

## Aluminum Electrolytic Capacitors

### Axial High Temperature, High Ripple Current

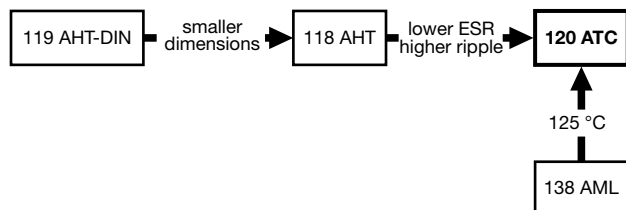


Fig. 1

| QUICK REFERENCE DATA                      |                          |
|-------------------------------------------|--------------------------|
| DESCRIPTION                               | VALUE                    |
| Nominal case sizes (Ø D x L in mm)        | 10 x 30 to 21 x 38       |
| Rated capacitance range, $C_R$            | 47 µF to 6800 µF         |
| Tolerance on $C_R$                        | ± 20 %                   |
| Rated voltage range, $U_R$                | 16 V to 100 V            |
| Category temperature range                | -40 °C to +125 °C        |
| Endurance test at 150 °C                  | 1000 h                   |
| Endurance test at 125 °C                  | 4000 h                   |
| Useful life at 125 °C                     | 8000 h                   |
| Useful life at 85 °C, 1.4 x $I_R$ applied | 40 000 h                 |
| Shelf life at 0 V, 125 °C                 | 1000 h<br>(100 V: 500 h) |
| Shelf life at 0 V, 150 °C                 | ≤ 63 V: 500 h            |
| Based on sectional specification          | IEC 60384-4 / EN 130300  |
| Climatic category IEC 60068               | 40 / 125 / 56            |

#### FEATURES

- Extra long useful life: up to 8000 h at 125 °C
- Extended temperature range: usable up to 150 °C
- Low ESR levels provide very high ripple current capability
- Miniaturized, high CV-product per unit volume
- Polarized aluminum electrolytic capacitors, non-solid electrolyte
- Axial leads, cylindrical aluminum case, insulated with a blue sleeve
- Taped versions up to case Ø 15 mm x 30 mm available for automatic insertion
- Lead diameter Ø d = 1.0 mm, available on request
- AEC-Q200 qualified
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)


RoHS  
COMPLIANT

#### APPLICATIONS

- Automotive, industrial, and telecommunication
- Smoothing, filtering, buffering
- Low mounting height applications, vibration and shock resistant
- SMPS and standard power supplies

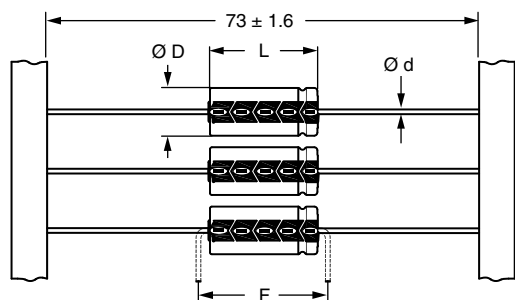
#### MARKING

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

- Rated capacitance (in µF)
- Tolerance on rated capacitance, code letter in accordance with IEC 60062 (M for ± 20 %)
- Rated voltage (in V)
- Upper category temperature (125 °C)
- Date code in accordance with IEC 60062
- Code for factory of origin
- Name of manufacturer
- Negative terminal identification
- Series number (120)

