Data Sheet

Customer:	
Product:	Automotive Grade High Voltage Low VCR Thick Film Chip Resistor - HVRC Series
Size:	1206/2010/2512
Issued Date:	15-Oct-24
Edition:	REV.A7

RoHS Compliant

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15-Oct-24	15-Oct-24	15-Oct-24		
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Automotive Grade High Voltage Low VCR Thick Film Chip Resistor



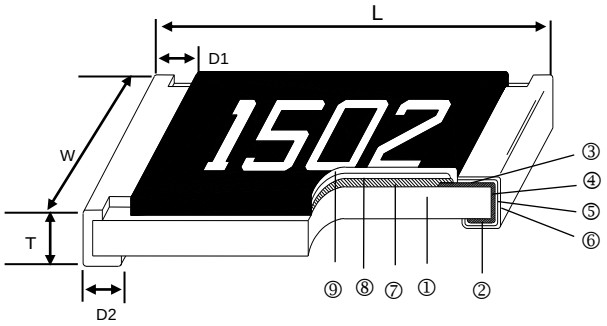
Scope

– This specification applies to all sizes of rectangular-type fixed chip resistors with Ruthenium-base as material.

Features

– Highly reliable multilayer electrode construction
– Higher component and equipment reliability
– Excellent performance at high voltage
– Reduced size of final equipment
– Low VCR
– AEC-Q200 Qualified
– IEC 62368-1:2018 Safety Certificate issued by UL Demko
– Excellent sulfur resistance against sulfur containing atmosphere

Construction



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

Applications

– Inverter
– Outdoor Equipments
– Converter
– High Pulse Equipment
– Automotive Industry

Dimensions

Type	Size (Inch)	L (mm)	W (mm)	T (mm)	D1 (mm)	D2 (mm)	Weight (g) (1000pcs)
HVRC06	1206	3.10±0.10	1.55±0.10	0.55±0.10	0.50±0.25	0.50±0.20	8.9
HVRC0A	2010	5.00±0.10	2.50±0.15	0.55±0.10	0.60±0.25	0.50±0.20	24.7
HVRC12	2512	6.35±0.10	3.10±0.15	0.55±0.10	0.60±0.25	0.50±0.20	39.8

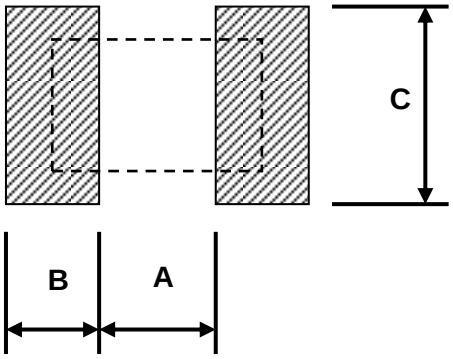
IEC 62368-1:2018

	HVRC06	HVRC0A	HVRC12
G.10.3 (2.5KV impulse test)	100K~470M	51K~470M	30K~470M
G.10.4 (10KV Voltage surge test)			
G.10.5 (5KV Impulse test)			
G.10.6 (396Vac Overload test)	100K~470M	100K~470M	100K~470M

■Part Numbering

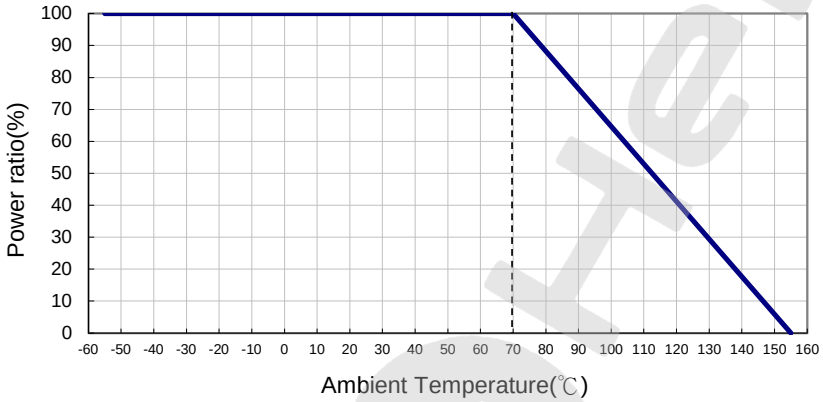
HVRC	06	F	T	E	O	1004
Product Type	Dimensions	Resistance Tolerance	Packaging Code	TCR (PPM/℃)	Power Rating	Resistance
	06: 1206 0A: 2010 12: 2512	D: ±0.5% F: ±1% J: ±5%	T: 7"Taping Reel V:10"Taping Reel W:13"Taping Reel	E: ±100	O: 1/3W U: 1/2W Q: 3/4W T: 1W	1004: 1MΩ 1005: 10MΩ 1006: 100MΩ

