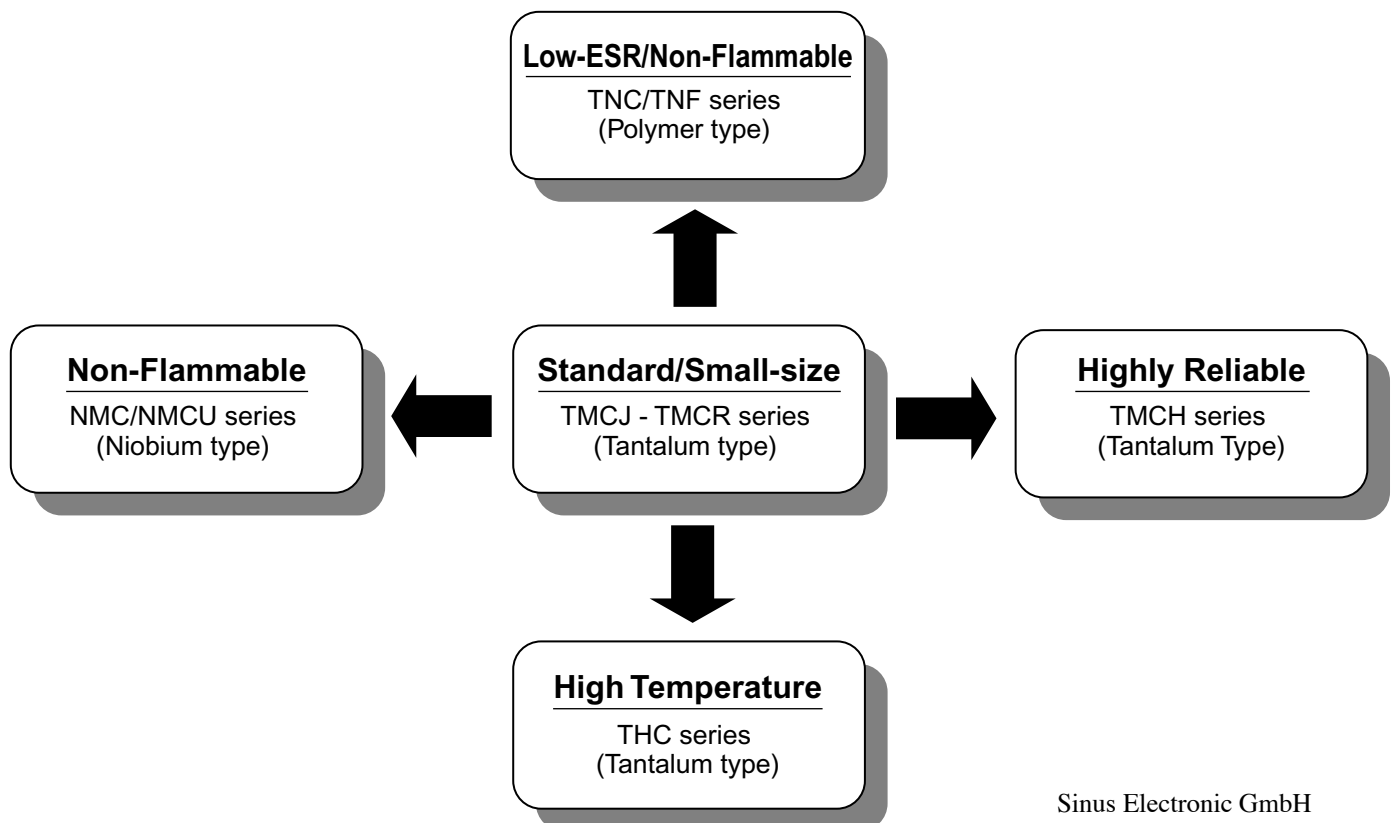


## Product Table

### List of Tantalum • Niobium electrolytic capacitor products (Former Hitachi AIC Technology)

Series	Description	Operating temperature range	Operating voltage V.DC	Capacitance range $\mu\text{F}$	See page:
TMCJ	Resin mold chip, ultra small-size type (0603)	-55 ~ +125°C	2.5 ~ 20	0.68 ~ 22	6
TMCP	Resin mold chip, ultra small-size type (0805)	-55 ~ +125°C	2.5 ~ 25	0.1 ~ 47	7
TMCM	Resin mold chip, small-size type	-55 ~ +125°C	2.5 ~ 35	0.47 ~ 470	9
TMCS	Resin mold chip, standard type	-55 ~ +125°C	4 ~ 35	0.1 ~ 68	12
TMCU	Resin mold chip, low profile type	-55 ~ +125°C	2.5 ~ 35	0.1 ~ 220	14
TMCR	Resin mold chip, low ESR type	-55 ~ +125°C	6.3 ~ 35	10 ~ 330	16
TMCH	Resin mold chip, highly reliable type	-55 ~ +125°C	4 ~ 35	0.1 ~ 100	18
TMCTX	Resin mold chip, with a built-in fuse	-55 ~ +125°C	10 ~ 35	1.0 ~ 68	20
TMF	Resin mold chip, capacitor with face down terminals	-55 ~ +125°C	2.5 ~ 16	2.2 ~ 220	22
THC	Resin mold chip, high reliable, high temperature	-55 ~ +150°C	10 ~ 35	0.33 ~ 47	24
NMC	Resin mold chip, small-size type	-55 ~ +105°C	2.5 ~ 16	10 ~ 470	26
NMCU	Resin mold chip, low profile type	-55 ~ +105°C	2.5 ~ 16	4.7 ~ 47	28
TNC	Resin mold chip, high performance polymer type	-55 ~ +105°C	2.5 ~ 10	3.3 ~ 330	30
TNF	Resin mold chip, polymer type with face down terminals	-55 ~ +105°C	2.5 ~ 10	10 ~ 100	32



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## Precautions in using Tantalum Niobium Capacitors

