

Aluminum Electrolytic Capacitors Power Long Life Printed Wiring


**RoHS
COMPLIANT**

FEATURES

- Polarized aluminum electrolytic capacitors, non-solid electrolyte
- Large types, minimized dimensions, cylindrical aluminum case, insulated with a blue sleeve
- Provided with keyed polarity
- Very long useful life: 5000 h at 105 °C
- High ripple current capability
- Temperature range up to 105 °C
- High resistance to shock and vibration
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

APPLICATIONS

- Computer, telecommunication and industrial 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
- Polarity of the terminals and “-” sign to indicate the negative terminal, visible from the top and / or side of the capacitor
- Code number
- Climatic category in accordance with IEC 60068

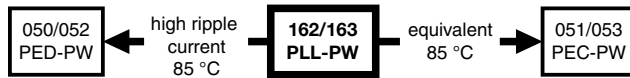


Fig. 1

| QUICK REFERENCE DATA | | |
|-----------------------------------------------------|------------------------|------------------|
| DESCRIPTION | VALUE | |
| | 162 | 163 |
| Nominal case size (Ø D x L in mm) | 25 x 30 to 40 x 100 | |
| Rated capacitance range (E6 series), C _R | 470 µF to 150 000 µF | 68 µF to 3300 µF |
| Tolerance on C _R | ± 20 % | |
| Rated voltage range, U _R | 10 V to 100 V | 200 V to 400 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 _R applied | 150 000 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 | |

| SELECTION CHART FOR C _R , U _R , AND RELEVANT NOMINAL CASE SIZES FOR 162 SERIES (Ø D x L in mm) | | | | | | |
|----------------------------------------------------------------------------------------------------------------------|--------------------|----------|----------|----------|----------|----------|
| C _R (µF) | U _R (V) | | | | | |
| | 10 | 16 | 25 | 40 | 63 | 100 |
| 470 | - | - | - | - | - | 25 x 30 |
| 680 | - | - | - | - | - | 25 x 40 |
| 1000 | - | - | - | - | 25 x 30 | 30 x 40 |
| 1500 | - | - | - | - | 25 x 40 | 35 x 40 |
| 2200 | - | - | - | 25 x 30 | 30 x 40 | 35 x 50 |
| | - | - | - | - | - | 40 x 40 |
| 3300 | - | - | - | 25 x 40 | 35 x 40 | 40 x 50 |
| | - | - | 25 x 30 | 30 x 40 | 35 x 50 | 40 x 70 |
| 4700 | - | - | - | - | 40 x 40 | - |
| | - | 25 x 30 | 25 x 40 | 35 x 40 | 40 x 50 | 40 x 100 |
| 10 000 | 25 x 30 | 25 x 40 | 30 x 40 | 35 x 50 | 40 x 70 | - |
| | - | - | - | 40 x 40 | - | - |
| 15 000 | 25 x 40 | 30 x 40 | 35 x 40 | 40 x 50 | 40 x 100 | - |
| | 30 x 40 | 35 x 40 | 35 x 50 | 40 x 70 | - | - |
| 22 000 | - | - | 40 x 40 | - | - | - |
| | 35 x 40 | 35 x 50 | 40 x 50 | 40 x 100 | - | - |
| 33 000 | - | 40 x 40 | - | - | - | - |
| | 35 x 50 | 40 x 50 | 40 x 70 | - | - | - |
| 47 000 | 40 x 40 | - | - | - | - | - |
| | 40 x 50 | 40 x 70 | 40 x 100 | - | - | - |
| 100 000 | 40 x 70 | 40 x 100 | - | - | - | - |
| 150 000 | 40 x 100 | - | - | - | - | - |

