Issue date :

Specification No. :
No.4FT3Q98Z1 − 1 ～ 16

Messrs. HIPRO

Electrolytic Capacitors

Specifications

Customer Part No. :

Customer Specification No. :

Nippon Chemi-Con Part No. : KME SERIES

Nippon Chemi-Con Corporation

Chemi-Con Miyagi Corporation

Design Group Assistant Supervisor

Receipt Stamp

1 Scope

This specification defines the requirements for aluminum electrolytic capacitors which comply with the first symbol W of JIS C 5141−1991.

2 Part Numbering System

Example;

T □ 0 □ R | □ | □ | VB | □ | M | □

Taping code | Series name | Rated voltage | Type | Capacitance | Cap. tol. | Special code

Taping code:

- Means taped products.
- Lead shape.
  - C : Formed leads.
  - D : Straight leads.
- Radial lead type.
- Pitch of product : P dimension.
  - 3 : 15mm
  - 4 : 12.7mm
  - 5 : 25.4mm
  - 7 : 30mm
- Polarity of direction for drawing out.
  - R : Positive lead comes to the right side.
  - N : Non-polarized capacitors.

Rated voltage: Expressed in volt.

Type:

JIS type code	Code
CE04 type	V B

Capacitance:

Capacitance μF	Code
0.1	R1
1.0	1
4.7	4R7
10	10
100	100

Cap. tol.:

Capacitance tolerance %	Code
±20	M

Special code:

Order of filling out the codes	Items	Code	
1	Case code (※1)		
2	Taped lead space Formed lead type	F50 ect. CC etc.	
3	Suffix	φ5 ～ φ8	E0
		φ10 min.	E1

(※1) Some series are not required to show case codes.

3 Rating

No.	Item	Specification
1	Category temperature range	−55 to +105℃(6.3 to 100 V DC)
		−40 to +105℃(160 to 400 V DC)
2	Rated voltage range	6.3 to 400 V DC
3	Surge voltage	See Table−1
4	Nominal capacitance range	See table of Standard Ratings
5	Capacitance tolerance	−20 to +20 %
6	Rated ripple current	See table of Standard Ratings

4 Performance

Unless otherwise specified, the capacitors shall be measured at +15 to +35℃ , 45 to 75%RH and 86 to 106kPa. However, if any doubt arises on the judgment, the measurement conditions shall be +20±2℃, 60 to 70%RH and 86 to 106kPa. The test conditions shall comply with JIS C 5102−1994.

4.1 Capacitance(Cap.)

〔Conditions〕 Measuring frequency : 120Hz±20%
Measuring voltage : 0.5V rms max. + 1.5 to 2.0V DC
Measuring circuit : Series equivalent circuit (○⊣⊢⩘⩗○)
〔Criteria〕 Shall be within the specified capacitance tolerance.

4.2 Tangent of loss angle (tan δ)

〔Conditions〕 Measuring frequency : 120Hz±20%
Measuring voltage : 0.5V rms max. + 1.5 to 2.0V DC
Measuring circuit : Series equivalent circuit (○⊣⊢⩘⩗○)
〔Criteria〕 Shall not exceed the values specified in the table of Standard Ratings.

4.3 Leakage current (L.C.)

〔Conditions〕 DC leakage current shall be measured with rated voltage, which is applied through a resistor of 1,000±10Ω connected in series with the capacitors, at the end of a specified period after the capacitors reached the rated voltage across the terminals.

〔Criteria〕 Shall not exceed the values specified in the table of Standard Ratings.

4.4 Temperature characteristics

〔Conditions〕

unit ℃

Step	Temperature
1	+20±2
2	−25±3, −40±3
3	+20±2
4	+105±2

Step 1 : Measure capacitance and impedance (at 120Hz±10%).
Step 2 : Measure impedance (at 120Hz±10%).
Step 3 : No measurement for the electrical characteristics.
Step 4 : Measure capacitance, tan δ and leakage current.

〔Criteria〕 Step 2 : Impedance ratio shall not exceed the values shown in Table−2 attached.

4.5 Terminal strength

(1) Pull strength

〔Conditions〕 The capacitor body shall be held. A force shall be gradually applied to the lead wire in the direction of the axis of the lead wire up to the specified pull force, and retained for 10±1 seconds.

Nominal lead diameter mm	Pull force N
Over 0.3 to 0.5 incl.	5
Over 0.5 to 0.8 incl.	10

〔Criteria〕 The lead wire shall neither loosen nor break away.

(2) Lead bending strength

〔Conditions〕 The capacitor shall be held so that the normal axis of the lead wire can be in a vertical position. A weight equivalent to the specified load shall be hung on the end of the lead wire. The capacitor body shall be inclined through 90° and returned to its normal position within 2 to 3 seconds. The consecutive bend shall then be in the opposite direction in the same manner.

Nominal lead diameter mm	Bending load N
Over 0.3 to 0.5 incl.	2.5
Over 0.5 to 0.8 incl.	5

〔Criteria〕 The lead wire shall neither loosen nor break away.

4.6 Vibration

〔Conditions〕 Vibration frequency range : 10 to 55Hz
Peak to peak amplitude : 1.5mm
Sweep rate : 10 to 55 to 10Hz in about 1 minute
Direction and period of motion : 2 hours in each of 3 mutually perpendicular directions (total of 6 hours)

Note : Capacitors shall be mounted on the pc board with their lead wires anchored at 4mm max. of their bodies, except for the capacitors with the case size φ16×30L, whose lead wire shall be anchored at 1mm max. of their bodies. The body of the capacitor with 12.5mm or larger in diameter or 25mm or longer in length, in addition, shall be anchored to the pc board with a fixture.

〔Criteria〕 Capacitance (during test) : The reading shall be stable.
Appearance : No significant damage
Capacitance change : Shall be within ±5% of the initial measured value.

