

ROYALOHM

C O N F I D E N T I A L D O C U M E N T

SPECIFICATION FOR APPROVAL

Description : High Power Thick Film Kit Resistors

Royalohm Part no.:

HP02WAFE024KIT	(HP02 1/10W (0402) +/- 1% KIT Series)
HP03W5FE024KIT	(HP03 1/5W (0603) +/- 1% KIT Series)
HP05W3FE024KIT	(HP05 1/3W (0805) +/- 1% KIT Series)
HP06W2FE024KIT	(HP06 1/2W (1206) +/- 1% KIT Series)
HP122WFE024KIT	(HP12 2W (2512) +/- 1% KIT Series)

Approved by

RoHS V3 Compliant (EU) 2015/863
REACH Compliant

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Approved	Checked	Prepared
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Issue Date: 2021/07/09

Chip Kit Resistors

1. Scope:

This specification for approval relates to High Power Thick Film KIT Resistors manufactured by ROYALOHM 's specifications.

2. Type designation:

The type designation shall be in the following form:

	Type	Power Rating	Resistance tolerance	Nominal Resistance
Ex.	HP02	1/10W (0.10W)	F	10Ω

3. Ratings:

Type	HP02	HP03	HP05	HP06	HP12
Power Rating	1/10W (0.10W)	1/5W (0.20W)	1/3W (0.33W)	1/2W (0.50W)	2W
Max. Working Voltage	50 V	50 V	150 V	200 V	250 V
Max. Overload Voltage	100 V	100 V	300 V	400 V	500 V
Dielectric Withstanding Voltage	100 V	300 V	500 V	500 V	500 V
Temperature Range	-55°C ~ +155°C				
Ambient Temperature	70 °C				

3.1 Power rating:

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

Figure 1

3.2 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 :

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

Note : Max. Working Voltage or $\sqrt{P \times R}$ whichever is lesser

Max. Overload Voltage or $2.5 \sqrt{P \times R}$ whichever is lesser

Were : RCWV = Rated DC or RMS AC continuous working voltage at commercial-line frequency and waveform (volt)

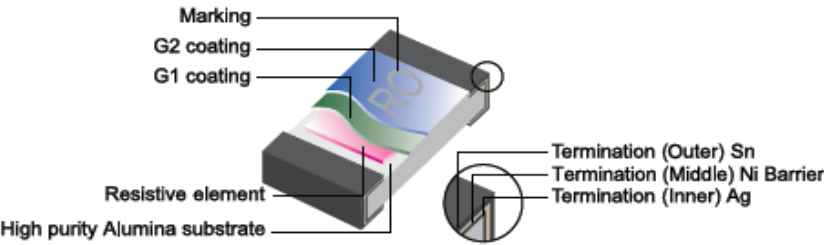
P = Power Rating (watt)

R = Nominal Resistance (ohm)

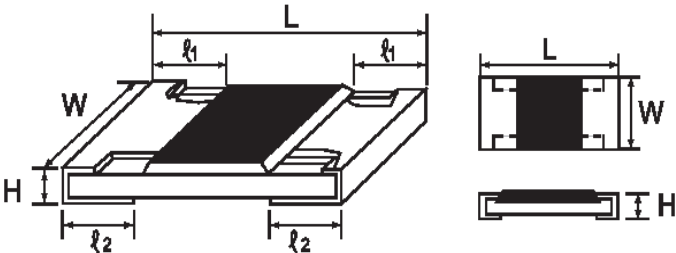
In no case shall the rated DC or RMS AC continuous working voltage be greater than the applicable maximum value.

Chip Kit Resistors

4. Construction :



5. Power rating and dimensions



Dimension :

Type	Dimension (mm)				
	L	W	H	ℓ1	ℓ2
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 + 0.15 - 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
HP12	6.35 ± 0.10	3.20 ± 0.15	0.55 ± 0.10	0.60 ± 0.25	0.50 ± 0.20

Power Rating :

Type	Power Rating at 70 °C	Tolerance %	Resistance Range	Standard Series
HP02	1/10W (0.10W)	± 1	1Ω ~ 10MΩ	E-96
HP03	1/5W (0.20W)	± 1	1Ω ~ 10MΩ	E-96
HP05	1/3W (0.33W)	± 1	1Ω ~ 10MΩ	E-96
HP06	1/2W (0.50W)	± 1	1Ω ~ 10MΩ	E-96
HP12	2W	± 1	1Ω ~ 10MΩ	E-96

Chip Kit Resistors

6. Marking :

6.1 Resistors

A. $\pm 5\%$ Tolerance HP03, HP05, HP06 , HP12: the first two digits are significant figures of resistance and the third one denoted number of zeros.

