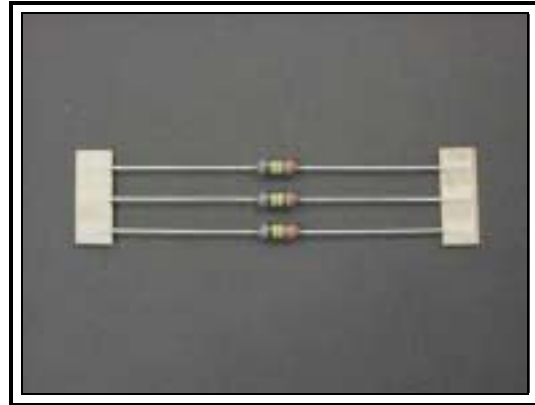


PRECISION FILM RESISTOR – MRS25

FEATURES

- Metal film;
- Precision resistors in small outlines;
- Low noise;
- Non-flammable;
- Defined pulse loading capabilities;
- High stability and uniformity characteristics;
- Several packing and taping configurations;
- Different forming styles available;
- Minor 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 high grade ceramic body. After a helical groove has been cut in the resistive layer, tinned connecting wires 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 202E, method 215" e "IEC 68-2-45".

MRS25

QUICK REFERENCE DATA

DESCRIPTION	MRS25± 1% ⁽²⁾ (E-24 / E-96 series)
	Cu-lead
Resistance range	1Ω to 10MΩ
Temperature Coefficient:	≤ ± 50 ppm/°C
Maximum dissipation T _{amb} = 70°C	0.60W
Thermal resistance (R _{th})	150 K/W
Limiting voltage (DC or RMS)	350V
Rated voltage ⁽¹⁾	$\sqrt{P_n \times R}$
Basic specifications	IEC 60115-1 and 60115-2
Climatic category (IEC 60068)	55/ 155/ 56
Stability after:	
Load:	ΔR/R _{max.} : ±0.5% + 0.05Ω
Climatic tests:	ΔR/R _{max.} : ±0.5% + 0.05Ω
Resistance to soldering heat	ΔR/R _{max.} : ±0.1% + 0.05Ω
Short time overload	ΔR/R _{max.} : ±0.25% + 0.05Ω

Note:

- 1- Maximum rated voltage is the "Limiting voltage".
- 2- 0.5% available on request.

MECHANICAL DATA

Axial style

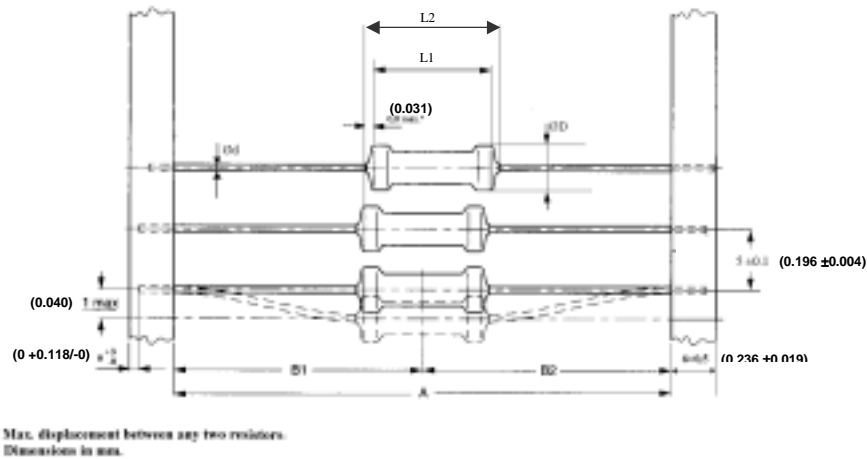


Table 1.

