

## Aluminum Electrolytic Capacitors Axial High Temperature, DIN-Based

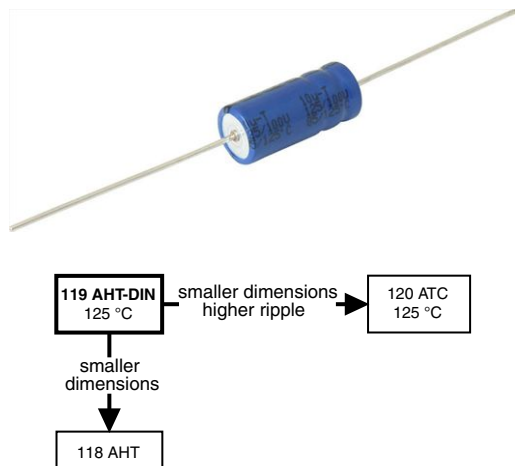


Fig. 1

### QUICK REFERENCE DATA

| DESCRIPTION                                                         | VALUE                       |                       |
|---------------------------------------------------------------------|-----------------------------|-----------------------|
| Nominal case sizes<br>( $\varnothing$ D x L in mm)                  | 6.5 x 18<br>to 10 x 25      | 10 x 30<br>to 21 x 38 |
| Rated capacitance range, $C_R$                                      | 4.7 $\mu$ F to 4700 $\mu$ F |                       |
| Tolerance on $C_R$                                                  | -10 % / +50 %               |                       |
| Rated voltage range, $U_R$                                          | 10 V to 100 V               |                       |
| Category temperature range                                          | -55 °C to +125 °C           |                       |
| Endurance test at 150 °C                                            | 500 h                       | 500 h                 |
| Endurance test at 125 °C                                            | 2000 h                      | 4000 h                |
| Useful life at 125 °C                                               | 4000 h                      | 8000 h                |
| Useful life at 40 °C,<br>1.8 x $I_R$ applied                        | 500 000 h                   | 1 000 000 h           |
| Shelf life at 0 V, 125 °C:<br>$U_R$ = 10 V to 63 V<br>$U_R$ = 100 V | 500 h<br>100 h              |                       |
| Based on sectional<br>specification                                 | IEC 60384-4 / EN 130300     |                       |
| Climatic category IEC 60068                                         | 55 / 125 / 56               |                       |

### FEATURES

- Extra long useful life: up to 8000 h at 125 °C
- High stability, high reliability
- Extended temperature range: 125 °C (usable up to 150 °C)
- High ripple current capability
- Taped versions up to case  $\varnothing$  15 mm x 30 mm available for automatic insertion
- Polarized aluminum electrolytic capacitors, non-solid electrolyte
- Axial leads, cylindrical aluminum case, insulated with a blue sleeve
- Mounting ring version not available in insulated form
- Charge and discharge proof
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)


**RoHS**  
COMPLIANT

### APPLICATIONS

- Military, industrial control, EDP and telecommunication
- Smoothing, filtering, buffering in SMPS; coupling, decoupling
- For use where low mounting height is important; vibration and shock resistant

### MARKING

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

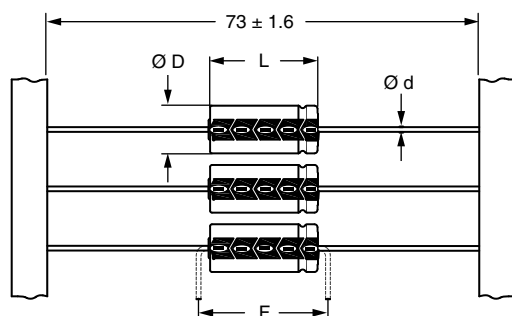
- Rated capacitance (in  $\mu$ F)
- Tolerance on rated capacitance, code letter in accordance with IEC 60062 (T for -10 % to +50 %)
- Rated voltage (in V) at 125 °C and 85 °C
- Date code, in accordance with IEC 60062
- Code for factory of origin
- Name of manufacturer
- Negative terminal identification
- Series number (119)

### 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       | 40        | 63       | 100       |
| 4.7                 | -         | -        | -        | -         | -        | 6.5 x 18  |
| 10                  | -         | -        | -        | -         | 6.5 x 18 | -         |
| 22                  | -         | -        | 6.5 x 18 | -         | 8 x 18   | -         |
| 47                  | -         | 6.5 x 18 | -        | 8 x 18    | 10 x 18  | 10 x 25   |
|                     | -         | -        | -        | -         | -        | 10 x 30   |
| 68                  | -         | -        | -        | -         | 10 x 30  | 12.5 x 30 |
| 100                 | 6.5 x 18  | 8 x 18   | 10 x 18  | 10 x 25   | 10 x 30  | 15 x 30   |
| 150                 | -         | -        | -        | 12.5 x 30 | 15 x 30  | 15 x 30   |

**SELECTION CHART FOR  $C_R$ ,  $U_R$ , AND RELEVANT NOMINAL CASE SIZES ( $\varnothing D \times L$  in mm)**

| $C_R$<br>( $\mu F$ ) | $U_R$ (V) |           |           |           |         |         |
|----------------------|-----------|-----------|-----------|-----------|---------|---------|
|                      | 10        | 16        | 25        | 40        | 63      | 100     |
| 220                  | 10 x 18   | 10 x 25   | 10 x 25   | 12.5 x 30 | 15 x 30 | 18 x 30 |
|                      | -         | -         | 12.5 x 30 | -         | -       | -       |
| 330                  | -         | 12.5 x 30 | 12.5 x 30 | 15 x 30   | 18 x 30 | 18 x 38 |
| 470                  | 10 x 25   | 12.5 x 30 | 12.5 x 30 | 15 x 30   | 18 x 38 | 21 x 38 |
|                      | 12.5 x 30 | -         | -         | -         | -       | -       |
| 680                  | 12.5 x 30 | 15 x 30   | 18 x 30   | 18 x 30   | 21 x 38 | -       |
| 1000                 | 15 x 30   | 15 x 30   | 18 x 30   | 18 x 38   | 21 x 38 | -       |
| 1500                 | 18 x 30   | 18 x 30   | 18 x 38   | 21 x 38   | -       | -       |
| 2200                 | 18 x 30   | 18 x 38   | 21 x 38   | 21 x 38   | -       | -       |
| 3300                 | 18 x 38   | 21 x 38   | -         | -         | -       | -       |
| 4700                 | 21 x 38   | 21 x 38   | -         | -         | -       | -       |

**DIMENSIONS in millimeters AND AVAILABLE FORMS**


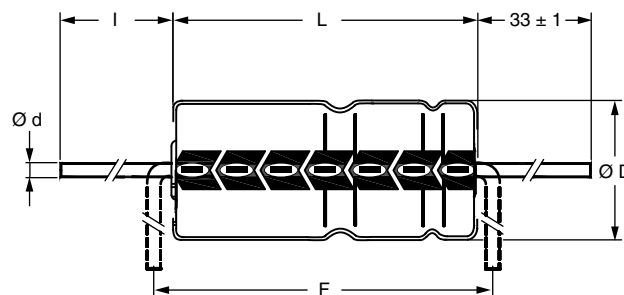
**Form BR:** Taped on reel

Case  $\varnothing D \times L = 6.5 \text{ mm} \times 18 \text{ mm}$  to  $15 \text{ mm} \times 30 \text{ mm}$

