香港電阻

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香港柴湾安业街十二号长益工业大厦**10**字楼**A**座

HONG KONG RESISTORS MANUFACTORY

(wholly owned by Hong Kong Resistors Manufactory International Ltd.)

AN ISO 9001:2015 CERTIFIED MANUFACTURER

AN ISO 45001: 2018 MANUFACTURER

AN ISO 14001: 2015 MANUFACTURER

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DATASHEET

Name of Product: Automotive Grade Thin Film Precision Chip Resistor -AAR Series

Sales Executive:_____ Date: 2024/6/13

制造 Prepared by	品质 Quality by	业务 Sales by	核准 Authorized by
客户 customer approval	客户 customer approval	客户 customer approval	客户 customer approval

Spec. No. AAR 2024

Rev. No.: 2024 Jun

Automotive Grade Thin Film Precision Chip Resistor



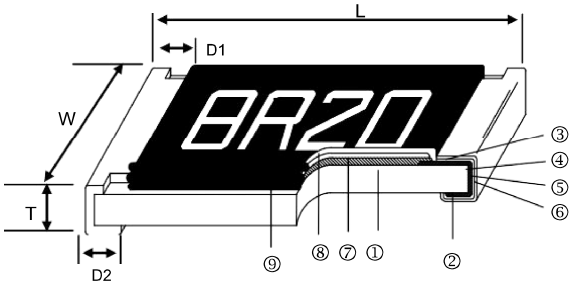
Features

- AEC-Q200 Compliance
- Advanced thin film technology
- RoHS compliant
- Special materials, design, and processing for high sulfur applications
- Test proven immunity to humidity, moisture, and sulfur

Applications

- Automotive
- Medical Equipment
- Testing / Measurement Equipment
- Printer Equipment
- Automatic Equipment Controller
- Converters
- Communication Device, Cell Phone, GPS, PDA

Construction



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

Dimensions

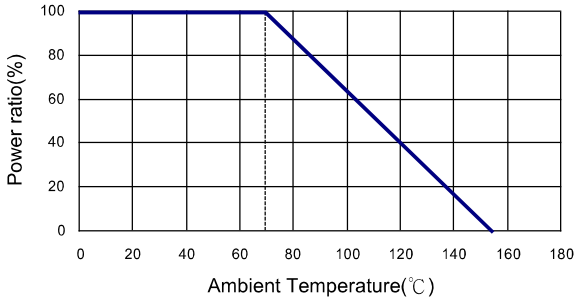
Unit: mm

Type	Size (Inch)	L	W	T	D1	D2
AAR02	0402	1.00±0.05	0.50±0.05	0.30±0.05	0.20±0.10	0.20±0.10
AAR03	0603	1.55±0.10	0.80±0.10	0.45±0.10	0.30±0.20	0.30±0.20
AAR05	0805	2.00±0.15	1.25±0.15	0.55±0.10	0.30±0.20	0.40±0.20
AAR06	1206	3.05±0.15	1.55±0.15	0.55±0.10	0.42±0.20	0.35±0.25
AAR10	1210	3.10±0.15	2.40±0.15	0.55±0.10	0.40±0.20	0.55±0.25
AAR20	2010	4.90±0.15	2.40±0.15	0.55±0.10	0.60±0.30	0.50±0.25
AAR25	2512	6.30±0.15	3.10±0.15	0.55±0.10	0.60±0.30	0.50±0.25

Part Numbering

AAR	06	100R	D	C3	1/8W
Type	Size	Value	Tolerance	TCR	Power
	02 : 0402		T : ±0.01%	C7: ±5PPM	1/16W
	03 : 0603		A : ±0.05%	C6: ±10PPM	1/10W
	05 : 0805		B : ±0.1%	C5: ±15PPM	1/8W
	06 : 1206		C : ±0.25%	C3: ±25PPM	1/5W
	10 : 1210		D : ±0.5%	C2: ±50PPM	2/5W
	20 : 2010		F : ±1%		1/4W
	25 : 2512				1/3W
					1/2W

