

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

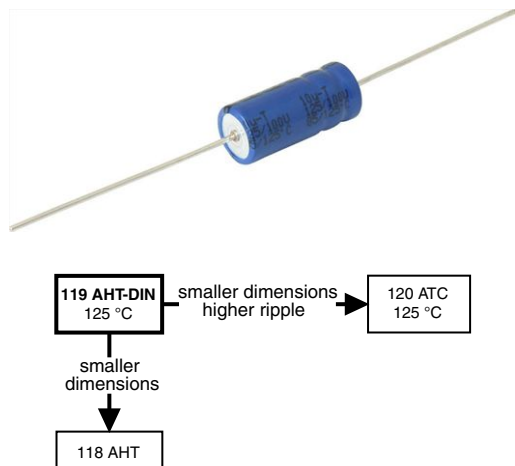


Fig. 1

### 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:

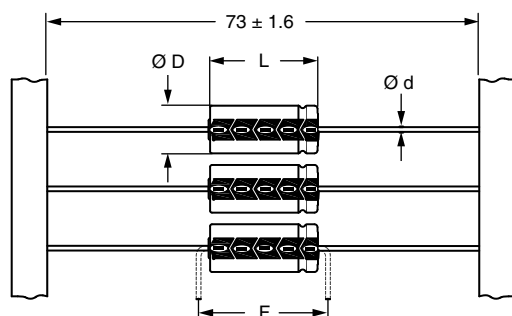
- Rated capacitance (in  $\mu$ F)
- Tolerance on rated capacitance, code letter in accordance with IEC 60062 (T for -10 % to +50 %)
- Rated voltage (in V) at 125 °C and 85 °C
- Date code, in accordance with IEC 60062
- Code for factory of origin
- Name of manufacturer
- Negative terminal identification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


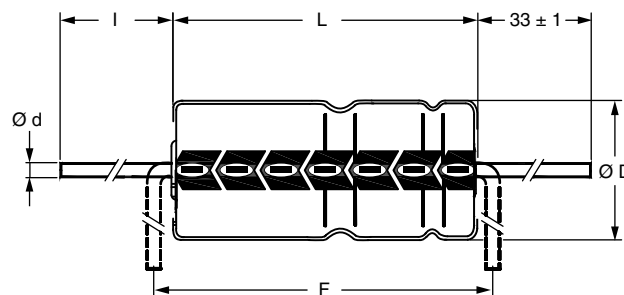
**Form BR:** Taped on reel

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 |            |            |
|--------------------------------------------------|--------------|---------------------------|--------|------------------------|------------|------------|-------------|----------------------|------------|------------|
|                                                  |              | $\varnothing d$           | $l$    | $\varnothing D_{max.}$ | $L_{max.}$ | $F_{min.}$ |             | 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)

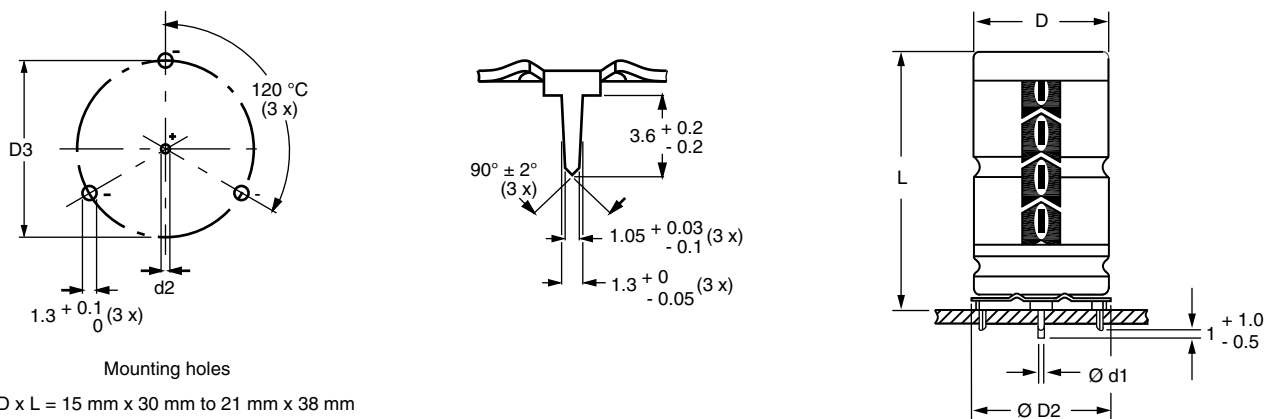


Fig. 4 - Mounting hole diagram and outline; **form MR:** With mounting ring and pins

