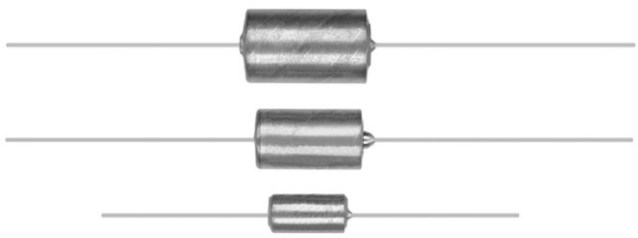
# Solid-Electrolyte TANTALEX® Capacitors, Military MIL-PRF-39003 Qualified, Styles CSR13, 21, 23



## FEATURES

- Hermetically sealed
- Metal cased
- Axial lead
- Tubular

## STYLE, DOCUMENT/DETAIL SPECIFICATION

Style CSR13, M39003/01

Style CSR23, M39003/03

Style CSR21, M39003/09

Solid-Electrolyte TANTALEX® Capacitors to Military Specification MIL-PRF-39003 - Exponential and Weibull Distribution: Hermetically sealed, metal cased, axial leaded tubular capacitors manufactured as Military Styles CSR13, CSR21 and CSR23. These capacitors are furnished to the requirements of the military specification, including marking, testing and inspection.

In accordance with the specification, all capacitors are marked with the Military Part Number (M39003/xx-xxxx) rather than the older Style designation (CSRxxxxxxxx) and should be ordered as such. All capacitors covered by MIL-PRF-39003 are now ordered with the Military Part Number as illustrated in the Part Numbering System chart. Capacitors must not be ordered using the Style number identification.

MIL-PRF-39003 establishes failure rates (expressed in percent per 1000 h) based on exponential and Weibull distribution. Care must be exercised in ordering to insure the part number correctly identifies the desired failure rate level.

Exponential failure rates are identified as levels M, P, R and S; Weibull failure rates are B, C and D. Failure rate levels M, P, R and S are inactive for new designs.

In addition, each order for Military Style CSR13, CSR23 capacitors requiring government inspection must state whether inspection is to be at the destination or at the Vishay Sprague Plant. Orders requiring source inspection cannot be shipped until this has been accomplished.

Style CS13 capacitors previously shown in MIL-C-26655 are directly replaced by Style CSR13 and Style CSR23 capacitors are extended capacitance range versions of Military Style CSR13.

For information on the performance characteristics of these capacitors, please refer to the latest issue of the military specification.

## MILITARY SPECIFICATION MIL-PRF-39003 PART NUMBERING SYSTEM INFORMATION

| M39003 | /01 | -2254 | A [1] |
|---|---|---|---|
| BASIC DOCUMENT NUMBER | DETAIL SPECIFICATION | DASH NUMBER | SURGE CURRENT OPTION CODE |
| Indicates the Basic Specification; in this case MIL-PRF-39003 | Indicates the Detail Specification of the Basic Military Specification | Taken from Standard/ Extended Ratings Tables | Blank = Standard (no surge current)<br>A = + 25 °C, after Weibull<br>B = - 55 °C and + 85 °C, after Weibull<br>C = - 55 °C and + 85 °C, before Weibull<br>D = + 25 °C, after Weibull, High Temperature solder<br>E = - 55 °C and + 85 °C, after Weibull, High Temperature solder<br>F = - 55 °C and + 85 °C, before Weibull, High Temperature solder<br>H = High Temperature solder only (no surge) |

