

Professional Thin Film Chip Resistors


RoHS
COMPLIANT

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 are of major concern. Typical applications include telecommunication, medical equipment, high-end computer and audio / video electronics.

FEATURES

- Approved to EN 140401-801
- Excellent overall stability: class 0.5
- Professional tolerance of resistance: $\pm 0.5\%$ and $\pm 1\%$
- Rated dissipation P_{70} up to 0.4 W for size 1206
- Sulfur resistance verified according to ASTM B 809
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

APPLICATIONS

- Automotive
- Telecommunication
- Medical equipment
- Industrial equipment

TECHNICAL SPECIFICATIONS

DESCRIPTION	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 M Ω ; 0 Ω	1 Ω to 10 M Ω ; 0 Ω	1 Ω to 10 M Ω ; 0 Ω	1 Ω to 2 M Ω ; 0 Ω
Resistance tolerance	$\pm 1\%; \pm 0.5\%$			
Temperature coefficient	$\pm 50 \text{ ppm/K}; \pm 25 \text{ ppm/K}$			
Rated dissipation, P_{70} ⁽¹⁾	0.100 W	0.125 W	0.200 W	0.400 W
Operating voltage, U_{\max} AC _{RMS} /DC	50 V	75 V	150 V	200 V
Permissible film temperature, θ_F _{max} ⁽¹⁾	155 $^{\circ}\text{C}$			
Operating temperature range	-55 $^{\circ}\text{C}$ to 155 $^{\circ}\text{C}$			
Permissible voltage against ambient (insulation): 1 min; U_{ins}	75 V	100 V	200 V	300 V
Failure rate: FIT _{observed}	$\leq 0.1 \times 10^{-9}/\text{h}$			

Note

⁽¹⁾ Please refer to APPLICATION INFORMATION below.

APPLICATION INFORMATION

When the resistor dissipates power, a temperature rise above the ambient temperature occurs, dependent on the thermal resistance of the assembled resistor together with the printed circuit board. The rated dissipation applies only if the permitted film temperature is not exceeded.

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.

MAXIMUM RESISTANCE CHANGE AT RATED DISSIPATION			
OPERATION MODE		STANDARD	POWER
Rated dissipation, P_{70}	MCS 0402	0.063 W	0.100 W
	MCT 0603	0.100 W	0.125 W
	MCU 0805	0.125 W	0.200 W
	MCA 1206	0.250 W	0.400 W
Operating temperature range		-55 °C to 125 °C	-55 °C to 155 °C
Permissible film temperature, θ_F max.		125 °C	155 °C
Max. resistance change at P_{70} for resistance range, $ \Delta R/R $ after:	MCS 0402	10 Ω to 4.99 MΩ	10 Ω to 4.99 MΩ
	MCT 0603	1 Ω to 10 MΩ	1 Ω to 10 MΩ
	MCU 0805	1 Ω to 10 MΩ	1 Ω to 10 MΩ
	MCA 1206	1 Ω to 2 MΩ	1 Ω to 2 MΩ
	1000 h	≤ 0.25 %	≤ 0.5 %
	8000 h	≤ 0.5 %	≤ 1.0 %
	225 000 h	≤ 1.5 %	-

Note

- The presented operation modes do not refer to different types of resistors, but actually show examples of different loads, that lead to different film temperatures and different achievable load-life stability (drift) of the resistance value. A suitable low thermal resistance of the circuit board assembly must be safeguarded in order to maintain the film temperature of the resistors within the specified limits. Please consider the application note "Thermal Management in Surface-Mounted Resistor Applications" (www.vishay.com/doc?28844) for information on the general nature of thermal resistance.

