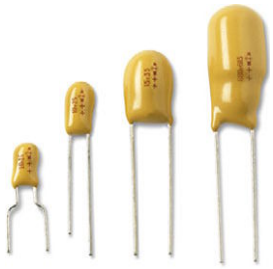
Resin-Coated, Radial-Lead Solid Tantalum Capacitors



FEATURES

- Terminations: standard SnPb, 100 % tin available
- Large capacitance range
- Encapsulated in a hard yellow epoxy resin
- Variety of lead styles available
- Supplied on tape (reel or ammopack) or in bulk
- Low impedance and ESR at high frequencies
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Pb-free Available

RoHS* Available

Note

* This datasheet provides information about parts that are RoHS-compliant and / or parts that are non RoHS-compliant. For example, parts with lead (Pb) terminations are not RoHS-compliant. Please see the information / tables in this datasheet for details

ELECTRICAL CHARACTERISTICS

Operating Temperature:

Type 489D: -55 °C to +85 °C

Type 499D: -55 °C to +125 °C
(above 85 °C, voltage derating is required)

APPLICATIONS

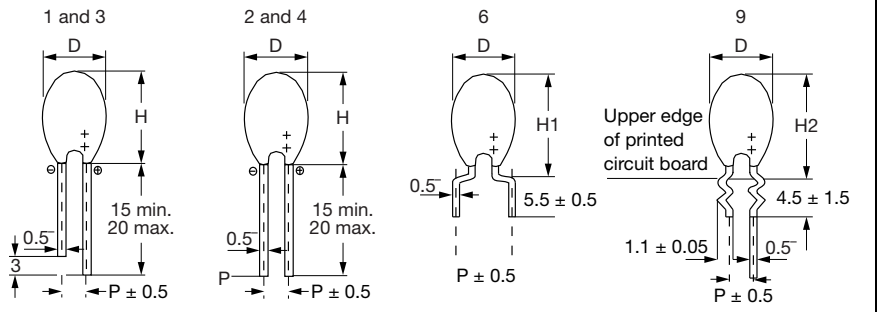
Offer a very cost effective solution in the consumer, industrial and professional electronics markets. The capacitors are intended for high volume applications.

ORDERING INFORMATION

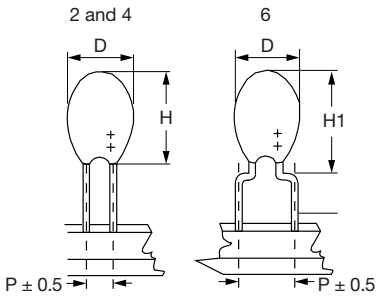
489D	686	X0	6R3	D	2	A	E3
TYPE	CAPACITANCE	CAPACITANCE TOLERANCE	DC VOLTAGE RATING AT +85 °C	CASE CODE	LEAD STYLE	PACKAGING	RoHS-COMPLIANT
489D Standard +85 °C **499D** Standard +125 °C Low IL	Expressed in picofarads. The first two digits are the significant figures. The third is the number of zeros following.	X0 = ± 20 % X9 = ± 10 %	Expressed by zeros if needed to complete the 3 digit block. A decimal point is indicated by an "R" (6R3 = 6.3 V).	See Ratings and Case Codes table	1, 2, 3, 4, 6, 9 See description on next pages	A = ammopack B = reel pack, positive leader C = reel pack, negative leader V = bulk pack	E3 = 100 % tin termination (RoHS-compliant design) Blank = SnPb termination (standard design)

LEAD STYLE CONFIGURATIONS, PACKAGING OPTIONS, AND DIMENSIONS in inches [millimeters]

