

Specification for Approval

Customer : 深圳碧綠天科技有限公司

Product Name: High Power Thick Film Chip Resistors

Part Name : HP、SP SERIES ±1%、±5%

Part No. : HP****F****T*E ; HP****J****T*E
SP****J****T*E ; SP****J****T*E

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Approved	Checked	Prepared	File NO.	Edition	Date	Page
William Zhao	Chen Nana	Chen Haiyan	BLT-01-004	1	2017.10.17	1/16



Contents

Introduction	Page
1.0 Scope	4
2.0 Ratings & Dimension	4~5
3.0 Power Rating.....	6
4.0 Structure.....	6
5.0 Marking.....	7~9
6.0 Performance Specification	9~11
7.0 Explanation of Part No. System.....	11~12
8.0 Ordering Procedure	12
9.0 Packing	13~15
10.0 Precaution for storage/Transportation.....	16

Approved	Checked	Prepared	File NO.	Edition	Date	Page
William Zhao	Chen Nana	Chen Haiyan	BLT-01-004	1	2017.10.17	2/16

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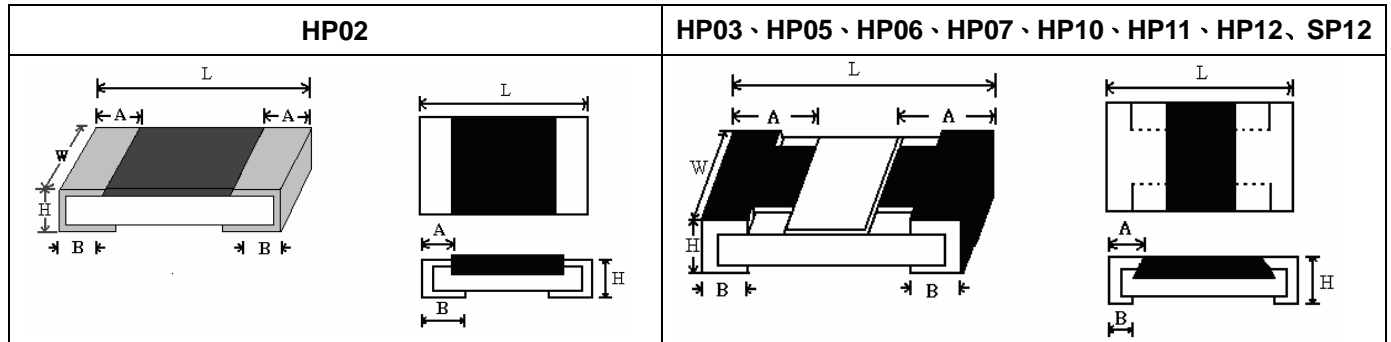
Approved	Checked	Prepared	File NO.	Edition	Date	Page
William Zhao	Chen Nana	Chen Haiyan	BLT-01-004	1	2017.10.17	3/16



1.0 Scope:

This sheet is the statement of the High Power Thick Film Chip Resistors specification that UNIOHM'S productions can meet.

2.0 Ratings & Dimension:



Dimension (mm)

2.1 Dimension:

Type	Dimension(mm)				
	L	W	H	A	B
HP02	1.00±0.10	0.50±0.05	0.35±0.05	0.20±0.10	0.25±0.10
HP03	1.60±0.10	0.80±0.10	0.45±0.10	0.30±0.20	0.30±0.20
HP05	2.00±0.15	1.25 ^{+0.15} _{-0.10}	0.55±0.10	0.40±0.20	0.40±0.20
HP06	3.10±0.15	1.55 ^{+0.15} _{-0.10}	0.55±0.10	0.45±0.20	0.45±0.20
HP07	3.10±0.10	2.60±0.20	0.55±0.10	0.50±0.25	0.50±0.20
HP10	5.00±0.10	2.50±0.20	0.55±0.10	0.60±0.25	0.50±0.20
HP11	4.50±0.20	3.20±0.20	0.55±0.20	0.50±0.20	0.50±0.20
HP12	6.35±0.10	3.20±0.20	0.55±0.10	0.60±0.25	0.50±0.20
SP12	6.35±0.10	3.20±0.15	1.10±0.10	0.60±0.25	1.80±0.20

