

## Aluminum Capacitors Axial High Temperature

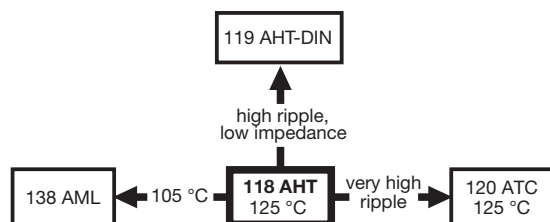


Fig. 1


**RoHS**  
COMPLIANT

### FEATURES

- 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
- Taped versions up to case Ø 15 mm x 30 mm available for automatic insertion
- Charge and discharge proof
- Extra long useful life: Up to 8000 h at 125 °C, high reliability
- Extended temperature range: 125 °C (usable up to 150 °C)
- Miniaturized, high CV-product per unit volume
- Material categorization: For definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)

### APPLICATIONS

- Automotive, industrial and telecommunication
- Smoothing, filtering, coupling, decoupling, timing
- For use after very long storage (10 years) without voltage applied
- Portable and mobile equipment (small size, low mass)
- Low mounting height boards, vibration and shock resistant
- Outdoor applications, e.g. aerial amplifiers

### MARKING

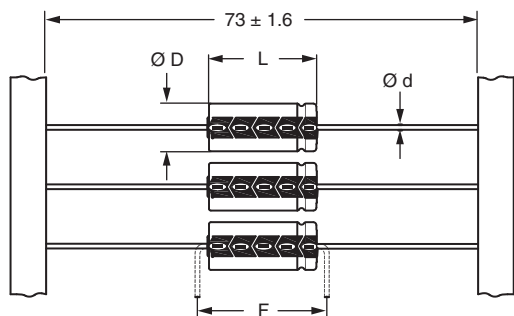
The capacitors are marked (where possible) with the following information:

- Rated capacitance (in  $\mu\text{F}$ )
- Tolerance on rated capacitance, code letter in accordance with IEC 60062 (M for  $\pm 20\%$ )
- Rated voltage (in V) at 125 °C and 85 °C
- Date code, in accordance with IEC 60062
- Code indicating factory of origin
- Name of manufacturer
- Negative terminal identification
- Series number (118)

| QUICK REFERENCE DATA                                                                                       |                                         |                        |
|------------------------------------------------------------------------------------------------------------|-----------------------------------------|------------------------|
| DESCRIPTION                                                                                                | VALUE                                   |                        |
| Nominal case sizes<br>(Ø 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, $C_R$                                                                             | 1 $\mu\text{F}$ to 10 000 $\mu\text{F}$ |                        |
| Tolerance on $C_R$                                                                                         | $\pm 20\%$                              |                        |
| Rated voltage range, $U_R$                                                                                 | 6.3 V to 200 V                          |                        |
| Category temperature range                                                                                 | - 40 °C to<br>+ 125 °C                  | - 55 °C to<br>+ 125 °C |
| Endurance test at 150 °C<br>(6.3 V to 100 V)                                                               | 500 h                                   | 500 h                  |
| Endurance test at 125 °C                                                                                   | 2000 h                                  | 3000 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>$U_R = 6.3\text{ V to }63\text{ V}$<br>$U_R = 100\text{ V and }200\text{ V}$ | 500 h<br>100 h                          |                        |
| Based on sectional<br>specification                                                                        | IEC 60384-4/EN130300                    |                        |
| Climatic category IEC 60068                                                                                | 40/125/56                               | 55/125/56              |

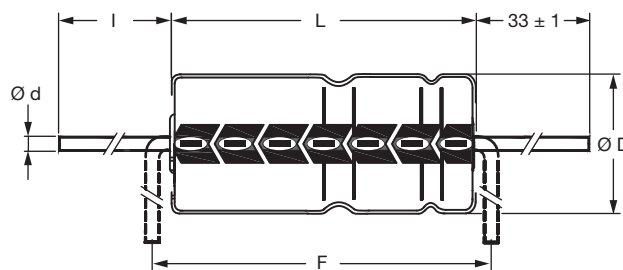
| <b>SELECTION CHART FOR <math>C_R</math>, <math>U_R</math>, AND RELEVANT NOMINAL CASE SIZES (<math>\varnothing D \times L</math> in mm)</b> |           |           |           |           |           |           |           |           |
|--------------------------------------------------------------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| $C_R$<br>( $\mu F$ )                                                                                                                       | $U_R$ (V) |           |           |           |           |           |           |           |
|                                                                                                                                            | 6.3       | 10        | 16        | 25        | 40        | 63        | 100       | 200       |
| 1.0                                                                                                                                        | -         | -         | -         | -         | -         | 6.5 x 18  | -         | -         |
| 2.2                                                                                                                                        | -         | -         | -         | -         | -         | 6.5 x 18  | -         | 6.5 x 18  |
| 4.7                                                                                                                                        | -         | -         | -         | -         | -         | 6.5 x 18  | 6.5 x 18  | 8 x 18    |
| 10                                                                                                                                         | -         | -         | -         | -         | -         | 6.5 x 18  | 6.5 x 18  | 10 x 25   |
| 15                                                                                                                                         | -         | -         | -         | -         | -         | -         | -         | 10 x 30   |
| 22                                                                                                                                         | -         | -         | -         | -         | -         | 6.5 x 18  | 8 x 18    | 12.5 x 30 |
| 33                                                                                                                                         | -         | -         | -         | -         | -         | -         | 10 x 25   | 15 x 30   |
| 47                                                                                                                                         | -         | -         | -         | -         | 6.5 x 18  | 8 x 18    | 10 x 25   | 18 x 30   |
|                                                                                                                                            | -         | -         | -         | -         | -         | -         | 10 x 30   | -         |
| 68                                                                                                                                         | -         | -         | -         | -         | -         | -         | 12.5 x 30 | 18 x 38   |
| 100                                                                                                                                        | -         | -         | -         | 6.5 x 18  | 8 x 18    | 10 x 25   | 12.5 x 30 | 21 x 38   |
|                                                                                                                                            | -         | -         | -         | -         | -         | 10 x 30   | -         | -         |
| 150                                                                                                                                        | -         | -         | -         | -         | 10 x 18   | 12.5 x 30 | 15 x 30   | -         |
| 220                                                                                                                                        | -         | 6.5 x 18  | 8 x 18    | 10 x 18   | 10 x 25   | 12.5 x 30 | 18 x 30   | -         |
|                                                                                                                                            | -         | -         | -         | -         | 10 x 30   | -         | -         | -         |
| 330                                                                                                                                        | -         | 8 x 18    | 10 x 18   | 10 x 25   | 12.5 x 30 | 15 x 30   | 18 x 38   | -         |
| 470                                                                                                                                        | -         | 8 x 18    | 10 x 18   | 10 x 25   | 12.5 x 30 | 18 x 30   | 21 x 38   | -         |
|                                                                                                                                            | -         | -         | -         | 10 x 30   | -         | -         | -         | -         |
| 680                                                                                                                                        | -         | -         | 10 x 30   | 12.5 x 30 | 15 x 30   | 18 x 38   | -         | -         |
| 1000                                                                                                                                       | 10 x 18   | 10 x 25   | 12.5 x 30 | 12.5 x 30 | 18 x 30   | 21 x 38   | -         | -         |
|                                                                                                                                            | -         | 10 x 30   | -         | -         | -         | -         | -         | -         |
| 1500                                                                                                                                       | 10 x 25   | 12.5 x 30 | 12.5 x 30 | 15 x 30   | 18 x 38   | -         | -         | -         |
| 2200                                                                                                                                       | -         | 12.5 x 30 | 15 x 30   | 18 x 30   | 21 x 38   | -         | -         | -         |
| 3300                                                                                                                                       | -         | 15 x 30   | 18 x 30   | 18 x 38   | -         | -         | -         | -         |
| 4700                                                                                                                                       | -         | 18 x 30   | 18 x 38   | 21 x 38   | -         | -         | -         | -         |
| 6800                                                                                                                                       | -         | 18 x 38   | 21 x 38   | -         | -         | -         | -         | -         |
| 10 000                                                                                                                                     | -         | 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  $21 \text{ mm} \times 38 \text{ mm}$

