DATA SHEET

MCT 0603; MCU 0805; MCA 1206
Precision flat chip resistors

Product specification
Supersedes data of 8th June 2001
File under BCcomponents, BC08

2002 Dec 19

BC COMPONENTS

FEATURES

- Thin-film technology
- Low TC: ±10 to ±25 ppm/K
- Precision tolerance of value: ±0,1 and ±0,25%
- Superior overall stability: class 0,1 and 0,25
- Green product, supports lead-free soldering.

Case sizes

Imperial:	0603	0805	1206
Metric:	RR 1608M	RR 2012M	RR 3216M

APPLICATIONS

- Test and measuring equipment
- Medical equipment
- Industrial equipment.

DESCRIPTION

MCT 0603, MCT 0805 and MCA 1206 Precision Thin Film Flat Chip Resistors combine the proven reliability of the professional products with an advanced level of precision and stability. Therefore they are perfectly suited for applications in the fields of test and measuring equipment together with industrial and medical electronics.

Production is strictly controlled and follows an extensive set of instructions established for reproducibility. A homogeneous film of metal alloy is deposited on a super high grade (96% Al_2O_3) ceramic substrate and conditioned to achieve the desired temperature coefficient. Specially designed inner contacts are deposited on both sides. A special laser is used to achieve the target value by smoothly fine trimming the resistive layer without damaging the ceramics. A further conditioning is applied in order to stabilize the trimming result. The resistor elements are covered by a blue protective coating designed for electrical, mechanical and climatic protection. The terminations receive a final pure tin on nickel plating.

The result of the determined production is verified by an extensive testing procedure and optical inspection performed on 100% of the individual chip resistors. Only accepted products are laid directly into the paper tape in accordance with **EN 60286-3**.

The resistors are suitable for processing on automatic SMD assembly systems and for automatic soldering using wave, reflow or vapour phase. The encapsulation is resistant to all cleaning solvents commonly used in the electronics industry, including alcohols, esters and aqueous solutions.

The resistors are lead-free, the pure tin plating provides compatibility with lead-free soldering processes. The immunity of the plating against tin whisker growth has been proven under extensive testing. All products comply with the CEFIC-EECA-EICTA list of legal restrictions on hazardous substances. Solderability is specified for 2 years after production or re-qualification. The permitted storage time is 20 years.

The resistors are tested in accordance with EN 140401-801 (superseding **CECC 40401-801)** which refers to **EN 60115-1** and **EN140400.** Approval of conformity is indicated by the CECC logo on the package label.

BCcomponents BEYSCHLAG has achieved **"Approval of Manufacturer"** in accordance with **EN 100114-1**. The release certificate for **"Technology Approval Schedule"** in accordance with **CECC 240001** based on **EN 100114-6** is granted for the BCcomponents BEYSCHLAG manufacturing process.

On request, resistors are available with established reliability in accordance with **CECC 40 401-801 Version E**. Please refer to the special data sheet for information on failure rate level, available resistance ranges and order codes.

QUICK REFERENCE DATA

DESCRIPTION	MCT 0603		MCU 0805		MCA 1206	
Metric size	RR 1608M		RR 2012M		RR 3216M	
Resistance range	47 Ω to 150 kΩ		47 Ω to 332 kΩ		47 Ω to 332 kΩ	
Resistance tolerance	±0,25%; ±0,1%				±0,1%	
Temperature coefficient	±25 ppm/K; ±15 ppm/K; ±10 ppm/K				±25 ppm/K	
Operation mode	precision	standard	precision	standard	precision	standard
Climatic category (LCT/UCT/days)	10/85/56	55/125/56	10/85/56	55/125/56	10/85/56	55/125/56
Rated dissipation, P_{70}	0,032 W	0,1 W	0,050 W	0,125 W	0,1 W	0,25 W
Operating voltage, U_{max} AC/DC	25 V	75 V	35 V	150 V	50 V	200 V
Film temperature	85 °C	125 °C	85 °C	125 °C	85 °C	125 °C
Max. resistance change at P_{70} for resistance range, $\Delta R/R$ max., after:	47 Ω to 150 kΩ		47 Ω to 332 kΩ		47 Ω to 332 kΩ	
1 000 h	≤ 0,1%	≤ 0,2%	≤ 0,1%	≤ 0,2%	≤ 0,05%	≤ 0,1%
8 000 h	≤ 0,2%	≤ 0,4%	≤ 0,2%	≤ 0,4%	≤ 0,1%	≤0,25%
225 000 h	≤ 0,5%	≤ 1,0%	≤ 0,5%	≤ 1,0%	≤ 0,25%	≤ 0,5%
Specified lifetime	225 000 h		225 000 h		225 000 h	
Insulation voltage :						
1 minute; U_{ins}	100 V		200 V		300 V	
continuous	75 V		75 V		75 V	
Failure rate	≤ 2×10^{-9}/h		≤ 2×10^{-9}/h		≤ 2×10^{-9}/h	

