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# **DIRECT**

## **Electronics Tech.**

# **(PR) Anti-Corrosive Precision Chip Resistors**

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**▶ Product Introduction****Anti-corrosive thin film resistor of moisture-proof  
is ideal for high humidity precision applications.****Features :**

- Tight Tolerance down to  $\pm 0.1\%$
- Wide R-Value Range  $10 \Omega \sim 1\text{Meg } \Omega$
- Extremely Low TCR down to  $\pm 25 \text{ PPM}/^\circ\text{C}$
- Special Passivated NiCr Film for Anti-Acid and Anti-Damp
- Long Term Life Stability with Advance Thin Film Technology
- Demonstrated the Anti-Corrosion Claims Characterized by  $\text{Ta}_2\text{N}$

**Applications :**

- Telecommunication Device
- Automotive, Medical Equipment
- Outdoor Electronic Applications
- High-end Multimedia Electronics
- Automatic Equipment Controller
- High-end Computer, Industrial Equipment

Direct Electronics has introduced a new line of SMD Anti-Corrosive Precision Resistors that eliminates moisture concerns associated with typical Nickel Chromium precision resistors. The PR Series is an ideal low-cost alternative for expensive and hard-to-find tantalum nitride chip resistors.

A proprietary passivation layer is introduced between the nichrome resistive element with a superior alumina substrate and the epoxy overcoat to ensure stable performance and long life in the harshest and wettest environments.

In MIL-STD-202F method moisture testing, the PR Series demonstrated excellent stability over time and no significant shift in resistance after the 1000 hour life test. Applications require operation in humid or high moisture environments or have experienced corrosion problems with standard Nichrome thin film resistors. For those applications, long term extended humidity testing is essential before a part can be considered for usage on a design.

Designated the (PR) SMD resistor, it is available in industry standard 0402, 0603, 0805, 1206, 2010, to 2512 sizes and has a resistance range from  $10 \Omega$  to  $1\text{M } \Omega$ , with tolerances tight to  $\pm 0.10\%$  and TCRs as low as  $25\text{ppm}/^\circ\text{C}$ . The PR Series has an operating temperature range of  $-55^\circ\text{C}$  to  $+155^\circ\text{C}$ . The PR chip also offers outstanding electrical stability and environmental stability performance that would be expected from a precision resistor.

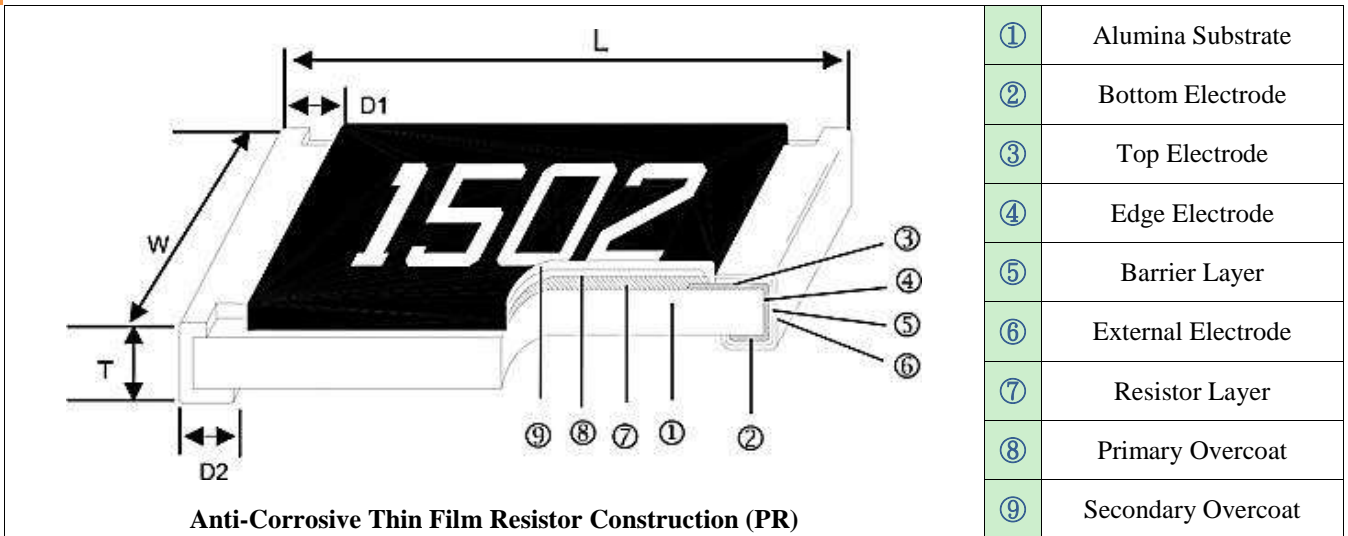
The standard packaging is tape and reel in 4Kpc, 5Kpc, and 10Kpc quantities depending on part size. Most sizes and resistance values are also offered in stock, making them an outstanding choice to support quick turn shortages. Pricing varies with size, tolerance, and TCR and ranges in reel quantities.

