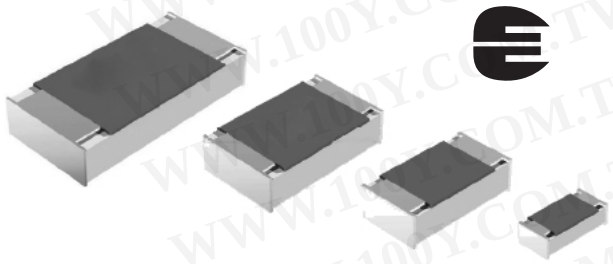
MCS 0402, MCT 0603, MCU 0805, MCA 1206 - Professional

Professional Thin Film Chip Resistors



MCS 0402, MCT 0603, MCU 0805 and MCA 1206 professional thin film flat chip resistors are the perfect choice for most fields of modern professional electronics where reliability and stability is of major concern. Typical applications include telecommunication, medical equipment and high-end computer and audio/video electronics.

FEATURES

- Approved to EN 140401-801
- Excellent overall stability: Class 0.5
- Professional tolerance of value: ± 0.5 % and ± 1 %
- Lead (Pb)-free solder contacts
- Waste gas resistance verified by ASTM B 809
- Material categorization: For definitions of compliance please see www.vishay.com/doc?99912

RoHS COMPLIANT

APPLICATIONS

- Automotive
- Telecommunication
- Medical equipment
- Industrial equipment

TECHNICAL SPECIFICATIONS

	MCS 0402		MCT 0603		MCU 0805		MCA 1206	
Imperial size	0402		0603		0805		1206	
Metric size code	RR1005M		RR1608M		RR2012M		RR3216M	
Resistance range	10 Ω to 4.99 MΩ; 0 Ω		1 Ω to 10 MΩ; 0 Ω		1 Ω to 10 MΩ; 0 Ω		1 Ω to 2 MΩ; 0 Ω	
Resistance tolerance	± 1 %; ± 0.5 %							
Temperature coefficient	± 50 ppm/K; ± 25 ppm/K							
Operation mode	Standard	Power	Standard	Power	Standard	Power	Standard	Power
Rated dissipation, P_{70} (1)	0.063 W	0.1 W	0.1 W	0.125 W	0.125 W	0.2 W	0.25 W	0.4 W
Operating voltage, $U_{max.}$ AC/DC	50 V		75 V		150 V		200 V	
Permissible film temperature, ϑ_F max.	125 °C	155 °C	125 °C	155 °C	125 °C	155 °C	125 °C	155 °C
Operating temperature range	- 55 °C to 125 °C	- 55 °C to 155 °C	- 55 °C to 125 °C	- 55 °C to 155 °C	- 55 °C to 125 °C	- 55 °C to 155 °C	- 55 °C to 125 °C	- 55 °C to 155 °C
Max. resistance change at P_{70} for resistance range, $\lvert\Delta R/R\rvert$ max., after:	10 Ω to 4.99 MΩ		1 Ω to 10 MΩ		1 Ω to 10 MΩ		1 Ω to 2 MΩ	
1000 h	≤ 0.25 %	≤ 0.5 %	≤ 0.25 %	≤ 0.5 %	≤ 0.25 %	≤ 0.5 %	≤ 0.25 %	≤ 0.5 %
8000 h	≤ 0.5 %	≤ 1.0 %	≤ 0.5 %	≤ 1.0 %	≤ 0.5 %	≤ 1.0 %	≤ 0.5 %	≤ 1.0 %
225 000 h	≤ 1.5 %	-	≤ 1.5 %	-	≤ 1.5 %	-	≤ 1.5 %	-
Insulation voltage:								
1 min; U_{ins}	75 V		100 V		200 V		300 V	
Continuous	75 V		75 V		75 V		75 V	
Failure rate: $FIT_{observed}$	≤ 0.1 x 10^{-9}/h		≤ 0.1 x 10^{-9}/h		≤ 0.1 x 10^{-9}/h		≤ 0.1 x 10^{-9}/h	

Notes

- These resistors do not feature a limited lifetime when operated within the permissible limits. However, resistance value drift increasing over operating time may result in exceeding a limit acceptable to the specific application, thereby establishing a functional lifetime.

(1) The power dissipation on the resistor generates a temperature rise against the local ambient, depending on the heat flow support of the printed-circuit board (thermal resistance). The rated dissipation applies only if the permitted film temperature is not exceeded.

