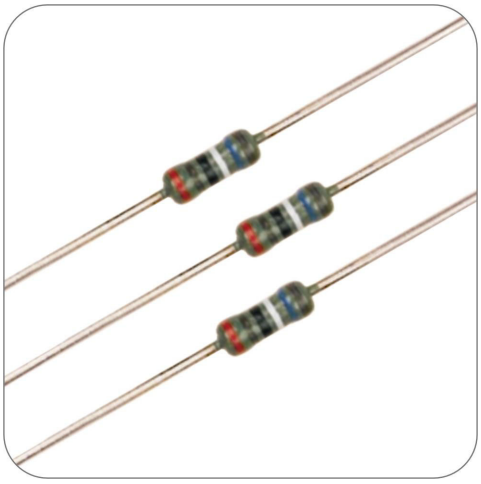
PROFESSIONAL FILM RESISTOR - MRS25

FEATURES

- Metal film technology
- Precision resistors in small outlines
- Low noise
- Non-flammable
- Defined pulse loading capabilities
- High stability and uniformity characteristics
- Various packing and taping configurations
- Various forming styles available
- Lower tolerance is available (0.5%)



MARKET SEGMENTS AND APPLICATIONS

INDUSTRY SECTOR	APPLICATION SEGMENT	END-USER EQUIPMENT
Industrial	Controls	Electrical testers Power system control Instruments (measuring) Surface scanners
	Security	Electric fence energizer
	Control / medical	Blood analyzers
Automotive	Engine management	Electronic fuel injection system
Consumer	Sound & Vision	Amplifiers, TV Professional audio equipment

TECHNOLOGY

A homogeneous film of metal alloy is deposited on a hit grade ceramic body. After a helical groove has been cut in the resistive layer, tinned connecting wires of electrolytic are welded copper to the end-caps. The resistors are coated with a green non-flammable lacquer that provides electrical, mechanical, and climatic protection. The encapsulation is resistant to all cleaning solvents in accordance with MIL-STD 202, method 215 e IEC 68-2-45.

QUICK REFERENCE DATA

DESCRIPTION	MRS25 ±1% (E24/E96 series)
	Cu-lead
Resistance range	1 Ω - 10 MΩ
Maximum dissipation: T_{amb} = 70 °C	0.60 W
Thermal resistance (R_{th})	150 K/W
Limiting voltage (DC or RMS)	350 V
Rated voltage (1)	$\sqrt{Pn \times R}$
Temperature Coefficient:	≤ ±50 ppm/°C
Basic specifications	IEC 60115-1 and 60115-2
Climatic category (IEC 60068)	55/155/56
Stability $\Delta R/R_{max}$ after:	
Load	±0.5% + 0.05 Ω
Climatic tests	±0.5% + 0.05 Ω
Resistance to soldering heat	±0.1% + 0.05 Ω
Short time overload	±0.25% + 0.05 Ω

