

## Aluminum Capacitors Axial High Temperature, DIN-Based

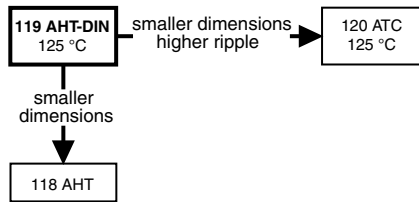


Fig. 1

| QUICK REFERENCE DATA  |   |
|---|---|
| DESCRIPTION   | VALUE                                       |
| Nominal case sizes<br>( $\varnothing$ D x L in mm)                            | 6.5 x 18 to 10 x 25      10 x 30 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 200 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 and 200 V | 500 h<br>100 h                              |
| Based on sectional 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

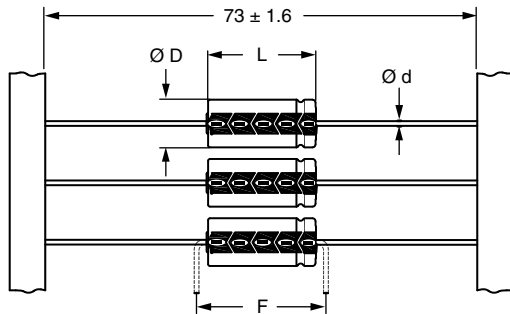
### MARKING

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)

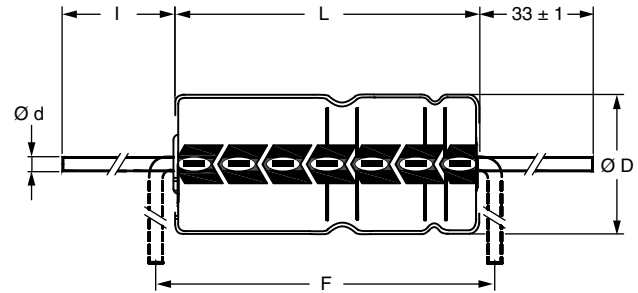
| SELECTION CHART FOR $C_R$ , $U_R$ , AND RELEVANT NOMINAL CASE SIZES ( $\varnothing$ D x L in mm) |           |          |          |           |          |           |         |
|--|-----------|----------|----------|-----------|----------|-----------|---------|
| $C_R$<br>( $\mu$ F)  | $U_R$ (V) |          |          |           |          |           |         |
|  | 10        | 16       | 25       | 40        | 63       | 100       | 200     |
| 4.7  | -         | -        | -        | -         | -        | 6.5 x 18  | 10 x 18 |
| 10   | -         | -        | -        | -         | 6.5 x 18 | 8 x 18    | 10 x 25 |
| 22   | -         | -        | 6.5 x 18 | -         | 8 x 18   | 10 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   | -       |

| <b>SELECTION CHART FOR <math>C_R</math>, <math>U_R</math>, AND RELEVANT NOMINAL CASE SIZES (<math>\varnothing D \times L</math> in mm)</b> |           |           |           |           |         |         |     |
|--|-----------|-----------|-----------|-----------|---------|---------|-----|
| $C_R$<br>( $\mu F$ )   | $U_R$ (V) |           |           |           |         |         |     |
|  | 10        | 16        | 25        | 40        | 63      | 100     | 200 |
| 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  $21 \text{ mm} \times 38 \text{ mm}$

