

Aluminum Electrolytic Capacitors

Power High Ripple Current Long Life 4-Terminal Snap-In

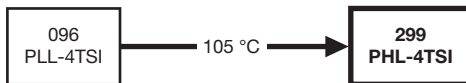

LINKS TO ADDITIONAL RESOURCES


Fig. 1

| QUICK REFERENCE DATA | |
|----------------------------------|--|
| DESCRIPTION | VALUE |
| Nominal case size (D x L in mm) | 35 x 50 to 45 x 100 |
| Rated capacitance range C_R | 270 μ F to 3300 μ F |
| Tolerance on C_R | $\pm 20\%$ |
| Rated voltage range, U_R | 350 V to 450 V 500 V to 600 V |
| Temperature range | -40 °C to +105 °C |
| Endurance test at 105 °C | 2000 h |
| Useful life at 105 °C | > 5000 h |
| Shelf life at 0 V, 105 °C | 1000 h |
| Based on sectional specification | IEC 60384-4 / EN 130300 |
| Climatic category IEC 60068 | 40 / 105 / 56 25 / 105 / 56 ⁽¹⁾ |

Note

⁽¹⁾ Capacitors can be operated in temperature range of -40 °C to +105 °C but impedance at -40 °C must be taken into consideration with regards to IEC 60068

FEATURES

- Polarized aluminum electrolytic capacitors, non-solid electrolyte
- Large types, minimized dimensions, cylindrical aluminum case, insulated with a blue sleeve
- **Rated voltages up to 600 V**
- Long useful life: > 5000 h at 105 °C
- Stable mounting and keyed polarity
- High ripple current capability
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912


**RoHS
COMPLIANT**
APPLICATIONS

- Switched mode power supplies
- Uninterruptible power supplies
- Renewable energy power converters
- Energy storage in pulse systems

MARKING

The capacitors are marked (where possible) with the following information:

- Rated capacitance (in μ F)
- Tolerance code on rated capacitance, code letter in accordance with IEC 60062 (M for $\pm 20\%$)
- Rated voltage (in V)
- Date code
- Name of manufacturer
- Code for factory of origin
- “-” sign to identify the negative terminal, visible from the top and side of the capacitor
- (Partial) ordering code
- Climatic category in accordance with IEC 60068

| SELECTION CHART FOR C_R , U_R , AND RELEVANT NOMINAL CASE SIZES (\varnothing D x L in mm) | | | | | | |
|--|--------------------|--------------------|--------------------|--------------------------------|--------------------------------|--------------------------------|
| C_R (μ F) | U_R (V) | | | | | |
| | 350 | 400 | 450 | 500 | 550 | 600 |
| 270 | - | - | - | - | - | 35 x 50 40 x 40 |
| 330 | - | - | - | - | 35 x 50 | 35 x 60 |
| 390 | - | - | - | 35 x 50 | 40 x 40 | 35 x 70 40 x 50 |
| 470 | - | - | 35 x 50 40 x 40 | 35 x 60 45 x 40 | 35 x 60 40 x 50 | 35 x 80 40 x 60 |
| 560 | - | 35 x 50 | 35 x 60 40 x 50 | 35 x 70 40 x 50 | 35 x 70 40 x 60 | 35 x 100 40 x 70 45 x 60 |
| 680 | - | 40 x 40 | 35 x 70 | 35 x 80 40 x 60 45 x 50 | 35 x 80 40 x 60 | 40 x 80 45 x 70 |
| 820 | 35 x 50 40 x 40 | 35 x 60 40 x 50 | 35 x 80 40 x 60 | 35 x 100 40 x 70 45 x 60 | 35 x 100 40 x 80 45 x 60 | 40 x 100 45 x 80 |