Ex.

	333	
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 33K Ω

B. For ohmic values below 10 Ω

Ex.

	2R2	
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 2.2 Ω

C. For E-96 series [$\pm 1\%$ (F) tolerance] in HP03 size 3 digit system (due to space restrictions) please refer to page 4 for coding formula

Ex.

	02C	
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 10.2K Ω

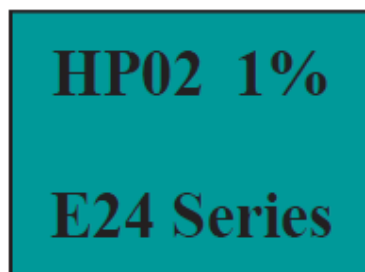
D. $\pm 1\%$ Tolerance HP05, HP06 , HP12 : 4 Digits, the first three digits are significant figures of resistance and the fourth digit denoted number of zeros. Letter "R" is for decimal point.

Ex.

	2701	
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 2.7K Ω

6.2 Labels



Chip Kit Resistors

Mutiplier 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

XX

Resistance Code

Formula

X

Multiplier Code

Example :

$$10.2K\Omega = \underset{\downarrow 02}{102} \times \underset{\downarrow C}{10^2} \Omega = 02C$$

$$33.2\Omega = \underset{\downarrow 51}{332} \times \underset{\downarrow X}{10^{-1}} \Omega = 51X$$

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

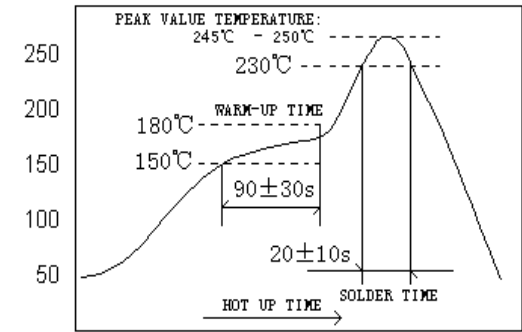
*Marking for HP03 E-96 series, the resistance value that no have multiplier code indicate marking follow this:

The first two digits are significant figures of resistance and the third one denoted number of zeros and under line the marking letters.

Ex.

	<u>122</u>	
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1.2KΩ

Chip Kit Resistors																	
7. Performance specification :																	
Characteristics	Limits	Test Methods (JIS C 5201-1)															
Dielectric withstanding voltage	No evidence of flashover mechanical damage, arcing or insulation break down	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															
Temperature Coefficient	$1\Omega \sim 10\Omega : \pm 200\text{PPM}/^\circ\text{C}$ $10.1\Omega \sim 10\text{M}\Omega : \pm 100\text{PPM}/^\circ\text{C}$ HP02: $1\Omega \sim 10\Omega : \pm 400\text{PPM}/^\circ\text{C}$ $10.1\Omega \sim 100\Omega : \pm 200\text{PPM}/^\circ\text{C}$ $>100\Omega : \pm 100\text{PPM}/^\circ\text{C}$	4.8 Natural resistance change per temp. degree centigrade. $\frac{R2-R1}{R1(t2-t1)} \times 10^6 \quad (\text{PPM}/^\circ\text{C})$ R1: Resistance value at room temperature (T1) R2: Resistance value at room temp. plus 100 °C(T2) Test pattern: room temp. (T1), room temp. +100°C(T2)															
Short time overload	Resistance change rate is $\pm (1.0\% + 0.1\Omega)$ Max.	4.13 Permanent resistance change after the application of a potential of 2.5 times RCWV for 5 seconds															
Solderability	95 % coverage Min.	Wave Solder: Test temperature of solder: 245°C $\pm 3^\circ\text{C}$ dipping time in solder : 2-3 seconds. Refolw: 															
Soldering heat	Resistance change rate is: $\pm (1.0\% + 0.05\Omega)$ Max.	4.18 Dip the resistor into a solder bath having a temperature of 260°C $\pm 3^\circ\text{C}$ and hold it for 10 ± 1 seconds.															
Temperature cycling	Resistance change rate is $\pm (0.5\% + 0.05\Omega)$ Max.	4.19 Resistance change after continuous 100 cycles for duty cycle specified below : <table border="1"> <thead> <tr> <th>Step</th><th>Temperature</th><th>Time</th></tr> </thead> <tbody> <tr> <td>1</td><td>-55°C $\pm 3^\circ\text{C}$</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 $\pm 2^\circ\text{C}$</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 $\pm 3^\circ\text{C}$	30 mins	2	Room temp.	10~15 mins	3	+155°C $\pm 2^\circ\text{C}$	30 mins	4	Room temp.	10~15 mins
Step	Temperature	Time															
1	-55°C $\pm 3^\circ\text{C}$	30 mins															
2	Room temp.	10~15 mins															
3	+155°C $\pm 2^\circ\text{C}$	30 mins															
4	Room temp.	10~15 mins															

