



# TR Series Thin Film Chip Resistor Product Specifications

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## Thin Film Chip Resistor Product Specifications — TR Series



Top view



Bottom view

### Applications

- Consumer electronics
- Computer
- Telecom
- Measuring instrument
- Printing equipment
- Converter

### Features

- Tolerance to  $\pm 0.1\%$
- Low TCR to  $\pm 10 \text{ ppm}/^\circ\text{C}$
- Halogen free and lead free
- RoHS compliant

### Parts Number Explanation

#### Example:

TR	1206	B	10K0	P	05	25	Z
<b>Product Type</b>	<b>Size (Inch)</b>	<b>Tolerance</b>	<b>Resistance</b>	<b>Package</b>	<b>Quantity (PCS)</b>	<b>TCR (ppm/°C)</b>	<b>Optional</b>
TR Series Thin Film Chip Resistor	0402 0603 0805 1206 1210 2010 2512	B : $\pm 0.1\%$ C : $\pm 0.25\%$ D : $\pm 0.5\%$ F : $\pm 1\%$	4 digits EX. 1R00 = 1 $\Omega$ 10R0 = 10 $\Omega$ 100R = 100 $\Omega$ 2K20 = 2.2 K $\Omega$ 332K = 332 K $\Omega$ 1M00 = 1 M $\Omega$	P、Q : Paper Taping E : Embossed Taping B : Bulk	04 : 4000 05 : 5000 10 : 10000 20 : 20000 40 : 40000 50 : 50000	10 : $\pm 10$ 15 : $\pm 15$ 25 : $\pm 25$ 50 : $\pm 50$	Z : default code



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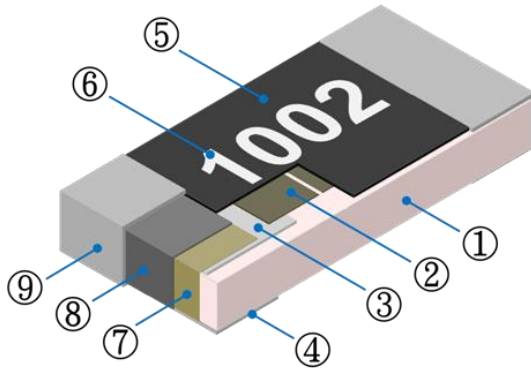
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## Standard Electrical Specifications

項目 Item 型別 Type	額定功率 Rated Power at 70°C	最大工作電壓 Max Working Voltage	最大過負載電壓 Max Overload Voltage	溫度係數 T.C.R. (PPM/°C)	阻值範圍 Resistance Range							
					B (±0.1%)	C (±0.25%)	D (±0.5%)	F (±1%)				
TR0402	0.063W	25V	50V	±10	10Ω ~ 10KΩ (10.1KΩ~68KΩ developing)							
				±15								
				±25	4.7Ω ~ 10KΩ (10.1KΩ~220KΩ developing)		1Ω ~ 10KΩ (10.1KΩ~220KΩ developing)					
				±50								
TR0603	0.1W	75V	150V	±10	10Ω ~ 100KΩ (101KΩ~332KΩ developing)							
				±15								
				±25	4.7Ω ~ 100KΩ (101KΩ~680KΩ developing)		1Ω ~ 100KΩ (101KΩ~680KΩ developing)					
				±50								
TR0805	0.125W	150V	300V	±10	10Ω ~ 100KΩ (101KΩ~680KΩ developing)							
				±15								
				±25	4.7Ω ~ 100KΩ (101KΩ~1MΩ developing)		1Ω ~ 100KΩ (101KΩ~1MΩ developing)					
				±50								
TR1206	0.25W	200V	400V	±10	10Ω ~ 100KΩ (101KΩ~1MΩ developing)							
				±15								
				±25	4.7Ω ~ 100KΩ (101KΩ~1.5MΩ developing)		1Ω ~ 100KΩ (101KΩ~1.5MΩ developing)					
				±50								
TR1210	0.25W			200V	400V	±10	10Ω ~ 100KΩ					
						±15						
						±25	4.7Ω ~ 100KΩ		1Ω ~ 100KΩ			
						±50						
TR2010	0.5W					200V	400V	±10	10Ω ~ 100KΩ			
								±15				
								±25	4.7Ω ~ 100KΩ		1Ω ~ 100KΩ	
								±50				
TR2512	0.75W	200V	400V					±10	10Ω ~ 100KΩ			
								±15				
								±25	4.7Ω ~ 100KΩ		1Ω ~ 100KΩ	
								±50				

- For non-standard parts, please contact our sales dept.
- Operating Temperature Range : -55°C ~ +155°C.

