

# Wet Tantalum Capacitors Sintered Anode TANTALEX<sup>®</sup> Capacitors Hermetically-Sealed with True Glass-to-Tantalum Seal


**FEATURES**

- Terminations: standard tin/lead (SnPb), 100 % tin (RoHS compliant) available
- Improved reliability through the use of a glass-to-tantalum true hermetic anode seal is the prime feature of the Type 138D sintered anode TANTALEX<sup>®</sup> capacitor. This construction offers outstanding resistance to thermal shock.
- Model 138D is the commercial equivalents of Tansitor styles WT, UWT, Mallory-NACC styles TLX, TXX and Military styles CL66, CL67, CLR65, and CLR69, designed to meet the performance requirements of Military Specification MIL-PRF-39006/09/21. Capacitors in accordance with military specifications should be ordered by their military part numbers.
- Compliant to RoHS Directive 2002/95/EC


**RoHS\***  
COMPLIANT

**PERFORMANCE CHARACTERISTICS**

**Operating Temperature:** - 55 °C to + 85 °C and with voltage derating to two-thirds the + 85 °C rating at + 125 °C. Use of Type 138D capacitors for high temperature applications is recommended.

**Capacitance Tolerance:** At 120 Hz, + 25 °C. ± 20 % standard. ± 10 %, ± 5 % available as special.

**DC Leakage Current (DCL Max.):** At + 25 °C, + 85 °C and + 125 °C: Leakage current shall not exceed the values listed in the Standard Ratings tables.

**Life Test:** Capacitors are capable of withstanding a 2000 h life test at a temperature of + 85 °C or + 125 °C at the applicable rated DC working voltage.

Following the life test:

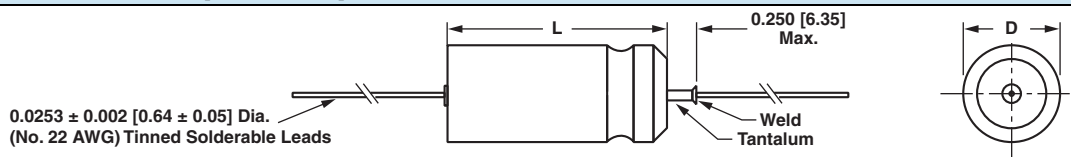
1. DCL shall not exceed 125 % of the original requirement.
2. The ESR shall not exceed 200 % of the initial requirement.
3. Change in capacitance value shall not exceed the percentages below.
  - a) 6 WV<sub>DC</sub> Units: + 10 % to - 25 % of initial measurement.
  - b) 8 WV<sub>DC</sub> and 10 WV<sub>DC</sub> Units: + 10 % to - 20 % of initial measurement.
  - c) 15 WV<sub>DC</sub> Units: + 10 % to - 15 % of initial measurement.
  - d) 20 WV<sub>DC</sub> and above: ± 10 % of initial measurement.

**ORDERING INFORMATION**

138D	306	X0	006	C	2	E3
MODEL	CAPACITANCE	CAPACITANCE TOLERANCE	DC VOLTAGE RATING AT + 85 °C	CASE CODE	TERMINATION	RoHS COMPLIANT
	This is expressed in picofarads. The first two digits are the significant figures. The third is the number of zeros to follow	X0 = ± 20 % X9 = ± 10 % X5 = ± 5 % Special Order	This is expressed in volts. To complete the three-digit block, zeros precede the voltage rating. A decimal point is indicated by an "R" (6R3 = 6.3 V)	See Ratings and Case Codes table	0 = No outer sleeve 2 = Outer plastic film insulation	E3 = 100 % tin termination (RoHS compliant) Blank = SnPb termination (standard design)

**Note**

**Packaging:** The use of formed plastic trays for packaging these axial lead components is standard. Tape and reel is not recommended due to the unit weight.

**DIMENSIONS** in inches [millimeters]


CASE CODE	BARE TUBE		WITH OUTER PLASTIC - FILM INSULATION		LEAD LENGTH	MAX. WEIGHT (oz./g)
	D	L	D (Max.)	L (Max.)		
C	0.188 ± 0.016 [4.78 ± 0.41]	0.453 + 0.031 - 0.016 [11.51 + 0.79 - 0.41]	0.219 [5.56]	0.608 [15.45]	1.500 ± 0.250 [38.10 ± 6.35]	0.07 [2.0]
F	0.281 ± 0.016 [7.14 ± 0.41]	0.641 + 0.031 - 0.016 [16.28 + 0.79 - 0.41]	0.312 [7.92]	0.796 [20.22]	2.250 ± 0.250 [57.15 ± 6.35]	0.18 [5.1]
T	0.375 ± 0.016 [9.53 ± 0.41]	0.766 + 0.031 - 0.016 [19.46 + 0.79 - 0.41]	0.406 [10.31]	0.921 [23.40]	2.250 ± 0.250 [57.15 ± 6.35]	0.36 [10.2]
K	0.375 ± 0.016 [9.53 ± 0.41]	1.062 + 0.031 - 0.023 [26.97 + 0.79 - 0.58]	0.406 [10.31]	1.127 [30.91]	2.250 ± 0.250 [57.15 ± 6.35]	0.49 [13.9]

