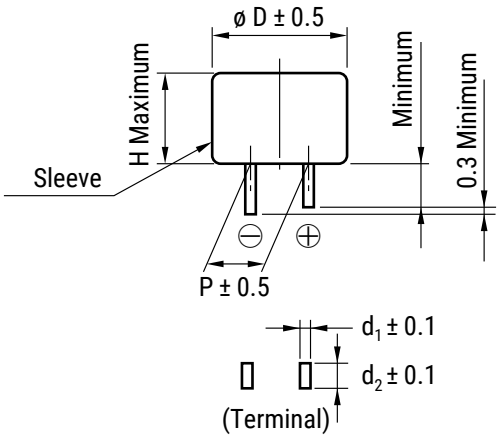
## Overview

FG Series Supercapacitors, also known as Electric Double-Layer Capacitors (EDLCs), are intended for high energy storage applications.

Supercapacitors have characteristics ranging from traditional capacitors and batteries. As a result, supercapacitors can be used like a secondary battery when applied in a DC circuit. These devices are best suited for use in low voltage DC hold-up applications such as

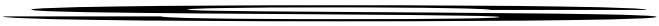
- Maintenance free
- 3.5 VDC and 5.5 VDC
- Highly reliable against liquid leakage

| FG | 0H | 104 | Z | F |
|---|---|---|---|---|
| Series | Maximum Operating Voltage | Capacitance Code (F) | Capacitance Tolerance | Environmental |
| FG<br>FGH | 0V = 3.5 VDC<br>0H = 5.5 VDC | First two digits represent | | F = Lead-free |




| | ø D | H | P | | $d_1$ | $d_2$ |
|---|---|---|---|---|---|---|
| FG0H103ZF | 11.0 | 5.5 | 5.08 | 2.7 | 0.2 | 1.2 |
| FG0H223ZF | 11.0 | 5.5 | 5.08 | 2.7 | 0.2 | 1.2 |
| FG0H473ZF | 11.0 | 5.5 | 5.08 | 2.7 | 0.2 | 1.2 |
| FG0H104ZF | 11.0 | 6.5 | 5.08 | 2.7 | 0.2 | 1.2 |
| FG0H224ZF | 13.0 | 9.0 | 5.08 | 2.2 | 0.4 | 1.2 |
| FG0H474ZF | 14.5 | 18.0 | 5.08 | 2.4 | 0.4 | 1.2 |
| FG0H105ZF | 16.5 | 19.0 | 5.08 | 2.7 | 0.4 | 1.2 |
| FG0H225ZF | 21.5 | 19.0 | 7.62 | 3.0 | 0.6 | 1.2 |
| FG0H475ZF | 28.5 | 22.0 | 10.16 | 6.1 | 0.6 | 1.4 |
| FG0V155ZF | 16.5 | 14.0 | 5.08 | 3.1 | 0.4 | 1.2 |
| FGH0H104ZF | 11.0 | 5.5 | 5.08 | 2.7 | 0.2 | 1.2 |
| FGH0H224ZF | 11.0 | 7.0 | 5.08 | 2.7 | 0.2 | 1.2 |
| FGH0H474ZF | 16.5 | 8.0 | 5.08 | 2.7 | 0.4 | 1.2 |
| FGH0H105ZF | 21.5 | 9.5 | 7.62 | 3.0 | 0.6 | 1.2 |
| FGH0V474ZF | 13.0 | 7.5 | 5.08 | 2.7 | 0.4 | 1.2 |
| | 14.5 | 18.0 | 5.08 | 2.4 | 0.4 | 1.2 |
| | 16.5 | 19.0 | 5.08 | 2.7 | 0.4 | 1.2 |
| | 21.5 | 19.0 | 7.62 | 3.0 | 0.6 | 1.2 |

Supercapacitors should not be used for applications such as ripple absorption because of their high internal resistance

