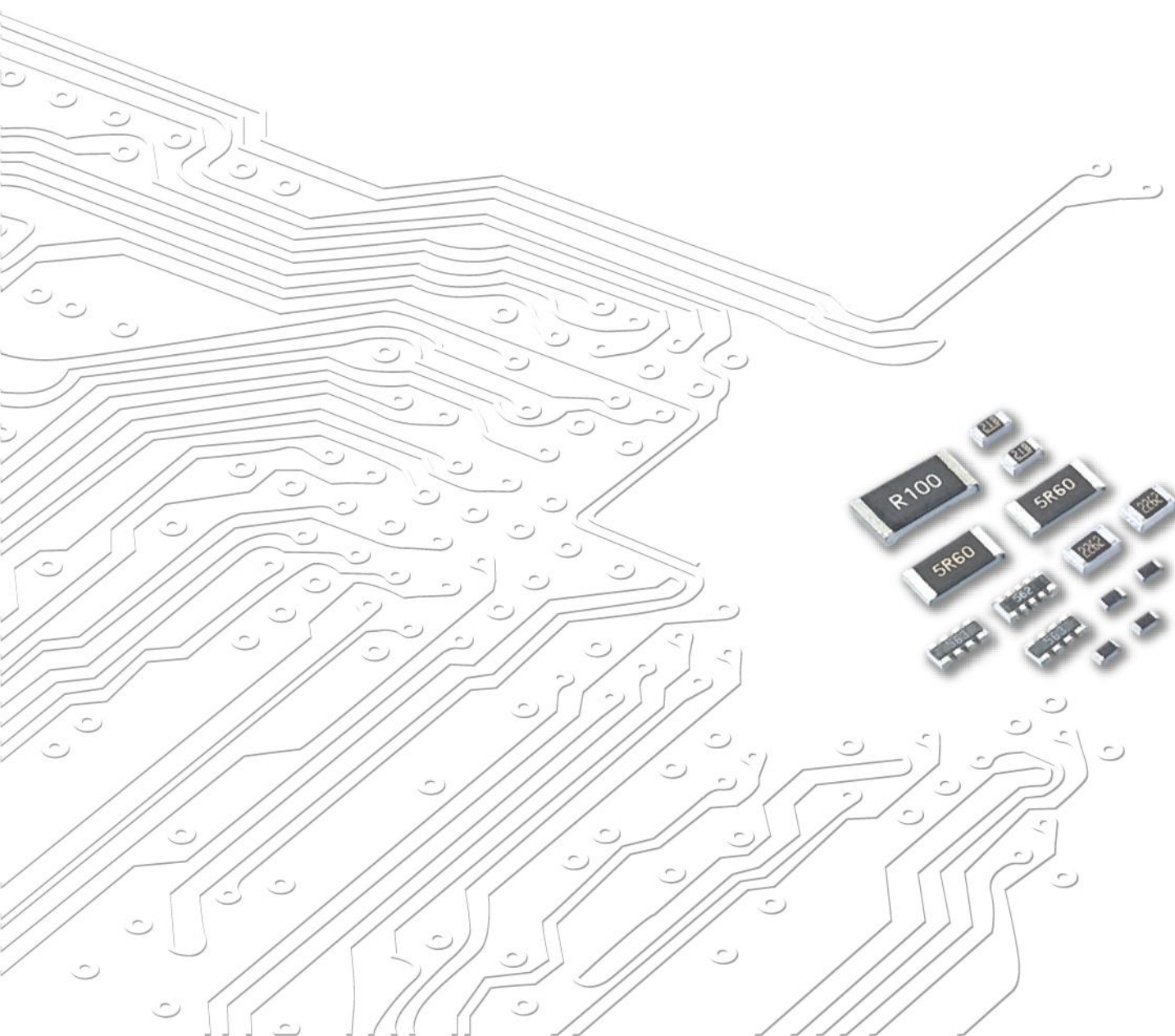



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Disc Capacitors



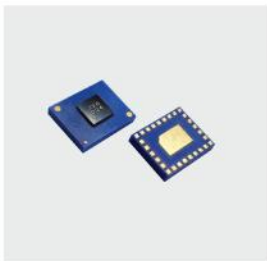
Inductors




RF Filters



Antenna



Antenna Switch & Module



MOV 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 | 3 |
| General Purpose Chip Resistors (1Ω~10MΩ) | 11 |
| Thick Film Low Ohm and Power Low Ohm Chip Resistors | 12 |
| Metal Low Ohm Current Sensing Chip Resistors (0.001Ω ~ 0.100Ω) | 13 |
| Chip Resistor Array: Convex Termination | 14 |
| WA06W Chip Resistor Array 16P8R | 15 |
| Chip Resistor Array: Concave Termination | 16 |
| High Precision Thin Film Chip Resistor Array: Convex Termination (AEC-Q200) | 17 |
| WT04X Chip Resistor Network 10P8R | 18 |
| WA04P Chip Attenuator | 19 |
| Special Chip Resistor | 20 |
| MR/SR Series of Automotive & Anti-Sulfuration Chip Resistor | 20 |
| WR_R Series of Total Lead Free Chip Resistor | 20 |
| WKxxM Series of Trimmable Chip Resistor | 21 |
| WKxxV Series of High Voltage Chip Resistor | 21 |
| WFxxP/WFxxA Series of High Power Chip Resistor | 22 |
| WKxxS Series of Anti-Surge Chip Resistor | 23 |
| Thick Film High Precision Chip Resistor | 23 |
| Thin Film Precision Chip Resistor: WF Series | 24 |
| Thin Film Pulse Withstanding Chip Resistor: WF_S Series | 25 |
| Thin Film Professional Chip Resistor (AEC-Q200): WF_Q Series | 26 |
| Thin Film Anti-Sulfuration Chip Resistor: SF Series | 27 |
| Thin Film Anti-Sulfuration (ASTM-B809 & under Oil 105°C+3.5% Sulfur power 500 hours): SF_A Serie | 27 |
| Thin Film Anti-Sulfuration Chip Resistor (AEC-Q200/ASTM-B809): SF_Q Series | 28 |
| TaN Thin Film Chip Resistor (AutoGrade/AEC-Q200/ASTM B-809): MF Series | 29 |
| Thin Film Low ohmic Current Sensor: WW Series | 29 |
| Thin Film High Power (Low TCR/Tight Tolerance) Current Sensor: TTL Series | 26 |
| Thin Film High Power Ultra Low Ohmic Current Sensor: TTU Series | 26 |
| MELF Thin Film Resistor: WM Series (AEC-Q200) | 31 |
| MELF Precision Thin Film Resistor: WM_Q Series (AEC-Q200) | 32 |
| MELF High Reliability Thin Film Resistor: MM Series (AEC-Q200) | 32 |
| Test and Requirements | 33 |
| Packing on Tape and Reel | 36 |
| Footprint Design | 37 |
| Storage and Handling Condition | 38 |
| Recommendation of Soldering Profiles | 38 |

*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 specifications before ordering.

■ HOW TO ORDER

| Type code | Size code | Functional code | Resistance | Tolerance | Packaging code | Termination code |
|--|---|---|---|---|--|---|
| WR | 12 | X | 1000 | F | T | L |
| WR : General 1~10MR MR : Automotive SR : Anti-Sulfuration ZR : Non magnetic | 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) | X : 5% for 1 ~ 10MΩ, 1% for 10 ~ 1MΩ W : 1% for <10Ω and >1MΩ F : TC100, 1-10ohm 1% E : TC100, 100-1Mohm 5% | E24 (J tol.) E24+E96 (F tol.) *Please see remark for detail explanation | F : ± 1% J : ± 5% P : Jumper X : random | 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) I : 13" up side down taping L : 01005 1mm pitch (35K/7" RL) | L= Sn base (Lead free) R= Pb ≤100ppm (total) W= Wide term. A= Anti-leaching P= 20% Pd |
| WW | 12 | M | R002 | F | T | L |
| WW : R < 1Ω | 25 : 2512 (6432) 20 : 2010 (5025) 18 : 1218 (3248) 12 : 1206 (3216) 10 : 1210 (3225) 08 : 0805 (2012) 06 : 0603 (1608) 04 : 0402 (1005) | X : Thick film low ohm (WTC) W : Thick film low TCR Hi-power 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 D : Metal Foil E : Thick film Power low ohm A : Metal low ohm NiCu 2512 3W B : Metal low ohm MnCu 2512 3W J : Metal low ohm low EMF K : Metal low ohm low EMF L : Thick film wide term. High power T : Thick film triple power WW25T 3W | R followed by 3 significant digits e.g. : 0.1Ω = R100 0.033Ω = R033 0.56Ω = R560 0.5mΩ = R0L5 15.5mΩ = 15L5 | F : ± 1% G : ± 2% J : ± 5% | P : 4" reel taping T : 7" reel taping Q : 10" reel taping G : 13" reel taping R : 0603 2mm pitch taping B : Bulk U : 7" reel taping (4kpcs/RL) Z : 7" reel taping (3kpcs/RL) | L= Sn base (Lead free) G= Au base S= Ag base |
| WF/WK | 12 | T | 1001 | B | T | L |
| WF: Special Function SF: Special Function Anti-Sulfur WK: Special function Made in KM | 25 : 2512 (6432) 20 : 2010 (5025) 18 : 1218 (3248) 12 : 1206 (3216) 10 : 1210 (3225) 08 : 0805 (2012) 06 : 0603 (1608) 04 : 0402 (1005) | G : High ohm (>10MΩ) H : Thick film, High Precision <1% K : Thick film, TCR50ppm M : Trimmable P : High Power S : Surge V : High voltage N : Ultra High voltage (WFxxN for UL) X : Special resistance Y : E24/E96 resistance with special Termination A : Triple Power 2512 3W E : Triple power + Surge | E24 (J tol.) E24+E96 (F tol.) *Please see remark for detail explanation | T : ± 0.01% U : ± 0.02% 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% | P : 4" reel taping T : 7" reel taping Q : 10" reel taping G : 13" reel taping R : 0603 2mm pitch taping B : Bulk D : 7" reel taping 20Kpcs V : 7" reel taping 1Kpcs A : 7" reel taping 15Kpcs W : 7" reel taping 2Kpcs Z : 7" reel taping (3kpcs/RL) | 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 |
| WA : Array MA : Array Automotive SA : Array Anti-Sulfur TA : Thin Film Array Convex | 06 : 0603 (1608) 04 : 0402 (1005) 02 : 0201 (0603) | 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 FLAT G : *2, Reverse FLAT | E24 (J tol.) E24+E96 (F tol.) **Please see remark for detail explanation | F : ± 1% J : ± 5% P : Jumper B : ± 0.1% C : ± 0.25% D : ± 0.5% | T : 7" reel taping A : 7" reel taping 15Kpcs Q : 10" reel taping G : 13" reel taping B : Bulk | L= Sn base (Lead free) |
| WT | 04 | X | 103_ | J | T | L |
| T : Network Resistors | 04 : total package size 1206 (3216) | X : *8, convex | E24 (J tol.) | J : ± 5% P : Jumper | T : 7" reel taping B : Bulk | L= Sn base (Lead free) |

■ HOW TO ORDER

Thin Film Series: Precision; Professional; Auto Grade; Current Sensing Chip Resistor; MELF.

| Type code | Size code | Functional code | Resistance | Tolerance | Packaging code | Termination code | Special code |
|---|--|--|--|---|--|---------------------------|---|
| WF/SF/MF | 12 | T | 1001 | B | T | L | Q |
| WF: Thin Film Precision SF: Thin Film Anti-Sulfuration WF_Q: Thin Film Professional/ AEC-Q200 Compliant WF_S: Thin Film Precision Pulse Withstanding SF_Q: Thin Film Anti-Sulfuration/ AEC-Q200 Compliant ASTM B809 SF_A: Thin Film Anti-Sulfuration ASTM B809 +Under Oil 105°C +3.5% Sulfur power 500hrs MF: Thin Film Auto Grade AEC-Q200 | 25 : 2512 (6432) 20 : 2010 (5025) 12 : 1206 (3216) 10 : 1210 (3225) 08 : 0805 (2012) 06 : 0603 (1608) 04 : 0402 (1005) 02 : 0201 (0603) | T : TCR 50 ppm U : TCR 25 ppm Q : TCR 50 ppm, Power R : TCR 25 ppm, Power F : Low TCR 15 ppm W : Low TCR 10 ppm Z : Ultra Low TCR 5 ppm B : Ultra Low TCR 3 ppm C : Ultra Low TCR 2 ppm D : Ultra Low TCR 1 ppm * * Available Upon Request | E24+E192 **Please see remark for detail explanation | T : ± 0.01% A : ± 0.05% B : ± 0.1% C : ± 0.25% D : ± 0.5% F : ± 1% | T : 7" Reel & Taped Q : 10" Reel & Taped G : 13" Reel & Taped V : 7" Reel & Taped 1Kpcs B : Bulk | L= Sn base (Lead free) | Q= AEC-Q200 Compliant A= Under Oil 105°C+3.5% Sulfur power 500 hrs S= Low Resistance Pulse withstanding |
| TA | 06 | M | xxxx | D | T | L | T |
| TA : Thin Film Array /Networks Convex (AEC-Q200) | 06 : 0603 (1608) | M : *4, TCR 50ppm N : *4, TCR 25ppm | E24+E192 **Please see remark for detail explanation | F : ±1% D : ±0.5% C : ±0.25% B : ±0.1% | T : Reeled | L= Sn base (Lead free) | D : Equal values B : Two pairs T : Different Values |
| WM_Q / MM / WM | 04 | C | 1002 | B | T | L | Q |
| WM: MELF (Thin Film) AEC-Q200 WM_Q: MELF (Precision Thin Film) AEC-Q200 MM: MELF/Ta2N (High Reliability Thin Film) AEC-Q200 | 04 (0204) 07 (0207) | B : TCR 50 ppm C : TCR 25 ppm N : TCR 50 ppm, Power O : TCR 25 ppm, Power D : Low TCR 15 ppm E : Low TCR 10 ppm P : Low TCR 15 ppm, Power Q : Low TCR 10 ppm, Power | E24+E192 **Please see remark for detail explanation | B : ± 0.1% C : ± 0.25% D : ± 0.5% F : ± 1% | T : 7" Reel & Taped | L= Sn base (Lead free) | Q= AEC-Q200 Compliant |

| Type code | Size code | Functional code | | Resistance | Tolerance | Packaging code | Termination code |
|--|--|---|--|--|--|---------------------|---------------------------|
| TTL | 12 | Q (Power Rating) | N (TCR) | XXXX | F | T | L |
| TTL: High Power Thin Film Current Sensor | 25 : 2512 (6432) 20 : 2010 (5025) 12 : 1206 (3216) 08 : 0805 (2012) 06 : 0603 (1608) 04 : 0402 (1005) 02 : 0201 (0603) | Q: 2W P: 1W M: 1/2W K: 1/3W J: 1/4W I: 1/5W H: 1/8W G: 1/10W | N : 50 ppm O : 75 ppm P : 100 ppm Q : 150 ppm R : 200 ppm U : 350 ppm | e.g: R020 = 20mΩ R0050 = 5mΩ R2L5 = 2.5mΩ | D : ± 0.5% F : ± 1% G : ± 2% J : ± 5% | T : 7" Reel & Taped | L= Sn base (Lead free) |
| TTU | 12 | Q (Power Rating) | N (TCR) | XXXX | F | T | L |
| TTU: Ultra Low Ohmic/High Power Current Sensor | 25 : 2512 (6432) 12 : 1206 (3216) | P: 1W Q: 2W R: 2.5W S: 3W | P : 100 ppm N : 50 ppm | e.g: R001=1mΩ R0L5=0.5mΩ | F : ± 1% J : ± 5% | T : 7" Reel & Taped | L= Sn base (Lead free) |
| WW | 12 | F (TCR) | | XXXX | F | T | L |
| WW: Low Ohmic Thin Film Current Sensor (>20mR ~900m) | 25 : 2512 (6432) 20 : 2010 (5025) 12 : 1206 (3216) 08 : 0805 (2012) 06 : 0603 (1608) 04 : 0402 (1005) | F: 75 ppm G: 100ppm H: 75 ppm | | e.g: R100= 100mΩ R050= 50mΩ | D : ± 0.5% F : ± 1% G : ± 2% J : ± 5% | T : 7" Reel & Taped | L= Sn base (Lead free) |

