

## Aluminum Electrolytic Capacitors Radial High Temperature Standard

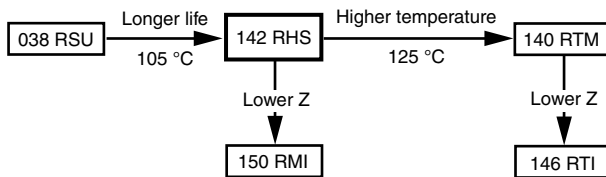
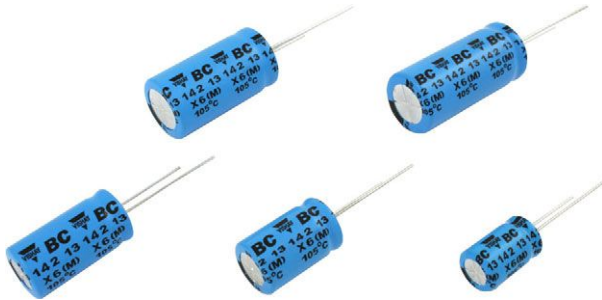


Fig. 1

| QUICK REFERENCE DATA                               |                        |
|--|------------------------|
| DESCRIPTION  | VALUE                  |
| Nominal case sizes (Ø D x L in mm)                 | 5 x 11 to 18 x 40      |
| Rated capacitance range, C <sub>R</sub>            | 1 µF to 22 000 µF      |
| Tolerance on C <sub>R</sub>                        | ± 20 %                 |
| Rated voltage range, U <sub>R</sub>                | 10 V to 450 V          |
| Category temperature range                         | -40 °C to +105 °C      |
| Endurance test at 105 °C                           | 2000 h                 |
| Useful life at 105 °C                              | 2500 h                 |
| Useful life at 40 °C, 1.6 x I <sub>R</sub> applied | 140 000 h              |
| Shelf life at 0 V, 105 °C                          | 1000 h                 |
| Based on sectional specification                   | IEC 60384-4 / EN130300 |
| Climatic category IEC 60068                        | 40 / 105 / 56          |

### FEATURES

- Useful life: 2500 h at 105 °C
- Miniaturized, high CV-product per unit volume
- Charge and discharge proof
- Polarized aluminum electrolytic capacitors, non-solid electrolyte
- Radial leads, cylindrical aluminum case, insulated with a blue sleeve
- Pressure relief for case Ø D ≥ 6.3 mm
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)


**RoHS  
COMPLIANT**

### APPLICATIONS

- Industrial, telecom and domestic appliances
- Decoupling, smoothing, filtering, buffering in SMPS
- Portable and mobile equipment (small size, low mass)

### MARKING

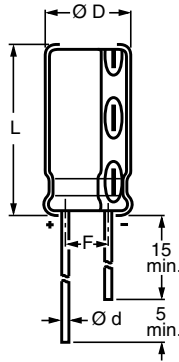
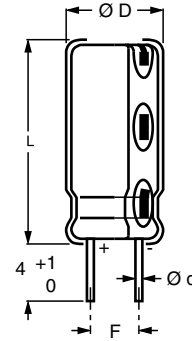
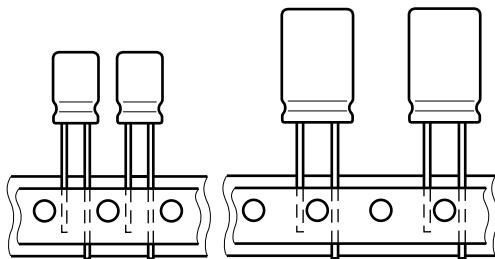
The capacitors are marked (where possible) with the following information:

- Rated capacitance (in µF)
- Tolerance on rated capacitance, code letter in accordance with IEC 60062 (M for ± 20 %)
- Rated voltage (in V)
- Date code, in accordance with IEC 60062
- Code indicating factory of origin
- Name or logo of manufacturer
- Negative terminal identification
- Series number (142)



| SELECTION CHART FOR $C_R$ , $U_R$ , AND RELEVANT NOMINAL CASE SIZES ( $\varnothing$ D x L in mm) |                    |                   |           |           |                      |                    |                      |
|--|--------------------|-------------------|-----------|-----------|----------------------|--------------------|----------------------|
| $C_R$<br>( $\mu$ F)  | $U_R$ (V)          |                   |           |           |                      |                    |                      |
|  | 10                 | 16                | 25        | 35        | 50                   | 63                 | 100                  |
| 1.0  | →                  | →                 | →         | →         | →                    | 5 x 11             | -                    |
| 2.2  | →                  | →                 | →         | →         | →                    | →                  | 5 x 11               |
| 3.3  | →                  | →                 | →         | →         | →                    | 5 x 11             | -                    |
| 4.7  | →                  | →                 | →         | →         | →                    | 5 x 11             | 5 x 11<br>6.3 x 11   |
| 6.8  | →                  | →                 | →         | →         | →                    | 5 x 11             | -                    |
| 10   | →                  | →                 | →         | →         | →                    | 5 x 11             | 6.3 x 11<br>8 x 12   |
| 22   | →                  | →                 | →         | →         | 5 x 11               | 5 x 11<br>6.3 x 11 | 6.3 x 11<br>8 x 12   |
| 33   | →                  | →                 | 5 x 11    | →         | 5 x 11               | 6.3 x 11           | 8 x 12<br>10 x 12    |
| 47   | →                  | →                 | 5 x 11    | 5 x 11    | 6.3 x 11             | 6.3 x 11<br>8 x 12 | 10 x 16              |
| 100  | →                  | 5 x 11            | 6.3 x 11  | 6.3 x 11  | 8 x 12               | 10 x 12            | 10 x 20              |
| 220  | 5 x 11             | 6.3 x 11          | 8 x 12    | 8 x 12    | 10 x 12              | 10 x 16            | 12.5 x 25            |
| 330  | 6.3 x 11           | 8 x 12            | 8 x 12    | 10 x 12   | 10 x 16              | 10 x 20            | 12.5 x 25<br>16 x 25 |
| 470  | 6.3 x 11<br>8 x 12 | 8 x 12<br>10 x 12 | 10 x 12   | 10 x 16   | 10 x 20<br>12.5 x 20 | 12.5 x 20          | 16 x 31              |
| 1000   | 10 x 12            | 10 x 16           | 10 x 20   | 12.5 x 20 | 12.5 x 25            | 16 x 25            | 18 x 40              |
| 2200   | 10 x 20            | 12.5 x 20         | 12.5 x 25 | 16 x 25   | 16 x 35              | 18 x 40            | -                    |
| 3300   | →                  | 12.5 x 25         | 16 x 25   | 16 x 31   | 18 x 35              | -                  | -                    |
| 4700   | 12.5 x 25          | 16 x 25           | 16 x 31   | 18 x 35   | -                    | -                  | -                    |
| 6800   | 16 x 25            | 16 x 31           | 18 x 35   | -         | -                    | -                  | -                    |
| 10 000   | 16 x 31            | 18 x 31           | -         | -         | -                    | -                  | -                    |
| 22 000   | 18 x 40            | -                 | -         | -         | -                    | -                  | -                    |

