客戶名稱 CUSTOMERS:				
日期 DATE:				
產品名稱 PRODUCT:	**HIGH VOLTAGE FIXED RESISTORS (HV SERIES)** 高 壓 固 定 型 電 阻 器			
物料代號 PART NO.:	Customer		版本 REV.:	**V18.01**
	Queen Mao	**HV□□□□-□□□-□□□□R□**		

規 格 承 認 書

APPROVAL SHEET

RoHS COMPLIANT

Halogen Free

客戶承認簽印 CUSTOMER APPROVED BY	核准 APPROVE	主管 CHIEF	承辦 RESPONSIBLE

APPROVED NO.:		ECN.:		/ /
MODEL:				/ /
CUSTOMER P/N:		PLANT:	■ Taiwan □ Dongguan ■ Suzhou	

ISO Certified • CB

昆 貿 電 子 股 份 有 限 公 司

QUEEN MAO ELECTRONIC CO., LTD.

22178 新 北 市 汐 止 區 大 安 街 **56** 巷 **33** 弄 **2** 號

No. 2, ALLEY 33, LANE 56, DA'AN STREET, XIZHI DISTRICT, NEW TAIPEI CITY 22178, TAIWAN (R.O.C.)

TEL: 886-2-8648-5566 FAX: 886-2-8648-0538

E-mail: service@queenmao.com.tw

URL: http://www.queenmao.com.tw

APPROVAL SHEET REVISIONS			
File No. Version	**Description**	**Approved By Edited By**	**Date**
HVSERIES V18.01	Upgrade safety approval to IEC/EN 62368.	Frank Kao Paul Chang	April 20, 2018

1. SCOPE

1.1 Application

This specification covers the detail requirements for High Voltage Fixed Resistors, style of HV / MG series.

1.2 Quality

The resistor is manufactured by highly quality-controlled process and guaranteed high reliability, it meets RoHS and Halogen Free requirement (Note: Pb apply exempted items).

1.3 Safety Approval

IEC 60065:2001+Amd 1:2005 (CB Ref. Certif. No.: DE1-39284/M1)
Application:

HV1/4W□-□□□-□□□□R□ (Resistance Range: 100K to 120M OHM)
HV1/2W□-□□□-□□□□R□ (Resistance Range: 100K to 120M OHM)
HV1W□-□□□-□□□□R□ (Resistance Range: 100K to 120M OHM)

IEC 62368-1:2014 ; EN 62368-1:2014+A11 (CB Ref. Certif. No.: SE-90860)
Application:

HV1/4W□-□□□-□□□□R□ (Resistance Range: 100K to 120M OHM)
HV1/2W□-□□□-□□□□R□ (Resistance Range: 100K to 120M OHM)
HV1W□-□□□-□□□□R□ (Resistance Range: 100K to 120M OHM)

2. SPECIFICATION

Type designation shall be the following form. (Example)

HV 1/2WS – T52 – 1.5MR J

Type	Rated Power	
HV	Normal	Small
or	1/8W	
MG	1/4W	1/4WS
HV = MG	1/2W	1/2WS
	1W	1WS
	2W	2WS

Form	
B	Bulk
Txx	Taping XXmm
PU	Horizontal -Form series
PF	Vertical -Form series
BF	Vertical-Form series
PN	Radial Taping

Nominal Value of Resistance	Tolerance on Resistance Value	
E-12 Series	K	±10%
E-24 Series	J	±5%
E-48 Series	G	±2%
E-96 Series	F	±1% (Special)

Example:	
Code	Resistance value
100KR	100KΩ
1MR	1MΩ
1.5MR	1.5MΩ
12MR	12MΩ
120MR	120MΩ

2.1 Type

The word “HV” or “MG” represents High Voltage Fixed Resistors.

2.2 Rated Power

“W” represents rated power as indicated in Table-1, Paragraph 3.
“S” stands for small size.

2.3 Form Type

Type differentiates the shape of resistors (Refer to Paragraph 5.2).

2.4 Characteristics

Characteristics mean the various electrical properties (Refer to Table-1).

2.5 Nominal Value of Resistance

It is expressed by Ω, K (Kilo) Ω, M (Meg.) Ω. In general, “R” represents symbol “Ω”.

