

### FEATURE

- AEC-Q200 qualified
- High stability and reliability
- Low resistance value down to 10mΩ.
- RoHS complaint.
- Compatible with reflow and wave soldering type
- 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%	0R01 <sup>①</sup> =0.01Ω, 10mΩ 0R47=0.47Ω, 470mΩ 1R=1Ω, 1000mΩ	T=T/R <sup>②</sup>	4=4K 5=5K	G=Std. S=P.C. <sup>③</sup>	00=Refer to table as below.

Note: ① R=Radix, 10<sup>0</sup>, Ω

② T/R=Taping in Reel package type

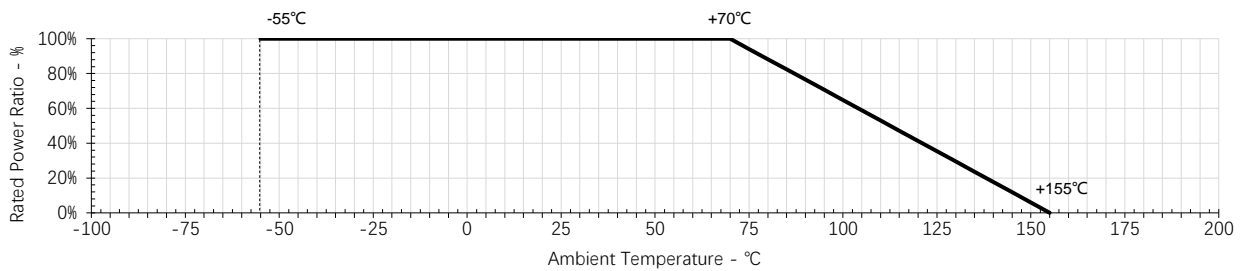
③ P.C.=Personal and Customized.

### 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
AG1206	1/8W	1.11A	2.79A	±1%/±5%	±800PPM/°C	100mΩ < R < 1000mΩ
					±1500PPM/°C	10mΩ ≤ R ≤ 15mΩ
AG1206	1/3W	5.77A	14.43A	±1%/±5%	±1000PPM/°C	15mΩ < R ≤ 30mΩ
					±800PPM/°C	30mΩ < R ≤ 100mΩ
					±800PPM/°C	100mΩ < R < 1000mΩ
AG1210	1/4W	1.58A	3.95A	±1%/±5%	±800PPM/°C	100mΩ < R < 1000mΩ
					±1500PPM/°C	10mΩ ≤ R ≤ 15mΩ
					±1000PPM/°C	15mΩ < R ≤ 30mΩ
AG1210	1/2W	7.07A	17.67A	±1%/±5%	±800PPM/°C	30mΩ < R < 1000mΩ
					±1500PPM/°C	10mΩ ≤ R ≤ 15mΩ
					±1000PPM/°C	15mΩ < R ≤ 30mΩ
AG2010	3/4W	8.66A	21.65A	±1%/±5%	±800PPM/°C	30mΩ < R < 1000mΩ
					±1500PPM/°C	10mΩ ≤ R ≤ 15mΩ
					±1000PPM/°C	15mΩ < R ≤ 30mΩ
AG2512	1W	10.00A	25.00A	±1%/±5%	±800PPM/°C	30mΩ < R < 1000mΩ
					±1500PPM/°C	10mΩ ≤ R ≤ 15mΩ
					±1000PPM/°C	15mΩ < R ≤ 30mΩ

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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.

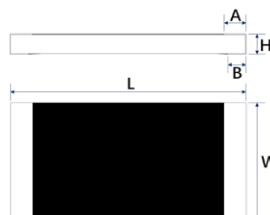
Formula:

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

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

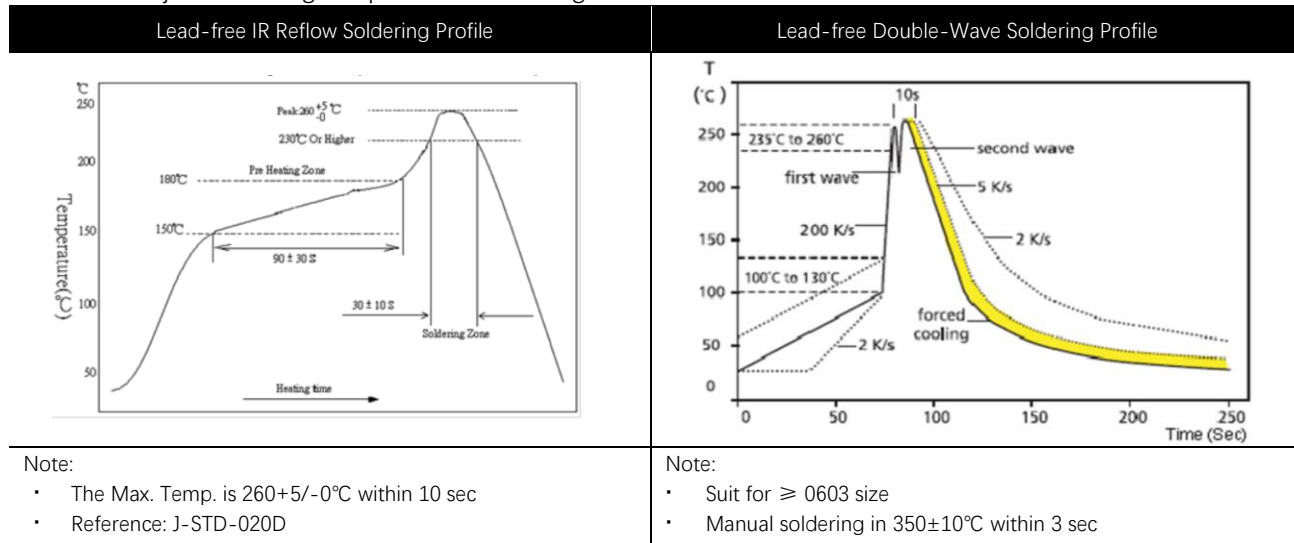
### RELIABILITY

Item	Test Method	Acceptable criterion
High Temperature Exposure	Put the specimens unpowered in test environment at +155°C for 1,000 hours, then take them out to measure the resistance value change rate. <b>Reference: AEC-Q200 Test 3, MIL-STD-202 Method 108</b>	1% series: ΔR/R=±1.0% 5% series: ΔR/R=±2.0%
Temperature Cycling	Put the specimens in test environment, rise temperature from -55°C to +125°C with speed 10~20 °C per minutes, then stabilize for 15 minutes, define these steps as a cycles, totally 1000 cycles. Finally, take them out to measure the resistance value change rate. <b>Reference: AEC-Q200 Test 4, JESD22 Method JA-104</b>	ΔR/R=±1.0%
Biased Humidity	Put the specimens applied 10% of rated power in test environment at 85°C and 85%RH for 1000 hours. then take them out to stabilize for 24 hours and measure resistance value change rate. <b>Reference: AEC-Q200 TEST 7, MIL-STD-202 Method 103</b>	1% series: ΔR/R=±2.0% 5% series: ΔR/R=±3.0%
Operational Life	Condition D Steady State $T_A = +125^\circ\text{C}$ . Put the specimens applied rated voltage in test environment, the maximum rated temperature and rated voltage for the dielectric employed shall be used. Set up 90 minutes power on and 30 minutes power off as a group, totally 1000 hours. Then take them out to stabilize for 24±4 hours and measure the resistance value change rate. <b>Reference: AEC-Q200 Test 8, MIL-STD -202 Method 108</b>	1% series: ΔR/R=±2.0% 5% series: ΔR/R=±3.0%

