

## **FPCAP** *Functional Polymer Aluminum Solid Electrolytic Capacitors*

### **Critical Precautions on FPCAP itself**

#### **1. Polarity**

The FPCAP has polarity. Consequently, make sure polarity is never reversed when using. If polarity is reversed, leakage current could increase or lifetime could decrease.

#### **2. Applied Voltage**

Under no circumstances can reverse voltage be applied. It may cause a short circuit.

#### **3. Sudden charge and discharge**

Keep sudden charge and discharge to a minimum. It may create a short circuit or cause high leakage current. In this case, it is recommended to use a protection circuit in order to maintain high reliability. Regardless, using protection circuit to ensure reliability is recommended when the rush current value exceeds 10A. Please make sure to insert a protection resistor of about 1k $\Omega$  for charge and discharge when measuring the leakage current.

#### **4. Soldering**

The soldering conditions must be kept within the permissible range prescribed in the catalog specification. If the specification is not kept, there is the possibility of abnormal appearance and abnormal leakage current and reduced capacitance.

#### **5. Installation on PC board**

When designing the layout of your PC board using the FPCAP please take into consideration the standard mounting specifications. The FPCAP can not be able to be mounted on a PC board if there is insufficient space.

#### **6. Directions for use in circuits**

Since leakage current fluctuations can occur during the soldering process the FPCAP cannot be used in the following circuits.

- (1) High impedance voltage retention circuits
- (2) Coupling circuits
- (3) Time constant circuits
- (4) Circuits greatly affected by leakage current
- (5) Connecting two or more FPCAP in series

## General Precautions at Designing, for Use and Handling

### 1. Circuit design precautions

(1) Check the rated performance

After checking the operation and installation environments, design the circuit so that it falls within the rated performance range stipulated in the catalog specification.

(2) Operating temperature and ripple current

a) Set the operating temperature so that it falls within the range stipulated in the catalog specification.

b) Do not apply current that exceeds the allowable ripple current in the catalog.

(3) Leakage current

Even when the soldering conditions fall within the range of the catalog specification, the leakage current increases slightly. It also increases slightly during high temperature no-load, moisture-proof no-load and temperature cycling tests with no voltage applied.

In cases such as these, leakage current will decrease by applying voltage in conditions below the maximum operating temperature.

(4) Applied voltage Considerations

a) Make sure the sum of the peak DC voltage and ripple voltage values does not exceed the rated voltage.

b) Please do not apply the reverse voltage to **FPCAP**.

c) When the DC voltage is low, please check whether the peak value of ripple voltage does not become a reverse voltage.

(5) Reduction of failure stress

The main failure mode of the **FPCAP** is in the open mode primarily caused by an electrostatic capacitance drop.

Random short circuit mode failures occur rarely.

The time it takes to reach the failure mode can be extended by using the **FPCAP** with reduced ambient temperature, ripple current and applied voltage.

(6) Capacitor insulation

a) Insulation is not guaranteed.

b) Be sure to completely separate the case, negative electrode terminal and positive electrode terminal from adjacent components and PC board traces.

(7) Operating environment

Do not use the **FPCAP** in the following environments.

a) Places where it can come into direct contact with water or salt water and places where condensation may form.

b) Places filled with noxious gasses such as: hydrogen sulfide, sulfurous acid, nitrous acid, chlorine, ammonia, etc.

c) Places exposed to ozone, ultraviolet rays and radiation.

d) Where severe vibration or shock which exceeds the condition specified in the specification sheets.

(8) Assembly Conditions Considerations

In designing a circuit, the following conditions should be checked before the **FPCAP** is mounted on the PC board.

a) The pitch and diameter of PCB holes to which the **FPCAP** is mounted, shall be designed in conformance with the dimensional tolerance stipulated in the catalog specifications.

(9) PC board

Avoid locating heat-generating components around the **FPCAP** and on the underside of the PC board under the **FPCAP**.

(10) Parallel connection

When used in a parallel connection with another capacitor, carefully select the type of capacitor.

