(0.106)	(0.035)
FYL0H473Z	12.0	5.0	5.08	0.2	1.2	2.7	1.2
	(0.47)	(0.197)	(0.200)	(0.016)	(0.047)	(0.106)	(0.042)

Note: Weight is typical.

Part Number	Max. Rated Voltage (V)	Nomial Capacitance Charge System (F) (F) (F)		Max. ESR (at 1 kHz) (Ω)	Max. Current at 30 minutes (mA)	Voltage Holding Characteristic Min. (V)	
FYL0H103Z	5.5	0.010	0.013	300	0.015	4.2	
FYL0H223Z	5.5	0.022	0.028	200	0.033	4.2	
FYL0H473Z	5.5	0.047	0.061	200	0.071	4.2	

Specifications

					Test Conditions			
Items	Items		Specifications	Confo	prming to JIS C 5102-1994			
Operating Temper	ature Range	-25°C to +70°C						
Maximum Operat		5.5 Vdc						
Nominal Capacitance Range		See standard list						
Capacitance Allo		+80 %, -20 %		See characteristics measuring conditions				
Equivalent Series		See standard list			teristics measuring conditions			
Current (30-minu		See standard list			teristics measuring conditions			
Current (30-minu	tes value)		More than 00 % of initial requirement	Conforms	ě			
		Capacitance	More than 90 % of initial requirement	Surge volt	age: 6.3 V			
		Equivalent Series Resistance	Less than 120% of initial requirement	Surge voltage: 6.3 V Temperature: 70 ± 2°C				
		Current at 30 minutes	Less than 120% of initial requirement	Discharging	for 30 seconds			
Surge Voltage		Appearance No significant change		Charge re 0.01 F 0.022 F 0.047 F 0.10 F 0.22 F	560 Ω 1.0 F 15 Ω			
	Dhasa 2	Capacitance	More than 50 % of initial value	Conforms				
	Phase 2	Equivalent Series Resistance	Less than 400% of initial value	Phase 1:				
		Capacitance	Less than 200% of initial value	Phase 2:				
Temperature	Phase 5	Equivalent Series Resistance	Initial requirement	Phase 3:				
Variation of Characteristics		Current at 30 minutes	Less than 1.5 CV (mA)	Phase 4:				
Characteristics		Capacitance	Within ± 20% of initial value	Phase 5:				
	Phase 6	Equivalent Series Resistance	Initial requirement	Phase 6:	+25 ±2 C			
	T Hase o	Current at 30 minutes	Initial requirement					
Lead Strength (Tensile)			anent damage of the leads	FYD0H145Z FYD0H225Z FYH0H474Z FYH0H105Z Others: 1.0 kg-f 10 ± 1 sec. Conforms to 8.2.3				
Vibration Resistance		Capacitance Equivalent Series Resistance Meet initial requirements			/: 10 to 55 Hz			
		Current at 30 minutes		I Ime of te	st: 6 hours			
		Appearance	No significant change					
Solderability		3/4 or more of the pin of surface should be covered with the solder		Conforms to 8.4 Temperature of solder: $230 \pm 5^{\circ}$ C Time of immersion: 5 ± 0.5 second To immerse capacitors up to 1.6 mm from the bottom				
Soldering Heat Resistance		Capacitance Equivalent Series Resistance Current at 30 minutes	Meet initial requirements	Conforms to 8.5 Temperature of solder: $260 \pm 10^{\circ}$ C Time of immersion: 10 ± 1 seconds To immerse capacitors up to 1.6 mm				
		Appearance	No significant change	from the b				
Temperature Cyc	le	Capacitance Equivalent Series Resistance Current at 30 minutes	Shall meet initial requirements	Conforms Temperatu –25°C –				
		Visual appearance	No significant change	Number o	f cycles: 5 cycles			
		Capacitance	Within ±20% of initial value	Conforms	to 9.5			
Humidity Resista	nce	Equivalent Series Resistance	Less than 120% of initial requirement	•	ure: 40 ± 2°C			
. annany rediata		Current at 30 minutes	Less than 120% of initial requirement		90 to 95% RH			
		Appearance	No significant change	Time of te	st: 240 ± 8 hours			
High Temperature Load		Capacitance	Within ±30% of initial value	Conforms				
		Equivalent Series Resistance	Less than 200% of initial requirement		ıre: 70 ±2°C istance: 0 Ω			
		Current at 30 minutes	Less than 200% of initial requirement	Applied vo	oltage: 5.5 VDC			
		Appearance No significant change		Time of te	oltage: 5.5 VDC st: 1000 -0 hours			
Voltage Holding			nal leads higher than 4.2 V.	Charging condition	Applied voltage: 5.0 VDC Series resistance: 0 Ω Curging time: 24 hours			
Characteristics (Self Discharge)		vonage between termi	nan reaus myner uidil 4.2 v.	Storage	Load: Nothing Temperature: Lower than 25°C Humidity: Lower than 70% RH Time: 24 hours			

Measurement Conditions

(9)

(1) Capacitance (Charge System)

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.

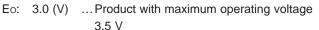
Capacitance: C = $\frac{\tau}{R_{C}}$ (F)

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Ro

Εo

Swich



5.0 (V) ... Product with maximum operating voltage 5.5 V

6.0 (V) ... Product with maximum operating voltage 6.5 V

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

12.0 (V) ... Product with maximum operating voltage 12 V

Time from start of charging until Vc becomes τ: 0.632Eo (V) (sec)

	Rc: See table below (Ω).													
Series Name	FA	FE	FS		FY		FR	3.5 V, 6.5 V Operation Series	FM FME	FMC	FG	FGH	FT	FC
Capacitance				FYD	FYH	FYL		•						
0.010F	-	-	-	-	-	5000 Ω	-	0.022 F to	5000 Ω	-	5000 Ω	-	-	-
0.022F	1000 Ω	-	1000 Ω	2000 Ω	2000 Ω	2000 Ω	2000 Ω	0.056 F	2000 Ω	-	2000 Ω	-	-	Discharg
0.047F	1000 Ω	1000 Ω	1000 Ω	2000 Ω	1000 Ω	2000 Ω	1000 Ω	2000 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	Discharg
0.22F	200 Ω	200 Ω	-	510 Ω	510 Ω	-	510 Ω	_	1000 Ω	-	1000 Ω	Discharge	200 Ω	Discharg
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	100 Ω	100 Ω	100 Ω	100 Ω	-	100 Ω	-	-	-	510 Ω	Discharge	100 Ω	Discharge
1.4F	-	-	-	200 Ω	-	-	-	-	-	-	-	-	-	-
1.5F	-	51 Ω	-	-	-	-	-	-	-	-	-	-	-	-
2.2F	-	_	-	100 Ω	-	-	_	-	-	-	200 Ω	-	51 Ω	-
3.3F	-	-	-	-	-	-	-	-	-	-	-	-	51 Ω	-
4.7F	-	_	-	51 Ω	-	-	_	-	-	-	100 Ω	-	-	-
5.0F	-	-	100 Ω	-	-	-	-	_	-	-	-	-	-	-
5.6F	-	-	-	-	-	-	-	_	-	-	-	-	20 Ω	-

as table balaw (O)

*Capacitance values according to the constant current discharge method.

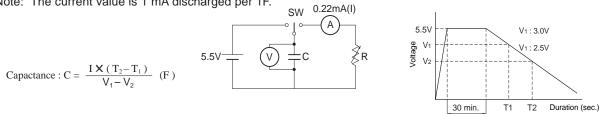
Table 3 Capacitance measurement

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.



* Difference owing to method of measuring capacitance

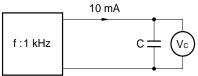
Measurement of the capacitance values by Super capacitors accords to the constant resistance charge method. If measured according to competitors' constant current, discharge and charge measurement methods, the specified current values are smaller than those specified by us and therefore they are apparently 1.3 to 1.5 times the capacitance values measured by our measurement method. Therefore, the backup capability of the same rated product as those of competitiors is 1.3 to 1.5 times that of competitors.

This catalog describes the constant resistance charge method and the constant current discharge method.

(2) Equivalent series resistance (ESR)

ESR is calculated from expression (10) by using a 1 kHz oscillator, applying an AC current of 10 mA and measuring the voltage (Vc) between both ends of the capacitor.

Equivalent series resistance : ESR =
$$\frac{Vc}{10^{-2}}$$
 (Ω) (10)



(3) Current (30-minute value)

The current value is calculated from expression (11) by applying a voltage to the capacitor (C), and measuring the voltage (V_R) between both ends of the series resistor (Rc) 30 minutes later. Prior to measurement, short between both pins of the capacitor for 30 minutes or more to let it discharge. Follow the indication of the product when determining the polarity of the capacitor during charging.

Current :
$$I = \frac{V_R}{R_c} \times 10^3 \text{ (mA)}$$
 (11)
Eo: Conforms to Eo of capacitance measuring condition.
Rc: 0.01 to 0.056 F: 1 kΩ
0.1 to 0.47 F: 100 Ω
1 to 2.2 F: 10 Ω
FS Series 11 VDC, 12 Vdc products
0.47 F to 1.0 F: 100 Ω
5.0 F: 10 Ω
FG Series
1.0 F to 4.7 F: 100Ω
FT Series
1.0 F to 5.6 F: 10Ω

(4) Self-discharge characteristlic

(except FA, FE, FS series, and 3.5 V and 6.5 V product)

The self-discharge characteristic is measured by charging a voltage of 5.0 VDC (charge protection resistance: 0 Ω) according to the capacitor polarity for 24 hours, then releasing between the pins for 24 hours and measuring the pinto-pin voltage.

This test should be carried out in an environment with an ambient temperature of 25°C or below and relative humidity of 70% RH or below.

Notes on Using the Super Capacitor (Electric Double-Layer Capacitor)

This capacitor uses an electrolyte and a rubber-sealed structure. Using it at a high temperature for many hours may cause water content in the electrolyte to evaporate and increase equivalent series resistance. The basic failure mode is an open mode caused by an increase of equivalent series resistance.

Failure rate

The failure rate calculated based on the field data is approximately 0.006 Fit.

Circuitry

- a. Ensure that the maximum operating voltage and other rated values are selected reliably.
 Application of a voltage exceeding the maximum operating voltage may not only deteriorate performance but also damage the case, etc.
- b. Since the equivalent series resistance (ESR) of the capacitor is relatively high, do not use it in a smoothing circuit such as a power supply circuit.
- c. For reasons related to the marking display lamp, a sleeve is used for the capacitor, but its isolation is not guaranteed. Contact with adjacent components may cause leakage.
- d. In the manufacturing process, the capacitor is processed with the pin on the case side designated as the (–) side. Note this (–) symbol when using the capacitor.

A discharge may occur during shipment, but some residual potential may have an adverse effect on other components.

- e. Use of a SuperCapacitor in the vicinity of a heating element (coil, power transistor, posistor, etc.) may heat the capacitor itself and considerably shorten its service life.
- f. Avoid exposure to acidic or alkaliue liquids.

Mounting

- a. This capacitor cannot be mounted with a reflow furnace such as IR and VPS. Avoid dipping the capacitor in a solder dip bath.
- b. When using flow automatic soldering, ensure that the soldering temperature is 260°C or below and soldering duration at one point does not exceed 10 sec.
- c. For soldering with a soldering rod, select a soldering rod with a capacity of approximately 30 W and ensure that the temperature at the rod tip does not exceed 350°C and that the soldering duration does not exceed 5 sec. The rod temperature should be controlled reliably. Heating pins excessively may increase the equivalent series resistance (ESR) of the capacitor.
- d. Do not deform or file capacitor pins.

Doing so may cause solder plating on the pin to fall off and prevent solder from sticking.

e. Avoid mechanical impacts such as dropping on the floor and touching with a hard blade, to prevent renting sleeves and pin wave.

Cleaning

- a. Basically do not wash capacitors except the FM series. When washing is unavoidable, use a washing resistant product.
- b. Drying after washing should be performed within the maximum operating temperature range.

Storage

- a. Store the product in an environment with a normal temperature and normal humidity without condensation.
- b. Avoid exposing the product in direct sunlight for many hours. (Doing so may cause deterioration or discoloration of the sleeve.)
- c. Avoid storage in an acidic or alkaline atmosphere.

Taking the capacitors apart

- a. The capacitors contains a trace of dilute sulfuric acid. Contact with hands, etc., may be harmful, so do not disassemble them.
- b. Do not use incineration for disposal. Instead, dispose of them as industrial waste.