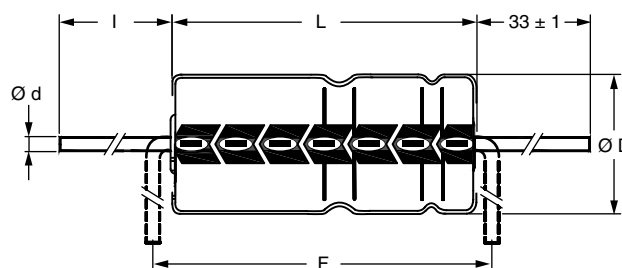
| SELECTION CHART FOR $C_R$ , $U_R$ , AND RELEVANT NOMINAL CASE SIZE (Ø D x L in mm) |           |           |           |           |           |
|------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|
| $C_R$<br>(µF)                                                                      | $U_R$ (V) |           |           |           |           |
|                                                                                    | 16        | 25        | 40        | 63        | 100       |
| 47                                                                                 | -         | -         | -         | -         | 10 x 30   |
| 68                                                                                 | -         | -         | -         | -         | 12.5 x 30 |
| 100                                                                                | -         | -         | -         | 10 x 30   | 12.5 x 30 |
| 150                                                                                | -         | -         | -         | 12.5 x 30 | 15 x 30   |
| 220                                                                                | -         | -         | 10 x 30   | 12.5 x 30 | 18 x 30   |
| 330                                                                                | -         | -         | 12.5 x 30 | 15 x 30   | 18 x 38   |
| 470                                                                                | -         | 10 x 30   | 12.5 x 30 | 18 x 30   | 21 x 38   |
| 680                                                                                | 10 x 30   | 12.5 x 30 | 15 x 30   | 18 x 38   | -         |
| 1000                                                                               | 12.5 x 30 | 12.5 x 30 | 18 x 30   | 21 x 38   | -         |
| 1500                                                                               | 12.5 x 30 | 15 x 30   | 18 x 38   | -         | -         |
| 2200                                                                               | 15 x 30   | 18 x 30   | 21 x 38   | -         | -         |
| 3300                                                                               | 18 x 30   | 18 x 38   | -         | -         | -         |
| 4700                                                                               | 18 x 38   | 21 x 38   | -         | -         | -         |
| 6800                                                                               | 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  $15 \text{ mm} \times 30 \text{ mm}$

Fig. 2 - Form BR



**Form AA:** Axial in box  
Case  $\varnothing D \times L = 10 \text{ mm} \times 30 \text{ mm}$  to  $21 \text{ mm} \times 38 \text{ mm}$

Fig. 3 - Form AA

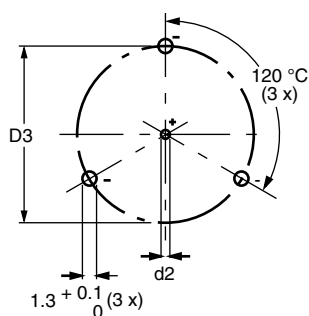
Table 1

| AXIAL; DIMENSIONS in millimeters, MASS, AND PACKAGING QUANTITIES |                       |            |                               |                   |                   |                |                      |         |
|------------------------------------------------------------------|-----------------------|------------|-------------------------------|-------------------|-------------------|----------------|----------------------|---------|
| NOMINAL CASE SIZE<br>$\varnothing D \times L$<br>(mm)            | AXIAL: FORM AA AND BR |            |                               |                   |                   | MASS<br>(g)    | PACKAGING QUANTITIES |         |
|                                                                  | $\varnothing d$ (1)   | I          | $\varnothing D_{\text{max.}}$ | $L_{\text{max.}}$ | $F_{\text{min.}}$ |                | FORM AA              | FORM BR |
| 10 x 30                                                          | 0.8                   | $55 \pm 1$ | 10.5                          | 30.5              | 35                | $\approx 4.8$  | 340                  | 500     |
| 12.5 x 30                                                        | 0.8                   | $55 \pm 1$ | 13.0                          | 30.5              | 35                | $\approx 7.4$  | 260                  | 400     |
| 15 x 30                                                          | 0.8                   | $55 \pm 1$ | 15.5                          | 30.5              | 35                | $\approx 11.7$ | 200                  | 250     |
| 18 x 30                                                          | 0.8                   | $55 \pm 1$ | 18.5                          | 30.5              | 35                | $\approx 12.9$ | 120                  | -       |
| 18 x 38                                                          | 0.8                   | $34 \pm 1$ | 18.5                          | 39.5              | 44                | $\approx 19.0$ | 125                  | -       |
| 21 x 38                                                          | 0.8                   | $34 \pm 1$ | 21.5                          | 39.5              | 44                | $\approx 24.0$ | 100                  | -       |