Table 1 Temperature coefficient and resistance range

DESCRIPTION		RESISTANCE VALUE[1]		
T.C.	**TOLERANCE**	**MCT 0603**	**MCU 0805**	**MCA 1206**
±25 ppm/K	±0,25%	**47 Ω to 150 kΩ**	**47 Ω to 332 kΩ**	–
	±0,1%	**100 Ω to 150 kΩ**	**47 Ω to 332 kΩ**	**47 Ω to 332 kΩ**
±15 ppm/K	±0,25%	47 Ω to 150 kΩ	47 Ω to 100 kΩ	–
	±0,1%	**100 Ω to 100 kΩ**	**100 Ω to 100 kΩ**	–
±10 ppm/K[2]	±0,25%	47 Ω to 20 kΩ	47 Ω to 36 kΩ	–
	±0,1%	**100 Ω to 20 kΩ**	**100 Ω to 36 kΩ**	–

Notes

1. Resistance values to be selected from E96 and E192 series, other values are available on request.
2. TC 10 is specified over the temperature range from –10 °C to 85 °C.

Resistance ranges printed in bold are preferred T.C. / tolerance combinations with optimized availability.

ORDERING INFORMATION

Components may be ordered by using either a simple clear text ordering code, see "Type description and ordering code" or BCcomponents' unique 12NC.

Numeric ordering code (12NC)

- The resistors have a 12-digit ordering code starting with 2312.
- The subsequent 4 digits indicate the resistor type, specification and packaging; see Table 2.
- The remaining 4 digits indicate the resistance value:
  - The first 3 digits indicate the resistance value.
  - The last digit indicates the resistance decade in accordance with Table 3.

Table 2 12NC ordering code indicating resistor type and packaging

DESCRIPTION			ORDERING CODE 2312		
			CARDBOARD TAPE ON REEL		
TYPE	T.C.	TOL.	P1 1000 units	P5 5000 units	PW 20000 units
MCT 0603	±25 ppm/K	±0,25%	201 6....	**216 6....**	206 6....
		±0,1%	201 7....	**216 7....**	206 7....
	±15 ppm/K	±0,25%	202 6....	217 6....	207 6....
		±0,1%	202 7....	**217 7....**	207 7....
	±10 ppm/K	±0,25%	203 6....	218 6....	208 6....
		±0,1%	203 7....	**218 7....**	208 7....
MCU 0805	±25 ppm/K	±0,25%	241 6....	**256 6....**	246 6....
		±0,1%	241 7....	**256 7....**	246 7....
	±15 ppm/K	±0,25%	242 6....	257 6....	247 6....
		±0,1%	242 7....	**257 7....**	247 7....
	±10 ppm/K	±0,25%	243 6....	258 6....	248 6....
		±0,1%	243 7....	**258 7....**	248 7....
MCA 1206	±25 ppm/K	±0,1%	381 7....	**396 7....**	386 7....

Resistance ranges printed in bold are preferred T.C. / tolerance combinations with optimized availability.