PART NUMBER AND PRODUCT DESCRIPTION

Part Number: MCT06030D4641DPW00

M	C	T	0	6	0	3	0	D	4	6	4	1	D	P	W	0	0

TYPE/SIZE	VERSION	TCR	RESISTANCE	TOLERANCE	PACKAGING
MCS0402 **MCT0603** **MCU0805** **MCA1206**	**0** = Neutral	**D** = ± 25 ppm/K **C** = ± 50 ppm/K **Z** = Jumper	**3 digit value** **1 digit** **multiplier** MULTIPLIER **8** = $*10^{-2}$ **9** = $*10^{-1}$ **0** = $*10^{0}$ **1** = $*10^{1}$ **2** = $*10^{2}$ **3** = $*10^{3}$ **4** = $*10^{4}$ **5** = $*10^{5}$ **0000** = Jumper	**D** = ± 0.5 % **F** = ± 1 % **Z** = Jumper	**P5** **PW** **E0**

Product Description: MCT 0603-25 0.5 % PW 4K64

MCT	0603	-25	0.5 %	PW	4K64
TYPE	SIZE	TCR	TOLERANCE	PACKAGING	RESISTANCE
MCS **MCT** **MCU** **MCA**	**0402** **0603** **0805** **1206**	± **25** ppm/K ± **50** ppm/K	± **0.5 %** ± **1 %**	**P5** **PW** **E0**	**4K64** = 4.64 kΩ **50R1** = 50.1 Ω **0R0** = Jumper (1)

Notes

- Products can be ordered using either the PRODUCT DESCRIPTION or PART NUMBER.

(1) Jumpers are ordered by the resistance value 0 Ω, e.g. MCT 0603 P5 0R0.

TEMPERATURE COEFFICIENT AND RESISTANCE RANGE

DESCRIPTION		RESISTANCE RANGE			
TCR	**TOLERANCE**	**MCS 0402**	**MCT 0603**	**MCU 0805**	**MCA 1206**
± 50 ppm/K	± 1 %	**10 Ω to 4.99 MΩ**	**1 Ω to 10 MΩ**	**1 Ω to 10 MΩ**	**1 Ω to 2 MΩ**
	± 0.5 %	10 Ω to 221 kΩ	10 Ω to 511 kΩ	10 Ω to 1.5 MΩ	10 Ω to 2 MΩ
± 25 ppm/K	± 0.5 %	**10 Ω to 221 kΩ**	**10 Ω to 511 kΩ**	**10 Ω to 1.5 MΩ**	**10 Ω to 2 MΩ**
Jumper	-	≤ 20 mΩ $I_{max.}$ = 0.63 A	≤ 20 mΩ $I_{max.}$ = 1 A	≤ 20 mΩ $I_{max.}$ = 1.5 A	≤ 20 mΩ $I_{max.}$ = 2 A

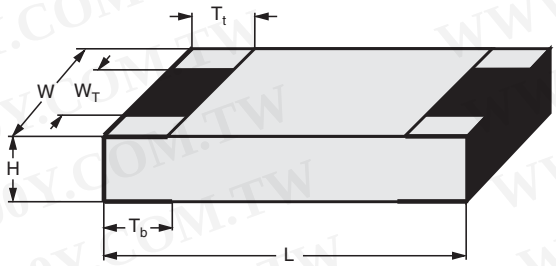
Notes

- Resistance values are available for ± 1 % tolerance from the E24 and E96 series; for ± 0.5 % tolerance from the E24 and E192 series.
- **Resistance ranges printed in bold are preferred TCR/tolerance combinations with optimized availability.**

PACKAGING

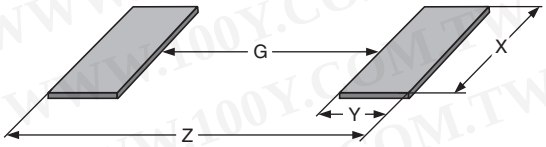
TYPE	CODE	QUANTITY	CARRIER TAPE	WIDTH	PITCH	REEL DIAMETER
MCS 0402	E0	10 000	Paper tape acc. IEC 60286-3 type I	8 mm	2 mm	180 mm/7"
MCT 0603	P5	5000			4 mm	180 mm/7"
	PW	20 000				330 mm/13"
MCU 0805	P5	5000				180 mm/7"
	PW	20 000				330 mm/13"
MCA 1206	P5	5000				180 mm/7"

DIMENSIONS



DIMENSIONS AND MASS							
TYPE	H (mm)	L (mm)	W (mm)	W_T (mm)	T_t (mm)	T_b (mm)	MASS (mg)
MCS 0402	0.32 ± 0.05	1.0 ± 0.05	0.5 ± 0.05	> 75 % of W	0.2 + 0.1/- 0.15	0.2 ± 0.1	0.6
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

SOLDER PAD DIMENSIONS



RECOMMENDED SOLDER PAD DIMENSIONS								
TYPE	WAVE SOLDERING				REFLOW SOLDERING			
	G (mm)	Y (mm)	X (mm)	Z (mm)	G (mm)	Y (mm)	X (mm)	Z (mm)
MCS 0402	-	-	-	-	0.35	0.55	0.55	1.45
MCT 0603	0.55	1.10	1.10	2.75	0.65	0.70	0.95	2.05
MCU 0805	0.80	1.25	1.50	3.30	0.90	0.90	1.40	2.70
MCA 1206	1.40	1.50	1.90	4.40	1.50	1.15	1.75	3.80

