FUSIBLE RESISTOR - NFR25

FEATURES

- Metal film technology
- Defined interruption behavior (fusing time)
- Overload protection without risk of fire
- Suitable for protection of circuit boards and designs
- Wide range of overload currents
- Flame retardant lacquer
- High stability, reliability and uniformity characteristics
- Various forming styles available
- Various packing and taping configurations
- RoHS compliant



MARKET SEGMENTS AND APPLICATIONS

INDUSTRY SECTOR	APPLICATION SEGMENT	END-USER EQUIPMENT
Industrial	Controls	Power supplies Power system control Central heating controls
Telecom	Data Communication	Line protection resistor Power supplies Modems
Consumer	Sound & Vision	Amplifiers TV VCR

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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 a gray, flame retardant lacquer, which provides electrical, mechanical and climatic protection. The encapsulation is resistant to all cleaning solvents in accordance with MIL-STD-202, method 215 and IEC 60068-2-45.

QUICK REFERENCE DATA

DESCRIPTION	NFR25 ±5% (E24 series)
	Cu-lead
Resistance range	0.22 Ω - 15 kΩ
Maximum dissipation at T_{amb} = 70 °C	0.33 W
Thermal resistance (R_{th})	240 K/W
Rated voltage (1)	$\sqrt{Pn \times R}$
Limiting voltage (DC or RMS)	250 V
Temperature coefficient: 0.22 Ω ≤ R ≤ 15 Ω 15 Ω < R < 15 kΩ	 ±200 ppm/°C ±100 ppm/°C
Climatic category (IEC 60068)	55/155/56
Basic specifications	IEC 60115 - 1 and 60115 - 2
Stability $\Delta R/R_{max}$ after:	
Load	±1% + 0.05 Ω
Climatic tests	±1% + 0.05 Ω
Resistance to soldering heat	±0.25% + 0.05 Ω

(1) Maximum rated voltage is the limiting voltage

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MECHANICAL DATA

AXIAL STYLE

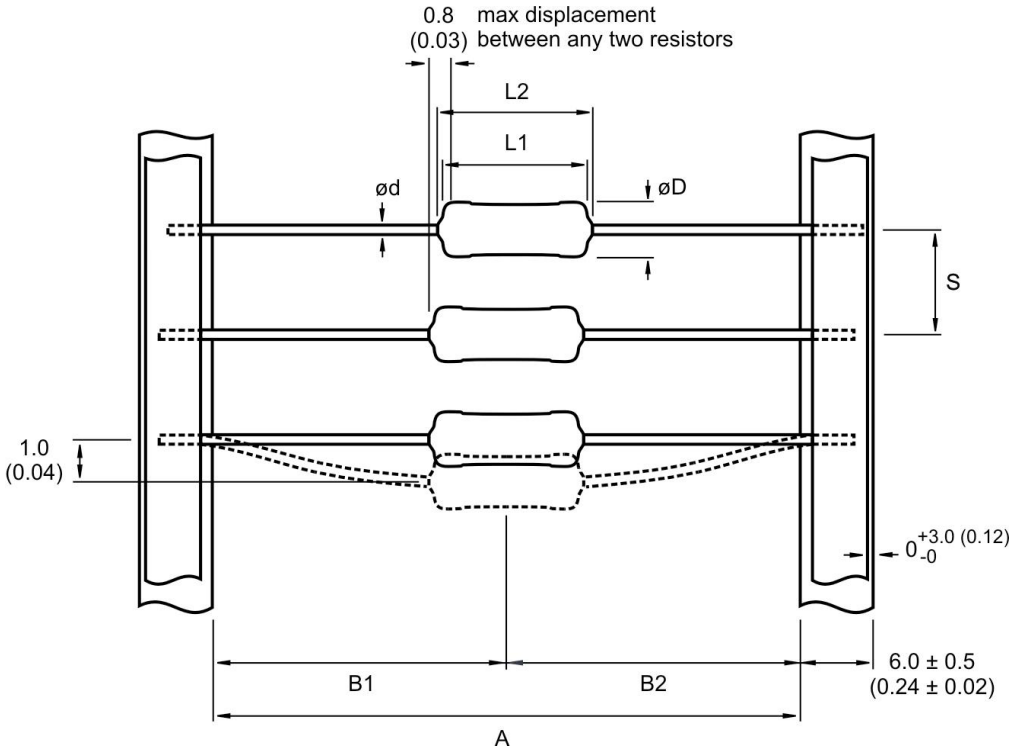


Fig. 1

Table 1. Mechanical data.