(1) Maximum rated voltage is the limiting voltage

MECHANICAL DATA

AXIAL STYLE

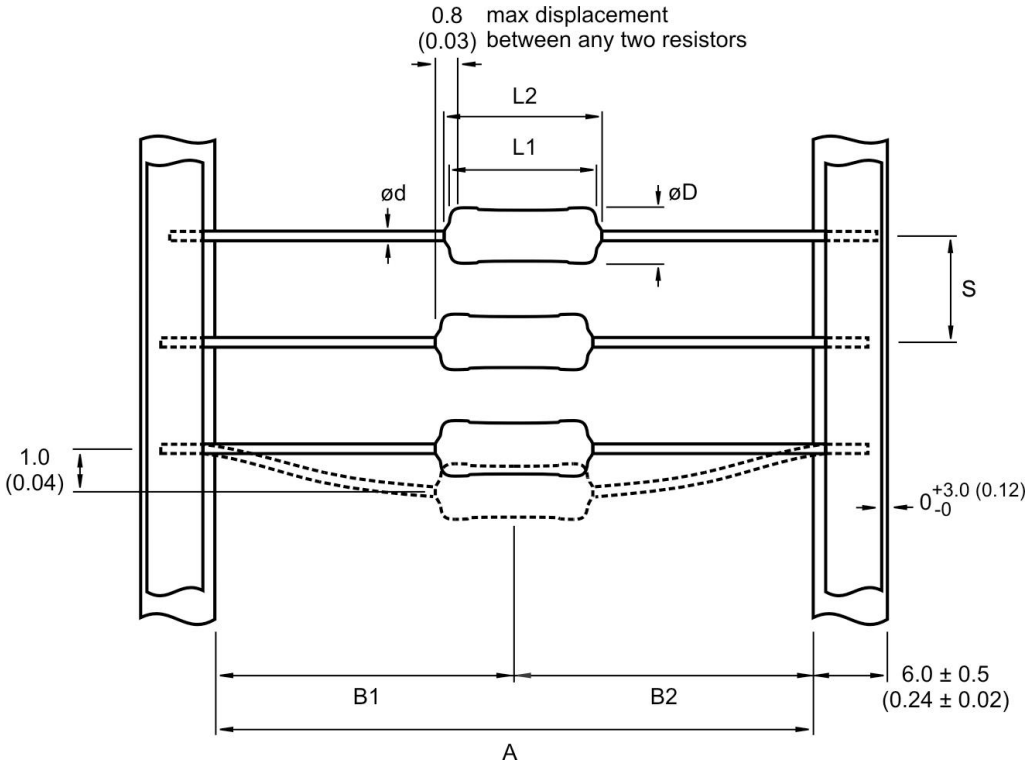


Fig. 1

Table 1. Mechanical Data.

PRODUCT	A	L1 max	L2 max	ϕD max	B1- B2	ϕd	S	WEIGHT gr/100 pcs
MRS25	52.0 + 1.5 / - 0.0 (2.05 + 0.06 / - 0.00)	6.5 (0.26)	7.0 (0.28)	2.5 (0.10)	±1.2 (±0.05)	0.58 ±0.05 (0.023 ±0.002)	5.0 ±0.1 (0.20 ±0.01)	22.0
	26.0 ±1.5 (1.03 ±0.06)							16.0

Dimensions unless specified in mm (inches)

MOUNTING

The resistors are suitable for processing on automatic insertion equipment, cutting and bending machines. A radial taped version economizes space on the PCB. The double kink style offers great advantages for manual insertion improving the mounting stability for the customer. They have a real snap in function to fix the resistor in PCB without weakening the connecting leads.

ELECTRICAL CHARACTERISTICS

DERATING

The power that the resistor can dissipate depends on the operating temperature.

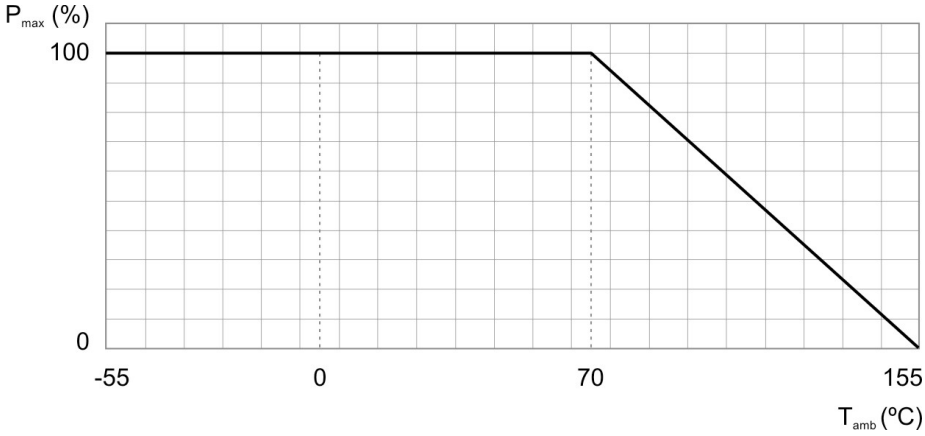


Fig. 2. Maximum dissipation (P_{max}) in percentage of rated power as a function of ambient temperature (T_{amb})

