AT Series

Automotive Grade Thin Film High Accuracy Chip Resistors

Version. G

FEATURE

- AEC-Q200 qualified.
- High accuracy up to ±0.05%
- Narrow TCR to ±5PPM/℃
- Total lead-free without RoHS exemptions (7C-1)
- High reliability and stability
- Meet application requirements for high temperature and high humidity with 85℃ and 85%RH
- Superior anti-sulfur performance
- RoHS and Halogen-free compliance
- Applications:
  - Automotive Electronics
  - Electric door and window, electric seat control unit
  - Reversing radar
  - Automotive lighting control unit
  - Medical devices
  - Industrial control system
  - etc.

MANUFACTURER PART NO.

For example: AT1206D49K9T5K25 - AT1206 ±0.5% 49.9KΩ T/R-5000 1/4W 25PPM/℃

Series	Size	Tol.	Nominal Resistance Value	PKG	SPQ	Power	TCR
2 codes	4 codes	1 code	2~5 codes	1 code	1 code	1 code	2 codes
AT	1206	D	49K9	T	5	K	25
Automotive Grade Thin Film High Accuracy Chip Resistors	0402 0603 0805 1206 1210 2010 2512	A=±0.05% B=±0.1% C=±0.25% D=±0.5% F=±1%	1R①=1Ω 4R7=4.7Ω 4K7=4.7KΩ 100K②=100KΩ 1M2③=1.2MΩ	T=T/R④	4=4K 5=5K A=10K	C=1/16W D=1/10W E=1/8W J=1/5W K=1/4W L=1/3W N=1/2W P=3/4W 1=1W	05=5PPM/℃ 10=10PPM/℃ 25=25PPM/℃ 50=50PPM/℃ 00=Refer to table as below.

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 package type. ⑤ P.C.: Personal and Customized.

