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

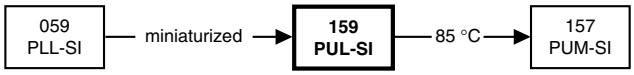



Fig. 1

## FEATURES

- Useful life: 5000 h at 105 °C
- Available up to 500 V
- Polarized aluminum electrolytic capacitors, non-solid electrolyte
- Large types, very small dimensions, cylindrical aluminum case, insulated with a blue sleeve
- Low ESR, high ripple current capability
- Keyed polarity snap-in version available
- High reliability
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Pb-free

RoHS COMPLIANT

## APPLICATIONS

- Solar PV inverters
- 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 µF)
- Tolerance code on rated capacitance, code letter in accordance with IEC 60062 (M for ± 20 %)
- Rated voltage (in V)
- Date code (YYMM or in 2 digits according to IEC 60062)
- Name of manufacturer
- Code for factory of origin
- "-" sign to identify the negative terminal, visible from the top and side of the capacitor
- Code number, last 8 digits 159 xxxxx
- Climatic category in accordance with IEC 60068

## QUICK REFERENCE DATA

| DESCRIPTION | VALUE |
|---|---|
| Nominal case size (Ø D x L in mm) | 22 x 25 to 35 x 60 |
| Rated capacitance range (E6 / E12 series), $C_R$ | 56 µF to 1800 µF |
| Tolerance on $C_R$ | ± 20 % |
| Rated voltage range, $U_R$ | 200 V to 500 V |
| Category temperature range | -25 °C to +105 °C |
| Endurance test at 105 °C | 2000 h |
| Load life at 105 °C | 2000 h |
| Useful life at 105 °C | 5000 h |
| Useful life at 40 °C and 1.6 x $I_R$ applied | 500 000 h |
| Shelf life at 0 V, 105 °C | 1000 h |
| Based on sectional specification | IEC 60384-4 / EN 130300 |
| Climatic category IEC 60068 | 25 / 105 / 56 |

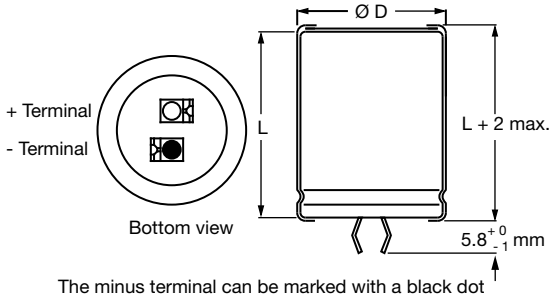
## SELECTION CHART FOR $C_R$, $U_R$, AND RELEVANT NOMINAL CASE SIZES (Ø D x L in mm)

| $C_R$ (µF) | $U_R$ (V) | | | | |
|---|---|---|---|---|---|
| | 200 | 250 | 400 | 450 | 500 |
| 56 | - | - | - | 22 x 25 | 22 x 30 |
| 68 | - | - | 22 x 25 | 22 x 30 | 22 x 35 |
| | - | - | - | 25 x 25 | 25 x 30 |
| 82 | - | - | 22 x 30 | 22 x 35 | 22 x 35 |
| | - | - | 25 x 25 | - | 25 x 30 |
| 100 | - | - | 22 x 35 | 22 x 40 | 22 x 40 |
| | - | - | 25 x 30 | 25 x 30 | 25 x 35 |
| | - | - | - | 30 x 25 | - |
| 120 | - | - | 22 x 35 | - | 25 x 40 |
| | - | - | 25 x 30 | 25 x 35 | 30 x 30 |
| | - | - | 30 x 25 | - | - |
| 150 | - | - | 22 x 40 | 25 x 40 | 25 x 45 |
| | - | - | 25 x 35 | 30 x 30 | 30 x 35 |
| | - | - | 30 x 30 | 35 x 25 | - |
| 180 | - | - | 25 x 40 | 25 x 45 | 25 x 50 |
| | - | - | 30 x 30 | 30 x 35 | 30 x 40 |
| | - | - | 35 x 25 | - | 35 x 30 |
| 220 | - | 22 x 30 | 25 x 45 | 30 x 40 | 30 x 45 |
| | - | 25 x 25 | 30 x 35 | 35 x 30 | 35 x 35 |
| | - | - | 35 x 30 | - | - |

