

## TC Series Tantalum Solid Electrolytic Capacitors - Resin Molded Chip Type, Standard Type

**TC SERIES:** The TC Series is designed for hybrid circuit and low profile printed circuit board applications where inductance is to be minimized, or where substrate space is at a premium. They can be attached to substrates or circuit boards by dipsoldering, welding, re-flow soldering or other conventional methods. These units have the further advantage of being compatible with automatic assembly equipment-minus the problems associated with flexible terminal lead wires. Our chip tantalums meet all EIA sizes.

### RATINGS

**Capacitance Range:** 0.1 $\mu$ F to 220 $\mu$ F  
**Tolerance Range:** M( $\pm$ 20%), K( $\pm$ 10%)  
**Rated Voltage:** 4V to 50V

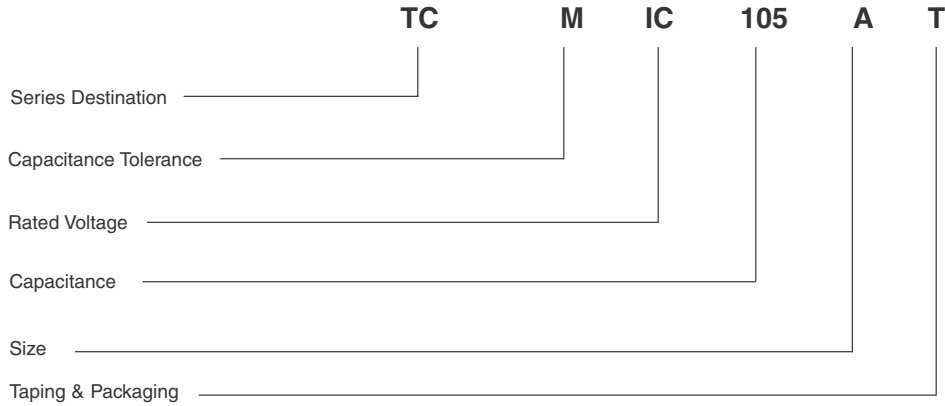


ITEMS		SPECIFICATIONS, PERFORMANCE			TEST CONDITIONS	
Operating Temperature Range		-55°C~+85°C(+125°C)				
Maximum Working Temperature		+85°C (+125°C with derating)			See Table of Standard Ratings	
Rated Voltage Range		4 VDC ~ 50 VCD				
Capacitance Range		0.1 $\mu$ F ~ 220 $\mu$ F				
Standard Capacitance Tolerance		$\pm$ 20% (M) $\pm$ 10%(K)			JIS-C-5102 20°C 120Hz	
Dissipation factor (tan $\delta$ )		0.1~1.0 $\mu$ F	4.0%		JIS-C-5102 20°C 120Hz	
		1.5~100 $\mu$ F	6.0%			
Leakage Current		Not more than 0.01CV or 0.5 $\mu$ A, whichever is greater			JIS-C-5102 20°C (5 minutes) (after rated voltage applied)	
Temperature Stability	Temp.	$\Delta$ C	Max. tan $\delta$		Max. Leakage Current	Procedure: 1. 20 $\pm$ 2°C 2. -55 $^{+0}_{-3}$ °C Stabilized 3. 20 $\pm$ 2°C 15 min. 4. +125 $^{+3}_{-0}$ °C 2 hrs.
	-55°C	Max $\pm$ 12%	0.1 ~ 1.0 $\mu$ F 6.0% 1.5 ~ 100 $\mu$ F 8.0%		NA	
	+125°C	Max. $\pm$ 15%	0.1 ~ 1.0 $\mu$ F 6.0% 1.5 ~ 100 $\mu$ F 8.0%		0.125CV or 6.25 $\mu$ A whichever is greater	
Surge Voltage		Capacitance Change	Less than $\pm$ 5%		JIS-C-5140 and 5102 85°C Surge voltage applied, 1000 times with series resistance of 1000 $\Omega$ for 30 seconds at intermittent intervals of 5 minutes	
		Dissipation Factor	Less than specified value			
		Leakage Current				
Solder Heat Resistance		Withstand solder immersion 5 seconds at 260°C or reflow 10 seconds at 260°C				
Humidity Test		Capacitance Change	Less than $\pm$ 5%		JIS-C-5102 at 60°C humidity 90% ~ 95% RH, 500 Hours	
		Dissipation Factor	Less than initial specified value			
		Leakage Current				
High Temperature Test		Capacitance Change	Less than $\pm$ 10%		JIS-C-5102 85°C, Rated voltage 2000 hours or 125°C Derating voltage 1000 hours with circuit resistance of 1 $\Omega$ /V	
		Dissipation Factor	Less than initial specified value			
		Leakage Current				
Failure Rate at 85°C		1% per 1,000 hours			MTBF 5 X 10 <sup>4</sup> Hr.	

