# Aluminum electrolytic capacitors

## Hybrid polymer aluminum electrolytic capacitors, very high ripple current capability

**Series/Type:** **B40650, B40750**

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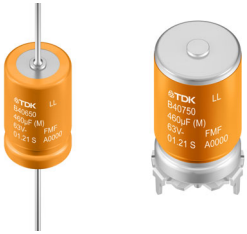
## Axial-lead and soldering star capacitors



### Applications

- Industrial electronics
- 48 V DC output filtering of SMPS
- 48 V DC motor control circuit
- Industrial and telecommunication equipment
- Server and data center
- Power tools
- Battery charger
- Servo drives
- Solar micro-inverter

### Features

- Very high ripple current capability
- Very low impedance
- Long useful life, 10000 h at up to 105 °C
- Operating temperature range up to 125 °C is available upon request
- Very low ESR at low temperatures down to –40 °C
- PCB area/volume saving
- RoHS-compatible

### Construction

- Polar
- Aluminum case with PET sleeve
- Negative pole connected to case

### Terminals

- Axial leads, welded to capacitor case and cover disc
- Soldering star option for upright mounting on PCB

### Taping and packing

- Axial-lead capacitors will be delivered in pallet package or taped on reel
- Soldering star capacitors are packed in blister trays

**Specifications and characteristics in brief**

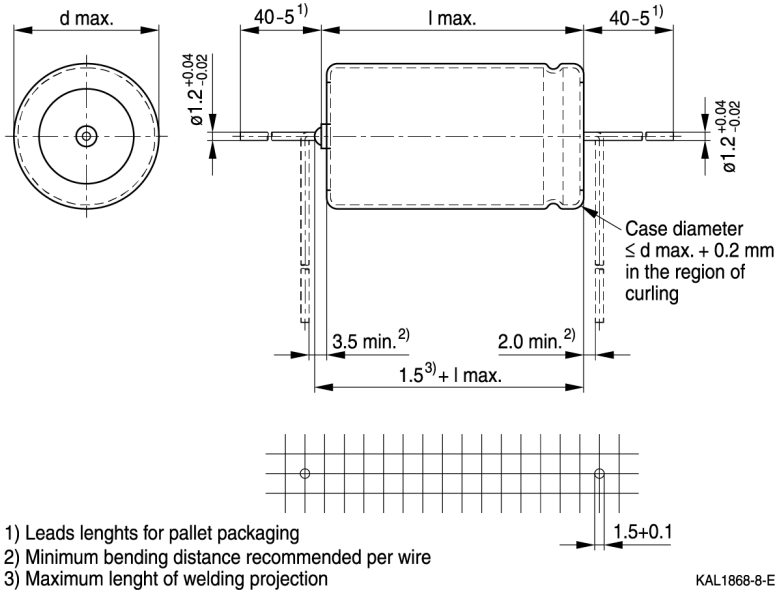
| | | | | | |
|---|---|---|---|---|---|
| Rated voltage $V_R$<br>Surge voltage $V_S$ | 25 … 80 V DC<br>1.15 $V_R$ | | | | |
| Rated capacitance $C_R$<br>Capacitance tolerance | 250 … 3600 µF<br>±20% ≙ M | | | | |
| Dissipation factor tan δ<br>(20 °C, 100 Hz) | For capacitance higher than 1000 µF add 0.02 for every increase of 1000 µF. | | | | |
| | $V_R$ ( V DC) | 25 | 35 | 63 | 80 |
| | tan δ (max.) | 0.14 | 0.12 | 0.08 | 0.08 |
| Leakage current $I_{leak}$<br>(2 min, 20 °C) | $I_{leak} \leq 0.01\ \mu A \cdot \left(\frac{C_R}{\mu F} \cdot \frac{V_R}{V}\right) + 4\ \mu A$ | | | | |
| Self-inductance ESL[1)] | Diameter (mm) | | 14 | 16 | 18 |
| | Terminals | Length l (mm) | Approx. ESL (nH) | | |
| | axial | 25 | 22 | 26 | 30 |
| | | 30 | 24 | 29 | 34 |
| | soldering star | 25 | 6 | 7 | 8 |
| | | 30 | 7 | 8 | 10 |
| Useful life[2)]<br>$T_A$ = 105 °C; $V_R$; $I_{AC,R}$ | > 10000 h | Requirements<br>I∆C/CI<br>ESR<br>$I_{leak}$ | ≤ 30% of initial value<br>≤ 3 times initial specified limit[3)]<br>≤ initial specified limit | | |
| Voltage endurance test<br>105 °C; $V_R$ | 2000 h | Post test requirements<br>I∆C/CI<br>ESR<br>$I_{leak}$ | ≤ 10% of initial value<br>≤ 1.5 times initial specified limit[3)]<br>≤ initial specified limit | | |
| Biased humidity test<br>85 °C, 85% RH, $V_R$ | 2000 h | Requirements<br>I∆C/CI<br>ESR<br>$I_{leak}$ | ≤ 30% of initial value<br>≤ 3 times initial specified limit[3)]<br>≤ initial specified limit | | |
| Vibration resistance test | To IEC 60068-2-6:2007, test Fc:<br>Frequency range 10 Hz ... 1 kHz, displacement amplitude max. 0.75 mm, acceleration max. 10 *g*, duration 3 x 2 h.<br>Capacitor rigidly clamped by the aluminum case, e.g. using our standard fixture | | | | |
| Characteristics at low temperature | Max. impedance ratio at 100 kHz | | $Z_{-55\ °C}$ / $Z_{20\ °C}$ | | 1.5 |

