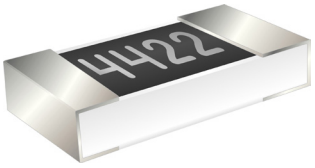
TFCR SERIES
PRECISION THIN FILM RESISTORS

VENKEL LTD.



FEATURES:

- TCR as low as ±25ppm
- 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 ±0.1%

RoHS Compliant | REACH Compliant | HF Halogen FREE | Conflict Minerals FREE 3TG

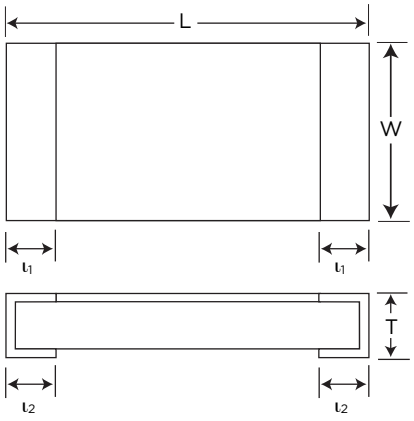
PART NUMBER STRUCTURE

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

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

Standard Termination is 100% matte Tin over Nickel.

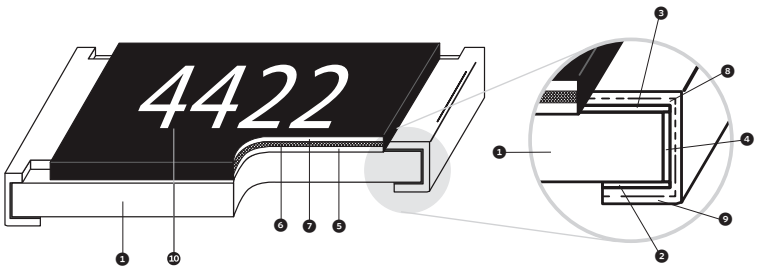
DIMENSIONS



Unit: inches (mm)

SIZE	L	W	T	t1	t2
0201	0.023 ± 0.001 (0.60 ± 0.03)	0.011 ± 0.001 (0.30 ± 0.03)	0.009 ± 0.001 (0.23 ± 0.03)	0.006 ± 0.002 (0.15 ± 0.05)	0.006 ± 0.002 (0.15 ± 0.05)
0402	0.040 ± 0.002 (1.0 ± 0.05)	0.019 ± 0.002 (0.5 ± 0.05)	0.012 ± 0.002 (0.30 ± 0.05)	0.008 ± 0.004 (0.2 ± 0.10)	0.008 ± 0.004 (0.2 ± 0.10)
0603	0.061 ± 0.004 (1.55 ± 0.10)	0.031 ± 0.004 (0.8 ± 0.1)	0.018 ± 0.004 (0.45 ± 0.10)	0.012 ± 0.008 (0.30 ± 0.20)	0.012 ± 0.008 (0.30 ± 0.20)
0805	0.079 ± 0.006 (2.0 ± 0.15)	0.049± 0.006 (1.25 ± 0.15)	0.022 ± 0.004 (0.55 ± 0.10)	0.012 ± 0.008 (0.30 ± 0.20)	0.016 ± 0.010 (0.40 ± 0.25)
1206	0.120 ± 0.006 (3.05 ± 0.15)	0.061 ± 0.006 (1.55 ± 0.15)	0.022 ± 0.004 (0.55 ± 0.10)	0.017 ± 0.008 (0.42 ± 0.20)	0.014 ± 0.010 (0.35 ± 0.25)
1210	0.122 ± 0.006 (3.10 ± 0.15)	0.094 ± 0.006 (2.40 ± 0.15)	0.022 ± 0.004 (0.55 ± 0.10)	0.016 ± 0.008 (0.40 ± 0.20)	0.022 ± 0.010 (0.55 ± 0.25)
2010	0.193 ± 0.006 (4.90 ± 0.15)	0.094 ± 0.006 (2.40 ± 0.15)	0.022 ± 0.004 (0.55 ± 0.10)	0.024 ± 0.012 (0.60 ± 0.30)	0.020 ± 0.010 (0.50 ± 0.25)
2512	0.248 ± 0.006 (6.30 ± 0.15)	0.122 ± 0.006 (3.10 ± 0.15)	0.022 ± 0.004 (0.55 ± 0.10)	0.024 ± 0.012 (0.60 ± 0.30)	0.020 ± 0.010 (0.50 ± 0.25)

STRUCTURE



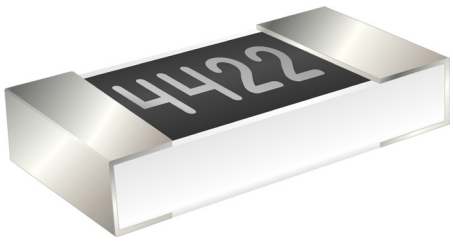
1	Alumina Substrate	5	Nickel Plating
2	Backside Electrode	6	Tin Plating
3	Top Electrode	7	Resistive layer
4	Edge Electrode	8	Overcoat