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### Ordering Information & Marking

Ordering Information Example: 1 MFD 16 volt 20%

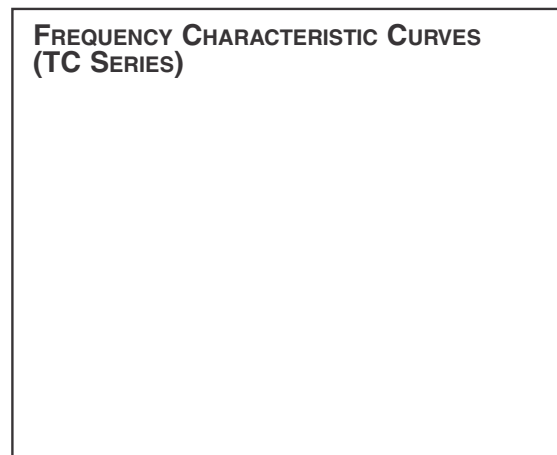
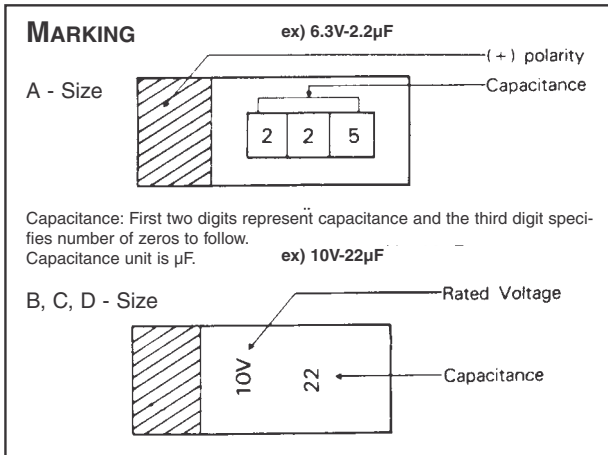


Capacitance Tolerance	±20%	±10%
Code	M	K

Rated Voltage	2	4	6.3	10	16	20	25	35	50
Code	OD	OG	OJ	IA	IC	ID	IE	IV	IX

Capacitance (ex)	0.1 ~ 0.68μF	1.0 ~ 6.8μF	10 ~ 470μF
Code	104 ~ 684	105 ~ 685	106 ~ 477

R: Decimal Point - First two digits represent significant figures and the third digit specifies number of zeros to follow. Capacitance unit is μF.



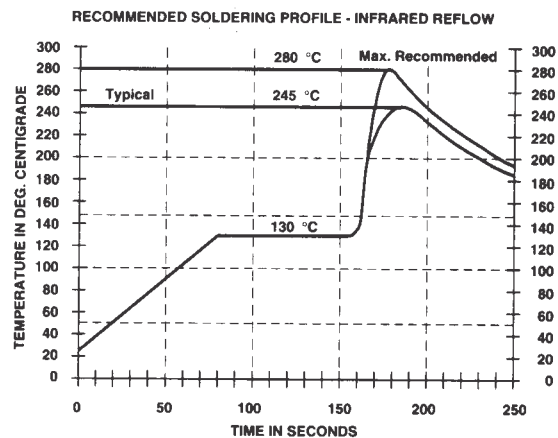
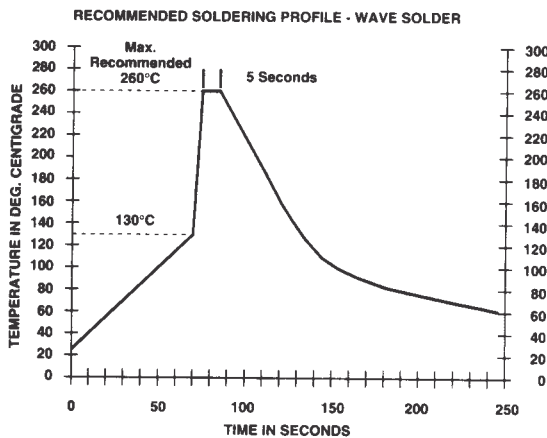
Note: See back cover for low ESR information