## Notes

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

(1) Lead diameter  $\varnothing d = 1.0 \text{ mm}$ , available on request



Mounting holes

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

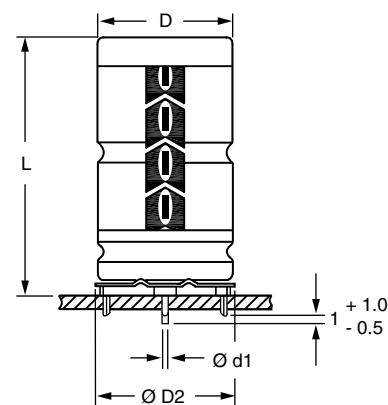
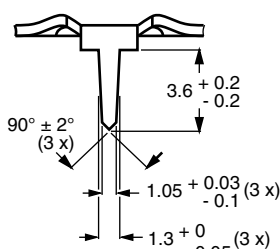


Fig. 4 - Mounting hole diagram and outline; **form MR:** With mounting ring and pins

Table 2

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



| ELECTRICAL DATA |                                                                                          |
|-----------------|------------------------------------------------------------------------------------------|
| SYMBOL          | DESCRIPTION                                                                              |
| $C_R$           | Rated capacitance at 100 Hz, tolerance $\pm 20\%$                                        |
| $I_R$           | Rated RMS ripple current at 10 kHz, 125 °C                                               |
| $I_{L1}$        | Max. leakage current after 1 min at $U_R$                                                |
| $I_{L5}$        | Max. leakage current after 5 min at $U_R$                                                |
| ESR             | Equivalent series resistance at 100 Hz (calculated from $\tan \delta_{\max}$ and $C_R$ ) |
| Z               | Max. impedance at 10 kHz                                                                 |