| SELECTION CHART FOR $C_R$, $U_R$, AND RELEVANT NOMINAL CASE SIZES (Ø D x L in mm) | | | | | |
|---|---|---|---|---|---|
| $C_R$ (µF) | $U_R$ (V) | | | | |
| | 200 | 250 | 400 | 450 | 500 |
| 270 | - | 22 x 35 | 25 x 50 | 30 x 45 | 30 x 50 |
| | - | 25 x 30 | 30 x 40 | 35 x 35 | 35 x 40 |
| | - | 30 x 25 | 35 x 30 | - | - |
| 330 | 22 x 30 | 22 x 40 | 30 x 45 | 30 x 50 | 35 x 45 |
| | - | 25 x 30 | 35 x 35 | 35 x 40 | - |
| | - | 30 x 25 | - | - | - |
| 390 | 22 x 35 | 25 x 35 | 30 x 50 | 35 x 45 | 35 x 55 |
| | 25 x 30 | 30 x 30 | 35 x 40 | - | - |
| 470 | 22 x 40 | 25 x 40 | 35 x 45 | 35 x 50 | 35 x 60 |
| | 30 x 25 | 30 x 30 | - | 35 x 40 | - |
| | - | 35 x 25 | - | - | - |
| 560 | - | 25 x 45 | - | 35 x 60 | - |
| | 25 x 35 | 30 x 35 | - | - | - |
| | 30 x 30 | 35 x 30 | - | - | - |
| 680 | 25 x 45 | 30 x 40 | 35 x 60 | - | - |
| | 30 x 30 | 35 x 35 | - | - | - |
| | 35 x 25 | - | - | - | - |
| 820 | 25 x 50 | 30 x 45 | - | - | - |
| | 30 x 35 | 35 x 35 | - | - | - |
| | 35 x 30 | 35 x 40 | - | - | - |
| 1000 | 30 x 45 | 35 x 40 | - | - | - |
| | 35 x 35 | 35 x 45 | - | - | - |
| 1200 | 30 x 50 | 35 x 45 | - | - | - |
| | 35 x 35 | 35 x 50 | - | - | - |
| 1500 | 35 x 45 | - | - | - | - |
| 1800 | 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

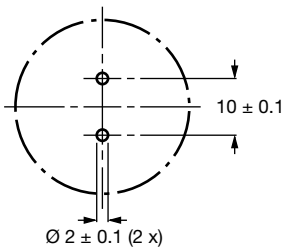
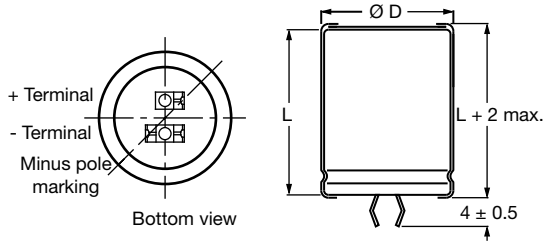


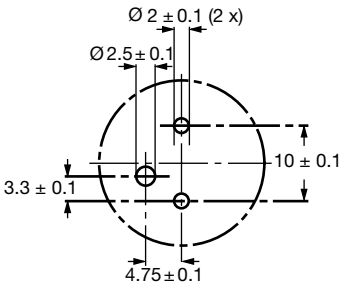

Fig. 3 - Mounting hole diagram

### 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**

| **DIMENSIONS** in millimeters, **MASS AND PACKAGING QUANTITIES** | | | | | |
|---|---|---|---|---|---|
| **NOMINAL CASE SIZE Ø D x L** | **Ø $D_{max.}$** | **$L_{max.}$** | **MASS (g)** | **PACKAGING QUANTITIES (units per box)** | **CARDBOARD BOX DIMENSIONS 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 25 | 26 | 27 | ≈ 20 | 100 | 290 x 280 x 39 |
| 25 x 30 | 26 | 32 | ≈ 22 | 100 | 290 x 280 x 44 |
| 25 x 35 | 26 | 37 | ≈ 24 | 100 | 290 x 280 x 49 |
| 25 x 40 | 26 | 42 | ≈ 27 | 100 | 290 x 280 x 54 |
| 25 x 45 | 26 | 47 | ≈ 32 | 100 | 290 x 280 x 59 |
| 25 x 50 | 26 | 52 | ≈ 38 | 100 | 290 x 280 x 64 |
| 30 x 25 | 31 | 27 | ≈ 25 | 100 | 340 x 330 x 39 |
| 30 x 30 | 31 | 32 | ≈ 30 | 100 | 340 x 330 x 44 |
| 30 x 35 | 31 | 37 | ≈ 35 | 100 | 340 x 330 x 49 |
| 30 x 40 | 31 | 42 | ≈ 40 | 100 | 340 x 330 x 54 |
| 30 x 45 | 31 | 47 | ≈ 45 | 100 | 340 x 330 x 59 |
| 30 x 50 | 31 | 52 | ≈ 50 | 100 | 340 x 330 x 64 |
| 35 x 25 | 36 | 27 | ≈ 33 | 50 | 390 x 198 x 39 |
| 35 x 30 | 36 | 32 | ≈ 40 | 50 | 390 x 198 x 44 |
| 35 x 35 | 36 | 37 | ≈ 48 | 50 | 390 x 198 x 49 |
| 35 x 40 | 36 | 42 | ≈ 55 | 50 | 390 x 198 x 54 |
| 35 x 45 | 36 | 47 | ≈ 63 | 50 | 390 x 198 x 59 |
| 35 x 50 | 36 | 52 | ≈ 72 | 50 | 390 x 198 x 64 |
| 35 x 55 | 36 | 57 | ≈ 80 | 50 | 390 x 198 x 69 |
| 35 x 60 | 36 | 62 | ≈ 84 | 50 | 390 x 198 x 74 |