Approved	Checked	Prepared	File NO.	Edition	Date	Page
William Zhao	Chen Nana	Chen Haiyan	BLT-01-004	1	2017.10.17	4/16

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Type	70°C Power	Resistance Range of 1% & 5%	Max. Working Voltage	Max. Overload Voltage	Dielectric withstanding Voltage	Operating Temperature
HP02	1/10W	1 Ω ~10M	50V	100V	100V	-55°C~155°C
		0 Ω		Rmax=10m Ω , Imax=3A		
HP03	1/5W	0.1 Ω ~10M	75V	150V	300V	-55°C~155°C
		0 Ω		Rmax=8m Ω , Imax=5A		
HP05	1/3W	0.01 Ω ~10M	150V	300V	500V	-55°C~155°C
		0 Ω		Rmax=5m Ω , Imax=6A		
HP06	1/2W	0.01 Ω ~10M	200V	400V	500V	-55°C~155°C
		0 Ω		Rmax=5m Ω , Imax=10A		
HP07	3/4W	0.1 Ω ~10M	200V	500V	500V	-55°C~155°C
		0 Ω		Rmax=4m Ω , Imax=12A		
HP10	1W	0.01 Ω ~10M	200V	500V	500V	-55°C~155°C
		0 Ω		Rmax=5m Ω , Imax=12A		
HP11	1.25W	0.1 Ω ~10M	200V	500V	500V	-55°C~155°C
		0 Ω		Rmax=5m Ω , Imax=12A		
HP12	2W	0.01 Ω ~10M	250V	500V	500V	-55°C~155°C
		0 Ω		Rmax=5m Ω , Imax=16A		
SP12	3W	1 Ω ~10M	250V	500V	500V	-55°C~155°C

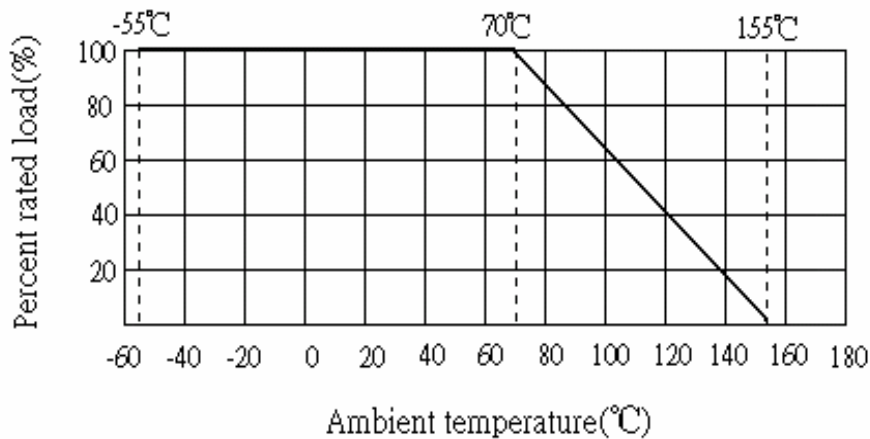
Approved	Checked	Prepared	File NO.	Edition	Date	Page
William Zhao	Chen Nana	Chen Haiyan	BLT-01-004	1	2017.10.17	5/16



3.0 Power Rating:

Resistors shall have a power rating based on continuous load operation at an ambient temperature from -55°C to 70°C. For temperature in excess of 70°C, the load shall be derate as shown in figure 1.