**Table 2**

| <b>MOUNTING RING; DIMENSIONS in millimeters, MASS, AND PACKAGING QUANTITIES</b> |           |                        |                  |                               |                                |                |                   |                |                      |
|---------------------------------------------------------------------------------|-----------|------------------------|------------------|-------------------------------|--------------------------------|----------------|-------------------|----------------|----------------------|
| NOMINAL CASE SIZE<br>$\varnothing D \times L$                                   | CASE CODE | MOUNTING RING: FORM MR |                  |                               |                                |                |                   | MASS (g)       | PACKAGING QUANTITIES |
|                                                                                 |           | $\varnothing d1$       | $\varnothing d2$ | $\varnothing D_{\text{max.}}$ | $\varnothing D2_{\text{max.}}$ | D3             | $L_{\text{max.}}$ |                |                      |
| 15 x 30                                                                         | 02        | 0.8                    | $1.0 + 0.4$      | 15.5                          | 17.5                           | $16.5 \pm 0.2$ | 33                | $\approx 8.6$  | 200                  |
| 18 x 30                                                                         | 03        | 0.8                    | $1.0 + 0.4$      | 18.5                          | 19.5                           | $18.5 \pm 0.2$ | 33                | $\approx 11.5$ | 240                  |
| 18 x 38                                                                         | 04        | 0.8                    | $1.0 + 0.4$      | 18.5                          | 19.5                           | $18.5 \pm 0.2$ | 42                | $\approx 14.0$ | 100                  |
| 21 x 38                                                                         | 05        | 0.8                    | $1.0 + 0.4$      | 21.5                          | 22.5                           | $21.5 \pm 0.2$ | 42                | $\approx 19.2$ | 100                  |

| <b>ELECTRICAL DATA</b> |                                                                                                 |
|------------------------|-------------------------------------------------------------------------------------------------|
| SYMBOL                 | DESCRIPTION                                                                                     |
| $C_R$                  | Rated capacitance at 100 Hz, tolerance -10 % / +50 %                                            |
| $I_R$                  | Rated RMS ripple current at 100 Hz, 125 °C                                                      |
| $I_{L1}$               | Max. leakage current after 1 min at $U_R$                                                       |
| $I_{L5}$               | Max. leakage current after 5 min at $U_R$                                                       |
| $\tan \delta$          | Max. dissipation factor at 100 Hz                                                               |
| ESR                    | Equivalent series resistance at 100 Hz (calculated from $\tan \delta_{\text{max.}}$ and $C_R$ ) |
| Z                      | Max. impedance at 10 kHz                                                                        |

**Note**

- Unless otherwise specified, all electrical values in Table 3 apply at  $T_{\text{amb}} = 20 \text{ °C}$ ,  $P = 86 \text{ kPa}$  to  $106 \text{ kPa}$ ,  $RH = 45 \text{ %}$  to  $75 \text{ %}$ .

**ORDERING EXAMPLE**

Electrolytic capacitor 119 series

470  $\mu\text{F}$  / 16 V; -10 % / +50 %

Nominal case size:  $\varnothing 12.5 \text{ mm} \times 30 \text{ mm}$ ; 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 $\mu\text{A}$<br>(whichever is greater)<br><br>$I_{L1} \leq 0.006 C_R \times U_R + 4 \text{ }\mu\text{A}$ , or 20 $\mu\text{A}$<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 $\mu\text{A}$<br>(whichever is greater)                                                 |               |

