

## Aluminum Capacitors Power Ultra Miniature Snap-In

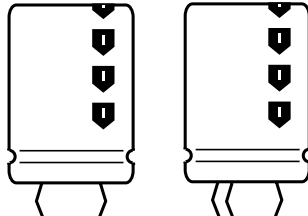
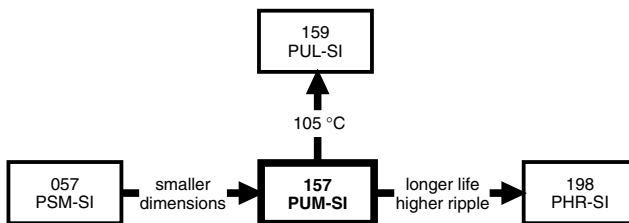


Fig.1 Component outlines


**FEATURES**

- Polarized aluminum electrolytic capacitors, non-solid electrolyte
- Large types, very small dimensions, cylindrical aluminum case, insulated with a blue sleeve
- Useful life: 5000 hours at 85 °C
- Keyed polarity version available


**RoHS  
COMPLIANT**
**APPLICATIONS**

- General purpose, industrial 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  $\mu\text{F}$ )
- Tolerance on rated capacitance, code letter in accordance with IEC 60062 (M for  $\pm 20\%$ )
- Rated voltage (in V)
- Date code (YYMM)
- 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, all 12 or last 8 digits (2222) 157 xxxxx
- Climatic category in accordance with IEC 60068

**QUICK REFERENCE DATA**

| DESCRIPTION  | VALUE                                  |
|--|--|
| Nominal case sizes<br>( $\varnothing$ D x L in mm) | 22 x 25<br>to 35 x 60                  |
| Rated capacitance range<br>(E6/E12 series), $C_R$  | 56 $\mu\text{F}$ to 2200 $\mu\text{F}$ |
| Tolerance on $C_R$                                 | $\pm 20\%$                             |
| Rated voltage range, $U_R$                         | 200 V, 250 V   400 V, 450 V            |
| Category temperature range                         | - 25 to + 85 °C                        |
| Endurance test at 85 °C                            | 3000 hours                             |
| Load life at 85 °C                                 | 3000 hours                             |
| Useful life at 85 °C                               | 5000 hours                             |
| Useful life at 40 °C,<br>1.4 x $I_R$ applied       | 90 000 hours                           |
| Shelf life at 0 V, 85 °C                           | 1000 hours                             |
| Based on sectional<br>specification                | IEC 60384-4/EN130300                   |
| Climatic category IEC 60038                        | 25/085/56                              |

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

| $C_R$<br>( $\mu\text{F}$ ) | $U_R$ (V) |     |         |         |
|----------------------------|-----------|-----|---------|---------|
|                            | 200       | 250 | 400     | 450     |
| 56                         | -         | -   | -       | 22 x 25 |
| 68                         | -         | -   | 22 x 25 | 22 x 30 |
| 82                         | -         | -   | 22 x 25 | 22 x 30 |
|                            | -         | -   | -       | 25 x 25 |
| 100                        | -         | -   | 22 x 30 | 22 x 35 |
|                            | -         | -   | -       | 25 x 30 |
| 120                        | -         | -   | 22 x 30 | 22 x 40 |
|                            | -         | -   | -       | 25 x 30 |
|                            | -         | -   | -       | 30 x 25 |

