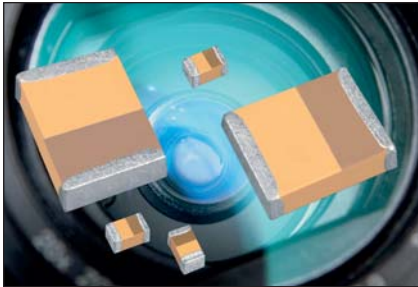


# TLC Series



## Tantalum Solid Electrolytic Chip Capacitors Consumer Series



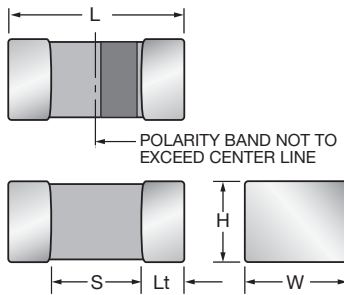
### FEATURES

- High capacitance vs. voltage ratio
- Super high volumetric efficiency
- CV range: 0.47-220µF / 2-35V
- 12 case sizes available
- Consumer applications (portable handheld electronics, cellular phones, digital equipments etc.)



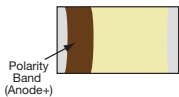
### APPLICATIONS

- Consumer portable applications with space limitations

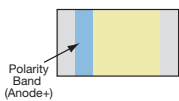


### MARKING

A, D, H, J, K, L, M, R, T,  
U, V, Z CASE



### E CASE



### CASE DIMENSIONS: millimeters (inches)

| Code | EIA Code | EIA Metric | L+0.20 (0.008)<br>-0.00 (0.000) | W+0.15 (0.006)<br>-0.00 (0.000)                 | H+0.15 (0.006)<br>-0.00 (0.000)                 | Termination Spacing(S) | Minimum Termination Length (Lt) |
|------|----------|------------|---------------------------------|---|---|------------------------|---------------------------------|
| A    | 1206     | 3216-18    | 3.20 ± 0.20<br>(0.126 ± 0.008)  | 1.60 ± 0.20<br>(0.063 ± 0.008)                  | 1.60 ± 0.20<br>(0.063 ± 0.008)                  | 1.80 (0.071) min       | 0.15 (0.006)                    |
| D    | 1206     | 3216-06    | 3.20 ± 0.20<br>(0.126 ± 0.008)  | 1.60 ± 0.20<br>(0.063 ± 0.008)                  | 0.60 (0.024) max                                | 1.80 (0.071) min       | 0.15 (0.006)                    |
| E**  | 0201     | 0603-03    | 0.60 ± 0.12<br>(0.024 ± 0.005)  | 0.33 ± 0.02<br>(0.013 ± 0.001)                  | 0.33 ± 0.02<br>(0.013 ± 0.001)                  | 0.20 (0.008) min       | 0.10 (0.004)                    |
| H    | 0805     | 2012-10    | 2.00 (0.079)                    | 1.35 (0.053)                                    | 1.00 (0.039) max                                | 0.70 (0.028) min       | 0.15 (0.006)                    |
| J    | 0603     | 1608-08    | 1.60 (0.063)                    | 0.85 (0.033)                                    | 0.75 (0.030) max                                | 0.55 (0.022) min       | 0.15 (0.006)                    |
| K    | 0402     | 1005-07    | 1.00 (0.039)                    | 0.50 +0.20<br>-0.00<br>(0.020 +0.008<br>-0.000) | 0.50 +0.20<br>-0.00<br>(0.020 +0.008<br>-0.000) | 0.40 (0.016) min       | 0.10 (0.004)                    |
| L    | 0603     | 1608-10    | 1.60 (0.063)                    | 0.85 (0.033)                                    | 0.85 (0.033)                                    | 0.55 (0.022) min       | 0.15 (0.006)                    |
| M    | 0803     | 2008-10    | 2.00 (0.079)                    | 0.85 (0.033)                                    | 0.85 (0.033)                                    | 0.70 (0.028) min       | 0.15 (0.006)                    |
| R    | 0805     | 2012-15    | 2.00 (0.079)                    | 1.35 (0.053)                                    | 1.35 (0.053)                                    | 0.70 (0.028) min       | 0.15 (0.006)                    |
| T    | 1210     | 3528-12    | 3.50 ± 0.20<br>(0.138 ± 0.008)  | 2.80 +0.20<br>-0.10<br>(0.110 +0.008<br>-0.004) | 1.20 (0.047) max                                | 2.00 (0.079) min       | 0.15 (0.006)                    |
| U    | 0805     | 2012-06    | 2.00 (0.079)                    | 1.35 (0.053)                                    | 0.60 (0.024) max                                | 0.70 (0.028) min       | 0.15 (0.006)                    |
| V    | 1206     | 3216-08    | 3.20 ± 0.20<br>(0.126 ± 0.008)  | 1.60 ± 0.20<br>(0.063 ± 0.008)                  | 0.75 (0.030) max                                | 1.80 (0.071) min       | 0.15 (0.006)                    |
| Z    | 0602     | 1605-07    | 1.60 (0.063)                    | 0.50 +0.20<br>-0.00<br>(0.020 +0.008<br>-0.000) | 0.50 +0.20<br>-0.00<br>(0.020 +0.008<br>-0.000) | 0.55 (0.022) min       | 0.15 (0.006)                    |

