

## Solid Tantalum Chip Capacitors

### TANTAMOUNT® Commercial, Surface Mount

### for Switch Mode Power Supplies and Converters



Effective September 2005, new capacitor ratings will not be added to the 593D series. All new ratings are available in the new TR3 series. The TR3 series offers state-of-the-art low ESR for switch Mode Power Supplies and DC/DC Converters.

#### FEATURES

- Terminations: 100 % Matte Tin, standard, Tin/Lead available
- Molded case available in five case codes
- Compatible with "High Volume" automatic pick and place equipment
- High ripple current carrying capability
- Low ESR
- Meets EIA 535BAAE and IEC Specification QC300801/US0001



**RoHS\***  
COMPLIANT

#### PERFORMANCE/ELECTRICAL CHARACTERISTICS

**Operating Temperature:** - 55 °C to + 125 °C

**Note:** Refer to Doc. 40088

**Capacitance Range:** 0.47 µF to 680 µF

**Capacitance Tolerance:** ± 20 %, ± 10 %

**Voltage Rating:** 4 VDC to 50 VDC

**Compliant Terminations**

**100 % Surge Current Tested (B, C, D and E Case Sizes)**

#### ORDERING INFORMATION

593D TYPE	107 CAPACITANCE	X9 CAPACITANCE TOLERANCE	010 DC VOLTAGE RATING AT + 85 °C	D CASE CODE	2WE3 TERMINATION 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 % X5 = ± 5 % (Special Order)	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 V)	See Ratings and Case Codes Table	2TE3: Matte Tin, 7" (178 mm) reel 2WE3: Matte Tin, 13" (330 mm) reel 8T: Tin/Lead, 7" (178 mm) reel 8W: Tin/Lead, 13" (330 mm) reel

#### Note:

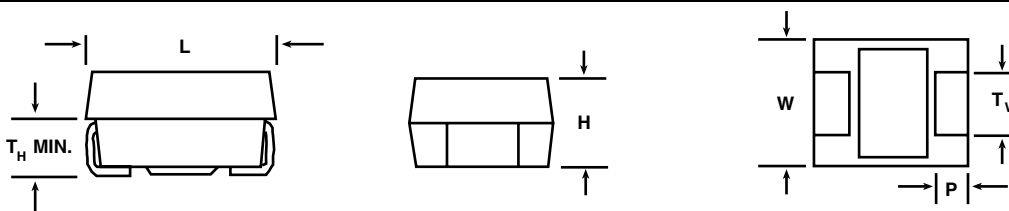
We reserve the right to supply higher voltage ratings and tighter capacitance tolerance capacitors in the same case size.

Voltage substitutions will be marked with the higher voltage rating.

Effective February 2008, Tin/Lead codes 2T and 2W will no longer be available. Tin/Lead replacement codes are 8T and 8W.

Available Matte Tin and Tin/Lead codes are shown in Termination and Packaging ordering information.

#### DIMENSIONS in inches [millimeters]



CASE CODE	EIA SIZE	L	W	H	P	T <sub>w</sub>	T <sub>H</sub> (MIN.)
A	3216-18	0.126 ± 0.008 [3.2 ± 0.20]	0.063 ± 0.008 [1.6 ± 0.20]	0.063 ± 0.008 [1.6 ± 0.20]	0.031 ± 0.012 [0.80 ± 0.30]	0.047 ± 0.004 [1.2 ± 0.10]	0.028 [0.70]
B	3528-21	0.138 ± 0.008 [3.5 ± 0.20]	0.110 ± 0.008 [2.8 ± 0.20]	0.075 ± 0.008 [1.9 ± 0.20]	0.031 ± 0.012 [0.80 ± 0.30]	0.087 ± 0.004 [2.2 ± 0.10]	0.028 [0.70]
C	6032-28	0.236 ± 0.012 [6.0 ± 0.30]	0.126 ± 0.012 [3.2 ± 0.30]	0.098 ± 0.012 [2.5 ± 0.30]	0.051 ± 0.012 [1.3 ± 0.30]	0.087 ± 0.004 [2.2 ± 0.10]	0.039 [1.0]
D	7343-31	0.287 ± 0.012 [7.3 ± 0.30]	0.170 ± 0.012 [4.3 ± 0.30]	0.110 ± 0.012 [2.8 ± 0.30]	0.051 ± 0.012 [1.3 ± 0.30]	0.095 ± 0.004 [2.4 ± 0.10]	0.039 [1.0]
E	7343-43	0.287 ± 0.012 [7.3 ± 0.30]	0.170 ± 0.012 [4.3 ± 0.30]	0.158 ± 0.012 [4.0 ± 0.30]	0.051 ± 0.012 [1.3 ± 0.30]	0.095 ± 0.004 [2.4 ± 0.10]	0.039 [1.0]

