Innovative Service Around the Globe YAGEO

DATA SHEET

THICK FILM LEAD FREE CHIP RESISTORS

Non-Magnetic

NM_P series

0.1%, 0.5%, 1%, 5%

sizes 0402/0603/0805/1206/2010/2512

Without RoHS exemption & Halogen Free

YAGEO

Product specification – October 23, 2023 V.0



SCOPE

This specification describes NM0402 to NM2512 Non-Magnetic chip resistors made by thick film process.

APPLICATIONS

- Total lead free without RoHS exemption
- Medical equipment
- Telecom
- Consumer

FEATURES

- Non-Magnetic
- Halogen Free Epoxy
- RoHS compliant
- Reducing environmentally hazardous wastes
- High component and equipment reliability
- Non-forbidden material used in products/production
- Moisture sensitivity level: MSL 1

ORDERING INFORMATION - GLOBAL PART NUMBER

Both part numbers are identified by the series, size, tolerance, packing type, temperature coefficient, taping reel and resistance value.

YAGEO BRAND ordering code

GLOBAL PART NUMBER (PREFERRED)

NM	XXXX	X	X	X	XX	XXXX	P
	(1)	(2)	(3)	(4)	(5)	(6)	(7)

(1) SIZE

0402 / 0603 / 0805 / 1206 / 2010 / 2512

(2) TOLERANCE

B = ± 0.1%

D = ± 0.5%

F = ± 1%

J = ± 5%

"-" = Jumper ordering

(3) PACKAGING TYPE

R = Paper taping reel

K = Embossed taping reel

(4) TEMPERATURE COEFFICIENT OF RESISTANCE

– = Base on spec

E = ± 50 ppm/°C (1206 only)

(5) TAPING REEL

07 = 7 inch dia. Reel

13 = 13 inch dia. Reel

(6) RESISTANCE VALUE

There are 2~4 digits indicated the resistor value. Letter R/K/M is decimal point, no need to mention the last zero after R/K/M, e.g.1K2, not 1K20.

Detailed resistance rules show in table of "Resistance rule of global part number".

(7) DEFAULT CODE

Letter P is lead free (without RoHS exemption)

Resistance rule of global part number

Resistance code rule	Example
XXRX (10 to 97.6 Ω)	10R = 10 Ω 97R6 = 97.6 Ω
XXXR (100 to 976 Ω)	100R = 100 Ω
XKXX (1 to 9.76 KΩ)	1K = 1,000 Ω 9K76 = 9760 Ω
XMXX (1 MΩ)	1M = 1,000,000 Ω

ORDERING EXAMPLE

The ordering code of a NM0603 chip resistor, value 56Ω with ±0.5% tolerance, supplied in 7-inch tape reel is: NM0603DR-0756RP.

MARKING

NM0805 / NM1206 / NM2010 / NM2512



Fig. 1 Value = 10 K Ω

Either resistance in E-24 or E-96: 4 digits

First three digits for significant figure and 4th digit for number of zeros

NM0603

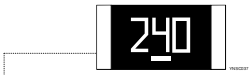


Fig. 2 Value = 24 Ω

1%, 0.5%, 0.1% E24 exception values 10/11/13/15/20/75 of E24 series



Fig. 3 Value = 12.4 K Ω

1%, 0.5%, 0.1% E96 refer to EIA-96 marking method, including values 10/11/13/15/20/75 of E24 series

NM0402



Fig. 4

No marking

For further marking information, please see special data sheet "Chip resistors marking".

CONSTRUCTION

The resistors are constructed out of a high-grade ceramic body. Internal metal electrodes are added at each end and connected by a resistive layer. The resistive layer is adjusted to give the approximate required resistance and laser cutting of this resistive layer that achieves tolerance trims the value. The resistive layer is covered with a protective coat and printed with the resistance value. Finally, the two external terminations (matte tin) are added. See fig. 5.

