Solid Tantalum Chip Capacitors, TANTAMOUNT® Lead Frameless Molded

P and R cases
Image is not to scale

FEATURES

- 0805 Footprint
- Wraparound lead (Pb)-free terminations: P and R Cases
- 8 mm, 12 mm, 16 mm tape and reel packaging available per EIA-481-1 and reeling per IEC 286-3, 7" [178 mm] standard 13" [330 mm] available

Pb-free Available
RoHS* COMPLIANT

PERFORMANCE CHARACTERISTICS

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

Note: Refer to Doc. 40088

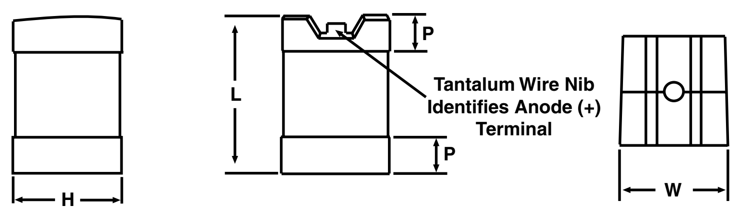
Capacitance Range: 1.0 µF to 47 µF
Capacitance Tolerance: ± 10 %, ± 20 % standard
Voltage Rating: 3 WVDC to 20 WVDC

ORDERING INFORMATION

292D	106	X0	010	P	2	T
TYPE	CAPACITANCE	CAPACITANCE TOLERANCE	DC VOLTAGE RATING AT + 85 °C	CASE CODE	TERMINATION	REEL SIZE AND 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 = 100 % Tin** 4 = Gold Plated 8 = Solder Plated (60/40) Special Order	**T = Tape and reel* 7" [178 mm] reel** W = 13" [330 mm] reel *Cathode nearest sprocket hole

Note: Preferred Tolerance and reel sizes are in bold

DIMENSIONS in inches [millimeters]



CASE	EIA	L	W	H	P
R	0805 [2012]	0.079 ± 0.008 [2.0 ± 0.2]	0.051 ± 0.008 [1.3 ± 0.2]	0.047 (Max.) [1.2 Max.]	0.020 ± 0.012 [0.5 ± 0.3]
P	0805 [2012]	0.079 ± 0.010 [2.0 ± 0.25]	0.053 ± 0.008 [1.35 ± 0.2]	0.053 ± 0.008 [1.35 ± 0.2]	0.020 ± 0.012 [0.5 ± 0.3]

RATINGS AND CASE CODES

µF	3 V	4 V	6.3 V	10 V	16 V	20 V
1.0				R	R	R
2.2		R	R	R	R	R
3.3		R		P/R	R	
4.7		R	R	P/R	R	
6.8		R	R	P/R		
10		R	P/R	P/R	P	
15		R	R	P		
22		P/R	P/R			
33		P/R	P			
47	P					

