Data Sheet

Customer：	
Product :	Resistor of Advanced Meter Thin Film Chip Resistor - RAM Series
Size:	0402/0603/0805/1206/1210/2010/2512
Issued Date:	11-Jun-24
Edition :	REV.A4



HONG KONG HELISTO INDUSTRIAL LIMITED
香港海利斯特实业有限公司

SHENZHEN HELISTO TECHNOLOGYCOLTD
深圳市海利斯特科技有限公司

ADD:5/F., A Block, Hongdu Industrial Park, Fanshen Road, 45 Area, Baoan, Shenzhen, China
TEL:+86-755-29741555 29749555
FAX:+86-755-29742111
E-mail:donnyhai@helisto.com
www.Helisto.com

Produced by (QC)	Checked (QC)	Approved by (QC)	Prepared by (Sales)	Accepted by (Customer)
11-Jun-24	11-Jun-24	11-Jun-24	11-Jun-24	
Chun	***Ben Chang***	***Ben Chang***		

Resistor of Advanced Meter Thin Film Chip Resistor (RAM Series)



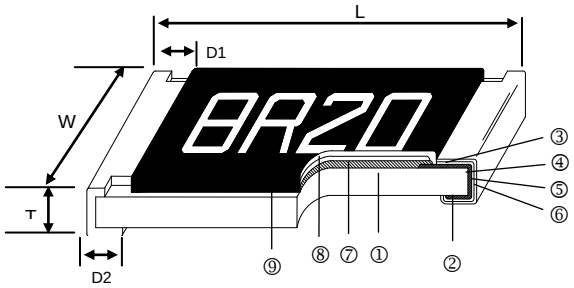
Features

- Q/GDW 11179.3 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

- Smart meter
- Testing / Measurement Equipment
- Advanced metering infrastructure

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

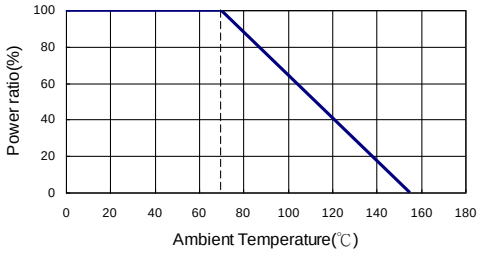
Type	Size (Inch)	L	W	T	D1	D2	Weight (g) (1000pcs)
RAM02	0402	1.00±0.05	0.50±0.05	0.30±0.05	0.20±0.10	0.30±0.10	0.54
RAM03	0603	1.55±0.10	0.80±0.10	0.45±0.10	0.30±0.20	0.45±0.20	1.83
RAM05	0805	2.00±0.15	1.25±0.15	0.55±0.10	0.30±0.20	0.55±0.20	4.71
RAM06	1206	3.05±0.15	1.55±0.15	0.55±0.10	0.42±0.20	0.50±0.25	9.02
RAM13	1210	3.10±0.15	2.40±0.15	0.55±0.10	0.40±0.20	0.60±0.25	10
RAM10	2010	4.90±0.15	2.40±0.15	0.55±0.10	0.60±0.30	0.65±0.25	23.61
RAM12	2512	6.30±0.15	3.10±0.15	0.55±0.10	0.60±0.30	0.65±0.25	38.06

Part Numbering

RAM	03	B	T	C	X	1001	
Product Type	Dimensions (L×W)	Resistance Tolerance	Packaging Code	TCR (PPM/°C)	Power Rating	Resistance	Marking Code
	02: 0402 03: 0603 05: 0805 06: 1206 13: 1210 10: 2010 12: 2512	B: ±0.1% C: ±0.25% D: ±0.5% F: ±1%	T: Taping Reel B: Bulk	B: ±10 N: ±15 C: ±25 D: ±50	: Standard* (See Remark) Y: 1/16W X: 1/10W W: 1/8W M: 1/6W V: 1/4W O: 1/3W U: 1/2W	0010: 1Ω 4R70: 4.7Ω 1001: 1KΩ 1004: 1MΩ	: Standard Marking for E96 / E24 N: No Marking

*Remark: Standard part no need for power rating code.

