Issue No. : WA-E-0016-S31

Date of Issue : 23 May 2002

SPECIFICATION

Winding Foil (Can type)

Product Description : **Specialty Polymer Aluminum Electrolytic Capacitors (WA series)**

Product Part Number : EEFWA*****P

Term of Validity : 22 May 2003 from the date of issue

This capacitor is designed to be used for electric decoupling circuits of, such as, audio/visual equipment, home appliances, computers and other office equipment, optical equipment, measuring equipment and industrial robots.
Therefore if you use for control circuits of safety device such as transportation equipment, Please contact our person signed below. And please don't use for control circuits which affect human life, such as medical equipment, airplane.

Ozone Depleting Chemicals(ODC's), are controlled under the Montreal Protocol Agreement, aren't used in producing this product.

This product does not contain PBBOs or PBBs.

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Contents

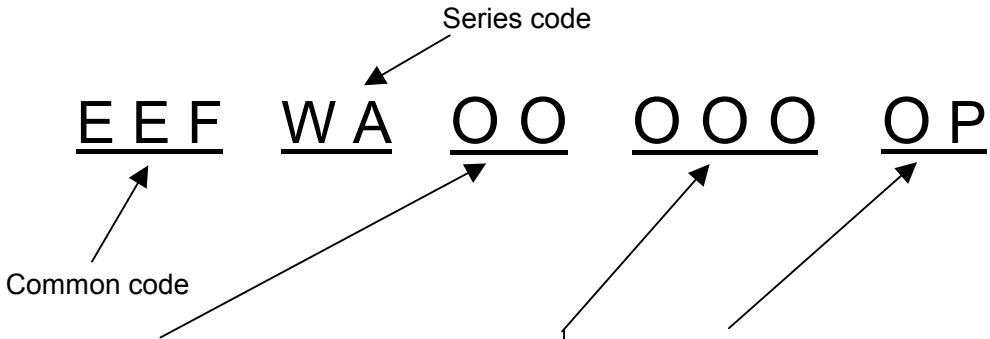
Matsushita Electronic Components Co., Ltd.
LCR Device Company Capacitor Business Unit

Specialty Polymer Aluminum Electrolytic Capacitors (Winding Foil(Can type)WA Series)

1. Scope

This specification applies to specialty polymer aluminum electrolytic capacitors V type WA series of being used for electronic equipment.

2. Explanation of Part Numbers



W.V. code	W.V.(V)
0J	6.3
1A	10
1C	16
1D	20
1E	25

Suffix code	Packaging Style
P	Taping

Capacitance code

Indicated Capacitance in µF by 3 letters. The 1st 2 figures are actual values and the 3rd denotes the number of zeros. "R" denotes the decimal point and all figures are the actual number with "R"
ex:4.7µF ---- 4R7 10µF ---- 100

3. Specifications

	Item	Specifications					
1	Category temperature range	-55°C to 105°C					
2	Rated voltage range	6.3V to 25V					
3	Capacitance range	22µF to 680µF (120Hz 20°C)					
4	Tolerance on capacitance	±20% (120Hz 20°C)					
5	Surge voltage (V.DC)	V.DC	6.3	10	16	20	25
		Surge	7.2	11.5	18.4	23.0	28.8
6	Rated ripple current	See products specifications on Page 2.					

Specifications

Part number	Voltage Rated (V.DC)	Cap. (μF)	tanδ max.	L.C. (μA) max.	ESR (mΩ) (100kHz,20°C)	Permissible Ripple Current mA r.m.s * 1	Case code
EEFWA0J151P	6.3	150	0.15	189	35	3050	E70
EEFWA0J221P	6.3	220	0.15	277	32	3050	E70
EEFWA0J331P	6.3	330	0.12	416	22	4130	G80
EEFWA0J391P	6.3	390	0.12	491	22	4130	G80
EEFWA0J471P	6.3	470	0.12	592	20	5100	G
EEFWA0J561P	6.3	560	0.12	706	20	5100	G
EEFWA0J681P	6.3	680	0.12	856	15	5100	G
EEFWA1A121P	10	120	0.15	240	35	2800	E70
EEFWA1A151P	10	150	0.15	300	35	2800	E70
EEFWA1A271P	10	270	0.12	540	24	3770	G80
EEFWA1A331P	10	330	0.12	660	22	4500	G
EEFWA1A471P	10	470	0.12	940	17	4500	G
EEFWA1C820P	16	82	0.12	262	39	2500	E70
EEFWA1C101P	16	100	0.12	320	39	2500	E70
EEFWA1C151P	16	150	0.12	480	29	3430	G80
EEFWA1C181P	16	180	0.12	576	29	3430	G80
EEFWA1C221P	16	220	0.12	704	27	4100	G
EEFWA1C271P	16	270	0.12	480	27	4100	G
EEFWA1C331P	16	330	0.12	1056	22	4100	G
EEFWA1D470P	20	47	0.10	188	50	2000	E70
EEFWA1D820P	20	82	0.10	328	39	2500	G80
EEFWA1D151P	20	150	0.10	480	26	3700	G
EEFWA1E220P	25	22	0.10	110	50	1600	E70
EEFWA1E330P	25	33	0.10	165	39	2200	G80
EEFWA1E820P	25	82	0.10	410	30	3300	G

