TC

Vishay Sprague

Subminiature, Leaded Solid Tantalum Capacitors Polar or Non-polar

FEATURES

- Subminiature package size and light weight
- Rectangular case with axial or radial leads
- 2 to 50 VDC
- 0.1 µF to 470 µF
- Operating temperature range: - 55 °C to + 125 °C
- High stability and reliability
- Tested in accordance with MIL-PRF-49137
- Unique and comprehensive custom design capability

ELECTRICAL CHARACTERISTICS

Operating temperature range: - 55 °C to + 125 °C

Capacitance: Measured at 120 Hz and 25 °C with a maximum of 2.2 VDC bias and 1.0 V_{rms} signal.

Capacitance Tolerance: Standard tolerance is ± 20 % for ratings 0.1 µF and above, and + 40, - 20 % for ratings below 0.1 µF. Special tolerances are also available.

Dissipation Factor: When measured simultaneously with capacitance, DF shall not exceed the value shown in theratings tables.

DC Leakage Current (DCL Max):

When measured with DC voltage applied through a 1000 Ω resistor for 5 minutes, DC leakage (µA) shall not exceed:

At 25 °C: Leakage current shall not exceed the values listed in the Standard Ratings Tables

At 85 °C: Leakage current shall not exceed 10 times the values listed in the Standard Ratings Tables

At 125 °C and 66 % of Rated Voltage: Leakage current shall not exceed 15 times the values listed in the Standard Ratings Tables.

Operating Voltage: Full working voltage up to 85 °C. From 85 °C to 125 °C working voltage derates linearly to 66 % of the 85 °C working voltage.

APPLICATIONS

- Hearing aids
- Portable communications
- Space/avionics
- Laptop computers

MECHANICAL SPECIFICATIONS

Solder coated nickel leads (type N32 per MIL-STD-1276) are standard on all case sizes.

Leads are weldable and/or solderable.

Special leads are available on request (e.g. bare nickel, gold plated nickel or ribbon leads).

Lead length is 1 1/2” [38.1 mm] minimum on nonpolar parts.

On polar parts the negative lead is 1-1/4” [31.8 mm] minimum and the positive lead is 1-1/2” [38.1 mm] minimum.

ORDERING INFORMATION

TC	1.0	35	C3	A*	M
MODEL	CAPACITANCE IN µF	DC VOLTAGE RATING AT + 85 °C	CASE CODE	LEAD CONFIGURATION	CAPACITANCE TOLERANCE
			C = Polar N = Nonpolar	A = Axial R = Radial	E = + 40, - 20 % M = ± 20 % K = ± 10 % J = ± 5 %

Example of Part Number Code: TC1.0-35C3AM

* To complete part number in rating tables, add A or R.
Change suffix if special capacitance tolerance is required.

For technical questions, contact: tantalum@vishay.com

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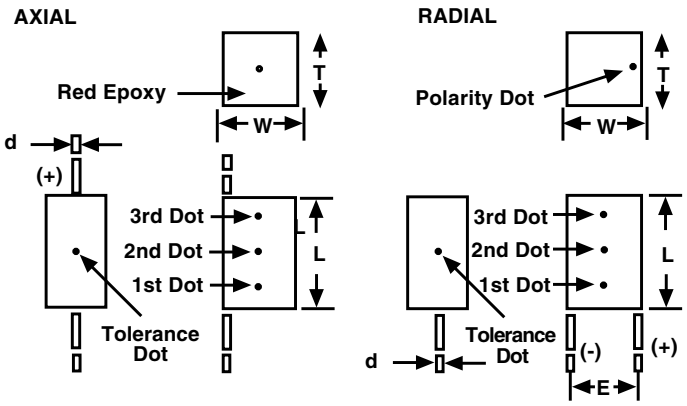
DIMENSIONS in inches [millimeters]