| SELECTION CHART FOR C_R , U_R , AND RELEVANT NOMINAL CASE SIZES FOR 163 SERIES ($\varnothing D \times L$ in mm) | | | | |
|----------------------------------------------------------------------------------------------------------------------|-----------|----------|----------|----------|
| C_R (μF) | U_R (V) | | | |
| | 200 | 250 | 385 | 400 |
| 68 | - | - | 25 x 30 | 25 x 30 |
| 100 | - | 25 x 30 | 25 x 40 | 25 x 40 |
| 150 | 25 x 30 | 25 x 40 | 30 x 40 | 30 x 40 |
| 220 | 25 x 40 | 30 x 40 | 35 x 40 | 35 x 40 |
| 330 | 30 x 40 | 35 x 40 | 35 x 50 | 35 x 50 |
| | - | - | 40 x 40 | 40 x 40 |
| 470 | 35 x 40 | 35 x 50 | 40 x 50 | 40 x 50 |
| | - | 40 x 40 | - | - |
| 680 | 35 x 50 | 40 x 50 | 40 x 70 | 40 x 70 |
| | 40 x 50 | - | - | - |
| 1000 | 40 x 50 | 40 x 70 | 40 x 100 | 40 x 100 |
| 1500 | 40 x 70 | 40 x 100 | - | - |
| 2200 | 40 x 100 | - | - | - |

DIMENSIONS in millimeters AND AVAILABLE FORMS

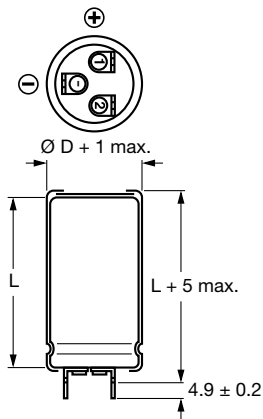


Fig. 2 - Printed wiring pin version
(case $\varnothing D = 25$ mm)

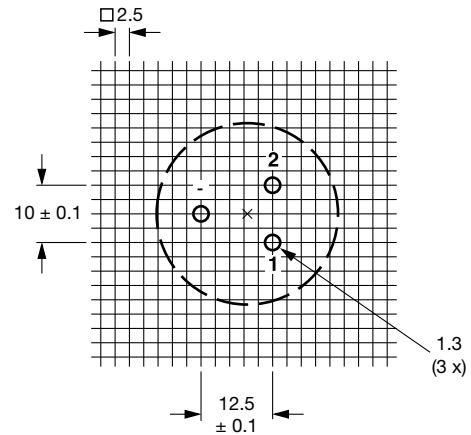


Fig. 3 - Mounting hole diagram viewed from component side
(case $\varnothing D = 25$ mm)

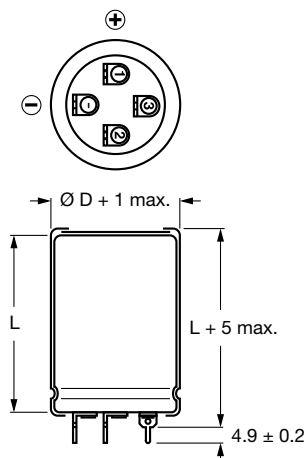


Fig. 4 - Printed wiring pin version
(case $\varnothing D = 30$ mm)

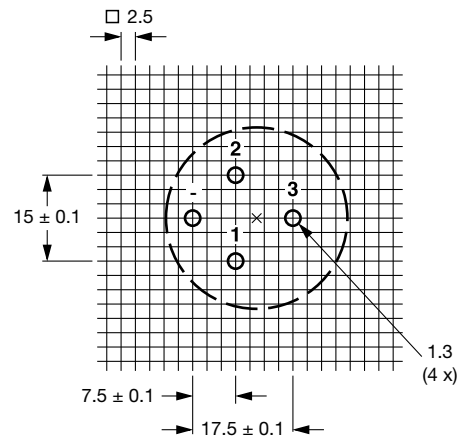


Fig. 5 - Mounting hole diagram viewed from component side
(case $\varnothing D = 30$ mm)

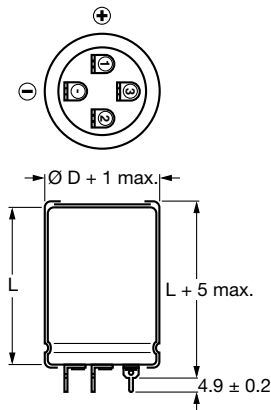


Fig. 6 - Printed wiring pin version
(case Ø D = 35 mm)