■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)
					±0.1%	±0.25%	±0.5%	±1%	
RAM02 (0402)	1/16W	-55 ~ +155°C	25V	50V	1Ω~100KΩ				±25,±50
RAM03 (0603)	1/16W	-55 ~ +155°C	50V	100V	1Ω~332KΩ				±25,±50
RAM05 (0805)	1/10W	-55 ~ +155°C	100V	200V	1Ω~1MΩ				±25,±50
RAM06 (1206)	1/8W	-55 ~ +155°C	150V	300V	1Ω~1MΩ				±25,±50
RAM13 (1210)	1/4W								
RAM10 (2010)	1/4W	-55 ~ +155°C	150V	300V	1Ω~1MΩ				±25,±50
RAM12 (2512)	1/2W								

■Special Electrical Specifications

Item / Type	Power Rating at 70°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range				TCR (PPM/°C)
					±0.1%	±0.25%	±0.5%	±1%	
RAM05 (0805)	1/10W	-55 ~ +155°C	100V	200V	4.7Ω– 15KΩ				±10,±15
RAM06 (1206)	1/8W	-55 ~ +155°C	150V	300V	4.7Ω- 20KΩ				±10,±15
RAM13 (1210)	1/4W	-55 ~ +155°C	150V	300V	4.7Ω- 20KΩ				±10,±15
RAM10 (2010)	1/4W	-55 ~ +155°C	150V	300V	4.7Ω- 20KΩ				±10,±15
RAM12 (2512)	1/2W	-55 ~ +155°C	150V	300V	4.7Ω- 20KΩ				±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)
					±0.1%	±0.25%	±0.5%	±1%	
RAM03 (0603)	1/10W	-55 ~ +155°C	75V	150V	1Ω~100KΩ				±25,±50
RAM05 (0805)	1/8W	-55 ~ +155°C	150V	300V	4.7Ω– 15KΩ				±10,±15
					1Ω~1MΩ				±25,±50
RAM06 (1206)	1/4W	-55 ~ +155°C	200V	400V	4.7Ω– 20KΩ				±10,±15
					1Ω~1MΩ				±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.
■Viking is capable of manufacturing the optional spec based on customer's requirement.

