



## Solid Tantalum Surface Mount Chip Capacitors TANTAMOUNT™, Molded Case, Low ESR



### LINKS TO ADDITIONAL RESOURCES



3D Models



Calculators



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Did You Know?



Technical Notes

### PERFORMANCE / ELECTRICAL CHARACTERISTICS

[www.vishay.com/doc?40192](http://www.vishay.com/doc?40192)

**Operating Temperature:** -55 °C to +125 °C  
(above 85 °C, voltage derating is required)

**Capacitance Range:** 0.47 µF to 1000 µF

**Capacitance Tolerance:** ± 10 %, ± 20 %

**Voltage Rating:** 4 V<sub>DC</sub> to 75 V<sub>DC</sub>

#### Note

- For recommended voltage derating guidelines see "Typical Performance Characteristics"

### FEATURES

- Low ESR
- Surge current tested:  
cases A and B - selected ratings  
cases C, D, E, and W - all ratings
- Qualified to EIA-717
- Molded case available in seven case codes
- High ripple current carrying capability
- Terminations: 100 % matte tin standard,  
tin / lead available
- Compatible with "high volume" automatic pick and place equipment
- Compliant terminations
- Moisture sensitivity level 1
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)

#### Note

\* This datasheet provides information about parts that are RoHS-compliant and / or parts that are non RoHS-compliant. For example, parts with lead (Pb) terminations are not RoHS-compliant. Please see the information / tables in this datasheet for details

### APPLICATIONS

- Industrial
- Telecom infrastructure
- Consumer
- Computer
- General purpose

Pb-free  
AvailableRoHS\*  
Available

HALOGEN

FREE

GREEN

(5-2008)

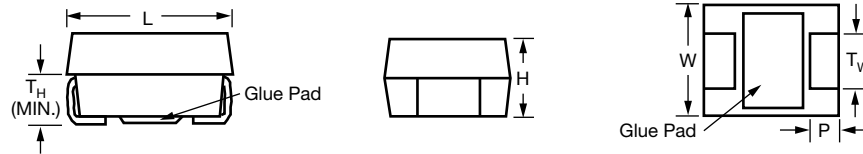
Available

### ORDERING INFORMATION

| TR3<br>TYPE | D<br>CASE CODE                   | 107<br>CAPACITANCE                                                                                                             | K<br>CAPACITANCE TOLERANCE | 010<br>DC VOLTAGE RATING AT +85 °C                                                                                                                 | C<br>TERMINATION AND PACKAGING                                                                                                                                                                                                                                                        | 0100<br>ESR                                |
|-------------|----------------------------------|--------------------------------------------------------------------------------------------------------------------------------|----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|
|             | See Ratings and Case Codes table | This is expressed in picofarads. The first two digits are the significant figures. The third is the number of zeros to follow. | K = ± 10 %<br>M = ± 20 %   | This is expressed in V. To complete the three-digit block, zeros precede the voltage rating. A decimal point is indicated by an "R" (6R3 = 6.3 V). | <b>Matte tin</b><br>C = 7" (178 mm) reel<br>D = 13" (330 mm) reel<br>V = 7" (178 mm) reel, dry pack<br>U = 13" (330 mm) reel, dry pack<br><br><b>Tin / lead</b><br>E = 7" (178 mm) reel<br>F = 13" (330 mm) reel<br>T = 7" (178 mm) reel, dry pack<br>W = 13" (330 mm) reel, dry pack | Maximum 100 kHz ESR in mΩ. See note below. |

#### Notes

- We reserve the right to supply higher voltage ratings and tighter capacitance tolerance capacitors in the same case size. Voltage substitutions will be marked with the higher voltage rating. Low ESR solid tantalum chip capacitors allow delta ESR of 1.25 times the datasheet limit after mounting
- Dry pack as specified in J-STD-033

**DIMENSIONS** in inches [millimeters]

| CASE CODE | EIA SIZE | L                             | W                             | H                             | P                              | T <sub>W</sub>                | T <sub>H</sub> (MIN.) |
|-----------|----------|-------------------------------|-------------------------------|-------------------------------|--------------------------------|-------------------------------|-----------------------|
| A         | 3216-18  | 0.126 ± 0.008<br>[3.2 ± 0.20] | 0.063 ± 0.008<br>[1.6 ± 0.20] | 0.063 ± 0.008<br>[1.6 ± 0.20] | 0.031 ± 0.012<br>[0.80 ± 0.30] | 0.047 ± 0.004<br>[1.2 ± 0.10] | 0.028<br>[0.70]       |
| B         | 3528-21  | 0.138 ± 0.008<br>[3.5 ± 0.20] | 0.110 ± 0.008<br>[2.8 ± 0.20] | 0.075 ± 0.008<br>[1.9 ± 0.20] | 0.031 ± 0.012<br>[0.80 ± 0.30] | 0.087 ± 0.004<br>[2.2 ± 0.10] | 0.028<br>[0.70]       |
| C         | 6032-28  | 0.236 ± 0.012<br>[6.0 ± 0.30] | 0.126 ± 0.012<br>[3.2 ± 0.30] | 0.098 ± 0.012<br>[2.5 ± 0.30] | 0.051 ± 0.012<br>[1.3 ± 0.30]  | 0.087 ± 0.004<br>[2.2 ± 0.10] | 0.039<br>[1.0]        |
| D         | 7343-31  | 0.287 ± 0.012<br>[7.3 ± 0.30] | 0.170 ± 0.012<br>[4.3 ± 0.30] | 0.110 ± 0.012<br>[2.8 ± 0.30] | 0.051 ± 0.012<br>[1.3 ± 0.30]  | 0.094 ± 0.004<br>[2.4 ± 0.10] | 0.039<br>[1.0]        |
| E         | 7343-43  | 0.287 ± 0.012<br>[7.3 ± 0.30] | 0.169 ± 0.012<br>[4.3 ± 0.30] | 0.157 ± 0.012<br>[4.0 ± 0.30] | 0.051 ± 0.012<br>[1.3 ± 0.30]  | 0.094 ± 0.004<br>[2.4 ± 0.10] | 0.039<br>[1.0]        |
| W         | 7361-38  | 0.287 ± 0.012<br>[7.3 ± 0.30] | 0.236 ± 0.012<br>[6.0 ± 0.30] | 0.138 ± 0.012<br>[3.5 ± 0.30] | 0.047 ± 0.008<br>[1.2 ± 0.20]  | 0.122 ± 0.004<br>[3.1 ± 0.10] | 0.069<br>[1.75]       |

**Note**

- Glue pad (non-conductive, part of molded case) is dedicated for glue attachment (as user option)

**RATINGS AND CASE CODES**

| μF   | 4 V | 6.3 V    | 10 V                                       | 16 V                                             | 20 V                                       | 25 V                                                                    | 35 V                                                             | 50 V                                                                         | 63 V              | 75 V                                        |
|------|-----|----------|--------------------------------------------|--------------------------------------------------|--------------------------------------------|-------------------------------------------------------------------------|------------------------------------------------------------------|------------------------------------------------------------------------------|-------------------|---------------------------------------------|
| 0.15 |     |          |                                            |                                                  |                                            |                                                                         |                                                                  | A (10.0)                                                                     |                   |                                             |
| 0.22 |     |          |                                            |                                                  |                                            |                                                                         | A (6.00)                                                         | A (10.0)                                                                     |                   |                                             |
| 0.33 |     |          |                                            |                                                  |                                            |                                                                         | A (6.00)                                                         | A (7.00)                                                                     |                   |                                             |
| 0.47 |     |          |                                            |                                                  |                                            | A (7.00)                                                                | A (4.00),<br>B (4.00)                                            | B (6.00),<br>C (2.30)                                                        |                   |                                             |
| 0.68 |     |          |                                            |                                                  |                                            | A (6.00)                                                                | A (6.00, 4.00)                                                   |                                                                              |                   |                                             |
| 1.0  |     |          |                                            | A (6.20)                                         | A (5.50, 3.00)                             | A (4.00)                                                                | A (6.00, 4.00,<br>3.00),<br>B (2.00)                             | B (4.00, 2.00),<br>C (1.60)                                                  |                   | D (3.00,<br>1.50)                           |
| 1.5  |     |          |                                            |                                                  | A (3.00)                                   | A (4.00, 3.00),<br>B (1.80)                                             | B (3.00, 2.00),<br>C (2.50, 0.90)                                | B (2.00),<br>C (1.50)                                                        |                   | B (2.00),<br>C (2.00),<br>D (2.00,<br>1.00) |
| 2.2  |     |          | A (6.80, 6.00,<br>1.80)                    | A (4.00, 3.50,<br>1.80)                          | A (4.00, 3.00)                             | A (4.00),<br>B (1.70, 1.50,<br>1.20, 0.90)                              | B (2.50, 2.00,<br>1.50),<br>C (1.50, 0.90)                       | B (2.00),<br>C (1.50),<br>D (0.80)                                           |                   | D (1.50)                                    |
| 3.3  |     | A (2.10) |                                            | A (4.00, 3.50),<br>B (2.50)                      | A (4.00),<br>B (1.30)                      | A (3.50, 3.00),<br>B (2.00, 1.50,<br>0.75)                              | B (1.50, 1.00),<br>C (0.80, 0.70,<br>0.60)                       | C (1.50),<br>D (0.80)                                                        | D (1.00,<br>0.80) | D (1.20,<br>1.00, 0.80)                     |
| 4.7  |     |          | A (3.00, 1.50,<br>1.40, 1.00),<br>B (1.40) | A (3.00, 2.50,<br>2.00, 1.50),<br>B (1.50, 0.80) | A (3.50, 1.80),<br>B (1.00, 0.75)          | A (3.50, 3.00),<br>B (1.50, 1.00,<br>0.90, 0.70),<br>C (0.60,<br>0.525) | B (1.50, 1.00,<br>0.70),<br>C (0.70, 0.60,<br>0.50),<br>D (0.70) | C (1.00, 0.70,<br>0.50),<br>D (0.70, 0.60,<br>0.50, 0.30),<br>E (0.60, 0.30) | D (0.70,<br>0.50) | E (1.50)                                    |
| 6.8  |     | A (1.80) | A (3.00, 1.80),<br>B (1.30)                | A (3.00, 1.50),<br>B (1.20, 0.60)                | A (3.20, 3.00,<br>2.60),<br>B (1.00, 0.60) | B (2.00, 1.50,<br>1.20, 0.70,<br>0.50, 0.40),<br>C (0.60, 0.50)         | C (0.90, 0.475),<br>D (0.50, 0.40,<br>0.30),<br>E (0.30)         | D (0.70, 0.60,<br>0.50, 0.30),<br>E (0.55, 0.50)                             |                   |                                             |

**Note**

- ESR limits in Ω are shown in parenthesis



| RATINGS AND CASE CODES |                                                                        |                                                                                              |                                                                                                                     |                                                                                                                                |                                                                                                       |                                                                                                |                                                                                                       |                                                                    |          |      |
|------------------------|------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------|----------|------|
| μF                     | 4 V                                                                    | 6.3 V                                                                                        | 10 V                                                                                                                | 16 V                                                                                                                           | 20 V                                                                                                  | 25 V                                                                                           | 35 V                                                                                                  | 50 V                                                               | 63 V     | 75 V |
| 10                     |                                                                        | A (2.00, 1.50),<br>B (1.50)                                                                  | A (2.00, 1.80,<br>1.00, 0.90),<br>B (1.00, 0.80,<br>0.75)                                                           | A (1.70),<br>B (0.80, 0.50),<br>C (0.60, 0.50,<br>0.45)                                                                        | B (1.00, 0.50),<br>C (0.70, 0.50,<br>0.475, 0.45,<br>0.40)                                            | B (1.30, 1.10,<br>0.90, 0.45),<br>C (0.60, 0.50,<br>0.45, 0.30),<br>D (0.40, 0.30)             | C (1.20, 0.45),<br>D (0.40, 0.30,<br>0.26, 0.25,<br>0.20, 0.135,<br>0.125),<br>E (0.25, 0.20)         | D (0.70, 0.55,<br>0.45),<br>E (0.70, 0.55,<br>0.50, 0.40,<br>0.30) | E (0.60) |      |
| 15                     | A (1.50)                                                               | A (2.00, 1.00)                                                                               | A (2.00, 1.00),<br>B (0.60, 0.45,<br>0.70), C (0.70)                                                                | B (0.80, 0.50),<br>C (0.40)                                                                                                    | B (1.00, 0.50),<br>C (0.40)                                                                           | B (1.00, 0.80,<br>0.60),<br>C (0.90,<br>0.425),<br>D (0.35,<br>0.275, 0.25,<br>0.20)           | C (0.60, 0.40),<br>D (0.35, 0.30,<br>0.26, 0.225,<br>0.20, 0.150),<br>E (0.30, 0.225,<br>0.20, 0.150) | E (0.40, 0.30,<br>0.25, 0.20)                                      |          |      |
| 22                     | A (1.50)                                                               | A (3.00, 2.00,<br>1.00, 0.90),<br>B (0.60),<br>C (0.50)                                      | A (1.50, 1.00,<br>0.90, 0.80),<br>B (1.00, 0.70,<br>0.50, 0.40),<br>C (0.40,<br>0.345, 0.30)                        | B (1.00, 0.70,<br>0.60, 0.40),<br>C (0.375,<br>0.350),<br>D (0.25)                                                             | B (0.80, 0.70,<br>0.60, 0.40),<br>C (0.40,<br>0.375),<br>D (0.30,<br>0.225, 0.20)                     | C (1.00, 0.90,<br>0.425, 0.40,<br>0.30, 0.275,<br>0.250),<br>D (0.30, 0.20),<br>E (0.30, 0.20) | D (0.40, 0.30,<br>0.275, 0.250,<br>0.20),<br>E (0.30, 0.275,<br>0.260, 0.20)                          |                                                                    |          |      |
| 33                     | A (1.50),<br>B (0.50)                                                  | A (2.00, 0.80,<br>0.60),<br>B (0.45, 0.35,<br>0.60, 0.50)                                    | B (0.140,<br>0.65, 0.60,<br>0.50, 0.425,<br>0.30),<br>C (0.375,<br>0.30)                                            | B (0.70, 0.50,<br>0.35),<br>C (0.30,<br>0.225),<br>D (0.25,<br>0.225, 0.15)                                                    | C (0.35, 0.30,<br>0.20),<br>D (0.40, 0.25,<br>0.20)                                                   | D (0.40, 0.30,<br>0.225, 0.20),<br>E (0.30, 0.20,<br>0.175)                                    | D (0.40, 0.25),<br>E (0.40, 0.25)                                                                     |                                                                    |          |      |
| 47                     | A (0.80, 0.50),<br>B (0.50)                                            | A (0.80),<br>B (0.55, 0.50,<br>0.35, 0.25),<br>C (0.30, 0.25)                                | B (0.65, 0.60,<br>0.50, 0.35),<br>C (0.35, 0.30,<br>0.20),<br>D (0.22, 0.20,<br>0.14, 0.135,<br>0.10)               | C (0.50, 0.35,<br>0.30),<br>D (0.20, 0.15,<br>0.12, 0.10,<br>0.080, 0.070)                                                     | D (0.20,<br>0.175, 0.15,<br>0.10),<br>E (0.15,<br>0.125)                                              | D (0.35, 0.25,<br>0.20, 0.15,<br>0.125, 0.10),<br>E (0.30, 0.20,<br>0.15, 0.125,<br>0.10)      | E<br>(0.40, 0.20) <sup>(1)</sup>                                                                      |                                                                    |          |      |
| 68                     | B (0.50),<br>C (0.275)                                                 | B (0.65, 0.55,<br>0.50, 0.35,<br>0.25),<br>C (0.275,<br>0.25, 0.20),<br>D (0.20,<br>0.175)   | B (1.50, 0.90,<br>0.75, 0.60),<br>C (0.30,<br>0.275, 0.225,<br>0.20),<br>D (0.20, 0.15,<br>0.10, 0.07),<br>E (0.15) | D (0.15, 0.10,<br>0.070)                                                                                                       | D (0.20,<br>0.175, 0.15,<br>0.115),<br>E (0.20, 0.15,<br>0.125, 0.12)                                 | E (0.25,<br>0.125)                                                                             |                                                                                                       |                                                                    |          |      |
| 100                    | A (1.00),<br>B (0.45),<br>C (0.225)                                    | B (1.50, 0.50,<br>0.40, 0.25),<br>C (0.30, 0.25,<br>0.15, 0.125,<br>0.10),<br>D (0.15, 0.14) | B (1.40),<br>C (0.20, 0.15,<br>0.10),<br>D (0.15, 0.10,<br>0.08, 0.07,<br>0.065, 0.05),<br>E (0.125,<br>0.15, 0.10) | D (0.15,<br>0.125, 0.10,<br>0.075),<br>E (0.15,<br>0.125, 0.10)                                                                | D (0.20, 0.15,<br>0.10, 0.085,<br>0.08),<br>E (0.20, 0.15,<br>0.10),<br>W (0.20, 0.10,<br>0.08, 0.06) | E (0.30, 0.25),<br>W (0.20, 0.15,<br>0.10)                                                     |                                                                                                       |                                                                    |          |      |
| 150                    | B (0.90, 0.50,<br>0.40),<br>C (0.25),<br>D (0.15)                      | C (0.30, 0.20),<br>D (0.15,<br>0.125,<br>0.075, 0.07,<br>0.05),<br>E (0.10)                  | C (0.50),<br>D (0.15, 0.10,<br>0.075, 0.07,<br>0.05),<br>E (0.10, 0.08)                                             | D (0.40, 0.15,<br>0.125, 0.10,<br>0.085, 0.075,<br>0.060),<br>E (0.40, 0.15,<br>0.10, 0.075,<br>0.060),<br>W (0.075,<br>0.060) | W (0.20, 0.15,<br>0.10, 0.08)                                                                         |                                                                                                |                                                                                                       |                                                                    |          |      |
| 220                    | B (1.10, 0.70,<br>0.50, 0.45),<br>C (0.20),<br>D (0.05, 0.15,<br>0.10) | C (0.30, 0.25,<br>0.225),<br>D (0.15, 0.10,<br>0.05),<br>E (0.15, 0.10)                      | D (0.15,<br>0.125, 0.10,<br>0.05),<br>E (0.15, 0.10,<br>0.070, 0.060,<br>0.050)                                     | E (0.15,<br>0.125, 0.10)                                                                                                       |                                                                                                       |                                                                                                |                                                                                                       |                                                                    |          |      |

**Notes**

- ESR limits in Ω are shown in parenthesis
- (1) 125 °C life test post test limits per AEC-Q200



## RATINGS AND CASE CODES

| μF   | 4 V                                                           | 6.3 V                                                                                           | 10 V                                                              | 16 V | 20 V | 25 V | 35 V | 50 V | 63 V | 75 V |
|------|---------------------------------------------------------------|-------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|------|------|------|------|------|------|------|
| 330  | D (0.10, 0.45, 0.035, 0.15)                                   | D (0.15, 0.125, 0.10, 0.06, 0.05, 0.45, 0.35),<br>E (0.15, 0.10, 0.05),<br>W (0.10, 0.06, 0.04) | D (0.15, 0.125, 0.10),<br>E (0.10, 0.06),<br>W (0.10, 0.06, 0.04) |      |      |      |      |      |      |      |
| 470  | D (0.125, 0.10, 0.06, 0.045, 0.035)<br>E (0.10, 0.045, 0.035) | D (0.20, 0.15, 0.125, 0.10),<br>E (0.10, 0.065, 0.06, 0.05),<br>W (0.10, 0.06, 0.05)            | E (0.20, 0.15, 0.10, 0.075),<br>W (0.10, 0.06, 0.05)              |      |      |      |      |      |      |      |
| 680  | D (0.10, 0.06),<br>E (0.10, 0.04)                             | E (0.10)                                                                                        |                                                                   |      |      |      |      |      |      |      |
| 1000 | E (0.10)                                                      | E (0.20, 0.15, 0.10),<br>W (0.05)                                                               |                                                                   |      |      |      |      |      |      |      |

## Note

- ESR limits in Ω are shown in parenthesis

## MARKING

|                                                                                                                                                                                                                                  |  | "A" CASE VOLTAGE CODE |      |                                                                                                                                                                                                                                                                 |  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|-----------------------|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
|                                                                                                                                                                                                                                  |  | VOLTS                 | CODE |                                                                                                                                                                                                                                                                 |  |
| <div><div>Capacitance code, pF</div><div>Indicates lead (Pb)-free</div><div>Date code designation</div><div><div><div></div><div>V 104L</div></div></div><div>Polarity band (+)</div><div>Voltage code</div></div> <p>A Case</p> |  | 4.0                   | G    | <div><div>Capacitance, μF</div><div>Voltage</div><div>Indicates lead (Pb)-free</div><div><div><div></div><div>22 10L</div></div><div>XX ②</div></div><div>Polarity band (+)</div><div>Date code</div><div>Vishay marking</div></div> <p>B, C, D, E, W Cases</p> |  |
|                                                                                                                                                                                                                                  |  | 6.3                   | J    |                                                                                                                                                                                                                                                                 |  |
|                                                                                                                                                                                                                                  |  | 10                    | A    |                                                                                                                                                                                                                                                                 |  |
|                                                                                                                                                                                                                                  |  | 16                    | C    |                                                                                                                                                                                                                                                                 |  |
|                                                                                                                                                                                                                                  |  | 20                    | D    |                                                                                                                                                                                                                                                                 |  |
|                                                                                                                                                                                                                                  |  | 25                    | E    |                                                                                                                                                                                                                                                                 |  |
|                                                                                                                                                                                                                                  |  | 35                    | V    |                                                                                                                                                                                                                                                                 |  |
|                                                                                                                                                                                                                                  |  | 50                    | T    |                                                                                                                                                                                                                                                                 |  |
|                                                                                                                                                                                                                                  |  | 75                    | S    |                                                                                                                                                                                                                                                                 |  |

## Marking

Capacitor marking includes an anode (+) polarity band, capacitance in microfarads and the voltage rating. "A" case capacitors use a letter code for the voltage and EIA capacitance code.

