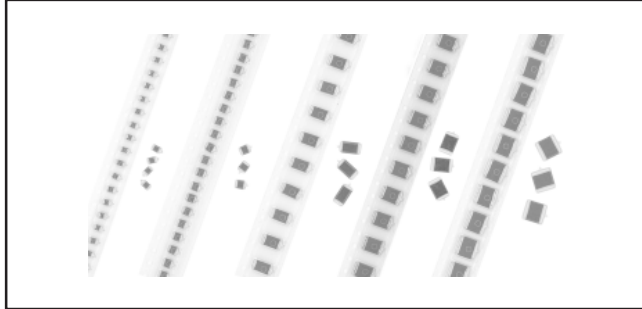




TYPE 592D

Solid Tantalum Chip Capacitors

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



FEATURES

- New extended range offerings.
- New A case size offering.
- Low profile .047" [1.2mm] height (nominal).
- Compatible with 293D molded chip mounting pad layout.
- Terminations: 60/40 Tin Lead (2) standard - (Electro-plate or solder dip).
- Operating temperature: - 55°C to + 125°C.
- Low ESR and inductance.
- Case code compatibility with EIA 535BAAC and CECC 30801 molded chips for length and width.

PERFORMANCE CHARACTERISTICS

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

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

Dissipation Factor: At 120 Hz, + 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:

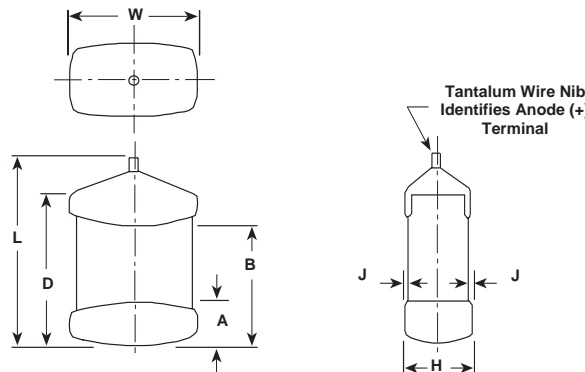
1. DCL shall meet the original requirement.
2. Dissipation Factor and ESR shall meet the original requirement.
3. Change in capacitance shall not exceed ± 10%.

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.)
A	.146 [3.7]	.072±.010 [1.8±.3]	.047±.008 1.2±.2	.031±.012 [.80±.30]	.085±.015 [2.2±0.4]	.115 [2.9]	.004 [.01]
B	.158 [4.0]	.110 + .010 - .016 [2.8 + .3 - .4]	.047±.012 [1.2±0.3]	.031±.012 [.80±.30]	.097±.015 [2.5±0.4]	.127 [3.2]	.004 [0.1]
C	.281 [7.1]	.126±.010 [3.2±0.3]	.047±.012 [1.2±0.3]	.051±.012 [1.3±.30]	.180±.025 [4.6±0.6]	.236 [6.0]	.004 [0.1]
D	.293 [7.5]	.170±.010 [4.3±0.3]	.047±.012 [1.2±0.3]	.051±.012 [1.3±.30]	.180±.025 [4.6±0.6]	.253 [6.4]	.004 [0.1]
R	.285 [7.2]	.235±.010 [6.0±0.3]	.047±.012 [1.2±0.3]	.051±.012 [1.3±.30]	.180±.025 [4.6±0.6]	.243 [6.2]	.004 [0.1]

Note: The anode termination (D less B) will be a minimum of .010" [0.3mm].

TYPE 592D

RATINGS AND CASE CODES														
RATED VOLTAGE VR @ + 85°C														
	4 V		6.3 V		10 V		16 V		20 V		25 V		35 V	
μF	STD	EXT	STD	EXT	STD	EXT	STD	EXT	STD	EXT	STD	EXT	STD	EXT
1.0													B	A
2.2											B	A	C	B
3.3												B	D	C
4.7									B	A	C			
6.8							B	A	C	B	D	C	R	D
10					B	A	C	B	D	B*	R	D		R
15			B	A				B*		C		R		
22	B	A			C	B	D	C	R	D				
33			C	B	D	C	R	D		R				
47	C	B	D	C		D		R						
68	D	C		D	R	D*								
100	R	D	R											
150		R												

* Contact factory for availability. This table shows the largest capacitance values available in the case size and voltage indicated.

