

Chip Resistors

How to Order

WR	06	X	1000	F	T	L
Type code R : Discrete 1-10MR	Size code 25 : 2512 (6432) 20 : 2010 (5025) 18 : 1218 (3248) 12 : 1206 (3216) 10 : 1210 (3225) 06 : 0603 (1608) 08 : 0805 (2012) 04 : 0402 (1005) 02 : 0201 (0603)	Functional code X : Normal W : 1% for < 10ohm and >1Mohm	Resistance E24 : 2 significant digits followed by No. of zeros and a blank e.g. : 3ohm=3R0_ 10ohm=100_ 220ohm=221_ 56Kohm=563_ ("_" means blank) E96 : 3 significant digits followed by No. of zeros	Tolerance F : +/- 1% J : +/- 5% P : Jumper	Packaging code T : 7" reel taping Q : 10" reel taping G : 13" reel taping R : 0603 2mm pitch taping B : Bulk K : Bulkcase	Termination code _ = SnPb base ("_" means blank) L = Sn base (Lead free) R = Pb 100 ppm (total)
WW	25	M	R002	F	T	L
Type code W : < 1ohm	Size code 25 : 2512 (6432) 20 : 2010 (5025) 18 : 1218 (3248) 12 : 1206 (3216) 10 : 1210 (3225) 08 : 0805 (2012) 06 : 0603 (1608) 04 : 0402 (1005)	Functional code X : Normal M : Sensing type L : Sensing type, wide termination W : Thick film low TCR type P : Power (2010 size=0.75 watt, 1206 size 0.5 watt, 0805 size 0.25 watt, 0603 size 0.125 watt)	Resistance "R" followed by 3 significant digits e.g.: 0.1ohm=R100 0.033ohm=R033 0.56ohm=R560	Tolerance F : +/- 1% G : +/- 2% J : +/- 5%	Packaging code T : 7" reel taping Q : 10" reel taping G : 13" reel taping B : Bulk K : BulkcaseK = Ni base	Termination code _ = SnPb base ("_" means blank) L = Sn base (Lead free) G = Au base S = Ag base
WF	04	H	1001	B	T	L
Type code F : Special function	Size code 25 : 2512 (6432) 20 : 2010 (5025) 18 : 1218 (3248) 12 : 1206 (3216) 10 : 1210 (3225) 08 : 0805 (2012) 06 : 0603 (1608) 04 : 0402 (1005)	Functional code G : High ohmic (>10Mohm) H : Thick film, Precision tolerance <1% K : Thick film, TCR50ppm M : Trimmable P : Power (> WR and WW series) S : Surge T : Thin film, TCR50ppm U : Thin film, TCR25ppm V : High voltage W : Filet less X : Special resistance Y : E24/E96 resistance with special termination (non SnPb or Sn base), 1%	Resistance E24 : 2 significant digits followed by No. of zeros and a blank e.g.: 3ohm=3R0_ 10ohm=100_ 220ohm=221_ 56Kohm=563_ ("_" means blank) E96 : 3 significant digits followed by No. of zeros	Tolerance B : +/- 0.1% C : +/- 0.25% D : +/- 0.5% F : +/- 1% G : +/- 2% J : +/- 5% M : 0/- 20% K : 0/-30% P : Jumper	Packaging code T : 7" reel taping Q : 10" reel taping G : 13" reel taping B : Bulk K : BulkcaseK = Ni base	Termination code _ = SnPb base ("_" means blank) L = Sn base (Lead free) G = Au base S = Ag base
WA	04	Y	103_	J	T	L
Type code A : Isolated Resistor Array	Size code 06 : 0603 (1608) 04 : 0402 (1005)	No. of element, term, style X : *4, convex Y : *2, convex W : *8, convex T : *4, concave U : *2, concave P : *3, convex (Attenuator)	Resistance E24 : 2 significant digits followed by No. of zeros and a blank e.g.: 3ohm=3R0_ 10ohm=100_ 220ohm=221_ 56Kohm=563_ ("_" means blank) E96 : 3 significant digits followed by No. of zeros	Tolerance F : +/- 1% J : +/- 5% P : Jumper	Packaging code T : 7" reel taping B : Bulk	Termination code _ = SnPb base ("_" means blank) L = Sn base (Lead free)
WT	04	X	103_	J	T	L
Type code T : Bussed/Network Resistors	Size per elements 04: total package size 1206 (3216)	No. of element, term, style X : *8, convex	Resistance E24 : 2 significant digits followed by No. of zeros e.g.: 3ohm=3R0_ 10ohm=100_ 220ohm=221_ 56Kohm=563_ ("_" means blank)	Tolerance J : +/- 5%	Packaging code T : 7" reel taping B : Bulk	Termination code _ = SnPb base ("_" means blank) L = Sn base (Lead free)

