

## Data Sheet

**Customer:**

**Product:** Aluminum Solid Electrolytic Capacitors – AVEA Series

**Part No.:** 0506/0606/0610/0645/0807/0810

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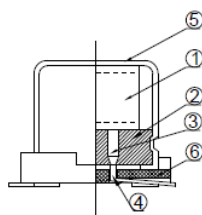
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## Aluminum Solid Electrolytic Capacitors

### Features

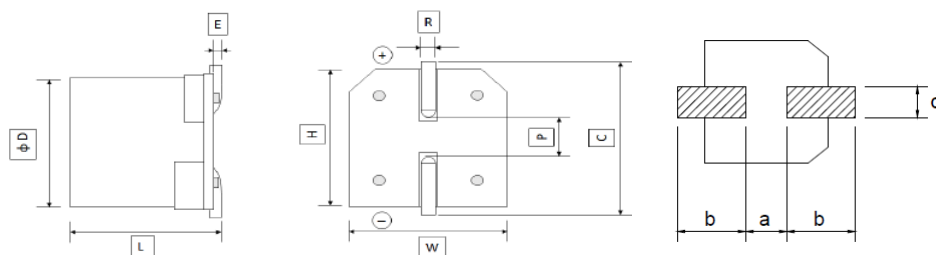
- Standard SMD type
- Rated voltage : 2.5~35Vdc
- Endurance : 2,000 hours at 105°C
- Suitable for DC-DC converters , voltage regulators and decoupling applications
- RoHS Compliant

### Construction



①	Element	④	Lead Wire
②	Seal	⑤	Case
③	Aluminum Tab	⑥	Base Plate

### Dimensions



Soldering pad

Unit: mm

Type	D	L	E	W	H	C	R	P	a	b	c
AVEA0506	5.0±0.5	5.8±0.2	0.00~0.20	5.3±0.2	5.3±0.2	6.0±0.2	0.5~0.8	1.4±0.2	1.4	3.0	1.6
AVEA0606	6.3±0.5	5.8±0.2	0.00~0.20	6.6±0.2	6.6±0.2	7.3±0.2	0.5~0.8	2.1±0.2	2.1	3.5	1.6
AVEA0610	6.3±0.5	9.7±0.3	0.00~0.20	6.6±0.2	6.6±0.2	7.3±0.2	0.6~0.9	2.1±0.2	2.1	3.5	1.6
AVEA0645	6.3±0.5	4.3±0.2	0.00~0.20	6.6±0.2	6.6±0.2	7.3±0.2	0.5~0.8	2.1±0.2	2.1	3.5	1.6
AVEA0807	8.0±0.5	6.8±0.2	0.00~0.20	8.3±0.2	8.3±0.2	9.0±0.2	0.8~1.1	2.9±0.2	2.9	4.15	1.9
AVEA0810	8.0±0.5	9.7±0.3	0.00~0.20	8.3±0.2	8.3±0.2	9.0±0.2	0.8~1.1	2.9±0.2	2.9	4.15	1.9

### Marking

The color of marking ink is red



(1)	Polarity	(4)	Production Period Code
(2)	Series	(5)	Rated Capacitance
(3)	Year Code EX: V-2015(WX), W-2016(WX)	(6)	Rated Voltage

## Aluminum Solid Electrolytic Capacitors

### Product Identification

AVEA	0606	M	T	6V3	101
Product Type	Dimensions (DxL)	Capacitance Tolerance	Packaging Code	Rated Voltage	Capacitance
	0506: 5.0x5.8 0606: 6.3x5.8 0610: 6.3x9.7 0645: 6.3x4.3 0807: 8.0x6.7 0810: 8.0x9.7	M: $\pm 20\%$	T: Taping Reel	2V5: 2.5V 4V0: 4.0V 6V3: 6.3V 100: 10V 160: 16V 250: 25V 350: 35V	470: 47uF 101: 100uF