Figure 1



3.1 Voltage rating:

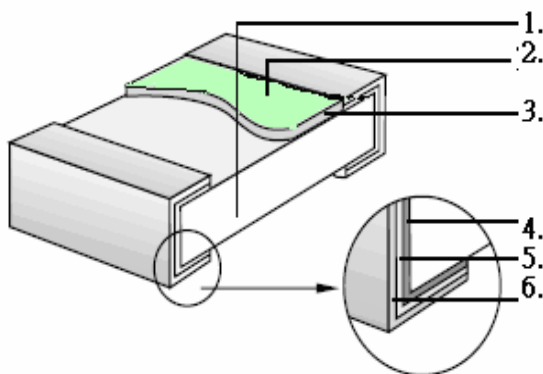
Resistors shall have a rated direct-current (DC) continuous working voltage or an approximate sine-wave root-mean-square (RMS) alternating-current (AC) continuous working voltage at commercial-line frequency and waveform corresponding to the power rating, as determined from the following formula:

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

Where: RCWV= Rated dc or RMS ac continuous working voltage at commercial-line frequency and waveform (VOLT.)
P=Power Rating (WATT.)
R=Nominal Resistance (OHM)

In no case shall the rated dc or RMS ac continuous working voltage be greater than the applicable maximum value.

4.0 Structure:



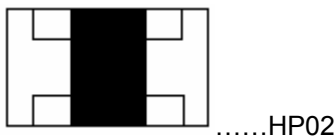
- 1) High purity alumina substrate
- 2) Protective covering
- 3) Resistive element
- 4) Termination inner (Ni/Cr)
- 5) Termination (between) Ni Barrier
- 6) Termination (outer) Sn

Approved	Checked	Prepared	File NO.	Edition	Date	Page
William Zhao	Chen Nana	Chen Haiyan	BLT-01-004	1	2017.10.17	6/16



5.0 Marking:

(1) For HP02 size. Due to the very small size of the resistor's body, there is no marking on the body.



(2) $\pm 5\%$ Tolerance: the first two digits are significant figures of resistance and the third denotes number of zeros following.



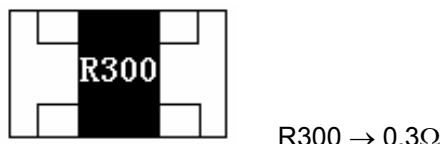
(3) $\pm 5\%$ Tolerance: below 10Ω Show as following, read alphabet "R" as decimal point.



(4) $\pm 1\%$ Tolerance: 4 digits, first three digits are significant; fourth digit is number of zeros. Letter "R" is decimal point.



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



(6) Standard E-96 series values ($\pm 1\%$ tolerance) of HP03 size. Due the small size of the resistor's body, 3 digits marking will be used to indicate the accurate resistance value by using the following multiplier & resistance code.

Multiplier code:

Code	A	B	C	D	E	F	G	H	X	Y	Z
Multiplier	10^0	10^1	10^2	10^3	10^4	10^5	10^6	10^7	10^{-1}	10^{-2}	10^{-3}

Coding formula

First two digits-----Resistance code; Third digit-----Multiplier code



Approved	Checked	Prepared	File NO.	Edition	Date	Page
William Zhao	Chen Nana	Chen Haiyan	BLT-01-004	1	2017.10.17	7/16

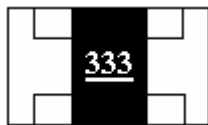
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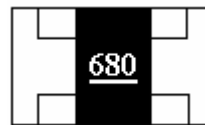
STANDARD E-96 VALUES AND HP03 RESISTANCE CODE

Ω VALUE	CODE	Ω VALUE	CODE	Ω VALUE	CODE	Ω VALUE	CODE
100	01	178	25	316	49	562	73
102	02	182	26	324	50	576	74
105	03	187	27	332	51	590	75
107	04	191	28	340	52	604	76
110	05	196	29	348	53	619	77
113	06	200	30	357	54	634	78
115	07	205	31	365	55	649	79
118	08	210	32	374	56	665	80
121	09	215	33	383	57	681	81
124	10	221	34	392	58	698	82
127	11	226	35	402	59	715	83
130	12	232	36	412	60	732	84
133	13	237	37	422	61	750	85
137	14	243	38	432	62	768	86
140	15	249	39	442	63	787	87
143	16	255	40	453	64	806	88
147	17	261	41	464	65	825	89
150	18	267	42	475	66	845	90
154	19	274	43	487	67	866	91
158	20	280	44	499	68	887	92
162	21	287	45	511	69	909	93
165	22	294	46	523	70	931	94
169	23	301	47	536	71	953	95
174	24	309	48	549	72	976	96