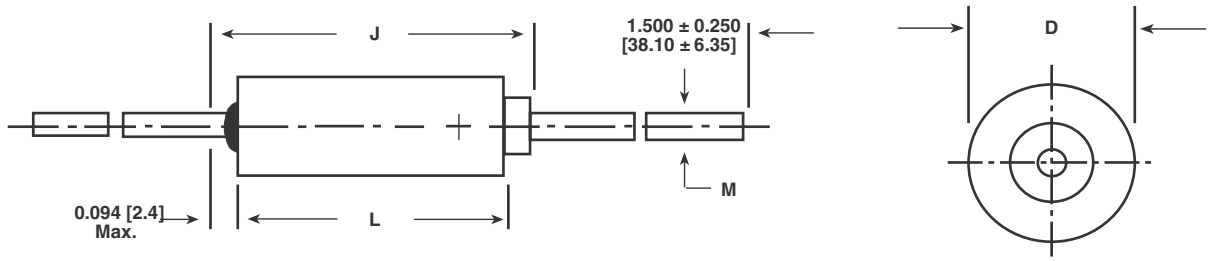
**Note**

[1] The material in this section has been abstracted from MIL-PRF-39003. If questions about optional surge current testing or high temperature solder, please see MIL-PRF-39003, paragraph 1.2, table II.



Downloaded from Elcodis.com electronic components distributor

## DIMENSIONS in inches [millimeters]




| 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 h) | | | | | | | MAX. DCL (µA) AT | | | MAX. DF (%) AT | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | M 1.0 | P 0.1 | R 0.01 | S 0.001 | B 0.1 | C 0.01 | D 0.001 | + 25 °C | + 85 °C | + 125 °C | - 55 °C + 25 °C | + 85 °C + 125 °C |
| 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 |



Downloaded from Elcodis.com electronic components distributor

## STANDARD RATINGS: CSR13, M39003/01-XXXX

| CAPACITANCE (µF) | CASE CODE | CAP. TOL. (± %) | PART NO. M39003/01- FAILURE RATE LEVEL (%/1000 h) M 1.0 | P 0.1 | R 0.01 | S 0.001 | B 0.1 | C 0.01 | D 0.001 | MAX. DCL (µA) AT + 25 °C | + 85 °C | + 125 °C | MAX. DF (%) AT - 55 °C + 25 °C | + 85 °C + 125 °C |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **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 |



Downloaded from Elcodis.com electronic components distributor

## STANDARD RATINGS: CSR13, M39003/01-XXXX

| CAPACITANCE (µF) | CASE CODE | CAP. TOL. (± %) | PART NO. M39003/01- FAILURE RATE LEVEL (%/1000 h) M 1.0 | P 0.1 | R 0.01 | S 0.001 | B 0.1 | C 0.01 | D 0.001 | MAX. DCL (µA) AT + 25 °C | + 85 °C | + 125 °C | MAX. DF (%) AT - 55 °C + 25 °C | + 85 °C + 125 °C |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 | 5368 | 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 |



Downloaded from Elcodis.com electronic components distributor

## STANDARD RATINGS: CSR13, M39003/01-XXXX

| CAPACITANCE (µF) | CASE CODE | CAP. TOL. (± %) | PART NO. M39003/01- FAILURE RATE LEVEL (%/1000 h) M 1.0 | P 0.1 | R 0.01 | S 0.001 | B 0.1 | C 0.01 | D 0.001 | MAX. DCL (µA) AT + 25 °C | + 85 °C | + 125 °C | MAX. DF (%) AT - 55 °C + 25 °C | + 85 °C + 125 °C |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 | 3819 | 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 |



Downloaded from Elcodis.com electronic components distributor

## STANDARD RATINGS: CSR13, M39003/01-XXXX

| CAPACITANCE (µF) | CASE CODE | CAP. TOL. (± %) | PART NO. M39003/01- FAILURE RATE LEVEL (%/1000 h) M 1.0 | P 0.1 | R 0.01 | S 0.001 | B 0.1 | C 0.01 | D 0.001 | MAX. DCL (µA) AT + 25 °C | + 85 °C | + 125 °C | MAX. DF (%) AT - 55 °C + 25 °C | + 85 °C + 125 °C |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 |



Downloaded from Elcodis.com electronic components distributor

## STANDARD RATINGS: CSR13, M39003/01-XXXX

| CAPACITANCE (µF) | CASE CODE | CAP. TOL. (± %) | PART NO. M39003/01- FAILURE RATE LEVEL (%/1000 h) M 1.0 | P 0.1 | R 0.01 | S 0.001 | B 0.1 | C 0.01 | D 0.001 | MAX. DCL (µA) AT + 25 °C | + 85 °C | + 125 °C | MAX. DF (%) AT - 55 °C + 25 °C | + 85 °C + 125 °C |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 | 5513 | 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 | 8295 | 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 |



