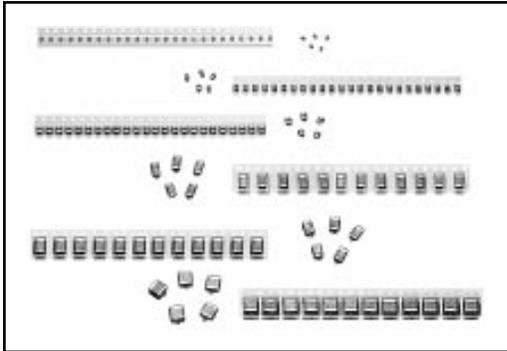


TYPE 595D

Solid Tantalum Chip Capacitors

TANTAMOUNT[®], Conformal Terminals, Maximum C/V



FEATURES

- Compatible with 293D molded chip mounting pad layout
- Smallest size/rating in the industry
- Largest capacitance rating in the industry
- Terminations: 60/40 Tin Lead (2) standard
- 8mm, 12mm tape available per EIA-481-1 and reeling per IEC 286-3. 7" [178mm] standard. 13" [330mm] available.
- Operating temperature: - 55°C to + 125°C
- Case code compatibility with EIA 535BAAC and CECC 30801 molded chips
- Low leakage current, impedance and inductance

PERFORMANCE CHARACTERISTICS

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

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

Dissipation Factor: At 120Hz, + 25°C. Dissipation factor, as determined from the expression $2\pi fRC$, 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:

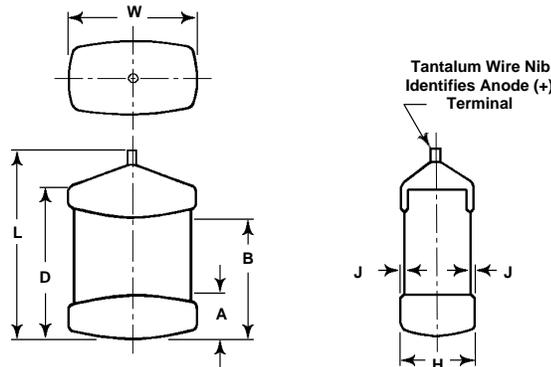
1. DCL shall meet the original requirement.
2. Dissipation Factor and ESR shall meet the initial requirement.
3. Change in capacitance shall not exceed ± 10%.

ELECTRICAL CHARACTERISTICS @ + 25°C

DCL: .01μA/CV or .5μA whichever is greater.

DF: 4% ≤ 1μF. 6% > 1μF < 100μF. 8% ≥ 100μF.

DIMENSIONAL CONFIGURATIONS [Numbers in brackets indicate millimeters]



CASE CODE	L (Max.)	W	H	A	B	D (Ref.)	J (Max.)
T	.087 [2.2]	.045 ± .010 [1.1 ± 0.3]	.045 ± .010 [1.1 ± 0.3]	.016 ± .008 [.4 ± 0.2]	.042 ± .010 [1.07 ± 0.25]	.063 [1.6]	.004 [0.1]
A	.146 [3.7]	.072 ± .010 [1.8 ± 0.3]	.056 ± .012 [1.4 ± 0.3]	.023 ± .010 [.6 ± 0.3]	.085 ± .015 [2.2 ± 0.4]	.115 [2.9]	.004 [0.1]
B	.158 [4.0]	.104 ± .010 [2.6 ± 0.3]	.062 ± .012 [1.6 ± 0.3]	.023 ± .010 [.6 ± 0.3]	.097 ± .015 [2.5 ± 0.4]	.127 [3.2]	.004 [0.1]
C	.281 [7.1]	.126 ± .010 [3.2 ± 0.3]	.098 ± .012 [2.5 ± 0.3]	.040 ± .015 [1.0 ± 0.4]	.200 ± .025 [5.1 ± 0.6]	.236 [6.0]	.004 [0.1]
D	.293 [7.5]	.170 ± .010 [4.3 ± 0.3]	.110 ± .012 [2.8 ± 0.3]	.050 ± .015 [1.3 ± 0.4]	.200 ± .025 [5.1 ± 0.6]	.253 [6.4]	.004 [0.1]
R	.283 [7.2]	.235 ± .010 [6.0 ± 0.3]	.136 ± .012 [3.5 ± 0.3]	.050 ± .015 [1.3 ± 0.4]	.190 ± .025 [4.8 ± 0.6]	.243 [6.2]	.004 [0.1]

Note: The anode termination (D less B) will be a minimum of .010" [0.3]. T Case = .005" [.13] minimum.