| **ELECTRICAL DATA** | |
|---|---|
| **SYMBOL** | **DESCRIPTION** |
| $C_R$ | Rated capacitance at 100 Hz |
| $I_R$ | Rated RMS ripple current at 120 Hz, 105 °C |
| $I_{L5}$ | Max. leakage current after 5 min at $U_R$ |
| ESR | Typ. / max. equivalent series resistance at 100 Hz (1) |
| Z | Typ. / max. impedance at 10 kHz |

**Notes**

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

(1) ESR at 120 Hz is approximately 0.95 x ESR 100 Hz

## ORDERING EXAMPLE

Electrolytic capacitor 159 series

1000 µF / 200 V; ± 20 %

Nominal case size: Ø 30 mm x 45 mm

**2-terminal snap-in:**

Ordering code: MAL215942102E3
Former 12NC: 222215942102

**3-terminal snap-in:**

Ordering code: MAL215922102E3
Former 12NC: 222215922102

**Table 2**

| ELECTRICAL DATA AND ORDERING INFORMATION | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| $U_R$ (V) | $C_R$ 100 Hz (µF) | NOMINAL CASE SIZE Ø D x L (mm) | $I_R$ 120 Hz 105 °C (A) | $I_{L5}$ 5 min (mA) | TYP. ESR 100 Hz [1] (mΩ) | MAX. ESR 100 Hz [1] (mΩ) | TYP. Z 10 kHz (mΩ) | MAX. Z 10 kHz (mΩ) | ORDERING CODE MAL2159..... | |
| | | | | | | | | | 2-TERM. | 3-TERM. |
| 200 | 330 | 22 x 30 | 1.08 | 0.66 | 450 | 730 | 300 | 500 | 52331E3 | 72331E3 |
| | 390 | 22 x 35 | 1.23 | 0.78 | 380 | 610 | 280 | 470 | 42391E3 | 22391E3 |
| | 390 | 25 x 30 | 1.23 | 0.78 | 380 | 610 | 280 | 470 | 52391E3 | 72391E3 |
| | 470 | 22 x 40 | 1.37 | 0.94 | 300 | 505 | 240 | 400 | 32471E3 | 12471E3 |
| | 470 | 30 x 25 | 1.27 | 0.94 | 300 | 505 | 240 | 400 | 52471E3 | 72471E3 |
| | 560 | 25 x 35 | 1.50 | 1.12 | 260 | 425 | 235 | 390 | 42561E3 | 22561E3 |
| | 560 | 30 x 30 | 1.52 | 1.12 | 260 | 425 | 235 | 390 | 52561E3 | 72561E3 |
| | 680 | 25 x 45 | 1.82 | 1.36 | 210 | 350 | 205 | 340 | 42681E3 | 22681E3 |
| | 680 | 30 x 30 | 1.59 | 1.36 | 210 | 350 | 205 | 340 | 52681E3 | 72681E3 |
| | 680 | 35 x 25 | 1.44 | 1.36 | 210 | 350 | 205 | 340 | 62681E3 | 82681E3 |
| | 820 | 25 x 50 | 2.04 | 1.64 | 180 | 290 | 145 | 240 | 32821E3 | 12821E3 |
| | 820 | 30 x 35 | 1.83 | 1.64 | 180 | 290 | 145 | 240 | 42821E3 | 22821E3 |
| | 820 | 35 x 30 | 1.77 | 1.64 | 180 | 290 | 145 | 240 | 52821E3 | 72821E3 |
| | 1000 | 30 x 45 | 2.23 | 2.00 | 150 | 235 | 135 | 225 | 42102E3 | 22102E3 |
| | 1000 | 35 x 35 | 2.04 | 2.00 | 150 | 235 | 135 | 225 | 52102E3 | 72102E3 |