Remark: 1. Detail product part number, functional code, tolerance combination,...please refer to specific data sheet.

2. Example: ("_" means blank)

Chip-R 0805 size, 4.3ohm, 5% Normal type, SnPb termination, 5000pcs taped in reel: WR08X4R3_JT_

Chip-R 0805 size, 4.3ohm, 5% Normal type, Sn Lead free termination, 5000pcs taped in reel: WR08X4R3_JTL

Chip-R 0603 size, 100ohm, 5% Normal type, SnPb termination, 5000pcs taped in reel: WR06X101_JT_

Chip-R 0603 size, 100ohm, 1% Normal type, Sn termination, 5000pcs taped in reel: WR06X1000FTL

Low ohmic Chip-R 2512 size, 0.1ohm, 1% Normal type, SnPb termination, 4000pcs taped in reel: WW25XR100FT_

Low ohmic Chip-R 2512 size, 0.1ohm, 1% Normal type, Sn Lead free termination, 4000pcs taped in reel: WW25XR100FTL

Chip-R array 0603x4, 10Kohm, 5% convex with SnPb termination, 5000pcs taped in reel: WA06X103_JT_

Chip-R 0402 size, 220ohm, Normal type, Gold termination, 5% 10,000pcs taped in reel: WF04Y221_JTG

Chip-R 0603 size, 0ohm, Normal type, SnPb termination, 5000pcs taped in reel: WR06X000_PT_

Chip Resistors

General Purpose Chip Resistors (1Ω~10MΩ)

Feature

1. High reliability and stability
2. Reduced size of final equipment
3. Lower assembly costs
4. Higher component and equipment reliability

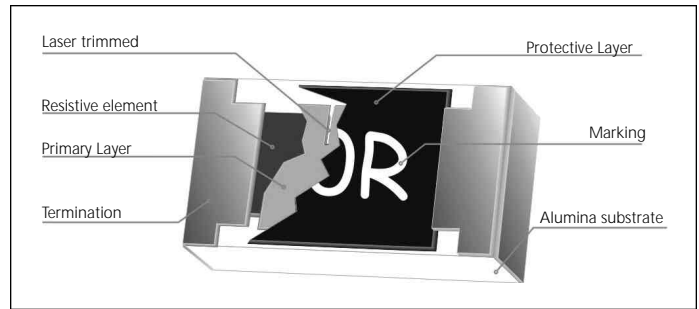
Description

The resistors are constructed in a high grade ceramic body (aluminum oxide). Internal metal electrodes are added at each end and connected by a resistive paste that is applied to the top surface of the substrate. The composition of the paste is adjusted to give the approximate resistance required and the value is trimmed to within tolerance by laser cutting of this resistive layer.

The resistive layer is covered with a protective coat. Finally, the two external end terminations are added. For ease of soldering the outer layer of these end terminations is a Lead-tin or Tin solder alloy.