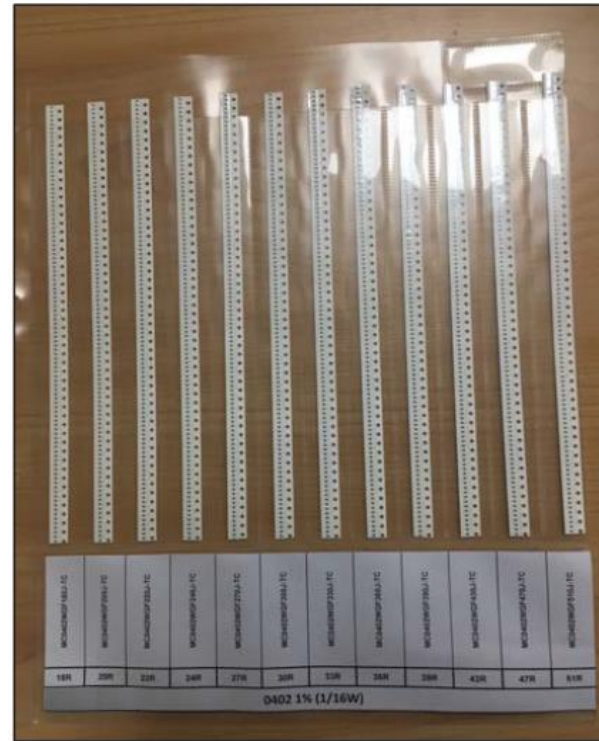
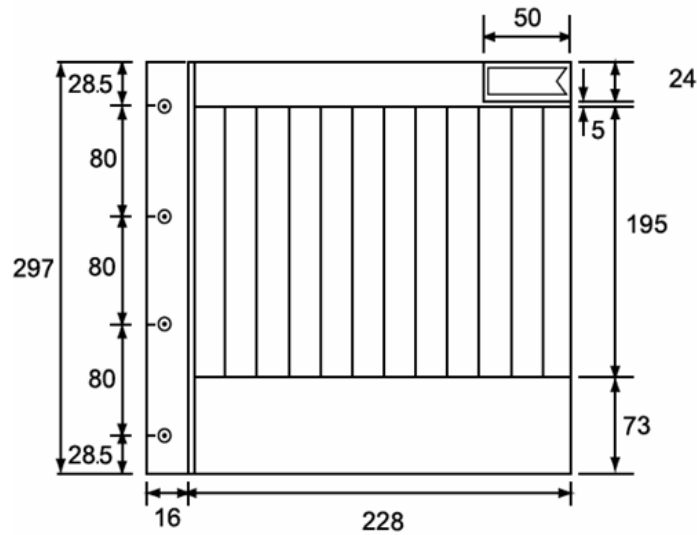
Chip Kit Resistors		
7. Performance specification :		
Characteristics	Limits	Test Methods (JIS C 5201-1)
Humidity	Resistance change rate is $\pm (0.5\% + 0.1\Omega)$ Max.	4.24 Temporary resistance change after 240 hours exposure in a humidity test chamber controlled at $40\pm 2^{\circ}\text{C}$ and 90-95% relative humidity
Load life in humidity	Resistance change rate is $\pm (1.0\% + 0.1\Omega)$ 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 $40^{\circ}\text{C} \pm 2^{\circ}\text{C}$ and 90 to 95 % relative humidity
Load Life	Resistance change rate is $\pm (1.0\% + 0.1\Omega)$ Max.	4.25.1 Permanent resistance change after 1,000 hours operating at RCWV, with duty cycle of (1.5 hours "on", 0.5 hour "off") at $70^{\circ}\text{C} \pm 2^{\circ}\text{C}$ ambient
Terminal bending	Resistance change rate is $\pm (1.0\% + 0.05\Omega)$ Max.	4.33 Twist of Test Board : Y/X = 3/90 mm for 60 seconds