2.6 Resistance Value Tolerance

K: ±10%
J: ±5%
G: ±2%
F: ±1%

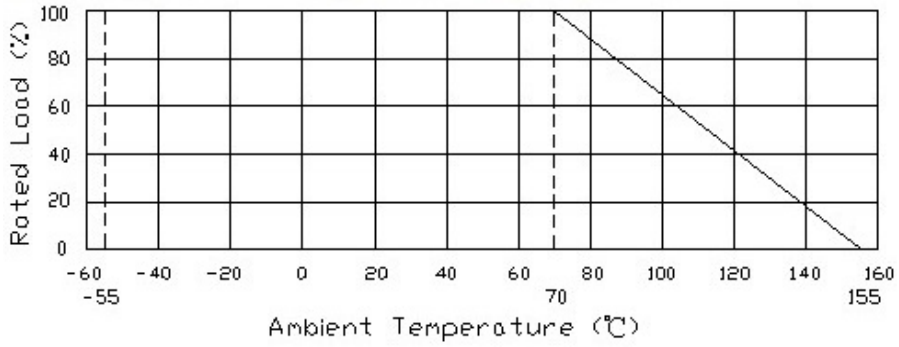
Table-1 Characteristics

Item	Specification									Remark & Test Method
Type / Kind	HV									
Working Temp. Range	-55℃ ~ +155℃									
Power	**1/8W**	**1/4WS**	**1/4W**	**1/2WS**	**1/2W**	**1WS**	**1W**	**2WS**	**2W**	
Max. Working Voltage (V)	800		1,600		2,000		3,500		3,500	3
Max. Overload Voltage (V)	1,000		2,000		3,000		4,000		4,000	3
Max. Impulse Voltage (V)	3,000		≤510KΩ 5,000 >510KΩ 10,000		10,000		10,000		10,000	6.3.3
Dielectric Strength (V)	400		700		700		1,000		1,000	6.3.1
Short-Time Overload (%)	±1.0									6.3.2
Impulse Test (%)	±20									6.3.3
Load Life Test (%)	±5.0									6.3.4
Humidity Test (%)	±50									6.3.5
Temperature Cycling Test (%)	±1.5									6.3.6
Effective Soldering Test (%)	±1.0									6.3.7
Temperature Coefficient (PPM/℃)	±200									6.3.8
Vibration Test (%)	±1.0									6.2
Terminal Strength Test (%)	±1.0									6.1
Resistance Range (Ω)	100KΩ ~ 120MΩ									
Insulation Resistance (Ω)	≥ 1,000MΩ									6.3.9
Solderability (%)	95%									6.3.10
Resistance Tolerance	±10% (K) ±5% (J) ±2% (G) ±1% (F)									

3. RATED POWER

3.1 Rated Power

The Rated Power means the allowed continuous and maximum Power and voltage under the ambient temperature of 70℃. If the temperature exceeds 70℃ the rated power shall be derated as according to the following curve.



3.2 Rated Voltage

Rated Voltage means the equivalent of rated power to the D.C. or A. C. (Commercial effective cycles) voltage. The result can be obtained from the following equation. If the rated voltage exceeds the maximum voltage, the maximum working voltage will apply.

$E = \sqrt{P \bullet R}$

E = Rated Voltage (V)

P = Rated Power (W)

R = Nominal Value (Ω)

4. NOMINAL RESISTANCE VALUES

The nominal resistance values shall be the numerical values given in Table-2 multiplied by 10^n (n is an integer) in the unit of ohm(Ω).

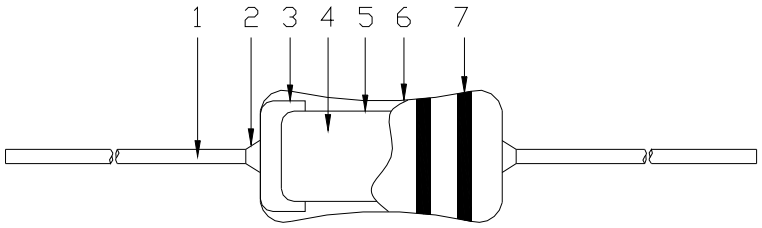
The minimum resistance and maximum resistance shall be as given in Table-1.

