DATA SHEET

153 CLV
Aluminum electrolytic capacitors
SMD (Chip) Long Life Vertical

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

2001 Oct 31

BC COMPONENTS

Aluminum electrolytic capacitors SMD (Chip) Long Life Vertical

153 CLV

FEATURES

- Polarized aluminum electrolytic capacitors, non-solid electrolyte, self healing
- SMD-version with base plate, vertical construction requiring minimum board space, reflow solderable
- High CV per unit volume
- Long useful life: 2000 to 3000 hours at 105 °C
- Charge and discharge proof, no peak current limitation
- Supplied in blister tape on reel.

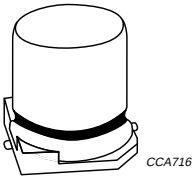
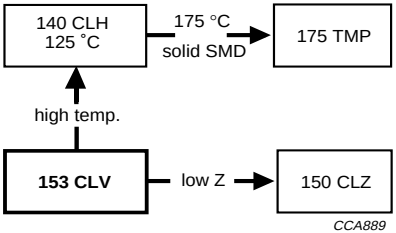


Fig.1 Component outline.

APPLICATIONS

- SMD technology, for high mounting density
- Coupling, decoupling, smoothing, filtering, buffering, timing
- Telecommunications, general industrial, EDP, automotive, portable and lightweight equipment.



QUICK REFERENCE DATA

DESCRIPTION	VALUE
Nominal case sizes (L × W × H in mm)	4.0 × 4.0 × 5.3 to 10 × 10 × 14
Rated capacitance range, C_R	0.47 to 1000 µF
Tolerance on C_R	±20%
Rated voltage range, U_R	6.3 to 100 V
Category temperature range	–55 to +105 °C
Endurance test at 105 °C:	
case sizes 4.0 × 4.0 × 5.3 to 6.3 × 6.3 × 5.3	1000 hours
case sizes 8.0 × 8.0 × 6.5 to 10 × 10 × 14	2000 hours
Useful life at 105 °C:	
case sizes 4.0 × 4.0 × 5.3 to 6.3 × 6.3 × 5.3	2000 hours
case sizes 8.0 × 8.0 × 6.5 to 10 × 10 × 14	3000 hours
Useful life at 40 °C; 1.3 × I_R applied:	
case sizes 4.0 × 4.0 × 5.3 to 6.3 × 6.3 × 5.3	200000 hours
case sizes 8.0 × 8.0 × 6.5 to 10 × 10 × 14	300000 hours
Shelf life at 0 V, 105 °C	1000 hours
Based on sectional specification	IEC 60384-18/CECC 32300
Climatic category IEC 60068	55/105/56

Aluminum electrolytic capacitors SMD (Chip) Long Life Vertical

153 CLV

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**	**100**
0.47	–	–	–	–	–	4.0 × 4.0 × 5.3	–	–
1.0	–	–	–	–	–	**4.0 × 4.0 × 5.3**	–	–
2.2	–	–	–	–	–	4.0 × 4.0 × 5.3	–	–
3.3	–	–	–	–	–	4.0 × 4.0 × 5.3	–	–
4.7	–	–	–	–	**4.0 × 4.0 × 5.3**	**5.0 × 5.0 × 5.3**	–	–
10	–	–	**4.0 × 4.0 × 5.3**	–	5.0 × 5.0 × 5.3	**6.3 × 6.3 × 5.3**	–	10 × 10 × 12
22	4.0 × 4.0 × 5.3	–	5.0 × 5.0 × 5.3	–	**6.3 × 6.3 × 5.3**	8.0 × 8.0 × 6.5	–	10 × 10 × 12
33	–	5.0 × 5.0 × 5.3	–	6.3 × 6.3 × 5.3	8.0 × 8.0 × 6.5	8.0 × 8.0 × 10	–	10 × 10 × 14
47	5.0 × 5.0 × 5.3	–	**6.3 × 6.3 × 5.3**	8.0 × 8.0 × 6.5	–	**8.0 × 8.0 × 10**	10 × 10 × 12	–
100	**6.3 × 6.3 × 5.3**	–	8.0 × 8.0 × 6.5	**8.0 × 8.0 × 10**	–	**10 × 10 × 10**	**10 × 10 × 14**	–
	–	–	–	–	–	10 × 10 × 12	–	–
220	–	**8.0 × 8.0 × 10**	10 × 10 × 10	10 × 10 × 12	**10 × 10 × 12**	–	–	–
330	8.0 × 8.0 × 10	10 × 10 × 10	10 × 10 × 12	10 × 10 × 14	–	–	–	–
470	10 × 10 × 10	10 × 10 × 12	**10 × 10 × 14**	–	–	–	–	–
680	10 × 10 × 12	10 × 10 × 14	–	–	–	–	–	–
1000	10 × 10 × 14	–	–	–	–	–	–	–