Application

1. Consumer electrical equipment, PDA, Digital Camcorder, ...
2. EDP, Computer application
3. Mobile phone, Telecom
4. Power supply, Battery charger, DC-DC power converter
5. Digital meter
6. Automotives



Quick Reference Data

Series No.	WR25X	WR20X	WR18X	WR10X	WR12X	WR08X	WR06X	WR04X	WR02X
Size Code	2512 (6432)	2010 (5025)	1218 (3248)	1210 (3225)	1206 (3216)	0805 (2012)	0603 (1608)	0402 (1005)	0201 (0603)
Resistance Range	1 ~ 10M , 0 Ditto				1 ~ 10M , 0 10 ~ 1M				10 ~ 1M , 0
±5% Tolerance (E24)									
±1% Tolerance (E24+E96)									
TCR (ppm/°C)									
>10	± 200		± 100		± 200		± 200		± 300
10	± 300		± 200		-300 ~ +500				
Max. dissipation @ T _{amb} =70°C	1.0 Watt	1/2 Watt	1.0 Watt	1/3 Watt	1/4 Watt	1/8 Watt	1/10 Watt	1/16 Watt	1/20 Watt
Max. Operation Voltage (DC or RMS)	250V	200V	200V	200V	200V	150V	50V	50V	15V
Climatic category (IEC 60068)	55/155/56								55/125/56
Basic Specification	JIS C 5202 / IEC 60115-1								

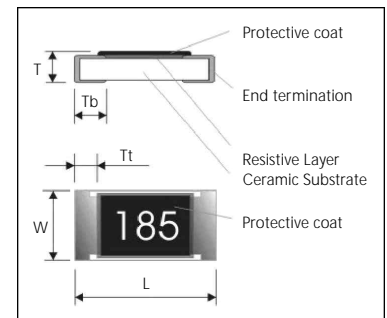
Note :

1. This is the maximum voltage that may be continuously supplied to the resistor element, see "IEC publication 60115-8"
2. Max. Operation Voltage : So called RCWV (Rated Continuous Working Voltage) is determined by $RCWV = \sqrt{\text{Rated Power} \times \text{Resistance Value}}$ or Max. RCWV listed above, whichever is lower.
3. Lead Free (Pb free) products are upon customer request.
4. The resistance range 1 ~ 10 and 1M ~ 10M with 1% tolerance please refer to WR12W / WR08W / WR06W / WR04W series specification.

Physical Dimensions

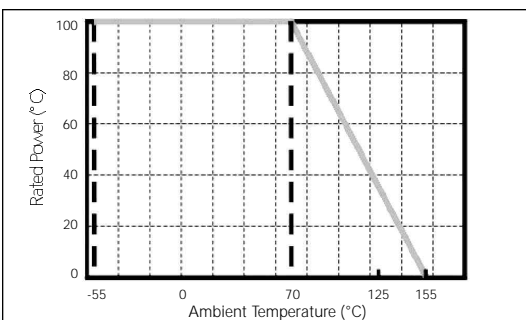
Unit: mm

Size	2512(6432)	2010(5025)	1218(3248)	1210 (3225)	1206(3216)	0805(2012)	0603(1608)	0402(1005)	0201(0603)
L	6.40±0.20	5.00±0.20	3.05±0.15	3.10 ± 0.10	3.10 ± 0.10	2.00 ± 0.10	1.60 ± 0.10	1.00 ± 0.05	0.60 ± 0.03
W	3.20±0.20	2.50±0.20	4.60±0.20	2.60 ± 0.10	1.60 ± 0.10	1.25 ± 0.10	0.80 ± 0.10	0.50 ± 0.05	0.30 ± 0.03
T	0.60±0.10	0.55±0.10	0.55±0.10	0.55 ± 0.10	0.60 ± 0.15	0.50 ± 0.15	0.45 ± 0.15	0.35 ± 0.05	0.25 ± 0.05
Tb	0.90±0.25	0.60±0.25	0.50±0.25	0.50 ± 0.20	0.45 ± 0.20	0.40 ± 0.20	0.30 ± 0.15	0.25 ± 0.10	0.15 ± 0.05
Tt	0.65±0.25	0.65±0.25	0.45±0.25	0.50 ± 0.20	0.50 ± 0.20	0.40 ± 0.20	0.30 ± 0.10	0.20 ± 0.10	0.15 ± 0.05