TEMPERATURE COEFFICIENT AND RESISTANCE RANGE				
TYPE / SIZE	TCR	TOLERANCE	RESISTANCE	E-SERIES
MCS 0402	± 50 ppm/K	± 1 %	10 Ω to 4.99 MΩ	E24; E96
		± 0.5 %	10 Ω to 221 kΩ	E24; E192
	± 25 ppm/K	± 0.5 %	10 Ω to 221 kΩ	E24; E192
	Jumper, $I_{max.} = 0.63$ A	≤ 20 mΩ	0 Ω	-
MCT 0603	± 50 ppm/K	± 1 %	1 Ω to 10 MΩ	E24; E96
		± 0.5 %	10 Ω to 511 kΩ	E24; E192
	± 25 ppm/K	± 0.5 %	10 Ω to 511 kΩ	E24; E192
	Jumper, $I_{max.} = 1$ A	≤ 20 mΩ	0 Ω	-
MCU 0805	± 50 ppm/K	± 1 %	1 Ω to 10 MΩ	E24; E96
		± 0.5 %	10 Ω to 1.5 MΩ	E24; E192
	± 25 ppm/K	± 0.5 %	10 Ω to 1.5 MΩ	E24; E192
	Jumper, $I_{max.} = 1.5$ A	≤ 20 mΩ	0 Ω	-
MCA 1206	± 50 ppm/K	± 1 %	1 Ω to 2 MΩ	E24; E96
		± 0.5 %	10 Ω to 2 MΩ	E24; E192
	± 25 ppm/K	± 0.5 %	10 Ω to 2 MΩ	E24; E192
	Jumper, $I_{max.} = 2$ A	≤ 20 mΩ	0 Ω	-

Note

- Resistance ranges printed in bold are preferred TCR / tolerance combinations with optimized availability.

PACKAGING						
TYPE / SIZE	CODE	QUANTITY	PACKAGING STYLE	WIDTH	PITCH	PACKAGING DIMENSIONS
MCS 0402	E5	5000	Paper tape acc. IEC 60286-3, Type 1a	8 mm	2 mm	Ø 180 mm/7"
	E0	10 000				
MCT 0603	P5	5000	Paper tape acc. IEC 60286-3, Type 1a	8 mm		Ø 180 mm/7"
	PW	20 000				Ø 330 mm/13"
MCU 0805	P5	5000	Paper tape acc. IEC 60286-3, Type 1a	8 mm	4 mm	Ø 180 mm/7"
	PW	20 000				Ø 330 mm/13"
MCA 1206	P5	5000				Ø 180 mm/7"

PART NUMBER AND PRODUCT DESCRIPTION
Part Number: MCT06030D4641DPW00
Part Number: MCT06030Z0000ZP500

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			D = ± 0.5 % F = ± 1 % Z = jumper			E5 E0 P5 PW		
									Multiplier 8 = $\times 10^{-2}$ 9 = $\times 10^{-1}$ 0 = $\times 10^0$ 1 = $\times 10^1$ 2 = $\times 10^2$ 3 = $\times 10^3$ 4 = $\times 10^4$ 5 = $\times 10^5$ 0000 = jumper								

Product Description: MCT 0603-25 0.5 % PW 4K64
Product Description: MCT 0603 P5 0R0

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 %	E5 E0 P5 PW	4K64 = 4.64 k Ω 50R1 = 50.1 Ω 0R0 = jumper

Note

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

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 ceramic substrate (Al_2O_3) 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 Type 1a** ⁽¹⁾.

ASSEMBLY

The resistors are suitable for processing on automatic SMD assembly systems. They are suitable for automatic soldering using wave, reflow or vapor 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, potting compounds and their processes, 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.

MATERIALS

Vishay acknowledges the following systems for the regulation of hazardous substances:

- IEC 62474, Material Declaration for Products of and for the Electrotechnical Industry, with the list of declarable substances given therein ⁽²⁾
- The Global Automotive Declarable Substance List (GADSL) ⁽³⁾
- The REACH regulation (1907/2006/EC) and the related list of substances with very high concern (SVHC) ⁽⁴⁾ for its supply chain

Notes

⁽¹⁾ The quoted IEC standards are also released as EN standards with the same number and identical contents.

⁽²⁾ The IEC 62474 list of declarable substances is maintained in a dedicated database, which is available at <http://std.iec.ch/iec62474>.

⁽³⁾ The Global Automotive Declarable Substance List (GADSL) is maintained by the American Chemistry Council and available at www.gadsl.org.

⁽⁴⁾ The SVHC list is maintained by the European Chemical Agency (ECHA) and available at <http://echa.europa.eu/candidate-list-table>.

The products do not contain any of the banned substances as per IEC 62474, GADSL, or the SVHC list, see www.vishay.com/how/leadfree.

Hence the products fully comply with the following directives:

- 2000/53/EC End-of-Life Vehicle Directive (ELV) and Annex II (ELV II)
- 2011/65/EU Restriction of the Use of Hazardous Substances Directive (RoHS) with amendment 2015/863/EU
- 2012/19/EU Waste Electrical and Electronic Equipment Directive (WEEE)

Vishay pursues the elimination of conflict minerals from its supply chain, see the Conflict Minerals Policy at www.vishay.com/doc?49037.