Remark:

- Detail product part number, functional code, tolerance combination; please refer to specific data sheet.
- 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+E192 (F tol.): 3 significant digits followed by No. of zeros, e.g.: 3Ω = 3R00, 10Ω = 10R0, 220Ω = 2200, 56KΩ = 5602.
- Example: ("_" means a blank)
Chip-R 0805 size, 4.3ohm, 5%, Normal type, SnPb termination, 5000pcs taped in reel: WR08X4R3_JTL
- 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 ±200 | ±1% ±5% | 1 ~ 10MΩ |
| WR18X | 1218 (3248) | 1W | ±100 ±200 | ±1% ±5% | |
| WR20X | 2010 (5025) | 3/4W | ±100 ±200 | ±1% ±5% | |
| WR10X | 1210 (3225) | 1/3W | ±100 ±200 | ±1% ±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 ±200 | ±1% ±5% | |
| WR01X | 01005 (0402) | 1/32W | ±200 ±200 | ±1% ±5% | |
| | | | | | 4.7 ~ 1MΩ |

Remark: 1. Detailed resistance vs. TCR and ordering code please refer to specific specifications.

2. Jumper resistor is not designed for fusing applications, designers shall apply dedicate fusible resistor or standard fuse in application circuits.

3. WRxxW defines for ±1% < 10ohm or > 1Mohm,

■ Thick Film Low Ohm Chip-R

| Series | Size | Rated Power | TCR (ppm/°C) | Tolerance | Resistance |
|--------|-------------|-------------|--------------|------------|------------------------------------|
| WW25X | 2512 (6432) | 1W | ≤ 1500** | ±1%, ±5% | 0.015Ω ~ 0.976Ω |
| WW25W | | | ±1000** | ±1%, ±5% | 0.010Ω ~ 0.910Ω |
| WW18X | 1218 (3248) | 1W | ≤ 1500** | ±1% ±5% | 0.020Ω ~ 0.976Ω 0.015Ω ~ 0.976Ω |
| WW20X | 2010 (5025) | 1/2W | ≤ 1500** | ±1%, ±5% | 0.020Ω ~ 0.976Ω |
| WW20W | | 3/4W | ±1000** | ±1%, ±5% | 0.010Ω ~ 0.910Ω |
| WW10X | 1210 (3225) | 1/3W | ±200 | ±1%, ±5% | 0.020Ω ~ 0.976Ω |
| WW10W | | 2/3W | ±600** | ±1%, ±5% | 0.010Ω ~ 0.910Ω |
| WW12X | 1206 (3216) | 1/4W | ≤ 1500** | ±1%, ±5% | 0.010Ω ~ 0.976Ω |
| WW12W | | 1/3W | ±1000** | ±1%, ±5% | 0.010Ω ~ 0.910Ω |
| WW08X | 0805 (2012) | 1/8W | ≤ 1500** | ±1%, ±5% | 0.020Ω ~ 0.976Ω |
| WW08W | | 1/4W | ±1000** | ±1%, ±5% | 0.010Ω ~ 0.910Ω |
| WW06X | 0603 (1608) | 1/10W | ≤ 500** | ±1%, ±5% | 0.100Ω ~ 0.976Ω |
| WW06W | | 1/8W | ≤ 400** | ±1%, ±5% | 0.050Ω ~ 0.910Ω |
| WW04X | 0402 (1005) | 1/16W | ≤ 600** | ±1%, ±5% | 0.100Ω ~ 0.976Ω |

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.

■ Thick Film Power Low Ohm Chip-R

| Series | Size | Rated Power | TCR (ppm/°C) | Tolerance | Resistance |
|---------|-------------|-------------|--|-----------|--|
| WW25T | 2512 (6432) | 3W | 100ppm | ±1%, ±5% | 0.100Ω ~ 0.910Ω |
| WW25P | | 2W | < 0.1Ω: 150ppm ≥ 0.1Ω: 100ppm | ±1%, ±5% | 0.040Ω ~ 0.976Ω |
| WW25W_J | | 2W | 100 ~ 1000ppm | ±1%, ±5% | 0.010Ω ~ 0.910Ω |
| WW20P | 2010 (5025) | 1W | < 0.1Ω: 150ppm ≥ 0.1Ω: 100ppm | ±1%, ±5% | 0.040Ω ~ 0.976Ω |
| WW20W_H | | 1W | 100ppm | ±1%, ±5% | 0.050Ω ~ 0.910Ω |
| WW10P | 1210 (3225) | 1/2W | < 0.1Ω: 300ppm ≥ 0.1Ω: 200ppm | ±1%, ±5% | 0.020Ω ~ 0.976Ω |
| WW10W_G | | 3/4W | 100ppm | ±1%, ±5% | 0.050Ω ~ 0.910Ω |
| WW12P | 1206 (3216) | 1/2W | < 0.1Ω: 200ppm ≥ 0.1Ω: 100ppm | ±1%, ±5% | 0.020Ω ~ 0.976Ω |
| WW12W_G | | 3/4W | 100 ~ 1000ppm | ±1%, ±5% | 0.010Ω ~ 0.910Ω |
| WW08P | 0805 (2012) | 1/3W | < 0.1Ω: 200ppm ≥ 0.1Ω: 150ppm | ±1%, ±5% | 0.047Ω ~ 0.976Ω |
| WW08W_F | | 1/2W | 100 ~ 1000ppm | ±1%, ±5% | 0.010Ω ~ 0.910Ω |
| WW06P | 0603 (1608) | 1/4W | < 0.1Ω: 250ppm ≥ 0.1Ω: 200ppm | ±1%, ±5% | 0.047Ω ~ 0.976Ω |
| WW06W_D | | 1/4W | 200 ~ 400ppm | ±1%, ±5% | 0.050Ω ~ 0.910Ω |
| 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% | 0.020 ~ 0.100Ω |
| WW08C | 0805 (2012) | 1/3W | < 0.03Ω: 200ppm ≥ 0.03Ω: 100ppm | ±1%, ±5% | 0.010 ~ 0.100Ω |
| WW06C | 0603 (1608) | 1/4W | < 0.051Ω: 0~+350ppm ≥ 0.051Ω: ±150ppm | ±1%, ±5% | 0.010 ~ 0.100Ω |
| WW04C | 0402 (1005) | 1/8W | < 0.051Ω: 0~+350ppm ≥ 0.051Ω: ±150ppm | ±1%, ±5% | 0.025 ~ 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, 5, 10mΩ |
| WW25A | 2512 (6432) | 3W | ±70/±50 | ±1%, ±5% | 5, 6, 7, 8, 9, 10, 12, 15, 18, 20, 25, 30, 33, 35, 40, 50mΩ |
| WW25B | | 3W | ±70/±50 | ±1%, ±5% | 3, 4, 5, 6, 7, 8, 9, 10, 20mΩ |
| WW25N | | 2W | ±70 | ±1%, ±5% | 3, 4, 5, 6, 7, 8, 9, 10, 12, 15, 20, 25, 30, 33, 35, 40, 50, 70, 75, 80, 100mΩ |
| WW25K | | 2W | ±70 | ±1%, ±5% | 3, 4, 5, 10, 15, 20mΩ |
| WW25R | | 2W | ±70 | ±1%, ±5% | 1, 2, 3, 4, 5, 6, 7, 8, 9, 10mΩ |
| WW25M | | 1W | ±70 | ±1%, ±5% | 3, 4, 5, 6, 7, 8, 9, 10, 12, 15, 20, 25, 30, 33, 35, 40, 50, 70, 75, 80, 100mΩ |
| WW25J | | 1W | ±70 | ±1%, ±5% | 3, 4, 5, 10, 15, 20mΩ |
| WW25Q | | 1W | ±70 | ±1%, ±5% | 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15mΩ |
| WW20N | 2010 (5025) | 1/2W | ±70 | ±1%, ±5% | 5, 10, 15, 20, 25mΩ |
| WW20M | | 1W | ±70 | ±1%, ±5% | 5, 10, 15, 20mΩ |
| WW12N | 1206 (3216) | 1W | ±70 | ±1%, ±5% | 5, 10, 15, 20, 25, 30mΩ |
| WW12K | | 1W | ±70 | ±1%, ±5% | 3, 4, 5, 6, 10, 15, 20, 25mΩ |
| WW12R | | 1W | ±70 | ±1%, ±5% | 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15mΩ |
| WW12D | | 1W | ±70 | ±1%, ±5% | 20, 25, 30, 40, 50mΩ |
| WW12M | | 1/2W | ±70 | ±1%, ±5% | 5, 10, 15, 20mΩ |
| WW12J | | 1/2W | ±70 | ±1%, ±5% | 3, 4, 5, 6, 10, 15, 20, 25mΩ |
| WW08D | 0805 (2012) | 1/2W | ±70 | ±1%, ±5% | 20, 25, 30, 40, 50mΩ |
| WW08R | | 1/2W | ±70 | ±1%, ±5% | 2, 3, 4, 5, 6, 7, 8, 9, 10mΩ |
| WW08K | | 1/2W | ±100 | ±1%, ±5% | 5, 6, 7, 8, 9, 10mΩ |
| WW08J | | 1/4W | ±100 | ±1%, ±5% | 5, 6, 7, 8, 9, 10mΩ |
| WW06R | 0603 (1608) | 1/3W | ±70 | ±1%, ±5% | 5, 10mΩ |

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/ SA06X | 1206 (0603x4) | 1/10W | ±200 | Convex | ±1%, ±5% | 10 ~ 1MΩ |
| WA06T | 1206 (0603x4) | 1/10W | ±200 | Concave | ±1%, ±5% | |
| WA06Y/ SA06Y | 0606 (0603x2) | 1/10W | ±200 | Convex | ±1%, ±5% | |
| WA04X/ SA04X | 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/ SA04Y | 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% | 10 ~ 100KΩ |
| WA06W | 1606 (0402x8) | 1/16W | ±200 | Convex | ±1%, ±5% | |
| WA02A | 0502 (0201x4) | 1/32W | ±200 | Flat | ±1%, ±5% | ±5% = 10 ~ 1MΩ |
| WA02B | 0202 (0201x2) | 1/32W | ±200 | Flat | ±1%, ±5% | ±1% = 10 ~ 100KΩ |
| WA02F | 0502 (0201x4) | 1/32W | ±200 | Reverse Flat | ±1%, ±5% | ±5% = 10 ~ 1MΩ |
| WA02G | 0202 (0201x2) | 1/32W | ±200 | Reverse Flat | ±1%, ±5% | ±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 | | Jumper; 1 ~ 1MΩ |
| WF10P | 1210 (3225) | 1/2W | ±100 | | Jumper; 1 ~ 1MΩ |
| WF12P | 1206 (3216) | 1/2W | ±100 | | Jumper; 1 ~ 10MΩ |
| WF08P | 0805 (2012) | 1/4W | ±100 | | Jumper; 1 ~ 10MΩ |
| WF06P | 0603 (1608) | 1/8W | ±100 | | Jumper; 1 ~ 1MΩ |
| WF04P | 0402 (1005) | 1/8W | ±100 | | Jumper; 1 ~ 1MΩ |
| WF25A | 2512 (6432) | 3W | ±100 | ±1%, ±5% | 1 ~ 1MΩ |
| WF20A | 2010 (5025) | 1.5W | ±100 | | 1 ~ 1MΩ |
| WF10A | 1210 (3225) | 3/4W | ±100 | | 1 ~ 1MΩ |
| MF12E | 1206 (3216) | 3/4W | ±100 | | 1 ~ 1MΩ |
| MF08E | 0805 (2012) | 1/2W | ±100 | | 1 ~ 1MΩ |
| MF06E | 0603 (1608) | 1/3W | ±100 | | 1 ~ 1MΩ |

■ 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 |
| WK06S | 0603 (1608) | 1/4W | ≤ 200 | ±5%, ±10% | 1 ~ 10MΩ |
| WF04S | 0402 (1005) | 1/8W | ≤ 200 | | 1 ~ 1MΩ |
| MK08S | 0805 (2012) | 1/3W | ≤ 100 | | 1 ~ 1MΩ |
| MK06S | 0603 (1608) | 1/4W | ≤ 100 | | 1 ~ 1MΩ |

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

| Series | Size | Rated Power | TCR(ppm/°C) | Tolerance | Resistance |
|--------|-------------|-------------|-------------|-----------|------------|
| 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 |
| MR02 | 0201 (0603) | 1/20W | ±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~ 10MΩ |
| SR12 | 1206 (3216) | 1/4W | ≤ 200 | | 1~ 10MΩ |
| SR08 | 0805 (2012) | 1/8W | ≤ 200 | | 1~ 10MΩ |
| SR06 | 0603 (1608) | 1/10W | ≤ 200 | | 1~ 10MΩ |
| SR04 | 0402 (1005) | 1/16W | ≤ 200 | | 1~ 10MΩ |

■ 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 | ±1%, ±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 |
| WF25N UL | 2512 (6432) | 1W | ≤ 200 | 3000 | ±1%, ±5% | 100K~ 100MΩ |
| WF20N UL | 2010 (5025) | 1/2W | ≤ 200 | 2000 | ±1%, ±5% | 100K~ 100MΩ |
| WF12N UL | 1206 (3216) | 1/4W | ≤ 200 | 800 | ±1%, ±5% | 100K~ 100MΩ |
| WF08N UL | 0805 (2012) | 1/8W | ≤ 200 | 400 | ±1%, ±5% | 100K~ 22MΩ |
| WF06N UL | 0603 (1608) | 1/10W | ≤ 200 | 200 | ±1%, ±5% | 100K~ 22MΩ |

