

ASJ

DATA SHEET

High Power Thick Film Chip Resistor

APW Series (Automotive Grade)

0.1% TO 5%, TCR ± 100 TO ± 200

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

RoHS-Compliant



HIGH POWER THICK FILM CHIP RESISTOR

APW Series (Automotive Grade)

DS-ENG-039

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1. SCOPE

- 1.1 This specification is applicable to Lead-free and Halogen-free of RoHS Directive for APW series high power thick film chip resistors.
- 1.2 This product is for automotive electronic application.
- 1.3 AEC-Q200 qualified, grade 0.

2. PART NUMBERING SYSTEM

Part Numbering is made in accordance with the following system:

Ordering Code / Information

APW	32	-	1002		-	F	L
Type	Size (Inch / mm)	Nominal Resistance			Resistance Tolerance	Packaging	
APW Series High Power Thick Film Chip Resistors	10(0402/1005) 16(0603/1608) 21(0805/2012) 32(1206/3216) 40(1210/3225) 50(2010/5025) 63(2512/6432)	Resistors	5% (3-Digit)	EX. 10Ω=100 4.7Ω=4R7	B=±0.1% D=±0.5% F=±1% J=±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	
			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°C	Max. Working Voltage	Max. Overload Voltage
APW10 (0402)	$\frac{1}{10}$ W	75V	100V
APW16 (0603)	$\frac{1}{4}$ W	75V	150V
APW21 (0805)	$\frac{2}{5}$ W	150V	300V
APW32 (1206)	$\frac{1}{2}$ W	200V	400V
APW40 (1210)	$\frac{3}{4}$ W	200V	400V
APW50 (2010)	1W	200V	400V
APW63 (2512)	2W	200V	400V



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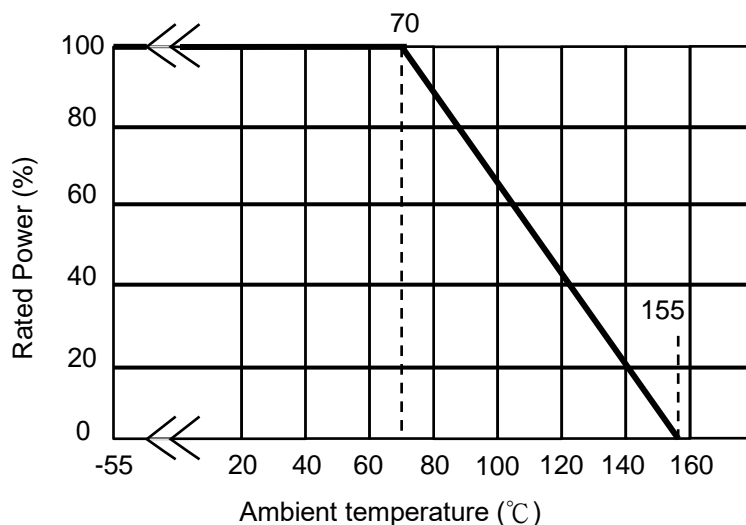
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3.2 Power Derating Curve:

Temperature Range: - 55°C ~ + 155°C

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 = $20 \pm 2^\circ\text{C}$

Relative Humidity = 60 to 70% RH

Air Pressure = 86 kPa to 106kPa

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



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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 / °C)	Resistance Range			
					B(±0.1%) E-24, E-96	D(±0.5%) E-24, E-96	F(±1%) E-24, E-96	J(±5%) E-24
APW10 (0402)	$\frac{1}{10}$ W	75V	100V	±100	$100\Omega \leq R \leq 1M\Omega$	$10\Omega \leq R < 1M\Omega$	$10\Omega \leq R < 10M\Omega$	$10\Omega \leq R < 20M\Omega$
				±200	-----	$1\Omega \leq R < 10\Omega$	$1\Omega \leq R < 10\Omega$	$1\Omega \leq R < 10\Omega$
APW16 (0603)	$\frac{1}{4}$ W	75V	150V	±150	$100\Omega \leq R \leq 1M\Omega$	$10\Omega \leq R < 1M\Omega$	$10\Omega \leq R < 10M\Omega$	$10\Omega \leq R < 20M\Omega$
				±200	-----	-----	$1\Omega \leq R < 10\Omega$	$1\Omega \leq R < 10\Omega$
APW21 (0805)	$\frac{2}{5}$ W	150V	300V	±100	$100\Omega \leq R \leq 1M\Omega$	$10\Omega \leq R < 1M\Omega$	$10\Omega \leq R < 10M\Omega$	$10\Omega \leq R < 20M\Omega$
				±200	-----	-----	$1\Omega \leq R < 10\Omega$	$1\Omega \leq R < 10\Omega$
APW32 (1206)	$\frac{1}{2}$ W	200V	400V	±100	$10\Omega \leq R \leq 1M\Omega$	$10\Omega \leq R < 1M\Omega$	$10\Omega \leq R < 10M\Omega$	$10\Omega \leq R < 20M\Omega$
				±200	$3\Omega \leq R < 10\Omega$	-----	$1\Omega \leq R < 10\Omega$	$1\Omega \leq R < 10\Omega$
APW40 (1210)	$\frac{3}{4}$ W	200V	400V	±100	$100\Omega \leq R \leq 1M\Omega$	$10\Omega \leq R < 1M\Omega$	$10\Omega \leq R < 10M\Omega$	$10\Omega \leq R < 20M\Omega$
				±200	-----	-----	$1\Omega \leq R < 10\Omega$	$1\Omega \leq R < 10\Omega$
APW50 (2010)	1W	200V	400V	±100	$100\Omega \leq R \leq 1M\Omega$	$10\Omega \leq R < 1M\Omega$	$10\Omega \leq R < 10M\Omega$	$10\Omega \leq R < 10M\Omega$
				±200	-----	-----	$1\Omega \leq R < 10\Omega$	$1\Omega \leq R < 10\Omega$
APW63 (2512)	2W	200V	400V	±100	$100\Omega \leq R \leq 1M\Omega$	$10\Omega \leq R < 1M\Omega$	$10\Omega \leq R < 10M\Omega$	$10\Omega \leq R < 10M\Omega$
				±200	-----	-----	$1\Omega \leq R < 10\Omega$	$1\Omega \leq R < 10\Omega$
Operating Temperature Range				-55°C ~ +155°C				

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, 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)



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4. MARKING ON PRODUCT

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

Part Number	Color	Marking on Product
APW10 (0402)	-	No marking
APW16 (0603)	Light Yellow	1) Tolerance : $\pm 1.0\%$ (F), $\pm 0.5\%$ (D), $\pm 0.1\%$ (B) ° Four Numerals Marking (E96 Series) ° 0603 Three Characters Marking based on E-96 marking standard. 2) Tolerance; $\pm 5.0\%$ (J) Three Numerals Marking 3) Zero ohm jumper resistor The marking used shall be 0
APW21 (0805)	Light Yellow	
APW32 (1206)	Light Yellow	
APW40 (1210)	Light Yellow	
APW63 (2512)	Light Yellow	

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	$1 \times 10^0 = 1$
10 Ω	10R0	$10 \times 10^0 = 10$
100 Ω	1000	$100 \times 10^0 = 100$
4.7K Ω	4701	$470 \times 10^1 = 4700$
47K Ω	4702	$470 \times 10^2 = 47000$
470K Ω	4703	$470 \times 10^3 = 470000$
1M Ω	1004	$100 \times 10^4 = 1000000$

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	$1 \times 10^0 = 1$
10 Ω	100	$10 \times 10^0 = 10$
100 Ω	101	$10 \times 10^1 = 100$
4.7K Ω	472	$47 \times 10^2 = 4700$
47K Ω	473	$47 \times 10^3 = 47000$
470K Ω	474	$47 \times 10^4 = 470000$
4.7M Ω	475	$47 \times 10^5 = 4700000$

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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, (Refer Table 2 & 3). 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 10 ³ Ω

4.1.4 EIA-96 Marking Scheme

Table 2 Significant figures

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

Table 3 Multiplier

Symbol	Multiplier	Symbol	Multiplier
A	10 ⁰	G	10 ⁶
B	10 ¹	H	10 ⁷
C	10 ²	X	10 ⁻¹
D	10 ³	Y	10 ⁻²
E	10 ⁴		
F	10 ⁵		



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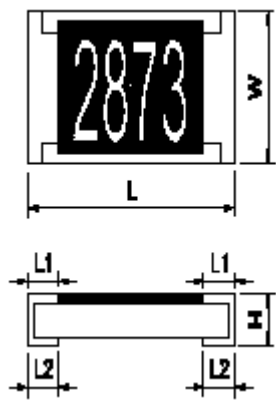
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5. DIMENSION, CONSTRUCTION AND MATERIAL

