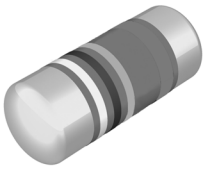
High Pulse Load MELF Resistor



CMA 0204 speciality MELF resistors with advanced pulse load capability are the perfect choice for the protection of circuitry with signal or mains input lines from surge pulses. The resistors are also suitable for circuits exposed to high levels of electromagnetic interference or electrostatic discharge. The applications are in all fields of automotive, telecommunication, industrial and medical equipment.

FEATURES

- Special carbon film technology
- Up to 4 kV single pulse capability
- Up to 70 W continuous pulse load
- Green product, supports lead-free soldering.

APPLICATIONS

- Automotive
- Telecommunication
- Industrial
- Medical equipment

METRIC SIZES	
DIN:	0204
CECC:	RC 3715M

TECHNICAL SPECIFICATIONS

DESCRIPTION	**CMA 0204**	
Metric CECC size	RC 3715M	
Resistance range	10 Ω to 100 kΩ	
Resistance tolerance	± 2 %	
Temperature coefficient	see T.C. graph	
Operation mode	standard	power
Climatic category (LCT/UCT/days)	55/125/56	55/155/56
Rated dissipation, P_{70}(1)	0.25 W	0.4 W
Operating voltage, U_{max} AC/DC	200 V	
Film temperature	125 °C	155 °C
Max. resistance change at P_{70} for resistance range, $\Delta R/R$ max., after:	10 Ω to 100 kΩ	
1000 h	± 1 %	± 2 %
8000 h	± 2 %	± 4 %
Specified lifetime	8 000 h	
Permissible voltage against ambient (insulation):		
1 minute; U_{ins}	300 V	
continuous	75 V	
Failure rate	≤ 1 × 10^{-9}/h	

Note

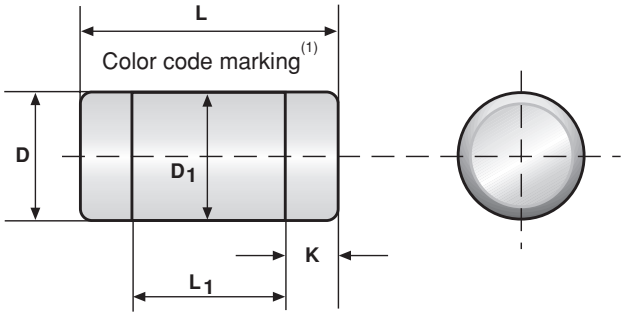
1. The power dissipation on the resistor generates a temperature rise against the local ambient, depending on the heatflow support of the printed-circuit board (thermal resistance). The rated dissipation applies only if the permitted film temperature is not exceeded. Furthermore, a high level of ambient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

ORDERING INFORMATION - type description and ordering code						
C	**M**	**A**	**0204**	**2 %**	**BL**	**47K**
FILM TYPE C = Carbon	PRODUCT CODE M = MELF, cylindrical	SIZE CODE A = 0204	METRIC DIN SIZE 0204	TOLERANCE ± 2 %	PACKAGING BL = 3000 units B0 = 10000 units	RESISTANCE VALUE See temperature Coefficient and Resistance Range Table

Note

1. For CMA 0204 the temperature coefficient is not identified in the ordering code.
2. We recommend that the clear text ordering code is used to minimize the possibilty of errors in order handling.

DIMENSIONS



DIMENSIONS - MELF resistor types, mass and relevant physical dimensions						
TYPE	**L (mm)**	**D (mm)**	**$L_{1\ min}$ (mm)**	**D_1 (mm)**	**K (mm)**	**MASS (mg)**
CMA 0204	3.6 + 0/–0.2	1.4 + 0/–0.1	1.8	D + 0/–0.15	0.8 ± 0.1	19

Note

1. Color code marking is applied according to IEC 60062 in four bands (E24 series). Each color band appears as a single solid line, voids are permissible if at least 1/3 of the band is visible from each radial angle of view. The last color band for tolerance is approx, 50 % wider than the other bands. An interrupted band between the 2nd and 3rd full band identifies the special carbon film type.

