Solid Tantalum Chip Capacitors, Tantamount® Leadless Molded


P and R Cases


Q Case Bottom


Q Case Top

Images are not to scale

FEATURES

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

PERFORMANCE CHARACTERISTICS

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

Capacitance Range: 1.0μF to 47μF

Capacitance Tolerance: ± 10%, ± 20% standard

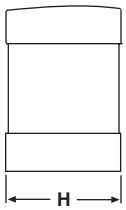
Voltage Rating: 3WVDC to 20WVDC

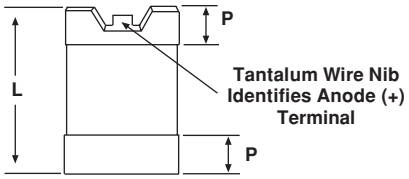
ORDERING INFORMATION

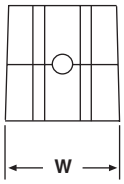
292D	106	X_	010	P	2	_
MODEL	CAPACITANCE	CAPACITANCE TOLERANCE	DC VOLTAGE RATING @ + 85°C	CASE CODE	TERMINATION	REEL SIZE AND PACKAGING
	This is expressed in picofarads. The first two digits are the significant figures. The third is the number of zeros to follow.	**X0 = ± 20%** X9 = ± 10%	This is expressed 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 = Solderable coating. Standard.** 4 = Gold plated 8 = Solder Plated (60/40) Special Order.	T = Tape and reel* **7" [178mm] reel** W =13" [330mm] reel *Cathode nearest sprocket hole.

Note: Preferred Tolerance and Reel size are in bold.

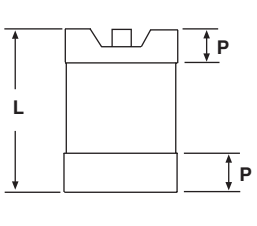
DIMENSIONS in inches [millimeters]

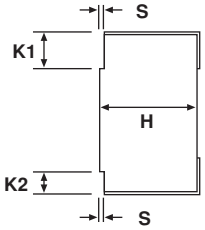


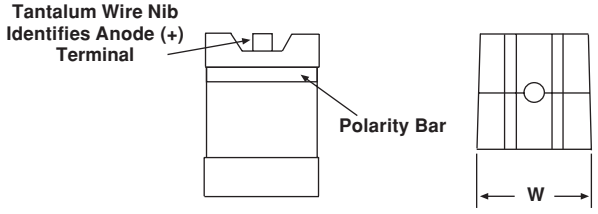




CASE	EIA	L	W	H	P
R	0805 [2012]	0.079 ± 0.008 [2.0 ± 0.2]	0.051 ± 0.008 [1.3 ± 0.2]	0.047 (Max.) [1.2 Max.]	0.020 ± 0.012 [0.5 ± 0.3]
P	0805 [2012]	0.079 ± 0.010 [2.0 ± 0.25]	0.053 ± 0.008 [1.35 ± 0.2]	0.053 ± 0.008 [1.35 ± 0.2]	0.020 ± 0.012 [0.5 ± 0.3]







CASE	EIA	L	W	H	P	K1	K2	S
Q	0805 [2012]	0.079 ± 0.008 [2.0 ± 0.2]	0.043 ± 0.008 [1.1 ± 0.2]	0.043 (Max.) [1.1 Max.]	0.020 ± 0.012 [0.5 ± 0.3]	0.008 [0.2 min]	0.006 min [0.15 min]	0.002 min [0.05 min]

RATINGS AND CASE CODES

µF	3V	4V	6.3V	10V	16V	20V
1				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	R	Q*/P/R	P	
15		R	R	P		
22		P/R	P/R			
33		P/R	P/R*			
47	P					

*Preliminary values, contact factory for availability.