(11) Other

a) Electrical characteristics are affected by fluctuations in temperature and frequency.

b) When mounting the **FPCAP** on a double-sided PC board, design the board so that extra PC board holes are not located underneath the **FPCAP**.

## 2. Mounting precautions

### (1) Things to know before mounting

- a) Do not reuse the **FPCAP** that has already been assembled in a device and energized.  
Excluding the **FPCAP** that has been removed for measuring electrical characteristics during a periodic inspection, they cannot be reused.
- b) Leakage current may increase if the part has been stored for a long period of time.  
In this case, use after voltage treatment under the rated voltage.

### (2) Mounting-1

- a) Mount after checking the capacitance and the rated voltage.
- b) Mount after checking the polarity.
- c) Do not drop on the floor and do not use parts that have been dropped.
- d) Do not deform and then mount.

### (3) Mounting-2

- a) Mount after checking the match between the lead pitch and the PC board holes pitch.
- b) When an automatic insertion equipment is used to clinch the lead wires, make sure it is set correctly.
- c) Be careful of the shock force that can be produced by the automatic insertion equipment.
- d) Do not apply excessive external force to the lead wires, the **FPCAP** itself, or the electrode terminals.

### (4) Soldering with a soldering iron

- a) Set the soldering conditions (temperature, time) so that they fall within the range stipulated by the catalog specification.
- b) When the lead wire terminal must be processed because the terminal spacing and the PC board holes spacing do not match, process it before soldering so that no stress is applied to the **FPCAP** itself.
- c) Do not subject the **FPCAP** itself to excessive stress when soldering with a soldering iron.
- d) When a soldering iron is used to repair the **FPCAP** that has already been soldered once and needs to be removed, do it after the solder has been completely melted so that no stress is applied to the **FPCAP** terminals.
- e) Do not let the tip of the soldering iron touch the **FPCAP** itself.
- f) The amount of leakage current after soldering may increase a slightly (from a few  $\mu\text{A}$  to several hundred  $\mu\text{A}$ ) depending on the soldering condition (preheating and solder temperature and time, PC board material and thickness, etc.)  
The leakage current can be reduced by applying voltage.

### (5) Flow soldering (Radial lead type)

- a) Never submerge the **FPCAP** in molten solder. Use the PC board to protect the **FPCAP** and only solder the opposite side of the board that the **FPCAP** is mounted on.
- b) Set the soldering conditions (soldering temperature, terminal submersion time) so that they fall within the range stipulated by the catalog specification. The amount of leakage current after soldering may increase slightly (from a few  $\mu\text{A}$  to several hundred  $\mu\text{A}$ ) depending on the soldering conditions (preheating and solder temperature and time, PC board material and thickness, etc.). The leakage current can be reduced through self-repair by applying voltage.
- c) Take care that flux does not adhere to any place other than the terminals.
- d) When soldering, take care that other components do not fall over and touch the **FPCAP**.
- e) Flow soldering under extremely abnormal conditions may reduce the capacitance of products before or after soldering.

### (6) Reflow soldering (SMD type)

Do not use reflow soldering for Radial lead type (Through Hole).

- a) Never submerge the **FPCAP** in molten solder. Use the PC board to protect the **FPCAP** and only solder the opposite side of the board that the **FPCAP** is mounted on.
- b) Set the soldering conditions (soldering temperature, terminal submersion time) so that they fall within the range stipulated by the catalog specification. The amount of leakage current after soldering may increase slightly (from a few  $\mu\text{A}$  to several hundred  $\mu\text{A}$ ) depending on the soldering conditions (preheating and solder temperature and time, PC board material and thickness, etc.). The leakage current can be reduced through self-repair by applying voltage.
- c) Take care that flux does not adhere to any place other than the terminals.
- d) When soldering, take care that other components do not fall over and touch the **FPCAP**.
- e) Reflow soldering under extremely abnormal conditions may reduce the capacitance of products before or after soldering.
- f) Do not use VPS (Vapor Phase Soldering).

