

# HIGH FREQUENCY (UP TO 70GHz) THIN FILM PRECISION CHIP RESISTOR - RHF SERIES -

## FEATURES

- Small standard size 0201 case size
- High Frequency up to 70GHz for 0201
- High Frequency up to 50GHz for 0402 - 0603
- High purity alumina substrate
- Ohmic range (10Ω~1KΩ)
- Resistor tolerance to ± 0.1%
- Low TCR (down to ± 25ppm/ °C)

## APPLICATIONS

- Low noise amplifiers
- Attenuation
- Line Termination

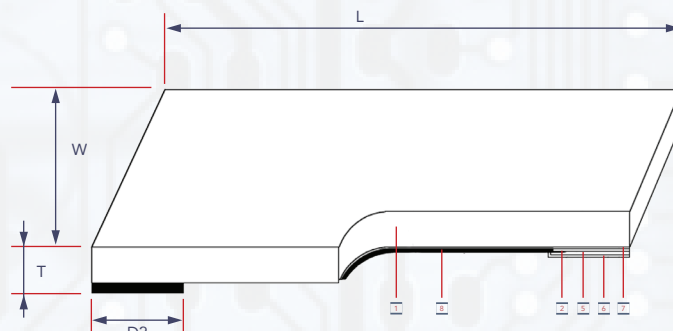
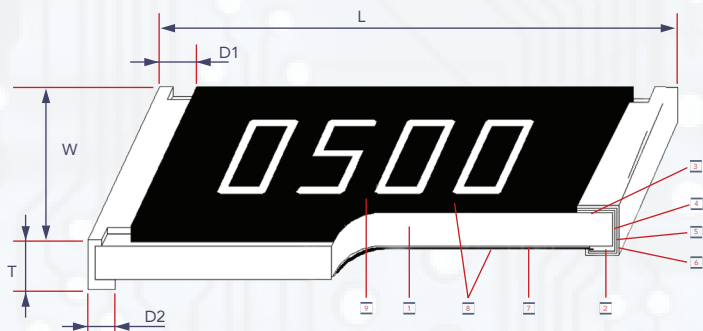
## TYPICAL PERFORMANCE

- TCR. 25ppm / °C
- TOL. 0.1%

## CONSTRUCTION

- 0402/0603/0805/1206

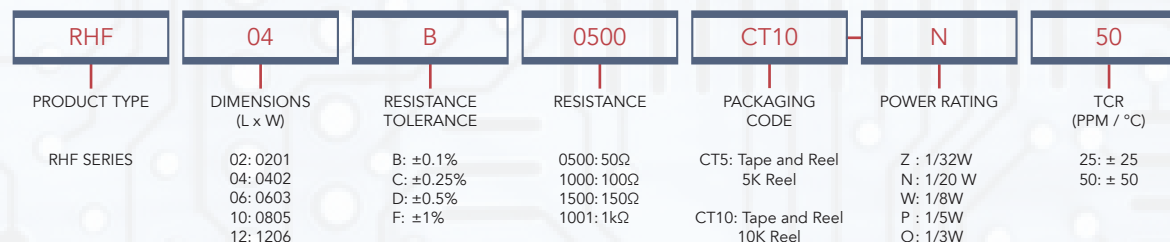
- 0201



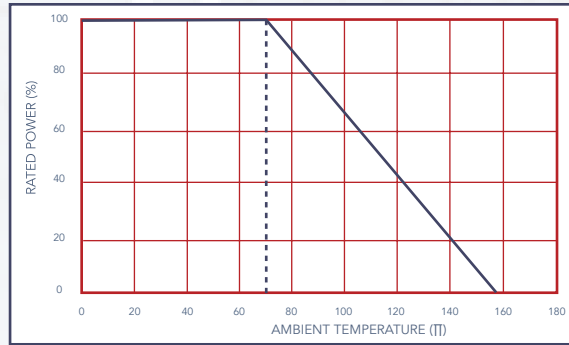
- |                                 |                      |                  |
|---------------------------------|----------------------|------------------|
| 1 High Purity Alumina Substrate | 4 Edge Electrode     | 7 Resistor Layer |
| 2 Bottom Electrode              | 5 Barrier Layer      | 8 Overcoat       |
| 3 Top Electrode                 | 6 External Electrode | 9 Marking        |