### Standard Ratings

#### 0506 Type

Part No.	Rated Voltage	Surge Voltage	Capacitance (uF)	Leakage Current (uA)	$\tan \delta$	ESR (m $\Omega$ max/20°C, 100K to 300KHz)	Rated Ripple Current (mA rms/105°C 100KHz)
AVEA0506MT6V3221	6.3	7.2	220	500	0.12	15	3150
AVEA0506MT160101	16	18.4	100	320	0.12	27	3000

#### 0606 Type

Part No.	Rated Voltage	Surge Voltage	Capacitance (uF)	Leakage Current (uA)	$\tan \delta$	ESR (m $\Omega$ max/20°C, 100K to 300KHz)	Rated Ripple Current (mA rms/105°C 100KHz)
AVEA0606MT2V5331	2.5	2.9	330	413	0.12	15	3160
AVEA0606MT2V5391	2.5	2.9	390	292	0.12	10	3900
AVEA0606MT2V5561	2.5	2.9	560	700	0.12	10	3900
AVEA0606MT4V0221	4.0	4.6	220	440	0.12	25	2500
AVEA0606MT4V0331	4.0	4.6	330	660	0.12	15	3160
AVEA0606MT6V3101	6.3	7.2	100	315	0.12	27	2400
AVEA0606MT6V3151	6.3	7.2	150	473	0.12	15	2700
AVEA0606MT6V3221	6.3	7.2	220	277	0.12	15	3160
AVEA0606MT6V3331	6.3	7.2	330	416	0.12	17	3390
AVEA0606MT100121	10.0	11.5	120	600	0.12	25	2530
AVEA0606MT100151	10.0	11.5	150	300	0.12	21	2880
AVEA0606MT160470	16.0	18.4	47	376	0.12	25	2500
AVEA0606MT160680	16.0	18.4	68	300	0.12	25	2440
AVEA0606MT160101	16.0	18.4	100	320	0.12	24	2490
AVEA0606MT160181	16.0	18.4	180	576	0.12	22	3300
AVEA0606MT200121	20	23	120	480	0.12	25	3200
AVEA0606MT250270	25	28.8	27	135	0.12	40	2100
AVEA0606MT250470	25	28.8	47	235	0.12	30	2500
AVEA0606MT250560	25	28.8	56	280	0.12	30	2800
AVEA0606MT350220	35	40.3	22	154	0.12	50	1300

#### 0610 Type

Part No.	Rated Voltage	Surge Voltage	Capacitance (uF)	Leakage Current (uA)	$\tan \delta$	ESR (m $\Omega$ max/20°C, 100K to 300KHz)	Rated Ripple Current (mA rms/105°C 100KHz)
AVEA0610MT2V5821	2.5	2.9	820	500	0.12	9	4500
AVEA0610MT100221	10	11.5	220	440	0.12	15	3100
AVEA0610MT160181	16	18.4	180	576	0.12	11	4460
AVEA0610MT160271	16	18.4	270	864	0.12	16	3500

■ Category temperature range: -55~+105°C

■ Surge voltage: rated voltage\*1.15

■ Rated ripple current: Rated ripple current shall be in accordance with standard ratings list.

These current are rms values of sine wave of 100KHz at 105°C

**■ Standard Ratings**
0645 Type

Part No.	Rated Voltage	Surge Voltage	Capacitance (uF)	Leakage Current (uA)	$\tan \delta$	ESR (mΩ <sub>max</sub> /20°C, 100K to 300KHz)	Rated Ripple Current (mA <sub>rms</sub> /105°C 100KHz)
AVEA0645MT2V5331	2.5	2.9	330	700	0.12	17	2300
AVEA0645MT4V0101	4.0	4.6	100	200	0.12	25	2000
AVEA0645MT6V3101	6.3	7.2	100	315	0.12	19	2300
AVEA0645MT6V3151	6.3	7.2	150	472	0.12	19	2780
AVEA0645MT6V3221	6.3	7.2	220	700	0.12	17	2300
AVEA0645MT160220	16.0	18.4	22	176	0.12	45	1490
AVEA0645MT160680	16.0	18.4	68	544	0.12	40	2450
AVEA0645MT250150	25.0	28.8	15	300	0.12	55	1650
AVEA0645MT250220	25.0	28.8	22	275	0.12	45	2350