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



**Solid Tantalum Chip Capacitors**  
**TANTAMOUNT® Commercial, Surface Mount**  
**for Switch Mode Power Supplies and Converters**

Vishay Sprague

<b>RATINGS AND CASE CODES</b>								
$\mu\text{F}$	4 V	6.3 V	10 V	16 V	20 V	25 V	35 V	50 V
0.47							A	
0.68							A	
1.0					A	A	A/B	B/C
1.5						A	B/C	B/C
2.2					A	A/B	B/C	C/D
3.3				A	A	B	C	C/D
4.7			A	A/B	A/B	B/C	C	E/D
6.8			A	A	B	C	C/D	D/E
10		A	A	A/B/C	B/C	C	C/D	E
15	A	A	A/B	B/C	B/C	C/D	D/E	
22	A	A/B	A/B/C	B/C	C/D	D	D/E	
33	A/B	A/B	B/C	B/C/D	C/D	D/E		
47	A/B	B/C	B/C/D	C/D	D/E	E		
68	B/C	B/C	C/D	D	D/E			
100	B/C	B/C/D	C/D	D/E	E			
150	B/C/D	C/D/E	D/E	E				
220	C/D	D/E	D/E					
330	D	D/E	E					
470	D/E	E						
680	E							

<b>CONSTRUCTION AND MARKING</b>																					
<b>CONSTRUCTION</b>		<b>MARKING</b>																			
		<table border="1"> <thead> <tr> <th>V</th> <th>CODE</th> </tr> </thead> <tbody> <tr><td>4.0</td><td>G</td></tr> <tr><td>6.3</td><td>J</td></tr> <tr><td>10</td><td>A</td></tr> <tr><td>16</td><td>C</td></tr> <tr><td>20</td><td>D</td></tr> <tr><td>25</td><td>E</td></tr> <tr><td>35</td><td>V</td></tr> <tr><td>50</td><td>T</td></tr> </tbody> </table>		V	CODE	4.0	G	6.3	J	10	A	16	C	20	D	25	E	35	V	50	T
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<p><b>Marking:</b>            Capacitor marking includes an anode (+) polarity band, capacitance in microfarads and the voltage rating of + 85 °C. "A" Case capacitors use a letter code for the voltage and EIA capacitance code.            The Vishay Sprague® trademark will be included if space permits. Capacitors keep rated at 6.3 V shall be marked 6 V.            A manufacturing date code is marked on all capacitors.            Call the factory for further explanation.</p>																					