| SELECTION CHART FOR C_R, U_R, AND RELEVANT NOMINAL CASE SIZES ($\varnothing D \times L$ in mm) | | | | | | |
|--|-----------|----------|----------|----------|----------|----------|
| C_R (μF) | U_R (V) | | | | | |
| | 350 | 400 | 450 | 500 | 550 | 600 |
| 1000 | 35 x 60 | 35 x 70 | 35 x 100 | 40 x 80 | 45 x 70 | 45 x 100 |
| | 40 x 50 | | 40 x 80 | 45 x 70 | 45 x 80 | |
| | | | 45 x 60 | | | |
| 1200 | 35 x 70 | 35 x 80 | 45 x 70 | 40 x 100 | 40 x 100 | - |
| | | 40 x 70 | | | | |
| | | 45 x 60 | | | | |
| 1500 | 35 x 80 | 35 x 100 | 40 x 100 | 45 x 100 | 45 x 100 | - |
| | 40 x 60 | 45 x 70 | 45 x 80 | | | |
| 1800 | 35 x 100 | 40 x 100 | 45 x 100 | - | - | - |
| | 40 x 80 | 45 x 80 | | | | |
| | 45 x 60 | | | | | |
| 2200 | 40 x 100 | 45 x 100 | - | - | - | - |
| | 45 x 80 | | | | | |
| 2700 | 40 x 100 | - | - | - | - | - |
| 3300 | 45 x 100 | - | - | - | - | - |

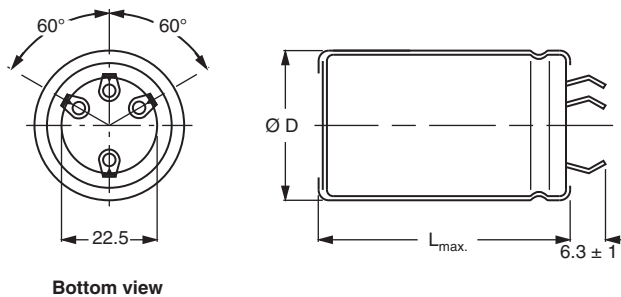
DIMENSIONS in millimeters AND AVAILABLE FORMS
4-TERMINAL SNAP-IN


Fig. 1 - 4-terminal snap-in

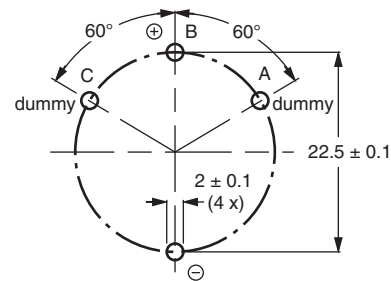


Fig. 2 - Mounting hole diagram

Dummy terminals (A and C) must be free from the electrical circuit.
Table 1

| DIMENSIONS in millimeters, MASS AND PACKAGING QUANTITIES | | | | | |
|---|------------------------|------------|-------------|---|---|
| NOMINAL CASE SIZE $\varnothing D \times L$ | $\varnothing D_{max.}$ | $L_{max.}$ | MASS (g) | PACKAGING QUANTITIES (units per box) | CARDBOARD BOX DIMENSIONS $L \times W \times H$ |
| 35 x 50 | 36 | 52 | 72 | 50 | 390 x 198 x 60 |
| 35 x 60 | 36 | 62 | 91 | 50 | 390 x 198 x 70 |
| 35 x 70 | 36 | 72 | 103 | 50 | 377 x 375 x 97 |
| 35 x 80 | 36 | 82 | 115 | 50 | 377 x 375 x 107 |
| 35 x 100 | 36 | 102 | 151 | 50 | 377 x 375 x 127 |
| 40 x 40 | 41 | 42 | 70 | 50 | 440 x 223 x 60 |
| 40 x 50 | 41 | 52 | 94 | 50 | 440 x 223 x 70 |
| 40 x 60 | 41 | 62 | 118 | 25 | 230 x 230 x 80 |
| 40 x 70 | 41 | 72 | 134 | 25 | 230 x 230 x 90 |
| 40 x 80 | 41 | 82 | 150 | 25 | 230 x 230 x 100 |
| 40 x 100 | 41 | 102 | 176 | 25 | 230 x 230 x 120 |
| 45 x 40 | 46 | 42 | 88 | 36 | 377 x 375 x 60 |
| 45 x 50 | 46 | 42 | 119 | 36 | 377 x 375 x 77 |
| 45 x 60 | 46 | 62 | 150 | 36 | 377 x 375 x 87 |
| 45 x 70 | 46 | 72 | 170 | 36 | 377 x 375 x 97 |
| 45 x 80 | 46 | 82 | 190 | 36 | 377 x 375 x 107 |
| 45 x 100 | 46 | 102 | 250 | 36 | 377 x 375 x 127 |