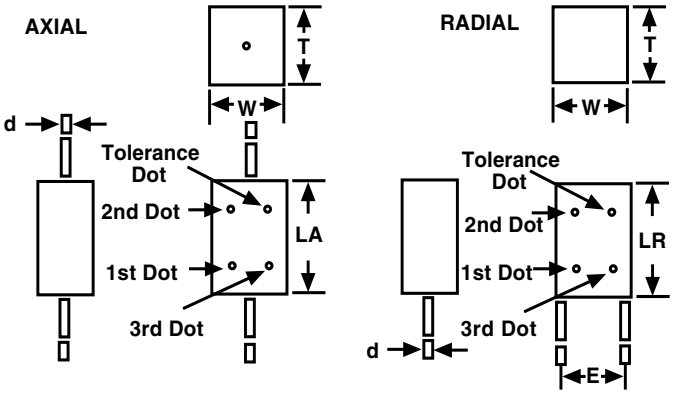
POLAR STYLE



The 3rd dot is on the end of the CX size

CASE CODE	L MAX	W MAX	T MAX	E	E TOL ±	d
CX	0.075 [1.91]	0.050 [1.27]	0.040 [1.02]	0.030 [0.76]	0.015 [0.38]	0.007 [0.18]
C0	0.100 [2.54]	0.050 [1.27]	0.040 [1.02]	0.030 [0.76]	0.015 [0.38]	0.007 [0.18]
C1	0.125 [3.18]	0.070 [1.78]	0.040 [1.02]	0.050 [1.27]	0.015 [0.38]	0.010 [0.25]
C2	0.165 [4.19]	0.120 [3.05]	0.070 [1.78]	0.100 [2.54]	0.020 [0.51]	0.010 [0.25]
C3	0.225 [5.72]	0.185 [4.70]	0.075 [1.91]	0.150 [3.81]	0.020 [0.51]	0.010 [0.25]
C4	0.290 [7.37]	0.220 [5.59]	0.110 [2.79]	0.180 [4.57]	0.025 [0.64]	0.016 [0.41]
C5	0.310 [7.87]	0.230 [5.84]	0.130 [3.30]	0.200 [5.08]	0.025 [0.64]	0.016 [0.41]
C6	0.475 [12.07]	0.375 [9.53]	0.150 [3.81]	0.300 [7.62]	0.025 [0.64]	0.016 [0.41]

NON POLAR STYLE



CASE CODE	LA MAX	LR MAX	W MAX	T MAX	E MAX	E TOL ±	d
N1	0.220 [5.59]	0.180 [4.57]	0.125 [3.18]	0.125 [3.18]	0.100 [2.54]	0.020 [0.51]	0.010 [0.25]
N2	0.280 [7.11]	0.240 [6.10]	0.140 [3.56]	0.180 [4.57]	0.100 [2.54]	0.025 [0.64]	0.010 [0.25]
N3	0.370 [9.40]	0.315 [8.00]	0.180 [4.57]	0.220 [5.59]	0.150 [3.81]	0.025 [0.64]	0.016 [0.41]
N4	0.390 [9.91]	0.335 [8.51]	0.230 [5.84]	0.230 [5.84]	0.180 [4.57]	0.025 [0.64]	0.016 [0.41]

STANDARD RATINGS - POLAR CAPACITORS

CAPACITANCE (µF)	MAX DF (%)	MAX. DCL at + 25 °C (µA)	CASE CODE	PART NUMBER
2 WVDC at + 85 °C				
0.47	10	0.5	C0	TC.47-2C0*M
0.68	10	0.5	C0	TC.68-2C0*M
1.0	10	0.5	C0	TC1.0-2C0*M
2.2	10	0.5	C1	TC2.2-2C1*M
10	10	0.5	C2	TC10-2C2*M
33	10	1.0	C3	TC33-2C3*M
100	15	2.0	C4	TC100-2C4*M
150	15	3.0	C5	TC150-2C5*M
470	20	9.0	C6	TC470-2C6*M
3 WVDC at + 85 °C				
1.5	10	0.5	C1	TC1.5-3C1*M
6.8	10	0.5	C2	TC6.8-3C2*M
22	10	1.0	C3	TC22-3C3*M
68	10	2.0	C4	TC68-3C4*M
100	10	3.0	C5	TC100-3C5*M
330	20	9.0	C6	TC330-3C6*M
4 WVDC at + 85 °C				
0.33	10	0.5	C0	TC.33-4C0*M
1.0	8	0.5	C1	TC1.0-4C1*M
4.7	8	0.5	C2	TC4.7-4C2*M
15	8	1.0	C3	TC15-4C3*M
47	8	2.0	C4	TC47-4C4*M
68	8	3.0	C5	TC68-4C5*M
220	15	9.0	C6	TC220-4C6*M
6 WVDC at + 85 °C				
0.22	10	0.5	C0	TC.22-6C0*M
0.68	6	0.5	C1	TC.68-6C1*M
3.3	6	0.5	C2	TC3.3-6C2*M
10	6	1.0	C3	TC10-6C3*M
33	6	2.0	C4	TC33-6C4*M
47	6	3.0	C5	TC47-6C5*M
150	10	9.0	C6	TC150-6C6*M
10 WVDC at + 85 °C				
0.0010	10	0.5	C0	TC.0010-10C0*E
0.0010	10	0.5	C1	TC.0010-10C1*E
0.0015	10	0.5	C0	TC.0015-10C0*E
0.0015	10	0.5	C1	TC.0015-10C1*E
0.0022	10	0.5	C0	TC.0022-10C0*E
0.0022	10	0.5	C1	TC.0022-10C1*E
0.0033	10	0.5	C0	TC.0033-10C0*E
0.0033	10	0.5	C1	TC.0033-10C1*E
0.0047	10	0.5	C0	TC.0047-10C0*E
0.0047	10	0.5	C1	TC.0047-10C1E
0.15	10	0.5	C0	TC.15-10C0*M
0.47	6	0.5	C1	TC.47-10C1*M
2.2	6	0.5	C2	TC2.2-10C2*M
6.8	6	1.0	C3	TC6.8-10C3*M
22	6	2.0	C4	TC22-10C4*M
33	6	3.0	C5	TC33-10C5*M
100	8	9.0	C6	TC100-10C6*M