The chip PR series is lead-free and RoHS compliant. Detailed specifications, both mechanical and electrical, please contact us with your specific needs, or link to Direct official website "[Chip Resistors](#)" to get more information.



► **Construction & Dimensions**

**Construction & Dimensions (Unit: mm) (PR)**



**Anti-Corrosive Thin Film Resistor Construction (PR)**

Type	L (Unit: mm)	W (Unit: mm)	T (Unit: mm)	D1 (Unit: mm)	D2 (Unit: mm)	Weight(g)/1000pcs
<b>PR02 (0402)</b>	1.00±0.05	0.50±0.05	0.35±0.05	0.20±0.10	0.20±0.10	0.55
<b>PR03 (0603)</b>	1.55±0.10	0.80±0.10	0.45±0.10	0.30±0.20	0.30±0.20	1.85
<b>PR05 (0805)</b>	2.00±0.15	1.25±0.15	0.55±0.10	0.35±0.20	0.40±0.25	4.76
<b>PR06 (1206)</b>	3.05±0.15	1.55±0.15	0.55±0.10	0.42±0.20	0.35±0.25	9.11
<b>PR10 (2010)</b>	4.90±0.15	2.40±0.15	0.55±0.10	0.60±0.30	0.50±0.25	23.82
<b>PR12 (2512)</b>	6.30±0.15	3.10±0.15	0.55±0.10	0.60±0.30	0.50±0.25	38.46

## ► Electrical Spec.

### Standard Electrical Specifications (PR)

Type	Power Rating at 70°C	Operating Temp. Range	Max Operating Voltage	Max Overloading Voltage	Resistance Tolerance %	Resistance Range	TCR PPM/°C
PR02 (0402)	1/16W	-55 ~ +155°C	25V	50V	±0.1, ±0.25, ±0.5	49.9Ω~12KΩ	±15
						24.9Ω~24.9KΩ	±25, ±50
PR03 (0603)	1/16W	-55 ~ +155°C	50V	100V	±0.1, ±0.25, ±0.5	24.9Ω~332KΩ	±15, ±25, ±50
PR05 (0805)	1/10W	-55 ~ +155°C	100V	200V	±0.1, ±0.25, ±0.5	10Ω~1MΩ	±15, ±25, ±50
PR06 (1206)	1/8W	-55 ~ +155°C	150V	300V	±0.1, ±0.25, ±0.5	10Ω~1MΩ	±15, ±25, ±50
PR10 (2010)	1/4W	-55 ~ +155°C	150V	300V	±0.1, ±0.25, ±0.5	24.9Ω~1MΩ	±15
						10Ω~1.5MΩ	±25, ±50
PR12 (2512)	1/2W	-55 ~ +155°C	150V	300V	±0.1, ±0.25, ±0.5	24.9Ω~1MΩ	±15
						10Ω~1.5MΩ	±25, ±50

- Operating Voltage =  $\sqrt{(P * R)}$  , or Max. Operating Voltage listed in above table whichever is lower.
- Overloading Voltage =  $2.5 * \sqrt{(P * R)}$  , or Max. Overloading Voltage listed in above table whichever is lower.
- Optional specifications can be required.