(7) Standard E-24 and not belong to E-96 series values(in $\pm 1\%$ tolerance)of HP03 size .The marking is the same as 5% tolerance but marking as underline



333=33000→33KΩ



680→68Ω

Approved	Checked	Prepared	File NO.	Edition	Date	Page
William Zhao	Chen Nana	Chen Haiyan	BLT-01-004	1	2017.10.17	8/16

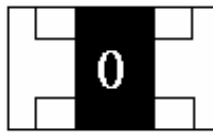


(8) 0Ω Marking:

Normally HP02 size, no marking on the body:



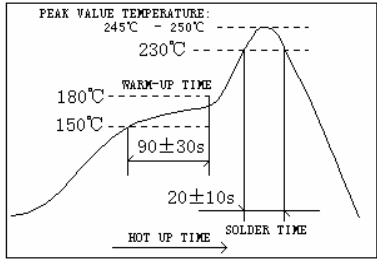
Normally, the making of 0Ω HP03, 0Ω HP05, 0Ω HP06, 0Ω HP07, 0Ω HP10, 0Ω HP12 resistors as following



6.0 Performance Specification:

Characteristic	Limits	Test Method (JIS-C-5201&JIS-C-5202)
Temperature Coefficient	HP02: $1\Omega \leq R \leq 10\Omega$: ± 400 PPM/°C $10\Omega < R \leq 100\Omega$: ± 200 PPM/°C $100\Omega < R \leq 10M$: ± 100 PPM/°C	4.8 Natural resistance changes per temp. Degree centigrade $\frac{R_2 - R_1}{R_1(T_2 - T_1)} \times 10^6 \text{ (PPM/°C)}$ R ₁ : resistance value at room temp. (T ₁) R ₂ : resistance value at room temp. +100°C (T ₂) Test pattern: room temp. (T ₁), room temp. +100°C (T ₂)
	HP03: $0.1\Omega \leq R < 0.2\Omega$: ± 200 PPM/°C $0.2\Omega \leq R \leq 10M$: ± 100 PPM/°C	
	HP05: $10m\Omega \leq R \leq 15m\Omega$: ± 800 ppm/°C $15m\Omega < R \leq 25m\Omega$: ± 600 ppm/°C $25m\Omega < R \leq 50m\Omega$: ± 400 ppm/°C $50m\Omega < R < 0.1\Omega$: ± 200 ppm/°C $0.1\Omega \leq R \leq 10M$: ± 100 ppm/°C	
	HP06: $10m\Omega \leq R < 15m\Omega$: ± 700 ppm/°C $15m\Omega \leq R < 30m\Omega$: ± 400 ppm/°C $30m\Omega \leq R < 50m\Omega$: ± 300 ppm/°C $50m\Omega \leq R < 0.1\Omega$: ± 150 ppm/°C $0.1\Omega \leq R \leq 10M$: ± 100 ppm/°C	
	HP10: $10m\Omega \leq R < 15m\Omega$: 0~+800 ppm/°C $15m\Omega \leq R < 50m\Omega$: 0~+600 ppm/°C $50m\Omega \leq R < 10M$: ± 100 ppm/°C	
	HP12: $10m\Omega \leq R < 20m\Omega$: 0~+800 ppm/°C $20m\Omega \leq R \leq 50m\Omega$: 0~+400 ppm/°C $50m\Omega < R \leq 10M$: ± 75 ppm/°C	
	HP07、HP11、SP12: ± 100 PPM/°C	

Approved	Checked	Prepared	File NO.	Edition	Date	Page
William Zhao	Chen Nana	Chen Haiyan	BLT-01-004	1	2017.10.17	9/16

