

Metal film precision resistors

MPR24/34

FEATURES

- Ultra high precision resistors
- Ultra high stability
- Ultra low temperature coefficient.

APPLICATIONS

- Test and measurement
- Telecom.

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 are welded to the end-caps. The resistors are coated with a 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 68-2-45".

Resistors with a resistance value of $\leq 200 \Omega$ and with tolerances of $\pm 0.05\%$, $\pm 0.02\%$ and $\pm 0.01\%$ have low inductance.

QUICK REFERENCE DATA

DESCRIPTION	VALUE	
	MPR24	MPR34
Resistance range	4.99 Ω to 1 M Ω	
Resistance tolerance and series: 24 Ω to 100 k Ω 4.99 Ω to 1 M Ω	$\pm 0.05\%$; $\pm 0.02\%$; $\pm 0.01\%$; all values $\pm 0.5\%$; $\pm 0.25\%$; $\pm 0.1\%$; all values	
Maximum dissipation at $T_{amb} = 70^\circ\text{C}$: $\pm 0.05\%$; $\pm 0.02\%$; $\pm 0.01\%$ $\pm 0.5\%$; $\pm 0.25\%$; $\pm 0.1\%$	0.125 W 0.25 W	0.25 W 0.4 W
Temperature coefficient characteristic between +20 and +70 $^\circ\text{C}$	$\leq \pm 25 \times 10^{-6}/\text{K}$ $\leq \pm 15 \times 10^{-6}/\text{K}$ $\leq \pm 10 \times 10^{-6}/\text{K}$ $\leq \pm 5 \times 10^{-6}/\text{K}$	
Failure level: 24 Ω to 100 k Ω 4.99 Ω to 1 M Ω	S R	
Maximum permissible voltage (DC or RMS)	250 V	350 V
Basic specifications	CECC 403000; MIL-R-10509; MIL-R-55182; DIN 44061; IEC 115-5	
Climatic category (IEC 68): $\pm 0.05\%$; $\pm 0.02\%$; $\pm 0.01\%$ $\pm 0.5\%$; $\pm 0.25\%$; $\pm 0.1\%$	55/125/56 55/155/56	
Vibration test	10 to 500 Hz; 0.75 or 98 m/s ²	
Air pressure (lower limit)	8.5 kN/m ²	
Stability after: load climatic tests soldering short time overload	$\Delta R/R$ max.: $\pm 0.05\%$ +0.01 Ω $\Delta R/R$ max.: $\pm 0.05\%$ +0.01 Ω $\Delta R/R$ max.: $\pm 0.01\%$ +0.01 Ω $\Delta R/R$ max.: $\pm 0.01\%$ +0.01 Ω	

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MPR24/34

ORDERING INFORMATION

Ordering code (12NC)

- The resistors have a 12-digit ordering code starting with 2322 14
- The 7th digit indicates product type and packaging quantity; see Table 2.
- The subsequent 2 digits (8 and 9) indicate temperature coefficient, tolerance, marking and packaging quantity:
 - Table 3 refers to $\pm 0.5\%$, $\pm 0.25\%$ and $\pm 0.1\%$ tolerance products.
 - Table 4 refers to $\pm 0.05\%$, $\pm 0.02\%$ and $\pm 0.01\%$ tolerance products.
- The remaining 3 digits indicate the resistance value. The number is available upon request and is fixed by the supplier.

Table 1 Quantity per package

PACKAGE	QUANTITY
Cassette including list with individual measuring details	20
Bandolier in cardboard box	100
Bandolier in ammpack	500 or 1000
Bandolier on reel	5000

Table 2 7th digit; type and quantity

TYPE	7 th DIGIT	QUANTITY	
		TOL. $\pm 0.5\%$ $\pm 0.25\%$ $\pm 0.1\%$	TOL. $\pm 0.05\%$ $\pm 0.02\%$ $\pm 0.01\%$
MPR24	1	100 or 1000	20 or 100
	3	500 or 5000	500 or 1000
MPR34	2	100 or 1000	20 or 100
	4	500 or 5000	500 or 1000

Table 3 8th and 9th digit; tol. $\pm 0.5\%$; $\pm 0.25\%$; $\pm 0.1\%$; range 4.99 Ω to 1 M Ω