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 60115-8** and the variety of environmental test procedures of the **IEC 60068** ⁽¹⁾ 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 (E) 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 03-3-1** is granted for the Vishay BEYSCHLAG manufacturing process.

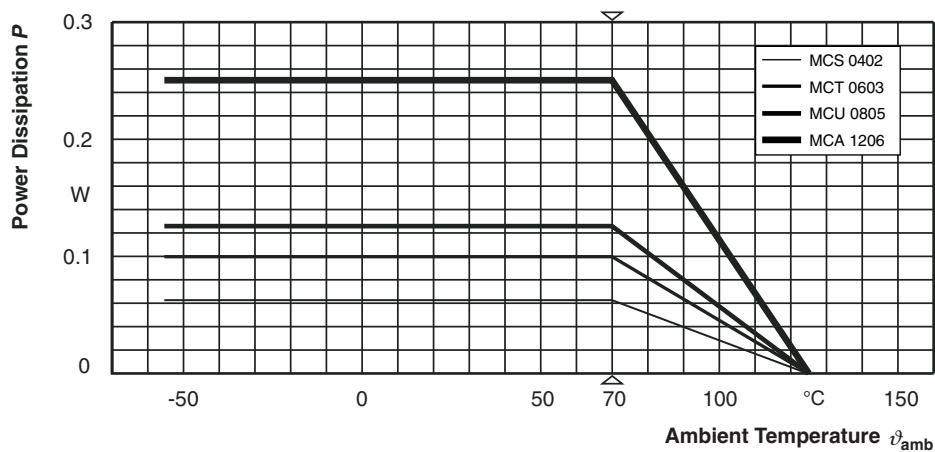
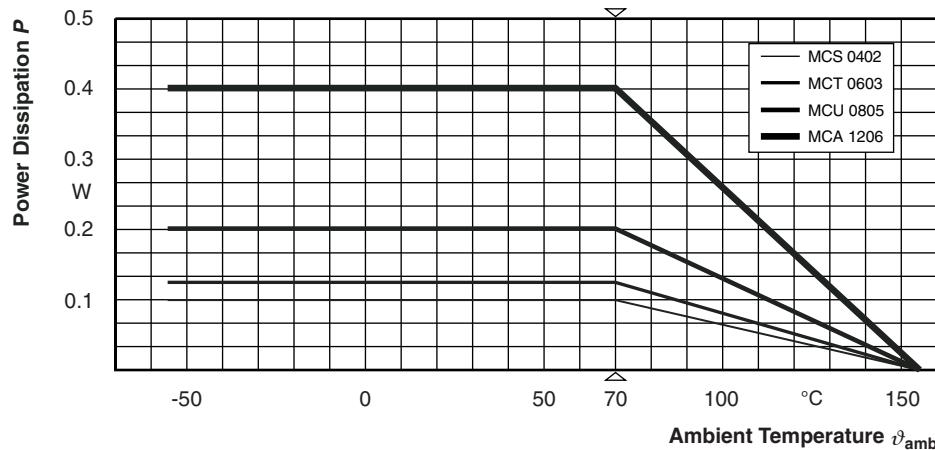
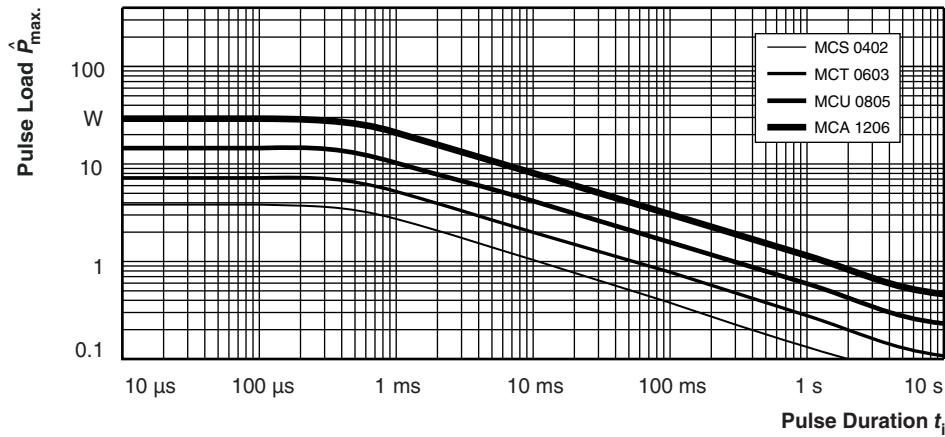
RELATED PRODUCTS

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.

