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SPECIFICATIONS

Anti Surge / Surge Withstanding

Chip Resistor

AEC-Q200

AS-Serie

Version January 2021

C O N F I D E N T I A L D O C U M E N T

SPECIFICATION FOR APPROVAL

SWISSDIS AG

Description : Anti- Surge Thick Film Chip Resistors (Lead Free) AEC-Q200 Compliant

Part no.:

ASxxxxxxxxTxE (AS Series +/- 5%, 10%, 20%)

Approved by

RoHS V3 Compliant (EU) 2015/863

REACH Compliant

Approved	Checked	Prepared
Mr. XP Hong	Mr. S. Polthanasan	Ms. Junyaporn Insamien

Issue Date: 2021/01/11

Anti- Surge Thick Film Chip Resistors (Lead Free) AEC-Q200 Compliant

1. Scope:

This specification for approval relates to Anti- Surge Thick Film Chip Resistors (Lead Free) manufactured by ROYALOHM. The test items follow the test standard of AEC-Q200 Grade 4.

2. Type designation:

The type designation shall be in the following form:

Type	Power Rating	Resistance tolerance	Nominal Resistance
Ex. AS03 (0603)	1/4W	J,K,M	10Ω

3. Ratings:

Type	AS02 (0402)	AS03 (0603)	AS05 (0805)	AS06 (1206)	AS07 (1210)	AS10 (2010)	AS12 (2512)
Power Rating	1/8W	1/4W	1/2W	0.6W	3/4W	1.5W	2W
Max. Working Voltage	50 V	75 V	150 V	200 V	200 V	400 V	500 V
Max. Overload Voltage	100 V	150 V	300 V	400 V	500 V	800 V	1000 V
Dielectric Withstanding Voltage	100 V	300 V	500 V	500 V	500 V	500 V	500 V
Temperature Range	-55°C ~ +155°C						
Ambient Temperature	70 °C						

3.1 Nominal Resistance

Effective figures of nominal resistance shall be in accordance :

E-24 values – these are preferred and will have standard MOQ

3.2 Voltage rating:

Resistors shall have a rated direct-current (DC) continuous working voltage or an approximate sine-wave root-mean-square (RMS) alternating-current (AC) continuous working voltage at commercial-line frequency and waveform corresponding to the power rating , as determined from the following formula :

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

Note : Max. Working Voltage or $\sqrt{P \times R}$ whichever is lesser

Max. Overload Voltage or $2.5 \sqrt{P \times R}$ whichever is lesser

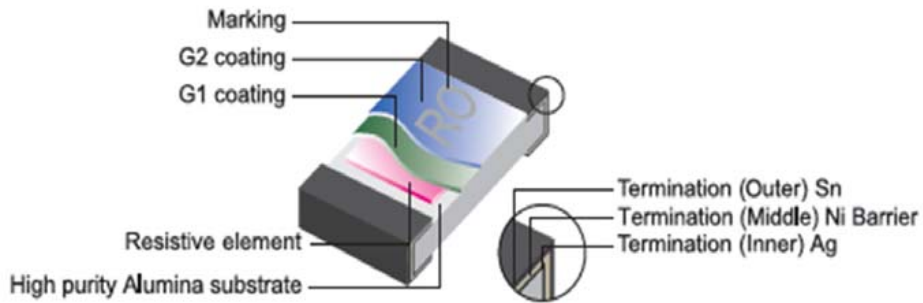
Where : RCWV = Rated DC or RMS AC continuous working voltage at commercial-line frequency and waveform (volt)

P = Power Rating (watt)

R = Nominal Resistance (ohm)

