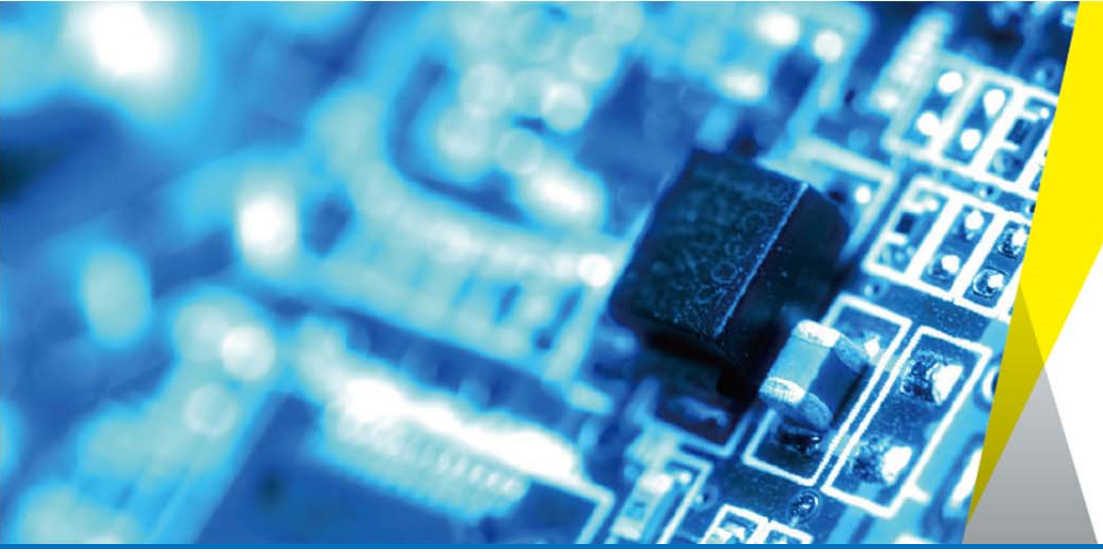

DATA SHEET

Product Name **High-Power Thick Film Chip Resistors**

Part Name **HP Series**

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1. Scope

1.1 This datasheet is the characteristics of High Power Thick Film Chip Resistors manufactured by UNI-ROYAL.
1.2 High power standard size
1.3 Suitable for both wave & re-flow soldering
1.4 Application：AV adapters，LCD back-light，camera strobe ect.

2. Part No. System

Part No. includes 14 codes shown as below:
2.1 1st~4th codes: Part name. E.g.: HP02、HP03、HP05、HP06、HP07、HP10、HP11、HP12
2.2 5th~6th codes: Power rating.

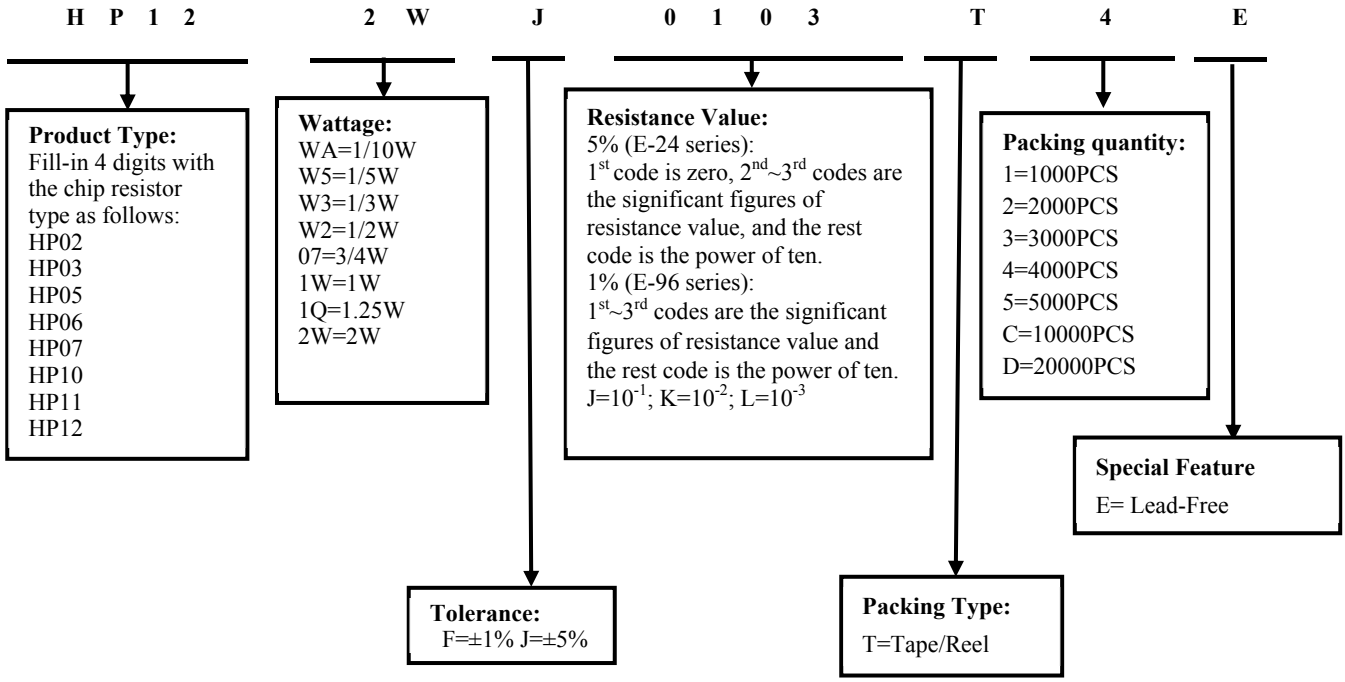
E.g.: W=Normal Size "1~G" = "1~16"