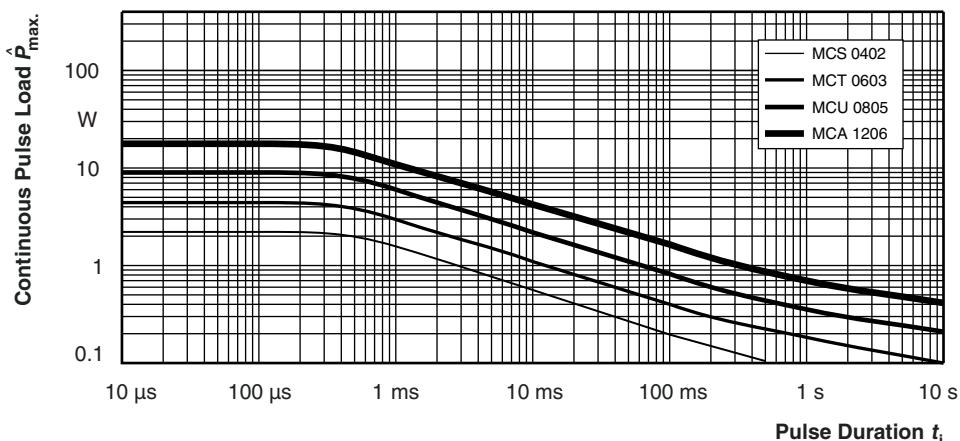
Precision chip resistor arrays may be used in voltage divider applications or precision amplifiers where close matching between multiple resistors is necessary. ACAS 0612 chip arrays are specified by the following datasheets:

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

FUNCTIONAL PERFORMANCE

Derating - Standard Operation

Derating - Power Operation


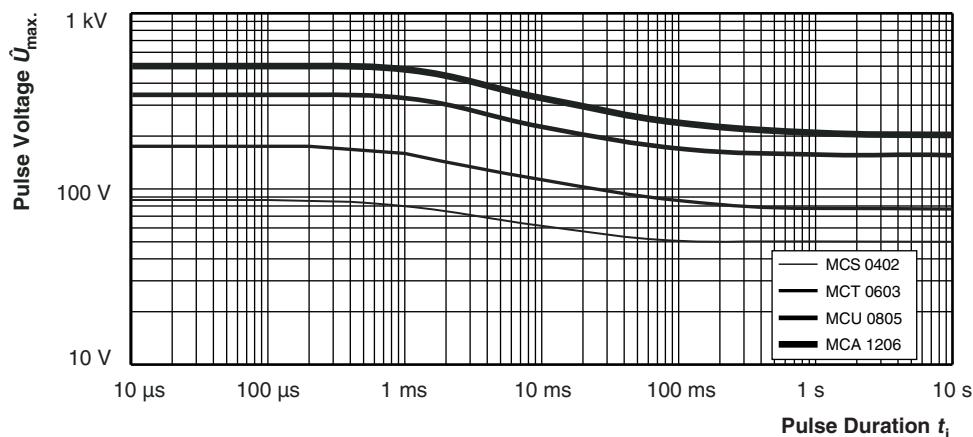
Maximum pulse load, single pulse; applicable if $\bar{P} \rightarrow 0$ and $n \leq 1000$ and $\dot{U} \leq \dot{U}_{\text{max}}$;
for permissible resistance change equivalent to 8000 h operation in standard operation mode

