



### FEATURES:

- TCR as low as  $\pm 5\text{ppm}$
- Tolerance as low as  $\pm 0.01\%$
- Higher operating frequency with less parasitics
- Noise characteristics superior to standard thick film resistors
- Reference standards of EIA JIS C 5201-1



### PART NUMBER STRUCTURE

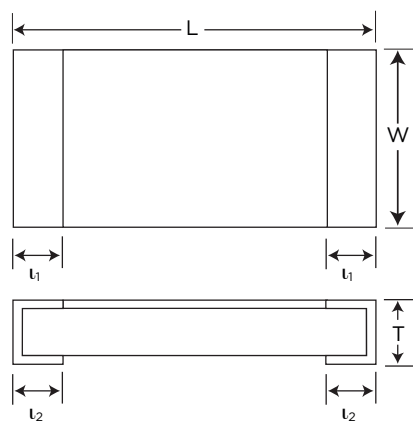
HPTF Series	1206 Size	- U Power Rating	E TCR	- 1001 Resistance Value	B Resistance Tolerance	T Packaging	Optional Reel Identifier
0402	Q = 1/10W	Q = 1/10W	P = $\pm 5\text{ppm}/^\circ\text{C}$	1001 = $1\text{K}\Omega$	U = $\pm 0.01\%$	T = Tape & Reel	Leave blank for standard quantity.
0603	R = 1/8W	R = 1/8W	N = $\pm 10\text{ppm}/^\circ\text{C}$	4R70 = $4.7\Omega$	A = $\pm 0.05\%$		
0805	S = 1/6W	S = 1/6W	E = $\pm 25\text{ppm}/^\circ\text{C}$	1001 = $1\text{K}\Omega$	B = $\pm 0.1\%$		
1206	T = 1/4W	T = 1/4W	C = $\pm 50\text{ppm}/^\circ\text{C}$	2494 = $2.49\text{M}\Omega$	C = $\pm 0.25\%$		Add "-1K" if 1000 piece reel is required
1210	U = 1/3W	U = 1/3W			D = $\pm 0.50\%$		
2010	W = 3/4W	W = 3/4W			F = $\pm 1\%$		
2512	X = 1W	X = 1W					

Example P/N: HPTF1206-UE-1001BT

Standard Termination is 100% matte Tin over Nickel.

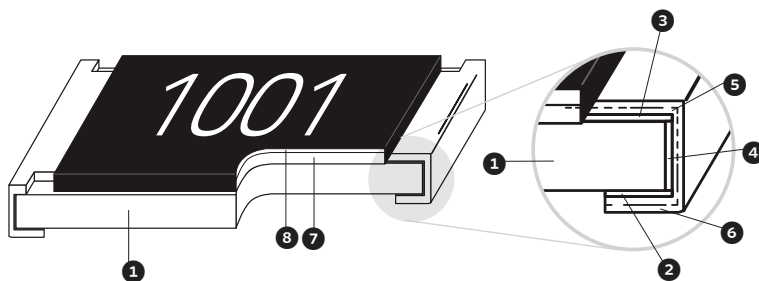
### DIMENSIONS

Unit: inches (mm)



