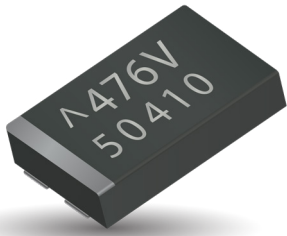


# J-CAP™ Series

## Highest Joules/cc Conductive Polymer Solid Electrolytic Chip Capacitors

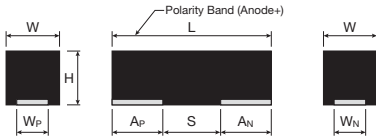


### FEATURES

- Highest Energy per Volume
- Fast DCL Drop With Voltage Applied After Reflow
- Benign Failure Mode Under Recommended Use Conditions
- Low ESR
- Undertab Terminations Layout:
  - High Volumetric Efficiency
  - Low Profile Case Sizes
  - High Capacitance in Smaller Dimensions
  - Close Positioning of Several Parts for Efficient High Density PCB Layout
- 3x Reflow 260°C Compatible
- 100% Surge Current Tested

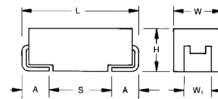
### APPLICATIONS

- Power Backup for SSDs (MLC, SLC, EFD, PCIe)
- Battery-Powered Portable Equipment
- Industrial Alarms
- Smart Power Meters
- Mobile Devices



### CASE DIMENSIONS UNDERTAB millimeters (inches)

| Code | EIA Code | EIA Metric | L±0.20 (0.008)          | W+0.20 (0.008) -0.10 (0.004) | H max.       | WP±0.10 (0.004) | WN±0.10 (0.004) | AP±0.10 (0.004)         | AN±0.10 (0.004)         | S Min.       |
|------|----------|------------|-------------------------|------------------------------|--------------|-----------------|-----------------|-------------------------|-------------------------|--------------|
| T    | 1210     | 3528-12    | 3.50 (0.138)            | 2.80 (0.110)                 | 1.20 (0.047) | 2.50 (0.098)    | 2.10 (0.083)    | 1.15 (0.045)            | 1.35 (0.053)            | 1.00 (0.039) |
| X    | 2917     | 7343-15    | 7.30 (0.287)            | 4.30 (0.169)                 | 1.50 (0.059) | 3.25 (0.128)    | 3.25 (0.128)    | 2.00 (0.079)            | 3.20 (0.126)            | 2.10 (0.083) |
| Z    | 2917     | 7343-15    | 7.30±0.30 (0.287±0.012) | 4.30±0.30 (0.169±0.012)      | 1.50 (0.059) | 2.40 (0.094)    | 2.40 (0.094)    | 1.30±0.30 (0.051±0.012) | 1.30±0.30 (0.051±0.012) | 4.40 (0.173) |
| 4    | 2924     | 7361-20    | 7.30 (0.287)            | 6.10 (0.240)                 | 2.00 (0.079) | 4.75 (0.187)    | 4.75 (0.187)    | 2.00 (0.079)            | 3.20 (0.126)            | 2.10 (0.083) |
| 8    | 2924     | 7361-20    | 7.30±0.30 (0.287±0.012) | 6.10 (0.240)                 | 2.00 (0.079) | 4.45 (0.175)    | 4.45 (0.175)    | 1.60±0.30 (0.063±0.012) | 1.60±0.30 (0.063±0.012) | 3.80 (0.150) |



### CASE DIMENSIONS J-LEAD millimeters (inches)

| Code | EIA Code | EIA Metric | L±0.20 (0.008) | W+0.20 (0.008) -0.10 (0.004) | H+0.20 (0.008) -0.10 (0.004) | W1±0.20 (0.008) | A+0.30 (0.012) -0.20 (0.008) | S Min.       |
|------|----------|------------|----------------|------------------------------|------------------------------|-----------------|------------------------------|--------------|
| C    | 2312     | 6032-28    | 6.00 (0.236)   | 3.20 (0.126)                 | 2.60 (0.102)                 | 2.20 (0.087)    | 1.30 (0.051)                 | 2.90 (0.114) |
| D    | 2917     | 7343-31    | 7.30 (0.287)   | 4.30 (0.169)                 | 2.90 (0.114)                 | 2.40 (0.094)    | 1.30 (0.051)                 | 4.40 (0.173) |
| E    | 2917     | 7343-43    | 7.30 (0.287)   | 4.30 (0.169)                 | 4.10 (0.162)                 | 2.40 (0.094)    | 1.30 (0.051)                 | 4.40 (0.173) |
| H    | 1210     | 3528-15    | 3.50 (0.138)   | 2.80 (0.110)                 | 1.50 (0.059) max.            | 2.20 (0.087)    | 0.80 (0.031)                 | 1.40 (0.055) |
| 5    | 2917     | 7343-40    | 7.30 (0.287)   | 4.30 (0.169)                 | 3.80 (0.150)                 | 2.40 (0.094)    | 1.30 (0.051)                 | 4.40 (0.173) |

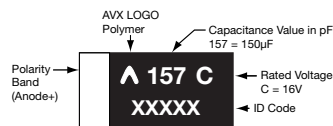
W<sub>1</sub> dimension applies to the termination width for A dimensional area only.