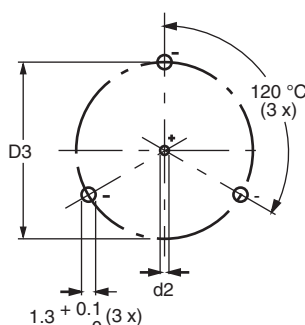
Fig. 3 - Form AA

**Table 1**

| <b>AXIAL; DIMENSIONS in millimeters, MASS AND PACKAGING QUANTITIES</b> |           |                           |        |                     |                   |                   |          |                      |         |         |
|------------------------------------------------------------------------|-----------|---------------------------|--------|---------------------|-------------------|-------------------|----------|----------------------|---------|---------|
| NOMINAL CASE SIZE<br>Ø D x L                                           | CASE CODE | AXIAL: FORM AA, BA AND BR |        |                     |                   |                   | MASS (g) | PACKAGING QUANTITIES |         |         |
|                                                                        |           | Ø d                       | l      | Ø D <sub>max.</sub> | L <sub>max.</sub> | F <sub>min.</sub> |          | 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                                                                | 0         | 0.8                       | 55 ± 1 | 10.5                | 30.5              | 35                | 4.8      | 340                  | -       | 500     |
| 12.5 x 30                                                              | 1         | 0.8                       | 55 ± 1 | 13.0                | 30.5              | 35                | 7.4      | 260                  | -       | 400     |
| 15 x 30                                                                | 2         | 0.8                       | 55 ± 1 | 15.5                | 30.5              | 35                | 11.7     | 200                  | -       | 250     |
| 18 x 30                                                                | 3         | 0.8                       | 55 ± 1 | 18.5                | 30.5              | 35                | 12.9     | 120                  | -       | -       |
| 18 x 38                                                                | 4         | 0.8                       | 55 ± 1 | 18.5                | 39.5              | 44                | 19       | 125                  | -       | -       |
| 21 x 38                                                                | 5         | 0.8                       | 55 ± 1 | 21.5                | 39.5              | 44                | 24       | 100                  | -       | -       |

**Note**

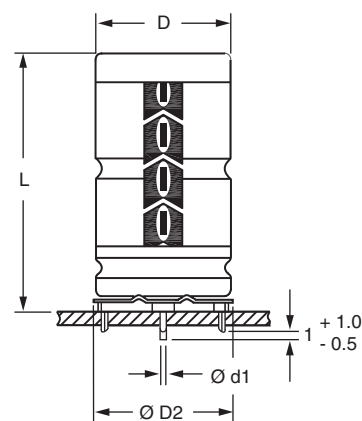
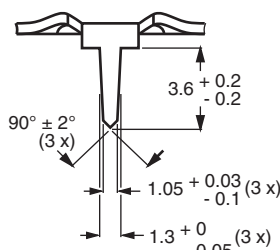
- Detailed tape dimensions see section “Packaging”.



Mounting holes

Case Ø D x L = 15 mm x 30 mm to 21 mm x 38 mm

Especially for applications with severe shocks and vibrations


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

| <b>MOUNTING RING; DIMENSIONS in millimeters, MASS AND PACKAGING QUANTITIES</b> |           |                        |           |                     |                      |            |                   |          |                      |
|--------------------------------------------------------------------------------|-----------|------------------------|-----------|---------------------|----------------------|------------|-------------------|----------|----------------------|
| NOMINAL CASE SIZE<br>Ø D x L                                                   | CASE CODE | MOUNTING RING: FORM MR |           |                     |                      |            |                   | MASS (g) | PACKAGING QUANTITIES |
|                                                                                |           | Ø d1                   | Ø d2      | Ø D <sub>max.</sub> | Ø D2 <sub>max.</sub> | D3         | L <sub>max.</sub> |          |                      |
| 15 x 30                                                                        | 2         | 0.8                    | 1.0 + 0.4 | 15.5                | 17.5                 | 16.5 ± 0.2 | 33                | ≈ 8.6    | 200                  |
| 18 x 30                                                                        | 3         | 0.8                    | 1.0 + 0.4 | 18.5                | 19.5                 | 18.5 ± 0.2 | 33                | ≈ 11.5   | 240                  |
| 18 x 38                                                                        | 4         | 0.8                    | 1.0 + 0.4 | 18.5                | 19.5                 | 18.5 ± 0.2 | 42                | ≈ 14.0   | 100                  |
| 21 x 38                                                                        | 5         | 0.8                    | 1.0 + 0.4 | 21.5                | 22.5                 | 21.5 ± 0.2 | 42                | ≈ 19.0   | 100                  |

| <b>ELECTRICAL DATA</b> |                                                                                                    |
|------------------------|----------------------------------------------------------------------------------------------------|
| SYMBOL                 | DESCRIPTION                                                                                        |
| C <sub>R</sub>         | Rated capacitance at 100 Hz, tolerance ± 20 %                                                      |
| I <sub>R</sub>         | Rated RMS ripple current at 100 Hz, 125 °C                                                         |
| I <sub>L1</sub>        | Max. leakage current after 1 min at U <sub>R</sub>                                                 |
| I <sub>L5</sub>        | Max. leakage current after 5 min at U <sub>R</sub>                                                 |
| tan δ                  | Max. dissipation factor at 100 Hz                                                                  |
| ESR                    | Equivalent series resistance at 100 Hz (calculated from tan δ <sub>max.</sub> and C <sub>R</sub> ) |
| Z                      | Max. impedance at 10 kHz                                                                           |

