

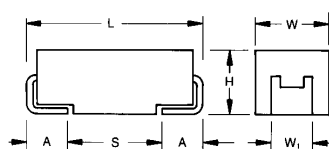


### FEATURES

- Robust design for long operation lifetime
- Volumetric efficiency
- Statistical screening with Accelerated Ageing
- Surge testing level option'
- Improved basic reliability 0.5%/1000hrs
- Humidity 85°C/85%RH, Vr, 500 hours
- -55 to +125°C operation temperature
- Shock and Vibration by MIL-STD-202
- DCL 0.1 CV
- Low ESR
- 3x reflow 260°C compatible
- High frequency capacitance retention
- Benign failure mode under recommended use conditions



For RoHS compliant products, please select correct termination style.

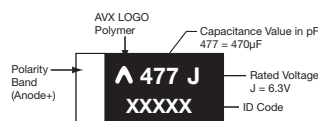


### APPLICATIONS

- Long life time DC/DC converter applications in Telecommunications, Industrial, Avionics.

### MARKING

#### E CASE



### CASE DIMENSIONS: millimeters (inches)

| Code | EIA Code | EIA Metric | L±0.20 (0.008) | W±0.20 (0.008)<br>-0.10 (0.004) | H±0.20 (0.008)<br>-0.10 (0.004) | W1±0.20 (0.008) | A±0.30 (0.012)<br>-0.20 (0.008) | S Min.       |
|------|----------|------------|----------------|---------------------------------|---------------------------------|-----------------|---------------------------------|--------------|
| 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) |

W1 dimension applies to the termination width for A dimensional area only.

### HOW TO ORDER

| TCS  | E               | 477                                                                                                                | M         | 006                                                                                                    | C                          | R          | S                        | Z                 | 0                   | ^                                     | ++                                                                       |
|------|-----------------|--------------------------------------------------------------------------------------------------------------------|-----------|--------------------------------------------------------------------------------------------------------|----------------------------|------------|--------------------------|-------------------|---------------------|---------------------------------------|--------------------------------------------------------------------------|
| Type | Case Size       | Capacitance Code                                                                                                   | Tolerance | Rated DC Voltage                                                                                       | ESR                        | Packaging  | Inspection Level         | Reliability Grade | Qualification Level | Termination Finish                    | Surge Test Option                                                        |
|      | See table above | pF code: 1st two digits represent significant figures, 3rd digit represents multiplier (number of zeros to follow) | M = ±20%  | 002 = 2.5Vdc<br>004 = 4Vdc<br>006 = 6.3Vdc<br>010 = 10Vdc<br>016 = 16Vdc<br>025 = 25Vdc<br>035 = 35Vdc | C = Std ESR<br>L = Low ESR | R = 7" T&R | S = Standard Conformance | Z = Non-ER        | 0 = N/A             | 7 = 100% Tin<br>H = Sn/Pb<br>Non RoHS | 00 = Standard<br>23 = 10x Cycles, 25°C<br>24 = 10x Cycles, -55°C & +85°C |

### TECHNICAL SPECIFICATIONS

|                        |                                                                                    |
|------------------------|------------------------------------------------------------------------------------|
| Technical Data:        | All technical data relate to an ambient temperature of +25°C                       |
| Capacitance Range:     | 22 µF to 1000 µF                                                                   |
| Capacitance Tolerance: | ±20%                                                                               |
| Leakage Current DCL:   | 0.1CV                                                                              |
| Temperature Range:     | -55°C to +125°C                                                                    |
| Reliability:           | 0.5% per 1000 hours at 85°C, Vr with 0.1Ω/V series impedance, 60% confidence level |
| Termination Finish:    | Sn Plating or SnPb Plating (Non RoHS)                                              |