TOLERANCE AND RESISTANCE RANGE	
TOLERANCE	**RESISTANCE VALUE(1)**
	CMA 0204
± 2 %	10 Ω to 100 kΩ

Note

1. Resistance value to be selected from E24 series.

DESCRIPTION

Production of the CMA 0204 speciality MELF resistors with advanced pulse load capability is strictly controlled and follows an extensive set of instructions established for reproducibility. A homogeneous and dense carbon film is deposited on a high grade ceramic body (85 % Al_2O_3). Nickel plated steel termination caps are firmly pressed on the coated rods. A special laser is used to achieve the target value by smoothly cutting a helical groove in the resistive layer without damaging the ceramics. The resistors are covered by protective coating designed for electrical, mechanical and climatic protection.The terminations receive a final pure tin on nickel plating. Four colour code rings designate the resistance value and tolerance in accordance with **IEC 60 062**.

The result of the determined production is verified by an extensive testing procedure performed on 100 % of the individual resistors. Only accepted products are laid directly into the blister tape in accordance with **IEC 60 286-3**.

ASSEMBLY

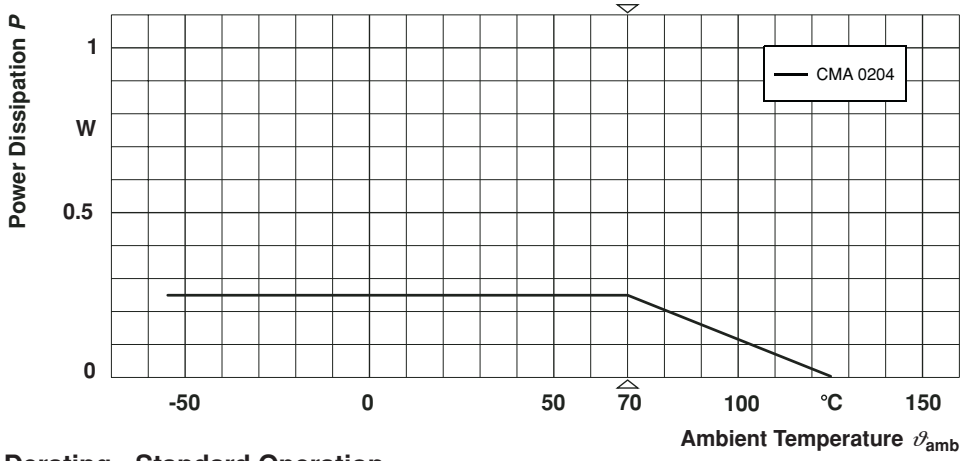
The resistors are suitable for processing on automatic SMD assembly systems. They are suitable for automatic soldering using wave, reflow or vapour phase. Excellent solderability is proven, even after extended storage in excess of 10 years. The encapsulation is resistant to all cleaning solvents commonly used in the electronics industry, including alcohols, esters and aqueous solutions. The resistors are completely lead (Pb)-free, the pure tin plating provides compatibility with lead (Pb)-free 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 European RoHS directive.