4.7 Solderability

〔Conditions〕 Type of solder : Sn−3Ag−0.5cu
Flux : Ethanol solution (25 wt.% rosin)
Solder temperature : +245±3℃
Depth of immersion : Up to 1.5 to 2.0mm
Speed of immersion : 1～5mm/s
〔Criteria〕 Solder shall cover at least 3/4 of the lead surface immersed.

4.8 Soldering heat

〔Conditions〕	Type of solder	: H60A, H60S or H63A
	Flux	: Ethanol solution (25 wt.% rosin)
	Solder temperature/immersion time	: +260±5℃ for 10±1 seconds or +380 ±10℃ for 3±0.5 seconds.
	Depth of immersion	: Up to 1.5 to 2.0mm from the root of the lead wire covered with a thermal screen.
	Speed of immersion	: 25±2.5mm/sec.
〔Criteria〕	Appearance	: No significant damage
	Leakage current	: Shall not exceed the initial specified value.
	Capacitance change	: Shall be within ±10% of the initial measured value.
	Tan δ	: Shall not exceed the initial specified value.

4.9 Operation of pressure relief vent

〔Conditions〕 Apply a reverse voltage with DC current 1 amp.(DC reverse voltage test)
〔Criteria〕 When the pressure relief vent operated, the capacitor shall not flame although gas generation or expulsion of a part of the inside element is allowable.
If the vent does not operate with the voltage applied for 30 minutes, the test is considered to be passed.

4.10 Humidity exposure

〔Conditions〕	Test temperature	: +40±2℃
	Relative humidity	: 90 to 95%RH
	Test time	: 240±8 hours
〔Criteria〕	Appearance	: No significant damage
	Leakage current	: Shall not exceed the initial specified value.
	Capacitance change	: Shall be within ±20% of the initial measured value.
	Tan δ	: Shall not exceed 120% of the initial specified value.

4.11 Endurance

〔Conditions〕 After the capacitors are subjected to DC voltage with the rated ripple current applied for $1{,}000^{+48}_{0}$ hours at 105℃±2℃, the following specifications shall be satisfied when the capacitors are restored to 20℃. The sum of DC voltage and peak AC voltage must not exceed their full rate voltage.

〔Criteria〕	Leakage current	: Shall not exceed the initial specified value.
	Capacitance change	: Shall be within ±20% of the initial measured value.
	Tan δ	: Shall not exceed 200% of the initial specified value.

4.12 Shelf life

〔Conditions〕 The capacitor shall be subjected to +105±2℃ for 1,000 $^{+48}_{0}$ hours without voltage applied, and the capacitor is then restored at 20℃ for the measurements. Before the measurements, the capacitor shall be preconditioned by applying voltage according to item 4.4 of JIS C 5102.

〔Criteria〕 Leakage current : Shall not exceed the initial specified value. (6.3 to 100VDC)
: Shall not exceed 500% of the initial specified value. (160 to 400VDC)

Capacitance change : Shall be within ±20% of the initial measured value.

Tan δ : Shall not exceed 200% of the initial specified value.

5 Others

5.1 Table

Table−1

Rated voltage VDC	6.3	10	16	25	35	50	63	100
Surge voltage V	8	13	20	32	44	63	79	125

Rated voltage VDC	160	200	250	350	400
Surge voltage V	200	250	300	400	450

Table−2

Rated voltage VDC	6.3	10	16	25	35	50	63	100
Z −25℃/ Z +20℃	4	3	2	2	2	2	2	2
Z −40℃/ Z +20℃	8	6	4	3	3	3	3	3

Rated voltage VDC	160	200	250	350	400
Z −25℃/ Z +20℃	3	3	3	6	6
Z −40℃/ Z +20℃	4	4	4	6	6

5.2 Multipliers for ripple current

Frequency multipliers

Capacitance \ Frequency	50Hz	120Hz	300Hz	1kHz	10kHz	100kHz
～ 4.7 μF	0.65	1.00	1.35	1.75	2.30	2.50
10 ～ 47 μF	0.75	1.00	1.25	1.50	1.75	1.80
100 ～ 1000 μF	0.80	1.00	1.15	1.30	1.40	1.50
2200 μF～	0.85	1.00	1.03	1.05	1.08	1.08

When frequency is different from the specified condition shown in the table of Standard Ratings, do not exceed the value obtained by multiplying the permissible maximum ripple current by the multiplier above.

5.3 Export Trade Control Ordinance

(To be complied for aluminum electrolytic capacitors to be exported from Japan)

1. Section 1 through 15 of Appendix Table 1 in Export Trade Control Ordinance

Item 41-4 in Section 2 of Appendix Table 1 (Section 49 in Chapter 1 of MITI's Ordinance) and Item 7 in Section 7 of Appendix Table 1 (Section 6 in Chapter 6 of MITI's Ordinance) state export regulations on pulse use capacitors (750V or higher) and high voltage use capacitors (5,000V or higher).
However, aluminum electrolytic capacitors are less than 750V in their voltage range, so that the regulations do not apply to the aluminum electrolytic capacitors.

2. Section 16 of Appendix Table 1 in Export Trade Control Ordinance

Item 41 in Section 16 of Appendix Table 1 (Section 42 in Chapter 14 of MITI's Ordinance) applies to pulse use capacitors or pulse generators. Since any capacitor, including Nippon Chemi-con's aluminum electrolytic capacitors, functions as pulse use, the Export Trade Control Ordinance applies export regulations to the aluminum electrolytic capacitors.

If an exporter has the information that his exporting goods are used to any development of extensive destructive weapons, the exporter must ask for exporting permission of the Ministry of international Trade and Industry (MITI).
Regardless of the above, when the MITI notified the exporter that his exporting goods are possibly used to any development of extensive destructive weapons and so forth, the exporter must ask for exporting permission of the MITI. If receiving the notice form the MITI, Nippon Chemi-Con will inform your company of it.

5.4 Cleaning of assembly boards

The products of the rated voltage range from 350 to 400V$_{DC}$ are not solvent-proof type.