■ Derating Curve



■ Standard Electrical Specifications

Item / Type	Power Rating at 70°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range					TCR (PPM/°C)
					±0.05%	±0.1%	±0.25%	±0.5%	±1%	
AAR02 (0402)	1/16W	-55 ~ +155°C	50V	100V	10Ω - 12KΩ	10Ω - 221KΩ				±25 ±50
AAR03 (0603)	1/16W	-55 ~ +155°C	50V	100V	10Ω - 49.9KΩ	4.7Ω -680KΩ				±25 ±50
AAR05 (0805)	1/10W	-55 ~ +155°C	100V	200V	10Ω - 100KΩ	4.7Ω –1MΩ				±25 ±50
AAR06 (1206)	1/8W	-55 ~ +155°C	150V	300V	10Ω - 200KΩ	4.7Ω – 1.5MΩ				±25 ±50
AAR10 (1210)	1/4W	-55 ~ +155°C	150V	300V	10Ω - 499KΩ	10Ω - 1MΩ				±25 ±50
AAR20 (2010)										
AAR25 (2512)	1/2W	-55 ~ +155°C	150V	300V	10Ω - 499KΩ	10Ω - 1MΩ				±25 ±50

■ Special Electrical Specifications

Item / Type	Power Rating at 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%	
AAR02 (0402)	1/16W	-55 ~ +155°C	50V	100V	49.9Ω - 12KΩ				-		±5
					49.9Ω - 12KΩ		49.9Ω – 69.8KΩ				±10 ±15
AAR03 (0603)	1/16W	-55 ~ +155°C	50V	100V	24.9Ω - 15KΩ				-		±5
					24.9Ω - 15KΩ	10Ω - 49K9Ω	10Ω - 332KΩ				±10 ±15
AAR05 (0805)	1/10W	-55 ~ +155°C	100V	200V	24.9Ω - 30KΩ				-		±5
					24.9Ω - 30KΩ	10Ω - 100KΩ	10Ω – 1MΩ				±10 ±15
AAR06 (1206)	1/8W	-55 ~ +155°C	150V	300V	24.9Ω - 50KΩ				-		±5
					24.9Ω - 50KΩ-	10Ω - 200KΩ	10Ω - 1MΩ				±10 ±15
AAR10 (1210)	1/ 4W	-55 ~ +155°C	150V	300V	-	10Ω- 499KΩ	10Ω - 1MΩ				±10 ±15
AAR20 (2010)	1/4W	-55 ~ +155°C	150V	300V	-	10Ω - 499KΩ	10Ω - 1MΩ				±10 ±15
AAR25 (2512)	1/2W	-55 ~ +155°C	150V	300V	-	10Ω - 499KΩ	10Ω - 1MΩ				±10 ±15

■ High Power Rating Electrical Specifications

Item / Type	Power Rating at 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%	
AAR02 (0402)	1/10W	-55 ~ +155°C	50V	100V	-	10Ω - 221KΩ					±25 ±50
AAR03 (0603)	1/10W	-55 ~ +155°C	75V	150V	24.9Ω - 15KΩ				-		±5
					24.9Ω - 15KΩ	10Ω - 49.9KΩ	10Ω -332KΩ				±10 ±15
					-		4.7Ω -680KΩ				±25 ±50
	1/8W				-		10Ω -680KΩ				±25 ±50
AAR05 (0805)	1/8W	-55 ~ +155°C	150V	300V	24.9Ω - 30KΩ				-		±5
					24.9Ω - 30KΩ	10Ω -100KΩ	10Ω - 1MΩ				±10 ±15
					-		4.7Ω - 1MΩ				±25 ±50
	1/5W				-		10Ω - 1MΩ				±25 ±50
AAR06 (1206)	1/4W	-55 ~ +155°C	200V	400V	24.9Ω - 50KΩ				-		±5
					24.9Ω - 50KΩ	10Ω - 200KΩ	10Ω - 1MΩ				±10 ±15
					-		4.7Ω – 1.5MΩ				±25 ±50
	2/5W				-		10Ω – 1.5MΩ				±25 ±50
AAR10 (1210)	1/3W	-55 ~ +155°C	200V	400V	-	10Ω - 499KΩ	10Ω - 1MΩ				±10 ±15 ±25 ±50
	1/2W				-		10Ω - 1MΩ				±25 ±50
AAR20 (2010)	1/3W	-55 ~ +155°C	200V	400V	-	10Ω - 499KΩ	10Ω - 1MΩ				±10 ±15 ±25 ±50

Operating Voltage=$\sqrt{}$(P*R) or Max. operating voltage listed above, whichever is lower.
Overload Voltage=2.5*$\sqrt{}$(P*R) or Max. overload voltage listed above, whichever is lower.
■HKR is capable of manufacturing the optional spec based on customer's requirement.