*Add A for axial, R for radial

STANDARD RATINGS - POLAR CAPACITORS				
CAPACITANCE (µF)	MAX DF (%)	MAX. DCL at + 25 °C (µA)	CASE CODE	PART NUMBER
15 WVDC at + 85 °C				
0.10	10	0.5	C0	TC.10-15C0*M
0.33	6	0.5	C1	TC.33-15C1*M
1.5	6	0.5	C2	TC1.5-15C2*M
15	6	2.0	C4	TC15-15C4*M
22	6	3.0	C5	TC22-15C5*M
68	8	9.0	C6	TC68-15C6*M
20 WVDC at + 85 °C				
0.033	10	0.5	C0	TC.033-20C0*E
0.033	6	0.5	C1	TC.033-20C1*E
0.047	10	0.5	C0	TC.047-20C0*E
0.047	6	0.5	C1	TC.047-20C1*E
0.068	10	0.5	C0	TC.068-20C0*E
0.068	6	0.5	C1	TC.068-20C1*E
0.10	6	0.5	C1	TC.10-20C1*M
0.15	6	0.5	C1	TC.15-20C1*M
0.22	6	0.5	C1	TC.22-20C1*M
1.0	6	0.5	C2	TC1.0-20C2*M
3.3	6	1.0	C3	TC3.3-20C3*M
4.7	6	1.0	C3	TC4.7-20C3*M
10	6	2.0	C4	TC10-20C4*M
15	6	3.0	C5	TC15-20C5*M
47	8	9.0	C6	TC47-20C6*M
25 WVDC at + 85 °C				
0.68	6	0.5	C2	TC.68-25C2*M
2.2	6	1.0	C3	TC2.2-25C3*M
6.8	6	2.0	C4	TC6.8-25C4*M
10	6	3.0	C5	TC10-25C5*M
33	6	9.0	C6	TC33-25C6*M
35 WVDC at + 85 °C				
0.22	6	0.5	C2	TC.22-35C2*M
0.33	6	0.5	C2	TC.33-35C2*M
0.47	6	0.5	C2	TC.47-35C2*M
0.68	6	1.0	C3	TC.68-35C3*M
1.0	6	1.0	C3	TC1.0-35C3*M
1.5	6	1.0	C3	TC1.5-35C3*M
2.2	6	2.0	C4	TC2.2-35C4*M
3.3	6	2.0	C4	TC3.3-35C4*M
4.7	6	2.0	C4	TC4.7-35C4*M
6.8	6	3.0	C5	TC6.8-35C5*M
10	6	9.0	C6	TC10-35C6*M
15	6	9.0	C6	TC15-35C6*M
22	6	9.0	C6	TC22.35C6*M
50 WVDC at + 85 °C				
0.15	6	0.5	C2	TC.15-50C2*M
4.7	6	3.0	C5	TC4.7-50C5*M
6.8	6	9.0	C6	TC6.8-50C6*M

