



Solid-Electrolyte TANTALEX® Capacitors,
Military MIL-C-39003 Qualified, Syles CSR13, 21, 23, 33

Vishay Sprague

| DIMENSIONS in inches [millimeters] | | | | |
|--|---------------------|---------------------------------------|---------------------|---------------|
| STYLE CSR13 STYLE CSR21 STYLE CSR23 STYLE CSR33 | | | | |
| | | | | |
| CASE CODE | L ± 0.031 [0.79] | D + 0.016 [0.41] - 0.015 [0.38] | M ± 0.002 [0.05] | J (MAX.) |
| A | 0.286 [7.26] | 0.135 [3.43] | 0.020 [0.51] | 0.422 [10.72] |
| B | 0.474 [12.04] | 0.185 [4.70] | 0.020 [0.51] | 0.610 [15.49] |
| C | 0.686 [17.42] | 0.289 [7.34] | 0.025 [0.64] | 0.822 [20.88] |
| D | 0.786 [19.96] | 0.351 [8.92] | 0.025 [0.64] | 0.922 [23.42] |

Notes:

1. The case insulation shall extend 0.015" [0.38 mm] minimum beyond each end. However, when a shrink-fitted insulation is used, it shall lap over the ends of the capacitor body.
2. A minimum lead length of 1.0" [2.54 mm] for use with tape and reel automatic insertion equipment is available upon request.
3. Failure Rate levels M, P, R and S are inactive for new design. insulation is used, it shall lap over the ends of the capacitor body.

| STANDARD RATINGS: CSR13, M39003/01-XXXX | | | | | | | | | | | | | | |
|---|--------------|-----------------------|--|------|------|-------|------|------|-------|------------------|---------|----------|--------------------|---------------------|
| CAPACITANCE (µF) | CASE CODE | CAP. TOL. (± %) | PART NO. M39003/01- FAILURE RATE LEVEL (%/1000 HOURS) | | | | | | | MAX. DCL (µA) AT | | | MAX. DF (%) AT | |
| | | | M | P | R | S | B | C | D | + 25 °C | + 85 °C | + 125 °C | - 55 °C + 25 °C | + 85 °C + 125 °C |
| | | | 1.0 | 0.1 | 0.01 | 0.001 | 0.1 | 0.01 | 0.001 | | | | | |
| 6 WVDC AT + 85 °C, SURGE = 8 V . . . 4 WVDC AT + 125 °C, SURGE = 5 V | | | | | | | | | | | | | | |
| 5.6 | A | 5 | 5001 | 5201 | 5401 | 5601 | 6001 | 7001 | 8001 | 0.3 | 6.0 | 7.5 | 4 | 4 |
| 5.6 | A | 10 | 2241 | 2481 | 2721 | 2961 | 6002 | 7002 | 8002 | 0.3 | 6.0 | 7.5 | 4 | 4 |
| 6.8 | A | 5 | 5002 | 5202 | 5402 | 5602 | 6003 | 7003 | 8003 | 0.3 | 6.0 | 7.5 | 6 | 6 |
| 6.8 | A | 10 | 2242 | 2482 | 2722 | 2962 | 6004 | 7004 | 8004 | 0.3 | 6.0 | 7.5 | 6 | 6 |
| 6.8 | A | 20 | 2243 | 2843 | 2723 | 2963 | 6005 | 7005 | 8005 | 0.3 | 6.0 | 7.5 | 6 | 6 |
| 47.0 | B | 5 | 5003 | 5203 | 5403 | 5603 | 6006 | 7006 | 8006 | 1.5 | 24.0 | 30.0 | 6 | 6 |
| 47.0 | B | 10 | 2244 | 2484 | 2724 | 2964 | 6007 | 7007 | 8007 | 1.5 | 24.0 | 30.0 | 6 | 6 |
| 47.0 | B | 20 | 2245 | 2485 | 2725 | 2965 | 6008 | 7008 | 8008 | 1.5 | 24.0 | 30.0 | 6 | 6 |
| 56.0 | B | 5 | 5004 | 5204 | 5404 | 5604 | 6009 | 7009 | 8009 | 1.5 | 24.0 | 30.0 | 6 | 6 |
| 56.0 | B | 10 | 2246 | 2486 | 2726 | 2966 | 6010 | 7010 | 8010 | 1.5 | 24.0 | 30.0 | 6 | 6 |
| 150.0 | C | 5 | 5005 | 5205 | 5405 | 5605 | 6011 | 7011 | 8011 | 4.5 | 90.0 | 113.0 | 8 | 8 |
| 150.0 | C | 10 | 2247 | 2487 | 2727 | 2967 | 6012 | 7012 | 8012 | 4.5 | 90.0 | 113.0 | 8 | 8 |
| 150.0 | C | 20 | 2248 | 2488 | 2728 | 2968 | 6013 | 7013 | 8013 | 4.5 | 90.0 | 113.0 | 8 | 8 |
| 180.0 | C | 5 | 5006 | 5206 | 5406 | 5606 | 6014 | 7014 | 8014 | 5.5 | 110.0 | 138.0 | 8 | 8 |
| 180.0 | C | 10 | 2249 | 2489 | 2729 | 2969 | 6015 | 7015 | 8015 | 5.5 | 110.0 | 138.0 | 8 | 8 |
| 270.0 | D | 5 | 5007 | 5207 | 5407 | 5607 | 6016 | 7016 | 8016 | 6.5 | 130.0 | 163.0 | 8 | 8 |
| 270.0 | D | 10 | 2250 | 2490 | 2730 | 2970 | 6017 | 7017 | 8017 | 6.5 | 130.0 | 163.0 | 8 | 8 |
| 330.0 | D | 5 | 5008 | 5208 | 5408 | 5608 | 6018 | 7018 | 8018 | 7.5 | 150.0 | 188.0 | 8 | 8 |
| 330.0 | D | 10 | 2251 | 2491 | 2731 | 2971 | 6019 | 7019 | 8019 | 7.5 | 150.0 | 188.0 | 8 | 8 |
| 330.0 | D | 20 | 2252 | 2492 | 2732 | 2972 | 6020 | 7020 | 8020 | 7.5 | 150.0 | 188.0 | 8 | 8 |



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|---|--------------|-----------------------|--|------|------|-------|------|------|-------|---------|------------------|----------|--------------------|---------------------|--|
| CAPACITANCE (µF) | CASE CODE | CAP. TOL. (± %) | PART NO. M39003/01- FAILURE RATE LEVEL (%/1000 HOURS) | | | | | | | | MAX. DCL (µA) AT | | | MAX. DF (%) AT | |
| | | | M | P | R | S | B | C | D | + 25 °C | + 85 °C | + 125 °C | - 55 °C + 25 °C | + 85 °C + 125 °C | |
| | | | 1.0 | 0.1 | 0.01 | 0.001 | 0.1 | 0.01 | 0.001 | | | | | | |
| 10 WVDC AT + 85 °C, SURGE = 13 V . . . 7 WVDC AT + 125 °C, SURGE = 9 V | | | | | | | | | | | | | | | |
| 3.9 | A | 5 | 5009 | 5209 | 5409 | 5609 | 6021 | 7021 | 8021 | 0.3 | 6.0 | 7.5 | 4 | 4 | |
| 3.9 | A | 10 | 2253 | 2493 | 2733 | 2973 | 6022 | 7022 | 8022 | 0.3 | 6.0 | 7.5 | 4 | 4 | |
| 4.7 | A | 5 | 5010 | 5210 | 5410 | 5610 | 6023 | 7023 | 8023 | 0.4 | 7.0 | 8.8 | 4 | 4 | |
| 4.7 | A | 10 | 2254 | 2494 | 2734 | 2974 | 6024 | 7024 | 8024 | 0.4 | 7.0 | 8.8 | 4 | 4 | |
| 4.7 | A | 20 | 2255 | 2495 | 2735 | 2975 | 6025 | 7025 | 8025 | 0.4 | 7.0 | 8.8 | 4 | 4 | |
| 27.0 | B | 5 | 5011 | 5211 | 5411 | 5611 | 6026 | 7026 | 8026 | 2.0 | 40.0 | 50.0 | 6 | 6 | |
| 27.0 | B | 10 | 2256 | 2496 | 2736 | 2976 | 6027 | 7027 | 8027 | 2.0 | 40.0 | 50.0 | 6 | 6 | |
| 33.0 | B | 5 | 5012 | 5212 | 5412 | 5612 | 6028 | 7028 | 8028 | 2.5 | 50.0 | 63.0 | 6 | 6 | |
| 33.0 | B | 10 | 2257 | 2497 | 2737 | 2977 | 6029 | 7029 | 8029 | 2.5 | 50.0 | 63.0 | 6 | 6 | |
| 33.0 | B | 20 | 2258 | 2498 | 2738 | 2978 | 6030 | 7030 | 8030 | 2.5 | 50.0 | 63.0 | 6 | 6 | |
| 39.0 | B | 5 | 5013 | 5213 | 5413 | 5613 | 6031 | 7031 | 8031 | 2.5 | 50.0 | 63.0 | 6 | 6 | |
| 39.0 | B | 10 | 2259 | 2499 | 2739 | 2979 | 6032 | 7032 | 8032 | 2.5 | 50.0 | 63.0 | 6 | 6 | |
| 82.0 | C | 5 | 5014 | 5214 | 5414 | 5614 | 6033 | 7033 | 8033 | 4.0 | 80.0 | 100.0 | 6 | 6 | |
| 82.0 | C | 10 | 2260 | 2500 | 2740 | 2980 | 6034 | 7034 | 8034 | 4.0 | 80.0 | 100.0 | 6 | 6 | |
| 100.0 | C | 5 | 5015 | 5215 | 5415 | 5615 | 6035 | 7035 | 8035 | 5.0 | 100.0 | 125.0 | 8 | 8 | |
| 100.0 | C | 10 | 2261 | 2501 | 2741 | 2981 | 6036 | 7036 | 8036 | 5.0 | 100.0 | 125.0 | 8 | 8 | |
| 100.0 | C | 20 | 2262 | 2502 | 2742 | 2982 | 6037 | 7037 | 8037 | 5.0 | 100.0 | 125.0 | 8 | 8 | |
| 120.0 | C | 5 | 5016 | 5216 | 5416 | 5616 | 6038 | 7038 | 8038 | 6.0 | 120.0 | 150.0 | 8 | 8 | |
| 120.0 | C | 10 | 2263 | 2503 | 2743 | 2983 | 6039 | 7039 | 8039 | 6.0 | 120.0 | 150.0 | 8 | 8 | |
| 180.0 | D | 5 | 5017 | 5217 | 5417 | 5617 | 6040 | 7040 | 8040 | 9.0 | 180.0 | 226.0 | 8 | 8 | |
| 180.0 | D | 10 | 2264 | 2504 | 2744 | 2984 | 6041 | 7041 | 8041 | 9.0 | 180.0 | 226.0 | 8 | 8 | |
| 220.0 | D | 5 | 5018 | 5218 | 5418 | 5618 | 6042 | 7042 | 8042 | 10.0 | 200.0 | 250.0 | 8 | 8 | |
| 220.0 | D | 10 | 2265 | 2505 | 2745 | 2985 | 6043 | 7043 | 8043 | 10.0 | 200.0 | 250.0 | 8 | 8 | |
| 220.0 | D | 20 | 2266 | 2506 | 2746 | 2986 | 6044 | 7044 | 8044 | 10.0 | 200.0 | 250.0 | 8 | 8 | |
| 15 WVDC AT + 85 °C, SURGE = 20 V . . . 10 WVDC AT + 125 °C, SURGE = 12 V | | | | | | | | | | | | | | | |
| 2.7 | A | 5 | 5019 | 5219 | 5419 | 5619 | 6045 | 7045 | 8045 | 0.3 | 6.0 | 7.5 | 4 | 4 | |
| 2.7 | A | 10 | 2267 | 2507 | 2747 | 2987 | 6046 | 7046 | 8046 | 0.3 | 6.0 | 7.5 | 4 | 4 | |
| 3.3 | A | 5 | 5020 | 5220 | 5420 | 5620 | 6047 | 7047 | 8047 | 0.4 | 8.0 | 10.0 | 4 | 4 | |
| 3.3 | A | 10 | 2268 | 2508 | 2748 | 2988 | 6048 | 7048 | 8048 | 0.4 | 8.0 | 10.0 | 4 | 4 | |
| 3.3 | A | 20 | 2269 | 2509 | 2749 | 2989 | 6049 | 7049 | 8049 | 0.4 | 8.0 | 10.0 | 4 | 4 | |
| 18.0 | B | 5 | 5021 | 5221 | 5421 | 5621 | 6050 | 7050 | 8050 | 2.0 | 35.0 | 44.0 | 6 | 6 | |
| 18.0 | B | 10 | 2270 | 2510 | 2750 | 2990 | 6051 | 7051 | 8051 | 2.0 | 35.0 | 44.0 | 6 | 6 | |
| 22.0 | B | 5 | 5022 | 5222 | 5422 | 5622 | 6052 | 7052 | 8052 | 2.0 | 40.0 | 50.0 | 6 | 6 | |
| 22.0 | B | 10 | 2271 | 2511 | 2751 | 2991 | 6053 | 7053 | 8053 | 2.0 | 40.0 | 50.0 | 6 | 6 | |
| 22.0 | B | 20 | 2272 | 2512 | 2752 | 2992 | 6054 | 7054 | 8054 | 2.0 | 40.0 | 50.0 | 6 | 6 | |
| 56.0 | C | 5 | 5023 | 5223 | 5423 | 5623 | 6055 | 7055 | 8055 | 4.0 | 80.0 | 100.0 | 6 | 6 | |
| 56.0 | C | 10 | 2273 | 2513 | 2753 | 2993 | 6056 | 7056 | 8056 | 4.0 | 80.0 | 100.0 | 6 | 6 | |
| 68.0 | C | 5 | 5024 | 5224 | 5424 | 5624 | 6057 | 7057 | 8057 | 5.0 | 100.0 | 125.0 | 6 | 6 | |
| 68.0 | C | 10 | 2274 | 2514 | 2754 | 2994 | 6058 | 7058 | 8058 | 5.0 | 100.0 | 125.0 | 6 | 6 | |
| 68.0 | C | 20 | 2275 | 2515 | 2755 | 2995 | 6059 | 7059 | 8059 | 5.0 | 100.0 | 125.0 | 6 | 6 | |
| 120.0 | D | 5 | 5025 | 5225 | 5425 | 5625 | 6060 | 7060 | 8060 | 9.0 | 180.0 | 226.0 | 8 | 8 | |
| 120.0 | D | 10 | 2276 | 2516 | 2756 | 2996 | 6061 | 7061 | 8061 | 9.0 | 180.0 | 226.0 | 8 | 8 | |
| 150.0 | D | 5 | 5026 | 5226 | 5426 | 5626 | 6062 | 7062 | 8062 | 10.0 | 200.0 | 250.0 | 8 | 8 | |
| 150.0 | D | 10 | 2277 | 2517 | 2757 | 2997 | 6063 | 7063 | 8063 | 10.0 | 200.0 | 250.0 | 8 | 8 | |
| 150.0 | D | 20 | 2278 | 2518 | 2758 | 2998 | 6064 | 7064 | 8064 | 10.0 | 200.0 | 250.0 | 8 | 8 | |
| 20 WVDC AT + 85 °C, SURGE = 26 V . . . 13 WVDC AT + 125 °C, SURGE = 16 V | | | | | | | | | | | | | | | |
| 1.2 | A | 5 | 5027 | 5227 | 5427 | 5627 | 6065 | 7065 | 8065 | 0.3 | 6.0 | 7.5 | 4 | 4 | |
| 1.2 | A | 10 | 2279 | 2519 | 2759 | 2999 | 6066 | 7066 | 8066 | 0.3 | 6.0 | 7.5 | 4 | 4 | |
| 1.5 | A | 5 | 5028 | 5228 | 5428 | 5628 | 6067 | 7067 | 8067 | 0.3 | 6.0 | 7.5 | 4 | 4 | |
| 1.5 | A | 10 | 2280 | 2520 | 2760 | 3000 | 6068 | 7068 | 8068 | 0.3 | 6.0 | 7.5 | 4 | 4 | |
| 1.5 | A | 20 | 2281 | 2521 | 2761 | 3001 | 6069 | 7069 | 8069 | 0.3 | 6.0 | 7.5 | 4 | 4 | |
| 1.5 | A | 5 | 5029 | 5229 | 5429 | 5629 | 6070 | 7070 | 8070 | 0.3 | 6.0 | 7.5 | 4 | 4 | |
| 1.8 | A | 10 | 2282 | 2522 | 2762 | 3002 | 6071 | 7071 | 8071 | 0.3 | 6.0 | 7.5 | 4 | 4 | |



