High Ohmic Flat Chip Resistors

FEATURES

- Unique very high ohmic chip resistor product
- Standard TCR: ± 100 ppm/K
- Excellent overall stability
- Low voltage coefficient: 0.05 %/V
- Wide high ohmic range: > 10 MΩ to 130 MΩ
- Lead (Pb)-free solder contacts
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

RoHS COMPLIANT

APPLICATIONS

- Any kind of battery driven electronics
- Low consumption CMOS circuitry
- Small signal measurement

OCT 0603 and OCU 0805 high ohmic flat chip resistors are best suited where high resistance, high stability and high reliability are required. Typical applications include any kind of battery driven electronics, particularly low consumption CMOS circuitry.

TECHNICAL SPECIFICATIONS		
DESCRIPTION	**OCT 0603**	**OCU 0805**
DIN size	0603	0805
Metric CECC size	RR 1608M	RR 2012M
Resistance range	11 MΩ to 130 MΩ	11 MΩ to 130 MΩ
Resistance tolerance	± 5 %	
Temperature coefficient	± 250 ppm/K; ± 100 ppm/K	
Rated dissipation, P_{70} (1)	Limited by $U_{max.}$	
Operating voltage, $U_{max.}$ AC/DC	150 V	200 V
Permissible film temperature, $\vartheta_{F\,max.}$ (1)	155 °C	
Operating temperature range	-55 °C to 155 °C	-55 °C to 155 °C
Permissible voltage against ambient (insulation):		
1 min; U_{ins}	100 V	200 V
Continuous	75 V	75 V
Failure rate: $FIT_{observed}$	≤ 0.1 x 10^{-9}/h	

Note

(1) Please refer to APPLICATION INFORMATION below.

APPLICATION INFORMATION

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. 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.

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. At the maximum permissible film temperature of 155 °C the useful lifetime is specified for 8000 h. The designer may estimate the performance of the particular resistor application or set certain load and temperature limits in order to maintain a desired stability.

MAXIMUM RESISTANCE CHANGE AT RATED DISSIPATION

OPERATIONE MODE		STANDARD	POWER
Operating voltage, $U_{max.}$ AC_{RMS}/DC	OCT 0603	75 V	150 V
	OCU 0805	150 V	200 V
Operating temperature range		-55 °C to 125 °C	-55 °C to 155 °C
Permissible film temperature, $\vartheta_{F\ max.}$		125 °C	155 °C
Climatic category (LCT / UCT / days)		55 / 125 / 56	55 / 155 / 56
Max. resistance change at P_{70} for resistance range, $\lvert\Delta R/R\rvert$ max., after:	OCT 0603	11 MΩ to 47 MΩ	11 MΩ to 47 MΩ
	OCU 0805	11 MΩ to 47 MΩ	11 MΩ to 47 MΩ
	1000 h	≤ 1 %	≤ 2 %
	8000 h	≤ 2 %	≤ 4 %
Specified lifetime		8000 h	

TEMPERATURE COEFFICIENT AND RESISTANCE RANGE

TYPE/SIZE	TCR	TOLERANCE	RESISTANCE	E-SERIES
OCT 0603	± 250 ppm/K	± 5 %	51 MΩ to 130 MΩ	E24
	± 100 ppm/K		11 MΩ to 47 MΩ	
OCT 0805	± 250 ppm/K		51 MΩ to 130 MΩ	
	± 100 ppm/K		11 MΩ to 47 MΩ	

PACKAGING

TYPE / SIZE	CODE	QUANTITY	CARRIER TAPE	WIDTH	PITCH	REEL DIAMETER
OCT 0603	P5	5000	Paper tape acc. IEC 60286-3 Type 1a	8 mm	4 mm	180 mm/7"
	PW	20 000				330 mm/13"
OCT 0805	P5	5000		8 mm	4 mm	180 mm/7"
	PW	20 000				330 mm/13"

