

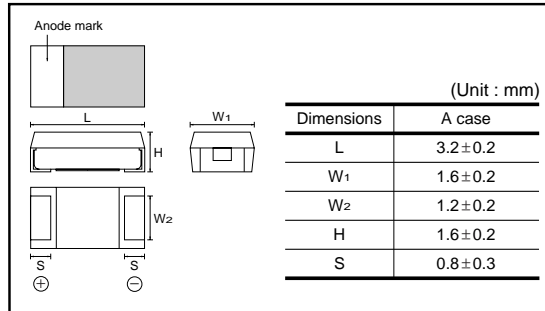
Chip tantalum capacitors

TCO Series A Case

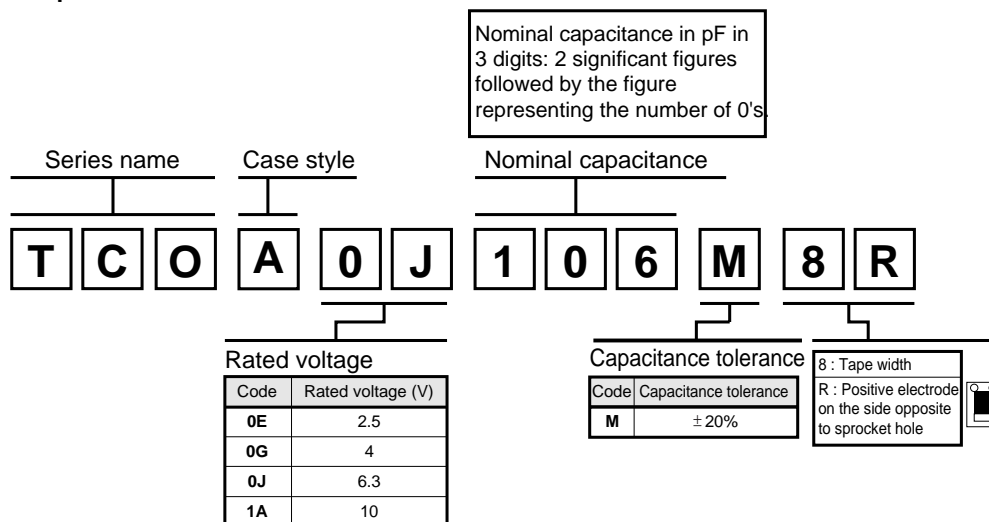
●Features (A)

- 1) Conductive polymer used for the cathode material.
- 2) Ultra-low ESR.
(1/10 compared with the conventional type)
- 3) Screening by thermal shock.

●Dimensions (Unit : mm)



●Part No. Explanation



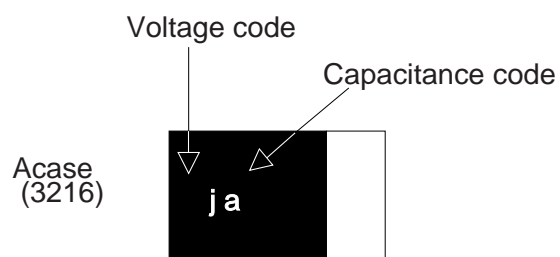
Tantalum capacitors

●Rated Table. Marking

TCO Series A Case

μF		Rated voltage (V.DC)			
		2.5 0E	4 0G	6.3 0J	10 1A
A	1.0				
E	1.5				
J	2.2				
N	3.3				A
S	4.7			A	A
W	6.8		A	A	A
a	10	A	A	A	A
e	15	A	A	A	
j	22	A	A	A	
n	33	A	A		
s	47	A	* A		
w	68				

