



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

Product specification – December 08, 2015 V.3



YAGEO Phícomp

Chip Resistor Surface Mount | AA | SERIES | 0201 to 2512

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: MSLI
- 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 <u>XXXX X X X XX XXXX L</u>

(1) (2) (3) (4) (5) (6) (7)

(I) SIZE

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

(2) TOLERANCE

 $D = \pm 0.5\%$ F = ±1%

 $J = \pm 5\%$ (for Jumper ordering, use code of J)

(3) PACKAGING TYPE

R = Paper/PE taping reel

K = Embossed taping reel

13 = 13 inch dia. Reel

(4) TEMPERATURE COEFFICIENT OF RESISTANCE

- = Base on spec

(5) TAPING REEL

07 = 7 inch dia. Reel

(6) RESISTANCE VALUE

$I\Omega$ to I0 M Ω

There are $2\sim4$ 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. IK2, not IK20.

(7) DEFAULT CODE

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

Resistance rule of global part number

Resistance coding	Example
XRXX (I to 9.76 Ω)	R = Ω R5 = .5 Ω 9R76 = 9.76 Ω
XXRX	IOR = IO Ω
(10 to 97.6 Ω)	97R6 = 97.6 Ω
XXXR	100R = 100 Ω
(100 to 976 Ω)	976R = 976 Ω
XKXX	K = 1,000 Ω
(Ι to 9.76 KΩ)	9K76 = 9760 Ω
XMXX	IM = 1,000,000 Ω
(I to 9.76 MΩ)	9M76= 9,760,000 Ω
XXMX (10 MΩ)	$10M = 10,000,000 \ \Omega$

ORDERING EXAMPLE

The ordering code for an AA0402 chip

resistor, value 100 K Ω with ±1% tolerance, supplied in 7-inch tape reel is: AA0402FR-07100KL

NOTE

- 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.

	Chip Resistor Surface Mount AA series 0201 to 2512					
MARKING AA0201 / AA	_					
Fig. I	yunto	No marking				
AA0603 / AA	A0805 / AA1206 / A	A1210 / AA2010 / AA2512				
Fig. 2 Va	alue=10 KΩ	E-24 series: 3 digits, ±5% First two digits for significant figure and 3rd digit for number of zeros				
AA0603						
Fig. 3 Va	2<u>μ</u>Ω alue = 24 Ω	E-24 series: 3 digits, ±1% One short bar under marking letter				
Fig. 4 Va	ΠΓ alue = 12.4 KΩ	E-96 series: 3 digits, $\pm 1\%$ First two digits for E-96 marking rule and 3rd letter for number of zeros				
AA0805 / AA	A1206 / AA1210 / A	A2010 / AA2512				
Fig. 5 Val	1002 ue = 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 Val	103 ue = 10 KΩ	E-24 series: 3 digits, $\pm 5\%$ First two digits for significant figure and 3rd digit for number of zeros				
Fig. 7 Val	ue = 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				

ΝΟΤΕ

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For further marking information, please refer to data sheet "Chip resistors marking". Marking of AA series is the same as RC series.



Product specification 3

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Chip Resistor Surface Mount AA SERIES 0201 to 2512

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



DIMENSIONS

Table I	For outlines, please refer to Fig. 9				
TYPE	L (mm)	W (mm)	H (mm)	lı (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	0.32 ±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	0.40 ±0.20
AA1210	3.10 ±0.10	2.60 ±0.15	0.50 ±0.10	0.45 ±0.15	0.50 ±0.20
AA1218	3.10 ±0.10	4.60 ±0.10	0.55 ±0.10	0.45 ±0.20	0.40 ±0.20
AA2010	5.00 ±0.10	2.50 ±0.15	0.55 ±0.10	0.55 ±0.15	0.50 ±0.20
AA2512	6.35 ±0.10	3.10 ±0.15	0.55 ±0.10	0.60 ±0.20	0.50 ±0.20





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ELECTRICAL CHARACTERISTICS

Table 2							
		CHARACTERISTICS					
ТҮРЕ	resistance Range	Operating Temperature Range	Max. Working Voltage	Max. Overload Voltage	Dielectric Withstanding Voltage	Temperature Coefficient of Resistance	Jumper Criteria
AA0201			25V	50V	50V	IΩ≤ R≤10Ω, -100/+400 ppm/°C	Rated Current 0.5A
						10Ω < R≤ 10 MΩ, ±300 ppm/°C	Max. Current 1.0A
AA0402		-	50 V	100 V	100 V		Rated Current IA
		-		100 V	100 \$ 100 \$	_	Max. Current 2A
AA0603	5% (E24)		75V	150 V	150 V		Rated Current IA
	$I\Omega \le R \le 22M\Omega$	-				-	Max. Current 2A
AA0805	(0201: Max. 10MΩ. 1218: Max. 1MΩ)		150 V	300 V	300 V		Rated Current 2A
	0.5%, 1% (E24/E96)	–55 °C to +155 °C ⁻				$ \Omega \leq R \leq 0\Omega, -$	Max. Current 5A
AA1206	Ω≤ R ≤10MΩ (1218: Max, 1MΩ)		200 V	400 V	500 V	±200 ppm/°C	Rated Current 2A
	Jumper < $50 \text{m}\Omega$	-				$10\Omega < R \le 10 M\Omega_{-}$	Max. Current 10A
AA1210			200 V	500 V	500 V	$\pm 150 \text{ ppm/°C}$ $10 \text{ M}\Omega < \text{R} \leq 22 \text{ M}\Omega$,	Rated Current 2A Max. Current 10A
		-				±200 ppm/°C	Rated Current 6A
AA1218			200 V	500 V	500 V		Max. Current 10A
		-				-	Rated Current 2A
AA2010			200 V	200 V 500 V	500 V		Max, Current 10A
		-				-	Rated Current 2A
AA2512			200 V	500 ∨	500 V		Max. Current 10A