\* Pb containing terminations are not RoHS compliant, exemptions may apply

STANDARD RATINGS												
CAPACITANCE ( $\mu$ F)	CASE CODE	PART NUMBER (1)	MAX. ESR		MAX. IMP.		MAX. DCL ( $\mu$ A)		MAX. CAPACITANCE CHANGE (%)			MAX. RMS RIPPLE CURRENT 120 Hz (mA)
			at + 25 °C 120 Hz ( $\Omega$ )	at - 55 °C 120 Hz ( $\Omega$ )	at + 25 °C	at + 85 °C + 125 °C	at - 55 °C	at + 85 °C	at + 125 °C			
<b>6 WV<sub>DC</sub> at + 85 °C . . . 4 WV<sub>DC</sub> at + 125 °C</b>												
30	C	138D306X0006C2	4	100	1	2	- 40	+ 10.5	+ 12	140		
68	C	138D686X0006C2	4	60	1	2	- 40	+ 14	+ 16	160		
140	F	138D147X0006F2	2	40	1	3	- 40	+ 14	+ 16	330		
270	F	138D277X0006F2	4	25	1	6.5	- 44	+ 17.5	+ 20	330		
330	T	138D337X0006T2	2	20	2	7.9	- 44	+ 14	+ 16	410		
560	T	138D567X0006T2	3	25	2	13	- 64	+ 17.5	+ 20	410		
1200	K	138D128X0006K2	1.6	20	3	14	- 80	+ 25	+ 25	530		
<b>8 WV<sub>DC</sub> at + 85 °C . . . 5 WV<sub>DC</sub> at + 125 °C</b>												
25	C	138D256X0008C2	4	100	1	2	- 40	+ 10.5	+ 12	140		
56	C	138D566X0008C2	4	59	1	2	- 40	+ 14	+ 16	160		
220	F	138D227X0008F2	4	30	1	7	- 44	+ 17.5	+ 20	270		
430	T	138D437X0008T2	3	25	2	14	- 64	+ 17.5	+ 20	410		
850	K	138D857X0008K2	1	22	4	16	- 80	+ 25	+ 25	670		
<b>10 WV<sub>DC</sub> at + 85 °C . . . 7 WV<sub>DC</sub> at + 125 °C</b>												
20	C	138D206X0010C2	4	175	1	2	- 32	+ 10.5	+ 12	140		
47	C	138D476X0010C2	5	100	1	2	- 36	+ 14	+ 16	160		
100	F	138D107X0010F2	2	60	1	4	- 36	+ 14	+ 16	270		
180	F	138D187X0010F2	4	40	1	7	- 36	+ 14	+ 16	270		
250	T	138D257X0010T2	2	30	2	10	- 40	+ 14	+ 16	410		
390	T	138D397X0010T2	3	25	2	16	- 64	+ 17.5	+ 20	410		
750	K	138D757X0010K2	1	23	4	16	- 80	+ 25	+ 25	670		
<b>15 WV<sub>DC</sub> at + 85 °C . . . 10 WV<sub>DC</sub> at + 125 °C</b>												
15	C	138D156X0015C2	5	155	1	2	- 24	+ 10.5	+ 12	130		
33	C	138D336X0015C2	5	90	1	2	- 28	+ 14	+ 16	160		
70	F	138D706X0015F2	4	75	1	4	- 28	+ 14	+ 16	270		
120	F	138D127X0015F2	4	50	1	7	- 28	+ 17.5	+ 20	270		
170	T	138D177X0015T2	2	35	2	10	- 32	+ 14	+ 16	410		
270	T	138D277X0015T2	3	30	2	16	- 56	+ 17.5	+ 20	410		
540	K	138D547X0015K2	1.0	23	6	24	- 80	+ 25	+ 25	610		
<b>20 WV<sub>DC</sub> at + 85 °C . . . 13 WV<sub>DC</sub> at + 125 °C</b>												
27	C	138D276X0020C2	5	100	1	2	- 20	+ 11	+ 14	160		
220	T	138D227X0020T2	4	30	2	16	- 48	+ 13	+ 15	410		
<b>25 WV<sub>DC</sub> at + 85 °C . . . 15 WV<sub>DC</sub> at + 125 °C</b>												
10	C	138D106X0025C2	6	220	1	2	- 16	+ 8	+ 9	130		
22	C	138D226X0025C2	5	140	1	2	- 20	+ 10.5	+ 12	160		
27	C	138D276X0025C2	4.3	110	2	9	- 35	+ 12	+ 15	160		
50	F	138D506X0025F2	4	70	1	5	- 28	+ 13	+ 15	270		
100	F	138D107X0025F2	4	50	1	10	- 28	+ 13	+ 15	270		
180	T	138D187X0025T2	4	32	2	18	- 48	+ 13	+ 15	340		
350	K	138D357X0025K2	1.3	24	7	28	- 70	+ 25	+ 25	580		
<b>30 WV<sub>DC</sub> at + 85 °C . . . 20 WV<sub>DC</sub> at + 125 °C</b>												
8.0	C	138D805X0030C2	7.5	275	1	2	- 16	+ 8	+ 12	130		
15	C	138D156X0030C2	8	175	1	2	- 20	+ 10.5	+ 12	160		
40	F	138D406X0030F2	4	65	1	5	- 24	+ 10.5	+ 12	270		
100	T	138D107X0030T2	6	40	2	12	- 28	+ 10.5	+ 12	410		
150	T	138D157X0030T2	2.5	35	2	16	- 48	+ 13	+ 15	340		
300	K	138D307X0030K2	1.6	25	8	32	- 60	+ 25	+ 25	550		