Environmental Impact Reduced Products

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

Types of plating and outer tube

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

Series	Part Number	Plating	Outer Tube
FA	All FA Series	a	PET (Blue)
FE	All FE Series	а	PET (Blue)
FS	All FS Series	а	PET (Blue)
FR	All FR Series	а	PET (Blue)
FT	All FT Series	а	PET (Blue)
	All FYD type	а	PET (Blue)
	All FYH type	а	PET (Blue)
FY	FYL0H473Z	а	PET (Blue)
	FYL0H223Z	b	PET (Blue)
	FYL0H103Z	b	PET (Blue)
	FG0H103Z	b	PET (Blue)
	FG0H223Z	b	PET (Blue)
	FG0H104Z	b	PET (Blue)
	FG0H473Z	b	PET (Blue)
	FG0H474Z	а	PET (Blue)
50	FG0H105Z	а	PET (Blue)
FG	FG0H225Z	а	PET (Blue)
	FG0H475Z	а	PET (Blue)
	FGH0H104Z	b	PET (Blue)
	FGH0H224Z	b	PET (Blue)
	FGH0H474Z	а	PET (Blue)
	FGH0H105Z	а	PET (Blue)
FM	All FM Series	а	No tube used
	FC0H473ZTBR24	b	No tube used
	FC0H104ZTBR24	b	No tube used
	FC0H224ZTBR24	b	No tube used
FC	FC0H474ZTBR32	а	No tube used
FC	FC0H105ZTBR44	а	No tube used
	FC0V104ZTBR24	b	No tube used
	FC0V224ZTBR24	b	No tube used
	FC0V474ZTBR24	b	No tube used
	FSH0H473Z	b	PET (Blue)
	FSH0V433Z	b	PET (Blue)
Others	FYD0V563Z	b	PET (Blue)
	FSH0J223Z	а	PET (Blue)
	FYD0J273Z	а	PET (Blue)

Recommended Pb-free solder : Sn / 3.5Ag / 0.75Cu Sn / 3.0Ag / 0.5Cu Sn / 0.7Cu Sn / 2.5Ag / 1.0Bi / 0.5Cu

FC Series

Prot Number	Max. Rated Voltage (Vdc)	Nominal Capacitance Discharge sytem (F)	Max. ESR (at 1kHz) (Ω)	Max. current at 30 minutes (mA)	Min. Voltage Holding Characteristic (V)
FC0H473ZFTBR24	5.5	0.047	lesss than 50	lesss than 0.071	more than 4.2
FC0H104ZFTBR24	5.5	0.10	lesss than 25	lesss than 0.15	more than 4.2
FC0H224ZFTBR24	5.5	0.22	lesss than 25	lesss than 0.33	more than 4.2
FC0H474ZFTBR32	5.5	0.47	lesss than 13	lesss than 0.71	more than 4.2
FC0H105ZFTBR44	5.5	1.00	lesss than 7	lesss than 1.50	more than 4.2
FC0V104ZFTBR24	3.5	0.10	lesss than 50	lesss than 0.090	-
FC0V224ZFTBR24	3.5	0.22	lesss than 25	lesss than 0.20	-
FC0V474ZFTBR24	3.5	0.47	lesss than 25	lesss than 0.42	_

Same shape as FC Series (See page 8.)

FC Series

Part Number	Max. Rated Voltage (V)	Nomial Capacitance Charge System (F)	Discharge System (F)	Max. ESR (at 1 kHz) (Ω)	Max. Current at 30 minutes (mA)
FT0H104ZF	5.5	0.10	0.14	less than 16	less than 0.15
FT0H224ZF	5.5	0.22	0.28	less than 10	less than 0.33
FT0H474ZF	5.5	0.47	0.60	less than 6.5	less than 0.71
FT0H105ZF	5.5	1.0	1.3	less than 3.5	less than 1.5
FT0H225ZF	5.5	2.2	2.8	less than 1.8	less than 3.3
FT0H335ZF	5.5	3.3	4.2	less than 1.0	less than 5.0
FT0H565ZF	5.5	5.6	7.2	less than 0.6	less than 8.4

Same shape as FT Series (See page 13.)

FG Series

Part Number	Max. Rated Voltage (V)	Nomial Capacitance Charge System (F)	Discharge System (F)	Max. ESR (at 1 kHz) (Ω)	Max. Current at 30 minutes (mA)	Voltage Holding Characteristic Min.(V)
FG0H103ZF	5.5	0.01	0.013	300	0.015	4.2
FG0H223ZF	5.5	0.022	0.028	200	0.033	4.2
FG0H473ZF	5.5	0.047	0.060	200	0.071	4.2
FG0H104ZF	5.5	0.10	0.13	100	0.15	4.2
FG0H224ZF	5.5	0.22	0.28	100	0.33	4.2
FG0H474ZF	5.5	0.47	0.60	120	0.71	4.2
FG0H105ZF	5.5	1.0	1.3	65	1.5	4.2
FG0H225ZF	5.5	2.2	2.8	35	3.3	4.2
FG0H475ZF	5.5	4.7	6.0	35	7.1	4.2
Part Number	Max. Rated Voltage (V)	Nomial Capacitance Charge System (F)	Discharge System (F)	Max. ESR (at 1 kHz) (Ω)	Max. Current at 30 minutes (mA)	Voltage Holding Characteristic Min.(V)
FGH0H104ZF	5.5	_	0.10	100	0.15	4.2
FGH0H224ZF	5.5	_	0.22	100	0.33	4.2
FGH0H474ZF	5.5	_	0.47	65	0.71	4.2
FGH0H105ZF	5.5	_	1.0	35	1.5	4.2

Same shape as FG Series (See page 16., 18.)

FM Series • 5.5 V Type

Par	t Number	Max. Rated Voltage	Nomial Capacitance		Max. ESR (at 1 kHz)	Max. Current at 30 minutes	Voltage Holding Characteristic	Sa FN
	Ammo pack	(VDC)	Charge System Discharge System	(Ω)	(mA)	min. (V)	Ту	
FM0H103ZF	FM0H103ZFTP()	5.5	0.01	0.014	300	0.015	4.2) (S
FM0H223ZF	FM0H223ZFTP()	5.5	0.022	0.028	200	0.033	4.2	
FM0H473ZF	FM0H473ZFTP()	5.5	0.047	0.06	200	0.071	4.2	
FM0H104ZF	FM0H104ZFTP()	5.5	0.10	0.13	100	0.15	4.2	
FM0H224ZF	FM0H224ZFTP()	5.5	-	0.22	100	0.33	4.2	

ame shape as M Series 5.5V /pe see page 21.)

Note: To complete part number, insert lead length H. (16 or 18 mm: Refer to Taping Specification on page 30.)

• 3.5 V Type

Par	Part Number		Nominal Capacitance	1	Max. ESR (at 1 kHz)	Max. Current at 30	Sa FI
	Ammo pack	Voltage Charge System (VDC) (F)		Discharge System (F)	(αι Τ κπ2) (Ω)	minutes (mA)	(S
FM0V473ZF	FM0V473ZFTP()	3.5	0.047	0.06	200	0.042	
FM0V104ZF	FM0V104ZFTP()	3.5	0.10	0.13	100	0.090	
FM0V224ZF	FM0V224ZFTP()	3.5	0.22	0.30	100	0.20	

Same shape as M Series 3.5V Type See page 22.)

Note: To complete part number, insert lead length H. (16 or 18 mm: Refer to Taping Specification on page 30.)

• FME Type (Backup Large Current, mA Order)

Par	Part Number		Nominal Capacitance		Max. ESR (at 1 kHz)	Max. Current at 30 minutes (mA)	
	Ammo pack	Voltage Charge System (VDC) (F)		Discharge System (F)	(Ω)		
FME0H223ZF	FME0H223ZFTP()	5.5	0.022	0.028	40	0.033	
FME0H473ZF	FME0H473ZFTP()	5.5	0.047	0.06	20	0.071	

Same shape as FM Series FME Type (See page 22.)

Note: To complete part number, insert lead length H. (16 or 18 mm: Refer to Taping Specification on page 30.)

• FMR Type (Extended Operating Temperature range)

Part	Number	Max. Rated Voltage	Nominal Capacitance	Discharge System	Max. ESR (at 1 kHz)	Max. Current at 30 minutes	Voltage Holding Characteristic	Same sh as FM Se
	Ammo pack	(VDC)	(F)	(F)	(Ω)	(mA)	min.(V)	FMR Ty
FMR0H473ZF	FMR0H473ZFTP()	5.5	0.047	0.062	200	0.071	4.2	(See pag 22.)

hape Series /pe ige

Note: To complete part number, insert lead length H. (16 or 18 mm: Refer to Taping Specification on page 30.)

• FM 6.5V Type

Part	Part Number		Nominal Capacitance	lominal Capacitance Charge System Discharge System		Max. Current at 30 minutes
	Ammo pack	Voltage (VDC)	(F)	(F)	(Ω)	(mA)
FM0J473ZF	FM0J473ZFTP()	6.5	0.047	0.062	200	0.071

Same shape as FM Series 6.5V Type (See page 22.)

Note: To complete part number, insert lead length H. (16 or 18 mm: Refer to Taping Specification on page 30.)

• FMC Type

Part	Number	Max. Rated Voltage	Nomial Capacitance Charge System		Max. LON	Max. Current at 30 minutes	Voltage Holding Characteristic
	Ammo pack	(VDC)	(F)	(F)	(Ω)	(mA)	min. (V)
FMC0H473ZF	FMC0H473ZFTP()	5.5	0.047	0.062	less than 100	less than 0.071	more than 4.2V
FMC0H104ZF	FMC0H104ZFTP()	5.5	0.10	0.13	less than 50	less than 0.15	more than 4.2V
FMC0H334ZF	FMC0H334ZFTP()	5.5	-	0.33	less than 30	less than 0.50	more than 4.2V

Same shape as FM Series FMC Type (See page 28.)

Chip parts applicable to treatment in bond hardening furnace (160 ± 5°C for 120 ±10 seconds)

FA Series

Part Number	Max. Rated Voltage (VDC)	Nominal Capacitance Charge System (F)	Discharge System (F)	Max. Current at 30 minutes (mA)	Max. ESR (at 1 kHz) (Ω)	Same shape as FA Series (See page 34.)
FA0H473ZF	5.5	0.047	0.075	0.071	20	(See page 54.)
FA0H104ZF	5.5	0.1	0.16	0.15	8	
FA0H224ZF	5.5	0.22	0.35	0.33	5	
FA0H474ZF	5.5	0.47	0.75	0.71	3.5	
FA0H105ZF	5.5	1.0	1.6	1.5	2.5	
FA1A223ZF	11	0.022	0.035	0.066	20	
FA1A104ZF	11	0.1	0.16	0.33	8	
FA1A224ZF	11	0.22	0.35	0.66	6	
FA1A474ZF	11	0.47	0.75	1.41	4	

FE Series

Part Number	Max. Rated Voltage (V)	Nominal Capacitance Charge System (F)	Discharge System (F)	Max. Current at 30 minutes (mA)	Max. ESR (at 1 kHz) (Ω)	Same shape as FE Series (See page 37.)
FE0H473ZF	5.5	0.047	0.075	0.071	14.0	(eee page e)
FE0H104ZF	5.5	0.10	0.16	0.15	6.5	
FE0H224ZF	5.5	0.22	0.35	0.33	3.5	
FE0H474ZF	5.5	0.47	0.75	0.71	1.8	
FE0H105ZF	5.5	1.0	1.4	1.5	1.0	
FE0H155ZF	5.5	1.5	2.1	2.3	0.6	

FS Series

Part Number	Max. Rated Voltage (V)	Nomial Capacitance Charge System (F)	Discharge System (F)	Max. ESR (at 1 kHz) (Ω)	Max. Current at 30 minutes (at 1 kHz) (mA)
FS0H223ZF	5.5	0.022	0.033	60	0.033
FS0H473ZF	5.5	0.047	0.072	40	0.071
FS0H104ZF	5.5	0.10	0.15	25	0.15
FS0H224ZF	5.5	0.22	0.33	25	0.33
FS0H474ZF	5.5	0.47	0.75	13	0.71
FS0H105ZF	5.5	1.0	1.3	7	1.5
FS1A474ZF	11.0	0.47	0.60	7	1.41
FS1A105ZF	11.0	1.0	1.3	7	3.0
FS1B105ZF	12.0	1.0	1.3	7.5	3.6
FS1B505ZF	12.0	5.0	6.5	4.0	18.0

Same shape as FS Series (See page 40.)

FR Series

Part Number	Max. Rated Voltage (V)	Nomial Capacitance Charge System (F)	Discharge System (F)	Max. ESR (at 1 kHz) (Ω)	Max. Current at 30 minutes (mA)	Voltage Holding Characteristic Min. (V)	Sa FF (S
FR0H223ZF	5.5	0.022	0.028	220	0.033	4.2	
FR0H473ZF	5.5	0.047	0.060	110	0.071	4.2	
FR0H104ZF	5.5	0.10	0.15	150	0.15	4.2	
FR0H224ZF	5.5	0.22	0.33	180	0.33	4.2	
FR0H474ZF	5.5	0.47	0.75	100	0.71	4.2	
FR0H105ZF	5.5	1.0	1.6	60	1.5	4.2	

Same shape as FR Series (See page 43.)

3.5 V, 6.5 V Rated Voltage Series

Part Number	Max. Rated Voltage (V)	Nomial Capacitance Charge System (F)	Discharge System (F)	Max. ESR (at 1 kHz) (Ω)	Max. Current at 30 minutes (mA)
FSH0V433ZF	3.5	0.043	0.055	50	0.039
FYD0V563ZF	3.5	0.056	0.070	150	0.050
FSH0J223ZF	6.5	0.022	0.033	60	0.040
FYD0J273ZF	6.5	0.027	0.040	200	0.049

Same shape as 3.5V, 6.5V Rated Voltage Series (See page 47.)