0807 Type

Part No.	Rated Voltage	Surge Voltage	Capacitance (uF)	Leakage Current (uA)	$\tan \delta$	ESR (mΩ <sub>max</sub> /20°C, 100K to 300KHz)	Rated Ripple Current (mA <sub>rms</sub> /105°C 100KHz)
AVEA0807MT160271	16	18.4	270	864	0.12	22	3300
AVEA0807MT200470	20	23	47	188	0.12	45	1890

0810 Type

Part No.	Rated Voltage	Surge Voltage	Capacitance (uF)	Leakage Current (uA)	$\tan \delta$	ESR (mΩ <sub>max</sub> /20°C, 100K to 300KHz)	Rated Ripple Current (mA <sub>rms</sub> /105°C 100KHz)
AVEA0810MT100331	10	11.5	330	660	0.12	17	3950
AVEA0810MT160221	16	18.4	220	704	0.12	18	3890
AVEA0810MT160271	16	18.4	270	864	0.12	16	4070
AVEA0810MT160331	16	18.4	330	1056	0.12	22	3150
AVEA0810MT160331	16	18.4	330	1056	0.12	16	4700

■ Category temperature range: -55~+105°C

■ Surge voltage: rated voltage\*1.15

■ Rated ripple current: Rated ripple current shall be in accordance with standard ratings list.

These current are rms values of sine wave of 100KHz at 105°C

## Aluminum Solid Electrolytic Capacitors

### Environmental Characteristics

#### General

Item	Specifications
Measurement condition	Each measurement shall be conducted at a temperature of 15 to 35 °C, and relative humidity of 45 to 85%. Furthermore, these measurements shall be preferably conducted at a temperature of 20±2 °C, and relative humidity of 60 to 70%, while the capacitors shall be kept enough time in the measuring temperature.
Voltage treatment	If leakage current is doubtful, measure it after performing voltage treatment, which shall contain the following steps: (1) Applied DC rated voltage to the capacitors for 60 minutes at 105±2 °C. (2) Cooled down to room temperature with applying voltage. (3) Discharged through a resistor of approximately 1Ω/V.

#### Electrical Performance Test

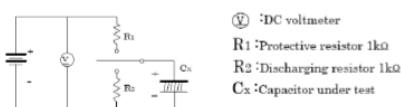
Item	Requirement	Test Condition						
Tolerance on Rated Capacitance	In Within specified tolerance	Rated capacitance shall meet within $\pm 20\%$ tolerance against the rated capacitance measured at $120\text{Hz} \pm 10\%$ at $20 \pm 2^\circ\text{C}$ .						
Leakage current	In accordance within electrical specification	DC rated voltage shall be applied between anode and cathode lead wire terminations of a capacitor through $1\text{K}\Omega$ protective resistance, and the leakage current shall be less than or equal to the value listed in accordance with electrical specification after 2 minutes with the voltage reaching the rated value at $20 \pm 2^\circ\text{C}$ . If the value is doubtful, measure the leakage current after performing voltage treatment as follows Voltage treatment						
Tangent of loss angle ( $\tan \delta$ )	In accordance within electrical specification	At $120\text{Hz} \pm 10\%$ at $20 \pm 2^\circ\text{C}$ .						
Equivalent Series Resistance (ESR)	In accordance within electrical specification	Equipment: Agilent technology 4263B or equivalent Test fixture: Agilent technology 16047E or equivalent Compensation: Short and open compensation would be required, Short correction is performed using the shorting plate made of 0.5 thickness copper plate with gold coating Signal level: 500mV Frequency: 100KHz Measurement point: Point of lead wire within 1mm from the body						
Impedance at high and low temperature	<table><tr><th>Impedance ratio</th><th>Performance</th></tr><tr><td><math>Z(-55^\circ\text{C})/Z(+20^\circ\text{C})</math></td><td><math>\leq 1.25</math></td></tr><tr><td><math>Z(105^\circ\text{C})/Z(+20^\circ\text{C})</math></td><td><math>\leq 1.25</math></td></tr></table>	Impedance ratio	Performance	$Z(-55^\circ\text{C})/Z(+20^\circ\text{C})$	$\leq 1.25$	$Z(105^\circ\text{C})/Z(+20^\circ\text{C})$	$\leq 1.25$	at $-55 \pm 3^\circ\text{C}$ or $105 \pm 2^\circ\text{C}$ , 100kHz
Impedance ratio	Performance							
$Z(-55^\circ\text{C})/Z(+20^\circ\text{C})$	$\leq 1.25$							
$Z(105^\circ\text{C})/Z(+20^\circ\text{C})$	$\leq 1.25$							

