



DATA SHEET

ANTI-SULFURATED CHIP RESISTORS

AF series 5%, 1% sizes 0402/0603/0805/1206 RoHS compliant & Halogen free





YAGEO Phícomp

Chip Resistor Surface Mount AF SERIES 0402 to 1206

<u>SCOPE</u>

This specification describes AF0402 to AF1206 chip resistors with anti-sulfuration capabilities.

APPLICATIONS

- Environments exposed to high levels of contamination, such as industrial control systems
- Car electronics, sensors, electric instrumentation and communication base stations

FEATURES

- Superior resistance against sulfur containing atmosphere
- Halogen free product and production
- RoHS compliant
 - Products with lead free terminations meet RoHS requirements
 - Pb-glass contained in electrodes, resistor element and glass are exempted by RoHS
- Reduces environmentally hazardous waste
- High component and equipment reliability
- Saving of PCB space

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

AF	<u>XXXX</u>	<u>X</u>	<u>X</u>	<u>X</u>	<u>XX</u>	<u>XXXX</u>	L
----	-------------	----------	----------	----------	-----------	-------------	---

(1)	(2)	(3)	(4)	(5)	(6)	(7)	
(I) SIZE							
0402 /	0603 / (0805	/ 12	06			

(2) TOLERANCE

 $F = \pm 1\%$

 $| = \pm 5\%$

(3) PACKAGING TYPE

R = Paper taping reel

(4) TEMPERATURE COEFFICIENT OF RESISTANCE

– = Base on spec

(5) TAPING REEL

07 = 7 inch dia. Reel	
13 = 13 inch dia. Reel	

10 = 10 inch dia. Reel 7D = 7 inch Dia. Reel with double quantity

(6) RESISTANCE VALUE

I Ω to 22 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 I K20.

Detailed resistance rules are displayed in the table of "Resistance rule of global part number".

(7) DEFAULT CODE

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

Resistance rule of global part

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

ORDERING EXAMPLE

The ordering code for an AF0402 chip resistor, value 100 K Ω with $\pm 1\%$ tolerance, supplied in 7-inch tape reel with 10Kpcs quantity is: AF0402FR-07100KL.

NOTE

- All our RSMD 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

YAGEO	Phicomp								Pro	oduct specifica	
	Chip Resistor	Surface Mount	AF	SERIES	04	02 to 12	06				8
MARKING											
AF0402											
Fig. I	tan a	No marking									
AF0603 / AF	-0805 / AF1206										
Fig. 2 Va	103 alue=10 KΩ	E-24 series: 3 dig First two digits fo				and 3	rd digit f	or numbe	er of zer	os	
AF0603											
Fig. 3 Va	$\frac{240}{2} = 24 \Omega$	E-24 series: 3 dig One short bar ur			etter						
	alue = 12.4 K Ω	E-96 series: 3 dig First two digits fo			ıg ru	le and	3rd lette	er for nun	nber of :	zeros	
AF0805 / AF	1206										
Fig. 5 Val	1002 lue = 10 KΩ	Both E-24 and E- First three digits					4th digit	for numb	per of ze	eros	

NOTE

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



YAGEO Phicomp

Chip Resistor Surface Mount AF SERIES

0402 to 1206

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.6

DIMENSIONS

Table 2

Table I For outlines see fig. 6

TYPE	L (mm)	W (mm)	H (mm)	l⊨(mm)	l₂ (mm)
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

OUTLINES



		CHARACTERISTICS						
ТҮРЕ	RESISTANCE RANGE	Operating Temperature Range	Max. Working Voltage	Max. Overload Voltage	Dielectric Withstanding Voltage	Temperature Coefficient of Resistance		
AF0402			50 V	100 V	100 V			
AF0603	±5% (E24), I Ω to 22 M Ω	-55 ℃ to +155 ℃ -	50 V	100 V	100 V	$I \Omega \le R \le I0 \Omega, \pm 200 \text{ ppm/°C}$		
AF0805	\pm 1% (E24/E96), 1 Ω to 10 MΩ Zero Ohm Jumper < 0.05 Ω		150 V	300 V	300 V	$10 \ \Omega < R \le 10 \ M\Omega, \pm 100 \ ppm/^{\circ}C$ $10 \ M\Omega < R \le 22 \ M\Omega, \pm 200 \ ppm/^{\circ}C$		
AF1206		_	200 V	400 V	500 V			

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	AF0402	AF0603	AF0805	AF1206		
Paper taping reel (R)	7" (178 mm)	10,000/20,000	5,000	5,000	5,000		
	10" (254 mm)	20,000	10,000	10,000	10,000		
	13" (330 mm)	50,000	20,000	20,000	20,000		