### MAXIMUM ENERGY PER CASE SIZE

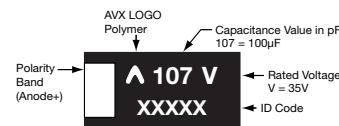
| Case Size | H Max (mm) | Max Energy (mJ) |
|-----------|------------|-----------------|
| C         | 2.8        | 5.8             |
| D         | 3.1        | 21.8            |
| E         | 4.3        | 11.9            |
| H         | 1.5        | 3.3             |
| T         | 1.2        | 4.7             |
| X         | 1.5        | 18.2            |
| Z         | 1.5        | 18.2            |
| 4         | 2.0        | 43.0            |
| 5         | 4.0        | 46.6            |
| 8         | 2.0        | 38.8            |

### MARKING

#### C, D, E, H, T, X, Z, 5 CASE



#### 4, 8 CASE



### HOW TO ORDER

| TCN                | 4                                  | 158  | M                     | 006   | R  | 0055      | E   |
|--------------------|------------------------------------|--|-----------------------|---|--|-----------|---|
| Type<br>TCJ<br>TCN | Case<br>Size<br>See table<br>above | Capacitance Code<br>pF code: 1st two digits represent<br>significant figures, 3rd digit<br>represents multiplier | Tolerance<br>M = ±20% | Rated DC Voltage<br>006 = 6.3Vdc<br>010 = 10Vdc<br>016 = 16Vdc<br>020 = 20Vdc<br>025 = 25Vdc<br>035 = 35Vdc | Packaging<br>R = Pure Tin 7" Reel<br>S = Pure Tin 13" Reel<br>(J-Lead) | ESR in mΩ | Additional<br>Character<br>E = Black resin<br>(it is possible to order<br>PN without "E"<br>as identical product) |



The Important Information/Disclaimer is incorporated in the catalog where these specifications came from or available online at [www.avx.com/disclaimer/](http://www.avx.com/disclaimer/) by reference and should be reviewed in full before placing any order.

### TECHNICAL SPECIFICATIONS

|                        |          |  |    |    |    |    |    |    |
|------------------------|----------|--|----|----|----|----|----|----|
| Technical Data:        |          | All technical data relate to an ambient temperature of +25°C |    |    |    |    |    |    |
| Capacitance Range:     |          | 4.7μF to 1500μF  |    |    |    |    |    |    |
| Capacitance Tolerance: |          | ±20%   |    |    |    |    |    |    |
| Leakage Current DCL:   |          | 0.1CV  |    |    |    |    |    |    |
| Rated Voltage DC (VR)  | ≤ +85°C: | 6.3  | 10 | 16 | 20 | 25 | 35 | 50 |
| Surge Voltage (VS)     | ≤ +85°C: | 8  | 13 | 21 | 26 | 33 | 46 | 65 |
| Temperature Range:     |          | -55°C up to +125°C   |    |    |    |    |    |    |

NOTE: Conductive Polymer Capacitors are designed to operate within the limits of the environmental conditions specified for each series. If operated continuously at their maximum temperature and / or humidity limit, or beyond these limits, capacitors may exhibit a parametric shift in capacitance and increases in ESR. These changes may occur earlier if the specified environmental conditions are exceeded. Similarly, their normal operational time period will be significantly extended if their general duty cycle includes operation below maximum temperature within humidity controlled environments. Careful attention should be paid to maximum temperature with associated high humidity environments as well as voltage derating, ripple current and current surges. Please reference the AVX Conductive Polymer Capacitor Guidelines for more information or contact factory for application assistance.

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

| Capacitance |      | Rated Voltage DC (VR) to 85°C, [mJ] |  |                      |  |                      |               |                     |                                |
|-------------|------|-------------------------------------|--|----------------------|--|----------------------|---------------|---------------------|--------------------------------|
| μF          | Code | 6.3V (J)                            |  | 10V (A)              |  | 16V (C)              |               | 20V(D)              |                                |
| 4.7         | 475  |                                     |  |                      |  |                      |               |                     | T(200) [1.8]                   |
| 6.8         | 685  |                                     |  |                      |  |                      |               |                     | C(200) [5.4]                   |
| 10          | 106  |                                     |  |                      |  |                      |               |                     | T(150, 200) [3.9] D(120) [8.0] |
| 15          | 456  |                                     |  |                      |  |                      |               |                     | C(200) [5.8] E(70) [11.9]      |
| 22          | 226  |                                     |  |                      |  |                      |               | T(200) [4.3]        | D(100) [8.5]                   |
| 33          | 336  |                                     |  |                      |  | H(150)/ T(200) [3.3] |               |                     | D(70) [12.8]                   |
| 47          | 476  |                                     |  | C(100)/ H(100) [1.7] |  | T(150) [4.7]         |               | X(100) [9.2]        | X(150)/ Z(150) [18.2]          |
| 68          | 686  | H(100) [0.8]                        |  | D(45) [2.5]          |  | D(50) [6.7]          | D(55) [8.4]   | D(70) [13.3]        |                                |
| 100         | 107  |                                     |  | D(45) [3.6]          |  | D(50) [9.9]          | D(55) [12.4]  | D(70) 4(100) [19.6] | 4(100)/ 8(100) [38.8]          |
| 150         | 157  | T(200) [1.7]                        |  | D(45) [5.4]          |  | X(100) [14.9]        |               | 4(70)/ 8(70) [29.3] |                                |
| 220         | 227  | H(170) [2.6]                        |  | D(40) [7.9]          |  | D(50) 4(70) [21.8]   | 4(100) [27.2] | 4(100) [43.0]       |                                |
| 330         | 337  | D(40) [3.8]                         |  | 5(100) [11.9]        |  | 4(70) 5(100) [32.7]  |               |                     |                                |
| 470         | 477  | X(50) [5.4]                         |  |                      |  | 5(100) [46.6]        |               |                     |                                |
| 1000        | 108  | 4(55) [11.6]                        |  |                      |  |                      |               |                     |                                |
| 1500        | 158  | 4(55) [17.4]                        |  |                      |  |                      |               |                     |                                |

Released ratings (ESR ratings in mOhms in parentheses) [Energy in mJ]