APPLICATION INFORMATION

Hot spot

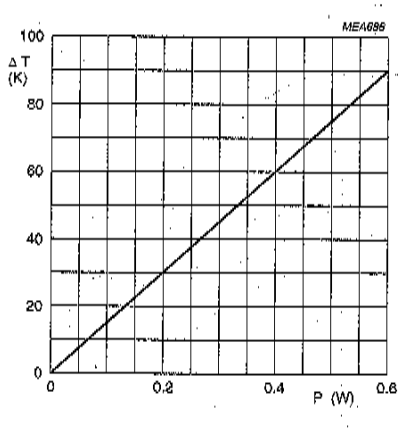


Fig. 3. Hot spot temperature rise (ΔT) as a function of dissipated power

Solder spot

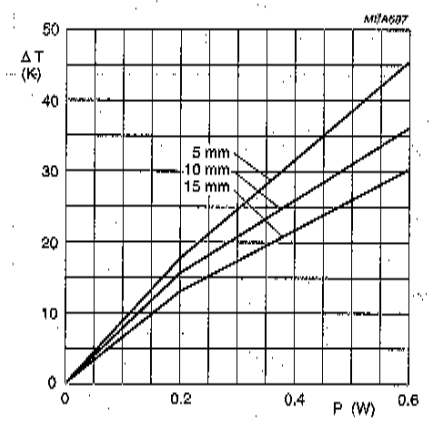


Fig. 4. Temperature rise (ΔT) at the lead (solder spot) as a function of dissipated power at various Lead lengths after mounting

Note: The maximum permissible hot spot temperature is 155 °C

PULSE LOADING CAPABILITIES

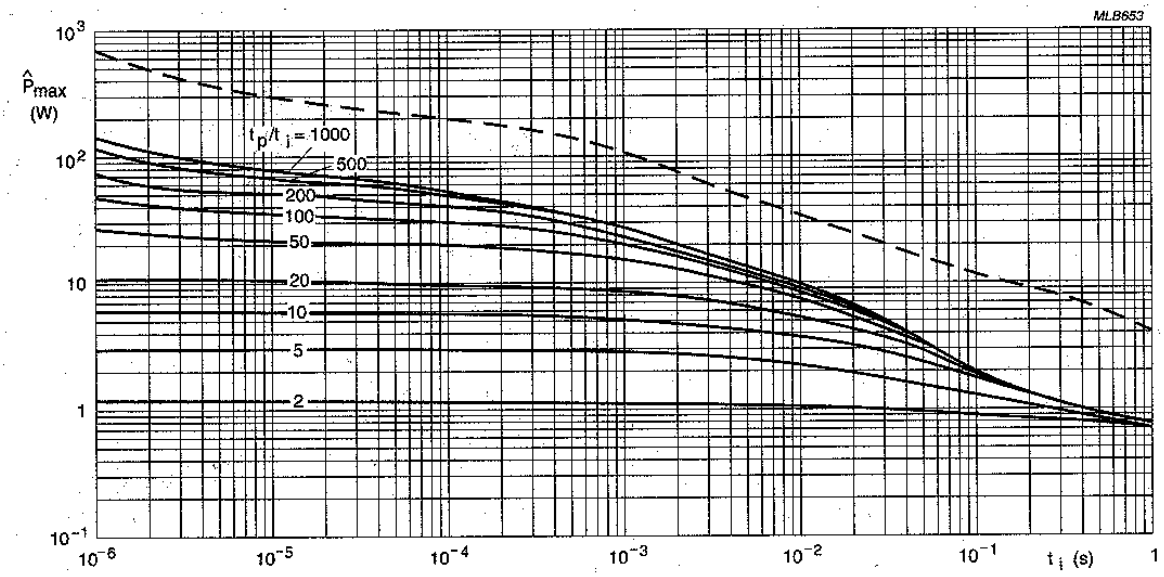


Fig. 5. Pulse on a regular basis, maximum permissible peak pulse power (^P_{max}) as a function of pulse duration (ti)