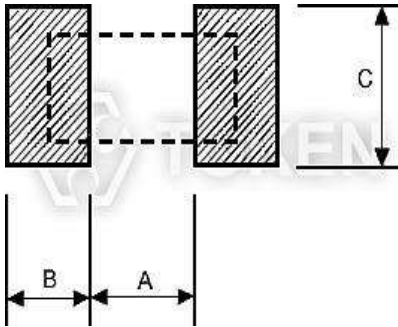
### High Power Rating Electrical Specifications (PR)

Type	Power Rating at 70°C	Operating Temp. Range	Max Operating Voltage	Max Overloading Voltage	Resistance Tolerance %	Resistance Range	TCR PPM/°C
PR03 (0603)	1/10W	-55 ~ +155°C	75V	150V	±0.1, ±0.25, ±0.5	24.9Ω~220KΩ	±15, ±25, ±50
PR05 (0805)	1/8W	-55 ~ +155°C	150V	300V	±0.1, ±0.25, ±0.5	24.9Ω~680KΩ	±15, ±25, ±50
PR06 (1206)	1/4W	-55 ~ +155°C	200V	400V	±0.1, ±0.25, ±0.5	24.9Ω~1MΩ	±15, ±25, ±50

- Operating Voltage =  $\sqrt{(P * R)}$  , or Max. Operating Voltage listed in above table whichever is lower.
- Overloading Voltage =  $2.5 * \sqrt{(P * R)}$  , or Max. Overloading Voltage listed in above table whichever is lower.
- Optional specifications can be required.

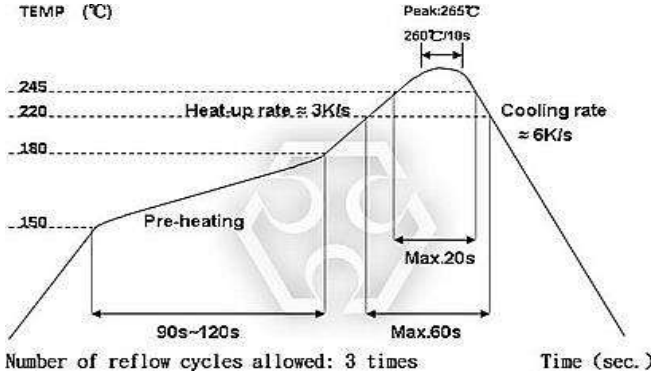
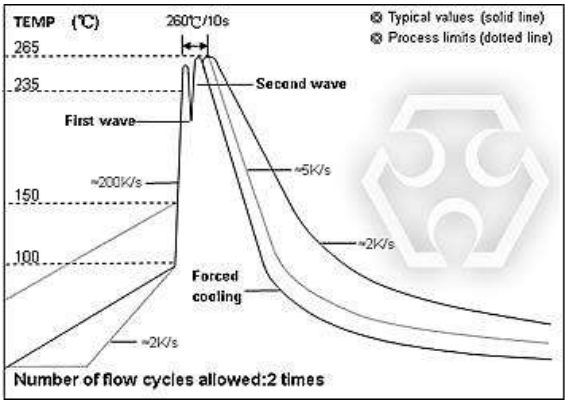
► **Recommend Conditions**

**Recommend Land Pattern (Unit: mm) (PR)**



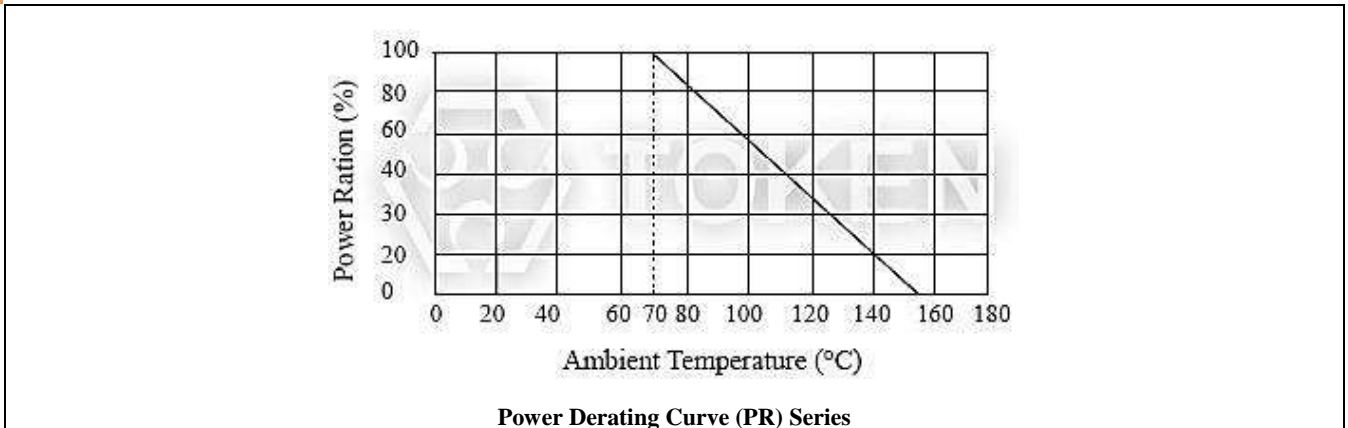
Codes	A	B	C
PR02 (0402)	0.50	0.50	0.60±0.2
PR03 (0603)	0.80	1.00	0.90±0.2
PR05 (0805)	1.00	1.00	1.35±0.2
PR06 (1206)	2.00	1.15	1.70±0.2
PR10 (2010)	3.60	1.40	2.50±0.2
PR12 (2512)	4.90	1.60	3.10±0.2