Downloaded from Elcodis.com electronic components distributor

**STANDARD RATINGS: CSR13, M39003/01-XXXX**

| CAPACITANCE (µF) | CASE CODE | CAP. TOL. (± %) | PART NO. M39003/01- FAILURE RATE LEVEL (%/1000 h) M 1.0 | P 0.1 | R 0.01 | S 0.001 | B 0.1 | C 0.01 | D 0.001 | MAX. DCL (µA) AT + 25 °C | + 85 °C | + 125 °C | MAX. DF (%) AT - 55 °C + 25 °C | + 85 °C + 125 °C |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 |
| 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 | 5436 | 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 |



Downloaded from Elcodis.com electronic components distributor

## STANDARD RATINGS: CSR13, M39003/01-XXXX

| CAPACITANCE (µF) | CASE CODE | CAP. TOL. (± %) | PART NO. M39003/01- FAILURE RATE LEVEL (%/1000 h) | | | | | | | MAX. DCL (µA) AT | | | MAX. DF (%) AT | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | M 1.0 | P 0.1 | R 0.01 | S 0.001 | B 0.1 | C 0.01 | D 0.001 | + 25 °C | + 85 °C | + 125 °C | - 55 °C + 25 °C | + 85 °C + 125 °C |
| 100 WVDC AT + 85 °C, SURGE = 130 V . . . 67 WVDC AT + 125 °C, SURGE = 86 V | | | | | | | | | | | | | | |
| 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 |
| 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 |



Downloaded from Elcodis.com electronic components distributor

## STANDARD RATINGS: CSR21, M39003/09-XXXX

| CAPACITANCE (µF) | CASE CODE | CAP. TOL. (± %) | PART NO. M39003/09- FAILURE RATE LEVEL (%/1000 h) M 1.0 | P 0.1 | R 0.01 | S 0.001 | B 0.1 | C 0.01 | D 0.001 | MAX. DCL (µA) AT + 25 °C | + 85 °C | + 125 °C | MAX. DF AT + 25 °C 1 kHz (%) | MAX. ESR AT + 25 °C 100 kHz (Ω) | DERATED MAX. RIPPLE CURRENT AT + 25 °C (A) 40 kHz | 1 kHz |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **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 | 0136 | 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 |



Downloaded from Elcodis.com electronic components distributor

## STANDARD RATINGS: CSR21, M39003/09-XXXX

| CAPACITANCE (µF) | CASE CODE | CAP. TOL. (± %) | PART NO. M39003/09- FAILURE RATE LEVEL (%/1000 h) M 1.0 | P 0.1 | R 0.01 | S 0.001 | B 0.1 | C 0.01 | D 0.001 | MAX. DCL (µA) AT + 25 °C | + 85 °C | + 125 °C | MAX. DF AT + 25 °C 1 kHz (%) | MAX. ESR AT + 25 °C 100 kHz (Ω) | DERATED MAX. RIPPLE CURRENT AT + 25 °C (A) 40 kHz | 1 kHz |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **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 |



Downloaded from Elcodis.com electronic components distributor

## STANDARD RATINGS: CSR23, M39003/03-XXXX

| CAPACITANCE (µF) | CASE CODE | CAP. TOL. (± %) | PART NO. M39003/03- FAILURE RATE LEVEL (%/1000 h) M 1.0 | P 0.1 | R 0.01 | S 0.001 | B 0.1 | C 0.01 | D 0.001 | MAX. DCL (µA) AT + 25 °C | + 85 °C | + 125 °C | MAX. DF (%) AT - 55 °C + 25 °C | + 85 °C + 125 °C |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 |