Short-time overload	±5%	±(2.0%+0.1Ω) Max	4.13 Permanent resistance change after the application of 2.5 times RCWV for 5 seconds.															
	±1%	±(1.0%+0.1Ω) Max																
Dielectric withstanding voltage	No evidence of flashover mechanical damage, arcing or insulation breaks done.		4.7 Clamped in the trough of a 90°C 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°C±5°C and hold it for 10±1 seconds															
Solderability	95% coverage Min.		Wave solder: Test temperature of solder: 245°C±3°C dipping time in solder: 2-3 seconds.															
			Reflow: 															
Temperature cycling	±5%	±(1.0%+0.05Ω)Max	4.19 Resistance change after continuous five cycles for duty cycle specified below: <table border="1" data-bbox="833 1666 1452 1912"> <thead> <tr> <th>STEP</th> <th>TEMPERATURE</th> <th>TIME</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>-55°C±3°C</td> <td>30 MINS</td> </tr> <tr> <td>2</td> <td>ROOM TEMP.</td> <td>10 --- 15 MINS</td> </tr> <tr> <td>3</td> <td>+155°C±2°C</td> <td>30 MINS</td> </tr> <tr> <td>4</td> <td>ROOM TEMP.</td> <td>10 --- 15 MINS</td> </tr> </tbody> </table>	STEP	TEMPERATURE	TIME	1	-55°C±3°C	30 MINS	2	ROOM TEMP.	10 --- 15 MINS	3	+155°C±2°C	30 MINS	4	ROOM TEMP.	10 --- 15 MINS
	STEP	TEMPERATURE		TIME														
1	-55°C±3°C	30 MINS																
2	ROOM TEMP.	10 --- 15 MINS																
3	+155°C±2°C	30 MINS																
4	ROOM TEMP.	10 --- 15 MINS																
	±1%	±(0.5%+0.05Ω)Max																

Approved	Checked	Prepared	File NO.	Edition	Date	Page
William Zhao	Chen Nana	Chen Haiyan	BLT-01-004	1	2017.10.17	10/16



Humidity (steady state)	±5%	±(3.0%+0.1Ω) Max.	4.24 Temporary resistance change after 240 hours exposure in a humidity test chamber controlled at 40±2°C and 90-95% relative humidity,
	±1%	±(0.5%+0.1Ω) Max.	
Load life in humidity	±5%	±(3.0%+0.1Ω) Max.	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°C±2°C and 90 to 95% relative humidity.
	±1%	±(1.0%+0.1Ω) Max.	
Load life	±5%	±(3.0%+0.1Ω) Max.	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°C±2°C ambient.
	±1%	±(1.0%+0.1Ω) Max.	

7.0 Explanation of Part No. System:

The standard Part No. includes 14 digits with the following explanation:

7.1 This is to indicate the High Power Thick Film Chip Resistors size.

Example: HP02、HP03、HP05、HP06、HP07、HP10、HP11、HP12、SP12

7.2 5th~6th digits:

7.2.1 This is to indicate the wattage or power rating. To dieting the size and the numbers,

The following codes are used; and please refer to the following chart for detail:

W=Normal Size; “1” ~ “G” to denotes “1” ~ “16” as Hexadecimal:

1/16W~ 1W:

Wattage	1/2	1/3	1/4	1/5	1/6	3/4	1/8	1/10	1/16	1	2
Normal Size	W2	W3	W4	W5	W6	07	W8	WA	WG	1W	2W

7.2.2 For power rating less than 1 watt, the 5th digit will be the letters “W” to represent the size required & the 6th digit will be a number or a letter code.

Example: W3=1/3W、W4=1/4W

7.3 The 7th digit is to denote the Resistance Tolerance. The following letter code is to be used for indicating the standard Resistance Tolerance.

F=±1% G=±2% J=±5% K= ±10%

7.4 The 8th to 11th digits is to denote the Resistance Value.

7.4.1 For the standard resistance values of E-24 series in 5%&10% tolerance, the 8th digit is “0” ,the 9th & 10th digits are to denote the significant figures of the resistance and the 11th digit is the number of zeros following;

For the standard resistance values of E-96 series in ≤2% tolerance, the 8th digit to the 10th digits is to denote the significant figures of the resistance and the 11th digit is the zeros following.