Table-2 Standard nominal resistance values

Name of series	Standard nominal resistance values (significant figures with the unit omitted)
E-24	1.0, 1.1, 1.2, 1.3, 1.5, 1.6, 1.8, 2.0, 2.2, 2.4, 2.7, 3.0 3.3, 3.6, 3.9, 4.3, 4.7, 5.1, 5.6, 6.2, 6.8, 7.5, 8.2, 9.1
E-48	1.00, 1.05, 1.10, 1.15, 1.21, 1.27, 1.33, 1.40, 1.47, 1.54, 1.62, 1.69 1.78, 1.87, 1.96, 2.05, 2.15, 2.26, 2.37, 2.49, 2.61, 2.74, 2.87, 3.01 3.16, 3.32, 3.48, 3.65, 3.83, 4.02, 4.22, 4.42, 4.64, 4.87, 5.11, 5.36 5.62, 5.90, 6.19, 6.49, 6.81, 7.15, 7.50, 7.87, 8.25, 8.66, 9.09, 9.53
E-96	1.00, 1.02, 1.05, 1.07, 1.10, 1.13, 1.15, 1.18, 1.21, 1.24, 1.27, 1.30 1.33, 1.37, 1.40, 1.43, 1.47, 1.50, 1.54, 1.58, 1.62, 1.65, 1.69, 1.74 1.78, 1.82, 1.87, 1.91, 1.96, 2.00, 2.05, 2.10, 2.15, 2.21, 2.26, 2.32 2.37, 2.43, 2.49, 2.55, 2.61, 2.67, 2.74, 2.80, 2.87, 2.94, 3.01, 3.09 3.16, 3.24, 3.32, 3.40, 3.48, 3.57, 3.65, 3.74, 3.83, 3.92, 4.02, 4.12 4.22, 4.32, 4.42, 4.53, 4.64, 4.75, 4.87, 4.99, 5.11, 5.23, 5.36, 5.49 5.62, 5.76, 5.90, 6.04, 6.19, 6.34, 6.49, 6.65, 6.81, 6.98, 7.15, 7.32 7.50, 7.68, 7.87, 8.06, 8.25, 8.45, 8.66, 8.87, 9.09, 9.31, 9.53, 9.76

5. CONSTRUCTION, DIMENSIONS AND PACKAGE

5.1 Construction

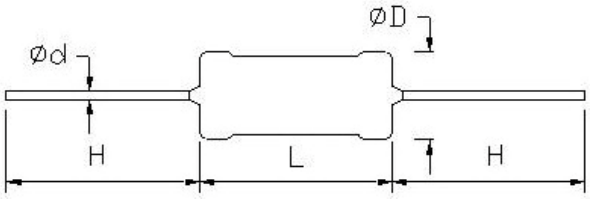


No.	Item	Material
1	Lead Wire	Tinned Copper Wire
2	Connection	The lead wire, which is plated with solder, shall be mounted to the caps by welding process.
3	Terminal	Tinned iron cap.
4	Ceramic Core	Ceramic Rod
5	Resistance Element	Surge resistance Resistive film. P.S.: High resistance parts will add Glass Powder (included Lead Oxide), for dilute resistors conductor medium. The higher resistance will need to add more Glass Powder, and it will be getting higher Pb. However, it must and apply to EU RoHS Exemptions.
6	Insulation Coating	See table below
7	Indication	Color code.

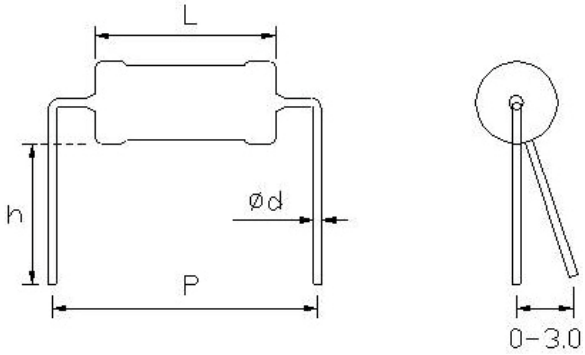
Type		Under	Upper
Normal Size	Small Size		
1/8W	1/4WS	Epoxy	Silicon or Epoxy
1/4W	1/2WS	Epoxy	Silicon or Epoxy
1/2W	1WS	Epoxy	Silicon or Epoxy
1W	2WS	Epoxy	Silicon or Epoxy
2W		Epoxy	Silicon or Epoxy

