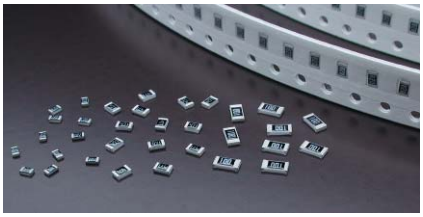
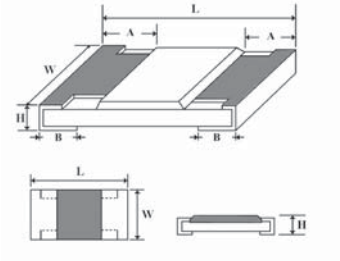
Thick Film Chip Resistors:

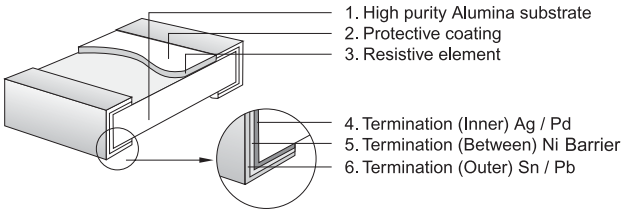
Feature

- Small size and light weight
- Reduction of assembly costs and matching with placement machines
- Suitable for both flow & re-flow soldering

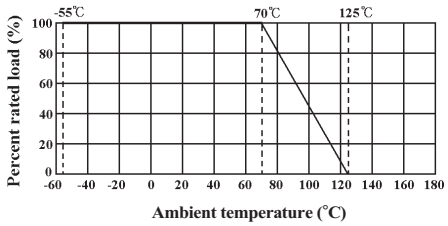


Figures





Derating Curve & Specification



Type	Max. working Voltage	Max. Overload Voltage	Dielectric withstanding Voltage	Operating Temperature
0402	25V	50V	500V	-55~+125°C
0603	50V	100V		
0805	150V	300V		
1206	200V	400V		
1210	200V	400V		
2010	200V	400V		
2512	200V	400V		

TYPE	0402	0603	0805	1206	1210	2010	2512
Power Rating at 70°C	1/16W	1/16W (1/10W-S)	1/10W (1/8W-S)	1/8W (1/4W-S)	1/4W (1/3W-S)	1/2W (3/4W-S)	1W
L (mm)	1.00 ± 0.10	1.60 ± 0.10	2.00 ± 0.15	3.10 ± 0.15	3.10 ± 0.10	5.00 ± 0.10	6.35 ± 0.10
W (mm)	0.50 ± 0.05	$0.80^{+0.15}_{-0.10}$	$1.25^{+0.15}_{-0.10}$	$1.55^{+0.15}_{-0.10}$	$2.60^{+0.15}_{-0.10}$	$2.50^{+0.15}_{-0.10}$	$3.20^{+0.15}_{-0.10}$
H (mm)	0.35 ± 0.05	0.45 ± 0.10	0.55 ± 0.10	0.55 ± 0.10	0.55 ± 0.10	0.55 ± 0.10	0.55 ± 0.10
A (mm)	0.20 ± 0.10	0.30 ± 0.20	0.40 ± 0.20	0.45 ± 0.20	0.50 ± 0.25	0.60 ± 0.25	0.60 ± 0.25
B (mm)	0.25 ± 0.10	0.30 ± 0.20	0.40 ± 0.20	0.45 ± 0.20	0.50 ± 0.20	0.50 ± 0.20	0.50 ± 0.20
Operating Temperature	-55~+125°C	-55~+125°C	-55~+125°C	-55~+125°C	-55~+125°C	-55~+125°C	-55~+125°C
Resistance Value of Jumper	<50mΩ	<50mΩ	<50mΩ	<50mΩ	<50mΩ	<50mΩ	<50mΩ
Resistance Range of 1% (E-96)	100Ω ~ 1MΩ	10Ω ~ 1MΩ	10Ω ~ 1MΩ	10Ω ~ 1MΩ	10Ω~ 1MΩ	10Ω ~ 1MΩ	10Ω ~ 1MΩ
Resistance Range of 2% (E-24)	100Ω ~ 1MΩ	10Ω ~ 1MΩ	10Ω ~ 1MΩ	10Ω ~ 1MΩ	10Ω ~ 1MΩ	10Ω ~ 1MΩ	10Ω ~ 1MΩ
Resistance Range of 5% (E-24)	100Ω ~ 1MΩ	1Ω ~ 10MΩ	1Ω ~ 10MΩ	1Ω ~ 10MΩ	1Ω ~ 10MΩ	1Ω ~ 10MΩ	1Ω ~ 10MΩ

Marking on the Resistors Body:

- For 0402 size, no marking on the body due to the small size of the resistor.
- ±5% tolerance product. The marking is 3 digits, the first 2 digits are the significant figures of the resistance and the 3rd digit denotes number of zeros following:

153 = 15000Ω = 15KΩ; **120** = 12Ω

Below 10Ω shown as this: **6R8** = 6.8Ω

- ±1% tolerance of 0805,1206 sizes. The marking is 4 digits, the first 3 digits are the significant figures of the Resistance and the 4th digit denotes number of zeros following:

2372 = 23700Ω = 23.7KΩ; **1430** = 143Ω

Below 10Ω shown as this: **3R24** = 3.24Ω

- Standard E-96 series values (±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 following Multiplier & Resistance Code.

Multiplier Code (for 0603 1% marking)

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}

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

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

So the resistance value are marked as the following examples:

1.96KΩ= 196 ×10^1 Ω = **29B**

12.4Ω= 124 ×10^{-1} = **10X**

- Standard E-24 and not belong to E-96 series values (in ±1% tolerance) of 0603 size. The marking is the same as 5% tolerance but marking as underline.

122 = 1200 = 1.2 KΩ

680 = 68Ω

Thick Film Chip Resistors:

Performance Specifications

Temperature coefficient	±5%: 1Ω~10Ω ≤ ±400PPM/°C; 11Ω~10MΩ ≤ ±200PPM/°C
	±1%: 10Ω~100Ω ≤ ±200PPM/°C; 101Ω~1MΩ ≤ ±100PPM/°C
Short-time overload	±5%: ±(2.0% + 0.1Ω) Max.
	±1%: ±(1.0% + 0.1Ω) Max.
Insulation resistance	≥ 1,000 Mega Ohm
Dielectric withstanding voltage	No evidence of flashover, mechanical damage, arcing or insulation breakdown.
Terminal bending	±(1.0% + 0.05Ω) Max.
Soldering heat	Resistance change rate is ±(1.0% + 0.05Ω) Max.
Solderability	Min. 95% coverage.
Temperature cycling	±5%: ±(1.0% + 0.05Ω) Max.
	±1%: ±(0.5% + 0.05Ω) Max.
Humidity (Steady State)	±5%: ±(3.0% + 0.1Ω) Max.
	±1%: ±(0.5% + 0.1Ω) Max.
Load life in humidity	±5%: ±(3.0% + 0.1Ω) Max.
	±1%: ±(1.0% + 0.1Ω) Max.
Load life	±5%: ±(3.0% + 0.1Ω) Max.
	±1%: ±(1.0% + 0.1Ω) 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.