The major conditions to be considered in relation to the use of the tantalum capacitors are as follows:

- 1) Electrical conditions
- 2) Climatic conditions
- 3) Conditions for mounting on equipment and circuit boards
- 4) Mechanical vibration, shock, and storage conditions

If the tantalum capacitors are used without satisfying any one of these conditions, the probability of short-circuiting, leakage current increase or other problems to occur. To avoid such problems, observe the following precautions when using the tantalum capacitors.

### 1. Operating Voltage

- (1) The voltage derating factor should be as great as possible. It is recommended that the operating voltage be 50% or less of the rated, particularly when the tantalum capacitors are used in a low-impedance circuit (see Figs. 1, 2, and 3).
- (2) It is recommended that the operating voltage be 80% or less of rated for niobium electrolytic capacitors.

#### • Low-impedance circuits

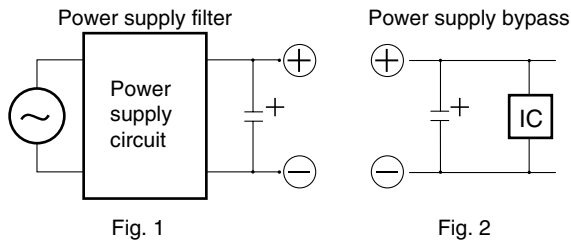


Fig. 1

Fig. 2

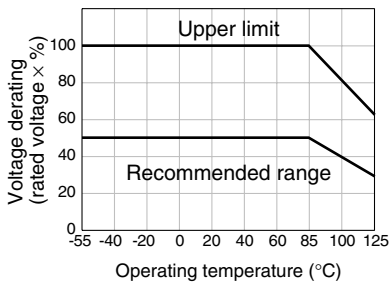


Fig. 3

### 2. Ripple

If an excessive ripple voltage is applied to the tantalum and niobium capacitors, their internal temperature rises due to Joule heat, resulting in the detriment of their reliability. The maximum permissible ripple voltage and current are related to the ratings or case size. Please consult us for detail information.

