

Aluminum Capacitors Power Ultra Long Life Snap-In

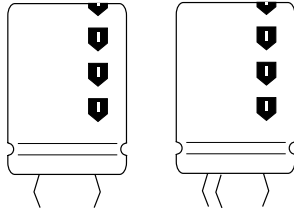


Fig.1 Component outlines



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

FEATURES

- 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
- Long useful life: up to 5000 hours at 105 °C
- Keyed polarity version available


**RoHS
COMPLIANT**
APPLICATIONS

- General purpose, industrial, telecom 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:

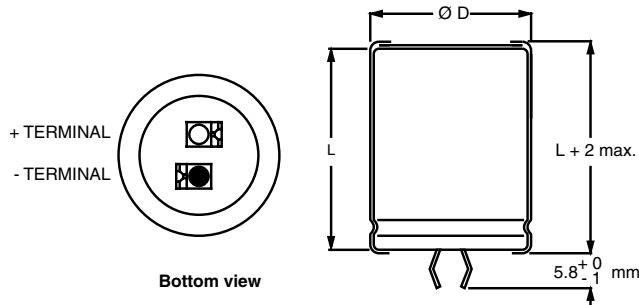
- Rated capacitance (in µF)
- Tolerance on rated capacitance, code letter in accordance with IEC 60062 (M for ± 20 %)
- Rated voltage (in V)
- Date code (YYMM)
- Name of manufacturer
- Code for factory of origin
- '-' sign to identify the negative terminal, visible from the top and side of the capacitor
- Code number
- Climatic category in accordance with IEC 60068

| SELECTION CHART FOR C _R , U _R AND RELEVANT NOMINAL CASE SIZES (Ø D x L in mm) | | | | | | | | |
|---|--------------------|---------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|
| C _R (µF) | U _R (V) | | | | | | | |
| | 16 | 25 | 35 | 40 | 50 | 63 | 80 | 100 |
| 560 | - | - | - | - | - | - | - | 22 x 25 |
| 680 | - | - | - | - | - | - | 22 x 25 | 22 x 30 |
| 1000 | - | - | - | - | - | - | 22 x 30 | 25 x 30 |
| 1200 | - | - | - | - | - | - | 25 x 30 | - |
| 1500 | - | - | - | - | - | 22 x 25 | - | 25 x 40 30 x 30 |
| 1800 | - | - | - | - | - | - | - | 30 x 35 |
| 2200 | - | - | - | - | 22 x 25 | 22 x 30 | 25 x 40 30 x 30 | 30 x 40 |
| 2700 | - | - | - | - | - | 25 x 30 | 30 x 35 | - |
| 3300 | - | - | - | 22 x 25 | 22 x 30 | 25 x 40 | 30 x 40 | 35 x 40 |
| 3900 | - | - | - | 22 x 30 | 25 x 30 | 25 x 40 30 x 30 | - | - |
| 4700 | - | 22 x 25 | 22 x 30 | 22 x 30 | 25 x 30 25 x 40 | 30 x 30 30 x 35 | 35 x 40 | - |
| 5600 | - | - | - | 25 x 30 | 25 x 40 | 30 x 35 | - | - |
| 6800 | 22 x 25 | 22 x 30 | 25 x 30 | 25 x 40 | 30 x 30 | 30 x 40 | - | - |
| 8200 | - | 25 x 30 | - | 30 x 30 | 30 x 35 | 35 x 40 | - | - |
| 10 000 | 22 x 30 | 25 x 40 | 25 x 40 30 x 30 | 30 x 35 30 x 40 | 30 x 40 | - | - | - |