Ordering Procedure (Example: 1206 1/4W-S 5% 1.2 Ω T/R-5000)

Wattage:
Fill-in 2 digits with the codes as follow:
Normal size: WG=1/16W, WA=1/10W, W8=1/8W, WH=1/32W
Small size: SA=1/10W-S, S8=1/8W-S, S4=1/4W-S, S3=1/3W-S, 07=3/4W-S

Tolerance: **F** = ±1% , **G** = ±2% , **J** = ±5%

Resistance Value:
E-24 series:
the 1st digit is "0", the 2nd & 3rd digits are for the significant figures of the resistance and the 4th indicate the numbers of zeros following;
E-96 series:
the 1st to 3rd digits are for the significant figures of the resistance and the 4th digit indicate the numbers of zeros following

Packing Type:
T = T/R packing , B = Bulk in Poly-bag , C = Bulk in cassette

Packing Quantity:
1=1,000pcs, 2=2,000pcs, 3=3,000pcs, 4=4,000pcs, 5=5,000pcs, C=10,000pcs, D=20,000pcs

Special Feature: 0 = NIL

Product Type:
Fill-in 4 digits with the Chip resistor type as follow:
0402, 0603, 0805, 1206, 1210, 2010, 2512, 08P4, 10P8, 16P8

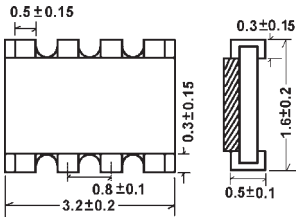
1 2 0 6 S 4 J 0 1 2 J T 5 0

Chip Resistor Array:

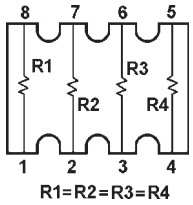
Feature

- High density, more than 1 Resistors in one small case.
- Improvement of placement efficiency.
- Tape / Reel packaging is suitable for automatic placement machine.
- Superior solderability.

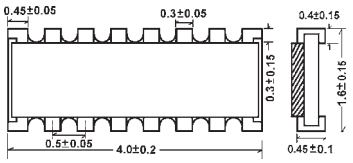
08P4 (8Pin 4R) Dimension (mm)



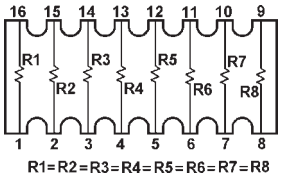
Equivalent Circuit Diagram



16P8 (16Pin 8R) Dimension (mm)



Equivalent Circuit Diagram



Type	08P4 (4 0603 elements in 8 terminals)	16P8 (8 resistors in 16 terminals)
Rated power at 70°C	1/16W	1/16W
Max. working voltage	50V	50V
Max. Overload Voltage	100V	100V
Dielectric withstanding voltage	500V	100V
Resistance range	1% (E-96 series): 100Ω~560KΩ 5% (E-24 series): 10Ω~1MΩ	5% (E-24 series): 10Ω~1MΩ
Temperature coefficient	5% 10Ω~1MΩ≤ ±400PPM/°C 1% 100Ω~560KΩ≤ ±200PPM/°C	±200PPM/°C
Operating temperature range	-55°C ~ +125 °C	-55 °C ~ +125 °C
Jumper rated current	1A	—

Performance Specifications

Short time overload	±(2.0% +0.1Ω) Max.
Insulation resistance	≥1,000 Mega Ohm.
Dielectric withstanding voltage	No evidence of flashover, mechanical damage, arcing or insulation breakdown.
Terminal bending	±(1.0% +0.05Ω) Max
Soldering heat	Resistance change rate is ±(1.0% +0.05Ω) Max.
Solderability	Min. 95% coverage.
Temperature cycling	ΔR/R ≤ ±(1.0% +0.05Ω)
Load life in humidity	±(3.0% +0.1Ω) Max.
Load life	±(3.0% +0.1Ω) Max.

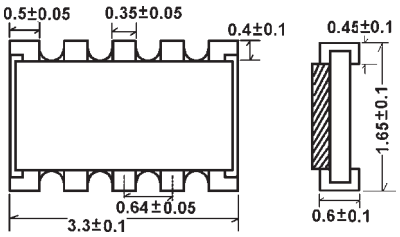
• Please refer to page 4 for the information of Ordering Procedure (Part No.)

Thick Film Chip Resistor Network:

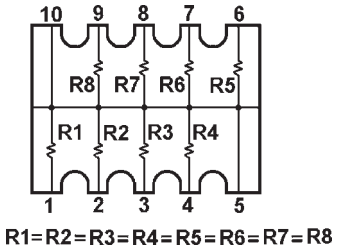
Feature

- High density, 8 Resistors in one SMD case.
- Improvement of placement efficiency.
- Tape / Reel packaging is suitable for automatic placement machine.
- Superior solderability.

10P8 (10Pin 8R) Dimension (mm)



Equivalent Circuit Diagram



R1=R2=R3=R4=R5=R6=R7=R8

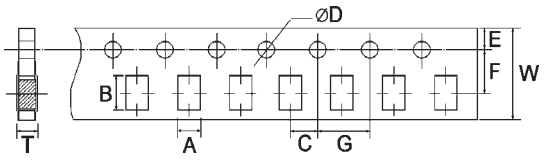
Type	**10P8(8 Resistors in 10 terminals)**
Rated power at 70°C	1/32W (special code “WH” in Part No.)
Max. working voltage	25V
Max. Overload Voltage	50V
Dielectric withstanding voltage	50V
Operating temperature range	-55°C ~ +125 °C
Resistance Range	5% (E-24 series): 33Ω~100KΩ

Performance Specifications

Temperature coefficient	±200PPM/°C
Short time overload	±(2.0% +0.05Ω) Max.
Insulation resistance	≥1,000 Mega Ohm.
Dielectric withstanding voltage	No evidence of flashover, mechanical damage, arcing or insulation breakdown.
Terminal bending	±(1.0% +0.05Ω) Max.
Soldering heat	Resistance change rate is ±(1.0% +0.05Ω) Max.
Solderability	Min. 95% coverage.
Load life in humidity	±(3.0% +0.1Ω) Max.
Load life	±(3.0% +0.1Ω) Max.