STANDARD RATINGS

CAPACITANCE (µF)	CASE CODE	PART NUMBER	MAX DCL @ +25°C (µA)	MAX DF @ + 25°C (%)	MAX ESR @ 100K Hz (Ω)	MAX RIPPLE 100K Hz IRMS (AMPS)
3WVDC @ + 85°C, SURGE = 3.9V. . .1.9WVDC @ + 125°C, SURGE = 2.9V						
47	P	292D476X_003P2T	1.5	12	6	0.21
4WVDC @ + 85°C, SURGE = 5.2V. . .2.7WVDC @ + 125°C, SURGE = 3.4V						
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
6.3WVDC @ + 85°C, SURGE = 8V. . .4WVDC @ + 125°C, SURGE = 5V						
2.2	R	292D225X_6R3R2T	0.14	10	3.0	0.091
4.7	R	292D475X_6R6R2T	0.6	6	3.4	0.086
6.8	R	292D685X_6R3R2T	0.5	6	5	0.071
10	R	292D106X_6R3R2T	0.9	10	3.5	0.085
15	R	292D156X_6R3R2T	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
33*	R*	292D336X_6R3R2T*	2.1*	12*	3.5*	0.085*
10WVDC @ + 85°C, SURGE = 13V. . .7WVDC @ + 125°C, SURGE = 8V						
1	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	0.11
3.3	R	292D335X_010R2_035	0.5	8	1.0	0.158
3.3	P	292D335X_010P2T	0.5	8	2.0	0.11
4.7	P	292D475X_010P2T	0.5	8	5.0	0.071
4.7	R	292D475X_010R2T	0.5	8	5.0	0.071
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*	Q*	292D106X_010Q2T*	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
16WVDC @ + 85°C, SURGE = 20V. . .10WVDC @ + 125°C, SURGE = 12V						
1	R	292D105X_016R2	0.5	4	9.3	0.052
2.2	R	292D225X_016R2T	0.35	8	6	0.065
3.3	R	292D335X_016R2T	0.53	8	6	0.065
3.3	R	292D335X_016R2_035	0.53	8	3	0.091
4.7	R	292D475X_016R2T	0.75	8	6	0.065
10	P	292D106X_016P2T	1.6	8	6	0.065
20WVDC @ + 85°C, SURGE = 26V. . .13WVDC @ + 125°C, SURGE = 16V						
1.0	R	292D105X_020R2T	0.2	8	5.0	0.071
2.2	R	292D225X_020R2T	0.5	8	6.0	0.14

*Preliminary values, contact factory for availability.

PERFORMANCE CHARACTERISTICS

1. Operating Temperature: Capacitors are designed to operate over the temperature range of - 55°C to + 85°C.

1.1 Capacitors may be operated to + 125°C with voltage derating to two-thirds the + 85°C rating.

+ 85°C		+ 125°C RATING	
WORKING VOLTAGE (V)	SURGE VOLTAGE (V)	WORKING VOLTAGE (V)	SURGE VOLTAGE (V)
4.0	5.2	2.7	3.4
6.3	8.0	4.0	5.0
10.0	13.0	7.0	8.0

2. DC Working Voltage: The DC working voltage is the maximum operating voltage for continuous duty at the rated temperature.

3. Surge Voltage: The surge DC rating is the maximum voltage to which the capacitors may be subjected under any conditions, including transients and peak ripple at the highest line voltage.

3.1 Surge Voltage Test: Capacitors shall withstand the surge voltage applied in series with a 33 ohm ± 5% resistor at the rate of one-half minute on, one-half minute off, at + 85°C, for 1000 successive test cycles.

3.2 Following the surge voltage test, the dissipation factor and the leakage current shall meet the initial require ments; the capacitance shall not have changed more than ± 10%.

4. Capacitance Tolerance: The capacitance of all capacitors shall be within the specified tolerance limits of the normal rating.

4.1 Capacitance measurements shall be made by means of polarized capacitance bridge. The polarizing voltage shall be of such magnitude that there shall be no reversal of polarity due to the AC component. The maximum voltage applied to capacitors during measure ment shall be 2 volts rms at 120Hz at + 25°C. If the AC voltage applied is less than one-half volt rms, no DC bias is required. Accuracy of the bridge shall be within ± 2%.