Single Pulse



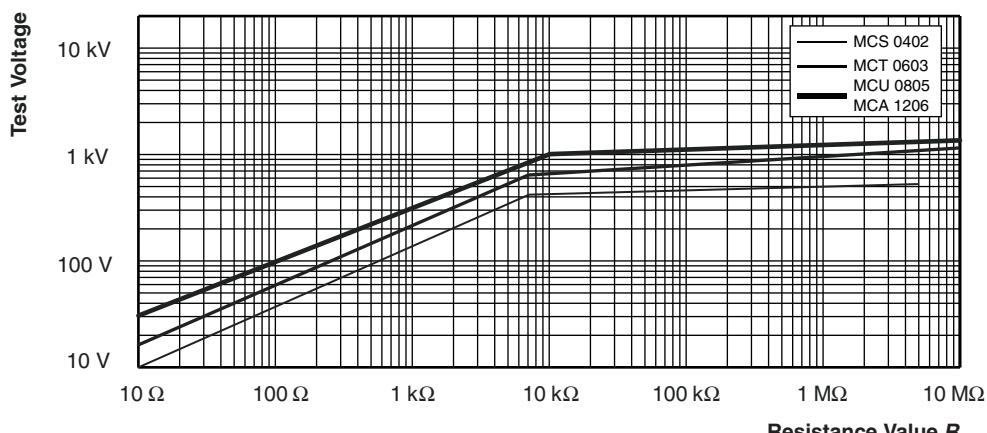
Maximum pulse load, continuous pulses; applicable if $\bar{P} \leq P(\vartheta_{\text{amb}})$ and $\dot{U} \leq \dot{U}_{\max}$;
for permissible resistance change equivalent to 8000 h operation in standard operation mode

Continuous Pulse



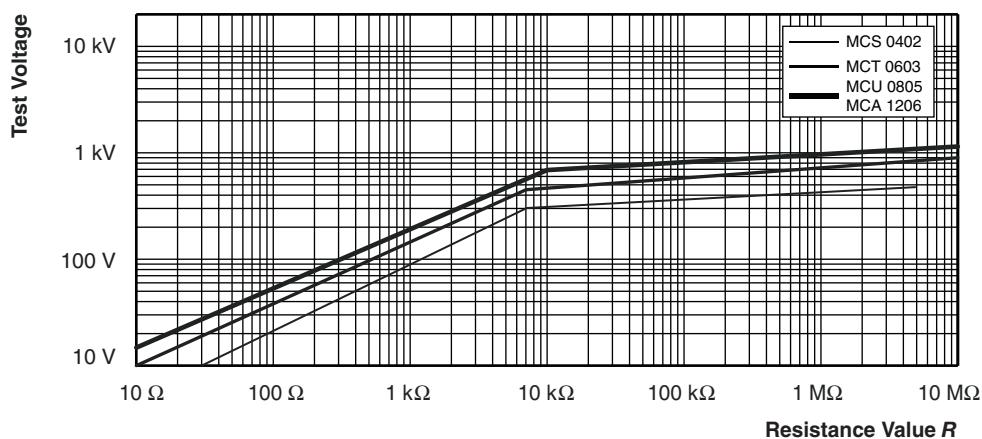
Maximum pulse voltage, single and continuous pulses; applicable if $\hat{P} \leq \hat{P}_{\max}$;
for permissible resistance change equivalent to 8000 h operation in standard operation mode

Pulse Voltage



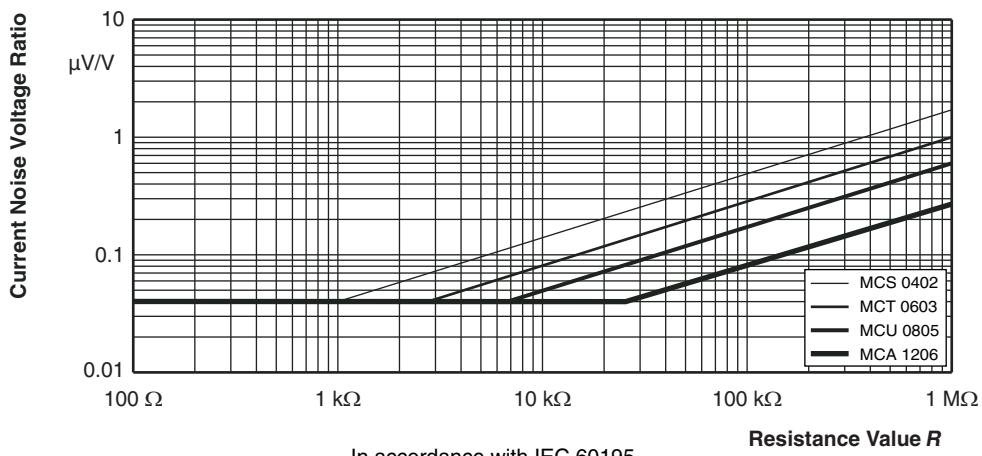
Pulse load rating in accordance with EN 60115-1 clause 4.27; 1.2 μ s/50 μ s; 5 pulses at 12 s interval;
for permissible resistance change $\pm (0.5\% R + 0.05 \Omega)$

