

## Aluminum Electrolytic Capacitors Power Ultra Long Life Snap-In

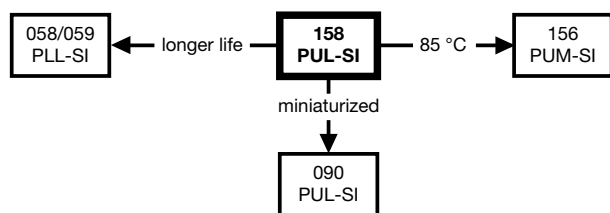


Fig. 1

### QUICK REFERENCE DATA

| DESCRIPTION                                             | VALUE                |
|---------------------------------------------------------|----------------------|
| Nominal case sizes (Ø D x L in mm)                      | 22 x 25 to 35 x 50   |
| Rated capacitance range (E6/E12 series), C <sub>R</sub> | 560 µF to 47 000 µF  |
| Tolerance on C <sub>R</sub>                             | ± 20 %               |
| Rated voltage range, U <sub>R</sub>                     | 16 V to 100 V        |
| Category temperature range                              | -40 °C to +105 °C    |
| Endurance test at 105 °C                                | 2000 h               |
| Useful life at 105 °C                                   | 5000 h               |
| Useful life at 40 °C, 1.9 x I <sub>R</sub> applied      | 125 000 h            |
| Shelf life at 0 V, 105 °C                               | 500 h                |
| Based on sectional specification                        | IEC 60384-4/EN130300 |
| Climatic category IEC 60068                             | 40/105/56            |

### FEATURES

- Useful life: 5000 h at +105 °C
- High ripple current capability
- Keyed polarity version available
- Polarized aluminum electrolytic capacitors, non-solid electrolyte
- Large types, very small dimensions, cylindrical aluminum case, insulated with a blue sleeve
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)


**RoHS**  
COMPLIANT

### APPLICATIONS

- General purpose, industrial telecommunication and audio/video systems
- Smoothing and filtering
- Standard and switched mode power supplies
- Energy storage in pulse systems

### 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)
- Date code (YYMM)
- 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
- Climatic category in accordance with IEC 60068

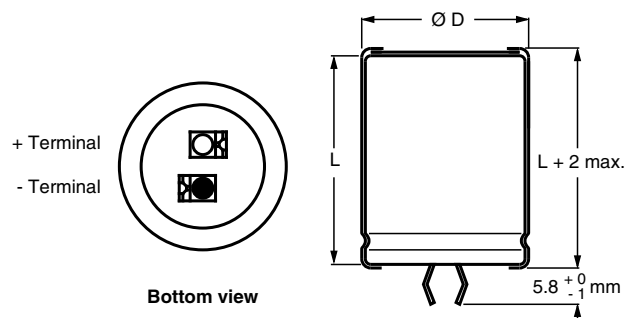
### SELECTION CHART FOR C<sub>R</sub>, U<sub>R</sub>, AND RELEVANT NOMINAL CASE SIZES (Ø D x L in mm)

| C <sub>R</sub><br>(µF) | U <sub>R</sub> (V) |    |    |         |         |         |         |
|------------------------|--------------------|----|----|---------|---------|---------|---------|
|                        | 16                 | 25 | 40 | 50      | 63      | 80      | 100     |
| 560                    | -                  | -  | -  | -       | -       | -       | 22 x 25 |
| 820                    | -                  | -  | -  | -       | -       | 22 x 25 | 22 x 30 |
| 1000                   | -                  | -  | -  | -       | -       | -       | 22 x 35 |
|                        | -                  | -  | -  | -       | -       | -       | 25 x 30 |
| 1200                   | -                  | -  | -  | -       | 22 x 25 | 22 x 30 | 25 x 35 |
| 1500                   | -                  | -  | -  | 22 x 25 | 22 x 30 | 22 x 35 | -       |
|                        | -                  | -  | -  | -       | -       | 25 x 30 | 25 x 40 |
| 1800                   | -                  | -  | -  | -       | -       | 25 x 35 | -       |
|                        | -                  | -  | -  | -       | -       | -       | 30 x 30 |

