AG Series

Automotive Grade General Purpose Thick Film Chip Resistors

Version. C

FEATURE

- AEC-Q200 qualified
- High stability and reliability
- Low resistance value down to 10mΩ.
- RoHS complaint.
- Compatible with reflow and wave soldering type
- MSL class： MSL 1
- Applications:
  - Automotive electronics, such as multimedia entertainment, vehicle navigation, audio control unit
  - Electric door and window, electric seat control unit
  - Reversing radar
  - Automotive lighting and control unit
  - Consumer electronics
  - etc.

MANUFACTURER PART NO.

For example：AG1206F0R01T5G00-AG1206 ±1% 10mΩ T/R-5000

Series	Size	Tol.	Nominal Resistance Value	PKG	SPQ	Feature	TCR
2 codes	4 codes	1 code	2~5 codes	1 code	1 code	1 code	2 codes
AG	1206	F	0R01	T	5	G	00
Automotive Grade General Purpose Low Resistors Thick Film Chip Resistors	0603 0805 1206 1210 2010 2512	F=±1% J=±5%	0R01①=0.01Ω, 10mΩ 0R47=0.47Ω, 470mΩ 1R=1Ω, 1000mΩ	T=T/R②	4=4K 5=5K	G=Std. S=P.C.③	00=Refer to table as below.

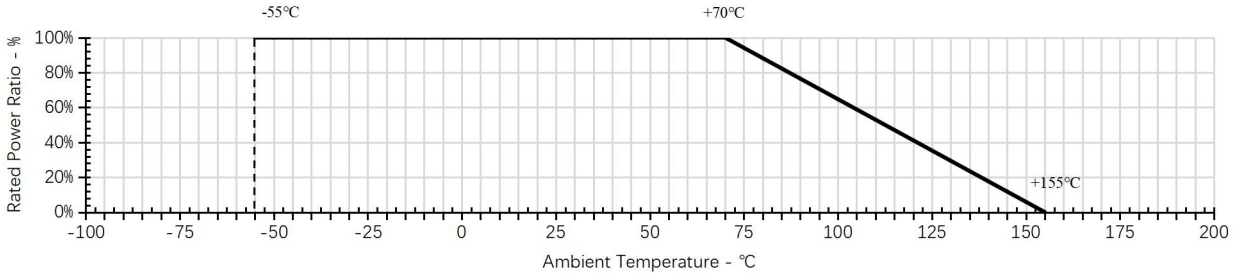
Note: ① R=Radix, 10^0 , Ω ② T/R=Taping in Reel package type ③ P.C.=Personal and Customized.

CHARACTERISTICS

Type	Rated Power	Max. Rated Current	Max. Overload Current	Tolerance	TCR（PPM/°C）	Resistance Range
AG0603	1/10W	3.16A	7.90A	±1%/±5%	±1500PPM/°C	10mΩ≤R≤30mΩ
					±1000PPM/°C	30mΩ < R≤50mΩ
					±800PPM/°C	50mΩ < R < 1000mΩ
AG0805	1/4W	5.00A	12.5A	±1%/±5%	±1500PPM/°C	10mΩ≤R≤15mΩ
					±1000PPM/°C	15mΩ < R≤30mΩ
					±800PPM/°C	30mΩ < R≤100mΩ
	1/8W	1.11A	2.79A	±1%/±5%	±800PPM/°C	100mΩ < R < 1000mΩ
AG1206	1/3W	5.77A	14.43A	±1%/±5%	±1500PPM/°C	10mΩ≤R≤15mΩ
					±1000PPM/°C	15mΩ < R≤30mΩ
					±800PPM/°C	30mΩ < R≤100mΩ
	1/4W	1.58A	3.95A	±1%/±5%	±800PPM/°C	100mΩ < R < 1000mΩ
AG1210	1/2W	7.07A	17.67A	±1%/±5%	±1500PPM/°C	10mΩ≤R≤15mΩ
					±1000PPM/°C	15mΩ < R≤30mΩ
					±800PPM/°C	30mΩ < R < 1000mΩ
AG2010	3/4W	8.66A	21.65A	±1%/±5%	±1500PPM/°C	10mΩ≤R≤15mΩ
					±1000PPM/°C	15mΩ < R≤30mΩ
					±800PPM/°C	30mΩ < R < 1000mΩ
AG2512	1W	10.00A	25.00A	±1%/±5%	±1500PPM/°C	10mΩ≤R≤15mΩ
					±1000PPM/°C	15mΩ < R≤30mΩ
					±800PPM/°C	30mΩ < R < 1000mΩ