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4. Construction



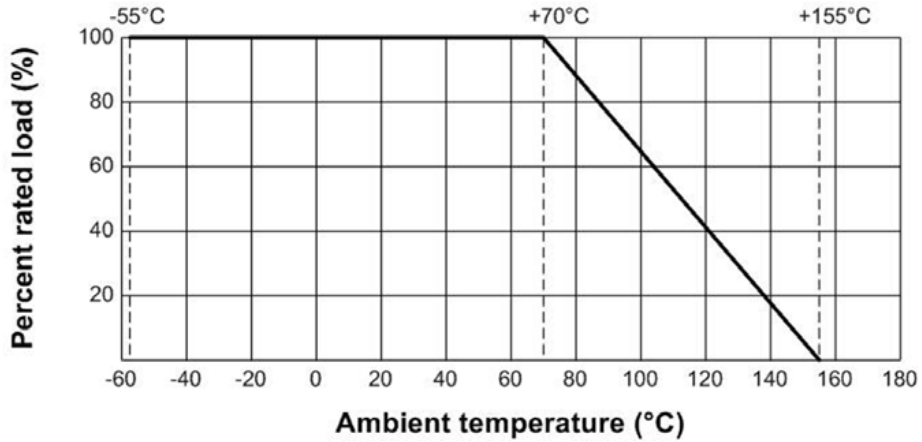
5. Power rating and dimensions

5.1 Power rating:

Resistors shall have a power rating based on continuous load operation at an ambient temperature of 70 °C .

For temperature in excess of 70 °C , The load shall be derate as shown in figure 1.

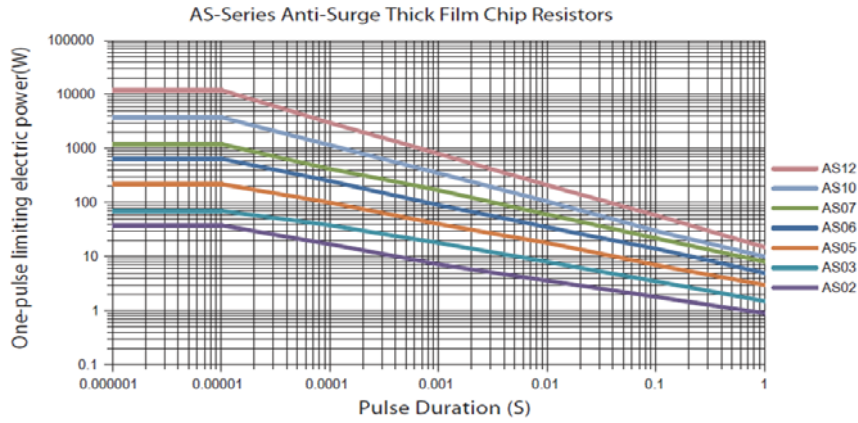
Figure. 1



Type	Power Rating at 70 °C	Tolerance %	Resistance Range	Standard Series
AS02 (0402)	1/8W	±5% ±10% ±20%	1Ω ~ 10MΩ	E-24
AS03 (0603)	1/4W			
AS05 (0805)	1/2W			
AS06 (1206)	0.6W			
AS07 (1210)	3/4W			
AS10 (2010)	1.5W			
AS12 (2512)	2W			

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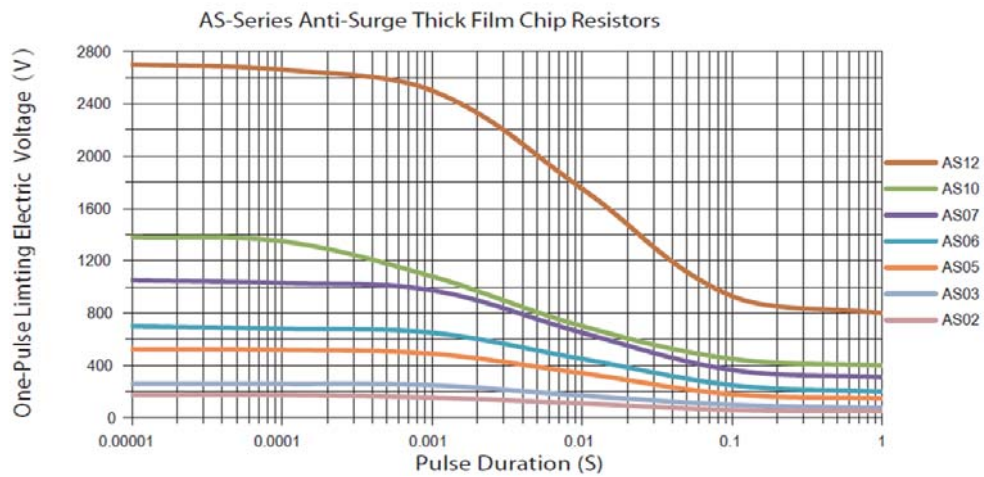
5.2 Curve of pulse duration:



5.3 Lightning Surge.

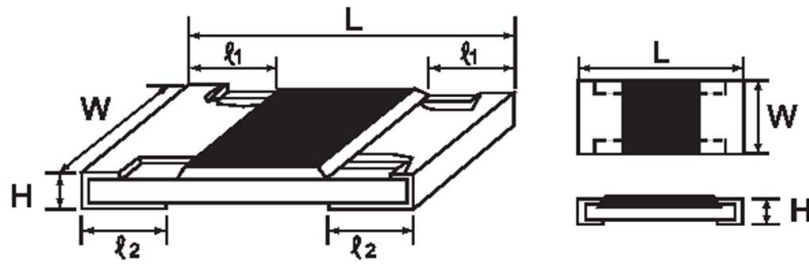


5.4 Pulse voltage limit



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5.5 Dimension :



Type	Dimension (mm)				
	L	W	H	l1	l2
AS02 (0402)	1.00 ± 0.10	0.50 ± 0.05	0.35 ± 0.05	0.20 ± 0.10	0.25 ± 0.10
AS03 (0603)	1.60 ± 0.10	0.80 ± 0.10	0.45 ± 0.10	0.30 ± 0.20	0.30 ± 0.20
AS05 (0805)	2.00 ± 0.15	1.25 + 0.15 - 0.10	0.55 ± 0.10	0.40 ± 0.20	0.40 ± 0.20
AS06 (1206)	3.10 ± 0.15	1.55 + 0.15 - 0.10		0.45 ± 0.20	0.45 ± 0.20
AS07 (1210)	3.10 ± 0.10	2.60 ± 0.20		0.50 ± 0.25	0.50 ± 0.20
AS10 (2010)	5.00 ± 0.10	2.50 ± 0.20	0.60 ± 0.25		
AS12 (2512)	6.35 ± 0.10	3.20 ± 0.20			

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6. Marking :

6.1 Resistors

A. Marking for E-24 series in AS03, AS05, AS06, AS07, AS10, AS12 size : 3 Digits

*The first two digits are significant figures of resistance and the third digit denoted number of zeros

Ex.	333	33K Ω
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*For ohmic values below 10 Ω , letter "R" is for decimal point.


Ex.	2R2	2.2 Ω
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B. Chip Resistors type AS02 No marking

6.2 Labels

Label shall be marked with the following item :

- A. Nominal Resistance and Resistance Tolerance
- B. Power Rating and Size
- C. Quantity
- D. Part No.
- E. P.O.No.
- F. Lot No.

Ex.	ROYALOHM CHIP RESISTOR		
	RESISTANCE:	10 Ω	\pm 5%
	WATTAGE:	0.6W-S	SIZE: AS06
	QUANTITY:	5,000 PCS	Pb-Free
	PART NO.:		
	P.O.NO.:		
	LOT NO. :	6050008	AS0606J0100T5E
			

