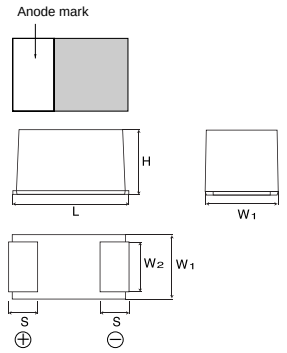
Chip tantalum capacitors

TCT Series P Case

●**Features (P)**

1) Vital for all hybrid integrated circuits board application.
2) Wide capacitance range.
3) Screening by thermal shock.

●**Dimensions** (Unit : mm)



(Unit : mm)

Dimensions	Size
L	2.0±0.2
W_1	1.25±0.2
W_2	0.85±0.2
H	1.1±0.1
S	0.5±0.1

●**Part No. Explanation**

T	C	T	P	0	J	3	3	6	M	8	R
①			②	③		④			⑤	⑥	

① Series name
TCT

② Case style
TC····· P

③ Rated voltage

Rated voltage (V)	2.5	4	6.3	10	16	20	25
CODE	0E	0G	0J	1A	1C	1D	1E

④ Nominal capacitance
Nominal capacitance in pF in 3 digits:
2 significant figures followed by the figure representing the number of 0's.

⑤ Capacitance tolerance
M : ±20%

⑥ Taping
8 : Tape width
R : Positive electrode on the side opposite to sprocket hole

● **Rated table**

(μF)	Rated voltage (V)						
	2.5 0E	4 0G	6.3 0J	10 1A	16 1C	20 1D	25 1E
2.2 (225)							New P
3.3 (335)							*P
4.7 (475)					*P		
6.8 (685)							
10 (106)					P		
15 (156)				P			
22 (226)			P	P			
33 (336)		P	P	New P			
47 (476)		P	P				
68 (686)		New P	*P				
100 (107)	New P	New P					
150 (157)	*P	*P					
220 (227)	*P						

Remark) Case size codes (P) in the above show products line-up.
* Under development
New New Product

● **Marking**

The indications listed below should be given on the surface of a capacitor.

(1) Polarity : The polarity should be shown by ☐ bar. (on the anode side)
(2) Rated DC voltage : Due to the small size of P case, a voltage code is used as shown below.
(3) Visual typical example (1) voltage code (2) capacitance code

Voltage Code	Rated DC Voltage (V)
e	2.5
g	4
j	6.3
A	10
C	16
D	20
E	25

Capacitance Code	Nominal Capacitance (μF)
A	1.0
E	1.5
J	2.2
N	3.3
S	4.7
W	6.8
a	10
e	15
j	22
n	33
s	47
w	68
$\overline{a}$	100
$\overline{e}$	150
$\overline{j}$	220

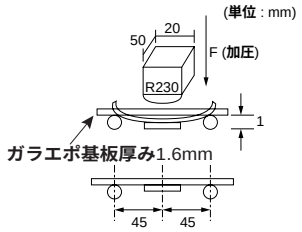
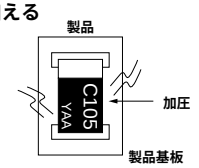
[P case] note 1) $\frac{j}{(1)}$ $\frac{n}{(2)}$

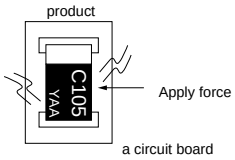
note 2) voltage code and capacitance code are variable with parts number