● Acceptable cleaning conditions

For higher alcohol system cleaning agents, capacitors are capable of withstanding immersion or ultrasonic cleaning within 10 minutes at a maximum temperature of 60℃. The wash, rinse and drying process should be so arranged that other components and pc boards can not rub off the marking of the capacitor. Especially note that shower cleaning can affect the marking.

Higher alcohol system cleaning agents, recommended:

Pine Alpha ST-100S
Clean Through 750H, 750K, 750L, and 710M
Technocare FRW-14 to 17

※ Other cleaning agents:

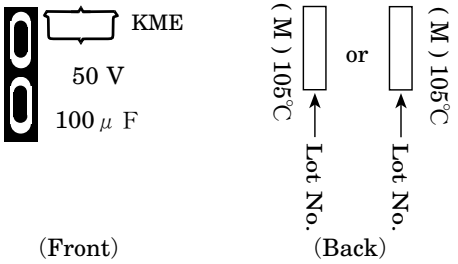
A terpene or petroleum system solvent swells and damages the rubber seal materials of a capacitor, so that the life of the capacitor can be shortened. An alkaline saponification detergent, which has high pH, erodes an aluminum metal or washes away the marking. Consequently, do not use all these cleaning agents.
For CFCs substitute, Asashi Glass AK225AES solvent is recommended to use only for Solvent-Proof type capacitors, which are especially designed. The Solvent-Proof type capacitors are capable of withstanding any one of immersion, ultrasonic or vapor cleaning within 5 minutes as acceptable cleaning conditions for the AK225AES solvent (except that 2 minutes max. for KRE and KRE-BP series capacitors and 3 minutes max. for SRM and KRF series capacitors).
From the environmental point of view, however, do not use the CFCs substitute solvent as much as possible.
IPA (Isopropyl alcohol) is usually one of the acceptable cleaning agents. Flux concentration in the IPA cleaning agent should be controlled at a maximum limit of 2wt.%, because the halogenide ions in flux can dissolve in the cleaning agent.

6 Marking

The following items shall be marked on each capacitor. (White marking on brown sleeve)

①Rated voltage
②Nominal capacitance
③Maximum operating temperature
④Polarity
⑤Manufacturer's identification mark
⑥Capacitance tolerance － (M)
⑦Lot No.

Example



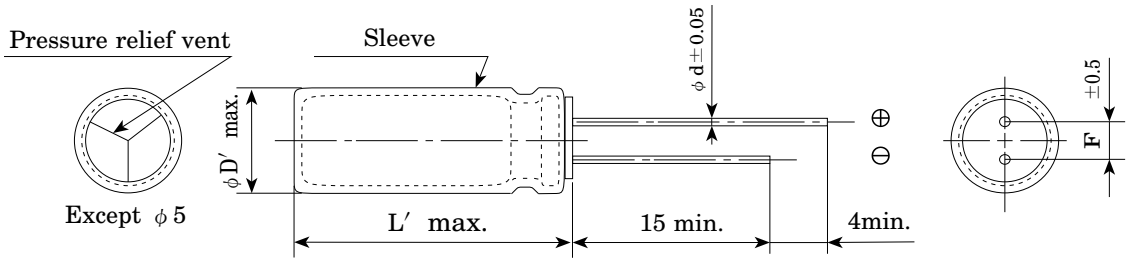
Finish method

1. Lot No. is marked on either of the sleeve or the top of the aluminum case.
2. The outer sleeve with the marking shall be covered onto the aluminum can so as to locate the negative stripe marking to the negative lead side.

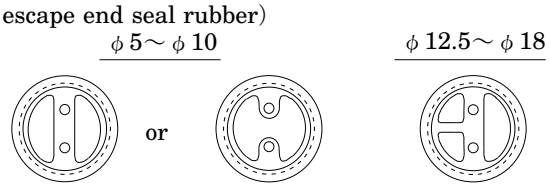
7 Dimension and construction

7.1 Dimension

unit mm



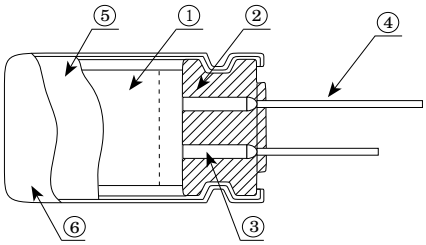
(Bottom view of gas escape end seal rubber)



φD	5	6.3	8	10	12.5	16	18
L	11～40						
φd	0.5	0.5	0.6			0.8	
F	2.0	2.5	3.5	5.0		7.5	
L′	L + 1.5 ※1						
φD′	φD + 0.5 ※1						

※1 φD, L : nominal case size

7.2 Construction



	Compositions		Materials
①	Element	Anode foil	Aluminum
		Cathode foil	Aluminum
		Separator	Paper
		Fixing tape	Polypropylene (PP)
②	Seal		Rubber
③	Aluminum tab		Aluminum
④	Lead wire		Containing tinned copper clad steel or Bismuth-containing tinned copper clad steel
⑤	Case		Aluminum
⑥	Sleeve		Polyester

※ No ozone depleting substance has been used.

8 Taping

8.1 Scope

This specification is applied to radial lead type aluminum electrolytic capacitors which are taped according to JIS C 0805-1989.