TYPE 595D

RATINGS AND CASE CODES								
μF	RATED VOLTAGE U_R @ + 85°C							
	4 V	6.3 V	10 V	16 V	20 V	25 V	35 V	50 V
0.10								T
0.15								T
0.22								T
0.33							T	A
0.47						T	A	A
0.68					T		A	B
1.0					T		A	B
1.5				T		A	B	C
2.2			T		A		B	C
3.3		T			A	B	C	C
4.7	T			A	B		C	C
6.8				A	B		C	D
10			A	B		C	D	R
15	A	A	B	B		C	D	R
22		B			C		D	R
33	B			C		D	R	
47				C	D	R		
68			C	D		R		
100		C		D	R			
120	C	D	D	R	R			
150	C		D	R				
180	D	D	R	R				
220	D	D	R					
270	D		R					
330		R	R					
390	R	R						
470	R							

STANDARD RATINGS							
CAPACITANCE (μF)	CASE CODE	PART NUMBER*	Max. DCL @ + 25°C (μA)	Max. DF @ + 25°C 120Hz (%)	Max. ESR @ + 25°C 100kHz (Ohms)	Max. RIPPLE 100kHz I _{rms} (Amps)	
4 WVDC @ + 85°C, SURGE = 5.2 V . . . 2.7 WVDC @ + 125°C, SURGE = 3.4 V							
4.7	T	595D475X0004T2T	0.5	6	8.7	0.08	
15.0	A	595D156X0004A2T	0.6	6	3.5	0.14	
33.0	B	595D336X0004B2T	1.3	6	2.0	0.20	
120.0	C	595D127X0004C2T	4.8	8	0.65	0.47	
150.0	C	595D157X0004C2T	6.0	8	0.70	0.40	
180.0	D	595D187X0004D2T	7.2	8	0.55	0.58	
220.0	D	595D227X0004D2T	8.8	8	0.45	0.58	
270.0	D	595D277X0004D2T	10.8	8	0.40	0.61	
390.0	R	595D397X0004R2T	15.6	8	0.16	1.25	
470.0	R	595D477X0004R2T	18.8	8	0.15	1.29	
6.3 WVDC @ + 85°C, SURGE = 8 V . . . 4 WVDC @ + 125°C, SURGE = 5 V							
3.3	T	595D335X006R3T2T	0.5	6	9.4	0.08	
15.0	A	595D156X006R3A2T	0.9	6	3.0	0.15	
22.0	B	595D226X006R3B2T	1.4	6	2.2	0.19	
100.0	C	595D107X006R3C2T	6.3	8	0.7	0.40	
120.0	C	595D127X006R3C2T	7.6	8	0.65	0.47	
180.0	D	595D187X006R3D2T	11.3	8	0.55	0.58	
220.0	D	595D227X006R3D2T	13.9	8	0.35	0.65	
330.0	R	595D337X006R3R2T	20.8	8	0.18	1.18	
390.0	R	595D397X006R3R2T	24.6	8	0.16	1.25	
10 WVDC @ + 85°C, SURGE = 13 V . . . 7 WVDC @ + 125°C, SURGE = 8 V							
2.2	T	595D225X0010T2T	0.5	6	9.5	0.08	
10.0	A	595D106X0010A2T	1.0	6	3.2	0.15	
15.0	B	595D156X0010B2T	1.5	6	2.2	0.19	
68.0	C	595D686X0010C2T	6.8	6	0.70	0.40	
120.0	D	595D127X0010D2T	12.0	8	0.50	0.61	
150.0	D	595D157X0010D2T	15.0	8	0.40	0.61	

* Part Numbers shown for units with $\pm 20\%$ capacitance tolerance. For $\pm 10\%$ units, change "X0" to "X9".