| <b>SELECTION CHART FOR <math>C_R</math>, <math>U_R</math>, AND RELEVANT NOMINAL CASE SIZES (<math>\varnothing D \times L</math> in mm)</b> |           |         |         |         |         |         |         |
|--------------------------------------------------------------------------------------------------------------------------------------------|-----------|---------|---------|---------|---------|---------|---------|
| $C_R$<br>( $\mu F$ )                                                                                                                       | $U_R$ (V) |         |         |         |         |         |         |
|                                                                                                                                            | 16        | 25      | 40      | 50      | 63      | 80      | 100     |
| 2200                                                                                                                                       | -         | -       | 22 x 25 | 22 x 30 | 22 x 35 | 25 x 40 | 30 x 35 |
|                                                                                                                                            | -         | -       | -       | -       | 25 x 30 | 30 x 30 | -       |
| 2700                                                                                                                                       | -         | -       | -       | 22 x 35 | -       | -       | 30 x 40 |
|                                                                                                                                            | -         | -       | -       | 25 x 30 | 25 x 35 | 30 x 35 | -       |
| 3300                                                                                                                                       | -         | 22 x 25 | 22 x 30 | -       | 25 x 40 | 25 x 50 | 30 x 50 |
|                                                                                                                                            | -         | -       | -       | 25 x 35 | 30 x 30 | -       | 35 x 35 |
| 3900                                                                                                                                       | -         | -       | 22 x 35 | 22 x 45 | -       | 30 x 40 | 35 x 40 |
|                                                                                                                                            | -         | -       | 25 x 30 | 25 x 40 | 30 x 35 | -       | -       |
| 4700                                                                                                                                       | -         | 22 x 30 | 22 x 40 | -       | 30 x 40 | 35 x 35 | 35 x 50 |
|                                                                                                                                            | -         | -       | -       | 30 x 30 | -       | -       | -       |
| 5600                                                                                                                                       | 22 x 25   | -       | -       | 25 x 50 | -       | 35 x 40 | -       |
|                                                                                                                                            | -         | -       | 25 x 35 | 30 x 35 | 35 x 35 | -       | -       |
| 6800                                                                                                                                       | -         | 22 x 35 | -       | 30 x 40 | 30 x 50 | 35 x 50 | -       |
|                                                                                                                                            | -         | 25 x 30 | 30 x 30 | -       | 35 x 40 | -       | -       |
| 8200                                                                                                                                       | 22 x 30   | 22 x 40 | 25 x 50 | -       | 35 x 45 | -       | -       |
|                                                                                                                                            | -         | 25 x 35 | 30 x 35 | 35 x 35 | -       | -       | -       |
| 10 000                                                                                                                                     | 22 x 35   | 25 x 40 | 30 x 40 | 35 x 40 | 35 x 50 | -       | -       |
|                                                                                                                                            | 25 x 30   | 30 x 30 | 35 x 30 | -       | -       | -       | -       |
| 12 000                                                                                                                                     | 22 x 40   | -       | -       | 35 x 45 | -       | -       | -       |
|                                                                                                                                            | 25 x 35   | 30 x 35 | 35 x 35 | -       | -       | -       | -       |
| 15 000                                                                                                                                     | 25 x 40   | 30 x 40 | 35 x 45 | -       | -       | -       | -       |
| 18 000                                                                                                                                     | -         | -       | 35 x 50 | -       | -       | -       | -       |
|                                                                                                                                            | 30 x 35   | 35 x 35 | -       | -       | -       | -       | -       |
| 22 000                                                                                                                                     | 30 x 40   | 30 x 50 | -       | -       | -       | -       | -       |
| 27 000                                                                                                                                     | -         | 35 x 45 | -       | -       | -       | -       | -       |
|                                                                                                                                            | 35 x 35   | -       | -       | -       | -       | -       | -       |
| 33 000                                                                                                                                     | 30 x 50   | 35 x 50 | -       | -       | -       | -       | -       |
|                                                                                                                                            | 35 x 40   | -       | -       | -       | -       | -       | -       |
| 39 000                                                                                                                                     | 35 x 45   | -       | -       | -       | -       | -       | -       |
| 47 000                                                                                                                                     | 35 x 50   | -       | -       | -       | -       | -       | -       |

## 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

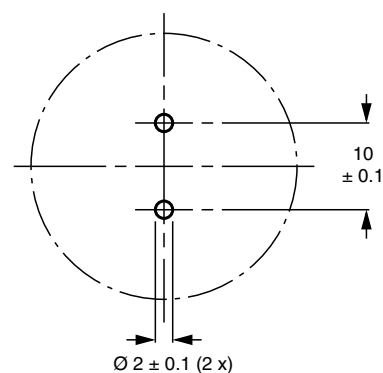
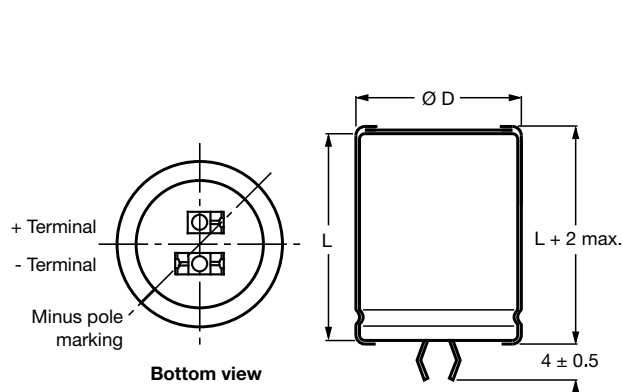
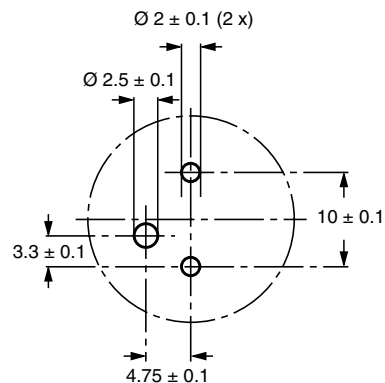