| SELECTION CHART FOR $C_R$ , $U_R$ , AND RELEVANT NOMINAL CASE SIZES ( $\varnothing$ D x L in mm) |           |           |           |           |           |
|--|-----------|-----------|-----------|-----------|-----------|
| $C_R$<br>( $\mu$ F)  | $U_R$ (V) |           |           |           |           |
|  | 200       | 250       | 350       | 400       | 450       |
| 1.0  | 5 x 11    | 5 x 11    | 6.3 x 11  | 6.3 x 11  | 8 x 12    |
| 2.2  | 6.3 x 11  | 6.3 x 11  | 8 x 12    | 8 x 12    | 10 x 12   |
| 4.7  | 8 x 12    | 8 x 12    | 10 x 12   | 10 x 12   | 10 x 16   |
| 10   | 10 x 12   | 10 x 12   | 10 x 16   | 10 x 20   | 12.5 x 20 |
| 22   | 10 x 16   | 10 x 20   | 12.5 x 20 | 12.5 x 25 | 16 x 20   |
| 33   | →         | 12.5 x 20 | →         | →         | 16 x 25   |
| 47   | 12.5 x 20 | 12.5 x 25 | 16 x 25   | 16 x 31   | 16 x 35   |
| 100  | 16 x 25   | 16 x 31   | 18 x 35   | 18 x 40   | -         |
| 220  | 18 x 35   | -         | -         | -         | -         |

**DIMENSIONS in millimeters AND AVAILABLE FORMS**

 Fig. 2 - Form CA  
Long leads

 Fig. 3 - Form CB  
Cut leads


Dimensions of lead space F see Table 2

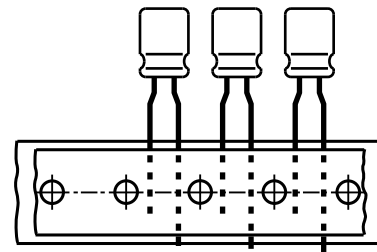
 Fig. 4 - Form TNA, Form TFA  
Taped in box (ammopack), straight leads

 Case  $\varnothing D = 5 \text{ mm to } 8 \text{ mm};$   
Lead space F is 5 mm

 Fig. 5 - Form TFA  
Taped in box (ammopack), formed leads

**Table 1**

| DIMENSIONS in millimeters, MASS AND PACKAGING QUANTITIES |           |                 |                        |            |               |                |                      |         |               |
|--|-----------|-----------------|------------------------|------------|---------------|----------------|----------------------|---------|---------------|
| NOMINAL CASE SIZE<br>$\varnothing D \times L$            | CASE CODE | $\varnothing d$ | $\varnothing D_{max.}$ | $L_{max.}$ | F             | MASS (g)       | PACKAGING QUANTITIES |         |               |
|  |           |                 |                        |            |               |                | FORM CA              | FORM CB | FORM TFA, TNA |
| 5 x 11   | 11        | 0.5             | 5.5                    | 12.5       | $2.0 \pm 0.5$ | $\approx 0.4$  | 5000                 | -       | 2000          |
| 6.3 x 11   | 12        | 0.5             | 6.8                    | 12.5       | $2.5 \pm 0.5$ | $\approx 0.6$  | 5000                 | -       | 2000          |
| 8 x 12   | 13        | 0.6             | 8.5                    | 13.0       | $3.5 \pm 0.5$ | $\approx 1.1$  | 5000                 | -       | 1000          |
| 10 x 12  | 14        | 0.6             | 10.5                   | 13.5       | $5.0 \pm 0.5$ | $\approx 1.6$  | 3000                 | 1000    | 500           |
| 10 x 16  | 15        | 0.6             | 10.5                   | 17.5       | $5.0 \pm 0.5$ | $\approx 1.9$  | 2500                 | 1000    | 500           |
| 10 x 20  | 16        | 0.6             | 10.5                   | 22.0       | $5.0 \pm 0.5$ | $\approx 2.2$  | 2000                 | 800     | 500           |
| 12.5 x 20  | 17        | 0.6             | 13.0                   | 22.0       | $5.0 \pm 0.5$ | $\approx 4.0$  | 1500                 | 400     | 300           |
| 12.5 x 25  | 18        | 0.6             | 13.0                   | 27.0       | $5.0 \pm 0.5$ | $\approx 5.0$  | 1000                 | 400     | 300           |
| 16 x 20  | 19a       | 0.8             | 16.5                   | 22.0       | $7.5 \pm 0.5$ | $\approx 6.0$  | 1000                 | 200     | 200           |
| 16 x 25  | 19        | 0.8             | 16.5                   | 27.0       | $7.5 \pm 0.5$ | $\approx 8.0$  | 750                  | 200     | 200           |
| 16 x 31  | 20        | 0.8             | 16.5                   | 33.5       | $7.5 \pm 0.5$ | $\approx 9.0$  | 600                  | 200     | 200           |
| 16 x 35  | 21        | 0.8             | 16.5                   | 37.5       | $7.5 \pm 0.5$ | $\approx 11.0$ | 500                  | 200     | -             |
| 18 x 31  | 1831      | 0.8             | 18.5                   | 33.5       | $7.5 \pm 0.5$ | $\approx 12.5$ | 400                  | 150     | -             |
| 18 x 35  | 22        | 0.8             | 18.5                   | 37.5       | $7.5 \pm 0.5$ | $\approx 14.5$ | 400                  | 150     | -             |
| 18 x 40  | 23        | 0.8             | 18.5                   | 42.0       | $7.5 \pm 0.5$ | $\approx 16.0$ | 400                  | 150     | -             |

**Note**

- For detailed tape dimensions please refer to packaging information: [www.vishay.com/doc?28360](http://www.vishay.com/doc?28360)



| ELECTRICAL DATA |   |
|-----------------|---|
| SYMBOL          | DESCRIPTION   |
| C <sub>R</sub>  | Rated capacitance at 100 Hz, tolerance ± 20 %                       |
| I <sub>R</sub>  | Rated RMS ripple current at 100 Hz, 105 °C                          |
| I <sub>L2</sub> | Max. leakage current after 2 min at U <sub>R</sub> = 10 V to 100 V  |
| I <sub>L5</sub> | Max. leakage current after 5 min at U <sub>R</sub> = 200 V to 450 V |
| tan δ           | Max. dissipation factor at 100 Hz                                   |

**ORDERING EXAMPLE**

Electrolytic capacitor 142 series  
 470 µF / 25 V; ± 20 %  
 Nominal case size: Ø 10 mm x 12 mm; Form TFA  
 Ordering Code: MAL214236471E3

**Note**

- Unless otherwise specified, all electrical values in Table 2 apply at T<sub>amb</sub> = 20 °C, P = 86 kPa to 106 kPa, RH = 45 % to 75 %.

