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# SPECIFICATIONS

High Voltage Thick Film Chip Resistor

**HVR-Serie**

Version February 2022

**High Voltage Thick Film Chip Resistor**



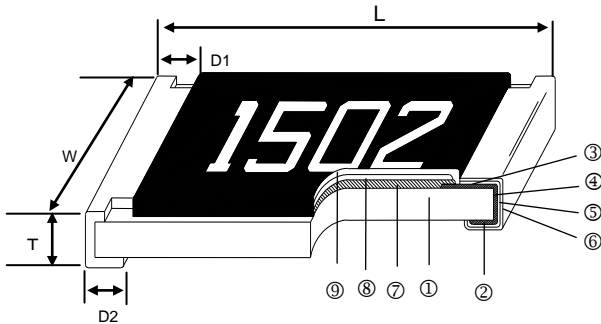
**Scope**

- 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
- IEC 62368-1 & IEC 60950-1 Safety Certificate issued by UL Demko

**Construction**



**Applications**

- Inverter
- Outdoor Equipments
- Converter
- High Pulse Equipment

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

**Dimensions**

Type	Size (Inch)	L (mm)	W (mm)	T (mm)	D1 (mm)	D2 (mm)	Weight (g) (1000pcs)
HVR02	0402	1.00±0.05	0.50±0.05	0.35±0.05	0.20±0.10	0.20±0.10	0.620
HVR03	0603	1.60±0.10	0.80±0.10	0.45±0.10	0.30±0.20	0.30±0.20	2.042
HVR05	0805	2.00±0.10	1.25±0.10	0.50±0.10	0.35±0.20	0.40±0.20	4.368
HVR06	1206	3.10±0.10	1.55±0.10	0.55±0.10	0.50±0.25	0.50±0.20	8.947
HVR0A	2010	5.00±0.10	2.50±0.15	0.55±0.10	0.60±0.25	0.50±0.20	24.241
HVR12	2512	6.35±0.10	3.10±0.15	0.55±0.10	0.60±0.25	0.50±0.20	39.448

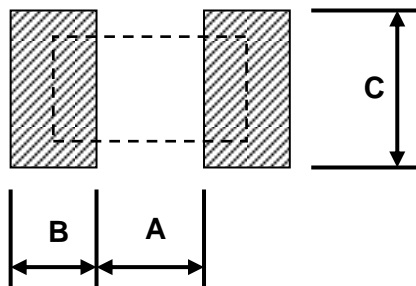
**IEC 62368-1 & IEC 60950-1 Safety Certificate Scope**

	HVR02	HVR03	HVR05	HVR06	HVR0A	HVR12
G.10.2 (2.5KV impulse test)	10M~100M	10M~100M	100K~100M	470K~100M	51K~100M	30K~100M
G.10.3.2 (10KV surge)			10M~100M			
G.10.3.3 (5KV impulse)			100K~100M			

**Part Numbering**

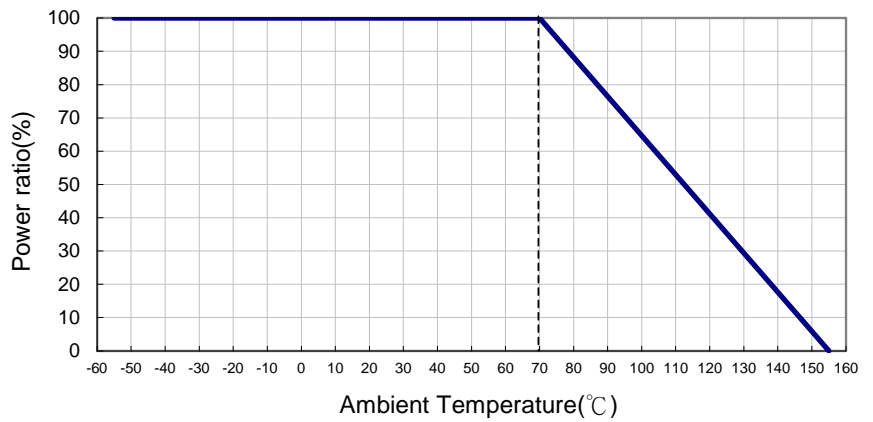
HVR	03	F	T	E	X	1003
Product Type	Dimensions	Resistance Tolerance	Packaging Code	TCR (PPM/°C)	Power Rating	Resistance
	02: 0402 03: 0603 05: 0805 06: 1206 0A: 2010 12: 2512	F: ±1% J: ±5%	T: 7" Taping Reel V: 10" Taping Reel W: 13" Taping Reel	E: ±100 F: ±200 H: ±400	Y: 1/16W X: 1/10W W: 1/8W V: 1/4W U: 1/2W T: 1W	1003: 100KΩ 1004: 1MΩ 1005: 10MΩ