■ Trimmable Chip-R

| Series | Size | Rated Power | TCR(ppm/°C) | Tolerance | Resistance |
|--------|-------------|-------------|-------------|----------------|------------|
| 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 |
| WR01X_R | 01005 (0402) | 1/32W | ≤ 200 | ±1%, ±5% | 10~ 1MΩ |
| WA04X_R | 0402X4 | 1/16W | ≤ 200 | ±1%, ±5% | 10 ~ 1MΩ |
| WA06X_R | 0603x4 | 1/10W | ≤ 200 | ±1%, ±5% | 10 ~ 1MΩ |

■ Thick Film High Precision Chip-R

| Series | Size | Rated Power | TCR(ppm/°C) | Tolerance | Resistance |
|--------|-------------|-------------|-------------|--------------|------------|
| WF25H | 2512 (6432) | 1W | ≤ 100 | ±0.1%, ±0.5% | 10 ~ 1MΩ |
| WF20H | 2010 (5025) | 1/2W | ≤ 100 | ±0.1%, ±0.5% | 10 ~ 1MΩ |
| 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 |
| WK02H | 0201 (0603) | 1/20W | ≤ 200 | ±0.1%, ±0.5% | 10 ~ 1MΩ |
| WF12K | 1206 (3216) | 1/4W | ≤ 50 | ±0.1%, ±0.5% | 10 ~ 1MΩ |
| WF08K | 0805 (2012) | 1/8W | ≤ 50 | ±0.1%, ±0.5% | 10 ~ 1MΩ |
| WF06K | 0603 (1608) | 1/10W | ≤ 50 | ±0.1%, ±0.5% | 10 ~ 1MΩ |
| WF04K | 0402 (1005) | 1/16W | ≤ 50 | ±0.1%, ±0.5% | 100 ~ 1MΩ |
| WK12K | 1206 (3216) | 1/4W | ≤ 50 | ±0.1%, ±0.5% | 10 ~ 1MΩ |
| WK08K | 0805 (2012) | 1/8W | ≤ 50 | ±0.1%, ±0.5% | 10 ~ 1MΩ |
| WK06K | 0603 (1608) | 1/10W | ≤ 50/100 | ±0.1%, ±0.5% | 10 ~ 1MΩ |
| WK04K | 0402 (1005) | 1/16W | ≤ 50/100 | ±0.1%, ±0.5% | 100 ~ 1MΩ |
| WK02K | 0201 (0603) | 1/20W | ≤ 50/100 | ±0.1%, ±0.5% | 10 ~ 1MΩ |

■ Thin Film Precision Chip-R

| Series | Size | Rated Power | TCR(ppm/°C) | Tolerance | Resistance |
|--------|-------------|-------------|-------------|--|--------------|
| WF25T | 2512(6432) | 3/4W | ±50 | ±0.01%,±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 1 ~ 3MΩ |
| WF25Q | 2512(6432) | 1W | ±50 | ±0.01%,±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 1 ~ 3MΩ |
| WF20T | 2010(5025) | 1/2W | ±50 | ±0.01%,±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 4.7 ~ 3MΩ |
| WF20Q | 2010(5025) | 3/4W | ±50 | ±0.01%,±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 4.7 ~ 3MΩ |
| WF10T | 1210(3225) | 1/4W | ±50 | ±0.01%,±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 4.7 ~ 2.49MΩ |
| WF10Q | 1210(3225) | 2/5W | ±50 | ±0.01%,±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 4.7 ~ 2.5MΩ |
| WF12T | 1206(3216) | 1/8W | ±50 | ±0.01%,±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 1 ~ 2.49MΩ |
| WF12Q | 1206(3216) | 1/4W | ±50 | ±0.01%,±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 1 ~ 2.5MΩ |
| WF08T | 0805(2012) | 1/10W | ±50 | ±0.01%,±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 4.7 ~ 2MΩ |
| WF08Q | 0805(2012) | 1/8W | ±50 | ±0.01%,±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 4.7 ~ 2MΩ |
| WF06T | 0603 (1608) | 1/16W | ±50 | ±0.01%,±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 4.7 ~ 1MΩ |
| WF06Q | 0603 (1608) | 1/10W | ±50 | ±0.01%,±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 4.7 ~ 1MΩ |
| WF04T | 0402 (1005) | 1/16W | ±50 | ±0.01%,±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 10 ~ 255KΩ |
| WF04Q | 0402 (1005) | 1/10W | ±50 | ±0.01%,±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 10 ~ 255KΩ |
| WF02T | 0201 (0603) | 1/32W | ±50 | ±0.1%, ±0.5%, ±1% | 100 ~ 12KΩ |
| WF02Q | 0201 (0603) | 1/20W | ±50 | ±0.5%, ±1% | 27 ~ 22.1KΩ |
| WF25U | 2512(6432) | 3/4W | ±25 | ±0.01%,±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 1 ~ 3MΩ |
| WF25R | 2512(6432) | 1W | ±25 | ±0.01%,±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 1 ~ 3MΩ |
| WF20U | 2010(5025) | 1/2W | ±25 | ±0.01%,±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 4.7 ~ 3MΩ |
| WF20R | 2010(5025) | 3/4W | ±25 | ±0.01%,±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 4.7 ~ 3MΩ |
| WF10U | 1210(3225) | 1/4W | ±25 | ±0.01%,±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 4.7 ~ 2.49MΩ |
| WF10R | 1210(3225) | 2/5W | ±25 | ±0.01%,±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 4.7 ~ 2.5MΩ |
| WF12U | 1206(3216) | 1/8W | ±25 | ±0.01%,±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 1 ~ 2.49MΩ |
| WF12R | 1206(3216) | 1/4W | ±25 | ±0.01%,±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 1 ~ 2.5MΩ |
| WF08U | 0805 (2012) | 1/10W | ±25 | ±0.01%,±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 4.7 ~ 2MΩ |
| WF08R | 0805 (2012) | 1/8W | ±25 | ±0.01%,±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 4.7 ~ 2MΩ |
| WF06U | 0603 (1608) | 1/16W | ±25 | ±0.01%,±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 4.7 ~ 1MΩ |
| WF06R | 0603 (1608) | 1/10W | ±25 | ±0.01%,±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 4.7 ~ 1MΩ |
| WF04U | 0402 (1005) | 1/16W | ±25 | ±0.01%,±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 10 ~ 255KΩ |
| WF04R | 0402 (1005) | 1/10W | ±25 | ±0.01%,±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 10 ~ 255KΩ |
| WF02U | 0201 (0603) | 1/32W | ±25 | ±0.1%, ±0.5%, ±1% | 100 ~ 12KΩ |
| WF02R | 0201 (0603) | 1/20W | ±25 | ±0.5%, ±1% | 27 ~ 12KΩ |
| WF25F | 2512(6432) | 1W | ±15 | ±0.01%,±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 10 ~ 1.5MΩ |
| WF20F | 2010(5025) | 3/4W | ±15 | ±0.01%,±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 10 ~ 1MΩ |
| WF10F | 1210(3225) | 2/5W | ±15 | ±0.01%,±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 10 ~ 600KΩ |
| WF12F | 1206(3216) | 1/4W | ±15 | ±0.01%,±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 4.7 ~ 500KΩ |
| WF08F | 0805(2012) | 1/8W | ±15 | ±0.01%,±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 4.7 ~ 400KΩ |
| WF06F | 0603 (1608) | 1/10W | ±15 | ±0.01%,±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 4.7 ~ 150KΩ |
| WF04F | 0402 (1005) | 1/10W | ±15 | ±0.01%,±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 10 ~ 60KΩ |
| WF25W | 2512(6432) | 1W | ±10 | ±0.01%,±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 10 ~ 1.5MΩ |
| WF20W | 2010(5025) | 3/4W | ±10 | ±0.01%,±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 10 ~ 1MΩ |
| WF10W | 1210(3225) | 2/5W | ±10 | ±0.01%,±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 10 ~ 600KΩ |
| WF12W | 1206(3216) | 1/4W | ±10 | ±0.01%,±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 4.7 ~ 500KΩ |
| WF08W | 0805(2012) | 1/8W | ±10 | ±0.01%,±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 4.7 ~ 400KΩ |
| WF06W | 0603 (1608) | 1/10W | ±10 | ±0.01%,±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 4.7 ~ 150KΩ |
| WF04W | 0402 (1005) | 1/10W | ±10 | ±0.01%,±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 10 ~ 60KΩ |
| WF25Z | 2512(6432) | 1W | ±5 | ±0.01%,±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 4.7 ~ 600KΩ |
| WF20Z | 2010(5025) | 3/4W | ±5 | ±0.01%,±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 4.7 ~ 360KΩ |
| WF10Z | 1210(3225) | 2/5W | ±5 | ±0.01%,±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 4.7 ~ 150KΩ |
| WF12Z | 1206(3216) | 1/4W | ±5 | ±0.01%,±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 4.7 ~ 150KΩ |
| WF08Z | 0805(2012) | 1/8W | ±5 | ±0.01%,±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 4.7 ~ 100KΩ |
| WF06Z | 0603 (1608) | 1/10W | ±5 | ±0.01%,±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 4.7 ~ 50KΩ |
| WF04Z | 0402 (1005) | 1/10W | ±5 | ±0.01%,±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 10 ~ 10KΩ |
| WF25B | 2512(6432) | 1W | ±3 | ±0.01%,±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 4.7 ~ 600KΩ |
| WF20B | 2010(5025) | 3/4W | ±3 | ±0.01%,±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 4.7 ~ 360KΩ |
| WF10B | 1210(3225) | 2/5W | ±3 | ±0.01%,±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 4.7 ~ 150KΩ |
| WF12B | 1206(3216) | 1/4W | ±3 | ±0.01%,±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 4.7 ~ 120KΩ |
| WF08B | 0805(2012) | 1/8W | ±3 | ±0.01%,±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 4.7 ~ 80KΩ |
| WF06B | 0603 (1608) | 1/10W | ±3 | ±0.01%,±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 4.7 ~ 40KΩ |
| WF04B | 0402 (1005) | 1/10W | ±3 | ±0.01%,±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 10 ~ 8KΩ |
| WF25C | 2512(6432) | 1W | ±2 | ±0.01%,±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 4.7 ~ 600KΩ |
| WF20C | 2010(5025) | 3/4W | ±2 | ±0.01%,±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 4.7 ~ 360KΩ |
| WF10C | 1210(3225) | 2/5W | ±2 | ±0.01%,±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 4.7 ~ 150KΩ |
| WF12C | 1206(3216) | 1/4W | ±2 | ±0.01%,±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 4.7 ~ 120KΩ |
| WF08C | 0805(2012) | 1/8W | ±2 | ±0.01%,±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 4.7 ~ 80KΩ |
| WF06C | 0603 (1608) | 1/10W | ±2 | ±0.01%,±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 4.7 ~ 40KΩ |
| WF04C | 0402 (1005) | 1/10W | ±2 | ±0.01%,±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 10 ~ 8KΩ |

■ Thin Film Pulse Withstanding Chip-R

| Series | Size | Rated Power | TCR(ppm/°C) | Tolerance | Resistance |
|---------|------------|-------------|-------------|---------------------------|---------------|
| WF12Q_S | 1206(3216) | 1/4W | ±50 | ±0.1%, ±0.25%, ±0.5%, ±1% | 1Ω ~ 300KΩ |
| WF12R_S | 1206(3216) | 1/4W | ±25 | ±0.1%, ±0.25%, ±0.5%, ±1% | 1Ω ~ 300KΩ |
| WF08Q_S | 0805(2012) | 1/8W | ±50 | ±0.1%, ±0.25%, ±0.5%, ±1% | 1Ω ~ 150KΩ |
| WF08R_S | 0805(2012) | 1/8W | ±25 | ±0.1%, ±0.25%, ±0.5%, ±1% | 1Ω ~ 150KΩ |
| WF06Q_S | 0603(1608) | 1/10W | ±50 | ±0.1%, ±0.25%, ±0.5%, ±1% | 1Ω ~ 49.9KΩ |
| WF06R_S | 0603(1608) | 1/10W | ±25 | ±0.1%, ±0.25%, ±0.5%, ±1% | 4.7Ω ~ 49.9KΩ |
| WF04Q_S | 0402(1005) | 1/10W | ±50 | ±0.1%, ±0.25%, ±0.5%, ±1% | 1Ω ~ 10KΩ |
| WF04R_S | 0402(1005) | 1/10W | ±25 | ±0.1%, ±0.25%, ±0.5%, ±1% | 4.7Ω ~ 10KΩ |

■ Thin Film Professional Chip-R (AEC-Q200 Compliant)