Solid-Electrolyte TANTALEX® Capacitors,
Military MIL-C-39003 Qualified, Syles CSR13, 21, 23, 33

Vishay Sprague

| STANDARD RATINGS: CSR13, M39003/01-XXXX | | | | | | | | | | | | | | |
|---|--------------|-----------------------|--|------|------|-------|------|------|-------|------------------|---------|----------|--------------------|---------------------|
| CAPACITANCE (µF) | CASE CODE | CAP. TOL. (± %) | PART NO. M39003/01- FAILURE RATE LEVEL (%/1000 HOURS) | | | | | | | MAX. DCL (µA) AT | | | MAX. DF (%) AT | |
| | | | M | P | R | S | B | C | D | + 25 °C | + 85 °C | + 125 °C | - 55 °C + 25 °C | + 85 °C + 125 °C |
| | | | 1.0 | 0.1 | 0.01 | 0.001 | 0.1 | 0.01 | 0.001 | | | | | |
| 20 WVDC AT + 85 °C, SURGE = 26 V . . . 13 WVDC AT + 125 °C, SURGE = 16 V | | | | | | | | | | | | | | |
| 2.2 | A | 5 | 5030 | 5230 | 5430 | 5630 | 6072 | 7072 | 8072 | 0.4 | 8.0 | 10.0 | 4 | 4 |
| 2.2 | A | 10 | 2283 | 2523 | 2763 | 3003 | 6073 | 7073 | 8073 | 0.4 | 8.0 | 10.0 | 4 | 4 |
| 2.2 | A | 20 | 2284 | 2524 | 2764 | 3004 | 6074 | 7074 | 8074 | 0.4 | 8.0 | 10.0 | 4 | 4 |
| 8.2 | B | 5 | 5031 | 5231 | 5431 | 5631 | 6075 | 7075 | 8075 | 1.0 | 20.0 | 25.0 | 6 | 6 |
| 8.2 | B | 10 | 2285 | 2525 | 2765 | 3005 | 6076 | 7076 | 8076 | 1.0 | 20.0 | 25.0 | 6 | 6 |
| 10.0 | B | 5 | 5032 | 5232 | 5432 | 5632 | 6077 | 7077 | 8077 | 1.5 | 30.0 | 38.0 | 6 | 6 |
| 10.0 | B | 10 | 2286 | 2526 | 2766 | 3006 | 6078 | 7078 | 8078 | 1.5 | 30.0 | 38.0 | 6 | 6 |
| 10.0 | B | 20 | 2287 | 2527 | 2767 | 3007 | 6079 | 7079 | 8079 | 1.5 | 30.0 | 38.0 | 6 | 6 |
| 12.0 | B | 5 | 5033 | 5233 | 5433 | 5633 | 6080 | 7080 | 8080 | 1.8 | 35.0 | 44.0 | 6 | 6 |
| 12.0 | B | 10 | 2288 | 2528 | 2768 | 3008 | 6081 | 7081 | 8081 | 1.8 | 35.0 | 44.0 | 6 | 6 |
| 15.0 | B | 5 | 5034 | 5234 | 5434 | 5634 | 6082 | 7082 | 8082 | 2.0 | 40.0 | 50.0 | 6 | 6 |
| 15.0 | B | 10 | 2289 | 2529 | 2769 | 3009 | 6083 | 7083 | 8083 | 2.0 | 40.0 | 50.0 | 6 | 6 |
| 15.0 | B | 20 | 2290 | 2530 | 2770 | 3010 | 6084 | 7084 | 8084 | 2.0 | 40.0 | 50.0 | 6 | 6 |
| 27.0 | C | 5 | 5035 | 5235 | 5435 | 5635 | 6085 | 7085 | 8085 | 2.5 | 50.0 | 63.0 | 6 | 6 |
| 27.0 | C | 10 | 2291 | 2531 | 2771 | 3011 | 6086 | 7086 | 8086 | 2.5 | 50.0 | 63.0 | 6 | 6 |
| 33.0 | C | 5 | 5036 | 5236 | 5436 | 5636 | 6087 | 7087 | 8087 | 3.5 | 70.0 | 88.0 | 6 | 6 |
| 33.0 | C | 10 | 2292 | 2532 | 2772 | 3012 | 6088 | 7088 | 8088 | 3.5 | 70.0 | 88.0 | 6 | 6 |
| 33.0 | C | 20 | 2293 | 2533 | 2773 | 3013 | 6089 | 7089 | 8089 | 3.5 | 70.0 | 88.0 | 6 | 6 |
| 39.0 | C | 5 | 5037 | 5237 | 5437 | 5637 | 6090 | 7090 | 8090 | 4.0 | 80.0 | 100.0 | 6 | 6 |
| 39.0 | C | 10 | 2294 | 2534 | 2774 | 3014 | 6091 | 7091 | 8091 | 4.0 | 80.0 | 100.0 | 6 | 6 |
| 47.0 | C | 5 | 5038 | 5238 | 5438 | 5638 | 6092 | 7092 | 8092 | 4.5 | 90.0 | 113.0 | 6 | 6 |
| 47.0 | C | 10 | 2295 | 2535 | 2775 | 3015 | 6093 | 7093 | 8093 | 4.5 | 90.0 | 113.0 | 6 | 6 |
| 47.0 | C | 20 | 2296 | 2536 | 2776 | 3016 | 6094 | 7094 | 8094 | 4.5 | 90.0 | 113.0 | 6 | 6 |
| 56.0 | D | 5 | 5039 | 5239 | 5439 | 5639 | 6095 | 7095 | 8095 | 5.5 | 110.0 | 138.0 | 6 | 6 |
| 56.0 | D | 10 | 2297 | 2537 | 2777 | 3017 | 6096 | 7096 | 8096 | 5.5 | 110.0 | 138.0 | 6 | 6 |
| 68.0 | D | 5 | 5040 | 5240 | 5440 | 5640 | 6097 | 7097 | 8097 | 7.0 | 140.0 | 175.0 | 6 | 6 |
| 68.0 | D | 10 | 2298 | 2538 | 2778 | 3018 | 6098 | 7098 | 8098 | 7.0 | 140.0 | 175.0 | 6 | 6 |
| 68.0 | D | 20 | 2299 | 2539 | 2779 | 3019 | 6099 | 7099 | 8099 | 7.0 | 140.0 | 175.0 | 6 | 6 |
| 82.0 | D | 5 | 5041 | 5241 | 5441 | 5641 | 6100 | 7100 | 8100 | 8.0 | 160.0 | 200.0 | 6 | 6 |
| 82.0 | D | 10 | 2300 | 2540 | 2780 | 3020 | 6101 | 7101 | 8101 | 8.0 | 160.0 | 200.0 | 6 | 6 |
| 100.0 | D | 5 | 5042 | 5242 | 5442 | 5642 | 6102 | 7102 | 8102 | 10.0 | 200.0 | 250.0 | 8 | 8 |
| 100.0 | D | 10 | 2301 | 2541 | 2781 | 3021 | 6103 | 7103 | 8103 | 10.0 | 200.0 | 250.0 | 8 | 8 |
| 100.0 | D | 20 | 2302 | 2542 | 2782 | 3022 | 6104 | 7104 | 8104 | 10.0 | 200.0 | 250.0 | 8 | 8 |
| 35 WVDC AT + 85 °C, SURGE = 46 V . . . 23 WVDC AT + 125 °C, SURGE = 28 V | | | | | | | | | | | | | | |
| 5.6 | B | 5 | 5043 | 5243 | 5443 | 5643 | 6105 | 7105 | 8105 | 1.3 | 25.0 | 32.0 | 4 | 4 |
| 5.6 | B | 10 | 2303 | 2543 | 2783 | 3023 | 6106 | 7106 | 8106 | 1.3 | 25.0 | 32.0 | 4 | 4 |
| 6.8 | B | 5 | 5044 | 5244 | 5444 | 5644 | 6107 | 7107 | 8107 | 1.5 | 30.0 | 38.0 | 6 | 6 |
| 6.8 | B | 10 | 2304 | 2544 | 2784 | 3024 | 6108 | 7108 | 8108 | 1.5 | 30.0 | 38.0 | 6 | 6 |
| 6.8 | B | 20 | 2305 | 2545 | 2785 | 3025 | 6109 | 7109 | 8109 | 1.5 | 30.0 | 38.0 | 6 | 6 |
| 22.0 | C | 5 | 5045 | 5245 | 5445 | 5645 | 6110 | 7110 | 8110 | 4.0 | 80.0 | 100.0 | 6 | 6 |
| 22.0 | C | 10 | 2306 | 2546 | 2786 | 3026 | 6111 | 7111 | 8111 | 4.0 | 80.0 | 100.0 | 6 | 6 |
| 22.0 | C | 20 | 2307 | 2547 | 2787 | 3027 | 6112 | 7112 | 8112 | 4.0 | 80.0 | 100.0 | 6 | 6 |
| 27.0 | D | 5 | 5046 | 5246 | 5446 | 5646 | 6113 | 7113 | 8113 | 4.5 | 90.0 | 113.0 | 6 | 6 |
| 27.0 | D | 10 | 2308 | 2548 | 2788 | 3028 | 6114 | 7114 | 8114 | 4.5 | 90.0 | 113.0 | 6 | 6 |
| 33.0 | D | 5 | 5047 | 5247 | 5447 | 5647 | 6115 | 7115 | 8115 | 5.5 | 110.0 | 138.0 | 6 | 6 |
| 33.0 | D | 10 | 2309 | 2549 | 2789 | 3029 | 6116 | 7116 | 8116 | 5.5 | 110.0 | 138.0 | 6 | 6 |
| 33.0 | D | 20 | 2310 | 2550 | 2790 | 3030 | 6117 | 7117 | 8117 | 5.5 | 110.0 | 138.0 | 6 | 6 |
| 39.0 | D | 5 | 5048 | 5248 | 5448 | 5648 | 6118 | 7118 | 8118 | 7.0 | 140.0 | 175.0 | 6 | 6 |
| 39.0 | D | 10 | 2311 | 2551 | 2791 | 3031 | 6119 | 7119 | 8119 | 7.0 | 140.0 | 175.0 | 6 | 6 |
| 47.0 | D | 5 | 5049 | 5249 | 5449 | 5649 | 6120 | 7120 | 8120 | 8.0 | 160.0 | 200.0 | 6 | 6 |
| 47.0 | D | 10 | 2312 | 2552 | 2792 | 3032 | 6121 | 7121 | 8121 | 8.0 | 160.0 | 200.0 | 6 | 6 |
| 47.0 | D | 20 | 2313 | 2553 | 2793 | 3033 | 6122 | 7122 | 8122 | 8.0 | 160.0 | 200.0 | 6 | 6 |



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|---|--------------|-----------------------|--|------|------|-------|------|------|-------|------------------|---------|----------|--------------------|---------------------|
| CAPACITANCE (µF) | CASE CODE | CAP. TOL. (± %) | PART NO. M39003/01- FAILURE RATE LEVEL (%/1000 HOURS) | | | | | | | MAX. DCL (µA) AT | | | MAX. DF (%) AT | |
| | | | M | P | R | S | B | C | D | + 25 °C | + 85 °C | + 125 °C | - 55 °C + 25 °C | + 85 °C + 125 °C |
| | | | 1.0 | 0.1 | 0.01 | 0.001 | 0.1 | 0.01 | 0.001 | | | | | |
| 50 WVDC AT + 85 °C, SURGE = 65 V . . . 33 WVDC AT + 125 °C, SURGE = 40 V | | | | | | | | | | | | | | |
| 0.056 | A | 5 | 5063 | 5263 | 5463 | 5663 | 6156 | 7156 | 8156 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 0.056 | A | 10 | 2334 | 2574 | 2814 | 3054 | 6157 | 7157 | 8157 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 0.068 | A | 5 | 5064 | 5264 | 5464 | 5664 | 6158 | 7158 | 8158 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 0.068 | A | 10 | 2335 | 2575 | 2815 | 3055 | 6159 | 7159 | 8159 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 0.068 | A | 20 | 2336 | 2576 | 2816 | 3056 | 6160 | 7160 | 8160 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 0.082 | A | 5 | 5065 | 5265 | 5465 | 5665 | 6161 | 7161 | 8161 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 0.082 | A | 10 | 2337 | 2577 | 2817 | 3057 | 6162 | 7162 | 8162 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 0.10 | A | 5 | 5066 | 5266 | 5466 | 5666 | 6163 | 7163 | 8163 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 0.10 | A | 10 | 2338 | 2578 | 2818 | 3058 | 6164 | 7164 | 8164 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 0.10 | A | 20 | 2339 | 2579 | 2819 | 3059 | 6165 | 7165 | 8165 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 0.12 | A | 5 | 5067 | 5267 | 5467 | 5667 | 6166 | 7166 | 8166 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 0.12 | A | 10 | 2340 | 2580 | 2820 | 3060 | 6167 | 7167 | 8167 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 0.15 | A | 5 | 5068 | 5268 | 5468 | 5668 | 6168 | 7168 | 8168 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 0.15 | A | 10 | 2341 | 2581 | 2821 | 3061 | 6169 | 7169 | 8169 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 0.15 | A | 20 | 2342 | 2582 | 2822 | 3062 | 6170 | 7170 | 8170 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 0.18 | A | 5 | 5069 | 5269 | 5469 | 5669 | 6171 | 7171 | 8171 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 0.18 | A | 10 | 2343 | 2583 | 2823 | 3063 | 6172 | 7172 | 8172 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 0.22 | A | 5 | 5070 | 5270 | 5470 | 5670 | 6173 | 7173 | 8173 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 0.22 | A | 10 | 2344 | 2584 | 2824 | 3064 | 6174 | 7174 | 8174 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 0.22 | A | 20 | 2345 | 2585 | 2825 | 3065 | 6175 | 7175 | 8175 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 0.27 | A | 5 | 5071 | 5271 | 5471 | 5671 | 6176 | 7176 | 8176 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 0.27 | A | 10 | 2346 | 2586 | 2826 | 3066 | 6177 | 7177 | 8177 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 0.33 | A | 5 | 5072 | 5272 | 5472 | 5672 | 6178 | 7178 | 8178 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 0.33 | A | 10 | 2347 | 2587 | 2827 | 3067 | 6179 | 7179 | 8179 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 0.33 | A | 20 | 2348 | 2588 | 2828 | 3068 | 6180 | 7180 | 8180 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 0.39 | A | 5 | 5073 | 5273 | 5473 | 5673 | 6181 | 7181 | 8181 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 0.39 | A | 10 | 2349 | 2589 | 2829 | 3069 | 6182 | 7182 | 8182 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 0.47 | A | 5 | 5074 | 5274 | 5474 | 5674 | 6183 | 7183 | 8183 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 0.47 | A | 10 | 2350 | 2590 | 2830 | 3070 | 6184 | 7184 | 8184 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 0.47 | A | 20 | 2351 | 2591 | 2831 | 3071 | 6185 | 7185 | 8185 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 0.56 | A | 5 | 5075 | 5275 | 5475 | 5675 | 6186 | 7186 | 8186 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 0.56 | A | 10 | 2352 | 2592 | 2832 | 3072 | 6187 | 7187 | 8187 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 0.68 | A | 5 | 5076 | 5276 | 5476 | 5676 | 6188 | 7188 | 8188 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 0.68 | A | 10 | 2353 | 2593 | 2833 | 3073 | 6189 | 7189 | 8189 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 0.68 | A | 20 | 2354 | 2594 | 2834 | 3074 | 6190 | 7190 | 8190 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 0.82 | A | 5 | 5077 | 5277 | 5477 | 5677 | 6191 | 7191 | 8191 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 0.82 | A | 10 | 2355 | 2595 | 2835 | 3075 | 6192 | 7192 | 8192 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 1.0 | A | 5 | 5078 | 5278 | 5478 | 5678 | 6193 | 7193 | 8193 | 0.4 | 8.0 | 10.0 | 4 | 4 |
| 1.0 | A | 10 | 2356 | 2596 | 2836 | 3076 | 6194 | 7194 | 8194 | 0.4 | 8.0 | 10.0 | 4 | 4 |
| 1.0 | A | 20 | 2357 | 2597 | 2837 | 3077 | 6195 | 7195 | 8195 | 0.4 | 8.0 | 10.0 | 4 | 4 |
| 1.2 | B | 5 | 5079 | 5279 | 5479 | 5679 | 6196 | 7196 | 8196 | 0.4 | 9.0 | 11.0 | 4 | 4 |
| 1.2 | B | 10 | 2358 | 2598 | 2838 | 3078 | 6197 | 7197 | 8197 | 0.4 | 9.0 | 11.0 | 4 | 4 |
| 1.5 | B | 5 | 5080 | 5280 | 5480 | 5680 | 6198 | 7198 | 8198 | 0.6 | 12.0 | 15.0 | 4 | 4 |
| 1.5 | B | 10 | 2359 | 2599 | 2839 | 3079 | 6199 | 7199 | 8199 | 0.6 | 12.0 | 15.0 | 4 | 4 |
| 1.5 | B | 20 | 2360 | 2600 | 2840 | 3080 | 6200 | 7200 | 8200 | 0.6 | 12.0 | 15.0 | 4 | 4 |
| 1.8 | B | 5 | 5081 | 5281 | 5481 | 5681 | 6201 | 7201 | 8201 | 0.7 | 14.0 | 18.0 | 4 | 4 |
| 1.8 | B | 10 | 2361 | 2601 | 2841 | 3081 | 6202 | 7202 | 8202 | 0.7 | 14.0 | 18.0 | 4 | 4 |
| 2.2 | B | 5 | 5082 | 5282 | 5482 | 5682 | 6203 | 7203 | 8203 | 0.8 | 17.0 | 22.0 | 4 | 4 |
| 2.2 | B | 10 | 2362 | 2602 | 2842 | 3082 | 6204 | 7204 | 8204 | 0.8 | 17.0 | 22.0 | 4 | 4 |
| 2.2 | B | 20 | 2363 | 2603 | 2843 | 3083 | 6205 | 7205 | 8205 | 0.8 | 17.0 | 22.0 | 4 | 4 |
| 2.7 | B | 5 | 5083 | 5283 | 5483 | 5683 | 6206 | 7206 | 8206 | 1.0 | 20.0 | 25.0 | 4 | 4 |
| 2.7 | B | 10 | 2364 | 2604 | 2844 | 3084 | 6207 | 7207 | 8207 | 1.0 | 20.0 | 25.0 | 4 | 4 |
| 3.3 | B | 5 | 5084 | 5284 | 5484 | 5684 | 6208 | 7208 | 8208 | 1.2 | 25.0 | 32.0 | 4 | 4 |
| 3.3 | B | 10 | 2365 | 2605 | 2845 | 3085 | 6209 | 7209 | 8209 | 1.2 | 25.0 | 32.0 | 4 | 4 |