TYPE	SIZE (INCH)	L	W	T	D1	D2	WEIGHT (G) (1000PCS)
RHF02	0201	0.58±0.05	0.30±0.05	0.21±0.07	-	0.15±0.10	0.12
RHF04	0402	1.00±0.07	0.50±0.07	0.38±0.15	0.20±0.15	0.20±0.15	0.73
RHF06	0603	1.55±0.10	0.80±0.10	0.45±0.15	0.30±0.20	0.50±0.20	2.08
RHF10	0805	2.00±0.15	1.25±0.15	0.45±0.15	0.30±0.20	0.35±0.20	4.15
RHF12	1206	3.05±0.20	1.55±0.20	0.45±0.15	0.45±0.20	0.35±0.25	7.59

## PART NUMBERING



## DERATING CURVE

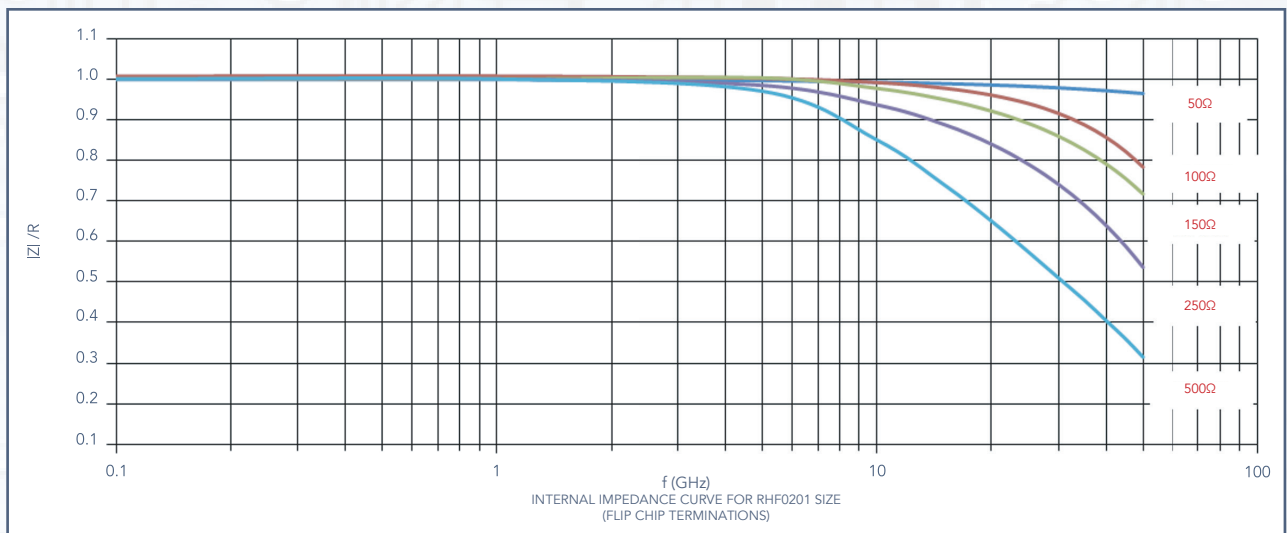


## STANDARD ELECTRICAL SPECIFICATIONS

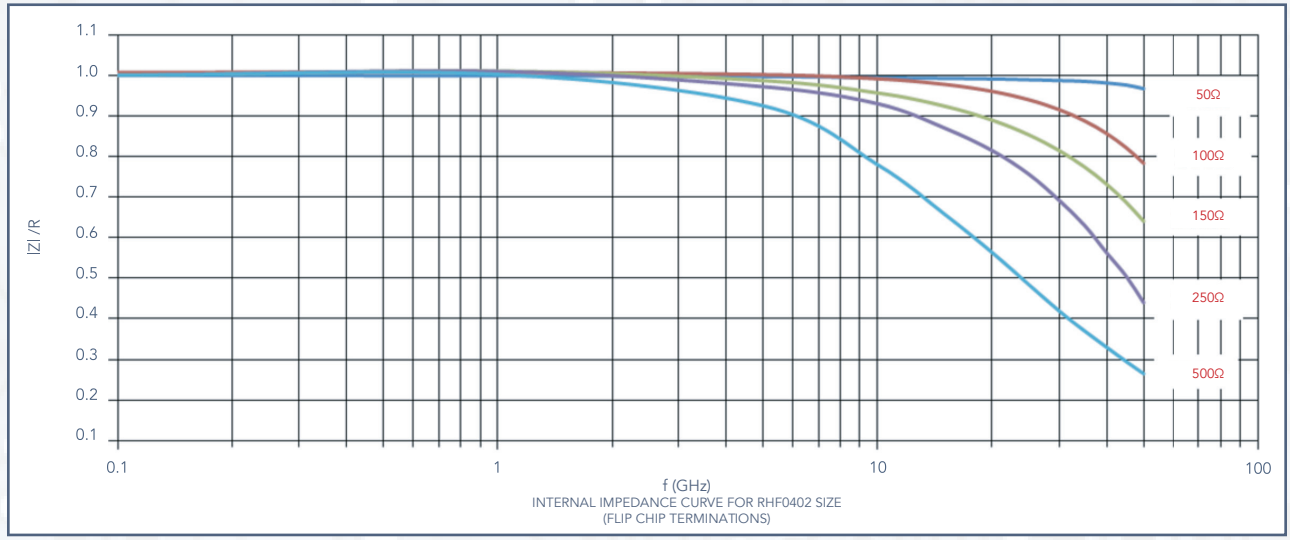
TYPE	POWER RATING AT 70°C	OPERATING TEMPERATURE RANGE	MAX OPERATING VOLTAGE	MAX OVERLOAD VOLTAGE	RESISTANCE RANGE				TCR (PPM/°C)
					±0.1%	±0.25%	±0.5%	±1%	
RHF02 (0201)	1/32W	-55°C ~ +155°C	15V	30V	25Ω~500Ω				±25   ±50
RHF04 (0402)	1/20W	-55°C ~ +155°C	30V	60V	10Ω~1KΩ				±25   ±50
RHF06 (0603)	1/8W	-55°C ~ +155°C	50V	100V	10Ω~1KΩ				±25   ±50
RHF10 (0805)	1/5W	-55°C ~ +155°C	50V	100V	10Ω~1KΩ				±25   ±50
RHF12 (1206)	1/3W	-55°C ~ +155°C	75V	150V	10Ω~1KΩ				±25   ±50

- Operating Voltage= $\sqrt{P \cdot R}$  or Max. operating voltage listed above, whichever is lower.
- Overload Voltage= $2.5 \cdot \sqrt{P \cdot R}$  or Max. overload voltage listed above, whichever is lower.
- Cal-Chip Electronics is capable of manufacturing the optional spec based on customer's requirement

