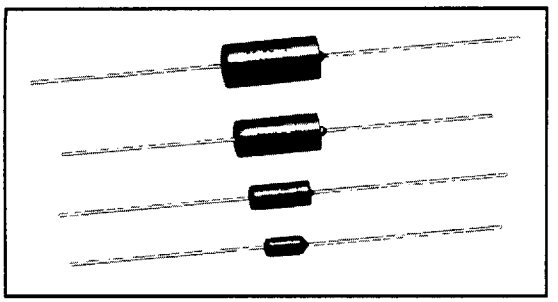
A COMPANY OF VISHAY SPRAGUE®

TYPE 152D
Solid Tantalum Capacitors
Solid-Electrolyte TANTALEX® Capacitors
Extended Capacitance, Hermetically-Sealed



High capacitance, small size, low leakage current, low dissipation factor and exceptional operating stability are important features of Type 152D TANTALEX® capacitors. These hermetically-sealed, metal-case, solid-electrolyte capacitors provide proven reliability in a wide variety of high performance military, industrial and commercial applications.

The military equivalent to the 152D is the CSR23 which is qualified to MIL-C-39003/03.

PERFORMANCE CHARACTERISTICS

Operating Temperature: - 55°C to + 85°C. (To + 125°C with voltage derating.)

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

Dissipation Factor: At 120Hz, + 25°C. Dissipation factor, as determined from the expression 2πfRC, shall not exceed the values listed in the Standard Ratings Tables.

DC Leakage Current (DCL Max.):

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

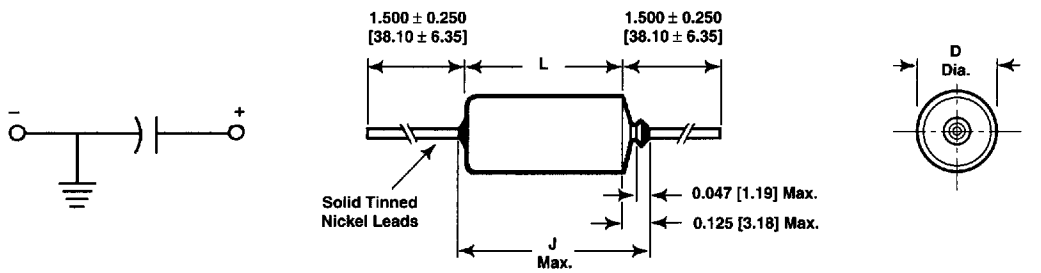
At + 85°C: Leakage current shall not exceed 10 times the values listed in the Standard Ratings Tables.

At + 125°C: Leakage current shall not exceed 12 times the values listed in the Standard Ratings Tables.

Life Test: Capacitors shall withstand rated DC voltage applied at + 85°C for 2000 hours or derated DC voltage applied at + 125°C for 1000 hours.
Following the life test:

1. DCL shall not exceed 125% of the initial requirements. In no case need the leakage current be less than 2μA.
2. Dissipation Factor shall meet the initial requirement.
3. Change in capacitance shall not exceed ± 2%.

DIMENSIONAL CONFIGURATIONS (Dimensions in brackets in millimeters)



CASE CODE	WITH INSULATING SLEEVE*		J (Max.)	LEAD SIZE	
	D	L		AWG NO.	NOM. DIA.
A	0.135 ± 0.016 [3.43 ± 0.41]	0.286 ± 0.031 [7.26 ± 0.79]	0.422 [10.72]	24	0.020 [0.51]
B	0.185 ± 0.016 [4.70 ± 0.41]	0.474 ± 0.031 [12.04 ± 0.79]	0.610 [15.49]	24	0.020 [0.51]
R	0.289 ± 0.016 [7.34 ± 0.41]	0.686 ± 0.031 [17.42 ± 0.79]	0.822 [20.88]	22	0.025 [0.64]
S	0.351 ± 0.016 [8.92 ± 0.41]	0.786 ± 0.031 [19.96 ± 0.79]	0.922 [23.42]	22	0.025 [0.64]

* When a shrink-fitted insulation is used, it shall lap over the ends of the capacitor body.