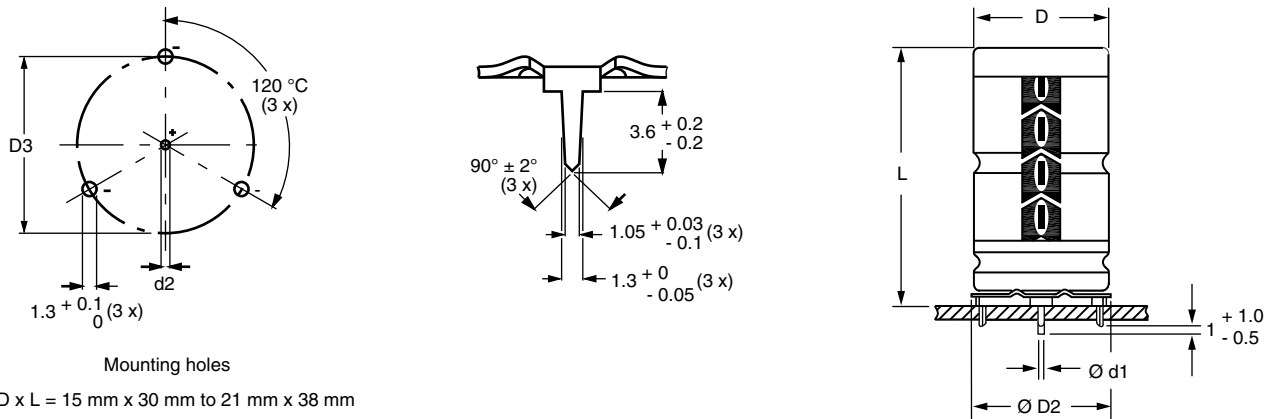
Fig. 3 - Form AA

Table 1

| <b>AXIAL; DIMENSIONS in millimeters, MASS, AND PACKAGING QUANTITIES</b> |           |                           |        |                        |            |            |          |                      |         |         |
|---|-----------|---------------------------|--------|------------------------|------------|------------|----------|----------------------|---------|---------|
| NOMINAL CASE SIZE<br>$\varnothing D \times L$                           | CASE CODE | AXIAL FORM AA, BA, AND BR |        |                        |            |            | MASS (g) | PACKAGING QUANTITIES |         |         |
|   |           | $\varnothing d$           | l      | $\varnothing D_{max.}$ | $L_{max.}$ | $F_{min.}$ |          | FORM AA              | FORM BA | FORM 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)



Mounting holes

Case  $\varnothing D \times L = 15 \text{ mm} \times 30 \text{ mm}$  to  $21 \text{ mm} \times 38 \text{ mm}$   
 Especially for applications with severe shocks and vibrations

 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 |
|   |           | $\varnothing d1$       | $\varnothing d2$ | $\varnothing D_{max.}$ | $\varnothing D2_{max.}$ | D3             | $L_{max.}$ |                |                      |
| 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 $\tan \delta_{max.}$ and $C_R$ ) |
| Z                      | Max. impedance at 10 kHz   |

**Note**

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

**ORDERING EXAMPLE**

Electrolytic capacitor 119 series

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

 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> (V)                       | C <sub>R</sub> 100 Hz (µF) | NOMINAL CASE SIZE Ø D x L (mm) | CASE CODE | I <sub>R</sub> 100 Hz 125 °C (mA) | I <sub>L1</sub> 1 min (µA) | I <sub>L5</sub> 5 min (µA) | tan δ 100 Hz | ESR 100 Hz (Ω) | Z 10 kHz (Ω) | ORDERING CODE MAL2119..... |                       |                      |                       |
|  |                            |                                |           |                                   |                            |                            |              |                |              | IN BOX FORM AA             | TAPED ON REEL FORM BR | TAPED IN BOX FORM BA | MOUNTING RING 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              | -                     |
|  | 10                         | 8 x 18                         | 5         | 70                                | 20                         | 10                         | 0.08         | 13.00          | 6.00         | -                          | 29109E3               | 39109E3              | -                     |
|  | 22                         | 10 x 18                        | 6         | 112                               | 20                         | 10                         | 0.08         | 5.80           | 3.50         | -                          | 29229E3               | 39229E3              | -                     |
|  | 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              |                       |
| 200                                      | 4.7                        | 10 x 18                        | 6         | 52                                | 20                         | 10                         | 0.08         | 27.0           | 10.0         | -                          | 90507E3               | 90508E3              | -                     |
|  | 10                         | 10 x 25                        | 7         | 82                                | 20                         | 10                         | 0.08         | 13.0           | 5.00         | -                          | 90509E3               | 90511E3              | -                     |