*1 100kHz/ -55 to 105°C

Specifications

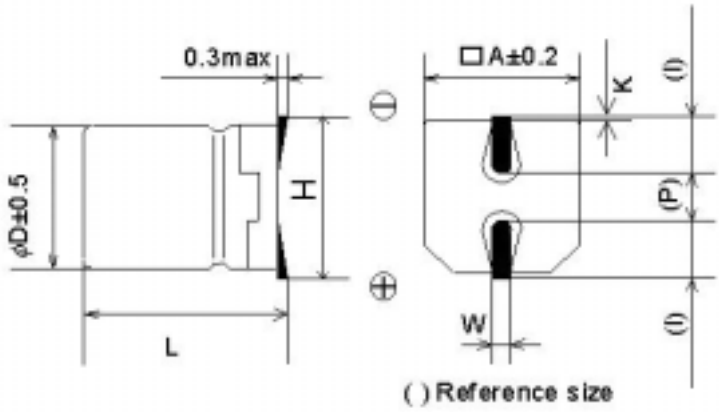
V.DC / μF	6.3 (0J)	10 (1A)	16 (1C)	20 (1D)	25 (1E)
22(220)					E70
33(330)					G80
47(470)				E70	
68(680)					
82(820)			E70	G80	G
100(101)			E70		
120(121)		E70			
150(151)	E70	E70	G80	G	
180(181)			G80		
220(221)	E70		G		
270(271)		G80	G		
330(331)	G80	G	G		
390(391)	G80				
470(471)	G	G			
560(561)	G				
680(681)	G				

( ) Shows W.V. and capacitance code.

4. Appearance, Dimensions, Construction

4.1 Appearance

By visual inspection, no deep cracks and blemishes.

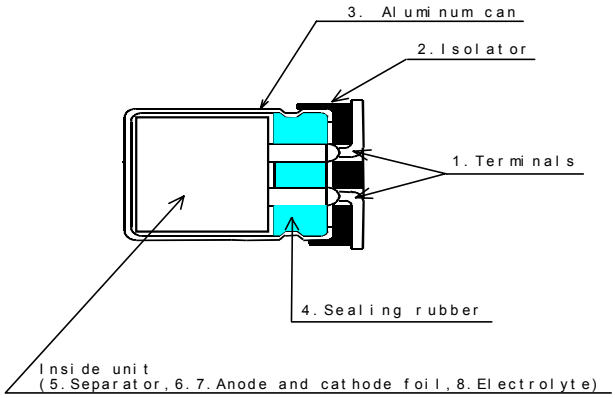


4.2 Dimensions

(mm)

Size Code	D	L	□ A	H	I	W	P	K
E70	8.0	6.9 $^{+0.1}_{-0.2}$	8.3	10.0max	('3.4)	0.9±0.2	('3.1)	0.5±0.2
G80	10.0	7.9 $^{+0.1}_{-0.3}$	10.3	12.0max	('3.5)	0.9±0.2	('4.6)	0.5±0.2
G	10.0	10.2 ±0.3	10.3	12.0max	('3.5)	0.9±0.2	('4.6)	0.5±0.2

4.3 Construction

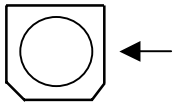


4.3.2 Constituent Components

	Parts	Materials		Parts	Materials
1	Terminal	Tinned Copper-Clad Steel wire	5	Separator	Synthetic fiber, non-woven fabric
2	Isolator	Thermo-plastic Resin	6	Anode Foil	High Purity Aluminum foil
3	Aluminum Can	Aluminum	7	Cathode Foil	Aluminum Foil
4	Sealing Rubber	Synthetic rubber	8	Electrolyte	Specialty Polymer

5. Characteristics

No	Item	Characteristics		Outline of test method
1	Leakage current	I ≤ 0.2CV		Series resistor: 1000Ω Applied voltage: Rated Voltage Leakage current shall be measured 2 minutes after applying voltage. If any doubts come up, conduct "Pre-conditioning" described below and measure leakage current again. Pre-conditioning ·Temperature: 105°C ·Series resistor: 1000Ω ·Applied voltage: Rated Voltage ·Charge time: 2hour ·Measuring After "Pre-conditioning" the capacitor shall be stored at room temperature and low humidity for 24 to 48 hours, then measurement shall be done.
2	Capaci-tance	±20%		Measuring frequency:120Hz±10% Measuring circuit: Equivalent series circuit Measuring voltage: +2.1 to 2.5V.DC≤ 0.5Vrms Measuring temperature: +20°C
3	tanδ	See product specification on Page 2.		
4	ESR	See product specification on Page 2.		Measuring frequency: 100KHz ± 10% Measuring voltage: ≤0.5Vrms +0V.DC Measuring temperature: +20°C
5	Solder-ability	More than 75% of the terminal face is covered by new solder.		Solder type: H60A or H63A Flax: About 25% rosin density being melted in ethanol. Solder temperature: 235 ± 5°C Immersing time: 2 ± 0.5s
6	Solubility resistance to marking	Appearance: No remarkable abnormal change shall be occurred.		Class of regent: Extra grade 2-propanol (JIS K8839) or superior. Test temperature: 20 to 25°C Immersing time: 30 ± 5s
7	Solder heat resistance	Leakage current	I≤ Initia specified value with "Pre-conditioning"	After reflow-soldering(see page 9), capacitors shall be left at room temperature prior to the measurement.
		Capacitance change	±10% of initial measured value.	
		tan δ	≤The value specified at Item 3.	
		Appearance	No remarkable abnormal change shall be occurred.	