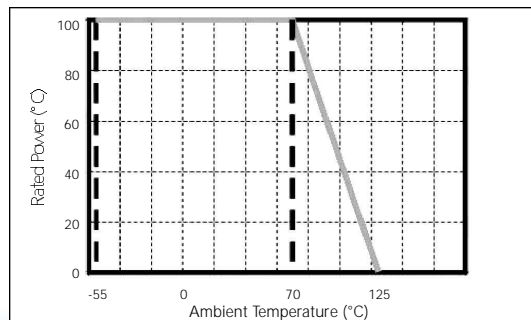


Power Deration Curve

For resistors operated in ambient temperature over 70°C, power rating should be derated in accordance with the following figures.



For Climatic category (IEC 60068) 55/155/56



For Climatic category (IEC 60068) 55/125/56

Chip Resistors

Test and Requirements

For WR Series, WA Series, and WT Series

(Detail please refer to specific data sheet)

Test	Procedure / Test Method	Requirement	
		Resistor	Jumper
DC resistance	JIS C 5202 5.1 / IEC 60115-1 4.5 DC resistance values measured at the test voltages specified below : <10 @0.1V, <100 @0.3V, <1K @1.0V, <10K @3V, <100K @10V, <1M @25V, <10M @30V	Within the specified tolerance	< 50m
Temperature Coefficient of Resistance	JIS C 5202 5.2 / IEC 60115-1 4.8.4.2 $\frac{R_2 - R_1}{R_1 (t_2 - t_1)} \times 10^6 \quad (\text{ppm}/^\circ\text{C})$ R1 : Resistance at reference temperature R2 : Resistance at test temperature t1 : room temperature; t2 : LCT or UCT	Within the specified TCR	N/a
Short Time Overload	JIS C 5202 5.5 / IEC 60115-1 4.13 Permanent resistance change after a 5sec application of a voltage 2.5xU _R or max. overload voltage, whichever is less.	R/R max ±(2%+0.10)	< 50m
Resistance to Solder Heat	JIS C 5202 6.4 / IEC 60115-1 4.18 Unmounted chip with a solder bath, 260°C±5°C, 10±1 sec	R/R max. ±(1%+0.05)	< 50m
Solderability	JIS C 5202 6.5 / IEC 60115-1 4.17 Termination SnPb base : Unmounted chips completely immersed for 2±0.5 sec. in a solder bath at 230±5°C Termination Sn base (lead free) : Unmounted chip completely immersed in a lead free solder bath, 245°C±5°C, 3±1 sec	95% coverage min., good tinning and no visible damage	
Leaching Test	JIS C 5202 6.4 / IEC 60115-1 4.18 Unmounted chip with a solder bath, 260°C±5°C, 60±1 sec	Ditto	
Temperature Cycling	JIS C 5202 7.4 / IEC 60115-1 4.19 30min at LCT, 30min at UCT, 5 cycles	R/R max. ±(1%+0.05)	< 50m
Damp heat (Humidity loaded in steady state)	JIS C 5202 7.9 1000+48/-0 hours@40±2°C, 90~95% RH; loaded with Pn or Vmax; 1.5 hours ON, 0.5 hours OFF	10 R<1M : R/R max. ±(3%+0.10) R<10 , R 1M : R/R max. ±(5%+0.10)	< 50m
Load Life (Endurance)	JIS C 5202 7.10 / IEC 60115-1 4.25.1 1000+48/-0 hours@70±2°C; loaded with Pn or Vmax; 1.5 hours ON, 0.5 hours OFF	Ditto	Ditto
Bending	JIS C 5202 6.1.4 / IEC 115-1 4.33 Resistors mounted on a 90mm glass epoxy resin PCB(FR4), bending once or 10sec : >2mm for 2512 and 2010; >3mm for 1206, 0805, 0603, and 0402	No visual damaged, R/R max. ±(1%+0.05)	< 50m

For WWxxX Series

(Detail please refer to specific data sheet.)