| <b>SELECTION CHART FOR C<sub>R</sub>, U<sub>R</sub> AND RELEVANT NOMINAL CASE SIZES (∅ D x L in mm)</b> |                    |         |         |         |
|---|--------------------|---------|---------|---------|
| C <sub>R</sub><br>(μF)  | U <sub>R</sub> (V) |         |         |         |
|   | 200                | 250     | 400     | 450     |
| 150   | -                  | -       | 22 x 35 | 25 x 35 |
|   | -                  | -       | 25 x 30 | 25 x 40 |
|   | -                  | -       | -       | 30 x 30 |
| 180   | -                  | -       | 22 x 40 | 25 x 40 |
|   | -                  | -       | 25 x 35 | 30 x 35 |
|   | -                  | -       | -       | 35 x 25 |
| 220   | -                  | 22 x 30 | 25 x 40 | 25 x 50 |
|   | -                  | -       | 30 x 30 | 30 x 40 |
|   | -                  | -       | 35 x 25 | 35 x 30 |
| 270   | 22 x 25            | 22 x 30 | 25 x 45 | 30 x 45 |
|   | -                  | 25 x 25 | 30 x 35 | 35 x 35 |
|   | -                  | -       | 35 x 30 | -       |
| 330   | 22 x 30            | 22 x 35 | 30 x 40 | 30 x 50 |
|   | -                  | 25 x 30 | 35 x 30 | 35 x 40 |
| 390   | 22 x 30            | 22 x 40 | 30 x 45 | 35 x 45 |
|   | -                  | 30 x 25 | 35 x 35 | -       |
| 470   | 22 x 35            | 25 x 35 | 30 x 50 | 35 x 50 |
|   | 25 x 30            | 30 x 30 | 35 x 40 | -       |
| 560   | 22 x 40            | 25 x 40 | 35 x 45 | -       |
|   | 25 x 35            | 30 x 30 | -       | -       |
|   | 30 x 25            | 35 x 25 | -       | -       |
| 680   | 25 x 40            | 25 x 45 | 35 x 50 | 35 x 60 |
|   | 30 x 30            | 30 x 35 | -       | -       |
|   | 35 x 25            | 35 x 30 | -       | -       |
| 820   | 25 x 45            | 30 x 40 | 35 x 60 | -       |
|   | 30 x 35            | 35 x 35 | -       | -       |
|   | 35 x 30            | -       | -       | -       |
| 1000  | 30 x 40            | 30 x 45 | -       | -       |
|   | 35 x 30            | 35 x 40 | -       | -       |
| 1200  | 30 x 45            | 35 x 45 | -       | -       |
|   | 35 x 35            | -       | -       | -       |
| 1500  | 30 x 50            | 35 x 50 | -       | -       |
|   | 35 x 40            | -       | -       | -       |
| 1800  | 35 x 45            | -       | -       | -       |
| 2200  | 35 x 50            | -       | -       | -       |

## DIMENSIONS in millimeters AND AVAILABLE FORMS

### TWO TERMINAL SNAP-IN

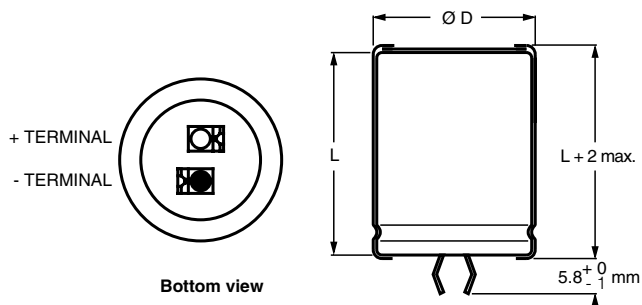


Fig.2 Two terminal snap-in

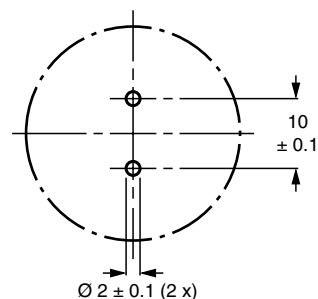
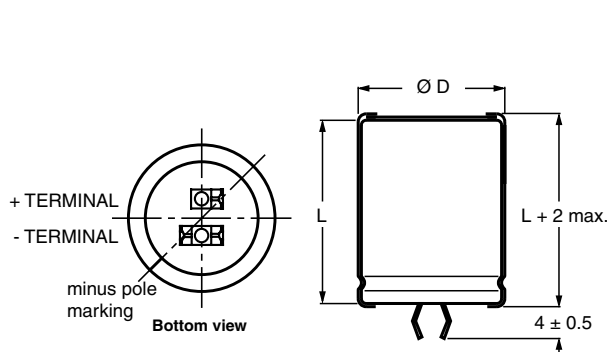


