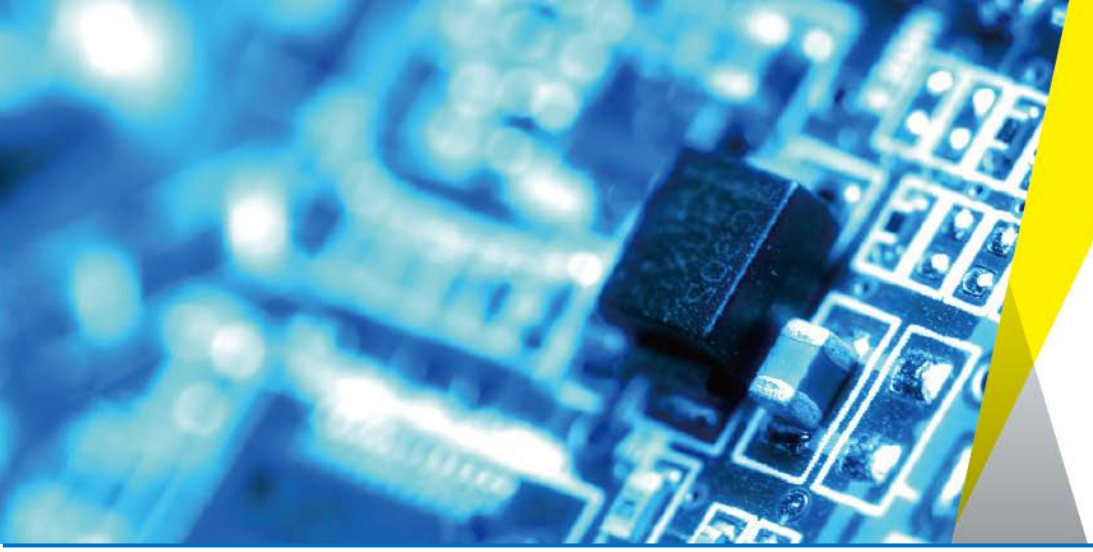

DATASHEET

Product Name	**High-Voltage Anti-Sulfurized Thick Film Chip Resistors**
Part Name	**VS05、VS06、VS10 、VS12 Series**
File No.	**SMD-SP-040**

Uniroyal Electronics Global Co., Ltd.

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Manufacture Plant	Uniroyal Electronics Industry Co., Ltd.
	Aeon Technology Corporation
	Royal Electronic Factory (Thailand) Co., Ltd.
	Royal Technology (Thailand) Co., Ltd.

1 Scope

1.1 This datasheet is the characteristics of High Voltage Anti-Sulfurized Thick Film Chip Resistors manufactured by UNI-ROYAL.
1.2 The performance in Max. Working Voltage is superior to the general thick film chip resistors.
1.3 Suitable for reflow & wave soldering
1.4 Applications: AV adapters, LCD backlight, Camera flash, etc.
1.5 Exellent Anti-Sulfurized
1.6 AEC-Q200 qualified
1.7 Compliant with RoHS directive.
1.8 Halogen free requirement.