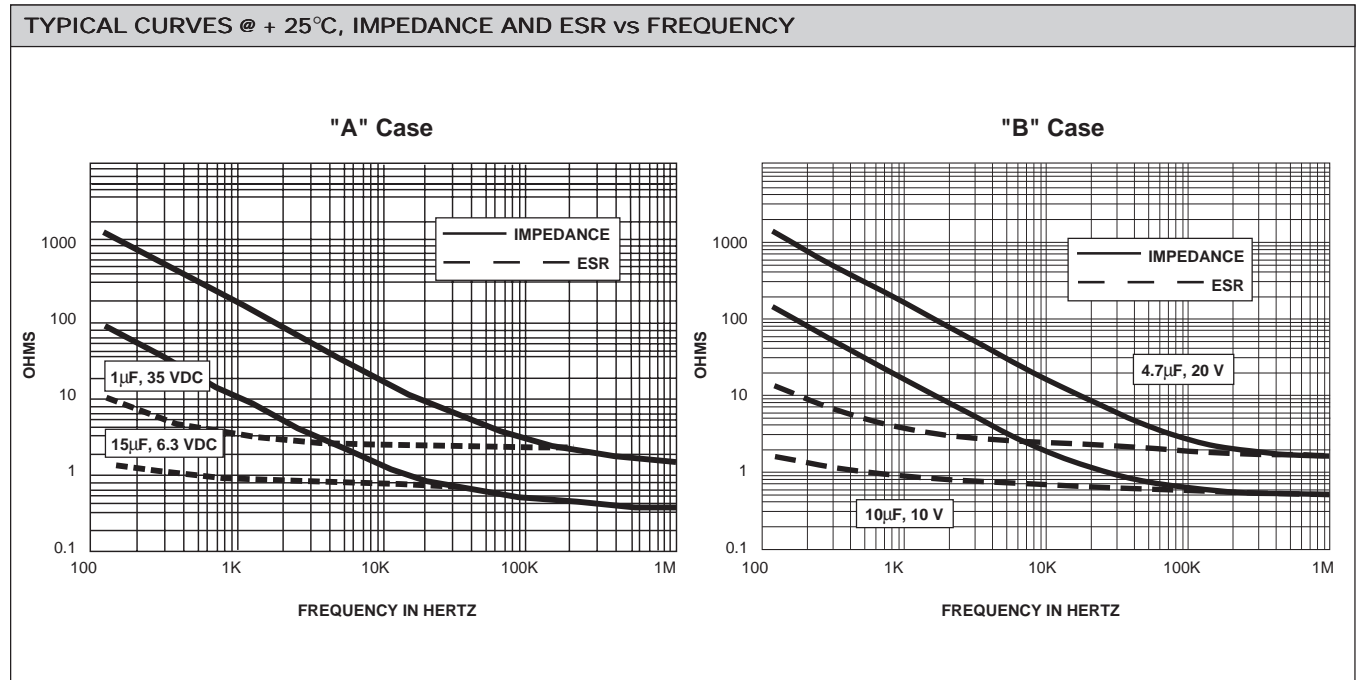
STANDARD RATINGS						
CAPACITANCE (μF)	CASE CODE	PART NUMBER**	Max. DCL @ + 25°C (μA)	Max. DF @ + 25°C 120 Hz (%)	Max. ESR @ + 25°C 100kHz (Ohms)	Max. RIPPLE 100kHz Irms (Amps)
4 WVDC @ + 85°C, SURGE = 5.2 V . . . 2.7 WVDC @ + 125°C, SURGE = 3.4 V						
22.0	A	592D226X0004A2T	0.9	6	2.4	0.16
22.0	B	592D226X0004B2T	0.9	6	1.6	0.22
47.0	B	592D476X0004B2T	1.9	6	1.5	0.23
47.0	C	592D476X0004C2T	1.9	6	0.40	0.50
68.0	C	592D686X0004C2T	2.7	6	0.35	0.53
68.0	D	592D686X0004D2T	2.7	6	0.27	0.68
100.0	D	592D107X0004D2T	4.0	8	0.26	0.69
100.0	R	592D107X0004R2T	4.0	8	0.20	0.87
150.0	R	592D157X0004R2T	6.0	8	0.20	0.87
6.3 WVDC @ + 85°C, SURGE = 8 V . . . 4 WVDC @ + 125°C, SURGE = 5 V						
15.0	A	592D156X06R3A2T	0.9	6	2.5	0.15
15.0	B	592D156X06R3B2T	0.9	6	1.7	0.22
22.0	B	592D226X06R3B2T	1.4	6	1.5	0.23
33.0	B	592D336X06R3B2T	2.1	6	1.4	0.24
33.0	C	592D336X06R3C2T	2.1	6	0.40	0.50
47.0	C	592D476X06R3C2T	3.0	6	0.40	0.50
47.0	D	592D476X06R3D2T	3.0	6	0.30	0.65
68.0	D	592D686X06R3D2T	4.0	6	0.27	0.68
