Solid Tantalum Surface Mount Capacitors
TANTAMOUNT®, Molded Case, Low ESR

Effective September 2005, new capacitor ratings will not be added to the 593D series. All new ratings are available in the 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
- Compliant terminations
- Molded case available in five case codes
- Compatible with “High Volume” automatic pick and place equipment
- High ripple current carrying capability
- Low ESR
- Meets IEC specification QC300801/US0001 and EIA535BAAC mechanical and performance requirements
- Compliant to RoHS directive 2002/95/EC

Pb-free Available

RoHS* COMPLIANT

PERFORMANCE/ELECTRICAL CHARACTERISTICS

Operating Temperature: - 55 °C to + 85 °C
(to + 125 °C with voltage derating)
Note: Refer to Doc. 40088
Capacitance Range: 0.47 µF to 680 µF

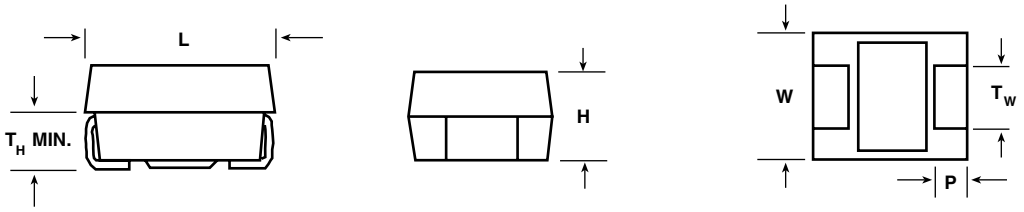
Capacitance Tolerance: ± 5 %, ± 10 %, ± 20 %
100 % Surge Current Tested (B, C, D and E Case Sizes)
Voltage Rating: 4 VDC to 50 VDC

ORDERING INFORMATION

593D	107	X9	010	D	2WE3
TYPE	CAPACITANCE	CAPACITANCE TOLERANCE	DC VOLTAGE RATING AT + 85 °C	CASE CODE	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 %	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 July 15, 2008, part numbers with solderable termination codes 2T and 2W may have either matte or tin/lead terminations. Codes 2TE3 and 2WE3 specify only matte tin terminations. Codes 8T and 8W specify only tin/lead terminations.

DIMENSIONS in inches [millimeters]



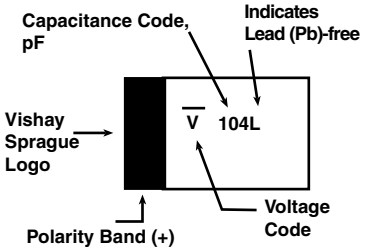
CASE CODE	EIA SIZE	L	W	H	P	T_W	T_H (MIN.)
A	3216-18	0.126 ± 0.008 [3.2 ± 0.20]	0.063 ± 0.008 [1.6 ± 0.20]	0.063 ± 0.008 [1.6 ± 0.20]	0.031 ± 0.012 [0.80 ± 0.30]	0.047 ± 0.004 [1.2 ± 0.10]	0.028 [0.70]
B	3528-21	0.138 ± 0.008 [3.5 ± 0.20]	0.110 ± 0.008 [2.8 ± 0.20]	0.075 ± 0.008 [1.9 ± 0.20]	0.031 ± 0.012 [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

RATINGS AND CASE CODES

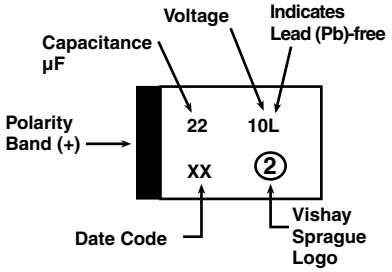
µF	4 V	6.3 V	10 V	16 V	20 V	25 V	35 V	50 V
0.47							A	
0.68							A	
1					A	A	A/B	B/C
1.5						A	B/C	B/C
2.2					A	A/B	B/C	C/D
3.3				A	A	B	C	C/D
4.7			A	A/B	A/B	B/C	C	E/D
6.8			A	A	B	C	C/D	D/E
10		A	A	A/B/C	B/C	C	C/D	D/E
15	A	A	A/B	B/C	B/C	C/D	D/E	
22	A	A/B	A/B/C	B/C	C/D	D	D/E	
33	A/B	A/B	B/C	B/C/D	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							

MARKING



"A" Case Size

"A" CASE VOLTAGE CODE	
VOLTS	CODE
4.0	G
6.3	J
10	A
16	C
20	D
25	E
35	V
50	T



"B, C, D, E, V" Case Sizes

Marking:

Capacitor marking includes an anode (+) polarity band, capacitance in microfarads and the voltage rating. "A" Case capacitors use a letter code for the voltage and EIA capacitance code.