**Soldering Condition (PR)**

- (1) Time of IR reflow soldering at maximum temperature point 260°C : 10s
- (2) Time of wave soldering at maximum temperature point 260°C : 10s
- (3) Time of soldering iron at maximum temperature point 410°C : 5s

## Power Derating Curve (PR)



## Environmental Characteristics

### Environmental Characteristics (PR)

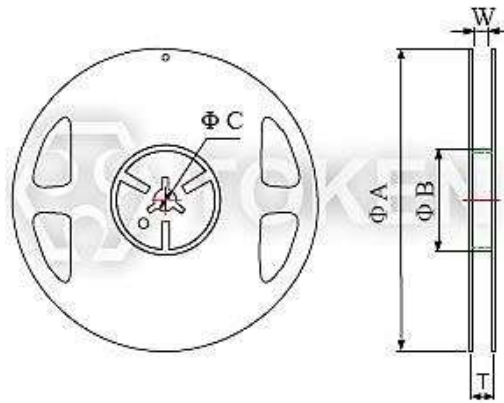
Test Item	Specification		Test Method
	Size 0603/0805/1206/2010/2512	Size 0402	
Short Time Overload	$\leq \pm 0.02\%$ $\leq \pm 0.2\%$ for high power rating	$\leq \pm 0.1\%$	JIS-C-5201-1 5.5 RCWV*2.5 or Max Overloading Voltage, 2 seconds
Thermal Shock	$\leq \pm 0.02\%$	$\leq \pm 0.1\%$	MIL-STD-202F Method 107G -55°C~125°C, 100 cycles
Load Life (Endurance)	$\leq \pm 0.05\%$ $\leq \pm 0.25\%$ for high power rating	$\leq \pm 0.25\%$	MIL-STD-202F Method 108A RCWV, 70°C, 1.5 hours ON, 0.5 hours OFF, total 1000 hours
Humidity (Steady State) (Damp Heat with Load)	$\leq \pm 0.05\%$ $\leq \pm 0.25\%$ for high power rating	$\leq \pm 0.5\%$	MIL-STD-202F Method 103B 40±2°C, 90~95%RH, RCWV 1.5 hours ON, 0.5 hours OFF, total 1000 hours
Resistance to Dry Heat	$\leq \pm 0.05\%$	$\leq \pm 0.5\%$	JIS-C-5202-7.2 1000 hours @ +155°C without load
Resistance to Soldering Heat	$\leq \pm 0.02\%$	$\leq \pm 0.1\%$	MIL-STD-202F Method 210E 260±5°C, 10±1seconds
Solderability	95% min coverage		MIL-STD-202F Method 208H 245°C±5°C, 3±0.5(sec)

- Rated continuous Working Voltage (RCWV) =  $\sqrt{(\text{Power Rating} \times \text{Resistance Value } (\Omega))}$  or Max. Operating voltage whichever is lower.
- Storage Temperature: 15~28°C; Humidity < 80%RH;

