

## Aluminum Electrolytic Capacitors Power Ripple Miniature Snap-In


**RoHS  
COMPLIANT**

### FEATURES

- Up to 500 V
- Useful life: 5000 h at 85 °C
- Polarized aluminum electrolytic capacitors, non-solid electrolyte
- Large types, very small dimensions, cylindrical aluminum case, insulated with a blue sleeve
- Keyed polarity version available
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)

### APPLICATIONS

- General purpose, industrial and audio / video systems
- Smoothing and filtering
- Standard and switched mode power supplies

### 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)
- Date code (YYMM or in 2 digits according to IEC 60062)
- Name of manufacturer
- Code for factory of origin
- “-” sign to identify the negative terminal, visible from the top and side of the capacitor
- Code number, last 8 digits 257 xxxxx
- Climatic category in accordance with IEC 60068

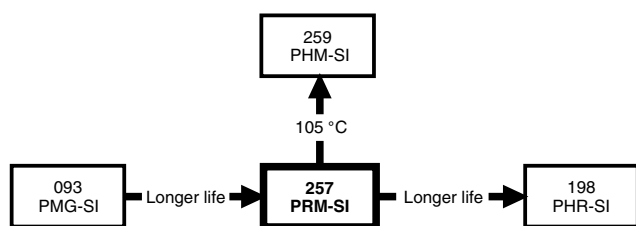


Fig. 1

### QUICK REFERENCE DATA

| DESCRIPTION                                             | VALUE                                  |                  |
|---------------------------------------------------------|----------------------------------------|------------------|
| Nominal case sizes<br>( $\varnothing D \times L$ in mm) | 22 x 25 to 35 x 60                     |                  |
| Rated capacitance range, $C_R$                          | 56 $\mu\text{F}$ to 3300 $\mu\text{F}$ |                  |
| Tolerance on $C_R$                                      | $\pm 20\%$                             |                  |
| Rated voltage range, $U_R$                              | 200 V to 450 V                         | 500 V            |
| Category temperature range                              | -40 °C to +85 °C                       | -25 °C to +85 °C |
| Endurance test at 85 °C                                 | 3000 h                                 |                  |
| Useful life at 85 °C                                    | 5000 h                                 |                  |
| Shelf life at 0 V, 85 °C                                | 1000 h                                 |                  |
| Based on sectional specification                        | IEC 60384-4 / EN 130300                |                  |
| Climatic category IEC 60038                             | 40 / 85 / 56                           | 25 / 85 / 56     |

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

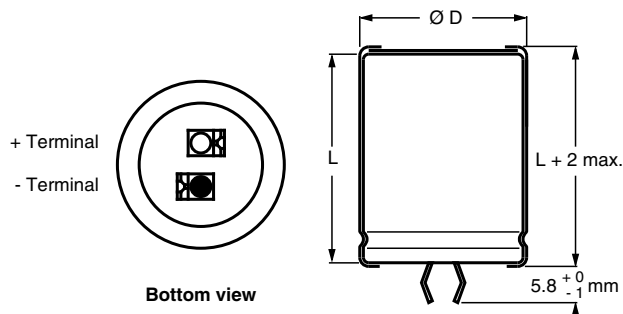
| $C_R$<br>( $\mu\text{F}$ ) | $U_R$ (V) |     |         |         |         |
|----------------------------|-----------|-----|---------|---------|---------|
|                            | 200       | 250 | 400     | 450     | 500     |
| 56                         | -         | -   | -       | -       | 22 x 25 |
| 68                         | -         | -   | -       | 22 x 25 | -       |
| 82                         | -         | -   | 22 x 25 | -       | 22 x 30 |
|                            | -         | -   | -       | -       | 25 x 25 |
| 100                        | -         | -   | -       | 22 x 30 | 22 x 35 |
|                            | -         | -   | -       | 25 x 25 | 25 x 30 |