Product	A	L1max	L2max	ϕd	Dmax	B1-B2	Mass per 100 units
MRS25	52 +1.5/-0 (2.047 +0.059/-0)	6.5 (0.256)	7.0 (0.276)	0.58 ± 0.05 (0.023 ±0.002)	2.5 (0.098)	± 1.2 (±0.047)	22.0g
	26 ± 1.5 (1.024 ±0.059)						16.0g

Dimensions in mm / (Inches)

MOUNTING

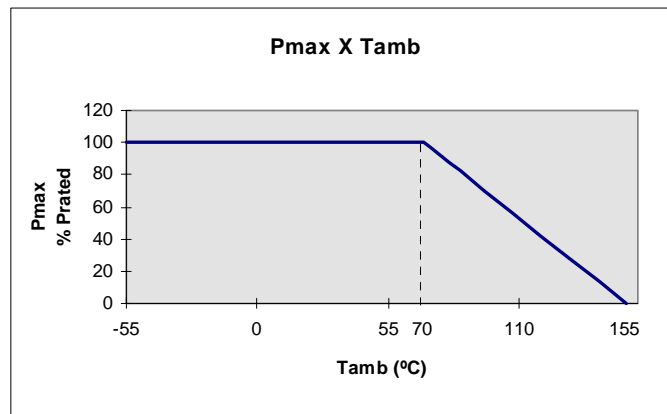
The resistors are suitable for processing on automatic insertion equipment, cutting and bending machines. A radial taped version economizes space on the PCB. The double kink style offers great advantages for manual insertion improving the mounting stability for the customer. They have a real *snap in*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

MRS25

ELECTRICAL CHARACTERISTICS

DERATING

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



Maximum dissipation (Pmax) in percentage of rated power as a function of the ambient temperature (Tamb)

APPLICATION INFORMATION

Hot-spot

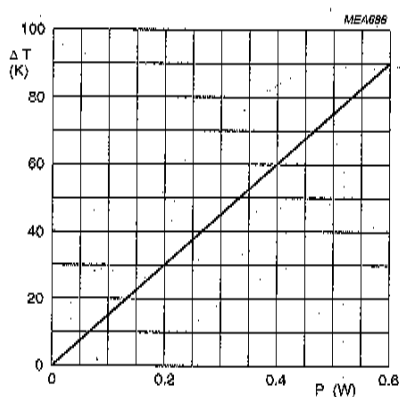


Fig. 1 - Hot spot temperature rise (ΔT) as a function of dissipated power.

Solder-spot

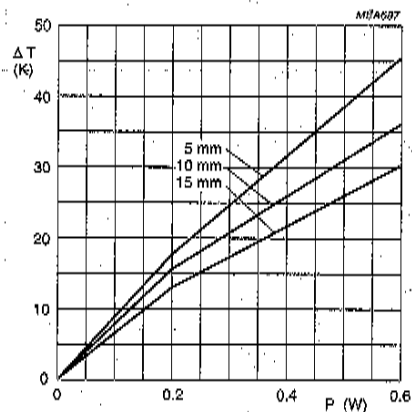


Fig. 2 - Temperature rise (ΔT) at the lead (soldering point) as a function of dissipated power at various lead lengths after mounting.

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

PULSE LOADING CAPABILITIES

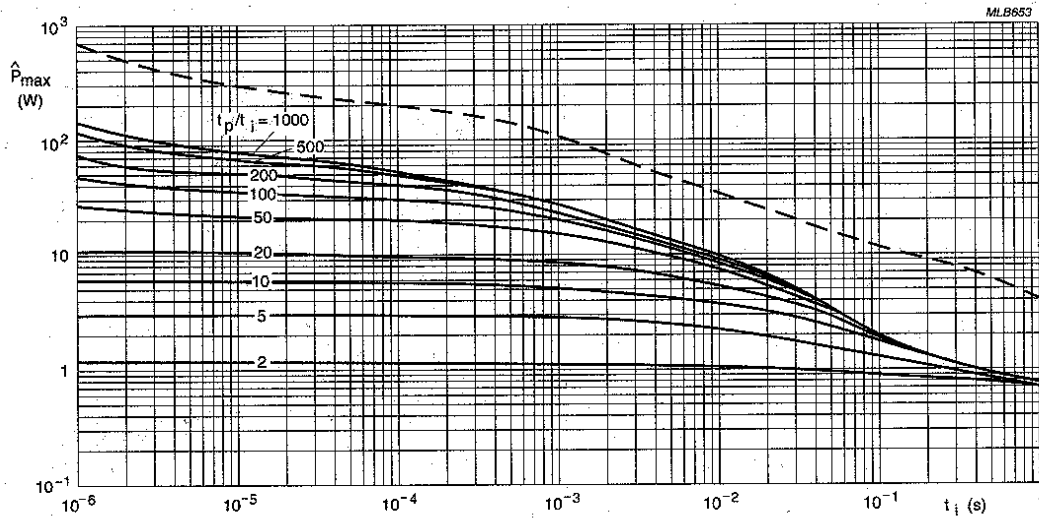


Fig. 3 - Pulse on a regular basis, maximum permissible peak pulse power (\hat{P}_{max}) as a function of pulse duration (t_i).