**► Packaging & Reel Tape**

**Packaging Quantity & Reel Specifications (Unit: mm) (PR)**

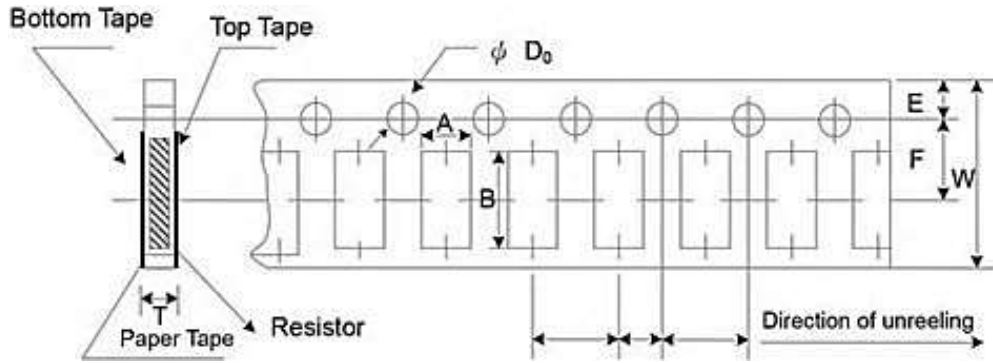
Codes	ΦA (Unit: mm)	ΦB (Unit: mm)	ΦC (Unit: mm)	W (Unit: mm)	T (Unit: mm)	Paper Tape (PCS)	Emboss Plastic Tape (PCS)
<b>PR02 (0402)</b>	178.0±1.0	60.0±1.0	13.5±0.7	9.5±1.0	11.5±1.0	10,000	-
<b>PR03 (0603)</b>	178.0±1.0	60.0±1.0	13.5±0.7	9.5±1.0	11.5±1.0	5,000	-
<b>PR05 (0805)</b>	178.0±1.0	60.0±1.0	13.5±0.7	9.5±1.0	11.5±1.0	5,000	-
<b>PR06 (1206)</b>	178.0±1.0	60.0±1.0	13.5±0.7	9.5±1.0	11.5±1.0	5,000	-
<b>PR10 (2010)</b>	178.0±1.0	60.0±1.0	13.5±0.7	13.5±1.0	15.5±1.0	-	4,000
<b>PR12 (2512)</b>	178.0±1.0	60.0±1.0	13.5±0.7	13.5±1.0	15.5±1.0	-	4,000



**Reel Packaging (PR)**

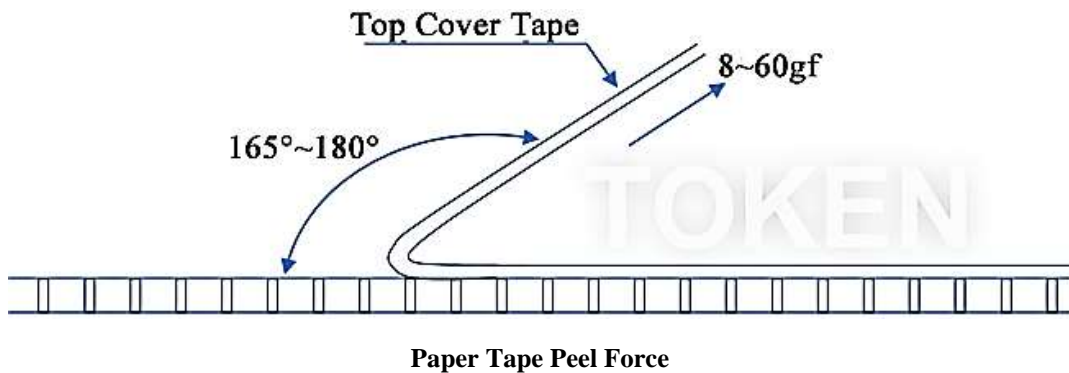
**Paper Tape Specifications (Unit: mm) (PR)**

Codes	A (mm)	B (mm)	W (mm)	E (mm)	F (mm)	P <sub>0</sub> (mm)	P <sub>1</sub> (mm)	P <sub>2</sub> (mm)	ΦD <sub>0</sub> (mm)	T (mm)
PR02	0.70±0.05	1.16±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	2.00±0.05	2.00±0.05	1.55±0.05	0.40±0.03
PR03	1.10±0.05	1.90±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.55±0.05	0.60±0.03
PR05	1.60±0.05	2.37±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.55±0.05	0.75±0.05
PR06	2.00±0.05	3.55±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.55±0.05	0.75±0.05