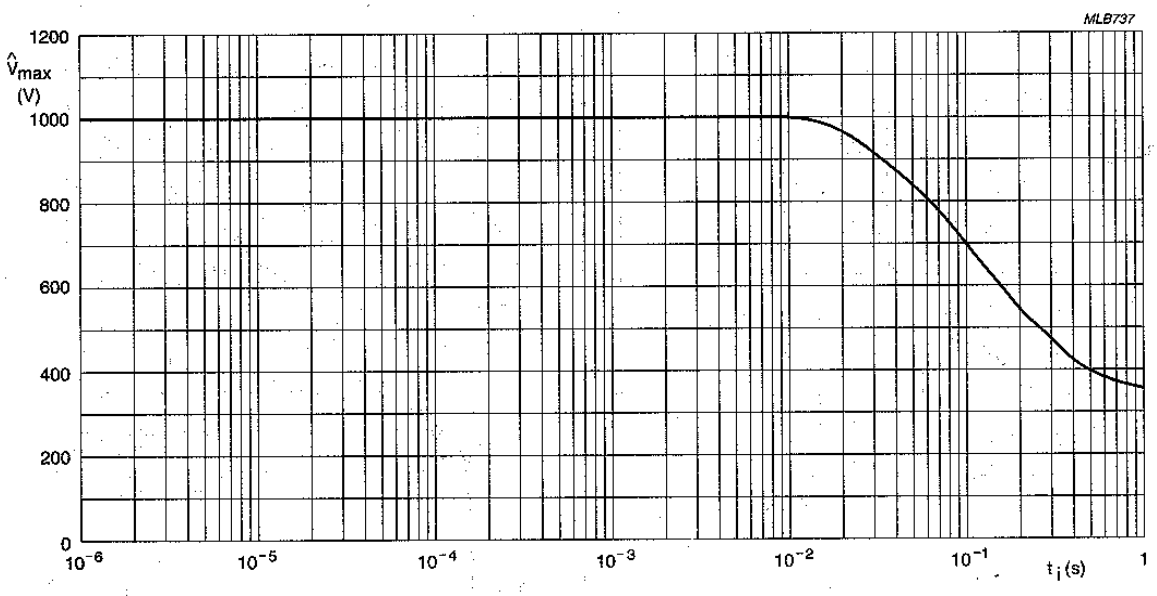


Fig. 6. Pulse on a regular basis, maximum permissible peak pulse voltage (^V_{max}) as a function of pulse duration (ti)

MARKING

The nominal resistance and tolerance are marked on the resistor using five colored bands in accordance with IEC publication 60062 “color code for fixed resistors”. Standard values of nominal resistance are taken from the E24/E96 series for resistors with a tolerance of 1%. The values of the E24/E96 series are in accordance with IEC publication 60063.

ORDERING INFORMATION

Table 2. Ordering code.

LEAD ∅	TOL	TAPING	QTY pcs	PACKAGING	ORDERING CODE
0.58 Cu (0.023)	±1%	26.0 (1.03)	4000	AMMOPACK	**2306 156 4xxxx**
		52.0 (2.05)	1000	AMMOPACK	**2322 156 1xxxx**
			5000	AMMOPACK	**2322 156 2xxxx**
			5000	REEL	**2322 156 3xxxx**

Dimensions unless specified in mm (inches)

The resistors have a 12 digit ordering code starting with 23.
The subsequent 6 digits indicate the resistor type and packaging see table 2.
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 table 3.

Table 3. Last digit of ordering code.

RESISTANCE DECADE	LAST DIGIT
1 – 9.76 Ω	8
10 – 97.6 Ω	9
100 – 976 Ω	1
1 – 9.76 kΩ	2
10 – 97.6 kΩ	3
100 – 976 kΩ	4
1 – 9.76 MΩ	5
10 MΩ	6

Example:
MRS25, 1.21 kΩ, ±5%, taping distance 52.0 mm, ammopack 1000 pcs is **2322 156 11212**

NAFTA ORDERING INFORMATION

Table 4. NAFTA ordering code.

LEAD ∅	TOL	TAPING	QTY pcs	PACKAGING	NAFTA ORDERING CODE
0.58 Cu (0.023)	±1%	52.0 (2.05)	1000	AMMOPACK	**5053MCxxxxxF08AF5**
		52.0 (2.05)	5000	AMMOPACK	**5053MCxxxxxF18AF5**
		52.0 (2.05)	5000	REEL	**5053MCxxxxxF12AF5**
		26.0 (1.03)	4000	AMMOPACK	**5053MCxxxxxF26M**

Dimensions unless specified in mm (inches)

The ohmic value in the NAFTA ordering code (see table 4) is represented by the “xxxxx” in the middle of the above ordering code. Table 5 gives some examples how to use these 5 digits.