#### 2.1 Ripple Current

The maximum permissible ripple current,  $I_{MAX}$ , is calculated as follows:

$$I_{MAX} = \sqrt{\frac{P_{MAX}}{ESR(D)}}$$

where:

- $I_{MAX}$ : Maximum permissible capacitor ripple current (Arms).
- $P_{MAX}$ : Maximum permissible capacitor power loss (W). Varies with the ambient temperature and case size. Calculated according to Table 1.
- ESR (D): Capacitor equivalent series resistance ( $\Omega$ ).

Since the ESR(D) value varies with the ripple frequency, however, the following correction must be made in accordance with the operating frequency (see Table 2 and Fig. 4).

$$ESR(D) = K \cdot ESR(120)$$

K: Coefficient for the operating frequency (Table 2 and Fig. 4).

$$ESR(120) = \tan \delta \cdot X_c = \frac{\tan \delta}{2\pi f C}$$

where:

ESR (120): Equivalent series resistance at 120 Hz ( $\Omega$ ).

$X_c$  : Capacitive reactance at 120 Hz ( $\Omega$ ).

C : Electrostatic capacitance at 120 Hz ( $\mu F$ ).

f : Operating frequency (Hz).

Table 1 Maximum permissible power loss values ( $P_{MAX}$ ) by case size

Ambient temperature (°C)	$P_{MAX}$ (W)						
	LM,J	LP,P	LA,UA,A	UB,B	C	E	F
25	0.050	0.064	0.078	0.096	0.100	0.120	0.160
55	0.032	0.045	0.051	0.062	0.065	0.078	0.104
85	0.018	0.023	0.029	0.035	0.037	0.044	0.059

Table 2

Frequency f	K
120	1.0
400	0.8
1k	0.65
10k	0.50
20k	0.45
40k	0.43
100k	0.40
1M	0.35

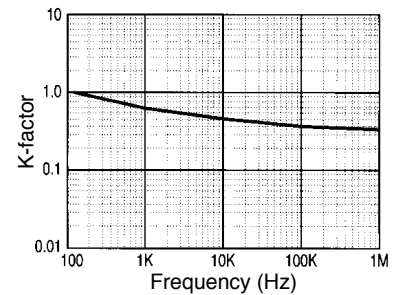


Fig. 4 Correction coefficient (K)

#### 2.2 Ripple Voltage

- (1) The tantalum capacitors must be used in such a conditions that the sum of the working voltage and ripple voltage peak values does not exceed the rated voltage (Fig. 5)

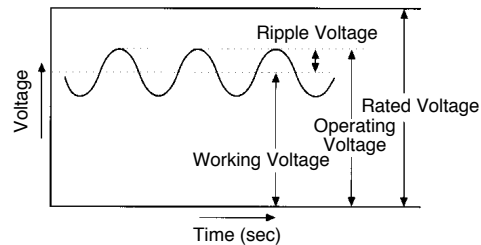


Fig. 5

- (2) Ensure that an reverse voltage due to superimposed voltages is not applied to the capacitors.
- (3) The maximum permissible ripple voltage varies with the rated voltage. Ensure that ripple voltage does not exceed the values shown in Figs. 6 and 7. If, however, the capacitors are used at a high temperature, the maximum permissible ripple voltage must be calculated as follows:

$$V_{rms} \text{ (at } 55^\circ\text{C)} = 0.8 \times V_{rms} \text{ (at } 25^\circ\text{C)}$$

$$V_{rms} \text{ (at } 85^\circ\text{C)} = 0.6 \times V_{rms} \text{ (at } 25^\circ\text{C)}$$

$$V_{rms} \text{ (at } 125^\circ\text{C)} = 0.4 \times V_{rms} \text{ (at } 25^\circ\text{C)}$$

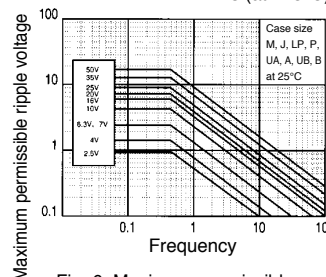


Fig. 6 Maximum permissible ripple voltage (LM, J, LP, P, UA, LA, A, UB, B)