| SELECTION CHART FOR C_R , U_R AND RELEVANT NOMINAL CASE SIZES ($\varnothing D \times L$ in mm) | | | | | | | | |
|---|--------------------|--------------------|---------|---------|----|----|----|-----|
| C_R (μF) | U_R (V) | | | | | | | |
| | 16 | 25 | 35 | 40 | 50 | 63 | 80 | 100 |
| 12 000 | - | 25 x 40 30 x 30 | - | - | - | - | - | - |
| 15 000 | 25 x 30 | 30 x 35 30 x 40 | 30 x 40 | 35 x 40 | - | - | - | - |
| 18 000 | - | - | - | 35 x 40 | - | - | - | - |
| 22 000 | 25 x 40 30 x 30 | 35 x 40 | 35 x 40 | - | - | - | - | - |
| 27 000 | 30 x 35 | - | - | - | - | - | - | - |
| 33 000 | 30 x 40 | - | - | - | - | - | - | - |
| 39 000 | - | - | - | - | - | - | - | - |
| 47 000 | 30 x 40 35 x 40 | - | - | - | - | - | - | - |

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

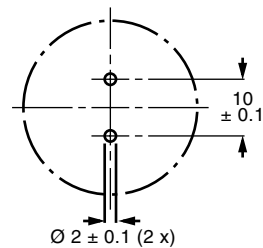
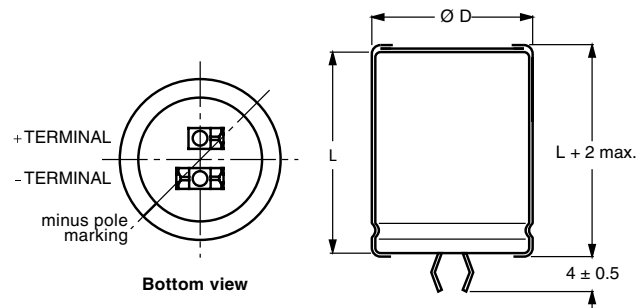


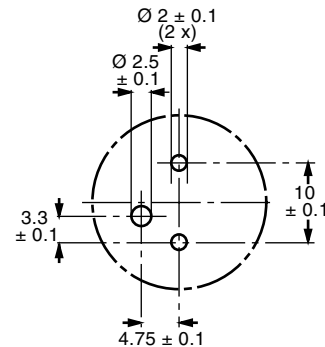
Fig.3 Mounting hole diagram

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 (mm) |
| 22 x 25 | 23 | 27 | 12 | 100 | 260 x 250 x 39 |
| 22 x 30 | 23 | 32 | 16 | 100 | 260 x 250 x 44 |
| 25 x 30 | 26 | 32 | 22 | 100 | 290 x 280 x 44 |
| 25 x 40 | 26 | 42 | 27 | 100 | 290 x 280 x 54 |
| 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 |
| 35 x 40 | 36 | 42 | 55 | 50 | 390 x 198 x 54 |

| ELECTRICAL DATA | |
|-----------------|--|
| SYMBOL | DESCRIPTION |
| C _R | rated capacitance at 100 Hz |
| I _R | rated RMS ripple current at 100 Hz or 10 kHz, 105 °C |
| I _{L5} | max. leakage current after 5 minutes at U _R |
| ESR | max. equivalent series resistance at 100 Hz ⁽¹⁾ |
| Z | max. impedance at 10 kHz |

Notes

- ⁽¹⁾ 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 °C, P = 86 to 106 kPa, RH = 45 to 75 %

ORDERING EXAMPLE

Electrolytic capacitor 090 series
3300 µF/80 V; ± 20 %
Nominal case size: Ø 30 x 40 mm
2-terminal snap-in:
Ordering code: MAL209032332E3
Former 12NC: 222209032332

