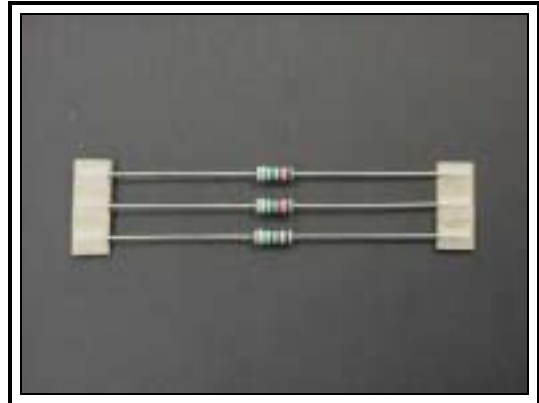


STANDARD FILM RESISTOR – SFR25

FEATURES

- Metal film technology;
- Non-flammable;
- General purpose resistors;
- High stability;
- Low cost;
- Low noise;
- Different forming styles available;
- Different packaging and taping configurations;
- Jumper available (0Ω).



MARKET SEGMENTS AND APPLICATIONS

Industry sector	Application segment	End-user equipment
Industrial	Power	Power supplies Motor speed controls
Telecom	Data Communication	Line protection resistor Power supplies
Consumer	Sound & Vision	Amplifiers, Television, Video cassette recorder
	Kitchen Appliances	Blender
	Lighting	Ballast equipment
Automotive	Electronic Systems	Dashboard electronics Lighting equipment Window/mirror steering ABS system, Alarm system Airbag, Electronic fuel injection

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 of electrolytic copper are welded to the end-caps. The resistors are coated with non-flammable light green lacquer, which provides electrical, mechanical and climatic protection. The encapsulation is resistant to all cleaning solvents in accordance with "MIL-STD-202E, method 215" and "IEC 60068-2-45".

SFR25

QUICK REFERENCE DATA

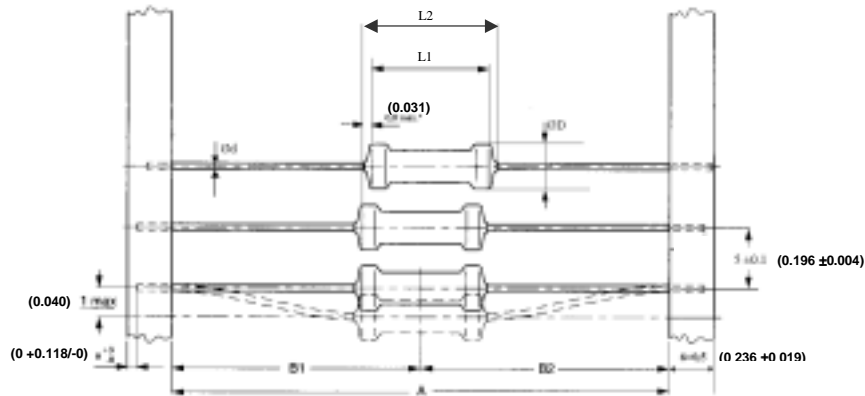
DESCRIPTION	SFR25 ± 5% (E24 serie)	SFR25 ± 1% (E24/E96 series)
	Cu-lead	
Resistance range	0.22Ω to 10MΩ	1Ω to 10MΩ
Temperature coefficient: R ≤ 1MΩ R > 1MΩ	≤ ±100 ppm/°C ≤ ±250 ppm/°C	
Absolute maximum dissipation at Tamb = 70°C	0.4W	
Thermal resistance. R _{th}	200KW	
Limiting voltage (DC or RMS)	250V	
Rated Voltage ⁽¹⁾	$\sqrt{P_n \times R}$	
Basic specification	IEC 60115-1 and 60115-2	
Climatic category (IEC 60068)	55 / 155 / 56	
Stability, ΔR/Rmax., after:		
Load	± 1% +0.05Ω	± 0.5% +0.05Ω
Climatic tests	± 1% +0.05Ω	± 0.5% +0.05Ω
Resistance to soldering heat	± 0.25% +0.05Ω	± 0.1% +0.05Ω
Short time overload	± 0.25% +0.05Ω	± 0.25% +0.05Ω

Note:

1- Maximum rated voltage is the "Limiting voltage".

MECHANICAL DATA

Axial style



* Max. displacement between any two resistors.
Dimension in mm.

Table 1.