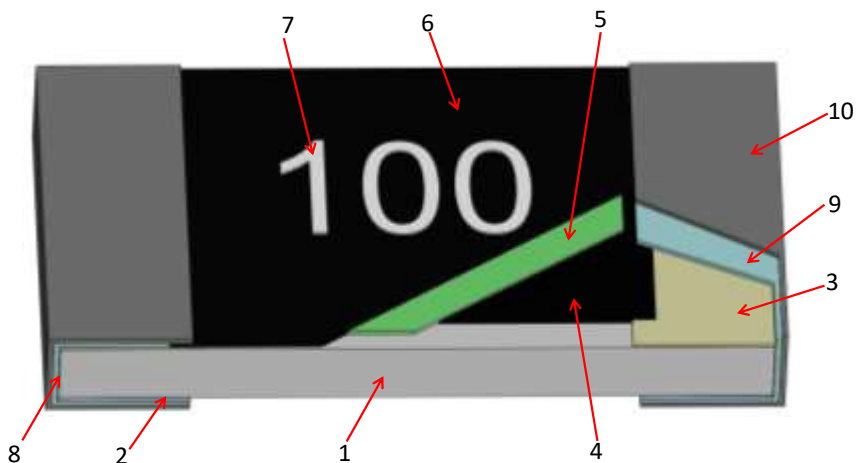
5.1 Dimension

Unit:mm



Dimension		L	W	H	L1	L2
Type	Size Code					
APW10	0402	1.00±0.10	0.50±0.05	0.30±0.05	0.20±0.10	0.25±0.10
APW16	0603	1.55±0.10	0.80±0.10	0.45±0.10	0.30±0.15	0.30±0.15
APW21	0805	2.00±0.10	1.25±0.10	0.50±0.10	0.35±0.20	0.35±0.15
APW32	1206	3.05±0.10	1.55±0.10	0.50±0.10	0.45±0.20	0.35±0.15
APW40	1210	3.05±0.10	2.55±0.10	0.55±0.10	0.50±0.20	0.50±0.20
APW50	2010	4.95±0.10	2.45±0.10	0.70±0.10	0.65±0.20	0.60±0.20
APW63	2512	6.40±0.20	3.20±0.20	0.70±0.10	0.60±0.20	1.25±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

5.3 Plating Thickness:

Ni : $\geq 2 \mu\text{m}$

Sn (Tin) : $\geq 3 \mu\text{m}$

Sn (Tin) : Matte Sn



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6. RELIABILITY TEST

Item	Conditions	Specifications
		Resistors
High Temperature Exposure (Storage)	Put the specimens in the chamber with temperature of $155\pm 3^{\circ}\text{C}$ for 1000 hours. Then take them out to stabilize in room temperature for 24 ± 4 hr or more, and measure of its resistance variance rate. Experiment evidence: AEC-Q200	0.1%、0.5%、1% : $\Delta R\%=\pm 1.0\%$ 5% : $\Delta R\%=\pm 2.0\%$
Temperature Cycling	Put the specimens in the High & low temperature test chamber with temperature varies from -55°C to 125°C for 15 minutes and total 1000 cycles. Then take them out to stabilize in room temperature for 24 ± 4 hr or more, and measure of its resistance variance rate. Experiment evidence: AEC-Q200	0.1%、0.5%、1% : $\Delta R\%=\pm 1.0\%$ 5% : $\Delta R\%=\pm 2.0\%$
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. (Rated voltage refers to item 3. general specifications) Refer to JIS-C5201-1 4.13	0.1%、0.5%、1% : $\Delta R\%=\pm 1.0\%$ 5% : $\Delta R\%=\pm 2.0\%$
Biased Humidity	Solder the specimens on the test PCB and put them into the constant temperature humidity chamber with $85\pm 2^{\circ}\text{C}$ and $85\pm 5\%$ 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 ± 4 hr or more, and measure of its resistance variance rate. Experiment evidence: AEC-Q200	0.1%、0.5%、1% : $\Delta R\%=\pm 2.0\%$ 5% : $\Delta R\%=\pm 3.0\%$
Operational Life	Solder the specimens on the test PCB and Put them in the chamber with temperature of $125\pm 3^{\circ}\text{C}$ and load the voltage for 1000 hours. Then take them out to stabilize in room temperature for 24 ± 4 hr or more, and measure of its resistance variance rate. Note: The input voltage shall refer to the power de-rating curve (referring to page 3, No.3.2) Experiment evidence: AEC-Q200	0.1%、0.5%、1% : $\Delta R\%=\pm 2.0\%$ 5% : $\Delta R\%=\pm 3.0\%$
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:0402、0603、0805=5mm 1206、1210=3mm 2010、2512= 2mm Experiment evidence: AEC-Q200	0.1%、0.5%、1% : $\Delta R\%=\pm 1.0\%$ 5% : $\Delta R\%=\pm 2.0\%$ No mechanical damage, peel-off of side end or chip crack.