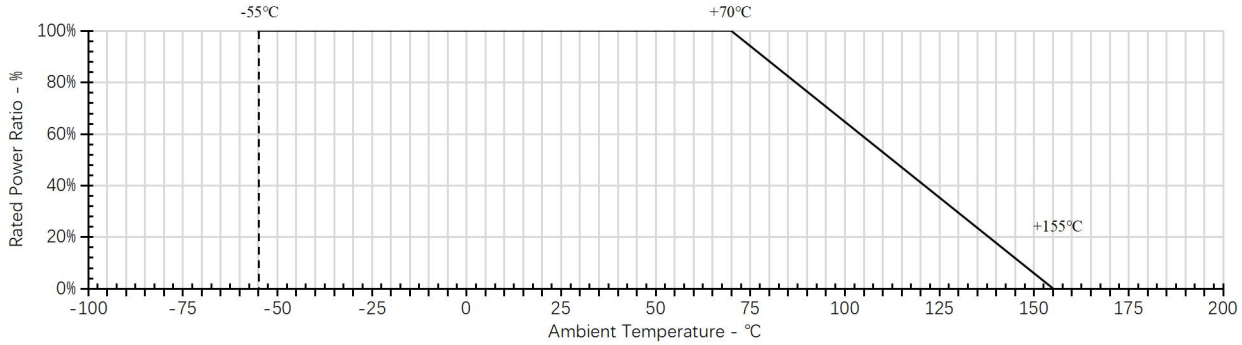
CHARACTERISTICS

Type	Rated Power	MWV①	MOV②	TCR(PPM/℃)	Resistance Range		
					±0.05%	±0.1%, ±0.25%	±0.5%, ±1%
AT0402	1/16W 1/10W 1/8W	50V	100V	±5	100Ω-2KΩ	100Ω-2KΩ	100Ω-2KΩ
				±10	10Ω-12KΩ	10Ω-12KΩ	10Ω-12KΩ
				±25, ±50	10Ω-330KΩ	10Ω-330KΩ	10Ω-330KΩ
AT0603	1/10W 1/5W	75V	150V	±5	100Ω-4KΩ	100Ω-4KΩ	100Ω-4KΩ
				±10	10Ω-50KΩ	10Ω-50KΩ	10Ω-50KΩ
				±25, ±50	10Ω-1MΩ	1Ω-1MΩ	1Ω-1MΩ
AT0805	1/8W 1/4W	150V	300V	±5	100Ω-15KΩ	100Ω-15KΩ	100Ω-15KΩ
				±10	10Ω-100KΩ	10Ω-100KΩ	10Ω-100KΩ
				±25, ±50	4.7Ω-511KΩ	1Ω-2MΩ	1Ω-2MΩ
AT1206	1/4W 1/2W	200V	400V	±5	100Ω-15KΩ	100Ω-15KΩ	100Ω-15KΩ
				±10	10Ω-200KΩ	10Ω-200KΩ	10Ω-200KΩ
				±25, ±50	4.7Ω-1MΩ	1Ω-3MΩ	1Ω-3MΩ
AT1210	1/3W 1/2W	200V	500V	±5	100Ω-15KΩ	100Ω-15KΩ	100Ω-15KΩ
				±10	10Ω-200KΩ	10Ω-200KΩ	10Ω-200KΩ
				±25, ±50	4.7Ω-1MΩ	1Ω-3MΩ	1Ω-3MΩ
AT2010	1/2W 3/4W	200V	500V	±5	100Ω-25KΩ	100Ω-25KΩ	100Ω-25KΩ
				±10	10Ω-200KΩ	10Ω-200KΩ	10Ω-200KΩ
				±25, ±50	4.7Ω-3MΩ	1Ω-3MΩ	1Ω-3MΩ
AT2512	3/4W 1W	200V	500V	±5	100Ω-25KΩ	100Ω-25KΩ	100Ω-25KΩ
				±10	10Ω-200KΩ	10Ω-200KΩ	10Ω-200KΩ
				±25, ±50	4.7Ω-3MΩ	1Ω-3MΩ	1Ω-3MΩ

Note: ① MWV=Max. Working Voltage; ② MOV=Max. Overload Voltage.

This document is subject to change without notice. The products described herein, and this document are subject to specific disclaimers, set forth at GiantOhm official website, http://www.giantohm.com/download/cid/22.html

POWER DERATING CURVE



Note: Working Temperature within -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.

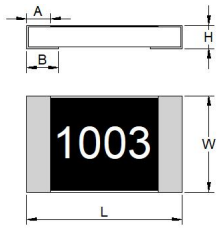
The Rated Voltage of certain resistance value should be the calculated result or Max. Working Voltage of product series whichever lower.

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

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

DIMENSION

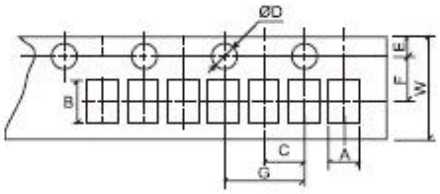
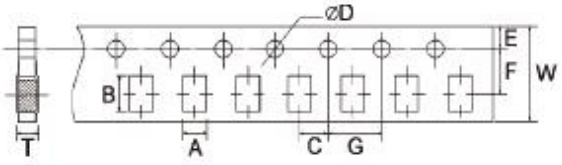
Unit: mm

Figure	Type	L	W	H	A	B
	AT0402	1.00±0.10	0.50±0.05	0.35±0.05	0.20±0.10	0.25±0.10
	AT0603	1.60±0.10	0.80±0.10	0.45±0.10	0.30±0.20	0.30±0.20
	AT0805	2.00±0.15	1.25±0.15	0.55±0.10	0.30±0.20	0.40±0.20
	AT1206	3.10±0.15	1.55±0.15	0.55±0.10	0.40±0.20	0.45±0.20
	AT1210	3.10±0.10	2.60±0.20	0.55±0.10	0.40±0.20	0.45±0.20
	AT2010	5.00±0.10	2.50±0.20	0.55±0.10	0.50±0.25	0.50±0.20
	AT2512	6.35±0.10	3.20±0.20	0.55±0.10	0.50±0.25	0.50±0.20

