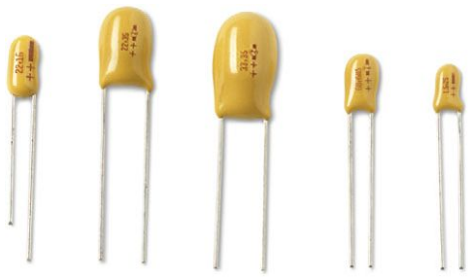
Resin-Coated, Radial-Leaded Solid Tantalum Capacitors



FEATURES

- Flame retardant encapsulation
- Very high temperature range
- Improved humidity class
- Low leakage current
- Very high CV product
- Low failure rate
- Tantalum capacitors with sintered anode and solid semiconductor electrolyte with flame retardant fluidized bed coating. The type ETPW is characterized by very favorable electrical values even at higher ambient temperatures. The capacitors comply with DIN 45910 part 146 and they are also available as a radially taped version.
- 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

MECHANICAL SPECIFICATIONS

Color: gold

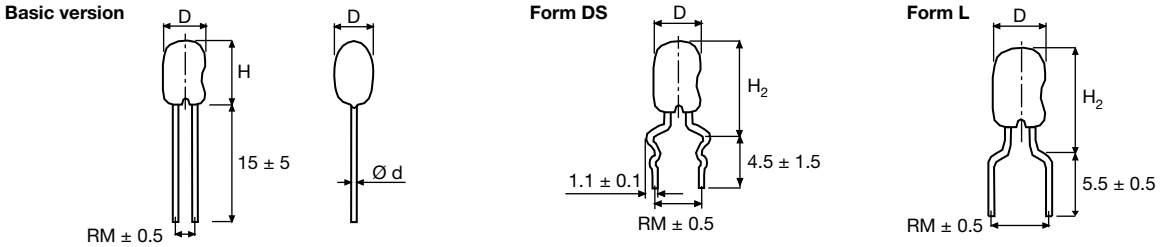
Laser Marked: capacity and voltage in clear text; plus pole marked

Leads: standard (tin / lead), RoHS compliant (100 % tin)

ORDERING INFORMATION

P1A	686	603	M	00	D	E3
TYPE	CAPACITANCE	DC VOLTAGE RATING AT +85 °C	CAPACITANCE TOLERANCE	LEAD STYLE AND PACKAGING		RoHS-COMPLIANT
ETPW 1A .... ETPW 6R	Expressed in picofarads. The first two digits are significant figures. The third is the number of zeros following.	Expressed by zeros if needed to complete the 3 digit block. A decimal point is indicated by an "0" (603 = 6.3 V).	M = ± 20 % K = ± 10 %	See Lead Styles and Packaging table.		E3 = 100 % tin termination (RoHS-compliant design) Blank = SnPb termination (standard design)

DIMENSIONS in millimeters



MODEL	D MAX.	H MAX.	RM ± 0.5	Ø D ± 0.05	FORM DS		FORM L	
					H_2 MAX.	RM	H_2 MAX.	RM
ETPW - 1 A, B	4.0	7.1	2.5	0.5	10.5	5	10.5	5
ETPW - 2 C, D	4.5	8.0	2.5	0.5	11.0	5	11.0	5
ETPW - 2 E	5.0	9.5	2.5	0.5	12.5	5	12.5	5
ETPW - 3 F	5.0	9.5	2.5	0.5	12.5	5	12.5	5
ETPW - 3 G	5.5	10.0	2.5	0.5	13.0	5	13.0	5
ETPW - 4 H	6.0	10.0	2.5	0.5	13.0	5	13.0	5
ETPW - 5 J, K (1)	8.6	12.5	2.5	0.5	15.5	5	15.5	5
ETPW - 5 J, K, L	8.6	12.5	5.0	0.5	15.5	5	-	-
ETPW - 6 M, N	9.5	15.0	5.0	0.5	18.0	5	-	-
ETPW - 6 P, R	9.5	16.0	5.0	0.5	19.0	5	-	-

Note

(1) J, K with RM 2.5 mm: 100 µF - 6.3 V, 68 µF - 10 V, 47 µF - 16 V, 22 µF - 25 V