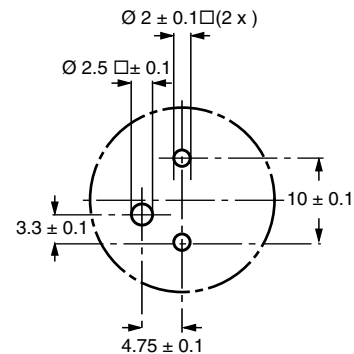
Fig.3 Mounting hole diagram

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

**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>$\varnothing D \times L$                   | $\varnothing D_{\text{max.}}$ | $L_{\text{max.}}$ | <b>MASS</b><br>(g) | <b>PACKAGING QUANTITIES</b><br>(units per box) |
| 22 x 25  | 23                            | 27                | ≈ 12               | 100  |
| 22 x 30  | 23                            | 32                | ≈ 16               | 100  |
| 22 x 35  | 23                            | 37                | ≈ 20               | 100  |
| 22 x 40  | 23                            | 42                | ≈ 23               | 100  |
| 25 x 25  | 26                            | 27                | ≈ 20               | 100  |
| 25 x 30  | 26                            | 32                | ≈ 22               | 100  |
| 25 x 35  | 26                            | 37                | ≈ 24               | 100  |
| 25 x 40  | 26                            | 42                | ≈ 27               | 100  |
| 25 x 45  | 26                            | 47                | ≈ 32               | 100  |
| 25 x 50  | 26                            | 52                | ≈ 38               | 100  |
| 30 x 25  | 31                            | 27                | ≈ 25               | 100  |
| 30 x 30  | 31                            | 32                | ≈ 30               | 100  |
| 30 x 35  | 31                            | 37                | ≈ 35               | 100  |
| 30 x 40  | 31                            | 42                | ≈ 40               | 100  |
| 30 x 45  | 31                            | 47                | ≈ 45               | 100  |
| 30 x 50  | 31                            | 52                | ≈ 50               | 100  |
| 35 x 25  | 36                            | 27                | ≈ 33               | 50   |
| 35 x 30  | 36                            | 32                | ≈ 40               | 50   |
| 35 x 35  | 36                            | 37                | ≈ 48               | 50   |
| 35 x 40  | 36                            | 42                | ≈ 55               | 50   |
| 35 x 45  | 36                            | 47                | ≈ 63               | 50   |
| 35 x 50  | 36                            | 52                | ≈ 72               | 50   |
| 35 x 60  | 36                            | 62                | ≈ 82               | 50   |



| ELECTRICAL DATA |   |
|-----------------|---|
| SYMBOL          | DESCRIPTION   |
| $C_R$           | rated capacitance at 100/120 Hz                                 |
| $I_R$           | rated RMS ripple current at 120 Hz, 85 °C                       |
| $I_{L5}$        | max. leakage current after 5 minutes 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  $T_{amb} = 20\text{ °C}$ ,  $P = 86\text{ to }106\text{ kPa}$ ,  $RH = 45\text{ to }75\%$

**ORDERING EXAMPLE**

Electrolytic capacitor 157 series  
1000  $\mu\text{F}/200\text{ V}$ ;  $\pm 20\%$   
Nominal case size:  $\varnothing 30 \times 40\text{ mm}$   
2-terminal snap-in:  
Ordering code: MAL2 157 52102 E3  
Former 12NC: 2222 157 52102  
3-terminal snap-in:  
Ordering code: MAL2 157 72102 E3  
Former 12NC: 2222 157 72102

