

**Power metal film resistors**

**PR37**

**DESCRIPTION**

A homogeneous film of metal alloy is deposited on a high grade ceramic body. After a helical groove has been cut in the resistive layer, tinned connecting wires of electrolytic copper or copper-clad iron are welded to the end-caps. The resistors are coated with a red, inflammable protective silicon lacquer which can withstand 500 V (RMS). This coating is not resistant to aggressive fluxes. The encapsulation is resistant to all cleaning solvents in accordance with "MIL-STD-202E" method 215, and "IEC 68-2-45".

**MECHANICAL DATA**

**Mass**

40 g (per 100 units).

**Mounting**

The resistors must be mounted stress free so as to allow thermal expansion over the wide permissible temperature range.

The minimum pitch for this type with cropped and formed leads is 7e.

**Marking**

The resistor is marked with the nominal resistance value and the tolerance on the resistance.

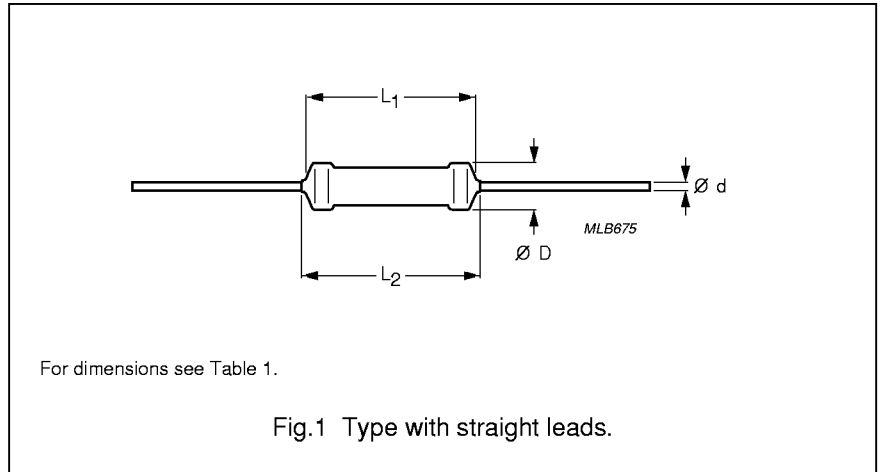
For values up to 910 Ω the R is used as the decimal point.

For values of 1 kΩ and upwards, the letter K is used as the decimal point for the kΩ indication.

For the value of 1 MΩ the letter M is used as the decimal point for the MΩ indication.

