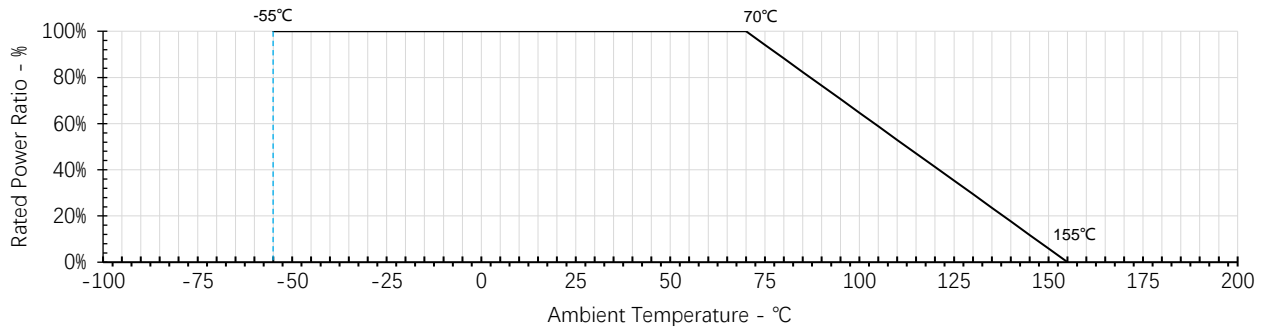


POWER DERATING CURVE



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:

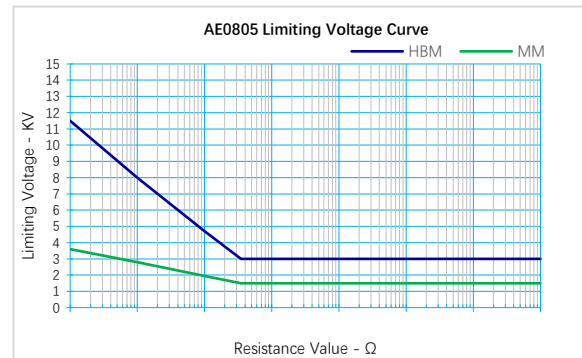
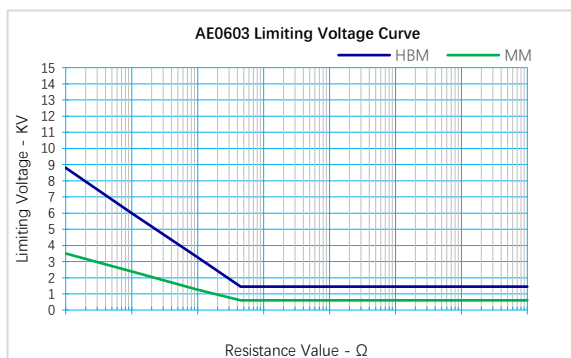
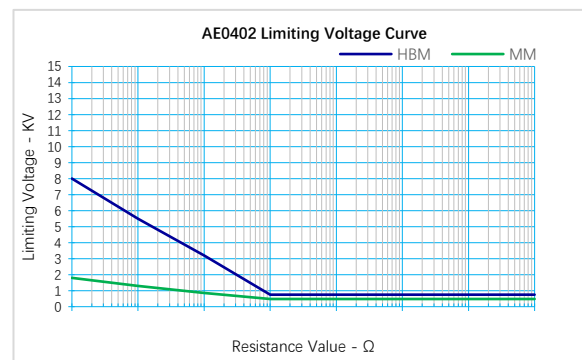
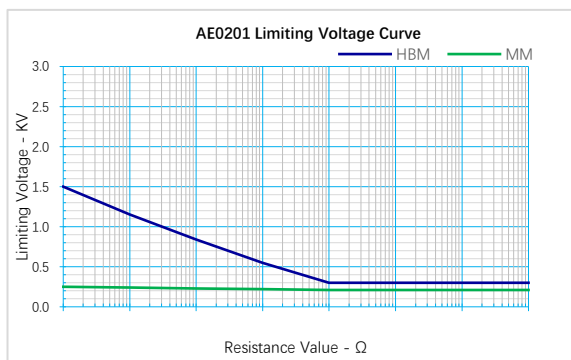
$$E = \sqrt{P \times R}$$

E=Rated voltage(V)

P=Rated power(W)

R=Nominal resistance(Ω)