* Under development



Tantalum capacitors

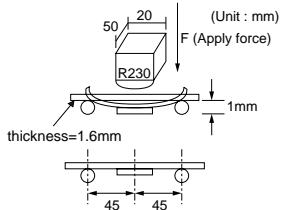
●Characteristics

Item		Performance	Test conditions (based on JIS C 5101-1 and JIS C 5101-3)
Operating Temperature		-55°C to +105°C	Voltage reduction when temperature exceeds +85°C
Maximum operating temperature with no voltage derating		+85°C	
Rated voltage (VDC)		2.5 4 6.3 10	at 85°C
Category voltage (VDC)		2 3.2 5 8	at 105°C
Surge voltage (VDC)		3.2 5.2 8 13	at 85°C
DC Leakage current		3μF or 0.1CV whichever is greater Shown in " Standard list "	Rated voltage for 5min
Capacitance tolerance		±20% Shall be satisfied allowance range.	Measuring frequency : 120±12Hz Measuring voltage : 0.5Vrms +1.5 to 2V.DC Measuring circuit : DC Equivalent series circuit
Tangent of loss angle (Df, tan δ)		Shall be satisfied the voltage on " Standard list "	Measuring frequency : 120±12Hz Measuring voltage : 0.5Vrms +1.5 to 2V.DC Measuring circuit : DC Equivalent series circuit
ESR		Shall be satisfied the voltage on " Standard list "	Measuring frequency : 100±10kHz Measuring voltage : 0.5Vrms or less
Resistance to Soldering heat	Appearance	There should be nonsignificant abnormality. The indications should be clear.	Dip in the solder bath Solder temp : 240±5°C Duration : 5±0.5s Repetition : 1
	L.C.	Less than 150% of initial limit	
	ΔC / C	Within ±20% of initial value	
	tan δ	Less than 150% of initial limit	

Tantalum capacitors

Item		Performance	Test conditions (based on JIS C 5101-1 and JIS C 5101-3)															
Temperature cycle	Appearance	There should be no significant abnormality.	Repetition : 5 cycles (1 cycle : steps 1 to 4) without discontinuation. <table><tr><td></td><td>Temp.</td><td>Time</td></tr><tr><td>1</td><td>-55±3℃</td><td>30±3min</td></tr><tr><td>2</td><td>Room temp.</td><td>3min.or less</td></tr><tr><td>3</td><td>105±2℃</td><td>30±3min</td></tr><tr><td>4</td><td>Room temp.</td><td>3min.or less</td></tr></table>		Temp.	Time	1	-55±3℃	30±3min	2	Room temp.	3min.or less	3	105±2℃	30±3min	4	Room temp.	3min.or less
		Temp.		Time														
	1	-55±3℃		30±3min														
	2	Room temp.		3min.or less														
	3	105±2℃		30±3min														
4	Room temp.	3min.or less																
L.C	Less than 500% of initial limit																	
ΔC / C	Within±20% of intial value																	
Df (tan δ)	Less than 150% of initial limit																	
Moisture resistance	Appearance	There should be no significant abnormality. The indications should be	After leaving the sample under such atmospheric condition that the temperature and humidity are 60 ±2℃ and 90 to 95% RH,respectively,for 500 12h leave it at room temperature for 1 to 2h and then measure the sample.															
	L.C	Less than 150% of initial limit																
	ΔC / C	+30% / -20%																
	Df (tan δ)	Less than 150% of initial limit																
	Temperature Stebility	Temp.		-55℃														
ΔC / C		Within 0/-20% of initial value																
Df (tan δ)		Shall be satisfied the voltage on " Standard list "																
L.C		-																
Temp.		+105℃																
ΔC / C		Within +50/0% of initial value																
Df (tan δ)		Shall be satisfied the voltage on " Standard list "																
L.C		Less than 1CV																
Surge voltage	Appearance	There should be no significant abnormality.	Apply the specified serge voltage every 5± 0.5 min. for 30±5 s. each time in the atmospheric condition of 85±2℃. Repeat this rocedure 1,000 times.															
	L.C	Less than initial limit																
	ΔC / C	Within± 20% of initial value																
	Df (tan δ)	Less than initial limit																

Tantalum capacitors

Item		Performance	Test conditions (based on JIS C 5101-1 and JIS C 5101-3)
Loading at High temperature	Appearance	There should be nonsignificant abnormality.	After applying the rated voltage for 1000^{+36}_{-10} h without discontinuation via the serial resistance of 3Ω or less at a temperature of $85 \pm 2^\circ\text{C}$, leave the sample at room temperature / humidity for 1 to 2h and measure the value.
	L.C	Less than 200% of initial limit	
	$\Delta C / C$	Within $\pm 20\%$ of initial value	
	Df (tan δ)	150% of initial limit less than	
Terminal strength	Capacitance	The measured value should be stable.	A force is applied to the terminal until it bends to 1mm and by a prescribed tool maintain the condition for 5s. (See the figure below)
	Appearance	There should nonsignificant abnormality.	
Adhesiveness		The terminal should not come off.	<p>Apply force of 5N in the two directions shown in the figure below for 10 ± 1 s after mounting the terminal on a circuit board.</p> 
Dimensions		Refer to "External dimensions"	Measure using a caliper of JISB 7507 Class 2 or higher grade.
Resistance to solvents		The indication should be clear	Dip in the isopropyl alcohol for 30 ± 5 s, at room temperature.
Solderability		3/4 or more surface area of the solder coated terminal dipped in the soldering bath should be covered with the new solder.	<p>Dip speed = 25 ± 2.5 mm / s Pre-treatment (accelerated aging): Leave the sample on the boiling distilled water for 1 h. Solder temp.: $245 \pm 5^\circ\text{C}$ Duration : 3 ± 0.5 s Solder : M705 Flux : Rosin25% IPA75%</p>
Vibration	Capacitance	Measure value should not fluctuate during the measurement.	<p>Frequency : 10 to 55 to 10Hz/min. Amplitude : 1.5mm Time : 2h each in X and Y directions Mounting : The terminal is soldered on a print circuit board.</p>
	Appearance	There should no significant abnormality.	