**Note**

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

**ORDERING EXAMPLE**

Electrolytic capacitor 118 series

1000 µF/10 V; ± 20 %

Nominal case size: Ø 10 mm x 30 mm; Form BR

Ordering code: MAL211824102E3

Former 12NC: 2222 118 24102


**Table 2**

| <b>ELECTRICAL DATA AND ORDERING INFORMATION</b> |                                                      |                                                                     |                            |                                                                       |                                                      |                                                      |                               |                                           |                                         |                                   |                                                  |                                                 |                                                  |
|-------------------------------------------------|------------------------------------------------------|---------------------------------------------------------------------|----------------------------|-----------------------------------------------------------------------|------------------------------------------------------|------------------------------------------------------|-------------------------------|-------------------------------------------|-----------------------------------------|-----------------------------------|--------------------------------------------------|-------------------------------------------------|--------------------------------------------------|
| <b>U<sub>R</sub></b><br><b>(V)</b>              | <b>C<sub>R</sub></b><br><b>100 Hz</b><br><b>(μF)</b> | <b>NOMINAL</b><br><b>CASE SIZE</b><br><b>Ø D x L</b><br><b>(mm)</b> | <b>CASE</b><br><b>CODE</b> | <b>I<sub>R</sub></b><br><b>100 Hz</b><br><b>125 °C</b><br><b>(mA)</b> | <b>I<sub>L1</sub></b><br><b>1 min</b><br><b>(μA)</b> | <b>I<sub>L5</sub></b><br><b>5 min</b><br><b>(μA)</b> | <b>tan δ</b><br><b>100 Hz</b> | <b>ESR</b><br><b>100 Hz</b><br><b>(Ω)</b> | <b>Z</b><br><b>10 kHz</b><br><b>(Ω)</b> | <b>ORDERING CODE MAL2118.....</b> |                                                  |                                                 |                                                  |
|                                                 |                                                      |                                                                     |                            |                                                                       |                                                      |                                                      |                               |                                           |                                         | <b>IN BOX</b><br><b>FORM AA</b>   | <b>TAPED</b><br><b>ON REEL</b><br><b>FORM BR</b> | <b>TAPED</b><br><b>IN BOX</b><br><b>FORM BA</b> | <b>MOUNTING</b><br><b>RING</b><br><b>FORM MR</b> |
| 6.3                                             | 1000                                                 | 10 x 18                                                             | 6                          | 251                                                                   | 42                                                   | 17                                                   | 0.50                          | 0.790                                     | 0.80                                    | -                                 | 23102E3                                          | 33102E3                                         | -                                                |
|                                                 | 1500                                                 | 10 x 25                                                             | 7                          | 352                                                                   | 61                                                   | 23                                                   | 0.50                          | 0.530                                     | 0.53                                    | -                                 | 90502E3                                          | 90503E3                                         | -                                                |
| 10                                              | 220                                                  | 6.5 x 18                                                            | 4                          | 109                                                                   | 20                                                   | 8.4                                                  | 0.35                          | 2.530                                     | 2.10                                    | -                                 | 24221E3                                          | 34221E3                                         | -                                                |
|                                                 | 330                                                  | 8 x 18                                                              | 5                          | 150                                                                   | 24                                                   | 11                                                   | 0.35                          | 1.690                                     | 1.40                                    | -                                 | 24331E3                                          | 34331E3                                         | -                                                |
|                                                 | 470                                                  | 8 x 18                                                              | 5                          | 179                                                                   | 32                                                   | 13                                                   | 0.35                          | 1.190                                     | 1.00                                    | -                                 | 24471E3                                          | 34471E3                                         | -                                                |
|                                                 | 1000                                                 | 10 x 25                                                             | 7                          | 343                                                                   | 64                                                   | 24                                                   | 0.35                          | 0.560                                     | 0.55                                    | -                                 | 90504E3                                          | 90505E3                                         | -                                                |
|                                                 | 1000                                                 | 10 x 30                                                             | 00                         | 550                                                                   | 64                                                   | 24                                                   | 0.32                          | 0.505                                     | 0.45                                    | 14102E3                           | 24102E3                                          | -                                               | -                                                |
|                                                 | 1500                                                 | 12.5 x 30                                                           | 01                         | 740                                                                   | 94                                                   | 34                                                   | 0.32                          | 0.340                                     | 0.28                                    | 14152E3                           | 24152E3                                          | -                                               | -                                                |
|                                                 | 2200                                                 | 12.5 x 30                                                           | 01                         | 830                                                                   | 136                                                  | 48                                                   | 0.40                          | 0.290                                     | 0.27                                    | 14222E3                           | 24222E3                                          | -                                               | -                                                |
|                                                 | 3300                                                 | 15 x 30                                                             | 02                         | 1070                                                                  | 202                                                  | 70                                                   | 0.40                          | 0.190                                     | 0.18                                    | 14332E3                           | 24332E3                                          | -                                               | 44332E3                                          |
|                                                 | 4700                                                 | 18 x 30                                                             | 03                         | 1350                                                                  | 286                                                  | 98                                                   | 0.46                          | 0.155                                     | 0.15                                    | 14472E3                           | -                                                | -                                               | 44472E3                                          |
|                                                 | 6800                                                 | 18 x 38                                                             | 04                         | 1730                                                                  | 412                                                  | 140                                                  | 0.53                          | 0.100                                     | 0.10                                    | 14682E3                           | -                                                | -                                               | 44682E3                                          |
|                                                 | 10 000                                               | 21 x 38                                                             | 05                         | 1860                                                                  | 604                                                  | 200                                                  | 0.53                          | 0.084                                     | 0.10                                    | 14103E3                           | -                                                | -                                               | 44103E3                                          |
| 16                                              | 220                                                  | 8 x 18                                                              | 5                          | 145                                                                   | 25                                                   | 11                                                   | 0.25                          | 1.810                                     | 1.50                                    | -                                 | 25221E3                                          | 35221E3                                         | -                                                |
|                                                 | 330                                                  | 10 x 18                                                             | 6                          | 204                                                                   | 36                                                   | 15                                                   | 0.25                          | 1.210                                     | 1.20                                    | -                                 | 25331E3                                          | 35331E3                                         | -                                                |
|                                                 | 470                                                  | 10 x 18                                                             | 6                          | 243                                                                   | 49                                                   | 19                                                   | 0.25                          | 0.850                                     | 0.83                                    | -                                 | 25471E3                                          | 35471E3                                         | -                                                |
|                                                 | 680                                                  | 10 x 30                                                             | 00                         | 510                                                                   | 69                                                   | 30                                                   | 0.22                          | 0.525                                     | 0.45                                    | 15681E3                           | 25681E3                                          | -                                               | -                                                |
|                                                 | 1000                                                 | 12.5 x 30                                                           | 01                         | 720                                                                   | 100                                                  | 36                                                   | 0.22                          | 0.345                                     | 0.28                                    | 15102E3                           | 25102E3                                          | -                                               | -                                                |
|                                                 | 1500                                                 | 12.5 x 30                                                           | 01                         | 790                                                                   | 148                                                  | 52                                                   | 0.29                          | 0.305                                     | 0.27                                    | 15152E3                           | 25152E3                                          | -                                               | -                                                |
|                                                 | 2200                                                 | 15 x 30                                                             | 02                         | 1010                                                                  | 215                                                  | 74                                                   | 0.29                          | 0.205                                     | 0.18                                    | 15222E3                           | 25222E3                                          | -                                               | 45222E3                                          |