1.2/50 Pulse



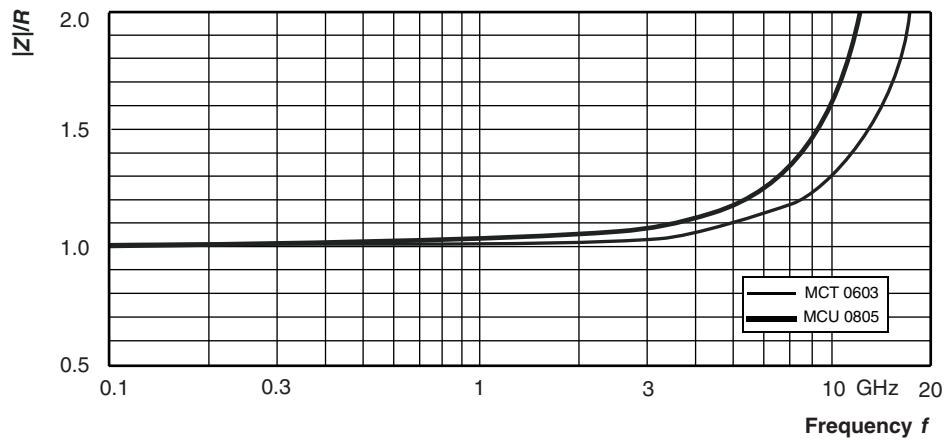
Pulse load rating in accordance with EN 60115-1 clause 4.27; 10 μ s/700 μ s;
10 pulses at 1 min intervals; for permissible resistance change $\pm (0.5\% R + 0.05 \Omega)$

10/700 Pulse



In accordance with IEC 60195

Current Noise Voltage Ratio



Relative impedance for 49.9 Ω chip resistor

RF-Behavior

TESTS AND REQUIREMENTS

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

EN 60115-1, generic specification

EN 60115-8 (successor of EN 140400), sectional specification

EN 140401-801, detail specification

IEC 60068-2-xx, test methods

The components are approved under the IECQ-CECC quality assessment system for electronic components.

The parameters stated in the Test Procedures and Requirements table are based on the required tests and permitted limits of EN 140401-801. The table presents only the most important tests, for the full test schedule refer to the documents listed above. However, some additional tests and a number of improvements against those minimum requirements have been included.

The testing also covers most of the requirements specified by EIA/ECA-703 and JIS-C-5201-1.

The tests are carried out under standard atmospheric conditions in accordance with IEC 60068-1, 4.3, whereupon the following values are applied:

Temperature: 15 °C to 35 °C

Relative humidity: 25 % to 75 %

Air pressure: 86 kPa to 106 kPa (860 mbar to 1060 mbar)

A climatic category LCT / UCT / 56 is applied, defined by the lower category temperature (LCT), the upper category temperature (UCT), and the duration of exposure in the damp heat, steady state test (56 days).

The components are mounted for testing on printed circuit boards in accordance with EN 60115-8, 2.4.2, unless otherwise specified.

TEST PROCEDURES AND REQUIREMENTS

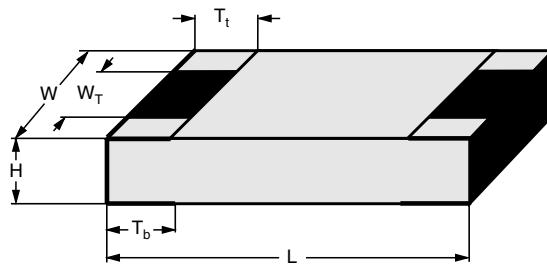
EN 60115-1 CLAUSE	IEC 60068-2 (1) TEST METHOD	TEST	PROCEDURE	REQUIREMENTS PERMISSIBLE CHANGE (ΔR)	
				STABILITY CLASS 0.5	STABILITY CLASS 1
			Stability for product types:		
			MCS 0402	10 Ω to 33.2 kΩ	> 33.2 kΩ to 4.99 MΩ
			MCT 0603	10 Ω to 100 kΩ	1 Ω to < 10 Ω; > 100 kΩ to 10 MΩ
			MCU 0805	10 Ω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