■Environmental Characteristics

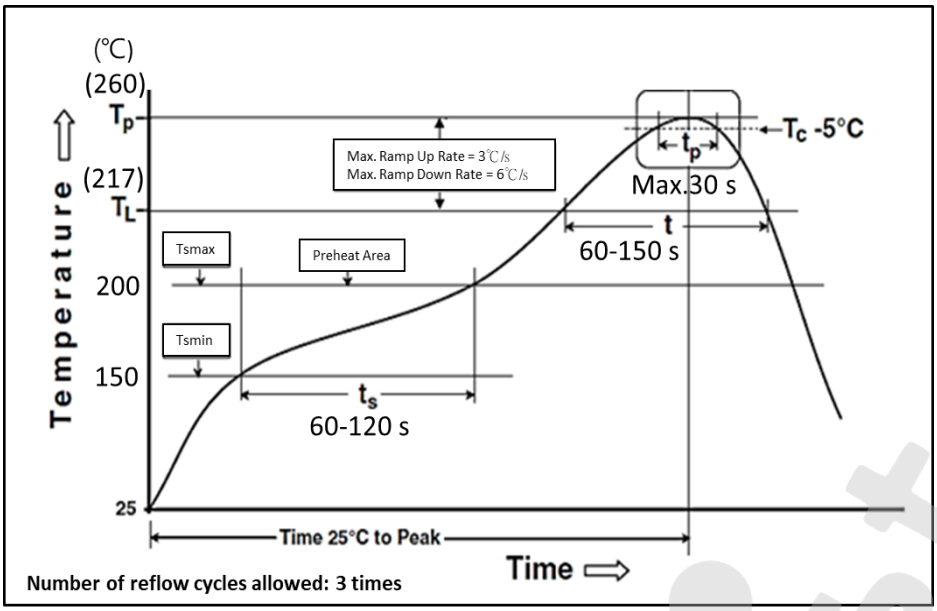
Item	Range	Requirement	Test Method
Temperature Coefficient of Resistance (T.C.R.)	As TCR Spec.		**MIL-STD-202 Method 304** **GB/T 5729-4.8** +25/-55/+25/+125/+25°C
Short Time Overload	ΔR ± 0.2%		**JIS-C-5201-1 4.13** **Q/GDW 11179.3-7.2.3** RCWV*2.5 or Max. overload voltage whichever is lower for 5 seconds Measurement at 0.5 hours after test conclusion."
Endurance	ΔR ± 0.2%		**MIL-STD-202 Method 108** **GB/T 5729-4.25.1** 70±2°C, RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hrs "OFF Measurement at 2 hours after test conclusion."
Biased Humidity	96 hrs	ΔR±0.2%	**Q/GDW 11179.3-7.5.4** **GB/T 5729-4.24** **MIL-STD-202 Method 103** 96 hrs 85°C/85%RH 10% of operating power. 96 hrs 85°C/85%RH No operating power. 1000 hrs 85°C/85%RH 10% of operating power. Measurement at 4 hours after test conclusion.
	1000 hrs	ΔR±0.5%	
Solderability	95% min. coverage		**Q/GDW 11179.3-7.4.1** **MIL-STD-202 Method 208** Solder bath method; 245± 3°C for 5 seconds
Resistance to Soldering Heat	ΔR±0.1%		**Q/GDW 11179.3-7.4.2** **GB/T 2423.28-5.4** 260 ± 5°C for 5±1 seconds
High Temperature Exposure	96 hrs	ΔR±0.1%	**Q/GDW 11179.3-7.5.1** **GB/T 5729-4.23.2** **MIL-STD-202 Method 108** at +155°C Measurement at 4 hours after test conclusion.
	1000 hrs	ΔR±0.3%	
Thermal Shock	ΔR±0.5%		**Q/GDW 11179.3-7.5.3** -40℃ 30min , 85℃ 30min, Temperature Change Time 2~3 min, 1 Cycle, Total 5 Cycles. Measurement at 16 hours after test conclusion.
Low Temperature Operation	ΔR±0.2%		**Q/GDW 11179.3- 7.5.5** 1 hour, -45°C, followed by 45 minutes of RCWV 1 hour, -65°C, followed by 45 minutes of RCWV Measurement at 24 hours after test conclusion
Low Temperature Exposure	ΔR±0.5%		**Q/GDW 11179.3-7.5.2** **GB/T 5729- 4.23.4** at -55°C for 96 hrs Measurement at 4 hours after test conclusion
Single pulse high voltage overload	ΔR±0.5%		**Q/GDW 11179.3- 8** **GB/T 5729-2003 4.27** **Class C:10*** RCWV or 5*Max. Operating voltage whichever is lower
Vibration	ΔR±0.5%		**Q/GDW 11179.3- 7.3.2** **GB/T 17215.211- 5.2.2.3** Vibration Frequency Range : 10Hz-150Hz crossover frequency: 60Hz f＜60Hz，uniform amplitude: 0.075mm f＞60Hz，Constant acceleration: 9.8m/ s²（1g） Scanning cycles for every axis: 10 Note: 10 Scanning cycles-75min.
Sulfur Test	ΔR±1%		**ASTM-B-809-95 Modified** 105±2 °C no power rating for **1000** hrs.

