# DATA SHEET

## 150 CLZ
## Aluminum electrolytic capacitors SMD (Chip)
## Long life base plate, very low impedance

Preliminary specification
Supersedes data of 26th September 2001
File under BCcomponents, BC01

2002 Feb 27

BC COMPONENTS

# Aluminum electrolytic capacitors SMD (Chip) Long life base plate, very low impedance

# 150 CLZ

## FEATURES

- Polarized aluminum electrolytic capacitors, non-solid electrolyte, self healing
- SMD-version with base plate, reflow solderable
- Very low impedance, very high ripple current
- Very long useful life: 3000 hours at 105 °C
- Charge and discharge proof, no peak current limitation
- Supplied in blister tape on reel.

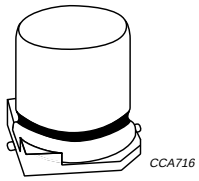
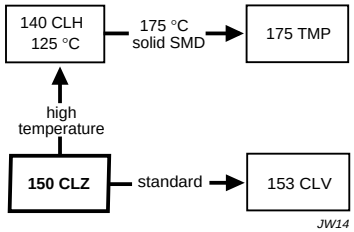



Fig.1 Component outline.

## APPLICATIONS

- SMD technology, for high mounting density
- Industrial and professional applications
- Automotive, general industrial
- Smoothing, filtering, buffering.




## QUICK REFERENCE DATA

| DESCRIPTION | VALUE |
|---|---|
| Nominal case sizes (L × W × H in mm) | 8 × 8 × 10 to 10 × 10 × 14 |
| Rated capacitance range, $C_R$ | 33 to 1000 µF |
| Tolerance on $C_R$ | ±20% |
| Rated voltage range, $U_R$ | 6.3 to 63 V |
| Category temperature range | –55 to +105 °C |
| Endurance test at 105 °C: | 2000 hours |
| Useful life at 105 °C: | |
| case size ≤10 × 10 × 10 | 2500 hours |
| case size 10 × 10 × 14 | 3000 hours |
| Useful life at 40 °C; 1.8 × $I_R$ applied: | |
| case size ≤10 × 10 × 10 | 125000 hours |
| case size 10 × 10 × 14 | 150000 hours |
| Shelf life at 0 V, 105 °C | 1000 hours |
| Based on sectional specification | IEC 60384-18/CECC32300 |
| Climatic category IEC 60068 | 55/105/56 |

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**Selection chart for $C_R$, $U_R$ and relevant nominal case sizes (L × W × H in mm)**

Preferred types in **bold**.

| $C_R$ (μF) | $U_R$ (V) | | | | | | |
|---|---|---|---|---|---|---|---|
| | **6.3** | **10** | **16** | **25** | **35** | **50** | **63** |
| 33 | – | – | – | – | – | – | 8 × 8 × 10 |
| **47** | – | – | – | – | – | – | **8 × 8 × 10** |
| | – | – | – | – | – | – | **10 × 10 × 10** |
| 68 | – | – | – | – | – | 8 × 8 × 10 | 10 × 10 × 10 |
| **100** | – | – | – | – | **8 × 8 × 10** | **10 × 10 × 10** | 10 × 10 × 14 |
| 150 | – | – | – | 8 × 8 × 10 | – | – | – |
| **220** | – | – | 8 × 8 × 10 | **8 × 8 × 10** | **10 × 10 × 10** | **10 × 10 × 14** | – |
| **330** | – | 8 × 8 × 10 | **8 × 8 × 10** | 10 × 10 × 10 | 10 × 10 × 14 | – | – |
| **470** | 8 × 8 × 10 | **8 × 8 × 10** | **10 × 10 × 10** | **10 × 10 × 14** | – | – | – |
| 680 | – | 10 × 10 × 10 | 10 × 10 × 14 | – | – | – | – |
| **1000** | 10 × 10 × 10 | **10 × 10 × 14** | – | – | – | – | – |

**MARKING**

- Rated capacitance (in μF)
- Rated voltage (in V)
- Black mark or '–' sign indicating the cathode (the anode is identified by bevelled edges)
- Code indicating group number (Z)
- Date code, in accordance with *"IEC 60062"*.