The Vishay identification marking is included if space permits. Vishay marking ("circled 2") may show additives in the form of short lines, depicting actual manufacturing facility. For A case capacitors discontinuation in polarity bar maybe used as actual manufacturing facility designation. Capacitors rated at 6.3 V are marked 6 V.

A manufacturing date code is marked on all capacitors, for details see FAQ: [www.vishay.com/doc?40110](http://www.vishay.com/doc?40110).

Capacitors may bear different marking scheme if parts are substituted with high performance Vishay Automotive Grade TP3 family or low DCL TX3 family products. Marking examples are shown below.

Call the factory for further explanation.

## ADDITIONAL MARKING EXAMPLES

## TP3 MARKING

|                      |                                |
|----------------------|--------------------------------|
| <p><b>A Case</b></p> | <p><b>B, C, D, E Cases</b></p> |
|----------------------|--------------------------------|

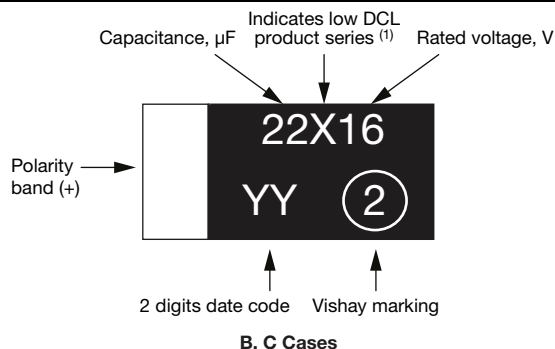
## Note

- (1) Capital letter indicates lead (Pb)-free



## ADDITIONAL MARKING EXAMPLES

## TX3 MARKING



## Note

<sup>(1)</sup> Capital letter indicates lead (Pb)-free

## STANDARD RATINGS

| CAPACITANCE<br>( $\mu\text{F}$ )                            | CASE<br>CODE | PART NUMBER          | MAX. DCL<br>AT +25 °C<br>( $\mu\text{A}$ ) | MAX. DF<br>AT +25 °C<br>120 Hz<br>(%) | MAX. ESR<br>AT +25 °C<br>100 kHz<br>( $\Omega$ ) | MAX. RIPPLE<br>100 kHz<br>$I_{\text{RMS}}$<br>(A) |
|-------------------------------------------------------------|--------------|----------------------|--------------------------------------------|---------------------------------------|--------------------------------------------------|---------------------------------------------------|
| 4 V <sub>DC</sub> AT +85 °C; 2.7 V <sub>DC</sub> AT +125 °C |              |                      |                                            |                                       |                                                  |                                                   |
| 15                                                          | A            | TR3A156(1)004(2)1500 | 0.6                                        | 6                                     | 1.500                                            | 0.22                                              |
| 22                                                          | A            | TR3A226(1)004(2)1500 | 0.9                                        | 6                                     | 1.500                                            | 0.22                                              |
| 33                                                          | A            | TR3A336(1)004(2)1500 | 1.3                                        | 6                                     | 1.500                                            | 0.22                                              |
| 33                                                          | B            | TR3B336(1)004(2)0500 | 1.3                                        | 6                                     | 0.500                                            | 0.41                                              |
| 47                                                          | A            | TR3A476(1)004(2)0800 | 1.9                                        | 14                                    | 0.800                                            | 0.31                                              |
| 47                                                          | A            | TR3A476(1)004(2)0500 | 1.9                                        | 14                                    | 0.500                                            | 0.39                                              |
| 47                                                          | B            | TR3B476(1)004(2)0500 | 1.9                                        | 6                                     | 0.500                                            | 0.41                                              |
| 68                                                          | B            | TR3B686(1)004(2)0500 | 2.7                                        | 6                                     | 0.500                                            | 0.41                                              |
| 68                                                          | C            | TR3C686(1)004(2)0275 | 2.7                                        | 6                                     | 0.275                                            | 0.63                                              |
| 100                                                         | A            | TR3A107M004(2)1000   | 10.0                                       | 30                                    | 1.000                                            | 0.27                                              |
| 100                                                         | B            | TR3B107(1)004(2)0450 | 4.0                                        | 8                                     | 0.450                                            | 0.43                                              |
| 100                                                         | C            | TR3C107(1)004(2)0225 | 4.0                                        | 6                                     | 0.225                                            | 0.70                                              |
| 150                                                         | B            | TR3B157(1)004(2)0900 | 6.0                                        | 14                                    | 0.900                                            | 0.31                                              |
| 150                                                         | B            | TR3B157(1)004(2)0500 | 6.0                                        | 14                                    | 0.500                                            | 0.41                                              |
| 150                                                         | B            | TR3B157(1)004(2)0400 | 6.0                                        | 14                                    | 0.400                                            | 0.46                                              |
| 150                                                         | C            | TR3C157(1)004(2)0250 | 6.0                                        | 12                                    | 0.250                                            | 0.66                                              |
| 150                                                         | D            | TR3D157(1)004(2)0150 | 6.0                                        | 8                                     | 0.150                                            | 1.00                                              |
| 220                                                         | B            | TR3B227M004(2)1100   | 8.8                                        | 18                                    | 1.100                                            | 0.28                                              |
| 220                                                         | B            | TR3B227M004(2)0700   | 8.8                                        | 18                                    | 0.700                                            | 0.35                                              |
| 220                                                         | B            | TR3B227M004(2)0500   | 8.8                                        | 18                                    | 0.500                                            | 0.41                                              |
| 220                                                         | B            | TR3B227M004(2)0450   | 8.8                                        | 18                                    | 0.450                                            | 0.43                                              |
| 220                                                         | C            | TR3C227(1)004(2)0200 | 8.8                                        | 8                                     | 0.200                                            | 0.74                                              |
| 220                                                         | D            | TR3D227(1)004(3)0050 | 8.8                                        | 8                                     | 0.050                                            | 1.73                                              |
| 220                                                         | D            | TR3D227(1)004(2)0150 | 8.8                                        | 8                                     | 0.150                                            | 1.00                                              |
| 220                                                         | D            | TR3D227(1)004(2)0100 | 8.8                                        | 8                                     | 0.100                                            | 1.22                                              |
| 330                                                         | D            | TR3D337(1)004(2)0100 | 13.2                                       | 8                                     | 0.100                                            | 1.22                                              |
| 330                                                         | D            | TR3D337(1)004(3)0045 | 13.2                                       | 8                                     | 0.045                                            | 1.83                                              |
| 330                                                         | D            | TR3D337(1)004(3)0035 | 13.2                                       | 8                                     | 0.035                                            | 2.07                                              |
| 330                                                         | D            | TR3D337(1)004(2)0150 | 13.2                                       | 8                                     | 0.150                                            | 1.00                                              |

## Note

- Part number definitions:
  - Capacitance tolerance codes: K, M
  - Terminations and packaging codes: C, D, E, F, V, U, T, W
  - Lead (Pb)-free terminations and packaging codes: C, D, V, U. Except: for case W, 7" reel is available only, codes C and V (dry pack option is recommended)



| STANDARD RATINGS                                            |              |                      |                                     |                                       |                                                  |                                            |
|-------------------------------------------------------------|--------------|----------------------|-------------------------------------|---------------------------------------|--------------------------------------------------|--------------------------------------------|
| CAPACITANCE<br>( $\mu$ F)                                   | CASE<br>CODE | PART NUMBER          | MAX. DCL<br>AT +25 °C<br>( $\mu$ A) | MAX. DF<br>AT +25 °C<br>120 Hz<br>(%) | MAX. ESR<br>AT +25 °C<br>100 kHz<br>( $\Omega$ ) | MAX. RIPPLE<br>100 kHz<br>$I_{RMS}$<br>(A) |
| 4 V <sub>DC</sub> AT +85 °C; 2.7 V <sub>DC</sub> AT +125 °C |              |                      |                                     |                                       |                                                  |                                            |
| 470                                                         | D            | TR3D477(1)004(2)0125 | 18.8                                | 10                                    | 0.125                                            | 1.10                                       |
| 470                                                         | D            | TR3D477(1)004(2)0100 | 18.8                                | 10                                    | 0.100                                            | 1.22                                       |
| 470                                                         | D            | TR3D477(1)004(2)0060 | 18.8                                | 10                                    | 0.060                                            | 1.58                                       |
| 470                                                         | D            | TR3D477(1)004(3)0045 | 18.8                                | 10                                    | 0.045                                            | 1.83                                       |
| 470                                                         | D            | TR3D477(1)004(3)0035 | 18.8                                | 10                                    | 0.035                                            | 2.07                                       |
| 470                                                         | E            | TR3E477(1)004(2)0100 | 18.8                                | 10                                    | 0.100                                            | 1.28                                       |
| 470                                                         | E            | TR3E477(1)004(3)0045 | 18.8                                | 10                                    | 0.045                                            | 1.91                                       |
| 470                                                         | E            | TR3E477(1)004(3)0035 | 18.8                                | 10                                    | 0.035                                            | 2.17                                       |
| 680                                                         | D            | TR3D687M004(2)0100   | 27.2                                | 25                                    | 0.100                                            | 1.22                                       |
| 680                                                         | D            | TR3D687M004(3)0060   | 27.2                                | 25                                    | 0.060                                            | 1.58                                       |
| 680                                                         | E            | TR3E687(1)004(2)0100 | 27.2                                | 12                                    | 0.100                                            | 1.28                                       |
| 680                                                         | E            | TR3E687(1)004(3)0040 | 27.2                                | 12                                    | 0.040                                            | 1.37                                       |
| 1000                                                        | E            | TR3E108M004(2)0100   | 40.0                                | 20                                    | 0.100                                            | 1.28                                       |
| 6.3 V <sub>DC</sub> AT +85 °C; 4 V <sub>DC</sub> AT +125 °C |              |                      |                                     |                                       |                                                  |                                            |
| 3.3                                                         | A            | TR3A335(1)6R3(2)2100 | 0.5                                 | 6                                     | 2.100                                            | 0.19                                       |
| 6.8                                                         | A            | TR3A685(1)6R3(2)1800 | 0.5                                 | 6                                     | 1.800                                            | 0.20                                       |
| 10                                                          | A            | TR3A106(1)6R3(2)2000 | 0.6                                 | 6                                     | 2.000                                            | 0.19                                       |
| 10                                                          | A            | TR3A106(1)6R3(2)1500 | 0.6                                 | 6                                     | 1.500                                            | 0.22                                       |
| 10                                                          | B            | TR3B106(1)6R3(2)1500 | 0.6                                 | 6                                     | 1.500                                            | 0.24                                       |
| 15                                                          | A            | TR3A156(1)6R3(2)2000 | 0.9                                 | 6                                     | 2.000                                            | 0.19                                       |
| 15                                                          | A            | TR3A156(1)6R3(2)1000 | 0.9                                 | 6                                     | 1.000                                            | 0.27                                       |
| 22                                                          | A            | TR3A226(1)6R3(2)3000 | 1.4                                 | 6                                     | 3.000                                            | 0.16                                       |
| 22                                                          | A            | TR3A226(1)6R3(2)2000 | 1.4                                 | 6                                     | 2.000                                            | 0.19                                       |
| 22                                                          | A            | TR3A226(1)6R3(2)1000 | 1.4                                 | 6                                     | 1.000                                            | 0.27                                       |
| 22                                                          | A            | TR3A226(1)6R3(2)0900 | 1.4                                 | 6                                     | 0.900                                            | 0.29                                       |
| 22                                                          | B            | TR3B226(1)6R3(2)0600 | 1.4                                 | 6                                     | 0.600                                            | 0.38                                       |
| 22                                                          | C            | TR3C226(1)6R3(2)0500 | 1.3                                 | 6                                     | 0.500                                            | 0.47                                       |
| 33                                                          | A            | TR3A336(1)6R3(2)2000 | 2.0                                 | 14                                    | 2.000                                            | 0.19                                       |
| 33                                                          | A            | TR3A336(1)6R3(2)0800 | 2.0                                 | 14                                    | 0.800                                            | 0.31                                       |
| 33                                                          | A            | TR3A336(1)6R3(2)0600 | 2.0                                 | 14                                    | 0.600                                            | 0.35                                       |
| 33                                                          | B            | TR3B336(1)6R3(2)0450 | 2.0                                 | 6                                     | 0.450                                            | 0.43                                       |
| 33                                                          | B            | TR3B336(1)6R3(2)0350 | 2.0                                 | 6                                     | 0.350                                            | 0.49                                       |
| 33                                                          | B            | TR3B336(1)6R3(2)0600 | 2.0                                 | 6                                     | 0.600                                            | 0.38                                       |
| 33                                                          | B            | TR3B336(1)6R3(2)0500 | 2.0                                 | 6                                     | 0.500                                            | 0.41                                       |
| 47                                                          | A            | TR3A476(1)6R3(2)0800 | 3.0                                 | 12                                    | 0.800                                            | 0.31                                       |
| 47                                                          | B            | TR3B476(1)6R3(2)0550 | 3.0                                 | 6                                     | 0.550                                            | 0.39                                       |
| 47                                                          | B            | TR3B476(1)6R3(2)0500 | 3.0                                 | 6                                     | 0.500                                            | 0.41                                       |
| 47                                                          | B            | TR3B476(1)6R3(2)0350 | 3.0                                 | 6                                     | 0.350                                            | 0.49                                       |
| 47                                                          | B            | TR3B476(1)6R3(2)0250 | 3.0                                 | 6                                     | 0.250                                            | 0.58                                       |
| 47                                                          | C            | TR3C476(1)6R3(2)0300 | 3.0                                 | 6                                     | 0.300                                            | 0.61                                       |
| 47                                                          | C            | TR3C476(1)6R3(2)0250 | 3.0                                 | 6                                     | 0.250                                            | 0.66                                       |
| 68                                                          | B            | TR3B686(1)6R3(2)0650 | 4.3                                 | 6                                     | 0.650                                            | 0.36                                       |
| 68                                                          | B            | TR3B686(1)6R3(2)0550 | 4.3                                 | 6                                     | 0.550                                            | 0.39                                       |
| 68                                                          | B            | TR3B686(1)6R3(2)0500 | 4.3                                 | 6                                     | 0.500                                            | 0.41                                       |

**Note**

- Part number definitions:
  - Capacitance tolerance codes: K, M
  - Terminations and packaging codes: C, D, E, F, V, U, T, W
  - Lead (Pb)-free terminations and packaging codes: C, D, V, U. Except: for case W, 7" reel is available only, codes C and V (dry pack option is recommended)



| STANDARD RATINGS                                            |              |                      |                                     |                                       |                                                  |                                            |
|-------------------------------------------------------------|--------------|----------------------|-------------------------------------|---------------------------------------|--------------------------------------------------|--------------------------------------------|
| CAPACITANCE<br>( $\mu$ F)                                   | CASE<br>CODE | PART NUMBER          | MAX. DCL<br>AT +25 °C<br>( $\mu$ A) | MAX. DF<br>AT +25 °C<br>120 Hz<br>(%) | MAX. ESR<br>AT +25 °C<br>100 kHz<br>( $\Omega$ ) | MAX. RIPPLE<br>100 kHz<br>$I_{RMS}$<br>(A) |
| 6.3 V <sub>DC</sub> AT +85 °C; 4 V <sub>DC</sub> AT +125 °C |              |                      |                                     |                                       |                                                  |                                            |
| 68                                                          | B            | TR3B686(1)6R3(2)0350 | 4.3                                 | 6                                     | 0.350                                            | 0.49                                       |
| 68                                                          | B            | TR3B686(1)6R3(2)0250 | 4.3                                 | 6                                     | 0.250                                            | 0.58                                       |
| 68                                                          | C            | TR3C686(1)6R3(2)0275 | 4.3                                 | 6                                     | 0.275                                            | 0.63                                       |
| 68                                                          | C            | TR3C686(1)6R3(2)0250 | 4.3                                 | 6                                     | 0.250                                            | 0.66                                       |
| 68                                                          | C            | TR3C686(1)6R3(2)0200 | 4.3                                 | 6                                     | 0.200                                            | 0.74                                       |
| 68                                                          | D            | TR3D686(1)6R3(2)0200 | 4.3                                 | 6                                     | 0.200                                            | 0.87                                       |
| 68                                                          | D            | TR3D686(1)6R3(2)0175 | 4.3                                 | 4                                     | 0.175                                            | 0.93                                       |
| 100                                                         | B            | TR3B107(1)6R3(2)1500 | 6.3                                 | 15                                    | 1.500                                            | 0.24                                       |
| 100                                                         | B            | TR3B107(1)6R3(2)0500 | 6.3                                 | 15                                    | 0.500                                            | 0.41                                       |
| 100                                                         | B            | TR3B107(1)6R3(2)0400 | 6.3                                 | 15                                    | 0.400                                            | 0.46                                       |
| 100                                                         | B            | TR3B107(1)6R3(2)0250 | 6.3                                 | 15                                    | 0.250                                            | 0.58                                       |
| 100                                                         | C            | TR3C107(1)6R3(2)0300 | 6.3                                 | 6                                     | 0.300                                            | 0.61                                       |
| 100                                                         | C            | TR3C107(1)6R3(2)0250 | 6.3                                 | 6                                     | 0.250                                            | 0.66                                       |
| 100                                                         | C            | TR3C107(1)6R3(2)0150 | 6.3                                 | 6                                     | 0.150                                            | 0.86                                       |
| 100                                                         | C            | TR3C107(1)6R3(2)0125 | 6.3                                 | 6                                     | 0.125                                            | 0.94                                       |
| 100                                                         | C            | TR3C107(1)6R3(2)0100 | 6.3                                 | 6                                     | 0.100                                            | 1.05                                       |
| 100                                                         | D            | TR3D107(1)6R3(2)0150 | 6.3                                 | 6                                     | 0.150                                            | 1.00                                       |
| 100                                                         | D            | TR3D107(1)6R3(2)0140 | 6.3                                 | 6                                     | 0.140                                            | 1.04                                       |
| 150                                                         | C            | TR3C157(1)6R3(2)0300 | 9.4                                 | 8                                     | 0.300                                            | 0.61                                       |
| 150                                                         | C            | TR3C157(1)6R3(2)0200 | 9.4                                 | 8                                     | 0.200                                            | 0.74                                       |
| 150                                                         | D            | TR3D157(1)6R3(2)0150 | 9.4                                 | 8                                     | 0.150                                            | 1.00                                       |
| 150                                                         | D            | TR3D157(1)6R3(2)0125 | 9.4                                 | 8                                     | 0.125                                            | 1.10                                       |
| 150                                                         | D            | TR3D157(1)6R3(2)0075 | 9.4                                 | 8                                     | 0.075                                            | 1.41                                       |
| 150                                                         | D            | TR3D157(1)6R3(2)0070 | 9.4                                 | 8                                     | 0.070                                            | 1.46                                       |
| 150                                                         | D            | TR3D157(1)6R3(3)0050 | 9.4                                 | 8                                     | 0.050                                            | 1.73                                       |
| 150                                                         | E            | TR3E157(1)6R3(2)0100 | 9.4                                 | 8                                     | 0.100                                            | 1.28                                       |
| 220                                                         | C            | TR3C227(1)6R3(2)0300 | 13.9                                | 14                                    | 0.300                                            | 0.61                                       |
| 220                                                         | C            | TR3C227(1)6R3(2)0250 | 13.9                                | 14                                    | 0.250                                            | 0.66                                       |
| 220                                                         | C            | TR3C227(1)6R3(2)0225 | 13.9                                | 14                                    | 0.225                                            | 0.70                                       |
| 220                                                         | D            | TR3D227(1)6R3(2)0150 | 13.9                                | 8                                     | 0.150                                            | 1.00                                       |
| 220                                                         | D            | TR3D227(1)6R3(2)0100 | 13.9                                | 8                                     | 0.100                                            | 1.22                                       |
| 220                                                         | D            | TR3D227(1)6R3(3)0050 | 13.9                                | 8                                     | 0.050                                            | 1.73                                       |
| 220                                                         | E            | TR3E227(1)6R3(2)0150 | 13.9                                | 8                                     | 0.150                                            | 1.05                                       |
| 220                                                         | E            | TR3E227(1)6R3(2)0100 | 13.9                                | 8                                     | 0.100                                            | 1.28                                       |
| 330                                                         | D            | TR3D337(1)6R3(2)0150 | 20.8                                | 8                                     | 0.150                                            | 1.00                                       |
| 330                                                         | D            | TR3D337(1)6R3(2)0125 | 20.8                                | 8                                     | 0.125                                            | 1.10                                       |
| 330                                                         | D            | TR3D337(1)6R3(2)0100 | 20.8                                | 8                                     | 0.100                                            | 1.22                                       |
| 330                                                         | D            | TR3D337(1)6R3(2)0060 | 20.8                                | 8                                     | 0.060                                            | 1.58                                       |
| 330                                                         | D            | TR3D337(1)6R3(3)0050 | 20.8                                | 8                                     | 0.050                                            | 1.73                                       |
| 330                                                         | D            | TR3D337(1)6R3(3)0045 | 20.8                                | 8                                     | 0.045                                            | 1.83                                       |
| 330                                                         | D            | TR3D337(1)6R3(3)0035 | 20.8                                | 8                                     | 0.035                                            | 2.07                                       |
| 330                                                         | E            | TR3E337(1)6R3(3)0150 | 20.8                                | 8                                     | 0.150                                            | 1.05                                       |
| 330                                                         | E            | TR3E337(1)6R3(2)0100 | 20.8                                | 8                                     | 0.100                                            | 1.28                                       |
| 330                                                         | E            | TR3E337(1)6R3(2)0050 | 20.8                                | 8                                     | 0.050                                            | 1.82                                       |
| 330                                                         | W            | TR3W337(1)6R3(3)0100 | 20.8                                | 8                                     | 0.100                                            | 1.58                                       |
| 330                                                         | W            | TR3W337(1)6R3(3)0060 | 20.8                                | 8                                     | 0.060                                            | 2.04                                       |
| 330                                                         | W            | TR3W337(1)6R3(3)0040 | 20.8                                | 8                                     | 0.040                                            | 2.50                                       |
| 470                                                         | D            | TR3D477(1)6R3(2)0200 | 29.6                                | 14                                    | 0.200                                            | 0.87                                       |
| 470                                                         | D            | TR3D477(1)6R3(2)0150 | 29.6                                | 14                                    | 0.150                                            | 1.00                                       |