Test	Procedure / Test Method	Requirement	
		Resistor	Jumper
Temperature Coefficient of Resistance	JIS C 5202 5.2 / IEC 60115-1 4.8.4.2 $\frac{R_2 - R_1}{R_1 (t_2 - t_1)} \times 10^6 \quad (\text{ppm}/^\circ\text{C})$ R1 : Resistance at reference temperature R2 : Resistance at test temperature t1 : room temperature; t2 : LCT or UCT	Within the specified TCR	
Short Time Overload	JIS C 5202 5.5 / IEC 60115-1 4.13 Permanent resistance change after a 5sec application of a voltage 2.5xU _R or max. overload voltage, whichever is less.	R/R max. ±(2%+0.005)	
Resistance to Solder Heat	JIS C 5202 6.4 / IEC 60115-1 4.18 Unmounted chip with a solder bath, 260°C±5°C, 10±1 sec	R/R max. ±(1%+0.005)	
Solderability	JIS C 5202 6.5 / IEC 60115-1 4.17 Termination SnPb base : Unmounted chips completely immersed for 2±0.5 sec. in a solder bath at 230±5°C Termination Sn base (lead free) : Unmounted chip completely immersed in a lead free solder bath, 245°C±5°C, 3±1 sec	95% coverage min., good tinning and no visible damage	
Leaching Test	JIS C 5202 6.4 / IEC 60115-1 4.18 Unmounted chip with a solder bath, 260°C±5°C, 60±1 sec	Ditto	
Temperature Cycling	JIS C 5202 7.4 / IEC 60115-1 4.19 30min at LCT, 30min at UCT, 5 cycles	R/R max. ±(1%+0.005)	
Damp heat (Humidity loaded in steady state)	JIS C 5202 7.9 1000+48/-0 hours@40±2°C, 90~95% RH; loaded with Pn or Vmax; 1.5 hours ON, 0.5 hours OFF	R/R max. ±(3%+0.005)	
Load Life (Endurance)	JIS C 5202 7.10 / IEC 60115-1 4.25.1 1000+48/-0 hours@70±2°C; loaded with Pn or Vmax; 1.5 hours ON, 0.5 hours OFF	Ditto	
Bending	JIS C 5202 6.1.4 / IEC 115-1 4.33 Resistors mounted on a 90mm glass epoxy resin PCB(FR4), bending once for 10sec : >2mm for 2512 and 2010; >3mm for 1206, 0805, 0603	No visual damaged, R/R max. ±(1%+0.005)	

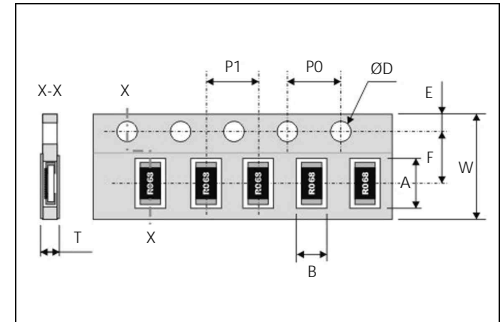
Chip Resistors

Packing on Tape and Reel

Paper Tape Specifications for WR, WF, WW Series and WA, WT Series

Unit: mm

Component Size / Series	W	F	E	P0	ØD
1206, 0805, 0603, 0402, WA06X, WA06T, WA04X, WA04Y, WA04P, WT04X	8.00±0.30	3.50±0.20	1.75±0.10	4.00±0.10	Ø1.50 ^{+0.1} _{-0.0}
WA06W	12.0±0.10	5.50±0.05			
WR02W	8.00±0.20	3.50±0.05			

