

DATA SHEET

ANTI-SULFURATED CHIP RESISTORS

AF series

5%, 1%, 0.5%

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

RoHS compliant & Halogen free

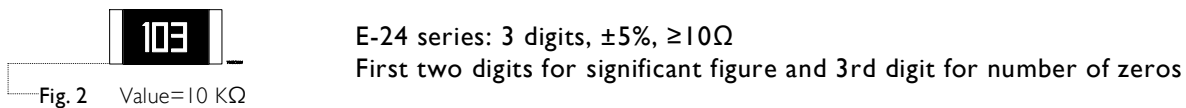


MARKING

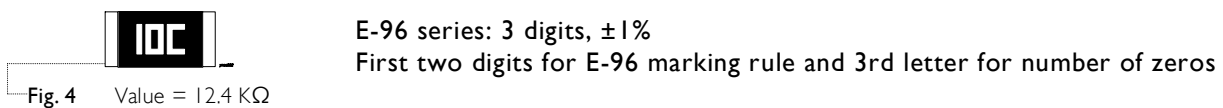
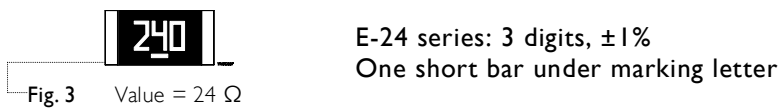
AF0201 / AF0402



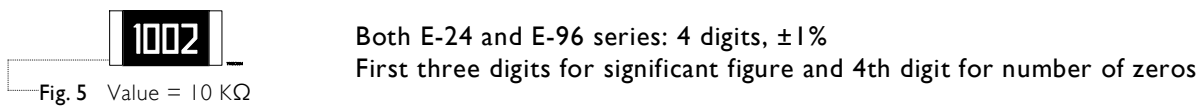
AF0603 / AF0805 / AF1206 / AF1210 / AF2010 / AF2512



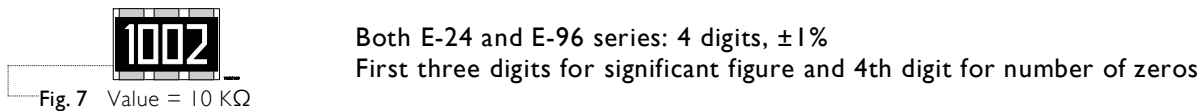
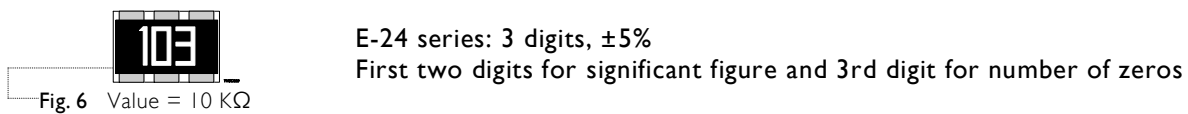
AF0603



AF0805 / AF1206 / AF1210 / AF2010 / AF2512



AF1218



NOTE

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

CONSTRUCTION

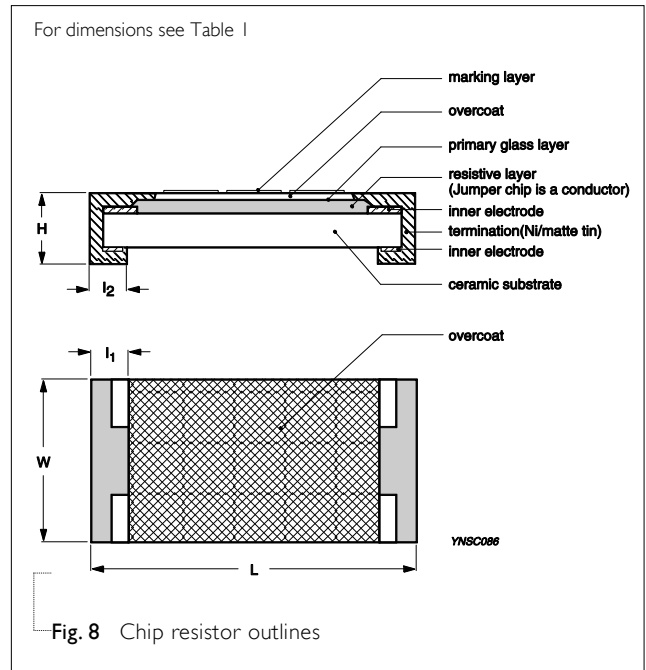
The resistors are constructed on top of a high grade ceramic body. Internal metal electrodes are added at each end and connected by a resistive glaze. The resistive glaze is covered by a lead-free glass. The composition of the glaze is adjusted to give the approximate required resistance value and laser 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.8