TYPE 595D

STANDARD RATINGS						
CAPACITANCE (μ F)	CASE CODE	PART NUMBER*	Max. DCL @ + 25°C (μ A)	Max. DF @ + 25°C 120Hz (%)	Max. ESR @ + 25°C 100kHz (Ohms)	Max. RIPPLE 100kHz I_{rms} (Amps)
10 WVDC @ + 85°C, SURGE = 13 V . . . 7 WVDC @ + 125°C, SURGE = 8 V						
180.0	R	595D187X0010R2T	18.0	8	0.22	1.05
220.0	R	595D227X0010R2T	22.0	8	0.20	1.12
270.0	R	595D277X0010R2T	27.0	8	0.18	1.17
330.0	R	595D337X0010R2T	33.0	8	0.15	1.29
16 WVDC @ + 85°C, SURGE = 20 V . . . 10 WVDC @ + 125°C, SURGE = 12 V						
1.5	T	595D155X0016T2T	0.5	6	9.7	0.675
4.7	A	595D475X0016A2T	0.8	6	3.6	0.14
6.8	A	595D685X0016A2T	1.1	6	3.2	0.15
10.0	B	595D106X0016B2T	1.6	6	2.2	0.19
15.0	B	595D156X0016B2T	2.4	6	1.8	0.21
33.0	C	595D336X0016C2T	5.3	6	0.9	0.35
47.0	C	595D476X0016C2T	7.5	6	0.7	0.40
68.0	D	595D686X0016D2T	10.9	6	0.50	0.55
100.0	D	595D107X0016D2T	16.0	8	0.45	0.58
120.0	R	595D127X0016R2T	19.2	8	0.26	0.98
150.0	R	595D157X0016R2T	24.0	8	0.22	1.07
180.0	R	595D187X0016R2T	28.8	8	0.22	1.07
20 WVDC @ + 85°C, SURGE = 26 V . . . 13 WVDC @ + 125°C, SURGE = 16 V						
0.68	T	595D684X0020T2T	0.5	4	12.0	0.065
1.0	T	595D105X0020T2T	0.5	4	10.0	0.07
2.2	A	595D225X0020A2T	0.5	6	4.5	0.13
3.3	A	595D335X0020A2T	0.7	6	3.8	0.14
4.7	B	595D475X0020B2T	0.9	6	2.8	0.17
6.8	B	595D685X0020B2T	1.4	6	2.4	0.18
22.0	C	595D226X0020C2T	4.4	6	0.9	0.35
47.0	D	595D476X0020D2T	9.4	6	0.50	0.55
100.0	R	595D107X0020R2T	20.0	8	0.25	1.00
120.0	R	595D127X0020R2T	24.0	8	0.25	1.00
25 WVDC @ + 85°C, SURGE = 32 V . . . 17 WVDC @ + 125°C, SURGE = 20 V						
0.47	T	595D474X0025T2T	0.5	4	15.0	0.06
1.5	A	595D155X0025A2T	0.5	6	5.0	0.12
3.3	B	595D335X0025B2T	0.8	6	2.8	0.17
10.0	C	595D106X0025C2T	2.5	6	1.2	0.20
15.0	C	595D156X0025C2T	3.8	6	1.0	0.30
22.0	D	595D226X0025D2T	5.5	6	0.80	0.36
33.0	D	595D336X0025D2T	8.3	6	0.60	0.43
47.0	R	595D476X0025R2T	11.8	6	0.27	0.96
68.0	R	595D686X0025R2T	17.0	6	0.25	1.00
35 WVDC @ + 85°C, SURGE = 46 V . . . 23 WVDC @ + 125°C, SURGE = 26 V						
0.33	T	595D334X0035T2T	0.5	4	16.0	0.055
0.47	A	595D474X0035A2T	0.5	4	7.0	0.10
0.68	A	595D684X0035A2T	0.5	4	6.0	0.11
1.0	A	595D105X0035A2T	0.5	4	5.5	0.11
1.5	B	595D155X0035B2T	0.5	6	4.2	0.14
2.2	B	595D225X0035B2T	0.8	6	3.5	0.15
3.3	C	595D335X0035C2T	1.2	6	2.0	0.24
4.7	C	595D475X0035C2T	1.6	6	1.5	0.27
6.8	C	595D685X0035C2T	2.4	6	1.3	0.29
10.0	D	595D106X0035D2T	3.5	6	0.9	0.41
15.0	D	595D156X0035D2T	5.3	6	0.8	0.43
22.0	R	595D226X0035R2T	7.7	6	0.6	0.65
33.0	R	595D336X0035R2T	11.6	6	0.5	0.71
50 WVDC @ + 85°C, SURGE = 65 V . . . 33 WVDC @ + 125°C, SURGE = 38 V						
0.10	T	595D104X0050T2T	0.5	4	25.0	0.035
0.15	T	595D154X0050T2T	0.5	4	20.0	0.038
0.22	T	595D224X0050T2T	0.5	4	17.0	0.04
0.33	A	595D334X0050A2T	0.5	4	9.0	0.09
0.47	A	595D474X0050A2T	0.5	4	8.0	0.09
0.68	B	595D684X0050B2T	0.5	4	6.0	0.12
1.0	B	595D105X0050B2T	0.5	4	5.0	0.13
1.5	C	595D155X0050C2T	0.8	6	3.0	0.19
2.2	C	595D225X0050C2T	1.1	6	2.5	0.21