| ADDITIONAL ELECTRICAL DATA |   |  |               |
|----------------------------|---|--|---------------|
| PARAMETER                  | CONDITIONS  | VALUE  |               |
|                            |   | AXIAL  | MOUNTING RING |
| <b>Voltage</b>             |   |  |               |
| Surge voltage              |   | $U_s \leq 1.15 \times U_R$   |               |
| Reverse voltage            |   | $U_{rev} \leq 1 V$   |               |
| <b>Current</b>             |   |  |               |
| Leakage current            | After 1 min:<br>$U_R = 10 V$ to $40 V$<br><br>$U_R = 63 V$ to $200 V$ | $I_{L1} \leq 0.006 C_R \times U_R + 4 \mu A$ , or $10 \mu A$ (whichever is greater)<br><br>$I_{L1} \leq 0.006 C_R \times U_R + 4 \mu A$ , or $20 \mu A$ (whichever is greater) |               |
|                            | After 5 min:<br>$U_R = 10 V$ to $63 V$<br>$U_R = 100 V$ and $200 V$   | $I_{L5} \leq 0.002 C_R \times U_R + 4 \mu A$<br><br>$I_{L5} \leq 0.002 C_R \times U_R + 4 \mu A$ , or $10 \mu A$ (whichever is greater)  |               |

| ADDITIONAL ELECTRICAL DATA         |                  |            |               |
|------------------------------------|------------------|------------|---------------|
| PARAMETER                          | CONDITIONS       | VALUE      |               |
|                                    |                  | AXIAL      | MOUNTING RING |
| <b>Inductance</b>                  |                  |            |               |
| 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 |
| $U_R$  | $T_{amb} > 85 \text{ to } 125 \text{ }^\circ\text{C}$ | 10     | 16 | 25 | 40 | 63  | 100 | 200 | V    |
| $U_{R2}$                                       | $T_{amb} \leq 85 \text{ }^\circ\text{C}$              | 16     | 25 | 40 | 63 | 100 | 125 | 250 |      |

**Note**

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

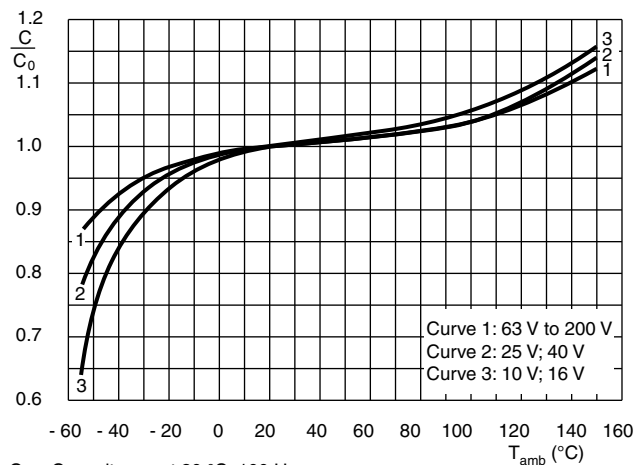
**CAPACITANCE (C)**


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

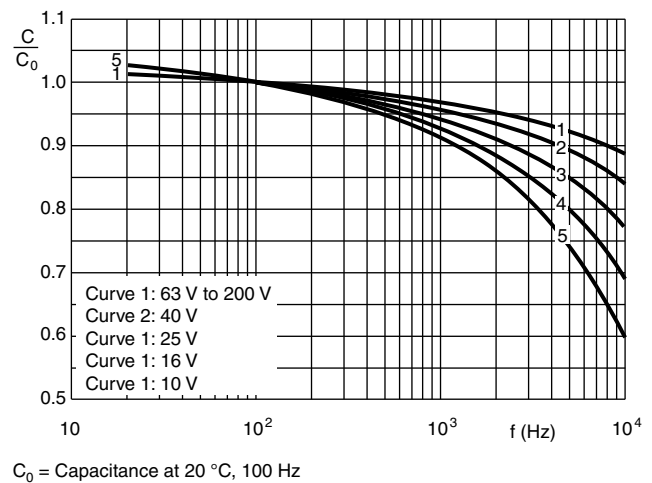
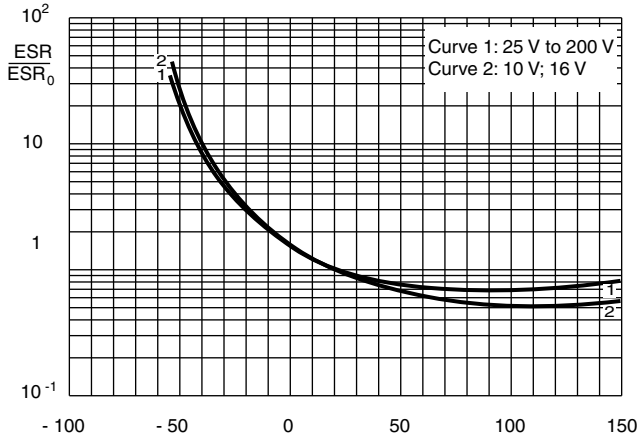


