Type 111

（No.P-111-E001）

Type 111 is hermetically sealed capacitors in metal case, designed for excellent stability.

FEATURES

1. The type is hermetically sealed capacitors in metal case, designed for excellent stability.
2. Designed for high reliability.
3. Available for capacitance tolerance code “J”(±5%).

RATING

Item	Rating
Category temperature range (Operating temperature)	-55 ~ +125°C
Rated Temperature (Maximum operating temperature for DC rated Voltage)	+85°C (1)
DC rated voltage range［U_R］	See CATALOG NUMBERS AND RATING OF STANDARD PRODUCTS(2)
Rated capacitance (Normal capacitance range［C_R］)	
Rated capacitance tolerance	
Failure rate level	1%/1000 h (Series M)
	0.5%/1000 h (Series N)
	0.1%/1000 h (Series P)

Note(1): For operation 125℃,derate voltage linearly to 67% of 85℃ voltage rating.
Note(2): Capacitance Tolrerence ±5% is avalable by demand.

ORDERING INFORMATION

111 M 1602 335 M

TYPE / SERIES / RATED VOLTAGE / CAPACITANCE / CAPACITANCE TOLERANCE

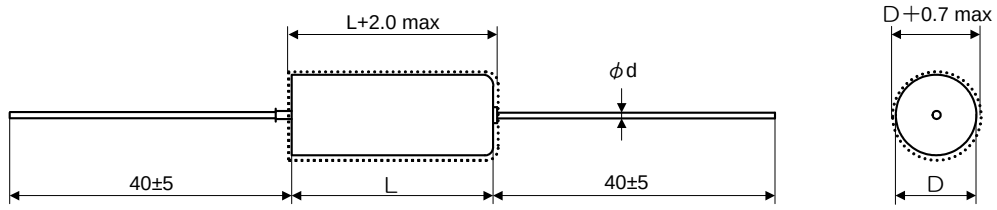
Series	Failure rate level
M	1%/1000h
N	0.5%/1000h
P	0.1%/1000h

Marking	Rated voltage	Marking	Rated voltage
6301	6.3VDC	5002	50VDC
1002	10VDC	7502	75VDC
1602	16VDC	1003	100VDC
2002	20VDC		
2502	25VDC		
3502	35VDC		

Marking	Capacitance	Marking	Capacitance	Marking	Capacitance
104	0.1 μF	155	1.5 μF	226	22 μF
154	0.15 μF	225	2.2 μF	336	33 μF
224	0.22 μF	335	3.3 μF	476	47 μF
334	0.33 μF	475	4.7 μF	686	68 μF
474	0.47 μF	685	6.8 μF	107	100 μF
684	0.68 μF	106	10 μF	157	150 μF
105	1.0 μF	156	15 μF	227	220 μF
				337	330 μF

Marking	Capacitance Tolerance
M	±20%
K	±10%

DIMENSIONS



Unit: mm

Case size	D±0.5	L±1	φ d
A	3.15	6.3	0.5 +0.1 -0.025
B	4.5	11.8	0.5 +0.1 -0.025
C	7.1	16.0	0.65 +0.12 -0.03
D	8.7	20.0	0.65 +0.12 -0.03