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>120 Hz<br>85 °C<br>(A) | $I_{L5}$<br>5 min<br>(mA) | TYP. ESR<br>100 Hz <sup>(1)</sup><br>(M $\Omega$ ) | MAX. ESR<br>100 Hz <sup>(1)</sup><br>(M $\Omega$ ) | TYP. Z<br>10 kHz<br>(M $\Omega$ ) | MAX. Z<br>10 kHz<br>(M $\Omega$ ) | ORDERING<br>CODE<br>MAL2157..... |         |
|  |                                      |  |                                 |                           |  |  |                                   |                                   | 2-TERM.                          | 3-TERM. |
| 200                                      | 270                                  | 22 x 25  | 1.15                            | 0.54                      | 550  | 880  | 420                               | 700                               | 52271E3                          | 72271E3 |
|  | 330                                  | 22 x 30  | 1.36                            | 0.66                      | 430  | 720  | 300                               | 500                               | 52331E3                          | 72331E3 |
|  | 390                                  | 22 x 30  | 1.46                            | 0.78                      | 390  | 650  | 295                               | 490                               | 52391E3                          | 72391E3 |
|  | 470                                  | 22 x 35  | 1.68                            | 0.94                      | 350  | 580  | 240                               | 400                               | 32471E3                          | 12471E3 |
|  | 470                                  | 25 x 30  | 1.67                            | 0.94                      | 350  | 580  | 240                               | 400                               | 52471E3                          | 72471E3 |
|  | 560                                  | 22 x 40  | 1.91                            | 1.12                      | 255  | 425  | 235                               | 390                               | 42561E3                          | 22561E3 |
|  | 560                                  | 25 x 35  | 1.91                            | 1.12                      | 255  | 425  | 235                               | 390                               | 32561E3                          | 12561E3 |
|  | 560                                  | 30 x 25  | 1.89                            | 1.12                      | 255  | 425  | 235                               | 390                               | 52561E3                          | 72561E3 |
|  | 680                                  | 25 x 40  | 2.18                            | 1.36                      | 210  | 350  | 205                               | 340                               | 42681E3                          | 22681E3 |
|  | 680                                  | 30 x 30  | 2.04                            | 1.36                      | 210  | 350  | 205                               | 340                               | 52681E3                          | 72681E3 |
|  | 680                                  | 35 x 25  | 2.06                            | 1.36                      | 210  | 350  | 205                               | 340                               | 62681E3                          | 82681E3 |
|  | 820                                  | 25 x 45  | 2.46                            | 1.64                      | 170  | 290  | 145                               | 240                               | 62821E3                          | 82821E3 |
|  | 820                                  | 30 x 35  | 2.35                            | 1.64                      | 170  | 290  | 145                               | 240                               | 32821E3                          | 12821E3 |
|  | 820                                  | 35 x 30  | 2.29                            | 1.64                      | 170  | 290  | 145                               | 240                               | 52821E3                          | 72821E3 |
|  | 1000                                 | 30 x 40  | 2.66                            | 2.00                      | 140  | 235  | 135                               | 225                               | 52102E3                          | 72102E3 |
|  | 1000                                 | 35 x 30  | 2.33                            | 2.00                      | 140  | 235  | 135                               | 225                               | 62102E3                          | 82102E3 |
|  | 1200                                 | 30 x 45  | 2.98                            | 2.40                      | 120  | 200  | 110                               | 190                               | 32122E3                          | 12122E3 |
|  | 1200                                 | 35 x 35  | 2.69                            | 2.40                      | 120  | 200  | 110                               | 190                               | 62122E3                          | 82122E3 |
|  | 1500                                 | 30 x 50  | 3.31                            | 3.00                      | 110  | 180  | 95                                | 155                               | 42152E3                          | 22152E3 |
|  | 1500                                 | 35 x 40  | 3.04                            | 3.00                      | 110  | 180  | 95                                | 155                               | 52152E3                          | 72152E3 |
| 1800                                     | 35 x 45                              | 3.36   | 3.60                            | 100                       | 160  | 80   | 130                               | 42182E3                           | 22182E3                          |         |
| 2200                                     | 35 x 50                              | 3.68   | 4.40                            | 90                        | 150  | 65   | 105                               | 52222E3                           | 72222E3                          |         |
| 250                                      | 220                                  | 22 x 30  | 1.23                            | 0.55                      | 600  | 1080   | 420                               | 700                               | 53221E3                          | 73221E3 |
|  | 270                                  | 22 x 30  | 1.32                            | 0.67                      | 490  | 880  | 335                               | 560                               | 43271E3                          | 23271E3 |
|  | 270                                  | 25 x 25  | 1.23                            | 0.67                      | 490  | 880  | 335                               | 560                               | 53271E3                          | 73271E3 |
|  | 330                                  | 22 x 35  | 1.53                            | 0.82                      | 400  | 720  | 255                               | 430                               | 33331E3                          | 13331E3 |
|  | 330                                  | 25 x 30  | 1.56                            | 0.82                      | 400  | 720  | 255                               | 430                               | 53331E3                          | 73331E3 |