**Note**

- Part number definitions:
  - Capacitance tolerance codes: K, M
  - Terminations and packaging codes: C, D, E, F, V, U, T, W
  - Lead (Pb)-free terminations and packaging codes: C, D, V, U. Except: for case W, 7" reel is available only, codes C and V (dry pack option is recommended)



| STANDARD RATINGS                                            |              |                      |                                            |                                       |                                                  |                                                   |
|-------------------------------------------------------------|--------------|----------------------|--------------------------------------------|---------------------------------------|--------------------------------------------------|---------------------------------------------------|
| CAPACITANCE<br>( $\mu\text{F}$ )                            | CASE<br>CODE | PART NUMBER          | MAX. DCL<br>AT +25 °C<br>( $\mu\text{A}$ ) | MAX. DF<br>AT +25 °C<br>120 Hz<br>(%) | MAX. ESR<br>AT +25 °C<br>100 kHz<br>( $\Omega$ ) | MAX. RIPPLE<br>100 kHz<br>$I_{\text{RMS}}$<br>(A) |
| 6.3 V <sub>DC</sub> AT +85 °C; 4 V <sub>DC</sub> AT +125 °C |              |                      |                                            |                                       |                                                  |                                                   |
| 470                                                         | D            | TR3D477(1)6R3(2)0125 | 29.6                                       | 14                                    | 0.125                                            | 1.10                                              |
| 470                                                         | D            | TR3D477(1)6R3(3)0100 | 29.6                                       | 14                                    | 0.100                                            | 1.22                                              |
| 470                                                         | E            | TR3E477(1)6R3(2)0100 | 29.6                                       | 10                                    | 0.100                                            | 1.28                                              |
| 470                                                         | E            | TR3E477(1)6R3(3)0065 | 29.6                                       | 10                                    | 0.065                                            | 1.59                                              |
| 470                                                         | E            | TR3E477(1)6R3(3)0060 | 29.6                                       | 10                                    | 0.060                                            | 1.66                                              |
| 470                                                         | E            | TR3E477(1)6R3(3)0050 | 29.6                                       | 10                                    | 0.050                                            | 1.82                                              |
| 470                                                         | W            | TR3W477(1)6R3(3)0100 | 29.6                                       | 20                                    | 0.100                                            | 1.58                                              |
| 470                                                         | W            | TR3W477(1)6R3(3)0060 | 29.6                                       | 20                                    | 0.060                                            | 2.04                                              |
| 470                                                         | W            | TR3W477(1)6R3(3)0050 | 29.6                                       | 20                                    | 0.050                                            | 2.24                                              |
| 680                                                         | E            | TR3E687(1)6R3(2)0100 | 42.8                                       | 20                                    | 0.100                                            | 1.28                                              |
| 1000                                                        | E            | TR3E108M6R3(2)0200   | 63.0                                       | 30                                    | 0.200                                            | 0.91                                              |
| 1000                                                        | E            | TR3E108M6R3(2)0150   | 63.0                                       | 30                                    | 0.150                                            | 1.05                                              |
| 1000                                                        | E            | TR3E108M6R3(3)0100   | 63.0                                       | 30                                    | 0.100                                            | 1.28                                              |
| 1000                                                        | W            | TR3W108(1)6R3(3)0050 | 60.0                                       | 16                                    | 0.050                                            | 2.24                                              |
| 10 V <sub>DC</sub> AT +85 °C; 7 V <sub>DC</sub> AT +125 °C  |              |                      |                                            |                                       |                                                  |                                                   |
| 2.2                                                         | A            | TR3A225(1)010(2)6800 | 0.5                                        | 6                                     | 6.800                                            | 0.11                                              |
| 2.2                                                         | A            | TR3A225(1)010(2)6000 | 0.5                                        | 6                                     | 6.000                                            | 0.11                                              |
| 2.2                                                         | A            | TR3A225(1)010(2)1800 | 0.5                                        | 6                                     | 1.800                                            | 0.20                                              |
| 4.7                                                         | A            | TR3A475(1)010(2)3000 | 0.5                                        | 6                                     | 3.000                                            | 0.16                                              |
| 4.7                                                         | A            | TR3A475(1)010(2)1500 | 0.5                                        | 6                                     | 1.500                                            | 0.22                                              |
| 4.7                                                         | A            | TR3A475(1)010(2)1400 | 0.5                                        | 6                                     | 1.400                                            | 0.23                                              |
| 4.7                                                         | A            | TR3A475(1)010(2)1000 | 0.5                                        | 6                                     | 1.000                                            | 0.27                                              |
| 4.7                                                         | B            | TR3B475(1)010(2)1400 | 0.5                                        | 6                                     | 1.400                                            | 0.25                                              |
| 6.8                                                         | A            | TR3A685(1)010(2)3000 | 0.7                                        | 6                                     | 3.000                                            | 0.16                                              |
| 6.8                                                         | A            | TR3A685(1)010(2)1800 | 0.7                                        | 6                                     | 1.800                                            | 0.20                                              |
| 6.8                                                         | B            | TR3B685(1)010(2)1300 | 0.7                                        | 6                                     | 1.300                                            | 0.26                                              |
| 10                                                          | A            | TR3A106(1)010(2)2000 | 1.0                                        | 6                                     | 2.000                                            | 0.19                                              |
| 10                                                          | A            | TR3A106(1)010(2)1800 | 1.0                                        | 6                                     | 1.800                                            | 0.20                                              |
| 10                                                          | A            | TR3A106(1)010(2)1000 | 1.0                                        | 6                                     | 1.000                                            | 0.27                                              |
| 10                                                          | A            | TR3A106(1)010(2)0900 | 1.0                                        | 6                                     | 0.900                                            | 0.29                                              |
| 10                                                          | B            | TR3B106(1)010(2)1000 | 1.0                                        | 6                                     | 1.000                                            | 0.29                                              |
| 10                                                          | B            | TR3B106(1)010(2)0800 | 1.0                                        | 6                                     | 0.800                                            | 0.33                                              |
| 10                                                          | B            | TR3B106(1)010(2)0750 | 1.0                                        | 6                                     | 0.750                                            | 0.34                                              |
| 15                                                          | A            | TR3A156(1)010(2)2000 | 1.5                                        | 6                                     | 2.000                                            | 0.19                                              |
| 15                                                          | A            | TR3A156(1)010(2)1000 | 1.5                                        | 6                                     | 1.000                                            | 0.27                                              |
| 15                                                          | B            | TR3B156(1)010(2)0600 | 1.5                                        | 6                                     | 0.600                                            | 0.38                                              |
| 15                                                          | B            | TR3B156(1)010(2)0450 | 1.5                                        | 6                                     | 0.450                                            | 0.43                                              |
| 15                                                          | B            | TR3B156(1)010(2)0700 | 1.5                                        | 6                                     | 0.700                                            | 0.35                                              |
| 15                                                          | C            | TR3C156(1)010(2)0700 | 1.5                                        | 6                                     | 0.700                                            | 0.40                                              |
| 22                                                          | A            | TR3A226(1)010(2)1500 | 2.2                                        | 8                                     | 1.500                                            | 0.22                                              |
| 22                                                          | A            | TR3A226(1)010(2)1000 | 2.2                                        | 8                                     | 1.000                                            | 0.27                                              |
| 22                                                          | A            | TR3A226(1)010(2)0900 | 2.2                                        | 8                                     | 0.900                                            | 0.29                                              |
| 22                                                          | A            | TR3A226(1)010(2)0800 | 2.2                                        | 8                                     | 0.800                                            | 0.31                                              |
| 22                                                          | B            | TR3B226(1)010(2)1000 | 2.2                                        | 6                                     | 1.000                                            | 0.29                                              |
| 22                                                          | B            | TR3B226(1)010(2)0700 | 2.2                                        | 6                                     | 0.700                                            | 0.35                                              |
| 22                                                          | B            | TR3B226(1)010(2)0500 | 2.2                                        | 6                                     | 0.500                                            | 0.41                                              |
| 22                                                          | B            | TR3B226(1)010(2)0400 | 2.2                                        | 6                                     | 0.400                                            | 0.46                                              |

**Note**

- Part number definitions:
  - Capacitance tolerance codes: K, M
  - Terminations and packaging codes: C, D, E, F, V, U, T, W
  - Lead (Pb)-free terminations and packaging codes: C, D, V, U. Except: for case W, 7" reel is available only, codes C and V (dry pack option is recommended)



| STANDARD RATINGS                                           |              |                      |                                     |                                       |                                                  |                                            |
|------------------------------------------------------------|--------------|----------------------|-------------------------------------|---------------------------------------|--------------------------------------------------|--------------------------------------------|
| CAPACITANCE<br>( $\mu$ F)                                  | CASE<br>CODE | PART NUMBER          | MAX. DCL<br>AT +25 °C<br>( $\mu$ A) | MAX. DF<br>AT +25 °C<br>120 Hz<br>(%) | MAX. ESR<br>AT +25 °C<br>100 kHz<br>( $\Omega$ ) | MAX. RIPPLE<br>100 kHz<br>$I_{RMS}$<br>(A) |
| 10 V <sub>DC</sub> AT +85 °C; 7 V <sub>DC</sub> AT +125 °C |              |                      |                                     |                                       |                                                  |                                            |
| 22                                                         | C            | TR3C226(1)010(2)0400 | 2.2                                 | 6                                     | 0.400                                            | 0.52                                       |
| 22                                                         | C            | TR3C226(1)010(2)0345 | 2.2                                 | 6                                     | 0.345                                            | 0.56                                       |
| 22                                                         | C            | TR3C226(1)010(2)0300 | 2.2                                 | 6                                     | 0.300                                            | 0.61                                       |
| 33                                                         | B            | TR3B336(1)010(2)1400 | 3.3                                 | 6                                     | 1.400                                            | 0.25                                       |
| 33                                                         | B            | TR3B336(1)010(2)0650 | 3.3                                 | 6                                     | 0.650                                            | 0.36                                       |
| 33                                                         | B            | TR3B336(1)010(2)0600 | 3.3                                 | 6                                     | 0.600                                            | 0.38                                       |
| 33                                                         | B            | TR3B336(1)010(2)0500 | 3.3                                 | 6                                     | 0.500                                            | 0.41                                       |
| 33                                                         | B            | TR3B336(1)010(2)0425 | 3.3                                 | 6                                     | 0.425                                            | 0.45                                       |
| 33                                                         | B            | TR3B336(1)010(2)0300 | 3.3                                 | 6                                     | 0.300                                            | 0.53                                       |
| 33                                                         | C            | TR3C336(1)010(2)0375 | 3.3                                 | 6                                     | 0.375                                            | 0.54                                       |
| 33                                                         | C            | TR3C336(1)010(2)0300 | 3.3                                 | 6                                     | 0.300                                            | 0.61                                       |
| 47                                                         | B            | TR3B476(1)010(2)0650 | 4.7                                 | 6                                     | 0.650                                            | 0.36                                       |
| 47                                                         | B            | TR3B476(1)010(2)0600 | 4.7                                 | 6                                     | 0.600                                            | 0.38                                       |
| 47                                                         | B            | TR3B476(1)010(2)0500 | 4.7                                 | 6                                     | 0.500                                            | 0.41                                       |
| 47                                                         | B            | TR3B476(1)010(2)0350 | 4.7                                 | 6                                     | 0.350                                            | 0.49                                       |
| 47                                                         | C            | TR3C476(1)010(2)0350 | 4.7                                 | 6                                     | 0.350                                            | 0.56                                       |
| 47                                                         | C            | TR3C476(1)010(2)0300 | 4.7                                 | 6                                     | 0.300                                            | 0.61                                       |
| 47                                                         | C            | TR3C476(1)010(2)0200 | 4.7                                 | 6                                     | 0.200                                            | 0.74                                       |
| 47                                                         | D            | TR3D476(1)010(2)0220 | 4.7                                 | 6                                     | 0.220                                            | 0.83                                       |
| 47                                                         | D            | TR3D476(1)010(2)0200 | 4.7                                 | 6                                     | 0.200                                            | 0.87                                       |
| 47                                                         | D            | TR3D476(1)010(2)0140 | 4.7                                 | 6                                     | 0.140                                            | 1.04                                       |
| 47                                                         | D            | TR3D476(1)010(2)0135 | 4.7                                 | 6                                     | 0.135                                            | 1.05                                       |
| 47                                                         | D            | TR3D476(1)010(2)0100 | 4.7                                 | 6                                     | 0.100                                            | 1.22                                       |
| 68                                                         | B            | TR3B686(1)010(2)1500 | 6.8                                 | 14                                    | 1.500                                            | 0.24                                       |
| 68                                                         | B            | TR3B686(1)010(2)0900 | 6.8                                 | 14                                    | 0.900                                            | 0.31                                       |
| 68                                                         | B            | TR3B686(1)010(2)0750 | 6.8                                 | 14                                    | 0.750                                            | 0.34                                       |
| 68                                                         | B            | TR3B686(1)010(2)0600 | 6.8                                 | 14                                    | 0.600                                            | 0.38                                       |
| 68                                                         | C            | TR3C686(1)010(2)0300 | 6.8                                 | 6                                     | 0.300                                            | 0.61                                       |
| 68                                                         | C            | TR3C686(1)010(2)0275 | 6.8                                 | 6                                     | 0.275                                            | 0.63                                       |
| 68                                                         | C            | TR3C686(1)010(2)0225 | 6.8                                 | 6                                     | 0.225                                            | 0.70                                       |
| 68                                                         | C            | TR3C686(1)010(2)0200 | 6.8                                 | 6                                     | 0.200                                            | 0.74                                       |
| 68                                                         | D            | TR3D686(1)010(2)0200 | 6.8                                 | 6                                     | 0.200                                            | 0.87                                       |
| 68                                                         | D            | TR3D686(1)010(2)0150 | 6.8                                 | 6                                     | 0.150                                            | 1.00                                       |
| 68                                                         | D            | TR3D686(1)010(2)0100 | 6.8                                 | 6                                     | 0.100                                            | 1.22                                       |
| 68                                                         | D            | TR3D686(1)010(3)0070 | 6.8                                 | 6                                     | 0.070                                            | 1.46                                       |
| 68                                                         | E            | TR3E686(1)010(2)0150 | 6.8                                 | 4                                     | 0.150                                            | 1.05                                       |
| 100                                                        | B            | TR3B107(1)010(2)1400 | 10.0                                | 25                                    | 1.400                                            | 0.25                                       |
| 100                                                        | C            | TR3C107(1)010(2)0200 | 10.0                                | 8                                     | 0.200                                            | 0.74                                       |
| 100                                                        | C            | TR3C107(1)010(2)0150 | 10.0                                | 8                                     | 0.150                                            | 0.86                                       |
| 100                                                        | C            | TR3C107(1)010(2)0100 | 10.0                                | 8                                     | 0.100                                            | 1.05                                       |
| 100                                                        | D            | TR3D107(1)010(2)0150 | 10.0                                | 6                                     | 0.150                                            | 1.00                                       |
| 100                                                        | D            | TR3D107(1)010(2)0100 | 10.0                                | 6                                     | 0.100                                            | 1.22                                       |
| 100                                                        | D            | TR3D107(1)010(2)0080 | 10.0                                | 6                                     | 0.080                                            | 1.37                                       |

**Note**

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  - Lead (Pb)-free terminations and packaging codes: C, D, V, U. Except: for case W, 7" reel is available only, codes C and V (dry pack option is recommended)



| STANDARD RATINGS                                           |              |                      |                                     |                                       |                                                  |                                            |
|------------------------------------------------------------|--------------|----------------------|-------------------------------------|---------------------------------------|--------------------------------------------------|--------------------------------------------|
| CAPACITANCE<br>( $\mu$ F)                                  | CASE<br>CODE | PART NUMBER          | MAX. DCL<br>AT +25 °C<br>( $\mu$ A) | MAX. DF<br>AT +25 °C<br>120 Hz<br>(%) | MAX. ESR<br>AT +25 °C<br>100 kHz<br>( $\Omega$ ) | MAX. RIPPLE<br>100 kHz<br>$I_{RMS}$<br>(A) |
| 10 V <sub>DC</sub> AT +85 °C; 7 V <sub>DC</sub> AT +125 °C |              |                      |                                     |                                       |                                                  |                                            |
| 100                                                        | D            | TR3D107(1)010(3)0070 | 10.0                                | 6                                     | 0.070                                            | 1.52                                       |
| 100                                                        | D            | TR3D107(1)010(3)0065 | 10.0                                | 6                                     | 0.065                                            | 1.46                                       |
| 100                                                        | D            | TR3D107(1)010(3)0050 | 10.0                                | 6                                     | 0.050                                            | 1.73                                       |
| 100                                                        | E            | TR3E107(1)010(2)0125 | 10.0                                | 6                                     | 0.125                                            | 1.15                                       |
| 100                                                        | E            | TR3E107(1)010(2)0150 | 10.0                                | 6                                     | 0.150                                            | 1.05                                       |
| 100                                                        | E            | TR3E107(1)010(2)0100 | 10.0                                | 6                                     | 0.100                                            | 1.28                                       |
| 150                                                        | C            | TR3C157(1)010(2)0500 | 15.0                                | 20                                    | 0.500                                            | 0.47                                       |
| 150                                                        | D            | TR3D157(1)010(2)0150 | 15.0                                | 8                                     | 0.150                                            | 1.00                                       |
| 150                                                        | D            | TR3D157(1)010(2)0100 | 15.0                                | 8                                     | 0.100                                            | 1.22                                       |
| 150                                                        | D            | TR3D157(1)010(2)0075 | 15.0                                | 8                                     | 0.075                                            | 1.41                                       |
| 150                                                        | D            | TR3D157(1)010(3)0070 | 15.0                                | 8                                     | 0.070                                            | 1.46                                       |
| 150                                                        | D            | TR3D157(1)010(3)0050 | 15.0                                | 8                                     | 0.050                                            | 1.73                                       |
| 150                                                        | E            | TR3E157(1)010(2)0100 | 15.0                                | 8                                     | 0.100                                            | 1.28                                       |
| 150                                                        | E            | TR3E157(1)010(2)0080 | 15.0                                | 8                                     | 0.080                                            | 1.44                                       |
| 220                                                        | D            | TR3D227(1)010(2)0150 | 22.0                                | 8                                     | 0.150                                            | 1.00                                       |
| 220                                                        | D            | TR3D227(1)010(2)0125 | 22.0                                | 8                                     | 0.125                                            | 1.10                                       |
| 220                                                        | D            | TR3D227(1)010(2)0100 | 22.0                                | 8                                     | 0.100                                            | 1.22                                       |
| 220                                                        | D            | TR3D227(1)010(3)0050 | 22.0                                | 8                                     | 0.050                                            | 1.73                                       |
| 220                                                        | E            | TR3E227(1)010(2)0150 | 22.0                                | 8                                     | 0.150                                            | 1.05                                       |
| 220                                                        | E            | TR3E227(1)010(2)0100 | 22.0                                | 8                                     | 0.100                                            | 1.28                                       |
| 220                                                        | E            | TR3E227(1)010(3)0070 | 22.0                                | 8                                     | 0.070                                            | 1.54                                       |
| 220                                                        | E            | TR3E227(1)010(3)0060 | 22.0                                | 8                                     | 0.060                                            | 1.66                                       |
| 220                                                        | E            | TR3E227(1)010(3)0050 | 22.0                                | 8                                     | 0.050                                            | 1.82                                       |
| 330                                                        | D            | TR3D337(1)010(2)0150 | 33.0                                | 15                                    | 0.150                                            | 1.00                                       |
| 330                                                        | D            | TR3D337(1)010(2)0125 | 33.0                                | 15                                    | 0.125                                            | 1.10                                       |
| 330                                                        | D            | TR3D337(1)010(2)0100 | 33.0                                | 15                                    | 0.100                                            | 1.22                                       |
| 330                                                        | E            | TR3E337(1)010(2)0100 | 33.0                                | 10                                    | 0.100                                            | 1.28                                       |
| 330                                                        | E            | TR3E337(1)010(3)0060 | 33.0                                | 10                                    | 0.060                                            | 1.66                                       |
| 330                                                        | W            | TR3W337(1)010(3)0100 | 33.0                                | 10                                    | 0.100                                            | 1.58                                       |
| 330                                                        | W            | TR3W337(1)010(3)0060 | 33.0                                | 10                                    | 0.060                                            | 2.04                                       |
| 330                                                        | W            | TR3W337(1)010(3)0040 | 33.0                                | 10                                    | 0.040                                            | 2.50                                       |
| 470                                                        | E            | TR3E477(1)010(2)0200 | 47.0                                | 15                                    | 0.200                                            | 0.91                                       |
| 470                                                        | E            | TR3E477(1)010(2)0150 | 47.0                                | 15                                    | 0.150                                            | 1.05                                       |
| 470                                                        | E            | TR3E477(1)010(2)0100 | 47.0                                | 15                                    | 0.100                                            | 1.28                                       |
| 470                                                        | E            | TR3E477(1)010(3)0075 | 47.0                                | 15                                    | 0.075                                            | 1.48                                       |
| 470                                                        | W            | TR3W477(1)010(3)0100 | 47.0                                | 20                                    | 0.100                                            | 1.58                                       |
| 470                                                        | W            | TR3W477(1)010(3)0060 | 47.0                                | 20                                    | 0.060                                            | 2.04                                       |
| 470                                                        | W            | TR3W477(1)010(3)0050 | 47.0                                | 20                                    | 0.050                                            | 2.24                                       |