**Note**

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

**Table 3**

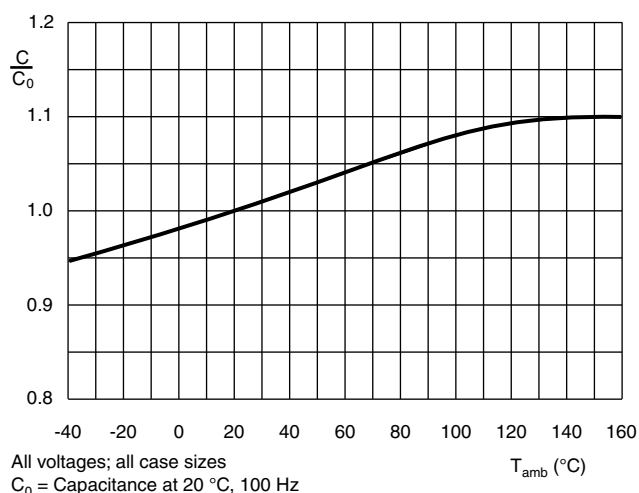
| ELECTRICAL DATA AND ORDERING INFORMATION |                                  |                                         |                                            |                                  |                                  |                               |                               |                               |                               |                             |                              |                            |                             |                             |
|------------------------------------------|----------------------------------|-----------------------------------------|--------------------------------------------|----------------------------------|----------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-----------------------------|------------------------------|----------------------------|-----------------------------|-----------------------------|
| U <sub>R</sub><br>(V)                    | C <sub>R</sub><br>100 Hz<br>(μF) | NOMINAL<br>CASE SIZE<br>Ø D x L<br>(mm) | I <sub>R</sub><br>10 kHz<br>125 °C<br>(mA) | I <sub>L1</sub><br>1 min<br>(μA) | I <sub>L5</sub><br>5 min<br>(μA) | TYP.<br>ESR<br>100 Hz<br>(mΩ) | MAX.<br>ESR<br>100 Hz<br>(mΩ) | TYP.<br>ESR<br>10 kHz<br>(mΩ) | MAX.<br>ESR<br>10 kHz<br>(mΩ) | Z<br>MAX.<br>10 kHz<br>(mΩ) | FREQ.<br>CODE <sup>(1)</sup> | ORDERING CODE MAL2120..... |                             |                             |
|                                          |                                  |                                         |                                            |                                  |                                  |                               |                               |                               |                               |                             |                              | IN BOX<br>FORM AA          | TAPED<br>ON REEL<br>FORM BR | MOUNTING<br>RING<br>FORM MR |
| 16                                       | 680                              | 10 x 30                                 | 2100                                       | 171                              | 84                               | 106                           | 177                           | 44                            | 74                            | 78                          | MF1                          | 15681E3                    | 25681E3                     | -                           |
|                                          | 1000                             | 12.5 x 30                               | 2550                                       | 232                              | 104                              | 77                            | 128                           | 35                            | 58                            | 61                          | MF1                          | 15102E3                    | 25102E3                     | -                           |
|                                          | 1500                             | 12.5 x 30                               | 2650                                       | 328                              | 136                              | 60                            | 100                           | 32                            | 53                            | 53                          | MF1                          | 15152E3                    | 25152E3                     | -                           |
|                                          | 2200                             | 15 x 30                                 | 2940                                       | 462                              | 181                              | 48                            | 79                            | 28                            | 46                            | 46                          | MF1                          | 15222E3                    | 25222E3                     | 45222E3                     |
|                                          | 3300                             | 18 x 30                                 | 3430                                       | 674                              | 251                              | 41                            | 68                            | 26                            | 43                            | 43                          | MF2                          | 15332E3                    | -                           | 45332E3                     |
|                                          | 4700                             | 18 x 38                                 | 4350                                       | 942                              | 341                              | 27                            | 45                            | 18                            | 29                            | 29                          | MF2                          | 15472E3                    | -                           | 45472E3                     |
|                                          | 6800                             | 21 x 38                                 | 4590                                       | 1346                             | 475                              | 26                            | 43                            | 18                            | 29                            | 29                          | MF2                          | 15682E3                    | -                           | 45682E3                     |
| 25                                       | 470                              | 10 x 30                                 | 2100                                       | 181                              | 87                               | 112                           | 187                           | 45                            | 74                            | 84                          | MF1                          | 16471E3                    | 26471E3                     | -                           |
|                                          | 680                              | 12.5 x 30                               | 2550                                       | 244                              | 108                              | 81                            | 136                           | 35                            | 59                            | 64                          | MF1                          | 16681E3                    | 26681E3                     | -                           |
|                                          | 1000                             | 12.5 x 30                               | 2600                                       | 340                              | 140                              | 64                            | 107                           | 32                            | 53                            | 55                          | MF1                          | 16102E3                    | 26102E3                     | -                           |
|                                          | 1500                             | 15 x 30                                 | 2890                                       | 490                              | 190                              | 49                            | 82                            | 28                            | 46                            | 46                          | MF1                          | 16152E3                    | 26152E3                     | 46152E3                     |
|                                          | 2200                             | 18 x 30                                 | 3310                                       | 700                              | 260                              | 43                            | 71                            | 27                            | 44                            | 44                          | MF2                          | 16222E3                    | -                           | 46222E3                     |
|                                          | 3300                             | 18 x 38                                 | 4350                                       | 1030                             | 370                              | 28                            | 47                            | 18                            | 29                            | 29                          | MF2                          | 16332E3                    | -                           | 46332E3                     |
|                                          | 4700                             | 21 x 38                                 | 4470                                       | 1450                             | 510                              | 27                            | 44                            | 18                            | 29                            | 29                          | MF2                          | 16472E3                    | -                           | 46472E3                     |
| 40                                       | 220                              | 10 x 30                                 | 1990                                       | 146                              | 75                               | 192                           | 320                           | 52                            | 87                            | 124                         | MF1                          | 17221E3                    | 27221E3                     | -                           |