Table 2

| ELECTRICAL DATA AND ORDERING INFORMATION |                                  |   |  |                                  |                 |                   |                          |           |            |           |                |           |             |           |
|--|----------------------------------|---|--|----------------------------------|-----------------|-------------------|--------------------------|-----------|------------|-----------|----------------|-----------|-------------|-----------|
| U <sub>R</sub><br>(V)                    | C <sub>R</sub><br>100 Hz<br>(µF) | NOMINAL<br>CASE SIZE<br>Ø D x L<br>(mm) | I <sub>R</sub><br>100 Hz<br>105 °C<br>(mA) | I <sub>L2</sub><br>2 min<br>(µA) | tan δ<br>100 Hz | FREQ.<br>CODE (1) | ORDERING CODE MAL2142... |           |            |           |                |           |             |           |
|  |                                  |   |  |                                  |                 |                   | BULK PACKAGING           |           |            |           | TAPED AMMOPACK |           |             |           |
|  |                                  |   |  |                                  |                 |                   | LONG LEADS               |           | CUT LEADS  |           |                |           |             |           |
|  |                                  |   |  |                                  |                 |                   | FORM<br>CA               | F<br>(mm) | FORM<br>CB | F<br>(mm) | FORM<br>TNA    | F<br>(mm) | FORM<br>TFA | F<br>(mm) |
| 10                                       | 220                              | 5 x 11                                  | 115  | 22                               | 0.20            | MF2               | 54221E3                  | 2.0       | -          | -         | 74221E3        | 2.5       | 34221E3     | 5.0       |
|  | 330                              | 6.3 x 11                                | 200  | 33                               | 0.20            | MF2               | 54331E3                  | 2.5       | -          | -         | 74331E3        | 2.5       | 34331E3     | 5.0       |
|  | 470                              | 6.3 x 11                                | 204  | 47                               | 0.20            | MF2               | 94475E3                  | 2.5       | -          | -         | 94477E3        | 2.5       | 94473E3     | 5.0       |
|  | 470                              | 8 x 12                                  | 290  | 47                               | 0.20            | MF2               | 54471E3                  | 3.5       | -          | -         | 74471E3        | 3.5       | 34471E3     | 5.0       |
|  | 1000                             | 10 x 12                                 | 460  | 100                              | 0.20            | MF2               | 54102E3                  | 5.0       | 64102E3    | 5.0       | -              | -         | 34102E3     | 5.0       |
|  | 2200                             | 10 x 20                                 | 760  | 220                              | 0.22            | MF3               | 54222E3                  | 5.0       | 64222E3    | 5.0       | -              | -         | 34222E3     | 5.0       |
|  | 4700                             | 12.5 x 25                               | 1260                                       | 470                              | 0.26            | MF3               | 54472E3                  | 5.0       | 64472E3    | 5.0       | -              | -         | 34472E3     | 5.0       |
|  | 6800                             | 16 x 25                                 | 1690                                       | 680                              | 0.28            | MF3               | 54682E3                  | 7.5       | 64682E3    | 7.5       | -              | -         | 34682E3     | 7.5       |
|  | 10 000                           | 16 x 31                                 | 2120                                       | 1000                             | 0.30            | MF3               | 54103E3                  | 7.5       | 64103E3    | 7.5       | -              | -         | 34103E3     | 7.5       |
|  | 22 000                           | 18 x 40                                 | 3100                                       | 2200                             | 0.32            | MF3               | 54223E3                  | 7.5       | 64223E3    | 7.5       | -              | -         | -           | -         |
| 16                                       | 100                              | 5 x 11                                  | 110  | 16                               | 0.16            | MF2               | 55101E3                  | 2.0       | -          | -         | 75101E3        | 2.5       | 35101E3     | 5.0       |
|  | 220                              | 6.3 x 11                                | 190  | 35                               | 0.16            | MF2               | 55221E3                  | 2.5       | -          | -         | 75221E3        | 2.5       | 35221E3     | 5.0       |
|  | 330                              | 8 x 12                                  | 270  | 53                               | 0.16            | MF2               | 55331E3                  | 3.5       | -          | -         | 75331E3        | 3.5       | 35331E3     | 5.0       |
|  | 470                              | 8 x 12                                  | 310  | 75                               | 0.16            | MF2               | 95475E3                  | 3.5       | -          | -         | 95477E3        | 3.5       | 95473E3     | 5.0       |
|  | 470                              | 10 x 12                                 | 370  | 75                               | 0.16            | MF2               | 55471E3                  | 5.0       | 65471E3    | 5.0       | -              | -         | 35471E3     | 5.0       |
|  | 1000                             | 10 x 16                                 | 560  | 160                              | 0.16            | MF2               | 55102E3                  | 5.0       | 65102E3    | 5.0       | -              | -         | 35102E3     | 5.0       |
|  | 2200                             | 12.5 x 20                               | 920  | 352                              | 0.18            | MF3               | 55222E3                  | 5.0       | 65222E3    | 5.0       | -              | -         | 35222E3     | 5.0       |
|  | 3300                             | 12.5 x 25                               | 1170                                       | 528                              | 0.20            | MF3               | 55332E3                  | 5.0       | 65332E3    | 5.0       | -              | -         | 35332E3     | 5.0       |
|  | 4700                             | 16 x 25                                 | 1480                                       | 752                              | 0.22            | MF3               | 55472E3                  | 7.5       | 65472E3    | 7.5       | -              | -         | 35472E3     | 7.5       |
|  | 6800                             | 16 x 31                                 | 1930                                       | 1088                             | 0.24            | MF3               | 55682E3                  | 7.5       | 65682E3    | 7.5       | -              | -         | 35682E3     | 7.5       |
| 10 000                                   | 18 x 31                          | 2330                                    | 1600                                       | 0.26                             | MF3             | 55103E3           | 7.5                      | 65103E3   | 7.5        | -         | -              | -         | -           |           |
| 25                                       | 33                               | 5 x 11                                  | 68   | 8                                | 0.14            | MF1               | 56339E3                  | 2.0       | -          | -         | 76339E3        | 2.5       | 36339E3     | 5.0       |
|  | 47                               | 5 x 11                                  | 97   | 12                               | 0.14            | MF1               | 56479E3                  | 2.0       | -          | -         | 76479E3        | 2.5       | 36479E3     | 5.0       |
|  | 100                              | 6.3 x 11                                | 142  | 25                               | 0.14            | MF2               | 56101E3                  | 2.5       | -          | -         | 76101E3        | 2.5       | 36101E3     | 5.0       |
|  | 220                              | 8 x 12                                  | 236  | 55                               | 0.14            | MF2               | 56221E3                  | 3.5       | -          | -         | 76221E3        | 3.5       | 36221E3     | 5.0       |
|  | 330                              | 8 x 12                                  | 310  | 82                               | 0.14            | MF2               | 56331E3                  | 3.5       | -          | -         | 76331E3        | 3.5       | 36331E3     | 5.0       |
|  | 470                              | 10 x 12                                 | 380  | 118                              | 0.14            | MF2               | 56471E3                  | 5.0       | 66471E3    | 5.0       | -              | -         | 36471E3     | 5.0       |
|  | 1000                             | 10 x 20                                 | 680  | 250                              | 0.14            | MF2               | 56102E3                  | 5.0       | 66102E3    | 5.0       | -              | -         | 36102E3     | 5.0       |
|  | 2200                             | 12.5 x 25                               | 1110                                       | 550                              | 0.16            | MF3               | 56222E3                  | 5.0       | 66222E3    | 5.0       | -              | -         | 36222E3     | 5.0       |
|  | 3300                             | 16 x 25                                 | 1440                                       | 825                              | 0.18            | MF3               | 56332E3                  | 7.5       | 66332E3    | 7.5       | -              | -         | 36332E3     | 7.5       |
|  | 4700                             | 16 x 31                                 | 1710                                       | 1175                             | 0.20            | MF3               | 56472E3                  | 7.5       | 66472E3    | 7.5       | -              | -         | 36472E3     | 7.5       |
| 6800                                     | 18 x 35                          | 2160                                    | 1700                                       | 0.22                             | MF3             | 56682E3           | 7.5                      | 66682E3   | 7.5        | -         | -              | -         | -           |           |