TYPE 152D

STANDARD RATINGS

CAPACITANCE (µF)	CASE CODE	PART NUMBER* CAP. TOL. ± 20%	PART NUMBER* CAP. TOL. ± 10%	Max. DCL @ + 25°C (µA)	Max. DF @ + 25°C 120Hz (%)
6 WVDC @ + 85°C, SURGE = 8 V . . . 4 WVDC @ + 125°C, SURGE = 5 V					
10	A	152D106X0006A2	152D106X9006A2	1.0	6
12	A	—	152D126X9006A2	1.0	6
15	A	152D156X0006A2	152D156X9006A2	1.0	6
68	B	152D686X0006B2	152D686X9006B2	3.0	6
82	B	—	152D826X9006B2	3.0	6
100	B	152D107X0006B2	152D107X9006B2	6.0	6
330	R	152D337X0006R2	152D337X9006R2	10.0	8
390	R	—	152D397X9006R2	10.0	8
470	R	152D477X0006R2	152D477X9006R2	10.0	8
560	S	—	152D567X9006S2	20.0	10
680	S	152D687X0006S2	152D687X9006S2	20.0	10
820	S	—	152D827X9006S2	20.0	10
1000	S	152D108X0006S2	152D108X9006S2	20.0	10
10 WVDC @ + 85°C, SURGE = 13 V . . . 7 WVDC @ + 125°C, SURGE = 9 V					
5.6	A	—	152D565X9010A2	1.0	4
6.8	A	152D685X0010A2	152D685X9010A2	1.0	6
8.2	A	—	152D825X9010A2	1.2	6
10	A	152D106X0010A2	152D106X9010A2	1.2	6
47	B	152D476X0010B2	152D476X9010B2	4.0	6
56	B	—	152D566X9010B2	5.0	6
68	B	152D686X0010B2	152D686X9010B2	6.0	6
82	B	—	152D826X9010B2	7.0	6
150	R	152D157X0010R2	152D157X9010R2	8.0	8
180	R	—	152D187X9010R2	8.0	8
220	R	152D227X0010R2	152D227X9010R2	12.0	8
270	R	—	152D277X9010R2	13.0	8
330	S	152D337X0010S2	152D337X9010S2	16.0	8
390	S	—	152D397X9010S2	16.0	10
470	S	152D477X0010S2	152D477X9010S2	16.0	10
560	S	—	152D567X9010S2	20.0	10
15 WVDC @ + 85°C, SURGE = 20 V . . . 10 WVDC @ + 125°C, SURGE = 12 V					
3.9	A	—	152D395X9015A2	1.0	4
4.7	A	152D475X0015A2	152D475X9015A2	1.0	4
5.6	A	—	152D565X9015A2	1.3	4
6.8	A	152D685X0015A2	152D685X9015A2	1.3	6
27	B	—	152D276X9015B2	3.0	6
33	B	152D336X0015B2	152D336X9015B2	5.0	6
39	B	—	152D396X9015B2	5.0	6
82	R	—	152D826X9015R2	8.0	6
100	R	152D107X0015R2	152D107X9015R2	10.0	8
120	R	—	152D127X9015R2	10.0	8
150	R	152D157X0015R2	152D157X9015R2	15.0	8
180	R	—	152D187X9015R2	15.0	8
220	S	152D227X0015S2	152D227X9015S2	20.0	8
270	S	—	152D277X9015S2	20.0	8
330	S	152D337X0015S2	152D337X9015S2	20.0	8

* Insert capacitance tolerance code "X5"; for ± 5% units (special order).

TYPE 152D

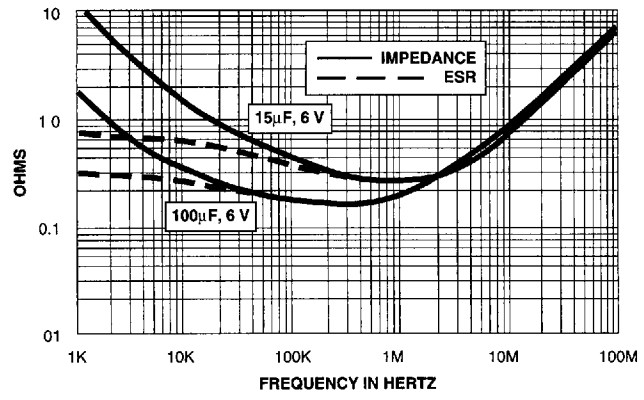
RATINGS

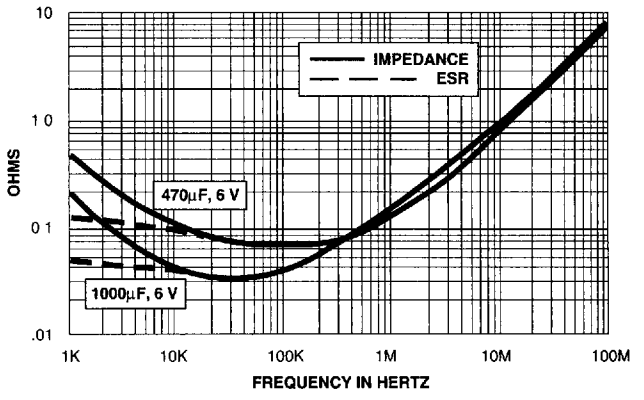
CAPACITANCE (µF)	CASE CODE	PART NUMBER* CAP. TOL. ± 20%	PART NUMBER* CAP. TOL. ± 10%	Max. DCL @ + 25°C (µA)	Max. DF @ + 25°C 120Hz (%)
20 WVDC @ + 85°C, SURGE = 26 V . . . 13 WVDC @ + 125°C, SURGE = 16 V					
2.7	A	—	152D275X9020A2	0.8	4
3.3	A	152D335X0020A2	152D335X9020A2	1.0	4
3.9	A	—	152D395X9020A2	1.2	4
4.7	A	152D475X0020A2	152D475X9020A2	1.2	4
18	B	—	152D186X9020B2	3.0	4
22	B	152D226X0020B2	152D226X9020B2	3.0	4
27	B	—	152D276X9020B2	4.0	4
56	R	—	152D566X9020R2	7.0	6
68	R	152D686X0020R2	152D686X9020R2	8.0	6
82	R	—	152D826X9020R2	10.0	6
100	R	152D107X0020R2	152D107X9020R2	12.0	6
120	R	—	152D127X9020R2	12.0	6
150	S	152D157X0020S2	152D157X9020S2	15.0	8
180	S	—	152D187X9020S2	15.0	8
220	S	152D227X0020S2	152D227X9020S2	15.0	8
30 WVDC @ + 85°C, SURGE = 39 V . . . 20 WVDC @ + 125°C, SURGE = 26 V					
2.2	A	152D225X0030A2	152D225X9030A2	1.0	4
2.7	A	—	152D275X9030A2	1.0	4
12	B	—	152D126X9030B2	3.0	4
15	B	152D156X0030B2	152D156X9030B2	3.0	4
18	B	—	152D186X9030B2	3.0	4
56	R	—	152D566X9030R2	7.0	6
68	R	152D686X0030R2	152D686X9030R2	7.0	6
82	S	—	152D826X9030S2	10.0	8
100	S	152D107X0030S2	152D107X9030S2	10.0	8
35 WVDC @ + 85°C, SURGE = 46 V . . . 23 WVDC @ + 125°C, SURGE = 28 V					
1.2	A	—	152D125X9035A2	0.6	4
1.5	A	152D155X0035A2	152D155X9035A2	0.8	4
1.8	A	—	152D185X9035A2	1.0	4
8.2	B	—	152D825X9035B2	3.0	4
10	B	152D106X0035B2	152D106X9035B2	3.0	4
27	R	—	152D276X9035R2	7.0	6
33	R	152D336X0035R2	152D336X9035R2	8.0	6
39	R	—	152D396X9035R2	10.0	6
47	R	152D476X0035R2	152D476X9035R2	10.0	6
56	S	—	152D566X9035S2	12.0	6
68	S	152D686X0035S2	152D686X9035S2	12.0	6
82	S	—	152D826X9035S2	30.0	8
100	S	152D107X0035S2	152D107X9035S2	30.0	8
50 WVDC @ + 85°C, SURGE = 65 V . . . 33 WVDC @ + 125°C, SURGE = 40 V					
1.2	A	—	152D125X9050A2	0.6	4
1.5	A	152D155X0050A2	152D155X9050A2	0.8	4
5.6	B	—	152D565X9050B2	2.5	4
6.8	B	152D685X0050B2	152D685X9050B2	2.5	4
22	R	152D226X0050R2	152D226X9050R2	7.0	6
27	R	—	152D276X9050R2	8.0	6
33	S	152D336X0050S2	152D336X9050S2	10.0	6
39	S	—	152D396X9050S2	10.0	6
47	S	152D476X0050S2	152D476X9050S2	10.0	6