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| STANDARD RATINGS                                            |              |                      |                                     |                                       |                                                  |                                            |
|-------------------------------------------------------------|--------------|----------------------|-------------------------------------|---------------------------------------|--------------------------------------------------|--------------------------------------------|
| CAPACITANCE<br>( $\mu$ F)                                   | CASE<br>CODE | PART NUMBER          | MAX. DCL<br>AT +25 °C<br>( $\mu$ A) | MAX. DF<br>AT +25 °C<br>120 Hz<br>(%) | MAX. ESR<br>AT +25 °C<br>100 kHz<br>( $\Omega$ ) | MAX. RIPPLE<br>100 kHz<br>$I_{RMS}$<br>(A) |
| 16 V <sub>DC</sub> AT +85 °C; 10 V <sub>DC</sub> AT +125 °C |              |                      |                                     |                                       |                                                  |                                            |
| 1.0                                                         | A            | TR3A105(1)016(2)6200 | 0.5                                 | 4                                     | 6.200                                            | 0.11                                       |
| 2.2                                                         | A            | TR3A225(1)016(2)4000 | 0.5                                 | 6                                     | 4.000                                            | 0.14                                       |
| 2.2                                                         | A            | TR3A225(1)016(2)3500 | 0.5                                 | 6                                     | 3.500                                            | 0.15                                       |
| 2.2                                                         | A            | TR3A225(1)016(2)1800 | 0.5                                 | 6                                     | 1.800                                            | 0.20                                       |
| 3.3                                                         | A            | TR3A335(1)016(2)4000 | 0.5                                 | 6                                     | 4.000                                            | 0.14                                       |
| 3.3                                                         | A            | TR3A335(1)016(2)3500 | 0.5                                 | 6                                     | 3.500                                            | 0.15                                       |
| 3.3                                                         | B            | TR3B335(1)016(2)2500 | 0.5                                 | 6                                     | 2.500                                            | 0.18                                       |
| 4.7                                                         | A            | TR3A475(1)016(2)3000 | 0.8                                 | 6                                     | 3.000                                            | 0.16                                       |
| 4.7                                                         | A            | TR3A475(1)016(2)2500 | 0.8                                 | 6                                     | 2.500                                            | 0.17                                       |
| 4.7                                                         | A            | TR3A475(1)016(2)2000 | 0.8                                 | 6                                     | 2.000                                            | 0.19                                       |
| 4.7                                                         | A            | TR3A475(1)016(2)1500 | 0.8                                 | 6                                     | 1.500                                            | 0.22                                       |
| 4.7                                                         | B            | TR3B475(1)016(2)1500 | 0.8                                 | 6                                     | 1.500                                            | 0.24                                       |
| 4.7                                                         | B            | TR3B475(1)016(2)0800 | 0.8                                 | 6                                     | 0.800                                            | 0.33                                       |
| 6.8                                                         | A            | TR3A685(1)016(2)3000 | 1.1                                 | 6                                     | 3.000                                            | 0.16                                       |
| 6.8                                                         | A            | TR3A685(1)016(2)1500 | 1.1                                 | 6                                     | 1.500                                            | 0.22                                       |
| 6.8                                                         | B            | TR3B685(1)016(2)1200 | 1.1                                 | 6                                     | 1.200                                            | 0.27                                       |
| 6.8                                                         | B            | TR3B685(1)016(2)0600 | 1.1                                 | 6                                     | 0.600                                            | 0.38                                       |
| 10                                                          | A            | TR3A106(1)016(2)1700 | 1.6                                 | 6                                     | 1.700                                            | 0.21                                       |
| 10                                                          | B            | TR3B106(1)016(2)0800 | 1.6                                 | 6                                     | 0.800                                            | 0.33                                       |
| 10                                                          | B            | TR3B106(1)016(2)0500 | 1.6                                 | 6                                     | 0.500                                            | 0.41                                       |
| 10                                                          | C            | TR3C106(1)016(2)0600 | 1.6                                 | 6                                     | 0.600                                            | 0.43                                       |
| 10                                                          | C            | TR3C106(1)016(2)0500 | 1.6                                 | 6                                     | 0.500                                            | 0.47                                       |
| 10                                                          | C            | TR3C106(1)016(2)0450 | 1.6                                 | 6                                     | 0.450                                            | 0.49                                       |
| 15                                                          | B            | TR3B156(1)016(2)0800 | 2.4                                 | 6                                     | 0.800                                            | 0.33                                       |
| 15                                                          | B            | TR3B156(1)016(2)0500 | 2.4                                 | 6                                     | 0.500                                            | 0.41                                       |
| 15                                                          | C            | TR3C156(1)016(2)0400 | 2.4                                 | 6                                     | 0.400                                            | 0.52                                       |
| 22                                                          | B            | TR3B226(1)016(2)1000 | 3.5                                 | 6                                     | 1.000                                            | 0.29                                       |
| 22                                                          | B            | TR3B226(1)016(2)0700 | 3.5                                 | 6                                     | 0.700                                            | 0.35                                       |
| 22                                                          | B            | TR3B226(1)016(2)0600 | 3.5                                 | 6                                     | 0.600                                            | 0.38                                       |
| 22                                                          | B            | TR3B226(1)016(2)0400 | 3.5                                 | 6                                     | 0.400                                            | 0.46                                       |
| 22                                                          | C            | TR3C226(1)016(2)0375 | 3.5                                 | 6                                     | 0.375                                            | 0.54                                       |
| 22                                                          | C            | TR3C226(1)016(2)0350 | 3.5                                 | 6                                     | 0.350                                            | 0.56                                       |
| 22                                                          | D            | TR3D226(1)016(2)0250 | 3.5                                 | 6                                     | 0.250                                            | 0.77                                       |
| 33                                                          | B            | TR3B336(1)016(2)0700 | 5.3                                 | 6                                     | 0.700                                            | 0.35                                       |
| 33                                                          | B            | TR3B336(1)016(2)0500 | 5.3                                 | 6                                     | 0.500                                            | 0.41                                       |
| 33                                                          | B            | TR3B336(1)016(2)0350 | 5.3                                 | 6                                     | 0.350                                            | 0.49                                       |
| 33                                                          | C            | TR3C336(1)016(2)0300 | 5.3                                 | 6                                     | 0.300                                            | 0.61                                       |
| 33                                                          | C            | TR3C336(1)016(2)0225 | 5.3                                 | 6                                     | 0.225                                            | 0.70                                       |
| 33                                                          | D            | TR3D336(1)016(2)0250 | 5.3                                 | 6                                     | 0.250                                            | 0.77                                       |
| 33                                                          | D            | TR3D336(1)016(2)0225 | 5.3                                 | 4                                     | 0.225                                            | 0.82                                       |
| 33                                                          | D            | TR3D336(1)016(2)0150 | 5.3                                 | 6                                     | 0.150                                            | 1.00                                       |
| 47                                                          | C            | TR3C476(1)016(2)0500 | 7.5                                 | 6                                     | 0.500                                            | 0.47                                       |
| 47                                                          | C            | TR3C476(1)016(2)0350 | 7.5                                 | 6                                     | 0.350                                            | 0.56                                       |
| 47                                                          | C            | TR3C476(1)016(2)0300 | 7.5                                 | 6                                     | 0.300                                            | 0.61                                       |
| 47                                                          | D            | TR3D476(1)016(2)0200 | 7.5                                 | 6                                     | 0.200                                            | 0.87                                       |
| 47                                                          | D            | TR3D476(1)016(2)0150 | 7.5                                 | 6                                     | 0.150                                            | 1.00                                       |
| 47                                                          | D            | TR3D476(1)016(2)0120 | 7.5                                 | 6                                     | 0.120                                            | 1.12                                       |
| 47                                                          | D            | TR3D476(1)016(2)0100 | 7.5                                 | 6                                     | 0.100                                            | 1.22                                       |
| 47                                                          | D            | TR3D476(1)016(3)0080 | 7.5                                 | 6                                     | 0.080                                            | 1.37                                       |
| 47                                                          | D            | TR3D476(1)016(3)0070 | 7.5                                 | 6                                     | 0.070                                            | 1.46                                       |

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  - Lead (Pb)-free terminations and packaging codes: C, D, V, U. Except: for case W, 7" reel is available only, codes C and V (dry pack option is recommended)



| STANDARD RATINGS                                            |              |                      |                                     |                                       |                                                  |                                            |
|-------------------------------------------------------------|--------------|----------------------|-------------------------------------|---------------------------------------|--------------------------------------------------|--------------------------------------------|
| CAPACITANCE<br>( $\mu$ F)                                   | CASE<br>CODE | PART NUMBER          | MAX. DCL<br>AT +25 °C<br>( $\mu$ A) | MAX. DF<br>AT +25 °C<br>120 Hz<br>(%) | MAX. ESR<br>AT +25 °C<br>100 kHz<br>( $\Omega$ ) | MAX. RIPPLE<br>100 kHz<br>$I_{RMS}$<br>(A) |
| 16 V <sub>DC</sub> AT +85 °C; 10 V <sub>DC</sub> AT +125 °C |              |                      |                                     |                                       |                                                  |                                            |
| 68                                                          | D            | TR3D686(1)016(2)0150 | 10.9                                | 6                                     | 0.150                                            | 1.00                                       |
| 68                                                          | D            | TR3D686(1)016(2)0100 | 10.9                                | 6                                     | 0.100                                            | 1.22                                       |
| 68                                                          | D            | TR3D686(1)016(3)0070 | 10.9                                | 6                                     | 0.070                                            | 1.46                                       |
| 100                                                         | D            | TR3D107(1)016(2)0150 | 16.0                                | 8                                     | 0.150                                            | 1.00                                       |
| 100                                                         | D            | TR3D107(1)016(2)0125 | 16.0                                | 8                                     | 0.125                                            | 1.10                                       |
| 100                                                         | D            | TR3D107(1)016(2)0100 | 16.0                                | 8                                     | 0.100                                            | 1.22                                       |
| 100                                                         | D            | TR3D107(1)016(3)0075 | 16.0                                | 8                                     | 0.075                                            | 1.41                                       |
| 100                                                         | E            | TR3E107(1)016(2)0150 | 16.0                                | 8                                     | 0.150                                            | 1.05                                       |
| 100                                                         | E            | TR3E107(1)016(2)0125 | 16.0                                | 8                                     | 0.125                                            | 1.15                                       |
| 100                                                         | E            | TR3E107(1)016(2)0100 | 16.0                                | 8                                     | 0.100                                            | 1.28                                       |
| 150                                                         | D            | TR3D157(1)016(2)0400 | 24.0                                | 8                                     | 0.400                                            | 0.61                                       |
| 150                                                         | D            | TR3D157(1)016(2)0150 | 24.0                                | 8                                     | 0.150                                            | 1.00                                       |
| 150                                                         | D            | TR3D157(1)016(2)0125 | 24.0                                | 8                                     | 0.125                                            | 1.10                                       |
| 150                                                         | D            | TR3D157(1)016(2)0100 | 24.0                                | 8                                     | 0.100                                            | 1.22                                       |
| 150                                                         | D            | TR3D157(1)016(2)0085 | 24.0                                | 8                                     | 0.085                                            | 1.33                                       |
| 150                                                         | D            | TR3D157(1)016(3)0075 | 24.0                                | 8                                     | 0.075                                            | 1.41                                       |
| 150                                                         | D            | TR3D157(1)016(3)0060 | 24.0                                | 8                                     | 0.060                                            | 1.58                                       |
| 150                                                         | E            | TR3E157(1)016(2)0400 | 24.0                                | 8                                     | 0.400                                            | 0.64                                       |
| 150                                                         | E            | TR3E157(1)016(2)0150 | 24.0                                | 8                                     | 0.150                                            | 1.05                                       |
| 150                                                         | E            | TR3E157(1)016(2)0100 | 24.0                                | 8                                     | 0.100                                            | 1.28                                       |
| 150                                                         | E            | TR3E157(1)016(3)0075 | 24.0                                | 8                                     | 0.075                                            | 1.48                                       |
| 150                                                         | E            | TR3E157(1)016(3)0060 | 24.0                                | 8                                     | 0.060                                            | 1.66                                       |
| 150                                                         | W            | TR3W157(1)016(3)0075 | 24.0                                | 10                                    | 0.075                                            | 1.83                                       |
| 150                                                         | W            | TR3W157(1)016(3)0060 | 24.0                                | 10                                    | 0.060                                            | 2.04                                       |
| 220                                                         | E            | TR3E227(1)016(2)0150 | 35.2                                | 14                                    | 0.150                                            | 1.05                                       |
| 220                                                         | E            | TR3E227(1)016(2)0125 | 35.2                                | 14                                    | 0.125                                            | 1.15                                       |
| 220                                                         | E            | TR3E227(1)016(2)0100 | 35.2                                | 14                                    | 0.100                                            | 1.28                                       |
| 20 V <sub>DC</sub> AT +85 °C; 13 V <sub>DC</sub> AT +125 °C |              |                      |                                     |                                       |                                                  |                                            |
| 1.0                                                         | A            | TR3A105(1)020(2)5500 | 0.5                                 | 4                                     | 5.500                                            | 0.12                                       |
| 1.0                                                         | A            | TR3A105(1)020(2)3000 | 0.5                                 | 4                                     | 3.000                                            | 0.16                                       |
| 1.5                                                         | A            | TR3A155(1)020(2)3000 | 0.5                                 | 6                                     | 3.000                                            | 0.16                                       |
| 2.2                                                         | A            | TR3A225(1)020(2)4000 | 0.5                                 | 6                                     | 4.000                                            | 0.14                                       |
| 2.2                                                         | A            | TR3A225(1)020(2)3000 | 0.5                                 | 6                                     | 3.000                                            | 0.16                                       |
| 3.3                                                         | A            | TR3A335(1)020(2)4000 | 0.7                                 | 6                                     | 4.000                                            | 0.14                                       |
| 3.3                                                         | B            | TR3B335(1)020(2)1300 | 0.7                                 | 6                                     | 1.300                                            | 0.26                                       |
| 4.7                                                         | A            | TR3A475(1)020(2)3500 | 0.9                                 | 6                                     | 3.500                                            | 0.15                                       |
| 4.7                                                         | A            | TR3A475(1)020(2)1800 | 0.9                                 | 6                                     | 1.800                                            | 0.20                                       |
| 4.7                                                         | B            | TR3B475(1)020(2)1000 | 0.9                                 | 6                                     | 1.000                                            | 0.29                                       |
| 4.7                                                         | B            | TR3B475(1)020(2)0750 | 0.9                                 | 6                                     | 0.750                                            | 0.34                                       |
| 6.8                                                         | A            | TR3A685(1)020(2)3200 | 1.4                                 | 6                                     | 3.200                                            | 0.15                                       |
| 6.8                                                         | A            | TR3A685(1)020(2)3000 | 1.4                                 | 6                                     | 3.000                                            | 0.16                                       |
| 6.8                                                         | A            | TR3A685(1)020(2)2600 | 1.4                                 | 6                                     | 2.600                                            | 0.17                                       |
| 6.8                                                         | B            | TR3B685(1)020(2)1000 | 1.4                                 | 6                                     | 1.000                                            | 0.29                                       |
| 6.8                                                         | B            | TR3B685(1)020(2)0600 | 1.4                                 | 6                                     | 0.600                                            | 0.38                                       |
| 10                                                          | B            | TR3B106(1)020(2)1000 | 2.0                                 | 6                                     | 1.000                                            | 0.29                                       |
| 10                                                          | B            | TR3B106(1)020(2)0500 | 2.0                                 | 6                                     | 0.500                                            | 0.41                                       |
| 10                                                          | C            | TR3C106(1)020(2)0700 | 2.0                                 | 6                                     | 0.700                                            | 0.40                                       |
| 10                                                          | C            | TR3C106(1)020(2)0500 | 2.0                                 | 6                                     | 0.500                                            | 0.47                                       |
| 10                                                          | C            | TR3C106(1)020(2)0475 | 2.0                                 | 6                                     | 0.475                                            | 0.48                                       |
| 10                                                          | C            | TR3C106(1)020(2)0450 | 2.0                                 | 6                                     | 0.450                                            | 0.49                                       |
| 10                                                          | C            | TR3C106(1)020(2)0400 | 2.0                                 | 6                                     | 0.400                                            | 0.52                                       |

**Note**

- Part number definitions:
  - Capacitance tolerance codes: K, M
  - Terminations and packaging codes: C, D, E, F, V, U, T, W
  - Lead (Pb)-free terminations and packaging codes: C, D, V, U. Except: for case W, 7" reel is available only, codes C and V (dry pack option is recommended)



| STANDARD RATINGS                                            |              |                      |                                     |                                       |                                                  |                                            |
|-------------------------------------------------------------|--------------|----------------------|-------------------------------------|---------------------------------------|--------------------------------------------------|--------------------------------------------|
| CAPACITANCE<br>( $\mu$ F)                                   | CASE<br>CODE | PART NUMBER          | MAX. DCL<br>AT +25 °C<br>( $\mu$ A) | MAX. DF<br>AT +25 °C<br>120 Hz<br>(%) | MAX. ESR<br>AT +25 °C<br>100 kHz<br>( $\Omega$ ) | MAX. RIPPLE<br>100 kHz<br>$I_{RMS}$<br>(A) |
| 20 V <sub>DC</sub> AT +85 °C; 13 V <sub>DC</sub> AT +125 °C |              |                      |                                     |                                       |                                                  |                                            |
| 15                                                          | B            | TR3B156(1)020(2)1000 | 3.0                                 | 6                                     | 1.000                                            | 0.29                                       |
| 15                                                          | B            | TR3B156(1)020(2)0500 | 3.0                                 | 6                                     | 0.500                                            | 0.41                                       |
| 15                                                          | C            | TR3C156(1)020(2)0400 | 3.0                                 | 6                                     | 0.400                                            | 0.52                                       |
| 22                                                          | B            | TR3B226(1)020(2)0800 | 4.4                                 | 6                                     | 0.800                                            | 0.33                                       |
| 22                                                          | B            | TR3B226(1)020(2)0700 | 4.4                                 | 6                                     | 0.700                                            | 0.35                                       |
| 22                                                          | B            | TR3B226(1)020(2)0600 | 4.4                                 | 6                                     | 0.600                                            | 0.38                                       |
| 22                                                          | B            | TR3B226(1)020(2)0400 | 4.4                                 | 6                                     | 0.400                                            | 0.46                                       |
| 22                                                          | C            | TR3C226(1)020(2)0400 | 4.4                                 | 6                                     | 0.400                                            | 0.52                                       |
| 22                                                          | C            | TR3C226(1)020(2)0375 | 4.4                                 | 6                                     | 0.375                                            | 0.54                                       |
| 22                                                          | D            | TR3D226(1)020(2)0300 | 4.4                                 | 6                                     | 0.300                                            | 0.71                                       |
| 22                                                          | D            | TR3D226(1)020(2)0225 | 3.5                                 | 4                                     | 0.225                                            | 0.82                                       |
| 22                                                          | D            | TR3D226(1)020(2)0200 | 4.4                                 | 6                                     | 0.200                                            | 0.87                                       |
| 33                                                          | C            | TR3C336(1)020(2)0350 | 6.6                                 | 6                                     | 0.350                                            | 0.56                                       |
| 33                                                          | C            | TR3C336(1)020(2)0300 | 6.6                                 | 6                                     | 0.300                                            | 0.61                                       |
| 33                                                          | C            | TR3C336(1)020(2)0200 | 6.6                                 | 6                                     | 0.200                                            | 0.74                                       |
| 33                                                          | D            | TR3D336(1)020(2)0400 | 6.6                                 | 6                                     | 0.400                                            | 0.61                                       |
| 33                                                          | D            | TR3D336(1)020(2)0250 | 6.6                                 | 6                                     | 0.250                                            | 0.77                                       |
| 33                                                          | D            | TR3D336(1)020(2)0200 | 6.6                                 | 6                                     | 0.200                                            | 0.87                                       |
| 47                                                          | D            | TR3D476(1)020(2)0200 | 9.4                                 | 6                                     | 0.200                                            | 0.87                                       |
| 47                                                          | D            | TR3D476(1)020(2)0175 | 9.4                                 | 6                                     | 0.175                                            | 0.93                                       |
| 47                                                          | D            | TR3D476(1)020(2)0150 | 9.4                                 | 6                                     | 0.150                                            | 1.00                                       |
| 47                                                          | D            | TR3D476(1)020(3)0100 | 9.4                                 | 6                                     | 0.100                                            | 1.22                                       |
| 47                                                          | E            | TR3E476(1)020(2)0150 | 9.4                                 | 6                                     | 0.150                                            | 1.05                                       |
| 47                                                          | E            | TR3E476(1)020(3)0125 | 9.4                                 | 6                                     | 0.125                                            | 1.15                                       |
| 68                                                          | D            | TR3D686(1)020(2)0200 | 13.6                                | 6                                     | 0.200                                            | 0.87                                       |
| 68                                                          | D            | TR3D686(1)020(2)0175 | 13.6                                | 6                                     | 0.175                                            | 0.93                                       |
| 68                                                          | D            | TR3D686(1)020(2)0150 | 13.6                                | 6                                     | 0.150                                            | 1.00                                       |
| 68                                                          | D            | TR3D686(1)020(2)0115 | 13.6                                | 6                                     | 0.115                                            | 1.14                                       |
| 68                                                          | E            | TR3E686(1)020(2)0200 | 13.6                                | 6                                     | 0.200                                            | 0.91                                       |
| 68                                                          | E            | TR3E686(1)020(2)0150 | 13.6                                | 6                                     | 0.150                                            | 1.05                                       |
| 68                                                          | E            | TR3E686(1)020(2)0125 | 13.6                                | 6                                     | 0.125                                            | 1.15                                       |
| 68                                                          | E            | TR3E686(1)020(2)0120 | 13.6                                | 6                                     | 0.120                                            | 1.17                                       |
| 100                                                         | D            | TR3D107(1)020(2)0200 | 20.0                                | 8                                     | 0.200                                            | 0.87                                       |
| 100                                                         | D            | TR3D107(1)020(2)0150 | 20.0                                | 8                                     | 0.150                                            | 1.00                                       |
| 100                                                         | D            | TR3D107(1)020(2)0100 | 20.0                                | 8                                     | 0.100                                            | 1.22                                       |
| 100                                                         | D            | TR3D107(1)020(3)0085 | 20.0                                | 8                                     | 0.085                                            | 1.33                                       |
| 100                                                         | D            | TR3D107(1)020(3)0080 | 20.0                                | 8                                     | 0.080                                            | 1.37                                       |
| 100                                                         | E            | TR3E107(1)020(2)0200 | 20.0                                | 8                                     | 0.200                                            | 0.91                                       |
| 100                                                         | E            | TR3E107(1)020(2)0150 | 20.0                                | 8                                     | 0.150                                            | 1.05                                       |
| 100                                                         | E            | TR3E107(1)020(2)0100 | 20.0                                | 8                                     | 0.100                                            | 1.28                                       |
| 100                                                         | W            | TR3W107(1)020(3)0200 | 20.0                                | 8                                     | 0.200                                            | 1.12                                       |
| 100                                                         | W            | TR3W107(1)020(3)0100 | 20.0                                | 8                                     | 0.100                                            | 1.58                                       |
| 100                                                         | W            | TR3W107(1)020(3)0080 | 20.0                                | 8                                     | 0.080                                            | 1.77                                       |
| 100                                                         | W            | TR3W107(1)020(3)0060 | 20.0                                | 8                                     | 0.060                                            | 2.04                                       |
| 150                                                         | W            | TR3W157(1)020(3)0200 | 30.0                                | 10                                    | 0.200                                            | 1.12                                       |
| 150                                                         | W            | TR3W157(1)020(3)0150 | 30.0                                | 10                                    | 0.150                                            | 1.29                                       |
| 150                                                         | W            | TR3W157(1)020(3)0100 | 30.0                                | 10                                    | 0.100                                            | 1.58                                       |
| 150                                                         | W            | TR3W157(1)020(3)0080 | 30.0                                | 10                                    | 0.080                                            | 1.77                                       |