| ELECTRICAL DATA AND ORDERING INFORMATION |                                  |   |  |                                  |                 |                              |                          |           |            |           |                |           |             |           |
|--|----------------------------------|---|--|----------------------------------|-----------------|------------------------------|--------------------------|-----------|------------|-----------|----------------|-----------|-------------|-----------|
| U <sub>R</sub><br>(V)                    | C <sub>R</sub><br>100 Hz<br>(µF) | NOMINAL<br>CASE SIZE<br>Ø D x L<br>(mm) | I <sub>R</sub><br>100 Hz<br>105 °C<br>(mA) | I <sub>L2</sub><br>2 min<br>(µA) | tan δ<br>100 Hz | FREQ.<br>CODE <sup>(1)</sup> | ORDERING CODE MAL2142... |           |            |           |                |           |             |           |
|  |                                  |   |  |                                  |                 |                              | BULK PACKAGING           |           |            |           | TAPED AMMOPACK |           |             |           |
|  |                                  |   |  |                                  |                 |                              | LONG LEADS               |           | CUT LEADS  |           | FORM TNA       |           | FORM TFA    |           |
|  |                                  |   |  |                                  |                 |                              | FORM<br>CA               | F<br>(mm) | FORM<br>CB | F<br>(mm) | FORM<br>TNA    | F<br>(mm) | FORM<br>TFA | F<br>(mm) |
| 35                                       | 47                               | 5 x 11                                  | 90   | 16                               | 0.12            | MF1                          | 50479E3                  | 2.0       | -          | -         | 70479E3        | 2.5       | 30479E3     | 5.0       |
|  | 100                              | 6.3 x 11                                | 150  | 35                               | 0.12            | MF2                          | 50101E3                  | 2.5       | -          | -         | 70101E3        | 2.5       | 30101E3     | 5.0       |
|  | 220                              | 8 x 12                                  | 270  | 77                               | 0.12            | MF2                          | 50221E3                  | 3.5       | -          | -         | 70221E3        | 3.5       | 30221E3     | 5.0       |
|  | 330                              | 10 x 12                                 | 350  | 116                              | 0.12            | MF2                          | 50331E3                  | 5.0       | 60331E3    | 5.0       | -              | -         | 30331E3     | 5.0       |
|  | 470                              | 10 x 16                                 | 460  | 165                              | 0.12            | MF2                          | 50471E3                  | 5.0       | 60471E3    | 5.0       | -              | -         | 30471E3     | 5.0       |
|  | 1000                             | 12.5 x 20                               | 810  | 350                              | 0.12            | MF2                          | 50102E3                  | 5.0       | 60102E3    | 5.0       | -              | -         | 30102E3     | 5.0       |
|  | 2200                             | 16 x 25                                 | 1260                                       | 770                              | 0.14            | MF3                          | 50222E3                  | 7.5       | 60222E3    | 7.5       | -              | -         | 30222E3     | 7.5       |
|  | 3300                             | 16 x 31                                 | 1420                                       | 1155                             | 0.16            | MF3                          | 50332E3                  | 7.5       | 60332E3    | 7.5       | -              | -         | 30332E3     | 7.5       |
|  | 4700                             | 18 x 35                                 | 1900                                       | 1645                             | 0.18            | MF3                          | 50472E3                  | 7.5       | 60472E3    | 7.5       | -              | -         | -           | -         |
| 50                                       | 22                               | 5 x 11                                  | 78   | 11                               | 0.10            | MF1                          | 51229E3                  | 2.0       | -          | -         | 71229E3        | 2.5       | 31229E3     | 5.0       |
|  | 33                               | 5 x 11                                  | 90   | 16                               | 0.10            | MF1                          | 51339E3                  | 2.0       | -          | -         | 71339E3        | 2.5       | 31339E3     | 5.0       |
|  | 47                               | 6.3 x 11                                | 120  | 24                               | 0.10            | MF1                          | 51479E3                  | 2.5       | -          | -         | 71479E3        | 2.5       | 31479E3     | 5.0       |
|  | 100                              | 8 x 12                                  | 188  | 50                               | 0.10            | MF2                          | 51101E3                  | 3.5       | -          | -         | 71101E3        | 3.5       | 31101E3     | 5.0       |
|  | 220                              | 10 x 12                                 | 240  | 110                              | 0.10            | MF2                          | 51221E3                  | 5.0       | 61221E3    | 5.0       | -              | -         | 31221E3     | 5.0       |
|  | 330                              | 10 x 16                                 | 410  | 165                              | 0.10            | MF2                          | 51331E3                  | 5.0       | 61331E3    | 5.0       | -              | -         | 31331E3     | 5.0       |
|  | 470                              | 10 x 20                                 | 530  | 235                              | 0.10            | MF2                          | 91475E3                  | 5.0       | 91476E3    | 5.0       | -              | -         | 91473E3     | 5.0       |
|  | 470                              | 12.5 x 20                               | 530  | 235                              | 0.10            | MF2                          | 51471E3                  | 5.0       | 61471E3    | 5.0       | -              | -         | 31471E3     | 5.0       |
|  | 1000                             | 12.5 x 25                               | 950  | 500                              | 0.10            | MF2                          | 51102E3                  | 5.0       | 61102E3    | 5.0       | -              | -         | 31102E3     | 5.0       |
|  | 2200                             | 16 x 35                                 | 1470                                       | 1100                             | 0.12            | MF3                          | 51222E3                  | 7.5       | 61222E3    | 7.5       | -              | -         | -           | -         |
|  | 3300                             | 18 x 35                                 | 1770                                       | 1650                             | 0.14            | MF3                          | 51332E3                  | 7.5       | 61332E3    | 7.5       | -              | -         | -           | -         |
| 63                                       | 1.0                              | 5 x 11                                  | 13   | 3                                | 0.09            | MF1                          | 58108E3                  | 2.0       | -          | -         | 78108E3        | 2.5       | 38108E3     | 5.0       |
|  | 3.3                              | 5 x 11                                  | 30   | 3                                | 0.09            | MF1                          | 58338E3                  | 2.0       | -          | -         | 78338E3        | 2.5       | 38338E3     | 5.0       |
|  | 4.7                              | 5 x 11                                  | 36   | 3                                | 0.09            | MF1                          | 58478E3                  | 2.0       | -          | -         | 78478E3        | 2.5       | 38478E3     | 5.0       |
|  | 6.8                              | 5 x 11                                  | 40   | 4                                | 0.09            | MF1                          | 58688E3                  | 2.0       | -          | -         | 78688E3        | 2.5       | 38688E3     | 5.0       |
|  | 10                               | 5 x 11                                  | 54   | 6                                | 0.09            | MF1                          | 58109E3                  | 2.0       | -          | -         | 78109E3        | 2.5       | 38109E3     | 5.0       |
|  | 22                               | 5 x 11                                  | 70   | 14                               | 0.09            | MF1                          | 98225E3                  | 2.0       | -          | -         | 98227E3        | 2.5       | 98223E3     | 5.0       |
|  | 22                               | 6.3 x 11                                | 86   | 14                               | 0.09            | MF1                          | 58229E3                  | 2.5       | -          | -         | 78229E3        | 2.5       | 38229E3     | 5.0       |
|  | 33                               | 6.3 x 11                                | 100  | 21                               | 0.09            | MF1                          | 58339E3                  | 2.5       | -          | -         | 78339E3        | 2.5       | 38339E3     | 5.0       |
|  | 47                               | 6.3 x 11                                | 130  | 30                               | 0.09            | MF1                          | 98475E3                  | 2.5       | -          | -         | 98477E3        | 2.5       | 98473E3     | 5.0       |
|  | 47                               | 8 x 12                                  | 141  | 30                               | 0.09            | MF1                          | 58479E3                  | 3.5       | -          | -         | 78479E3        | 3.5       | 38479E3     | 5.0       |
|  | 100                              | 10 x 12                                 | 235  | 63                               | 0.09            | MF2                          | 58101E3                  | 5.0       | 68101E3    | 5.0       | -              | -         | 38101E3     | 5.0       |
|  | 220                              | 10 x 16                                 | 335  | 139                              | 0.09            | MF2                          | 58221E3                  | 5.0       | 68221E3    | 5.0       | -              | -         | 38221E3     | 5.0       |
|  | 330                              | 10 x 20                                 | 510  | 208                              | 0.09            | MF2                          | 58331E3                  | 5.0       | 68331E3    | 5.0       | -              | -         | 38331E3     | 5.0       |
|  | 470                              | 12.5 x 20                               | 640  | 296                              | 0.09            | MF2                          | 58471E3                  | 5.0       | 68471E3    | 5.0       | -              | -         | 38471E3     | 5.0       |
|  | 1000                             | 16 x 25                                 | 930  | 630                              | 0.09            | MF2                          | 58102E3                  | 7.5       | 68102E3    | 7.5       | -              | -         | 38102E3     | 7.5       |
|  | 2200                             | 18 x 40                                 | 2340                                       | 1380                             | 0.09            | MF3                          | 58222E3                  | 7.5       | 68222E3    | 7.5       | -              | -         | -           | -         |