3-terminal snap-in:
Ordering code: MAL209072332E3
Former 12NC: 222209072332

Table 2

| ELECTRICAL DATA AND ORDERING INFORMATION FOR 2 AND 3 TERMINAL SNAP-IN VERSIONS | | | | | | | | | |
|--|----------------------------|--------------------------------|----------------------------------|----------------------------------|----------------------------|-------------------------------------|--------------------|----------------------------|------------|
| U _R (V) | C _R 100 Hz (µF) | NOMINAL CASE SIZE Ø D x L (mm) | I _R 100 Hz 105 °C (A) | I _R 10 kHz 105 °C (A) | I _{L5} 5 min (mA) | MAX. ESR 100 Hz ⁽¹⁾ (mΩ) | MAX. Z 10 kHz (mΩ) | ORDERING CODE MAL2090..... | |
| | | | | | | | | 2-TERM. SI | 3-TERM. SI |
| 16 | 6800 | 22 x 25 | 2.8 | 3.3 | 222 | 82 | 66 | 15682E3 | 55682E3 |
| | 10 000 | 22 x 30 | 3.4 | 4.0 | 324 | 59 | 48 | 15103E3 | 55103E3 |
| | 15 000 | 25 x 30 | 3.6 | 4.3 | 484 | 53 | 44 | 25153E3 | 65153E3 |
| | 22 000 | 25 x 40 | 4.5 | 5.5 | 708 | 38 | 33 | 25223E3 | 65223E3 |
| | 22 000 | 30 x 30 | 3.7 | 4.5 | 708 | 54 | 43 | 35223E3 | 75223E3 |
| | 27 000 | 30 x 35 | 4.2 | 5.1 | 868 | 45 | 36 | 35273E3 | 75273E3 |
| | 33 000 | 30 x 40 | 4.7 | 5.6 | 1060 | 39 | 32 | 35333E3 | 75333E3 |
| | 47 000 | 35 x 40 | 4.8 | 5.8 | 1508 | 43 | 32 | 45473E3 | 85473E3 |
| 25 | 4700 | 22 x 25 | 2.6 | 3.1 | 236 | 89 | 66 | 16472E3 | 56472E3 |
| | 6800 | 22 x 30 | 3.2 | 3.8 | 341 | 65 | 49 | 16682E3 | 56682E3 |
| | 8200 | 25 x 30 | 3.4 | 4.1 | 411 | 60 | 46 | 26822E3 | 66822E3 |
| | 10 000 | 25 x 40 | 4.3 | 5.1 | 501 | 46 | 35 | 26103E3 | 66103E3 |
| | 12 000 | 25 x 40 | 4.3 | 5.2 | 601 | 43 | 34 | 26123E3 | 66123E3 |
| | 12 000 | 30 x 30 | 3.7 | 4.5 | 601 | 56 | 44 | 36123E3 | 76123E3 |
| | 15 000 | 30 x 35 | 4.2 | 5.1 | 751 | 46 | 36 | 16153E3 | 56153E3 |
| | 15 000 | 30 x 40 | 4.8 | 5.7 | 751 | 40 | 33 | 36153E3 | 76153E3 |
| 22 000 | 35 x 40 | 5.1 | 6.1 | 1101 | 40 | 31 | 46223E3 | 86223E3 | |
| 35 | 4700 | 22 x 30 | 2.8 | 3.4 | 330 | 78 | 53 | 10472E3 | 50472E3 |
| | 6800 | 25 x 30 | 3.0 | 3.6 | 477 | 70 | 50 | 20682E3 | 60682E3 |
| | 10 000 | 25 x 40 | 3.9 | 4.7 | 701 | 49 | 36 | 20103E3 | 60103E3 |
| | 10 000 | 30 x 30 | 3.2 | 3.9 | 701 | 70 | 49 | 30103E3 | 70103E3 |
| | 15 000 | 30 x 40 | 4.1 | 4.9 | 1051 | 49 | 35 | 30153E3 | 70153E3 |
| 22 000 | 35 x 40 | 4.2 | 5.0 | 1541 | 55 | 35 | 40223E3 | 80223E3 | |