**Note**

- Part number definitions:
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  - Lead (Pb)-free terminations and packaging codes: C, D, V, U. Except: for case W, 7" reel is available only, codes C and V (dry pack option is recommended)



| STANDARD RATINGS                                            |              |                      |                                     |                                       |                                                  |                                            |
|-------------------------------------------------------------|--------------|----------------------|-------------------------------------|---------------------------------------|--------------------------------------------------|--------------------------------------------|
| CAPACITANCE<br>( $\mu$ F)                                   | CASE<br>CODE | PART NUMBER          | MAX. DCL<br>AT +25 °C<br>( $\mu$ A) | MAX. DF<br>AT +25 °C<br>120 Hz<br>(%) | MAX. ESR<br>AT +25 °C<br>100 kHz<br>( $\Omega$ ) | MAX. RIPPLE<br>100 kHz<br>$I_{RMS}$<br>(A) |
| 25 V <sub>DC</sub> AT +85 °C; 17 V <sub>DC</sub> AT +125 °C |              |                      |                                     |                                       |                                                  |                                            |
| 0.47                                                        | A            | TR3A474(1)025(2)7000 | 0.5                                 | 4                                     | 7.000                                            | 0.10                                       |
| 0.68                                                        | A            | TR3A684(1)025(2)6000 | 0.5                                 | 4                                     | 6.000                                            | 0.11                                       |
| 1.0                                                         | A            | TR3A105(1)025(2)4000 | 0.5                                 | 4                                     | 4.000                                            | 0.14                                       |
| 1.5                                                         | A            | TR3A155(1)025(2)4000 | 0.5                                 | 6                                     | 4.000                                            | 0.14                                       |
| 1.5                                                         | A            | TR3A155(1)025(2)3000 | 0.5                                 | 6                                     | 3.000                                            | 0.16                                       |
| 1.5                                                         | B            | TR3B155(1)025(2)1800 | 0.5                                 | 6                                     | 1.800                                            | 0.22                                       |
| 2.2                                                         | A            | TR3A225(1)025(2)4000 | 0.6                                 | 6                                     | 4.000                                            | 0.14                                       |
| 2.2                                                         | B            | TR3B225(1)025(2)1700 | 0.6                                 | 8                                     | 1.700                                            | 0.22                                       |
| 2.2                                                         | B            | TR3B225(1)025(2)1500 | 0.6                                 | 6                                     | 1.500                                            | 0.24                                       |
| 2.2                                                         | B            | TR3B225(1)025(2)1200 | 0.6                                 | 6                                     | 1.200                                            | 0.27                                       |
| 2.2                                                         | B            | TR3B225(1)025(2)0900 | 0.6                                 | 6                                     | 0.900                                            | 0.31                                       |
| 3.3                                                         | A            | TR3A335(1)025(2)3500 | 0.8                                 | 6                                     | 3.500                                            | 0.15                                       |
| 3.3                                                         | A            | TR3A335(1)025(2)3000 | 0.8                                 | 6                                     | 3.000                                            | 0.16                                       |
| 3.3                                                         | B            | TR3B335(1)025(2)2000 | 0.8                                 | 6                                     | 2.000                                            | 0.21                                       |
| 3.3                                                         | B            | TR3B335(1)025(2)1500 | 0.8                                 | 6                                     | 1.500                                            | 0.24                                       |
| 3.3                                                         | B            | TR3B335(1)025(2)0750 | 0.8                                 | 6                                     | 0.750                                            | 0.34                                       |
| 4.7                                                         | A            | TR3A475(1)025(2)3500 | 1.2                                 | 6                                     | 3.500                                            | 0.15                                       |
| 4.7                                                         | A            | TR3A475(1)025(2)3000 | 1.2                                 | 6                                     | 3.000                                            | 0.16                                       |
| 4.7                                                         | B            | TR3B475(1)025(2)1500 | 1.2                                 | 6                                     | 1.500                                            | 0.24                                       |
| 4.7                                                         | B            | TR3B475(1)025(2)1000 | 1.2                                 | 6                                     | 1.000                                            | 0.29                                       |
| 4.7                                                         | B            | TR3B475(1)025(2)0900 | 1.2                                 | 6                                     | 0.900                                            | 0.10                                       |
| 4.7                                                         | B            | TR3B475(1)025(2)0700 | 1.2                                 | 6                                     | 0.700                                            | 0.35                                       |
| 4.7                                                         | C            | TR3C475(1)025(2)0600 | 1.2                                 | 6                                     | 0.600                                            | 0.43                                       |
| 4.7                                                         | C            | TR3C475(1)025(2)0525 | 1.2                                 | 6                                     | 0.525                                            | 0.46                                       |
| 6.8                                                         | B            | TR3B685(1)025(2)2000 | 1.7                                 | 6                                     | 2.000                                            | 0.21                                       |
| 6.8                                                         | B            | TR3B685(1)025(2)1500 | 1.7                                 | 6                                     | 1.500                                            | 0.24                                       |
| 6.8                                                         | B            | TR3B685(1)025(2)1200 | 1.7                                 | 6                                     | 1.200                                            | 0.27                                       |
| 6.8                                                         | B            | TR3B685(1)025(2)0700 | 1.7                                 | 6                                     | 0.700                                            | 0.35                                       |
| 6.8                                                         | B            | TR3B685(1)025(3)0500 | 1.7                                 | 6                                     | 0.500                                            | 0.41                                       |
| 6.8                                                         | B            | TR3B685(1)025(3)0400 | 1.7                                 | 6                                     | 0.400                                            | 0.46                                       |
| 6.8                                                         | C            | TR3C685(1)025(2)0600 | 1.7                                 | 6                                     | 0.600                                            | 0.43                                       |
| 6.8                                                         | C            | TR3C685(1)025(2)0500 | 1.7                                 | 6                                     | 0.500                                            | 0.47                                       |
| 10                                                          | B            | TR3B106(1)025(2)1300 | 2.5                                 | 6                                     | 1.300                                            | 0.26                                       |
| 10                                                          | B            | TR3B106(1)025(2)1100 | 2.5                                 | 6                                     | 1.100                                            | 0.28                                       |
| 10                                                          | B            | TR3B106(1)025(2)0900 | 2.5                                 | 6                                     | 0.900                                            | 0.31                                       |
| 10                                                          | B            | TR3B106(1)025(2)0450 | 2.5                                 | 6                                     | 0.450                                            | 0.43                                       |
| 10                                                          | C            | TR3C106(1)025(2)0600 | 2.5                                 | 6                                     | 0.600                                            | 0.43                                       |
| 10                                                          | C            | TR3C106(1)025(2)0500 | 2.5                                 | 6                                     | 0.500                                            | 0.47                                       |
| 10                                                          | C            | TR3C106(1)025(2)0450 | 2.5                                 | 6                                     | 0.450                                            | 0.49                                       |
| 10                                                          | C            | TR3C106(1)025(2)0300 | 2.5                                 | 6                                     | 0.300                                            | 0.61                                       |
| 10                                                          | D            | TR3D106(1)025(2)0400 | 2.5                                 | 6                                     | 0.400                                            | 0.61                                       |
| 10                                                          | D            | TR3D106(1)025(2)0300 | 2.5                                 | 6                                     | 0.300                                            | 0.71                                       |
| 15                                                          | B            | TR3B156(1)025(2)1000 | 3.8                                 | 6                                     | 1.000                                            | 0.29                                       |
| 15                                                          | B            | TR3B156(1)025(2)0800 | 3.8                                 | 6                                     | 0.800                                            | 0.33                                       |
| 15                                                          | B            | TR3B156(1)025(2)0600 | 3.8                                 | 6                                     | 0.600                                            | 0.38                                       |
| 15                                                          | C            | TR3C156(1)025(2)0900 | 3.8                                 | 6                                     | 0.900                                            | 0.35                                       |
| 15                                                          | C            | TR3C156(1)025(2)0425 | 3.8                                 | 6                                     | 0.425                                            | 0.51                                       |

**Note**

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  - Lead (Pb)-free terminations and packaging codes: C, D, V, U. Except: for case W, 7" reel is available only, codes C and V (dry pack option is recommended)



| STANDARD RATINGS                                            |              |                      |                                            |                                       |                                                  |                                                   |
|-------------------------------------------------------------|--------------|----------------------|--------------------------------------------|---------------------------------------|--------------------------------------------------|---------------------------------------------------|
| CAPACITANCE<br>( $\mu\text{F}$ )                            | CASE<br>CODE | PART NUMBER          | MAX. DCL<br>AT +25 °C<br>( $\mu\text{A}$ ) | MAX. DF<br>AT +25 °C<br>120 Hz<br>(%) | MAX. ESR<br>AT +25 °C<br>100 kHz<br>( $\Omega$ ) | MAX. RIPPLE<br>100 kHz<br>$I_{\text{RMS}}$<br>(A) |
| 25 V <sub>DC</sub> AT +85 °C; 17 V <sub>DC</sub> AT +125 °C |              |                      |                                            |                                       |                                                  |                                                   |
| 15                                                          | D            | TR3D156(1)025(2)0350 | 3.8                                        | 6                                     | 0.350                                            | 0.65                                              |
| 15                                                          | D            | TR3D156(1)025(2)0275 | 3.8                                        | 6                                     | 0.275                                            | 0.74                                              |
| 15                                                          | D            | TR3D156(1)025(2)0250 | 3.8                                        | 6                                     | 0.250                                            | 0.77                                              |
| 15                                                          | D            | TR3D156(1)025(2)0200 | 3.8                                        | 6                                     | 0.200                                            | 0.87                                              |
| 22                                                          | C            | TR3C226(1)025(2)1000 | 5.5                                        | 6                                     | 1.000                                            | 0.33                                              |
| 22                                                          | C            | TR3C226(1)025(2)0900 | 5.5                                        | 6                                     | 0.900                                            | 0.35                                              |
| 22                                                          | C            | TR3C226(1)025(2)0425 | 5.5                                        | 6                                     | 0.425                                            | 0.51                                              |
| 22                                                          | C            | TR3C226(1)025(2)0400 | 5.5                                        | 6                                     | 0.400                                            | 0.52                                              |
| 22                                                          | C            | TR3C226(1)025(2)0300 | 5.5                                        | 6                                     | 0.300                                            | 0.61                                              |
| 22                                                          | C            | TR3C226(1)025(2)0275 | 5.5                                        | 6                                     | 0.275                                            | 0.63                                              |
| 22                                                          | C            | TR3C226(1)025(2)0250 | 5.5                                        | 6                                     | 0.250                                            | 0.66                                              |
| 22                                                          | D            | TR3D226(1)025(2)0300 | 5.5                                        | 6                                     | 0.300                                            | 0.71                                              |
| 22                                                          | D            | TR3D226(1)025(2)0200 | 5.5                                        | 6                                     | 0.200                                            | 0.87                                              |
| 22                                                          | E            | TR3E226(1)025(2)0300 | 5.5                                        | 6                                     | 0.300                                            | 0.74                                              |
| 22                                                          | E            | TR3E226(1)025(2)0200 | 5.5                                        | 6                                     | 0.200                                            | 0.91                                              |
| 33                                                          | D            | TR3D336(1)025(2)0400 | 8.3                                        | 6                                     | 0.400                                            | 0.61                                              |
| 33                                                          | D            | TR3D336(1)025(2)0300 | 8.3                                        | 6                                     | 0.300                                            | 0.71                                              |
| 33                                                          | D            | TR3D336(1)025(2)0225 | 8.3                                        | 6                                     | 0.225                                            | 0.82                                              |
| 33                                                          | D            | TR3D336(1)025(2)0200 | 8.3                                        | 6                                     | 0.200                                            | 0.87                                              |
| 33                                                          | E            | TR3E336(1)025(2)0300 | 8.3                                        | 6                                     | 0.300                                            | 0.74                                              |
| 33                                                          | E            | TR3E336(1)025(2)0200 | 8.3                                        | 6                                     | 0.200                                            | 0.91                                              |
| 33                                                          | E            | TR3E336(1)025(2)0175 | 6.6                                        | 4                                     | 0.175                                            | 0.97                                              |
| 47                                                          | D            | TR3D476(1)025(2)0350 | 11.8                                       | 8                                     | 0.350                                            | 0.65                                              |
| 47                                                          | D            | TR3D476(1)025(2)0250 | 11.8                                       | 8                                     | 0.250                                            | 0.77                                              |
| 47                                                          | D            | TR3D476(1)025(2)0200 | 11.8                                       | 8                                     | 0.200                                            | 0.87                                              |
| 47                                                          | D            | TR3D476(1)025(2)0150 | 11.8                                       | 8                                     | 0.150                                            | 1.00                                              |
| 47                                                          | D            | TR3D476(1)025(3)0125 | 11.8                                       | 8                                     | 0.125                                            | 1.10                                              |
| 47                                                          | D            | TR3D476(1)025(3)0100 | 11.8                                       | 8                                     | 0.100                                            | 1.22                                              |
| 47                                                          | E            | TR3E476(1)025(2)0300 | 11.8                                       | 6                                     | 0.300                                            | 0.74                                              |
| 47                                                          | E            | TR3E476(1)025(2)0200 | 11.8                                       | 6                                     | 0.200                                            | 0.91                                              |
| 47                                                          | E            | TR3E476(1)025(2)0150 | 11.8                                       | 8                                     | 0.150                                            | 1.05                                              |
| 47                                                          | E            | TR3E476(1)025(3)0125 | 11.8                                       | 8                                     | 0.125                                            | 1.15                                              |
| 47                                                          | E            | TR3E476(1)025(3)0100 | 11.8                                       | 8                                     | 0.100                                            | 1.28                                              |
| 68                                                          | E            | TR3E686(1)025(2)0250 | 17.0                                       | 8                                     | 0.250                                            | 0.81                                              |
| 68                                                          | E            | TR3E686(1)025(3)0125 | 17.0                                       | 8                                     | 0.125                                            | 1.15                                              |
| 100                                                         | E            | TR3E107(1)025(2)0300 | 35.0                                       | 10                                    | 0.300                                            | 0.74                                              |
| 100                                                         | E            | TR3E107(1)025(2)0250 | 35.0                                       | 10                                    | 0.250                                            | 0.81                                              |
| 100                                                         | W            | TR3W107(1)025(3)0200 | 25.0                                       | 15                                    | 0.200                                            | 1.12                                              |
| 100                                                         | W            | TR3W107(1)025(3)0150 | 25.0                                       | 15                                    | 0.150                                            | 1.29                                              |
| 100                                                         | W            | TR3W107(1)025(3)0100 | 25.0                                       | 15                                    | 0.100                                            | 1.58                                              |

**Note**

- Part number definitions:
  - Capacitance tolerance codes: K, M
  - Terminations and packaging codes: C, D, E, F, V, U, T, W
  - Lead (Pb)-free terminations and packaging codes: C, D, V, U. Except: for case W, 7" reel is available only, codes C and V (dry pack option is recommended)



| STANDARD RATINGS                                            |              |                      |                                     |                                       |                                                  |                                            |
|-------------------------------------------------------------|--------------|----------------------|-------------------------------------|---------------------------------------|--------------------------------------------------|--------------------------------------------|
| CAPACITANCE<br>( $\mu$ F)                                   | CASE<br>CODE | PART NUMBER          | MAX. DCL<br>AT +25 °C<br>( $\mu$ A) | MAX. DF<br>AT +25 °C<br>120 Hz<br>(%) | MAX. ESR<br>AT +25 °C<br>100 kHz<br>( $\Omega$ ) | MAX. RIPPLE<br>100 kHz<br>$I_{RMS}$<br>(A) |
| 35 V <sub>DC</sub> AT +85 °C; 23 V <sub>DC</sub> AT +125 °C |              |                      |                                     |                                       |                                                  |                                            |
| 0.22                                                        | A            | TR3A224(1)035(2)6000 | 0.5                                 | 4                                     | 6.000                                            | 0.11                                       |
| 0.33                                                        | A            | TR3A334(1)035(2)6000 | 0.5                                 | 4                                     | 6.000                                            | 0.11                                       |
| 0.47                                                        | A            | TR3A474(1)035(2)4000 | 0.5                                 | 4                                     | 4.000                                            | 0.14                                       |
| 0.47                                                        | B            | TR3B474(1)035(2)4000 | 0.5                                 | 6                                     | 4.000                                            | 0.15                                       |
| 0.68                                                        | A            | TR3A684(1)035(2)6000 | 0.5                                 | 4                                     | 6.000                                            | 0.11                                       |
| 0.68                                                        | A            | TR3A684(1)035(2)4000 | 0.5                                 | 4                                     | 4.000                                            | 0.14                                       |
| 1.0                                                         | A            | TR3A105(1)035(2)6000 | 0.5                                 | 4                                     | 6.000                                            | 0.11                                       |
| 1.0                                                         | A            | TR3A105(1)035(2)4000 | 0.5                                 | 4                                     | 4.000                                            | 0.14                                       |
| 1.0                                                         | A            | TR3A105(1)035(2)3000 | 0.5                                 | 4                                     | 3.000                                            | 0.16                                       |
| 1.0                                                         | B            | TR3B105(1)035(2)2000 | 0.5                                 | 4                                     | 2.000                                            | 0.21                                       |
| 1.5                                                         | B            | TR3B155(1)035(2)3000 | 0.5                                 | 6                                     | 3.000                                            | 0.17                                       |
| 1.5                                                         | B            | TR3B155(1)035(2)2000 | 0.5                                 | 6                                     | 2.000                                            | 0.21                                       |
| 1.5                                                         | C            | TR3C155(1)035(2)2500 | 0.5                                 | 6                                     | 2.500                                            | 0.21                                       |
| 1.5                                                         | C            | TR3C155(1)035(2)0900 | 0.5                                 | 6                                     | 0.900                                            | 0.35                                       |
| 2.2                                                         | B            | TR3B225(1)035(2)2500 | 0.8                                 | 6                                     | 2.500                                            | 0.18                                       |
| 2.2                                                         | B            | TR3B225(1)035(2)2000 | 0.8                                 | 6                                     | 2.000                                            | 0.21                                       |
| 2.2                                                         | B            | TR3B225(1)035(2)1500 | 0.8                                 | 6                                     | 1.500                                            | 0.24                                       |
| 2.2                                                         | C            | TR3C225(1)035(2)1500 | 0.8                                 | 6                                     | 1.500                                            | 0.27                                       |
| 2.2                                                         | C            | TR3C225(1)035(2)0900 | 0.8                                 | 6                                     | 0.900                                            | 0.35                                       |
| 3.3                                                         | B            | TR3B335(1)035(2)1500 | 1.2                                 | 6                                     | 1.500                                            | 0.24                                       |
| 3.3                                                         | B            | TR3B335(1)035(2)1000 | 1.2                                 | 6                                     | 1.000                                            | 0.29                                       |
| 3.3                                                         | C            | TR3C335(1)035(2)0800 | 1.2                                 | 6                                     | 0.800                                            | 0.37                                       |
| 3.3                                                         | C            | TR3C335(1)035(2)0700 | 1.2                                 | 6                                     | 0.700                                            | 0.40                                       |
| 3.3                                                         | C            | TR3C335(1)035(2)0600 | 1.2                                 | 6                                     | 0.600                                            | 0.43                                       |
| 4.7                                                         | B            | TR3B475(1)035(2)1500 | 1.6                                 | 6                                     | 1.500                                            | 0.24                                       |
| 4.7                                                         | B            | TR3B475(1)035(2)1000 | 1.6                                 | 6                                     | 1.000                                            | 0.29                                       |
| 4.7                                                         | B            | TR3B475(1)035(2)0700 | 1.6                                 | 6                                     | 0.700                                            | 0.35                                       |
| 4.7                                                         | C            | TR3C475(1)035(2)0700 | 1.6                                 | 6                                     | 0.700                                            | 0.40                                       |
| 4.7                                                         | C            | TR3C475(1)035(2)0600 | 1.6                                 | 6                                     | 0.600                                            | 0.43                                       |
| 4.7                                                         | C            | TR3C475(1)035(2)0500 | 1.6                                 | 6                                     | 0.500                                            | 0.47                                       |
| 4.7                                                         | D            | TR3D475(1)035(2)0700 | 1.6                                 | 6                                     | 0.700                                            | 0.46                                       |
| 6.8                                                         | C            | TR3C685(1)035(2)0900 | 2.4                                 | 6                                     | 0.900                                            | 0.35                                       |
| 6.8                                                         | C            | TR3C685(1)035(2)0475 | 2.4                                 | 6                                     | 0.475                                            | 0.48                                       |
| 6.8                                                         | D            | TR3D685(1)035(2)0500 | 2.4                                 | 6                                     | 0.500                                            | 0.55                                       |
| 6.8                                                         | D            | TR3D685(1)035(2)0400 | 2.4                                 | 6                                     | 0.400                                            | 0.61                                       |
| 6.8                                                         | D            | TR3D685(1)035(2)0300 | 2.4                                 | 6                                     | 0.300                                            | 0.71                                       |
| 6.8                                                         | E            | TR3E685(1)035(2)0300 | 2.4                                 | 4                                     | 0.300                                            | 0.74                                       |
| 10                                                          | C            | TR3C106(1)035(2)1200 | 3.5                                 | 6                                     | 1.200                                            | 0.30                                       |
| 10                                                          | C            | TR3C106(1)035(2)0450 | 3.5                                 | 6                                     | 0.450                                            | 0.49                                       |
| 10                                                          | D            | TR3D106(1)035(2)0400 | 3.5                                 | 6                                     | 0.400                                            | 0.61                                       |
| 10                                                          | D            | TR3D106(1)035(2)0300 | 3.5                                 | 6                                     | 0.300                                            | 0.71                                       |
| 10                                                          | D            | TR3D106(1)035(2)0260 | 3.5                                 | 6                                     | 0.260                                            | 0.76                                       |
| 10                                                          | D            | TR3D106(1)035(2)0250 | 3.5                                 | 6                                     | 0.250                                            | 0.77                                       |
| 10                                                          | D            | TR3D106(1)035(2)0200 | 3.5                                 | 6                                     | 0.200                                            | 0.87                                       |
| 10                                                          | D            | TR3D106(1)035(3)0135 | 3.5                                 | 6                                     | 0.135                                            | 1.05                                       |
| 10                                                          | D            | TR3D106(1)035(3)0125 | 3.5                                 | 6                                     | 0.125                                            | 1.10                                       |
| 10                                                          | E            | TR3E106(1)035(2)0250 | 3.5                                 | 6                                     | 0.250                                            | 0.81                                       |
| 10                                                          | E            | TR3E106(1)035(2)0200 | 3.5                                 | 6                                     | 0.200                                            | 0.91                                       |
| 15                                                          | C            | TR3C156(1)035(2)0600 | 5.3                                 | 6                                     | 0.600                                            | 0.43                                       |

