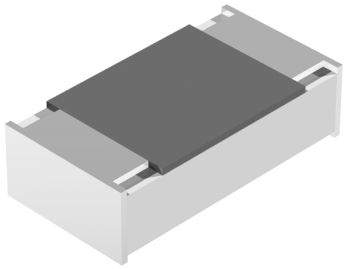
High Frequency Flat Chip Resistors



FEATURES

- Speciality product for RF applications
- Low-inductance trimmed product
- Suitable for more than 10 GHz
- Resistance range: 6.8 Ω to 470 Ω
- Green product, supports lead-free soldering.

APPLICATIONS

- Telecommunication equipment
- Industrial electronics.

MCT 0603 HF speciality thin film flat chip resistors for RF applications is the perfect choice in high frequency circuit designs where the impedance change due to the parasitic inductance of regular and professional resistors can not be accepted. Typical applications are in the fields of telecommunication equipment and industrial electronics.

METRIC SIZE	
INCH:	0603
METRIC:	RR 1608M

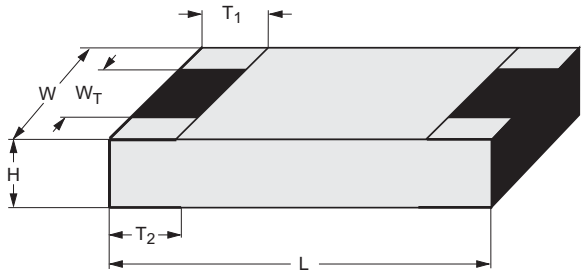
TECHNICAL SPECIFICATIONS		
DESCRIPTION	**MCT 0603 HF**	
Metric size	RR 1608M	
Resistance range	6.8 Ω to 470 Ω; 50 Ω	
Resistance tolerance	± 2 %	
Temperature coefficient	± 50 ppm/K	
Operation mode	standard	power
Climatic category (LCT/UCT/days)	55/125/56	55/155/56
Rated dissipation, P_{70}(1)	0.1 W	0.125 W
Operating voltage, U_{max} AC/DC	limited by P_{70}	
Film temperature	125 °C	155 °C
Max. resistance change at P_{70} for resistance range, $\Delta R/R$ max., after:	6.8 Ω to 470 Ω	
1000 h	≤ 0.5 %	≤ 1.0 %
8000 h	≤ 1.0 %	≤ 2.0 %
225000 h	≤ 3.0 %	–
Specified lifetime	225000 h	8000 h
Insulation voltage:		
1 minute; U_{ins}	100 V	
continuous	75 V	
Failure rate	≤ 2.0×10^{-9}/h	

Note

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.

ORDERING INFORMATION - type description and ordering code								
M	**C**	**T**	**0603**	**- 50**	**2 %**	**HF**	**P5**	**50 R**
FILM TYPE	PRODUCT CODE	SIZE CODE	IMPERIAL SIZE	TEMPERATURE COEFFICIENT	TOLERANCE	SUFFIX	PACKAGING	RESISTANCE VALUE
M = metal	C = flat chip	T = 0603	0603	± 50 ppm/K	± 2 %	HF = High frequency	P1 = 1 000 units P5 = 5 000 units PW = 20 000 units	See Temperature Coefficient and Resistance Range Table.

DIMENSIONS



DIMENSIONS - CHIP resistor types, mass and relevant physical dimensions							
TYPE	**H (mm)**	**L (mm)**	**W (mm)**	**W_T (mm)**	**T_1 (mm)**	**T_2 (mm)**	**MASS (mg)**
MCT 0603 HF	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

TEMPERATURE COEFFICIENT AND RESISTANCE RANGE		
DESCRIPTION		**RESISTANCE VALUE(1)**
T.C.	**TOLERANCE**	**MCT 0603 HF**
± 50 ppm/K	± 2 %	6.8 Ω to 470 Ω; 50 Ω

Note

1. Resistance values to be selected from E24 series.

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 (96 % Al_2O_3) ceramic body and conditioned to achieve the desired temperature coefficient. Specially designed pre-contacts are deposited on both sides using the same thin film technology. A special laser is used to achieve the target value by smoothly cutting a groove - with a resulting low inductivity - in the resistive layer without damaging the ceramics. 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 performed on 100 % of the individual chip resistors. Only accepted products are laid directly into the paper tape in accordance with **IEC 60286-3.**

ASSEMBLY

The resistors are suitable for processing on automatic SMD assembly systems. They are suitable for automatic soldering using wave, reflow or vapour phase. The encapsulation is resistant to all cleaning solvents commonly used in the electronics industry, including alcohols, esters and aqueous solutions. The resistors are lead (Pb)-free, the pure tin plating provides compatibility with lead (Pb)-free and lead-containing 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.

