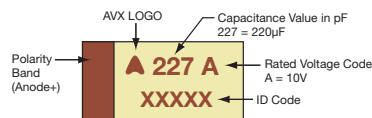


### MARKING

#### A, B, C, D, E, U CASE



### HOW TO ORDER

| TRJ  | B                            | 105                                                                                                                                    | *                             | 035                                                                                                                      | R                                                                                                                                                                                                                                           | RJ                                                    | —                                                                                                        |
|------|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|--------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|----------------------------------------------------------------------------------------------------------|
| Type | Case Size<br>See table above | Capacitance Code<br>pF code: 1st two digits represent significant figures, 3rd digit represents multiplier (number of zeros to follow) | Tolerance<br>K=±10%<br>M=±20% | Rated DC Voltage<br>004 = 4V<br>006 = 6.3V<br>010 = 10V<br>016 = 16V<br>020 = 20V<br>025 = 25V<br>035 = 35V<br>050 = 50V | Packaging<br>R = Pure Tin 7" Reel<br>S = Pure Tin 13" Reel<br>A = Gold Plating 7" Reel<br>B = Gold Plating 13" Reel<br>H = Tin Lead 7" Reel<br>(Contact Manufacturer)<br>K = Tin Lead 13" Reel<br>(Contact Manufacturer)<br>H, K = Non RoHS | Standard Suffix<br>OR<br><b>0100</b><br>Low ESR in mΩ | Additional characters may be added for special requirements<br>V = Dry pack Option (selected codes only) |

### TECHNICAL SPECIFICATIONS

|                                    |                                                                                                |     |     |    |    |    |    |    |    |  |
|------------------------------------|------------------------------------------------------------------------------------------------|-----|-----|----|----|----|----|----|----|--|
| Technical Data:                    | All technical data relate to an ambient temperature of +25°C                                   |     |     |    |    |    |    |    |    |  |
| Capacitance Range:                 | 0.10 µF to 680 µF                                                                              |     |     |    |    |    |    |    |    |  |
| Capacitance Tolerance:             | ±10%; ±20%                                                                                     |     |     |    |    |    |    |    |    |  |
| Leakage Current DCL:               | 0.0075CV or 0.3µA whichever is the greater                                                     |     |     |    |    |    |    |    |    |  |
| Rated Voltage (V <sub>R</sub> )    | ≤ +85°C:                                                                                       | 4   | 6.3 | 10 | 16 | 20 | 25 | 35 | 50 |  |
| Category Voltage (V <sub>C</sub> ) | ≤ +125°C:                                                                                      | 2.7 | 4   | 7  | 10 | 13 | 17 | 23 | 33 |  |
| Surge Voltage (V <sub>S</sub> )    | ≤ +85°C:                                                                                       | 5.2 | 8   | 13 | 20 | 26 | 32 | 46 | 65 |  |
| Surge Voltage (V <sub>S</sub> )    | ≤ +125°C:                                                                                      | 3.4 | 5   | 8  | 13 | 16 | 20 | 28 | 40 |  |
| Temperature Range:                 | -55°C to +125°C                                                                                |     |     |    |    |    |    |    |    |  |
| Reliability:                       | 0.5% per 1000 hours at 85°C, V <sub>R</sub> with 0.1Ω/V series impedance, 60% confidence level |     |     |    |    |    |    |    |    |  |
| Termination Plating:               | Sn Plating (standard), Gold and SnPb Plating upon request<br>Meets requirements of AEC-Q200    |     |     |    |    |    |    |    |    |  |

### FEATURES

- Improved reliability – 2x standard
- DCL reduced by 25% to 0.0075 CV
- Robust against higher thermo-mechanical stresses during assembly process
- CV range: 0.10-680µF / 4-50V
- 6 case sizes available
- 130 low ESR parts released
- Automotive, medical, aerospace, military and other high-end applications

### APPLICATIONS

- Automotive ECU
- ABS
- Airbag systems
- Avionics,
- Industrial control units

### 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) | W <sub>1</sub> ±0.20 (0.008) | A±0.30 (0.012)<br>-0.20 (0.008) | S Min.       |
|------|----------|------------|----------------|---------------------------------|---------------------------------|------------------------------|---------------------------------|--------------|
| A    | 1206     | 3216-18    | 3.20 (0.126)   | 1.60 (0.063)                    | 1.60 (0.063)                    | 1.20 (0.047)                 | 0.80 (0.031)                    | 1.10 (0.043) |
| B    | 1210     | 3528-21    | 3.50 (0.138)   | 2.80 (0.110)                    | 1.90 (0.075)                    | 2.20 (0.087)                 | 0.80 (0.031)                    | 1.40 (0.055) |
| 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) |
| U    | 2924     | 7361-43    | 7.30 (0.287)   | 6.10 (0.240)                    | 4.10 (0.162)                    | 3.10 (0.120)                 | 1.30 (0.051)                    | 4.40 (0.173) |

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

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

| Capacitance |      | Rated Voltage DC (V <sub>R</sub> ) to 85°C |                         |                                     |                           |                          |                        |                          |                        |
|-------------|------|--------------------------------------------|-------------------------|-------------------------------------|---------------------------|--------------------------|------------------------|--------------------------|------------------------|
| μF          | Code | 4V (G)                                     | 6.3V (J)                | 10V (A)                             | 16V (C)                   | 20V (D)                  | 25V (E)                | 35V (V)                  | 50V (T)                |
| 0.10        | 104  |                                            |                         |                                     |                           |                          |                        | A                        |                        |
| 0.15        | 154  |                                            |                         |                                     |                           |                          |                        | A, A(6000)               |                        |
| 0.22        | 224  |                                            |                         |                                     |                           |                          |                        | A, A(6000)               | A, A(7000)             |
| 0.33        | 334  |                                            |                         |                                     |                           |                          |                        | A, A(6000)               | A                      |
| 0.47        | 474  |                                            |                         |                                     |                           |                          | A, A(7000)             | A, A(4000)               | B                      |
| 0.68        | 684  |                                            |                         |                                     |                           |                          | A, A(6000)             | A, A(6000)               | B, B(2000)             |
| 1.0         | 105  |                                            |                         |                                     | A                         | A, A(3000)               | A, A(3000)             | A, B, A(3000), B(2000)   | C, B, B(2000)          |
| 1.5         | 155  |                                            |                         | A                                   |                           | A, A(3000)               | A, B, A(3000)          | A, B, A(2000), B(2500)   | C, C(1500)             |
| 2.2         | 225  |                                            |                         | A                                   | A, A(3500)                | A, A(3000)               | A, B, A(1600), B(1200) | B, B(2000)               | C, D, C(1000), D(1200) |
| 3.3         | 335  |                                            |                         |                                     | A, B, A(3500)             | A, B, A(2500), B(1300)   | B, B(2000)             | B, C, D, B(1000), C(800) | C, D, C(1000), D(800)  |
| 4.7         | 475  |                                            |                         | A, A(2000)                          | A, B, A(2000), B(1500)    | A, B, A(1800), B(1000)   | B, B(1000)             | B, C, D, B(1500), C(600) | D, D(600)              |
| 6.8         | 685  |                                            |                         | A, B, A(1800)                       | A, B, C, A(1500), B(1200) | B, C, B(1000)            | B, C, B(1000), C(600)  | C, D, C(600)             | D                      |
| 10          | 106  |                                            | A, B, A(1500)           | A, B, A(1800), B(800)               | B, C, B(800)              | B, C, B(1000), C(500)    | C, D, C(600)           | C, D, C(600), D(250,400) | E, E(300,400)          |
| 15          | 156  | B                                          | A, B, A(1500), B(700)   | A, B, C, A(1000), B(600)            | B, B(800)                 | B, C, D, B(500), C(400)  | C, D, C(500), D(300)   | D, D(225)                | U                      |
| 22          | 226  |                                            | A, B, C, A(900), B(600) | B, B(700)                           | B, C, D, B(600), C(350)   | C, D, C(400), D(150,300) | D, D(300)              | D, D(200,400)            | U                      |
| 33          | 336  | C                                          | B, C, B(600)            | B, C, D, B(650), C(300)             | C, C(300)                 | C, D, C(300), D(250)     | D, D(400)              | E, E(150,250)            |                        |
| 47          | 476  |                                            | B, C, B(500), C(250)    | C, D, C(300)                        | C, D, C(350), D(200)      | D, D(200)                | D, E, D(250), E(150)   | U, U(200)                |                        |
| 68          | 686  |                                            | C, C(200)               | C, C(300)                           | C, D, C(200), D(150)      | D, E, D(200), E(120,200) | U                      |                          |                        |
| 100         | 107  |                                            | C, C(300)               | C, D, E, C(200), D(100,150), E(100) | D, E, D(150), E(150)      | E, E(150)                | U                      |                          |                        |
| 150         | 157  |                                            | C, D, C(300), D(150)    | D, E, D(150), E(150)                | E, E(150)                 | U, U(250)                |                        |                          |                        |
| 220         | 227  |                                            | D, D(150)               | D, E, E(150)                        | U, U(200)                 |                          |                        |                          |                        |
| 330         | 337  |                                            | D, E, E(150)            | E, E(100)                           | U, U(200)                 |                          |                        |                          |                        |
| 470         | 477  |                                            | E, E(200)               | U, U(200)                           |                           |                          |                        |                          |                        |
| 680         | 687  |                                            | U, U(250)               |                                     |                           |                          |                        |                          |                        |

Not recommended for new designs, higher voltage or smaller case size substitution are offered.