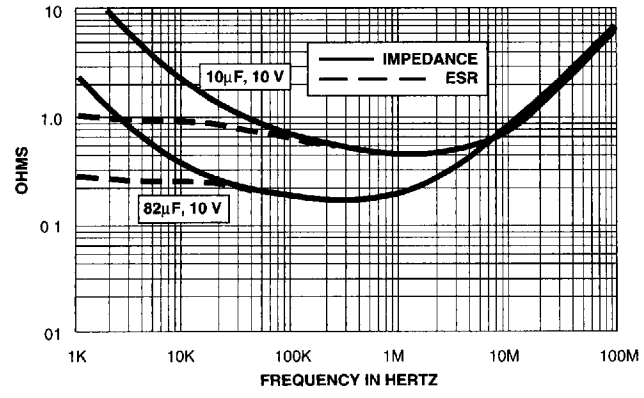
* Insert capacitance tolerance code "X5"; for ± 5% units (special order).

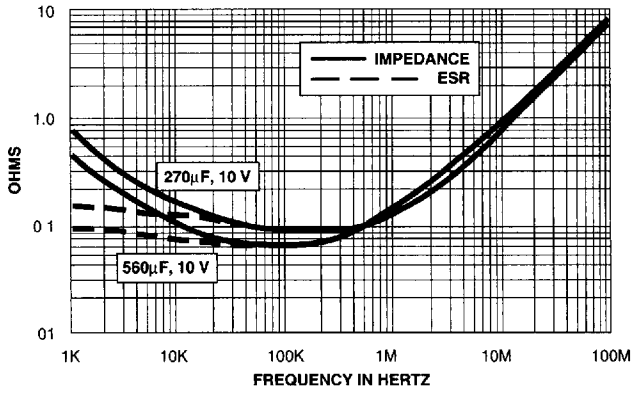
TYPE 152D

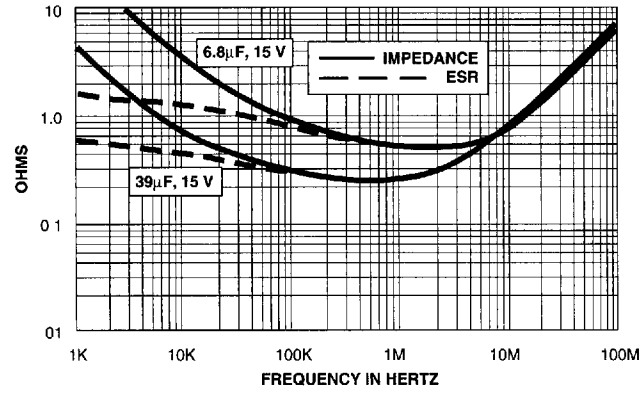
TYPICAL CURVES @ + 25°C, IMPEDANCE AND ESR vs FREQUENCY