| <b>SELECTION CHART FOR <math>C_R</math>, <math>U_R</math>, AND RELEVANT NOMINAL CASE SIZES (<math>\varnothing D \times L</math> in mm)</b> |                             |            |            |            |            |
|--------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|------------|------------|------------|------------|
| <b><math>C_R</math><br/>(<math>\mu F</math>)</b>                                                                                           | <b><math>U_R</math> (V)</b> |            |            |            |            |
|                                                                                                                                            | <b>200</b>                  | <b>250</b> | <b>400</b> | <b>450</b> | <b>500</b> |
| 120                                                                                                                                        | -                           | -          | 22 x 30    | 22 x 35    | 22 x 40    |
|                                                                                                                                            | -                           | -          | 25 x 25    | 25 x 30    | 30 x 25    |
| 150                                                                                                                                        | -                           | -          | 22 x 35    | 22 x 40    | 25 x 35    |
|                                                                                                                                            | -                           | -          | -          | 30 x 25    | -          |
| 180                                                                                                                                        | -                           | -          | 22 x 40    | 25 x 35    | 25 x 40    |
|                                                                                                                                            | -                           | -          | 25 x 30    | -          | 30 x 30    |
|                                                                                                                                            | -                           | -          | 30 x 25    | -          | 35 x 25    |
| 220                                                                                                                                        | -                           | 22 x 25    | 22 x 45    | 25 x 45    | 25 x 50    |
|                                                                                                                                            | -                           | -          | 25 x 35    | 30 x 30    | 30 x 35    |
|                                                                                                                                            | -                           | -          | -          | 35 x 25    | 35 x 30    |
| 270                                                                                                                                        | -                           | 25 x 25    | 25 x 40    | 25 x 50    | 30 x 40    |
|                                                                                                                                            | -                           | -          | 30 x 30    | 30 x 35    | -          |
|                                                                                                                                            | -                           | -          | 35 x 25    | 35 x 30    | -          |
| 330                                                                                                                                        | 22 x 25                     | 22 x 30    | 25 x 45    | 30 x 40    | 30 x 45    |
|                                                                                                                                            | -                           | -          | 30 x 35    | -          | 35 x 35    |
| 390                                                                                                                                        | 22 x 30                     | 22 x 35    | 30 x 40    | 30 x 45    | 30 x 50    |
|                                                                                                                                            | 25 x 25                     | 25 x 30    | 35 x 30    | 35 x 35    | 35 x 40    |
| 470                                                                                                                                        | 22 x 35                     | 22 x 40    | 30 x 45    | 35 x 40    | 35 x 45    |
|                                                                                                                                            | 25 x 30                     | 30 x 25    | 35 x 35    | -          | -          |
|                                                                                                                                            | 30 x 25                     | -          | -          | -          | -          |
| 560                                                                                                                                        | 22 x 35                     | 22 x 45    | 30 x 50    | 35 x 45    | 35 x 50    |
|                                                                                                                                            | 25 x 30                     | 25 x 35    | 35 x 40    | -          | -          |
|                                                                                                                                            | 30 x 25                     | 30 x 30    | -          | -          | -          |
| 680                                                                                                                                        | 22 x 40                     | 25 x 45    | 35 x 45    | 35 x 55    | 35 x 60    |
|                                                                                                                                            | 25 x 35                     | 30 x 35    | -          | -          | -          |
|                                                                                                                                            | -                           | 35 x 25    | -          | -          | -          |
| 820                                                                                                                                        | 22 x 45                     | 25 x 50    | 35 x 50    | -          | -          |
|                                                                                                                                            | 25 x 40                     | 35 x 30    | -          | -          | -          |
|                                                                                                                                            | 30 x 30                     | -          | -          | -          | -          |
|                                                                                                                                            | 35 x 25                     | -          | -          | -          | -          |
| 1000                                                                                                                                       | 25 x 45                     | 30 x 40    | 35 x 60    | -          | -          |
|                                                                                                                                            | 30 x 35                     | -          | -          | -          | -          |
| 1200                                                                                                                                       | 25 x 50                     | 30 x 45    | -          | -          | -          |
|                                                                                                                                            | 30 x 35                     | 35 x 35    | -          | -          | -          |
|                                                                                                                                            | 35 x 30                     | -          | -          | -          | -          |
| 1500                                                                                                                                       | 30 x 45                     | 35 x 45    | -          | -          | -          |
|                                                                                                                                            | 35 x 35                     | -          | -          | -          | -          |
| 1800                                                                                                                                       | 30 x 50                     | 35 x 50    | -          | -          | -          |
|                                                                                                                                            | 35 x 40                     | -          | -          | -          | -          |
| 2200                                                                                                                                       | 35 x 45                     | 35 x 55    | -          | -          | -          |
| 2700                                                                                                                                       | 35 x 50                     | -          | -          | -          | -          |
| 3300                                                                                                                                       | 35 x 60                     | -          | -          | -          | -          |

## DIMENSIONS in millimeters **AND AVAILABLE FORMS**

### TWO TERMINAL SNAP-IN



The minus terminal can be marked with a black dot or with an imprinted “-” sign.

Fig. 2 - Two terminal snap-in

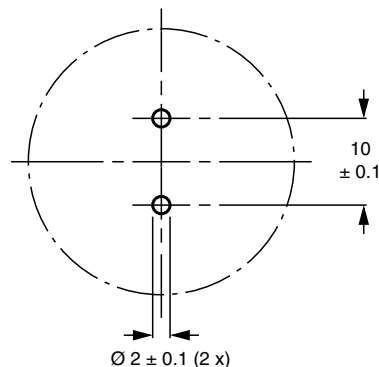
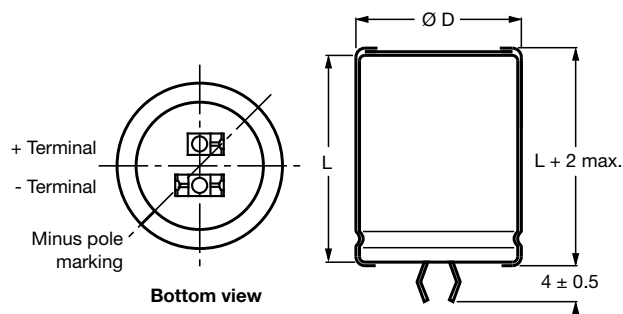


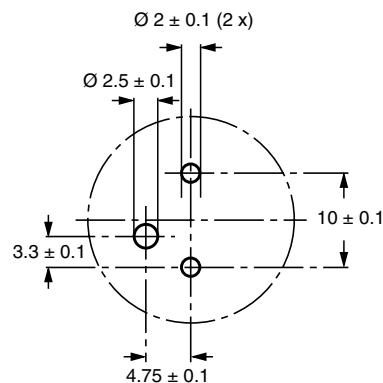
Fig. 3 - Mounting hole diagram

### THREE TERMINAL SNAP-IN



The negative terminal has **TWO** pins which are **BOTH** electrically connected.

Fig. 4 - Three terminal snap-in



The 10 mm spacing of the 2 pin snap-in is used as the base layout and a third hole is added.

The third hole is closer to the negative primary hole so that polarization is always maintained, together with added mechanical stability.