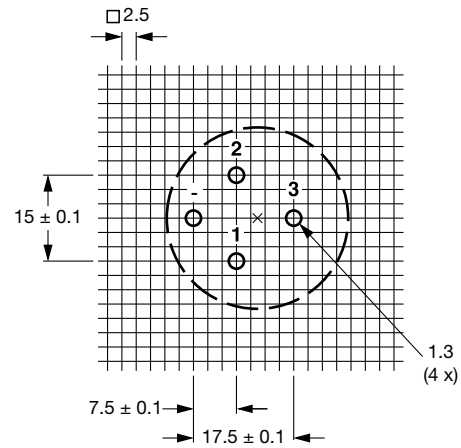


Fig. 7 - Mounting hole diagram viewed from component side
(case Ø D = 35 mm)

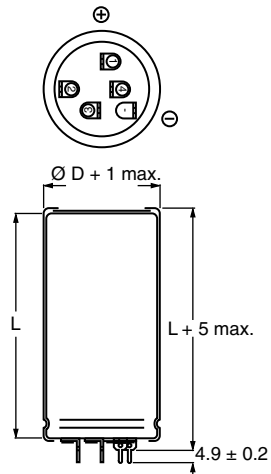


Fig. 8 - Printed wiring pin version
(case Ø D = 40 mm)

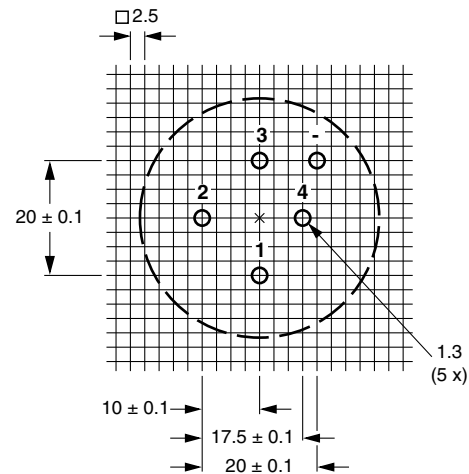


Fig. 9 - Mounting hole diagram viewed from component side
(case Ø D = 40 mm)

Table 1

| DIMENSIONS in millimeters, MASS AND PACKAGING QUANTITIES PW VERSIONS | | | | | |
|----------------------------------------------------------------------|---------------------|-------------------|-------------|-----------------------------------------|---------------------------------------|
| 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 |
| 25 x 30 | 26 | 35 | ≈ 24 | 100 | 290 x 280 x 50 |
| 25 x 40 | 26 | 45 | ≈ 28 | 100 | 290 x 280 x 60 |
| 30 x 40 | 31 | 45 | ≈ 38 | 100 | 340 x 330 x 60 |
| 35 x 40 | 36 | 45 | ≈ 51 | 50 | 390 x 198 x 60 |
| 35 x 50 | 36 | 55 | ≈ 66 | 50 | 390 x 198 x 70 |
| 40 x 40 | 41 | 45 | ≈ 78 | 50 | 440 x 223 x 60 |
| 40 x 50 | 41 | 55 | ≈ 82 | 50 | 440 x 223 x 70 |
| 40 x 70 | 41 | 75 | ≈ 110 | 25 | 230 x 230 x 90 |
| 40 x 100 | 41 | 105 | ≈ 176 | 25 | 230 x 230 x 120 |

MOUNTING

When a number of capacitors are connected in a bank, they must not be closer together than 15 mm, when no derating of ripple current and / or temperature is applied.

Pin number 1 is the positive terminal. Pin “-” is the negative terminal.

Pin numbers 2, 3 and 4 (if present) should be free from the electrical circuit or connected to the minus terminal.



| ELECTRICAL DATA | |
|-----------------|----------------------------------------------------|
| SYMBOL | DESCRIPTION |
| C _R | Rated capacitance at 100 Hz |
| I _R | Rated RMS ripple current at 100 Hz and 105 °C |
| I _{L1} | Max. leakage current after 1 min at U _R |
| I _{L5} | Max. leakage current after 5 min at U _R |
| ESR | Max. equivalent series resistance at 100 Hz |
| Z | Max. impedance at 10 kHz |

ORDERING EXAMPLE

Electrolytic capacitor 162 series
 10 000 µF / 25 V; ± 20 %
 Nominal case size: Ø 30 mm x 40 mm
 Ordering code: MAL2 16256103E3
 Former 12NC: 2222 16256103