2 Part No. System

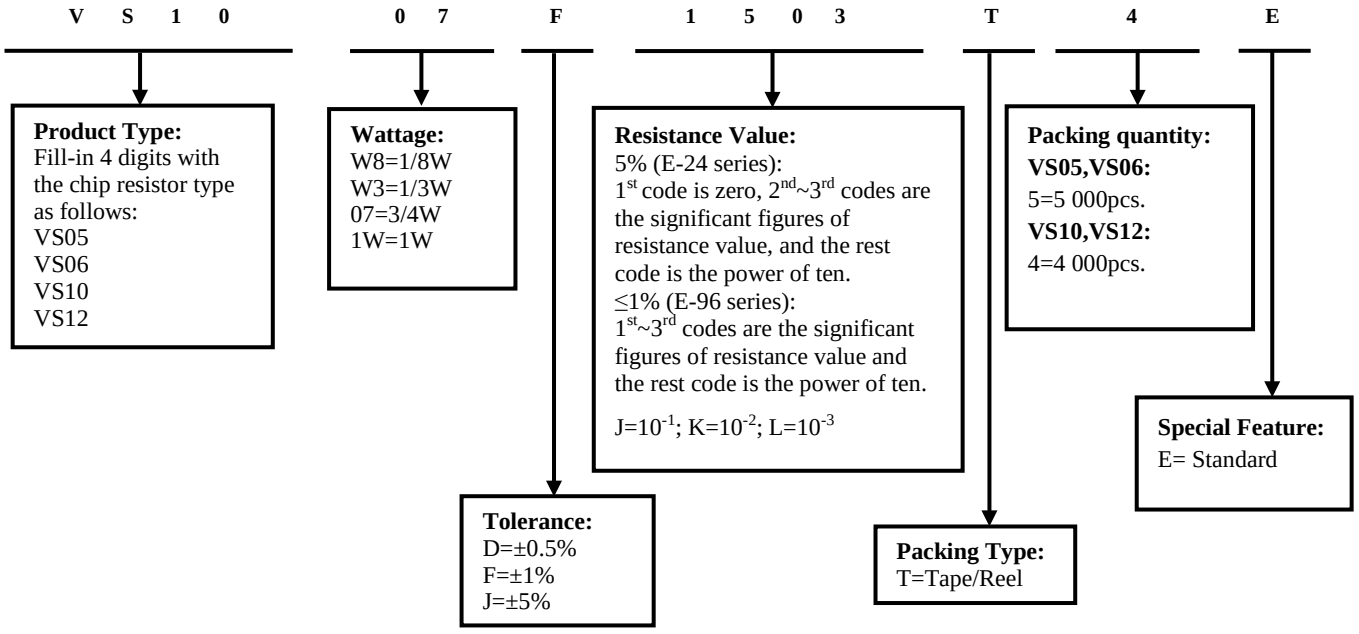
Part No. includes 14 codes shown as below:
2.1 1st~4th codes: Part name. E.g.: VS05, VS06, VS10,VS12
2.2 5th~6th codes: Power rating.

Wattage	1	1/3	3/4	1/8
Normal Size	1W	W3	07	W8

2.3 7th code: Tolerance. E.g.: D=±0.5% F=±1% J=±5%
2.4 8th~11th codes: Resistance value.
2.4.1 If value belongs to standard value of E-24 series, the 8th code is zero, 9th~10th codes are the significant figures of resistance value, and the 11th code is the power of ten.
2.4.2 If value belongs to standard value of E-96 series, the 8th~10th codes are the significant figures of resistance value, and the 11th code is the power of ten.
2.4.3 11th codes listed as following:
0=10^0 1=10^1 2=10^2 3=10^3 4=10^4 5=10^5 6=10^6 J=10^{-1} K=10^{-2} L=10^{-3} M=10^{-4}
2.5 12th~14th codes.
2.5.1 12th code: Packaging Type. E.g.: T=Tape/Reel
2.5.2 13th code: Standard Packing Quantity.
4=4,000pcs 5=5,000pcs
2.5.3 14th code: Special features.
E = Standard

3 Ordering Procedure

(Example: VS10 3/4W ±1% 150KΩ T/R-4000)



4 Marking

4.1 ±5% tolerance products (E-24 series):
3 codes.
1st~2nd codes are the significant figures of resistance value, and the rest code is the power of ten.

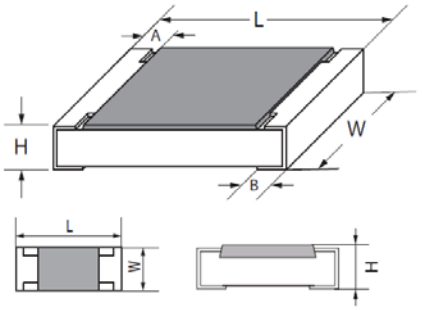
104 → 100KΩ

4.2 ≤±1% tolerance products (E-96 series):
4 codes.
1st~3rd codes are the significant figures of resistance value, and the rest code is the power of ten.
Letter "R" in mark means decimal point.