TEST PROCEDURES AND REQUIREMENTS					
EN 60115-1 CLAUSE	IEC 60068-2 ⁽¹⁾ 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 k Ω	> 33.2 k Ω to 4.99 M Ω
			MCT 0603	10 Ω to 100 k Ω	1 Ω to < 10 Ω ; > 100 k Ω to 10 M Ω
			MCU 0805	10 Ω to 221 k Ω	1 Ω to < 10 Ω ; > 221 k Ω to 10 M Ω
			MCA 1206	10 Ω to 332 k Ω	1 Ω to < 10 Ω ; > 332 k Ω to 2 M Ω
4.23		Climatic sequence: standard operation mode:			
4.23.2	2 (Bb)	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 (Ab)	cold	-55 °C; 2 h		
4.23.5	13 (M)	low air pressure	8.5 kPa; 2 h; (25 ± 10) °C	$\pm (0.5 \% R + 0.05 \Omega)$	$\pm (1 \% R + 0.05 \Omega)$
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	$\pm (0.1 \% R + 0.01 \Omega)$	$\pm (0.25 \% R + 0.05 \Omega)$
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	$\pm (0.1 \% R + 0.01 \Omega)$ no visible damage	
			LCT = -55 °C; UCT = 125 °C; 1000 cycles	$\pm (0.25 \% R + 0.05 \Omega)$ 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	$\pm (0.1 \% R + 0.01 \Omega)$	$\pm (0.25 \% R + 0.05 \Omega)$
		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	$\pm (0.25 \% R + 0.05 \Omega)$	$\pm (0.5 \% R + 0.05 \Omega)$
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 μ s/700 μ s	$\pm (0.5 \% R + 0.05 \Omega)$ no visible damage	
4.39	-	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	$\pm (0.5 \% R + 0.05 \Omega)$ 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	$\pm (1 \% R + 0.05 \Omega)$ no visible damage	

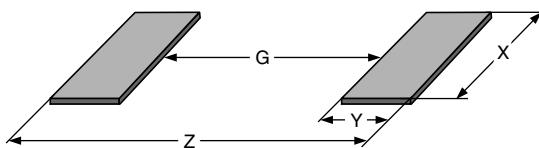
TEST PROCEDURES AND REQUIREMENTS					
EN 60115-1 CLAUSE	IEC 60068-2 ⁽¹⁾ TEST METHOD	TEST	PROCEDURE	REQUIREMENTS PERMISSIBLE CHANGE (ΔR)	
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			Stability for product types:		
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			MCT 0603	10 Ω to 100 k Ω	1 Ω to < 10 Ω ; > 100 k Ω to 10 M Ω
			MCU 0805	10 Ω to 221 k Ω	1 Ω to < 10 Ω ; > 221 k Ω to 10 M Ω
			MCA 1206	10 Ω to 332 k Ω	1 Ω to < 10 Ω ; > 332 k Ω to 2 M Ω
4.38	-	Electro static discharge (human body model)	IEC 61340-3-1 ⁽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	$\pm (0.5 \% R + 0.05 \Omega)$	
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	$\pm (0.1 \% R + 0.01 \Omega)$ no visible damage	
4.17	58 (Td)	Solderability	Solder bath method; SnPb40; non-activated flux; (215 \pm 3) °C; (3 \pm 0.3) s	Good tinning ($\geq 95\%$ covered); no visible damage	
			Solder bath method; SnAg3Cu0.5 or SnAg3.5; non-activated flux; (235 \pm 3) °C; (2 \pm 0.2) s	Good tinning ($\geq 95\%$ covered); no visible damage	
4.18	58 (Td)	Resistance to soldering heat	Solder bath method; (260 \pm 5) °C; (10 \pm 1) s	$\pm (0.1 \% R + 0.01 \Omega)$ no visible damage	$\pm (0.25 \% R + 0.05 \Omega)$ 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)	MCS 0402 and MCT 0603: 9 N	No visible damage	
			MCU 0805 and MCA 1206: 45 N		
4.33	21 (Ue ₁)	Substrate bending	Depth 2 mm, 3 times	$\pm (0.1 \% R + 0.01 \Omega)$ no visible damage, no open circuit in bent position	
4.7	-	Voltage proof	$U_{RMS} = U_{ins}$; (60 \pm 5) s	No flashover or breakdown	
4.35	-	Flammability	IEC 60695-11-5 ⁽¹⁾ , needle flame test; 10 s	No burning after 30 s	

Note

⁽¹⁾ The quoted IEC standards are also released as EN standards with the same number and identical contents.

DIMENSIONS


DIMENSIONS AND MASS							
TYPE / SIZE	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 / SIZE	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

Notes

- The given solder pad dimensions reflect the considerations for board design and assembly as outlined e.g. in standards IEC 61188-5-x⁽¹⁾, or in publication IPC-7351.