RCWV(Rated continuous working voltage)= √(P*R) or Max. Operating voltage whichever is lower

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

■ **Shelf Life: 2 years from production date.**

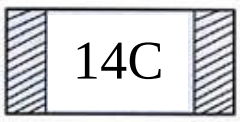
■Soldering Condition(IPC/JEDEC J-STD-020)



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

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}

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

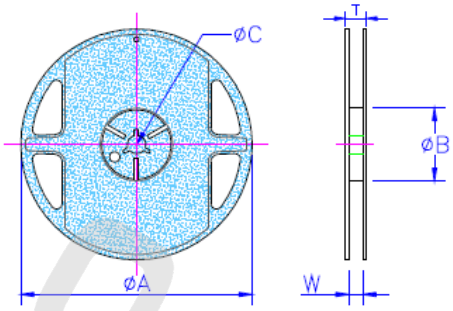
Resistance	100Ω	2.2KΩ	10KΩ	49.9KΩ	100KΩ
marking	1000	2201	1002	4992	1003

■Packaging

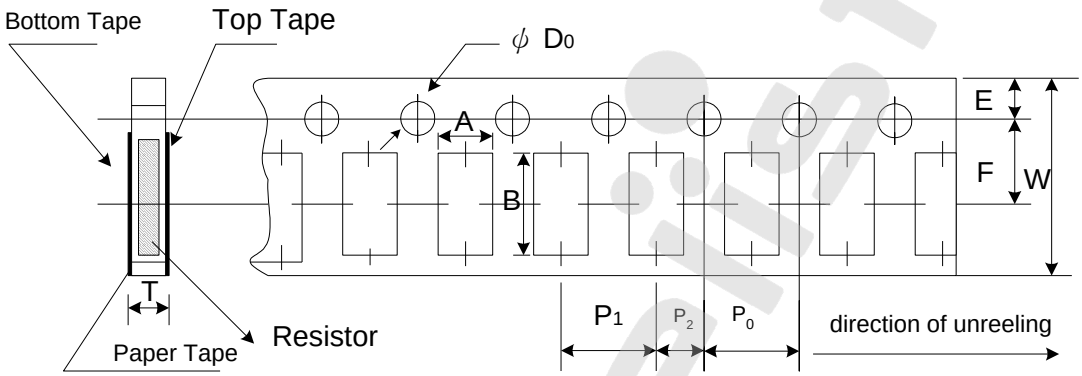
Packing Quantity & Reel Specifications

Unit :mm

Type	ØA	ØB	ØC	W	T	Paper Tape (EA)	Emboss Plastic Tape (EA)
RAM02	178.0±1.0	60.0+1.0	13.5±0.7	9.5±1.0	11.5±1.0	10,000	-
RAM03	178.0±1.0	60.0+1.0	13.5±0.7	9.5±1.0	11.5±1.0	5,000	-
RAM05	178.0±1.0	60.0+1.0	13.5±0.7	9.5±1.0	11.5±1.0	5,000	-
RAM06	178.0±1.0	60.0+1.0	13.5±0.7	9.5±1.0	11.5±1.0	5,000	-
RAM13	178.0±1.0	60.0±1.0	13.5±0.7	9.5±1.0	11.5±1.0	5,000	-
RAM10	178.0±1.0	60.0+1.0	13.5±0.7	13.5±1.0	15.5±1.0	-	4,000
RAM12	178.0±1.0	60.0+1.0	13.5±0.7	13.5±1.0	15.5±1.0	-	4,000