Available Ratings, (ESR ratings in mOhms in brackets)

Engineering samples - please contact manufacturer

\*Codes under development - subject to change

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<br>Part No.   | Case<br>Size | Capacitance<br>(µF) | Rated<br>Voltage<br>(V) | Rated<br>Temperature<br>(°C) | Category<br>Voltage<br>(V) | Category<br>Temperature<br>(°C) | DCL<br>(µA)<br>Max. | DF<br>%<br>Max. | ESR<br>Max. (mΩ)<br>@ 100kHz | MSL             | 100kHz RMS Current (mA) |      |       |
|-------------------|--------------|---------------------|-------------------------|------------------------------|----------------------------|---------------------------------|---------------------|-----------------|------------------------------|-----------------|-------------------------|------|-------|
|                   |              |                     |                         |                              |                            |                                 |                     |                 |                              |                 | 25°C                    | 85°C | 125°C |
| 4 Volt @ 85°C     |              |                     |                         |                              |                            |                                 |                     |                 |                              |                 |                         |      |       |
| TRJB156*004#RJ    | B            | 15                  | 4                       | 85                           | 2.7                        | 125                             | 0.45                | 6               | 3000                         | 1               | 168                     | 151  | 67    |
| TRJC336*004#RJ    | C            | 33                  | 4                       | 85                           | 2.7                        | 125                             | 1                   | 6               | 2000                         | 1               | 235                     | 211  | 94    |
| 6.3 Volt @ 85°C   |              |                     |                         |                              |                            |                                 |                     |                 |                              |                 |                         |      |       |
| TRJA106*006#RJ    | A            | 10                  | 6.3                     | 85                           | 4                          | 125                             | 0.45                | 6               | 2200                         | 1               | 185                     | 166  | 74    |
| TRJA106*006#1500  | A            | 10                  | 6.3                     | 85                           | 4                          | 125                             | 0.45                | 6               | 1500                         | 1               | 224                     | 201  | 89    |
| TRJB106*006#RJ    | B            | 10                  | 6.3                     | 85                           | 4                          | 125                             | 0.45                | 6               | 3000                         | 1               | 168                     | 151  | 67    |
| TRJA156*006#RJ    | A            | 15                  | 6.3                     | 85                           | 4                          | 125                             | 0.68                | 6               | 2030                         | 1               | 192                     | 173  | 77    |
| TRJA156*006#1500  | A            | 15                  | 6.3                     | 85                           | 4                          | 125                             | 0.68                | 6               | 1500                         | 1               | 224                     | 201  | 89    |
| TRJB156*006#RJ    | B            | 15                  | 6.3                     | 85                           | 4                          | 125                             | 0.68                | 6               | 2030                         | 1               | 205                     | 184  | 82    |
| TRJB156*006#0700  | B            | 15                  | 6.3                     | 85                           | 4                          | 125                             | 0.68                | 6               | 700                          | 1               | 348                     | 314  | 139   |
| TRJA226*006#RJ    | A            | 22                  | 6.3                     | 85                           | 4                          | 125                             | 0.99                | 6               | 1700                         | 1               | 210                     | 189  | 84    |
| TRJA226*006#0900  | A            | 22                  | 6.3                     | 85                           | 4                          | 125                             | 0.99                | 6               | 900                          | 1               | 289                     | 260  | 115   |
| TRJB226*006#RJ    | B            | 22                  | 6.3                     | 85                           | 4                          | 125                             | 0.99                | 6               | 1880                         | 1               | 213                     | 191  | 85    |
| TRJB226*006#0600  | B            | 22                  | 6.3                     | 85                           | 4                          | 125                             | 0.99                | 6               | 600                          | 1               | 376                     | 339  | 151   |
| TRJC226*006#RJ    | C            | 22                  | 6.3                     | 85                           | 4                          | 125                             | 0.99                | 6               | 2000                         | 1               | 235                     | 211  | 94    |
| TRJB336*006#RJ    | B            | 33                  | 6.3                     | 85                           | 4                          | 125                             | 1.5                 | 6               | 1740                         | 1               | 221                     | 199  | 88    |
| TRJB336*006#0600  | B            | 33                  | 6.3                     | 85                           | 4                          | 125                             | 1.5                 | 6               | 600                          | 1               | 376                     | 339  | 151   |
| TRJC336*006#RJ    | C            | 33                  | 6.3                     | 85                           | 4                          | 125                             | 1.5                 | 6               | 1800                         | 1               | 247                     | 222  | 99    |
| TRJB476*006#RJ    | B            | 47                  | 6.3                     | 85                           | 4                          | 125                             | 2.1                 | 6               | 1620                         | 1               | 229                     | 206  | 92    |
| TRJB476*006#0500  | B            | 47                  | 6.3                     | 85                           | 4                          | 125                             | 2.1                 | 6               | 500                          | 1               | 412                     | 371  | 165   |
| TRJC476*006#RJ    | C            | 47                  | 6.3                     | 85                           | 4                          | 125                             | 2.1                 | 6               | 540                          | 1               | 451                     | 406  | 181   |
| TRJC476*006#0250  | C            | 47                  | 6.3                     | 85                           | 4                          | 125                             | 2.1                 | 6               | 250                          | 1               | 663                     | 597  | 265   |
| TRJC686*006#RJ    | C            | 68                  | 6.3                     | 85                           | 4                          | 125                             | 3.1                 | 6               | 490                          | 1               | 474                     | 426  | 190   |
| TRJC686*006#0200  | C            | 68                  | 6.3                     | 85                           | 4                          | 125                             | 3.1                 | 6               | 200                          | 1               | 742                     | 667  | 297   |
| TRJC107*006#RJ    | C            | 100                 | 6.3                     | 85                           | 4                          | 125                             | 4.5                 | 6               | 440                          | 1               | 500                     | 450  | 200   |
| TRJC107*006#0300  | C            | 100                 | 6.3                     | 85                           | 4                          | 125                             | 4.5                 | 6               | 300                          | 1               | 606                     | 545  | 242   |
| TRJC157*006#RJ    | C            | 150                 | 6.3                     | 85                           | 4                          | 125                             | 6.8                 | 8               | 500                          | 1               | 469                     | 422  | 188   |
| TRJC157*006#0300  | C            | 150                 | 6.3                     | 85                           | 4                          | 125                             | 6.8                 | 8               | 300                          | 1               | 606                     | 545  | 242   |
| TRJD157*006#RJ    | D            | 150                 | 6.3                     | 85                           | 4                          | 125                             | 6.8                 | 6               | 400                          | 1               | 612                     | 551  | 245   |
| TRJD157*006#0150  | D            | 150                 | 6.3                     | 85                           | 4                          | 125                             | 6.8                 | 6               | 150                          | 1               | 1000                    | 900  | 400   |
| TRJD227*006#RJ    | D            | 220                 | 6.3                     | 85                           | 4                          | 125                             | 9.9                 | 8               | 360                          | 1               | 645                     | 581  | 258   |
| TRJD227*006#0150  | D            | 220                 | 6.3                     | 85                           | 4                          | 125                             | 9.9                 | 8               | 150                          | 1               | 1000                    | 900  | 400   |
| TRJD337*006#RJ    | D            | 330                 | 6.3                     | 85                           | 4                          | 125                             | 14                  | 8               | 400                          | 1               | 612                     | 551  | 245   |