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POWER DERATING CURVE



RATED VOLTAGE

The resistor shall have a Rated Current which would be DC or AC corresponding to the Rated Power, and it can be calculated by formula as below.

The Rated Current of certain resistance value should be the calculated result or Max. Working Current of product series whichever less.

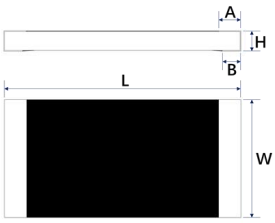
Formula:

$$I = \sqrt{P/R}$$

I=Rated current (A)
P=Rated power (W)
R=Nominal resistance (Ω)

DIMENSIONS

Unit: mm

Figure	Type	L	W	H	A	B
	AG0603	1.60±0.10	0.80±0.10	0.45±0.10	0.30±0.20	0.30±0.20
	AG0805	2.00±0.15	1.25±0.15	0.55±0.10	0.40±0.20	0.40±0.20
	AG1206	3.10±0.15	1.55±0.15	0.55±0.10	0.45±0.20	0.45±0.20
	AG1210	3.10±0.10	2.60±0.20	0.55±0.10	0.50±0.25	0.50±0.20
	AG2010	5.00±0.10	2.50±0.20	0.55±0.10	0.60±0.25	0.50±0.20
	AG2512	6.35±0.10	3.20±0.20	0.55±0.10	0.60±0.25	0.50±0.20

RELIABILITY

Item	Test Method	Acceptable criterion
High Temperature Exposure	+155℃, 1000hrs., unpowered, measure the resistance change rate after test. **Reference: AEC-Q200 Test 3, MIL-STD-202 Method 108**	1% series: △R/R=±(1.0%+0.05Ω) 5% series: △R/R=±(2.0%+0.05Ω)
Temperature Cycling	-55~+155℃, soak time 30min, Transition Time :1minute, 1000 cycles **Reference: AEC-Q200 Test 4, JESD22 Method JA-104**	△R/R=±(1.0%+0.05Ω)
Humidity Bias	85℃, 85%, 10% rated power, 1000H, after the test and stand 24H to measure the change rate of resistance value for components with specified operating voltages higher or equal to500V, 10% of operating voltage **Reference: AEC-Q200 TEST 7, MIL-STD-202 Method 103**	1% series: △R/R=±(2.0%+0.05Ω) 5% series: △R/R=±(3.0%+0.05Ω)
High Temperature Operating Life	maximum specified operating temperature at 100% rated power without derating, 1000H, 90 min ON,30 min OFF **Reference: AEC-Q200 Test 8, MIL-STD -202 Method 108**	1% series: △R/R=±(2.0%+0.05Ω) 5% series: △R/R=±(3.0%+0.05Ω)

