Subminiature, Leaded Solid Tantalum Capacitors Polar or Non-Polar

FEATURES

- Subminiature package size and light weight
- Cylindrical case with axial or radial leads
- 2 V_{DC} to 50 V_{DC}
- 0.001 µF to 68 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

APPLICATIONS

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

ELECTRICAL CHARACTERISTICS

Operating Temperature Range: -55 °C to +125 °C

Capacitance: measured at 120 Hz and 25 °C with a maximum of 2.2 V_{DC} 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 the ratings tables.

DC Leakage Current (DCL Max.):
when measured with DC voltage applied through a 1000 Ω resistor for 5 min, 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.

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 nickle, gold plated nickle or ribbon leads).

Lead length is 1 1/2" [38.1 mm] minimum on non-polar 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

HA	1.0	35	C7	A [1]	M
MODEL	CAPACITANCE IN µF	DC VOLTAGE RATING AT +85 °C	CASE CODE	LEAD CONFIGURATION	CAPACITANCE TOLERANCE
			C = Polar N = Non-polar	A = Axial R = Radial	E = + 40 %, - 20 % M = ± 20 % K = ± 10 % J = ± 5 %

Example of Part Number Code: HA1.0-35C7AM

Note

(1) 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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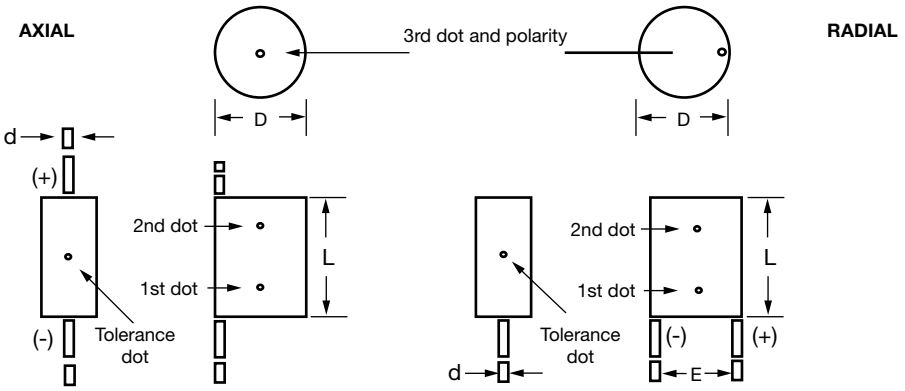
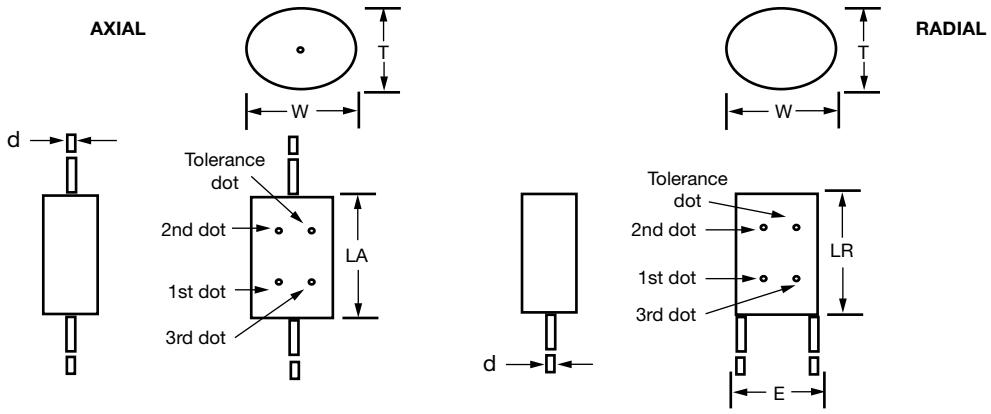
DIMENSIONS in inches [millimeters]