■Recommend Land Pattern

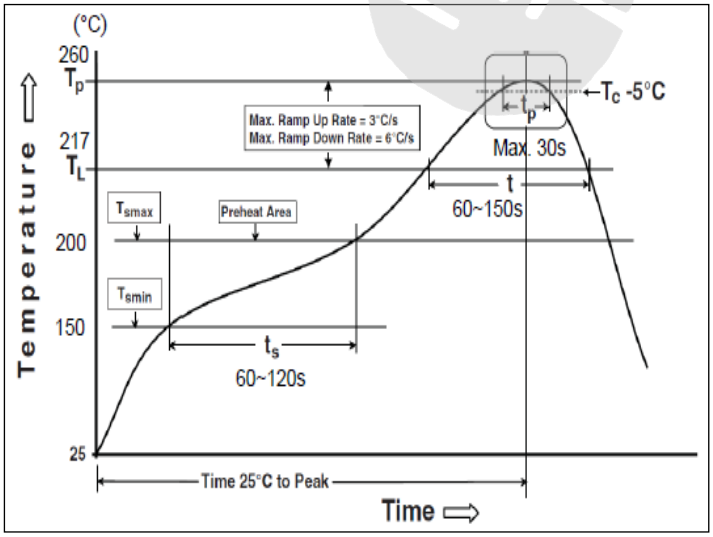


Type	A (mm)	B (mm)	C (mm)
HVRC06	2.00	0.90	1.60
HVRC0A	3.80	0.90	2.80
HVRC12	4.90	1.60	3.50

■Derating Curve



■Soldering Condition (Ref. IPC/JEDEC J-STD-020 & J-STD-002)



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 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.

■Standard Electrical Specifications

Item / Type	Power Rating at 70℃	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range			TCR (PPM/℃)	VCR (PPM/V)
					±0.5% (E24、E96)	±1% (E24、E96)	±5% (E24)		
HVRC06 (1206)	1/3W	-55 ~ +155°C	1000V	1500V	100KΩ - 1MΩ	100KΩ - 10MΩ	100KΩ-500MΩ	±100	<25
HVRC0A (2010)	1/2W		2000V	3000V	51KΩ- 1MΩ	51KΩ- 20MΩ	51KΩ - 500MΩ	±100	
	3/4W								
HVRC12 (2512)	1W		3000V	4000V	30KΩ - 1MΩ	30KΩ - 20MΩ	30KΩ - 500MΩ	±100	

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	Requirement		Test Method
	±1% and Below	±5%	
Temperature Coefficient of Resistance (T.C.R.)	As Spec.		**JIS-C-5201-1 4.8** **IEC-60115-1 4.8** At 25°C/-55°C and 25°C/+125°C, 25°C is the reference temperature
Voltage Coefficient (VCR)	As Spec.		**IEC-60115-1 4.11** measured at 10 % and at 100 % of either the rated voltage or the limiting element voltage, whichever is the smaller
Short Time Overload	±(1.0%+0.05Ω)	±(1.0%+0.05Ω)	**JIS-C-5201-1 4.13** **IEC-60115-1 4.13** RCWV*2.5 or Max. Overload Voltage whichever is lower for 5 seconds
Insulation Resistance	≥10G		**JIS-C-5201-1 4.6** **IEC-60115-1 4.6** Max. Overload Voltage for 1 minute
Endurance	±(1.0%+0.10Ω)	±(2.0%+0.10Ω)	**JIS-C-5201-1 4.25** **IEC-60115-1 4.25.1** 70±2°C, RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"
Biased Humidity	±(1.0%+0.10Ω)	±(3.0%+0.10Ω)	**MIL-STD-202 Method 103** 1000 hrs 85°C/85%RH 10% of operating power (≦100 V)
High Temperature Exposure	±(1.0%+0.05Ω)	±(1.0%+0.05Ω)	**MIL-STD-202 Method 108** at +155°C for 1000 hrs
Board Flex	±(1.0%+0.05Ω)	±(1.0%+0.05Ω)	**AEC-Q200-005** Bending once for 60 seconds 1206 size: 3mm 2010, 2512 sizes: 2mm
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	±(0.5%+0.05Ω)	±(1.0%+0.05Ω)	**JIS-C-5201-1 4.18** **IEC-60115-1 4.18** 260±5°C for 10 seconds