Aluminum electrolytic capacitors SMD (Chip) Long Life Vertical

153 CLV

PACKAGING

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

Table 1 Tape, reel dimensions and packaging quantities

CASE CODE	PITCH P_1 (mm)	TAPE WIDTH W (mm)	TAPE THICKNESS T_2 (mm)	REEL DIA. (mm)	PACKAGING QUANTITY PER REEL
0405	8	12	5.8	380	2000
0505	12	12	5.8	380	1000
0605	12	16	5.8	380	1000
0807	12	16	6.8	380	1000
0810	16	24	11	380	500
1010	16	24	11	380(1)	500
				330(1)	250
1012	16	24	13	330	250
1014	16	24	15	330	250

Note

1. Depending on production location.

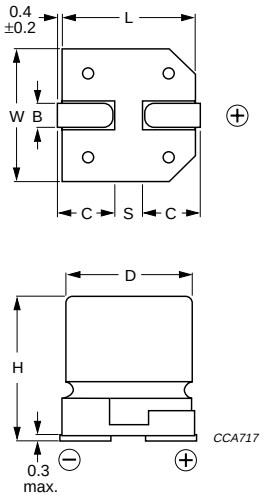
MARKING

- 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 (V)
- Date code, in accordance with *"IEC 60062"*.

Aluminum electrolytic capacitors SMD (Chip) Long Life Vertical

153 CLV

MECHANICAL DATA



Dimensions in mm.

Fig.2 Dimensional outline.

Table 2 Physical dimensions and mass; 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)	C (mm)	MASS (g)
4.0 × 4.0 × 5.3	0405	4.5	4.5	5.5	4.0	0.8	1.0	2.0 ±0.2	≈0.13
5.0 × 5.0 × 5.3	0505	5.5	5.5	5.5	5.0	0.8	1.4	2.3 ±0.2	≈0.20
6.3 × 6.3 × 5.3	0605	6.8	6.8	5.5	6.3	0.8	2.0	2.7 ±0.2	≈0.30
8.0 × 8.0 × 6.5	0807	8.6	8.6	6.8	8.0	0.8	2.3	3.4 ±0.2	≈0.50
8.0 × 8.0 × 10	0810	8.6	8.6	10.5	8.0	1.1	3.1	3.0 ±0.2	≈1.00
10 × 10 × 10	1010	10.6	10.6	10.5	10.0	1.1	4.7	3.3 ±0.2	≈1.30
10 × 10 × 12	1012	10.6	10.6	12.3	10.0	1.2	4.5	3.9 ±0.2	≈1.40
10 × 10 × 14	1014	10.6	10.6	14.3	10.0	1.2	4.5	3.9 ±0.2	≈1.50

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.3and Table 3.

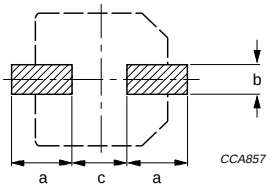
Soldering

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.



Dimensions in mm.

Fig.3 Recommended soldering pad dimensions.