5. Capacitance Change With Temperature: The capacitance change with temperature shall not exceed the following percentage of the capacitance measured at + 25°C: at

- 55°C	+ 85°C	+ 125°C
- 10%	+ 10%	+ 12%

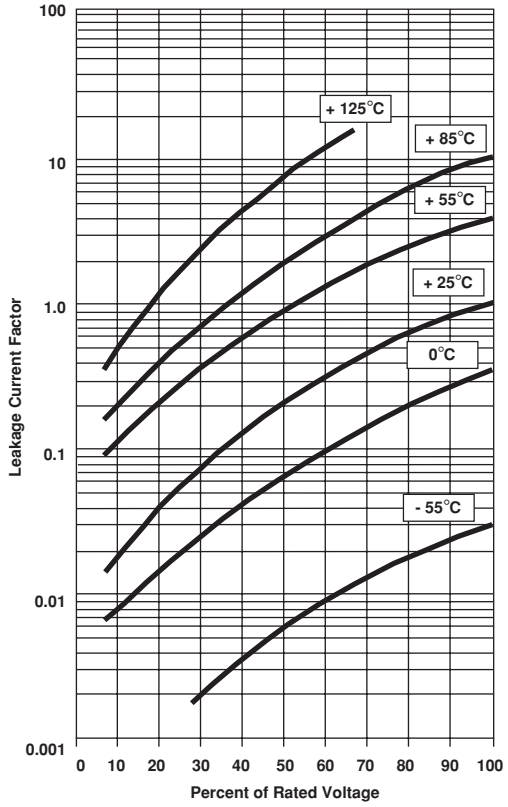
6. Dissipation Factor: The dissipation factor, determined from the expression $2\pi fRC$, shall not exceed values listed in the Standard Ratings Table.

6.1 Measurements shall be made by the bridge method at, or referred to, a frequency of 120Hz and a temperature of + 25°C.

7. Leakage Current: Capacitors shall be stabilized at the rated temperature for 30 minutes. Rated voltage shall be applied to capacitors for 5 minutes using a steady source of power (such as a regulated power supply) with 1000 ohm resistor connected in series with the capacitor under test to limit the charging current. Leakage current shall then be measured.

Note that the leakage current varies with applied voltage. See graph below for the appropriate adjustment factor.

TYPICAL LEAKAGE CURRENT FACTOR RANGE



7.1 At + 25°C, the leakage current shall not exceed the value listed in the Standard Ratings Table.

7.2 At + 85°C, the leakage current shall not exceed 10 times the value listed in the Standard Ratings Table.

7.3 At + 125°C, the leakage current shall not exceed 12 times the value listed in the Standard Ratings Table.

PERFORMANCE CHARACTERISTICS (Continued)

8. ESR

8.1 ESR (Equivalent Series Resistance) shall not exceed the values listed in the Ratings Table. Measurement shall be made by the bridge method at a frequency of 100kHz and a temperature of + 25°C.

9. Life Test: Capacitors shall withstand rated DC voltage applied at + 85°C or two-thirds rated voltage applied at + 125°C for 2000 hours.

9.1 Following the life test, the dissipation factor shall meet the initial requirement; the capacitance change shall not exceed ± 10%; the leakage current shall not exceed 125% of the initial requirement.

10 Solderability: Capacitors will meet the solderability requirements of (MIL-STD-202, method 208), ANSI/J-STD-002, Test B.

11. Resistance to Solder Heat: Capacitors will withstand exposure to + 245°C + 5°C for 5 seconds.

11.1 Following the resistance to solder heat test, capacitance, dissipation factor and DC leakage current shall meet the initial requirement.

12. Terminal Strength: Per IEC-384-3, minimum of 3N shear force.

13. Flammability:

14. Encapsulant materials meet UL94 V0 with an oxygen index of 32%.

15. Capacitor Failure Mode: The predominant failure mode for solid tantalum capacitors is increased leakage current resulting in a shorted circuit. Capacitor failure may result from excess forward or reverse DC voltage, surge current, ripple current, thermal shock or excessive temperature. The increase in leakage is caused by a breakdown of the Ta_2O_5 dielectric. For additional information on leakage failure of solid tantalum chip capacitors, refer to Vishay Sprague Technical Paper, "Leakage Failure Mode in Solid Tantalum Chip Capacitors."

