HoAR Thin Film Precision Chip Resistor

■ Features

① Miniature size 0201 available
② Advanced thin film technology
③ Very tight tolerance down to ±0.01%
④ Extremely lowTCR down to±1PPM/℃
⑤ Wide resistance range 1ohm ~ 3Mega ohm
⑥ Test proven immunity toBiasedhumidity(85°C/ 85%RH)

■ Applications

① Converters
② PrinterEquipment
③ MedicalEquipment
④ Automatic EquipmentController
⑤ Testing/Measurement Equipment
⑥ CommunicationDevice,CellPhone, GPS, PDA

■ Standard Electrical Specifications

Item / Type	Power Rating at 70°C	Operating Temp.Range	Max.Operating Voltage	Max.Overload Voltage	Resistance Range					TCR (PPM/℃)
					±0.05%	±0.1%	±0.25%	±0.5%	±1%	
0201	1/32W	-55 ~ +155℃	15V	30V	-	22Ω - 75KΩ				±25,±50
0402	1/16W		50V	100V	49.9Ω -12KΩ	4Ω - 511KΩ				±25,±50
0603	1/16W		50V	100V	4.7Ω -332KΩ	1Ω - 1MΩ				±25,±50
0805	1/10W		100V	200V	4.7Ω -1MΩ	1Ω - 2MΩ				±25,±50
1206	1/8W		150V	300V	4.7Ω - 1MΩ	1Ω - 3MΩ				±25,±50
1210	1/4W									
2010	1/4W		150V	300V	4.7Ω - 1MΩ	1Ω - 3MΩ				±25,±50
2512	1/2W									

.Lower Resistance:1~10Ω

High-tech enterprises IATF16949 ISO9001 RoHS REACH

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■ Special Electrical Specifications

Item / Type	Power Ratingat 70°C	Operating Temp.Range	Max.Operating Voltage	Max.Overload Voltage	Resistance Range						TCR (PPM/°C)
					±0.01%	±0.05%	±0.1%	±0.25%	±0.5%	±1%	
0402	1/16W	-55 ~ +155℃	50V	100V	49.9Ω - 4.99KΩ			-			±1, ±2,±3
					49.9Ω - 20KΩ						±5
					49.9Ω - 20KΩ		49.9Ω - 100KΩ				±10, ±15
0603	1/16W		50V	100V	24.9Ω - 15KΩ			-			±1, ±2,±3
					24.9Ω - 60KΩ						±5
					24.9Ω - 100KΩ	4.7Ω-332KΩ	4.7Ω - 511KΩ				±10, ±15
0805	1/10W		100V	200V	24.9Ω - 30KΩ			-			±1, ±2,±3
					24.9Ω - 150KΩ						±5
					24.9Ω - 200KΩ	4.7Ω – 1MΩ					±10, ±15
1206	1/8W		150V	300V	24.9Ω - 49.9KΩ			-			±1, ±2,±3
					24.9Ω - 300KΩ						±5
					24.9Ω - 499KΩ	4.7Ω – 1.5MΩ					±10, ±15
1210	1/ 4W		150V	300V	24.9Ω - 49.9KΩ			-			±1, ±2,±3
					24.9Ω - 300KΩ						±5
					24.9Ω - 499KΩ	4.7Ω - 1MΩ					±10, ±15
2010	1/4W		150V	300V	24.9Ω - 100KΩ			-			±1, ±2,±3
					24.9Ω - 300KΩ						±5
					24.9Ω - 499KΩ	4.7Ω - 1MΩ					±10, ±15
2512	1/2W		150V	300V	24.9Ω - 100KΩ			-			±1, ±2,±3
					24.9Ω - 300KΩ						±5
					24.9Ω - 499KΩ	4.7Ω - 1MΩ					±10, ±15