**Note**

(1) Part Numbers listed are for units with outer plastic-film insulation and a capacitance tolerance of  $\pm 20\%$ . For bare case units, substitute "0" for "2" at the end of the Part Number. For capacitors with  $\pm 10\%$  tolerance, change the digit following the letter "X" to "9". For RoHS compliant add "E3".



Wet Tantalum Capacitors Sintered Anode TANTALEX® Capacitors  
Hermetically-Sealed with True Glass-to-Tantalum Seal

STANDARD RATINGS											
CAPACITANCE (µF)	CASE CODE	PART NUMBER <sup>(1)</sup>	MAX. ESR	MAX. IMP.	MAX. DCL (µA)		MAX. CAPACITANCE CHANGE (%)			MAX. RMS RIPPLE CURRENT 120 Hz (mA)	
			at + 25 °C 120 Hz (Ω)	at - 55 °C 120 Hz (Ω)	at + 25 °C	at + 85 °C + 125 °C	- 55 °C	+ 85 °C	+ 125 °C		
35 WV <sub>DC</sub> at + 85 °C . . . 22 WV <sub>DC</sub> at + 125 °C											
68	F	138D686X0035F2	6	60	1	8	- 24	+ 12	+ 15	270	
120	T	138D127X0035T2	4	38	2	16	- 30	+ 13	+ 15	410	
270	K	138D277X0035K2	2.2	23	8	32	- 45	+ 20	+ 25	500	
50 WV <sub>DC</sub> C at + 85 °C . . . 30 WV <sub>DC</sub> at + 125 °C											
5.0	C	138D505X0050C2	9	400	1	2	- 16	+ 5	+ 6	130	
10	C	138D106X0050C2	8	250	1	2	- 24	+ 8	+ 9	160	
25	F	138D256X0050F2	6	95	1	5	- 20	+ 10.5	+ 12	270	
47	F	138D476X0050F2	6	70	1	9	- 28	+ 10.5	+ 15	270	
60	T	138D606X0050T2	3	45	2	12	- 16	+ 10.5	+ 12	410	
82	T	138D826X0050T2	4	45	2	16	- 32	+ 13	+ 15	410	
160	K	138D167X0050K2	2.2	27	8	32	- 50	+ 25	+ 25	460	
60 WV <sub>DC</sub> at + 85 °C . . . 40 WV <sub>DC</sub> at + 125 °C											
4.0	C	138D405X0060C2	10	550	1	2	- 16	+ 5	+ 6	110	
8.2	C	138D825X0060C2	8	275	1	2	- 24	+ 8	+ 9	140	
20	F	138D206X0060F2	5	105	1	5	- 16	+ 10.5	+ 12	270	
39	F	138D396X0060F2	7	90	1	9	- 28	+ 10.5	+ 12	330	
50	T	138D506X0060T2	4	50	2	12	- 16	+ 10.5	+ 12	410	
68	T	138D686X0060T2	6	50	2	16	- 32	+ 10.5	+ 12	410	
140	K	138D147X0060K2	2.4	28	8	32	- 40	+ 20	+ 20	430	
75 WV <sub>DC</sub> at + 85 °C . . . 50 WV <sub>DC</sub> at + 125 °C											
3.5	C	138D355X0075C2	10	650	1	2	- 16	+ 5	+ 6	110	
6.8	C	138D685X0075C2	8	300	1	2	- 20	+ 8	+ 9	140	
15	F	138D156X0075F2	6.5	150	1	5	- 16	+ 8	+ 9	270	
33	F	138D336X0075F2	7	90	1	10	- 24	+ 10.5	+ 15	270	
40	T	138D406X0075T2	5	60	2	12	- 16	+ 10.5	+ 12	410	
56	T	138D566X0075T2	6	60	2	17	- 28	+ 10.5	+ 15	410	
110	K	138D117X0075K2	3.1	29	9	36	- 35	+ 20	+ 20	110	
100 WV <sub>DC</sub> at + 85 °C . . . 65 WV <sub>DC</sub> at + 125 °C											
2.5	C	138D255X0100C2	26.5	950	1	2	- 16	+ 7	+ 8	100	
4.7	C	138D475X0100C2	10	500	1	2	- 16	+ 7	+ 8	130	
11	F	138D116X0100F2	6	200	1	4	- 16	+ 7	+ 8	230	
22	F	138D226X0100F2	7	100	1	9	- 16	+ 7	+ 8	230	
30	T	138D306X0100T2	4	80	2	12	- 16	+ 7	+ 8	340	
43	T	138D436X0100T2	6	70	2	17	- 20	+ 7	+ 8	340	
86	K	138D866X0100K2	3.1	30	9	36	- 25	+ 15	+ 15	400	
125 WV <sub>DC</sub> at + 85 °C . . . 85 WV <sub>DC</sub> at + 125 °C											
1.7	C	138D175X0125C2	54.6	1250	1	2	- 16	+ 7	+ 8	100	
3.6	C	138D365X0125C2	15	600	1	2	- 16	+ 7	+ 8	110	
9.0	F	138D905X0125F2	15	240	1	5	- 16	+ 7	+ 8	210	
14	F	138D146X0125F2	12	167	1	7	- 16	+ 7	+ 8	210	
18	T	138D186X0125T2	11	129	2	9	- 16	+ 7	+ 8	340	
25	T	138D256X0125T2	10	93	2	13	- 16	+ 7	+ 8	340	
56	K	138D566X0125K2	4.1	32	10	40	- 25	+ 15	+ 15	400	

