Towards Excellence in *Quality, Service & Innovation*

ASJ

DATA SHEET

Anti-Sulphur Thick Film Chip Resistor

SAS (A/B) Series

0.1% TO 5.0%, TCR -200 TO +400

SIZE: 0201/0402/0603/0805/1206/1210/2010/2512

RoHS-Compliant

Product Specification – Mar. 13, 2023 V15

1. SCOPE

1.1 This specification is applicable to Lead-free and Halogen-free of RoHS directive for SAS series anti-sulfurated thick film chip resistors.

1.2 Superior Sulfur-resistant capability (Refer to ASTM-B-809-95 & EIA977 sulfur vapor test).

1.3 The product is for general electronic purpose.

2. PART NUMBERING SYSTEM

Part Numbering is made in accordance with the following system:

SAS	10	-	XXXX	-	F	K	-	A

Type	Size (Inch/mm)	Nominal Resistance		Resistance Tolerance	Packaging	FoS Test
Anti - Sulfurated Thick Film Chip Resistors	05(0201/0603) 10(0402/1005) 16(0603/1608) 21(0805/2012) 32(1206/3216) 40(1210/3225) 50(2010/5025) 63(2512/6432)	5% (3-Digit)	EX. 10Ω = 100 4.7Ω = 4R7 JUMPER = 0	B = ±0.1% D = ±0.5% F = ±1% J = ±5% Z = Zero Ohm (±5%)	E = 4,000 pcs Lead Free L = 5,000 pcs Lead Free K = 10,000 pcs Lead Free Y = 20,000 pcs Lead Free N = 50,000 pcs Lead Free Refer item 7.3.2	A : 60ºC B :105ºC
		0.1% 0.5% 1% (4-Digit)	EX. 10.2Ω = 10R2 10KΩ = 1002			

3. RATING

3.1 Rated Power

3.1.1 Resistor Rated Power

Type	Rated Power at 70℃	Max. Working Voltage	Max. Overload Voltage	JUMPER (0Ω) Rated Current				JUMPER (0Ω) Resistance Value			
				Z(±5%)		F(±1%)		Z(±5%)		F(±1%)	
				A	B	A	B	A	B	A	B
SAS05 (0201)	1/20 W	25V	50V	0.5A		0.5A		50mΩ MAX	100mΩ MAX	---	50mΩ MAX.
SAS10 (0402)	1/16 W	50V	100V	1A		1.5A		50mΩ MAX	100mΩ MAX	35mΩ MAX	50mΩ MAX.
SAS16 (0603)	1/10 W	75V	150V	1A		2A		50mΩ MAX	100mΩ MAX	25mΩ MAX	50mΩ MAX.
SAS21 (0805)	1/8 W	150V	300V	2A		2.5A		50mΩ MAX	100mΩ MAX	20mΩ MAX	50mΩ MAX.
SAS32 (1206)	1/3 W	200V	400V	2A		3.5A		50mΩ MAX	100mΩ MAX	20mΩ MAX	50mΩ MAX.
SAS40 (1210)	1/2 W	200V	400V	2A		4A		50mΩ MAX	100mΩ MAX	20mΩ MAX	50mΩ MAX.
SAS50 (2010)	3/4 W	200V	400V	2A		5A		50mΩ MAX	100mΩ MAX	20mΩ MAX	50mΩ MAX.
SAS63 (2512)	1 W	200V	400V	2A		7A		50mΩ MAX	100mΩ MAX	20mΩ MAX	50mΩ MAX.

3.2 Power Derating Characteristics

Rated Power shall be the load power corresponding to nominal wattage suitable for continuous use at 70°C ambient temperatures. In case the ambient temperature exceeds 70°C, reduce the load power in accordance with Derating curve in Fig. 1.

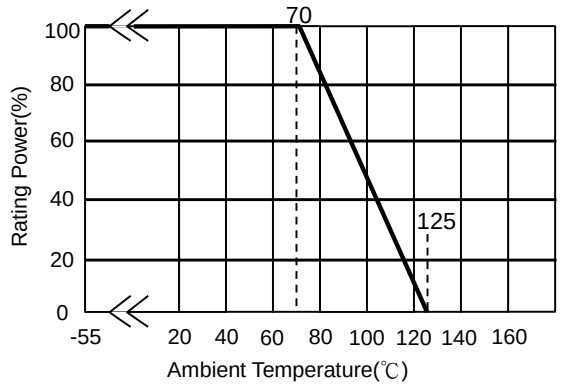
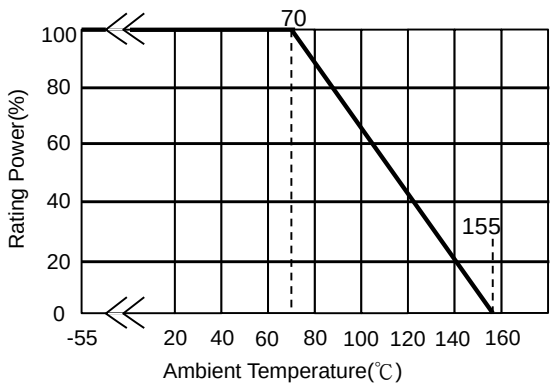
Type	SAS05 (0201)	Other
Operating Temperature Range	－55℃ ~ ＋125℃	－55℃ ~ ＋155℃
Explain	If the ambient temperature exceeds 70 degrees centigrade to 125 degrees centigrade, the power can be modified by the curve as below.	If the ambient temperature exceeds 70 degrees centigrade to 155 degrees centigrade, the power can be modified by the curve as below.
Figure		

Fig.1 Power Derating Characteristics

3.3 Standard Atmospheric Condition

Unless otherwise specified, the standard range of atmospheric conditions for making measurements and tests is as follows:

Ambient Temperature = + 5°C to +35°C

Relative Humidity = < 85% RH

Air Pressure = 86 kPa to 106kPa

If there may be any doubt about the results, measurement shall be made within the following limits:

Ambient Temperature = 20 ± 2°C

Relative Humidity = 60 to 70% RH

Air Pressure = 86 kPa to 106kPa

3.4 Operating Temperature Range -55°C to +155°C (SAS05 -55°C to +125°C)

3.5 Storage Temperature Range -5°C to + 40°C / < 85% RH

3.6 Flammability Rating Tested in accordance to UL-94, V-0

3.7 Moisture Sensitivity Level Rating: Level 1

3.8 Product Assurance

ASJ resistor shall warranty 24 months from manufacturing date with control conditions.

3.9 ASJ resistors are RoHS-compliant in accordance to RoHS Directive.

3.10 Resistance, Resistance Tolerance and Temperature Coefficient of Resistance.

Type	Rated Power at 70˚C	Max. Working Voltage	Max. Overload Voltage	T.C.R. (ppm/℃)	Resistance Range				JUMPER (0Ω) Rated Current				JUMPER (0Ω) Resistance Value			
					B(±0.1%) E-24、E-96	D(±0.5%) E-24、E-96	F(±1%) E-24、E-96	J(±5%) E-24	Z(±5%)		F(±1%)		Z(±5%)		F(±1%)	
									A	B	A	B	A	B	A	B
SAS05 (0201)	1/20 W	25V	50V	-200 +400	------	1Ω≦R＜10Ω	1Ω≦R＜10Ω	1Ω≦R＜10Ω	0.5A		0.5A		50mΩ MAX	100mΩ MAX	---	50mΩ MAX.
				±200	------	10Ω≦R≦10MΩ	10Ω≦R≦10MΩ	10Ω≦R≦10MΩ								
SAS10 (0402)	1/16 W	50V	100V	±100	------	10Ω≦R≦1MΩ	10Ω≦R≦10MΩ	10Ω≦R≦20MΩ	1A		1.5A		50mΩ MAX	100mΩ MAX	35mΩ MAX	50mΩ MAX.
				±200	------	------	1Ω≦R＜10Ω	1Ω≦R＜10Ω								
SAS16 (0603)	1/10 W	75V	150V	±100	100Ω≦R≦1MΩ	10Ω≦R≦1MΩ	10Ω≦R≦10MΩ	10Ω≦R≦20MΩ	1A		2A		50mΩ MAX	100mΩ MAX	25mΩ MAX	50mΩ MAX.
				±200	------	1Ω≦R＜10Ω	1Ω≦R＜10Ω	1Ω≦R ＜10Ω								
SAS21 (0805)	1/8 W	150V	300V	±100	100Ω≦R≦1MΩ	10Ω≦R≦1MΩ	10Ω≦R≦10MΩ	10Ω≦R≦20MΩ	2A		2.5A		50mΩ MAX	100mΩ MAX	20mΩ MAX	50mΩ MAX.
				±200	------	1Ω≦R＜10Ω	1Ω≦R＜10Ω	1Ω≦R＜10Ω								
SAS32 (1206)	1/3 W	200V	400V	±100	100Ω≦R≦1MΩ	10Ω≦R≦1MΩ	10Ω≦R≦10MΩ	10Ω≦R≦20MΩ	2A		3.5A		50mΩ MAX	100mΩ MAX	20mΩ MAX	50mΩ MAX.
				±200	------	1Ω≦R＜10Ω	1Ω≦R＜10Ω	1Ω≦R＜10Ω								
SAS40 (1210)	1/2 W	200V	400V	±100	100Ω≦R≦1MΩ	10Ω≦R≦1MΩ	10Ω≦R≦10MΩ	10Ω≦R≦20MΩ	2A		4A		50mΩ MAX	100mΩ MAX	20mΩ MAX	50mΩ MAX.
				±200	------	1Ω≦R＜10Ω	1Ω≦R＜10Ω	1Ω≦R＜10Ω								
SAS50 (2010)	3/4 W	200V	400V	±100	100Ω≦R≦1MΩ	10Ω≦R≦1MΩ	10Ω≦R≦10MΩ	10Ω≦R≦20MΩ	2A		5A		50mΩ MAX	100mΩ MAX	20mΩ MAX	50mΩ MAX.
				±200	------	1Ω≦R＜10Ω	1Ω≦R＜10Ω	1Ω≦R＜10Ω								
SAS63 (2512)	1W	200V	400V	±100	100Ω≦R≦1MΩ	10Ω≦R≦1MΩ	10Ω≦R≦10MΩ	10Ω≦R≦20MΩ	2A		7A		50mΩ MAX	100mΩ MAX	20mΩ MAX	50mΩ MAX.
				±200	------	1Ω≦R＜10Ω	1Ω≦R＜10Ω	1Ω≦R＜10Ω								
Operating Temperature Range					-55℃ ~ +155℃ (0201:-55℃ ~ +125℃)											

3.11 Rated Voltage

DC voltage or AC voltage (rms) based on the rated power.

