



## Molded Chip Tantalum Capacitors, Automotive Grade

ELECTRICAL PERFORMANCE CHARACTERISTICS					
ITEM	PERFORMANCE CHARACTERISTICS				
Category temperature range	-55 °C to +85 °C (to +125 °C / +150 °C / +175 °C with voltage derating - refer to graph "Category Voltage vs. Temperature") <sup>(1)</sup>				
Capacitance tolerance	± 20 %, ± 10 %, tested via bridge method, at 25 °C, 120 Hz				
Dissipation factor	Limits per Standard Ratings table. Tested via bridge method, at 25 °C, 120 Hz				
ESR	Limits 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 "Typical Leakage Current Temperature Factor" for the appropriate adjustment factor.</i>				
Capacitance change by temperature	+30 % max. (at +175 °C) +20 % max. (at +125 °C and +150 °C) +10 % max. (at +85 °C) -10 % 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 1 % of the DC rating at +125 °C				
Ripple current	For maximum ripple current values (at 25 °C) refer to relevant datasheet. 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 0.3 at +150 °C 0.2 at +175 °C				
Maximum operating and surge voltages vs. temperature	+85 °C		+125 °C		+150 °C / +175 °C
	RATED VOLTAGE (V)	SURGE VOLTAGE (V)	CATEGORY VOLTAGE (V)	SURGE VOLTAGE (V)	CATEGORY VOLTAGE (V)
	4	5.2	2.7	3.4	n/a
	6.3	8	4	5	3
	10	13	7	8	5
	16	20	10	12	8
	20	26	13	16	10
	25	32	17	20	12.5
	35	46	23	28	17.5
	50	65	33	40	25
	50 <sup>(2)</sup>	60	33	40	n/a
	63	75	42	50	n/a
75 <sup>(3)</sup>	75	50	50	n/a	

### Notes

- All information presented in this document reflects typical performance characteristics
- <sup>(1)</sup> Series TH3 - up to 150 °C; TH4 - up to 175 °C
- <sup>(2)</sup> Capacitance value 15 μF and higher
- <sup>(3)</sup> For 293D and TR3 only

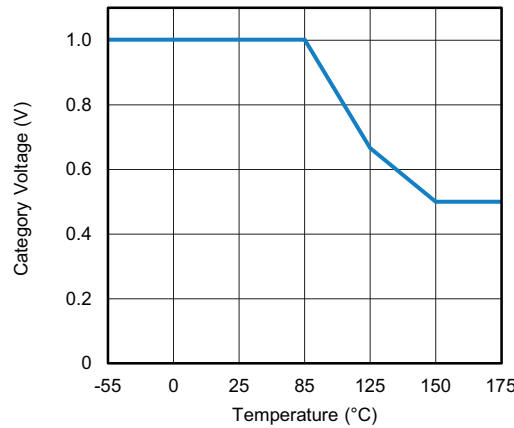


RECOMMENDED VOLTAGE DERATING GUIDELINES (for temperature below +85 °C)	
VOLTAGE RAIL (V)	CAPACITOR VOLTAGE RATING (V)
≤ 3.3	6.3
5	10
10	20
12	25
15	35
24	50 or series configuration

### Notes

- For temperatures above +85 °C the same voltage derating ratio is recommended, but with respect to category voltage.  
 Up to +85 °C: category voltage = rated voltage  
 At +125 °C: category voltage = 2/3 of rated voltage  
 At 150 °C / 175 °C: category voltage = 1/2 of rated voltage
- For more information about recommended voltage derating see: [www.vishay.com/doc?40246](http://www.vishay.com/doc?40246)