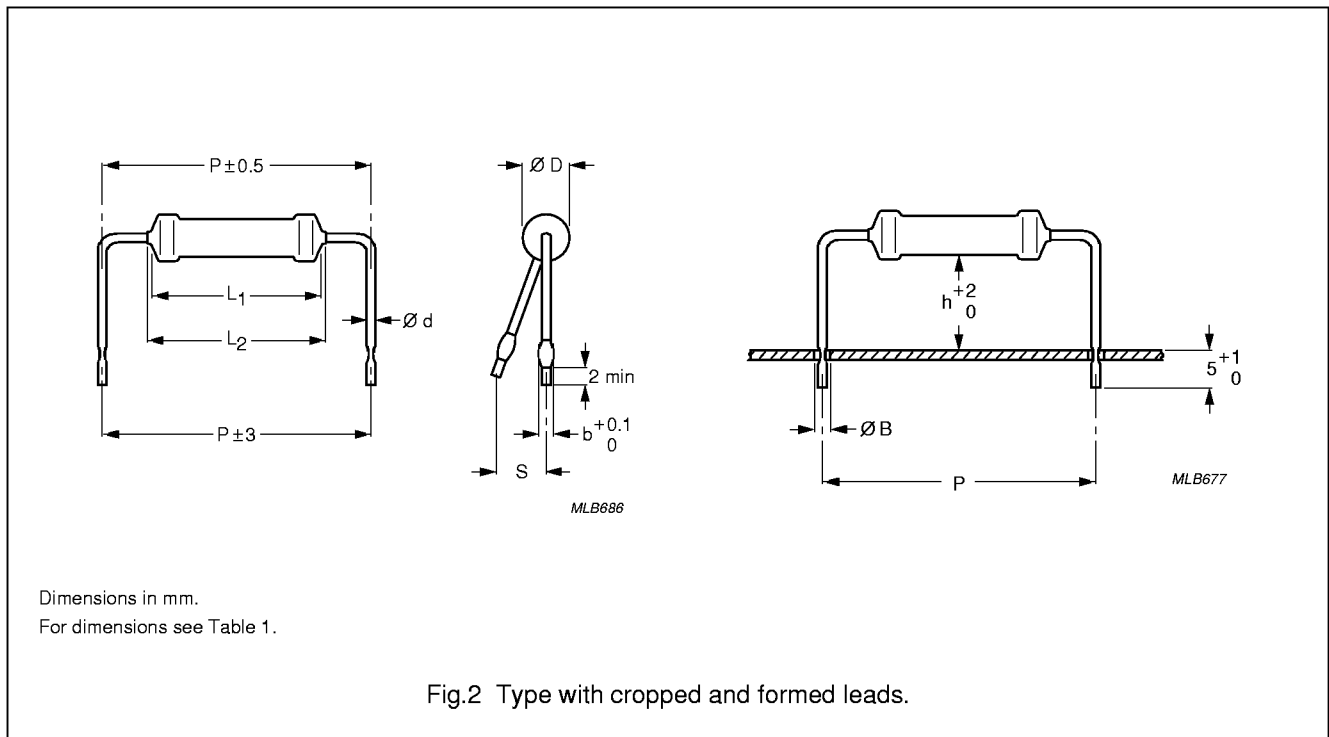
**QUICK REFERENCE DATA**

DESCRIPTION	VALUE
Resistance range	1 Ω to 1 MΩ; E24 series
Resistance tolerance	±5%
Maximum body temperature (hot-spot)	300 °C
Absolute maximum dissipation at T <sub>amb</sub> = 70 °C (P <sub>70</sub> ); see Fig.3: R ≤ 27 kΩ R > 27 kΩ	1.6 W 1.2 W
Maximum permissible voltage	500 V
Basic specifications	IEC 115-4 and MIL-R-11804/2, char. G
Climatic category (IEC 68)	55/200/56
Stability after: load, 1000 hours climatic tests soldering	ΔR/R max.: ±5% +0.1 Ω ΔR/R max.: ±3% +0.1 Ω ΔR/R max.: ±1% +0.05 Ω



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**Table 1** Lead type and physical dimensions; see Figs 1 and 2

LEADS	ØD MAX. (mm)	L <sub>1</sub> MAX. (mm)	L <sub>2</sub> MAX. (mm)	Ød (mm)	b (mm)	h (mm)	P (mm)	S MAX. (mm)	ØB MAX. (mm)
Copper-clad iron	3.9	10	12	0.6	1.1	8	17.8	2	1.0
						15		3	
Copper	3.9	10	12	0.8	1.3	8	17.8	2	1.2
						15		3	

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**ELECTRICAL DATA**

**Standard values of rated resistance and tolerance**

Standard values of rated (nominal) resistance are taken from the E24 series within the range 1 Ω to 1 MΩ. The values of the E24 series are in accordance with "IEC publication 63".

The tolerance on the rated resistance is ±5%.

The limiting voltage (RMS) is 500 V. This is the maximum voltage that may be applied continuously to the resistor element, see "IEC publications 115-1 and 115-4".

The maximum permissible hot-spot temperature is 300 °C.