| Series | Size | Rated Power | TCR(ppm/°C) | Tolerance | Resistance |
|---------|------------|-------------|-------------|---|--------------|
| WF25T_Q | 2512(6432) | 3/4W | ±50 | ±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 10Ω ~ 1.5MΩ |
| WF25Q_Q | 2512(6432) | 1W | ±50 | ±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 10Ω ~ 1.5MΩ |
| WF20T_Q | 2010(5025) | 1/2W | ±50 | ±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 10Ω ~ 1.5MΩ |
| WF20Q_Q | 2010(5025) | 3/4W | ±50 | ±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 10Ω ~ 1.5MΩ |
| WF10T_Q | 1210(3225) | 1/4W | ±50 | ±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 10Ω ~ 1MΩ |
| WF10Q_Q | 1210(3225) | 2/5W | ±50 | ±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 10Ω ~ 1MΩ |
| WF12T_Q | 1206(3216) | 1/8W | ±50 | ±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 4.7Ω ~ 1MΩ |
| WF12Q_Q | 1206(3216) | 1/4W | ±50 | ±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 4.7Ω ~ 1MΩ |
| WF08T_Q | 0805(2012) | 1/10W | ±50 | ±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 4.7Ω ~ 1MΩ |
| WF08Q_Q | 0805(2012) | 1/8W | ±50 | ±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 4.7Ω ~ 1MΩ |
| WF06T_Q | 0603(1608) | 1/16W | ±50 | ±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 4.7Ω ~ 330KΩ |
| WF06Q_Q | 0603(1608) | 1/10W | ±50 | ±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 4.7Ω ~ 330KΩ |
| WF04T_Q | 0402(1005) | 1/16W | ±50 | ±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 10Ω ~ 100KΩ |
| WF04Q_Q | 0402(1005) | 1/10W | ±50 | ±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 10Ω ~ 100KΩ |
| WF25U_Q | 2512(6432) | 3/4W | ±25 | ±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 10Ω ~ 1.5MΩ |
| WF25R_Q | 2512(6432) | 1W | ±25 | ±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 10Ω ~ 1.5MΩ |
| WF20U_Q | 2010(5025) | 1/2W | ±25 | ±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 10Ω ~ 1.5MΩ |
| WF20R_Q | 2010(5025) | 3/4W | ±25 | ±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 10Ω ~ 1.5MΩ |
| WF10U_Q | 1210(3225) | 1/4W | ±25 | ±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 10Ω ~ 1MΩ |
| WF10R_Q | 1210(3225) | 2/5W | ±25 | ±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 10Ω ~ 1MΩ |
| WF12U_Q | 1206(3216) | 1/8W | ±25 | ±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 4.7Ω ~ 1MΩ |
| WF12R_Q | 1206(3216) | 1/4W | ±25 | ±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 4.7Ω ~ 1MΩ |
| WF08U_Q | 0805(2012) | 1/10W | ±25 | ±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 4.7Ω ~ 1MΩ |
| WF08R_Q | 0805(2012) | 1/8W | ±25 | ±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 4.7Ω ~ 1MΩ |
| WF06U_Q | 0603(1608) | 1/16W | ±25 | ±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 4.7Ω ~ 330KΩ |
| WF06R_Q | 0603(1608) | 1/10W | ±25 | ±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 4.7Ω ~ 330KΩ |
| WF04U_Q | 0402(1005) | 1/16W | ±25 | ±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 10Ω ~ 100KΩ |
| WF04R_Q | 0402(1005) | 1/10W | ±25 | ±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 10Ω ~ 100KΩ |
| WF25F_Q | 2512(6432) | 1W | ±15 | ±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 10Ω ~ 1.5MΩ |
| WF20F_Q | 2010(5025) | 3/4W | ±15 | ±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 10Ω ~ 1MΩ |
| WF10F_Q | 1210(3225) | 2/5W | ±15 | ±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 10Ω ~ 600KΩ |
| WF12F_Q | 1206(3216) | 1/4W | ±15 | ±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 4.7Ω ~ 500KΩ |
| WF08F_Q | 0805(2012) | 1/8W | ±15 | ±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 4.7Ω ~ 400KΩ |
| WF06F_Q | 0603(1608) | 1/10W | ±15 | ±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 4.7Ω ~ 150KΩ |
| WF04F_Q | 0402(1005) | 1/10W | ±15 | ±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 10Ω ~ 60KΩ |
| WF25W_Q | 2512(6432) | 1W | ±10 | ±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 10Ω ~ 1.5MΩ |
| WF20W_Q | 2010(5025) | 3/4W | ±10 | ±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 10Ω ~ 1MΩ |
| WF10W_Q | 1210(3225) | 2/5W | ±10 | ±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 10Ω ~ 600KΩ |
| WF12W_Q | 1206(3216) | 1/4W | ±10 | ±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 4.7Ω ~ 500KΩ |
| WF08W_Q | 0805(2012) | 1/8W | ±10 | ±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 4.7Ω ~ 400KΩ |
| WF06W_Q | 0603(1608) | 1/10W | ±10 | ±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 4.7Ω ~ 150KΩ |
| WF04W_Q | 0402(1005) | 1/10W | ±10 | ±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 10Ω ~ 60KΩ |
| WF25Z_Q | 2512(6432) | 1W | ±5 | ±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 10Ω ~ 600KΩ |
| WF20Z_Q | 2010(5025) | 3/4W | ±5 | ±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 10Ω ~ 360KΩ |
| WF10Z_Q | 1210(3225) | 2/5W | ±5 | ±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 10Ω ~ 150KΩ |
| WF12Z_Q | 1206(3216) | 1/4W | ±5 | ±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 4.7Ω ~ 150KΩ |
| WF08Z_Q | 0805(2012) | 1/8W | ±5 | ±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 4.7Ω ~ 100KΩ |
| WF06Z_Q | 0603(1608) | 1/10W | ±5 | ±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 4.7Ω ~ 50KΩ |
| WF04Z_Q | 0402(1005) | 1/10W | ±5 | ±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 10Ω ~ 10KΩ |
| WF25B_Q | 2512(6432) | 1W | ±3 | ±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 10Ω ~ 600KΩ |
| WF20B_Q | 2010(5025) | 3/4W | ±3 | ±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 10Ω ~ 360KΩ |
| WF10B_Q | 1210(3225) | 2/5W | ±3 | ±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 10Ω ~ 150KΩ |
| WF12B_Q | 1206(3216) | 1/4W | ±3 | ±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 4.7Ω ~ 120KΩ |
| WF08B_Q | 0805(2012) | 1/8W | ±3 | ±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 4.7Ω ~ 80KΩ |
| WF06B_Q | 0603(1608) | 1/10W | ±3 | ±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 4.7Ω ~ 40KΩ |
| WF04B_Q | 0402(1005) | 1/10W | ±3 | ±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 10Ω ~ 8KΩ |
| WF25C_Q | 2512(6432) | 1W | ±2 | ±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 10Ω ~ 600KΩ |
| WF20C_Q | 2010(5025) | 3/4W | ±2 | ±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 10Ω ~ 360KΩ |
| WF10C_Q | 1210(3225) | 2/5W | ±2 | ±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 10Ω ~ 150KΩ |
| WF12C_Q | 1206(3216) | 1/4W | ±2 | ±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 4.7Ω ~ 120KΩ |
| WF08C_Q | 0805(2012) | 1/8W | ±2 | ±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 4.7Ω ~ 80KΩ |
| WF06C_Q | 0603(1608) | 1/10W | ±2 | ±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 4.7Ω ~ 40KΩ |
| WF04C_Q | 0402(1005) | 1/10W | ±2 | ±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% | 10Ω ~ 8KΩ |

■ Thin Film Anti-Sulfuration Chip-R (AEC-Q200 Compliant & ASTM B-809)

| Series | Size | Rated Power | TCR(ppm/°C) | Tolerance | Resistance |
|---------|------------|-------------|-------------|------------------------------------|--------------|
| SF25Q_Q | 2512(6432) | 1W | ±50 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 10Ω ~ 1.5MΩ |
| SF20Q_Q | 2010(5025) | 3/4W | ±50 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 10Ω ~ 1.5MΩ |
| SF10Q_Q | 1210(3225) | 2/5W | ±50 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 10Ω ~ 1MΩ |
| SF12Q_Q | 1206(3216) | 1/4W | ±50 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 10Ω ~ 1MΩ |
| SF08Q_Q | 0805(2012) | 1/8W | ±50 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 10Ω ~ 1MΩ |
| SF06Q_Q | 0603(1608) | 1/10W | ±50 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 4.7Ω ~ 330KΩ |
| SF04Q_Q | 0402(1005) | 1/10W | ±50 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 10Ω ~ 100KΩ |
| SF25T_Q | 2512(6432) | 3/4W | ±50 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 10Ω ~ 1.5MΩ |
| SF20T_Q | 2010(5025) | 1/2W | ±50 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 10Ω ~ 1.5MΩ |
| SF10T_Q | 1210(3225) | 1/4W | ±50 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 10Ω ~ 1MΩ |
| SF12T_Q | 1206(3216) | 1/8W | ±50 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 10Ω ~ 1MΩ |
| SF08T_Q | 0805(2012) | 1/10W | ±50 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 10Ω ~ 1MΩ |
| SF06T_Q | 0603(1608) | 1/16W | ±50 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 4.7Ω ~ 330KΩ |
| SF04T_Q | 0402(1005) | 1/16W | ±50 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 10Ω ~ 100KΩ |
| SF25R_Q | 2512(6432) | 1W | ±25 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 10Ω ~ 1.5MΩ |
| SF20R_Q | 2010(5025) | 3/4W | ±25 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 10Ω ~ 1.5MΩ |
| SF10R_Q | 1210(3225) | 2/5W | ±25 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 10Ω ~ 1MΩ |
| SF12R_Q | 1206(3216) | 1/4W | ±25 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 10Ω ~ 1MΩ |
| SF08R_Q | 0805(2012) | 1/8W | ±25 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 10Ω ~ 1MΩ |
| SF06R_Q | 0603(1608) | 1/10W | ±25 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 4.7Ω ~ 330KΩ |
| SF04R_Q | 0402(1005) | 1/10W | ±25 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 10Ω ~ 100KΩ |
| SF25U_Q | 2512(6432) | 3/4W | ±25 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 10Ω ~ 1.5MΩ |
| SF20U_Q | 2010(5025) | 1/2W | ±25 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 10Ω ~ 1.5MΩ |
| SF10U_Q | 1210(3225) | 1/4W | ±25 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 10Ω ~ 1MΩ |
| SF12U_Q | 1206(3216) | 1/8W | ±25 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 10Ω ~ 1MΩ |
| SF08U_Q | 0805(2012) | 1/10W | ±25 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 10Ω ~ 1MΩ |
| SF06U_Q | 0603(1608) | 1/16W | ±25 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 4.7Ω ~ 330KΩ |
| SF04U_Q | 0402(1005) | 1/16W | ±25 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 10Ω ~ 100KΩ |
| SF25F_Q | 2512(6432) | 1W | ±15 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 10Ω ~ 1.5MΩ |
| SF20F_Q | 2010(5025) | 3/4W | ±15 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 10Ω ~ 900KΩ |
| SF10F_Q | 1210(3225) | 2/5W | ±15 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 10Ω ~ 400KΩ |
| SF12F_Q | 1206(3216) | 1/4W | ±15 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 10Ω ~ 300KΩ |
| SF08F_Q | 0805(2012) | 1/8W | ±15 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 10Ω ~ 200KΩ |
| SF06F_Q | 0603(1608) | 1/10W | ±15 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 10Ω ~ 100KΩ |
| SF04F_Q | 0402(1005) | 1/10W | ±15 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 10Ω ~ 20KΩ |
| SF25W_Q | 2512(6432) | 1W | ±10 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 10Ω ~ 1.5MΩ |
| SF20W_Q | 2010(5025) | 3/4W | ±10 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 10Ω ~ 900KΩ |
| SF10W_Q | 1210(3225) | 2/5W | ±10 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 10Ω ~ 400KΩ |
| SF12W_Q | 1206(3216) | 1/4W | ±10 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 10Ω ~ 300KΩ |
| SF08W_Q | 0805(2012) | 1/8W | ±10 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 10Ω ~ 200KΩ |
| SF06W_Q | 0603(1608) | 1/10W | ±10 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 10Ω ~ 100KΩ |
| SF04W_Q | 0402(1005) | 1/10W | ±10 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 10Ω ~ 20KΩ |
| SF25Z_Q | 2512(6432) | 1W | ±5 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 4.7Ω ~ 600KΩ |
| SF20Z_Q | 2010(5025) | 3/4W | ±5 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 4.7Ω ~ 360KΩ |
| SF10Z_Q | 1210(3225) | 2/5W | ±5 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 4.7Ω ~ 150KΩ |
| SF12Z_Q | 1206(3216) | 1/4W | ±5 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 4.7Ω ~ 150KΩ |
| SF08Z_Q | 0805(2012) | 1/8W | ±5 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 4.7Ω ~ 100KΩ |
| SF06Z_Q | 0603(1608) | 1/10W | ±5 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 4.7Ω ~ 50KΩ |
| SF04Z_Q | 0402(1005) | 1/10W | ±5 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 10Ω ~ 10KΩ |

■ Thin Film Anti-Sulfuration Chip-R

| Series | Size | Rated Power | TCR(ppm/°C) | Tolerance | Resistance |
|--------|------------|-------------|-------------|------------------------------------|--------------|
| SF25Q | 2512(6432) | 1W | ±50 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 1Ω ~ 3MΩ |
| SF20Q | 2010(5025) | 3/4W | ±50 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 4.7Ω ~ 3MΩ |
| SF10Q | 1210(3225) | 2/5W | ±50 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 4.7Ω ~ 2.5MΩ |
| SF12Q | 1206(3216) | 1/4W | ±50 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 1Ω ~ 2.5MΩ |
| SF08Q | 0805(2012) | 1/8W | ±50 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 4.7Ω ~ 2MΩ |
| SF06Q | 0603(1608) | 1/10W | ±50 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 4.7Ω ~ 1MΩ |
| SF04Q | 0402(1005) | 1/10W | ±50 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 10Ω ~ 255KΩ |
| SF25T | 2512(6432) | 3/4W | ±50 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 1Ω ~ 3MΩ |
| SF20T | 2010(5025) | 1/2W | ±50 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 4.7Ω ~ 3MΩ |
| SF10T | 1210(3225) | 1/4W | ±50 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 4.7Ω ~ 2.5MΩ |
| SF12T | 1206(3216) | 1/8W | ±50 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 1Ω ~ 2.5MΩ |
| SF08T | 0805(2012) | 1/10W | ±50 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 4.7Ω ~ 2MΩ |
| SF06T | 0603(1608) | 1/16W | ±50 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 4.7Ω ~ 1MΩ |
| SF04T | 0402(1005) | 1/16W | ±50 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 10Ω ~ 255KΩ |
| SF25R | 2512(6432) | 1W | ±25 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 1Ω ~ 3MΩ |
| SF20R | 2010(5025) | 3/4W | ±25 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 4.7Ω ~ 3MΩ |
| SF10R | 1210(3225) | 2/5W | ±25 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 4.7Ω ~ 2.5MΩ |
| SF12R | 1206(3216) | 1/4W | ±25 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 1Ω ~ 2.5MΩ |
| SF08R | 0805(2012) | 1/8W | ±25 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 4.7Ω ~ 2MΩ |
| SF06R | 0603(1608) | 1/10W | ±25 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 4.7Ω ~ 1MΩ |
| SF04R | 0402(1005) | 1/10W | ±25 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 10Ω ~ 255KΩ |
| SF25U | 2512(6432) | 3/4W | ±25 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 1Ω ~ 3MΩ |
| SF20U | 2010(5025) | 1/2W | ±25 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 4.7Ω ~ 3MΩ |
| SF10U | 1210(3225) | 1/4W | ±25 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 4.7Ω ~ 2.5MΩ |
| SF12U | 1206(3216) | 1/8W | ±25 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 1Ω ~ 2.5MΩ |
| SF08U | 0805(2012) | 1/10W | ±25 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 4.7Ω ~ 2MΩ |
| SF06U | 0603(1608) | 1/16W | ±25 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 4.7Ω ~ 1MΩ |
| SF04U | 0402(1005) | 1/16W | ±25 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 10Ω ~ 255KΩ |