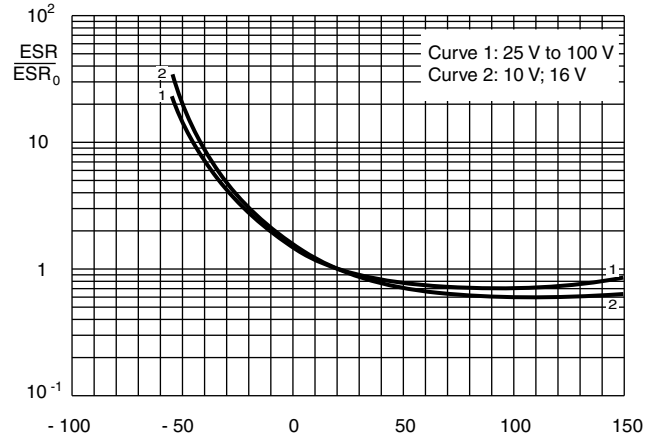
Fig. 6 - Typical multiplier of capacitance as a function of ambient temperature

**EQUIVALENT SERIES RESISTANCE (ESR)**



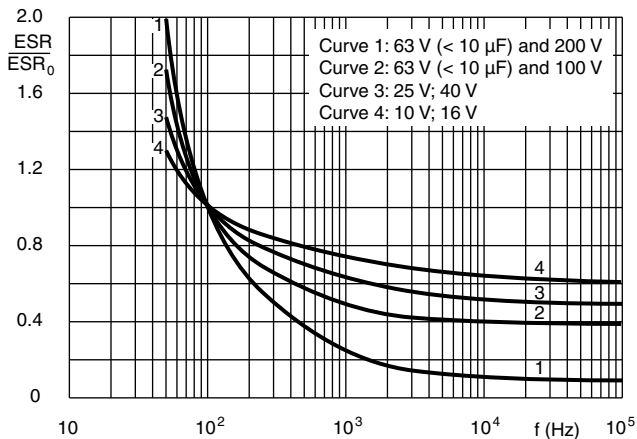
Case Ø D x L = 6.5 mm x 18 mm to 15 mm x 30 mm  
ESR<sub>0</sub> = Typical at 20 °C, 100 Hz

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



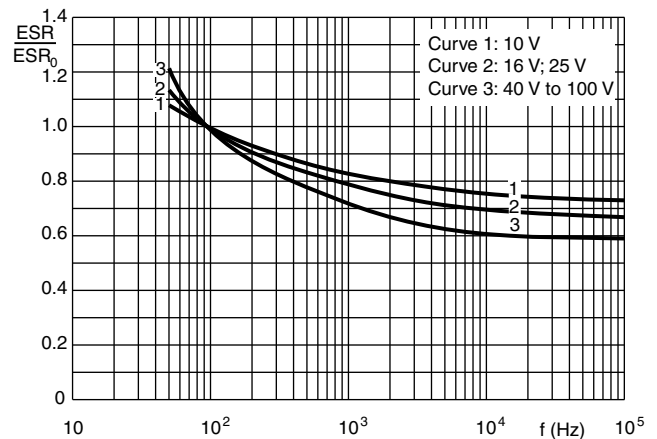
Case Ø D x L = 18 mm x 30 mm to 21 mm x 38 mm  
ESR<sub>0</sub> = Typical at 20 °C, 100 Hz

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



Case Ø D x L = 6.5 mm x 18 mm to 10 mm x 25 mm  
ESR<sub>0</sub> = Typical at 20 °C, 100 Hz