5.2 Dimensions

5.2.1 P Type ─ PS Type & PU Type



PS Type



PU Type

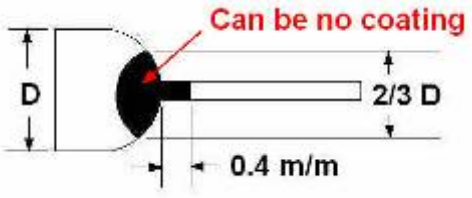
Unit: m/m

PS Type / PU Type		Dimensions						Remarks
Normal Size	Small Size	L	ϕ D	H	ϕ d (±0.05)	P (±0.5)	h (±0.5)	
1/8W	1/4WS	3.3±0.2	1.7±0.2	27±2	0.45	5.0	3.5	
1/4W	1/2WS	6.5±0.5	2.5±0.5	27±2	0.55	10.0	3.5	
1/2W	1WS	9.0±1.0	3.5±0.5	26±2	0.65	12.5±1.0 15.0±1.0	3.5	
1W	2WS	11.5±1.0	4.5±0.5	33±3	0.75	15.0±1.0 17.5±1.0 20.0±1.0	3.5	
2W		15.0±1.0	5.0±0.5	33±3	0.75	20.0±1.0 25.0±1.0	3.5	

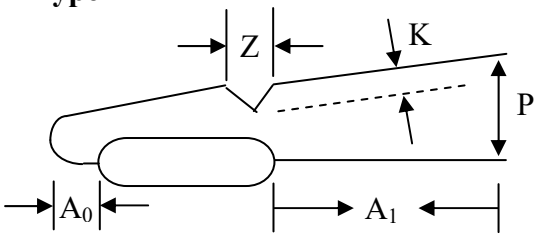
Remarks: 1. The measurement of "P" is from lead center to lead center.
2. "P" & "h" accept customized.

Note:

In general regulation, 1/8W & 1/4WS allowed to have 3/4 by the side of Cap with Coating or No Coating (refer to below photo).



5.2.2 P Type – PF Type



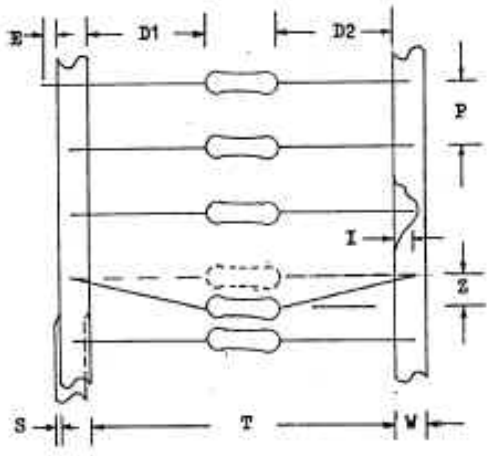
PF Type

Unit: m/m

PF Type		Dimensions			Remark
Normal Size	Small Size	P (±1)	A_0 (Max.)	A_1 (±0.5)	
1/8W	1/4WS	5.0	4.0	3.5	No Kink
1/4W	1/2WS	5.0	4.0	3.5	
1/2W	1WS	6.5 / 7.5 / 8.5	4.0	3.5	
1W		7.5	4.0	3.5	

Remarks: 1. Z = 3±1; K = 2±0.5
2. "P" only for reference.

5.2.3 Taping Dimensions



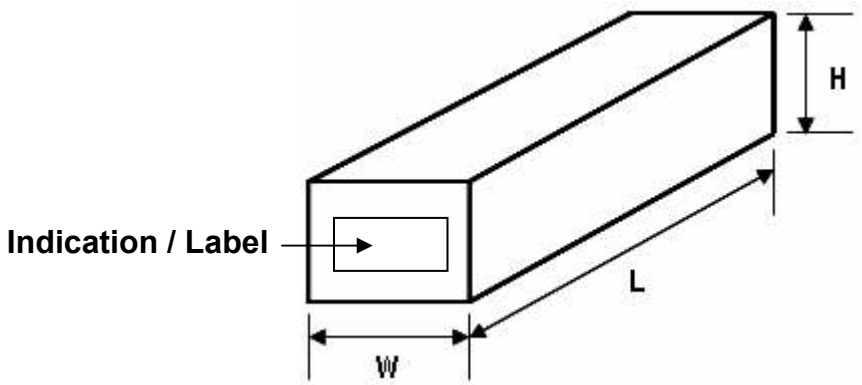
Unit: m/m

Watts		Type	T	P ±0.5	W ±0.5	$D_1 - D_2$ Max.	E Max.	Z Max.	S Max.	I Min.
1/8W	1/4WS	T-52	52±1.5	5	6	0.8	0	1.2	0.8	3.2
1/4W	1/2WS	T-52	52±1.5	5	6	0.8	0	1.2	0.8	3.2
1/2W	1WS	T-52	52±1.5	5	6	0.8	0	1.2	0.8	3.2
1W	2WS	T-73	73±1.5	5	6	1.4	0	1.2	0.8	3.2
2W		T-73	73±1.5	5	6	1.4	0	1.2	0.8	3.2