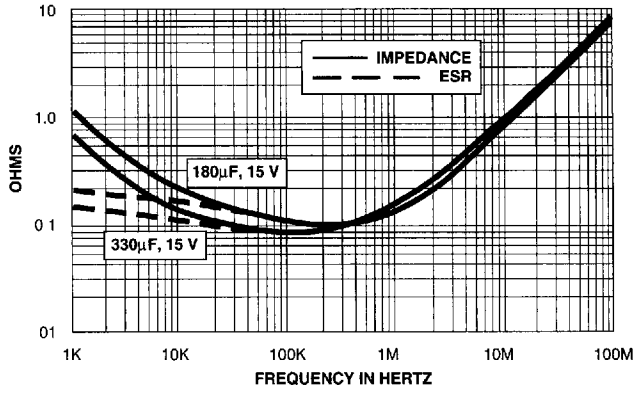


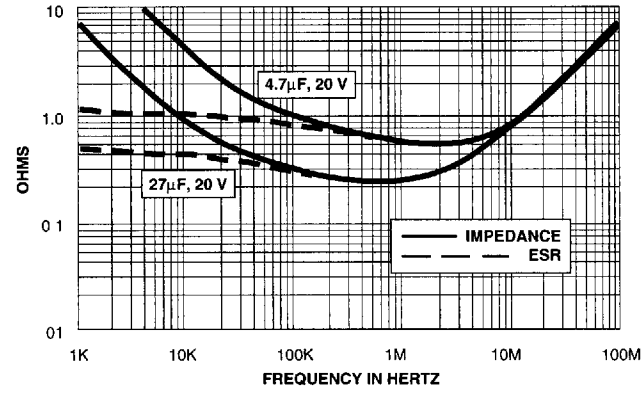


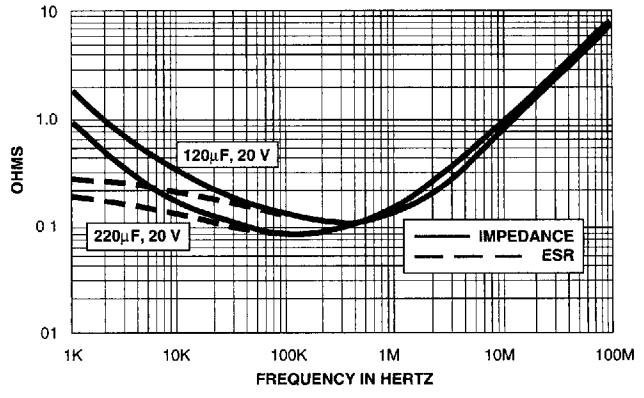












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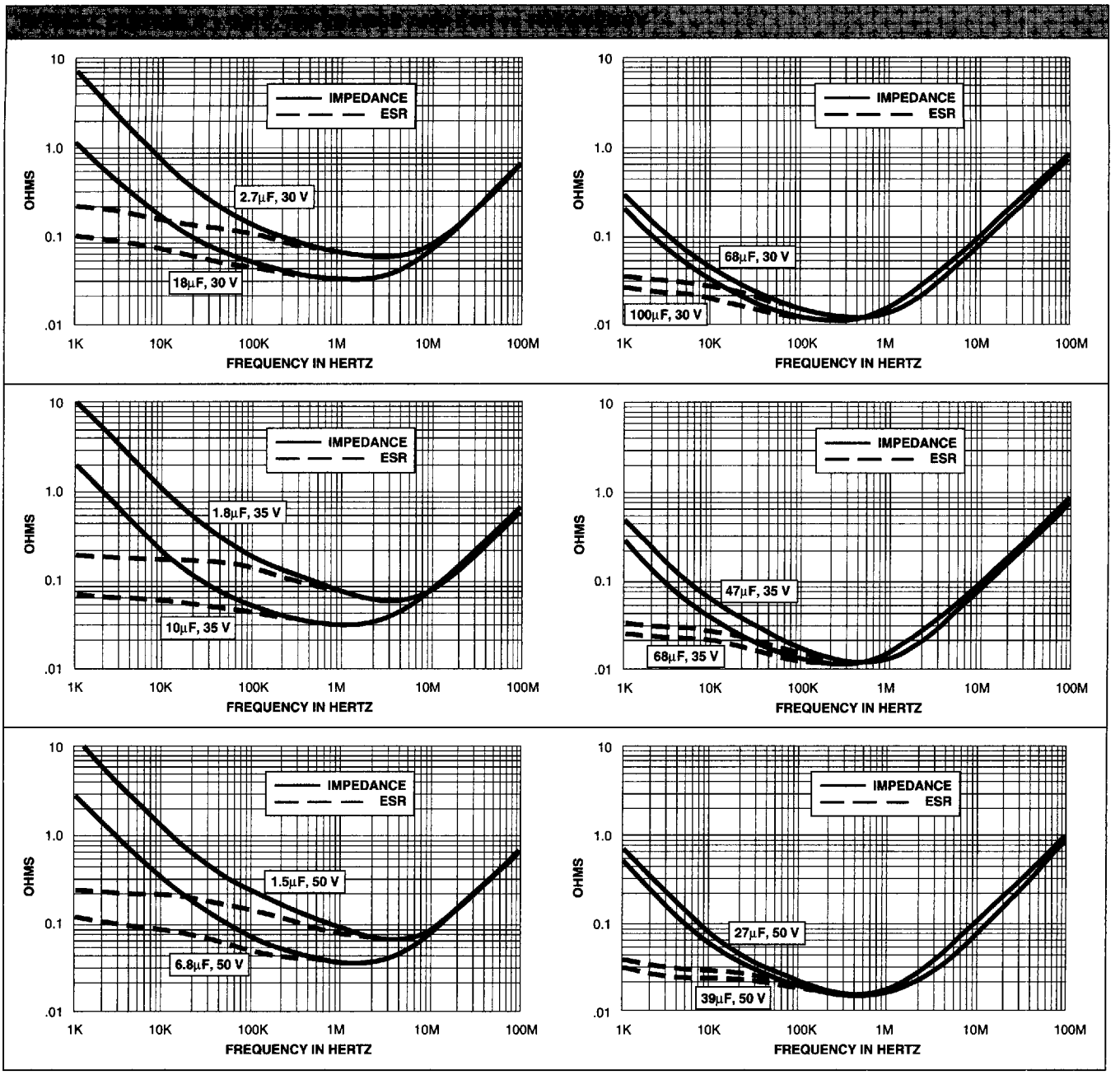

PERFORMANCE CHARACTERISTICS

1. **Operating Temperature:** Capacitors are designed to operate over the temperature range of - 55°C to + 85°C with no derating.

1.1 Capacitors may be operated up to + 125°C with voltage derating as shown:

+ 85°C Rating		+ 125°C Rating	
Working Voltage (V)	Surge Voltage (V)	Working Voltage (V)	Surge Voltage (V)
6	8	4	5
10	13	7	9
15	20	10	12
20	26	13	16
30	39	20	26
35	46	23	28
50	65	33	40

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 may be subjected under any conditions, including transients and peak ripple at the highest line voltage.

3.1 **Surge Voltage Test:** Capacitors shall withstand the surge voltage applied in series with a 33 ohm ± 5% resistor at the rate of one-half minute on, one-half minute off, at + 85°C, for 1000 successive test cycles.

3.2 Following the surge voltage test, the dissipation factor and the leakage current shall meet the initial requirements; the capacitance shall not have changed more than ± 10%.