Solid-Electrolyte TANTALEX® Capacitors,
Military MIL-C-39003 Qualified, Syles CSR13, 21, 23, 33

Vishay Sprague

| STANDARD RATINGS: CSR13, M39003/01-XXXX | | | | | | | | | | | | | | | |
|---|--------------|-----------------------|--|------|------|-------|------|------|-------|---------|------------------|----------|--------------------|---------------------|--|
| CAPACITANCE (µF) | CASE CODE | CAP. TOL. (± %) | PART NO. M39003/01- FAILURE RATE LEVEL (%/1000 HOURS) | | | | | | | | MAX. DCL (µA) AT | | | MAX. DF (%) AT | |
| | | | M | P | R | S | B | C | D | + 25 °C | + 85 °C | + 125 °C | - 55 °C + 25 °C | + 85 °C + 125 °C | |
| | | | 1.0 | 0.1 | 0.01 | 0.001 | 0.1 | 0.01 | 0.001 | | | | | | |
| 50 WVDC AT + 85 °C, SURGE = 65 V . . . 33 WVDC AT + 125 °C, SURGE = 40 V | | | | | | | | | | | | | | | |
| 3.3 | B | 20 | 2366 | 2606 | 2846 | 3086 | 6210 | 7210 | 8210 | 1.2 | 25.0 | 32.0 | 4 | 4 | |
| 3.9 | B | 5 | 5085 | 5285 | 5485 | 5685 | 6211 | 7211 | 8211 | 1.5 | 30.0 | 38.0 | 4 | 4 | |
| 3.9 | B | 10 | 2367 | 2607 | 2847 | 3087 | 6212 | 7212 | 8212 | 1.5 | 30.0 | 38.0 | 4 | 4 | |
| 4.7 | B | 5 | 5086 | 5286 | 5486 | 5686 | 6213 | 7213 | 8213 | 1.7 | 35.0 | 44.0 | 4 | 4 | |
| 4.7 | B | 10 | 2368 | 2608 | 2848 | 3088 | 6214 | 7214 | 8214 | 1.7 | 35.0 | 44.0 | 4 | 4 | |
| 4.7 | B | 20 | 2369 | 2609 | 2849 | 3089 | 6215 | 7215 | 8215 | 1.7 | 35.0 | 44.0 | 4 | 4 | |
| 5.6 | C | 5 | 5087 | 5287 | 5487 | 5687 | 6216 | 7216 | 8216 | 2.2 | 45.0 | 56.0 | 4 | 4 | |
| 5.6 | C | 10 | 2370 | 2610 | 2850 | 3090 | 6217 | 7217 | 8217 | 2.2 | 45.0 | 56.0 | 4 | 4 | |
| 6.8 | C | 5 | 5088 | 5288 | 5488 | 5688 | 6218 | 7218 | 8218 | 2.2 | 45.0 | 56.0 | 6 | 6 | |
| 6.8 | C | 10 | 2371 | 2611 | 2851 | 3091 | 6219 | 7219 | 8219 | 2.2 | 45.0 | 56.0 | 6 | 6 | |
| 6.8 | C | 20 | 2372 | 2612 | 2852 | 3092 | 6220 | 7220 | 8220 | 2.2 | 45.0 | 56.0 | 6 | 6 | |
| 8.2 | C | 5 | 5089 | 5289 | 5489 | 5689 | 6221 | 7221 | 8221 | 2.5 | 50.0 | 63.0 | 6 | 6 | |
| 8.2 | C | 10 | 2373 | 2613 | 2853 | 3093 | 6222 | 7222 | 8222 | 2.5 | 50.0 | 63.0 | 6 | 6 | |
| 10.0 | C | 5 | 5090 | 5290 | 5490 | 5690 | 6223 | 7223 | 8223 | 2.5 | 50.0 | 63.0 | 6 | 6 | |
| 10.0 | C | 10 | 2374 | 2614 | 2854 | 3094 | 6224 | 7224 | 8224 | 2.5 | 50.0 | 63.0 | 6 | 6 | |
| 10.0 | C | 20 | 2375 | 2615 | 2855 | 3095 | 6225 | 7225 | 8225 | 2.5 | 50.0 | 63.0 | 6 | 6 | |
| 12.0 | C | 5 | 5091 | 5291 | 5491 | 5691 | 6226 | 7226 | 8226 | 3.0 | 60.0 | 75.0 | 6 | 6 | |
| 12.0 | C | 10 | 2376 | 2616 | 2856 | 3096 | 6227 | 7227 | 8227 | 3.0 | 60.0 | 75.0 | 6 | 6 | |
| 15.0 | C | 5 | 5092 | 5292 | 5492 | 5692 | 6228 | 7228 | 8228 | 4.0 | 80.0 | 100.0 | 6 | 6 | |
| 15.0 | C | 10 | 2377 | 2617 | 2857 | 3097 | 6229 | 7229 | 8229 | 4.0 | 80.0 | 100.0 | 6 | 6 | |
| 15.0 | C | 20 | 2378 | 2618 | 2858 | 3098 | 6230 | 7230 | 8230 | 4.0 | 80.0 | 100.0 | 6 | 6 | |
| 18.0 | C | 5 | 5093 | 5293 | 5493 | 5693 | 6231 | 7231 | 8231 | 4.5 | 90.0 | 113.0 | 6 | 6 | |
| 18.0 | C | 10 | 2379 | 2619 | 2859 | 3099 | 6232 | 7232 | 8232 | 4.5 | 90.0 | 113.0 | 6 | 6 | |
| 22.0 | D | 5 | 5094 | 5294 | 5494 | 5694 | 6233 | 7233 | 8233 | 5.5 | 110.0 | 138.0 | 6 | 6 | |
| 22.0 | D | 10 | 2380 | 2620 | 2860 | 3100 | 6234 | 7234 | 8234 | 5.5 | 110.0 | 138.0 | 6 | 6 | |
| 22.0 | D | 20 | 2381 | 2621 | 2861 | 3101 | 6235 | 7235 | 8235 | 5.5 | 110.0 | 138.0 | 6 | 6 | |
| 75 WVDC AT + 85 °C, SURGE = 98 V . . . 50 WVDC AT + 125 °C, SURGE = 64 V | | | | | | | | | | | | | | | |
| 0.1 | A | 5 | 5095 | 5295 | 5495 | 5695 | 6236 | 7236 | 8236 | 0.3 | 5.0 | 6.3 | 2 | 4 | |
| 0.1 | A | 10 | 2382 | 2622 | 2862 | 3102 | 6237 | 7237 | 8237 | 0.3 | 5.0 | 6.3 | 2 | 4 | |
| 0.1 | A | 20 | 2383 | 2623 | 2863 | 3103 | 6238 | 7238 | 8238 | 0.3 | 5.0 | 6.3 | 2 | 4 | |
| 0.12 | A | 5 | 5096 | 5296 | 5496 | 5696 | 6239 | 7239 | 8239 | 0.3 | 5.0 | 6.3 | 2 | 4 | |
| 0.12 | A | 10 | 2384 | 2624 | 2864 | 3104 | 6240 | 7240 | 8240 | 0.3 | 5.0 | 6.3 | 2 | 4 | |
| 0.15 | A | 5 | 5097 | 5297 | 5497 | 5697 | 6241 | 7241 | 8241 | 0.3 | 5.0 | 6.3 | 2 | 4 | |
| 0.15 | A | 10 | 2385 | 2625 | 2865 | 3105 | 6242 | 7242 | 8242 | 0.3 | 5.0 | 6.3 | 2 | 4 | |
| 0.15 | A | 20 | 2386 | 2626 | 2866 | 3106 | 6243 | 7243 | 8243 | 0.3 | 5.0 | 6.3 | 2 | 4 | |
| 0.18 | A | 5 | 5098 | 5298 | 5498 | 5698 | 6244 | 7244 | 8244 | 0.3 | 5.0 | 6.3 | 2 | 4 | |
| 0.18 | A | 10 | 2387 | 2627 | 2867 | 3107 | 6245 | 7245 | 8245 | 0.3 | 5.0 | 6.3 | 2 | 4 | |
| 0.22 | A | 5 | 5099 | 5299 | 5499 | 5699 | 6246 | 7246 | 8246 | 0.3 | 5.0 | 6.3 | 2 | 4 | |
| 0.22 | A | 10 | 2388 | 2628 | 2868 | 3108 | 6247 | 7247 | 8247 | 0.3 | 5.0 | 6.3 | 2 | 4 | |
| 0.22 | A | 20 | 2389 | 2629 | 2869 | 3109 | 6248 | 7248 | 8248 | 0.3 | 5.0 | 6.3 | 2 | 4 | |
| 0.27 | A | 5 | 5100 | 5300 | 5500 | 5700 | 6249 | 7249 | 8249 | 0.3 | 5.0 | 6.3 | 2 | 4 | |
| 0.27 | A | 10 | 2390 | 2630 | 2870 | 3110 | 6250 | 7250 | 8250 | 0.3 | 5.0 | 6.3 | 2 | 4 | |
| 0.33 | A | 5 | 5101 | 5301 | 5501 | 5701 | 6251 | 7251 | 8251 | 0.3 | 5.0 | 6.3 | 2 | 4 | |
| 0.33 | A | 10 | 2391 | 2631 | 2871 | 3111 | 6252 | 7252 | 8252 | 0.3 | 5.0 | 6.3 | 2 | 4 | |
| 0.33 | A | 20 | 2392 | 2632 | 2872 | 3112 | 6253 | 7253 | 8253 | 0.3 | 5.0 | 6.3 | 2 | 4 | |
| 0.39 | A | 5 | 5102 | 5302 | 5502 | 5702 | 6254 | 7254 | 8254 | 0.3 | 5.0 | 6.3 | 2 | 4 | |
| 0.39 | A | 10 | 2393 | 2633 | 2873 | 3113 | 6255 | 7255 | 8255 | 0.3 | 5.0 | 6.3 | 2 | 4 | |
| 0.47 | A | 5 | 5103 | 5303 | 5503 | 5703 | 6256 | 7256 | 8256 | 0.3 | 5.0 | 6.3 | 2 | 4 | |
| 0.47 | A | 10 | 2394 | 2634 | 2874 | 3114 | 6257 | 7257 | 8257 | 0.3 | 5.0 | 6.3 | 2 | 4 | |
| 0.47 | A | 20 | 2395 | 2635 | 2875 | 3115 | 6258 | 7258 | 8258 | 0.3 | 5.0 | 6.3 | 2 | 4 | |
| 0.56 | A | 5 | 5104 | 5304 | 5504 | 5704 | 6259 | 7259 | 8259 | 0.3 | 5.0 | 6.3 | 2 | 4 | |
| 0.56 | A | 10 | 2396 | 2636 | 2876 | 3116 | 6260 | 7260 | 8260 | 0.3 | 5.0 | 6.3 | 2 | 4 | |