5.3 Package

5.3.1 Packing Box Size and Quantity

The standard package shall be in accordance as follow:



Style		PCS Per Box	Dimension (mm)		
Normal Size	Small Size		L	W	H
1/8W	1/4WS	5,000	255±2	75±2	70±2
1/4W	1/2WS	5,000	265±2	77±2	120±2
1/2W	1WS	2,000	255±2	75±2	100±2
1W	2WS	1,000	265±5	102±5	80±5
2W		1,000	265±5	102±5	95±5

5.3.2 Marking on Package (Indication / Label)

The label of a minimum package shall be legibly marked with follow:

1.) Style name
2.) Rated Resistance
3.) Tolerance on rated resistance
4.) Lot number
5.) Quantity
6.) Manufacturer's name or trade mark
7.) Safety standard certification mark
8.) Others

6. PERFORMANCE

The performance shall be satisfied as below:

6.1 Terminal Strength

6.1.1 Tensile Strength

When the lead wire is welded and fixed at one terminal, the other terminal on the axial direction of the body is applied a force of 10N for 10±1 seconds. The terminal lead wire shall not break or loosen.

6.1.2 Twist Strength

At the point of 6 mm. from the body of the resistor nearing the cap, a 90° bend with a radius of 0.75~0.8 mm is made. Then the free end of the terminal is clamped at a point 1.2±0.4 mm away from the bend. After the resistor is held in a fixed position, the terminal lead wire is twisted around the axis, making a 360°rotation, in both directions, at the rate of 5 seconds per one revolution. There should be no breakage or loosening. The same action can be applied if the lead wire is fixed while twisting the body of the resistor.

6.1.3 Bending Strength

The terminal lead wire shall hold a bending force of 5N at vertical position. The terminal lead wire shall be bent 2 times at 90° for each direction. Time required is 5 seconds. The terminal lead wire shall not break or loosen.

6.2 Vibration Test

Condition of test:

Frequency range: 10 Hz to 55 Hz.

Amplitude: 0.75 mm or acceleration 98 m/s^2 (whichever is the less severe)

Total duration: 6 hours

After the above condition of test, visual examination shall be no visible damage and the change of the resistance value should be within ±(1%+0.05Ω).

6.3 Electrical Characteristic

6.3.1 Dielectric Withstanding Voltage

The resistor is placed in the metallic V-block. Apply to the A.C. voltage (Sine Wave Voltage) as indicated in Table 1, between the terminals connected together with the block for about 5 seconds. The resistor shall be able to withstand the voltage without any sign of a breakdown or flashover.

6.3.2 Short Time Overload Test

After applying 2.5 times the rated voltage (Sine Wave Voltage A.C. or D.C., if the voltage exceeds the maximum load voltage, the maximum load voltage will be used as the rated voltage) for 5 seconds to the resistor, the resistors should be free from defects after the resistor is released from load for about 30 min. The change of the resistance value should be within ±1.0%.

6.3.3 Impulse Test

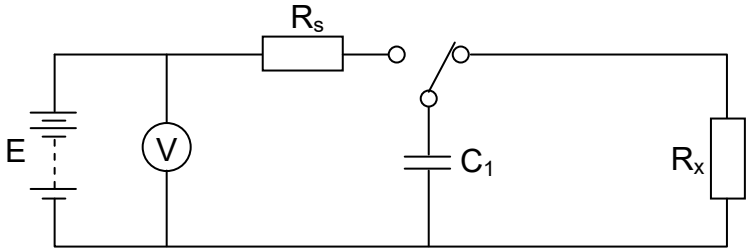
The resistor shall be subjected to 10 times which the capacitors are charged for 2.5 seconds and discharged for 2.5 seconds, in a test circuit as shown in below

Figure-1.

After the test, leaving at the room temperature for about 2 hours, and then measure the resistance.

The value of resistance shall not be differ more than 20% from the value measured before the damp heat test.