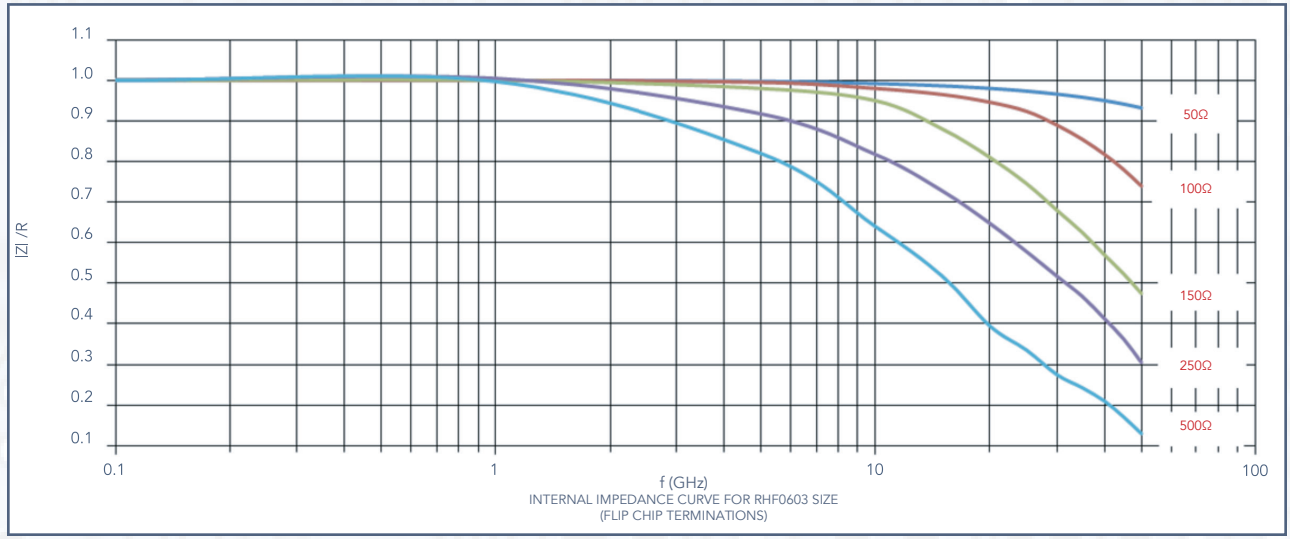
## INTERNAL IMPEDANCE CURVES



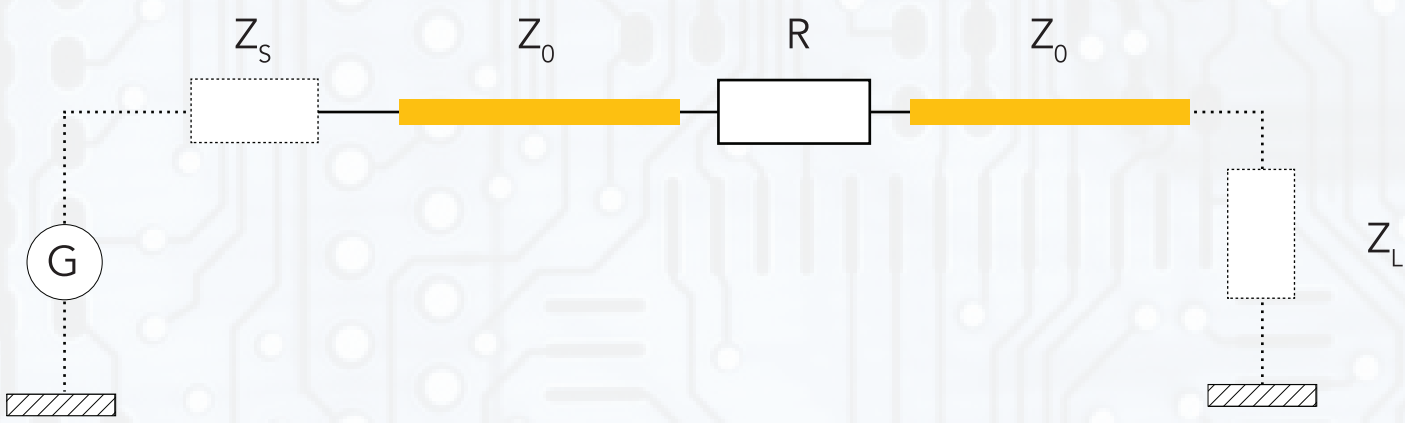
INTERNAL IMPEDANCE CURVES