Note

- Unless otherwise specified, all electrical values in Tables 2 and 3 apply at T_{amb} = 20 °C, P = 86 kPa to 106 kPa, RH = 45 % to 75 %

Table 2

| ELECTRICAL DATA AND ORDERING INFORMATION FOR 162 SERIES | | | | | | | | |
|---------------------------------------------------------|----------------------------------|--------------------------------------|-------------------------------------------|----------------------------------|----------------------------------|-----------------------|---------------------|-------------------------------|
| U _R (V) | C _R 100 Hz (µF) | NOMINAL CASE SIZE Ø D x L (mm) | I _R 100 Hz 105 °C (A) | I _{L1} 1 min (mA) | I _{L5} 5 min (mA) | ESR 100 Hz (mΩ) | Z 10 kHz (mΩ) | ORDERING CODE MAL2162..... |
| 10 | 10 000 | 25 x 30 | 3.17 | 0.60 | 0.20 | 48 | 37 | 54103E3 |
| | 15 000 | 25 x 40 | 4.21 | 0.90 | 0.30 | 34 | 27 | 54153E3 |
| | 22 000 | 30 x 40 | 5.05 | 1.32 | 0.44 | 29 | 23 | 54223E3 |
| | 33 000 | 35 x 40 | 5.63 | 1.98 | 0.66 | 27 | 22 | 54333E3 |
| | 47 000 | 35 x 50 | 6.19 | 2.82 | 0.94 | 26 | 21 | 54473E3 |
| | 47 000 | 40 x 40 | 6.19 | 2.82 | 0.94 | 26 | 21 | 44473E3 |
| | 68 000 | 40 x 50 | 7.64 | 4.08 | 1.36 | 21 | 18 | 54683E3 |
| | 100 000 | 40 x 70 | 10.0 | 6.00 | 2.00 | 16 | 15 | 54104E3 |
| 150 000 | 40 x 100 | 12.9 | 9.00 | 3.00 | 13 | 12 | 54154E3 | |
| 16 | 6800 | 25 x 30 | 3.11 | 0.65 | 0.22 | 50 | 37 | 55682E3 |
| | 10 000 | 25 x 40 | 4.09 | 0.96 | 0.32 | 36 | 27 | 55103E3 |
| | 15 000 | 30 x 40 | 4.97 | 1.44 | 0.48 | 30 | 23 | 55153E3 |
| | 22 000 | 35 x 40 | 5.53 | 2.12 | 0.71 | 29 | 22 | 55223E3 |
| | 33 000 | 35 x 50 | 6.08 | 3.17 | 1.06 | 28 | 21 | 55333E3 |
| | 33 000 | 40 x 40 | 6.08 | 3.17 | 1.06 | 28 | 21 | 45333E3 |
| | 47 000 | 40 x 50 | 7.46 | 4.52 | 1.51 | 22 | 18 | 55473E3 |
| | 68 000 | 40 x 70 | 9.70 | 6.53 | 2.18 | 17 | 15 | 55683E3 |
| 100 000 | 40 x 100 | 12.90 | 9.60 | 3.20 | 13 | 12 | 55104E3 | |
| 25 | 4700 | 25 x 30 | 2.94 | 0.71 | 0.24 | 56 | 37 | 56472E3 |
| | 6800 | 25 x 40 | 3.93 | 1.02 | 0.34 | 39 | 27 | 56682E3 |
| | 10 000 | 30 x 40 | 4.81 | 1.50 | 0.50 | 32 | 23 | 56103E3 |
| | 15 000 | 35 x 40 | 5.43 | 2.25 | 0.75 | 30 | 22 | 56153E3 |
| | 22 000 | 35 x 50 | 5.98 | 3.30 | 1.10 | 29 | 21 | 56223E3 |
| | 22 000 | 40 x 40 | 5.98 | 3.30 | 1.10 | 29 | 21 | 46223E3 |
| | 33 000 | 40 x 50 | 7.30 | 4.95 | 1.65 | 23 | 18 | 56333E3 |
| | 47 000 | 40 x 70 | 9.43 | 7.05 | 2.35 | 18 | 15 | 56473E3 |
| 68 000 | 40 x 100 | 12.44 | 10.20 | 3.40 | 14 | 12 | 56683E3 | |
| 40 | 2200 | 25 x 30 | 2.36 | 0.53 | 0.18 | 87 | 54 | 57222E3 |
| | 3300 | 25 x 40 | 3.17 | 0.79 | 0.27 | 60 | 38 | 57332E3 |
| | 4700 | 30 x 40 | 3.93 | 1.13 | 0.38 | 48 | 33 | 57472E3 |
| | 6800 | 35 x 40 | 4.59 | 1.63 | 0.55 | 42 | 31 | 57682E3 |
| | 10 000 | 35 x 50 | 5.03 | 2.40 | 0.80 | 41 | 29 | 57103E3 |
| | 10 000 | 40 x 40 | 5.03 | 2.40 | 0.80 | 41 | 29 | 47103E3 |
| | 15 000 | 40 x 50 | 6.09 | 3.60 | 1.20 | 33 | 24 | 57153E3 |
| | 22 000 | 40 x 70 | 8.34 | 5.28 | 1.76 | 23 | 18 | 57223E3 |
| 33 000 | 40 x 100 | 10.97 | 7.92 | 2.64 | 18 | 15 | 57333E3 | |
| 63 | 1000 | 25 x 30 | 1.55 | 0.38 | 0.13 | 202 | 155 | 58102E3 |
| | 1500 | 25 x 40 | 2.10 | 0.57 | 0.19 | 137 | 109 | 58152E3 |
| | 2200 | 30 x 40 | 2.72 | 0.83 | 0.28 | 100 | 79 | 58222E3 |
| | 3300 | 35 x 40 | 3.44 | 1.25 | 0.42 | 75 | 61 | 58332E3 |
| | 4700 | 35 x 50 | 4.09 | 1.78 | 0.60 | 62 | 53 | 58472E3 |
| | 4700 | 40 x 40 | 4.09 | 1.78 | 0.60 | 62 | 53 | 48472E3 |
| | 6800 | 40 x 50 | 5.10 | 2.57 | 0.86 | 47 | 40 | 58682E3 |
| | 10 000 | 40 x 70 | 6.86 | 3.78 | 1.26 | 34 | 29 | 58103E3 |
| 15 000 | 40 x 100 | 9.31 | 5.67 | 1.89 | 25 | 21 | 58153E3 | |