Table 5. Ohmic value examples.

VALUE	5 DIGITS
1 Ω	1R000
10 Ω	10R00
100 Ω	100R0
1 kΩ	1K000
10 kΩ	10K00
100 kΩ	100K0
1 MΩ	1M000

PACKAGING

TAPE IN AMMOPACK

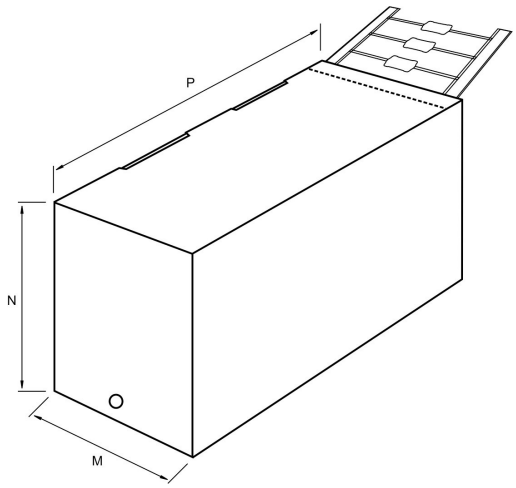


Table 6. Ammopack.

PRODUCT	TAPING	M	N	P	QTY pcs
MRS25	52.0 + 1.5 / - 0.0 (2.05 + 0.06 / - 0.00)	78 (3.1)	98 (3.9)	260 (10.3)	5000
		82 (3.3)	28 (1.2)	262 (10.4)	1000
	26.0 ±1.5 (1.03 ±0.06)	50 (1.9)	96 (3.8)	256 (10.1)	4000

Dimensions unless specified in mm (inches)

TAPE IN REEL

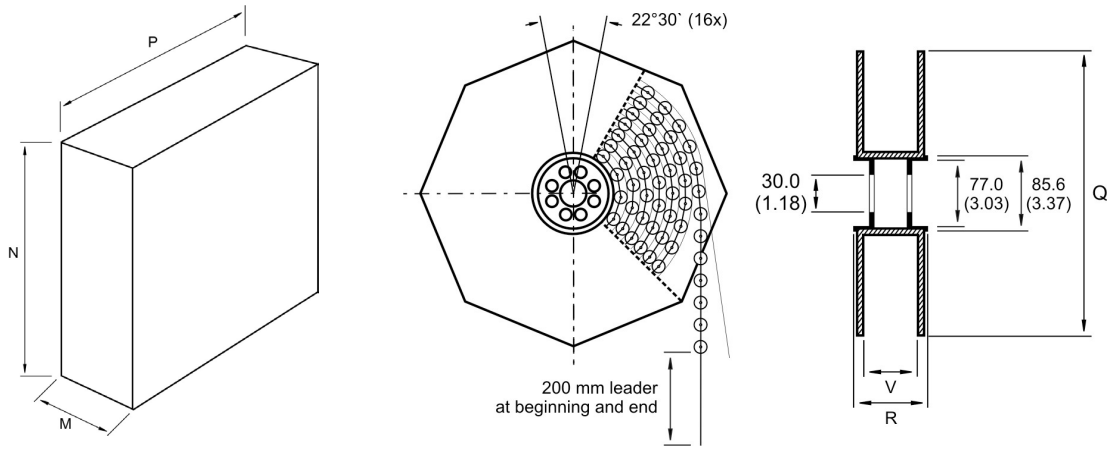


Table 7. Reel.

PRODUCT	TAPING	M	N	P	Q	V	R	QTY pcs
MRS25	52.0 + 1.5 / - 0.0 (2.05 + 0.06 / - 0.00)	92 (3.7)	311 (12.3)	311 (12.3)	305 (12.1)	75 (2.9)	86 (3.4)	5000

Dimensions unless specified in mm (inches)

TESTS AND REQUERIMENTS

Essentially all tests are carried out in accordance to the schedule of IEC publications 60115 – 1, category 55/155/56 (rated temperature range – 55 to + 155 °C; damp heat, long term, 56 days and along the lines of IEC publications 60068-2); “Recommended basic climatic and mechanical robustness testing procedure for electronic components” and under standard atmosphere conditions according to IEC 60068-1 subclause 5.3, unless otherwise specified.
In some instances deviations from IEC applications were necessary for our method specified.