68.0	R	592D686X06R3R2T	4.0	6	0.20	0.87
100.0	R	592D107X06R3R2T	6.0	8	0.20	0.87
10 WVDC @ + 85°C, SURGE = 13 V . . . 7 WVDC @ + 125°C, SURGE = 8 V						
10.0	A	592D106X0010A2T	1.0	6	2.6	0.15
10.0	B	592D106X0010B2T	1.0	6	1.7	0.22
22.0	B	592D226X0010B2T	2.2	6	1.5	0.23
22.0	C	592D226X0010C2T	2.2	6	0.40	0.50
33.0	C	592D336X0010C2T	3.3	6	0.40	0.50
33.0	D	592D336X0010D2T	3.3	6	0.30	0.65
47.0	D	592D476X0010D2T	4.7	6	0.27	0.68
47.0	R	592D476X0010R2T	4.7	6	0.20	0.87
68.0*	D*	592D686X0010D2T*	6.8	6	0.27	0.68
68.0	R	592D686X0010R2T	6.8	6	0.20	0.87
16 WVDC @ + 85°C, SURGE = 20 V . . . 10 WVDC @ + 125°C, SURGE = 12 V						
4.7	A	592D475X0016A2T	0.80	6	3.5	0.13
6.8	A	592D685X0016A2T	1.10	6	3.5	0.13
6.8	B	592D685X0016B2T	1.10	6	1.8	0.21
10	B	592D106X0016B2T	1.60	6	1.6	0.22
10	C	592D106X0016C2T	1.60	6	1.0	0.32
15*	B*	592D156X0016B2T*	2.40	6	1.4	0.24
15	D	592D156X0016D2T	2.40	6	0.5	0.50
22	C	592D226X0016C2T	3.50	6	0.5	0.46
22	D	592D226X0016D2T	3.50	6	0.4	0.60
33	D	592D336X0016D2T	5.30	6	0.3	0.62