\*\*Please contact manufacturer, availability upon request

Under development

### HOW TO ORDER

**TLC**

↓

Type

**L**

↓

Case Size  
See table above

**226**

↓

Capacitance Code  
pF code: 1st two digits represent significant figures, 3rd digit represents multiplier (number of zeros to follow)

**M**

↓

Tolerance  
M=±20%

**006**

↓

Rated DC Voltage  
002=2Vdc  
003=3Vdc  
004=4Vdc  
006=6.3Vdc  
008=8Vdc  
010=10Vdc  
016=16Vdc  
020=20Vdc  
025=25Vdc  
035=35Vdc

**R**

↓

Packaging  
R, P = 7" Standard Tin Termination Plastic Tape  
X, Q = 4 1/4" Standard Tin Termination Plastic Tape  
A, M = 7" Gold Termination Plastic Tape  
F, N = 4 1/4" Gold Termination Plastic Tape  
H = Chip Tray (waffle)

**TA**

↓

Standard Suffix  
OR  
**4000**  
↓  
ESR in mΩ

## Tantalum Solid Electrolytic Chip Capacitors Consumer Series

### TECHNICAL SPECIFICATIONS

|                            |  |     |     |     |     |     |    |     |    |      |      |
|----------------------------|--|-----|-----|-----|-----|-----|----|-----|----|------|------|
| Technical Data:            | All technical data relate to an ambient temperature of +25°C   |     |     |     |     |     |    |     |    |      |      |
| Capacitance Range:         | 0.47 $\mu$ F to 220 $\mu$ F  |     |     |     |     |     |    |     |    |      |      |
| Capacitance Tolerance:     | $\pm$ 20%  |     |     |     |     |     |    |     |    |      |      |
| Rated Voltage ( $V_R$ )    | -55°C $\leq$ +40°C:  | 2   | 3   | 4   | 6.3 | 8   | 10 | 16  | 20 | 25   | 35   |
| Category Voltage ( $V_C$ ) | at 85°C:   | 1   | 1.5 | 2   | 3.2 | 4   | 5  | 8   | 10 | 12.5 | 17.5 |
| Category Voltage ( $V_C$ ) | at 125°C:  | 0.4 | 0.6 | 0.8 | 1.3 | 1.6 | 2  | 3.2 | 4  | 5    | 7    |
| Temperature Range:         | -55°C to +125°C with category voltage  |     |     |     |     |     |    |     |    |      |      |
| Reliability:               | 0.2% per 1000 hours at 85°C, 0.5x $V_R$ with 0.1 $\Omega/V$ series impedance with 60% confidence level |     |     |     |     |     |    |     |    |      |      |