ΝΟΤΕ

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



Chip Resistor Surface Mount AF SERIES

0402 to 1206

5
8

FUNCTIONAL DESCRIPTION

OPERATING TEMPERATURE RANGE

Range: -55 °C to +155 °C

POWER RATING

Each type rated power at 70 °C: AF0402=1/16 W (0.0625W) AF0603=1/10 W (0.1W) AF0805=1/8 W (0.125W) AF1206=1/4 W (0.25W)

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)

 $R = Resistance value (\Omega)$



YAGEO Phicomp

Chip Resistor Surface Mount AF SERIES 0402 to 1206

6 8

TESTS AND REQUIREMENTS

Table 4 Test condition, procedure and requirements

TEST	TEST METHOD	PROCEDURE	REQUIREMENTS
Temperature Coefficient of Resistance	IEC 60115-14.8	At +25/–55 °C and +25/+125 °C Formula:	Refer to table 2
(T.C.R.)		T.C.R= $\frac{R_2 - R_1}{R_1(t_2 - t_1)} \times 10^6 \text{ (ppm/°C)}$	
		Where $t = 125$ %C are a side of a set to the set of t	
		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	
_ife/Endurance	IEC 60115-1 4.25	At 70±2 °C for 1,000 hours, RCWV applied for	±(1.0%+0.05 Ω)
	MIL-STD-202 Method 108	1.5 hours on, 0.5 hour off, still air required	<100 m Ω for Jumper
High	MIL-STD-202 Method 108	1,000 hours at 155±5 °C, unpowered	±(1.0%+0.05 Ω) for 1% tol.
Temperature			\pm (1.0%+0.05 Ω) for 5% tol.
Exposure/ Endurance at Upper Category Temperature			<100 m Ω for Jumper
Moisture	MIL-STD-202 Method 106	Each temperature / humidity cycle is defined at 8	±(0.5%+0.05 Ω) for 1% tol.
Resistance		hours, 3 cycles / 24 hours for 10d. with 25 °C / 65 °C 95% R.H, without steps 7a & 7b, unpowered	$\pm(1.0\%{+}0.05~\Omega)$ for 5% tol. ${<}100~m\Omega$ for Jumper
		Parts mounted on test-boards, without condensation on parts	
Thermal Shock	MIL-STD-202 Method 107	_55 / +125 ℃	±(0.5%+0.05 Ω) for 1% tol.
		Number of cycles required is 300. Devices unmounted	\pm (1%+0.05 Ω) for 5% tol. <100 mΩ for Jumper
		Maximum transfer time is 20 seconds. Dwell time is 15 minutes	
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	±(1.0%+0.05 Ω)
		temperature	No visible damage
Bending	IEC 60115-1 4.33	Chips mounted on a 90 mm glass epoxy resin	±(1.0%+0.05 Ω)
	IEC 60068-2-21	PCB (FR4)	<100 m Ω for Jumper
		Bending: 0402: 5 mm 0603/0805: 3 mm 1206: 2 mm	No visible damage
		Bending time: 60±5 seconds	

YAGEO P	hícomp
---------	--------

Chip Resistor Surface Mount AF SERIES 0402 to 1206

7 8 Product specification

TEST	TEST METHOD	PROCEDURE	REQUIREMENTS
Biased Humidity	IEC 60115-1 4.37	I,000 hours at 85 °C / 85% R.H.	±(3.0%+0.05 Ω)
(steady state)	MIL-STD-202 Method 103	10% operating power	
		Measurement at 24±2 hours after test conclusion	
Solderability			
- Resistance to	IEC 60115-1 4.18	Condition B, no pre-heat of samples	$\pm(0.5\%{+}0.05~\Omega)$ for 1% tol.
Soldering Heat	MIL-STD-202 Method 215	Lead-free solder, 260 \pm 5 °C, 10 \pm 1 seconds immersion time	\pm (1.0%+0.05 Ω) for 5% tol. <50 mΩ for Jumper
		Procedure 2 for SMD: devices fluxed and cleaned with isopropanol	No visible damage
- Wetting	J-STD-002	Electrical test not required	Well tinned (≥95% covered)
-		Magnification 10X	No visible damage
		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	
ESD	AEC-Q200-002	Human body model,	±(3.0%+0.05 Ω)
		l pos. + l neg. discharges:	
		0402/0603: 1 KV 0805/1206: 2 KV	
Terminal Strength	IEC 60115-1 4.32 IEC 60068-2-21	A force of 5N applied for 10±1 seconds	±(1.0%+0.05 Ω)
FOS	ASTM-B-809-95	Sulfur (saturated vapor) 1,000 hours, 60±2 °C, 91-93% R.H., unpowered	±(1.0%+0.05 Ω)



YAGEO	Product specification 8					
	Chip Resistor Surface Mount	AF	SERIES	0402 to 1206		8

<u>REVISION HISTORY</u>

REVISION	DATE	CHANGE NOTIFICATION	DESCRIPTION
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."