RATINGS AND CASE CODES

C_R (µF)	RATED VOLTAGE U_R AT +85 °C						
	3.0 V	6.3 V	10 V	16 V	25 V	35 V	50 V
0.10						1A	1A
0.15						1A	1A
0.22						1A	1A
0.33						1A	1B
0.47						1A	1B
0.68						1A	2C
1.0					1A	1A	2D
1.5					1A	1B	2E
2.2				1A	1B	2C	3F
3.3			1A	1B	2C	2D	3G
4.7		1A	1B	2C	2D	2E	4H
6.8	1A	1B	2C	2D	2E	3F	5J
10	1A	2C	2D	2E	3F	3G	5L
15	1B	2D	2E	3F	4H	5J	6M
22	2C	2E	3F	3G	5J	5L	6P
33	2D	3F	3G	4H	5K	6M	
47	2E	3G	4H	5K	6M	6P	
68	3F	4H	5J	5L	6N		
100	3G	5J	5L	6N			
150	4H	5L	6N	6R			
220	5J	6M	6P				
330	5L	6P					
470							

STANDARD RATINGS

C_R (µF)	CASE CODE	PART NUMBER	DIMENSIONS					MAX. DCL AT +20 °C (µA)	MAX. Z AT 100 kHz (Ω)	MAX. DF AT 120 Hz +20 °C
			D MAX. (mm)	H MAX. (mm)	H_2 MAX. (mm)	RM ± 0.05	d ± 0.05			
U_R = 3 V_{DC} AT +85 °C, SURGE = 3.9 V; U_C = 2 V_{DC} AT +125 °C										
6.8	1A	P1A685003(1)(2)D	4.0	7.1	10.5	2.5	0.5	0.5	6.0	0.06
10	1A	P1A106003(1)(2)D	4.0	7.1	10.5	2.5	0.5	0.5	5.0	0.08
15	1B	P1B156003(1)(2)D	4.0	7.1	10.5	2.5	0.5	0.5	4.0	0.08
22	2C	P2C226003(1)(2)D	4.5	8.0	11.0	2.5	0.5	0.7	3.2	0.08
33	2D	P2D336003(1)(2)D	4.5	8.0	11.0	2.5	0.5	1.0	2.5	0.08
47	2E	P2E476003(1)(2)D	5.0	9.5	12.5	2.5	0.5	1.4	2.0	0.08
68	3F	P3F686003(1)(2)D	5.0	9.5	12.5	2.5	0.5	2.0	1.6	0.08
100	3G	P3G107003(1)(2)D	5.5	10.0	13.0	2.5	0.5	3.0	1.2	0.10
150	4H	P4H157003(1)(2)D	6.0	10.0	13.0	2.5	0.5	4.5	1.0	0.10
220	5J	P5J227003(1)(2)D	8.6	12.5	15.5	5.0	0.5	6.6	0.8	0.10
330	5L	P5L337003(1)(2)D	8.6	12.5	15.5	5.0	0.5	9.9	0.6	0.10

Note

- Part number definitions:
  (1) Insert M for ± 20 % tolerance or K for ± 10 %
  (2) Lead style and packaging code, see Lead Styles and Packaging table