ELECTRICAL DATA AND ORDERING INFORMATION FOR 2 AND 3 TERMINAL SNAP-IN VERSIONS

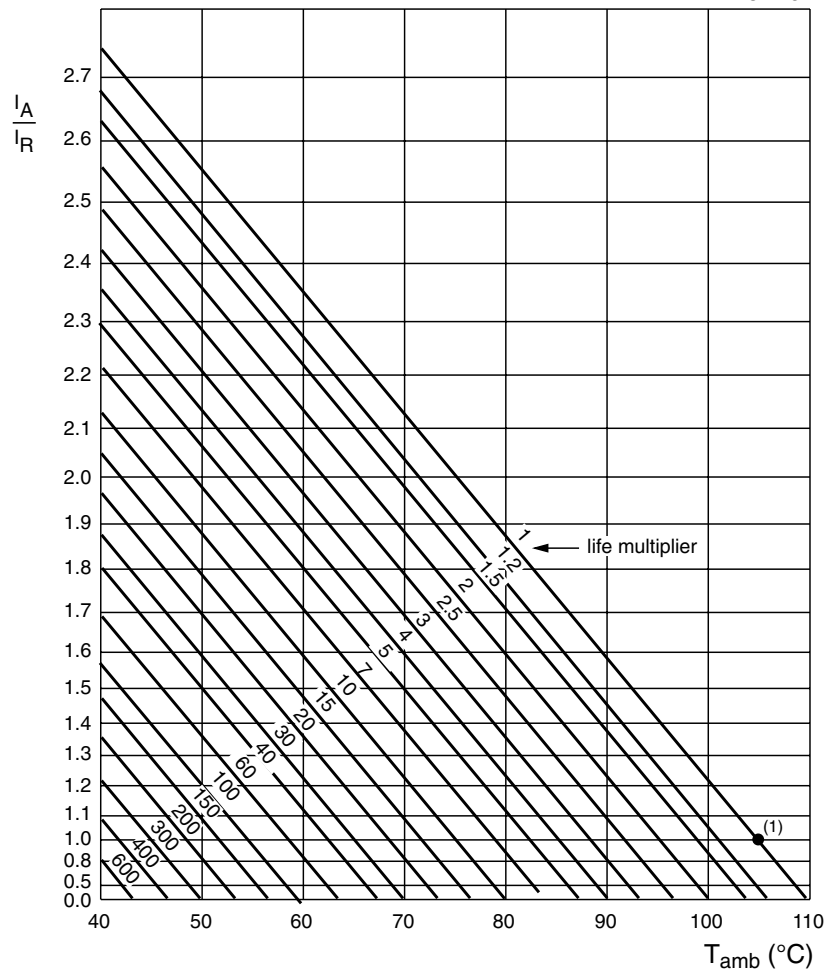
| U _R (V) | C _R 100 Hz (μF) | NOMINAL CASE SIZE Ø D x L (mm) | I _R 100 Hz 105 °C (A) | I _R 10 kHz 105 °C (A) | I _{L5} 5 min (mA) | MAX. ESR 100 Hz ⁽¹⁾ (mΩ) | MAX. Z 10 kHz (mΩ) | ORDERING CODE MAL2090..... | |
|-----------------------|----------------------------------|---|---|---|----------------------------------|---|--------------------------|-------------------------------|------------|
| | | | | | | | | 2-TERM. SI | 3-TERM. SI |
| 40 | 3300 | 22 x 25 | 2.4 | 2.9 | 265 | 99 | 70 | 17332E3 | 57332E3 |
| | 3900 | 22 x 30 | 2.9 | 3.4 | 313 | 76 | 54 | 17392E3 | 57392E3 |
| | 4700 | 22 x 30 | 2.9 | 3.5 | 377 | 71 | 51 | 17472E3 | 57472E3 |
| | 5600 | 25 x 30 | 3.1 | 3.7 | 449 | 69 | 50 | 27562E3 | 67562E3 |
| | 6800 | 25 x 40 | 3.9 | 4.7 | 545 | 51 | 38 | 27682E3 | 67682E3 |
| | 8200 | 30 x 30 | 3.3 | 3.9 | 657 | 69 | 49 | 37822E3 | 77822E3 |
| | 10 000 | 30 x 35 | 3.8 | 4.5 | 801 | 56 | 41 | 17103E3 | 57103E3 |
| | 10 000 | 30 x 40 | 4.3 | 5.1 | 801 | 48 | 36 | 37103E3 | 77103E3 |
| | 15 000 | 35 x 40 | 4.5 | 5.4 | 1201 | 50 | 35 | 47153E3 | 87153E3 |
| 18 000 | 35 x 40 | 4.3 | 5.1 | 1441 | 54 | 35 | 47183E3 | 87183E3 | |
| 50 | 2200 | 22 x 25 | 2.1 | 2.6 | 221 | 145 | 106 | 11222E3 | 51222E3 |
| | 3300 | 22 x 30 | 2.6 | 3.2 | 331 | 101 | 76 | 11332E3 | 51332E3 |
| | 3900 | 25 x 30 | 2.8 | 3.4 | 391 | 93 | 71 | 21392E3 | 61392E3 |
| | 4700 | 25 x 30 | 2.9 | 3.5 | 471 | 85 | 70 | 31472E3 | 71472E3 |
| | 4700 | 25 x 40 | 3.6 | 4.3 | 471 | 71 | 55 | 21472E3 | 61472E3 |
| | 5600 | 25 x 40 | 3.6 | 4.4 | 561 | 66 | 51 | 21562E3 | 61562E3 |
| | 6800 | 30 x 30 | 3.1 | 3.7 | 681 | 83 | 65 | 31682E3 | 71682E3 |
| | 8200 | 30 x 35 | 3.5 | 4.2 | 821 | 68 | 54 | 31822E3 | 71822E3 |
| | 10 000 | 30 x 40 | 4.0 | 4.7 | 1001 | 58 | 46 | 31103E3 | 71103E3 |