| TRJE337*006#RJ    | E            | 330                 | 6.3                     | 85                           | 4                          | 125                             | 14                  | 8               | 330                          | 1 <sup>1)</sup> | 707                     | 636  | 283   |
| TRJE337*006#0150  | E            | 330                 | 6.3                     | 85                           | 4                          | 125                             | 14                  | 8               | 150                          | 1 <sup>1)</sup> | 1049                    | 944  | 420   |
| TRJE477*006#RJ    | E            | 470                 | 6.3                     | 85                           | 4                          | 125                             | 21                  | 8               | 250                          | 1 <sup>1)</sup> | 812                     | 731  | 325   |
| TRJE477*006#0200  | E            | 470                 | 6.3                     | 85                           | 4                          | 125                             | 21                  | 8               | 200                          | 1 <sup>1)</sup> | 908                     | 817  | 363   |
| TRJU687*006RRJV   | U            | 680                 | 6.3                     | 85                           | 4                          | 125                             | 30                  | 30              | 500                          | 3               | 574                     | 517  | 230   |
| TRJU687*006R0250V | U            | 680                 | 6.3                     | 85                           | 4                          | 125                             | 30                  | 30              | 250                          | 3               | 812                     | 731  | 325   |
| 10 Volt @ 85°C    |              |                     |                         |                              |                            |                                 |                     |                 |                              |                 |                         |      |       |
| TRJA155*010#RJ    | A            | 1.5                 | 10                      | 85                           | 7                          | 125                             | 0.3                 | 6               | 7000                         | 1               | 104                     | 93   | 41    |
| TRJA225*010#RJ    | A            | 2.2                 | 10                      | 85                           | 7                          | 125                             | 0.3                 | 6               | 7000                         | 1               | 104                     | 93   | 41    |
| TRJA475*010#RJ    | A            | 4.7                 | 10                      | 85                           | 7                          | 125                             | 0.35                | 6               | 2900                         | 1               | 161                     | 145  | 64    |
| TRJA475*010#2000  | A            | 4.7                 | 10                      | 85                           | 7                          | 125                             | 0.35                | 6               | 2000                         | 1               | 194                     | 174  | 77    |
| TRJA685*010#RJ    | A            | 6.8                 | 10                      | 85                           | 7                          | 125                             | 0.51                | 6               | 2650                         | 1               | 168                     | 151  | 67    |
| TRJA685*010#1800  | A            | 6.8                 | 10                      | 85                           | 7                          | 125                             | 0.51                | 6               | 1800                         | 1               | 204                     | 184  | 82    |
| TRJB685*010#RJ    | B            | 6.8                 | 10                      | 85                           | 7                          | 125                             | 0.51                | 6               | 3000                         | 1               | 168                     | 151  | 67    |
| TRJA106*010#RJ    | A            | 10                  | 10                      | 85                           | 7                          | 125                             | 0.75                | 6               | 2200                         | 1               | 185                     | 166  | 74    |
| TRJA106*010#1800  | A            | 10                  | 10                      | 85                           | 7                          | 125                             | 0.75                | 6               | 1800                         | 1               | 204                     | 184  | 82    |
| TRJB106*010#RJ    | B            | 10                  | 10                      | 85                           | 7                          | 125                             | 0.75                | 6               | 2200                         | 1               | 197                     | 177  | 79    |
| TRJB106*010#0800  | B            | 10                  | 10                      | 85                           | 7                          | 125                             | 0.75                | 6               | 800                          | 1               | 326                     | 293  | 130   |
| TRJA156*010#RJ    | A            | 15                  | 10                      | 85                           | 7                          | 125                             | 1.1                 | 6               | 1800                         | 1               | 204                     | 184  | 82    |
| TRJA156*010#1000  | A            | 15                  | 10                      | 85                           | 7                          | 125                             | 1.1                 | 6               | 1000                         | 1               | 274                     | 246  | 110   |
| TRJB156*010#RJ    | B            | 15                  | 10                      | 85                           | 7                          | 125                             | 1.1                 | 6               | 2030                         | 1               | 205                     | 184  | 82    |
| TRJB156*010#0600  | B            | 15                  | 10                      | 85                           | 7                          | 125                             | 1.1                 | 6               | 600                          | 1               | 376                     | 339  | 151   |
| TRJC156*010#RJ    | C            | 15                  | 10                      | 85                           | 7                          | 125                             | 1.1                 | 6               | 2000                         | 1               | 235                     | 211  | 94    |
| TRJB226*010#RJ    | B            | 22                  | 10                      | 85                           | 7                          | 125                             | 1.7                 | 6               | 1880                         | 1               | 213                     | 191  | 85    |
| TRJB226*010#0700  | B            | 22                  | 10                      | 85                           | 7                          | 125                             | 1.7                 | 6               | 700                          | 1               | 348                     | 314  | 139   |
| TRJB336*010#RJ    | B            | 33                  | 10                      | 85                           | 7                          | 125                             | 2.5                 | 6               | 1000                         | 1               | 292                     | 262  | 117   |
| TRJB336*010#0650  | B            | 33                  | 10                      | 85                           | 7                          | 125                             | 2.5                 | 6               | 650                          | 1               | 362                     | 325  | 145   |
| TRJC336*010#RJ    | C            | 33                  | 10                      | 85                           | 7                          | 125                             | 2.5                 | 6               | 590                          | 1               | 432                     | 389  | 173   |
| TRJC336*010#0300  | C            | 33                  | 10                      | 85                           | 7                          | 125                             | 2.5                 | 6               | 300                          | 1               | 606                     | 545  | 242   |
| TRJD336*010#RJ    | D            | 33                  | 10                      | 85                           | 7                          | 125                             | 2.5                 | 6               | 1100                         | 1               | 369                     | 332  | 148   |
| TRJC476*010#RJ    | C            | 47                  | 10                      | 85                           | 7                          | 125                             | 3.5                 | 6               | 540                          | 1               | 451                     | 406  | 181   |
| TRJC476*010#0300  | C            | 47                  | 10                      | 85                           | 7                          | 125                             | 3.5                 | 6               | 300                          | 1               | 606                     | 545  | 242   |
| TRJD476*010#RJ    | D            | 47                  | 10                      | 85                           | 7                          | 125                             | 3.5                 | 6               | 400                          | 1               | 612                     | 551  | 245   |
| TRJC686*010#RJ    | C            | 68                  | 10                      | 85                           | 7                          | 125                             | 5.1                 | 6               | 490                          | 1               | 474                     | 426  | 190   |
| TRJC686*010#0300  | C            | 68                  | 10                      | 85                           | 7                          | 125                             | 5.1                 | 6               | 300                          | 1               | 606                     | 545  | 242   |
| TRJC107*010#RJ    | C            | 100                 | 10                      | 85                           | 7                          | 125                             | 7.5                 | 8               | 500                          | 1               | 469                     | 422  | 188   |
| TRJC107*010#0200  | C            | 100                 | 10                      | 85                           | 7                          | 125                             | 7.5                 | 8               | 200                          | 1               | 742                     | 667  | 297   |

