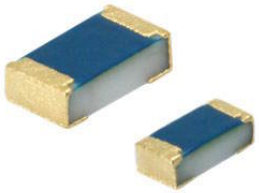
Precision Gold Terminated Thin Film Chip Resistors for Conductive Gluing



The MC series automotive thin film chip resistors are designed for conductive gluing technology. They are the perfect choice for most fields of modern precision electronics where reliability and stability are of major concern. Typical applications include automotive as well as industrial systems.

FEATURES

- Gold terminations for conductive gluing
- Superior temperature cycling robustness
- Superior moisture resistivity, $|\Delta R/R| < 0.5$ % (85 °C; 85 % RH; 1000 h)
- Sulfur resistance verified according to ASTM B 809
- AEC-Q200 qualified
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

AUTOMOTIVE GRADE

Pb-free

RoHS COMPLIANT

APPLICATIONS

- Automotive
- Precision analog circuits
- Hybrid circuits

TECHNICAL SPECIFICATIONS

DESCRIPTION	MCS 0402 ATAU	MCT 0603 ATAU
Imperial size	0402	0603
Metric size code	RR1005M	RR1608M
Resistance range	100 Ω to 47 kΩ	100 Ω to 100 kΩ
Resistance tolerance	± 0.1 %	
Temperature coefficient	± 25 ppm/K; ± 15 ppm/K	
Rated dissipation, P_{70} (1)	0.100 W	0.125 W
Operating voltage, $U_{max.}$ AC_{RMS}/DC	50 V	75 V
Permissible film temperature, ϑ_F max. (1)	155 °C	
Operating temperature range	-55 °C to 155 °C	
Permissible voltage against ambient (insulation): 1 min; U_{ins}	75 V	100 V
Failure rate: $FIT_{observed}$	≤ 0.1 x 10^{-9}/h	

Note

(1) Please refer to APPLICATION INFORMATION next page.

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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 ATAU**	0.063 W	0.100 W
	MCT 0603 ATAU	0.100 W	0.125 W
Operating temperature range		-55 °C to 125 °C	-55 °C to 155 °C
Permissible film temperature, $\vartheta_{F\ max.}$		125 °C	155 °C
Required thermal resistance, R_{th}	**MCS 0402 ATAU**	≤ 870 K/W	≤ 850 K/W
	MCT 0603 ATAU	≤ 550 K/W	≤ 680 K/W
Max. resistance change at P_{70} for resistance range, $\lvert\Delta R/R\rvert$ after:	**MCS 0402 ATAU**	100 Ω to 47 kΩ	100 Ω to 47 kΩ
	MCT 0603 ATAU	100 Ω to 100 kΩ	100 Ω to 100 kΩ
	1000 h	≤ 0.1 %	≤ 0.2 %
	8000 h	≤ 0.2 %	≤ 0.4 %
	225 000 h	≤ 0.6 %	-

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 ATAU	± 25 ppm/K	± 0.1 %	100 Ω to 47 kΩ	E24; E192
	± 15 ppm/K			
MCT 0603 ATAU	± 25 ppm/K		100 Ω to 100 kΩ	
	± 15 ppm/K			

PACKAGING						
TYPE / SIZE	**CODE**	**QUANTITY**	**PACKAGING STYLE**	**WIDTH**	**PITCH**	**PACKAGING DIMENSIONS**
MCS 0402 ATAU	E1	1000	Tape and reel cardboard tape according to IEC 60286-3, Type 1a	8 mm	2 mm	Ø 180 mm/7"
	E0	10 000				
MCT 0603 ATAU	P1	1000			4 mm	Ø 180 mm/7"
	P5	5000				
	PW	20 000				Ø 330 mm/13"

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PART NUMBER AND PRODUCT DESCRIPTION

PART NUMBER: MCT0603UD4641BPW00

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

TYPE / SIZE	VERSION	TCR	RESISTANCE	TOLERANCE	PACKAGING
MCS0402 **MCT0603**	**U** = AT AU (automotive / gold termination)	**E** = ± 15 ppm/K **D** = ± 25 ppm/K	3 digit value 1 digit multiplier **Multiplier** **9** = x 10^{-1} **0** = x 10^{0} **1** = x 10^{1} **2** = x 10^{2} **3** = x 10^{3}	**B** = ± 0.1 %	**E1** **E0** **P1** **P5** **PW**