8.2 Taping configurations

Figure 1
TC04 type
ϕ 5 to ϕ 8

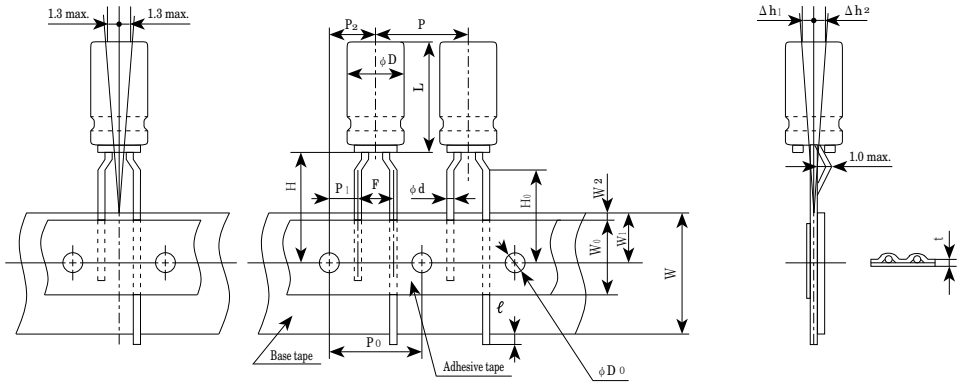


Figure 2
TD04 type
ϕ 5

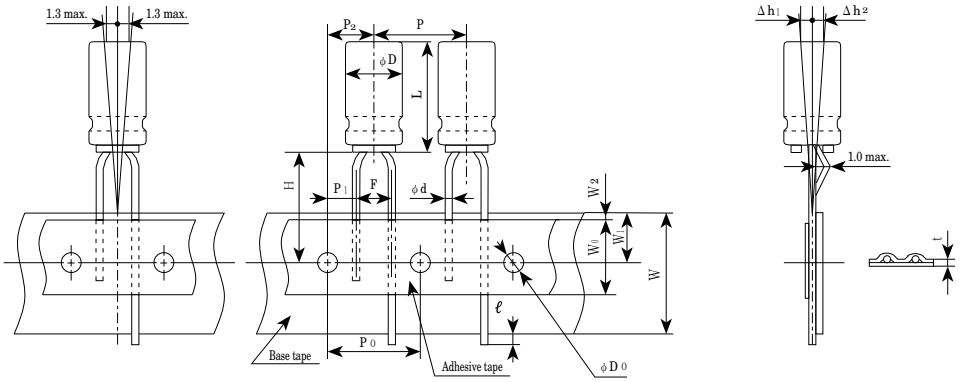


Figure 3
TD04 type
ϕ 6.3, ϕ 10
TD03 type
ϕ 12.5

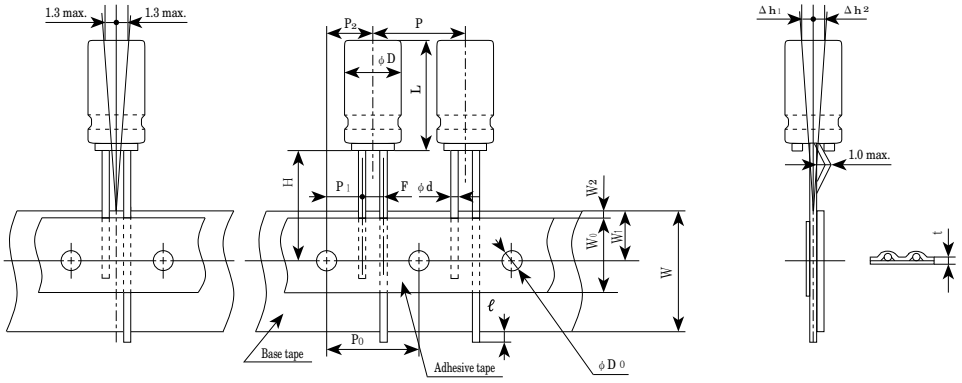
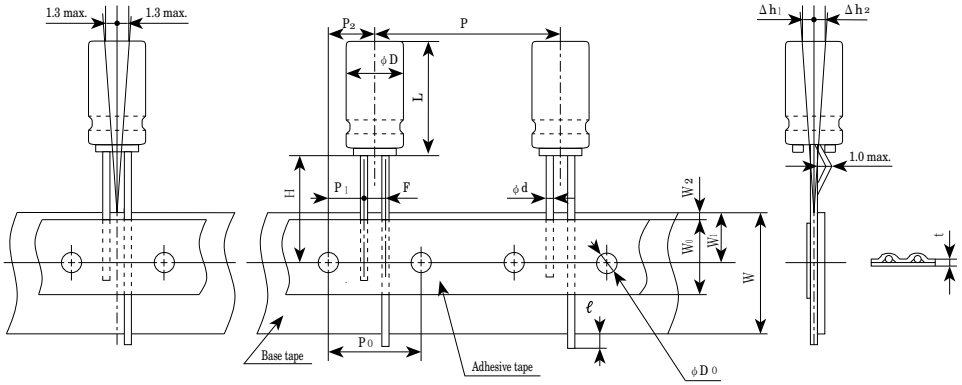


Figure 4
TD05 type
ϕ 12.5
TD07 type
ϕ 16



8.3 Taping dimensions

unit mm

Symbol	Tolerance	Nominal value					Remarks
ϕ D	—	5		6.3		8	
L	—	11		11		11.5	
ϕ d	±0.05	0.5		0.5		0.6	
P	±1.0	12.7		12.7		12.7	
P_0	±0.2	12.7		12.7		12.7	※1
P_1	±0.7	5.1	3.85	5.1	3.85	3.85	※2
P_2	±1.0	6.35		6.35		6.35	
F	−0.2/+0.8	2.5	5.0	2.5	5.0	5.0	※2
W	±0.5	18.0		18.0		18.0	
W_0	min.	10.0		10.0		10.0	※3
W_1	±0.5	9.0		9.0		9.0	
W_2	max.	1.5		1.5		1.5	※3
H	±0.75	18.5		18.5		20.0	
H_0	±0.5	—	16.0	—	16.0	16.0	※4
ϕD_0	±0.2	4.0		4.0		4.0	
ℓ	max.	1.0		1.0		1.0	
t	±0.2	0.7		0.7		0.7	
$\Delta h_1, \Delta h_2$	max.	2.0		2.0		2.0	※5
Figure		2	1	3	1	1	