No	Item	Characteristics		Outline of test method
8	Adhesion	Appearance: Without mechanical damage such as breaks after test.		Push direction: Side Force: 5N Holding time: 10 ± 0.5s 
9	Damp heat, Steady State	Leakage current	I≤ Initia specified value with "Pre-conditioning"	Test temperature: 60 ± 2°C Relative humidity: 90 to 95%R.H Test time: 1000^{+48}_{-0} hours
		Capacitance change	±20% of initial measured value.	
		tanδ	≤150% of initial specified value.	
		Appearance	No remarkable abnormal change shall be occurred.	
10	Endurance	Leakage current	≤The value specified at Item 1.	Test temperature: 105 ± 2°C Applied voltage: Rated working voltage Test time: 2000^{+48}_{-0} hours
		Capacitance change	±20% of initial measured value.	
		tan δ	≤150% of initial specified value.	
		Appearance	No remarkable abnormal change shall be occurred.	
11	Shelf life	Leakage current	I≤ Initia specified value with "Pre-conditioning"	Test temperature: 105 ± 2°C Test time: 2000^{+48}_{-0} hours
		Capacitance change	±20% of initial measured value.	
		tan δ	≤150% of initial specified value.	
		Appearance	No remarkable abnormal change shall be occurred.	

<table>
<tr><th>No</th><th>Item</th><th colspan="3">Characteristics</th><th>Outline of test method</th></tr>
<tr><td>12</td><td>Character-istics at high and low temp-erature</td><td>Step</td><td>Item</td><td>Electrical Characteristics</td><td rowspan="9"><table><tr><th>Step</th><th>Temperature</th></tr><tr><td>1</td><td>20±2°C</td></tr><tr><td>2</td><td>- 55±3°C</td></tr><tr><td>3</td><td>20±2°C</td></tr><tr><td>4</td><td>105±2°C</td></tr><tr><td>5</td><td>20±2°C</td></tr></table></td></tr>
<tr><td></td><td></td><td rowspan="2">2</td><td>Capaci-tance</td><td>-20% to 0% of the value measured at Step 1.</td></tr>
<tr><td></td><td></td><td>ESR</td><td>≤125% times of the value specified at Item 4.</td></tr>
<tr><td></td><td></td><td rowspan="3">4</td><td>Capaci-tance</td><td>0% to 50% of the value Measured at Step 1.</td></tr>
<tr><td></td><td></td><td>tan δ</td><td>≤150% times of the value specified at Item 4</td></tr>
<tr><td></td><td></td><td>ESR</td><td>≤The value specified at Item 4.</td></tr>
<tr><td></td><td></td><td rowspan="3">5</td><td>Capaci-tance</td><td>±5% of the value measured at Step 1.</td></tr>
<tr><td></td><td></td><td>Leakage current</td><td>≤The value specified at Item 1.</td></tr>
<tr><td></td><td></td><td>tan δ</td><td>≤The value of item 3.</td></tr>
<tr><td>13</td><td>Surge voltage</td><td colspan="2">Leakage current</td><td>≤The value specified at Item 1.</td><td rowspan="4">Test temperature: 15 to 35°C
Series resister: 1000Ω
Test voltage: Surge voltage (See attached individual Specification of P1)
Applied voltage:1000 duty cycles of 30±5s “ON” and 5 min 30s “OFF”.</td></tr>
<tr><td></td><td></td><td colspan="2">Capacitance change</td><td>±15% of initial measured value.</td></tr>
<tr><td></td><td></td><td colspan="2">tan δ</td><td>≤The value specified at Item 3.</td></tr>
<tr><td></td><td></td><td colspan="2">Appearance</td><td>No remarkable abnormal change shall be occurred.</td></tr>
<tr><td>14</td><td>Vibration</td><td colspan="3">Capacitance: ±5% of initial measured change value.
Appearance: No remarkable abnormal change shall be occurred</td><td>Frequency: 10 to 55Hz
(1 minute per cycle)
Total amplitude: 1.5mm
Direction and duration of vibration:
3 directions X, Y, and Z axis for 2 hours each with total 6 hours.</td></tr>
</table>

6. Marking

1) Rated voltage

Rated Voltage Mark	
j	6.3V
A	10V
C	16V
D	20V
E	25V

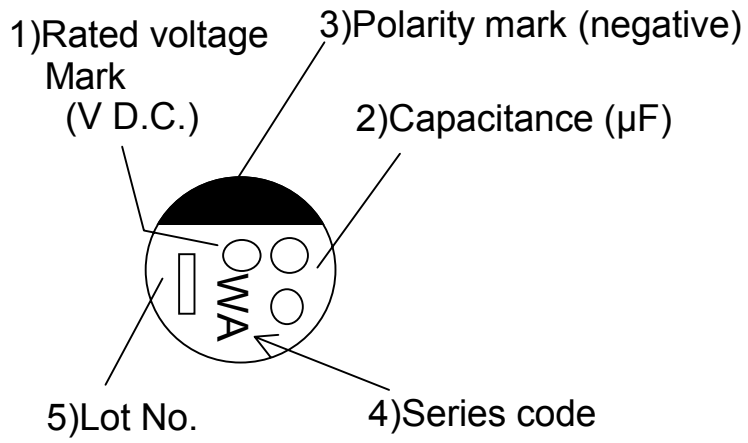
2) Capacitance

3) Polarity mark(negative)