| | 15 000 | 35 x 40 | 4.0 | 4.9 | 1501 | 63 | 45 | 41153E3 | 81153E3 |
| 63 | 1500 | 22 x 25 | 2.1 | 2.5 | 190 | 161 | 126 | 18152E3 | 58152E3 |
| | 2200 | 22 x 30 | 2.6 | 3.1 | 279 | 114 | 90 | 18222E3 | 58222E3 |
| | 2700 | 25 x 30 | 2.8 | 3.4 | 342 | 101 | 81 | 28272E3 | 68272E3 |
| | 3300 | 25 x 40 | 3.5 | 4.2 | 417 | 79 | 63 | 28332E3 | 68332E3 |
| | 3900 | 25 x 40 | 3.6 | 4.3 | 493 | 71 | 58 | 28392E3 | 68392E3 |
| | 3900 | 30 x 30 | 3.1 | 3.8 | 493 | 89 | 74 | 38392E3 | 78392E3 |
| | 4700 | 30 x 30 | 3.1 | 3.7 | 594 | 88 | 71 | 18472E3 | 58472E3 |
| | 4700 | 30 x 35 | 3.6 | 4.3 | 594 | 74 | 61 | 38472E3 | 78472E3 |
| | 5600 | 30 x 35 | 3.5 | 4.2 | 707 | 71 | 59 | 38562E3 | 78562E3 |
| | 6800 | 30 x 40 | 4.0 | 4.7 | 858 | 61 | 51 | 38682E3 | 78682E3 |
| | 8200 | 35 x 40 | 4.3 | 5.1 | 1035 | 61 | 50 | 48822E3 | 88822E3 |
| 80 | 820 | 22 x 25 | 1.5 | 1.8 | 133 | 244 | 184 | 12821E3 | 52821E3 |
| | 1000 | 22 x 30 | 1.8 | 2.1 | 161 | 196 | 146 | 12102E3 | 52102E3 |
| | 1500 | 25 x 30 | 2.1 | 2.6 | 241 | 145 | 113 | 22152E3 | 62152E3 |
| | 2200 | 25 x 40 | 2.8 | 3.3 | 353 | 101 | 79 | 22222E3 | 62222E3 |
| | 2200 | 30 x 30 | 2.5 | 3.0 | 353 | 119 | 96 | 32222E3 | 72222E3 |
| | 2700 | 30 x 35 | 2.8 | 3.4 | 433 | 98 | 79 | 32272E3 | 72272E3 |
| | 3300 | 30 x 40 | 3.2 | 3.8 | 529 | 81 | 66 | 32332E3 | 72332E3 |
| | 4700 | 35 x 40 | 3.4 | 4.1 | 753 | 75 | 63 | 42472E3 | 82472E3 |
| 100 | 560 | 22 x 25 | 1.4 | 1.6 | 113 | 269 | 184 | 19561E3 | 59561E3 |
| | 680 | 22 x 30 | 1.6 | 1.9 | 137 | 216 | 146 | 19681E3 | 59681E3 |
| | 1000 | 25 x 30 | 1.9 | 2.3 | 201 | 163 | 114 | 29102E3 | 69102E3 |
| | 1500 | 25 x 40 | 2.5 | 3.1 | 301 | 111 | 79 | 29152E3 | 69152E3 |
| | 1500 | 30 x 30 | 2.3 | 2.7 | 301 | 130 | 98 | 39152E3 | 79152E3 |
| | 1800 | 30 x 35 | 2.6 | 3.2 | 361 | 108 | 80 | 39182E3 | 79182E3 |
| | 2200 | 30 x 40 | 3.0 | 3.6 | 441 | 90 | 68 | 39222E3 | 79222E3 |
| | 3300 | 35 x 40 | 3.2 | 3.8 | 661 | 81 | 64 | 49332E3 | 89332E3 |