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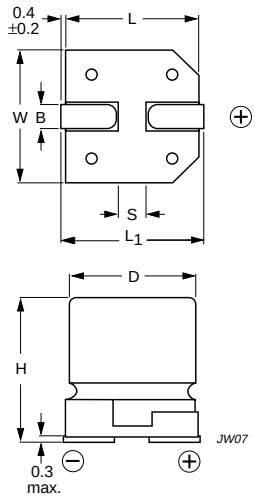
## MECHANICAL DATA




Dimensions in mm.
For dimensions see Table 1.

Fig.2 Dimensional outline.

**Table 1** Physical dimensions, mass and packaging quantities; see Fig.2

| NOMINAL CASE SIZE L × W × H (mm) | CASE CODE | $L_{max}$ (mm) | $W_{max}$ (mm) | $H_{max}$ (mm) | ∅D (mm) | $B_{max}$ (mm) | S (mm) | $L_{1\ max}$ (mm) | MASS (g) |
|---|---|---|---|---|---|---|---|---|---|
| 8 × 8 × 10 | 0810 | 8.5 | 8.5 | 10.5 | 8.0 | 1.0 | 3.1 | 9.9 | ≈1.0 |
| 10 ×10 × 10 | 1010 | 10.5 | 10.5 | 10.5 | 10.0 | 1.0 | 4.5 | 11.8 | ≈1.3 |
| 10 × 10 × 14 | 1014 | 10.5 | 10.5 | 14.3 | 10.0 | 1.0 | 4.5 | 11.8 | ≈1.5 |

## PACKAGING

Supplied in blister tape on reel. For general packaging information refer to data handbook BC01, section *"Packaging"*.

**Table 2** Tape and reel dimensions

| NOMINAL CASE SIZE L × W × H (mm) | CASE CODE | PITCH $P_1$ (mm) | TAPE WIDTH W (mm) | TAPE THICKNESS $T_2$ (mm) | REEL DIA. (mm) | PACKAGING QUANTITY PER REEL |
|---|---|---|---|---|---|---|
| 8 × 8 × 10 | 0810 | 16 | 24 | 11.8 | 380 | 500 |
| 10 ×10 × 10 | 1010 | 16 | 24 | 11.8 | 380 | 500 |
| 10 × 10 × 14 | 1014 | 16 | 24 | 15.0 | 330 | 250 |

## MOUNTING

The capacitors are designed for automatic placement on to printed-circuit boards.

Optimum dimensions of soldering pads depend amongst others on soldering method, mounting accuracy, print lay-out and/or adjacent components.

For recommended soldering pad dimensions, refer to Fig.3 and Table 3

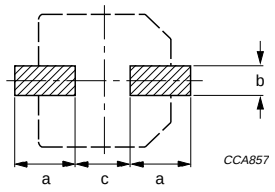
### Soldering

Soldering conditions are defined by the curve, temperature versus time, where the temperature is that measured on the soldering pad during processing.

For maximum conditions refer to Fig.4.

Any temperature versus time curve which does not exceed the specified maximum curves may be applied.

AS A GENERAL PRINCIPLE, TEMPERATURE AND DURATION SHALL BE THE **MINIMUM** NECESSARY REQUIRED TO ENSURE GOOD SOLDERING CONNECTIONS. HOWEVER, THE SPECIFIED MAXIMUM CURVES SHOULD NEVER BE EXCEEDED.




For dimensions see Table 3.

Fig.3 Recommended soldering pad dimensions.