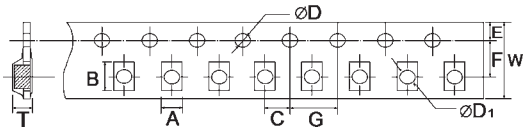
• *Please refer to page 4 for the information of Ordering Procedure (Part No.)*

Packing of Chip, Chip Array & Network:



Dimension of Paper Taping (mm)

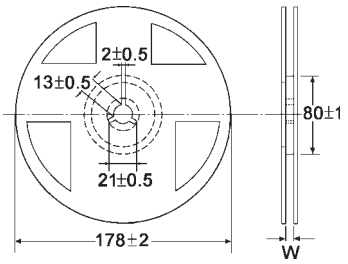
TYPE	A±0.2	B±0.2	C±0.05	Ø D $^{+0.1}_{-0}$	E±0.1	F±0.05	G±0.1	W±0.2	T±0.1
0402	0.65	1.15	2.0	1.5	1.75	3.5	4.0	8.0	0.45
0603	1.10	1.90	2.0	1.5	1.75	3.5	4.0	8.0	0.67
0805	1.65	2.40	2.0	1.5	1.75	3.5	4.0	8.0	0.81
1206	2.00	3.60	2.0	1.5	1.75	3.5	4.0	8.0	0.81
1210	2.80	3.50	2.0	1.5	1.75	3.5	4.0	8.0	0.75
08P4	2.00	3.60	2.0	1.5	1.75	3.5	4.0	8.0	0.83
10P8	2.00	3.60	2.0	1.5	1.75	3.5	4.0	8.0	0.85



Dimension of Embossed Taping (mm)

TYPE	A±0.2	B±0.2	C±0.05	ØD $^{+0.1}_{-0}$	$ØD_1$ $^{+0.25}_{-0}$	E±0.1	F±0.05	G±0.1	W±0.2	T±0.1
2010	2.9	5.6	2.0	1.5	1.5	1.75	5.5	4.0	12	1.0
2512	3.5	6.7	2.0	1.5	1.5	1.75	5.5	4.0	12	1.0
16P8	1.8	4.4	2.0	1.5	1.5	1.75	5.5	4.0	12	1.0

Dimension of Reel (mm)



TYPE	Taping	Qty./ Reel	Tape Width	W±1
0402	Paper	10,000pcs	8mm	10
0603	Paper	5,000pcs	8mm	10
0805	Paper	5,000pcs	8mm	10
1206	Paper	5,000pcs	8mm	10
1210	Paper	5,000pcs	8mm	10
2010	Embossed	4,000pcs	12mm	13.8
2512	Embossed	4,000pcs	12mm	13.8
08P4	Paper	5,000pcs	8mm	10
10P8	Paper	5,000pcs	8mm	10
16P8	Embossed	4,000pcs	12mm	13.8

Dimension of Bulk Cassette (mm)

36(H)×12(W)×110(L)

Bulk Cassette packing available on a case to case basis.

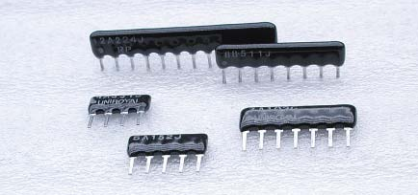
Resistor Network-SIP Series:

Feature

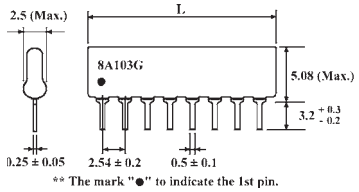
- Miniature, high density packaging
- High reliability with R_U0_2 paste

Application:

- Control circuit of V.T.R.
- Air-conditioner
- Computer, color TV.
- Facsimile



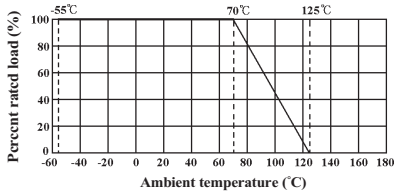
Dimension



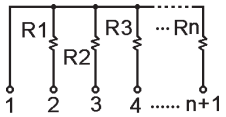
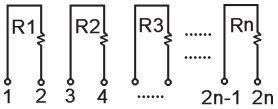
Dimension of L (max.)

4 PIN : 10.2mm	9 PIN : 22.9mm
5 PIN : 12.7mm	10 PIN : 25.4mm
6 PIN : 15.3mm	11 PIN : 28.0mm
7 PIN : 17.8mm	12 PIN : 30.5mm
8 PIN : 20.4mm	13 PIN : 33.1mm
	14 PIN : 35.6mm

Derating Curve:



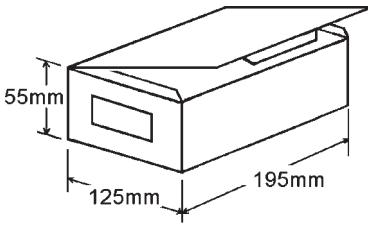
Performance Specifications

Circuit	A (Single common type)	B (Isolated type)
Circuit Structure	 R1=R2=……=Rn	 R1=R2=……=Rn
Power Rating at 70°C	1/8W (0.125W)	1/5W (0.2W)
Max. Working Voltage	100V	100V
Max. Overload Voltage	150V	150V
Dielectric Withstanding Voltage	200V	200V
Resistance (E-24 Series)	10Ω ~ 1MΩ	10Ω ~ 1MΩ
Resistance Tolerance	±2%, ±5%	±2%, ±5%
Operating Temperature Range	-55°C ~ +125 °C	-55°C ~ +125 °C

Temperature coefficient	50Ω ~ 1MΩ: ±200PPM/°C
	<50Ω & >1MΩ: ±250PPM/°C
Short time overload	ΔR/R ≤ ±(0.5% +0.1Ω)
Insulation Resistance	Min. 10,000 Mega ohm.
Dielectric withstanding voltage	No Evidence of flashover, mechanical damage, arcing or insulation breakdown.
Terminal strength	ΔR/R ≤ ±(0.5% +0.1Ω)
Resistance to soldering heat	ΔR/R ≤ ±(0.5% +0.1Ω)
Solderability	Covering 95%.
Thermal shock	ΔR/R ≤ ±(0.5% +0.1Ω)
Temperature cycling	ΔR/R ≤ ±(0.5% +0.1Ω)
Load life in humidity	ΔR/R ≤ ±(3% +0.1Ω)
Load life	ΔR/R ≤ ±(3% +0.1Ω)

Resistor Network-SIP Series:

Standard Packing of Resistor Network



No. of Pins	Weight Of 1,000pcs	Qty. Per Bag	Qty. Per Box	Qty. Per Carton
4	210g	500	5,000	75,000
5	250g	400	4,000	60,000
6	320g	300	3,000	45,000
7	360g	200	2,000	30,000
8	430g	200	2,000	30,000
9	450g	200	2,000	30,000
10	530g	150	1,500	22,500
11	600g	100	1,000	15,000
12	650g	100	1,000	15,000
13	710g	100	1,000	15,000
14	770g	100	1,000	15,000

• *Standard Carton dimension (mm) : 395×367×195*

Ordering Procedure (Example: RNL A type 10 PIN 2% 10KΩ B/B)

R N L A 1 0 G 0 1 0 3 B 0 0

Product Type:
Fill-in "RNL" to indicate "Resistor Network Low Profile"

Circuit Type: A = Single common, B = Isolated

Number of Pins:
04 = 4 pins, 05 = 5 pins, 06 = 6 pins, 07 = 7pins, 08 = 8 pins, 09 = 9 pins, 10 = 10 pins
11 = 11 pins, 12 = 12 pins, 13 = 13 pins, 14 = 14 pins

Tolerance: G = ± 2% , J = ± 5%

Resistance Value:
E-24 series:
The 1st digit will be "0"; the 2nd & 3rd digits are for the significant figures of the resistance and the 4th digit denotes number of zeros following

Packing Type: B = Bulk / Box

Packing Quantity: Indicate "0" for Bulk/Box packing

Special Feature: 0 = NIL

Test Methods of JIS-C-5202:

Temperature coefficient: (JIS-C-5202 5.2)	Natural resistance change per temperature degree centigrade: $\frac{R_2-R_1}{R_1(t_2-t_1)}$ X 10^6 (PPM / °C) R_1: Resistance value at room temperature (t_1); R_2: Resistance value at room temperature plus 100 °C (t_2). Test pattern: Room temperature (t_1), Room temperature + 100 °C (t_2).
Short-time overload: (JIS-C-5202 5.5)	Permanent resistance change after the application of a potential of 2.5 times RCWV for 5 seconds.
Insulation resistance: (JIS-C-5202 5.6)	Apply 500V DC between protective coating and termination for 1 min., then measure. (100V DC especially for Resistor Network)
Dielectric withstanding voltage: (JIS-C-5202 5.7)	Resistors shall be clamped in the trough of a 90 °C metallic V – block and shall be tested at AC potential respectively specified in the given list of each product type for 60 – 70 seconds. For Cement Fixed Resistors, the testing voltage is 1,000 volts.
Pulse overload: (JIS-C 5202 5.8)	Resistance change after 10,000 cycles (1 seconds "ON", 25 seconds "OFF") at 4 times of RCWV or max. RCWV whichever less.
Terminal strength: (JIS-C 5202 6.1)	**Direct Load:** Resistance to a 2.5kg direct load for 10 seconds in the direction of the longitudinal axis of the terminal leads. **Twist Test:** Terminal leads shall be bent through 90° at a point of about 6mm from the body of the resistor and shall be rotated through 360° about the original axis of the bent terminal in alternating direction for a total of 3 rotations.
Terminal strength: (JIS-C 5202 6.1)	(Applicable for Resistor Network) Tensile: 1KG, 30 seconds; Bending: 500g, 2 times.
Terminal bending: (JIS-C 5202 6.1.4)	(Applicable for CHIP resistors) Twist of Test Board: Y/X = 3/90mm for 10 seconds.
Soldering heat: (JIS-C 5202 6.4)	(Applicable for CHIP resistors) Dip the resistor into a solder bath having a temp. of 260± 5 °C and hold it for 10±1 seconds.
Resistance to soldering heat: (JIS-C 5202 6.4)	Permanent resistance change when leads immersed to a point 2.0~2.5mm from the body in 350±10 °C solder for 3~4 seconds.
Solderability: (JIS-C 5202 6.5)	The area covered with a new, smooth, clean, shiny and continuous surface free from concentrated pinholes. Test temperature of solder: 235±5 °C; Dwell time in solder: 3~3.5 seconds.
Resistance to solvent: (JIS-C 5202 6.9)	Specimens shall be immersed in a bath of alcohol completely for 3 minutes using ultrasonic test equipment.
Thermal shock: (JIS-C 5202 7.3)	(Applicable for Resistor Network) Load V, Room temperature, 30 minutes. Unload, -55 °C, 15 minutes. Over 2 hours in room temperature before measuring.
Temperature cycling: (JIS-C 5202 7.4)	Resistance change after continuous 5 cycles for duty cycle specified below Step 1: 30 minutes at -55±3 °C Step 2: 10~15 minutes at Room temperature Step 3: 30 minutes at 155±2 °C Step 4: 10~15 minutes at Room temperature
Humidity (Steady state): (JIS-C 5202 7.5)	Temporary resistance change after 240 hours exposure in a humidity test chamber controlled at 40±2 °C and 90~95% relative humidity.
Load life in humidity: (JIS-C 5202 7.9)	Resistance change after 1,000 hours (1.5 hours "ON", 0.5 hours "OFF") at RCWV or max. RCWV whichever less in a humidity test chamber controlled at 40±2 °C and 90~95% relative humidity.
Load life: (JIS-C 5202 7.10)	Permanent resistance change after 1,000 hours operating at RCWV or max. RCWV whichever less with duty cycle of 1.5 hours "ON", 0.5 hour "OFF" at 70±2 °C ambient.
Flame retardant: (JIS-C 5202 7.12)	Resistors shall resist flaming or arcing when overload up to 16 times RCWV or max. RCWV whichever less.
Flame retardant: (JIS-C 5202 7.12)	(Applicable for Fusing Resistor) The burner is placed remote from resistor ignited and adjusted to produce a blue flame 38mm in height and a top of flame 127mm above the top of burner tube. Resistor is supported from its lead at 45° from the horizontal so that the lower end of resistor is the top of blue flame. The test flame is placed to remain for 15 seconds and removed for 15 seconds. The operation is to be repeated until resistor has been subjected to 5 application of test flame.