PERFORMANCE

No.	Item			Performance	Test method
1	Leakage Current (μA)			Shall not exceed 0.01 CV or 0.5 whichever is greater.	JIS C 5101-1, 4.9 Applied Voltage : Rated Voltage for 5 min. Temperature : 20°C
2	Capacitance (μF)			Shall be within tolerance of the nominal value specified.	JIS C 5101-1, 4.7 Frequency : 120 Hz± 20% Voltage : 0.5Vrms+1.5 ~2VDC Temperature : 20°C
3	Dissipation Factor			Shall not exceed the values shown in CATALOG NUMBERS AND RATING OF STANDARD PRODUCTS.	JIS C 5101-1, 4.8 Frequency : 120 Hz± 20% Voltage : 0.5Vrms+1.5 ~2VDC Temperature : 20°C
4	Characteristics at High and LowTemperature				JIS C 5101-1, 4.29
		Step1	Leakage Current Capacitance Dissipation Factor	Shall not exceed the value in No.1. Shall be within the specified tolerance. Shall not exceed the value in No.3.	Measuring temperature : 20 ± 2°C
		Step2	Capacitance Change Dissipation Factor	Shall be within ± 10% of the value at Step 1. Shall not exceed the values shown in CATALOG NUMBERS AND RATING OF STANDARD PRODUCTS.	Measuring temperature : -55 ± 3 °C
		Step3	Leakage Current Capacitance Change Dissipation Factor	Shall not exceed the value in No.1. Shall be within ± 2% of the value at Step 1. Shall not exceed the value in No.3.	Measuring temperature : 20 ± 2°C
		Step4	Leakage Current Capacitance Change Dissipation Factor	Shall not exceed 0.1 CV or 5 whichever is greater. Shall be within ± 8% of the value at Step 1. Shall not exceed the values shown in CATALOG NUMBERS AND RATING OF STANDARD PRODUCTS.	Measuring temperature : 85 ± 2 °C
		Step5	Leakage Current Capacitance Change Dissipation Factor	Shall not exceed 0.125 CV or 6.3 whichever is greater. Shall be within ± 12% of the value at Step 1. Shall not exceed the values shown in CATALOG NUMBERS AND RATING OF STANDARD PRODUCTS.	Measuring temperature : 125 ± 2 °C
		Step6	Leakage Current Capacitance Change Dissipation Factor	Shall not exceed the value in No.1. Shall be within ± 2% of the value at Step 1. Shall not exceed the value in No.3.	Measuring temperature : 20 ± 2°C
5	Surge		Leakage Current Capacitance Change Dissipation Factor Appearance	Shall not exceed the value in No.1. Shall be within ± 5% of initial value. Shall not exceed the value in No.3. There shall be no evidence of mechanical damage.	JIS C 5101-1, 4.26 Test temperature : 85 ± 2°C, Applied Voltage :DC surge voltage Series protective resistance : 1000 Ω Discharge resistance : 1000 Ω
6	Sleeving		Dielectric withstanding voltage	There shall be no dielectric breakdown.	JIS C 5101-1,4.6(C) Voltage: 2000VDC Duration : 1 min.
			Insulation resistanc	More than 1000M Ω	JIS C 5101-1,4.5(C) Voltage: 100VDC Duration : 2 min.
7	Terminal strength		Tensile strength	No fault such as breakage and loosening terminal	JIS C 5101-1, 4.13.1 Applied force: 5N (d=ϕ0.5), 10N (d=ϕ0.65) Duration:10± 1 s
			Bending strength		JIS C 5101-1,4.13.2 Bending force : 2.5 N (d=ϕ0.5), 5N (d=ϕ0.65) Bending cycle:2