Table 3 Recommended soldering pad dimensions

CASE CODE	a (mm)	b (mm)	c (mm)
0405	2.6	1.6	1.0
0505	3.0	1.6	1.4
0605	3.5	1.6	1.9
0807	4.0	1.6	2.1
0810	3.5	2.5	3.0
1010	4.0	2.5	4.0
1012	4.3	2.5	4.0
1014	4.3	2.5	4.0

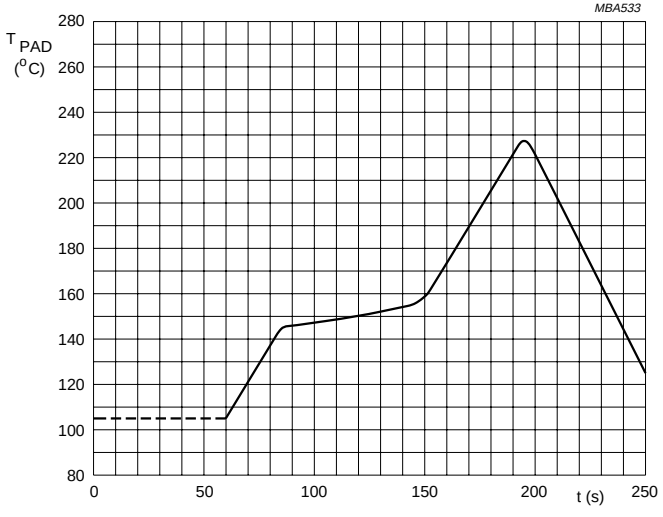


Fig.4 Maximum temperature load during infrared reflow soldering measured on the soldering pad.

Aluminum electrolytic capacitors SMD (Chip) Long Life Vertical

153 CLV

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 or 120 Hz, tolerance ±20%
I_R	rated RMS ripple current at 100 or 120 Hz, 105 °C
I_{L2}	max. leakage current after 2 minutes at U_R
Tan δ	max. dissipation factor at 100 or 120 Hz
ESR	equivalent series resistance at 100 kHz

Ordering example

Electrolytic capacitor 153 series

100 μF/25 V; ±20%

Nominal case size:
8 × 8 × 10 mm; taped on reel

Catalogue number: 2222 153 66101.

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)	I_{L2} 2 min (μA)	Tan δ	ESR 100 kHz (Ω)	CATALOGUE NUMBER 2222 153 .....
6.3	22	4.0 × 4.0 × 5.3	21	3.0	0.30	8	63229
	47	5.0 × 5.0 × 5.3	36	3.0	0.30	4	63479
	100	**6.3 × 6.3 × 5.3**	61	6.3	0.30	2	**63101**
	330	8.0 × 8.0 × 10	180	21	0.30	0.5	63331
	470	10 × 10 × 10	320	30	0.30	0.3	63471
	680	10 × 10 × 12	340	43	0.24	0.29	63681
	1000	10 × 10 × 14	400	63	0.24	0.24	63102
10	33	5.0 × 5.0 × 5.3	31	3.3	0.26	4	64339
	220	**8.0 × 8.0 × 10**	180	22	0.26	0.5	**64221**
	330	10 × 10 × 10	320	33	0.26	0.3	64331
	470	10 × 10 × 12	330	47	0.19	0.29	64471
	680	10 × 10 × 14	380	68	0.19	0.24	64681
16	**10**	**4.0 × 4.0 × 5.3**	16	3.0	0.22	8	**65109**
	22	5.0 × 5.0 × 5.3	28	3.5	0.22	4	65229
	47	**6.3 × 6.3 × 5.3**	47	7.5	0.22	2.2	**65479**
	100	8.0 × 8.0 × 6.5	110	16	0.22	1.2	65101
	220	10 × 10 × 10	320	35	0.22	0.3	65221
	330	10 × 10 × 12	330	53	0.16	0.29	65331
	470	**10 × 10 × 14**	370	75	0.16	0.25	**65471**
25	33	6.3 × 6.3 × 5.3	44	8.3	0.16	2.2	66339
	47	8.0 × 8.0 × 6.5	110	12	0.16	1.2	66479
	100	**8.0 × 8.0 × 10**	180	25	0.16	0.5	**66101**
	220	10 × 10 × 12	270	55	0.14	0.29	66221
	330	10 × 10 × 14	300	83	0.14	0.27	66331