PRODUCT	A	L1 max	L2 max	ØD max	|B1 - B2| max	Ød	S	WEIGHT gr/100 pcs
NFR25	52.0 + 1.5 / - 0.0 (2.05 + 0.06 / - 0.00)	6.5 (0.26)	7.5 (0.30)	2.5 (0.10)	1.2 (0.05)	0.58 ±0.05 (0.023 ±0.002)	5.0 ±0.1 (0.20 ±0.01)	21.0

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.

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ELECTRICAL CHARACTERISTICS

DERATING

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

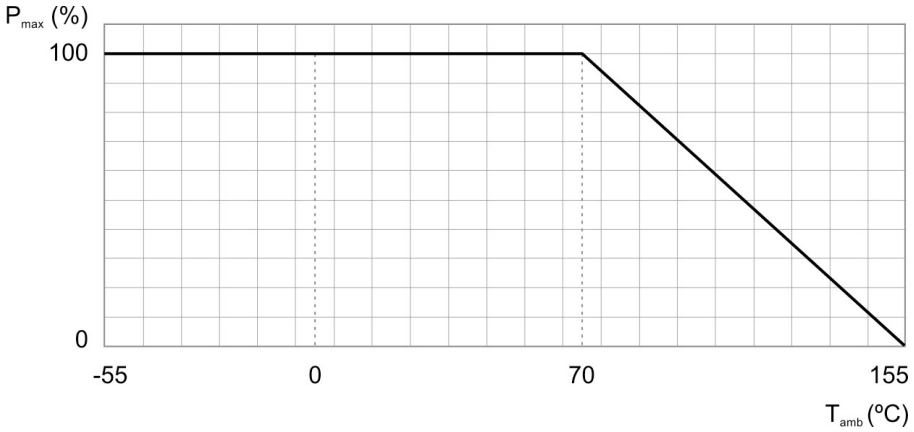


Fig. 2. Maximum dissipation (P_{max}) in percentage of rated power as a function of ambient temperature (T_{amb})

APPLICATION INFORMATION

Hot spot

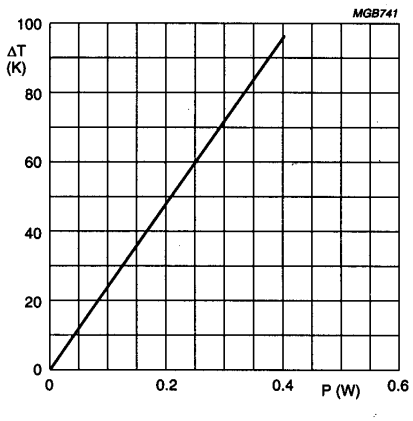


Fig. 3. Hot spot temperature rise (ΔT) as a function of dissipated power

Solder spot

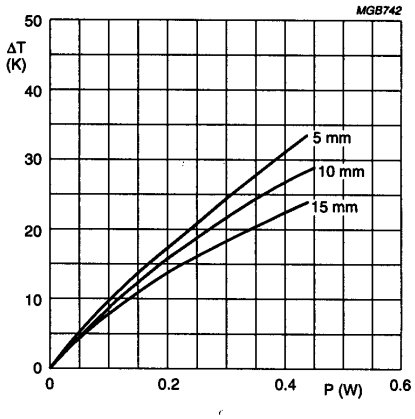


Fig. 4. Temperature rise (ΔT) at the lead (solder spot) as a function of dissipated power at various lead lengths after mounting

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

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FUSING CHARACTERISTIC

The resistors will fuse without the risk of fire and within an indicated range of overload. Fusing means that resistive value of the resistor increases at least 100 times; see Figs. 5, 6 and 7.
The fusing characteristic is measured under constant voltage.
This graph is based on measured data witch may deviate according to the application.