| ADDITIONAL ELECTRICAL DATA | | |
|------------------------------------|--------------------------|--|
| PARAMETER | CONDITIONS | VALUE |
| Voltage | | |
| Surge voltage | | $U_s = 1.15 \times U_R$ |
| Reverse voltage | | $U_{rev} \leq 1 \text{ V}$ |
| Current | | |
| Leakage current | After 1 minute at U_R | $I_{L1} \leq 0.006 C_R \times U_R + 4 \mu\text{A}$ |
| | After 5 minutes at U_R | $I_{L5} \leq 0.002 C_R \times U_R + 4 \mu\text{A}$ |
| Inductance | | |
| Equivalent series inductance (ESL) | All case sizes | typ. 19 nH |
| | | max. 25 nH |

RIPPLE CURRENT AND USEFUL LIFE

MGA 454



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 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 |
| | $U_R = 25$ to 100 V |
| 50 | 0.91 |
| 100 | 1.00 |
| 200 | 1.05 |
| 400 | 1.09 |
| 1000 | 1.13 |
| 2000 | 1.15 |
| 4000 | 1.18 |
| $\geq 10\ 000$ | 1.22 |

Table 4

| 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 hours | $\Delta C/C: \pm 15$ % ESR ≤ 1.3 x spec. limit $Z \leq 2$ x spec. limit $I_{L5} \leq$ spec. limit |
| Useful life | CECC 30301 subclause 1.8.1 | $T_{amb} = 105$ °C; U_R and I_R applied; 5000 hours | $\Delta C/C: \pm 20$ % ESR ≤ 3 x spec. limit $Z \leq 3$ x spec. limit $I_{L5} \leq$ spec. limit no short or open circuit, no visible damage total failure percentage: $U_R: \leq 1$ % |
| Shelf life (storage at high temperature) | IEC 60384-4/ EN130300 subclause 4.17 | $T_{amb} = 105$ °C; no voltage applied; 500 hours after test: U_R to be applied for 30 minutes, 24 hours to 48 hours before measurement | $\Delta C/C: \pm 15$ % ESR ≤ 1.5 x spec. limit $I_{L5} \leq 2$ x spec. limit |



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