| STANDARD RATINGS: CSR13, M39003/01-XXXX | | | | | | | | | | | | | | |
|---|--------------|-----------------------|--|------|------|-------|------|------|-------|------------------|---------|----------|--------------------|---------------------|
| CAPACITANCE (µF) | CASE CODE | CAP. TOL. (± %) | PART NO. M39003/01- FAILURE RATE LEVEL (%/1000 HOURS) | | | | | | | MAX. DCL (µA) AT | | | MAX. DF (%) AT | |
| | | | M | P | R | S | B | C | D | + 25 °C | + 85 °C | + 125 °C | - 55 °C + 25 °C | + 85 °C + 125 °C |
| | | | 1.0 | 0.1 | 0.01 | 0.001 | 0.1 | 0.01 | 0.001 | | | | | |
| 75 WVDC AT + 85 °C, SURGE = 98 V . . . 50 WVDC AT + 125 °C, SURGE = 64 V | | | | | | | | | | | | | | |
| 0.68 | A | 5 | 5105 | 5305 | 5505 | 5705 | 6261 | 7261 | 8261 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 0.68 | A | 10 | 2397 | 2637 | 2877 | 3117 | 6262 | 7262 | 8262 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 0.68 | A | 20 | 2398 | 2638 | 2878 | 3118 | 6263 | 7263 | 8263 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 0.82 | B | 5 | 5106 | 5306 | 5506 | 5706 | 6264 | 7264 | 8264 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 0.82 | B | 10 | 2399 | 2879 | 2879 | 3119 | 6265 | 7265 | 8265 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 1.0 | B | 5 | 5107 | 5307 | 5507 | 5707 | 6266 | 7266 | 8266 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 1.0 | B | 10 | 2400 | 2410 | 2880 | 3120 | 6267 | 7267 | 8267 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 1.0 | B | 20 | 2401 | 2641 | 2881 | 3121 | 6268 | 7268 | 8268 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 1.2 | B | 5 | 5108 | 5308 | 5508 | 5708 | 6269 | 7269 | 8269 | 0.3 | 5.0 | 6.3 | 4 | 4 |
| 1.2 | B | 10 | 2402 | 2642 | 2882 | 3122 | 6270 | 7270 | 8270 | 0.3 | 5.0 | 6.3 | 4 | 4 |
| 1.5 | B | 5 | 5109 | 5309 | 5509 | 5709 | 6271 | 7271 | 8271 | 0.6 | 10.0 | 13.0 | 4 | 4 |
| 1.5 | B | 10 | 2403 | 2643 | 2883 | 3123 | 6272 | 7272 | 8272 | 0.6 | 10.0 | 13.0 | 4 | 4 |
| 1.5 | B | 20 | 2404 | 2664 | 2884 | 3124 | 6273 | 7273 | 8273 | 0.6 | 10.0 | 13.0 | 4 | 4 |
| 1.8 | B | 5 | 5110 | 5310 | 5510 | 5710 | 6274 | 7274 | 8274 | 0.7 | 10.0 | 13.0 | 4 | 4 |
| 1.8 | B | 10 | 2405 | 2645 | 2885 | 3125 | 6275 | 7275 | 8275 | 0.7 | 10.0 | 13.0 | 4 | 4 |
| 1.8 | B | 10 | 2405 | 2645 | 2885 | 3125 | 6275 | 7275 | 8275 | 0.7 | 10.0 | 13.0 | 4 | 4 |
| 2.2 | B | 5 | 5111 | 5311 | 5511 | 5711 | 6276 | 7276 | 8276 | 0.8 | 15.0 | 19.0 | 4 | 4 |
| 2.2 | B | 10 | 2406 | 2646 | 2886 | 3126 | 6277 | 7277 | 8277 | 0.8 | 15.0 | 19.0 | 4 | 4 |
| 2.2 | B | 20 | 2407 | 2647 | 2887 | 3127 | 6278 | 7278 | 8278 | 1.0 | 15.0 | 19.0 | 4 | 4 |
| 2.7 | B | 5 | 5112 | 5312 | 5512 | 5712 | 6279 | 7279 | 8279 | 1.0 | 15.0 | 19.0 | 4 | 4 |
| 2.7 | B | 10 | 2408 | 2648 | 2888 | 3128 | 6280 | 7280 | 8280 | 1.2 | 15.0 | 19.0 | 4 | 4 |
| 3.3 | B | 5 | 5113 | 5313 | 5513 | 5713 | 6281 | 7281 | 8281 | 1.2 | 20.0 | 25.0 | 4 | 4 |
| 3.3 | B | 10 | 2409 | 2649 | 2889 | 3129 | 6282 | 7282 | 8282 | 1.2 | 20.0 | 25.0 | 4 | 4 |
| 3.3 | B | 20 | 2410 | 2650 | 2890 | 3130 | 6283 | 7283 | 8283 | 1.5 | 20.0 | 25.0 | 4 | 4 |
| 3.9 | B | 5 | 5114 | 5314 | 5514 | 5714 | 6284 | 7284 | 8284 | 1.5 | 20.0 | 25.0 | 4 | 4 |
| 3.9 | B | 10 | 2411 | 2651 | 2891 | 3131 | 6285 | 7285 | 8285 | 3.0 | 20.0 | 25.0 | 4 | 4 |
| 4.7 | C | 5 | 5115 | 5315 | 5515 | 5715 | 6286 | 7286 | 8286 | 3.0 | 60.0 | 75.0 | 4 | 4 |
| 4.7 | C | 10 | 2412 | 2652 | 2892 | 3132 | 6287 | 7287 | 8287 | 3.0 | 60.0 | 75.0 | 4 | 4 |
| 4.7 | C | 20 | 2413 | 2653 | 2893 | 3133 | 6288 | 7288 | 8288 | 3.0 | 60.0 | 75.0 | 4 | 4 |
| 5.6 | C | 5 | 5116 | 5316 | 5516 | 5716 | 6289 | 7289 | 8289 | 3.0 | 60.0 | 75.0 | 4 | 4 |
| 5.6 | C | 10 | 2414 | 2654 | 2894 | 3134 | 6290 | 7290 | 8290 | 5.0 | 60.0 | 75.0 | 4 | 4 |
| 6.8 | C | 5 | 5117 | 5317 | 5517 | 5717 | 6291 | 7291 | 8291 | 5.0 | 100.0 | 125.0 | 6 | 6 |
| 6.8 | C | 10 | 2415 | 2655 | 2895 | 3135 | 6292 | 7292 | 8292 | 5.0 | 100.0 | 125.0 | 6 | 6 |
| 6.8 | C | 20 | 2416 | 2656 | 2896 | 3136 | 6293 | 7293 | 8293 | 5.0 | 100.0 | 125.0 | 6 | 6 |
| 8.2 | C | 5 | 5118 | 5318 | 5518 | 5718 | 6294 | 7294 | 8294 | 5.0 | 100.0 | 125.0 | 6 | 6 |
| 8.2 | C | 10 | 2417 | 2657 | 2897 | 3137 | 6295 | 7295 | 8295 | 5.0 | 100.0 | 125.0 | 6 | 6 |
| 10.0 | C | 5 | 5119 | 5319 | 5519 | 5719 | 6296 | 7296 | 8296 | 5.0 | 100.0 | 125.0 | 6 | 6 |
| 10.0 | C | 10 | 2418 | 2658 | 2898 | 3138 | 6297 | 7297 | 8297 | 5.0 | 100.0 | 125.0 | 6 | 6 |
| 10.0 | C | 20 | 2419 | 2659 | 2899 | 3139 | 6298 | 7298 | 8298 | 5.0 | 100.0 | 125.0 | 6 | 6 |
| 12.0 | D | 5 | 5120 | 5320 | 5520 | 5720 | 6299 | 7299 | 8299 | 5.0 | 100.0 | 125.0 | 6 | 6 |
| 12.0 | D | 10 | 2420 | 2660 | 2900 | 3140 | 6300 | 7300 | 8300 | 5.0 | 100.0 | 125.0 | 6 | 6 |
| 15.0 | D | 5 | 5121 | 5321 | 5521 | 5721 | 6301 | 7301 | 8301 | 7.0 | 140.0 | 175.0 | 6 | 6 |
| 15.0 | D | 10 | 2421 | 2661 | 2901 | 3141 | 6302 | 7302 | 8302 | 7.0 | 140.0 | 175.0 | 6 | 6 |
| 15.0 | D | 20 | 2422 | 2662 | 2902 | 3142 | 6303 | 7303 | 8303 | 7.0 | 140.0 | 175.0 | 6 | 6 |
| 100 WVDC AT + 85 °C, SURGE = 130 V . . . 67 WVDC AT + 125 °C, SURGE = 86 V | | | | | | | | | | | | | | |
| 0.056 | A | 5 | 5135 | 5335 | 5535 | 5735 | 6337 | 7337 | 8337 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 0.056 | A | 10 | 2443 | 2683 | 2923 | 3163 | 6338 | 7338 | 8338 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 0.068 | A | 5 | 5136 | 5336 | 5536 | 5736 | 6339 | 7339 | 8339 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 0.068 | A | 10 | 2444 | 2684 | 2924 | 3164 | 6340 | 7340 | 8340 | 0.3 | 5.0 | 6.3 | 2 | 4 |



Solid-Electrolyte TANTALEX® Capacitors,
Military MIL-C-39003 Qualified, Syles CSR13, 21, 23, 33

Vishay Sprague

| STANDARD RATINGS: CSR13, M39003/01-XXXX | | | | | | | | | | | | | | |
|---|--------------|-----------------------|--|------|------|-------|------|------|-------|------------------|---------|----------|--------------------|---------------------|
| CAPACITANCE (µF) | CASE CODE | CAP. TOL. (± %) | PART NO. M39003/01- FAILURE RATE LEVEL (%/1000 HOURS) | | | | | | | MAX. DCL (µA) AT | | | MAX. DF (%) AT | |
| | | | M | P | R | S | B | C | D | + 25 °C | + 85 °C | + 125 °C | - 55 °C + 25 °C | + 85 °C + 125 °C |
| | | | 1.0 | 0.1 | 0.01 | 0.001 | 0.1 | 0.01 | 0.001 | | | | | |
| 100 WVDC AT + 85 °C, SURGE = 130 V . . . 67 WVDC AT + 125 °C, SURGE = 86 V | | | | | | | | | | | | | | |
| 0.068 | A | 20 | 2445 | 2685 | 2925 | 3165 | 6341 | 7341 | 8341 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 0.082 | A | 5 | 5137 | 5337 | 5537 | 5737 | 6342 | 7342 | 8342 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 0.082 | A | 10 | 2446 | 2686 | 2926 | 3166 | 6343 | 7343 | 8343 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 0.1 | A | 5 | 5138 | 5338 | 5538 | 5738 | 6344 | 7344 | 8344 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 0.1 | A | 10 | 2447 | 2687 | 2927 | 3167 | 6345 | 7345 | 8345 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 0.1 | A | 20 | 2448 | 2688 | 2928 | 3168 | 6346 | 7346 | 8346 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 0.12 | A | 5 | 5139 | 5339 | 5539 | 5739 | 6347 | 7347 | 8347 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 0.12 | A | 10 | 2449 | 2689 | 2929 | 3169 | 6348 | 7348 | 8348 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 0.15 | A | 5 | 5140 | 5340 | 5540 | 5740 | 6349 | 7349 | 8349 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 0.15 | A | 10 | 2450 | 2690 | 2930 | 3170 | 6350 | 7350 | 8350 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 0.15 | A | 20 | 2451 | 2691 | 2931 | 3171 | 6351 | 7351 | 8351 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 0.18 | A | 5 | 5141 | 5341 | 5541 | 5741 | 6352 | 7352 | 8352 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 0.18 | A | 10 | 2452 | 2692 | 2932 | 3172 | 6353 | 7353 | 8353 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 0.22 | A | 5 | 5142 | 5342 | 5542 | 5742 | 6354 | 7354 | 8354 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 0.22 | A | 10 | 2453 | 2693 | 2933 | 3173 | 6355 | 7355 | 8355 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 0.22 | A | 20 | 2454 | 2694 | 2934 | 3174 | 6356 | 7356 | 8356 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 0.27 | A | 5 | 5143 | 5343 | 5543 | 5743 | 6357 | 7357 | 8357 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 0.27 | A | 10 | 2455 | 2695 | 2935 | 3175 | 6358 | 7358 | 8358 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 0.33 | A | 5 | 5144 | 5344 | 5544 | 5744 | 6359 | 7359 | 8359 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 0.33 | A | 10 | 2456 | 2696 | 2936 | 3176 | 6360 | 7360 | 8360 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 0.33 | A | 20 | 2457 | 2697 | 2937 | 3177 | 6361 | 7361 | 8361 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 0.39 | A | 5 | 5145 | 5345 | 5545 | 5745 | 6362 | 7362 | 8362 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 0.39 | A | 10 | 2458 | 2698 | 2938 | 3178 | 6363 | 7363 | 8363 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 0.47 | A | 5 | 5146 | 5346 | 5546 | 5746 | 6364 | 7364 | 8364 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 0.47 | A | 10 | 2459 | 2699 | 2939 | 3179 | 6365 | 7365 | 8365 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 0.47 | A | 20 | 2460 | 2700 | 2940 | 3180 | 6366 | 7366 | 8366 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 0.56 | A | 5 | 5147 | 5347 | 5547 | 5747 | 6367 | 7367 | 8367 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 0.56 | A | 10 | 2461 | 2701 | 2941 | 3181 | 6368 | 7368 | 8368 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 0.68 | B | 5 | 5148 | 5348 | 5548 | 5748 | 6369 | 7369 | 8369 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 0.68 | B | 10 | 2462 | 2702 | 2942 | 3182 | 6370 | 7370 | 8370 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 0.68 | B | 20 | 2463 | 2703 | 2943 | 3183 | 6371 | 7371 | 8371 | 0.3 | 5.0 | 6.3 | 2 | 4 |
| 0.82 | B | 5 | 5149 | 5349 | 5549 | 5749 | 6372 | 7372 | 8372 | 0.4 | 5.0 | 6.3 | 2 | 4 |
| 0.82 | B | 10 | 2464 | 2704 | 2944 | 3184 | 6373 | 7373 | 8373 | 0.4 | 5.0 | 6.3 | 2 | 4 |
| 1.0 | B | 5 | 5150 | 5350 | 5550 | 5750 | 6374 | 7374 | 8374 | 0.5 | 5.0 | 6.3 | 2 | 4 |
| 1.0 | B | 10 | 2465 | 2705 | 2945 | 3185 | 6375 | 7375 | 8375 | 0.5 | 5.0 | 6.3 | 2 | 4 |
| 1.0 | B | 20 | 2466 | 2706 | 2946 | 3186 | 6376 | 7376 | 8376 | 0.5 | 5.0 | 6.3 | 2 | 4 |
| 1.2 | B | 5 | 5151 | 5351 | 5551 | 5751 | 6377 | 7377 | 8377 | 0.5 | 5.0 | 6.3 | 4 | 4 |
| 1.2 | B | 10 | 2467 | 2707 | 2947 | 3187 | 6378 | 7378 | 8378 | 0.5 | 5.0 | 6.3 | 4 | 4 |
| 1.5 | B | 5 | 5152 | 5352 | 5552 | 5752 | 6379 | 7379 | 8379 | 0.7 | 10.0 | 13.0 | 4 | 4 |
| 1.5 | B | 10 | 2468 | 2708 | 2948 | 3188 | 6380 | 7380 | 8380 | 0.7 | 10.0 | 13.0 | 4 | 4 |
| 1.5 | B | 20 | 2469 | 2709 | 2949 | 3189 | 6381 | 7381 | 8381 | 0.7 | 10.0 | 13.0 | 4 | 4 |
| 1.8 | B | 5 | 5153 | 5353 | 5553 | 5753 | 6382 | 7382 | 8382 | 0.7 | 10.0 | 13.0 | 4 | 4 |
| 1.8 | B | 10 | 2470 | 2710 | 2950 | 3190 | 6383 | 7383 | 8383 | 0.7 | 10.0 | 13.0 | 4 | 4 |
| 2.2 | B | 5 | 5154 | 5354 | 5554 | 5754 | 6384 | 7384 | 8384 | 0.9 | 15.0 | 19.0 | 4 | 4 |
| 2.2 | B | 10 | 2471 | 2711 | 2951 | 3191 | 6385 | 7385 | 8385 | 0.9 | 15.0 | 19.0 | 4 | 4 |
| 2.2 | B | 20 | 2472 | 2712 | 2952 | 3192 | 6386 | 7386 | 8386 | 0.9 | 15.0 | 19.0 | 4 | 4 |
| 2.7 | B | 5 | 5155 | 5355 | 5555 | 5755 | 6387 | 7387 | 8387 | 1.1 | 15.0 | 19.0 | 4 | 4 |
| 2.7 | B | 10 | 2473 | 2713 | 2953 | 3193 | 6388 | 7388 | 8388 | 1.1 | 15.0 | 19.0 | 4 | 4 |
| 3.3 | C | 5 | 5156 | 5356 | 5556 | 5756 | 6389 | 7389 | 8389 | 1.5 | 30.0 | 38.0 | 6 | 6 |



| STANDARD RATINGS: CSR13, M39003/01-XXXX | | | | | | | | | | | | | | |
|---|--------------|-----------------------|--|------|------|-------|------|------|-------|------------------|---------|----------|----------------|----------|
| CAPACITANCE (µF) | CASE CODE | CAP. TOL. (± %) | PART NO. M39003/01- FAILURE RATE LEVEL (%/1000 HOURS) | | | | | | | MAX. DCL (µA) AT | | | MAX. DF (%) AT | |
| | | | M | P | R | S | B | C | D | + 25 °C | + 85 °C | + 125 °C | - 55 °C | + 85 °C |
| | | | 1.0 | 0.1 | 0.01 | 0.001 | 0.1 | 0.01 | 0.001 | | | | + 25 °C | + 125 °C |
| 100 WVDC AT + 85 °C, SURGE = 130 V . . . 67 WVDC AT + 125 °C, SURGE = 86 V | | | | | | | | | | | | | | |
| 3.3 | C | 10 | 5157 | 5357 | 5557 | 5757 | 6390 | 7390 | 8390 | 1.5 | 30.0 | 38.0 | 6 | 6 |
| 3.3 | C | 20 | 5158 | 5358 | 5558 | 5758 | 6391 | 7391 | 8391 | 1.5 | 30.0 | 38.0 | 6 | 6 |
| 3.9 | C | 5 | 5159 | 5359 | 5559 | 5759 | 6392 | 7392 | 8392 | 1.5 | 30.0 | 38.0 | 6 | 6 |
| 3.9 | C | 10 | 5160 | 5360 | 5560 | 5760 | 6393 | 7393 | 8393 | 1.5 | 30.0 | 38.0 | 6 | 6 |
| 4.7 | C | 5 | 5161 | 5361 | 5561 | 5761 | 6394 | 7394 | 8394 | 2.5 | 50.0 | 63.0 | 6 | 6 |
| 4.7 | C | 10 | 5162 | 5362 | 5562 | 5762 | 6395 | 7395 | 8395 | 2.5 | 50.0 | 63.0 | 6 | 6 |
| 4.7 | C | 20 | 5163 | 5363 | 5563 | 5763 | 6396 | 7396 | 8396 | 2.5 | 50.0 | 63.0 | 6 | 6 |
| 5.6 | C | 5 | 5164 | 5364 | 5564 | 5764 | 6397 | 7397 | 8397 | 2.5 | 50.0 | 63.0 | 6 | 6 |
| 5.6 | C | 10 | 5165 | 5365 | 5565 | 5765 | 6398 | 7398 | 8398 | 2.5 | 50.0 | 63.0 | 6 | 6 |
| 6.8 | C | 5 | 5166 | 5366 | 5566 | 5766 | 6399 | 7399 | 8399 | 2.5 | 50.0 | 63.0 | 6 | 6 |
| 6.8 | C | 10 | 5167 | 5367 | 5567 | 5767 | 6400 | 7400 | 8400 | 2.5 | 50.0 | 63.0 | 6 | 6 |
| 6.8 | C | 20 | 5168 | 5368 | 5568 | 5768 | 6401 | 7401 | 8401 | 2.5 | 50.0 | 63.0 | 6 | 6 |



Solid-Electrolyte TANTALEX® Capacitors,
Military MIL-C-39003 Qualified, Syles CSR13, 21, 23, 33