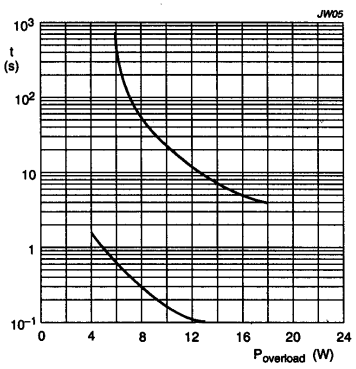


Fig. 5. Fusing characteristic:
≤ 1 Ω

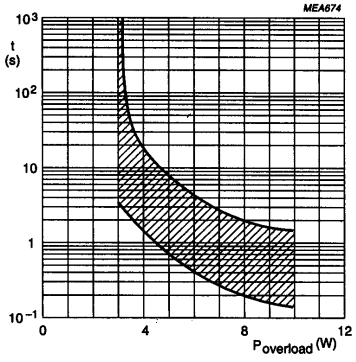


Fig. 6. Fusing characteristic:
1 Ω ≤ R ≤ 15 Ω

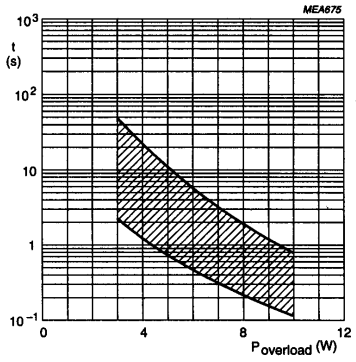


Fig. 7. Fusing characteristic:
15 Ω < R ≤ 15 KΩ

PULSE LOADING CAPABILITIES

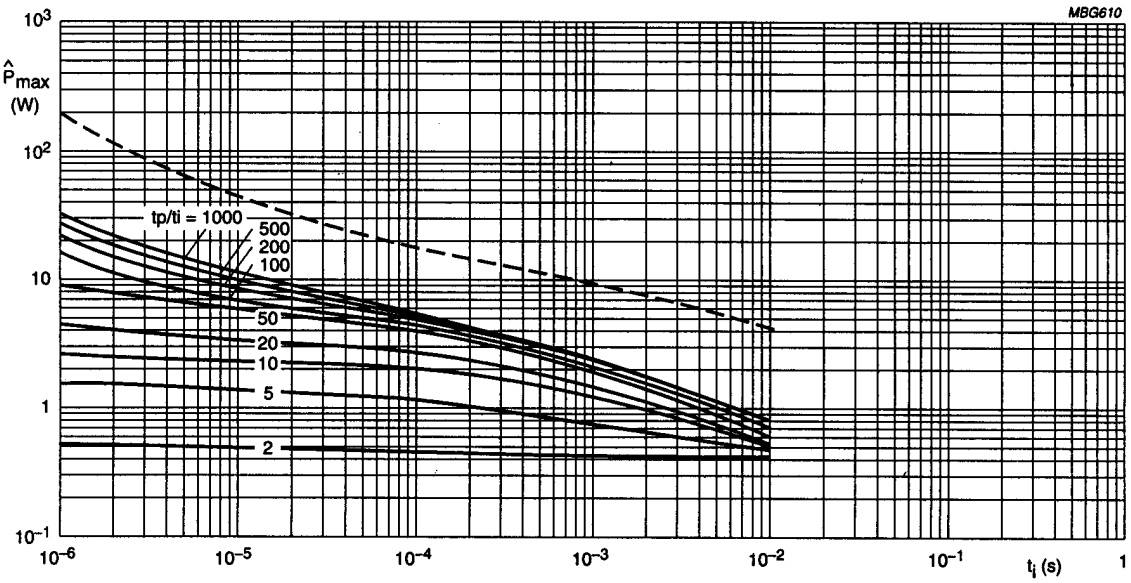


Fig. 8. Pulse on a regular basis, maximum permissible peak pulse powers ($\hat{P}_{max}$) as a function of pulse duration (ti):
0.22 Ω ≤ R < 15 Ω

