Innovative Service Around the Globe YAGEO

DATA SHEET

ANTI-SULFURATED HIGH TEMPERATURE AUTOMOTIVE GRADE CHIP RESISTORS

AG series

5%, 1%, 0.5%

sizes 0402/0603/0805/1206

RoHS compliant & Halogen free

Product specification – April 08, 2022 V.0

YAGEO

SCOPE

This specification describes AG0402 to AG1206 chip resistors with anti-sulfuration and high temperature application capabilities.

APPLICATIONS

- Industrial Equipment
- Power Application
- Networking Application
- High-end Computer & Multimedia Electronics in high sulfur environment
- Automotive electronics

FEATURES

- AEC-Q200 qualified
- Superior resistance against sulfur containing atmosphere
- Halogen free product and production
- RoHS compliant
- Reduces environmentally hazardous waste
- High component and equipment reliability
- Saving of PCB space
- Moisture sensitivity level: MSL 1

ORDERING INFORMATION - GLOBAL PART NUMBER

Part number is identified by the series name, size, tolerance, packaging type, temperature coefficient, taping reel and resistance value.

GLOBAL PART NUMBER

AG XXXX X X X XX XXXX L
(1) (2) (3) (4) (5) (6) (7)

(1) SIZE

0402/0603/0805/1206

(2) TOLERANCE

D = ±0.5%
F = ±1%
J = ±5% (for jumper ordering, use code of J)

(3) PACKAGING TYPE

R = Paper taping reel
K = Embossed plastic tape reel

(4) TEMPERATURE COEFFICIENT OF RESISTANCE

– = Base on spec

(5) TAPING REEL

07 = 7 inch dia. Reel
13 = 13 inch dia. Reel
7W = 7 inch dia. Reel & High power

(6) RESISTANCE VALUE

There are 2~4 digits indicated the resistance value. Letter R/K/M is decimal point.
Detailed resistance rules are displayed in the table of "Resistance rule of global part number".

(7) DEFAULT CODE

Letter L is the system default code for ordering only. (Note)

Resistance rule of global part number

Resistance coding rule	Example
XRXX (1 to 9.76 Ω)	1R = 1 Ω 1R5 = 1.5 Ω 9R76 = 9.76 Ω
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 to 9.76 MΩ)	1M = 1,000,000 Ω 9M76= 9,760,000 Ω

ORDERING EXAMPLE

The ordering code for an AG0402 chip resistor, value 100 KΩ with ±1% tolerance, supplied in 7-inch tape reel with 10Kpcs quantity is: AG0402FR-07100KL.

NOTE

1. All our R-Chip products are RoHS compliant and Halogen free. "LFP" of the internal 2D reel label states "Lead-Free Process"
2. On customized label, "LFP" or specific symbol can be printed

MARKING

AG0402

Fig. 1

No marking

AG0603 / AG0805 / AG1206

Fig. 2 Value=10 KΩ

E-24 series: 3 digits, ±5%, ≥10Ω
First two digits for significant figure and 3rd digit for number of zeros

AG0603

Fig. 3 Value = 24 Ω

E-24 series: 3 digits, ±1%
One short bar under marking letter

Fig. 4 Value = 12.4 KΩ

E-96 series: 3 digits, ±1%
First two digits for E-96 marking rule and 3rd letter for number of zeros

AG0805 / AG1206

Fig. 5 Value = 10 KΩ

Both E-24 and E-96 series: 4 digits, ±1%
First three digits for significant figure and 4th digit for number of zeros

NOTE

For further marking information, please see special data sheet "Chip resistors marking". Marking of AG series is the same as RC series

CONSTRUCTION

The resistors are constructed on top of a high grade ceramic body. Internal metal electrodes are added at each end and connected by a resistive glaze. The resistive glaze is covered by a glass.
The composition of the glaze is adjusted to give the approximate required resistance value and laser trimming of this resistive glaze achieves the value within tolerance. The whole element is covered by a protective overcoat. Size 0603 and bigger is marked with the resistance value on top. Finally, the two external terminations (Ni / matte tin) are added. See fig.6.