Engineering samples - please contact AVX

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

## RATINGS &amp; PART NUMBER REFERENCE

| AVX Part No.      | Case Size | Capacitance (μF) | Rated Voltage (V) | Maximum Operating Temperature (°C) | DCL Max. (μA) | DF Max. (%) | ESR Max. @ 100kHz (mΩ) | 1000kHz RMS Current (mA) 45°C | Product Category | MSL | ENERGY          |                        |                      |
|-------------------|-----------|------------------|-------------------|------------------------------------|---------------|-------------|------------------------|-------------------------------|------------------|-----|-----------------|------------------------|----------------------|
|                   |           |                  |                   |                                    |               |             |                        |                               |                  |     | Energy (mJ)     | Energy/volume (mJ/cm³) | Energy/area (mJ/cm²) |
| 6.3 Volt @ 85°C   |           |                  |                   |                                    |               |             |                        |                               |                  |     | 6.3 Volt @ 85°C |                        |                      |
| TCJH686M006#0100E | H         | 68               | 6.3               | 105                                | 40.8          | 6           | 100                    | 1000                          | 3                | 3   | 0.8             | 54                     | 8.0                  |
| TCNT157M006#0200E | T         | 150              | 6.3               | 105                                | 90            | 10          | 200                    | 700                           | 3                | 4   | 1.7             | 147                    | 17.7                 |
| TCJH227M006#0170E | H         | 220              | 6.3               | 105                                | 132           | 10          | 170                    | 800                           | 3                | 3   | 2.6             | 173                    | 26.0                 |
| TCJD337M006#0040E | D         | 330              | 6.3               | 105                                | 198           | 6           | 40                     | 2400                          | 2                | 3   | 3.8             | 42                     | 12.2                 |
| TCNX477M006#0050E | X         | 470              | 6.3               | 85                                 | 282           | 10          | 50                     | 1900                          | 5                | 5   | 5.4             | 115                    | 17.3                 |
| TCN4108M006#0055E | 4         | 1000             | 6.3               | 85                                 | 600           | 20          | 55                     | 1860                          | 5                | 4   | 11.6            | 130                    | 26.0                 |
| TCN4158M006#0055E | 4         | 1500             | 6.3               | 85                                 | 900           | 20          | 55                     | 1860                          | 5                | 4   | 17.4            | 195                    | 39.0                 |
| 10 Volt @ 85°C    |           |                  |                   |                                    |               |             |                        |                               |                  |     | 10 Volt @ 85°C  |                        |                      |
| TCJH476M010#0100E | H         | 47               | 10                | 105                                | 47            | 6           | 100                    | 1000                          | 3                | 3   | 1.7             | 115                    | 17.3                 |
| TCJC476M010#0100E | C         | 47               | 10                | 125                                | 47            | 6           | 100                    | 1300                          | 1                | 3   | 1.7             | 34                     | 8.8                  |
| TCJD686M010#0045E | D         | 68               | 10                | 105                                | 68            | 6           | 45                     | 2200                          | 3                | 3   | 2.5             | 27                     | 7.8                  |
| TCJD107M010#0045E | D         | 100              | 10                | 105                                | 100           | 6           | 45                     | 2200                          | 3                | 3   | 3.6             | 40                     | 11.5                 |
| TCJD157M010#0045E | D         | 150              | 10                | 105                                | 150           | 6           | 45                     | 2200                          | 3                | 3   | 5.4             | 59                     | 17.2                 |
| TCJD227M010#0040E | D         | 220              | 10                | 105                                | 220           | 6           | 40                     | 2400                          | 3                | 3   | 7.9             | 87                     | 25.2                 |
| TCJ5337M010#0100E | 5         | 330              | 10                | 105                                | 330           | 10          | 100                    | 1300                          | 2                | 3   | 11.9            | 100                    | 37.8                 |
| 16 Volt @ 85°C    |           |                  |                   |                                    |               |             |                        |                               |                  |     | 16 Volt @ 85°C  |                        |                      |
| TCJH336M016#0150E | H         | 33               | 16                | 105                                | 52.8          | 6           | 150                    | 800                           | 3                | 3   | 3.3             | 223                    | 33.4                 |
| TCNT336M016#0200E | T         | 33               | 16                | 105                                | 52.8          | 6           | 200                    | 700                           | 3                | 4   | 3.3             | 277                    | 33.4                 |
| TCNT476M016#0150E | T         | 47               | 16                | 105                                | 75.2          | 6           | 150                    | 800                           | 3                | 4   | 4.7             | 395                    | 47.6                 |
| TCJD686M016#0050E | D         | 68               | 16                | 105                                | 108.8         | 6           | 50                     | 2100                          | 2                | 3   | 6.7             | 74                     | 21.5                 |
| TCJD107M016#0050E | D         | 100              | 16                | 105                                | 160           | 6           | 50                     | 2100                          | 2                | 3   | 9.9             | 109                    | 31.6                 |
| TCNX157M016#0100E | X         | 150              | 16                | 105                                | 240           | 6           | 100                    | 1300                          | 3                | 4   | 14.9            | 316                    | 47.4                 |
| TCJD227M016#0050E | D         | 220              | 16                | 105                                | 352           | 10          | 50                     | 2100                          | 2                | 3   | 21.8            | 240                    | 69.5                 |
| TCN4227M016#0070E | 4         | 220              | 16                | 105                                | 352           | 20          | 70                     | 1650                          | 2                | 4   | 21.8            | 245                    | 49.0                 |
| TCN4337M016#0070E | 4         | 330              | 16                | 105                                | 528           | 20          | 70                     | 1650                          | 3                | 4   | 32.7            | 367                    | 73.5                 |