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PERFORMANCE CHARACTERISTICS (Continued)

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 means of a polarized capacitance bridge. The polarizing voltage shall be of such magnitude that there shall be no reversal of polarity due to the AC component. The maximum voltage applied to capacitors during measurement shall be 2 volts rms at 120Hz at + 25°C. If the AC voltage applied is less than one-half volt rms, no DC bias is required. Accuracy of the bridge shall be within ± 2%.

5. **Capacitance Change with Temperature:** The capacitance change with temperature shall not exceed the following percentages of the capacitance measured at + 25%:

- 55°C	+ 85°C	+ 125°C
- 10%	+ 8%	+ 12%

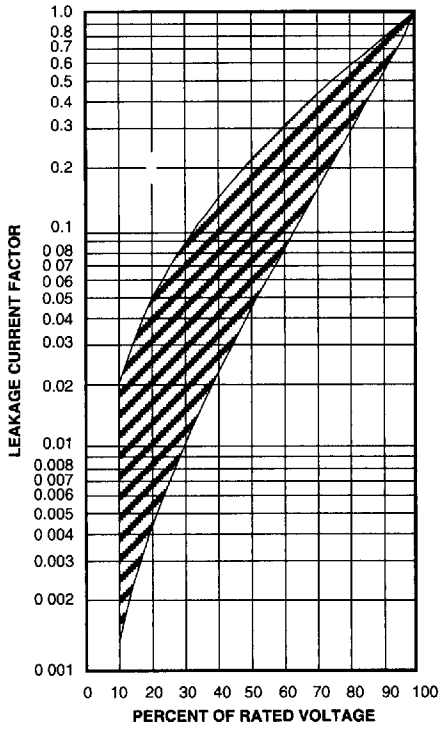
6. **Dissipation Factor:** The dissipation factor, as determined from the expression $2\pi fRC$, shall not exceed values listed in the Standard Ratings Table.

6.1 Measurements shall be made by the bridge method at, or referred to, a frequency of 120Hz and a temperature of + 25°C.

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

TYPICAL LEAKAGE CURRENT FACTOR RANGE

At + 25°C



7. **Leakage Current:** Capacitors shall be stabilized at the rated temperature for 30 minutes. Rated voltage shall be applied to capacitors for 5 minutes using a steady source of power (such as a regulated power supply) with a 1000 ohm resistor connected in series with the capacitor under test to limit the charging current. Leakage current shall then be measured.

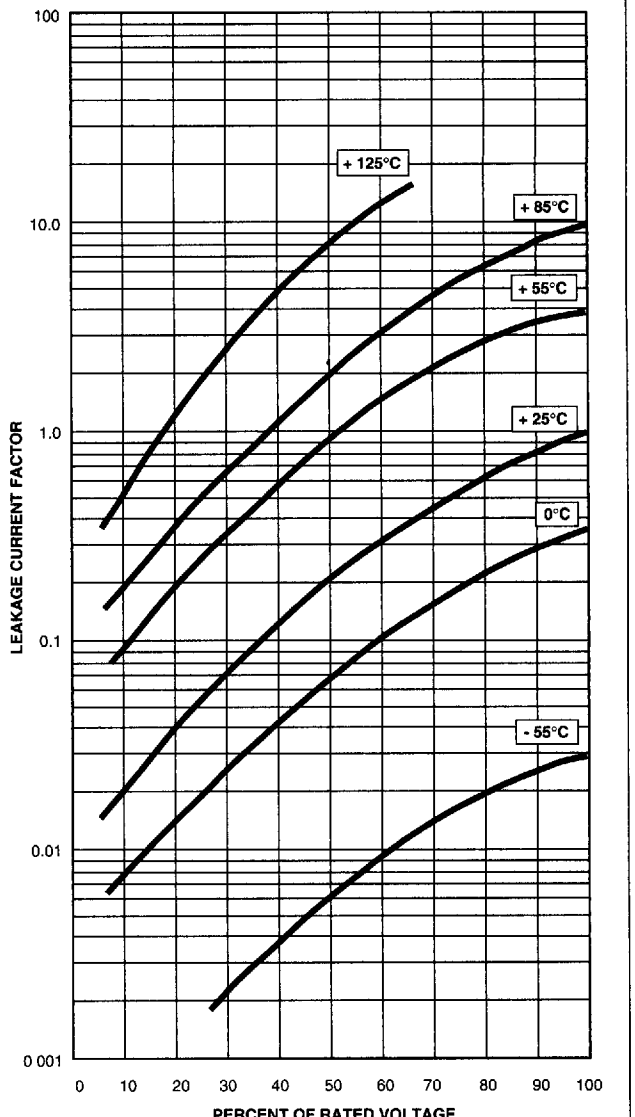
7.1 **At + 25°C,** the leakage current shall not exceed the value listed in the Standard Ratings Table.

7.2 **At + 85°C,** the leakage current shall not exceed 10 times the value listed in the Standard Ratings Table.

7.3 **At + 125°C,** the leakage current shall not exceed 15 times the value listed in the Standard Ratings Table.

TYPICAL LEAKAGE CURRENT FACTOR RANGE

As a function of applied voltage at various temperatures for all voltage ratings.



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PERFORMANCE CHARACTERISTICS (Continued)

8. **Life Test:** Capacitors shall withstand rated DC voltage applied at + 85°C for 2000 hours or derated DC voltage applied at + 125°C for 1000 hours.

8.1 Following the life test, the dissipation factor shall meet the initial requirement; the capacitance change shall not exceed ± 2%; the leakage current shall not exceed 125% of the initial requirement.

9. **Shelf Life:** Capacitors shall withstand a shelf life test for 5000 hours at a temperature of + 85°C, with no voltage applied.