■ High Power Rating Electrical Specifications

Item / Type	PowerRatingat 70℃	Operating Temp.Range	Max.OperatingVoltage	Max.Overload Voltage	Resistance Range						TCR (PPM/℃)
					±0.01%	±0.05%	±0.1%	±0.25%	±0.5%	±1%	
0201	1/20W	-55 ~ +155℃	25V	50V	-		22Ω - 75KΩ				±25,±50
0402	1/10W		50V	100V	49.9Ω - 4.99KΩ			-			±1, ±2,±3
					49.9Ω - 20KΩ						±5
					49.9Ω - 12KΩ		49.9Ω - 100KΩ				±10, ±15
					-	49.9Ω-12KΩ	4.7Ω~255KΩ				±25,±50
0603	1/10W		75V	150V	24.9Ω - 15KΩ			-			±1, ±2,±3
					24.9Ω - 60KΩ						±5
					24.9Ω - 100KΩ	4.7Ω - 332KΩ	4.7Ω - 511KΩ				±10,±15
							1Ω -1MΩ				±25,±50
	1/6W(Ultra)		100V	150V	-	10Ω - 332KΩ					±25,±50
0805	1/8W		150V	300V	24.9Ω - 30KΩ			-			±1, ±2,±3
					24.9Ω -150KΩ						±5
					24.9Ω - 200KΩ	4.7Ω -511KΩ	4.7Ω -1MΩ				±10, ±15
							1Ω - 2MΩ				±25,±50
	1/4W(Ultra)		150V	300V	-	10Ω - 499KΩ					±25,±50

1206	1/4W	-55 ~ +155℃	200V	400V	24.9Ω - 49.9KΩ	-	±1, ±2,±3
					24.9Ω - 300KΩ		±5
					24.9Ω - 499KΩ	4.7Ω - 1MΩ	±10,±15
						1Ω - 1MΩ / 1Ω - 3MΩ	±25,±50
	1/3W(Ultra)		200V	400V	-	10Ω ~1MΩ	±25,±50
1210	1/3W		200V	400V	24.9Ω – 49.9KΩ	-	±1, ±2,±3
					24.9Ω - 300KΩ		±5
					24.9Ω - 499KΩ	4.7Ω - 1MΩ	±10,±15
						1Ω - 1MΩ / 1Ω - 3MΩ	±25,±50
2010	1/3W		200V	400V	24.9Ω - 49.9KΩ	-	±1, ±2,±3
					24.9Ω - 300KΩ		±5
					24.9Ω - 499KΩ	4.7Ω - 1MΩ	±10,±15
						1Ω - 1MΩ / 1Ω - 3MΩ	±25,±50
	1/2W(Ultra)		200V	400V	24.9Ω - 2KΩ	4.7Ω –1MΩ	1Ω –1MΩ / ±10,±15
					24.9Ω - 2KΩ	4.7Ω –1MΩ / 4.7Ω – 3MΩ	1Ω –3MΩ / ±25,±50
2512	3/4W		200V	400V	24.9Ω - 2KΩ	4.7Ω – 2KΩ	1Ω – 2KΩ / ±10,±15
					24.9Ω - 2KΩ	4.7Ω – 2KΩ / 4.7Ω – 3MΩ	1Ω – 3MΩ / ±25,±50
	1W(Ultra)		200V	400V	24.9Ω - 2KΩ	4.7Ω –1MΩ	1Ω –1MΩ / ±10,±15
					24.9Ω - 2KΩ	4.7Ω –1MΩ / 4.7Ω – 3MΩ	1Ω – 3MΩ / ±25,±50

Operating Voltage=√(P*R) or Max. operating voltage listed above, whichever is lower.
Overload Voltage=2.5*√(P*R) or Max. overload voltage listed above , whichever is lower.
(Lower Resistance:1~10Ω ; High Power Rating)