| ELECTRICAL DATA AND ORDERING INFORMATION |                                  |   |  |                                  |                 |                              |                          |           |            |           |                |           |             |           |
|--|----------------------------------|---|--|----------------------------------|-----------------|------------------------------|--------------------------|-----------|------------|-----------|----------------|-----------|-------------|-----------|
| U <sub>R</sub><br>(V)                    | C <sub>R</sub><br>100 Hz<br>(µF) | NOMINAL<br>CASE SIZE<br>Ø D x L<br>(mm) | I <sub>R</sub><br>100 Hz<br>105 °C<br>(mA) | I <sub>L2</sub><br>2 min<br>(µA) | tan δ<br>100 Hz | FREQ.<br>CODE <sup>(1)</sup> | ORDERING CODE MAL2142... |           |            |           |                |           |             |           |
|  |                                  |   |  |                                  |                 |                              | BULK PACKAGING           |           |            |           | TAPED AMMOPACK |           |             |           |
|  |                                  |   |  |                                  |                 |                              | LONG LEADS               |           | CUT LEADS  |           | FORM TNA       |           | FORM TFA    |           |
|  |                                  |   |  |                                  |                 |                              | FORM<br>CA               | F<br>(mm) | FORM<br>CB | F<br>(mm) | FORM<br>TNA    | F<br>(mm) | FORM<br>TFA | F<br>(mm) |
| 100                                      | 2.2                              | 5 x 11                                  | 30   | 3                                | 0.08            | MF1                          | 59228E3                  | 2.0       | -          | -         | 79228E3        | 2.5       | 39228E3     | 5.0       |
|  | 4.7                              | 5 x 11                                  | 36   | 5                                | 0.08            | MF1                          | 99475E3                  | 2.0       | -          | -         | 99477E3        | 2.5       | 99473E3     | 5.0       |
|  | 4.7                              | 6.3 x 11                                | 40   | 5                                | 0.08            | MF1                          | 59478E3                  | 2.5       | -          | -         | 79478E3        | 2.5       | 39478E3     | 5.0       |
|  | 10                               | 6.3 x 11                                | 54   | 10                               | 0.08            | MF1                          | 99105E3                  | 2.5       | -          | -         | 99107E3        | 2.5       | 99103E3     | 5.0       |
|  | 10                               | 8 x 12                                  | 66   | 10                               | 0.08            | MF1                          | 59109E3                  | 3.5       | -          | -         | 79109E3        | 3.5       | 39109E3     | 5.0       |
|  | 22                               | 6.3 x 11                                | 93   | 22                               | 0.08            | MF1                          | 99225E3                  | 2.5       | -          | -         | 99227E3        | 2.5       | 99223E3     | 5.0       |
|  | 22                               | 8 x 12                                  | 99   | 22                               | 0.08            | MF1                          | 59229E3                  | 3.5       | -          | -         | 79229E3        | 3.5       | 39229E3     | 5.0       |
|  | 33                               | 8 x 12                                  | 130  | 33                               | 0.08            | MF1                          | 99395E3                  | 3.5       | -          | -         | 99397E3        | 3.5       | 99393E3     | 5.0       |
|  | 33                               | 10 x 12                                 | 148  | 33                               | 0.08            | MF1                          | 59339E3                  | 5.0       | 69339E3    | 5.0       | -              | -         | 39339E3     | 5.0       |
|  | 47                               | 10 x 16                                 | 180  | 47                               | 0.08            | MF1                          | 59479E3                  | 5.0       | 69479E3    | 5.0       | -              | -         | 39479E3     | 5.0       |
|  | 100                              | 10 x 20                                 | 265  | 100                              | 0.08            | MF2                          | 59101E3                  | 5.0       | 69101E3    | 5.0       | -              | -         | 39101E3     | 5.0       |
|  | 220                              | 12.5 x 25                               | 440  | 220                              | 0.08            | MF2                          | 59221E3                  | 5.0       | 69221E3    | 5.0       | -              | -         | 39221E3     | 5.0       |
|  | 330                              | 12.5 x 25                               | 400  | 330                              | 0.08            | MF2                          | 99315E3                  | 5.0       | 99316E3    | 5.0       | -              | -         | 99313E3     | 5.0       |
|  | 330                              | 16 x 25                                 | 540  | 330                              | 0.08            | MF2                          | 59331E3                  | 7.5       | 69331E3    | 7.5       | -              | -         | 39331E3     | 7.5       |
| 470                                      | 16 x 31                          | 715                                     | 470  | 0.08                             | MF2             | 59471E3                      | 7.5                      | 69471E3   | 7.5        | -         | -              | 39471E3   | 7.5         |           |
| 1000                                     | 18 x 40                          | 985                                     | 1000                                       | 0.08                             | MF2             | 59102E3                      | 7.5                      | 69102E3   | 7.5        | -         | -              | -         | -           |           |
| 200                                      | 1.0                              | 5 x 11                                  | 18   | 21                               | 0.14            | MF1                          | 52108E3                  | 2.0       | -          | -         | 72108E3        | 2.5       | 32108E3     | 5.0       |
|  | 2.2                              | 6.3 x 11                                | 30   | 28                               | 0.14            | MF1                          | 52228E3                  | 2.5       | -          | -         | 72228E3        | 2.5       | 32228E3     | 5.0       |
|  | 4.7                              | 8 x 12                                  | 54   | 43                               | 0.14            | MF1                          | 52478E3                  | 3.5       | -          | -         | 72478E3        | 3.5       | 32478E3     | 5.0       |
|  | 10                               | 10 x 12                                 | 94   | 65                               | 0.14            | MF1                          | 52109E3                  | 5.0       | 62109E3    | 5.0       | -              | -         | 32109E3     | 5.0       |
|  | 22                               | 10 x 16                                 | 142  | 113                              | 0.14            | MF1                          | 52229E3                  | 5.0       | 62229E3    | 5.0       | -              | -         | 32229E3     | 5.0       |
|  | 47                               | 12.5 x 20                               | 250  | 213                              | 0.14            | MF1                          | 52479E3                  | 5.0       | 62479E3    | 5.0       | -              | -         | 32479E3     | 5.0       |
|  | 100                              | 16 x 25                                 | 485  | 425                              | 0.14            | MF2                          | 52101E3                  | 7.5       | 62101E3    | 7.5       | -              | -         | 32101E3     | 7.5       |
| 220                                      | 18 x 35                          | 835                                     | 905  | 0.14                             | MF2             | 52221E3                      | 7.5                      | 62221E3   | 7.5        | -         | -              | -         | -           |           |