**Form BA:** Taped in box (ammopack)

Case  $\varnothing D \times L = 6.5 \text{ mm} \times 18 \text{ mm}$  to  $10 \text{ mm} \times 25 \text{ mm}$

Fig. 2 - Forms BA and BR



**Form AA:** Axial in box

Case  $\varnothing D \times L = 10 \text{ mm} \times 30 \text{ mm}$  to  $21 \text{ mm} \times 38 \text{ mm}$

Fig. 3 - Form AA

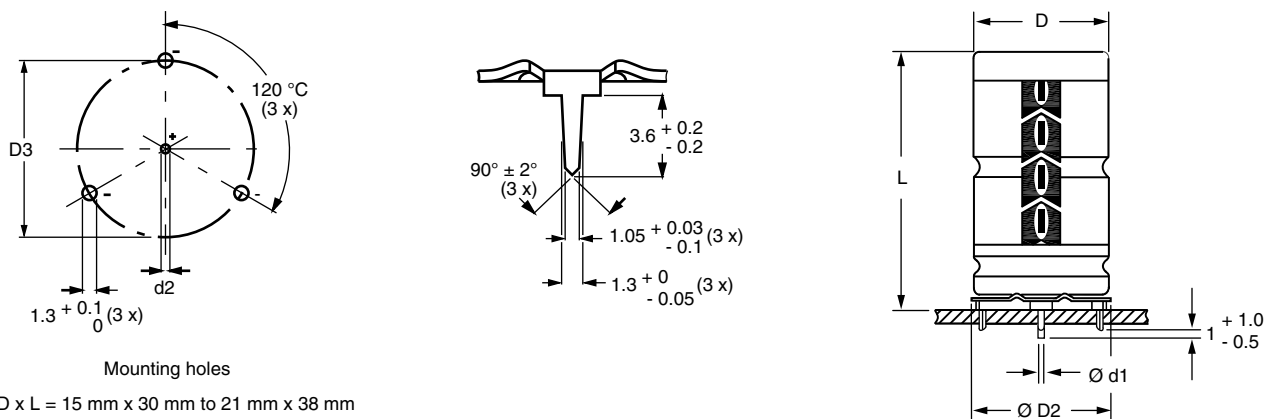
Table 1

**AXIAL; DIMENSIONS in millimeters, MASS, AND PACKAGING QUANTITIES**

| NOMINAL<br>CASE SIZE<br>$\varnothing D \times L$ | CASE<br>CODE | AXIAL FORM AA, BA, AND BR |        |                               |                   |                   | MASS<br>(g) | PACKAGING QUANTITIES |            |            |
|--------------------------------------------------|--------------|---------------------------|--------|-------------------------------|-------------------|-------------------|-------------|----------------------|------------|------------|
|                                                  |              | $\varnothing d$           | $l$    | $\varnothing D_{\text{max.}}$ | $L_{\text{max.}}$ | $F_{\text{min.}}$ |             | FORM<br>AA           | FORM<br>BA | FORM<br>BR |
| 6.5 x 18                                         | 4            | 0.8                       | -      | 6.9                           | 18.5              | 25                | ≈ 1.3       | -                    | 1000       | 1000       |
| 8 x 18                                           | 5            | 0.8                       | -      | 8.5                           | 18.5              | 25                | ≈ 1.7       | -                    | 500        | 500        |
| 10 x 18                                          | 6            | 0.8                       | -      | 10.5                          | 18.5              | 25                | ≈ 2.5       | -                    | 500        | 500        |
| 10 x 25                                          | 7            | 0.8                       | -      | 10.5                          | 25.5              | 30                | ≈ 3.3       | -                    | 500        | 500        |
| 10 x 30                                          | 00           | 0.8                       | 55 ± 1 | 10.5                          | 30.5              | 35                | ≈ 4.8       | 340                  | -          | 500        |
| 12.5 x 30                                        | 01           | 0.8                       | 55 ± 1 | 13.0                          | 30.5              | 35                | ≈ 7.4       | 260                  | -          | 400        |
| 15 x 30                                          | 02           | 0.8                       | 55 ± 1 | 15.5                          | 30.5              | 35                | ≈ 11.7      | 200                  | -          | 250        |
| 18 x 30                                          | 03           | 0.8                       | 55 ± 1 | 18.5                          | 30.5              | 35                | ≈ 12.9      | 120                  | -          | -          |
| 18 x 38                                          | 04           | 0.8                       | 34 ± 1 | 18.5                          | 39.5              | 44                | ≈ 19.0      | 125                  | -          | -          |
| 21 x 38                                          | 05           | 0.8                       | 34 ± 1 | 21.5                          | 39.5              | 44                | ≈ 24.0      | 100                  | -          | -          |

**Note**

- For detailed tape dimensions please see [www.vishay.com/doc?28361](http://www.vishay.com/doc?28361)


Fig. 4 - Mounting hole diagram and outline; **form MR:** With mounting ring and pins

**Table 2**

| <b>MOUNTING RING; DIMENSIONS in millimeters, MASS, AND PACKAGING QUANTITIES</b> |              |                        |           |                     |                      |            |                   |             |                         |
|---------------------------------------------------------------------------------|--------------|------------------------|-----------|---------------------|----------------------|------------|-------------------|-------------|-------------------------|
| NOMINAL<br>CASE SIZE<br>Ø D x L                                                 | CASE<br>CODE | MOUNTING RING: FORM MR |           |                     |                      |            |                   | MASS<br>(g) | PACKAGING<br>QUANTITIES |
|                                                                                 |              | Ø d1                   | Ø d2      | Ø D <sub>max.</sub> | Ø D2 <sub>max.</sub> | D3         | L <sub>max.</sub> |             |                         |
| 15 x 30                                                                         | 02           | 0.8                    | 1.0 + 0.4 | 15.5                | 17.5                 | 16.5 ± 0.2 | 33                | ≈ 8.6       | 200                     |
| 18 x 30                                                                         | 03           | 0.8                    | 1.0 + 0.4 | 18.5                | 19.5                 | 18.5 ± 0.2 | 33                | ≈ 11.5      | 240                     |
| 18 x 38                                                                         | 04           | 0.8                    | 1.0 + 0.4 | 18.5                | 19.5                 | 18.5 ± 0.2 | 42                | ≈ 14.0      | 100                     |
| 21 x 38                                                                         | 05           | 0.8                    | 1.0 + 0.4 | 21.5                | 22.5                 | 21.5 ± 0.2 | 42                | ≈ 19.2      | 100                     |

| <b>ELECTRICAL DATA</b> |                                                                                                       |
|------------------------|-------------------------------------------------------------------------------------------------------|
| SYMBOL                 | DESCRIPTION                                                                                           |
| C <sub>R</sub>         | Rated capacitance at 100 Hz, tolerance -10 % / +50 %                                                  |
| I <sub>R</sub>         | Rated RMS ripple current at 100 Hz, 125 °C                                                            |
| I <sub>L1</sub>        | Max. leakage current after 1 min at U <sub>R</sub>                                                    |
| I <sub>L5</sub>        | Max. leakage current after 5 min at U <sub>R</sub>                                                    |
| tan δ                  | Max. dissipation factor at 100 Hz                                                                     |
| ESR                    | Equivalent series resistance at 100 Hz<br>(calculated from tan δ <sub>max.</sub> and C <sub>R</sub> ) |
| Z                      | Max. impedance at 10 kHz                                                                              |

**Note**

- Unless otherwise specified, all electrical values in Table 3 apply at T<sub>amb</sub> = 20 °C, P = 86 kPa to 106 kPa, RH = 45 % to 75 %.