| ELECTRICAL DATA | |
|-----------------|---|
| SYMBOL | DESCRIPTION |
| C_R | Rated capacitance at 100 Hz |
| I_R | Rated RMS ripple current at 100 Hz and 105 °C |
| I_{L5} | Max. leakage current after 5 min at U_R |
| $\tan \delta$ | Max. dissipation factor at 100 Hz |
| ESR | Max. equivalent series resistance at 100 Hz |
| Z | Max. impedance at 10 kHz |

Note

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

ORDERING EXAMPLE

Electrolytic capacitor 299 PHL-4TSI series

2200 μF / 400 V / 45 mm x 100 mm

4-terminal snap-in:

Ordering code: MAL229956222E3

Table 2

| ELECTRICAL DATA AND ORDERING INFORMATION | | | | | | | | |
|--|----------------------------|---|----------------------------------|---------------------------|-------------------------|-------------------------------------|-----------------------------------|--------------------------------|
| U_R (V) | C_R (μF) | NOMINAL CASE SIZE $\varnothing D \times L$ (mm) | I_R 100 Hz 105 °C (A) | I_{L5} 5 min (mA) | $\tan \delta$ 100 Hz | MAX. ESR 100 Hz (m Ω) | MAX. Z 10 kHz (m Ω) | CATALOG NUMBER MAL2299..... |
| 350 | 820 | 35 x 50 | 3.15 | 0.578 | 0.15 | 170 | 125 | 55821E3 |
| | 820 | 40 x 40 | 3.00 | 0.578 | 0.15 | 180 | 130 | 65821E3 |
| | 1000 | 35 x 60 | 3.70 | 0.704 | 0.15 | 140 | 105 | 55102E3 |
| | 1000 | 40 x 50 | 3.75 | 0.704 | 0.15 | 145 | 105 | 65102E3 |
| | 1200 | 35 x 70 | 4.15 | 0.844 | 0.15 | 120 | 85 | 55122E3 |
| | 1500 | 35 x 80 | 4.70 | 1.054 | 0.15 | 95 | 70 | 55152E3 |
| | 1500 | 40 x 60 | 4.60 | 1.054 | 0.15 | 100 | 75 | 65152E3 |
| | 1800 | 35 x 100 | 5.90 | 1.264 | 0.15 | 80 | 60 | 55182E3 |
| | 1800 | 40 x 80 | 5.40 | 1.264 | 0.15 | 85 | 65 | 65182E3 |
| | 1800 | 45 x 60 | 5.20 | 1.264 | 0.15 | 90 | 70 | 75182E3 |
| | 2200 | 40 x 100 | 6.45 | 1.544 | 0.15 | 65 | 50 | 55222E3 |
| | 2200 | 45 x 80 | 6.10 | 1.544 | 0.15 | 70 | 55 | 65222E3 |