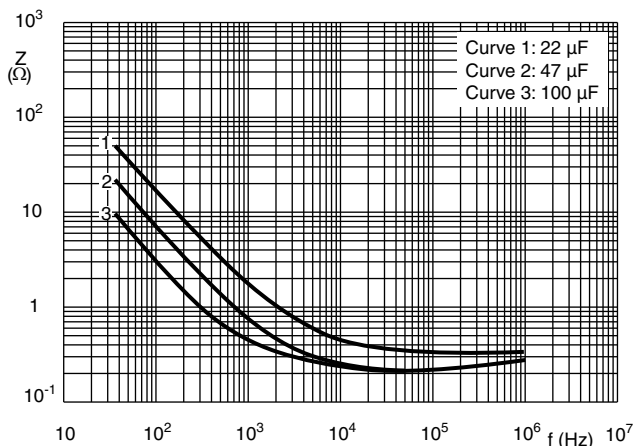
Fig. 9 - Typical multiplier of ESR as a function of frequency



Case Ø D x L = 10 mm x 30 mm to 21 mm x 38 mm  
ESR<sub>0</sub> = Typical at 20 °C, 100 Hz

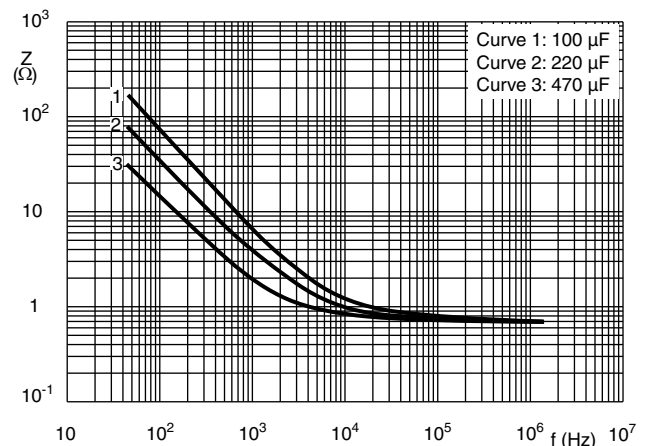
Fig. 10 - Typical multiplier of ESR as a function of frequency

**IMPEDANCE (Z)**



Case Ø D x L = 8 mm x 18 mm

Fig. 11 - Typical impedance as a function of frequency



Case Ø D x L = 8 mm x 18 mm

Fig. 12 - Typical impedance as a function of frequency



IMPEDANCE (Z)