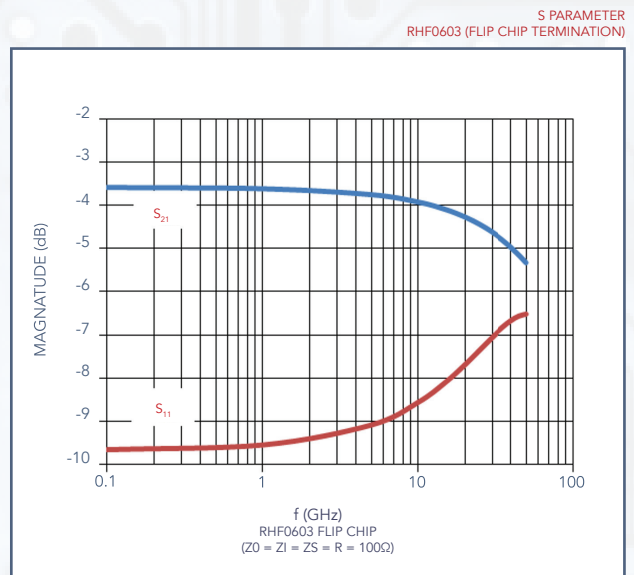
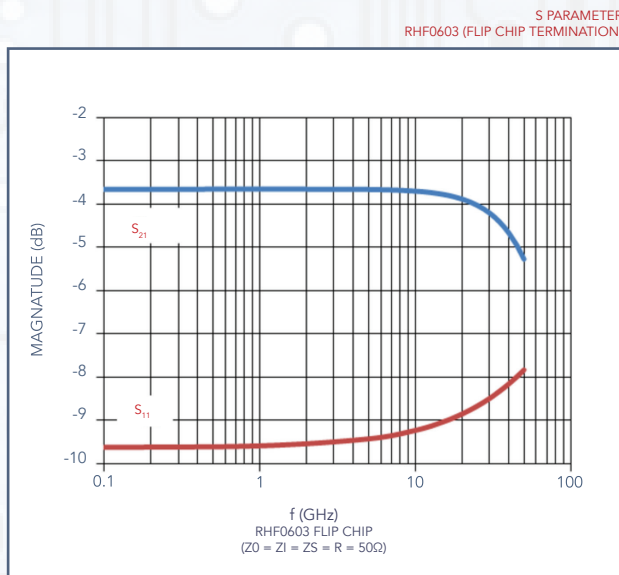
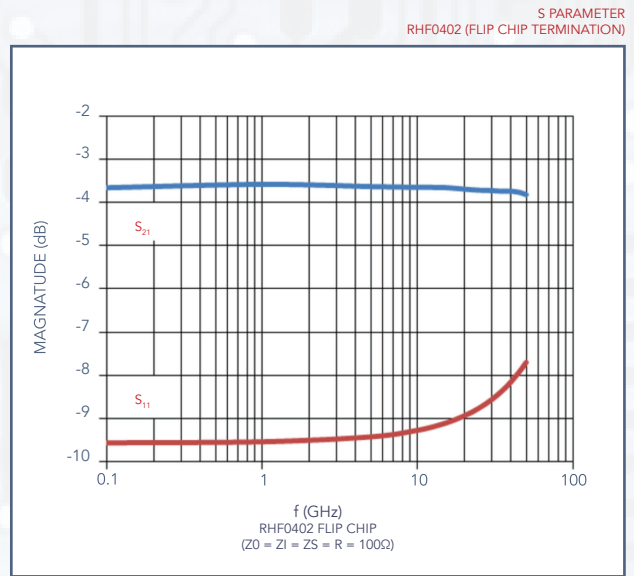