DIMENSION

Table 1 For outlines see fig. 5

TYPE	L (mm)	W (mm)	H (mm)	I_1 (mm)	I_2 (mm)
NM0402	1.00 ±0.05	0.50 ±0.05	0.32 ±0.05	0.20 ±0.10	0.25 ±0.10
NM0603	1.60 ±0.10	0.80 ±0.10	0.45 ±0.10	0.25 ±0.15	0.25 ±0.15
NM0805	2.00 ±0.10	1.25 ±0.10	0.50 ±0.10	0.35 ±0.20	0.35 ±0.20
NM1206	3.10 ±0.10	1.60 ±0.10	0.55 ±0.10	0.45 ±0.20	0.45 ±0.20
NM2010	5.00 ±0.10	2.50 ±0.15	0.55 ±0.10	0.60 ±0.20	0.55 ±0.20
NM2512	6.35 ±0.10	3.10 ±0.15	0.55 ±0.10	0.60 ±0.20	0.60 ±0.20

OUTLINES

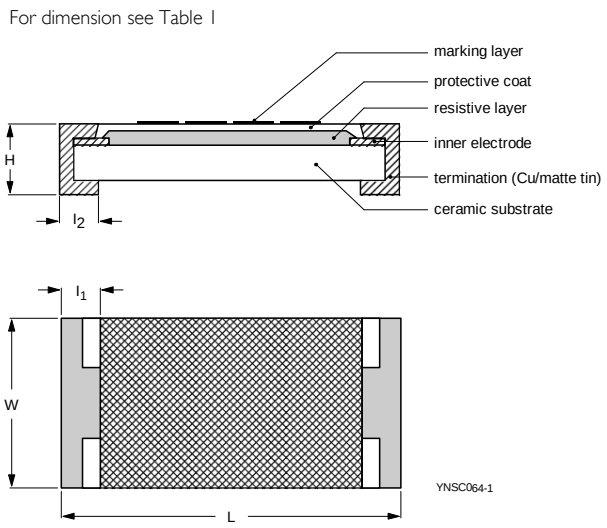


Fig. 5 Chip resistor outlines

ELECTRICAL CHARACTERISTICS

Table 2

TYPE	RESISTANCE RANGE (E24/E96)	OPERATING TEMPERATURE RANGE	POWER RATING	MAXIMUM WORKING VOLTAGE	DIELECTRIC WITHSTAND VOLTAGE	MAXIMUM OVERLOAD VOLTAGE	TEMPERATURE COEFFICIENT OF RESISTANCE	JUMPER CRITERIA
NM0402	1 Ω to 10 MΩ	–55 °C to +155 °C	1/10 W	75 V	150 V	150 V	1Ω≤R≤10Ω: ± 200ppm °C 10Ω<R≤10MΩ: ± 100ppm °C 10MΩ<R≤22MΩ: ± 200ppm °C 10Ω≤R≤10MΩ: ± 50ppm °C (1206 only)	Rated Current 1.0A Max. Current 2.0A
NM0603	1 Ω to 22 MΩ	–55 °C to +155 °C	1/10 W	75 V	150 V	150 V		Rated Current 1.0A Max. Current 2.0A
NM0805	1 Ω to 22 MΩ	–55 °C to +155 °C	1/8 W	150 V	300 V	300 V		Rated Current 2.0A Max. Current 5.0A
NM1206	1 Ω to 22 MΩ	–55 °C to +155 °C	1/4 W	200 V	500 V	400 V		Rated Current 2.0A Max. Current 10.0A
NM2010	1 Ω to 22 MΩ	–55 °C to +155 °C	3/4 W	200 V	500 V	500 V		Rated Current 2.0A Max. Current 10.0A
NM2512	1 Ω to 22 MΩ	–55 °C to +155 °C	1 W	200 V	500 V	500 V		Rated Current 2.0A Max. Current 10.0A

NOTE
The maximum working voltage that may be continuously applied to the resistor element, see "IEC publication 60115-8"
Jumper < 50mohm

FOOTPRINT AND SOLDERING PROFILES

For recommended footprint and soldering profiles, please see the special data sheet "Chip resistors mounting".

PACKING STYLE AND PACKAGING QUANTITY

Table 3 Packing style and packaging quantity

PACKING STYLE	REEL DIMENSION	NM0402	NM0603	NM0805	NM1206	NM2010	NM2512
Paper/PE taping reel (R)	7" (178 mm)	10,000	5,000	5,000	5,000	4,000	4,000
	13" (330 mm)	50,000	20,000	20,000	20,000	--	--

NOTE

1. For Paper/PE tape and reel specification/dimensions, please see the special data sheet "Chip resistors packing"

FUNCTIONAL DESCRIPTION

POWER RATING

Each type rated power at 70°C:
NM0402=1/10W, NM0603=1/10W,
NM0805=1/8 W, NM1206=1/4W,
NM2010=3/4W, NM2512=1W