* Contact factory for availability. ** Part Numbers shown for units with ± 20% capacitance tolerance. For ± 10% units, change "X0" to "X9". **Extended Range ratings shown in bold print.**

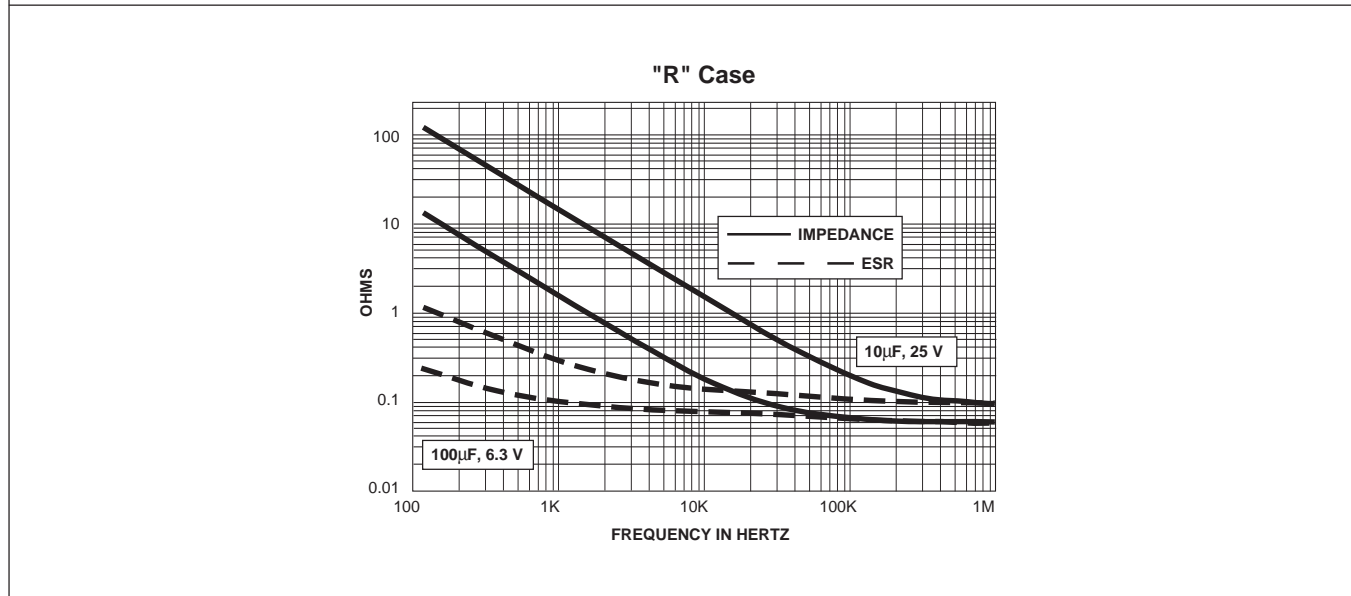
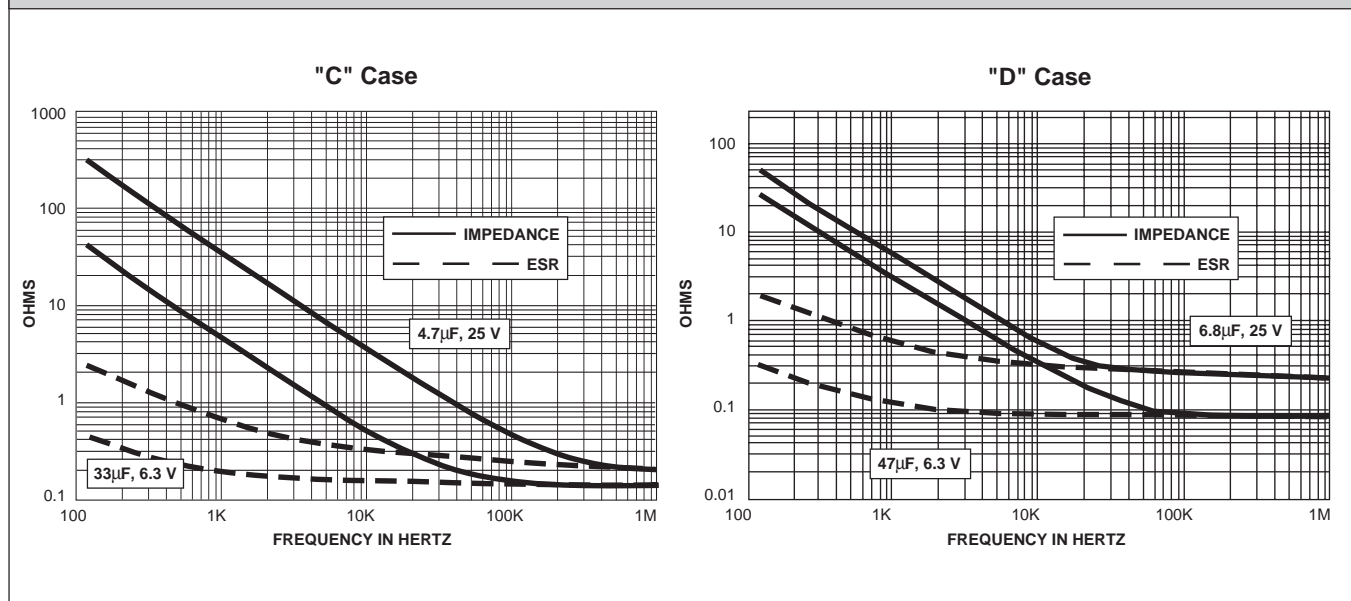
TYPE 592D