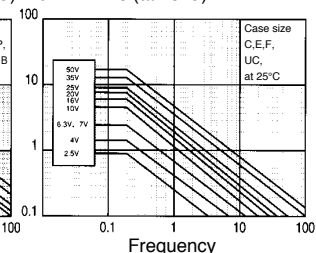


Fig. 7 Maximum permissible ripple voltage (C, E, F)

### 3. Reverse Voltage

- (1) The tantalum and niobium capacitors must not be operated and charged in reverse mode. And also the capacitors must not be used in an pure AC circuit.
- (2) The tantalum and niobium capacitor dielectric has a rectifying characteristics. Therefore, when a reverse voltage is applied to it, a large current flows even at a low reverse voltage. As a result, it may spontaneously generate heat and lead to shorting.
- (3) Make sure that the polarity and voltage is correct when applying a multimeter or similar testing instrument to the capacitors because a reverse voltage or overvoltage can be accidentally applied.
- (4) When using the capacitors in a circuit in which a reverse voltage is applied, consult your local Holy Stone Polytech agent. If the application of an reverse voltage is unavoidable, it must not exceed the following values:

At 25°C: 10% of the rated voltage or 1 V, whichever smaller.  
 At 85°C: 5% of the rated voltage or 0.5 V, whichever smaller.  
 Further, the reverse voltage application time must be no longer than 240 hours, with the power supply impedance maintained at 33Ω or more.

\*These limits are reference value.

### 4. Reliability of Tantalum and Niobium Capacitors

The failure rate of the tantalum and niobium capacitor varies with the derating ratio, ambient temperature, circuit resistance, circuit application, etc. Therefore, when proper selections are made so as to afford additional margins, higher reliabilities can be derived from the tantalum capacitors.

If you need to estimate failure rate of the capacitor under your using condition, please contact us.

### 5. Mounting Precautions

#### 5.1 Limit Pressure on Capacitor Installation with Moulder

Pressure must not exceed 4.9 N with a tool end diameter of 1.5 mm when applied to the capacitors using an absorber, centering tweezers, or the like (maximum permitted pressurization time: 5 seconds). An excessively low absorber setting position would result in not only the application of undue force to the capacitors but capacitor and other component scattering, circuit board wiring breakage, and/or cracking as well, particularly when the capacitors are mounted together with other chips having a height of 1 mm or less.

#### 5.2 Flux Selection

- (1) Select a flux that contains a minimum of chlorine and amine.
- (2) After flux use, the chlorine and amine in the flux remain must be removed.

#### 5.3 Recommended Soldering Pattern Dimensions

The recommended chip soldering pattern dimensions are as shown in Table 4 and Fig. 10. Note, however, that they are affected by such factors as reflow conditions, solder type, and circuit board size.

If the pattern area is significantly larger than the capacitor terminal area, the capacitor in place may be displaced when the solder melts.

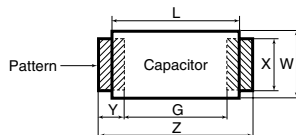


Fig. 10

Table 4 Recommended soldering pattern dimensions (mm)

Dimensions Case	Capacitor size		Pattern dimensions			
	L	W	G(MAX)	Z(MIN)	X(MIN)	Y(Ref.)
LM	1.6	0.8	0.65	1.65	0.65	0.5
J	1.6	0.8	0.7	2.5	1.0	0.9
LP	2.0	1.25	1.05	2.05	0.8	0.5
P	2.0	1.25	0.5	2.6	1.2	1.05
LA	3.2	1.6	1.65	3.25	1.2	0.8
UA,A	3.2	1.6	1.1	3.8	1.5	1.35
UB,B	3.5	2.8	1.4	4.1	2.7	1.35
C	5.8	3.2	2.9	6.9	2.7	2.0
E	7.3	4.3	4.1	7.2	2.9	2.05

### 5.4 Chip Soldering Temperature and Time

For the capacitor body, the chip soldering temperature and time must be as shown below.

- (1) Reflow soldering (infrared, hot air, hot plate)  
 Capacitor body temperature: 260°C or lower(TNC, TNF:240°C or lower)  
 Time: 10 sec. max.  
 Permitted temperature/time range: See Fig. 11.

