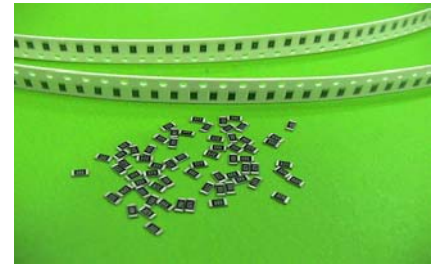


# THICK FILM CHIP RESISTORS

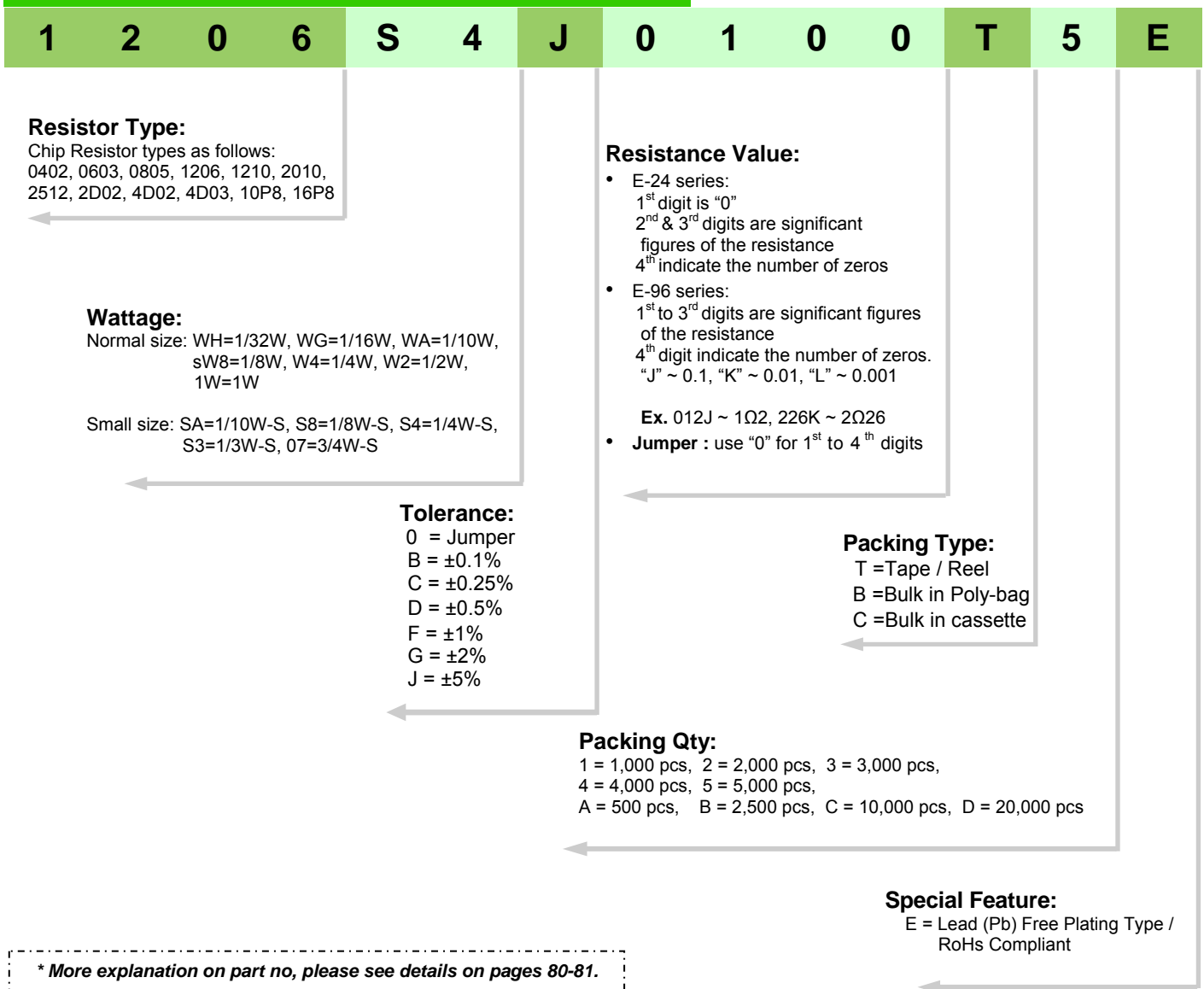
## Features

- Small size and lightweight
- Suitable for both flow and reflow soldering
- Reduction of assembly costs and matching with placement machines