| 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>120 Hz<br>85 °C<br>(A) | I <sub>L5</sub><br>5 min<br>(mA) | TYP. ESR<br>100 Hz <sup>(1)</sup><br>(MΩ) | MAX. ESR<br>100 Hz <sup>(1)</sup><br>(MΩ) | TYP. Z<br>10 kHz<br>(MΩ) | MAX. Z<br>10 kHz<br>(MΩ) | ORDERING<br>CODE<br>MAL2157..... |         |
|  |                                  |   |  |                                  |   |   |                          |                          | 2-TERM.                          | 3-TERM. |
| 250                                      | 390                              | 22 x 40                                 | 1.74                                     | 0.97                             | 330                                       | 610                                       | 250                      | 425                      | 43391E3                          | 23391E3 |
|  | 390                              | 30 x 25                                 | 1.58                                     | 0.97                             | 330                                       | 610                                       | 250                      | 425                      | 53391E3                          | 73391E3 |
|  | 470                              | 25 x 35                                 | 1.87                                     | 1.17                             | 280                                       | 505                                       | 190                      | 320                      | 33471E3                          | 13471E3 |
|  | 470                              | 30 x 30                                 | 1.89                                     | 1.17                             | 280                                       | 505                                       | 190                      | 320                      | 53471E3                          | 73471E3 |
|  | 560                              | 25 x 40                                 | 2.12                                     | 1.40                             | 240                                       | 425                                       | 185                      | 310                      | 43561E3                          | 23561E3 |
|  | 560                              | 30 x 30                                 | 1.97                                     | 1.40                             | 240                                       | 425                                       | 185                      | 310                      | 53561E3                          | 73561E3 |
|  | 560                              | 35 x 25                                 | 1.80                                     | 1.40                             | 240                                       | 425                                       | 185                      | 310                      | 63561E3                          | 83561E3 |
|  | 680                              | 25 x 45                                 | 2.29                                     | 1.70                             | 200                                       | 350                                       | 155                      | 260                      | 63681E3                          | 83681E3 |
|  | 680                              | 30 x 35                                 | 2.28                                     | 1.70                             | 200                                       | 350                                       | 155                      | 260                      | 33681E3                          | 13681E3 |
|  | 680                              | 35 x 30                                 | 2.20                                     | 1.70                             | 200                                       | 350                                       | 155                      | 260                      | 53681E3                          | 73681E3 |
|  | 820                              | 30 x 40                                 | 2.57                                     | 2.05                             | 160                                       | 290                                       | 125                      | 210                      | 53821E3                          | 73821E3 |
|  | 820                              | 35 x 35                                 | 2.54                                     | 2.05                             | 160                                       | 290                                       | 125                      | 210                      | 63821E3                          | 83821E3 |
|  | 1000                             | 30 x 45                                 | 2.88                                     | 2.50                             | 140                                       | 235                                       | 105                      | 180                      | 33102E3                          | 13102E3 |
|  | 1000                             | 35 x 40                                 | 2.86                                     | 2.50                             | 140                                       | 235                                       | 105                      | 180                      | 53102E3                          | 73102E3 |
|  | 1200                             | 35 x 45                                 | 3.17                                     | 3.00                             | 120                                       | 200                                       | 95                       | 160                      | 43122E3                          | 23122E3 |
|  | 1500                             | 35 x 50                                 | 3.49                                     | 3.75                             | 90  | 160                                       | 85                       | 140                      | 53152E3                          | 73152E3 |
| 400                                      | 68                               | 22 x 25                                 | 0.71                                     | 0.27                             | 1400                                      | 2800                                      | 1170                     | 1950                     | 56689E3                          | 76689E3 |
|  | 82                               | 22 x 25                                 | 0.77                                     | 0.33                             | 1250                                      | 2500                                      | 970                      | 1620                     | 56829E3                          | 76829E3 |
|  | 100                              | 22 x 30                                 | 0.94                                     | 0.40                             | 1125                                      | 2250                                      | 750                      | 1220                     | 56101E3                          | 76101E3 |
|  | 120                              | 22 x 30                                 | 0.97                                     | 0.48                             | 990                                       | 1980                                      | 700                      | 1140                     | 56121E3                          | 76121E3 |
|  | 150                              | 22 x 35                                 | 1.13                                     | 0.60                             | 750                                       | 1500                                      | 540                      | 900                      | 36151E3                          | 16151E3 |
|  | 150                              | 25 x 30                                 | 1.16                                     | 0.60                             | 750                                       | 1500                                      | 540                      | 900                      | 56151E3                          | 76151E3 |
|  | 180                              | 22 x 40                                 | 1.29                                     | 0.72                             | 630                                       | 1260                                      | 435                      | 725                      | 46181E3                          | 26181E3 |
|  | 180                              | 25 x 35                                 | 1.35                                     | 0.72                             | 630                                       | 1260                                      | 435                      | 725                      | 36181E3                          | 16181E3 |
|  | 220                              | 25 x 40                                 | 1.54                                     | 0.88                             | 520                                       | 1040                                      | 355                      | 590                      | 46221E3                          | 26221E3 |
|  | 220                              | 30 x 30                                 | 1.50                                     | 0.88                             | 520                                       | 1040                                      | 355                      | 590                      | 56221E3                          | 76221E3 |
|  | 220                              | 35 x 25                                 | 1.42                                     | 0.88                             | 520                                       | 1040                                      | 355                      | 590                      | 66221E3                          | 86221E3 |
|  | 270                              | 25 x 45                                 | 1.72                                     | 1.08                             | 430                                       | 860                                       | 335                      | 560                      | 66271E3                          | 86271E3 |
|  | 270                              | 30 x 35                                 | 1.74                                     | 1.08                             | 430                                       | 860                                       | 335                      | 560                      | 36271E3                          | 16271E3 |
|  | 270                              | 35 x 30                                 | 1.71                                     | 1.08                             | 430                                       | 860                                       | 335                      | 560                      | 56271E3                          | 76271E3 |
|  | 330                              | 30 x 40                                 | 1.97                                     | 1.32                             | 350                                       | 700                                       | 315                      | 525                      | 56331E3                          | 76331E3 |
|  | 330                              | 35 x 30                                 | 1.76                                     | 1.32                             | 350                                       | 700                                       | 315                      | 525                      | 66331E3                          | 86331E3 |
|  | 390                              | 30 x 45                                 | 2.19                                     | 1.56                             | 300                                       | 610                                       | 250                      | 420                      | 56391E3                          | 76391E3 |
|  | 390                              | 35 x 35                                 | 2.04                                     | 1.56                             | 300                                       | 610                                       | 250                      | 420                      | 36391E3                          | 16391E3 |
|  | 470                              | 30 x 50                                 | 2.40                                     | 1.88                             | 250                                       | 505                                       | 210                      | 350                      | 46471E3                          | 26471E3 |
|  | 470                              | 35 x 40                                 | 2.30                                     | 1.88                             | 250                                       | 505                                       | 210                      | 350                      | 56471E3                          | 76471E3 |
| 560                                      | 35 x 45                          | 2.55                                    | 2.24                                     | 210                              | 425                                       | 180                                       | 305                      | 46561E3                  | 26561E3                          |         |
| 680                                      | 35 x 50                          | 2.79                                    | 2.72                                     | 190                              | 380                                       | 160                                       | 265                      | 56681E3                  | 76681E3                          |         |
| 820                                      | 35 x 60                          | 3.33                                    | 3.28                                     | 155                              | 315                                       | 115                                       | 215                      | 56821E3                  | 76821E3                          |         |