|                                          | 330                              | 12.5 x 30                               | 2430                                       | 198                              | 93                               | 130                           | 216                           | 37                            | 62                            | 83                          | MF1                          | 17331E3                    | 27331E3                     | -                           |
|                                          | 470                              | 12.5 x 30                               | 2550                                       | 266                              | 115                              | 101                           | 169                           | 35                            | 58                            | 70                          | MF1                          | 17471E3                    | 27471E3                     | -                           |
|                                          | 680                              | 15 x 30                                 | 2840                                       | 366                              | 149                              | 75                            | 125                           | 30                            | 50                            | 55                          | MF1                          | 17681E3                    | 27681E3                     | 47681E3                     |
|                                          | 1000                             | 18 x 30                                 | 3150                                       | 520                              | 200                              | 59                            | 99                            | 28                            | 47                            | 49                          | MF2                          | 17102E3                    | -                           | 47102E3                     |
|                                          | 1500                             | 18 x 38                                 | 4130                                       | 760                              | 280                              | 39                            | 65                            | 19                            | 31                            | 32                          | MF2                          | 17152E3                    | -                           | 47152E3                     |
|                                          | 2200                             | 21 x 38                                 | 4170                                       | 1096                             | 392                              | 34                            | 56                            | 19                            | 31                            | 31                          | MF2                          | 17222E3                    | -                           | 47222E3                     |
| 63                                       | 100                              | 10 x 30                                 | 1560                                       | 116                              | 65                               | 297                           | 495                           | 92                            | 154                           | 249                         | MF3                          | 18101E3                    | 28101E3                     | -                           |
|                                          | 150                              | 12.5 x 30                               | 2050                                       | 153                              | 78                               | 195                           | 325                           | 61                            | 102                           | 162                         | MF3                          | 18151E3                    | 28151E3                     | -                           |
|                                          | 220                              | 12.5 x 30                               | 2150                                       | 206                              | 95                               | 149                           | 249                           | 55                            | 92                            | 126                         | MF3                          | 18221E3                    | 28221E3                     | -                           |
|                                          | 330                              | 15 x 30                                 | 2510                                       | 289                              | 123                              | 105                           | 175                           | 44                            | 73                            | 91                          | MF3                          | 18331E3                    | 28331E3                     | 48331E3                     |
|                                          | 470                              | 18 x 30                                 | 2860                                       | 395                              | 158                              | 81                            | 135                           | 38                            | 64                            | 74                          | MF4                          | 18471E3                    | -                           | 48471E3                     |
|                                          | 680                              | 18 x 38                                 | 3720                                       | 554                              | 211                              | 55                            | 92                            | 26                            | 43                            | 49                          | MF4                          | 18681E3                    | -                           | 48681E3                     |
|                                          | 1000                             | 21 x 38                                 | 3780                                       | 796                              | 292                              | 44                            | 74                            | 25                            | 41                            | 43                          | MF4                          | 18102E3                    | -                           | 48102E3                     |
| 100                                      | 47                               | 10 x 30                                 | 760                                        | 96                               | 59                               | 760                           | 1269                          | 349                           | 581                           | 720                         | MF3                          | 19479E3                    | 29479E3                     | -                           |
|                                          | 68                               | 12.5 x 30                               | 1030                                       | 122                              | 67                               | 531                           | 885                           | 246                           | 410                           | 503                         | MF3                          | 19689E3                    | 29689E3                     | -                           |
|                                          | 100                              | 12.5 x 30                               | 1140                                       | 160                              | 80                               | 389                           | 648                           | 196                           | 327                           | 381                         | MF3                          | 19101E3                    | 29101E3                     | -                           |
|                                          | 150                              | 15 x 30                                 | 1480                                       | 220                              | 100                              | 266                           | 443                           | 137                           | 229                           | 262                         | MF3                          | 19151E3                    | 29151E3                     | 49151E3                     |
|                                          | 220                              | 18 x 30                                 | 1960                                       | 304                              | 128                              | 181                           | 302                           | 95                            | 158                           | 179                         | MF4                          | 19221E3                    | -                           | 49221E3                     |
|                                          | 330                              | 18 x 38                                 | 2550                                       | 436                              | 172                              | 120                           | 200                           | 62                            | 104                           | 117                         | MF4                          | 19331E3                    | -                           | 49331E3                     |
|                                          | 470                              | 21 x 38                                 | 2800                                       | 604                              | 228                              | 92                            | 154                           | 52                            | 86                            | 94                          | MF4                          | 19471E3                    | -                           | 49471E3                     |