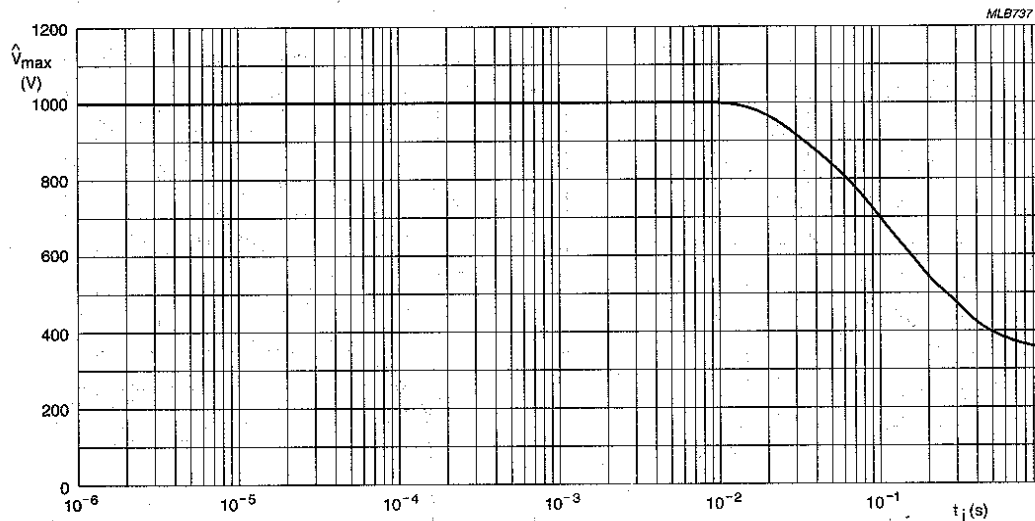


Fig. 4 - Pulse on a regular basis, maximum permissible peak pulse voltage (\hat{V}_{max}) as a function of pulse duration (t_i).

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". There is a sixth red band in order to indicate the temperature coefficient (50 ppm/°C). 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 indicating resistor type and packaging

TYPE	LEAD Ø mm	TOL %	ORDERING CODE 23xx xxx xxxxx			
			BANDOLIER IN AMMOPACK		BANDOLIER ON REEL	
			STRAIGHT LEADS			
			52 (2.047)	52 (2.047)	26 (1.024)	52 (2.047)
5000units		1000 units		4000 units		
MRS25	Cu 0.58 (Cu 0.023)	1	2322 156 2xxxx	2322 156 1xxxx	2306 156 4xxxx	2322 156 3xxxx

Dimensions in mm / (Inches)

Note: For formed types see "Formed Types Specification"

ORDERING CODE

- 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 12NC

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

Example:

The ordering code for resistor type MRS25 with Cu leads and a value of 1K21 1%, supplied on a bandolier of 1000 units in ammpack, is 2322 156 11212.

MRS25

NAFTA ORDERING INFORMATION – CROSS REFERENCE

NAFTA ORDERING CODES

Table 4. Ordering code indicating resistor type and packaging

Type	Tol. %	Resistance range	12NC	NAFTA Part Number	Taping	SPQ units
MRS25	± 1	1Ω to 10MΩ	2322 156 1xxxx	5053MCxxxxxF08AF5	52 (2.047)	1000; ammopack
			2322 156 2xxxx	5053MCxxxxxF18AF5	52 (2.047)	5000; ammopack
			2322 156 3xxxx	5053MCxxxxxF12AF5	52 (2.047)	5000; reel
		1Ω to 1MΩ	2306 156 4xxxx	5053MCxxxxxF26M	26 (1.024)	4000; ammopack

Dimensions in mm / (Inches)

COMPOSITION OF OHMIC VALUE

The ohmic value is represented by 5 digits; see table 5.