|                                                 | 3300                                                 | 18 x 30                                                             | 03                         | 1300                                                                  | 321                                                  | 110                                                  | 0.34                          | 0.165                                     | 0.15                                    | 15332E3                           | -                                                | -                                               | 45332E3                                          |
|                                                 | 4700                                                 | 18 x 38                                                             | 04                         | 1670                                                                  | 455                                                  | 150                                                  | 0.34                          | 0.105                                     | 0.10                                    | 15472E3                           | -                                                | -                                               | 45472E3                                          |
|                                                 | 6800                                                 | 21 x 38                                                             | 05                         | 1790                                                                  | 657                                                  | 220                                                  | 0.38                          | 0.088                                     | 0.10                                    | 15682E3                           | -                                                | -                                               | 45682E3                                          |
| 25                                              | 100                                                  | 6.5 x 18                                                            | 4                          | 102                                                                   | 20                                                   | 9                                                    | 0.18                          | 2.860                                     | 2.30                                    | -                                 | 26101E3                                          | 36101E3                                         | -                                                |
|                                                 | 220                                                  | 10 x 18                                                             | 6                          | 196                                                                   | 37                                                   | 15                                                   | 0.18                          | 1.300                                     | 1.25                                    | -                                 | 26221E3                                          | 36221E3                                         | -                                                |
|                                                 | 330                                                  | 10 x 25                                                             | 7                          | 274                                                                   | 54                                                   | 21                                                   | 0.18                          | 0.870                                     | 0.82                                    | -                                 | 26331E3                                          | 36331E3                                         | -                                                |
|                                                 | 470                                                  | 10 x 25                                                             | 7                          | 327                                                                   | 75                                                   | 28                                                   | 0.18                          | 0.610                                     | 0.57                                    | -                                 | 90508E3                                          | 90509E3                                         | -                                                |
|                                                 | 470                                                  | 10 x 30                                                             | 00                         | 490                                                                   | 75                                                   | 28                                                   | 0.18                          | 0.610                                     | 0.50                                    | 16471E3                           | 26471E3                                          | -                                               | -                                                |
|                                                 | 680                                                  | 12.5 x 30                                                           | 01                         | 680                                                                   | 106                                                  | 38                                                   | 0.18                          | 0.420                                     | 0.30                                    | 16681E3                           | 26681E3                                          | -                                               | -                                                |
|                                                 | 1000                                                 | 12.5 x 30                                                           | 01                         | 760                                                                   | 154                                                  | 54                                                   | 0.24                          | 0.375                                     | 0.28                                    | 16102E3                           | 26102E3                                          | -                                               | -                                                |
|                                                 | 1500                                                 | 15 x 30                                                             | 02                         | 980                                                                   | 229                                                  | 79                                                   | 0.25                          | 0.263                                     | 0.22                                    | 16152E3                           | 26152E3                                          | -                                               | 46152E3                                          |
|                                                 | 2200                                                 | 18 x 30                                                             | 03                         | 1240                                                                  | 334                                                  | 110                                                  | 0.26                          | 0.185                                     | 0.17                                    | 16222E3                           | -                                                | -                                               | 46222E3                                          |
|                                                 | 3300                                                 | 18 x 38                                                             | 04                         | 1610                                                                  | 499                                                  | 170                                                  | 0.26                          | 0.120                                     | 0.11                                    | 16332E3                           | -                                                | -                                               | 46332E3                                          |
|                                                 | 4700                                                 | 21 x 38                                                             | 05                         | 1710                                                                  | 709                                                  | 240                                                  | 0.28                          | 0.095                                     | 0.10                                    | 16472E3                           | -                                                | -                                               | 46472E3                                          |
|                                                 | 4700                                                 | 21 x 38                                                             | 05                         | 1710                                                                  | 709                                                  | 240                                                  | 0.28                          | 0.095                                     | 0.10                                    | 16472E3                           | -                                                | -                                               | 46472E3                                          |
| 40                                              | 47                                                   | 6.5 x 18                                                            | 4                          | 89.8                                                                  | 20                                                   | 7.8                                                  | 0.11                          | 3.720                                     | 2.80                                    | -                                 | 27479E3                                          | 37479E3                                         | -                                                |
|                                                 | 100                                                  | 8 x 18                                                              | 5                          | 147                                                                   | 28                                                   | 12                                                   | 0.11                          | 1.750                                     | 1.30                                    | -                                 | 27101E3                                          | 37101E3                                         | -                                                |
|                                                 | 150                                                  | 10 x 18                                                             | 6                          | 207                                                                   | 40                                                   | 16                                                   | 0.11                          | 1.170                                     | 1.00                                    | -                                 | 27151E3                                          | 37151E3                                         | -                                                |
|                                                 | 220                                                  | 10 x 25                                                             | 7                          | 287                                                                   | 57                                                   | 22                                                   | 0.11                          | 0.800                                     | 0.68                                    | -                                 | 90511E3                                          | 90512E3                                         | -                                                |
|                                                 | 220                                                  | 10 x 30                                                             | 00                         | 390                                                                   | 57                                                   | 22                                                   | 0.10                          | 0.700                                     | 0.55                                    | 17221E3                           | 27221E3                                          | -                                               | -                                                |
|                                                 | 330                                                  | 12.5 x 30                                                           | 01                         | 570                                                                   | 83                                                   | 30                                                   | 0.10                          | 0.430                                     | 0.33                                    | 17331E3                           | 27331E3                                          | -                                               | -                                                |
|                                                 | 470                                                  | 12.5 x 30                                                           | 01                         | 620                                                                   | 117                                                  | 42                                                   | 0.11                          | 0.380                                     | 0.30                                    | 17471E3                           | 27471E3                                          | -                                               | -                                                |
|                                                 | 680                                                  | 15 x 30                                                             | 02                         | 810                                                                   | 167                                                  | 58                                                   | 0.11                          | 0.255                                     | 0.23                                    | 17681E3                           | 27681E3                                          | -                                               | 47681E3                                          |
|                                                 | 1000                                                 | 18 x 30                                                             | 03                         | 1070                                                                  | 244                                                  | 84                                                   | 0.13                          | 0.205                                     | 0.18                                    | 17102E3                           | -                                                | -                                               | 47102E3                                          |
|                                                 | 1500                                                 | 18 x 38                                                             | 04                         | 1390                                                                  | 364                                                  | 120                                                  | 0.13                          | 0.130                                     | 0.11                                    | 17152E3                           | -                                                | -                                               | 47152E3                                          |