### RATINGS & PART NUMBER REFERENCE

| AVX Part No.      | Case Size | Capacitance (µF) | Rated Voltage (V) | Rated Temperature (°C) | Category Voltage (V) | Category Temperature (°C) | DCL (µA) Max. | DF % Max. | ESR Max. (mΩ) @ 100kHz | MSL             | 100kHz RMS Current (mA) |      |       |
|-------------------|-----------|------------------|-------------------|------------------------|----------------------|---------------------------|---------------|-----------|------------------------|-----------------|-------------------------|------|-------|
|                   |           |                  |                   |                        |                      |                           |               |           |                        |                 | 25°C                    | 85°C | 125°C |
| TRJD107*010#RJ    | D         | 100              | 10                | 85                     | 7                    | 125                       | 7.5           | 6         | 440                    | 1               | 584                     | 525  | 234   |
| TRJD107*010#0100  | D         | 100              | 10                | 85                     | 7                    | 125                       | 7.5           | 6         | 100                    | 1               | 1225                    | 1102 | 490   |
| TRJD107*010#0150  | D         | 100              | 10                | 85                     | 7                    | 125                       | 7.5           | 6         | 150                    | 1               | 1000                    | 900  | 400   |
| TRJE107*010#RJ    | E         | 100              | 10                | 85                     | 7                    | 125                       | 7.5           | 6         | 440                    | 1 <sup>1)</sup> | 612                     | 551  | 245   |
| TRJE107*010#0100  | E         | 100              | 10                | 85                     | 7                    | 125                       | 7.5           | 6         | 100                    | 1 <sup>1)</sup> | 1285                    | 1156 | 514   |
| TRJD157*010#RJ    | D         | 150              | 10                | 85                     | 7                    | 125                       | 11            | 8         | 400                    | 1               | 612                     | 551  | 245   |
| TRJD157*010#0150  | D         | 150              | 10                | 85                     | 7                    | 125                       | 11            | 8         | 150                    | 1               | 1000                    | 900  | 400   |
| TRJE157*010#RJ    | E         | 150              | 10                | 85                     | 7                    | 125                       | 11            | 8         | 400                    | 1 <sup>1)</sup> | 642                     | 578  | 257   |
| TRJE157*010#0150  | E         | 150              | 10                | 85                     | 7                    | 125                       | 11            | 8         | 150                    | 1 <sup>1)</sup> | 1049                    | 944  | 420   |
| TRJD227*010#RJ    | D         | 220              | 10                | 85                     | 7                    | 125                       | 17            | 8         | 500                    | 1               | 548                     | 493  | 219   |
| TRJE227*010#RJ    | E         | 220              | 10                | 85                     | 7                    | 125                       | 17            | 8         | 360                    | 1 <sup>1)</sup> | 677                     | 609  | 271   |
| TRJE227*010#0150  | E         | 220              | 10                | 85                     | 7                    | 125                       | 17            | 8         | 150                    | 1 <sup>1)</sup> | 1049                    | 944  | 420   |
| TRJE337*010#RJ    | E         | 330              | 10                | 85                     | 7                    | 125                       | 25            | 8         | 300                    | 1 <sup>1)</sup> | 742                     | 667  | 297   |
| TRJE337*010#0100  | E         | 330              | 10                | 85                     | 7                    | 125                       | 25            | 8         | 100                    | 1 <sup>1)</sup> | 1285                    | 1156 | 514   |
| TRJU477*010RRJV   | U         | 470              | 10                | 85                     | 7                    | 125                       | 35            | 30        | 400                    | 3               | 642                     | 578  | 257   |
| TRJU477*010R0200V | U         | 470              | 10                | 85                     | 7                    | 125                       | 35            | 30        | 200                    | 3               | 908                     | 817  | 363   |
| 16 Volt @ 85°C    |           |                  |                   |                        |                      |                           |               |           |                        |                 |                         |      |       |
| TRJA105*016#RJ    | A         | 1.0              | 16                | 85                     | 10                   | 125                       | 0.3           | 6         | 10000                  | 1               | 87                      | 78   | 35    |
| TRJA225*016#RJ    | A         | 2.2              | 16                | 85                     | 10                   | 125                       | 0.3           | 6         | 4550                   | 1               | 128                     | 116  | 51    |
| TRJA225*016#3500  | A         | 2.2              | 16                | 85                     | 10                   | 125                       | 0.3           | 6         | 3500                   | 1               | 146                     | 132  | 59    |
| TRJA335*016#RJ    | A         | 3.3              | 16                | 85                     | 10                   | 125                       | 0.4           | 6         | 3740                   | 1               | 142                     | 127  | 57    |
| TRJA335*016#3500  | A         | 3.3              | 16                | 85                     | 10                   | 125                       | 0.4           | 6         | 3500                   | 1               | 146                     | 132  | 59    |
| TRJB335*016#RJ    | B         | 3.3              | 16                | 85                     | 10                   | 125                       | 0.4           | 6         | 4500                   | 1               | 137                     | 124  | 55    |
| TRJA475*016#RJ    | A         | 4.7              | 16                | 85                     | 10                   | 125                       | 0.56          | 6         | 3160                   | 1               | 154                     | 139  | 62    |
| TRJA475*016#2000  | A         | 4.7              | 16                | 85                     | 10                   | 125                       | 0.56          | 6         | 2000                   | 1               | 194                     | 174  | 77    |
| TRJB475*016#RJ    | B         | 4.7              | 16                | 85                     | 10                   | 125                       | 0.56          | 6         | 3160                   | 1               | 164                     | 148  | 66    |
| TRJB475*016#1500  | B         | 4.7              | 16                | 85                     | 10                   | 125                       | 0.56          | 6         | 1500                   | 1               | 238                     | 214  | 95    |
| TRJA685*016#RJ    | A         | 6.8              | 16                | 85                     | 10                   | 125                       | 0.82          | 4         | 2000                   | 1               | 194                     | 174  | 77    |
| TRJA685*016#1500  | A         | 6.8              | 16                | 85                     | 10                   | 125                       | 0.82          | 4         | 1500                   | 1               | 224                     | 201  | 89    |
| TRJB685*016#RJ    | B         | 6.8              | 16                | 85                     | 10                   | 125                       | 0.82          | 6         | 2650                   | 1               | 179                     | 161  | 72    |
| TRJB685*016#1200  | B         | 6.8              | 16                | 85                     | 10                   | 125                       | 0.82          | 6         | 1200                   | 1               | 266                     | 240  | 106   |
| TRJC685*016#RJ    | C         | 6.8              | 16                | 85                     | 10                   | 125                       | 0.82          | 6         | 2500                   | 1               | 210                     | 189  | 84    |
| TRJB106*016#RJ    | B         | 10               | 16                | 85                     | 10                   | 125                       | 1.2           | 6         | 2200                   | 1               | 197                     | 177  | 79    |
| TRJB106*016#0800  | B         | 10               | 16                | 85                     | 10                   | 125                       | 1.2           | 6         | 800                    | 1               | 326                     | 293  | 130   |
| TRJC106*016#RJ    | C         | 10               | 16                | 85                     | 10                   | 125                       | 1.2           | 6         | 2000                   | 1               | 235                     | 211  | 94    |
| TRJB156*016#RJ    | B         | 15               | 16                | 85                     | 10                   | 125                       | 1.8           | 6         | 2030                   | 1               | 205                     | 184  | 82    |
| TRJB156*016#0800  | B         | 15               | 16                | 85                     | 10                   | 125                       | 1.8           | 6         | 800                    | 1               | 326                     | 293  | 130   |
| TRJB226*016#RJ    | B         | 22               | 16                | 85                     | 10                   | 125                       | 2.6           | 6         | 1100                   | 1               | 278                     | 250  | 111   |
| TRJB226*016#0600  | B         | 22               | 16                | 85                     | 10                   | 125                       | 2.6           | 6         | 600                    | 1               | 376                     | 339  | 151   |
| TRJC226*016#RJ    | C         | 22               | 16                | 85                     | 10                   | 125                       | 2.6           | 6         | 700                    | 1               | 396                     | 357  | 159   |
| TRJC226*016#0350  | C         | 22               | 16                | 85                     | 10                   | 125                       | 2.6           | 6         | 350                    | 1               | 561                     | 505  | 224   |
| TRJD226*016#RJ    | D         | 22               | 16                | 85                     | 10                   | 125                       | 2.6           | 6         | 1100                   | 1               | 369                     | 332  | 148   |
| TRJC336*016#RJ    | C         | 33               | 16                | 85                     | 10                   | 125                       | 4             | 6         | 590                    | 1               | 432                     | 389  | 173   |
| TRJC336*016#0300  | C         | 33               | 16                | 85                     | 10                   | 125                       | 4             | 6         | 300                    | 1               | 606                     | 545  | 242   |
| TRJC476*016#RJ    | C         | 47               | 16                | 85                     | 10                   | 125                       | 5.6           | 6         | 540                    | 1               | 451                     | 406  | 181   |
| TRJC476*016#0350  | C         | 47               | 16                | 85                     | 10                   | 125                       | 5.6           | 6         | 350                    | 1               | 561                     | 505  | 224   |
| TRJD476*016#RJ    | D         | 47               | 16                | 85                     | 10                   | 125                       | 5.6           | 6         | 540                    | 1               | 527                     | 474  | 211   |
| TRJD476*016#0200  | D         | 47               | 16                | 85                     | 10                   | 125                       | 5.6           | 6         | 200                    | 1               | 866                     | 779  | 346   |
| TRJC686*016#RJ    | C         | 68               | 16                | 85                     | 10                   | 125                       | 8.2           | 6         | 490                    | 1               | 474                     | 426  | 190   |
| TRJC686*016#0200  | C         | 68               | 16                | 85                     | 10                   | 125                       | 8.2           | 6         | 200                    | 1               | 742                     | 667  | 297   |
| TRJD686*016#RJ    | D         | 68               | 16                | 85                     | 10                   | 125                       | 8.2           | 6         | 490                    | 1               | 553                     | 498  | 221   |
| TRJD686*016#0150  | D         | 68               | 16                | 85                     | 10                   | 125                       | 8.2           | 6         | 150                    | 1               | 1000                    | 900  | 400   |
| TRJD107*016#RJ    | D         | 100              | 16                | 85                     | 10                   | 125                       | 12            | 6         | 440                    | 1               | 584                     | 525  | 234   |
| TRJD107*016#0150  | D         | 100              | 16                | 85                     | 10                   | 125                       | 12            | 6         | 150                    | 1               | 1000                    | 900  | 400   |
| TRJE107*016#RJ    | E         | 100              | 16                | 85                     | 10                   | 125                       | 12            | 6         | 440                    | 1 <sup>1)</sup> | 612                     | 551  | 245   |
| TRJE107*016#0150  | E         | 100              | 16                | 85                     | 10                   | 125                       | 12            | 6         | 150                    | 1 <sup>1)</sup> | 1049                    | 944  | 420   |
| TRJE157*016#RJ    | E         | 150              | 16                | 85                     | 10                   | 125                       | 16            | 6         | 300                    | 1 <sup>1)</sup> | 742                     | 667  | 297   |
| TRJE157*016#0150  | E         | 150              | 16                | 85                     | 10                   | 125                       | 16            | 6         | 150                    | 1 <sup>1)</sup> | 1049                    | 944  | 420   |
| TRJU227*016RRJV   | U         | 220              | 16                | 85                     | 10                   | 125                       | 26.4          | 12        | 500                    | 3               | 574                     | 517  | 230   |
| TRJU227*016R0200V | U         | 220              | 16                | 85                     | 10                   | 125                       | 26.4          | 12        | 200                    | 3               | 908                     | 817  | 363   |
| TRJU337*016RRJV   | U         | 330              | 16                | 85                     | 10                   | 125                       | 39            | 30        | 400                    | 3               | 642                     | 578  | 257   |
| TRJU337*016R0200V | U         | 330              | 16                | 85                     | 10                   | 125                       | 39            | 30        | 200                    | 3               | 908                     | 817  | 363   |
| 20 Volt @ 85°C    |           |                  |                   |                        |                      |                           |               |           |                        |                 |                         |      |       |
| TRJA105*020#RJ    | A         | 1                | 20                | 85                     | 13                   | 125                       | 0.3           | 4         | 6630                   | 1               | 106                     | 96   | 43    |
| TRJA105*020#3000  | A         | 1                | 20                | 85                     | 13                   | 125                       | 0.3           | 4         | 3000                   | 1               | 158                     | 142  | 63    |
| TRJA155*020#RJ    | A         | 1.5              | 20                | 85                     | 13                   | 125                       | 0.3           | 6         | 5460                   | 1               | 117                     | 105  | 47    |
| TRJA155*020#3000  | A         | 1.5              | 20                | 85                     | 13                   | 125                       | 0.3           | 6         | 3000                   | 1               | 158                     | 142  | 63    |
| TRJA225*020#RJ    | A         | 2.2              | 20                | 85                     | 13                   | 125                       | 0.33          | 6         | 4550                   | 1               | 128                     | 116  | 51    |
| TRJA225*020#3000  | A         | 2.2              | 20                | 85                     | 13                   | 125                       | 0.33          | 6         | 3000                   | 1               | 158                     | 142  | 63    |
| TRJA335*020#RJ    | A         | 3.3              | 20                | 85                     | 13                   | 125                       | 0.5           | 6         | 3740                   | 1               | 142                     | 127  | 57    |
| TRJA335*020#2500  | A         | 3.3              | 20                | 85                     | 13                   | 125                       | 0.5           | 6         | 2500                   | 1               | 173                     | 156  | 69    |