No.	Item		Performance	Test method
8	Vibration	Capacitance	Initial value to remain steady during measurement.	JIS C 5101-1,4.17 Frequency range : 10 ~ 2000 Hz Swing width : 1.5 mm Peak acceleration : 196m/s^2 Vibration direction : 2 directions with mutually right-angled Duration : 4 hours in each of these mutually perpendicular directions (total 8 hours)
		Appearance	There shall be no evidence of mechanical damage.	
9	Shock		There shall be no intermittent contact of 0.5 ms or greater, short, or open. Nor shall there be any spark discharge, insulation breakdown, or evidence of mechanical damage.	JIS C 5101-1,4.19 Peak acceleration :981 m/s^2 Duration : 6 ms Wave form : Sawtooth
10	Solderability		Shall be covered to over 3/4 of terminal surface by new soldering.	JIS C 5101-1,4.15 Solder temperature : 230 ± 5°C Dipping time : 2 ± 0.5 s Dipping depth : 2.0 to 2.5 mm from the terminal base
11	Resistance to Soldering Heat	Leakage Current Capacitance Change Dissipation Factor Appearance	Shall not exceed the value in No.1. Shall be within ± 3% of initial value. Shall not exceed the value in No.3. There shall be no evidence of mechanical damage.	JIS C 5101-1,4.14 Solder temperature: 260 ± 5°C Dipping time: 10 ± 1 s Dipping depth : 2.0 to 2.5 mm from the terminal base
12	Component solvent resistance	Appearance	There shall be no evidence of mechanical damage.	JIS C 5101-1, 4.31 Temperature : 23 ± 5°C Dipping time : 5 ± 0.5 min. Solvent : 2-propanol (Isopropyl alcohol)
13	Solvent resistance of marking	Visual examination	After the test the marking shall be legible.	JIS C 5101-1, 4.32 Temperature : 23 ± 5°C Dipping time : 5 ± 0.5 min. Solvent : 2-propanol (Isopropyl alcohol)
14	Seal		There shall be no evidence of leakage.	JIS C 5101-1,4.20 Test condition : Qc, method 1 Temperature : 125 $^{+5}_{-1}$°C Duration : 1min.
15	Rapid Change of Temperature and immersion cycle	Rapid Change of Temperature	Measurements after cycling, are not applicable.	JIS C 5101-1,4.16 Step 1 : -55 $^{0}_{-3}$°C, 30 ± 3 min. Step 2 : 25 $^{+10}_{-5}$ °C, 3 min. max. Step 3 : 125 $^{+3}_{0}$ °C, 30 ± 3 min. Step 4 : 25 $^{+10}_{-5}$ °C, 3 min. max. Number of cycles : 5
		Immersion cycle Leakage Current Capacitance Change Dissipation Factor Appearance	 Shall not exceed the value in No.1. Shall be within ± 5% of initial value. Shall not exceed the value in No.3. There shall be no evidence of mechanical damage.	MIL-STD-202 method 104A Temperature of hot bath of fresh water: 65 $^{+5}_{0}$ °C Temperature of saturated solution of sodium chloride and water: 0±3°C Duration of immersion: 15 ± 2 min. Number of cycle: 2
16	Moisture resistance	Leakage Current Capacitance Change Dissipation Factor Appearance	Shall not exceed the value in No.1. Shall be within ± 5% of initial value. Shall not exceed the value in No.3. There shall be no evidence of mechanical damage.	JIS C 60068-2-38 High temperature : 65 $^{+5}_{0}$ °C 90 to 98%R.H. Low temperature : 25 $^{0}_{-2}$ °C 90 to 98%R.H.
17	Salt spray		There shall be no harmful corrosion, and at least 90% of any exposed surfaca of the capacitor shall be protected by the finish. There shall be no unwraping of, or mechanical damage to, the sleeving. Marking shall remain legible.	JIS C 60068-2-11 Temperature : 35 ± 2°C Salt solution : 5±1% (wt) Duration : 48±4 h
18	Endurance	Leakage Current Capacitance Change Dissipation Factor Appearance	Shall not exceed the value in No.1. Shall be within ± 5% of initial value. Shall not exceed the value in No.3. There shall be no evidence of mechanical damage.	JIS C 5101-1,4.23 Test temperature and applied voltage : 85 ± 2°C and rated voltage or 125 ± 3°C and 2/3 × rated voltage Duration : 2000 $^{+72}_{0}$ h Power supply impedance : 3 Ω or less

⚠ Application Notes for Tantalum Solid Electrolytic Capacitor （Hermetically sealed capacitors in metal case）