| | 1200 | 30 x 50 | 2.47 | 2.40 | 130 | 210 | 115 | 190 | 42122E3 | 22122E3 |
| | 1200 | 35 x 35 | 2.07 | 2.40 | 130 | 210 | 115 | 190 | 52122E3 | 72122E3 |
| | 1500 | 35 x 45 | 2.56 | 3.00 | 100 | 170 | 95 | 155 | 52152E3 | 72152E3 |
| | 1800 | 35 x 50 | 2.80 | 3.60 | 90 | 150 | 80 | 130 | 52182E3 | 72182E3 |
| 250 | 220 | 22 x 30 | 1.00 | 0.55 | 540 | 1080 | 420 | 700 | 43221E3 | 23221E3 |
| | 220 | 25 x 25 | 1.00 | 0.55 | 540 | 1080 | 420 | 700 | 53221E3 | 73221E3 |
| | 270 | 22 x 35 | 1.07 | 0.67 | 440 | 880 | 335 | 560 | 43271E3 | 23271E3 |
| | 270 | 25 x 30 | 1.08 | 0.67 | 440 | 880 | 335 | 560 | 53271E3 | 73271E3 |
| | 270 | 30 x 25 | 1.08 | 0.67 | 440 | 880 | 335 | 560 | 63271E3 | 83271E3 |
| | 330 | 22 x 40 | 1.20 | 0.82 | 360 | 720 | 255 | 430 | 33331E3 | 13331E3 |
| | 330 | 25 x 30 | 1.21 | 0.82 | 360 | 720 | 255 | 430 | 43331E3 | 23331E3 |
| | 330 | 30 x 25 | 1.19 | 0.82 | 360 | 720 | 255 | 430 | 53331E3 | 73331E3 |
| | 390 | 25 x 35 | 1.39 | 0.97 | 330 | 610 | 245 | 410 | 43391E3 | 23391E3 |
| | 390 | 30 x 30 | 1.41 | 0.97 | 330 | 610 | 245 | 410 | 53391E3 | 73391E3 |
| | 470 | 25 x 40 | 1.58 | 1.17 | 270 | 505 | 240 | 400 | 33471E3 | 13471E3 |
| | 470 | 30 x 30 | 1.57 | 1.17 | 270 | 505 | 240 | 400 | 43471E3 | 23471E3 |
| | 470 | 35 x 25 | 1.37 | 1.17 | 270 | 505 | 240 | 400 | 53471E3 | 73471E3 |
| | 560 | 25 x 45 | 1.78 | 1.40 | 230 | 425 | 185 | 310 | 43561E3 | 23561E3 |
| | 560 | 30 x 35 | 1.71 | 1.40 | 230 | 425 | 185 | 310 | 53561E3 | 73561E3 |
| | 560 | 35 x 30 | 1.67 | 1.40 | 230 | 425 | 185 | 310 | 63561E3 | 83561E3 |
| | 680 | 30 x 40 | 1.93 | 1.70 | 210 | 350 | 155 | 260 | 43681E3 | 23681E3 |
| | 680 | 35 x 35 | 1.92 | 1.70 | 210 | 350 | 155 | 260 | 53681E3 | 73681E3 |
| | 820 | 30 x 45 | 2.16 | 2.05 | 180 | 290 | 125 | 210 | 43821E3 | 23821E3 |
| | 820 | 35 x 35 | 1.97 | 2.05 | 180 | 290 | 125 | 210 | 53821E3 | 73821E3 |
| | 820 | 35 x 40 | 2.16 | 2.05 | 180 | 290 | 125 | 210 | 63821E3 | 83821E3 |
| | 1000 | 35 x 40 | 2.22 | 2.50 | 140 | 235 | 105 | 180 | 53102E3 | 73102E3 |
| | 1000 | 35 x 45 | 2.41 | 2.50 | 140 | 235 | 105 | 180 | 63102E3 | 83102E3 |
| | 1200 | 35 x 45 | 2.46 | 3.00 | 130 | 200 | 95 | 160 | 43122E3 | 23122E3 |
| | 1200 | 35 x 50 | 2.65 | 3.00 | 130 | 200 | 95 | 160 | 53122E3 | 73122E3 |