| TCJ5337M016#0100E | 5         | 330              | 16                | 105                                | 528           | 10          | 100                    | 1300                          | 2                | 3   | 32.7            | 274                    | 104.2                |
| TCJ5477M016#0100E | 5         | 470              | 16                | 105                                | 752           | 10          | 100                    | 1300                          | 3                | 3   | 46.6            | 391                    | 148.5                |
| 20 Volt @ 85°C    |           |                  |                   |                                    |               |             |                        |                               |                  |     | 20 Volt @ 85°C  |                        |                      |
| TCJD686M020#0055E | D         | 68               | 20                | 105                                | 136           | 6           | 55                     | 2000                          | 3                | 3   | 8.4             | 92                     | 26.7                 |
| TCJD107M020#0055E | D         | 100              | 20                | 105                                | 200           | 6           | 55                     | 2000                          | 3                | 3   | 12.4            | 136                    | 39.3                 |
| TCN4227M020#0100E | 4         | 220              | 20                | 85                                 | 440           | 10          | 100                    | 1380                          | 5                | 4   | 27.2            | 305                    | 61.1                 |
| 25 Volt @ 85°C    |           |                  |                   |                                    |               |             |                        |                               |                  |     | 25 Volt @ 85°C  |                        |                      |
| TCNT226M025#0200E | T         | 22               | 25                | 105                                | 55            | 6           | 200                    | 700                           | 3                | 4   | 4.3             | 364                    | 43.9                 |
| TCNX476M025#0100E | X         | 47               | 25                | 105                                | 117.5         | 6           | 100                    | 1300                          | 2                | 5   | 9.2             | 195                    | 29.3                 |
| TCJD686M025#0070E | D         | 68               | 25                | 105                                | 170           | 6           | 70                     | 1800                          | 2                | 3   | 13.3            | 146                    | 42.3                 |
| TCJD107M025#0070E | D         | 100              | 25                | 105                                | 250           | 6           | 70                     | 1800                          | 2                | 3   | 19.6            | 215                    | 62.3                 |
| TCN4107M025#0100E | 4         | 100              | 25                | 105                                | 250           | 6           | 100                    | 1380                          | 2                | 4   | 19.6            | 219                    | 43.9                 |
| TCN4157M025#0070E | 4         | 150              | 25                | 105                                | 375           | 6           | 70                     | 1650                          | 2                | 4   | 29.3            | 329                    | 65.9                 |
| TCN8157M025#0070E | 8         | 150              | 25                | 105                                | 375           | 8           | 70                     | 1650                          | 2                | 3   | 29.3            | 329                    | 65.9                 |
| TCN4227M025#0100E | 4         | 220              | 25                | 105                                | 550           | 10          | 100                    | 1380                          | 3                | 4   | 43.0            | 483                    | 96.7                 |
| 35 Volt @ 85°C    |           |                  |                   |                                    |               |             |                        |                               |                  |     | 35 Volt @ 85°C  |                        |                      |
| TCNT475M035#0200E | T         | 4.7              | 35                | 105                                | 16.5          | 10          | 200                    | 700                           | 3                | 4   | 1.8             | 154                    | 18.6                 |
| TCNT106M035#0150E | T         | 10               | 35                | 105                                | 35            | 10          | 200                    | 700                           | 3                | 4   | 3.9             | 328                    | 39.5                 |
| TCNT106M035#0200E | T         | 10               | 35                | 105                                | 35            | 10          | 200                    | 700                           | 3                | 4   | 3.9             | 328                    | 39.5                 |
| TCJC156M035#0200E | C         | 15               | 35                | 105                                | 52.5          | 6           | 200                    | 900                           | 3                | 3   | 5.8             | 116                    | 30.3                 |
| TCJD226M035#0100E | D         | 22               | 35                | 105                                | 77            | 6           | 100                    | 1500                          | 2                | 3   | 8.5             | 94                     | 27.1                 |
| TCJD336M035#0070E | D         | 33               | 35                | 105                                | 115.5         | 6           | 70                     | 1800                          | 2                | 3   | 12.8            | 141                    | 40.7                 |
| TCNX476M035#0150E | X         | 47               | 35                | 105                                | 165           | 10          | 150                    | 1100                          | 3                | 4   | 18.2            | 387                    | 58.0                 |
| TCNZ476M035#0150E | Z         | 47               | 35                | 105                                | 165           | 10          | 150                    | 1100                          | 3                | 4   | 18.2            | 387                    | 58.0                 |
| TCN4107M035#0100E | 4         | 100              | 35                | 105                                | 350           | 10          | 100                    | 1380                          | 2                | 3   | 38.8            | 435                    | 87.1                 |
| TCN8107M035#0100E | 8         | 100              | 35                | 105                                | 350           | 10          | 100                    | 1380                          | 2                | 3   | 38.8            | 435                    | 87.1                 |
| 50 Volt @ 85°C    |           |                  |                   |                                    |               |             |                        |                               |                  |     | 50 Volt @ 85°C  |                        |                      |
| TCJC685M050#0200E | C         | 6.8              | 50                | 105                                | 34            | 8           | 200                    | 900                           | 3                | 3   | 5.4             | 108                    | 28.2                 |
| TCJD106M050#0120E | D         | 10               | 50                | 105                                | 50            | 10          | 120                    | 1400                          | 3                | 3   | 8.0             | 87                     | 25.3                 |
| TCJE156M050#0070E | E         | 15               | 50                | 105                                | 75            | 6           | 70                     | 1900                          | 3                | 3   | 11.9            | 93                     | 38.0                 |