FY Series

• FYD-Type

Part Number	Max. Rated Voltage (V)	Nomial Capacitance Charge System (F)	Discharge System (F)	Max. ESR (at 1 kHz) (Ω)	Max. Current at 30 minutes (mA)	Voltage Holding Characteristic Min. (V)	Same shape as FY Series FYD Type
FYD0H223ZF	5.5	0.022	0.033	220	0.033	4.2	(See page 50.)
FYD0H473ZF	5.5	0.047	0.070	220	0.071	4.2	
FYD0H104ZF	5.5	0.10	0.14	100	0.15	4.2	
FYD0H224ZF	5.5	0.22	0.35	120	0.33	4.2	
FYD0H474ZF	5.5	0.47	0.75	65	0.71	4.2	
FYD0H105ZF	5.5	1.0	1.6	35	1.5	4.2	
FYD0H145ZF	5.5	1.4	2.1	45	2.1	4.2	
FYD0H225ZF	5.5	2.2	3.3	35	3.3	4.2	

• FYH-Type

Part Number	Max. Rated Voltage (V)	Nomial Capacitance Charge System (F)	Discharge System (F)	Max. ESR (at 1 kHz) (Ω)	Max. Current at 30 minutes (mA)	Voltage Holding Characteristic Min. (V)	Same shape as FY Series FYH Type
FYH0H223ZF	5.5	0.022	0.033	200	0.033	4.2	(See page 51.)
FYH0H473ZF	5.5	0.047	0.075	100	0.071	4.2	
FYH0H104ZF	5.5	0.10	0.16	50	0.15	4.2	
FYH0H224ZF	5.5	0.22	0.30	60	0.33	4.2	
FYH0H474ZF	5.5	0.47	0.70	35	0.71	4.2	
FYH0H105ZF	5.5	1.0	0.50	20	1.5	4.2	

• FYL-Type

Part Number	Max. Rated Voltage (V)	Nomial Capacitance Charge System (F)	e Discharge System (F)	Max. ESR (at 1 kHz) (Ω)	Max. Current at 30 minutes (mA)	Voltage Holding Characteristic Min. (V)	Same shape as FY Series FYL Type
FYL0H103ZF	5.5	0.010	0.013	300	0.015	4.2	(See page 52.)
FYL0H223ZF	5.5	0.022	0.028	200	0.033	4.2	
FYL0H473ZF	5.5	0.047	0.061	200	0.071	4.2	

Environmental Impact Reduced Products Specifications

FS Series 5.5V Type

Item			Standard	Test Conditions conforming to JIS C 5102-1994	
Operating Temperat	ture Range	–25°C to +70°C			
Maximum Operatin	g Voltage	5.5 VDC			
Nominal Capacitance Range		0.047 to 1.0F		See characteristics measuring method.	
Capacitance Allow	ance	+80%, -20%		See characteristics measuring method.	
Equivalent Series I	Resistance	See standard list		See characteristics measuring method.	
Current (30-minute	es value)	See standard list		See characteristics measuring method.	
		Capacitance	More than 90% of initial requirement	Conforms to 7.14	
		Equivalent series resistance	Not to exceed 120% of initial requirement	Surge Voltage: 6.3 V(5.5V products)	
		Current (30-minute value)	Not to exceed 120% of initial requirement	Temperature: 70±2°C	
*				Charge: 30 sec.	
Surge Voltage20				Discharge: 9 min. 30 sec.	
		Appearance	No obvious abnormality	Number of cycles 1000 cycles.	
		, ppcalairee		Charge resistance: 0.047F 300 Ω	
				Discharge resistance: 0 Ω	
		Capacitance	50% or higher of initial value	Conforms to 7.12	
	Phase 2	Equivalent series resistance	4 or less times initial value	Phase 1: +25 \pm 2°C	
*		Capacitance	200% or below of initial value	Phase 2: $-25 \pm 2^{\circ}C$	
Temperature Variation of	Phase 5	Equivalent series resistance		Phase 2: -25 ± 2 C Phase 3: $-40 \pm 2^{\circ}$ C	
Characteristics	Phase 5		Satisty initial standard value		
Characteriotics		Current (30-minute value)	1.5 CV (mA) or below	Phase 4: +25 ± 2°C	
	Dharas	Capacitance	Within ±20% of initial value	Phase 5: +70 ± 2°C	
Phase 6	Equivalent series resistance	Satisty initial standard value	Phase 6: +25 ± 2°C		
		Current (30-minute value)	Satisty initial standard value		
		Capacitance		Conforms to 8.2.3	
* Vibration Resistand	се	Equivalent series resistance	Satisty initial standard value	Frequency : 10 to 55 Hz	
		Current (30-minute value)		Test duration : 6 hours	
		Appearance	No obvious abnormality	Ocuforma to 0.5	
		Capacitance		Conforms to 8.5 Solder temperature: $260 \pm 10^{\circ}$ C Dipping duration: 10 ± 1 sec. Dipped up to 1.6 mm from the lower end	
* Soldering Heat Re	sistance	Equivalent series resistance	Satisty initial standard value		
3		Current (30-minute value)			
		Appearance	No obvious able abnormality	of the capacitor.	
		Capacitance		Conforms to 9.3 Temperature condition:	
* Temperature Cycle)	Equivalent series resistance	Satisty initial standard value		
		Current (30-minute value)		$-25^{\circ}C \rightarrow normal temperature$	
		Appearance	No obvious abnormality	\rightarrow +70°C \rightarrow normal temperature	
		Capacitance	Within 20% of initial value	Number of cycles: 5 cycles	
*Humidity Resistand	ce	Equivalent series resistance	1.2 or less times initial standard value	Conforms to 9.5 Temperature: 40 ± 2°C	
Furnitury Resistance		Current (30-minute value)	1.2 or less times initial standard value	Relative humidity: 90 to 95% RH	
		Appearance	No obuious abnormality	Test duration: 240 ± 8 hours	
* High Temperature Load		Capacitance	Within 30% of initial value	Conforms to 9.10	
		Equivalent series resistance	Twice or less times initial standard value	Temperature: 70 ± 2°C Voltage applied: 5.5 Vdc	
		Current (30-minute value)	Twice or less times initial standard value	Series protection resistance: 0Ω	
		Appearance	No obvious abnormality	Test duration: 1000 ⁺⁴⁸ ₀ hours	
* Voltage Holding Characteristics		Voltage between termin	al leads higher than 4.2 V	Charging condition Voltage applied: 5.0 VDC Series resistance: 0 Ω Charging time: 24hours Time: 24hours	
(Self Dischage)				Storage Temperature:Lower than 25°C	

* The characteristics above must be satisfied for asterisked items after the end of reflow soldering (according to the reflow condition shown on page).

FC Series 3.5V Type

				Test Conditions	
Item			Standard	Conforming to JIS C 5102 ⁻¹⁹⁹⁴	
Operating Temperat	ture Range	–25°C to +70°C			
Maximum Operating Voltage		3.5 VDC			
Nominal Capacitar	nce Range	0.010 to 0.47F		See characteristics measuring method.	
Capacitance Allow	ance	+80%, -20%		See characteristics measuring method.	
Equivalent Series	Resistance	See standard list		See characteristics measuring method.	
Current (30-minute	es value)	See standard list		See characteristics measuring method.	
		Capacitance	More than 90% of initial requirement	Conforms to 7.14	
		Equivalent series resistance	Not to exceed 120% of initial requirement	Surge Voltage: $4.0 V(3.5V \text{ products})$ Temperature: $70 \pm 2^{\circ}C$	
		Current (30-minute value)	Not to exceed 120% of initial requirement	Charge: 30 sec.	
* Surge Voltage		Appearance	No obvious abnormality	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	
		Capacitance	50% or higher of initial value	Conforms to 7.12	
	Phase 2	Equivalent series resistance	4 or less times initial value	Phase 1: +25 ± 2°C	
* Temperature		Capacitance	200% or below of initial value	Phase 2: -25 ± 2°C	
Variation of	Phase 5	Equivalent series resistance	Satisty initial standard value	Phase 3: -40 ± 2°C	
Characteristics		Current (30-minute value)	1.5 CV (mA) or below	Phase 4: +25 ± 2°C	
		Capacitance	Within ±20% of initial value	Phase 5: +70 ± 2°C	
	Phase 6	Equivalent series resistance	Satisty initial standard value	Phase 6: +25 ± 2°C	
		Current (30-minute value)	Satisty initial standard value		
		Capacitance		Conforms to 8.2.3	
* Vibration Resistan	~~	Equivalent series resistance	Satisty initial standard value	Frequency : 10 to 55 Hz	
VIDIATION RESISTAN	ce	Current (30-minute value)		Test duration : 6 hours	
		Appearance	No obvious abnormality		
		Capacitance		Conforms to 8.5	
* Soldering Heat Re	sistanco	Equivalent series resistance	Satisty initial standard value	Solder temperature: $260 \pm 10^{\circ}C$ Dipping duration: 10 ± 1 sec.	
Soluening heat Ke	SISIGNUE	Current (30-minute value)		Dipped up to 1.6 mm from the lower end	
		Appearance	No obvious able abnormality	of the capacitor.	
		Capacitance		Conforms to 9.3	
* Temperature Cycle	2	Equivalent series resistance	Satisty initial standard value	Temperature condition: -25°C → normal temperature	
		Current (30-minute value)		\rightarrow +70°C \rightarrow normal temperature	
		Appearance	No obvious abnormality	Number of cycles: 5 cycles	
* Humidity Resistance		Capacitance	Within 20% of initial value	Conforms to 9.5	
		Equivalent series resistance	1.2 or less times initial standard value	Temperature: $40 \pm 2^{\circ}C$ Relative humidity: 90 to 95% RH	
		Current (30-minute value)	1.2 or less times initial standard value	Test duration: 240 ± 8 hours	
		Appearance	No obuious abnormality		
		Capacitance	Within 30% of initial value	Conforms to 9.10	
* High Temperature	load	Equivalent series resistance	Twice or less times initial standard value	Temperature: 70 ± 2°C Voltage applied: 3.5 Vdc	
ingri ieniperature	LJau	Current (30-minute value)	Twice or less times initial standard value	Series protection resistance: 0Ω	
		Appearance	No obvious abnormality	Test duration: 1000^{+48}_{0} hours	

* The characteristics above must be satisfied for asterisked items after the end of reflow soldering (according to the reflow condition shown on page).

FT Series

				Test Conditions
ltem			Conforming to JIS C 5102-1994	
Operating Temperatu	ure Range	–40°C to +85°C		
Maximum Operating Voltage		5.5 Vdc		
Nominal Capacitan	ice Range	0.1 to 5.6 F (Refer to s	tandard ratings)	
Capacitance Allowa	ance	+80 %, -20 %		See characteristics measuring conditions
Equivalent Series R	lesistance	See standard list		See characteristics measuring conditions
Current (30-minute	value)	See standard list		See characteristics measuring conditions
		Capacitance	More than 90 % of initial requirement	Conforms to 7.14 At 85°C Surge voltage 6.3 V Charge: 30 sec. Discharge: 9 min. 30 sec. 1000 cycles
Surge Voltage		Equivalent Series Resistance	Not to exceed 120 % of initial requirement	Charge resistance: $0.10 ext{ F } 150 ext{ } \Omega$ $0.22 ext{ F } 56 ext{ } \Omega$ $0.47 ext{ F } 30 ext{ } \Omega$ $1.0 ext{ F } 15 ext{ } \Omega$
		Current at 30 minutes	Not to exceed 120 % of initial requirement	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$
	Dhose C	Capacitance	More than 50 % of initial value	Conforms to 7.12
	Phase 2	Equivalent Series Resistance	Not to exceed 3 times initial value	Phase 1: +25±2°C
	Dhase 2	Capacitance	More than 30 % of initial value	Phase 2: -25 ±2°C
Temperature	Phase 3	Equivalent Series Resistance	Not to exceed 7 times initial value	Phase 3: -40 ±2°C
Variation of Characteristics		Capacitance	Not to exceed 150 % of initial value	Phase 4: +25 ±2°C
	Phase 5	Equivalent Series Resistance	Not to exceed initial requirement	Phase 5: +85±2°C
		Current at 30 minutes	Not to exceed 1.5 CV (mA)	Phase 6: +25±2°C
		ΔC/C	Within ±20 % of initial value	
	Phase 6	Equivalent Series Resistance	Not to exceed initial requirement	
		Current at 30 minutes	Not to exceed initial requirement	
Lead Strength (Ten	isile)	No loosening nor permanent damage of the leads		Conforms to 8.1.2(1) 0.022 to 0.47 F: 1 kg, 10 sec. 1 F: 2.5 kg, 10 sec.
		Capacitance	Meet initial requirement	Conforms to 8.2.3
Vibration Resistance	ce	Equivalent Series Resistance	Meet initial requirement	Frequency: 10 to 55 Hz
		Current at 30 minutes	Meet initial requirement	Test duration: 6 hours
Solderability		3/4 or more of the pin s	surface should be covered with new solder	Conforms to 8.4 245 \pm 5°C 5 \pm 0.5 sec. 1.6 mm from body
		Capacitance	Meet initial requirement	Conforms to 8.5
Soldering Heat Resistance		Equivalent Series Resistance	Meet initial requirement	$260 \pm 10^{\circ}$ C, 10 ± 1 sec. Immersion depth:
Resistance		Current at 30 minutes	Meet initial requirement	1.6 mm from body
Temperature Cycle		Capacitance	Meet initial requirement	Conforms to 9.3 Temperatuve condition:
		Equivalent Series Resistance	Meet initial requirement	–40°C → Normai temperature
		Current at 30 minutes	Meet initial requirement	→ +85°C→ Normai temperature Number of cycles : 5 cycles
Humidity Resistance		Capacitance	Within $\pm 20\%$ of initial value	Conforms to 9.5
		Equivalent Series Resistance	Not to exceed120 % of initial requirement	$40 \pm 2^{\circ}$ C, 90 to 95% RH
,		Current at 30 minutes	Not to exceed120 % of initial requirement	240 ± 8 hours
		Capacitance change	Within ±30% of initial value	Conforms to 9.10
High temperature L	oad	Equivalent Series Resistance	Not to exceed 200% of initial requirement	 Temperature: 85 ± 2°C Series resistance: 0 Ω
nightemperatule L	-0au			Applied voltage: 5.5 VDC
		Current at 30 minutes	Not to exceed 200% of initial requirement	Time of test: 1000^{+48}_{-0} hours