|                                                 | 2200                                                 | 21 x 38                                                             | 05                         | 1540                                                                  | 532                                                  | 180                                                  | 0.15                          | 0.105                                     | 0.10                                    | 17222E3                           | -                                                | -                                               | 47222E3                                          |
|                                                 | 2200                                                 | 21 x 38                                                             | 05                         | 1540                                                                  | 532                                                  | 180                                                  | 0.15                          | 0.105                                     | 0.10                                    | 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 MAL2118..... |                             |                            |                             |
|                                          |                                  |                                         |              |                                            |                                  |                                  |                 |                      |                    | 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                                       | 1.0                              | 6.5 x 18                                | 4            | 16.4                                       | 20                               | 4.1                              | 0.07            | 110                  | 22.0               | -                          | 28108E3                     | 38108E3                    | -                           |
|                                          | 2.2                              | 6.5 x 18                                | 4            | 24.3                                       | 20                               | 4.3                              | 0.07            | 51.0                 | 15.0               | -                          | 28228E3                     | 38228E3                    | -                           |
|                                          | 4.7                              | 6.5 x 18                                | 4            | 35.6                                       | 20                               | 4.6                              | 0.07            | 24.0                 | 8.90               | -                          | 28478E3                     | 38478E3                    | -                           |
|                                          | 10                               | 6.5 x 18                                | 4            | 51.9                                       | 20                               | 5.3                              | 0.07            | 11.0                 | 5.60               | -                          | 28109E3                     | 38109E3                    | -                           |
|                                          | 22                               | 6.5 x 18                                | 4            | 77.0                                       | 20                               | 6.8                              | 0.07            | 5.10                 | 3.20               | -                          | 28229E3                     | 38229E3                    | -                           |
|                                          | 47                               | 8 x 18                                  | 5            | 126                                        | 22                               | 9.9                              | 0.07            | 2.40                 | 1.50               | -                          | 28479E3                     | 38479E3                    | -                           |
|                                          | 100                              | 10 x 25                                 | 7            | 243                                        | 42                               | 17                               | 0.07            | 1.10                 | 0.70               | -                          | 90513E3                     | 90514E3                    | -                           |
|                                          | 100                              | 10 x 30                                 | 00           | 340                                        | 42                               | 17                               | 0.07            | 1.91                 | 1.62               | 18101E3                    | 28101E3                     | -                          | -                           |
|                                          | 150                              | 12.5 x 30                               | 01           | 490                                        | 61                               | 23                               | 0.07            | 1.00                 | 0.79               | 18151E3                    | 28151E3                     | -                          | -                           |
|                                          | 220                              | 12.5 x 30                               | 01           | 550                                        | 87                               | 32                               | 0.08            | 0.94                 | 0.82               | 18221E3                    | 28221E3                     | -                          | -                           |
|                                          | 330                              | 15 x 30                                 | 02           | 730                                        | 129                              | 46                               | 0.09            | 0.63                 | 0.56               | 18331E3                    | 28331E3                     | -                          | 48331E3                     |
|                                          | 470                              | 18 x 30                                 | 03           | 970                                        | 182                              | 63                               | 0.09            | 0.44                 | 0.39               | 18471E3                    | -                           | -                          | 48471E3                     |
|                                          | 680                              | 18 x 38                                 | 04           | 1230                                       | 261                              | 90                               | 0.09            | 0.30                 | 0.26               | 18681E3                    | -                           | -                          | 48681E3                     |
|                                          | 1000                             | 21 x 38                                 | 05           | 1400                                       | 383                              | 130                              | 0.10            | 0.16                 | 0.20               | 18102E3                    | -                           | -                          | 48102E3                     |
| 100                                      | 4.7                              | 6.5 x 18                                | 4            | 36                                         | 20                               | 4.9                              | 0.07            | 24.0                 | 19.0               | -                          | 29478E3                     | 39478E3                    | -                           |
|                                          | 10                               | 6.5 x 18                                | 4            | 52                                         | 20                               | 6.0                              | 0.07            | 11.0                 | 9.00               | -                          | 29109E3                     | 39109E3                    | -                           |
|                                          | 22                               | 8 x 18                                  | 5            | 91                                         | 20                               | 8.4                              | 0.07            | 5.10                 | 4.00               | -                          | 29229E3                     | 39229E3                    | -                           |
|                                          | 33                               | 10 x 25                                 | 7            | 140                                        | 24                               | 11                               | 0.07            | 3.40                 | 2.70               | -                          | 29339E3                     | 39339E3                    | -                           |
|                                          | 47                               | 10 x 25                                 | 7            | 170                                        | 33                               | 13                               | 0.07            | 2.60                 | 2.00               | -                          | 90535E3                     | 90536E3                    | -                           |
|                                          | 47                               | 10 x 30                                 | 00           | 240                                        | 33                               | 13                               | 0.08            | 2.60                 | 2.00               | 19479E3                    | 29479E3                     | -                          | -                           |
|                                          | 68                               | 12.5 x 30                               | 01           | 320                                        | 45                               | 18                               | 0.08            | 1.80                 | 1.20               | 19689E3                    | 29689E3                     | -                          | -                           |
|                                          | 100                              | 12.5 x 30                               | 01           | 380                                        | 64                               | 24                               | 0.09            | 1.40                 | 1.15               | 19101E3                    | 29101E3                     | -                          | -                           |
|                                          | 150                              | 15 x 30                                 | 02           | 500                                        | 94                               | 34                               | 0.10            | 0.94                 | 0.78               | 19151E3                    | 29151E3                     | -                          | 49151E3                     |
|                                          | 220                              | 18 x 30                                 | 03           | 690                                        | 136                              | 48                               | 0.10            | 0.66                 | 0.55               | 19221E3                    | -                           | -                          | 49221E3                     |
|                                          | 330                              | 18 x 38                                 | 04           | 890                                        | 202                              | 70                               | 0.10            | 0.45                 | 0.37               | 19331E3                    | -                           | -                          | 49331E3                     |
|                                          | 470                              | 21 x 38                                 | 05           | 1050                                       | 286                              | 98                               | 0.10            | 0.33                 | 0.28               | 19471E3                    | -                           | -                          | 49471E3                     |
| 200                                      | 2.2                              | 6.5 x 18                                | 4            | 27                                         | 20                               | 4.9                              | 0.06            | 44.0                 | 23.0               | -                          | 90537E3                     | 90538E3                    | -                           |
|                                          | 4.7                              | 8 x 18                                  | 5            | 46                                         | 20                               | 5.9                              | 0.06            | 21.0                 | 11.0               | -                          | 90539E3                     | 90541E3                    | -                           |
|                                          | 10                               | 10 x 25                                 | 7            | 85                                         | 20                               | 8.0                              | 0.06            | 9.40                 | 5.00               | -                          | 90542E3                     | 90543E3                    | -                           |
|                                          | 15                               | 10 x 30                                 | 00           | 150                                        | 22                               | 10                               | 0.046           | 4.76                 | 3.75               | 92159E3                    | 90012E3                     | -                          | -                           |
|                                          | 22                               | 12.5 x 30                               | 01           | 210                                        | 31                               | 13                               | 0.046           | 3.17                 | 2.22               | 92229E3                    | 90013E3                     | -                          | -                           |
|                                          | 33                               | 15 x 30                                 | 02           | 290                                        | 44                               | 17                               | 0.046           | 2.11                 | 1.11               | 92339E3                    | 90014E3                     | -                          | 90002E3                     |
|                                          | 47                               | 18 x 30                                 | 03           | 390                                        | 61                               | 23                               | 0.046           | 1.48                 | 0.60               | 92479E3                    | -                           | -                          | 90003E3                     |
|                                          | 68                               | 18 x 38                                 | 04           | 500                                        | 86                               | 31                               | 0.046           | 1.02                 | 0.42               | 92689E3                    | -                           | -                          | 90004E3                     |
|                                          | 100                              | 21 x 38                                 | 05           | 610                                        | 124                              | 44                               | 0.046           | 0.96                 | 0.39               | 92101E3                    | -                           | -                          | 90005E3                     |