## (7) Handling after soldering

- a) Do not tilt, bend or twist the **FPCAP** after it has been soldered on the PC board.
- b) Do not use the **FPCAP** as a handle to move the PC board after it has been attached to it.
- c) Do not bump the **FPCAP** with objects after it has been soldered to the PC board. Make sure the **FPCAP** does not touch other PC boards or components.
- d) Do not subject to excessive stress after it has been soldered to the PC board.

## (8) Washing the PC board

Check the following items before washing the PC board with these detergents; high quality alcohol-based cleaning fluid such as Pine- $\alpha$  ST-100S, Clean-thru 750H, 750L, 750K, or Techno Care FRW14 through 17; or detergents including substitute Freon such as AK-225AES and IPA.

- a) Use immersion or ultrasonic wave to clean for a total of less than five minutes.
- b) The temperature of the cleaning fluid should be less than 60°C.
- c) Watch for contamination of the detergent (conductivity, pH, specific gravity, water content, etc.).
- d) After cleaning do not store in a location subject to gases from the cleaning fluid or in an airtight container.  
Dry the PC board and the **FPCAP** using hot air (less than the maximum operating temperature).
- e) Please contact our company for details about detergents and cleaning methods, and about detergents other than those listed above.

## (9) Fixatives and coatings

- a) Select appropriate material for the **FPCAP** marking material and sealant.  
In particular, make sure the fixative, coating and thinner do not contain acetone or toluene.
- b) Before applying a fixative or coating, completely remove any flux residue and foreign matter from the area where the PC board and the **FPCAP** are to be joined together.
- c) Allow any detergent to dry before applying the fixative or coating.
- d) Please contact our company for fixative and coating heat curing conditions.

## 3. Precautions with completed board

- (1) Do not directly touch the **FPCAP** terminals.
- (2) Do not use electric conductors to cause a short circuit between the **FPCAP** terminals.  
Do not subject the **FPCAP** to conductive solutions.
- (3) Check the installation environment of the board on which the **FPCAP** is mounted.
- (4) Aging of the completed board, please use the voltage below the rated voltage of the capacitor.
- (5) It is recommended that the board be used at room temperature and in ordinary humidity.  
For details, refer to the Operating Precaution Guidelines for the EIAJ RCR-2367C. (Safety Application Guide for fixed aluminum electrolytic capacitors for use in electronic equipment.)  
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## 4. If trouble should occur

- (1) In the event that a short circuit causes the current to become relatively small (Radial lead type : less than approximately 3A for  $\phi 10$  and less than approximately 1A for  $\phi 6.3$ ), the **FPCAP** itself will generate some heat, but the appearance will not be affected even when electricity is supplied continuously. However, if there is a short circuit and the current value exceeds the above mentioned values, the temperature inside the **FPCAP** will increase.  
When the temperature exceeds approximately 200°C the internal pressure will increase, and an odorous gas will be released.  
In this case, do not allow contact with your face and hands.
- (2) If a short circuit occurs and an odorous gas is released, either turn off the device's main power or unplug the power cord from the outlet.
- (3) If a short circuit should occur, it may take anywhere from a few seconds to a few minutes until an odorous gas develops, depending on the conditions. Design the device so that a power protection circuit works during this time period.

- (4) If the gas gets in your eyes, rinse them immediately. If it has been inhaled, gargle with water immediately.
- (5) When the polymer or gas of the polymer comes in contact with your skin, wash it off with soap and water.
- (6) The electrolyte, separator paper, rubber and tube used in the **FPCAP** are all combustible. When the current value is extraordinarily high during a short circuit, and assuming the worst possibility, the shorted-out section in the lead wire or inside the capacitor could create a spark, and cause the resin or tube to catch fire.  
Give due consideration to the capacitors mounting methods, mounting positions, pattern design etc.

## 5. Storage conditions

Do not store capacitors without load more than a year because of potential increased leakage current.