Fig. 5 - Mounting hole diagram

**Table 1**

| <b>DIMENSIONS</b> in millimeters, <b>MASS AND PACKAGING QUANTITIES</b> |                           |                         |                     |                                                     |                                                   |
|------------------------------------------------------------------------|---------------------------|-------------------------|---------------------|-----------------------------------------------------|---------------------------------------------------|
| <b>NOMINAL CASE SIZE<br/>Ø D x L</b>                                   | <b>Ø D<sub>max.</sub></b> | <b>L<sub>max.</sub></b> | <b>MASS<br/>(g)</b> | <b>PACKAGING<br/>QUANTITIES<br/>(units per box)</b> | <b>CARDBOARD BOX<br/>DIMENSIONS<br/>L x W x H</b> |
| 22 x 25                                                                | 23                        | 27                      | ≈ 12                | 100                                                 | 260 x 250 x 39                                    |
| 22 x 30                                                                | 23                        | 32                      | ≈ 16                | 100                                                 | 260 x 250 x 44                                    |
| 22 x 35                                                                | 23                        | 37                      | ≈ 20                | 100                                                 | 260 x 250 x 49                                    |
| 22 x 40                                                                | 23                        | 42                      | ≈ 23                | 100                                                 | 260 x 250 x 54                                    |
| 22 x 45                                                                | 23                        | 47                      | ≈ 26                | 100                                                 | 260 x 250 x 59                                    |
| 25 x 25                                                                | 26                        | 27                      | ≈ 20                | 100                                                 | 290 x 280 x 39                                    |
| 25 x 30                                                                | 26                        | 32                      | ≈ 22                | 100                                                 | 290 x 280 x 44                                    |
| 25 x 35                                                                | 26                        | 37                      | ≈ 24                | 100                                                 | 290 x 280 x 49                                    |
| 25 x 40                                                                | 26                        | 42                      | ≈ 27                | 100                                                 | 290 x 280 x 54                                    |
| 25 x 45                                                                | 26                        | 47                      | ≈ 32                | 100                                                 | 290 x 280 x 59                                    |
| 25 x 50                                                                | 26                        | 52                      | ≈ 38                | 100                                                 | 290 x 280 x 64                                    |
| 30 x 25                                                                | 31                        | 27                      | ≈ 25                | 100                                                 | 340 x 330 x 39                                    |
| 30 x 30                                                                | 31                        | 32                      | ≈ 30                | 100                                                 | 340 x 330 x 44                                    |
| 30 x 35                                                                | 31                        | 37                      | ≈ 35                | 100                                                 | 340 x 330 x 49                                    |
| 30 x 40                                                                | 31                        | 42                      | ≈ 40                | 100                                                 | 340 x 330 x 54                                    |
| 30 x 45                                                                | 31                        | 47                      | ≈ 45                | 100                                                 | 340 x 330 x 59                                    |
| 30 x 50                                                                | 31                        | 52                      | ≈ 50                | 100                                                 | 340 x 330 x 64                                    |
| 35 x 25                                                                | 36                        | 27                      | ≈ 33                | 50                                                  | 390 x 198 x 39                                    |
| 35 x 30                                                                | 36                        | 32                      | ≈ 40                | 50                                                  | 390 x 198 x 44                                    |
| 35 x 35                                                                | 36                        | 37                      | ≈ 48                | 50                                                  | 390 x 198 x 49                                    |
| 35 x 40                                                                | 36                        | 42                      | ≈ 55                | 50                                                  | 390 x 198 x 54                                    |
| 35 x 45                                                                | 36                        | 47                      | ≈ 63                | 50                                                  | 390 x 198 x 59                                    |
| 35 x 50                                                                | 36                        | 52                      | ≈ 72                | 50                                                  | 390 x 198 x 64                                    |
| 35 x 55                                                                | 36                        | 57                      | ≈ 80                | 50                                                  | 390 x 198 x 69                                    |
| 35 x 60                                                                | 36                        | 62                      | ≈ 82                | 50                                                  | 390 x 198 x 74                                    |

| <b>ELECTRICAL DATA</b> |                                                    |
|------------------------|----------------------------------------------------|
| <b>SYMBOL</b>          | <b>DESCRIPTION</b>                                 |
| C <sub>R</sub>         | Rated capacitance at 100 Hz                        |
| I <sub>R</sub>         | Rated RMS ripple current at 100 Hz, 85 °C          |
| I <sub>L5</sub>        | Max. leakage current after 5 min at U <sub>R</sub> |
| ESR                    | Typ. / max. equivalent series resistance at 100 Hz |
| Z                      | Typ. / 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 257 series