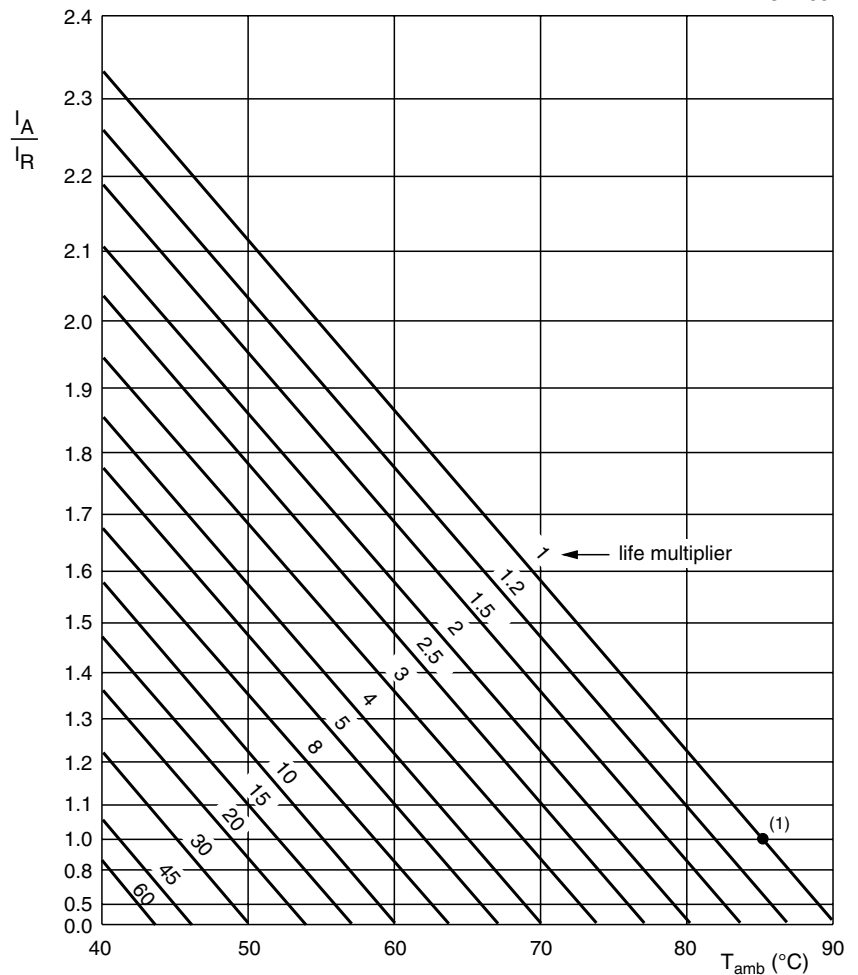
| ELECTRICAL DATA AND ORDERING INFORMATION |                                  |   |  |                                  |   |   |                          |                          |                                  |         |
|--|----------------------------------|---|--|----------------------------------|---|---|--------------------------|--------------------------|----------------------------------|---------|
| 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>120 Hz<br>85 °C<br>(A) | I <sub>L5</sub><br>5 min<br>(mA) | TYP. ESR<br>100 Hz <sup>(1)</sup><br>(MΩ) | MAX. ESR<br>100 Hz <sup>(1)</sup><br>(MΩ) | TYP. Z<br>10 kHz<br>(MΩ) | MAX. Z<br>10 kHz<br>(MΩ) | ORDERING<br>CODE<br>MAL2157..... |         |
|  |                                  |   |  |                                  |   |   |                          |                          | 2-TERM.                          | 3-TERM. |
| 450                                      | 56                               | 22 x 25                                 | 0.68                                     | 0.25                             | 1650                                      | 3300                                      | 1120                     | 1880                     | 57569E3                          | 77569E3 |
|  | 68                               | 22 x 30                                 | 0.80                                     | 0.30                             | 1400                                      | 2800                                      | 920                      | 1530                     | 57689E3                          | 77689E3 |
|  | 82                               | 22 x 30                                 | 0.87                                     | 0.36                             | 1200                                      | 2400                                      | 780                      | 1290                     | 47829E3                          | 27829E3 |
|  | 82                               | 25 x 25                                 | 0.85                                     | 0.36                             | 1200                                      | 2400                                      | 780                      | 1290                     | 57829E3                          | 77829E3 |
|  | 100                              | 22 x 35                                 | 1.00                                     | 0.45                             | 1000                                      | 2000                                      | 630                      | 1050                     | 37101E3                          | 17101E3 |
|  | 100                              | 25 x 30                                 | 1.02                                     | 0.45                             | 1000                                      | 2000                                      | 630                      | 1050                     | 57101E3                          | 77101E3 |
|  | 120                              | 22 x 40                                 | 1.15                                     | 0.54                             | 800                                       | 1600                                      | 530                      | 885                      | 47121E3                          | 27121E3 |
|  | 120                              | 25 x 30                                 | 1.09                                     | 0.54                             | 800                                       | 1600                                      | 530                      | 885                      | 57121E3                          | 77121E3 |
|  | 120                              | 30 x 25                                 | 1.10                                     | 0.54                             | 800                                       | 1600                                      | 530                      | 885                      | 67121E3                          | 87121E3 |
|  | 150                              | 25 x 40                                 | 1.35                                     | 0.67                             | 650                                       | 1300                                      | 420                      | 705                      | 47151E3                          | 27151E3 |
|  | 150                              | 25 x 35                                 | 1.27                                     | 0.67                             | 650                                       | 1300                                      | 420                      | 705                      | 67151E3                          | 87151E3 |