This includes full compatibility with the following directives:

- 2000/53/EC End of Vehicle life Directive (ELV)
- 2000/53/EC Annex II to End of Vehicle Life Directive (ELV II)
- 2002/95/EC Restriction of the use of Hazardous Substances Directive (RoHS)
- 2002/96/EC Waste Electrical and Electronic Equipment Directive (WEEE)

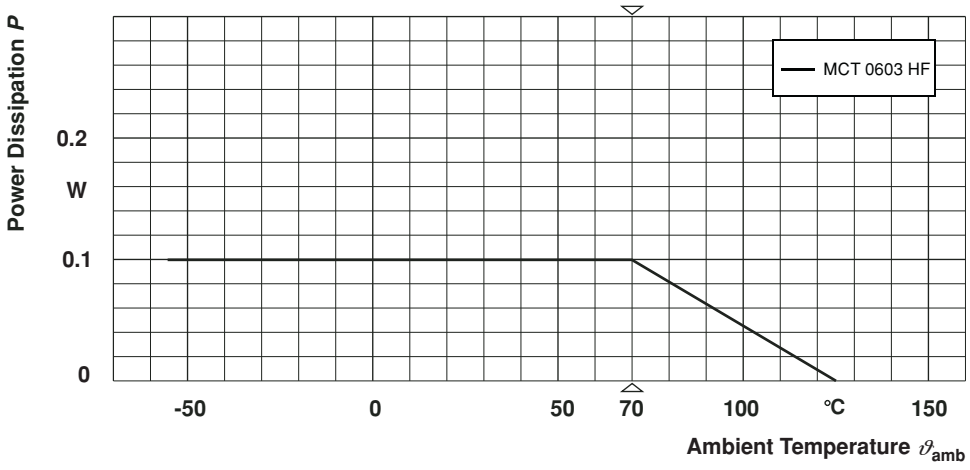
Solderability is specified for 2 years after production or re-qualification. The permitted storage time is 20 years.

APPROVALS

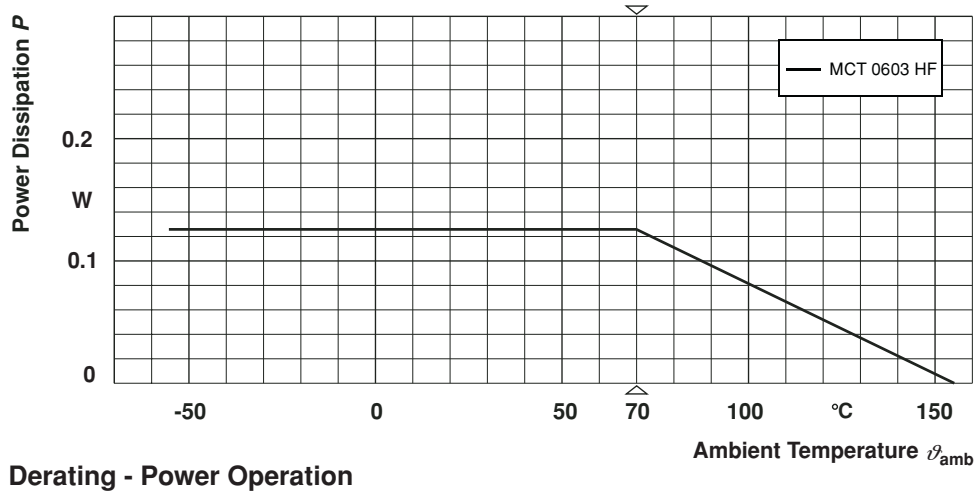
The resistors are tested in accordance with **EN 140 401-801** (superseding **CECC 40 401-801**) which refers to **EN 60115-1** and **EN 140 400**.

Vishay BEYSCHLAG has achieved **"Approval of Manufacturer"** in accordance with **EN 100114-1**.