The voltage can be calculated by the following formula. If the calculated value exceeds the Max. voltage specified in the Table 3.1.1, the Max. Voltage rating is set as the voltage rating.

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

E= Voltage rating (v)
P= Power rating (w)
R= Nominal resistance(Ω)

4. MARKING ON PRODUCT

The nominal resistance shall be marked on the surface of each resistor

Type	Resistance Range	Tolerance≦1%	Tolerance＞1%
SAS05 SAS10	All	No Marking	
	Jumper = 0Ω		
SAS16	＜1Ω	4-digits Marking	4-digits Marking
	≧1Ω	3-digits Marking	3-digits Marking
	Jumper=0Ω	3-digits Marking	1-digit Marking
SAS21, SAS32, SAS40, SAS50, SAS63	＜1Ω	4-digits Marking	4-digits Marking
	≧1Ω	4-digits Marking	3-digits Marking
	Jumper=0Ω	3-digits Marking	1-digit Marking

4.1 Numeric Numbering

4.1.1 ≦1% Tolerance : ***Four Numerals Marking***

First 3 digits are significant figures; fourth digit is number of zeros.

Examples:

Nominal Resistance	***Marking***	***Remarks***
1 Ω	1R00	1 X 10^0 = 1
10 Ω	10R0	10 X 10^0 = 10
100 Ω	1000	100 X 10^0 = 100
4.7K Ω	4701	470 X 10^1 = 470 0
47K Ω	4702	470 X 10^2 = 470 00
470K Ω	4703	470 X 10^3 = 470 000
1M Ω	1004	100 X 10^4 = 100 0000

4.1.2 5% Tolerance: ***Three Numerals Marking***

First 2 digits are significant figures, third digit is number of zeros. Letter R is decimal point.

Example:

Nominal Resistance	***Marking***	***Remarks***
1 Ω	1R0	1 X 10^0 = 1
10 Ω	100	10 X 10^0 = 1 0
100 Ω	101	10 X 10^1 = 1 00
4.7K Ω	472	47 X 10^2 = 47 00
47K Ω	473	47 X 10^3 = 47 000
470K Ω	474	47 X 10^4 = 47 0000
4.7M Ω	475	47 X 10^5 = 47 00000

4.1.3 0603 1% Tolerance : ***Three Character E-96 Marking Standard.***

The first 2 digits for the 3 digits E-96 part marking standard.

The third character is a letter multiplier :

Nominal resistance	*Marking*	*Remark*
33.2 Ω	51 X	332 X 10^{-1} Ω
150 Ω	18 A	150 X 10^{0} Ω
4.99K Ω	68 B	499 X 10^{1} Ω
1 0.2K Ω	02 C	102 X 10^{2} Ω
100K Ω	01 D	100 X 10^{3} Ω

4.1.4 Marking Table

E24 Series

10	11	12	13	15	16	18	20	22	24	27	30
33	36	39	43	47	51	56	62	68	75	82	91

E96 Series

100	102	105	107	110	113	115	118	121	124	127	130
133	137	140	143	147	150	154	158	162	165	169	174
178	182	187	191	196	200	205	210	215	221	226	232
237	243	249	255	261	267	274	280	287	294	301	309
316	324	332	340	348	357	365	374	383	392	402	412
422	432	442	453	464	475	487	499	511	523	536	549
562	576	590	604	619	634	649	665	681	698	715	732
750	768	787	806	825	845	866	887	909	931	953	976

EIAJ-96

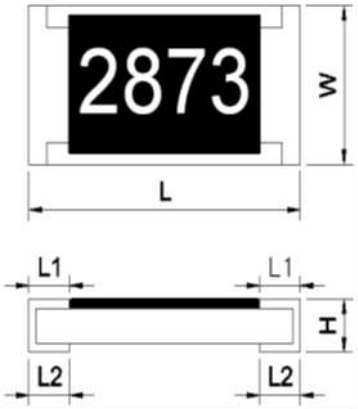
Code	Ω	Code	Ω	Code	Ω	Code	Ω	Code	Ω	Code	Ω	Code	Ω	Code	Ω
01	100	13	133	25	178	37	237	49	316	61	422	73	562	85	750
02	102	14	137	26	182	38	243	50	324	62	432	74	576	86	768
03	105	15	140	27	187	39	249	51	332	63	442	75	590	87	787
04	107	16	143	28	191	40	255	52	340	64	453	76	604	88	806
05	110	17	147	29	196	41	261	53	348	65	464	77	619	89	825
06	113	18	150	30	200	42	267	54	357	66	475	78	634	90	845
07	115	19	154	31	205	43	274	55	365	67	487	79	649	91	866
08	118	20	158	32	210	44	280	56	374	68	499	80	665	92	887
09	121	21	162	33	215	45	287	57	383	69	511	81	681	93	909
10	124	22	165	34	221	46	294	58	392	70	523	82	698	94	931
11	127	23	169	35	226	47	301	59	402	71	536	83	715	95	953
12	130	24	174	36	232	48	309	60	412	72	549	84	732	96	976

Y=10^{-2} X=10^{-1} A=10^{0} B=10^{1} C=10^{2} D=10^{3} E=10^{4} F=10^{5}

5. DIMENSION, CONSTRUCTION AND MATERIAL

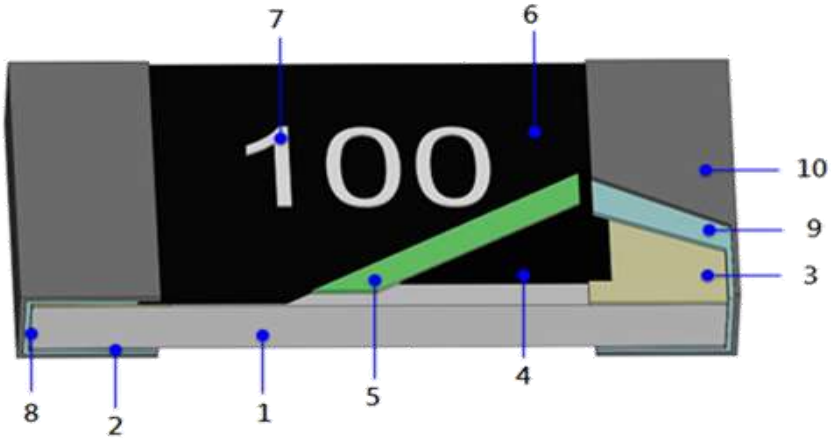
5.1 Dimension

Unit:mm



Type / Dimensions	Size Code	L	W	H	L1	L2
SAS05	**0201**	0.60±0.03	0.30±0.03	0.23±0.03	0.10±0.05	0.20±0.10
SAS10	**0402**	1.00±0.10	0.50±0.05	0.30±0.05	0.20±0.10	0.30±0.15
SAS16	**0603**	1.60±0.10	0.80±0.10	0.45±0.10	0.30±0.15	0.30±0.20
SAS21	**0805**	2.00±0.10	1.25±0.10	0.50±0.10	0.35±0.20	0.35±0.20
SAS32	**1206**	3.05±0.10	1.55±0.10	0.50±0.10	0.45±0.20	0.35±0.20
SAS40	**1210**	3.05±0.10	2.55±0.10	0.55±0.10	0.50±0.20	0.50±0.30
SAS50	**2010**	5.00±0.20	2.50±0.20	0.55±0.10	0.60±0.20	0.60±0.30
SAS63	**2512**	6.30±0.20	3.20±0.20	0.55±0.10	0.60±0.20	0.60±0.30

5.2 Structure Graph



1	Ceramic substrate	6	2nd Protective coating
2	Bottom inner electrode	7	Marking
3	Top inner electrode	8	Terminal inner electrode
4	Resistive layer	9	Ni plating
5	1st Protective coating	10	Sn plating

5.3 Plating Thickness

5.3.1 Ni: ≧ 2 µm

5.3.2 Sn (Tin): ≧ 3 µm

5.3.3 Sn (Tin): Matte Sn

6. RELIABILITY TEST

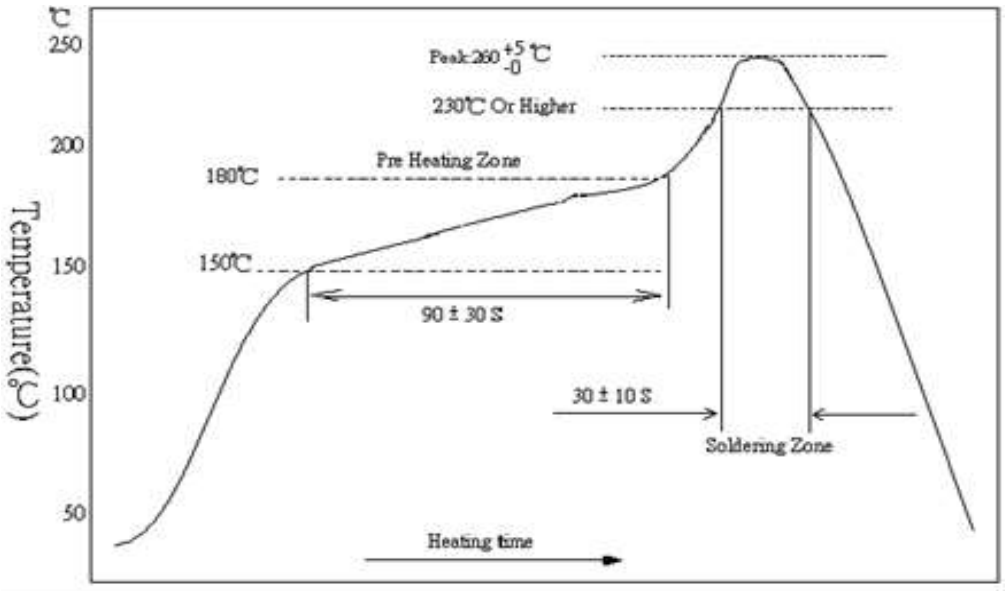
Item	Conditions	Specifications	
		Resistors	Jumper
High Temperature Exposure (Storage)	Put the specimens in the chamber with temperature of 155±3℃ for 1000 hours. Then take them out to stabilize in room temperature for 24±4hr or more, and measure of its resistance variance rate. Experiment evidence: AEC-Q200	1. 0.1%、0.5%、1%： △R=±1.0% 2. 5%： △R=±2.0%	Refer to item 3.10
Temperature Cycling	Put the specimens in the High & low temperature test chamber with temperature varies from -55℃ to 125℃ for 15 minutes and total 1000 cycles. Then take them out to stabilize in room temperature for 24±4hr or more, and measure of its resistance variance rate. Experiment evidence: AEC-Q200	△R=±2.0%	Refer to item 3.10
Biased Humidity	Solder the specimens on the test PCB and put them into the constant temperature humidity chamber with 85±2℃ and 85±5%RH. Then apply the test voltage that calculates based on the 10% of rated power for 1000hrs. Then take them out to stabilize in room temperature for 24±4hr or more, and measure of its resistance variance rate. Experiment evidence: AEC-Q200	1. 0.1%、0.5%、1%： △R=±2.0% 2. 5%： △R=±3.0%	Refer to item 3.10
Operational Life	Solder the specimens on the test PCB and Put them in the chamber with temperature of 125±3℃ and load the voltage for 1000 hours. Then take them out to stabilize in room temperature for 24±4hr or more, and measure of its resistance variance rate. Note: The input voltage shall refer to the power de-rating curve Experiment evidence: AEC-Q200	1. 0.1%、0.5%、1%： △R=±2.0% 2. 5%： △R=±3.0%	Refer to item 3.10
Short Time Overload	Applied 2.5 times rated voltage for 5 seconds and release the load for about 30 minutes, then measure its resistance variance rate. Refer to JIS-C5201-14.13	1. 0.1%、0.5、1%： △R=±1.0% 2. 5%： △R=±2.0%	Refer to item 3.10
Resistance to Soldering Heat	The specimens are fully immersed into the Pb-free solder pot, then take them out to stabilize for 1 hour or more and measure of its resistance variance rate. Temp of solder pot：260±5℃ Soldering duration：10±1sec. Experiment evidence AEC-Q200	△R=±1.0%	Refer to item 3.10
ESD	Put the specimens on the test fixture and two (2)discharges (2KVDC) shall be applied to each PUT, one (1) with a positive polarity and one (1) with a negative polarity. Afterwards, the specimens stabilize for 30min or more and measure of its resistance variance rate. The test is performed with direct contact and regular discharge mode. The resistor and capacitor used on the spearhead is 2000Ω and 150pF respectively. Experiment evidence AEC-Q200	△R=±3.0%	Refer to item 3.10