**ORDERING EXAMPLE**

Electrolytic capacitor 119 series

470 µF / 16 V; -10 % / +50 %

Nominal case size: Ø 12.5 mm x 30 mm; form BR

Ordering code: MAL211925471E3

Former 12NC: 2222 119 25471



Table 3

| 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) | CASE<br>CODE | I <sub>R</sub><br>100 Hz<br>125 °C<br>(mA) | I <sub>L1</sub><br>1 min<br>(μA) | I <sub>L5</sub><br>5 min<br>(μA) | tan δ<br>100 Hz | ESR<br>100 Hz<br>(Ω) | Z<br>10 kHz<br>(Ω) | ORDERING CODE MAL2119..... |                             |                            |                             |
|                                          |                                  |                                         |              |                                            |                                  |                                  |                 |                      |                    | IN BOX<br>FORM AA          | TAPED<br>ON REEL<br>FORM BR | TAPED<br>IN BOX<br>FORM BA | MOUNTING<br>RING<br>FORM MR |
| 10                                       | 100                              | 6.5 x 18                                | 4            | 130                                        | 10                               | 6                                | 0.20            | 3.50                 | 2.20               | -                          | 24101E3                     | 34101E3                    | -                           |
|                                          | 220                              | 10 x 18                                 | 6            | 240                                        | 17                               | 8.4                              | 0.18            | 1.30                 | 1.00               | -                          | 24221E3                     | 34221E3                    | -                           |
|                                          | 470                              | 10 x 25                                 | 7            | 380                                        | 32                               | 13                               | 0.18            | 0.61                 | 0.49               | -                          | 90501E3                     | 90502E3                    | -                           |
|                                          | 470                              | 12.5 x 30                               | 01           | 550                                        | 32                               | 13                               | 0.16            | 0.54                 | 0.38               | 14471E3                    | 24471E3                     | -                          | -                           |
|                                          | 680                              | 12.5 x 30                               | 01           | 640                                        | 45                               | 18                               | 0.20            | 0.47                 | 0.38               | 14681E3                    | 24681E3                     | -                          | -                           |
|                                          | 1000                             | 15 x 30                                 | 02           | 830                                        | 64                               | 24                               | 0.20            | 0.32                 | 0.24               | 14102E3                    | 24102E3                     | -                          | 44102E3                     |
|                                          | 1500                             | 18 x 30                                 | 03           | 1100                                       | 94                               | 34                               | 0.22            | 0.23                 | 0.17               | 14152E3                    | -                           | -                          | 44152E3                     |
|                                          | 2200                             | 18 x 30                                 | 03           | 1190                                       | 136                              | 48                               | 0.26            | 0.19                 | 0.17               | 14222E3                    | -                           | -                          | 44222E3                     |
|                                          | 3300                             | 18 x 38                                 | 04           | 1550                                       | 202                              | 70                               | 0.27            | 0.13                 | 0.10               | 14332E3                    | -                           | -                          | 44332E3                     |
|                                          | 4700                             | 21 x 38                                 | 05           | 1700                                       | 286                              | 90                               | 0.30            | 0.10                 | 0.09               | 14472E3                    | -                           | -                          | 44472E3                     |
| 16                                       | 47                               | 6.5 x 18                                | 4            | 110                                        | 10                               | 5.5                              | 0.13            | 4.40                 | 2.20               | -                          | 25479E3                     | 35479E3                    | -                           |
|                                          | 100                              | 8 x 18                                  | 5            | 170                                        | 14                               | 7.2                              | 0.13            | 2.10                 | 1.30               | -                          | 25101E3                     | 35101E3                    | -                           |
|                                          | 220                              | 10 x 25                                 | 7            | 300                                        | 25                               | 11                               | 0.13            | 0.94                 | 0.55               | -                          | 25221E3                     | 35221E3                    | -                           |
|                                          | 330                              | 12.5 x 30                               | 01           | 560                                        | 36                               | 15                               | 0.13            | 0.63                 | 0.38               | 15331E3                    | 25331E3                     | -                          | -                           |
|                                          | 470                              | 12.5 x 30                               | 01           | 570                                        | 50                               | 19                               | 0.15            | 0.51                 | 0.38               | 15471E3                    | 25471E3                     | -                          | -                           |
|                                          | 680                              | 15 x 30                                 | 02           | 750                                        | 69                               | 26                               | 0.15            | 0.35                 | 0.24               | 15681E3                    | 25681E3                     | -                          | 45681E3                     |
|                                          | 1000                             | 15 x 30                                 | 02           | 850                                        | 100                              | 36                               | 0.19            | 0.30                 | 0.24               | 15102E3                    | 25102E3                     | -                          | 45102E3                     |
|                                          | 1500                             | 18 x 30                                 | 03           | 1120                                       | 148                              | 52                               | 0.20            | 0.21                 | 0.17               | 15152E3                    | -                           | -                          | 45152E3                     |
|                                          | 2200                             | 18 x 38                                 | 04           | 1440                                       | 215                              | 74                               | 0.20            | 0.14                 | 0.10               | 15222E3                    | -                           | -                          | 45222E3                     |
|                                          | 3300                             | 21 x 38                                 | 05           | 1650                                       | 321                              | 110                              | 0.22            | 0.11                 | 0.09               | 15332E3                    | -                           | -                          | 45332E3                     |
|                                          | 4700                             | 21 x 38                                 | 05           | 1710                                       | 455                              | 154                              | 0.28            | 0.09                 | 0.09               | 15472E3                    | -                           | -                          | 45472E3                     |
| 25                                       | 22                               | 6.5 x 18                                | 4            | 85                                         | 10                               | 5.1                              | 0.10            | 7.20                 | 3.20               | -                          | 26229E3                     | 36229E3                    | -                           |
|                                          | 100                              | 10 x 18                                 | 6            | 210                                        | 19                               | 9                                | 0.10            | 1.60                 | 1.00               | -                          | 26101E3                     | 36101E3                    | -                           |
|                                          | 220                              | 10 x 25                                 | 7            | 350                                        | 37                               | 15                               | 0.10            | 0.72                 | 0.58               | -                          | 90503E3                     | 90504E3                    | -                           |
|                                          | 220                              | 12.5 x 30                               | 01           | 500                                        | 37                               | 15                               | 0.09            | 0.65                 | 0.38               | 16221E3                    | 26221E3                     | -                          | -                           |
|                                          | 330                              | 12.5 x 30                               | 01           | 580                                        | 54                               | 21                               | 0.11            | 0.53                 | 0.38               | 16331E3                    | 26331E3                     | -                          | -                           |
|                                          | 470                              | 12.5 x 30                               | 01           | 630                                        | 75                               | 28                               | 0.13            | 0.44                 | 0.38               | 16471E3                    | 26471E3                     | -                          | -                           |
|                                          | 680                              | 18 x 30                                 | 03           | 990                                        | 106                              | 38                               | 0.13            | 0.30                 | 0.17               | 16681E3                    | -                           | -                          | 46681E3                     |
|                                          | 1000                             | 18 x 30                                 | 03           | 1090                                       | 154                              | 54                               | 0.13            | 0.21                 | 0.17               | 16102E3                    | -                           | -                          | 46102E3                     |
|                                          | 1500                             | 18 x 38                                 | 04           | 1420                                       | 229                              | 79                               | 0.13            | 0.14                 | 0.10               | 16152E3                    | -                           | -                          | 46152E3                     |
|                                          | 2200                             | 21 x 38                                 | 05           | 1550                                       | 334                              | 114                              | 0.13            | 0.11                 | 0.09               | 16222E3                    | -                           | -                          | 46222E3                     |
| 40                                       | 47                               | 8 x 18                                  | 5            | 150                                        | 15                               | 7.8                              | 0.08            | 2.70                 | 1.50               | -                          | 27479E3                     | 37479E3                    | -                           |
|                                          | 100                              | 10 x 25                                 | 7            | 260                                        | 28                               | 12                               | 0.08            | 1.30                 | 0.70               | -                          | 27101E3                     | 37101E3                    | -                           |
|                                          | 150                              | 12.5 x 30                               | 01           | 440                                        | 40                               | 16                               | 0.08            | 0.85                 | 0.51               | 17151E3                    | 27151E3                     | -                          | -                           |
|                                          | 220                              | 12.5 x 30                               | 01           | 500                                        | 57                               | 22                               | 0.09            | 0.65                 | 0.48               | 17221E3                    | 27221E3                     | -                          | -                           |
|                                          | 330                              | 15 x 30                                 | 02           | 630                                        | 83                               | 30                               | 0.09            | 0.43                 | 0.37               | 17331E3                    | 27331E3                     | -                          | 47331E3                     |
|                                          | 470                              | 15 x 30                                 | 02           | 720                                        | 117                              | 42                               | 0.12            | 0.41                 | 0.37               | 17471E3                    | 27471E3                     | -                          | 47471E3                     |
|                                          | 680                              | 18 x 30                                 | 03           | 970                                        | 167                              | 58                               | 0.12            | 0.28                 | 0.22               | 17681E3                    | -                           | -                          | 47681E3                     |
|                                          | 1000                             | 18 x 38                                 | 04           | 1250                                       | 244                              | 84                               | 0.12            | 0.19                 | 0.14               | 17102E3                    | -                           | -                          | 47102E3                     |
|                                          | 1500                             | 21 x 38                                 | 05           | 1410                                       | 364                              | 124                              | 0.14            | 0.15                 | 0.12               | 17152E3                    | -                           | -                          | 47152E3                     |
|                                          | 2200                             | 21 x 38                                 | 05           | 1550                                       | 532                              | 180                              | 0.18            | 0.13                 | 0.11               | 17222E3                    | -                           | -                          | 47222E3                     |