### RATINGS & PART NUMBER REFERENCE

| AVX Part No.      | Case Size | Capacitance (µF) | Rated Voltage (V) | Rated Temperature (°C) | Category Voltage (V) | Category Temperature (°C) | DCL (µA) Max. | DF % Max. | ESR Max. (mΩ) @ 100kHz | MSL             | 100kHz RMS Current (mA) |      |       |
|-------------------|-----------|------------------|-------------------|------------------------|----------------------|---------------------------|---------------|-----------|------------------------|-----------------|-------------------------|------|-------|
|                   |           |                  |                   |                        |                      |                           |               |           |                        |                 | 25°C                    | 85°C | 125°C |
| TRJB335*020#RJ    | B         | 3.3              | 20                | 85                     | 13                   | 125                       | 0.5           | 6         | 3740                   | 1               | 151                     | 136  | 60    |
| TRJB335*020#1300  | B         | 3.3              | 20                | 85                     | 13                   | 125                       | 0.5           | 6         | 1300                   | 1               | 256                     | 230  | 102   |
| TRJA475*020#RJ    | A         | 4.7              | 20                | 85                     | 13                   | 125                       | 0.71          | 5         | 2500                   | 1               | 184                     | 166  | 74    |
| TRJA475*020#1800  | A         | 4.7              | 20                | 85                     | 13                   | 125                       | 0.71          | 5         | 1800                   | 1               | 217                     | 196  | 87    |
| TRJB475*020#RJ    | B         | 4.7              | 20                | 85                     | 13                   | 125                       | 0.71          | 6         | 3160                   | 1               | 164                     | 148  | 66    |
| TRJB475*020#1000  | B         | 4.7              | 20                | 85                     | 13                   | 125                       | 0.71          | 6         | 1000                   | 1               | 292                     | 262  | 117   |
| TRJB685*020#RJ    | B         | 6.8              | 20                | 85                     | 13                   | 125                       | 1             | 6         | 2650                   | 1               | 179                     | 161  | 72    |
| TRJB685*020#1000  | B         | 6.8              | 20                | 85                     | 13                   | 125                       | 1             | 6         | 1000                   | 1               | 292                     | 262  | 117   |
| TRJC685*020#RJ    | C         | 6.8              | 20                | 85                     | 13                   | 125                       | 1             | 6         | 2000                   | 1               | 235                     | 211  | 94    |
| TRJB106*020#RJ    | B         | 10               | 20                | 85                     | 13                   | 125                       | 1.5           | 6         | 2200                   | 1               | 197                     | 177  | 79    |
| TRJB106*020#1000  | B         | 10               | 20                | 85                     | 13                   | 125                       | 1.5           | 6         | 1000                   | 1               | 292                     | 262  | 117   |
| TRJC106*020#RJ    | C         | 10               | 20                | 85                     | 13                   | 125                       | 1.5           | 6         | 800                    | 1               | 371                     | 334  | 148   |
| TRJC106*020#0500  | C         | 10               | 20                | 85                     | 13                   | 125                       | 1.5           | 6         | 500                    | 1               | 469                     | 422  | 188   |
| TRJB156*020#RJ    | B         | 15               | 20                | 85                     | 13                   | 125                       | 2.3           | 6         | 1400                   | 1               | 280                     | 252  | 112   |
| TRJB156*020#0500  | B         | 15               | 20                | 85                     | 13                   | 125                       | 2.3           | 6         | 500                    | 1               | 469                     | 422  | 188   |
| TRJC156*020#RJ    | C         | 15               | 20                | 85                     | 13                   | 125                       | 2.3           | 6         | 720                    | 1               | 391                     | 352  | 156   |
| TRJC156*020#0400  | C         | 15               | 20                | 85                     | 13                   | 125                       | 2.3           | 6         | 400                    | 1               | 524                     | 472  | 210   |
| TRJD156*020#RJ    | D         | 15               | 20                | 85                     | 13                   | 125                       | 2.3           | 6         | 1100                   | 1               | 369                     | 332  | 148   |
| TRJC226*020#RJ    | C         | 22               | 20                | 85                     | 13                   | 125                       | 3.3           | 6         | 650                    | 1               | 411                     | 370  | 165   |
| TRJC226*020#0400  | C         | 22               | 20                | 85                     | 13                   | 125                       | 3.3           | 6         | 400                    | 1               | 524                     | 472  | 210   |
| TRJD226*020#RJ    | D         | 22               | 20                | 85                     | 13                   | 125                       | 3.3           | 6         | 650                    | 1               | 480                     | 432  | 192   |
| TRJD226*020#0150  | D         | 22               | 20                | 85                     | 13                   | 125                       | 3.3           | 6         | 150                    | 1               | 1000                    | 900  | 400   |
| TRJD226*020#0300  | D         | 22               | 20                | 85                     | 13                   | 125                       | 3.3           | 6         | 300                    | 1               | 707                     | 636  | 283   |
| TRJC336*020#RJ    | C         | 33               | 20                | 85                     | 13                   | 125                       | 5             | 6         | 590                    | 1               | 432                     | 389  | 173   |
| TRJC336*020#0300  | C         | 33               | 20                | 85                     | 13                   | 125                       | 5             | 6         | 300                    | 1               | 606                     | 545  | 242   |
| TRJD336*020#RJ    | D         | 33               | 20                | 85                     | 13                   | 125                       | 5             | 6         | 590                    | 1               | 504                     | 454  | 202   |
| TRJD336*020#0250  | D         | 33               | 20                | 85                     | 13                   | 125                       | 5             | 6         | 250                    | 1               | 775                     | 697  | 310   |
| TRJD476*020#RJ    | D         | 47               | 20                | 85                     | 13                   | 125                       | 7.1           | 6         | 540                    | 1               | 527                     | 474  | 211   |
| TRJD476*020#0200  | D         | 47               | 20                | 85                     | 13                   | 125                       | 7.1           | 6         | 200                    | 1               | 866                     | 779  | 346   |
| TRJD686*020#RJ    | D         | 68               | 20                | 85                     | 13                   | 125                       | 10            | 6         | 490                    | 1               | 553                     | 498  | 221   |
| TRJD686*020#0200  | D         | 68               | 20                | 85                     | 13                   | 125                       | 10            | 6         | 200                    | 1               | 866                     | 779  | 346   |
| TRJE686*020#RJ    | E         | 68               | 20                | 85                     | 13                   | 125                       | 10            | 6         | 490                    | 1 <sup>1)</sup> | 580                     | 522  | 232   |
| TRJE686*020#0120  | E         | 68               | 20                | 85                     | 13                   | 125                       | 10            | 6         | 120                    | 1 <sup>1)</sup> | 1173                    | 1055 | 469   |
| TRJE686*020#0200  | E         | 68               | 20                | 85                     | 13                   | 125                       | 10            | 6         | 200                    | 1 <sup>1)</sup> | 908                     | 817  | 363   |
| TRJE107*020#RJ    | E         | 100              | 20                | 85                     | 13                   | 125                       | 15            | 6         | 300                    | 1 <sup>1)</sup> | 742                     | 667  | 297   |
| TRJE107*020#0150  | E         | 100              | 20                | 85                     | 13                   | 125                       | 15            | 6         | 150                    | 1 <sup>1)</sup> | 1049                    | 944  | 420   |
| TRJU157*020RRJV   | U         | 150              | 20                | 85                     | 13                   | 125                       | 22            | 30        | 500                    | 3               | 574                     | 517  | 230   |
| TRJU157*020R0250V | U         | 150              | 20                | 85                     | 13                   | 125                       | 22            | 30        | 250                    | 3               | 812                     | 731  | 325   |
| 25 Volt @ 85°C    |           |                  |                   |                        |                      |                           |               |           |                        |                 |                         |      |       |
| TRJA474*025#RJ    | A         | 0.47             | 25                | 85                     | 17                   | 125                       | 0.3           | 4         | 9530                   | 1               | 89                      | 80   | 35    |
| TRJA474*025#7000  | A         | 0.47             | 25                | 85                     | 17                   | 125                       | 0.3           | 4         | 7000                   | 1               | 104                     | 93   | 41    |
| TRJA684*025#RJ    | A         | 0.68             | 25                | 85                     | 17                   | 125                       | 0.3           | 4         | 7980                   | 1               | 97                      | 87   | 39    |
| TRJA684*025#6000  | A         | 0.68             | 25                | 85                     | 17                   | 125                       | 0.3           | 4         | 6000                   | 1               | 112                     | 101  | 45    |
| TRJA105*025#RJ    | A         | 1                | 25                | 85                     | 17                   | 125                       | 0.3           | 4         | 6630                   | 1               | 106                     | 96   | 43    |
| TRJA105*025#3000  | A         | 1                | 25                | 85                     | 17                   | 125                       | 0.3           | 4         | 3000                   | 1               | 158                     | 142  | 63    |
| TRJA155*025#RJ    | A         | 1.5              | 25                | 85                     | 17                   | 125                       | 0.3           | 6         | 5460                   | 1               | 117                     | 105  | 47    |
| TRJA155*025#3000  | A         | 1.5              | 25                | 85                     | 17                   | 125                       | 0.3           | 6         | 3000                   | 1               | 158                     | 142  | 63    |
| TRJB155*025#RJ    | B         | 1.5              | 25                | 85                     | 17                   | 125                       | 0.3           | 6         | 5000                   | 1               | 130                     | 117  | 52    |
| TRJA225*025#RJ    | A         | 2.2              | 25                | 85                     | 17                   | 125                       | 0.41          | 6         | 2900                   | 1               | 161                     | 145  | 64    |
| TRJA225*025#1600  | A         | 2.2              | 25                | 85                     | 17                   | 125                       | 0.41          | 6         | 1600                   | 1               | 217                     | 195  | 87    |
| TRJB225*025#RJ    | B         | 2.2              | 25                | 85                     | 17                   | 125                       | 0.41          | 6         | 4550                   | 1               | 137                     | 123  | 55    |
| TRJB225*025#1200  | B         | 2.2              | 25                | 85                     | 17                   | 125                       | 0.41          | 6         | 1200                   | 1               | 266                     | 240  | 106   |
| TRJB335*025#RJ    | B         | 3.3              | 25                | 85                     | 17                   | 125                       | 0.62          | 6         | 3740                   | 1               | 151                     | 136  | 60    |
| TRJB335*025#2000  | B         | 3.3              | 25                | 85                     | 17                   | 125                       | 0.62          | 6         | 2000                   | 1               | 206                     | 186  | 82    |
| TRJB475*025#RJ    | B         | 4.7              | 25                | 85                     | 17                   | 125                       | 0.88          | 6         | 3160                   | 1               | 164                     | 148  | 66    |
| TRJB475*025#1000  | B         | 4.7              | 25                | 85                     | 17                   | 125                       | 0.88          | 6         | 1000                   | 1               | 292                     | 262  | 117   |
| TRJB685*025#RJ    | B         | 6.8              | 25                | 85                     | 17                   | 125                       | 1.3           | 6         | 1500                   | 1               | 238                     | 214  | 95    |
| TRJB685*025#1000  | B         | 6.8              | 25                | 85                     | 17                   | 125                       | 1.3           | 6         | 1000                   | 1               | 292                     | 262  | 117   |
| TRJC685*025#RJ    | C         | 6.8              | 25                | 85                     | 17                   | 125                       | 1.3           | 6         | 1070                   | 1               | 321                     | 289  | 128   |
| TRJC685*025#0600  | C         | 6.8              | 25                | 85                     | 17                   | 125                       | 1.3           | 6         | 600                    | 1               | 428                     | 385  | 171   |
| TRJC106*025#RJ    | C         | 10               | 25                | 85                     | 17                   | 125                       | 1.9           | 6         | 800                    | 1               | 371                     | 334  | 148   |
| TRJC106*025#0600  | C         | 10               | 25                | 85                     | 17                   | 125                       | 1.9           | 6         | 600                    | 1               | 428                     | 385  | 171   |
| TRJD106*025#RJ    | D         | 10               | 25                | 85                     | 17                   | 125                       | 1.9           | 6         | 1200                   | 1               | 354                     | 318  | 141   |
| TRJC156*025#RJ    | C         | 15               | 25                | 85                     | 17                   | 125                       | 2.8           | 6         | 720                    | 1               | 391                     | 352  | 156   |
| TRJC156*025#0500  | C         | 15               | 25                | 85                     | 17                   | 125                       | 2.8           | 6         | 500                    | 1               | 469                     | 422  | 188   |
| TRJD156*025#RJ    | D         | 15               | 25                | 85                     | 17                   | 125                       | 2.8           | 6         | 720                    | 1               | 456                     | 411  | 183   |
| TRJD156*025#0300  | D         | 15               | 25                | 85                     | 17                   | 125                       | 2.8           | 6         | 300                    | 1               | 707                     | 636  | 283   |
| TRJD226*025#RJ    | D         | 22               | 25                | 85                     | 17                   | 125                       | 4.1           | 6         | 650                    | 1               | 480                     | 432  | 192   |
| TRJD226*025#0300  | D         | 22               | 25                | 85                     | 17                   | 125                       | 4.1           | 6         | 300                    | 1               | 707                     | 636  | 283   |
| TRJD336*025#RJ    | D         | 33               | 25                | 85                     | 17                   | 125                       | 6.2           | 6         | 590                    | 1               | 504                     | 454  | 202   |
| TRJD336*025#0400  | D         | 33               | 25                | 85                     | 17                   | 125                       | 6.2           | 6         | 400                    | 1               | 612                     | 551  | 245   |