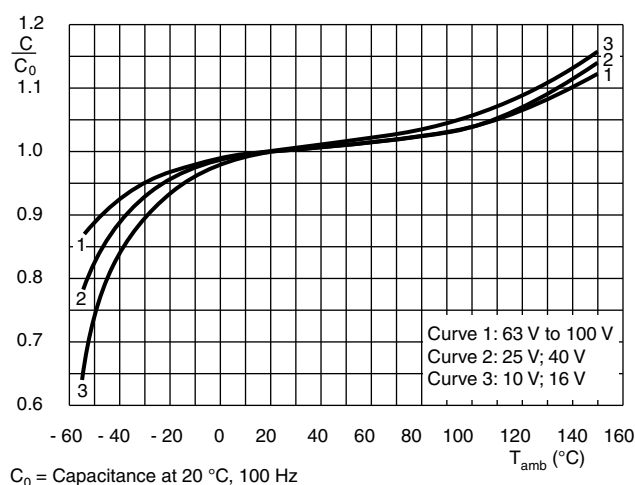
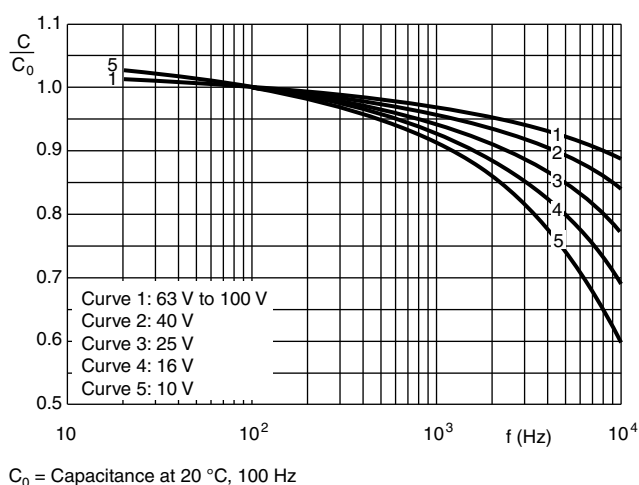
| ADDITIONAL ELECTRICAL DATA         |                  |            |               |
|------------------------------------|------------------|------------|---------------|
| PARAMETER                          | CONDITIONS       | VALUE      |               |
|                                    |                  | 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 ambient temperature**