Fig. 3 - Mounting hole diagram

**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</b><br>Ø D x L                                    | Ø D <sub>max.</sub> | L <sub>max.</sub> | <b>MASS</b><br>(g) | <b>PACKAGING QUANTITIES</b><br>(units per box) | <b>CARDBOARD BOX DIMENSIONS</b><br>L x W x H |
| 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                               |
| 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 50                                                                | 26                  | 52                | ≈ 38               | 100                                            | 290 x 280 x 64                               |
| 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 50                                                                | 31                  | 52                | ≈ 50               | 100                                            | 340 x 330 x 64                               |
| 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                               |



| ELECTRICAL DATA |                                                                   |
|-----------------|-------------------------------------------------------------------|
| SYMBOL          | DESCRIPTION                                                       |
| $C_R$           | Rated capacitance at 100 Hz                                       |
| $I_R$           | Rated RMS ripple current at 100 Hz, 105 °C                        |
| $I_{L5}$        | Max. leakage current after 5 min at $U_R$                         |
| ESR             | Typ. / max. equivalent series resistance at 100 Hz <sup>(1)</sup> |
| Z               | Typ. / max. impedance at 10 kHz                                   |

**Notes**

<sup>(1)</sup> ESR at 120 Hz is approximately 0.95 x ESR 100 Hz

- Unless otherwise specified, all electrical values in Table 2 apply at  $T_{amb} = 20\text{ °C}$ ,  $P = 86\text{ kPa}$  to  $106\text{ kPa}$ ,  $RH = 45\text{ %}$  to  $75\text{ %}$

**ORDERING EXAMPLE**

Electrolytic capacitor 158 series

3900  $\mu\text{F}/80\text{ V}$ ;  $\pm 20\text{ %}$

Nominal case size:  $\varnothing 30\text{ mm} \times 40\text{ mm}$

2-terminal snap-in:

Ordering code: MAL2 158 32392 E3

Former 12NC: 2222 158 32392

3-terminal snap-in:

Ordering code: MAL2 158 72392 E3

Former 12NC: 2222 158 72392

Table 2

| ELECTRICAL DATA AND ORDERING INFORMATION |                                      |                                                          |                                  |                                  |                           |                                                    |                                   |                               |         |
|------------------------------------------|--------------------------------------|----------------------------------------------------------|----------------------------------|----------------------------------|---------------------------|----------------------------------------------------|-----------------------------------|-------------------------------|---------|
| $U_R$<br>(V)                             | $C_R$<br>100 Hz<br>( $\mu\text{F}$ ) | NOMINAL<br>CASE SIZE<br>$\varnothing D \times L$<br>(mm) | $I_R$<br>100 Hz<br>105 °C<br>(A) | $I_R$<br>10 kHz<br>105 °C<br>(A) | $I_{L5}$<br>5 min<br>(mA) | MAX. ESR<br>100 Hz <sup>(1)</sup><br>(m $\Omega$ ) | MAX. Z<br>10 kHz<br>(m $\Omega$ ) | ORDERING CODE<br>MAL2158..... |         |
|                                          |                                      |                                                          |                                  |                                  |                           |                                                    |                                   | 2-TERM.                       | 3-TERM. |
| 16                                       | 5600                                 | 22 x 25                                                  | 2.50                             | 2.95                             | 0.18                      | 111                                                | 98                                | 15562E3                       | 55562E3 |
|                                          | 8200                                 | 22 x 30                                                  | 3.10                             | 3.66                             | 0.27                      | 79                                                 | 70                                | 15822E3                       | 55822E3 |
|                                          | 10 000                               | 22 x 35                                                  | 3.56                             | 4.20                             | 0.32                      | 65                                                 | 58                                | 15103E3                       | 55103E3 |
|                                          | 10 000                               | 25 x 30                                                  | 3.42                             | 4.04                             | 0.32                      | 70                                                 | 63                                | 25103E3                       | 65103E3 |
|                                          | 12 000                               | 22 x 40                                                  | 4.00                             | 4.72                             | 0.39                      | 56                                                 | 50                                | 15123E3                       | 55123E3 |
|                                          | 12 000                               | 25 x 35                                                  | 3.91                             | 4.61                             | 0.39                      | 59                                                 | 53                                | 25123E3                       | 65123E3 |
|                                          | 15 000                               | 25 x 40                                                  | 4.39                             | 5.18                             | 0.48                      | 49                                                 | 45                                | 25153E3                       | 65153E3 |
|                                          | 15 000                               | 30 x 30                                                  | 3.80                             | 4.48                             | 0.48                      | 61                                                 | 55                                | 35153E3                       | 75153E3 |
|                                          | 18 000                               | 30 x 35                                                  | 4.36                             | 5.14                             | 0.58                      | 50                                                 | 46                                | 35183E3                       | 75183E3 |
|                                          | 22 000                               | 30 x 40                                                  | 4.85                             | 5.72                             | 0.71                      | 43                                                 | 39                                | 35223E3                       | 75223E3 |
|                                          | 27 000                               | 35 x 35                                                  | 4.49                             | 5.30                             | 0.87                      | 49                                                 | 43                                | 45273E3                       | 85273E3 |
|                                          | 33 000                               | 30 x 50                                                  | 5.70                             | 6.73                             | 1.06                      | 33                                                 | 31                                | 35333E3                       | 75333E3 |
|                                          | 33 000                               | 35 x 40                                                  | 4.97                             | 5.86                             | 1.06                      | 42                                                 | 37                                | 45333E3                       | 85333E3 |
|                                          | 39 000                               | 35 x 45                                                  | 5.42                             | 6.40                             | 1.25                      | 37                                                 | 33                                | 45393E3                       | 85393E3 |
| 25                                       | 47 000                               | 35 x 50                                                  | 5.80                             | 6.84                             | 1.51                      | 33                                                 | 30                                | 45473E3                       | 85473E3 |
|                                          | 3300                                 | 22 x 25                                                  | 2.27                             | 2.68                             | 0.17                      | 130                                                | 105                               | 16332E3                       | 56332E3 |
|                                          | 4700                                 | 22 x 30                                                  | 2.82                             | 3.33                             | 0.24                      | 93                                                 | 76                                | 16472E3                       | 56472E3 |
|                                          | 6800                                 | 22 x 35                                                  | 3.37                             | 3.98                             | 0.34                      | 69                                                 | 57                                | 16682E3                       | 56682E3 |
|                                          | 6800                                 | 25 x 30                                                  | 3.25                             | 3.84                             | 0.34                      | 74                                                 | 62                                | 26682E3                       | 66682E3 |
|                                          | 8200                                 | 22 x 40                                                  | 3.79                             | 4.47                             | 0.41                      | 58                                                 | 49                                | 16822E3                       | 56822E3 |
|                                          | 8200                                 | 25 x 35                                                  | 3.72                             | 4.39                             | 0.41                      | 62                                                 | 52                                | 26822E3                       | 66822E3 |
|                                          | 10 000                               | 25 x 40                                                  | 4.18                             | 4.93                             | 0.50                      | 52                                                 | 44                                | 26103E3                       | 66103E3 |
|                                          | 10 000                               | 30 x 30                                                  | 3.65                             | 4.31                             | 0.50                      | 64                                                 | 55                                | 36103E3                       | 76103E3 |
|                                          | 12 000                               | 30 x 35                                                  | 4.19                             | 4.94                             | 0.60                      | 53                                                 | 46                                | 36123E3                       | 76123E3 |
|                                          | 15 000                               | 30 x 40                                                  | 4.66                             | 5.50                             | 0.75                      | 45                                                 | 39                                | 36153E3                       | 76153E3 |
|                                          | 18 000                               | 35 x 35                                                  | 4.36                             | 5.14                             | 0.90                      | 51                                                 | 43                                | 46183E3                       | 86183E3 |
|                                          | 22 000                               | 30 x 50                                                  | 5.52                             | 6.51                             | 1.10                      | 35                                                 | 31                                | 36223E3                       | 76223E3 |
|                                          | 22 000                               | 35 x 40                                                  | 4.83                             | 5.70                             | 1.10                      | 44                                                 | 37                                | 46223E3                       | 86223E3 |
|                                          | 27 000                               | 35 x 45                                                  | 5.24                             | 6.18                             | 1.35                      | 39                                                 | 33                                | 46273E3                       | 86273E3 |
|                                          | 33 000                               | 35 x 50                                                  | 5.32                             | 6.27                             | 1.65                      | 36                                                 | 31                                | 46333E3                       | 86333E3 |