Item	Conditions	Specifications	
		Resistors	Jumper
Solderability	**Test method:** **Test item 1 (solder pot test): Method B** Precondition: The specimens are subjected to 155℃ dry bake for 4hrs±15min. The specimens are immersed into the flux first, then fully immersed into the solder pot, at a temperature of 235± 5℃ for $5^{+0}_{-0.5}$ sec. Then rinse with water and observe the soldering coverage under the microscope. **Test item 2 (Leaching test): Method D** The specimens are immersed into the flux first, then fully immersed into the solder pot, at a temperature of 260±5℃ for $30^{+0}_{-0.5}$ sec. Then rinse with water and observe the soldering coverage under the microscope. Experiment evidence AEC-Q200	1. Soldering coverage over 95% 2. At the edge of terminal, the object underneath (e.g. white ceramic) shall not expose.	
Electrical Characterization	$TCR(ppm/^{\circ}C) = \frac{(R2-R1)}{R1(T2-T1)} x10^6$ R1: Resistance at room temperature (Ω) R2: Resistance at -55℃ or +125℃(Ω) T1: Room temperature (℃) T2: Temperature -55℃ or +125℃ Experiment evidence: AEC-Q200	Refer to item 3.10	NA
Board Flex (Bending Test)	Solder the specimens on the test PCB and put the PCBA onto the Bending Tester. Add force at the central part of PCB, and the duration of the applied forces shall be 60 (+ 5) Sec. Measure of its resistance variance rate in load. Bending depth D: SAS10、16、21=5mm SAS05、32、40=3mm SAS50、63=2mm Experiment evidence: AEC-Q200	△R=±1.0% No mechanical damage, peel-off of side end or chip crack.	Refer to item 3.10
Sulfuration Test	Class : A: Put the tested resistor in sulfur vapor, at a temperature of 60±2℃for 1000hrs Refer to ASTM-B-809-95&EIA977	△R=±4.0%	Refer to item 3.10
	Class : B: Put the tested resistor in sulfur vapor, at a temperature of 105±2℃for 750hrs Refer to ASTM-B-809-95&EIA977	△R=±4.0%	

6.1 Soldering Profile

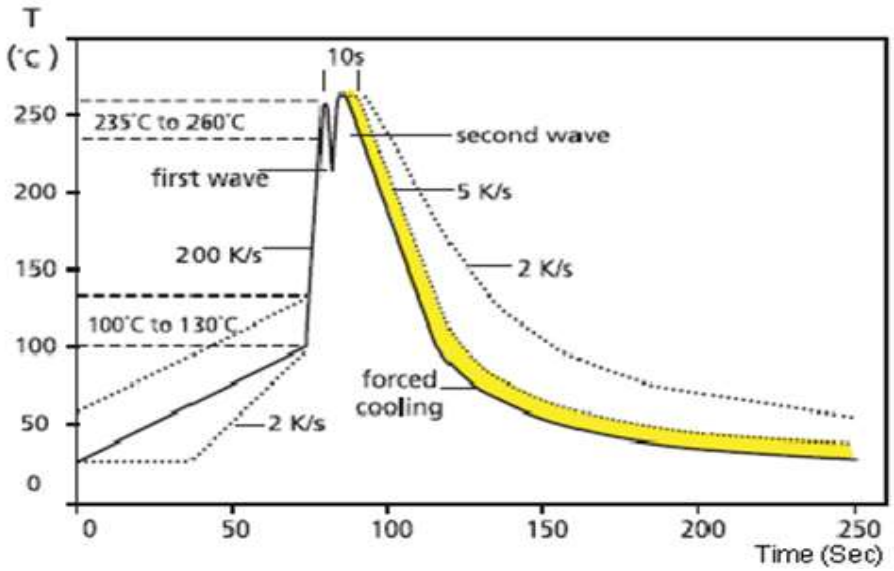
Technical application notes : This is for recommendation, customer please perform adjustment according to actual application.

6.1.1 Lead-Free IR Reflow Soldering Profile (MEET J-STD-020D)



Remark: The peak temperature of soldering heat is 260^{+5}_{-0} ºC for 10 seconds.