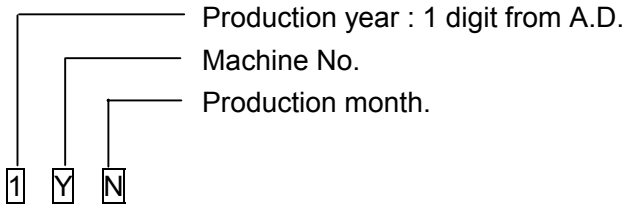
4) Series code

5) Lot No.

*Color of the marking: Blue



Lot No.

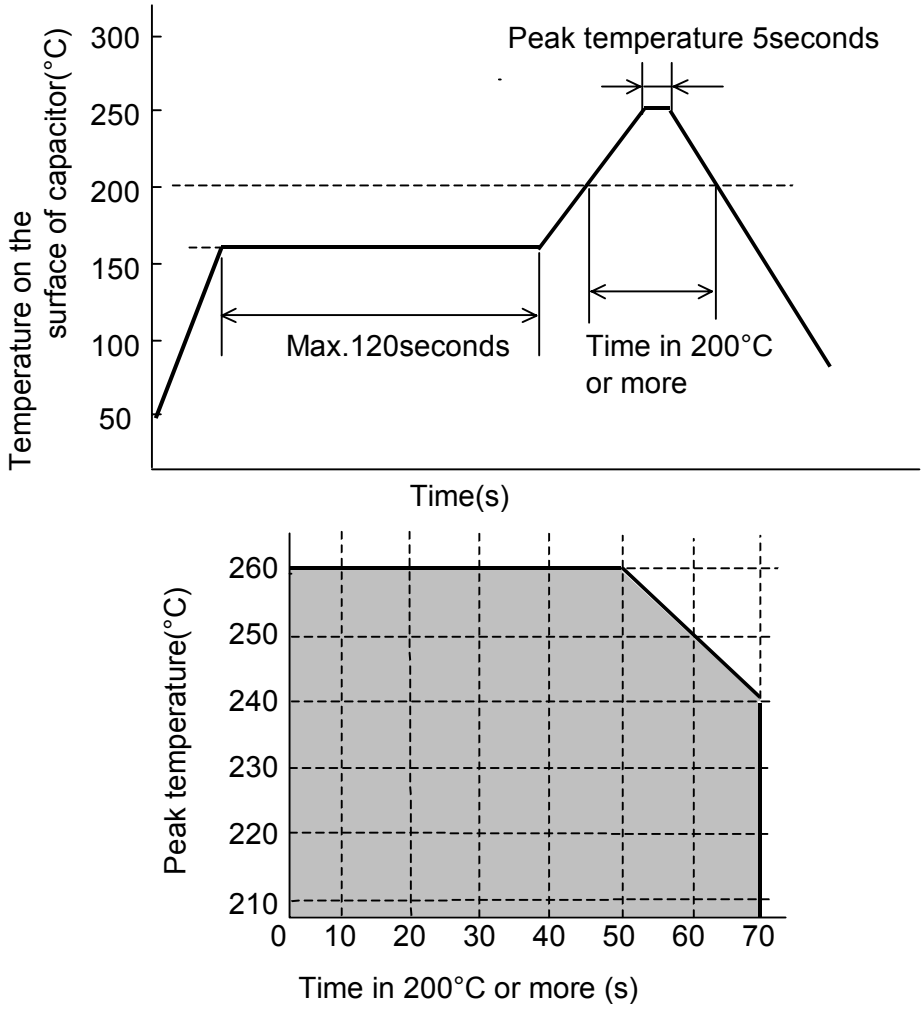


Production year	Production month
1:2001 2:2002 3:2003 4:2004 5:2005	Jun to Sep: Numerals 0: Oct N: Nov D: Dec

7.Maximum permissible reflow soldering temperature profile

We recommend soldering shall be done according to following maximum permissible reflow soldering temperature profile.

Reflow soldering
(This is a method to heat parts and the substrate by hot air or infrared furnace.)