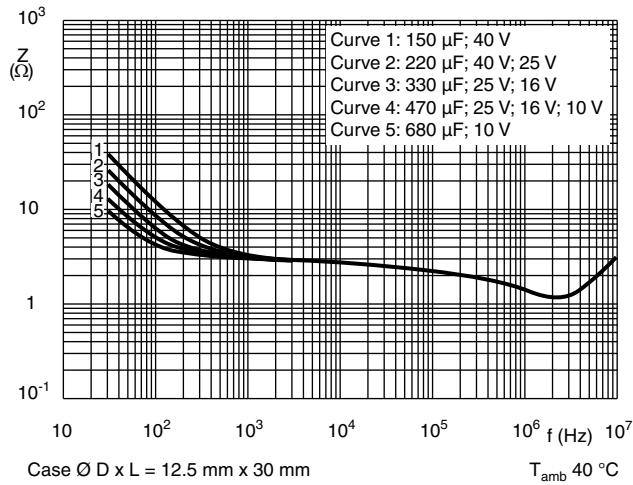


Fig. 13 - Typical impedance as a function of frequency

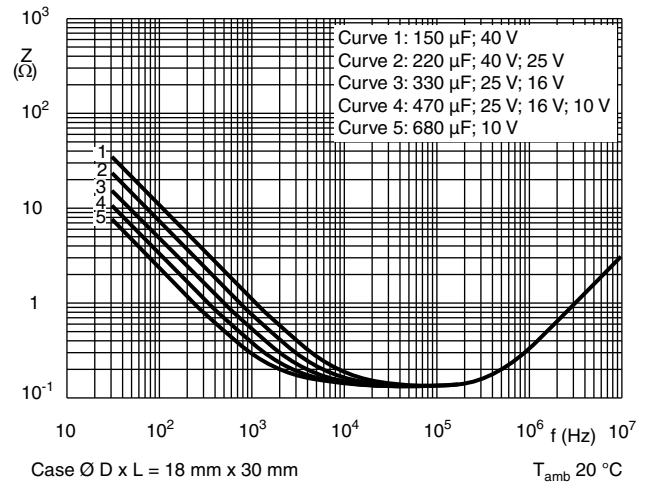


Fig. 14 - Typical impedance as a function of frequency

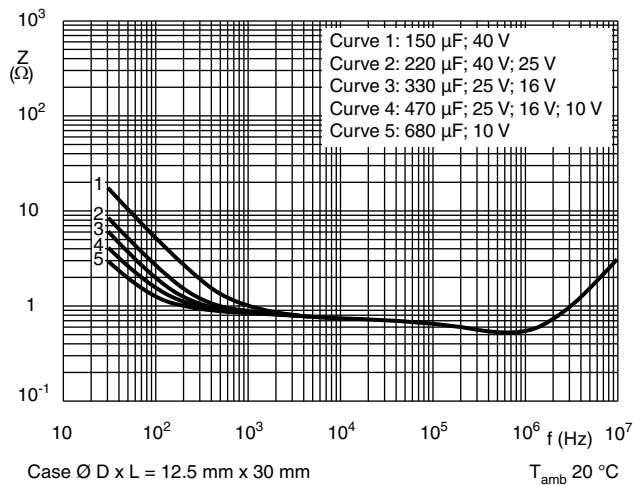


Fig. 15 - Typical impedance as a function of frequency

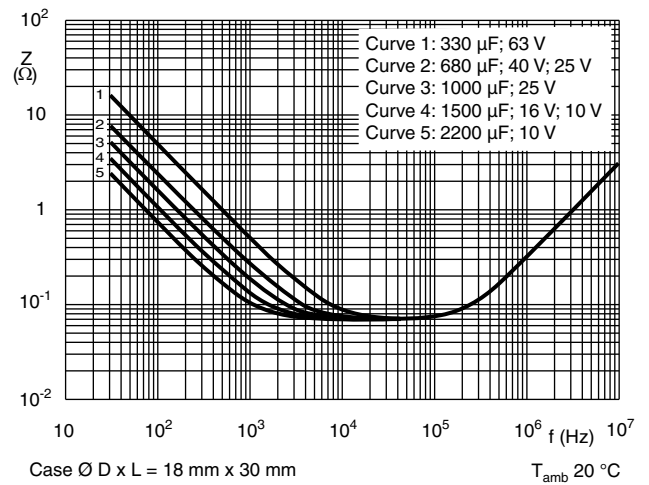


Fig. 16 - Typical impedance as a function of frequency



**RIPPLE CURRENT AND USEFUL LIFE**

MBC242

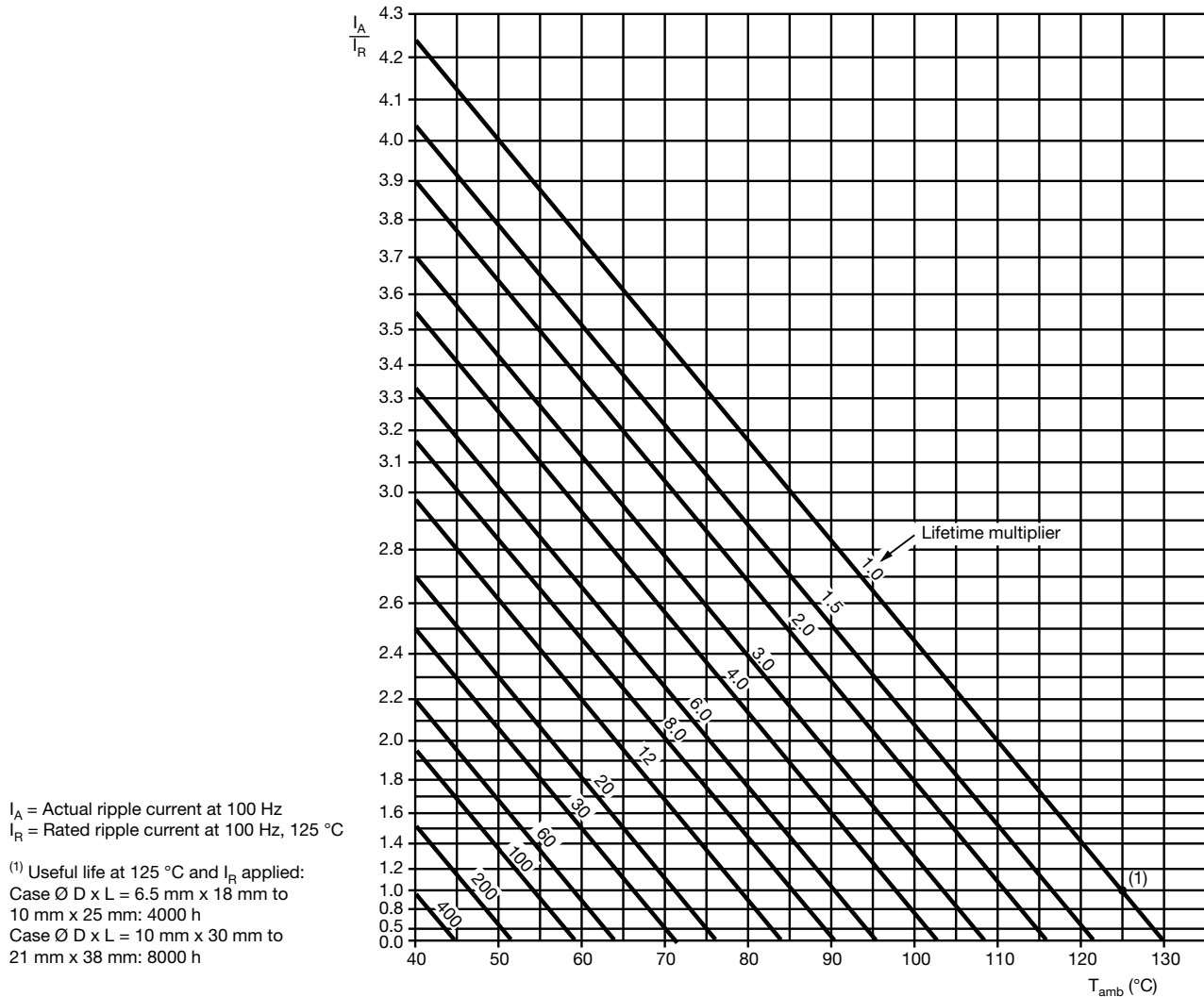


Fig. 17 - Multiplier of useful life as a function of ambient temperature and ripple current load

Table 5

| MULTIPLIER OF RIPPLE CURRENT ( $I_R$ ) AS A FUNCTION OF FREQUENCY |                                     |                                     |                                     |
|---|-------------------------------------|-------------------------------------|-------------------------------------|
| FREQUENCY (Hz)  | $I_R$ MULTIPLIER                    |                                     |                                     |
|   | $U_R = 10\text{ V AND }16\text{ V}$ | $U_R = 25\text{ V AND }40\text{ V}$ | $U_R = 63\text{ V TO }200\text{ V}$ |
| 50  | 0.95                                | 0.90                                | 0.85                                |
| 100   | 1.00                                | 1.00                                | 1.00                                |
| 300   | 1.07                                | 1.12                                | 1.20                                |