RATED VOLTAGE

The DC or AC (rms) continuous working voltage corresponding to the rated power is determined by the following formula:

$V=\sqrt{(P \times R)}$

or max. working voltage whichever is less

Where

V=Continuous rated DC or AC (rms) working voltage (V)

P=Rated power (W)

R=Resistance value (Ω)

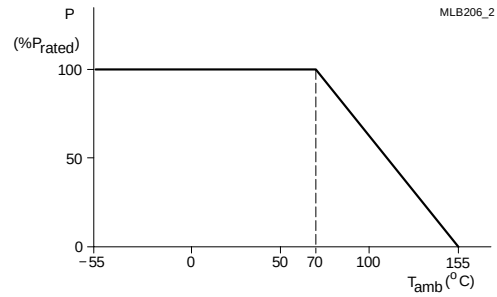


Fig. 6 Maximum dissipation (P) in percentage of rated power as a function of the operating ambient temperature (T_{amb})

TESTS AND REQUIREMENTS

Table 4 Test condition, procedure and requirements

TEST	TEST METHOD	PROCEDURE	REQUIREMENTS
Temperature Coefficient of Resistance (T.C.R.)	MIL-STD-202 Method 304	At +25/–55 °C and +25/+125 °C **Formula:** $T.C.R=\frac{R_2-R_1}{R_1(t_2-t_1)}\times 10^6$ (ppm/°C) Where t_1=+25 °C or specified room temperature t_2=–55 °C or +125 °C test temperature R_1=resistance at reference temperature in ohms R_2=resistance at test temperature in ohms	Refer to table 2
Life/Endurance	IEC 60115-1 7.1 MIL-STD-202 Method 108	At 70±2 °C for 1,000 hours, RCWV applied for 1.5 hours on, 0.5 hour off, still air required	±(3%+0.05 Ω) <100mR for jumper
High Temperature Exposure	MIL-STD-202 Method 108	1,000 hours at 155±5 °C, unpowered	±(3%+0.05 Ω) <50mR for jumper
Moisture Resistance	MIL-STD-202 Method 106	Each temperature / humidity cycle is defined at 8 hours, 3 cycles / 24 hours for 10d. with 25 °C / 65 °C 95% R.H, without steps 7a & 7b, unpowered Parts mounted on test-boards, without condensation on parts Measurement at 24±2 hours after test conclusion	±(3%+0.05 Ω) <100mR for jumper
Thermal Shock	MIL-STD-202 Method 107	-55/+125 °C Number of cycles required is 300. Devices mounted Maximum transfer time is 20 seconds. Dwell time is 15 minutes. Air – Air	±(1%+0.05 Ω) <50mR for jumper
Short Time Overload	IEC60115-1 8.1	2.5 times of rated voltage or maximum overload voltage whichever is less for 5 sec at room temperature	±(1%+0.05 Ω) No visible damage <50mR for jumper
Board Flex/ Bending	IEC 60115-1 9.8	Chips mounted on a 100mm x 40mm glass epoxy resin PCB (FR4) Bending: see table 5 for each size Bending time: 60±5 seconds	±(1%+0.05 Ω) No visible damage <50mR for jumper

TEST	TEST METHOD	PROCEDURE	REQUIREMENTS
Humidity	IEC 60115-1 10.4	Steady state for 1000 hours at 40 °C / 95% R.H. RCWV applied for 1.5 hours on and 0.5 hour off	±(3%+0.05 Ω) <100mR for jumper
Solderability - Wetting	J-STD-002 test	Electrical Test not required Magnification 50X SMD conditions: 1st step: aging 4 hours at 155°C dry heat 2nd step: method B1, leadfree solder bath at 245± 3°C Dipping time: 3± 0.5 seconds	Well tinned (≥95% covered) No visible damage
- Resistance to Soldering Heat	MIL-STD-202 Method 210	Condition B, no pre-heat of samples. Leadfree solder, 260 °C, 10 seconds immersion time Procedure 2 for SMD: devices fluxed and cleaned with isopropanol	±(1%+0.05 Ω) No visible damage <50mR for jumper

Table 5 Bending for sizes 0402 to 2512

TYPE	NM0402	NM0603	NM0805	NM1206	NM2010	NM2512
Specification (mm)	5	3	3	2	2	2

REVISION HISTORY

REVISION	DATE	CHANGE NOTIFICATION	DESCRIPTION
Version 0	Oct. 23, 2023	-	- First issue of this specification

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