

# DATA SHEET

## ANTI-SULFURATED CHIP RESISTORS

AF122 (4Pin/2R) / AF124 (8Pin/4R) /  
AF164 (8Pin/ 4R)

5%, 1%

sizes 2 × 0402, 4 × 0402, 4 × 0603

RoHS compliant



SCOPE

This specification describes AF122/AF124/AF164 (convex) series chip resistor arrays with lead-free terminations made by thick film process.

APPLICATIONS

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

FEATURES

- RoHS compliant
  - Products with lead free terminations meet RoHS requirements
  - Pb-glass contained in electrodes
  - Resistor element and glass are exempted by RoHS
- Reducing environmentally hazardous wastes
- High component and equipment reliability
- Saving of PCB space
- None forbidden-materials used in products/production
- Halogen Free Epoxy
- Moisture sensitivity level: MSL 1

ORDERING INFORMATION – GLOBAL PART NUMBER & 12NC

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)**

**AF XX X - X X X XX XXXX L**

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

(1) SIZE

12 = 0402 x 2 (0404)

12 = 0402 x 4 (0408)

16 = 0603 x 4 (0612)

(2) NUMBER OF RESISTORS

2 = 2 resistors

4 = 4 resistors

(3) TOLERANCE

F = ±1%

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

(4) PACKAGING TYPE

R = Paper taping reel

(5) TEMPERATURE COEFFICIENT OF RESISTANCE

- = Base on spec

(6) TAPING REEL

07 = 7 inch dia. Reel

13 = 13 inch dia. Reel

(7) 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".

(8) DEFAULT CODE

Resistance code rule	Example
OR	0R = Jumper
XRXX	1R = 1 Ω
(1 to 9.76 Ω)	1R5 = 1.5 Ω
	9R76 = 9.76 Ω
XXRX	10R = 10 Ω
(10 to 97.6 Ω)	97R6 = 97.6 Ω
XXXR	100R = 100 Ω
(100 to 976 Ω)	
XKXX	1K = 1,000 Ω
(1 to 9.76 KΩ)	9K76 = 9760 Ω
XM	1M = 1,000,000 Ω
(1 MΩ)	

Resistance rule of global part number

**ORDERING EXAMPLE**

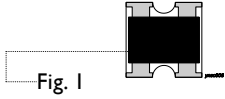
The ordering code of a AF122 convex chip resistor array, value 1,000Ω with ±5% tolerance, supplied in 7-inch tape reel is: AF122-JR-071KL.

**NOTE**

1. All our R-Chip products meet RoHS compliant. "LFP" of the internal 2D reel label mentions "Lead Free Process"
2. On customized label, "LFP" or specific symbol printed and the optional "L" at the end of GLOBAL PART NUMBER

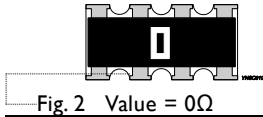
**MARKING**

**AF122**

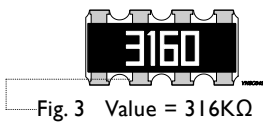


No marking

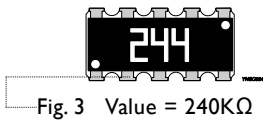
**AF124 / 164**



I-Digit marking



1% E-24/E-96:  $R \geq 100\Omega$  4digits  
First three digits for significant figure and 4th digit for number of zeros



5% E-24:  $R \geq 10\Omega$   
First two digits for significant figure and 3rd digit for number of zeros

For further marking information, please refer to data sheet “Chip resistors marking”.

**CONSTRUCTION**

The resistor is constructed on top of a high-grade ceramic body. Internal metal electrodes are added on each end to make the contacts to the thick film resistive element. The composition of the resistive element is a noble metal imbedded into a glass and covered by a second glass to prevent environment influences. The resistor is laser trimmed to the rated resistance value. The resistor is covered with a protective epoxy coat, finally the external terminations (matte tin on Ni-barrier) are added as shown in Fig.4.