Wattage	1/32	3/4	1/2	1/3	1/4	1/8	1/10	1/16	1/20	1
Normal Size	WH	07	W2	W3	W4	W8	WA	WG	WM	1W

If power rating is equal or lower than 1 watt, 5th code would be "W" and 6th code would be a number or letter.
E.g.: WA=1/10W W4=1/4W
2.3 7th code: Tolerance. E.g.: D=±0.5% F=±1% G=±2% J=±5% K= ±10%
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.: B = Bulk / Box T=Tape/Reel
2.5.2 13th code: Standard Packing Quantity.
4=4,000pcs 5=5,000pcs C=10,000pcs D=20,000pcs E=15,000pcs
Chip Product: BD=B/B-20000pcs TC=T/R-10000pcs
2.5.3 14th code: Special features.
E = Environmental Protection, Lead Free, or Standard type.

3. Ordering Procedure

(Example: HP12 2W ±5% 10KΩ T/R-4000)



4. Marking

4.1 For HP02 size. Due to the very small size of the resistor'sbody, there is no marking on the body.

4.2 Normally, the making of 0Ω HP03, 0Ω HP05, 0Ω HP06,0Ω HP07， 0Ω HP10,0Ω HP11， 0Ω HP12 resistors as following

0 → 0Ω

333 → 33KΩ

4.3 ±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.

2701 → 2.7KΩ

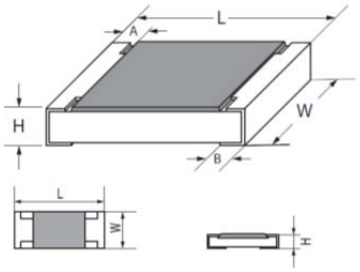
4.4 ±1% tolerance products (E-96 series):
4 codes.
1st~3rd codes are the significant figures of resistance value, and the rest code is the power of ten.
Letter "R" in mark means decimal point.

R300 → 0.3Ω

4.5 More than HP05 specifications (including) 4 digits, Product below 1Ω, show as following, the first digit Is "R" which as decimal point.

5. Dimension

Type	Dimension(mm)				
	L	W	H	A	B
HP02(0402)	1.00±0.10	0.50±0.05	0.35±0.05	0.20±0.10	0.25±0.10
HP03(0603)	1.60±0.10	0.80±0.10	0.45±0.10	0.30±0.20	0.30±0.20
HP05(0805)	2.00±0.15	1.25+0.15/ -0.10	0.55±0.10	0.40±0.20	0.40±0.20
HP06(1206)	3.10±0.15	1.55+0.15/-0.10	0.55±0.10	0.45±0.20	0.45±0.20
HP07(1210)	3.10±0.10	2.60±0.20	0.55±0.10	0.50±0.25	0.50±0.20
HP10(2010)	5.00±0.10	2.50±0.20	0.55±0.10	0.60±0.25	0.50±0.20
HP11(1812)	4.50±0.20	3.20±0.20	0.55±0.20	0.50±0.20	0.50±0.20
HP12(2512)	6.35±0.10	3.20±0.20	0.55±0.10	0.60±0.25	0.50±0.20