APPROVALS

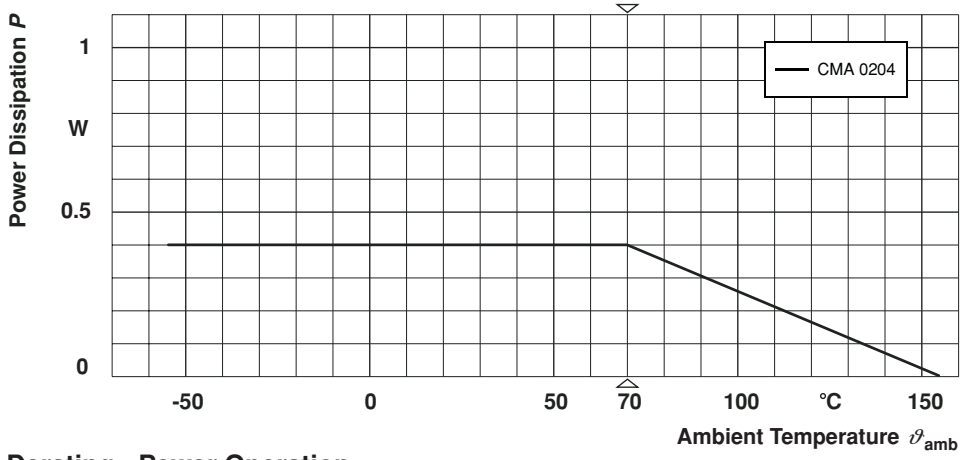
Where applicable the resistors are tested in accordance with **EN 140401-803** (superseding **CECC 40401-803**) which refers to **EN 60115-1, EN 140400** and the variety of enviromental text procedures of the **IEC 60068** series.

Vishay BEYSCHLAG has achieved **"Approval of Manufacturer"** in accordance with **EN 100 114-1**. The release certificate for **"Technology Approval Schedule"** in accordance with **CECC 240001** based on **EN 100114-6** is granted for the Vishay BEYSCHLAG manufacturing process.