**Note**

[1] ESR at 120 Hz is approximately 0.95 x ESR 100 Hz

## ELECTRICAL DATA AND ORDERING INFORMATION

| $U_R$ (V) | $C_R$ 100 Hz (µF) | NOMINAL CASE SIZE Ø D x L (mm) | $I_R$ 120 Hz 105 °C (A) | $I_{L5}$ 5 min (mA) | TYP. ESR 100 Hz [1] (mΩ) | MAX. ESR 100 Hz [1] (mΩ) | TYP. Z 10 kHz (mΩ) | MAX. Z 10 kHz (mΩ) | ORDERING CODE MAL2159..... | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 2-TERM. | 3-TERM. |
| 400 | 68 | 22 x 25 | 0.51 | 0.27 | 1600 | 3200 | 1170 | 1950 | 56689E3 | 76689E3 |
| | 82 | 22 x 30 | 0.60 | 0.33 | 1200 | 2400 | 910 | 1520 | 46829E3 | 26829E3 |
| | 82 | 25 x 25 | 0.60 | 0.33 | 1200 | 2400 | 910 | 1520 | 56829E3 | 76829E3 |
| | 100 | 22 x 35 | 0.69 | 0.40 | 990 | 1980 | 740 | 1240 | 46101E3 | 26101E3 |
| | 100 | 25 x 30 | 0.70 | 0.40 | 990 | 1980 | 740 | 1240 | 56101E3 | 76101E3 |
| | 120 | 22 x 35 | 0.76 | 0.48 | 800 | 1600 | 660 | 1100 | 46121E3 | 26121E3 |
| | 120 | 25 x 30 | 0.76 | 0.48 | 800 | 1600 | 660 | 1100 | 56121E3 | 76121E3 |
| | 120 | 30 x 25 | 0.77 | 0.48 | 800 | 1600 | 660 | 1100 | 66121E3 | 86121E3 |
| | 150 | 22 x 40 | 0.86 | 0.60 | 700 | 1400 | 510 | 860 | 36151E3 | 16151E3 |
| | 150 | 25 x 35 | 0.89 | 0.60 | 700 | 1400 | 510 | 860 | 46151E3 | 26151E3 |
| | 150 | 30 x 30 | 0.92 | 0.60 | 700 | 1400 | 510 | 860 | 56151E3 | 76151E3 |
| | 180 | 25 x 40 | 1.01 | 0.72 | 590 | 1170 | 420 | 700 | 36181E3 | 16181E3 |
| | 180 | 30 x 30 | 0.99 | 0.72 | 590 | 1170 | 420 | 700 | 46181E3 | 26181E3 |
| | 180 | 35 x 25 | 0.96 | 0.72 | 590 | 1170 | 420 | 700 | 56181E3 | 76181E3 |
| | 220 | 25 x 45 | 1.15 | 0.88 | 470 | 940 | 350 | 590 | 46221E3 | 26221E3 |
| | 220 | 30 x 35 | 1.15 | 0.88 | 470 | 940 | 350 | 590 | 56221E3 | 76221E3 |
| | 220 | 35 x 30 | 1.14 | 0.88 | 470 | 940 | 350 | 590 | 66221E3 | 86221E3 |
| | 270 | 25 x 50 | 1.31 | 1.08 | 380 | 760 | 330 | 550 | 46271E3 | 26271E3 |
| | 270 | 30 x 40 | 1.30 | 1.08 | 380 | 760 | 330 | 550 | 56271E3 | 76271E3 |
| | 270 | 35 x 30 | 1.21 | 1.08 | 380 | 760 | 330 | 550 | 66271E3 | 86271E3 |
| | 330 | 30 x 45 | 1.47 | 1.32 | 320 | 640 | 270 | 450 | 56331E3 | 76331E3 |
| | 330 | 35 x 35 | 1.40 | 1.32 | 320 | 640 | 270 | 450 | 66331E3 | 86331E3 |