PART NUMBER AND PRODUCT DESCRIPTION

Part Number: OCT06030B5106JP500

O	C	T	0	6	0	3	0	B	5	1	0	6	J	P	5	0	0

MODEL/SIZE	SPECIAL CHARACTER	TCR	VALUE	TOLERANCE	PACKAGING	SPECIAL
OCT0603 **OCU0805**	**0** = neutral	**B** = ± 100 ppm/K **W** = ± 250 ppm/K	**3 digit value** **1 digit multiplier** MULTIPLIER **5** = $*10^5$ **6** = $*10^6$	**J** = ± 5 %	**P5** **PW**	Up to 2 digits **00** = standard

Product Description: OCT 0603-100 5 % P5 51M

OCT	0603	-100	5 %	P5	51M
MODEL	SIZE	TCR	TOLERANCE	PACKAGING (1)	RESISTANCE VALUE
OCT **OCU**	**0603** **0805**	± **100** ppm/K ± **250** ppm/K	± **5** %	**P5** **PW**	**47M** = 47 MΩ **220M** = 220 MΩ

Note

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

DESCRIPTION

Production is strictly controlled and follows an extensive set of instructions established for reproducibility. A newly developed cermet layer is deposited on a high grade (Al_2O_3) ceramic substrate and conditioned to achieve the desired temperature coefficient. Inner contacts are built on both sides of the substrate. A special laser is used to achieve the target value by smoothly cutting 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 and optical inspection performed on 100 % of the individual chip resistors. Only accepted products are laid directly into the paper tape in accordance with **IEC 60286-3** [(2)].

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** [(2)]. 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 **IEC 62474**, Material Declaration for Products of and for the Electrotechnical Industry.

The dedicated database [(1)], that list declarable substances, ensures full compliance with the following directives:

- 2000/53/EC End of Vehicle life Directive (ELV) and Annex II (ELV II)
- 2011/65/EU Restriction of the use of Hazardous Substances directive (RoHS)
- 2012/19/EU Waste Electrical and Electronic Equipment Directive (WEEE)

APPROVALS

The resistors are tested in accordance with **EN 140401-802** which refers to **EN 60115-1** and **EN 140400**. The detail specification refers to the climatic category 55/125/56, which relates to the "Standard operation mode" of this datasheet.

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

Notes

(1) IEC 62474 database can be found at http://std.iec.ch/iec62474.

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

TEST 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 140401-802, 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.

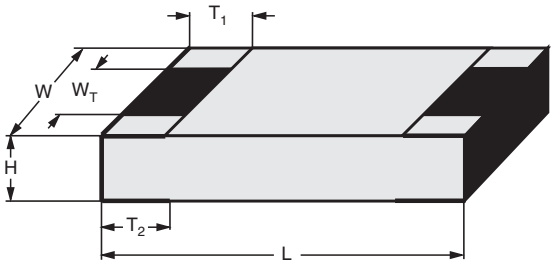
The requirements stated in the Test Procedures and Requirements table are based on the required tests and permitted limits of EN 140401-802. However, some additional tests and a number of improvements against those minimum requirements have been included.

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:	
			OCT 0603	11 MΩ to 130 MΩ
			OCU 0805	11 MΩ to 130 MΩ
4.5	-	Resistance	U = 100 V	± 5 %
4.8.4.2	-	Temperature coefficient	At (20 / -55 / 20) °C and (20 / 125 / 20) °C	± 250 ppm/K; ± 100 ppm/K
4.25.1	-	Endurance at 70 °C: standard operation mode	$U = U_{max.}$; 1.5 h on; 0.5 h off;	
			70 °C; 1000 h	± 1 %
			70 °C; 8000 h	± 2 %
4.25.3	-	Endurance at upper category temperature	125 °C; 1000 h	± 2 %
			155 °C; 1000 h	± 3 %
4.24	78 (Cab)	Damp heat, steady state	(40 ± 2) °C; 56 days; (93 ± 3) % RH	± 1 %
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 % no visible damage
-	1 (Aa)	Cold	- 55 °C; 2 h	± 0.5 %