POLAR STYLE



CASE CODE	MAX. L	MAX. D	E	E TOL.	d
C0	0.100 [2.54]	0.057 [1.45]	0.030 [0.76]	± 0.015 [0.38]	0.007 [0.18]
C1	0.110 [2.80]	0.067 [1.70]	0.050 [1.27]	± 0.015 [0.38]	0.010 [0.25]
C2	0.125 [3.18]	0.067 [1.70]	0.050 [1.27]	± 0.015 [0.38]	0.010 [0.25]
C3	0.145 [3.68]	0.067 [1.70]	0.050 [1.27]	± 0.015 [0.38]	0.010 [0.25]
C4	0.160 [4.06]	0.070 [1.78]	0.050 [1.27]	± 0.015 [0.38]	0.010 [0.25]
C5	0.160 [4.06]	0.077 [1.96]	0.050 [1.27]	± 0.015 [0.38]	0.010 [0.25]
C6	0.190 [4.83]	0.077 [1.96]	0.050 [1.27]	± 0.015 [0.38]	0.010 [0.25]
C7	0.200 [5.08]	0.080 [2.03]	0.050 [1.27]	± 0.015 [0.38]	0.010 [0.25]
C8	0.225 [5.72]	0.100 [2.54]	0.070 [1.78]	± 0.020 [0.51]	0.010 [0.25]
C9	0.250 [6.35]	0.150 [3.81]	0.120 [3.05]	± 0.025 [0.64]	0.016 [0.41]

NON-POLAR STYLE



CASE CODE	MAX. LA	MAX. LR	MAX. W	MAX. T	E	E TOL.	d
N1	0.175 [4.45]	0.135 [3.43]	0.120 [3.05]	0.070 [1.78]	0.100 [2.54]	± 0.020 [0.51]	0.010 [0.25]
N2	0.210 [5.33]	0.160 [4.06]	0.120 [3.05]	0.070 [1.78]	0.100 [2.54]	± 0.020 [0.51]	0.010 [0.25]
N3	0.240 [6.10]	0.200 [5.08]	0.140 [3.56]	0.080 [2.03]	0.100 [2.54]	± 0.020 [0.51]	0.010 [0.25]
N4	0.275 [6.99]	0.235 [5.97]	0.190 [4.83]	0.105 [2.67]	0.125 [3.18]	± 0.020 [0.51]	0.010 [0.25]
N5	0.310 [7.87]	0.270 [6.86]	0.290 [7.37]	0.155 [3.94]	0.200 [5.08]	± 0.025 [0.64]	0.016 [0.41]

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STANDARD RATINGS - POLAR CAPACITORS