| | |
|---|---|
| IEC climatic category | To IEC 60068-1:2013, 55/105/56 (–55 °C/+105 °C/56 days damp heat test) |
| Operating temperature range[4)] | –55 °C to +105 °C |
| Sectional specification | IEC 60384-4:2016 |

1) If optimum circuit design is used, the values are lower by 30%.
2) Refer to chapter "General technical information, 5 Useful life" on how to interpret useful life.
3) $ESR_{max}$ at 100 kHz, +20 °C is measured with the probe connected in close proximity to the capacitor body. In case of soldering star capacitors with all negative pins connected in parallel.
4) Operating temperature range up to 125 °C is available upon request.

### B40650, Axial-lead capacitors

### Dimensional drawing




1) Leads lenghts for pallet packaging
2) Minimum bending distance recommended per wire
3) Maximum lenght of welding projection

KAL1868-8-E

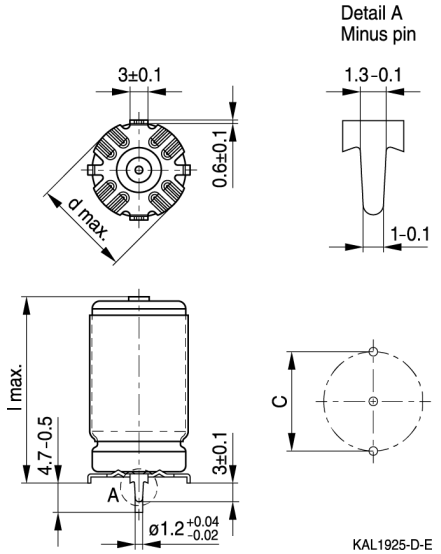
### Dimensions, weights and packing units

| d x l | $d_{max}$ x $l_{max}$ | Approx. weight | Packing units (pcs.) | |
|---|---|---|---|---|
| mm | mm | g | Pallet | Reel |
| 14 x 25 | 14.5 x 26 | 6.1 | 200 | 350 |
| 14 x 30 | 14.5 x 31 | 7.3 | 200 | 350 |
| 16 x 25 | 16.5 x 26 | 7.7 | 180 | 250 |
| 16 x 30 | 16.5 x 31 | 9.1 | 180 | 250 |
| 18 x 25 | 18.5 x 26 | 9.6 | 160 | – |
| 18 x 30 | 18.5 x 31 | 11.2 | 160 | – |

### B40750, Soldering star capacitors

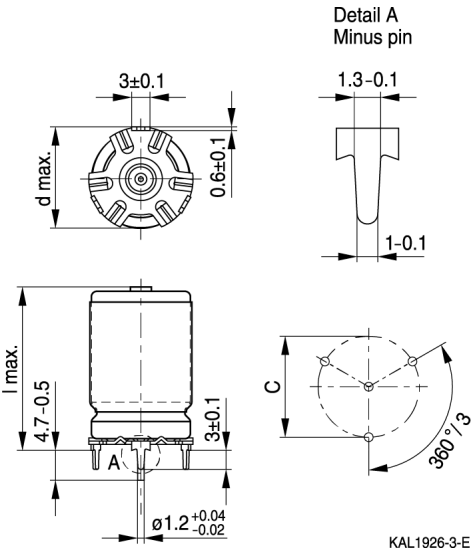
#### Dimensional drawing

Mounting holes d = 14 ... 16 mm




2 negative pins, 1 positive pin[1)]