Chip Kit Resistors

8. Kit resistors:

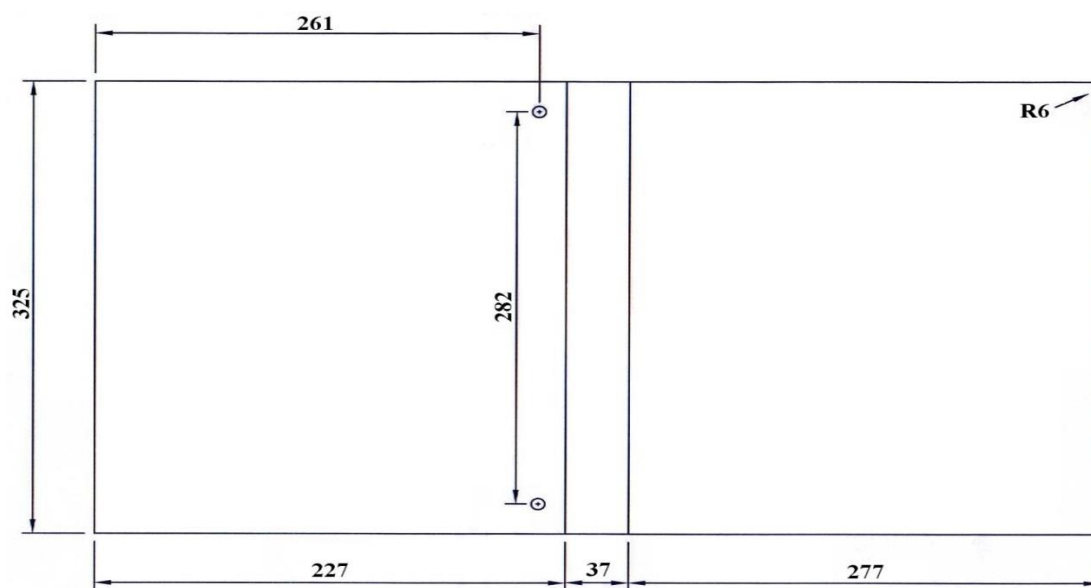
8.1 Insert for Chip Kit

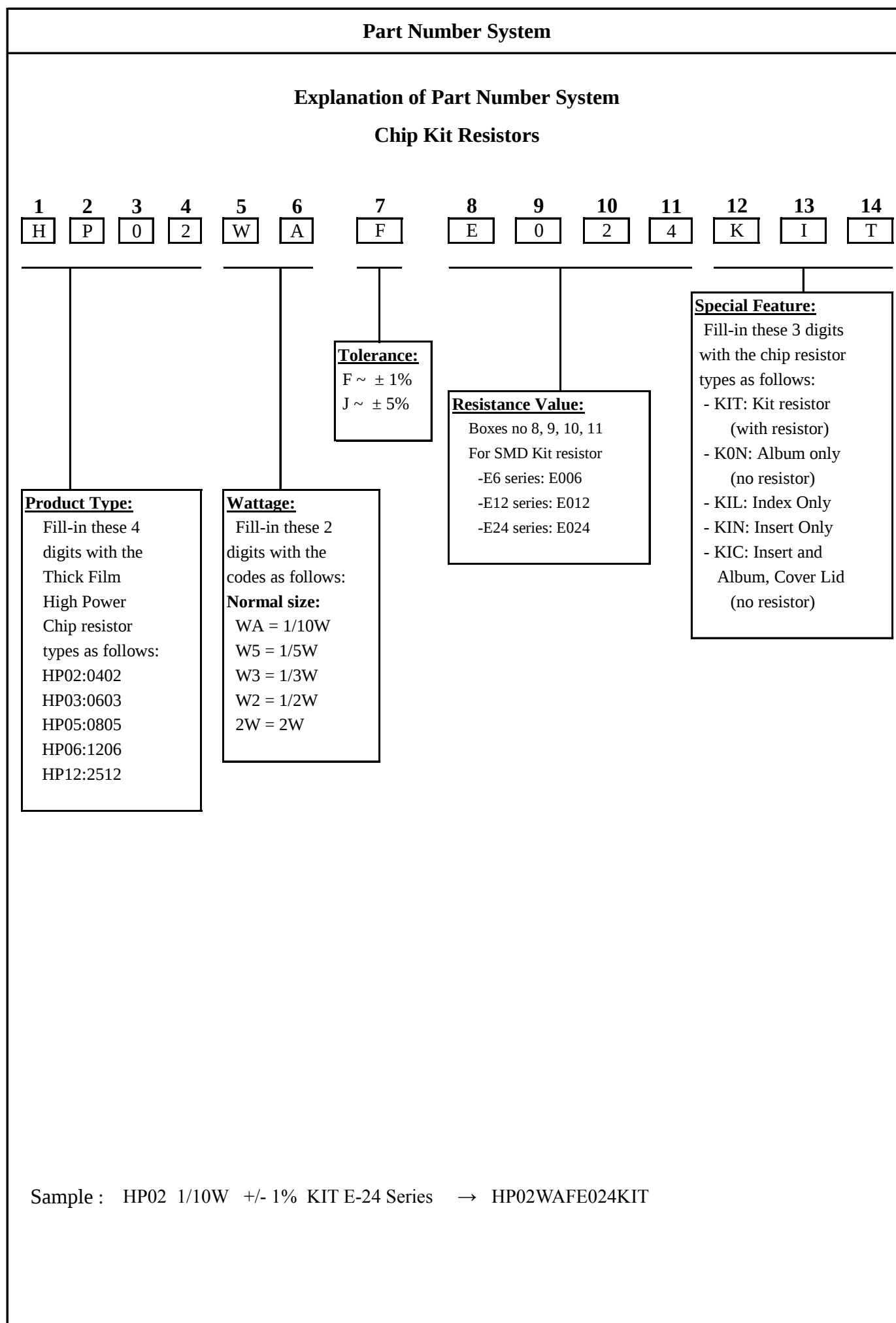
Dimension (mm)



8.2 Album for Chip Kit

Dimension (mm)





Chip Kit Resistors

Environment Related Substance

This product complies to EU RoHS directive, EU PAHs directive, EU PFOS directive and Halogen free.

Ozone layer depleting substances.

Ozone depleting substances are not used in our manufacturing process of this product.

This product is not manufactured using Chloro fluorocarbons (CFCs), Hydrochlorofluorocarbons (HCFCs), Hydrobromofluorocarbons (HBFCs) or other ozone depleting substances in any phase of the manufacturing process.

Storage Condition (MSL1)

The performance of these products, including the solderability, is guaranteed for a year from the date of arrival at your company, provided that they remain packed as they were when delivered and stored at a temperature of $25^{\circ}\text{C} \pm 10^{\circ}\text{C}$ and a relative humidity of $60\%\text{RH} \pm 10\%\text{RH}$, chemical and dust free atmosphere

Even within the above guarantee periods, do not store these products in the following conditions. Otherwise, their electrical performance and/or solderability may be deteriorated, and the packaging materials (e.g. taping materials) may be deformed or deteriorated, resulting in mounting failures.