NOTE 1: When upward heating is provided by infrared, the capacitor body temperature rises above the circuit board surface temperature.

When a high-power hot blast stove or the like is used, a sudden temperature rise occurs.

Therefore, a 130-160°C, 1-minute preheating zone should be provided to ensure that the difference from the reflow maximum temperature is not greater than 100°C (see Fig. 12).

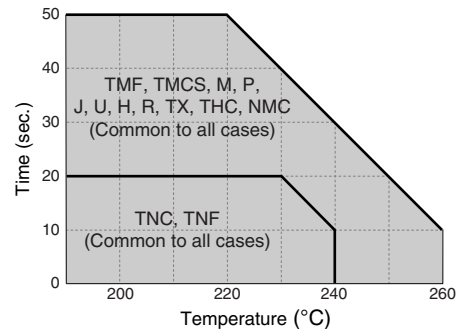


Fig. 11 Reflow soldering permitted temperature / time range

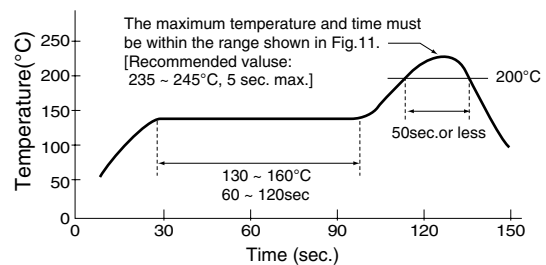


Fig. 12 Recommended temperature profile

- (2) Flow soldering (not available for TNC, TNF type)  
 Solder bath temperature: 260°C or lower  
 Time: LM, J, LP, P, UA, LA,A, UB, or B case, 10 sec max. C, E, F case, 5 sec max.

Permitted temperature and time range: See Fig. 13.

NOTE 1: To avoid sudden heating, conduct preheating. 130-160°C, 1-minute preheating zone should be provided (see Fig. 14).

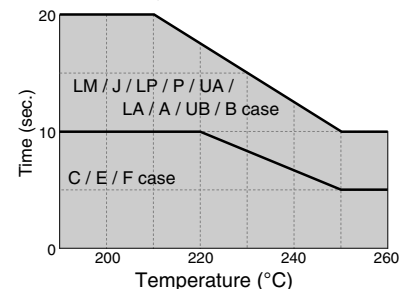


Fig. 13 Flow soldering permitted temperature / time range

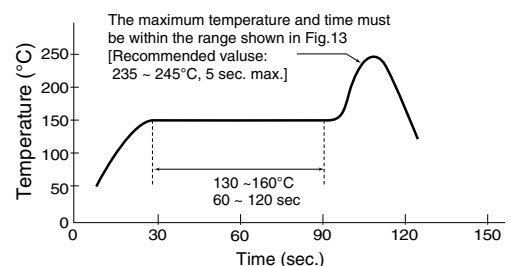


Fig. 14 Recommended temperature profile

- (3) Soldering with a soldering iron  
 The use of a soldering iron should be avoided wherever possible.  
 If it is unavoidable, follow the instructions set forth in Table 5.  
 The time of soldering with an iron should be one.

Table 5

Type	TMCR, TMCS, TMCM, TMCP, TMCJ, TMCU, TMCH, THC, NMC	TMCTX *
Soldering-iron tip temperature	350°C <sub>MAX</sub>	290°C <sub>MAX</sub>
Time	3 sec <sub>MAX</sub>	3 sec <sub>MAX</sub>
Soldering-iron power	30 W <sub>MAX</sub>	30 W <sub>MAX</sub>

\*If a soldering iron is used at a high temperature for the TMCTX type which incorporates a thermal fuse, the fuse opens. Due care must be used to avoid such a trouble.

\*If a soldering iron needs to be used for TMF and/or TNC, TNF type, please contact us for information.