7.4.2 The following number s and the letter codes are to be used to indicate the number of zeros in the 11th digit:

0=10⁰ 1=10¹ 2=10² 3=10³ 4=10⁴ 5=10⁵ 6=10⁶ J=10⁻¹ K=10⁻² L=10⁻³ M=10⁻⁴

Approved	Checked	Prepared	File NO.	Edition	Date	Page
William Zhao	Chen Nana	Chen Haiyan	BLT-01-004	1	2017.10.17	11/16



7.4.3 The 12th, 13th & 14th digits.

The 12th digit is to denote the Packaging Type with the following codes:

C=Bulk in (Chip Product) T=Tape/Reel

7.4.4 The 13th digit is normally to indicate the Packing Quantity of Tape/Box & Tape/Reel packaging types. The following letter code and number is to be used for some packing quantities:

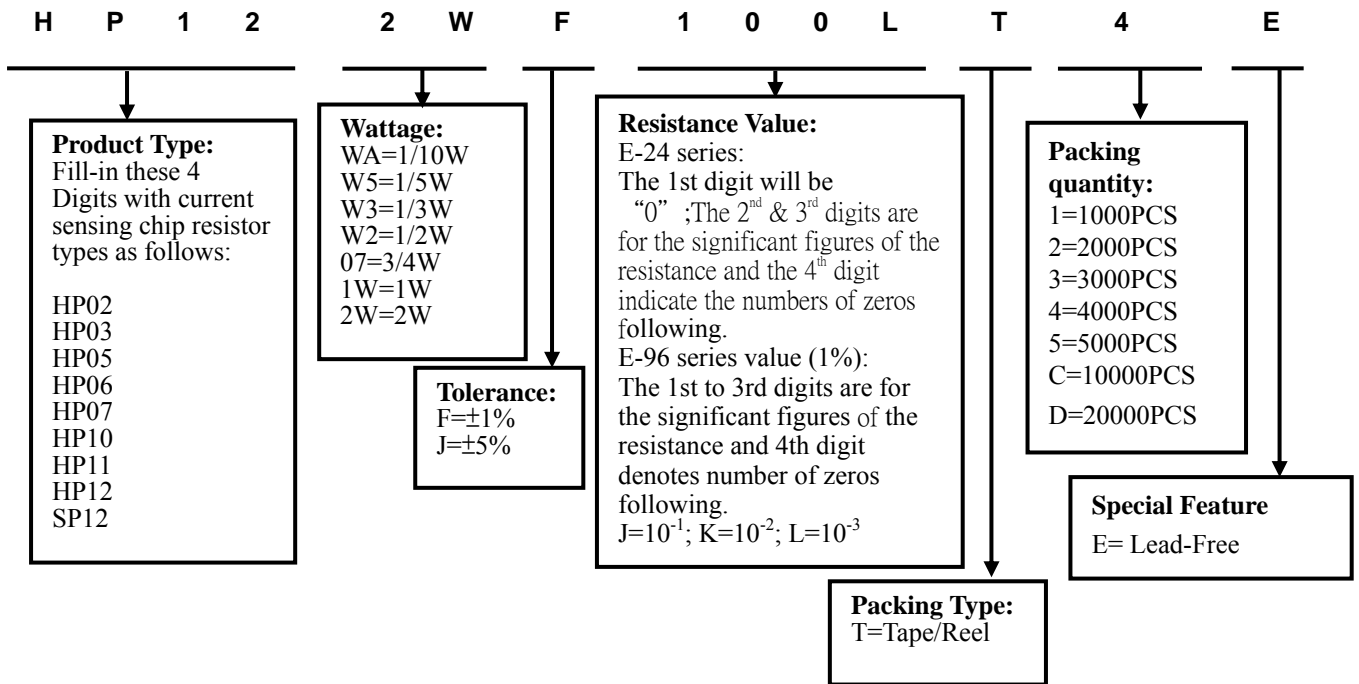
1=1000pcs 2=2000pcs 3=3000pcs 4=4000pcs
5=5000pcs C=10000pcs D=20000pcs E=15000pcs

Chip Product: BD=B/B-20000pcs TC=T/R-10000pcs

7.4.5 For some items, the 14th digit alone can use to denote special features of additional information with the following codes:

E=For “Environmental Protection, Lead Free type” of Chip.