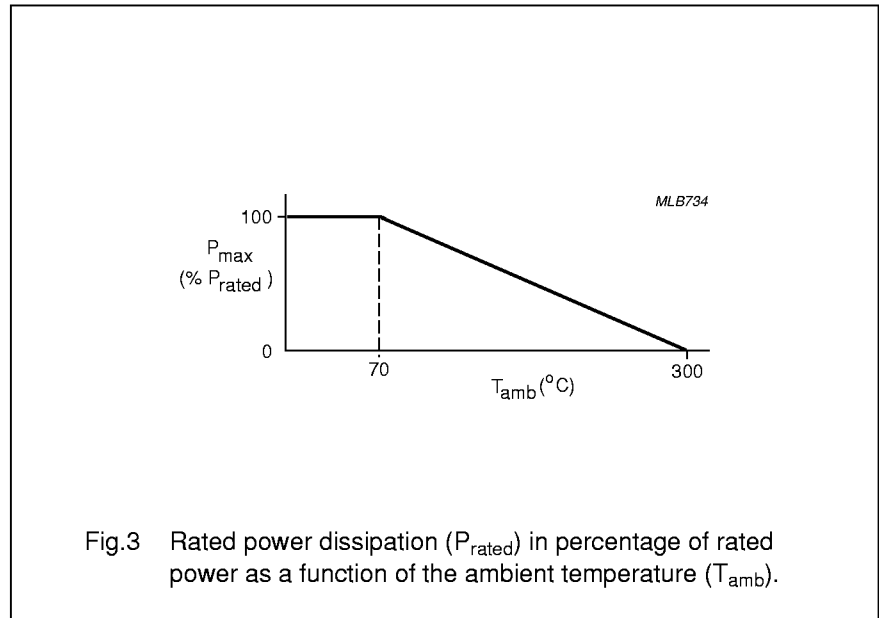


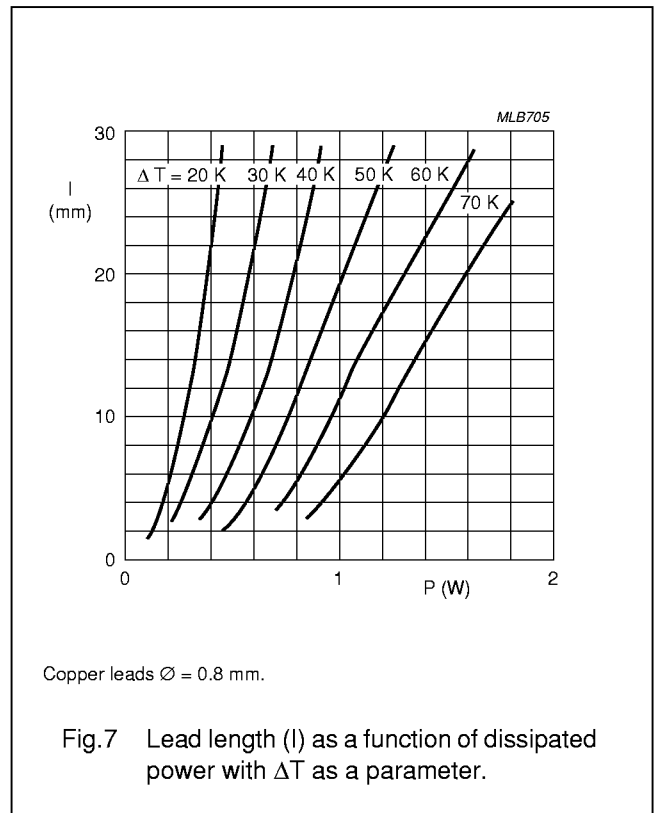
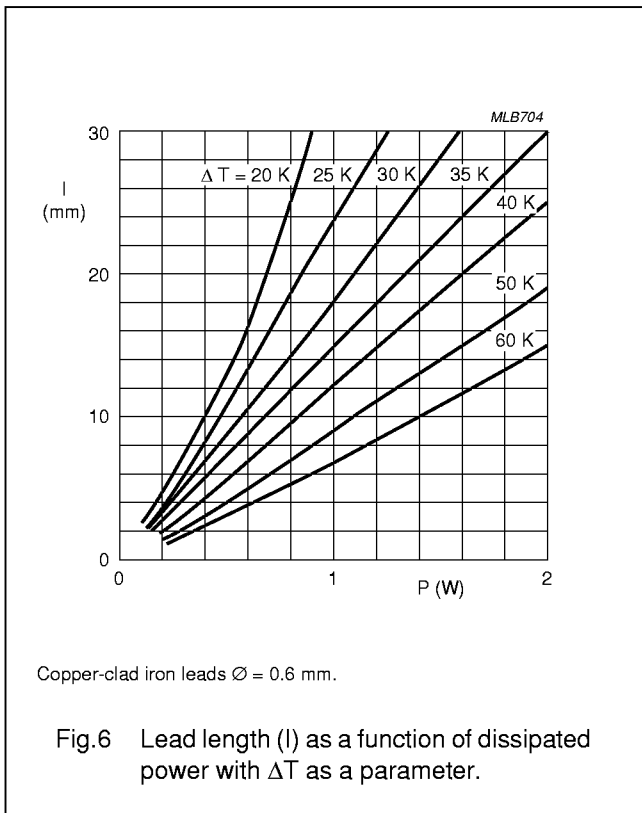
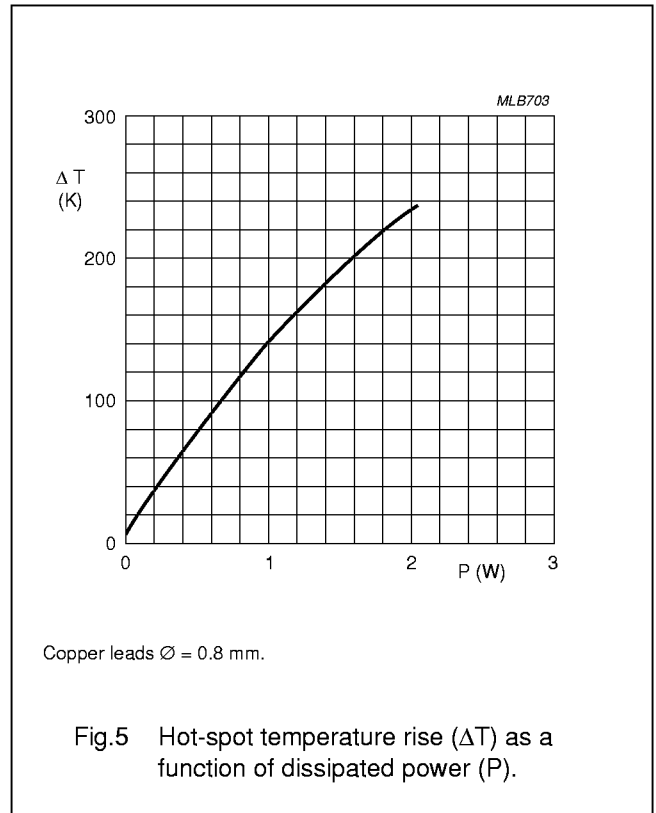