### RATINGS & PART NUMBER REFERENCE

| AVX Part No.          | Case Size | Capacitance (µF) | Rated Voltage (V) | Rated Temperature (°C) | Category Voltage (V) | Category Temperature (°C) | DCL (µA) Max. | DF % Max. | ESR Max. (mΩ) @ 100kHz | MSL             | 100kHz RMS Current (mA) |      |       |
|-----------------------|-----------|------------------|-------------------|------------------------|----------------------|---------------------------|---------------|-----------|------------------------|-----------------|-------------------------|------|-------|
|                       |           |                  |                   |                        |                      |                           |               |           |                        |                 | 25°C                    | 85°C | 125°C |
| TRJD476*025#RJ        | D         | 47               | 25                | 85                     | 17                   | 125                       | 8.8           | 6         | 540                    | 1               | 527                     | 474  | 211   |
| TRJD476*025#0250      | D         | 47               | 25                | 85                     | 17                   | 125                       | 8.8           | 6         | 250                    | 1               | 775                     | 697  | 310   |
| TRJE476*025#RJ        | E         | 47               | 25                | 85                     | 17                   | 125                       | 8.8           | 6         | 540                    | 1 <sup>1)</sup> | 553                     | 497  | 221   |
| TRJE476*025#0150      | E         | 47               | 25                | 85                     | 17                   | 125                       | 8.8           | 6         | 150                    | 1 <sup>1)</sup> | 1049                    | 944  | 420   |
| TRJU686*025RRJV       | U         | 68               | 25                | 85                     | 17                   | 125                       | 12            | 30        | 500                    | 3               | 574                     | 517  | 230   |
| TRJU107*025RRJV       | U         | 100              | 25                | 85                     | 17                   | 125                       | 18            | 30        | 500                    | 3               | 574                     | 517  | 230   |
| <b>35 Volt @ 85°C</b> |           |                  |                   |                        |                      |                           |               |           |                        |                 |                         |      |       |
| TRJA104*035#RJ        | A         | 0.1              | 35                | 85                     | 23                   | 125                       | 0.3           | 4         | 20000                  | 1               | 61                      | 55   | 24    |
| TRJA154*035#RJ        | A         | 0.15             | 35                | 85                     | 23                   | 125                       | 0.3           | 4         | 16470                  | 1               | 67                      | 61   | 27    |
| TRJA154*035#6000      | A         | 0.15             | 35                | 85                     | 23                   | 125                       | 0.3           | 4         | 6000                   | 1               | 112                     | 101  | 45    |
| TRJA224*035#RJ        | A         | 0.22             | 35                | 85                     | 23                   | 125                       | 0.3           | 4         | 13710                  | 1               | 74                      | 67   | 30    |
| TRJA224*035#6000      | A         | 0.22             | 35                | 85                     | 23                   | 125                       | 0.3           | 4         | 6000                   | 1               | 112                     | 101  | 45    |
| TRJA334*035#RJ        | A         | 0.33             | 35                | 85                     | 23                   | 125                       | 0.3           | 4         | 11280                  | 1               | 82                      | 73   | 33    |
| TRJA334*035#6000      | A         | 0.33             | 35                | 85                     | 23                   | 125                       | 0.3           | 4         | 6000                   | 1               | 112                     | 101  | 45    |
| TRJA474*035#RJ        | A         | 0.47             | 35                | 85                     | 23                   | 125                       | 0.3           | 4         | 9530                   | 1               | 89                      | 80   | 35    |
| TRJA474*035#4000      | A         | 0.47             | 35                | 85                     | 23                   | 125                       | 0.3           | 4         | 4000                   | 1               | 137                     | 123  | 55    |
| TRJA684*035#RJ        | A         | 0.68             | 35                | 85                     | 23                   | 125                       | 0.3           | 4         | 7980                   | 1               | 97                      | 87   | 39    |
| TRJA684*035#6000      | A         | 0.68             | 35                | 85                     | 23                   | 125                       | 0.3           | 4         | 6000                   | 1               | 112                     | 101  | 45    |
| TRJA105*035#RJ        | A         | 1                | 35                | 85                     | 23                   | 125                       | 0.3           | 4         | 6630                   | 1               | 106                     | 96   | 43    |
| TRJA105*035#3000      | A         | 1                | 35                | 85                     | 23                   | 125                       | 0.3           | 4         | 3000                   | 1               | 158                     | 142  | 63    |
| TRJB105*035#RJ        | B         | 1                | 35                | 85                     | 23                   | 125                       | 0.3           | 4         | 3400                   | 1               | 158                     | 142  | 63    |
| TRJB105*035#2000      | B         | 1                | 35                | 85                     | 23                   | 125                       | 0.3           | 4         | 2000                   | 1               | 206                     | 186  | 82    |
| TRJA155*035#RJ        | A         | 1.5              | 35                | 85                     | 23                   | 125                       | 0.39          | 6         | 3100                   | 1               | 166                     | 149  | 66    |
| TRJA155*035#2000      | A         | 1.5              | 35                | 85                     | 23                   | 125                       | 0.39          | 6         | 2000                   | 1               | 206                     | 186  | 82    |
| TRJB155*035#RJ        | B         | 1.5              | 35                | 85                     | 23                   | 125                       | 0.39          | 6         | 5460                   | 1               | 125                     | 112  | 50    |
| TRJB155*035#2500      | B         | 1.5              | 35                | 85                     | 23                   | 125                       | 0.39          | 6         | 2500                   | 1               | 184                     | 166  | 74    |
| TRJB225*035#RJ        | B         | 2.2              | 35                | 85                     | 23                   | 125                       | 0.58          | 6         | 4550                   | 1               | 137                     | 123  | 55    |
| TRJB225*035#2000      | B         | 2.2              | 35                | 85                     | 23                   | 125                       | 0.58          | 6         | 2000                   | 1               | 206                     | 186  | 82    |
| TRJB335*035#RJ        | B         | 3.3              | 35                | 85                     | 23                   | 125                       | 0.87          | 6         | 3740                   | 1               | 151                     | 136  | 60    |
| TRJB335*035#1000      | B         | 3.3              | 35                | 85                     | 23                   | 125                       | 0.87          | 6         | 1000                   | 1               | 292                     | 262  | 117   |
| TRJC335*035#RJ        | C         | 3.3              | 35                | 85                     | 23                   | 125                       | 0.87          | 6         | 1840                   | 1               | 245                     | 220  | 98    |
| TRJC335*035#0800      | C         | 3.3              | 35                | 85                     | 23                   | 125                       | 0.87          | 6         | 800                    | 1               | 371                     | 334  | 148   |
| TRJD335*035#RJ        | D         | 3.3              | 35                | 85                     | 23                   | 125                       | 0.87          | 6         | 2000                   | 1               | 274                     | 246  | 110   |
| TRJB475*035#RJ        | B         | 4.7              | 35                | 85                     | 23                   | 125                       | 1.2           | 6         | 2200                   | 1               | 224                     | 201  | 89    |