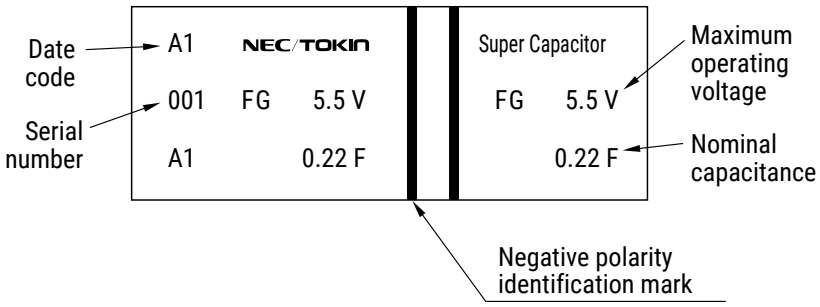
s 

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| FG0V155ZF | 3.5 | 1.5 | 2.2 | 65 | 1.5 | – | 5.2 |
| FG0H103ZF | 5.5 | 0.010 | 0.013 | 300 | 0.015 | 4.2 | 0.9 |
| FG0H223ZF | 5.5 | 0.022 | 0.028 | 200 | 0.033 | 4.2 | 1.0 |
| FG0H473ZF | 5.5 | 0.047 | 0.060 | 200 | 0.071 | 4.2 | 1.0 |
| **FG0H104ZF** | 5.5 | 0.10 | 0.13 | 100 | 0.15 | 4.2 | 1.3 |
| FGH0H104ZF | 5.5 | – | 0.10 | 100 | 0.15 | 4.2 | 1.0 |
| FG0H224ZF | 5.5 | 0.22 | 0.28 | 100 | 0.33 | 4.2 | 2.5 |
| FGH0H224ZF | 5.5 | – | 0.22 | 100 | 0.33 | 4.2 | 1.3 |
| **FGH0H105ZF** | 5.5 | 0.47 | 1.0 | 35 | 1.5 | 4.2 | 7.2 |
| FGH0H474ZF | 5.5 | – | 0.47 | 65 | 0.71 | 4.2 | 4.1 |
| **FGH0V474ZF** | 3.5 | – | 0.47 | 25 | 0.42 | – | 2.6 |
| **FG0H474ZF** | 5.5 | 0.47 | 0.60 | 120 | 0.71 | 4.2 | 5.1 |
| | 5.5 | 0.47 | 0.60 | 120 | 0.71 | 4.2 | 5.1 |
| **FG0H105ZF** | 5.5 | 1.0 | 1.3 | 65 | 1.5 | 4.2 | 7.0 |
| | 5.5 | 1.0 | 1.3 | 65 | 1.5 | 4.2 | 7.0 |
| **FG0H225ZF** | 5.5 | 2.2 | 2.8 | 35 | 3.3 | 4.2 | 12.1 |
| | 5.5 | 2.2 | 2.8 | 35 | 3.3 | 4.2 | 12.1 |
| FG0H475ZF | 5.5 | 4.7 | 6.0 | 35 | 7.1 | 4.2 | 27.3 |

*3.3*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Maximum Operating Voltage | | 5.5 VDC, 3.5 VDC | | 5.5 VDC | | | |
| Capacitance | | | | | | | |
| Capacitance Allowance | | | | | | | |
| | | | | | | | |
| Current (30 minutes value) | | | | | | | |
| Surge | Capacitance | | | | | Surge voltage: | 6.3 V (5.5 V type)<br>4.0 V (3.5 V type) |
| | | | | | | Charge: | 30 seconds |
| | | | | | | Discharge: | 9 minutes 30 seconds |
| | | | | | | Number of cycles: | 1,000 |
| | | | | | | Series resistance: | |
| | Current (30 minutes value) | | | | | | |
| | | | | | | Discharge resistance: | |
| | Appearance | No obvious abnormality | | No obvious abnormality | | Temperature: | |
| Characteristics in Different Temperature | Capacitance | Phase 2 | initial value | Phase 2 | initial value | Conforms to 4.17<br>Phase 1: | |
| | | | initial value | | initial value | Phase 2: | |
| | Capacitance | Phase 3 | | Phase 3 | initial value | Phase 3: | |
| | | | | | initial value | Phase 4: | |
| | Capacitance | Phase 5 | initial value | Phase 5 | initial value | Phase 5: | |
| | | | Satisfy initial ratings | | Satisfy initial ratings | | |
| | Current (30 minutes value) | | | | | Phase 6: | |
| | Capacitance | Phase 6 | initial value | Phase 6 | initial value | | |
| | | | Satisfy initial ratings | | Satisfy initial ratings | | |
| | Current (30 minutes value) | | Satisfy initial ratings | | Satisfy initial ratings | | |
| Vibration | Capacitance | Satisfy initial ratings | | Satisfy initial ratings | | Conforms to 4.13<br>Frequency: | |
| | | | | | | Testing Time: | 6 hours |
| | Current (30 minutes value) | | | | | | |
| | Appearance | No obvious abnormality | | No obvious abnormality | | | |
| Solderability | | Over 3/4 of the terminal should be covered by the new solder | | Over 3/4 of the terminal should be covered by the new solder | | Conforms to 4.11<br>Solder temp:<br>Dipping time: | <br><br>5±0.5 seconds |
| | | | | | | 1.6 mm from the bottom should be dipped. | |