Mounting holes d = 14 ... 18 mm




3 negative pins, 1 positive pin[2)]

#### Dimensions, weights and packing units

| d x l<br>mm | $d_{max}$ x $l_{max}$<br>mm | c ±0.1<br>mm | Approx. weight<br>g | Packing units<br>pcs. |
|---|---|---|---|---|
| 14 x 25 | 15.5 x 28 | 14.5 | 6.1 | 480 |
| 14 x 30 | 15.5 x 33 | 14.5 | 7.3 | 480 |
| 16 x 25 | 17.5 x 28 | 16.5 | 7.7 | 300 |
| 16 x 30 | 17.5 x 33 | 16.5 | 9.1 | 300 |
| 18 x 25 | 19.5 x 28 | 18.5 | 9.6 | 300 |
| 18 x 30 | 19.5 x 33 | 18.5 | 11.2 | 300 |

1) Two negative pins on soldering star, one positive lead wire in the center.
2) Three negative pins on soldering star, one positive lead wire in the center.

### Case dimensions and ordering codes[1)]

| $C_R$ 100 Hz 20 °C µF | Case dimensions d x l mm | Ordering code Axial pallet | Ordering code Axial reel | Ordering code Soldering star 2 negative pins 1 positive pin[2)] | Ordering code Soldering star 3 negative pins 1 positive pin[3)] |
|---|---|---|---|---|---|
| $V_R$ = 25 V DC | | | | | |
| 1600 | 14 x 25 | B40650A5168M001 | B40650A5168M003 | B40750A5168M002 | B40750A5168M001 |
| 2100 | 14 x 30 | B40650A5218M001 | B40650A5218M003 | B40750A5218M002 | B40750A5218M001 |
| 2200 | 16 x 25 | B40650A5228M001 | B40650A5228M003 | B40750A5228M002 | B40750A5228M001 |
| 2700 | 16 x 30 | B40650A5278M001 | B40650A5278M003 | B40750A5278M002 | B40750A5278M001 |
| 2700 | 18 x 25 | B40650B5278M001 | | | B40750B5278M001 |
| 3700 | 18 x 30 | B40650A5378M001 | | | B40750A5378M001 |
| $V_R$ = 35 V DC | | | | | |
| 1100 | 14 x 25 | B40650A7118M001 | B40650A7118M003 | B40750A7118M002 | B40750A7118M001 |
| 1400 | 14 x 30 | B40650A7148M001 | B40650A7148M003 | B40750A7148M002 | B40750A7148M001 |
| 1400 | 16 x 25 | B40650B7148M001 | B40650B7148M003 | B40750B7148M002 | B40750B7148M001 |
| 1800 | 16 x 30 | B40650A7188M001 | B40650A7188M003 | B40750A7188M002 | B40750A7188M001 |
| 1800 | 18 x 25 | B40650B7188M001 | | | B40750B7188M001 |
| 2500 | 18 x 30 | B40650A7258M001 | | | B40750A7258M001 |
| $V_R$ = 63 V DC | | | | | |
| 460 | 14 x 25 | B40650A8467M001 | B40650A8467M003 | B40750A8467M002 | B40750A8467M001 |
| 600 | 14 x 30 | B40650A8607M001 | B40650A8607M003 | B40750A8607M002 | B40750A8607M001 |
| 600 | 16 x 25 | B40650B8607M001 | B40650B8607M003 | B40750B8607M002 | B40750B8607M001 |
| 790 | 16 x 30 | B40650A8797M001 | B40650A8797M003 | B40750A8797M002 | B40750A8797M001 |
| 750 | 18 x 25 | B40650A8757M001 | | | B40750A8757M001 |
| 1000 | 18 x 30 | B40650A8108M001 | | | B40750A8108M001 |
| $V_R$ = 80 V DC | | | | | |
| 250 | 14 x 25 | B40650A0257M001 | B40650A0257M003 | B40750A0257M002 | B40750A0257M001 |
| 340 | 14 x 30 | B40650A0347M001 | B40650A0347M003 | B40750A0347M002 | B40750A0347M001 |
| 330 | 16 x 25 | B40650A0337M001 | B40650A0337M003 | B40750A0337M002 | B40750A0337M001 |
| 430 | 16 x 30 | B40650A0437M001 | B40650A0437M003 | B40750A0437M002 | B40750A0437M001 |
| 440 | 18 x 25 | B40650A0447M001 | | | B40750A0447M001 |
| 600 | 18 x 30 | B40650A0607M001 | | | B40750A0607M001 |

1) Other voltage and capacitance ratings are available upon request.
2) Two negative pins on soldering star, one positive lead wire in the center.
3) Three negative pins on soldering star, one positive lead wire in the center.