| | 390 | 30 x 50 | 1.63 | 1.56 | 270 | 540 | 240 | 410 | 46391E3 | 26391E3 |
| | 390 | 35 x 40 | 1.57 | 1.56 | 270 | 540 | 240 | 410 | 56391E3 | 76391E3 |
| | 470 | 35 x 45 | 1.72 | 1.88 | 230 | 450 | 200 | 330 | 56471E3 | 76471E3 |
| | 560 | 35 x 50 | 1.84 | 2.24 | 210 | 420 | 170 | 280 | 56561E3 | 76561E3 |
| | 680 | 35 x 60 | 2.24 | 2.72 | 180 | 350 | 130 | 230 | 56681E3 | 76681E3 |
| 450 | 56 | 22 x 25 | 0.48 | 0.25 | 1600 | 3200 | 1120 | 1880 | 57569E3 | 77569E3 |
| | 68 | 22 x 30 | 0.56 | 0.30 | 1200 | 2400 | 910 | 1530 | 47689E3 | 27689E3 |
| | 68 | 25 x 25 | 0.56 | 0.30 | 1200 | 2400 | 910 | 1530 | 57689E3 | 77689E3 |
| | 82 | 22 x 35 | 0.64 | 0.36 | 1100 | 2200 | 770 | 1290 | 57829E3 | 77829E3 |
| | 100 | 22 x 40 | 0.74 | 0.45 | 900 | 1800 | 630 | 1050 | 37101E3 | 17101E3 |
| | 100 | 25 x 30 | 0.71 | 0.45 | 900 | 1800 | 630 | 1050 | 47101E3 | 27101E3 |
| | 100 | 30 x 25 | 0.73 | 0.45 | 900 | 1800 | 630 | 1050 | 57101E3 | 77101E3 |
| | 120 | 25 x 35 | 0.82 | 0.54 | 750 | 1500 | 530 | 885 | 57121E3 | 77121E3 |
| | 150 | 25 x 40 | 0.95 | 0.67 | 600 | 1200 | 420 | 705 | 47151E3 | 27151E3 |
| | 150 | 30 x 30 | 0.93 | 0.67 | 600 | 1200 | 420 | 705 | 57151E3 | 77151E3 |
| | 150 | 35 x 25 | 0.91 | 0.67 | 600 | 1200 | 420 | 705 | 67151E3 | 87151E3 |
| | 180 | 25 x 45 | 1.07 | 0.81 | 500 | 1000 | 360 | 605 | 47181E3 | 27181E3 |
| | 180 | 30 x 35 | 1.06 | 0.81 | 500 | 1000 | 360 | 605 | 57181E3 | 77181E3 |
| | 220 | 30 x 40 | 1.21 | 0.99 | 370 | 740 | 310 | 525 | 47221E3 | 27221E3 |
| | 220 | 35 x 30 | 1.14 | 0.99 | 370 | 740 | 310 | 525 | 57221E3 | 77221E3 |
| | 270 | 30 x 45 | 1.37 | 1.21 | 350 | 700 | 270 | 450 | 47271E3 | 27271E3 |
| | 270 | 35 x 35 | 1.32 | 1.21 | 350 | 700 | 270 | 450 | 57271E3 | 77271E3 |
| | 330 | 30 x 50 | 1.54 | 1.48 | 300 | 600 | 230 | 390 | 47331E3 | 27331E3 |
| | 330 | 35 x 40 | 1.49 | 1.48 | 300 | 600 | 230 | 390 | 57331E3 | 77331E3 |
| | 390 | 35 x 45 | 1.61 | 1.75 | 250 | 500 | 200 | 340 | 57391E3 | 77391E3 |
| | 470 | 35 x 40 | 1.90 | 1.50 | 210 | 300 | 115 | 190 | 90103E3D | - |
| | 470 | 35 x 50 | 1.72 | 2.11 | 210 | 420 | 170 | 290 | 57471E3 | 77471E3 |
| | 560 | 35 x 60 | 2.11 | 2.52 | 190 | 380 | 140 | 240 | 57561E3 | 77561E3 |