| 2700 | 40 x 100 | 6.85 | 1.894 | 0.15 | 55 | 45 | 55272E3 | |
| 3300 | 45 x 100 | 7.60 | 2.314 | 0.15 | 50 | 40 | 55332E3 | |
| 400 | 560 | 35 x 50 | 2.70 | 0.452 | 0.15 | 220 | 160 | 56561E3 |
| | 680 | 40 x 40 | 2.79 | 0.548 | 0.15 | 190 | 140 | 56681E3 |
| | 820 | 35 x 60 | 3.44 | 0.660 | 0.15 | 150 | 110 | 56821E3 |
| | 820 | 40 x 50 | 3.51 | 0.660 | 0.15 | 160 | 110 | 66821E3 |
| | 1000 | 35 x 70 | 3.88 | 0.804 | 0.15 | 130 | 90 | 56102E3 |
| | 1200 | 35 x 80 | 4.34 | 0.964 | 0.15 | 110 | 80 | 56122E3 |
| | 1200 | 40 x 70 | 4.50 | 0.964 | 0.15 | 110 | 80 | 66122E3 |
| | 1200 | 45 x 60 | 4.61 | 0.964 | 0.15 | 110 | 80 | 76122E3 |
| | 1500 | 35 x 100 | 5.54 | 1.204 | 0.15 | 90 | 60 | 56152E3 |
| | 1500 | 45 x 70 | 5.20 | 1.204 | 0.15 | 90 | 70 | 66152E3 |
| | 1800 | 40 x 100 | 6.02 | 1.444 | 0.15 | 70 | 50 | 56182E3 |
| | 1800 | 45 x 80 | 5.74 | 1.444 | 0.15 | 80 | 60 | 66182E3 |
| 2200 | 45 x 100 | 6.77 | 1.764 | 0.15 | 60 | 50 | 56222E3 | |
| 450 | 470 | 35 x 50 | 2.54 | 0.427 | 0.20 | 240 | 160 | 57471E3 |
| | 470 | 40 x 40 | 2.45 | 0.427 | 0.20 | 240 | 170 | 67471E3 |
| | 560 | 35 x 60 | 2.96 | 0.508 | 0.20 | 200 | 130 | 57561E3 |
| | 560 | 40 x 50 | 3.05 | 0.508 | 0.20 | 200 | 140 | 67561E3 |
| | 680 | 35 x 70 | 3.34 | 0.616 | 0.20 | 160 | 110 | 57681E3 |
| | 820 | 35 x 80 | 3.76 | 0.742 | 0.20 | 140 | 90 | 57821E3 |
| | 820 | 40 x 60 | 3.73 | 0.742 | 0.20 | 140 | 100 | 67821E3 |
| | 1000 | 35 x 100 | 4.74 | 0.904 | 0.20 | 110 | 80 | 57102E3 |
| | 1000 | 40 x 80 | 4.41 | 0.904 | 0.20 | 110 | 80 | 67102E3 |
| | 1000 | 45 x 60 | 4.34 | 0.904 | 0.20 | 120 | 80 | 77102E3 |
| | 1200 | 45 x 70 | 4.84 | 1.084 | 0.20 | 100 | 70 | 57122E3 |
| | 1500 | 40 x 100 | 5.67 | 1.354 | 0.20 | 80 | 50 | 57152E3 |
| | 1500 | 45 x 80 | 5.39 | 1.354 | 0.20 | 80 | 60 | 67152E3 |
| | 1800 | 45 x 100 | 6.36 | 1.624 | 0.20 | 70 | 50 | 57182E3 |