■ Thin Film Anti-Sulfuration Chip-R (ASTM-B809 & under Oil 105°C+3.5% Sulfur power 500 hours)

| Series | Size | Rated Power | TCR(ppm/°C) | Tolerance | Resistance |
|---------|------------|-------------|-------------|------------------------------------|--------------|
| SF25Q_A | 2512(6432) | 1W | ±50 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 1Ω ~ 3MΩ |
| SF20Q_A | 2010(5025) | 3/4W | ±50 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 4.7Ω ~ 3MΩ |
| SF10Q_A | 1210(3225) | 2/5W | ±50 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 4.7Ω ~ 2.5MΩ |
| SF12Q_A | 1206(3216) | 1/4W | ±50 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 1Ω ~ 2.5MΩ |
| SF08Q_A | 0805(2012) | 1/8W | ±50 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 4.7Ω ~ 2MΩ |
| SF06Q_A | 0603(1608) | 1/10W | ±50 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 4.7Ω ~ 1MΩ |
| SF04Q_A | 0402(1005) | 1/10W | ±50 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 10Ω ~ 255KΩ |
| SF25R_A | 2512(6432) | 1W | ±25 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 1Ω ~ 3MΩ |
| SF20R_A | 2010(5025) | 3/4W | ±25 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 4.7Ω ~ 3MΩ |
| SF10R_A | 1210(3225) | 2/5W | ±25 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 4.7Ω ~ 2.5MΩ |
| SF12R_A | 1206(3216) | 1/4W | ±25 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 1Ω ~ 2.5MΩ |
| SF08R_A | 0805(2012) | 1/8W | ±25 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 4.7Ω ~ 2MΩ |
| SF06R_A | 0603(1608) | 1/10W | ±25 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 4.7Ω ~ 1MΩ |
| SF04R_A | 0402(1005) | 1/10W | ±25 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 10Ω ~ 255KΩ |
| SF25T_A | 2512(6432) | 1W | ±50 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 1Ω ~ 3MΩ |
| SF20T_A | 2010(5025) | 3/4W | ±50 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 4.7Ω ~ 3MΩ |
| SF10T_A | 1210(3225) | 2/5W | ±50 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 4.7Ω ~ 2.5MΩ |
| SF12T_A | 1206(3216) | 1/8W | ±50 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 1Ω ~ 2.5MΩ |
| SF08T_A | 0805(2012) | 1/10W | ±50 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 4.7Ω ~ 2MΩ |
| SF06T_A | 0603(1608) | 1/16W | ±50 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 4.7Ω ~ 1MΩ |
| SF04T_A | 0402(1005) | 1/16W | ±50 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 10Ω ~ 255KΩ |
| SF25U_A | 2512(6432) | 1W | ±25 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 1Ω ~ 3MΩ |
| SF20U_A | 2010(5025) | 3/4W | ±25 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 4.7Ω ~ 3MΩ |
| SF10U_A | 1210(3225) | 2/5W | ±25 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 4.7Ω ~ 2.5MΩ |
| SF12U_A | 1206(3216) | 1/8W | ±25 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 1Ω ~ 2.5MΩ |
| SF08U_A | 0805(2012) | 1/10W | ±25 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 4.7Ω ~ 2MΩ |
| SF06U_A | 0603(1608) | 1/16W | ±25 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 4.7Ω ~ 1MΩ |
| SF04U_A | 0402(1005) | 1/16W | ±25 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 10Ω ~ 255KΩ |

■ TaN Thin Film Chip-R (Auto Grade, AEC-Q200 Qualified & ASTM-B809)

| Series | Size | Rated Power | TCR(ppm/°C) | Tolerance | Resistance |
|--------|------------|-------------|-------------|------------------------------------|-------------|
| MF12Q | 1206(3216) | 0.4W | ±50 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 10Ω ~ 1MΩ |
| MF08Q | 0805(2012) | 0.2W | ±50 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 10Ω ~ 350KΩ |
| MF06Q | 0603(1608) | 0.15W | ±50 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 40Ω ~ 130KΩ |
| MF04Q | 0402(1005) | 0.0625W | ±50 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 40Ω ~ 35KΩ |
| MF12R | 1206(3216) | 0.4W | ±25 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 10Ω ~ 1MΩ |
| MF08R | 0805(2012) | 0.2W | ±25 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 10Ω ~ 350KΩ |
| MF06R | 0603(1608) | 0.15W | ±25 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 40Ω ~ 130KΩ |
| MF04R | 0402(1005) | 0.0625W | ±25 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 40Ω ~ 35KΩ |
| MF12F | 1206(3216) | 0.4W | ±15 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 10Ω ~ 1MΩ |
| MF08F | 0805(2012) | 0.2W | ±15 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 10Ω ~ 350KΩ |
| MF06F | 0603(1608) | 0.15W | ±15 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 40Ω ~ 130KΩ |
| MF04F | 0402(1005) | 0.0625W | ±15 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 40Ω ~ 35KΩ |
| MF12W | 1206(3216) | 0.4W | ±10 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 10Ω ~ 1MΩ |
| MF08W | 0805(2012) | 0.2W | ±10 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 10Ω ~ 350KΩ |
| MF06W | 0603(1608) | 0.15W | ±10 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 40Ω ~ 130KΩ |
| MF04W | 0402(1005) | 0.0625W | ±10 | ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1%, | 40Ω ~ 35KΩ |

■ Precision Thin Film Chip-R Array: Convex Termination (AEC-Q200 Compliant)

| Series | Size | Rated Power | TCR (ppm/°C) | Termination | Tolerance | Resistance |
|--------|-------------|-------------|--------------|-------------|-----------------------------|-------------|
| TA06N | 0603*4 (4R) | 1/10W | ±25 | Convex | ±0.1%, ±0.25%, ±0.5%, ±1.0% | 20Ω ~ 200KΩ |
| TA06M | 0603*4 (4R) | 1/10W | ±50 | Convex | ±0.1%, ±0.25%, ±0.5%, ±1.0% | 20Ω ~ 200KΩ |

■ MELF Thin Film Resistor (AEC-Q200 Compliant)

| Series | Size | Rated Power | TCR(ppm/°C) | Tolerance | Resistance |
|--------|------|-------------|-------------|----------------------------|---------------|
| WM04B | 0204 | 1/4W | ±50 | ±0.1%, ±0.25%, ±0.5%, ±1%, | 0.2Ω ~ 1MΩ |
| WM04N | 0204 | 2/5W | ±50 | ±0.1%, ±0.25%, ±0.5%, ±1%, | 0.2Ω ~ 1MΩ |
| WM04C | 0204 | 1/4W | ±25 | ±0.1%, ±0.25%, ±0.5%, ±1%, | 10Ω ~ 1MΩ |
| WM04O | 0204 | 2/5W | ±25 | ±0.1%, ±0.25%, ±0.5%, ±1%, | 10Ω ~ 1MΩ |
| WM04D | 0204 | 1/4W | ±15 | ±0.1%, ±0.25%, ±0.5%, ±1%, | 49.9Ω ~ 250KΩ |
| WM04P | 0204 | 2/5W | ±15 | ±0.1%, ±0.25%, ±0.5%, ±1%, | 49.9Ω ~ 250KΩ |
| WM04E | 0204 | 1/4W | ±10 | ±0.1%, ±0.25%, ±0.5%, ±1%, | 49.9Ω ~ 25KΩ |
| WM04Q | 0204 | 2/5W | ±10 | ±0.1%, ±0.25%, ±0.5%, ±1%, | 49.9Ω ~ 25KΩ |
| WM07B | 0207 | 1/2W | ±50 | ±0.1%, ±0.25%, ±0.5%, ±1%, | 0.2Ω ~ 1MΩ |
| WM07N | 0207 | 1W | ±50 | ±0.1%, ±0.25%, ±0.5%, ±1%, | 0.2Ω ~ 1MΩ |
| WM07C | 0207 | 1/2W | ±25 | ±0.1%, ±0.25%, ±0.5%, ±1%, | 10Ω ~ 1MΩ |
| WM07O | 0207 | 1W | ±25 | ±0.1%, ±0.25%, ±0.5%, ±1%, | 10Ω ~ 1MΩ |
| WM07D | 0207 | 1/2W | ±15 | ±0.1%, ±0.25%, ±0.5%, ±1%, | 49.9Ω ~ 250KΩ |
| WM07P | 0207 | 1W | ±15 | ±0.1%, ±0.25%, ±0.5%, ±1%, | 49.9Ω ~ 250KΩ |
| WM07E | 0207 | 1/2W | ±10 | ±0.1%, ±0.25%, ±0.5%, ±1%, | 49.9Ω ~ 25KΩ |
| WM07Q | 0207 | 1W | ±10 | ±0.1%, ±0.25%, ±0.5%, ±1%, | 49.9Ω ~ 25KΩ |

■ MELF Precision Thin Film Resistor (AEC-Q200 Compliant)/Epoxy Molding

| Series | Size | Rated Power | TCR(ppm/°C) | Tolerance | Resistance |
|---------|------|-------------|-------------|----------------------------|---------------|
| WM04B_Q | 0204 | 1/4W | ±50 | ±0.1%, ±0.25%, ±0.5%, ±1%, | 0.2Ω ~ 1MΩ |
| WM04N_Q | 0204 | 2/5W | ±50 | ±0.1%, ±0.25%, ±0.5%, ±1%, | 0.2Ω ~ 1MΩ |
| WM04C_Q | 0204 | 1/4W | ±25 | ±0.1%, ±0.25%, ±0.5%, ±1%, | 10Ω ~ 1MΩ |
| WM04O_Q | 0204 | 2/5W | ±25 | ±0.1%, ±0.25%, ±0.5%, ±1%, | 10Ω ~ 1MΩ |
| WM04D_Q | 0204 | 1/4W | ±15 | ±0.1%, ±0.25%, ±0.5%, ±1%, | 49.9Ω ~ 250KΩ |
| WM04P_Q | 0204 | 2/5W | ±15 | ±0.1%, ±0.25%, ±0.5%, ±1%, | 49.9Ω ~ 250KΩ |
| WM04E_Q | 0204 | 1/4W | ±10 | ±0.1%, ±0.25%, ±0.5%, ±1%, | 49.9Ω ~ 25KΩ |
| WM04Q_Q | 0204 | 2/5W | ±10 | ±0.1%, ±0.25%, ±0.5%, ±1%, | 49.9Ω ~ 25KΩ |
| WM07B_Q | 0207 | 1/2W | ±50 | ±0.1%, ±0.25%, ±0.5%, ±1%, | 0.2Ω ~ 1MΩ |
| WM07N_Q | 0207 | 1W | ±50 | ±0.1%, ±0.25%, ±0.5%, ±1%, | 0.2Ω ~ 1MΩ |
| WM07C_Q | 0207 | 1/2W | ±25 | ±0.1%, ±0.25%, ±0.5%, ±1%, | 10Ω ~ 1MΩ |
| WM07O_Q | 0207 | 1W | ±25 | ±0.1%, ±0.25%, ±0.5%, ±1%, | 10Ω ~ 1MΩ |
| WM07D_Q | 0207 | 1/2W | ±15 | ±0.1%, ±0.25%, ±0.5%, ±1%, | 49.9Ω ~ 250KΩ |
| WM07P_Q | 0207 | 1W | ±15 | ±0.1%, ±0.25%, ±0.5%, ±1%, | 49.9Ω ~ 250KΩ |
| WM07E_Q | 0207 | 1/2W | ±10 | ±0.1%, ±0.25%, ±0.5%, ±1%, | 49.9Ω ~ 25KΩ |
| WM07Q_Q | 0207 | 1W | ±10 | ±0.1%, ±0.25%, ±0.5%, ±1%, | 49.9Ω ~ 25KΩ |

■ MELF High Reliability Thin Film Resistor (AEC-Q200 Compliant)/Epoxy Molding

| Series | Size | Rated Power | TCR(ppm/°C) | Tolerance | Resistance |
|--------|------|-------------|-------------|----------------------------|-------------|
| MM04B | 0204 | 1/4W | ±50 | ±0.1%, ±0.25%, ±0.5%, ±1%, | 10Ω ~ 50KΩ |
| MM04N | 0204 | 2/5W | ±50 | ±0.1%, ±0.25%, ±0.5%, ±1%, | 10Ω ~ 50KΩ |
| MM04C | 0204 | 1/4W | ±25 | ±0.1%, ±0.25%, ±0.5%, ±1%, | 10Ω ~ 50KΩ |
| MM04O | 0204 | 2/5W | ±25 | ±0.1%, ±0.25%, ±0.5%, ±1%, | 10Ω ~ 50KΩ |
| MM07B | 0207 | 1/2W | ±50 | ±0.1%, ±0.25%, ±0.5%, ±1%, | 11Ω ~ 100KΩ |
| MM07N | 0207 | 1W | ±50 | ±0.1%, ±0.25%, ±0.5%, ±1%, | 11Ω ~ 100KΩ |
| MM07C | 0207 | 1/2W | ±25 | ±0.1%, ±0.25%, ±0.5%, ±1%, | 11Ω ~ 100KΩ |
| MM07O | 0207 | 1W | ±25 | ±0.1%, ±0.25%, ±0.5%, ±1%, | 11Ω ~ 100KΩ |

■ Thin Film Low ohmic Current Sensor

| Series | Size | Rated Power | TCR (ppm/°C) | Tolerance | Resistance |
|--------|-------------|-------------|--------------|------------|---------------|
| WW25F | 2512 (6432) | 2W | ±75 | ±0.5%, ±1% | 101mΩ ~ 900mΩ |
| WW25G | | | ±100 | | 21mΩ ~ 900mΩ |
| WW20F | 2010 (5025) | 1W | ±75 | ±0.5%, ±1% | 101mΩ ~ 900mΩ |
| WW20G | | | ±100 | | 21mΩ ~ 900mΩ |
| WW12F | 1206 (3216) | 1/2W | ±75 | ±0.5%, ±1% | 101mΩ ~ 900mΩ |
| WW12G | | | ±100 | | 21mΩ ~ 900mΩ |
| WW12H | 0805 (2012) | 1W | ±75 | ±0.5%, ±1% | 101mΩ ~ 900mΩ |
| WW08F | | | ±75 | | 101mΩ ~ 900mΩ |
| WW08G | 0603 (1608) | 1/8W | ±100 | ±0.5%, ±1% | 21mΩ ~ 900mΩ |
| WW06F | | | ±75 | | 101mΩ ~ 900mΩ |
| WW06G | 0402 (1005) | 1/10W | ±100 | ±0.5%, ±1% | 21mΩ ~ 900mΩ |
| WW04F | | | ±75 | | 101mΩ ~ 900mΩ |
| WW04G | | | ±100 | | 21mΩ ~ 900mΩ |

■ Thin Film High Power (Low TCR/Tight Tolerance) Current Sensor

| Series | Size | Rated Power | TCR (ppm/°C) | Tolerance | Resistance |
|--------|-------------|-------------|----------------|-----------------------|--------------|
| TTL25P | 2512 (6432) | 1W | ±50, ±75, ±100 | ±0.5%(>10mΩ), ±1%,±5% | 5mΩ ~ 20mΩ |
| TTL25Q | | 2W | | | |
| TTL20P | 2010 (5025) | 1W | ±50, ±75, ±100 | ±0.5%(>10mΩ), ±1%,±5% | 5mΩ ~ 20mΩ |
| TTL20Q | | 2W | | | |
| TTL12J | 1206 (3216) | 1/4W | ±75 | ±0.5%(>10mΩ), ±1%,±5% | 5mΩ ~ 20mΩ |
| TTL12K | | 1/3W | | | |
| TTL12M | | 1/2W | | | |
| TTL12P | | 1W | | | |
| TTL08J | 0805 (2012) | 1/4W | ±75 | ±0.5%(>10mΩ), ±1%,±5% | 5mΩ ~ 20mΩ |
| TTL08K | | 1/3W | | | |
| TTL08M | | 1/2W | | | |
| TTL06I | 0603 (1608) | 1/5W | ±75 | ±0.5%(>10mΩ), ±1%,±5% | 5mΩ ~ 20mΩ |
| TTL06J | | 1/4W | | | |
| TTL06K | | 1/3W | | | |
| TTL06M | | 1/2W | | | |
| TTL04H | 0402 (1005) | 1/8W | ±150 | ±0.5%(>10mΩ), ±1%,±5% | 2.5mΩ ~ 20mΩ |
| TTL04I | | 1/5W | | | |
| TTL04J | | 1/4W | | | |
| TTL04K | | 1/3W | | | |
| TTL04M | 0201 (0603) | 1/2W | ±350 | ±0.5%(>10mΩ), ±1%,±5% | 5mΩ ~ 20mΩ |
| TTL02G | | 1/10W | | | |
| TTL02H | | 1/8W | | | |
| TTL02I | | 1/5W | | | |
| TTL02J | | 1/4W | | | |
| TTL02K | | 1/3W | | | |