Energy is calculated by this formula (consider derating factor):

$$\text{Energy} = \frac{1}{2} C \times ((V_r \times X)^2 - V_x^2)$$

where C = Capacitance

V<sub>r</sub> = Rated Voltage

X = Recommended derating factor

V<sub>x</sub> = 3V (invariable)

Moisture Sensitivity Level (MSL) is defined according to J-STD-020. All technical data relates to an ambient temperature of +25°C. Capacitance is measured at 120Hz, 0.5RMS with DC bias of 2.2 volts. DCL is measured at rated voltage after 5 minutes. ESR allowed to move up to 1.25 times catalog limit post mounting. For typical weight and composition see page 259.

**NOTE: AVX reserves the right to supply higher voltage ratings in the same case size, to the same reliability standards.**

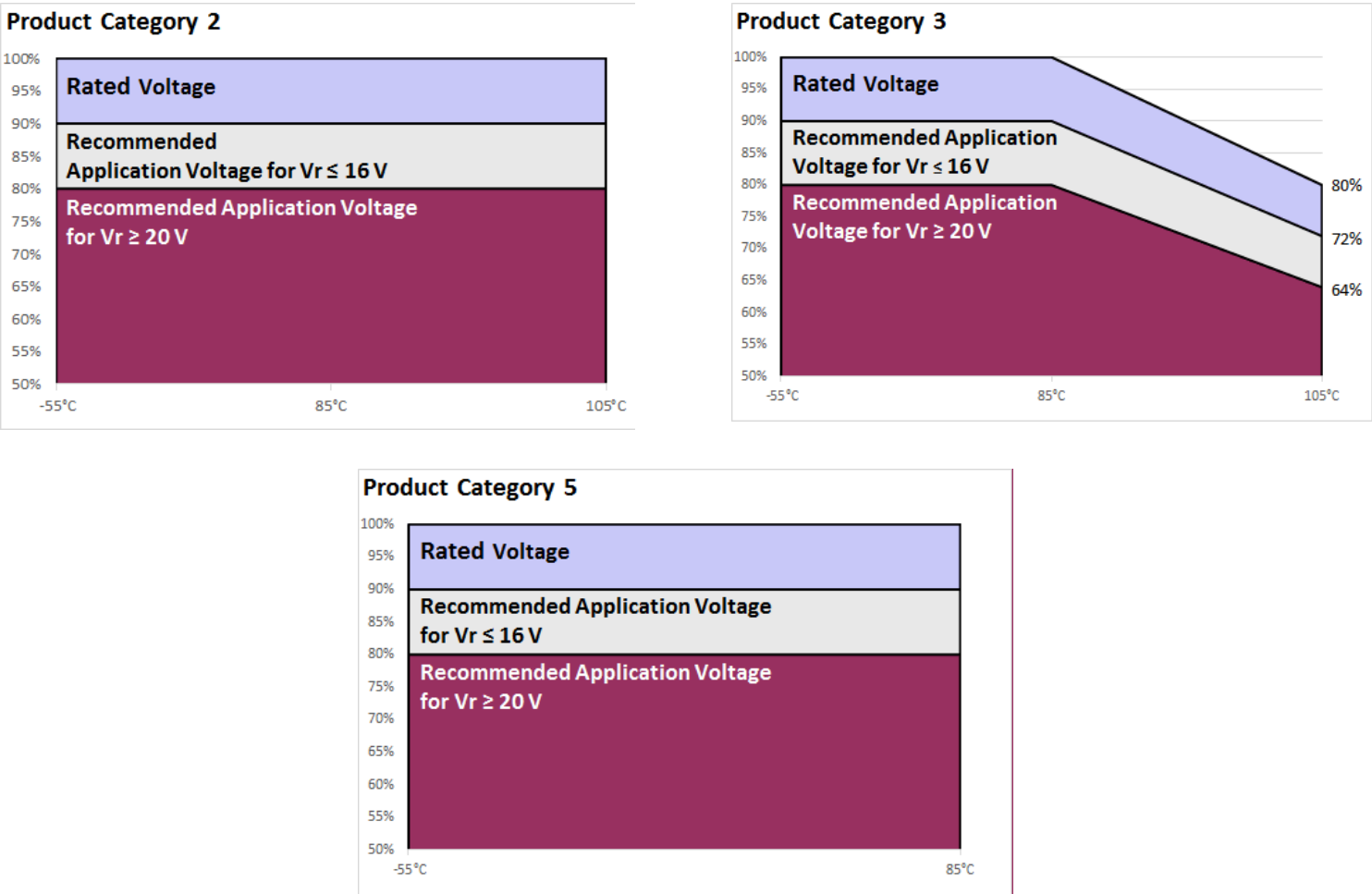
J-CAP™ Series

Highest Joules/cc Conductive Polymer Solid Electrolytic Chip Capacitors



RECOMMENDED DERATING FACTOR

Voltage and temperature derating as percentage of Vr



### PRODUCT CATEGORY 1 (TEMPERATURE RANGE -55°C TO +125°C)

| TEST                  | Condition   |               |               | Characteristics    |  |           |       |           |            |       |  |
|-----------------------|---|---------------|---------------|--------------------|--|-----------|-------|-----------|------------|-------|--|
| Endurance             | Apply rated voltage (Ur) at 85°C and /or 2/3 rated voltage (Ur) at 125°C for 2000 hours through a circuit impedance of ≤0.1Ω/V. Stabilize at room temperature for 1-2 hours before measuring. |               |               | Visual examination | no visible damage  |           |       |           |            |       |  |
|                       |   |               |               | DCL                | 1.25 x initial limit   |           |       |           |            |       |  |
|                       |   |               |               | ΔC/C               | within ±20% of initial value   |           |       |           |            |       |  |
|                       |   |               |               | DF                 | 1.5 x initial limit  |           |       |           |            |       |  |
|                       |   |               |               | ESR                | 2 x initial limit  |           |       |           |            |       |  |
| Storage Life          | Store at 125°C, no voltage applied, for 2000 hours. Stabilize at room temperature for 1-2 hours before measuring.   |               |               | Visual examination | no visible damage  |           |       |           |            |       |  |
|                       |   |               |               | DCL                | 2 x initial limit  |           |       |           |            |       |  |
|                       |   |               |               | ΔC/C               | within ±20% of initial value   |           |       |           |            |       |  |
|                       |   |               |               | DF                 | 1.5 x initial limit  |           |       |           |            |       |  |
|                       |   |               |               | ESR                | 2 x initial limit  |           |       |           |            |       |  |
| Humidity              | Store at 65°C and 95% relative humidity for 500 hours, with no applied voltage. Stabilize at room temperature and humidity for 1-2 hours before measuring.                                    |               |               | Visual examination | no visible damage  |           |       |           |            |       |  |
|                       |   |               |               | DCL                | 3 x initial limit  |           |       |           |            |       |  |
|                       |   |               |               | ΔC/C               | within +30/-20% of initial value   |           |       |           |            |       |  |