**Recommend Land Pattern**

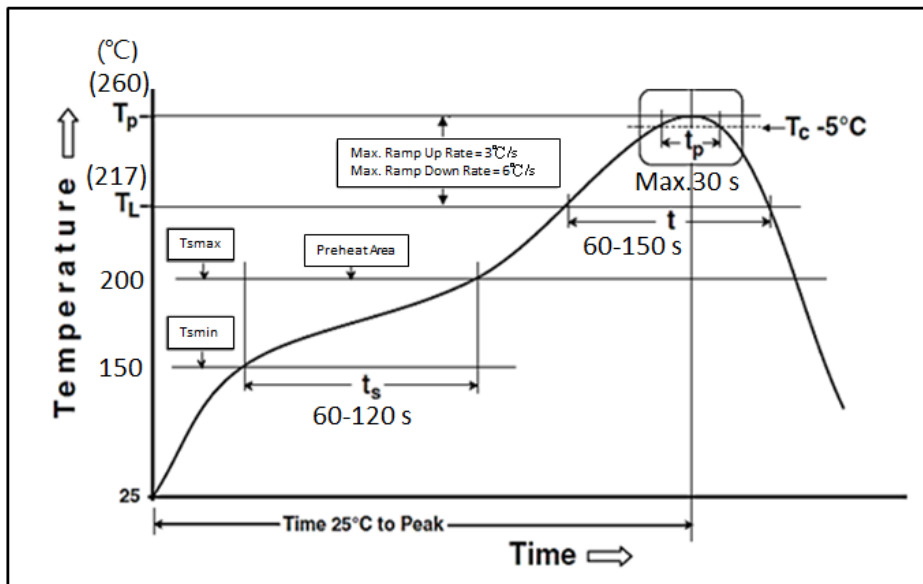


Type	A (mm)	B (mm)	C (mm)
HVR02	0.50	0.45	0.60
HVR03	0.90	0.60	0.90
HVR05	1.20	0.70	1.30
HVR06	2.00	0.90	1.60
HVR0A	3.80	0.90	2.80
HVR12	4.90	1.60	3.50

**Derating Curve**



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



**■ Standard Electrical Specifications**

Type	Item	Power Rating at 70°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range		TCR (PPM/°C)
						±1%(E24、E96)	±5%(E24)	
HVR02 (0402)	1/16W		-55 ~ +155°C	100V	200V	39KΩ - 1MΩ		±100
						1.02MΩ - 10MΩ	1.1MΩ - 20MΩ	±200
						-	22MΩ - 100MΩ	±400
HVR03 (0603)	1/10W			200V	400V	56KΩ - 1MΩ		±100
						1.02MΩ - 10MΩ	1.1MΩ - 20MΩ	±200
						-	22MΩ - 100MΩ	±400
HVR05 (0805)	1/8W			400V	800V	100KΩ - 1MΩ		±100
						1.02MΩ - 10MΩ	1.1MΩ - 20MΩ	±200
						-	22MΩ - 100MΩ	±400
HVR06 (1206)	1/4W			500V	1000V	100KΩ - 1MΩ		±100
						1.02MΩ - 10MΩ	1.1MΩ - 20MΩ	±200
						-	22MΩ - 100MΩ	±400
HVR0A (2010)	1/2W		2000V	3000V	51KΩ - 1MΩ		±100	
					1.02MΩ - 20MΩ	1.1MΩ - 20MΩ	±200	
					-	22MΩ - 100MΩ	±400	
HVR12 (2512)	1W		3000V	4000V	30KΩ - 1MΩ		±100	
					1.02MΩ - 20MΩ	1.1MΩ - 20MΩ	±200	
					-	22MΩ - 100MΩ	±400	

Operating Voltage= $\sqrt{P \cdot R}$  or Max. Operating Voltage listed above, whichever is lower.