6.1.2 Lead-Free Double-Wave Soldering Profile (This applies to 0603 size inclusive above products)

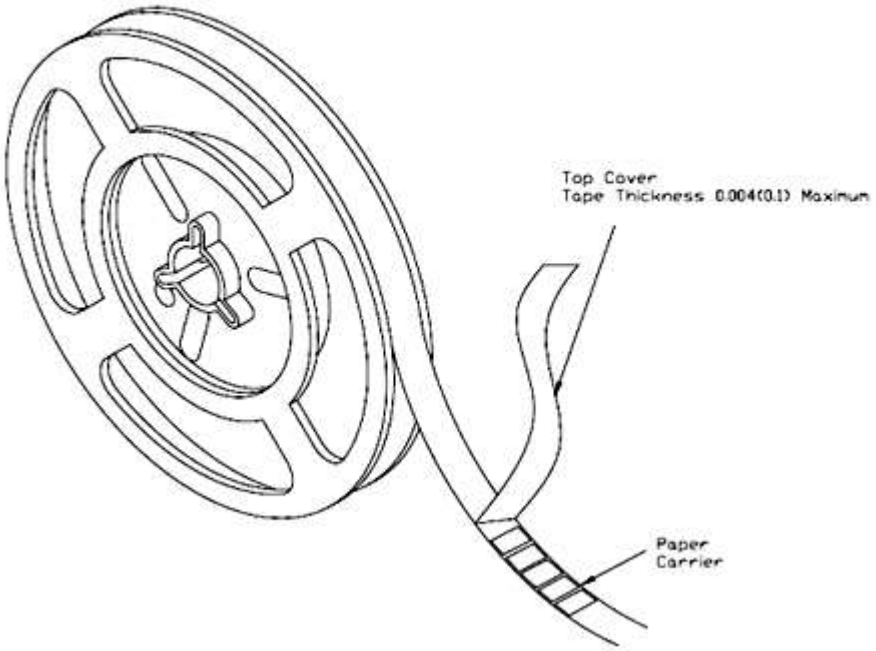


6.1.3 Soldering Iron : Temperature 350ºC±10ºC, dwell time shall be less than 3 sec.

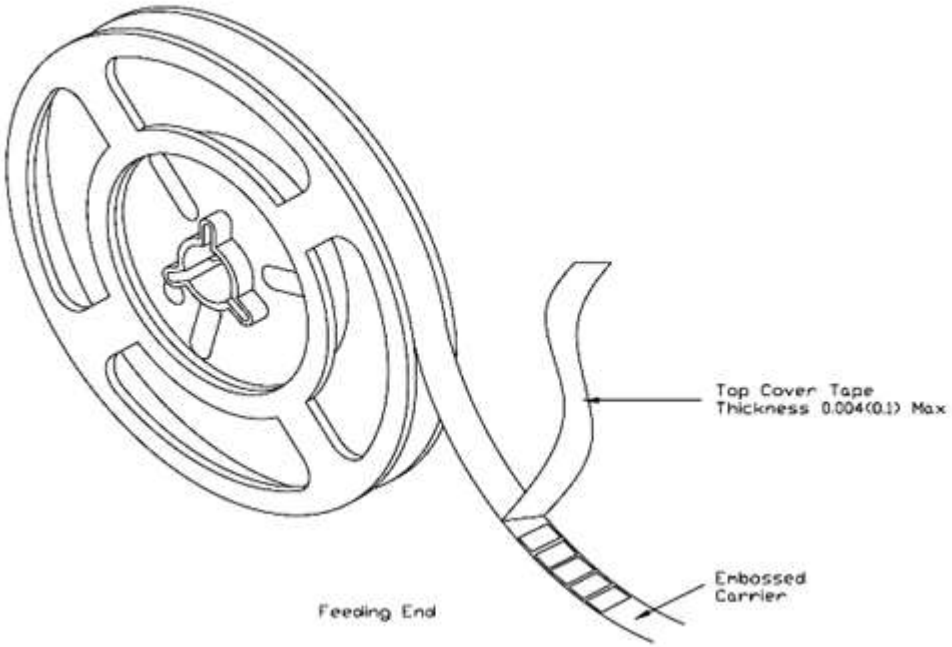
7. TAPING

7.1 Structure of Taping

Paper Carrier

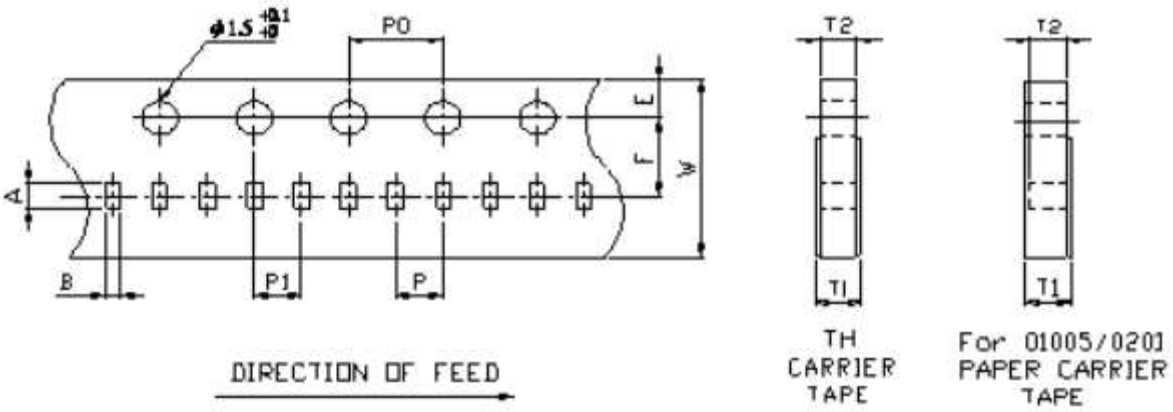


Embossed Plastic Carrier



7.2 Dimension

7.2.1 Dimension of Punched Paper Tape Carrier System (SAS05,SAS10)



Remark: Pitch tolerance over any 10 pitches of Po is ± 0.2 mm

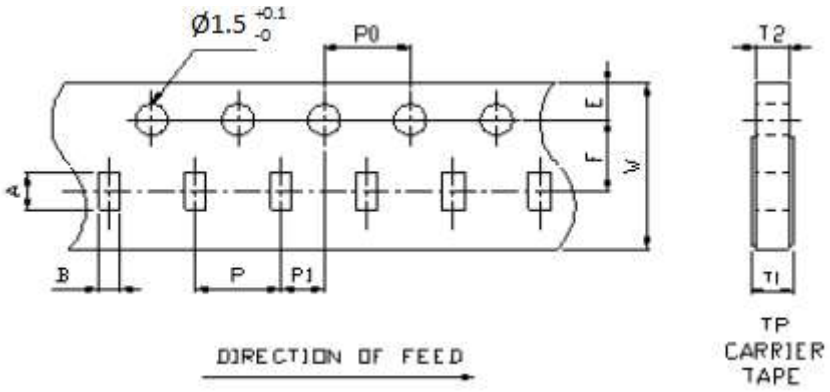
Dimension of Punched Paper Tape Carrier System (SAS05, 10)

(unit : mm)

Code	A	B	W	E	F	T_1
SAS05	0.68±0.05	0.38±0.03	8.00±0.10	1.75±0.10	3.50±0.05	$0.42^{+0.1}_{-0}$
SAS10	1.15±0.05	0.65±0.05	8.00±0.20	1.75±0.10	3.50±0.05	$0.42^{+0.2}_{-0}$

Code	T_2	P	P0	10 x P0	P1
SAS05	0.28±0.02	2.00±0.05	4.00±0.05	40.0±0.20	2.00±0.05
SAS10	0.40±0.05	2.00±0.10	4.00±0.05	40.0±0.20	2.00±0.05

7.2.2 Dimension of Punched Paper Tape Carrier System /Plastic Embossed Carrier System (SAS16, 21, 32, 40)

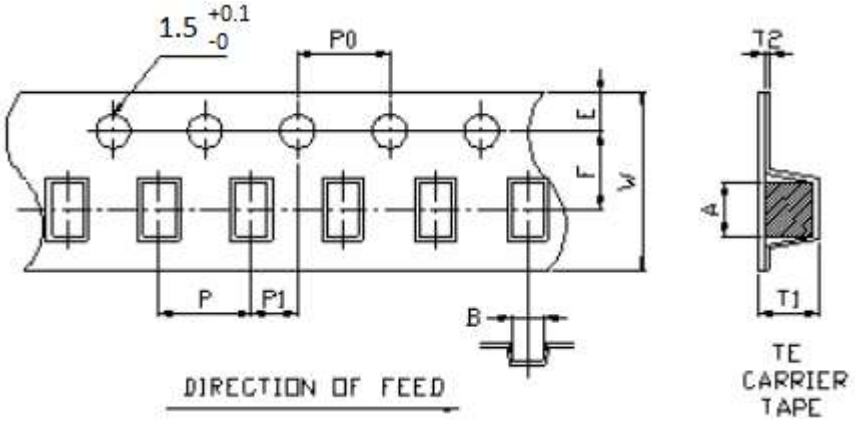


Remark: Pitch tolerance over any 10 pitches of Po is ± 0.2 mm

Dimension of Punched Paper Tape Carrier System (SAS - 16, 21, 32, 40)

Code	A	B	W	E	F	T1	T2	P	P0	P1
SAS16	1.8±0.10	1.0±0.10	8.0±0.20	1.75±0.10	3.50±0.05	$0.60^{+0.2}_{-0}$	0.60±0.10	4.0±0.10	4.0±0.05	2.0±0.05
SAS21	2.3±0.10	1.55±0.1	8.0±0.20	1.75±0.10	3.50±0.05	$0.75^{+0.2}_{-0}$	0.75±0.10	4.0±0.10	4.0±0.05	2.0±0.05
SAS32	3.5±0.20	1.9±0.20	8.0±0.20	1.75±0.10	3.50±0.05	$0.75^{+0.2}_{-0}$	0.75±0.10	4.0±0.10	4.0±0.05	2.0±0.05
SAS40	3.5±0.20	2.8±0.20	8.0±0.20	1.75±0.10	3.50±0.05	$0.75^{+0.2}_{-0}$	0.75±0.10	4.0±0.10	4.0±0.05	2.0±0.05

Dimension of Plastic Embossed Carrier System (SAS - 50, 63)



Code	A	B	W	E	F	T1	T2	P	P0	P1
SAS50	5.5±0.20	2.8±0.20	12.0±0.20	1.75±0.10	5.50±0.05	1.10±0.15	0.23±0.15	4.0±0.10	4.0±0.05	2.0±0.05
SAS63	6.7±0.20	3.4±0.20	12.0±0.20	1.75±0.10	5.50±0.05	1.10±0.15	0.23±0.15	4.0±0.10	4.0±0.05	2.0±0.05

7.3 Packaging

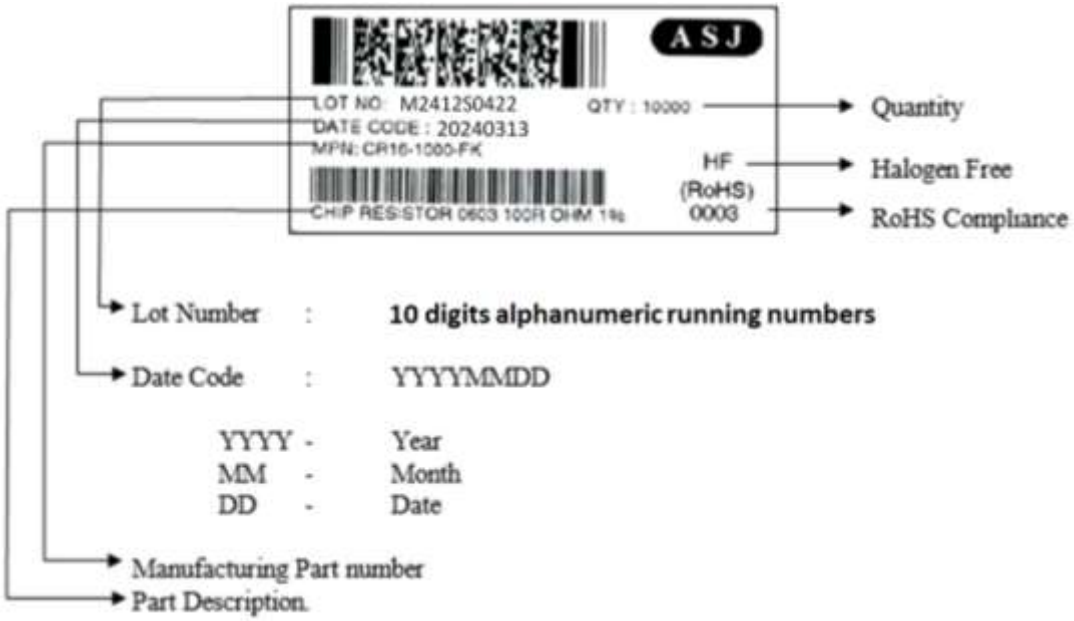
7.3.1 Taping

Quantity – Tape and Reels

Code	Quantity	Model	Remarks
SAS05 SAS10	10,000 pcs	7" Reel	2mm pitch (Paper Carrier)
	20,000 pcs	7" Reel	2mm pitch (Paper Carrier)
	50,000 pcs	13" Reel	2mm pitch (Paper Carrier)
SAS16 SAS21 SAS32 SAS40	5,000 pcs	7" Reel	4mm pitch (Paper Carrier)
	10,000 pcs	10" Reel	4mm pitch (Paper Carrier)
	20,000 pcs	13" Reel	4mm pitch (Paper Carrier)
SAS50	4,000 pcs	7" Reel	4mm pitch (Embossed Carrier)
SAS63	4,000 pcs	7" Reel	4mm pitch (Embossed Carrier)