#### Mechanical Characteristics Test

Item	Requirement	Test Condition
Adhesion by Soldering	The soldered terminals shall not be damaged	A force of 5N shall be applied for 10 seconds to the capacitor, which was mounted on a print circuit board, in the perpendicular direction to the seal side of the capacitor
Vibration	The appearance shall not appear any remarkable abnormality.	Vibration cycle should vary from 10 to 55Hz with total amplitude of 1.5mm and return to 10Hz in about 1 minute. Vibration applied to a capacitor should be three directions, which each perpendicular to the other two as longitudinal axis of capacitor set as z axis, and last for 2 hours in each direction. During this test, measured electrical value shall be stabilized when that capacitor is measured 5 times within 30 minutes before completion of test
Solderability	Solder shall cover at least 3/4 of the lead surface immersed	The lead surface shall be immersed for 2±0.5 seconds in the flux of ethanol or isopropyl alcohol solution (25±2%) of colophonium. Then that lead surface shall be immersed to a solder (H60A, H60S or H63A) of 235±5°C and up to the point 1.5 to 2.0mm from the body and kept for 2±0.5 seconds, and pulling it out.
Soldering Heat	The capacitors shall satisfy their test criteria.	After the capacitors are soldered by the recommended soldering conditions below, the tests of the item Humidity resistance and Load life shall be conducted.