**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) | CASE<br>CODE | I <sub>R</sub><br>100 Hz<br>125 °C<br>(mA) | I <sub>L1</sub><br>1 min<br>(μA) | I <sub>L5</sub><br>5 min<br>(μA) | tan δ<br>100 Hz | ESR<br>100 Hz<br>(Ω) | Z<br>10 kHz<br>(Ω) | ORDERING CODE MAL2119..... |                             |                            |                             |
|-----------------------|----------------------------------|-----------------------------------------|--------------|--------------------------------------------|----------------------------------|----------------------------------|-----------------|----------------------|--------------------|----------------------------|-----------------------------|----------------------------|-----------------------------|
|                       |                                  |                                         |              |                                            |                                  |                                  |                 |                      |                    | IN BOX<br>FORM AA          | TAPED<br>ON REEL<br>FORM BR | TAPED<br>IN BOX<br>FORM BA | MOUNTING<br>RING<br>FORM MR |
| 63                    | 10                               | 6.5 x 18                                | 4            | 68                                         | 20                               | 5.3                              | 0.07            | 11.0                 | 5.60               | -                          | 28109E3                     | 38109E3                    | -                           |
|                       | 22                               | 8 x 18                                  | 5            | 110                                        | 20                               | 6.7                              | 0.07            | 5.10                 | 2.80               | -                          | 28229E3                     | 38229E3                    | -                           |
|                       | 47                               | 10 x 18                                 | 6            | 180                                        | 22                               | 9.9                              | 0.07            | 2.40                 | 1.30               | -                          | 28479E3                     | 38479E3                    | -                           |
|                       | 68                               | 10 x 25                                 | 7            | 230                                        | 30                               | 13                               | 0.07            | 1.60                 | 1.00               | -                          | 90505E3                     | 90506E3                    | -                           |
|                       | 68                               | 10 x 30                                 | 00           | 300                                        | 30                               | 13                               | 0.07            | 1.60                 | 0.92               | 18689E3                    | 28689E3                     | -                          | -                           |
|                       | 100                              | 10 x 30                                 | 00           | 360                                        | 42                               | 17                               | 0.08            | 1.30                 | 0.75               | 18101E3                    | 28101E3                     | -                          | -                           |
|                       | 150                              | 15 x 30                                 | 02           | 560                                        | 61                               | 23                               | 0.08            | 0.85                 | 0.37               | 18151E3                    | 28151E3                     | -                          | 48151E3                     |
|                       | 220                              | 15 x 30                                 | 02           | 640                                        | 87                               | 32                               | 0.08            | 0.58                 | 0.37               | 18221E3                    | 28221E3                     | -                          | 48221E3                     |
|                       | 330                              | 18 x 30                                 | 03           | 880                                        | 129                              | 46                               | 0.09            | 0.43                 | 0.23               | 18331E3                    | -                           | -                          | 48331E3                     |
|                       | 470                              | 18 x 38                                 | 04           | 1130                                       | 182                              | 63                               | 0.09            | 0.30                 | 0.15               | 18471E3                    | -                           | -                          | 48471E3                     |
|                       | 680                              | 21 x 38                                 | 05           | 1290                                       | 261                              | 90                               | 0.09            | 0.21                 | 0.12               | 18681E3                    | -                           | -                          | 48681E3                     |
|                       | 1000                             | 21 x 38                                 | 05           | 1430                                       | 382                              | 130                              | 0.10            | 0.16                 | 0.11               | 18102E3                    | -                           | -                          | 48102E3                     |
| 100                   | 4.7                              | 6.5 x 18                                | 4            | 44                                         | 20                               | 10                               | 0.08            | 27.00                | 10.0               | -                          | 29478E3                     | 39478E3                    | -                           |
|                       | 47                               | 10 x 25                                 | 7            | 178                                        | 32                               | 13                               | 0.08            | 2.70                 | 2.00               | -                          | 90518E3                     | 90519E3                    | -                           |
|                       | 47                               | 10 x 30                                 | 00           | 240                                        | 32                               | 13                               | 0.08            | 2.70                 | 2.00               | 19479E3                    | 29479E3                     | -                          | -                           |
|                       | 68                               | 12.5 x 30                               | 01           | 330                                        | 45                               | 18                               | 0.08            | 1.90                 | 1.20               | 19689E3                    | 29689E3                     | -                          | -                           |
|                       | 100                              | 15 x 30                                 | 02           | 440                                        | 64                               | 24                               | 0.09            | 1.40                 | 0.96               | 19101E3                    | 29101E3                     | -                          | 49101E3                     |
|                       | 150                              | 15 x 30                                 | 02           | 520                                        | 94                               | 34                               | 0.10            | 1.10                 | 0.78               | 19151E3                    | 29151E3                     | -                          | 49151E3                     |
|                       | 220                              | 18 x 30                                 | 03           | 710                                        | 136                              | 48                               | 0.10            | 0.72                 | 0.55               | 19221E3                    | -                           | -                          | 49221E3                     |
|                       | 330                              | 18 x 38                                 | 04           | 920                                        | 202                              | 70                               | 0.10            | 0.48                 | 0.37               | 19331E3                    | -                           | -                          | 49331E3                     |
|                       | 470                              | 21 x 38                                 | 05           | 1070                                       | 286                              | 98                               | 0.10            | 0.34                 | 0.28               | 19471E3                    | -                           | -                          | 49471E3                     |