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### STANDARD RATINGS AND CASE SIZE DISTRIBUTION\*

Rated Voltage @ +85°C	4	6.3	10	16	20	25	35	50
Surge Voltage @ +85°C	5.2	8	13	20	26	32	46	65
Derated Voltage @ 125°C	2.7	4	7	10	13	17	23	33
Derated Surge Voltage @ +125°C	3.4	5	9	12	16	22	28	40
Capacitance $\mu\text{F}$	STD/EXT	STD/EXT	STD/EXT	STD/EXT	STD/EXT	STD/EXT	STD/EXT	STD/EXT
0.1							A	A
0.15							A	B/A
0.22							A	B
0.33						A	A	B
0.47				A	A	A	B/A	C/B
0.68				A	A	A	B/A	C
1.0			A	A	A	B/A	B/A	C
1.5		A	A	A	/A	B/A	C/B	/C
2.2	A	A	A	B/A	B/A	C/B	C/B	D/C
3.3	A	A	/A	B/A	C/B	C/B	C	D/
4.7	A	/A	B/A	C/B/A	C/B	C/B	D/C	D
6.8	A	B/A	B/A	C/B	C/B	D/C	D/	D/E
10	B/A	B/A	C/B/A	C/B	D/C/B	D/C	D	
15	B/A	A/C/B	D/C/B	C/B	D/C	D/C	D/E	
22	C/B	A/C/B	D/C/B	D/C/B	D/C	D/C	/E	
33	C/B	B/C	D/C/B	D/C/B	/D	E/D		
47	C/B	D/C/B	D/C	/D	D/E	E		
68	D/C	D/	/D	E/D	/E			
100	D/	D/C	E/D	E/D				
150	D/	D/E	D/E					
220	E	D/E	D/E					

\*Letter code after / indicates new extended range. Please indicate size code on ordering.



### NOTES

1. Be sure polarity. Positive (+) side has white belt.
2. For cleaning, freon® TE, TES and TMS are recommended at a temperature less than 50°C for a period less than 5 minutes.
3. When ultrasonic cleaning is necessary, fixing capacitor body by epoxy adhesive before soldering is recommended.  
Establish adequate cleaning conditions by experiment to avoid damaging capacitor terminations.
4. Limit reverse voltage to 1.0V or less than 5% of rated voltage whichever is smaller.
5. In case of low impedance circuit use (Less than 3  $\Omega/V$ ), adequate voltage derating is recommended to improve M.T.B.F.
6. In case of automatic mounting, the tweezer pressure shall be less than 500 grams and should not exceed 5 seconds.

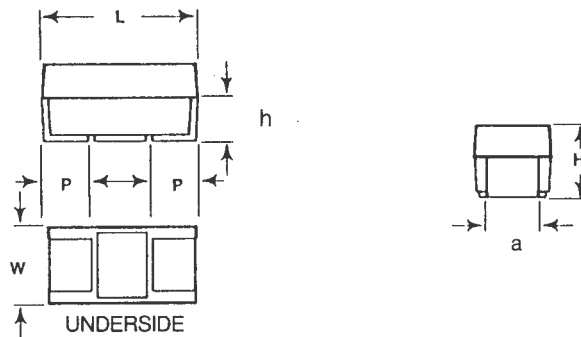
## TC Series Tantalum Solid Electrolytic Capacitors - Resin Molded Chip Type, Standard Type