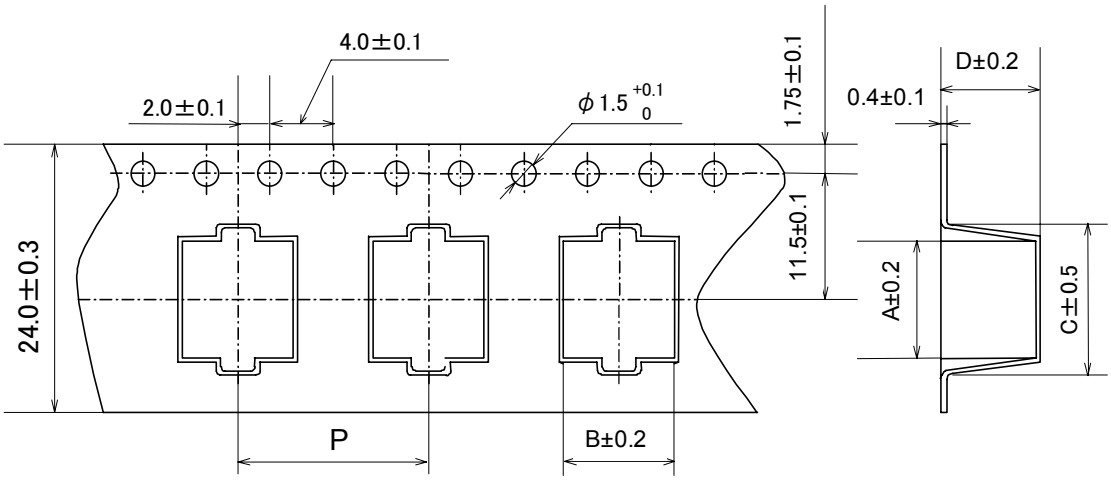


∗ Please carry out reflow soldering to 2 times.

8.Embossed tape dimension

Carrier Tape

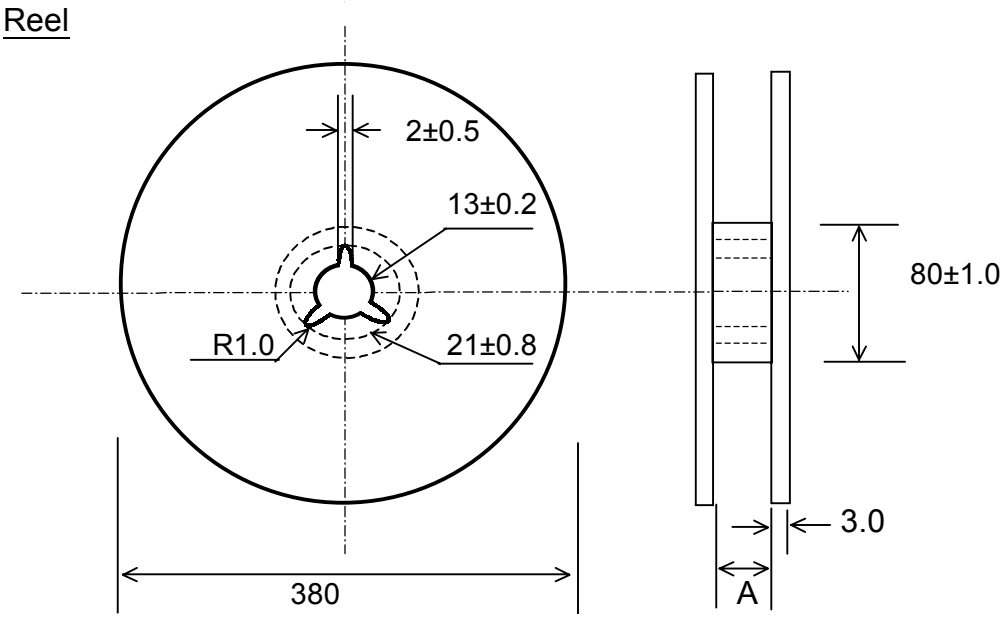
Unit:mm



(mm)

Size Code	A	B	C	D	P
E70	8.6±0.2	8.6±0.2	12.1±0.5	7.7±0.2	12.0±0.1
G80	10.7±0.2	10.7±0.2	14.2±0.5	8.6±0.2	16.0±0.1
G	10.7±0.2	10.7±0.2	14.5±0.5	11.0±0.2	16.0±0.1

Reel

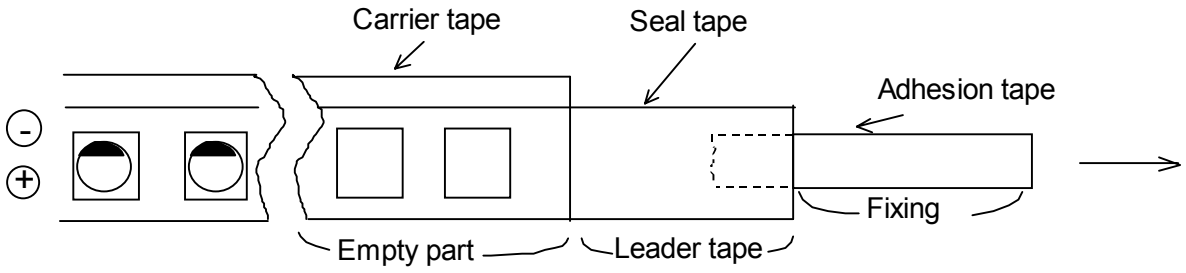


(mm)