Table 1 For outlines see fig. 6

TYPE	L (mm)	W (mm)	H (mm)	I_1 (mm)	I_2 (mm)
AG0402	1.00±0.05	0.50±0.05	0.35±0.05	0.20±0.10	0.25±0.10
AG0603	1.60±0.10	0.80±0.10	0.45±0.10	0.25±0.15	0.25±0.15
AG0805	2.00±0.10	1.25±0.10	0.50±0.10	0.35±0.20	0.45±0.20
AG1206	3.10±0.10	1.60±0.10	0.55±0.10	0.45±0.20	0.50±0.20

OUTLINES

For dimensions see Table 1

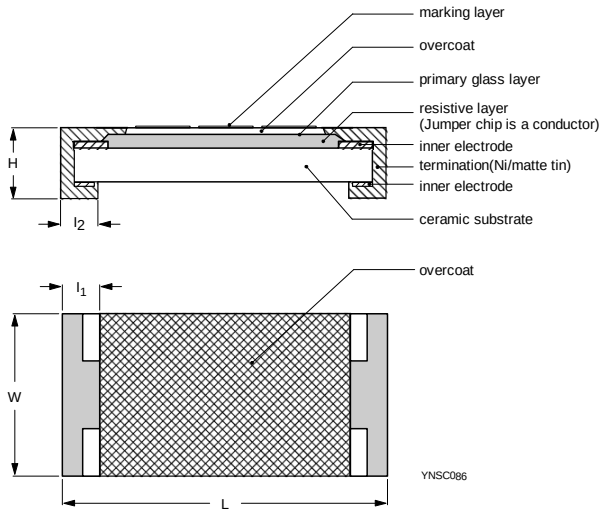

Fig. 6 Chip resistor outlines

ELECTRICAL CHARACTERISTICS

Table 2

TYPE	POWER	CHARACTERISTICS						
		Operating Temperature Range	Max. Working Voltage	Max. Overload Voltage	Dielectric Withstanding Voltage	Resistance Range	Temperature Coefficient	Jumper Criteria
AG0402	1/16 W	–55 °C to 175 °C	50V	100V	100V	5% (E24) 1Ω ≤ R ≤ 22MΩ 0.5%, 1% (E24/E96) 1Ω ≤ R ≤ 10MΩ Jumper < 50mΩ	1Ω ≤ R ≤ 10Ω ±200 ppm/°C 10Ω < R ≤ 10MΩ ±100 ppm/°C 10MΩ < R ≤ 22MΩ ±200 ppm/°C	Rated Current 1A Max. Current 2A
	1/10 W		50V	100V	100V	5% (E24) 1Ω ≤ R ≤ 10 MΩ 0.5%, 1% (E24/E96) 1Ω ≤ R ≤ 10MΩ	1Ω ≤ R ≤ 10Ω ±200 ppm/°C 10Ω < R ≤ 10MΩ ±100 ppm/°C	
AG0603	1/10 W		75V	150V	150V	5% (E24) 1Ω ≤ R ≤ 22MΩ 0.5%, 1% (E24/E96) 1Ω ≤ R ≤ 10MΩ Jumper < 50mΩ	1Ω ≤ R ≤ 10Ω ±200 ppm/°C 10Ω < R ≤ 10MΩ ±100 ppm/°C 10MΩ < R ≤ 22MΩ ±200 ppm/°C	Rated Current 1A Max. Current 2A
	1/8 W		75V	150V	150V	5% (E24) 1Ω ≤ R ≤ 10 MΩ 0.5%, 1% (E24/E96) 1Ω ≤ R ≤ 10MΩ	1Ω ≤ R ≤ 10Ω ±200 ppm/°C 10Ω < R ≤ 10MΩ ±100 ppm/°C	
AG0805	0.15 W		150V	300V	300V	5% (E24) 1Ω ≤ R ≤ 22MΩ 0.5%, 1% (E24/E96) 1Ω ≤ R ≤ 10MΩ Jumper < 50mΩ	1Ω ≤ R ≤ 10Ω ±200 ppm/°C 10Ω < R ≤ 10MΩ ±100 ppm/°C 10MΩ < R ≤ 22MΩ ±200 ppm/°C	Rated Current 2A Max. Current 5A
AG1206	1/4 W		200V	400V	500V	5% (E24) 1Ω ≤ R ≤ 22MΩ 0.5%, 1% (E24/E96) 1Ω ≤ R ≤ 10MΩ Jumper < 50mΩ	1Ω ≤ R ≤ 10Ω ±200 ppm/°C 10Ω < R ≤ 10MΩ ±100 ppm/°C 10MΩ < R ≤ 22MΩ ±200 ppm/°C	Rated Current 2A Max. Current 10A

FOOTPRINT AND SOLDERING PROFILES

For recommended footprint and soldering profiles of AG-series is the same as RC-series. 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	AG0402	AG0603 AG0805 AG1206
Paper taping reel (R)	7" (178 mm)	10,000/20,000	5,000
	13" (330 mm)	50,000	20,000

NOTE

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

FUNCTIONAL DESCRIPTION

OPERATING TEMPERATURE RANGE

AG0402 - AG1206 Range: -55°C to + 175°C

POWER RATING

Each type rated power at 105°C:

AG0402=1/16W (0.0625W); 1/10W (0.1W)

AG0603=1/10W (0.1W); 1/8W (0.125W)

AG0805=0.15 W

AG1206=1/4 W (0.25W)

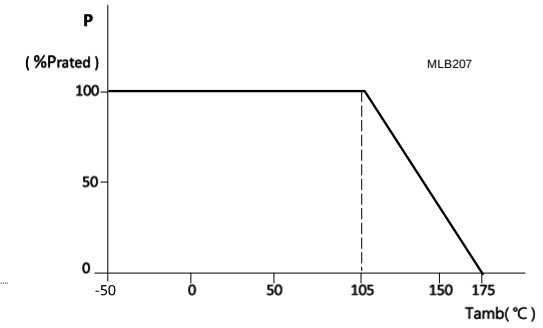

Fig. 7 Maximum dissipation (P_{max}) in percentage of rated power as a function of the operating ambient temperature (T_{amb})

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)

TESTS AND REQUIREMENTS

Table 4 Test condition, procedure and requirements

TEST	TEST METHOD	PROCEDURE	REQUIREMENTS
High Temperature Exposure	AEC-Q200 Test 3 MIL-STD-202 Method 108	1,000 hours at 175± 3°C , unpowered	±(1.0%+0.05Ω) for D/F tol ±(2.0%+0.05Ω) for J tol <100 mΩ 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	±(0.5%+0.05Ω) for D/F tol ±(2.0%+0.05Ω) <100 mΩ for Jumper
Biased Humidity	AEC-Q200 Test 7 MIL-STD-202 Method 103	1,000 hours; 85 °C / 85% RH 10% of operating power Measurement at 24±4 hours after test conclusion.	±(3.0%+0.05Ω) <100 mΩ for Jumper
Operational Life	AEC-Q200 Test 8 MIL-STD-202 Method 108	1,000 hours at 125 °C, derated voltage applied for 1.5 hours on, 0.5 hour off, still-air required	±(1.0%+0.05Ω) for D/F tol ±(3.0%+0.05Ω) for J tol <100 mΩ for Jumper
Resistance to Soldering Heat	AEC-Q200 Test 15 MIL-STD-202 Method 210	Condition B, no pre-heat of samples Lead-free solder, 260±5 °C, 10±1 seconds immersion time Procedure 2 for SMD: devices fluxed and cleaned with isopropanol	±(0.5%+0.05Ω) for D/F tol ±(1.0%+0.05Ω) for J tol <50 mΩ for Jumper No visible damage
Thermal Shock	MIL-STD-202 Method 107	-55/+125 °C Number of cycles is 300. Devices mounted Maximum transfer time is 20 seconds. Dwell time is 15 minutes. Air – Air	±(0.5%+0.05Ω) for D/F tol ±(1.0%+0.05Ω) for J tol <50 mΩ for Jumper
ESD	AEC-Q200 Test 17 AEC-Q200-002	Human Body Model, 1 $_{pos.}$ + 1 $_{neg.}$ discharges 0402/0603: 1KV 0805 and above: 2KV	±(3.0%+0.05Ω) <50 mΩ for Jumper

TEST	TEST METHOD	PROCEDURE	REQUIREMENTS
Solderability - Wetting	AEC-Q200 Test 18 J-STD-002	Electrical Test not required Magnification 50X SMD conditions: (a) Method B, aging 4 hours at 155 °C dry heat, dipping at 235±3 °C for 5±0.5 seconds. (b) Method B, steam aging 8 hours, dipping at 215±3 °C for 5±0.5 seconds. (c) Method D, steam aging 8 hours, dipping at 260±3 °C for 30±0.5 seconds.	Well tinned (≥95% covered) No visible damage
Board Flex	AEC-Q200 Test 21 AEC-Q200-005	Chips mounted on a 100mm x 40mm glass epoxy resin PCB (FR4) Bending for 0402: 5 mm 0603/0805: 3 mm 1206 and above: 2 mm Holding time: minimum 60 seconds	±(1.0%+0.05Ω) <50 mΩ for Jumper
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
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%+0.05Ω) for D/F tol ±(2.0%+0.05Ω) for J tol <50 mΩ for Jumper
FOS	ASTM-B 809-95* * Modified	Oil 105° 500 hours. unpowered	± (5.0%+0.05Ω) <100 mΩ for Jumper

REVISION HISTORY

REVISION	DATE	CHANGE NOTIFICATION	DESCRIPTION
Version 0	Apr. 08, 2022	-	- Preliminary specification

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