Overload Voltage= $2.5 \cdot \sqrt{P \cdot R}$  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%	±5%	
Temperature Coefficient of Resistance (T.C.R.)	As Spec.		<b>JIS-C-5201-1 4.8</b> <b>IEC-60115-1 4.8</b> At 25°C/-55°C and 25°C/+125°C, 25°C is the reference temperature
Short Time Overload	±(1.0%+0.05Ω)	±(2.0%+0.05Ω)	<b>JIS-C-5201-1 4.13</b> <b>IEC-60115-1 4.13</b> RCWV*2.5 or Max. Overload Voltage whichever is lower for 5 seconds
Insulation Resistance	≥10G		<b>JIS-C-5201-1 4.6</b> <b>IEC-60115-1 4.6</b> Max. Overload Voltage for 1 minute
Endurance	±(2.0%+0.10Ω)	±(3.0%+0.10Ω)	<b>JIS-C-5201-1 4.25</b> <b>IEC-60115-1 4.25.1</b> 70±2°C, RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"
Damp Heat with Load	±(2.0%+0.10Ω)	±(3.0%+0.10Ω)	<b>JIS-C-5201-1 4.24</b> <b>IEC-60115-1 4.24</b> 40±2°C, 90~95% R.H., RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"
Dry Heat	±(1.0%+0.05Ω)	±(1.5%+0.10Ω)	<b>JIS-C-5201-1 4.23</b> <b>IEC-60115-1 4.23.2</b> at +155°C for 1000 hrs
Bending Strength	±(1.0%+0.05Ω)	±(1.0%+0.05Ω)	<b>JIS-C-5201-1 4.33</b> <b>IEC-60115-1 4.33</b> Bending once for 60 seconds 2010, 2512 sizes: 2mm Other sizes: 3mm
Solderability	95% min. coverage		<b>JIS-C-5201-1 4.17</b> <b>IEC-60115-1 4.17</b> 245±5°C for 3 seconds
Resistance to Soldering Heat	±(0.5%+0.05Ω)	±(1.0%+0.05Ω)	<b>JIS-C-5201-1 4.18</b> <b>IEC-60115-1 4.18</b> 260±5°C for 10 seconds
Voltage Proof	No breakdown or flashover		<b>JIS-C-5201-1 4.7</b> <b>IEC-60115-1 4.7</b> HVR02: 150V for 1 minute HVR03: 300V for 1 minute HVR05/HVR06/HVR0A/HVR12: 500V for 1 minute
Leaching	Individual leaching area ≤ 5% Total leaching area ≤ 10%		<b>JIS-C-5201-1 4.18</b> <b>IEC-60068-2-58 8.2.1</b> 260±5°C for 30 seconds
Rapid Change of Temperature	±(0.5%+0.05Ω)	±(1.0%+0.05Ω)	<b>JIS-C-5201-1 4.19</b> <b>IEC-60115-1 4.19</b> -55°C to +155°C, 5 cycles

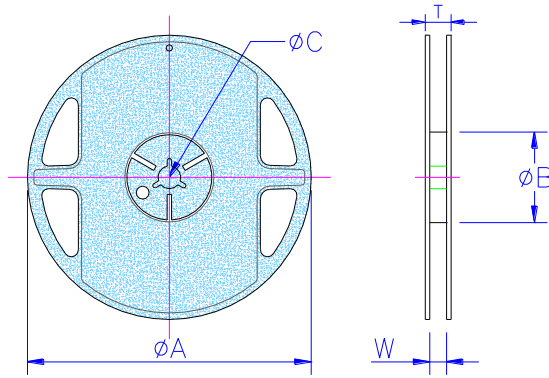
RCWV(Rated Continuous Working Voltage)=√(P\*R) or Max. Operating Voltage whichever is lower.