Type	A	φD max.	L1 max.	L2 max.	φd	B1-B2	Mass per 100 units
SFR25	52 +1.5 / -0 (2.047 +0.059/-0)	2.5 (0.098)	6.5 (0.256)	-	0.58 ± 0.05 (0.023 ±0.002)	±1.2 (±0.047)	21g
	26 ± 1.5 (1.024 ±0.059)						15g

Dimensions in mm / (Inches)

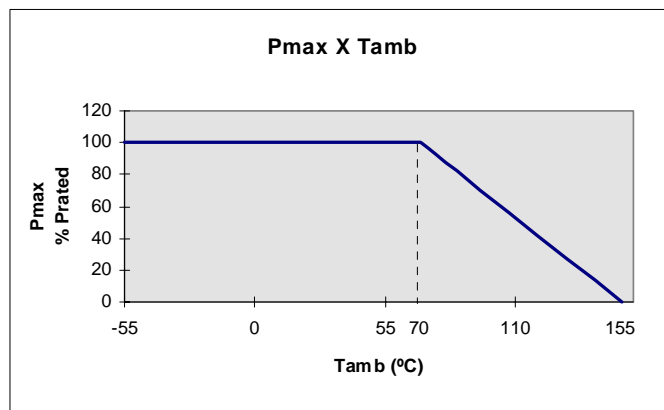
MOUNTING

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.

ELECTRICAL CHARACTERISTICS

DERATING

The power that 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

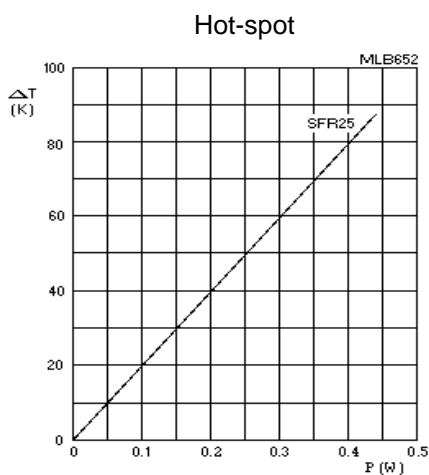


Fig. 1 - Hot spot temperature rise (ΔT) as a function of dissipated power.

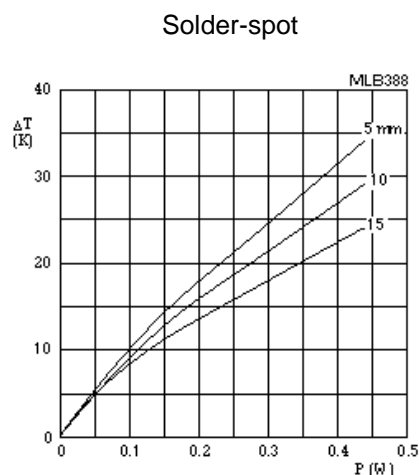


Fig. 2 - Temperature rise (ΔT) at the lead (soldering point) as a function of dissipated power at various lead lengths after mounting.

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

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PULSE LOADING CAPABILITIES

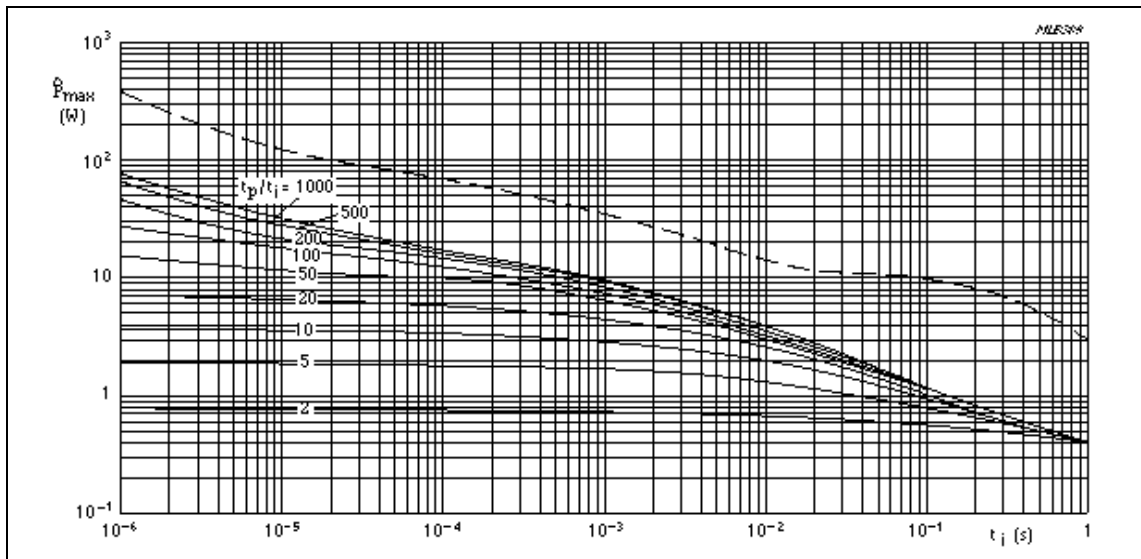


Fig. 3 – Pulse on a regular basis, maximum permissible peak pulse power (\hat{P}_{max}) as a function of pulse duration (t_i).