Table 3 Last digit of 12NC indicating resistance decade

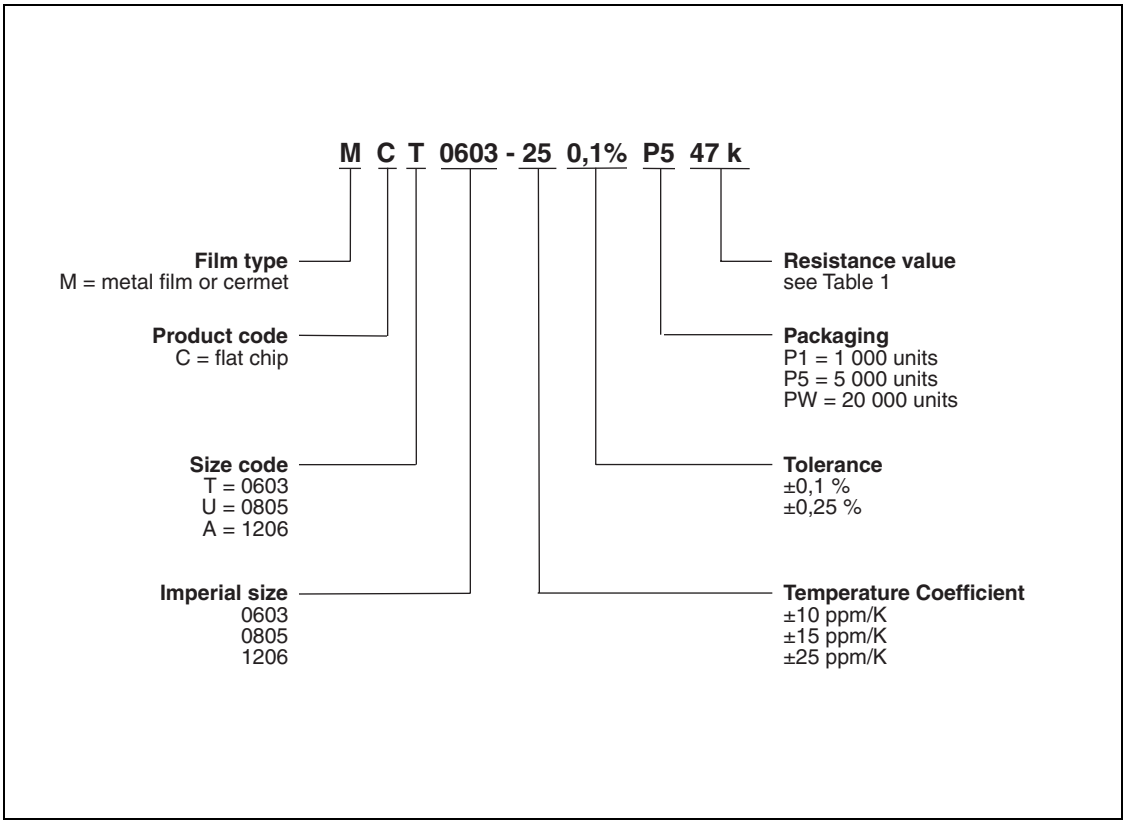
RESISTANCE DECADE	LAST DIGIT
10 to 99,9 Ω	9
100 to 999 Ω	1
1 to 9,99 kΩ	2
10 to 99,9 kΩ	3
100 to 999 kΩ	4

ORDERING EXAMPLE

The ordering code of a MCT 0603 resistor, value 47 kΩ and TC 25 with ±0,1% tolerance, supplied in cardboard tape of 5 000 units per reel is: 2312 216 74703.

Type description and ordering code

- We recommend that the clear text ordering code is used, to minimize the possibility of errors in order handling.