| ELECTRICAL DATA AND ORDERING INFORMATION | | | | | | | | |
|--|------------------------|--------------------------------------|---|----------------------------------|-----------------|----------------------------|--------------------------|--------------------------------|
| U _R (V) | C _R (μF) | NOMINAL CASE SIZE Ø D x L (mm) | I _R 100 Hz 105 °C (A) | I _{L5} 5 min (mA) | tan δ 100 Hz | MAX. ESR 100 Hz (mΩ) | MAX. Z 10 kHz (mΩ) | CATALOG NUMBER MAL2299..... |
| 500 | 390 | 35 x 50 | 2.35 | 0.394 | 0.20 | 290 | 200 | 59391E3 |
| | 470 | 35 x 60 | 2.75 | 0.474 | 0.20 | 240 | 165 | 59471E3 |
| | 470 | 45 x 40 | 2.45 | 0.474 | 0.20 | 250 | 175 | 69471E3 |
| | 560 | 35 x 70 | 3.05 | 0.564 | 0.20 | 200 | 140 | 59561E3 |
| | 560 | 40 x 50 | 3.05 | 0.564 | 0.20 | 205 | 145 | 69561E3 |
| | 680 | 35 x 80 | 3.45 | 0.684 | 0.20 | 165 | 115 | 59681E3 |
| | 680 | 40 x 60 | 3.45 | 0.684 | 0.20 | 170 | 120 | 69681E3 |
| | 680 | 45 x 50 | 3.50 | 0.684 | 0.20 | 175 | 125 | 79681E3 |
| | 820 | 35 x 100 | 4.35 | 0.824 | 0.20 | 140 | 95 | 59821E3 |
| | 820 | 40 x 70 | 3.90 | 0.824 | 0.20 | 140 | 100 | 69821E3 |
| | 820 | 45 x 60 | 4.05 | 0.824 | 0.20 | 145 | 100 | 79821E3 |
| | 1000 | 40 x 80 | 4.40 | 1.004 | 0.20 | 115 | 80 | 59102E3 |
| | 1000 | 45 x 70 | 4.50 | 1.004 | 0.20 | 120 | 85 | 69102E3 |
| | 1200 | 40 x 100 | 5.20 | 1.204 | 0.20 | 100 | 70 | 59122E3 |
| 1500 | 45 x 100 | 5.95 | 1.504 | 0.20 | 80 | 55 | 59152E3 | |
| 550 | 330 | 35 x 50 | 2.10 | 0.367 | 0.20 | 415 | 320 | 50331E3 |
| | 390 | 40 x 40 | 2.20 | 0.433 | 0.20 | 360 | 280 | 50391E3 |
| | 470 | 35 x 60 | 2.65 | 0.521 | 0.20 | 295 | 225 | 50471E3 |
| | 470 | 40 x 50 | 2.75 | 0.521 | 0.20 | 300 | 230 | 60471E3 |
| | 560 | 35 x 70 | 3.00 | 0.620 | 0.20 | 250 | 190 | 50561E3 |
| | 560 | 40 x 60 | 3.10 | 0.620 | 0.20 | 250 | 190 | 60561E3 |
| | 680 | 35 x 80 | 3.35 | 0.752 | 0.20 | 205 | 155 | 50681E3 |
| | 680 | 40 x 60 | 3.35 | 0.752 | 0.20 | 210 | 165 | 60681E3 |
| | 820 | 35 x 100 | 4.25 | 0.906 | 0.20 | 170 | 130 | 50821E3 |
| | 820 | 40 x 80 | 3.95 | 0.906 | 0.20 | 170 | 140 | 60821E3 |
| | 820 | 45 x 60 | 3.90 | 0.906 | 0.20 | 175 | 140 | 70821E3 |
| | 1000 | 45 x 70 | 4.35 | 1.104 | 0.20 | 150 | 115 | 50102E3 |
| | 1000 | 45 x 80 | 4.50 | 1.104 | 0.20 | 145 | 110 | 60102E3 |
| | 1200 | 40 x 100 | 5.05 | 1.324 | 0.20 | 120 | 95 | 50122E3 |
| 1500 | 45 x 100 | 5.75 | 1.654 | 0.20 | 100 | 75 | 50152E3 | |
| 600 | 270 | 35 x 50 | 1.90 | 0.328 | 0.20 | 620 | 515 | 51271E3 |
| | 270 | 40 x 40 | 1.85 | 0.328 | 0.20 | 630 | 520 | 61271E3 |
| | 330 | 35 x 60 | 2.25 | 0.400 | 0.20 | 510 | 420 | 51331E3 |
| | 390 | 35 x 70 | 2.55 | 0.472 | 0.20 | 430 | 355 | 51391E3 |
| | 390 | 40 x 50 | 2.50 | 0.472 | 0.20 | 440 | 365 | 61391E3 |
| | 470 | 35 x 80 | 2.85 | 0.568 | 0.20 | 360 | 295 | 51471E3 |
| | 470 | 40 x 60 | 2.85 | 0.568 | 0.20 | 360 | 300 | 61471E3 |
| | 560 | 35 x 100 | 3.55 | 0.676 | 0.20 | 300 | 250 | 51561E3 |
| | 560 | 40 x 70 | 3.30 | 0.676 | 0.20 | 305 | 255 | 61561E3 |
| | 560 | 45 x 60 | 3.30 | 0.676 | 0.20 | 305 | 255 | 71561E3 |
| | 680 | 40 x 80 | 3.60 | 0.820 | 0.20 | 250 | 210 | 51681E3 |
| | 680 | 45 x 70 | 3.75 | 0.820 | 0.20 | 255 | 210 | 61681E3 |
| | 820 | 40 x 100 | 4.30 | 0.988 | 0.20 | 210 | 175 | 51821E3 |
| | 820 | 45 x 80 | 4.15 | 0.988 | 0.20 | 210 | 175 | 61821E3 |
| 1000 | 45 x 100 | 4.90 | 1.204 | 0.20 | 175 | 145 | 51102E3 | |