**ADDITIONAL ELECTRICAL DATA**

| ADDITIONAL ELECTRICAL DATA |                                                                                                         |                                                                                                                                                                                                                                              |               |
|----------------------------|---------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| PARAMETER                  | CONDITIONS                                                                                              | VALUE                                                                                                                                                                                                                                        |               |
|                            |                                                                                                         | AXIAL                                                                                                                                                                                                                                        | MOUNTING RING |
| Voltage                    |                                                                                                         |                                                                                                                                                                                                                                              |               |
| Surge voltage              |                                                                                                         | $U_s \leq 1.15 \times U_R$                                                                                                                                                                                                                   |               |
| Reverse voltage            |                                                                                                         | $U_{rev} \leq 1 \text{ V}$                                                                                                                                                                                                                   |               |
| Current                    |                                                                                                         |                                                                                                                                                                                                                                              |               |
| Leakage current            | After 1 min:<br><br>$U_R = 10 \text{ V to } 40 \text{ V}$<br><br>$U_R = 63 \text{ V to } 100 \text{ V}$ | $I_{L1} \leq 0.006 C_R \times U_R + 4 \text{ }\mu\text{A}$ , or $10 \text{ }\mu\text{A}$<br>(whichever is greater)<br><br>$I_{L1} \leq 0.006 C_R \times U_R + 4 \text{ }\mu\text{A}$ , or $20 \text{ }\mu\text{A}$<br>(whichever is greater) |               |
|                            | After 5 min:<br><br>$U_R = 10 \text{ V to } 63 \text{ V}$<br><br>$U_R = 100 \text{ V}$                  | $I_{L5} \leq 0.002 C_R \times U_R + 4 \text{ }\mu\text{A}$<br><br>$I_{L5} \leq 0.002 C_R \times U_R + 4 \text{ }\mu\text{A}$ , or $10 \text{ }\mu\text{A}$<br>(whichever is greater)                                                         |               |

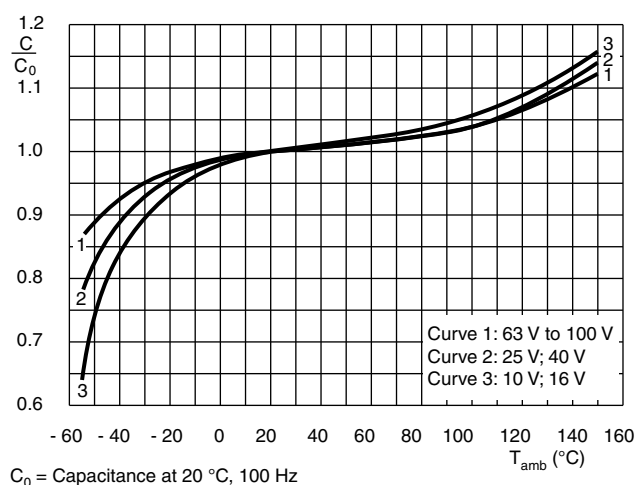
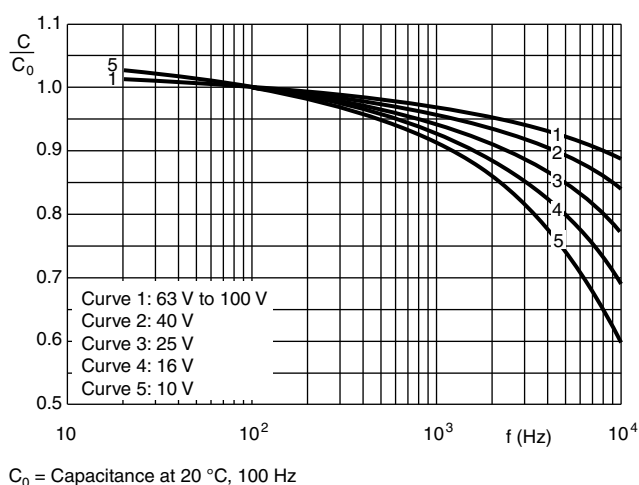
| ADDITIONAL ELECTRICAL DATA         |                  |            |               |
|------------------------------------|------------------|------------|---------------|
| PARAMETER                          | CONDITIONS       | VALUE      |               |
|                                    |                  | AXIAL      | MOUNTING RING |
| Inductance                         |                  |            |               |
| Equivalent series inductance (ESL) | Case Ø D x L mm: |            |               |
|                                    | 6.5 x 18         | Typ. 15 nH | -             |
|                                    | 8 x 18           | Typ. 35 nH | -             |
|                                    | 10 x 18          | Typ. 69 nH | -             |
|                                    | 10 x 25          | Typ. 38 nH | -             |
|                                    | 10 x 30          | Typ. 38 nH | -             |
|                                    | 12.5 x 30        | Typ. 46 nH | -             |
|                                    | 15 x 30          | Typ. 48 nH | Typ. 39 nH    |
|                                    | 18 x 30          | Typ. 50 nH | Typ. 39 nH    |
|                                    | 18 x 38          | Typ. 54 nH | Typ. 39 nH    |
|                                    | 21 x 38          | Typ. 59 nH | Typ. 39 nH    |

**Table 4**

| UPRATING VALUES AT REDUCED AMBIENT TEMPERATURE |                                             |        |    |    |    |     |     |      |
|------------------------------------------------|---------------------------------------------|--------|----|----|----|-----|-----|------|
| SYMBOL                                         | CONDITIONS                                  | VALUES |    |    |    |     |     | UNIT |
| $U_R$                                          | $T_{amb} > 85\text{ °C}$ to $125\text{ °C}$ | 10     | 16 | 25 | 40 | 63  | 100 | V    |
| $U_{R2}$                                       | $T_{amb} \leq 85\text{ °C}$                 | 16     | 25 | 40 | 63 | 100 | 125 |      |

**Note**

- For applications at ambient temperatures of  $\leq 85\text{ °C}$ , the rated voltage ( $U_R$ ) may be raised to  $U_{R2}$ .