FUNCTIONAL DESCRIPTION

Derating

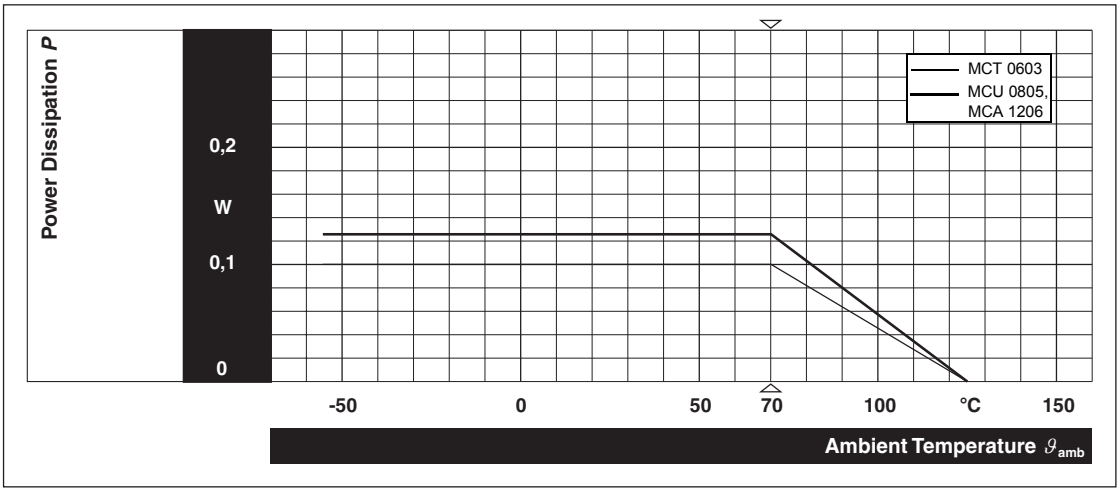


Fig.1 Derating, standard operation.

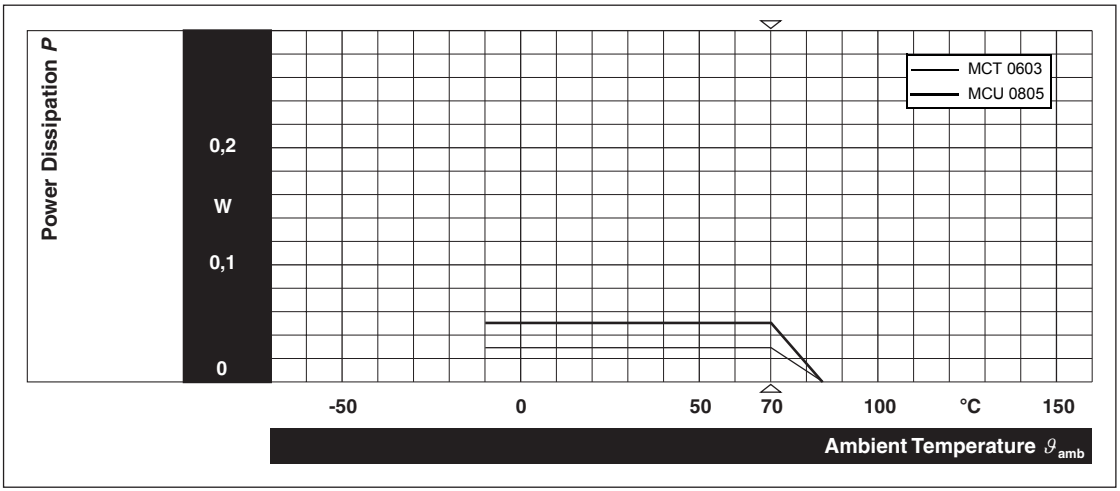


Fig.2 Derating, precision operation.