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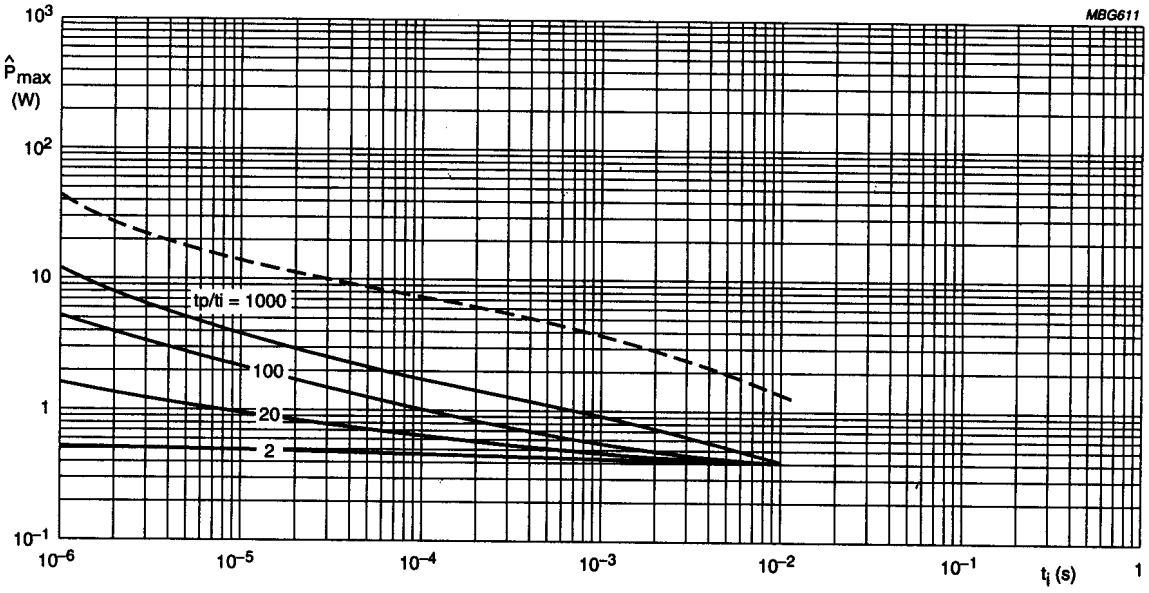


Fig. 9. Pulse on a regular basis, maximum permissible peak pulse powers (^P_{max}) as a function of pulse duration (ti): 15Ω < R ≤ 15 KΩ

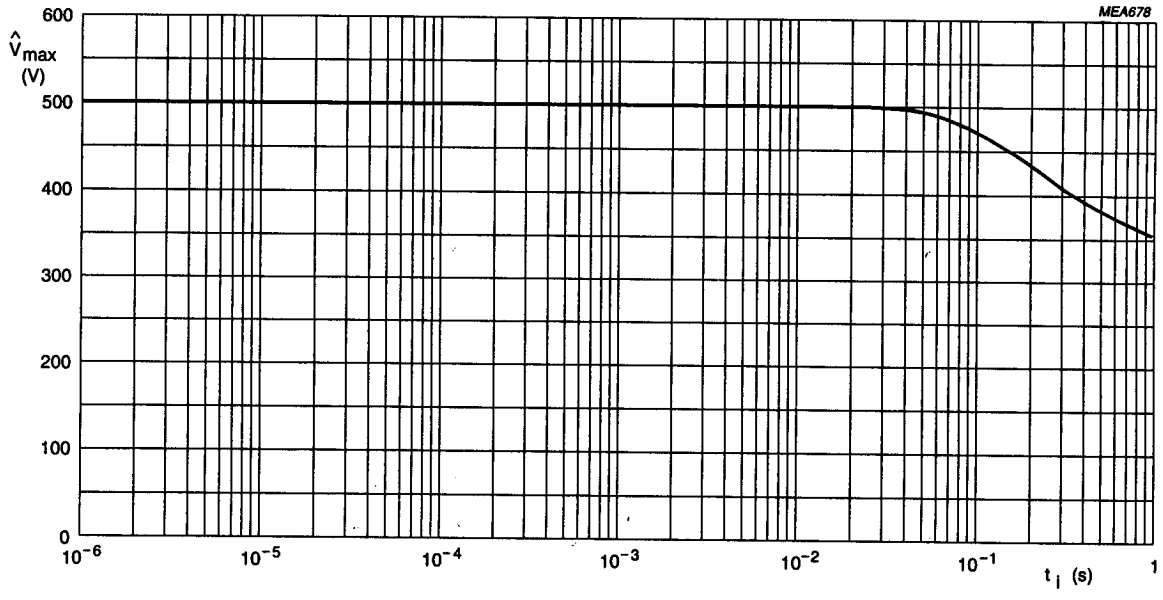


Fig. 10. Pulse on a regular basis, maximum permissible peak pulse voltage (^V_{max}) as a function of pulse duration (ti)

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MARKING

The nominal resistance and tolerance are marked on the resistor using four colored bands in accordance with IEC publication 60062.There is a fifth violet band in order to indicate the type of resistor. Standard values of nominal resistance are taken from the E24 series for resistors with a tolerance of 5%. The values of the E24 series are in accordance with IEC publication 60063.