Symbol	Tolerance	Nominal value				Remarks
ϕ D	—	10	12.5		16	
L	—	12.5～20	20～25		25	
ϕ d	±0.05	0.6	0.6	0.6	0.8	
P	±1.0	12.7	15	25.4	30	
P_0	±0.3	12.7	15	12.7	15	※1
P_1	±0.7	3.85	5.0	3.85	3.75	※2
P_2	±1.3	6.35	7.5	6.35	7.5	
F	−0.2/+0.8	5.0	5.0	5.0	7.5	※2
W	±0.5	18.0	18.0	18.0	18.0	
W_0	min.	12.5	12.5	12.5	12.5	※3
W_1	±0.5	9.0	9.0	9.0	9.0	
W_2	max.	1.5	1.5	1.5	1.5	※3
H	−0/+2.0	18.0	18.0	18.0	18.0	
ϕD_0	±0.2	4.0	4.0	4.0	4.0	
ℓ	max.	1.0	1.0	1.0	1.0	
t	±0.2	0.7	0.7	0.7	0.7	
$\Delta h_1, \Delta h_2$	max.	2.0	2.0	2.0	2.0	※5
Figure		3	3	4	4	

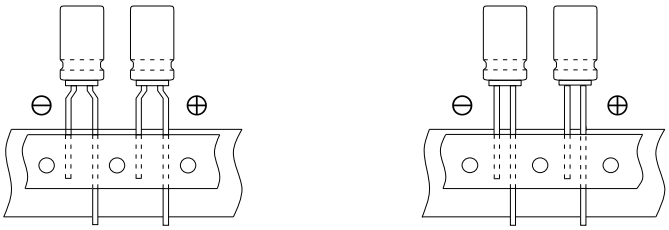
※1 Cumulative pitch error shall not exceed ± 1.0mm per 20 pitches.
※2 Measurement shall be made at the top of the tape and the center of the lead.
※3 Adhesive tape shall not extend beyond the edge of the base tape.
※4 Measurement shall be made from the bottom of the lead clinch.
※5 Measurement shall be made at the top of the capacitor.

8.4 Taping method and polarity

(1) Taping method

Capacitors shall be taped on the base tape with the adhesive tape so that their lead wires can be perpendicular to the longitudinal direction of the base tape, and their polarities shall be arranged in one orientation.

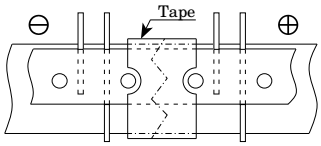
※The polarity orientation does not apply to non-polarized capacitors.



(2) Splicing of base tapes

Splicing shall be made with a tape by means of a prescribed tool as shown below. The base tapes spliced shall be aligned within a error of 1.0mm. The splicing joint shall not have capacitors.

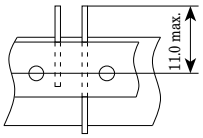
※The polarity orientation does not apply to non-polarized capacitors.



(3) Missing of capacitor

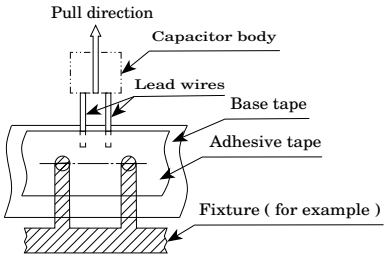
Consecutive missing capacitors shall not exceed 3 pcs after taped. Although a quantity of discontinuous missing capacitors is not specified, the total quantity per a box shall be satisfied.

When a capacitor is removed from the tape after taped, its lead wires shall be cut off or the capacitor shall be pulled out. Cutting the lead wires shall be made as follows,



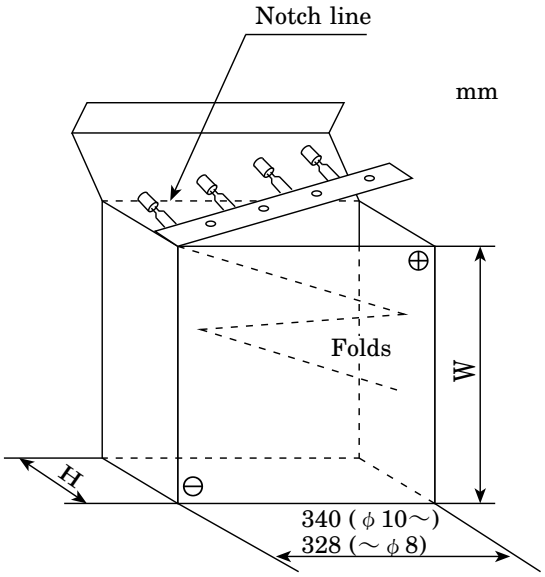
(4) Pull strength of taped capacitor

The capacitor which was fixed in between the base tape and adhesive tape shall have adhesion of at least 5N when the capacitor was pulled out in the axis direction of the capacitor as follows,



9 Packaging

9.1 Packaging for taping



Case size (ϕ D×L)		W	H	Quantity packed
mm				(pcs)
ϕ 5	length 11	232	51	2000
ϕ 6.3	length 11	284	51	2000
ϕ 8	length 11.5	232	51	1000
ϕ 10	length 20 max.	308	62	800
ϕ 12.5	length 25 max.	308	67	500
ϕ 16	length 25 max.	350	67	250

Note: The box dimensions may change slightly.

※For ϕ 10 and ϕ 12.5 with P=15, the capacitors located on folds shall be removed.
(The polarity orientation does not apply to non-polarized capacitors.)

The following items shall be marked on the box.

1) Taping code
2) Series name
3) Part description
4) Production drawing No.
5) Quantity
6) Customer-required marking (Where customers designated.)
7) Customer part No. (Where customers designated.)
8) Lot No. (Assembly lot No. of capacitor.)