### CAPACITANCE AND RATED VOLTAGE RANGE (LETTER DENOTES CASE SIZE)

| Capacitance |      | Voltage Rating DC ( $V_R$ ) to 40°C |      |       |                 |    |      |     |     |     |     |
|-------------|------|-------------------------------------|------|-------|-----------------|----|------|-----|-----|-----|-----|
| $\mu$ F     | Code | 2.0V                                | 3.0V | 4.0V  | 6.3V            | 8V | 10V  | 16V | 20V | 25V | 35V |
| 0.47        | 474  |                                     |      |       | E**             |    |      | K   |     |     |     |
| 1.0         | 105  |                                     |      |       | E**             |    |      | K   |     | L   | R   |
| 2.2         | 225  |                                     |      |       |                 |    | K    |     | H   | R   |     |
| 3.3         | 335  |                                     |      |       |                 |    |      | L   |     |     |     |
| 4.7         | 475  |                                     |      | K     | K/U             |    | J    |     |     |     |     |
| 6.8         | 685  |                                     | K    | K     |                 |    | U    |     |     |     |     |
| 10          | 106  |                                     | K    | J/K/Z | J/K/Z           |    | U    | V   | R   |     |     |
| 15          | 156  | K                                   | K*   | K     |                 |    | H/L  |     |     |     |     |
| 22          | 226  | J                                   | J    | K*/U  | L/U             |    | L/M  |     |     |     |     |
| 33          | 336  |                                     |      | L/U   | H/L/L(4000)/U/V | L  | H    |     |     |     |     |
| 47          | 476  | L                                   | L/R  | H/L   | H/L/R/V         | D  | H/R  |     |     |     |     |
| 68          | 686  |                                     |      | R     | R               |    | R*   |     |     |     |     |
| 100         | 107  |                                     |      | I*/R  | D*/I*/R/T       |    | R*/T |     |     |     |     |
| 150         | 157  |                                     |      | R*    | R*              |    | A*   |     |     |     |     |
| 220         | 227  | R*                                  |      | R*/T  |                 |    |      |     |     |     |     |

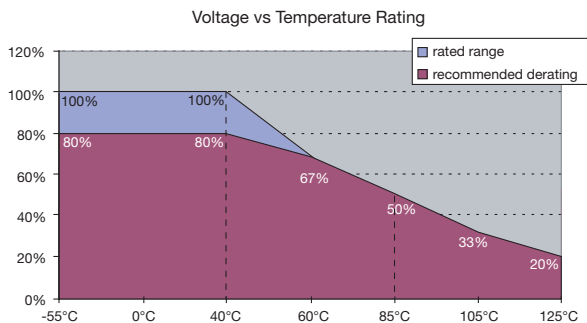
Available Ratings, (ESR ratings in mOhms in brackets)

Engineering samples - please contact manufacturer

\*Codes under development - subject to change.

\*\*Please contact manufacturer, availability upon request

Note: Voltage ratings are minimum values. AVX reserves the right to supply higher ratings in the same case size, to the same reliability standards.