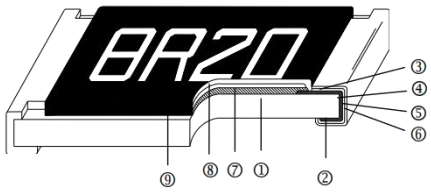
■ Part Numbering

Selection Example: HoAR2512-1/2W-10R-1%-50ppm

H o A R 2 5 1 2 1 / 2 W 1 0 R 1 % 50ppm

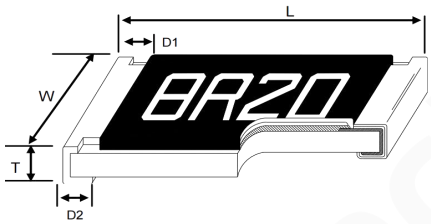
makers	Product Type	Dimensions (L×D)	Power Rating	Resistance	Resistance Tolerance	TCR (ppm/°C)
Ho	AR	0201 0402 0603 0805 1206 1210 2010 2512	1/32W 1/16W 1/10W 1/8W 1/6W 1/5W 1/4W 1/3W 1/2W 3/4W 1W	1R=0010 4.7R=4R70 1KR=1001 1MR=1004	±0.01% ±0.05% ±0.1% ±0.25% ±0.5% ±1%	±1 ±2 ±3 ±5 ±15 ±25 ±50

■ Construction



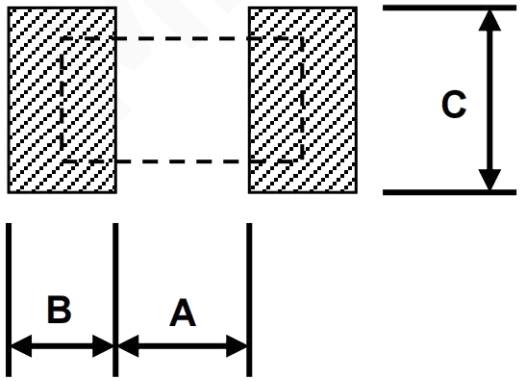
1	2	3	4	5
Alumina Substrate	Bottom Electrode	Top Electrode	Edge Electrode	Barrier Layer
6	7	8	9	
External Electrode	Resistor Layer	Overcoat	Marking	

■ Dimensions



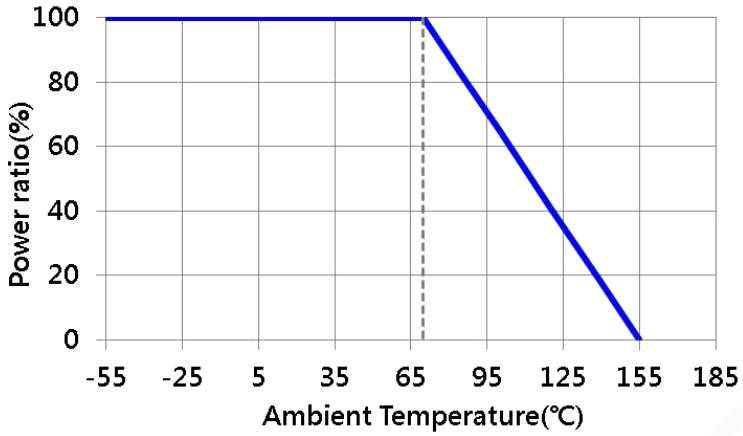
Type	L (mm)	W (mm)	T (mm)	D1 (mm)	D2 (mm)	Weight(g) (1000pcs)
0201	0.58±0.05	0.29±0.05	0.23±0.05	0.12±0.05	0.15±0.05	0.14
0402	1.00±0.05	0.50±0.05	0.30±0.05	0.20±0.15	0.20±0.10	0.54
0603	1.55±0.10	0.80±0.10	0.45±0.10	0.30±0.25	0.30±0.20	1.83
0805	2.00±0.15	1.25±0.15	0.55±0.10	0.30±0.25	0.40±0.20	4.71
1206	3.05±0.15	1.55±0.15	0.55±0.10	0.42±0.30	0.35±0.25	9.02
1210	3.10±0.15	2.40±0.15	0.55±0.10	0.40±0.30	0.55±0.25	10
2010	4.90±0.15	2.40±0.15	0.55±0.10	0.60±0.40	0.50±0.25	23.61
2010(1/2W)	4.90±0.15	2.40±0.15	0.55±0.10	0.60±0.40	2.20±0.25	26.68
2512	6.30±0.15	3.10±0.15	0.55±0.10	0.60±0.40	0.50±0.25	38.06
2512(1W)1~100Ω	6.30±0.15	3.10±0.15	0.55±0.10	0.60±0.40	0.50±0.25	44.65
2512(1W)101Ωabove	6.30±0.15	3.10±0.15	0.55±0.10	0.60±0.40	2.50±0.25	44.65