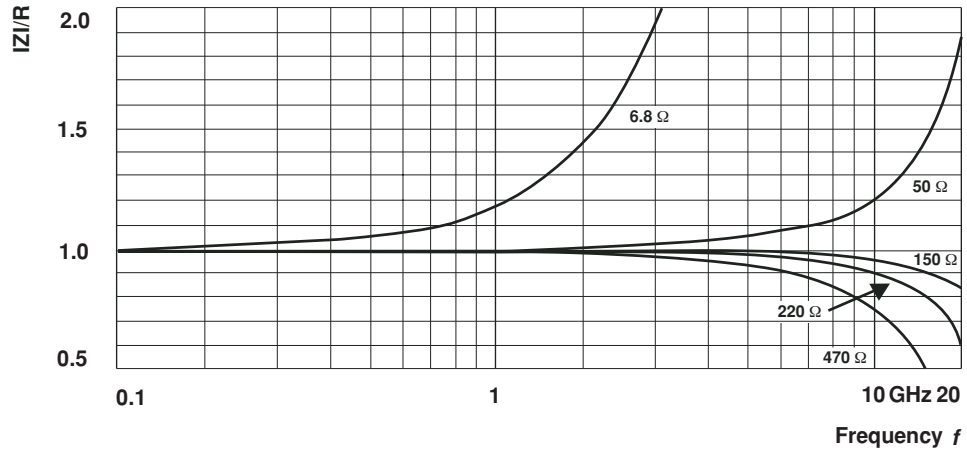
FUNCTIONAL PERFORMANCE



Derating - Standard Operation



Derating - Power Operation



IZI/R for MCT 0603 HF.

RF-Behaviour

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. 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 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 the Test Procedures and Requirements table below 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.

TEST PROCEDURES AND REQUIREMENTS

EN 60115-1 CLAUSE	IEC 60068-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS PERMISSIBLE CHANGE ($\Delta R/R$)
			stability for product types:	
			MCT 0603 HF	6.8 Ω to 470 Ω
4.5	–	resistance		± 2 %
4.8.4.2	–	temperature coefficient	at 20 / –55 / 20 °C and 20 / 125 / 20 °C	± 50 ppm/K
4.25.1	–	endurance at 70 °C: standard operation mode	$U = \sqrt{P_{70} \times R}$ 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	± (1 %R + 0.05 Ω)
4.24	78 (Cab)	damp heat, steady state	(40 ± 2) °C; 56 days; (93 ± 3) % RH	± (1 %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	± (1 %R + 0.05 Ω)
–	1 (Aa)	cold	–55 °C; 2 h	± (0.5 %R + 0.05 Ω)
4.19	14 (Na)	rapid change of temperature	30 minutes at LCT and 30 minutes at UCT; LCT = –55 °C; UCT = 125 °C; 5 cycles	± (0.5 %R + 0.05 Ω) no visible damage
4.13	–	short time overload; standard operation mode	$U = 2.5 \times \sqrt{P_{70} \times R}$	± (0.5 %R + 0.05 Ω)
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	± (0.5 %R + 0.05 Ω) no visible damage

TEST PROCEDURES AND REQUIREMENTS - continued				
EN 60115-1 CLAUSE	**IEC 60068-2 TEST METHOD**	**TEST**	**PROCEDURE**	**REQUIREMENTS PERMISSIBLE CHANGE ($\Delta R/R$)**
			stability for product types: **MCT 0603 HF**	6.8 Ω to 470 Ω
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	
4.29	45 (XA)	component solvent resistance	isopropyl alcohol + 50 °C; method 2	no visible damage
4.18.2	58 (Td)	resistance to soldering heat	solder bath method; (260 ± 5) °C; (10 ± 1) s	± (1 %R + 0.05 Ω) no visible damage
4.32	21 (Ue_3)	shear (adhesion)	RR 1608M; 9 N	no visible damage
4.33	21 (Ue_1)	substrate bending	depth 2 mm, 3 times	± (0.5 %R + 0.05 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

ORDERING INFORMATION

Components may be ordered by using either a simple clear text ordering code, see “Type description and ordering code” or Vishay 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 the 12NC Ordering Code table.
- 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 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

Ordering example

The ordering code of a MCT 0603 HF resistor, value 50 Ω and TC 50 with ± 2 % tolerance, supplied in cardboard tape of 5000 units per reel is: 2312 218 05009.

12NC ORDERING CODE - resistor type and packaging					
DESCRIPTION			**ORDERING CODE 2312 ... .**		
			CARDBOARD TAPE ON REEL		
TYPE	**T.C.**	**TOL.**	**P1 1 000 UNITS**	**P5 5 000 UNITS**	**PW 20 000 UNITS**
MCT 0603 HF	± 50 ppm/K	± 2 %	203 0....	**218 0....**	208 0....

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

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