## Construction



①	Alumina Substrate	④	Bottom Inner Electrode	⑦	Side Inner Electrode
②	Resistive Layer	⑤	Protective Overcoat	⑧	Nickel Barrier
③	Top Inner Electrode	⑥	Marking	⑨	Solder coating (Sn)

## Dimensions



Unit : mm

TYPE	L	W	H	l <sub>1</sub>	l <sub>2</sub>
TR0402	1.00 ± 0.10	0.50 ± 0.05	0.30 ± 0.05	0.15 ± 0.10	0.20 ± 0.10
TR0603	1.60 ± 0.20	0.80 ± 0.15	0.40 ± 0.10	0.20 ± 0.15	0.30 ± 0.10
TR0805	2.00 ± 0.20	1.25 ± 0.15	0.50 ± 0.15	0.20 ± 0.15	0.40 ± 0.15
TR1206	3.05 ± 0.10	1.60 ± 0.20	0.55 ± 0.15	0.30 ± 0.20	0.50 ± 0.20
TR1210	3.05 ± 0.10	2.50 ± 0.20	0.55 ± 0.15	0.30 ± 0.20	0.50 ± 0.20
TR2010	5.00 ± 0.20	2.50 ± 0.20	0.55 ± 0.10	0.30 ± 0.15	0.60 ± 0.20
TR2512	6.30 ± 0.20	3.20 ± 0.20	0.55 ± 0.10	0.40 ± 0.20	0.60 ± 0.20



## TR Series Thin Film Chip Resistor Product Specifications

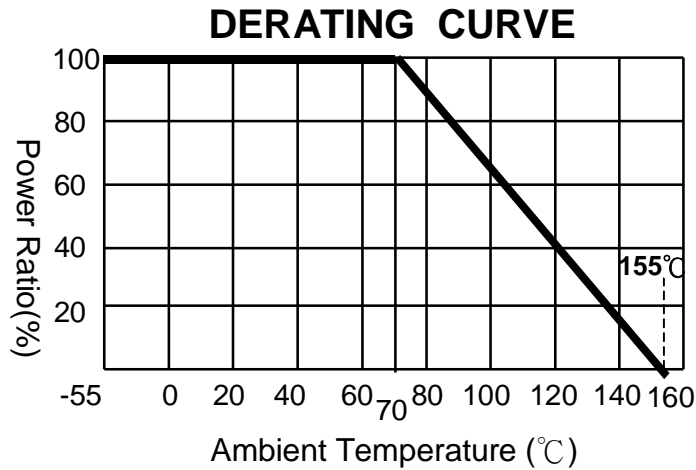
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### ■ Performance Characteristics

#### ■ Power Derating Curve

The Operating Temperature Range: -55°C ~+155°C.

Power rating is in the case based on continuous full-load at ambient temperature of 70°C. For operation at ambient temperature in excess of 70°C, the load should be derated in accordance with figure of derating Curve.



#### ■ Rated Voltage

Resistance Range:  $\geq 1\Omega$

Rated Voltage: The resistor shall have a DC continuous working voltage or a RMS AC continuous working voltage at commercial-line frequency and wave form corresponding to the power rating, as determined formula as following:

$$V = \sqrt{P \times R}$$

V = Rated voltage (V)

P = Rated power (W)

R = Nominal resistance ( $\Omega$ )