TCO series A Case

Tantalum capacitors

●Standard list, TCO series

< A case : 3216 size >

Part No.	Rated Voltage 85°C	Category Voltage 105°C	Surge Voltage 85°C	Cap. 120Hz	Tolerance	Leakage Current 25°C 1WV 5min	Df 120Hz (%)			ESR 100kHz
	(V)	(V)	(V)	(μF)	(%)	(μA)	-55°C	25°C 85°C	105°C	(mΩ)
TCO A 0E 106 □	2.5	2.0	3.2	10	±20	3.0	6	6	9	500
TCO A 0E 156 □				15		3.8				
TCO A 0E 226 □				22		5.5				
TCO A 0E 336 □				33		8.3				
TCO A 0E 476 □				47		11.7				
TCO A 0G 685 □	4	3.2	5.2	6.8	±20	3.0	6	6	9	800
TCO A 0G 106 □				10		4.0				500
TCO A 0G 156 □				15		6.0				
TCO A 0G 226 □				22		8.8				
TCO A 0G 336 □				33		13.2				
TCO A 0J 475 □	6.3	5	8	4.7	±20	3.0	6	6	9	800
TCO A 0J 685 □				6.8		4.3				500
TCO A 0J 106 □				10		6.3				
TCO A 0J 156 □				15		9.5				
TCO A 0J 226 □				22		13.9				
TCO A 1A 335 □	10	8	13	3.3	±20	3.3	6	6	9	800
TCO A 1A 475 □				4.7		4.7				
TCO A 1A 685 □				6.8		6.8				
TCO A 1A 106 □				10		10.0				500

□=Tolerance(M : ±20%)

●Packaging specifications

Tape [A case]	Reel [A case]										
<div><table><thead><tr><th>Case</th><th>A ± 0.1</th><th>B ± 0.1</th><th>t1 ± 0.05</th><th>t2 ± 0.1</th></tr></thead><tbody><tr><td>A</td><td>1.9</td><td>3.5</td><td>0.25</td><td>1.9</td></tr></tbody></table><p>Unit : [mm]</p></div>	Case	A ± 0.1	B ± 0.1	t1 ± 0.05	t2 ± 0.1	A	1.9	3.5	0.25	1.9	<div><p>EIAJ ET-7200B compatible</p></div>
Case	A ± 0.1	B ± 0.1	t1 ± 0.05	t2 ± 0.1							
A	1.9	3.5	0.25	1.9							

●Packaging style

Case code	package	Packaging style		Symbol	Basic ordering units
A	Taping	plastic taping	φ180mmReel	R	2,000pcs

Tantalum capacitors

● Electrical characteristics and operation notes

(1) Soldering conditions (soldering temperature and soldering time)

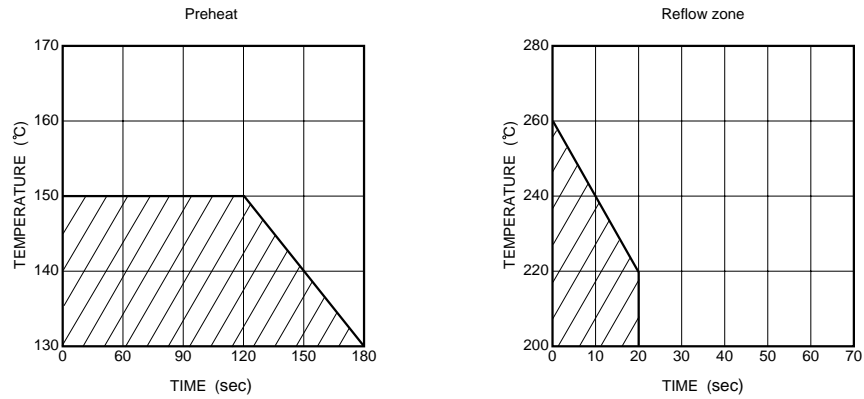


Fig.1 reflow soldering

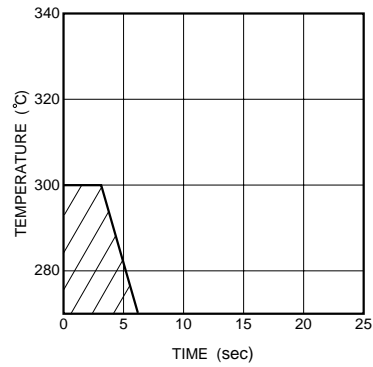


Fig.2 Hand soldering (Wattage : 30W MAX.)