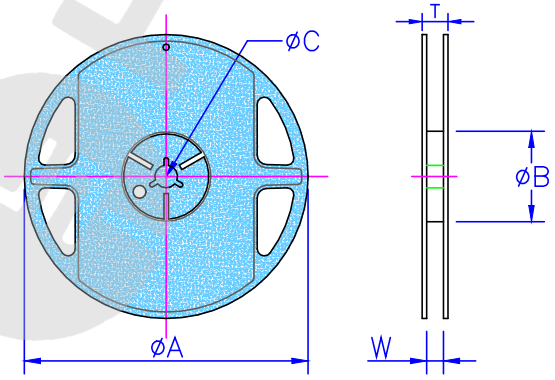
Item	Requirement		Test Method
	±1% and Below	±5%	
Voltage Proof	No breakdown or flashover		**JIS-C-5201-1 4.7** **IEC-60115-1 4.7** HVRC06/HVRC0A/HVRC12: 500V for 1 minute
Leaching	Individual leaching area ≦5% Total leaching area ≦ 10%		**JIS-C-5201-1 4.18** **IEC-60068-2-58 8.2.1** 260±5°C for 30 seconds
Temperature Cycling	±(1.0%+0.05Ω)		**JESD22 Method JA-104** -55°C to +125°C, 1000 cycles
Mechanical Shock	±(1.0%+0.05Ω)		**MIL-STD-202 Method 213** Wave Form: Tolerance for half sine shock pulse. Peak value is 100g's. Normal duration (D) is 6.
Vibration	±(1.0%+0.05Ω)		**MIL-STD-202 Method 204** 5 g's for 20 min., 12 cycles each of 3 orientations, 10-2000 Hz
ESD	±(3%+0.05Ω)		**AEC-Q200-002** Human body model 2KV
Resistance to Solvents	No visible damage on appearance and marking.		**MIL-STD-202 Method 215** Add Aqueous wash chemical - OKEM Clean or equivalent. Do not use banned solvents.
Terminal Strength	No broken		**AEC-Q200-006** Force of 1.8kg for 60 seconds.
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.
Sulfur Test	△R±1%		**EIA-977 (Condition A)** 60±2°C, no power rating for 500 hrs.