Current noise

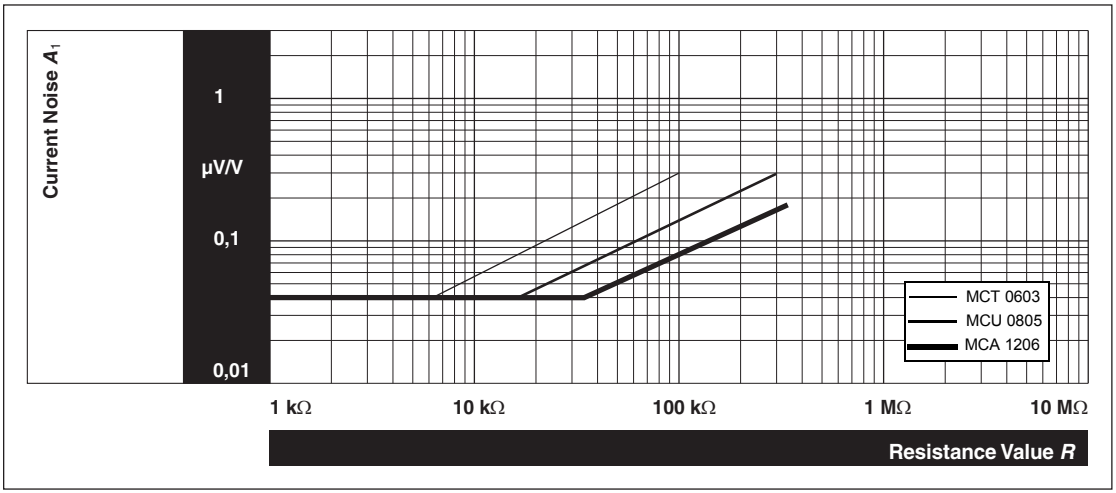
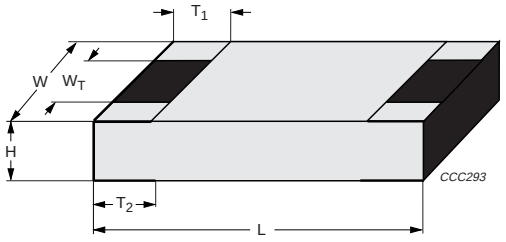


Fig.3 Current noise A_1 in accordance with IEC 60195.

MECHANICAL DATA

Outlines



For dimensions see Table 4.

Fig.4 Outlines.

Table 4 Chip resistor types, mass and relevant physical dimensions; see Fig.4

TYPE	H (mm)	L (mm)	W (mm)	W_T (mm)	T_1 (mm)	T_2 (mm)	MASS (mg)
MCT 0603	0,45 +0,1/–0,05	1,55 ±0,05	0,85 ±0,1	> 75% of W	0,3 +0,15/–0,2	0,3 +0,15/–0,2	1,9
MCU 0805	0,45 +0,1/–0,05	2,0 ±0,1	1,25 ±0,15	> 75% of W	0,4 +0,1/–0,2	0,4 +0,1/–0,2	4,6
MCA 1206	0,55 ±0,1	3,2 +0,1/–0,2	1,6 ±0,15	> 75% of W	0,5 ±0,25	0,5 ±0,25	9,2

TESTS AND REQUIREMENTS

All tests are carried out in accordance with the following specifications:

EN 60115-1, Generic specification (includes tests)

EN 140 400, Sectional specification (includes schedule for qualification approval)

EN 140 401-801, Detail specification (includes schedule for conformance inspection)

The components are approved in accordance with the European CECC-system, where applicable. Table 5 contains only the most important tests. For the full test schedule refer to the documents listed above. The testing also covers most of the requirements specified by EIA/IS-703 and JIS-C-5202.

The tests are carried out in accordance with IEC 60068 and under standard atmospheric conditions in accordance with IEC 60068-1, 5.3. Climatic category LCT/UCT/56 (rated temperature range: Lower Category Temperature, Upper Category Temperature; damp heat, long term, 56 days) is valid.

Unless otherwise specified the following values apply:

Temperature: 15 °C to 35 °C

Relative humidity: 45% to 75%

Air pressure: 86 kPa to 106 kPa (860 mbar to 1 060 mbar).

The components are mounted for testing on boards in accordance with EN 60115-1, 4.31 unless otherwise specified.

The requirements stated in Table 5 are based on the required tests and permitted limits of EN 140 401-801. However, some additional tests and a number of improvements against those minimum requirements have been included.