■ Recommend Land Pattern

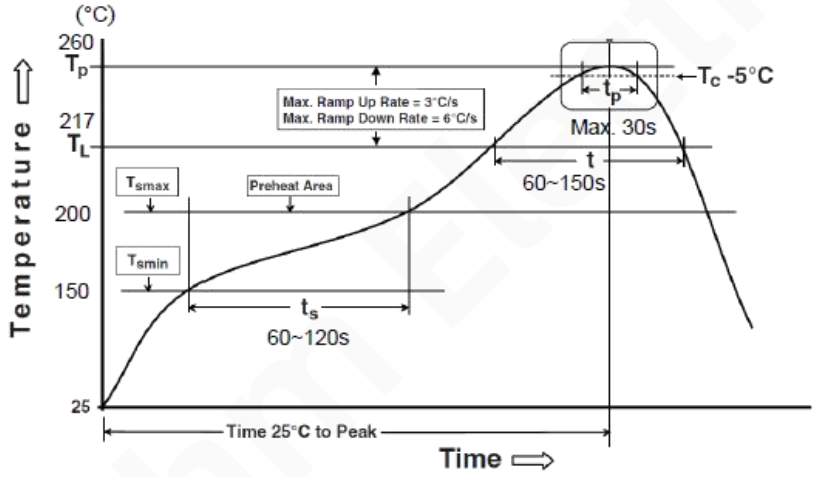


Type	A(mm)	B(mm)	C(mm)
0201	0.25	0.30	0.40±0.2
0402	0.50	0.50	0.60±0.2
0603	0.80	1.00	0.90±0.2
0805	1.00	1.00	1.35±0.2
1206	2.00	1.15	1.70±0.2
1210	2.00	1.15	2.50±0.2
2010	3.60	1.40	2.50±0.2
2010(1/2W)	1.00	2.70	2.50±0.2
2512	4.90	1.60	3.10±0.2
2512(1W)1~100Ω	4.90	1.60	3.10±0.2
2512(1W)101Ωabove	1.00	3.55	3.10±0.2

■ Derating Curve



■ Soldering Condition(IPC/JEDEC J-STD-020)



Reflow Profiles	
Profile Feature	**Pb-Free Assembly**
Preheat Min. Temperature (Tsmin) Max Temperature (Tsmax) Preheating time (ts) from (Tsmin to Tsmax)	 150 °C 200 °C 60-120 seconds
Ramp-up rate (T_L to T_p)	3 °C/second max.
Liquidous temperature (T_L) Time (t_L) maintained above T_L	217 °C 60-150 seconds
Min. Peak temperature (T_p min)	235°C
Max. Peak temperature (T_p max)	260°C
Time (t_p) within 5 °C of the specified classification temperature (T_c)	30 seconds max.
Ramp-down rate (Tp to T_L)	6 °C/second max.
Time 25 °C to peak temperature	8 minutes max.