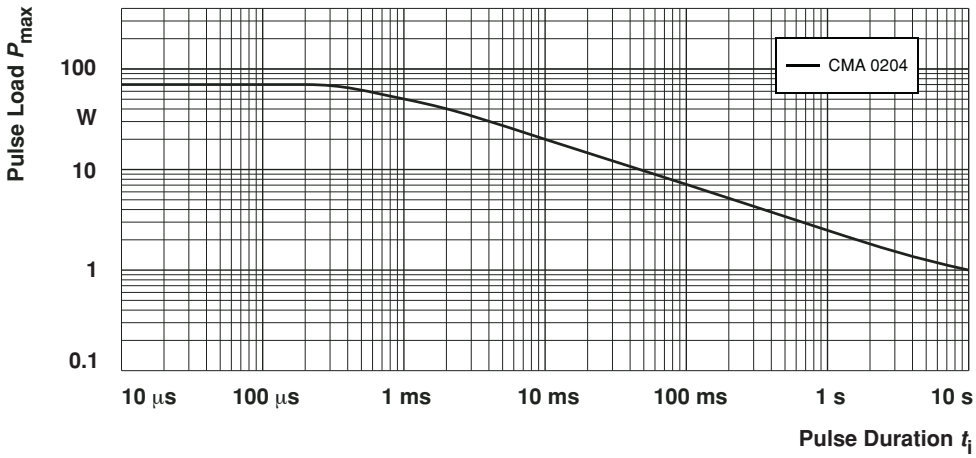
FUNCTIONAL PERFORMANCE



Derating - Standard Operation

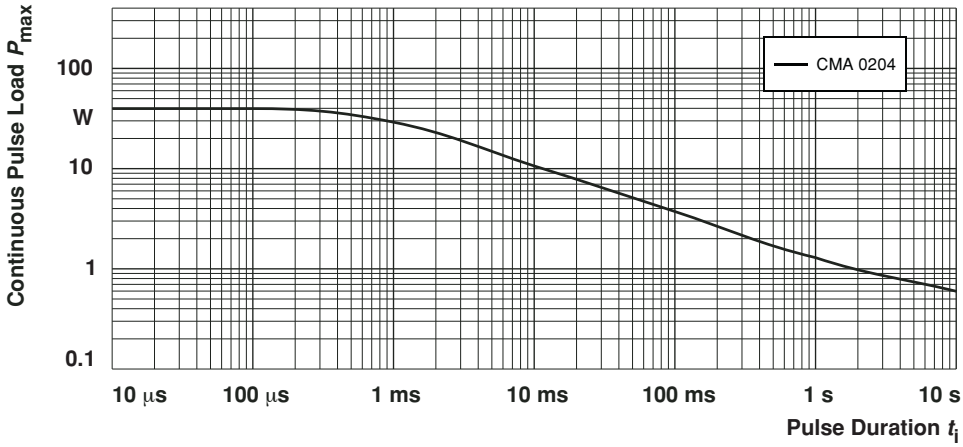


Derating - Power Operation



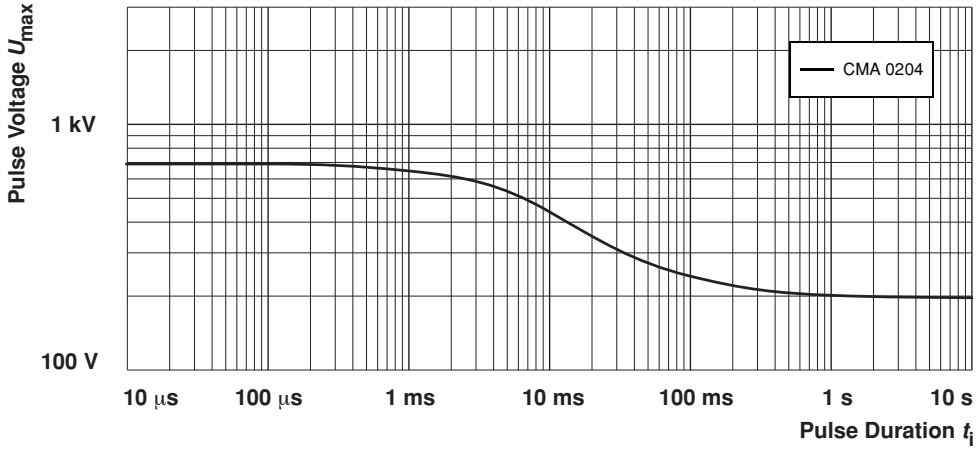
Maximum pulse load, single pulse; for permissible resistance change equivalent to 8000 h operation.

Single Pulse



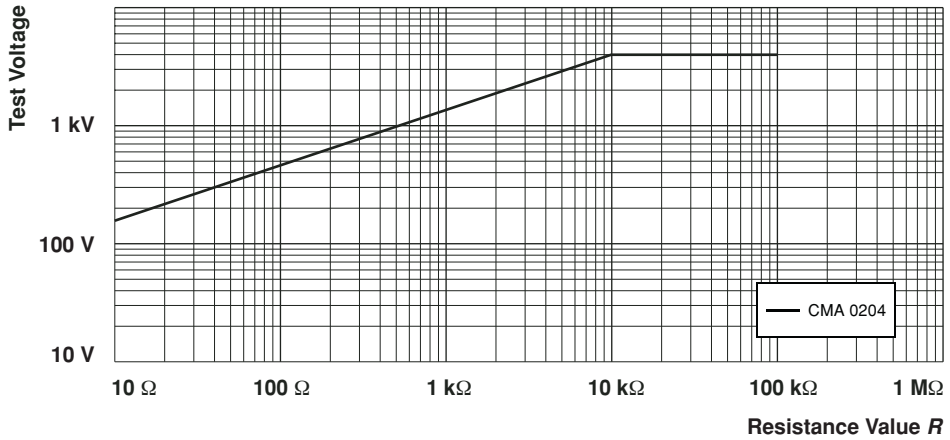
Maximum pulse load, continuous pulses; for permissible resistance change equivalent to 8000 h operation.