1003 → 100KΩ

5 Dimension

Type	Dimension(mm)				
	L	W	H	A	B
VS05(0805)	2.00±0.15	1.25+0.15/-0.10	0.55±0.10	0.40±0.20	0.40±0.20
VS06(1206)	3.10±0.15	$1.55^{+0.15}_{-0.10}$	0.55±0.10	0.45±0.20	0.45±0.20
VS10(2010)	5.00±0.10	2.50±0.20	0.55±0.10	0.60±0.25	0.50±0.20
VS12(2512)	6.35±0.10	3.20±0.20	0.55±0.10	0.60±0.25	0.50±0.20

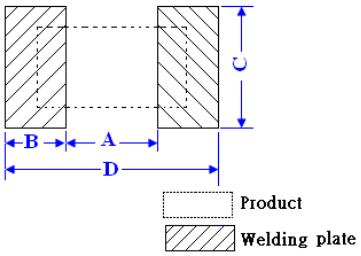


6 Ratings

Type	Power Rating	Max. Working Voltage	Max. Overload Voltage	Dielectric withstanding Voltage	Resistance Range ±0.5%,±1%,±5%	Operating Temperature
VS05	1/8W	400V	800V	500V	100KΩ~10MΩ	-55℃~155℃
VS06	1/3W	1000V	1500V	1000V	100KΩ~10MΩ	-55℃~155℃
VS10	3/4W	2000V	3000V	500V	50KΩ~10MΩ	-55℃~155℃
VS12	1W	3000V	4000V	500V	39KΩ~10MΩ	-55℃~155℃

7 Soldering pad size recommended

Type	Dimension(mm)			
	A	B	C	D
VS05	1.0±0.1	1.0±0.1	1.3±0.1	3.0±0.1
VS06	2.2±0.1	1.1±0.1	1.6±0.1	4.4±0.1
VS10	3.6±0.1	1.3±0.1	2.6±0.1	6.2±0.1
VS12	5.0±0.1	1.6±0.1	3.3±0.1	8.2±0.1

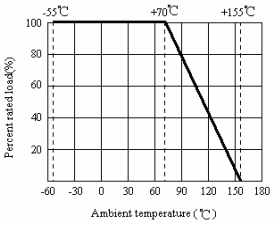


8 Derating Curve

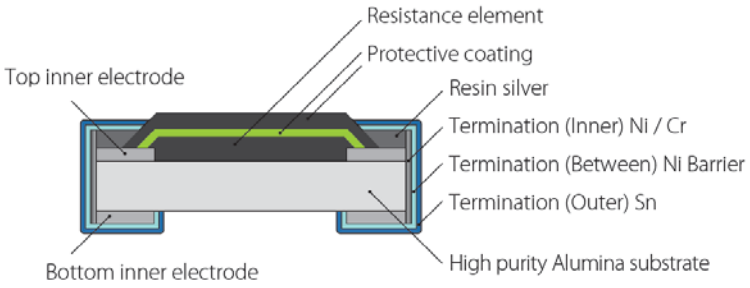
Power rating will change based on continuous load at ambient temperature from -55 to 155℃.
It is constant between -55 to 70℃, and derate to zero when temperature rise from 70 to 155℃.
Voltage rating:
Resistors shall have a rated direct-current (DC) continuous working voltage or an approximate sine-wave root-mean-square (RMS) alternating-current (AC) continuous working voltage at commercial-line frequency and waveform corresponding to the power rating, as determined from the following formula:

$$RCWV = \sqrt{P \times R}$$

Remark: RCWV: Rating Continuous Working Voltage (Volt.) P: power rating (Watt) R: nominal resistance (Ω)
In no case, the rated DC or RMS AC continuous working voltage must be greater than the applicable maximum value.
The overload voltage is 2.5 times RCWV or Max. Overload voltage whichever is lower.