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<b>RATINGS AND PART NUMBER REFERENCE</b>						
CAPACITANCE ( $\mu$ F)	CASE CODE	PART NUMBER	MAX. DC LEAKAGE AT + 25 °C ( $\mu$ A)	MAX. DF AT + 25 °C 120 Hz (%)	MAX. ESR AT + 25 °C 100 kHz ( $\Omega$ )	MAX. RIPPLE 100 kHz $I_{rms}$ (A)
<b>4 WVDC AT + 85 °C, SURGE = 5.2 V . . . 2.7 WVDC AT + 125 °C, SURGE = 3.4 V</b>						
15	A	593D156(1)004A2(2)	0.6	6	1.500	0.22
22	A	593D226(1)004A2(2)	0.9	6	1.500	0.22
33	A	593D336(1)004A2(2)	1.3	6	1.500	0.22
33	B	593D336(1)004B2(2)	1.3	6	0.500	0.41
47	A	593D476(1)004A2(2)	1.9	14	0.800	0.31
47	B	593D476(1)004B2(2)	1.9	6	0.500	0.41
68	B	593D686(1)004B2(2)	2.7	6	0.500	0.41
68	C	593D686(1)004C2(2)	2.7	6	0.275	0.63
100	B	593D107(1)004B2(2)	4.0	6	0.450	0.43
100	C	593D107(1)004C2(2)	4.0	6	0.225	0.66
150	B	593D157(1)004B2(2)	6.0	14	0.500	0.41
150	C	593D157(1)004C2(2)	6.0	8	0.250	0.66
150	D	593D157(1)004D2(2)	6.0	8	0.150	1.00
220	C	593D227(1)004C2(2)	8.8	8	0.200	0.74
220	D	593D227(1)004D2(2)	8.8	8	0.150	1.00
330	D	593D337(1)004D2(2)	13.2	8	0.150	1.00
470	D	593D477(1)004D2(2)	18.8	10	0.125	1.10
470	E	593D477(1)004E2(2)	18.8	10	0.100	1.28
680	E	593D687(1)004E2(2)	27.2	12	0.100	1.28
<b>6.3 WVDC AT + 85 °C, SURGE = 8 V . . . 4 WVDC AT 125 °C, SURGE = 5 V</b>						
10	A	593D106(1)6R3A2(2)	0.6	6	2.000	0.19
15	A	593D156(1)6R3A2(2)	0.9	6	2.000	0.19
22	A	593D226(1)6R3A2(2)	1.3	6	2.000	0.19
22	B	593D226(1)6R3B2(2)	1.3	6	0.600	0.38
33	A	593D336(1)6R3A2(2)	2.0	14	0.800	0.31
33	B	593D336(1)6R3B2(2)	2.0	6	0.600	0.38
47	B	593D476(1)6R3B2(2)	2.8	6	0.550	0.39
47	C	593D476(1)6R3C2(2)	2.8	6	0.300	0.61
68	B	593D686(1)6R3B2(2)	4.1	6	0.550	0.39
68	C	593D686(1)6R3C2(2)	4.1	6	0.275	0.63
100	B	593D107(1)6R3B2(2)	6.0	15	0.500	0.41
100	C	593D107(1)6R3C2(2)	6.0	6	0.250	0.66
100	D	593D107(1)6R3D2(2)	6.0	6	0.140	1.04
150	C	593D157(1)6R3C2(2)	9.0	8	0.200	0.74
150	D	593D157(1)6R3D2(2)	9.0	8	0.125	1.10
150	E	593D157(1)6R3E2(2)	9.0	8	0.100	1.28
220	D	593D227(1)6R3D2(2)	13.2	8	0.100	1.22
220	E	593D227(1)6R3E2(2)	13.2	8	0.100	1.28
330	D	593D337(1)6R3D2(2)	19.8	8	0.125	1.10
330	E	593D337(1)6R3E2(2)	19.8	8	0.100	1.28
470	E	593D477(1)6R3E2(2)	28.2	10	0.100	1.28
<b>10 WVDC AT + 85 °C, SURGE = 13 V . . . 7 WVDC AT 125 °C, SURGE = 8 V</b>						
4.7	A	593D475(1)010A2(2)	0.5	6	3.000	0.16
6.8	A	593D685(1)010A2(2)	0.7	6	3.000	0.16
10	A	593D106(1)010A2(2)	1.0	6	2.000	0.19
15	A	593D156(1)010A2(2)	1.5	6	2.000	0.19
15	B	593D156(1)010B2(2)	1.5	6	0.700	0.35
22	A	593D226(1)010A2(2)	2.2	8	1.500	0.22
22	B	593D226(1)010B2(2)	2.2	6	0.700	0.35
22	C	593D226(1)010C2(2)	2.2	6	0.345	0.56
33	B	593D336(1)010B2(2)	3.3	6	0.600	0.38
33	C	593D336(1)010C2(2)	3.3	6	0.300	0.61

**Notes:**

(1) Capacitance tolerance: Specify "X9" for 10 % and "X0" for 20 %

(2) Termination and packaging: Specify 2TE3 or 2WE3 for lead (Pb)-free and 8T or 8W for Tin/Lead