# TLC Series



## Tantalum Solid Electrolytic Chip Capacitors Consumer Series

### RATINGS & PART NUMBER REFERENCE

| AVX Part No.           | Case Size | Capacitance (µF) | Rated Voltage (V) | Rated Temperature (°C) | Category Voltage (V) | Category Temperature (°C) | DCL Max. (µA) | ESR Max. @ 100kHz (Ω) | MSL | 100kHz RMS Current (mA) |      |       |
|------------------------|-----------|------------------|-------------------|------------------------|----------------------|---------------------------|---------------|-----------------------|-----|-------------------------|------|-------|
|                        |           |                  |                   |                        |                      |                           |               |                       |     | 25°C                    | 85°C | 125°C |
| <b>2 Volt @ 40°C</b>   |           |                  |                   |                        |                      |                           |               |                       |     |                         |      |       |
| TLCK156M002#TA         | K         | 15               | 2                 | 40                     | 0.4                  | 125                       | 0.5           | 15                    | 3   | 32                      | 28   | 13    |
| TLCJ226M002#TA         | J         | 22               | 2                 | 40                     | 0.4                  | 125                       | 0.5           | 7.5                   | 3   | 52                      | 46   | 21    |
| TLCL476M002#TA         | L         | 47               | 2                 | 40                     | 0.4                  | 125                       | 0.9           | 7.5                   | 3   | 58                      | 52   | 23    |
| <b>3 Volt @ 40°C</b>   |           |                  |                   |                        |                      |                           |               |                       |     |                         |      |       |
| TLCK685M003#TA         | K         | 6.8              | 3                 | 40                     | 0.6                  | 125                       | 0.5           | 15                    | 3   | 32                      | 28   | 13    |
| TLCK106M003#TA         | K         | 10               | 3                 | 40                     | 0.6                  | 125                       | 0.5           | 15                    | 3   | 32                      | 28   | 13    |
| TLCJ226M003#TA         | J         | 22               | 3                 | 40                     | 0.6                  | 125                       | 0.7           | 7.5                   | 3   | 52                      | 46   | 21    |
| TLCL476M003#TA         | L         | 47               | 3                 | 40                     | 0.6                  | 125                       | 1.4           | 7.5                   | 3   | 58                      | 52   | 23    |
| TLCR476M003#TA         | R         | 47               | 3                 | 40                     | 0.6                  | 125                       | 3.0           | 7.5                   | 3   | 77                      | 70   | 31    |
| <b>4 Volt @ 40°C</b>   |           |                  |                   |                        |                      |                           |               |                       |     |                         |      |       |
| TLCK475M004#TA         | K         | 4.7              | 4                 | 40                     | 0.8                  | 125                       | 0.5           | 15                    | 3   | 32                      | 28   | 13    |
| TLCK685M004#TA         | K         | 6.8              | 4                 | 40                     | 0.8                  | 125                       | 0.5           | 15                    | 3   | 32                      | 28   | 13    |
| TLCJ106M004#TA         | J         | 10               | 4                 | 40                     | 0.8                  | 125                       | 0.5           | 7.5                   | 3   | 52                      | 46   | 21    |
| TLCK106M004#TA         | K         | 10               | 4                 | 40                     | 0.8                  | 125                       | 0.5           | 15                    | 3   | 32                      | 28   | 13    |
| TLCZ106M004#TA         | Z         | 10               | 4                 | 40                     | 0.8                  | 125                       | 0.5           | 15                    | 3   | 37                      | 33   | 15    |
| TLCK156M004#TA         | K         | 15               | 4                 | 40                     | 0.8                  | 125                       | 3.0           | 15                    | 3   | 32                      | 28   | 13    |
| TLCU226M004#TA         | U         | 22               | 4                 | 40                     | 0.8                  | 125                       | 0.9           | 12                    | 3   | 54                      | 49   | 22    |
| TLCL336M004#TA         | L         | 33               | 4                 | 40                     | 0.8                  | 125                       | 1.3           | 7.5                   | 3   | 58                      | 52   | 23    |
| TLCU336M004#TA         | U         | 33               | 4                 | 40                     | 0.8                  | 125                       | 2.6           | 9                     | 3   | 62                      | 56   | 25    |