SIZE	L	W	T	l1	l2
0402	0.040 $\pm$ 0.002 (1.0 $\pm$ 0.05)	0.020 $\pm$ 0.001 (0.5 $\pm$ 0.02)	0.012 $\pm$ 0.002 (0.30 $\pm$ .05)	0.008 $\pm$ 0.004 (0.20 $\pm$ 0.10)	0.008 $\pm$ 0.004 (0.20 $\pm$ 0.10)
0603	0.061 $\pm$ 0.004 (1.55 $\pm$ 0.10)	0.031 $\pm$ 0.004 (0.80 $\pm$ 0.10)	0.018 $\pm$ 0.004 (0.45 $\pm$ 0.10)	0.012 $\pm$ 0.008 (0.30 $\pm$ 0.20)	0.012 $\pm$ 0.008 (0.30 $\pm$ 0.20)
0805	0.079 $\pm$ 0.006 (2.0 $\pm$ 0.15)	0.049 $\pm$ 0.006 (1.25 $\pm$ 0.15)	0.022 $\pm$ 0.004 (0.55 $\pm$ 0.10)	0.012 $\pm$ 0.008 (0.30 $\pm$ 0.20)	0.016 $\pm$ 0.010 (0.40 $\pm$ 0.25)
1206	0.120 $\pm$ 0.006 (3.05 $\pm$ 0.15)	0.061 $\pm$ 0.006 (1.55 $\pm$ 0.15)	0.022 $\pm$ 0.004 (0.55 $\pm$ 0.10)	0.017 $\pm$ 0.008 (0.42 $\pm$ 0.20)	0.014 $\pm$ 0.010 (0.35 $\pm$ 0.25)
1210	0.122 $\pm$ 0.006 (3.10 $\pm$ 0.15)	0.094 $\pm$ 0.006 (2.40 $\pm$ 0.15)	0.022 $\pm$ 0.004 (0.55 $\pm$ 0.10)	0.016 $\pm$ 0.008 (0.40 $\pm$ 0.20)	0.022 $\pm$ 0.010 (0.55 $\pm$ 0.25)
2010	0.192 $\pm$ 0.006 (4.90 $\pm$ 0.15)	0.094 $\pm$ 0.006 (2.40 $\pm$ 0.15)	0.022 $\pm$ 0.004 (0.55 $\pm$ 0.10)	0.024 $\pm$ 0.012 (0.60 $\pm$ 0.30)	0.020 $\pm$ 0.010 (0.50 $\pm$ 0.25)
2010 (3/4 W)	0.197 $\pm$ 0.005 (5.00 $\pm$ 0.12)	0.098 $\pm$ 0.006 (2.50 $\pm$ 0.15)	0.022 $\pm$ 0.004 (0.55 $\pm$ 0.10)	0.024 $\pm$ 0.008 (0.60 $\pm$ 0.20)	0.024 $\pm$ 0.010 (0.60 $\pm$ 0.25)
2512 ( $\leq 100\Omega$ )	0.248 $\pm$ 0.006 (6.30 $\pm$ 0.15)	0.122 $\pm$ 0.006 (3.10 $\pm$ 0.15)	0.022 $\pm$ 0.004 (0.55 $\pm$ 0.10)	0.024 $\pm$ 0.012 (0.60 $\pm$ 0.30)	0.020 $\pm$ 0.010 (0.50 $\pm$ 0.25)
2512 ( $> 100\Omega$ )	0.248 $\pm$ 0.006 (6.30 $\pm$ 0.15)	0.122 $\pm$ 0.006 (3.10 $\pm$ 0.15)	0.022 $\pm$ 0.004 (0.55 $\pm$ 0.10)	0.024 $\pm$ 0.012 (0.60 $\pm$ 0.30)	0.0984 $\pm$ 0.01 (2.50 $\pm$ 0.25)

### STRUCTURE



1	Alumina Substrate	5	Nickel Plating
2	Backside Electrode	6	Tin Plating
3	Top Electrode	7	Resistive Layer
4	Edge Electrode	8	Overcoat