1000 µF / 200 V; ± 20 %

Nominal case size: Ø 30 x 35 mm

**2-terminal snap-in:**

Ordering code: MAL2 257 32102 E3

**3-terminal snap-in:**

Ordering code: MAL2 257 82102 E3



Table 2

| 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>100 Hz <sup>(1)</sup><br>(A) | I <sub>L5</sub><br>(mA) | TYP. ESR<br>100 Hz<br>(mΩ) | MAX. ESR<br>100 Hz<br>(mΩ) | TYP. Z<br>10 kHz<br>(mΩ) | MAX. Z<br>10 kHz<br>(mΩ) | ORDERING CODE<br>MAL2257..... |         |
|                                          |                                  |                                         |                                                |                         |                            |                            |                          |                          | 2-TERM.                       | 3-TERM. |
| 200                                      | 330                              | 22 x 25                                 | 1.51                                           | 0.66                    | 308                        | 440                        | 217                      | 310                      | 52331E3                       | 62331E3 |
|                                          | 390                              | 22 x 30                                 | 1.74                                           | 0.78                    | 259                        | 370                        | 182                      | 260                      | 52391E3                       | 62391E3 |
|                                          | 390                              | 25 x 25                                 | 1.67                                           | 0.78                    | 273                        | 390                        | 196                      | 280                      | 42391E3                       | 72391E3 |
|                                          | 470                              | 22 x 35                                 | 2.00                                           | 0.94                    | 238                        | 340                        | 175                      | 250                      | 52471E3                       | 62471E3 |
|                                          | 470                              | 25 x 30                                 | 1.96                                           | 0.94                    | 245                        | 350                        | 182                      | 260                      | 42471E3                       | 72471E3 |
|                                          | 470                              | 30 x 25                                 | 1.93                                           | 0.94                    | 266                        | 380                        | 203                      | 290                      | 32471E3                       | 82471E3 |
|                                          | 560                              | 22 x 35                                 | 2.13                                           | 1.12                    | 182                        | 260                        | 133                      | 190                      | 52561E3                       | 62561E3 |
|                                          | 560                              | 25 x 30                                 | 2.06                                           | 1.12                    | 196                        | 280                        | 140                      | 200                      | 42561E3                       | 72561E3 |
|                                          | 560                              | 30 x 25                                 | 1.99                                           | 1.12                    | 217                        | 310                        | 161                      | 230                      | 32561E3                       | 82561E3 |
|                                          | 680                              | 22 x 40                                 | 2.44                                           | 1.36                    | 154                        | 220                        | 112                      | 160                      | 52681E3                       | 62681E3 |
|                                          | 680                              | 25 x 35                                 | 2.38                                           | 1.36                    | 161                        | 230                        | 112                      | 160                      | 42681E3                       | 72681E3 |
|                                          | 820                              | 22 x 45                                 | 2.76                                           | 1.64                    | 126                        | 180                        | 91                       | 130                      | 52821E3                       | 62821E3 |
|                                          | 820                              | 25 x 40                                 | 2.71                                           | 1.64                    | 133                        | 190                        | 98                       | 140                      | 42821E3                       | 72821E3 |
|                                          | 820                              | 30 x 30                                 | 2.44                                           | 1.64                    | 147                        | 210                        | 112                      | 160                      | 32821E3                       | 82821E3 |
|                                          | 820                              | 35 x 25                                 | 2.29                                           | 1.64                    | 182                        | 260                        | 140                      | 200                      | 22821E3                       | 12821E3 |
|                                          | 1000                             | 25 x 45                                 | 3.11                                           | 2.00                    | 112                        | 160                        | 77                       | 110                      | 42102E3                       | 72102E3 |
|                                          | 1000                             | 30 x 35                                 | 2.84                                           | 2.00                    | 119                        | 170                        | 91                       | 130                      | 32102E3                       | 82102E3 |
|                                          | 1200                             | 25 x 50                                 | 3.52                                           | 2.40                    | 91                         | 130                        | 70                       | 100                      | 42122E3                       | 72122E3 |
|                                          | 1200                             | 30 x 35                                 | 2.89                                           | 2.40                    | 112                        | 160                        | 84                       | 120                      | 32122E3                       | 82122E3 |
|                                          | 1200                             | 35 x 30                                 | 2.78                                           | 2.40                    | 126                        | 180                        | 98                       | 140                      | 22122E3                       | 12122E3 |
|                                          | 1500                             | 30 x 45                                 | 3.60                                           | 3.00                    | 84                         | 120                        | 63                       | 90                       | 32152E3                       | 82152E3 |
|                                          | 1500                             | 35 x 35                                 | 3.22                                           | 3.00                    | 98                         | 140                        | 77                       | 110                      | 22152E3                       | 12152E3 |
|                                          | 1800                             | 30 x 50                                 | 4.03                                           | 3.60                    | 70                         | 100                        | 56                       | 80                       | 32182E3                       | 82182E3 |