| 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 at $U_R$ | $I_{L1} \leq 0.006 C_R \times U_R + 4 \mu\text{A}$ or $20 \mu\text{A}$<br>(whichever is greater) |               |
|                                    | After 5 min at $U_R$ | $I_{L5} \leq 0.002 C_R \times U_R + 4 \mu\text{A}$                                               |               |
| 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 3

| UPRATING VALUES AT REDUCED AMBIENT TEMPERATURE |                                                     |        |    |    |    |    |     |     |     |      |
|------------------------------------------------|-----------------------------------------------------|--------|----|----|----|----|-----|-----|-----|------|
| SYMBOL                                         | CONDITIONS                                          | VALUES |    |    |    |    |     |     |     | UNIT |
| $U_R$                                          | $T_{amb} > 85^\circ\text{C}$ to $125^\circ\text{C}$ | 6.3    | 10 | 16 | 25 | 40 | 63  | 100 | 200 | V    |
| $U_{R2}$                                       | $T_{amb} \leq 85^\circ\text{C}$                     | 10     | 16 | 25 | 40 | 63 | 100 | 125 | 250 | V    |

**Note**

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

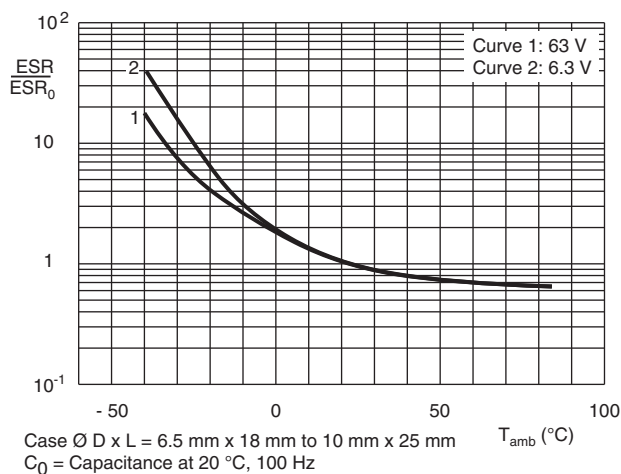
**CAPACITANCE**


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

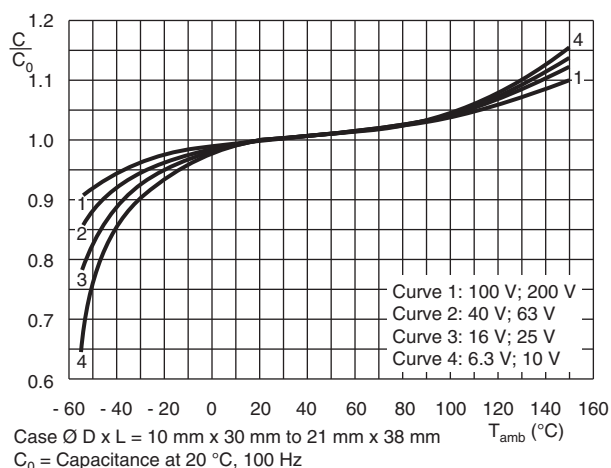


Fig. 6 - Typical multiplier of capacitance as a function of ambient temperature

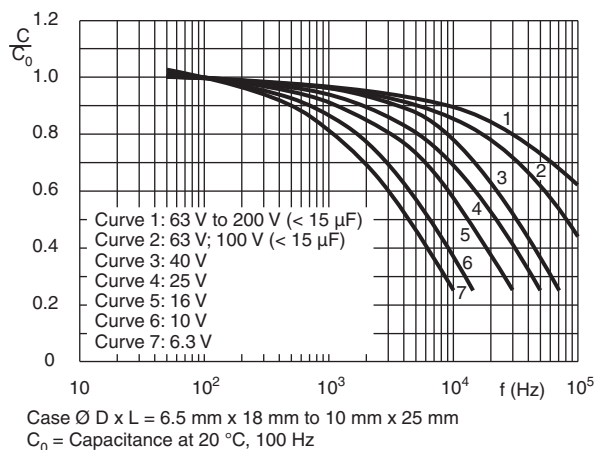


Fig. 7 - Typical multiplier of capacitance as a function of frequency

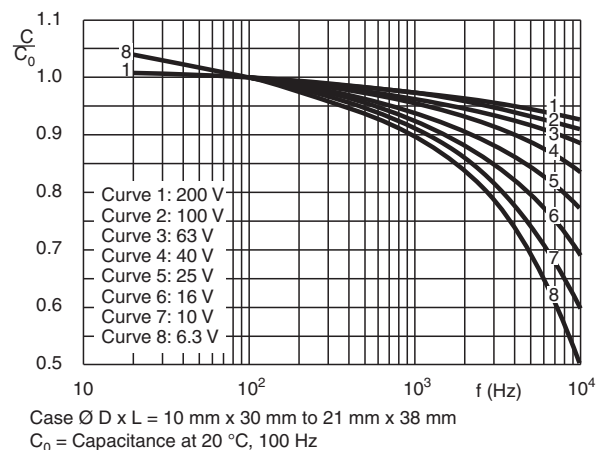


Fig. 8 - Typical multiplier of capacitance as a function of frequency

## EQUIVALENT SERIES RESISTANCE (ESR)

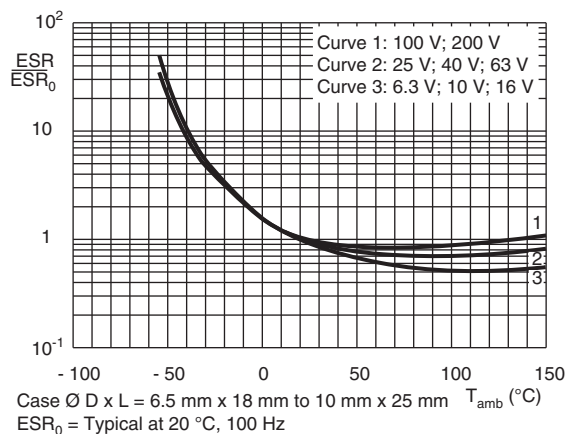


Fig. 9 - Typical multiplier of ESR as a function of ambient temperature

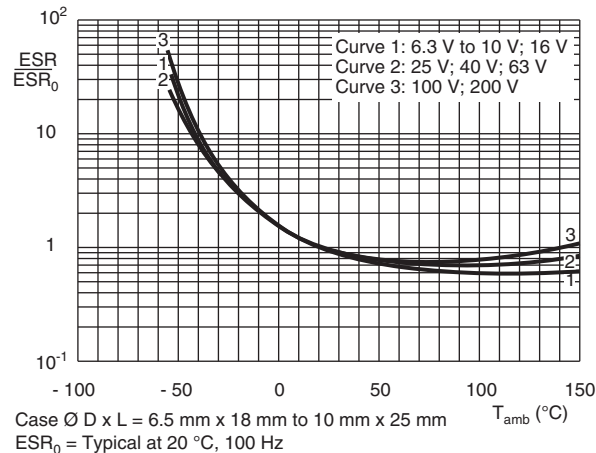


Fig. 10 - Typical multiplier of ESR as a function of ambient temperature

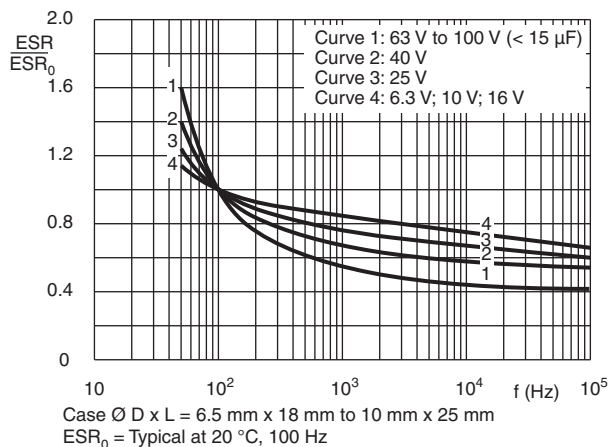


Fig. 11 - Typical multiplier of ESR as a function of frequency

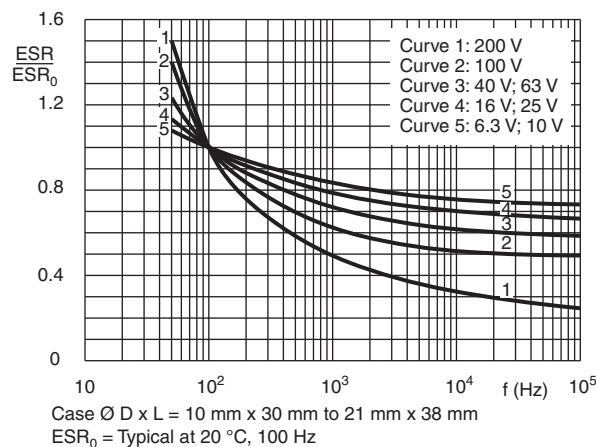


Fig. 12 - Typical multiplier of ESR as a function of frequency

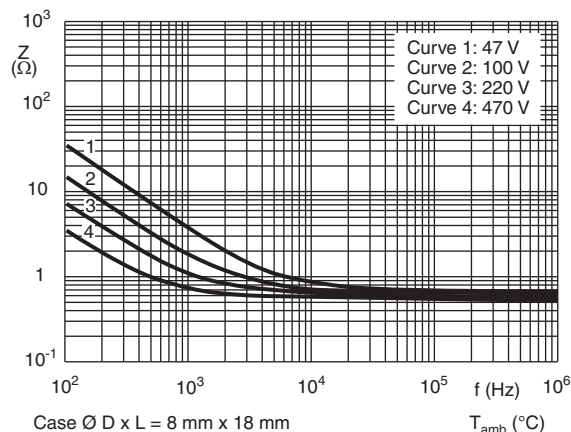
**IMPEDANCE (Z)**


Fig. 13 - Typical impedance as a function of frequency

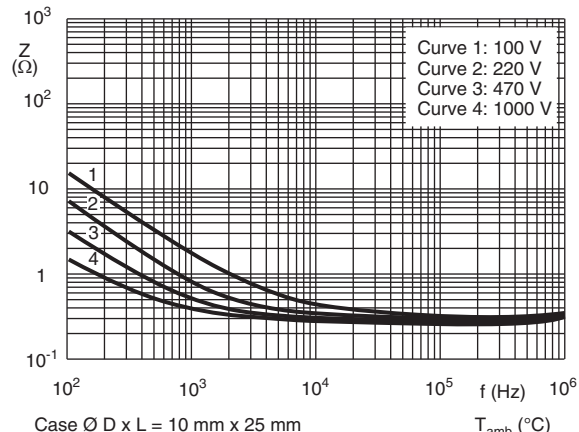


Fig. 14 - Typical impedance as a function of frequency

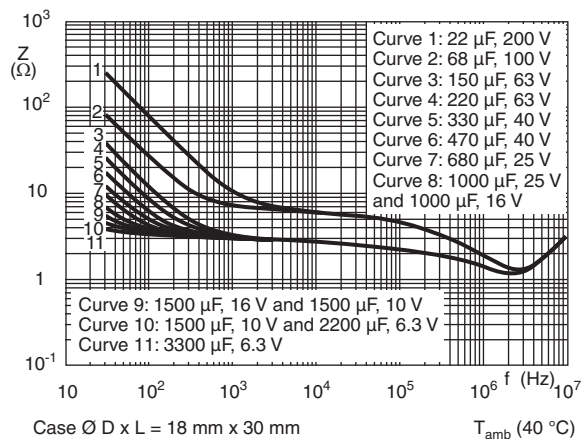


Fig. 15 - Typical impedance as a function of frequency

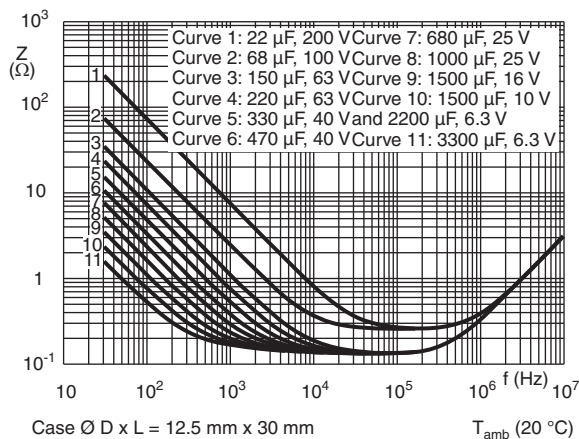


Fig. 16 - Typical impedance as a function of frequency

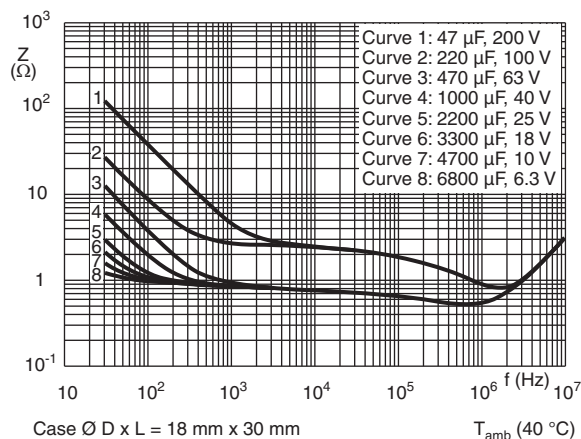


Fig. 17 - Typical impedance as a function of frequency

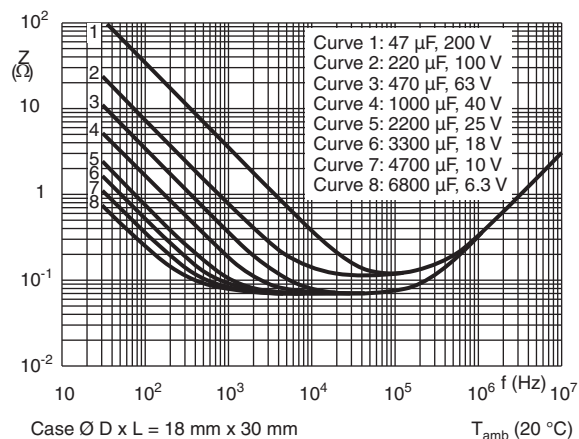


Fig. 18 - Typical impedance as a function of frequency

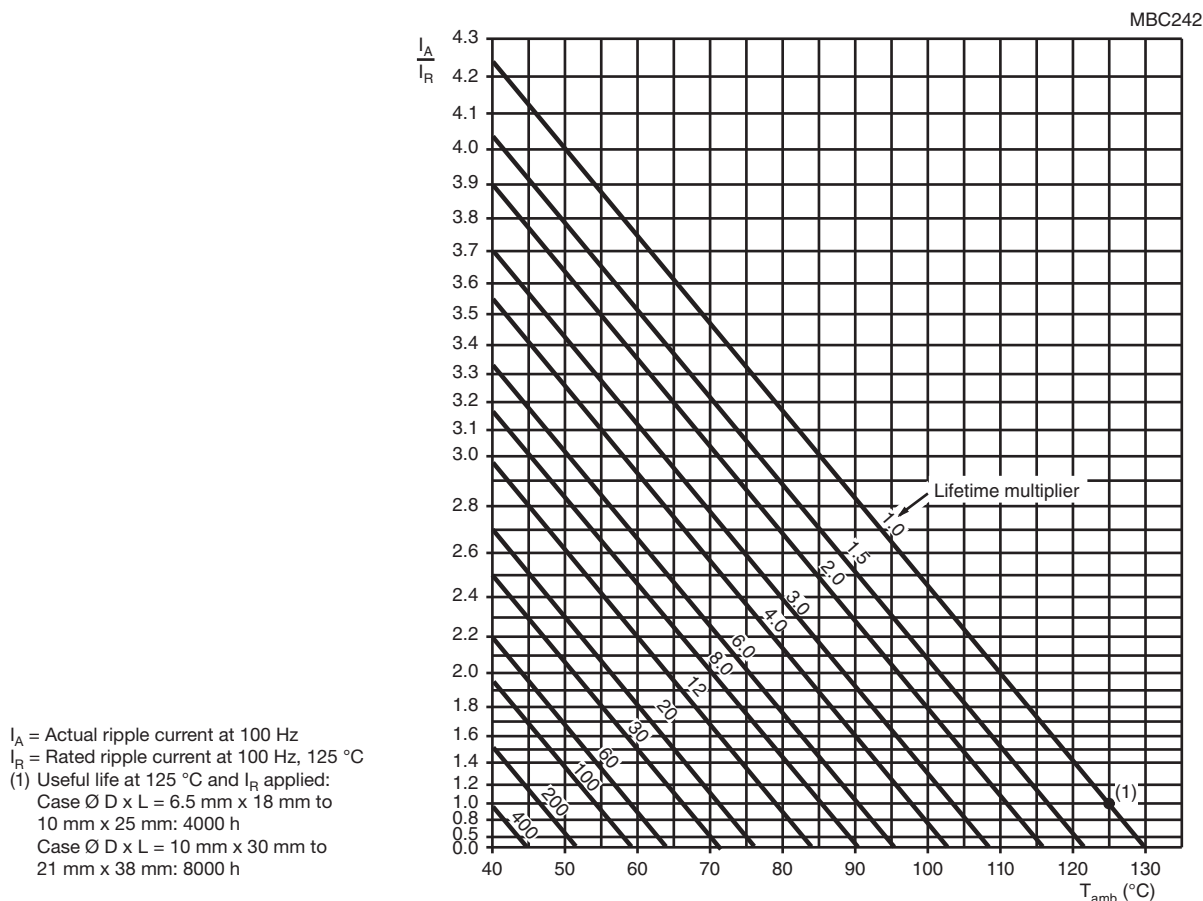
**RIPPLE CURRENT AND USEFUL LIFE**


Fig. 19 - Multiplier of useful life as a function of ambient temperature and ripple current load

Table 4

| MULTIPLIER OF RIPPLE CURRENT ( $I_R$ ) AS A FUNCTION OF FREQUENCY |                                        |                                       |                                         |
|-------------------------------------------------------------------|----------------------------------------|---------------------------------------|-----------------------------------------|