FG Series

				Τος	st Conditions
Items			Standard		ng to JIS C 5102-1994
Operating Tempera	ature Range	–25°C to +70°C			
Maximum Operating Voltage.		5.5 Vdc			
Nominal Capacita		0.010 to 4.7 F		See characteri	stics measuring method
Capacitance Allow	-	+80 %, -20 %			stics measuring method
Equivalent Series		See standard list			stics measuring method
Current (30-minut		See standard list			stics measuring method
		Capacitance	More than 90% of initial requirement	Conforms to 7	
		Equivalent series resistance	Not to exceed 120% of initial requirement	Surge voltage:	6.3V
		Current at 30 min.		Temperature: 7	70±2°C
Surge Voltage		Appearance	Not to exceed 120% of initial requirement No obvious abnormality	Charge: 30 set Discharge: 9 m Number of cyc Series resistar 0.010F: 1500 0.022F: 560 0.047F: 300 0.10F: 150 Ω 0.22F: 56 Ω Discharge resi	hin 30 sec. les: 1000 cycles loc: $\Omega = 0.47F$: 30 Ω $\Omega = 1.0F$: 15 Ω $\Omega = 2.2F$: 10 Ω $\Omega = 4.7F$: 10 Ω
	Phase 2	Capacitance	50% or higher of initial value	Conforms to 7	.12
	Phase 2	Equivalent series resistance	4 or less times initial value	Phase 1: +25	±2°C
Temperature		Capacitance	200% or below of initial value	Phase 2: -25	±2°C
Variation of	Phase 5	Equivalent series resistance	Satisfy initial standard value	Phase 3: -40	±2°C
Characteristics		Current at 30 min.	1.5 CV (mA) or below	Phase 4: +25	±2°C
		Capacitance	Within ±20% of initial value	Phase 5: +70	±2°C
	Phase 6	Equivalent series resistance	Satisfy initial standard value	Phase 6: +25	±2°C
		Current at 30 min.	Satisfy initial standard value		
Lead Strength (Te	ensile)	No loosening nor perm	anent damage of the leads	Conforms to 8	.1.2 (1)
		Capacitance			
Vibration Resista	nce	Equivalent series resistance	Meet initial standard value	Conforms to 8.	()
		Current at 30 min.		Frequency: 10	
		Appearance	No obvious abnormality	Test duration: 6 hours	
Solderability		3 / 4 or more of the pin surface should be covered with new solder		Dipping duration	ature: 245±5°C
Soldering Heat R	esistance	Capacitance Equivalent series resistance Current at 30 min.	Dipping duration: 10		ature: 260±10°C
		Appearance	No obvious abnormality		of the capacitor
Temperature Cycle		Capacitance Equivalent series resistance Current at 30 min.	Satisfy initial standard value	→ +7($5^{\circ}C \rightarrow normal temperature$ $0^{\circ}C \rightarrow normal temperature$
		Appearance	No obvious abnormality	Number of cyc	les: 5 cycles
		Capacitance	Within ±20% of initial value	Conforms to 9	.5
Humidity Resistance		Equivalent series resistance	1.2 or less times initial standard value	Temperature: 4	10±2°C
		Current at 30 min.	1.2 or less times initial standard value	Relative humic	lity: 90 to 95% RH
		Appearance	No obvious abnormality	Test duration:	
		Capacitance	Within ±30% of initial value	Conforms to 9	-
High Temperature Load		Equivalent series resistance	Twice or less times initial standard value	Temperature: 7	
		Current at 30 min.	Twice or less times initial standard value	Voltage applie	d: 5.5Vdc on resistance: 0Ω
		Appearance	No obvious abnormality	Test duration:	
Voltage Holding C (Self Discharge)	haracteristics		al leads higher than 4.2V	Charging Condition	$\begin{array}{l} \text{Voltage applied: 5.0VDC} \\ \text{(with case side terminal negative)} \\ \text{Series resistance: } 0\Omega \\ \text{Charging time: 24 hours} \\ \hline \text{Time: 24 hours} \end{array}$
				Storage	Temperature: Lower than 25°C Humidity: Lower than 70%RH

FG Series FGH Type

Items	;		Standard		t Conditions	
		25°C to 170°C		Conformin	g to JIS C 5102-1994	
Operating Tempera		-25°C to +70°C				
Maximum Operat		5.5 Vdc		Coo choractori		
Nominal Capacita	-	0.10 to 1.0 F			stics measuring method	
Capacitance Allo		+80 %, -20 %			stics measuring method	
Equivalent Series		See standard list			stics measuring method	
Current (30-minu	te value)	See standard list			stics measuring method	
		Capacitance	More than 90% of initial requirement	Conforms to 7. Surge voltage:		
		Equivalent series resistance	Not to exceed 120% of initial requirement	Temperature: 7	′0±2°C	
		Current at 30 min.	Not to exceed 120% of inital requirement	Charge: 30 sec. Discharge: 9 min 30 sec.		
Surge Voltage		Appearance	No obvious abnormality		les: 1000 cycles ce: Ω 0.47F: 30 Ω Ω 1.0F: 15 Ω Ω 2.2F: 10 Ω 2 4.7F: 10 Ω	
		Capacitance	50% or higher of initial value	Conforms to 7.	12	
	Phase 2	Equivalent series resistance	4 or less times initial value	Phase 1: +25	±2°C	
Temperature		Capacitance	200% or below of initial value	Phase 2: -25	±2°C	
Variation of	Phase 5	Equivalent series resistance	Satisfy initial standard value	Phase 3: -40	±2°C	
Characteristics		Current at 30 min.	1.5 CV (mA) or below	Phase 4: +25	±2°C	
		Capacitance	Within ±20% of initial value	Phase 5: +70	±2°C	
	Phase 6	Equivalent series resistance	Satisfy initial standard value	Phase 6: +25	±2°C	
		Current at 30 min.	Satisfy initial standard value			
Lead Strength (Te	ensile)	No loosening nor perm	anent damage of the leads	Conforms to 8.	1.2 (1)	
		Capacitance				
Vibration Resista	nce	Equivalent series resistance	uivalent series resistance Meet initial standard value		2.3	
		Current at 30 min.		Frequency: 10		
		Appearance	No obvious abnormality	Test duration: 6 hours		
			,	Conforms to 8.	4	
				Solder temperature: $245\pm5^{\circ}$ C Dipping duration: 5 ± 0.5 sec. Should be dipped up to 1.6mm from		
Solderability		3 / 4 or more of the pin	surface should be covered with new solder			
					of the capacitor	
		Capacitance		Conforms to 8.5		
Solder Heat Resi	stance	Equivalent series resistance	uivalent series resistance Should satisfy initial standard value		Solder temperature: 260±10°C	
		Current at 30 min.			on: 10±1 sec.	
		Appearance	No obvious abnormality		bed up to 1.6mm from of the capacitor	
		Capacitance	· · · · · · · · · · · · · · · · · · ·			
Temperature Cyc	le	Equivalent series resistance	Satisfy initial standard value	Conforms to 9. Temperature: -25	3 $C \rightarrow normal temperature$	
		Current at 30 min.			$^{\circ}C \rightarrow \text{normal temperature}$	
		Appearance	No obvious abnormality	Number of cyc		
		Capacitance	Within ±20% of initial value	Conforms to 9.	5	
Humidity Resistance		Equivalent series resistance	1.2 or less times initial standard value	Temperature: 4		
		Current at 30 min.	1.2 or less times initial standard value	·	lity: 90 to 95% RH	
			No obvious abnormality	Test duration: 2		
		Appearance Capacitance	Within ±30% of initial value	Conforms to 9.		
High Temperature Load			Twice or less times initial standard value	Temperature: 7		
		Equivalent series resistance		Voltage applied: 5.5Vdc		
		Current at 30 min.	Twice or less times initial standard value	Series protecti	on resistance: 0Ω	
		Appearance	No obvious abnormality	Test duration:		
Voltage Holding C (Self Discharge)	haracteristics	Voltage between termin	al leads higher than 4.2V	Charging Condition	Voltage applied: 5.0VDC (with case side terminal negative Series resistance: 0Ω Charging time: 24 hours Time: 24 hours	
(Sell Discharge)				Storage	Temperature: Lower than 25°C Humidity: Lower than 70%RH	

FM Series 5.5V Type

Item			Standard	Confo	Test Conditions orming to JIS C 5102 ⁻¹⁹⁹⁴	
Operating Tempera	ture Range	-25°C to +70°C		Conic		
Maximum Operatir	-	5.5 VDC				
Nominal Capacitance Range		See standard list				
Capacitance Allow	0	+80%, -20%		See charac	teristics measuring method.	
Equivalent Series		See standard list			teristics measuring method.	
Current (30-minute		See standard list			teristics measuring method.	
	,	Capacitance	More than 90% of initial requirement	Conforms	6	
		Equivalent series resistance	Not to exceed 120% of initial requirement	Surge Volt	age: 6.3 V	
		Current (30-minute value) Not to exceed 120% of initial requirement		 Temperatu Charge: 	ire: 70 ± 2°C 30 sec.	
Surge Voltage		Appearance	Appearance No obvious abnormality.		9 min. 30 sec. cycles 1000 cycles. istance: 1500 Ω 0.22F: 56 Ω 560 Ω 300 Ω 150 Ω resistance: 0 Ω	
	Dhase 2	Capacitance	50% or higher of initial value	Conforms	to 7.12	
	Phase 2	Equivalent series resistance	4 or less times initial value	Phase 1:		
Temperature		Capacitance	200% or below of initial value	Phase 2:		
Variation of Characteristics	Phase 5	Equivalent series resistance	Satisty initial standard value	Phase 4:	-40 ± 2°C ±25 ± 2°C	
Characteristics		Current (30-minute value)	1.5 CV (mA) or below		+20 ± 2°C	
		Capacitance	Within ±20% of initial value	Phase 6:		
	Phase 6	Equivalent series resistance	Satisty initial standard value			
		Current (30-minute value)	Satisty initial standard value]		
Lead Strengh (Ten	sile)	No loosening nor perma	anent damage of the leads	Conforms 1 kg 10sed	to 8.1.2 (1)	
		Capacitance		Conforms		
		Equivalent series resistance Satisty initial standard value Current (30-minute value)		Frequency	: 10 to 55 Hz	
Vibration Resistan	се				on : 6 hours	
		Appearance	No obvious abnormality	-		
Solderability		3/4 or more of the pin su	rface should be covered with new solder	Conforms to 8.4 Solder temperature: $245 \pm 5^{\circ}$ C Dipping duration: 5 ± 0.5 sec. Dipped up to 1.6 mm from the lower end of the capacitor.		
		Capacitance		Conforms	to 8.5	
		Equivalent series resistance			Solder temperature: 260 ± 10°C	
Soldering Heat Re	sistance	Current (30-minute value)			to 1.6 mm from the lower en	
		Appearance	No obvious able abnormality	of the capa		
		Capacitance		Conforms		
Temperature Or		Equivalent series resistance	Satisty initial standard value	Temperatu	re condition:	
Temperature Cycle	9	Current (30-minute value)		$-25^{\circ}C$ $\rightarrow +70^{\circ}$	\rightarrow normal temperature $^{\circ}C \rightarrow$ normal temperature	
		Appearance	No obvious abnormality		cycles: 5 cycles	
		Capacitance	Within 20% of initial value	Conforms	to 9.5	
		Equivalent series resistance	1.2 or less times initial standard value	Temperatu	ıre: 40 ± 2°C	
Humidity Resistance		Current (30-minute value)	1.2 or less times initial standard value	Relative h	umidity: 90 to 95% RH	
		Appearance	No obuious abnormality	Test durati	on: 240 ± 8 hours	
		Capacitance	Within 30% of initial value	Conforms		
High Temperature Load		Equivalent series resistance	Twice or less times initial standard value	Temperatu		
		Current (30-minute value)	Twice or less times initial standard value	Voltage applied: 5.5 Vdc		
		Appearance	No obvious abnormality	Test durati	tection resistance: 0Ω on: 1000^{+48}_{0} hours	
Voltage Holding Characteristics			al leads higher than 4.2 V	Charging condition	Voltage applied: 5.0 VDC Series resistance: 0Ω Charging time: 24hours	
Characteristics (Self Discharge)				Storage	Time: 24hours Temperature:Lower than 25° Humidity:Lower than 70%RH	