Note

<sup>(1)</sup> Part Numbers listed are for units with outer plastic-film insulation and a capacitance tolerance of ± 20 %. For bare case units, substitute "0" for "2" at the end of the Part Number. For capacitors with ± 10 % tolerance, change the digit following the letter "X" to "9". For RoHS compliant add "E3".

EXTENDED RATINGS										
CAPACITANCE ( $\mu$ F)	CASE CODE	PART NUMBER <sup>(1)</sup>	MAX. ESR	MAX. IMP.	MAX. DCL ( $\mu$ A)		MAX. CAPACITANCE CHANGE			MAX. RMS RIPPLE CURRENT 120 Hz (mA)
			at + 25 °C 120 Hz ( $\Omega$ )	at - 55 °C 120 Hz ( $\Omega$ )	at		( $\%$ ) at			
					+ 25 °C	+ 85 °C	- 55 °C	+ 85 °C	+ 125 °C	
			6 WV <sub>DC</sub> at + 85 °C . . . 4 WV <sub>DC</sub> at + 125 °C							
560	F	138D567X0006F2	2.5	20	3	14	- 80	+ 16	+ 20	300
820	F	138D827X0006F2	2.5	18	3	14	- 88	+ 16	+ 20	300
1500	T	138D158X0006T2	1.5	18	5	20	- 90	+ 20	+ 25	480
2200	K	138D228X0006K2	1	13	6	24	- 90	+ 25	+ 30	670
			8 WV <sub>DC</sub> at + 85 °C . . . 5 WV <sub>DC</sub> at + 125 °C							
180	C	138D187X0008C2	3	45	2	9	- 60	+ 13	+ 16	180
470	F	138D477X0008F2	2.5	25	3	14	- 75	+ 16	+ 20	300
680	F	138D687X0008F2	2.5	22	3	14	- 83	+ 16	+ 20	300
1800	K	138D188X0008K2	1	14	7	25	- 90	+ 20	+ 30	670
			10 WV <sub>DC</sub> at + 85 °C . . . 7 WV <sub>DC</sub> at + 125 °C							
100	C	138D107X0010C2	3	60	2	9	- 50	+ 13	+ 16	160
150	C	138D157X0010C2	3	54	2	9	- 55	+ 13	+ 16	180
390	F	138D397X0010F2	2.5	30	3	16	- 70	+ 16	+ 20	300
560	F	138D567X0010F2	2.5	27	3	16	- 77	+ 16	+ 20	300
1200	T	138D128X0010T2	1.5	18	5	20	- 88	+ 20	+ 25	480
1500	K	138D158X0010K2	1	15	7	25	- 88	+ 25	+ 30	670
			15 WV <sub>DC</sub> at + 85 °C . . . 10 WV <sub>DC</sub> at + 125 °C							
68	C	138D686X0015C2	4	80	2	9	- 40	+ 13	+ 16	140
100	C	138D107X0015C2	4	72	2	9	- 44	+ 13	+ 16	160
270	F	138D277X0015F2	2.5	35	3	16	- 60	+ 16	+ 20	300
390	F	138D397X0015F2	2.5	31	3	16	- 16	+ 16	+ 20	300
540	T	138D547X0015T2	1.8	25	6	24	- 70	+ 20	+ 25	440
820	T	138D827X0015T2	1.8	22	6	24	- 77	+ 20	+ 25	440
1000	K	138D108X0015K2	1.2	17	8	32	- 77	+ 25	+ 30	610
			20 WV <sub>DC</sub> at + 85 °C . . . 13 WV <sub>DC</sub> at + 125 °C							
56	C	138D566X0020C2	4.3	90	2	9	- 38	+ 13	+ 16	140
82	C	138D826X0020C2	4.3	81	2	9	- 43	+ 13	+ 16	160
220	F	138D227X0020F2	2.7	35	3	16	- 60	+ 16	+ 20	300
330	F	138D337X0020F2	2.7	31	3	16	- 66	+ 16	+ 20	300
			25 WV <sub>DC</sub> at + 85 °C . . . 15 WV <sub>DC</sub> at + 125 °C							
47	C	138D476X0025C2	4.3	100	2	9	- 35	+ 12	+ 15	140
68	C	138D686X0025C2	4.3	90	2	9	- 40	+ 12	+ 15	160
180	F	138D187X0025F2	2.7	37	3	16	- 55	+ 13	+ 16	300
270	F	138D277X0025F2	2.7	33	3	16	- 62	+ 13	+ 16	300
350	T	138D357X0025T2	1.8	27	7	28	- 60	+ 20	+ 25	440
			30 WV <sub>DC</sub> at + 85 °C . . . 20 WV <sub>DC</sub> at + 125 °C							
39	C	138D396X0030C2	5.2	110	2	9	- 32	+ 12	+ 15	140
56	C	138D566X0030C2	5.2	100	2	9	- 38	+ 12	+ 15	140
150	F	138D157X0030F2	2.5	40	3	16	- 50	+ 13	+ 16	300
220	F	138D227X0030F2	2.5	36	3	16	- 60	+ 13	+ 16	300
330	T	138D337X0030T2	1.8	28	8	32	- 50	+ 20	+ 25	440
470	T	138D477X0030T2	1.8	25	8	32	- 65	+ 20	+ 25	440
560	K	138D567X0030K2	1.3	20	9	36	- 65	+ 25	+ 30	590

**Note**

<sup>(1)</sup> Part Numbers listed are for units with outer plastic-film insulation and a capacitance tolerance of  $\pm 20\%$ . For bare case units, substitute "0" for "2" at the end of the Part Number. For capacitors with  $\pm 10\%$  tolerance, change the digit following the letter "X" to "9". For RoHS compliant add "E3".



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Hermetically-Sealed with True Glass-to-Tantalum Seal