| 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<br>105 °C<br>(A) | I <sub>R</sub><br>10 kHz<br>105 °C<br>(A) | I <sub>L5</sub><br>5 min<br>(mA) | MAX. ESR<br>100 Hz <sup>(1)</sup><br>(mΩ) | MAX. Z<br>10 kHz<br>(mΩ) | ORDERING CODE<br>MAL2158..... |         |
|                                          |                                  |                                         |                                           |                                           |                                  |                                           |                          | 2-TERM.                       | 3-TERM. |
| 40                                       | 2200                             | 22 x 25                                 | 2.17                                      | 2.65                                      | 0.18                             | 131                                       | 100                      | 17222E3                       | 57222E3 |
|                                          | 3300                             | 22 x 30                                 | 2.73                                      | 3.33                                      | 0.27                             | 91                                        | 70                       | 17332E3                       | 57332E3 |
|                                          | 3900                             | 22 x 35                                 | 3.12                                      | 3.81                                      | 0.32                             | 77                                        | 59                       | 17392E3                       | 57392E3 |
|                                          | 3900                             | 25 x 30                                 | 3.02                                      | 3.68                                      | 0.32                             | 83                                        | 65                       | 27392E3                       | 67392E3 |
|                                          | 4700                             | 22 x 40                                 | 3.52                                      | 4.29                                      | 0.38                             | 65                                        | 51                       | 17472E3                       | 57472E3 |
|                                          | 5600                             | 25 x 35                                 | 3.53                                      | 4.31                                      | 0.45                             | 63                                        | 51                       | 27562E3                       | 67562E3 |
|                                          | 6800                             | 30 x 30                                 | 3.39                                      | 4.14                                      | 0.55                             | 69                                        | 56                       | 37682E3                       | 77682E3 |
|                                          | 8200                             | 25 x 50                                 | 4.72                                      | 5.76                                      | 0.66                             | 44                                        | 36                       | 27822E3                       | 67822E3 |
|                                          | 8200                             | 30 x 35                                 | 3.90                                      | 4.76                                      | 0.66                             | 57                                        | 47                       | 37822E3                       | 77822E3 |
|                                          | 10 000                           | 30 x 40                                 | 4.36                                      | 5.32                                      | 0.80                             | 48                                        | 40                       | 37103E3                       | 77103E3 |
|                                          | 12 000                           | 35 x 35                                 | 4.00                                      | 4.88                                      | 0.96                             | 56                                        | 45                       | 47123E3                       | 87123E3 |
|                                          | 15 000                           | 35 x 45                                 | 4.99                                      | 6.09                                      | 1.20                             | 42                                        | 35                       | 47153E3                       | 87153E3 |
|                                          | 18 000                           | 35 x 50                                 | 5.36                                      | 6.54                                      | 1.44                             | 38                                        | 31                       | 47183E3                       | 87183E3 |
| 50                                       | 1500                             | 22 x 25                                 | 1.99                                      | 2.43                                      | 0.15                             | 148                                       | 102                      | 11152E3                       | 51152E3 |
|                                          | 2200                             | 22 x 30                                 | 2.50                                      | 3.05                                      | 0.22                             | 104                                       | 73                       | 11222E3                       | 51222E3 |
|                                          | 2700                             | 22 x 35                                 | 2.88                                      | 3.51                                      | 0.27                             | 85                                        | 60                       | 11272E3                       | 51272E3 |
|                                          | 2700                             | 25 x 30                                 | 2.81                                      | 3.43                                      | 0.27                             | 91                                        | 66                       | 21272E3                       | 61272E3 |
|                                          | 3300                             | 22 x 40                                 | 3.27                                      | 3.99                                      | 0.33                             | 71                                        | 51                       | 11332E3                       | 51332E3 |
|                                          | 3300                             | 25 x 35                                 | 3.23                                      | 3.94                                      | 0.33                             | 75                                        | 55                       | 21332E3                       | 61332E3 |
|                                          | 3900                             | 25 x 40                                 | 3.62                                      | 4.42                                      | 0.39                             | 64                                        | 47                       | 21392E3                       | 61392E3 |