### ELECTRICAL SPECIFICATION & RANGE

	SIZE	0402	0603		0805	
	Power Rating at 70°C (W)	0.10W (1/10W)	0.10W (1/10W)	0.166W (1/6W)	0.125W (1/8W)	0.25W (1/4W)
	Max. Working Voltage	50V	75V	100V	150V	
	Max. Overload Voltage	100V	150V		300V	
	Operating Temp. Range	-55°C to +155°C	-55°C to +155°C		-55°C to +155°C	
Tol.	TCR	Resistance Range	Resistance Range		Resistance Range	
±0.01% (U)	±5ppm	49.9Ω - 4.99KΩ	24.9Ω - 15KΩ	-	24.9Ω - 30KΩ	-
	±10ppm	49.9Ω - 12KΩ	24.9Ω - 100KΩ	-	24.9Ω - 200KΩ	-
	±25ppm	-	24.9Ω - 100KΩ	-	24.9Ω - 200KΩ	-
	±50ppm	-	24.9Ω - 100KΩ	-	24.9Ω - 200KΩ	-
±0.05% (A)	±5ppm	49.9Ω - 4.99KΩ	24.9Ω - 15KΩ	-	24.9Ω - 30KΩ	-
	±10ppm	49.9Ω - 12KΩ	4.7Ω - 332KΩ	-	4.7Ω - 511KΩ	-
	±25ppm	49.9Ω - 12KΩ	4.7Ω - 332KΩ	10Ω - 332KΩ	4.7Ω - 511KΩ	10Ω - 499KΩ
	±50ppm	49.9Ω - 12KΩ	4.7Ω - 332KΩ	10Ω - 332KΩ	4.7Ω - 511KΩ	10Ω - 499KΩ
±0.1% (B)	±5ppm	49.9Ω - 4.99KΩ	24.9Ω - 15KΩ	-	24.9Ω - 30KΩ	-
	±10ppm	49.9Ω - 60KΩ	4.7Ω - 332KΩ	-	4.7Ω - 511KΩ	-
	±25ppm	10Ω - 255KΩ	-	10Ω - 332KΩ	-	10Ω - 499KΩ
	±50ppm	10Ω - 255KΩ	-	10Ω - 332KΩ	-	10Ω - 499KΩ
±0.25% (C)	±5ppm	49.9Ω - 4.99KΩ	24.9Ω - 15KΩ	-	24.9Ω - 30KΩ	-
	±10ppm	49.9Ω - 60KΩ	4.7Ω - 332KΩ	-	4.7Ω - 511KΩ	-
	±25ppm	4.7Ω - 255KΩ	-	10Ω - 332KΩ	-	10Ω - 499KΩ
	±50ppm	4.7Ω - 255KΩ	-	10Ω - 332KΩ	-	10Ω - 499KΩ
±0.5% (D)	±5ppm	49.9Ω - 4.99KΩ	24.9Ω - 15KΩ	-	24.9Ω - 30KΩ	-
	±10ppm	49.9Ω - 60KΩ	4.7Ω - 332KΩ	-	4.7Ω - 511KΩ	-
	±25ppm	4.7Ω - 255KΩ	-	10Ω - 332KΩ	-	10Ω - 499KΩ
	±50ppm	4.7Ω - 255KΩ	-	10Ω - 332KΩ	-	10Ω - 499KΩ
±1% (F)	±5ppm	49.9Ω - 4.99KΩ	24.9Ω - 15KΩ	-	24.9Ω - 30KΩ	-
	±10ppm	49.9Ω - 60KΩ	4.7Ω - 332KΩ	-	4.7Ω - 511KΩ	-
	±25ppm	4.7Ω - 255KΩ	-	10Ω - 332KΩ	-	10Ω - 499KΩ
	±50ppm	4.7Ω - 255KΩ	-	10Ω - 332KΩ	-	10Ω - 499KΩ

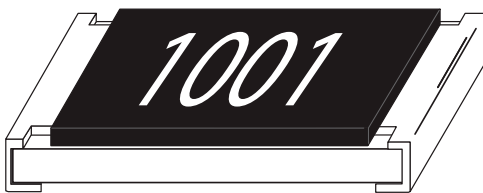
**NOTE:** Overload Voltage=2.5\*√(P\*R). or Max. overload voltage listed above, whichever is lower.

