# **Automotive Grade General Purpose Thick Film Chip Resistors** Version. B

**FEATURE** 

- · AEC-Q200 Compliant
- · High stability and reliability
- RoHS complaint
- 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: AG1206J100KT5G00-AG1206  $\pm 5\%$  100K $\Omega$  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	J	100K	Т	5	G	00
Automotive Grade General Purpose Thick Film Chip Resistors	0201 0402 0603 0805 1206 1210 2010 2512	F=±1% J=±5%	$\begin{array}{l} 1 R^0 \! \! = \! 1 \Omega \\ 4 R 7 \! \! \! \! = \! \! \! 4.7 \Omega \\ 4 K 7^2 \! \! \! \! \! \! \! \! \! \! \! \! \! \! \! \! \! \! \!$	T=T/R <sup>⊕</sup>	4=4K 5=5K A=10K B=15K	G=Std. S=P.C. <sup>®</sup>	00=Refer to table as below.

Note: ① R=Radix,  $10^{0}$ ,  $\Omega$ 

② K=Kilo, 10<sup>3</sup>, KΩ

③ M=Mega, 10<sup>6</sup>, MΩ

4 T/R=Taping in Reel packing type

⑤ P.C.=Personal and Customized.

#### **CHARACTERISTICS**

T. #2.0	Rated Power	Rated Power MWV <sup>1</sup>		Toloropoo	Value Range	Jumper( $0\Omega$ )		
туре	Type Rated Power MWV	MOV <sup>2</sup> Tolerance		value Range	Rated Current	MOC <sup>®</sup>	Range	
AG0201	1/20W	25V	50V	±1%, ±5%	1Ω≤R≤10Ω	0.5A	1A	50mΩ Max.
AG0201	1/2000				10Ω <r≤10mω< td=""></r≤10mω<>			
AG0402	1 /16\\\	1/16W 50V	100V	±1%, ±5%	1Ω≤R≤10Ω	- 1A I	2A	50mΩ Max.
AG0402	1/10//				10Ω <r≤10mω< td=""></r≤10mω<>			
V C0603	1/10W	1/10/4/ 75/4	150V	±1%, ±5%	1Ω≤R≤10Ω	1A	2A	50mΩ Max.
AG0603 1/1	1/1000	75V			10Ω <r≤10mω< td=""></r≤10mω<>			
AG0805	1/8W	1/8W 150V	300V	±1%, ±5%	1Ω≤R≤10Ω	2A	5A	50mΩ Max.
					10Ω <r≤10mω< td=""></r≤10mω<>			
AG1206	1/4W	2001/	200V 400V	±1%, ±5%	1Ω≤R≤10Ω	2A	10A	50mΩ Max.
	1/400	200V			10Ω <r≤10mω< td=""></r≤10mω<>			
AC1210	1/2W 200V	200V 50	E00\/	±1%, ±5%	1Ω≤R≤10Ω	- 2A	10A	50mΩ Max.
AG1210			500V		10Ω <r≤10mω< td=""></r≤10mω<>			
AG2010	3/4W	W 200V	500V	±1%, ±5%	1Ω≤R≤10Ω	2A	10A	50mΩ Max.
					10Ω <r≤10mω< td=""></r≤10mω<>			
AG2512	1W	1W 200V	500V	±1%, ±5%	1Ω≤R≤10Ω	2A	10A	50mΩ Max.
					10Ω <r≤10mω< td=""></r≤10mω<>			

Note: ① MWV=Max. Working Voltage

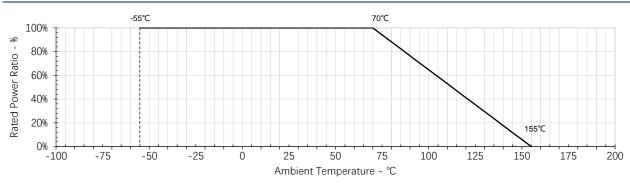
② MOV=Max. Overload Voltage

③ MOC=Max. Overload Current

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POWER DERATING CURVE



Note: Operating Temperature Range: -55°C~+155°C

#### **RATED VOLTAGE**

Resistors should have a Rated Voltage DC or AC corresponding to Rated Power which can be calculated by formula as below.

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

Formula:

$$\begin{aligned} \mathsf{E} &= \mathsf{Rated\ voltage}(\mathsf{V}) \\ \mathsf{E} &= \sqrt{\mathsf{P} \times \mathsf{R}} \end{aligned} \qquad \begin{aligned} \mathsf{P} &= \mathsf{Rated\ power}(\mathsf{W}) \\ \mathsf{R} &= \mathsf{Nominal\ resistance}(\Omega) \end{aligned}$$