STANDARD RATINGS

V_{DC} V	Cap. μF	Case size φD×L mm	tan δ	L.C. μA 1min	L.C. μA 2min	L.C. μA 5min	Rated ripple current mA rms/105℃ 120Hz	
6.3	33	5×11	0.22	6.2	3.0	—	54	
6.3	47	5×11	0.22	8.9	3.0	—	65	
6.3	100	5×11	0.22	18.9	6.3	—	95	
6.3	220	6.3×11	0.22	41.6	13.9	—	160	
6.3	330	6.3×11	0.22	62.4	20.8	—	195	
6.3	470	8×11.5	0.22	88.8	29.6	—	270	
6.3	1000	10×12.5	0.22	189	63.0	—	460	
6.3	2200	12.5×20	0.26	416	139	—	810	
6.3	3300	12.5×20	0.28	624	208	—	960	
6.3	4700	16×25	0.30	888	296	—	1330	
6.3	6800	16×25	0.34	1290	428	—	1500	
6.3	10000	16×31.5	0.40	1890	630	—	1765	
6.3	15000	18×35.5	0.50	2840	945	—	2075	
10	22	5×11	0.19	6.6	3.0	—	49	
10	33	5×11	0.19	9.9	3.3	—	60	
10	47	5×11	0.19	14.1	4.7	—	70	
10	100	5×11	0.19	30.0	10.0	—	105	
10	220	6.3×11	0.19	66.0	22.0	—	175	
10	330	8×11.5	0.19	99.0	33.0	—	245	
10	470	8×11.5	0.19	141	47.0	—	290	
10	1000	10×16	0.19	300	100	—	550	
10	2200	12.5×20	0.23	660	220	—	860	
10	3300	12.5×25	0.25	990	330	—	1100	
10	4700	16×25	0.27	1410	470	—	1400	
10	6800	16×31.5	0.31	2040	680	—	1690	
10	10000	18×35.5	0.37	3000	1000	—	1950	
16	10	5×11	0.16	4.8	3.0	—	35	
16	22	5×11	0.16	10.6	3.5	—	54	
16	33	5×11	0.16	15.8	5.3	—	64	
16	47	5×11	0.16	22.6	7.5	—	77	
16	100	6.3×11	0.16	48.0	16.0	—	125	
16	220	8×11.5	0.16	106	35.2	—	215	
16	330	8×11.5	0.16	158	52.8	—	260	
16	470	10×12.5	0.16	226	75.2	—	370	
16	1000	10×20	0.16	480	160	—	640	
16	2200	12.5×25	0.20	1060	352	—	1000	
16	3300	16×25	0.22	1580	528	—	1300	
16	4700	16×31.5	0.24	2260	752	—	1600	
16	6800	18×35.5	0.28	3260	1090	—	1900	
16	10000	18×40	0.34	4800	1600	—	2060	
25	4.7	5×11	0.14	4.0	3.0	—	26	
25	10	5×11	0.14	7.5	3.0	—	38	
25	22	5×11	0.14	16.5	5.5	—	57	
25	33	5×11	0.14	24.8	8.3	—	69	
25	47	5×11	0.14	35.3	11.8	—	82	
25	100	6.3×11	0.14	75.0	25.0	—	135	
25	220	8×11.5	0.14	165	55.0	—	230	
25	330	10×12.5	0.14	248	82.5	—	335	
25	470	10×16	0.14	353	118	—	440	
25	1000	12.5×20	0.14	750	250	—	770	
25	2200	16×25	0.18	1650	550	—	1170	
25	3300	16×31.5	0.20	2480	825	—	1460	
25	4700	18×35.5	0.22	3530	1180	—	1780	
25	6800	18×40	0.26	5100	1700	—	1950	
35	4.7	5×11	0.12	4.9	3.0	—	28	
35	10	5×11	0.12	10.5	3.5	—	41	
35	22	5×11	0.12	23.1	7.7	—	61	
35	33	5×11	0.12	34.7	11.6	—	75	
35	47	6.3×11	0.12	49.4	16.5	—	100	
35	100	8×11.5	0.12	105	35.0	—	170	
35	220	10×12.5	0.12	231	77.0	—	300	

STANDARD RATINGS

V_{DC} V	Cap. μF	Case size φD×L mm	tan δ	L.C. μA 1min	L.C. μA 2min	L.C. μA 5min	Rated ripple current mA rms/105℃ 120Hz	
35	330	10×16	0.12	347	116	—	400	
35	470	10×20	0.12	494	165	—	520	
35	1000	12.5×25	0.12	1050	350	—	920	
35	2200	16×31.5	0.16	2310	770	—	1340	
35	3300	18×35.5	0.18	3470	1160	—	1650	
35	4700	18×40	0.20	4940	1650	—	1900	
50	0.1	5×11	0.10	4.0	3.0	—	1.3	
50	0.22	5×11	0.10	4.0	3.0	—	2.9	
50	0.33	5×11	0.10	4.0	3.0	—	4.4	
50	0.47	5×11	0.10	4.0	3.0	—	7	
50	1	5×11	0.10	4.0	3.0	—	13	
50	2.2	5×11	0.10	4.0	3.0	—	20	
50	3.3	5×11	0.10	5.0	3.0	—	25	
50	4.7	5×11	0.10	7.1	3.0	—	30	
50	10	5×11	0.10	15.0	5.0	—	46	
50	22	5×11	0.10	33.0	11.0	—	68	
50	33	6.3×11	0.10	49.5	16.5	—	90	
50	47	6.3×11	0.10	70.5	23.5	—	110	
50	100	8×11.5	0.10	150	50.0	—	180	
50	220	10×16	0.10	330	110	—	345	
50	330	10×20	0.10	495	165	—	460	
50	470	12.5×20	0.10	705	235	—	610	
50	1000	16×25	0.10	1500	500	—	1080	
50	2200	18×35.5	0.14	3300	1100	—	1530	
63	4.7	5×11	0.09	8.9	3.0	—	32	
63	10	5×11	0.09	18.9	6.3	—	50	
63	22	6.3×11	0.09	41.6	13.9	—	82	
63	33	6.3×11	0.09	62.4	20.8	—	100	
63	47	8×11.5	0.09	88.8	29.6	—	135	
63	100	10×12.5	0.09	189	63.0	—	225	
63	220	10×20	0.09	416	139	—	400	
63	330	12.5×20	0.09	624	208	—	540	
63	470	12.5×25	0.09	888	296	—	700	
63	1000	16×31.5	0.09	1890	630	—	1210	
100	0.1	5×11	0.08	4.0	3.0	—	2.6	
100	0.22	5×11	0.08	4.0	3.0	—	5.8	
100	0.33	5×11	0.08	4.0	3.0	—	7.8	
100	0.47	5×11	0.08	4.0	3.0	—	10	
100	1	5×11	0.08	4.0	3.0	—	15	
100	2.2	5×11	0.08	6.6	3.0	—	23	
100	3.3	5×11	0.08	9.9	3.3	—	29	
100	4.7	5×11	0.08	14.1	4.7	—	34	
100	10	6.3×11	0.08	30.0	10.0	—	56	
100	22	8×11.5	0.08	66.0	22.0	—	96	
100	33	10×12.5	0.08	99.0	33.0	—	140	
100	47	10×16	0.08	141	47.0	—	180	
100	100	12.5×20	0.08	300	100	—	320	
100	220	16×25	0.08	660	220	—	570	
100	330	16×25	0.08	990	330	—	700	
100	470	16×31.5	0.08	1410	470	—	880	
160	0.47	6.3×11	0.20	47.5	—	17.3	9	
160	1	6.3×11	0.20	56.0	—	19.8	12	
160	2.2	6.3×11	0.20	75.2	—	25.6	19	
160	3.3	8×11.5	0.20	92.8	—	30.8	26	
160	4.7	8×11.5	0.20	115	—	37.6	31	
160	10	10×16	0.20	164	—	57.0	59	
160	22	10×20	0.20	241	—	95.4	95	
160	33	12.5×20	0.20	311	—	131	125	
160	47	12.5×25	0.20	401	—	175	165	
160	100	16×25	0.20	740	—	345	270	
160	220	18×35.5	0.20	1510	—	729	450	
200	0.47	6.3×11	0.20	49.4	—	17.8	9	
200	1	6.3×11	0.20	60.0	—	21.0	12	

