Innovative Service Around the Globe YAGEO

DATA SHEET

ANTI-SULFURATED CHIP RESISTORS AUTOMOTIVE GRADE

AA series

±5%, ±1%, ±0.5%

sizes 0201/0402/0603/0805/1206/ 1210/1218/2010/2512

RoHS compliant & Halogen free

YAGEO

Product specification – December 08, 2015 V.3

SCOPE

This specification describes AA0201 to AA2512 chip resistors with lead-free terminations made by thick film process.

APPLICATIONS

- Car electronics
- Engine control unit
- Body control system
- Safety devices

FEATURES

- Superior resistance against sulfur containing atmosphere
- AEC-Q200 qualified
- Moisture sensitivity level: MSL1
- AA series soldering is compliant with J-STD-020D
- Halogen free epoxy
- RoHS compliant
- Reduce environmentally hazardous waste
- High component and equipment reliability
- The resistors are 100% performed by automatic optical inspection

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

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

(1) SIZE

0201 / 0402 / 0603 / 0805 / 1206 / 1210 / 1218 / 2010 / 2512

(2) TOLERANCE

D = ±0.5%

F = ±1%

J = ±5% (for Jumper ordering, use code of J)

(3) PACKAGING TYPE

R = Paper/PE taping reel

K = Embossed taping reel

(4) TEMPERATURE COEFFICIENT OF RESISTANCE

– = Base on spec

(5) TAPING REEL

07 = 7 inch dia. Reel

13 = 13 inch dia. Reel

(6) RESISTANCE VALUE

1Ω to 10 MΩ

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

(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 976R = 976 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
XXMX (10 MΩ)	10M = 10,000,000 Ω

ORDERING EXAMPLE

The ordering code for an AA0402 chip resistor, value 100 KΩ with ±1% tolerance, supplied in 7-inch tape reel is: AA0402FR-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

AA0201 / AA0402

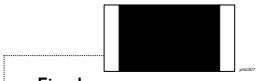

Fig. 1

No marking

AA0603 / AA0805 / AA1206 / AA1210 / AA2010 / AA2512

Fig. 2 Value=10 KΩ

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

AA0603

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

AA0805 / AA1206 / AA1210 / AA2010 / AA2512

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

AA1218

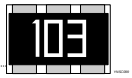

Fig. 6 Value = 10 KΩ

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

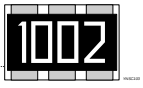

Fig. 7 Value = 10 KΩ

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 refer to data sheet "Chip resistors marking". Marking of AA series is the same as RC series.

CONSTRUCTION

The resistors are constructed on top of an automotive grade ceramic body. Internal metal electrodes are added at each end and connected by a resistive glaze. The resistive glaze is covered by a lead-free glass. The composition of the glaze is adjusted to give the approximately 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, as shown in Fig.8.

OUTLINES

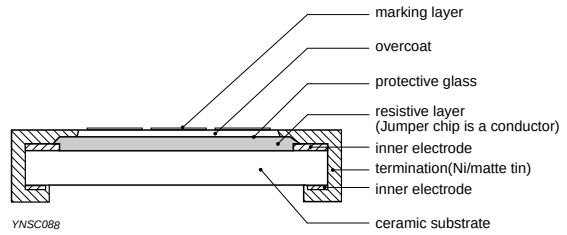

Fig. 8 Chip resistor outlines

DIMENSIONS

Table 1 For outlines, please refer to Fig. 9

TYPE	L (mm)	W (mm)	H (mm)	l_1 (mm)	l_2 (mm)
AA0201	0.60 ±0.03	0.30 ±0.03	0.23 ±0.03	0.12 ±0.05	0.15 ±0.05
AA0402	1.00 ±0.05	0.50 ±0.05	0.35 ±0.05	0.20 ±0.10	0.25 ±0.10
AA0603	1.60 ±0.10	0.80 ±0.10	0.45 ±0.10	0.25 ±0.15	0.25 ±0.15
AA0805	2.00 ±0.10	1.25 ±0.10	0.50 ±0.10	0.35 ±0.20	0.35 ±0.20
AA1206	3.10 ±0.10	1.60 ±0.10	0.55 ±0.10	0.45 ±0.20	0.50 ±0.20
AA1210	3.10 ±0.10	2.60 ±0.15	0.57 ±0.10	0.45 ±0.20	0.50 ±0.20
AA1218	3.10 ±0.10	4.60 ±0.10	0.57 ±0.10	0.45 ±0.20	0.50 ±0.20
AA2010	5.00 ±0.10	2.50 ±0.15	0.57 ±0.10	0.55 ±0.20	0.55 ±0.20
AA2512	6.35 ±0.10	3.20 ±0.15	0.57 ±0.10	0.60 ±0.20	0.60 ±0.20