|                                          | 1800                             | 35 x 40                                 | 3.57                                           | 3.60                    | 84                         | 120                        | 70                       | 100                      | 22182E3                       | 12182E3 |
|                                          | 2200                             | 35 x 45                                 | 3.96                                           | 4.40                    | 70                         | 100                        | 56                       | 80                       | 22222E3                       | 12222E3 |
|                                          | 2700                             | 35 x 50                                 | 4.36                                           | 5.40                    | 63                         | 90                         | 49                       | 70                       | 22272E3                       | 12272E3 |
|                                          | 3300                             | 35 x 60                                 | 5.05                                           | 6.60                    | 49                         | 70                         | 42                       | 60                       | 22332E3                       | 12332E3 |
| 250                                      | 220                              | 22 x 25                                 | 1.32                                           | 0.55                    | 378                        | 540                        | 252                      | 360                      | 53221E3                       | 63221E3 |
|                                          | 270                              | 25 x 25                                 | 1.50                                           | 0.68                    | 322                        | 460                        | 210                      | 300                      | 43271E3                       | 73271E3 |
|                                          | 330                              | 22 x 30                                 | 1.66                                           | 0.83                    | 252                        | 360                        | 168                      | 240                      | 53331E3                       | 63331E3 |
|                                          | 390                              | 22 x 35                                 | 1.90                                           | 0.98                    | 217                        | 310                        | 140                      | 200                      | 53391E3                       | 63391E3 |
|                                          | 390                              | 25 x 30                                 | 1.85                                           | 0.98                    | 224                        | 320                        | 147                      | 210                      | 43391E3                       | 73391E3 |
|                                          | 470                              | 22 x 40                                 | 2.17                                           | 1.18                    | 182                        | 260                        | 119                      | 170                      | 53471E3                       | 63471E3 |
|                                          | 470                              | 30 x 25                                 | 1.88                                           | 1.18                    | 217                        | 310                        | 154                      | 220                      | 33471E3                       | 83471E3 |
|                                          | 560                              | 22 x 45                                 | 2.45                                           | 1.40                    | 154                        | 220                        | 98                       | 140                      | 53561E3                       | 63561E3 |
|                                          | 560                              | 25 x 35                                 | 2.25                                           | 1.40                    | 161                        | 230                        | 112                      | 160                      | 43561E3                       | 73561E3 |
|                                          | 560                              | 30 x 30                                 | 2.25                                           | 1.40                    | 168                        | 240                        | 119                      | 170                      | 33561E3                       | 83561E3 |
|                                          | 680                              | 25 x 45                                 | 2.78                                           | 1.70                    | 126                        | 180                        | 84                       | 120                      | 43681E3                       | 73681E3 |
|                                          | 680                              | 30 x 35                                 | 2.60                                           | 1.70                    | 140                        | 200                        | 98                       | 140                      | 33681E3                       | 83681E3 |
|                                          | 680                              | 35 x 25                                 | 2.16                                           | 1.70                    | 189                        | 270                        | 140                      | 200                      | 23681E3                       | 13681E3 |
|                                          | 820                              | 25 x 50                                 | 3.17                                           | 2.05                    | 105                        | 150                        | 70                       | 100                      | 43821E3                       | 73821E3 |
|                                          | 820                              | 35 x 30                                 | 2.64                                           | 2.05                    | 140                        | 200                        | 105                      | 150                      | 23821E3                       | 13821E3 |
|                                          | 1000                             | 30 x 40                                 | 3.02                                           | 2.50                    | 105                        | 150                        | 77                       | 110                      | 33102E3                       | 83102E3 |
|                                          | 1200                             | 30 x 45                                 | 3.4                                            | 3.00                    | 91                         | 130                        | 63                       | 90                       | 33122E3                       | 83122E3 |
|                                          | 1200                             | 35 x 35                                 | 3.06                                           | 3.00                    | 105                        | 150                        | 77                       | 110                      | 23122E3                       | 13122E3 |
|                                          | 1500                             | 35 x 45                                 | 3.78                                           | 3.75                    | 77                         | 110                        | 56                       | 80                       | 23152E3                       | 13152E3 |
|                                          | 1800                             | 35 x 50                                 | 4.18                                           | 4.50                    | 70                         | 100                        | 49                       | 70                       | 23182E3                       | 13182E3 |
|                                          | 2200                             | 35 x 55                                 | 4.48                                           | 5.50                    | 63                         | 90                         | 49                       | 70                       | 23222E3                       | 13222E3 |

