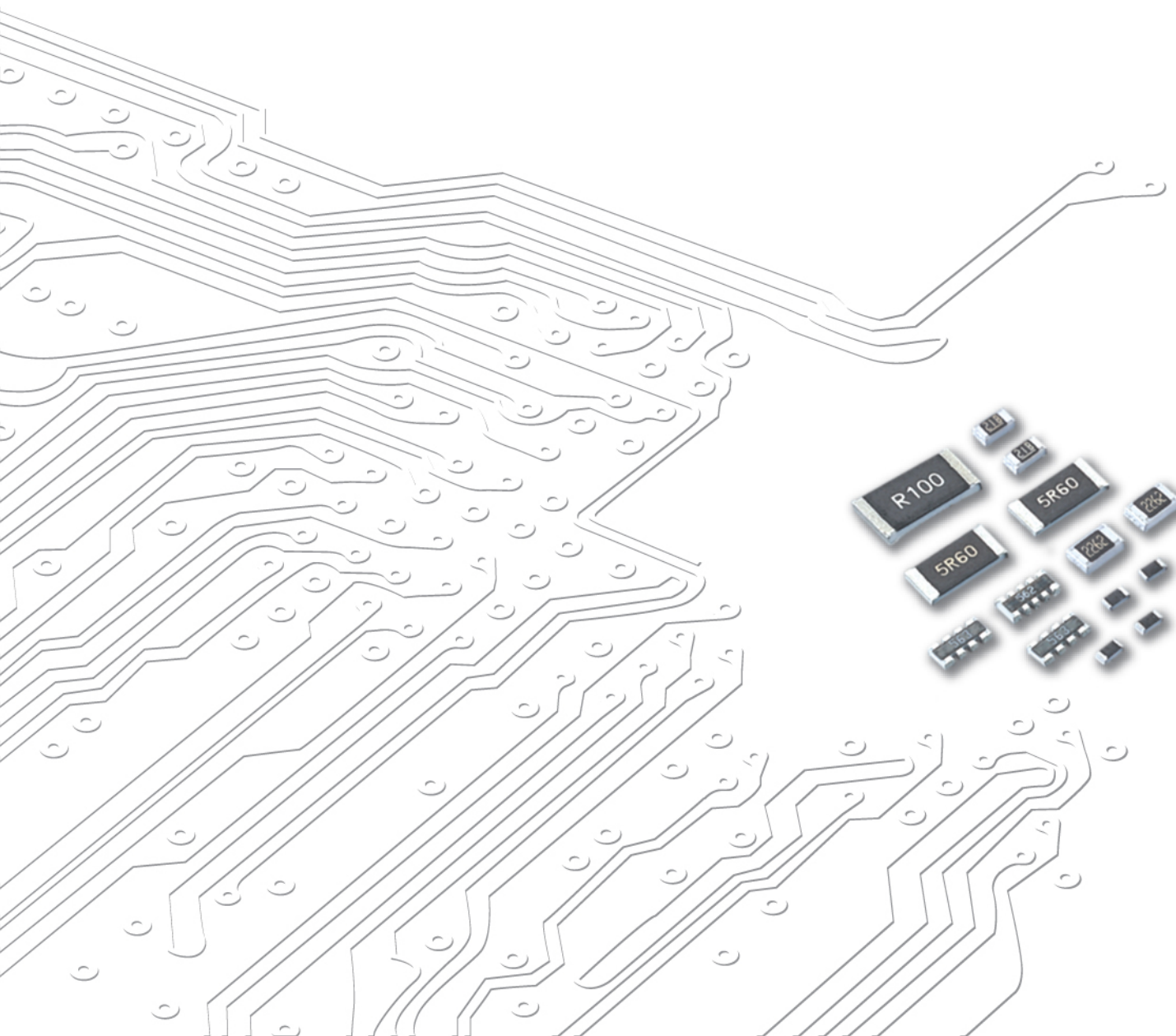
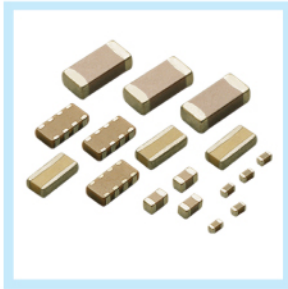


Chip Resistors

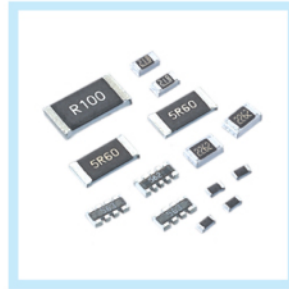
Product catalog



Product Portfolio



Multilayer Ceramic Capacitors (MLCC)



Chip-Resistor



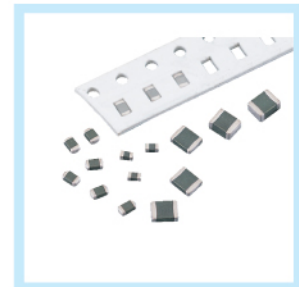
Disc Capacitors



RF Device and High Frequency Inductors



Inductors



Varistors and SMD-Varistors

IEC-63 Nominal Resistance / Capacitance

| | | | | | | | | | | | | | | | | | | | | | | | | |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| E1 | 100 | | | | | | | | | | | | | | | | | | | | | | | |
| E3 | 100 | | | | | | | | 220 | | | | | | | | 470 | | | | | | | |
| E6 | 100 | | 150 | | 220 | | 330 | | 470 | | 680 | | | | | | | | | | | | | |
| E12 | 100 | 120 | 150 | 180 | 220 | 270 | 330 | 390 | 470 | 560 | 680 | 820 | | | | | | | | | | | | |
| E24 | 100 | 110 | 120 | 130 | 150 | 160 | 180 | 200 | 220 | 240 | 270 | 300 | 330 | 360 | 390 | 430 | 470 | 510 | 560 | 620 | 680 | 750 | 820 | 910 |
| E96 | 100 | 102 | 121 | 124 | 147 | 150 | 178 | 182 | 215 | 221 | 261 | 267 | 316 | 324 | 383 | 392 | 464 | 475 | 562 | 576 | 681 | 698 | 825 | 845 |
| | 105 | 107 | 127 | 130 | 154 | 158 | 187 | 191 | 226 | 232 | 274 | 280 | 332 | 340 | 402 | 412 | 487 | 499 | 590 | 604 | 715 | 732 | 866 | 887 |
| | 110 | 113 | 133 | 137 | 162 | 165 | 196 | 200 | 237 | 243 | 287 | 294 | 348 | 357 | 422 | 432 | 511 | 523 | 619 | 634 | 750 | 768 | 909 | 931 |
| | 115 | 118 | 140 | 143 | 169 | 174 | 205 | 210 | 249 | 255 | 301 | 309 | 365 | 374 | 442 | 453 | 536 | 549 | 649 | 665 | 787 | 806 | 953 | 976 |

E6: $\sqrt[6]{10} \approx 1.46$ E12: $\sqrt[12]{10} \approx 1.21$

E1 series resistance: 1Ω, 10Ω, 100Ω, 1000Ω, 10000Ω, 100000Ω

INDEX

| Subject | Page |
|--|-------------|
| How to Order..... | 1 |
| Chip resistors Selection Guide | 2 |
| General Purpose Chip Resistors (1Ω ~10MΩ) | 5 |
| Thick Film Low Ohm/ Power Low Ohm Chip Resistors (0.02Ω ~ 0.976Ω) | 6 |
| Metal Low Ohm Current Sensing Chip resistors (0.001Ω ~ 0.050Ω) | 7 |
| Chip Resistor Array:Convex Termination | 8 |
| WA06W Chip Resistor Array 16P8R | 9 |
| Chip Resistor Array:Concave Termination | 10 |
| WT04X Chip Resistor Network | 11 |
| WA04P Chip Attenuator | 12 |
| Special Chip Resistors | 13 |
| MR/SR Series of Automotive & Anti-Sulfuration Chip Resistors | 13 |
| WR_R Series of Total Lead Free Chip Resistors | 13 |
| WKxxM Series of Trimmable Chip Resistors | 14 |
| WKxxV Series of High Voltage Chip Resistors..... | 14 |
| WFxxP Series of High Power Chip Resistors | 15 |
| WKxxS series of Surge Chip Resistors | 15 |
| High Precision Chip Resistors | 16 |
| Test and Requirements | 17 |
| Packing on Tape and Reel | 19 |
| Footprint Design | 20 |
| Storage and Handling Condition..... | 21 |
| Recommendation of Soldering Profiles | 21 |

* The specifications are subject to change or our products in it may be discontinued without advance notice. Please check with our sales representatives or product engineers before ordering.

* This catalog has only typical specifications because there is no space for detailed specifications. Therefore, please approve our product specifications or transact the approval sheet for product specification before ordering.

HOW TO ORDER

| WR | 12 | X | 1000 | F | T | L |
|---|---|---|---|---|---|--|
| Type code WR : General 1~10MR MR: Automotive SR: Anti-Sulfuration ZR: Non magnetic | 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) 02 : 0201 (0603) 01 : 01005 (0402) | Functional code X : 5% for 1 ~ 10MΩ 1% for 10 ~ 1MΩ W : 1% for <10Ω and >1MΩ Y : 5% for 1 ~ 10MΩ (Low profile) 1% for 10 ~ 1MΩ (Low profile) Z : 1% for <10Ω or >1MΩ (Low profile) F: TC100 1-10ohm, 1% E: TC100, 100-1Mohm, 5% | Resistance E24(J tol.) : 2 significant digits followed by No. of zeros and a blank e.g. : 3ohm = 3R0_ 10ohm = 100_ 220ohm = 221_ 56Kohm = 563_ (" " means blank) E24+E96 (F tol.) : 3 significant digits followed by No. of zeros e.g. : 3Ω = 3R00 10Ω = 10R0 220Ω = 2200 56KΩ = 5602 | Tolerance F : ± 1% J : ± 5% P : Jumper H : +5% ~ 0% S : -16,5% ~ -15% X : random | Packaging code P : 4" reel taping T : 7" reel taping A : 7" reel taping 15Kpcs D : 7" reel taping 20Kpcs E : 7" up side down taping V : 7" reel taping 1Kpcs Q : 10" reel taping G : 13" reel taping H : 0402-50K/13" reel R : 0603 2mm pitch 7" reel B : Bulk C : Bulk after measuring F : 0402 1mm pitch (30k/ 7" reel) K : 10" reel taping (0402 30K/RL) J : 10" reel taping (0402 40K/RL) | Termination code L = Sn base (Lead free) R = Pb ≤100ppm (total) W = Wide term. A = Anti-leaching X = No plating Ni/Sn |
| WW | 12 | M | R002 | F | T | L |
| Type code WW: R < 1Ω MW: R < 1Ω, AUTO SW: R < 1Ω, Anti-Sulfu | 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 : Thick film low ohm (WTC) W : Thick film low ohm low TCR Q : Metal low ohm M : Metal low ohm R : Metal low ohm high power N : Metal low ohm high power P : Thick film low TCR high Power 2512 = 2W 2010 = 1W 1210 = 0.5W 1206 = 0.5W C : Thick film Power low ohm low TCR, up side down E : Thick film Power low ohm low cost, A : Metal low ohm Hi-P 2512 3W B : Metal low ohm Hi-P 1206 1.5W | Resistance R followed by 3 significant digits e.g. : 0.1Ω = R100 0.033Ω = R033 0.56Ω = R560 | Tolerance F : ± 1% G : ± 2% J : ± 5% | Packaging code P : 4" reel taping T : 7" reel taping Q : 10" reel taping G : 13" reel taping R : 0603 2mm pitch taping B : Bulk K : Bulkcase U : 7" reel taping (4kpcs/RL) | Termination code L = Sn base (Lead free) G = Au base S = Ag base |
| WF | 12 | T | 1001 | B | T | L |
| Type code WF : Special function MF : Special function AUTO SF : Special function Anti-Sulfur WK: Special function made in KM | 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 ohm (>10MΩ) H : Thick film, High Precision <1% K : Thick film, TCR50ppm M : Trimmable P : High Power S : Surge T : Thin film, TCR50ppm U : Thin film, TCR25ppm Q : Thin film, TCR50ppm, power R : Thin film, TCR25ppm, power F : Thin film TCR15ppm W : Thin film TCR10ppm Z : Thin film TCR 5ppm V : High voltage N : Ultra High voltage X : Special resistance Y : E24/E96 resistance with special termination A : Hi-power 2010, 1.5W/ 0603, 0.25W | Resistance E24(J tol.) : 2 significant digits followed by No. of zeros and a blank e.g. : 3ohm = 3R0_ 10ohm = 100_ 220ohm = 221_ 56Kohm = 563_ (" " means blank) E24+E96 (F tol.) : 3 significant digits followed by No. of zeros e.g. : 3Ω = 3R00 10Ω = 10R0 220Ω = 2200 56KΩ = 5602 | Tolerance A : ± 0.05% B : ± 0.1% C : ± 0.25% D : ± 0.5% F : ± 1% G : ± 2% J : ± 5% K : ± 10% L : ± 15% M : ± 20% P : Jumper X : 0/-30% Y : 0/-20% Z : 0/-10% Q : -0.8%~-1.0% R : +0,8%~+1,0% E : -10% ~ -9% | Packaging code P : 4" reel taping T : 7" reel taping Q : 10" reel taping G : 13" reel taping R : 0603 2mm pitch taping B : Bulk K : Bulkcase D : 7" reel taping 20Kpcs V : 7" reel taping 1Kpcs A : 7" reel taping 15Kpcs W : 7" reel taping 2Kpcs | Termination code L = Sn base (Lead free) G = Au base S = Ag base C = Cu base D = Cu base + Low profile N = Narrow termination |
| WA | 04 | X | 103 | J | T | L |
| Type code WA: Array MA: Convex Array Auto SA: Concave Array Anti-Sulfur | Size code 06 : 0603 (1608) 04 : 0402 (1005) 02 : 0201 (0603) | Functional code X : *4, convex Y : *2, convex W : *8, convex T : *4, concave U : *2, concave P : *3, convex (Attenuator) A : *4, FLAT B : *2, FLAT F : *4, Reverse array G : *2, Reverse array | Resistance E24(J tol.) : 2 significant digits followed by No. of zeros and a blank e.g. : 3ohm = 3R0_ 10ohm = 100_ 220ohm = 221_ 56Kohm = 563_ (" " means blank) E24+E96 (F tol.) : 3 significant digits followed by No. of zeros e.g. : 3Ω = 3R00 10Ω = 10R0 220Ω = 2200 56KΩ = 5602 | Tolerance F : ± 1% J : ± 5% P : Jumper | Packaging code T : 7" reel taping A : 7" reel taping 15Kpcs Q : 10" reel taping G : 13" reel taping B : Bulk K : Bulkcase | Termination code L = Sn base (Lead free) |
| WT | 04 | X | 103 | J | T | L |
| Type code T : Network Resistors | Size code 04 : total package size 1206 (3216) | Functional code X : *8, convex | Resistance E24(J tol.) : 2 significant digits followed by No. of zeros and a blank e.g. : 3ohm = 3R0_ 10ohm = 100_ 220ohm = 221_ 56Kohm = 563_ (" " means blank) | Tolerance J : ± 5% P : Jumper | Packaging code T : 7" reel taping B : Bulk | Termination code L = Sn base (Lead free) |

Remark :

1. Detail product part number, functional code, tolerance combination,..... please refer to specific data sheet.
2. Example : (" " means a blank)
Chip-R 0805 size, 4.3ohm, 5%, Normal type, SnPb termination, 5000pcs taped in reel : WR08X4R3_JTL
3. 1218 standard packing q'ty is 3Kpcs in 10" reel and packing code is T code

Chip Resistor Selection Guide

General Purpose Chip-R

| Series | Size | Rated Power | TCR (ppm/°C)* | Tolerance | Resistance |
|--------|--------------|-------------|---------------|-----------|------------|
| WR25X | 2512 (6432) | 1W | ±100 | ±1% | 1 ~ 10MΩ |
| | | | ±200 | ±5% | |
| WR18X | 1218 (3248) | 1W | ±100 | ±1% | |
| | | | ±200 | ±5% | |
| WR20X | 2010 (5025) | 1/2W | ±100 | ±1% | |
| | | | ±200 | ±5% | |
| WR10X | 1210 (3225) | 1/3W | ±100 | ±1% | |
| | | | ±200 | ±5% | |
| WR12X | 1206 (3216) | 1/4W | ±100 | ±1% | |
| | | | | ±5% | |
| WR08X | 0805 (2012) | 1/8W | ±100 | ±1% | |
| | | | | ±5% | |
| WR06X | 0603 (1608) | 1/10W | ±100 | ±1% | |
| | | | | ±5% | |
| WR04X | 0402 (1005) | 1/16W | ±100 | ±1% | |
| | | | | ±5% | |
| WR02X | 0201 (0603) | 1/20W | ±200 | ±1% | |
| | | | ±200 | ±5% | |
| WR01X | 01005 (0402) | 1/32W | ±200 | ±1% | 4.7 ~ 1MΩ |
| | | | ±200 | ±5% | |

- Remark:**
- Detailed resistance vs. TCR and ordering code please refer to specific specifications.
 - Jumper resistor is not designed for fusing applications, designers shall apply dedicate fusible resistor or standard fuse in application circuits.
 - WRxxW defines for ±1% < 10ohm or > 1Mohm.