|  | 150                              | 30 x 30                                 | 1.32                                     | 0.67                             | 650                                       | 1300                                      | 420                      | 705                      | 57151E3                          | 77151E3 |
|  | 180                              | 25 x 40                                 | 1.45                                     | 0.81                             | 570                                       | 1150                                      | 360                      | 605                      | 47181E3                          | 27181E3 |
|  | 180                              | 30 x 35                                 | 1.49                                     | 0.81                             | 570                                       | 1150                                      | 360                      | 605                      | 57181E3                          | 77181E3 |
|  | 180                              | 35 x 25                                 | 1.35                                     | 0.81                             | 570                                       | 1150                                      | 360                      | 605                      | 67181E3                          | 87181E3 |
|  | 220                              | 25 x 50                                 | 1.73                                     | 0.99                             | 450                                       | 900                                       | 315                      | 525                      | 47221E3                          | 27221E3 |
|  | 220                              | 30 x 40                                 | 1.72                                     | 0.99                             | 450                                       | 900                                       | 315                      | 525                      | 57221E3                          | 77221E3 |
|  | 220                              | 35 x 30                                 | 1.61                                     | 0.99                             | 450                                       | 900                                       | 315                      | 525                      | 67221E3                          | 87221E3 |
|  | 270                              | 30 x 45                                 | 1.95                                     | 1.21                             | 380                                       | 770                                       | 270                      | 450                      | 37271E3                          | 17271E3 |
|  | 270                              | 35 x 35                                 | 1.86                                     | 1.21                             | 380                                       | 770                                       | 270                      | 450                      | 67271E3                          | 87271E3 |
| 330                                      | 30 x 50                          | 2.19                                    | 1.48                                     | 300                              | 600                                       | 230                                       | 390                      | 47331E3                  | 27331E3                          |         |
| 330                                      | 35 x 40                          | 2.10                                    | 1.48                                     | 300                              | 600                                       | 230                                       | 390                      | 57331E3                  | 77331E3                          |         |
| 390                                      | 35 x 45                          | 2.34                                    | 1.75                                     | 250                              | 500                                       | 190                                       | 340                      | 47391E3                  | 27391E3                          |         |
| 470                                      | 35 x 50                          | 2.60                                    | 2.11                                     | 210                              | 420                                       | 170                                       | 290                      | 57471E3                  | 77471E3                          |         |
| 680                                      | 35 x 60                          | 3.15                                    | 3.06                                     | 150                              | 300                                       | 110                                       | 200                      | 57681E3                  | 77681E3                          |         |