**ELECTRICAL DATA AND ORDERING INFORMATION**

| $U_R$<br>(V) | $C_R$<br>100 Hz<br>( $\mu$ F) | NOMINAL<br>CASE SIZE<br>$\varnothing$ D x L<br>(mm) | $I_R$<br>100 Hz <sup>(1)</sup><br>(A) | $I_{L5}$<br>(mA) | TYP. ESR<br>100 Hz<br>(m $\Omega$ ) | MAX. ESR<br>100 Hz<br>(m $\Omega$ ) | TYP. Z<br>10 kHz<br>(m $\Omega$ ) | MAX. Z<br>10 kHz<br>(m $\Omega$ ) | ORDERING CODE<br>MAL2257..... |         |
|--------------|-------------------------------|-----------------------------------------------------|---------------------------------------|------------------|-------------------------------------|-------------------------------------|-----------------------------------|-----------------------------------|-------------------------------|---------|
|              |                               |                                                     |                                       |                  |                                     |                                     |                                   |                                   | 2-TERM.                       | 3-TERM. |
| 400          | 82                            | 22 x 25                                             | 0.78                                  | 0.33             | 1512                                | 2160                                | 1232                              | 1760                              | 56829E3                       | 66829E3 |
|              | 120                           | 22 x 30                                             | 0.98                                  | 0.48             | 1036                                | 1480                                | 847                               | 1210                              | 56121E3                       | 66121E3 |
|              | 120                           | 25 x 25                                             | 0.98                                  | 0.48             | 1050                                | 1500                                | 861                               | 1230                              | 46121E3                       | 76121E3 |
|              | 150                           | 22 x 35                                             | 1.14                                  | 0.60             | 826                                 | 1180                                | 672                               | 960                               | 56151E3                       | 66151E3 |
|              | 180                           | 22 x 40                                             | 1.31                                  | 0.72             | 693                                 | 990                                 | 567                               | 810                               | 56181E3                       | 66181E3 |
|              | 180                           | 25 x 30                                             | 1.23                                  | 0.72             | 700                                 | 1000                                | 574                               | 820                               | 46181E3                       | 76181E3 |
|              | 180                           | 30 x 25                                             | 1.27                                  | 0.72             | 721                                 | 1030                                | 602                               | 860                               | 36181E3                       | 86181E3 |
|              | 220                           | 22 x 45                                             | 1.50                                  | 0.88             | 567                                 | 810                                 | 462                               | 660                               | 56221E3                       | 66221E3 |
|              | 220                           | 25 x 35                                             | 1.42                                  | 0.88             | 574                                 | 820                                 | 469                               | 670                               | 46221E3                       | 76221E3 |
|              | 270                           | 25 x 40                                             | 1.64                                  | 1.08             | 469                                 | 670                                 | 385                               | 550                               | 46271E3                       | 76271E3 |
|              | 270                           | 30 x 30                                             | 1.59                                  | 1.08             | 490                                 | 700                                 | 406                               | 580                               | 36271E3                       | 86271E3 |
|              | 270                           | 35 x 25                                             | 1.63                                  | 1.08             | 518                                 | 740                                 | 441                               | 630                               | 26271E3                       | 16271E3 |
|              | 330                           | 25 x 45                                             | 1.90                                  | 1.32             | 385                                 | 550                                 | 315                               | 450                               | 46331E3                       | 76331E3 |
|              | 330                           | 30 x 35                                             | 1.83                                  | 1.32             | 399                                 | 570                                 | 329                               | 470                               | 36331E3                       | 86331E3 |
|              | 390                           | 30 x 40                                             | 2.06                                  | 1.56             | 336                                 | 480                                 | 280                               | 400                               | 36391E3                       | 86391E3 |
|              | 390                           | 35 x 30                                             | 1.99                                  | 1.56             | 364                                 | 520                                 | 308                               | 440                               | 26391E3                       | 16391E3 |
|              | 470                           | 30 x 45                                             | 2.34                                  | 1.88             | 280                                 | 400                                 | 231                               | 330                               | 36471E3                       | 86471E3 |
|              | 470                           | 35 x 35                                             | 2.27                                  | 1.88             | 294                                 | 420                                 | 252                               | 360                               | 26471E3                       | 16471E3 |
|              | 560                           | 30 x 50                                             | 2.64                                  | 2.24             | 238                                 | 340                                 | 196                               | 280                               | 36561E3                       | 86561E3 |
|              | 560                           | 35 x 40                                             | 2.54                                  | 2.24             | 252                                 | 360                                 | 210                               | 300                               | 26561E3                       | 16561E3 |
|              | 680                           | 35 x 45                                             | 2.84                                  | 2.72             | 210                                 | 300                                 | 175                               | 250                               | 26681E3                       | 16681E3 |
|              | 820                           | 35 x 50                                             | 3.18                                  | 3.28             | 175                                 | 250                                 | 147                               | 210                               | 26821E3                       | 16821E3 |
|              | 1000                          | 35 x 60                                             | 3.69                                  | 4.00             | 147                                 | 210                                 | 119                               | 170                               | 26102E3                       | 16102E3 |
| 450          | 68                            | 22 x 25                                             | 0.71                                  | 0.31             | 1834                                | 2620                                | 1505                              | 2150                              | 57689E3                       | 67689E3 |
|              | 100                           | 22 x 30                                             | 0.90                                  | 0.45             | 1246                                | 1780                                | 1029                              | 1470                              | 57101E3                       | 67101E3 |
|              | 100                           | 25 x 25                                             | 0.90                                  | 0.45             | 1260                                | 1800                                | 1043                              | 1490                              | 47101E3                       | 77101E3 |
|              | 120                           | 22 x 35                                             | 1.03                                  | 0.54             | 1036                                | 1480                                | 854                               | 1220                              | 57121E3                       | 67121E3 |
|              | 120                           | 25 x 30                                             | 1.03                                  | 0.54             | 1043                                | 1490                                | 861                               | 1230                              | 47121E3                       | 77121E3 |
|              | 150                           | 22 x 40                                             | 1.20                                  | 0.68             | 833                                 | 1190                                | 686                               | 980                               | 57151E3                       | 67151E3 |
|              | 150                           | 30 x 25                                             | 1.18                                  | 0.68             | 868                                 | 1240                                | 721                               | 1030                              | 37151E3                       | 87151E3 |
|              | 180                           | 25 x 35                                             | 1.30                                  | 0.81             | 700                                 | 1000                                | 581                               | 830                               | 47181E3                       | 77181E3 |
|              | 220                           | 25 x 45                                             | 1.59                                  | 0.99             | 574                                 | 820                                 | 476                               | 680                               | 47221E3                       | 77221E3 |
|              | 220                           | 30 x 30                                             | 1.47                                  | 0.99             | 595                                 | 850                                 | 497                               | 710                               | 37221E3                       | 87221E3 |
|              | 220                           | 35 x 25                                             | 1.52                                  | 0.99             | 623                                 | 890                                 | 525                               | 750                               | 27221E3                       | 17221E3 |
|              | 270                           | 25 x 50                                             | 1.84                                  | 1.22             | 469                                 | 670                                 | 385                               | 550                               | 47271E3                       | 77271E3 |
|              | 270                           | 30 x 35                                             | 1.69                                  | 1.22             | 483                                 | 690                                 | 399                               | 570                               | 37271E3                       | 87271E3 |
|              | 270                           | 35 x 30                                             | 1.77                                  | 1.22             | 497                                 | 710                                 | 420                               | 600                               | 27271E3                       | 17271E3 |
|              | 330                           | 30 x 40                                             | 1.92                                  | 1.49             | 399                                 | 570                                 | 329                               | 470                               | 37331E3                       | 87331E3 |
|              | 390                           | 30 x 45                                             | 2.17                                  | 1.76             | 336                                 | 480                                 | 280                               | 400                               | 37391E3                       | 87391E3 |
|              | 390                           | 35 x 35                                             | 2.13                                  | 1.76             | 350                                 | 500                                 | 294                               | 420                               | 27391E3                       | 17391E3 |
|              | 470                           | 35 x 40                                             | 2.39                                  | 2.12             | 294                                 | 420                                 | 245                               | 350                               | 27471E3                       | 17471E3 |
|              | 560                           | 35 x 45                                             | 2.66                                  | 2.52             | 245                                 | 350                                 | 210                               | 300                               | 27561E3                       | 17561E3 |
|              | 680                           | 35 x 55                                             | 3.13                                  | 3.06             | 203                                 | 290                                 | 168                               | 240                               | 27681E3                       | 17681E3 |