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

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

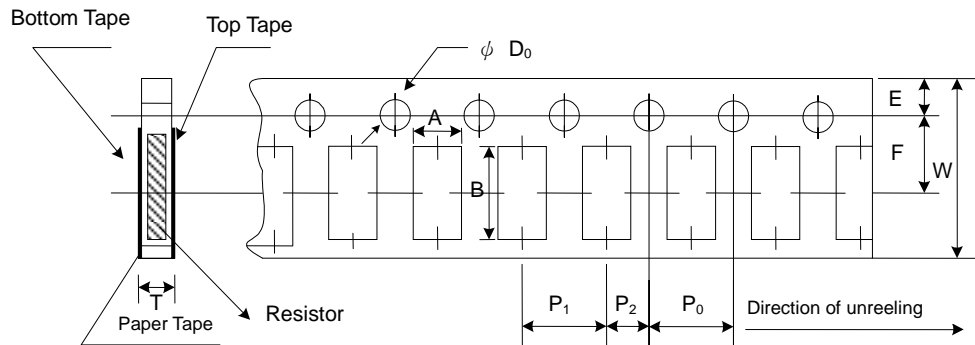
**■ Packaging**

Reel Specifications & Packaging Quantity



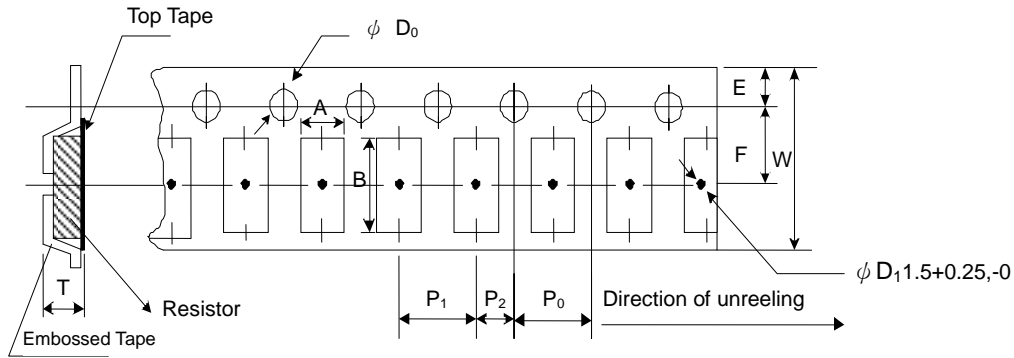
Type	Packaging Quantity	Tape Width	Reel Diameter	ΦA (mm)	ΦB (mm)	ΦC (mm)	W (mm)	T (mm)	
HVR02	Paper	10K	8mm	7 inch	178.5±1.5	60 <sup>+1/-0</sup>	13.0±0.2	9.0±0.5	12.5±0.5
		20K	8mm	10 inch	254±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
		40K	8mm	13 inch	330±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
HVR03 HVR05 HVR06	Paper	5K	8mm	7 inch	178.5±1.5	60 <sup>+1/-0</sup>	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
HVR0A HVR12	Embossed	4K	12mm	7 inch	178.5±1.5	60 <sup>+1/-0</sup>	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 <sub>0</sub> (mm)	P <sub>1</sub> (mm)	P <sub>2</sub> (mm)	ΦD <sub>0</sub> (mm)	T (mm)
HVR02	0.65±0.10	1.15±0.10	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	2.00±0.05	2.00±0.05	1.50+0.1,-0	0.45±0.10
HVR03	1.10±0.10	1.90±0.10	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	0.70±0.10
HVR05	1.60±0.10	2.40±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
HVR06	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 <sub>0</sub> (mm)	P <sub>1</sub> (mm)	P <sub>2</sub> (mm)	ΦD <sub>0</sub> (mm)	T (mm)
HVR0A	2.80±0.10	5.40±0.20	12.0±0.30	1.75±0.10	5.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.50+0.1, -0	1.2 <sup>+0</sup>
HVR12	3.50±0.10	6.70±0.10	12.0±0.30	1.75±0.10	5.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.50+0.1, -0	1.2 <sup>+0</sup>

**■ Marking**

No Marking for 0402

1% for 0805/1206/2010/2512: 4 digits marking

Example:

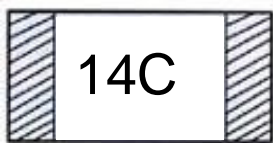
Resistance	49.9KΩ	100KΩ	1MΩ	4.99MΩ	10MΩ
Marking	4992	1003	1004	4994	1005

5% for 0603/0805/1206/2010/2512: 3 digits marking in E24

Example: 124=120KΩ 106=10MΩ (1<sup>st</sup> and 2<sup>nd</sup> are E24 code and 3<sup>rd</sup> 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
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1% for 0603: 3 digits marking in E96



3 digits marking for Example: 75C=59KΩ 39E=2.49MΩ

**■ 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	X	Y			
Multiplier	10 <sup>0</sup>	10 <sup>1</sup>	10 <sup>2</sup>	10 <sup>3</sup>	10 <sup>4</sup>	10 <sup>5</sup>	10 <sup>-1</sup>	10 <sup>-2</sup>			



**REVISION HISTORY**

<b>REVISION</b>	<b>DATE</b>	<b>CHANGE NOTIFICATION</b>	<b>DESCRIPTION</b>
Version B	Jun 03, 2014	-	- Environmental Characteristics updated
Version B1	Oct 27, 2014	-	- Standard Electrical Specifications updated - Environmental Characteristics updated
Version B2	Jul 15, 2016	-	- Remove Material Description - Modify Storage Temperature
Version B3	Jan 12, 2018	-	- Increase IEC 62368-1 & IEC 60950-1 Safety Certificate Scope
Version B4	May 20, 2019	-	- Modify TCR Test description
Version B5	Mar 10, 2021	-	- Modify Bending Test description - Increase large reel packaging code - modify 2010 Embossed Plastic Tape B Specification - modify Soldering Condition (IPC/JEDEC J-STD-020)
Version B6	Nov 15, 2021	-	- Increase the shelf life description
Version B7	Feb 15, 2022	-	- Derating Curve changes the temperature range