| TLCH476M004#TA         | H         | 47               | 4                 | 40                     | 0.8                  | 125                       | 1.9           | 5                     | 3   | 89                      | 80   | 36    |
| TLCL476M004#TA         | L         | 47               | 4                 | 40                     | 0.8                  | 125                       | 1.9           | 7.5                   | 3   | 58                      | 52   | 23    |
| TLCR686M004#TA         | R         | 68               | 4                 | 40                     | 0.8                  | 125                       | 2.7           | 5                     | 3   | 95                      | 85   | 38    |
| TLCR107M004#TA         | R         | 100              | 4                 | 40                     | 0.8                  | 125                       | 4.0           | 5                     | 3   | 95                      | 85   | 38    |
| TLCT227M004#TA         | T         | 220              | 4                 | 40                     | 0.8                  | 125                       | 8.8           | 1                     | 3   | 200                     | 180  | 80    |
| <b>6.3 Volt @ 40°C</b> |           |                  |                   |                        |                      |                           |               |                       |     |                         |      |       |
| TLCE474M006HTA**       | E         | 0.47             | 6.3               | 40                     | 1.3                  | 125                       | 1.0           | 60                    | 3   | 13                      | 12   | 5     |
| TLCE105M006HTA**       | E         | 1                | 6.3               | 40                     | 1.3                  | 125                       | 1.0           | 60                    | 3   | 13                      | 12   | 5     |
| TLCK475M006#TA         | K         | 4.7              | 6.3               | 40                     | 1.3                  | 125                       | 0.5           | 15                    | 3   | 32                      | 28   | 13    |
| TLCU475M006#TA         | U         | 4.7              | 6.3               | 40                     | 1.3                  | 125                       | 0.5           | 5                     | 3   | 84                      | 75   | 33    |
| TLCJ106M006#TA         | J         | 10               | 6.3               | 40                     | 1.3                  | 125                       | 0.6           | 7.5                   | 3   | 52                      | 46   | 21    |
| TLCK106M006#TA         | K         | 10               | 6.3               | 40                     | 1.3                  | 125                       | 3.1           | 15                    | 3   | 32                      | 28   | 13    |
| TLCZ106M006#TA         | Z         | 10               | 6.3               | 40                     | 1.3                  | 125                       | 0.6           | 15                    | 3   | 37                      | 33   | 15    |
| TLCL226M006#TA         | L         | 22               | 6.3               | 40                     | 1.3                  | 125                       | 1.4           | 7.5                   | 3   | 58                      | 52   | 23    |
| TLCU226M006#TA         | U         | 22               | 6.3               | 40                     | 1.3                  | 125                       | 2.8           | 12                    | 3   | 54                      | 49   | 22    |
| TLCH336M006#TA         | H         | 33               | 6.3               | 40                     | 1.3                  | 125                       | 2.0           | 5                     | 3   | 89                      | 80   | 36    |
| TLCL336M006#TA         | L         | 33               | 6.3               | 40                     | 1.3                  | 125                       | 2.1           | 7.5                   | 3   | 58                      | 52   | 23    |
| TLCL336M006#4000       | L         | 33               | 6.3               | 40                     | 1.3                  | 125                       | 2.1           | 4                     | 3   | 79                      | 71   | 32    |
| TLCU336M006#TA         | U         | 33               | 6.3               | 40                     | 1.3                  | 125                       | 10.4          | 7.5                   | 3   | 68                      | 61   | 27    |
| TLCV336M006#TA         | V         | 33               | 6.3               | 40                     | 1.3                  | 125                       | 4.2           | 5                     | 3   | 84                      | 75   | 33    |
| TLCH476M006#TA         | H         | 47               | 6.3               | 40                     | 1.3                  | 125                       | 3.0           | 5                     | 3   | 89                      | 80   | 36    |
| TLCL476M006#TA         | L         | 47               | 6.3               | 40                     | 1.3                  | 125                       | 29.6          | 10                    | 3   | 50                      | 45   | 20    |
| TLCR476M006#TA         | R         | 47               | 6.3               | 40                     | 1.3                  | 125                       | 6.0           | 5                     | 3   | 95                      | 85   | 38    |
| TLCV476M006#TA         | V         | 47               | 6.3               | 40                     | 1.3                  | 125                       | 6.0           | 15                    | 3   | 48                      | 43   | 19    |