ELECTRICAL SPECIFICATION & RANGE

	SIZE	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	22Ω - 75KΩ	22Ω - 75KΩ	4.02Ω - 511KΩ	1Ω - 1MΩ		1Ω - 2MΩ	1Ω - 1MΩ	1Ω - 2.49MΩ	1Ω - 1MΩ	1Ω - 2.49MΩ	1Ω - 3MΩ	1Ω - 3MΩ
	±50ppm	22Ω - 75KΩ	22Ω - 75KΩ	4.02Ω - 511KΩ	1Ω - 1MΩ		1Ω - 2MΩ	1Ω - 1MΩ	1Ω - 2.49MΩ	1Ω - 1MΩ	1Ω - 2.49MΩ	1Ω - 3MΩ	1Ω - 3MΩ
	±100ppm	22Ω - 75KΩ	22Ω - 75KΩ	4.02Ω - 511KΩ	1Ω - 1MΩ		1Ω - 2MΩ	1Ω - 1MΩ	1Ω - 2.49MΩ	1Ω - 1MΩ	1Ω - 2.49MΩ	1Ω - 3MΩ	1Ω - 3MΩ
±0.25% (C)	±25ppm	22Ω - 75KΩ	22Ω - 75KΩ	4.02Ω - 511KΩ	1Ω - 1MΩ		1Ω - 2MΩ	1Ω - 1MΩ	1Ω - 2.49MΩ	1Ω - 1MΩ	1Ω - 2.49MΩ	1Ω - 3MΩ	1Ω - 3MΩ
	±50ppm	22Ω - 75KΩ	22Ω - 75KΩ	4.02Ω - 511KΩ	1Ω - 1MΩ		1Ω - 2MΩ	1Ω - 1MΩ	1Ω - 2.49MΩ	1Ω - 1MΩ	1Ω - 2.49MΩ	1Ω - 3MΩ	1Ω - 3MΩ
	±100ppm	22Ω - 75KΩ	22Ω - 75KΩ	4.02Ω - 511KΩ	1Ω - 1MΩ		1Ω - 2MΩ	1Ω - 1MΩ	1Ω - 2.49MΩ	1Ω - 1MΩ	1Ω - 2.49MΩ	1Ω - 3MΩ	1Ω - 3MΩ
±0.5% (D)	±25ppm	22Ω - 75KΩ	22Ω - 75KΩ	4.02Ω - 511KΩ	1Ω - 1MΩ		1Ω - 2MΩ	1Ω - 1MΩ	1Ω - 2.49MΩ	1Ω - 1MΩ	1Ω - 2.49MΩ	1Ω - 3MΩ	1Ω - 3MΩ
	±50ppm	22Ω - 75KΩ	22Ω - 75KΩ	4.02Ω - 511KΩ	1Ω - 1MΩ		1Ω - 2MΩ	1Ω - 1MΩ	1Ω - 2.49MΩ	1Ω - 1MΩ	1Ω - 2.49MΩ	1Ω - 3MΩ	1Ω - 3MΩ
	±100ppm	22Ω - 75KΩ	22Ω - 75KΩ	4.02Ω - 511KΩ	1Ω - 1MΩ		1Ω - 2MΩ	1Ω - 1MΩ	1Ω - 2.49MΩ	1Ω - 1MΩ	1Ω - 2.49MΩ	1Ω - 3MΩ	1Ω - 3MΩ
±1% (F)	±25ppm	22Ω - 75KΩ	22Ω - 75KΩ	4.02Ω - 511KΩ	1Ω - 1MΩ		1Ω - 2MΩ	1Ω - 1MΩ	1Ω - 2.49MΩ	1Ω - 1MΩ	1Ω - 2.49MΩ	1Ω - 3MΩ	1Ω - 3MΩ
	±50ppm	22Ω - 75KΩ	22Ω - 75KΩ	4.02Ω - 511KΩ	1Ω - 1MΩ		1Ω - 2MΩ	1Ω - 1MΩ	1Ω - 2.49MΩ	1Ω - 1MΩ	1Ω - 2.49MΩ	1Ω - 3MΩ	1Ω - 3MΩ
	±100ppm	22Ω - 75KΩ	22Ω - 75KΩ	4.02Ω - 511KΩ	1Ω - 1MΩ		1Ω - 2MΩ	1Ω - 1MΩ	1Ω - 2.49MΩ	1Ω - 1MΩ	1Ω - 2.49MΩ	1Ω - 3MΩ	1Ω - 3MΩ