FM Series 3.5V Type

Item			Standard	Test Conditions		
Operating Temperature Range		-25°C to +70°C		Conforming to JIS C 5102 ⁻¹⁹⁹⁴		
Maximum Operatin		3.5 VDC				
Nominal Capacitar		See standard list				
Capacitance Allow		+80%, -20%		See characteristics measuring method.		
Equivalent Series		See standard list		See characteristics measuring method.		
Current (30-minute		See standard list		See characteristics measuring method.		
		Capacitance	More than 90% of initial requirement			
		Equivalent series resistance	Not to exceed 120% of initial requirement	Conforms to 7.14 Surge voltage: $4.0 V$		
		Current (30-minute value)	Not to exceed 120% of initial requirement	 Temperature: 70 ± 2°C Charge: 30 sec. 		
Surge Voltage		Appearance	No obvious abnormality	Discharge: 9 min. 30 sec. Number of cycles 1000 cycles. Series resistance: 0.047 F: 300 Ω 0.10 F: 150 Ω 0.22 F: 56 Ω Discharge resistance: 0 Ω		
		Capacitance	50% or higher of initial value	Conforms to 7.12		
	Phase 2	Equivalent series resistance	4 or less times initial value	Phase 1: +25 ± 2°C		
_		Capacitance	200% or below of initial value	Phase 2: -25 ± 2°C		
Temperature	Phase 5	Equivalent series resistance	Satisty initial standard value	Phase 3: $-40 \pm 2^{\circ}C$		
Variation of Characteristics		Current (30-minute value)	1.5 CV (mA) or below	Phase 4: +25 ± 2°C Phase 5: +70 ± 2°C		
Onaraciensiles		Capacitance	Within ±20% of initial value	Phase 6: +25 ± 2°C		
	Phase 6	Equivalent series resistance	Satisty initial standard value			
		Current (30-minute value)	Satisty initial standard value	_		
Lead Strengh (Ten	sile)	No loosening nor permanent damage of the leads		Conforms to 8.1.2 (1) 1 kg 10 sec		
		Capacitance		Conforms to 8.2.3		
Vibration Resistan	re	Equivalent series resistance	Satisty initial standard value	Frequency: 10 to 55 Hz Test duration: 6 hours		
violation resistan		Current (30-minute value)				
		Appearance No considerable abnormality				
Solderability		3/4 or more of the pin surface should be covered with new solder		Conforms to 8.4 Solder temperature: $245 \pm 5^{\circ}$ C Dipping duration: 5 ± 0.5 sec. Dipped up to 1.6 mm from for the lower end of the capacitor.		
		Capacitance		Conforms to 8.5		
o	· .	Equivalent series resistance	Satisty initial standard value	Solder temperature: $260 \pm 10^{\circ}$ C		
Soldering Heat Re	sistance	Current (30-minute value)		Dipping duration: 10 ± 1 sec. Dipped up to 1.6 mm from for the lower		
		Appearance	No obvious abnormality	end of the capacitor.		
		Capacitance	······································	Conforms to 9.3		
		Equivalent series resistance	Satisty initial standard value	Temperature condition:		
Temperature Cycle		Current (30-minute value)	Salisty Initial standard value	–25°C → normal temperature		
		, , ,		\rightarrow +70°C \rightarrow normal temperature		
		Appearance	No obvious abnormality	Number of cycles: 5 cycles		
Humidity Resistance		Capacitance	Within ±20% of initial value	Conforms to 9.5 Temperature: 40 ± 2°C		
		Equivalent series resistance	1.2 or less times initial standard value	- Relative humidity: 90 to 95% RH		
		Current (30-minute value)	1.2 or less times initial standard value	Test duration: 240 ± 8 hours		
		Appearance	No obvious abnormality			
		Capacitance	Within 30% of initial value	Conforms to 9.10		
High Temperature	load	Equivalent series resistance	Twice or less times initial standard value	Temperature: 70 ± 2°C Voltage applied: 3.5 Vdc		
ingii remperature	LUQU	Current (30-minute value)	Twice or less times initial standard value	Series protection resistance: 0Ω		

FM Series FME Type

				Test Conditions	
Item		Standard		Conforming JIS C 5102-1994	
Operating Temperature Range		-25°C to +70°C			
Maximum Operating Voltage		5.5 VDC			
Nominal Capacitance Range		See standard list			
Capacitance Allowance		+80%, -20%		See characteristics measuring method.	
Equivalent Series Resistance		See standard list		See characteristics measuring method.	
Current (30-minutes value)		See standard list		See characteristics measuring method.	
Surge Voltage		Capacitance	More than 90% of initial requirement	Conforms to 7.14 Surge Voltage: 7.4 V Temperature: $70 \pm 2^{\circ}$ C Chargs: 30 sec. Dischargs: 9 min. 30 sec. Number of cycles 1000 cycles. Series resistance: 0.022 F: 560 Ω 0.047 F: 300 Ω	
		Equivalent series resistance	Not to exceed 120% of initial requirement		
		Current (30-minute value) Appearance	Not to exceed 120% of initial requirement No obvious abnormality		
		Canaaitanaa	50% or higher of initial value	Discharge resistance: 0 Ω	
	Phase 2	Capacitance	50% or higher of initial value	Conforms to 7.12 Phase 1: +25 ± 2°C	
-		Equivalent series resistance	3 or less times initial value	Phase 1: $+25 \pm 2$ C Phase 2: $-25 \pm 2^{\circ}$ C	
Temperature Variation of	Phase 5	Capacitance	150% or below of initial value	Phase 3: $-40 \pm 2^{\circ}C$	
Characteristics		Equivalent series resistance Current (30-minute value)	Satisty initial standard value 1.5 CV (mA) or below	Phase 4: +25 ± 2°C	
		Capacitance	Within ±20% of initial value	Phase 5: +70 ± 2°C	
	Phase 6	Equivalent series resistance		Phase 6: +25 ± 2°C	
		Current (30-minute value)	Satisty initial standard value Satisty initial standard value		
Lead Strengh (Tensile)		No loosening nor permanent damage of the leads		Conforms to 8.1.2 (1) 1 kg 10 sec	
Vibration Resistance		Capacitance Equivalent series resistance Current (30-minute value)	Should satisty initial standard value	Conforms to 8.2.3 Frequency: 10 to 55 Hz Test duration: 6 hours	
		Appearance	There should be no considerable abnormality		
Solderability		3/4 or more of the pin surface should be covered with new solder		Conforms to 8.4 Solder temperature: $245 \pm 5^{\circ}$ C Dipping duration: 5 ± 0.5 sec. Dipped up to 1.6 mm from the lower end of the capacitor.	
Soldering Heat Resistance		Capacitance		Conforms to 8.5Solder temperature: $260 \pm 10^{\circ}$ CDipping duration: 10 ± 1 sec.	
		Equivalent series resistance	Satisty initial standard value		
		Current (30-minute value)		Dipped up to 1.6 mm from the lower end	
		Appearance	No obvious abnormality	of the capacitor.	
Temperature Cycle		Capacitance		Conforms to 9.3	
		Equivalent series resistance	Satisty initial standard value	Temperature condition: -25°C → normal temperature	
		Current (30-minute value)		\rightarrow +70°C \rightarrow normal temperature	
		Appearance	No obvious abnormality	Number of cycles: 5 cycles	
Humidity Resistance		Capacitance	Within ±20% of initial value	Conforms to 9.5Temperature: $40 \pm 2^{\circ}C$ Relative humidity:90 to 95% RH	
		Equivalent series resistance	1.2 or less times initial standard value		
		Current (30-minute value)	1.2 or less times initial standard value		
		Appearance	No obvious abnormality	Test duration: 240 ± 8 hours	
High Temperature Load		Capacitance	Within 30% of initial value		
		Equivalent series resistance	Twice or less times initial standard value		
		Current (30-minute value)	Twice or less times initial standard value		
		Appearance	No obvious abnormality		

NEC/TOKIN FM Series FMR Type

Item		Standard		Test Conditions Conforming to JIS C 5102 ⁻¹⁹⁹⁴		
Operating Temperature Range		-40°C to +85°C				
Maximum Operating Voltage		5.5 VDC				
Nominal Capacitar		See standard list				
Capacitance Allowance		+80%, -20%		See charac	teristics measuring method.	
Equivalent Series Resistance		See standard list		See characteristics measuring method.		
Current (30-minutes value)		See standard list		See characteristics measuring method.		
		Capacitance More than 90% of initial requirement		Conforms to 7.14		
Surge Voltage		Equivalent series resistance	Not to exceed 120% of initial requirement	Surge Voltage: $6.3 V$ Temperature: $85 \pm 2^{\circ}C$ Charge: $30 \sec$. Discharge: $9 \min$. $30 \sec$. Number of cycles 1000 cycles . Series resistance: 0.047 F : 300Ω Discharge resistance: 0Ω		
		Current (30-minute value)	Not to exceed 120% of initial requirement			
		Appearance	No obvious abnormality			
	Phase 2 Phase 3	Capacitance	50% or higher initial value	Conforms	to 7.12	
		Equivalent series resistance	4 or less times initial value	Phase 1: $+25 \pm 2^{\circ}C$		
		Capacitance	30% or higher initial value	Phase 2: -		
		Equivalent series resistance	7 or less times initial value	$\begin{array}{c} \text{Phase 2:} -2.5 \pm 2 \text{ °C} \\ \text{Phase 3:} -40 \pm 2^{\circ}\text{C} \\ \text{Phase 4:} +25 \pm 2^{\circ}\text{C} \\ \text{Phase 5:} +85 \pm 2^{\circ}\text{C} \\ \text{Phase 6:} +25 \pm 2^{\circ}\text{C} \end{array}$		
Temperature		Capacitance	200% or higher initial value			
Variation of	Dhoop F	Equivalent series resistance	Satisfy initial standard value			
Characteristics	Phase 5					
		Current (30-minute value)	1.5 CV (mA) or below	-		
	Phase 6	Capacitance	Within ±20% of initial standard value			
		Equivalent series resistance	Satisfy initial standard value	4		
		Current (30-minute value)	Satisfy initial standard value			
Lead Strengh (Tensile)		No loosening nor permanent damage of the leads		Conforms 1 kg 10sec	to 8.1.2 (1) c.	
		Capacitance		Conforms to 8.2.3		
		Equivalent series resistance			Frequency : 10 to 55 Hz	
Vibration Resistan	ce	Current (30-minute value)				
		Appearance	No obvious abnormality	Test duration : 6 hours		
		Арреанансе	No obvious abriormality	Conforme	to 9.4	
Solderability		3/4 or more of the pin surface should be covered with new solder.		Conforms to 8.4 Solder temperature: $245 \pm 5^{\circ}$ C Dipping duration: 5 ± 0.5 sec. Dipped up to 1.6 mm from the lower en of the capacitor.		
		Capacitance		Conforms to 8.5		
*Soldering Heat Resistance (1)		Equivalent series resistance	Satisty initial standard value	Solder temperature: 260 ± 10°C		
		Current (30-minute value)			Dipping duration: 10 ± 1 sec.	
		· · · · · · · · · · · · · · · · · · ·	No obvious obla skrasmality	 Dipped up to 1.6 mm from the lower er of the capacitor. After reflow pre-heating (160°C ± 5°C 120 ±10 sec.) 		
		Appearance	No obvious able abnormality			
*Soldering Heat Resistance ②		Capacitance				
		Equivalent series resistance	Satisty initial standard value			
5		Current (30-minute value)				
		Appearance	No obvious able abnormality			
		Capacitance		Conforms to 9.3		
Temperature Cycle		Equivalent series resistance	Satisty initial standard value	Temperature condition: $-40^{\circ}C \rightarrow \text{normal temperature}$ $\rightarrow +85^{\circ}C \rightarrow \text{normal temperature}$		
Temperature Oycie	•	Current (30-minute value)				
		Appearance	No obvious abnormality	Number of cycles: 5 cycles		
* Humidity Resistance		Capacitance	Within 20% of initial value	Conforms	, ,	
		Equivalent series resistance	1.2 or less times initial standard value	Temperatu		
		Current (30-minute value)	1.2 or less times initial standard value		umidity: 90 to 95% RH	
		Appearance	No obuious abnormality	Test durati		
* High Temperature Load		Capacitance	Within 30% of initial value			
		· ·				
		Equivalent series resistance	Twice or less times initial standard value			
		Current (30-minute value)	Twice or less times initial standard value			
Voltage Holding Characteristics (Self Discharge)		Appearance No obvious abnormality Voltage between terminal leads higher than 4.2 V *Performance items indicated with * are guara		Charging condition	Voltage applied: 5.0 VD Series resistance: 0Ω Charging time:24hoursTime:24hours	
				Storage	Temperature:Lower than 25° Humidity:Lower than 70%RF	