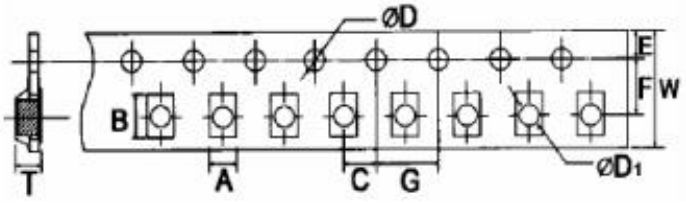
PACKING

- Taping

Unit: mm

Carrier Taping A	Carrier Taping B
	

Embossed Taping



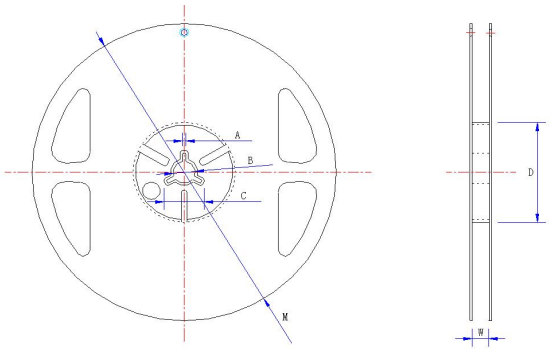
This document is subject to change without notice. The products described herein, and this document are subject to specific disclaimers, set forth at GiantOhm official website, http://www.giantohm.com/download/cid/22.html

- Taping Dimensions

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	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
	1812	3.50	4.80	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



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
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
1812	4,000	2.0	13.0	21.0	60.0	178.0	13.8
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

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	△R/R=±(0.2%+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=±(0.2%+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	△R/R=±(0.2%+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	△R/R=±(0.2%+0.05Ω)

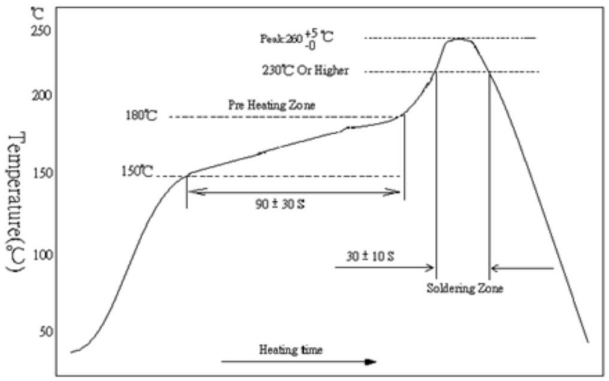
This document is subject to change without notice. The products described herein, and this document are subject to specific disclaimers, set forth at GiantOhm official website, http://www.giantohm.com/download/cid/22.html

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=±(0.1%+0.05Ω)
ESD	Human body mode, two discharges, positive and negative polarity once each Size: 0402, 0603 | 0805 and above Voltage: 1,000V | 2,000V Reference: AEC-Q200 Test 17, AEC-Q200-002	△R/R=±(0.5%+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	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 CHARACTERISTICS
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=±(0.1%+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	△R/R=±(0.1%+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=±(0.1%+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=±(0.1%+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	9V_{DC} to 32V_{DC} (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 1	Put the test sample resistor in sulfur vapor, at a temperature of 105±2℃ for 750hrs Reference: ASTM-B-809-95&EIA977	△R/R=±(1%+0.05Ω)
Sulfide test 2	Cutting oil with sulfur powder with a specific gravity of 96.5:3.5, 105℃, 500 hrs. Customer requirements	△R/R=±(2%+0.05Ω)

This document is subject to change without notice. The products described herein, and this document are subject to specific disclaimers, set forth at GiantOhm official website, http://www.giantohm.com/download/cid/22.html