**Note**

[1] ESR at 120 Hz is approximately 0.95 x ESR 100 Hz

## ELECTRICAL DATA AND ORDERING INFORMATION

| $U_R$ (V) | $C_R$ 100 Hz (µF) | NOMINAL CASE SIZE Ø D x L (mm) | $I_R$ 120 Hz 105 °C (A) | $I_{L5}$ 5 min (mA) | TYP. ESR 100 Hz [1] (mΩ) | MAX. ESR 100 Hz [1] (mΩ) | TYP. Z 10 kHz (mΩ) | MAX. Z 10 kHz (mΩ) | ORDERING CODE MAL2159..... | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 2-TERM. | 3-TERM. |
| | 56 | 22 x 30 | 0.56 | 0.28 | 1730 | 2310 | 1280 | 1700 | 19569E3 | 89569E3 |
| | 68 | 22 x 35 | 0.63 | 0.34 | 1430 | 1900 | 1050 | 1400 | 19689E3 | 89689E3 |
| | 68 | 25 x 30 | 0.64 | 0.34 | 1430 | 1910 | 1060 | 1410 | 29689E3 | 69689E3 |
| | 82 | 22 x 35 | 0.69 | 0.41 | 1190 | 1580 | 880 | 1170 | 19829E3 | 89829E3 |
| | 82 | 25 x 30 | 0.69 | 0.41 | 1190 | 1590 | 890 | 1180 | 29829E3 | 69829E3 |
| | 100 | 22 x 40 | 0.80 | 0.50 | 980 | 1300 | 720 | 960 | 19101E3 | 89101E3 |
| | 100 | 25 x 35 | 0.80 | 0.50 | 980 | 1310 | 720 | 960 | 29101E3 | 69101E3 |
| | 120 | 25 x 40 | 0.92 | 0.60 | 820 | 1090 | 610 | 810 | 29121E3 | 89121E3 |
| | 120 | 30 x 30 | 0.91 | 0.60 | 830 | 1110 | 620 | 830 | 19121E3 | 69121E3 |
| | 150 | 25 x 45 | 1.07 | 0.75 | 650 | 870 | 490 | 650 | 19151E3 | 89151E3 |
| 500 | 150 | 30 x 35 | 1.05 | 0.75 | 670 | 890 | 500 | 660 | 29151E3 | 39151E3 |
| | 180 | 25 x 50 | 1.23 | 0.90 | 550 | 730 | 410 | 540 | 29181E3 | 89181E3 |
| | 180 | 30 x 40 | 1.19 | 0.90 | 560 | 740 | 410 | 550 | 19181E3 | 69181E3 |
| | 180 | 35 x 30 | 1.20 | 0.90 | 580 | 770 | 440 | 590 | 39181E3 | 49181E3 |
| | 220 | 30 x 45 | 1.37 | 1.10 | 460 | 610 | 340 | 450 | 29221E3 | 89221E3 |
| | 220 | 35 x 35 | 1.37 | 1.10 | 470 | 630 | 360 | 480 | 19221E3 | 69221E3 |
| | 270 | 30 x 50 | 1.57 | 1.35 | 380 | 500 | 280 | 370 | 19271E3 | 89271E3 |
| | 270 | 35 x 40 | 1.55 | 1.35 | 390 | 520 | 290 | 390 | 29271E3 | 69271E3 |
| | 330 | 35 x 45 | 1.74 | 1.65 | 320 | 430 | 240 | 320 | 19331E3 | 89331E3 |
| | 390 | 35 x 55 | 2.02 | 1.95 | 270 | 360 | 200 | 270 | 19391E3 | 89391E3 |
| | 470 | 35 x 60 | 2.24 | 2.35 | 230 | 300 | 170 | 230 | 19471E3 | 89471E3 |