*Add A for axial, R for radial

STANDARD RATINGS - NON-POLAR CAPACITORS

CAPACITANCE (µF)	MAX DF (%)	MAX. DCL at + 25 °C (µA)	CASE CODE	PART NUMBER
2 WVDC at + 85 °C				
4.7	10	0.5	N1	TC4.7-2N1*M
15	10	1.0	N2	TC15-2N2*M
47	15	2.0	N3	TC47-2N3*M
68	15	3.0	N4	TC68-2N4*M
3 WVDC at + 85 °C				
3.3	10	0.5	N1	TC3.3-3N1*M
10	10	1.0	N2	TC10-3N2*M
33	10	2.0	N3	TC33-3N3*M
47	10	3.0	N4	TC47-3N4*M
4 WVDC at + 85 °C				
2.2	8	0.5	N1	TC2.2-4N1*M
6.8	8	1.0	N2	TC6.8-4N2*M
22	8	2.0	N3	TC22-4N3*M
33	8	3.0	N4	TC33-4N4*M
6 WVDC at + 85 °C				
1.5	6	0.5	N1	TC1.5-6N1*M
4.7	6	1.0	N2	TC4.7-6N2*M
15	6	2.0	N3	TC15-6N3*M
22	6	3.0	N4	TC22-6N4*M
10 WVDC at + 85 °C				
1.0	6	0.5	N1	TC1.0-10N1*M
3.3	6	1.0	N2	TC3.3-10N2*M
10	6	2.0	N3	TC10-10N3*M
15	6	3.0	N4	TC15-10N4*M
15 WVDC at + 85 °C				
0.68	6	0.5	N1	TC.68-15N1*M
6.8	6	2.0	N3	TC6.8-15N3*M
10	6	3.0	N4	TC10-15N4*M
20 WVDC at + 85 °C				
0.47	6	0.5	N1	TC.47-20N1*M
1.5	6	1.0	N2	TC1.5-20N2*M
2.2	6	1.0	N2	TC2.2-20N2*M
4.7	6	2.0	N3	TC4.7-20N3*M
6.8	6	3.0	N4	TC6.8-20N4*M
25 WVDC at + 85 °C				
0.33	6	0.5	N1	TC.33-25N1*M
1.0	6	1.0	N2	TC1.0-25N2*M
3.3	6	2.0	N3	TC3.3-25N3*M
4.7	6	3.0	N4	TC4.7-25N4*M
35 WVDC at + 85 °C				
0.10	6	0.5	N1	TC.10-35N1*M
0.15	6	0.5	N1	TC.15-35N1*M
0.22	6	0.5	N1	TC.22-35N1*M
0.33	6	1.0	N2	TC.33-35N2*M
0.47	6	1.0	N2	TC.47-35N2*M
0.68	6	1.0	N2	TC.68-35N2*M
1.0	6	2.0	N3	TC1.0-35N3*M
50 WVDC at + 85 °C				
2.2	6	3.0	N4	TC2.2-50N4*M

*Add A for axial, R for radial

MARKING

TC Capacitors case sizes C3 - C6 and N2 - N4 are print marked:
- Capacitance is in picofarads
- 1st and 2nd digits are significant figures
- 3rd digit indicates the number of zeros.

Capacitance Tolerance	Color	Tolerance
Is indicated by a dot on the	Gold	± 5 %
side of the case.	Silver	± 10 %
Black dot is omitted.	None	± 20 %
	None	+ 40 %/- 20 %

The positive lead is indicated by a color dot of red epoxy on the unit.

All other case sizes are have color dot marking:

Capacitance	Color	Digit
In picofarads, indicated by 3 dots.	Black	0
1st and 2nd dot give	Brown	1
the significant digits.	Red	2
3rd dot indicates the number	Orange	3
of zeros.	Yellow	4
Color dot location is shown on	Green	5
the dimensional sketches.	Blue	6
Black dot is omitted on black sleeve.	Violet	7
	Grey	8
	White	9

e.g. Yellow-Violet-Green = 4 700 000 pF

= 4.7 µF

PERFORMANCE AND RELIABILITY

The capacitors are tested in accordance with MIL-PRF-49137, with specific requirements as follows:

Temperature Stability: When tested per MIL-PRF-49137/6, capacitance shall be within ±15 % at - 55 °C and 85 °C, and ± 10 % at 25 °C after exposure to temperature extremes. DF shall be within 200 % of initial limit at - 55 °C, 150 % of initial limit at 85°C, and meet the initial at 25 °C. DCL shall be within 10 x initial limit at 85 °C, and meet the initial limit at 25 °C.

Moisture Resistance: (per Method 106 of MIL-STD-202) After 10 cycles of 24 hours at 25 °C to 65 °C and 80 - 98 % RH; capacitance shall be within ± 15 % of initial value, DF within 1.5 x initial limit and leakage within 3 x initial limit.

Life: (per Method 108 of MIL-STD-202) after 1000 hours at 85 °C and rated voltage; capacitance shall be within ± 10 % of initial limit, DF within initial limits, and leakage within 200 % of initial limit.