Note

- The rated dissipation applies only if the permitted film temperature is not exceeded. Furthermore, a high level of ambient temperature or of power dissipation may raise the temperature of the solder joint, hence special solder alloys or board materials may be required to maintain the reliability of the assembly.
  Specified power rating above 125 °C requires dedicated heat-sink pads, which depend on board materials.
  The given solder pad dimensions reflect the considerations for board design and assembly as outlined e.g. in standards IEC 61188-5-x, or in publication IPC-7351. They do not guarantee any supposed thermal properties, particularly as these are also strongly influenced by many other parameters.
  Still, the given solder pad dimensions will be found adequate for most general applications, e.g. those referring to “standard operation mode”. Please note however that applications for “power operation mode” require special considerations for the design of solder pads and adjacent conductor areas.

DESCRIPTION

Production is strictly controlled and follows an extensive set of instructions established for reproducibility. A homogeneous film of metal alloy is deposited on a high grade (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 cutting a meander groove in the resistive layer without damaging the ceramics. For the high and low ohmic range, optimized Cermet products provide comparable properties. The resistor elements are covered by a 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. This includes full screening for the elimination of products with potential risk of early field failures (feasible for $R \geq 10\ \Omega$). Only accepted products are laid directly into the paper tape in accordance with **IEC 60286-3** [3].

ASSEMBLY

The resistors are suitable for processing on automatic SMD assembly systems. They are suitable for automatic soldering using wave, reflow or vapour phase as shown in **IEC 61760-1**. The encapsulation is resistant to all cleaning solvents commonly used in the electronics industry, including alcohols, esters and aqueous solutions. The suitability of conformal coatings, if applied, shall be qualified by appropriate means to ensure the long-term stability of the whole system.

The resistors are RoHS compliant, the pure tin plating provides compatibility with lead (Pb)-free and lead-containing soldering processes. Solderability is specified for 2 years after production or requalification. The permitted storage time is 20 years. The immunity of the plating against tin whisker growth has been proven under extensive testing.

All products comply with the **GADSL** [1] and the **CEFIC-EECA-EICTA** [2] list of legal restrictions on hazardous substances. This includes full compliance with the following directives:

- 2000/53/EC End of Vehicle life Directive (ELV) an Annex II (ELV II)
- 2011/65/EU Restriction of the use of Hazardous Substances Directive (RoHS)
- 2002/96/EC Waste Electrical and Electronic Equipment Directive (WEEE)

APPROVALS

The resistors are approved within the IECQ-CECC Quality Assessment System for Electronic Components to the detail specification **EN 140401-801** which refers to **EN 60115-1**, **EN 140400** and the variety of environmental test procedures of the **IEC 60068** [3] series. The detail specification refers to the climatic category 55/125/56, which relates to the "standard operation mode" of this datasheet.

Conformity is attested by the use of the **CECC** logo ( ) as the mark of conformity on the package label.

Vishay BEYSCHLAG has achieved **"Approval of Manufacturer"** in accordance with **IECQ 03-1**. The release certificate for **"Technology Approval Schedule"** in accordance with **CECC 240001** based on **IECQ 03-3** is granted for the Vishay BEYSCHLAG manufacturing process.

RELATED PRODUCTS

For more information about products with better TCR and tighter tolerance please refer to the **Precision Thin Film Chip Resistors** datasheet (www.vishay.com/doc?28700).

Resistors are available with **established reliability** in accordance with **EN 140401-801** version E. Please refer to the special datasheet (www.vishay.com/doc?28744) for information on failure rate level, available resistance ranges and order codes.

Precision **chip resistor arrays** may be used in voltage divider applications or precision amplifiers where close matching between multiple resistors is necessary. ACAS 0612 chip arrays are specified by the following datasheets:

- Professional type (www.vishay.com/doc?28754)
- Precision type (www.vishay.com/doc?28751)