STANDARD RATINGS						
CAPACITANCE (μ F)	CASE CODE	PART NUMBER**	Max. DCL @ + 25°C (μ A)	Max. DF @ + 25°C 120 Hz (%)	Max. ESR @ + 25°C 100kHz (Ohms)	Max. RIPPLE 100kHz I _{rms} (Amps)
16 WVDC @ + 85°C, SURGE = 20 V . . . 10 WVDC @ + 125°C, SURGE = 12 V						
33.0	R	592D336X0016R2T	5.30	6	0.27	0.75
47.0	R	592D476X0016R2T	7.5	6	0.25	0.77
20 WVDC @ + 85°C, SURGE = 26 V . . . 13 WVDC @ + 125°C, SURGE = 16 V						
4.7	A	592D475X0020A2T	0.9	6	3.80	0.13
4.7	B	592D475X0020B2T	0.9	6	3.20	0.16
6.8	B	592D685X0020B2T	1.4	6	3.10	0.16
6.8	C	592D685X0020C2T	1.4	6	1.10	0.30
10.0*	B*	592D106X0020B2*	2.0	6	3.00	0.16
10.0	D	592D106X0020D2T	2.0	6	0.50	0.48
15.0	C	592D156X0020C2T	3.0	6	0.60	0.42
15.0	R	592D156X0020R2T	3.0	6	0.40	0.65
22.0	D	592D226X0020D2T	4.4	6	0.40	0.56
22.0	R	592D226X0020R2T	4.4	6	0.28	0.73
33.0	R	592D336X0020R2T	6.6	6	0.28	0.73
25 WVDC @ + 85°C, SURGE = 33 V . . . 17 WVDC @ + 125°C, SURGE = 20 V						
2.2	A	592D225X0025A2T	0.6	6	8.00	0.09
2.2	B	592D225X0025B2T	0.6	6	6.00	0.12
3.3	B	592D335X0025B2T	0.8	6	5.60	0.12
3.3	C	592D335X0025C2T	0.8	6	2.00	0.22
4.7	C	592D475X0025C2T	1.2	6	1.60	0.25
6.8	C	592D685X0025C2T	1.7	6	1.50	0.26
6.8	D	592D685X0025D2T	1.7	6	1.30	0.31
10.0	D	592D106X0025D2T	2.5	6	1.20	0.32
10.0	R	592D106X0025R2T	2.5	6	0.48	0.56
15.0	R	592D156X0025R2T	3.8	6	0.40	0.61
35 WVDC @ + 85°C, SURGE = 46 V . . . 23 WVDC @ + 125°C, SURGE = 26 V						
1.0	A	592D105X0035A2T	0.5	4	10.0	0.08
1.0	B	592D105X0035B2T	0.5	4	6.50	0.11
2.2	B	592D225X0035B2T	0.8	6	6.00	0.12
2.2	C	592D225X0035C2T	0.8	6	3.50	0.17
3.3	C	592D335X0035C2T	1.2	6	3.20	0.18
3.3	D	592D335X0035D2T	1.2	6	2.10	0.24
4.7	R	592D475X0035R2T	1.6	6	1.30	0.34
6.8	D	592D685X0035D2T	2.4	6	1.30	0.31
6.8	R	592D685X0035R2T	2.4	6	1.20	0.35
10.0	R	592D106X0035R2T	3.5	6	1.20	0.35

* Contact factory for availability. ** Part numbers shown for units with $\pm 20\%$ capacitance tolerance. For $\pm 10\%$ units, change "X0" to X9. **Extended Range ratings shown in bold print.**



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



HOW TO ORDER

592D
TYPE

106
CAPACITANCE

This is expressed in picofarads. The first two digits are the significant figures. The third is the number of zeros to follow.

X0
CAPACITANCE TOLERANCE

X0 = ± 20%
X9 = ± 10%

010
DC VOLTAGE RATING @ + 85°C

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).

B
CASE CODE

See Ratings and Case Codes Table.

2
TERMINATION

2 = 60/40 Tin Lead. Standard.