Vishay Sprague

| STANDARD RATINGS: CSR21, M39003/09-XXXX | | | | | | | | | | | | | | | | | |
|---|--------------|-----------------------|--|------|------|-------|------|------|-------|--------|---------------------|---------|--------|---|---|--|--|
| CAPACITANCE E (µF) | CASE CODE | CAP. TOL. (± %) | PART NO. M39003/09- FAILURE RATE LEVEL (%/1000 HOURS) | | | | | | | | MAX. DCL (µA) AT | | | Max. DF at +25 °C 1 kHz (%) | Max. ESR at +25 °C 100 kHz (Ohms) | DERATED Max. RIPPLE CURRENT at +25 °C (Amps) | |
| | | | M | P | R | S | B | C | D | +25 °C | +85 °C | +125 °C | 40 kHz | | | 1 kHz | |
| | | | 1.0 | 0.1 | 0.01 | 0.001 | 0.1 | 0.01 | 0.001 | | | | | | | | |
| 6 WVDC AT + 85 °C, SURGE = 8 V . . . 4 WVDC AT + 125 °C, SURGE = 5 V | | | | | | | | | | | | | | | | | |
| 150.0 | C | 5 | 0001 | 0101 | 0201 | 0301 | 2001 | 3001 | 4001 | 4.5 | 90.0 | 113.0 | 10 | 0.065 | 3.3 | 2.0 | |
| 150.0 | C | 10 | 0002 | 0102 | 0202 | 0302 | 2002 | 3002 | 4002 | 4.5 | 90.0 | 113.0 | 10 | 0.065 | 3.3 | 2.0 | |
| 150.0 | C | 20 | 0003 | 0103 | 0203 | 0303 | 2003 | 3003 | 4003 | 4.5 | 90.0 | 113.0 | 10 | 0.065 | 3.3 | 2.0 | |
| 180.0 | C | 5 | 0004 | 0104 | 0204 | 0304 | 2004 | 3004 | 4004 | 5.5 | 110.0 | 138.0 | 10 | 0.060 | 3.4 | 2.4 | |
| 180.0 | C | 10 | 0005 | 0105 | 0205 | 0305 | 2005 | 3005 | 4005 | 5.5 | 110.0 | 138.0 | 10 | 0.060 | 3.4 | 2.4 | |
| 270.0 | D | 5 | 0006 | 0106 | 0206 | 0306 | 2006 | 3006 | 4006 | 6.5 | 130.0 | 163.0 | 10 | 0.050 | 4.1 | 3.4 | |
| 270.0 | D | 10 | 0007 | 0107 | 0207 | 0307 | 2007 | 3007 | 4007 | 6.5 | 130.0 | 163.0 | 10 | 0.050 | 4.1 | 3.4 | |
| 330.0 | D | 5 | 0008 | 0108 | 0208 | 0308 | 2008 | 3008 | 4008 | 7.5 | 150.0 | 188.0 | 12 | 0.045 | 4.3 | 3.8 | |
| 330.0 | D | 10 | 0009 | 0109 | 0209 | 0309 | 2009 | 3009 | 4009 | 7.5 | 150.0 | 188.0 | 12 | 0.045 | 4.3 | 3.8 | |
| 330.0 | D | 20 | 0010 | 0110 | 0210 | 0310 | 2010 | 3010 | 4010 | 7.5 | 150.0 | 188.0 | 12 | 0.045 | 4.3 | 3.8 | |
| 10 WVDC AT + 85 °C, SURGE = 13 V . . . 7 WVDC AT + 125 °C, SURGE = 9 V | | | | | | | | | | | | | | | | | |
| 82.0 | C | 5 | 0011 | 0111 | 0211 | 0311 | 2011 | 3011 | 4011 | 4.0 | 80.0 | 100.0 | 8 | 0.085 | 2.9 | 1.8 | |
| 82.0 | C | 10 | 0012 | 0112 | 0212 | 0312 | 2012 | 3012 | 4012 | 4.0 | 80.0 | 100.0 | 8 | 0.085 | 2.9 | 1.8 | |
| 100.0 | C | 5 | 0013 | 0113 | 0213 | 0313 | 2013 | 3013 | 4013 | 5.0 | 100.0 | 125.0 | 8 | 0.075 | 3.0 | 2.2 | |
| 100.0 | C | 10 | 0014 | 0114 | 0214 | 0314 | 2014 | 3014 | 4014 | 5.0 | 100.0 | 125.0 | 8 | 0.075 | 3.0 | 2.2 | |
| 100.0 | C | 20 | 0015 | 0115 | 0215 | 0315 | 2015 | 3015 | 4015 | 5.0 | 100.0 | 125.0 | 8 | 0.075 | 3.0 | 2.2 | |
| 120.0 | C | 5 | 0016 | 0116 | 0216 | 0316 | 2016 | 3016 | 4016 | 6.0 | 120.0 | 150.0 | 8 | 0.070 | 3.2 | 2.5 | |
| 120.0 | C | 10 | 0017 | 0117 | 0217 | 0317 | 2017 | 3017 | 4017 | 6.0 | 120.0 | 150.0 | 8 | 0.070 | 3.2 | 2.5 | |
| 180.0 | D | 5 | 0018 | 0118 | 0218 | 0318 | 2018 | 3018 | 4018 | 9.0 | 180.0 | 226.0 | 8 | 0.060 | 3.7 | 3.4 | |
| 180.0 | D | 10 | 0019 | 0119 | 0219 | 0319 | 2019 | 3019 | 4019 | 9.0 | 180.0 | 226.0 | 8 | 0.060 | 3.7 | 3.4 | |
| 220.0 | D | 5 | 0020 | 0120 | 0220 | 0320 | 2020 | 3020 | 4020 | 10.0 | 200.0 | 250.0 | 10 | 0.055 | 3.9 | 3.4 | |
| 220.0 | D | 10 | 0021 | 0121 | 0221 | 0321 | 2021 | 3021 | 4021 | 10.0 | 200.0 | 250.0 | 10 | 0.055 | 3.9 | 3.4 | |
| 220.0 | D | 20 | 0022 | 0122 | 0222 | 0322 | 2022 | 3022 | 4022 | 10.0 | 200.0 | 250.0 | 10 | 0.055 | 3.9 | 3.4 | |
| 15 WVDC AT + 85 °C, SURGE = 20 V . . . 10 WVDC AT + 125 °C, SURGE = 12 V | | | | | | | | | | | | | | | | | |
| 56.0 | C | 5 | 0023 | 0123 | 0223 | 0323 | 2023 | 3023 | 4023 | 4.0 | 80.0 | 100.0 | 6 | 0.100 | 2.6 | 1.8 | |
| 56.0 | C | 10 | 0024 | 0124 | 0224 | 0324 | 2024 | 3024 | 4024 | 4.0 | 80.0 | 100.0 | 6 | 0.100 | 2.6 | 1.8 | |
| 68.0 | C | 5 | 0025 | 0125 | 0225 | 0325 | 2025 | 3025 | 4025 | 5.0 | 100.0 | 125.0 | 6 | 0.095 | 2.7 | 2.2 | |
| 68.0 | C | 10 | 0026 | 0126 | 0226 | 0326 | 2026 | 3026 | 4026 | 5.0 | 100.0 | 125.0 | 6 | 0.095 | 2.7 | 2.2 | |
| 68.0 | C | 20 | 0027 | 0127 | 0227 | 0327 | 2027 | 3027 | 4027 | 5.0 | 100.0 | 125.0 | 6 | 0.095 | 2.7 | 2.2 | |
| 120.0 | D | 5 | 0028 | 0128 | 0228 | 0328 | 2028 | 3028 | 4028 | 9.0 | 180.0 | 226.0 | 8 | 0.070 | 3.5 | 2.8 | |
| 120.0 | D | 10 | 0029 | 0129 | 0229 | 0329 | 2029 | 3029 | 4029 | 9.0 | 180.0 | 226.0 | 8 | 0.070 | 3.5 | 2.8 | |
| 150.0 | D | 5 | 0030 | 0130 | 0230 | 0330 | 2030 | 3030 | 4030 | 10.0 | 200.0 | 250.0 | 8 | 0.065 | 3.6 | 3.1 | |
| 150.0 | D | 10 | 0031 | 0131 | 0231 | 0331 | 2031 | 3031 | 4031 | 10.0 | 200.0 | 250.0 | 8 | 0.065 | 3.6 | 3.1 | |
| 150.0 | D | 20 | 0032 | 0132 | 0232 | 0332 | 2032 | 3032 | 4032 | 10.0 | 200.0 | 250.0 | 8 | 0.065 | 3.6 | 3.1 | |
| 20 WVDC AT + 85 °C, SURGE = 26 V . . . 13 WVDC AT + 125 °C, SURGE = 16 V | | | | | | | | | | | | | | | | | |
| 27.0 | C | 5 | 0033 | 0133 | 0233 | 0333 | 2033 | 3033 | 4033 | 2.5 | 50.0 | 63.0 | 5 | 0.145 | 2.2 | 1.2 | |
| 27.0 | C | 10 | 0034 | 0134 | 0234 | 0334 | 2034 | 3034 | 4034 | 2.5 | 50.0 | 63.0 | 5 | 0.145 | 2.2 | 1.2 | |
| 33.0 | C | 5 | 0035 | 0135 | 0235 | 0335 | 2035 | 3035 | 4035 | 3.5 | 70.0 | 88.0 | 5 | 0.130 | 2.3 | 1.4 | |
| 33.0 | C | 10 | 0036 | 0136 | 0236 | 0336 | 2036 | 3036 | 4036 | 3.5 | 70.0 | 88.0 | 5 | 0.130 | 2.3 | 1.4 | |
| 33.0 | C | 20 | 0037 | 0137 | 0237 | 0337 | 2037 | 3037 | 4037 | 3.5 | 70.0 | 88.0 | 5 | 0.130 | 2.3 | 1.4 | |
| 39.0 | C | 5 | 0038 | 0138 | 0238 | 0338 | 2038 | 3038 | 4038 | 4.0 | 80.0 | 100.0 | 5 | 0.120 | 2.4 | 1.7 | |
| 39.0 | C | 10 | 0039 | 0139 | 0239 | 0339 | 2039 | 3039 | 4039 | 4.0 | 80.0 | 100.0 | 5 | 0.120 | 2.4 | 1.7 | |
| 47.0 | C | 5 | 0040 | 0140 | 0240 | 0340 | 2040 | 3040 | 4040 | 4.5 | 90.0 | 113.0 | 6 | 0.110 | 2.5 | 1.8 | |
| 47.0 | C | 10 | 0041 | 0141 | 0241 | 0341 | 2041 | 3041 | 4041 | 4.5 | 90.0 | 113.0 | 6 | 0.110 | 2.5 | 1.8 | |
| 47.0 | C | 20 | 0042 | 0142 | 0242 | 0342 | 2042 | 3042 | 4042 | 4.5 | 90.0 | 113.0 | 6 | 0.110 | 2.5 | 1.8 | |
| 56.0 | D | 5 | 0043 | 0143 | 0243 | 0343 | 2043 | 3043 | 4043 | 5.5 | 110.0 | 138.0 | 6 | 0.100 | 2.9 | 2.2 | |
| 56.0 | D | 10 | 0044 | 0144 | 0244 | 0344 | 2044 | 3044 | 4044 | 5.5 | 110.0 | 138.0 | 6 | 0.100 | 2.9 | 2.2 | |



| STANDARD RATINGS: CSR21, M39003/09-XXXX | | | | | | | | | | | | | | | | | |
|---|--------------|-----------------------|--|------|------|-------|------|------|-------|---------|---------------------|----------|---------------|-------------------|----------|---|--|
| CAPACITANCE (µF) | CASE CODE | CAP. TOL. (± %) | PART NO. M39003/09- FAILURE RATE LEVEL (%/1000 HOURS) | | | | | | | | MAX. DCL (µA) AT | | | Max. DF | Max. ESR | DERATED Max. RIPPLE CURRENT at + 25 °C (Amps) | |
| | | | M | P | R | S | B | C | D | + 25 °C | + 85 °C | + 125 °C | at + 25 °C | at + 25 °C | 40 kHz | 1 kHz | |
| | | | 1.0 | 0.1 | 0.01 | 0.001 | 0.1 | 0.01 | 0.001 | + 25 °C | + 85 °C | + 125 °C | 1 kHz (%) | 100 kHz (Ohms) | | | |
| 20 WVDC AT + 85 °C, SURGE = 26 V . . . 13 WVDC AT + 125 °C, SURGE = 16 V | | | | | | | | | | | | | | | | | |
| 68.0 | D | 5 | 0045 | 0145 | 0245 | 0345 | 2045 | 3045 | 4045 | 7.0 | 140.0 | 175.0 | 6 | 0.095 | 3.0 | 2.4 | |
| 68.0 | D | 10 | 0046 | 0146 | 0246 | 0346 | 2046 | 3046 | 4046 | 7.0 | 140.0 | 175.0 | 6 | 0.095 | 3.0 | 2.4 | |
| 68.0 | D | 20 | 0047 | 0147 | 0247 | 0347 | 2047 | 3047 | 4047 | 7.0 | 140.0 | 175.0 | 6 | 0.095 | 3.0 | 2.4 | |
| 82.0 | D | 5 | 0048 | 0148 | 0248 | 0348 | 2048 | 3048 | 4048 | 8.0 | 160.0 | 200.0 | 6 | 0.085 | 3.1 | 2.5 | |
| 82.0 | D | 10 | 0049 | 0149 | 0249 | 0349 | 2049 | 3049 | 4049 | 8.0 | 160.0 | 200.0 | 6 | 0.085 | 3.1 | 2.5 | |
| 100.0 | D | 5 | 0050 | 0150 | 0250 | 0350 | 2050 | 3050 | 4050 | 10.0 | 200.0 | 250.0 | 8 | 0.075 | 3.3 | 2.5 | |
| 100.0 | D | 10 | 0051 | 0151 | 0251 | 0351 | 2051 | 3051 | 4051 | 10.0 | 200.0 | 250.0 | 8 | 0.075 | 3.3 | 2.5 | |
| 100.0 | D | 20 | 0052 | 0152 | 0252 | 0352 | 2052 | 3052 | 4052 | 10.0 | 200.0 | 250.0 | 8 | 0.075 | 3.3 | 2.5 | |
| 35 WVDC AT + 85 °C, SURGE = 46 V . . . 23 WVDC AT + 125 °C, SURGE = 28 V | | | | | | | | | | | | | | | | | |
| 22.0 | C | 5 | 0053 | 0153 | 0253 | 0353 | 2053 | 3053 | 4053 | 4.0 | 80.0 | 100.0 | 4 | 0.160 | 2.1 | 1.5 | |
| 22.0 | C | 10 | 0054 | 0154 | 0254 | 0354 | 2054 | 3054 | 4054 | 4.0 | 80.0 | 100.0 | 4 | 0.160 | 2.1 | 1.5 | |
| 22.0 | C | 20 | 0055 | 0155 | 0255 | 0355 | 2055 | 3055 | 4055 | 4.0 | 80.0 | 100.0 | 4 | 0.160 | 2.1 | 1.5 | |
| 27.0 | D | 5 | 0056 | 0156 | 0256 | 0356 | 2056 | 3056 | 4056 | 4.5 | 90.0 | 113.0 | 4 | 0.145 | 2.4 | 1.9 | |
| 27.0 | D | 10 | 0057 | 0157 | 0257 | 0357 | 2057 | 3057 | 4057 | 4.5 | 90.0 | 113.0 | 4 | 0.145 | 2.4 | 1.9 | |
| 33.0 | D | 5 | 0058 | 0158 | 0258 | 0358 | 2058 | 3058 | 4058 | 5.5 | 110.0 | 138.0 | 5 | 0.130 | 2.5 | 1.9 | |
| 33.0 | D | 10 | 0059 | 0159 | 0259 | 0359 | 2059 | 3059 | 4059 | 5.5 | 110.0 | 138.0 | 5 | 0.130 | 2.5 | 1.9 | |
| 33.0 | D | 20 | 0060 | 0160 | 0260 | 0360 | 2060 | 3060 | 4060 | 5.5 | 110.0 | 138.0 | 5 | 0.130 | 2.5 | 1.9 | |
| 39.0 | D | 5 | 0061 | 0161 | 0261 | 0361 | 2061 | 3061 | 4061 | 7.0 | 140.0 | 175.0 | 5 | 0.120 | 2.6 | 2.0 | |
| 39.0 | D | 10 | 0062 | 0162 | 0262 | 0362 | 2062 | 3062 | 4062 | 7.0 | 140.0 | 175.0 | 5 | 0.120 | 2.6 | 2.0 | |
| 47.0 | D | 5 | 0063 | 0163 | 0263 | 0363 | 2063 | 3063 | 4063 | 8.0 | 160.0 | 200.0 | 5 | 0.110 | 2.7 | 2.2 | |
| 47.0 | D | 10 | 0064 | 0164 | 0264 | 0364 | 2064 | 3064 | 4064 | 8.0 | 160.0 | 200.0 | 5 | 0.110 | 2.7 | 2.2 | |
| 47.0 | D | 20 | 0065 | 0165 | 0265 | 0365 | 2065 | 3065 | 4065 | 8.0 | 160.0 | 200.0 | 5 | 0.110 | 2.7 | 2.2 | |
| 50 WVDC AT + 85 °C, SURGE = 65 V . . . 33 WVDC AT + 125 °C, SURGE = 40 V | | | | | | | | | | | | | | | | | |
| 5.6 | C | 5 | 0066 | 0166 | 0266 | 0366 | 2066 | 3066 | 4066 | 2.2 | 45.0 | 56.0 | 3 | 0.300 | 1.5 | 0.6 | |
| 5.6 | C | 10 | 0067 | 0167 | 0267 | 0367 | 2067 | 3067 | 4067 | 2.2 | 45.0 | 56.0 | 3 | 0.300 | 1.5 | 0.6 | |
| 6.8 | C | 5 | 0068 | 0168 | 0268 | 0368 | 2068 | 3068 | 4068 | 2.2 | 45.0 | 56.0 | 3 | 0.275 | 1.6 | 0.7 | |
| 6.8 | C | 10 | 0069 | 0169 | 0269 | 0369 | 2069 | 3069 | 4069 | 2.2 | 45.0 | 56.0 | 3 | 0.275 | 1.6 | 0.7 | |
| 6.8 | C | 20 | 0070 | 0170 | 0270 | 0370 | 2070 | 3070 | 4070 | 2.2 | 45.0 | 56.0 | 3 | 0.275 | 1.6 | 0.7 | |
| 8.2 | C | 5 | 0071 | 0171 | 0271 | 0371 | 2071 | 3071 | 4071 | 2.5 | 50.0 | 63.0 | 3 | 0.250 | 1.6 | 0.9 | |
| 8.2 | C | 10 | 0072 | 0172 | 0272 | 0372 | 2072 | 3072 | 4072 | 2.5 | 50.0 | 63.0 | 3 | 0.250 | 1.6 | 0.9 | |
| 10.0 | C | 5 | 0073 | 0173 | 0273 | 0373 | 2073 | 3073 | 4073 | 2.5 | 50.0 | 63.0 | 3 | 0.230 | 1.7 | 1.1 | |
| 10.0 | C | 10 | 0074 | 0174 | 0274 | 0374 | 2074 | 3074 | 4074 | 2.5 | 50.0 | 63.0 | 3 | 0.230 | 1.7 | 1.1 | |
| 10.0 | C | 20 | 0075 | 0175 | 0275 | 0375 | 2075 | 3075 | 4075 | 2.5 | 50.0 | 63.0 | 3 | 0.230 | 1.7 | 1.1 | |
| 12.0 | C | 5 | 0076 | 0176 | 0276 | 0376 | 2076 | 3076 | 4076 | 3.0 | 60.0 | 75.0 | 3 | 0.210 | 1.8 | 1.3 | |
| 12.0 | C | 10 | 0077 | 0177 | 0277 | 0377 | 2077 | 3077 | 4077 | 3.0 | 60.0 | 75.0 | 3 | 0.210 | 1.8 | 1.3 | |
| 15.0 | C | 5 | 0078 | 0178 | 0278 | 0378 | 2078 | 3078 | 4078 | 4.0 | 80.0 | 100.0 | 3 | 0.190 | 1.9 | 1.4 | |
| 15.0 | C | 10 | 0079 | 0179 | 0279 | 0379 | 2079 | 3079 | 4079 | 4.0 | 80.0 | 100.0 | 3 | 0.190 | 1.9 | 1.4 | |
| 15.0 | C | 20 | 0080 | 0180 | 0280 | 0380 | 2080 | 3080 | 4080 | 4.0 | 80.0 | 100.0 | 3 | 0.190 | 1.9 | 1.4 | |
| 18.0 | C | 5 | 0081 | 0181 | 0281 | 0381 | 2081 | 3081 | 4081 | 4.5 | 90.0 | 113.0 | 4 | 0.175 | 2.0 | 1.4 | |
| 18.0 | C | 10 | 0082 | 0182 | 0282 | 0382 | 2082 | 3082 | 4082 | 4.5 | 90.0 | 113.0 | 4 | 0.175 | 2.0 | 1.4 | |
| 22.0 | D | 5 | 0083 | 0183 | 0283 | 0383 | 2083 | 3083 | 4083 | 5.5 | 110.0 | 138.0 | 4 | 0.160 | 2.3 | 1.7 | |
| 22.0 | D | 10 | 0084 | 0184 | 0284 | 0384 | 2084 | 3084 | 4084 | 5.5 | 110.0 | 138.0 | 4 | 0.160 | 2.3 | 1.7 | |
| 22.0 | D | 20 | 0085 | 0185 | 0285 | 0385 | 2085 | 3085 | 4085 | 5.5 | 110.0 | 138.0 | 4 | 0.160 | 2.3 | 1.7 | |