**Note**

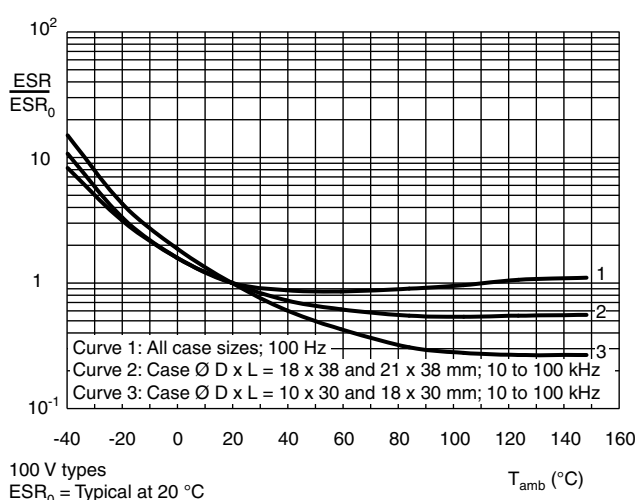
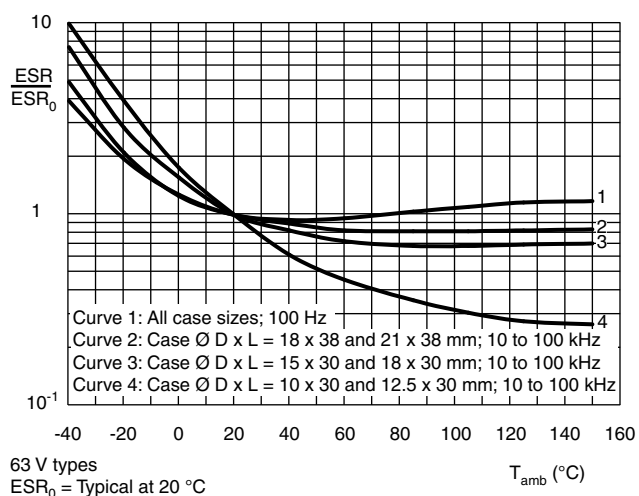
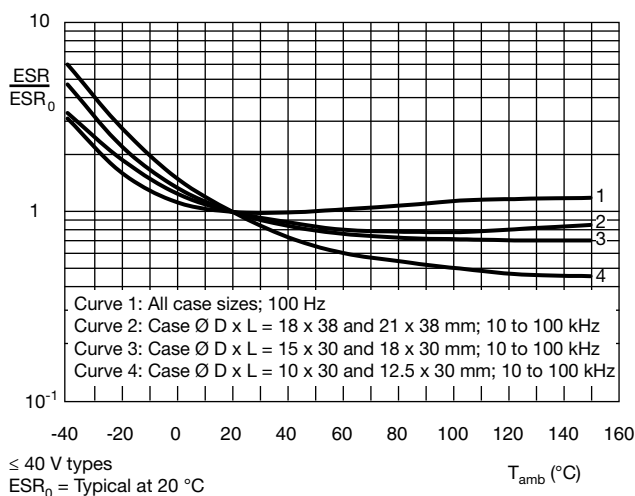
<sup>(1)</sup> Determines the applicable row in the table "Multiplier of Ripple Current ( $I_R$ ) as a Function of Frequency"

| ADDITIONAL ELECTRICAL DATA         |                      |                                                     |               |
|------------------------------------|----------------------|-----------------------------------------------------|---------------|
| PARAMETER                          | CONDITIONS           | VALUE                                               |               |
|                                    |                      | AXIAL                                               | MOUNTING RING |
| <b>Voltage</b>                     |                      |                                                     |               |
| Surge voltage                      |                      | $U_s \leq 1.15 \times U_R$                          |               |
| Reverse voltage                    |                      | $U_{rev} \leq 1 \text{ V}$                          |               |
| <b>Current</b>                     |                      |                                                     |               |
| Leakage current                    | After 1 min at $U_R$ | $I_{L1} \leq 0.012 C_R \times U_R + 40 \mu\text{A}$ |               |
|                                    | After 5 min at $U_R$ | $I_{L5} \leq 0.004 C_R \times U_R + 40 \mu\text{A}$ |               |
| <b>Inductance</b>                  |                      |                                                     |               |
| Equivalent series inductance (ESL) | Case Ø D x L mm:     |                                                     |               |
|                                    | 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    |