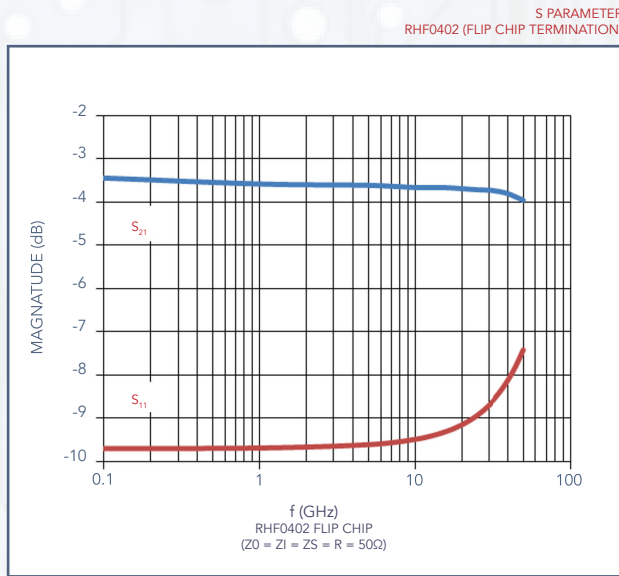
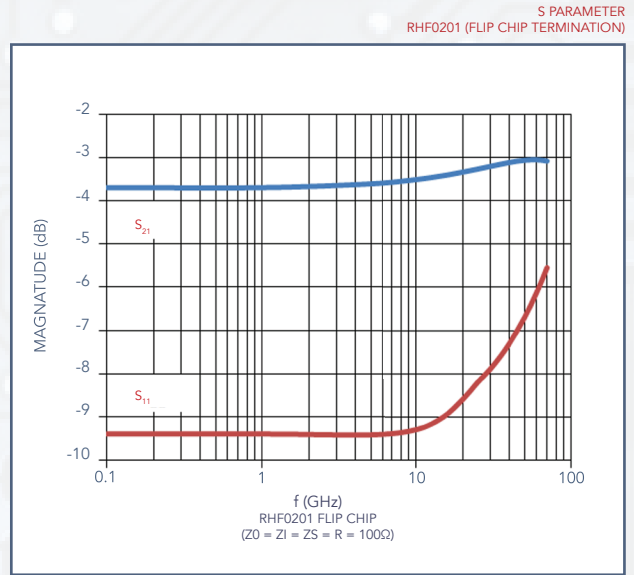
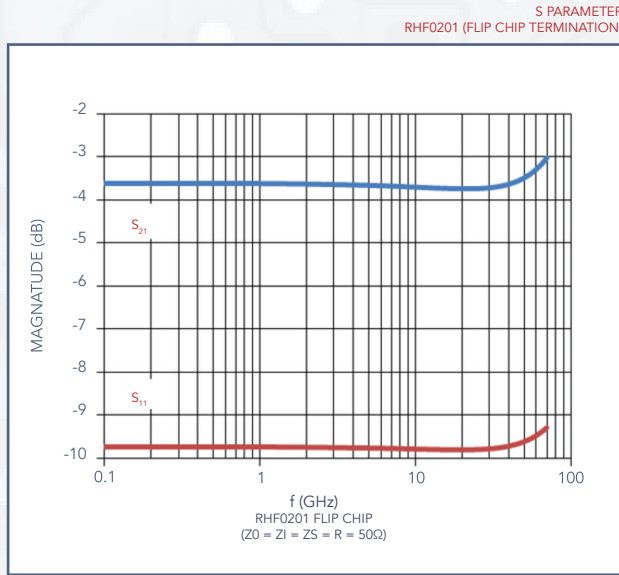
INTERNAL IMPEDANCE CURVES