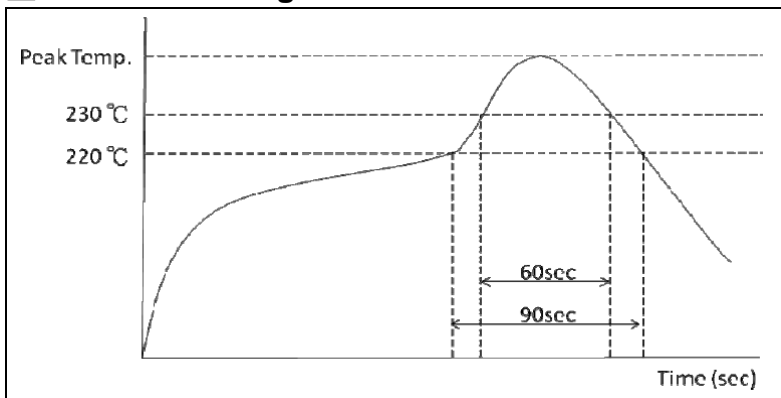
Environmental Performance Test

Item	Requirements	Test Condition
Damp Heat, Steady State	Appearance: No significant damage Capacitance change: $\leq \pm 20\%$ of the initial value $\tan \delta$ & ESR: $\leq 150\%$ of the initial specified value Leakage current: $\leq$ the initial specified value	A capacitor shall be subjected to a temperature of $60 \pm 2^\circ\text{C}$ and relative humidity of 90 to 95% without voltage applied for a period of $1000 \pm 24/-0$ hours. Then that capacitor shall be taken out from the above condition to a temperature of $20^\circ\text{C}$
Endurance		A capacitor shall be subjected to a temperature of $105 \pm 2^\circ\text{C}$ with test voltage applied for a period of $2,000 \pm 72/-0$ hours and take out from the above condition to a temperature of $20^\circ\text{C}$ . Besides, the applied voltage shall increase up from 0V to test voltage step by step (maximum 5 minutes), and the impedance of the source shall be equal to about $3\Omega/\text{V}$ .
Surge Voltage		when the capacitors are restored to $+20^\circ\text{C}$ after the surge voltage is applied at a cycle of 360 seconds which consists charge for $30 \pm 5$ seconds through a protective resistor of $1\text{k}\Omega$ and discharge for 330 seconds, for 1000 cycles at $105 \pm 2^\circ\text{C}$



Surge voltage circuit

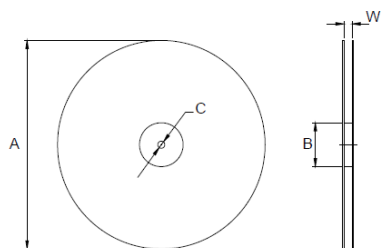
■ Reflow soldering



Recommended condition:

Peak temperature(max)	260°C
220°C over time(max)	90sec
230°C over time(max)	60sec
Reflow number	Only 1 time

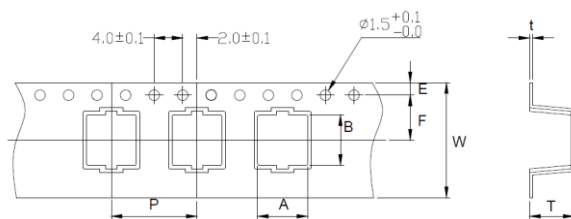
■ Packaging



Packaging Quantity & Reel Specifications

Type	A (mm)	B (mm)	C (mm)	W (mm)	Emboss Plastic Tape (EA)
AVEA0506	381.0±2.0	100.0±0.5	13.0±0.5	14.0±0.8	1,200
AVEA0606	381.0±2.0	100.0±0.5	13.0±0.5	16.5±0.8	1,200
AVEA0610	381.0±2.0	100.0±0.5	13.0±0.5	16.5±0.8	750
AVEA0645	381.0±2.0	100.0±0.5	13.0±0.5	16.5±0.8	1,500
AVEA0807	381.0±2.0	100.0±0.5	13.0±0.5	25.9±0.8	1,000
AVEA0810	381.0±2.0	100.0±0.5	13.0±0.5	25.9±0.8	500

Emboss Plastic Tape Specifications



Type	A (mm)	B (mm)	W (mm)	E (mm)	F (mm)	P (mm)	T (mm)	t (mm)
AVEA0506	5.7±0.2	5.7±0.2	12.0±0.3	1.75±0.1	5.50±0.1	12.0±0.1	6.0±0.2	0.4±0.1
AVEA0606	7.0±0.2	7.0±0.2	16.0±0.3	1.75±0.1	7.50±0.1	12.0±0.1	6.3±0.2	0.4±0.1
AVEA0610	7.0±0.2	7.0±0.2	16.0±0.3	1.75±0.1	7.50±0.1	12.0±0.1	10.0±0.2	0.5±0.1
AVEA0645	7.0±0.2	7.0±0.2	16.0±0.3	1.75±0.1	7.50±0.1	12.0±0.1	4.8±0.2	0.4±0.1
AVEA0807	8.7±0.2	8.7±0.2	24.0±0.3	1.75±0.1	11.5±0.1	16.0±0.1	7.2±0.2	0.4±0.1
AVEA0810	8.7±0.2	8.7±0.2	24.0±0.3	1.75±0.1	11.5±0.1	16.0±0.1	10.0±0.2	0.5±0.1

## ■ Instructions of Capacitors

### 1. Cautions on use of Capacitor

#### ■ Polarity

Solid electrolytic capacitors are polarized capacitors. Use capacitors after verifying their positive and negative polarities. If these capacitors are installed in the reverse polarity, its life may shorten because of increasing leakage current or short circuit.

