# Aluminum Capacitors
# Radial Low Profile, 5 mm






Fig. 1

## FEATURES

- Useful life: 1500 h at 85 °C
- Very low profile, 5 mm height
- Extremely miniaturized
- Polarized aluminum electrolytic capacitors, non-solid electrolyte
- Radial leads, cylindrical aluminum case, insulated with a blue sleeve
- Charge and discharge proof
- Material categorization: For definitions of compliance please see www.vishay.com/doc?99912

Pb-free

RoHS COMPLIANT

## APPLICATIONS

- General purpose, industrial, automotive and audio-video
- Coupling, decoupling, smoothing, filtering and timing
- High mounting density
- Portable and mobile equipment (very small size and very low mass), low profile equipment

## MARKING

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

- Rated capacitance (in µF)
- Rated voltage (in V)
- Negative terminal identification
- Code indicating factory of origin
- Name of manufacturer
- Date code, in accordance with IEC 60062
- Series number (134)

| QUICK REFERENCE DATA | |
|---|---|
| **DESCRIPTION** | **VALUE** |
| Nominal case sizes (Ø D x L in mm) | 4 x 5 to 6.3 x 5 |
| Rated capacitance range, $C_R$ | 1.0 µF to 100 µF |
| Tolerance on $C_R$ | ± 20 % |
| Rated voltage range, $U_R$ | 6.3 V to 50 V |
| Category temperature range | - 40 °C to + 85 °C |
| Endurance test at 85 °C | 1000 h |
| Useful life at 85 °C | 1500 h |
| Useful life at 40 °C, 1.4 x $I_R$ applied | 40 000 h |
| Shelf life at 0 V, 85 °C | 500 h |
| Based on sectional specification | IEC 60384-4/EN 130300 |
| Climatic category IEC 60068 | 40/085/56 |

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

| $C_R$ (µF) | $U_R$ (V) | | | | | |
|---|---|---|---|---|---|---|
| | **6.3** | **10** | **16** | **25** | **35** | **50** |
| 1.0 | - | - | - | - | - | 4 x 5 |
| 2.2 | - | - | - | - | - | 4 x 5 |
| 3.3 | - | - | - | - | - | 4 x 5 |
| 4.7 | - | - | - | - | 4 x 5 | 5 x 5 |
| 10 | - | - | 4 x 5 | - | 5 x 5 | 6.3 x 5 |
| 22 | 4 x 5 | - | 5 x 5 | - | 6.3 x 5 | - |
| 33 | - | 5 x 5 | - | 6.3 x 5 | - | - |
| 47 | 5 x 5 | - | 6.3 x 5 | - | - | - |
| 100 | 6.3 x 5 | - | - | - | - | - |



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## **DIMENSIONS** in millimeters **AND AVAILABLE FORMS**

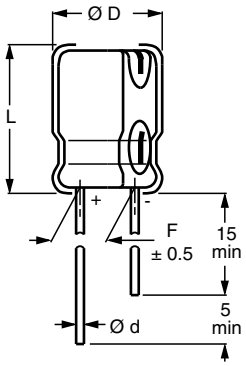
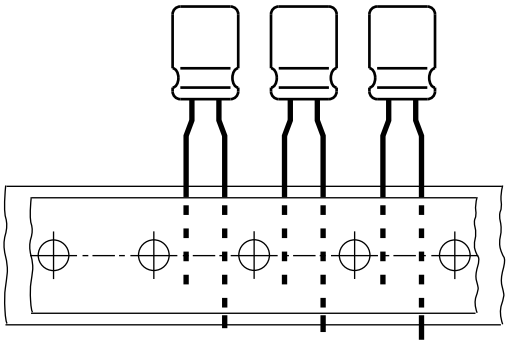
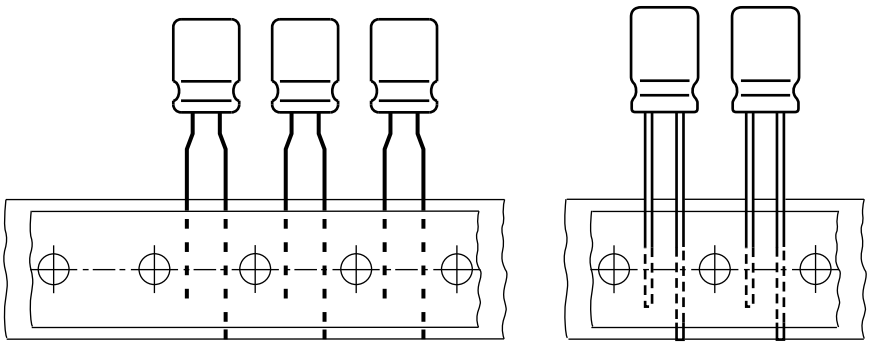



Fig. 2 - **Form CA:** Long leads



Case Ø D = 4 mm to 6.3 mm; pitch F = 5 mm

Fig. 3 - **Form TFA:** Taped in box (ammopack)