● Characteristics

Item		Performance	Test conditions (based on JIS C 5101–1 and JIS C 5101–3)
Operating Temperature		–55°C to +125°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 16 20 25	at 85°C
Category voltage (VDC)		1.6 2.5 4 6.3 10 13 16	at 125°C
Surge voltage (VDC)		3.2 5.0 8 13 20 26 32	at 85°C
DC Leakage current		Shown in " Standard list "	As per 4.9 JIS C 5101-1 As per 4.5.1 JIS C 5101-3 Voltage : Rated voltage for 5min
Capacitance tolerance		Shall be satisfied allowance range. ±20%	As per 4.7 JIS C 5101-1 As per 4.5.2 JIS C 5101-3 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 "	As per 4.8 JIS C 5101-1 As per 4.5.3 JIS C 5101-3 Measuring frequency : 120±12Hz Measuring voltage : 0.5Vrms +1.5 to 2V.DC Measuring circuit : DC Equivalent series circuit
Impedance		Shall be satisfied the voltage on " Standard list "	As per 4.10 JIS C 5101-1 As per 4.5.4 JIS C 5101-3 Measuring frequency : 100±10kHz Measuring voltage : 0.5Vrms or less Measuring circuit : DC Equivalent series circuit
Resistance to Soldering heat	Appearance	There should be no significant abnormality. The indications should be clear.	As per 4.14 JIS C 5101-1 As per 4.6 JIS C 5101-3 Dip in the solder bath Solder temp : 260±5°C Duration : 5±0.5s Repetition : 1 After the specimens, leave it at room temperature for over 24h and then measure the sample.
	L.C.	Less than initial limit	
	ΔC / C	Within ±20% of initial value	
	Df (tan δ)	Less than 200% of initial limit	
Temperature cycle	Appearance	There should be no significant abnormality. The indications should be clear.	As per 4.16 JIS C 5101-1 As per 4.10 JIS C 5101-3 Repetition : 5 cycles (1 cycle : steps 1 to 4) without discontinuation. After the specimens, leave it at room temperature for over 24h and then measure the sample.
	L.C.	Less than 200% of initial limit	
	ΔC / C	Within ±20% of initial value	
	Df (tan δ)	Less than 200%of initial limit	
Moisture resistance	Appearance	There should be no significant abnormality. The indications should be clear.	As per 4.22 JIS C 5101-1 As per 4.12 JIS C 5101-3 After leaving the sample under such atmospheric condition that the temperature and humidity are 60±2°C and 90 to 95% RH, respectiveiy, for 500±12h leave it at room temperature for over 24h and then measure the sample.
	L.C.	Less than 200% of initial limit	
	ΔC / C	Within ±20% of initial value	
	Df (tan δ)	Less than 200% of initial limit	

	Temp.	Time
1	–55± 3°C	30±3min.
2	Room temp.	3min. or less
3	125± 2°C	30±3min.
4	Room temp.	3min. or less

項目		性能	試験条件（JIS C 5101–1, JIS C 5101– 3に準拠）
温度特性	温度	温度 –55°C	JIS C 5101-1 4.29項 JIS C 5101-3 4.13項
	ΔC / C	試験前の値に対し0/–15%以内	
	tan δ	「標準品一覧」に記載の値以下	
	L.C.	–	
	温度	温度 +85°C	
	ΔC / C	試験前の値に対し+15/0%以内	
	tan δ	「標準品一覧」に記載の値以下	
	L.C.	POG107：0.5CV値以下 POJ476 ：0.5CV値以下 その他：5μA又は0.1CVの いずれか大きい方の値以下	
	温度	温度 +125°C	
	ΔC / C	試験前の値に対し+20/0%以内	
	tan δ	「標準品一覧」に記載の値以下	
	L.C.	POG107：0.625CV値以下 POJ476 ：0.625CV値以下 その他：6.3μA又は0.125CVのいずれか 大きい方の値以下	
耐サージ電圧	外観	著しい異常がなく、表示は容易に 判読できること	JIS C 5101-1 4.26項 JIS C 5101-3 4.14項 85±2°C温度雰囲気中で規定のサージ電圧を5±0.5分の 周期で毎回30±5秒間加えることを、1,000回繰り返し行う。 試験後、常温常湿中に24時間以上放置し、測定する。
	L.C.	初期規格値の2.0倍以下	
	ΔC / C	試験前の値に対し±20%以内	
	tan δ	初期規格値の2.0倍以下	
高温負荷	外観	著しい異常がなく，表示は容易に判読できること	JIS C 5101-1 4.23項 JIS C 5101-3 4.15項 温度85±2°Cの中で直列抵抗3Ω以下を通じて定格電圧を 1000+36/0時間連続印加後、常温常湿中に24時間以上 放置し測定する。
	L.C.	初期規格値の2.0倍以下	
	ΔC / C	試験前の値に対し±20%以内	
	tan δ	初期規格値の2.0倍以下	
端子強度	静電容量	測定中に、測定値が安定していること	JIS C 5101-1 4.35項 JIS C 5101-3 4.9項 曲がりが1mmに達するまでの規定の治具で加圧し、 そのまま5秒間保持する。(下図参照) 
	外観	著しい異常がないこと	
固着性		端子の剥離がないこと	JIS C 5101-1 4.34項 JIS C 5101-3 4.8項 基板実装後下図の2方向に5Nの力を 10±1秒間加える 