(2) Leakage current-to-voltage ratio

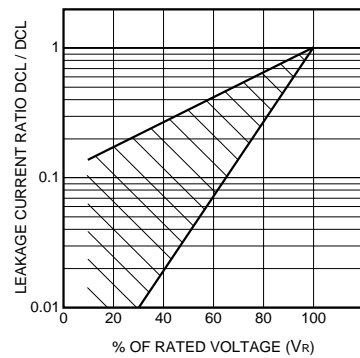


Fig.3

Tantalum capacitors

(3) Derating voltage as function of temperature

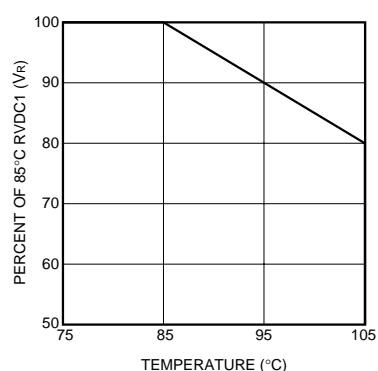


Fig.4

85°C		105°C
Rated Voltage (V.DC)	Surge Voltage (V.DC)	Category Voltage (V.DC)
2.5	3.2	2
4	5.2	3.2
6.3	8	5
10	13	8

(4) Reliability

The malfunction rate of tantalum solid state electrolytic capacitors varies considerably depending on the conditions of usage (ambient temperature, applied voltage, circuit resistance).

Formula for calculating malfunction rate

$$\lambda_p = \lambda_b \times (\pi_E \times \pi_{SR} \times \pi_Q \times \pi_{CV})$$

- λ_p : Malfunction rate stemming from operation
- λ_b : Basic malfunction rate
- π_E : Environmental factors
- π_{SR} : Series resistance
- π_Q : Level of malfunction rate
- π_{CV} : Capacitance

For details on how to calculate the malfunction rate stemming from operation, see the tantalum solid state electrolytic capacitors column in MIL-HDBK-217.

(5) Impedance frequency characteristics

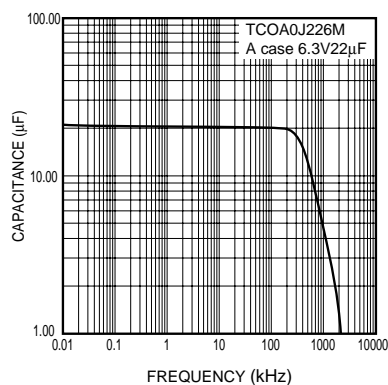


Fig.5

(6) ESR frequency characteristics

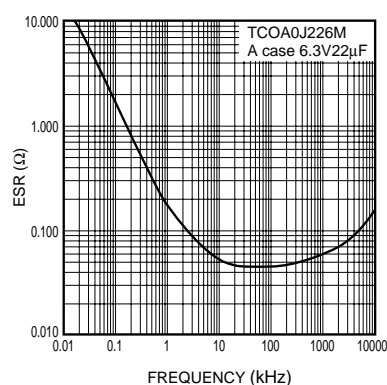


Fig.6

Tantalum capacitors

(7) Capacitance temperature characteristics 120Hz

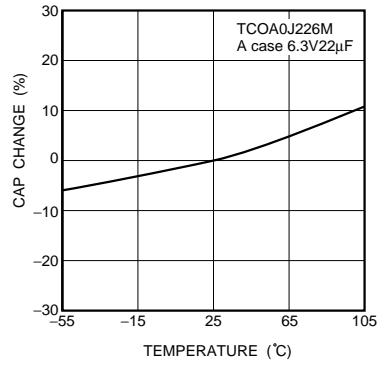


Fig.7

(8) ESR temperature characteristics 100kHz

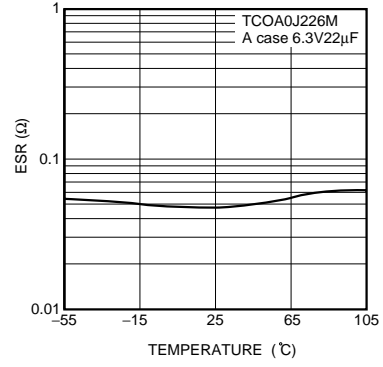


Fig.8

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