ODERING INFORMATION

Table 2. Ordering code.

LEAD ∅	TOLERANCE	TAPING	QUANTITY (pcs)	PACKAGING	ORDERING CODE
0.58 Cu (0.023)	±5%	52.0 (2.05)	5000	AMMOPACK	**2322 205 33xxx**
				REEL	**2322 205 23xxx**
			1000	AMMOPACK	**2322 205 13xxx**

Dimensions unless specified in mm (inches)
Check "***Formed leads***" specifications to see related part-numbers

The resistors have a 12 digit ordering code starting with 2306 or 2322.
The next 5 digits indicate the resistor type and packaging, see table 2.
The last 3 digits indicate the resistance value:
- The first 2 digits of these last 3 indicate the actual 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
0.22 Ω - 0.91 Ω	7
1 Ω - 9.1 Ω	8
10 Ω - 91 Ω	9
100 Ω - 910 Ω	1
1 kΩ - 9.1 kΩ	2
10 kΩ - 15 kΩ	3

Example:
NFR25, 10 Ω, ±5%, ammopack 1000 pcs is **2322 205 13109**

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NAFTA ORDERING INFORMATION

Table 4. NAFTA ordering code.

LEAD ∅	TOLERANCE	TAPING	QUANTITY (pcs)	PACKAGING	NAFTA ORDERING CODE
0.58 Cu (0.023)	±5%	52.0 (2.05)	5000	REEL	**5063FMxxxxxJ12AFX** (1) **5063FDxxxxxJ12AFX** (2)
		52.0 (2.05)	5000	AMMOPACK	**5063FMxxxxxJ18AFX** (1) **5063FDxxxxxJ18AFX** (2)
		52.0 (2.05)	1000	AMMOPACK	**5063FMxxxxxJ08AFX** (1) **5063FDxxxxxJ08AFX** (2)

Dimensions unless specified in mm (inches)
(1) Part number for values ≤ 15 Ω
(2) Part number for values > 15 Ω

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

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PACKAGING

TAPE IN AMMOPACK

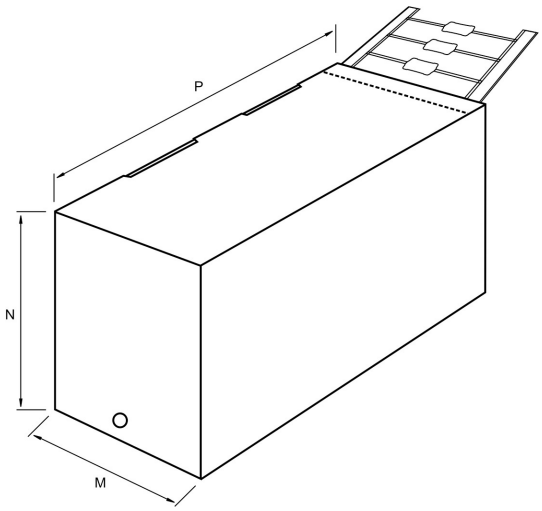
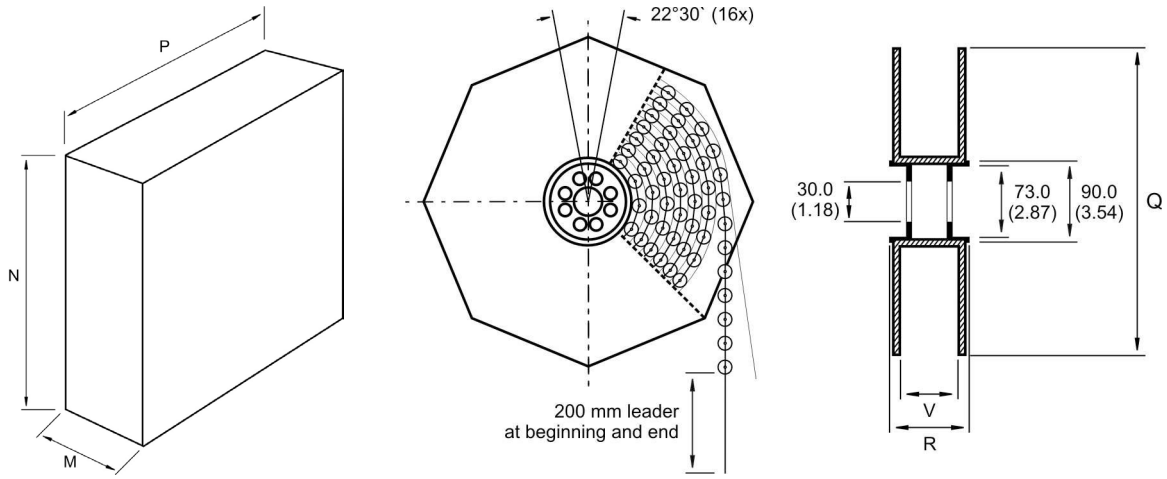