Thick Film Low Ohm Chip-R

| Series | Size | Rated Power | TCR (ppm/°C) | Tolerance | Resistance |
|----------------|-------------|-------------|--------------|-----------|-----------------|
| WW25X WW25W | 2512 (6432) | 1W | ≤ 1500** | ±1%, ±5% | 0.015Ω ~ 0.976Ω |
| | | | ±1000** | ±1%, ±5% | 0.010Ω ~ 0.100Ω |
| WW18X | 1218 (3248) | 1W | ≤ 1500** | ±1% | 0.020Ω ~ 0.976Ω |
| | | | | ±5% | 0.015Ω ~ 0.976Ω |
| WW20X WW20W | 2010 (5025) | 1/2W | ≤ 1500** | ±1%, ±5% | 0.020Ω ~ 0.976Ω |
| | | 3/4W | ±1000** | ±1%, ±5% | 0.010Ω ~ 0.100Ω |
| WW10X WW10W | 1210 (3225) | 1/3W | ±200 | ±1%, ±5% | 0.020Ω ~ 0.976Ω |
| | | 2/3W | ±500** | ±1%, ±5% | 0.020Ω ~ 0.100Ω |
| WW12X WW12W | 1206 (3216) | 1/4W | ≤ 1500** | ±1%, ±5% | 0.010Ω ~ 0.976Ω |
| | | 1/3W | ±1000** | ±1%, ±5% | 0.010Ω ~ 0.100Ω |
| WW08X WW08W | 0805 (2012) | 1/8W | ≤ 1500** | ±1%, ±5% | 0.020Ω ~ 0.976Ω |
| | | | ±200 | ±1%, ±5% | 0.050Ω ~ 0.100Ω |
| WW06X WW06W | 0603 (1608) | 1/10W | ≤ 500** | ±1%, ±5% | 0.100Ω ~ 0.976Ω |
| | | | ±400 | ±1%, ±5% | 0.050Ω ~ 0.100Ω |
| WW04X | 0402 (1005) | 1/16W | ≤ 600** | ±1%, ±5% | 0.100Ω ~ 0.976Ω |

- Remark:**
- Detailed resistance vs. TCR and ordering code please refer to specific specifications.
 - Resistance value will be changed by soldering condition and design of soldering pad, please design products in consideration of this change.

Thick Film Power Low Ohm Chip-R

| Series | Size | Rated Power | TCR (ppm/°C) | Tolerance | Resistance |
|--------|-------------|-------------|--|-----------|--|
| WW25P | 2512 (6432) | 2W | < 0.1Ω: 150ppm ≥ 0.1Ω: 100ppm | ±1%, ±5% | 0.047Ω ~ 0.976Ω |
| WW20P | 2010 (5025) | 1W | < 0.1Ω: 150ppm ≥ 0.1Ω: 100ppm | ±1%, ±5% | 0.047Ω ~ 0.976Ω |
| WW10P | 1210 (3225) | 1/2W | < 0.1Ω: 500ppm ≥ 0.1Ω: 200ppm | ±1%, ±5% | 0.020Ω ~ 0.976Ω |
| WW12P | 1206 (3216) | 1/2W | < 0.1Ω: 200ppm ≥ 0.1Ω: 100ppm | ±1%, ±5% | 0.020Ω ~ 0.976Ω |
| WW08P | 0805 (2012) | 1/3W | < 0.1Ω: 200ppm ≥ 0.1Ω: 150ppm | ±1%, ±5% | 0.047Ω ~ 0.976Ω |
| WW06P | 0603 (1608) | 1/4W | < 0.1Ω: 250ppm ≥ 0.1Ω: 200ppm | ±1%, ±5% | 0.047Ω ~ 0.976Ω |
| WW04P | 0402 (1005) | 1/8W | < 0.1Ω: 300ppm ≥ 0.1Ω: 200ppm | ±1%, ±5% | 0.100Ω ~ 0.976Ω |
| WW12C | 1206 (3216) | 1/2W | < 0.02Ω: 150ppm ≥ 0.02Ω: 100ppm | ±1%, ±5% | 0.020Ω ~ 0.100Ω |
| WW08C | 0805 (2012) | 1/3W | < 0.03Ω: 200ppm ≥ 0.03Ω: 100ppm | ±1%, ±5% | 0.010Ω ~ 0.100Ω |
| WW06C | 0603 (1608) | 1/4W | < 0.051Ω: 0~+250ppm ≥ 0.051Ω: ±150ppm | ±1%, ±5% | 0.010Ω ~ 0.100Ω |
| WW04C | 0402 (1005) | 1/8W | < 0.051Ω: 0~+350ppm ≥ 0.051Ω: ±150ppm | ±1%, ±5% | 0.025Ω ~ 0.100Ω |
| WW02C | 0201 (0603) | 1/10W | 0 ~ +500ppm | ±1%, ±5% | ±5%: 0.020 ~ 0.100Ω ±1%: 0.040 ~ 0.100Ω |

Metal Low Ohm Sensing Type Chip-R

| Series | Size | Rated Power | TCR (ppm/°C)* | Tolerance | Resistance |
|--------|--------------|-------------|---------------|-----------|---|
| WW59M | 5931 (15079) | 5W | ±75 | ±1%, ±5% | 2, 3, 5mΩ |
| WW25N | 2512 (6432) | 2W | ±75 | ±1%, ±5% | 3, 5, 10, 15, 20, 25mΩ |
| WW25R | | 2W | ±70 | ±1%, ±5% | 1, 2, 3, 4, 5, 6, 7, 8, 9, 10mΩ |
| WW25M | | 1W | ±75 | ±1%, ±5% | 3, 5, 10, 15, 20, 25, 50mΩ |
| WW25Q | | 1W | ±70 | ±1%, ±5% | 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15mΩ |
| WW20N | 2010 (5025) | 1W | ±75 | ±1%, ±5% | 5, 10, 15, 20mΩ |
| WW12N | 1206 (3216) | 1W | ±70 | ±1%, ±5% | 5, 10, 15, 20, 25mΩ |
| WW12R | | 1W | ±70 | ±1%, ±5% | 1 ~ 15mΩ |
| WW12D | | 1W | ±70 | ±1%, ±5% | 20, 25, 30, 40, 50mΩ |
| WW08D | | 1/2W | ±70 | ±1%, ±5% | 20, 25, 30, 40, 50mΩ |
| WW08R | 0805 (2012) | 1/2W | ±70 | ±1%, ±5% | 4, 5, 10mΩ |
| WW06R | 0603 (1608) | 1/3W | ±70 | ±1%, ±5% | 5, 10, 15mΩ |

Remark:
 1. Detailed resistance vs. TCR and ordering code please refer to specific specifications.
 2. Resistance value will be changed by soldering condition and design of soldering pad, please design products in consideration of this change.

Chip Resistor Array

| Series | Size | Rated Power | TCR (ppm/°C) | Termination | Tolerance | Resistance |
|--------|---------------|-------------|--------------|-----------------|-----------|-----------------------------------|
| WA06X | 1206 (0603x4) | 1/10W | ±200 | Convex | ±1%, ±5% | 10 ~ 1MΩ |
| WA06T | 1206 (0603x4) | 1/10W | ±200 | Concave | ±1%, ±5% | |
| WA06Y | 0606 (0603x2) | 1/10W | ±200 | Convex | ±1%, ±5% | |
| WA04X | 0804 (0402x4) | 1/16W | ±200 | Convex | ±1%, ±5% | |
| WA04T | 0804 (0402x4) | 1/16W | ±300 | Concave | ±1%, ±5% | |
| WA04F | 0804 (0402x4) | 1/16W | ±300 | Reverse Concave | ±1%, ±5% | |
| WA04Y | 0404 (0402x2) | 1/16W | ±200 | Convex | ±1%, ±5% | |
| WA04U | 0404 (0402x2) | 1/16W | ±300 | Concave | ±1%, ±5% | |
| WA04G | 0804 (0402x2) | 1/16W | ±300 | Reverse Concave | ±1%, ±5% | |
| WA06W | 1606 (0402x8) | 1/16W | ±200 | Convex | ±1%, ±5% | |
| WA02F | 0602 (0201x4) | 1/32W | ±200 | Reverse Flat | ±1%, ±5% | 10 ~ 100KΩ |
| WA02G | 0202 (0201x2) | 1/32W | ±200 | Reverse Flat | ±1%, ±5% | ±5%: 10 ~ 1MΩ; ±1%: 10 ~ 100KΩ |

Remark:
 1. Detailed resistance vs. TCR and ordering code please refer to specific specifications.
 2. Resistance value will be changed by soldering condition and design of soldering pad, please design products in consideration of this change.

Chip Attenuator

| Series | Size | Type | Termination | Tolerance | Attenuation | Impedance |
|--------|---------------|--------------|-------------|----------------|-----------------|-----------|
| WA04P | 0404 (0402x2) | 4P3R, Π type | Convex | ±0.1dB ~ 2.5dB | 0, 0.5dB ~ 20dB | 50Ω |

Chip Resistor Network

| Series | Size | Rated Power | TCR (ppm/°C) | Termination | Tolerance | Resistance |
|--------|--------------|-------------|--------------|-------------|-----------|------------|
| WT04X | 1206 (10P8R) | 1/16W | ±200 | Convex | ±5% | 10 ~ 100KΩ |

High Power Chip-R

| Series | Size | Rated Power | TCR (ppm/°C) | Tolerance | Resistance |
|--------|-------------|-------------|--------------|-----------|-----------------|
| WF25P | 2512 (6432) | 2W | ±100 | ±1%, ±5% | Jumper; 1 ~ 1MΩ |
| WF20P | 2010 (5025) | 1W | ±100 | | |
| WF10P | 1210 (3225) | 1/2W | ±100 | | |
| WF12P | 1206 (3216) | 1/2W | ±100 | | |
| WF08P | 0805 (2012) | 1/4W | ±100 | | |
| WF06P | 0603 (1608) | 1/8W | ±100 | | |
| WF04P | 0402 (1005) | 1/8W | ±100 | | |

Automotive Chip-R (Details please refer Automotive resistor introduction)

| Series | Size | Rated Power | TCR(ppm/°C) | Tolerance | Resistance |
|--------|-------------|-------------|-------------|---------------------------|------------|
| MR06R | 0603 (1608) | 0.15W | ±25 | ±0.05%, 0.1%, 0.25%, 0.5% | 40Ω~100KΩ |
| MR04R | 0402 (1005) | 1/16W | ±25 | ±0.05%, 0.1%, 0.25%, 0.5% | 40Ω~30KΩ |
| MR25 | 2512 (6432) | 1W | ±200 | ±1%, ±5% | 1~ 10MΩ |
| MR20 | 2010 (5025) | 1/2W | ±200 | | 1~ 10MΩ |
| MR18 | 1218 (3248) | 1W | ±200 | | 1~ 10MΩ |
| MR10 | 1210 (3225) | 1/2W | ±200 | | 1~ 10MΩ |
| MR12 | 1206 (3216) | 1/4W | ±200 | | 1~ 10MΩ |
| MR08 | 0805 (2012) | 1/8W | ±200 | | 1~ 10MΩ |
| MR06 | 0603 (1608) | 1/10W | ±200 | | 1~ 10MΩ |
| MR04 | 0402 (1005) | 1/16W | ±200 | | 1~ 10MΩ |

Anti-Sulfuration Chip-R (Details please refer Anti-sulfur resistor introduction)

| Series | Size | Rated Power | TCR(ppm/°C) | Tolerance | Resistance |
|--------|-------------|-------------|-------------|-----------|------------|
| SR25 | 2512 (6432) | 1W | ≤ 200 | ±1%, ±5% | 1~ 10MΩ |
| SR20 | 2010 (5025) | 1/2W | ≤ 200 | ±1%, ±5% | 1~ 10MΩ |
| SR12 | 1206 (3216) | 1/4W | ≤ 200 | ±1%, ±5% | 1~ 10MΩ |
| SR08 | 0805 (2012) | 1/8W | ≤ 200 | ±1%, ±5% | 1~ 10MΩ |
| SR06 | 0603 (1608) | 1/10W | ≤ 200 | ±1%, ±5% | 1~ 10MΩ |
| SR04 | 0402 (1005) | 1/16W | ≤ 200 | ±1%, ±5% | 1~ 10MΩ |

Surge Chip-R

| Series | Size | Rated Power | TCR(ppm/°C) | Tolerance | Resistance |
|--------|-------------|-------------|-------------|-----------------|-------------|
| WK25S | 2512 (6432) | 1W | ≤ 200 | ±5%, ±10%, ±20% | 0.27 ~ 22MΩ |
| WK20S | 2010 (5025) | 3/4W | ≤ 200 | | 0.27 ~ 22MΩ |
| WK10S | 1210 (3225) | 1/2W | ≤ 200 | | 0.27 ~ 22MΩ |
| WK12S | 1206 (3216) | 1/3W | ≤ 200 | | 0.27 ~ 22MΩ |
| WK08S | 0805 (2012) | 1/4W | ≤ 200 | | 0.27 ~ 22MΩ |

High Ohm Chip-R

| Series | Size | Rated Power | TCR(ppm/°C) | Tolerance | Resistance |
|--------|-------------|-------------|-------------|-----------|------------|
| WF12G | 1206 (3216) | 1/4W | ≤ 200 | ±1%, ±5% | 11M~100MΩ |
| WF08G | 0805 (2012) | 1/8W | ≤ 200 | ±1%, ±5% | 11M~100MΩ |
| WF06G | 0603 (1608) | 1/10W | ≤ 200 | ±1%, ±5% | 11M~100MΩ |
| WF04G | 0402 (1005) | 1/16W | ≤ 300 | ±5% | 11M~30MΩ |

High Voltage Chip-R

| Series | Size | Rated Power | TCR(ppm/°C) | Voltage (V) | Tolerance | Resistance |
|--------|-------------|-------------|-------------|-------------|-----------------|-------------|
| WK25N | 2512 (6432) | 1W | ≤ 200 | 2000 | ±5%, ±10%, ±20% | 4.7M ~ 16MΩ |
| WK20N | 2010 (5025) | 1/2W | ≤ 200 | 1500 | ±5%, ±10%, ±20% | 1M ~ 16MΩ |
| WK25V | 2512 (6432) | 1W | ≤ 200 | 800 | ±1%, ±5% | 47~ 51MΩ |
| WK20V | 2010 (5025) | 1/2W | ≤ 200 | 500 | ±1%, ±5% | 47~ 51MΩ |
| WK12V | 1206 (3216) | 1/4W | ≤ 200 | 500 | ±1%, ±5% | 47~ 51MΩ |
| WK08V | 0805 (2012) | 1/8W | ≤ 200 | 400 | ±1%, ±5% | 47~ 51MΩ |
| WK06V | 0603 (1608) | 1/10W | ≤ 200 | 200 | ±1%, ±5% | 47~ 10MΩ |

