

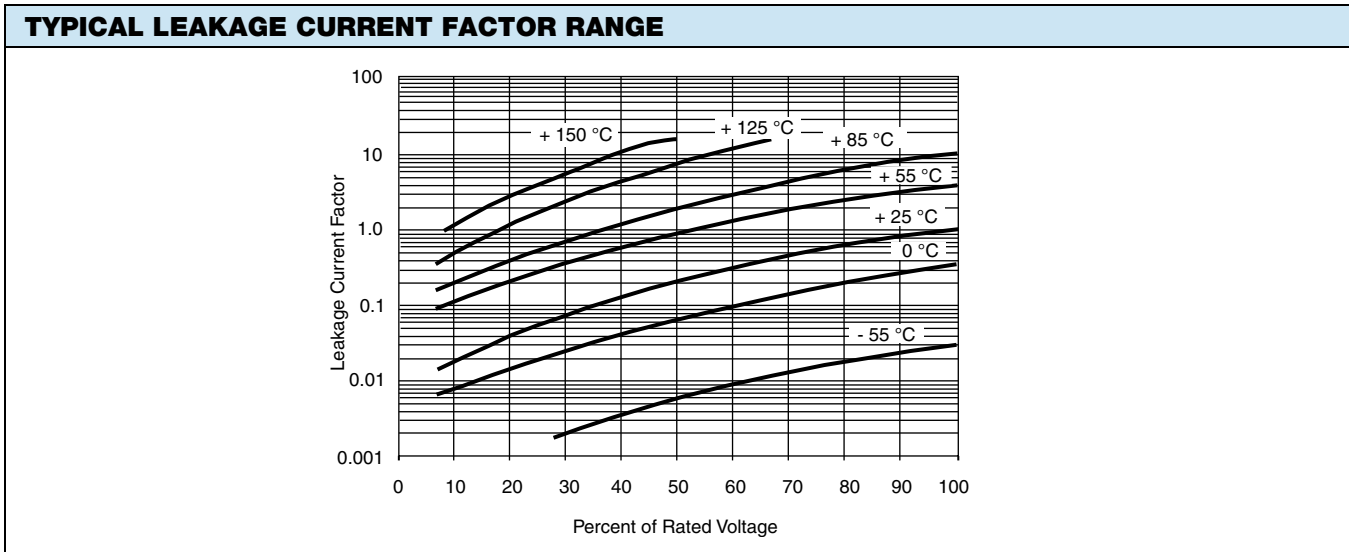


## Typical Performance Characteristics Tantalum Capacitors

CAPACITOR ELECTRICAL PERFORMANCE CHARACTERISTICS				
ITEM	PERFORMANCE CHARACTERISTICS			
Category temperature range	-55 °C to +85 °C (to +125 °C with voltage derating)			
Capacitance tolerance	± 20 %, ± 10 % (at 120 Hz) 2 V <sub>RMS</sub> (max.) at +25 °C using a capacitance bridge			
Dissipation factor	Limit per Standard Ratings table. Tested via bridge method, at 25 °C, 120 Hz			
ESR	Limit per Standard Ratings table. Tested via bridge method, at 25 °C, 100 kHz			
Leakage current	After application of rated voltage applied to capacitors for 5 min using a steady source of power with 1 kΩ resistor in series with the capacitor under test, leakage current at 25 °C is not more than 0.01 CV or 0.5 μA, whichever is greater. <i>Note that the leakage current varies with temperature and applied voltage. See graph below for the appropriate adjustment factor.</i>			
Capacitance change by temperature	+12 % max. (at +125 °C) +10 % max. (at +85 °C) -10 % max. (at -55 °C)		For capacitance value > 300 μF +20 % max. (at +125 °C) +15 % max. (at +85 °C) -15 % max. (at -55 °C)	
Reverse voltage	Capacitors are capable of withstanding peak voltages in the reverse direction equal to: 10 % of the DC rating at +25 °C 5 % of the DC rating at +85 °C Vishay does not recommend intentional or repetitive application of reverse voltage			
Temperature derating	If capacitors are to be used at temperatures above +25 °C, the permissible RMS ripple current or voltage shall be calculated using the derating factors: 1.0 at +25 °C 0.9 at +85 °C 0.4 at +125 °C			
Operating temperature	<b>+85 °C</b>		<b>+125 °C</b>	
	<b>RATED VOLTAGE (V)</b>	<b>SURGE VOLTAGE (V)</b>	<b>RATED VOLTAGE (V)</b>	<b>SURGE VOLTAGE (V)</b>
	4	5.2	2.7	3.4
	6.3	8	4	5
	10	13	7	8
	16	20	10	12
	20	26	13	16
	25	32	17	20
	35	46	23	28
	50	65	33	40
	50 <sup>(1)</sup>	60	33	40
	63	76	42	50
75 <sup>(2)</sup>	75	50	50	