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Item	Conditions	Specifications	
		Resistors	
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°C Soldering duration : 10±1sec. Experiment evidence AEC-Q200	0.1%、0.5%、1% : ΔR%=±1.0% 5% : ΔR%=±2.0%	
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	ΔR%=±3.0%	
Solderability	Test method: Test item 1 (solder pot test): Method B Precondition: The specimens are subjected to 155°C 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°C for 5 _{-0.5} ⁺⁰ 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°C for 30 _{-0.5} ⁺⁰ 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	$TCR(ppm/^{\circ}C) = \frac{(R2 - R1)}{R1(T2 - T1)} \times 10^6$ R1: Resistance at room temperature (Ω) R2: Resistance at -55°C or +125°C(Ω) T1: Room temperature (°C) T2: Temperature -55°C or +125°C Experiment evidence: AEC-Q200	Refer to item 3.10 General Specifications	
Sulfuration Test	<u>Class A</u> Put the tested resistor in sulfur vapor, at a temperature of 60±2°C for 1000hrs. Refer to ASTM-B-809-95 & EIA977	ΔR=±4.0%	Refer to item 3.10

6.1 Technical application notes : (This is for recommendation, customer please



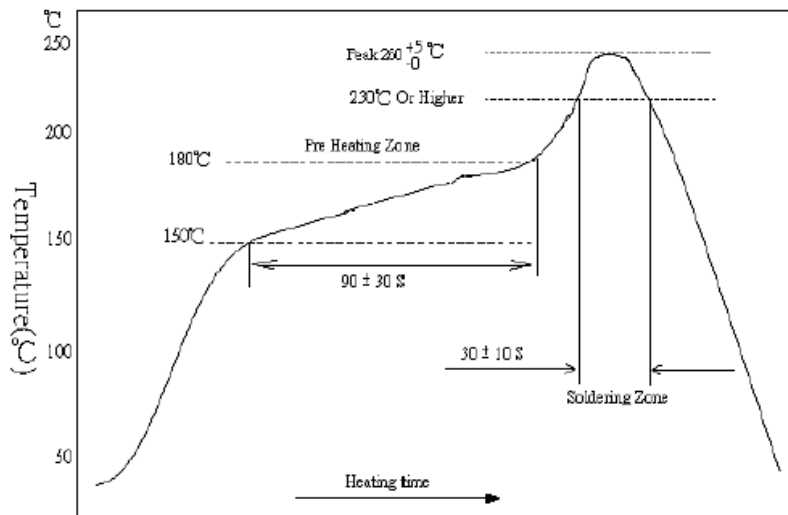
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perform adjustment according to actual application)

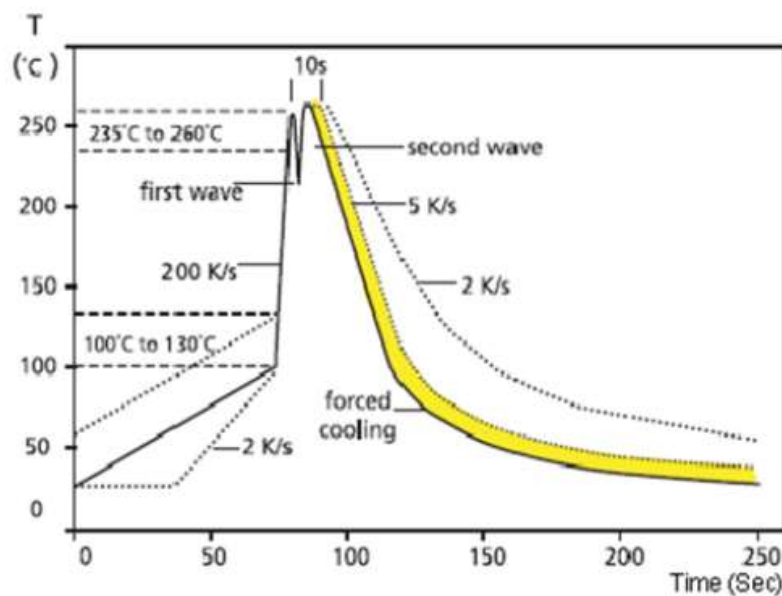
Soldering Profile

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



Remark : The peak temperature of soldering heat is 260 ± 5 °C for 10 seconds.