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 (V <sub>r</sub> ) |          |          |         |         |         |         |
|-------------|------|------------------------------------|----------|----------|---------|---------|---------|---------|
| μF          | Code | 2.5 (e)                            | 4V (G)   | 6.3V (J) | 10V (A) | 16V (C) | 25V (E) | 35V (V) |
| 22          | 226  |                                    |          |          |         |         |         | E(60)   |
| 33          | 336  |                                    |          |          |         |         | E(60)   | E(60)   |
| 47          | 476  |                                    |          |          |         |         | E(60)   |         |
| 220         | 227  |                                    |          |          |         | E(40)   |         |         |
| 330         | 337  |                                    |          | E(15)    | E(25)   |         |         |         |
| 470         | 477  | E(10,12)                           | E(10,12) | E(10,12) |         |         |         |         |
| 680         | 687  | E(10,12)                           | E(10,12) |          |         |         |         |         |
| 1000        | 108  | E(10,12)                           | E(10,12) |          |         |         |         |         |

Released Ratings, (ESR ratings in mOhms in parentheses)

Engineering samples - please contact AVX

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

### RATINGS & 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) | 100kHz RMS Current (mA) |      |       |       | MSL | Humidity 85°C/85% RH V <sub>r</sub> (hrs) |
|---------------------|-----------|------------------|-------------------|------------------------------------|---------------|-------------|-----------------------|-------------------------|------|-------|-------|-----|-------------------------------------------|
|                     |           |                  |                   |                                    |               |             |                       | 45°C                    | 85°C | 105°C | 125°C |     |                                           |
| 2.5 Volt            |           |                  |                   |                                    |               |             |                       |                         |      |       |       |     |                                           |
| TCSE477M002LRSZ0^++ | E         | 470              | 2.5               | 125                                | 117.5         | 8           | 10                    | 6400                    | 4500 | 2900  | 1600  | 3   | 500                                       |
| TCSE477M002CRSZ0^++ | E         | 470              | 2.5               | 125                                | 117.5         | 8           | 12                    | 5800                    | 4100 | 2600  | 1500  | 3   | 500                                       |
| TCSE687M002LRSZ0^++ | E         | 680              | 2.5               | 125                                | 170           | 8           | 10                    | 6400                    | 4500 | 2900  | 1600  | 3   | 500                                       |
| TCSE687M002CRSZ0^++ | E         | 680              | 2.5               | 125                                | 170           | 8           | 12                    | 5800                    | 4100 | 2600  | 1500  | 3   | 500                                       |
| TCSE108M002LRSZ0^++ | E         | 1000             | 2.5               | 125                                | 250           | 8           | 10                    | 6400                    | 4500 | 2900  | 1600  | 3   | 500                                       |
| TCSE108M002CRSZ0^++ | E         | 1000             | 2.5               | 125                                | 250           | 8           | 12                    | 5800                    | 4100 | 2600  | 1500  | 3   | 500                                       |
| 4 Volt              |           |                  |                   |                                    |               |             |                       |                         |      |       |       |     |                                           |
| TCSE477M004LRSZ0^++ | E         | 470              | 4                 | 125                                | 188           | 8           | 10                    | 6400                    | 4500 | 2900  | 1600  | 3   | 500                                       |
| TCSE477M004CRSZ0^++ | E         | 470              | 4                 | 125                                | 188           | 8           | 12                    | 5800                    | 4100 | 2600  | 1500  | 3   | 500                                       |
| TCSE687M004LRSZ0^++ | E         | 680              | 4                 | 125                                | 272           | 8           | 10                    | 6400                    | 4500 | 2900  | 1600  | 3   | 500                                       |
| TCSE687M004CRSZ0^++ | E         | 680              | 4                 | 125                                | 272           | 8           | 12                    | 5800                    | 4100 | 2600  | 1500  | 3   | 500                                       |
| TCSE108M004LRSZ0^++ | E         | 1000             | 4                 | 125                                | 400           | 8           | 10                    | 6400                    | 4500 | 2900  | 1600  | 3   | 500                                       |
| TCSE108M004CRSZ0^++ | E         | 1000             | 4                 | 125                                | 400           | 8           | 12                    | 5800                    | 4100 | 2600  | 1500  | 3   | 500                                       |
| 6.3 Volt            |           |                  |                   |                                    |               |             |                       |                         |      |       |       |     |                                           |
| TCSE337M006CRSZ0^++ | E         | 330              | 6.3               | 125                                | 208           | 8           | 15                    | 5200                    | 3600 | 2300  | 1300  | 3   | 500                                       |
| TCSE477M006LRSZ0^++ | E         | 470              | 6.3               | 125                                | 296           | 8           | 10                    | 6400                    | 4500 | 2900  | 1600  | 3   | 500                                       |
| TCSE477M006CRSZ0^++ | E         | 470              | 6.3               | 125                                | 296           | 8           | 12                    | 5800                    | 4100 | 2600  | 1500  | 3   | 500                                       |
| 10 Volt             |           |                  |                   |                                    |               |             |                       |                         |      |       |       |     |                                           |
| TCSE337M010CRSZ0^++ | E         | 330              | 10                | 125                                | 330           | 8           | 25                    | 4000                    | 2800 | 1800  | 1000  | 3   | 500                                       |
| 16 Volt             |           |                  |                   |                                    |               |             |                       |                         |      |       |       |     |                                           |
| TCSE227M016CRSZ0^++ | E         | 220              | 16                | 125                                | 352           | 8           | 40                    | 3200                    | 2200 | 1400  | 800   | 3   | 500                                       |
| 25 Volt             |           |                  |                   |                                    |               |             |                       |                         |      |       |       |     |                                           |
| TCSE336M025CRSZ0^++ | E         | 33               | 25                | 125                                | 82.5          | 8           | 60                    | 2600                    | 1800 | 1200  | 700   | 3   | 500                                       |
| TCSE476M025CRSZ0^++ | E         | 47               | 25                | 125                                | 117.5         | 8           | 60                    | 2600                    | 1800 | 1200  | 700   | 3   | 500                                       |
| 35 Volt             |           |                  |                   |                                    |               |             |                       |                         |      |       |       |     |                                           |
| TCSE226M035CRSZ0^++ | E         | 22               | 35                | 125                                | 77            | 8           | 60                    | 2600                    | 1800 | 1200  | 700   | 3   | 500                                       |
| TCSE336M035CRSZ0^++ | E         | 33               | 35                | 125                                | 115.5         | 8           | 60                    | 2600                    | 1800 | 1200  | 700   | 3   | 500                                       |