1. In salty air or in air with a high concentration of corrosive gas, such as Cl_2 , H_2S , NH_3 , SO_2 , or NO_2
2. In direct sunlight

Chip Kit Resistors

PRODUCT:HP Kit (HP02, HP03, HP05, HP06) +/-1%

E24 Series = 122 values (0R&1R to 10M)

Total Qty: (HP02) 12,200pcs (100 pcs per value)

Total Qty: (HP03, HP05, HP06) 6,100pcs (50 pcs per value)

NO.	Value
1	0R
2	10R
3	11R
4	12R
5	13R
6	15R
7	16R
8	18R
9	20R
10	22R
11	24R
12	27R
13	30R
14	33R
15	36R
16	39R
17	43R
18	47R
19	51R
20	56R
21	62R
22	68R
23	75R
24	82R
25	91R
26	100R
27	110R
28	120R
29	130R
30	150R
31	160R
32	180R
33	200R
34	220R
35	240R

NO.	Value
36	270R
37	300R
38	330R
39	360R
40	390R
41	430R
42	470R
43	510R
44	560R
45	620R
46	680R
47	750R
48	820R
49	910R
50	1K
51	1K1
52	1K2
53	1K3
54	1K5
55	1K6
56	1K8
57	2K
58	2K2
59	2K4
60	2K7
61	3K
62	3K3
63	3K6
64	3K9
65	4K3
66	4K7
67	5K1
68	5K6
69	6K2
70	6K8

NO.	Value
71	7K5
72	8K2
73	9K1
74	10K
75	11K
76	12K
77	13K
78	15K
79	16K
80	18K
81	20K
82	22K
83	24K
84	27K
85	30K
86	33K
87	36K
88	39K
89	43K
90	47K
91	51K
92	56K
93	62K
94	68K
95	75K
96	82K
97	91K
98	100K
99	110K
100	120K
101	130K
102	150K
103	160K
104	180K
105	200K

NO.	Value
106	220K
107	240K
108	270K
109	300K
110	330K
111	360K
112	390K
113	430K
114	470K
115	510K
116	560K
117	620K
118	680K
119	750K
120	820K
121	910K
122	1M

Chip Kit Resistors**PRODUCT:HP Kit (HP12) +/-1%****E24 Series = 134 values (1R to 10M)****Total Qty: (HP12) 6,700pcs (50 pcs per value)**

NO.	Value
1	1R0
2	1R5
3	2R2
4	3R3
5	4R7
6	5R1
7	6R8
8	10R
9	11R
10	12R
11	13R
12	15R
13	16R
14	18R
15	20R
16	22R
17	24R
18	27R
19	30R
20	33R
21	36R
22	39R
23	43R
24	47R
25	51R
26	56R
27	62R
28	68R
29	75R
30	82R
31	91R
32	100R
33	110R
34	120R
35	130R

NO.	Value
36	150R
37	160R
38	180R
39	200R
40	220R
41	240R
42	270R
43	300R
44	330R
45	360R
46	390R
47	430R
48	470R
49	510R
50	560R
51	620R
52	680R
53	750R
54	820R
55	910R
56	1K0
57	1K1
58	1K2
59	1K3
60	1K5
61	1K6
62	1K8
63	2K0
64	2K2
65	2K4
66	2K7
67	3K0
68	3K3
69	3K6
70	3K9

NO.	Value
71	4K3
72	4K7
73	5K1
74	5K6
75	6K2
76	6K8
77	7K5
78	8K2
79	9K1
80	10K
81	11K
82	12K
83	13K
84	15K
85	16K
86	18K
87	20K
88	22K
89	24K
90	27K
91	30K
92	33K
93	36K
94	39K
95	43K
96	47K
97	51K
98	56K
99	62K
100	68K
101	75K
102	82K
103	91K
104	100K
105	110K

NO.	Value
106	120K
107	130K
108	150K
109	160K
110	180K
111	200K
112	220K
113	240K
114	270K
115	300K
116	330K
117	360K
118	390K
119	430K
120	470K
121	510K
122	560K
123	620K
124	680K
125	750K
126	820K
127	910K
128	1M0
129	1M5
130	2M2
131	3M3
132	4M7
133	6M8
134	10M