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CAPACITANCE ( $\mu$ F)	CASE CODE	PART NUMBER	MAX. DC LEAKAGE AT + 25 °C ( $\mu$ A)	MAX. DF AT + 25 °C 120 Hz (%)	MAX. ESR AT + 25 °C 100 kHz ( $\Omega$ )	MAX. RIPPLE 100 kHz $I_{rms}$ (A)
<b>10 WVDC AT + 85 °C, SURGE = 13 V . . . 7 WVDC AT 125 °C, SURGE = 8 V</b>						
47	B	593D476(1)010B2(2)	4.7	6	0.600	0.38
47	C	593D476(1)010C2(2)	4.7	6	0.300	0.61
47	D	593D476(1)010D2(2)	4.7	6	0.200	0.87
68	C	593D686(1)010C2(2)	6.8	6	0.275	0.63
68	D	593D686(1)010D2(2)	6.8	6	0.150	1.00
100	C	593D107(1)010C2(2)	10.0	8	0.200	0.74
100	D	593D107(1)010D2(2)	10.0	6	0.100	1.22
150	D	593D157(1)010D2(2)	15.0	8	0.100	1.22
150	E	593D157(1)010E2(2)	15.0	8	0.100	1.28
220	D	593D227(1)010D2(2)	22.0	8	0.125	1.10
220	E	593D227(1)010E2(2)	22.0	8	0.100	1.28
330	E	593D337(1)010E2(2)	33.0	10	0.100	1.28
<b>16 WVDC AT + 85 °C, SURGE = 20 V . . . 10 WVDC AT + 125 °C, SURGE = 12 V</b>						
3.3	A	593D335(1)016A2(2)	0.5	6	3.500	0.15
4.7	A	593D475(1)016A2(2)	0.8	6	2.500	0.17
4.7	B	593D475(1)016B2(2)	0.8	6	1.500	0.24
6.8	A	593D685(1)016A2(2)	1.1	6	3.000	0.16
10	A	593D106(1)016A2(2)	1.6	6	1.700	0.21
10	B	593D106(1)016B2(2)	1.6	6	0.800	0.33
10	C	593D106(1)016C2(2)	1.6	6	0.450	0.49
15	B	593D156(1)016B2(2)	2.4	6	0.800	0.33
15	C	593D156(1)016C2(2)	2.4	6	0.400	0.52
22	B	593D226(1)016B2(2)	3.5	6	0.700	0.35
22	C	593D226(1)016C2(2)	3.5	6	0.350	0.56
33	B	593D336X0016B2(2)	5.3	6	0.700	0.35
33	C	593D336(1)016C2(2)	5.3	6	0.300	0.61
33	D	593D336(1)016D2(2)	4.2	4	0.225	0.82
47	C	593D476(1)016C2(2)	7.5	6	0.300	0.61
47	D	593D476(1)016D2(2)	7.5	6	0.150	1.00
68	D	593D686(1)016D2(2)	10.9	6	0.150	1.00
100	D	593D107(1)016D2(2)	16.0	8	0.125	1.10
100	E	593D107(1)016E2(2)	16.0	8	0.100	1.28
150	E	593D157(1)016E2(2)	24.0	8	0.100	1.28
<b>20 WVDC AT + 85 °C, SURGE = 26 V . . . 13 WVDC AT + 125 °C, SURGE = 16 V</b>						
1.0	A	593D105(1)020A2(2)	0.5	4	5.500	0.12
2.2	A	593D225(1)020A2(2)	0.5	6	4.000	0.14
3.3	A	593D335(1)020A2(2)	0.7	6	4.000	0.14
4.7	A	593D475(1)020A2(2)	0.9	6	3.500	0.15
4.7	B	593D475(1)020B2(2)	0.9	6	1.000	0.29
6.8	B	593D685(1)020B2(2)	1.4	6	1.000	0.29
10	B	593D106(1)020B2(2)	2.0	6	1.000	0.29
10	C	593D106(1)020C2(2)	2.0	6	0.450	0.49
15	B	593D156(1)020B2(2)	3.0	6	1.000	0.29
15	C	593D156(1)020C2(2)	3.0	6	0.400	0.52
22	C	593D226(1)020C2(2)	4.4	6	0.375	0.54
22	D	593D226(1)020D2(2)	3.5	4	0.225	0.82
33	C	593D336(1)020C2(2)	6.6	6	0.350	0.56
33	D	593D336(1)020D2(2)	6.6	6	0.200	0.87
47	D	593D476(1)020D2(2)	9.4	6	0.200	0.87
47	E	593D476(1)020E2(2)	7.5	4	0.150	1.05
68	D	593D686(1)020D2(2)	13.6	6	0.175	0.93
68	E	593D686(1)020E2(2)	13.6	6	0.150	1.05
100	E	593D107(1)020E2(2)	20.0	8	0.150	1.05

**Notes:**

(1) Capacitance tolerance: Specify "X9" for 10 % and "X0" for 20 %

(2) Termination and packaging: Specify 2TE3 or 2WE3 for lead (Pb)-free and 8T or 8W for Tin/Lead