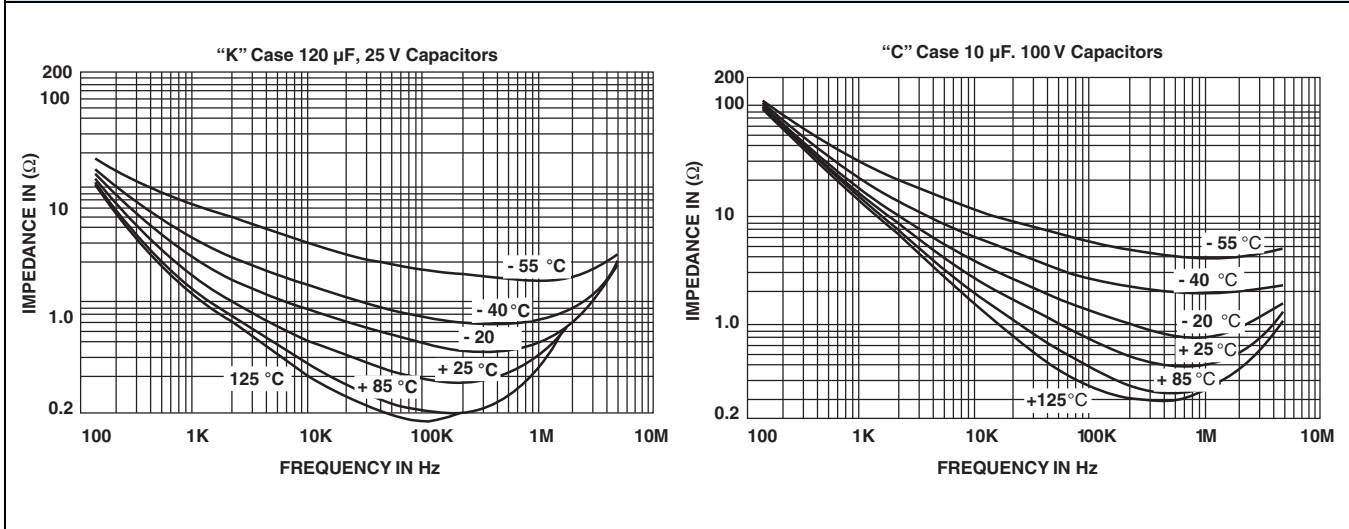
EXTENDED RATINGS										
CAPACITANCE (μF)	CASE CODE	PART NUMBER (1)	MAX. ESR	MAX. IMP.	MAX. DCL (μA)		MAX. CAPACITANCE CHANGE (%)			MAX. RMS RIPPLE CURRENT 120 Hz (mA)
			at + 25 °C 120 Hz (Ω)	at - 55 °C 120 Hz (Ω)	at		at			
					+ 25 °C	+ 85 °C	- 55 °C	+ 85 °C	+ 125 °C	
<b>35 WV<sub>DC</sub> at + 85 °C . . . 22 WV<sub>DC</sub> at + 125 °C</b>										
33	C	138D336X0035C2	5.2	130	2	9	- 30	+ 10	+ 12	140
47	C	138D476X0035C2	5.2	115	2	9	- 35	+ 10	+ 12	140
120	F	138D127X0035F2	2.5	45	3	16	- 45	+ 13	+ 16	300
220	T	138D227X0035T2	1.8	30	8	32	- 45	+ 20	+ 25	440
390	T	138D397X0035T2	1.8	27	8	32	- 58	+ 20	+ 25	440
470	K	138D477X0035K2	1.3	21	9	36	- 58	+ 25	+ 30	590
<b>50 WV<sub>DC</sub> at + 85 °C . . . 30 WV<sub>DC</sub> at + 125 °C</b>										
22	C	138D226X0050C2	5	150	2	9	- 24	+ 10	+ 12	140
33	C	138D336X0050C2	5	135	2	9	- 29	+ 10	+ 12	140
82	F	138D826X0050F2	2.5	55	4	24	- 35	+ 10	+ 15	300
120	F	138D127X0050F2	2.5	49	4	24	- 42	+ 12	+ 15	300
160	T	138D167X0050T2	1.8	32	6	32	- 35	+ 20	+ 25	420
270	T	138D277X0050T2	1.8	29	8	32	- 46	+ 20	+ 25	440
330	K	138D337X0050K2	1.5	22	9	36	- 46	+ 25	+ 30	550
<b>60 WV<sub>DC</sub> at + 85 °C . . . 40 WV<sub>DC</sub> at + 125 °C</b>										
18	C	138D186X0060C2	5	160	3	12	- 20	+ 10	+ 12	140
27	C	138D276X0060C2	5	144	3	12	- 24	+ 10	+ 12	140
68	F	138D686X0060F2	3	60	4	20	- 30	+ 12	+ 15	270