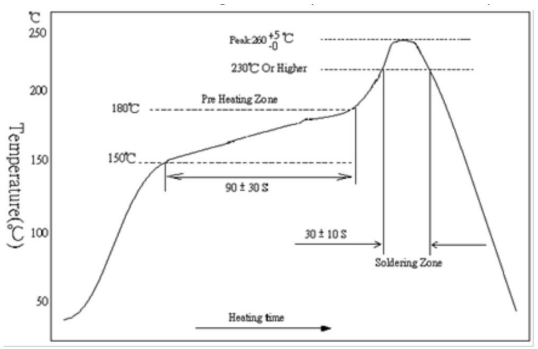
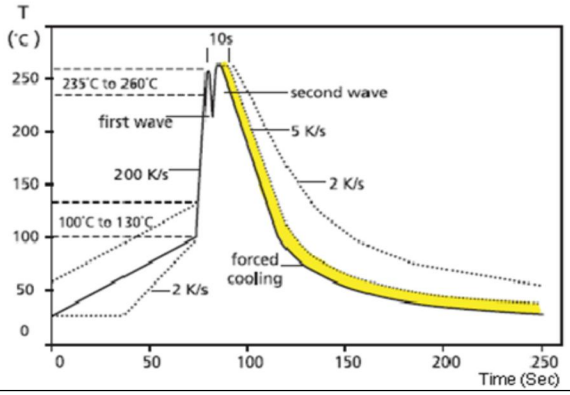
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Item	Test Method	Acceptable criterion
Resistance to Solvent	Immerse in isopropanol solvent at room temperature (23±5℃) for 5min, wipe 10 times with a hard toothbrush, repeat 3 times, take out and blow dry for examination **Reference: AEC-Q200 Test 12, MIL-STD-202 Method 215**	No visible damage
Resistance to Soldering Heat	Reflow test, time above 217 °C is 60s-150s, time above 250 ± 5°C is 30± 5s. **Reference: AEC-Q200 TEST 15, MIL-STD-202 Method 210**	△R/R=±(1.0%+0.05Ω)
ESD	Human body mode, two discharges, positive and negative polarity once each. Size: 0201 | 0402, 0603 | 0805 and above Test Voltage: 500V | 1000V | 2000V **Reference: AEC-Q200 Test 17, AEC-Q200-002**	△R/R=±(2.0%+0.05Ω)
Solderability	Dip the resistance in a tin furnace at 245±5℃ for Pretreatment: dry heat 155℃, 4H, after take out, stand at room temperature for 2 hours. Test method B1: 5 seconds, then take it out and observe the solder area under a microscope; Test method D: 260±5℃, T=30+5/-0s. **Reference: AEC-Q200 Test 18, J-STD-002 & IEC 60115-1 11.1.4.3**	Soldering coverage over 95% At the edge of terminal, the object underneath (e.g., white ceramic) shall not expose.
Electrical Characterization	TCR(ppm/℃)=$\frac{(R_2-R_1)}{R_1\times(T_2-T_1)}\times10^6$ R_1: Resistance value at room temperature (Ω) R_2: Resistance value at test temperature -55℃ or +125℃ T_1: Temperature at room temperature (℃) T_2: Temperature at -55℃ or +125℃ **Reference: AEC-Q200 Test 19,IEC 60115-1 6.2**	Details in table CHARACTERISTIC
Board Flex	The SMD resistance was welded to the test board and bent with the standard pressure block. After standing for 60s under the corresponding deformation condition, the change rate of resistance value of the part was tested Size: 0402, 0603, 0805 | 0201, 1206, 1210 | 2010, 2512 Depth: 5mm | 3mm | 2mm **Reference: AEC-Q200 TEST 21, AEC-Q200-005**	△R/R=±(1.0%+0.05Ω)
Terminal Strength	Apply 1.8Kgf external force (0402,1 Kgf) on the side of the part to test the solder joint adhesion of the part. **Reference: AEC Q200-005**	No mechanical damage or peel-off of side end
Short Time Overload	Apply 2.5 times of rated voltage or maximum overload voltage whichever is less for 5 seconds **Reference: IEC 60115-1 8.1.4.2**	1% series: △R/R=±(1.0%+0.05Ω) 5% series: △R/R=±(2.0%+0.05Ω)
Mechanical shock	Half sine wave, acceleration 100g's, each three times in X, Y and Z directions, pulse width 6ms **Reference: AEC-Q200 Test 13, MIL-STD -202 Method 213**	△R/R=±(1.0%+0.05Ω)
Vibration	Frequency: 10HZ~2000HZ, acceleration: 5g's, X, Y, Z three directions, 12 cycles in each direction, a total of 36 cycles, a single cycle test for 20min **Reference: AEC-Q200 Test 14, MIL-STD -202 Method 204**	△R/R=±(1.0%+0.05Ω)
Flammability	Protective layer flammability report or component needle flame test report **Reference: AEC-Q200 Test 20, UL-94，IEC 60695-11-5**	Do not burn and cotton below do not ignite
Flame retardancy	9VDC to 32VDC (clamp current 500A) in each increment $1V_{DC}$ for 1 hr. **Reference: AEC-Q200 Test 24, AEC-Q200-001**	1. Nonflammable 2. Do not explode 3. The temperature cannot be higher than 350℃ for 10 seconds
Sulfide test	Sulfur (saturated vapor) 500 hours, 60± 2°C, unpowered **Reference: ASTM-B-809-95**	△R/R=±(1.0%+0.05Ω)