### ELECTRICAL SPECIFICATION & RANGE

SIZE	1206		1210	2010		2512		
	Power Rating at 70°C (W)	0.25W (1/4W)	0.333W (1/3W)	0.333W (1/3W)	0.333W (1/3W)	0.75W (3/4W)	0.75W (3/4W)	1W
Max. Working Voltage	200V		200V	200V		200V		
Max. Overload Voltage	400V		400V	400V		400V		
Operating Temp. Range	-55°C to +155°C		-55°C to +155°C	-55°C to +155°C		-55°C to +155°C		
Tol.	TCR	Resistance Range		Resistance Range	Resistance Range		Resistance Range	
±0.01% (U)	±5ppm	24.9Ω - 49.9KΩ	-	24.9Ω - 49.9KΩ	24.9Ω - 49.9KΩ	-	-	-
	±10ppm	24.9Ω - 499KΩ	-	24.9Ω - 499KΩ	24.9Ω - 499KΩ	-	24.9Ω - 2KΩ	-
	±25ppm	24.9Ω - 499KΩ	-	24.9Ω - 499KΩ	24.9Ω - 499KΩ	-	24.9Ω - 2KΩ	-
	±50ppm	24.9Ω - 499KΩ	-	24.9Ω - 499KΩ	24.9Ω - 499KΩ	10Ω - 1MΩ	24.9Ω - 2KΩ	-
±0.05% (A)	±5ppm	24.9Ω - 49.9KΩ	-	24.9Ω - 49.9KΩ	24.9Ω - 49.9KΩ	-	-	-
	±10ppm	4.7Ω - 1MΩ	-	4.7Ω - 1MΩ	4.7Ω - 1MΩ	-	4.7Ω - 2KΩ	-
	±25ppm	4.7Ω - 1MΩ	10Ω - 1MΩ	4.7Ω - 1MΩ	4.7Ω - 1MΩ	-	4.7Ω - 2KΩ	-
	±50ppm	4.7Ω - 1MΩ	10Ω - 1MΩ	4.7Ω - 1MΩ	4.7Ω - 1MΩ	10Ω - 1MΩ	4.7Ω - 2KΩ	-
±0.1% (B)	±5ppm	24.9Ω - 49.9KΩ	-	24.9Ω - 49.9KΩ	24.9Ω - 49.9KΩ	-	-	-
	±10ppm	4.7Ω - 1MΩ	-	4.7Ω - 1MΩ	4.7Ω - 1MΩ	-	4.7Ω - 2KΩ	-
	±25ppm	-	10Ω - 1MΩ	4.7Ω - 1MΩ	4.7Ω - 1MΩ	-	4.7Ω - 2KΩ	4.7Ω - 100Ω
	±50ppm	-	10Ω - 1MΩ	4.7Ω - 1MΩ	4.7Ω - 1MΩ	10Ω - 1MΩ	4.7Ω - 2KΩ	4.7Ω - 100Ω
±0.25% (C)	±5ppm	24.9Ω - 49.9KΩ	-	24.9Ω - 49.9KΩ	24.9Ω - 49.9KΩ	-	-	-
	±10ppm	4.7Ω - 1MΩ	-	4.7Ω - 1MΩ	4.7Ω - 1MΩ	-	1Ω - 2KΩ	-
	±25ppm	-	10Ω - 1MΩ	4.7Ω - 1MΩ	4.7Ω - 1MΩ	-	1Ω - 2KΩ	1Ω - 100Ω
	±50ppm	-	10Ω - 1MΩ	4.7Ω - 1MΩ	4.7Ω - 1MΩ	10Ω - 1MΩ	1Ω - 2KΩ	1Ω - 100Ω
±0.5% (D)	±5ppm	24.9Ω - 49.9KΩ	-	24.9Ω - 49.9KΩ	24.9Ω - 49.9KΩ	-	-	-
	±10ppm	4.7Ω - 1MΩ	-	4.7Ω - 1MΩ	4.7Ω - 1MΩ	-	1Ω - 2KΩ	-
	±25ppm	-	10Ω - 1MΩ	4.7Ω - 1MΩ	4.7Ω - 1MΩ	-	1Ω - 2KΩ	1Ω - 100Ω
	±50ppm	-	10Ω - 1MΩ	4.7Ω - 1MΩ	4.7Ω - 1MΩ	10Ω - 1MΩ	1Ω - 2KΩ	1Ω - 100Ω
±1% (F)	±5ppm	24.9Ω - 49.9KΩ	-	24.9Ω - 49.9KΩ	24.9Ω - 49.9KΩ	-	-	-
	±10ppm	4.7Ω - 1MΩ	-	4.7Ω - 1MΩ	4.7Ω - 1MΩ	-	1Ω - 2KΩ	-
	±25ppm	-	10Ω - 1MΩ	4.7Ω - 1MΩ	4.7Ω - 1MΩ	-	1Ω - 2KΩ	1Ω - 100Ω
	±50ppm	-	10Ω - 1MΩ	4.7Ω - 1MΩ	4.7Ω - 1MΩ	10Ω - 1MΩ	1Ω - 2KΩ	1Ω - 100Ω