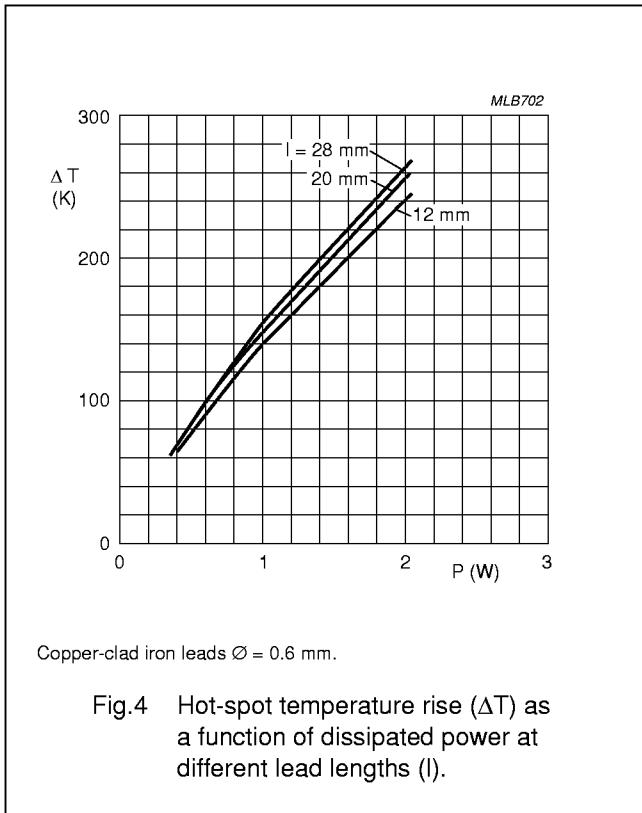
Fig.3 Rated power dissipation (P<sub>rated</sub>) in percentage of rated power as a function of the ambient temperature (T<sub>amb</sub>).