Bulk lead styles



Tape (reel / ammo) lead styles



PACKAGING		BULK						TAPE (REEL / AMMO BOX)			
LEAD STYLES		1, 2, 3, 4		6		9		2, 4		6	
CASE	D (MAX.)	P [1] ± 0.020 [0.50]	H (MAX.)	P [1] ± 0.020 [0.50]	H1 (MAX.)	P [1] ± 0.020 [0.50]	H2 (MAX.)	P [1] ± 0.020 [0.50]	H (MAX.)	P [1] ± 0.020 [0.50]	H1 (MAX.)
A	0.146 [3.70]	0.100 [2.54]	0.276 [7.0]	0.200 [5.08]	0.433 [11.0]	0.200 [5.08]	0.394 [10.0]	0.100 [2.54]	0.276 [7.0]	0.200 [5.08]	0.433 [11.0]
B	0.157 [4.00]	0.100 [2.54]	0.295 [7.50]	0.200 [5.08]	0.453 [11.5]	0.200 [5.08]	0.413 [10.5]	0.100 [2.54]	0.295 [7.50]	0.200 [5.08]	0.453 [11.5]
C	0.177 [4.50]	0.100 [2.54]	0.315 [8.0]	0.200 [5.08]	0.472 [12.0]	0.200 [5.08]	0.433 [11.0]	0.100 [2.54]	0.315 [8.0]	0.200 [5.08]	0.472 [12.0]
D	0.197 [5.00]	0.100 [2.54]	0.354 [9.0]	0.200 [5.08]	0.512 [13.0]	0.200 [5.08]	0.472 [12.0]	0.100 [2.54]	0.354 [9.0]	0.200 [5.08]	0.512 [13.0]
E	0.217 [5.50]	0.100 [2.54]	0.394 [10.0]	0.200 [5.08]	0.551 [14.0]	0.200 [5.08]	0.512 [13.0]	0.100 [2.54]	0.394 [10.0]	0.200 [5.08]	0.551 [14.0]
F	0.236 [6.00]	0.100 [2.54]	0.433 [11.0]	0.200 [5.08]	0.591 [15.0]	0.200 [5.08]	0.551 [14.0]	0.100 [2.54]	0.433 [11.0]	0.200 [5.08]	0.591 [15.0]
H	0.260 [6.50]	0.100 [2.54]	0.472 [12.0]	0.200 [5.08]	0.623 [16.0]	0.200 [5.08]	0.591 [15.0]	0.100 [2.54]	0.472 [12.0]	0.200 [5.08]	0.623 [16.0]
M	0.394 [10.0]	0.200 [5.08]	0.571 [14.5]	n/a	n/a	0.200 [5.08]	0.709 [18.0]	0.200 [5.08]	0.571 [14.5]	n/a	n/a
N	0.433 [11.0]	0.200 [5.08]	0.623 [16.0]	n/a	n/a	0.200 [5.08]	0.748 [19.0]	0.200 [5.08]	0.623 [16.0]	n/a	n/a
R	0.472 [12.0]	0.200 [5.08]	0.748 [19.0]	n/a	n/a	0.200 [5.08]	0.866 [22.0]	n/a	n/a	n/a	n/a

Note

[1] Pitch or lead spacing P measured within 0.05" [1.27 mm] of the body of the capacitor or from the bottom of the crimp

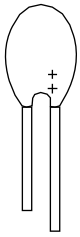
LEAD STYLE

LEAD STYLE 1:

Straight leads,
0.1" [2.5 mm] lead space,
uneven length

LEAD STYLE 3:

Straight leads,
0.2" [5 mm] lead space,
uneven length

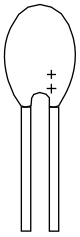


LEAD STYLE 2:

Straight leads,
0.1" [2.5 mm] lead space,
even length

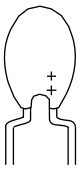
LEAD STYLE 4:

Straight leads,
0.2" [5 mm] lead space,
even length



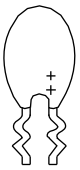
LEAD STYLE 6:

Shouldered leads,
0.2" [5 mm] lead space



LEAD STYLE 9:

Snap-In leads,
0.2" [5 mm] lead space



RATINGS, CASE CODES, AND LEAD STYLE

C_R µF	RATED VOLTAGE U_R AT +85 °C								LEAD STYLE	
	3.0 V	6.3 V	10 V	16 V	20 V	25 V	35 V	50 V	BULK	AMMO / REEL
0.10							A	A	1, 2, 6, 9	2, 6
0.15							A	A		
0.22							A	A		
0.33							A	B		
0.47							A	B		
0.68							B	C		
1.0						A	B	D		
1.5					A	B	C	E		
2.2				A	B	B	C	F		
3.3			A	B	C	C	D	F		
4.7		A	A	B	C	C	D	H		
6.8	A	A	B	C	D	D	E	N	3, 4, 9	4 (except R case)
10	B	B	B	C	D	D	F	N		
15	B	B	C	D	E	E	M	N		
22	C	C	C	D	F	H	M	N		
33	C	C	D	E	H	M	N			
47	D	D	D	F	M	M	N			
68	D	D	E	M	N	N				
100	E	E	M	N	N					
150	H	M	M	N						
220	M	M	N	R						
330	N	N	R							
470	N	R								
680	R	R								