9.1 Following the shelf life test, the leakage current shall meet the initial requirement; the dissipation factor shall not exceed 150% of the initial requirement; the capacitance change shall not exceed ± 5%.

10. **Vibration Tests:** Capacitors shall be subjected to vibration tests in accordance with the following criteria.

10.1 Capacitors shall be secured for test by means of a rigid mounting using suitable brackets.

10.2 **Low Frequency Vibration:** Vibration shall consist of a simple harmonic motion having an amplitude of 0.03" [0.76] and a maximum total excursion of 0.06" [1.52], in a direction perpendicular to the major axis of the capacitor.

10.2.1 Vibration frequency shall be varied uniformly between the approximate limits of 10Hz to 55Hz during a period of approximately one minute, continuously for one and one-half hours.

10.2.2 A cathode ray oscilloscope or other comparable means shall be used in determining electrical intermittency during the final 30 minutes of the test. The AC voltage applied shall not exceed 2 volts rms.

10.2.3 Electrical tests shall show no evidence of intermittent contacts, open circuits or short circuits during these tests.

10.2.4 Following the low frequency vibration test, capacitors shall meet the original requirements for leakage current and dissipation factor; and capacitance change shall not exceed ± 5% of the original measured value.

10.3 **High Frequency Vibration:** Vibration shall consist of a simple harmonic motion having an amplitude of 0.06" [1.52] ± 10% maximum total excursion or 20 g peak, whichever is less.

10.3.1 Vibration frequency shall be varied logarithmically from 50Hz to 2000Hz and return to 50Hz during a cycle period of 20 minutes.

10.3.2 The vibration shall be applied for 4 hours in each of 2 directions, parallel and perpendicular to the major axis of the capacitors.

10.3.3 Rated DC voltage shall be applied during the vibration cycling.

10.3.4 A cathode ray oscilloscope or other comparable means shall be used in determining electrical intermittency during the last cycle. The AC voltage applied shall not exceed 2 volts rms.

10.3.5 Electrical tests shall show no evidence of intermittent contacts, open circuits or short circuits during these tests.

10.3.6 There shall be no mechanical damage to these capacitors as a result of these tests.

10.3.7 Following the high frequency vibration test, capacitors shall meet the original limits for capacitance, dissipation factor and leakage current.

11. **Acceleration Test:**

11.1 Capacitors shall be rigidly mounted by means of suitable brackets.

11.2 Capacitors shall be subjected to a constant acceleration of 100 g for a period of 10 seconds in each of 2 mutually perpendicular planes.

11.2.1 The direction of motion shall be parallel to and perpendicular to the cylindrical axis of the capacitors.

11.3 Rated DC voltage shall be applied during acceleration test.

11.3.1 A cathode ray oscilloscope or other comparable means shall be used in determining electrical intermittency during test. The AC voltage applied shall not exceed 2 volts rms.

11.4 Electrical tests shall show no evidence of intermittent contacts, open circuits or short circuits during these tests.

11.5 There shall be no mechanical damage to these capacitors as a result of these tests.

11.6 Following the acceleration test, capacitors shall meet the original limits for capacitance, dissipation factor and leakage current.

12. **Shock Test:**

12.1 Capacitors shall be rigidly mounted by means of suitable brackets. The test load shall be distributed uniformly on the test platform to minimize the effects of unbalanced loads.

12.1.1 Test equipment shall be adjusted to produce a shock of 100 g peak with the duration of 6 mS and a sawtooth waveform at a velocity change of 9.7 feet/second.

12.2 Capacitors shall be subjected to 3 shocks applied in each of 3 directions corresponding to the 3 mutually perpendicular axes of the capacitors.

12.3 Rated DC voltage shall be applied to capacitors during test.

12.3.1 A cathode ray oscilloscope or other comparable means shall be used in determining electrical intermittency during test. The AC voltage applied shall not exceed 2 volts rms.

PERFORMANCE CHARACTERISTICS (Continued)

12.4 Electrical tests shall show no evidence of intermittent contacts, open circuits or short circuits during these tests.

12.5 There shall be no mechanical damage to these capacitors as a result of these tests.

12.6 Following the shock test, capacitors shall meet the original limits for capacitance, dissipation factor and leakage current.

13. **Moisture Resistance:**

13.1 Capacitors shall be subjected to temperature cycling at 90% to 98% relative humidity, in a test chamber constructed of non-reactive materials (non-resiniferous and containing no formaldehyde or phenol). No rust, corrosive contaminants or dripping condensate shall be imposed on test specimens.

13.1.1 Capacitors shall be mounted in a normal mounting position and placed in the test chamber so that uniform and thorough exposure is obtained.

13.1.2 No conditioning or initial measurements will be performed prior to temperature cycling. Polarization and load voltages are not applicable.

13.1.3 Capacitors shall be subjected to temperature cycling from + 25°C to + 65°C to + 25°C (+ 10°C, - 2°C) over a period of 8 hours per cycle for 10 cycles.

13.1.4 After stabilization, capacitors shall be removed from the humidity chamber and shall be conditioned for 3 hours at - 10°C ± 2°C.

13.1.5 After cold conditioning, capacitors shall be subjected to vibration cycling consisting of a simple harmonic vibration having an amplitude of 0.03" [0.76] and a maximum total excursion of 0.06" [1.52] varied uniformly from 10Hz to 55Hz to 10Hz over a period of 1 minute, for 15 cycles.

13.1.6 Capacitors shall then be returned to temperature/humidity cycling.

13.2 After completion of temperature cycling, capacitors shall be removed from the test chamber and stabilized at room temperature for 2 to 6 hours.

13.3 Capacitors shall show no evidence of harmful or extensive corrosion, obliteration of marking or other visible damage.

13.4 Following the moisture resistance test, capacitors shall meet the original limits for capacitance, dissipation factor and leakage current.