CAPACITANCE (µF)	MAX. DF (%)	MAX. DCL AT +25 °C (µA)	CASE CODE	PART NUMBER
		2 V_{DC} AT +85 °C		
0.47	10	0.5	C0	HA.47-2C0(1)M
1.5	10	0.5	C1	HA1.5-2C1(1)M
2.2	10	0.5	C2	HA2.2-2C2(1)M
3.3	10	0.5	C3	HA3.3-2C3(1)M
4.7	10	0.5	C4	HA4.7-2C4(1)M
6.8	10	0.5	C5	HA6.8-2C5(1)M
10	10	0.5	C6	HA10-2C6(1)M
15	10	0.5	C7	HA15-2C7(1)M
22	10	1.0	C8	HA22-2C8(1)M
68	10	1.5	C9	HA68-2C9(1)M
		3 V_{DC} AT +85 °C		
1.0	10	0.5	C1	HA1.0-3C1(1)M
1.5	10	0.5	C2	HA1.5-3C2(1)M
2.2	10	0.5	C3	HA2.2-3C3(1)M
3.3	10	0.5	C4	HA3.3-3C4(1)M
4.7	10	0.5	C5	HA4.7-3C5(1)M
6.8	10	0.5	C6	HA6.8-3C6(1)M
10	10	0.5	C7	HA10-3C7(1)M
15	10	1.0	C8	HA15-3C8(1)M
47	10	1.5	C9	HA47-3C9(1)M
		4 V_{DC} AT +85 °C		
0.33	10	0.5	C0	HA.33-4C0(1)M
0.68	8	0.5	C1	HA.68-4C1(1)M
1.0	8	0.5	C2	HA1.0-4C2(1)M
1.5	8	0.5	C3	HA1.5-4C3(1)M
2.2	8	0.5	C4	HA2.2-4C4(1)M
3.3	8	0.5	C5	HA3.3-4C5(1)M
4.7	8	0.5	C6	HA4.7-4C6(1)M
6.8	8	0.5	C7	HA6.8-4C7(1)M
10	8	1.0	C8	HA10-4C8(1)M
33	8	1.5	C9	HA33-4C9(1)M
		6 V_{DC} AT +85 °C		
0.22	10	0.5	C0	HA.22-6C0(1)M
0.47	6	0.5	C1	HA.47-6C1(1)M
0.68	6	0.5	C2	HA.68-6C2(1)M
1.0	6	0.5	C3	HA1.0-6C3(1)M
1.5	6	0.5	C4	HA1.5-6C4(1)M
2.2	6	0.5	C5	HA2.2-6C5(1)M
3.3	6	0.5	C6	HA3.3-6C6(1)M
4.7	6	0.5	C7	HA4.7-6C7(1)M
6.8	6	1.0	C8	HA6.8-6C8(1)M
22	6	1.5	C9	HA22-6C9(1)M
		10 V_{DC} AT +85 °C		
0.0010	10	0.5	C0	HA.0010-10C0(1)E
0.0010	10	0.5	C1	HA.0010-10C1(1)E
0.0015	10	0.5	C0	HA.0015-10C0(1)E
0.0015	10	0.5	C1	HA.0015-10C1(1)E
0.0022	10	0.5	C0	HA.0022-10C0(1)E
0.0022	10	0.5	C1	HA.0022-10C1(1)E
0.0033	10	0.5	C0	HA.0033-10C0(1)E
0.0033	10	0.5	C1	HA.0033-10C1(1)E
0.0047	10	0.5	C0	HA.0047-10C0(1)E
0.0047	10	0.5	C1	HA.0047-10C1(1)E
0.15	10	0.5	C0	HA.15-10C0(1)M
0.33	6	0.5	C1	HA.33-10C1(1)M

Note

- Part number definition:
  (1) Add A for axial, R for radial

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STANDARD RATINGS - POLAR CAPACITORS