|                                          | 4700                             | 30 x 30                                 | 3.24                                      | 3.95                                      | 0.47                             | 74                                        | 57                       | 31472E3                       | 71472E3 |
|                                          | 5600                             | 25 x 50                                 | 4.43                                      | 5.40                                      | 0.56                             | 48                                        | 36                       | 21562E3                       | 61562E3 |
|                                          | 5600                             | 30 x 35                                 | 3.73                                      | 4.55                                      | 0.56                             | 61                                        | 47                       | 31562E3                       | 71562E3 |
|                                          | 6800                             | 30 x 40                                 | 4.17                                      | 5.09                                      | 0.68                             | 52                                        | 41                       | 31682E3                       | 71682E3 |
|                                          | 8200                             | 35 x 35                                 | 3.88                                      | 4.73                                      | 0.82                             | 61                                        | 46                       | 41822E3                       | 81822E3 |
|                                          | 10 000                           | 35 x 40                                 | 4.33                                      | 5.28                                      | 1.00                             | 52                                        | 40                       | 41103E3                       | 81103E3 |
|                                          | 12 000                           | 35 x 45                                 | 4.72                                      | 5.76                                      | 1.20                             | 46                                        | 35                       | 41123E3                       | 81123E3 |
| 63                                       | 1200                             | 22 x 25                                 | 2.07                                      | 2.53                                      | 0.16                             | 137                                       | 100                      | 18122E3                       | 58122E3 |
|                                          | 1500                             | 22 x 30                                 | 2.49                                      | 3.04                                      | 0.19                             | 107                                       | 78                       | 18152E3                       | 58152E3 |
|                                          | 2200                             | 22 x 35                                 | 3.00                                      | 3.66                                      | 0.26                             | 79                                        | 58                       | 18222E3                       | 58222E3 |
|                                          | 2200                             | 25 x 30                                 | 2.90                                      | 3.54                                      | 0.28                             | 85                                        | 64                       | 28222E3                       | 68222E3 |
|                                          | 2700                             | 25 x 35                                 | 3.34                                      | 4.07                                      | 0.34                             | 70                                        | 53                       | 28272E3                       | 68272E3 |
|                                          | 3300                             | 25 x 40                                 | 3.76                                      | 4.59                                      | 0.42                             | 59                                        | 45                       | 28332E3                       | 68332E3 |
|                                          | 3300                             | 30 x 30                                 | 3.28                                      | 4.00                                      | 0.42                             | 74                                        | 58                       | 38332E3                       | 78332E3 |
|                                          | 3900                             | 30 x 35                                 | 3.77                                      | 4.60                                      | 0.50                             | 61                                        | 48                       | 38392E3                       | 78392E3 |
|                                          | 4700                             | 30 x 40                                 | 4.22                                      | 5.15                                      | 0.60                             | 52                                        | 41                       | 38472E3                       | 78472E3 |
|                                          | 5600                             | 35 x 35                                 | 3.97                                      | 4.84                                      | 0.71                             | 59                                        | 47                       | 48562E3                       | 88562E3 |
|                                          | 6800                             | 30 x 50                                 | 5.04                                      | 6.15                                      | 0.86                             | 40                                        | 33                       | 38682E3                       | 78682E3 |
|                                          | 6800                             | 35 x 40                                 | 4.42                                      | 5.39                                      | 0.86                             | 51                                        | 40                       | 48682E3                       | 88682E3 |
|                                          | 8200                             | 35 x 45                                 | 4.82                                      | 5.88                                      | 1.04                             | 45                                        | 35                       | 48822E3                       | 88822E3 |
|                                          | 10 000                           | 35 x 50                                 | 5.17                                      | 6.31                                      | 1.26                             | 40                                        | 32                       | 48103E3                       | 88103E3 |