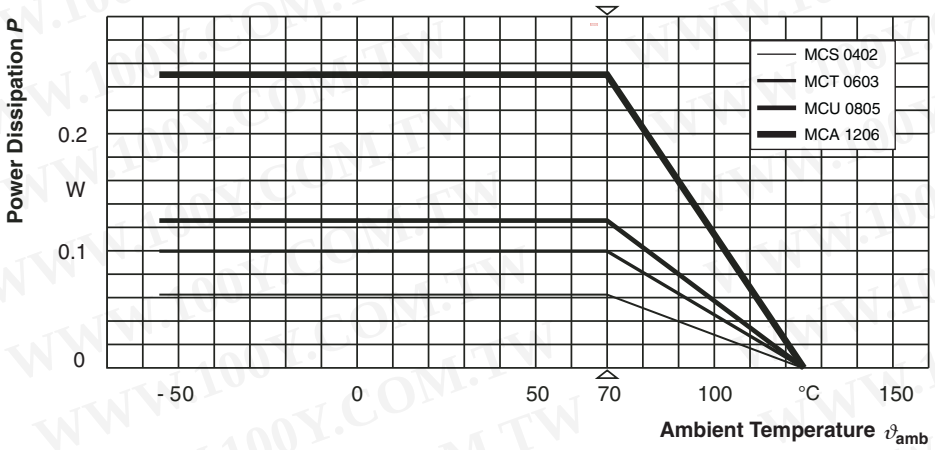
Notes

(1) Global Automotive Declarable Substance List, see www.gadsl.org.

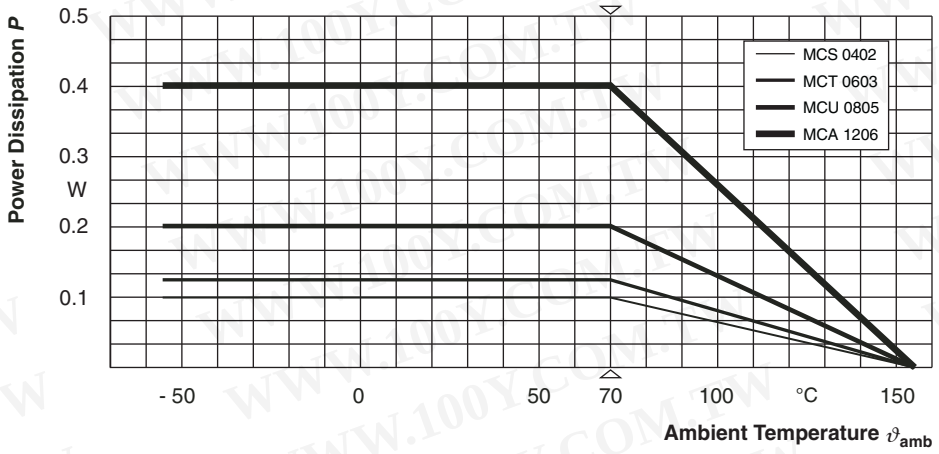
(2) CEFIC (European Chemical Industry Council), EECA (European Electronic Component Manufacturers Association), EICTA (European trade organisation representing the information and communications technology and consumer electronics), see www.eicta.org/index.php?id=995 → issues → environment policy → chemicals → chemicals for electronics.

(3) The quoted IEC standards are also released as EN standards with the same number and identical contents.