* Part Numbers shown for units with $\pm 20\%$ capacitance tolerance. For $\pm 10\%$ units, change "X0" to "X9".

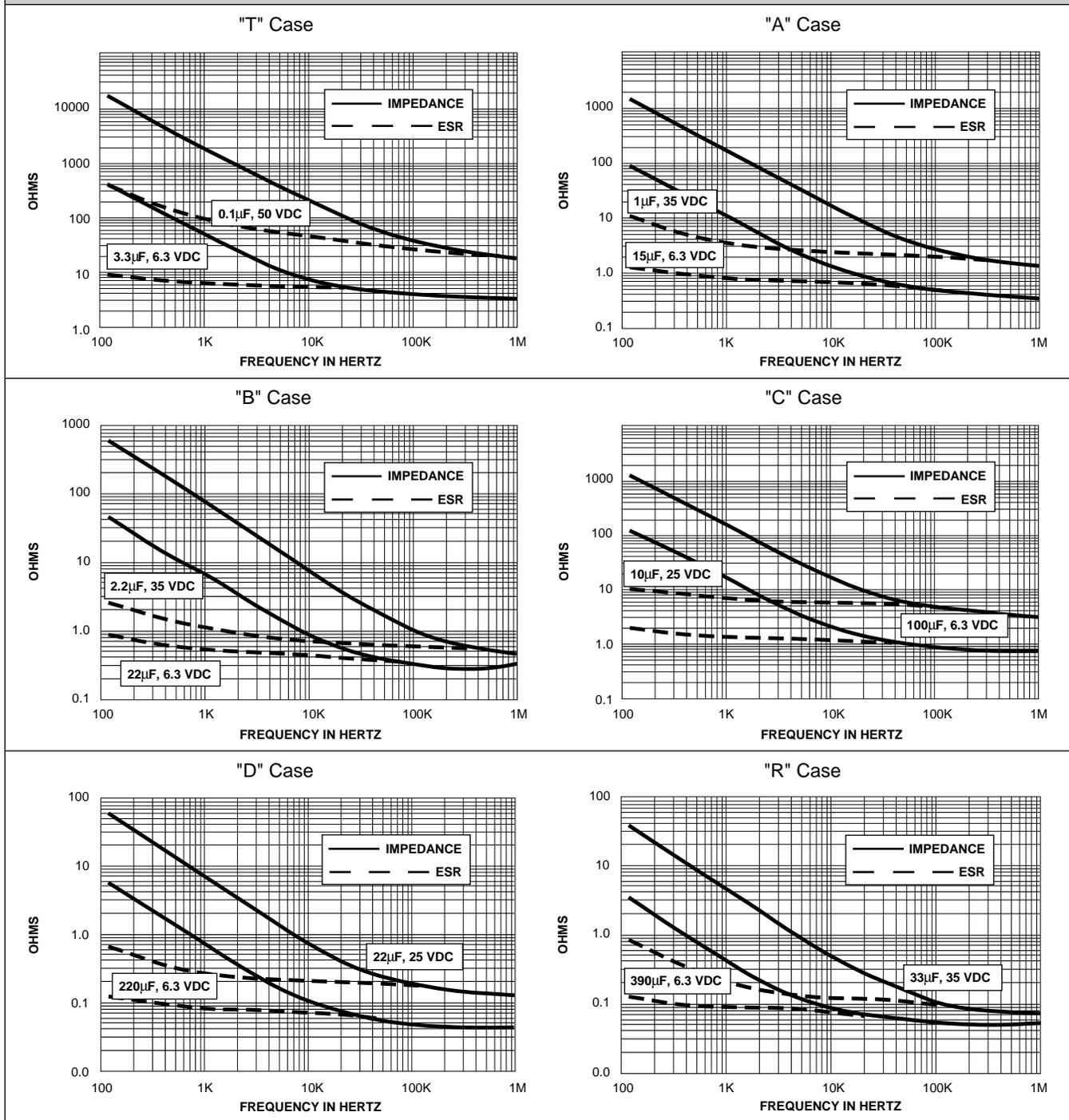
TYPE 595D

STANDARD RATINGS

CAPACITANCE (μ F)	CASE CODE	PART NUMBER*	Max. DCL @ + 25°C (μ A)	Max. DF @ + 25°C 120Hz (%)	Max. ESR @ + 25°C 100kHz (Ohms)	Max. RIPPLE 100kHz I _{rms} (Amps)
50 WVDC @ + 85°C, SURGE = 65 V . . . 33 WVDC @ + 125°C, SURGE = 38 V						
3.3	C	595D335X0050C2T	1.7	6	2.0	0.23
4.7	C	595D475X0050C2T	2.4	6	1.5	0.27
6.8	D	595D685X0050D2T	3.4	6	1.2	0.35
10	R	595D106X0050R2T	5.0	6	0.90	0.53
15	R	595D156X0050R2T	7.5	6	0.80	0.56

* Part Numbers shown for units with $\pm 20\%$ capacitance tolerance. For $\pm 10\%$ units, change "X0" to "X9".

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



TYPE 595D

PERFORMANCE CHARACTERISTICS

1. **Operating Temperature:** Capacitors are designed to operate over the temperature range of - 55°C to + 85°C.
- 1.1 Capacitors may be operated to + 125°C with voltage derating to two-thirds the + 85°C rating.

+ 85°C Rating		+ 125°C Rating	
Working Voltage (V)	Surge Voltage (V)	Working Voltage (V)	Surge Voltage (V)
4.0	5.2	2.7	3.4
6.3	8.0	4.0	5.0
10.0	13.0	7.0	8.0
16.0	20.0	10.0	12.0
20.0	26.0	13.0	16.0
25.0	32.0	17.0	20.0
35.0	46.0	23.0	26.0
50.0	65.0	33.0	38.0

