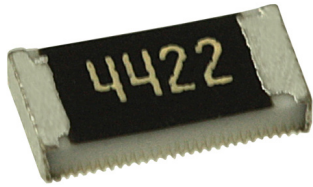


Precision Thin Film Resistors (TFCR Series)



Features:

- RoHS Compliant and Halogen Free
- TCR as low as ± 25 ppm
- Higher operating frequency with less parasitics
- Noise characteristics superior to standard thick film resistors
- Reference standards of EIA JIS C 5201-1
- Tolerance as low as $\pm 0.1\%$

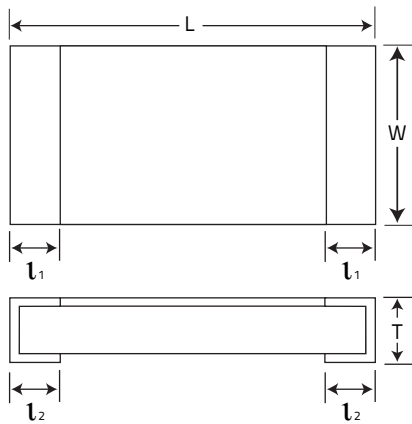
Part Number Structure

TFCR Series	1206 Size	8W Power Rating	- E TCR	- 1001 Resistance Value	B Resistance Tolerance	T Packaging	Optional Reel Identifier						
0201	0402	0603	0805	1206	1210	2010	2512	32W = 0.03W 20W = 0.05W 16W = 0.063W 10W = 0.10W 8W = 0.125W 4W = 0.25W 2W = 0.50W	E = ± 25 ppm/ $^{\circ}$ C C = ± 50 ppm/ $^{\circ}$ C K = ± 100 ppm/ $^{\circ}$ C	1001 = 1K Ω 4 digit code e.g. 4R70 = 4.7 Ω 1001 = 1K Ω 2494 = 2.49M Ω	B = $\pm 0.1\%$ C = $\pm 0.25\%$ D = $\pm 0.50\%$ F = $\pm 1\%$	T = Tape & Reel	Leave blank for standard quantity. Add "-1K" if 1000 piece reel is required

Example P/N: TFCR1206-8W-E-1001BT

Standard termination finish is 100% matte Tin (Sn) over Nickel.

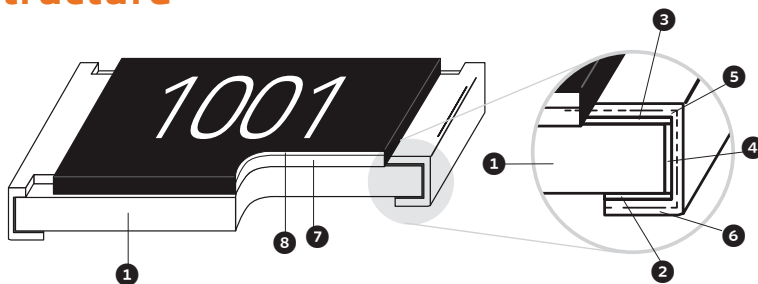
Dimensions



Unit: inches (mm)

Size	L	W	T	l1	l2
0201	0.023 \pm 0.001 (0.60 \pm 0.03)	0.011 \pm 0.001 (0.30 \pm 0.03)	0.009 \pm 0.001 (0.23 \pm 0.03)	0.003 \pm 0.002 (0.10 \pm 0.05)	0.006 \pm 0.002 (0.15 \pm 0.05)
0402	0.040 \pm 0.002 (1.0 \pm 0.05)	0.019 \pm 0.002 (0.5 \pm 0.05)	0.012 \pm 0.002 (0.30 \pm 0.05)	0.008 \pm 0.004 (0.2 \pm 0.10)	0.008 \pm 0.004 (0.2 \pm 0.10)
0603	0.061 \pm 0.004 (1.55 \pm 0.10)	0.031 \pm 0.004 (0.8 \pm 0.1)	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	0.193 \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)
2512	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)

Structure



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

Precision Thin Film Resistors (TFCR Series)