**Note**

- Part number definitions:
  - Capacitance tolerance codes: K, M
  - Terminations and packaging codes: C, D, E, F, V, U, T, W
  - Lead (Pb)-free terminations and packaging codes: C, D, V, U. Except: for case W, 7" reel is available only, codes C and V (dry pack option is recommended)



| STANDARD RATINGS                                            |              |                      |                                     |                                       |                                                  |                                            |
|-------------------------------------------------------------|--------------|----------------------|-------------------------------------|---------------------------------------|--------------------------------------------------|--------------------------------------------|
| CAPACITANCE<br>( $\mu$ F)                                   | CASE<br>CODE | PART NUMBER          | MAX. DCL<br>AT +25 °C<br>( $\mu$ A) | MAX. DF<br>AT +25 °C<br>120 Hz<br>(%) | MAX. ESR<br>AT +25 °C<br>100 kHz<br>( $\Omega$ ) | MAX. RIPPLE<br>100 kHz<br>$I_{RMS}$<br>(A) |
| 35 V <sub>DC</sub> AT +85 °C; 23 V <sub>DC</sub> AT +125 °C |              |                      |                                     |                                       |                                                  |                                            |
| 15                                                          | C            | TR3C156(1)035(2)0400 | 5.3                                 | 6                                     | 0.400                                            | 0.52                                       |
| 15                                                          | D            | TR3D156(1)035(2)0350 | 5.3                                 | 6                                     | 0.350                                            | 0.65                                       |
| 15                                                          | D            | TR3D156(1)035(2)0300 | 5.3                                 | 6                                     | 0.300                                            | 0.71                                       |
| 15                                                          | D            | TR3D156(1)035(2)0260 | 5.3                                 | 6                                     | 0.260                                            | 0.76                                       |
| 15                                                          | D            | TR3D156(1)035(2)0225 | 5.3                                 | 6                                     | 0.225                                            | 0.82                                       |
| 15                                                          | D            | TR3D156(1)035(2)0200 | 5.3                                 | 6                                     | 0.200                                            | 0.87                                       |
| 15                                                          | D            | TR3D156(1)035(2)0150 | 5.3                                 | 6                                     | 0.150                                            | 1.00                                       |
| 15                                                          | E            | TR3E156(1)035(2)0300 | 5.3                                 | 6                                     | 0.300                                            | 0.74                                       |
| 15                                                          | E            | TR3E156(1)035(2)0225 | 5.3                                 | 6                                     | 0.225                                            | 0.86                                       |
| 15                                                          | E            | TR3E156(1)035(2)0200 | 5.3                                 | 6                                     | 0.200                                            | 0.91                                       |
| 15                                                          | E            | TR3E156(1)035(2)0150 | 5.3                                 | 6                                     | 0.150                                            | 1.05                                       |
| 22                                                          | D            | TR3D226(1)035(2)0400 | 7.7                                 | 6                                     | 0.400                                            | 0.61                                       |
| 22                                                          | D            | TR3D226(1)035(2)0300 | 7.7                                 | 6                                     | 0.300                                            | 0.71                                       |
| 22                                                          | D            | TR3D226(1)035(2)0275 | 7.7                                 | 6                                     | 0.275                                            | 0.74                                       |
| 22                                                          | D            | TR3D226(1)035(2)0250 | 7.7                                 | 6                                     | 0.250                                            | 0.77                                       |
| 22                                                          | D            | TR3D226(1)035(2)0200 | 7.7                                 | 6                                     | 0.200                                            | 0.87                                       |
| 22                                                          | E            | TR3E226(1)035(2)0300 | 7.7                                 | 6                                     | 0.300                                            | 0.74                                       |
| 22                                                          | E            | TR3E226(1)035(2)0275 | 7.7                                 | 6                                     | 0.275                                            | 0.77                                       |
| 22                                                          | E            | TR3E226(1)035(2)0260 | 7.7                                 | 6                                     | 0.260                                            | 0.80                                       |
| 22                                                          | E            | TR3E226(1)035(2)0200 | 7.7                                 | 6                                     | 0.200                                            | 0.91                                       |
| 33                                                          | D            | TR3D336(1)035(2)0400 | 11.6                                | 6                                     | 0.400                                            | 0.61                                       |
| 33                                                          | D            | TR3D336(1)035(3)0250 | 11.6                                | 6                                     | 0.250                                            | 0.77                                       |
| 33                                                          | E            | TR3E336(1)035(2)0400 | 11.6                                | 6                                     | 0.400                                            | 0.64                                       |
| 33                                                          | E            | TR3E336(1)035(3)0250 | 11.6                                | 6                                     | 0.250                                            | 0.81                                       |
| 47                                                          | E            | TR3E476(1)035(2)0400 | 20.0                                | 10                                    | 0.400                                            | 0.64                                       |
| 47                                                          | E            | TR3E476(1)035(3)0200 | 20.0                                | 10                                    | 0.200                                            | 0.91                                       |
| 50 V <sub>DC</sub> AT +85 °C; 33 V <sub>DC</sub> AT +125 °C |              |                      |                                     |                                       |                                                  |                                            |
| 0.15                                                        | A            | TR3A154(1)050(2)10R0 | 0.5                                 | 4                                     | 10.000                                           | 0.09                                       |
| 0.22                                                        | A            | TR3A224(1)050(2)10R0 | 0.5                                 | 4                                     | 10.000                                           | 0.09                                       |
| 0.33                                                        | A            | TR3A334(1)050(2)7000 | 0.5                                 | 4                                     | 7.000                                            | 0.10                                       |
| 0.47                                                        | B            | TR3B474(1)050(2)6000 | 0.5                                 | 4                                     | 6.000                                            | 0.12                                       |
| 0.47                                                        | C            | TR3C474(1)050(2)2300 | 0.5                                 | 4                                     | 2.300                                            | 0.22                                       |
| 1.0                                                         | B            | TR3B105(1)050(2)4000 | 0.5                                 | 4                                     | 4.000                                            | 0.15                                       |
| 1.0                                                         | B            | TR3B105(1)050(2)2000 | 0.5                                 | 4                                     | 2.000                                            | 0.21                                       |
| 1.0                                                         | C            | TR3C105(1)050(2)1600 | 0.5                                 | 4                                     | 1.600                                            | 0.26                                       |
| 1.5                                                         | B            | TR3B155(1)050(2)2000 | 0.8                                 | 6                                     | 2.000                                            | 0.21                                       |
| 1.5                                                         | C            | TR3C155(1)050(2)1500 | 0.8                                 | 6                                     | 1.500                                            | 0.27                                       |
| 2.2                                                         | B            | TR3B225(1)050(2)2000 | 1.1                                 | 6                                     | 2.000                                            | 0.21                                       |
| 2.2                                                         | C            | TR3C225(1)050(2)1500 | 1.1                                 | 6                                     | 1.500                                            | 0.27                                       |
| 2.2                                                         | D            | TR3D225(1)050(2)0800 | 1.1                                 | 6                                     | 0.800                                            | 0.43                                       |
| 3.3                                                         | C            | TR3C335(1)050(2)1500 | 1.7                                 | 6                                     | 1.500                                            | 0.27                                       |
| 3.3                                                         | D            | TR3D335(1)050(2)0800 | 1.7                                 | 6                                     | 0.800                                            | 0.43                                       |
| 4.7                                                         | C            | TR3C475(1)050(2)1000 | 2.4                                 | 6                                     | 1.000                                            | 0.33                                       |
| 4.7                                                         | C            | TR3C475(1)050(2)0700 | 2.4                                 | 6                                     | 0.700                                            | 0.40                                       |
| 4.7                                                         | C            | TR3C475(1)050(2)0500 | 2.4                                 | 6                                     | 0.500                                            | 0.47                                       |
| 4.7                                                         | D            | TR3D475(1)050(2)0700 | 2.4                                 | 6                                     | 0.700                                            | 0.46                                       |
| 4.7                                                         | D            | TR3D475(1)050(2)0600 | 2.4                                 | 6                                     | 0.600                                            | 0.50                                       |
| 4.7                                                         | D            | TR3D475(1)050(2)0500 | 2.4                                 | 6                                     | 0.500                                            | 0.55                                       |
| 4.7                                                         | D            | TR3D475(1)050(2)0300 | 2.4                                 | 6                                     | 0.300                                            | 0.71                                       |
| 4.7                                                         | E            | TR3E475(1)050(2)0600 | 2.4                                 | 4                                     | 0.600                                            | 0.52                                       |
| 4.7                                                         | E            | TR3E475(1)050(2)0300 | 2.4                                 | 4                                     | 0.300                                            | 0.74                                       |

**Note**

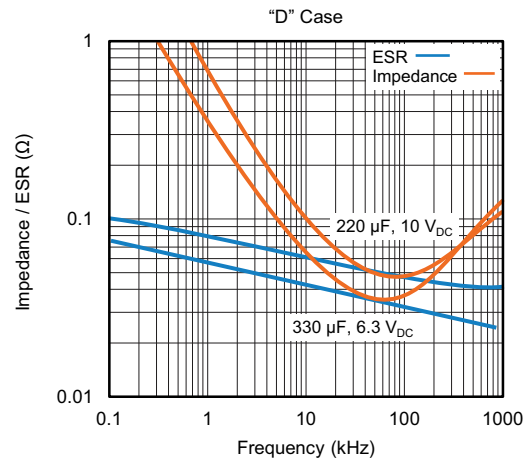
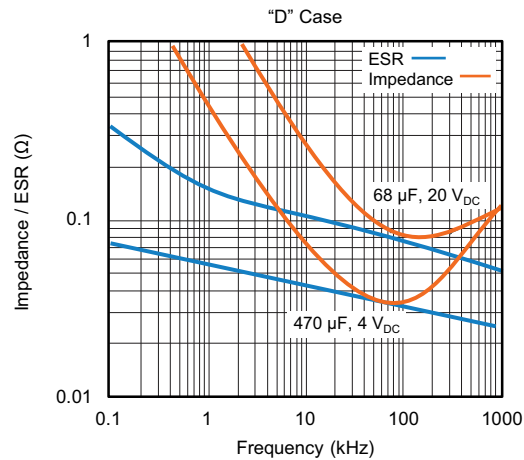
- Part number definitions:
  - Capacitance tolerance codes: K, M
  - Terminations and packaging codes: C, D, E, F, V, U, T, W
  - Lead (Pb)-free terminations and packaging codes: C, D, V, U. Except: for case W, 7" reel is available only, codes C and V (dry pack option is recommended)



| STANDARD RATINGS                                            |              |                      |                                     |                                       |                                                  |                                            |
|-------------------------------------------------------------|--------------|----------------------|-------------------------------------|---------------------------------------|--------------------------------------------------|--------------------------------------------|
| CAPACITANCE<br>( $\mu$ F)                                   | CASE<br>CODE | PART NUMBER          | MAX. DCL<br>AT +25 °C<br>( $\mu$ A) | MAX. DF<br>AT +25 °C<br>120 Hz<br>(%) | MAX. ESR<br>AT +25 °C<br>100 kHz<br>( $\Omega$ ) | MAX. RIPPLE<br>100 kHz<br>$I_{RMS}$<br>(A) |
| 50 V <sub>DC</sub> AT +85 °C; 33 V <sub>DC</sub> AT +125 °C |              |                      |                                     |                                       |                                                  |                                            |
| 6.8                                                         | D            | TR3D685(1)050(2)0700 | 3.4                                 | 6                                     | 0.700                                            | 0.46                                       |
| 6.8                                                         | D            | TR3D685(1)050(2)0600 | 3.4                                 | 6                                     | 0.600                                            | 0.50                                       |
| 6.8                                                         | D            | TR3D685(1)050(2)0500 | 3.4                                 | 6                                     | 0.500                                            | 0.55                                       |
| 6.8                                                         | D            | TR3D685(1)050(2)0300 | 3.4                                 | 6                                     | 0.300                                            | 0.71                                       |
| 6.8                                                         | E            | TR3E685(1)050(2)0550 | 3.4                                 | 6                                     | 0.550                                            | 0.55                                       |
| 6.8                                                         | E            | TR3E685(1)050(2)0500 | 3.4                                 | 6                                     | 0.500                                            | 0.57                                       |
| 10                                                          | D            | TR3D106(1)050(2)0700 | 5.0                                 | 6                                     | 0.700                                            | 0.46                                       |
| 10                                                          | D            | TR3D106(1)050(2)0550 | 5.0                                 | 6                                     | 0.550                                            | 0.52                                       |
| 10                                                          | D            | TR3D106(1)050(2)0450 | 5.0                                 | 6                                     | 0.450                                            | 0.58                                       |
| 10                                                          | E            | TR3E106(1)050(2)0700 | 5.0                                 | 6                                     | 0.700                                            | 0.49                                       |
| 10                                                          | E            | TR3E106(1)050(2)0550 | 5.0                                 | 6                                     | 0.550                                            | 0.55                                       |
| 10                                                          | E            | TR3E106(1)050(2)0500 | 5.0                                 | 6                                     | 0.500                                            | 0.57                                       |
| 10                                                          | E            | TR3E106(1)050(2)0400 | 5.0                                 | 6                                     | 0.400                                            | 0.64                                       |
| 10                                                          | E            | TR3E106(1)050(2)0300 | 5.0                                 | 6                                     | 0.300                                            | 0.74                                       |
| 15                                                          | E            | TR3E156(1)050(2)0400 | 7.5                                 | 6                                     | 0.400                                            | 0.64                                       |
| 15                                                          | E            | TR3E156(1)050(3)0300 | 7.5                                 | 6                                     | 0.300                                            | 0.74                                       |
| 15                                                          | E            | TR3E156M050(2)0250   | 7.5                                 | 6                                     | 0.250                                            | 0.81                                       |
| 15                                                          | E            | TR3E156M050(3)0200   | 7.5                                 | 6                                     | 0.200                                            | 0.91                                       |
| 63 V <sub>DC</sub> AT +85 °C; 40 V <sub>DC</sub> AT +125 °C |              |                      |                                     |                                       |                                                  |                                            |
| 3.3                                                         | D            | TR3D335(1)063(2)1000 | 2.1                                 | 6                                     | 1.000                                            | 0.39                                       |
| 3.3                                                         | D            | TR3D335(1)063(2)0800 | 2.1                                 | 6                                     | 0.800                                            | 0.43                                       |
| 4.7                                                         | D            | TR3D475(1)063(2)0700 | 3.0                                 | 6                                     | 0.700                                            | 0.46                                       |
| 4.7                                                         | D            | TR3D475(1)063(2)0500 | 3.0                                 | 6                                     | 0.500                                            | 0.55                                       |
| 10                                                          | E            | TR3E106(1)063(2)0600 | 6.3                                 | 6                                     | 0.600                                            | 0.52                                       |
| 75 V <sub>DC</sub> AT +85 °C; 50 V <sub>DC</sub> AT +125 °C |              |                      |                                     |                                       |                                                  |                                            |
| 1.0                                                         | D            | TR3D105(1)075(2)3000 | 0.8                                 | 6                                     | 3.000                                            | 0.22                                       |
| 1.0                                                         | D            | TR3D105(1)075(2)1500 | 0.8                                 | 6                                     | 1.500                                            | 0.32                                       |
| 1.5                                                         | B            | TR3B155(1)075(2)2000 | 1.1                                 | 6                                     | 2.000                                            | 0.21                                       |
| 1.5                                                         | C            | TR3C155(1)075(2)2000 | 1.1                                 | 6                                     | 2.000                                            | 0.23                                       |
| 1.5                                                         | D            | TR3D155(1)075(2)2000 | 1.1                                 | 6                                     | 2.000                                            | 0.27                                       |
| 1.5                                                         | D            | TR3D155(1)075(2)1000 | 1.1                                 | 6                                     | 1.000                                            | 0.27                                       |
| 2.2                                                         | D            | TR3D225(1)075(2)1500 | 1.7                                 | 6                                     | 1.500                                            | 0.32                                       |
| 3.3                                                         | D            | TR3D335(1)075(2)1200 | 2.5                                 | 6                                     | 1.200                                            | 0.35                                       |
| 3.3                                                         | D            | TR3D335(1)075(2)1000 | 2.5                                 | 6                                     | 1.000                                            | 0.39                                       |
| 3.3                                                         | D            | TR3D335(1)075(2)0800 | 2.5                                 | 6                                     | 0.800                                            | 0.43                                       |
| 4.7                                                         | E            | TR3E475(1)075(2)1500 | 3.5                                 | 10                                    | 1.500                                            | 0.26                                       |

**Note**

- Part number definitions:
  - Capacitance tolerance codes: K, M
  - Terminations and packaging codes: C, D, E, F, V, U, T, W
  - Lead (Pb)-free terminations and packaging codes: C, D, V, U. Except: for case W, 7" reel is available only, codes C and V (dry pack option is recommended)


**TYPICAL CURVES AT +25 °C, IMPEDANCE AND ESR VS. FREQUENCY**

**POWER DISSIPATION**

| CASE CODE | MAXIMUM PERMISSIBLE POWER DISSIPATION AT +25 °C (W) IN FREE AIR |
|-----------|-----------------------------------------------------------------|
| A         | 0.075                                                           |
| B         | 0.085                                                           |
| C         | 0.110                                                           |
| D         | 0.150                                                           |
| E         | 0.165                                                           |
| W         | 0.250                                                           |

**STANDARD PACKAGING QUANTITY**

| CASE CODE | UNITS PER REEL |          |
|-----------|----------------|----------|
|           | 7" REEL        | 13" REEL |
| A         | 2000           | 9000     |
| B         | 2000           | 8000     |
| C         | 500            | 3000     |
| D         | 500            | 2500     |
| E         | 400            | 1500     |
| W         | 500            | n/a      |

**PRODUCT INFORMATION**

|                                      |                                                                        |
|--------------------------------------|------------------------------------------------------------------------|
| Guide for Molded Tantalum Capacitors | <a href="http://www.vishay.com/doc?40074">www.vishay.com/doc?40074</a> |
| Pad Dimensions                       |                                                                        |
| Packaging Dimensions                 |                                                                        |
| Moisture Sensitivity (MSL)           |                                                                        |
| <b>SELECTOR GUIDES</b>               |                                                                        |
| Solid Tantalum Selector Guide        | <a href="http://www.vishay.com/doc?49053">www.vishay.com/doc?49053</a> |
| Solid Tantalum Chip Capacitors       | <a href="http://www.vishay.com/doc?40091">www.vishay.com/doc?40091</a> |
| <b>FAQ</b>                           |                                                                        |
| Frequently Asked Questions           | <a href="http://www.vishay.com/doc?40110">www.vishay.com/doc?40110</a> |



## Guide for Molded Tantalum Capacitors

### INTRODUCTION

Tantalum electrolytic capacitors are the preferred choice in applications where volumetric efficiency, stable electrical parameters, high reliability, and long service life are primary considerations. The stability and resistance to elevated temperatures of the tantalum / tantalum oxide / manganese dioxide system make solid tantalum capacitors an appropriate choice for today's surface-mount assembly technology.