CAPACITANCE (µF)	MAX. DF (%)	MAX. DCL AT +25 °C (µA)	CASE CODE	PART NUMBER
		10 V_{DC} AT +85 °C		
0.47	6	0.5	C2	HA.47-10C2(1)M
0.68	6	0.5	C3	HA.68-10C3(1)M
1.0	6	0.5	C4	HA1.0-10C4(1)M
1.5	6	0.5	C5	HA1.5-10C5(1)M
2.2	6	0.5	C6	HA2.2-10C6(1)M
3.3	6	0.5	C7	HA3.3-10C7(1)M
4.7	6	1.0	C8	HA4.7-10C8(1)M
15	6	1.5	C9	HA15-10C9(1)M
		15 V_{DC} AT +85 °C		
0.10	10	0.5	C0	HA.10-15C0(1)M
0.22	6	0.5	C1	HA.22-15C1(1)M
0.33	6	0.5	C2	HA.33-15C2(1)M
0.47	6	0.5	C3	HA.47-15C3(1)M
0.68	6	0.5	C4	HA.68-15C4(1)M
1.0	6	0.5	C5	HA1.0-15C5(1)M
1.5	6	0.5	C6	HA1.5-15C6(1)M
2.2	6	0.5	C7	HA2.2-15C7(1)M
3.3	6	1.0	C8	HA3.3-15C8(1)M
10	6	1.5	C9	HA10-15C9(1)M
		20 V_{DC} AT +85 °C		
0.033	10	0.5	C0	HA.033-20C0(1)E
0.047	10	0.5	C0	HA.047-20C0(1)E
0.068	10	0.5	C0	HA.068-20C0(1)E
0.15	6	0.5	C1	HA.15-20C1(1)M
0.22	6	0.5	C2	HA.22-20C2(1)M
0.33	6	0.5	C3	HA.33-20C3(1)M
0.47	6	0.5	C4	HA.47-20C4(1)M
0.68	6	0.5	C5	HA.68-20C5(1)M
1.0	6	0.5	C6	HA1.0-20C6(1)M
1.5	6	0.5	C7	HA1.5-20C7(1)M
2.2	6	1.0	C8	HA2.2-20C8(1)M
4.7	6	1.5	C9	HA4.7-20C9(1)M
6.8	6	1.5	C9	HA6.8-20C9(1)M
		35 V_{DC} AT +85 °C		
0.033	6	0.5	C1	HA.033-35C1(1)E
0.047	6	0.5	C1	HA.047-35C1(1)E
0.068	6	0.5	C1	HA.068-35C1(1)E
0.10	6	0.5	C1	HA.10-35C1(1)M
0.15	6	0.5	C2	HA.15-35C2(1)M
0.22	6	0.5	C3	HA.22-35C3(1)M
0.33	6	0.5	C4	HA.33-35C4(1)M
0.47	6	0.5	C5	HA.47-35C5(1)M
0.68	6	0.5	C6	HA.68-35C6(1)M
1.0	6	0.5	C7	HA1.0-35C7(1)M
1.5	6	0.5	C8	HA1.5-35C8(1)M
3.3	6	1.5	C9	HA3.3-35C9(1)M
		50 V_{DC} AT +85 °C		
0.10	6	0.5	C2	HA.10-50C2(1)M
0.15	6	0.5	C3	HA.15-50C3(1)M
0.22	6	0.5	C4	HA.22-50C4(1)M
0.33	6	0.5	C5	HA.33-50C5(1)M
0.47	6	0.5	C6	HA.47-50C6(1)M
0.68	6	0.5	C7	HA.68-50C7(1)M
1.0	6	1.0	C8	HA1.0-50C8(1)M
1.5	6	1.5	C9	HA1.5-50C9(1)M
2.2	6	1.5	C9	HA2.2-50C9(1)M