** ***RCWV = Rated Continuous Working Voltage*** = $\sqrt{\textit{Rated Power} \times \textit{Resistance Value}}$

Standard Nominal Resistance Values:

The below chart shows the nominal resistance value for each series. The values in the chart have been in this order using the approximate values that are based on the common ratios given in the following table:

Series	Common Ratio	Remarks
E-6	$\sqrt[6]{10}$ (1.46)	Rounded off to a 2-digit figure
E-12	$\sqrt[12]{10}$ (1.21)	
E-24	$\sqrt[24]{10}$ (1.10)	
E-96	$\sqrt[96]{10}$ (1.02)	Rounded off to a 3-digit figure

E-6	E-12	E-24	E-96
1.0	1.0	1.0	1.00
			1.02
			1.05
			1.07
		1.1	1.10
			1.13
			1.15
			1.18
	1.2	1.2	1.21
			1.24
			1.27
			1.30
		1.3	1.33
			1.37
			1.40
			1.43
1.5	1.5	1.5	1.47
			1.50
			1.54
			1.58
		1.6	1.62
			1.65
			1.69
			1.74
	1.8	1.8	1.78
			1.82
			1.87
			1.91
		2.0	1.96
			2.00
			2.05
			2.10

E-6	E-12	E-24	E-96
2.2	2.2	2.2	2.15
			2.21
			2.26
			2.32
		2.4	2.37
			2.43
			2.49
			2.55
	2.7	2.7	2.61
			2.67
			2.74
			2.80
		3.0	2.87
			2.94
			3.01
			3.09
3.3	3.3	3.3	3.16
			3.24
			3.32
			3.40
		3.6	3.48
			3.57
			3.65
			3.74
	3.9	3.9	3.83
			3.92
			4.02
			4.12
		4.3	4.22
			4.32
			4.42
			4.53

E-6	E-12	E-24	E-96
4.7	4.7	4.7	4.64
			4.75
			4.87
			4.99
		5.1	5.11
			5.23
			5.36
			5.49
	5.6	5.6	5.62
			5.76
			5.90
			6.04
		6.2	6.19
			6.34
			6.49
			6.65
6.8	6.8	6.8	6.81
			6.98
			7.15
			7.32
		7.5	7.50
			7.68
			7.87
			8.06
	8.2	8.2	8.25
			8.45
			8.66
			8.87
		9.1	9.09
			9.31
			9.53
			9.76

Standard Nominal Resistance Values:

E-24 series standard resistance values & the codes to be used in the part No. system (4 digits):

VALUE	CODE	VALUE	CODE	VALUE	CODE	VALUE	CODE	VALUE	CODE	VALUE	CODE	VALUE	CODE
1.0Ω	**010J**	10Ω	**0100**	100Ω	**0101**	1.0KΩ	**0102**	10KΩ	**0103**	100KΩ	**0104**	1.0MΩ	**0105**
1.1Ω	**011J**	11Ω	**0110**	110Ω	**0111**	1.1KΩ	**0112**	11KΩ	**0113**	110KΩ	**0114**	1.1MΩ	**0115**
1.2Ω	**012J**	12Ω	**0120**	120Ω	**0121**	1.2KΩ	**0122**	12KΩ	**0123**	120KΩ	**0124**	1.2MΩ	**0125**
1.3Ω	**013J**	13Ω	**0130**	130Ω	**0131**	1.3KΩ	**0132**	13KΩ	**0133**	130KΩ	**0134**	1.3MΩ	**0135**
1.5Ω	**015J**	15Ω	**0150**	150Ω	**0151**	1.5KΩ	**0152**	15KΩ	**0153**	150KΩ	**0154**	1.5MΩ	**0155**
1.6Ω	**016J**	16Ω	**0160**	160Ω	**0161**	1.6KΩ	**0162**	16KΩ	**0163**	160KΩ	**0164**	1.6MΩ	**0165**
1.8Ω	**018J**	18Ω	**0180**	180Ω	**0181**	1.8KΩ	**0182**	18KΩ	**0183**	180KΩ	**0184**	1.8MΩ	**0185**
2.0Ω	**020J**	20Ω	**0200**	200Ω	**0201**	2.0KΩ	**0202**	20KΩ	**0203**	200KΩ	**0204**	2.0MΩ	**0205**
2.2Ω	**022J**	22Ω	**0220**	220Ω	**0221**	2.2KΩ	**0222**	22KΩ	**0223**	220KΩ	**0224**	2.2MΩ	**0225**
2.4Ω	**024J**	24Ω	**0240**	240Ω	**0241**	2.4KΩ	**0242**	24KΩ	**0243**	240KΩ	**0244**	2.4MΩ	**0245**
2.7Ω	**027J**	27Ω	**0270**	270Ω	**0271**	2.7KΩ	**0272**	27KΩ	**0273**	270KΩ	**0274**	2.7MΩ	**0275**
3.0Ω	**030J**	30Ω	**0300**	300Ω	**0301**	3.0KΩ	**0302**	30KΩ	**0303**	300KΩ	**0304**	3.0MΩ	**0305**
3.3Ω	**033J**	33Ω	**0330**	330Ω	**0331**	3.3KΩ	**0332**	33KΩ	**0333**	330KΩ	**0334**	3.3MΩ	**0335**
3.6Ω	**036J**	36Ω	**0360**	360Ω	**0361**	3.6KΩ	**0362**	36KΩ	**0363**	360KΩ	**0364**	3.6MΩ	**0365**
3.9Ω	**039J**	39Ω	**0390**	390Ω	**0391**	3.9KΩ	**0392**	39KΩ	**0393**	390KΩ	**0394**	3.9MΩ	**0395**
4.3Ω	**043J**	43Ω	**0430**	430Ω	**0431**	4.3KΩ	**0432**	43KΩ	**0433**	430KΩ	**0434**	4.3MΩ	**0435**
4.7Ω	**047J**	47Ω	**0470**	470Ω	**0471**	4.7KΩ	**0472**	47KΩ	**0473**	470KΩ	**0474**	4.7MΩ	**0475**
5.1Ω	**051J**	51Ω	**0510**	510Ω	**0511**	5.1KΩ	**0512**	51KΩ	**0513**	510KΩ	**0514**	5.1MΩ	**0515**
5.6Ω	**056J**	56Ω	**0560**	560Ω	**0561**	5.6KΩ	**0562**	56KΩ	**0563**	560KΩ	**0564**	5.6MΩ	**0565**
6.2Ω	**062J**	62Ω	**0620**	620Ω	**0621**	6.2KΩ	**0622**	62KΩ	**0623**	620KΩ	**0624**	6.2MΩ	**0625**
6.8Ω	**068J**	68Ω	**0680**	680Ω	**0681**	6.8KΩ	**0682**	68KΩ	**0683**	680KΩ	**0684**	6.8MΩ	**0685**
7.5Ω	**075J**	75Ω	**0750**	750Ω	**0751**	7.5KΩ	**0752**	75KΩ	**0753**	750KΩ	**0754**	7.5MΩ	**0755**
8.2Ω	**082J**	82Ω	**0820**	820Ω	**0821**	8.2KΩ	**0822**	82KΩ	**0823**	820KΩ	**0824**	8.2MΩ	**0825**
9.1Ω	**091J**	91Ω	**0910**	910Ω	**0911**	9.1KΩ	**0912**	91KΩ	**0913**	910KΩ	**0914**	9.1MΩ	**0915**
												10MΩ	**0106**