Vishay Sprague has been a pioneer and leader in this field, producing a large variety of tantalum capacitor types for consumer, industrial, automotive, military, and aerospace electronic applications.

Tantalum is not found in its pure state. Rather, it is commonly found in a number of oxide minerals, often in combination with Columbium ore. This combination is known as "tantalite" when its contents are more than one-half tantalum. Important sources of tantalite include Australia, Brazil, Canada, China, and several African countries. Synthetic tantalite concentrates produced from tin slags in Thailand, Malaysia, and Brazil are also a significant raw material for tantalum production.

Electronic applications, and particularly capacitors, consume the largest share of world tantalum production. Other important applications for tantalum include cutting tools (tantalum carbide), high temperature super alloys, chemical processing equipment, medical implants, and military ordnance.

Vishay Sprague is a major user of tantalum materials in the form of powder and wire for capacitor elements and rod and sheet for high temperature vacuum processing.

### THE BASICS OF TANTALUM CAPACITORS

Most metals form crystalline oxides which are non-protecting, such as rust on iron or black oxide on copper. A few metals form dense, stable, tightly adhering, electrically insulating oxides. These are the so-called "valve" metals and include titanium, zirconium, niobium, tantalum, hafnium, and aluminum. Only a few of these permit the accurate control of oxide thickness by electrochemical means. Of these, the most valuable for the electronics industry are aluminum and tantalum.

Capacitors are basic to all kinds of electrical equipment, from radios and television sets to missile controls and automobile ignitions. Their function is to store an electrical charge for later use.

Capacitors consist of two conducting surfaces, usually metal plates, whose function is to conduct electricity. They are separated by an insulating material or dielectric. The dielectric used in all tantalum electrolytic capacitors is tantalum pentoxide.

Tantalum pentoxide compound possesses high-dielectric strength and a high-dielectric constant. As capacitors are being manufactured, a film of tantalum pentoxide is applied to their electrodes by means of an electrolytic process. The film is applied in various thicknesses and at various voltages and although transparent to begin with, it takes on different colors as light refracts through it. This coloring occurs on the tantalum electrodes of all types of tantalum capacitors.

Rating for rating, tantalum capacitors tend to have as much as three times better capacitance / volume efficiency than aluminum electrolytic capacitors. An approximation of the capacitance / volume efficiency of other types of capacitors may be inferred from the following table, which shows the dielectric constant ranges of the various materials used in each type. Note that tantalum pentoxide has a dielectric constant of 26, some three times greater than that of aluminum oxide. This, in addition to the fact that extremely thin films can be deposited during the electrolytic process mentioned earlier, makes the tantalum capacitor extremely efficient with respect to the number of microfarads available per unit volume. The capacitance of any capacitor is determined by the surface area of the two conducting plates, the distance between the plates, and the dielectric constant of the insulating material between the plates.

#### COMPARISON OF CAPACITOR DIELECTRIC CONSTANTS

| DIELECTRIC                | $\epsilon$<br>DIELECTRIC CONSTANT |
|---------------------------|-----------------------------------|
| Air or vacuum             | 1.0                               |
| Paper                     | 2.0 to 6.0                        |
| Plastic                   | 2.1 to 6.0                        |
| Mineral oil               | 2.2 to 2.3                        |
| Silicone oil              | 2.7 to 2.8                        |
| Quartz                    | 3.8 to 4.4                        |
| Glass                     | 4.8 to 8.0                        |
| Porcelain                 | 5.1 to 5.9                        |
| Mica                      | 5.4 to 8.7                        |
| Aluminum oxide            | 8.4                               |
| <b>Tantalum pentoxide</b> | <b>26</b>                         |
| Ceramic                   | 12 to 400K                        |

In the tantalum electrolytic capacitor, the distance between the plates is very small since it is only the thickness of the tantalum pentoxide film. As the dielectric constant of the tantalum pentoxide is high, the capacitance of a tantalum capacitor is high if the area of the plates is large:

$$C = \frac{\epsilon A}{t}$$

where

C = capacitance

$\epsilon$  = dielectric constant

A = surface area of the dielectric

t = thickness of the dielectric

Tantalum capacitors contain either liquid or solid electrolytes. In solid electrolyte capacitors, a dry material (manganese dioxide) forms the cathode plate. A tantalum lead is embedded in or welded to the pellet, which is in turn connected to a termination or lead wire. The drawings show the construction details of the surface-mount types of tantalum capacitors shown in this catalog.

## SOLID ELECTROLYTE TANTALUM CAPACITORS

Solid electrolyte capacitors contain manganese dioxide, which is formed on the tantalum pentoxide dielectric layer by impregnating the pellet with a solution of manganous nitrate. The pellet is then heated in an oven, and the manganous nitrate is converted to manganese dioxide.

The pellet is next coated with graphite, followed by a layer of metallic silver, which provides a conductive surface between the pellet and the leadframe.

Molded Chip tantalum capacitor encases the element in plastic resins, such as epoxy materials. The molding compound has been selected to meet the requirements of UL 94 V-0 and outgassing requirements of ASTM E-595. After assembly, the capacitors are tested and inspected to assure long life and reliability. It offers excellent reliability and high stability for consumer and commercial electronics with the added feature of low cost

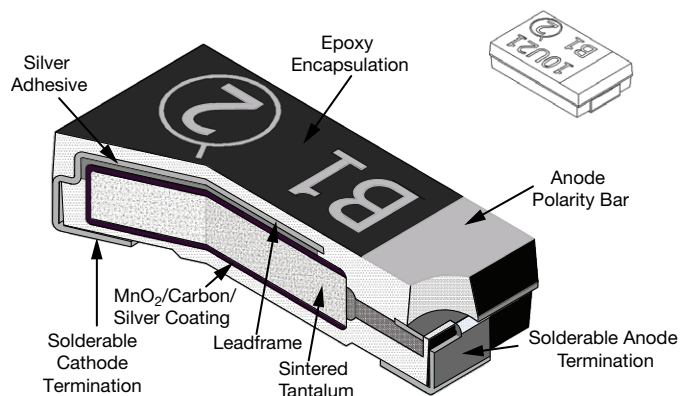
Surface-mount designs of “solid tantalum” capacitors use lead frames or lead frameless designs as shown in the accompanying drawings.

## TANTALUM CAPACITORS FOR ALL DESIGN CONSIDERATIONS

Solid electrolyte designs are the least expensive for a given rating and are used in many applications where their very small size for a given unit of capacitance is of importance. They will typically withstand up to about 10 % of the rated DC working voltage in a reverse direction. Also important are their good low temperature performance characteristics and freedom from corrosive electrolytes.

Vishay Sprague patented the original solid electrolyte capacitors and was the first to market them in 1956. Vishay Sprague has the broadest line of tantalum capacitors and has continued its position of leadership in this field. Data sheets covering the various types and styles of Vishay Sprague capacitors for consumer and entertainment electronics, industry, and military applications are available where detailed performance characteristics must be specified.

### MOLDED CHIP CAPACITOR



**COMMERCIAL PRODUCTS**

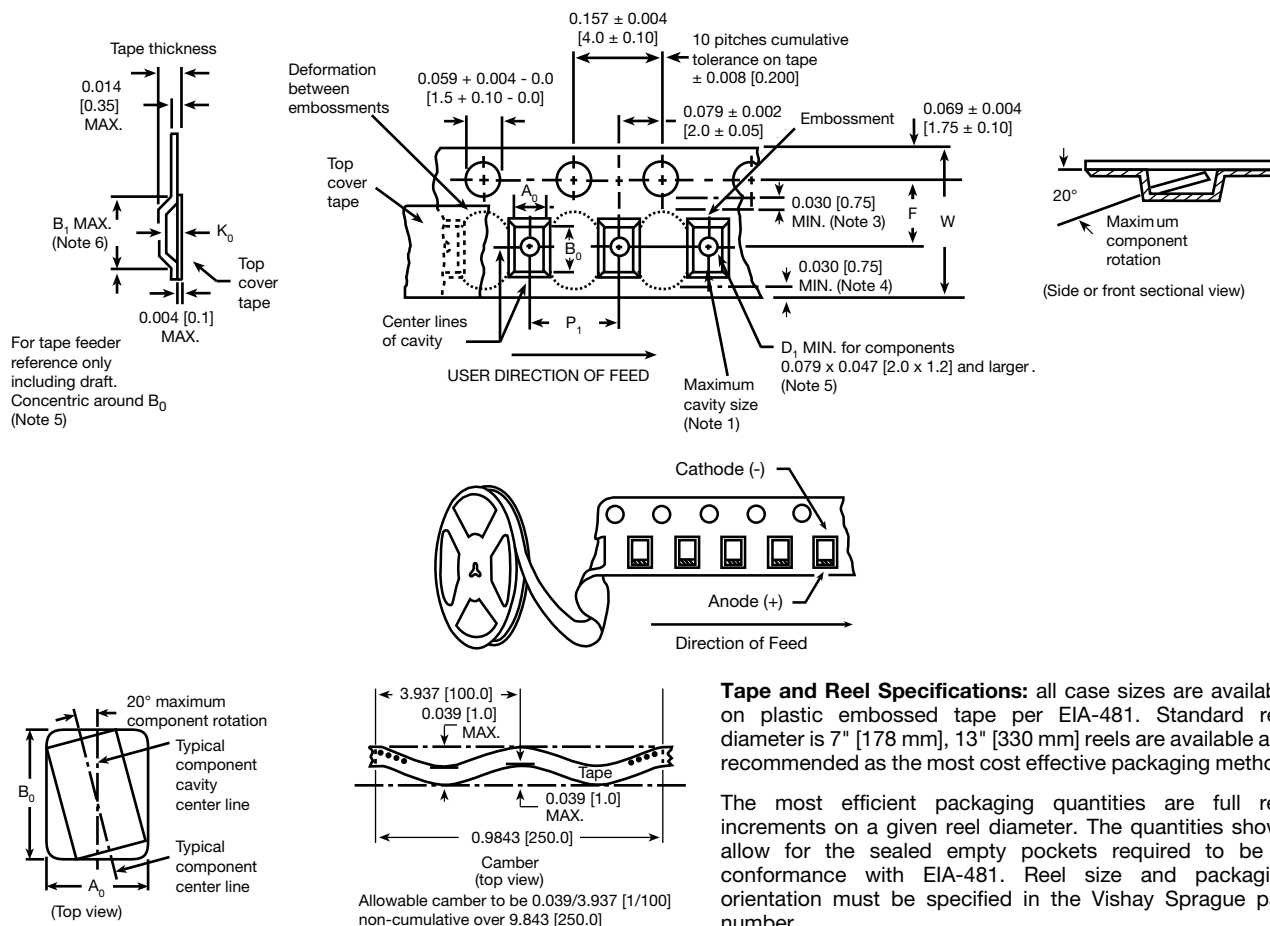
| <b>SOLID TANTALUM CAPACITORS - MOLDED CASE</b> |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |
|------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| SERIES                                         | 293D                                                                              | 793DX-CTC3-CTC4                                                                   | 593D                                                                              | TR3                                                                                | TP3                                                                                 | TL3                                                                                 |
| PRODUCT IMAGE                                  |  |  |  |  |  |  |
| TYPE                                           | Surface-mount TANTAMOUNT™, molded case                                            |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |
| FEATURES                                       | Standard industrial grade                                                         | CECC approved                                                                     | Low ESR                                                                           | Low ESR                                                                            | High performance, automotive grade                                                  | Very low DCL                                                                        |
| TEMPERATURE RANGE                              | -55 °C to +125 °C                                                                 |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |
| CAPACITANCE RANGE                              | 0.1 µF to 1000 µF                                                                 | 0.1 µF to 100 µF                                                                  | 1 µF to 470 µF                                                                    | 0.47 µF to 1000 µF                                                                 | 0.1 µF to 470 µF                                                                    | 0.1 µF to 470 µF                                                                    |
| VOLTAGE RANGE                                  | 4 V to 75 V                                                                       | 4 V to 50 V                                                                       | 4 V to 50 V                                                                       | 4 V to 75 V                                                                        | 4 V to 50 V                                                                         | 4 V to 50 V                                                                         |
| CAPACITANCE TOLERANCE                          | ± 10 %, ± 20 %                                                                    |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |
| LEAKAGE CURRENT                                | 0.01 CV or 0.5 µA, whichever is greater                                           |                                                                                   |                                                                                   |                                                                                    |                                                                                     | 0.005 CV or 0.25 µA, whichever is greater                                           |
| DISSIPATION FACTOR                             | 4 % to 30 %                                                                       | 4 % to 6 %                                                                        | 4 % to 15 %                                                                       | 4 % to 30 %                                                                        | 4 % to 15 %                                                                         | 4 % to 15 %                                                                         |
| CASE CODES                                     | A, B, C, D, E                                                                     | A, B, C, D                                                                        | A, B, C, D, E                                                                     | A, B, C, D, E, W                                                                   | A, B, C, D, E                                                                       | A, B, C, D, E                                                                       |
| TERMINATION                                    | 100 % matte tin standard, tin / lead available                                    |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |

| <b>SOLID TANTALUM CAPACITORS - MOLDED CASE</b> |                                                                                     |                                                                                     |                                                                                      |                                                                                       |
|------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| SERIES                                         | TX3                                                                                 | TH3                                                                                 | TH4                                                                                  | TH5                                                                                   |
| PRODUCT IMAGE                                  |  |  |  |  |
| TYPE                                           | Surface-mount TANTAMOUNT™, molded case                                              |                                                                                     |                                                                                      |                                                                                       |
| FEATURES                                       | E-detonators                                                                        | High temperature +150 °C, automotive grade                                          | High temperature +175 °C, automotive grade                                           | Very high temperature +200 °C                                                         |
| TEMPERATURE RANGE                              | -55 °C to +125 °C                                                                   | -55 °C to +150 °C                                                                   | -55 °C to +175 °C                                                                    | -55 °C to +200 °C                                                                     |
| CAPACITANCE RANGE                              | 10 µF to 100 µF                                                                     | 0.33 µF to 220 µF                                                                   | 10 µF to 100 µF                                                                      | 4.7 µF to 100 µF                                                                      |
| VOLTAGE RANGE                                  | 16 V to 25 V                                                                        | 6.3 V to 50 V                                                                       | 6.3 V to 35 V                                                                        | 5 V to 24 V                                                                           |
| CAPACITANCE TOLERANCE                          | ± 10 %, ± 20 %                                                                      |                                                                                     |                                                                                      |                                                                                       |
| LEAKAGE CURRENT                                | 0.005 CV                                                                            | 0.01 CV or 0.5 µA, whichever is greater                                             |                                                                                      |                                                                                       |
| DISSIPATION FACTOR                             | 6 % to 20 %                                                                         | 4 % to 8 %                                                                          | 4.5 % to 8 %                                                                         | 6 % to 10 %                                                                           |
| CASE CODES                                     | B, C                                                                                | A, B, C, D, E                                                                       | B, C, D, E                                                                           | D, E                                                                                  |
| TERMINATION                                    | 100 % matte tin                                                                     | 100 % matte tin standard, tin / lead and gold plated available                      | 100 % matte tin                                                                      | Gold plated                                                                           |

## HIGH RELIABILITY PRODUCTS

| SOLID TANTALUM CAPACITORS - MOLDED CASE |                                                                                   |                                                                                   |                                                                                    |                                                                                     |
|-----------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| SERIES                                  | TM3                                                                               | T83                                                                               | CWR11                                                                              | 95158                                                                               |
| PRODUCT IMAGE                           |  |  |  |  |
| TYPE                                    | TANTAMOUNT™, molded case, hi-rel.                                                 | TANTAMOUNT™, molded case, hi-rel. COTS                                            | TANTAMOUNT™, molded case, DLA approved                                             |                                                                                     |
| FEATURES                                | High reliability, for medical Instruments                                         | High reliability, standard and low ESR                                            | MIL-PRF-55365/8 qualified                                                          | Low ESR                                                                             |
| TEMPERATURE RANGE                       | -55 °C to +125 °C                                                                 |                                                                                   |                                                                                    |                                                                                     |
| CAPACITANCE RANGE                       | 1 µF to 220 µF                                                                    | 0.1 µF to 470 µF                                                                  | 0.1 µF to 100 µF                                                                   | 4.7 µF to 220 µF                                                                    |
| VOLTAGE RANGE                           | 4 V to 20 V                                                                       | 4 V to 63 V                                                                       | 4 V to 50 V                                                                        |                                                                                     |
| CAPACITANCE TOLERANCE                   | ± 10 %, ± 20 %                                                                    |                                                                                   | ± 5 %, ± 10 %, ± 20 %                                                              | ± 10 %, ± 20 %                                                                      |
| LEAKAGE CURRENT                         | 0.005 CV or 0.25 µA, whichever is greater                                         | 0.01 CV or 0.5 µA, whichever is greater                                           |                                                                                    |                                                                                     |
| DISSIPATION FACTOR                      | 4 % to 8 %                                                                        | 4 % to 15 %                                                                       | 4 % to 6 %                                                                         | 4 % to 12 %                                                                         |
| CASE CODES                              | A, B, C, D, E                                                                     | A, B, C, D, E                                                                     | A, B, C, D                                                                         | C, D, E                                                                             |
| TERMINATION                             | 100 % matte tin; tin / lead                                                       | 100 % matte tin; tin / lead; tin / lead solder fused                              | Tin / lead; tin / lead solder fused                                                | Tin / lead solder plated; gold plated                                               |

### PLASTIC TAPE AND REEL PACKAGING in inches [millimeters]



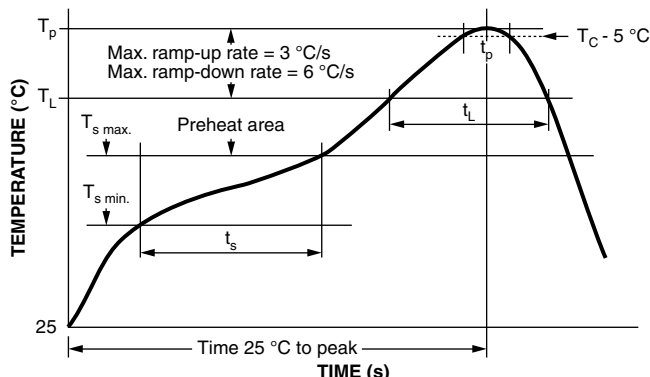
#### Notes

- Metric dimensions will govern. Dimensions in inches are rounded and for reference only
- $A_0$ ,  $B_0$ ,  $K_0$ , are determined by the maximum dimensions to the ends of the terminals extending from the component body and / or the body dimensions of the component. The clearance between the ends of the terminals or body of the component to the sides and depth of the cavity ( $A_0$ ,  $B_0$ ,  $K_0$ ) must be within 0.002" (0.05 mm) minimum and 0.020" (0.50 mm) maximum. The clearance allowed must also prevent rotation of the component within the cavity of not more than 20°
- Tape with components shall pass around radius "R" without damage. The minimum trailer length may require additional length to provide "R" minimum for 12 mm embossed tape for reels with hub diameters approaching N minimum
- This dimension is the flat area from the edge of the sprocket hole to either outward deformation of the carrier tape between the embossed cavities or to the edge of the cavity whichever is less
- This dimension is the flat area from the edge of the carrier tape opposite the sprocket holes to either the outward deformation of the carrier tape between the embossed cavity or to the edge of the cavity whichever is less
- The embossed hole location shall be measured from the sprocket hole controlling the location of the embossment. Dimensions of embossment location shall be applied independent of each other
- $B_1$  dimension is a reference dimension tape feeder clearance only

| CASE CODE                                | TAPE SIZE | $B_1$ (MAX.) | $D_1$ (MIN.) | F             | $K_0$ (MAX.) | $P_1$         | W             |
|------------------------------------------|-----------|--------------|--------------|---------------|--------------|---------------|---------------|
| <b>MOLDED CHIP CAPACITORS; ALL TYPES</b> |           |              |              |               |              |               |               |
| A                                        | 8 mm      | 0.165        | 0.039        | 0.138 ± 0.002 | 0.094        | 0.157 ± 0.004 | 0.315 ± 0.012 |
| B                                        |           | [4.2]        | [1.0]        | [3.5 ± 0.05]  | [2.4]        | [4.0 ± 1.0]   | [8.0 ± 0.30]  |
| C                                        |           |              |              |               |              |               |               |
| D                                        | 12 mm     | 0.32         | 0.059        | 0.217 ± 0.00  | 0.177        | 0.315 ± 0.004 | 0.472 ± 0.012 |
| E                                        |           | [8.2]        | [1.5]        | [5.5 ± 0.05]  | [4.5]        | [8.0 ± 1.0]   | [12.0 ± 0.30] |
| W                                        |           |              |              |               |              |               |               |

## RECOMMENDED REFLOW PROFILES

Capacitors should withstand reflow profile as per J-STD-020 standard, three cycles.