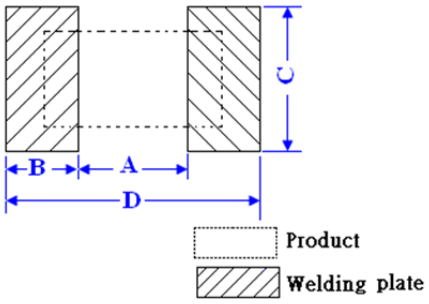


6. Resistance Range

Type	Size	70℃ Power	Resistance Range of 1% & 5%	Max. Working Voltage	Max. Overload Voltage	Dielectric withstanding Voltage	Operating Temperature
HP02	0402	1/10W	1Ω~10M	50V	100V	100V	-55℃~155℃
			0Ω		Rmax=10mΩ, Imax=3A		
HP03	0603	1/5W	0.1Ω~10M	75V	150V	300V	-55℃~155℃
			0Ω		Rmax=8mΩ，Imax=5A		
HP05	0805	1/3W	0.01Ω~10M	150V	300V	500V	-55℃~155℃
			0Ω		Rmax=5mΩ，Imax=6A		
HP06	1206	1/2W	0.01Ω~10M	200V	400V	500V	-55℃~155℃
			0Ω		Rmax=5mΩ，Imax=10A		
HP07	1210	3/4W	0.1Ω~10M	200V	500V	500V	-55℃~155℃
			0Ω		Rmax=4mΩ，Imax=12A		
HP10	2010	1W	0.01Ω~10M	200V	500V	500V	-55℃~155℃
			0Ω		Rmax=5mΩ，Imax=12A		
HP11	1812	1.25W	0.1Ω~10M	200V	500V	500V	-55℃~155℃
			0Ω		Rmax=5mΩ，Imax=12A		
HP12	2512	2W	0.01Ω~10M	250V	500V	500V	-55℃~155℃
			0Ω		Rmax=5mΩ，Imax=16A		

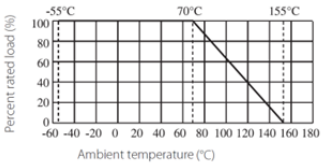
7. Soldering pad size recommended

Type	Dimension(mm)			
	A	B	C	D
HP02	0.5±0.05	0.5±0.05	0.6±0.05	1.5±0.05
HP03	0.8±0.05	0.8±0.05	0.9±0.05	2.4±0.05
HP05	1.0±0.1	1±0.1	1.4±0.1	3±0.1
HP06	2.0±0.1	1.1±0.1	1.8±0.1	4.2±0.1
HP07	2.0±0.1	1.1±0.1	2.9±0.1	4.2±0.1
HP10	3.6±0.1	1.4±0.1	3±0.1	6.4±0.1
HP11	3.0±0.1	1.4±0.1	3.7±0.1	5.8±0.1
HP12	4.9±0.1	1.35±0.1	3.7±0.1	7.6±0.1



8. Derating Curve

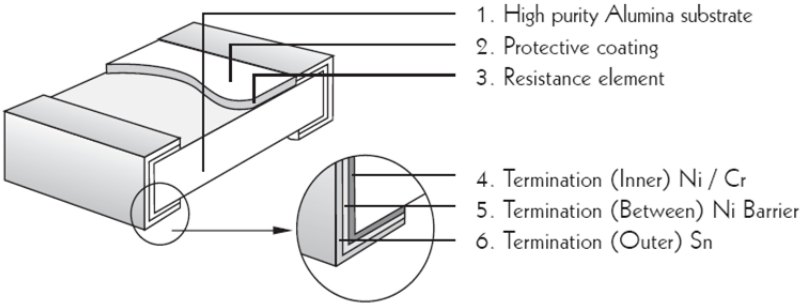
Power rating will change based on continuous load at ambient temperature from -55 to 155℃.
It is constant between -55 to 70℃, and derate to zero when temperature rise from 70 to 155℃.
Voltage rating:
Resistors shall have a rated direct-current (DC) continuous working voltage or an approximate sine-wave 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