**CAPACITANCE (C)**

**Fig. 5 - Typical multiplier of capacitance as a function of ambient temperature**

**Fig. 6 - Typical multiplier of capacitance as a function of frequency**

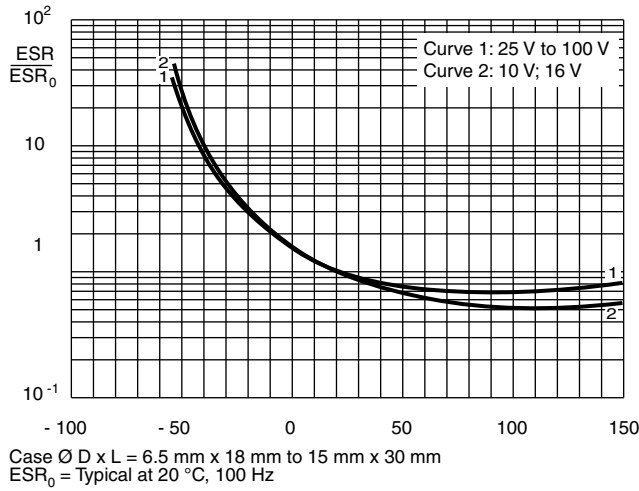
**EQUIVALENT SERIES RESISTANCE (ESR)**


Fig. 7 - Typical multiplier of ESR  
as a function of ambient temperature

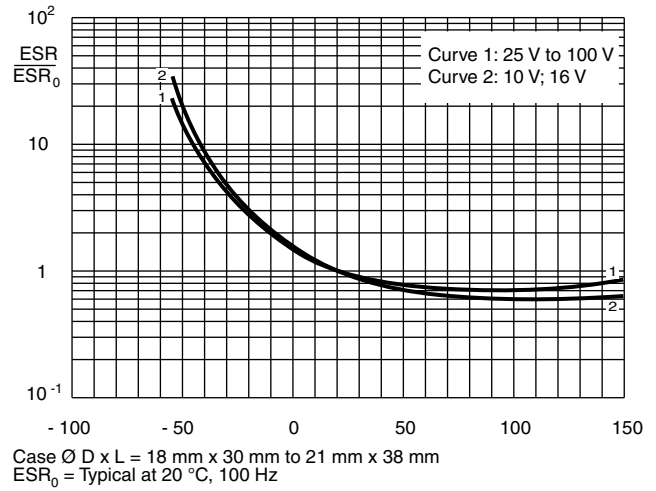


Fig. 8 - Typical multiplier of ESR  
as a function of ambient temperature

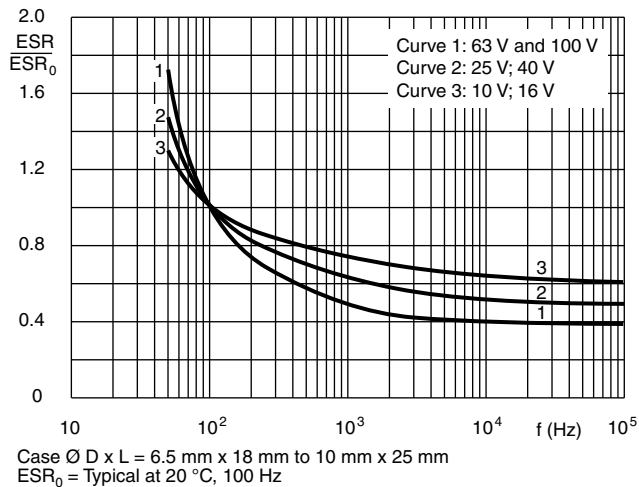


Fig. 9 - Typical multiplier of ESR as a function of frequency

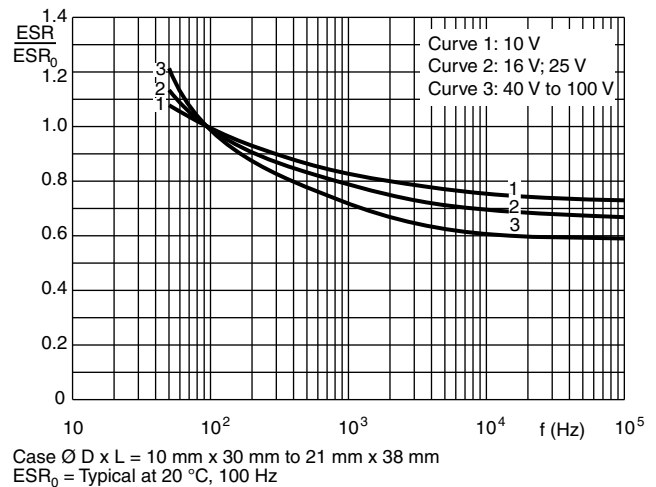


Fig. 10 - Typical multiplier of ESR as a function of frequency

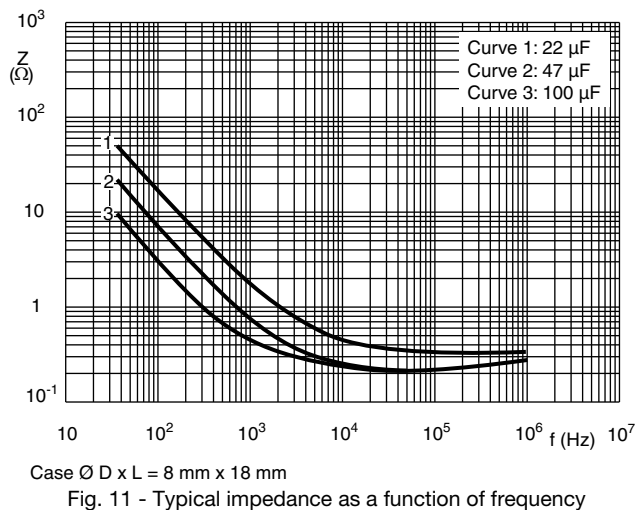
**IMPEDANCE (Z)**


Fig. 11 - Typical impedance as a function of frequency

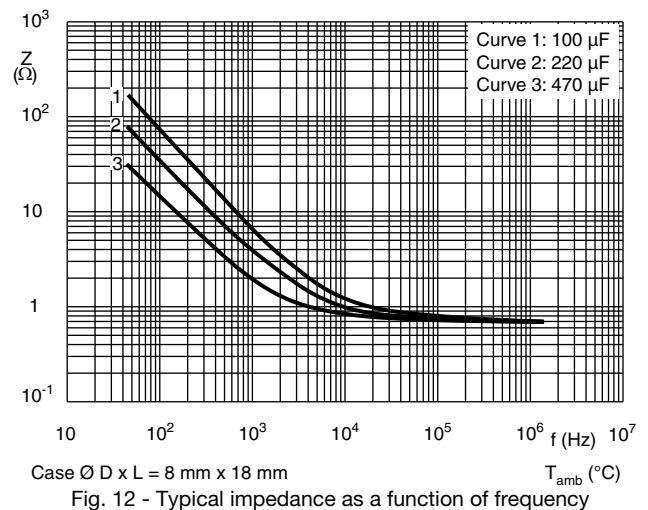


Fig. 12 - Typical impedance as a function of frequency

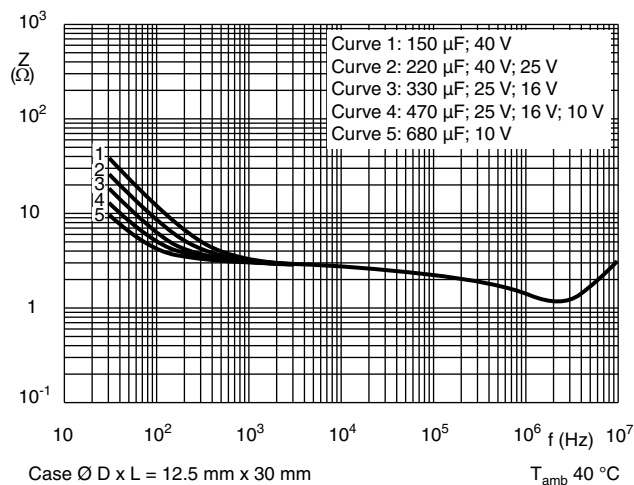
**IMPEDANCE (Z)**


Fig. 13 - Typical impedance as a function of frequency

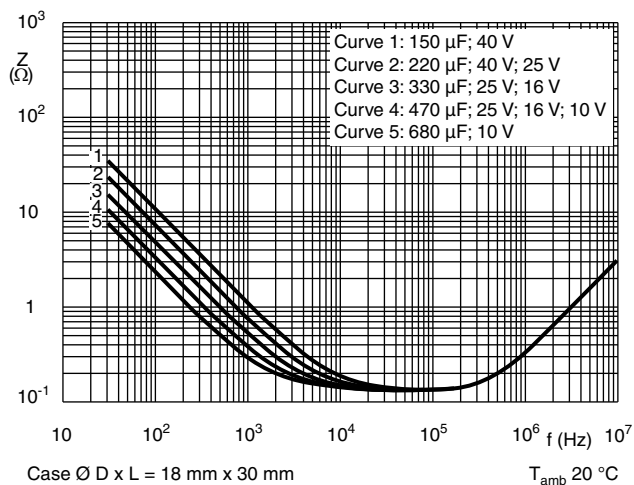


Fig. 14 - Typical impedance as a function of frequency

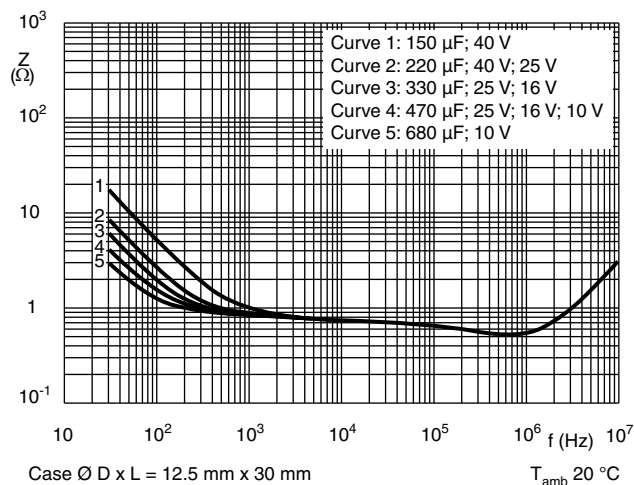


Fig. 15 - Typical impedance as a function of frequency

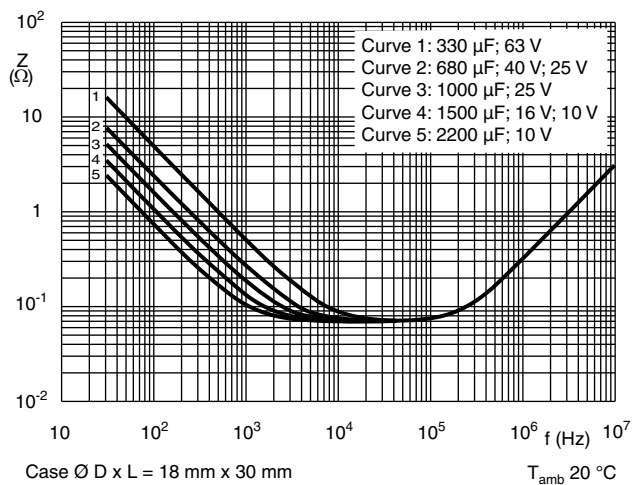


Fig. 16 - Typical impedance as a function of frequency

**RIPPLE CURRENT AND USEFUL LIFE**

Table 5

| ENDURANCE TEST DURATION AND USEFUL LIFE |                               |                                 |
|-----------------------------------------|-------------------------------|---------------------------------|
| NOMINAL CASE SIZE<br>Ø D x L<br>(mm)    | ENDURANCE<br>AT 125 °C<br>(h) | USEFUL LIFE<br>AT 125 °C<br>(h) |
| 6.5 x 18                                | 2000                          | 4000                            |
| 8 x 18                                  | 2000                          | 4000                            |
| 10 x 18                                 | 2000                          | 4000                            |
| 10 x 25                                 | 2000                          | 4000                            |
| 10 x 30                                 | 4000                          | 8000                            |
| 12.5 x 30                               | 4000                          | 8000                            |
| 15 x 30                                 | 4000                          | 8000                            |
| 18 x 30                                 | 4000                          | 8000                            |
| 18 x 38                                 | 4000                          | 8000                            |
| 21 x 38                                 | 4000                          | 8000                            |