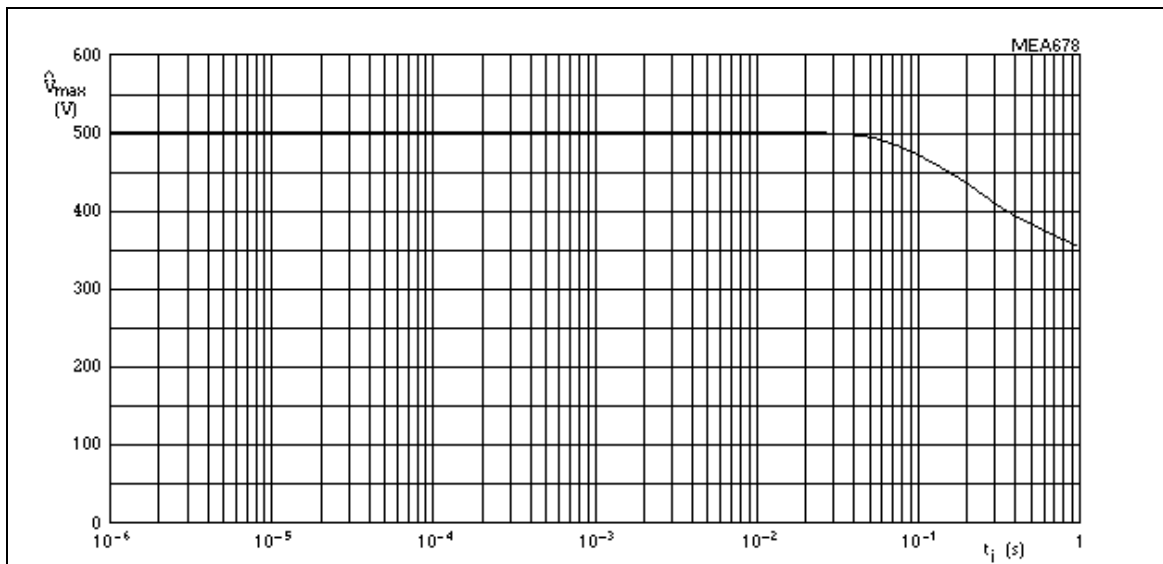


Fig. 4 - Pulse on a regular basis, maximum permissible peak pulse voltage (\hat{V}_{max}) as a function of pulse duration (t_i).

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MARKING

The nominal resistance and tolerance are marked on the resistor using four or 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 $\pm 5\%$ or 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 \varnothing mm	TOL %	ORDERING CODE 23xx xxx xxxxx			
			BANDOLIER IN AMMOPACK			BANDOLIER ON REEL
			STRAIGHT LEADS			
			52 (2.047)	26 (1.024)	52 (2.047)	52 (2.047)
			5000 units	4000 units	1000 units	5000 units
SFR25	Cu 0,58 (Cu 0.023)	1	2322 188 2xxxx	-	-	2306 181 8xxxx
		5	2322 181 43xxx	2306 181 43xxx	2322 181 53xxx	2322 181 63xxx
			-	-	-	2306 181 63xxx ⁽¹⁾

Dimensions in mm / (Inches)

(1) Min. Order Quantity 50.000pçs.

Note: For formed types see "Formed Types Specification"

ORDERING CODE

- The resistors have a 12 digit ordering code starting with 23
- The subsequent 6 or 7 digits indicate the resistor type and packaging, see table 2.
- For 5% tolerance the remaining 3 digits indicate the resistance value;
 - The first 2 digits indicate the resistance value.
 - The last digit indicates the resistance decade in accordance with table 3.
- For 1% tolerance 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 (12NC)

Resistance Decade for 5%	Resistance Decade for 1%	Last Digit
0.22 to 0.91 Ω	-	7
1 to 9.1 Ω	1 to 9.76 Ω	8
10 to 91 Ω	10 to 97.6 Ω	9
100 to 910 Ω	100 to 976 Ω	1
1 to 9.1k Ω	1 to 9.76k Ω	2
10 to 91k Ω	10 to 97.6k Ω	3
100 to 910k Ω	100 to 976k Ω	4
1M Ω to 9.1 M Ω	1M Ω to 9.76 M Ω	5
10M Ω	10M Ω	6

Example:

The ordering code for resistor type SFR25 resistor, value of 1000 Ω $\pm 5\%$, taped on a bandolier of 5000 units in ammopack, is: 2322 181 43102.