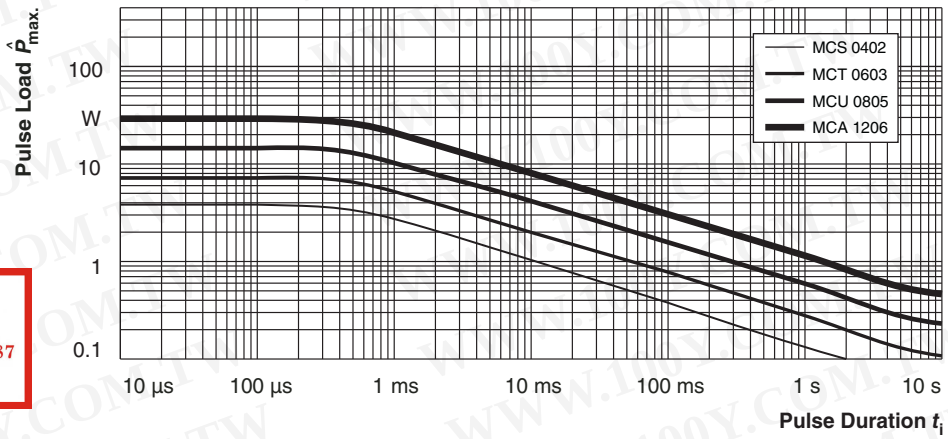
FUNCTIONAL PERFORMANCE



Derating - Standard Operation

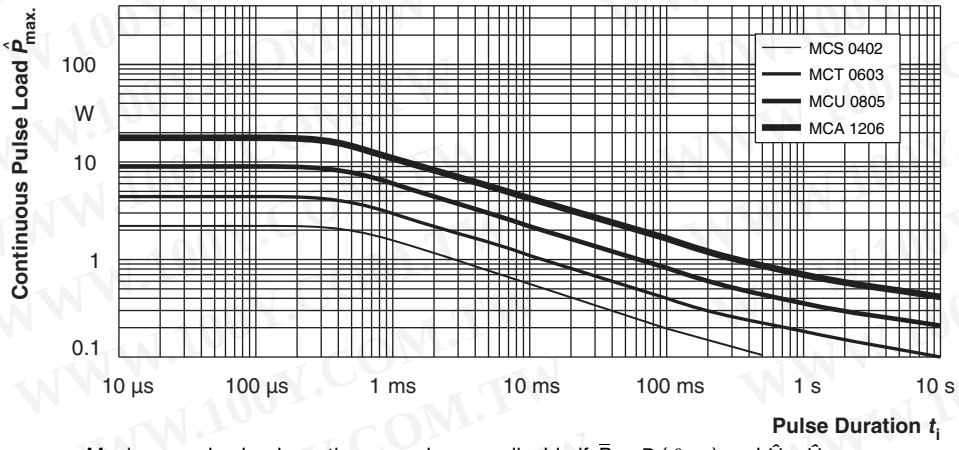


Derating - Power Operation



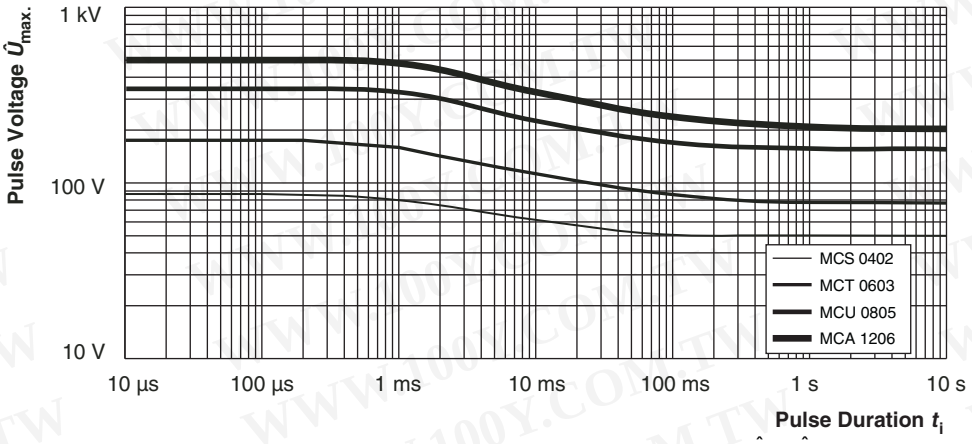
Maximum pulse load, single pulse; applicable if $\bar{P} \rightarrow 0$ and n ≤ 1000 and $\hat{U} \leq \hat{U}_{max.}$;
for permissible resistance change equivalent to 8000 h operation in standard operation mode

Single Pulse



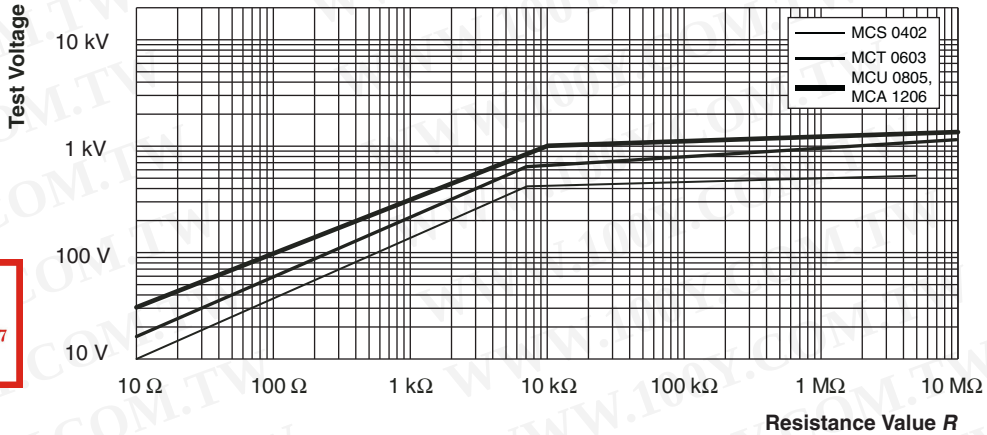
Maximum pulse load, continuous pulses; applicable if $\bar{P} \leq P(\vartheta_{amb})$ and $\hat{U} \leq \hat{U}_{max.}$;
for permissible resistance change equivalent to 8000 h operation in standard operation mode