| TRJB475*035#1500      | B         | 4.7              | 35                | 85                     | 23                   | 125                       | 1.2           | 6         | 1500                   | 1               | 271                     | 244  | 108   |
| TRJC475*035#RJ        | C         | 4.7              | 35                | 85                     | 23                   | 125                       | 1.2           | 6         | 1410                   | 1               | 279                     | 251  | 112   |
| TRJC475*035#0600      | C         | 4.7              | 35                | 85                     | 23                   | 125                       | 1.2           | 6         | 600                    | 1               | 428                     | 385  | 171   |
| TRJD475*035#RJ        | D         | 4.7              | 35                | 85                     | 23                   | 125                       | 1.2           | 6         | 1500                   | 1               | 316                     | 285  | 126   |
| TRJC685*035#RJ        | C         | 6.8              | 35                | 85                     | 23                   | 125                       | 1.8           | 6         | 1070                   | 1               | 321                     | 289  | 128   |
| TRJC685*035#0600      | C         | 6.8              | 35                | 85                     | 23                   | 125                       | 1.8           | 6         | 600                    | 1               | 428                     | 385  | 171   |
| TRJD685*035#RJ        | D         | 6.8              | 35                | 85                     | 23                   | 125                       | 1.8           | 6         | 1300                   | 1               | 340                     | 306  | 136   |
| TRJC106*035#RJ        | C         | 10               | 35                | 85                     | 23                   | 125                       | 2.6           | 6         | 800                    | 1               | 371                     | 334  | 148   |
| TRJC106*035#0600      | C         | 10               | 35                | 85                     | 23                   | 125                       | 2.6           | 6         | 600                    | 1               | 428                     | 385  | 171   |
| TRJD106*035#RJ        | D         | 10               | 35                | 85                     | 23                   | 125                       | 2.6           | 6         | 800                    | 1               | 433                     | 390  | 173   |
| TRJD106*035#0250      | D         | 10               | 35                | 85                     | 23                   | 125                       | 2.6           | 6         | 250                    | 1               | 775                     | 697  | 310   |
| TRJD106*035#0400      | D         | 10               | 35                | 85                     | 23                   | 125                       | 2.6           | 6         | 400                    | 1               | 612                     | 551  | 245   |
| TRJD156*035#RJ        | D         | 15               | 35                | 85                     | 23                   | 125                       | 3.9           | 6         | 720                    | 1               | 456                     | 411  | 183   |
| TRJD156*035#0225      | D         | 15               | 35                | 85                     | 23                   | 125                       | 3.9           | 6         | 225                    | 1               | 816                     | 735  | 327   |
| TRJD226*035#RJ        | D         | 22               | 35                | 85                     | 23                   | 125                       | 5.8           | 6         | 650                    | 1               | 480                     | 432  | 192   |
| TRJD226*035#0200      | D         | 22               | 35                | 85                     | 23                   | 125                       | 5.8           | 6         | 200                    | 1               | 866                     | 779  | 346   |
| TRJD226*035#0400      | D         | 22               | 35                | 85                     | 23                   | 125                       | 5.8           | 6         | 400                    | 1               | 612                     | 551  | 245   |
| TRJE336*035#RJ        | E         | 33               | 35                | 85                     | 23                   | 125                       | 8.7           | 6         | 590                    | 1 <sup>1)</sup> | 529                     | 476  | 212   |
| TRJE336*035#0150      | E         | 33               | 35                | 85                     | 23                   | 125                       | 8.7           | 6         | 150                    | 1 <sup>1)</sup> | 1049                    | 944  | 420   |
| TRJE336*035#0250      | E         | 33               | 35                | 85                     | 23                   | 125                       | 8.7           | 6         | 250                    | 1 <sup>1)</sup> | 812                     | 731  | 325   |
| TRJU476*035RRJV       | U         | 47               | 35                | 85                     | 23                   | 125                       | 12.3          | 10        | 400                    | 3               | 642                     | 578  | 257   |
| TRJU476*035R0200V     | U         | 47               | 35                | 85                     | 23                   | 125                       | 12.3          | 10        | 200                    | 3               | 908                     | 8.17 | 363   |
| <b>50 Volt @ 85°C</b> |           |                  |                   |                        |                      |                           |               |           |                        |                 |                         |      |       |
| TRJA224*050#RJ        | A         | 0.22             | 50                | 85                     | 33                   | 125                       | 0.3           | 4         | 7500                   | 1               | 100                     | 90   | 40    |
| TRJA224*050#7000      | A         | 0.22             | 50                | 85                     | 33                   | 125                       | 0.3           | 4         | 7000                   | 1               | 104                     | 93   | 41    |
| TRJA334*050#RJ        | A         | 0.33             | 50                | 85                     | 33                   | 125                       | 0.3           | 4         | 7000                   | 1               | 104                     | 93   | 41    |
| TRJB474*050#RJ        | B         | 0.47             | 50                | 85                     | 33                   | 125                       | 0.3           | 4         | 5000                   | 1               | 130                     | 117  | 52    |
| TRJB684*050#RJ        | B         | 0.68             | 50                | 85                     | 33                   | 125                       | 0.3           | 4         | 4000                   | 1               | 146                     | 131  | 58    |
| TRJB684*050#2000      | B         | 0.68             | 50                | 85                     | 33                   | 125                       | 0.3           | 4         | 2000                   | 1               | 206                     | 186  | 82    |
| TRJB105*050#RJ        | B         | 1                | 50                | 85                     | 33                   | 125                       | 0.4           | 4         | 3400                   | 1               | 158                     | 142  | 63    |
| TRJB105*050#2000      | B         | 1                | 50                | 85                     | 33                   | 125                       | 0.4           | 4         | 2000                   | 1               | 206                     | 186  | 82    |
| TRJC105*050#RJ        | C         | 1                | 50                | 85                     | 33                   | 125                       | 0.4           | 4         | 3000                   | 1               | 191                     | 172  | 77    |
| TRJC155*050#RJ        | C         | 1.5              | 50                | 85                     | 33                   | 125                       | 0.6           | 6         | 2500                   | 1               | 210                     | 189  | 84    |
| TRJC155*050#1500      | C         | 1.5              | 50                | 85                     | 33                   | 125                       | 0.6           | 6         | 1500                   | 1               | 271                     | 244  | 108   |
| TRJC225*050#RJ        | C         | 2.2              | 50                | 85                     | 33                   | 125                       | 0.8           | 6         | 1700                   | 1               | 254                     | 229  | 102   |
| TRJC225*050#1000      | C         | 2.2              | 50                | 85                     | 33                   | 125                       | 0.8           | 6         | 1000                   | 1               | 332                     | 298  | 133   |
| TRJD225*050#RJ        | D         | 2.2              | 50                | 85                     | 33                   | 125                       | 0.8           | 4.5       | 2000                   | 1               | 274                     | 246  | 110   |