MAX ESR ( $\Omega$ ) @ 100kHz, +25°C / BY VALUE AND CASE SIZE

VW (V) CAP ( $\mu$ F)	4.0	6.3	10	16	20	25	35	50
0.1							A 24.0	A 22.0
0.15							A 21.0	A 20.0 B 17.0
0.22							A 18.0	B 14.0
0.33							A 15.0	B 12.0
0.47						A 14.0	A 12.0 B 10.0 C 8.0	B 10.0 C 8.0
0.68					A 12.0	A 10.0	A 9.0 B 8.0	C 7.5
1.0				A 11.0	A 10.0	A 9.0 B 7.0	B 6.5	C 5.5
1.5			A 10.0	A 8.0	A 7.5	B 5.5	B 5.2 C 4.5	C 4.0
2.2		A 9.0	A 7.5	A 7.0 B 5.5	B 5.0	B 4.5	C 3.5	C 3.5 D 2.5
3.3	A 9.0	A 7.5	A 6.5	A 6.2 B 4.4	B 3.8	B 3.6 C 2.8	C 2.5	D 2.0
4.7	A 7.5	A 6.5	A 6.0 B 4.0	B 3.6	B 3.5 C 2.8	C 2.4	C 2.2 D 1.5	D 1.4
6.8	A 6.5	A 6.0 B 4.0	B 3.5	B 3.3 C 2.6	C 2.4	C 2.0 D 1.4	D 1.3	E 1.2
10	A 6.0 B 4.0	B 3.5	B 3.2 C 2.5	B 2.4 C 2.2	C 2.0 D 1.3	C 1.8 D 1.2	D 1.0	
15	B 3.5	B 3.2 C 2.5	B 2.4 C 2.2	C 1.8	C 1.7 D 1.1	D 1.0	E 0.8	
22	B 3.2 C 2.5	B 2.4 C 2.2	B 2.5 C 1.8	B 2.3 C 1.6 D 1.1	C 1.5 D 0.9	D 0.8	E 0.7	
33	B 2.4 C 2.2	B 2.0 C 1.8	C 1.6 D 1.1	C 1.2 D 0.9	D 0.8	E 0.7		
47	C 1.8	C 1.6 D 1.1	C 1.6 D 0.9	D 0.8	D 0.7 E 0.9	E 0.9		
68	C 1.6 D 1.1	D 0.9	D 0.8	D 0.7 E 0.8	E 0.6			
100	D 0.9	D 0.8	D 0.7 E 0.7	D 0.7 E 0.7				
150	D 0.7	D 0.6 E 0.6	D 0.8 E 0.6					
220	E 0.6	D 0.7 E 0.6	D 0.9 E 0.6					

MAX RIPPLE CURRENT (Arms) @ 100kHz, +25°C / BY VALUE AND CASE SIZE

VW (V) CAP ( $\mu$ F)	4.0	6.3	10	16	20	25	35	50
0.1							A0.054	A0.056
0.15							A0.058	A0.059 B0.069
0.22							A0.062	B0.076
0.33							A 0.068	B0.076 B0.082
0.47						A0.071	A0.076 B0.089	B0.089 C0.117
0.68					A0.076	A0.084	A0.088 B0.100	C0.121
1.0					A0.080	A0.084	A0.088 B0.107	B0.111 C0.141
1.5				A0.084	A0.094	A0.097	B0.121	B0.124 C0.156
2.2		A0.088	A0.097	B0.100 B0.121	B0.126	B0.133	C0.177	C0.177 D0.249
3.3	A0.088	A0.097	A0.104	A0.106 B0.135	B0.145	B0.149 C0.198	C0.210	C0.210 D0.274
4.7	A0.097	A0.104	A0.108 B0.141	B0.149	B0.151 C0.198	C0.214	C0.224 D 0.316	D0.327
6.8	A0.104	A0.108 B0.141	B0.151	B0.156 C 0.206	C0.214	C0.235 D0.327	D0.340	D0.340 E0.371
10	A0.108 B0.141	B0.151	B0.158 C0.210	B 0.183 C 0.224	C0.235 D0.340	C 0.247 D0.354	D0.387	
15	B0.151	B0.158 C0.210	B0.183 C0.224	C0.247	C0.254 D0.369	D0.387	E0.454	
22	B0.158 C0.210	B0.183 C0.224	B0.208 C0.247	B0.35 C0.262 D0.369	C0.277 D0.408	D0.433	E0.486	
33	B0.183 C0.224	B0.208 C0.247	C0.262 D0.369	C0.277 D0.408	D0.433	E0.486		
47	C0.247	C0.262 D0.369	C0.277 D0.408	D0.433	D0.486 E0.454	E0.524		
68	C0.262 D0.369	D0.408	D0.433	D0.463 E0.454	E0.486			
100	D0.408	D0.8	D0.462 E0.486	D0.463 E0.486				
150	D0.463	D0.486 E0.524	D0.524 E0.524					
220	E0.524	E0.524 D0.486	E0.524 D0.524					