Pitch F = 2.5 mm
Case Ø D = 4 mm to 6.3 mm

Fig. 4 - **Form TNA:** Taped in box (ammopack)

**Table 1**

| **DIMENSIONS** in millimeters **AND PACKAGING QUANTITIES** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **NOMINAL CASE SIZE Ø D x L** | **CASE CODE** | **Ø d** | **Ø $D_{max.}$** | **$L_{max.}$** | **F** | **PACKAGING QUANTITIES** | | |
| | | | | | | **FORM CA** | **FORM TFA** | **FORM TNA** |
| 4 x 5 | 53 | 0.45 | 4.5 | 6.0 | 1.5 ± 0.5 | 2000 | 2000 | 2000 |
| 5 x 5 | 54 | 0.45 | 5.5 | 6.0 | 2.0 ± 0.5 | 2000 | 2000 | 2000 |
| 6.3 x 5 | 55 | 0.45 | 6.8 | 6.0 | 2.5 ± 0.5 | 2000 | 2000 | 2000 |

**Note**

- For detailed tape dimensions please see www.vishay.com/doc?28360


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| ELECTRICAL DATA | |
|---|---|
| SYMBOL | DESCRIPTION |
| $C_R$ | Rated capacitance at 120 Hz, tolerance ± 20 % |
| $I_R$ | Rated RMS ripple current at 120 Hz, 85 °C |
| $I_{L2}$ | Max. leakage current after 2 min at $U_R$ |
| tan δ | Max. dissipation factor at 120 Hz |
| Z | Max. impedance at 100 kHz |

**Note**

- 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 %

## ORDERING EXAMPLE

Electrolytic capacitor 134 series

22 µF/16 V; ± 20 %

Nominal case size: Ø 5 mm x 5 mm; form TFA

Ordering code: MAL213435229E3

Former 12NC: 2222 134 35229

**Table 2**

| ELECTRICAL DATA AND ORDERING INFORMATION | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $U_R$ (V) | $C_R$ 120 Hz (µF) | NOMINAL CASE SIZE Ø D x L (mm) | $I_R$ 120 Hz 85 °C (mA) | $I_{L2}$ 2 min (µA) | tan δ 120 Hz | Z 100 kHz (Ω) | ORDERING CODE MAL2134..... | | | | | |
| | | | | | | | BULK LONG LEADS | | TAPED AMMOPACK | | | |
| | | | | | | | FORM CA | F (mm) | FORM TFA | F (mm) | FORM TNA | F (mm) |
| 6.3 | 22 | 4 x 5 | 23 | 3 | 0.24 | 11 | 53229E3 | 1.5 | 33229E3 | 5.0 | 73229E3 | 2.5 |
| | 47 | 5 x 5 | 38 | 3 | 0.24 | 5.2 | 53479E3 | 2.0 | 33479E3 | 5.0 | 73479E3 | 2.5 |
| | 100 | 6.3 x 5 | 60 | 7 | 0.24 | 3.4 | 53101E3 | 2.5 | 33101E3 | 5.0 | 73101E3 | 2.5 |
| 10 | 33 | 5 x 5 | 35 | 4 | 0.20 | 6.0 | 54339E3 | 2.0 | 34339E3 | 5.0 | 74339E3 | 2.5 |
| 16 | 10 | 4 x 5 | 20 | 3 | 0.16 | 12 | 95105E3 | 1.5 | 95103E3 | 5.0 | 95107E3 | 2.5 |
| | 22 | 5 x 5 | 32 | 4 | 0.16 | 6.4 | 55229E3 | 2.0 | 35229E3 | 5.0 | 75229E3 | 2.5 |
| | 47 | 6.3 x 5 | 50 | 8 | 0.16 | 4.2 | 55479E3 | 2.5 | 35479E3 | 5.0 | 75479E3 | 2.5 |
| 25 | 33 | 6.3 x 5 | 45 | 9 | 0.14 | 4.6 | 56339E3 | 2.5 | 36339E3 | 5.0 | 76339E3 | 2.5 |
| 35 | 4.7 | 4 x 5 | 15 | 3 | 0.12 | 27 | 50478E3 | 1.5 | 30478E3 | 5.0 | 70478E3 | 2.5 |
| | 10 | 5 x 5 | 25 | 4 | 0.12 | 17 | 50109E3 | 2.0 | 30109E3 | 5.0 | 70109E3 | 2.5 |
| | 22 | 6.3 x 5 | 40 | 8 | 0.12 | 11 | 50229E3 | 2.5 | 30229E3 | 5.0 | 70229E3 | 2.5 |
| 50 | 1.0 | 4 x 5 | 7.5 | 3 | 0.10 | 28 | 91105E3 | 1.5 | 91103E3 | 5.0 | 91107E3 | 2.5 |
| | 2.2 | 4 x 5 | 12 | 3 | 0.10 | 26 | 91225E3 | 1.5 | 91223E3 | 5.0 | 91227E3 | 2.5 |
| | 3.3 | 4 x 5 | 14 | 3 | 0.10 | 25 | 51338E3 | 1.5 | 31338E3 | 5.0 | 71338E3 | 2.5 |
| | 4.7 | 5 x 5 | 19 | 3 | 0.10 | 22 | 51478E3 | 2.0 | 31478E3 | 5.0 | 71478E3 | 2.5 |
| | 10 | 6.3 x 5 | 29 | 5 | 0.10 | 14 | 51109E3 | 2.5 | 31109E3 | 5.0 | 71109E3 | 2.5 |