Table 5 Test procedures and requirements

EN 60115-1 CLAUSE	IEC 60068-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS PERMISSIBLE CHANGE ($\Delta R/R$)	
				STABILITY CLASS 0,1	STABILITY CLASS 0,25
			stability for product types:		
			MCT 0603	100 Ω to 10 kΩ	47 Ω to < 100 Ω; > 10 kΩ to 150 kΩ
			MCU 0805	100 Ω to 47,5 kΩ	47 Ω to < 100 Ω; > 47,5 kΩ to 332 kΩ
			MCA 1206	47 Ω to 332 kΩ	–
4.5	–	resistance		±0,1%; ±0,25%	
4.8.4.2	–	temperature coefficient	at 20 / –10 / 20 °C and 20 / 85 / 20 °C	±25 ppm/K; ±15 ppm/K; ±10 ppm/K	
4.25.1	–	endurance at 70 °C: precision operation mode	$U = \sqrt{P_{70} \times R}$ or $U = U_{max}$; whichever is the less severe 1,5 h on; 0,5 h off		
			70 °C; 1000 h	±(0,1%R + 0,02 Ω)[1]	
			70 °C; 8000 h	±(0,2%R + 0,05 Ω)[1]	
	–	endurance at 70 °C: standard operation mode	$U = \sqrt{P_{70} \times R}$ or $U = U_{max}$; whichever is the less severe; 1,5 h on; 0,5 h off		
			70 °C; 1000 h	±(0,2%R + 0,02 Ω)[1]	
			70 °C; 8000 h	±(0,4%R + 0,05 Ω)[1]	

EN 60115-1 CLAUSE	IEC 60068-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS PERMISSIBLE CHANGE ($\Delta R/R$)	
				STABILITY CLASS 0,1	STABILITY CLASS 0,25
			stability for product types:		
			MCT 0603	100 Ω to 10 kΩ	47 Ω to < 100 Ω; > 10 kΩ to 150 kΩ
			MCU 0805	100 Ω to 47,5 kΩ	47 Ω to < 100 Ω; > 47,5 kΩ to 332 kΩ
			MCA 1206	47 Ω to 332 kΩ	–
4.25.3	–	endurance at upper category temperature	85 °C; 1000 h	±(0,1%R + 0,02 Ω)	±(0,2%R + 0,02 Ω)
			125 °C; 1000 h	±(0,2%R + 0,02 Ω)	±(0,4%R + 0,05 Ω)
4.24	3 (Ca)	damp heat, steady state	40 ±2 °C; 56 days; 93 +2/–3% RH	±(0,1%R + 0,02 Ω)	±(0,25%R + 0,05 Ω)
4.23		climatic sequence:			
4.23.2	2 (Ba)	dry heat	UCT; 16 h		
4.23.3	30 (Db)	damp heat, cyclic	55 °C; 24 h; >90% RH; 1 cycle		
4.23.4	1 (Aa)	cold	LCT; 2 h		
4.23.5	13 (M)	low air pressure	8,5 kPa; 2 h; 25 ±10 °C		
4.23.6	30 (Db)	damp heat, cyclic	55 °C; 5 days; >95 to 100 % RH; 5 cycles LCT = –55 °C; UCT = 125 °C	±(0,1%R + 0,02 Ω)	±(0,25%R + 0,05 Ω)
–	1 (Aa)	cold	–55 °C; 2 h	±(0,05%R + 0,01 Ω)	
4.19	14 (Na)	rapid change of temperature	30 minutes at LCT and 30 minutes at UCT; LCT = –10 °C; UCT = 85 °C; 5 cycles	±(0,05R + 0,01 Ω) no visible damage	
			LCT = –55 °C; UCT = 125 °C; 1000 cycles	±(0,25%R + 0,05 Ω) no visible damage	