DIMENSIONS

Table I For outlines see fig. 8

TYPE	L (mm)	W (mm)	H (mm)	l ₁ (mm)	l ₂ (mm)
AF0201	0.60±0.03	0.30±0.03	0.23±0.03	0.10±0.05	0.15±0.05
AF0402	1.00 ±0.05	0.50 ±0.05	0.32 ±0.05	0.20 ±0.10	0.25 ±0.10
AF0603	1.60 ±0.10	0.80 ±0.10	0.45 ±0.10	0.25 ±0.15	0.25 ±0.15
AF0805	2.00 ±0.10	1.25 ±0.10	0.50 ±0.10	0.35 ±0.20	0.35 ±0.20
AF1206	3.10 ±0.10	1.60 ±0.10	0.55 ±0.10	0.45 ±0.20	0.40 ±0.20
AF1210	3.10±0.10	2.60±0.15	0.50±0.10	0.45±0.15	0.50±0.20
AF1218	3.10±0.10	4.60±0.10	0.55±0.10	0.45±0.20	0.40±0.20
AF2010	5.00±0.10	2.50±0.15	0.55±0.10	0.55±0.15	0.50±0.20
AF2512	6.35±0.10	3.10±0.15	0.55±0.10	0.60±0.20	0.50±0.20

OUTLINES



ELECTRICAL CHARACTERISTICS

Table 2

TYPE	RESISTANCE RANGE	CHARACTERISTICS				
		Operating Temperature Range	Max. Working Voltage	Max. Overload Voltage	Dielectric Withstanding Voltage	Temperature Coefficient of Resistance
AF0201	±5% (E24), 1Ω to 10MΩ ±0.5%, ±1% (E24/E96), 1Ω to 10MΩ Zero Ohm Jumper < 0.05Ω	-55°C to +125°C	25 V	50 V	50 V	1Ω ≤ R ≤ 10Ω, -100/+350 ppm/°C 10Ω < R ≤ 10MΩ, ±200 ppm/°C
AF0402	±5% (E24), 1 Ω to 22 MΩ ±0.5%, ±1% (E24/E96), 1 Ω to 10 MΩ Zero Ohm Jumper < 0.05 Ω	-55 °C to +155 °C	50 V	100 V	100 V	1 Ω ≤ R ≤ 10 Ω, ±200 ppm/°C 10 Ω < R ≤ 10 MΩ, ±100 ppm/°C 10 MΩ < R ≤ 22 MΩ, ±200 ppm/°C
AF0603			75 V	150 V	100 V	
AF0805			150 V	300 V	300 V	
AF1206			200 V	400 V	500 V	
AF1210			200 V	500 V	500 V	
AF1218	±5% (E24), 1Ω to 10MΩ ±0.5%, ±1% (E24/E96),	-55 °C to +155 °C	200 V	500 V	500 V	1Ω ≤ R ≤ 10Ω, ±200 ppm/°C
AF2010	1Ω to 10M		200 V	500 V	500 V	10Ω < R ≤ 10MΩ, ±200 ppm/°C
AF2512	Zero Ohm Jumper < 0.05Ω		200V	500V	500V	

FOOTPRINT AND SOLDERING PROFILES

For recommended footprint and soldering profiles of AF-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	AF0201	AF0402	AF0603/0805/1206	AF1210	AF1218/2010/2512
Paper taping reel (R)	7" (178 mm)	10,000/20,000	10,000/20,000	5,000	5,000	--
	13" (330 mm)	50,000	50,000	20,000	20,000	--
Embossed taping reel (K)	7" (178 mm)	--	--	--	--	4,000

NOTE

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

FUNCTIONAL DESCRIPTION

OPERATING TEMPERATURE RANGE

AF0201 Range: -55 °C to + 125 °C
 AF0402 - AF2512 Range: -55 °C to + 155 °C

POWER RATING

Each type rated power at 70 °C:

- AF0201=1/20W (0.05W)
- AF0402=1/16 W (0.0625W)
- AF0603=1/10 W (0.1W)
- AF0805=1/8 W (0.125W)
- AF1206=1/4 W (0.25W)
- AF1210=1/2W (0.5W)
- AF1218=1W
- AF2010=3/4W (0.75W)
- AF2512=1W

RATED VOLTAGE

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

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

Where

- V = Continuous rated DC or AC (rms) working voltage (V)
- P = Rated power (W)
- R = Resistance value (Ω)