Continuous Pulse



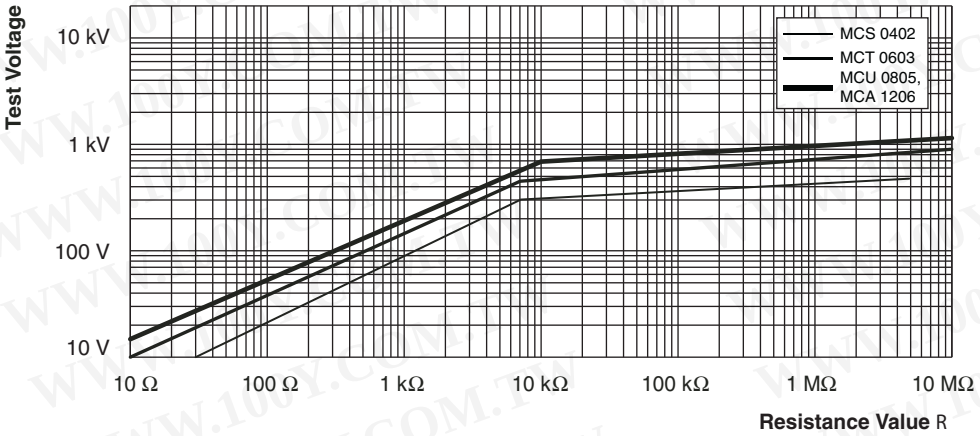
Maximum pulse voltage, single and continuous pulses; applicable if $\hat{P} \leq \hat{P}_{max.}$;
for permissible resistance change equivalent to 8000 h operation in standard operation mode

Pulse Voltage



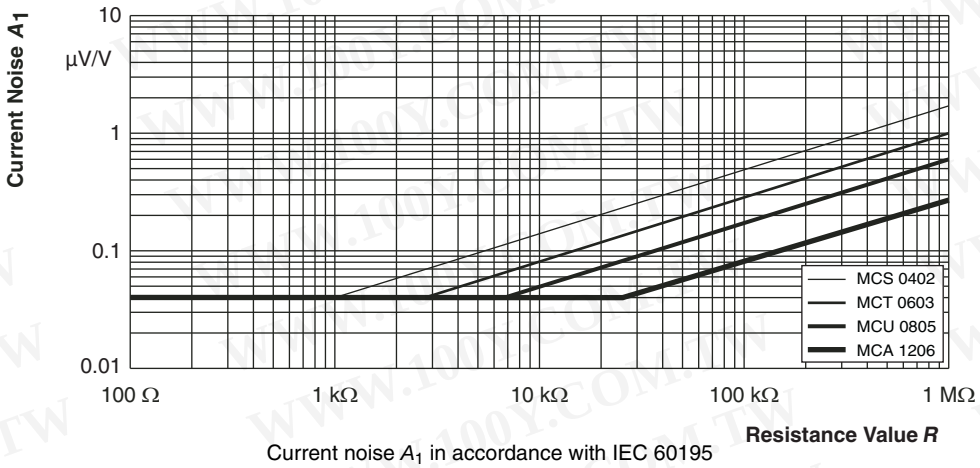
Pulse load rating in accordance with EN 60115-1 clause 4.27; 1.2 µs/50 µs; 5 pulses at 12 s interval;
for permissible resistance change ± (0.5 % R + 0.05 Ω)

1.2/50 Pulse



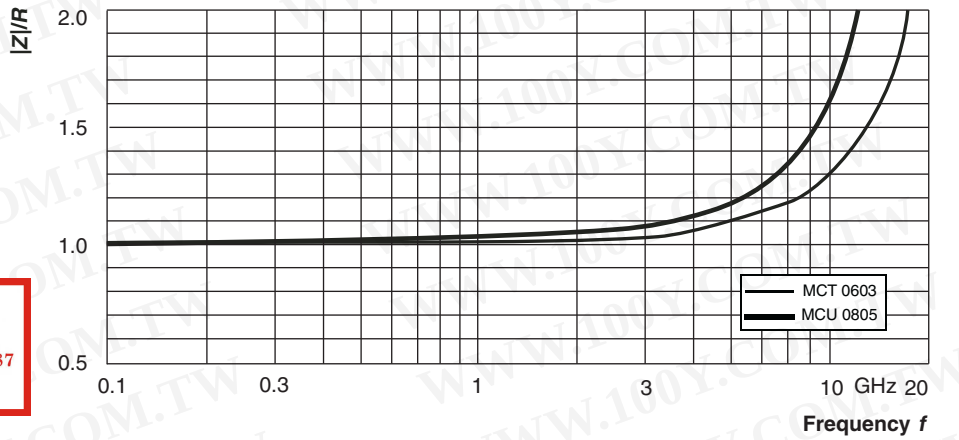
Pulse load rating in accordance with EN 60115-1 clause 4.27; 10 µs/700 µs;
10 pulses at 1 min intervals; for permissible resistance change ± (0.5 % *R* + 0.05 Ω)

10/700 Pulse



Current noise A_1 in accordance with IEC 60195

Current Noise



|*Z*|/*R* for 49.9 Ω chip resistor

RF-Behaviour

TESTS AND REQUIREMENTS

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

EN 60115-1, generic specification (includes tests)

EN 140400, sectional specification (includes schedule for qualification approval)

EN 140401-801, detail specification (includes schedule for conformance inspection)

The components are approved in accordance with the European CECC-system, where applicable. The following table 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 1060 mbar).