Standard: 2%, 5%, 10%---E 24 series  
1%---E 96 series

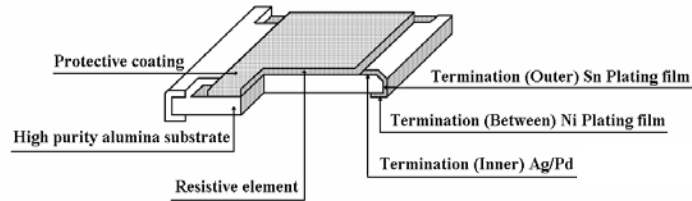
## Ordering Procedure: (Ex.: 1206, 1/4W-S, 5%, 10Ω, T/R-5000)



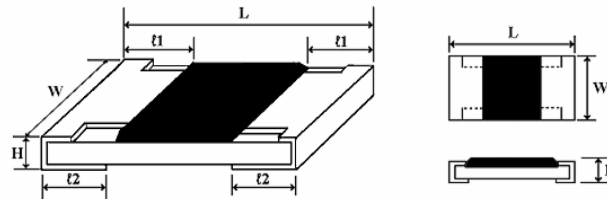
**Note :**  
Special resistance value or tolerance or T.C.R. requirement available on a case-to-case basis. Please indicate when ordering.

# THICK FILM CHIP RESISTORS

## Construction



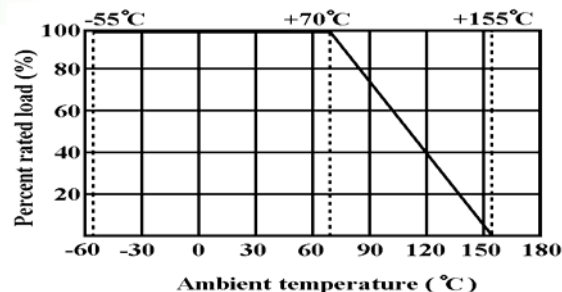
## Power Rating & Dimension



Type	Power Rating at 70°C	Max Working Voltage	Max Overload Voltage	Operating Temp. (°C)	Tolerance %	Resistance Range	Standard Series	Dimension (mm)				
								L	W	H	ℓ1	ℓ2
0402 (1005)	1/16W	1A	2A	-55~+155	Jumper	< 50 m Ω	E-96 E-24 E-24	1.00±0.10	0.50±0.05	0.35±0.05	0.20±0.10	0.25±0.10
		50V	100V		±1 ±2 ±5	10 Ω -1M Ω 1 Ω -10M Ω 1 Ω -10M Ω						
0603 (1608)	1/10W-S 1/16W	1A	2A	-55~+155	Jumper	< 50 m Ω	E-96 E-24 E-24	1.60±0.10	0.80 +0.15 -0.10	0.45±0.10	0.30±0.20	0.30±0.20
		50V	100V		±1 ±2 ±5	10 Ω -1M Ω 1 Ω -10M Ω 1 Ω -10M Ω						
0805 (2012)	1/8W-S 1/10W	2A	4A	-55~+155	Jumper	< 50 m Ω	E-96 E-24 E-24	2.00±0.15	1.25 +0.15 -0.10	0.55±0.10	0.40±0.20	0.40±0.20
		150V	300V		±1 ±2 ±5	10 Ω -1M Ω 1 Ω -10M Ω 1 Ω -10M Ω						
1206 (3216)	1/4W-S 1/8W	2A	4A	-55~+155	Jumper	< 50 m Ω	E-96 E-24 E-24	3.10±0.15	1.55 +0.15 -0.10	0.55±0.10	0.45±0.20	0.45±0.20
		200V	400V		±1 ±2 ±5	10 Ω -1M Ω 1 Ω -10M Ω 1 Ω -10M Ω						
1210 (3225)	1/3W-S 1/4W	2A	4A	-55~+155	Jumper	< 50 m Ω	E-96 E-24 E-24	3.10±0.10	2.60±0.15	0.55±0.10	0.50±0.25	0.50±0.20
		200V	400V		±1 ±2 ±5	10 Ω -1M Ω 1 Ω -10M Ω 1 Ω -10M Ω						
2010 (5025)	3/4W-S 1/2W	2A	4A	-55~+155	Jumper	< 50 m Ω	E-96 E-24 E-24	5.00±0.10	2.50±0.15	0.55±0.10	0.60±0.25	0.50±0.20
		200V	400V		±1 ±2 ±5	10 Ω -1M Ω 1 Ω -10M Ω 1 Ω -10M Ω						
2512 (6432)	1W	2.5A	5A	-55~+155	Jumper	< 50 m Ω	E-96 E-24 E-24	6.35±0.10	3.20±0.15	0.55±0.10	0.60±0.25	0.50±0.20
		200V	400V		±1 ±2 ±5	10Ω-1M Ω 1Ω-10M Ω 1Ω-10M Ω						

Note: Information in parenthesis are Japanese sizes.