| ELECTRICAL DATA AND ORDERING INFORMATION FOR 162 SERIES | | | | | | | | |
|---------------------------------------------------------|-------------------------------|--------------------------------------------------|----------------------------------|---------------------------|---------------------------|--------------------------------|------------------------------|-------------------------------|
| U_R (V) | C_R 100 Hz (μ F) | NOMINAL CASE SIZE \varnothing D x L (mm) | I_R 100 Hz 105 °C (A) | I_{L1} 1 min (mA) | I_{L5} 5 min (mA) | ESR 100 Hz (m Ω) | Z 10 kHz (m Ω) | ORDERING CODE MAL2162..... |
| 100 | 470 | 25 x 30 | 1.42 | 0.28 | 0.10 | 240 | 155 | 59471E3 |
| | 680 | 25 x 40 | 1.90 | 0.41 | 0.14 | 167 | 109 | 59681E3 |
| | 1000 | 30 x 40 | 2.48 | 0.60 | 0.20 | 120 | 79 | 59102E3 |
| | 1500 | 35 x 40 | 3.17 | 0.90 | 0.30 | 88 | 61 | 59152E3 |
| | 2200 | 35 x 50 | 3.79 | 1.32 | 0.44 | 72 | 53 | 59222E3 |
| | 2200 | 40 x 40 | 3.79 | 1.32 | 0.44 | 72 | 53 | 49222E3 |
| | 3300 | 40 x 50 | 4.81 | 1.98 | 0.66 | 53 | 40 | 59332E3 |
| | 4700 | 40 x 70 | 6.49 | 2.82 | 0.94 | 38 | 29 | 59472E3 |
| | 6800 | 40 x 100 | 8.80 | 4.08 | 1.36 | 28 | 21 | 59682E3 |