Aluminum electrolytic capacitors SMD (Chip) Long Life Vertical

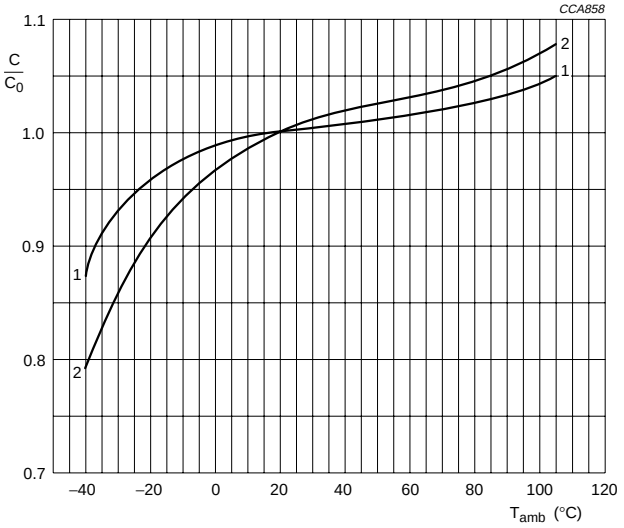
153 CLV

U_R (V)	C_R (μF)	NOMINAL CASE SIZE L × W × H (mm)	I_R 105 °C (mA)	I_{L2} 2 min (μA)	Tan δ	ESR 100 kHz (Ω)	CATALOGUE NUMBER 2222 153 .....
35	**4.7**	**4.0 × 4.0 × 5.3**	14	3.0	0.13	8	**60478**
	10	5.0 × 5.0 × 5.3	23	3.5	0.13	4	60109
	22	**6.3 × 6.3 × 5.3**	50	7.7	0.13	2.2	**60229**
	33	8.0 × 8.0 × 6.5	110	12	0.13	1.2	60339
	220	**10 × 10 × 12**	270	77	0.12	0.29	**60221**
50	0.47	4.0 × 4.0 × 5.3	5	3.0	0.12	12	61477
	1.0	**4.0 × 4.0 × 5.3**	7	3.0	0.12	12	**61108**
	2.2	4.0 × 4.0 × 5.3	10	3.0	0.12	12	61228
	3.3	4.0 × 4.0 × 5.3	12	3.0	0.12	12	61338
	4.7	**5.0 × 5.0 × 5.3**	17	3.0	0.12	6	**61478**
	10	**6.3 × 6.3 × 5.3**	26	5.0	0.12	3	**61109**
	22	8.0 × 8.0 × 6.5	110	11.0	0.12	1.2	61229
	33	8.0 × 8.0 × 10	180	17	0.12	0.5	61339
	47	**8.0 × 8.0 × 10**	180	24	0.12	0.5	**61479**
	100	**10 × 10 × 10**	320	50	0.12	0.3	**61101**
	100	10 × 10 × 12	230	50	0.12	0.29	91106
63	47	10 × 10 × 12	220	30	0.09	0.29	68479
	100	**10 × 10 × 14**	240	63	0.09	0.41	**68101**
100	10	10 × 10 × 12	150	10	0.07	0.9	69109
	22	10 × 10 × 12	150	25	0.07	0.9	69229
	33	10 × 10 × 14	170	33	0.07	0.65	69339

Additional electrical data

PARAMETER	CONDITIONS	VALUE
Voltage		
Surge voltage	IEC 60384-18, subclause 4.14	$U_s \leq 1.15 \times U_R$
Reverse voltage	IEC 60384-18, subclause 4.16	$U_{rev} \leq 1$ V
Current		
Leakage current	after 2 minutes at U_R	$I_{L2} \leq 0.01 \times C_R \times U_R$ or 3 μA, whichever is greater
Inductance		
Equivalent series inductance (ESL)	case codes 0405 to 0605	typ. 10 nH
	case codes 0807 to 1010	typ. 15 nH
	case codes 1012 and 1014	typ. 16 nH