E-96 series standard resistance values & the codes to be used in the part No. system (4 digits):

VALUE	CODE	VALUE	CODE	VALUE	CODE	VALUE	CODE	VALUE	CODE	VALUE	CODE	VALUE	CODE	VALUE	CODE
10.0Ω	**100J**	17.8Ω	**178J**	31.6Ω	**316J**	56.2Ω	**562J**	100Ω	**1000**	178Ω	**1780**	316Ω	**3160**	562Ω	**5620**
10.2Ω	**102J**	18.2Ω	**182J**	32.4Ω	**324J**	57.6Ω	**576J**	102Ω	**1020**	182Ω	**1820**	324Ω	**3240**	576Ω	**5760**
10.5Ω	**105J**	18.7Ω	**187J**	33.2Ω	**332J**	59.0Ω	**590J**	105Ω	**1050**	187Ω	**1870**	332Ω	**3320**	590Ω	**5900**
10.7Ω	**107J**	19.1Ω	**191J**	34.0Ω	**340J**	60.4Ω	**604J**	107Ω	**1070**	191Ω	**1910**	340Ω	**3400**	604Ω	**6040**
11.0Ω	**110J**	19.6Ω	**196J**	34.8Ω	**348J**	61.9Ω	**619J**	110Ω	**1100**	196Ω	**1960**	348Ω	**3480**	619Ω	**6190**
11.3Ω	**113J**	20.0Ω	**200J**	35.7Ω	**357J**	63.4Ω	**634J**	113Ω	**1130**	200Ω	**2000**	357Ω	**3570**	634Ω	**6340**
11.5Ω	**115J**	20.5Ω	**205J**	36.5Ω	**365J**	64.9Ω	**649J**	115Ω	**1150**	205Ω	**2050**	365Ω	**3650**	649Ω	**6490**
11.8Ω	**118J**	21.0Ω	**210J**	37.4Ω	**374J**	66.5Ω	**665J**	118Ω	**1180**	210Ω	**2100**	374Ω	**3740**	665Ω	**6650**
12.1Ω	**121J**	21.5Ω	**215J**	38.3Ω	**383J**	68.1Ω	**681J**	121Ω	**1210**	215Ω	**2150**	383Ω	**3830**	681Ω	**6810**
12.4Ω	**124J**	22.1Ω	**221J**	39.2Ω	**392J**	69.8Ω	**698J**	124Ω	**1240**	221Ω	**2210**	392Ω	**3920**	698Ω	**6980**
12.7Ω	**127J**	22.6Ω	**226J**	40.2Ω	**402J**	71.5Ω	**715J**	127Ω	**1270**	226Ω	**2260**	402Ω	**4020**	715Ω	**7150**
13.0Ω	**130J**	23.2Ω	**232J**	41.2Ω	**412J**	73.2Ω	**732J**	130Ω	**1300**	232Ω	**2320**	412Ω	**4120**	732Ω	**7320**
13.3Ω	**133J**	23.7Ω	**237J**	42.2Ω	**422J**	75.0Ω	**750J**	133Ω	**1330**	237Ω	**2370**	422Ω	**4220**	750Ω	**7500**
13.7Ω	**137J**	24.3Ω	**243J**	43.2Ω	**432J**	76.8Ω	**768J**	137Ω	**1370**	243Ω	**2430**	432Ω	**4320**	768Ω	**7680**
14.0Ω	**140J**	24.9Ω	**249J**	44.2Ω	**442J**	78.7Ω	**787J**	140Ω	**1400**	249Ω	**2490**	442Ω	**4420**	787Ω	**7870**
14.3Ω	**143J**	25.5Ω	**255J**	45.3Ω	**453J**	80.6Ω	**806J**	143Ω	**1430**	255Ω	**2550**	453Ω	**4530**	806Ω	**8060**
14.7Ω	**147J**	26.1Ω	**261J**	46.4Ω	**464J**	82.5Ω	**825J**	147Ω	**1470**	261Ω	**2610**	464Ω	**4640**	825Ω	**8250**
15.0Ω	**150J**	26.7Ω	**267J**	47.5Ω	**475J**	84.5Ω	**845J**	150Ω	**1500**	267Ω	**2670**	475Ω	**4750**	845Ω	**8450**
15.4Ω	**154J**	27.4Ω	**274J**	48.7Ω	**487J**	86.6Ω	**866J**	154Ω	**1540**	274Ω	**2740**	487Ω	**4870**	866Ω	**8660**
15.8Ω	**158J**	28.0Ω	**280J**	49.9Ω	**499J**	88.7Ω	**887J**	158Ω	**1580**	280Ω	**2800**	499Ω	**4990**	887Ω	**8870**
16.2Ω	**162J**	28.7Ω	**287J**	51.1Ω	**511J**	90.9Ω	**909J**	162Ω	**1620**	287Ω	**2870**	511Ω	**5110**	909Ω	**9090**
16.5Ω	**165J**	29.4Ω	**294J**	52.3Ω	**523J**	93.1Ω	**931J**	165Ω	**1650**	294Ω	**2940**	523Ω	**5230**	931Ω	**9310**
16.9Ω	**169J**	30.1Ω	**301J**	53.6Ω	**536J**	95.3Ω	**953J**	169Ω	**1690**	301Ω	**3010**	536Ω	**5360**	953Ω	**9530**
17.4Ω	**174J**	30.9Ω	**309J**	54.9Ω	**549J**	97.6Ω	**976J**	174Ω	**1740**	309Ω	**3090**	549Ω	**5490**	976Ω	**9760**

Standard Nominal Resistance Values:

VALUE	CODE	VALUE	CODE	VALUE	CODE	VALUE	CODE	VALUE	CODE	VALUE	CODE	VALUE	CODE	VALUE	CODE
1.00K	**1001**	2.37K	**2371**	5.62K	**5621**	13.3K	**1332**	31.6K	**3162**	75.0K	**7502**	178K	**1783**	422K	**4223**
1.02K	**1021**	2.43K	**2431**	5.76K	**5761**	13.7K	**1372**	32.4K	**3242**	76.8K	**7682**	182K	**1823**	432K	**4323**
1.05K	**1051**	2.49K	**2491**	5.90K	**5901**	14.0K	**1402**	33.2K	**3322**	78.7K	**7872**	187K	**1873**	442K	**4423**
1.07K	**1071**	2.55K	**2551**	6.04K	**6041**	14.3K	**1432**	34.0K	**3402**	80.6K	**8062**	191K	**1913**	453K	**4533**
1.10K	**1101**	2.61K	**2611**	6.19K	**6191**	14.7K	**1472**	34.8K	**3482**	82.5K	**8252**	196K	**1963**	464K	**4643**
1.13K	**1131**	2.67K	**2671**	6.34K	**6341**	15.0K	**1502**	35.7K	**3572**	84.5K	**8452**	200K	**2003**	475K	**4753**
1.15K	**1151**	2.74K	**2741**	6.49K	**6491**	15.4K	**1542**	36.5K	**3652**	86.6K	**8662**	205K	**2053**	487K	**4873**
1.18K	**1181**	2.80K	**2801**	6.65K	**6651**	15.8K	**1582**	37.4K	**3742**	88.7K	**8872**	210K	**2103**	499K	**4993**
1.21K	**1211**	2.87K	**2871**	6.81K	**6811**	16.2K	**1622**	38.3K	**3832**	90.9K	**9092**	215K	**2153**	511K	**5113**
1.24K	**1241**	2.94K	**2941**	6.98K	**6981**	16.5K	**1652**	39.2K	**3922**	93.1K	**9312**	221K	**2213**	523K	**5233**
1.27K	**1271**	3.01K	**3011**	7.15K	**7151**	16.9K	**1692**	40.2K	**4022**	95.3K	**9532**	226K	**2263**	536K	**5363**
1.30K	**1301**	3.09K	**3091**	7.32K	**7321**	17.4K	**1742**	41.2K	**4122**	97.6K	**9762**	232K	**2323**	549K	**5493**
1.33K	**1331**	3.16K	**3161**	7.50K	**7501**	17.8K	**1782**	42.2K	**4222**	100K	**1003**	237K	**2373**	562K	**5623**
1.37K	**1371**	3.24K	**3241**	7.68K	**7681**	18.2K	**1822**	43.2K	**4322**	102K	**1023**	243K	**2433**	576K	**5763**
1.40K	**1401**	3.32K	**3321**	7.87K	**7871**	18.7K	**1872**	44.2K	**4422**	105K	**1053**	249K	**2493**	590K	**5903**
1.43K	**1431**	3.40K	**3401**	8.06K	**8061**	19.1K	**1912**	45.3K	**4532**	107K	**1073**	255K	**2553**	604K	**6043**
1.47K	**1471**	3.48K	**3481**	8.25K	**8251**	19.6K	**1962**	46.4K	**4642**	110K	**1103**	261K	**2613**	619K	**6193**
1.50K	**1501**	3.57K	**3571**	8.45K	**8451**	20.0K	**2002**	47.5K	**4752**	113K	**1133**	267K	**2673**	634K	**6343**
1.54K	**1541**	3.65K	**3651**	8.66K	**8661**	20.5K	**2052**	48.7K	**4872**	115K	**1153**	274K	**2743**	649K	**6493**
1.58K	**1581**	3.74K	**3741**	8.87K	**8871**	21.0K	**2102**	49.9K	**4992**	118K	**1183**	280K	**2803**	665K	**6653**
1.62K	**1621**	3.83K	**3831**	9.09K	**9091**	21.5K	**2152**	51.1K	**5112**	121K	**1213**	287K	**2873**	681K	**6813**
1.65K	**1651**	3.92K	**3921**	9.31K	**9311**	22.1K	**2212**	52.3K	**5232**	124K	**1243**	294K	**2943**	698K	**6983**
1.69K	**1691**	4.02K	**4021**	9.53K	**9531**	22.6K	**2262**	53.6K	**5362**	127K	**1273**	301K	**3013**	715K	**7153**
1.74K	**1741**	4.12K	**4121**	9.76K	**9761**	23.2K	**2322**	54.9K	**5492**	130K	**1303**	309K	**3093**	732K	**7323**
1.78K	**1781**	4.22K	**4221**	10.0K	**1002**	23.7K	**2372**	56.2K	**5622**	133K	**1333**	316K	**3163**	750K	**7503**
1.82K	**1821**	4.32K	**4321**	10.2K	**1022**	24.3K	**2432**	57.6K	**5762**	137K	**1373**	324K	**3243**	768K	**7683**
1.87K	**1871**	4.42K	**4421**	10.5K	**1052**	24.9K	**2492**	59.0K	**5902**	140K	**1403**	332K	**3323**	787K	**7873**
1.91K	**1911**	4.53K	**4531**	10.7K	**1072**	25.5K	**2552**	60.4K	**6042**	143K	**1433**	340K	**3403**	806K	**8063**
1.96K	**1961**	4.64K	**4641**	11.0K	**1102**	26.1K	**2612**	61.9K	**6192**	147K	**1473**	348K	**3483**	825K	**8253**
2.00K	**2001**	4.75K	**4751**	11.3K	**1132**	26.7K	**2672**	63.4K	**6342**	150K	**1503**	357K	**3573**	845K	**8453**
2.05K	**2051**	4.87K	**4871**	11.5K	**1152**	27.4K	**2742**	64.9K	**6492**	154K	**1543**	365K	**3653**	866K	**8663**
2.10K	**2101**	4.99K	**4991**	11.8K	**1182**	28.0K	**2802**	66.5K	**6652**	158K	**1583**	374K	**3743**	887K	**8873**
2.15K	**2151**	5.11K	**5111**	12.1K	**1212**	28.7K	**2872**	68.1K	**6812**	162K	**1623**	383K	**3833**	909K	**9093**
2.21K	**2211**	5.23K	**5231**	12.4K	**1242**	29.4K	**2942**	69.8K	**6982**	165K	**1653**	392K	**3923**	931K	**9313**
2.26K	**2261**	5.36K	**5361**	12.7K	**1272**	30.1K	**3012**	71.5K	**7152**	169K	**1693**	402K	**4023**	953K	**9533**
2.32K	**2321**	5.49K	**5491**	13.0K	**1302**	30.9K	**3092**	73.2K	**7322**	174K	**1743**	412K	**4123**	976K	**9763**
														1M	**1004**

*** All values shown above are standard resistance values, other values could also be provided on a case to case basis.*

Explanation of Part No. System:

1	2	3	4	5	6	7	8	9	10	11	12	13	14

The standard Part No. includes 14 digits with the following explanation:

1. 1st ~ 4th digits:
   a) This is to indicate the Chip Resistor size. Example: 1206, 0805 or 0603;
   b) For Network Resistor & Coated type, the 1st to 3rd digits are to indicate the product type and the 4th digit is the special feature. Example: RNLA = Resistor Network Circuit A type; CFRF = Carbon Film Fixed Resistors Non Flame type; MORI = Metal Oxide Film Fixed Resistors Non-Inductive type.
   c) For Cement Fixed Resistors, these 4 digits are to indicate the product type but if the product type has only 3 digits, the 4th digit will be "0". Example:PRW0=PRW type; PRWC=PRWC type.
2. 5th ~ 6th digits:
   a) This is to indicate the wattage or power rating. To distinguish the sizes and the numbers, the following codes are used; and please refer to the following chart for details:
   W = Normal Size; S = Small Size; U = Extra Small Size; And "1" ~ "G" to denotes "1" ~ "16" as Hexadecimal:

1/16W ~ 1/2W (<1W)

Wattage		1/2	1/3	1/4	1/5	1/6	1/7	1/8	1/9	1/10	1/11	1/12	1/13	1/14	1/15	1/16
Normal Size		W2	W3	W4	W5	W6	W7	W8	W9	WA	WB	WC	WD	WE	WF	WG
Small Size		S2	S3	S4	S5	S6	S7	S8	S9	SA	SB	SC	SD	SE	SF	SG
Extra Small Size		U2	U3	U4	U5	U6	U7	U8	U9	UA	UB	UC	UD	UE	UF	UG

1W ~ 16W (≥1W)

Wattage	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Normal Size	1W	2W	3W	4W	5W	6W	7W	8W	9W	AW	BW	CW	DW	EW	FW	GW
Small Size	1S	2S	3S	4S	5S	6S	7S	8S	9S	AS	BS	CS	DS	ES	FS	GS
Extra Small Size	1U	2U	3U	4U	5U	6U	7U	8U	9U	AU	BU	CU	DU	EU	FU	GU

   b) For power rating less than 1 watt, the 5th digit will be the letters W, S or U to represent the size required & the 6th digit will be a number or a letter code. Example: WA = 1/10W; U2 = 1/2W-SS.
   c) For power rating of 1watt to 16 watt, the 5th digit will be a number or a letter code and the 6th digit will be the letters of W, S or U. Example: AW = 10W; 3S = 3W-S.
   d) For power rating between 20 watt to 99 watt, the 5th and the 6th digits will show the whole numbers of the power rating itself. Example: 20 = 20W; 75 = 75W.
   e) For power rating of 100W and over, the 5th & the 6th digits will be indicated with "00" and the actual wattage being indicated at the last 3 digits (12th ~ 14th) of the part No.
   f) For special power ratings, the following codes are to be used:
      1). WH = 1/32W (Chip Network 10P8)
      2). 07 = 3/4-S (CHIP 2010)
      3). 04 = 0.4W-SS (0.4 watt Extra Small Size)
      4). 06 = 0.6W-S (0.6watt Small Size)
      5). 2A = 2.5W
      6). 6A = 6.5W
   g) For Resistor Network, since the power rating is fixed as 1/8W for A circuit & 1/5W for B circuit, the 5th & 6th digit is to be used to denote the number of pins required. Example: 09 = 9pins; 12 = 12pins.
   h) For Jumper Wire resistors, the 5th & 6th digits will be indicated with "00".
3. The 7th digit is to denote the Resistance Tolerance. The following letter code is to be used for indicating the standard Resistance Tolerance. As for Metal Film Fixed Resistor products, it is also to denote the standard PPM as follows:

B = ±0.1% (15PPM)
C = ±0.25% (25PPM)
D = ±0.5% (50PPM)
F = ±1% (50PPM)
G = ±2% (100PPM)
J = ±5% (200PPM)
K = ±10%

Remark: *if it is not one of the above standard "tolerance-PPM", the requirement should be clearly stated when placing order. Example: ±1% (25PPM), the 7th digit still shows "F" but separately note that requirement of 25PPM.*

Explanation of Part No. System:

4. The 8th to 11th digits is to denote the Resistance Value.
   a) For the standard resistance values of E-24 series, the 8th digit is "0", the 9th & 10th digits are to denote the significant figures of the resistance and the 11th digit is the number of zeros following.
   b) For the standard resistance values of E-96 series, the 8th digit to the 10th digit is to denote the significant figures of the resistance and the 11th digit is the zeros following.
   c) For the code of the significant figures of E-24 & E-96 series, please refer to page 50 & 51 of the Standard Resistance Value List.
   d) The following numbers and the letter codes is to be used to indicate the number of zeros in the 11th digit:

      0= 10^0 1= 10^1 2= 10^2 3= 10^3 4= 10^4
      5= 10^5 6= 10^6 J= 10^{-1} K= 10^{-2} L= 10^{-3}

   e) For Cement Fixed Resistors the 8th digit will be coded with "W" or "P" to denote Wire-wound type or Power Film type respectively of the Cement Fixed Resistor product. The 9th to 11th please refer to point a) of item 4.

      Example:

E-24 series		E-96 series		Cement Fixed Resistors
0120	= 12 ohm	1210	= 121 ohm	W120 = 12 ohm Wire-wound
0123	= 12K ohm	1302	=13K ohm	W12J = 1.2 ohm Wire-wound
012J	= 1.2 ohm	196J	= 19.6 ohm	P273 = 27 kohm Power Film

5. The 12th, 13th & 14th digits.
   a) The 12th digit is to denote the Packaging Type with the following codes:

      A = Tape / Box (Ammo pack) C = Bulk in Cassette (Chip Product)
      B = Bulk / Box T = Tape / Reel P = Tape / Box of PT-26 products

   b) The 13th digit is normally to indicate the Packing Quantity of Tape/Box & Tape/Reel packaging types. Except for CHIP products Bulk packing, this digit should be filled with "0" for other products with "Bulk/Box" packaging requirements. The following letter codes is to be used for some packaging quantities:

      A = 500pcs B = 2,500pcs C = 10,000pcs
      D = 20,000pcs G = 25,000pcs H = 50,000pcs

      Examples:

CHIP product	Other products
BD = B/B-20,000	A5 = T/B-5,000
TC = T/R-10,000	TB = T/R-2,500
CG = B/C-25,000	B0 = B/B (standard packing quantity available)

   c) For the FORMED type products, the 13th & 14th digits are used to denote the forming types of the product with the following letter codes:

      MF = M-type with flattened lead wire F0 = F-type
      MK = M-type with kinked lead wire F1 = F1 type
      ML = M-type with normal lead wire F2 = F2 type
      F3 = F3 type

   d) For power rating over 100 watt, the 12th to the 14th digits are to denote the actual wattage of the products:
      Example: 100 = 100 watt 150 = 150 watt 225 = 225 watt
   e) For some items, the 14th digit alone can use to denote special features or additional information with the following codes:

      P = Panasert type
      1 = Avisert type 1
      2 = Avisert type 2
      3 = Avisert type 3
      A = Cutting type CO 1/4W - A type
      B = Cutting type CO 1/4W - B type