Size Code	Reel Width(A)
E70,G80,G	25.5

9.Packaging Specifications

9.1 Details of carrier tape

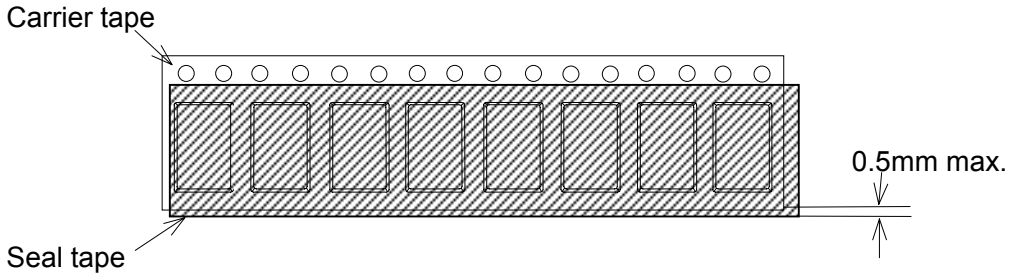


1-1 Note

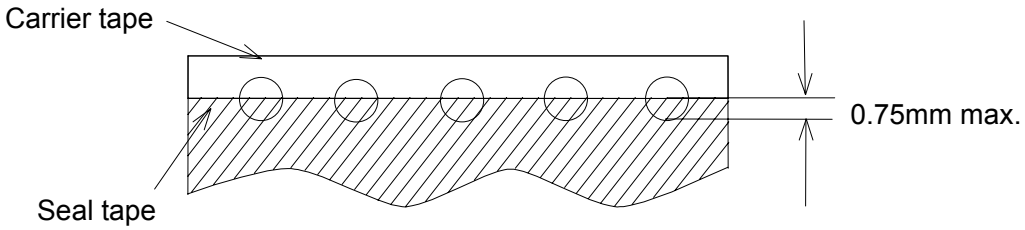
a. Last reeling empty part of carrier tape shall be kept more than 10cm.
b. Leader part of seal tape shall be kept more than 20cm.
c. First reeling empty part of carrier tape shall be kept more than 10cm.
d. Adhesive tape to be fixed leader part of seal tape shall be kept about 10cm.

1-2 Deviation between carrier tape and seal tape

a. Deviation between carrier tape and seal tape shall be less than 0.5mm



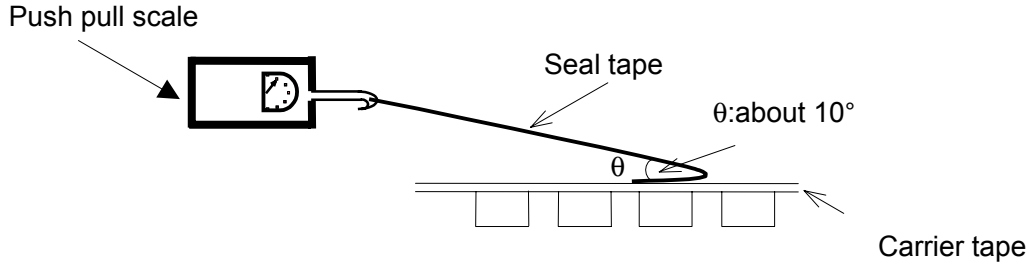
b. Seal tape shall not be covered on the feeding holes more than 0.75mm



9.2 Adhesion test

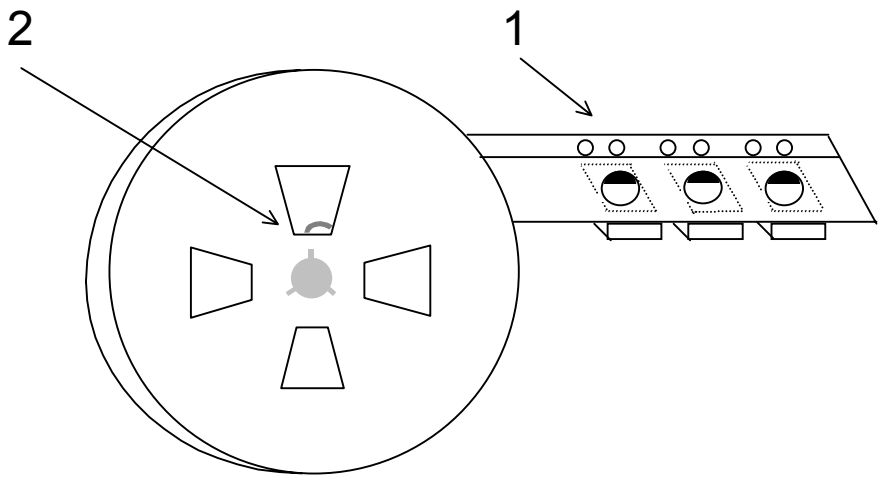
Reasonable pulling strength: 0.1 to 0.7N

Pulling speed: 0.005m/s



9.3 Packaging style

1) Carrier tape shall be reeling inside.(seal tape shall be outside.)
2) First of the carrier tape shall be inserted directly to the reel as shown in the below figure and leader part of seal tape shall not be attached.