Table 3

| ELECTRICAL DATA AND ORDERING INFORMATION FOR 163 SERIES | | | | | | | | |
|---------------------------------------------------------|-------------------------------|--------------------------------------------------|----------------------------------|---------------------------|---------------------------|--------------------------------|------------------------------|-------------------------------|
| U_R (V) | C_R 100 Hz (μ F) | NOMINAL CASE SIZE \varnothing D x L (mm) | I_R 100 Hz 105 °C (A) | I_{L1} 1 min (mA) | I_{L5} 5 min (mA) | ESR 100 Hz (m Ω) | Z 10 kHz (m Ω) | ORDERING CODE MAL2163..... |
| 200 | 150 | 25 x 30 | 0.72 | 0.18 | 0.06 | 950 | 710 | 52151E3 |
| | 220 | 25 x 40 | 0.96 | 0.26 | 0.09 | 650 | 485 | 52221E3 |
| | 330 | 30 x 40 | 1.29 | 0.40 | 0.14 | 442 | 330 | 52331E3 |
| | 470 | 35 x 40 | 1.66 | 0.57 | 0.19 | 321 | 240 | 52471E3 |
| | 680 | 35 x 50 | 2.09 | 0.82 | 0.28 | 237 | 185 | 52681E3 |
| | 680 | 40 x 40 | 2.09 | 0.82 | 0.28 | 237 | 185 | 42681E3 |
| | 1000 | 40 x 50 | 2.71 | 1.20 | 0.40 | 167 | 133 | 52102E3 |
| | 1500 | 40 x 70 | 3.75 | 1.80 | 0.60 | 114 | 90 | 52152E3 |
| | 2200 | 40 x 100 | 5.24 | 2.64 | 0.88 | 79 | 62 | 52222E3 |
| 250 | 100 | 25 x 30 | 0.67 | 0.15 | 0.05 | 1060 | 710 | 53101E3 |
| | 150 | 25 x 40 | 0.92 | 0.22 | 0.08 | 710 | 485 | 53151E3 |
| | 220 | 30 x 40 | 1.28 | 0.33 | 0.11 | 492 | 330 | 53221E3 |
| | 330 | 35 x 40 | 1.65 | 0.49 | 0.17 | 325 | 240 | 53331E3 |
| | 470 | 35 x 50 | 2.01 | 0.70 | 0.24 | 256 | 185 | 53471E3 |
| | 470 | 40 x 40 | 2.01 | 0.70 | 0.24 | 256 | 185 | 43471E3 |
| | 680 | 40 x 50 | 2.59 | 1.02 | 0.34 | 182 | 133 | 53681E3 |
| | 1000 | 40 x 70 | 3.58 | 1.50 | 0.50 | 125 | 90 | 53102E3 |
| | 1500 | 40 x 100 | 5.05 | 2.25 | 0.75 | 85 | 62 | 53152E3 |
| 385 | 68 | 25 x 30 | 0.61 | 0.16 | 0.06 | 1650 | 1260 | 58689E3 |
| | 100 | 25 x 40 | 0.82 | 0.23 | 0.08 | 1120 | 855 | 58101E3 |
| | 150 | 30 x 40 | 1.10 | 0.35 | 0.12 | 755 | 580 | 58151E3 |
| | 220 | 35 x 40 | 1.44 | 0.51 | 0.17 | 525 | 405 | 58221E3 |
| | 330 | 35 x 50 | 1.84 | 0.77 | 0.26 | 360 | 280 | 58331E3 |
| | 330 | 40 x 40 | 1.84 | 0.77 | 0.26 | 360 | 280 | 48331E3 |
| | 470 | 40 x 50 | 2.37 | 1.09 | 0.36 | 260 | 205 | 58471E3 |
| | 680 | 40 x 70 | 3.24 | 1.58 | 0.53 | 180 | 140 | 58681E3 |
| | 1000 | 40 x 100 | 4.54 | 2.31 | 0.78 | 125 | 100 | 58102E3 |
| 400 | 68 | 25 x 30 | 0.39 | 0.16 | 0.06 | 3200 | 2660 | 56689E3 |
| | 100 | 25 x 40 | 0.53 | 0.24 | 0.08 | 2180 | 1810 | 56101E3 |
| | 150 | 30 x 40 | 0.72 | 0.36 | 0.12 | 1460 | 1210 | 56151E3 |
| | 220 | 35 x 40 | 0.94 | 0.52 | 0.17 | 1010 | 830 | 56221E3 |
| | 330 | 35 x 50 | 1.24 | 0.79 | 0.26 | 680 | 570 | 56331E3 |
| | 330 | 40 x 40 | 1.24 | 0.79 | 0.26 | 680 | 570 | 46331E3 |
| | 470 | 40 x 50 | 1.59 | 1.12 | 0.37 | 485 | 407 | 56471E3 |
| | 680 | 40 x 70 | 2.18 | 1.63 | 0.54 | 336 | 282 | 56681E3 |
| | 1000 | 40 x 100 | 3.07 | 2.40 | 0.80 | 230 | 193 | 56102E3 |