Trimable Chip-R

| Series | Size | Rated Power | TCR(ppm/°C) | Tolerance | Resistance |
|--------|-------------|-------------|-------------|----------------|------------|
| WK25M | 2512 (6432) | 1W | ≤ 200 | 0/-20%, 0/-30% | 1 ~ 4.7MΩ |
| WK20M | 2010 (5025) | 1/2W | ≤ 200 | 0/-20%, 0/-30% | 1 ~ 4.7MΩ |
| WK10M | 1210 (3225) | 1/4W | ≤ 200 | 0/-20%, 0/-30% | 1 ~ 4.7MΩ |
| WK12M | 1206 (3216) | 1/8W | ≤ 200 | 0/-20%, 0/-30% | 1 ~ 4.7MΩ |
| WK08M | 0805 (2012) | 1/10W | ≤ 200 | 0/-20%, 0/-30% | 1 ~ 4.7MΩ |
| WK06M | 0603 (1608) | 1/16W | ≤ 100 | 0/-20%, 0/-30% | 10~ 4.7MΩ |

Total lead free Chip-R (Pb < 100ppm)

| Series | Size | Rated Power | TCR(ppm/°C) | Tolerance | Resistance |
|---------|-------------|-------------|-------------|-----------|------------|
| WR25X_R | 2512 (6432) | 1W | ≤ 200 | ±1%, ±5% | 1~ 10MΩ |
| WR18X_R | 1218 (3248) | 1W | ≤ 200 | ±1%, ±5% | 1~ 10MΩ |
| WR20X_R | 2010 (5025) | 1/2W | ≤ 200 | ±1%, ±5% | 1~ 10MΩ |
| WR10X_R | 1210 (3225) | 1/3W | ≤ 200 | ±1%, ±5% | 1~ 10MΩ |
| WR12X_R | 1206 (3216) | 1/4W | ≤ 200 | ±1%, ±5% | 1~ 10MΩ |
| WR08X_R | 0805 (2012) | 1/8W | ≤ 200 | ±1%, ±5% | 1~ 10MΩ |
| WR06X_R | 0603 (1608) | 1/10W | ≤ 200 | ±1%, ±5% | 1~ 10MΩ |
| WR04X_R | 0402 (1005) | 1/16W | ≤ 200 | ±1%, ±5% | 1~ 10MΩ |
| WR02X_R | 0201 (0603) | 1/20W | ≤ 200 | ±1%, ±5% | 1~ 10MΩ |
| WA04X_R | 0402X4 | 1/16W | ≤ 200 | ±1%, ±5% | 10 ~ 1MΩ |
| WA06X_R | 0603X4 | 1/10W | ≤ 200 | ±1%, ±5% | 10 ~ 1MΩ |

High Precision Chip-R

| Series | Size | Rated Power | TCR(ppm/°C) | Tolerance | Resistance |
|--------|-------------|-------------|-------------|---------------------------------------|-------------|
| WF10H | 1210 (3225) | 1/3W | ≤ 100 | ±0.1%, ±0.5% | 10 ~ 1MΩ |
| WF12H | 1206 (3216) | 1/4W | ≤ 100 | ±0.1%, ±0.5% | 10 ~ 1MΩ |
| WF08H | 0805 (2012) | 1/8W | ≤ 100 | ±0.1%, ±0.5% | 10 ~ 1MΩ |
| WF06H | 0603 (1608) | 1/10W | ≤ 100 | ±0.1%, ±0.5% | 10 ~ 1MΩ |
| WF04H | 0402 (1005) | 1/16W | ≤ 100 | ±0.1%, ±0.5% | 10 ~ 1MΩ |
| WF25T | 2512 (6432) | 3/4W | ≤ 50 | ±0.05%, ±0.10%, ±0.25%, ±0.50%, ±1.0% | 10 ~ 1.5MΩ |
| WF25Q | 2512 (6432) | 1W | ≤ 50 | ±0.05%, ±0.10%, ±0.25%, ±0.50%, ±1.0% | 10 ~ 1.5MΩ |
| WF20T | 2010 (5025) | 1/2W | ≤ 50 | ±0.05%, ±0.10%, ±0.25%, ±0.50%, ±1.0% | 10 ~ 1.5MΩ |
| WF20Q | 2010 (5025) | 3/4W | ≤ 50 | ±0.05%, ±0.10%, ±0.25%, ±0.50%, ±1.0% | 10 ~ 1.5MΩ |
| WF10T | 1210 (3225) | 1/4W | ≤ 50 | ±0.05%, ±0.10%, ±0.25%, ±0.50%, ±1.0% | 10 ~ 1MΩ |
| WF10Q | 1210 (3225) | 2/5W | ≤ 50 | ±0.05%, ±0.10%, ±0.25%, ±0.50%, ±1.0% | 10 ~ 1MΩ |
| WF12T | 1206 (3216) | 1/8W | ≤ 50 | ±0.05%, ±0.10%, ±0.25%, ±0.50%, ±1.0% | 4.7 ~ 1MΩ |
| WF12Q | 1206 (3216) | 1/4W | ≤ 50 | ±0.05%, ±0.10%, ±0.25%, ±0.50%, ±1.0% | 4.7 ~ 1MΩ |
| WF08T | 0805 (2012) | 1/10W | ≤ 50 | ±0.05%, ±0.10%, ±0.25%, ±0.50%, ±1.0% | 4.7 ~ 1MΩ |
| WF08Q | 0805 (2012) | 1/8W | ≤ 50 | ±0.05%, ±0.10%, ±0.25%, ±0.50%, ±1.0% | 4.7 ~ 1MΩ |
| WF06T | 0603 (1608) | 1/16W | ≤ 50 | ±0.05%, ±0.10%, ±0.25%, ±0.50%, ±1.0% | 4.7 ~ 680KΩ |
| WF06Q | 0603 (1608) | 1/10W | ≤ 50 | ±0.05%, ±0.10%, ±0.25%, ±0.50%, ±1.0% | 4.7 ~ 680KΩ |
| WF04T | 0402 (1005) | 1/16W | ≤ 50 | ±0.05%, ±0.10%, ±0.25%, ±0.50%, ±1.0% | 10 ~ 100KΩ |
| WF02T | 0201 (0603) | 1/20W | ≤ 50 | ±0.10%, ±0.50% | 47 ~ 10KΩ |
| WF25U | 2512 (6432) | 3/4W | ≤ 25 | ±0.05%, ±0.10%, ±0.25%, ±0.50%, ±1.0% | 10 ~ 1.5MΩ |
| WF25R | 2512 (6432) | 1W | ≤ 25 | ±0.05%, ±0.10%, ±0.25%, ±0.50%, ±1.0% | 10 ~ 1.5MΩ |
| WF20U | 2010 (5025) | 1/2W | ≤ 25 | ±0.05%, ±0.10%, ±0.25%, ±0.50%, ±1.0% | 10 ~ 1.5MΩ |
| WF20R | 2010 (5025) | 3/4W | ≤ 25 | ±0.05%, ±0.10%, ±0.25%, ±0.50%, ±1.0% | 10 ~ 1.5MΩ |
| WF10U | 1210 (3225) | 1/4W | ≤ 25 | ±0.05%, ±0.10%, ±0.25%, ±0.50%, ±1.0% | 10 ~ 1MΩ |
| WF10R | 1210 (3225) | 2/5W | ≤ 25 | ±0.05%, ±0.10%, ±0.25%, ±0.50%, ±1.0% | 10 ~ 1MΩ |
| WF12U | 1206 (3216) | 1/8W | ≤ 25 | ±0.05%, ±0.10%, ±0.25%, ±0.50%, ±1.0% | 4.7 ~ 1MΩ |
| WF12R | 1206 (3216) | 1/4W | ≤ 25 | ±0.05%, ±0.10%, ±0.25%, ±0.50%, ±1.0% | 4.7 ~ 1MΩ |
| WF08U | 0805 (2012) | 1/10W | ≤ 25 | ±0.05%, ±0.10%, ±0.25%, ±0.50%, ±1.0% | 4.7 ~ 1MΩ |
| WF08R | 0805 (2012) | 1/8W | ≤ 25 | ±0.05%, ±0.10%, ±0.25%, ±0.50%, ±1.0% | 4.7 ~ 1MΩ |
| WF06U | 0603 (1608) | 1/16W | ≤ 25 | ±0.05%, ±0.10%, ±0.25%, ±0.50%, ±1.0% | 4.7 ~ 680KΩ |
| WF06R | 0603 (1608) | 1/10W | ≤ 25 | ±0.05%, ±0.10%, ±0.25%, ±0.50%, ±1.0% | 4.7 ~ 680KΩ |
| WF04U | 0402 (1005) | 1/16W | ≤ 25 | ±0.05%, ±0.10%, ±0.25%, ±0.50%, ±1.0% | 10 ~ 100KΩ |
| WF02U | 0201 (0603) | 1/20W | ≤ 25 | ±0.10%, ±0.50% | 47 ~ 5KΩ |
| WF12F | 1206 (3216) | 1/8W | ≤ 15 | ±0.05%, ±0.10%, ±0.25% | 25 ~ 300KΩ |
| WF08F | 0805 (2012) | 1/8W | ≤ 15 | ±0.05%, ±0.10%, ±0.25% | 25 ~ 200KΩ |
| WF06F | 0603 (1608) | 1/10W | ≤ 15 | ±0.05%, ±0.10%, ±0.25% | 25 ~ 100KΩ |
| WF04F | 0402 (1005) | 1/16W | ≤ 15 | ±0.05%, ±0.10%, ±0.25% | 25 ~ 20KΩ |
| WF12W | 1206 (3216) | 1/8W | ≤ 10 | ±0.05%, ±0.10%, ±0.25% | 25 ~ 300KΩ |
| WF08W | 0805 (2012) | 1/8W | ≤ 10 | ±0.05%, ±0.10%, ±0.25% | 25 ~ 200KΩ |
| WF06W | 0603 (1608) | 1/10W | ≤ 10 | ±0.05%, ±0.10%, ±0.25% | 25 ~ 100KΩ |
| WF04W | 0402 (1005) | 1/16W | ≤ 10 | ±0.05%, ±0.10%, ±0.25% | 25 ~ 20KΩ |
| WF12Z | 1206 (3216) | 1/8W | ≤ 5 | ±0.05%, ±0.10%, ±0.25% | 25 ~ 120KΩ |
| WF08Z | 0805 (2012) | 1/8W | ≤ 5 | ±0.05%, ±0.10%, ±0.25% | 25 ~ 80KΩ |
| WF06Z | 0603 (1608) | 1/10W | ≤ 5 | ±0.05%, ±0.10%, ±0.25% | 25 ~ 40KΩ |
| WF04Z | 0402 (1005) | 1/16W | ≤ 5 | ±0.05%, ±0.10%, ±0.25% | 25 ~ 8KΩ |

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
5. RoHs compliant and lead free products

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. Automotive.

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 Tin solder (Pb free) alloy.



Quick Reference Data

| Series No. | WR25X | WR20X | WR18X | WR10X | WR12X | WR08X | WR06X | WR04X | WR02X | WR01X |
|--|--|----------------|----------------------------|----------------|----------------------------|----------------|---------------------------------|----------------|--------------------------------------|-----------------|
| Size code | 2512 (6432) | 2010 (5025) | 1218 (3248) | 1210 (3225) | 1206 (3216) | 0805 (2012) | 0603 (1608) | 0402 (1005) | 0201 (0603) | 01005 (0402) |
| Resistance Range ±5% Tolerance (E24) ±1% Tolerance (E24+E96) | ±5% (E24): 1Ω~10MΩ; Jumper ±1% (E24+E96): 1Ω~10MΩ | | | | | | | | | |
| TCR (ppm/°C) | R > 1MΩ 1MΩ ≥ R > 10Ω R ≤ 10Ω | | ≤ ±200 ≤ ±100 ≤ ±200 | | ≤ ±200 ≤ ±100 ≤ ±200 | | ≤ ±100 ≤ ±100 -200 ~ +400 | | ≤ ±200 ≤ ±300 ≤ ±200 ≤ ±300 | |
| Max. dissipation @ Tamb=70°C | 1.0 W | 1/2 W | 1.0 W | 1/3 W | 1/4 W | 1/8 W | 1/10 W | 1/16 W | 1/20 W | 1/32 W |
| Max. Operation Voltage (DC or RMS) | 250V | 200V | 200V | 200V | 200V | 150V | 50V | 50V | 25V | 20V |
| Operation Temperature | -55 ~ +155°C | | | | | | | | -55 ~ +125°C | |
| Basic Specification | JIS C 5201-1 / IEC 60115-1 | | | | | | | | | |

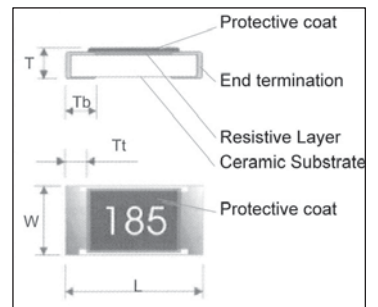
Note:

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 RCWW (Rated Continuous Working Voltage) is determined by $RCWV = \sqrt{\text{Rated Power} \times \text{Resistance Value}}$ or Max. RCWW listed above, whichever is lower.
3. Detailed TCR please refer to specific specification.

Physical Dimensions

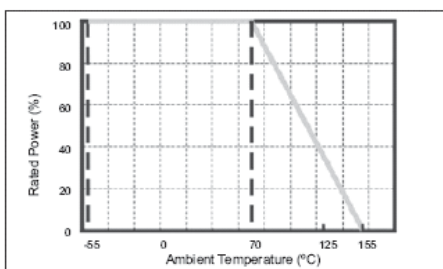
Unit: mm

| Size | 2512 (6432) | 2010 (5025) | 1218 (3248) | 1210 (3225) | 1206 (3216) | 0805 (2012) | 0603 (1608) | 0402 (1005) | 0201 (0603) | 01005 (0402) |
|------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|-----------------|
| 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 | 0.40±0.02 |
| 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 | 0.20±0.02 |
| 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 | 0.23±0.03 | 0.13±0.02 |
| 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 | 0.10±0.03 |
| 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 | 0.10±0.05 | 0.08±0.03 |

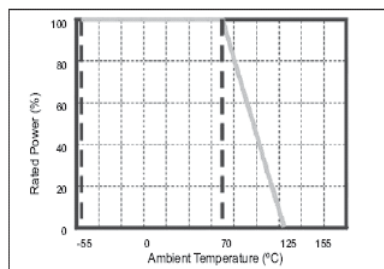


Power Deration Curve

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 (for 0201 type)

Thick Film Low Ohm/Power Low Ohm Chip Resistors

Function For Low Ohm Chip Resistors

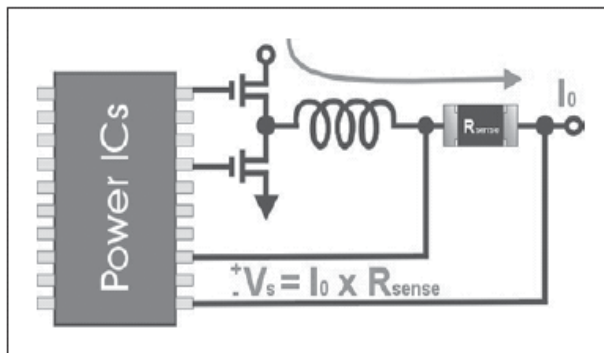
The low ohmic resistors are used to sense output current in power supply, automotive and engine control management system, and other power sensing application. As shows in figure below, the typical function of low ohmic (power) chip resistor is to be a current sensor (R_{sense}) to generate the sensing voltage (V_s) for the purpose of feedback control when output current (I_o) passed on it. The sensing voltage be treated as a signal to trigger the switches (CMOS) ON/OFF duration so that to monitor and/or adjust the output current from inductor.