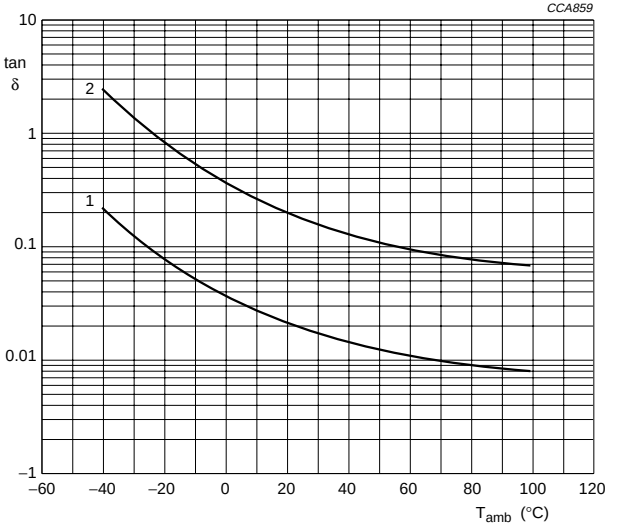
Capacitance (C)



Curve 1: 1 μF, 50 V.
Curve 2: 100 μF, 6.3 V.
C_0 = capacitance at 20 °C, 100 or 120 Hz.

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

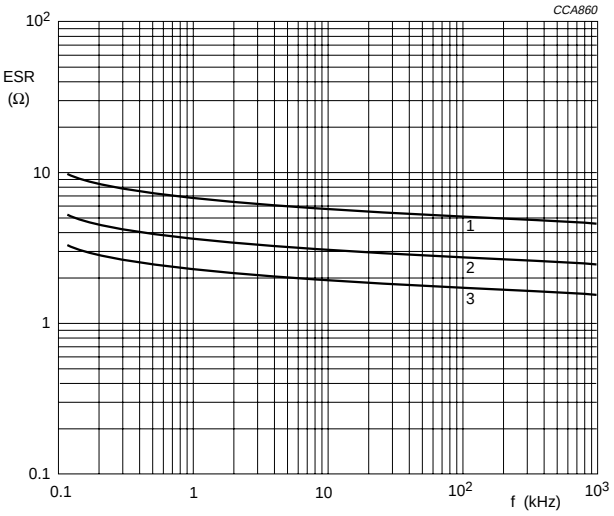
Dissipation factor (tan δ)



Curve 1: 1 μF, 50 V.
Curve 2: 100 μF, 6.3 V.
f = 100 or 120 Hz.

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

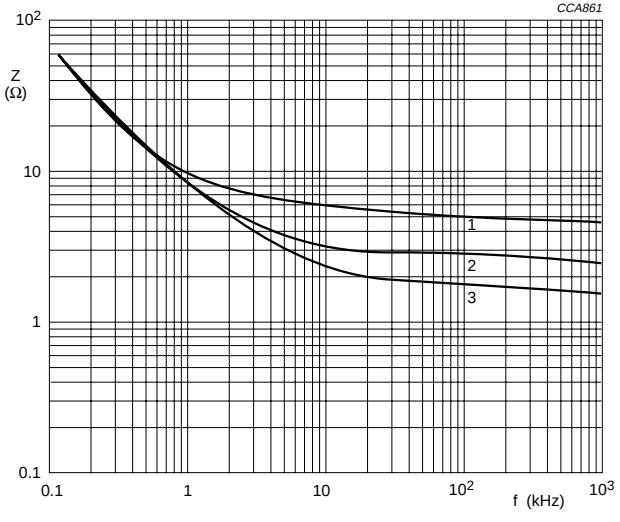
Equivalent series resistance (ESR)



Curve 1: 22 µF, 6.3 V.
Curve 2: 22 µF, 16 V.
Curve 3: 22 µF, 25 V.
T_{amb} = 20 °C.

Fig.7 Typical ESR as a function of frequency.