**OUTLINES**

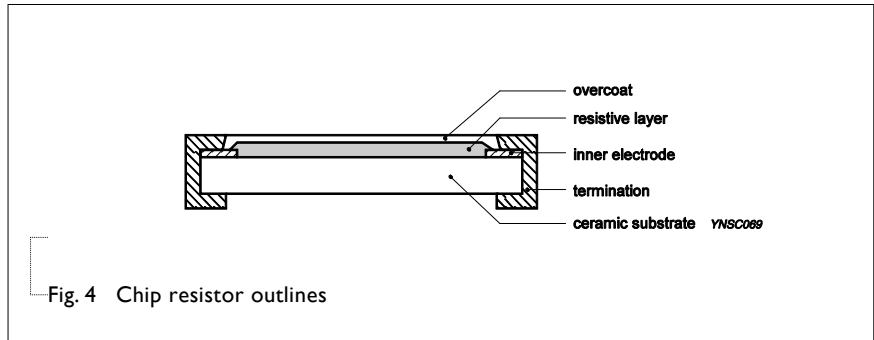


Fig. 4 Chip resistor outlines

**DIMENSIONS**

Table I

TYPE	AF122	AF124	AF164
B (mm)	0.24±0.10	0.25±0.15	0.35±0.15
H (mm)	0.30+0.10/-0.05	0.45±0.05	0.65±0.05
H <sub>i</sub> (mm)	---	0.30±0.05	0.50±0.15
P (mm)	0.67±0.05	0.50±0.05	0.80±0.05
L (mm)	1.00±0.10	2.00±0.10	3.20±0.15
T (mm)	0.30±0.10	0.45±0.10	0.60±0.10
W <sub>1</sub> (mm)	0.25±0.10	0.30±0.15	0.30±0.15
W <sub>2</sub> (mm)	1.00±0.10	1.00±0.10	1.60±0.15

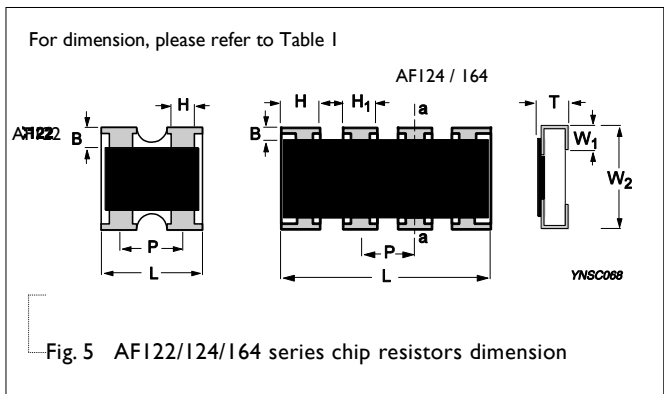
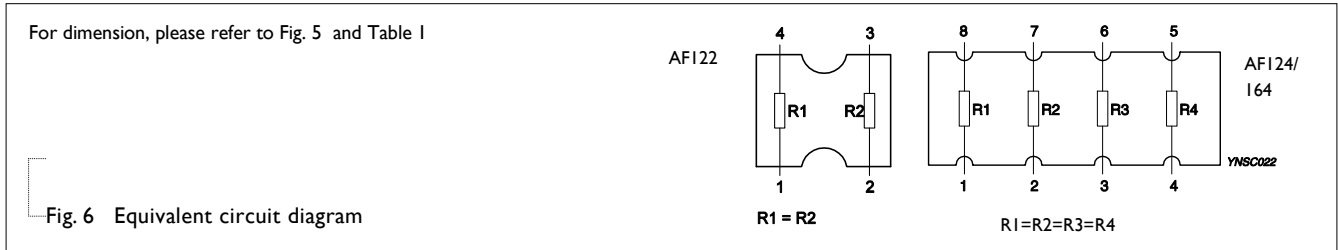


Fig. 5 AF122/124/164 series chip resistors dimension

**SCHEMATIC**



**ELECTRICAL CHARACTERISTICS**

Table 2

CHARACTERISTICS	AF122		AF124		AF164	
Operating Temperature Range	-55 °C to +125 °C		-55 °C to +155 °C		-55 °C to +155 °C	
Rated Power	1/16 W		1/16 W		1/16W	
Maximum Working Voltage	50 V		25 V		50V	
Maximum Overload Voltage	100 V		50 V		100V	
Dielectric Withstanding Voltage	100 V		100 V		100V	
Resistance Range	5% (E24)	1 Ω to 1 MΩ	5% (E24)	1 Ω to 1 MΩ	5%(E24)	1 Ω to 1MΩ
	1% (E24/E96)	10 Ω to 1 MΩ	1% (E24/E96)	1 Ω to 1 MΩ	1% (E24/E96)	1 Ω to 1MΩ
	Jumper < 50 mΩ		Jumper < 50 mΩ		Jumper <50 mΩ	
Temperature Coefficient	1 Ω ≤ R < 10 Ω	±250 ppm/°C	1 Ω ≤ R < 10 Ω	±250 ppm/°C	±250 ppm/°C	
	10 Ω ≤ R ≤ 1 MΩ	±200 ppm/°C	10 Ω ≤ R ≤ 1 MΩ	±200 ppm/°C		
Jumper Criteria	Rated Current	0.5 A	Rated Current	1.0 A	Rated Current	1.0A
	Maximum Current	1.0 A	Maximum Current	2.0 A	Maximum Current	2.0A