## CAPACITANCE (C)



## EQUIVALENT SERIES RESISTANCE (ESR)



# RIPPLE CURRENT AND USEFUL LIFE

Table 4

| ENDURANCE TEST DURATION AND USEFUL LIFE |                                 |
|-----------------------------------------|---------------------------------|
| ENDURANCE<br>AT 125 °C<br>(h)           | USEFUL LIFE<br>AT 125 °C<br>(h) |
| 4000                                    | 8000                            |

## Note

- Multiplier of useful life code: JW64

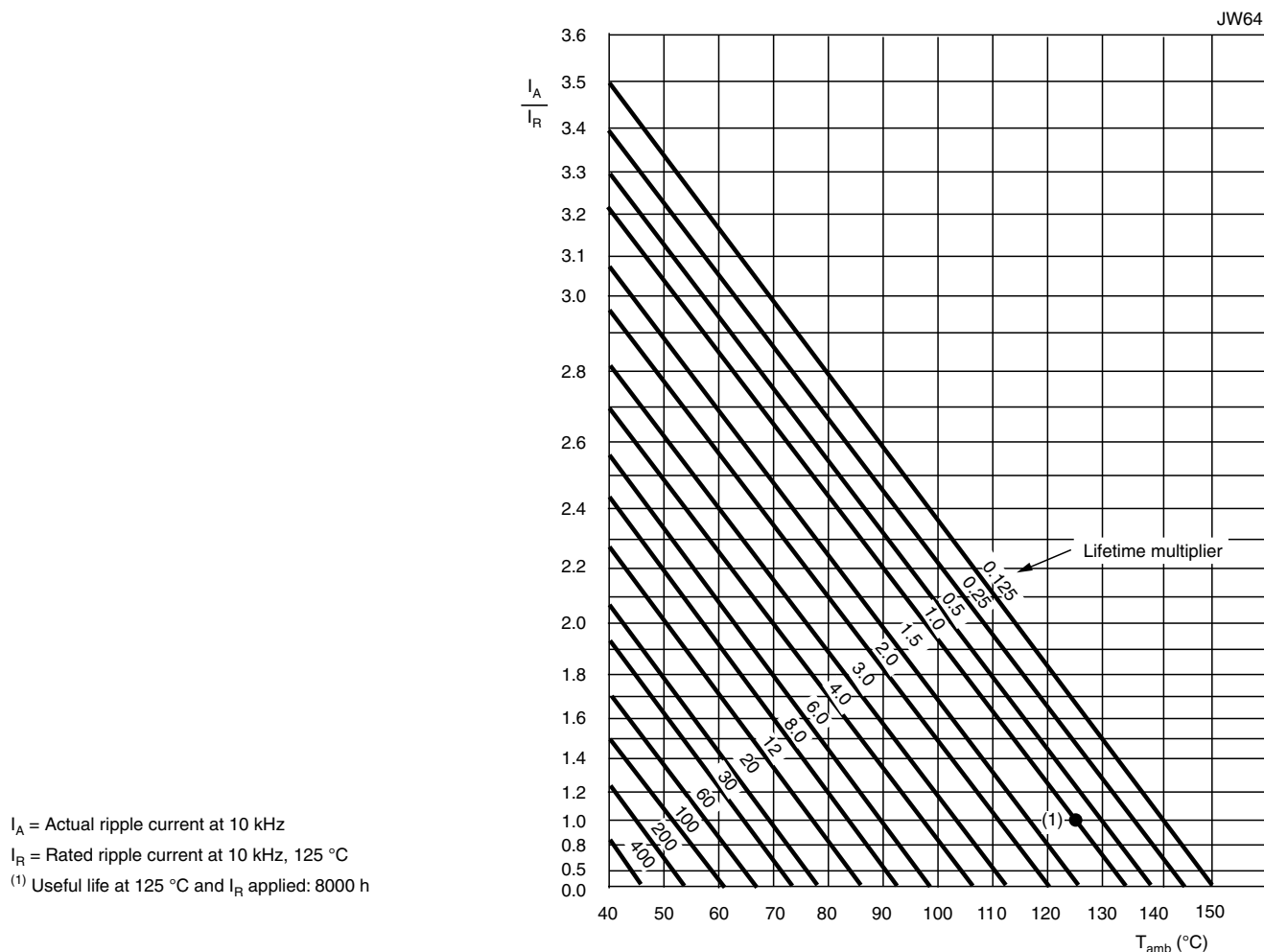


Fig. 9 - Multiplier of useful life as a function of ambient temperature and ripple current load