Simplify to say, $V_s = I_o \times R_{sense}$.

In general case, this feedback voltage is setting around 100mV for considering both on power saving and noise robustness. To sense a 5 ampere average output current, the R_{sense} resistance value therefore be required as $100mV / 5A = 20 m\Omega$, the power dissipation will be :

$$P = I^2 \times R = 5A^2 \times 20m\Omega = 0.5Watt$$

A low ohmic chip resistor with a power rating of 1.0 watt is recommended on this application in case the power safety margin is taken into account.



Quick Reference Data of Low Ohm Chip Resistor

| Series No. | WW25X | WW20X | WW18X | WW10X | WW12X | WW08X | WW06X | WW04X |
|------------------------------------|---|-------------|-------------|-------------|-------------|-----------------|-------------|-------------|
| Size code | 2512 (6432) | 2010 (5025) | 1218 (3248) | 1210 (3225) | 1206 (3216) | 0805 (2012) | 0603 (1608) | 0402 (1005) |
| Resistance Tolerance | ±5% , ±1% | | | | | | | |
| Resistance Range | 0.020Ω ~ 0.976Ω | | | | | 0.100Ω ~ 0.976Ω | | |
| TCR (ppm/°C) | Detailed TCR please refer to specific data sheets | | | | | | | |
| Max. dissipation @ Tamb=70°C | 1 Watt | 0.5 Watt | 1 Watt | 1/3 Watt | 1/4 Watt | 1/8 Watt | 1/10 Watt | 1/16 Watt |
| Max. Operation Voltage (DC or RMS) | 250V | 200V | 200V | 200V | 200V | 100V | 50V | 50V |
| Operation Temperature | -55 ~ +155°C | | | | | | | |
| Basic Specification | JIS C 5201-1 / IEC 60115-1 | | | | | | | |

Note :

1. This is the maximum voltage that may be continuously supplied to the resistor element, see "IEC publication 60115-9" .
2. Power derating curve, and detail specification please refer to specific data sheets.
3. Resistance value will be changed by soldering condition and design of soldering pad, please design products in consideration of change of resistance value.

Quick Reference Data of Power Low Ohm Chip Resistor

| Item | General Specification | | | | | |
|------------------------------------|-----------------------|-------------|-------------|------------|------------|--------------|
| Series No. | WW25P | WW20P | WW12P | WW08P | WW06P | WW04P |
| Size code | 2512 (6432) | 2010 (5025) | 1206 (3216) | 0805(2012) | 0603(1608) | 0402(1005) |
| Resistance Tolerance | ±5% , ±1% | | | | | |
| Resistance Range | 0.047Ω ~ 0.976Ω | | | | | 0.1Ω~0.976Ω |
| TCR (ppm/°C) < 0.100Ω | ±150ppm/°C | ±150ppm/°C | ±200ppm/°C | ±200ppm/°C | ±250ppm/°C | - |
| ≥ 0.100Ω | ±100ppm/°C | ±100ppm/°C | ±100ppm/°C | ±150ppm/°C | ±200ppm/°C | 0~+300ppm/°C |
| Max. dissipation @ Tamb=70°C | 2 W | 1 W | 1/2 W | 1/3 W | 1/4 W | 1/8 W |
| Max. Operation Voltage (DC or RMS) | 300V | 200V | 200V | 150V | 50V | 50V |
| Operation Temperature | -55 ~ +155°C | | | | | |

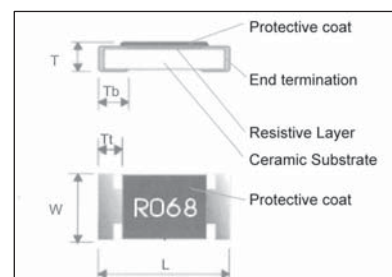
Note :

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 RCWW (Rated Continuous Working Voltage) is determined by $RCWW = \sqrt{\text{Rater Power} \times \text{Resistance Value or Max. RCWW listed above, whichever is lower.}}$
3. 2W loading with total solder-pad and trace size of 300mm²

Physical Dimensions

Unit: mm

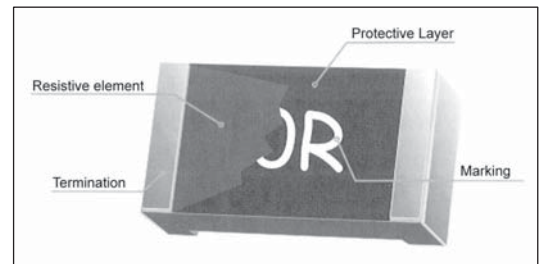
| Dimensions | WW25P | WW20P | WW12P | WW08P | WW06P | WW04P |
|------------|-----------|-----------|-----------|-----------|-----------|----------------|
| L | 6.30±0.20 | 5.00±0.20 | 3.10±0.15 | 2.00±0.15 | 1.60±0.10 | 1.00±0.05 |
| W | 3.10±0.20 | 2.50±0.20 | 1.60±0.15 | 1.20±0.15 | 0.80±0.10 | 0.50±0.05 |
| T | 0.60±0.15 | 0.60±0.10 | 0.55±0.10 | 0.50±0.10 | 0.45±0.10 | 0.35±0.05 |
| Tt | 0.60±0.25 | 0.60±0.25 | 0.50±0.25 | 0.40±0.20 | 0.30±0.20 | 0.20±0.10 |
| Tb | 1.80±0.25 | 0.65±0.25 | 0.50±0.25 | 0.40±0.20 | 0.30±0.20 | 0.25±0.05/-0.1 |



■ Metal Low Ohm Sensing Chip Resistors (0.001Ω~ 0.050Ω)

■ Description

The resistors are constructed in a high grade low resistive metal body. The resistive layer is covered with a protective coat and printed a resistance marking code over it. Finally, the two external end terminations are added. For ease of soldering the outer layer of these end terminations is a lead free terminations.



■ Quick Reference Data

| Item | General Specification | | | | | | |
|------------------------------------|---------------------------|----------|------------|-------------------------|-------------|------------------------|-------------|
| Series No. | WW25R | WW25Q | WW12R | WW12D | WW08R | WW08D | WW06R |
| Size code | 2512 (6432) | | 1206(3216) | | 0805 (2012) | | 0603 (1608) |
| Resistance Tolerance | ±5% , ±1% | | | | | | |
| Resistance Range | 1,2,3,4,5,6 7,8,9,10mΩ | 1 ~ 15mΩ | 1 ~ 15mΩ | 20, 25, 30, 40, 50mΩ | 4, 5, 10mΩ | 20, 25, 30, 40 50mΩ | 5, 10, 15mΩ |
| TCR (ppm/°C) | ±100ppm | | ±75ppm | | ±75ppm | | ±75ppm |
| Max. dissipation @ Tamb=70°C | 2 W | 1 W | 1 W | 1 W | 1/2 W | 1/2 W | 1/3 W |
| Max. Operation Current (DC or RMS) | 44.7A | | 14A | | 11A | 5A | 8.1A |
| Operation Temperature | -55 ~ +155°C | | | | | | |

| Item | General Specification | | | | | |
|------------------------------------|-----------------------------------|-----------------------|-----------------|-------|---------------------|-------|
| Series No. | WW25M | WW25N | WW20M | WW20N | WW12N | WW12M |
| Size code | 2512 (6432) | | 2010 (5025) | | 1206(3216) | |
| Resistance Tolerance | ±5% , ±1% | | | | | |
| Resistance Range | 3, 5, 10, 12, 15, 20, 25, 50mΩ | 3, 5, 10,15, 20, 25mΩ | 5, 10, 15, 20mΩ | | 5, 10, 15, 20, 25mΩ | |
| TCR (ppm/°C) | 3mΩ: ±100ppm; > 3m: ±75ppm/°C | | ± 75 ppm/°C | | ± 70 ppm/°C | |
| Max. dissipation @ Tamb=70°C | 1 W | 2 W | 1/2 W | 1 W | 1 W | 1/2 W |
| Max. Operation Voltage (DC or RMS) | 250V | | 250V | | 200V | |
| Max. Overload Voltage (DC or RMS) | 500V | | 500V | | 400V | |
| Operation Temperature | -55 ~ +155°C | | | | | |

Note :

1. This is the maximum voltage that may be continuously supplied to the resistor element, see "IEC publication 60115-8".
2. Power derating curve, and detail specification please refer to specific data sheets.
3. Resistance value will be changed by soldering condition and design of soldering pad, please design products in consideration of change of resistance value.

■ Physical Dimensions:

WW25M(0.002Ω~0.025Ω), WW25N(0.003Ω~0.025Ω), WW20N, WW12N

Unit: mm

| Symbol | 2512 | 2010 | 1206 |
|--------|-----------|-----------|-----------|
| L | 6.40±0.20 | 5.00±0.20 | 3.10±0.20 |
| W | 3.20±0.20 | 2.50±0.20 | 1.60±0.20 |
| T | 0.60±0.15 | 0.60±0.15 | 0.60±0.25 |
| Tt | 0.65±0.25 | 0.65±0.25 | 0.60±0.20 |
| Tb | 0.65±0.25 | 0.65±0.25 | 0.60±0.20 |

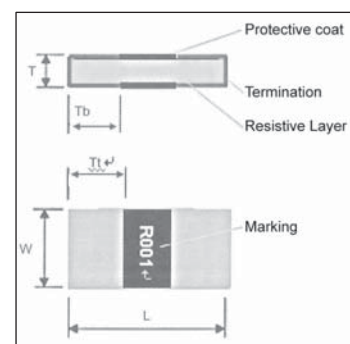
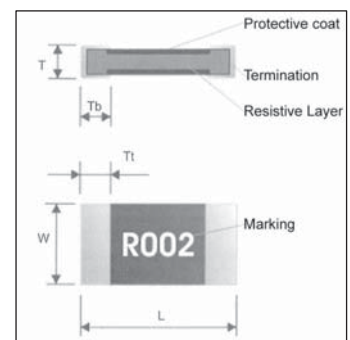
WW25M(0.001Ω), WW25N(0.001Ω~0.002Ω)

Unit: mm

| Symbol | 2512 |
|--------|-----------|
| L | 6.40±0.20 |
| W | 3.20±0.20 |
| T | 0.60±0.10 |
| Tt | 1.60±0.25 |
| Tb | 1.60±0.25 |

WW25Q, WW25R, WW12R, WW12D, WW06R

Note : 1. The detailed dimensions please refer to data sheet per type!



Chip Resistors Array : Convex Termination

Feature

1. High reliability and stability
2. Reduced size of final equipment
3. Lower assembly cost and higher surface mounted efficiency
4. Higher component and equipment reliability

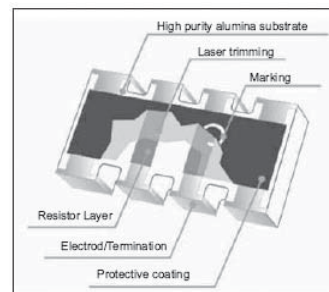
Application

1. Consumer electrical equipment, PDA Digital Camcorder,
2. EDP, Computer application
3. Mobile phone, Telecom
4. DIMM

Description and Physical Dimensions

The resistors array is 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.

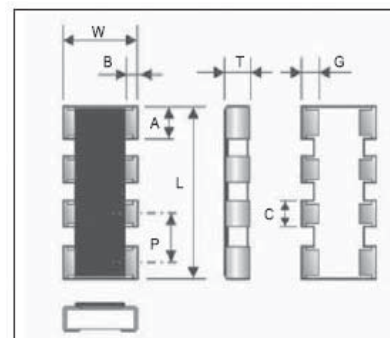
The resistive layer is covered with a protective coat. Finally, the two external end terminations are added. For ease of soldering the outer layer of these end termination is Tin solder alloy. Marking code description is depended on component size and tolerance. Following figure shown the construction of a Chip-R array.



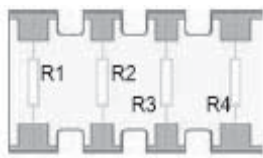
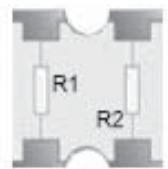
Physical Dimensions

Unit: mm

| Type | WA06X | WA04X | WA06Y | WA04Y |
|------|-----------|-----------|-----------|-----------|
| L | 3.20±0.10 | 2.00±0.10 | 1.60±0.10 | 1.00±0.10 |
| W | 1.60±0.10 | 1.00±0.10 | 1.50±0.10 | 1.00±0.10 |
| T | 0.50±0.10 | 0.45±0.10 | 0.50±0.10 | 0.35±0.10 |
| P | 0.80±0.10 | 0.50±0.05 | 1.00±0.10 | 0.65±0.10 |
| A | 0.60±0.10 | 0.40±0.10 | 0.60±0.10 | 0.34±0.10 |
| B | 0.30±0.10 | 0.20±0.10 | 0.30±0.15 | 0.20±0.15 |
| C | 0.40±0.10 | 0.30±0.05 | - | - |
| G | 0.30±0.20 | 0.25±0.10 | 0.30±0.15 | 0.25±0.17 |



Quick Reference Data

| Series No. | WA06X | WA04X | WA06Y | WA04Y |
|------------------------------------|---|----------------|---|----------------|
| Size | 0603×4(1608×4) | 0402×4(1005×4) | 0603×2(1608×4) | 0402×2(1005×2) |
| Termination construction | 8P4R,Convex | | 4P2R,Convex | |
| Resistance Tolerance | ±5%, ±1% (E24 series) | | | |
| Resistance Range | 10Ω~1MΩ(E24 series), Jumper (0Ω) | | | |
| TCR (ppm/°C) | ±200 ppm/°C | | | |
| Max. dissipation @ Tamb=70°C | 1/10 Watt | 1/16 Watt | 1/10 Watt | 1/16 Watt |
| Max. Operation Voltage (DC or RMS) | 50V | 50V | 50V | 25V |
| Max. Overload Voltage (DC or RMS) | 100V | 100V | 100V | 50V |
| Operation Temperature | -55 ~ +155 °C | | | |
| Basic Specification | JIS C5201-1 / IEC 60115-1 | | | |
| Circuit Mode: R1=R2(=R3=R4) |  | |  | |

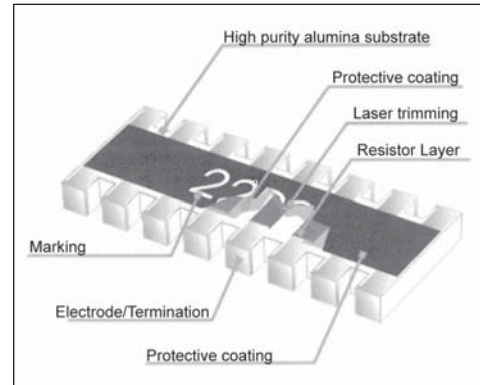
Note : Power derating curve and detail specification please refer to specific data sheets.

WA06W Chip Resistors Array 16P8R

Description

The resistors array is 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 resistors 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 termination is Tin (Pb free) solder alloy.