EN 60115-1 CLAUSE	IEC 60068-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS PERMISSIBLE CHANGE ($\Delta R/R$)	
				STABILITY CLASS 0,1	STABILITY CLASS 0,25
			stability for product types:		
			MCT 0603	100 Ω to 10 kΩ	47 Ω to < 100 Ω; > 10 kΩ to 150 kΩ
			MCU 0805	100 Ω to 47,5 kΩ	47 Ω to < 100 Ω; > 47,5 kΩ to 332 kΩ
			MCA 1206	47 Ω to 332 kΩ	–
4.13	–	short time overload; precision operation mode	$U = 2{,}5 \times \sqrt{P_{70} \times R}$ or U = 2 × U_{max}; whichever is the less severe; 5 s	±(0,05%R + 0,01 Ω)	
		short time overload; standard operation mode		±(0,05%R + 0,01 Ω)	
4.27	–	single pulse high voltage overload; standard operation mode	severity no. 4: $U = 10 \times \sqrt{P_{70} \times R}$ or $U = 2 \times U_{max}$; whichever is the less severe; 10 pulses 10 µs/700 µs	±(0,5%R + 0,05 Ω)[2] no visible damage	
4.37	–	periodic electric overload; standard operation mode	$U = \sqrt{15 \times P_{70} \times R}$ or U = 2 × U_{max}; whichever is the less severe; 0,1 s on; 2,5 s off; 1000 cycles	±(0,5%R + 0,05 Ω)[2] no visible damage	
4.22	6 (Fc)	vibration	endurance by sweeping; 10 to 2000 Hz; no resonance; amplitude ≤1,5 mm or ≤200 m/s^2; 6 h	±(0,05%R + 0,01 Ω) no visible damage	
4.17.2	58 (Td)	solderability	solder bath method; SnPb40; non-activated flux 215 ±3 °C; 3 ±0,3 s	good tinning (≥95% covered); no visible damage	
			solder bath method; SnAg3Cu0,5 or SnAg3,5; non-activated flux 235 ±3 °C; 2 ±0,2 s		
4.18.2	58 (Td)	resistance to soldering heat	solder bath method; 260 ±5 °C; 10 ±1 s	±(0,05%R + 0,01 Ω)	

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				STABILITY CLASS 0,1	STABILITY CLASS 0,25
			stability for product types:		
			MCT 0603	100 Ω to 10 kΩ	47 Ω to < 100 Ω; > 10 kΩ to 150 kΩ
			MCU 0805	100 Ω to 47,5 kΩ	47 Ω to < 100 Ω; > 47,5 kΩ to 332 kΩ
			MCA 1206	47 Ω to 332 kΩ	–
4.29	45 (XA)	component solvent resistance	isopropyl alcohol +50 °C; method 2	no visible damage	
4.32	21 (Ue_3)	shear (adhesion)	RR 1608M; 9 N	no visible damage	
			RR 2012M and RR 3216; 45 N		
4.33	21 (Ue_1)	substrate bending	depth 2 mm, 3 times	±(0,05%R + 0,01 Ω) no visible damage, no open circuit in bent position	
4.7	–	voltage proof	$U_{rms} = U_{ins}$; 60 ±5 s	no flashover or breakdown	
4.35	–	flammability	IEC 60695-2-2, needle flame test; 10 s	no burning after 30 s	
Special requirements for type MCA 1206					
4.25.1	–	endurance at 70 °C: precision operation mode	$U = \sqrt{P_{70} \times R}$ or $U = U_{max}$; whichever is the less severe; 1,5 h on; 0,5 h off		
			70 °C; 1000 h	±(0,05%R + 0,02 Ω)	
			70 °C; 8000 h	±(0,1%R + 0,02 Ω)	
	–	endurance at 70 °C: standard operation mode	$U = \sqrt{P_{70} \times R}$ or $U = U_{max}$; whichever is the less severe; 1,5 h on; 0,5 h off		
			70 °C; 1000 h	±(0,1%R + 0,02 Ω)	
			70 °C; 8000 h	±(0,25%R + 0,05 Ω)	

Notes

1. See *4.25.1 (above):* special requirements for type MCA 1206.
2. The pulse load stability of professional MFC resistors applies for precision resistors also. However, severe pulse loads are likely to jeopardise precision stability requirements.