Remark : Value is 10 Ω , marking is 100

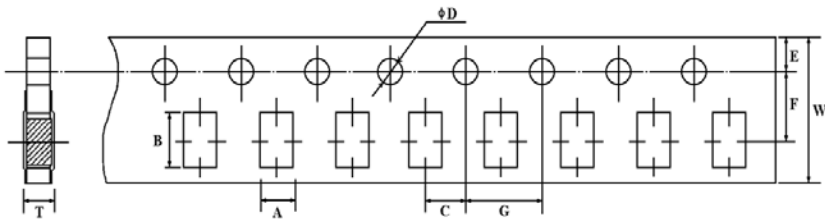
Anti- Surge Thick Film Chip Resistors (Lead Free) AEC-Q200 Compliant		
7. Performance specification :		
Characteristics	Limits	Test Methods (AEC - Q200)
Operational Life	± (3.0% + 0.1 Ω) Max.	125°C, at 35% of operating power, 1000H(1.5 hours "ON", 0.5 hour "OFF") (MIL-STD-202 Method 108)
Temperature Coefficient of Resistance	1Ω ~ 10Ω : ± 400 PPM/°C 10.1Ω ~ 10MΩ : ± 100 PPM/°C	Natural resistance change per temp. degree centigrade. $\frac{R2-R1}{R1(t2-t1)} \times 10^6 \text{ (PPM/°C)}$ R1: Resistance value at room temperature (T1) R2: Resistance value at room temp. plus 100 °C(T2) Test pattern: room temp. (T1), room temp. +100°C(T2)
External Visual	No Mechanical Pamage	Electrical test not required. Inspect device construction, marking and workmanship (MIL-STD-883 Method 2009)
Physical Dimension	Reference 2.0 Dimension Standards	Verify physical dimensions to the applicable device detail specification. Note: User(s) and Suppliers spec. Electrical test not required. (JESD22 MH Method JB-100)
Resistance to Solvent	Marking Unsmearad	Note: Add Aqueous wash chemical – OKEM Clean or equivalent. Do not use banned solvents. (MIL-STD-202 Method 215)
Terminal Strength	Not broken	Force of 1.8kg for 60 seconds. (MIL-STD-202 Method 213)
High Temperature Exposure (Storage)	± (1.0% + 0.1 Ω) Max.	1000hrs. at T=155°C. Unpowered. Measurement at 24±2 hours after test conclusion. (MIL-STD-202 Method 108)
Temperature cycling	± (1.0%+0.1Ω) Max.	1000 Cycles (-55°C to +155°C). Measurement at 24±2 hours after test conclusion. (JESD22 Method JA-104)
Solderability	95% coverage Min.	For both leaded & SMD. Electrical test not required. Magnification 50X. Conditions: (J-STD-002)
Soldering Temperature Reference	Electrical characteristics shall be satisfied. Without distinct deformation in appearance. (95 % coverage Min.)	<p><u>Wave soldering condition:</u> (2 cycles Max.) Pre-heat : 100 ~ 120 °C, 30 ± 5 sec. Suggestion solder temp.: 235 ~ 255 °C, 10 sec. (Max.) Peak temp.: 260 °C</p> <p><u>Reflow soldering condition:</u> (2 cycles Max.) Pre-heat : 150 ~ 180 °C, 90 ~ 120 sec. Suggestion solder temp.: 235 ~ 255 °C, 20 ~ 40 sec. Peak temp.: 260 °C</p> <p><u>Hand soldering condition:</u> The soldering iron tip temperature should be less than 300°C and maximum contract time should be 5 sec.</p>