**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<br>105 °C<br>(A) | $I_R$<br>10 kHz<br>105 °C<br>(A) | $I_{L5}$<br>5 min<br>(mA) | MAX. ESR<br>100 Hz <sup>(1)</sup><br>(m $\Omega$ ) | MAX. Z<br>10 kHz<br>(m $\Omega$ ) | ORDERING CODE<br>MAL2158..... |         |
|--------------|-------------------------------|-----------------------------------------------------|----------------------------------|----------------------------------|---------------------------|----------------------------------------------------|-----------------------------------|-------------------------------|---------|
|              |                               |                                                     |                                  |                                  |                           |                                                    |                                   | 2-TERM.                       | 3-TERM. |
| 80           | 820                           | 22 x 25                                             | 1.44                             | 1.76                             | 0.14                      | 422                                                | 397                               | 12821E3                       | 52821E3 |
|              | 1200                          | 22 x 30                                             | 1.82                             | 2.22                             | 0.20                      | 291                                                | 274                               | 12122E3                       | 52122E3 |
|              | 1500                          | 22 x 35                                             | 2.12                             | 2.59                             | 0.24                      | 234                                                | 221                               | 12152E3                       | 52152E3 |
|              | 1500                          | 25 x 30                                             | 2.10                             | 2.56                             | 0.24                      | 240                                                | 228                               | 22152E3                       | 62152E3 |
|              | 1800                          | 25 x 35                                             | 2.41                             | 2.94                             | 0.29                      | 201                                                | 189                               | 22182E3                       | 62182E3 |
|              | 2200                          | 25 x 40                                             | 2.74                             | 3.34                             | 0.36                      | 166                                                | 156                               | 22222E3                       | 62222E3 |
|              | 2200                          | 30 x 30                                             | 2.55                             | 3.11                             | 0.36                      | 180                                                | 172                               | 32222E3                       | 72222E3 |
|              | 2700                          | 30 x 35                                             | 2.93                             | 3.57                             | 0.44                      | 147                                                | 141                               | 32272E3                       | 72272E3 |
|              | 3300                          | 25 x 50                                             | 3.46                             | 4.22                             | 0.53                      | 114                                                | 109                               | 22332E3                       | 62332E3 |
|              | 3900                          | 30 x 40                                             | 3.39                             | 4.14                             | 0.63                      | 110                                                | 106                               | 32392E3                       | 72392E3 |
|              | 4700                          | 35 x 35                                             | 3.29                             | 4.01                             | 0.76                      | 110                                                | 107                               | 42472E3                       | 82472E3 |
|              | 5600                          | 35 x 40                                             | 3.69                             | 4.50                             | 0.90                      | 93                                                 | 90                                | 42562E3                       | 82562E3 |
|              | 6800                          | 35 x 50                                             | 4.43                             | 5.40                             | 1.09                      | 75                                                 | 71                                | 42682E3                       | 82682E3 |
| 100          | 560                           | 22 x 25                                             | 1.33                             | 1.62                             | 0.12                      | 461                                                | 412                               | 19561E3                       | 59561E3 |
|              | 820                           | 22 x 30                                             | 1.69                             | 2.06                             | 0.17                      | 318                                                | 284                               | 19821E3                       | 59821E3 |
|              | 1000                          | 22 x 35                                             | 1.95                             | 2.38                             | 0.20                      | 261                                                | 234                               | 19102E3                       | 59102E3 |
|              | 1000                          | 25 x 30                                             | 1.95                             | 2.38                             | 0.20                      | 267                                                | 240                               | 29102E3                       | 69102E3 |
|              | 1200                          | 25 x 35                                             | 2.23                             | 2.72                             | 0.24                      | 223                                                | 200                               | 29122E3                       | 69122E3 |
|              | 1500                          | 25 x 40                                             | 2.56                             | 3.12                             | 0.30                      | 180                                                | 162                               | 29152E3                       | 69152E3 |
|              | 1800                          | 30 x 30                                             | 2.49                             | 3.04                             | 0.36                      | 172                                                | 158                               | 39182E3                       | 79182E3 |
|              | 2200                          | 30 x 35                                             | 2.87                             | 3.50                             | 0.44                      | 141                                                | 129                               | 39222E3                       | 79222E3 |
|              | 2700                          | 30 x 40                                             | 3.24                             | 3.95                             | 0.54                      | 117                                                | 108                               | 39272E3                       | 79272E3 |
|              | 3300                          | 30 x 50                                             | 3.87                             | 4.72                             | 0.66                      | 94                                                 | 87                                | 39332E3                       | 79332E3 |
|              | 3300                          | 35 x 35                                             | 3.19                             | 3.89                             | 0.66                      | 115                                                | 107                               | 49332E3                       | 89332E3 |
|              | 3900                          | 35 x 40                                             | 3.58                             | 4.37                             | 0.78                      | 98                                                 | 91                                | 49392E3                       | 89392E3 |
|              | 4700                          | 35 x 50                                             | 4.29                             | 5.23                             | 0.94                      | 78                                                 | 73                                | 49472E3                       | 89472E3 |