| 250                                      | 1.0                              | 5 x 11                                  | 16   | 23                               | 0.17            | MF1                          | 51083E3                  | 2.0       | -          | -         | 71083E3        | 2.5       | 31083E3     | 5.0       |
|  | 2.2                              | 6.3 x 11                                | 35   | 32                               | 0.17            | MF1                          | 52283E3                  | 2.5       | -          | -         | 72283E3        | 2.5       | 32283E3     | 5.0       |
|  | 4.7                              | 8 x 12                                  | 60   | 50                               | 0.17            | MF1                          | 54783E3                  | 3.5       | -          | -         | 74783E3        | 3.5       | 34783E3     | 5.0       |
|  | 10                               | 10 x 12                                 | 92   | 75                               | 0.17            | MF1                          | 51093E3                  | 5.0       | 61093E3    | 5.0       | -              | -         | 31093E3     | 5.0       |
|  | 22                               | 10 x 20                                 | 215  | 135                              | 0.17            | MF1                          | 52293E3                  | 5.0       | 62293E3    | 5.0       | -              | -         | 32293E3     | 5.0       |
|  | 33                               | 12.5 x 20                               | 315  | 190                              | 0.17            | MF1                          | 53393E3                  | 5.0       | 63393E3    | 5.0       | -              | -         | 33393E3     | 5.0       |
|  | 47                               | 12.5 x 25                               | 350  | 260                              | 0.17            | MF1                          | 54793E3                  | 5.0       | 64793E3    | 5.0       | -              | -         | 34793E3     | 5.0       |
|  | 100                              | 16 x 31                                 | 530  | 525                              | 0.17            | MF2                          | 51013E3                  | 7.5       | 61013E3    | 7.5       | -              | -         | 31013E3     | 7.5       |
| 350                                      | 1.0                              | 6.3 x 11                                | 23   | 26                               | 0.20            | MF1                          | 51085E3                  | 2.5       | -          | -         | 71085E3        | 2.5       | 31085E3     | 5.0       |
|  | 2.2                              | 8 x 12                                  | 41   | 38                               | 0.20            | MF1                          | 52285E3                  | 3.5       | -          | -         | 72285E3        | 3.5       | 32285E3     | 5.0       |
|  | 4.7                              | 10 x 12                                 | 65   | 58                               | 0.20            | MF1                          | 54785E3                  | 5.0       | 64785E3    | 5.0       | -              | -         | 34785E3     | 5.0       |
|  | 10                               | 10 x 16                                 | 105  | 95                               | 0.20            | MF1                          | 51095E3                  | 5.0       | 61095E3    | 5.0       | -              | -         | 31095E3     | 5.0       |
|  | 22                               | 12.5 x 20                               | 210  | 179                              | 0.20            | MF1                          | 52295E3                  | 5.0       | 62295E3    | 5.0       | -              | -         | 32295E3     | 5.0       |
|  | 47                               | 16 x 25                                 | 365  | 354                              | 0.20            | MF1                          | 54795E3                  | 7.5       | 64795E3    | 7.5       | -              | -         | 34795E3     | 7.5       |
|  | 100                              | 18 x 35                                 | 505  | 725                              | 0.20            | MF2                          | 51015E3                  | 7.5       | 61015E3    | 7.5       | -              | -         | -           | -         |
| 400                                      | 1.0                              | 6.3 x 11                                | 21   | 27                               | 0.25            | MF1                          | 51086E3                  | 2.5       | -          | -         | 71086E3        | 2.5       | 31086E3     | 5.0       |
|  | 2.2                              | 8 x 12                                  | 39   | 41                               | 0.25            | MF1                          | 52286E3                  | 3.5       | -          | -         | 72286E3        | 3.5       | 32286E3     | 5.0       |
|  | 4.7                              | 10 x 12                                 | 70   | 63                               | 0.25            | MF1                          | 54786E3                  | 5.0       | 64786E3    | 5.0       | -              | -         | 34786E3     | 5.0       |
|  | 10                               | 10 x 20                                 | 125  | 105                              | 0.25            | MF1                          | 51096E3                  | 5.0       | 61096E3    | 5.0       | -              | -         | 31096E3     | 5.0       |
|  | 22                               | 12.5 x 25                               | 235  | 201                              | 0.25            | MF1                          | 52296E3                  | 5.0       | 62296E3    | 5.0       | -              | -         | 32296E3     | 5.0       |
|  | 47                               | 16 x 31                                 | 390  | 401                              | 0.25            | MF1                          | 54796E3                  | 7.5       | 64796E3    | 7.5       | -              | -         | 34796E3     | 7.5       |
| 100                                      | 18 x 40                          | 530                                     | 825  | 0.25                             | MF2             | 51016E3                      | 7.5                      | 61016E3   | 7.5        | -         | -              | -         | -           |           |
| 450                                      | 1.0                              | 8 x 12                                  | 27   | 29                               | 0.25            | MF1                          | 57108E3                  | 3.5       | -          | -         | 77108E3        | 3.5       | 37108E3     | 5.0       |
|  | 2.2                              | 10 x 12                                 | 48   | 45                               | 0.25            | MF1                          | 57228E3                  | 5.0       | 67228E3    | 5.0       | -              | -         | 37228E3     | 5.0       |
|  | 4.7                              | 10 x 16                                 | 75   | 67                               | 0.25            | MF1                          | 57478E3                  | 5.0       | 67478E3    | 5.0       | -              | -         | 37478E3     | 5.0       |
|  | 10                               | 12.5 x 20                               | 145  | 115                              | 0.25            | MF1                          | 57109E3                  | 5.0       | 67109E3    | 5.0       | -              | -         | 37109E3     | 5.0       |
|  | 22                               | 16 x 20                                 | 245  | 223                              | 0.25            | MF1                          | 57229E3                  | 7.5       | 67229E3    | 7.5       | -              | -         | 37229E3     | 7.5       |
|  | 33                               | 16 x 25                                 | 325  | 322                              | 0.25            | MF1                          | 57339E3                  | 7.5       | 67339E3    | 7.5       | -              | -         | 37339E3     | 7.5       |
| 47                                       | 16 x 35                          | 420                                     | 448  | 0.25                             | MF1             | 57479E3                      | 7.5                      | 67479E3   | 7.5        | -         | -              | -         | -           |           |