Anti- Surge Thick Film Chip Resistors (Lead Free) AEC-Q200 Compliant		
7. Performance specification :		
Characteristics	Limits	Test Methods
Mechanical Shock	$\pm (1\%+0.1\Omega)\text{max}$	Wave Form: Tolerance for half sine shock pulse. Peak value is 100g's. Normal duration (D) is 6. (MIL-STD-202 Method 213)
Vibration	$\pm (1\%+0.1\Omega)\text{max}$	5g's for 20 min., 12cycle each of 3 orientations. Note: Use 8"*5"*PCB. 031" thick 7 secure points (onone) long side and 2 secure points at corners of opposite sides. Parts mounted within 2' from any secure point. Test from 10-2000Hz. (MIL-STD-202 Method 204)
Biased Humidity	$\pm (3\%+0.1\Omega)\text{Max.}$	10% rated power, 85°C/85%RH, 1000H, Measurement at 24 hours after test conclusion. (MIL-STD-202 Method 103)
ESD	$\pm (10\%+0.1\Omega)\text{max}$	With the electrometer in direct contact with the discharge tip, verify the voltage setting at levels of $\pm 500\text{V}, \pm 1\text{KV}, \pm 2\text{KV}, \pm 4\text{KV}, \pm 8\text{KV}$. The electrometer reading shall be within $\pm 10\%$ for voltages from 500V to 800V. (AEC-Q200-002 or ISO/DIS 10605)
Flammability	No ignition of the tissue paper or scorching or the pinewood board	V-0 or V-1 are acceptable. Electrical test not required. (UL-94)
Board Flex	$\pm(1\%+0.05\Omega)\text{max}$	60 seconds minimum holding time. (JIS-C-6429)
Flame Retardance	No flame	Temperature sensing at 500°C, Voltage power subjected to 32VDC current clamped up to 500ADC and decreased in 1.0VDC/hour. (AEC-Q200-001)
Resistance to Soldering Heat	$\pm(1\%+0.05\Omega)\text{max.}$	Condition B No per-heat of samples. Note: Single Wave Solder-Procedure 2 for SMD and Procedure 1 for Leaded with solder within 1.5mm of device body. (MIL-STD-202 Method 210)
* Sulfuration test: H ₂ S 3~5PPM 50°C \pm 2°C 91%~93%RH 1000H		

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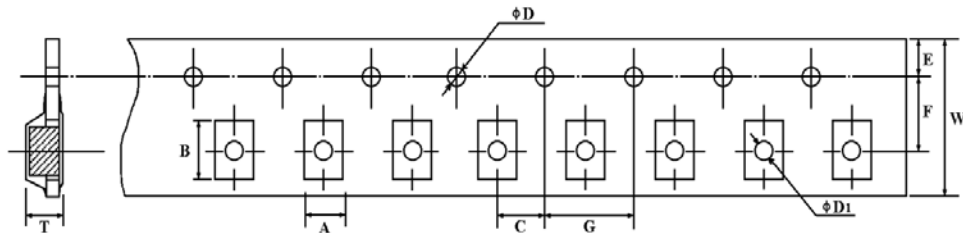
8. Packing specification :

A. Tapping Dimension (mm)



Type	A	B	C	ØD - 0	E	F	G	W	T
AS02 (0402)	0.65 ± 0.1	1.2 ± 0.1	2.00 ± 0.05	1.5 + 0.1 - 0	1.75 ± 0.1	3.50 ± 0.05	4.0 ± 0.1	8.0 ± 0.2	0.42 ± 0.05
AS03 (0603)	1.10 ± 0.2	1.9 ± 0.2							0.67 ± 0.1
AS05 (0805)	1.65 ± 0.2	2.4 ± 0.2							0.81 ± 0.1
AS06 (1206)	2.00 ± 0.2	3.6 ± 0.2							
AS07 (1210)	2.80 ± 0.2	3.5 ± 0.2							0.75 ± 0.1

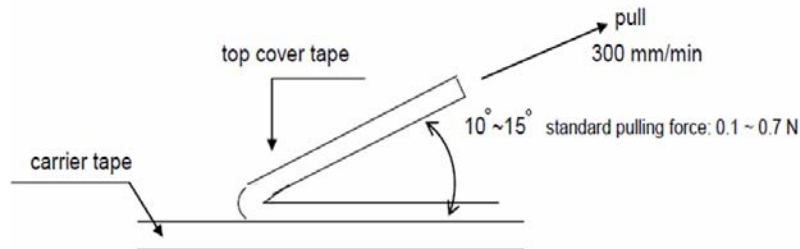
B. Embossed tapping



Type	A ±0.2	B ±0.2	C ±0.05	φ D+0.1	E ±0.1	F ±0.05	G ±0.1	W ±0.2	φ D1	T
AS10 (2010)	2.90	5.60	2.0	1.5 + 0.1	1.75	5.5	4.0	12.0	1.5 + 0.1	1.0 ± 0.1
AS12 (2512)	3.50	6.70		- 0					- 0	