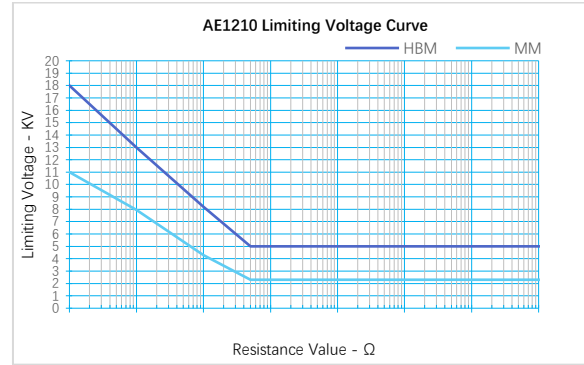
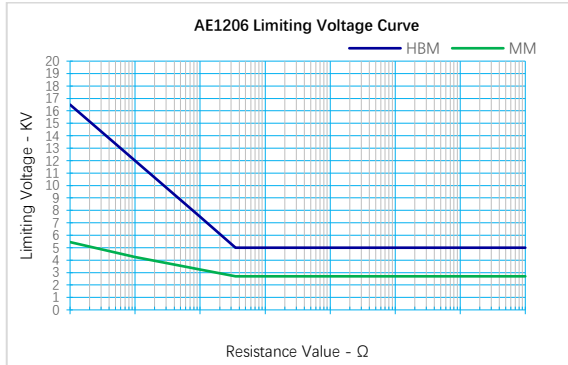
ESD LIMITING VOLTAGE CURVE



AE Series

Automotive Grade Anti-ESD Thick Film Chip Resistors

Version. A



Note: HBM:100PF 1K5 1Cycle MM: 200PF 0E 1Cycle

DIMENSIONS

Figure	Type	L	W	H	A	B	Unit: mm
	AE0201	0.60±0.03	0.30±0.03	0.23±0.03	0.12±0.05	0.15±0.05	
	AE0402	1.00±0.10	0.50±0.05	0.35±0.05	0.20±0.10	0.25±0.10	
	AE0603	1.60±0.10	0.80±0.10	0.45±0.10	0.30±0.20	0.30±0.20	
	AE0805	2.00±0.15	1.25±0.15	0.55±0.10	0.40±0.20	0.40±0.20	
	AE1206	3.10±0.15	1.55±0.15	0.55±0.10	0.45±0.20	0.45±0.20	
	AE1210	3.10±0.10	2.60±0.20	0.55±0.10	0.50±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: $\Delta R/R = \pm 1.0\%$ 5% Series: $\Delta R/R = \pm 2.0\%$
Temperature Cycling	-55~+125°C, slope 10~20°C/min, dwell time 15min, 1000 cycles Reference: AEC-Q200 Test 4, JESD22 Method JA-104	$\Delta R/R = \pm 2.0\%$
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: $\Delta R/R = \pm 2.0\%$ 5% Series: $\Delta R/R = \pm 3.0\%$
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: $\Delta R/R = \pm 2.0\%$ 5% Series: $\Delta R/R = \pm 3.0\%$
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
Resistance to Soldering Heat	Soak in a tin furnace at 260±5°C for 10±1 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	$\Delta R/R = \pm 1.0\%$
ESD	HBM:100PF 1K5 1Cycle MM: 200PF 0E 1Cycle Note: ESD Voltage Refer to "ESD Limiting Voltage Curve" Reference: AEC-Q200 Test 17, AEC-Q200-002	$\Delta R/R = \pm 2.0\%$