TC	ORDERING CODE 8th and 9th DIGIT						PACKAGING QUANTITY
	TOL. $\pm 0.5\%$		TOL. $\pm 0.25\%$		TOL. $\pm 0.1\%$		
	colour coded	marked	colour coded	marked	colour coded	marked	
± 25	00...	04...	20...	24...	40...	44...	100 or 500
	10...	14...	30...	34...	50...	54...	1000 or 5000
± 15	01...	05...	21...	25...	41...	45...	100 or 500
	11...	15...	31...	35...	51...	55...	1000 or 5000
± 10	02...	06...	22...	26...	42...	46...	100 or 500
	12...	16...	32...	36...	52...	56...	1000 or 5000
± 5	03...	07...	23...	27...	43...	47...	100 or 500
	13...	17...	33...	37...	53...	57...	1000 or 5000

Table 4 8th and 9th digit; tol. $\pm 0.05\%$; $\pm 0.02\%$; $\pm 0.01\%$; range 24 Ω to 100 k Ω

TC	ORDERING CODE 8th and 9th DIGIT			PACKAGING QUANTITY
	TOL. $\pm 0.05\%$	TOL. $\pm 0.02\%$	TOL. $\pm 0.01\%$	
	marked			
± 25	60...	70...	80...	20 or 500
	64...	74...	84...	100 or 1000
± 15	61...	71...	81...	20 or 500
	65...	75...	85...	100 or 1000
± 10	62...	72...	82...	20 or 500
	66...	76...	86...	100 or 1000
± 5	63...	73...	83...	20 or 500
	67...	77...	87...	100 or 1000

Ordering example

The ordering code of an MPR24 resistor with tolerance of $\pm 0.02\%$, $TC = \pm 5 \times 10^{-6}/K$, taped on bandolier in box of 100 units starts with 2322 141 77...; the last 3 digits are available upon request and are fixed by the supplier.

Metal film precision resistors

MPR24/34

FUNCTIONAL DESCRIPTION

Product characterization

Any value within the range can be ordered.

The stability as a function of dissipation and ambient temperature is indicated in the performance nomogram (see Fig.1) for resistors with resistance tolerance $\geq 0.1\%$.

NOTES ON THE NOMOGRAM

- The nomogram should not be extended beyond the maximum permissible hot-spot temperature of 175 °C.
- The resistance range given by the nomogram for $P = 0$ at a particular ambient temperature is indicative of the shelf life stability of a resistor at that temperature.
- The stability lines do not give exact values but represent a probability of 95% that the real values will be smaller than those indicated in the nomogram.
- In the nomogram the limiting voltage of the resistors have not been taken into consideration.