FM Series FM 6.5V Type

Item			Standard	Test Conditions Conforming to JIS C 5102 ⁻¹⁹⁹⁴		
Operating Temperature Range		-25°C to +70°C		5		
Maximum Operating Voltage		6.5 VDC				
Nominal Capacitar	nce Range	See standard list				
Capacitance Allow	ance	+80%, -20%		See characteristics measuring method.		
Equivalent Series	Resistance	See standard list		See characteristics measuring method.		
Current (30-minute	es value)	See standard list		See characteristics measuring method.		
		Capacitance	More than 90% of initial requirement	Conforms to 7.14		
		Equivalent series resistance	Not to exceed 120% of initial requirement	Surge Voltage: 7.4 V		
Surge Voltage		Current (30-minute value) Appearance	Not to exceed 120% of initial requirement No obvious abnormality	Temperature: $70 \pm 2^{\circ}$ C Charge: 30 sec. Discharge: 9 min. 30 sec. Number of cycles 1000 cycles. Series resistance: 0.047 F: 300 Ω		
	Dhara 0	Capacitance	50% or higher of initial value	Discharge resistance: 0 Ω Conforms to 7.12		
	Phase 2	Equivalent series resistance	4 or less times initial value	Phase 1: +25 ± 2°C		
Tomporatura		Capacitance	200% or below of initial value	Phase 2: -25 ± 2°C		
Temperature Variation of	Phase 5	Equivalent series resistance	Satisty initial standard value	 Phase 3: −40 ± 2°C Phase 4: +25 ± 2°C 		
Characteristics		Current (30-minute value)	1.5 CV (mA) or below	Phase 5: $+70 \pm 2^{\circ}C$		
		Capacitance	Within ±20% of initial value	Phase 6: $+25 \pm 2^{\circ}C$		
	Phase 6	Equivalent series resistance	Satisty initial standard value	_		
		Current (30-minute value)	Satisty initial standard value	_		
Lead Strengh (Ten	sile)	No loosening nor perma	anent damage of the leads	Conforms to 8.1.2 (1) 1 kg 10sec.		
		Capacitance		Conforms to 8.2.3		
		Equivalent series resistance	Satisty initial standard value	Frequency : 10 to 55 Hz		
Vibration Resistan	ce	Current (30-minute value)	-	Test duration : 6 hours		
		Appearance	No obvious abnormality			
Solderability		3/4 or more of the pin surface should be covered with new solder		Conforms to 8.4 Solder temperature: $245 \pm 5^{\circ}$ C Dipping duration: 5 ± 0.5 sec. Dipped up to 1.6 mm from the lower end of the capacitor.		
		Capacitance		Conforms to 8.5		
		Equivalent series resistance	Satisty initial standard value	Solder temperature: $260 \pm 10^{\circ}$ C Dipping duration: 10 ± 1 sec.		
Soidering Heat Re	sistance	Current (30-minute value)	+	Dipping duration: 10 ± 1 sec. Dipped up to 1.6 mm from the lower end		
		Appearance	No obvious able abnormality	of the capacitor.		
		Capacitance		Conforms to 9.3		
Tomporatura Cual		Equivalent series resistance	Satisty initial standard value	Temperature condition:		
Temperature Cycle	5	Current (30-minute value)	-	$-25^{\circ}C$ → normal temperature → +70°C → normal temperature		
		Appearance	No obvious abnormality	Number of cycles: 5 cycles		
Humidity Resistance		Capacitance	Within 20% of initial value	Conforms to 9.5		
		Equivalent series resistance	1.2 or less times initial standard value	Temperature: 40 ± 2°C		
		Current (30-minute value)	1.2 or less times initial standard value	Relative humidity: 90 to 95% RH		
		Appearance	No obuious abnormality	Test duration: 240 ± 8 hours		
		Capacitance	Within 30% of initial value	Conforms to 9.10		
High Tomassture	Lood	Equivalent series resistance	Twice or less times initial standard value	Temperature: $70 \pm 2^{\circ}C$		
High Temperature Load		Current (30-minute value)	Twice or less times initial standard value	Voltage applied: 6.5 Vdc Series protection resistance: 0 Ω Test duration: 1000 ⁺⁴⁸ ₀ hours		

FM Series FMC Type

					Test Canditions		
Item		Standard			Test Conditions rming to JIS C 5102 ⁻¹⁹⁹⁴		
Operating Temperature Range		–25°C to +70°C		Conto			
Maximum Operating Voltage		5.5 VDC					
Nominal Capacitar	<u> </u>	0.047F, 0.10F, 0.33F					
Capacitance Allow	-	+80%, -20%		See charac	teristics measuring method.		
Equivalent Series		See standard list			teristics measuring method.		
Current (30-minute		See standard list			teristics measuring method.		
Ourient (00 minute		Capacitance	More than 90% of initial requirement	Conforms			
		Equivalent series resistance	Not to exceed 120% of initial requirement	Surge Volt	age: 6.3 V		
		Current (30-minute value)	Not to exceed 120% of initial requirement	- Temperatu			
Surge Voltage		Appearance	No obvious abnormality.	hent Chargs: 30 sec. Dischargs: 9 min. 30 Number of cycles 1000 cycle Series resistance: 0.1 F: 0.33 F: 51 Ω 0.047 F: 30 Ω Discharge resistance: 0 Ω			
	Phase 2	Capacitance	50% or higher of initial value	Conforms	to 7.12		
		Equivalent series resistance	3 or less times initial value	Phase 1:			
Temperature		Capacitance	150% or below of initial value	Phase 2:			
Variation of	Phase 5	Equivalent series resistance	Satisty initial standard value	Phase 3:			
Characteristics		Current (30-minute value)	1.5 CV (mA) or below	Phase 4:			
		Capacitance	Within ±20% of initial value	Phase 5: · Phase 6: ·			
	Phase 6	Equivalent series resistance	Satisty initial standard value	Phase 6.	+25±2 C		
		Current (30-minute value)	Satisty initial standard value	-			
Lead Strengh (Tenile)		No loosening nor permanent damage of the leads		Conforms to 8.1.2 (1) 1 kg 10 sec			
		Capacitance		Conforms	to 8.2.3		
		Equivalent series resistance	Should satisty initial standard value	Frequency: 10 to 55 Hz			
Vibration Resistan	ce	Current (30-minute value)		Test durati	on: 6 hours		
		Appearance	There should be no considerable abnormality				
Solderability		3/4 or more of the pin surface should be covered with new solder		Conforms to 8.4 Solder temperature: $245 \pm 5^{\circ}$ C Dipping duration: 5 ± 0.5 sec. Dipped up to 1.6 mm from the lower en of the capacitor.			
		Capacitance	pacitance		Conforms to 8.5		
		Equivalent series resistance Satisty initial standard value		Solder temperature: 260 ± 10°C			
Soldering Heat Re	sistance	Current (30-minute value)		Dipping duration: 10 ± 1 sec. Dipped up to 1.6 mm from the lower of the capacitor.			
		Appearance	No obvious abnormality				
		Capacitance		Conforms			
Tomporatura Oval	`	Equivalent series resistance	Satisty initial standard value		re condition: → normal temperature		
Temperature Cycle	,	Current (30-minute value)			\rightarrow normal temperature		
		Appearance	No obvious abnormality		cycles: 5 cycles		
		Capacitance	Within ±20% of initial value	Conforms	to 9.5		
Humidity Resistan	20	Equivalent series resistance	1.2 or less times initial standard value	Temperatu			
	66	Current (30-minute value)	1.2 or less times initial standard value		umidity: 90 to 95% RH		
		Appearance	No obvious abnormality	Test durati	on: 240 ± 8 hours		
		Capacitance	Within 30% of initial value	Conforms			
High Temperature Load		Equivalent series resistance	Twice or less times initial standard value	 Temperatu Voltage ap 			
		Current (30-minute value)	Twice or less times initial standard value	Series pro	tection resistance: 0Ω		
		Appearance	No obvious abnormality	Test durati	on: 1000 ⁺⁴⁸ hours		
*Voltage Holding Characteristics (Self Dischage)		Voltage between terminal le	eads higher then 4.2V	Charging condition	Voltage applied: 5.0 VDCSeries resistance: 0Ω Charging time:24hoursTime:24hours		
					Temperature:Lower than 25°C Humidity:Lower than 70%RH		

*The characteristics above must be satisfied for asterisked items after the end of reflow soldering (according to the reflow condition shown on page).

FA Series

ltem			Test Conditions Conforming to JIS C 5102 ⁻¹⁹⁹⁴			
Operating Temperature Range		–25°C to 70°C				
Maximun Rated Voltage		5.5 VDC, 11.0 VDC				
Nominal Capacit	-	0.047 to 1.0 F (Refer to	o standard ratings)			
Capacitance Allo	-	+80 %, -20 %		See characteristics measuring conditions		
Equivalent Series		See standard list		See characteristics measuring conditions		
Current (30-minu		See standard list		See characteristics measuring conditions		
	At min. temp.	Capacitance	More than 70 % of initial value	Conforms to 7.14		
	$\begin{pmatrix} -25^{\circ}C\\ Step 2 \end{pmatrix}$	Equivalent Series Resistance	Not to exceed 3 times initial value	Phase 1 : +25±2.0°C		
	At max. temp.	Capacitance	Not to exceed 150 % of initial value	Phase 2 : -25±2.0°C		
Temperature	(+70°C	Equivalent Series Resistance	Not to exceed initial requirement	Phase 3 : +25±2.0°C Phase 4 : +70±2.0°C		
Variation of	Step 4/	Current at 30 minutes	Not to exceed 1.5 CV (mA)	Phase 5 : +25±2.0 °C		
Characteristics	At room temp.	Capacitance	Not to change more than ±20 % from initial value			
	(+25°C) Step 5)	Equivalent Series Resistance	Not to exceed initial requirement	-		
		Current at 30 minutes	Not to exceed initial requirement	-		
Lead Strength (Tensile)		No loosening nor permanent damage of the leads		Conforms to 8.1.2 (1) 5.5 VDC 0.047 F to 0.22 F: 1 kg 10 sec 0.47 F to 1.0 F: 2.5 kg 10 sec 11 VDC 0.022 F to 0.1 F: 1 kg 10 sec 0.22 F to 0.47 F: 2.5 kg 10 sec		
		Capacitance	Meet initial requirement	Conforms to 8.2.3		
Vibration Resista	ance	Equivalent Series Resistance Meet initial requirement		Frequency: 10 to 55 Hz		
		Current at 30 minutes	Meet initial requirement	Test duration: 6 hours		
Solderability		3/4 or more of the pin surface should be covered with new solder		Conforms to 8.4 245 ± 5°C, 5 ± 0.5 sec. Immersion depth: 2.5 mm from body		
		Capacitance	Meet initial requirement	Conforms to 8.5		
Soldering Heat F	Resistance	Equivalent Series Resistance	Meet initial requirement	$260 \pm 10^{\circ}$ C, 10 ±1 sec. Immersion depth:		
		Current at 30 minutes	Meet initial requirement	2.5 mm from body		
		Capacitance	Meet initial requirement	Conforms to 9.3		
Temperature Cycle		Equivalent Series Resistance	Meet initial requirement	 Temperature conitiom: –25°C → normal temperature 		
		Current at 30 minutes	Meet initial requirement	→+70°C normal temperature Number of cycles : 5 cycles		
Humidity Resistance		Capacitance	More than 90 % of initial requirement	Conforms to 9.5		
		Equivalent Series Resistance	Not to exceed 120 % of initial requirement	$40 \pm 2^{\circ}C$, 90 to 95 % RH		
		Current at 30 minutes	Not to exceed 120 % of initial requirement	240 ± 8 hours		
		Capacitance	More than 85 % of initial requirement	Conforms to 9.10		
High Temperatur	beolo		· ·	70 ± 2°C		
High Temperature Load		Equivalent Series Resistance Not to exceed 120 % of initial requirement		5.5 V applied for 5 V type 11 V applied for 10 V type		
		Current at 30 minutes	Not to exceed 200 % of initial requirement	1 000 ⁺⁴⁸ ₋₀ hours		