9 Structure



10 Performance Specification

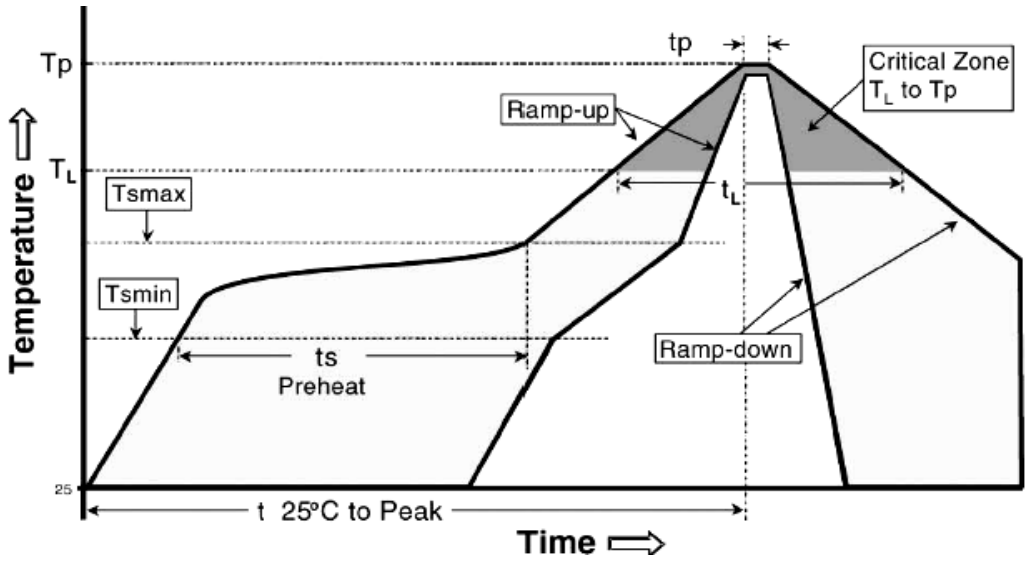
Characteristic	Limits	Ref. Standards	Test Methods
Operational life	±(3.0%+0.1Ω)	MIL-STD-202 Method 108	125℃, at 36% of operating power, 1000H(1.5 hours "ON", 0.5 hour "OFF"). Measurement at 24±4 hours after test conclusion.
Electrical Characterization (T.C.R)	±100PPM/℃	GB/T 5729 4.8 JIS-C-5201 4.8 IEC60115-1 6.2	Natural resistance changes per temp. Degree centigrade $\frac{R2-R1}{R1(t2-t1)} \times 10^6$ (PPM/℃) R_1: Resistance Value at room temperature t_1 R_2: Resistance at test temperature (t_2) t_1: Room temperature +25℃ or specified t_2: Test temperature (-55℃ or 125℃)
Short-time overload	±(2.0%+0.1Ω)	GB/T 5729 4.13 JIS-C-5201 4.13 IEC 60115-1 8.1.4.2	Permanent resistance change after the application of a potential of 2.5 times RCWV or Max. Overload Voltage whichever less for 5 seconds..
External Visual	Marking Complete , no mechanical damage	MIL-STD-883 Method 2009	Electrical test not required Inspect device construction, marking and workmanship
Physical Dimension	Reference 5. Dimension Standards	JESD22 MH Method JB-100	Verify physical dimensions to the applicable device detail specification. Note: User(s) and Suppliers spec. Electrical test not required.
Resistance to Solvent	Marking Complete , no mechanical damage	MIL-STD-202 Method 215	Note: Add Aqueous wash chemical – OKEM Clean or equivalent. Do not use banned solvents.
Terminal Strength	Not broken	AEC-Q200-006	Force of 17.7N for 60±1 seconds.
High Temperature Exposure (Storage)	±(3.0%+0.1Ω)	MIL-STD-202 Method 108	1000hrs. @T=155℃.Unpowered. Measurement at 24±4hours after test conclusion.
Temperature Cycling	±(1%+0.1Ω)	JESD22 Method JA-104	1000 Cycles (-55℃ to +125℃). Measurement at 24±4hours after test conclusion.
Biased Humidity	±(3.0%+0.1Ω)	MIL-STD-202 Method 103	1000 hours 85℃,85%RH. Note: Specified conditions: 10% of operating power. Measurement at 24±4 hours after test conclusion.
Mechanical Shock	±(1.0%+0.1Ω)	MIL-STD-202 Method 213	Half sine wave, acceleration 100g's, each three times in X, Y and Z directions, pulse width 6ms.