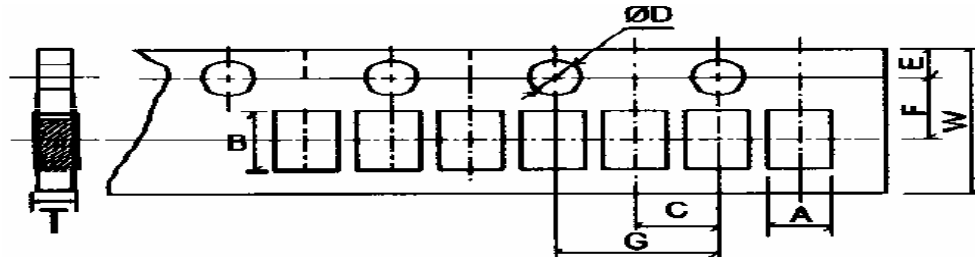
8.0 Ordering Procedure: (Example: HP12 2W ±1% 0.1Ω T/R-4000)



Approved	Checked	Prepared	File NO.	Edition	Date	Page
William Zhao	Chen Nana	Chen Haiyan	BLT-01-004	1	2017.10.17	12/16

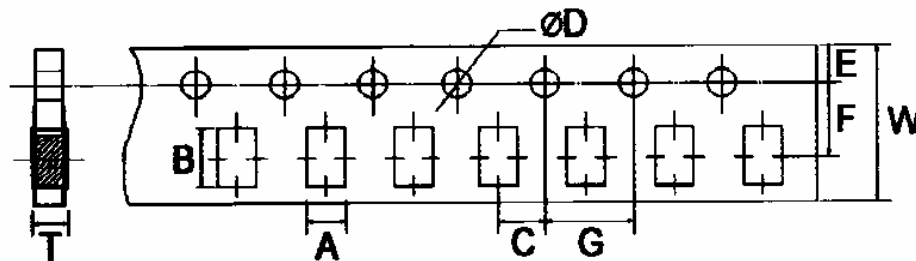
9.0 Packaging:

9.1 Tapping Dimension:



Unit: mm

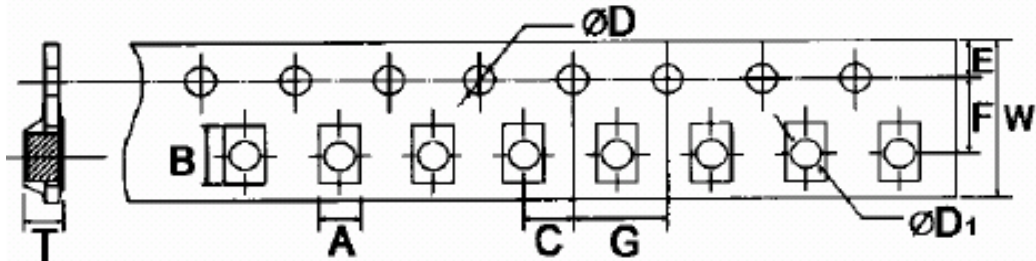
Type	A ± 0.1	B ± 0.1	C ± 0.05	ϕD +0.1 -0	E ± 0.1	F ± 0.05	G ± 0.1	W ± 0.2	T ± 0.05
HP02	0.65	1.20	2.00	1.50	1.75	3.5	4.00	8.0	0.42



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 ± 0.10
HP03	1.10	1.90	2.00	1.50	1.75	3.5	4.00	8.0	0.67
HP05	1.65	2.40	2.00	1.50	1.75	3.5	4.00	8.0	0.81
HP06	2.00	3.60	2.00	1.50	1.75	3.5	4.00	8.0	0.81
HP07	2.80	3.50	2.00	1.50	1.75	3.5	4.00	8.00	0.75