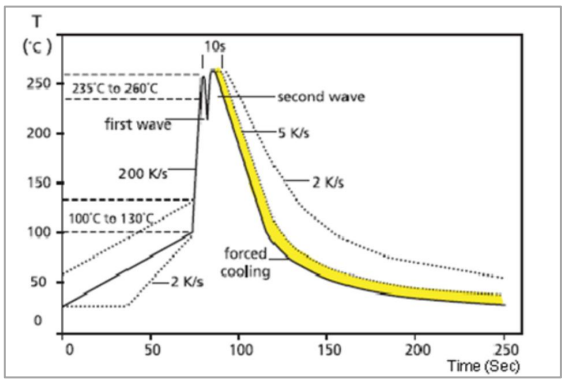
SOLDERING

Lead Free IR Reflow Soldering Profile



- Top temperature should be under 260^{+5}_{-0}℃ for 10 sec.
- Reference: J-STD-020D

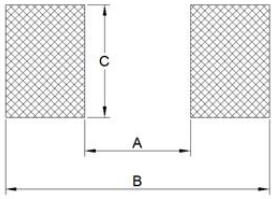
Lead Free Double-Wave Soldering Profile



- Suitable for 0603 above size products
- 350±10℃ for 3 sec. by soldering iron.

SOLDERING PAD

Unit: mm

Figure	Type	A	B	C
	AT0402	0.5	1.5	0.6
	AT0603	0.8	2.1	0.9
	AT0805	1.2	3.0	1.3
	AT1206	2.2	4.2	1.6
	AT1210	2.2	4.2	2.8
	AT2010	3.5	6.1	2.8
	AT2512	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.

This document is subject to change without notice. The products described herein, and this document are subject to specific disclaimers, set forth at GiantOhm official website, http://www.giantohm.com/download/cid/22.html

LEGAL DISCLAIMER

1. Right to Modify Information

- NingBo Giantohm Micro Electronics Technology Co., Ltd. (hereinafter referred to as Giantohm, including distributors and agents, the same applies hereinafter) retains the right to interpret, update, and revise product information (specifications, data, images, etc.).
- Product information shall be subject to the published version on GiantOhm official website (www.giantohm.com). Please note to check for updates.

2. Limitation of Liability

To the maximum extent permitted by applicable laws, GiantOhm shall not be liable for:

- **Misuse Liability**: All liabilities arising from improper use or application of the products.
- **Damages**: Any direct/indirect losses (including loss of profit, special damages, punitive damages, etc.) caused by improper use or application of the products, regardless of the legal theory (contract, tort, or otherwise).
- **Implied Warranties**: Exclusion of implied fitness warranties for a particular purpose, non-infringement, and merchantability (except as mandated by law).

3. Product Use Scope and Technical Advice Liability

- Statements regarding the suitability of products for certain types of applications are based on GiantOhm knowledge of typical requirements that are often placed on GiantOhm products in generic applications. Such statements are not binding statements about the suitability of products for a particular application. It is the user's responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application.
- Parameters provided in datasheets and / or specifications may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated for each user application by the user's technical experts for the application, with the user assuming full responsibility.
- Except as expressly indicated in writing, GiantOhm products are not designed for use in medical, life-saving, or life-sustaining applications or for any other application in which the failure of the GiantOhm product could result in personal injury or death. users using or selling GiantOhm products not expressly indicated for use in such applications do so at their own risk.

4. Combined Use Risk

- When the product is used in combination with other materials or processes, the Buyer assumes all risks and liabilities. GiantOhm does not warrant the suitability of the combination and shall not be liable for any responsibilities.

5. Disclaimer Updates

- The updated Terms shall prevail over previous versions and shall be subject to the latest version published on the official website (http://www.giantohm.com/download/cid/22.html), except for transactions concluded prior to the effective date of the amendments.
- Continued use of the products by the user after the Terms update shall constitute deemed acceptance of the new Terms.

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	2022/04/25	-	First version
B	2022/11/24	Reliability	Update test items, test method and acceptable criterion.
C	2023/12/20	Packing	Add Packing section
D	2024/03/01	Characteristics	Add high-power criterion
E	2024/8/30	Reliability	Update test items, test method and acceptable criterion.
F	2024/10/24	Reliability	Update Sulfide test method
G	2025/7/22	Legal Disclaimer	Update Legal Disclaimer

This document is subject to change without notice. The products described herein, and this document are subject to specific disclaimers, set forth at GiantOhm official website, http://www.giantohm.com/download/cid/22.html