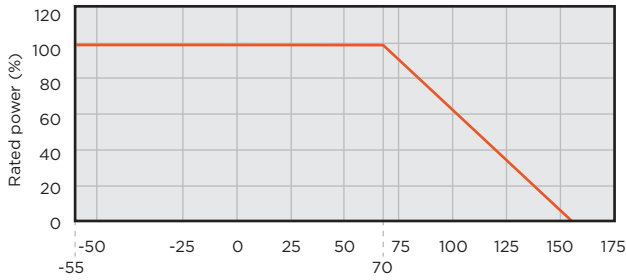
NOTE: Overload Voltage=2.5\*√(P\*R). or Max. overload voltage listed above, whichever is lower.

### MARKING CODE

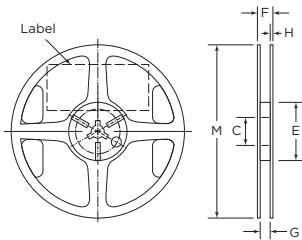


- E-96 values for 0805 size and larger, will be marked with standard 4 digit marking code.
- E-24 values for 0603 size and larger, will be marked with standard 3 digit marking code.
- 0603 - E-96 values will be marked with a standard 3 digit alpha numeric code (Please see alpha numeric codes).
- 0402 size is not marked

### DERATING CURVE



### REEL SPECIFICATIONS

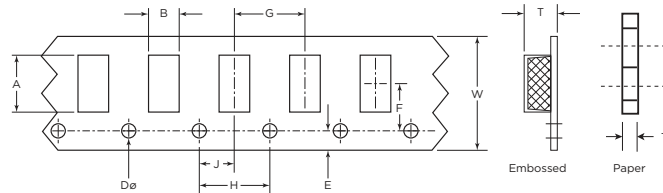


Unit: mm (inch)

C	E	F	G	H	M
13.0 ± 0.2 (0.51 ± 0.008)	60.0 ± 1.0 (2.36 ± 0.03)	11.4 ± 1.0 (0.45 ± 0.04)	9.0 ± .3 (0.35 ± 0.012)	1.5 ± .3 (0.06 ± 0.012)	180 ± 2.0 (7.09 ± 0.08)

Minimum of 30 empty pockets at the beginning of reel, 65 minimum empty pockets at the end.

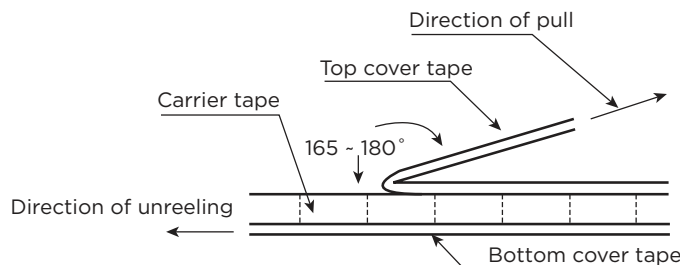
### TAPE SPECIFICATIONS



Units: mm.