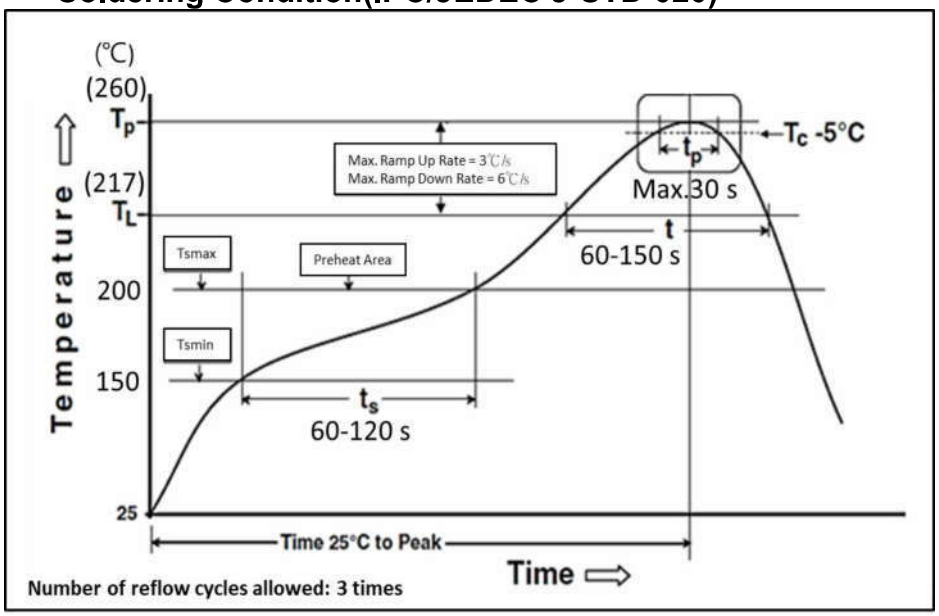
■ Environmental Characteristics

Item	Requirement		Test Method
	Tol. ≦ 0.05%	Tol. > 0.05%	
Temperature Coefficient of Resistance (T.C.R.)	As Spec.		**JIS-C-5201-1 4.8** **IEC-60115-1 4.8** -55°C~+125°C, 25°C is the reference temperature
Short Time Overload	△R±0.05% △R±0.1% (0402 1/10W、0603 1/8W、0805 1/5W、1206 2/5W、1210 1/2W)		**JIS-C-5201-1 4.13** RCWV*2.5 or Max. overload voltage whichever is lower for 5 seconds
Insulation Resistance	>1000 MΩ		**JIS-C-5201-1 4.6** **IEC-60115-1 4.6** Apply 100V_{DC} for 1 minute
Operational Life	ΔR±0.05%	ΔR±0.2%	**MIL-STD-202 Method 108** Condition D Steady State T_A=125°C at derated power. Measurement at 24±4 hours after test conclusion.
	>7kΩ ΔR±0.2%		
	ΔR±0.2% for high power rating		
Biased Humidity	△R±0.1%		**MIL-STD-202 Method 103** 1000 hrs 85°C/85%RH 10% of operating power.
High Temperature Exposure	ΔR±0.2%		**MIL-STD-202 Method 108** at +155°C for 1000 hrs
Temperature Cycling	△R±0.1%		**JESD22 Method JA-104** -55°C to +125°C, 1000 cycles
Bending Strength (Board Flex)	△R±0.1%		**JIS-C-5201-1 4.33** Bending once for 60 seconds Bending displacement: 2010 2512 sizes: 2 mm Other sizes: 3 mm
Solderability	95% min. coverage		**JIS-C-5201-1 4.17** **IEC-60115-1 4.17** 245±5°C for 3 seconds
Resistance to Soldering Heat	△R±0.05%		**JIS-C-5201-1 4.18** **IEC-60115-1 4.18** 260±5°C for 10 seconds
Terminal strength	No broken		**AEC-Q200-006** Force of 1.8kg for 60 seconds.
Mechanical Shock	ΔR±0.05%	ΔR±0.1%	**MIL-STD-202 Method 213** Wave Form: Tolerance for half sine shock pulse. Peak value is 100g's. Normal duration (D) is 6.
Vibration	△R±0.05%	ΔR±0.1%	**MIL-STD-202 Method 204** 5 g's for 20 min., 12 cycles each of 3 orientations, 10-2000 Hz
ESD	ΔR±0.5%		**AEC-Q200-002** Human body model AAR02 0.4KV AAR03 1KV AAR05 1.5KV AAR06 、AAR20、AAR25、AAR10 2KV
Resistance to solvents	Marking Unsmeared		**MIL-STD-202 Method 215** Add Aqueous wash chemical - OKEM Clean or equivalent. Do not use banned solvents.
Sulfur Test	ΔR±1%		**ASTM-B-809-95 Modified** 105±2 °C no power rating for **1000** hrs.
Flammability	No ignition of the tissue paper or scorching or the pinewood board		**UL-94** V-0 or V-1 are acceptable. Electrical test not required.