| 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>100 Hz <sup>(1)</sup><br>(A) | I <sub>L5</sub><br>(mA) | TYP. ESR<br>100 Hz<br>(mΩ) | MAX. ESR<br>100 Hz<br>(mΩ) | TYP. Z<br>10 kHz<br>(mΩ) | MAX. Z<br>10 kHz<br>(mΩ) | ORDERING CODE<br>MAL2257..... |         |
|                                          |                                  |                                         |                                                |                         |                            |                            |                          |                          | 2-TERM.                       | 3-TERM. |
| 500                                      | 56                               | 22 x 25                                 | 0.67                                           | 0.28                    | 2618                       | 3740                       | 2268                     | 3240                     | 59569E3                       | 69569E3 |
|                                          | 82                               | 22 x 30                                 | 0.85                                           | 0.41                    | 1792                       | 2560                       | 1554                     | 2220                     | 59829E3                       | 69829E3 |
|                                          | 82                               | 25 x 25                                 | 0.85                                           | 0.41                    | 1806                       | 2580                       | 1568                     | 2240                     | 49829E3                       | 79829E3 |
|                                          | 100                              | 22 x 35                                 | 0.97                                           | 0.50                    | 1470                       | 2100                       | 1274                     | 1820                     | 59101E3                       | 69101E3 |
|                                          | 100                              | 25 x 30                                 | 0.98                                           | 0.50                    | 1477                       | 2110                       | 1281                     | 1830                     | 49101E3                       | 79101E3 |
|                                          | 120                              | 22 x 40                                 | 1.12                                           | 0.60                    | 1225                       | 1750                       | 1064                     | 1520                     | 59121E3                       | 69121E3 |
|                                          | 120                              | 30 x 25                                 | 1.10                                           | 0.60                    | 1253                       | 1790                       | 1092                     | 1560                     | 39121E3                       | 89121E3 |
|                                          | 150                              | 25 x 35                                 | 1.23                                           | 0.75                    | 987                        | 1410                       | 861                      | 1230                     | 49151E3                       | 79151E3 |
|                                          | 180                              | 25 x 40                                 | 1.41                                           | 0.90                    | 826                        | 1180                       | 714                      | 1020                     | 49181E3                       | 79181E3 |
|                                          | 180                              | 30 x 30                                 | 1.39                                           | 0.90                    | 840                        | 1200                       | 735                      | 1050                     | 39181E3                       | 89181E3 |
|                                          | 180                              | 35 x 25                                 | 1.44                                           | 0.90                    | 868                        | 1240                       | 770                      | 1100                     | 29181E3                       | 19181E3 |
|                                          | 220                              | 25 x 50                                 | 1.72                                           | 1.10                    | 672                        | 960                        | 588                      | 840                      | 49221E3                       | 79221E3 |
|                                          | 220                              | 30 x 35                                 | 1.59                                           | 1.10                    | 686                        | 980                        | 602                      | 860                      | 39221E3                       | 89221E3 |
|                                          | 220                              | 35 x 30                                 | 1.68                                           | 1.10                    | 700                        | 1000                       | 616                      | 880                      | 29221E3                       | 19221E3 |
|                                          | 270                              | 30 x 40                                 | 1.82                                           | 1.35                    | 560                        | 800                        | 490                      | 700                      | 39271E3                       | 89271E3 |
|                                          | 330                              | 30 x 45                                 | 2.08                                           | 1.65                    | 462                        | 660                        | 406                      | 580                      | 39331E3                       | 89331E3 |
|                                          | 330                              | 35 x 35                                 | 2.05                                           | 1.65                    | 476                        | 680                        | 420                      | 600                      | 29331E3                       | 19331E3 |
|                                          | 390                              | 30 x 50                                 | 2.34                                           | 1.95                    | 392                        | 560                        | 343                      | 490                      | 39391E3                       | 89391E3 |
|                                          | 390                              | 35 x 40                                 | 2.28                                           | 1.95                    | 406                        | 580                        | 357                      | 510                      | 29391E3                       | 19391E3 |
|                                          | 470                              | 35 x 45                                 | 2.55                                           | 2.35                    | 336                        | 480                        | 294                      | 420                      | 29471E3                       | 19471E3 |
|                                          | 560                              | 35 x 50                                 | 2.85                                           | 2.80                    | 287                        | 410                        | 252                      | 360                      | 29561E3                       | 19561E3 |
|                                          | 680                              | 35 x 60                                 | 3.31                                           | 3.40                    | 231                        | 330                        | 210                      | 300                      | 29681E3                       | 19681E3 |

**Note**(1) Ripple currents (I<sub>R</sub>) are based on an (internal) temperature increase of 10 °C

| ADDITIONAL ELECTRICAL DATA         |                               |                                                        |
|------------------------------------|-------------------------------|--------------------------------------------------------|
| PARAMETER                          | CONDITIONS                    | VALUE                                                  |
| <b>Voltage</b>                     |                               |                                                        |
| Surge voltage                      | ≥ 400 V versions              | U <sub>s</sub> = 1.1 x U <sub>R</sub>                  |
|                                    | ≤ 250 V versions              | U <sub>s</sub> = 1.15 x U <sub>R</sub>                 |
| Reverse voltage                    |                               | ≤ 1 V                                                  |
| <b>Current</b>                     |                               |                                                        |
| Leakage current                    | After 5 min at U <sub>R</sub> | I <sub>L5</sub> ≤ 0.01 C <sub>R</sub> x U <sub>R</sub> |
| <b>Inductance</b>                  |                               |                                                        |
| Equivalent series inductance (ESL) | All case sizes                | Typ. 19 nH                                             |
|                                    |                               | Max. 25 nH                                             |

## RIPPLE CURRENT AND USEFUL LIFE

Table 3

| ENDURANCE TEST DURATION AND USEFUL LIFE |                                |
|-----------------------------------------|--------------------------------|
| ENDURANCE<br>AT 85 °C<br>(h)            | USEFUL LIFE<br>AT 85 °C<br>(h) |
| 3000                                    | 5000                           |