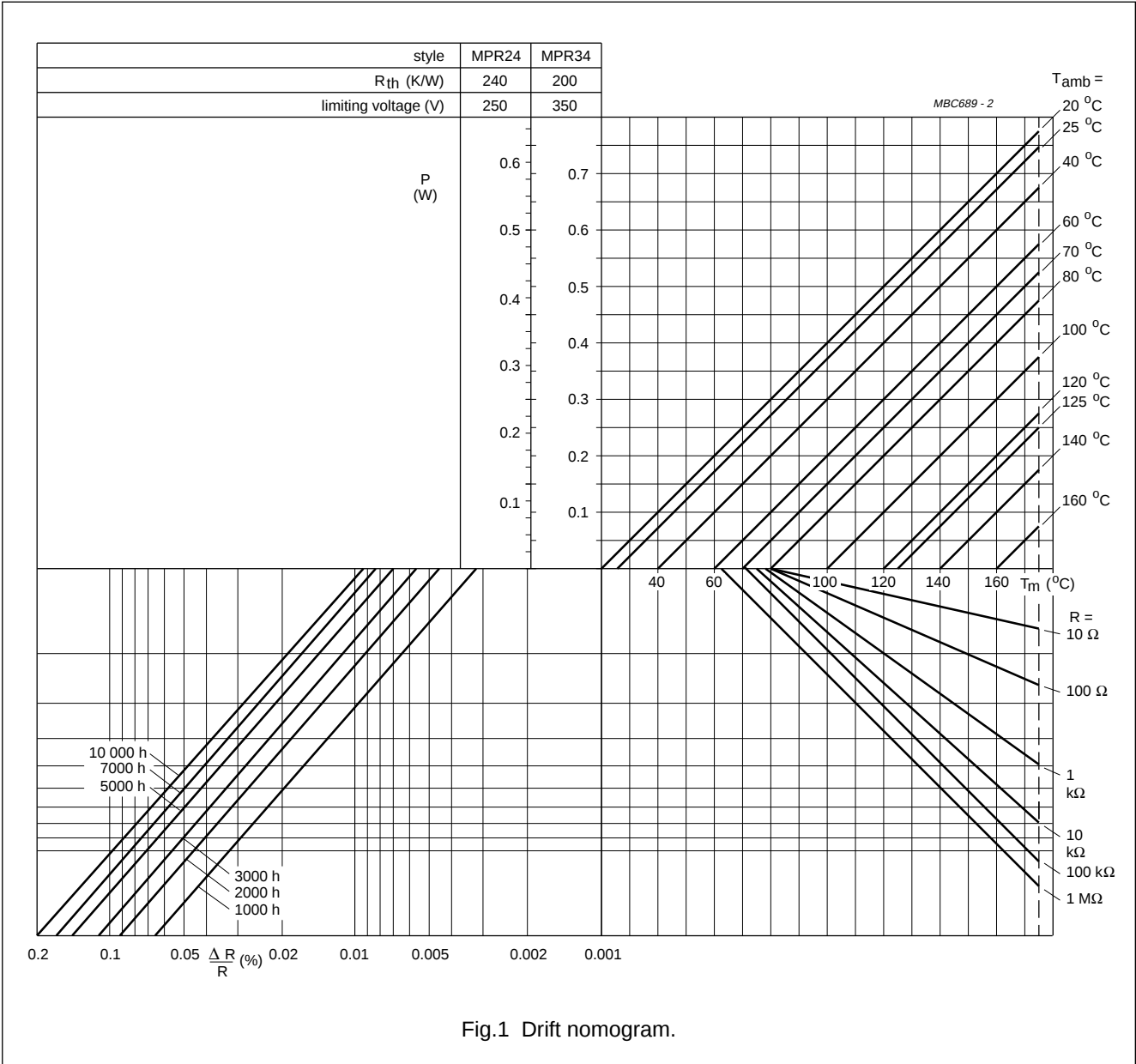


Fig.1 Drift nomogram.

Metal film precision resistors

MPR24/34

Limiting values

TYPE	LIMITING VOLTAGE ⁽¹⁾ (V)	LIMITING POWER (W)	
		TOL. (%) ±0.5; ±0.25; ±0.1	TOL. (%) ±0.05; ±0.02; ±0.01
MPR24	250	0.25	0.125
MPR34	350	0.4	0.25

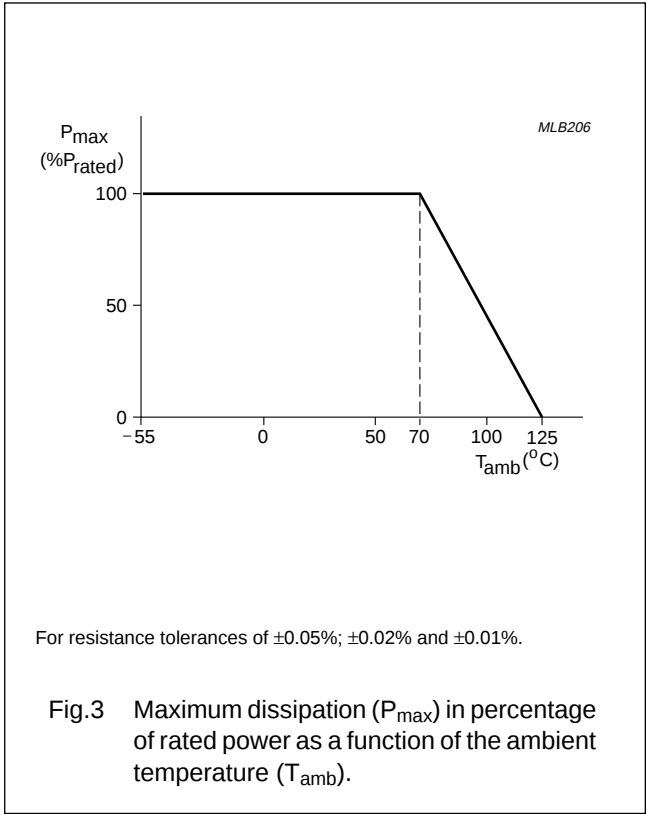
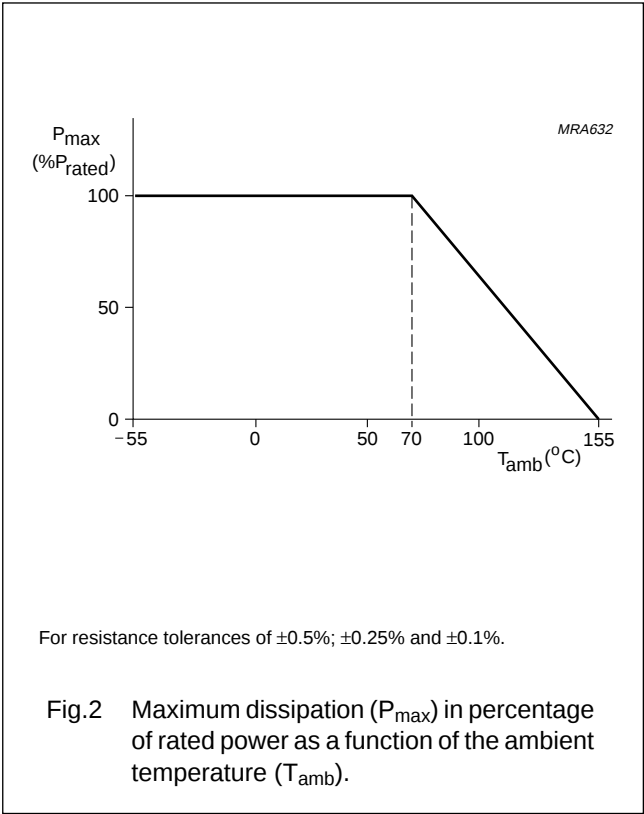
Note