* Pb containing terminations are not RoHS compliant, exemptions may apply

STANDARD RATINGS

CAPACITANCE (µF)	CASE CODE	PART NUMBER	MAX DCL AT + 25 °C (µA)	MAX DF AT + 25 °C (%)	MAX ESR at 100 kHz (Ω)	MAX RIPPLE 100 kHz I_{rms} (A)
3 WVDC AT + 85 °C, SURGE = 3.9 V. . .1.9 WVDC AT + 125 °C, SURGE = 2.9 V						
47	P	292D476X_003P2T	1.5	12	6.0	0.21
4 WVDC AT + 85 °C, SURGE = 5.2 V. . .2.7 WVDC AT + 125 °C, SURGE = 3.4 V						
2.2	R	292D225X_004R2T	0.5	6	7.6	0.057
3.3	R	292D335X_004R2T	0.5	6	7.6	0.057
4.7	R	292D475X_004R2T	0.5	6	6.3	0.063
6.8	R	292D685X_004R2T	0.5	6	5.5	0.067
10	R	292D106X_004R2T	0.5	6	5.1	0.070
15	R	292D156X_004R27	0.8	8	3.5	0.085
22	P	292D226X_004P2T	0.9	8	3.5	0.085
22	R	292D226X_004R2T	0.9	10	3.5	0.085
33	P	292D336X_004P2T	1.3	10	3.5	0.085
33	P	292D336X_004P2T_035	1.3	10	1.1	0.151
33	R	292D336X_004R2T	1.3	12	3.5	0.085
6.3 WVDC AT + 85 °C, SURGE = 8 V. . .4 WVDC AT + 125 °C, SURGE = 5 V						
2.2	R	292D225X_6R3R2T	0.5	10	7.6	0.057
4.7	R	292D475X_6R3R2T_035	0.6	6	2.0	0.086
4.7	R	292D475X_6R3R2T	0.6	6	3.4	0.086
6.8	R	292D685X_6R3R2T	0.5	6	5.0	0.071
6.8	R	292D685X_6R3R2T_035	0.5	6	2.0	0.067
10	P	292D106X_6R3P2T	0.6	6	3.5	0.085
10	R	292D106X_6R3R2T	0.6	6	1.2	0.144
15	R	292D156X_6R3R2T_035	0.9	10	3.5	0.085
15	R	292D15X_6R3R2_035	0.9	10	1.8	0.118
22	P	292D226X_6R3P2T	1.3	10	3.5	0.118
22	P	292D226X_6R3P2_035	0.9	10	1.1	0.151
22	R	292D226X_6R3R2T	1.4	10	3.5	0.085
33	P	292D336X_6R3P2T	2.1	12	3.5	0.085
10 WVDC AT+ 85 °C, SURGE = 13 V. . .7 WVDC AT + 125 °C, SURGE = 8 V						
1.0	R	292D105X_010R2	0.5	4	9.6	0.051
2.2	R	292D225X_010R2T	0.5	6	6.3	0.063
3.3	R	292D335X_010R2T	0.5	8	2.0	0.112
3.3	R	292D335X_010R2_035	0.5	8	1.0	0.158
3.3	P	292D335X_010P2T	0.5	8	2.0	0.112
4.7	P	292D475X_010P2T	0.5	8	5.0	0.071
4.7	R	292D475X_010R2T	0.5	8	5.0	0.071
4.7	R	292D475X_010R2T_035	0.5	8	2.0	0.112
6.8	P	292D685X_010P2T	0.7	8	2.0	0.112
6.8	R	292D685X_010R2T	0.7	8	2.0	0.112
10	P	292D106X_010P2T	1.0	8	2.0	0.112
10	R	292D106X_010R2T	1.0	8	2.0	0.112
15	P	292D156X_010P2T	1.5	8	3.5	0.085
15	P	292D156X_010P2_035	1.5	8	1.1	0.151
16 WVDC AT + 85 °C, SURGE = 20 V. . .10 WVDC AT + 125 °C, SURGE = 12 V						
1.0	R	292D105X_016R2	0.5	4	9.3	0.052
2.2	R	292D225X_016R2T	0.35	8	6.0	0.065
3.3	R	292D335X_016R2T	0.53	8	6.0	0.065
3.3	R	292D335X_016R2_035	0.53	8	3.0	0.091
4.7	R	292D475X_016R2T	0.75	8	6.0	0.065
10	P	292D106X_016P2T	1.6	8	6.0	0.065
20 WVDC AT + 85 °C, SURGE = 26 V. . .13 WVDC AT + 125 °C, SURGE = 16 V						
1.0	R	292D105X_020R2T	0.2	8	5.0	0.071
2.2	R	292D225X_020R2T	0.5	8	6.0	0.140