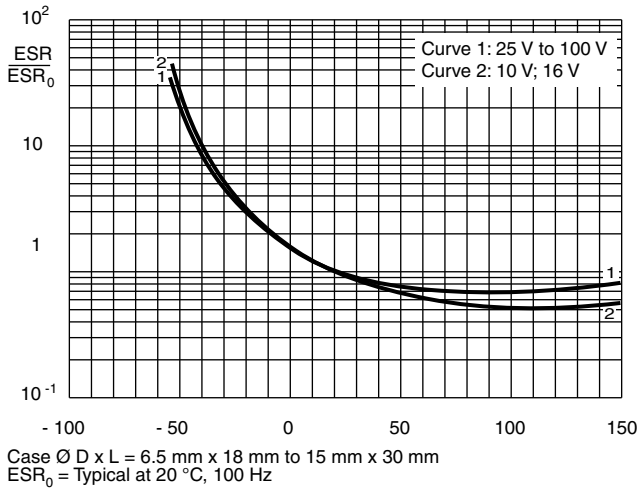
**EQUIVALENT SERIES RESISTANCE (ESR)**


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

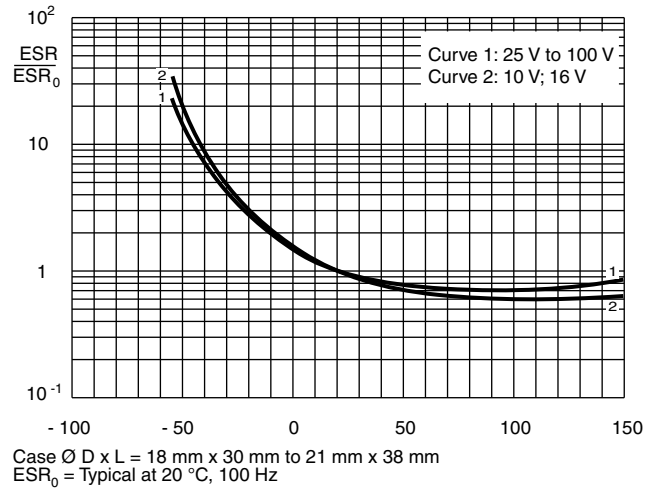


Fig. 8 - Typical multiplier of ESR  
as a function of ambient temperature

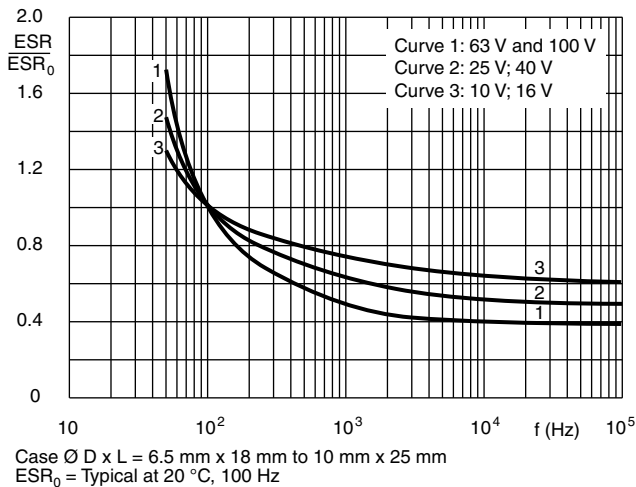


Fig. 9 - Typical multiplier of ESR as a function of frequency

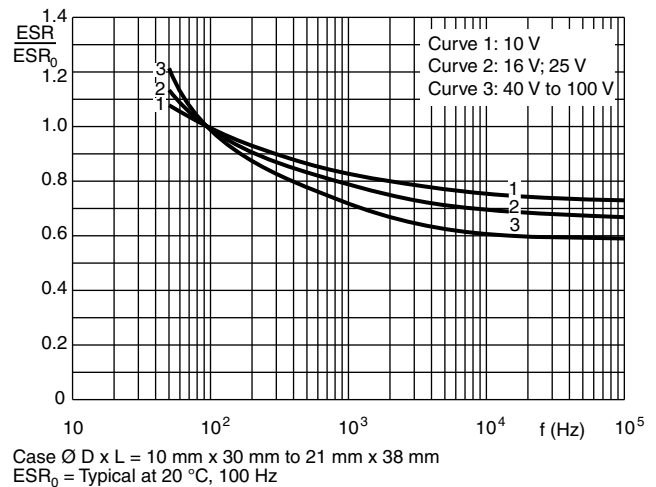


Fig. 10 - Typical multiplier of ESR as a function of frequency