Table 5. Examples of the ohmic value

Value	5 Digits (All Other)
1 Ω	1R000
10 Ω	10R00
100 Ω	100R0
1 KΩ	1K000
10 KΩ	10K00
100 KΩ	100K0
1 MΩ	1M000

PACKAGING

Bandolier in ammopack

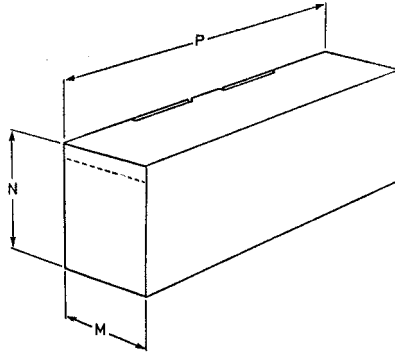


Table 6.

Type	Quantity	M	N	P	Bandolier width
MRS25	5000	78 (3.071)	98 (3.858)	260 (10.236)	52 +1.5/-0 (2.047 +0.059/-0)
	1000	82 (3.228)	28 (1.102)	262 (10.315)	

Dimensions in mm / (inches)

Bandolier in Reel

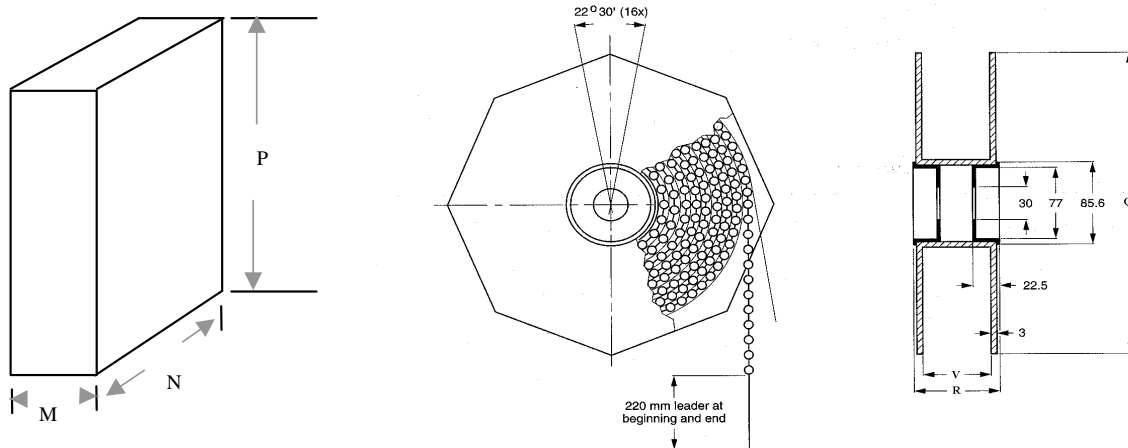


Table 7.

Type	Quantity	M	N	P	Q	V	R	Bandolier Width
MRS25	5000	92 (3.622)	311 (12.244)	311 (12.244)	305 (12.008)	75 (2.953)	86 (3.386)	52 +1.5/-0 (2.047 +0.059/-0)

Dimensions in mm / (Inches)

MRS25

TESTS AND REQUERIMENTS

Essentially all tests are carried out in accordance with the schedule of "IEC publication 60115-1", category **LCT/UCT/56** (rated temperature range: **Lower Category Temperature**, **Upper Category Temperature**; damp heat, long term, 56 days). The testing also covers the requirements specified by IEA and IEAJ.

The tests are carried out in accordance with IEC publication 60068, "Recommended basic climatic and mechanical robustness testing procedure for electronic Components and under standard atmospheric conditions according to "IEC 60068-1".

In table 8 the tests and requirements are listed with reference to the relevant clauses of "IEC publications 60115-1 and 60068, a short description of the tests procedure is also given. In some instances deviations from the IEC recommendations were necessary for our method of specifying. All soldering tests are performed with mildly activate

Table 8. Test procedures and requirements.