**Table 2** Electrical data

DESCRIPTION	VALUE
Temperature coefficient	R < 10 Ω: ≤ ±350 × 10 <sup>-6</sup> /K
	R ≥ 10 Ω: ≤ ±250 × 10 <sup>-6</sup> /K
Maximum body temperature (hot-spot)	300 °C
Absolute maximum dissipation at T <sub>amb</sub> = 70 °C:	
R ≤ 27 kΩ	1.6 W
R > 27 kΩ	1.2 W
Limiting voltage	500 V
Dielectric withstanding minimum RMS voltage of the insulation for 1 min	500 V
Basic specifications	IEC 115-4 and MIL-R-11804/2, char. G
Climatic category (IEC 68)	55/200/56
Temperature rise (ΔT) of the resistor body as a function of dissipation	see Figs 4 and 5
Lead length (l) as a function of dissipation with temperature rise at end of lead (soldering point) as parameter	see Figs 6 and 7

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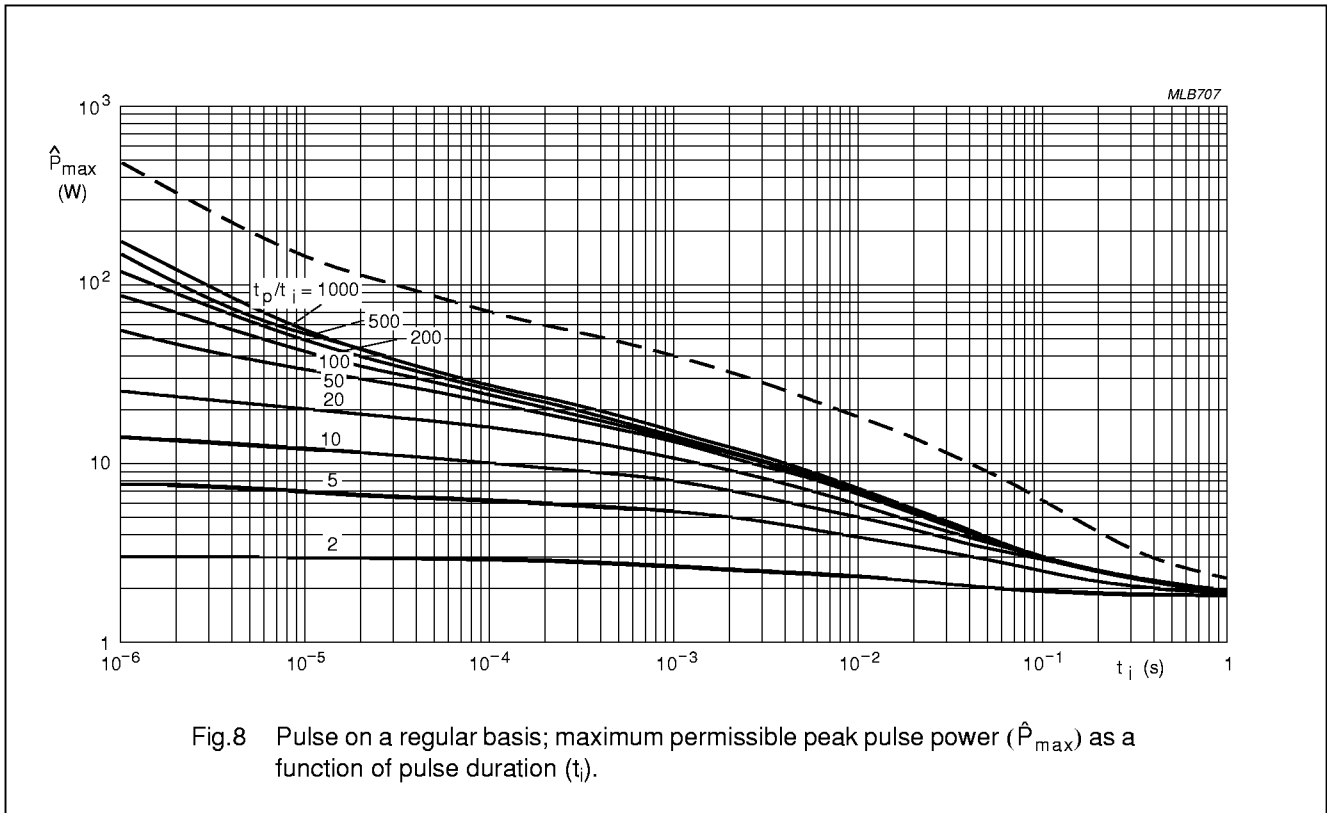


Fig.8 Pulse on a regular basis; maximum permissible peak pulse power ( $\hat{P}_{max}$ ) as a function of pulse duration ( $t_i$ ).