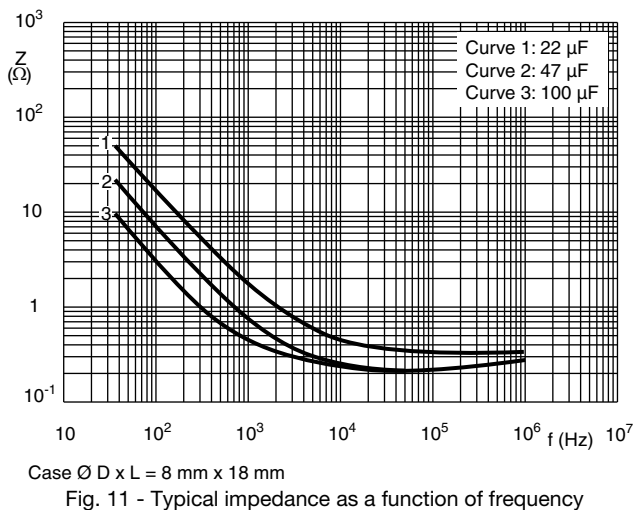
**IMPEDANCE (Z)**


Fig. 11 - Typical impedance as a function of frequency

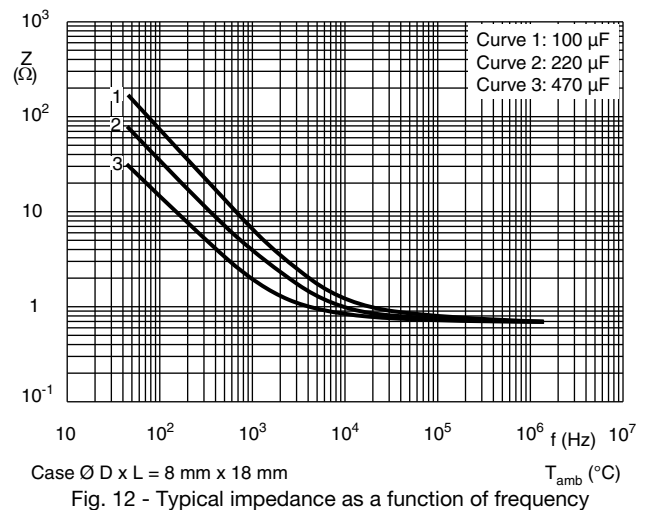


Fig. 12 - Typical impedance as a function of frequency

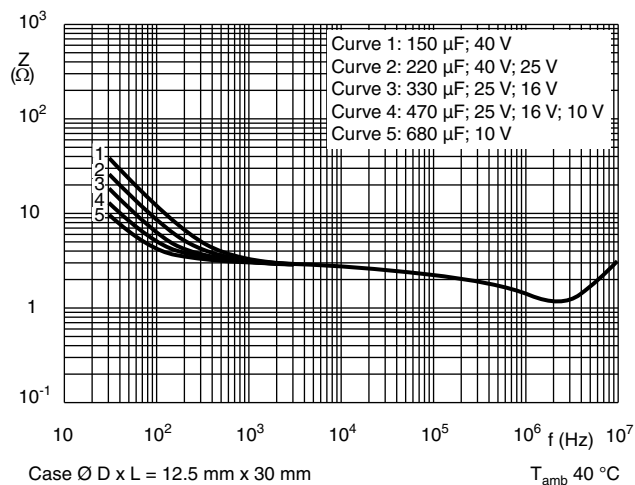
**IMPEDANCE (Z)**


Fig. 13 - Typical impedance as a function of frequency

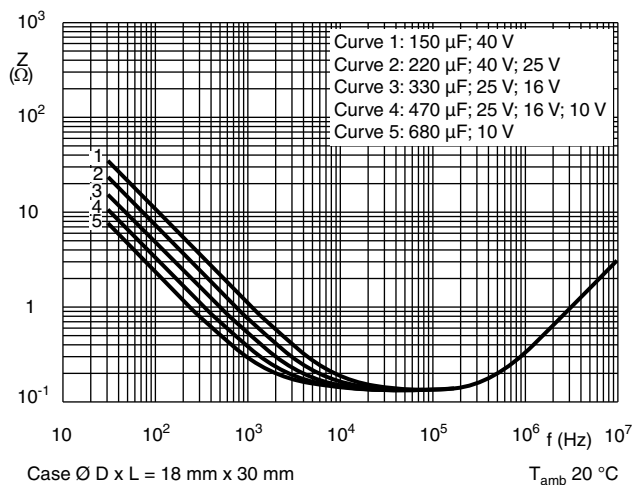


Fig. 14 - Typical impedance as a function of frequency

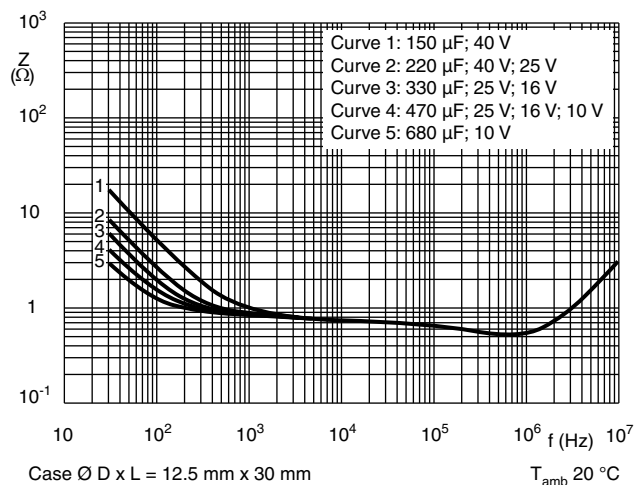