RCW V(Rated continuous working voltage)= $\sqrt{(P*R)}$ or Max. Operating voltage whichever is lower

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

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



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

■ 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

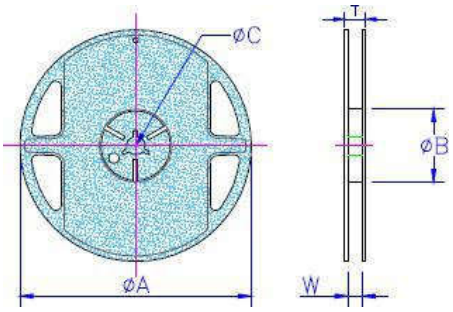
Code	A	B	C	D	E	F	G	H	X	Y	Z
Multiplier	10^0	10^1	10^2	10^3	10^4	10^5	10^6	10^7	10^{-1}	10^{-2}	10^{-3}

■ Packaging

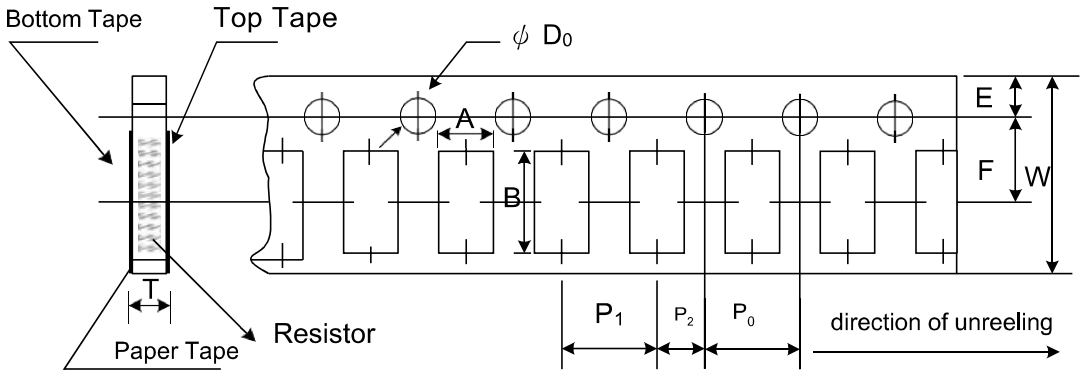
Packing Quantity & Reel Specifications

Unit :mm

Type	Ø A	Ø B	Ø C	W	T	Paper Tape (EA)	Emboss Plastic Tape (EA)
AAR02	178.0±1.0	60.0+1.0	13.5±0.7	9.5±1.0	11.5±1.0	10,000	-
AAR03	178.0±1.0	60.0+1.0	13.5±0.7	9.5±1.0	11.5±1.0	5,000	-
AAR05	178.0±1.0	60.0+1.0	13.5±0.7	9.5±1.0	11.5±1.0	5,000	-
AAR06	178.0±1.0	60.0+1.0	13.5±0.7	9.5±1.0	11.5±1.0	5,000	-
AAR10	178.0±1.0	60.0±1.0	13.5±0.7	9.5±1.0	11.5±1.0	5,000	-
AAR20	178.0±1.0	60.0+1.0	13.5±0.7	13.5±1.0	15.5±1.0	-	4,000
AAR25	178.0±1.0	60.0+1.0	13.5±0.7	13.5±1.0	15.5±1.0	-	4,000