| FREQUENCY<br>(Hz)                                                 | $I_R$ MULTIPLIER                       |                                       |                                         |
|                                                                   | $U_R = 6.3 \text{ V TO } 25 \text{ V}$ | $U_R = 40 \text{ V TO } 63 \text{ V}$ | $U_R = 100 \text{ V TO } 200 \text{ V}$ |
| 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 5

| TEST PROCEDURES AND REQUIREMENTS               |                                            |                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                  |
|------------------------------------------------|--------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| TEST                                           |                                            | PROCEDURE<br>(quick reference)                                                                                                                                                                                                                                                                                  | REQUIREMENTS                                                                                                                                                                                                                                                                                                                                                     |
| NAME OF TEST                                   | REFERENCE                                  |                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                  |
| Endurance                                      | IEC 60384-4/<br>EN130300<br>subclause 4.13 | $T_{amb} = 125\text{ }^{\circ}\text{C}$ ; $U_R$ applied;<br>Case sizes:<br>6.5 mm x 18 mm to 10 mm x 25 mm: 2000 h;<br>10 mm x 30 mm to 21 mm x 38 mm: 3000 h                                                                                                                                                   | $U_R \leq 6.3\text{ V}$ ; $\Delta C/C$ : + 15 %/- 30 %<br>$U_R > 6.3\text{ V}$ ; $\Delta C/C$ : $\pm 15\text{ %}$<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              | $T_{amb} = 125\text{ }^{\circ}\text{C}$ ; $U_R$ and $I_R$ applied;<br>Case $\varnothing D \times L = 6.5\text{ mm} \times 18\text{ mm}$ to $10\text{ mm} \times 25\text{ mm}$ :<br>4000 h<br>Case $\varnothing D \times L = 10\text{ mm} \times 30\text{ mm}$ to $21\text{ mm} \times 38\text{ mm}$ :<br>8000 h | $U_R \leq 6.3\text{ V}$ ; $\Delta C/C$ : + 45 %/- 50 %<br>$U_R > 6.3\text{ V}$ ; $\Delta C/C$ : $\pm 45\text{ %}$<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: $\leq 1\text{ %}$<br>( $200\text{ V} \leq 3\text{ %}$ ) |