Quick Reference Data

| Item | General Specification | |
|--|------------------------|------------------------|
| Series No. | WA06W | WA06W_N |
| Size | 1606 (0602×8) | 1606 (0602×8) |
| Termination construction | Convex type | Convex type |
| Resistance Tolerance | ±5% (E24 series) | ±5% (E24 series) |
| Resistance Range | 10Ω~100KΩ, Jumper (0Ω) | 10Ω~100KΩ, Jumper (0Ω) |
| TCR (ppm/°C) | ± 200 ppm/°C | ± 200 ppm/°C |
| Max. dissipation @ Tamb=70°C | 1/16 W | 1/16 W |
| Max. Operation Voltage (DC or RMS) | 50V | 25V |
| Max. Overload Voltage (DC or RMS) | 100V | 50V |
| Carrier Tape width | 12mm | 8mm |
| Operation Temperature | -55 ~ +155 °C | |
| Circuit Mode: R1=R2=R3=R4=R5=R6=R7=R8 | | |

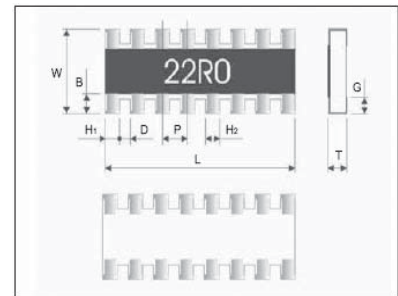
Note :

Power derating curve and detail specification please refer to specific data sheets.

Physical Dimensions:

Unit: mm

| Symbol | WA06W | WA06W_N |
|--------|-----------|-----------|
| L | 4.00±0.20 | 3.80±0.10 |
| W | 1.60±0.15 | 1.60±0.10 |
| T | 0.45±0.10 | 0.45±0.10 |
| B | 0.30±0.20 | 0.30±0.10 |
| G | 0.30±0.20 | 0.30±0.10 |
| D | 0.20±0.10 | 0.20±0.10 |
| P | 0.50±0.20 | 0.50±0.10 |
| H1 | 0.40±0.20 | 0.30±0.10 |
| H2 | 0.30±0.10 | 0.30±0.10 |



Chip Resistors Array : Concave Termination

Feature

1. High reliability and stability
2. Reduced size of final equipment
3. Lower assembly cost and higher surface mounted efficiency
4. Higher component and equipment reliability
5. Strong body and terminations
6. Excellent performance in surface mounting assembly.

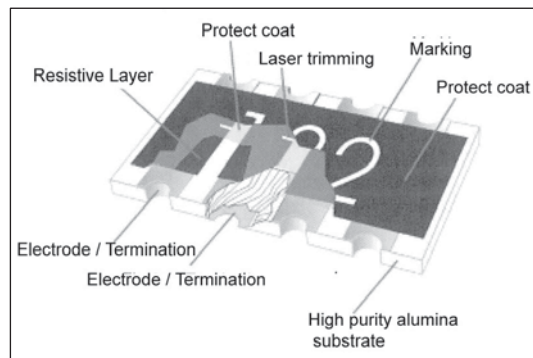
Description and Physical Dimensions

The resistor array is 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.

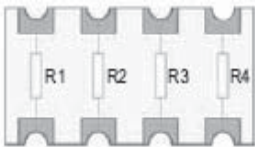
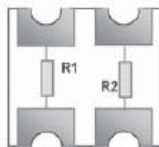
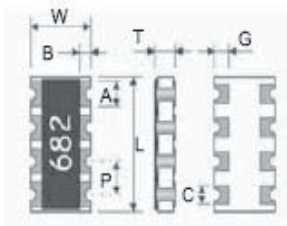
The resistive layer is covered with a protective coat. Finally, the two external end terminations are added. For ease of soldering the outer layer of these end termination is Tin solder alloy. Marking code description is depended on component size and tolerance. Following figure shown the construction of a Chip-R array.

Application

1. Consumer electrical equipment, PDA Digital Camcorder,
2. EDP, Computer application
3. Mobile phone, Telecom
4. DIMM



Quick Reference Data

| Item | General Specification | | | |
|---|--|-------------------|--|-------------|
| Series No. | WA06T | WA04T | WA04U | |
| Size | 0603×4 (1608×4) | 0402×4 (1005×4) | 0402×2 (1005×2) | |
| Termination construction | Concave type | | | |
| Resistance Tolerance | ±5% , ±1% (E24 series) | | | |
| Resistance Range | 10Ω~1MΩ, Jumper (0Ω) | | | |
| TCR (ppm/°C) | ± 200 ppm/°C | ± 300 ppm/°C | ± 300 ppm/°C | |
| Max. dissipation @ Tamb=70°C | 1/10 W | 1/16 W | 1/16 W | |
| Max. Operation Voltage (DC or RMS) | 50V | 25V | 25V | |
| Max. Overload Voltage | 100V | 50V | 50V | |
| Operation Temperature | -55 ~ +155°C | | | |
| Circuit Mode |  <p>R1=R2=R3=R4</p> | |  <p>R1 = R2</p> | |
|  | L | 3.20+0.20/-0.10mm | 2.00±0.10mm | 1.00±0.10mm |
| | W | 1.60+0.20/-0.10mm | 1.00±0.10mm | 1.00±0.10mm |
| | T | 0.60±0.20mm | 0.45±0.10mm | 0.30±0.10mm |
| | P | 0.80±0.10mm | 0.50±0.05mm | 0.50±0.05mm |
| | A | 0.60±0.15mm | 0.35±0.05mm | 0.35±0.10mm |
| | B | 0.35±0.15mm | 0.20±0.15mm | 0.25±0.15mm |
| | C | 0.50±0.15mm | 0.25±0.05mm | 0.35±0.10mm |
| | G | 0.50±0.15mm | 0.25±0.15mm | 0.25±0.15mm |

Note :

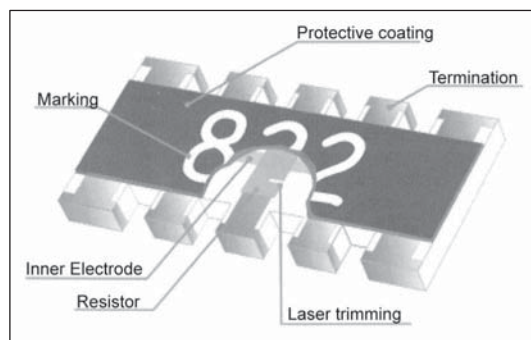
1. Power derating curve and detail specification please refer to specific data sheets.
2. Max. Operation Voltage : So called RCWW (Rated Continuous Working Voltage) is determined by $RCWW = \sqrt{\text{Rated Power} \times \text{Resistance Value}}$ or Max. RCWW listed above, whichever is lower.

WT04X Chip Resistor Network 10P8R

Description

The resistor array is 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 termination is Tin (Pb free) solder alloy.



Quick Reference Data

| Item | General Specification |
|--|-----------------------|
| Series No. | WT04X |
| Size | 0402x8 (1005x8) |
| Termination construction | Convex type |
| Resistance Tolerance | ±5% (E24 series) |
| Resistance Range | 10Ω ~ 100KΩ |
| TCR (ppm/°C) | ± 200 ppm/°C |
| Max. dissipation @ Tamb=70°C | 1/16 W |
| Max. Operation Voltage (DC or RMS) | 25V |
| Max. Overload Voltage (DC or RMS) | 50V |
| Operation Temperature | -55 ~ +155°C |
| Circuit Mode: Resistor elements on pin1 ~ pin4, pin6 ~ pin9; R1=R2=R3=R4=R6=R7=R8=R9 | |

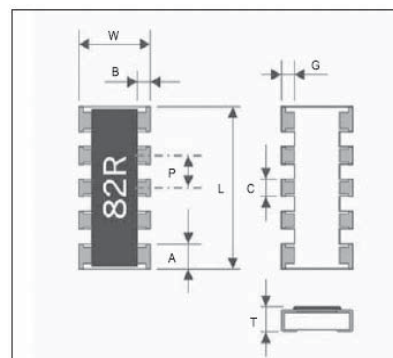
Note :

1. Power derating curve and detail specification please refer to specific data sheets.

Physical Dimensions:

Unit: mm

| Symbol | |
|--------|-----------|
| L | 3.30±0.20 |
| W | 1.60±0.15 |
| T | 0.55±0.10 |
| P | 0.64±0.05 |
| A | 0.50±0.05 |
| B | 0.40±0.15 |
| C | 0.40±0.15 |
| G | 0.40±0.15 |

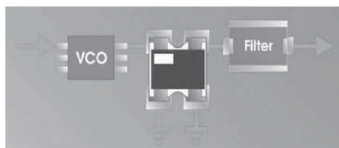


WA04P Chip Attenuator

Typical Application of Chip Attenuator

| WA04 | P | 001 | X | B | T | L |
|------------------------|----------------------------------|--|--------------------------|---|-----------------|-----------------------|
| Size code | Type code | Attenuation Range | Characteristic Impedance | Attenuation Tolerance | Termination | Packaging |
| WA04: 0402 per element | P: convex, π type attenuator | 000 = 0dB R05 = 0.5dB 001 = 1dB R15 = 1,5dB 002 = 2dB 003 = 3dB 004 = 4dB 005 = 5dB 006 = 6dB 007 = 7dB 008 = 8dB 009 = 9dB 010 = 10dB 011 = 11dB 012 = 12dB 013 = 13dB 014 = 14dB 015 = 15dB 016 = 16dB 017 = 17dB 018 = 18dB 019 = 19dB 020 = 20dB | X:50 Ω | A : ± 0.1 dB B : ± 0.3 dB C : ± 0.4 dB D : ± 0.8 dB E : ± 1.0 dB F : ± 1.5 dB G : ± 2.0 dB H : ± 2.5 dB P : - | T=7" reel taped | L=Sn base (lead free) |

π type Attenuator for VSWR improvement and output frequency level matching on VCO application.

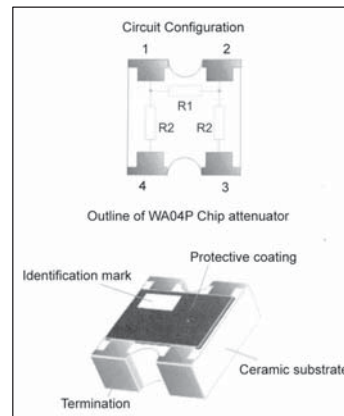
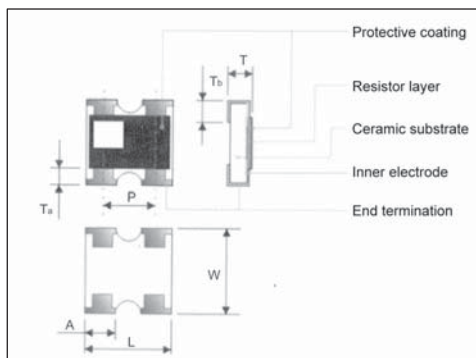


Quick Reference Data

| Item | General Specification |
|-------------------------------------|-----------------------------------|
| Series No. | WA04P |
| Size | 0402 \times 2 (1005 \times 2) |
| Termination construction | Convex type |
| Attenuation Range | 0dB, 0.5dB ~ 20dB |
| Attenuation Tolerance | |
| 0dB | - |
| 0.5dB | ± 0.1 dB |
| 1dB~ 5dB | ± 0.3 dB |
| 6dB~ 10dB | ± 0.4 dB |
| 11dB~ 13dB | ± 0.8 dB |
| 14dB | ± 1.0 dB |
| 15dB~ 16dB | ± 1.5 dB |
| 17dB~ 19dB | ± 2.0 dB |
| 20dB | ± 2.5 dB |
| Characteristic impedance | 50 Ω |
| Rated power at Tamb=70 $^{\circ}$ C | 0.1 W / package |
| Limiting Voltage (DC) | 50V |
| Frequency range (DC) | MAX. 3 GHz |
| VSWR (Voltage Standing Wave Ratio) | MAX. 1.2 |
| Number of Resistors | 3 resistors |
| Number of Terminals | 4 terminals |
| Operation Temperature | -40 ~ 125 $^{\circ}$ C |

Physical Dimensions:

| Unit: mm | WA04P |
|----------|-----------------|
| L | 1.00 \pm 0.10 |
| W | 1.00+0.10/-0 |
| T | 0.35 \pm 0.10 |
| P | 0.65 \pm 0.20 |
| A | 0.33 \pm 0.10 |
| Ta | 0.15 \pm 0.10 |
| Tb | 0.25 \pm 0.10 |



Special Application Chip Resistors

Feature

1. Provided Automotive & Anti-sulfuration resistors (MR/SR series) for Auto & Anti-sulfuration application.
2. Provided Total Lead Free resistors (WR_R series) to fulfill RoHS environmental regulation.
3. Provided trimmable resistors (WKxxM series) for customer special tolerance requirement.
4. Provided high precision tolerance (WFxxH/ WFxxT/ WFxxU/ WFxxW) down to $\pm 0.05\%$ and TCR down to $10\text{ppm}/^\circ\text{C}$ for voltage sensing application.
5. High reliability and stability.
6. Reduced size of final equipment
7. Lower assembly costs.
8. Higher component and equipment reliability
9. Special resistance, tolerance are available upon customer's request.

MR/SR Series of Automotive & Anti-sulfuration Chip Resistor

Feature

1. High reliability and stability $\pm 1\%$.
2. Sulfuration resistant
3. Automotive grade AEC Q-200 compliant.
4. 100% CCD inspection.
5. RoHS compliant and lead free.

Application

1. Automotive application.
2. Consumer electrical equipment.
3. EDP, Computer application.
4. Telecom Application.

Quick Reference Data

| Series No. | MR25X | MR20X | MR18X | MR10X | MR12X | MR08X | MR06X | MR04X |
|---|--|------------|------------|------------|--|------------|------------|------------|
| Size code | 2512(6432) | 2010(5025) | 1218(3248) | 1210(3225) | 1206(3126) | 0805(2012) | 0603(1608) | 0402(1005) |
| Resistance Range | 1 Ω ~10M Ω ($\pm 1\%$, $\pm 5\%$), Jumper | | | | 1 Ω ~10M Ω ($\pm 1\%$, $\pm 5\%$), Jumper | | | |
| TCR (ppm/ $^\circ\text{C}$) | ± 200 ppm* | | | | ± 200 ppm* | | | |
| Max. dissipation @ Tamb=70 $^\circ\text{C}$ | 1W | 1/2W | 1W | 1/2W | 1/4 W | 1/8 W | 1/10 W | 1/16 W |
| Max. Operation Voltage | 250V | 200V | 200V | 200V | 200V | 150V | 75V | 50V |
| Operation Temperature | -55 ~ +155 $^\circ\text{C}$ | | | | -55 ~ +155 $^\circ\text{C}$ | | | |

| Series No. | SR25X | SR20X | SR12X | SR08X | SR06X | SR04X |
|---|--|------------|------------|------------|------------|------------|
| Size code | 2512(6432) | 2010(5025) | 1206(3126) | 0805(2012) | 0603(1608) | 0402(1005) |
| Resistance Range | 1 Ω ~10M Ω ($\pm 1\%$, $\pm 5\%$), Jumper | | | | | |
| TCR (ppm/ $^\circ\text{C}$) | ± 200 ppm* | | | | | |
| Max. dissipation @ Tamb=70 $^\circ\text{C}$ | 1W | 1/2 W | 1/4 W | 1/8 W | 1/10 W | 1/16 W |
| Max. Operation Voltage | 250V | 200V | 200V | 150V | 75V | 50V |
| Operation Temperature | -55 ~ +155 $^\circ\text{C}$ | | | | | |

Remark: *Detail specification please refer to specific data sheets!

*MR series can withstand H2S 3ppm \times 1000hrs.

*SR series can withstand H2S 1000ppm \times 720hrs.