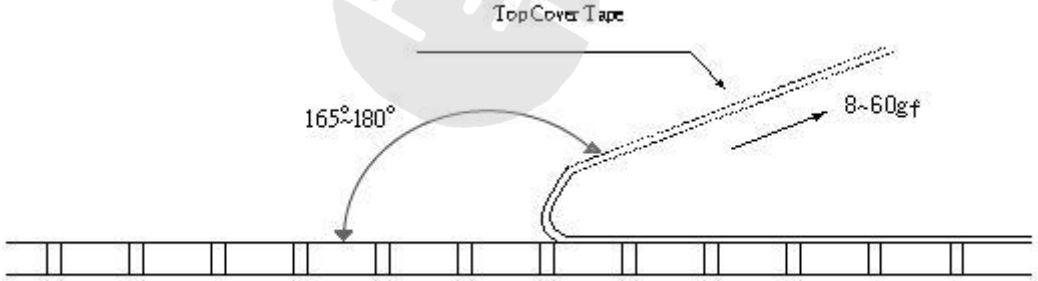
Paper Tape Specifications



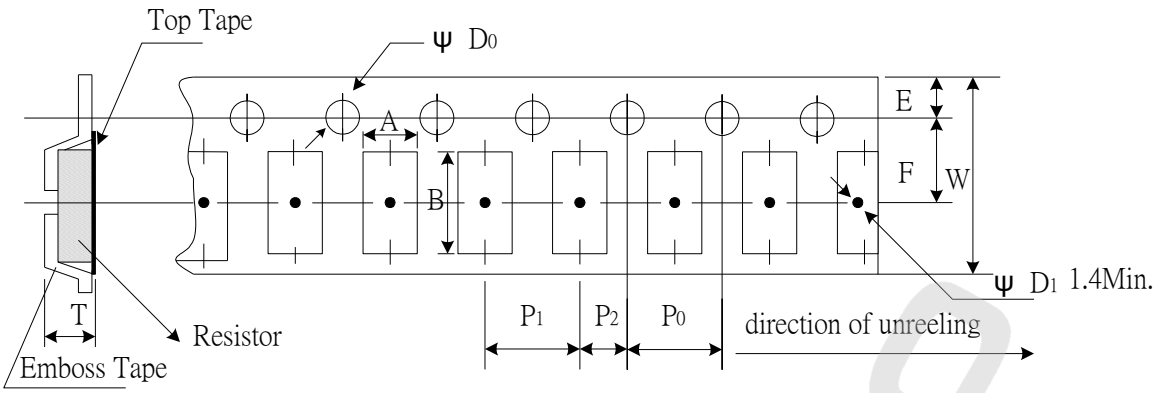
Unit: mm

Type	A	B	W	E	F	P_0	P_1	P_2	ΦD_0	T
RAM02	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
RAM03	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
RAM05	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
RAM06	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
RAM13	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



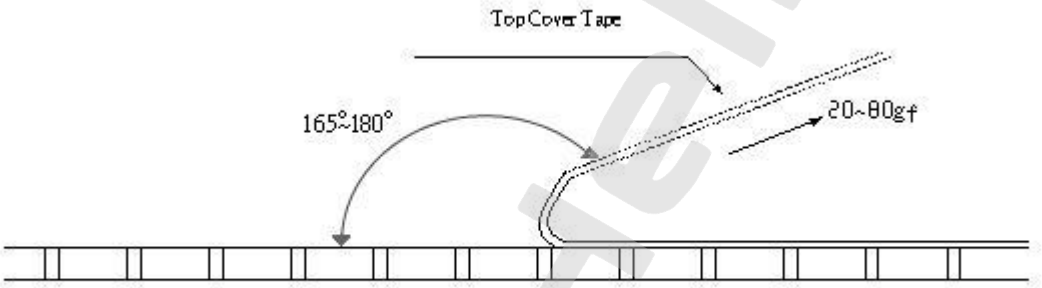
Emboss Plastic Tape Specifications



Unit: mm

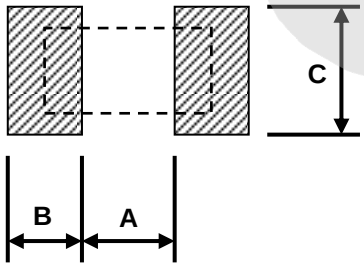
Type	A	B	W	E	F	P_0	P_1	P_2	$ØD_0$	T
RAM10	2.85±0.10	5.45±0.10	12.0±0.10	1.75±0.10	5.5±0.05	4.00±0.05	4.00±0.10	2.00±0.05	1.50+0.10	1.00±0.20
RAM12	3.40±0.10	6.65±0.10	12.0±0.10	1.75±0.10	5.5±0.05	4.00±0.05	4.00±0.10	2.00±0.05	1.50+0.10	1.00±0.20

- 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
RAM02	0.50	0.50	0.60±0.2
RAM03	0.80	1.00	0.90±0.2
RAM05	1.00	1.00	1.35±0.2
RAM06	2.00	1.15	1.70±0.2
RAM13	2.00	1.15	2.50±0.2
RAM10	3.60	1.40	2.50±0.2
RAM12	4.90	1.60	3.10±0.2