Solid-Electrolyte TANTALEX® Capacitors,
Military MIL-C-39003 Qualified, Syles CSR13, 21, 23, 33

Vishay Sprague

| STANDARD RATINGS: CSR23, M39003/03-XXXX | | | | | | | | | | | | | | |
|---|--------------|-----------------------|--|------|------|-------|------|------|-------|------------------|---------|----------|--------------------|---------------------|
| CAPACITANCE (µF) | CASE CODE | CAP. TOL. (± %) | PART NO. M39003/03- FAILURE RATE LEVEL (%/1000 HOURS) | | | | | | | MAX. DCL (µA) AT | | | MAX. DF (%) AT | |
| | | | M | P | R | S | B | C | D | + 25 °C | + 85 °C | + 125 °C | - 55 °C + 25 °C | + 85 °C + 125 °C |
| | | | 1.0 | 0.1 | 0.01 | 0.001 | 0.1 | 0.01 | 0.001 | | | | | |
| 6 WVDC AT + 85 °C, SURGE = 8 V . . . 4 WVDC AT + 125 °C, SURGE = 5 V | | | | | | | | | | | | | | |
| 10.0 | A | 10 | 0101 | 0201 | 0301 | 0401 | 2001 | 3001 | 4001 | 0.9 | 9.0 | 11.0 | 6 | 6 |
| 10.0 | A | 20 | 0102 | 0202 | 0302 | 0402 | 2002 | 3002 | 4002 | 0.9 | 9.0 | 11.0 | 6 | 6 |
| 12.0 | A | 10 | 0103 | 0203 | 0303 | 0403 | 2003 | 3003 | 4003 | 1.0 | 10.0 | 12.5 | 6 | 6 |
| 100.0 | B | 10 | 0104 | 0204 | 0304 | 0404 | 2004 | 3004 | 4004 | 6.0 | 60.0 | 75.0 | 8 | 8 |
| 100.0 | B | 20 | 0105 | 0205 | 0305 | 0405 | 2005 | 3005 | 4005 | 6.0 | 60.0 | 75.0 | 8 | 8 |
| 330.0 | C | 10 | 0106 | 0206 | 0306 | 0406 | 2006 | 3006 | 4006 | 15.0 | 150.0 | 188.0 | 8 | 8 |
| 330.0 | C | 20 | 0107 | 0207 | 0307 | 0407 | 2007 | 3007 | 4007 | 15.0 | 150.0 | 188.0 | 8 | 8 |
| 390.0 | C | 10 | 0108 | 0208 | 0308 | 0408 | 2008 | 3008 | 4008 | 15.0 | 150.0 | 188.0 | 10 | 10 |
| 470.0 | C | 10 | 0109 | 0209 | 0309 | 0409 | 2009 | 3009 | 4009 | 15.0 | 150.0 | 188.0 | 10 | 10 |
| 470.0 | C | 20 | 0110 | 0210 | 0310 | 0410 | 2010 | 3010 | 4010 | 15.0 | 150.0 | 188.0 | 10 | 10 |
| 680.0 | D | 10 | 0111 | 0211 | 0311 | 0411 | 2011 | 3011 | 4011 | 20.0 | 200.0 | 250.0 | 10 | 10 |
| 680.0 | D | 20 | 0112 | 0212 | 0312 | 0412 | 2012 | 3012 | 4012 | 20.0 | 200.0 | 250.0 | 10 | 10 |
| 820.0 | D | 10 | 0113 | 0213 | 0313 | 0413 | 2013 | 3013 | 4013 | 20.0 | 200.0 | 250.0 | 10 | 10 |
| 1000.0 | D | 10 | 0114 | 0214 | 0314 | 0414 | 2014 | 3014 | 4014 | 30.0 | 300.0 | 375.0 | 10 | 10 |
| 1000.0 | D | 20 | 0115 | 0215 | 0315 | 0415 | 2015 | 3015 | 4015 | 30.0 | 300.0 | 375.0 | 10 | 10 |
| 10 WVDC AT + 85 °C, SURGE = 13 V . . . 7 WVDC AT + 125 °C, SURGE = 9 V | | | | | | | | | | | | | | |
| 6.8 | A | 10 | 0116 | 0216 | 0316 | 0416 | 2016 | 3016 | 4016 | 1.0 | 10.0 | 12.5 | 6 | 6 |
| 6.8 | A | 20 | 0117 | 0217 | 0317 | 0417 | 2017 | 3017 | 4017 | 1.0 | 10.0 | 12.5 | 6 | 6 |
| 8.2 | A | 10 | 0118 | 0218 | 0318 | 0418 | 2018 | 3018 | 4018 | 1.2 | 12.0 | 15.0 | 6 | 6 |
| 47.0 | B | 10 | 0119 | 0219 | 0319 | 0419 | 2019 | 3019 | 4019 | 5.0 | 50.0 | 63.0 | 6 | 6 |
| 47.0 | B | 20 | 0120 | 0220 | 0320 | 0420 | 2020 | 3020 | 4020 | 5.0 | 50.0 | 63.0 | 6 | 6 |
| 56.0 | B | 10 | 0121 | 0221 | 0321 | 0421 | 2021 | 3021 | 4021 | 6.0 | 60.0 | 75.0 | 6 | 6 |
| 68.0 | B | 10 | 0122 | 0222 | 0322 | 0422 | 2022 | 3022 | 4022 | 7.0 | 70.0 | 88.0 | 6 | 6 |
| 68.0 | B | 20 | 0123 | 0223 | 0323 | 0423 | 2023 | 3023 | 4023 | 7.0 | 70.0 | 88.0 | 6 | 6 |
| 82.0 | B | 10 | 0124 | 0224 | 0324 | 0424 | 2024 | 3024 | 4024 | 8.0 | 80.0 | 100.0 | 6 | 6 |
| 220.0 | C | 10 | 0125 | 0225 | 0325 | 0425 | 2025 | 3025 | 4025 | 15.0 | 150.0 | 188.0 | 8 | 8 |
| 220.0 | C | 20 | 0126 | 0226 | 0326 | 0426 | 2026 | 3026 | 4026 | 15.0 | 150.0 | 188.0 | 8 | 8 |
| 270.0 | C | 10 | 0127 | 0227 | 0327 | 0427 | 2027 | 3027 | 4027 | 15.0 | 150.0 | 188.0 | 8 | 8 |
| 390.0 | D | 10 | 0128 | 0228 | 0328 | 0428 | 2028 | 3028 | 4028 | 20.0 | 200.0 | 250.0 | 10 | 10 |
| 470.0 | D | 10 | 0129 | 0229 | 0329 | 0429 | 2029 | 3029 | 4029 | 20.0 | 200.0 | 250.0 | 10 | 10 |
| 470.0 | D | 20 | 0130 | 0230 | 0330 | 0430 | 2030 | 3030 | 4030 | 20.0 | 200.0 | 250.0 | 10 | 10 |
| 560.0 | D | 10 | 0131 | 0231 | 0331 | 0431 | 2031 | 3031 | 4031 | 30.0 | 300.0 | 375.0 | 10 | 10 |
| 15 WVDC AT + 85 °C, SURGE = 20 V . . . 10 WVDC AT + 125 °C, SURGE = 12 V | | | | | | | | | | | | | | |
| 4.7 | A | 10 | 0132 | 0232 | 0332 | 0432 | 2032 | 3032 | 4032 | 1.0 | 10.0 | 12.5 | 4 | 4 |
| 4.7 | A | 20 | 0133 | 0233 | 0333 | 0433 | 2033 | 3033 | 4033 | 1.0 | 10.0 | 12.5 | 4 | 4 |
| 5.6 | A | 10 | 0134 | 0234 | 0334 | 0434 | 2034 | 3034 | 4034 | 1.3 | 13.0 | 16.5 | 4 | 4 |
| 33.0 | B | 10 | 0135 | 0235 | 0335 | 0435 | 2035 | 3035 | 4035 | 6.0 | 60.0 | 75.0 | 6 | 6 |
| 33.0 | B | 20 | 0136 | 0236 | 0336 | 0436 | 2036 | 3036 | 4036 | 6.0 | 60.0 | 75.0 | 6 | 6 |
| 39.0 | B | 10 | 0137 | 0237 | 0337 | 0437 | 2037 | 3037 | 4037 | 6.0 | 60.0 | 75.0 | 6 | 6 |
| 150.0 | C | 10 | 0138 | 0238 | 0338 | 0438 | 2038 | 3038 | 4038 | 15.0 | 150.0 | 188.0 | 8 | 8 |
| 150.0 | C | 20 | 0139 | 0239 | 0339 | 0439 | 2039 | 3039 | 4039 | 15.0 | 150.0 | 188.0 | 8 | 8 |
| 180.0 | C | 10 | 0140 | 0240 | 0340 | 0440 | 2040 | 3040 | 4040 | 15.0 | 150.0 | 188.0 | 8 | 8 |
| 220.0 | D | 10 | 0141 | 0241 | 0341 | 0441 | 2041 | 3041 | 4041 | 20.0 | 200.0 | 250.0 | 8 | 8 |
| 220.0 | D | 20 | 0142 | 0242 | 0342 | 0442 | 2042 | 3042 | 4042 | 20.0 | 200.0 | 250.0 | 8 | 8 |
| 270.0 | D | 10 | 0143 | 0243 | 0343 | 0443 | 2043 | 3043 | 4043 | 20.0 | 200.0 | 250.0 | 8 | 8 |
| 330.0 | D | 10 | 0144 | 0244 | 0344 | 0444 | 2044 | 3044 | 4044 | 20.0 | 200.0 | 250.0 | 8 | 8 |
| 330.0 | D | 20 | 0145 | 0245 | 0345 | 0445 | 2045 | 3045 | 4045 | 20.0 | 200.0 | 250.0 | 8 | 8 |