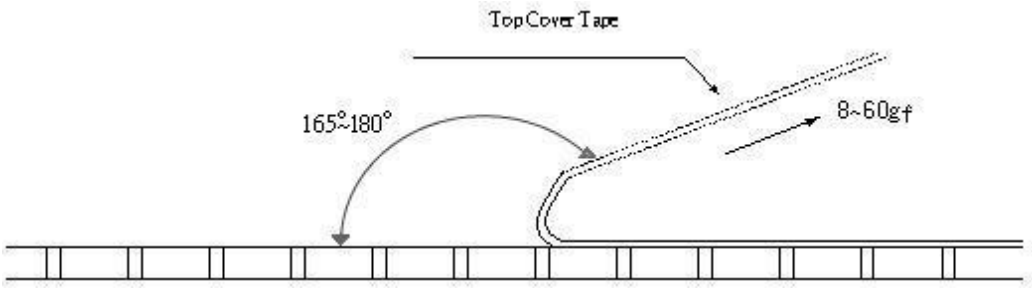
Paper Tape Specifications



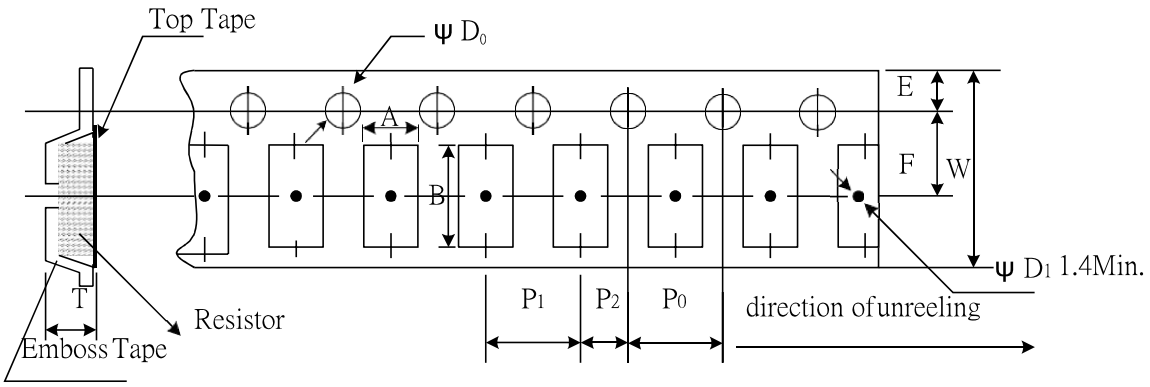
Unit: mm

Type	A	B	W	E	F	P_0	P_1	P_2	ΦD_0	T
AAR02	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
AAR03	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
AAR05	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
AAR06	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
AAR10	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

■ 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



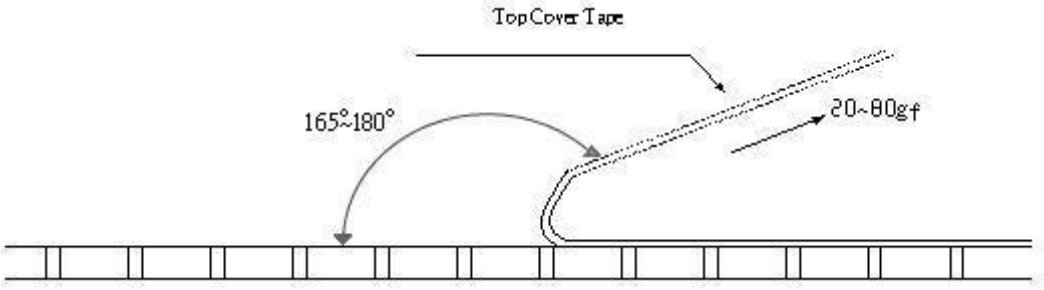
Emboss Plastic Tape Specifications



Unit: mm

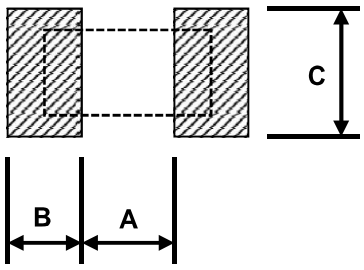
Type	A	B	W	E	F	P_0	P_1	P_2	$ØD_0$	T
AAR20	2.85±0.10	5.45±0.10	12.0±0.10	1.75±0.10	5.5±0.05	4.00±0.05	4.00±0.10	2.00±0.05	1.50+0.10	1.00±0.20
AAR25	3.40±0.10	6.65±0.10	12.0±0.10	1.75±0.10	5.5±0.05	4.00±0.05	4.00±0.10	2.00±0.05	1.50+0.10	1.00±0.20

- 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 20gf to 80gf



■ Recommend Land Pattern

Unit: mm



Type	A	B	C
AAR02	0.50	0.50	0.60±0.2
AAR03	0.80	1.00	0.90±0.2
AAR05	1.00	1.00	1.35±0.2
AAR06	2.00	1.15	1.70±0.2
AAR10	2.00	1.15	2.50±0.2
AAR20	3.60	1.40	2.50±0.2
AAR25	4.90	1.60	3.10±0.2