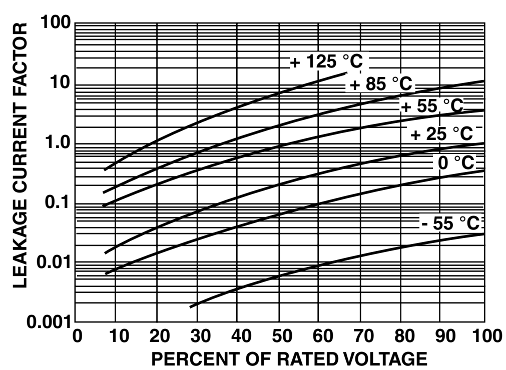
CAPACITORS PERFORMANCE CHARACTERISTICS

ELECTRICAL PERFORMANCE CHARACTERISTICS

ITEM	PERFORMANCE CHARACTERISTICS
Category Temperature Range	- 55 °C to + 85 °C (to + 125 °C with voltage derating)
Capacitance Tolerance	± 20 %, ± 10 % (at 120 Hz) 2 V_{rms} at + 25 °C using a capacitance bridge
Dissipation Factor (at 120 Hz)	Limits per Standard Ratings Table. Tested via bridge method, at 25 °C, 120 Hz.
ESR (100 kHz)	Limits per Standard Ratings Table. Tested via bridge method, at 25 °C, 100 kHz.
Leakage Current	After application of rated voltage applied to capacitors for 5 minutes using a steady source of power with 1 kΩ resistor in series with the capacitor under test, leakage current at 25 °C is not more than described in. See graph below for the appropriate adjustment factor.
Reverse Voltage	Capacitors are capable of withstanding peak voltages in the reverse direction equal to: 10 % of the DC 5 % of the DC rating at + 85 °C Vishay does not recommended intentional or repetitive application of reverse voltage
Temperature Derating	If capacitors are to be used at temperatures above + 25 °C, the permissible rms ripple current or voltage 1.0 at + 25 °C 0.9 at + 85 °C 0.4 at + 125 °C
Maximum Permissible Power Dissipation at 25 °C (W) in free air	P- + R-case: 0.025

Operating Temperature	+ 85 °C RATING		+ 125 °C RATING	
	WORKING VOLTAGE	SURGE VOLTAGE	WORKING VOLTAGE	SURGE VOLTAGE
	4	5.2	2.7	3.4
	6.3	8	4	5
	10	13	7	8
	16	20	10	12
	20	26	13	16
	25	32	17	20
	35	46	23	28
	50	65	33	40

TYPICAL LEAKAGE CURRENT FACTOR RANGE

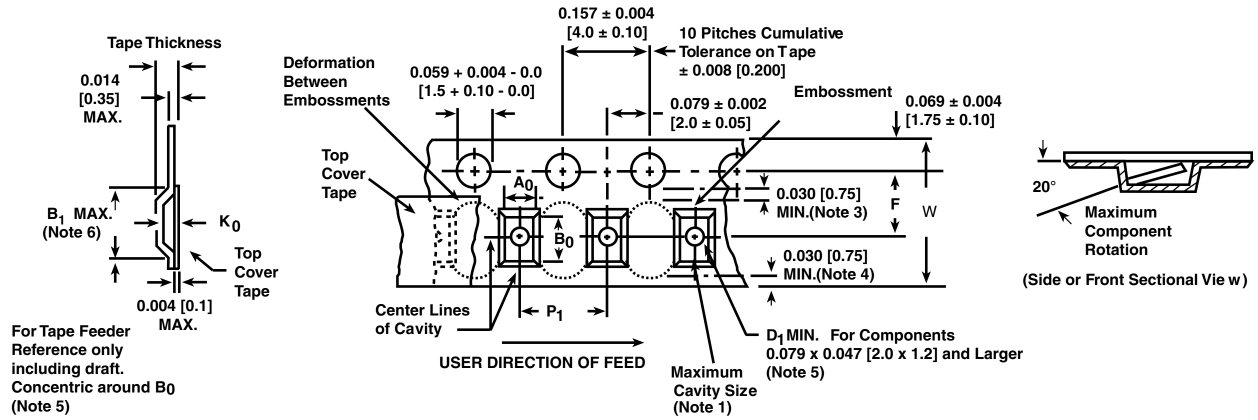


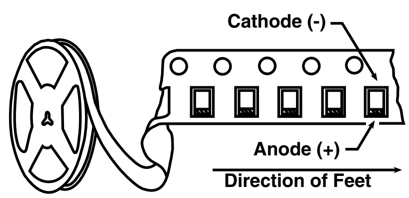
Notes:
- **At + 25 °C,** the leakage current shall not exceed the value listed in the Standard Ratings Table
- **At + 85 °C**, the leakage current shall not exceed 10 times the value listed in the Standard Ratings Table
- **At + 125 °C**, the leakage current shall not exceed 12 times the value listed in the Standard Ratings Table