IEC 60115-1 CLAUSE	IEC 60068-2 TEST METHOD	TESTS	PROCEDURE	REQUEREMENTS
4.4.1		Visual examination		No holes; clean surface; no damage
4.4.2		Dimensions (outline)	Gauge (mm)	Table 1
4.5		Resistance	Applied voltage (+0/-10%): R<10Ω: 0.1V 10Ω ≤ R < 100Ω: 0.3V 100Ω ≤ R < 1 kΩ : 1V 1kΩ ≤ R < 10 kΩ:3V 10 kΩ ≤ R < 100 kΩ: 10V 100 kΩ ≤ R < 1MΩ: 25V R = 1MΩ: 50V	R - Rnom: max.: ± 1%
4.6.1.1		Insulation resistance	Voltage (DC) after 1 minute, metal block method: 500V	R _{ins} min.: 10 ⁴ MΩ
4.7		Voltage proof on insulation	Voltage (RMS) during 1minute, metal block method: 700V.	No breakdown
4.8.4.2		Temperature coefficient	At 20/LCT/20°C (TC x ppm/°C)	≤± 50 ppm/°C
4.12		Noise	"IEC publication 60195" (measured with Quantech-equipment): R≤1MΩ R>1MΩ	Max. 0.1μV/V Max. 1.5μV/V
4.13		Short time overload	Room temperature; P=6.25xPn; 5s on 45s off, 10 cycles (V≤2xVmax.)	ΔR/R max. ± 0.25% + 0.05Ω
4.16	U	Robustness of terminations:		
4.16.2	Ua	Tensile other half of samples	Load 10N; 10s	Number of failures <10x10 ⁻⁶
4.16.3	Ub	Bending half number of samples	Load 5N; 4 x 90°	Number of failures < 10x10 ⁻⁶
4.16.4	Uc	Torsion other half of samples	3 x 360° in opposite directions	no damage ΔR/R max. ± 0.1% + 0.05Ω

IEC 60115-1 CLAUSE	IEC 60068-2 TEST METHOD	TESTS	PROCEDURE	REQUEREMENTS
4.17	20(Ta)	Solderability	2s; 235 °C	Good tinning, no damage
	20(Tb)	Solderability (after aging)	8 hours steam or 16 hours 155°C; leads immersed 6mm for 2±0.5s in a solder bath at 235±5° C	Good tinning (≥ 95% covered); no damage
4.18	Tb	Resistance to soldering heat	Thermal shock 3s; 350°C; 6mm from body:	$\Delta R/R$ max. $\pm 0,1\% + 0.05\Omega$
4.19	(14)Na	Rapid change of temperature	30 minutes at LCT and 30 minutes at UCT; 5 cycles:	$\Delta R/R$ max. $\pm 0.1\% + 0.05\Omega$
4.22	Fc	Vibration	Frequency 10 to 500Hz; displacement 1.5 mm or acceleration 10g; 3directions; total 6 hours (3 x 2 hours)	no damage $\Delta R/R$ max. $\pm 0.1\% + 0.05\Omega$
4.23	27(Ba)	Climatic sequence:		R_{isol} min. $10^3 M\Omega$
4.23.2		Endurance at upper category temperature	1000 hours; no load	
4.23.3		Damp heat (accelerated) 1 cycle	6 days; 55°C; 95 a 98% R.H.:	
4.23.6		Damp heat (accelerated) remaining cycles		$\Delta R/R$ max. : $\pm 0.5 \% + 0.05\Omega$.
4.24.2	3(Ca)	Damp heat (steady state) (IEC)	56 days; 40°C; 90 to 95% RH : loaded with 0.01 Pn (IEC steps: 4 to 100V) :	R_{isol} min. $10^3 M\Omega$ $\Delta R/R$ max. $\pm 0.5\% + 0.05\Omega$
4.25.1		Endurance (at 70°C)	1000 hours; loaded with Pn or Vmax; 1.5 hours on and 0.5 hours off:	$\Delta R/R$ ma. $\pm 0.5\% + 0.05\Omega$
4.29	45(Xa)	Component solvent resistance	Isopropyl alcohol or H ₂ O followed by brushing in accordance with "MIL 202 F"	No visual damage
See 2 nd amendment to "IEC 60115-1".		Pulse load		See Figs. 3 and 4