**Surface Mount Paper Tape Specifications (PR)**

**Paper Tape Peel Force (PR)**

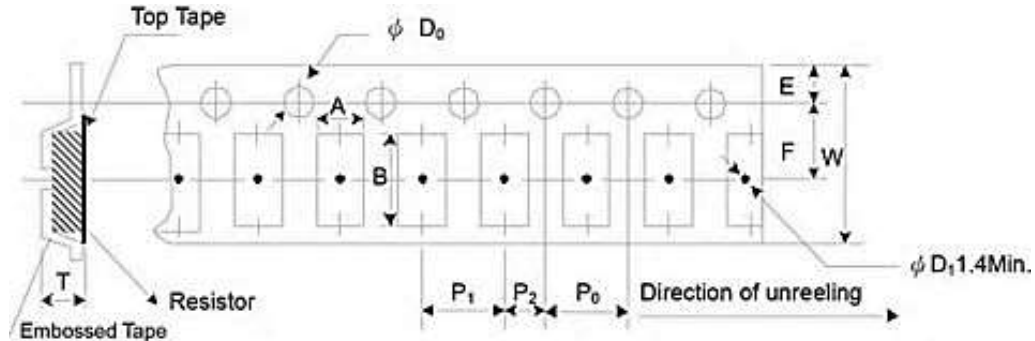


- (1) Peel force of top cover tape.
- (2) The peel speed shall be about 300 mm/min±5%
- (3) The peel force of top cover tape shall be between 8gf to 60gf.



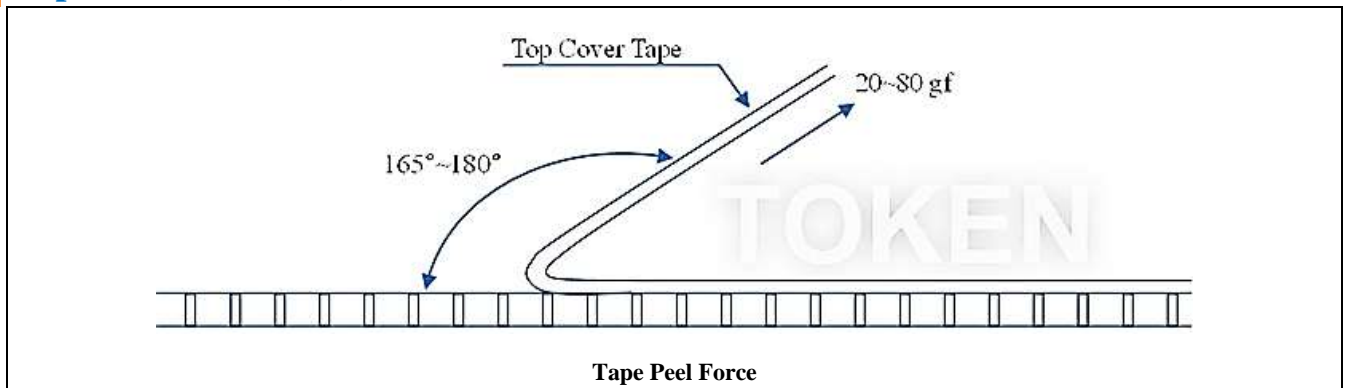
**Emboss Plastic Tape Specifications (Unit: mm) (PR)**

Codes	A (mm)	B (mm)	W (mm)	E (mm)	F (mm)	P <sub>0</sub> (mm)	P <sub>1</sub> (mm)	P <sub>2</sub> (mm)	ΦD <sub>0</sub> (mm)	T (mm)
<b>PR10</b>	2.85±0.10	5.45±0.10	12.0±0.10	1.75±0.10	5.5±0.05	4.00±0.05	4.00±0.10	2.00±0.05	1.50±0.10	1.00±0.20
<b>PR12</b>	3.40±0.10	6.65±0.10	12.0±0.10	1.75±0.10	5.5±0.05	4.00±0.05	4.00±0.10	2.00±0.05	1.50±0.10	1.00±0.20



**Surface Mount Emboss Plastic Tape Specifications (PR)**

**Tape Peel Force (PR)**



- (1) Peel force of top cover tape.
- (2) The peel speed shall be about 300 mm/min±5%
- (3) The peel force of top cover tape shall be between 20gf to 80gf.