■ Environmental Characteristics

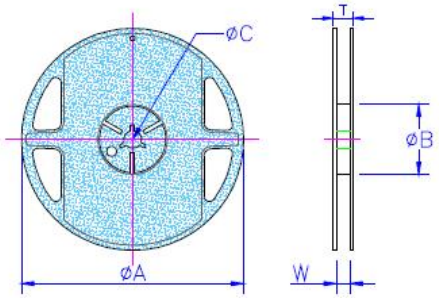
Item	Requirement		Test Method
	Tol. ≤ 0.05%	Tol. > 0.05%	
TemperatureCoefficient of Resistance (T.C.R.)	As Spec.		MIL-STD-202 Method 304 +25/-55/+25/+125/+25℃
Short Time Overload	ΔR±0.05%	ΔR±0.1% ΔR ± 0.2% for 0201	JIS-C-5201-1 4.13 RCWV*2.5 or Max. overload voltage whichever is lower for 5 seconds
	ΔR±0.2% for Ultra high power rating		
Insulation Resistance	>9999 MΩ		MIL-STD-202 Method 302 Apply 100V_{DC} for 1 minute
Endurance	ΔR±0.05%	ΔR±0.1%	MIL-STD-202 Method 108A 70±2℃, RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hrs "OFF"
	ΔR±0.5% for Ultra high power rating		
	0201: >7kΩ →ΔR±0.5% ≦7kΩ→ΔR±0 2%		
Bending Strength	ΔR±0.05%	ΔR±0.1%	JIS-C-5201-1 4.33 Bending amplitude 3 mm for 60 seconds 2010 2512 sizes: 2 mm Other sizes: 3mm
Damp Heat with Load (for 0201 size)	ΔR±0.3%		MIL-STD-202 Method 103B 40±2℃, 90~95% R.H. RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hrs "OFF"
Solderability	95% min. coverage		MIL-STD-202 Method 208H 245±5℃ for 3 seconds
Resistance to Soldering Heat	ΔR±0.05%	ΔR±0.1%	MIL-STD-202 Method 210E 260±5℃ for 10 seconds
Dielectric Withstand Voltage	By Type		MIL-STD-202 Method 301 Max. overload voltage for 1 minute
Low Temperature Operation	ΔR±0.05%	ΔR±0.2%	JIS-C-5201-1 4.36 1 hour, -65℃, followed by 45 minutes of RCWV
	ΔR±0.5% for high power & Ultra Powerrating		
High Temperature Exposure	ΔR±0.5% 0402 ≧255.01K 0603 ≧402.01K 0805 ≧1.01M 1206 ≧1.01M 1210 ≧1.01M 2010 ≧1.01M 2512 ≧1.01M ΔR±0.2% for the other		MIL-STD-202 Method 108 at +155℃ for 1000 hrs
Temperature Cycling	ΔR±0.2% (0201 product is excluded)		JESD22 Method JA-104 -55℃ to +125℃, 1000 cycles
ESD	ΔR±0.5% (0201 product is excluded)		AEC-Q200-002 Human body model 0402 0603 200V 0805 1206 1000V 2010 、2512 、1213 2000V
Sulfur Test	ΔR±2% (0201 product is excluded)		ASTM-B-809-95 Modified 105±2 °C no power rating for 1000 hrs.
Biased Humidity	ΔR±0.1% (0201 product is excluded)		MIL-STD-202 Method 103 1000 hrs 85℃ /85%RH 10% of operating power.

RCWV(Rated Continuous Working Voltage)=√(P*R) or Max. Operating Voltage whichever is lower.

■ Storage Temperature: 15~28。C; Humidity < 80%RH

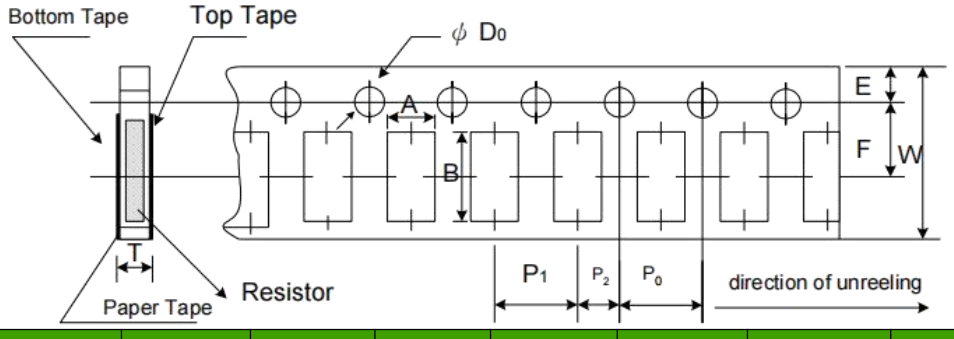
■ Shelf Life: 2 years from production date.