**Technical data**

| $C_R$ 100 Hz 20 °C | Case dimensions d x l | $ESR_{max}$ [1] 100 kHz 20 °C | $ESR_{max}$ [1] 100 kHz –40 °C | $Z_{max}$ [2] 100 kHz 20 °C | $I_{AC,R}$ 100 kHz $T_A$ = 105 °C |
|---|---|---|---|---|---|
| µF | mm | mΩ | mΩ | mΩ | A |
| $V_R$ = 25 V DC | | | | | |
| 1600 | 14 x 25 | 5.6 | 6.8 | 7.3 | 11.7 |
| 2100 | 14 x 30 | 4.9 | 6.1 | 6.4 | 13.8 |
| 2200 | 16 x 25 | 4.4 | 5.6 | 5.7 | 14.6 |
| 2700 | 16 x 30 | 3.9 | 5.1 | 5.1 | 17.2 |
| 2700 | 18 x 25 | 4.9 | 6.1 | 6.4 | 14.7 |
| 3700 | 18 x 30 | 4.3 | 5.5 | 5.6 | 17.2 |
| $V_R$ = 35 V DC | | | | | |
| 1100 | 14 x 25 | 5.6 | 6.8 | 7.3 | 11.7 |
| 1400 | 14 x 30 | 4.9 | 6.1 | 6.4 | 13.8 |
| 1400 | 16 x 25 | 4.4 | 5.6 | 5.7 | 14.6 |
| 1800 | 16 x 30 | 3.9 | 5.1 | 5.1 | 17.2 |
| 1800 | 18 x 25 | 4.9 | 6.1 | 6.4 | 14.7 |
| 2500 | 18 x 30 | 4.3 | 5.5 | 5.6 | 17.2 |
| $V_R$ = 63 V DC | | | | | |
| 460 | 14 x 25 | 5.9 | 7.1 | 6.5 | 13.8 |
| 600 | 14 x 30 | 5.2 | 6.2 | 5.7 | 16.0 |
| 600 | 16 x 25 | 4.5 | 5.3 | 5.0 | 17.0 |
| 790 | 16 x 30 | 4.0 | 4.7 | 4.4 | 19.5 |
| 750 | 18 x 25 | 4.4 | 5.0 | 5.9 | 18.0 |
| 1000 | 18 x 30 | 4.2 | 4.5 | 5.1 | 20.2 |
| $V_R$ = 80 V DC | | | | | |
| 250 | 14 x 25 | 5.9 | 7.1 | 6.5 | 11.7 |
| 340 | 14 x 30 | 5.2 | 6.2 | 5.7 | 14.5 |
| 330 | 16 x 25 | 4.5 | 5.3 | 5.0 | 14.4 |
| 430 | 16 x 30 | 4.0 | 4.7 | 4.4 | 18.0 |
| 440 | 18 x 25 | 4.4 | 5.0 | 5.9 | 14.6 |
| 600 | 18 x 30 | 4.2 | 4.5 | 5.1 | 18.0 |

1) $ESR_{max}$ at 100 kHz, +20 °C measured with the probe connected in close proximity to the capacitor body. In case of soldering star capacitors with all negative pins connected in parallel.
2) $Z_{max}$ at 100 kHz, +20 °C measured at soldering star capacitors with at least two negative pins connected.

**Useful life[1)]**

Calculations of useful life are performed on request, based on operational conditions stated by the customer, or based on temperatures measured by the user in the application.

1) Refer to chapter "General technical information, 5 Useful life" on how to interpret useful life.

## Cautions and warnings

### Personal safety

The electrolytes used have been optimized both with a view to the intended application and with regard to health and environmental compatibility. They do not contain any solvents that are detrimental to health, e.g. dimethyl formamide (DMF) or dimethyl acetamide (DMAC). Furthermore, some of the high-voltage electrolytes used are self-extinguishing.