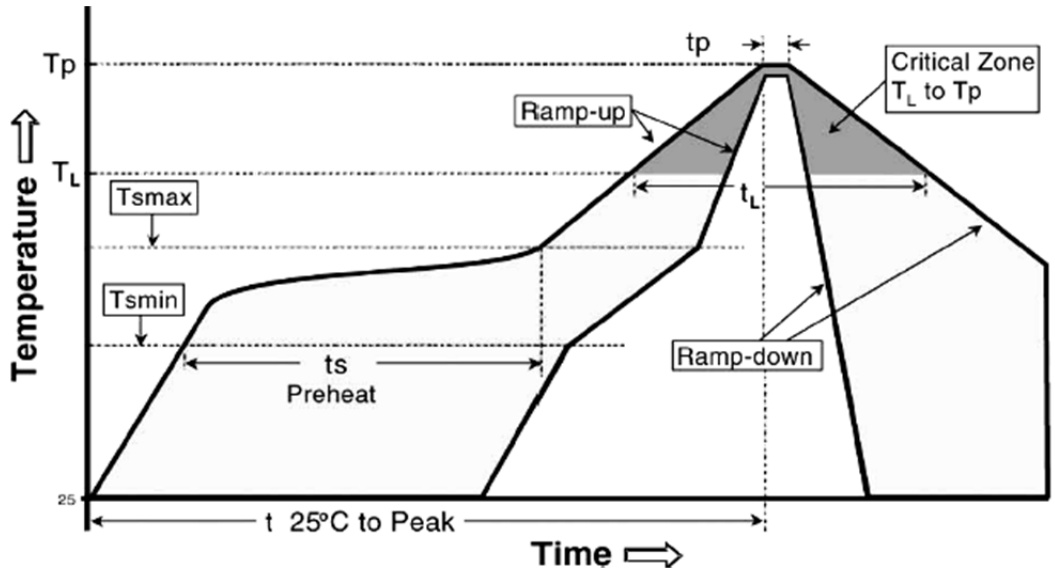
Characteristic	Limits	Test Methods (GB/T5729&JIS-C-5201&IEC60115-1)
Temperature Coefficient	**HP02:** 1Ω≤R≤10Ω: ±400 PPM/℃ 10Ω＜R≤100Ω: ±200 PPM/℃ 100Ω＜R≤10M: ±100 PPM/℃	4.8 Natural resistance changes per temp. Degree centigrade $\frac{R_2-R_1}{R_1(t_2-t_1)} \times 10^6$ (PPM/℃) R_1: Resistance Value at room temperature （t_1）; R_2: Resistance at test temperature (Upper limit temperature or Lower limit temperature) t_1: +25℃ or specified room temperature t_2: Upper limit temperature or Lower limit temperature test temperature
	HP03: 0.1Ω≤R＜0.2Ω: ±200PPM/℃ 0.2Ω≤R≤10M: ±100 PPM/℃	
	HP05: 10mΩ≤R≤15mΩ:±800ppm/°C 15mΩ<R≤25mΩ: ±600ppm/°C 25mΩ<R≤50mΩ: ±400ppm/°C 50mΩ<R<0.1Ω: ±200ppm/°C 0.1Ω≤R≤10M: ±100ppm/°C	