7.3.2 Identification

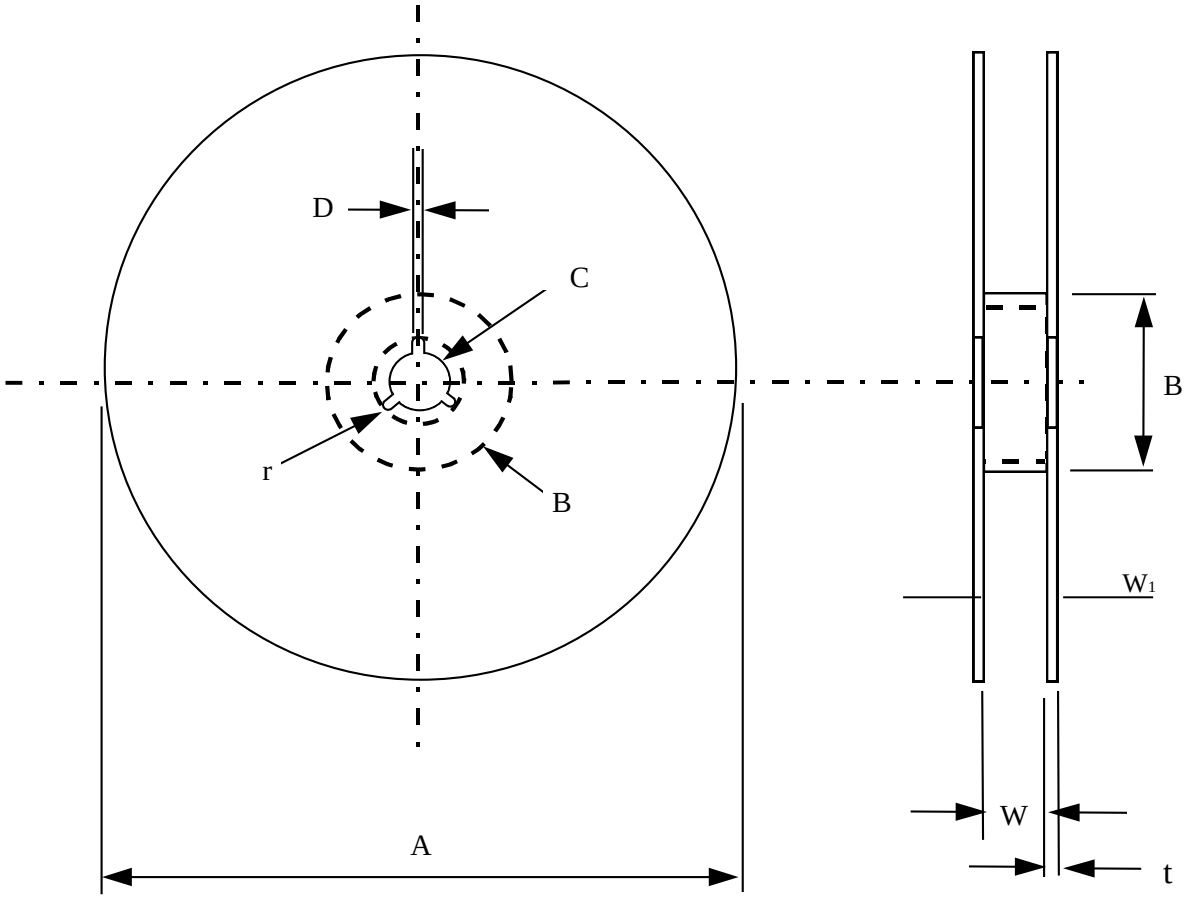
Production label that indicates the 10 digits lot number, product type, resistance value and tolerance shall be pasted on the surface of each reel.



7.3.3 Packaging Reel Box

Dimension	Reel Box	Number of Reels
185 × 60 × 186 mm	25K Box	5
185 × 120 × 186 mm	50K Box	10

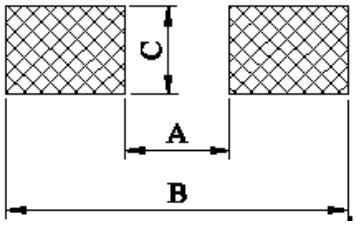
7.3.4 Reel Dimensions



Model	A	B	C	D	W	W_1	t	r
7”Reel (5K) (except 0402 10K)	ϕ178±2.0	ϕ60min	13± 0.2	ϕ2.0± 0.5	11± 0.1	14.4 max	1.0± 0.1	1.0
7”Reel (4K)	ϕ178±2.0	ϕ60min	13± 0.2	ϕ2.0± 0.5	13±1.0	14.4 max	1.2± 0.1	1.0
7’’Reel (10K)	ϕ178±2.0	ϕ60min	13± 0.2	ϕ2.0± 0.5	11± 0.1	14.4 max	1.0± 0.1	1.0
10”Reel (10K)	ϕ254±2.0	ϕ60min	13± 0.2	ϕ2.0± 0.5	11± 1.0	14.4 max	1.5± 0.1	1.0
13”Reel (20K)	ϕ330±2.0	ϕ60min	13± 0.2	ϕ2.0± 0.5	11± 1.0	14.4 max	2.1± 0.1	-
13”Reel (20K)	ϕ330±1.0	ϕ100±1	13.5±0.5	2~3±0.5	10±0.5	-	-	-

8. SURFACE MOUNT LAND PATTERN DESIGN (FOR REFLOW SOLDERING)

When a component is soldered, the resistance after soldering changes slightly depending on the size of the soldering area and the amount of soldering. When designing a circuit, it is necessary to consider the effect of a decrease or increase in its resistance.

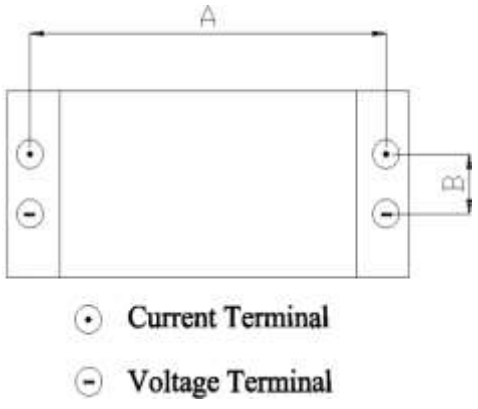


Unit : mm

TYPE \ DIM	A	B	C
SAS05	0.3	1.0	0.4
SAS10	0.5	1.5	0.6
SAS16	0.8	2.1	0.9
SAS21	1.2	3.0	1.3
SAS32	2.2	4.2	1.6
SAS40	2.2	4.2	2.8
SAS50	3.5	6.1	2.8
SAS63	3.8	8.0	3.5

9. MEASUREMENT POINT

Bottom electrode



Unit : mm

TYPE \ DIM	A	B
SAS05	**0.44±0.05**	**0.22±0.05**
SAS10	**0.80±0.05**	**0.24±0.05**
SAS16	**1.35±0.05**	**0.35±0.05**
SAS21	**1.80±0.05**	**0.35±0.05**
SAS32	**2.90±0.05**	**0.35±0.05**
SAS40	**2.90±0.05**	**0.35±0.05**
SAS50	**4.50±0.05**	**1.15±0.05**
SAS63	**5.90±0.05**	**1.60±0.05**

10. REVISION HISTORY

REVISION	DATE	CHANGE NOTIFICATION	DESCRIPTION
Version. 1	February 13,2015		Initial Release
Version. 2	October 03, 2016		Update information for :- Part Numbering System Rated Power Table Power Derating Characteristic Resistance, Tolerance, TCR Reliability test Punch paper tape Packaging Reel Dimension
Version.3	November 16, 2016	Refer to PCN-ECO NO.: 01/RL/2016	Update clause 5.1 L1 dimension for SAS05 Typo error in clause 5.1
Version.4	May 08 2017		Insert Measurement Point in clause 9 Rename SAS Series to SAS(A/B) Series
Version.5	Feb 07 2018		1、Update clause 1 information 2、Update clause 2 part numbering system 3、Update clause 3.1.1 resistor rated power table 4、Update clause 3.10 TCR table 5、Update clause 6 information on High Temperature Exposure(Storage), Temperature Cycling, Biased Humidity, Operational Life, Solderability, Board Flex(Bending Test) 6、Delete Physical Dimension, Resistance to solvents strength on clause 6 7、Add Short time overload to clause 6
Version.6	18.12.2018		Datasheet Update
Version.7	21.02.2019		1、Update clause 1.2 2、Update clause 6 Sulfuration Test
Version.8	07.08.2019		1、Update clause 1.2 2、Update clause 2, delete 90˚FoS test 3、Update clause 6 Sulfuration Test condition
Version.9	04.09.2019		1、Revise clause 2 Part Numbering System 2、Revise clause 3.10, TCR table 3、Revise clause 4, Marking on Product Table
Version.10	17.09.2020		Revise clause 3.5 Revise clause 8 8.SURFACE MOUNT LAND PATTERN DESIGN

REVISION	DATE	CHANGE NOTIFICATION	DESCRIPTION
Version.11	13.10.2021		Revise clause 6 item temperature cycling from 5

			minute to 15 minute.
Version.12	09.12.2021		Add clause 5.3 Structure Graph
Version.13	15.02.2022		Revise clause 3.10 TCR table
Version 14	01.11.2023		Revise clause 2 Part Numbering System table Revise clause 3.1.1 Resistor Rated Power table Revise clause 3.8 Product Assurance Revise clause 3.10 table
Version 15	13.03.2024		Revise clause 7.3.2 Identification.

Towards Excellence in *Quality, Service & Innovation*

ASJ

DATA SHEET

Anti-Sulfurated Wide Electrode Thick Film Chip Resistors

SASW Series

0.5% TO 5%, TCR ±100 TO ±200

SIZE: 0612/1020/1225

RoHS-Compliant

Product Specification – June 13, 2023 V.2

1. SCOPE

1.1 This specification is applicable to Lead-free and Halogen-free of RoHS Directive for SASW series anti-sulfurated wide terminal thick film chip resistors.

1.2 Superior sulfur-resistant capability (Refer to ASTM-B-809-95 & EIA977 sulfur vapor test).

1.3 The product is for general electronic purpose.

2. PART NUMBERING SYSTEM

Part Numbering is made in accordance with the following system:

SAS	32W	-	100		-	J	L
Type	Size (Inch)		Nominal Resistance			Resistance Tolerance	Packaging
Anti-Sulfurated Wide Electrode Thick Film Chip Resistors	32W(0612) 50W(1020 63W(1225)		5% (3-Digit)	EX: 10Ω=100 4.7Ω=4R7 JUMPER=000		D=± 0.5% F=± 1% J=± 5% Z=Zero	E = 4000 pcs Lead Free L = 5000 pcs Lead Free K = 10000 pcs Lead Free Y = 20000 pcs Lead Free
			0.5% 1% (4-Digit)	EX: 10.2Ω=10R2 10KΩ=1002 JUMPER=0000			

3. RATING

3.1 Rated Power

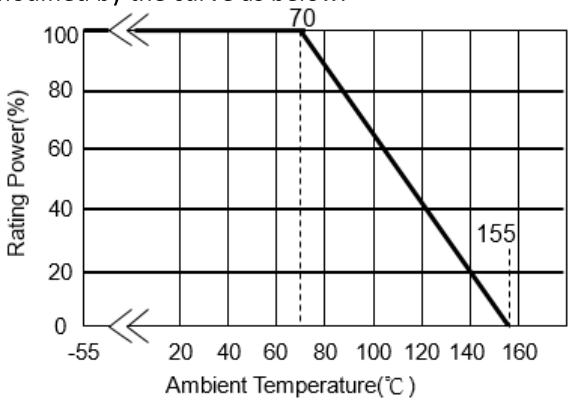
3.1.1 Resistor Rated Power

Type	Rated Power at 70℃	Max. Working Voltage	Max. Overload Voltage
SAS32W (0612)	$\frac{3}{4}$W	200V	400V
SAS50W (1020)	1W	200V	400V
SAS63W (1225)	2W	200V	400V

3.2 Power Derating Curve.

Temperature Range: －55℃ ~ ＋155℃

If the ambient temperature exceeds 70 degrees centigrade to 155 degrees centigrade, the power can be modified by the curve as below.