1. The maximum voltage that may be continuously applied to the resistor element, see “IEC publication 115-1”.

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

DERATING

The power that the resistor can dissipate depends on the operating temperature; see Figs 2 and 3.



Metal film precision resistors

MPR24/34

MECHANICAL DATA

Mass per 100 units

TYPE	MASS (g)
MPR24	25
MPR34	30

Marking

The resistors are either colour coded or marked.

Any value within the range can be supplied colour coded, provided the resistance can be expressed in 3 coloured bands.

All other resistors are marked including those in cassette packaging.

COLOUR CODING

Colour coding is in accordance with IEC publication 62 “Colour codes for fixed resistors”.

MARKING

When marked, the following details are printed on the resistors:

- Manufacturers symbol
- Tolerance code (in accordance with “IEC 62”)
- Temperature coefficient code TC:
 - $\pm 25 = 1$
 - $\pm 15 = 2$
 - $\pm 10 = 3$
 - $\pm 5 = 4$
- Resistance value code (in accordance with “IEC 62”), with a maximum of nine positions.

Outlines

The length of the body (L_1) is measured by inserting the leads into holes of two identical gauge plates and moving these plates parallel to each other until the resistor body is clamped without deformation (“IEC publication 294”).

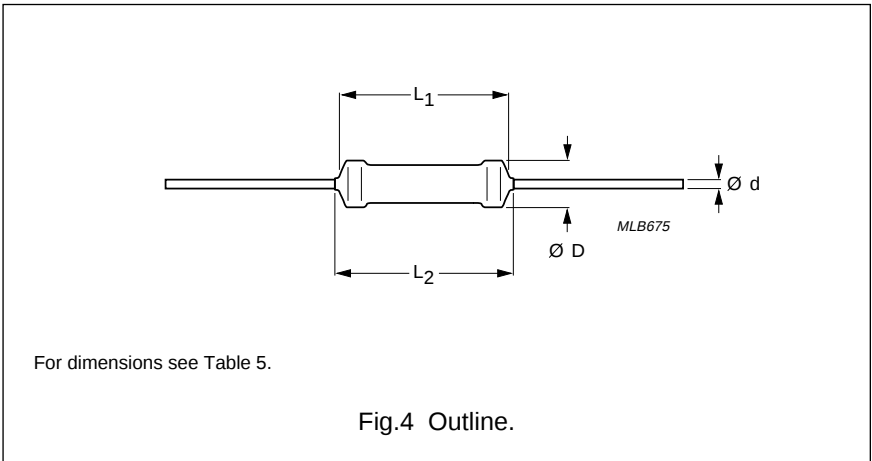


Table 5 Resistor type and relevant physical dimensions; see Fig.4

TYPE	ØD MAX. (mm)	L ₁ MAX. (mm)	L ₂ MAX. (mm)	Ød (mm)
MPR24	2.5	6.5	7.5	0.6
MPR34	3.0	10.0	11.0	0.6

Metal film precision resistors

MPR24/34

TESTS AND REQUIREMENTS

Essentially all tests are carried out in accordance with the schedule of "CECC publication 40.300", category **LCT/UCT/56** (rated temperature range: Lower Category Temperature, Upper Category Temperature; damp heat, long term, **56** days) along the lines of "CECC 40000".
"Recommended basic climatic and mechanical robustness testing procedure for electronic components".