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AE Series

Automotive Grade Anti-ESD Thick Film Chip Resistors

Version. A



Item	Test Method	Acceptable Criterion						
Solderability	<p>Pretreatment: dry heat 155°C, 4 hrs. or PCT aging for 4 hrs. (equivalent), after take out, stand at room temperature for 2 hrs.</p> <p>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.</p> <p>Reference: AEC-Q200 Test 18, J-STD-002 & IEC 60115-1 11.1.4.3</p>	<p>Soldering coverage over 95% At the edge of terminal, the object underneath (e.g., white ceramic) shall not expose.</p>						
Electrical Characterization	$TCR(PPM/°C) = \frac{(R_2 - R_1)}{R_1 \times (T_2 - T_1)} \times 10^6$ <p>R_1: Resistance value tested at room temperature (Ω) R_2: Resistance value tested at -55°C or +125°C T_1: Temperature at room temperature ($^{\circ}C$) T_2: Temperature at -55°C or +125°C</p> <p>Reference: AEC-Q200 Test 19, IEC 60115-1 6.2</p>	<p>1Ω ≤ R ≤ 10Ω: 0201: -100~+350 PPM/°C 0402~1210: ±200 PPM/°C 10Ω < R ≤ 10MΩ: 0201: ±200 PPM/°C 0402~1210: ±100 PPM/°C</p>						
Board Flex	<p>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.</p> <table border="1"> <tr> <td>Size</td> <td>0402, 0603, 0805</td> <td>0201, 1206, 1210</td> </tr> <tr> <td>Depth</td> <td>5mm</td> <td>3mm</td> </tr> </table> <p>Reference: AEC-Q200 TEST 21, AEC-Q200-005</p>	Size	0402, 0603, 0805	0201, 1206, 1210	Depth	5mm	3mm	<p>ΔR/R=±1.0%</p>
Size	0402, 0603, 0805	0201, 1206, 1210						
Depth	5mm	3mm						
Terminal Strength	<p>Apply 1.8Kgf. external force (0402,1 Kgf.) on the side of the part to test the solder joint adhesion of the part</p> <p>Reference: AEC Q200-005</p>	<p>No mechanical damage or peel-off of side end</p>						
Short Time Overload	<p>Apply 2.5 times rated voltage or maximum overload voltage (whichever is the smallest) for 5 seconds.</p> <p>Reference: IEC 60115-1 8.1.4.2</p>	<p>1% Series: ΔR/R=±1.0% 5% Series: ΔR/R=±2.0%</p>						
Mechanical shock	<p>Half sine wave, acceleration 100g's, each three times in X, Y and Z directions, pulse width 6ms.</p> <p>Reference: AEC-Q200 Test 13, MIL-STD -202 Method 213</p>	<p>ΔR/R=±1.0%</p>						
Vibration	<p>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.</p> <p>Reference: AEC-Q200 Test 14, MIL-STD -202 Method 204</p>	<p>ΔR/R=±1.0%</p>						
Flammability	<p>V-0</p> <p>Reference: AEC-Q200 Test 20, UL-94</p>	<p>Do not burn and cotton below do not ignite</p>						
Flame retardancy	<p>9VDC to 32VDC (clamp current 500A) in each increment 1VDC for 1 hr.</p> <p>Reference: AEC-Q200 Test 24, AEC-Q200-001</p>	<p>1. Nonflammable 2. Do not explode 3. The temperature cannot be higher than 350°C for 10 seconds</p>						
Sulfide test	<p>Put the test sample resistor in sulfur vapor, at a temperature of 105±2°C for 750hrs</p> <p>Reference: ASTM-B-809-95&EIA977</p>	<p>ΔR/R=±4.0%</p>						

AE Series

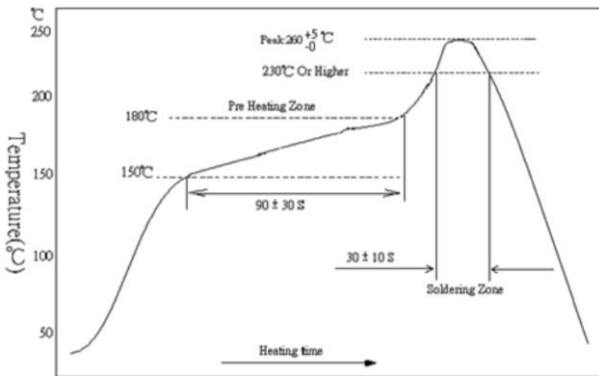
Automotive Grade Anti-ESD Thick Film Chip Resistors

Version. A



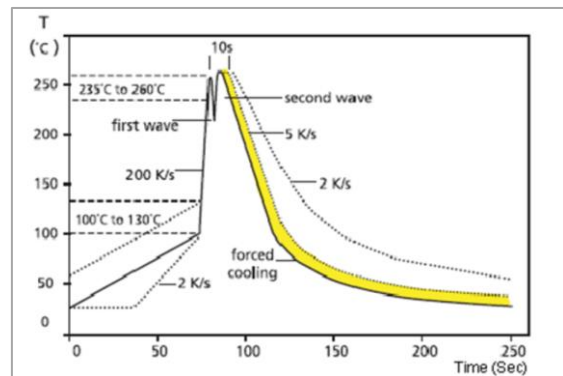
SOLDERING

Lead Free IR Reflow Soldering Profile



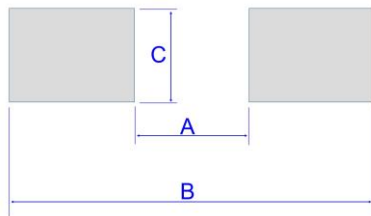
- Top temperature should be under 260 +5/-0 °C ,10Sec.
- Reference: J-STD-020D

Lead Free Double-Wave Soldering Profile



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

SOLDERING PAD



Unit: mm

Type	A	B	C
AE0201	0.3	1.0	0.4
AE0402	0.5	1.5	0.6
AE0603	0.8	2.1	0.9
AE0805	1.2	3.0	1.3
AE1206	2.2	4.2	1.6
AE1210	2.2	4.2	2.8

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.
- Near the sea, or corrosive gas, such as Cl₂、 H₂S、 NH₃、 SO₂ and NO₂, 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:
 - 0201 size: 1 year;
 - 0402 and above size: 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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