STANDARD RATINGS

CAPACITANCE C_R (µF)	CASE CODE	PART NUMBER	MAX. DCL AT +25 °C (µA) 489D	MAX. DCL AT +25 °C (µA) 499D	MAX. DF, 100 Hz AT +25 °C (%) 489D, 499D
U_R = 3 V_{DC} AT +85 °C, SURGE = 4 V; U_C = 2 V_{DC} AT +125 °C, SURGE = 2.6 V (ONLY 499D)					
6.8	A	489D685X(*)003A_ _	1.0	0.5	6
10	B	489D106X(*)003B_ _	1.0	0.5	8
15	B	489D156X(*)003B_ _	1.0	0.5	8
22	C	489D226X(*)003C_ _	1.0	0.5	8
33	C	489D336X(*)003C_ _	1.4	0.7	8
47	D	489D476X(*)003D_ _	2.1	1.1	8
68	D	489D686X(*)003D_ _	3.0	1.6	8
100	E	489D107X(*)003E_ _	4.5	2.4	10
150	H	489D157X(*)003H_ _	6.7	3.6	10
220	M	489D227X(*)003M_ _	9.9	5.2	10
330	N	489D337X(*)003N_ _	14.8	7.9	10
470	N	489D477X(*)003N_ _	21.1	11.2	12
680	R	489D687X(*)003R_ _	30.6	16.3	12
U_R = 6.3 V_{DC} AT +85 °C, SURGE = 8 V; U_C = 4 V_{DC} AT +125 °C, SURGE = 5.2 V (ONLY 499D)					
4.7	A	489D475X(*)6R3A_ _	1.0	0.5	6
6.8	A	489D685X(*)6R3A_ _	1.0	0.5	6
10	B	489D106X(*)6R3B_ _	1.0	0.5	8
15	B	489D156X(*)6R3B_ _	1.4	0.7	8
22	C	489D226X(*)6R3C_ _	2.0	1.1	8
33	C	489D336X(*)6R3C_ _	3.1	1.6	8
47	D	489D476X(*)6R3D_ _	4.4	2.3	8
68	D	489D686X(*)6R3D_ _	6.4	3.4	8
100	E	489D107X(*)6R3E_ _	9.4	5.0	10
150	M	489D157X(*)6R3M_ _	14.1	7.5	10
220	M	489D227X(*)6R3M_ _	20.7	11.0	10
330	N	489D337X(*)6R3N_ _	31.1	16.6	10
470	R	489D477X(*)6R3R_ _	44.4	23.6	12
680	R	489D687X(*)6R3R_ _	64.2	34.2	12
U_R = 10 V_{DC} AT +85 °C, SURGE = 13 V; U_C = 7 V_{DC} AT +125 °C, SURGE = 8.6 V (ONLY 499D)					
3.3	A	489D335X(*)010A_ _	1.0	0.5	6
4.7	A	489D475X(*)010A_ _	1.0	0.5	6
6.8	B	489D685X(*)010B_ _	1.0	0.5	6
10	B	489D106X(*)010B_ _	1.5	0.8	8
15	C	489D156X(*)010C_ _	2.2	1.2	8
22	C	489D226X(*)010C_ _	3.3	1.7	8
33	D	489D336X(*)010D_ _	4.9	2.6	8
47	D	489D476X(*)010D_ _	7.0	3.7	8
68	E	489D686X(*)010E_ _	10.2	5.4	8
100	M	489D107X(*)010M_ _	15.0	8.0	10
150	M	489D157X(*)010M_ _	22.5	12.0	10
220	N	489D227X(*)010N_ _	33.0	17.6	10
330	R	489D337X(*)010R_ _	49.5	26.4	10

Note

489D Type part number 489D, 499D
(*) Insert 0 for ± 20 % tolerance or 9 for ± 10 %
_ _ Case code / lead style see case code table