| ADDITIONAL ELECTRICAL DATA | | |
|------------------------------------|----------------------|--|
| PARAMETER | CONDITIONS | VALUE |
| Voltage | | |
| Surge voltage | ≥ 350 V versions | $U_s = 1.1 \times U_R$ |
| Reverse voltage | | $U_{rev} \leq 1 V$ |
| Current | | |
| Leakage current | After 1 min at U_R | $I_{L1} \leq 0.006 C_R \times U_R + 4 \mu A$ |
| | After 5 min at U_R | $I_{L5} \leq 0.002 C_R \times U_R + 4 \mu A$ |
| Inductance | | |
| Equivalent series inductance (ESL) | All case sizes | Ca. 20 nH |

RIPPLE CURRENT AND USEFUL LIFE

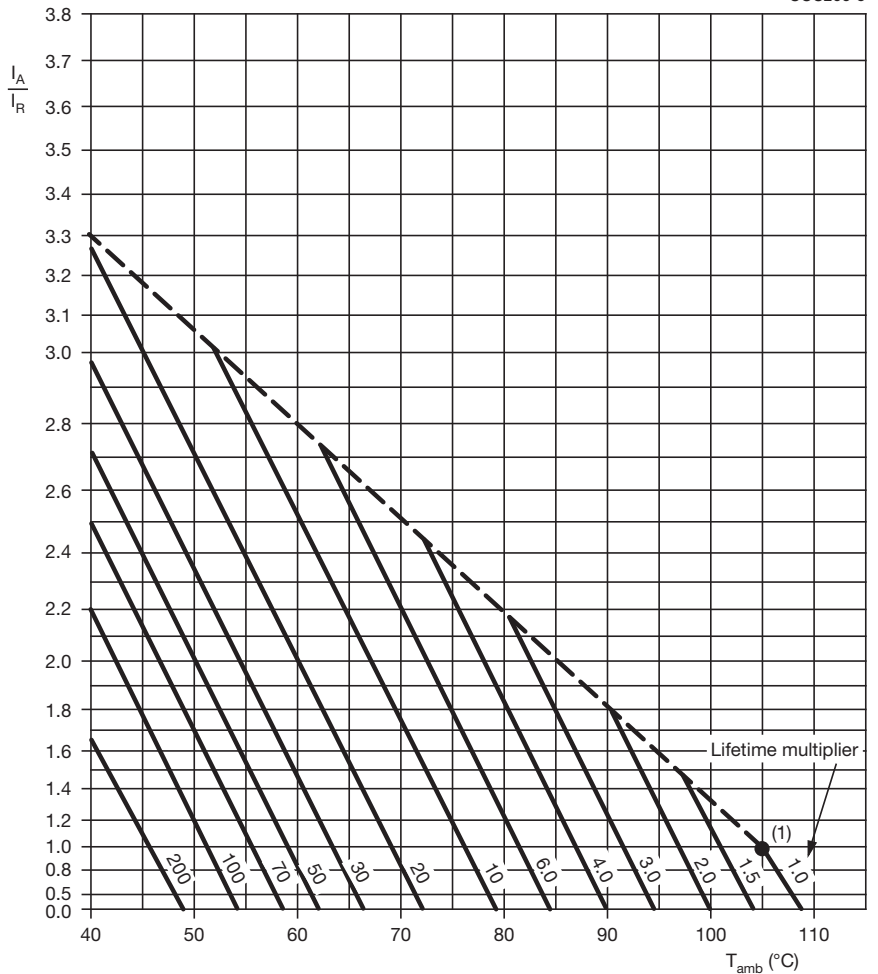
Table 3

| 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: CCC206-5

CCC206-5



I_A = Actual ripple current at 100 Hz
 I_R = Actual ripple current at 100 Hz and 105 °C
 (1) Useful life at 105 °C and I_R applied: > 5000 h

Fig. 3 - Multiplier of useful life as a function of ambient temperature and ripple current load



Table 4

| MULTIPLIER OF RIPPLE CURRENT (I_R) AS A FUNCTION OF FREQUENCY | | | | | |
|---|-----|-----|-----|------|--------|
| FREQUENCY (Hz) | | | | | |
| 50 | 100 | 200 | 400 | 1000 | 10 000 |
| I_R MULTIPLIER | | | | | |
| 0.9 | 1.0 | 1.2 | 1.3 | 1.4 | 1.5 |

Table 5

| TEST PROCEDURES AND REQUIREMENTS | | | |
|----------------------------------|---------------------------------------|--|--|
| TEST | | PROCEDURE (quick reference) | REQUIREMENTS |
| NAME OF TEST | REFERENCE | | |
| Endurance | IEC 60384-4 / EN130300 subclause 4.13 | $T_{amb} = 105\text{ °C}$; U_R applied 2000 h | $\Delta C/C: \pm 10\%$ $ESR \leq 1.3 \times \text{spec. limit}$ $Z \leq 2 \times \text{spec. limit}$ $I_{L5} \leq \text{spec. limit}$ |
| Useful life | | $T_{amb} = 105\text{ °C}$; U_R and I_R applied; > 5000 h | $\Delta C/C: \leq \pm 20\%$ $\tan \delta \leq 2 \text{ times initial spec. limit}$ $I_{L5} \leq \text{spec. limit}$ |
| Shelf life | IEC 60384-4 / EN130300 subclause 4.17 | $T_{amb} = 105\text{ °C}$; no voltage applied; 1000 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.



Disclaimer

ALL PRODUCT, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, "Vishay"), disclaim any and all liability for any errors, inaccuracies or incompleteness contained in any datasheet or in any other disclosure relating to any product.