| ADDITIONAL ELECTRICAL DATA | | |
|------------------------------------|------------------------------------------------|----------------------------------------------------|
| PARAMETER | CONDITIONS | VALUE |
| Voltage | | |
| Surge voltage | ≤ 200 V versions | $U_s = 1.15 \times U_R$ |
| | ≥ 385 V versions | $U_s = 1.1 \times U_R$ |
| Reverse voltage | | $U_{rev} \leq 1 \text{ V}$ |
| Current | | |
| 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 | $I_{L5} \leq 0.002 C_R \times U_R + 4 \mu\text{A}$ |
| Inductance | | |
| Equivalent series inductance (ESL) | Case $\varnothing D = 25 \text{ mm}$ | Max. 25 nH |
| | Case $\varnothing D = 30 \text{ mm}$ and 35 mm | Max. 30 nH |
| | Case $\varnothing D = 40 \text{ mm}$ | Max. 35 nH |

RIPPLE CURRENT AND USEFUL LIFE

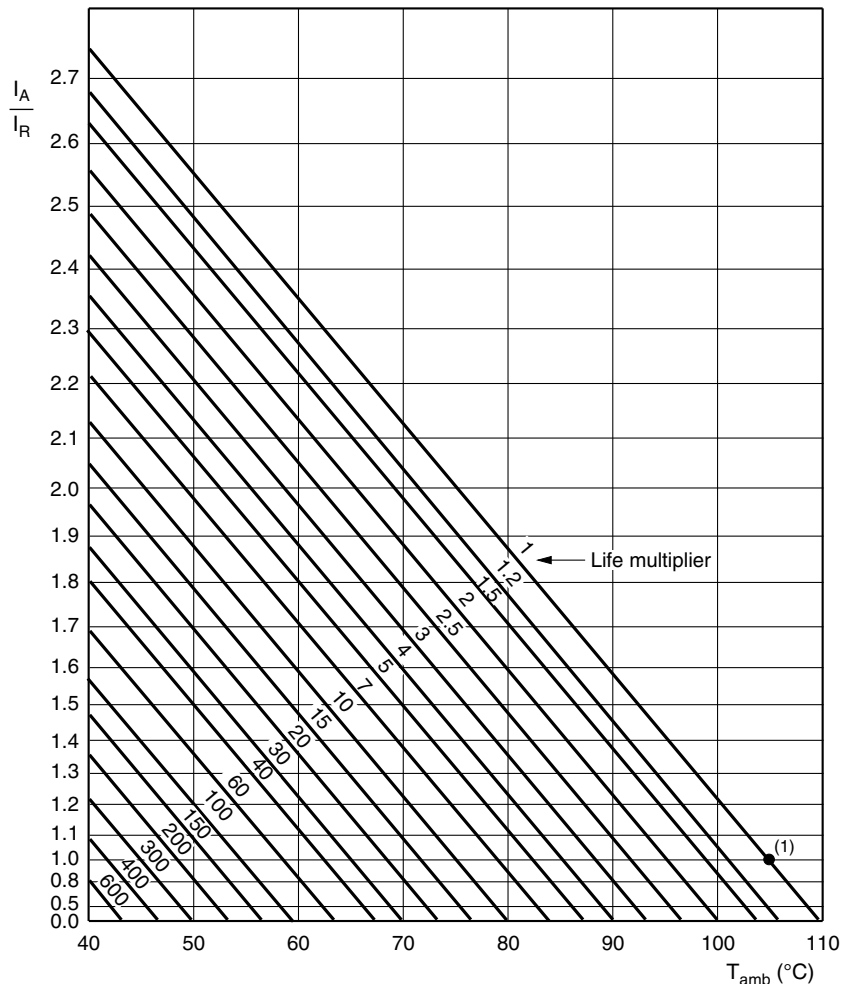
Table 4

| 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

MGA454



I_A = Actual ripple current at 100 Hz

I_R = Rated ripple current at 100 Hz and 105 °C

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

Fig. 10 - Multiplier of useful life as a function of ambient temperature and ripple current load