100	F	138D107X0060F2	2.5	54	4	20	- 36	+ 12	+ 15	300
140	T	138D147X0060T2	2	32	8	32	- 30	+ 16	+ 20	420
220	T	138D227X0060T2	1.8	29	8	32	- 40	+ 16	+ 20	440
270	K	138D277X0060K2	1.5	23	9	36	- 45	+ 20	+ 25	550
<b>75 WV<sub>DC</sub> at + 85 °C . . . 50 WV<sub>DC</sub> at + 125 °C</b>										
15	C	138D156X0075C2	5	175	3	12	- 16	+ 10	+ 12	140
22	C	138D226X0075C2	5	157	3	12	- 19	+ 10	+ 12	140
56	F	138D566X0075F2	3	70	4	24	- 25	+ 12	+ 15	270
82	F	138D826X0075F2	2.5	63	4	24	- 30	+ 12	+ 15	300
110	T	138D117X0075T2	2	33	9	36	- 25	+ 16	+ 20	420
180	T	138D187X0075T2	1.8	30	9	36	- 35	+ 16	+ 20	440
220	K	138D227X0075K2	2.2	24	10	40	- 40	+ 20	+ 25	450
<b>100 WV<sub>DC</sub> at + 85 °C . . . 65 v at + 125 °C</b>										
8.2	C	138D825X0100C2	6	250	3	12	- 12	+ 10	+ 12	130
10	C	138D106X0100C2	6	200	3	12	- 17	+ 10	+ 12	130
33	F	138D336X0100F2	3.5	85	5	24	- 18	+ 12	+ 15	250
39	F	138D396X0100F2	3.5	80	5	24	- 20	+ 12	+ 15	250
68	T	138D686X0100T2	2.2	40	10	40	- 30	+ 14	+ 16	400
120	K	138D127X0100K2	2.8	30	12	48	- 35	+ 15	+ 17	440
<b>125 WV<sub>DC</sub> at + 85 °C . . . 85 WV<sub>DC</sub> at + 125 °C</b>										
6.8	C	138D685X0125C2	11.7	300	3	12	- 14	+ 10	+ 12	130
27	F	138D276X0125F2	3.5	90	5	24	- 18	+ 12	+ 15	250
39	T	138D396X0125T2	2.2	60	10	40	- 16	+ 14	+ 16	400
47	T	138D476X0125T2	2.2	50	10	40	- 26	+ 14	+ 16	400
82	K	138D826X0125K2	2.8	32	12	48	- 30	+ 15	+ 17	440