#### ■ Types of circuits in which capacitors are prohibited from being used

AVEA series may be heated by soldering to increase in its leakage current slightly. This may have some influence on the characteristics capacitors in the following circuits.

- (1) Time constant circuit
- (2) Coupling circuit
- (3) High impedance voltage holding circuit
- (4) Connection of two or more capacitors in series for higher withstand voltage.

#### ■ Over voltage

If AVEA series is applied a voltage higher than the rated voltage for an instantaneous period, it may be defected due to short circuit. Note that the voltage over the rated voltage must not be applied to capacitors

#### ■ Repeat of rapid charging and discharging

If AVEA series is used in a rapid charging and discharging circuit or receive the flow of excess rush current, its life may shorten by large leakage current or short circuit. The charging and discharging current through AVEA series should be less than 10A.

#### ■ Reflow soldering

High soldering temperature and long soldering time will affect the characteristics of the capacitors. Use reflow soldering condition within the recommended range. Also, the temperature varies with the location and population of the components, the material and the thickness of printed circuit board. Verify temperature profiles prior to actual production run.

#### ■ Use of capacitors for industrial equipment

When capacitors are used for industrial equipment, the circuits should be designed to have sufficient margins in the ratings of capacitors including capacitance and impedance. Without sufficient margins in the characteristics, the reliability of the capacitors may be reduced by their shorter life. Always contact us if you want to use capacitors for equipment affecting human lives such as space, aviation, atomic power, and medical devices. Never use capacitors for the used without our prior approval.

### 2. Notes on circuit designs for capacitors

#### ■ Rating and performance

Use capacitors within the rating and performance ranges defined in the brochures and delivery specification of capacitors after checking the operating and installation environments.

#### ■ Operating temperature

If AVEA series is used at a temperature higher than the upper specified temperature (105°C), its life may be remarkably shortened or the leakage current may increase to cause defective.

#### ■ Ripple current

Never make current larger than the rated ripple current through AVEA series. If excess ripple current flows through AVEA series, internal heat may be generated largely to make its life shortened or cause it to be defected due to short circuit.

#### ■ Leakage current

Depending on the soldering conditions, the leakage current of AVEA series may increase slightly. The application of DC voltage enables the capacitors to be repaired by itself. This leads the leakage current to be smaller gradually. The leakage current can be reduced fast if the DC voltage, which is less than the rating voltage, is applied at the temperature close to the upper specified temperature.

#### ■ Applied voltage

- (1) To secure the reliability of capacitors, it is recommended that the voltage applied to them should be less than 80% of the rated voltage.
- (2) The peak value of the ripple voltage superimposed with the DC voltage should be less than the rated voltage.

#### ■ Failure mode

AVEA series contains a conductive polymer as material of cathode electrode. Therefore, like other solid electrolyte capacitors, the life ends mostly due to random failure mode, mainly short circuit. If a current continuously flow through the capacitor due to short circuit, the capacitor would be overheated higher than 300°C and then aluminum case of the capacitor would be removed by increasing internal pressure due to the vaporization of materials.

#### ■ Insulation

- (1) Plastic coated case of capacitors is not secured to insulate. Do not use capacitors in areas requiring insulation.
- (2) Isolate the case of AVEA series from the positive and negative terminals and adjacent circuit patterns.