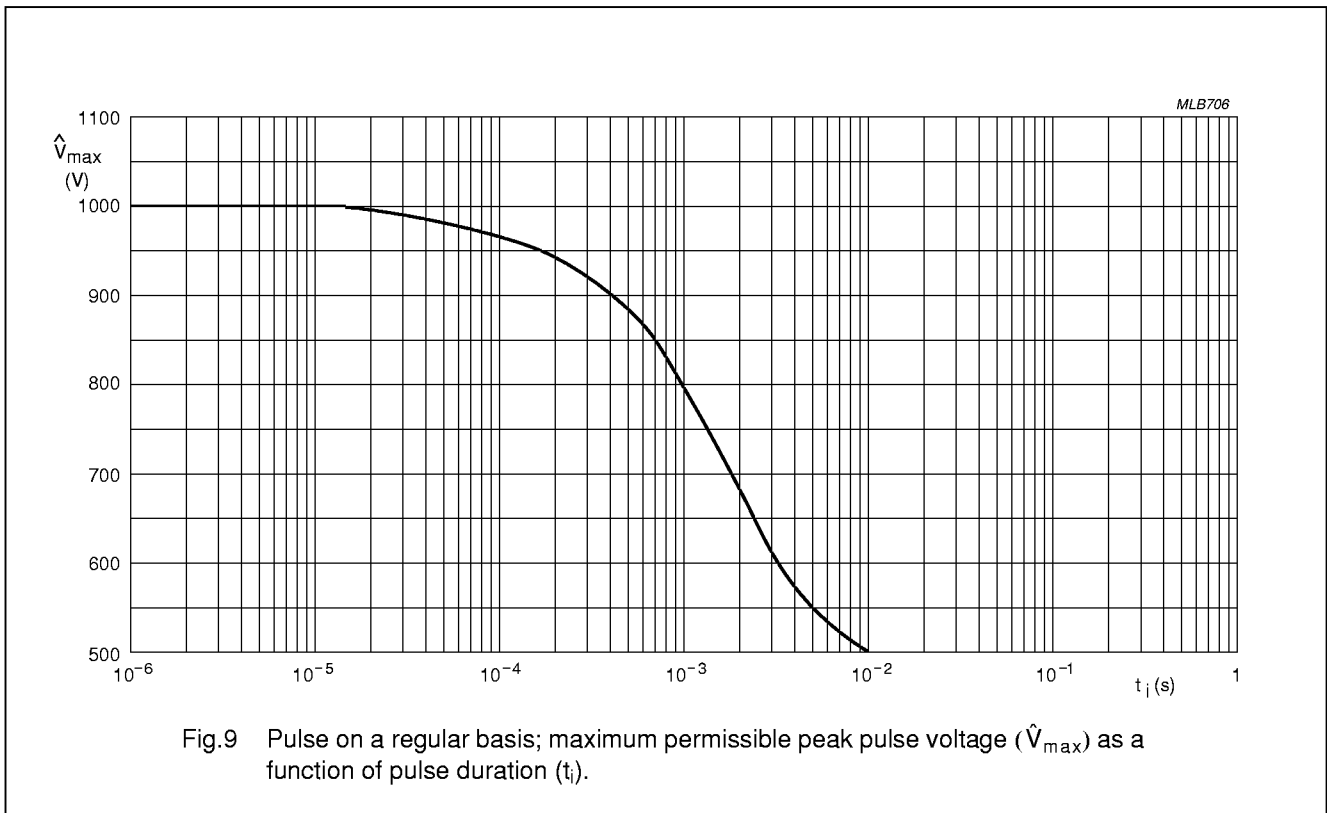
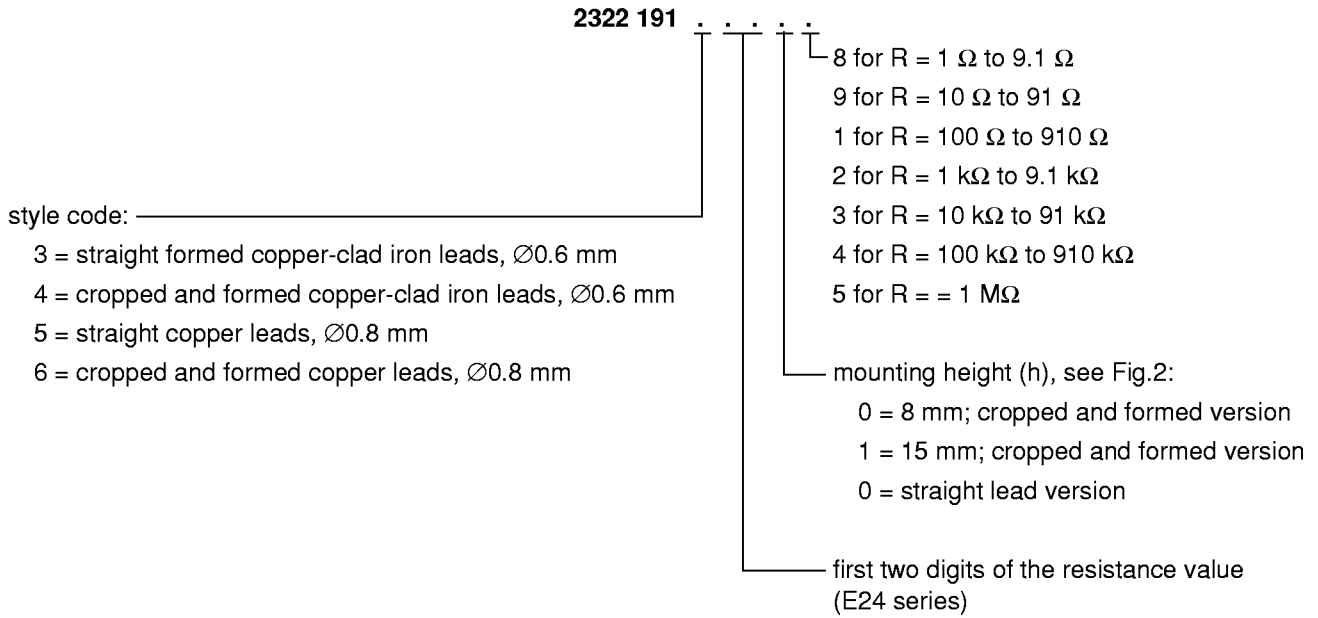


Fig.9 Pulse on a regular basis; maximum permissible peak pulse voltage ( $\hat{V}_{max}$ ) as a function of pulse duration ( $t_i$ ).