Note

(1) Part Numbers listed are for units with outer plastic-film insulation and a capacitance tolerance of ± 20 %. For bare case units, substitute "0" for "2" at the end of the Part Number. For capacitors with ± 10 % tolerance, change the digit following the letter "X" to "9". For RoHS compliant add "E3".



**TYPICAL CURVES OF IMPEDANCE AS A FUNCTION OF FREQUENCY AT VARIOUS TEMPERATURES**



**PERFORMANCE CHARACTERISTICS**

1. Operating Temperature: Capacitors are designed to operate over the temperature range of - 55 °C to + 125 °C.

UP TO + 85 °C WORKING VOLTAGE (V)	AT + 125 °C WORKING VOLTAGE (V)	UP TO + 85 °C WORKING VOLTAGE (V)	AT + 125 °C WORKING VOLTAGE (V)
6	4	35	22
8	5	50	30
10	7	60	40
15	10	75	50
20	13	100	70
25	15	125	85
30	20	150	100

2. **DC Working Voltage:** The DC working voltage is the maximum operating voltage for continuous duty at the rated temperature.
3. **Surge Voltage:** The surge DC rating is the maximum voltage to which the capacitors should be subjected under any conditions. This includes transients and peak ripple at the highest line voltage. The surge voltage of capacitors rated below 150 V is 115 % of the rated DC working voltage. The surge voltage of capacitors rated at 150 V DC is 165 volts.
- 3.1 **Surge Voltage Test:** Capacitors shall withstand the surge voltage test applied through a 1000 Ω ± 10 % resistor in series with the capacitor and voltage source at the rate of one-half minute on, four and one-half minutes off, for 1000 successive test cycles at + 85 °C or + 125 °C.
4. **Capacitance Tolerance:** The capacitance of all capacitors shall be within the specified tolerance limits of the nominal rating.

- 4.1 Capacitance measurements shall be made by the bridge method at or referred to, a frequency of 120 Hz at a temperature of + 25 °C. A polarizing voltage shall be used of such magnitude that there shall be no reversal of polarity due to the AC component. The maximum AC voltage will be 1 volt rms applied during measurement.

5. **Capacitance Change With Temperature:** The capacitance change with temperature shall not exceed the limits given in the Standard and Extended Ratings Table for each capacitor.

6. **Equivalent Series Resistance:** Measurements shall be made by the bridge method at or referred to, a frequency of 120 Hz at a temperature of + 25 °C. A polarizing voltage shall be used of such magnitude that there shall be no reversal of polarity due to the AC component. The maximum AC voltage will be 1 V<sub>rms</sub> applied during measurement.

- 6.1 The equivalent series resistance shall not exceed the maximum value in ohms listed in the Standard and Extended Ratings Table for each capacitor.

- 6.2 The dissipation factor may be calculated from the equivalent series resistance and capacitance values as shown:

$$DF = \frac{2\pi fRC}{10^4}$$

where:

DF = Dissipation Factor in %

R = ESR in ohms

C = Capacitance in µF

f = frequency in Hz

At 120 Hz, the above equation becomes:

$$DF = \frac{R \times C}{13.26}$$

**PERFORMANCE CHARACTERISTICS** (Continued)

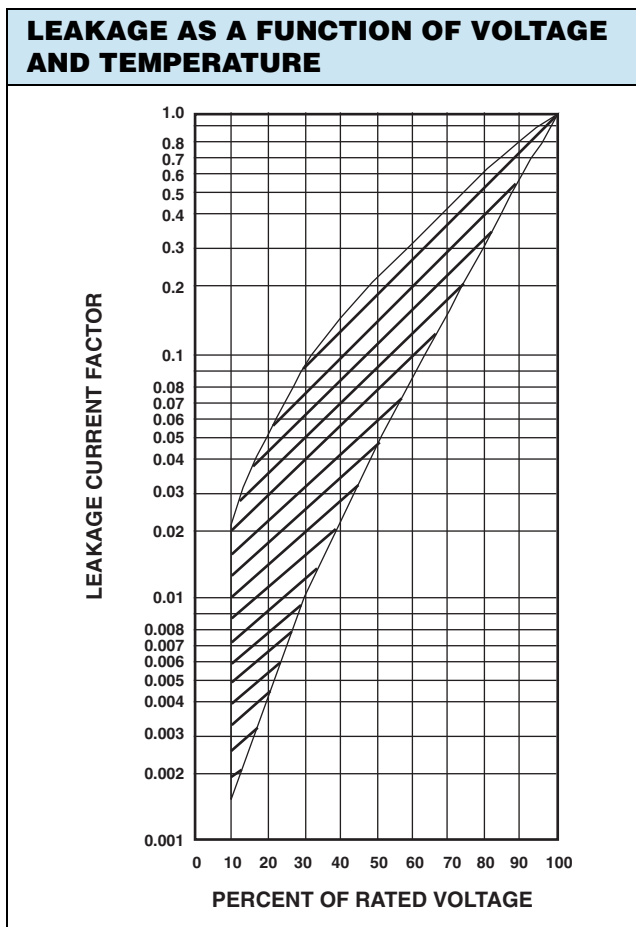
For example, percent dissipation factor of a 30 μF, 6 V capacitor, which has a maximum ESR of 3.4 Ω at + 25 °C and 120 Hz, would be calculated as shown:

$$DF = \frac{2\pi \times 120 \times 3.4 \times 30}{10^4} = \frac{3.4 \times 30}{13.26} = 7.7 \%$$

7. **Leakage Current:** Measurements shall be made at the applicable rated working voltage at + 25 °C ± 5 °C through application of a steady source of power, such as a regulated power supply. The total resistance in series with each capacitor shall be between 1000 Ω and 10 000 Ω. The voltage shall be applied to the capacitor for 5 minutes before making the leakage current measurement.

7.1 The maximum leakage current for any capacitor shall not exceed the value in microamperes listed in the Standard and Extended Ratings Table for each capacitor.

**Note:** leakage current varies with applied voltage. See graph below for the appropriate adjustment factor.



8. **Low Temperature Impedance:** The impedance of any capacitor at - 55 °C at 120 Hz, shall not exceed the values given in the Standard and Extended Ratings tables.

- 9. **Life Test:** Capacitors are capable of withstanding a 2000 h life test at a temperature of + 85 °C or + 125 °C at the applicable rated DC working voltage.
- 10. **High Frequency Vibration:** Capacitors shall withstand vibration from 10 Hz to 2000 Hz at 20 g when tested.
- 11. **Lead Pull Test:** Capacitors shall withstand a lead tensile stress of 3 pounds (13.2 N) for 30 s, applied axially.
- 12. **Marking:** Capacitors shall be marked with Sprague® and/or the Sprague trademark 2, the Sprague type (138D); rated capacitance and tolerance (the tolerance shall be coded, using the list shown in How to Order); rated DC working voltage at + 85 °C; the standard EIA date code of manufacture.

**GUIDE TO APPLICATION**

1. **Ripple Current:** All capacitors will withstand rms ripple currents as listed for each capacitor.

1.1 The rms ripple current rating is independent of temperature or frequency within the following limitations:

1.1.1 At frequencies of less than 120 Hz, the rated rms ripple current must be multiplied by the factors shown:

FREQUENCY IN HERTZ			
25	50	60	100
0.36	0.59	0.65	0.88

1.1.2 The sum of the peak AC voltage plus the DC voltage shall not exceed the DC working voltage of the capacitor.

1.1.3 The sum of the negative peak AC voltage, plus the applied DC voltage shall not allow a voltage reversal.

2. **Cleaning wiring boards with Type 138D capacitors:** Customary cleaning solvents used in the electronics industry at present will not affect Type 138D capacitors. However, the use of ultrasonic cleaning techniques is not recommended under any circumstances.

3. **Apparent Capacitance:** Note that in timing circuit applications, the circuit designer must take into account two important variables which affect any electrolytic capacitor. These are the internal leakage resistance of the capacitor and its dielectric absorption, which will depend on the elapsed time since the capacitor was last energized. In applications where electrolytic capacitors are subjected to DC energy, or in effect, extremely low frequencies, the value of the apparent capacitance will be somewhat higher than that which is measured at 120 Hz.

4. **No Reverse Voltage:** The application of reverse voltage to these capacitors will cause internal damage. The resulting damage will lead to immediate or delayed failure of the unit. This will take the form of a catastrophic short circuit with possible expulsion of the electrolyte.



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