3.3 Standard Atmospheric Condition

Unless otherwise specified, the standard range of atmospheric conditions for making measurements and tests is as follows:

Ambient Temperature = + 5°C to +35°C

Relative Humidity = < 85% RH

Air Pressure = 86 kPa to 106kPa

If there may be any doubt about the results, measurement shall be made within the following limits:

Ambient Temperature = 20 ± 2°C

Relative Humidity = 60 to 70% RH

Air Pressure = 86 kPa to 106kPa

3.4 Operating Temperature Range -55°C to +155°C

3.4 Storage Temperature Range -5°C to + 40°C / < 85% RH

3.6 Flammability Rating Tested in accordance to UL-94, V-0

3.7 Moisture Sensitivity Level Rating: Level 1

3.8 Product Assurance
ASJ resistor shall warranty 24 months from manufacturing date with control conditions.

3.9 ASJ resistors are RoHS-compliant in accordance to RoHS Directive.

3.10 Resistance, Resistance Tolerance and Temperature Coefficient of Resistance.

Type	Rated Power at 70℃	Max. Working Voltage	Max. Overload Voltage	T.C.R (ppm/℃)	Resistance Range		JUMPER (0Ω) Rated Current		JUMPER (0Ω) Resistance Value	
					D(±0.5%)F(±1%) E-24,E-96	J(±5%) E-24	Z (±5%)	F (±1%	Z (±5%)	F (±1%)
SAS32W (0612)	3/4 W	200V	400V	±200	1Ω≦R < 10Ω	1Ω≦R < 10Ω	2A	4A	50mΩ MAX	20mΩ MAX
				±100	10Ω≦R≦1MΩ	10Ω≦R≦1MΩ				
SAS50W (1020)	1W	200V	400V	±200	1Ω≦R < 10Ω	1Ω≦R < 10Ω	2A	7A	50mΩ MAX	20mΩ MAX
				±100	10Ω≦R≦1MΩ	10Ω≦R≦1MΩ				
SAS63W (1225)	2W	200V	400V	±200	1Ω≦R < 10Ω	1Ω≦R < 10Ω	2A	8.5A	50mΩ MAX	20mΩ MAX
				±100	10Ω≦R≦1MΩ	10Ω≦R≦1MΩ				
Operating Temperature Range				-55℃ ~ +155℃						

3.11 Voltage Rating:
Rated Voltage: DC voltage or AC voltage (rms) based on the rated power.
The voltage can be calculated by the following formula. If the calculated value exceeds the Max. voltage specified in the Table 3.10, the Max. voltage rating is set as the voltage rating.

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

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

3.12 All product, product specifications and data are subject to change without notice to improve reliability, function or design or otherwise.

4. MARKING ON PRODUCT

The nominal resistance shall be marked on the surface of each resistor

Type		Resistance Range	Tolerance≦1%	Tolerance > 1%
	Sizes: 0612, 1020,1225	< 1Ω	4-digits Marking	4-digits Marking
		≧1Ω	4-digits Marking	3-digits Marking
		Jumper=0Ω	3-digits Marking	1-digit Marking

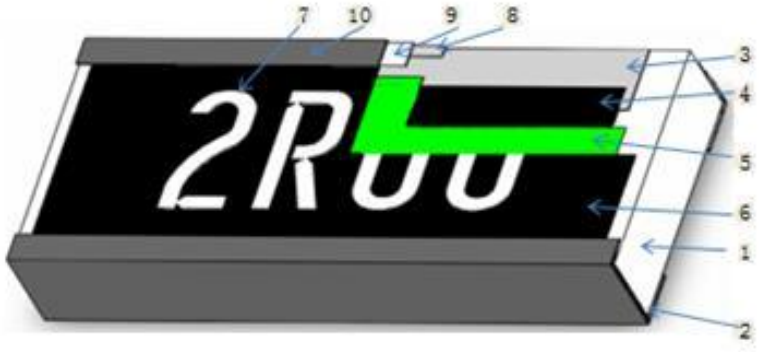
5. DIMENSION AND STRUCTURE GRAPH

5.1 Dimension

Unit:mm

Type \ Dimension / Size Code	L	W	H	L1	L2
SAS32W **0612**	1.60±0.20	3.20±0.20	0.55±0.10	0.35±0.15	0.25±0.15
SAS50W **1020**	2.50±0.20	5.00±0.20	0.55±0.10	0.25±0.20	0.90±0.20
SAS63W **1225**	3.20±0.20	6.40±0.20	0.55±0.10	0.45±0.20	0.75±0.20

5.2 Structure Graph



1	Ceramic substrate	6	2nd Protective coating
2	Bottom inner electrode	7	Marking
3	Top inner electrode	8	Terminal inner electrode
4	Resistive layer	9	Ni plating
5	1st Protective coating	10	Sn plating

6. RELIABILITY TEST

6.1 Electrical Performance Test

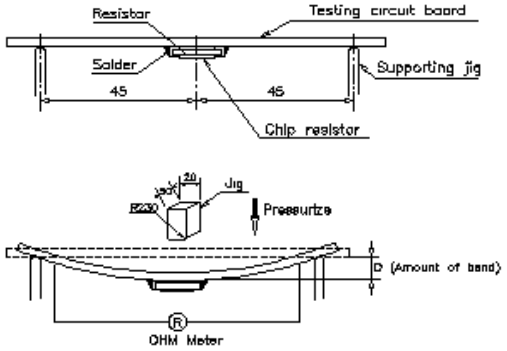
<table>
<tr><th rowspan="2">Item</th><th rowspan="2">Conditions</th><th colspan="2">Specifications</th></tr>
<tr><th>Resistors</th><th>Jumper</th></tr>
<tr><td>Temperature Coefficient of Resistance</td><td>$TCR(ppm/^oC) = \frac{(R2-R1)}{R1(T2-T1)} x10^6$
R1: Resistance at room temperature(Ω)
R2: Resistance at -55℃or +125℃(Ω)
T1: Room temperature(℃)
T2:Temperature -55℃ or +125℃(℃).

Refer to JIS-C5201-1 4.8</td><td>Refer to item 3.10 General specifications</td><td>NA</td></tr>
<tr><td>Short Time Overload</td><td>SAW32W/50W/63W apply 2.5 times the rated voltage for 2 seconds and let stand for more than 30 minutes before measuring the resistance change rate.
(Rated voltage refer to item 3. general specifications)

Refer to JIS-C5201-1 4.13</td><td>0.5%、1%:△R=±1.0%
5%:△R=±2.0%</td><td>Refer to item 3.10 general specifications</td></tr>
<tr><td>Dielectric Withstand Voltage</td><td>Put the resistor in the fixture, add VAC (see SPEC below) in +,- terminal for.
SAS32W(0612) apply 400VAC 1 minute.
SAS50W(1020)apply 500VAC 1minute
SAS63W(1225) apply500VAC 1 minute

Refer to JIS-C5201-1 4.7</td><td colspan="2">No short or burned on the appearance.</td></tr>
<tr><td>Intermittent Overload</td><td>Put it in the thermostat, apply 2.0 times rated voltage, 1 second ON, 25 seconds OFF, count 10000^{+400}_{-0} times, take it out and stand for 60 minutes, then measure the change of resistance value.
Jumper: Applied Maximum overload current
<table>
<tr><th>Type / Jumper</th><th>SAS32W (0612)</th><th>SAS50W (1020)</th><th>SAS63W (1225)</th></tr>
<tr><td>±5%</td><td>4A</td><td>4A</td><td>4A</td></tr>
<tr><td>±1%</td><td>8A</td><td>14A</td><td>17A</td></tr>
</table>
Refer to JIS-C5201-1 4.13</td><td>△R=±5.0%</td><td>Refer to item 3.10 general specifications</td></tr>
</table>

6.2 Mechanical Performance Test

Item	Conditions	Specifications	
		Resistors	Jumper
Solderability	Pre-treatment: The chip resistor was placed in the PCT machine, and the aging test was conducted for 4 hours under the saturation condition of 105℃, 100% humidity and 1.22×10^5Pa air pressure. Then, the chip resistor was placed at room temperature for 2 hours Test method： The resistor be immersed into solder pot in temperature 235±5℃ for 2 sec. Then take out to observe its solder area under microscope. Refer to JIS-C5201-1 4.17	Solder coverage over 95%	
Resistance to Soldering Heat	◎Test method 1(Solder pot test): The tested resistor be immersed into molten solder of 260^{+5}_{-0} ℃ for 10^{+1}_{-0} seconds，let stand for more than 1 hour before measuring the resistance change rate ◎Test method 2 (Solder pot test): The tested resistor be immersed into molten solder of 260^{+5}_{-0}℃ for 30^{+1}_{-0} seconds.Then remove and wash it to observe the solder area under a microscope. ◎Test method 3 (Electric iron test): Preheating temperature : 350±10℃ Electric iron preheating time : 3^{+1}_{-0} sec Preheating the electric iron on electrode termination, as after that step placed the iron over 60mins. and measured its resistance variance rate. Refer to JIS-C5201-1 4.18	Test item 1: (1)Variance rate on resistance △R=±1.0% Test item 2 (1)Solder coverage over 95%。 (2)The underlying material (such as ceramic) shall not be visible at the crest corner area of the electrode. Test item 3: (1) Variance rate on resistance. △R=±1.0%	Refer to item 3.10 general specifications
Joint Strength of Solder	◎Bending Strength Test: Solder chip resistors on to bending test plate and placed on the bending test machine. Apply pressure in the center of the test plate and measure the rate of change of resistance under load D:SAS32W=3mm SAS50W、SAS63W=2mm  Refer toJIS-C5201-1 4.33	△R%=±1.0%	Refer to item 3.10 general specifications

6.3 Environmental Test

<table>
<tr><th rowspan="2">Item</th><th rowspan="2">Conditions</th><th colspan="2">Specifications</th></tr>
<tr><th>Resistors</th><th>Jumper</th></tr>
<tr><td>Resistance to Dry Heat</td><td>Put tested resistor in the oven under temperature 155±5℃ for 1000^{+48}_{-0} hours. Then take out and let stand for more than 1 hour before measuring the resistance change rate
PS:SAS32W for 125±3℃.