| TLCR686M006#TA         | R         | 68               | 6.3               | 40                     | 1.3                  | 125                       | 4.3           | 5                     | 3   | 95                      | 85   | 38    |
| TLCR107M006#TA         | R         | 100              | 6.3               | 40                     | 1.3                  | 125                       | 6.0           | 5                     | 3   | 95                      | 85   | 38    |
| TLCT107M006#TA         | T         | 100              | 6.3               | 40                     | 1.3                  | 125                       | 31.5          | 15                    | 3   | 52                      | 46   | 21    |
| <b>8 Volt @ 40°C</b>   |           |                  |                   |                        |                      |                           |               |                       |     |                         |      |       |
| TLCL336M008#TA         | L         | 33               | 8                 | 40                     | 1.6                  | 125                       | 26.4          | 10                    | 3   | 50                      | 45   | 20    |
| TLCD476M008#TA         | D         | 47               | 8                 | 40                     | 1.6                  | 125                       | 18.8          | 7                     | 3   | 71                      | 64   | 28    |
| <b>10 Volt @ 40°C</b>  |           |                  |                   |                        |                      |                           |               |                       |     |                         |      |       |
| TLCK225M010#TA         | K         | 2.2              | 10                | 40                     | 2                    | 125                       | 0.5           | 15                    | 3   | 32                      | 28   | 13    |
| TLCJ475M010#TA         | J         | 4.7              | 10                | 40                     | 2                    | 125                       | 0.5           | 10                    | 3   | 45                      | 40   | 18    |
| TLCU685M010#TA         | U         | 6.8              | 10                | 40                     | 2                    | 125                       | 0.7           | 5                     | 3   | 84                      | 75   | 33    |
| TLCU106M010#TA         | U         | 10               | 10                | 40                     | 2                    | 125                       | 1.0           | 5                     | 3   | 84                      | 75   | 33    |
| TLCH156M010#TA         | H         | 15               | 10                | 40                     | 2                    | 125                       | 1.5           | 5                     | 3   | 58                      | 52   | 23    |
| TLCL156M010#TA         | L         | 15               | 10                | 40                     | 2                    | 125                       | 1.5           | 7.5                   | 3   | 89                      | 80   | 36    |
| TLCL226M010#TA         | L         | 22               | 10                | 40                     | 2                    | 125                       | 11            | 10                    | 3   | 50                      | 45   | 20    |
| TLCM226M010#TA         | M         | 22               | 10                | 40                     | 2                    | 125                       | 2.2           | 7.5                   | 3   | 63                      | 57   | 25    |
| TLCH336M010#TA         | H         | 33               | 10                | 40                     | 2                    | 125                       | 3.3           | 5                     | 3   | 89                      | 80   | 36    |
| TLCH476M010#TA         | H         | 47               | 10                | 40                     | 2                    | 125                       | 23.5          | 7.5                   | 3   | 73                      | 66   | 29    |
| TLCR476M010#TA         | R         | 47               | 10                | 40                     | 2                    | 125                       | 4.7           | 5                     | 3   | 95                      | 85   | 38    |
| TLCT107M010#TA         | T         | 100              | 10                | 40                     | 2                    | 125                       | 10            | 1                     | 3   | 200                     | 180  | 80    |
| <b>16 Volt @ 40°C</b>  |           |                  |                   |                        |                      |                           |               |                       |     |                         |      |       |
| TLCK474M016#TA         | K         | 0.47             | 16                | 40                     | 3.2                  | 125                       | 0.5           | 15                    | 3   | 32                      | 28   | 13    |
| TLCK105M016#TA         | K         | 1                | 16                | 40                     | 3.2                  | 125                       | 0.8           | 15                    | 3   | 32                      | 28   | 13    |
| TLCL335M016#TA         | L         | 3.3              | 16                | 40                     | 3.2                  | 125                       | 0.5           | 7.5                   | 3   | 58                      | 52   | 23    |
| TLCV106M016#TA         | V         | 10               | 16                | 40                     | 3.2                  | 125                       | 1.6           | 2                     | 3   | 132                     | 119  | 53    |