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



6.1.3 Soldering Iron: temperature $350^{\circ}\text{C} \pm 10^{\circ}\text{C}$, dwell time shall be less than 3 sec.

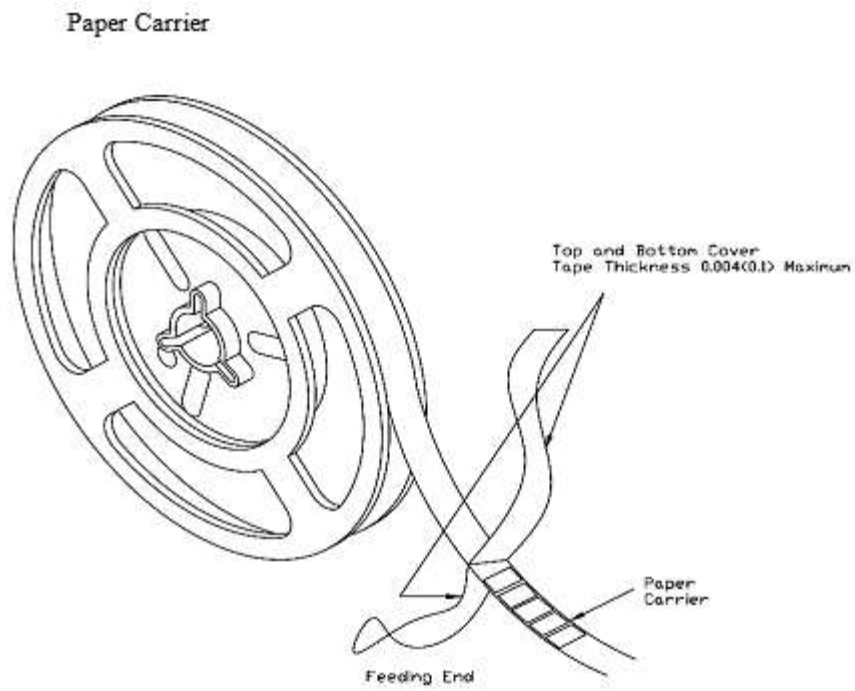
7. TAPING



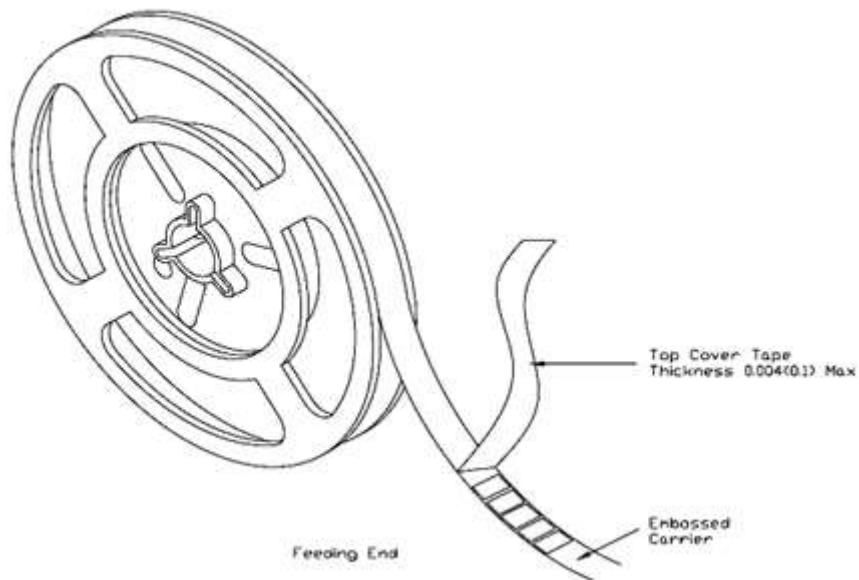
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7.1 Structure of Taping



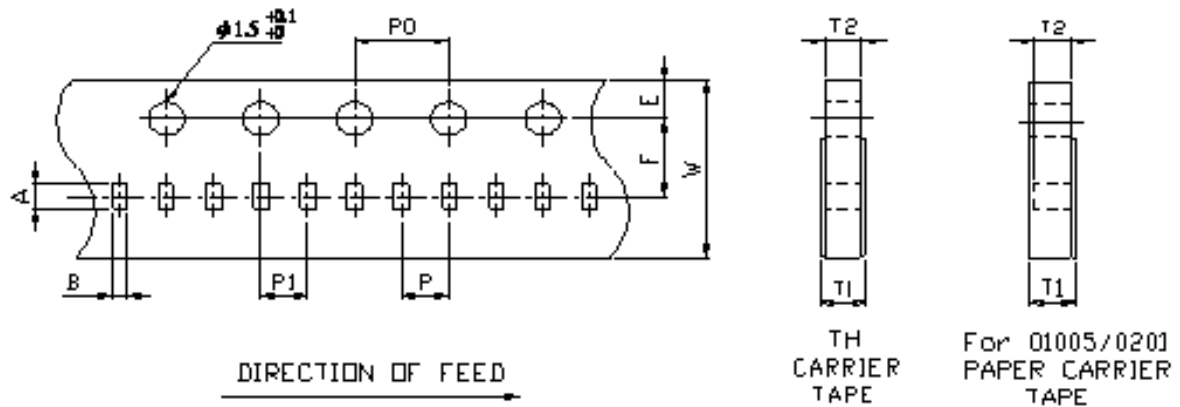
Embossed Plastic Carrier



7.2 Dimension



7.2.1 Dimension of Punched Paper Tape Carrier System (APW –10)



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

Dimension of Punched Paper Tape Carrier System (APW- 10)

Type	Dimensions (mm)										
Size	A	B	W	E	F	T1	T2	P	P0	10xP0	P1
APW10	1.15 \pm 0.05	0.65 \pm 0.05	8.00 \pm 0.20	1.75 \pm 0.10	3.50 \pm 0.05	0.40 $^{+0.2}_{-0}$	0.40 \pm 0.05	2.00 \pm 0.10	4.00 \pm 0.05	40.00 \pm 0.20	2.00 \pm 0.05