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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
SFR25	± 1	1Ω to 10MΩ	2322 188 2xxxx	5043EDxxxxxF18AF5	52 (2.047)	5000; ammopack
			2306 181 8xxxx	5043EDxxxxxF12AF5	52 (2.047)	5000; reel
	± 5	0.22Ω to 10MΩ	2322 181 43xxx	5043EMxxxxxJ18AFX	52 (2.047)	5000; ammopack
			2322 181 53xxx	5043EMxxxxxJ08AFX	52 (2.047)	1000; ammopack
			2322 181 63xxx	5043EMxxxxxJ12AFX	52 (2.047)	5000; reel

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 ammpack

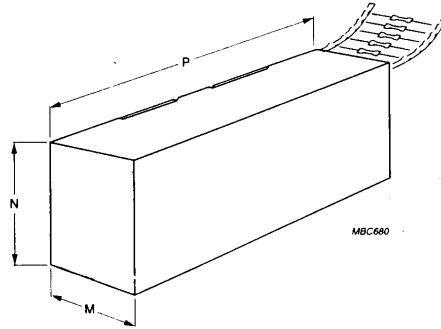


Table 6.

Type	Quantity	M	N	P	Bandolier Width
SFR25	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)	52 +1.5/-0 (2.047 +0.059/-0)
	5000	52 (2.047)	98 (3.858)	255 (10.039)	26 ±1.5 (1.024 ±0.059)

Dimensions in mm / (Inches)

Bandolier in Reel

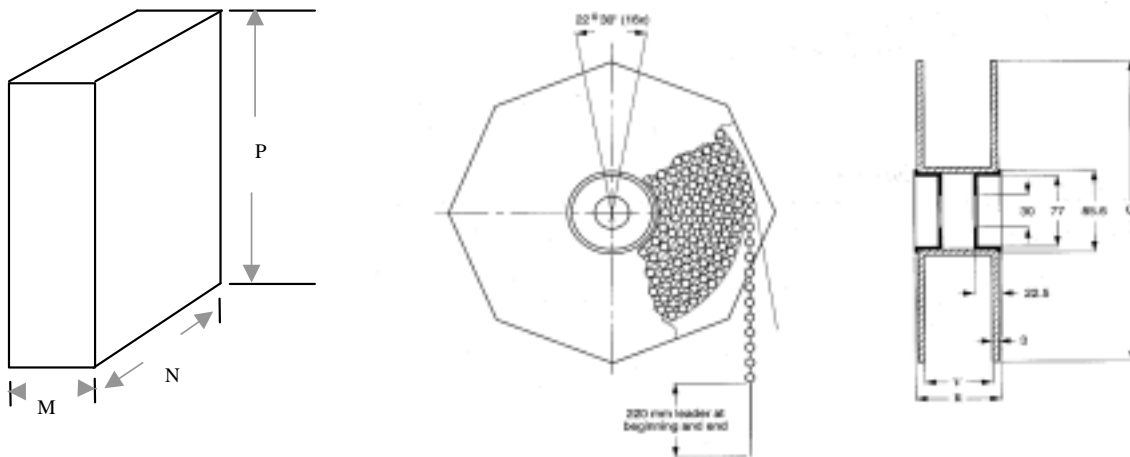


Table 7.

Type	Quantity	M	N	P	Q	V	R	Bandolier Width
SFR25	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)

SFR25

TEST AND REQUERIMENTS

Essentially all tests are carried out in accordance with the schedule of "IEC publication 60115-1", category 55/155/56 (rated temperature range -55 °C to +155°C; damp heat, long term, 56 days).

The tests are carried out in accordance with IEC publication 60068-2, "Recommended basic climatic and mechanical robustness testing procedure for electronic components" and under standard atmospheric conditions according to "IEC 60068-1" subclause 5.3.

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 test procedure is also given. In some instances deviations from the IEC recommendations were necessary for our method of specifying.