Electrical Specifications and Range

Size	0201		0402	0603		0805		1206		1210	2010	2512
Power Rating at 70°C (W)	0.03W (1/32W)	0.05W (1/20W)	0.063W (1/16W)	0.063W (1/16W)	0.10W (1/10W)	0.10W (1/10W)	0.125W (1/8W)	0.125W (1/8W)	0.25W (1/4W)	0.25W (1/4W)	0.25W (1/4W)	0.50W (1/2W)
Max. Working Voltage	15V		25V	50V		100V		150V		150V	150V	150V
Max. Overload Voltage	30V		50V	100V		200V		300V		300V	300V	300V
Operating Temp. Range	-55°C to +125°C		-55°C to +155°C	-55°C to +155°C		-55°C to +155°C		-55°C to +155°C		-55°C to +155°C	-55°C to +155°C	-55°C to +155°C
Tolerance	TCR	Resistance Range		Resistance Range	Resistance Range		Resistance Range		Resistance Range	Resistance Range	Resistance Range	Resistance Range
±0.1% (B)	±25ppm	100Ω - 10KΩ	-	10Ω - 511KΩ	4.7Ω - 1MΩ	4.7Ω - 2MΩ	4.7Ω - 1MΩ	4.7Ω - 2.49MΩ	4.7Ω - 1MΩ	4.7Ω - 2.49MΩ	4.7Ω - 3MΩ	4.7Ω - 3MΩ
	±50ppm	100Ω - 10KΩ	-	10Ω - 511KΩ	4.7Ω - 1MΩ	4.7Ω - 2MΩ	4.7Ω - 1MΩ	4.7Ω - 2.49MΩ	4.7Ω - 1MΩ	4.7Ω - 2.49MΩ	4.7Ω - 3MΩ	4.7Ω - 3MΩ
	±100ppm	100Ω - 10KΩ	-	10Ω - 511KΩ	4.7Ω - 1MΩ	4.7Ω - 2MΩ	4.7Ω - 1MΩ	4.7Ω - 2.49MΩ	4.7Ω - 1MΩ	4.7Ω - 2.49MΩ	4.7Ω - 3MΩ	4.7Ω - 3MΩ
±0.25% (C)	±25ppm	100Ω - 10KΩ	-	4.7Ω - 511KΩ	1Ω - 1MΩ	4.7Ω - 1MΩ	1Ω - 2MΩ	1Ω - 1MΩ	1Ω - 2.49MΩ	4.7Ω - 1MΩ	1Ω - 2.49MΩ	1Ω - 3MΩ
	±50ppm	100Ω - 10KΩ	-	4.7Ω - 511KΩ	1Ω - 1MΩ	4.7Ω - 1MΩ	1Ω - 2MΩ	1Ω - 1MΩ	1Ω - 2.49MΩ	4.7Ω - 1MΩ	1Ω - 2.49MΩ	1Ω - 3MΩ
	±100ppm	100Ω - 10KΩ	-	4.7Ω - 511KΩ	1Ω - 1MΩ	4.7Ω - 1MΩ	1Ω - 2MΩ	1Ω - 1MΩ	1Ω - 2.49MΩ	4.7Ω - 1MΩ	1Ω - 2.49MΩ	1Ω - 3MΩ
±0.5% (D)	±25ppm	-	27Ω - 4.99KΩ	4.7Ω - 511KΩ	1Ω - 1MΩ	4.7Ω - 1MΩ	1Ω - 2MΩ	1Ω - 1MΩ	1Ω - 2.49MΩ	4.7Ω - 1MΩ	1Ω - 2.49MΩ	1Ω - 3MΩ
	±50ppm	49.9Ω-33KΩ	27Ω - 10KΩ	4.7Ω - 511KΩ	1Ω - 1MΩ	4.7Ω - 1MΩ	1Ω - 2MΩ	1Ω - 1MΩ	1Ω - 2.49MΩ	4.7Ω - 1MΩ	1Ω - 2.49MΩ	1Ω - 3MΩ
	±100ppm	49.9Ω-33KΩ	27Ω - 10KΩ	4.7Ω - 511KΩ	1Ω - 1MΩ	4.7Ω - 1MΩ	1Ω - 2MΩ	1Ω - 1MΩ	1Ω - 2.49MΩ	4.7Ω - 1MΩ	1Ω - 2.49MΩ	1Ω - 3MΩ
±1% (F)	±25ppm	-	27Ω - 4.99KΩ	4.7Ω - 511KΩ	1Ω - 1MΩ	4.7Ω - 1MΩ	1Ω - 2MΩ	1Ω - 1MΩ	1Ω - 2.49MΩ	4.7Ω - 1MΩ	1Ω - 2.49MΩ	1Ω - 3MΩ
	±50ppm	49.9Ω-33KΩ	27Ω - 10KΩ	4.7Ω - 511KΩ	1Ω - 1MΩ	4.7Ω - 1MΩ	1Ω - 2MΩ	1Ω - 1MΩ	1Ω - 2.49MΩ	4.7Ω - 1MΩ	1Ω - 2.49MΩ	1Ω - 3MΩ
	±100ppm	49.9Ω-33KΩ	27Ω - 10KΩ	4.7Ω - 511KΩ	1Ω - 1MΩ	4.7Ω - 1MΩ	1Ω - 2MΩ	1Ω - 1MΩ	1Ω - 2.49MΩ	4.7Ω - 1MΩ	1Ω - 2.49MΩ	1Ω - 3MΩ

NOTE: Max Working Voltage is listed above or $\sqrt{P \cdot R}$, whichever is lower. Max overload Voltage is listed above or $2.5 \cdot \sqrt{P \cdot R}$, whichever is lower.

Marking Code



E-24 values for 0603 size maybe marked with the standard 3 digit marking code.

E-96 values for 0805 size and larger, will be marked with standard 4 digit marking code.