**Note**

- Multiplier of useful life code: MBC242

MBC242

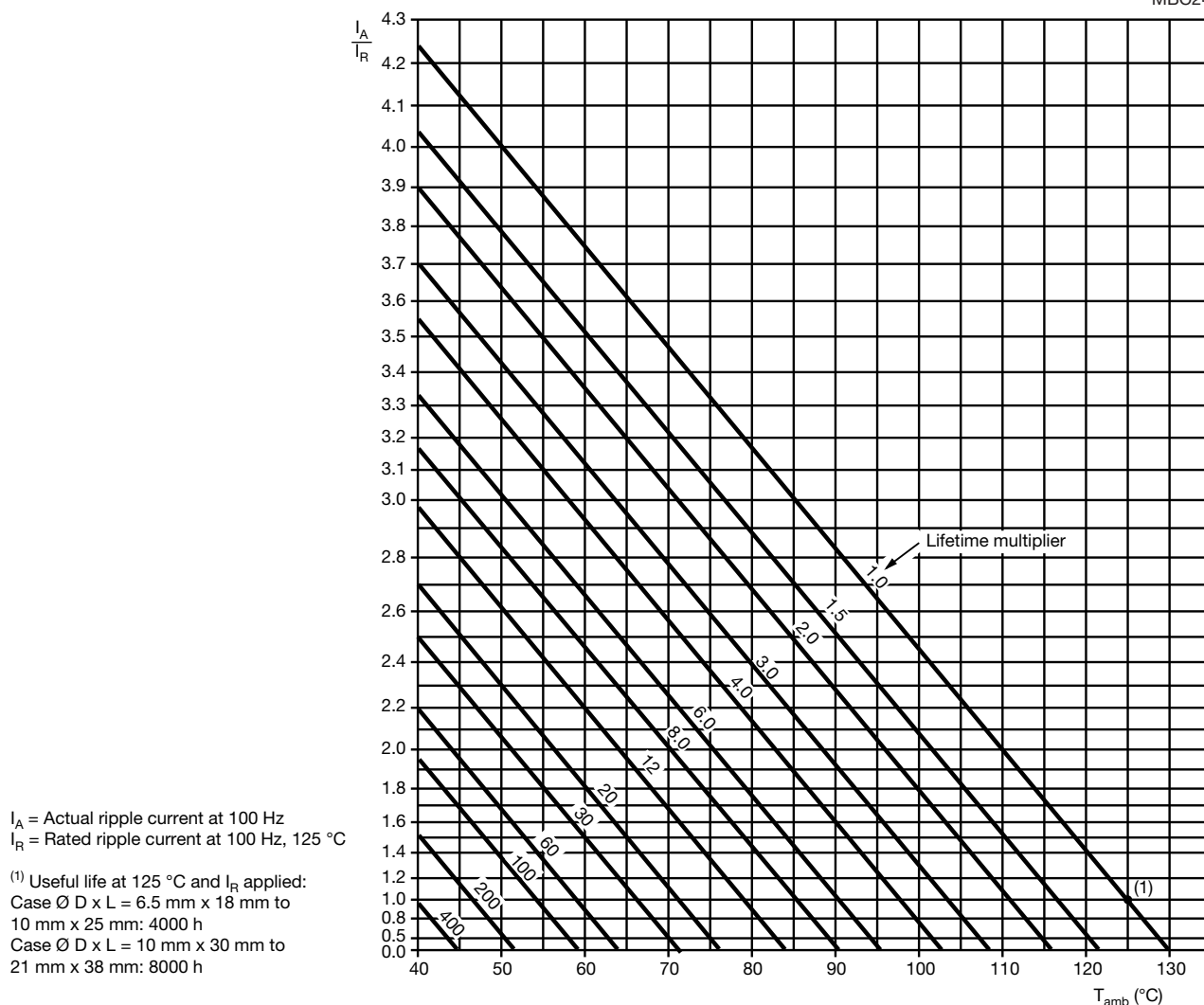


Fig. 17 - Multiplier of useful life as a function of ambient temperature and ripple current load

**Table 6**

| <b>MULTIPLIER OF RIPPLE CURRENT (<math>I_R</math>) AS A FUNCTION OF FREQUENCY</b> |                  |      |      |      |      |                |
|-----------------------------------------------------------------------------------|------------------|------|------|------|------|----------------|
| $U_R$<br>(V)                                                                      | FREQUENCY (Hz)   |      |      |      |      |                |
|                                                                                   | 50               | 100  | 300  | 1000 | 3000 | $\geq 10\,000$ |
|                                                                                   | $I_R$ MULTIPLIER |      |      |      |      |                |
| 10                                                                                | 0.95             | 1.00 | 1.07 | 1.12 | 1.15 | 1.20           |
| 16                                                                                | 0.95             | 1.00 | 1.07 | 1.12 | 1.15 | 1.20           |
| 25                                                                                | 0.90             | 1.00 | 1.12 | 1.20 | 1.25 | 1.30           |
| 40                                                                                | 0.90             | 1.00 | 1.12 | 1.20 | 1.25 | 1.30           |
| 63                                                                                | 0.85             | 1.00 | 1.20 | 1.30 | 1.35 | 1.40           |
| 100                                                                               | 0.85             | 1.00 | 1.20 | 1.30 | 1.35 | 1.40           |

**Table 7**

| <b>TEST PROCEDURES AND REQUIREMENTS</b>        |                                              |                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                              |
|------------------------------------------------|----------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| TEST                                           |                                              | PROCEDURE<br>(quick reference)                                                                                                                                                                                                                                     | REQUIREMENTS                                                                                                                                                                                                                 |
| NAME OF TEST                                   | REFERENCE                                    |                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                              |
| Endurance                                      | IEC 60384-4 /<br>EN 130300<br>subclause 4.13 | $T_{amb} = 125\,^{\circ}\text{C}$ ; $U_R$ applied;<br>Case $\varnothing D \times L = 6.5\,\text{mm} \times 18\,\text{mm}$ to<br>10 mm x 25 mm: 2000 h;<br>Case $\varnothing D \times L = 10\,\text{mm} \times 30\,\text{mm}$ to<br>21 mm x 38 mm: 4000 h           | $\Delta C/C: \pm 15\,\%$<br>$\tan \delta \leq 1.3 \times \text{spec. limit}$<br>$Z \leq 2 \times \text{spec. limit}$<br>$I_{L5} \leq \text{spec. limit}$                                                                     |
| Useful life                                    | CECC 30301<br>subclause 1.8.1                | $T_{amb} = 125\,^{\circ}\text{C}$ ; $U_R$ and $I_R$ applied;<br>Case $\varnothing D \times L = 6.5\,\text{mm} \times 18\,\text{mm}$ to<br>10 mm x 25 mm: 4000 h;<br>Case $\varnothing D \times L = 10\,\text{mm} \times 30\,\text{mm}$ to<br>21 mm x 38 mm: 8000 h | $\Delta C/C: \pm 45\,\%$<br>$\tan \delta \leq 3 \times \text{spec. limit}$<br>$Z \leq 3 \times \text{spec. limit}$<br>$I_{L5} \leq \text{spec. limit}$<br>no short or open circuit<br>total failure percentage: $\leq 1\,\%$ |
| Shelf life<br>(storage at high<br>temperature) | IEC 60384-4 /<br>EN 130300<br>subclause 4.17 | $T_{amb} = 125\,^{\circ}\text{C}$ ; no voltage applied;<br>$U_R = 10\,\text{V}$ to 63 V: 500 h;<br>$U_R = 100\,\text{V}$ : 100 h<br><br>After test: $U_R$ to be applied for 30 min,<br>24 h to 48 h before measurement                                             | $\Delta C/C, \tan \delta, Z$ :<br>for requirements<br>see "Endurance test" above<br>$I_{L5} \leq 2 \times \text{spec. limit}$                                                                                                |
| Reverse voltage                                | IEC 60384-4 /<br>EN 130300<br>subclause 4.15 | $T_{amb} = 125\,^{\circ}\text{C}$ :<br>125 h at $U = -1\,\text{V}$<br>followed by 125 h at $U_R$                                                                                                                                                                   | $\Delta C/C: \pm 20\,\%$<br>$\tan \delta \leq \text{spec. limit}$<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.

Except as expressly indicated in writing, Vishay products are not designed for use in medical, life-saving, or life-sustaining applications or for any other application in which the failure of the Vishay product could result in personal injury or death. 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.