Continuous Pulses



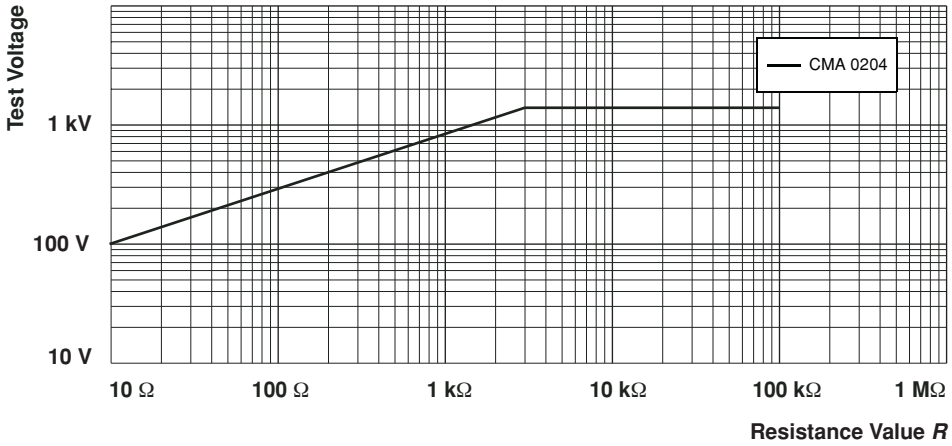
Maximum pulse voltage, single and continuous pulses; for permissible resistance change equivalent to 8000 h operation.

Pulse Voltage



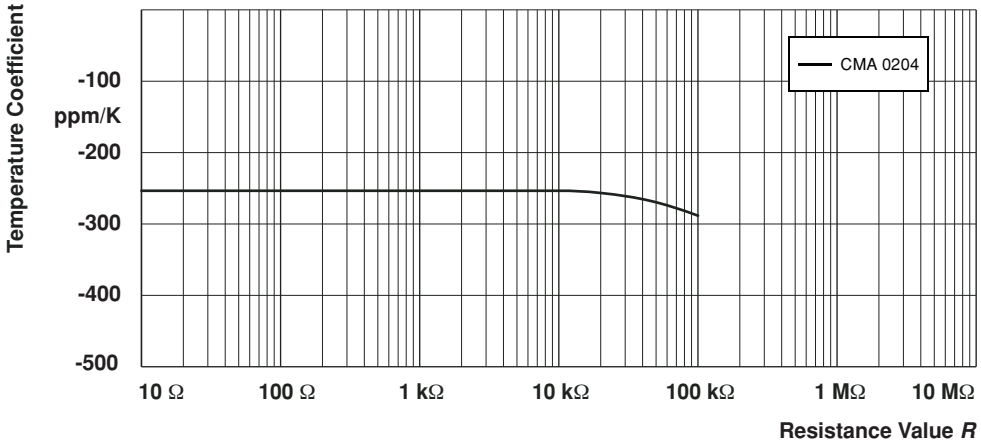
Pulse load rating in accordance with IEC 60115-1, 4.27; 1,2 µs / 50 µs; 5 pulses at 12 s intervals; for permissible resistance change 0.5 %.

1.2/50 Pulse



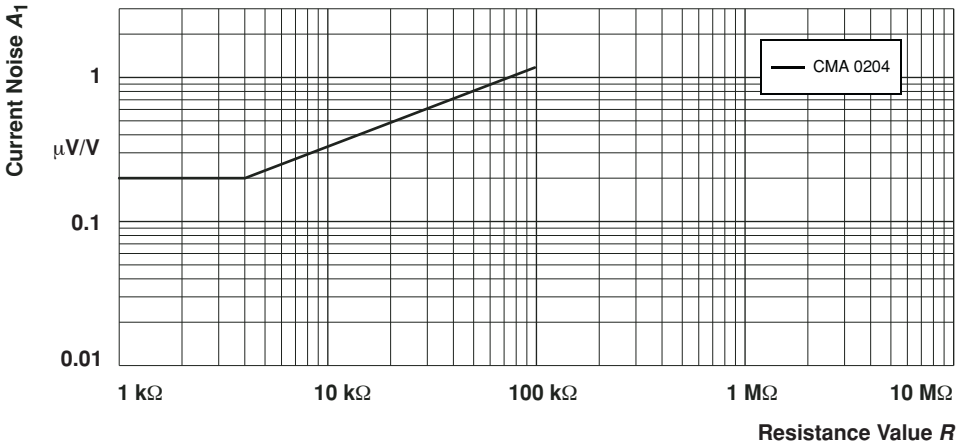
Pulse load rating in accordance with IEC 60115-1, 4.27; 10 μs / 700 μs; 10 pulses at 1minute intervals; for permissible resistance change 0.5 %.