	HP06: 10mΩ≤R<15mΩ: ±700 ppm/°C 15mΩ≤R<30mΩ: ±400 ppm/°C 30mΩ≤R<50mΩ: ±300 ppm/°C 50mΩ≤R<0.1Ω: ±150 ppm/°C 0.1Ω≤R≤10M:±100 ppm/°C		
	HP10: 10mΩ≤R<15mΩ: 0~+800 ppm/°C 15mΩ≤R<50mΩ: 0~+600 ppm/°C 50mΩ≤R<10M: ±100 ppm/°C		
	HP12: 10mΩ≤R<20mΩ: 0~+800ppm/°C 20mΩ≤R≤50mΩ: 0~+400ppm/°C 50mΩ<R≤10M: ±100ppm/°C		
	HP07、HP11: ±100PPM/℃		
Short-time overload	±5%	±(2.0%+0.1Ω)	4.13 Permanent resistance change after the application of 2.5 times RCWV for 5 seconds.
	±1%	±(1.0%+0.1Ω)	
Dielectric withstanding voltage	No evidence of flashover mechanical damage, arcing or insulation breaks done.		4.7 Clamped in the trough of a 90℃ metallic v-block and shall be tested at ac potential respectively specified in the type for 60-70 seconds
Terminal bending	±(1.0%+0.05Ω) Max		4.33 Twist of test board: Y/X = 3/90 mm for 60seconds
Soldering heat	Resistance change rate must be in ±(1.0%+0.05Ω) Max		4.18 Dipping the resistor into a solder bath having a temperature of 260℃±5℃ and hold it for 10±1 seconds
Solderability	Coverage must be over 95%.		4.17 The area covered with a new, smooth, clean, shiny and continuous surface free from concentrated pinholes. Temperature of solder:245±3℃; Dwell time in solder: 2~3 seconds.
Rapid change of temperature	±5%	±(1.0%+0.05Ω)	4.19 30 min at lower limit temperature and 30 min at upper limit temperature，100 cycles..
	±1%	±(0.5%+0.05Ω)	
Humidity (steady state)	±5%	±(3.0%+0.1Ω)	4.24Temporary resistance change after 240 hours exposure in a humidity test chamber controlled at 40±2℃ and 90-95% relative humidity,
	±1%	±(0.5%+0.1Ω)	
Load life in humidity	±5%	±(3.0%+0.1Ω)	7.9 Resistance change after 1,000 hours (1.5 hours “ON”,0.5 hour “OFF”) at RCWV in a humidity chamber controlled at 40 ℃±2℃ and 90-95% relative humidity.
	±1%	±(1.0%+0.1Ω)	
Load life	±5%	±(3.0%+0.1Ω)	4.25.1 Permanent resistance change after 1,000 hours operating at RCWV with duty cycle 1.5 hours “ON”, 0.5 hour “OFF” at 70 ℃±2℃ ambient.
	±1%	±(1.0%+0.1Ω)	
Low Temperature Storage	±5%	±(3.0%+0.1Ω)	4.23.4 Lower limit temperature，for 2H.
	±1%	±(1.0%+0.1Ω)	
High Temperature Exposure	±5%	±(3.0%+0.1Ω)	4.23.2 Upper limit temperature ，for 1000H.
	±1%	±(1.0%+0.1Ω)	
Leaching	No visible damage		J-STD-002 Test D Samples completely immersed for 30 sec in solder bath at 260℃.

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)

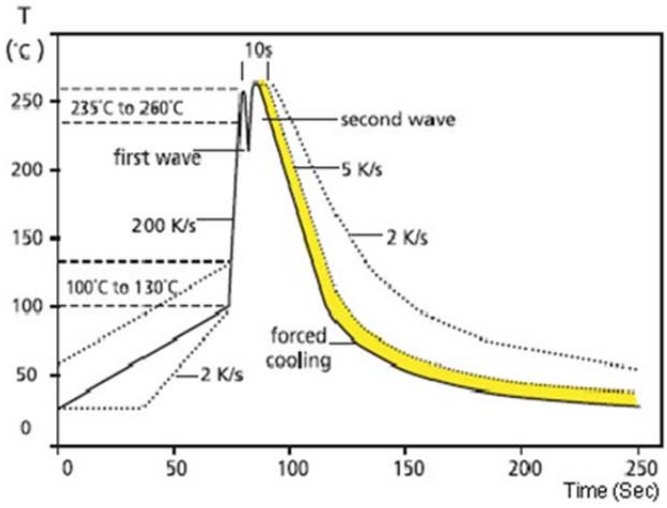


Profile Feature	Lead (Pb)-Free solder
Preheat： Temperature Min (Ts_{min}) Temperature Max (Ts_{max}) Time (Ts_{min} to Ts_{max}) (ts)	 150℃ 200℃ 60 -120 seconds
Average ramp-up rate： (Ts max to Tp)	 3℃ / second max.
Time maintained above : Temperature (T_L) Time (t_L)	 217℃ 60-150 seconds
Peak Temperature (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	8mimutes max.

Allowed Re-flow times : 2 times

Remark : To avoid discoloration phenomena of chip on terminal electrodes, please use N2 Re-flow furnace .