| STANDARD RATINGS: CSR23, M39003/03-XXXX | | | | | | | | | | | | | | |
|---|--------------|-----------------------|--|------|------|-------|------|------|-------|------------------|---------|----------|--------------------|---------------------|
| CAPACITANCE (µF) | CASE CODE | CAP. TOL. (± %) | PART NO. M39003/03- FAILURE RATE LEVEL (%/1000 HOURS) | | | | | | | MAX. DCL (µA) AT | | | MAX. DF (%) AT | |
| | | | M | P | R | S | B | C | D | + 25 °C | + 85 °C | + 125 °C | - 55 °C + 25 °C | + 85 °C + 125 °C |
| | | | 1.0 | 0.1 | 0.01 | 0.001 | 0.1 | 0.01 | 0.001 | | | | | |
| 20 WVDC AT + 85 °C, SURGE = 26 V . . . 13 WVDC AT + 125 °C, SURGE = 16 V | | | | | | | | | | | | | | |
| 2.7 | A | 10 | 0146 | 0246 | 0346 | 0446 | 2046 | 3046 | 4046 | 0.8 | 8.0 | 10.0 | 4 | 4 |
| 3.3 | A | 10 | 0147 | 0247 | 0347 | 0447 | 2047 | 3047 | 4047 | 1.0 | 10.0 | 12.5 | 4 | 4 |
| 3.3 | A | 20 | 0148 | 0248 | 0348 | 0448 | 2048 | 3048 | 4048 | 1.0 | 10.0 | 12.5 | 4 | 4 |
| 3.9 | A | 10 | 0149 | 0249 | 0349 | 0449 | 2049 | 3049 | 4049 | 1.2 | 12.0 | 15.0 | 4 | 4 |
| 18.0 | B | 10 | 0150 | 0250 | 0350 | 0450 | 2050 | 3050 | 4050 | 4.0 | 40.0 | 50.0 | 6 | 6 |
| 22.0 | B | 10 | 0151 | 0251 | 0351 | 0451 | 2051 | 3051 | 4051 | 4.0 | 40.0 | 50.0 | 6 | 6 |
| 22.0 | B | 20 | 0152 | 0252 | 0352 | 0452 | 2052 | 3052 | 4052 | 4.0 | 40.0 | 50.0 | 6 | 6 |
| 27.0 | B | 10 | 0153 | 0253 | 0353 | 0453 | 2053 | 3053 | 4053 | 5.0 | 50.0 | 63.0 | 6 | 6 |
| 56.0 | C | 10 | 0154 | 0254 | 0354 | 0454 | 2054 | 3054 | 4054 | 9.0 | 90.0 | 110.0 | 6 | 6 |
| 68.0 | C | 10 | 0155 | 0255 | 0355 | 0455 | 2055 | 3055 | 4055 | 10.0 | 100.0 | 125.0 | 6 | 6 |
| 68.0 | C | 20 | 0156 | 0256 | 0356 | 0456 | 2056 | 3056 | 4056 | 10.0 | 100.0 | 125.0 | 6 | 6 |
| 82.0 | C | 10 | 0157 | 0257 | 0357 | 0457 | 2057 | 3057 | 4057 | 10.0 | 100.0 | 125.0 | 6 | 6 |
| 100.0 | C | 10 | 0158 | 0258 | 0358 | 0458 | 2058 | 3058 | 4058 | 15.0 | 150.0 | 188.0 | 6 | 6 |
| 100.0 | C | 20 | 0159 | 0259 | 0359 | 0459 | 2059 | 3059 | 4059 | 15.0 | 150.0 | 188.0 | 6 | 6 |
| 120.0 | C | 10 | 0160 | 0260 | 0360 | 0460 | 2060 | 3060 | 4060 | 15.0 | 150.0 | 188.0 | 6 | 6 |
| 150.0 | D | 10 | 0161 | 0261 | 0361 | 0461 | 2061 | 3061 | 4061 | 20.0 | 200.0 | 250.0 | 8 | 8 |
| 150.0 | D | 20 | 0162 | 0262 | 0362 | 0462 | 2062 | 3062 | 4062 | 20.0 | 200.0 | 250.0 | 8 | 8 |
| 180.0 | D | 10 | 0163 | 0263 | 0363 | 0463 | 2063 | 3063 | 4063 | 20.0 | 200.0 | 250.0 | 8 | 8 |
| 35 WVDC AT + 85 °C, SURGE = 46 V . . . 23 WVDC AT + 125 °C, SURGE = 28 V | | | | | | | | | | | | | | |
| 1.8 | A | 10 | 0164 | 0264 | 0364 | 0464 | 2064 | 3064 | 4064 | 1.0 | 10.0 | 12.5 | 4 | 4 |
| 8.2 | B | 10 | 0165 | 0265 | 0365 | 0465 | 2065 | 3065 | 4065 | 3.5 | 35.0 | 44.0 | 6 | 6 |
| 10.0 | B | 10 | 0166 | 0266 | 0366 | 0466 | 2066 | 3066 | 4066 | 4.0 | 40.0 | 50.0 | 6 | 6 |
| 10.0 | B | 20 | 0167 | 0267 | 0367 | 0467 | 2067 | 3067 | 4067 | 4.0 | 40.0 | 50.0 | 6 | 6 |
| 33.0 | C | 10 | 0168 | 0268 | 0368 | 0468 | 2068 | 3068 | 4068 | 10.0 | 100.0 | 125.0 | 6 | 6 |
| 33.0 | C | 20 | 0169 | 0269 | 0369 | 0469 | 2069 | 3069 | 4069 | 10.0 | 100.0 | 125.0 | 6 | 6 |
| 39.0 | C | 10 | 0170 | 0270 | 0370 | 0470 | 2070 | 3070 | 4070 | 10.0 | 100.0 | 125.0 | 6 | 6 |
| 47.0 | C | 10 | 0171 | 0271 | 0371 | 0471 | 2071 | 3071 | 4071 | 10.0 | 100.0 | 125.0 | 6 | 6 |
| 47.0 | C | 20 | 0172 | 0272 | 0372 | 0472 | 2072 | 3072 | 4072 | 10.0 | 100.0 | 125.0 | 6 | 6 |
| 56.0 | D | 10 | 0173 | 0273 | 0373 | 0473 | 2073 | 3073 | 4073 | 15.0 | 150.0 | 188.0 | 6 | 6 |
| 68.0 | D | 10 | 0174 | 0274 | 0374 | 0474 | 2074 | 3074 | 4074 | 15.0 | 150.0 | 188.0 | 6 | 6 |
| 68.0 | D | 20 | 0175 | 0275 | 0375 | 0475 | 2075 | 3075 | 4075 | 15.0 | 150.0 | 188.0 | 6 | 6 |
| 50 WVDC AT + 85 °C, SURGE = 65 V . . . 33 WVDC AT + 125 °C, SURGE = 40 V | | | | | | | | | | | | | | |
| 1.2 | A | 10 | 0176 | 0276 | 0376 | 0476 | 2076 | 3076 | 4076 | 0.9 | 9.0 | 11.0 | 4 | 4 |
| 1.5 | A | 10 | 0177 | 0277 | 0377 | 0477 | 2077 | 3077 | 4077 | 1.2 | 12.0 | 15.0 | 4 | 4 |
| 1.5 | A | 20 | 0178 | 0278 | 0378 | 0478 | 2078 | 3078 | 4078 | 1.2 | 12.0 | 15.0 | 4 | 4 |
| 5.6 | B | 10 | 0179 | 0279 | 0379 | 0479 | 2079 | 3079 | 4079 | 4.5 | 45.0 | 56.0 | 4 | 4 |
| 6.8 | B | 10 | 0180 | 0280 | 0380 | 0480 | 2080 | 3080 | 4080 | 4.5 | 45.0 | 56.0 | 6 | 6 |
| 6.8 | B | 20 | 0181 | 0281 | 0381 | 0481 | 2081 | 3081 | 4081 | 4.5 | 45.0 | 56.0 | 6 | 6 |
| 22.0 | C | 10 | 0182 | 0282 | 0382 | 0482 | 2082 | 3082 | 4082 | 10.0 | 100.0 | 125.0 | 6 | 6 |
| 22.0 | C | 20 | 0183 | 0283 | 0383 | 0483 | 2083 | 3083 | 4083 | 10.0 | 100.0 | 125.0 | 6 | 6 |
| 27.0 | C | 10 | 0184 | 0284 | 0384 | 0484 | 2084 | 3084 | 4084 | 10.0 | 100.0 | 125.0 | 6 | 6 |
| 33.0 | D | 10 | 0185 | 0285 | 0385 | 0485 | 2085 | 3085 | 4085 | 10.0 | 100.0 | 125.0 | 6 | 6 |
| 33.0 | D | 20 | 0186 | 0286 | 0386 | 0486 | 2086 | 3086 | 4086 | 10.0 | 100.0 | 125.0 | 6 | 6 |
| 39.0 | D | 10 | 0187 | 0287 | 0387 | 0487 | 2087 | 3087 | 4087 | 10.0 | 100.0 | 125.0 | 6 | 6 |



Solid-Electrolyte TANTALEX® Capacitors,
Military MIL-C-39003 Qualified, Syles CSR13, 21, 23, 33

Vishay Sprague

| STANDARD RATINGS: CSR33, M39003/06-XXXX | | | | | | | | | | | | | | |
|---|--------------|-----------------------|--|------|------|-------|------|------|-------|------------------|---------|----------|----------------|----------|
| CAPACITANCE (µF) | CASE CODE | CAP. TOL. (± %) | PART NO. M39003/03- FAILURE RATE LEVEL (%/1000 HOURS) | | | | | | | MAX. DCL (µA) AT | | | MAX. DF (%) AT | |
| | | | M | P | R | S | B | C | D | + 25 °C | + 85 °C | + 125 °C | - 55 °C | + 85 °C |
| | | | 1.0 | 0.1 | 0.01 | 0.001 | 0.1 | 0.01 | 0.001 | | | | + 25 °C | + 125 °C |
| 6 WVDC AT + 85 °C, SURGE = 8 V . . . 4 WVDC AT + 125 °C, SURGE = 5 V | | | | | | | | | | | | | | |
| 10.0 | A | 10 | 0001 | 0101 | 0201 | 0301 | 2001 | 3001 | 4001 | 0.5 | 2.0 | 2.0 | 6 | 6 |
| 10.0 | A | 20 | 0002 | 0102 | 0202 | 0302 | 2002 | 3002 | 4002 | 0.5 | 2.0 | 2.0 | 6 | 6 |
| 12.0 | A | 10 | 0003 | 0103 | 0203 | 0303 | 2003 | 3003 | 4003 | 0.5 | 2.0 | 2.0 | 6 | 6 |
| 100.0 | B | 10 | 0004 | 0104 | 0204 | 0304 | 2004 | 3004 | 4004 | 1.0 | 3.0 | 3.0 | 8 | 8 |
| 100.0 | B | 20 | 0005 | 0105 | 0205 | 0305 | 2005 | 3005 | 4005 | 1.0 | 3.0 | 3.0 | 8 | 8 |
| 330.0 | C | 10 | 0006 | 0106 | 0206 | 0306 | 2006 | 3006 | 4006 | 2.0 | 8.0 | 8.0 | 8 | 8 |
| 330.0 | C | 20 | 0007 | 0107 | 0207 | 0307 | 2007 | 3007 | 4007 | 2.0 | 8.0 | 8.0 | 8 | 8 |
| 390.0 | C | 10 | 0008 | 0108 | 0208 | 0308 | 2008 | 3008 | 4008 | 2.0 | 8.0 | 8.0 | 10 | 10 |
| 470.0 | C | 10 | 0009 | 0109 | 0209 | 0309 | 2009 | 3009 | 4009 | 2.0 | 8.0 | 8.0 | 10 | 10 |
| 470.0 | C | 20 | 0010 | 0110 | 0210 | 0310 | 2010 | 3010 | 4010 | 2.0 | 8.0 | 8.0 | 10 | 10 |
| 680.0 | D | 10 | 0011 | 0111 | 0211 | 0311 | 2011 | 3011 | 4011 | 5.0 | 10.0 | 10.0 | 10 | 10 |
| 680.0 | D | 20 | 0012 | 0112 | 0212 | 0312 | 2012 | 3012 | 4012 | 5.0 | 10.0 | 10.0 | 10 | 10 |
| 820.0 | D | 10 | 0013 | 0113 | 0213 | 0313 | 2013 | 3013 | 4013 | 5.0 | 10.0 | 10.0 | 10 | 10 |
| 1000.0 | D | 10 | 0014 | 0114 | 0214 | 0314 | 2014 | 3014 | 4014 | 5.0 | 10.0 | 10.0 | 10 | 10 |
| 1000.0 | D | 20 | 0015 | 0115 | 0215 | 0315 | 2015 | 3015 | 4015 | 5.0 | 10.0 | 10.0 | 10 | 10 |
| 10 WVDC AT + 85 °C, SURGE = 13 V . . . 7 WVDC AT + 125 °C, SURGE = 9 V | | | | | | | | | | | | | | |
| 6.8 | A | 10 | 0016 | 0116 | 0216 | 0316 | 2016 | 3016 | 4016 | 0.5 | 2.0 | 2.0 | 6 | 6 |
| 6.8 | A | 20 | 0017 | 0117 | 0217 | 0317 | 2017 | 3017 | 4017 | 0.5 | 2.0 | 2.0 | 6 | 6 |
| 8.2 | A | 10 | 0018 | 0118 | 0218 | 0318 | 2018 | 3018 | 4018 | 0.5 | 2.0 | 2.0 | 6 | 6 |
| 47.0 | B | 10 | 0019 | 0119 | 0219 | 0319 | 2019 | 3019 | 4019 | 1.0 | 2.0 | 2.0 | 6 | 6 |
| 47.0 | B | 20 | 0020 | 0120 | 0220 | 0320 | 2020 | 3020 | 4020 | 1.0 | 2.0 | 2.0 | 6 | 6 |
| 56.0 | B | 10 | 0021 | 0121 | 0221 | 0321 | 2021 | 3021 | 4021 | 1.0 | 4.0 | 4.0 | 6 | 6 |
| 68.0 | B | 10 | 0022 | 0122 | 0222 | 0322 | 2022 | 3022 | 4022 | 1.0 | 4.0 | 4.0 | 6 | 6 |
| 68.0 | B | 20 | 0023 | 0123 | 0223 | 0323 | 2023 | 3023 | 4023 | 1.0 | 4.0 | 4.0 | 6 | 6 |
| 82.0 | B | 10 | 0024 | 0124 | 0224 | 0324 | 2024 | 3024 | 4024 | 1.0 | 4.0 | 4.0 | 6 | 6 |
| 220.0 | C | 10 | 0025 | 0125 | 0225 | 0325 | 2025 | 3025 | 4025 | 1.0 | 7.0 | 7.0 | 8 | 8 |
| 220.0 | C | 20 | 0026 | 0126 | 0226 | 0326 | 2026 | 3026 | 4026 | 1.0 | 7.0 | 7.0 | 8 | 8 |
| 270.0 | C | 10 | 0027 | 0127 | 0227 | 0327 | 2027 | 3027 | 4027 | 2.0 | 10.0 | 10.0 | 8 | 8 |
| 390.0 | D | 10 | 0028 | 0128 | 0228 | 0328 | 2028 | 3028 | 4028 | 2.0 | 16.0 | 16.0 | 10 | 10 |
| 470.0 | D | 10 | 0029 | 0129 | 0229 | 0329 | 2029 | 3029 | 4029 | 4.0 | 16.0 | 16.0 | 10 | 10 |
| 470.0 | D | 20 | 0030 | 0130 | 0230 | 0330 | 2030 | 3030 | 4030 | 4.0 | 16.0 | 16.0 | 10 | 10 |
| 560.0 | D | 10 | 0031 | 0131 | 0231 | 0331 | 2031 | 3031 | 4031 | 4.0 | 16.0 | 16.0 | 10 | 10 |
| 15 WVDC AT + 85 °C, SURGE = 20 V . . . 10 WVDC AT + 125 °C, SURGE = 12 V | | | | | | | | | | | | | | |
| 4.7 | A | 10 | 0032 | 0132 | 0232 | 0332 | 2032 | 3032 | 4032 | 0.5 | 2.0 | 2.0 | 4 | 4 |
| 4.7 | A | 20 | 0033 | 0133 | 0233 | 0333 | 2033 | 3033 | 4033 | 0.5 | 2.0 | 2.0 | 4 | 4 |
| 5.6 | A | 10 | 0034 | 0134 | 0234 | 0334 | 2034 | 3034 | 4034 | 0.5 | 2.0 | 2.0 | 4 | 4 |
| 33.0 | B | 10 | 0035 | 0135 | 0235 | 0335 | 2035 | 3035 | 4035 | 1.0 | 2.0 | 2.0 | 6 | 6 |
| 33.0 | B | 20 | 0036 | 0136 | 0236 | 0336 | 2036 | 3036 | 4036 | 1.0 | 2.0 | 2.0 | 6 | 6 |
| 39.0 | B | 10 | 0037 | 0137 | 0237 | 0337 | 2037 | 3037 | 4037 | 1.0 | 2.0 | 2.0 | 6 | 6 |
| 150.0 | C | 10 | 0038 | 0138 | 0238 | 0338 | 2038 | 3038 | 4038 | 1.0 | 7.0 | 7.0 | 8 | 8 |
| 150.0 | C | 20 | 0039 | 0139 | 0239 | 0339 | 2039 | 3039 | 4039 | 1.0 | 7.0 | 7.0 | 8 | 8 |
| 180.0 | C | 10 | 0040 | 0140 | 0240 | 0340 | 2040 | 3040 | 4040 | 2.0 | 10.0 | 10.0 | 8 | 8 |
| 220.0 | D | 10 | 0041 | 0141 | 0241 | 0341 | 2041 | 3041 | 4041 | 2.0 | 10.0 | 10.0 | 8 | 8 |
| 220.0 | D | 20 | 0042 | 0142 | 0242 | 0342 | 2042 | 3042 | 4042 | 2.0 | 10.0 | 10.0 | 8 | 8 |
| 270.0 | D | 10 | 0043 | 0143 | 0243 | 0343 | 2043 | 3043 | 4043 | 2.0 | 16.0 | 16.0 | 8 | 8 |
| 330.0 | D | 10 | 0044 | 0144 | 0244 | 0344 | 2044 | 3044 | 4044 | 2.0 | 16.0 | 16.0 | 8 | 8 |
| 330.0 | D | 20 | 0045 | 0145 | 0245 | 0345 | 2045 | 3045 | 4045 | 2.0 | 16.0 | 16.0 | 8 | 8 |