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<b>RATINGS AND PART NUMBER REFERENCE</b>						
CAPACITANCE ( $\mu$ F)	CASE CODE	PART NUMBER	MAX. DC LEAKAGE AT + 25 °C ( $\mu$ A)	MAX. DF AT + 25 °C 120 Hz (%)	MAX. ESR AT + 25 °C 100 kHz ( $\Omega$ )	MAX. RIPPLE 100 kHz $I_{rms}$ (A)
<b>25 WVDC AT + 85 °C, SURGE = 32 V . . . 17 WVDC AT + 125 °C, SURGE = 20 V</b>						
1.0	A	593D105(1)025A2(2)	0.5	4	4.000	0.14
1.5	A	593D155(1)025A2(2)	0.5	6	4.000	0.14
2.2	A	593D225(1)025A2(2)	0.5	6	4.000	0.14
2.2	B	593D225(1)025B2(2)	0.6	6	1.500	0.24
3.3	B	593D335(1)025B2(2)	0.8	6	1.500	0.24
4.7	B	593D475(1)025B2(2)	1.2	6	1.500	0.24
4.7	C	593D475(1)025C2(2)	1.2	6	0.525	0.46
6.8	C	593D685(1)025C2(2)	1.7	6	0.500	0.47
10	C	593D106(1)025C2(2)	2.5	6	0.450	0.49
15	C	593D156(1)025C2(2)	3.8	6	0.425	0.51
15	D	593D156(1)025D2(2)	3.8	6	0.250	0.77
22	D	593D226(1)025D2(2)	5.5	6	0.200	0.87
33	D	593D336(1)025D2(2)	8.3	6	0.200	0.87
33	E	593D336(1)025E2(2)	8.3	6	0.200	0.91
47	E	593D476(1)025E2(2)	11.8	6	0.200	0.91
<b>35 WVDC AT + 85 °C, SURGE = 46 V . . . 23 WVDC AT + 125 °C, SURGE = 28 V</b>						
0.47	A	593D474(1)035A2(2)	0.5	4	4.000	0.14
0.68	A	593D684(1)035A2(2)	0.5	4	4.000	0.14
1.0	A	593D105(1)035A2(2)	0.5	4	4.000	0.14
1.0	B	593D105(1)035B2(2)	0.5	4	2.000	0.21
1.5	B	593D155(1)035B2(2)	0.5	6	2.000	0.21
1.5	C	593D155(1)035C2(2)	0.5	6	0.900	0.35
2.2	B	593D225(1)035B2(2)	0.8	6	2.000	0.21
2.2	C	593D225(1)035C2(2)	0.8	6	0.900	0.40
3.3	C	593D335(1)035C2(2)	1.2	6	0.700	0.45
4.7	C	593D475(1)035C2(2)	1.6	6	0.500	0.47
6.8	C	593D685(1)035C2(2)	2.4	6	0.475	0.48
6.8	D	593D685(1)035D2(2)	2.4	6	0.300	0.71
10	C	593D106(1)035C2(2)	3.5	6	0.450	0.49
10	D	593D106(1)035D2(2)	3.5	6	0.300	0.71
15	D	593D156(1)035D2(2)	5.3	6	0.300	0.71
15	E	593D156(1)035E2(2)	5.3	6	0.300	0.74
22	D	593D226(1)035D2(2)	7.7	6	0.300	0.71
22	E	593D226(1)035E2(2)	7.7	6	0.275	0.77
<b>50 WVDC AT + 85 °C, SURGE = 65 V . . . 33 WVDC AT + 125 °C, SURGE = 40 V</b>						
1.0	B	593D105(1)050B2(2)	0.5	4	2.000	0.21
1.0	C	593D105(1)050C2(2)	0.5	4	1.600	0.26
1.5	B	593D155(1)050B2(2)	0.8	6	2.000	0.21
1.5	C	593D155(1)050C2(2)	0.8	6	1.500	0.27
2.2	C	593D225(1)050C2(2)	1.1	6	1.500	0.27
2.2	D	593D225(1)050D2(2)	1.1	6	0.800	0.43
3.3	C	593D335(1)050C2(2)	1.7	6	1.500	0.27
3.3	D	593D335(1)050D2(2)	1.7	6	0.800	0.43
4.7	D	593D475(1)050D2(2)	2.4	6	0.600	0.50
4.7	E	593D475(1)050E2(2)	1.9	6	0.600	0.50
6.8	D	593D685(1)050D2(2)	3.4	6	0.600	0.50
6.8	E	593D685(1)050E2(2)	3.4	6	0.550	0.55
10	E	593D106(1)050E2(2)	5.0	6	0.550	0.55

**Notes:**

- (1) Capacitance tolerance: Specify "X9" for 10 % and "X0" for 20 %  
 (2) Termination and packaging: Specify 2TE3 or 2WE3 for lead (Pb)-free and 8T or 8W for Tin/Lead



## Disclaimer

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