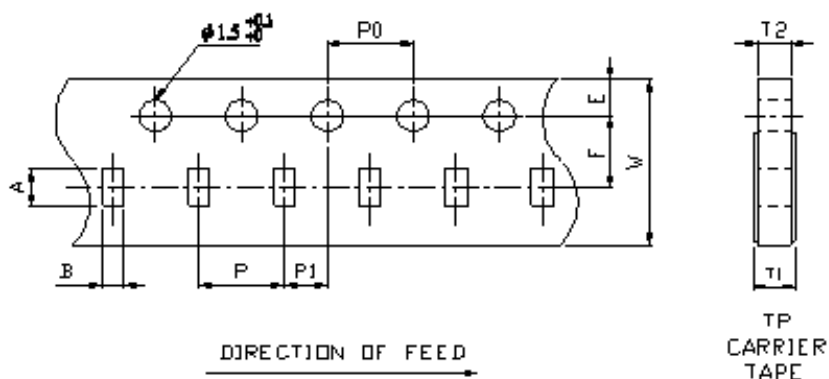
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7.2.2 Dimension of Punched Paper Tape Carrier System /Plastic Embossed Carrier System (APW-16, 21, 32, 40)

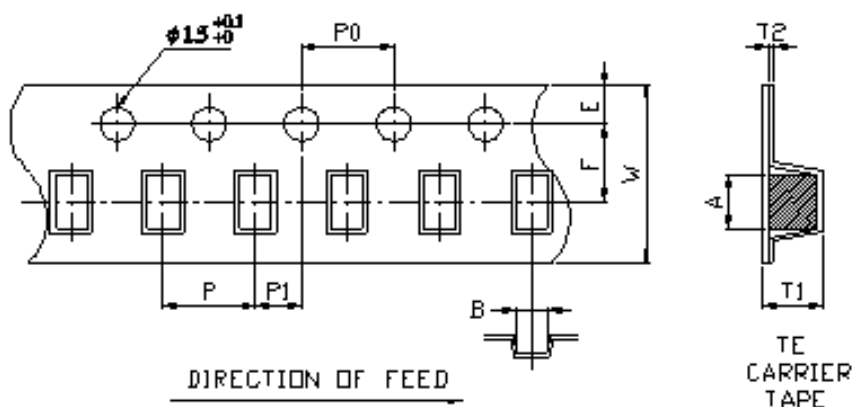


Remark : Pitch tolerance over any 10 pitches of P_0 is ± 0.2 mm

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

Type	Dimensions (mm)										
Size	A	B	W	E	F	T1	T2	P	P0	10xP0	P1
APW16	1.80 \pm 0.10	1.00 \pm 0.10	8.00 \pm 0.20	1.75 \pm 0.10	3.50 \pm 0.05	0.60 $^{+0.2}_{-0}$	0.60 \pm 0.10	4.00 \pm 0.10	4.00 \pm 0.05	40.00 \pm 0.20	2.00 \pm 0.05
APW21	2.30 \pm 0.10	1.55 \pm 0.10	8.00 \pm 0.20	1.75 \pm 0.10	3.50 \pm 0.05	0.75 $^{+0.2}_{-0}$	0.75 \pm 0.10	4.00 \pm 0.10	4.00 \pm 0.05	40.00 \pm 0.20	2.00 \pm 0.05
APW32	3.50 \pm 0.20	1.90 \pm 0.20	8.00 \pm 0.20	1.75 \pm 0.10	3.50 \pm 0.05	0.75 $^{+0.2}_{-0}$	0.75 \pm 0.10	4.00 \pm 0.10	4.00 \pm 0.05	40.00 \pm 0.20	2.00 \pm 0.05
APW40	3.50 \pm 0.20	2.80 \pm 0.20	8.00 \pm 0.20	1.75 \pm 0.10	3.50 \pm 0.05	0.75 $^{+0.2}_{-0}$	0.75 \pm 0.10	4.00 \pm 0.10	4.00 \pm 0.05	40.00 \pm 0.20	2.00 \pm 0.05

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



Type	Dimensions (mm)										
Size	A	B	W	E	F	T1	T2	P	P0	10xP0	P1
APW50	5.50 \pm 0.20	2.80 \pm 0.20	12.00 \pm 0.20	1.75 \pm 0.10	5.50 \pm 0.05	1.10 \pm 0.15	0.23 \pm 0.15	4.00 \pm 0.10	4.00 \pm 0.05	40.00 \pm 0.20	2.00 \pm 0.05
APW63	6.70 \pm 0.20	3.40 \pm 0.20	12.00 \pm 0.20	1.75 \pm 0.10	5.50 \pm 0.05	1.10 \pm 0.15	0.23 \pm 0.15	4.00 \pm 0.10	4.00 \pm 0.05	40.00 \pm 0.20	2.00 \pm 0.05