### RATINGS & PART NUMBER REFERENCE

| AVX Part No.     | Case Size | Capacitance (μF) | Rated Voltage (V) | Rated Temperature (°C) | Category Voltage (V) | Category Temperature (°C) | DCL (μA) Max. | DF % Max. | ESR Max. (mΩ) @ 100kHz | MSL             | 100kHz RMS Current (mA) |      |       |
|------------------|-----------|------------------|-------------------|------------------------|----------------------|---------------------------|---------------|-----------|------------------------|-----------------|-------------------------|------|-------|
|                  |           |                  |                   |                        |                      |                           |               |           |                        |                 | 25°C                    | 85°C | 125°C |
| TRJD225*050#1200 | D         | 2.2              | 50                | 85                     | 33                   | 125                       | 0.8           | 4.5       | 1200                   | 1               | 354                     | 318  | 141   |
| TRJC335*050#RJ   | C         | 3.3              | 50                | 85                     | 33                   | 125                       | 1.2           | 6         | 1400                   | 1               | 280                     | 252  | 112   |
| TRJC335*050#1000 | C         | 3.3              | 50                | 85                     | 33                   | 125                       | 1.2           | 6         | 1000                   | 1               | 332                     | 298  | 133   |
| TRJD335*050#RJ   | D         | 3.3              | 50                | 85                     | 33                   | 125                       | 1.2           | 4.5       | 1100                   | 1               | 369                     | 332  | 148   |
| TRJD335*050#0800 | D         | 3.3              | 50                | 85                     | 33                   | 125                       | 1.2           | 4.5       | 800                    | 1               | 433                     | 390  | 173   |
| TRJD475*050#RJ   | D         | 4.7              | 50                | 85                     | 33                   | 125                       | 1.8           | 4.5       | 900                    | 1               | 408                     | 367  | 163   |
| TRJD475*050#0600 | D         | 4.7              | 50                | 85                     | 33                   | 125                       | 1.8           | 4.5       | 600                    | 1               | 500                     | 450  | 200   |
| TRJD685*050#RJ   | D         | 6.8              | 50                | 85                     | 33                   | 125                       | 2.6           | 4.5       | 700                    | 1               | 463                     | 417  | 185   |
| TRJE106*050#RJ   | E         | 10               | 50                | 85                     | 33                   | 125                       | 3.8           | 4.5       | 700                    | 1 <sup>1)</sup> | 486                     | 437  | 194   |
| TRJE106*050#0300 | E         | 10               | 50                | 85                     | 33                   | 125                       | 3.8           | 4.5       | 300                    | 1 <sup>1)</sup> | 742                     | 667  | 297   |
| TRJE106*050#0400 | E         | 10               | 50                | 85                     | 33                   | 125                       | 3.8           | 4.5       | 400                    | 1 <sup>1)</sup> | 642                     | 578  | 257   |
| TRJU156*050RRJV  | U         | 15               | 50                | 85                     | 33                   | 125                       | 5.6           | 30        | 500                    | 3               | 574                     | 517  | 230   |
| TRJU226*050RRJV  | U         | 22               | 50                | 85                     | 33                   | 125                       | 8.2           | 30        | 500                    | 3               | 574                     | 517  | 230   |

<sup>1)</sup> Dry pack option (see How to order) recommended for reduction of stress during soldering. Dry pack parts should be treated as MSL 3.

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.

The EIA & CECC standards for low ESR Solid Tantalum Capacitors allow an ESR movement to 1.25 times catalogue limit post mounting.

For typical weight and composition see page 202.

**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                  | TRJ professional series (Temperature range -55°C to +125°C)                                                                                                                                                                                                                                    |               |               |                    |                              |           |       |           |            |       |
|-----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|---------------|--------------------|------------------------------|-----------|-------|-----------|------------|-------|
|                       | Condition                                                                                                                                                                                                                                                                                      |               |               | Characteristics    |                              |           |       |           |            |       |
| Endurance             | Determine after application of rated voltage for 2000 +48/-0 hours at 85±2°C and then leaving 1-2 hours at room temperature. Also determine of 125°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 ±10% of initial value |           |       |           |            |       |
|                       |                                                                                                                                                                                                                                                                                                |               |               | DF                 | initial limit                |           |       |           |            |       |
|                       |                                                                                                                                                                                                                                                                                                |               |               | ESR                | 1.25 x initial limit         |           |       |           |            |       |
| Storage Life          | 125°C, 0V, 2000h                                                                                                                                                                                                                                                                               |               |               | Visual examination | no visible damage            |           |       |           |            |       |
|                       |                                                                                                                                                                                                                                                                                                |               |               | DCL                | 1.25 x initial limit         |           |       |           |            |       |
|                       |                                                                                                                                                                                                                                                                                                |               |               | ΔC/C               | within ±10% of initial value |           |       |           |            |       |
|                       |                                                                                                                                                                                                                                                                                                |               |               | DF                 | initial limit                |           |       |           |            |       |
|                       |                                                                                                                                                                                                                                                                                                |               |               | ESR                | 1.25 x initial limit         |           |       |           |            |       |
| Humidity              | Determine after storage without applied voltage at 65±2°C and 95±2% relative humidity for 500 hours and then recovery 1-2 hours at room temperature.                                                                                                                                           |               |               | Visual examination | no visible damage            |           |       |           |            |       |
|                       |                                                                                                                                                                                                                                                                                                |               |               | DCL                | 1.5 x initial limit          |           |       |           |            |       |
|                       |                                                                                                                                                                                                                                                                                                |               |               | ΔC/C               | within ±10% of initial value |           |       |           |            |       |
|                       |                                                                                                                                                                                                                                                                                                |               |               | DF                 | 1.2 x initial limit          |           |       |           |            |       |
|                       |                                                                                                                                                                                                                                                                                                |               |               | ESR                | 1.25 x initial limit         |           |       |           |            |       |
| Biased Humidity       | Determine after leaving for 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                | 2 x initial limit            |           |       |           |            |       |
|                       |                                                                                                                                                                                                                                                                                                |               |               | ΔC/C               | within ±10% of initial value |           |       |           |            |       |
|                       |                                                                                                                                                                                                                                                                                                |               |               | DF                 | 1.2 x initial limit          |           |       |           |            |       |
|                       |                                                                                                                                                                                                                                                                                                |               |               | ESR                | 1.25 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            |                    | IL*                          | n/a       | IL*   | 10 x IL*  | 12.5 x IL* | IL*   |
|                       | 2                                                                                                                                                                                                                                                                                              | -55+0/-3      | 15            | DCL                |                              |           |       |           |            |       |
|                       | 3                                                                                                                                                                                                                                                                                              | +20±2         | 15            | ΔC/C               | n/a                          | +0/-10%   | ±5%   | +10/-0%   | +12/-0%    | ±5%   |
|                       | 4                                                                                                                                                                                                                                                                                              | +85+3/-0      | 15            | DF                 | IL*                          | 1.5 x IL* | IL*   | 1.5 x IL* | 2 x IL*    | IL*   |
|                       | 5                                                                                                                                                                                                                                                                                              | +125+3/-0     | 15            |                    |                              |           |       |           |            |       |
| Surge Voltage         | Test temperature: 125°C±3/0°C<br>Test voltage: Category voltage at 125°C<br>Surge voltage: 1.3 x category voltage at 125°C<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                | initial limit                |           |       |           |            |       |
|                       |                                                                                                                                                                                                                                                                                                |               |               | ΔC/C               | within ±5% of initial value  |           |       |           |            |       |
|                       |                                                                                                                                                                                                                                                                                                |               |               | DF                 | initial limit                |           |       |           |            |       |
|                       |                                                                                                                                                                                                                                                                                                |               |               | ESR                | 1.25 x initial limit         |           |       |           |            |       |

\*Initial Limit