- (4) Repetition of soldering  
 The soldering conditions for soldering operations (1) through (3) above are established on the presumption that only one type of soldering operation is conducted.  
 When repeating a reflow soldering or a combined flow-and-reflow soldering operation, comply with the following conditions:
- i) Once the capacitor is mounted, it must not be removed for reuse.
  - ii) Any type of soldering operation may be performed to the capacitor only twice.
  - iii) The second performance of a type of soldering operation must not be initiated until a 2-hour or longer heat dissipation period has elapsed after completion of the first performance.
  - iv) Cleaning must be conducted upon completion of the second performance.

\*Soldering conditions (temperature, time) of Sn 100 terminal products are same as the above.

## 5.5 Cleaning after Mounting

The following solvents are usable when cleaning the capacitors after mounting. Never use a highly active solvent.

- Halogen organic solvent (HCFC225, etc.)
- Alcoholic solvent (IPA, ethanol, etc.)
- Petroleum solvent, alkali saponifying agent, water, etc.

Circuit board cleaning must be conducted at a temperature of not higher than 50°C and for an immersion time of not longer than 30 minutes. When an ultrasonic cleaning method is used, cleaning must be conducted at a frequency of 48 kHz or lower, at an vibrator output of 0.02 W/cm<sup>2</sup>, at a temperature of not higher than 40°C, and for a time of 5 minutes or shorter.

NOTE 1: Care must be exercised in cleaning process so that the mounted capacitor will not come into contact with any cleaned object or the like or will not get rubbed by a stiff brush or the like. If such precautions are not taken particularly when the ultrasonic cleaning method is employed, terminal breakage may occur.

NOTE 2: When performing ultrasonic cleaning under conditions other than stated above, conduct adequate advance checkout.

## 6. Others

- (1) For further details, refer to EIAJ RCR-2368B, Precautions and Guidelines for Using Electronic Device Tantalum Capacitors.
- (2) If you have any questions, feel free to contact your local Hitachi AIC agent.

## TAPING SPECIFICATION FOR TANTALUM AND NIOBIUM ELECTROLYTIC CAPACITORS

### 1. Product Symbol

Example: TCMC Series A case 4V 10 $\mu$ F  $\pm$ 20%  
(Tape delivery, insertion direction, feed hole side cathode)

**TCMC A 0G 106 M T R F**

- Terminal code (F: Pb free plating)
- Packing polarity code
- Packing method code (T: carrier tape)
- Capacitance tolerance code (M:  $\pm$ 20%, K:  $\pm$ 10%)
- Capacitance code
- Rated voltage code
- Case size code

Type of series

### 2. Tape Materials

Transparent or half-transparent plastic covering tape is stuck by heat press.

### 3. Tape Size

See Fig. 1 and Table 1.

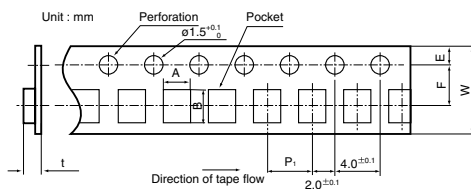


Fig. 1

Table 1 (Unit: mm)

Capacitor dimensions	A $\pm$ 0.1	B $\pm$ 0.1	W $\pm$ 0.1	F $\pm$ 0.1	E $\pm$ 0.1	P $\pm$ 0.1	t <sup>MAX</sup>	Quantity per reel
P	1.5	2.2	8.0	3.5	1.75	4.0	1.6	3000pcs
UA	1.9	3.5	8.0	3.5	1.75	4.0	1.7	3000pcs
UB	3.1	3.9	8.0	3.5	1.75	4.0	1.7	3000pcs
A	1.9	3.5	8.0	3.5	1.75	4.0	2.5	2000pcs
B	3.1	3.9	8.0	3.5	1.75	4.0	2.5	2000pcs
C	3.7	6.3	12.0	5.5	1.75	8.0	3.0	500pcs
E	4.8	7.7	12.0	5.5	1.75	8.0	3.4	500pcs
F	6.3	7.5	12.0	5.5	1.75	8.0	4.1	500pcs
LM, J	1.0 $\pm$ 0.2	1.8 $\pm$ 0.2	8.0	3.5	1.75	4.0	1.3	4000pcs
LP	1.5	2.3	8.0	3.5	1.75	4.0	1.5	3000pcs
LA	1.9	3.5	8.0	3.5	1.75	4.0	1.5	3000pcs

### 4. Inserting Direction

Capacitors are packed with their cathodes on perforation side and with their electrodes faced with the bottoms of the pockets. (See Fig. 3.)