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COMPOSITION OF THE CATALOGUE NUMBER



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**TESTS AND REQUIREMENTS**

Essentially all tests are carried out in accordance with the schedule of "IEC publication 115-1", category 55/200/56 (rated temperature range  $-55\text{ }^{\circ}\text{C}$  to  $+200\text{ }^{\circ}\text{C}$ ; damp heat, long term, 56 days). The testing also covers the requirements specified by EIA and EIAJ.

The tests are carried out in accordance with IEC publication 68, "Recommended basic climatic and mechanical robustness testing procedure for electronic components" and under standard atmospheric conditions according to "IEC 68-1", subclause 5.3.

Unless otherwise specified the following values apply:

Temperature:  $15\text{ }^{\circ}\text{C}$  to  $35\text{ }^{\circ}\text{C}$

Relative humidity: 45% to 75%

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

In Table 3 the tests and requirements are listed with reference to the relevant clauses of "IEC publications 115-1 and 68", a short description of the test procedure is also given. In some instances deviations from the IEC recommendations were necessary for our method of specifying.

**Table 3** Test procedures and requirements

IEC115-1 CLAUSE	IEC 68 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
4.16	U	robustness of terminations:		
4.16.2	Ua	tensile all samples	load 10 N; 10 s	number of failures $<1 \times 10^{-6}$
4.16.3	Ub	bending half number of samples	load 5 N; $4 \times 90^{\circ}$	number of failures $<1 \times 10^{-6}$
4.16.4	Uc	torsion other half of samples	$3 \times 360^{\circ}$ in opposite directions	no damage $\Delta R/R$ max.: $\pm 0.5\% + 0.05\ \Omega$
4.17	Ta	solderability	2 s; $235\text{ }^{\circ}\text{C}$ ; flux 600	good tinning; no damage
4.18	Tb	resistance to soldering heat	thermal shock: 3 s; $350\text{ }^{\circ}\text{C}$ ; 6 mm from body	$\Delta R/R$ max.: $\pm 0.5\% + 0.05\ \Omega$
4.19	Na	rapid change of temperature	30 minutes at $-55\text{ }^{\circ}\text{C}$ and 30 minutes at $+155\text{ }^{\circ}\text{C}$ ; 5 cycles	no damage $\Delta R/R$ max.: $\pm 2\% + 0.1\ \Omega$
4.20	Eb	bump	$3 \times 1500$ bumps in three directions; 40 g	no damage $\Delta R/R$ max.: $\pm 0.5\% + 0.05\ \Omega$
4.22	Fc	vibration	frequency 10 to 500 Hz; displacement 1.5 mm or acceleration 10 g; 3 directions; total 6 hours ( $3 \times 2$ hours)	no damage $\Delta R/R$ max.: $\pm 0.5\% + 0.05\ \Omega$
4.23		climatic sequence:		
4.23.2	Ba	dry heat	16 hours; $155\text{ }^{\circ}\text{C}$	
4.23.3	Db	damp heat (accelerated) 1st cycle	24 hours; $55\text{ }^{\circ}\text{C}$ ; 95 to 100% RH	
4.23.4	Aa	cold	2 hours; $-55\text{ }^{\circ}\text{C}$	
4.23.5	M	low air pressure	1 hour; 8.5 kPa; 15 to $35\text{ }^{\circ}\text{C}$	
4.23.6	Db	damp heat (accelerated) remaining cycles	5 days; $55\text{ }^{\circ}\text{C}$ ; 95 to 100% RH	$R_{\text{ins}}$ min.: 1000 M $\Omega$ $\Delta R/R$ max.: $\pm 3\% + 0.1\ \Omega$

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IEC 115-1 CLAUSE	IEC 68 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
4.24.2	Ca	damp heat (steady state)	56 days; 40 °C; 90 to 95% RH; dissipation $0.01 \times P_{70}$	$R_{ins}$ min.: 1 000 M $\Omega$ $\Delta R/R$ max.: $\pm 3\% + 0.1 \Omega$
4.25.1		endurance	1 000 hours; 70 °C; $P_{70}$ or $V_{max}$	$\Delta R/R$ max.: $\pm 5\% + 0.1 \Omega$
4.8.4.2		temperature coefficient	between -55 °C and +155 °C	$R < 10 \Omega$ : $\leq \pm 350 \times 10^{-6}/K$ $R \geq 10 \Omega$ : $\leq \pm 250 \times 10^{-6}/K$
4.7		voltage proof on insulation	500 V (RMS) for 1 minute; V-block method	no breakdown
4.12		noise	IEC publication 195	
4.6.1.1		insulation resistance	500 V (DC) for 1 minute; V-block method	$R_{ins}$ min.: 1 000 M $\Omega$
see 2nd amendment to IEC 115-1, Jan. '87 and present 40 central office 532 & 533		pulse load		see Figs 8 and 9