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 @ + 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:

$$V_{rms} = \sqrt{\frac{P}{R_{ESR}}}$$

or, from the formula:

where, $V_{rms} = I_{rms} \times Z$

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.

2.3 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

2.4 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. It is important that the equivalent *Irms* value be established when calculating permissible operating levels. (Power Dissipation calculated using +25°C temperature rise.

CASE CODE	MAXIMUM PERMISSIBLE POWER DISSIPATION @ + 25C (Watts) IN FREE AIR
P	0.025
R	0.025
Q	0.025

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. **Recommended rated working voltage guidelines:**

APPLICATION VOLTAGE (V)	RECOMMENDED CAPACITOR VOLTAGE RATING (V)
2.5	4.0
4.0	6.3
6.0	10.0
10.0	16.0
12.0	20.0

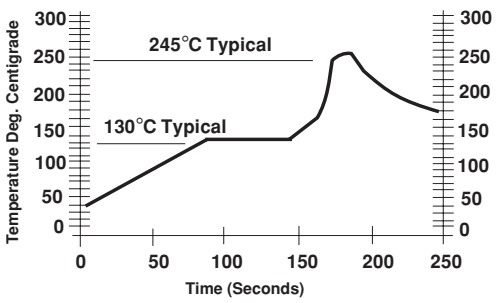
5. **Printed Circuit Board Materials**: The 292D is compatible with commonly used printed circuit board materials (alumina substrates, FR4, FR5, G10, PTFE- fluorocarbon and porcelanized steel).

6. **Attachment:**

6.1 Solder Paste: The recommended thickness of the solder paste after application is .007" ± .001" [.178mm ± 0.025mm]. Care should be exercised in selecting the solder paste. The metal purity should be 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.

6.2 Soldering: Capacitors can be attached by conventional soldering techniques - vapor phase, infrared reflow, wave soldering and hot plate methods. The Soldering Profile chart shows maximum recommended time/ temperature conditions for soldering. Attachment with a soldering iron is not recommended due to the difficulty of controlling temperature and time at temperature. If hand soldering is necessary, the soldering iron must never come in contact with the capacitor.

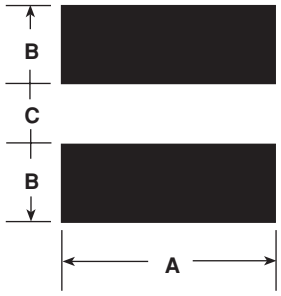
REFLOW SOLDERING PROFILE



8. **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.

REFLOW SOLDER PADS*

in inches [millimeters]