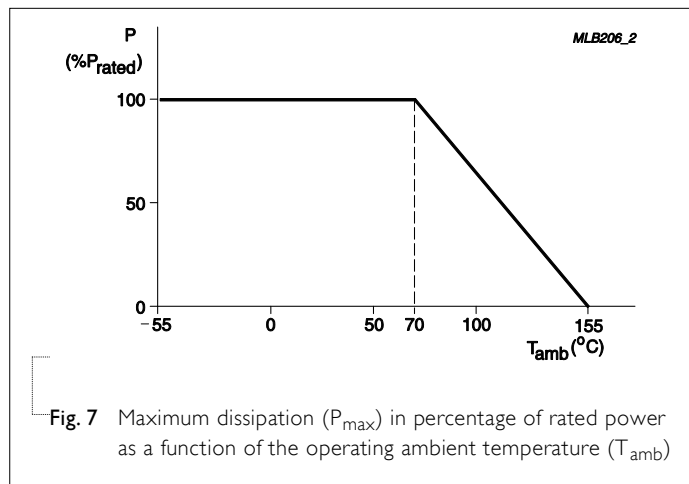


Fig. 7 Maximum dissipation (P_{max}) in percentage of rated power as a function of the operating ambient temperature (T_{amb})

TESTS AND REQUIREMENTS
Table 4 Test condition, procedure and requirements

TEST	TEST METHOD	PROCEDURE	REQUIREMENTS
Temperature Coefficient of Resistance (T.C.R.)	IEC 60115-1 4.8	At +25/-55 °C and +25/+125 °C Formula: $T.C.R. = \frac{R_2 - R_1}{R_1(t_2 - t_1)} \times 10^6 \text{ (ppm/°C)}$ 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	Refer to table 2
Life/Endurance	IEC 60115-1 4.25 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	±(1.0%+0.05 Ω) <100 mΩ for Jumper
High Temperature Exposure/Endurance at Upper Category Temperature	MIL-STD-202 Method 108	1,000 hours at 155±5 °C, unpowered	±(1.0%+0.05 Ω) for 0.5%, 1% tol. ±(1.0%+0.05 Ω) for 5% 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 Parts mounted on test-boards, without condensation on parts	±(0.5%+0.05 Ω) for 0.5%, 1% tol. ±(1.0%+0.05 Ω) for 5% tol. <100 mΩ for Jumper
Thermal Shock	MIL-STD-202 Method 107	-55 / +125 °C Number of cycles required is 300. Devices unmounted Maximum transfer time is 20 seconds. Dwell time is 15 minutes	±(0.5%+0.05 Ω) for 0.5%, 1% tol. ±(1%+0.05 Ω) for 5% tol. <100 mΩ for Jumper
Short Time Overload	IEC60115-1 4.13	2.5 times of rated voltage or maximum overload voltage whichever is less for 5 seconds at room temperature	±(1.0%+0.05 Ω) No visible damage
Bending	IEC 60115-1 4.33 IEC 60068-2-21	Chips mounted on a 90 mm glass epoxy resin PCB (FR4) Bending: 0201/0402: 5 mm 0603/0805: 3 mm 1206 & above: 2 mm Bending time: 60±5 seconds	±(1.0%+0.05 Ω) <100 mΩ for Jumper No visible damage

TEST	TEST METHOD	PROCEDURE	REQUIREMENTS
Biased Humidity (steady state)	IEC 60115-1 4.37	Steady state for 1,000 hours at 40°C / 95% R.H. RCWV applied for 1.5 hours on and 0.5 hour off	±(3.0%+0.05 Ω)
Solderability			
- Resistance to Soldering Heat	IEC 60115-1 4.18 MIL-STD-202 Method 215	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%+0.05 Ω) for 0.5%, 1% tol. ±(1.0%+0.05 Ω) for 5% tol. <50 mΩ for Jumper No visible damage
- Wetting	J-STD-002	Electrical test not required Magnification 10X SMD conditions: (a) Method B, aging 4 hours at 155 °C dry heat, lead-free solder bath at 245 °C (b) Method B, dipping at 215 °C for 3 seconds	Well tinned (≥95% covered) No visible damage
FOS	ASTM-B-809-95	Sulfur (saturated vapor) 1,000 hours, 90±2 °C, 91~93% R.H., unpowered	±(1.0%+0.05 Ω)
	Enhanced ASTM test	Sulfur 750 hours, 105 °C. unpowered	±(4.0%+0.05Ω)

REVISION HISTORY

REVISION	DATE	CHANGE NOTIFICATION	DESCRIPTION
Version 2	Jul 17, 2014	-	- Tests and requirement update
Version 1	Sep. 27, 2013	-	- Size 0201/1210/1218/2010/2512 extend
Version 0	Jan 07, 2011	-	- First issue of this specification

“Yageo reserves all the rights for revising the content of this datasheet without further notification, as long as the products are unchanged. Any product change will be announced by PCN.”