STANDARD RATINGS

C_R (µF)	CASE CODE	PART NUMBER	DIMENSIONS					MAX. DCL AT +20 °C (µA)	MAX. Z AT 100 kHz (Ω)	MAX. DF AT 120 Hz +20 °C
			D MAX. (mm)	H MAX. (mm)	H_2 MAX. (mm)	RM ± 0.05	d ± 0.05			
U_R = 6.3 V_{DC} AT +85 °C, SURGE = 7.8 V; U_C = 4 V_{DC} AT +125 °C										
4.7	1A	P1A475603(1)(2)D	4.0	7.1	10.5	2.5	0.5	0.5	6.0	0.06
6.8	1B	P1B685603(1)(2)D	4.0	7.1	10.5	2.5	0.5	0.5	5.0	0.06
10	2C	P2C106603(1)(2)D	4.5	8.0	11.0	2.5	0.5	0.6	4.0	0.08
15	2D	P2D156603(1)(2)D	4.5	8.0	11.0	2.5	0.5	0.9	3.2	0.08
22	2E	P2E226603(1)(2)D	5.0	9.5	12.5	2.5	0.5	1.4	2.5	0.08
33	3F	P3F336603(1)(2)D	5.0	9.5	12.5	2.5	0.5	2.1	2.0	0.08
47	3G	P3G476603(1)(2)D	5.5	10.0	13.0	2.5	0.5	3.0	1.6	0.08
68	4H	P4H686603(1)(2)D	6.0	10.0	13.0	2.5	0.5	4.3	1.2	0.08
100	5J	P5J107603(1)(2)D	8.6	12.5	15.5	2.5	0.5	6.3	1.0	0.10
150	5L	P5L157603(1)(2)D	8.6	12.5	15.5	5.0	0.5	9.5	0.8	0.10
220	6M	P6M227603(1)(2)D	9.5	15.0	18.0	5.0	0.5	13.9	0.6	0.10
330	6P	P6P337603(1)(2)D	9.5	16.0	19.0	5.0	0.5	20.8	0.5	0.10
U_R = 10 V_{DC} AT +85 °C, SURGE = 13 V; U_C = 6.3 V_{DC} AT +125 °C										
3.3	1A	P1A335010(1)(2)D	4.0	7.1	10.5	2.5	0.5	0.5	6.5	0.06
4.7	1B	P1B475010(1)(2)D	4.0	7.1	10.5	2.5	0.5	0.5	5.0	0.06
6.8	2C	P2C685010(1)(2)D	4.5	8.0	11.0	2.5	0.5	0.7	4.0	0.06
10	2D	P2D106010(1)(2)D	4.5	8.0	11.0	2.5	0.5	1.0	3.2	0.08
15	2E	P2E156010(1)(2)D	5.0	9.5	12.5	2.5	0.5	1.5	2.5	0.08
22	3F	P3F226010(1)(2)D	5.0	9.5	12.5	2.5	0.5	2.2	2.0	0.08
33	3G	P3G336010(1)(2)D	5.5	10.0	13.0	2.5	0.5	3.3	1.6	0.08
47	4H	P4H476010(1)(2)D	6.0	10.0	13.0	2.5	0.5	4.7	1.2	0.08
68	5J	P5J686010(1)(2)D	8.6	12.5	15.5	2.5	0.5	6.8	1.0	0.08
100	5L	P5L107010(1)(2)D	8.6	12.5	15.5	5.0	0.5	10.0	0.8	0.10
150	6N	P6N157010(1)(2)D	9.5	15.0	18.0	5.0	0.5	15.0	0.6	0.10
220	6P	P6P227010(1)(2)D	9.5	16.0	19.0	5.0	0.5	22.0	0.5	0.10
U_R = 16 V_{DC} AT +85 °C, SURGE = 20.8 V; U_C = 10 V_{DC} AT +125 °C										
2.2	1A	P1A225016(1)(2)D	4.0	7.1	10.5	2.5	0.5	0.5	7.0	0.06
3.3	1B	P1B335016(1)(2)D	4.0	7.1	10.5	2.5	0.5	0.5	6.0	0.06
4.7	2C	P2C475016(1)(2)D	4.5	8.0	11.0	2.5	0.5	0.8	4.5	0.06
6.8	2D	P2D685016(1)(2)D	4.5	8.0	11.0	2.5	0.5	1.1	3.2	0.06
10	2E	P2E106016(1)(2)D	5.0	9.5	12.5	2.5	0.5	1.6	2.5	0.08
15	3F	P3F156016(1)(2)D	5.0	9.5	12.5	2.5	0.5	2.4	2.0	0.08
22	3G	P3G226016(1)(2)D	5.5	10.0	13.0	2.5	0.5	3.5	1.6	0.08
33	4H	P4H336016(1)(2)D	6.0	10.0	13.0	2.5	0.5	5.3	1.2	0.08
47	5K	P5K476016(1)(2)D	8.6	12.5	15.5	2.5	0.5	7.5	1.0	0.08
68	5L	P5L686016(1)(2)D	8.6	12.5	15.5	5.0	0.5	10.9	0.8	0.08
100	6N	P6N107016(1)(2)D	9.5	15.0	18.0	5.0	0.5	16.0	0.6	0.10
150	6R	P6R157016(1)(2)D	9.5	16.0	19.0	5.0	0.5	24.0	0.5	0.10