■ Thin Film High Power Ultra Low Ohmic Current Sensor

| Series | Size | Rated Power | TCR (ppm/°C) | Tolerance | Resistance |
|--------|-------------|-------------|--------------|-----------|--------------------------|
| TTU25S | 2512 (6432) | 3W | ±50 | ±1%,±5% | 1m,1.5m,2m,2.5m,3m,3.5mΩ |
| TTU25R | 2512 (6432) | 2.5W | ±50 | ±1%,±5% | 4m,4.5m,5m,6mΩ |
| TTU25Q | 2512 (6432) | 2W | ±50 | ±1%,±5% | 6.5m,7m,7.5m,8m,9m,10mΩ |
| TTU25S | 2512 (6432) | 3W | ±100 | ±1%,±5% | 0.5mΩ |
| TTU12Q | 1206 (3216) | 2W | ±100 | ±1%,±5% | 1m,2m,3mΩ |

■ 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. Automotives

■ 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% (E2+E964): 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 | 3/4 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 | 75V | 50V | 25V | 20V |
| Operating Temperature | -55 ~ +155°C | | | | | | | | -55 ~ +125°C | |
| Basic Specification | JIS C 5201-1 / IEC 60115-1 | | | | | | | | | |

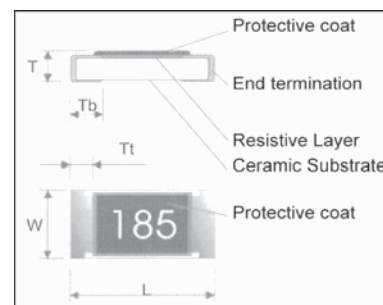
Note:

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 $RCWW = \sqrt{\text{Rater Power} \times \text{Resistance Value}}$ or Max. RCWW listed above, whichever is lower.
3. Detailed TCR please refer to specific specification.

■ Quick Reference Data

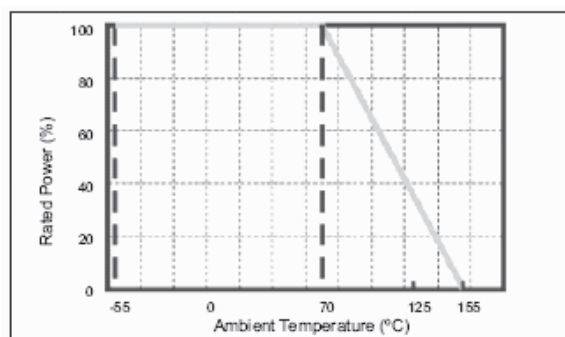
Unit: mm

| 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 |

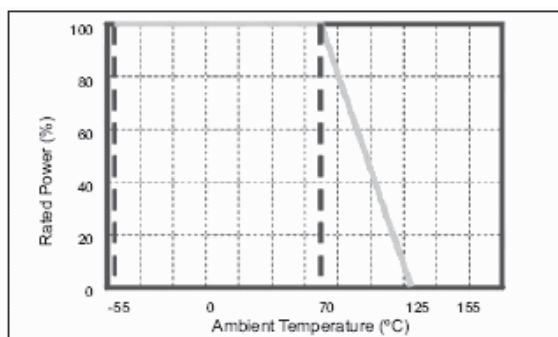


■ Power Deration Curve

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

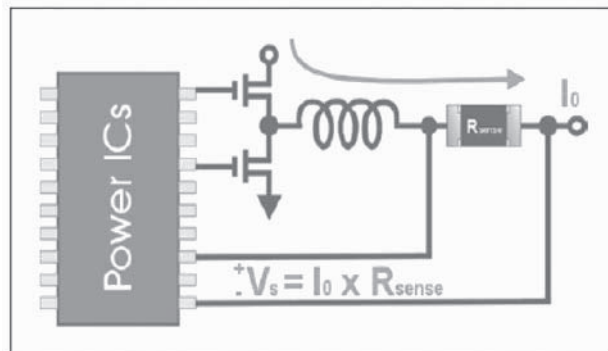
■ Function for Low Ohm Chip Resistor

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 $100\text{mV} / 5\text{A} = 20\text{ m}\Omega$, the power dissipation will be :

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



■ 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 |
| Operating 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

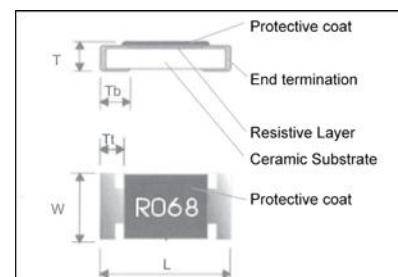
| Item | General Specification | | | | | |
|---|--------------------------------------|--------------------------------------|--------------------------------------|--------------------------------------|--------------------------------------|-------------------------------|
| Series No. | WW25P | WW20P | WW12P | WW08P | WW06P | WW04P |
| Size code | 2512 (6432) | 2010 (5025) | 1206 (3216) | 0805(2012) | 0603(1608) | 0402(1005) |
| Resistance Tolerance | $\pm 5\%$, $\pm 1\%$ | | | | | |
| Resistance Range | 0.047 Ω ~ 0.976 Ω | | | | | 0.1 Ω ~0.976 Ω |
| TCR (ppm/ $^{\circ}\text{C}$) < 0.100 Ω | $\pm 150\text{ppm}/^{\circ}\text{C}$ | $\pm 150\text{ppm}/^{\circ}\text{C}$ | $\pm 200\text{ppm}/^{\circ}\text{C}$ | $\pm 200\text{ppm}/^{\circ}\text{C}$ | $\pm 250\text{ppm}/^{\circ}\text{C}$ | - |
| $\geq 0.100\Omega$ | $\pm 100\text{ppm}/^{\circ}\text{C}$ | $\pm 100\text{ppm}/^{\circ}\text{C}$ | $\pm 100\text{ppm}/^{\circ}\text{C}$ | $\pm 150\text{ppm}/^{\circ}\text{C}$ | $\pm 200\text{ppm}/^{\circ}\text{C}$ | 0~+300ppm/ $^{\circ}\text{C}$ |
| Max. dissipation @ Tamb=70 $^{\circ}\text{C}$ | 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 |
| Operating Temperature | -55 ~ +155 $^{\circ}\text{C}$ | | | | | |

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

■ Physical Dimensions

Unit: mm

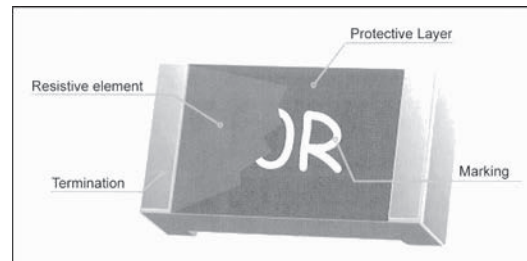
| Dimensions | WW25P | WW20P | WW12P | WW08P | WW06P | WW04P |
|------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| L | 6.30 \pm 0.20 | 5.00 \pm 0.20 | 3.10 \pm 0.15 | 2.00 \pm 0.15 | 1.60 \pm 0.10 | 1.00 \pm 0.05 |
| W | 3.10 \pm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



■ Metal Low Ohm Sensing Chip Resistors (0.001Ω~ 0.100Ω)

■ 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 layers of these end terminations are 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) | 0805 (2012) | 0603 (1608) |
| Resistance Tolerance | ±5% , ±1% | | | | | | |
| Resistance Range (mΩ) | 1 ~ 10 | 1 ~ 15 | 1 ~15 | 20, 25, 30, 40, 50 | 2 ~ 10 | 20, 25, 30, 40, 50 | 5, 10 |
| TCR (ppm/°C) | ±100 | | ±75 | | ±75 | ±75 | ±75 |
| Max. dissipation @ Tamb=70°C | 2 W | 1 W | 1 W | 1 W | 1/2 W | 1/2 W | 1/3 W |
| Operating Temperature | -55 ~ +155°C | | | | | | |

| Item | General Specification | | | | | | | |
|------------------------------|--|-----------------------------|---|-------|---------------|-------------------|---------------|-----------------------|
| Series No. | WW25A | WW25B | WW25N | WW25M | WW20M | WW20N | WW12M | WW12N |
| Size code | 2512 (6432) | | | | 2010 (5025) | | 1206(3216) | |
| Resistance Tolerance | ±5% , ±1% | | | | | | | |
| Resistance Range (mΩ) | 5, 6, 7, 8, 9, 10, 12, 15 18, 20, 25, 30, 33, 35, 40, 50 | 3, 4, 5, 6, 7, 8, 9, 10, 20 | 3, 4, 5, 6, 7, 8, 9, 10, 12,15, 20, 25, 30, 33, 35, 40, 50, 70, 75, 80, 100 | | 5, 10, 15, 20 | 5, 10, 15, 20, 25 | 5, 10, 15, 20 | 5, 10, 15, 20, 25, 30 |
| TCR (ppm/°C) | ± 70/ ± 50 | | ± 70 | | ± 70 | | ± 70 | |
| Max. dissipation @ Tamb=70°C | 3W | | 2W | 1W | 1/2 W | 1 W | 1/2 W | 1W |
| Operating 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

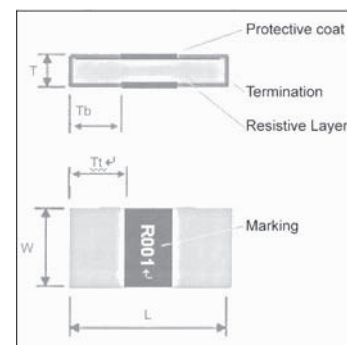
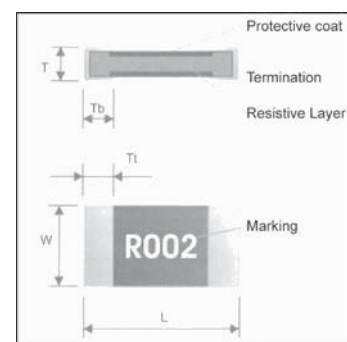
Unit: mm

| Symbol | WW25N/ WW25M | WW20N/ WW20M | WW12N/ WW12M |
|--------|--------------|--------------|--------------|
| L | 6.20±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±0.20 | 0.60±0.15 | 0.60±0.25 |
| Tt | 0.80±0.20 | 0.65±0.25 | 0.60±0.20 |
| Tb | 0.80±0.20 | 0.65±0.25 | 0.60±0.20 |

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

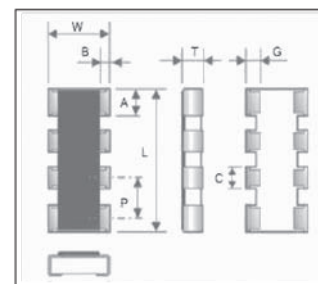
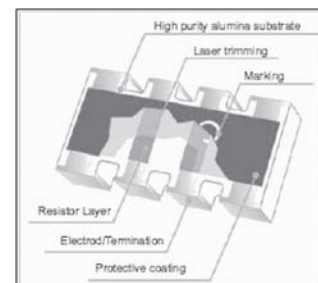
The resistors array is constructed in a high grade ceramic body (aluminum oxide). Internal metal electrodes are added at each end and connected by a resistive paste that is applied to the top surface of the substrate. The composition of the paste is adjusted to give the approximate resistance required 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 terminations are Tin solder alloy. Marking code description is depended on component size and tolerance. Following figure shown the construction of a Chip-R array..

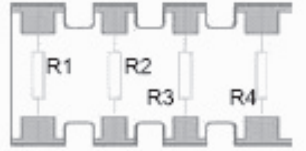
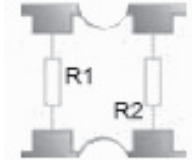
■ Physical Dimensions

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 |
| Operating Temperature | -55 ~ +155°C | | | |
| Basic Specification | JIS C5201-1 / IEC 60115-1 | | | |
| Circuit Mode: R1=R2(=R3=R4) |  | |  | |

Note:

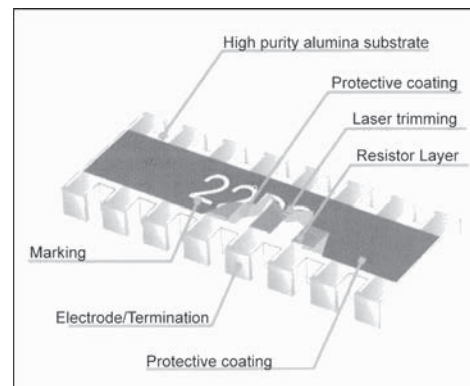
1. Power derating curve and detail specification please refer to specific data sheets.

■ 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 (0402×8) | 1506 (0402×8) |
| 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 | 12 mm | 8 mm |
| Operating Temperature | -55 ~ +155°C | |
| Circuit Mode: R1=R2=R3=R4=R5=R6=R7=R8 | | |

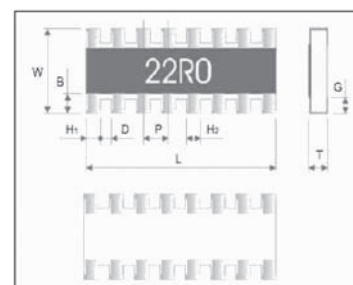
Note:

1. 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.

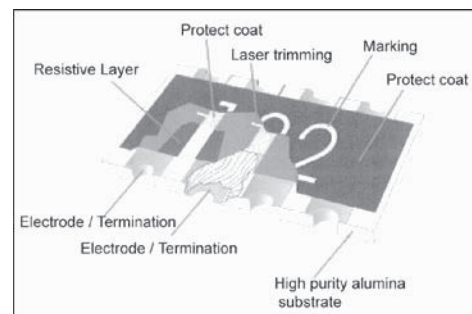
■ Application

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

■ 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 ends 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.



■ 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 |
| Operating Temperature | -55 ~ +155°C | | |
| Circuit Mode | $R1=R2=R3=R4$ | | |
| | L | 3.20±0.20/-0.10mm | 2.00±0.10mm |
| | W | 1.60±0.20/-0.10mm | 1.00±0.10mm |
| | T | 0.60±0.20mm | 0.45±0.10mm |
| | P | 0.80±0.10mm | 0.50±0.05mm |
| | A | 0.60±0.15mm | 0.35±0.05mm |
| | B | 0.35±0.15mm | 0.20±0.15mm |
| | C | 0.50±0.15mm | 0.25±0.05mm |
| | G | 0.50±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.