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.**

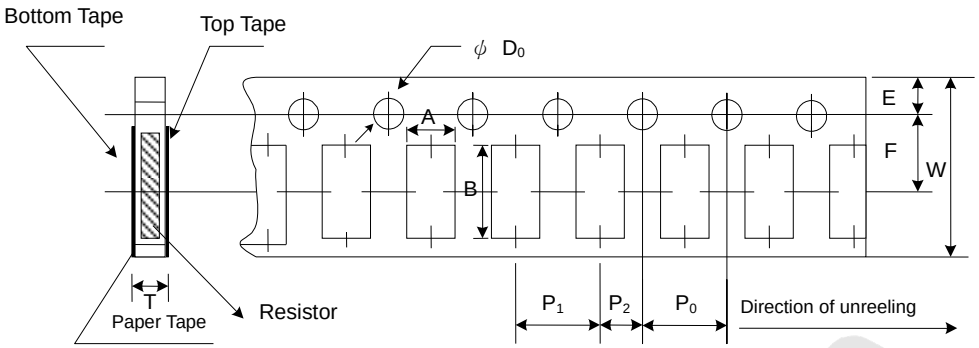
■Packaging

Reel Specifications & Packaging Quantity



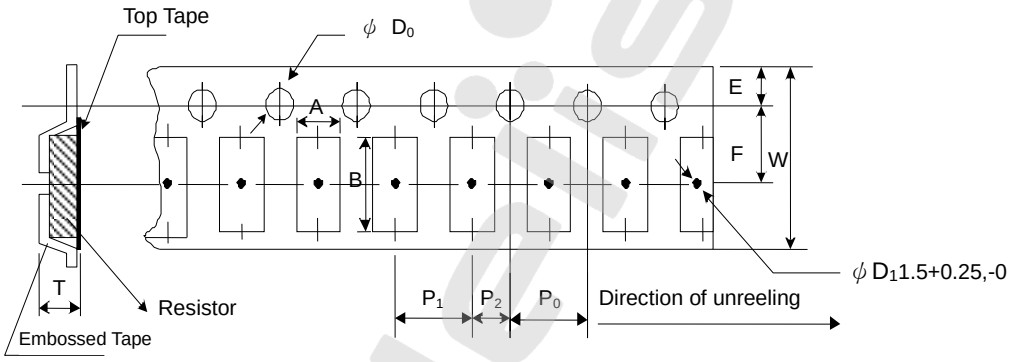
Type	Packaging Quantity		Tape Width	Reel Diameter	ΦA (mm)	ΦB (mm)	ΦC (mm)	W (mm)	T (mm)
HVRC06	Paper	5K	8mm	7 inch	178.5±1.5	$60^{+1/-0}$	13.0±0.2	9.0±0.5	12.5±0.5
		10K	8mm	10 inch	254±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
		20K	8mm	13 inch	330±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
HVRC0A HVRC12	Embossed	4K	12mm	7 inch	178.5±1.5	$60^{+1/-0}$	13.0±0.5	13.0±0.5	15.5±0.5
		8K	12mm	10 inch	250±1.0	62±0.5	13.0±0.5	12.5±0.5	16.5±0.5

Paper Tape Specifications



Type	A (mm)	B (mm)	W (mm)	E (mm)	F (mm)	P_0 (mm)	P_1 (mm)	P_2 (mm)	ΦD_0 (mm)	T (mm)
HVRC06	1.90±0.10	3.50±0.20	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10

Embossed Plastic Tape Specifications



Type	A (mm)	B (mm)	W (mm)	E (mm)	F (mm)	P_0 (mm)	P_1 (mm)	P_2 (mm)	ΦD_0 (mm)	T (mm)
HVRC0A	2.80±0.10	5.40±0.20	12.0±0.30	1.75±0.10	5.5±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.50+0.1, -0	1.2^{+0}
HVRC12	3.50±0.10	6.70±0.10	12.0±0.30	1.75±0.10	5.5±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.50+0.1, -0	1.2^{+0}

■Marking

1% for 1206/2010/2512: 4 digits marking

Example:

Resistance	1MΩ	4.99MΩ	10MΩ
Marking	1004	4994	1005

5% for 1206/2010/2512: 3 digits marking in E24

Example: 124=120KΩ 106=10MΩ (1^{st} and 2^{nd} are E24 code and 3^{rd} code is multiplier)

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

REVISION HISTORY

REVISION	DATE	CHANGE NOTIFICATION	DESCRIPTION
Version A	Nov 8, 2021	-	- Develop a new specification
Version A1	Dec 21, 2021	-	- Features newly added AEC-Q200 Compliance - Features added UL Certification - Added 0.5% resistance value specification range
Version A2	Feb 15, 2022	-	- Derating Curve changes the temperature range
Version A3	Mar 01, 2022	-	- Upgrade to Automotive Grade
Version A4	Jun 15, 2022	-	- Modify Soldering Condition
Version A5	Sep 28, 2023	-	- Add Sulfur Test
Version A6	Jul 08, 2024	-	- Modify the descriptions in the Features
Version A7	Oct 15, 2024	-	-- Increase HVRC2010 3/4W