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7.3 Packaging

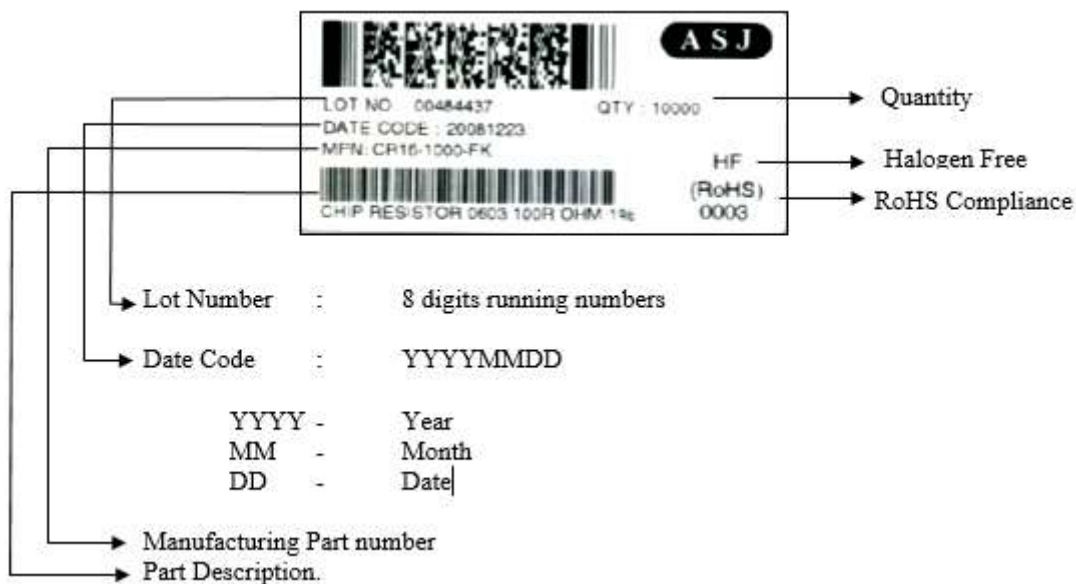
7.3.1 Taping

7.3.1.1 Quantity – Tape and Reels

Code	Quantity	Reel	Remark
APW10	10,000 pcs	7"	2mm pitch
	20,000 pcs	7"	2mm pitch
	50,000 pcs	13"	2mm pitch
APW16	5,000 pcs	7"	4mm pitch
APW21	10,000 pcs	10"	4mm pitch
APW32	20,000 pcs	13"	4mm pitch
APW40			
APW50	4,000 pcs	7"	Embossed 4mm pitch
APW63	4,000 pcs	7"	Embossed 4mm pitch

7.3.2 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.