## Derating Curve



## THICK FILM CHIP RESISTORS

### Multiplier Code (for 0603 1% marking)

Code	A	B	C	D	E	F	G	H	X	Y	Z
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>6</sup>	10 <sup>7</sup>	10 <sup>-1</sup>	10 <sup>-2</sup>	10 <sup>-3</sup>

### Standard E-96 Series Resistance Value Code (for 0603 1% marking)

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

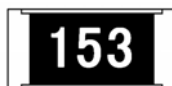
### Marking on the Resistors Body:

- For 0402 size, no marking on the body due to the small size of the resistor.
- ±5% tolerance product. (Including resistance values less than 1Ω; both 1% and 5%) The marking is 3 digits, the first 2 digits are the significant figures of the resistance and the 3<sup>rd</sup> digit denotes number of zeros.

153 = 15000Ω = 15KΩ; 120 = 12Ω

Below 10Ω shown as this: 6R8 = 6.8Ω

0.1Ω~0.99Ω shown as this: R33 = 0.33Ω

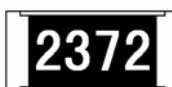


- ±1% tolerance marking of case size 0805 and bigger is 4 digits, the first 3 digits are the significant figures of the resistance and the 4<sup>th</sup> digit denotes number of zeros.

2372 = 23700Ω = 23.7KΩ; 1430 = 143Ω

Below 10Ω shown as this: 3R24 = 3.24Ω

0.1Ω~0.99Ω shown as this: R33 = 0.33Ω



## THICK FILM CHIP RESISTORS

- Standard E-96 series values ( $\pm 1\%$  tolerance) of 0603 size. Due to the small size of the resistor's body, 3 digits marking will be used to indicate the accurate resistance value by using the Multiplier code & Standard E-96 Series Resistance Value Code as shown on Page 6.

$$1.96\text{K}\Omega = 196 \times 10^1 \Omega = \mathbf{29B}$$



$$12.4\Omega = 124 \times 10^{-1} \Omega = \mathbf{10X}$$



- Standard E-24 series values which does not belong to E-96 series values (in  $\pm 1\%$  tolerance) of 0603 size. The marking is the same as 5% tolerance but marked with underline.

$$\underline{\mathbf{122}} = 1200 = 1.2\text{K}\Omega$$



$$\underline{\mathbf{680}} = 68\Omega$$



### Performance Specifications

<b>Temperature coefficient</b>	$\pm 5\%$ : $1\Omega \sim 10\text{M}\Omega \leq \pm 200\text{PPM}/^\circ\text{C}$ $\pm 1\%$ : $10\Omega \sim 100\Omega \leq \pm 200\text{PPM}/^\circ\text{C}$ ; $101\Omega \sim 1\text{M}\Omega \leq \pm 100\text{PPM}/^\circ\text{C}$
<b>Short-time overload</b>	$\pm 5\%$ : $\pm(2.0\% + 0.1\Omega)$ Max. $\pm 1\%$ : $\pm(1.0\% + 0.1\Omega)$ Max.
<b>Insulation resistance</b>	Min. 1,000 Mega Ohm
<b>Dielectric withstanding voltage</b>	No evidence of flashover, mechanical damage, arcing or insulation breakdown
<b>Terminal bending</b>	$\pm(1.0\% + 0.05\Omega)$ Max.
<b>Soldering heat</b>	Resistance change rate is $\pm(1.0\% + 0.05\Omega)$ Max.
<b>Solderability</b>	Min. 95% coverage
<b>Temperature cycling</b>	$\pm 5\%$ : $\pm(1.0\% + 0.05\Omega)$ Max. $\pm 1\%$ : $\pm(0.5\% + 0.05\Omega)$ Max.
<b>Humidity (Steady State)</b>	$\pm 5\%$ : $\pm(3.0\% + 0.1\Omega)$ Max. $\pm 1\%$ : $\pm(0.5\% + 0.1\Omega)$ Max.
<b>Load life in humidity</b>	$\pm 5\%$ : $\pm(3.0\% + 0.1\Omega)$ Max. $\pm 1\%$ : $\pm(1.0\% + 0.1\Omega)$ Max.
<b>Load life</b>	$\pm 5\%$ : $\pm(3.0\% + 0.1\Omega)$ Max. $\pm 1\%$ : $\pm(1.0\% + 0.1\Omega)$ Max.

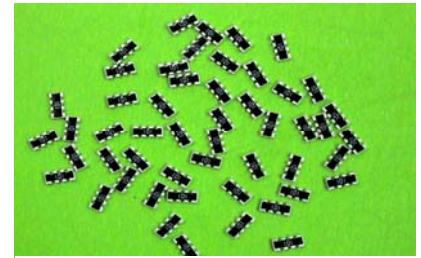
\* The values which are not of standard E-24 series (2% & 5%) and not of E-96 series (1%) could be offered on a case to case basis.

