AP Series

Automotive Grade High Power Thick Film Chip Resistors

Version. H

FEATURE

- AEC-Q200 qualified
- Higher rated power than general purpose series product
- High reliability and stability
- RoHS and Halogen-free compliance
- Superior Anti-Sulfur performance
- Compatible with Reflow and Wave soldering
- MSL class: MSL 1
- Applications:
  - Automotive lighting
  - Communication devices
  - Computer, notebook, workstation, tablet, and peripherals
  - Home appliances
  - Medical devices
  - Industrial control system
  - etc.

MANUFACTURER PART NO.

For example: AP1206J100KT5G00-AP1206 ±5% 100KΩ T/R-5000

Series	Size	Tol.	Value	PKG	SPQ	Feature	TCR
2 codes	4 codes	1 code	2~5 codes	1 code	1 code	1 code	2 codes
AP	1206	J	100K	T	5	G	00
Automotive Grade High Power Thick Film Chip Resistors	0402 0603 0805 1206 1210 2010 2512	F=1% J=5%	0R=Jumper 1R[1]=1Ω 4R7=4.7Ω 4K7[2]=4.7KΩ 100K=100KΩ 4M7[3]=4.7MΩ	T=T/R[4]	4=4K 5=5K A=10K	G=Std. S=P.C.[5] 1=1W	00=Refer to table Reliability.

Note: ① R=Radix, 10^0, Ω ② K=Kilo, 10^3, KΩ ③ M=Mega, 10^6, MΩ

④ T/R=Taping in Reel packing type ⑤ P.C.=Personal and Customized.

CHARACTERISTICS

Type	Rated Power	MWV[1]	MOV[2]	Tolerance	Value Range	Jumper(0Ω)		
						Max Value	MRC	MOC
AP0402	1/10W	50V	100V	±1%, ±5%	1Ω~10M	10mΩ	3A	6A
AP0603	1/5W	75V	150V	±1%, ±5%	1Ω~10M	8mΩ	5A	10A
AP0805	1/3W	150V	300V	±1%, ±5%	1Ω~10M	5mΩ	6A	12A
AP1206	1/2W	200V	400V	±1%, ±5%	1Ω~10M	5mΩ	10A	20A
AP1210	3/4W 1W	200V	500V	±1%, ±5%	1Ω~10M	4mΩ	12A	24A
AP2010	1W	200V	500V	±1%, ±5%	1Ω~10M	5mΩ	12A	24A
AP2512	2W	200V	500V	±1%, ±5%	1Ω~10M	5mΩ	16A	32A

Note:

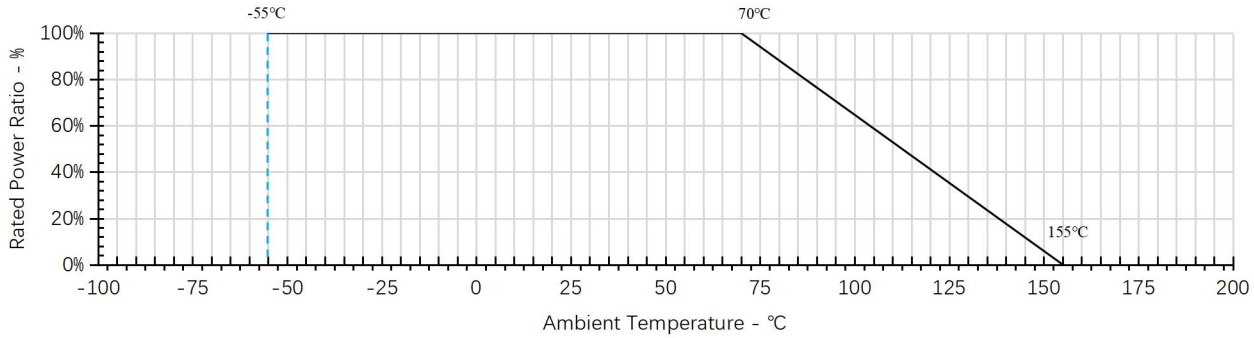
① MWV: Max. Working Voltage

② MRC: Max. Rated Current.

③ MOC: Max. Overload Current

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POWER DERATING CURVE



Note: Operating Temperature Range: -55℃~+155℃

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.