Impedance (Z)



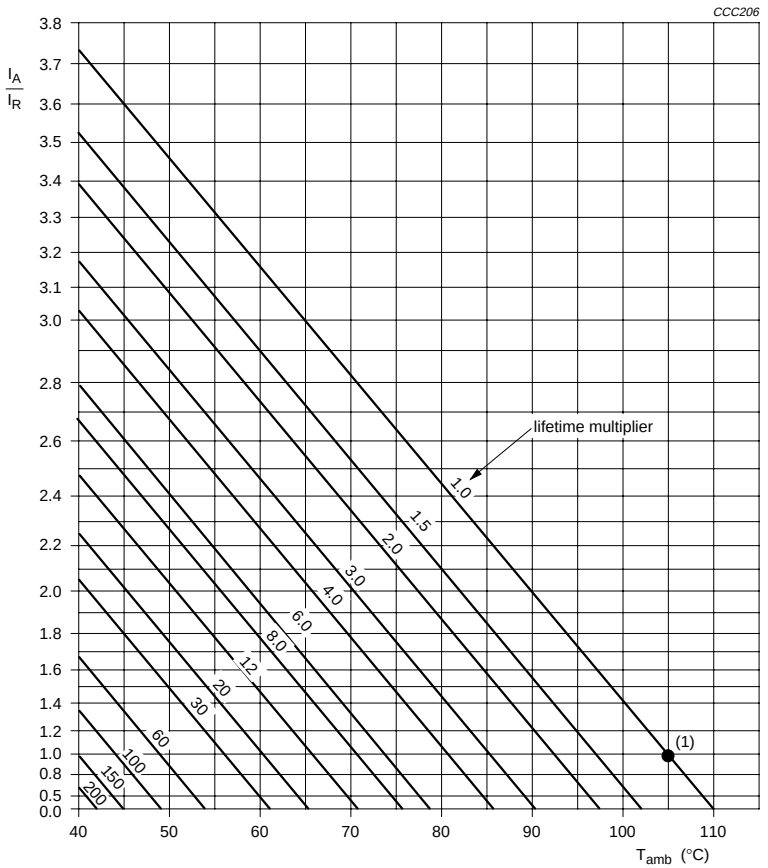
Curve 1: 22 µF, 6.3 V.
Curve 2: 22 µF, 16 V.
Curve 3: 22 µF, 25 V.
T_{amb} = 20 °C.

Fig.8 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 16 V	U_R = 25 or 35 V	U_R = 50 to 100 V
50 or 60	0.80	0.80	0.80
100 or 120	1.00	1.00	1.00
300	1.10	1.15	1.20
1000	1.15	1.25	1.35
3000	1.20	1.35	1.45
≥10000	1.25	1.40	1.50



I_A = actual ripple current at 100 or 120 Hz.

I_R = rated ripple current at 100 or 120 Hz, 105 °C.

For case codes 0405 to 1010 max. I_A/I_R = 2.4.

(1) Useful life at 105 °C and I_R applied: 2000 hours for case codes 0405 to 0605; 3000 hours for case codes 0807 to 1014.

Fig.9 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; reflow soldering; for maximum temperature load refer to chapter "Mounting"	$\Delta C/C$: ±10% tan $\delta \leq$ spec. limit $I_{L2} \leq$ spec. limit
Endurance	IEC 60384-18/ CECC 32300, subclause 4.15	T_{amb} = 105 °C; U_R applied; 1000 hours, case codes 0405 to 0605 2000 hours, case codes 0807 to 1014	$\Delta C/C$: ±20% tan $\delta \leq 2 \times$ spec. limit $I_{L2} \leq$ spec. limit
Useful life	CECC 30301, subclause 1.8.1	T_{amb} = 105 °C; U_R and I_R applied; 2000 hours, case codes 0405 to 0605 3000 hours, case codes 0807 to 1014	$\Delta C/C$: ±50% tan $\delta \leq 3 \times$ spec. limit $I_{L2} \leq$ spec. limit no short or open circuit total failure percentage: ≤1%
Shelf life (storage at high temperature)	IEC 60384-18/ CECC 32300, subclause 4.17	T_{amb} = 105 °C; no voltage applied; 1000 hours after test: U_R to be applied for 30 minutes, 24 to 48 hours before measurement	for requirements see 'Endurance test' above