|                       |   |               |               | DF                 | 1.5 x initial limit  |           |       |           |            |       |  |
|                       |   |               |               | ESR                | 2 x initial limit  |           |       |           |            |       |  |
| Temperature Stability | Step  | Temperature°C | Duration(min) |                    | +20°C  | -55°C     | +20°C | +85°C     | +125°C     | +20°C |  |
|                       | 1   | +20           | 15            |                    |  |           |       |           |            |       |  |
|                       | 2   | -55           | 15            | DCL                | IL*  | n/a       | IL*   | 10 x IL*  | 12.5 x IL* | IL*   |  |
|                       | 3   | +20           | 15            |                    |  |           |       |           |            |       |  |
|                       | 4   | +85           | 15            | ΔC/C               | n/a  | +0/-20%   | ±5%   | +20/-0%   | +30/-0%    | ±5%   |  |
|                       | 5   | +125          | 15            |                    |  |           |       |           |            |       |  |
|                       | 6   | +20           | 15            | DF                 | IL*  | 1.5 x IL* | IL*   | 1.5 x IL* | 2 x IL*    | IL*   |  |
| Surge Voltage         | Apply 1.3x 0.67x rated voltage (Ur) at 125°C for 1000 cycles of duration 6 min (30 sec charge, 5 min 30 sec discharge) through a charge / discharge resistance of 1000Ω                       |               |               | Visual examination | no visible damage  |           |       |           |            |       |  |
|                       |   |               |               | DCL                | initial limit  |           |       |           |            |       |  |
|                       |   |               |               | ΔC/C               | within +10/-20% of initial value for Vr ≤ 10V<br>within +20/-30% of initial value for Vr ≥ 16V |           |       |           |            |       |  |
|                       |   |               |               | DF                 | 1.25 x initial limit   |           |       |           |            |       |  |
| Mechanical Shock      | MIL-STD-202, Method 213, Condition C  |               |               | Visual examination | no visible damage  |           |       |           |            |       |  |
|                       |   |               |               | DCL                | initial limit  |           |       |           |            |       |  |
|                       |   |               |               | ΔC/C               | within ±5% of initial value  |           |       |           |            |       |  |
|                       |   |               |               | DF                 | initial limit  |           |       |           |            |       |  |
|                       |   |               |               | ESR                | initial limit  |           |       |           |            |       |  |
| Vibration             | MIL-STD-202, Method 204, Condition D  |               |               | Visual examination | no visible damage  |           |       |           |            |       |  |
|                       |   |               |               | DCL                | initial limit  |           |       |           |            |       |  |
|                       |   |               |               | ΔC/C               | within ±5% of initial value  |           |       |           |            |       |  |
|                       |   |               |               | DF                 | initial limit  |           |       |           |            |       |  |
|                       |   |               |               | ESR                | initial limit  |           |       |           |            |       |  |

\*Initial Limit

Initial measurement max. 1 hr after the removal from dry pack or after pretreatment at 85°C for 24 hours.