Unless otherwise specified the following values apply:

Temperature: 15 °C to 35 °C

Relative humidity: 45% to 75%

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

In Table 6 the tests and requirements are listed with reference to the relevant clauses of "CECC publications 40000 and IEC publication 68", a short

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

All soldering tests are performed with mildly activated flux.

Table 6 Test procedures and requirements

CECC 40000 TEST METHOD	IEC 68-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
4.5		insulation resistance	voltage (DC) after 1 minute; metal block method: 500 V for MPR24 , 700 V for MPR34	$R_{ins} \text{ min.: } 10^4 \text{ M}\Omega$
4.6		voltage proof	$2 \times$ limiting voltage (AC) during 1 minute, metal block method	no breakdown or flashover
4.7		temperature coefficient	at 20/70/20 °C at 20/LCT/20 °C and 20/UCT/20 °C ($TC \times 10^{-6}/K$)	$\leq \pm 25 \times 10^{-6}/K$; $\leq \pm 15 \times 10^{-6}/K$; $\leq \pm 10 \times 10^{-6}/K$; $\leq \pm 5 \times 10^{-6}/K$ $\leq \pm 25 \times 10^{-6}/K$
4.10		noise	IEC publication 195 (measured with Quantech - equipment) $R \leq 100 \text{ k}\Omega$ $R > 100 \text{ k}\Omega$	max. $0.25 \mu V/V$ max. $0.5 \mu V/V$
4.11		short time overload	room temperature; $P = 6.25 \times P_n$; 5 s ($V \leq 2 \times V_{max}$)	$\Delta R/R \text{ max.: } \pm 0.01\% + 0.01 \Omega$
4.16	U Ua Ub Uc	robustness of terminations: tensile all samples bending half number of samples torsion other half of samples	load 10 N; 10 s load 5 N; $4 \times 90^\circ$ $3 \times 360^\circ$ in opposite directions	number of failures $< 10 \times 10^{-6}$ number of failures $< 10 \times 10^{-6}$ no damage $\Delta R/R \text{ max.: } \pm 0.01\% + 0.01 \Omega$
4.15	Ta	solderability	2 s; 235 °C	good tinning; no damage
4.15	Tb	resistance to soldering heat	thermal shock: 3 s; 350 °C; 6 mm from body	$\Delta R/R \text{ max.: } \pm 0.01\% + 0.01 \Omega$

Metal film precision resistors

MPR24/34

CECC 40000 TEST METHOD	IEC 68-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
4.16	Na	rapid change of temperature	30 minutes at LCT and 30 minutes at UCT; 5 cycles	no visual damage $\Delta R/R$ max.: $\pm 0.01\% + 0.01 \Omega$
4.17	Eb	bump	3×1500 bumps in 3 directions; 40 g	no damage $\Delta R/R$ max.: $\pm 0.01\% + 0.01 \Omega$
4.19	Fc	vibration	frequency 10 to 500 Hz; displacement 1.5 mm or acceleration 10 g; 3 directions; total 6 hours (3×2 hours)	no damage $\Delta R/R$ max.: $\pm 0.01\% + 0.01 \Omega$
4.4.1		visual examination		no holes; clean surface; no damage
4.20 4.20.2 4.20.3 4.20.4 4.20.5 4.20.6	B D Aa M D	climatic sequence: dry heat damp heat (accelerated) 1st cycle cold low air pressure damp heat (accelerated) remaining cycles	16 hours at UCT 24 hours; 95 to 100% RH 2 hours at LCT 1 hour; 8.5 kPa 5 days; 55 °C; 95 to 100% RH	R_{ins} min.: $10^3 M\Omega$ $\Delta R/R$ max.: $\pm 0.05\% + 0.01 \Omega$
4.21	Ca	damp heat, steady state (long term exposure)	56 days; 40 °C; 90 to 95% RH; loaded with 1.25 mW max.	R_{ins} min.: $100 M\Omega$ $\Delta R/R$ max.: $\pm 0.05\% + 0.01 \Omega$
4.25.1		endurance (at 70 °C)	2 000 hours; loaded with P_n or V_{max} ; 1.5 hours on and 0.5 hours off	R_{ins} min.: $10^3 M\Omega$ $\Delta R/R$ max.: $\pm 0.05\% + 0.01 \Omega$