| Shelf life<br>(storage at high<br>temperature) | IEC 60384-4/<br>EN130300<br>subclause 4.17 | $T_{amb} = 125\text{ }^{\circ}\text{C}$ ; no voltage applied;<br>$U_R = 6.3\text{ V}$ to $63\text{ V}$ : 500 h;<br>$U_R = 100\text{ V}$ and $200\text{ V}$ : 100 h<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>EN130300<br>subclause 4.15 | $T_{amb} = 125\text{ }^{\circ}\text{C}$ :<br>125 h at $U = -1\text{ V}$<br>followed by 125 h at $U_R$                                                                                                                                                                                                           | $\Delta C/C$ : $\pm 20\text{ %}$<br>$\tan \delta \leq \text{spec. limit}$<br>$I_{L5} \leq \text{spec. limit}$                                                                                                                                                                                                                                                    |



## Disclaimer

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

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

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

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

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

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

## Material Category Policy

**Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as RoHS-Compliant fulfill the definitions and restrictions defined under Directive 2011/65/EU of The European Parliament and of the Council of June 8, 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (EEE) - recast, unless otherwise specified as non-compliant.**

**Please note that some Vishay documentation may still make reference to RoHS Directive 2002/95/EC. We confirm that all the products identified as being compliant to Directive 2002/95/EC conform to Directive 2011/65/EU.**

**Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as Halogen-Free follow Halogen-Free requirements as per JEDEC JS709A standards. Please note that some Vishay documentation may still make reference to the IEC 61249-2-21 definition. We confirm that all the products identified as being compliant to IEC 61249-2-21 conform to JEDEC JS709A standards.**

## Данный компонент на территории Российской Федерации

**Вы можете приобрести в компании MosChip.**

Для оперативного оформления запроса Вам необходимо перейти по данной ссылке:

<http://moschip.ru/get-element>

Вы можете разместить у нас заказ для любого Вашего проекта, будь то серийное производство или разработка единичного прибора.

В нашем ассортименте представлены ведущие мировые производители активных и пассивных электронных компонентов.

Нашей специализацией является поставка электронной компонентной базы двойного назначения, продукции таких производителей как XILINX, Intel (ex.ALTERA), Vicor, Microchip, Texas Instruments, Analog Devices, Mini-Circuits, Amphenol, Glenair.

Сотрудничество с глобальными дистрибьюторами электронных компонентов, предоставляет возможность заказывать и получать с международных складов практически любой перечень компонентов в оптимальные для Вас сроки.

На всех этапах разработки и производства наши партнеры могут получить квалифицированную поддержку опытных инженеров.

Система менеджмента качества компании отвечает требованиям в соответствии с ГОСТ Р ИСО 9001, ГОСТ РВ 0015-002 и ЭС РД 009

### Офис по работе с юридическими лицами:

105318, г.Москва, ул.Щербаковская д.3, офис 1107, 1118, ДЦ «Щербаковский»

Телефон: +7 495 668-12-70 (многоканальный)

Факс: +7 495 668-12-70 (доб.304)

E-mail: [info@moschip.ru](mailto:info@moschip.ru)

Skype отдела продаж:

moschip.ru

moschip.ru\_4

moschip.ru\_6

moschip.ru\_9