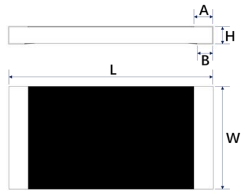
Formula:

$$E = \sqrt{P \times R}$$

E=Rated voltage(V)
P=Rated power(W)
R=Nominal resistance(Ω)

DIMENSIONS

Unit: mm

Figure	Type	L	W	H	A	B
	AP0402	1.00±0.10	0.50±0.05	0.35±0.05	0.20±0.10	0.25±0.10
	AP0603	1.60±0.10	0.80±0.10	0.45±0.10	0.30±0.20	0.30±0.20
	AP0805	2.00±0.15	1.25±0.15	0.55±0.10	0.40±0.20	0.40±0.20
	AP1206	3.10±0.15	1.55±0.15	0.55±0.10	0.45±0.20	0.45±0.20
	AP1210	3.10±0.10	2.60±0.20	0.55±0.10	0.50±0.25	0.50±0.20
	AP2010	5.00±0.10	2.50±0.20	0.55±0.10	0.60±0.25	0.50±0.20
	AP2512	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℃, 1000 hrs., 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=±(2.0%+0.05Ω)
Biased Humidity	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)

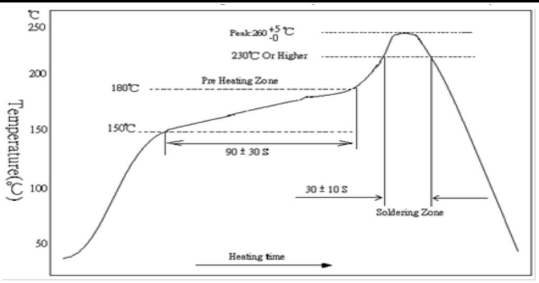
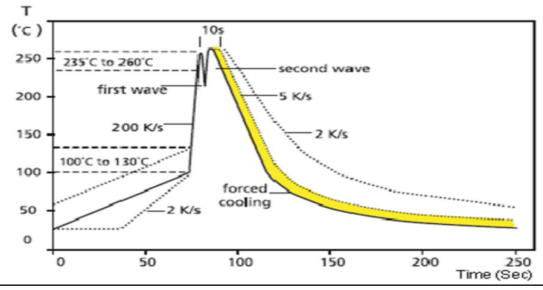
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Item	Test method	Acceptable Criterion
Resistance to Solvent	Immerse in isopropanol solvent at room temperature (23±5℃) for 5min, wipe 10 times with a hard toothbrush, repeat 3 times, take out and blow dry for examination **Reference: AEC-Q200 Test 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: 0402, 0603 / 0805 and above Test Voltage: 1000V / 2000V Reference: AEC-Q200 Test 17, AEC-Q200-002	△R/R=±(2.0%+0.05Ω)
Solderability	Pretreatment: dry heat 155℃, 4H, after take out, stand at room temperature for 2 hours. Test method B1: Dip the resistance in a tin furnace at 245±5℃ for 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	$\mathrm{TCR(PPM/℃)} = \frac{(R_2 - R_1)}{R1 \times (T_2 - T_1)} \times 10^6$ R_1: Resistance value tested at room temperature (Ω) R_2: Resistance value tested at-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**	1Ω≤ R≤10Ω: ±200PPM/°C ＞10Ω: ±100PPM/°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 / 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 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%+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 1VDC 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	Put the test sample resistor in sulfur vapor, at a temperature of 105±2℃ for 750hrs **Reference: ASTM-B-809-95&EIA977**	△R/R=±(4.0%+0.05Ω)

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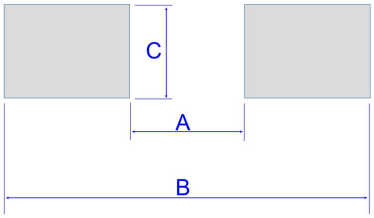
SOLDERING

Recommendation only. Please adjust it according to the actual application

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

Unit: mm

Figure	Type	A	B	C
	AP0402	0.5	1.5	0.6
	AP0603	0.8	2.1	0.9
	AP0805	1.2	3.0	1.3
	AP1206	2.2	4.2	1.6
	AP1210	2.2	4.2	2.8
	AP2010	3.5	6.1	2.8
	AP2512	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.

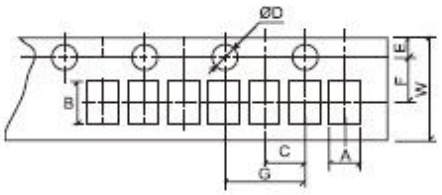
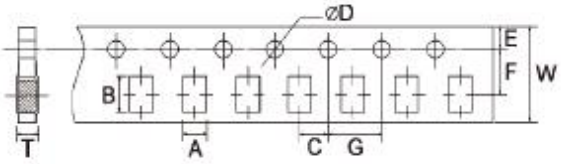
A. High temperature.
B. Near the sea, or corrosive gas, such as Cl_2, H_2S, NH_3, SO_2 and NO_2, etc.
C. Unverified liquids, such as water, oil, chemical or organic solvent.
D. Unverified resin or paint to cover products.
E. Products should be washed with water soluble cleaner even if non cleaning flux.