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

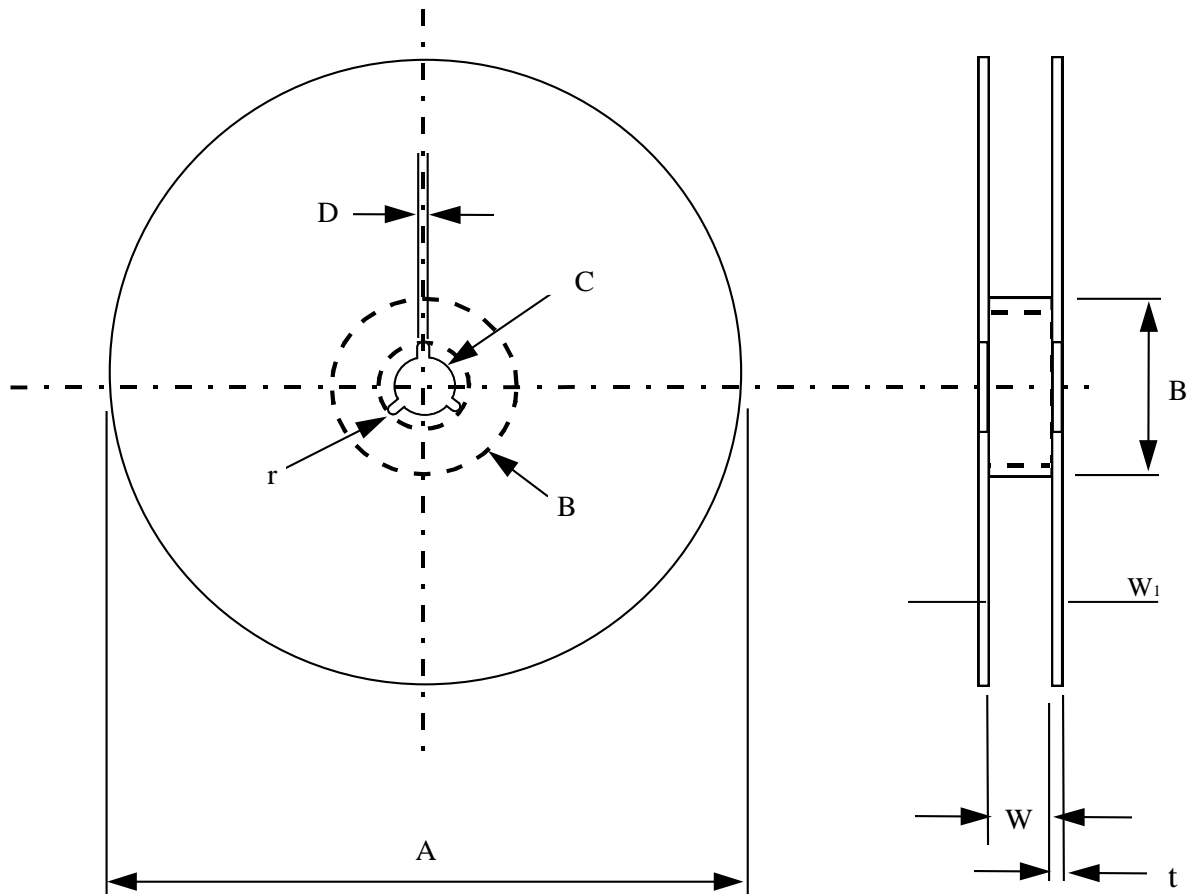
HIGH POWER THICK FILM CHIP RESISTOR

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7.3.4 Reel Dimensions



Model	A	B	C	D	W	W ₁	t	r
7" Reel (5K) (except 0402 10K)	φ178±2.0	φ80min	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 (2K) (for 2512)	φ178±2.0	φ60min	13.5±0.5	φ2.0±0.5	13.8±0.5	14.4 max	1.2±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	-	-	-



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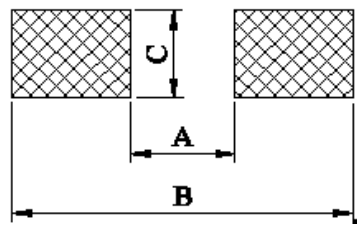
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8. SURFACE MOUNT LAND PATTERNS DESIGN (FOR REFLOW SOLDERING)

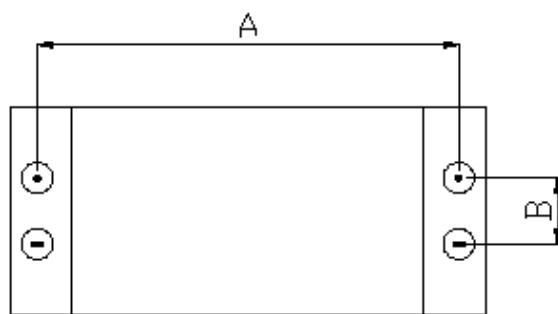
When a component is soldered, the resistance after soldering changes slightly depending on the size of the soldering area and the amount of soldering. When designing a circuit, it is necessary to consider the effect of a decrease or increase in its resistance.

Unit:mm



TYPE \ DIM	A	B	C
APW10	0.5	1.5	0.6
APW16	0.8	2.1	0.9
APW21	1.2	3.0	1.3
APW32	2.2	4.2	1.6
APW40	2.2	4.2	2.8
APW50	3.5	6.1	2.8
APW63	3.8	8.0	3.5

9. MEASUREMENT POINT

Bottom electrode		Unit : mm	
 <p>⊙ Current Terminal</p> <p>⊖ Voltage Terminal</p>	TYPE \ DIM	A	B
	APW10	0.80±0.05	0.24±0.05
	APW16	1.35±0.05	0.35±0.05
	APW21	1.80±0.05	0.35±0.05
	APW32	2.90±0.05	0.35±0.05
	APW40	2.90±0.05	0.35±0.05
	APW50	4.50±0.05	1.15±0.05
	APW63	5.90±0.05	1.60±0.05



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10. REVISION HISTORY

REVISION	DATE	CHANGE NOTIFICATION	DESCRIPTION
Version.1	02.01.2019		Initial Release
Version.2	29.10.2019		Revise clause 3.1.1 Revise clause 3.9 Revise clause 3.10
Version.3	08.10.2020		Review clause 2 part numbering system Review clause 3.5 Storage temp. range Review clause 3.10 TCR table Review clause 6 Reliability test
Version.4	07.09.2021		Revise clause 1.3, grade 1 to grade 0 Revise clause 6 item temperature cycling test, 5 minute to 15 minute
Version 5	31.03.2023		Revise clause 3.8 Product assurance
Version 6	25.07.2023		Add clause 6 Item Sulfuration Test



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