STANDARD RATINGS

CAPACITANCE C_R (µF)	CASE CODE	PART NUMBER	MAX. DCL AT +25 °C (µA) 489D	MAX. DCL AT +25 °C (µA) 499D	MAX. DF, 100 Hz AT +25 °C (%) 489D, 499D
U_R = 16 V_{DC} AT +85 °C, SURGE = 20 V; U_C = 10 V_{DC} AT +125 °C, SURGE = 13 V (ONLY 499D)					
2.2	A	489D225X(*)016A_ _	1.0	0.5	6
3.3	B	489D335X(*)016B_ _	1.0	0.5	6
4.7	B	489D475X(*)016B_ _	1.1	0.6	6
6.8	C	489D685X(*)016C_ _	1.6	0.8	6
10	C	489D106X(*)016C_ _	2.4	1.2	8
15	D	489D156X(*)016D_ _	3.6	1.9	8
22	D	489D226X(*)016D_ _	5.2	2.8	8
33	E	489D336X(*)016E_ _	7.9	4.2	8
47	F	489D476X(*)016F_ _	11.2	6.0	8
68	M	489D686X(*)016M_ _	16.3	8.7	8
100	N	489D107X(*)016N_ _	24.0	12.8	10
150	N	489D157X(*)016N_ _	36.0	19.2	10
220	R	489D227X(*)016R_ _	52.8	28.1	10
U_R = 20 V_{DC} AT +85 °C, SURGE = 26 V; U_C = 13 V_{DC} AT +125 °C, SURGE = 16 V (ONLY 499D)					
1.5	A	489D155X(*)020A_ _	1.0	0.5	4
2.2	B	489D225X(*)020B_ _	1.0	0.5	6
3.3	C	489D335X(*)020C_ _	1.0	0.5	6
4.7	C	489D475X(*)020C_ _	1.4	0.7	6
6.8	D	489D685X(*)020D_ _	2.0	1.0	6
10	D	489D106X(*)020D_ _	3.0	1.6	8
15	E	489D156X(*)020E_ _	4.5	2.4	8
22	F	489D226X(*)020F_ _	6.6	3.5	8
33	H	489D336X(*)020H_ _	9.9	5.2	8
47	M	489D476X(*)020M_ _	14.1	7.5	8
68	N	489D686X(*)020N_ _	20.4	10.8	8
100	N	489D107X(*)020N_ _	30.0	16.0	10
U_R = 25 V_{DC} AT +85 °C, SURGE = 32 V; U_C = 17 V_{DC} AT +125 °C, SURGE = 21 V (ONLY 499D)					
1.0	A	489D105X(*)025A_ _	1.0	0.5	4
1.5	B	489D155X(*)025B_ _	1.0	0.5	4
2.2	B	489D225X(*)025B_ _	1.0	0.5	6
3.3	C	489D335X(*)025C_ _	1.2	0.6	6
4.7	C	489D475X(*)025C_ _	1.7	0.9	6
6.8	D	489D685X(*)025D_ _	2.5	1.3	6
10	D	489D106X(*)025D_ _	3.7	2.0	8
15	E	489D156X(*)025E_ _	5.6	3.0	8
22	H	489D226X(*)025H_ _	8.2	4.4	8
33	M	489D336X(*)025M_ _	12.3	6.6	8
47	M	489D476X(*)025M_ _	17.6	9.4	8
68	N	489D686X(*)025N_ _	25.5	13.6	8

Note

489D Type part number 489D, 499D
(*) Insert 0 for ± 20 % tolerance or 9 for ± 10 %
_ _ Case code / lead style see case code table