PRODUCT DESCRIPTION: MCT 0603 - 25 0.1 % AT AU PW 4K64

MCT	0603	- 25	0.1 %	AT AU	PW	4K64
TYPE	SIZE	TCR	TOLERANCE	VERSION	PACKAGING	RESISTANCE
MCS **MCT**	**0402** **0603**	± **15** ppm/K ± **25** ppm/K	± **0.1 %**	**AT AU** = automotive / gold termination	**E1** **E0** **P1** **P5** **PW**	**4K64** = 4640 Ω

Note

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

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DESCRIPTION

The MC ATAU series is derived from the precision MC AT series, datasheet number 28785, which is qualified according AEC-Q200 and approved to EN140401-801. The MC ATAU series is manufactured identically except the termination. Production is strictly controlled and follows an extensive set of instructions established for reproducibility. A homogeneous film of special 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. The resistor elements are covered by a unique protective coating designed for electrical, mechanical and climatic protection. The terminations receive a final layer appropriate for conductive gluing.

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. 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 conductive gluing technology. 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.

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

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 qualified according to AEC-Q200.

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

Chip resistor arrays for conductive gluing may be used in high temperature applications where close tolerance matching and tight TCR tracking are necessary.

Please refer to the ACAS 0606 ATAU - Precision datasheet (www.vishay.com/doc?28876).

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.

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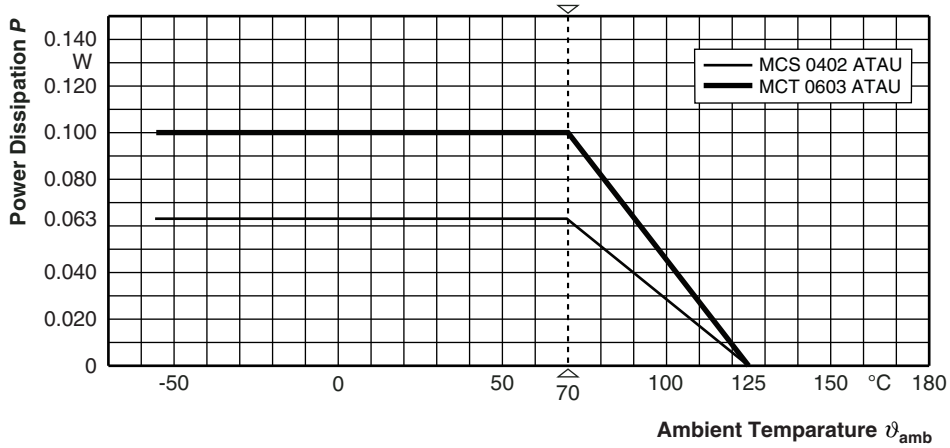
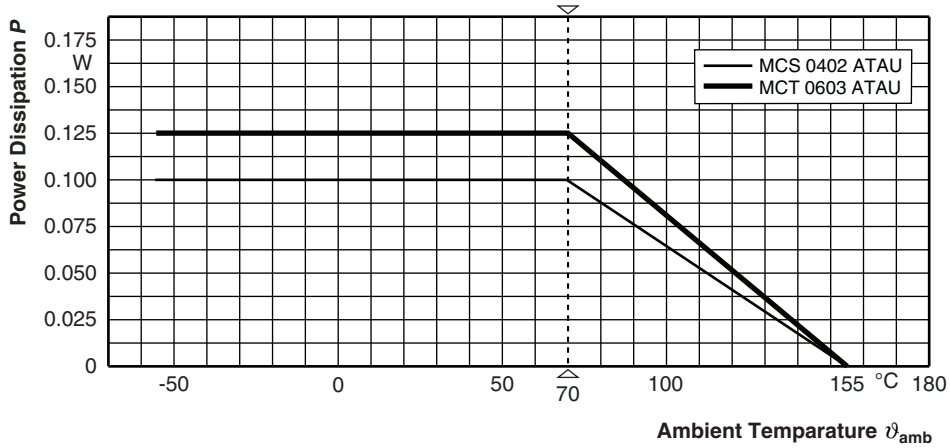
FUNCTIONAL PERFORMANCE



For permissible resistance change please refer to table MAXIMUM RESISTANCE CHANGE AT RATED DISSIPATION, above.