Item		Performance	Test conditions (JIS C 5101−1 and JIS C 5101− 3)
Adhesiveness		The terminal should not come off.	As per 4.34 JIS C 5101-1 As per 4.8 JIS C 5101-3 Apply force of 5N in the two directions shown in the figure below for 10±1s after mounting the terminal on a circuit board. 
Dimensions		Refer to "External dimensions"	Measure using a caliper of JIS B 7507 Class 2 or higher grade.
Resistance to solvents		The indication should be clear	As per 4.32 JIS C 5101-1 As per 4.18 JIS C 5101-3 Dip in the isopropyl alcohol for 30±5s, 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.	As per 4.15.2 JIS C 5101-1 As per 4.7 JIS C 5101-3 Dip speed=25±2.5mm / s Pre−treatment(accelerated aging): Leave the sample on the boiling distilled water for 1 h. Solder temp. : 245±5°C Duration : 3±0.5s Solder : M705 Flux : Rosin 25% IPA 75%
Vibration	Capacitance	Measure value should not fluctuate during the measurement.	As per 4.17 JIS C 5101-1 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.
	Appearance	There should be no significant abnormality.	

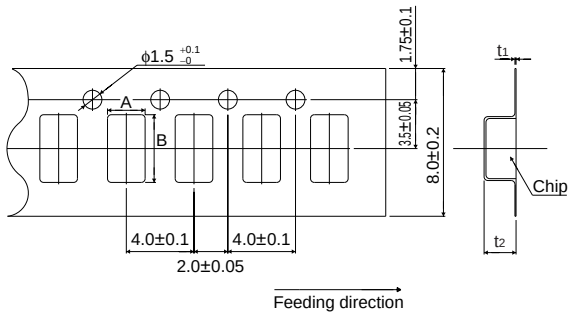
● **Standard products list, TCT series P case**

Part No.	Rated voltage 85°C (V)	Category voltage 125°C (V)	Surge voltage 85°C (V)	Cap. 120Hz (µF)	Tolerance (%)	Leakage current 25°C 1WV.60s (µA)	Df 120Hz (%)			Impedance 100kHz
							−55°C	25°C 85°C	125°C	(Ω)
TCT P 0E 107M8R	2.5	1.6	3.2	100	±20	12.5	60	30	40	4.0
TCT P 0G 107M8R	4	2.5	5	100	±20	20	60	30	40	4.0
TCT P 0G 336M8R	4	2.5	5	33	±20	1.3	30	20	30	4.0
TCT P 0G 476M8R	4	2.5	5	47	±20	1.9	30	20	30	4.0
TCT P 0G 686M8R	4	2.5	5	68	±20	13.6	60	30	40	4.0
TCT P 0J 226M8R	6.3	4	8	22	±20	1.4	30	20	30	5.0
TCT P 0J 336M8R	6.3	4	8	33	±20	2.1	30	20	30	4.0
TCT P 0J 476M8R	6.3	4	8	47	±20	14.8	60	30	40	4.0
TCT P 1A 156M8R	10	6.3	13	15	±20	1.5	30	20	30	6.0
TCT P 1A 226M8R	10	6.3	13	22	±20	2.2	30	20	30	5.0
TCT P 1A 336M8R	10	6.3	13	33	±20	16.5	60	30	40	4.0
TCT P 1C 106M8R	16	10	20	10	±20	1.6	30	20	30	6.0
TCT P 1E 225M8R	25	16	32	2.2	±20	0.55	30	20	30	8.0