EQUIVALENT CIRCUIT FOR S-PARAMETERS



# EQUIVALENT CIRCUIT FOR S-PARAMETERS





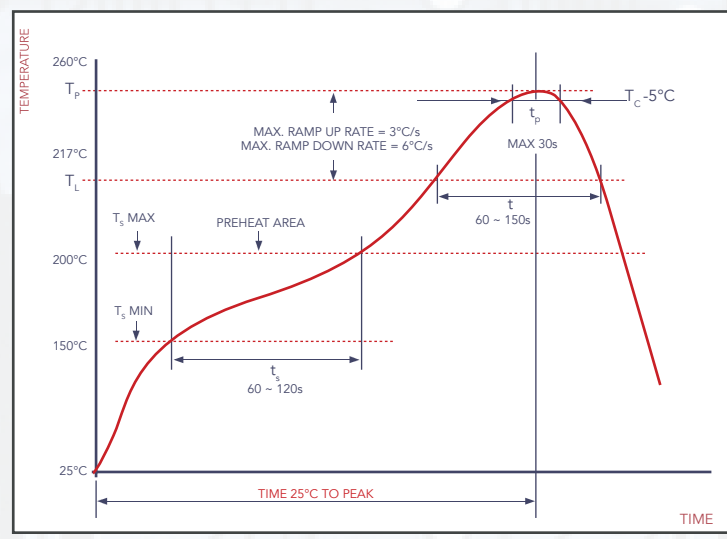
## ENVIRONMENTAL CHARACTERISTICS

ITEMS	REQUIREMENT	TEST METHODS
Temperature Coefficient of Resistance (T.C.R.)	As Spec.	MIL-STD-202 Method 304 +25/-55/+25/+125/+25°C
Short Time Overload	$\Delta R \pm 0.2\%$	JIS-C-5201-1 4.13 RCWV*2.5 or Max. overload voltage whichever is lower for 5 seconds
Insulation Resistance	>9999 M $\Omega$	MIL-STD-202 Method 302 Apply 100VDC for 1 minute
Endurance	$\Delta R \pm 0.5\%$	MIL-STD-202 Method 108 70 $\pm$ 2°C, RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hrs "OFF"
Damp Heat with Load	$\Delta R \pm 0.5\%$	MIL-STD-202 Method 103 40 $\pm$ 2°C, 90~95% R.H. RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hrs "OFF"
Bending Strength	$\Delta R \pm 0.1\%$	JIS-C-5201-1 4.33 Bending amplitude 3 mm for 60 seconds
Solderability	95% min coverage 0201:except	MIL-STD-202 Method 208 245 $\pm$ 5°C for 3 seconds
Resistance to Soldering Heat	$\Delta R \pm 0.1\%$ 0201:except	MIL-STD-202 Method 210 260 $\pm$ 5°C for 10 seconds
Dielectric Withstand Voltage	By Type	MIL-STD-202 Method 301 Max. overload voltage for 1 minute
Low Temperature Operation	$\Delta R \pm 0.2\%$	JIS-C-5201-1 4.36 1 hour, -65°C, followed by 45 minutes of RCWV
High Temperature Exposure	$\Delta R \pm 0.5\%$	MIL-STD-202 Method 108 at +155°C for 1000 hrs