Refer to JIS-C5201-1 4.25</td><td>0.5%、1%:△R=±1.0%
5%:△R=±2.0%</td><td>Refer to item 3.10 general specifications</td></tr>
<tr><td>Thermal Shock</td><td>Put chip resistors in the thermal shock machine ,and the temperature was -55℃ for 15 minutes and +125℃ for 15 minutes, the total of 300 times and then removed, let stand for more than 1 hour before measuring the resistance change rate
.
<table><tr><th colspan="2">Testing Condition</th></tr><tr><td>Lowest Temperature</td><td>-55±5℃</td></tr><tr><td>Highest Temperature</td><td>125±5℃</td></tr><tr><td>Temperature-retaining time</td><td>15 minutes each</td></tr></table>
Refer to MIL-STD 202 Method 107</td><td>0.5%、1%:△R=±0.5%
5%:△R=±1.0%</td><td>Refer to item 3.10 general specifications</td></tr>
<tr><td>Loading Life in Moisture</td><td>Put the tested resistor in the constant temperature and humidity tank, under temperature 40±2℃, relative humidity 90~95% and load the rated voltage for 90 minutes on, 30 minutes off, total 1000 hours. Then take out and let stand for more than 1 hour before measuring the resistance change rate

Refer to JIS-C5201-1 4.24</td><td>±5.0%</td><td>Refer to item 3.10 general specifications</td></tr>
<tr><td>Load Life</td><td>Put the tested resistor in the oven under temperature 70±2℃and load the rated voltage for 90 minutes on, 30 minutes off, total 1000 hours. Then take out and let stand for more than 1 hour before measuring the resistance change rate

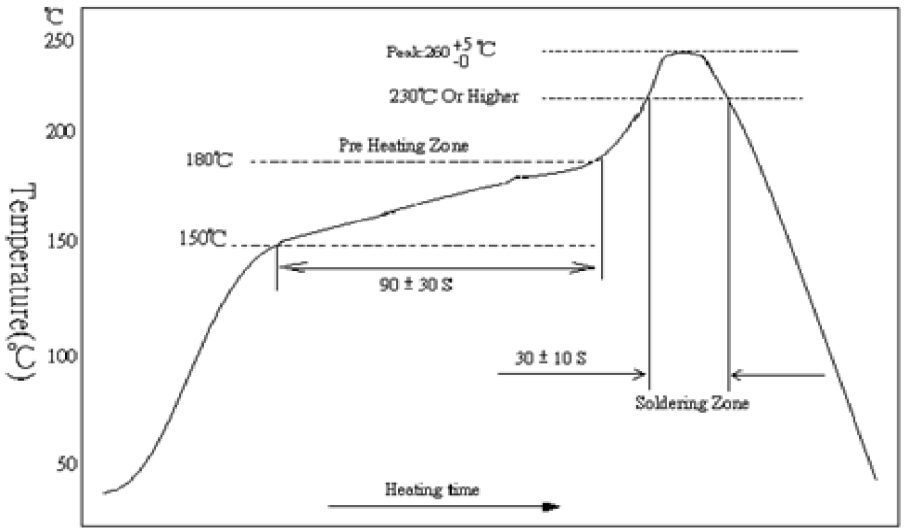
Refer toJIS-C5201-1 4.25</td><td>±5.0%</td><td>Refer to item 3.10 general specifications</td></tr>
<tr><td>Sulfuration Test</td><td>Class:B
Put the tested resistor in sulfur vapor, at a temperature of 105±2℃for 750hrs

Refer toASTM-B-809-95&EIA977</td><td>△R=±4.0%</td><td>Refer to item 3.10 general specifications</td></tr>
</table>

7. Technical application note: (This is for recommendation, customer please perform adjustment according to the actual application)

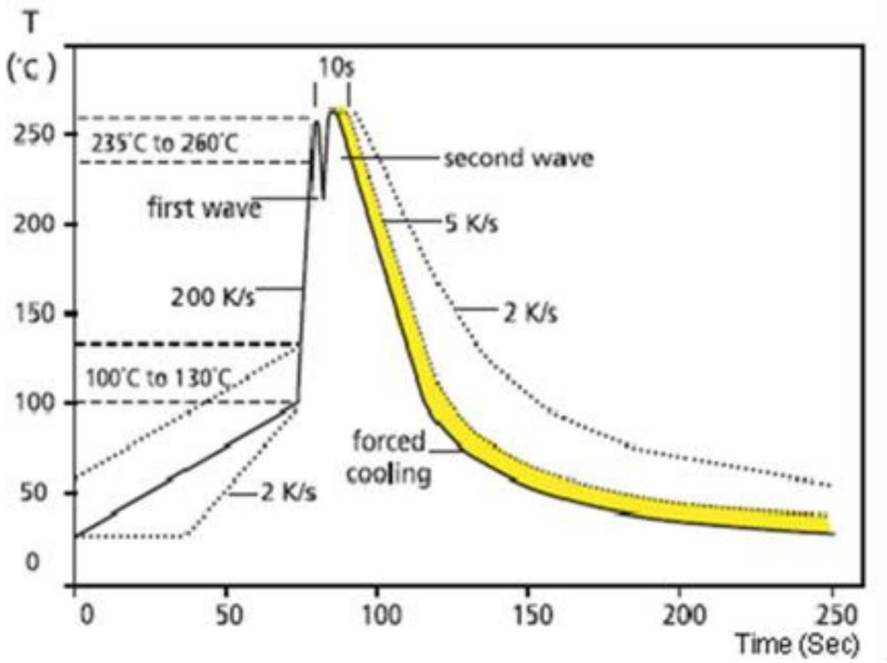
7.1 Recommend Soldering Method:

7.1.1 Lead Free IR Reflow Soldering Profile



Remark: The peak temperature of soldering heat is 260^{+5}_{-0} ℃ for 10 seconds

7.1.2 Lead Free Double-Wave Soldering Profile

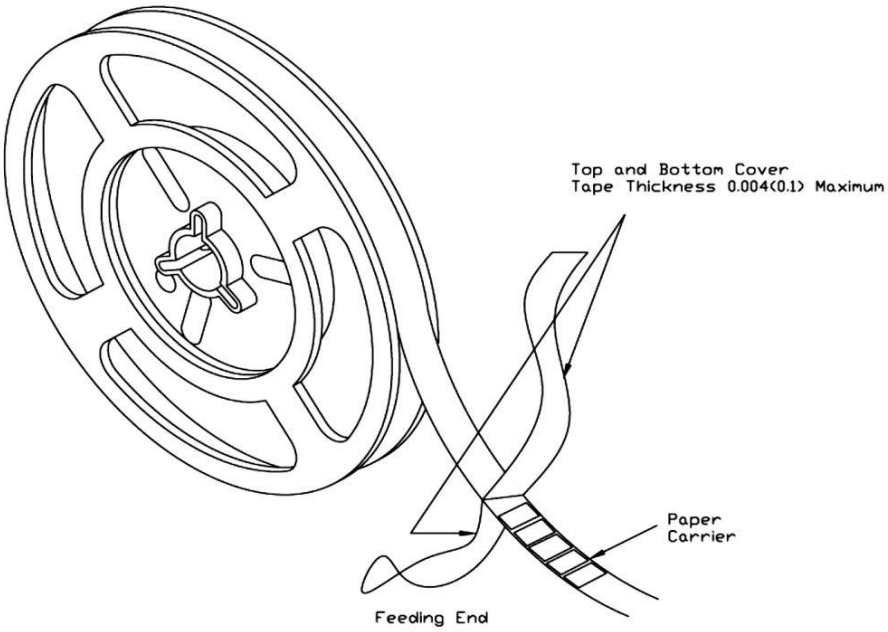


7.1.3 Soldering Iron: Temperature 350℃±10℃, dwell time shall be less than 3 sec.

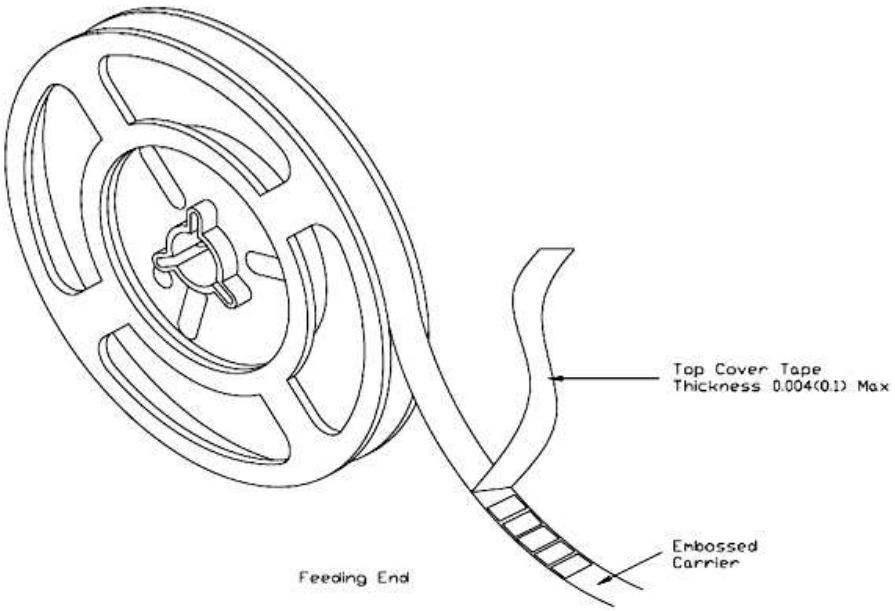
8. TAPING

8.1 Structure of Taping

Paper Carrier

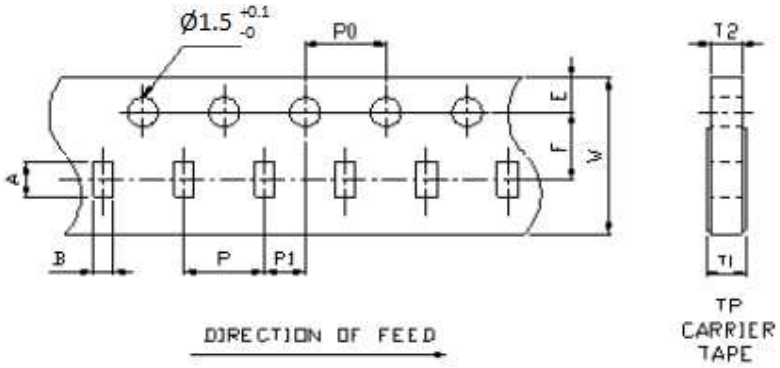


Embossed Plastic Carrier



8.2 Dimension

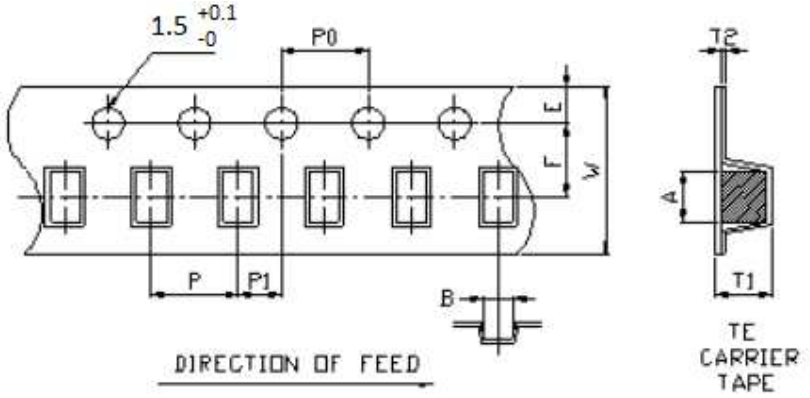
8.2.1 Dimension of Punched Paper Tape Carrier System /Plastic Embossed Carrier System (SAW32W)