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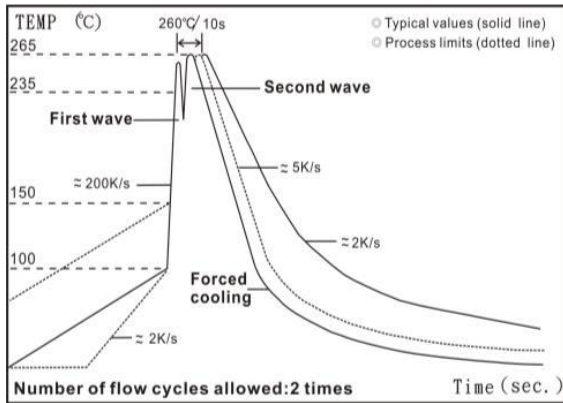
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### ■ Reliability Tests and Requirements

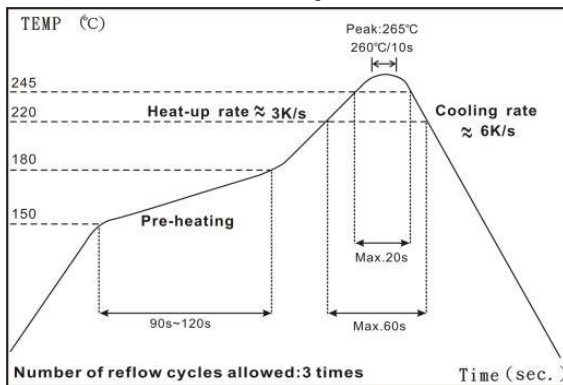
Test Item	Test Method	Procedure	Requirements
Temperature Coefficient of Resistance (T.C.R)	JIS C 5201-1 clause 4.8	At +25°C/-55°C and +25°C/+125°C.	Refer to Standard Electrical Specifications
Short Time Overload	JIS C 5201-1 clause 4.13	2.5 times RCWV or Max. Overload voltage whichever is less for 5 seconds.	±(0.5%+0.05Ω) No Visual damage
Insulation Resistance	JIS C 5201-1 clause 4.6	100V for 1 minute.	≥10GΩ
Solderability	JIS C 5201-1 clause 4.17	245±5°C for 3±0.5secs.	>95% Coverage No Visual damage
Resistance to Soldering Heat	JIS-C5201-1 clause 4.18	260±5°C for 10 seconds.	±(0.5%+0.05Ω) No Visual damage
Leaching	JIS-C5201-1 clause 4.18	260±5°C for 30 seconds.	>95% Coverage No Visual damage
Temperature Cycling	JIS C 5201-1 clause 4.19	-55°C to +155°C, 300 cycles	±(0.5%+0.05Ω) No Visual damage
High Temperature Exposure	JIS-C5201-1 4.25	155±5°C for 1000 +48/-0 hours.	±(0.5%+0.05Ω)
Resistance to Solvent	JIS C 5201-1 clause 4.29	The tested resistor be immersed into isopropyl alcohol of 20~25°C for 60 secs. Then the resistor is left in the room for 48 hrs.	±(0.5%+0.05Ω) No Visual damage
Load Life in Humidity	JIS C 5201-1 clause 4.24	40±2°C, 90~95% R.H. , Rated power or Max. working current whichever is less for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF" .	±(0.5%+0.05Ω)
Load Life (Endurance)	JIS C 5201-1 clause 4.25	70±2°C, Rated power, or Max. working current whichever is less for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF" .	±(0.5%+0.05Ω)
Terminal Bending Strength	JIS C 5201-1 clause 4.33	Bending once for 5 seconds D : 0402 · 0603 · 0805=5mm 1206 · 1210 =3mm 2010 · 2512 = 2mm	±(0.5%+0.05Ω) No Visual damage

## ■ Recommended Customer Soldering Parameters

### ■ Wave solder Temperature condition



### ■ Solder reflow Temperature condition



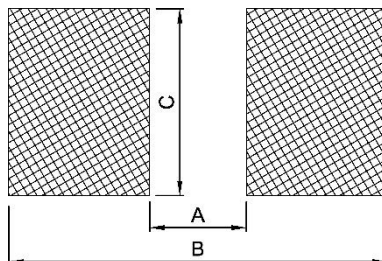
### ■ Rework temperature ( hot air equipment ) : 350°C, 3~5seconds

### ■ Recommended reflow methods

IR, vapor phase oven, hot air oven

If reflow temperatures exceed the recommended profile, devices may not meet the performance requirements.