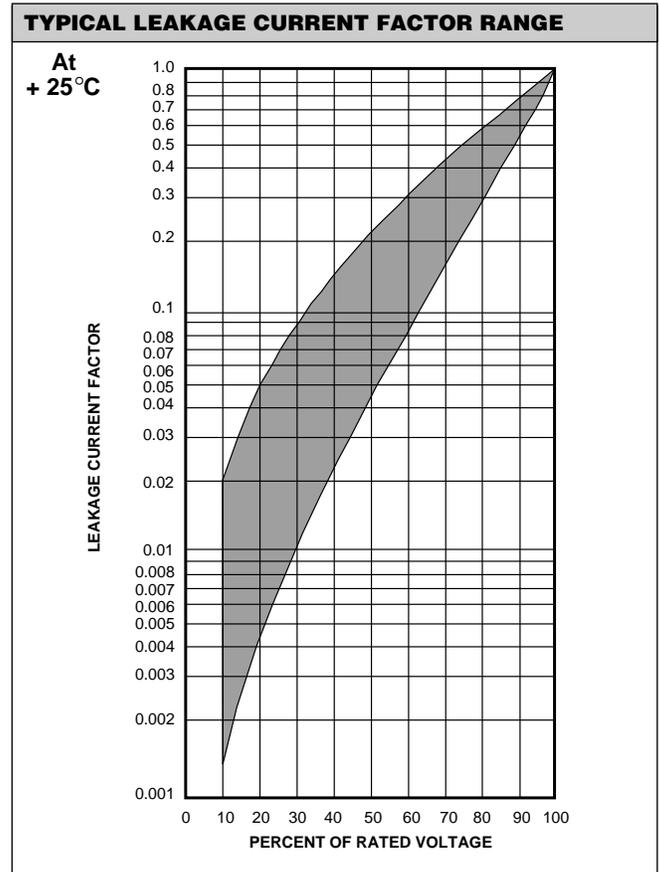
2. **DC Working Voltage:** The DC working voltage is the maximum operating voltage for continuous duty at the rated temperature.
3. **Surge Voltage:** The surge DC rating is the maximum voltage to which the capacitors may be subjected under any conditions, including transients and peak ripple at the 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%.
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 measurements 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 percentage of the capacitance measured at + 25°C:

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

6. **Dissipation Factor:** The dissipation factor, 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.

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.

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



- 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 12 times the value listed in the Standard Ratings Table.
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 and leakage current shall meet the initial requirement; the capacitance change shall not exceed ± 10% of the initial value.
9. **Humidity Test:** Capacitors shall withstand 1000 hours at + 40°C, 90% to 95% relative humidity, with no voltage applied.
- 9.1 Following the humidity test, capacitance change shall be within 10% of initial value; the dissipation factor shall not exceed 150% of the initial requirement; the leakage current shall not exceed 200% of the initial requirement at + 25°C.

TYPE 595D

PERFORMANCE CHARACTERISTICS (Continued)

- 10. **Soldering Testing:** Capacitors shall be checked by the following method: Terminations are immersed in non-activated flux and dipped in 60/40 Sn/Pb solder for 5 seconds at + 245°C. Wetting must occur on at least 95% of the external surface of the terminations.
- 11. **Resistance to Soldering Heat:** Capacitors mounted on a substrate will withstand exposure to + 260°C for 5 seconds.
- 11.1 Following the resistance to soldering heat test, capacitance shall be within initial tolerance;

dissipation factor shall be within 120% of initial requirements at + 25°C; the leakage current shall be within initial requirement at + 25°C.

- 12. **Marking:** The small body area of these capacitors does not allow elaborate marking schemes. All required information is present on the carton or package in which the parts are shipped; in addition, part number, quantity and date code are indicated on the reels.

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 10% 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 10% of the DC rating at + 25°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	0.9
+ 85°C	0.8
+ 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 *I_{rms}* value be established when calculating permissible operating levels. (Power Dissipation calculated using 25°C temperature rise.)

Case Code	Maximum Permissible Power Dissipation @ + 25°C (Watts) in free air
T	0.030
A	0.070
B	0.080
C	0.110
D	0.150
R	0.250

- 6. **Printed Circuit Board Materials:** The 595D is compatible with most commonly used printed circuit board materials (alumina substrates, FR4, FR5, G10, PTFE-fluorocarbon and porcelainized steel). If your desired board material is not shown here please contact the Tantalum Marketing Department for assistance in determining compatibility.
- 7. **Attachment:**
 - 7.1 **Solder Paste:** The recommended thickness of the solder paste after application is .007" ± .001" [.178 ± .025]. Care should be exercised in selecting the solder paste. The metal purity should be as high as practical. The flux (in the paste) must be active enough to remove the oxides formed on the metallization prior to the exposure to soldering heat. In practice this can be aided by extending the solder preheat time at temperatures below the liquidous state of the solder.
 - 7.2 **Soldering:** Capacitors can be attached by conventional soldering techniques - vapor phase, infrared reflow, wave soldering and hot plate methods. The solder temperature/soldering time chart shows maximum recommended time/temperature conditions for soldering. Attachment with a soldering iron is not recommended due to the difficulty of controlling temperature and time at temperature.
- 8. **Cleaning (Flux Removal) After Soldering:** The 595D is compatible with all commonly used solvents such as TES, TMS, Prelete and Chlorethane. Solvents containing methylene chloride or other epoxy solvents should be avoided since these will attack the epoxy encapsulation material.