■ Packaging

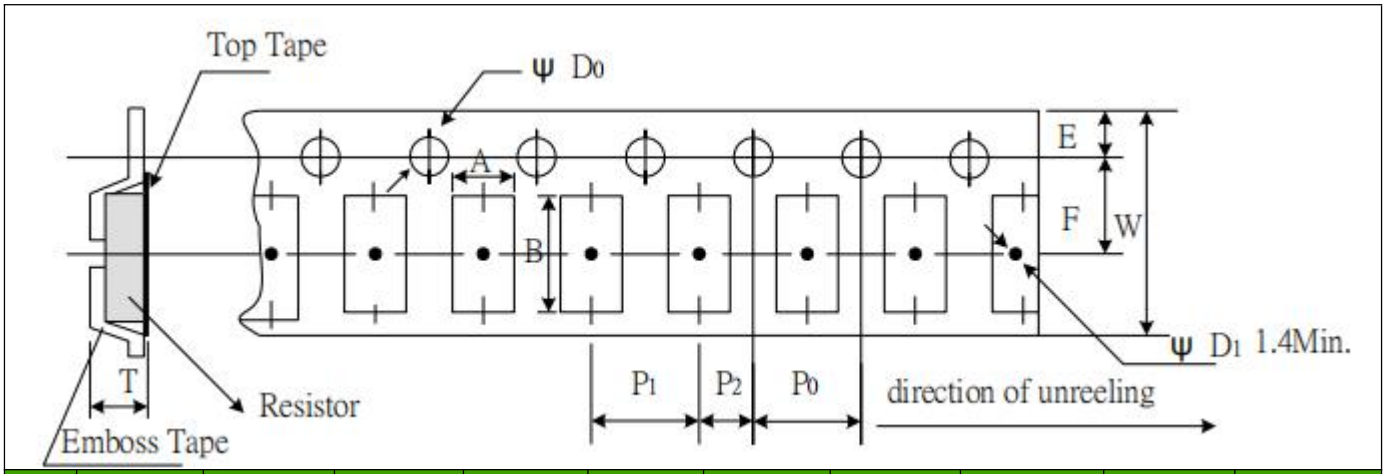


Type	ØA	Ø B	ØC	W	T	Paper Tape (EA)	Emboss Plastic Tape (EA)
0201	178.0±1.0	60.0+1.0	13.5±0.7	9.5±1.0	11.5±1.0	10,000	-
0402	178.0±1.0	60.0+1.0	13.5±0.7	9.5±1.0	11.5±1.0	10,000	-
0603	178.0±1.0	60.0+1.0	13.5±0.7	9.5±1.0	11.5±1.0	5,000	-
0805	178.0±1.0	60.0+1.0	13.5±0.7	9.5±1.0	11.5±1.0	5,000	-
1206	178.0±1.0	60.0+1.0	13.5±0.7	9.5±1.0	11.5±1.0	5,000	-
1210	178.0±1.0	60.0±1.0	13.5±0.7	9.5±1.0	11.5±1.0	5,000	-
2010	178.0±1.0	60.0+1.0	13.5±0.7	13.5±1.0	15.5±1.0	-	4,000
2512	178.0±1.0	60.0+1.0	13.5±0.7	13.5±1.0	15.5±1.0	-	4,000

■ Packaging



Type	A	B	W	E	F	P0	P1	P2	ΦD0	T
0201	0.40±0.05	0.70±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	2.00±0.05	2.00±0.05	1.55±0.03	0.42±0.02
0402	0.70±0.05	1.16±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	2.00±0.05	2.00±0.05	1.55±0.05	0.40±0.03
0603	1.10±0.05	1.90±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.55±0.05	0.60±0.03
0805	1.60±0.05	2.37±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.55±0.05	0.75±0.05
1206	2.00±0.05	3.55±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.55±0.05	0.75±0.05
1210	2.75±0.05	3.40±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.05	4.00±0.10	2.00±0.05	1.60±0.10	0.75±0.05