| STANDARD RATINGS: CSR33, M39003/06-XXXX | | | | | | | | | | | | | | |
|---|--------------|-----------------------|--|------|------|-------|------|------|-------|------------------|---------|----------|--------------------|---------------------|
| CAPACITANCE (µF) | CASE CODE | CAP. TOL. (± %) | PART NO. M39003/03- FAILURE RATE LEVEL (%/1000 HOURS) | | | | | | | MAX. DCL (µA) AT | | | MAX. DF (%) AT | |
| | | | M | P | R | S | B | C | D | + 25 °C | + 85 °C | + 125 °C | - 55 °C + 25 °C | + 85 °C + 125 °C |
| | | | 1.0 | 0.1 | 0.01 | 0.001 | 0.1 | 0.01 | 0.001 | | | | | |
| 20 WVDC AT + 85 °C, SURGE = 26 V . . . 13 WVDC AT + 125 °C, SURGE = 16 V | | | | | | | | | | | | | | |
| 2.7 | A | 10 | 0046 | 0146 | 0246 | 0346 | 2046 | 3046 | 4046 | 0.5 | 2.0 | 2.0 | 4 | 4 |
| 3.3 | A | 10 | 0047 | 0147 | 0247 | 0347 | 2047 | 3047 | 4047 | 0.5 | 2.0 | 2.0 | 4 | 4 |
| 3.3 | A | 20 | 0048 | 0148 | 0248 | 0348 | 2048 | 3048 | 4048 | 0.5 | 2.0 | 2.0 | 4 | 4 |
| 3.9 | A | 10 | 0049 | 0149 | 0249 | 0349 | 2049 | 3049 | 4049 | 0.5 | 2.0 | 2.0 | 4 | 4 |
| 18.0 | B | 10 | 0050 | 0150 | 0250 | 0350 | 2050 | 3050 | 4050 | 1.0 | 2.0 | 2.0 | 6 | 6 |
| 22.0 | B | 10 | 0051 | 0151 | 0251 | 0351 | 2051 | 3051 | 4051 | 1.0 | 2.0 | 2.0 | 6 | 6 |
| 22.0 | B | 20 | 0052 | 0152 | 0252 | 0352 | 2052 | 3052 | 4052 | 1.0 | 2.0 | 2.0 | 6 | 6 |
| 27.0 | B | 10 | 0053 | 0153 | 0253 | 0353 | 2053 | 3053 | 4053 | 1.0 | 2.0 | 2.0 | 6 | 6 |
| 56.0 | C | 10 | 0054 | 0154 | 0254 | 0354 | 2054 | 3054 | 4054 | 1.0 | 10.0 | 10.0 | 6 | 6 |
| 68.0 | C | 10 | 0055 | 0155 | 0255 | 0355 | 2055 | 3055 | 4055 | 1.0 | 10.0 | 10.0 | 6 | 6 |
| 68.0 | C | 20 | 0056 | 0156 | 0256 | 0356 | 2056 | 3056 | 4056 | 1.0 | 10.0 | 10.0 | 6 | 6 |
| 82.0 | C | 10 | 0057 | 0157 | 0257 | 0357 | 2057 | 3057 | 4057 | 1.0 | 10.0 | 10.0 | 6 | 6 |
| 100.0 | C | 10 | 0058 | 0158 | 0258 | 0358 | 2058 | 3058 | 4058 | 1.0 | 10.0 | 10.0 | 6 | 6 |
| 100.0 | C | 20 | 0059 | 0159 | 0259 | 0359 | 2059 | 3059 | 4059 | 1.0 | 10.0 | 10.0 | 6 | 6 |
| 120.0 | C | 10 | 0060 | 0160 | 0260 | 0360 | 2060 | 3060 | 4060 | 1.0 | 10.0 | 10.0 | 6 | 6 |
| 150.0 | D | 10 | 0061 | 0161 | 0261 | 0361 | 2061 | 3061 | 4061 | 2.0 | 10.0 | 10.0 | 8 | 8 |
| 150.0 | D | 20 | 0062 | 0162 | 0262 | 0362 | 2062 | 3062 | 4062 | 2.0 | 10.0 | 10.0 | 8 | 8 |
| 180.0 | D | 10 | 0063 | 0163 | 0263 | 0363 | 2063 | 3063 | 4063 | 2.0 | 10.0 | 10.0 | 8 | 8 |
| 35 WVDC AT + 85 °C, SURGE = 46 V . . . 23 WVDC AT + 125 °C, SURGE = 28 V | | | | | | | | | | | | | | |
| 1.8 | A | 10 | 0064 | 0164 | 0264 | 0364 | 2064 | 3064 | 4064 | 0.5 | 2.0 | 2.0 | 4 | 4 |
| 8.2 | B | 10 | 0065 | 0165 | 0265 | 0365 | 2065 | 3065 | 4065 | 1.0 | 2.0 | 2.0 | 6 | 6 |
| 10.0 | B | 10 | 0066 | 0166 | 0266 | 0366 | 2066 | 3066 | 4066 | 1.0 | 2.0 | 2.0 | 6 | 6 |
| 10.0 | B | 20 | 0067 | 0167 | 0267 | 0367 | 2067 | 3067 | 4067 | 1.0 | 2.0 | 2.0 | 6 | 6 |
| 33.0 | C | 10 | 0068 | 0168 | 0268 | 0368 | 2068 | 3068 | 4068 | 1.0 | 5.0 | 5.0 | 6 | 6 |
| 33.0 | C | 20 | 0069 | 0169 | 0269 | 0369 | 2069 | 3069 | 4069 | 1.0 | 5.0 | 5.0 | 6 | 6 |
| 39.0 | C | 10 | 0070 | 0170 | 0270 | 0370 | 2070 | 3070 | 4070 | 1.0 | 5.0 | 5.0 | 6 | 6 |
| 47.0 | C | 10 | 0071 | 0171 | 0271 | 0371 | 2071 | 3071 | 4071 | 1.0 | 5.0 | 5.0 | 6 | 6 |
| 47.0 | C | 20 | 0072 | 0172 | 0272 | 0372 | 2072 | 3072 | 4072 | 1.0 | 5.0 | 5.0 | 6 | 6 |
| 56.0 | D | 10 | 0073 | 0173 | 0273 | 0373 | 2073 | 3073 | 4073 | 2.0 | 10.0 | 10.0 | 6 | 6 |
| 68.0 | D | 10 | 0074 | 0174 | 0274 | 0374 | 2074 | 3074 | 4074 | 2.0 | 10.0 | 10.0 | 6 | 6 |
| 68.0 | D | 20 | 0075 | 0175 | 0275 | 0375 | 2075 | 3075 | 4075 | 2.0 | 10.0 | 10.0 | 6 | 6 |
| 50 WVDC AT + 85 °C, SURGE = 65 V . . . 33 WVDC AT + 125 °C, SURGE = 40 V | | | | | | | | | | | | | | |
| 1.2 | A | 10 | 0076 | 0176 | 0276 | 0376 | 2076 | 3076 | 4076 | 0.5 | 2.0 | 2.0 | 4 | 4 |
| 1.5 | A | 10 | 0077 | 0177 | 0277 | 0377 | 2077 | 3077 | 4077 | 0.5 | 2.0 | 2.0 | 4 | 4 |
| 1.5 | A | 20 | 0078 | 0178 | 0278 | 0378 | 2078 | 3078 | 4078 | 0.5 | 2.0 | 2.0 | 4 | 4 |
| 5.6 | B | 10 | 0079 | 0179 | 0279 | 0379 | 2079 | 3079 | 4079 | 1.0 | 2.0 | 2.0 | 4 | 4 |
| 6.8 | B | 10 | 0080 | 0180 | 0280 | 0380 | 2080 | 3080 | 4080 | 1.0 | 2.0 | 2.0 | 6 | 6 |
| 6.8 | B | 20 | 0081 | 0181 | 0281 | 0381 | 2081 | 3081 | 4081 | 1.0 | 2.0 | 2.0 | 6 | 6 |
| 22.0 | C | 10 | 0082 | 0182 | 0282 | 0382 | 2082 | 3082 | 4082 | 1.0 | 5.0 | 5.0 | 6 | 6 |
| 22.0 | C | 20 | 0083 | 0183 | 0283 | 0383 | 2083 | 3083 | 4083 | 1.0 | 5.0 | 5.0 | 6 | 6 |
| 27.0 | C | 10 | 0084 | 0184 | 0284 | 0384 | 2084 | 3084 | 4084 | 1.0 | 5.0 | 5.0 | 6 | 6 |
| 33.0 | D | 10 | 0085 | 0185 | 0285 | 0385 | 2085 | 3085 | 4085 | 1.0 | 9.0 | 9.0 | 6 | 6 |
| 33.0 | D | 20 | 0086 | 0186 | 0286 | 0386 | 2086 | 3086 | 4086 | 1.0 | 9.0 | 9.0 | 6 | 6 |
| 39.0 | D | 10 | 0087 | 0187 | 0287 | 0387 | 2087 | 3087 | 4087 | 1.0 | 9.0 | 9.0 | 6 | 6 |

WEIBULL DISTRIBUTION METHOD FOR DETERMINING FAILURE RATE, MIL-C-39003

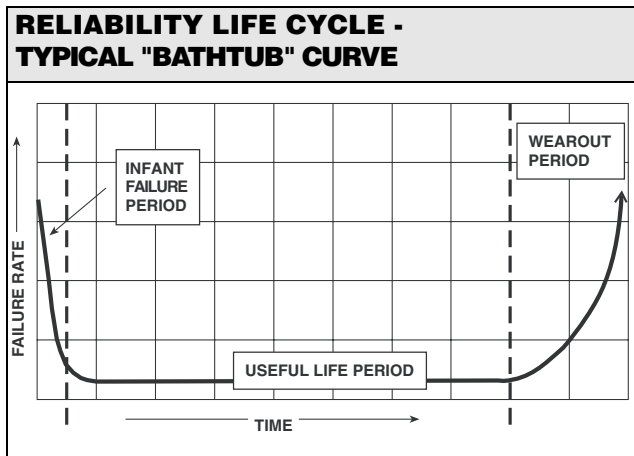
The current issue of Military Specification MIL-C-39003 incorporates Weibull distribution techniques as a means for calculating failure rates for solid tantalum capacitors. The exponential failure rates (M, P, R and S) are inactive for new designs. Weibull graded failure rate level "B" capacitors supersede exponential failure rates M, P, R and S.

Increasingly, more stringent quality measurement systems are being used in the electronics industry. AQL sample plans are being replaced by programs measuring component quality in PPM (Parts Per Million). Product quality specifications seemingly approach perfection. Procedures used to calculate PPM quality levels are based on manufacturers' in-process controls and final inspection results and by users' data at incoming inspection and equipment assembly.

Initial quality requirements are only part of a good product specification. Reliability and useful life should be considered as well - to fit the reliability and useful life requirements of end equipment.

Reliability is a measure of the expected failure rate during the useful life of the capacitor. When plotted the failure rate follows a characteristic "bathtub" curve, covering three periods in the typical capacitor life cycle.

The bathtub curve shows the early time period called infant failure period, the uniform failure rate period or useful life and a period of increasing failure rate due to wearout.



The Weibull shape parameter beta (β) is shown as less than one ($\beta < 1$) during infant mortality, one ($\beta = 1$) during the useful life and greater than one ($\beta > 1$) during the wearout period. Since Weibull distribution works well on units with a beta less than 1, solid tantalum capacitors can use this method for determining failure rates. Solid tantalum capacitors fail early in life (normally during the aging or burnin cycles) and show a slightly decreasing failure rate with time - however, there is no known wearout failure mode.

The processing of solid tantalum capacitors is not "perfectly clean". Impurities in the tantalum powders along with microscopic dust particles can cause flaws in the dielectric tantalum oxide. These flaws in the dielectric can cause failure sites which are normally found during the in-process aging or burn-in cycles. A very large percentage of failures

occur during these burn-ins. Since the worst flaws are presumed to fail first, we eventually arrive at flaw sizes which are presumably too small to cause further degradation.

Weibull states that the failure rate of a component that shows a decreasing failure rate with time can be predicted within a short period of time under accelerated conditions.

Accelerated conditions for solid tantalum capacitors can be imposed by means of either voltage or temperature stress.

Since temperatures above + 125 °C can cause degradation of the solid manganese dioxide electrolyte, voltage acceleration is performed instead.

The Navy's Crane NAD facility completed testing on solid tantalum capacitors from several manufacturers in late 1981.

During testing, acceleration factors (A.F.) were derived from life test results and the following formula used:

$$A.F. = 7.034 \times 10^{-9} e^{(18.7724 V_s/V_r)}$$

V_s = Voltage Stress

V_r = Rated voltage of unit under test

The acceleration factors used in MIL-C-39003 are as shown:

| V_s/V_r | A.F. |
|-----------|---------|
| 1.0 | 1.0 |
| 1.1 | 6.53 |
| 1.2 | 42.7 |
| 1.3 | 279.0 |
| 1.4 | 1824.0 |
| 1.5 | - |
| 1.527 | 11923.0 |

FOR EXAMPLE: 20000.00

If a 15 μ F, 20 V part is placed on test for 1 hour at + 85 °C and 26 V ($V_s/V_r = 1.3$), this is equivalent to 279 hours of testing at + 85 °C and 20/ V (exponential grading).

To explain the Weibull analysis, several formulas must be shown. The basic Weibull formula is as shown:

$$F(x) = 1 - e^{-\left(\frac{t\beta}{a}\right)}$$

$F(x)$ = Cumulative fraction failed (P) at time (t)

t = Actual test time

β = Weibull shape parameter (beta)

a = Weibull scale parameter (alpha)

To calculate Weibull failure rates, special burn-in ovens must be used which will record an actual time to failure for each of the units on test.

To perform the test, 100 % of the units (or 500 pieces whichever is less) are placed in the Weibull oven and taken to test conditions (+ 85 °C and voltage stress per the acceleration factors chosen). For lots over 500 pieces, the balance of the lot is placed in a standard burn-in oven at the same Weibull conditions. Failures that occur during the start-up are not used in the calculation. After test conditions are reached (< 5 minutes), the start time is considered to be t0.

A count of good pieces is taken at no later than 15 minutes after t0. This will be the sample size. At least two hours after t0, the number of failures are counted. If no failures occur, the lot must be put back on test and recounted after 10 hours.

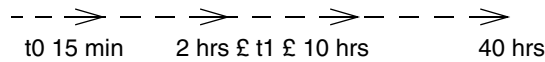


Vishay Sprague

Solid-Electrolyte TANTALEX® Capacitors,
 Military MIL-C-39003 Qualified, Syles CSR13, 21, 23,
 33

WEIBULL DISTRIBUTION METHOD FOR DETERMINING FAILURE RATE, MIL-C-39003 (Cont'd)

If no failures occur, the lot can be re-started at a higher stress level only once. If no failures occur at the higher stress level, the lot is not suitable for Weibull analysis.



After a minimum of 40 hours, the failure count is again taken. If no further failures occur, one is added to the count. Failure rate is calculated by the following:

$$Z(t) = [-\beta \ln(1-P)105]/tA.F.$$

Where

- Z(t) = Failure Rate
- β = Weibull shape parameter (slope of the line between t1 & t2 graphed on paper with a 1n (t) abscissa and 1n 1n (1/(1-P)) ordinate
- P = Ratio of failures to units on test at stop time
- t2 = Number of hours on test
- A.F. = Acceleration Factor

The failure rate can be calculated from the previous formula as follows:

$$Z(t) = [-\beta \ln(1-P)105]/t A.F.$$

$$Z(t) = [-0.2119 \ln(1-0.0326)105]/40(17356)$$

$$Z(t) = [-0.2119 (-0.0331) 105]/6.9424 (105)$$

$$Z(t) = [0.0070/6.9424]$$

$$Z(t) = 0.0010 \%/1000 \text{ hrs}$$

ACTUAL WEIBULL TEST ANALYSIS FOR THE VISHAY SPRAGUE® EQUIPMENT

SPRAGUE ELECTRIC COMPANY
 SANFORD MAINE

WEIBULL TEST ANALYSIS
 (TWO POINT)

OVEN NUMBER: 4

ZONE NUMBER: 10

LOT NUMBER : HS398-02
 OPERATOR : B KIMBALL
 FAMILY : 5750 DTN
 RATING : 220-10
 CASE : S
 TOTAL PARTS ON TEST : 468
 POWDER LOT : 9468

START DATE : 17 Nov 1997
 START TIME : 18:45:00
 END DATE : 19 Nov 1997
 END TIME : 10:45:00
 APPLIED VOLTAGE : 15.3
 ACCELERATION FACTOR : 20000

| HOURS ON TEST | # OF FAILURES | CUM % FAIL |
|---------------------|---------------|------------|
| 0.00 | 0 | 0.00 |
| ..17 | 0 | 0.00 |
| 2.00 | 2 | .43 |
| 40.00 | 7 | 1.50 |
| Total # of failures | 7 | 1.50 |

THE CURRENT FAILURE RATE IS .00079 D Level

ALPHA= 312.4013
 BETA = .41998

OPERATOR B. Kimball mllc. Q.A.R./ENG. Rita Thibault



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