### PRODUCT CATEGORY 2, 3 (TEMPERATURE RANGE -55°C TO +105°C)

| TEST                  | Condition  | Characteristics    |  |  |  |  |  |  |
|-----------------------|--|--------------------|--|--|--|--|--|--|
| Endurance             | Apply rated voltage (Ur) at 85°C for 2000 hours through a circuit impedance of $\leq 0.1\Omega/V$ (all CATEGORIES). And / or apply rated voltage (Ur) (CATEGORY 2) or 0.8x rated voltage (CATEGORY 3) at 105°C for 2000 hours through a circuit impedance of $\leq 0.1\Omega/V$ . Always stabilize at room temperature for 1-2 hours before measuring. | Visual examination | no visible damage  |  |  |  |  |  |
|                       |  | DCL                | 1.25 x initial limit   |  |  |  |  |  |
|                       |  | $\Delta C/C$       | within +10/-20% of initial value for $V_r \leq 16V$<br>within $\pm 20\%$ of initial value for $V_r \geq 20V$ |  |  |  |  |  |
|                       |  | DF                 | 1.5 x initial limit  |  |  |  |  |  |
|                       |  | ESR                | 2 x initial limit  |  |  |  |  |  |
| Storage Life          | Store at 105°C, no voltage applied, for 2000 hours. Stabilize at room temperature for 1-2 hours before measuring.  | Visual examination | no visible damage  |  |  |  |  |  |
|                       |  | DCL                | 1.25 x initial limit   |  |  |  |  |  |
|                       |  | $\Delta C/C$       | within +10/-20% of initial value for $V_r \leq 16V$<br>within $\pm 20\%$ of initial value for $V_r \geq 20V$ |  |  |  |  |  |
|                       |  | DF                 | 1.5 x initial limit  |  |  |  |  |  |
|                       |  | ESR                | 2 x initial limit  |  |  |  |  |  |
| Humidity              | Store at 65°C and 95% relative humidity for 500 hours, with no applied voltage. Stabilize at room temperature and humidity for 1-2 hours before measuring.   | Visual examination | no visible damage  |  |  |  |  |  |
|                       |  | DCL                | 3 x initial limit  |  |  |  |  |  |
|                       |  | $\Delta C/C$       | within +30/-20% of initial value   |  |  |  |  |  |
|                       |  | DF                 | 1.5 x initial limit  |  |  |  |  |  |
|                       |  | ESR                | 2 x initial limit  |  |  |  |  |  |
| Temperature Stability | Step   | Temperature°C      | Duration(min)  |  |  |  |  |  |
|                       | 1  | +20                | 15   |  |  |  |  |  |
|                       | 2  | -55                | 15   |  |  |  |  |  |
|                       | 3  | +20                | 15   |  |  |  |  |  |
|                       | 4  | +85                | 15   |  |  |  |  |  |
|                       | 5  | +105               | 15   |  |  |  |  |  |
|                       | 6  | +20                | 15   |  |  |  |  |  |
| Surge Voltage         | Apply 1.3x rated voltage (Ur) at 105°C for CATEGORY 2, or apply 1.3x 0.8x rated voltage (Ur) at 105°C for CATEGORY 3 for 1000 cycles of duration 6 min (30 sec charge, 5 min 30 sec discharge) through a charge / discharge resistance of 1000 $\Omega$  | Visual examination | no visible damage  |  |  |  |  |  |
|                       |  | DCL                | initial limit  |  |  |  |  |  |
|                       |  | $\Delta C/C$       | within +10/-20% of initial value for $V_r \leq 16V$<br>within +20/-30% of initial value for $V_r \geq 20V$   |  |  |  |  |  |
|                       |  | DF                 | 1.25 x initial limit   |  |  |  |  |  |
|                       |  | ESR                | 2 x initial limit  |  |  |  |  |  |
| Mechanical Shock      | MIL-STD-202, Method 213, Condition C   | Visual examination | no visible damage  |  |  |  |  |  |
|                       |  | DCL                | initial limit  |  |  |  |  |  |
|                       |  | $\Delta C/C$       | within $\pm 5\%$ of initial value  |  |  |  |  |  |
|                       |  | DF                 | initial limit  |  |  |  |  |  |
|                       |  | ESR                | initial limit  |  |  |  |  |  |
| Vibration             | MIL-STD-202, Method 204, Condition D   | Visual examination | no visible damage  |  |  |  |  |  |
|                       |  | DCL                | initial limit  |  |  |  |  |  |
|                       |  | $\Delta C/C$       | within $\pm 5\%$ of initial value  |  |  |  |  |  |
|                       |  | DF                 | initial limit  |  |  |  |  |  |
|                       |  | ESR                | initial limit  |  |  |  |  |  |

\*Initial Limit

Initial measurement max. 1 hr after the removal from dry pack or after pretreatment at 85°C for 24 hours.

### PRODUCT CATEGORY 5 (TEMPERATURE RANGE -55°C TO +85°C)

| TEST                  | Condition  |               |               | Characteristics    |  |           |       |           |       |
|-----------------------|--|---------------|---------------|--------------------|--|-----------|-------|-----------|-------|
| Endurance             | Apply rated voltage (Ur) at 85°C for 2000 hours through a circuit impedance of ≤0.1Ω/V. Stabilize at room temperature for 1-2 hours before measuring.            |               |               | Visual examination | no visible damage  |           |       |           |       |
|                       |  |               |               | DCL                | 1.25 x initial limit   |           |       |           |       |
|                       |  |               |               | ΔC/C               | within +10/-20% of initial value for Vr ≤ 16V<br>within ±20% of initial value for Vr ≥ 20V     |           |       |           |       |
|                       |  |               |               | DF                 | 1.5 x initial limit  |           |       |           |       |
|                       |  |               |               | ESR                | 2 x initial limit  |           |       |           |       |
| Storage Life          | Store at 85°C, no voltage applied, for 2000 hours. Stabilize at room temperature for 1-2 hours before measuring.   |               |               | Visual examination | no visible damage  |           |       |           |       |
|                       |  |               |               | DCL                | 1.25 x initial limit   |           |       |           |       |
|                       |  |               |               | ΔC/C               | within +10/-20% of initial value for Vr ≤ 16V<br>within ±20% of initial value for Vr ≥ 20V     |           |       |           |       |
|                       |  |               |               | DF                 | 1.5 x initial limit  |           |       |           |       |
|                       |  |               |               | ESR                | 2 x initial limit  |           |       |           |       |
| Humidity              | Store at 65°C and 95% relative humidity for 500 hours, with no applied voltage. Stabilize at room temperature and humidity for 1-2 hours before measuring.       |               |               | Visual examination | no visible damage  |           |       |           |       |
|                       |  |               |               | DCL                | 5 x initial limit  |           |       |           |       |
|                       |  |               |               | ΔC/C               | within +40/-20% of initial value   |           |       |           |       |
|                       |  |               |               | DF                 | 1.5 x initial limit  |           |       |           |       |
|                       |  |               |               | ESR                | 2 x initial limit  |           |       |           |       |
| Temperature Stability | Step   | Temperature°C | Duration(min) |                    | +20°C  | -55°C     | +20°C | +85°C     | +20°C |
|                       | 1  | +20           | 15            |                    |  |           |       |           |       |
|                       | 2  | -55           | 15            | DCL                | IL*  | n/a       | IL*   | 10 x IL*  | IL*   |
|                       | 3  | +20           | 15            | ΔC/C               | n/a  | +0/-20%   | ±5%   | +20/-0%   | ±5%   |
|                       | 4  | +85           | 15            |                    |  |           |       |           |       |
|                       | 5  | +20           | 15            | DF                 | IL*  | 1.5 x IL* | IL*   | 1.5 x IL* | IL*   |
|                       |  |               |               |                    |  |           |       |           |       |
| Surge Voltage         | Apply 1.3x rated voltage (Ur) at 85°C for 1000 cycles of duration 6 min (30 sec charge, 5 min 30 sec discharge) through a charge / discharge resistance of 1000Ω |               |               | Visual examination | no visible damage  |           |       |           |       |
|                       |  |               |               | DCL                | initial limit  |           |       |           |       |
|                       |  |               |               | ΔC/C               | within +10/-20% of initial value for Vr ≤ 16V<br>within +20/-30% of initial value for Vr ≥ 20V |           |       |           |       |
|                       |  |               |               | DF                 | 1.25 x initial limit   |           |       |           |       |
|                       |  |               |               |                    |  |           |       |           |       |
| Mechanical Shock      | MIL-STD-202, Method 213, Condition C   |               |               | Visual examination | no visible damage  |           |       |           |       |
|                       |  |               |               | DCL                | initial limit  |           |       |           |       |
|                       |  |               |               | ΔC/C               | within ±5% of initial value  |           |       |           |       |
|                       |  |               |               | DF                 | initial limit  |           |       |           |       |
|                       |  |               |               | ESR                | initial limit  |           |       |           |       |
| Vibration             | MIL-STD-202, Method 204, Condition D   |               |               | Visual examination | no visible damage  |           |       |           |       |
|                       |  |               |               | DCL                | initial limit  |           |       |           |       |
|                       |  |               |               | ΔC/C               | within ±5% of initial value  |           |       |           |       |
|                       |  |               |               | DF                 | initial limit  |           |       |           |       |
|                       |  |               |               | ESR                | initial limit  |           |       |           |       |