| | | | | |
|---|---|---|---|---|
| Solder Heat | Capacitance<br><br>Current (30 minutes value) | Satisfy initial ratings | Satisfy initial ratings | Conforms to 4.10<br>Solder temp:<br>Dipping time: 10±1 seconds<br>1.6 mm from the bottom should be dipped. |
| | Appearance | No obvious abnormality | No obvious abnormality | |
| Temperature Cycle | Capacitance<br><br>Current (30 minutes value) | Satisfy initial ratings | Satisfy initial ratings | Conforms to 4.12<br>Temperature Condition: Minimum temperature<br>» Category maximum temperature<br>Number of cycles: 5 cycles |
| | Appearance | No obvious abnormality | No obvious abnormality | |
| High Temperature and High Humidity | Capacitance<br><br>Current (30 minutes value) | | | Conforms to 4.14<br>Temperature:<br>Testing time: 240±8 hours |
| | Appearance | No obvious abnormality | No obvious abnormality | |
| High Temperature Load | Capacitance | | | Conforms to 4.15<br>Temperature: Category maximum<br>Voltage applied: Maximum operating voltage<br>Series protection resistance:<br>Testing time:<br>hours |
| | | | | |
| | | | | |
| | | | | |




| | |
|---|---|
| FG0H103ZF | 2,000 pieces |
| FG0H223ZF | 2,000 pieces |
| FG0H473ZF | 2,000 pieces |
| FG0H104ZF | 1,600 pieces |
| FG0H224ZF | 800 pieces |
| FG0H474ZF | 300 pieces |
| FG0H105ZF | 240 pieces |
| FG0H225ZF | 90 pieces |
| FG0H475ZF | 50 pieces |
| FG0V155ZF | 160 pieces |
| FGH0H104ZF | 2,000 pieces |
| FGH0H224ZF | 1,600 pieces |
| FGH0H474ZF | 600 pieces |
| FGH0H105ZF | 90 pieces |
| FGH0V474ZF | 800 pieces |
| | 300 pieces |
| | 240 pieces |
| | 90 pieces |

By changing the solder plating from leaded solder to lead-free solder and the outer tube material of can-cased conventional supercapacitor from polyvinyl chloride to polyethylene terephthalate (PET), our supercapacitor is now even friendlier to the environment.

| | | | Sleeve |
|---|---|---|---|
| FG | FG0H103ZF | b | PET (Blue) |
| | FG0H223ZF | b | PET (Blue) |
| | FG0H473ZF | b | PET (Blue) |
| | FG0H104ZF | b | PET (Blue) |
| | FG0H224ZF | a | PET (Blue) |
| | FG0H474ZF | a | PET (Blue) |
| | FG0H105ZF | a | PET (Blue) |
| | FG0H225ZF | a | PET (Blue) |
| | FG0H475ZF | a | PET (Blue) |
| | FG0V155ZF | a | PET (Blue) |
| | FGH0H104ZF | b | PET (Blue) |
| | FGH0H224ZF | b | PET (Blue) |
| | FGH0H474ZF | a | PET (Blue) |
| | FGH0H105ZF | a | PET (Blue) |
| | FGH0V474ZF | a | PET (Blue) |
| | | a | 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*

measurement, the capacitor is discharged by shorting both pins of the device for at least 30 minutes. In addition, use the polarity indicator on the device to determine correct orientation of capacitor for charging.

Eo: 3.0 (V) Product with maximum operating voltage of 3.5 V
5.0 (V) Product with maximum operating voltage of 5.5 V
6.0 (V) Product with maximum operating voltage of 6.5 V
10.0 (V) Product with maximum operating voltage of 11 V
12.0 (V) Product with maximum operating voltage of 12 V

(seconds)