Application: HV1/8W, 1/4WS, 1/4W, 1/2WS, 1/2W, 1WS, 1W, 2WS, 2W



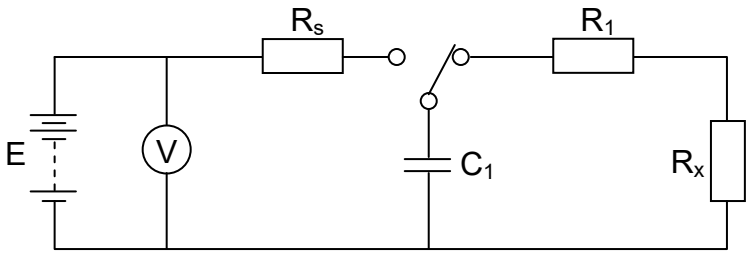
C_1: 0.01μF R_s: 10KΩ R_x: Sample

E:	HV1/8W, 1/4WS:		3,000V
	HV1/4W, 1/2WS:	≤510KΩ:	5,000V
		>510KΩ:	10,000V
	HV1/2W (above):		10,000V

Figure-1

50 discharges at a maximum rate of 12/min, from a 1,000pF capacitor charged to 10,000V in a test circuit as shown in below Figure-2.

The value of resistance shall not be differ more than 20% from the value measured before the damp heat test.
Applications: HV1W



E: 10KV C_1: 1,000pF
R_1: 1KΩ R_s: 15MΩ R_x: Sample

Figure-2

6.3.4 Load Life Test

Placed in a constant temperature chamber of 70°C±2°C the resistor shall be

connected to the lead wire at the point of 25 mm length with each terminal. The resistor shall be arranged so that the temperature of one resistor cannot affect that of another, and there should be no excessive ventilation. The rated D. C. voltage is applied for 90 minutes on and 30 minuets off, continuously for 1,000±12 hours. Then the resistor will be left at no-load for 1 hour. The change of the resistance value measured at this time from the value before the test shall be within ±5%.

6.3.5 Humidity Test

Put the resistor in a 40±2°C at the RH 90 ~ 95% chamber for 21 days (504 hours), the change of the resistance value before and after the test shall be within ±50%.

6.3.6 Temperature Cycling Test

The temperature cycle shown in the following table shall be repeated 5 times consecutively. The measurement of the resistance value is done before the first cycle and at the end of the fifth cycle. After leaving the resistor in room temperature for about 1 hour, the change shall be within ±(1.5% + 0.05Ω). After the test, the resistor shall be free from the electrical or mechanical damage.

Step	Temperature	Time
1	–55± 3°C	30 minutes
2	20± 5°C	10 ~ 15 minutes
3	155± 2°C	30 minutes
4	20±5°C	10 ~ 15 minutes

6.3.7 Effective Soldering

The terminal lead shall be dipped in to molten solder of 350±10°C for 3±0.5 seconds up to a level of 3.2 to 4.8mm from the body of the resistor. Then the resistor is left in room temperature for 3 hours. The change of the resistance value shall be within ±1% as compared with the value before the test. No remarkable change in appearance or mechanical damage should be observed.

6.3.8 Temperature Coefficient Test

Test resistors above room temperature 40°C ~ 60°C (Testing Temp.) at a constant temperature oven for 30 ~ 40 minutes. Then measure the resistance. The Temperature Coefficient can be calculated by the following equation, and its value should be within ±200PPM/°C.

$$\text{Resistor Temp. Coefficient} = \frac{R-R_0}{R_0} \times \frac{1}{t-t_0} \times 10^6 \ (\text{PPM/°C})$$

R : Resistance value under the testing temperature.
R_0 : Resistance value at the room temperature.
T : The testing temperature.
t_0 : Room temperature.

6.3.9 Insulation Resistance

The sample resistance element shall be clamped in the metallic V-block, and

shall be measured at DC 500V between the V-block and lead wire.

The insulation resistance shall not be less than 1,000MΩ.

6.3.10 Solderability

In condition of 260℃±5℃ for 3±0.5 seconds, coverage shall be more than 95%.

7. NOTE

7.1 Revision

This specification is able to revise after discussed between the customer and the manufacture.

7.2 Storage Condition

It is desirable that the resistors are stored in the following conditions:
5℃ to 35℃, 40% to 75% R.H.

High humidity, dust, harmful gas, for example, hydrogen and chloride and sulfuric gas should be avoided.

Please do not store the resistors for a long time, use the resistors with a year after the delivery is recommended.