TYPE 595D

GUIDE TO APPLICATION (Continued)

9. **Recommended Mounting Pad Geometries:** The area under the tantalum wire nib should not be metallized on the PC board. The nib must have sufficient clearance to avoid electrical contact with other components. The width dimension indicated is the same as the maximum width of the capacitor. This is to minimize lateral movement.

REFLOW SOLDER PADS*

[Numbers in brackets indicate millimeters]

CASE CODE	WIDTH (A)	PAD METALLIZATION (B)	SEPARATION (C)
T	.055 [1.5]	.030 [0.7]	.025 [0.6]
A	.082 [2.1]	.065 [1.7]	.050 [1.3]
B	.114 [3.0]	.065 [1.7]	.065 [1.7]
C	.136 [3.5]	.090 [2.3]	.120 [3.1]
D	.180 [4.6]	.090 [2.3]	.145 [3.7]
R	.245 [6.3]	.090 [2.3]	.145 [3.7]

* Pads for B, C and D case codes are otherwise pad compatible with Type 293D, B, C and D case codes respectively.

SOLDERING PROFILE

RECOMMENDED SOLDERING PROFILE - WAVE SOLDER

RECOMMENDED SOLDERING PROFILE - INFRARED REFLOW

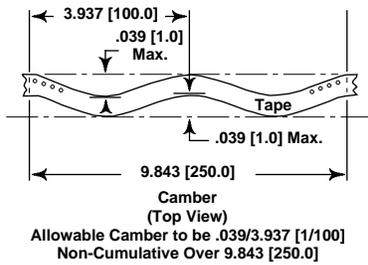
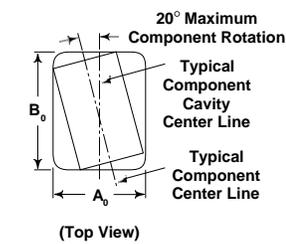
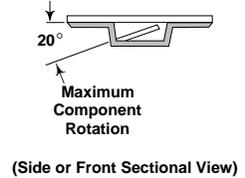
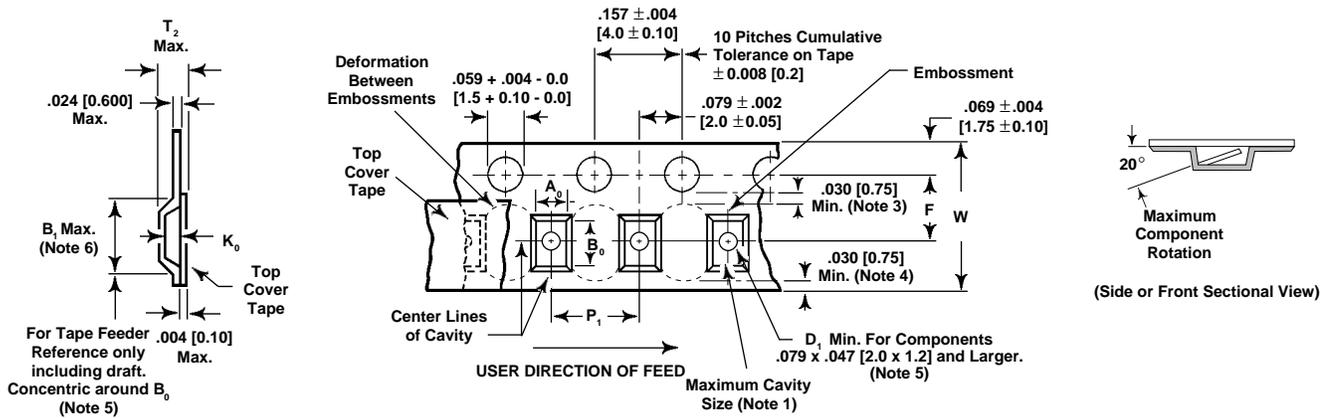
HOW TO ORDER

595D TYPE	106 CAPACITANCE	X0 CAPACITANCE TOLERANCE	010 DC VOLTAGE RATING AT + 85°C	A CASE CODE	2 TERMINATION	T PACKAGING
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%	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 volts).	See Ratings and Case Codes Table.	2 = 60/40 Tin Lead Standard.	B = Bulk Pack T = Tape and Reel 7" [178] Reel (1/2 reel minimum) W = 13" [330] Reel (1/2 reel minimum) See Tape and Reel Specifications.	