**ADDITIONAL ELECTRICAL DATA**

| PARAMETER                          | CONDITIONS           | VALUE                                              |
|------------------------------------|----------------------|----------------------------------------------------|
| <b>Voltage</b>                     |                      |                                                    |
| Surge voltage                      |                      | $U_S = 1.15 \times U_R$                            |
| Reverse voltage                    |                      | $U_{rev} \leq 1 \text{ V}$                         |
| <b>Current</b>                     |                      |                                                    |
| Leakage current                    | After 1 min at $U_R$ | $I_{L1} \leq 0.006 C_R \times U_R + 4 \mu\text{A}$ |
|                                    | After 5 min at $U_R$ | $I_{L5} \leq 0.002 C_R \times U_R + 4 \mu\text{A}$ |
| <b>Inductance</b>                  |                      |                                                    |
| Equivalent series inductance (ESL) | All case sizes       | Typ. 19 nH                                         |
|                                    |                      | Max. 25 nH                                         |

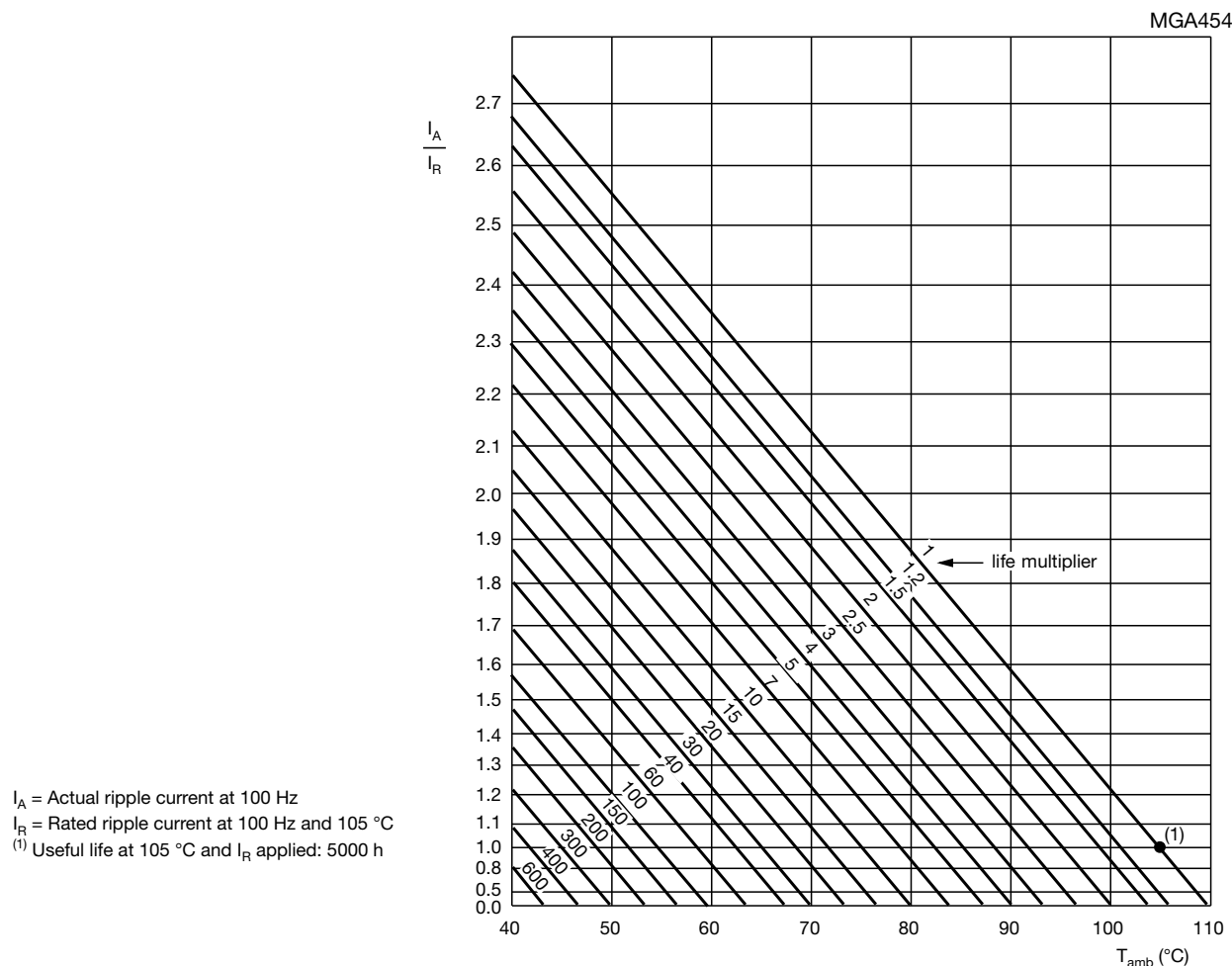
**RIPPLE CURRENT AND USEFUL LIFE**


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

**Table 3**

| MULTIPLIER OF RIPPLE CURRENT ( $I_R$ ) AS A FUNCTION OF FREQUENCY |                                    |                                     |
|-------------------------------------------------------------------|------------------------------------|-------------------------------------|
| FREQUENCY<br>(Hz)                                                 | $I_R$ MULTIPLIER                   |                                     |
|                                                                   | $U_R = 16\text{ V TO }25\text{ V}$ | $U_R = 40\text{ V TO }100\text{ V}$ |
| 50                                                                | 0.93                               | 0.91                                |
| 100                                                               | 1.00                               | 1.00                                |
| 200                                                               | 1.04                               | 1.05                                |
| 400                                                               | 1.07                               | 1.09                                |
| 1000                                                              | 1.11                               | 1.13                                |
| 2000                                                              | 1.13                               | 1.15                                |
| 4000                                                              | 1.15                               | 1.18                                |
| $\geq 10\ 000$                                                    | 1.18                               | 1.22                                |



Table 4

| TEST PROCEDURES AND REQUIREMENTS               |                                            |                                                                                                                                                          |                                                                                                                                                                                                                                                |
|------------------------------------------------|--------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| TEST                                           |                                            | PROCEDURE<br>(quick reference)                                                                                                                           | REQUIREMENTS                                                                                                                                                                                                                                   |
| NAME OF TEST                                   | REFERENCE                                  |                                                                                                                                                          |                                                                                                                                                                                                                                                |
| Endurance                                      | IEC 60384-4/<br>EN130300<br>subclause 4.13 | $T_{amb} = 105\text{ }^{\circ}\text{C}$ ; $U_R$ applied;<br>2000 h                                                                                       | $\Delta C/C: \pm 15\%$<br>$ESR \leq 1.3 \times \text{spec. limit}$<br>$Z \leq 2 \times \text{spec. limit}$<br>$I_{L5} \leq \text{spec. limit}$                                                                                                 |
| Useful life                                    | CECC 30301<br>subclause 1.8.1              | $T_{amb} = 105\text{ }^{\circ}\text{C}$ ; $U_R$ and $I_R$ applied;<br>5000 h                                                                             | $\Delta C/C: \pm 20\%$<br>$ESR \leq 3 \times \text{spec. limit}$<br>$Z \leq 3 \times \text{spec. limit}$<br>$I_{L5} \leq \text{spec. limit}$<br>no short or open circuit,<br>no visible damage<br>total failure percentage:<br>$U_R: \leq 1\%$ |
| Shelf life<br>(storage at<br>high temperature) | IEC 60384-4/<br>EN130300<br>subclause 4.17 | $T_{amb} = 105\text{ }^{\circ}\text{C}$ ; no voltage applied;<br>500 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>$I_{L5} \leq 2 \times \text{spec. limit}$                                                                                                                                |





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