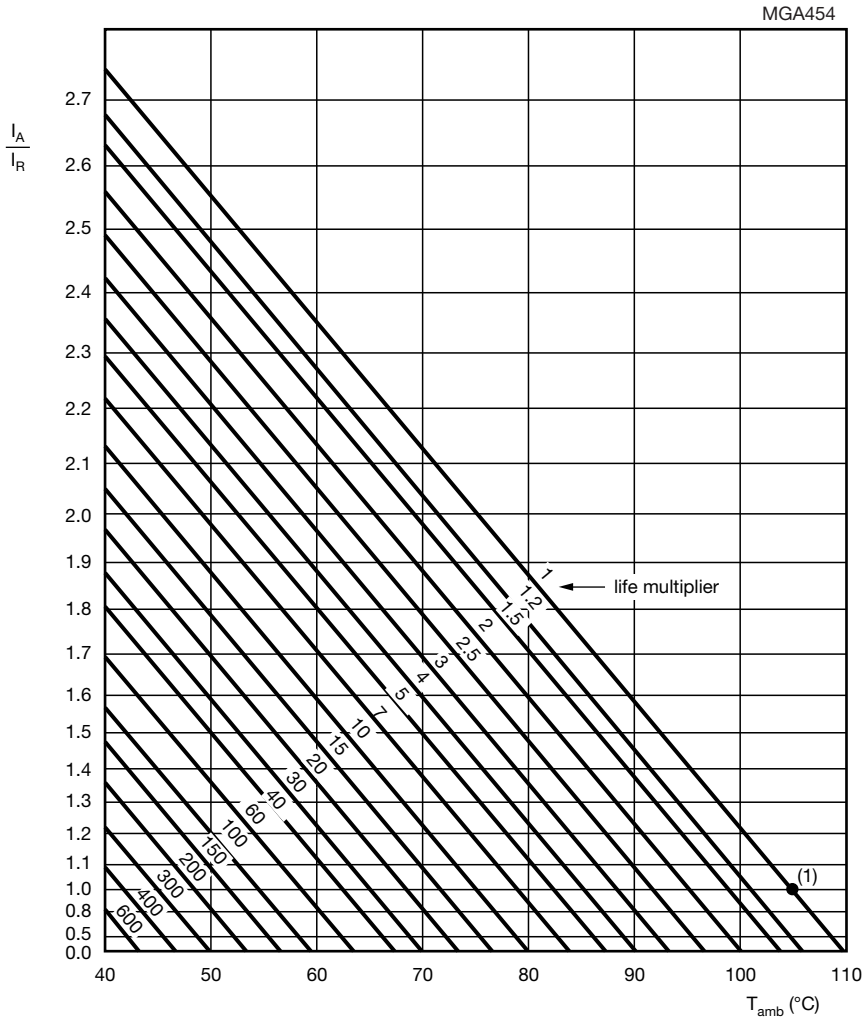
**Note**

[1] ESR at 120 Hz is approximately 0.95 x ESR 100 Hz

## ADDITIONAL ELECTRICAL DATA

| PARAMETER | CONDITIONS | VALUE |
|---|---|---|
| **Voltage** | | |
| Surge voltage | ≥ 400 V versions | $U_s = 1.1 \times U_R$ |
| | ≤ 250 V versions | $U_s = 1.15 \times U_R$ |
| Reverse voltage | | ≤ 1 V |
| **Current** | | |
| Leakage current | After 5 min at $U_R$ | $I_{L5} \leq 0.01\ C_R \times U_R$ |
| **Inductance** | | |
| Equivalent series inductance (ESL) | All case sizes | Typ. 19 nH |
| | | Max. 25 nH |

## RIPPLE CURRENT AND USEFUL LIFE




$I_A$ = Actual ripple current at 120 Hz

$I_R$ = Rated ripple current at 120 Hz and 105 °C

(1) Useful life at 105 °C and $I_R$ applied: 5000 h

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

**Table 3**

| ENDURANCE TEST DURATION AND USEFUL LIFE | |
|---|---|
| **ENDURANCE AT 105 °C (h)** | **USEFUL LIFE AT 105 °C (h)** |
| 2000 | 5000 |

**Note**

- Multiplier of useful life code: MGA454

**Table 4**

| MULTIPLIER OF RIPPLE CURRENT ($I_R$) AS A FUNCTION OF FREQUENCY | | | | | |
|---|---|---|---|---|---|
| **FREQUENCY (Hz)** | | | | | |
| **50** | **100** | **120** | **200** | **1000** | **≥ 10 000** |
| **$I_R$ MULTIPLIER** | | | | | |
| 0.90 | 0.95 | 1.00 | 1.15 | 1.30 | 1.40 |

**Table 5**

| TEST PROCEDURES AND REQUIREMENTS | | | |
|---|---|---|---|
| **TEST** | | **PROCEDURE (quick reference)** | **REQUIREMENTS** |
| **NAME OF TEST** | **REFERENCE** | | |
| Endurance | IEC 60384-4 / EN130300 subclause 4.13 | $T_{amb}$ = 105 °C; $U_R$ applied; 2000 h | ΔC/C: ± 15 %<br>ESR ≤ 1.3 x spec. limit<br>$I_{L5}$ ≤ spec. limit |
| Load life | | $T_{amb}$ = 105 °C; $U_R$ and $I_R$ applied; 2000 h | ΔC/C: ± 20 %<br>ESR ≤ 2 x spec. limit<br>$I_{L5}$ ≤ spec. limit |
| Useful life | CECC 30301 subclause 1.8.1 | $T_{amb}$ = 105 °C; $U_R$ and $I_R$ applied; 5000 h | ΔC/C: ± 30 %<br>ESR ≤ 3 x spec. limit<br>$I_{L5}$ ≤ spec. limit<br>total failure percentage: ≤ 3 % |
| Shelf life (storage at high temperature) | IEC 60384-4 / EN130300 subclause 4.17 | $T_{amb}$ = 105 °C; no voltage applied; 1000 h<br>after test: $U_R$ to be applied for 30 min, 24 h to 48 h before measurement | ΔC/C: ± 15 %<br>ESR ≤ 1.5 x spec. limit<br>$I_{L5}$ ≤ spec. limit |

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

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