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

The requirements stated in the Test Procedures and Requirements table are based on the required tests and permitted limits of EN 140401-801. However, some additional tests and a number of improvements against those minimum requirements have been included.

TEST PROCEDURES AND REQUIREMENTS

EN 60115-1 CLAUSE	IEC 60068-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS PERMISSIBLE CHANGE (Δ*R*)	
				STABILITY CLASS 0.5	STABILITY CLASS 1
			Stability for product types:		
			MCS 0402	10 Ω to 33.2 kΩ	> 33.2 kΩ to 4.99 MΩ
			MCT 0603	10 Ω to 100 kΩ	1 Ω to < 10 Ω; > 100 kΩ to 10 MΩ
			MCU 0805	10 Ω to 221 kΩ	1 Ω to < 10 Ω; > 221 kΩ to 10 MΩ
			MCA 1206	10 Ω to 332 kΩ	1 Ω to < 10 Ω; > 332 kΩ to 2 MΩ
4.5	-	Resistance	-	± 1 % *R*; ± 0.5 % *R*	
4.8.4.2	-	Temperature coefficient	At (20/- 55/20) °C and (20/125/20) °C	± 50 ppm/K; ± 25 ppm/K	
4.25.1	-	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	± (0.25 % *R* + 0.05 Ω)	
			70 °C; 8000 h	± (0.5 % *R* + 0.05 Ω)	
		Endurance at 70 °C: Power 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	± (0.5 % *R* + 0.05 Ω)	
			70 °C; 8000 h	± (1 % *R* + 0.05 Ω)	
4.25.3	-	Endurance at upper category temperature	125 °C; 1000 h	± (0.25 % *R* + 0.05 Ω)	± (0.5 % *R* + 0.05 Ω)
			155 °C; 1000 h	± (0.5 % *R* + 0.05 Ω)	± (1 % *R* + 0.05 Ω)
4.24	78 (Cab)	Damp heat, steady state	(40 ± 2) °C; 56 days; (93 ± 3) % RH	± (0.5 % *R* + 0.05 Ω)	± (1 % *R* + 0.05 Ω)

TEST PROCEDURES AND REQUIREMENTS

EN 60115-1 CLAUSE	IEC 60068-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS PERMISSIBLE CHANGE (ΔR)	
				STABILITY CLASS 0.5	STABILITY CLASS 1
			Stability for product types:		
			MCS 0402	10 Ω to 33.2 kΩ	> 33.2 kΩ to 4.99 MΩ
			MCT 0603	10 Ω to 100 kΩ	1 Ω to < 10 Ω; > 100 kΩ to 10 MΩ
			MCU 0805	10 Ω to 221 kΩ	1 Ω to < 10 Ω; > 221 kΩ to 10 MΩ
			MCA 1206	10 Ω to 332 kΩ	1 Ω to < 10 Ω; > 332 kΩ to 2 MΩ
4.23		Climatic sequence: Standard operation mode:		± (0.5 % R + 0.05 Ω)	± (1 % R + 0.05 Ω)
4.23.2	2 (Ba)	Dry heat	125 °C; 16 h		
4.23.3	30 (Db)	Damp heat, cyclic	55 °C; 24 h; > 90 % RH; 1 cycle		
4.23.4	1 (Aa)	Cold	- 55 °C; 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; 24 h; > 90 % RH; 5 cycles		
4.23.7	-	DC load	$U = \sqrt{P_{70} \times R} \leq U_{max.}$; 1 min.		
-	1 (Aa)	Cold	- 55 °C; 2 h	± (0.1 % R + 0.01 Ω)	± (0.25 % R + 0.05 Ω)
4.19	14 (Na)	Rapid change of temperature	30 min at LCT and 30 min at UCT; LCT = - 55 °C; UCT = 125 °C; 5 cycles	± (0.1 % R + 0.01 Ω) no visible damage	
			LCT = - 55 °C; UCT = 125 °C; 1000 cycles	± (0.25 % R + 0.05 Ω) no visible damage	
4.13	-	Short time overload: Standard operation mode	$U = 2.5 \times \sqrt{P_{70} \times R}$ or $U = 2 \times U_{max.}$; whichever is the less severe; 5 s	± (0.1 % R + 0.01 Ω)	± (0.25 % R + 0.05 Ω)
		Short time overload: Power operation mode	$U = 2.5 \times \sqrt{P_{70} \times R}$ or $U = 2 \times U_{max.}$; whichever is the less severe; 5 s	± (0.25 % R + 0.05 Ω)	± (0.5 % R + 0.05 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) no visible damage	
4.37	-	Periodic electric overload: Standard operation mode	$U = \sqrt{15 \times P_{70} \times R}$ or $U = 2 \times U_{max.}$; 0.1 s on; 2.5 s off; whichever is the less severe; 1000 cycles	± (0.5 % R + 0.05 Ω) no visible damage	
		Periodic electric overload: Power operation mode	$U = \sqrt{15 \times P_{70} \times R}$ or $U = 2 \times U_{max.}$; 0.1 s on; 2.5 s off; whichever is the less severe; 1000 cycles	± (1 % R + 0.05 Ω) no visible damage	