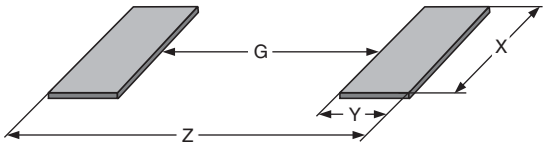
TEST PROCEDURES AND REQUIREMENTS				
EN 60115-1 CLAUSE	**IEC 60068-2 TEST METHOD**	**TEST**	**PROCEDURE**	**REQUIREMENTS PERMISSIBLE CHANGE ($\Delta R/R$)**
			Stability for product types:	
			OCT 0603	11 MΩ to 130 MΩ
			OCU 0805	11 MΩ to 130 MΩ
4.19	14 (Na)	Rapid change of temperature	30 min at LCT and 30 min at UCT; LCT = -55 °C; UCT = 125 °C; 5 cycles LCT = -55 °C; UCT = 125 °C; 1000 cycles	± 0.5 % no visible damage ± 1 % no visible damage
4.13	-	Short time overload	U = 2 x $U_{max.}$; 5 s	± 0.5 %
4.27	-	Single pulse high voltage overload; standard operation mode	Severity no. 4, U = 2 x $U_{max.}$; 10 pulses 10 µs/700 µs	± 1 % no visible damage
4.22	6 (Fc)	Vibration	Endurance by sweeping; 10 Hz to 2000 Hz; no resonance; amplitude ≤ 1.5 mm or ≤ 200 m/s^2; 6 h	± 0.5 % 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	± 0.5 % 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)	RR 1608M; 9 N	No visible damage
			RR 2012M; 45 N	
4.33	21 (Ue_1)	Substrate bending	Depth 2 mm, 3 times	± 0.5 % 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

DIMENSIONS



DIMENSIONS AND MASS							
TYPE	H (mm)	L (mm)	W (mm)	W_T (mm)	T_1 (mm)	T_2 (mm)	MASS (mg)
OCT 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
OCU 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

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)
OCT 0603	0.55	1.10	1.10	2.75	0.65	0.70	0.95	2.05
OCU 0805	0.80	1.25	1.50	3.30	0.90	0.90	1.40	2.70

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.

12NC INFORMATION FOR HISTORICAL CODING REFERENCE ONLY

- The resistors have a 12 digit numeric code starting with 2312.
- The subsequent 4 digits indicate the resistor type, specification and packaging; see the 12NC 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 12NC indicating resistance decade table.

Last digit of 12NC indicating resistance decade

RESISTANCE DECADE	LAST DIGIT
10 MΩ to 99.9 MΩ	6

Last two digits indicating sequential code number

RESISTANCE VALUE	LAST DIGITS
100 MΩ	01
110 MΩ	02
120 MΩ	03
130 MΩ	04

12NC example

The 12NC of a OCT 0603 resistor, value 51 MΩ and TC 250 with ± 5 % tolerance, supplied in cardboard tape of 20 000 units per reel is: 2312 209 35106.

The 12NC of a OCT 0603 resistor, value 130 MΩ and TC 250 with ± 5 % tolerance, supplied in cardboard tape of 5000 units per reel is: 2312 219 90104.

12NC - Resistor type and packaging

DESCRIPTION				CODE 2312	
				CARDBOARD TAPE ON REEL	
TYPE	TCR	TOL.	RESISTANCE VALUE	P5 5000 UNITS	PW 20 000 UNITS
OCT 0603	± 250 ppm/K	± 5 %	51 MΩ to 91 MΩ	219 3....	209 3....
			≥ 100 MΩ (1)	219 901..	209 901..
	± 100 ppm/K	± 5 %	11 MΩ to 47 MΩ	219 3....	209 3....
OCU 0805	± 250 ppm/K	± 5 %	51 MΩ to 91 MΩ	259 3....	249 3....
			≥ 100 MΩ (1)	259 901..	249 901..
	± 100 ppm/K	± 5 %	11 MΩ to 47 MΩ	259 3....	249 3....

Note

(1) Readable coding of resistance values is restricted to values below 100 MΩ. For resistance values from 100 MΩ onwards, refer to the pre-defined table of non-readable sequential numbers above.

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