Table 8. Test procedures and requirements

IEC 60115-1 CLAUSE	IEC 60068-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS	
				SFR25 5%	SFR25 1%
4.6.1.1		Insulation resistance	500V (DC or RMS) during 1 minute; V-block method	$R_{ins} \text{ min.: } 10^4 \text{ M}\Omega$	
4.7		Voltage proof on insulation	600V (RMS) during 1 minute; V-block method	no breakdown	
4.8.4		Temperature coefficient	Between -55 °C and + 155 °C (TC ppm/°C)	$R \leq 1\text{M}\Omega : \pm 100\text{ppm}/^\circ\text{C}$ $R > 1\text{M}\Omega : \pm 250\text{ppm}/^\circ\text{C}$	
4.12		noise	IEC publication 60195	$R \leq 1\text{M}\Omega : \text{max. } 0.1\mu\text{V/V}$ $R > 1\text{M}\Omega : \text{max. } 1.5\mu\text{V/V}$	
4.13		Short time overload	Room temperature; $P = 6.25 \times P_n$; 5s on 45s off ($V \leq 2 \times V_{max}$); 10 cycles;	$\Delta R/R \text{ max.:}$ $\pm 0.25\% + 0.05\Omega$	$\Delta R/R \text{ max.:}$ $\pm 0.25\% + 0.05\Omega$
4.16	U	Robustness of terminations:		Number of failures < 10×10^{-6} Number of failures < 10×10^{-6}	
4.16.2	Ua	Tensile all samples	Load 10N; 10s		
4.16.3	Ub	Bending half number of samples	Load 5N; 4 x 90°		
4.16.4	Uc	Torsion other half of samples	3 x 360° in opposite directions		
				no damage	
				$\Delta R/R \text{ max.:}$ $\pm 0.25\% + 0.05\Omega$	$\Delta R/R \text{ max.:}$ $\pm 0.1\% + 0.05\Omega$
4.17	Ta	Solderability	2s; 235°C; flux 600	Good tinning; no damage	
4.18	Tb	Resistance to soldering heat	Thermal shock: 3s; 350 °C; 6 mm from body	$\Delta R/R \text{ max.:}$ $\pm 0.25\% + 0.05\Omega$	$\Delta R/R \text{ max.:}$ $\pm 0.1\% + 0.05\Omega$
4.19	Na	Rapid change of temperature	30 minutes at -55 °C and 30 minutes at +155 °C; 5 cycles	$\Delta R/R \text{ max.:}$ $\pm 0.25\% + 0.05\Omega$	$\Delta R/R \text{ max.:}$ $\pm 0.1\% + 0.05\Omega$
4.22	Fc	Vibration	Frequency 10 to 500 Hz; displacement 1.5 mm or acceleration 10g; 3 directions; total 6 hours (3x2 hours)	no damage	
				$\Delta R/R \text{ max.:}$ $\pm 0.25\% + 0.05\Omega$	$\Delta R/R \text{ max.:}$ $\pm 0.1\% + 0.05\Omega$

SFR25

IEC 60115-1 CLAUSE	IEC 60068-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS	
				SFR25 5%	SFR25 1%
4.23		Climatic sequence:		$R_{ins} \text{ min.: } 10^3 \text{ M}\Omega$	
4.23.2	Ba	Dry heat	16 hours; 155 °C		
4.23.3	Db	Damp heat (accelerated) 1 st cycle	24 hours; 55 °C; 90 to 100% RH		
4.23.4	Aa	Cold	2 hours; - 55 °C		
4.23.5	M	Low air pressure	2 hours; 8.5 kPa; 15 to 35 °C		
4.23.6	Db	Damp heat (accelerated) remaining cycles	5 days; 55 °C; 95 to 100% RH	$\Delta R/R_{max.}: \pm 1\% + 0.05\Omega$	$\Delta R/R_{max.}: \pm 0.5\% + 0.05\Omega$
4.24.2	Ca	Damp heat (steady state)	56 days; 40 ° C; 90 to 95% RH; dissipation 0.01 Pn	$R_{ins} \text{ min.: } 10^3 \text{ M}\Omega$	
				$\Delta R/R_{max.}: \pm 1\% + 0.05 \Omega$	$\Delta R/R_{max.}: \pm 0.5\% + 0.05\Omega$
4.25.1		Endurance	1000 hours at 70 °C; Pn or Vmax	$\Delta R/R_{max.}: \pm 1\% + 0.05\Omega$	$\Delta R/R_{max.}: \pm 0.5\% + 0.05\Omega$
See 2 nd amendment to "IEC 60115-1".		Pulse load		See Figs. 3 and 4	

SFR25