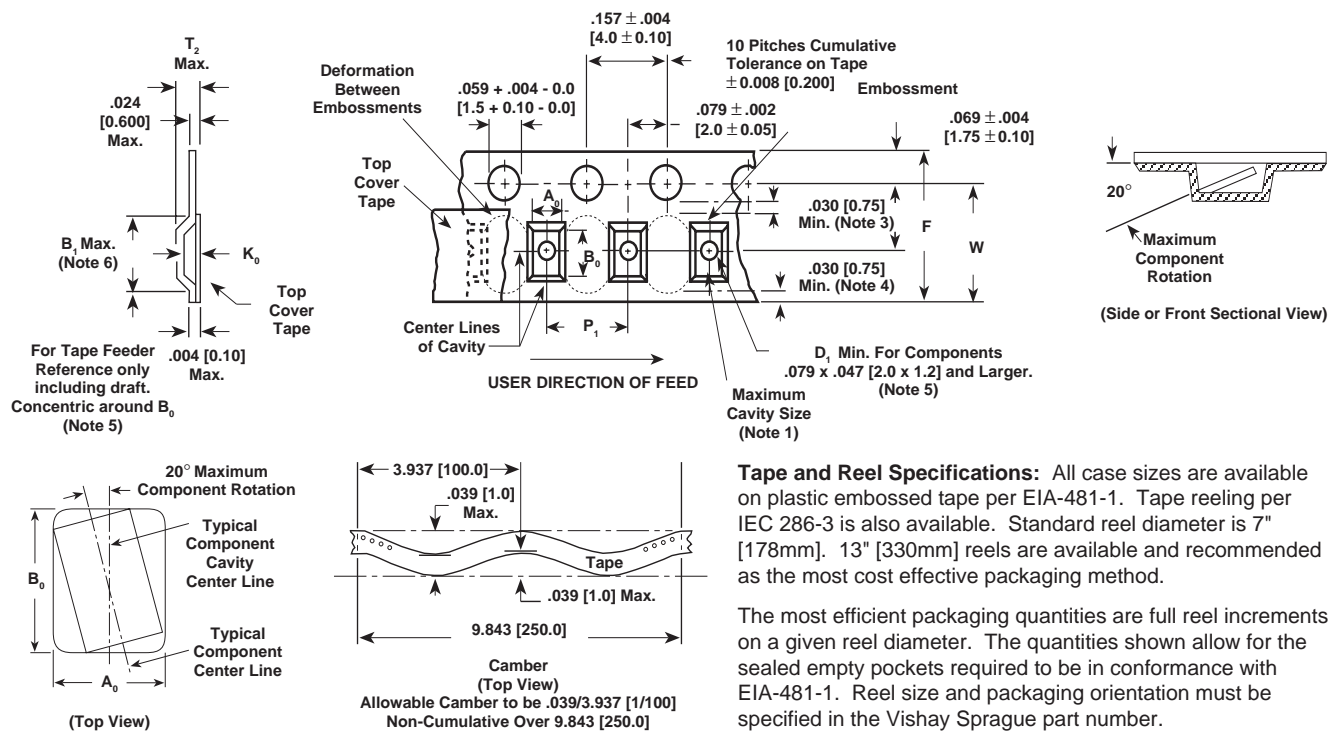
T
REEL SIZE AND PACKAGING

Blank = Bulk Pack
T = Tape and Reel
7" [178mm] Reel
W = 13" [330mm] Reel
See Tape and Reel Specifications.

Note: Parts qualified and identified to tighter capacitance tolerance and/or higher rated voltage, are substitutable for parts ordered to looser capacitance tolerance and/or lower rated voltage, provided other values, such as case size and termination remain the same.

TAPE AND REEL PACKAGING [Numbers in brackets indicate millimeters]

Note: Metric dimensions will govern. Dimensions in inches are rounded and for reference only.



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 ± 0.10]	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 ± 0.10]	1.181 [30.0]	.256 [6.5]	.472 ± .012 [12.0 ± .30]	

Notes:

- $A_0 B_0 K_0$ 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 ($A_0 B_0 K_0$) must be within .002" [0.05mm] minimum and .020" [0.50mm] 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.
- B_1 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
	A	8mm	4mm	2500	10000
	B	12mm	4mm	2000	8000
	C	12mm	8mm	1000	4000
	D	12mm	8mm	1000	4000
	R	12mm	8mm	1000	4000

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

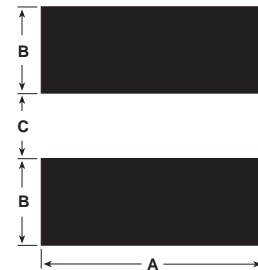
5. **Power Dissipation:** Power dissipation will be affected by the heat sinking capability of the mounting surface. Non-sinusoidal ripple current may produce heating effects which differ from those shown. It is important that the equivalent *I_{rms}* value be established when calculating permissible operating levels. (Power dissipation calculated using + 25°C temperature rise.)

Case Code	Maximum Permissible Power Dissipation @ + 25°C (Watts) in free air
A	0.060
B	0.080
C	0.100
D	0.125
R	0.150

6. **Recommended Mounting Pad Geometries:** 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)
A	.082 [2.1]	.065 [1.7]	.050 [1.3]
B	.120 [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.