**Table 3** Recommended soldering pad dimensions; see Fig.3

| CASE CODE | a (mm) | b (mm) | c (mm) |
|---|---|---|---|
| 0810 | 3.5 | 2.5 | 3.0 |
| 1010 | 4.3 | 2.5 | 4.0 |
| 1014 | 4.3 | 2.5 | 4.0 |

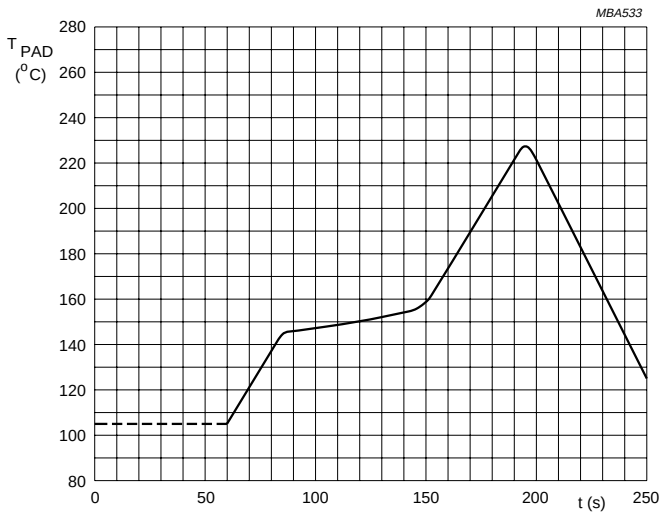



Fig.4 Maximum temperature load during infrared reflow soldering measured on the soldering pad.

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## ELECTRICAL DATA AND ORDERING INFORMATION

Unless otherwise specified, all electrical values in Table 4 apply at $T_{amb}$ = 20 °C, P = 86 to 106 kPa, RH = 45 to 75%.

| SYMBOL | DESCRIPTION |
|---|---|
| $C_R$ | rated capacitance at 100 Hz, tolerance ±20% |
| $I_R$ | rated RMS ripple current at 100 kHz, 105 °C |
| $I_{L2}$ | max. leakage current after 2 minutes at $U_R$ |
| Tan δ | max. dissipation factor at 100 Hz |
| Z | max. impedance at 100 kHz |

Electrolytic capacitor 150 CLZ series

220 μF/50 V; ±20%

Nominal case size:
10 × 10 × 14 mm; taped on reel

Catalogue number: 2222 150 95102.

**Ordering example**

**Table 4** Electrical data and ordering information; preferred types in **bold**

| $U_R$ (V) | $C_R$ (μF) | NOMINAL CASE SIZE L × W × H (mm) | $I_R$ 105 °C (mA) 100 kHz | $I_{L2}$ 2 min (μA) | Tan δ 100 Hz | Z 100 kHz +20 °C (Ω) | CATALOGUE NUMBER 2222 150 ..... |
|---|---|---|---|---|---|---|---|
| 6.3 | 470 | 8 × 8 × 10 | 435 | 30 | 0.24 | 0.25 | 95311 |
| | 1000 | 10 × 10 × 10 | 670 | 63 | 0.24 | 0.13 | 95301 |
| 10 | 330 | 8 × 8 × 10 | 435 | 33 | 0.20 | 0.25 | 95411 |
| | **470** | **8 × 8 × 10** | 435 | 47 | 0.20 | 0.25 | **95412** |
| | 680 | 10 × 10 × 10 | 670 | 68 | 0.20 | 0.13 | 95401 |
| | **1000** | **10 × 10 × 14** | 850 | 100 | 0.20 | 0.10 | **95402** |
| 16 | 220 | 8 × 8 × 10 | 435 | 35 | 0.16 | 0.25 | 95511 |
| | **330** | **8 × 8 × 10** | 435 | 53 | 0.16 | 0.25 | **95512** |
| | **470** | **10 × 10 × 10** | 670 | 75 | 0.16 | 0.13 | **95501** |
| | 680 | 10 × 10 × 14 | 850 | 109 | 0.16 | 0.10 | 95502 |
| 25 | 150 | 8 × 8 × 10 | 420 | 38 | 0.14 | 0.28 | 95611 |
| | **220** | **8 × 8 × 10** | 420 | 55 | 0.14 | 0.28 | **95612** |
| | 330 | 10 × 10 × 10 | 640 | 83 | 0.14 | 0.14 | 95601 |
| | **470** | **10 × 10 × 14** | 820 | 118 | 0.14 | 0.11 | **95602** |
| 35 | **100** | **8 × 8 × 10** | 405 | 35 | 0.12 | 0.30 | **95011** |
| | **220** | **10 × 10 × 10** | 630 | 77 | 0.12 | 0.15 | **95001** |
| | 330 | 10 × 10 × 14 | 790 | 116 | 0.12 | 0.12 | 95002 |
| 50 | 68 | 8 × 8 × 10 | 333 | 34 | 0.12 | 0.48 | 95111 |
| | **100** | **10 × 10 × 10** | 490 | 50 | 0.12 | 0.24 | **95101** |
| | **220** | **10 × 10 × 14** | 620 | 110 | 0.12 | 0.19 | **95102** |
| 63 | 33 | 8 × 8 × 10 | 270 | 21 | 0.10 | 0.65 | 95812 |
| | **47** | **8 × 8 × 10** | 270 | 30 | 0.10 | 0.65 | **95811** |
| | **47** | **10 × 10 × 10** | 390 | 30 | 0.10 | 0.38 | **95801** |
| | 68 | 10 × 10 × 10 | 390 | 43 | 0.10 | 0.38 | 95802 |
| | 100 | 10 × 10 × 14 | 507 | 63 | 0.10 | 0.29 | 95803 |