Vibration	±(1.0%+0.1Ω)	MIL-STD-202 Method 204	5g's for 20 min., 12cycle each of 3 orientations. Note: Use 8"*5"PCB. 031" thick 7 secure points onone long side and 2 secure points at corners of opposite sides. Parts mounted within 2' from any secure point. Test from 10-2000Hz.
ESD	±(3.0%+0.1Ω)	AEC-Q200-002	With the electrometer in direct contact with the discharge tip, verify the voltage setting at levels of ±500V,±1KV, ±2KV, ±4KV, ±8KV, The electrometer reading shall be within ±10% for voltages from 500V to ≦800V
Solderability	Coverage must be over 95%.	J-STD-002	For both leaded & SMD. Electrical test not required. Magnification 50X. Conditions: a) Method B 4hrs at 155℃ dry heat, the dip in bath with 245±3℃,5±0.5s. b) Method D: at 260±3℃, 30±0.5s.
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.
Board Flex	±(1.0%+0.1Ω)	AEC-Q200-005	Bending 2mm(min) for 60+5sec
Flame Retardance	No flame	AEC-Q200-001	Only requested, when voltage/power will increase the surface temp to 350℃.Apply voltage from 9V to 32V. No flame; No explosion.
Resistance to Soldering Heat	±(1.0%+0.05Ω)	MIL-STD-202 Method 210	Condition B No per-heat of samples. Dipping the resistor into a solder bath having a temperature of 260℃±5℃ and hold it for 10±1 seconds
Sulfuration test	±(3.0%+0.05Ω)	ASTMB-809-95	Sulfur (Saturated vapor) : Test temp.: 105°C Test time: 1000h
	±(5.0%+0.05Ω)	/	Soaked in industrial oil with sulfur substance 3.5% contained 105°C ±3°C, 500H

11. Soldering Condition

(This is for recommendation, please customer perform adjustment according to actual application)

11.1 Recommend Reflow Soldering Profile：(solder : Sn96.5 / Ag3 / Cu0.5)

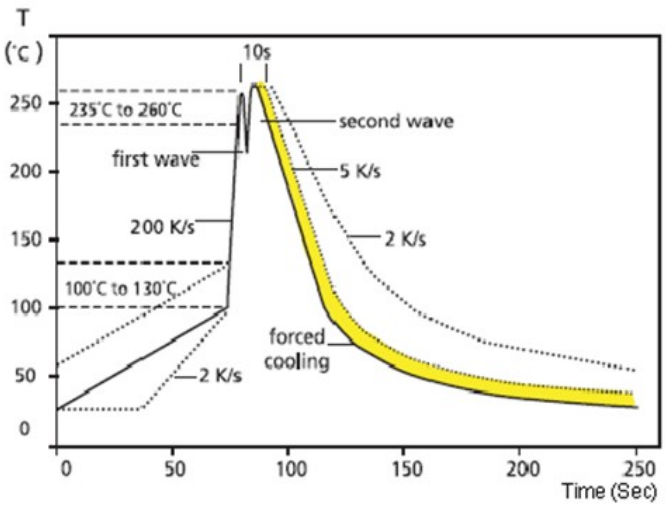


Profile Feature	Lead (Pb)-Free solder
Preheat： Temperature Min (Ts_{min}) Temperature Max (Ts_{max}) Time (Ts_{min} to Ts_{max}) (ts)	 150℃ 200℃ 60 -120 seconds
Average ramp-up rate： (Ts max to Tp)	 3℃ / second max.
Time maintained above : Temperature (T_L) Time (t_L)	 217℃ 60-150 seconds
Peak Temperature (Tp)	260℃
Time within $^{+0}_{-5}$℃ of actual peak Temperature (tp)[2]	10 seconds
Ramp-own Rate	6℃/second max.
Time 25℃ to Peak Temperature	8minutes max.