WR_R Series of Total Lead Free Chip Resistors

Feature

1. High reliability and stability
2. Reduced size of final equipment
3. Lower assembly cost
4. Higher component and equipment reliability
5. RoHS compliant and total lead free

Quick Reference Data

| Series No. | WR10_R | WR12_R | WR08_R | WR06_R | WR04_R | WR02_R |
|---|--|------------|------------|------------|------------|-----------------------------|
| Size code | 1210(3225) | 1206(3216) | 0805(2012) | 0603(1608) | 0402(1005) | 0201(0603) |
| Resistance Range | 1 Ω ~10M Ω ($\pm 1\%$, $\pm 5\%$), Jumper | | | | | |
| TCR (ppm/ $^\circ\text{C}$) | ± 200 ppm* | | | | | |
| Max. dissipation @ Tamb=70 $^\circ\text{C}$ | 1/3 W | 1/4 W | 1/8 W | 1/10 W | 1/16 W | 1/20 W |
| Max. Operation Voltage (DC or RMS) | 200V | 200V | 150V | 50V | 50V | 25V |
| Operation Temperature | -55 ~ +155 $^\circ\text{C}$ | | | | | -55 ~ +125 $^\circ\text{C}$ |

Remark: *Detail specification please refer to specific data sheets!

Part No. Definition

| 1 st code | 2 nd code | 3 rd - 4 th code | 5 th code | 6 th - 9 th code | 10 th code | 11 th code | 12 th code |
|----------------------|----------------------|--|----------------------|--|-----------------------|-----------------------|-----------------------|
| □ | □ | □□ | □ | □□□□ | □ | □ | R |
| WTC | Type code | Size code | Functional code | Marking code (Resistance) | Tolerance code | Packaging code | Termination code |
| For example: | | | | | | | |
| W | R | 04 | X | 1000 | F | T | R |

WKxxM Series of Trimmable Chip Resistors

Feature

1. High precision, reliability and stability
2. Miniature size down to 00603 (1608)

Description

The resistors are constructed on 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.

The resistive layer is covered with a transparent protective coat. Finally, the two external end terminations are added. For ease of soldering the outer layer of these end termination is Tin (Pb free) solder alloy.

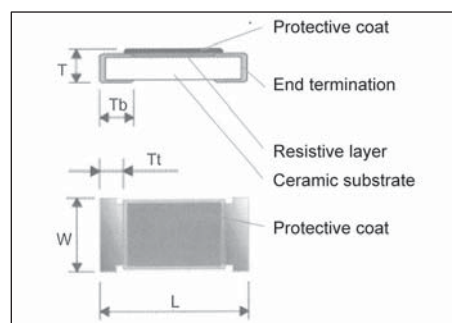
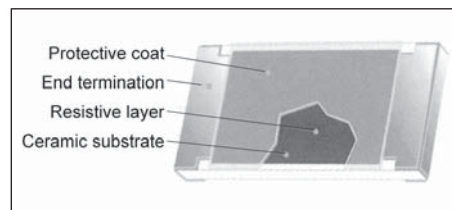
Application

1. Automotive application.
2. Consumer electrical equipment.
3. EDP, Computer application.
4. Telecom Application.

Physical Dimensions

Unit: mm

| Type | WK25M | WK20M | WK10M | WK12M | WK08M | WK06M |
|------|-----------|-----------|-----------|-----------|-----------|-----------------|
| L | 6.30±0.15 | 5.00±0.15 | 3.10±0.15 | 3.10±0.15 | 2.00±0.10 | 1.60±0.10 |
| W | 3.20±0.15 | 2.50±0.15 | 2.50±0.15 | 1.60±0.15 | 1.25±0.10 | 0.80±0.15/-0.10 |
| T | 0.55±0.15 | 0.55±0.15 | 0.55±0.15 | 0.55±0.10 | 0.55±0.10 | 0.45±0.10 |
| Tb | 0.60±0.20 | 0.60±0.20 | 0.50±0.25 | 0.50±0.25 | 0.40±0.20 | 0.30±0.10 |
| Tt | 0.60±0.20 | 0.60±0.20 | 0.50±0.25 | 0.50±0.25 | 0.40±0.20 | 0.30±0.10 |



Quick Reference Data

| Series No. | WK25M | WK20M | WK10M | WK12M | WK08M | WK06M |
|------------------------------------|------------------------------------|-------------|------------|------------|------------|-------------|
| Size code | 2512 (6332) | 2010 (5025) | 1210(3225) | 1206(3216) | 0805(2012) | 0603(1608) |
| Resistance Tolerance | 0/-20%(Y) and 0/-30%(X) E24 series | | | | | |
| Resistance Range | 1Ω ~ 4.7MΩ | | | | | 10Ω ~ 4.7MΩ |
| TCR (ppm/°C) | 10Ω ~ 4.7MΩ: ±200 ppm/°C | | | | | ±200 ppm/°C |
| | 1Ω ~ 9.1Ω: -200 ~ +500 ppm/°C | | | | | |
| Max. dissipation @ Tamb=70°C | 1 W | 1/2 W | 1/4 W | 1/8 W | 1/10 W | 1/16 W |
| Max. Operation Voltage (DC or RMS) | 200V | 200V | 200V | 200V | 150V | 50V |
| Operation Temperature | -55 ~ +125 °C | | | | | |
| Basic Specification | JIS C 5201-1 / IEC 60115-1 | | | | | |

WKxxV Series of High Voltage Chip Resistors

Feature

1. Special material and design for high working voltage required
2. Compatible with flow and reflow soldering.
3. Suitable for lead free soldering.

Application

1. Power supply.
2. Automotive industry.
3. Measurement instrument.
4. Back light inverter.
5. Medical or Military equipment

Quick Reference Data

| Series No. | WK25N | WK20N | WK25V | WK20V | WK12V | WK08V | WK06V |
|------------------------------------|---|-------------|-------------|-------------|------------|------------|------------|
| Size code | 2512 (6332) | 2010 (5025) | 2512 (6332) | 2010 (5025) | 1206(3216) | 0805(2012) | 0603(1608) |
| Resistance Tolerance | ±5% ; ±10% | | ±5% ; ±1% | | | | |
| Resistance Range | 4.7MΩ ~ 16MΩ | 1MΩ ~ 16MΩ | 47Ω ~ 51MΩ | | | | 47Ω ~ 10MΩ |
| TCR (ppm/°C) | ± 200 ppm/°C * detail refer to data sheet | | | | | | |
| Max. dissipation @ Tamb=70°C | 1 W | 1/2W | 1 W | 1/2 W | 1/4 W | 1/8 W | 1/10 W |
| Max. Operation Voltage (DC or RMS) | 2000V | 1500V | 800V | 500V | 500V | 400V | 200V |
| Operation Temperature | -55 ~ +125 °C | | | | | | |

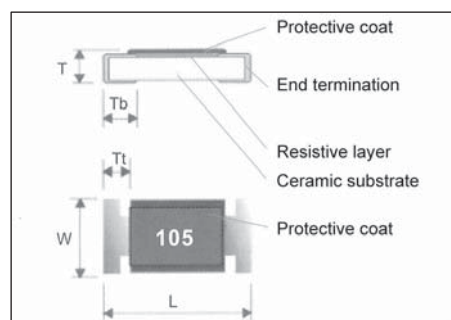
Note :

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 RCWW (Rated Continuous Working Voltage) is determined by $RCWW = \sqrt{\text{Rater Power} \times \text{Resistance Value}}$ or Max. RCWW listed above, whichever is lower.

Physical Dimensions

Unit: mm

| Symbol | WK25N | WK20N | WK25V | WK20V | WK12V | WK08V | WK06V |
|--------|-----------|-----------|-----------|-----------|-----------|-----------|-----------------|
| L | 6.30±0.15 | 5.00±0.15 | 6.30±0.15 | 5.00±0.15 | 3.10±0.15 | 2.00±0.10 | 1.60±0.10 |
| W | 3.20±0.15 | 2.50±0.15 | 3.20±0.15 | 2.50±0.15 | 1.60±0.15 | 1.25±0.10 | 0.80±0.15/-0.10 |
| T | 0.55±0.15 | 0.55±0.15 | 0.55±0.15 | 0.55±0.15 | 0.55±0.10 | 0.55±0.10 | 0.45±0.10 |
| Tt | 0.60±0.20 | 0.50±0.20 | 0.60±0.20 | 0.60±0.20 | 0.50±0.25 | 0.40±0.20 | 0.30±0.10 |
| Tb | 0.60±0.20 | 0.60±0.20 | 0.60±0.20 | 0.60±0.20 | 0.50±0.25 | 0.40±0.20 | 0.30±0.10 |



WFxxP Series of High Power Chip Resistors

Feature

1. High power rating and compact size
2. High reliability and stability
3. Reduced size of final equipment
4. Lead free product is upon customer requested

Application

1. Power supply
2. PDA
3. Digital meter
4. Computer
5. Automotives.

Quick Reference Data

| Item | General Specification | | | | | | |
|------------------------------------|-----------------------|------------|------------|------------|------------|-------------|------------|
| Series No. | WF25P | WF20P | WF10P | WF12P | WF08P | WF06P | WF04P |
| Size code | 2512(6432) | 2010(5025) | 1210(3225) | 1206(3216) | 0805(2012) | 0603 (1608) | 0402(1005) |
| Resistance Tolerance | ±1% , ±5% | | | | | | |
| Resistance Range | 0Ω, 1Ω ~ 1MΩ | | | | | | |
| TCR (ppm/°C) | ± 100 ppm/°C | | | | | | |
| Max. dissipation @ Tamb=70°C | 2W | 1W | 1/2W | 1/2W | 1/4W | 1/8W | 1/8W |
| Max. Operation Voltage (DC or RMS) | 300V | 200V | 200V | 200V | 150V | 50V | 50V |
| Operation Temperature | -55 ~ +155°C | | | | | | |

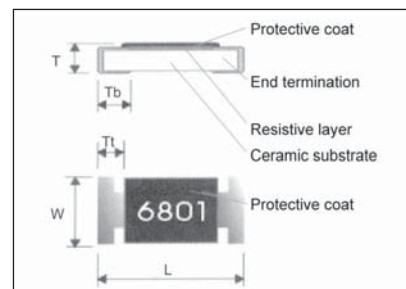
Note :

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 $RCWV = \sqrt{\text{Rater Power} \times \text{Resistance Value}}$ or Max. RCWV listed above, whichever is lower.
3. 2W loading with total solder-pad and trace size of 300mm²
4. 0Ω maximum resistance Rmax < 15mΩ and rated current < 4Amp

Physical Dimensions

Unit: mm

| Symbol | WF25P | WF20P | WF10P | WF12P | WF08P | WF06P | WF04P |
|--------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| L | 6.30±0.20 | 5.00±0.20 | 3.10±0.10 | 3.10±0.15 | 2.00±0.15 | 1.60±0.10 | 1.00±0.05 |
| W | 3.10±0.20 | 2.50±0.20 | 2.60±0.10 | 1.60±0.15 | 1.20±0.15 | 0.80±0.10 | 0.50±0.05 |
| T | 0.60±0.15 | 0.60±0.10 | 0.55±0.10 | 0.55±0.10 | 0.50±0.10 | 0.45±0.10 | 0.35±0.05 |
| Tt | 0.60±0.25 | 0.60±0.25 | 0.50±0.20 | 0.50±0.25 | 0.40±0.20 | 0.30±0.20 | 0.25±0.10 |
| Tb | 1.80±0.25 | 0.60±0.25 | 0.50±0.20 | 0.50±0.25 | 0.40±0.20 | 0.30±0.20 | 0.25±0.10 |



WKxxS Series of Anti-Surge Chip Resistors

Feature

1. Power rating and compact size
2. High reliability and stability
3. Reduced size of final equipment
4. Surge protection

Application

1. Power supply.
2. Measurement instrument.
3. Automotive industry.
4. Medical or Military equipment.

Quick Reference Data

| Item | General Specification | | | | |
|------------------------------------|---------------------------|------------|------------|------------|------------|
| Series No. | WK25S | WK20S | WK10S | WK12S | WK08S |
| Size code | 2512(6432) | 2010(5025) | 1210(3225) | 1206(3216) | 0805(2012) |
| Resistance Tolerance | ±5% , ±10% , ±20% , (E24) | | | | |
| Resistance Range | 0.27Ω ~ 22MΩ | | | | |
| TCR (ppm/°C) | ± 200 ppm/°C | | | | |
| Max. dissipation @ Tamb=70°C | 1 W | 3/4W | 1/2W | 1/4W | 1/8W |
| Max. Operation Voltage (DC or RMS) | 200V | | | | 150V |
| Operation Temperature | -55 ~ +155°C | | | | |

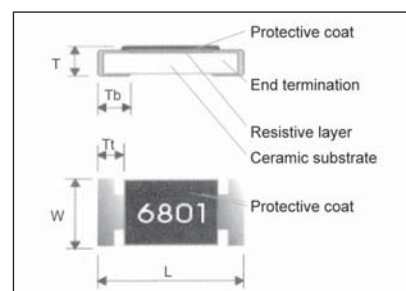
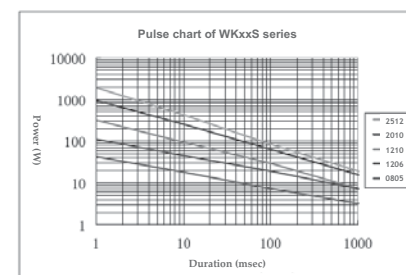
Note :

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 $RCWV = \sqrt{\text{Rater Power} \times \text{Resistance Value}}$ or Max. RCWV listed above, whichever is lower.

Physical Dimensions

Unit: mm

| Symbol | WK25S | WK20S | WK10S | WK12S | WK08S |
|--------|-----------|-----------|-----------|-----------|-----------|
| L | 6.30±0.15 | 5.00±0.15 | 3.20±0.15 | 3.20±0.15 | 2.00±0.10 |
| W | 3.20±0.15 | 2.50±0.15 | 2.50±0.15 | 1.60±0.15 | 1.25±0.10 |
| T | 0.55±0.15 | 0.55±0.15 | 0.55±0.15 | 0.55±0.10 | 0.55±0.10 |
| Tt | 0.30±0.15 | 0.30±0.15 | 0.30±0.20 | 0.30±0.20 | 0.30±0.20 |
| Tb | 0.60±0.20 | 0.60±0.20 | 0.50±0.25 | 0.50±0.25 | 0.40±0.20 |



High Precision Chip Resistors

Narrow Tolerance Thick Film TC100 WFxxH Series

| Series No. | WF12H | WF08H | WF06H | WF04H |
|------------------------------------|----------------------------|------------|------------|------------|
| Size | 1206(3216) | 0805(2012) | 0603(1608) | 0402(1005) |
| Resistance Tolerance | ±0.5%, ±0.1% | | | |
| Resistance Range | 10Ω ~ 1MΩ (E96+E24 series) | | | |
| TCR (ppm/°C) | ±100 ppm/°C | | | |
| Max. dissipation @ Tamb=70°C | 1/4 W | 1/8 W | 1/10 W | 1/16 W |
| Max. Operation Voltage (DC or RMS) | 200V | 100V | 50V | 50V |
| Operation Temperature | -55 ~ +155°C | | | |
| Basic Specification | JIS C5201-1 / IEC 60115-1 | | | |

(Detail specification please refer to specific data sheets)

Narrow Tolerance Thin Film TC50 WFxxT/ WFxxQ Series

| Series No. | WF25T | WF25Q | WF20T | WF20Q | WF10T | WF10Q | WF12T | WF12Q | WF08T | WF08Q | WF06T | WF06Q | WF04T |
|------------------------------------|---------------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| Size | 2512 (6432) | 2512 (6432) | 2010 (5025) | 2010 (5025) | 1210 (3225) | 1210 (3225) | 1206 (3216) | 1206 (3216) | 0805 (2012) | 0805 (2012) | 0603 (1608) | 0603 (1608) | 0402 (1005) |
| Resistance Tolerance | ±1%, ±0.5%, ±0.1%, ±0.05% | | | | | | | | | | | | |
| Resistance Range | 10 ~ 1.5MΩ | | | | 10 ~ 1MΩ | | 4.7 ~ 1MΩ | | | 4.7 ~ 680KΩ | | 10 ~ 100KΩ | |
| TCR (ppm/°C) | ±50 ppm/°C | | | | | | | | | | | | |
| Max. dissipation @ Tamb=70°C | 3/4W | 1W | 1/2W | 3/4W | 1/4W | 2/5W | 1/8W | 1/4W | 1/10W | 1/8W | 1/16W | 1/10W | 1/16W |
| Max. Operation Voltage (DC or RMS) | 200V | 200V | 200V | 200V | 200V | 200V | 200V | 200V | 100V | 150V | 50V | 75V | 25V |
| Operation Temperature | -55 ~ +155°C | | | | | | | | | | | | |
| Basic Specification | JIS C5201-1 / IEC 60115-1 | | | | | | | | | | | | |