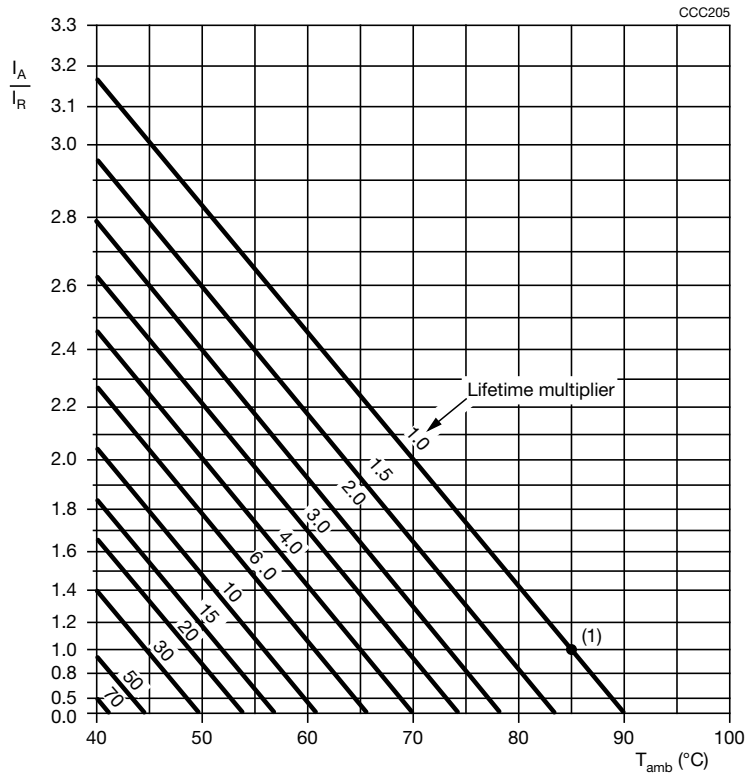
| ADDITIONAL ELECTRICAL DATA | | |
|---|---|---|
| PARAMETER | CONDITIONS | VALUE |
| **Voltage** | | |
| Surge voltage | | $U_s \leq 1.15 \times U_R$ |
| Reverse voltage | | $U_{rev} \leq 1$ V |
| **Current** | | |
| Leakage current | After 2 min at $U_R$ | $I_{L2} \leq 0.01\ C_R \times U_R$ or 3 µA (whichever is greater) |
| **Resistance** | | |
| Equivalent series resistance (ESR) | Calculated from tan $\delta_{max.}$ and $C_R$ (see Table 3) | ESR = tan $\delta/2\ \pi\ f\ C_R$ |



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## RIPPLE CURRENT AND USEFUL LIFE




$I_A$ = Actual ripple current at 120 Hz
$I_R$ = Rated ripple current at 120 Hz, 85 °C

(1) Useful life at 85 °C and $I_R$ applied: 1500 h

Fig. 5 - 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 | 0.60 |
| 120 | 1.00 |
| 400 | 1.20 |
| 800 | 1.30 |
| ≥ 2000 | 1.40 |

**Table 4**

| TEST PROCEDURES AND REQUIREMENTS | | | |
|---|---|---|---|
| TEST | | PROCEDURE (quick reference) | REQUIREMENTS |
| NAME OF TEST | REFERENCE | | |
| Endurance | IEC 60384-4/ EN 130300, subclause 4.13 | $T_{amb}$ = 85 °C; $U_R$ applied; 1000 h | ΔC/C: ± 20 %<br>tan δ ≤ 2 x spec. limit<br>$I_{L2}$ ≤ spec. limit |
| Useful life | CECC 30301, subclause 1.8.1 | $T_{amb}$ = 85 °C; $U_R$ and $I_R$ applied; 1500 h | ΔC/C: ± 50 %<br>tan δ ≤ 3 x spec. limit<br>Z ≤ 3 x spec. limit<br>$I_{L2}$ ≤ spec. limit<br>no short or open circuit<br>total failure percentage: ≤ 3 % |
| Shelf life (storage at high temperature) | IEC 60384-4/ EN 130300, subclause 4.17 | $T_{amb}$ = 85 °C; no voltage applied; 500 h<br>After test: $U_R$ to be applied for 30 min, 24 h to 48 h before measurement | ΔC/C, tan δ, Z:<br>For requirements see “Endurance test” above<br>$I_{L2}$ ≤ spec. limit |


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