

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

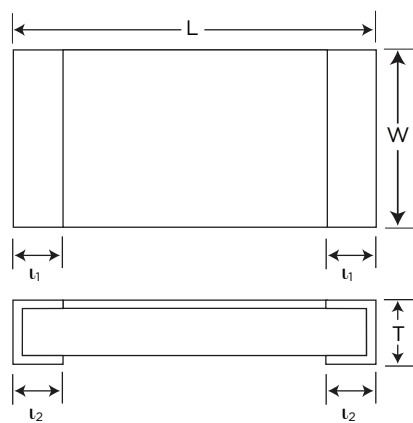
HPTF Series	1206 Size	- U Power Rating	E TCR	- 1001 Resistance Value	B Resistance Tolerance	T Packaging	Optional Reel Identifier
0402	Q = 1/10W	Q = 1/10W	P = $\pm 5\text{ppm}/^\circ\text{C}$	1001 = 1K Ω	U = $\pm 0.01\%$	T = Tape & Reel	Leave blank for standard quantity.
0603	R = 1/8W	R = 1/8W	N = $\pm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

Example P/N: HPTF1206-UE-1001BT

Standard Termination is 100% matte Tin over Nickel.

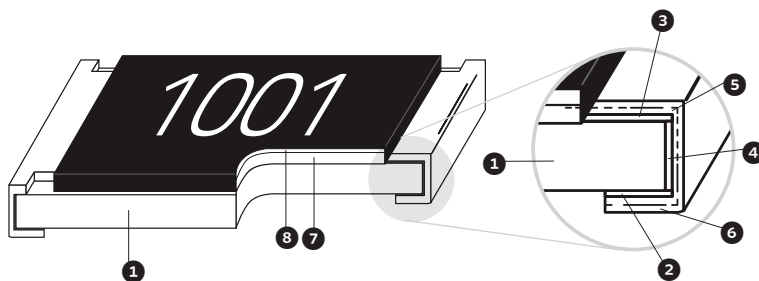
DIMENSIONS

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

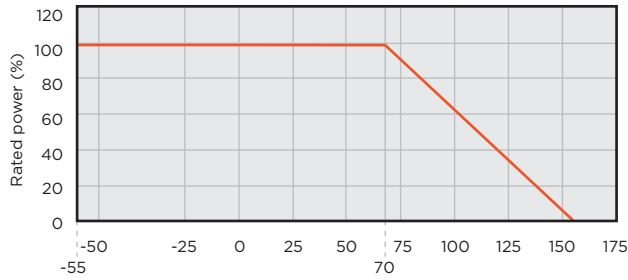
NOTE: Overload Voltage=2.5*√(P*R). or Max. overload voltage listed above, whichever is lower.

MARKING CODE

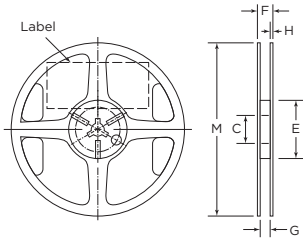


- E-96 values for 0805 size and larger, will be marked with standard 4 digit marking code.
- E-24 values for 0603 size and larger, will be marked with standard 3 digit marking code.
- 0603 - E-96 values will be marked with a standard 3 digit alpha numeric code (Please see alpha numeric codes).
- 0402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

DERATING CURVE



REEL SPECIFICATIONS

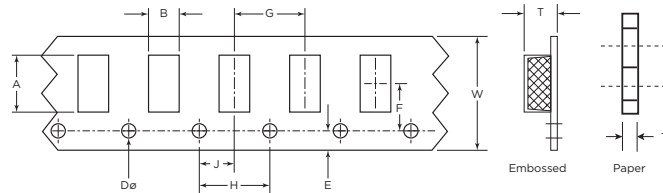


Unit: mm (inch)

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.

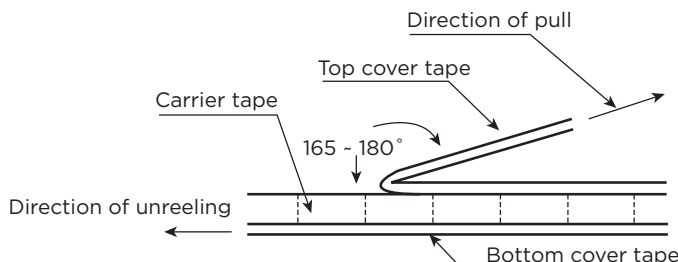
TAPE SPECIFICATIONS



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