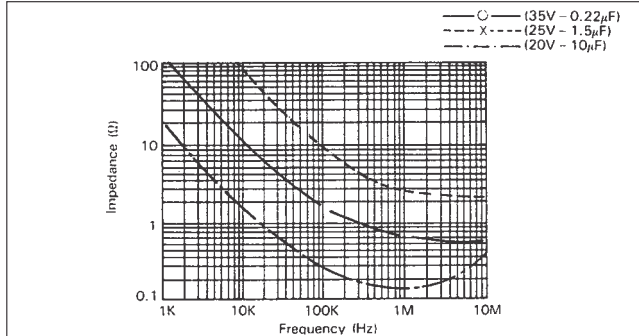


Dimensions in mm

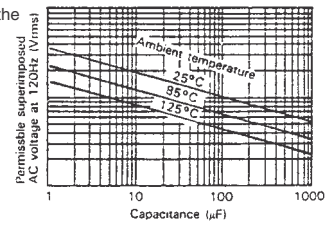
EIA Case Code	L $\pm 0.2$	W $\pm 0.2$	H $\pm 0.2$	P $\pm 0.3$	a $\pm 0.2$	h(min)
A(3216)	3.2	1.6	1.7	0.8	1.2	0.7
B(3528)	3.5	2.8	1.9	0.8	2.2	0.7
C(6032)	6.0	3.2	2.5	1.3	2.2	1.0
D(7343)	7.3	4.3	2.9	1.3	2.4	1.0
E(7343H)	7.3	4.3	4.0	1.3	2.4	1.0

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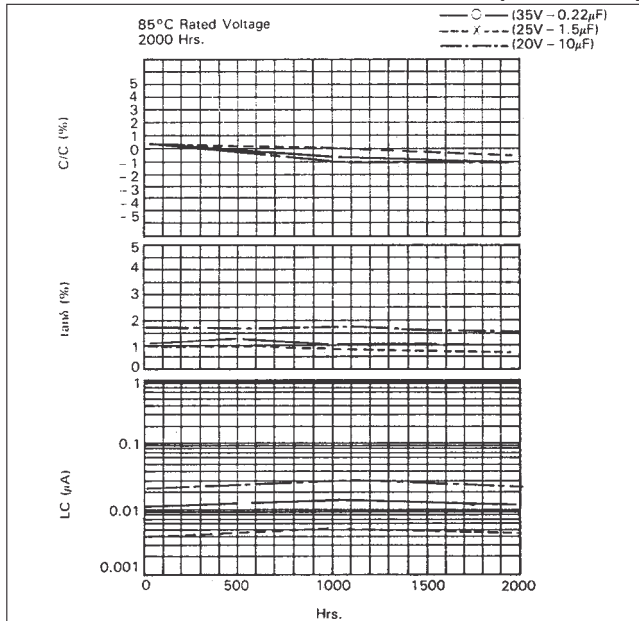
### CHARACTERISTIC DATA & CURVES



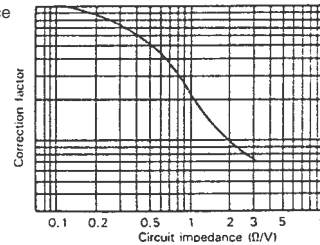
Frequency Dependence of the Permissible Superimposed AC Voltage