(Detail specification please refer to specific data sheets)

Narrow Tolerance Thin Film TC25 WFxxU/ WFxxR Series

| Series No. | WF25U | WF25R | WF20U | WF20R | WF10U | WF10R | WF12U | WF12R | WF08U | WF08R | WF06U | WF06R | WF04U |
|------------------------------------|---------------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| Size | 2512 (6432) | 2512 (6432) | 2010 (5025) | 2010 (5025) | 1210 (3225) | 1210 (3225) | 1206 (3216) | 1206 (3216) | 0805 (2012) | 0805 (2012) | 0603 (1608) | 0603 (1608) | 0402 (1005) |
| Resistance Tolerance | ±1%, ±0.5%, ±0.1%, ±0.05% | | | | | | | | | | | | |
| Resistance Range | 10 ~ 1.5MΩ | | | | 10 ~ 1MΩ | | 4.7 ~ 1MΩ | | | 4.7 ~ 680KΩ | | 10 ~ 100KΩ | |
| TCR (ppm/°C) | ±25 ppm/°C | | | | | | | | | | | | |
| Max. dissipation @ Tamb=70°C | 3/4W | 1W | 1/2W | 3/4W | 1/4W | 2/5W | 1/8W | 1/4W | 1/10W | 1/8W | 1/16W | 1/10W | 1/16W |
| Max. Operation Voltage (DC or RMS) | 200V | 200V | 200V | 200V | 200V | 200V | 200V | 200V | 100V | 150V | 50V | 75V | 50V |
| Operation Temperature | -55 ~ +155°C | | | | | | | | | | | | |
| Basic Specification | JIS C5201-1 / IEC 60115-1 | | | | | | | | | | | | |

(Detail specification please refer to specific data sheets)

Narrow Tolerance Thin Film TC15 WFxxF Series

| Series No. | WF12F | WF08F | WF06F | WF04F |
|------------------------------------|---------------------------|-------------|-------------|-------------|
| Size | 1206 (3216) | 0805 (2012) | 0603 (1608) | 0402 (1005) |
| Resistance Tolerance | ±0.5%, ±0.1%, ±0.05% | | | |
| Resistance Range | 25 ~ 300KΩ | 25 ~ 200KΩ | 25 ~ 100KΩ | 25 ~ 20KΩ |
| TCR (ppm/°C) | ±15 ppm/°C | | | |
| Max. dissipation @ Tamb=70°C | 1/8W | 1/8W | 1/10W | 1/16W |
| Max. Operation Voltage (DC or RMS) | 150V | 100V | 50V | 25V |
| Operation Temperature | -55 ~ +155°C | | | |
| Basic Specification | JIS C5201-1 / IEC 60115-1 | | | |

(Detail specification please refer to specific data sheets) * Sample is available upon request

Narrow Tolerance Thin Film TC10 WFxxW Series

| Series No. | WF12W | WF08W | WF06W | WF04W |
|------------------------------------|---------------------------|------------|------------|------------|
| Size | 1206(3216) | 0805(2012) | 0603(1608) | 0402(1005) |
| Resistance Tolerance | ±0.5%, ±0.1%, ±0.05% | | | |
| Resistance Range | 25 ~ 300KΩ | 25 ~ 200KΩ | 25 ~ 100KΩ | 25 ~ 20KΩ |
| TCR (ppm/°C) | ±10 ppm/°C | | | |
| Max. dissipation @ Tamb=70°C | 1/8W | 1/8W | 1/10W | 1/16W |
| Max. Operation Voltage (DC or RMS) | 150V | 100V | 50V | 25V |
| Operation Temperature | -55 ~ +155°C | | | |
| Basic Specification | JIS C5201-1 / IEC 60115-1 | | | |

(Detail specification please refer to specific data sheets)

Narrow Tolerance Thin Film TC5 WFxxZ Series

| Series No. | WF12Z | WF08Z | WF06Z | WF04Z |
|------------------------------------|---------------------------|------------|------------|------------|
| Size | 1206(3216) | 0805(2012) | 0603(1608) | 0402(1005) |
| Resistance Tolerance | ±0.5%, ±0.1%, ±0.05% | | | |
| Resistance Range | 25 ~ 120KΩ | 25 ~ 80KΩ | 25 ~ 40KΩ | 25 ~ 8KΩ |
| TCR (ppm/°C) | ±5 ppm/°C | | | |
| Max. dissipation @ Tamb=70°C | 1/8W | 1/8W | 1/10W | 1/16W |
| Max. Operation Voltage (DC or RMS) | 150V | 100V | 50V | 25V |
| Operation Temperature | -55 ~ +155°C | | | |
| Basic Specification | JIS C5201-1 / IEC 60115-1 | | | |

(Detail specification please refer to specific data sheets)

Test and Requirements

For WR Series

| Test | Procedure / Test Method | Requirements | |
|---|---|---|--------|
| | | Resistor | 0Ω |
| Electrical Characteristics JISC5201-1: 1998 Clause 4.8 | - DC resistance values measurement - Temperature Coefficient of Resistance (T.C.R) Natural resistance change per change in degree centigrade. $[(R2-R1)/R1(T2-T1)] \times 10^6$ (ppm /°C) T1:20°C+5°C-1°C R1:Resistance at reference temperature (20°C+5°C/-1°C) R2:Resistance at test temperature (-55°C or +155°C) | Within the specified tolerance Refer to "QUICK REFERENCE DATA" | < 50mΩ |
| Resistance to soldering heat(R.S.H) JISC5201-1:1998 Clause 4.18 | Un-mounted chips completely immersed for 10±1second in a SAC solder bath at 260°C±5°C | ±5%: $\Delta R/R_{max}$. (1%+0.05Ω) ±1%: $\Delta R/R_{max}$. (0.5%+0.05Ω) no visible damage | < 50mΩ |
| Solder ability JISC5201-1:1998 Clause 4.17 | Un-mounted chips completely immersed for 2±0.5 second in a SAC solder bath at 235°C±5°C | 95% coverage min., good tinning and no visible damage | |
| Temperature cycling JISC5201-1:1998 Clause 4.19 | 30minutes at -55°C±3°C, 2~3minutes at 20°C+5°C-1°C,30minutes at +155°C±3°C,2~3minutes at 20°C+5°C-1°C,total 5continuous cycles | ±5%: $\Delta R/R_{max}$. (1%+0.05Ω) ±1%: $\Delta R/R_{max}$. (0.5%+0.05Ω) no visible damage | < 50mΩ |
| High Temperature Exposure MIL-STD-202 Mothod 108 | 1000+48/-0 hours; without load in a temperature chamber controlled 155°C±3°C | ±5%: $\Delta R/R_{max}$. (2%+0.1Ω) ±1%: $\Delta R/R_{max}$. (1%+0.1Ω) no visible damage | < 50mΩ |
| Bending strength JISC5201-1:1998 Clause 4.33 | Resistors mounted on a 90mm glass epoxy resin PCB(FR-4), bending once 3mm for 10sec, 5mm for WR04 | ±5%: $\Delta R/R_{max}$. (1%+0.05Ω) ±1%: $\Delta R/R_{max}$. (1%+0.05Ω) no visible damage | < 50mΩ |
| Adhesion JISC5201-1:1998 Clause 4.32 | Pressurizing force: 5N, Test time: 10±1sec. | No remarkable damage or removal of the terminations | |
| Short Time Overload (STOL) JISC5201-1:1998 Clause 4.13 | 2.5 times RCWV or max. overload voltage, for 5seconds | ±5%: $\Delta R/R_{max}$. (2%+0.1Ω) ±1%: $\Delta R/R_{max}$. (1%+0.1Ω) no visible damage | < 50mΩ |
| Load life in Humidity JISC5201-1:1998 Clause 4.24 | 1000+48/-0 hours, loaded with RCWV or Vmax in humidity chamber controller 40°C±2°C at and 90~95% relative humidity, 1.5 hours on and 0.5 hours off | ±5%: $\Delta R/R_{max}$. (2%+0.1Ω) ±1%: $\Delta R/R_{max}$. (1%+0.1Ω) no visible damage | < 50mΩ |
| Load life (endurance) JISC5201-1:1998 Clause 4.25 | 1000+48/-0 hours, loaded with RCWV or Vmax in chamber controller 70°C±2°C 1.5 hours on and 0.5 hours off | ±5%: $\Delta R/R_{max}$. (2%+0.1Ω) ±1%: $\Delta R/R_{max}$. (1%+0.1Ω) no visible damage | < 50mΩ |
| Insulation Resistance JISC5201-1:1998 Clause 4.6 | Apply the maximum overload voltage (DC) for 1minute | $R \geq 10G\Omega$ | |
| Dielectric Withstand Voltage JISC5201-1:1998 Clause 4.7 | Apply the maximum overload voltage (AC) for 1minute | No breakdown or flashover | |

■ For WW Series

| Test | Procedure / Test Method | Requirements |
|---|--|---|
| | | Resistor |
| Electrical Characteristics JISC5201-1: 1998 Clause 4.8 | - DC resistance values measurement - Temperature Coefficient of Resistance (T.C.R) Natural resistance change per change in degree centigrade. $[(R2-R1)/R1(T2-T1)] \times 10^6$ (ppm/°C) T1:20°C+5°C-1°C R1:Resistance at reference temperature (20°C+5°C/-1°C) R2:Resistance at test temperature (-55°C or +155°C) | Within the specified tolerance Refer to "QUICK REFERENCE DATA" |
| Resistance to soldering heat(R.S.H) JISC5201-1:1998 Clause 4.18 | Un-mounted chips completely immersed for 10±1second in a SAC solder bath at 260°C±5°C | ΔR/R max. ±(1%+0.005Ω) no visible damage |
| Solder ability JISC5201-1:1998 Clause 4.17 | Un-mounted chips completely immersed for 2±0.5 second in a SAC solder bath at 235°C±5°C | 95% coverage min., good tinning and no visible damage |
| Temperature cycling JISC5201-1:1998 Clause 4.19 | 30minutes at -55°C±3°C, 2~3minutes at 20°C+5°C-1°C,30minutes at +155°C±3°C,2~3minutes at 20°C+5°C-1°C,total 5continuous cycles | ΔR/R max. ±(1%+0.005Ω) no visible damage |
| High Temperature Exposure MIL-STD-202 Method 108 | 1000+48/-0 hours; without load in a temperature chamber controlled 155°C±3°C | ΔR/R max. ±(3%+0.005Ω) no visible damage |
| Bending strength JISC5201-1:1998 Clause 4.33 | Resistors mounted on a 90mm glass epoxy resin PCB(FR-4), bending once 3mm for 10sec, 5mm for WR04 | ΔR/R max. ±(1%+0.005Ω) no visible damage |
| Adhesion JISC5201-1:1998 Clause 4.32 | Pressurizing force: 5N, Test time: 10±1sec. | No remarkable damage or removal of the terminations |
| Short Time Overload (STOL) JISC5201-1:1998 Clause 4.13 | 2.5 times RCWV or max. overload voltage, for 5 seconds | ΔR/R max. ±(2%+0.005Ω) no visible damage |
| Load life in Humidity JISC5201-1:1998 Clause 4.24 | 1000+48/-0 hours, loaded with RCWV or Vmax in humidity chamber controller 40°C±2°C at and 90~95% relative humidity, 1.5 hours on and 0.5 hours off | ΔR/R max. ±(3%+0.005Ω) no visible damage |
| Load life (endurance) JISC5201-1:1998 Clause 4.25 | 1000+48/-0 hours, loaded with RCWV or Vmax in chamber controller 70°C±2°C 1.5 hours on and 0.5 hours off | ΔR/R max. ±(3%+0.005Ω) no visible damage |
| Insulation Resistance JISC5201-1:1998 Clause 4.6 | Apply the maximum overload voltage (DC) for 1minute | R ≥ 10GΩ |
| Dielectric Withstand Voltage JISC5201-1:1998 Clause 4.7 | Apply the maximum overload voltage (AC) for 1minute | No breakdown or flashover |

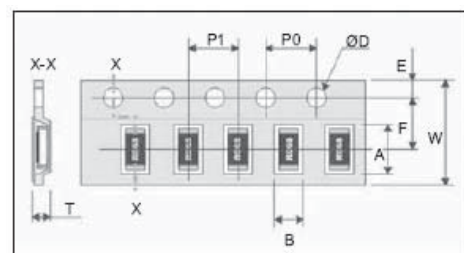
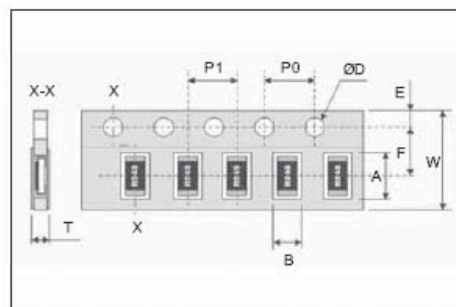
Packing on Tape and Reel: All specifications are in accordance with IEC 60286-3 !