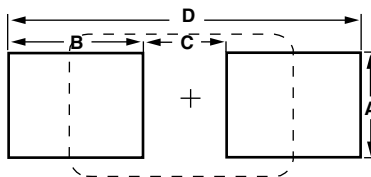


| PROFILE FEATURE                                                                  | SnPb EUTECTIC ASSEMBLY                 | LEAD (Pb)-FREE ASSEMBLY |
|----------------------------------------------------------------------------------|----------------------------------------|-------------------------|
| <b>Preheat / soak</b>                                                            |                                        |                         |
| Temperature min. ( $T_{s \text{ min.}}$ )                                        | 100 °C                                 | 150 °C                  |
| Temperature max. ( $T_{s \text{ max.}}$ )                                        | 150 °C                                 | 200 °C                  |
| Time ( $t_s$ ) from ( $T_{s \text{ min.}}$ to $T_{s \text{ max.}}$ )             | 60 s to 120 s                          | 60 s to 120 s           |
| <b>Ramp-up</b>                                                                   |                                        |                         |
| Ramp-up rate ( $T_L$ to $T_p$ )                                                  | 3 °C/s max.                            | 3 °C/s max.             |
| Liquidus temperature ( $T_L$ )                                                   | 183 °C                                 | 217 °C                  |
| Time ( $t_L$ ) maintained above $T_L$                                            | 60 s to 150 s                          | 60 s to 150 s           |
| Peak package body temperature ( $T_p$ )                                          | Depends on case size - see table below |                         |
| Time ( $t_p$ ) within 5 °C of the specified classification temperature ( $T_C$ ) | 20 s                                   | 30 s                    |
| Time 25 °C to peak temperature                                                   | 6 min max.                             | 8 min max.              |
| <b>Ramp-down</b>                                                                 |                                        |                         |
| Ramp-down rate ( $T_p$ to $T_L$ )                                                | 6 °C/s max.                            | 6 °C/s max.             |

## PEAK PACKAGE BODY TEMPERATURE ( $T_p$ )

| CASE CODE | PEAK PACKAGE BODY TEMPERATURE ( $T_p$ ) |                        |
|-----------|-----------------------------------------|------------------------|
|           | SnPb EUTECTIC PROCESS                   | LEAD (Pb)-FREE PROCESS |
| A, B, C   | 235 °C                                  | 260 °C                 |
| D, E, W   | 220 °C                                  | 250 °C                 |

## PAD DIMENSIONS in inches [millimeters]



| CASE CODE                                | A<br>(MIN.)  | B<br>(NOM.)  | C<br>(NOM.)  | D<br>(NOM.)  |
|------------------------------------------|--------------|--------------|--------------|--------------|
| <b>MOLDED CHIP CAPACITORS, ALL TYPES</b> |              |              |              |              |
| A                                        | 0.071 [1.80] | 0.067 [1.70] | 0.053 [1.35] | 0.187 [4.75] |
| B                                        | 0.118 [3.00] | 0.071 [1.80] | 0.065 [1.65] | 0.207 [5.25] |
| C                                        | 0.118 [3.00] | 0.094 [2.40] | 0.118 [3.00] | 0.307 [7.80] |
| D                                        | 0.157 [4.00] | 0.098 [2.50] | 0.150 [3.80] | 0.346 [8.80] |
| E                                        | 0.157 [4.00] | 0.098 [2.50] | 0.150 [3.80] | 0.346 [8.80] |
| W                                        | 0.185 [4.70] | 0.098 [2.50] | 0.150 [3.80] | 0.346 [8.80] |



## GUIDE TO APPLICATION

1. **AC Ripple Current:** the maximum allowable ripple current shall be determined from the formula:

$$I_{RMS} = \sqrt{\frac{P}{R_{ESR}}}$$

where,

P = power dissipation in W at +25 °C as given in the tables in the product datasheets (Power Dissipation).

$R_{ESR}$  = the capacitor equivalent series resistance at the specified frequency

2. **AC Ripple Voltage:** the maximum allowable ripple voltage shall be determined from the formula:

$$V_{RMS} = I_{RMS} \times Z$$

or, from the formula:

$$V_{RMS} = Z \sqrt{\frac{P}{R_{ESR}}}$$

where,

P = power dissipation in W at +25 °C as given in the tables in the product datasheets (Power Dissipation).

$R_{ESR}$  = the capacitor equivalent series resistance at the specified frequency

Z = the capacitor impedance at the specified frequency

- 2.1 The sum of the peak AC voltage plus the applied DC voltage shall not exceed the DC voltage rating of the capacitor.
- 2.2 The sum of the negative peak AC voltage plus the applied DC voltage shall not allow a voltage reversal exceeding 10 % of the DC working voltage at +25 °C.
3. **Reverse Voltage:** solid tantalum capacitors are not intended for use with reverse voltage applied. However, they have been shown to be capable of withstanding momentary reverse voltage peaks of up to 10 % of the DC rating at 25 °C and 5 % of the DC rating at +85 °C.
4. **Temperature Derating:** if these capacitors are to be operated at temperatures above +25 °C, the permissible RMS ripple current shall be calculated using the derating factors as shown:

| TEMPERATURE (°C)    | DERATING FACTOR |
|---------------------|-----------------|
| +25                 | 1.0             |
| +85                 | 0.9             |
| +125                | 0.4             |
| +150 <sup>(1)</sup> | 0.3             |
| +175 <sup>(1)</sup> | 0.2             |
| +200 <sup>(1)</sup> | 0.1             |

**Note**

<sup>(1)</sup> Applicable for dedicated high temperature product series

5. **Power Dissipation:** power dissipation will be affected by the heat sinking capability of the mounting surface. Non-sinusoidal ripple current may produce heating effects which differ from those shown. It is important that the equivalent  $I_{RMS}$  value

be established when calculating permissible operating levels. (Power dissipation calculated using +25 °C temperature rise).

6. **Printed Circuit Board Materials:** molded capacitors are compatible with commonly used printed circuit board materials (alumina substrates, FR4, FR5, G10, PTFE-fluorocarbon and porcelainized steel).

7. **Attachment:**

- 7.1 **Solder Paste:** the recommended thickness of the solder paste after application is 0.007" ± 0.001" [0.178 mm ± 0.025 mm]. Care should be exercised in selecting the solder paste. The metal purity should be as high as practical. The flux (in the paste) must be active enough to remove the oxides formed on the metallization prior to the exposure to soldering heat. In practice this can be aided by extending the solder preheat time at temperatures below the liquidous state of the solder.

- 7.2 **Soldering:** capacitors can be attached by conventional soldering techniques; vapor phase, convection reflow, infrared reflow, wave soldering, and hot plate methods. The soldering profile charts show recommended time / temperature conditions for soldering. Preheating is recommended. The recommended maximum ramp rate is 3 °C per second. Attachment with a soldering iron is not recommended due to the difficulty of controlling temperature and time at temperature. The soldering iron must never come in contact with the capacitor. For details see [www.vishay.com/doc?40214](http://www.vishay.com/doc?40214).

- 7.2.1 **Backward and Forward Compatibility:** capacitors with SnPb or 100 % tin termination finishes can be soldered using SnPb or lead (Pb)-free soldering processes.

8. **Cleaning (Flux Removal) After Soldering:** molded capacitors are compatible with all commonly used solvents such as TES, TMS, Prelete, Chloroethane, Terpene and aqueous cleaning media. However, CFC / ODS products are not used in the production of these devices and are not recommended. Solvents containing methylene chloride or other epoxy solvents should be avoided since these will attack the epoxy encapsulation material.

- 8.1 When using ultrasonic cleaning, the board may resonate if the output power is too high. This vibration can cause cracking or a decrease in the adherence of the termination. DO NOT EXCEED 9W/l at 40 kHz for 2 min.

9. **Recommended Mounting Pad Geometries:** proper mounting pad geometries are essential for successful solder connections. These dimensions are highly process sensitive and should be designed to minimize component rework due to unacceptable solder joints. The dimensional configurations shown are the recommended pad geometries for both wave and reflow soldering techniques. These dimensions are intended to be a starting point for circuit board designers and may be fine tuned if necessary based upon the peculiarities of the soldering process and / or circuit board design.



## Molded Chip Tantalum Capacitors

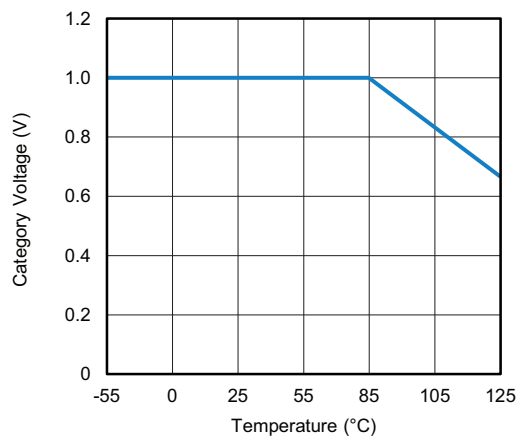
| CAPACITOR ELECTRICAL PERFORMANCE CHARACTERISTICS                     |                                                                                                                                                                                                                                                                                                                                                                                           |                          |                                     |                          |
|----------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|-------------------------------------|--------------------------|
| ITEM                                                                 | PERFORMANCE CHARACTERISTICS                                                                                                                                                                                                                                                                                                                                                               |                          |                                     |                          |
| Category temperature range                                           | -55 °C to +85 °C (to +125 °C with voltage derating)                                                                                                                                                                                                                                                                                                                                       |                          |                                     |                          |
| Capacitance tolerance                                                | ± 20 %, ± 10 %. Tested via bridge method, at +25 °C, 120 Hz                                                                                                                                                                                                                                                                                                                               |                          |                                     |                          |
| Dissipation factor                                                   | Limit per Standard Ratings table. Tested via bridge method, at 25 °C, 120 Hz                                                                                                                                                                                                                                                                                                              |                          |                                     |                          |
| ESR                                                                  | Limit per Standard Ratings table. Tested via bridge method, at 25 °C, 100 kHz                                                                                                                                                                                                                                                                                                             |                          |                                     |                          |
| Leakage current                                                      | After application of rated voltage applied to capacitors for 5 min using a steady source of power with 1 kΩ resistor in series with the capacitor under test, leakage current at 25 °C is not more than 0.01 CV or 0.5 μA, whichever is greater. <i>Note that the leakage current varies with temperature and applied voltage. See graph below for the appropriate adjustment factor.</i> |                          |                                     |                          |
| Capacitance change by temperature                                    | +20 % max. (at +125 °C)<br>+10 % max. (at +85 °C)<br>-10 % max. (at -55 °C)                                                                                                                                                                                                                                                                                                               |                          |                                     |                          |
| Reverse voltage                                                      | Capacitors are capable of withstanding peak voltages in the reverse direction equal to:<br>10 % of the DC rating at +25 °C<br>5 % of the DC rating at +85 °C<br>Vishay does not recommend intentional or repetitive application of reverse voltage                                                                                                                                        |                          |                                     |                          |
| Ripple current                                                       | For maximum ripple current values (at 25 °C) refer to relevant datasheet. If capacitors are to be used at temperatures above +25 °C, the permissible RMS ripple current (or voltage) shall be calculated using the derating factors: 1.0 at +25 °C; 0.9 at +85 °C; 0.4 at +125 °C                                                                                                         |                          |                                     |                          |
| Maximum operating and surge voltages vs. temperature                 | +85 °C                                                                                                                                                                                                                                                                                                                                                                                    |                          | +125 °C                             |                          |
|                                                                      | <b>RATED VOLTAGE (V)</b>                                                                                                                                                                                                                                                                                                                                                                  | <b>SURGE VOLTAGE (V)</b> | <b>CATEGORY VOLTAGE (V)</b>         | <b>SURGE VOLTAGE (V)</b> |
|                                                                      | 4                                                                                                                                                                                                                                                                                                                                                                                         | 5.2                      | 2.7                                 | 3.4                      |
|                                                                      | 6.3                                                                                                                                                                                                                                                                                                                                                                                       | 8                        | 4                                   | 5                        |
|                                                                      | 10                                                                                                                                                                                                                                                                                                                                                                                        | 13                       | 7                                   | 8                        |
|                                                                      | 16                                                                                                                                                                                                                                                                                                                                                                                        | 20                       | 10                                  | 12                       |
|                                                                      | 20                                                                                                                                                                                                                                                                                                                                                                                        | 26                       | 13                                  | 16                       |
|                                                                      | 25 <sup>(1)</sup>                                                                                                                                                                                                                                                                                                                                                                         | 32                       | 17                                  | 20                       |
|                                                                      | 25 <sup>(2)</sup>                                                                                                                                                                                                                                                                                                                                                                         | 27                       | 17                                  | 20                       |
|                                                                      | 35 <sup>(3)</sup>                                                                                                                                                                                                                                                                                                                                                                         | 46                       | 23                                  | 28                       |
|                                                                      | 35 <sup>(4)</sup>                                                                                                                                                                                                                                                                                                                                                                         | 42                       | 23                                  | 28                       |
|                                                                      | 50                                                                                                                                                                                                                                                                                                                                                                                        | 65                       | 33                                  | 40                       |
|                                                                      | 50 <sup>(5)</sup>                                                                                                                                                                                                                                                                                                                                                                         | 60                       | 33                                  | 40                       |
|                                                                      | 63                                                                                                                                                                                                                                                                                                                                                                                        | 75                       | 42                                  | 50                       |
|                                                                      | 75 <sup>(6)</sup>                                                                                                                                                                                                                                                                                                                                                                         | 75                       | 50                                  | 50                       |
| Recommended voltage derating guidelines (below 85 °C) <sup>(7)</sup> | <b>VOLTAGE RAIL (V)</b>                                                                                                                                                                                                                                                                                                                                                                   |                          | <b>CAPACITOR VOLTAGE RATING (V)</b> |                          |
|                                                                      | ≤ 3.3                                                                                                                                                                                                                                                                                                                                                                                     |                          | 6.3                                 |                          |
|                                                                      | 5                                                                                                                                                                                                                                                                                                                                                                                         |                          | 10                                  |                          |
|                                                                      | 10                                                                                                                                                                                                                                                                                                                                                                                        |                          | 20                                  |                          |
|                                                                      | 12                                                                                                                                                                                                                                                                                                                                                                                        |                          | 25                                  |                          |
|                                                                      | 15                                                                                                                                                                                                                                                                                                                                                                                        |                          | 35                                  |                          |
|                                                                      | 24                                                                                                                                                                                                                                                                                                                                                                                        |                          | 50 or series configuration          |                          |
|                                                                      | 28                                                                                                                                                                                                                                                                                                                                                                                        |                          | 63 or series configuration          |                          |
|                                                                      | ≥ 32                                                                                                                                                                                                                                                                                                                                                                                      |                          | 75 or series configuration          |                          |

## Notes

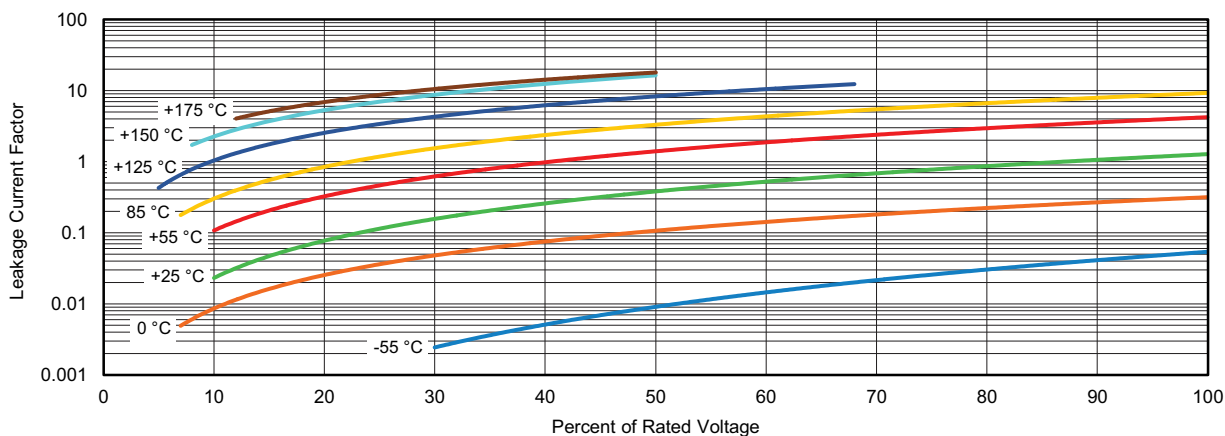
- All information presented in this document reflects typical performance characteristics
  - For more information about recommended voltage derating see: [www.vishay.com/doc?40246](http://www.vishay.com/doc?40246)
- (1) Capacitance values lower than 100 μF  
 (2) Capacitance values 100 μF and higher  
 (3) Capacitance values lower than 33 μF  
 (4) Capacitance values 33 μF and higher  
 (5) Capacitance values 15 μF and higher  
 (6) For 293D and TR3 only  
 (7) For temperatures above +85 °C the same voltage derating ratio is recommended, but with respect to category voltage: up to +85 °C: category voltage = rated voltage; at +125 °C: category voltage = 2/3 of rated voltage, between these temperatures it decreases linearly - see graph below



## CATEGORY VOLTAGE VS. TEMPERATURE



## TYPICAL LEAKAGE CURRENT TEMPERATURE FACTOR



### Note

- At +25 °C, the leakage current shall not exceed the value listed in the Standard Ratings table.
- At +85 °C, the leakage current shall not exceed 10 times the value listed in the Standard Ratings table.
- At +125 °C, the leakage current shall not exceed 12 times the value listed in the Standard Ratings table.
- At +150 °C, the leakage current shall not exceed 15 times the value listed in the Standard Ratings table.
- At +175 °C, the leakage current shall not exceed 18 times the value listed in the Standard Ratings table.

**ENVIRONMENTAL PERFORMANCE CHARACTERISTICS**

| ITEM                 | CONDITION                                                                                                                                                                             | POST TEST PERFORMANCE                                       |                                                                                                                          |
|----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|
| Surge voltage        | Post application of surge voltage (as specified in the table above) in series with a 33 $\Omega$ resistor at the rate of 30 s ON, 30 s OFF, for 1000 successive test cycles at 85 °C. | Capacitance change<br>Dissipation factor<br>Leakage current | Within $\pm 10$ % of initial value<br>Initial specified limit<br>Initial specified limit                                 |
| Life test at +85 °C  | 1000 h application of rated voltage at 85 °C.<br>MIL-STD-202, method 108                                                                                                              | Capacitance change<br>Dissipation factor<br>Leakage current | Within -20 % / +10 % of initial value<br>Initial specified limit<br>Shall not exceed 125 % of initial limit              |
| Life test at +125 °C | 1000 h application 2/3 of rated voltage at 125 °C.<br>MIL-STD-202, method 108                                                                                                         | Capacitance change<br>Dissipation factor<br>Leakage current | Within -20 % / +10 % of initial value<br>Initial specified limit<br>Shall not exceed 125 % of initial limit              |
| Humidity tests       | At 60 °C / 90 % RH 1000 h, biased                                                                                                                                                     | Capacitance change<br>Dissipation factor<br>Leakage current | Within -10 % / +20 % of initial value<br>Not to exceed 150 % of initial limit<br>Shall not exceed 200 % of initial limit |
| Thermal shock        | MIL-STD-202, method 107, test condition A<br>(-55 °C / +85 °C, for 1000 cycles)                                                                                                       | Capacitance change<br>Dissipation factor<br>Leakage current | Within $\pm 10$ % of initial value<br>Initial specified limit<br>Initial specified limit                                 |

**MECHANICAL PERFORMANCE CHARACTERISTICS**

| TEST CONDITION                                 | CONDITION                                                                                                                                                       | POST TEST PERFORMANCE                                                                                                                                                                         |                                                                                          |
|------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|
| Terminal strength / shear force test           | Apply a pressure load of 17.7 N for 60 s horizontally to the center of capacitor side body.                                                                     | Capacitance change<br>Dissipation factor<br>Leakage current                                                                                                                                   | Within $\pm 10$ % of initial value<br>Initial specified limit<br>Initial specified limit |
|                                                |                                                                                                                                                                 | There shall be no mechanical or visual damage to capacitors post-conditioning.                                                                                                                |                                                                                          |
| Vibration                                      | MIL-STD-202, method 204, condition D,<br>10 Hz to 2000 Hz, 20 g peak, 8 h, at rated voltage                                                                     | Electrical measurements are not applicable, since the same parts are used for shock (specified pulse) test.<br>There shall be no mechanical or visual damage to capacitors post-conditioning. |                                                                                          |
| Shock (specified pulse)                        | MIL-STD-202, method 213, condition I,<br>100 g peak                                                                                                             | Capacitance change<br>Dissipation factor<br>Leakage current                                                                                                                                   | Within $\pm 10$ % of initial value<br>Initial specified limit<br>Initial specified limit |
|                                                |                                                                                                                                                                 | There shall be no mechanical or visual damage to capacitors post-conditioning.                                                                                                                |                                                                                          |
| Resistance to soldering heat                   | Recommended reflow profiles temperatures and durations are located within the Capacitor Series Guides<br>MIL-STD-202, method 210, condition B                   | Capacitance change<br>Dissipation factor<br>Leakage current                                                                                                                                   | Within $\pm 10$ % of initial value<br>Initial specified limit<br>Initial specified limit |
|                                                |                                                                                                                                                                 | There shall be no mechanical or visual damage to capacitors post-conditioning.                                                                                                                |                                                                                          |
| Solderability and dissolution of metallization | MIL-STD-202, method 208, ANSI/J-STD-002, test B (SnPb) and B1 (lead (Pb)-free). Dissolution of metallization: method D.<br>Does not apply to gold terminations. | There shall be no mechanical or visual damage to capacitors post-conditioning.                                                                                                                |                                                                                          |
| Flammability                                   | Encapsulation materials meet UL 94 V-0 with an oxygen index of 32 %.                                                                                            |                                                                                                                                                                                               |                                                                                          |



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