- (1) Do not store at high temperatures and high humidity. Store it in a location that is not subject to direct sunlight and that has low temperatures and humidity (generally, temperatures between 5 and 35°C and a relative humidity of 75% or less).  
(SMD type VA/VB series : Temperatures between 5 and 30°C and a relative humidity of 70% or less)
- (2) Storage period (SMD type VA/VB series)  
Store in an aluminum laminated bag.  
Before opening : 1 year  
After opening : 1 week (Use up all the products after having opened out. Surplus products should be put into the aluminum laminated bag, and seal up.)
- (3) Baking conditions (SMD type VA/VB series)  
When you use it exceeding a storage term, please carry out and use baking by the following conditions.  
Temperature: 60(+0, -5) °C  
Time: 168hours (only one time)
- (4) Store in an airtight plastic bag to keep the leads in good condition.
- (5) To keep the leads in good condition, store lead-type the **FPCAP** for no more than one year.
- (6) Do not store in places where water, salt water or oil can directly fall on them, or places where condensation may form.
- (7) Do not store in places filled with noxious gas (hydrogen sulfide, sulfurous acid, nitrous acid, chlorine, ammonia, etc.).
- (8) Do not store in places exposed to ozone, ultraviolet rays and radiation.

## 6. Disposal

Please treat the **FPCAP** as industrial waste when needing to dispose of the **FPCAP**.

For details, refer to the Operating Precaution Guidelines for the EIAJ RCR-2367C. (Safety Application Guide for fixed aluminum electrolytic capacitors for use in electronic equipment.)  
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FPCAP Functional Polymer Aluminum Solid Electrolytic Capacitors

Type numbering system (Example:2.5V560μF L8)  
Nichicon Part Number

R	L8	0E	561	M	DN	1	
Type	Series name	Rated Voltage	Rated Capacitance	Capacitance Tolerance	Configuration VA/VB series Size Code :N	Control code	Taping & Lead Forming

FPCAP Part Number

FP	—	2R5	RE	561	M	—	L8	R	
Commodity Mark		Rated Voltage	Classification	Rated Capacitance	Capacitance Tolerance		Series name	Taping & Lead Forming	Control code

Type & Classification

Type & Classification	Nichicon P/N Symbol	FPCAP P/N Symbol
Radial Lead Type	R	RE
SMD Type		ME
		CM

Series Name

Classification	Series
Radial Lead Type	NS
	R7
	R5
	L8
	E5
	S8
	F8
	NU
	NE
	S6
SMD Type	HT
	PS, PA
	HS, HA
	SS, SA, SB
	FS
	SL
	VA, VB

Rated Voltage

Voltage [V]	Nichicon P/N Symbol	FPCAP P/N Symbol
2.5	0E	2R5
4.0	0G	4R0
6.3	0J	6R3
10	1A	010
16	1C	016
20	1D	020
25	1E	025
35	1V	035
50	1H	050
63	1J	063

Rated Capacitance

Capacitance [μF]	Symbol
8.2	8R2
10	100
22	220
100	101
220	221
1500	152

Capacitance Tolerance

Tolerances	Symbol
± 20%	M

Control code\*

Endurance	Nichicon P/N Symbol	FPCAP P/N Symbol
5000hrs	ASQ	-5K
2000hrs	1	no sign
VA/VB series	no sign	no sign

\* In case of endurance

Taping & Lead Forming

Classification	Taping & Lead Forming	Case Size (mm)	Nichicon P/N Symbol	FPCAP P/N Symbol
Radial Lead Type	Long lead (Bulk)	All	no sign	R
	Cut lead (Bulk)	All	CG	CG
	2.5mm pitch taping	φ5×8, φ6.3×5 to 8	JT	JT
		φ5×10, φ6.3×10	JX	J
	3.5mm pitch taping	φ8	KX	K
	5.0mm pitch taping	φ5, φ6.3, φ8	PX	P
		φ10	PH	PH
SMD Type	Taping	Height under 5.2mm	GB	R
		Height over 5.7mm	GS	
		7.3×4.3×2.8	G	
	Bulk	All	no sign	N