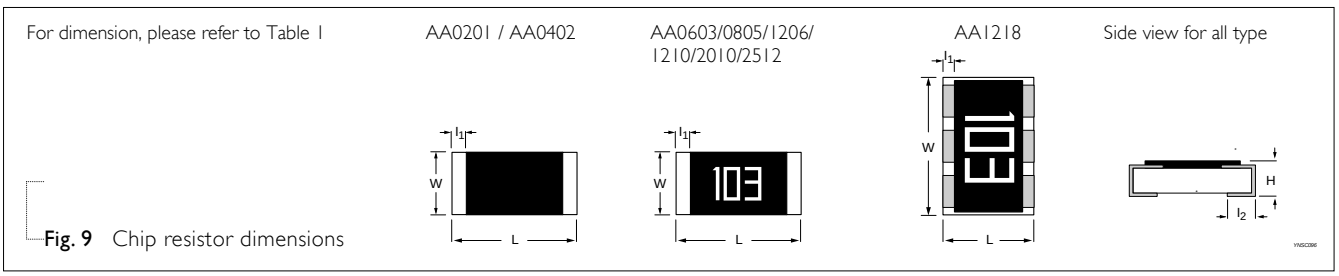

Fig. 9 Chip resistor dimensions

ELECTRICAL CHARACTERISTICS

Table 2

TYPE	RESISTANCE RANGE	CHARACTERISTICS					
		Operating Temperature Range	Max. Working Voltage	Max. Overload Voltage	Dielectric Withstanding Voltage	Temperature Coefficient of Resistance	Jumper Criteria
AA0201	5% (E24) 1Ω≤ R ≤ 22MΩ (0201: Max. 10MΩ. 1218: Max. 1MΩ) 0.5%, 1% (E24/E96) 1Ω≤ R ≤10MΩ (1218: Max. 1MΩ) Jumper < 50mΩ	–55 °C to +155 °C	25V	50V	50V	1Ω ≤ R ≤ 10Ω, -100/+400 ppm/°C 10Ω < R ≤ 10 MΩ, ±300 ppm/°C	Rated Current 0.5A Max. Current 1.0A
AA0402			50 V	100 V	100 V	1Ω ≤ R ≤ 10Ω, ±200 ppm/°C 10Ω < R ≤ 10 MΩ, ±150 ppm/°C 10 MΩ < R ≤ 22 MΩ, ±200 ppm/°C	Rated Current 1A Max. Current 2A
AA0603			75V	150 V	150 V		Rated Current 1A Max. Current 2A
AA0805			150 V	300 V	300 V		Rated Current 2A Max. Current 5A
AA1206			200 V	400 V	500 V		Rated Current 2A Max. Current 10A
AA1210			200 V	500 V	500 V		Rated Current 2A Max. Current 10A
AA1218			200 V	500 V	500 V		Rated Current 6A Max. Current 10A
AA2010			200 V	500 V	500 V		Rated Current 2A Max. Current 10A
AA2512			200 V	500 V	500 V		Rated Current 2A Max. Current 10A

FOOTPRINT AND SOLDERING PROFILES

Recommended footprint and soldering profiles. Please refer to data sheet "Chip resistors mounting".