Note

- Part number definition:
  (1) Add A for axial, R for radial

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STANDARD RATINGS - NON-POLAR CAPACITORS				
CAPACITANCE (µF)	MAX. DF (%)	MAX. DCL AT +25 °C (µA)	CASE CODE	PART NUMBER
2 V_{DC} AT +85 °C				
1.0	10	0.5	N1	HA1.0-2N1(1)M
2.2	10	0.5	N2	HA2.2-2N2(1)M
4.7	10	0.5	N3	HA4.7-2N3(1)M
10	10	1.0	N4	HA10-2N4(1)M
33	10	1.5	N5	HA33-2N5(1)M
3 V_{DC} AT +85 °C				
0.68	10	0.5	N1	HA.68-3N1(1)M
1.5	10	0.5	N2	HA1.5-3N2(1)M
3.3	10	0.5	N3	HA3.3-3N3(1)M
6.8	10	1.0	N4	HA6.8-3N4(1)M
22	10	1.5	N5	HA22-3N5(1)M
4 V_{DC} AT +85 °C				
0.47	8	0.5	N1	HA.47-4N1(1)M
1.0	8	0.5	N2	HA1.0-4N2(1)M
2.2	8	0.5	N3	HA2.2-4N3(1)M
4.7	8	1.0	N4	HA4.7-4N4(1)M
15	8	1.5	N5	HA15-4N5(1)M
6 V_{DC} AT +85 °C				
0.33	6	0.5	N1	HA.33-6N1(1)M
0.68	6	0.5	N2	HA.68-6N2(1)M
1.5	6	0.5	N3	HA1.5-6N3(1)M
3.3	6	1.0	N4	HA3.3-6N4(1)M
10	6	1.5	N5	HA10-6N5(1)M
10 V_{DC} AT +85 °C				
0.22	6	0.5	N1	HA.22-10N1(1)M
0.47	6	0.5	N2	HA.47-10N2(1)M
1.0	6	0.5	N3	HA1.0-10N3(1)M
2.2	6	1.0	N4	HA2.2-10N4(1)M
6.8	6	1.5	N5	HA6.8-10N5(1)M
15 V_{DC} AT +85 °C				
0.15	6	0.5	N1	HA.15-15N1(1)M
0.33	6	0.5	N2	HA.33-15N2(1)M
0.68	6	0.5	N3	HA.68-15N3(1)M
1.5	6	1.0	N4	HA1.5-15N4(1)M
4.7	6	1.5	N5	HA4.7-15N5(1)M
20 V_{DC} AT +85 °C				
0.022	6	0.5	N1	HA.022-20N1(1)M
0.033	6	0.5	N2	HA.033-20N2(1)M
0.047	6	0.5	N2	HA.047-20N2(1)M
0.068	6	0.5	N2	HA.068-20N2(1)M
0.10	6	0.5	N1	HA.10-20N1(1)M
0.22	6	0.5	N2	HA.22-20N2(1)M
0.47	6	0.5	N3	HA.47-20N3(1)M
1.0	6	1.0	N4	HA1.0-20N4(1)M
2.2	6	1.5	N5	HA2.2-20N5(1)M
3.3	6	1.5	N5	HA3.3-20N5(1)M

Note

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STANDARD RATINGS - NON-POLAR CAPACITORS

CAPACITANCE (µF)	MAX. DF (%)	MAX. DCL AT +25 °C (µA)	CASE CODE	PART NUMBER
		35 V_{DC} AT +85 °C		
0.10	6	0.5	N2	HA.10-35N2(1)M
0.15	6	0.5	N2	HA.15-35N2(1)M
0.22	6	0.5	N3	HA.22-35N3(1)M
0.33	6	0.5	N3	HA.33-35N3(1)M
0.47	6	1.0	N4	HA.47-35N4(1)M
0.68	6	1.0	N4	HA.68-35N4(1)M
1.0	6	1.5	N5	HA1.0-35N5(1)M
1.5	6	1.5	N5	HA1.5-35N5(1)M
		50 V_{DC} AT +85 °C		
0.068	6	0.5	N3	HA.068-50N3(1)M
0.15	6	0.5	N3	HA.15-50N3(1)M
0.33	6	1.0	N4	HA.33-50N4(1)M
0.68	6	1.5	N5	HA.68-50N5(1)M

Note

- Part number definition:
  (1) Add A for axial, R for radial

MARKING

HA capacitors case sizes N4 and N5 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 side of the case. Black dot is omitted.	Gold	± 5 %
	Silver	± 10 %
	None	± 20 %
	None	+ 40 % / - 20 %

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

All other case sizes have color dot marking:

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

e.g. Yellow-Violet-Green = 4 700 000 pF
= 4.7 µF

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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 h at 25 °C to 65 °C and 80 % to 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 h 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.