Note

- Part number definitions:
  (1) Insert M for ± 20 % tolerance or K for ± 10 %
  (2) Lead style and packaging code, see Lead Styles and Packaging table

STANDARD RATINGS

C_R (µF)	CASE CODE	PART NUMBER	DIMENSIONS					MAX. DCL AT +20 °C (µA)	MAX. Z AT 100 kHz (Ω)	MAX. DF AT 120 Hz +20 °C
			D MAX. (mm)	H MAX. (mm)	H_2 MAX. (mm)	RM ± 0.05	d ± 0.05			
U_R = 25 V_{DC} AT +85 °C, SURGE = 32.5 V; U_C = 16 V_{DC} AT +125 °C										
1.0	1A	P1A105025(1)(2)D	4.0	7.1	10.5	2.5	0.5	0.5	8.5	0.04
1.5	1A	P1A155025(1)(2)D	4.0	7.1	10.5	2.5	0.5	0.5	7.5	0.04
2.2	1B	P1B225025(1)(2)D	4.0	7.1	10.5	2.5	0.5	0.6	6.0	0.06
3.3	2C	P2C335025(1)(2)D	4.5	8.0	11.0	2.5	0.5	0.8	4.5	0.06
4.7	2D	P2D475025(1)(2)D	4.5	8.0	11.0	2.5	0.5	1.2	3.2	0.06
6.8	2E	P2E685025(1)(2)D	5.0	9.5	12.5	2.5	0.5	1.7	2.5	0.06
10	3F	P3F106025(1)(2)D	5.0	9.5	12.5	2.5	0.5	2.5	2.0	0.08
15	4H	P4H156025(1)(2)D	6.0	10.0	13.0	2.5	0.5	3.8	1.6	0.08
22	5J	P5J226025(1)(2)D	8.6	12.5	15.5	2.5	0.5	5.5	1.2	0.08
33	5K	P5K336025(1)(2)D	8.6	12.5	15.5	5.0	0.5	8.3	1.0	0.08
47	6M	P6M476025(1)(2)D	9.5	15.0	18.0	5.0	0.5	11.8	0.8	0.08
68	6N	P6N686025(1)(2)D	9.5	15.0	18.0	5.0	0.5	17.0	0.6	0.08
U_R = 35 V_{DC} AT +85 °C, SURGE = 45.5 V; U_C = 23 V_{DC} AT +125 °C										
0.10	1A	P1A104035(1)(2)D	4.0	7.1	10.5	2.5	0.5	0.5	38.0	0.04
0.15	1A	P1A154035(1)(2)D	4.0	7.1	10.5	2.5	0.5	0.5	30.0	0.04
0.22	1A	P1A224035(1)(2)D	4.0	7.1	10.5	2.5	0.5	0.5	23.0	0.04
0.33	1A	P1A334035(1)(2)D	4.0	7.1	10.5	2.5	0.5	0.5	18.0	0.04
0.47	1A	P1A474035(1)(2)D	4.0	7.1	10.5	2.5	0.5	0.5	14.0	0.04
0.68	1A	P1A684035(1)(2)D	4.0	7.1	10.5	2.5	0.5	0.5	10.0	0.04
1.0	1A	P1A105035(1)(2)D	4.0	7.1	10.5	2.5	0.5	0.5	8.0	0.04
1.5	1B	P1B155035(1)(2)D	4.0	7.1	10.5	2.5	0.5	0.5	6.5	0.04
2.2	2C	P2C225035(1)(2)D	4.5	8.0	11.0	2.5	0.5	0.8	5.0	0.06
3.3	2D	P2D335035(1)(2)D	4.5	8.0	11.0	2.5	0.5	1.2	3.5	0.06
4.7	2E	P2E475035(1)(2)D	5.0	9.5	12.5	2.5	0.5	1.6	2.5	0.06
6.8	3F	P3F685035(1)(2)D	5.0	9.5	12.5	2.5	0.5	2.4	2.0	0.06
10	3G	P3G106035(1)(2)D	5.5	10.0	13.0	2.5	0.5	3.5	1.6	0.08
15	5J	P5J156035(1)(2)D	8.6	12.5	15.5	5.0	0.5	5.3	1.2	0.08
22	5L	P5L226035(1)(2)D	8.6	12.5	15.5	5.0	0.5	7.7	1.0	0.08
33	6M	P6M336035(1)(2)D	9.5	15.0	18.0	5.0	0.5	11.6	0.8	0.08
47	6P	P6P476035(1)(2)D	9.5	16.0	19.0	5.0	0.5	16.5	0.8	0.08
U_R = 50 V_{DC} AT +85 °C, SURGE = 65 V; U_C = 33 V_{DC} AT +125 °C										
0.10	1A	P1A104050(1)(2)D	4.0	7.1	10.5	2.5	0.5	0.5	38.0	0.04
0.15	1A	P1A154050(1)(2)D	4.0	7.1	10.5	2.5	0.5	0.5	30.0	0.04
0.22	1A	P1A224050(1)(2)D	4.0	7.1	10.5	2.5	0.5	0.5	23.0	0.04
0.33	1B	P1B334050(1)(2)D	4.0	7.1	10.5	2.5	0.5	0.5	18.0	0.04
0.47	1B	P1B474050(1)(2)D	4.0	7.1	10.5	2.5	0.5	0.5	14.0	0.04
0.68	2C	P2C684050(1)(2)D	4.5	8.0	11.0	2.5	0.5	0.5	10.0	0.04
1.0	2D	P2D105050(1)(2)D	4.5	8.0	11.0	2.5	0.5	0.5	8.0	0.04
1.5	2E	P2E155050(1)(2)D	5.0	9.5	12.5	2.5	0.5	0.8	6.5	0.04
2.2	3F	P3F225050(1)(2)D	5.0	9.5	12.5	2.5	0.5	1.1	5.0	0.06
3.3	3G	P3G335050(1)(2)D	5.5	10.0	13.0	2.5	0.5	1.7	3.5	0.06
4.7	4H	P4H475050(1)(2)D	6.0	10.0	13.0	2.5	0.5	2.4	2.5	0.06
6.8	5J	P5J685050(1)(2)D	8.6	12.5	15.5	5.0	0.5	3.4	2.0	0.06
10	5L	P5L106050(1)(2)D	8.6	12.5	15.5	5.0	0.5	5.0	1.6	0.08
15	6M	P6M156050(1)(2)D	9.5	15.0	18.0	5.0	0.5	7.5	1.2	0.08
22	6P	P6P226050(1)(2)D	9.5	16.0	19.0	5.0	0.5	11.0	1.0	0.08