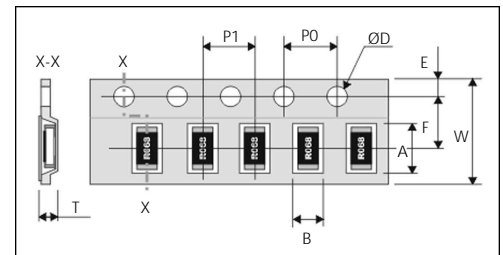


Component Size / Series	A	B	P1	T
1206 (3216), WA06X, WA06T	3.60±0.20	2.00±0.20	4.00±0.10	Max. 1.0
0805 (2012)	2.40±0.20	1.65±0.20		
0603 (1608)	1.90±0.20	1.10±0.20		
0402 (1005)	1.20±0.10	0.70±0.10	2.00±0.10	0.40±0.05
WA04X	2.20±0.20	1.20±0.20	2.00±0.05	Max. 0.6
WA04Y, WA04P	1.15±0.10	1.15±0.10	2.00±0.05	0.45±0.05
WT04X	3.45+0.20/-0	1.85+0.20/-0	4.00±0.10	0.85±0.05
WA06W	1.80+0.2/-0	4.20+0.2/-0	4.00±0.10	0.65±0.05
WR02X	0.70±0.05	0.40±0.05	2.00±0.05	0.30±0.05

Plastic Tape Specifications for WR, WF, WW Series of Chip-R

Unit: mm

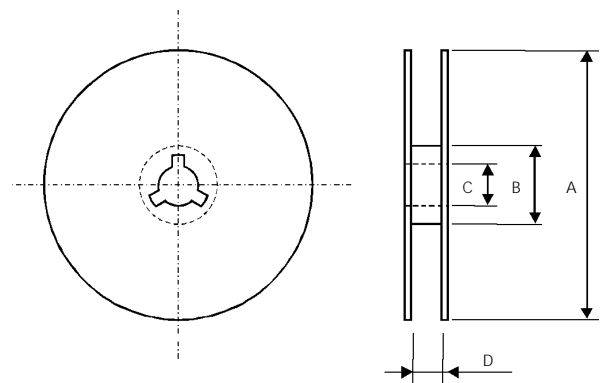
Component Size	2512 (6432)	2010 (5025)	1218 (3248)
A	6.90±0.20	5.50±0.20	3.55±0.30
B	3.60±0.20	2.80±0.20	4.90±0.20
W	12.00±0.30		
F	5.50±0.1		
E	1.75±0.10		
P1	4.00±0.10		
P0	4.00±0.10		
ØD	Ø1.50 ^{+0.1} _{-0.0}		
T	Max. 1.2		



Reel Dimensions

Unit: mm

Reel / Tape	A	B	C	D
7" reel for 8mm tape	Ø178.0±2.0	Ø60.0±1.0	13.0±0.2	9.0 ± 0.50
7" reel for 12mm tape				12.4 ± 1.00
10" reel for 8mm tape	Ø254.0±2.0	Ø100.0±1.0	13.0±0.2	9.0 ± 0.50
10" reel for 12mm tape				14.0 ± 0.20
13" reel for 8mm tape	Ø330.0±2.0	Ø100.0±1.0	13.0±0.2	9.0 ± 0.50