7.2 Attentive Matters of Usage

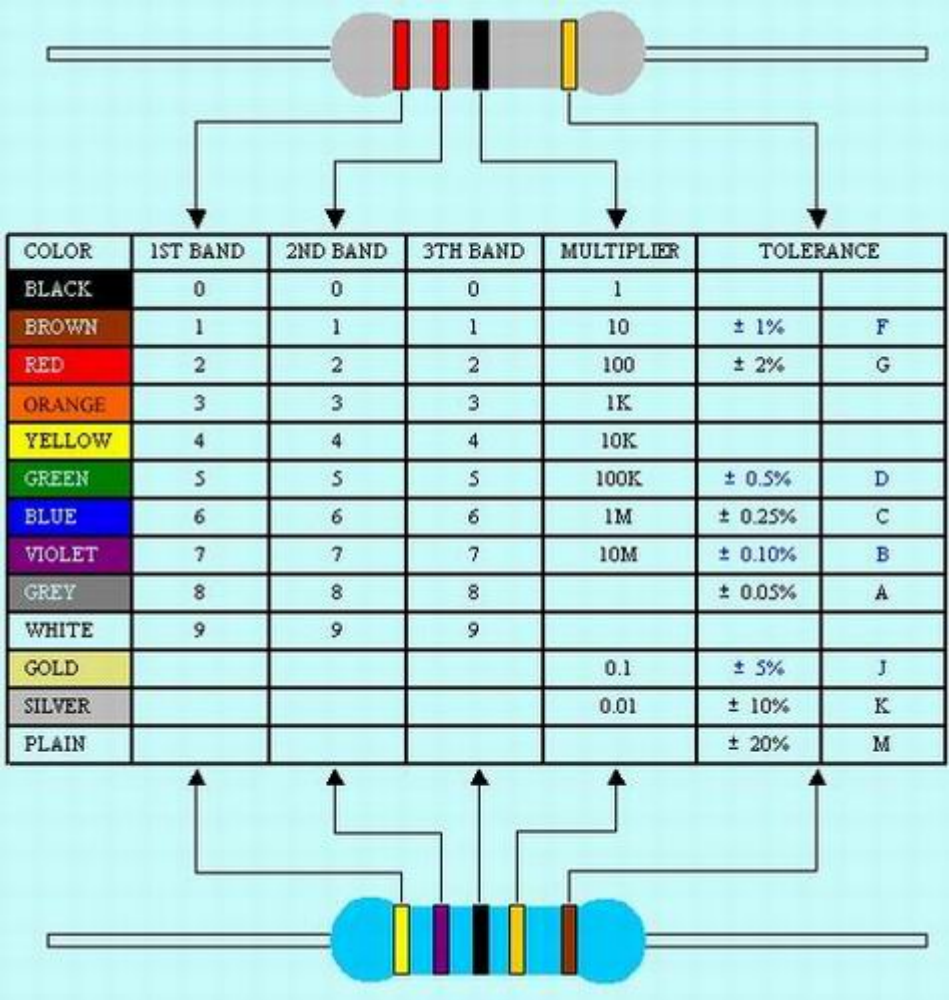
For the long term stability of the application, power should be derated accordingly by the power derating curve.

When resistors are placed around other electrical components, the minimum spacing between them should be kept above 5mm.

In order to avoid corrode to the resistor's film and influence to dispel the heat, please do not use the glue (viscose) or sleeve on the resistor's body.

If must use the glue (viscose) or sleeve, please contact our company to make analysis in order to confirm whether can be used.

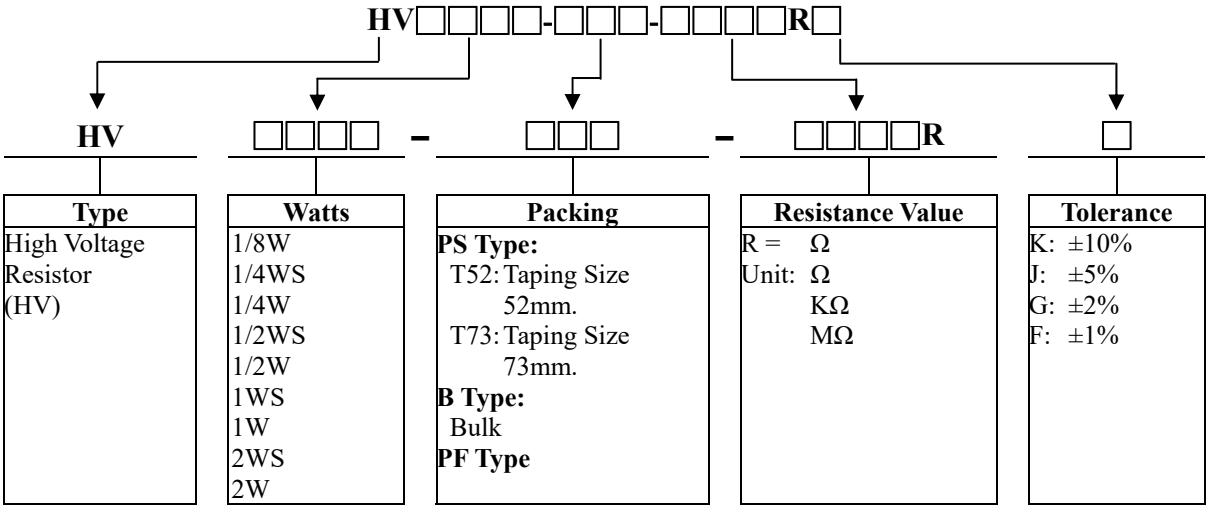
8. MARKING (REFER TO EIA - RS - 279 STANDARD)