### Note

- Multiplier of useful life code: MGA453

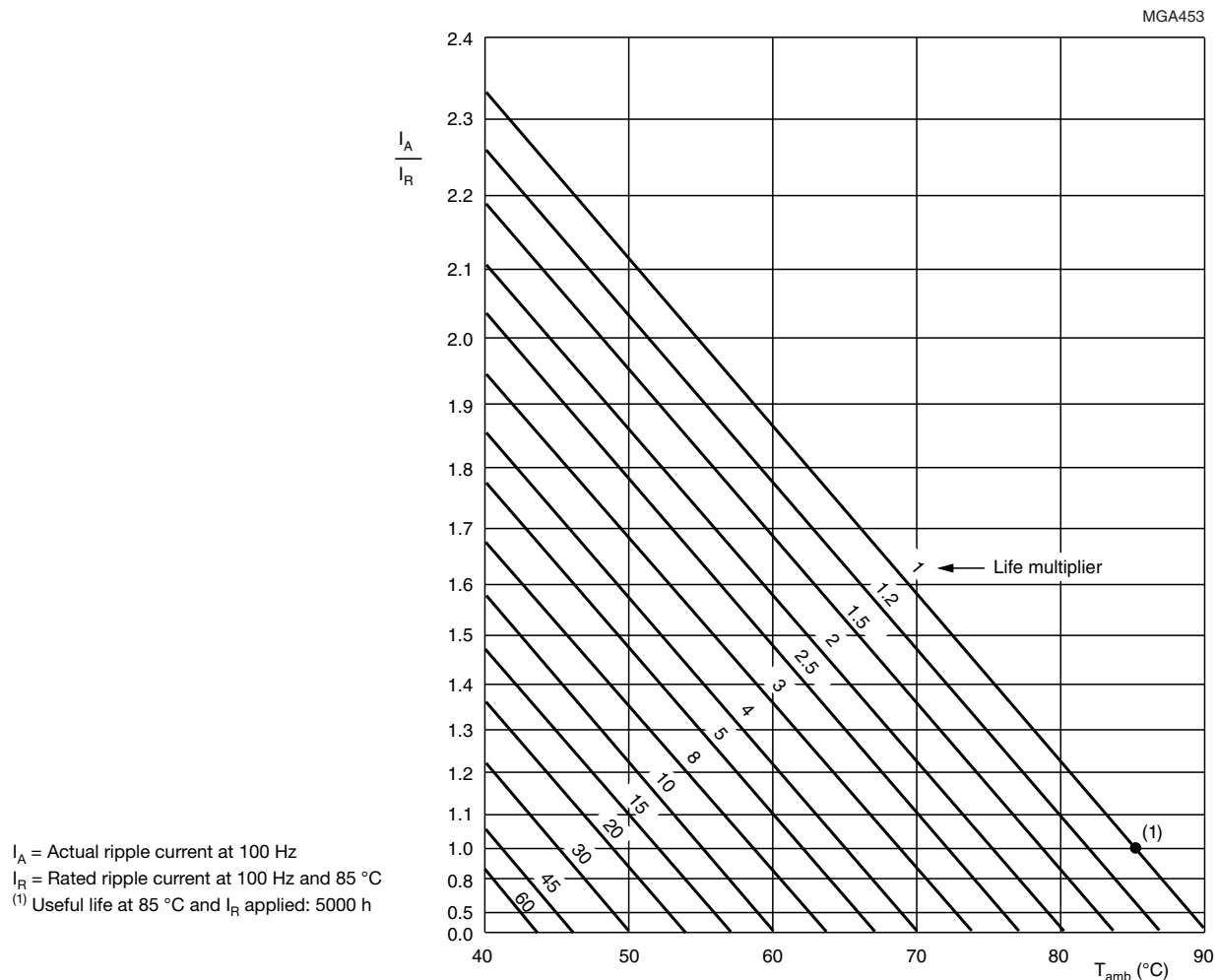


Fig. 6 - Multiplier of useful life as a function of ambient temperature and ripple current load

Table 4

| MULTIPLIER OF RIPPLE CURRENT ( $I_R$ ) AS A FUNCTION OF FREQUENCY |      |      |      |      |          |
|-------------------------------------------------------------------|------|------|------|------|----------|
| FREQUENCY (Hz)                                                    |      |      |      |      |          |
| 50                                                                | 100  | 120  | 200  | 1000 | ≥ 10 000 |
| $I_R$ MULTIPLIER                                                  |      |      |      |      |          |
| 0.80                                                              | 1.00 | 1.05 | 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>EN 130300<br>subclause 4.13 | $T_{amb} = 85\text{ }^{\circ}\text{C}$ ; $U_R$ applied; 3000 h                                                                                        | $\Delta C/C: \pm 15\%$<br>$ESR \leq 1.3 \times \text{spec. limit}$<br>$I_{L5} \leq \text{spec. limit}$ |
| Useful life                                    | CECC 3030<br>subclause 1.8.1                 | $T_{amb} = 85\text{ }^{\circ}\text{C}$ ; $U_R$ and $I_R$ applied; 5000 h                                                                              | $\Delta C/C: \pm 30\%$<br>$ESR \leq 3 \times \text{spec. limit}$<br>$I_{L5} \leq \text{spec. limit}$   |
| Shelf life<br>(storage at<br>high temperature) | IEC 60384-4 /<br>EN 130300<br>subclause 4.17 | $T_{amb} = 85\text{ }^{\circ}\text{C}$ ; no voltage applied; 1000 h<br>After test: $U_R$ to be applied for 30 min,<br>24 h to 48 h before measurement | $\Delta C/C: \pm 15\%$<br>$ESR \leq 1.5 \times \text{spec. limit}$<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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