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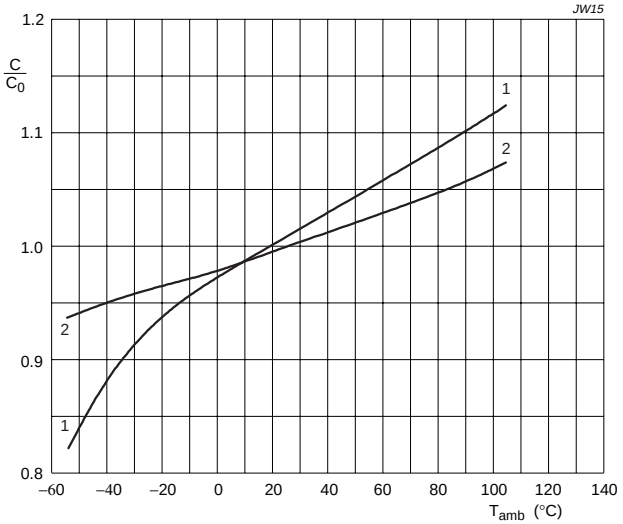
**150 CLZ**

**Additional electrical data**

| PARAMETER | CONDITIONS | VALUE |
|---|---|---|
| **Voltage** | | |
| Surge voltage for short periods | IEC 60384-18, subclause 4.14 | $U_s \leq 1.15 \times U_R$ |
| Reverse voltage for short periods | IEC 60384-18, subclause 4.16 | $U_{rev} \leq 1$ V |
| **Current** | | |
| Leakage current | after 2 minutes at $U_R$ | $I_{L2} \leq 0.01 \times C_R \times U_R$ |
| **Inductance** | | |
| Equivalent series inductance (ESL) | | typ. 16 nH |
| **Resistance** | | |
| Equivalent series resistance (ESR) at 100 Hz | calculated from tan $\delta_{max}$ and $C_R$ (see Table 4) | ESR = tan $\delta$ / $2\pi f C_R$ |