- RCWV (Rated continuous working voltage) =  $\sqrt{(P \cdot R)}$  or Max. Operating voltage whichever is lower
- Storage Temperature: 15~28°C; Humidity < 80%RH
- Shelf Life: 2 years from production date



## SOLDERING CONDITION (IPC/JEDEC J-STD020)



PROFILE FEATURE	Pb-FREE ASSEMBLY
<b>PREHEAT</b>	
Min. Temperature (T <sub>smin</sub> )	150 °C
Max Temperature (T <sub>smax</sub> )	200 °C
Preheating time (t <sub>s</sub> ) from (T <sub>smin</sub> to T <sub>smax</sub> )	60-120 seconds
Ramp-up rate (T <sub>L</sub> to T <sub>p</sub> )	3 °C/second max.
Liquidous temperature (T <sub>L</sub> )	217 °C
Time (t <sub>L</sub> ) maintained above T <sub>L</sub>	60-150 seconds
Min. Peak temperature (T <sub>p</sub> min)	235°C
Max. Peak temperature (T <sub>p</sub> max)	260°C
Time (t <sub>p</sub> ) within 5 °C of the specified classification temperature (T <sub>c</sub> )	30 seconds max.
Ramp-down rate (T <sub>p</sub> to T <sub>L</sub> )	6 °C/second max.
Time 25 °C to peak temperature	8 minutes max.

- Number of reflow cycles allowed 3 times



**MARKING**

- 0603 3 digit marking



- 3digit marking for Example:

14C=13K7Ω    13C=13K3Ω  
68B=4K99Ω    68X=49.9Ω

- 0603 3digit marking for E24    Example:    101=100Ω    102=1KΩ

E24	10	11	12	13	15	16	18	20	22	24	27	30	33	36	39	43	47	51	56	62	68	75	82	91
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- Marking Table

CODE	E96	CODE	E96	CODE	E96	CODE	E96				
01	100	25	178	49	316	73	562				
02	102	26	182	50	324	74	576				
03	105	27	187	51	332	75	590				
04	107	28	191	52	340	76	604				
05	110	29	196	53	348	77	619				
06	113	30	200	54	357	78	634				
07	115	31	205	55	365	79	649				
08	118	32	210	56	374	80	665				
09	121	33	215	57	383	81	681				
10	124	34	221	58	392	82	698				
11	127	35	226	59	402	83	715				
12	130	36	232	60	412	84	732				
13	133	37	237	61	422	85	750				
14	137	38	243	62	432	86	768				
15	140	39	249	63	442	87	787				
16	143	40	255	64	453	88	806				
17	147	41	261	65	464	89	825				
18	150	42	267	66	475	90	845				
19	154	43	274	67	487	91	866				
20	158	44	280	68	499	92	887				
21	162	45	287	69	511	93	909				
22	165	46	294	70	523	94	931				
23	169	47	301	71	536	95	953				
24	174	48	309	72	549	96	976				
CODE	A	B	C	D	E	F	G	H	X	Y	Z
MULTIPLIER	10 <sup>0</sup>	10 <sup>1</sup>	10 <sup>2</sup>	10 <sup>3</sup>	10 <sup>4</sup>	10 <sup>5</sup>	10 <sup>6</sup>	10 <sup>7</sup>	10 <sup>-1</sup>	10 <sup>-2</sup>	10 <sup>-3</sup>