### Notes

- All information presented in this document reflects typical performance characteristics.
- <sup>(1)</sup> Capacitance values 15 μF and higher.
- <sup>(2)</sup> For 293D and TR3 only.



**Notes**

- At +25 °C, the leakage current shall not exceed the value listed in the Standard Ratings table.
- At +85 °C, the leakage current shall not exceed 10 times the value listed in the Standard Ratings table.
- At +125 °C, the leakage current shall not exceed 12 times the value listed in the Standard Ratings table.

CAPACITOR PERFORMANCE CHARACTERISTICS							
ITEM	PERFORMANCE CHARACTERISTICS						
Surge voltage	<p>Post application of surge voltage (as specified in the table above) in series with a 33 Ω resistor at the rate of 30 s ON, 30 s OFF, for 1000 successive test cycles at 85 °C, capacitors meet the characteristics requirements listed below.</p> <table border="0"> <tr> <td>Capacitance change</td> <td>Within ± 10 % of initial value</td> </tr> <tr> <td>Dissipation factor</td> <td>Initial specified value or less</td> </tr> <tr> <td>Leakage current</td> <td>Initial specified value or less</td> </tr> </table>	Capacitance change	Within ± 10 % of initial value	Dissipation factor	Initial specified value or less	Leakage current	Initial specified value or less
Capacitance change	Within ± 10 % of initial value						
Dissipation factor	Initial specified value or less						
Leakage current	Initial specified value or less						
Surge current	<p>After subjecting parts in series with a 1 Ω resistor at the rate of 3 s CHARGE, 3 s DISCHARGE, and a cap bank of 100K μF for 3 successive test cycles at 25 °C, capacitors meet the characteristics requirements listed below.</p> <table border="0"> <tr> <td>Capacitance change</td> <td>Within ± 10 % of initial value</td> </tr> <tr> <td>Dissipation factor</td> <td>Initial specified value or less</td> </tr> <tr> <td>Leakage current</td> <td>Initial specified value or less</td> </tr> </table>	Capacitance change	Within ± 10 % of initial value	Dissipation factor	Initial specified value or less	Leakage current	Initial specified value or less
Capacitance change	Within ± 10 % of initial value						
Dissipation factor	Initial specified value or less						
Leakage current	Initial specified value or less						
Life test at +85 °C	<p>Capacitors meet the characteristic requirements listed below. After 2000 h application of rated voltage at 85 °C.</p> <table border="0"> <tr> <td>Capacitance change</td> <td>Within ± 10 % of initial value</td> </tr> <tr> <td>Leakage current</td> <td>Shall not exceed 125 % of initial value</td> </tr> </table>	Capacitance change	Within ± 10 % of initial value	Leakage current	Shall not exceed 125 % of initial value		
Capacitance change	Within ± 10 % of initial value						
Leakage current	Shall not exceed 125 % of initial value						
Life test at +125 °C	<p>Capacitors meet the characteristic requirements listed below. After 1000 h application 2/3 of rated voltage at 125 °C.</p> <table border="0"> <tr> <td>Capacitance change for parts with cap. ≤ 600 μF</td> <td>Within ± 10 % of initial value</td> </tr> <tr> <td>for parts with cap. &gt; 600 μF</td> <td>Within ± 20 % of initial value</td> </tr> <tr> <td>Leakage current</td> <td>Shall not exceed 125 % of initial value</td> </tr> </table>	Capacitance change for parts with cap. ≤ 600 μF	Within ± 10 % of initial value	for parts with cap. > 600 μF	Within ± 20 % of initial value	Leakage current	Shall not exceed 125 % of initial value
Capacitance change for parts with cap. ≤ 600 μF	Within ± 10 % of initial value						
for parts with cap. > 600 μF	Within ± 20 % of initial value						
Leakage current	Shall not exceed 125 % of initial value						