Approved	Checked	Prepared	File NO.	Edition	Date	Page
William Zhao	Chen Nana	Chen Haiyan	BLT-01-004	1	2017.10.17	13/16

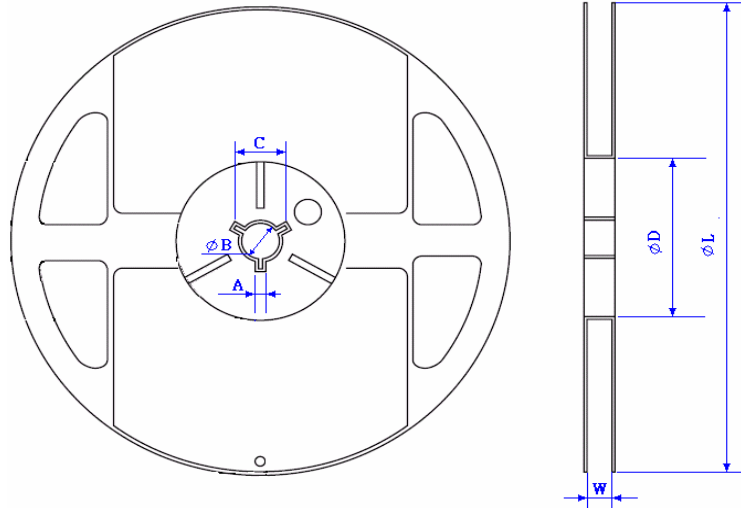


Unit: mm

Type	A±0.2	B±0.2	C±0.05	+ 0.1 φD - 0	+0.25 φD1 - 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	1.0
HP11	3.5	4.8	2.0	1.5	1.5	1.75	5.5	4.0	12	1.0
HP12	3.5	6.7	2.0	1.5	1.5	1.75	5.5	4.0	12	1.0
SP12	3.5	6.7	2.0	1.5	1.5	1.75	5.5	4.0	12	1.35

Approved	Checked	Prepared	File NO.	Edition	Date	Page
William Zhao	Chen Nana	Chen Haiyan	BLT-01-004	1	2017.10.17	14/16

9.2 Dimension:



Unit: mm

Type	Taping	Size	A±0.5	B±0.5	C±0.5	ΦD±1	ΦL±2	W±1
HP02	Paper	10,000pcs reel	2.0	13.0	21.0	60.0	178.0	10.0
HP03	Paper	5,000pcs reel	2.0	13.0	21.0	60.0	178.0	10.0
HP05	Paper	5,000pcs reel	2.0	13.0	21.0	60.0	178.0	10.0
HP06	Paper	5,000pcs reel	2.0	13.0	21.0	60.0	178.0	10.0
HP07	Paper	5,000pcs reel	2.0	13.0	21.0	60.0	178.0	10.0
HP10	Embossed	4,000pcs reel	2.0	13.0	21.0	60.0	178.0	13.8
HP11	Embossed	4,000pcs reel	2.0	13.0	21.0	60.0	178.0	13.8
HP12	Embossed	4,000pcs reel	2.0	13.0	21.0	60.0	178.0	13.8
SP12	Embossed/ Paper	2,000pcs reel	2.0	13.0	21.0	60.0	178.0	13.8

Approved	Checked	Prepared	File NO.	Edition	Date	Page
William Zhao	Chen Nana	Chen Haiyan	BLT-01-004	1	2017.10.17	15/16



10.0 Precaution for storage/Transportation:

101. UNIOHM recommend the storage condition temperature: 15°C~35°C, humidity :25%~75%.
(Put condition for individual product)
Even under UNIOHM recommended storage condition, solderability of products over 1 year old.
(Put condition for each product) may be degraded.
- 10.2. 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.
- 10.3. 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 Cl₂, H₂S₃, NH₃, SO₂, NO₂.

Approved	Checked	Prepared	File NO.	Edition	Date	Page
William Zhao	Chen Nana	Chen Haiyan	BLT-01-004	1	2017.10.17	16/16