As far as possible, we do not use any dangerous chemicals or compounds to produce operating electrolytes, although in exceptional cases, such materials must be used in order to achieve specific physical and electrical properties because no alternative materials are currently known. We do, however, restrict the amount of dangerous materials used in our products to an absolute minimum.

Materials and chemicals used in our aluminum electrolytic capacitors are continuously adapted in compliance with the TDK Electronics Corporate Environmental Policy and the latest EU regulations and guidelines such as RoHS, REACH/SVHC, GADSL, and ELV.

MDS (Material Data Sheets) are available on our website for all types listed in the data book. MDS for customer specific capacitors are available upon request.

Nevertheless, the following rules should be observed when handling aluminum electrolytic capacitors: No electrolyte should come into contact with eyes or skin. If electrolyte does come into contact with the skin, wash the affected areas immediately with running water. If the eyes are affected, rinse them for 10 minutes with plenty of water. If symptoms persist, seek medical treatment. Avoid inhaling electrolyte vapor or mists. Workplaces and other affected areas should be well ventilated. Clothing that has been contaminated by electrolyte must be changed and rinsed in water.

**Product safety**

The table below summarizes the safety instructions that must be observed without fail. A detailed description can be found in the relevant sections of seperate file chapter "General technical information".

| Topic | Safety information | Reference chapter "General technical information" |
|---|---|---|
| Polarity | Make sure that polar capacitors are connected with the right polarity. | 1 "Basic construction of aluminum electrolytic capacitors" |
| Reverse voltage | Voltages of opposite polarity should be prevented by connecting a diode. | 3.1.6 "Reverse voltage" |
| Mounting position of capacitors with screw or multi-pin terminals | Multi-pin capacitors with pressure relief vent on the can base must not be mounted with terminals facing up unless otherwise specified. | 11.1 "Mounting positions of capacitors with screw or multi-pin terminals" |
| Robustness of terminals | The following maximum tightening torques must not be exceeded when connecting screw terminals:<br>M5: 2.5 Nm<br>M6: 4.0 Nm | 11.2 "Mounting torques" |
| Mounting of single-ended capacitors | The internal structure of single-ended capacitors might be damaged if excessive force is applied to the lead wires.<br>Avoid any compressive, tensile or flexural stress.<br>Do not move the capacitor after soldering to PC board.<br>Do not pick up the PC board by the soldered capacitor.<br>Do not insert the capacitor on the PC board with a hole space different to the lead space specified. | 11.3 "Mounting considerations for single-ended capacitors" |
| Soldering | Do not exceed the specified time or temperature limits during soldering. | 11.5 "Soldering" |
| Soldering, cleaning agents | Do not allow halogenated hydrocarbons to come into contact with aluminum electrolytic capacitors. | 11.6 "Cleaning agents" |
| Upper category temperature | Do not exceed the upper category temperature. | 7.2 "Maximum permissible operating temperature" |
| Passive flammability | Avoid external energy, e.g. fire. | 8.1 "Passive flammability" |

| Topic | Safety information | Reference chapter "General technical information" |
|---|---|---|
| Active flammability | Avoid overload of the capacitors. | 8.2 "Active flammability" |
| Maintenance | Make periodic inspections of the capacitors. Before the inspection, make sure that the power supply is turned off and carefully discharge the capacitors. Do not apply excessive mechanical stress to the capacitor terminals when mounting. | 10 "Maintenance" |
| Storage | Do not store capacitors at high temperatures or high humidity. Capacitors should be stored at +5 to +35 °C and a relative humidity of ≤ 75%. | 7.3 "Shelf life and storage conditions" |
| | | Reference chapter "Capacitors with screw terminals" |
| Breakdown strength of insulating sleeves | Do not damage the insulating sleeve, especially when ring clips are used for mounting. | "Screw terminals – accessories" |

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Detailed information can be found on the Internet under www.tdk-electronics.tdk.com/orderingcodes.