● **Packaging specifications**

Case code	A±0.1	B±0.1	t_1± 0.05	t_2 ± 0.1
P	1.55	2.3	0.25	1.5

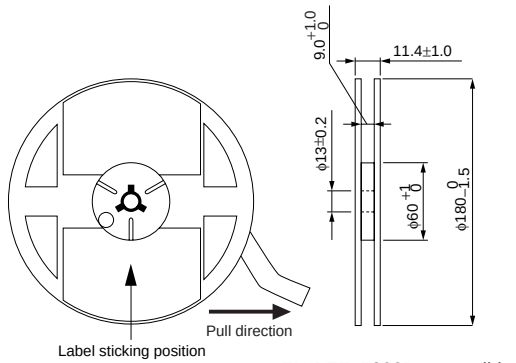
Taping [P case]



● **Packaging style**

Case code	Packaging	Packaging style		Symbol	Basic ordering units
P case	Taping	plastic taping	φ180mm Reel	R	3,000pcs

Reel [P case]



EIAJ ET−7200B compatible

●Recommended condition of reflow soldering

(1) Leakage current-to-voltage ratio

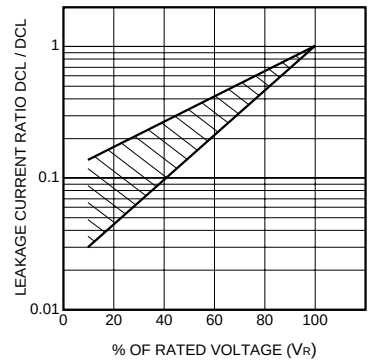


Fig.1

(2) Derating voltage as function of temperature

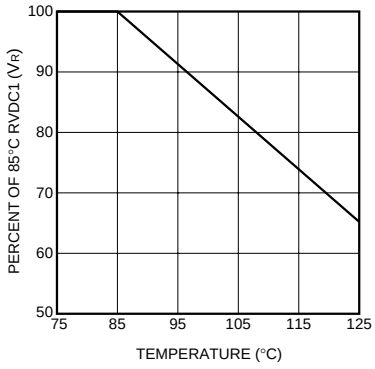


Fig.2

85°C		125°C	
Rated Voltage (V.DC)	Surge Voltage (V.DC)	Category Voltage (V.DC)	Surge Voltage (V.DC)
2.5	3.2	1.6	2.0
4	5.2	2.5	3.2
6.3	8	4	5
10	13	6.3	8
16	20	10	13
20	26	13	16
25	32	16	20

(3) 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

$\lambda p = \lambda b \times (\pi E \times \pi SR \times \pi Q \times \pi CV)$

- λp : Malfunction rate stemming from operation
- λb : Basic malfunction rate
- πE : Environmental factors
- πSR : Series resistance
- πQ : Level of malfunction rate
- πCV : 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.

Malfunction rate as function of operating temperature and rated voltage

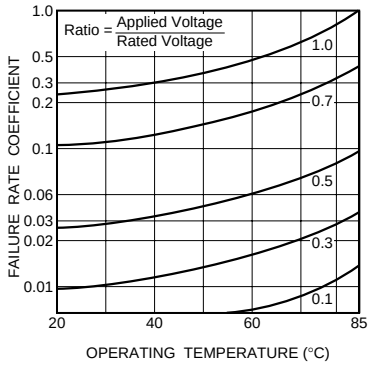


Fig.3

Malfunction rate as function of circuit resistance (Ω/V)

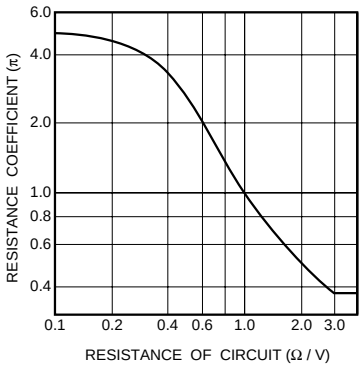


Fig.4

(4) Maximum power dissipation

Warming of the capacitor due to ripple voltage balances with warming caused by Joule heating and by radiated heat. Maximum allowable warming of the capacitor is to 5°C above ambient temperature. When warming exceeds 5°C, it can damage the dielectric and cause a short circuit.