PACKING STYLE AND PACKAGING QUANTITY

Table 3 Packing style and packaging quantity

PACKING STYLE	REEL DIMENSION	AA0201	AA0402	AA0603	AA0805	AA1206	AA1210	AA1218	AA2010	AA2512
Paper/PE taping reel (R)	7" (178 mm)	10,000	10,000	5,000	5,000	5,000	5,000	---	---	---
	13" (330 mm)	50,000	50,000	20,000	20,000	20,000	20,000	---	---	---
Embossed taping reel (K)	7" (178 mm)	---	---	---	---	---	---	4,000	4,000	4,000

NOTE

1. For paper/PE/embossed tape and reel specifications/dimensions, please refer to data sheet "Chip resistors packing".

FUNCTIONAL DESCRIPTION

OPERATING TEMPERATURE RANGE

Range: -55°C to +155°C

POWER RATING

Each type rated power at 70°C:
AA0201=1/20W (0.05W)
AA0402=1/16 W (0.0625W)
AA0603=1/10 W (0.1W)
AA0805=1/8 W (0.125W)
AA1206=1/4 W (0.25W)
AA1210=1/2 W (0.5W)
AA1218=1 W
AA2010=3/4 W (0.75W)
AA2512=1 W

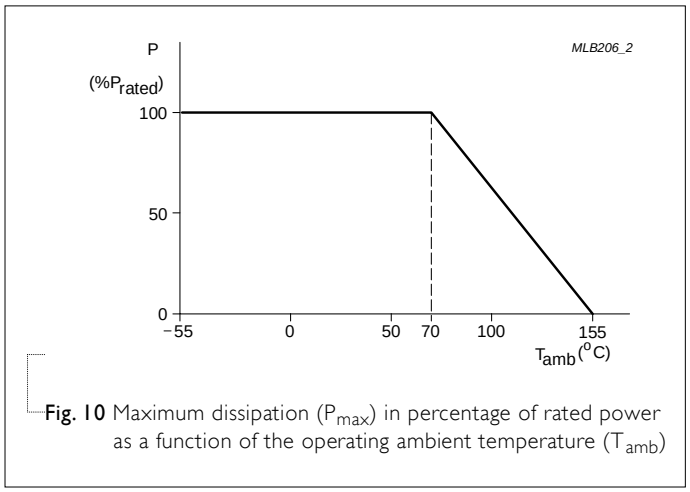

Fig. 10 Maximum dissipation (P_{max}) in percentage of rated power as a function of the operating ambient temperature (T_{amb})

RATED VOLTAGE

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

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

Or Maximum working voltage whichever is less

Where

V = Continuous rated DC or AA (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 T_A = 155 °C, unpowered	±(1.0%+0.05Ω) <50 mΩ for Jumper
Moisture Resistance	AEC-Q200 Test 6 MIL-STD-202 Method 106	Each temperature / humidity cycle is defined at 8 hours (method 106F), 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	±(0.5%+0.05Ω) for D/F tol. ±(2.0%+0.05Ω) for J tol. <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) <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	AEC-Q200 Test 16 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	±(1.0%+0.05Ω) <50 mΩ for Jumper
ESD	AEC-Q200 Test 17 AEC-Q200-002	1 pos. + 1 neg. discharges 0201: 500V 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 7±0.5 seconds.	Well tinned (≥95% covered) No visible damage
Board Flex	AEC-Q200 Test 21 AEC-Q200-005	Chips mounted on a 90mm glass epoxy resin PCB (FR4) Bending for 0201/0402: 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.)	IEC 60115-1 4.8 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 4.13	2.5 times of rated voltage or maximum overload voltage whichever is less for 5 sec at room temperature	±(1.0%+0.05Ω) <50 mΩ for Jumper
FOS	ASTM-B-809-95	- Sulfur (saturated vapor) 1000 hours, 90±2 °C unpowered	±(1.0%+0.05Ω)
	ASTM-B-809-95* *Modified	- Sulfur 750 hours, 105 °C. unpowered	±(4.0%+0.05Ω)

REVISION HISTORY

REVISION	DATE	CHANGE NOTIFICATION	DESCRIPTION
Version 3	Dec. 08, 2015	-	- Update Dielectric Withstanding Voltage
Version 2	Apr. 09, 2015	-	- Modified FOS test procedure
Version 1	Jan. 27, 2015	-	- Dimensions update
Version 0	Feb. 27, 2014	-	- First issue of this specification

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