Remark : Pitch tolerance over any 10 pitches of Po is ± 0.2 mm

Dimension of Punched Paper Tape Carrier System (SAS32W)

Code	A	B	W	E	F	T1	T2	P	P0	P1
SAS32W	3.5±0.20	1.9±0.20	8.0±0.20	1.75±0.10	3.50±0.05	$0.75^{+0.2}_{-0}$	0.75±0.10	4.0±0.10	4.0±0.05	2.0±0.05



Dimension of Plastic Embossed Carrier System (SAS – 50W, 63W)

Code	**A**	**B**	**W**	**E**	**F**	**T1**	**T2**	**P**	**P0**	**P1**
SAS50W	5.5±0.20	2.8±0.20	12.0±0.20	1.75±0.10	5.50±0.05	1.10±0.15	0.23±0.15	4.0±0.10	4.0±0.05	2.0±0.05
SAS63W	6.7±0.20	3.4±0.20	12.0±0.20	1.75±0.10	5.50±0.05	1.10±0.15	0.23±0.15	4.0±0.10	4.0±0.05	2.0±0.05

8.3 Packaging

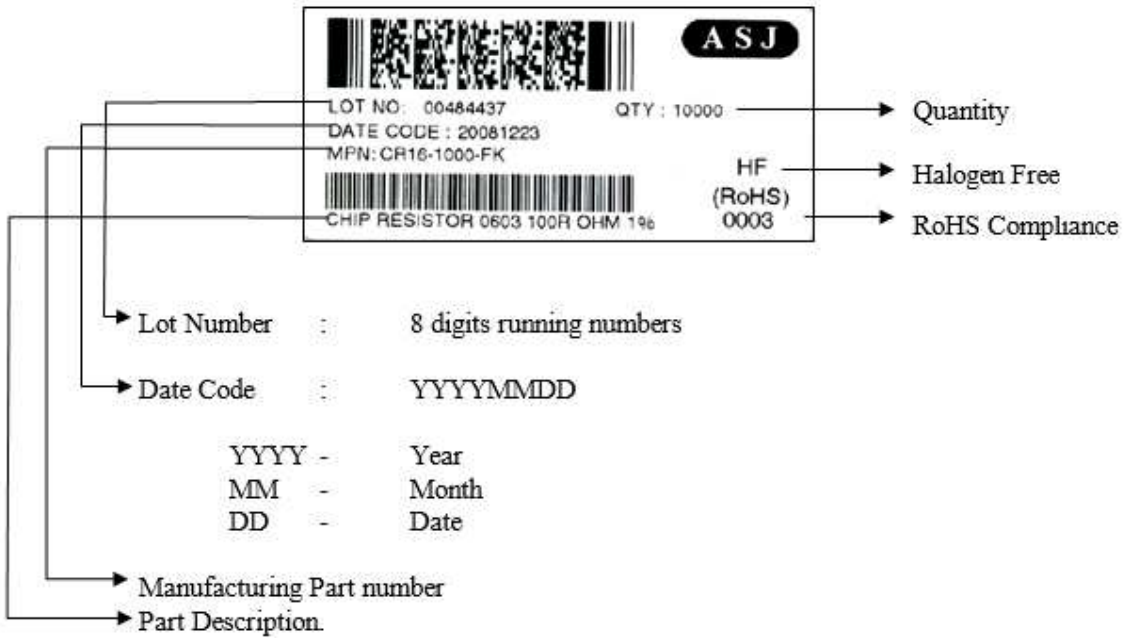
8.3.1 Taping

8.3.2 Quantity – Tape and Reels

Code	Quantity	Model	Remark
SAS32W	5000 pcs	7'' Reel	4mm pitch
	10000 pcs	10" Reel	4mm pitch
	20000 pcs	13" Reel	4mm pitch
SAS50W **SAS63W**	4000 pcs	7" Reel	4mm pitch

8.4 Identification

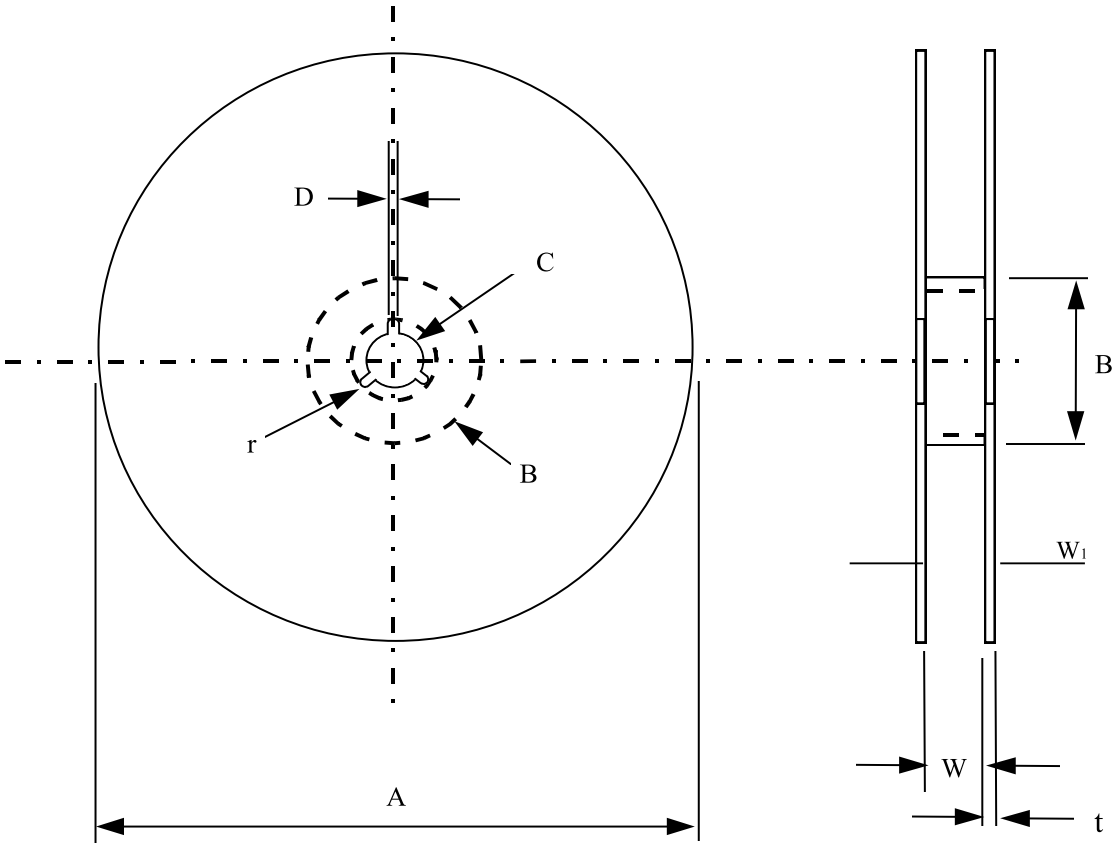
Production label that indicates the 8 digits lot number, product type, resistance value and tolerance shall be pasted on the surface of each reel.



8.5 Packaging Reel Box

Dimension	Reel Box	Number of Reels
185 × 60 × 186 mm	25K Box	5
185 × 120 × 186 mm	50K Box	10

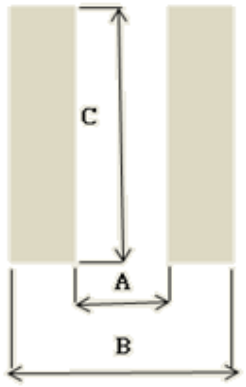
8.6 Reel Dimensions



Model	A	B	C	D	W	W_1	t	r
7"Reel (5K) (except 0402 10K)	ϕ178±2.0	ϕ60min	13± 0.2	ϕ2.0± 0.5	11± 0.1	14.4 max	1.0± 0.1	1.0
7"Reel (4K)	ϕ178±2.0	ϕ60min	13± 0.2	ϕ2.0± 0.5	13±1.0	14.4 max	1.2± 0.1	1.0
7''Reel (10K)	ϕ178±2.0	ϕ60min	13± 0.2	ϕ2.0± 0.5	11± 0.1	14.4 max	1.0± 0.1	1.0
10"Reel (10K)	ϕ254±2.0	ϕ60min	13± 0.2	ϕ2.0± 0.5	11± 1.0	14.4 max	1.5± 0.1	1.0
13"Reel (20K, 50K)	ϕ330±2.0	ϕ60min	13± 0.2	ϕ2.0± 0.5	11± 1.0	14.4 max	2.1± 0.1	-
13"Reel (20K, 50K)	ϕ330±1.0	ϕ100±1	13.5±0.5	2~3±0.5	10±0.5	-	-	-

9. LAND PATTERNS DESIGN (FOR REFLOW SOLDERING)

When a component is soldered, the resistance after soldering changes slightly depending on the size of the soldering area and the amount of soldering. When designing a circuit, it is necessary to consider the effect of a decrease or increase in its resistance.

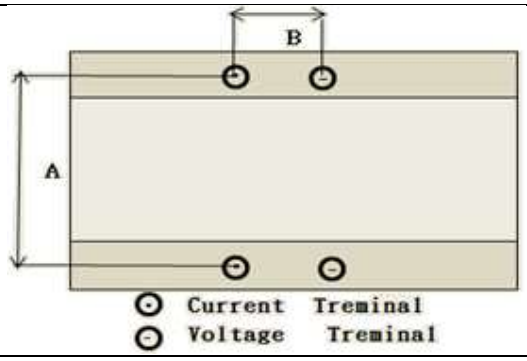


Unit:mm

TYPE \ DIM	A	B	C
SAS32W (0612)	0.7	2.6	3.5
SAS50W (1020)	0.5	3.5	5.3
SAS63W (1225)	1.3	4.2	6.4

10. MEASUREMENT POINT

Bottom electrode



Unit : mm

TYPE \ DIM	A	B
SAS32W (0612)	1.35±0.05	1.30±0.05
SAS50W (1020)	2.10±0.05	2.40±0.05
SAS63W (1225)	2.90±0.05	3.00±0.05

11. PLATING THICKNESS

Ni: ≧ 2 µm
Sn (Tin): ≧ 3µm
Sn (Tin): Matte Sn

12. REVISION HISTORY

REVISION	DATE	CHANGE NOTIFICATION	DESCRIPTION
Version.1	01.06.2022		Initial Release
Version 2	13.06.2023		Revise clause 3.8 Product Assurance