Power dissipation (P) = $I^2 \bullet R$

Ripple current

P : As shown in table at right

R : Equivalent series resistance

Notes:

1. Please be aware that when case size is changed, maximum allowable power dissipation is reduced.
2. Maximum power dissipation varies depending on the package. Be sure to use a case which will keep warming within the limits shown in the table below.

Allowable power dissipation (W) and maximum temperature rising

Case \ Temp.	+25°C	+55°C	+85°C	+125°C
P case (2012)	0.025	0.022	0.020	0.010
Max. Temp Rise [°C]	5	5	5	2

(5) Impedance frequency characteristics

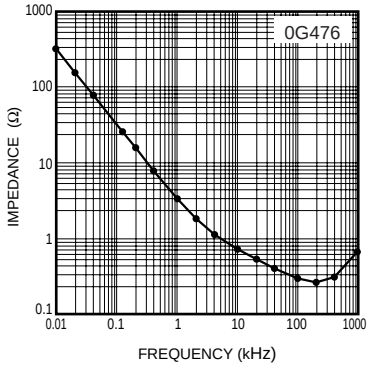


Fig.5

(6) ESR frequency characteristics

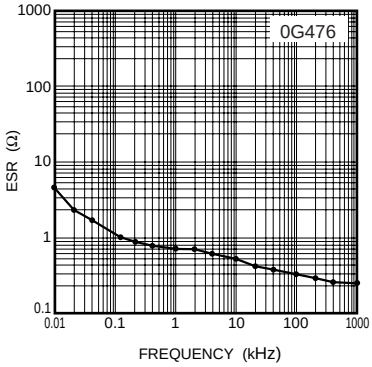


Fig.6

(7) Temperature characteristics

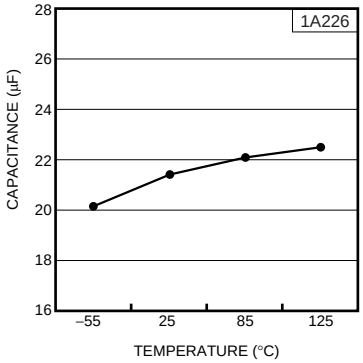


Fig.7

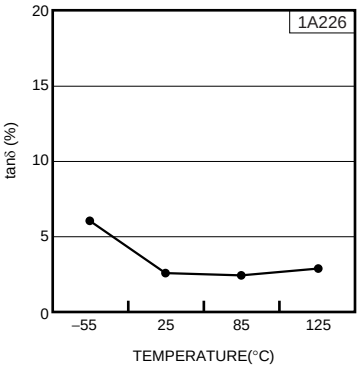


Fig.8

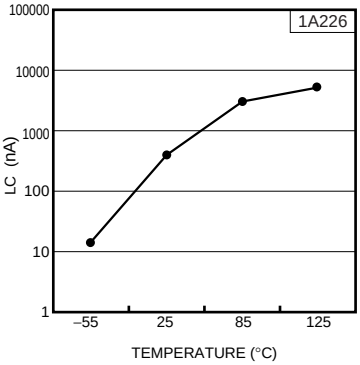


Fig.9

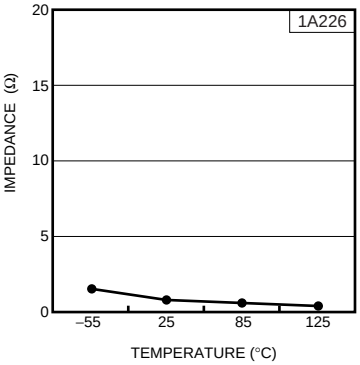


Fig.10