Table 5

| MULTIPLIER OF RIPPLE CURRENT (I_R) AS A FUNCTION OF FREQUENCY | | | | | | | | |
|-------------------------------------------------------------------|------------------|------|------|------|------|------|------|----------|
| U_R (V) | FREQUENCY (Hz) | | | | | | | |
| | 50 | 100 | 200 | 400 | 1000 | 2000 | 4000 | ≥ 10 000 |
| | I_R MULTIPLIER | | | | | | | |
| 10 | 0.93 | 1.00 | 1.04 | 1.07 | 1.11 | 1.13 | 1.15 | 1.18 |
| 16 | 0.93 | 1.00 | 1.04 | 1.07 | 1.11 | 1.13 | 1.15 | 1.18 |
| 25 | 0.93 | 1.00 | 1.04 | 1.07 | 1.11 | 1.13 | 1.15 | 1.18 |
| 40 | 0.91 | 1.00 | 1.05 | 1.09 | 1.13 | 1.15 | 1.18 | 1.22 |
| 63 | 0.91 | 1.00 | 1.05 | 1.09 | 1.13 | 1.15 | 1.18 | 1.22 |
| 100 | 0.91 | 1.00 | 1.05 | 1.09 | 1.13 | 1.15 | 1.18 | 1.22 |
| 200 | 0.86 | 1.00 | 1.13 | 1.21 | 1.29 | 1.32 | 1.35 | 1.40 |
| 250 | 0.86 | 1.00 | 1.13 | 1.21 | 1.29 | 1.32 | 1.35 | 1.40 |
| 385 | 0.86 | 1.00 | 1.13 | 1.21 | 1.29 | 1.32 | 1.35 | 1.40 |
| 400 | 0.86 | 1.00 | 1.13 | 1.21 | 1.29 | 1.32 | 1.35 | 1.40 |

Table 6

| TEST PROCEDURES AND REQUIREMENT | | | |
|---------------------------------------------|---------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| TEST | | PROCEDURE (quick reference) | REQUIREMENTS |
| NAME OF TEST | REFERENCE | | |
| Endurance | IEC 60384-4 / EN130300 subclause 4.13 | $T_{amb} = 105\text{ °C}$; U_R applied; 2000 h | $U_R \leq 100\text{ V}$; $\Delta C/C: \pm 15\%$ $U_R > 100\text{ V}$; $\Delta C/C: \pm 10\%$ $ESR \leq 1.3 \times \text{spec. limit}$ $Z \leq 2 \times \text{spec. limit}$ $I_{L5} \leq \text{spec. limit}$ |
| Useful life | CECC 30301 subclause 1.8.1 | $T_{amb} = 105\text{ °C}$; U_R and I_R applied; 5000 h | $U_R \leq 100\text{ V}$; $\Delta C/C: \pm 45\%$ $U_R > 100\text{ V}$; $\Delta C/C: \pm 30\%$ $ESR \leq 3 \times \text{spec. limit}$ $Z \leq 3 \times \text{spec. limit}$ $I_{L5} \leq \text{spec. limit}$ no short or open circuit, no visible damage total failure percentage: $U_R \leq 100\text{ V}: \leq 1\%$; $U_R > 100\text{ V}: \leq 3\%$ |
| Shelf life (storage at high temperature) | IEC 60384-4 / EN130300 subclause 4.17 | $T_{amb} = 105\text{ °C}$; no voltage applied; 500 h After test: U_R to be applied for 30 min, 24 h to 48 h before measurement | $\Delta C/C: \pm 10\%$ $ESR \leq 1.2 \times \text{spec. limit}$ $I_{L5} \leq 2 \times \text{spec. limit}$ |

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



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