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SOLDERING TEMPERATURE

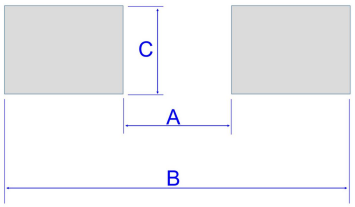
- Recommendation only.
- Please adjust soldering temperature according to the actual condition.

Lead-free IR Reflow Soldering Profile	Lead-free Double-Wave Soldering Profile
	
Note: • The Max. Temp. is 260+5/-0℃ within 10 sec • Reference: J-STD-020D	Note: • Suit for ⩾ 0603 size • Manual soldering in 350±10℃ within 3 sec

SOLDERING PAD

Resistance value would be lower than nominal value because of joint with soldering material, so designing circuit should adjust the pad size

Unit: mm

Figure	Type	A	B	C
	AG0603	0.8	2.1	0.9
	AG0805	1.2	3.0	1.3
	AG1206	2.2	4.2	1.6
	AG1210	2.2	4.2	2.8
	AG2010	3.5	6.1	2.8
	AG2512	3.8	8.0	3.5

WORKING ENVIRONMENT

If user intends to use products in special environments or states (including but not limited to the following), it is necessary to approve special characteristics and reliability for the following or other application environments.

A. High temperature, high moisture.
B. Near the sea, or corrosive gas, such as Cl_2, H_2S, NH_3, SO_2 and NO_2, etc.
C. Unverified liquids, such as water, oil, chemical or organic solvent.
D. Unverified resin or paint to cover products.
E. Products should be washed with water soluble cleaner even if non cleaning flux.

STORAGE / CARRY CONDITIONS

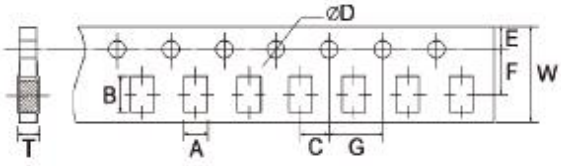
A. Temperature: 25±5℃
B. Humidity: 60±15%RH
C. Storage life: 2 years, FIFO
D. Please hold box correct orientation when storing and carrying. It is strictly prohibited to fall or squeeze the box, otherwise the product electrode or body may be damaged.

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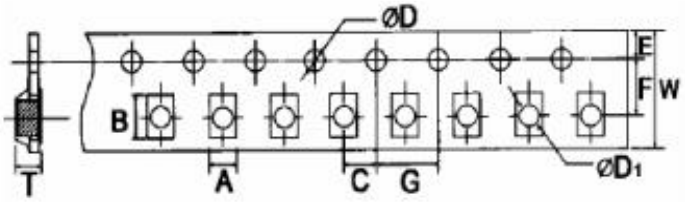
TAPING SPECIFICATIONS

A. Taping drawing

Carrier Taping A



Embossed Taping



B. Taping Dimensions unit: mm

Type or Size		A±0.2	B±0.2	C±0.05	$ØD^{+0.1}_{-0}$	E±0.1	F±0.05	G±0.1	W±0.2	T±0.1
Carrier Taping A	0603	1.10	1.90	2.0	1.5	1.75	3.5	4.0	8.0	0.67
	0805	1.65	2.40	2.0	1.5	1.75	3.5	4.0	8.0	0.81
	1206	1.90	3.45	2.0	1.5	1.75	3.5	4.0	8.0	0.81
	1210	2.85	3.50	2.0	1.5	1.75	3.5	4.0	8.0	0.81