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

| 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 minutes 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**

MGA453



$I_A$  = actual ripple current at 120 Hz  
 $I_R$  = rated ripple current at 120 Hz and 85 °C  
 (1) Useful life at 85 °C and  $I_R$  applied: 5000 hours

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 (Hz)  | $I_R$ MULTIPLIER |
| 50  | 0.90             |
| 100   | 0.95             |
| 120   | 1.00             |
| 200   | 1.15             |
| 1000  | 1.30             |
| ≥ 10 000  | 1.40             |

Table 4

| <b>TEST PROCEDURES AND REQUIREMENTS</b>        |  |  |  |
|--|--|--|--|
| <b>TEST</b>                                    |  | <b>PROCEDURE<br/>(quick reference)</b>   | <b>REQUIREMENTS</b>  |
| <b>NAME OF TEST</b>                            | <b>REFERENCE</b>                           |  |  |
| Endurance                                      | IEC 60384-4/<br>EN130300<br>subclause 4.13 | $T_{amb} = 85\text{ }^{\circ}\text{C}$ ; $U_R$ applied;<br>3000 hours  | $\Delta C/C: \pm 10\%$<br>$ESR \leq 2 \times \text{spec. limit}$<br>$I_{L5} \leq \text{spec. limit}$   |
| Load life                                      |  | $T_{amb} = 85\text{ }^{\circ}\text{C}$ ; $U_R$ and $I_R$ applied;<br>3000 hours  | $\Delta C/C: \pm 20\%$<br>$ESR \leq 2 \times \text{spec. limit}$<br>$I_{L5} \leq \text{spec. limit}$   |
| Useful life                                    | CECC 30301<br>subclause 1.8.1              | $T_{amb} = 85\text{ }^{\circ}\text{C}$ ; $U_R$ and $I_R$ applied;<br>5000 hours  | $\Delta C/C: \pm 30\%$<br>$ESR \leq 3 \times \text{spec. limit}$<br>$I_{L5} \leq \text{spec. limit}$<br>no short or open circuit,<br>no visible damage<br>total failure percentage: $\leq 3\%$ |
| Shelf life<br>(storage at<br>high temperature) | IEC 60384-4/<br>EN130300<br>subclause 4.17 | $T_{amb} = 85\text{ }^{\circ}\text{C}$ ; no voltage applied;<br>1000 hours<br><br>After test: $U_R$ to be applied for 30 minutes,<br>24 hours to 48 hours before measurement | $\Delta C/C: \pm 15\%$<br>$ESR \leq 1.5 \times \text{spec. limit}$<br>$I_{L5} \leq 1 \times \text{spec. limit}$  |





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