10/700 Pulse



Temperature coefficient of resistance.

Temperature Coefficient (T.C.)



In accordance with IEC 60 195

Current Noise - A_1

TESTS AND REQUIREMENTS

Essentially all tests are carried out in accordance with the following specifications:

EN 60115-1, generic specification

EN 140400, sectional specification

EN 140401-803, detail specification

The Test Procedures and Requirements table contains the applicable tests selected from the documents listed above.

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 printed-circuit boards in accordance with EN 140400, 2.3.3, unless otherwise specified.

The requirements stated in the Test Procedures and Requirements table are based on the required tests and permitted limits of EN 140401-803.

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:	
			CMA 0204	10 Ω to 100 kΩ
4.5	–	resistance	-	± 2 %
4.8.4.2	-	temperature coefficient	at 20 / – 55 / 20 °C and 20 / 125 / 20 °C	see Temperature Coefficient graph
4.25.1	-	endurance at 70 °C: standard operation mode	$U = \sqrt{P_{70} \times R} \leq U_{max}$; 1.5 h on; 0.5 h off; 70 °C; 1000 h 70 °C; 8000 h	 ± (1 % + 0.05 Ω) ± (2 % + 0.05 Ω)
4.25.1	-	endurance at 70 °C: power operation mode	$U = \sqrt{P_{70} \times R} \leq U_{max}$; 1.5 h on; 0.5 h off; 70 °C; 1000 h 70 °C; 8000 h	 ± (2 % + 0.05 Ω) ± (4 % + 0.05 Ω)
4.25.3	-	endurance at upper category temperature	125 °C; 1000 h 155 °C; 1000 h	± (2 % + 0.05 Ω) ± (4 % + 0.05 Ω)
4.24	78 (Cab)	damp heat, steady state	(40 ± 2) °C; 56 days; (93 ± 3) % RH	± (1 % + 0.1 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; 24 h; ≥ 90 % RH; 5 cycles	
			LCT = – 55 °C; UCT = 155 °C	± (1 % + 0.1 Ω) no visible damage
-	1 (Aa)	cold	– 55 °C; 2 h	± (0.5 % + 0.1 Ω)
4.19	14 (Na)	rapid change of temperature	30 minutes at – 55 °C; 30 minutes at + 125 °C; 5 cycles	± (0.5 % + 0.1 Ω)

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: **CMA 0204**	 10 Ω to 100 kΩ
4.13	-	short time overload; standard operation mode	$U = 2.5 \times \sqrt{P_{70} \times R} \leq 2 \times U_{max}$; 5 s	± (0.25 % + 0.1 Ω)
		short time overload; power operation mode	$U = 2.5 \times \sqrt{P_{70} \times R} \leq 2 \times U_{max}$; 5 s	± (0.25 % + 0.1 Ω)
4.29	45 (XA)	component solvent resistance	isopropyl alcohol; 50 °C; method 2	no visible damage
4.30	45 (XA)	solvent resistance of marking	isopropyl alcohol; 50 °C; method 1, toothbrush	marking legible; 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	± (0.5 % + 0.1 Ω)
4.32	21 (Ue_3)	shear (adhesion)	45 N	no visible damage
4.7	-	voltage proof	$U_{rms} = U_{ins}$; 60 s	no flashover or breakdown
4.35	-	flammability	IEC 60 695-2-2, 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 12NC Indicating Resistance Decade table.

Last Digit of 12NC Indicating Resistance Decade

RESISTANCE DECADE	LAST DIGIT
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

Ordering Example

The ordering code of a CMA 0204 resistor, value 47 kΩ with ± 2 % tolerance, supplied in blister tape of 3000 units per reel is: 2312 159 24703.

12NC ORDERING CODE - resistor type and packaging			
DESCRIPTION		**ORDERING CODE 2312 ... .**	
		BLISTER TAPE ON REEL	
TYPE	**TOL.**	**BL**	**B0**
CMA 0204	± 2 %	**159 2....**	149 2....

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