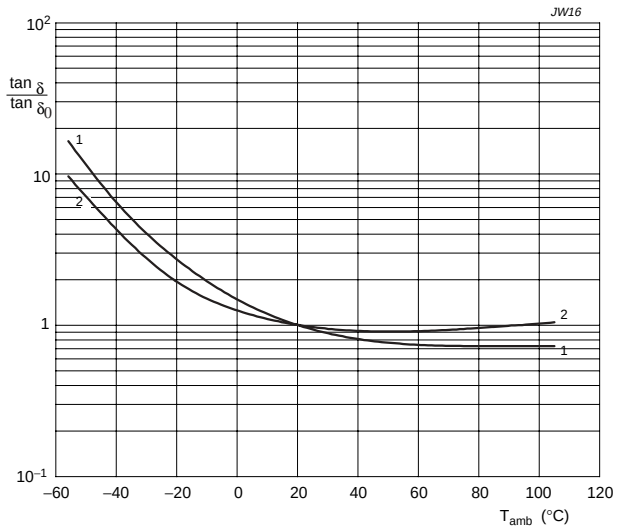
**Capacitance (C)**




Curve 1: 10 V.
Curve 2: 63 V.
$C_0$ = capacitance at 20 °C, 100 Hz.

Fig.5 Typical multiplier of capacitance as a function of ambient temperature.

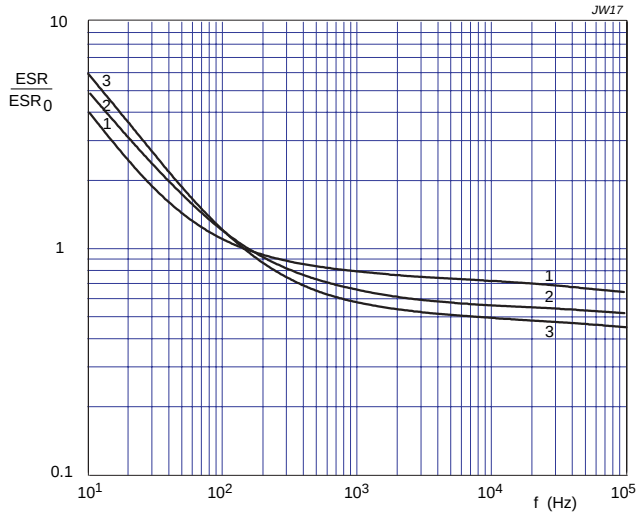
**Dissipation factor (tan δ)**




Curve 1: 10 V.
Curve 2: 63 V.
Tan $\delta_0$ = typical tan δ at 20 °C, 100 Hz.

Fig.6 Multiplier of dissipation factor (tan δ) as a function of ambient temperature.

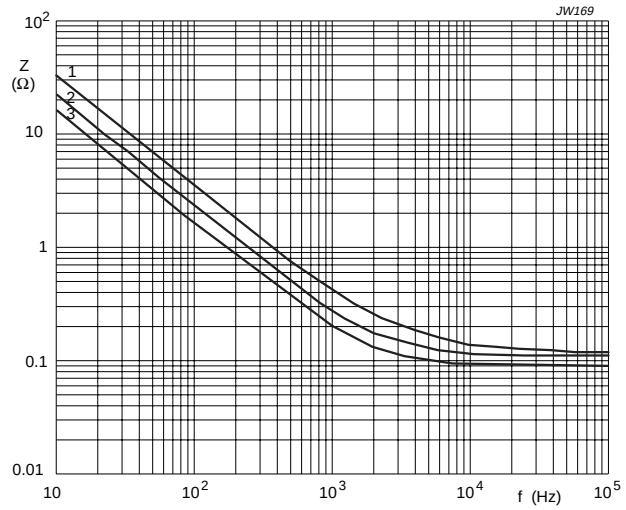
**Equivalent series resistance (ESR)**




Curve 1: 10 V.
Curve 2: 35 V.
Curve 3: 63 V.
$ESR_0$ = typical ESR at 20 °C, 100 Hz.