| 1000  | 1.12                                | 1.20                                | 1.30                                |
| 3000  | 1.15                                | 1.25                                | 1.35                                |
| $\geq 10\ 000$  | 1.20                                | 1.30                                | 1.40                                |

Table 6

| <b>TEST PROCEDURES AND REQUIREMENTS</b>        |   |  |   |
|--|---|--|---|
| <b>TEST</b>                                    |   | <b>PROCEDURE<br/>(quick reference)</b>   | <b>REQUIREMENTS</b>   |
| <b>NAME OF TEST</b>                            | <b>REFERENCE</b>                            |  |   |
| Endurance                                      | IEC 60384-4/<br>EN 130300<br>subclause 4.13 | $T_{amb} = 125\text{ °C}$ ; $U_R$ 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               | $T_{amb} = 125\text{ °C}$ ; $U_R$ 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: $\leq 1\%$<br>( $200\text{ V} \leq 3\%$ ) |
| Shelf life<br>(storage at high<br>temperature) | IEC 60384-4/<br>EN 130300<br>subclause 4.17 | $T_{amb} = 125\text{ °C}$ ; no voltage applied;<br>$U_R = 10\text{ V}$ to 63 V: 500 h;<br>$U_R = 100\text{ V}$ and 200 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 | $T_{amb} = 125\text{ °C}$ :<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>$I_{L5} \leq \text{spec. limit}$   |



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