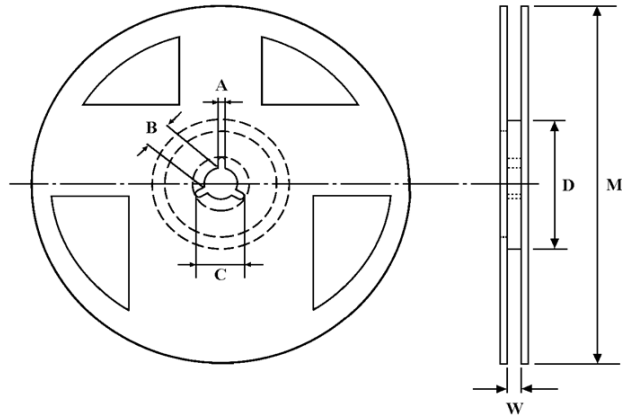
*** Peeling Strength of Top**

Test Condition: 0.1 to 0.7 N at a peel-off speed of 300 mm / min.



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* Reel Dimension (mm)

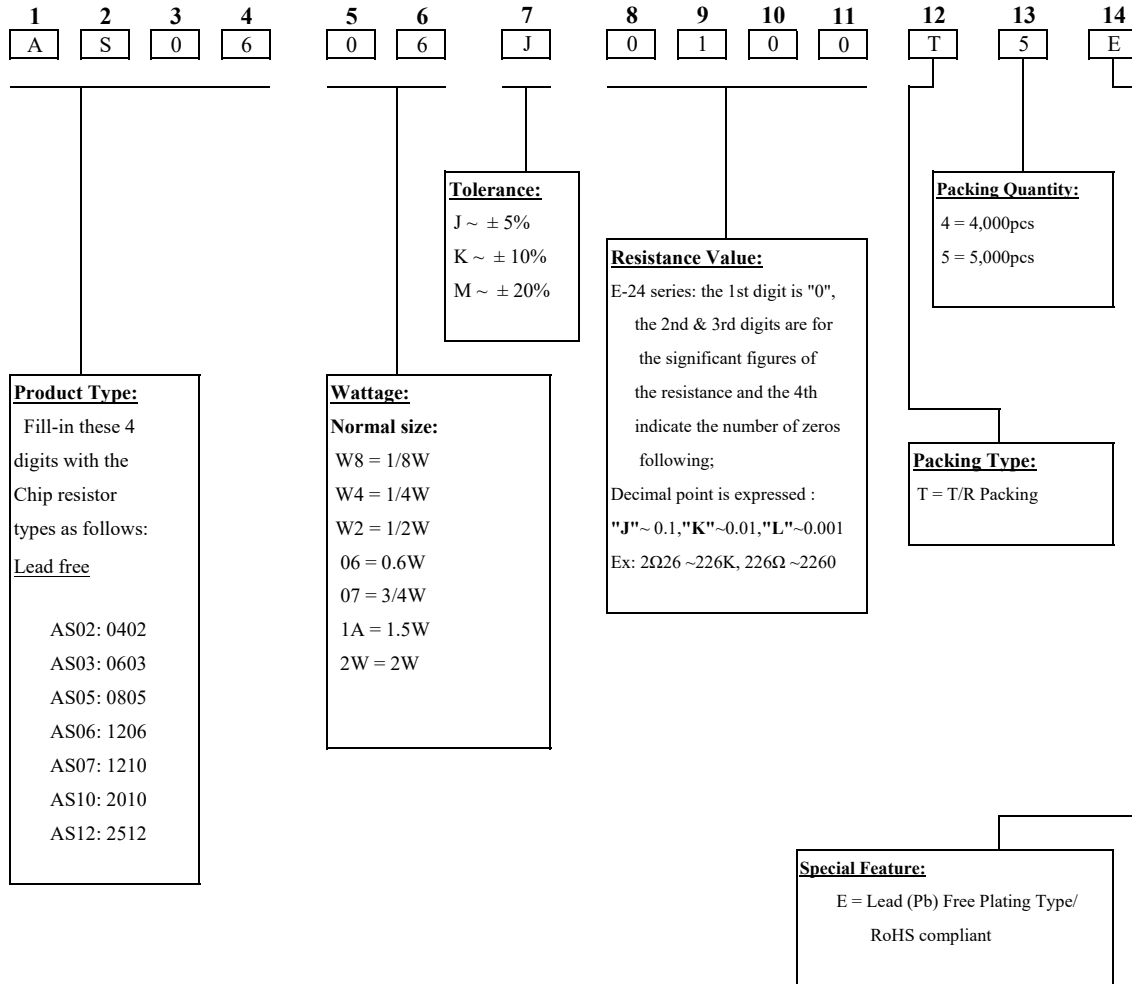


Type	Packaging	Quantity Per Reel	A ± 0.5	B ± 0.5	C ± 0.5	D ± 1	M ± 2	W ± 1
AS02 0402	Paper	10,000 pcs.	2	13	21	60	178	10
AS03 0603		5,000 pcs.						
AS05 0805								
AS06 1206								
AS07 1210								
AS10 2010	Embossed	4,000 pcs.	2	13	21	60	178	13.8
AS12 2512								

Part Number System

Explanation of Part Number System

Anti-Surge Thick Film Chip Resistors (Lead Free) AEC-Q200 Compliant



Sample : AS03 (0603) 1/4W +/- 5% 10Ω T/R--5000 → AS03W4J0100T5E
 AS03 (0603) 1/4W +/- 10% 10Ω T/R--5000 → AS03W4K0100T5E
 AS03 (0603) 1/4W +/- 20% 10Ω T/R--5000 → AS03W4M0100T5E

Anti- Surge Thick Film Chip Resistors (Lead Free) AEC-Q200 Compliant

Environment Related Substance

This product complies to EU RoHS directive, EU PAHs directive, EU PFOS directive and Halogen free.

Ozone layer depleting substances.

Ozone depleting substances are not used in our manufacturing process of this product.

This product is not manufactured using Chloro fluorocarbons (CFCs), Hydrochlorofluorocarbons (HCFCs), Hydrobromofluorocarbons (HBFCs) or other ozone depleting substances in any phase of the manufacturing process.

Storage Condition (MSL1)