Allowed Re-flow times : 2 times

Remark : To avoid discoloration phenomena of chip on terminal electrodes, we suggest N_2 Re-flow furnace .

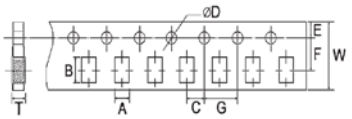
11.2 Recommend Wave Soldering Profile：(Apply to 0603 and above size)



12. Packing

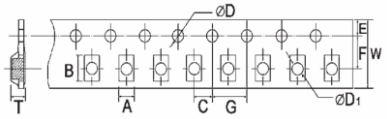
12.1Dimension of Paper Taping: (Unit: mm)

Type	A±0.2	B±0.2	C±0.05	ΦD $^{+0.1}_{-0}$	E±0.1	F±0.05	G±0.1	W±0.2	T±0.1
VS05	1.65	2.40	2.00	1.50	1.75	3.50	4.00	8.00	0.81
VS06	2.00	3.60	2.00	1.50	1.75	3.50	4.00	8.00	0.81



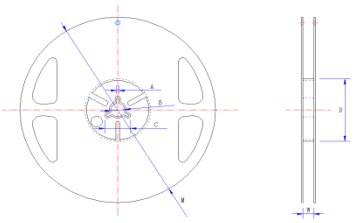
12.2 Dimension of plastic taping (Unit: mm)

Type	A±0.2	B±0.2	C±0.05	ΦD $^{+0.1}_{-0}$	ΦD1 $^{+0.25}_{-0}$	E±0.1	F±0.05	G±0.1	W±0.2	T±0.1
VS10	2.90	5.60	2.00	1.50	1.50	1.75	5.50	4.00	12.00	1.00
VS12	3.50	6.70	2.00	1.50	1.50	1.75	5.50	4.00	12.00	1.00



12.3 Dimension of Reel：(Unit: mm)

Type	Taping	Qty./Reel	A±0.5	B±0.5	C±0.5	D±1	M±2	W±1
VS05	Paper	5,000pcs	2.0	13.0	21.0	60.0	178.0	10.0
VS06	Paper	5,000pcs	2.0	13.0	21.0	60.0	178.0	10.0
VS10	Embossed	4,000pcs	2.0	13.0	21.0	60.0	178.0	13.8
VS12	Embossed	4,000pcs	2.0	13.0	21.0	60.0	178.0	13.8



13 Note

13.1 UNI-ROYAL recommend products store in warehouse with temperature between 15 to 35℃ under humidity between 25 to 75%RH. Even under storage conditions recommended above, solder ability of products will be degraded stored over 1 year old.

13.2 Cartons must be placed in correct direction which indicated on carton, otherwise the reel or wire will be deformed.

13.3 Storage conditions as below are inappropriate:

a. Stored in high electrostatic environment

b. Stored in direct sunshine, rain, snow or condensation.

13.4 This product is used for automotive electronics. UNI-ROYAL will not be responsible for any damage, expense or loss caused by the use of this specification in any special environment. This series of products are suitable for automotive electronics applications, as shown below, If there are other applications, you need to confirm with UNI-ROYAL whether they are applicable:

a. Control unit for information, entertainment, navigation, audio;

b. Control unit for comfortable doors, windows, seat;

c. Control unit for internal lighting.

14 Record

Version	Description	Page	Date	Amended by	Checked by
1	First version	1~6	Jul.22, 2022	Haiyan Chen	Yuhua Xu
2	Update Performance Specification	4~5	Aug.02, 2024	Haiyan Chen	Yuhua Xu
3	Modify temperature cycling test	5	Aug.10, 2024	Haiyan Chen	Yuhua Xu
4	1.Add the ±0.5% tolerance 2.Modify the test conditions and determination of ASTMB-809-95	2,3 5	Apr.17, 2025	Haiyan Chen	Yuhua Xu
5	Add VS06 series	1~7	Dec.05, 2025	Junying Ye	Haiyan Chen