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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)
- $R = Resistance value (\Omega)$

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TESTS AND REQUIREMENTS

TEST	dition, procedure and require TEST METHOD	PROCEDURE	REQUIREMENTS
High Temperature	AEC-Q200 Test 3	1,000 hours at $T_A = 155$ °C, unpowered	\pm (1.0%+0.05 Ω)
Exposure	MIL-STD-202 Method 108		$<\!50~\text{m}\Omega$ for Jumper
Moisture	AEC-Q200 Test 6	Each temperature / humidity cycle is defined at	±(0.5%+0.05Ω) for D/F to
Resistance	MIL-STD-202 Method 106	8 hours (method 106F), 3 cycles / 24 hours for 10d. with 25 °C / 65 °C 95% R.H, without steps 7a & 7b, unpowered	\pm (2.0%+0.05 Ω) for J tol. <100 m Ω for Jumper
		Parts mounted on test-boards, without condensation on parts	
Biased	AEC-Q200 Test 7	I,000 hours; 85 °C / 85% RH	±(3.0%+0.05Ω)
Humidity	MIL-STD-202 Method 103	10% of operating power Measurement at 24±4 hours after test conclusion.	<100 m Ω for Jumper
Operational Life	AEC-Q200 Test 8	1,000 hours at 125 °C, derated voltage applied for	±(1.0%+0.05Ω)
	MIL-STD-202 Method 108	1.5 hours on, 0.5 hour off, still-air required	<100 m Ω for Jumper
Resistance to	AEC-Q200 Test 15	Condition B, no pre-heat of samples	±(0.5%+0.05Ω) for D/F to
Soldering Heat	MIL-STD-202 Method 210	Lead-free solder, 260±5 °C, 10±1 seconds immersion time	±(1.0%+0.05Ω) for J tol. <50 mΩ for Jumper
		Procedure 2 for SMD: devices fluxed and cleaned with isopropanol	No visible damage
Thermal Shock	AEC-Q200 Test 16	-55/+125 °C	±(1.0%+0.05Ω)
	MIL-STD-202 Method 107	Number of cycles is 300. Devices mounted	$<$ 50 m Ω for Jumper
		Maximum transfer time is 20 seconds. Dwell time is 15 minutes. Air – Air	
ESD	AEC-Q200 Test 17	l pos. + l neg. discharges	±(3.0%+0.05Ω)
	AEC-Q200-002	0201: 500V	$<$ 50 m Ω for Jumper
		0402/0603: TKV 0805 and above: 2KV	

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TEST	TEST METHOD	PROCEDURE	REQUIREMENTS
Solderability			
- Wetting	AEC-Q200 Test 18	Electrical Test not required Magnification 50X	Well tinned (≥95% covered)
	J-STD-002	SMD conditions:	No visible damage
		(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 ℃ for 7±0.5 seconds.	
Board Flex	AEC-Q200 Test 21 AEC-Q200-005	Chips mounted on a 90mm glass epoxy resin PCB (FR4)	\pm (1.0%+0.05 Ω) <50 mΩ for Jumper
		Bending for 0201/0402: 5 mm 0603/0805: 3 mm 1206 and above: 2 mm	
		Holding time: minimum 60 seconds	
Temperature Coefficient of	IEC 60115-1 4.8 MIL-STD-202 Method 304	At +25/–55 °C and +25/+125 °C	Refer to table 2
Resistance (T.C.R.)		Formula:	
		T.C.R= $\frac{R_2 - R_1}{R_1(t_2 - t_1)} \times 10^6 \text{ (ppm/°C)}$	
		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	
Short Time	IEC60115-14.13	2.5 times of rated voltage or maximum	±(1.0%+0.05 Ω)
Overload		overload voltage whichever is less for 5 sec at room temperature	<50 m Ω for Jumper
FOS	ASTM-B-809-95	- Sulfur (saturated vapor) 1000 hours, 90 ±2 °C unpowered	±(1.0%+0.05 Ω)
_	ASTM-B-809-95* *Modified	- Sulfur 750 hours, 105 °C. unpowered	±(4.0%+0.05 Ω)

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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 I	Jan. 27, 2015	-	- Dimensions update
Version 0	Feb. 27, 2014	-	- First issue of this specification



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