Table 5

| MULTIPLIER OF RIPPLE CURRENT ( $I_R$ ) AS A FUNCTION OF FREQUENCY |                  |      |      |      |      |          |
|-------------------------------------------------------------------|------------------|------|------|------|------|----------|
| FREQ.<br>CODE                                                     | FREQUENCY (Hz)   |      |      |      |      |          |
|                                                                   | 50               | 100  | 300  | 1000 | 3000 | ≥ 10 000 |
|                                                                   | $I_R$ MULTIPLIER |      |      |      |      |          |
| MF1                                                               | 0.37             | 0.48 | 0.69 | 0.86 | 0.96 | 1.00     |
| MF2                                                               | 0.54             | 0.63 | 0.75 | 0.81 | 0.87 | 1.00     |
| MF3                                                               | 0.23             | 0.32 | 0.53 | 0.77 | 0.93 | 1.00     |
| MF4                                                               | 0.44             | 0.56 | 0.76 | 0.88 | 0.94 | 1.00     |

Table 6

| TEST PROCEDURES AND REQUIREMENTS               |                                              |                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                             |
|------------------------------------------------|----------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| TEST                                           |                                              | PROCEDURE<br>(quick reference)                                                                                                                                                                                                                                                              | REQUIREMENTS                                                                                                                                                                                                                |
| NAME OF TEST                                   | REFERENCE                                    |                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                             |
| Endurance                                      | IEC 60384-4 /<br>EN 130300<br>subclause 4.13 | $T_{amb} = 125\text{ }^{\circ}\text{C}$ ; $U_R$ applied;<br>4000 h<br><br>$T_{amb} = 150\text{ }^{\circ}\text{C}$ ; $U_R$ applied;<br>1000 h                                                                                                                                                | $\Delta C/C$ : $\pm 15\%$<br>$\tan \delta \leq 1.3 \times \text{spec. limit}$<br>$Z \leq 2 \times \text{spec. limit}$<br>$I_{L5} \leq \text{spec. limit}$                                                                   |
| Useful life                                    | CECC 30301<br>subclause 1.8.1                | $T_{amb} = 125\text{ }^{\circ}\text{C}$ ; $U_R$ and $I_R$ applied;<br>8000 h                                                                                                                                                                                                                | $\Delta C/C$ : $\pm 45\%$<br>$\tan \delta \leq 3 \times \text{spec. limit}$<br>$Z \leq 3 \times \text{spec. limit}$<br>$I_{L5} \leq \text{spec. limit}$<br>no short or open circuit<br>total failure percentage: $\leq 1\%$ |
| Shelf life<br>(storage at high<br>temperature) | IEC 60384-4 /<br>EN 130300<br>subclause 4.17 | $T_{amb} = 125\text{ }^{\circ}\text{C}$ ; no voltage applied;<br>1000 h (100 V: 500 h)<br><br>$T_{amb} = 150\text{ }^{\circ}\text{C}$ ; no voltage applied;<br>500 h for voltages: $\leq 63\text{ V}$<br><br>After test: $U_R$ to be applied for 30 min,<br>24 h to 48 h before measurement | $\Delta C/C$ , $\tan \delta$ , $Z$ :<br>for requirements<br>see "Endurance test" above<br>$I_{L5} \leq 2 \times \text{spec. limit}$                                                                                         |
| Reverse voltage                                | IEC 60384-4 /<br>EN 130300<br>subclause 4.15 | $T_{amb} = 125\text{ }^{\circ}\text{C}$ :<br>125 h at $U = -1\text{ V}$<br>Followed by 125 h at $U_R$                                                                                                                                                                                       | $\Delta C/C$ : $\pm 20\%$<br>$\tan \delta \leq \text{spec. limit}$<br>$I_{L5} \leq \text{spec. limit}$                                                                                                                      |

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



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