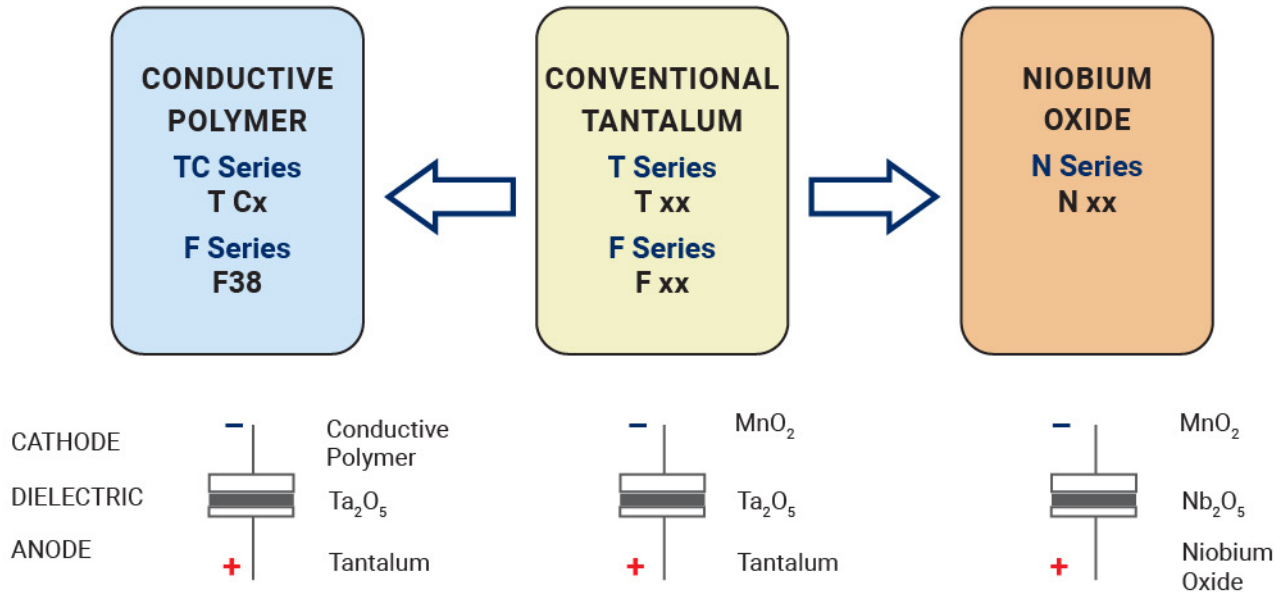
\*Initial Limit

Initial measurement max. 1 hr after the removal from dry pack or after pretreatment at 85°C for 24 hours.

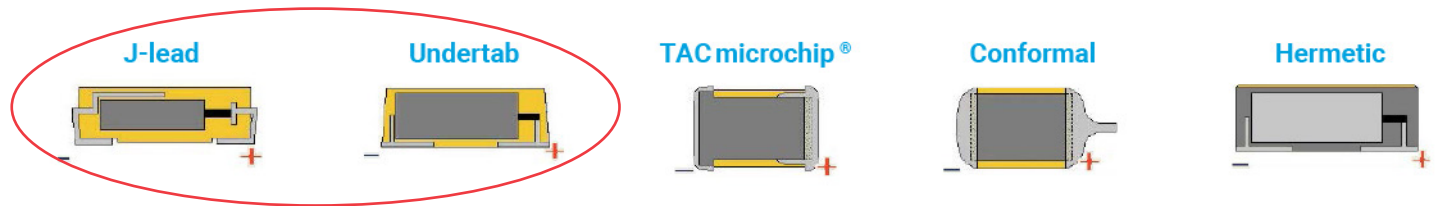
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