Note

- Part number definitions:
  (1) Insert M for ± 20 % tolerance or K for ± 10 %
  (2) Lead style and packaging code, see Lead Styles and Packaging table

PERFORMANCE CHARACTERISTICS

1. **Climatic Category:** 55 / 125 / 56 according to IEC
2. **Temperature Range:** -55 °C up to +125 °C with linear voltage derating to category voltage U_C
3. **Rated Voltage, Category Voltage:**
   3 V to 50 V; 2 V to 33 V
4. **Surge Voltage:** 1.3 times of rated voltage at +85 °C
5. **Reverse Voltage (Temporary):**
   15 % of the rated DC voltage at +20 °C
   10 % of the rated DC voltage at +55 °C
   5 % of the rated DC voltage at +85 °C
6. **Rated Capacitance:** 0.1 µF to 330 µF
7. **Capacitance Tolerance:** ± 20 %, ± 10 %
8. **Leakage Current in µA:** measured at +20 °C after 5 min: ≤ 0.01 x C_R x U_R or 0.5 µA, whichever is greater
9. **Dissipation Factor:** at 120 Hz and +20 °C
   See table
10. **Impedance:** measured at 100 kHz and +20 °C
    See table
11. **Permissible AC Voltage Stress:** the highest permissible AC voltage for the respective frequency may be taken from the brochure “General Information”.
    The values apply for +20 °C For higher temperatures, the values have to be multiplied with the following factors:

TEMPERATURE	FACTOR
+50 °C	0.7
+85 °C	0.5
+125 °C	0.3

    Intermediate values can be obtained by linear interpolation.
    For further notes on AC voltage stress: see general information
12. **Service life:** > 300 000 h (1)
13. **Failure percentage:** ≤ 0.6 % within 100 000 h (1)
14. **Failure rate (λ):** ≤ 0.6 10- 7/h = ≤ 60 fit (1)
15. **Failure criteria:** catastrophic failure: short circuit or interruption
    Drift failure: DC/C > + 5 % - 15 %
    Z > 3 times initial limit value
    IR > 5 times initial value + 5 µA

Note

(1) Related to U_R, +40 °C and a circuit resistance of ≥ 3 Ω/V

16. **Characteristics at high and low temperatures** (the values shall not exceed the following limits)

TEST TEMPERATURE	-55 °C	+20 °C	+85 °C	+125 °C
ΔC/C < tanδ ≤ 1.5 µF < 10 µF < 100 µF ≥ 100 µF	-10 % 0.04 0.06 0.08 0.10	- 0.04 0.06 0.08 0.10	+12 % 0.04 0.06 0.08 0.10	+15 % 0.06 0.08 0.08 0.10
Leakage current IR	-	≤ 0.01 x C_R x U_R or 0.5 µA whichever is greater	≤ 0.1 x C_R x U_R or 10 µA whichever is greater	≤ 0.125 x C_R x U_R or 12.5 µA whichever is greater (1)

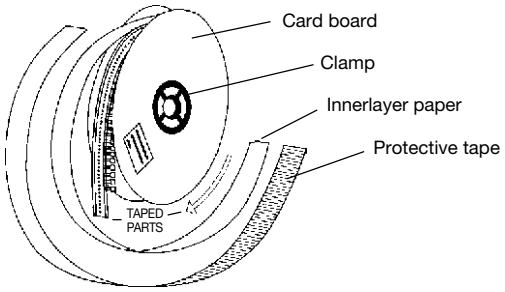
Note

(1) Measured at category voltage

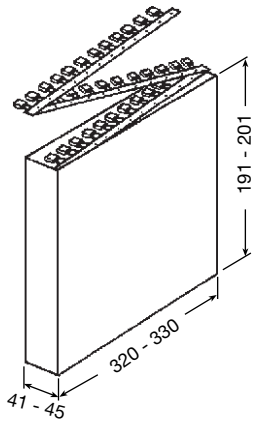
PRODUCT INFORMATION	
Mounting of Through Hole Components	www.vishay.com/doc?40108
Solid Tantalum Capacitors (With MnO_2 Electrolyte) Voltage Derating	www.vishay.com/doc?40246
SELECTOR GUIDES	
Quick Reference Guide	www.vishay.com/doc?40037
Selector Guide	www.vishay.com/doc?49054
Parameter Comparison Guide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

LEAD STYLES AND PACKAGING

Reel packaging



Ammo packaging (mm)