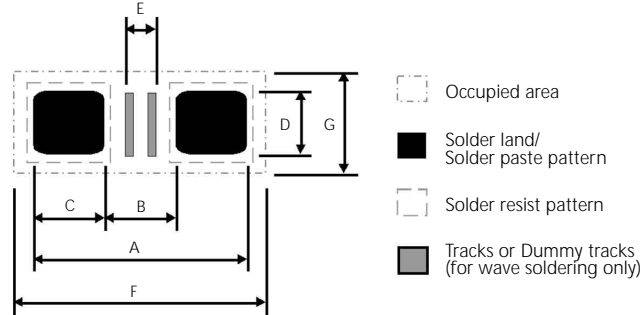
Typical Taping Quantity

Component Size / Series	Q'ty per reel	Reel diameter
1210, 1206, 0805, 0603, WA06X, WA06T, WT04X	5,000 pcs	7" reel
0201, 0402, WA04X, WA04Y, WA04P	10,000 pcs	7" reel
WA06W	5,000 pcs	7" reel
2512, 2010	4,000 pcs	7" reel
1218	3,000 pcs	10" reel
1206, 0805, 0603	10,000 pcs	10" reel
0402, WA04X, WA04Y	20,000 pcs	10" reel
0402	70,000 pcs	13" reel
WA04X, WA04Y	40,000 pcs	13" reel
1206, 0805, 0603	20,000 pcs	13" reel

Chip Resistors

Footprint Design

Footprint Design for WRxx Series, WFxx Series, WWxx Series :



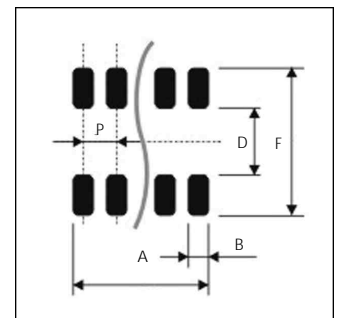
Unit: mm

Size	Reflow Soldering							Processing remarks	Placement Accuracy
	A	B	C	D	E	F	G		
0201	0.75	0.30	0.30	0.30	0.20	1.10	0.50	IR or hot plate soldering	± 0.05
0402	1.50	0.50	0.50	0.60	0.10	1.90	1.00		± 0.15
0603	2.10	0.90	0.60	0.90	0.50	2.35	1.45		± 0.25
0805	2.60	1.20	0.70	1.30	0.75	2.85	1.90		± 0.25
1206	3.80	2.00	0.90	1.60	1.60	4.05	2.25		± 0.25
1218	3.80	2.00	0.90	4.80	1.40	4.20	5.50		± 0.25
2010	5.60	3.80	0.90	2.80	3.40	5.85	3.15		± 0.25
2512	7.00	3.80	1.60	3.50	3.40	7.25	3.85		± 0.25
Size	Wave Soldering							Proposed number & Dimensions of dummy tracks	Placement Accuracy
A	B	C	D	E	F	G			
0603	2.70	0.90	0.90	0.80	0.15	3.40	1.90	1x (0.15x0.80)	± 0.25
0805	3.40	1.30	1.05	1.30	0.20	4.30	2.70	1x (0.20x1.30)	± 0.25
1206	4.80	2.30	1.25	1.70	1.25	5.90	3.20	3x (0.25x1.70)	± 0.25
1218	4.80	2.30	1.25	4.80	1.30	5.90	5.60	3x (0.25x4.80)	± 0.25
2010	6.30	3.50	1.40	2.50	3.00	7.00	3.60	3x (0.75x2.50)	± 0.25
2512	8.50	4.50	2.00	3.20	3.00	9.00	4.30	3x (1.00x3.20)	± 0.25

Footprint Design for Array Resistor/Attenuator :

Unit: mm

Symbol	0603*4 array	0402*4 array	WA04Y, WA04P	WA06W
A	2.85 +0.10/-0.05	1.80 +0.15/-0.05	1.20 ± 0.05	3.85 +0.20/-0.05
B	0.45 ± 0.05	0.30 ± 0.05	0.40 +0/-0.05	0.28 +0/-0.05
D	0.80 ± 0.10	0.50 ± 0.1	0.50 ± 0.05	1.00 +0.10/-0.20
P	0.80	0.50	0.65	0.50
F	3.10 ± 0.30	2.00 +0.40/-0.20	1.50 +0.20/-0.10	3.20 ± 0.40



Footprint Design for 10P8R Network Resistor :

Unit: mm

Symbol	WT04X
W1	0.35 ± 0.05
W2	0.50 ± 0.05
H2	0.80 ± 0.10
P1	0.70 ± 0.05
P2	0.65 ± 0.05
A	3.20 ± 0.10
F	2.80 +0.40/-0.20