14. **Insulating Sleeves:**

14.1 Capacitors with insulating sleeves shall withstand a 2000 volt DC potential applied for 1 minute between the case and a metal 'V' block in intimate contact with the insulating sleeve.

14.2 Capacitors with insulating sleeves shall have the insulation resistance measured between the case and a metal 'V' block in intimate contact with the insulating sleeve. The insulation resistance shall be at least 1000 megohms.

15. **Thermal Shock and Immersion Cycling:**

15.1 Capacitors shall be conditioned prior to temperature cycling for 15 minutes at + 25°C, at less than 50% relative humidity and a barometric pressure at 28 to 31 inches.

15.2 Capacitors shall be subjected to thermal shock in a cycle of exposure to ambient air at - 65°C (+ 0°C, - 5°C) for 30 minutes, then + 25°C (+ 10°C, - 5°C) for 5 minutes then + 125°C (+ 3°C, - 0°C) for 30 minutes, then + 25°C (+ 10°C, - 5°C) for 5 minutes, for 5 cycles.

15.3 Between 4 and 24 hours after temperature cycling, capacitors shall be subjected to immersion in a bath of fresh tap water with the non-corrosive dye Rhodamine B added, at + 65°C (+ 5°C, - 0°C) for 15 minutes, then, within 3 seconds, immersed in a saturated solution of sodium chloride and water with Rhodamine B added, at a temperature of + 25°C (+ 10°C, - 5°C) for 15 minutes, for 2 cycles.

15.3.1 Capacitors shall be thoroughly rinsed and wiped or air-blasted dry immediately upon removal from immersion cycling.

15.4 Capacitors shall show no evidence of harmful or extensive corrosion, obliteration of marking or other visible damage.

15.5 Following the thermal shock and immersion cycling test, capacitors shall meet the original requirements for leakage current and dissipation factor; capacitance change shall not exceed ± 5% of the original measured value.

15.6 Capacitors shall be opened and examined. There shall be no evidence of dye penetration.

16. **Reduced Pressure Test:**

16.1 Capacitors shall be stabilized a reduced pressure of 0.315" [8.0] of mercury, equivalent to an altitude of 100,000 feet (30,480 meters), for a period of 5 minutes.

16.2 Rated DC voltage shall be applied for 1 minute.

16.3 Capacitors shall not flash over nor shall end seals be damaged.

16.4 Following the reduced pressure test, the capacitance, dissipation factor and leakage current shall meet the original requirements.

17. **Lead Pull Test:** Leads shall withstand a tensile stress test of 3 pounds (1.4 kilogram) applied in any direction for 30 seconds.

18. **Marking:** Capacitors shall be marked with Sprague® or ②; the type number 152D; rated capacitance and tolerance; rated DC working voltage and the standard EIA date code.

18.1 Capacitors shall be marked on one end with a plus sign (+) to identify the positive terminal.

TYPE 152D

GUIDE TO APPLICATION

1. **A-C Ripple Current:** The maximum allowable ripple current shall be determined from the formula:

$$I_{rms} = \sqrt{\frac{P}{R_{ESR}}}$$

where,

P = Power Dissipation in Watts @ + 25°C as given in the table in Paragraph Number 5 (Power Dissipation).

R_{ESR} = The capacitor Equivalent Series Resistance at the specified frequency.

2. **A-C Ripple Voltage:** The maximum allowable ripple voltage shall be determined from the formula:

$$V_{rms} = Z\sqrt{\frac{P}{R_{ESR}}}$$

or, from the formula:

$$V_{rms} = I_{rms} \times Z$$

where,

P = Power Dissipation in Watts @ + 25°C as given in the table in Paragraph Number 5 (Power Dissipation).

R_{ESR} = The capacitor Equivalent Series Resistance at the specified frequency.

Z = The capacitor Impedance at the specified frequency.

2.1 The sum of the peak AC voltage plus the DC voltage shall not exceed the DC voltage rating of the capacitor.

2.2 The sum of the negative peak AC voltage plus the applied DC voltage shall not allow a voltage reversal exceeding 15% of the DC working voltage at + 25°C.

3. **Reverse Voltage:** These capacitors are capable of withstanding peak voltages in the reverse direction equal to 15% of the DC rating at + 25°C, 10% of the DC rating at + 55°C and 5% of the DC rating at + 85°C.

4. **Temperature Derating:** If these capacitors are to be operated at temperatures above + 25°C, the permissible rms ripple current or voltage shall be calculated using the derating factors as shown:

Temperature	Derating Factor
+ 25°C	1.0
+ 55°C	0.8
+ 85°C	0.6
+ 125°C	0.4

5. **Power Dissipation:** Power dissipation will be affected by the heat sinking capability of the mounting surface. Non-sinusoidal ripple current may produce heating effects which differ from those shown. It is important that the equivalent Irms value be established when calculating permissible operating levels.

Case Code	Maximum Permissible Power Dissipation @ + 25°C (Watts) in free air
A	0.115
B	0.145
R	0.185
S	0.225