9.4 Packaging quantity

Quantity per reel

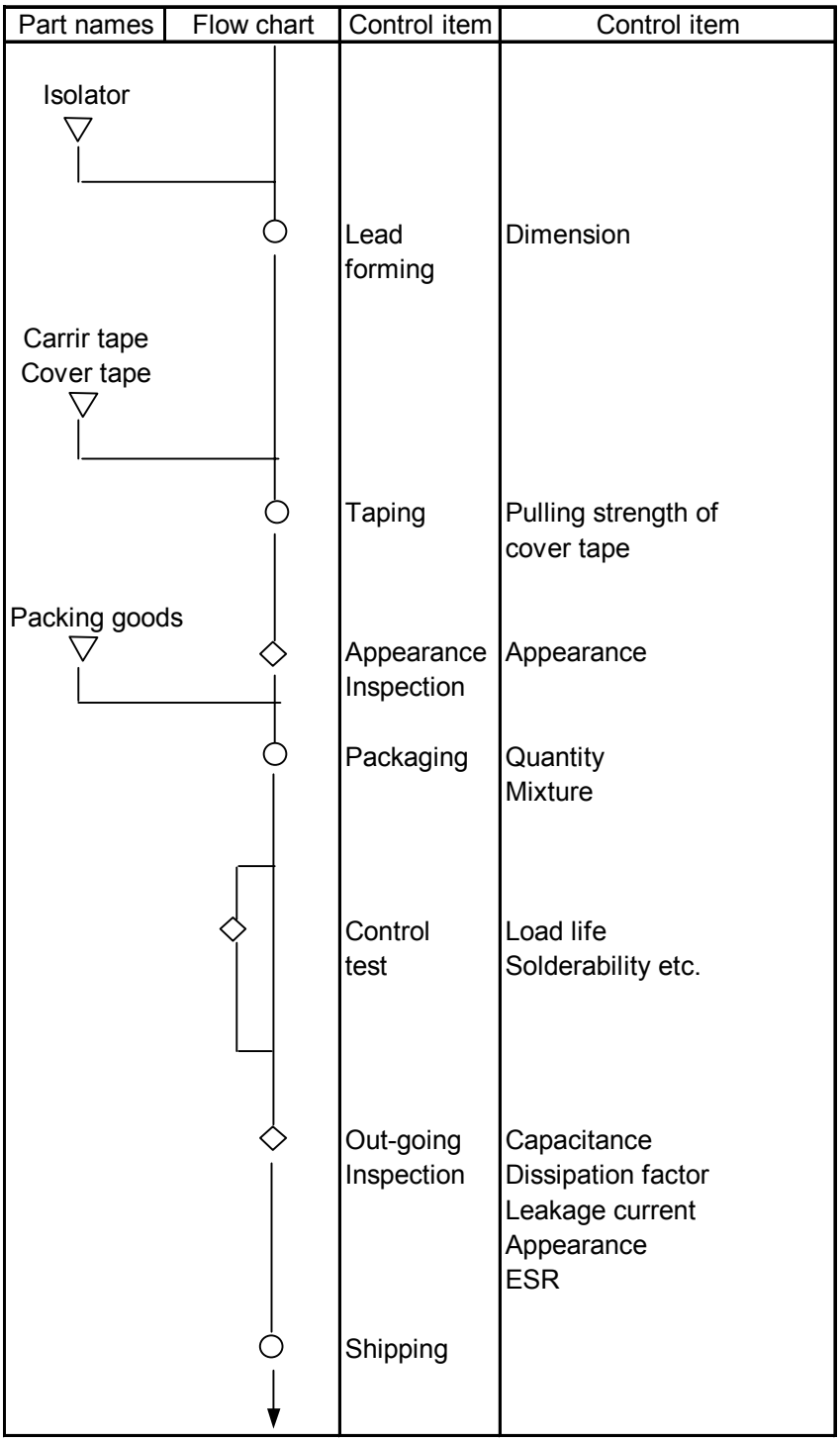
E70 : 1000 pieces
G,G80 : 500 pieces

Process Control Flow Chart (1/2)

Part names	Flow chart	Control item	Control item
High-purity aluminum foil Etching chemical			
		Incoming inspectin	<High-purity aluminum foil> Appearance Thickness etc.
			<Etching chemical> Gravity
		Etching	Current,Velocity Temperature Concentration
Forming chemical		Cleening	Chloride
		Process inspection	Capacitance Strength Chloride
		Incoming inspection	<Forming chemical> Chloride
		Forming	Voltage,Speed Temperature Concentration Chloride
		Coating inspection	Coating condition Capacitance
Lead Wire Separator		Foil slitting	Foil width dim.
		Incoming inspection	<Lead Wire> Appearance Chloride

Part names	Flow chart	Control item	Control item
		Joining	Thickness Contact resistance
Electrolyte		Winding	Winding condition
		inspectin	Purity Content,ratio
Sealing rubber Aluminum can		Polymerization	Polymerization conditions
		Incoming inspection	<Sealing rubber> Appearance Chloride <Aluminum can> Aluminum can Dimension etc.
		Assmebly	Sealing dimension
		Printing	Appearance
		Aging	Voltage Temperature
		Finishing inspection	Short circuit Capacitance Dissipation factor Leakage current ESR

Process Control Flow Chart (2/2)



Application Guidelines

1. Polarity

The specialty polymer capacitor has polarity, so be sure to verify the orientation of capacitor before use.
If reverse voltage is applied to the capacitor, it not only causes a short in the circuit, but also damages the capacitor.
Design your circuit to eliminate the possibility of reverse voltage conditions.
However, if you expect that reverse voltages may occur anyhow, please inform the factory.