STANDARD RATINGS

CAPACITANCE C_R (µF)	CASE CODE	PART NUMBER	MAX. DCL AT +25 °C (µA) 489D	MAX. DCL AT +25 °C (µA) 499D	MAX. DF, 100 Hz AT +25 °C (%) 489D, 499D
U_R = 35 V_{DC} AT +85 °C, SURGE = 46 V; U_C = 23 V_{DC} AT +125 °C, SURGE = 28 V (ONLY 499D)					
0.10	A	489D104X(*)035A_ _	1.0	0.5	4
0.15	A	489D154X(*)035A_ _	1.0	0.5	4
0.22	A	489D224X(*)035A_ _	1.0	0.5	4
0.33	A	489D334X(*)035A_ _	1.0	0.5	4
0.47	A	489D474X(*)035A_ _	1.0	0.5	4
0.68	B	489D684X(*)035B_ _	1.0	0.5	4
1.0	B	489D105X(*)035B_ _	1.0	0.5	4
1.5	C	489D155X(*)035C_ _	1.0	0.5	4
2.2	C	489D225X(*)035C_ _	1.1	0.6	6
3.3	D	489D335X(*)035D_ _	1.7	0.9	6
4.7	D	489D475X(*)035D_ _	2.4	1.3	6
6.8	E	489D685X(*)035E_ _	3.5	1.9	6
10	F	489D106X(*)035F_ _	5.2	2.8	8
15	M	489D156X(*)035M_ _	7.8	4.2	8
22	M	489D226X(*)035M_ _	11.5	6.1	8
33	N	489D336X(*)035N_ _	17.3	9.2	8
47	N	489D476X(*)035N_ _	24.6	13.1	8
U_R = 50 V_{DC} AT +85 °C, SURGE = 65 V; U_C = 33 V_{DC} AT +125 °C, SURGE = 40 V (ONLY 499D)					
0.10	A	489D104X(*)050A_ _	1.0	0.5	4
0.15	A	489D154X(*)050A_ _	1.0	0.5	4
0.22	A	489D224X(*)050A_ _	1.0	0.5	4
0.33	B	489D334X(*)050B_ _	1.0	0.5	4
0.47	B	489D474X(*)050B_ _	1.0	0.5	4
0.68	C	489D684X(*)050C_ _	1.0	0.5	4
1.0	D	489D105X(*)050D_ _	1.0	0.5	4
1.5	E	489D155X(*)050E_ _	1.1	0.6	4
2.2	F	489D225X(*)050F_ _	1.6	0.8	6
3.3	F	489D335X(*)050F_ _	2.4	1.3	6
4.7	H	489D475X(*)050H_ _	3.5	1.8	6
6.8	N	489D685X(*)050N_ _	5.1	2.7	6
10	N	489D106X(*)050N_ _	7.5	4.0	8
15	N	489D156X(*)050N_ _	11.2	6.0	8
22	N	489D226X(*)050N_ _	16.5	8.8	8

Note

489D Type part number 489D, 499D
(*) Insert 0 for ± 20 % tolerance or 9 for ± 10 %
_ _ Case code / lead style see case code table

PACKAGING QUANTITIES

CASE CODE	A	B	C	D	E	F	H	M	N	R
BULK	500							100		
AMMOPACK	2500		2000		1500			500		
REEL PACK	2500		2000		1500			500		

PERFORMANCE CHARACTERISTICS

1. **Operating Temperature:** -55 °C to +85 °C with rated DC voltage U_R applied. +85 °C to +125° C with linear voltage derating to category voltage UC for 499D only (see general information)
2. **Capacitance and Tolerance:** capacitance measured at 100 Hz and +25 °C shall be within the specified tolerance limits of the nominal rating. Capacitance measurement shall be made by means of a polarized capacitance bridge. No polarizing voltage is required. The maximum voltage applied during measurements shall be 0.5 V_{RMS} at 100 Hz and +25 °C.
3. **Reverse Voltage:** these capacitors are capable of withstanding peak voltage in the reverse direction equal to:
   15 % of the rated DC voltage at +20 °C
   10 % of the rated DC voltage at +25 °C
   5 % of the rated DC voltage at +85 °C
4. **Surge Voltage:**

DC rated voltage at +85 °C (V)	3	6.3	10	16	20	25	35	50
DC surge voltage at +85 °C (V)	4	8	13	20	26	32	46	65
DC rated voltage at +125 °C (V) (1)	2	4	7	10	13	17	23	33
DC surge voltage at +125 °C (V) (1)	2.6	5.2	8.6	13	16	21	28	40

Note
(1) For 499D

Capacitors shall withstand the surge voltage applied in series with a 1000 Ω (± 5 %) resistor, at the rate of 1.5 min on, 5.5 min off for 1000 successive test cycles at +85 °C.

5. **Stability at low and high temperatures:**

After test, capacitance change shall not exceed 10 % of initial value, dissipation factor and DC leakage current shall meet initial requirements at +25 °C - Table 2.

6. **Life Test:** after 2000 h at +85 °C with rated DC voltage applied, or after 1000 h at +125 °C. With derated DC voltage (only for 499D), capacitors shall meet the requirements in table below.