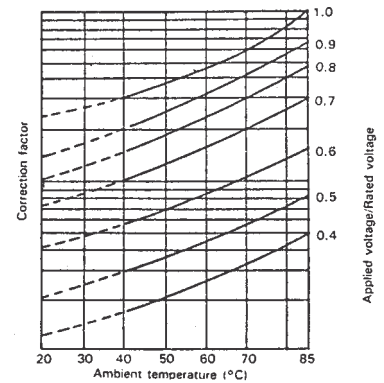
### LOAD LIFE CHARACTERISTIC CURVES (TC SERIES)



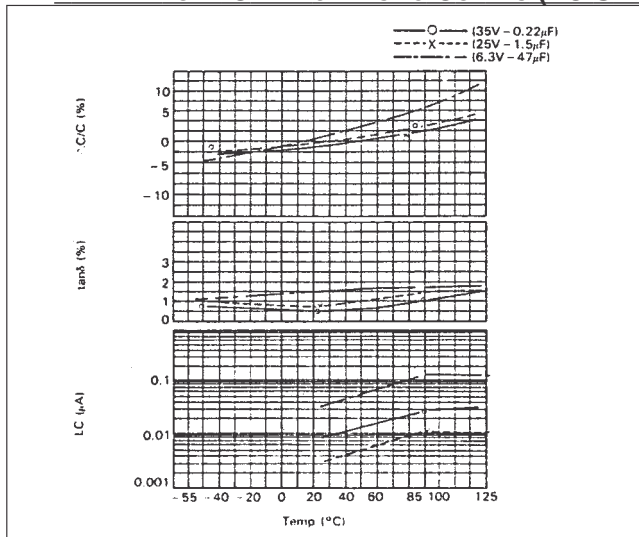
Effect of Circuit Impedance on the Failure Rate



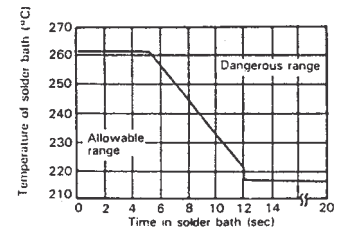
Effect of the Applied Voltage and Ambient Temperature on the Failure Rate



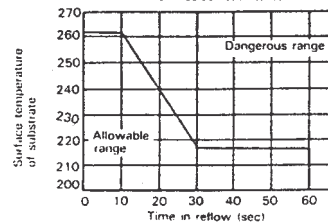
### TEMPERATURE CHARACTERISTIC CURVES (TC SERIES)