Item	Test Method	Acceptable criterion								
Resistance to Solvent	Put the specimens in isopropanol solvent at room temperature 23±5°C for 5 minutes, brush 10 times as a group with a hard toothbrush, 3 times for each group. Then take them out to blow dry, and check their appearance. <b>Reference: AEC-Q200 Test 12, MIL-STD-202 Method 215</b>	No visible damage								
Resistance to Soldering Heat	Put the specimens in tin furnace at 260±5°C for 10±1 seconds. Then take them out to stabilize for 1 hour, and measure the resistance value change rate. <b>Reference: AEC-Q200 TEST 15, MIL-STD-202 Method 210</b>	ΔR/R=±1.0%								
ESD	Put the specimens with voltage in test machine, and the voltage shall be set up as following table. Test method: Electro-Static discharges twice which positive and negative polarity once each by human body mode.	ΔR/R=±2.0%								
	<table border="1"> <thead> <tr> <th>Size</th> <th>0201</th> <th>0402, 0603</th> <th>0805 and above</th> </tr> </thead> <tbody> <tr> <td>Voltage</td> <td>500V</td> <td>1,000V</td> <td>2,000V</td> </tr> </tbody> </table> <b>Reference: AEC-Q200 Test 17, AEC-Q200-002</b>		Size	0201	0402, 0603	0805 and above	Voltage	500V	1,000V	2,000V
Size	0201	0402, 0603	0805 and above							
Voltage	500V	1,000V	2,000V							
Solderability	Pretreatment: Dry heat +155°C for 4 hours, or with equivalent test method, PCT aging for 4 hours. Then take the specimens out to stabilize at room temperature for 2 hours. Test method: 1. Put the specimens in a tin furnace at 245±3°C for 3 seconds, then take them out and check the soldering appearance by microscope. 2. Reflow soldering test with peak temperature 235°C for 40± 5 seconds. <b>Reference:</b> 1. <b>AEC-Q200 Test 18, J-STD-002, IEC 60115-1 11.1.4.3</b> 2. <b>IPC-A-610 8.3.2</b>	<ol style="list-style-type: none"> <li>Solder coverage must be 95% minimum.</li> <li>Without welding rejection. And soldering is higher than 1/2 of side termination height.</li> </ol>								
Electrical Characterization	$TCR(ppm/^{\circ}C) = -\frac{(R_2 - R_1)}{R_1 \times (T_2 - T_1)} \times 10^6$ <p> <math>R_1</math>: Resistance value at room temperature (Ω)  <math>R_2</math>: Resistance value at test temperature -55°C or +125°C  <math>T_1</math>: Temperature at room temperature (°C)  <math>T_2</math>: Temperature at -55°C or +125°C  <b>Reference: AEC-Q200 Test 19, IEC 60115-1 6.2</b> </p>	Details in table CHARACTERISTIC								
Board Flex / Bending	Put PCBA mounted with the specimens in test machine, press down the PCBA to standard depth with testing block and stabilize for 60 seconds, then measure the resistance value change rate. <table border="1"> <thead> <tr> <th>Size</th> <th>0402, 0603, 0805</th> <th>0201, 1206, 1210</th> <th>2010, 2512</th> </tr> </thead> <tbody> <tr> <td>Depth</td> <td>5mm</td> <td>3mm</td> <td>2mm</td> </tr> </tbody> </table> <b>Reference: AEC-Q200 TEST 21, AEC-Q200-005</b>	Size	0402, 0603, 0805	0201, 1206, 1210	2010, 2512	Depth	5mm	3mm	2mm	ΔR/R=±1.0%
Size	0402, 0603, 0805	0201, 1206, 1210	2010, 2512							
Depth	5mm	3mm	2mm							
Terminal Strength	Apply 1.8Kgf external force on the side of specimen, then check the soldering joint strength. <table border="1"> <thead> <tr> <th>Size</th> <th>0402</th> <th>0603 and above</th> </tr> </thead> <tbody> <tr> <td>Force</td> <td>1 Kgf.</td> <td>1.8 Kgf.</td> </tr> </tbody> </table> <b>Reference: AEC Q200-005</b>	Size	0402	0603 and above	Force	1 Kgf.	1.8 Kgf.	No mechanical damage or peel-off of side end		
Size	0402	0603 and above								
Force	1 Kgf.	1.8 Kgf.								
Short Time Overload	Load 2.5 times of rated voltage or maximum overload voltage whichever is less for 5 seconds. Then measure the resistance value change rate. <b>Reference: IEC 60115-1 8.1.4.2</b>	1% series: ΔR/R=±1.0%、 5% series: ΔR/R=±2.0%								
Mechanical shock	Put the specimens in test machine, shocks with half sine wave which acceleration set up as 100g's and each three times in X, Y and Z directions with pulse duration as 6 ms. <b>Reference: AEC-Q200 Test 13, MIL-STD -202 Method 213</b>	ΔR/R=±1.0%								
Vibration	Put the specimens in test machine, vibrates with 10 to 20Hz frequency which acceleration set up as 5g's, and each 12 times in X, Y and Z directions as a cycle which duration as 20 minutes, totally 36 cycles. <b>Reference: AEC-Q200 Test 14, MIL-STD -202 Method 204</b>	ΔR/R=±1.0%								
Flammability	Put the specimens in test environment, and burn them for 10 seconds and the flame extinguished within 60 seconds. <b>Reference: AEC-Q200 Test 20, UL-94</b>	V-0 Specimens haven't burn, and the bottom cotton without flame.								
Flame retardancy	Put the specimens mounted on PCB and subjected to voltage from 9.0 to 32.0 VDC (current clamped up to 500A) in 1.0 VDC increments. Each voltage level shall be applied for one hour minimum, or until the specimens is either electrically open or a failure occurs. <b>Reference: AEC-Q200 Test 24, AEC-Q200-001</b>	<ol style="list-style-type: none"> <li>A flame duration less than 3.0 seconds.</li> <li>Without explosion</li> <li>A temperature above 350°C sustained for less than 10 seconds</li> </ol>								

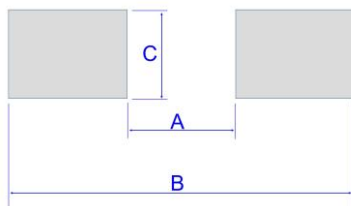
### SOLDERING TEMPERATURE

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



### 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

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.

- High temperature, high moisture.
- Near the sea, or corrosive gas, such as Cl<sub>2</sub>, H<sub>2</sub>S, NH<sub>3</sub>, SO<sub>2</sub> and NO<sub>2</sub>, etc.
- Unverified liquids, such as water, oil, chemical or organic solvent.
- Unverified resin or paint to cover products.
- Products should be washed with water soluble cleaner even if non cleaning flux.

### STORAGE / CARRY CONDITIONS

- Temperature: 25±5°C
- Humidity: 60±15%RH
- Storage life: 2 years, FIFO
- 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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