Capacitance change	Within ± 10 % of initial value
DC leakage current	Within initial requirements at +25 °C
Dissipation factor	Within initial requirements at +25 °C

7. **Humidity Test:** after 21 days (504 h) (1) at +40 °C, 90 % to 95 % of relative humidity (per IEC 68-2-3) with no voltage applied, capacitors shall meet the requirements in table below.

Capacitance change	Within ± 5 % of initial value
DC leakage current	Within initial requirements at +25 °C - Table 2
Dissipation factor	Within initial requirements at +25 °C - Table 2

Note
(1) Humidity test is 56 days (1350 hours) for 499D

8. **Marking:** the capacitors shall be marked with the rated capacitance and the rated DC working voltage. A code may be used for both capacitance and voltage. Units rated at 6.3 volts are usually marked as 6 volts. The package shall be marked with full Vishay part number, date code, and quantity.

489D - Table 2A

TEMP.	CAPACITANCE CHANGE	DC LEAKAGE CURRENT (1)	DISSIPATION FACTOR AT 100 Hz	
-55 °C	-10 % of initial value	----------	$C_R \leq 1.5$ µF	4 % max.
+25 °C	----------	0.015 C_R x U_R or 1 µA, whichever is greater	1.5 µF < C_R < 10 µF	6 % max.
			10 µF < C_R < 100 µF	8 % max.
+85 °C	+10 % of initial value	0.15 C_R x U_R or 10 µA, whichever is greater	100 µF ≤ C_R ≤ 330 µF	10 % max.
			330 µF < C_R	12 % max.

TEMP.	CAPACITANCE CHANGE	DC LEAKAGE CURRENT (1)	DISSIPATION FACTOR AT 100 Hz	
-55 °C	-10 % of initial value	----------		
+25 °C	----------	0.008 C_R x U_R or 0.5 µA, whichever is greater	$C_R \leq 1.5$ µF	4 % max.
			1.5 µF < C_R < 10 µF	6 % max.
+85 °C	+10 % of initial value	0.08 C_R x U_R or 5 µA, whichever is greater	10 µF < C_R < 100 µF	8 % max.
			100 µF ≤ C_R ≤ 330 µF	10 % max.
+125 °C (2)	+10 % of initial value	0.1 C_R x U_R or 6.25 µA, whichever is greater	330 µF < C_R	12 % max.

Notes
(1) Rated voltage applied for 5 min with a series resistor of 1000 Ω
(2) Only for 499D

GUIDE TO APPLICATION

1. **AC 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 W at +25 °C as given below

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

2. **AC Ripple Voltage:** the maximum allowable ripple voltage shall be determined from the formula:

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

where,

Z = the capacitor impedance at the specified frequency

3. **AC Ripple Current or Voltage Derating Factor:** 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 in the table below:

TEMPERATURE	DERATING FACTOR
+25 °C	1.0
+55 °C	0.9
+85 °C	0.8
+125 °C	0.4

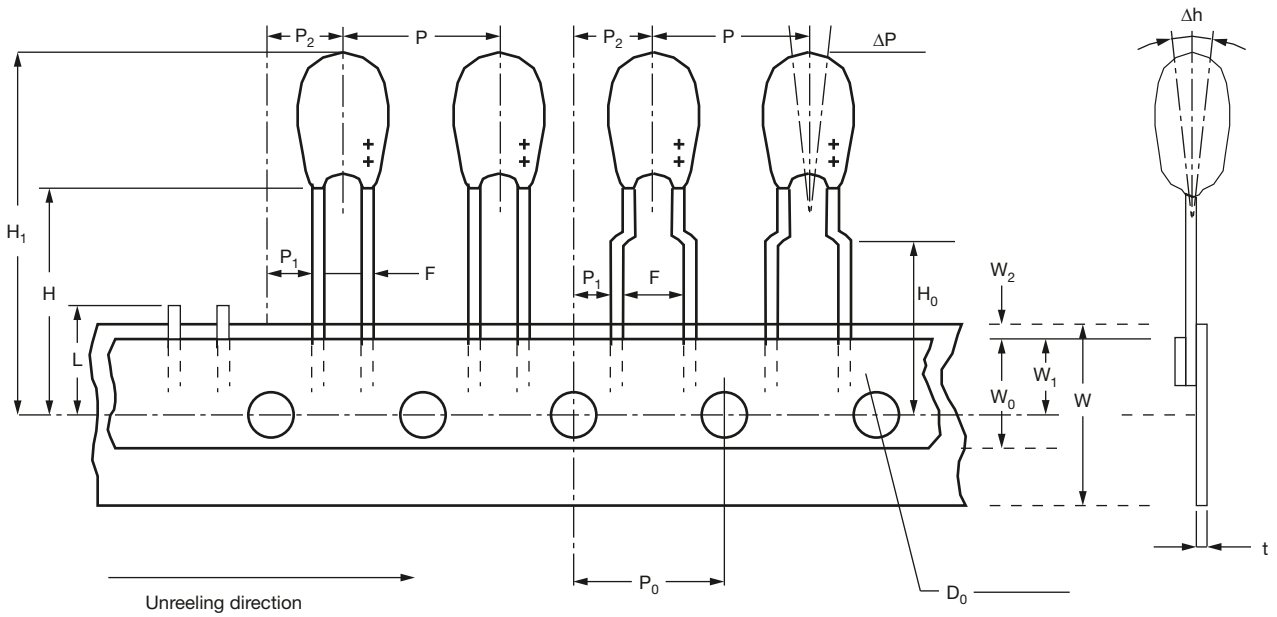
4. **Power Dissipation:** power dissipation will be affected by the heat sinking capability of the mounting surface. Non-sinusoidal ripple current may produce heating effects which differ from those shown in the following table. It is important that the equivalent I_{RMS} value be established when calculating permissible operating levels.

CASE CODE	POWER DISSIPATION AT +25 °C (W)
A	0.080
B	0.090
C	0.100
D	0.110
E	0.120
F	0.130
H	0.140
M	0.150
N	0.160
R	0.180

5. **Cleaning:** these capacitors are compatible with all commonly used solvents, such as TES, TMS, Prelete and Chloretane. Solvents containing methylene chloride or other epoxy solvents should be avoided since these will attack the epoxy encapsulation material.

PRODUCT INFORMATION	
Mounting of Through Hole Components	www.vishay.com/doc?40108
Solid Tantalum Capacitors (With MnO_2 Electrolyte) Voltage Derating	www.vishay.com/doc?40246
SELECTOR GUIDES	
Quick Reference Guide	www.vishay.com/doc?40037
Selector Guide	www.vishay.com/doc?49054
Parameter Comparison Guide	www.vishay.com/doc?40033
FAQ	
Frequently Asked Questions	www.vishay.com/doc?40110

TAPE PACKAGING DIMENSIONS in inches [millimeters] per EIA-468 (available on reel or in ammo box)



SYMBOL	DESCRIPTION	DIMENSIONS	TOLERANCE
P	Component pitch	0.500 [12.7]	± 0.039 [± 1.0]
P_0	Feed hole pitch	0.500 [12.7]	± 0.012 [± 0.3]
W	Tape width	0.709 [18.0]	+0.039 / -0.020 [+1.0 / -0.5]
W_0	Hold down tape width	0.20 [5.0]	Minimum
W_1	Feed hole position	0.354 [9.0]	+0.030 / -0.020 [+0.075 / -0.5]
W_2	Hold down tape position	0.118 [3.0]	Maximum
H_1	Overall component height above tape central line	1.26 [32.0]	Maximum
D_0	Feed hole diameter	0.157 [4.0]	± 0.012 [± 0.3]
t	Tape thickness	0.028 [0.7]	Maximum
H_0	Height to seating plane (style 6 - shouldered leads)	0.63 [16.0]	± 0.02 [± 0.5]
H	Height to seating plane (styles 2 and 4 - straight leads)	0.748 [19.0]	± 0.039 [± 1.0]
F	Pitch, or lead wire spacing	See lead styles dimensions table	
ΔP	Component alignment	0.051 [1.3]	Maximum
ΔH	Component alignment	0.079 [2.0]	Maximum
L	Length of shipped leads	0.433 [11.0]	Maximum
P_1	Feed hole center to wire center (lead spacing 2.5 mm)	0.20 [5.1]	± 0.028 [± 0.7]
	Feed hole center to wire center (lead spacing 5.0 mm)	0.144 [3.65]	± 0.028 [± 0.7]
P_2	Feed hole center to component center	0.25 [6.35]	± 0.051 [± 1.3]

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