COLOR	1ST BAND	2ND BAND	3TH BAND	MULTIPLIER	TOLERANCE	
BLACK	0	0	0	1		
BROWN	1	1	1	10	± 1%	F
RED	2	2	2	100	± 2%	G
ORANGE	3	3	3	1K		
YELLOW	4	4	4	10K		
GREEN	5	5	5	100K	± 0.5%	D
BLUE	6	6	6	1M	± 0.25%	C
VIOLET	7	7	7	10M	± 0.10%	B
GREY	8	8	8		± 0.05%	A
WHITE	9	9	9			
GOLD				0.1	± 5%	J
SILVER				0.01	± 10%	K
PLAIN					± 20%	M

9. HOW TO ORDER

9.1 PS Type, B Type and PF Type



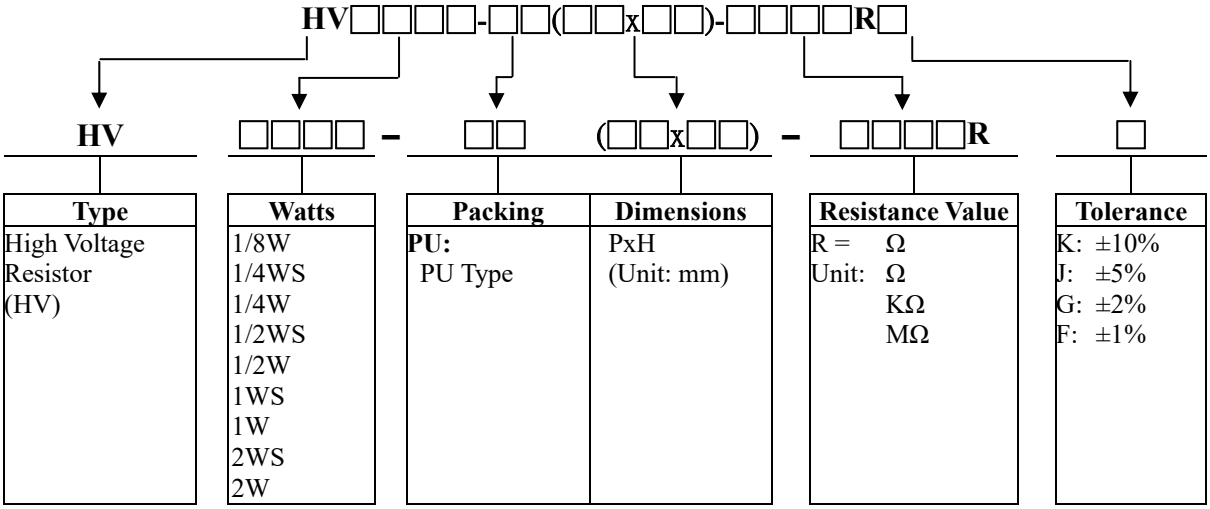
Example:

PS Type: HV1/2WS-T52-1.5MRJ
Means: HV1/2W small size, taping size T52, 1.5M ohm, tolerance ±5%.

B Type: HV1/2WS-B-1.5MRJ
Means: HV1/2W small size, bulk, 1.5M ohm, tolerance ±5%.

PF Type: HV1/2WS-PF-1.5MRJ
Means: HV1/2W small size, PF type forming, 1.5M ohm, tolerance ±5%.

9.2 PU Type



Example:

PU Type: HV1/2WS-PU(5.0x3.5)-1.5MRJ
Means: HV1/2W small size, formed PU type, dimensions 5.0x3.5, 1.5M ohm, tolerance ±5%.

9.3 Single Weight

Type	High Voltage Fixed Resistors (HV SERIES)								
Rated Power (W)	1/8W	1/4WS	1/4W	1/2WS	1/2W	1WS	1W	2WS	2W
Single Weigh (gm.)	0.100	0.101	0.203	0.204	0.390	0.392	0.823	0.825	1.050