# TLC Series



## Tantalum Solid Electrolytic Chip Capacitors Consumer Series

### RATINGS & PART NUMBER REFERENCE

| AVX Part No.          | Case Size | Capacitance (µF) | Rated Voltage (V) | Rated Temperature (°C) | Category Voltage (V) | Category Temperature (°C) | DCL Max. (µA) | ESR Max. @ 100kHz (Ω) | MSL | 100kHz RMS Current (mA) |      |       |
|-----------------------|-----------|------------------|-------------------|------------------------|----------------------|---------------------------|---------------|-----------------------|-----|-------------------------|------|-------|
|                       |           |                  |                   |                        |                      |                           |               |                       |     | 25°C                    | 85°C | 125°C |
| <b>20 Volt @ 40°C</b> |           |                  |                   |                        |                      |                           |               |                       |     |                         |      |       |
| TLCH225M020#TA        | H         | 2.2              | 20                | 40                     | 4                    | 125                       | 0.5           | 7.5                   | 3   | 89                      | 80   | 36    |
| TLCR106M020#TA        | R         | 10               | 20                | 40                     | 4                    | 125                       | 0.6           | 5                     | 3   | 95                      | 85   | 38    |
| <b>25 Volt @ 40°C</b> |           |                  |                   |                        |                      |                           |               |                       |     |                         |      |       |
| TLCL105M025#TA        | L         | 1.0              | 25                | 40                     | 5                    | 125                       | 0.5           | 7.5                   | 3   | 58                      | 85   | 23    |
| TLCR225M025#TA        | R         | 2.2              | 25                | 40                     | 5                    | 125                       | 0.6           | 5                     | 3   | 95                      | 85   | 38    |
| <b>35 Volt @ 40°C</b> |           |                  |                   |                        |                      |                           |               |                       |     |                         |      |       |
| TLCR105M035#TA        | R         | 1.0              | 35                | 40                     | 7                    | 125                       | 0.5           | 5                     | 3   | 95                      | 85   | 38    |

\*\*Please contact manufacturer, availability upon request

Moisture Sensitivity Level (MSL) is defined according to J-STD-020.

All technical data relates to an ambient temperature of +25°C. Capacitance and DF are measured at 120Hz, 0.5V RMS with a maximum DC bias of 2.2 volts.

DCL is measured at rated voltage after 5 minutes.

DCL allowed to move up to 2.00 times the limit post mounting.

For typical weight and composition see page 226.

**NOTE: AVX reserves the right to supply a higher voltage rating or tighter tolerance part in the same case size, to the same reliability standards.**