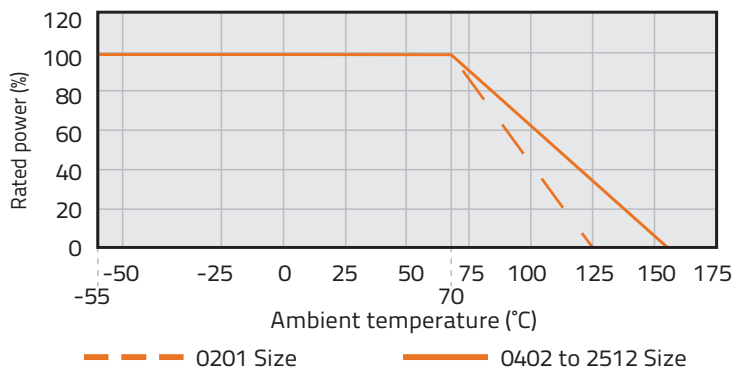
E-24 values for 0603 size and larger, will be marked with standard 3 digit marking code.

0603 - E-96 values will be marked with a standard 3 digit alpha numeric code

(Please see page 61 for alpha numeric codes).

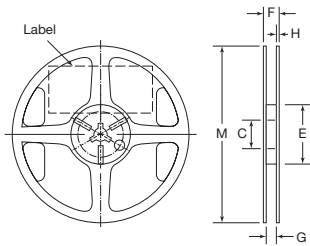
Note: 0201 and 0402 cannot be marked.

Derating Curve



Precision Thin Film Resistors (TFCR Series)

Reel Specifications

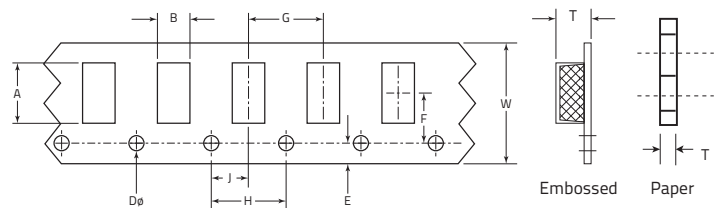


Unit: mm (inch)

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.

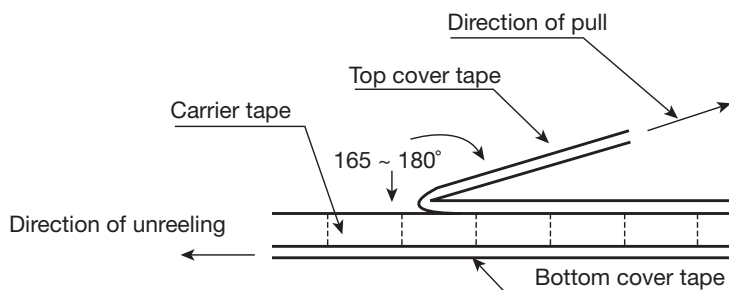
Tape Specifications



All dimensions in mm.

Tape	Size (inches)	A	B	W	E	F	T	G	H	J	Dø
Paper	0201	0.70 ± 0.05	0.40 ± 0.05	8.0 ± 0.10	1.75 ± 0.05	3.50 ± 0.05	0.42 ± 0.02	2.00 ± 0.05	4.00 ± 0.10	2.00 ± 0.05	1.55 ± 0.03
	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 +0.20, -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 +0.20, -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°.

Precision Thin Film Resistors (TFCR Series)

Environmental Characteristics

Item	Requirement	Test Method
Temperature Coefficient of Resistance (T.C.R.)	As Spec.	+25/-55/+125/+25°C
Short Time Overload	$\Delta R \pm 2\%$	RCWV*2.5 or Max. Overload Voltage whichever is lower for 5 seconds
Insulation Resistance	> 1000 M Ω	Apply 100VDC for 1 minute
Endurance	$\Delta R \pm 0.2\%$	70 $\pm 2^\circ\text{C}$ RCWV for 1000 hrs with 1.5 hrs 'ON' and 0.5 hrs 'OFF'
	> 7K Ω $\Delta R \pm 0.5\%$	
Damp Heat with Load	$\Delta R \pm 0.3\%$	40 $\pm 2^\circ\text{C}$ 90-95% R.H. RCWV for 1000 hrs with 1.5 hrs 'ON' and 0.5 hrs 'OFF'
Bending Strength	$\Delta R \pm 2\%$	Bending amplitude 3mm for 10 seconds
Solderability	95% min coverage	245 $\pm 5^\circ\text{C}$ for 3 seconds
Resistance to Soldering Heat	$\Delta R \pm 2\%$	260 $\pm 5^\circ\text{C}$ for 10 seconds
Dielectric Withstanding Voltage	By Type	Max. Overload Voltage for 1 minute
Thermal Shock	$\Delta R \pm 0.25\%$	-55 $^\circ\text{C}$ ~150 $^\circ\text{C}$ 100 cycles
Low Temperature Operation	$\Delta R \pm 0.2\%$	1 hour -65 $^\circ\text{C}$ followed by 45 minutes of RCWV

RCWV(Rated continuous working voltage) = $\sqrt{P \cdot R}$ or Max operating voltage whichever is lower

Reference Standards: MIL-STD-202, JIS-C 5201-1

Storage Temperature: 25 $\pm 3^\circ\text{C}$; Humidity < 80% RH