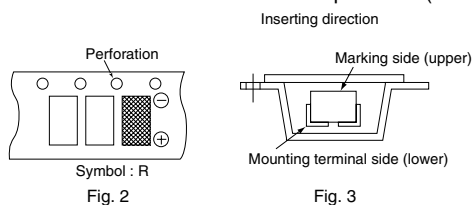


Fig. 2

Fig. 3

### 5. Adhesion Strength of Cover at Peeling off

When cover tape is peeled off in such manner as Fig. 4 adhesion strength F must be with the range of 0.3 $\pm$ 0.2N.

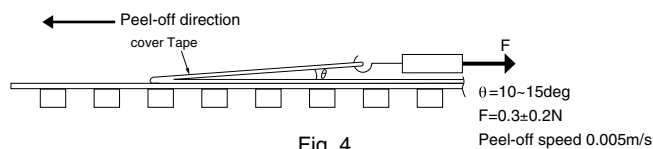


Fig. 4

### 6. Reel Drawings and Dimensions

As indicated in Fig. 5.

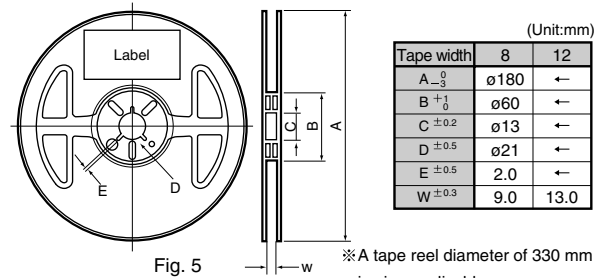


Fig. 5

※A tape reel diameter of 330 mm is also applicable.

### 7. Quantity Packed in Reel and Description

The standard number of capacitors to be accommodated by one reel is as indicated in Table 1.

One side surface of a reel is basically marked with the following items of information.

- (1) Name of capacitor or product identification
- (2) Rated voltage
- (3) Capacitance value
- (4) Capacitance tolerance value
- (5) Quantity
- (6) Lot number for production
- (7) Manufacturer's name or symbol.

※Lot Number Description		
0	1	0 1 2 3
production Year	production Month	production control Number
2010 : 0	1-9 : 1-9	
2011 : 1	Oct. : X	
2012 : 2	Nov. : Y	
2013 : 3	Dec. : Z	

The lot number of the products which pass 1 year from the date of manufacture and return to us, changes new lot number.

And the guarantee period is another 1 year from the date that confirm the quality of the returned products.

### 8. Packing and Storage

#### 8.1 High performance polymer type (TNC type · TNF type)

TNC, TNF series are moisture sensitive and they are dry packed to prevent absorb moisture. The maximum storage is within 1year from the date of manufacture under normal temperature and normal humidity (5°C - 30°C, less than 60% RH).

In case that pass 1 year even not open the package, please don't use it and contact us. Depend on the bag's condition, need to check the quality of the products. In the case that the products absorb moisture, the characteristic of the capacitor might be change after soldering, however this is not a kind of deterioration. And please check the production date (month and year) by Lot Number on the label. The storage condition recommends JEDEC level 3.

Once Dry pack is opened, the parts must be stored at less than 60% RH and 5°C - 30°C and must be Reflow Soldered within 168 hours.

Please pay attention, because a soldering faulty sometimes occurs, in the case that it came off an above storage conditions.

#### 8.2 High reliability type (TMCH type), High reliability at High Temperature (THC type), Niobium (NMC type), Standard type and Small-size type

The maximum storage is within 1year from the date of manufacture under normal temperature and normal humidity (5°C - 30°C, less than 60% RH). In case that pass 1 year, please don't use it and contact us, because need a baking or checking the quality.

### 9. Other Specification

The JIS C 0806 Standard, EIAJ EXT-7001 Standard, and relevant agreements are complied with.