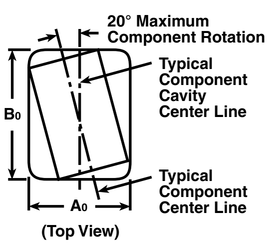
ENVIRONMENTAL PERFORMANCE CHARACTERISTICS		
ITEM	**CONDITION**	**POST TEST PERFORMANCE**
Life Test at + 85 °C	1000 h application of rated voltage at 85 °C with a 3 Ω series resistance, MIL-STD 202G Method 108A	Capacitance Change: Refer to Standard Ratings Table Dissipation Factor: Not to exceed 150 % of initial Leakage Current: Not to exceed 200 % of initial
Humidity Tests	At 40 °C/90 % RH 500 h, no voltage applied. MIL-STD 202G Method 103B	Capacitance Change: Refer to Standard Ratings Table Dissipation Factor: Not to exceed 150 % of initial Leakage Current: Not to exceed 200 % of initial
Thermal Shock	At - 55 °C/+ 125 °C, 30 min. each, for 5 cycles. MIL-STD 202G Method 107G	Capacitance Change: Refer to Standard Ratings Table Dissipation Factor: Not to exceed 150 % of initial Leakage Current: Not to exceed 200 % of initial

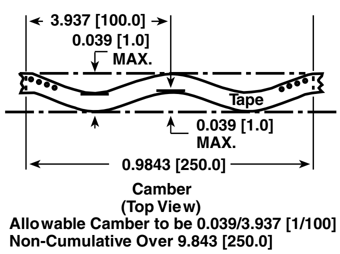
MECHANICAL PERFORMANCE CHARACTERISTICS		
TEST CONDITION	**CONDITION**	**POST TEST PERFORMANCE**
Terminal Strength	Apply a pressure load of 5 N for 10 ± 1 s horizontally to the center of capacitor side body. AECQ-200 rev. C Method 006	Capacitance Change: Refer to Standard Ratings Table Dissipation Factor: Initial specified value or less Leakage Current: Initial specified value or less There shall be no mechanical or visual damage to capacitors post-conditioning.
Substrate Bending (Board flex)	With parts soldered onto substrate test board, apply force to the test board for a deflection of 1 mm. AECQ-200 rev. C Method 005	Capacitance Change: Refer to Standard Ratings Table Dissipation Factor: Initial specified value or less Leakage Current: Initial specified value or less
Vibration	MIL-STD-202G, Method 204D, 10 Hz to 2000 Hz, 20 G Peak	Capacitance Change: Refer to Standard Ratings Table Dissipation Factor: Initial specified value or less Leakage Current: Initial specified value or less There shall be no mechanical or visual damage to capacitors post-conditioning.
Shock	Mil-Std-202G, Method 213B, Condition I, 100G Peak	Capacitance Change: Refer to Standard Ratings Table Dissipation Factor: Initial specified value or less Leakage Current: Initial specified value or less There shall be no mechanical or visual damage to capacitors post-conditioning.
Resistance to Solder Heat	At 260 °C, for 10 s, reflow	Capacitance Change: Refer to Standard Ratings Table Dissipation Factor: Not to exceed 150 % of initial Leakage Current: Not to exceed 200 % of initial There shall be no mechanical or visual damage to capacitors post-conditioning.
Solderability	MIL-STD-202G, Method 208H, ANSI/J-Std-002, Test B. Applies only to Solder and tin plated terminations. Does not apply to gold terminations.	There shall be no mechanical or visual damage to capacitors post-conditioning.
Resistance to Solvents	MIL-STD-202, Method 215D	There shall be no mechanical or visual damage to capacitors post-conditioning.
Flammability	Encapsulation materials meet UL94 VO with an oxygen index of 32 %.	

PLASTIC TAPE AND REEL PACKAGING in inches [millimeters]









Tape and Reel Specifications: All case sizes 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 mm], 13" [330 mm] 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 Vishay Sprague part number.

CASE CODE	TAPE SIZE	B_1 (MAX.)	D_1 (MIN.)	F	K_0 (MAX.)	P_1	W
292D							
P R	8 mm	0.092 ± 0.0039 [2.34 ± 0.100]	0.0394 + 0.0098 [1.5 + 0.100]	0.1378 ± 0.0098 [3.5 ± 0.05]	0.053 ± 0.0039 [1.35 ± 0.100]	0.157 ± 0.0039 [4.0 ± 0.2]	0.315 + 0.0118/- 0.0039 [8.0 + 0.30/- 0.10]