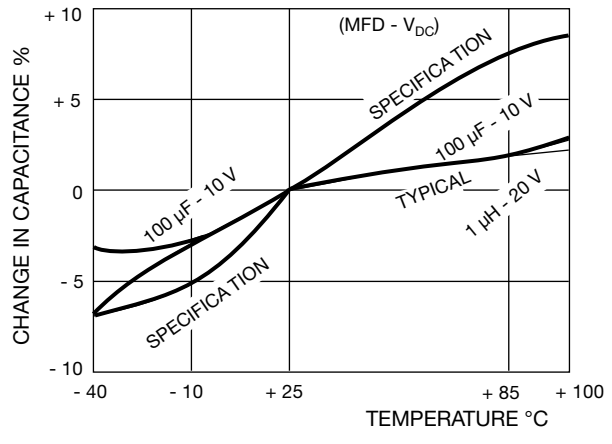
Surge Voltage: (per MIL-PRF-49317) after 1000 cycles at 85 °C and 1.3 x V_{DC}; capacitance shall be within ± 10 % of initial limit, DF and leakage within initial limits.

Resistance to Soldering Heat: (per method 210 0f MIL-STD-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.

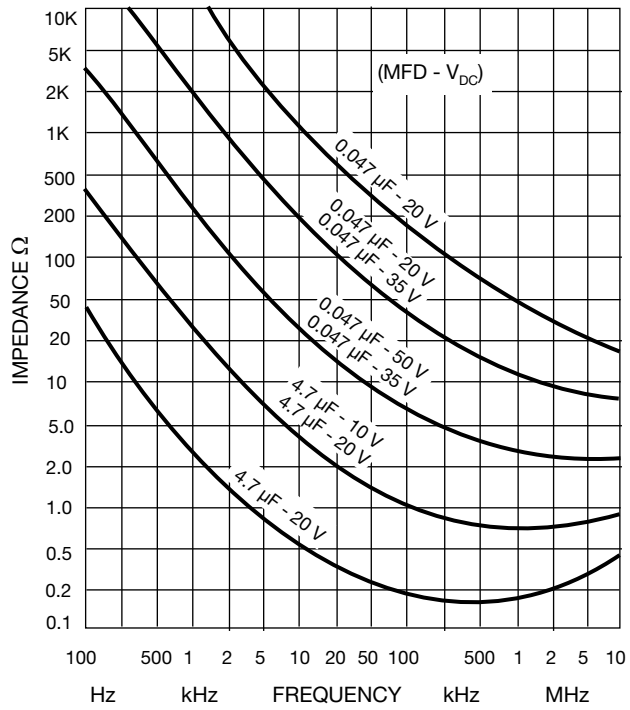
Solderability: (per method 208 of MIL-STD-202) after dipping leads in 235 °C molten solder to within 0.125" of the body of the unit, the solder shall cover 95 % of the lead surface.

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° to 90° bends with a 1/2 pound applied force.

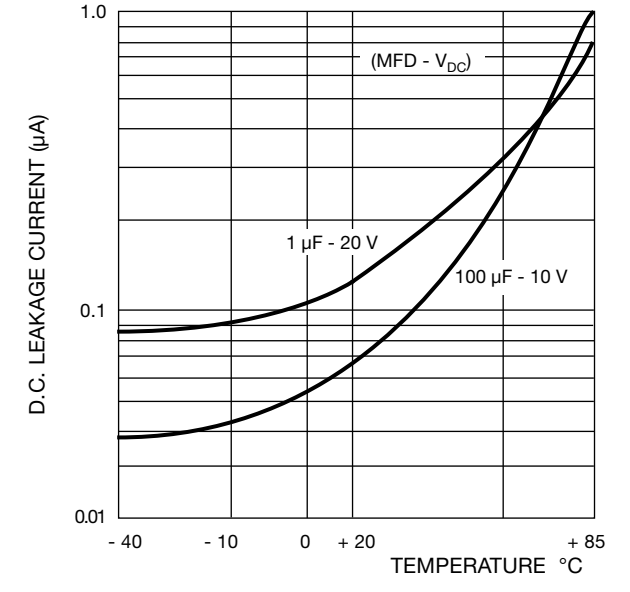
CAPACITANCE VS. TEMPERATURE



IMPEDANCE VS. FREQUENCY



LEAKAGE CURRENT VS. TEMPERATURE



For technical questions, contact: tantalum@vishay.com
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