Immersion Method



Reflow Method

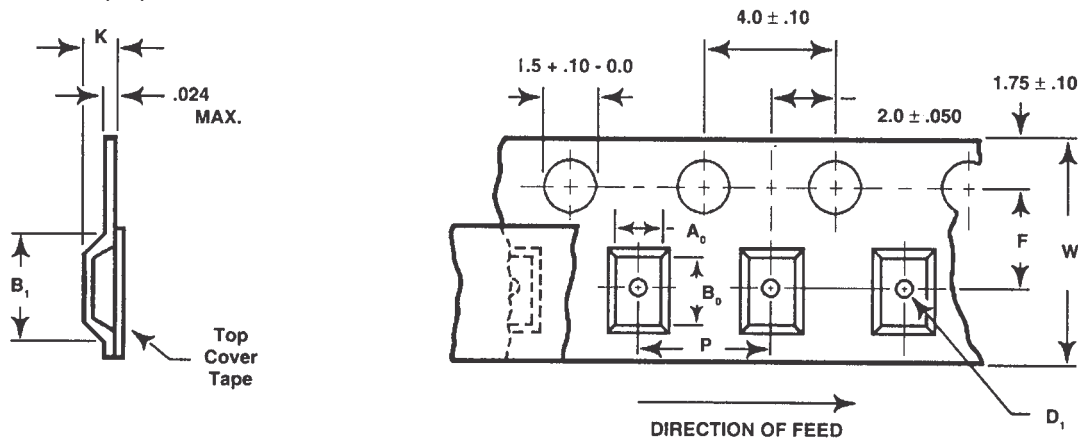


## TC Series Tantalum Solid Electrolytic Capacitors - Resin Molded Chip Type, Standard Type

### TAPING SPECIFICATIONS

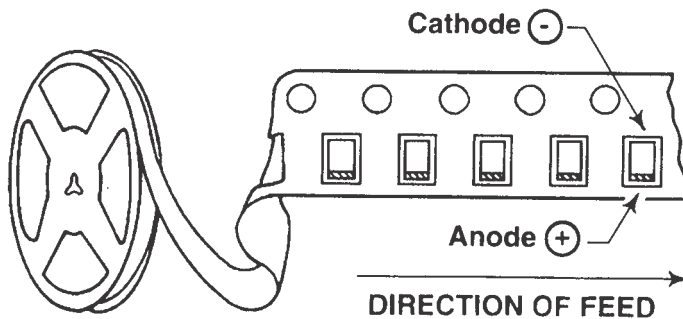
Dimensions in mm

Embossed Plastic Tape per EIA-481-1



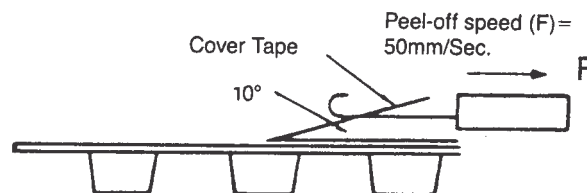
EIA SIZE	CASE CODE	$A_0 \pm 0.2$	$B_0 \pm 0.2$	W	F	P	$D_1$	$B_1$	$K_{MAX}$	TAPE SIZE	QUANTITY PER REEL	
											7" REEL	13" REEL
3216	A	1.9	3.9	$8.0 \pm .30$	$3.5 \pm .05$	4.0	1.0	4.2	2.4	8mm	2000	9000
3528	B	3.1	3.9	$8.0 \pm .30$	$3.5 \pm .05$	4.0	1.0	4.2	2.4	8mm	2000	8000
6032	C	3.9	6.3	$12.0 \pm .30$	$5.5 \pm .05$	8.0	1.5	8.2	4.5	12mm	500	3000
7343	D	4.7	7.7	$12.0 \pm .30$	$5.5 \pm .05$	8.0	1.5	8.2	4.5	12mm	500	2500
7343H	E	4.7	7.7	$12.0 \pm .30$	$5.5 \pm .05$	8.0	1.5	8.2	4.5	12mm	500	2500

### STANDARD ORIENTATION



Standard reel diameter is 7" and 13" reels are available on special order with (13) added to the end of the part number.

- Cover tape peel-off specification
1. Peel-off speed: 300 mm/min.
  2. Peel-off force:  $F = 30 - 75g$
  3. Peel-off angle:  $\Theta = 0 - 15^\circ$

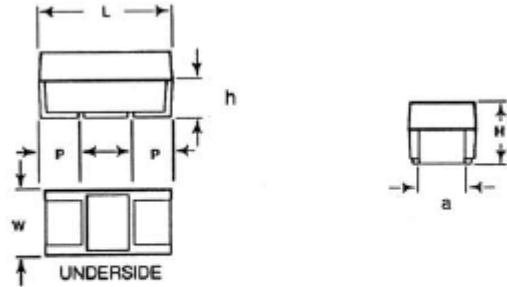


## Low ESR Tantalum Capacitors

CAPACITANCE RANGE (letter equivalent to case size)

Uf	6.3V	10V	16V	20V	25V	35V
4.7						C-600
10					C-500	
15				C-450		D-300
22			C-375		D-200	E-300
33		C-375		D-200	E-250	
47		C-350	D-175			
68				E-200		
100		D-100	D-125			
		E-125	E-150			
150	D-125					
220		E-125				

ESR limits quoted next to case size in mega Ohms



### Dimensions in mm

EIA Case Code	L $\pm 0.2$	W $\pm 0.2$	H $\pm 0.2$	P $\pm 0.3$	a $\pm 0.2$	h(min)
C(6032)	6.0	3.2	2.5	1.3	2.2	1.0
D(7343)	7.3	4.3	2.9	1.3	2.4	1.0
E(7343H)	7.3	4.3	4.0	1.3	2.4	1.0