Table 8. Test and requirements.

IEC 60115-1 CLAUSE	IEC 60068-2 TEST METHOD	TEST	PROCEDURE	REQUEREMENTS
4.6.1.1	-	Insulation resistance	500 V (DC) during 1 minute; V-block method	$R_{ins\ min}$ 10^4 MΩ
4.7	-	Voltage proof on insulation	700 V (RMS) during 1 minute; V-block method	No breakdown or flashover
4.8	-	Temperature coefficient	Between - 55 °C and + 155 °C	≤ ±50 ppm/°C
4.12	-	Noise	IEC publication 60195 R ≤ 1MΩ R > 1MΩ	 ≤ 0.1 µV/V ≤ 1.5 µV/V
4.13	-	Short time overload	Room temperature; P = 6.25 x Pn; 5 s ON and 45 s OFF (V ≤ 2 x V_{max}); 10 cycles	$\Delta R/R_{max}$ ±0.25% + 0.05 Ω
4.16	21(U)	Robustness of terminations:		No damage $\Delta R/R_{max}$ ±0.1% + 0.05 Ω
4.16.2	21(Ua1)	Tensile all samples	Load 10 N, 10s	
4.16.3	21(Ub)	Bending half number of samples	Load 5 N, 4 x 90°	
4.16.4	21(Uc)	Torsion other half of samples	3 x 360 °C in opposite directions	

IEC 60115-1 CLAUSE	IEC 60068-2 TEST METHOD	TEST	PROCEDURE	REQUEREMENTS
4.17	20(Ta)	Solderability (after aging)	16 h 155 °C; leads immersed in flux 600, leads immersed 2 mm for 2 ±0.5 s in a solder bath at 235 ±5 °C	Good tinning (≥ 95% covered); no damage
4.18	20(Tb)	Resistance to soldering heat	Thermal shock: 3 s; 350 °C; 6 mm from body	$\Delta R/R_{max}$ ±0.1% + 0.05 Ω
4.19	14(Na)	Rapid change of temperature	30 minutes at – 55 °C and 30 minutes at + 155 °C; 5 cycles	No visual damage $\Delta R/R_{max}$ ±0.1% + 0.05 Ω
4.22	6(Fc)	Vibration	Frequency 10 to 500Hz; displacement 1.5 mm or acceleration 10g; three directions; total 6 h (3 x 2 h)	No damage $\Delta R/R_{max}$ ±0.1% + 0.05 Ω
4.23		Climatic sequence:		$R_{ins\ min}$ 10^3 MΩ $\Delta R/R_{max}$ ±0.5% + 0.05 Ω.
4.23.2	2(Ba)	Dry heat	16 h, 155 °C	
4.23.3	30(Db)	Damp heat (accelerated) 1st cycle	24 h; 25 ºC to 55 °C; 90 to 100% R.H	
4.23.4	1(Aa)	Cold	2 h; - 55 °C	
4.23.6	30(Db)	Damp heat (accelerated) remaining cycles	5 days; 25 ºC to 55 °C; 90 to 100% R.H.	
4.24	3(Ca)	Damp heat (steady state)	56 days; 40 °C; 90 to 95% R.H. loaded with 0.01 Pn	$R_{ins\ min}$ 10^3 MΩ $\Delta R/R_{max}$ ±0.5%+ 0.05 Ω
4.25.1	-	Endurance (at 70°C)	1000 h; loaded with Pn or V_{max}; 1.5 h ON and 0.5 h OFF	$\Delta R/R_{max}$ ±0.5% + 0.05 Ω
4.25.3	-	Endurance at upper category temperature	1000 h at 155 °C	$\Delta R/R_{max}$ ±0.5% + 0.05 Ω
4.29	45 (Xa)	Component solvent resistance	Isopropyl alcohol followed by brushing in accordance with MIL STD 202	No visual damage
See 2nd amendment to IEC 60115-1		Pulse load		See Figs. 5 and 6