#### ■ Design of printed circuit board

Take note on the subjects when capacitors are installed on printed circuit boards:

- (1) For surface mount capacitors, design the copper pads/lands of a printed circuit board according to the catalog or product specifications.
- (2) Do not place heating components on boards to be close to capacitors or in the backside of them.

#### ■ Parallel connection

If AVEA series is connected with another type of a capacitor in parallel, larger ripple current may flow through one of capacitors. Take the current balance among them into account in circuit designs.

#### ■ Using temperature and frequency

The electric characteristics of capacitors depend on the variations of the ambient temperature and frequency. Check the variations in designing circuits.

### 3. Notes on installation of capacitors

#### ■ Notes on pre-installation of capacitors

- (1) Do not reuse capacitors installed in a unit with the power supply turned on for another unit. No used capacitors shall be reused excluding those removed to measure their electric characteristics in periodical inspection.
- (2) If AVEA series stored for a long period may often increase in its leakage current, connect a resistor of approximately 1kΩ to the capacitors for voltage treatment.



## Aluminum Solid Electrolytic Capacitors

### ■ Notes at installation of capacitors

- (1) Install capacitors in a unit after confirming that their ratings (rated capacitance and rated voltages) meet the conditions of the unit.
- (2) Install capacitors in the correct polarities.
- (3) Take care not to drop capacitors on floors. Do not use capacitors dropped on floors.
- (4) Do not deform capacitors to install them in units.
- (5) Note capacitors may be damaged by mechanical shocks caused by the vacuum head, component checker or centering operation of an automatic mounting machine.
- (6) Do not dip the body of a capacitor into the solder bath.
- (7) Do not solder capacitors more than once by reflow. Consult us for reflow-soldering them twice over.
- (8) Do not apply mechanical stress to the capacitor after soldering to the printed circuit board.
- (9) Do not use adhesives and coating materials containing halogenated solvents.

### 4. Notes on use of capacitors in unit

- (1) Never make your fingers contact with the lead wire terminations of capacitors.
- (2) Do not make lead wire terminations of AR5K series to be in contact with each other through a conductor. Do not put conductive liquid such as acid and alkali solutions on capacitors.
- (3) Confirm that the unit including capacitors is placed in proper conditions. Do not place the unit in the following areas:
  - (a) Area in which they are directly exposed to water, brine, or oil or in condensation status.
  - (b) Area filled with poisonous gases including hydrogen sulfide, sulfurous acid, nitrous acid, chlorine and ammonia.
  - (c) Area to which ultraviolet and/or radial rays are radiated
- (4) Provide aging for a unit containing capacitors within the period defined for them.
- (5) It is recommended to use a unit containing capacitors in the normal temperature range of 15°C to 35°C and the normal humidity range of 75% or less.

### 5. Action at emergency

- (1) At the occurrence of short circuit in AVEA series, some heat is generated from it if the short-current rather small. If the short current exceeds the above value, the capacitors are heated excessively. If so, turn off the power of the unit without your face and hands being close to the capacitors.
- (2) If you should expose your eyes to smoke from the capacitor or inhale it, immediately flush the open eyes and gargle with water.

### 6. Storage

- (1) Store capacitors in an area in the temperature range between 15°C to 35°C and the relative humidity of 75% or less without direct sunshine. In addition, store them in the package states if possible.
- (2) SMD products are sealed in a special laminated aluminum bag. Use all capacitors once the bag is opened. Return unused capacitors to the bag, and seal it with a zipper. After the bag is opened, please use all capacitors within 1 month.
- (3) Store capacitors in an airtight bag to keep the terminals in good condition.
- (4) Store in a location where the capacitor is not exposed to ozone, ultraviolet radiation, or other radiation.
- (5) Never store capacitors in any area in which they are directly exposed to water, brine, or oil or in condensation status.

### 7. Exhaustion of capacitors

Capacitors are composed of organic compounds, resins and metals. Request an industrial dispose company to dispose of used capacitors.