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

MARKING CODE

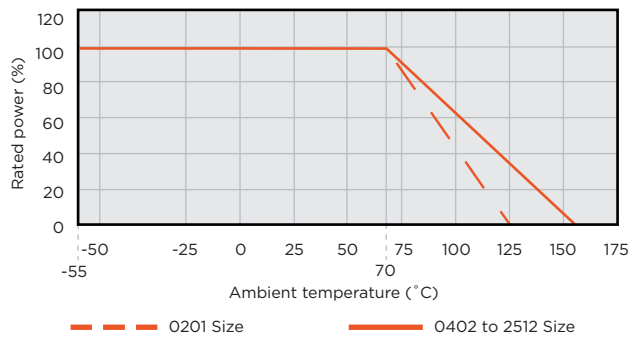


- E-24 values for 0603 size maybe marked with the standard 3 digit marking code.
- E-96 values for 0805 size and larger, will be marked with standard 4 digit marking code.
- E-24 values for 0603 size and larger, will be marked with standard 3 digit marking code.
- 0603 - E-96 values will be marked with a standard 3 digit alpha numeric code

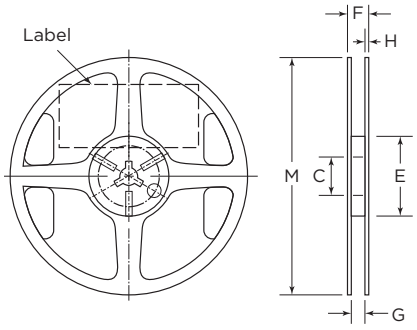
Please see 0603 marking codes PDF.

Note: 0201 and 0402 cannot be marked.

DERATING CURVE



REEL SPECIFICATIONS

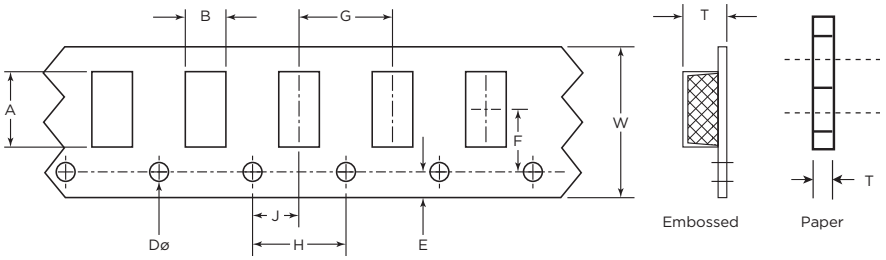


Unit: mm (inch)

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.

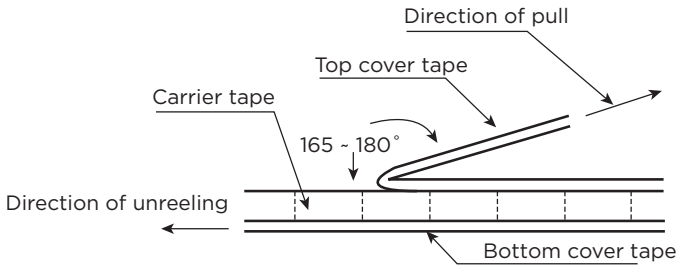
TAPE SPECIFICATIONS



Units: mm

TAPE	SIZE (in)	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±0.10	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±0.10	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 +.02.0, -0	4.00±0.10	4.00±0.10	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. ≤0.05%	Tol. >0.05%	
Temperature Coefficient of Resistance (T.C.R.)	As Specified.		**MIL-STD-202 Method 304** +25/-55/+125/+25°C
Short Time Overload	ΔR±0.05 %	ΔR±0.2%	**JIS-C-5201-1 4.13** RCWV*2.5 or Max. Overload Voltage whichever is lower for 5 seconds
	ΔR±0.02% for high power rating		
Insulation Resistance	>9999MΩ		**MIL-STD-202 Method 302** Apply 100VDC for 1 minute
Endurance	ΔR±0.05%	ΔR±0.2%	**MIL-STD-202 Method 108A** 70±2°C RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hrs "OFF"
	0201: ΔR≤(±1%+0.05Ω)		
Damp Heat with Load	ΔR±0.05%	ΔR±0.3%	**MIL-STD-202 Method 103B** 40±2°C 90-95% R.H. RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hrs "OFF"
	ΔR±0.5% for high power rating		
Bending Strength	ΔR±0.05%	ΔR±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±5°C for 3 seconds
Resistance to Soldering Heat	ΔR±0.05%	ΔR±0.1%	**MIL-STD-202 Method 210E** 260±5°C for 10 seconds
Dielectric Withstanding Voltage	By Type		**MIL-STD-202 Method 301** Max. Overload Voltage for 1 minute
Low Temperature Operation	ΔR±0.05%	ΔR±0.2%	**JIS-C-5201-1 4.36** 1 hour, -65°C, followed by 45 minutes of RCWV
	ΔR±0.5% for high power rating		
High Temperature Exposure	ΔR±0.5%		**MIL-STD-202 Method 108** at +155°C for 1000 hrs

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

Storage Temperature: 25±3°C; **Humidity** <80% RH