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

STANDARD PACKAGING QUANTITY

SERIES	CASE CODE	QTY (PCS/REEL)	
		7" REEL	13" REEL
292D	P, R	2500	10 000

RECOMMENDED VOLTAGE DERATING GUIDELINES

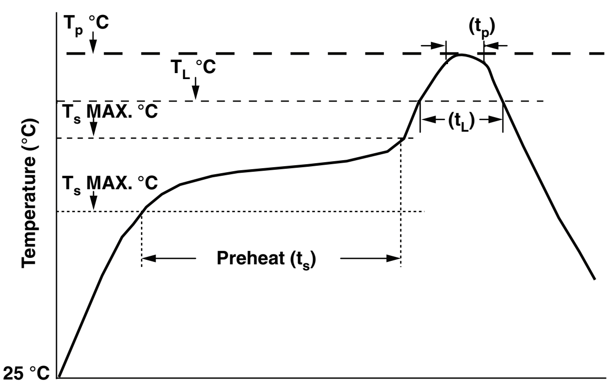
STANDARD CONDITIONS: FOR EXAMPLE: OUTPUT FILTERS

Capacitor Voltage Rating	Operating Voltage
4.0	2.5
6.3	3.6
10	6.0
16	10
20	12
25	15
35	24
50	28

SEVERE CONDITIONS: FOR EXAMPLE: INPUT FILTERS

Capacitor Voltage Rating	Operating Voltage
4.0	2.5
6.3	3.3
10	5.0
16	8.0
20	10
25	12
35	15
50	24

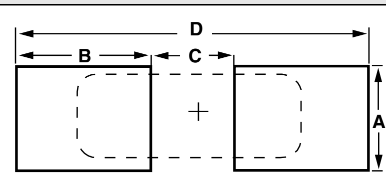
RECOMMENDED REFLOW PROFILES



All Case Codes

TYPE	T_P lead (Pb)-free	T_P Sn/Pb	t_P	T_L lead (Pb)-free	T_L Sn/Pb	T_S MIN. lead (Pb)-free	T_S MIN. Sn/Pb	T_S MAX. lead (Pb)-free	T_S MAX. Sn/Pb	t_S lead (Pb)-free	t_S Sn/Pb	t_L
292D	260 °C	225 °C	10	217 °C	183 °C	150 °C	100 °C	200 °C	150 °C	60 - 150	60 - 90	70

PAD DIMENSIONS in inches [millimeters]



CASE CODE	A	B	C	D
292D				
P, R	0.059 [1.50]	0.031 [0.80]	0.039 [1.00]	0.102 [2.60]

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 at + 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 at + 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 applied 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, 5 % of the DC rating at + 85 °C and 1 % of the DC rating at + 125 °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
+ 85 °C	0.9
+ 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.)

6. **Printed Circuit Board Materials:** Molded capacitors are compatible with commonly used printed circuit board materials (alumina substrates, FR4, FR5, G10, PTFE-fluorocarbon and porcelanized steel).

7. **Attachment:**

7.1 **Solder Paste:** The recommended thickness of the solder paste after application is 0.007" ± 0.001" [0.178 mm ± 0.025 mm]. 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, convection reflow, infrared reflow, wave soldering and hot plate methods. The Soldering Profile charts show recommended time/temperature conditions for soldering. Preheating is recommended. The recommended maximum ramp rate is 2 °C per second. Attachment with a soldering iron is not recommended due to the difficulty of controlling temperature and time at temperature. The soldering iron must never come in contact with the capacitor.

7.2.1 **Backward and Forward Compatibility:** Capacitors with SnPb or 100 % tin termination finishes can be soldered using SnPb or lead (Pb)-free soldering processes.

8. **Cleaning (Flux Removal) After Soldering:** Molded capacitors are compatible with all commonly used solvents such as TES, TMS, Prelete, Chlorethane, Terpene and aqueous cleaning media. However, CFC/ODS products are not used in the production of these devices and are not recommended. Solvents containing methylene chloride or other epoxy solvents should be avoided since these will attack the epoxy encapsulation material.

8.1 When using ultrasonic cleaning, the board may resonate if the output power is too high. This vibration can cause cracking or a decrease in the adherence of the termination. DO NOT EXCEED 9W/l at 40 kHz for 2 minutes.

9. **Recommended Mounting Pad Geometries:** Proper mounting pad geometries are essential for successful solder connections. These dimensions are highly process sensitive and should be designed to minimize component rework due to unacceptable solder joints. The dimensional configurations shown are the recommended pad geometries for both wave and reflow soldering techniques. These dimensions are intended to be a starting point for circuit board designers and may be fine tuned if necessary based upon the peculiarities of the soldering process and/or circuit board design.

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