**Symbols and terms**

| Symbol | English | German |
|---|---|---|
| C | Capacitance | Kapazität |
| $C_R$ | Rated capacitance | Nennkapazität |
| $C_S$ | Series capacitance | Serienkapazität |
| $C_{S,T}$ | Series capacitance at temperature T | Serienkapazität bei Temperatur T |
| $C_f$ | Capacitance at frequency f | Kapazität bei Frequenz f |
| d | Case diameter, nominal dimension | Gehäusedurchmesser, Nennmaß |
| $d_{max}$ | Maximum case diameter | Maximaler Gehäusedurchmesser |
| ESL | Self-inductance | Eigeninduktivität |
| ESR | Equivalent series resistance | Ersatzserienwiderstand |
| $ESR_f$ | Equivalent series resistance at frequency f | Ersatzserienwiderstand bei Frequenz f |
| $ESR_T$ | Equivalent series resistance at temperature T | Ersatzserienwiderstand bei Temperatur T |
| f | Frequency | Frequenz |
| I | Current | Strom |
| $I_{AC}$ | Alternating current (ripple current) | Wechselstrom |
| $I_{AC,RMS}$ | Root-mean-square value of alternating current | Wechselstrom, Effektivwert |
| $I_{AC,f}$ | Ripple current at frequency f | Wechselstrom bei Frequenz f |
| $I_{AC,max}$ | Maximum permissible ripple current | Maximal zulässiger Wechselstrom |
| $I_{AC,R}$ | Rated ripple current | Nennwechselstrom |
| $I_{leak}$ | Leakage current | Reststrom |
| $I_{leak,op}$ | Operating leakage current | Betriebsreststrom |
| l | Case length, nominal dimension | Gehäuselänge, Nennmaß |
| $l_{max}$ | Maximum case length (without terminals and mounting stud) | Maximale Gehäuselänge (ohne Anschlüsse und Gewindebolzen) |
| R | Resistance | Widerstand |
| $R_{ins}$ | Insulation resistance | Isolationswiderstand |
| $R_{symm}$ | Balancing resistance | Symmetrierwiderstand |
| T | Temperature | Temperatur |
| $\Delta T$ | Temperature difference | Temperaturdifferenz |
| $T_A$ | Ambient temperature | Umgebungstemperatur |
| $T_B$ | Capacitor base temperature | Temperatur des Gehäusebodens |
| $T_C$ | Case temperature | Gehäusetemperatur |
| t | Time | Zeit |
| $\Delta t$ | Period | Zeitraum |
| $t_b$ | Service life (operating hours) | Brauchbarkeitsdauer (Betriebszeit) |
| V | Voltage | Spannung |
| $V_F$ | Forming voltage | Formierspannung |
| $V_{op}$ | Operating voltage | Betriebsspannung |
| $V_R$ | Rated voltage, DC voltage | Nennspannung, Gleichspannung |
| $V_S$ | Surge voltage | Spitzenspannung |
| $X_C$ | Capacitive reactance | Kapazitiver Blindwiderstand |

| Symbol | English | German |
|---|---|---|
| $X_L$ | Inductive reactance | Induktiver Blindwiderstand |
| Z | Impedance | Scheinwiderstand |
| $Z_T$ | Impedance at temperature T | Scheinwiderstand bei Temperatur T |
| tan $\delta$ | Dissipation factor | Verlustfaktor |
| $\lambda$ | Failure rate | Ausfallrate |
| $\varepsilon_0$ | Absolute permittivity | Elektrische Feldkonstante |
| $\varepsilon_r$ | Relative permittivity | Dielektrizitätszahl |
| $\omega$ | Angular frequency; $2 \cdot \pi \cdot f$ | Kreisfrequenz; $2 \cdot \pi \cdot f$ |

**Note:**

All dimensions are given in mm.

## Important notes

The following applies to all products named in this publication:

1. Some parts of this publication contain **statements about the suitability of our products for certain areas of application**. These statements are based on our knowledge of typical requirements that are often placed on our products in the areas of application concerned. We nevertheless expressly point out **that such statements cannot be regarded as binding statements about the suitability of our products for a particular customer application**. As a rule we are either unfamiliar with individual customer applications or less familiar with them than the customers themselves. For these reasons, it is always ultimately incumbent on the customer to check and decide whether a product with the properties described in the product specification is suitable for use in a particular customer application.

2. We also point out that **in individual cases, a malfunction of electronic components or failure before the end of their usual service life cannot be completely ruled out in the current state of the art, even if they are operated as specified**. In customer applications requiring a very high level of operational safety and especially in customer applications in which the malfunction or failure of an electronic component could endanger human life or health (e.g. in accident prevention or life-saving systems), it must therefore be ensured by means of suitable design of the customer application or other action taken by the customer (e.g. installation of protective circuitry or redundancy) that no injury or damage is sustained by third parties in the event of malfunction or failure of an electronic component.

3. **The warnings, cautions and product-specific notes must be observed**.

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