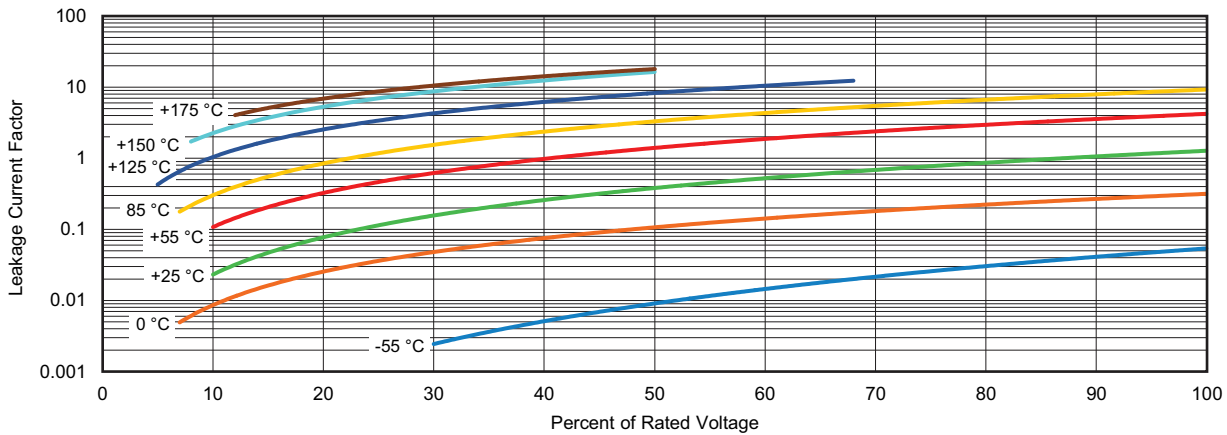
## CATEGORY VOLTAGE VS. TEMPERATURE



### Note

- Below 85 °C category voltage is equal to rated voltage

## TYPICAL LEAKAGE CURRENT FACTOR



### Note

- 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.
- At +150 °C, the leakage current shall not exceed 15 times the value listed in the Standard Ratings table.
- At +175 °C, the leakage current shall not exceed 18 times the value listed in the Standard Ratings table



ENVIRONMENTAL PERFORMANCE CHARACTERISTICS			
ITEM	CONDITION	POST TEST PERFORMANCE	
High temperature exposure (storage)	MIL-STD-202, method 108 1000 h, at maximum rated temperature, unpowered	Capacitance change Dissipation factor Leakage current ESR	Within $\pm 20\%$ of initial value Initial specified limit Initial specified limit Initial specified limit
Operational life test at +125 °C	AEC-Q200 1000 h application 2/3 of rated voltage	Capacitance change Dissipation factor Leakage current ESR	Within $\pm 20\%$ of initial value Initial specified limit Shall not exceed 10 times the initial limit Initial specified limit
Operational life test at +150 °C (for TH3) and at +175 °C (for TH4)	AEC-Q200 1000 h application 1/2 of rated voltage	Capacitance change Dissipation factor Leakage current ESR	Within $\pm 20\%$ of initial value Shall not exceed 3 times the initial limit Shall not exceed 10 times the initial limit Shall not exceed 3 times the initial limit
Surge voltage	MIL-PRF-55365: 1000 successive test cycles at 85 °C of surge voltage (as specified in the table above), in series with a 33 $\Omega$ resistor at the rate of 30 s ON, 30 s OFF	Capacitance change Dissipation factor Leakage current ESR	Within $\pm 30\%$ of initial value Shall not exceed 1.5 times the initial limit Shall not exceed 2 times the initial limit Shall not exceed 1.5 times the initial limit
Biased humidity test	AEC-Q200 At 85 °C / 85 % RH, 1000 h, with rated voltage applied	Capacitance change Dissipation factor Leakage current ESR	Within $\pm 20\%$ of initial value Shall not exceed 3 times the initial limit Shall not exceed 10 times the initial limit Shall not exceed 3 times the initial limit
Temperature cycling	AEC-Q200 / JESD22, method JA-104 -55 °C / +125 °C, for 1000 cycles	Capacitance change Dissipation factor Leakage current ESR	Within $\pm 20\%$ of initial value Initial specified limit Initial specified limit Initial specified limit

MECHANICAL PERFORMANCE CHARACTERISTICS			
ITEM	CONDITION	POST TEST PERFORMANCE	
Vibration	MIL-STD-202, method 204: 10 Hz to 2000 Hz, 5 g peak for 20 min, 12 cycles each of 3 orientations (total 36 cycles), at rated voltage	Capacitance change Dissipation factor Leakage current	Within $\pm 20\%$ of initial value Initial specified limit Initial specified limit
Mechanical shock	MIL-STD-202, method 213, condition F, 1500 g peak, 0.5 ms, half-sine	Capacitance change Dissipation factor Leakage current	Within $\pm 20\%$ of initial value Initial specified limit Initial specified limit
Resistance to solder heat	MIL-STD-202, method 210, condition D Solder dip 260 °C $\pm$ 5 °C, 10 s	Capacitance change Dissipation factor Leakage current	Within $\pm 20\%$ of initial value Initial specified limit Initial specified limit
Resistance to solvents	MIL-STD-202, method 215	Capacitance change Dissipation factor Leakage current	Within $\pm 20\%$ of initial value Initial specified limit Initial specified limit
Solderability	AEC-Q200 / J-STD-002	Electrical test not required	
Terminal strength / Shear force test	AEC-Q200-006 Apply a pressure load of 17.7 N (1.8 kg) for 60 s horizontally to the center of capacitor side body Exception: for case size 0603 pressure load is 5N	Part should not be sheared off the pads and no body cracking post-conditioning. Electrical test not required.	
Flammability	Encapsulation materials meet UL 94 V-0 with an oxygen index of 32 %	n/a	