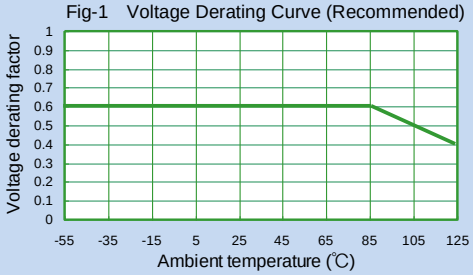
1. Operating Voltage

Tantalum Solid Electrolytic Capacitor shall be operated at the rated voltage or lower.
Rated voltage: The “rated voltage” refers to the maximum DC voltage that is allowed to be continuously applied between the capacitor terminals at the rated temperature.
Surge voltage: The “surge voltage” refers to the voltage that is allowed to be instantaneously applied to the capacitor at the rated temperature or the maximum working temperature. The capacitor shall withstand the voltage when a 30-second cycle of application of the voltage through a 1000 Ω series resistance is repeated 1000 times in 6-minute periods.

Rated voltage (VDC)	6.3	10	16	20	25	35	50	75	100
Surge voltage (VDC)	8	13	20	25	32	44	63	98	125

When designing the circuit, the equipment’s required reliability must be considered and appropriate voltage derating must be performed. Figure 1 shows the recommended voltage derating curve for Tantalum capacitors as described by NASA APPLICATION NOTES.

Fig-1 Voltage Derating Curve (Recommended)



2. Application that contain AC Voltage

Special attention to the following 3 items.
(1) The sum of the DC bias voltage and the positive peak value of the AC voltage should not exceed the rated voltage.
(2) Reverse voltage should not exceed the allowable values of the negative peak AC voltage.
(3) Ripple current should not exceed the allowable values.

3. Reverse Voltage

Tantalum solid electrolytic capacitor is polarity. Please do not impress reverse voltage. As well, please confirm the potential of the tester beforehand when both ends of the capacitor are checked with the tester etc.

4. Permissible Ripple Voltage

Permissible ripple voltage is determined by the heat loss of the element and heat radiation of the lead wire. This is influenced by capacitance, ESR, operating temperature, and frequency or ripple. Please consult Matsuo’s Engineering Bulletin for details on calculating ripple current values.

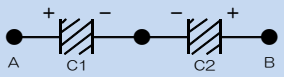
5. Application on low-impedance circuit

The failure rate of low impedance circuit at 0.1Ω/V is about five times greater than that of a 1Ω/V circuit. To curtail this higher failure rate, tantalum capacitors used in low impedance circuits, such as filters for power supplies, particularly switching power supplies, or for noise by-passing, require that operating voltage be derated to less than half of the rated voltage. Actually, less than 1/3 of the rated voltage is recommended.

6. Non Polar Application(BACK TO BACK)

Tantalum capacitors can be used as a non-polar unit if two capacitors are connected “BACK-TO-BACK” when reserve voltage is applied at a more than permissible value, or in a purely AC circuit. The two capacitors should both be of the same rated voltage and capacitance tolerance, and they should both be twice the required capacitance value.

Fig-2



Ripple Voltage: Permissible Ripple Voltage shall not exceed the value allowed for either C1 or C2 (This will be the same, as the capacitors should be identical.)
Capacitance: (C1 × C2) / (C1 + C2)
Leakage Current: If terminal A is (+), the Leakage Current will be equal to C1’s Leakage Current.
If terminal B is (+), the Leakage Current will be equal to C2’s Leakage Current.

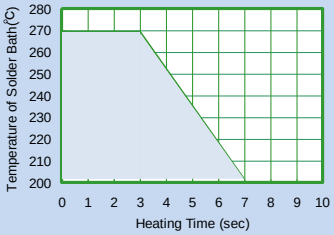
7. Soldering

The soldering of Type 111 should be operated per the following recommended conditions.
(1) Flow Soldering (Direct heating from the substrate)
Solder temperature: 260°C or less
Dipping time: 10 s

Note1: Noted that solder part of hermetic could be melted If soldering temperature is too high or dipping time is too long for the operation.

(2) Soldering with a Soldering Iron

Fig-2



Note2: Please be noted that soldering should be done more than 4mm apart from product body.