STORAGE / CARRY CONDITIONS

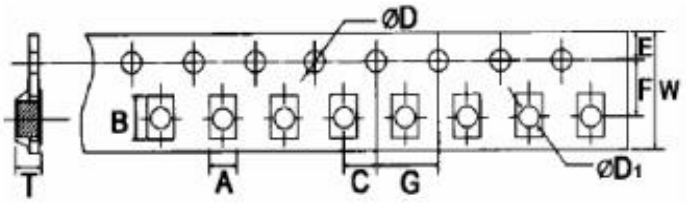
A. Temperature: 25±5℃
B. Humidity: 60±15%RH
C. Storage life: 2 years. FIFO
D. Please hold box correct orientation when storing and carrying. It is strictly prohibited to fall or squeeze the box, otherwise the product electrode or body may be damaged.

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TAPING SPECIFICATIONS Taping drawing

Carrier Taping A	Carrier Taping B
	

Embossed Taping



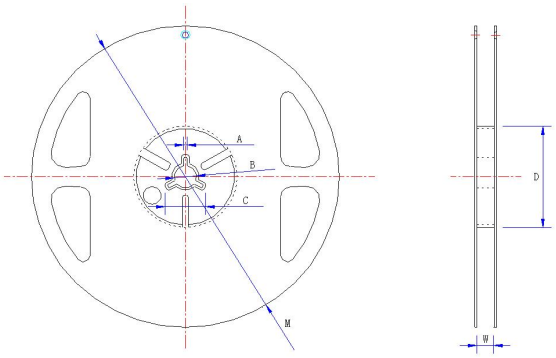
B. Taping Dimensions Unit: mm

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	0402	0.67±0.1	1.17±0.1	2.0	1.5	1.75	3.5	4.0	8.0	0.47
	0603	1.10	1.90	2.0	1.5	1.75	3.5	4.0	8.0	0.67
Carrier Taping B	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

REEL SPECIFICATION

A. Reel drawing

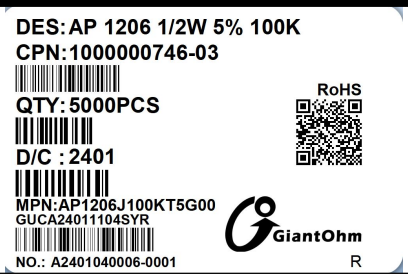


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B. Reel dimension Unit: mm

Type	SPQ PCS/Rl.	A±0.5	B±0.5	C±0.5	D±1	M±2	W±1
0402	10,000	2.0	13.0	21.0	60.0	178.0	10.0
	15,000	2.0	13.0	21.0	60.0	178.0	10.0
0603	5,000	2.0	13.0	21.0	60.0	178.0	10.0
	10,000	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

Produce Label	Customer Label
	

PACKING BOX

A. Packing Type

Taping in reel / Bulk in plastic bag.

B. Inner box

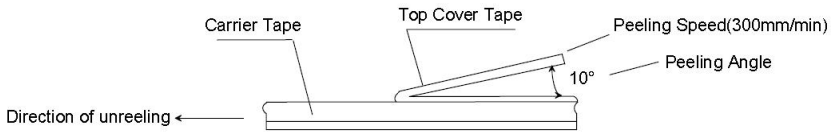
The inner box has several capacities hold 1 reel, 2 reels, 3 reels, 4 reels, 5 reels and 10 reels.

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	0402	0603 and above
Adhesive force limit	10~40gf	10~70gf

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6. Effectiveness:

This disclaimer does not exclude liability for personal injury caused by intentional misconduct or gross negligence, or other liabilities prohibited from exclusion by law.

VERSION HISTORY

Version	Date	Change Item(s)	Description
A	2022/05/11	-	First version
B	2022/10/31	Reliabilities	Updated test items, test method and acceptable criterion.
C	2024/02/01	Full	Add Packing Specifications and update according to AEC-Q200 version E.
D	2024/07/16	Full	Add Packing Specifications. Add Jumper Description in MPN. Add Jumper test acceptable criterion. Add Moisture sensitivity level description.
E	2025/05/24	Full	Update RoHS,Revise the entire text,Update Format
F	2025/10/11	Characteristics	1210 size increase 1W power
G	2026/01/09	Packaging Solution	Increase the reel parameters of:0402 15Kpcs and 0603 10Kpcs
H	2026/07/07	Full	Update Jumper(0Ω)

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