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

Unit: mm

| Component Size / Series | W | F | E | PO | ΦD |
|--|-----------|-----------|-----------|-----------|-----------|
| 1210, 1206, 0805, 0603, 0402, WA06X, WA06T, WA04X, WA04Y, WA04P, WA04T, WA04U, WT04X | 8.00±0.30 | 3.50±0.20 | 1.75±0.10 | 4.00±0.10 | Φ1.50±0.1 |
| WA06W | 12.0±0.10 | 5.50±0.05 | | | |
| WR02X | 8.00±0.20 | 3.50±0.05 | | | |

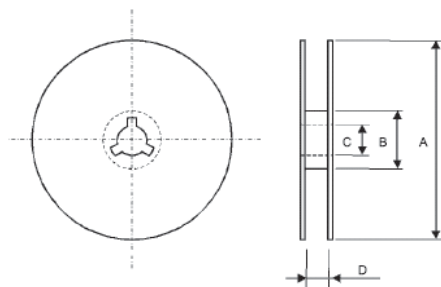
| Component Size / Series | A | B | P1 | T |
|--------------------------|-------------|-------------|-----------|-----------|
| 1206(3216), WA06X, WA06T | 3.60±0.20 | 2.00±0.20 | 4.00±0.10 | Max. 1.0 |
| 0805(2012) | 2.40±0.20 | 1.65±0.20 | | 0.65±0.05 |
| 0603(1608) | 1.90±0.20 | 1.10±0.20 | | 0.40±0.05 |
| 0402(1005) | 1.20±0.10 | 0.70±0.10 | 2.00±0.10 | 0.40±0.05 |
| WA04X, WA04T | 2.20±0.20 | 1.20±0.20 | 2.00±0.05 | Max. 0.6 |
| WA04Y, WA04P, WA04U | 1.15±0.10 | 1.15±0.10 | 2.00±0.05 | 0.45±0.05 |
| WT04X | 3.45+0.2/-0 | 1.85+0.2/-0 | 4.00±0.10 | 0.85±0.05 |
| WA06W | 4.20+0.2/-0 | 1.80+0.2/-0 | 4.00±0.10 | 0.65±0.05 |
| WR02X | 0.67±0.05 | 0.37±0.05 | 2.00±0.05 | 0.45±0.05 |
| 1210(3225) | 3.60±0.20 | 3.00±0.20 | 4.00±0.10 | Max. 1.0 |



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±0.10 | | |
| E | 1.75±0.10 | | |
| P1 | 4.00±0.10 | 8.00±0.10 | |
| P0 | 4.00±0.10 | | |
| ΦD | Φ1.50±0.1 | | |
| T | Max. 1.2 | | |



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

Unit: mm

| Reel/Tape | A | B | C | D |
|------------------------|-------------|-------------|-----------|-----------|
| 7" reel for 8mm tape | Φ178.0±0.20 | Φ60.0±1.00 | 13.0±0.20 | 9.00±0.50 |
| 7" reel for 12mm tape | | | | 12.4±1.00 |
| 10" reel for 8mm tape | Φ254.0±2.00 | Φ100.0±1.00 | 13.0±0.20 | 9.00±0.50 |
| 10" reel for 12mm tape | Φ254.0±2.00 | Φ100.0±1.00 | 13.0±0.20 | 14.0±0.20 |
| 13" reel for 8mm tape | Φ330.0±2.00 | Φ100.0±1.00 | 13.0±0.20 | 9.00±0.50 |

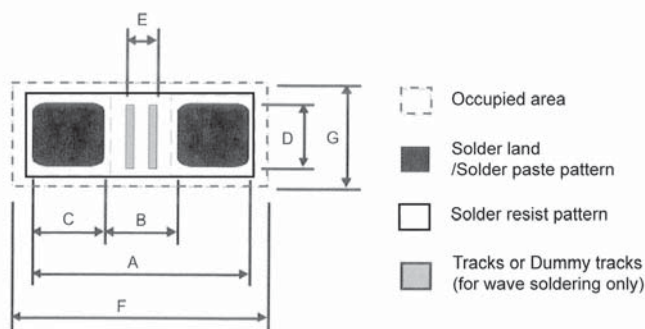
Reel Taping Quantity Specifications for WR,WF,WW Series and WA,WT Series

Unit: mm

| Component Size / Series | Q'ty per reel | Reel Diameter |
|---|------------------------------|---------------|
| 0603, 0805, 1206 | 1,000 pcs | 4" reel |
| 1210, 1206, 0805, 0603, WA06X, WA06T, WT04X | 5,000 pcs | 7" reel |
| 0201, 0402, WA04X, WA04Y, WA04P, WA04T, WA04U | 10,000 pcs | 7" reel |
| 0201, 0402 | 15,000 pcs | 7" reel |
| WA06X, WA06Y | 5,000 pcs | 7" reel |
| 2512, 2010 | 4,000 pcs | 7" reel |
| 1218 | 3,000 pcs | 10" reel |
| 1206, 0805, 0603, WA06X, WA06T | 10,000 pcs | 10" reel |
| 0201, 0402, WA04X, WA04Y | Q: 20,000 pcs/ J: 40,000 pcs | 10" reel |
| 2010, 2512 | 8,000 pcs | 10" reel |
| 0201 | H: 50,000 pcs/ G: 70,000 pcs | 13" reel |
| 0402 | H: 50,000 pcs/ G: 70,000 pcs | 13" reel |
| WA04X, WA04Y | 40,000 pcs | 13" reel |
| 1206, 0805, 0603, WA06X, | 20,000 pcs | 13" reel |
| 2010, 2512 | 16,000 pcs | 13" reel |

Footprint Design

Footprint Design for WRxx, WFxx, WWxx Series :



Unit: mm

| Size | Reflow Soldering | | | | | | | Processing Remarks | Placement Accuracy |
|-------|------------------|------|------|------|------|------|------|---------------------------|--------------------|
| | A | B | C | D | E | F | G | | |
| 01005 | 0.58 | 0.18 | 0.20 | 0.20 | 0.10 | 0.90 | 0.40 | IR or hot plate soldering | ±0.03 |
| 0201 | 0.75 | 0.30 | 0.30 | 0.30 | 0.20 | 1.10 | 0.50 | | ±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 |
| 1210 | 3.80 | 2.00 | 0.90 | 2.80 | 1.60 | 4.05 | 3.15 | | ±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 | | | | | | | Processing 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 | 1× (0.15 × 0.80) | ±0.25 |
| 0805 | 3.40 | 1.30 | 1.05 | 1.30 | 0.20 | 4.30 | 2.70 | 1× (0.20 × 1.30) | ±0.25 |
| 1206 | 4.80 | 2.30 | 1.25 | 1.70 | 1.25 | 5.90 | 3.20 | 3× (0.25 × 1.70) | ±0.25 |
| 1210 | 4.80 | 2.30 | 1.25 | 2.50 | 1.25 | 5.90 | 3.60 | 3× (0.25 × 1.70) | ±0.25 |
| 1218 | 4.80 | 2.30 | 1.25 | 4.80 | 1.30 | 5.90 | 5.60 | 3× (0.25 × 4.80) | ±0.25 |
| 2010 | 6.30 | 3.50 | 1.40 | 2.50 | 3.00 | 7.00 | 3.60 | 3× (0.75 × 2.50) | ±0.25 |
| 2512 | 8.50 | 4.50 | 2.00 | 3.20 | 3.00 | 9.00 | 4.30 | 3× (1.00 × 3.20) | ±0.25 |

Footprint Design for Array Resistor/Attenuator :

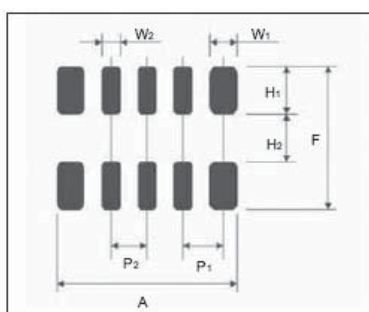
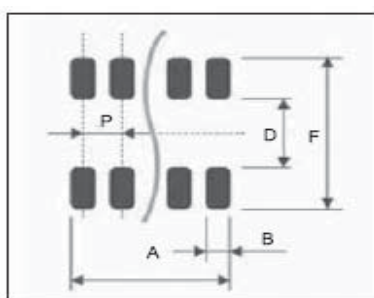
Unit: mm

| Symbol | 0603*4 array | 0402*4 array | WA04Y, WA04P | WA06W | WA02Y | WA02A | WA02B |
|--------|-----------------|-----------------|-----------------|-----------------|---------------|---------------|---------------|
| A | 2.85+0.10/-0.05 | 1.80+0.15/-0.05 | 1.20±0.05 | 3.85+0.20/-0.05 | 1.00±0.05 | 1.40±0.05 | 0.80±0.05 |
| B | 0.45±0.05 | 0.30±0.05 | 0.40 +0/-0.05 | 0.28 +0/-0.05 | 0.40 +0/-0.05 | 0.20 +0/-0.05 | 0.30 +0/-0.05 |
| D | 0.80±0.10 | 0.50±0.10 | 0.50±0.05 | 1.00 +0.1/-0.20 | 0.30±0.05 | 0.30±0.05 | 0.30±0.05 |
| P | 0.8 | 0.5 | 0.65 | 0.5 | 0.5 | 0.4 | 0.5 |
| F | 3.10±0.30 | 2.00+0.40/-0.20 | 1.5 +0.20/-0.10 | 3.20±0.40 | 1.00±0.10 | 0.9±0.10 | 0.9±0.10 |

Footprint Design for 10P8R Network Resistor :

Unit: mm

| Symbol | WT04X |
|--------|---------------------|
| W1 | 0.50±0.05 |
| W2 | 0.35±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 |



Storage and Handling Conditions:

- Products are recommended to be used up within two years since production as ensured shelf life . Check solderability in case shelf life extension is needed.
- To store products with following condition:
 - Temperature :5 to 40°C
 - Humidity : 20 to 70% relative humidity
- Caution:
 - Don't store products in a corrosive environment such as sulfide, chloride gas, or acid. It may cause oxidization of electrode, which easily be resulted in poor soldering
 - To store products on the shelf and avoid exposure to moisture.
 - Don't expose products to excessive shock, vibration, direct sunlight and so on

Precaution of Soldering

- It is recommended to use a mildly activated rosin flux (less than 0.1% wt chlorine)
- Excessive flux must be avoided
- When water-soluble flux is used, enough washing is necessary
- Two times limitations for reflow soldering is highly recommended
- Solder repair by soldering iron
 - Max. 350°C for below 3 seconds is highly recommended
 - Do not directly contact termination to avoid thermal shock.
- Prevent any external force on the products until solder is cooled

Mounting

- Imperfect adjustment of mounting machine may cause the cracks, the chipping and the alignment error. Check and inspect the mounting machine in advance.
- Set the backup pins in proper layout otherwise the components mounted on the backside of the board are damaged. Do not set these pins at the position of the nozzle.
- Adjust the bottom dead point of dispenser away from the board when you apply adhesive.
- Confirm that the products are corresponding to flow soldering when you perform it.
- Pay attention to the amount of solder because improper amount of solder place large stress on the products and cause cracks or malfunctions.

Washing

- Confirm the ionic residues in solder do not remain after washing for moisture resistance and corrosion. Resistance may cause deterioration when these substances are attached to the products.
- Confirm the reliability in advance when using no washing solder, water or soluble agent.
- Wash thoroughly after soldering to remove ionic substances like sweat and salinity.
- The ultrasonic washing may destruct the products due to resonance by vibration. High hydraulic pressure may also damage the products.
- Dry the products sufficiently after washing.

Recommendation of Soldering Profiles:

In general application, the lead free (Pb-free) termination CRs are used and may be mounted on PCB by IR reflow or wave soldering process with lead-free solder material. The recommended soldering profiles are shown as Fig.1 & 2. The lead-free termination CRs are also suitable on SMT process against lead-containing solder paste. But the soldering temperature should be higher than the melting point of solder paste 30°C at least. If the optimized solder joint is requested, increasing soldering time, temperature and concentration of N2 within oven are recommended. Advised IR reflow soldering profile is shown as Fig.3.

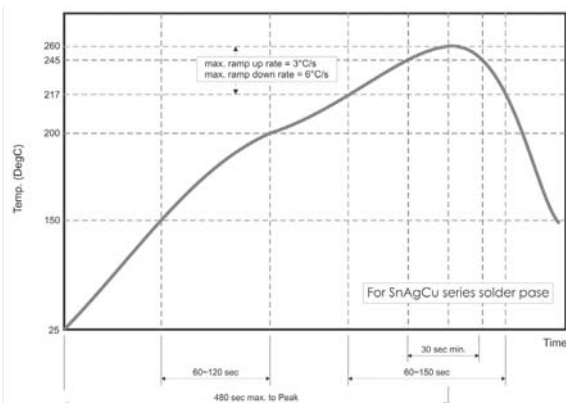


Fig. 1 Recommended IR reflow soldering profile for SMT process with SnAgCu series solder paste

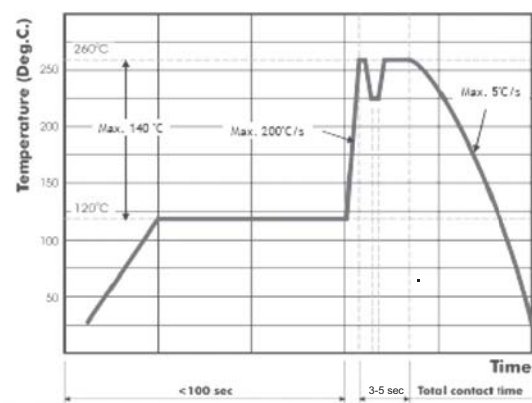


Fig. 2 Recommended wave soldering profile for SMT process with SnAgCu series solder

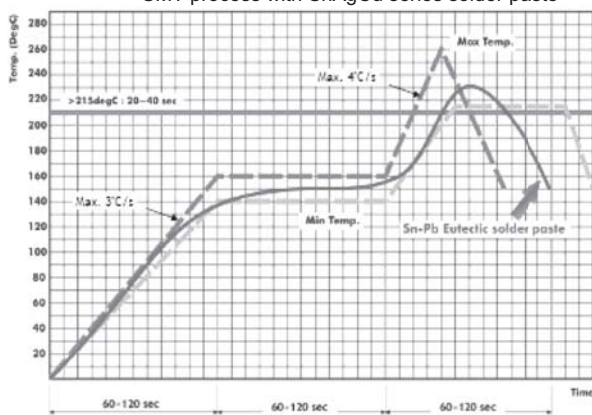


Fig. 3 Recommended reflow soldering profile for SMT process with eutectic SnPb solder paste.

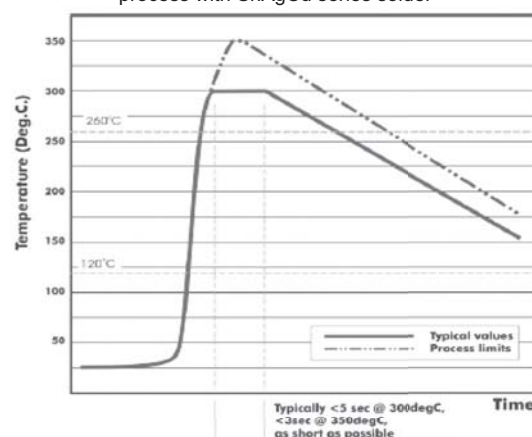


Fig. 4 Recommended soldering profile by manual with SnAgCu series solder material

Lined area for writing the plan and memo.

A series of horizontal dashed lines for writing, starting below the header and extending to the bottom of the page.

Taiwan - Yang-Mei Plant / Sales Office

Walsin Technology Corporation
566-1, Kao-Shi Road, Yang-Mei,
Tao-Yuan, Taiwan
Tel: +886-3-475-8711
Fax: +886-3-475-7130
Email: info@passivecomponent.com

Germany - Munich Sales Office

Walsin Technology Corporation Europe
Stefan-George-Ring 29,
81929 Munich, Germany
Tel: +49-(0)89-9308-6475
Fax: +49-(0)89-9308-6464
Email: aw@passivecomponent.com

China - Dalang Plant / Sales Office

Dongguan Walsin Tech. Electronics CO., Ltd.
Xiniupo Administrative Zone,
Dalang Town, Dongguan City,
Guangdong Province 523799
Tel: +86-769-831-15168
Fax: +86-769-831-15188
Email: davidcheng@passivecomponent.com

Singapore - Sales Office

WTC Singapore Sales Office, Singapore
8 Ubi View #04-01
Serial System Building
Singapore 408554
Tel: +65-6896-3877
Fax: +65-6861-3381
Email: michaelchee@sg.passivecomponent.com

China - Suzhou Plant / Sales Office

Suzhou Walsin Technology Electronics Co., Ltd.
No. 369, Changyan Street,
Suzhou Industrial Park,
Jiangsu Province 215126
Tel: +86-512-628-36888
Fax: +86-512-628-37888
Email: davidcheng@passivecomponent.com

United States - West Coast Sales Office

Walsin Technology Corporation, USA
Contact: FC Tseng
Tel: +1-214-708-5182
E-mail: fctsen@passivecomponent.com

China - Guangzhou Plant / Sales Office

Pan Overseas (Guangzhou) Electronic Co., Ltd.
No. 277, Hong Ming Road, Eastern Section,
Guangzhou Economic and Technology
Development Zone, China
Tel: +86-20-8223-7476
Fax: +86-20-8223-7475
Email: davidcheng@passivecomponent.com

JAPAN - Sales Office

WTC Japan Sales Office, Japan
8-4-17, Fukayanaka,
Ayase-shi, Kanagawa,
252-1107, Japan.
Tel: +81-467-71-0884
Fax: +81-467-71-0910
Email: tsakano@kamaya.co.jp



Walsin Technology Corporation

TAIWAN - WTC Yang-Mei Plant / Sales Office

Walsin Technology Corporation

566-1, Kao-Shi Road, Yang-Mei, Tao-Yuan, Taiwan

Tel: +886-3-475-8711

Fax: +886-3-475-7130

Email: info@passivecomponent.com



November 2015