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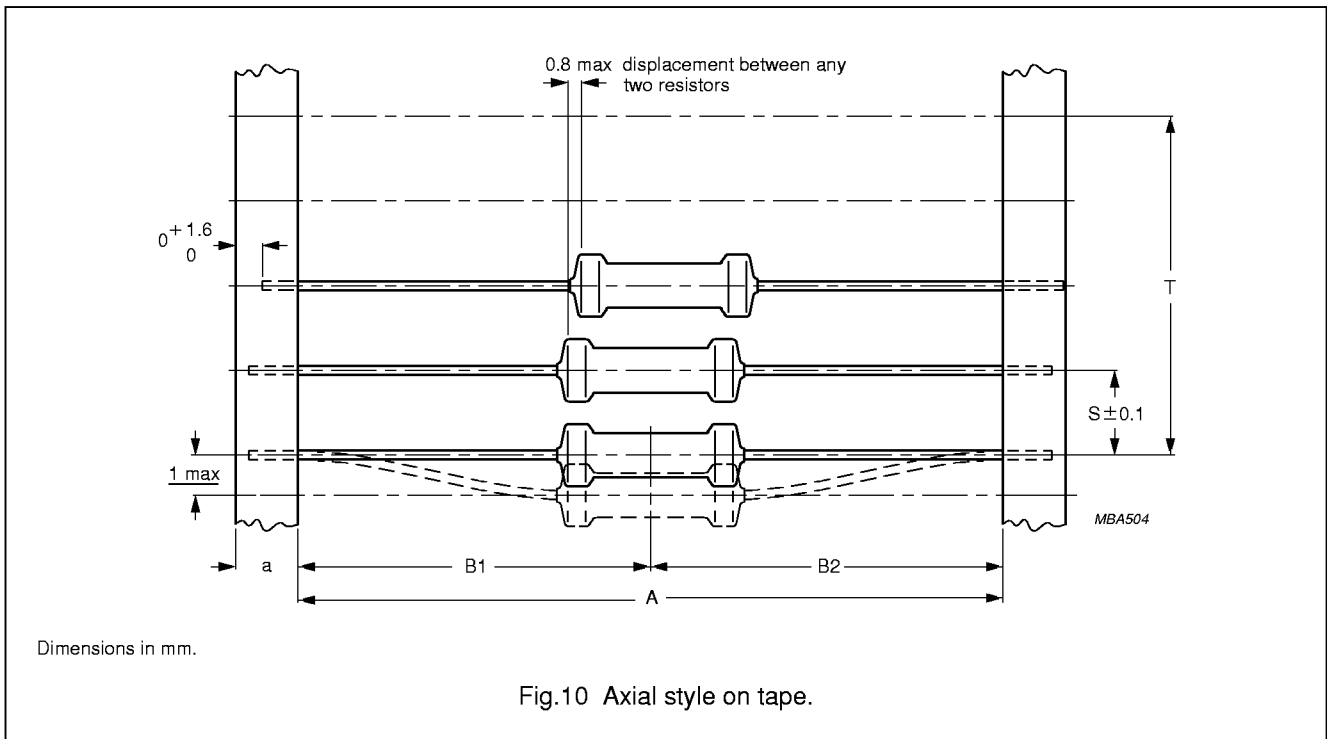
**PACKAGING**

The resistors may be supplied on bandolier in ammpack. Those with bent leads are supplied loose in a box. For details refer to this handbook, section "General Introduction leaded resistors".

**Dimensions of the packaging**

STYLE	PACKAGING	MOUNTING HEIGHT (mm)	QUANTITY PER BOX	
			ON BANDOLIER	BULK
Straight leads	ammpack	—	1 000	—
Cropped and formed leads	loose in box	8	—	1 000
		15	—	500

**Tape and reel data**



**Dimensions of bandolier**

a (mm)	A (mm)	B <sub>1</sub> - B <sub>2</sub>   (mm)	S (mm)	T (deviation of spacing)
6 ± 0.5	73 ± 1.5	± 1.2	5	max. 1 mm per 10 spacings max. 0.5 mm per 5 spacings

**Dimensions of box**

STYLE	QUANTITY	M (mm)	N (mm)	P (mm)
Ammpack	1 000	97	59	262
Loose in box	500 or 1 000	105	70	205