### QUALIFICATION TABLE

| TEST                  | TLC series (Temperature range -55°C to +125°C)  |               |                |                       |                    |                              |       |       |       |       |        |         |            |            |            |            |            |            |
|-----------------------|---|---------------|----------------|-----------------------|--------------------|------------------------------|-------|-------|-------|-------|--------|---------|------------|------------|------------|------------|------------|------------|
|                       | Condition   |               |                |                       | Characteristics    |                              |       |       |       |       |        |         |            |            |            |            |            |            |
| Endurance             | Determine after application of rated voltage for 2000 +48/-0 hours at 40±2°C and then leaving 1-2 hours at room temperature. Also determine of 85°C temperature, category voltage for 2000 +48/-0 hours and then leaving 1-2 hours at room temperature. Power supply impedance to be ≤0.1Ω/V. |               |                |                       | Visual examination | no visible damage            |       |       |       |       |        |         |            |            |            |            |            |            |
|                       |   |               |                |                       | DCL                | 1.25 x initial limit         |       |       |       |       |        |         |            |            |            |            |            |            |
|                       |   |               |                |                       | ΔC/C               | within ±30% of initial value |       |       |       |       |        |         |            |            |            |            |            |            |
|                       |   |               |                |                       | ESR                | 1.5 x initial limit          |       |       |       |       |        |         |            |            |            |            |            |            |
| Humidity              | Determine after storage without applied voltage at 40±2°C and 90-95% relative humidity for 56 days and then recovery 1-2 hours at room temperature.   |               |                |                       | Visual examination | no visible damage            |       |       |       |       |        |         |            |            |            |            |            |            |
|                       |   |               |                |                       | DCL                | 2 x initial limit            |       |       |       |       |        |         |            |            |            |            |            |            |
|                       |   |               |                |                       | ΔC/C               | ±30% of initial value        |       |       |       |       |        |         |            |            |            |            |            |            |
|                       |   |               |                |                       | ESR                | 1.25 x initial limit         |       |       |       |       |        |         |            |            |            |            |            |            |
| Temperature Stability | Step  | Temperature°C | Duration (min) | Voltage Applied       |                    |                              |       |       |       |       |        |         |            |            |            |            |            |            |
|                       | 1   | +20±2         | 15             | N/A                   | +20°C              | -55°C                        | +20°C | +40°C | +60°C | +85°C | +125°C | +20°C   |            |            |            |            |            |            |
|                       | 2   | -55+0/-3      | 15             | N/A                   | DCL                |                              |       |       |       |       | IL*    | n/a     | IL*        | 1.25 x IL* | 1.25 x IL* | 1.25 x IL* | 1.25 x IL* | IL*        |
|                       | 3   | +20±2         | 15             | N/A                   |                    |                              |       |       |       |       |        |         |            |            |            |            |            |            |
|                       | 4   | +40+2/-0      | 15             | V <sub>R</sub>        | ΔC/C               |                              |       |       |       |       | n/a    | +0/-25% | ±5%        | +10/-0%    | +10/-0%    | +20/-0%    | +25/-0%    | +20/-10%   |
|                       | 5   | +60+2/-0      | 15             | 0.66 x V <sub>R</sub> |                    |                              |       |       |       |       |        |         |            |            |            |            |            |            |
|                       | 6   | +85+3/-0      | 15             | 0.50 x V <sub>R</sub> | ESR                |                              |       |       |       |       | IL*    | n/a     | 1.25 x IL* | 1.25 x IL* | 1.25 x IL* | 1.25 x IL* | 1.25 x IL* | 1.25 x IL* |
|                       | 7   | +125+3/-0     | 15             | 0.20 x V <sub>R</sub> |                    |                              |       |       |       |       |        |         |            |            |            |            |            |            |
| 8                     | +20±2   | 15            | N/A            |                       |                    |                              |       |       |       |       |        |         |            |            |            |            |            |            |
| Surge Voltage         | Test temperature: 40°C±3/0°C<br>Test voltage: 1.3 x rated voltage<br>Series protection resistance 1000±100Ω<br>Discharge resistance: 1000Ω<br>Number of cycles: 1000x<br>Cycle duration: 6 min; 30 sec charge, 5 min 30 sec discharge   |               |                |                       | Visual examination | no visible damage            |       |       |       |       |        |         |            |            |            |            |            |            |
|                       |   |               |                |                       | DCL                | 2 x initial limit            |       |       |       |       |        |         |            |            |            |            |            |            |
|                       |   |               |                |                       | ΔC/C               | within ±30% of initial value |       |       |       |       |        |         |            |            |            |            |            |            |
|                       |   |               |                |                       | ESR                | 1.25 x initial limit         |       |       |       |       |        |         |            |            |            |            |            |            |

\*Initial Limit