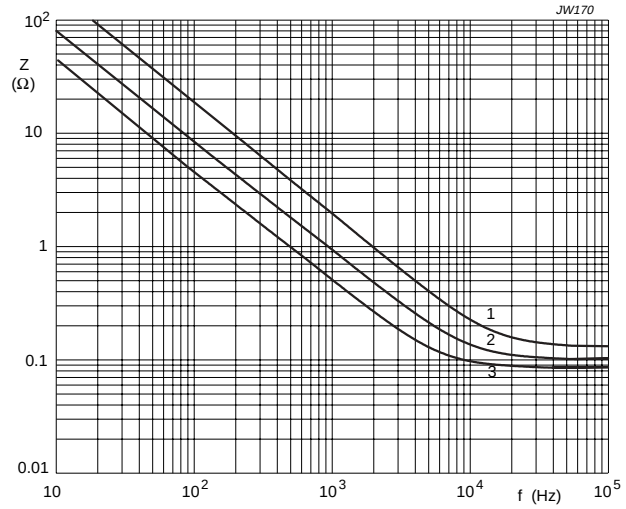
Fig.7 Typical multiplier of ESR as a function of frequency.

**Impedance (Z)**



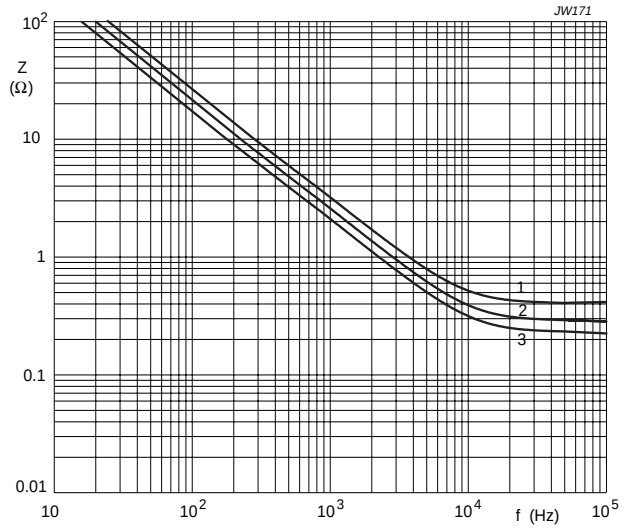

$U_R$ = 10 V
Curve 1: case code 0810, 470 µF.
Curve 2: case code 1010, 680 µF.
Curve 3: case code 1014, 1000 µF.
$T_{amb}$ = 20 °C.

Fig.8 Typical impedance as a function of frequency.




$U_R$ = 35 V
Curve 1: case code 0810, 100 µF.
Curve 2: case code 1010, 220 µF.
Curve 3: case code 1014, 330 µF.
$T_{amb}$ = 20 °C.

Fig.9 Typical impedance as a function of frequency.