STANDARD RATINGS

V_{DC} V	Cap. μF	Case size φD×L mm	tan δ	L.C. μA 1min	L.C. μA 2min	L.C. μA 5min	Rated ripple current mA rms/105℃ 120Hz	
200	2.2	6.3×11	0.20	84.0	—	28.2	19	
200	3.3	8×11.5	0.20	106	—	34.8	26	
200	4.7	10×12.5	0.20	134	—	43.2	36	
200	10	10×16	0.20	180	—	65.0	59	
200	22	10×20	0.20	276	—	113	95	
200	33	12.5×25	0.20	364	—	157	140	
200	47	12.5×25	0.20	476	—	213	165	
200	100	16×31.5	0.20	900	—	425	285	
200	220	18×40	0.20	1860	—	905	470	
250	0.47	6.3×11	0.20	51.8	—	18.5	9	
250	1	6.3×11	0.20	65.0	—	22.5	12	
250	2.2	8×11.5	0.20	95.0	—	31.5	21	
250	3.3	10×12.5	0.20	123	—	39.8	30	
250	4.7	10×12.5	0.20	147	—	48.5	36	
250	10	10×20	0.20	200	—	75.0	64	
250	22	12.5×25	0.20	320	—	135	110	
250	33	12.5×25	0.20	430	—	190	140	
250	47	16×25	0.20	570	—	260	180	
250	100	18×35.5	0.20	1100	—	525	310	
350	0.47	8×11.5	0.24	56.5	—	19.9	10	
350	1	10×12.5	0.24	75.0	—	25.5	18	
350	2.2	10×16	0.24	117	—	38.1	30	
350	3.3	10×16	0.24	146	—	48.1	37	
350	4.7	10×20	0.24	166	—	57.9	48	
350	10	12.5×20	0.24	240	—	95.0	79	
350	22	16×20	0.24	408	—	179	130	
350	33	16×25	0.24	562	—	256	175	
350	47	16×35.5	0.24	758	—	354	230	
350	100	18×40	0.24	1500	—	725	330	
400	1	10×12.5	0.24	80.0	—	27.0	18	
400	2.2	10×16	0.24	128	—	41.4	30	
400	3.3	10×20	0.24	153	—	51.4	40	
400	4.7	10×25	0.24	175	—	62.6	52	
400	10	12.5×25	0.24	260	—	105	79	
400	22	16×25	0.24	452	—	201	145	
400	33	16×31.5	0.24	628	—	289	185	
400	47	18×31.5	0.24	852	—	401	230	