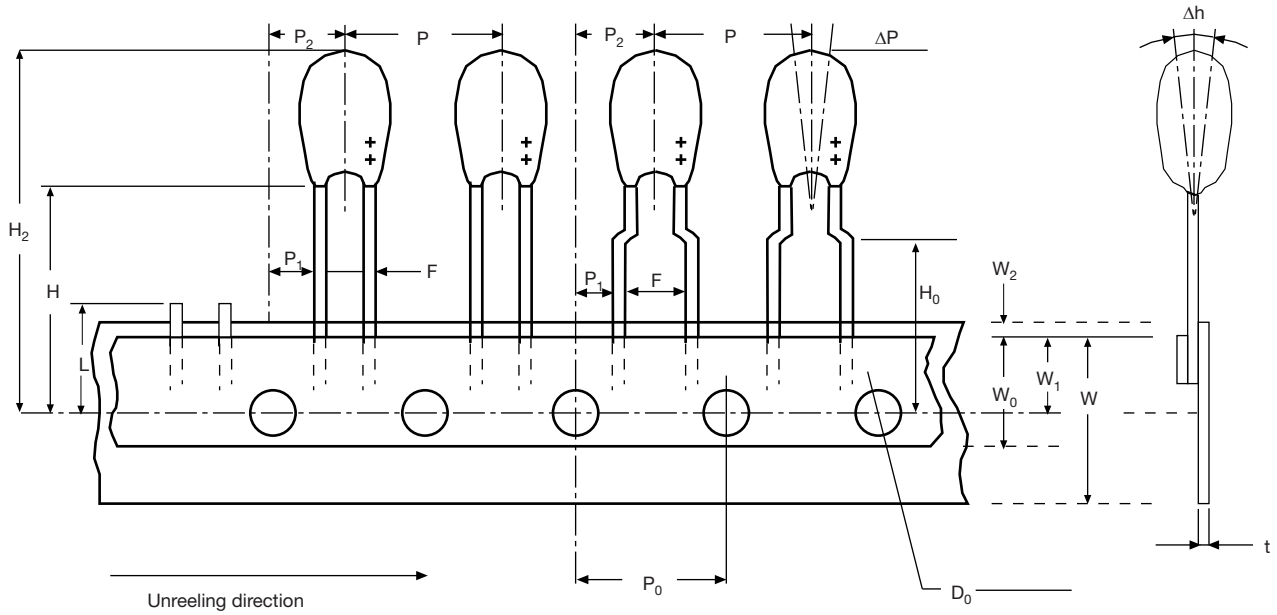
CASE SIZE	CODE	RM IN mm ± 0.5	SPECIFICATION	REMARKS
1 - 6	00	2.5 / 5	Bulk	Reel with positive pole in tape run direction in front is standard
1 - 4 (1)	C0	5	Form L, bulk	
1 - 6	V0	5	Form DS, bulk	
1 - 4 (1)	W0	2.5	Reel, positive pole in front of unreeling direction	
1 - 4 (1)	T0	2.5	Reel, negative pole in front of unreeling direction	
1 - 4 (1)	H0	2.5	Ammo	
1 - 5	V2	5	Reel, positive pole in front of unreeling direction	
1 - 5	R0	5	Reel, negative pole in front of unreeling direction	
1 - 5	O8	5	Ammo	

Note

(1) 100 µF - 6.3 V, 68 µF - 10 V, 47 µF - 16 V, 22 µF - 25 V

CASE SIZE	BULK 00, V0, C0	REEL W0, T0, V2, R0	AMMO H0, O8
ETPW 1 A, B	500	2500	2500
ETPW 2 C, D, E	500	2000	2000
ETPW 3 F, G	500	1500	1500
ETPW 4 H	500	1500	1500
ETPW 5 J, K, L	100	500	500
ETPW 6 M, N, P, R	100	-	-

TAPING according to IEC 286-2



Dimensions for components on tape and tolerances:

DESIGNATION	SYMBOL	DIMENSIONS (mm)
Holding tape width	W	18.0 (+ 1 / - 0.5)
Adhesive tape width	W_0	Min. 5.0
Distance of components	P	12.7 ± 1
Hole center to component center	P_2	6.35 ± 1.3
Hole center to lead	P_1	5.1 / 3.8 ± 0.7
Distance of body to hole center	H (1)	18.0 (+ 2 / - 0)
Distance of lead to hole center	H_0	16.0 ± 0.5
Component upper edge to hole center	H_1	Max. 32.0
Adhesive tape location	W_2	Max. 3.0
Hole location	W_1	9.0 (+ 0.75 / - 0.5)
Distance of holes	P_0	12.7 ± 0.3
Hole diameter	D_0	4.0 ± 0.3
Lead diameter	d	0.5 ± 0.05
Component alignment	Δh	Max. ± 2.0
Pitch	F	2.5 / 5.0 (+ 0.6 / - 0.1)
Holding tape thickness	t	0.5 ± 0.2
Component alignment	ΔP	Max. ± 1.3
Length of snipped leads	L	Max. 11.0

Note

(1) Also available: 16 mm and 20 mm taping according to DIN-IEC 286 part 2

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