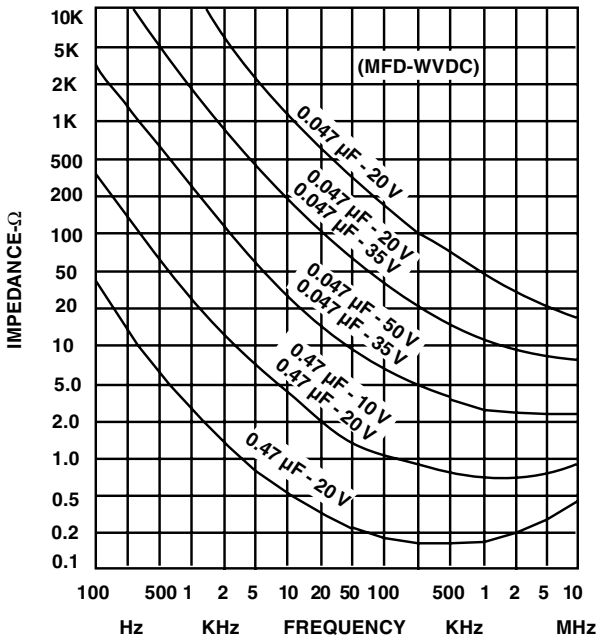
Surge Voltage: (per MIL-PRF-49317) After 1000 cycles at 85 °C and 1.3 x WVDC; capacitance shall be within ± 10 % of initial limit, DF and leakage within initial limits.

Resistance to Soldering Heat: (per Method 210 0f MILSTD- 202, Condition B) After immersion in 260 °C molten solder to within a 1/4" of the body of the unit, there shall be no evidence of mechanical or electrical degradation.

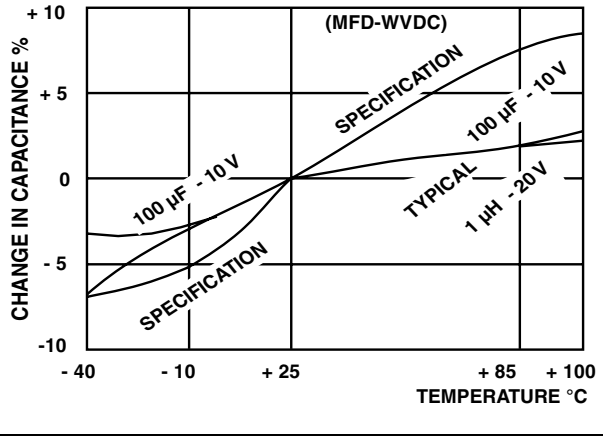
Solderability: (per Method 208 of MIL-STD-202) After dipping leads in 235 °C molten solder to within 0.125" of the body of the unit, the solder shall cover 95 % of the lead surface.

Terminal Strength: (per Method 211 of MIL-STD-202) After the following test there shall be no loosening of the terminals or permanent damage to the terminals. Test Condition A: (Pull Test) 0.010" leads withstand 1 pound, 0.016" leads 2 pounds and 0.007" leads 1/2 pound. Test Condition C: (Bend Test) All leads shall withstand 3 - 90° bends with a 1/2 pound applied force.

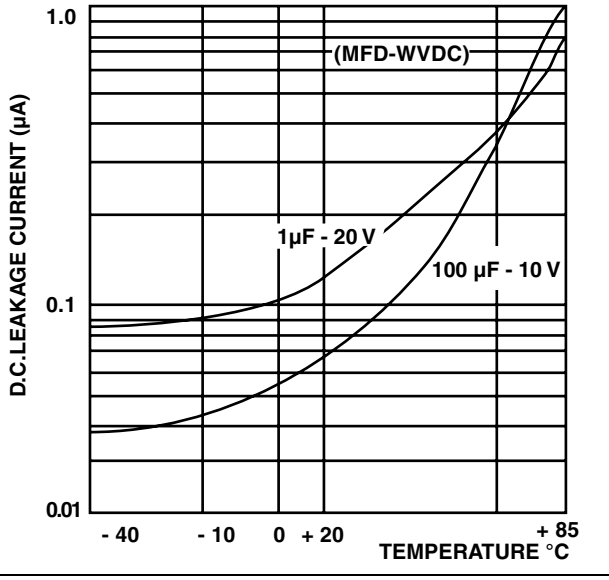
IMPEDANCE VS. FREQUENCY



CAPACITANCE VS. TEMPERATURE



LEAKAGE CURRENT - TEMPERATURE



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