CAPACITOR ENVIRONMENTAL CHARACTERISTICS		
ITEM	CONDITION	ENVIRONMENTAL CHARACTERISTICS
Humidity tests	At 40 °C/90 % RH 1000 h, no voltage applied.	Capacitance change Cap. ≤ 600 μF      Within ± 10 % of initial value Cap. > 600 μF      Within ± 20 % of initial value Dissipation factor      Not to exceed 150 % of initial +25 °C requirement
Temperature cycles	At -55 °C/+125 °C, 30 min each, for 5 cycles.	Capacitance change Cap. ≤ 600 μF      Within ± 10 % of initial value Cap. > 600 μF      Within ± 20 % of initial value Dissipation factor      Initial specified value or less Leakage current      Initial specified value or less
Moisture resistance	MIL-STD-202, method 106 at rated voltage, 42 cycles.	Capacitance change Cap. ≤ 600 μF      Within ± 10 % of initial value Cap. > 600 μF      Within ± 20 % of initial value Dissipation factor      Initial specified value or less Leakage current      Initial specified value or less
Thermal shock	Capacitors are subjected to 5 cycles of the following: -55 °C (+0 °C, -5 °C) for 30 min, then +25 °C (+10 °C, -5 °C) for 5 min, then +125 °C (+3 °C, -0 °C) for 30 min, then +25 °C (+10 °C, -5 °C) for 5 min	Capacitance change Cap. ≤ 600 μF      Within ± 10 % of initial value Cap. > 600 μF      Within ± 20 % of initial value Dissipation factor      Initial specified value or less Leakage current      Initial specified value or less

MECHANICAL PERFORMANCE CHARACTERISTICS		
TEST CONDITION	CONDITION	POST TEST PERFORMANCE
Shear test	Apply a pressure load of 5 N for 10 s ± 1 s horizontally to the center of capacitor side body.	Capacitance change      Within ± 10 % of initial value Dissipation factor      Initial specified value or less Leakage current      Initial specified value or less  There shall be no mechanical or visual damage to capacitors post-conditioning.
Substrate bend	With parts soldered onto substrate test board, apply force to the test board for a deflection of 3 mm, for a total of 3 bends at a rate of 1 mm/s.	Capacitance change      Within ± 10 % of initial value Dissipation factor      Initial specified value or less Leakage current      Initial specified value or less
Vibration	MIL-STD-202, method 204, condition D, 10 Hz to 2000 Hz, 20 g peak	Capacitance change      Within ± 10 % of initial value Dissipation factor      Initial specified value or less Leakage current      Initial specified value or less  There shall be no mechanical or visual damage to capacitors post-conditioning.
Shock	MIL-STD-202, method 213B shock (specified pulse), condition I, 100 g peak	Capacitance change      Within ± 10 % of initial value Dissipation factor      Initial specified value or less Leakage current      Initial specified value or less  There shall be no mechanical or visual damage to capacitors post-conditioning.
Resistance to solder heat	<ul style="list-style-type: none"> <li>Recommended reflow profiles temperatures and durations are located within the Capacitor Series Guides</li> <li>Pb-free and lead-bearing series caps are backward and forward compatible</li> </ul>	Capacitance change      Within ± 10 % of initial value Dissipation factor      Initial specified value or less Leakage current      Initial specified value or less  There shall be no mechanical or visual damage to capacitors post-conditioning.
Solderability	MIL-STD-2002, method 208, ANSI/J-STD-002, test B. Applies only to solder and tin plated terminations. Does not apply to gold terminations.	Capacitance change      Within ± 10 % of initial value Dissipation factor      Initial specified value or less Leakage current      Initial specified value or less  There shall be no mechanical or visual damage to capacitors post-conditioning.
Resistance to solvents	MIL-STD-202, method 215	Capacitance change      Within ± 10 % of initial value Dissipation factor      Initial specified value or less Leakage current      Initial specified value or less  There shall be no mechanical or visual damage to capacitors post-conditioning.
Flammability	Encapsulant materials meet UL 94 V-0 with an oxygen index of 32 %.	