#### **DIMENSIONS**

Unit: mm

Figure	Type	L	W	Н	А	В
L <b>A</b> J	AG0201	$0.60 \pm 0.03$	$0.30 \pm 0.03$	0.23±0.03	0.12±0.05	0.15±0.05
]H	AG0402	1.00±0.10	0.50±0.05	0.35±0.05	0.20±0.10	0.25±0.10
. B	AG0603	$1.60 \pm 0.10$	$0.80 \pm 0.10$	0.45±0.10	$0.30 \pm 0.20$	0.30±0.20
<u> </u>	AG0805	2.00±0.15	1.25±0.15	0.55±0.10	0.40±0.20	0.40±0.20
	AG1206	3.10±0.10	1.55±0.15	0.55±0.10	0.45±0.20	0.45±0.20
w	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°C, 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% 5% Series: △R/R=±2.0%
Temperature Cycling	-55~+125°C, slope 10~20°C/min, dwell time 15min, 1000 cycles  Reference: AEC-Q200 Test 4, JESD22 Method JA-104	△R/R=±2.0%
Biased Humidity	85°C, 85%RH, load 10% rated power, 1000hrs., take it out and stabilized 24 hrs. then measure the change rate of resistance value.  Reference: AEC-Q200 TEST 7, MIL-STD-202 Method 103	1% Series: △R/R=±2.0% 5% Series: △R/R=±3.0%
Operational Life	125°C, rated voltage (calculated according to derating curve), 1000 hrs., with cycle 90 min ON, 30 min OFF  Reference: AEC-Q200 Test 8, MIL-STD -202 Method 108	1% Series: △R/R=±2.0% 5% Series: △R/R= ±3.0%
Resistance to Solvent	Immerse in isopropanol solvent at room temperature (23±5°C) 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

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ltem	Conditions	Acceptable Criterion
Resistance to Soldering Heat	Soak in a tin furnace at 260 <sup>+5</sup> <sub>0</sub> °C for 10 <sup>+1</sup> <sub>0</sub> seconds, take out and stand for more than 60 minutes, then measure the change rate of resistance value.  Reference: AEC-Q200 TEST 15, MIL-STD-202 Method 210	△R/R=±1.0%
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%
Solderability	Pretreatment: dry heat 155°C, 4 hrs. or PCT aging for 4 hrs. (equivalent), after take out, stand at room temperature for 2 hrs.  Test method:  1. Dip the resistance in a tin furnace at 245±3°C for 3 seconds, then take it out and observe the solder area under a microscope;  2. Reflow soldering test, Peak Temperature: +235°C, T=40±5 seconds.  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	$TCR(PPM/^{\circ}C) = \frac{(R_2 - R_1)}{R1 \times (T_2 - T_1)} \times 10^6$ $R_1: \text{ Resistance value tested at room temperature } (\Omega)$ $R_2: \text{ Resistance value tested at-}55^{\circ}C \text{ or } +125^{\circ}C$ $T_1: \text{ Temperature at room temperature } (^{\circ}C)$ $T_2: \text{ Temperature at-}55^{\circ}C \text{ or } +125^{\circ}C$ $Reference: \text{ AEC-}Q200 \text{ Test } 19, \text{ IEC } 60115-1 \text{ 6.2}$	1Ω ≤ R ≤ 10Ω: 0201: $-100$ ~ +350 PPM/°C $0402$ ~ 2512: $\pm 200$ PPM/°C 10Ω < R ≤ 10MΩ: $0201$ : $\pm 200$ PPM/°C $0402$ ~ 2512: $\pm 100$ PPM/°C
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	$\triangle$ R/R=±1.0%
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 rated voltage or maximum overload voltage (whichever is the smallest) for 5 seconds.  Reference: IEC 60115-1 8.1.4.2	1% Series: △R/R=±1.0% 5% Series: △R/R=±2.0%
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%
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%
Flammability	V-0 Reference: AEC-Q200 Test 20, UL-94	Do not burn and cotton below do not ignite
Flame retardancy	$9V_{DC}$ to $32V_{DC}$ (clamp current 500A) in each increment $1V_{DC}$ for 1 hr. <b>Reference:</b> AEC-Q200 Test 24, AEC-Q200-001	1. Nonflammable 2. Do not explode 3. The temperature cannot be higher than 350°C for 10 seconds

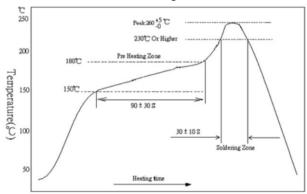
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Unit: mm

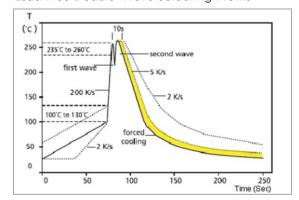
#### **SOLDERING**

Lead Free IR Reflow Soldering Profile



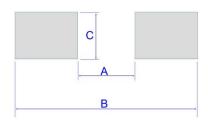
- Top temperature should be under 260<sup>+5</sup>°C ,10Sec.
- Reference: J-STD-020D

#### Lead Free Double-Wave Soldering Profile



- Suitable for 0603 above size products
- 350±10°C within 3 Sec. if soldering iron.

#### **SOLDERING PAD**



			Offic. Hilli
Type	А	В	С
AG0201	0.3	1.0	0.4
AG0402	0.5	1.5	0.6
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. Hot temperature.
- 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°CB. Humidity: 60±15%RH

C. Storage life:

0201 size: 1 year;

• 0402 and above size: 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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### VERSION HISTORY

Version	Date	Change Item(s)	Description
А	2022/05/25	-	First version
В	2022/10/31	Reliabilities	Updated test and requirements

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