TEST PROCEDURES AND REQUIREMENTS

EN 60115-1 CLAUSE	IEC 60068-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS PERMISSIBLE CHANGE (ΔR)	
				STABILITY CLASS 0.5	STABILITY CLASS 1
			Stability for product types:		
			MCS 0402	10 Ω to 33.2 kΩ	> 33.2 kΩ to 4.99 MΩ
			MCT 0603	10 Ω to 100 kΩ	1 Ω to < 10 Ω; > 100 kΩ to 10 MΩ
			MCU 0805	10 Ω to 221 kΩ	1 Ω to < 10 Ω; > 221 kΩ to 10 MΩ
			MCA 1206	10 Ω to 332 kΩ	1 Ω to < 10 Ω; > 332 kΩ to 2 MΩ
4.40	-	Electro static discharge (Human Body Model)	IEC 61340-3-1; 3 pos. + 3 neg. (equivalent to MIL-STD-883, method 3015) MCS 0402: 500 V MCT 0603: 1000 V MCU 0805: 1500 V MCA 1206: 2000 V	± (0.5 % R + 0.05 Ω)	
4.22	6 (Fc)	Vibration	Endurance by sweeping; 10 Hz to 2000 Hz; no resonance; amplitude ≤ 1.5 mm or ≤ 200 m/s^2; 7.5 h	± (0.1 % 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	Good tinning (≥ 95 % covered); no visible damage	
4.18.2	58 (Td)	Resistance to soldering heat	Solder bath method; (260 ± 5) °C; (10 ± 1) s	± (0.1 % R + 0.01 Ω) no visible damage	± (0.25 % R + 0.05 Ω) no visible damage
4.29	45 (XA)	Component solvent resistance	Isopropyl alcohol + 50 °C; method 2	No visible damage	
4.32	21 (Ue_3)	Shear (adhesion)	RR1005M and RR1608M; 9 N	No visible damage	
			RR2012M and RR3216M; 45 N		
4.33	21 (Ue_1)	Substrate bending	Depth 2 mm, 3 times	± (0.1 % 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 60695-11-5, needle flame test; 10 s	No burning after 30 s	

HISTORICAL 12NC INFORMATION

- The resistors had a 12-digit numeric code starting with 2312.
- The subsequent 4 digits indicated the resistor type, specification and packaging; see the 12NC table.
- The remaining 4 digits indicated the resistance value:
  - The first 3 digits indicated the resistance value.
  - The last digit indicated the resistance decade in accordance with the last digit of 12NC indicating resistance decade table.

Last Digit of 12NC Indicating Resistance Decade

RESISTANCE DECADE	LAST DIGIT
1 Ω to 9.99 Ω	8
10 Ω to 99.9 Ω	9
100 Ω to 999 Ω	1
1 kΩ to 9.99 kΩ	2
10 kΩ to 99.9 kΩ	3
100 kΩ to 999 kΩ	4
1 MΩ to 9.99 MΩ	5
10 MΩ to 99.9 MΩ	6

Historical 12NC example

The 12NC of a MCT 0603 resistor, value 47 kΩ and TCR 50 with ± 1 % tolerance, supplied in cardboard tape of 5000 units per reel was: 2312 215 14703.

HISTORICAL 12NC - Resistor type and packaging

DESCRIPTION			2312...		
			CARDBOARD TAPE ON REEL		
TYPE	TCR	TOL.	P5 (5000 UNITS)	E0 (10 000 UNITS)	PW (20 000 UNITS)
MCS 0402	± 50 ppm/K	± 1 %	-	275 1....	-
		± 0.5 %	-	275 5....	-
	± 25 ppm/K	± 0.5 %	-	276 5....	-
	Jumper	-	-	275 90001	-
MCT 0603	± 50 ppm/K	± 1 %	215 1....	-	205 1..
		± 0.5 %	215 5....	-	205 5....
	± 25 ppm/K	± 0.5 %	216 5....	-	206 5....
	Jumper	-	215 90001	-	205 90001
MCU 0805	± 50 ppm/K	± 0.5 %	255 5....	-	245 5....
	± 25 ppm/K	± 0.5 %	256 5....	-	246 5....
	Jumper	-	255 90001	-	245 90001

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