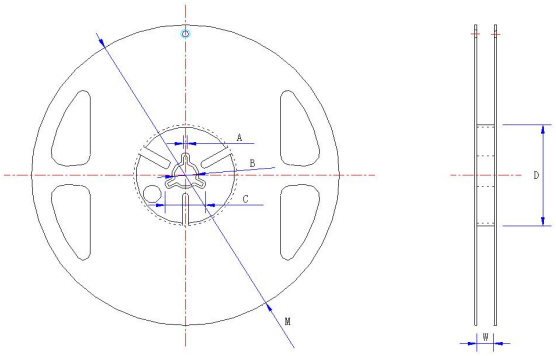
Type or Size		A±0.2	B±0.2	C±0.05	$ØD^{+0.1}_{-0}$	$ØD^{+0.25}_{-0}$	E±0.1	F±0.05	G±0.1	W±0.2	T±0.1
Embossed Taping	2010	2.90	5.60	2.00	1.50	1.50	1.75	5.50	4.00	12.00	1.00
	2512	3.50	6.70	2.00	1.50	1.50	1.75	5.50	4.00	12.00	1.00

STANDARD PACKING

Series	0603	0805	1206	1210	2010	2512
SPQ, PCS/Reel	5,000	5,000	5,000	5,000	4,000	4,000
Taping material	Carrier	Carrier	Carrier	Carrier	Embossed	Embossed

REEL SPECIFICATION

A. Reel drawing



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B. Reel dimension unit: mm

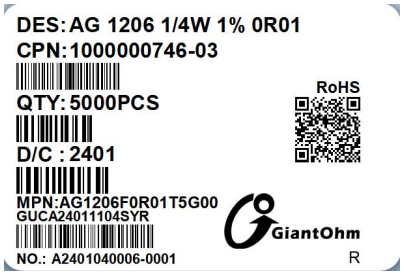
Type	SPQ PCS/Rl.	A±0.5	B±0.5	C±0.5	D±1	M±2	W±1
0603	5,000	2.0	13.0	21.0	60.0	178.0	10.0
0805	5,000	2.0	13.0	21.0	60.0	178.0	10.0
1206	5,000	2.0	13.0	21.0	60.0	178.0	10.0
1210	5,000	2.0	13.0	21.0	60.0	178.0	10.0
2010	4,000	2.0	13.0	21.0	60.0	178.0	13.8
2512	4,000	2.0	13.0	21.0	60.0	178.0	13.8

LABEL SPECIFICATION

A. Produce Label



B. Customer Label



PACKING BOX

A. Packing Type

Taping in reel / Bulk in plastic bag.

B. Inner box

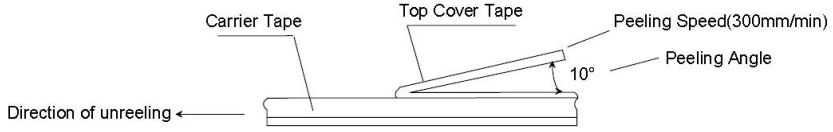
The inner box has several capacities hold 1 reel, 2 reels, 3 reels, 4 reels, 5 reels and 10 reels.

C. Out box

The out box has two capacities hold 6- or 8-pieces inner box.

NOTE OF COVER TAPE PEEL OFF

A. Figure of cover tape peel off.



B. Please keep peeling speed under 300mm per minute.

C. Please keep the angle between cover tape and direction of unreeling narrower than 10 degree.

D. There is limit of adhesive force between cover tape and carrier tape or embossed tape shown as following table.

Size of chip resistors	0603 and above
Adhesive force limit	10~70gf

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VERSION HISTORY

Version	Date	Change Item(s)	Description
A	2022/11/28	-	First version
B	2024/02/01	Full	Add Packing Specifications and update according to AEC-Q200 version E.
C	2024/07/16	Full	Updated test acceptable criterion. Add Moisture sensitivity level description.

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