The performance of these products, including the solderability, is guaranteed for a year from the date of arrival at your company, provided that they remain packed as they were when delivered and stored at a temperature of $25^{\circ}\text{C} \pm 10^{\circ}\text{C}$ and a relative humidity of $60\%\text{RH} \pm 10\%\text{RH}$, chemical and dust free atmosphere

Even within the above guarantee periods, do not store these products in the following conditions.

Otherwise, their electrical performance and/or solderability may be deteriorated, and the packaging materials (e.g. taping materials) may be deformed or deteriorated, resulting in mounting failures.

1. In salty air or in air with a high concentration of corrosive gas, such as Cl_2 , H_2S , NH_3 , SO_2 , or NO_2
2. In direct sunlight

This production is used for automotive electronics, ROYALOHM will not be responsible for any damage, expense or loss caused by the use of this specification in any special environment. This series of product are suitable for automotive electronics applications, as show below, if there are other application, you need to confirm with ROYALOHM whether they are applicable:

- a. Control unit for informatiom, entertainment, navigation, audio;
- b. Control unit for comfortable doors, windows, seat;
- c. Control unit for internal lighting.

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Regardless of the application of ROYALOHM products, it is recommended to carry out safety tests while using measures such as protective circuits and redundant circuits to protect the safety of equipment.