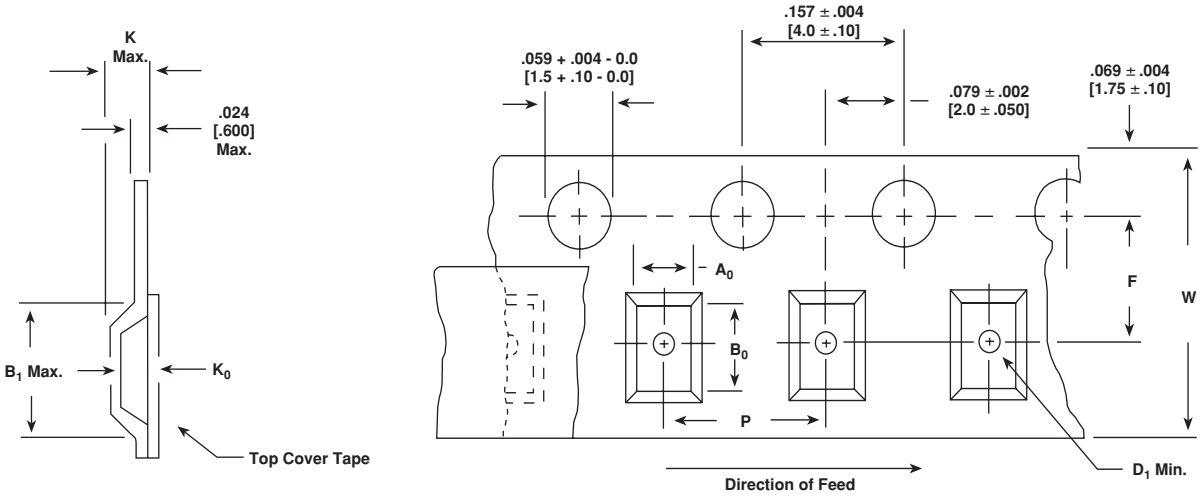


Case Code	Width (A)	Pad Metallization (B)	Separation (C)
P/R	0.059 [1.5]	0.071 [1.8]	0.039 [1.0]
Q	0.051 [1.3]	0.071 [1.8]	0.039 [1.0]

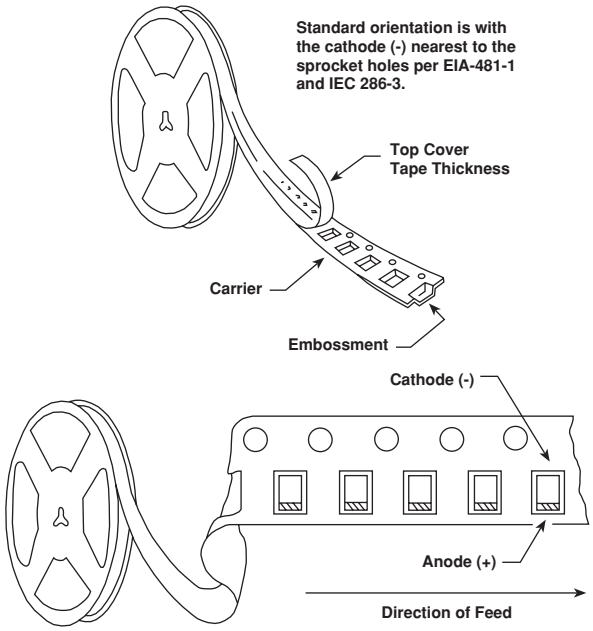
9. **Cleaning (Flux Removal) After Soldering:** The 292D is compatible with all commonly used solvents such as TES, TMS, Prelete, Chlorethane, Terpene and aqueous cleaning media. However, CFC/ODS products are not used in the production of these devices and are not recommended. Solvents containing methylene chloride or other epoxy solvents should be avoided since these will attack the epoxy encapsulation material.

9.1 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 @ 40kHz for 2 minutes.

TAPE AND REEL PACKAGING in inches [millimeters]



TAPE SIZE	B_1 (Max.)	D_1 (Min.)	F	K (Max.)	P	W	$A_0B_0K_0$
8mm	0.092 ± 0.0039 [2.34±0.100]	0.0394 + 0.0098 [1.5+0.100]	0.1378 ± 0 .0098 [3.5 ± .05] .	0.053 ± 0.0039 [1.35+0.100]	0.1575 ± 0 .0039 [4.0 ± 0.2]	0.315 + 0.0118 -0.0039 [8.0+.30-0.1]	**Notes:** $A_0B_0K_0$ are determined by component size. The clearance between the component and the cavity must be within .002" [.05mm] minimum to .020" [.50mm] maximum for 8mm tape and .002" [.05mm] minimum to .026" [.65mm] maximum for 12mm tape.



Tape and Reel Specifications: All case codes are available on plastic embossed tape per EIA-481-1. Tape reeling per IEC 286-3 is also available. Standard reel diameter is 7" [178mm]. 13" [330mm] reels are available.

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 must be specified in the Vishay Sprague® part number.

Case Code	Tape Width	Component Pitch	Units Per Reel	
			7" [178] Reel	13" [330] Reel
P	8mm	4mm	2500	10000
R	8mm	4mm	2500	10000
Q	8mm	4mm	2500	10000