Derating - Standard Mode



For permissible resistance change please refer to table MAXIMUM RESISTANCE CHANGE AT RATED DISSIPATION, above.

Derating - Power Mode

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TESTS AND REQUIREMENTS

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

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 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).

TEST PROCEDURES AND REQUIREMENTS

EN 60115-1 CLAUSE	IEC 60068-2 [1] TEST METHOD	TEST	PROCEDURE	REQUIREMENTS PERMISSIBLE CHANGE (ΔR)
				STABILITY CLASS 0.25 OR BETTER
			Stability for product types:	
			MCS 0402 ATAU	100 Ω to 47 kΩ
			MCT 0603 ATAU	100 Ω to 100 kΩ
4.5	-	Resistance		± 0.1 % R
4.8	-	Temperature coefficient	At (20 / -55 / 20) °C and (20 / 155 / 20) °C	± 25 ppm/K; ± 15 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	± (0.1 % R + 0.02 Ω) ± (0.2 % R + 0.02 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 70 °C; 8000 h	± (0.2 % R + 0.02 Ω) ± (0.4 % R + 0.05 Ω)
4.25.3	-	Endurance at upper category temperature	125 °C; 1000 h 155 °C; 1000 h	± (0.15 % R + 0.02 Ω) ± (0.3 % R + 0.02 Ω)
4.24	78 (Cab)	Damp heat, steady state	(40 ± 2) °C; 56 days; (93 ± 3) % RH	± (0.1 % R + 0.02 Ω)
4.37	67 (Cy)	Damp heat, steady state, accelerated; standard operation mode	(85 ± 2) °C (85 ± 5) % RH $U = 0.1 \times \sqrt{P_{70} \times R} \leq 100$ V; 1000 h	± (0.5 % R + 0.05 Ω)
4.13	-	Short time overload; standard operation mode	$U = 2.5 \times \sqrt{P_{70} \times R} \leq 2 \times U_{max.}$; 5 s	± (0.05 % R + 0.01 Ω)
4.27	-	Single pulse high voltage overload; standard operation mode	Severity no. 4: $U = 10 \times \sqrt{P_{70} \times R} \leq 2 \times U_{max.}$; 10 pulses	± (0.25 % R + 0.05 Ω)
4.40	-	ESD (Electro Static Discharge)	IEC 61340-3-1 [1]; 3 pos. + 3 neg. (equivalent to MIL-STD-883, method 3015) MCS 0402 ATAU: 500 V MCT 0603 ATAU: 1000 V	± (0.5 % R + 0.05 Ω)

Note

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

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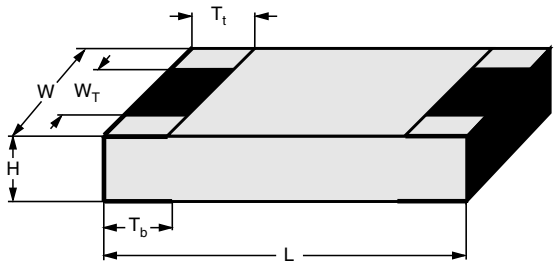
DIMENSIONS



DIMENSIONS AND MASS							
TYPE / SIZE	H (mm)	L (mm)	W (mm)	W_T (mm)	T_t (mm)	T_b (mm)	MASS (mg)
MCS 0402 ATAU	0.3 ± 0.05	0.98 ± 0.05	0.5 ± 0.05	> 75 % of W	0.2 + 0.1 / - 0.15	0.2 ± 0.1	0.6
MCT 0603 ATAU	0.43 + 0.1 / - 0.05	1.53 ± 0.05	0.85 ± 0.1	> 75 % of W	0.3 + 0.15 / - 0.2	0.3 + 0.15 / - 0.2	1.9

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