Table 6. Ammopack.

PRODUCT	TAPING	M	N	P	QUANTITY (pcs)
NFR25	52.0 + 1.5 / - 0.0 (2.05 + 0.06 / - 0.00)	82 (3.3)	28 (10.2)	262 (10.4)	1000
		78 (3.1)	98 (3.9)	260 (10.3)	5000

Dimensions unless specified in mm (inches)

TAPE ON REEL



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Table 7. Reel

PRODUCT	TAPING	M	N	P	Q	V	R	QTY (pcs)
NFR25	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 (3.0)	86 (3.4)	5000

Dimensions unless specified in mm (inches)

TESTS AND REQUIREMENTS

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	REQUIREMENTS
4.6.1.1	-	Insulation resistance	500 V (DC) after 1 minute; V-block method.	$R_{ins\ min}$ 10^4 MΩ
4.7	-	Voltage proof on insulation	500 (RMS) during 1 minute; V-block method.	No breakdown or flashover
4.8	-	Temperature coefficient	Between - 55 °C and + 155 °C: 0.22 Ω ≤ R ≤ 15 Ω 15 Ω < R ≤15 kΩ	 ±200 ppm/°C ±100 ppm/°C
4.12	-	Noise	IEC publication 60195	< 0.1 µV/V
4.16	21(U)	Robustness of terminations:		
4.16.2	21(Ua1)	Tensile all samples	Load 10 N; 10 s	No damage $\Delta R/R_{max}$ ±0.25% + 0.05 Ω
4.16.3	21(Ub)	Bending half number of samples	Load 5 N; 4 x 90°	
4.16.4	21(Uc)	Torsion other half number of samples	3 x 360° in opposite directions	

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IEC 60115-1 CLAUSE	IEC 60068-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
4.17	20(Ta)	Solderability (after ageing)	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	$\Delta R/R_{max}$ ±0.25% + 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 $\Delta R/R_{max}$ ±0.25% + 0.05 Ω
4.22	6(Fc)	Vibration	Frequency 10 to 500 Hz; displacement 1.5 mm or acceleration 10 g; three directions; total 6 h (3 x 2 h)	No damage $\Delta R/R_{max}$ ±0.25% + 0.05 Ω
4.23		Climatic sequence:		
4.23.2	2(Ba)	Dry heat	16 h, + 155 °C	
4.23.3	30(Db)	Damp heat (accelerated) 1st cycle	24 h, 25 °C to 55 °C, 90% to 100% R.H.	$R_{ins\ min}$ 10^3 MΩ $\Delta R/R_{max}$ ±1% + 0.05 Ω
4.23.4	1(Aa)	Cold	2 h, - 55 °C	
4.23.6	30(Db)	Damp heat (accelerated) remaining cycles	5 days; 25 °C to 55 °C; 90 to 98% R.H.	
4.24	3(Ca)	Damp heat (steady state)	56 days; 40 °C; 90 to 95% R.H.; loaded with 0.01 Pn	$R_{ins\ max}$ 10^3 MΩ $\Delta R/R_{max}$ ±1% + 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	$\Delta R/R_{max}$ ±1% + 0.05 Ω
4.26	-	Accidental overload	Overload of 5, 10, 16, 25, 40, 63 and 100 times the rated power, but the applied voltage shall not exceed four times the limiting voltage.	Non-flammable
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. 8, 9 and 10

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