| | FA | FE | FS | FY | | | | | | FG | FGH | FT | | HV |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | FYD | FYH | FYL | | | | | | | | |
| 0.010 F | – | – | – | – | – | | – | | – | | – | – | – | – |
| 0.022 F | | – | | | | | | | – | | – | – | Discharge | – |
| 0.033 F | – | – | – | – | – | – | – | Discharge | – | – | – | – | – | – |
| 0.047 F | | | | | | | | | | | – | – | – | – |
| 0.10 F | | | | | | – | | | | | Discharge | | Discharge | – |
| 0.22 F | | | | | | – | | 0H: Discharge | – | | Discharge | | Discharge | – |
| 0.33 F | – | – | – | – | – | – | – | – | Discharge | – | – | – | – | – |
| 0.47 F | | | | | | – | | – | – | | Discharge | | Discharge | – |
| 1.0 F | | | | | | – | | – | – | | Discharge | | Discharge | Discharge |
| 1.4 F | – | – | – | | – | – | – | – | – | – | – | – | – | – |
| 1.5 F | – | | – | – | – | – | – | – | – | | – | – | – | – |
| 2.2 F | – | – | – | | – | – | – | – | – | | – | | – | – |
| 2.7 F | – | – | – | – | – | – | – | – | – | – | – | – | – | Discharge |
| 3.3 F | – | – | – | – | – | – | – | – | – | – | – | | – | – |
| 4.7 F | – | – | – | – | – | – | – | – | – | | – | – | – | Discharge |
| 5.0 F | – | – | | – | – | – | – | – | – | – | – | – | – | – |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |

As shown in the diagram below, charging is performed for a duration of 30 minutes once the voltage of the capacitor 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 per 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 1 F.*

As shown in the diagram below, charging is performed for a duration of 30 minutes once the voltage of the capacitor terminal reaches 3.5 V. Then, use a constant current load device and measure the time for the terminal voltage to drop from 1.8 to 1.5 V upon discharge at 1.0 mA per 1.0 F, for example, and calculate the static capacitance according to the equation shown below.

$$C = \frac{I \times (T_2 - T_1)}{V_1 - V_2} \quad (F)$$

As shown in the diagram below, charging is performed for a duration of 30 minutes once the voltage of the capacitor terminal reaches maximum operating voltage. Then, use a constant current load device and measure the time for the terminal voltage to drop from 2.0 to 1.5 V upon discharge at 1.0 mA per 1.0 F, and calculate the static capacitance according to the equation shown below.

Current shall be calculated from the equation below. Prior to measurement, both lead terminals must be short-circuited for a minimum of 30 minutes. The lead terminal connected to the metal can case is connected to the negative side of the power supply.

Eo: 2.5 VDC (HV Series 50 F)
2.7 VDC (HV Series except 50 F)
3.0 VDC (3.5 V type)
5.0 VDC (5.5 V type)

according to the capacitor polarity for 24 hours, then releasing between the pins for 24 hours and measuring the pin-to-

the soldering is checked.

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

1.1 Useful life
The FC Series Supercapacitor (EDLC) uses an electrolyte in a sealed container. Water in the electrolyte can evaporate while in use over long periods of time at high temperatures, thus reducing electrostatic capacity which in turn will create greater internal resistance. The characteristics of the supercapacitor can vary greatly depending on the environment in which it is used. Basic breakdown mode is an open mode due to increased internal resistance.

times this amount. Therefore, we assume that the fail rate is below 0.06 Fit.

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

1.4 Use of capacitor as a smoothing capacitor (ripple absorption)
As supercapacitors contain a high level of internal resistance, they are not recommended for use as smoothing capacitors in electrical circuits. Performance may be compromised and, in some cases, leakage or damage may occur if a supercapacitor is used in ripple absorption.

1.5 Series connections
As applied voltage balance to each supercapacitor is lost when used in series connection, excess voltage may be applied to some supercapacitors, which will not only negatively affect its performance but may also cause leakage and/or damage. Allow ample margin for maximum voltage or attach a circuit for applying equal voltage to each supercapacitor (partial pressure resistor/voltage divider) when using supercapacitors in series connection. Also, arrange supercapacitors so that the temperature between each capacitor will not vary.

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

1.7 Use next to heat emitters

and posistors, etc.) where the supercapacitor itself may become heated.

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

capacitor into a soldering dip tank.

2.2 Flow soldering conditions

2.3 Installation using a soldering iron
Care must be taken to prevent the soldering iron from touching other parts when soldering. Keep the tip of the soldering

Internal capacitor resistance is likely to increase if the terminals are overheated.

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

2.5 Cleaning, Coating, and Potting
Except for the FM series, cleaning, coating and potting must not be carried out. Consult KEMET if this type of procedure is necessary. Terminals should be dried at less than the maximum operating temperature after cleaning.

3.1 Temperature and humidity

change.

3.2 Environment conditions
Make sure there are no corrosive gasses such as sulfur dioxide, as penetration of the lead terminals is possible. Always store this item in an area with low dust and dirt levels. Make sure that the packaging will not be deformed through heavy loading, movement and/or knocks. Keep out of direct sunlight and away from radiation, static electricity and magnetic

3.3 Maximum storage period
This item may be stored up to one year from the date of delivery if stored at the conditions stated above.