\* More details, please see pages 78-79.

# THICK FILM CHIP RESISTOR ARRAYS

## Features

- High density 2, 4, 8 resistors in one small case (convex type)
- Improvement of placement efficiency
- Packaging is suitable for automatic placement machines
- Superior solderability
- Scalloped

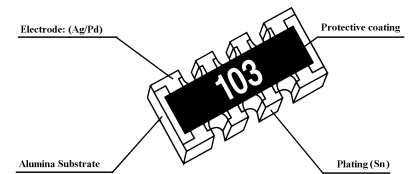
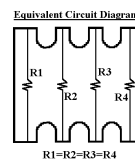
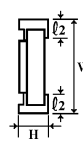
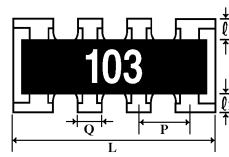
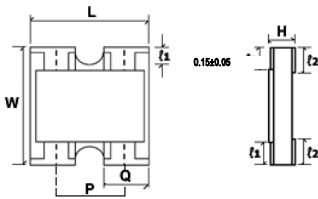


Standard: 2%, 5%, 10%---E 24 series  
1%---E 96 series

## Dimension (mm)

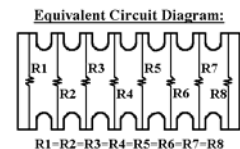
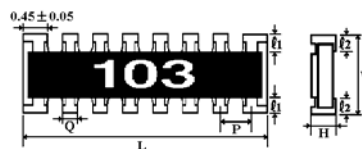
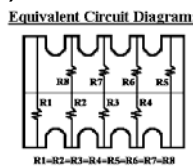
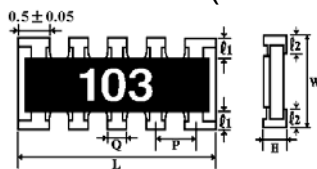
• 2D02 (4Pin 2R)

• 4D02, 4D03 (8Pin 4R)



• 10P8 (10Pin 8R)

• 16P8 (16Pin 8R)



Part No.	Style	L	W	H	l <sub>1</sub>	l <sub>2</sub>	P	Q
2D02 (0402x2)	2D02 (4Pin 2R)	1.0 ± 0.1	1.0 ± 0.1	0.35 ± 0.1	0.17 ± 0.1	0.25 ± 0.1	0.65 ± 0.05	0.33 ± 0.1
4D02 (0402x4)	4D02 (8Pin 4R)	2.0 ± 0.1	1.0 ± 0.1	0.45 ± 0.1	0.2 ± 0.15	0.3 ± 0.15	0.5 ± 0.05	0.3 ± 0.05
4D03 (0603x4)	4D03 (8Pin 4R)	3.2 ± 0.2	1.6 ± 0.2	0.5 ± 0.1	0.3 ± 0.15	0.3 ± 0.15	0.8 ± 0.1	0.5 ± 0.15
16P8	16P8 (16Pin 8R)	4.0 ± 0.2	1.6 ± 0.15	0.45 ± 0.1	0.3 ± 0.15	0.4 ± 0.15	0.5 ± 0.05	0.3 ± 0.05
10P8	10P8 (10Pin 8R)	3.2 ± 0.2	1.6 ± 0.15	0.55 ± 0.1	0.4 ± 0.1	0.3 ± 0.15	0.64 ± 0.05	0.35 ± 0.05

## Power Rating

Part No.	Style	Power Rating at 70°C	Max. Working Voltage	Max. Overload Voltage	Dielectric With-standing Voltage	Operated Temp. Range	Resistance Range		Jumper Rated Current
							F (±1%) E-96 series	J (±5%) E-24 series	
2D02	2D02 (4Pin2R)	1/16W	50V	100V	500V	-55°C~+155°C	-	10Ω~ 1MΩ	-
4D02	4D02 (8Pin4R)	1/16W	50V	100V	500V	-55°C~+155°C	-	10Ω~ 1MΩ	-
4D03	4D03 (8Pin4R)	1/16W	50V	100V	500V	-55°C~+155°C	100Ω~560KΩ	10Ω~ 1MΩ	1A
16P8	16P8 (16Pin8R)	1/16W	50V	100V	100V	-55°C~+155°C	-	10Ω~ 1MΩ	-
10P8	10P8 (10Pin8R)	1/32W	25V	50V	50V	-55°C~+155°C	-	33Ω~ 100KΩ	-

Note: Part number and ordering procedure the same as Thick Film Chip Resistors on Page 4.