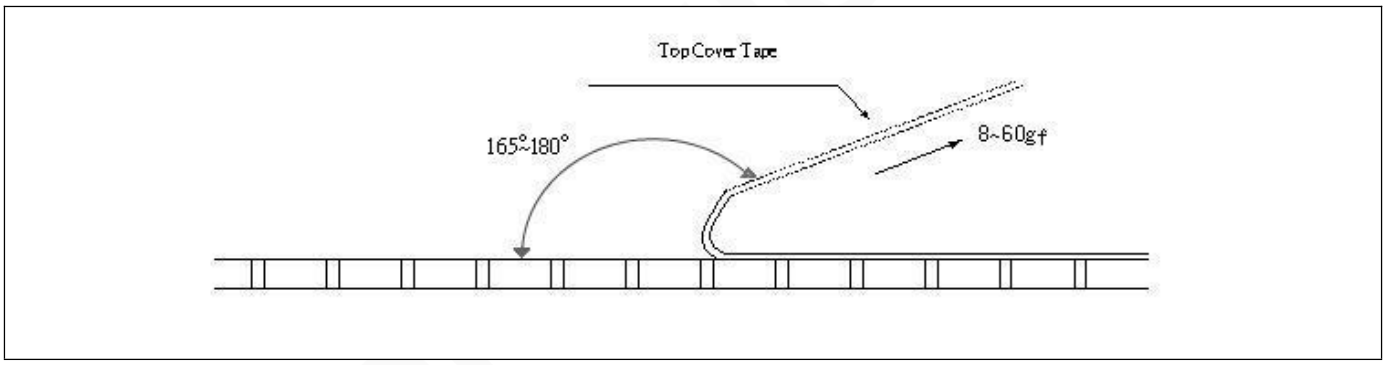


Type	A	B	W	E	F	P0	P1	P2	ΦD0	T
2010	2.85±0.10	5.45±0.10	12.0±0.10	1.75±0.1	5.5±0.05	4.00±0.05	4.00±0.10	2.00±0.05	1.50+0.10	1.00±0.20
2512	3.40±0.10	6.65±0.10	12.0±0.10	1.75±0.1	5.5±0.05	4.00±0.05	4.00±0.10	2.00±0.05	1.50+0.10	1.00±0.20

■ Peel force of top cover tape

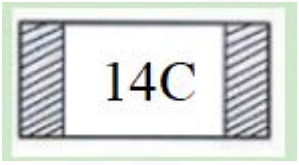
■ The peel speed shall be about 300mm/min±5%

■ The peel force of top cover tape shall be between 8gf to 60gf



■ Marking

0603 3digit marking



3digit marking for Example:

14C=13K7Ω 13C=13K3Ω 68B=4K99Ω 68X=49.9Ω

0603 3digit marking for E24 Example: 101=100Ω 102=1KΩ

E24	10	11	12	13	15	16	18	20	22	24	27	30	33	36	39	43	47	51	56	62	68	75	82	91

0805~2512 4digit marking Example

Resistance	100Ω	2.2KΩ	10KΩ	49.9KΩ	100KΩ
marking	1000	2201	1002	4992	1003

■ Marking Table

Code	E96	Code	E96	Code	E96	Code	E96
01	100	25	178	49	316	73	562
02	102	26	182	50	324	74	576
03	105	27	187	51	332	75	590
04	107	28	191	52	340	76	604
05	110	29	196	53	348	77	619
06	113	30	200	54	357	78	634
07	115	31	205	55	365	79	649
08	118	32	210	56	374	80	665
09	121	33	215	57	383	81	681
10	124	34	221	58	392	82	698
11	127	35	226	59	402	83	715
12	130	36	232	60	412	84	732
13	133	37	237	61	422	85	750
14	137	38	243	62	432	86	768
15	140	39	249	63	442	87	787
16	143	40	255	64	453	88	806
17	147	41	261	65	464	89	825
18	150	42	267	66	475	90	845
19	154	43	274	67	487	91	866
20	158	44	280	68	499	92	887
21	162	45	287	69	511	93	909
22	165	46	294	70	523	94	931
23	169	47	301	71	536	95	953
24	174	48	309	72	549	96	976

Code	A	B	C	D	E	F	G	H	X	Y	Z
Multiplier	10^0	10^1	10^2	10^3	10^4	10^5	10^6	10^7	10^{-1}	10^{-2}	10^{-3}

■ Revision of curriculum vitae:

serial number	Contents of the modification	Modification Date	Reason for modification	releases	reviewer	auditor
1	Specification content update	2022-08-17	Harmonization of formats	A0 to B 0	YongKang Huang	YiWenLeng
2	Electrical parameters and specification content update	2025-05-25	standardised format	B0 to B1	YongKang Huang	YiWenLeng