2. Voltage

Do not apply over voltages exceeding the rated voltage.Doing so increases leakage current and may damage the capacitor due to internal heating.
Do not connect capacitors in series for higher voltage use.Short-circuit may happen when over-voltage is applied.
Also do not design circuit where peak voltage exceeds the rated voltage.When large amount amount of current gose through due to sudden quick charge and discharge,short-circuit may happen or leakage current may increase.So,when rush current exceeds 10A and the rush current is 10 times higher than ripple current of the capacitor,put either protective resistor or protective circuit for the capacitor.

3. Temperature

Use at or under the rated(guaranteed) temperature.
Operation at temperatures exceeding specifications causes large changes in the capacitor's electrical properties, and deterioration that can potentially lead to failure.
When calculating the operating temperature of the capacitor, be sure to include not only the ambient temperature and internal temperature of the unit, but also radiation from heat generating
elements inside the unit (power transistors, resistors, etc.), and self-heating due to ripple current.

4. Ripple Current

Do not apply ripple current exceeding the capacitor's specified value.
Excessive ripple current results in high internal heat generation, causing capacitor failure.
Make sure that the sum of the DC voltage and the peak value of the induced voltage by allowable ripple current does not exceed the rated voltage.
Even when using the capacitor under the permissible ripple current, a reverse voltage may occur if the DC bias voltage is low.
Ripple current must be corrected for frequency. Use the frequency correction factor given below.

Frequency correction factor
(Sine-wave current, Ambient temperature: Room temperature to 105°C)

Frequency (kHz)	1	10	100	300	500
Frequency correction factor	0.25	0.6	1.0	1.0	1.0

5. Circuit Type

Do not use the capacitor in time-constant or coupling circuits. In these types of circuit, electrical characteristics such as capacitance can change under certain environmental conditions.

6. Long Term Storage

Products are packed in an moisture proof package.
When products absorb the excessive moisture, heat stress while soldering might cause the damage to resin seal.
Therefore, it is desirable to keep storage conditions below.

Preferred storage conditions
Temperature : 5 to 30°C without direct sunlight
Humidity : Less than 70%RH

Leakage current of a capacitor increases with long storage times.
The aluminum oxide film deteriorates as a function of temperature and time.
If used without reconditioning, an abnormally high current will be required to restore the oxide film.
This current surge could cause the circuit or the capacitor to fail.
Therefore, capacitors should be used within 12 months.

7. Transportation

Handle with care as excessive vibration or shock may degrade reliability of the capacitor.

8. Capacitor Disposal

Since capacitors are composed of various metals and resins, treat them as industrial waste when arranging for their disposal.

9. Circuit Board Cleaning

Capacitors can withstand immersion in solvent at 60°C or under for up to 5 minutes (ultrasonic cleaning is available).
Be sure to sufficiently wash (about 3 min. with water) and dry (20min. at 100°C)the board afterward.
[Recommended cleaning solvents include]
Pine Alpha ST-100S, Sunelec B-12, DK beclear CW-5790, Aqua Cleaner 210SEP, Cold Cleaner
P3-375, Telpen Cleaner EC-7R, Clean-thru 750H, Clean-thru 750L, Clean-thru710M, Techno Cleaner 219, Techno Care FRW-17, Techno Care FRW-1, Techno care FRV-1
*The use of ozone depleting cleaning agents are not recommended in the interest of protecting the environment.

Capacitor Handling Techniques

1. Capacitor Insertion

The specialty polymer capacitor is designed for reflow soldering,but vapour phase soldering is not available.Flow soldering and dipped soldering are not available,neither.
Maintain soldering conditions (pre-heating, reflow temperature, time)within the range
Please see page 8 for recommend soldering profile.
If soldering time is lengthened or temperature is higher, the heat can damage the capacitor element and/or the molded case.

2. Capacitor Insertion

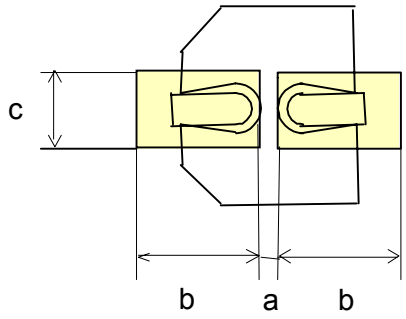
Do not apply excessive force to the capacitor, since this can damage the electrodes and badly affect capacitor mountability.
There is also the possibility of an internal short circuit, increase in leakage current, separation of lead wire and element, or damage to the capacitor body, all of which can badly affect the electrical performance of the capacitor.

3. Soldering

When using a soldering iron, set the tip temperature to no more than 350°C,and work in as short a time as possible under 10 seconds.
While soldering, do not apply strong force to the capacitor.

Typical land pattern (mm)

Size code	a	b	c
E70	3.1	4.0	2.0
G,G80	4.6	4.1	2.0



Always consider safety when designing equipment and circuits .
Plan for worst case failure modes such as short circuits and open circuits which could occur during use.
(1) Provide protection circuits and protection devices to allow safe failure modes.
(2) Design redundant or secondary circuits where possible to assure continued operation in case of main circuit failure.