＊Precautions to User for Non-Solid Aluminum Electrolytic Capacitors＊

CLASSIFICATION	ITEM
1.Designing device circuits	(1) Make sure that installation and operating environments are within the rated performance limits of capacitors prescribed in their catalogs or product specifications, and select the capacitors to meet the service life of a device. Do not use capacitors at the following conditions, a)High temperature (exceeding the maximum rated operating temperature of capacitors) b)Excessive current (more than the rated permissible rated ripple current of the capacitors) c)Over-voltage (exceeding the rated voltage of the capacitors) d)Reverse voltage or AC voltage. e)In circuits in which charge and discharge are frequently repeated.
	(2) Electrically isolate the outer can case of a capacitor from the positive and negative terminals and the circuits. If the capacitor has a dummy terminal for mounting stability, isolate it as well.
	(3) The outer sleeves of capacitors are not assured as insulation-functioning parts. Do not use the capacitors for places that require the outer sleeves functioning as insulation.
	(4) Do not use capacitors to devices exposed to the following environment. a)Water, salt water or oil spatters, or dewy places. b)Toxic gas (hydrogen sulfide, sulfurous acid, nitrous acid, chlorine, ammonium, etc.) fills into. c)Direct sunlight, ozone, ultraviolet rays or radiation is applied to. d)Severe vibration or mechanical shock exceeding the limits prescribed in the catalogs or product specifications is applied to.
	(5) Design considerations for installing a capacitor to the print circuit board. a)Provide the appropriate hole spacing on the printed circuit board to match the terminal spacing of the capacitor. b)Make an open space over the pressure relief vent of the capacitor. c)Do not locate any wire or copper trace over the vent. d)If mounting the capacitor with its vent face down on the pc board, provide a ventilation hole in the pc board in place. e)Do not locate any copper trace under the seal side of a capacitor. f)Avoid locating any heat-producing object around a capacitor or on the reverse side of the print circuit board under the capacitor. g)For surface mount capacitors, design the copper pads of a print circuit board according to the product specifications.
	(6) Other precautions in designing devices. a)Take account of the changes in the electrical characteristics of capacitors varying with respect to temperature and frequency. b)If using a double-sided printed circuit board, do not locate any via hole within the pc board area under the seal side of the capacitor. c)If using more than one capacitor to connect in parallel, balance the currents flowing into the individual capacitors. d)If using more than one capacitor to connect in series, connect resistors in parallel with the individual capacitors for balancing the voltages.
2.Installing capacitors in devices	(1)Follow the instructions below for installing capacitors in devices. a)Do not re-use the capacitors already used in devices. The used capacitors are not reusable, except the case that they are taken from a device for periodic inspection measuring their electrical characteristics and then returned to the device. b)Although discharged at manufacturing process, capacitors may have been re-charged by a recovery voltage phenomenon. In this case, discharge them through a resistor of approximately 1 kΩ before installation. c)The capacitors that has been stored for long periods of time may have high leakage current. In this case, make pre-conditioning by applying a voltage through a resistor of approximately 1 kΩ. d)Make sure of the rated values (nominal capacitance and voltage) and polarity when installation. e)Do not drop capacitors on the floor etc. If they should fall down, do not use them. f)Do not deform capacitors in installing to a device. g)Make sure that the terminal spacing equals the hole spacing of the pc board before installation. h)If the lead wires of the capacitor are clinched to the pc board with the clinch unit of an automatic insertion machine, adjust the clinch unit not to apply an excessive lead pull force to the lead wires of the capacitor. i)Note a mechanical shock that is caused by the vacuum head, component checker or centering operation of an automatic insertion or mounting machine.

CLASSIFICATION	ITEM
2.Installing capacitors in devices	(2) Follow the instructions below for soldering. a)Do not put flux on any part of capacitors other than their terminals. b)Soldering conditions (temperature, time and the number of repeats) should be within the limits prescribed in the catalogs or product specifications. c)Do not dip the bodies of capacitors into the solder bath. d)Do not let other components lean against the capacitors during soldering.
	(3) Do not apply a mechanical stress to the capacitor after soldering to the pc board. a)Do not incline, twist or push the capacitor body. b)Do not take the assembly board by the capacitor in lifting or carrying the assembly board. c)Do not bump or strike any object against the capacitor.
	(4) Do not wash capacitors by using cleaning agents. If it is necessary to wash capacitors, use the only capacitors that are capable of withstanding the cleaning agents and apply the cleaning conditions within the limits prescribed in the product specifications.
	(5) Precautions for the washable capacitors. a)Prevent cleaning agents from being contaminated, by controlling their conductivity, pH, specific gravity, water content, etc. b)After washing the capacitors, do not keep them in an atmosphere of the cleaning agents or a closed container. Remove the residual cleaning agents by drying the assembly board by a forced hot air at temperatures less than the maximum rated operating temperature of the capacitors.
	(6) Do not use any adhesive or coating material containing halogenated solvents.
	(7) Precautions for using adhesives and coating materials. a)Do not apply adhesives or coating materials with flux or dirt left on the rubber seal of the capacitor or between the pc board surface and the capacitor seal. b)Before applying the adhesives or coating materials to the capacitors, dry and remove the residual cleaning agents. Also, do not cover up the whole surface of the capacitor rubber seal with the adhesives or coating materials. c)For permissible heat conditions for curing adhesives or coating materials, follow the instructions in the product specifications of capacitors.
3.During operation	(1) Follow the following precautions for a device in operation. a)Do not touch a capacitor directly with bare hands. b)Do not short-circuit the terminals of a capacitor by applying any conductive object.
	(2) Do not use devices at the following environment. a)Water, oil or dew spatters on the capacitors. b)Direct sunlight, ozone, ultraviolet rays or radiation is applied to the capacitors. c)Toxic gas (hydrogen sulfide, sulfurous acid, nitrous acid, chlorine, ammonium, etc.) fills into. d)Severe vibration or mechanical shock, exceeding the limits prescribed in the catalogs or product specifications, is applied to the capacitors.
4.Maintenance inspection	(1) Make periodic inspections for the capacitors that have been used in devices for industrial application. The appearance and electrical characteristics of the capacitors should be checked for the periodic inspections.
5.In the event of venting on capacitors.	(1) If the capacitor should blow out gas with its vent open, turn off or unplug the main power supply of the device.
	(2) When venting, the capacitor blows a hot gas of more than 100℃. Never expose the face close to the venting capacitor. If you should expose your eyes to the spouting gas and inhale it, immediately flush the open eyes and gargle with water. Do not lick the electrolyte of a capacitor. Wash the electrolyte away from the skin with soap and water.
6.Fumigation	(1) Fumigation process may be required when exporting the end electrical product. The process, actually halogenated ions, may cause the aluminum electrolytic capacitor to corrode. The fumigation solvent must not directly adhere to the electrical product and the solvent must be dried completely. Please consult us if solvent adheres to the aluminum electrolytic capacitors or drying condition is not satisfaction.
7.Storage	(1) Store capacitors indoors at a temperature of 5 to 35℃ and a humidity of less than 75% RH.
	(2) Do not store capacitors in the environment prohibited with Section 3.(2).
8.Disposal	(1) In the interests of the environment and in order to comply with local disposal regulations, ask a specialist for the disposal of industrial wastes.

∗For other precautions and the details of these precautions, refer to Engineering Bulletin No.634A.
The following technical terms have been changed according to change of reference standard from JIS C 5141-1991 to JIS C 5101-1998.

New standard JIS C 5101-1998	Old standard JIS C 5141-1991
Category temperature range	Operating temperature range
Rated ripple current	Ripple current
Endurance	Load life