## Order Codes

### Order Codes (PR)

PR	02	D	TR	C3	U	1002						
Part Number	Dimensions (L×W) (mm)		Package		TCR (ppm/°C)	Power Rating(W)		Resistance (Ω)		Marking		
	02	EIA0402	P	Bulk		U	1/2	1000	100		Standard Marking for E96/E24	
	03	EIA0603	TR	Taping Reel	C5	±5	V	1/4	2201	2200		
	05	EIA0805			C3	±25	W	1/8	1002	10000		
	06	EIA1206	D	±0.10	C2	±50	X	1/10	4992	49900		N
	10	EIA2010		±0.25			Y	1/16	1003	100K		
	12	EIA2512		±0.5					1004	1M		

### 0805~2512 4 digits marking for Example Marking

Resistance	100Ω	2.2KΩ	10KΩ	49.9KΩ	100KΩ	1MΩ
Marking	1000	2201	1002	4992	1003	1004

### 0603: 3 digits Marking E24 Nominal Table

E24 code	10	11	12	13	15	16	18	20	22	24	27	30	33	36	39	43	47	51	56	62	68	75	82	91
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- Example: 101=100Ω 102=1KΩ (1<sup>st</sup> and 2<sup>nd</sup> are E24 code and 3<sup>rd</sup> code is multiplier)
- Resistance tolerance 1% for 0603: 3 digits marking in E96 (E96 series except E24 series)
- Digits marking for Example: 13C=13K3Ω; 68B=4K99Ω; 68X=49.9Ω

### Marking Table E96 Nominal Table

code	02	03	04	06	07	08	09	10	11	13	14	15	16	17	19	20	21	22	23	24	25	26	27
E96	102	103	107	113	115	118	121	124	127	133	137	140	143	147	154	158	162	165	169	174	178	182	187
code	28	29	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
E96	191	196	205	210	215	221	226	232	237	243	249	255	261	267	274	280	287	294	301	309	316	324	332
code	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74
E96	340	348	357	365	374	383	392	402	412	422	432	442	453	464	475	487	499	511	523	536	549	562	576
code	75	76	77	78	79	80	81	82	83	84	86	87	88	89	90	91	92	93	94	95	96		
E96	590	604	619	634	649	665	681	698	715	732	768	787	806	825	845	866	887	909	931	953	976		

### Multiplier E96 Marking

Code	A	B	C	D	E	F	X	Y
Multiplier	10 <sup>0</sup>	10 <sup>1</sup>	10 <sup>2</sup>	10 <sup>3</sup>	10 <sup>4</sup>	10 <sup>5</sup>	10 <sup>-1</sup>	10 <sup>-2</sup>



## ► General Information

### **Direct Thin Film Chips Add Powerful New Options**

Direct electronics provides the industry's most comprehensive range of precision thin film technologies for discrete, network, and integrated passive components used in instrumentation; automotive electronics; communications systems; and portable electronics applications. Ultra-reliable precision Nichrome resistive elements are available on ceramic or silicon substrates in a wide variety of surface mount resistors.

In response to market demands for increased precision and stability, Direct has expanded range of nichrome thin-film chip resistors. Offering solutions to precision test and measurement and voltage regulation across industrial, military and medical monitoring equipment markets designed to offer superior humidity performance.

### **Direct Thick Film Chips Cut the Cost of Precision Resistors**

Direct electronics has developed an extensive range of thick film / thin film resistive technologies for electronic circuits in power supplies; test and measurement; industrial electronics; telecommunications; audio circuits; automotive control systems; lighting controls; medical electronics; industrial equipment; and control systems applications.

In addition to this, proven thick film technologies from Direct electronics provide a large range of standard resistive low Ohmic current sense products for critical battery management, and line termination. The enhanced performance of the chips is made possible by the precise use of the best resistance inks and a closely controlled production process.

### **Direct Chip Low Ohmic Resistors come in Smaller Sizes and Minimized Power Consumption**

Today's electronic devices are becoming smaller and smaller. As a result, designers are moving more towards surface mount components not only for new designs but also to design out large axial and other through-hole resistors.

In most cases this is a straight forward task as several resistor manufacturers offer chip resistors with performances to match axial parts. However in some cases, due to power rating or pulse withstanding requirements, this has been impossible. The requirement, in particular, for pulse withstand capability is growing due to the need to protect sensitive modern electronic systems. To meet this demand Direct electronics have designed a Pulse Withstanding Chip Resistor (PWR Series).