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, 0.5RMS with DC bias of 2.2 volts. DCL is measured at rated voltage after 5 minutes.

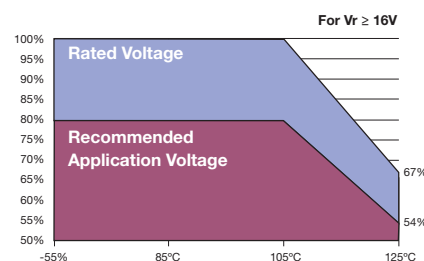
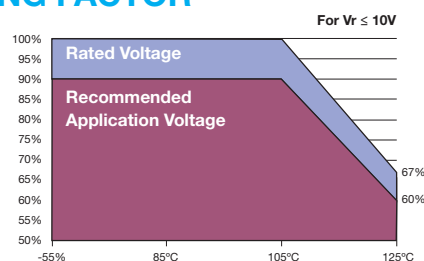
ESR allowed to move up to 1.25 times catalog limit post mounting.

**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.**

### RECOMMENDED DERATING FACTOR

Voltage and temperature derating as percentage of V<sub>r</sub>.

| Rated voltage | Operating Temperature |       |       |
|---------------|-----------------------|-------|-------|
|               | ≤85°C                 | 105°C | 125°C |
| ≤10V          | 90%                   | 90%   | 60%   |
| ≥16V          | 80%                   | 80%   | 54%   |