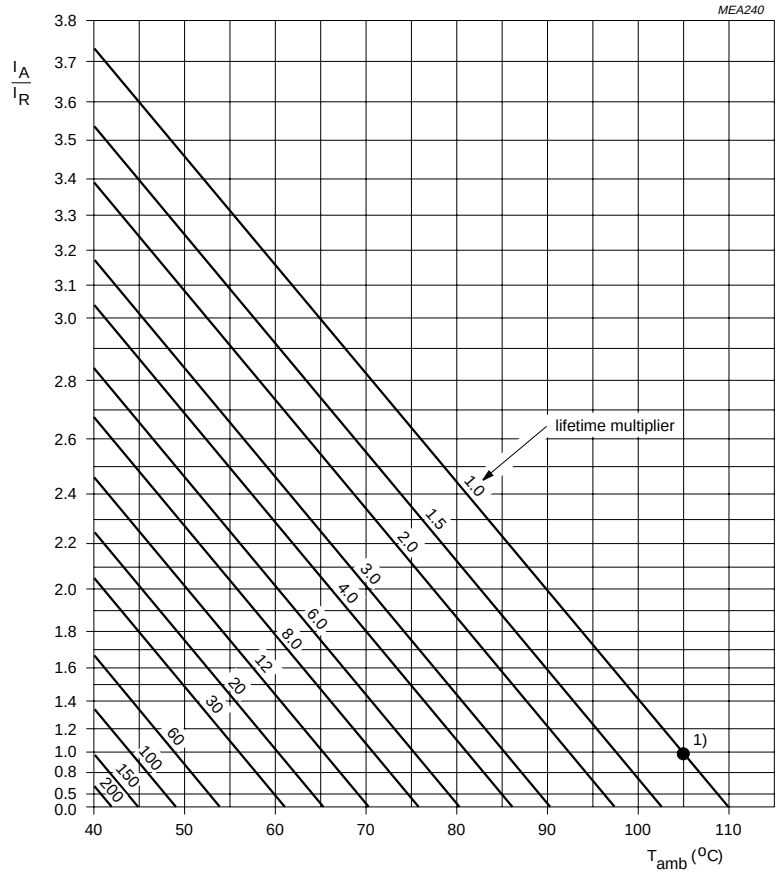

$U_R$ = 63 V
Curve 1: case code 0810, 47 µF.
Curve 2: case code 1010, 68 µF.
Curve 3: case code 1014, 100 µF.
$T_{amb}$ = 20 °C.

Fig.10 Typical impedance as a function of frequency.

**RIPPLE CURRENT AND USEFUL LIFE**

**Table 5** Multiplier of ripple current ($I_R$) as a function of frequency

| FREQUENCY (Hz) | $I_R$ MULTIPLIER | | |
|---|---|---|---|
| | $U_R$ = 6.3 to 25 V | $U_R$ = 35 V | $U_R$ = 50 to 63 V |
| 100 | 0.70 | 0.65 | 0.60 |
| 300 | 0.80 | 0.80 | 0.75 |
| 1000 | 0.85 | 0.85 | 0.85 |
| 3000 | 0.93 | 0.93 | 0.93 |
| 10000 | 0.95 | 0.95 | 0.95 |
| 30000 | 0.97 | 0.97 | 0.97 |
| 100000 | 1.00 | 1.00 | 1.00 |




$I_A$ = actual ripple current at 100 kHz.

$I_R$ = rated ripple current at 100 kHz, 105 °C.

(1) Useful life at 105 °C and $I_R$ applied:
case code ≤1010: 2500 hours;
case code = 1014: 3000 hours.

Fig.11 Multiplier of useful life as a function of ambient temperature and ripple current load.

**SPECIFIC TESTS AND REQUIREMENTS**

General tests and requirements are specified in data handbook BC01, section *"Tests and Requirements".*

**Table 6** Test procedures and requirements

| TEST | | PROCEDURE (quick reference) | REQUIREMENTS |
|---|---|---|---|
| NAME OF TEST | REFERENCE | | |
| Mounting | IEC 60384-18, subclause 4.3 | shall be performed prior to tests mentioned below;<br>reflow soldering;<br>for maximum temperature load refer to chapter "Mounting" | $\Delta C/C$: ±5%<br>tan $\delta \leq$ spec. limit<br>$I_{L2} \leq$ spec. limit |
| Endurance | IEC 60384-18/ CECC32300, subclause 4.15 | $T_{amb}$ = 105 °C; $U_R$ applied;<br>2000 hours | $U_R$ = 6.3 V; $\Delta C/C$: ±25%<br>$U_R \geq$ 10 V; $\Delta C/C$: ±20%<br>tan $\delta \leq 2 \times$ spec. limit<br>$I_{L2} \leq$ spec. limit |
| Useful life | CECC 30301, subclause 1.8.1 | $T_{amb}$ = 105 °C; $U_R$ and $I_R$ applied;<br>case size $\leq 10 \times 10 \times 10$: 2500 hours<br>case size = $10 \times 10 \times 14$: 3000 hours, | $\Delta C/C$: ±50%<br>tan $\delta \leq 3 \times$ spec. limit<br>$I_{L2} \leq$ spec. limit<br>no short or open circuit<br>total failure percentage: ≤1% |
| Shelf life (storage at high temperature) | IEC 60384-18/ CECC32300, subclause 4.17 | $T_{amb}$ = 105 °C; no voltage applied;<br>1000 hours<br>after test: $U_R$ to be applied for 30 minutes, 24 to 48 hours before measurement | for requirements see 'Endurance test' above |