TYPE 595D

TAPE AND REEL PACKAGING

Please Note: [Numbers in brackets indicate millimeters]. Metric dimensions will govern. Dimensions in inches are rounded and for reference only.



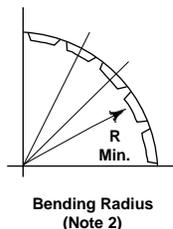
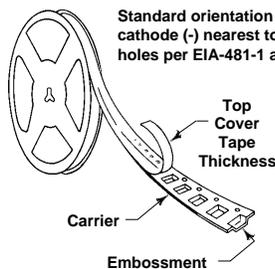
Tape and Reel Specifications: All case codes are available on plastic embossed tape per EIA-481-1. Tape reeling per IEC 286-3 is also available. Standard reel diameter is 7" [178]. 13" [330] reels are available and recommended as the most cost effective packaging method.

The most efficient packaging quantities are full reel increments on a given reel diameter. The quantities shown allow for the sealed empty pockets required to be in conformance with EIA-481-1. Reel size and packaging orientation must be specified in the Sprague® part number.

TAPE SIZE	B ₁ (Max.) (Note 6)	D ₁ (Min.) (Note 5)	F	P ₁	R (Min.) (Note 2)	T ₂ (Max.)	W	A ₀ B ₀ K ₀
8mm	.179 [4.55]	.039 [1.0]	.138 ± .002 [3.5 ± 0.05]	.157 ± .004 [4.0 ± 0.1]	.984 [25.0]	.098 [2.5]	.315 + .012 - .004 [8.0 + 0.3 - 0.1]	(Note 1)
12mm	.323 [8.2]	.059 [1.5]	.217 ± .002 [5.5 ± 0.05]	.157 ± .004 [4.0 ± 0.1]	1.181 [30.0]	.256 [6.5]	.472 ± .012 [12.0 ± .30]	
12mm Double Pitch	.323 [8.2]	.059 [1.5]	.217 ± .002 [5.5 ± 0.05]	.315 ± .004 [8.0 ± 0.1]	1.181 [30.0]	.256 [6.5]	.472 ± .012 [12.0 ± .30]	

Notes:

- A₀B₀K₀ are determined by the maximum dimensions to the ends of the terminals extending from the component body and/or the body dimensions of the component. The clearance between the ends of the terminals or body of the component to the sides and depth of the cavity (A₀B₀K₀) must be within .002" [0.05] minimum and .020" [0.50] maximum. The clearance allowed must also prevent rotation of the component within the cavity of not more than 20 degrees.
- Tape with components shall pass around radius "R" without damage. The minimum trailer length may require additional length to provide R minimum for 12mm embossed tape for reels with hub diameters approaching N minimum.
- This dimension is the flat area from the edge of the sprocket hole to either the outward deformation of the carrier tape between the embossed cavities or to the edge of the cavity whichever is less.
- This dimension is the flat area from the edge of the carrier tape opposite the sprocket holes to either the outward deformation of the carrier tape between the embossed cavity or to the edge of the cavity whichever is less.
- The embossment hole location shall be measured from the sprocket hole controlling the location of the embossment. Dimensions of embossment location and hole location shall be applied independent of each other.
- B₁ dimension is a reference dimension for tape feeder clearance only.



Case Code	Tape Width	Component Pitch	Units Per Reel	
			7" [178] Reel	13" [330] Reel
T	8mm	4mm	2500	10,000
A	8mm	4mm	2000	9000
B	12mm	4mm	2000	8000
C	12mm	8mm	500	3000
D	12mm	8mm	500	2500
R	12mm	8mm	600	—