8.Example of trouble phenomenon happening by excessive heating when soldering

When mounting, the following breakdown phenomena might be caused when excessive heating that exceeds the above-mentioned tolerance is done. Therefore, please pay attention to the operation.
In a case that solder is used for cathode connection of molding type product, Ag in silver paste could merge into solder if solder in product have melted. That might cause excessive Leakage Current and Short etc. by changing in deterioration in DF and the high frequency impedance or internal stresses in that case.
Mechanical stress according to heat stress and expansion shrinkage or concentrations of internal stress might increase failure rate. Defect sealing could sometimes come for solder melting in seal entrance part of Type 111. Or, solder flows, might become a bridge between inside and outside circles of the Hermetic seal, be good at the solder grain if inhaled, and the phenomenon such as a short or intermittent shorts be caused.

9.Flux
Please use flux as much as possible with non-acidity and little content of both chlorine and amine.

10. Cleaning
Cleaning by organic solvent may damage capacitor's appearance and performance. However, our capacitors are not effected even when soaked at 20 ~ 30°C 2-propanol for 5 minutes. When introducing new cleaning methods or changing the cleaning term, please consult us.

11. Protective Resin Coating
After components are assembled to substrate, a protective resin coating is sometimes applied. As this resin coating cures, it gives mechanical and thermal stress to Tantalum capacitors. This stress can cause damage to the capacitors, which affects their reliability. Before using a resin coating, proper research must be done in regards to the material and process to insure that excessive stress will not be applied to capacitors and other components.

12. Vibration
Approximately 300 G shall be applied to a capacitor, when dropped from 1 meter to a concrete floor.
Although capacitors are made to withstand this drop test, stress from shock due to falling or striking does cause damage to the capacitors and increases failure rates. Do not subject capacitors to this type of mechanical stress.

13. Additional Notes
· When more than one capacitor is connected in series, a resistor that can distribute the voltage equally to the capacitors shall be connected in parallel.
· The capacitor cases shall not be cut even if the mounting space is insufficient.
· Do not process lead wire terminal in a way other than cutting or bending the part that projects from printed circuit board (plated through hole).
· Do not add the outside power more than regulations to lead wire terminal. Do not add excessive power to capacitor.
· During a customers aging process, voltage should remain under the rated voltage at all times.
· Capacitors should never be touched or manipulated while operating.
· Capacitors are not meant to be dismantled.
· When testing capacitors, please examine the power source before conducting test to insure the tester's polarity and applied voltage.
· Do not touch terminals of other parts if electrode is applied and checked while energizing. Do not bend the lead wire terminal with the electrode testers.
· In the event of a capacitor burning, smoking, or emitting an offensive smell during operation, please turn the circuit "off" and keep hands and face away from the burning capacitor.
· If a capacitor be electrical shorted, it becomes hot, and the capacitor element may ignite. In this case, the printed board may be burnt out.
· A for capacitors (Type 111) with the metal casing, pressure in the cases might go up by Short before they explode, and then high-temperature solder might disperse.
· Capacitors should be stored at room temperature under low humidity. Capacitors should never be stored under direct sunlight, and should be stored in an environment containing dust.
· If the capacitors will be operated in a humid environment, they should be sealed with a compound under proper conditions.
· Capacitors should not be stored or operated in environments containing acids, alkalis or active gasses.
· When capacitors are disposed of as "scrap" or waste, they should be treated as Industria Waste since they contain various metals and polymers.
· Capacitors submitted as samples should not be used for production purposes.

These application notes are prepared based on "Guideline of notabilia for fixed tantalum electrolytic capacitors with solid electrolyte for use in electronic equipment" (EIAJ RCR-2368) issued by Japan Electronics and Information Technology Industries Association (JEITA). For the details of the instructions (explanation, reasons and concrete examples), please refer to this guideline, or consult our Sales Department.

MATSUO ELECTRIC CO., LTD.

Please feel free to ask our Sales Department for more information on Tantalum Solid Electrolytic Capacitor.

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