FE Series

Item			Test Conditions Conforming to JIS C 5102 ⁻¹⁹⁹⁴			
Operating Temperature Range		–40°C to 70°C				
Maximun Rated Voltage		5.5 VDC				
Nominal Capacita	ance Range	0.047 to 1.5 F (Refer to	o standard ratings)			
Capacitance Allo	wance	+80 %, -20 %		See characteristics measuring conditions		
Equivalent Series	Resistance	See standard list		See characteristics measuring conditions		
Current (30-minu	ite value)	See standard list		See characteristics measuring conditions		
		Capacitance	More than 90 % of initial requirement	Conforms to 7.14 At 70°C Surge voltage 6.3 V Temperature : 70±2°C Charge: 30 sec.		
Surge Voltage		Equivalent Series Resistance	Not to exceed 120 % of initial requirement	Discharge: 9 min. 30 sec. 1 000 cycles Charge resistance : 0.047 F 300Ω 0.10 F 150Ω		
		Current at 30 minutes	Not to exceed 120 % of initial requirement	0.22 F 56 Ω 0.47 F 30 Ω 1.0, 1.5 F 15 Ω Discharge resistance: Not applicable (0 Ω)		
	Phase 3	Capacitance	More than 40 % of initial value	Conforms to 7.12		
	1 110000	Equivalent Series Resistance	Not to exceed 4 times initial value	Phase 1: +25 ± 2°C		
		Capacitance	Not to exceed 200 % of initial value	Phase 2: −25 ± 2°C Phase 3: −40 ± 2°C		
Temperature	Phase 5	Equivalent Series Resistance	Not to exceed initial requirement	Phase 3: -40 ± 2 C Phase 4: $+25 \pm 2^{\circ}$ C		
Variation of Characteristics		Current at 30 minutes	Not to exceed 1.5 CV (mA)	Phase 5: +70 ± 2°C		
Characteriotics	Phase 6	Capacitance	Within ±20 % of initial value	Phase 6: +25 ± 2°C		
		Equivalent Series Resistance	Not to exceed initial requirement			
		Current at 30 minutes	Not to exceed initial requirement			
Lead Strength (T	ensile)	No loosening nor perm	Conforms to 8.1.2 (1) 0.047 to 0.47 F: 1 kg, 10 sec. 1 F, 1.5 F : 2.5 kg, 10 sec			
		Capacitance	Meet initial requirement	Conforms to 8.2.3		
Vibration Resista	ince	Equivalent Series Resistance	Meet initial requirement	Frequency: 10 to 55 Hz		
		Current at 30 minutes	Meet initial requirement	Test duration: 6 hours		
Solderability		3/4 or more of the pin surface should be covered with new solder		Conforms to 8.4 245 \pm 5°C Immersion depth: 5 \pm 0.5 sec. 1.6 mm from body		
		Capacitance	Meet initial requirement	Conforms to 8.5		
Soldering Heat R	lesistance	Equivalent Series Resistance	Meet initial requirement	260 ±10°C, 10 ±1 sec. Immersion depth :		
		Current at 30 minutes	Meet initial requirement	1.6 mm from body		
		Capacitance	Shall meet initial requirement	Conforms to 9.3		
Temperature Cyc	le	Equivalent Series Resistance	Meet initial requirement	Temperature condition: -40°C → normal temperture		
		Current at 30 minutes	Meet initial requirement	\rightarrow +70°C \rightarrow normal temperture Number of cycles : 5 cycles		
		Capacitance change	Within ±20 % of initial value	Conforms to 9.5		
Humidity Resista	nce	Equivalent Series Resistance	Not to exceed 120 % of initial requirement	40 ± 2°C, 90 to 95 % RH		
rumully resistence		Current at 30 minutes	Not to exceed 120 % of initial requirement	240 hours 240 ± 8 hours		
		Capacitance change	Within ± 30 % of initial value	Conforms to 9.10		
High Temperature	e Load	Equivalent Series Resistance	Not to exceed 300 % of initial requirement	70 ± 2°C		
.g emperator			•	5.5 V applied		
		Current at 30 minutes Not to exceed 200 % of initial requirement		1 000 ⁺⁴⁸ ₋₀ hours		

FS Series

				Test Conditions			
Item			Standard	Conforming to JIS C 5102 ⁻¹⁹⁹⁴			
Operating Temperature Range		-25°C to +70°C		ŭ			
Maximum Operating Voltage		5.5 VDC, 11 VDC, 12 V	DC				
Nominal Capacitar		0.022 to 1.0 F (5.5 V products), 0	0.47 F to 1.0 F (11 V products), 1.0 F to 5.0 F (12 V products)	See characteristics measuring method.			
Capacitance Allow	ance	+80%, -20%					
Equivalent Series	Resistance	See standard list		See characteristics measuring method.			
Current (30-minute	es value)	See standard list		See characteristics measuring method.			
		Capacitance	More than 90% of initial requirement	Conforms to 7.14			
		Equivalent series resistance	Not to exceed 120% of initial requirement	Surge voltage: 6.3 V (5.5 V products) 12.6 V (11 V products)			
		Current (30-minute value)	Not to exceed 120% of initial requirement	13.6 V (12 V products)			
Surge Voltage		Appearance	No obvious abnormality	$\begin{array}{ccccc} \mbox{Temperature:} & 70 \pm 2^\circ\mbox{C} \\ \mbox{Chargs:} & 30 \mbox{ seconds} \\ \mbox{Discharge:} & 9 \mbox{ min. } 30 \mbox{ sec.} \\ \mbox{Number of cycles } 1000 \mbox{ cycles.} \\ \mbox{Series resistance:} \\ & 0.022 \mbox{ F } 560 \Omega \\ & 0.047 \mbox{ F } 300 \Omega \\ & 0.22 \mbox{ F } 56 \Omega \\ & 0.47 \mbox{ F } 30 \Omega \\ & 1 \mbox{ F } 15 \Omega \\ & 5 \mbox{ F } 10 \Omega \\ & 5 \mbox{ F } 10 \Omega \end{array}$			
		Capacitance	50% or higher of initial value	Conforms to 7.12			
	Phase 2	Equivalent series resistance	3 or less times initial value	Phase 1: +25 ±2°C			
Tomporatura		Capacitance	150% or below of initial value	Phase 2: $-25 \pm 2^{\circ}C$			
Temperature Variation of	Phase 5	Equivalent series resistance	Satisty initial standard value	Phase 3: -40 ±2°C			
Characteristics		Current (30-minute value)	1.5 CV (mA) or below	Phase 4: +25 ±2°C			
		Capacitance	Within ± 20% of initial value	Phase 5: +70 ±2°C			
	Phase 6	Equivalent series resistance	Satisty initial standard value	Phase 6: +25 ±2°C			
		Current (30-minute value)	Satisty initial standard value				
Lead Strengh (Ten	sile)	No loosening nor perma	ment damage of the leads	5.5 VDC 0.022 F to 0.22 F: 1 kg 10 sec 0.47 F to 1.0 F: 2.5 kg 10 sec 11 VDC 2.5 kg 10 sec 12 VDC 2.5 kg 10 sec			
		Capacitance		Conforms to 8.2.3			
Mileardian D. 1.1		Equivalent series resistance	Satisty initial standard value				
Vibration Resistan	ce	Current (30-minute value)					
		Appearance	No obvious abnormality	Test duration: 6 hours			
Solderability		3/4 or more of the pin surface should be covered with new solder		Conforms to 8.4 Solder temperature: $245 \pm 5^{\circ}$ C Dipping duration: 5 ± 0.5 sec. Should be dipped up to 1.6 mm from the lower end of the capacitor.			
		Capacitance		Conforms to 8.5			
Soldoring Light D-	aistonas	Equivalent series resistance	Satisty initial standard value	Solder temperature: $260 \pm 10^{\circ}$ C Dipping duration: 10 ± 1 sec.			
Soldering Heat Re	sistance	Current (30-minute value)		Dipped up to 1.6 mm from the lower end			
		Appearance	No obvious abnormality	of the capacitor.			
		Capacitance		Conforms to 9.3			
Temperature Cycle	2	Equivalent series resistance	Satisty initial standard value	Temperature condition: –25°C → normal temperature			
		Current (30-minute value)		\rightarrow +70°C \rightarrow normal temperature			
		Appearance	No obvious abnormality	Number of cycles: 5 cycles			
Humidity Resistance		Capacitance	90% or higher of initial standard value (5.5 V products) Within 20% of initial value (11 V, 12 V products)	Conforms to 9.5 Temperature: 40 ± 2°C			
		Equivalent series resistance	1.2 or less times initial standard value	Relative humidity: 90 to 95% RH			
		Current (30-minute value)	1.2 or less times initial standard value	Test duration: 240 ± 8 hours			
		Appearance	No obvious abnormality				
		Capacitance	85% or higher of initial standard value (5.5 V products) Within ±30% of initial value (11 V, 12 V products)	Conforms to 9.10 Temperature: $70 \pm 2^{\circ}$ C			
High Temperature	Load	Equivalent series resistance	Twice or less times initial standard value	Voltage applied: Maximum operating voltage			
		Current (30-minute value)	Twice or less times initial standard value	Series protection resistance: 0Ω			
		Appearance	No obvious abnormality	Test duration: 1000 ⁺⁴⁸ / ₀ hours			

FR Series

				Test Conditions
Item			Conforming to JIS C 5102-1994	
Operating Temperature Range		–40°C to +85°C		
Maximun Working	Voltage	5.5 Vdc		
Nominal Capacitar	ice Range	0.022 to 1.0 F (Refer to	o standard ratings)	
Capacitance Allow	ance	+80 %, -20 %		See characteristics measuring conditions
Equivalent Series F	Resistance	See standard list		See characteristics measuring conditions
Current (30-minute	Value)	See standard list		See characteristics measuring conditions
		Capacitance	More than 90 % of initial requirement	Conform to 7.14 Surge voltage 6.3 V Temperature : 85±2°C Charge: 30 sec. Discharge: 9 min. 30 sec.
Surge Voltage		Equivalent Series Resistance	Not to exceed 120 % of initial requirement	1 000 cycles Charge resistance: 0.022 F 560 Ω 0.047 F 300 Ω 0.10 F 150 Ω
		Current at 30 minutes	Not to exceed 120 % of initial requirement	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$
	Phase 2	Capacitance	More than 50 % of initial value	Conform to 7.12
	Filase 2	Equivalent Series Resistance Not to exceed 4 times initial value		Phase 1: +25 ±2°C
	Phase 3	Capacitance	More than 30 % of initial value	─ Phase 2: −25 ±2°C ○ Phase 3: −40 ±2°C
	T Hase 5	Equivalent Series Resistance	Phase 4: +25 ±2°C	
Temperature Variation of		Capacitance Not to exceed 200 % of initial value		Phase 5: +85 ±2°C Phase 6: +25 ±2°C
Characteristics	Phase 5 Phase 6	Equivalent Series Resistance	Not to exceed initial requirement	
		Current at 30 minutes	Not to exceed 1.5 CV (mA)	
		Capacitance	Within ±20 % of initial value	
		Equivalent Series Resistance	Not to exceed initial requirement	
		Current at 30 minutes	Not to exceed initial requirement	
Lead Strength (Ter	nsile)	No loosening nor perm	anent damage of the leads	Conform to 8.1.2 (1) 0.022 to 0.47 F: 1 kg, 10 sec. 1 F: 2.5 kg, 10 sec.
		Capacitance	Meet initial requirement	Conform to 8.2.3
Vibration Resietan	се	Equivalent Series Resistance	Meet initial requirement	Frequency: 10 to 55 Hz Test duration: 6 hours
		Current at 30 minutes	Meet initial requirement	
Solderability		3/4 or more of the pins	surface shoud be covered with new solder	Conform to 8.4 245 \pm 5°C 5 \pm 0.5 sec. 1.6 mm from body
		Capacitance	Meet initial requirement	Conform to 8.5
Soldering Heat Resistance		Equivalent Series Resistance	Meet initial requirement	$260 \pm 10^{\circ}$ C, 10 ± 1 sec. Immersion depth:
		Current at 30 minutes	Meet initial requirement	1.6 mm from body
		Capacitance	Meet initial requirement	Conform to 9.3 Temperature condition:
Temperature Cycle	•	Equivalent Series Resistance	Meet initial requirement	–40°C → normal temperature
		Current at 30 minutes	Meet initial requirement	→ +85°C → normal temperature Number of cycles: 5 cycles
		Capacitance	Within $\pm 20\%$ of initial value	Conform to 9.5
Humidity Resistand	ce	Equivalent Series Resistance	Not to exceed120 % of initial requirement	40 ± 2°C, 90 to 95% RH
		Current at 30 minutes	Not to exceed120 % of initial requirement	— 240 ± 8 hours
				· · ·

Item	Specification			Test Conditions Conforming to JIS C 5102 ⁻¹⁹⁹⁴		
High	Capacitance change	Within ±30% of initial value		Conforms to 9.10 Temperature: 85 ± 2°C		
Temperature	Equivalent Series Resistance	Not to exceed 200% of initial requirement	Series res	sistance: 0 Ω		
Load Current at 30 minutes		Not to exceed 200% of initial requirement		Applied voltage: 5.5 VDC Time of test: 1000 ⁺⁴⁸ ₋₀ hours		
Voltage Holding		Charging	(1) Applied Voltage(2) Series Resistation(3) Charging time	ance: 0Ω		
Characteristics	Voltage between terminal leads higher than 4.2V		Storege	(1) Load:(2) Temp.:(3) Humidity:(4) Storage time:	Nothing Less than 25°C Less than 70% RH 24 h	