Note

<sup>(1)</sup> Determines the applicable row in the table “Multiplier of Ripple Current (I<sub>R</sub>) as a Function of Frequency”

| ADDITIONAL ELECTRICAL DATA         |   |   |
|------------------------------------|---|---|
| PARAMETER                          | CONDITIONS  | VALUE   |
| <b>Voltage</b>                     |   |   |
| Surge voltage                      |   | $U_s \leq 1.15 \times U_R$  |
| Reverse voltage                    |   | $U_{rev} \leq 1 \text{ V}$  |
| <b>Current</b>                     |   |   |
| Leakage current                    | After 2 min at $U_R = 10 \text{ V}$ to $100 \text{ V}$      | $I_{L2} \leq 0.01 C_R \times U_R$ or $3 \mu\text{A}$ , whichever is greater   |
|                                    | After 5 min at $U_R = 200 \text{ V}$ to $450 \text{ V}$     | $I_{L5} \leq 0.03 C_R \times U_R + 15 \mu\text{A}$ ( $C_R \times U_R \leq 1000$ )<br>$I_{L5} \leq 0.02 C_R \times U_R + 25 \mu\text{A}$ ( $C_R \times U_R > 1000$ ) |
| <b>Inductance</b>                  |   |   |
| Equivalent series inductance (ESL) | Case $\varnothing D \leq 8 \text{ mm}$                      | Typ. 13 nH  |
|                                    | Case $\varnothing D = 10 \text{ mm}$                        | Typ. 16 nH  |
|                                    | Case $\varnothing D \geq 12.5 \text{ mm}$                   | Typ. 18 nH  |
| <b>Resistance</b>                  |   |   |
| Equivalent series resistance (ESR) | Calculated from $\tan \delta_{max}$ and $C_R$ (see Table 2) | $ESR = \tan \delta / 2 \pi f C_R$   |