## ■ Recommend Land Pattern Design ( For Reflow Soldering )



Unit: mm

Type	0402	0603	0805	1206	1210	2010	2512
A	0.60	0.80	1.30	2.20	2.00	3.80	4.90
B	1.60	2.40	2.90	4.20	4.40	6.60	8.10
C	0.70	1.00	1.40	1.70	2.70	2.70	3.40



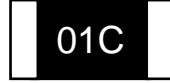
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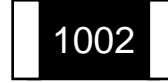
## ■ Marking



0402: no marking



0603: 3 digits code



0805~2512: 4 digits code

### ■ No marking on 0402 type

### ■ 3 digits code for 0603 type

#### ● Standard E96 Values and 0603 Resistance Codes

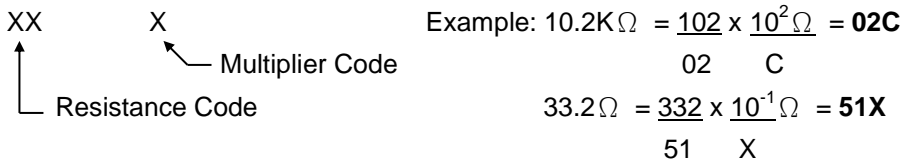
<b>R-Value</b>	100	102	105	107	110	113	115	118	121	124	127	130	133	137	140	143	147	150	154	158	162	165	169	174
<b>Code</b>	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
<b>R-Value</b>	178	182	187	191	196	200	205	210	215	221	226	232	237	243	249	255	261	267	274	280	287	294	301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

#### ● E96 Multiplier Code

Code	A	B	C	D	E	F	G	H	X	Y	Z
Multiplier	$10^0$	$10^1$	$10^2$	$10^3$	$10^4$	$10^5$	$10^6$	$10^7$	$10^{-1}$	$10^{-2}$	$10^{-3}$

1. 0603 3 digits coding formula for E96 values as following:

CODING FORMULA



EX.:  $1\Omega = 01Y$  ;  $7.5\Omega = 85Y$  ;  $11\Omega = 05X$  ;  $130\Omega = 12A$  ;  $2\text{K}\Omega = 30B$  ;  $10\text{K}\Omega = 01C$  ;  $150\text{K}\Omega = 18D$

2. 0603 3 digits for E24 values

E24	12	16	18	22	24	27	30	33	36	39	43	47	51	56	62	68	82	91
-----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----

Examples:

Resistance	$2.2\Omega$	$33\Omega$	$470\Omega$	$5.6\text{K}\Omega$	$62\text{K}\Omega$	$680\text{K}\Omega$
3 digits code	2R2	330	471	562	623	684

("R" = decimal point)

3. 0603 E192 values are no marking.

### ■ 4 digits code for 0805 ~ 2512 type

First 3 digits are the significant figures, the 4th digit is the multiplier. "R" = decimal point.

Examples:

Resistance	$1\Omega$	$5.6\Omega$	$10\Omega$	$22.6\Omega$	$100\Omega$	$1.1\text{K}\Omega$	$10\text{K}\Omega$	$332\text{K}\Omega$	$1\text{M}\Omega$
4 digits code	1R00	5R60	10R0	22R6	1000	1101	1002	3323	1004



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## ■ Packaging Information

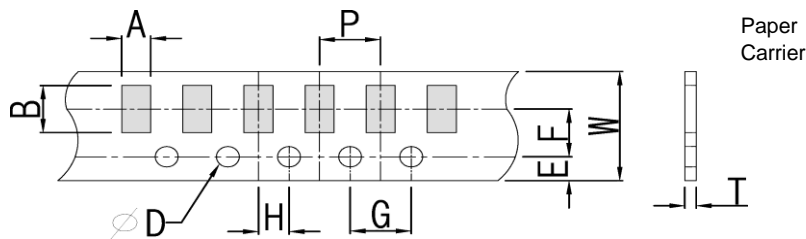
### ■ Reel Dimensions



Unit: mm

TYPE	SIZE	A	φB	φC	φD	W	φM
0402	7"	10K/Reel	2.0±0.5	13.5±1.0	21±1.0	60±1.0	11.5±2.0
0402	13"	40K/50K Reel	2.0±0.5	13.5±1.0	21±1.0	100±1.0	11.5±2.0
0603/0805/1206/1210	7"	5K/Reel	2.0±0.5	13.5±1.0	21±1.0	60±1.0	11.5±2.0
0603/0805/1206	10"	10K/Reel	2.0±0.5	13.5±1.0	21±1.0	100±1.0	11.5±2.0
	13"	20K/Reel	2.0±0.5	13.5±1.0	21±1.0	100±1.0	11.5±2.0
2010/2512	7"	4K/Reel	2.0±0.5	13.5±1.0	21±1.0	60±1.0	16.0±2.0