- 0805 ~ 1206 4 digit marking

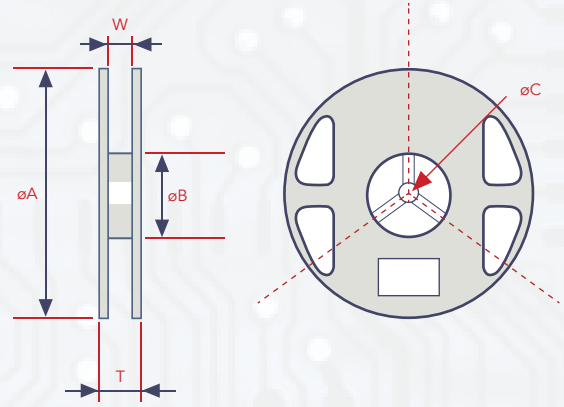
RESISTANCE	500Ω	2.2KΩ	10KΩ	12.5KΩ
MARKING	5000	2201	1002	1252



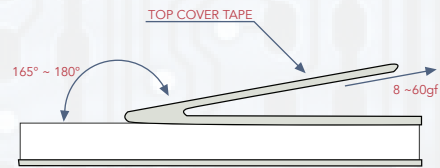
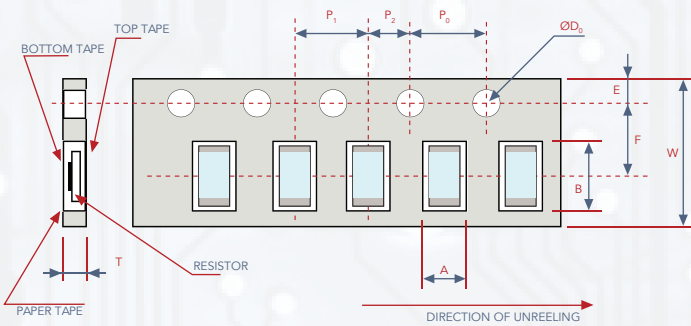
# PACKAGING

## - Packing Quantity & Reel Specifications

TYPE	ØA	ØB	ØC	W	T	PAPER TAPE (EA)	EMBOSS PLASTIC TAPE (EA)
RHF02	178.0±1.0	60.0±1.0	13.5±0.7	9.5±1.0	11.5±1.0	10,000	-
RHF04	178.0±1.0	60.0±1.0	13.5±0.7	9.5±1.0	11.5±1.0	10,000	-
RHF06	178.0±1.0	60.0±1.0	13.5±0.7	9.5±1.0	11.5±1.0	5,000	-
RHF10	178.0±1.0	60.0±1.0	13.5±0.7	9.5±1.0	11.5±1.0	5,000	-
RHF12	178.0±1.0	60.0±1.0	13.5±0.7	9.5±1.0	11.5±1.0	5,000	-



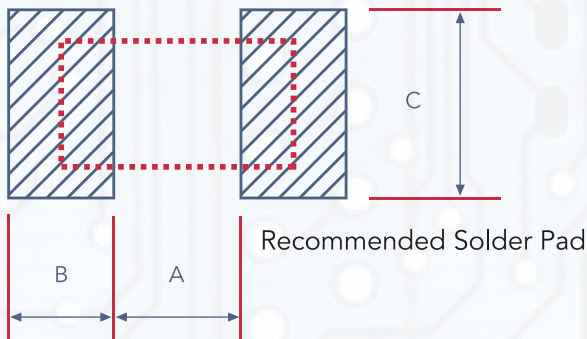
## - Paper Tape Specifications



- Peel force of top cover tape
- The peel speed shall be about 300mm/min±5%
- The peel force of top cover tape shall be between 8gf to 60gf

TYPE	A	B	W	E	F	P <sub>0</sub>	P <sub>1</sub>	P <sub>2</sub>	ØD <sub>0</sub>	T
RHF02	0.40±0.05	0.70±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	2.00±0.05	2.00±0.05	1.55±0.03	0.42±0.02
RHF04	0.66±0.06	1.18±0.06	8.00±0.20	1.75±0.10	3.5±0.05	4.00±0.10	2.00±0.05	2.00±0.05	1.55±0.05	0.60±0.03
RHF06	1.10±0.05	1.90±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.55±0.05	0.60±0.03
RHF10	1.60±0.05	2.37±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.55±0.05	0.75±0.05
RHF12	2.00±0.05	3.55±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.55±0.05	0.75±0.05

## RECOMMEND LAND PATTERN



TYPE	A	B	C
RHF02	0.25	0.30	0.40±0.2
RHF04	0.50	0.50	0.60±0.2
RHF06	0.80	1.00	0.90±0.2
RHF10	1.00	1.00	1.35±0.2
RHF12	2.00	1.15	1.70±0.2