## CAPACITANCE (C)

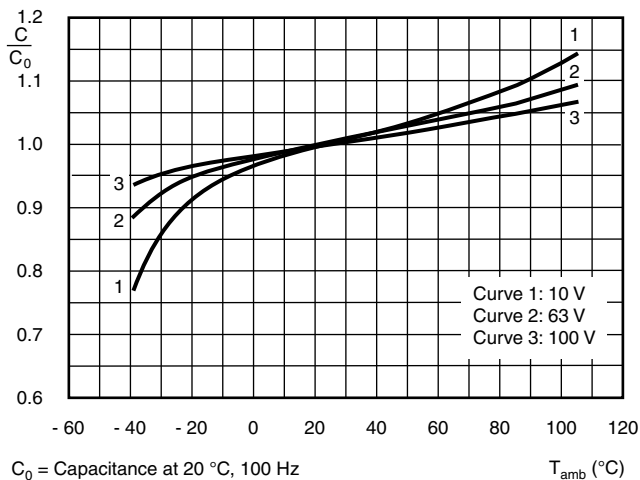


Fig. 6 - Typical multiplier of capacitance as a function of ambient temperature

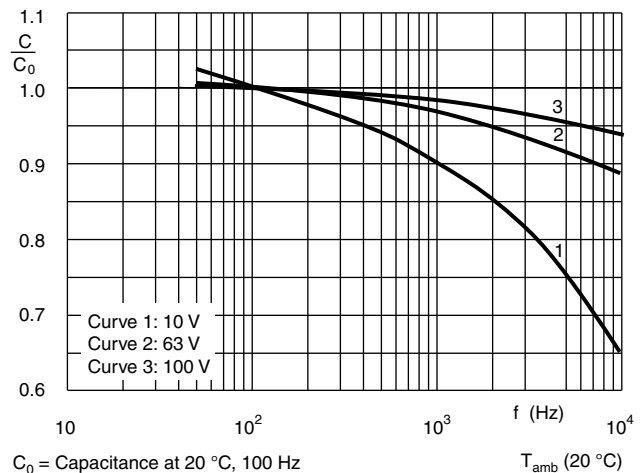


Fig. 7 - Typical multiplier of capacitance as a function of frequency

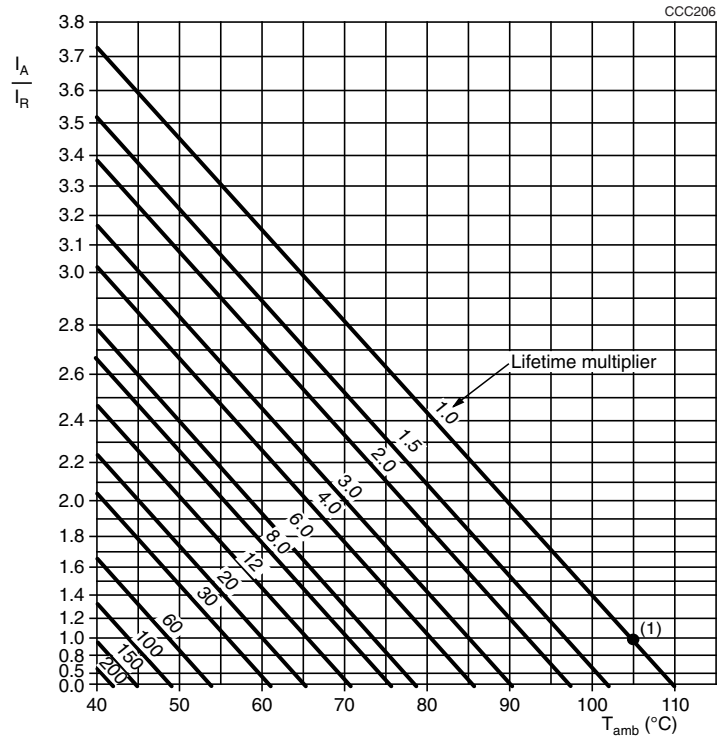
## RIPPLE CURRENT AND USEFUL LIFE

Table 3

| ENDURANCE TEST DURATION AND USEFUL LIFE |                           |
|---|---------------------------|
| ENDURANCE AT 105 °C (h)                 | USEFUL LIFE AT 105 °C (h) |
| 2000                                    | 2500                      |

**Note**

- Multiplier of useful life code: CCC206



$I_A$  = Actual ripple current at 100 Hz, 105 °C  
 $I_R$  = Rated ripple current at 100 Hz, 105 °C

(1) Useful life at 105 °C and  $I_R$  applied

Fig. 8 - Multiplier of useful life as a function of ambient temperature and ripple current load

Table 4

| MULTIPLIER OF RIPPLE CURRENT ( $I_R$ ) AS A FUNCTION OF FREQUENCY |                |      |      |      |          |
|---|----------------|------|------|------|----------|
| FREQ. CODE  | FREQUENCY (Hz) |      |      |      |          |
|   | 50             | 100  | 500  | 1000 | ≥ 10 000 |
| $I_R$ MULTIPLIER  |                |      |      |      |          |
| MF1   | 0.70           | 1.00 | 1.30 | 1.40 | 1.50     |
| MF2   | 0.75           | 1.00 | 1.20 | 1.30 | 1.35     |
| MF3   | 0.80           | 1.00 | 1.10 | 1.12 | 1.15     |

Table 5

| TEST PROCEDURES AND REQUIREMENTS         |                                       |  |  |
|--|---------------------------------------|--|--|
| TEST                                     |                                       | PROCEDURE (quick reference)  | REQUIREMENTS   |
| NAME OF TEST                             | REFERENCE                             |  |  |
| Endurance                                | IEC 60384-4 / EN130300 subclause 4.13 | $T_{amb} = 105\text{ °C}$ ; $U_R$ applied; 2000 h  | $\Delta C/C: \pm 20\%$<br>$\tan \delta \leq 2 \times \text{spec. limit}$<br>$I_{L5} \leq \text{spec. limit}$   |
| Useful life                              | CECC 30301 subclause 1.8.1            | $T_{amb} = 105\text{ °C}$ ; $U_R$ and $I_R$ applied; 2500 h  | $\Delta C/C: \pm 30\%$<br>$\tan \delta \leq 3 \times \text{spec. limit}$<br>$I_{L5} \leq \text{spec. limit}$<br>no short or open circuit<br>total failure percentage: $\leq 1\%$ |
| Shelf life (storage at high temperature) | IEC 60384-4 / EN130300 subclause 4.17 | $T_{amb} = 105\text{ °C}$ ; no voltage applied; 1000 h<br>After test: $U_R$ to be applied for 30 min, 24 h to 48 h before measurement  | $\Delta C/C: \pm 20\%$<br>$\tan \delta \leq 2 \times \text{spec. limit}$<br>$I_{L5} \leq \text{spec. limit}$   |
| Surge                                    | IEC 60384-4 / EN130300 subclause 4.14 | From source of $1.15 \times U_R$ ;<br>$RC = 0.1\text{ s} \pm 0.05\text{ s}$ ;<br>1000 cycles of 30 s on, 330 s off, at $105\text{ °C}$ | $\Delta C/C: \pm 25\%$<br>$\tan \delta \leq 1.5 \times \text{spec. limit}$<br>$I_{L5} \leq \text{spec. limit}$   |

Statements about product lifetime are based on calculations and internal testing. They should only be interpreted as estimations. Also due to external factors, the lifetime in the field application may deviate from the calculated lifetime. In general, nothing stated herein shall be construed as a guarantee of durability.





## Disclaimer

ALL PRODUCT, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, "Vishay"), disclaim any and all liability for any errors, inaccuracies or incompleteness contained in any datasheet or in any other disclosure relating to any product.

Vishay makes no warranty, representation or guarantee regarding the suitability of the products for any particular purpose or the continuing production of any product. To the maximum extent permitted by applicable law, Vishay disclaims (i) any and all liability arising out of the application or use of any product, (ii) any and all liability, including without limitation special, consequential or incidental damages, and (iii) any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.

Statements regarding the suitability of products for certain types of applications are based on Vishay's knowledge of typical requirements that are often placed on Vishay products in generic applications. Such statements are not binding statements about the suitability of products for a particular application. It is the customer's responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application. Parameters provided in datasheets and / or specifications may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated for each customer application by the customer's technical experts. Product specifications do not expand or otherwise modify Vishay's terms and conditions of purchase, including but not limited to the warranty expressed therein.

Hyperlinks included in this datasheet may direct users to third-party websites. These links are provided as a convenience and for informational purposes only. Inclusion of these hyperlinks does not constitute an endorsement or an approval by Vishay of any of the products, services or opinions of the corporation, organization or individual associated with the third-party website. Vishay disclaims any and all liability and bears no responsibility for the accuracy, legality or content of the third-party website or for that of subsequent links.

Vishay products are not designed for use in life-saving or life-sustaining applications or any application in which the failure of the Vishay product could result in personal injury or death unless specifically qualified in writing by Vishay. Customers using or selling Vishay products not expressly indicated for use in such applications do so at their own risk. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay. Product names and markings noted herein may be trademarks of their respective owners.