### ■ Paper Tape Dimensions



Unit: mm

Type	A	B	W	E	F	G	H	T	φD	P
0402	0.70±0.10	1.20±0.10	8.0±0.20	1.75±0.10	3.5±0.05	4.0±0.10	2.0±0.05	0.45±0.10	1.50 <sup>+0.10</sup> <sub>-0</sub>	2.0±0.10
0603	1.05±0.20	1.80±0.20	8.0±0.20	1.75±0.10	3.5±0.05	4.0±0.10	2.0±0.05	0.60±0.10		4.0±0.10
0805	1.55±0.20	2.30±0.20	8.0±0.20	1.75±0.10	3.5±0.05	4.0±0.10	2.0±0.05	0.75±0.10		
1206	1.90±0.20	3.50±0.20	8.0±0.20	1.75±0.10	3.5±0.05	4.0±0.10	2.0±0.05	0.75±0.10		
1210	2.85±0.20	3.50±0.20	8.0±0.20	1.75±0.10	3.5±0.05	4.0±0.10	2.0±0.05	0.75±0.10		

### ■ Plastic Embossed Tape Dimensions



Unit: mm

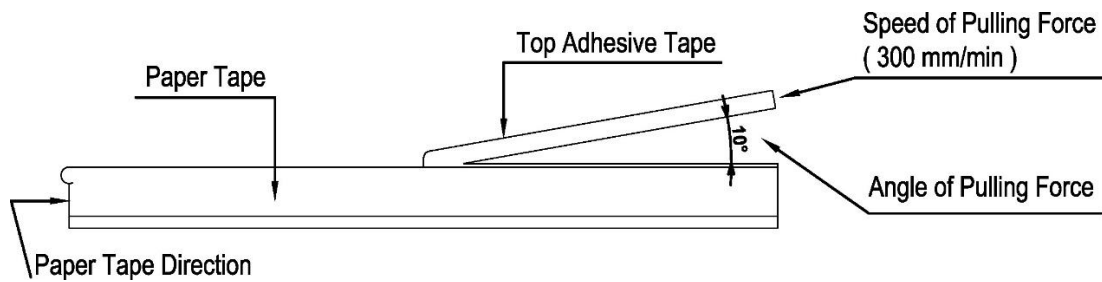
Type	A	B	W	E	F	G	H	T	φD	ψD1	T1	P
2010	2.80±0.20	5.60±0.20	12±0.10	1.75±0.10	5.5±0.05	4.0±0.10	2.0±0.05	0.23±0.10	1.50 <sup>+0.10</sup> <sub>-0</sub>	1.50±0.10	0.85±0.15	4.0±0.10
2512	3.40±0.20	6.70±0.20	12±0.10	1.75±0.10	5.5±0.05	4.0±0.10	2.0±0.05	0.23±0.10		1.50±0.10	0.85±0.15	



■ **Front & Back Lead Dimensions**

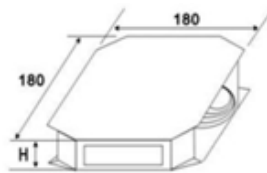


■ **Top Adhesive Peel Off Strength : 10~70g**



■ **Package**

Inner Box Size	
Reel	Size H(mm)
1	13
2	24
3	36
5	60
10	113



External Box Size			
Contain (Kpcs)	Length (mm)	Width (mm)	Width (mm)
25K	180	180	60
50K	180	180	110
150K	430	200	200
300K	400	400	200



■ **Storage Data :**

Storage time at the environment temp:  $25\pm 5^{\circ}\text{C}$  & humidity:  $60\pm 20\%$  is valid for one year from the date of delivery.

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