### QUALIFICATION TABLE

| TEST                       | TCS COTS-Plus series (Temperature range -55°C to +125°C)                                                                                                                                                                                                               |               |               |                    |                                  |           |       |           |            |       |
|----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|---------------|--------------------|----------------------------------|-----------|-------|-----------|------------|-------|
|                            | Condition                                                                                                                                                                                                                                                              |               |               | Characteristics    |                                  |           |       |           |            |       |
| Endurance                  | Determine after application of rated voltage for 2000 +48/-0 hours at 105±2°C. Also determine after application of 125°C temperature, 2/3 rated voltage for 2000 +48/-0 hours. After test 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 +10/-20% of initial value |           |       |           |            |       |
|                            |                                                                                                                                                                                                                                                                        |               |               | DF                 | initial limit                    |           |       |           |            |       |
|                            |                                                                                                                                                                                                                                                                        |               |               | ESR                | 2 x initial limit                |           |       |           |            |       |
| Storage Life               | 125°C, 0V, 2000h                                                                                                                                                                                                                                                       |               |               | Visual examination | no visible damage                |           |       |           |            |       |
|                            |                                                                                                                                                                                                                                                                        |               |               | DCL                | 2 x initial limit                |           |       |           |            |       |
|                            |                                                                                                                                                                                                                                                                        |               |               | ΔC/C               | within +10/-20% of initial value |           |       |           |            |       |
|                            |                                                                                                                                                                                                                                                                        |               |               | DF                 | initial limit                    |           |       |           |            |       |
|                            |                                                                                                                                                                                                                                                                        |               |               | ESR                | 2 x initial limit                |           |       |           |            |       |
| Biased Humidity            | Determine after leaving for 500 or 1000 hours at 85±2°C, 85% relative humidity and rated voltage and then recovery 1-2 hours at room temperature.                                                                                                                      |               |               | Visual examination | no visible damage                |           |       |           |            |       |
|                            |                                                                                                                                                                                                                                                                        |               |               | DCL                | 3 x initial limit                |           |       |           |            |       |
|                            |                                                                                                                                                                                                                                                                        |               |               | ΔC/C               | within +35/-5% of initial value  |           |       |           |            |       |
|                            |                                                                                                                                                                                                                                                                        |               |               | DF                 | 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±2         | 15            |                    |                                  |           |       |           |            |       |
|                            | 2                                                                                                                                                                                                                                                                      | -55+0/-3      | 15            | DCL                | IL*                              | n/a       | IL*   | 10 x IL*  | 12.5 x IL* | IL*   |
|                            | 3                                                                                                                                                                                                                                                                      | +20±2         | 15            |                    |                                  |           |       |           |            |       |
|                            | 4                                                                                                                                                                                                                                                                      | +85+3/-0      | 15            | ΔC/C               | n/a                              | +0/-20%   | ±5%   | +20/-0%   | +30/-0%    | ±5%   |
|                            | 5                                                                                                                                                                                                                                                                      | +125+3/-0     | 15            |                    |                                  |           |       |           |            |       |
|                            | 6                                                                                                                                                                                                                                                                      | +20±2         | 15            | DF                 | IL*                              | 1.5 x IL* | IL*   | 1.5 x IL* | 2 x IL*    | IL*   |
| Surge Voltage              | Test temperature: 125°C+3/0°C<br>Surge voltage: 1.3 x 2/3 rated voltage<br>Charge/Discharge resistance: 1000±100Ω<br>Number of cycles: 1000x<br>Cycle duration: 6 min; 30 sec charge, 5 min 30 sec discharge                                                           |               |               | Visual examination | no visible damage                |           |       |           |            |       |
|                            |                                                                                                                                                                                                                                                                        |               |               | DCL                | initial limit                    |           |       |           |            |       |
|                            |                                                                                                                                                                                                                                                                        |               |               | ΔC/C               | within +5/-20% of initial value  |           |       |           |            |       |
|                            |                                                                                                                                                                                                                                                                        |               |               | DF                 | initial limit                    |           |       |           |            |       |
|                            |                                                                                                                                                                                                                                                                        |               |               | ESR                | 1.25 x initial limit             |           |       |           |            |       |
| Mechanical Shock/Vibration | MIL-STD-202, Method 213, Condition I, 100 G peak<br>MIL-STD-202, Method 204, Condition D, 10 Hz to 2,000 Hz, 20 G peak                                                                                                                                                 |               |               | Visual examination | no visible damage                |           |       |           |            |       |
|                            |                                                                                                                                                                                                                                                                        |               |               | DCL                | initial limit                    |           |       |           |            |       |
|                            |                                                                                                                                                                                                                                                                        |               |               | ΔC/C               | within ±10% of initial value     |           |       |           |            |       |
|                            |                                                                                                                                                                                                                                                                        |               |               | DF                 | initial limit                    |           |       |           |            |       |
|                            |                                                                                                                                                                                                                                                                        |               |               | ESR                | 1.25 x initial limit             |           |       |           |            |       |

\*Initial Limit

For use outside of recommended conditions and special request, please contact manufacturer.

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

# Mouser Electronics

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