TAPE	SIZE (inches)	A	B	W	E	F	T	G	H	J	DØ
Paper	0402	1.16 ± 0.10	0.70 ± 0.10	8.0 ± 0.10	1.75 ± 0.05	3.50 ± 0.05	0.40 ± 0.03	2.00 ± 0.05	4.00 ± 0.10	2.00 ± 0.05	1.55 ± 0.05
	0603	1.90 ± 0.10	1.10 ± 0.05	8.0 ± 0.10	1.75 ± 0.05	3.50 ± 0.05	0.60 ± 0.03	4.00 ± 0.10	4.00 ± 0.10	2.00 ± 0.05	1.55 ± 0.05
	0805	2.37 ± 0.20	1.60 ± 0.05	8.0 ± 0.10	1.75 ± 0.05	3.50 ± 0.05	0.75 ± 0.05	4.00 ± 0.10	4.00 ± 0.10	2.00 ± 0.05	1.55 ± 0.05
	1206	3.55 ± 0.05	2.00 ± 0.05	8.0 ± 0.10	1.75 ± 0.05	3.50 ± 0.05	0.75 ± 0.05	4.00 ± 0.10	4.00 ± 0.10	2.00 ± 0.05	1.55 ± 0.05
	1210	3.40 ± 0.05	2.75 ± 0.05	8.0 ± 0.10	1.75 ± 0.05	3.50 ± 0.05	0.75 ± 0.05	4.00 ± 0.10	4.00 ± 0.05	2.00 ± 0.05	1.60 ± 0.10
Embossed	2010	5.45 ± 0.10	2.85 ± 0.10	12.00 ± 0.10	1.75 ± 0.10	5.50 ± 0.05	1.00 +0.02, -0	4.00 ± 0.10	4.00 ± 0.05	2.00 ± 0.05	1.50 +0.1, -0
	2512	6.65 ± 0.10	3.40 ± 0.10	12.00 ± 0.10	1.75 ± 0.10	5.50 ± 0.05	1.00 +0.02, -0	4.00 ± 0.10	4.00 ± 0.05	2.00 ± 0.05	1.50 +0.1, -0

### PEEL BACK FORCE AND DIRECTION DIAGRAM



Peel back force and direction of peel back angle should follow EIA481-1-A. Peel back force should be between 0.1N - 1.3N and peel back angle of 165° - 180°.

### ENVIRONMENTAL CHARACTERISTICS

TEST	REQUIREMENT		TEST METHOD
	Tol. $\leq 0.05\%$	Tol. $> 0.05\%$	
Temperature Coefficient of Resistance (T.C.R.)	As Spec.		MIL-STD-202 Method 304 +25/-55/+125/+25°C
Short Time Overload	$\Delta R \pm 0.05\%$	$\Delta R \pm 0.02\%$	JIS-C-5201-1 4.13 RCWV*2.5 or Max. Overload Voltage whichever is lower for 5 seconds
	$\Delta R \pm 0.02\%$ for high power rating		
Insulation Resistance	$> 9999M\Omega$		MIL-STD-202 Method 302 Apply 100VDC for 1 minute
Endurance	$\Delta R \pm 0.05\%$	$\Delta R \pm 0.02\%$	MIL-STD-202 Method 108A 70 $\pm 2^\circ\text{C}$ RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hrs "OFF"
	$\Delta R \pm 0.05\%$ for high power rating		
	0201:	$> 7k\Omega \rightarrow \Delta R \pm 0.05\%$ $\leq 7k\Omega \rightarrow \Delta R \pm 0.02\%$	
Damp Heat with Load	$\Delta R \pm 0.05\%$	$\Delta R \pm 0.3\%$	MIL-STD-202 Method 103B 40 $\pm 2^\circ\text{C}$ 90-95% R.H. RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hrs "OFF"
	$\Delta R \pm 0.5\%$ for high power rating		
Bending Strength	$\Delta R \pm 0.05\%$	$\Delta R \pm 0.1\%$	JIS-C-5201-1 4.33 Bending amplitude 3mm for 10 seconds 2010 / 2512 sizes: 2mm Other sizes: 3mm
Solderability	95% min. coverage		MIL-STD-202 Method 208H 245 $\pm 5^\circ\text{C}$ for 3 seconds
Resistance to Soldering Heat	$\Delta R \pm 0.05\%$	$\Delta R \pm 0.1\%$	MIL-STD-202 Method 210E 260 $\pm 5^\circ\text{C}$ for 10 seconds
Dielectric Withstanding Voltage	By Type		MIL-STD-202 Method 301 Max. Overload Voltage for 1 minute
Low Temperature Operation	$\Delta R \pm 0.05\%$	$\Delta R \pm 0.2\%$	JIS-C-5201-1 4.36 1 hour, -65°C, followed by 45 minutes of RCWV
	$\Delta R \pm 0.5\%$ for high power rating		
High Temperature Exposure	$\Delta R \pm 0.05\%$		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: 25 $\pm 3^\circ\text{C}$ ; Humidity: <80% RH