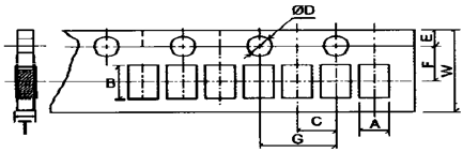
11.2 Recommend Wave Soldering Profile：(Apply to 0603 and above size)



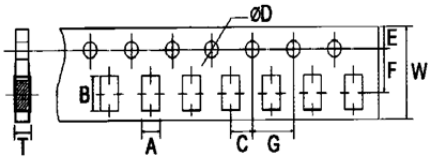
12. Packing

12.1 Dimension of Paper Taping :(Unit: mm)

Type	A ± 0.1	B ± 0.1	C ±0.05	ΦD$^{+0.1}_{-0}$	E ±0.1	F ±0.05	G ±0.1	W ±0.2	T ±0.05
HP02	0.65	1.20	2.00	1.50	1.75	3.5	4.00	8.0	0.42

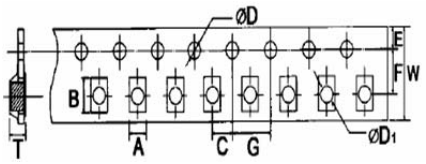


TYPE	A ± 0.2	B ± 0.2	C ± 0.05	ΦD$^{+0.1}_{-0}$	E ± 0.1	F ± 0.05	G ± 0.1	W ± 0.2	T ±0.10
HP03	1.10	1.90	2.00	1.50	1.75	3.5	4.00	8.00	0.67
HP05	1.65	2.40	2.00	1.50	1.75	3.5	4.00	8.00	0.81
HP06	2.00	3.60	2.00	1.50	1.75	3.5	4.00	8.00	0.81
HP07	2.80	3.50	2.00	1.50	1.75	3.5	4.00	8.00	0.75



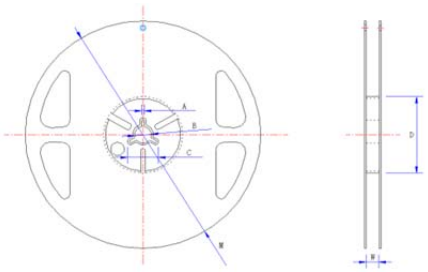
12.2 Dimension of plastic taping：(Unit: mm)

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
HP10	2.9	5.6	2.0	1.5	1.5	1.75	5.5	4.0	12.0	1.0
HP11	3.5	4.8	2.0	1.5	1.5	1.75	5.5	4.0	12.0	1.0
HP12	3.5	6.7	2.0	1.5	1.5	1.75	5.5	4.0	12.0	1.0



12.3 Dimension of Reel：(Unit: mm)

Type	Taping	Qty/Reel	A±0.5	B±0.5	C±0.5	ΦD±1	ΦL±2	W±1
HP02	Paper	10,000pcs	2.0	13.0	21.0	60.0	178.0	10.0
HP03	Paper	5,000pcs	2.0	13.0	21.0	60.0	178.0	10.0
HP05	Paper	5,000pcs	2.0	13.0	21.0	60.0	178.0	10.0
HP06	Paper	5,000pcs	2.0	13.0	21.0	60.0	178.0	10.0
HP07	Paper	5,000pcs	2.0	13.0	21.0	60.0	178.0	10.0
HP10	Embossed	4,000pcs	2.0	13.0	21.0	60.0	178.0	13.8
HP11	Embossed	4,000pcs	2.0	13.0	21.0	60.0	178.0	13.8
HP12	Embossed	4,000pcs	2.0	13.0	21.0	60.0	178.0	13.8



13. Note

13.1. UNI-ROYAL recommend the storage condition temperature: 15℃~35℃, humidity :25%~75%.
(Put condition for individual product).Even under UNI-ROYAL recommended storage condition, solderability of products over 1 year old.
(Put condition for each product) may be degraded.

13.2. Store / transport cartons in the correct direction, which is indicated on a carton as a symbol.
Otherwise bent leads may occur due to excessive stress applied when dropping of a carton.

13.3. Product performance and soldered connections may deteriorate if the products are stored in the following places:
a. Storage in high Electrostatic.
b. Storage in direct sunshine、rain and snow or condensation.
c. Where the products are exposed to sea winds or corrosive gases, including Cl_2, H_2S_3 NH_3, SO_2, NO_2.

14. Record

Version	Description	Page	Date	Amended by	Checked by
1	First version	1~8	Mar.20, 2018	Haiyan Chen	Nana Chen
2	Modify characteristic	4~5	Feb.12, 2019	Haiyan Chen	Xu Yuhua
3	Modify the High Temperature Exposure conditions	5	July.29, 2019	Haiyan Chen	Yuhua Xu
4	Modify the HP12 50mΩ<R≤10M Temperature Coefficient	5	Nov.15, 2019	Haiyan Chen	Yuhua Xu
5	Modify the reflow curve and add the wave soldering curve	6	Apr.29, 2020	Haiyan Chen	Yuhua Xu