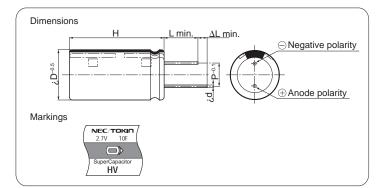
3.5V, 6.5V Rated Voltage Series

Items		Specifications		Test Conditions Conforming to JIS C 5102 ⁻¹⁹⁹⁴
Operating Temperating	ature Range	-25°C to +70°C		
Maximum Rated Voltage		3.5 VDC, 6.5 VDC		
Nominal Capacita	ance Range	See standard ratings		
Capacitance Allo		+80 %, -20 %		See characteristics measuring conditions
Equivalent Series	Resistance	See standard list		See characteristics measuring conditions
Current (30-minu	tes value)	See standard list		See characteristics measuring conditions
	,	Capacitance	More than 90 % of initial requirement	Conforms to 7.14
		Equivalent Series Resistance	Less than 200% of initial requirement	Surge voltage: 4.0 V (3.5 VDC), 7.4 V (6.5 VDC)
		Current 30 minutes	Less than 120% of initial requirement	rated part rated part
Surge Voltage		Appearance	No significant change	Temperature: $70 \pm 2^{\circ}C$ Charging for 30 seconds Discharging for 9 min 30 sec. Number of cycles: 1 000 cycles Charge resistance: 0.022 F 560 Ω 0.027 F 560 Ω 0.043 F 300 Ω 0.056 F 240 Ω No discharge resistance
		Capacitance	More than 50 % of initial value	Conforms to 7.12
	Phase 2	Equivalent Series Resistance	Less than 400% of initial value	Phase 1: +25 ±2°C
		Capacitance	Less than 200% of initial value	Phase 2: –25 ±2°C
Temperature	Phase 5	Equivalent Series Resistance	Initial requirement	Phase 3: –40 ±2°C
Variation of		Current 30 minutes	Less than 1.5 CV (mA)	Phase 4: +25 ±2°C
Characteristics	Phase 6	Capacitance	Within ±20% of initial value	Phase 5: +70 ±2°C
		Equivalent Series Resistance	Initial requirement	- Phase 6: +25 ±2°C
		Current 30 minutes	Initial requirement	-
		Capacitance	·	Conforms to 8.2.3
		Equivalent Series Resistance	Shall meet initial requirements	Frequency: 10 to 55 Hz
Vibration Resista	nce	Current 30 minutes		Time of test: 6 hours
		Appearance	No significant change	-
Solderability		3/ 4 or more of the pin surface should be covered with new solder		Conforms to 8.4 Temperature of solder: $245 \pm 5^{\circ}$ C Time of immersion: 5 ± 0.5 seconds To immerse capacitors up to 1.6 mm from the bottom
		Capacitance		Conforms to 8.5
Soldering Heat		Equivalent Series Resistance	Shall meet initial requirements	Temperature of solder: $260 \pm 10^{\circ}$ C
Resistance		Current 30 minutes		Time of immersion: 10 ± 1 seconds To immerse capacitors up to 1.6 mm
		Appearance	No significant change	from the bottom
		Capacitance		Conforms to 9.3
Temperature Cuo	le	Equivalent Series Resistance	Shall meet initial requirements	Temperature condition:
Temperature Cycle		Current 30 minutes		$-25^{\circ}C$ → normal temperature → +70°C → normal temperature
		Appearance	No significant change	Number of cycles: 5 cycles
		Capacitance	Within ±20% of initial value	Conforms to 9.5
Lumidity Desist		Equivalent Series Resistance	Less than 200% of initial requirement	Temperature: $40 \pm 2^{\circ}C$
Humidity Resistance		Current 30 minutes	Less than 120% of initial requirement	Humidity: 90 to 95% RH Time of test: 240 ± 8 hours
		Appearance	No significant change]
		Capacitance	Within ±30% of initial requirement	Conforms to 9.10
		Equivalent Series Resistance	Less than 300% of initial requirement	Temperature: 70 ± 2°C
High Temperature	e Load	Current 30 minutes	Less than 200% of initial requirement	- Series resistance: 0 Ω Applied voltage: 3.5 VDC, 6.5 VDC
		Appearance	No significant change	Time of test: $1000 \stackrel{+48}{_{-0}}$ hours

FY Series

					Test Conditions	
Items		Specifications		Confo	Conforming to JIS C 5102 ⁻¹⁹⁹⁴	
Operating Tempera	ature Range	-25°C to +70°C				
Maximum Operating Voltage		5.5 Vdc				
Nominal Capacita	ince Range	See standard list				
Capacitance Allow	vance	+80 %, -20 %		See charac	teristics measuring conditions	
Equivalent Series	R esistance	See standard list		See charac	teristics measuring conditions	
Current (30-minut	tes Value)	See standard list			teristics measuring conditions	
		Capacitance	More than 90 % of initial requirement	Conforms	to 7.14	
		Equivalent Series Resistance	Less than 120% of initial requirement	Surge voltage: 6.3 V Temperature: 70 ± 2°C		
		Current at 30 minutes	Less than 120% of initial requirement	Charging f	or 30 seconds	
Surge Voltage		Appearance	Appearance No significant change		$\begin{array}{c} \text{g for 9 min. 30 sec.} \\ \text{f cycles 1 000 cycles} \\ \text{sistance :} \\ 1500 \ \Omega \\ 560 \ \Omega \\ 1.0 \ \text{F} \\ 150 \ \Omega \\ 2.2 \ \text{F} \\ 150 \ \Omega \\ 56 \ \Omega \\ \text{rge resistance} \end{array}$	
	Dhasa 0	Capacitance	More than 50 % of initial value	Conforms	to 7.12	
	Phase 2	Equivalent Series Resistance	Less than 400% of initial value	Phase 1:	+25 ±2°C	
To some small some		Capacitance	Less than 200% of initial value	Phase 2:		
Temperature Variation of	Phase 5	Equivalent Series Resistance	Initial requirement	Phase 3:		
Characteristics		Current at 30 minutes	Less than 1.5 CV (mA)	Phase 4:		
Charaotonotios		Capacitance	Within ± 20% of initial value	Phase 5: Phase 6:		
	Phase 6	Equivalent Series Resistance	Initial requirement	FIIASE 0.	+23±2 C	
		Current at 30 minutes	Initial requirement			
Lead Strength (Tensile)		No loosening nor permanent damage of the leads		FYD0H105Z FYD0H145Z FYD0H225Z FYD0H225Z FYH0H474Z FYH0H105Z Others: 1.0 kg-f 10 ± 1 sec.		
		Capacitance	Capacitance		to 8.2.3	
Vibration Resistar	200	Equivalent Series Resistance Meet initial requirements		Frequency: 10 to 55 Hz Time of test: 6 hours		
VIDIALION RESISTA	ice	Current at 30 minutes		lime of tes	st: 6 hours	
		Appearance	No significant change			
Solderability		3/4 or more of the pin of surface should be covered with the solder		Conforms to 8.4 Temperature of solder: 230 ± 5°C Time of immersion: 5 ± 0.5 second To immerse capacitors up to 1.6 mm from the bottom		
Soldering Heat Resistance			Series Resistance Meet initial requirements Temperature of s Time of immersion		tre of solder: $260 \pm 10^{\circ}$ C mersion: 10 ± 1 seconds	
1.001010100		Current at 30 minutes	No significant change	To immers from the b	e capacitors up to 1.6 mm	
		Appearance Capacitance	ino significant change	Conforms		
Temperature Cyc	le	Equivalent Series Resistance Current at 30 minutes	Shall meet initial requirements	Temperatu –25°C →	re condition: → normal temperature C → normal temperature	
		Visual appearance	No significant change		f cycles: 5 cycles	
		Capacitance	Within ±20% of initial value	Conforms	to 9.5	
Humidity Resistor		Equivalent Series Resistance	Less than 120% of initial requirement	Temperatu	ıre: 40 ±2°C	
Humidity Resistance		Current at 30 minutes	Less than 120% of initial requirement		90 to 95% RH	
		Appearance	No significant change	Time of tes	st: 240 ± 8 hours	
High Temperature Load		Capacitance	Within ±30% of initial value	Conforms		
		Equivalent Series Resistance Less than 200% of initial requirement		Series res	ire: 70 ±2°C istance: 0 O	
		Current at 30 minutes	Less than 200% of initial requirement	- Series resistance: 0 Ω Applied voltage: 5.5 VDC		
		Appearance	No significant change	Time of tes	st: 1000 ⁺⁴⁸ hours	
Voltage Holding Characteristics (Self Discharge)		Voltage between termi	nal leads higher than 4.2 V.	Charging condition	Applied voltage: 5.0 VDC Series resistance: 0 Ω Curging time: 24 hours	
		Voltage between terminal leads higher than 4.2 V.		Storage	Load: Nothing Temperature: Lower than 25°C Humidity: Lower than 70% RH Time: 24 hours	

Super Capacitor HV Series





Standard Rating

Desthic	Max. Rated Voltage	Nominal Capacitance	Max. ESR (at 1 kHz)	Max. Current at 30 minutes		Dim	ensions	(Unit: r	nm)		Weight
Part No.	(Vdc)	(F)	(mΩ)	(mA)	ØD	н	Р	Ød	I	ΔL	(g)
HV0E106N	2.7	10	500	8	10.0	35±2	5.0	0.6	15.0	5.0	3.0
HV0E226N	2.7	22	500	18	12.5	35±2	5.0	0.6	15.0	5.0	3.7
HV0E506N	2.7	50	100	40	18.0	40±5	7.5	0.8	15.0	5.0	9.1
HV0E107N	2.7	100	100	80	22.0	50±5	10.2	1.0	18.0	7.0	2.5

Specifications

- Item		S	pecification	Test Conditions Conforming to JIS C 5102-1994	
	Operating Temperature Range		peemeation		
Maximum Operating Voltage	0	-25°C to +60°C 5.5 Vdc			
Nominal Capacitance Range		10F to 50F			
Capacitance Allowance		+30%			
Equivalent Series Resistance	e (FSR)	See Standard list			
Current at 30 minutes	.0 (2011)	See Standard list			
		Capacitance	More than 50% of initial value	Conforms to 7.12	
	Phase 2	ESR	Not to exceed 4 times initial value	Phase2: -25±2°C	
		Capacitance	Not to exceed 150% of initial value	Phase4: +60±2°C	
Tempere Variation of	Phase 4	ESR	Not to exceed initial requirement	Phase5: +25±2°C	
Characteristics	1 11000 1	Current at 30minutes	Not to exceed 1.5CV(mA)	Phases: +25±2 C	
		$\Delta C/C$	Within ±20% of initial value		
	Phase 5	ESR	Not to exceed initial requirement		
			Not to exceed initial requirement		
Lead Strength (Tensile)			ermanent damage of the leads	Conforms to 8.1.2 (1)	
		Caoacitance	interie damage of the leads	Conforms to 8.2.3 (1)	
		FSR	Meet initial standard value	Frequency: 10 to 55Hz	
Vibration Resistance		Current at 30 minutes		Test duration: 6 hours	
		Appearance	Noobvious abnormality	l'est duration: 6 nours	
		Appearance	NOODVIOUS ADHOITHAIIty	Conforms to 8.4	
Solderability		3/4 or more of the pin surface should be covered with new solder		Solder temperature: 230±5°C Dipping duration: 5±0.5sec. Shold be dipped up to 1.6mm from the lower end of the capacitor	
		Capacitance		Conforms to 8.5	
Soldering Heat Resistance		ESR	Should satisfy initial standard value	Solder temperature: 260±10°C	
Soldening Heat Resistance		Current at 30 minutes	,	Dipping duration: 10±1sec. Shold be dipped up to 1.6mm from the lower	
		Appearance	No obvious abnormality	end of the capacitor	
				Conforms to 9.3	
To an and an Andrea		ESR	Meet initial standard value	Temperature: –25°C→R.T.→+60°C→R.T.	
Temperature Cycle		Current at 30 minutes		Number of cycles: 5 cycles	
		Appearance	No obvious abnormality		
Humidity Resistance		Capacitance	Within ±20% of initial value	Conforms 9.5	
		ESR	1.2 or less time initial standard value	Temperature: 40±2°C	
		Current at 30 minutes	1.2 or less time initial standard value	Relative humidity: 90 to 95% RH Test duration: 240±8hours	
		Appearance	No obvious abnormality	rest duration: 240±8nours	
		Capacitance	Within ±30% of initial value	Conforms 9.10	
			Twice or less times initial standard value	Temperature: 60±2°C	
High Temperature Load Life		ESR Current at 30 minutes	Twice or less times initial standard value	Voltage applied: 5.5Vdc Test duration: 1000 ^{_48} hours	
		Appearance	No obvious abnormality	Series protection resistance: 0Ω	
			· · · · · · · · · · · · · · · · · · ·		

When using our products, the following precautions should be taken.

(1) Safety designing of an apparatus or a system allowing for failures of electronic components used in the system

In general, failures will occur in electronic components at a certain probability. NEC TOKIN makes every effort to improve the quality and reliability of electronic component products. However, it is impossible to completely eliminate the probability of failures. Therefore, when using NEC TOKIN's electronic component products, systems should be carefully designed to ensure redundancy in the event of an accident which would result in injury or death, fire, or social damage, to ensure the prevention of the spread of fire, and the prevention of faulty operation. (Please refer to pre-cautions to be taken when using SuperCapacitor capacitors for the details of failures.)

(2) Quality level of various kinds of parts, and equipment in which the parts can be utilized Electronic components have a standard quality level unless otherwise specified.

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