Vishay makes no warranty, representation or guarantee regarding the suitability of the products for any particular purpose or the continuing production of any product. To the maximum extent permitted by applicable law, Vishay disclaims (i) any and all liability arising out of the application or use of any product, (ii) any and all liability, including without limitation special, consequential or incidental damages, and (iii) any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.

Statements regarding the suitability of products for certain types of applications are based on Vishay's knowledge of typical requirements that are often placed on Vishay products in generic applications. Such statements are not binding statements about the suitability of products for a particular application. It is the customer's responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application. Parameters provided in datasheets and / or specifications may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated for each customer application by the customer's technical experts. Product specifications do not expand or otherwise modify Vishay's terms and conditions of purchase, including but not limited to the warranty expressed therein.

Hyperlinks included in this datasheet may direct users to third-party websites. These links are provided as a convenience and for informational purposes only. Inclusion of these hyperlinks does not constitute an endorsement or an approval by Vishay of any of the products, services or opinions of the corporation, organization or individual associated with the third-party website. Vishay disclaims any and all liability and bears no responsibility for the accuracy, legality or content of the third-party website or for that of subsequent links.

Except as expressly indicated in writing, Vishay products are not designed for use in medical, life-saving, or life-sustaining applications or for any other application in which the failure of the Vishay product could result in personal injury or death. Customers using or selling Vishay products not expressly indicated for use in such applications do so at their own risk. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay. Product names and markings noted herein may be trademarks of their respective owners.