⁽¹⁾ The quoted IEC standards are also released as EN standards with the same number and identical contents.

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 $\pm 1\%$ tolerance, supplied in cardboard tape of 5000 units per reel was: 2312 215 14703.

HISTORICAL 12NC - Resistor type and packaging			2312...		
DESCRIPTION			CARDBOARD TAPE ON REEL		
TYPE	TCR	TOL.	P5 (5000 UNITS)	E0 (10 000 UNITS)	PW (20 000 UNITS)
MCS 0402	± 50 ppm/K	$\pm 1\%$	-	275 1....	-
		$\pm 0.5\%$	-	275 5....	-
	± 25 ppm/K	$\pm 0.5\%$	-	276 5....	-
	Jumper	-	-	275 90001	-
MCT 0603	± 50 ppm/K	$\pm 1\%$	215 1....	-	205 1..
		$\pm 0.5\%$	215 5....	-	205 5....
	± 25 ppm/K	$\pm 0.5\%$	216 5....	-	206 5....
	Jumper	-	215 90001	-	205 90001
MCU 0805	± 50 ppm/K	$\pm 0.5\%$	255 5....	-	245 5....
	± 25 ppm/K	$\pm 0.5\%$	256 5....	-	246 5....
	Jumper	-	255 90001	-	245 90001

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MCU08050D1802DP500	MCT06030C1002FP500	MCS04020C1000FE000	MCS04020C1002FE000
MCT06030C1212FP500	MCT06030C1622FP500	MCT06030D1620BP100	MCT06030D1650BP100
MCT06030D1820BP100	MCT06030D1502BP100	MCT06030D1740BP100	MCT06030D4752BP100
MCT06030D4122BP100	MCT06030D7681BP100	MCS04020C1004FE000	MCA12060C1008FP500
MCU08050C1009FP500	MCA12060C1009FP500	MCA12060C1004FP500	MCA12060C1001FP500
MCU08050C1004FP500	MCS04020C1009FE000	MCU08050C1003FP500	MCU08050C1000FP500
MCA12060C1002FP500	MCU08050C1002FP500	MCS04020C1001FE000	MCA12060C1003FP500
MCA12060C1000FP500	MCS04020C1003FE000	MCU08050C1001FP500	MCT06030C4702FP500
MCT06030C3300FP500	MCT06030C1500FP500	MCT06030C1508FP500	MCT06030C2493FP500
MCT06030C5601FP500	MCT06030C2401FP500	MCT06030C4708FP500	MCT06030C1203FP500
MCT06030C3303FP500	MCT06030D1003BP500	MCT06030C7502FP500	MCT06030C3322FP500
MCS04020C4993FE000	MCT06030C1001FP500	MCT06030C1501FP500	MCT06030C2701FP500
MCT06030C2200FP500	MCT06030C3013FP500	MCT06030C2209FP500	MCT06030C2201FP500
MCT06030C6800FP500	MCT06030C1003FP500	MCU08050C3301FP500	MCT06030C3922FP500
MCT06030C1302FP500	MCT06030C3321FP500	MCU08050C2401FP500	MCT06030D1000DP500
MCT06030C3011FP500	MCS04020C3309FE000	MCU08050D1003BP100	MCT06030C6812FP500
MCU08050C1501FP500	MCT06030C3309FP500	MCT06030C2490FP500	MCT06030C2002FP500
MCS04020C4703FE000	MCS04020C8201FE000	MCT06030C4758FP500	MCS04020C3300FE000
MCT06030C6803FP500	MCT06030C2009FP500	MCT06030C7509FP500	MCT06030C3323FP500
MCT06030C2000FP500	MCT06030C1009FP500	MCT06030C3308FP500	MCT06030C3000FP500
MCT06030C2492FP500	MCT06030C7503FP500	MCT06030C5112FP500	MCT06030C4302FP500
MCS04020C3301FE000	MCT06030C4991FP500	MCT06030C1201FP500	MCT06030C1801FP500
MCS04020C2200FE000	MCT06030C2202FP500	MCU08050C4702FP500	MCT06030C3243FP500
MCT06030C2211FP500	MCT06030C4700FP500	MCS04020C2209FE000	MCT06030C6809FP500
MCT06030C1503FP500	MCT06030C2700FP500	MCT06030C7501FP500	MCU08050C1008FP500