Fig. 15 - Typical impedance as a function of frequency

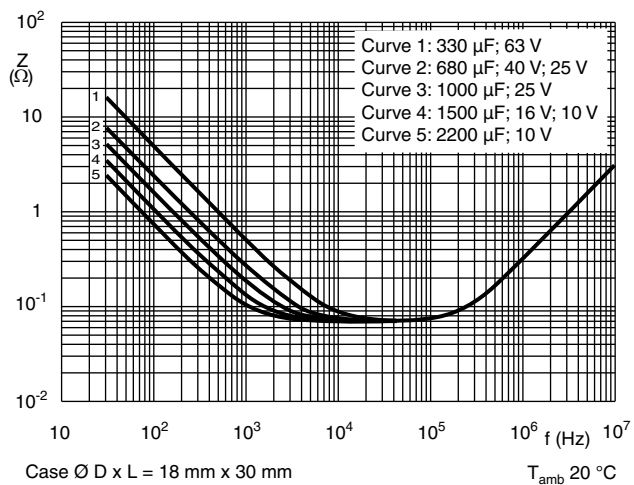


Fig. 16 - Typical impedance as a function of frequency

**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

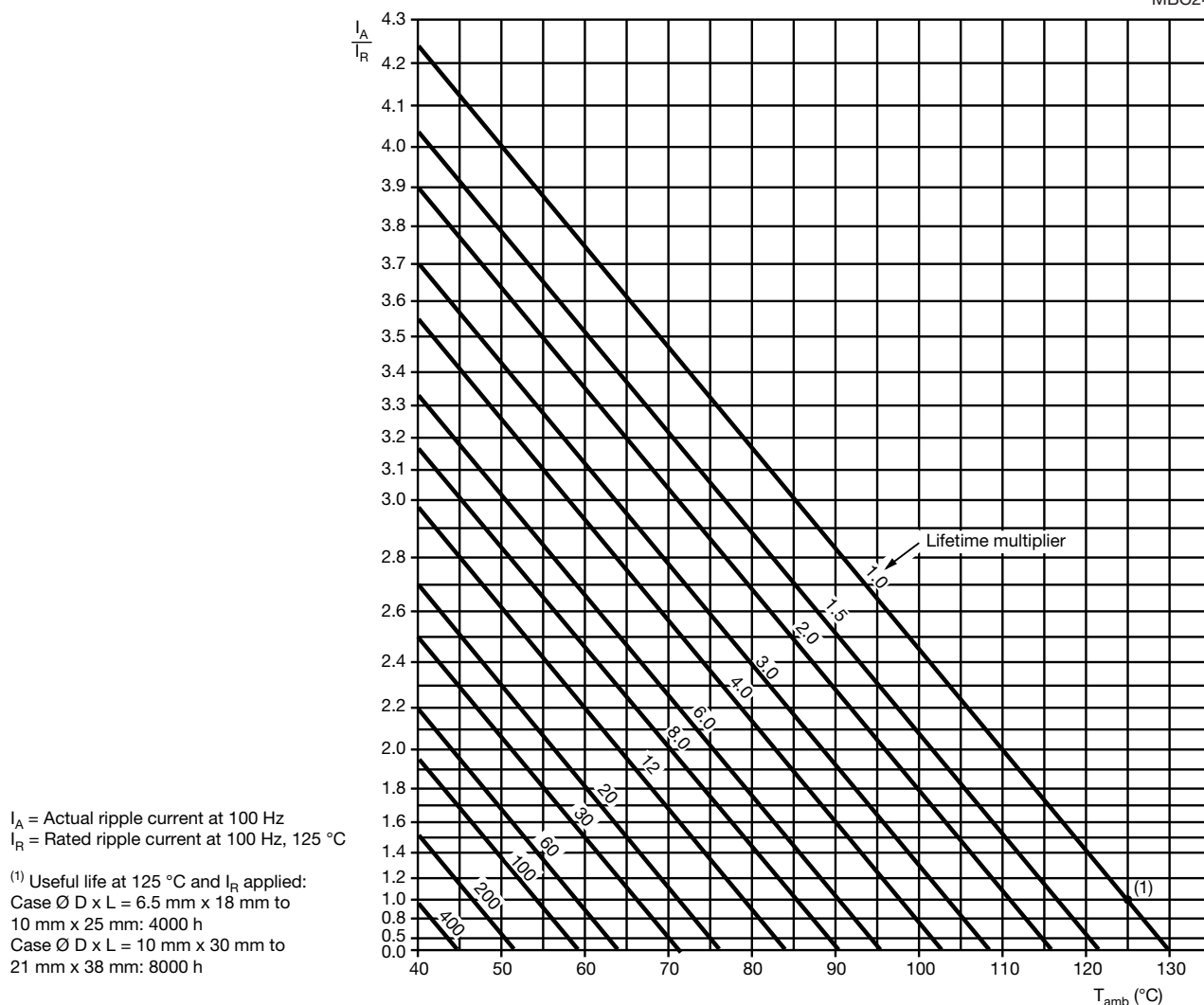


Fig. 17 - Multiplier of useful life as a function of ambient temperature and ripple current load

**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.



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