**FOOTPRINT AND SOLDERING PROFILES**

For 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	AF122	AF124	AF164
Paper Taping Reel (R)	7" (178 mm)	10,000 units	10,000 units	5,000 units
	13" (330 mm)	50,000 units	40,000 units	20,000 units

**NOTE**

I. For paper tape and reel specification/dimensions, please refer to data sheet “Chip resistors packing”.

FUNCTIONAL DESCRIPTION

**POWER RATING**

AF122 / AF124 / AF164 rated power at 70 °C is 1/16 W

**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 ( $\Omega$ )

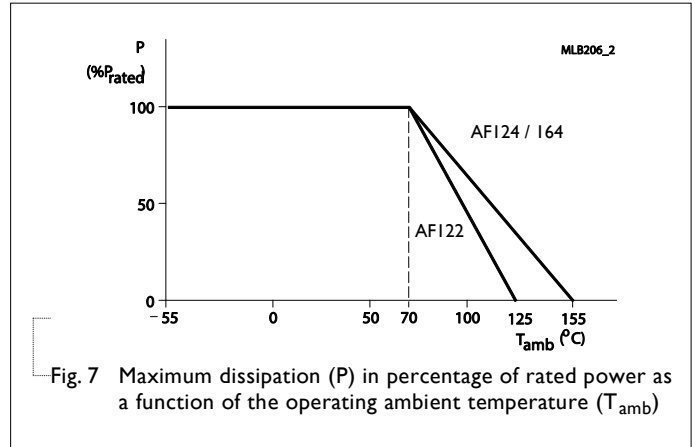


Fig. 7 Maximum dissipation (P) in percentage of rated power as a function of the operating ambient temperature (T<sub>amb</sub>)

**TESTS AND REQUIREMENTS**

Table 4 Test condition, procedure and requirements

TEST	TEST METHOD	PROCEDURE	REQUIREMENTS
Life/ Operational Life/ Endurance	MIL-STD-202-method 108 IEC 60115-1 4.25.1 JIS C 5202-7.10	1,000 hours at 70±5 °C applied RCWV 1.5 hours on, 0.5 hour off, still air required	±(2%+0.05 Ω) <100 mΩ for Jumper
High Temperature Exposure	MIL-STD-202-method 108	1,000 hours at maximum operating temperature depending on specification, unpowered  No direct impingement of forced air to the parts  Tolerances: 125±3 °C	±(1%+0.05 Ω) <50 mΩ for Jumper
Moisture Resistance	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  Measurement at 24±2 hours after test conclusion	±(2%+0.05 Ω) <100 mΩ for Jumper
Thermal Shock	MIL-STD-202-method 107	-55/+125 °C  Note: 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) <50 mΩ for Jumper
Short Time Overload	IEC60115-1 4.13	2.5 times RCWV or maximum overload voltage whichever is less for 5 sec at room temperature	±(2%+0.05 Ω) <50 mΩ for Jumper No visible damage
Board Flex/ Bending	IEC60115-1 4.33	Device mounted on PCB test board as described, only 1 board bending required  3 mm bending  Bending time: 60±5 seconds  Ohmic value checked during bending	±(1%+0.05 Ω) <50 mΩ for Jumper No visible damage

TEST	TEST METHOD	PROCEDURE	REQUIREMENTS
Solderability - Wetting	J-STD-002B test B	Electrical Test not required Magnification 50X SMD conditions: 1 <sup>st</sup> step: method B, aging 4 hours at 155 °C dry heat 2 <sup>nd</sup> step: leadfree solder bath at 245±3 °C Dipping time: 3±0.5 seconds	Well tinned (≥95% covered) No visible damage
- Leaching	STD-002B test D	Leadfree solder, 260 °C, 30 seconds immersion time	No visible damage
- Resistance to Soldering Heat	IEC 60115-1 4.18 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%+0.05Ω) <50 mΩ for Jumper No visible damage
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 2	May 29,2015	-	- Add in AF164
Version 1	Aug. 15, 2014	-	- Update AF124 dimensions
Version 0	Oct. 02, 2013	-	- First issue of this specification

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