Downloaded from Elcodis.com electronic components distributor

## STANDARD RATINGS: CSR23, M39003/03-XXXX

| CAPACITANCE (µF) | CASE CODE | CAP. TOL. (± %) | PART NO. M39003/03- FAILURE RATE LEVEL (%/1000 h) M 1.0 | P 0.1 | R 0.01 | S 0.001 | B 0.1 | C 0.01 | D 0.001 | MAX. DCL (µA) AT + 25 °C | + 85 °C | + 125 °C | MAX. DF (%) AT - 55 °C + 25 °C | + 85 °C + 125 °C |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 |



Downloaded from Elcodis.com electronic components distributor

## WEIBULL DISTRIBUTION METHOD FOR DETERMINING FAILURE RATE, MIL-PRF-39003

The current issue of Military Specification MIL-PRF-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.

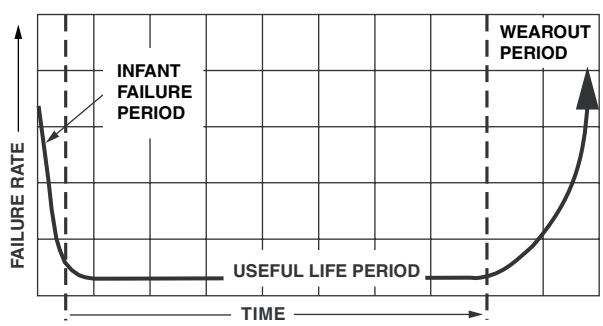
Increasingly, more stringent quality measurement systems are being used in the electronics industry. AQL sample plans are being replaced by programs measuring component quality in PPM (Parts Per Million). Product quality specifications seemingly approach perfection. Procedures used to calculate PPM quality 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.

**RELIABILITY LIFE CYCLE - TYPICAL "BATHTUB" CURVE**




The Weibull shape parameter beta (β) is shown as less than one (β < 1) during infant mortality, one (β = 1) during the useful life and greater than one (β > 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 x 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 | 11 923.0 |
| FOR EXAMPLE: | 20 000.00 |

If a 15 µF, 20 V part is placed on test for 1 h 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:

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

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

t = Actual test time

β = Weibull shape parameter (beta)

α = 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 min), the start time is considered to be $t_0$.

A count of good pieces is taken at no later than 15 minutes after $t_0$. This will be the sample size. At least two hours after $t_0$, the number of failures are counted. If no failures occur, the lot must be put back on test and recounted after 10 h.



Downloaded from Elcodis.com electronic components distributor

## WEIBULL DISTRIBUTION METHOD FOR DETERMINING FAILURE RATE, MIL-PRF-39003 (Continued)

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.

$t_0$ 15 min  $2\ h \le t_1 \le 10\ h$  40 h

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

$Z(t) = [-\beta\ 1n\ (1 - P2)105]/t_2$ A.F.

Where

$Z(t)$ = Failure Rate

$\beta$ = Weibull shape parameter (slope of the line between $t_1$ and $t_2$ 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

$t_2$ = Number of hours on test

A.F. = Acceleration Factor

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

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

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

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

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

$Z(t) = 0.0010$ %/1000 h

## 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 : H5398-02
OPERATOR : B KIMBALL
FAMILY : 576D 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 mellK. Q.A.R./ENG. Rita Thibault



Downloaded from Elcodis.com electronic components distributor

# Disclaimer

All product specifications and data are subject to change without notice.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, “Vishay”), disclaim any and all liability for any errors, inaccuracies or incompleteness contained herein or in any other disclosure relating to any product.

Vishay disclaims any and all liability arising out of the use or application of any product described herein or of any information provided herein to the maximum extent permitted by law. The product specifications do not expand or otherwise modify Vishay’s terms and conditions of purchase, including but not limited to the warranty expressed therein, which apply to these products.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay.

The products shown herein are not designed for use in medical, life-saving, or life-sustaining applications unless otherwise expressly indicated. Customers using or selling Vishay products not expressly indicated for use in such applications do so entirely at their own risk and agree to fully indemnify Vishay for any damages arising or resulting from such use or sale. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

Product names and markings noted herein may be trademarks of their respective owners.



Downloaded from Elcodis.com electronic components distributor