The Vishay Sprague® trademark is included if space permits. Capacitors rated at 6.3 V are marked 6 V.

A manufacturing date code is marked on all capacitors.

Capacitors might bear a slightly different marking than the one shown above. For example, rating 22 µF 10 V could be marked either as 22-10L or 22R10.

Call the factory for further explanation.

RATINGS AND PART NUMBER REFERENCE

CAPACITANCE (µF)	CASE CODE	PART NUMBER	MAX. DC LEAKAGE AT + 25 °C (µA)	MAX. DF AT + 25 °C 120 Hz (%)	MAX. ESR AT + 25 °C 100 kHz (Ω)	MAX. RIPPLE 100 kHz I_{rms} (A)
4 VDC AT + 85 °C, 2.7 VDC AT + 125 °C						
15	A	593D156(1)004A(2)	0.6	6	1.500	0.22
22	A	593D226(1)004A(2)	0.9	6	1.500	0.22
33	A	593D336(1)004A(2)	1.3	6	1.500	0.22
33	B	593D336(1)004B(2)	1.3	6	0.500	0.41
47	A	593D476(1)004A(2)	1.9	14	0.800	0.31
47	B	593D476(1)004B(2)	1.9	6	0.500	0.41
68	B	593D686(1)004B(2)	2.7	6	0.500	0.41
68	C	593D686(1)004C(2)	2.7	6	0.275	0.63
100	B	593D107(1)004B(2)	4.0	8	0.450	0.43
100	C	593D107(1)004C(2)	4.0	6	0.225	0.66
150	B	593D157(1)004B(2)	6.0	14	0.500	0.41
150	C	593D157(1)004C(2)	6.0	12	0.250	0.66
150	D	593D157(1)004D(2)	6.0	8	0.150	1.00
220	C	593D227(1)004C(2)	8.8	8	0.200	0.74
220	D	593D227(1)004D(2)	8.8	8	0.150	1.00
330	D	593D337(1)004D(2)	13.2	8	0.150	1.00
470	D	593D477(1)004D(2)	18.8	10	0.125	1.10
470	E	593D477(1)004E(2)	18.8	10	0.100	1.28
680	E	593D687(1)004E(2)	27.2	12	0.100	1.28
6.3 VDC AT + 85 °C, 4 VDC AT 125 °C						
10	A	593D106(1)6R3A(2)	0.6	6	2.000	0.19
15	A	593D156(1)6R3A(2)	0.9	6	2.000	0.19
22	A	593D226(1)6R3A(2)	1.3	6	2.000	0.19
22	B	593D226(1)6R3B(2)	1.3	6	0.600	0.38
33	A	593D336(1)6R3A(2)	2.0	14	0.800	0.31
33	B	593D336(1)6R3B(2)	2.0	6	0.600	0.38
47	B	593D476(1)6R3B(2)	2.8	6	0.550	0.39
47	C	593D476(1)6R3C(2)	2.8	6	0.300	0.61
68	B	593D686(1)6R3B(2)	4.1	6	0.550	0.39
68	C	593D686(1)6R3C(2)	4.1	6	0.275	0.63
100	B	593D107(1)6R3B(2)	6.0	15	0.500	0.41
100	C	593D107(1)6R3C(2)	6.0	6	0.250	0.66
100	D	593D107(1)6R3D(2)	6.0	6	0.140	1.04
150	C	593D157(1)6R3C(2)	9.0	8	0.200	0.74
150	D	593D157(1)6R3D(2)	9.0	8	0.125	1.10
150	E	593D157(1)6R3E(2)	9.0	8	0.100	1.28
220	D	593D227(1)6R3D(2)	13.2	8	0.100	1.22
220	E	593D227(1)6R3E(2)	13.2	8	0.100	1.28
330	D	593D337(1)6R3D(2)	19.8	8	0.125	1.10
330	E	593D337(1)6R3E(2)	19.8	8	0.100	1.28
470	E	593D477(1)6R3E(2)	28.2	10	0.100	1.28
10 VDC AT + 85 °C, 7 VDC AT 125 °C						
4.7	A	593D475(1)010A(2)	0.5	6	3.000	0.16
6.8	A	593D685(1)010A(2)	0.7	6	3.000	0.16
10	A	593D106(1)010A(2)	1.0	6	2.000	0.19
15	A	593D156(1)010A(2)	1.5	6	2.000	0.19
15	B	593D156(1)010B(2)	1.5	6	0.700	0.35
22	A	593D226(1)010A(2)	2.2	8	1.500	0.22
22	B	593D226(1)010B(2)	2.2	6	0.700	0.35
22	C	593D226(1)010C(2)	2.2	6	0.345	0.56
33	B	593D336(1)010B(2)	3.3	6	0.600	0.38
33	C	593D336(1)010C(2)	3.3	6	0.300	0.61