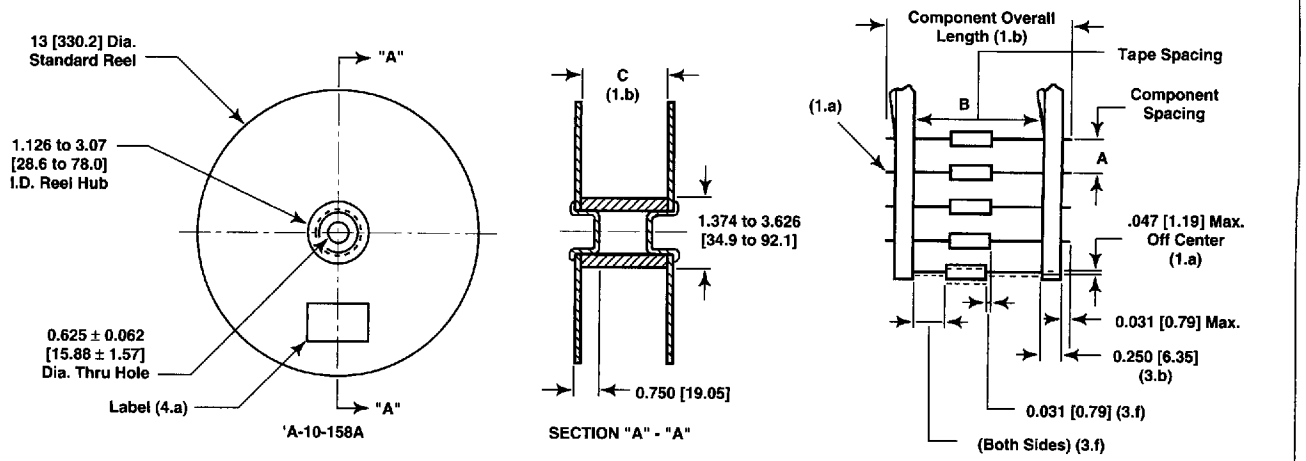
HOW TO ORDER

152D	106	X0	006	A	2
TYPE	CAPACITANCE	CAPACITANCE TOLERANCE	DC VOLTAGE RATING AT + 85°C	CASE CODE	STYLE NUMBER
	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%	This is expressed in volts. To complete the three-digit block, zeros precede the voltage rating.	See Ratings and Case Codes Table.	2 = Insulated sleeve.

TYPE 152D

STANDARD REEL PACKAGING SPECIFICATIONS - Meets EIA Standard RS-296

[Numbers in brackets indicate millimeters]



CASE CODE	TYPE 152D UNITS WITH INSULATING SLEEVE		J (Max.)	LEAD SIZE		COMPONENT SPACING	TAPE SPACING	QUANTITY/REEL*	
	D	L		AWG NO.	NOM. DIA.	A	B	(Min.)	(Max.)
A	0.135 ± 0.016 [3.43 ± 0.41]	0.286 ± 0.031 [7.26 ± 0.79]	0.422 [10.72]	24	0.020 [0.51]	0.200 ± 0.015 [5.08 ± 0.38]	2.500 ± 0.062 [63.5 ± 1.57]	1000	4000
B	0.185 ± 0.016 [4.70 ± 0.41]	0.474 ± 0.031 [12.04 ± 0.79]	0.610 [15.49]	24	0.020 [0.51]	0.200 ± 0.015 [5.08 ± 0.38]	2.500 ± 0.062 [63.5 ± 1.57]	1000	3000
R	0.289 ± 0.016 [7.34 ± 0.41]	0.686 ± 0.031 [17.42 ± 0.79]	0.822 [20.88]	22	0.025 [0.64]	0.400 ± 0.015 [10.16 ± 0.38]	2.875 ± 0.062 [73.03 ± 1.57]	500	900
S	0.351 ± 0.016 [8.92 ± 0.41]	0.786 ± 0.031 [19.96 ± 0.79]	0.922 [23.42]	22	0.025 [0.64]	0.400 ± 0.015 [10.16 ± 0.38]	2.875 ± 0.062 [73.03 ± 1.57]	500	700

* For quantities greater than the maximum shown for each case code, the maximum quantity will be used on as many reels as possible, with the last reel quantity being variable, i.e. an order for 10,000 Type 152D capacitors in Case Code A will consist of 2 reels with 4000 units and 1 reel with 2000 units.

STANDARD REEL PACKAGING INFORMATION

1. **Component Leads:**
   a. Component leads shall not be bent beyond 0.047" [1.19] maximum from their nominal position when measured from the leading edge of the component lead at the inside tape edge and at the lead egress from the component.
   b. The 'C' dimension shall be governed by the overall length of the reel packaged component. The distance between flanges shall be 0.125" to 0.250" [3.18 to 6.35] greater than the overall component length.
2. **Orientation:**
   a. All polarized components must be oriented to one direction. The cathode lead tape shall be a color and the anode lead tape shall be white.
3. **Reeling:**
   a. Components on any reel shall not represent more than two date codes when date code identification is required.
   b. Component leads shall be positioned between pairs of 0.250" [6.35] tape.
   c. The disposable reels have hubs and corrugated fiberboard flanges and core or equivalent.
   d. A minimum of 12" [304.8] leader of tape shall be provided before the first and after the last component on the reel.
   e. 50 or 60 lb. Kraft paper must be wound between layer of components as far as necessary for component protection. Width of paper to be 0.062" to 0.250" [1.57 to 6.35] less than the 'C' dimension of the reel.
   f. A row of components must be centered between tapes ± 0.047" [1.19]. In addition, individual components may deviate from center of component row ± 0.031" [0.79].
   g. Staples shall not be used for splicing. Not more than 4 layers of tape shall be used in any splice area and no tape shall be offset from another by more than 0.031" [0.79] non-cumulative. Tape splices shall overlap at least 6" [152.4] for butt joints and at least 3" [76.2] for lap joints and shall not be weaker than unspliced tape. Universal splicing clips may also be used.
   h. Quantity per reel shall be controlled so that tape components and cover shall not extend beyond the smallest dimension of the flange (either across flats or diameter). Once the quantity per reel for each part number has been established, future orders for that part number shall be packaged in that quantity. When order or release quantity is less than the established quantity, a standard commercial pack is to be used.
   i. A maximum of 0.25% of the components per reel quantity may be missing without consecutive missing components.
   j. Adequate protection must be provided to prevent physical damage to both reel and components during shipment and storage.
4. **Marking:**
   a. Minimum reel and carton marking shall consist of the following: Customer Part Number, Purchase Order No., Quantity, Package Date, Manufacturer's Name, Electrical Value, Date Code, Sprague® Part Number and Country of Origin.