RATINGS AND PART NUMBER REFERENCE

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

RATINGS AND PART NUMBER REFERENCE

CAPACITANCE (µF)	CASE CODE	PART NUMBER	MAX. DC LEAKAGE AT + 25 °C (µA)	MAX. DF AT + 25 °C 120 Hz (%)	MAX. ESR AT + 25 °C 100 kHz (Ω)	MAX. RIPPLE 100 kHz I_{rms} (A)
25 VDC AT + 85 °C, 17 VDC AT + 125 °C						
1	A	593D105(1)025A(2)	0.5	4	4.000	0.14
1.5	A	593D155(1)025A(2)	0.5	6	4.000	0.14
2.2	A	593D225(1)025A(2)	0.6	6	4.000	0.14
2.2	B	593D225(1)025B(2)	0.6	6	1.500	0.24
3.3	B	593D335(1)025B(2)	0.8	6	1.500	0.24
4.7	B	593D475(1)025B(2)	1.2	6	1.500	0.24
4.7	C	593D475(1)025C(2)	1.2	6	0.525	0.46
6.8	C	593D685(1)025C(2)	1.7	6	0.500	0.47
10	C	593D106(1)025C(2)	2.5	6	0.450	0.49
15	C	593D156(1)025C(2)	3.8	6	0.425	0.51
15	D	593D156(1)025D(2)	3.8	6	0.250	0.77
22	D	593D226(1)025D(2)	5.5	6	0.200	0.87
33	D	593D336(1)025D(2)	8.3	6	0.200	0.87
33	E	593D336(1)025E(2)	8.3	6	0.200	0.91
47	E	593D476(1)025E(2)	11.8	6	0.200	0.91
35 VDC AT + 85 °C, 23 VDC AT + 125 °C						
0.47	A	593D474(1)035A(2)	0.5	4	4.000	0.14
0.68	A	593D684(1)035A(2)	0.5	4	4.000	0.14
1	A	593D105(1)035A(2)	0.5	4	4.000	0.14
1	B	593D105(1)035B(2)	0.5	4	2.000	0.21
1.5	B	593D155(1)035B(2)	0.5	6	2.000	0.21
1.5	C	593D155(1)035C(2)	0.5	6	0.900	0.35
2.2	B	593D225(1)035B(2)	0.8	6	2.000	0.21
2.2	C	593D225(1)035C(2)	0.8	6	0.900	0.40
3.3	C	593D335(1)035C(2)	1.2	6	0.700	0.45
4.7	C	593D475(1)035C(2)	1.6	6	0.500	0.47
6.8	C	593D685(1)035C(2)	2.4	6	0.475	0.48
6.8	D	593D685(1)035D(2)	2.4	6	0.300	0.71
10	C	593D106(1)035C(2)	3.5	6	0.450	0.49
10	D	593D106(1)035D(2)	3.5	6	0.300	0.71
15	D	593D156(1)035D(2)	5.3	6	0.300	0.71
15	E	593D156(1)035E(2)	5.3	6	0.300	0.74
22	D	593D226(1)035D(2)	7.7	6	0.300	0.71
22	E	593D226(1)035E(2)	7.7	6	0.275	0.77
50 VDC AT + 85 °C, 33 VDC AT + 125 °C						
1	B	593D105(1)050B(2)	0.5	4	2.000	0.21
1	C	593D105(1)050C(2)	0.5	4	1.600	0.26
1.5	B	593D155(1)050B(2)	0.8	6	2.000	0.21
1.5	C	593D155(1)050C(2)	0.8	6	1.500	0.27
2.2	C	593D225(1)050C(2)	1.1	6	1.500	0.27
2.2	D	593D225(1)050D(2)	1.1	6	0.800	0.43
3.3	C	593D335(1)050C(2)	1.7	6	1.500	0.27
3.3	D	593D335(1)050D(2)	1.7	6	0.800	0.43
4.7	D	593D475(1)050D(2)	2.4	6	0.600	0.50
4.7	E	593D475(1)050E(2)	1.9	6	0.600	0.50
6.8	D	593D685(1)050D(2)	3.4	6	0.600	0.50
6.8	E	593D685(1)050E(2)	3.4	6	0.550	0.55
10	D	593D106(1)050D(2)	5.0	6	0.550	0.52
10	E	593D106(1)050E(2)	5.0	6	0.550	0.55

Notes
- (1) Tolerance: X0, X9, X5
- (2) Terminations and packaging: 2TE3, 2WE3, 8T, 8W

Disclaimer

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