■ High Precision Thin Film Chip Resistors Array : Convex Termination (AEC-Q200 Compliant)

■ Feature

1. SMD metal film resistor
2. High reliability and stability of 0.1% and below per customer request
3. Low current noise
4. $\pm 0.02\%$ is upon the customer request
5. TCR tracking down to 5 ppm/°C
6. Tolerance tracking down to 0.05%
7. AEC-Q200 compliant

■ Application

1. Medical equipment
2. Measuring instrument
3. Communication device
4. Computer.

■ Description

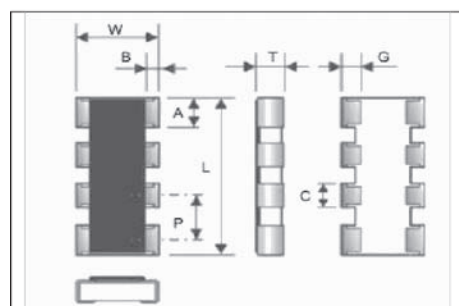
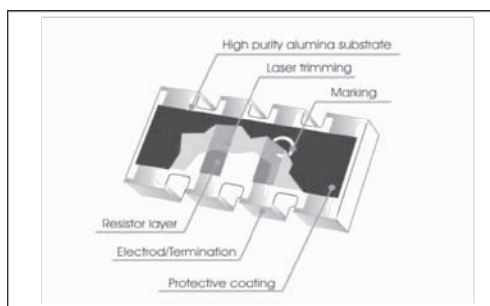
The resistors are constructed in a high grade ceramic body (aluminum oxide). Internal metal electrodes are added at each end and connected by a resistive layer that is applied to the top surface of the substrate. The composition of the resistive layer is adjusted to give the approximate resistance required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

The resistive layer is covered with a protective coat. Finally, the two external end terminations are added. For environmental soldering issue, the outer layer of these end terminations is a Lead-free solder.

■ Physical Dimensions

Unit: mm

| Type | TA06N/TA06M |
|------|-------------|
| W | 1.50±0.15 |
| L | 3.20±0.15 |
| P | 0.80±0.10 |
| C | 0.40±0.10 |
| A | 0.60±0.10 |
| B | 0.40±0.15 |
| G | 0.30±0.15 |
| T | 0.40±0.04 |



■ Quick Reference Data

| Series No. | TA06N | TA06M |
|------------------------------------|---|-----------------|
| Size | 0603×4 | |
| Termination construction | Convex | |
| Resistance Tolerance | $\pm 1\%$, $\pm 0.5\%$, $\pm 0.25\%$, $\pm 0.1\%$ (E24+E96 series) | |
| Resistance Range | 20R ~ 200K Ω | |
| TCR (ppm/°C) | ± 25 ppm/°C | ± 50 ppm/°C |
| Max. dissipation at Tamb=70°C | 0.1watts / element @70°C 0.4watts / package @70°C | |
| Max. Operating Voltage (DC or RMS) | 75V | |
| Max. Overload Voltage (DC or RMS) | 150V | |
| Operating Temperature | -55 ~ +155°C | |
| Basic Specification | JIS C5201-1 / IEC 60115-8 | |
| Circuit Mode: R1=R2(=R3=R4) | | |

Note:

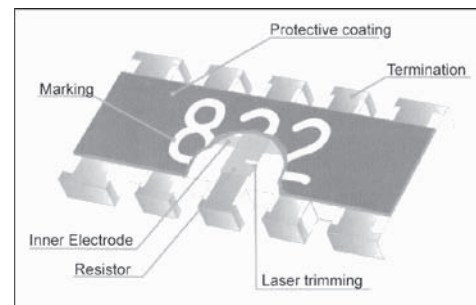
1. Power derating curve and detail specification please refer to specific data sheets.

■ 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 |
| Operating Temperature | -55 ~ +155°C |
| Circuit Mode: Resistor elements on pin1 ~ pin4, pin6 ~ pin9; R1=R2=R3=R4=R6=R7=R8=R9 | |

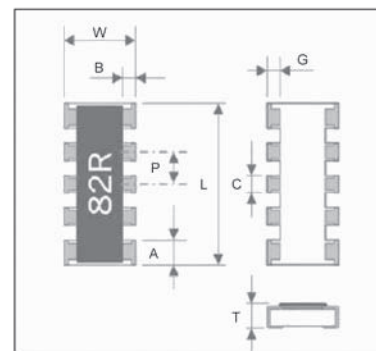
Note:

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 |

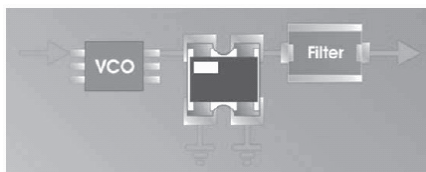


■ WA04P Chip Attenuator

■ 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, p 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:50Ω | A : ± 0.1dB B : ± 0.3dB C : ± 0.4dB D : ± 0.8dB E : ± 1.0dB F : ± 1.5dB G : ± 2.0dB H : ± 2.5dB P : - | T=7" reel taped | L=Sn base (lead free) |

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



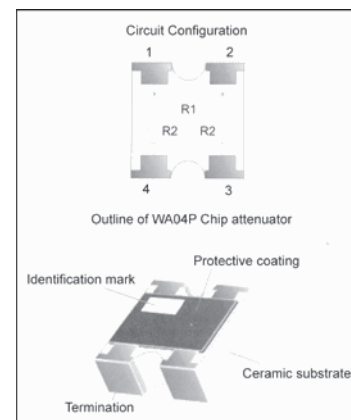
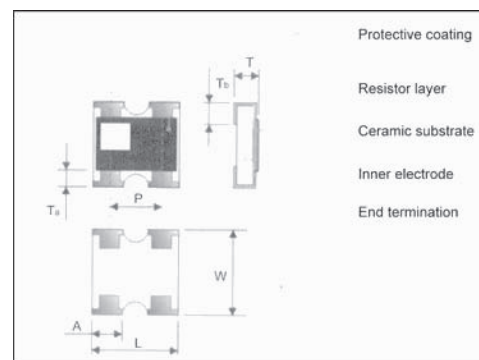
■ Quick Reference Data

| Item | General Specification |
|------------------------------------|-----------------------|
| Series No. | WA04P |
| Size | 0402×2 (1005×2) |
| Termination construction | Convex type |
| Attenuation Range | 0dB, 0.5dB ~ 20dB |
| Attenuation Tolerance | |
| 0dB | - |
| 0.5 dB | ±0.1dB |
| 1dB ~ 5dB | ±0.3dB |
| 6dB ~ 10dB | ±0.4dB |
| 11dB ~ 13dB | ±0.8dB |
| 14dB | ±1.0dB |
| 15 ~ 16dB | ±1.5dB |
| 17 ~ 19dB | ±2.0dB |
| 20dB | ±2.5dB |
| Characteristic impedance | 50Ω |
| Rated power at Tamb=70°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 |
| Operating Temperature | -40 ~ +125°C |

■ Physical Dimensions

Unit: mm

| | WA04P |
|----|--------------|
| L | 1.00±0.10 |
| W | 1.00±0.10/-0 |
| T | 0.35±0.10 |
| P | 0.65±0.20 |
| A | 0.33±0.10 |
| Ta | 0.15±0.10 |
| Tb | 0.25±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 10ppm/°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, tolerances are available upon customer's request.

■ MR Series of Automotive & SR Series of 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 | 1Ω~10MΩ ($\pm 1\%$, $\pm 5\%$) ,Jumper | | | | 1Ω~10MΩ ($\pm 1\%$, $\pm 5\%$) ,Jumper | | | |
| TCR (ppm/°C) | ± 200 ppm* | | | | ± 200 ppm* | | | |
| Max. dissipation @ Tamb=70°C | 1 W | 3/4 W | 1 W | 1/2 W | 1/4 W | 1/4 W | 1/8 W | 1/10 W |
| Max. Operation Voltage | 250V | 200V | 200V | 200V | 200V | 150V | 75V | 50V |
| Operating Temperature | -55 ~ +155°C | | | | -55 ~ +155°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 | 1Ω~10MΩ ($\pm 1\%$, $\pm 5\%$) ,Jumper | | | | | |
| TCR (ppm/°C) | ± 200 ppm* | | | | | |
| Max. dissipation @ Tamb=70°C | 1 W | 3/4 W | 1/4 W | 1/4 W | 1/8 W | 1/10 W |
| Max. Operation Voltage | 250V | 200V | 200V | 150V | 75V | 50V |
| Operating Temperature | -55 ~ +155°C | | | | | |

Remark: *Detail specification please refers to specific data sheets. *MR series can withstand H2S 3ppm×1000hrs. *SR series can withstand H2S 1000ppm×720hrs.

■ WR_R Series of Total Lead Free Chip Resistor

■ 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. | WR25_R | WR18_R | WR20_R | WR10_R | WR12_R | WR08_R | WR06_R | WR04_R | WR02_R |
|------------------------------|--|-------------|------------|-------------|-------------|-------------|-------------|-------------|--------------|
| Size code | 2512 (6432) | 1218 (3248) | 2010(5025) | 1210 (3225) | 1206 (3216) | 0805 (2012) | 0603 (1608) | 0402 (1005) | 0201 (0603) |
| Resistance Range | 1Ω~10MΩ ($\pm 1\%$, $\pm 5\%$) , Jumper | | | | | | | | |
| TCR (ppm/°C) | ± 200 ppm* | | | | | | | | |
| Max. dissipation @ Tamb=70°C | 1 W | 1W | 1/2W | 1/3W | 1/4 W | 1/8 W | 1/10 W | 1/16 W | 1/20 W |
| Max. Operation Voltage | 250V | 200V | 200V | 200V | 200V | 150V | 50V | 50V | 25V |
| Operating Temperature | -55 ~ +155°C | | | | | | | | -55 ~ +125°C |

Remark: *Detail specification please refers 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 Resistor

■ Feature

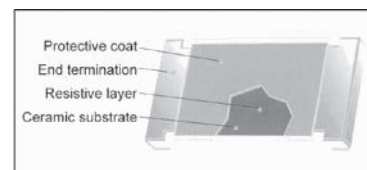
1. High precision, reliability and stability
2. Miniature size down to 0603 (1608)

■ Application

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

■ Description

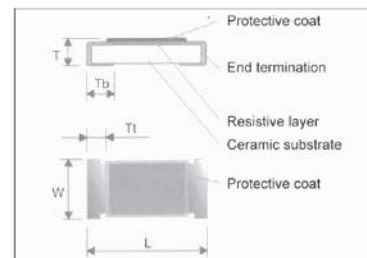
The resistors are constructed on a high grade ceramic body (aluminum oxide). Internal metal electrodes are added at each end and connected by a resistive paste that is applied to the top surface of the substrate. The composition of the paste is adjusted to give the approximate resistance required. The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



■ 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 1Ω ~ 9.1Ω: -200 ~ +500 ppm/°C | | | | | ±200 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 |
| Operating Temperature | -55 ~ +125°C | | | | | |
| Basic Specification | JIS C 5201-1 / IEC 60115-1 | | | | | |

■ WKxxV Series of High Voltage Chip Resistor

■ 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 | 1/2 W | 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 |
| Operating Temperature | -55 ~ +125°C | | | | | | |

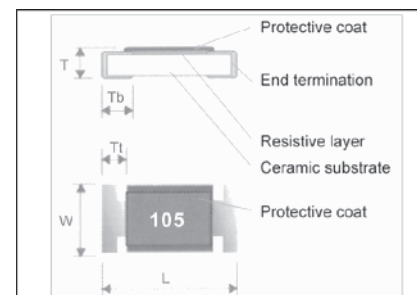
Note:

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 and WFxxA Series of High Power Chip Resistor

■ 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 WFxxP

| 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 |
| Operating Temperature | -55 ~ +155°C | | | | | | |

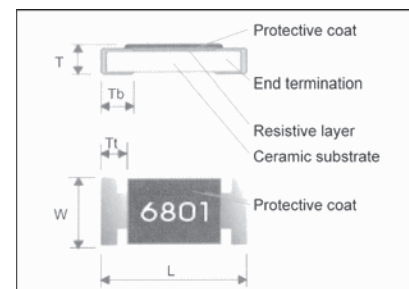
Note:

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 $RCWV = \sqrt{\text{Rated Power} \times \text{Resistance Value}}$ or Max. RCWW listed above, whichever is lower.
3. 2W loading with total solder-pad and trace size of 300mm²
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 |



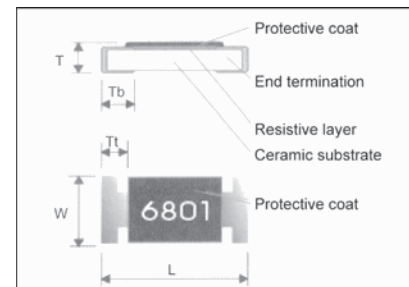
■ Quick Reference Data WFxxA

| Item | General Specification | | | | | |
|------------------------------------|-----------------------|------------|------------|------------|------------|-------------|
| Series No. | WF25A | WF20A | WF10A | WF12A | WF08A | WF06A |
| Size code | 2512(6432) | 2010(5025) | 1210(3225) | 1206(3216) | 0805(2012) | 0603 (1608) |
| Resistance Tolerance | ±1% , ±5% | | | | | |
| Resistance Range | 1Ω ~ 1MΩ | | | | | |
| TCR (ppm/°C) | ± 100 ppm/°C | | | | | |
| Max. dissipation @ Tamb=70°C | 3W | 1.5W | 3/4W | 3/4W | 1/2W | 1/3W |
| Max. Operation Voltage (DC or RMS) | 250V | 200V | 200V | 250V | 200V | 75V |
| Operating Temperature | -55 ~ +155°C | | | | | |

■ Physical Dimensions

Unit: mm

| Symbol | WF25A | WF20A | WF10A | WF12A | WF08A | WF06A |
|--------|-----------|-----------|-----------|-----------|-----------|-----------|
| L | 6.40±0.20 | 5.00±0.20 | 3.10±0.10 | 3.10±0.10 | 2.00±0.10 | 1.60±0.10 |
| W | 3.10±0.20 | 2.50±0.20 | 2.60±0.10 | 1.60±0.10 | 1.20±0.10 | 0.80±0.10 |
| T | 1.10±0.20 | 0.60±0.10 | 0.55±0.10 | 0.55±0.10 | 0.50±0.10 | 0.45±0.10 |
| Tt | 0.40±0.25 | 0.60±0.25 | 0.50±0.20 | 0.50±0.25 | 0.40±0.20 | 0.30±0.20 |
| 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 |



■ WKxxS Series of Anti-Surge Chip Resistor

■ 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 |
| Operating Temperature | -55 ~ +155°C | | | | |

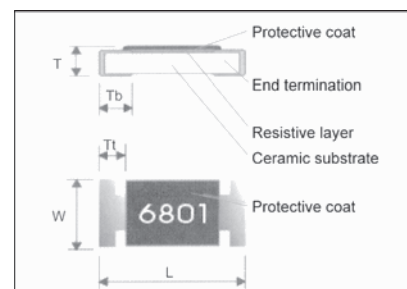
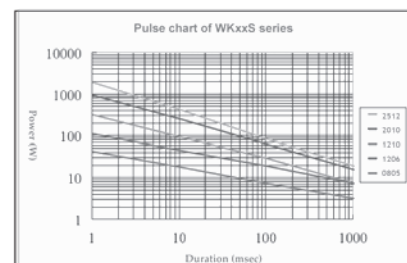
Note:

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 |



■ Thick Film High Precision Chip Resistor

■ Narrow Tolerance Thick Film TC100 WFxxH Series (E96+E24 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 |
| Operating Temperature | -55 ~ +155°C | | | |
| Basic Specification | JIS C5201-1 / IEC 60115-1 | | | |

(Detail specification please refer to specific data sheets)

■ Narrow Tolerance Thick Film TC50 WFxxK Series (E96+E24 series)

| Series No. | WF12K | WF08K | WF06K | WF04K |
|------------------------------------|----------------------------|------------|------------|------------|
| 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) | ±50 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 | | | |

■ Thin Film Precision Chip Resistor: WF Series

■ Feature

1. SMD metal film resistor
2. High reliability and stability of 0.25% and below per customer request
3. High performance of TCR: 50 ppm/°C and below per customer request
4. Low current noise
5. RoHS compliant and lead free

■ Application

1. Medical equipment
2. Measuring instrument
3. Communication device
4. Computer

■ Thin Film TC50 / TC25 WFxxT & U Series (E192+E24 series)

| Series No. | WF25T&U | WF20T&U | WF10T&U | WF12T&U | WF08T&U | WF06T&U | WF04T&U | WF02T&U |
|------------------------------------|--|------------|-------------|-------------|-------------|-------------|-------------|-----------------|
| Size | 2512(6432) | 2010(5025) | 1210(3225) | 1206 (3216) | 0805 (2012) | 0603 (1608) | 0402 (1005) | 0201 (0603) |
| Resistance Tolerance | ±1%, ±0.5%, ±0.25%, ±0.1%, ±0.05%, ±0.02% ±0.01% | | | | | | | ±1%, ±0.5%±0.1% |
| Resistance Range | 1~ 3MΩ | 4.7~ 3MΩ | 4.7~ 2.49MΩ | 1~ 2.49MΩ | 4.7~ 2MΩ | 4.7~ 1MΩ | 10~ 255KΩ | 100~ 12KΩ |
| TCR (ppm/°C) | ±50 / 25 ppm/°C | | | | | | | |
| Max. dissipation @ Tamb=70°C | 3/4W | 1/2W | 1/4W | 1/8W | 1/10W | 1/16W | 1/16W | 1/32W |
| Max. Operating Voltage (DC or RMS) | 200V | 200V | 200V | 200V | 100V | 50V | 50V | 15V |
| Operating Temperature | -55 ~ +155°C | | | | | | | |
| Basic Specification | JIS C5201-1 / IEC 60115-1 | | | | | | | |

■ Thin Film TC50 / TC25 WFxxQ & R (Power) Series (E192+E24 series)

| Series No. | WF25Q&R | WF20Q&R | WF10Q&R | WF12Q&R | WF08Q&R | WF06Q&R | WF04Q&R | WF02Q&R |
|------------------------------------|--|------------|------------|-------------|-------------|-------------|-------------|---------------------|
| Size | 2512(6432) | 2010(5025) | 1210(3225) | 1206 (3216) | 0805 (2012) | 0603 (1608) | 0402 (1005) | 0201 (0603) |
| Resistance Tolerance | ±1%, ±0.5%, ±0.25%, ±0.1%, ±0.05%, ±0.02% ±0.01% | | | | | | | ±1%, ±0.5% |
| Resistance Range | 1~ 3MΩ | 4.7~ 3MΩ | 4.7~ 2.5MΩ | 1~ 2.5MΩ | 4.7~ 2MΩ | 4.7~ 1MΩ | 10~ KΩ | 27~ 22.1KΩ 27~ 12KΩ |
| TCR (ppm/°C) | ±50 / 25 ppm/°C | | | | | | | 50 ppm/°C 25 ppm/°C |
| Max. dissipation @ Tamb=70°C | 1W | 3/4W | 2/5W | 1/4W | 1/8W | 1/10W | 1/10W | 1/20W |
| Max. Operating Voltage (DC or RMS) | 200V | 200V | 200V | 200V | 150V | 75V | 50V | 15V |
| Operating Temperature | -55 ~ +155°C | | | | | | | |
| Basic Specification | JIS C5201-1 / IEC 60115-1 | | | | | | | |

■ Thin Film TC15 / TC10 WFxxF & W Series (E192+E24 series)

| Series No. | WF25F&W | WF20F&W | WF10F&W | WF12F&W | WF08F&W | WF06F&W | WF04F&W |
|------------------------------------|--|------------|------------|-------------|-------------|-------------|-------------|
| Size | 2512(6432) | 2010(5025) | 1210(3225) | 1206 (3216) | 0805 (2012) | 0603 (1608) | 0402 (1005) |
| Resistance Tolerance | ±1%, ±0.5%, ±0.25%, ±0.1%, ±0.05%, ±0.02% ±0.01% | | | | | | |
| Resistance Range | 10 ~ 1.5MΩ | 10~ 1MΩ | 10~ 600KΩ | 4.7~ 500KΩ | 4.7~ 400KΩ | 4.7~ 150KΩ | 10~ 60KΩ |
| TCR (ppm/°C) | ±15 / 10 ppm/°C | | | | | | |
| Max. dissipation @ Tamb=70°C | 1W | 3/4W | 2/5W | 1/4W | 1/8W | 1/10W | 1/10W |
| Max. Operating Voltage (DC or RMS) | 200V | 200V | 200V | 200V | 150V | 75V | 50V |
| Operating Temperature | -55 ~ +155°C | | | | | | |
| Basic Specification | JIS C5201-1 / IEC 60115-1 | | | | | | |

■ Thin Film TC5 WFxxZ Series (E192+E24 series)

| Series No. | WF25Z | WF20Z | WF10Z | WF12Z | WF08Z | WF06Z | WF04Z |
|------------------------------------|--|------------|------------|-------------|-------------|-------------|-------------|
| Size | 2512(6432) | 2010(5025) | 1210(3225) | 1206 (3216) | 0805 (2012) | 0603 (1608) | 0402 (1005) |
| Resistance Tolerance | ±1%, ±0.5%, ±0.25%, ±0.1%, ±0.05%, ±0.02% ±0.01% | | | | | | |
| Resistance Range | 4.7~ 600KΩ | 4.7~ 360KΩ | 4.7~ 150KΩ | 4.7~ 150KΩ | 4.7~ 100KΩ | 4.7~ 50KΩ | 10~ 10KΩ |
| TCR (ppm/°C) | ±5 ppm/°C | | | | | | |
| Max. dissipation @ Tamb=70°C | 1W | 3/4W | 2/5W | 1/4W | 1/8W | 1/10W | 1/10W |
| Max. Operating Voltage (DC or RMS) | 200V | 200V | 200V | 200V | 150V | 75V | 50V |
| Operating Temperature | -55 ~ +155°C | | | | | | |
| Basic Specification | JIS C5201-1 / IEC 60115-1 | | | | | | |

■ Thin Film TC3 WFxxB Series (E192+E24 series)

| Series No. | WF25B | WF20B | WF10B | WF12B | WF08B | WF06B | WF04B |
|------------------------------------|--|-------------|-------------|-------------|-------------|-------------|-------------|
| Size | 2512(6432) | 2010(5025) | 1210(3225) | 1206 (3216) | 0805 (2012) | 0603 (1608) | 0402 (1005) |
| Resistance Tolerance | ±1%, ±0.5%, ±0.25%, ±0.1%, ±0.05%, ±0.02% ±0.01% | | | | | | |
| Resistance Range | 4.7 ~ 600KΩ | 4.7 ~ 360KΩ | 4.7 ~ 150KΩ | 4.7 ~ 120KΩ | 4.7 ~ 80KΩ | 4.7 ~ 40KΩ | 10 ~ 8KΩ |
| TCR (ppm/°C) | ±3 ppm/°C | | | | | | |
| Max. dissipation @ Tamb=70°C | 1W | 3/4W | 2/5W | 1/4W | 1/8W | 1/10W | 1/10W |
| Max. Operating Voltage (DC or RMS) | 200V | 200V | 200V | 200V | 150V | 75V | 50V |
| Operating Temperature | -55 ~ +155°C | | | | | | |
| Basic Specification | JIS C5201-1 / IEC 60115-1 | | | | | | |

■ Thin Film TC2 WFxxC Series (E192+E24 series)

| Series No. | WF25C | WF20C | WF10C | WF12C | WF08C | WF06C | WF04C |
|------------------------------------|--|-------------|-------------|-------------|-------------|-------------|-------------|
| Size | 2512(6432) | 2010(5025) | 1210(3225) | 1206 (3216) | 0805 (2012) | 0603 (1608) | 0402 (1005) |
| Resistance Tolerance | ±1%, ±0.5%, ±0.25%, ±0.1%, ±0.05%, ±0.02% ±0.01% | | | | | | |
| Resistance Range | 4.7~ 600KΩ | 4.7 ~ 360KΩ | 4.7 ~ 150KΩ | 4.7 ~ 120KΩ | 4.7 ~ 80KΩ | 4.7 ~ 40KΩ | 10 ~ 8KΩ |
| TCR (ppm/°C) | ±2 ppm/°C | | | | | | |
| Max. dissipation @ Tamb=70°C | 1W | 3/4W | 2/5W | 1/4W | 1/8W | 1/10W | 1/10W |
| Max. Operating Voltage (DC or RMS) | 200V | 200V | 200V | 200V | 150V | 75V | 50V |
| Operating Temperature | -55 ~ +155°C | | | | | | |
| Basic Specification | JIS C5201-1 / IEC 60115-1 | | | | | | |

Detail specification please refer to specific data sheets

■ Thin Film Pulse Withstanding : WF_S Series

■ Feature

1. SMD metal film resistor
2. High reliability and stability of 0.5% and below per customer request
3. High performance of TCR:50&25 ppm/°C and below per customer request
4. Low current noise
5. RoHS compliant and lead free
6. Meet the requirements of standards of specification as
GB/T 5729-2003/IEC 60115:2001, Q/DW 11179.3-2014
7. Low Resistance with superior pulse withstand ability

■ Application

1. Test equipment
2. Measuring instrument
3. E-meter
4. Smart meter
5. Advanced Metering Infrastructure

■ Thin Film Low Resistor TC50 / TC25 WFxxQ & R_S Series (E192+E24 series)

| Series No. | WF12Q&R_S | WF08Q&R_S | WF06Q&R_S | | WF04Q&R_S | |
|------------------------------------|----------------------------|-------------|-------------|-------------|-------------|------------|
| Size | 1206 (3216) | 0805 (2012) | 0603 (1608) | | 0402 (1005) | |
| Resistance Tolerance | ±1%, ±0.5%, ±0.25% , ±0.1% | | | | | |
| Resistance Range | 1~ 300KΩ | 1~ 150KΩ | 1~ 49.9KΩ | 4.7~ 49.9KΩ | 1~ 10KΩ | 4.7~ 10KΩ |
| TCR (ppm/°C) | ±50 / 25 ppm/°C | | ±50 ppm/°C | ±25 ppm/°C | ±50 ppm/°C | ±25 ppm/°C |
| Max. dissipation @ Tamb=70°C | 1/4W | 1/8W | 1/10W | | 1/10W | |
| Max. Operating Voltage (DC or RMS) | 200V | 150V | 75V | | 50V | |
| Operating Temperature | -55 ~ +155°C | | | | | |
| Basic Specification | JIS C5201-1 / IEC 60115-1 | | | | | |

■ Thin Film Professional Chip Resistor (AEC-Q200 Compliant): WF_Q Series

■ Feature

1. NiCr Thin Film Resistor.
2. AEC-Q200 compliant.
3. High reliability and stability of 0.3%
4. TCR down to 5ppm/°C and below per Customer Request.
5. Tight Tolerance : 0.01%
6. Low current noise
7. RoHS compliant and lead free.

■ Application

1. Medical equipment
2. Measuring instrument
3. Communication device
4. Electronic Energy Meter
5. Audio System.

■ Thin Film Professional (AEC-Q200 Compliant) TC50 / 25 WFxxT & U_Q Series (E192+E24 series)

| Series No. | WF25T&U_Q | WF20T&U_Q | WF10T&U_Q | WF12T&U_Q | WF08T&U_Q | WF06T&U_Q | WF04T&U_Q |
|------------------------------------|---|------------|------------|-------------|-------------|-------------|-------------|
| Size | 2512(6432) | 2010(5025) | 1210(3225) | 1206 (3216) | 0805 (2012) | 0603 (1608) | 0402 (1005) |
| Resistance Tolerance | ±1%, ±0.5%, ±0.25%, ±0.1%, ±0.05%, ±0.02% | | | | | | |
| Resistance Range | 10~ 1.5MΩ | 10~ 1.5MΩ | 10~ 1MΩ | 4.7~ 1MΩ | 4.7~ 1MΩ | 4.7~ 330KΩ | 10~ 100KΩ |
| TCR (ppm/°C) | ±50 / 25 ppm/°C | | | | | | |
| Max. dissipation @ Tamb=70°C | 3/4W | 1/2W | 1/4W | 1/8W | 1/10W | 1/16W | 1/16W |
| Max. Operating Voltage (DC or RMS) | 200V | 200V | 200V | 200V | 100V | 50V | 50V |
| Operating Temperature | -55 ~ +155°C | | | | | | |
| Basic Specification | JIS C5201-1 / IEC 60115-1 / AEC-Q200 | | | | | | |

■ Thin Film Professional (AEC-Q200 Compliant) TC50 / 25 WFxxQ & R_Q (Power) Series (E192+E24 series)

| Series No. | WF25Q&R_Q | WF20Q&R_Q | WF10Q&R_Q | WF12Q&R_Q | WF08Q&R_Q | WF06Q&R_Q | WF04Q&R_Q |
|------------------------------------|---|------------|------------|-------------|-------------|-------------|-------------|
| Size | 2512(6432) | 2010(5025) | 1210(3225) | 1206 (3216) | 0805 (2012) | 0603 (1608) | 0402 (1005) |
| Resistance Tolerance | ±1%, ±0.5%, ±0.25%, ±0.1%, ±0.05%, ±0.02% | | | | | | |
| Resistance Range | 10~ 1.5MΩ | 10~ 1.5MΩ | 10~ 1MΩ | 4.7~ 1MΩ | 4.7~ 1MΩ | 4.7~ 330KΩ | 10~ 100KΩ |
| TCR (ppm/°C) | ±50 / 25 ppm/°C | | | | | | |
| Max. dissipation @ Tamb=70°C | 1W | 3/4W | 2/5W | 1/4W | 1/8W | 1/10W | 1/10W |
| Max. Operating Voltage (DC or RMS) | 200V | 200V | 200V | 200V | 150V | 75V | 50V |
| Operating Temperature | -55 ~ +155°C | | | | | | |
| Basic Specification | JIS C5201-1 / IEC 60115-1 / AEC-Q200 | | | | | | |

■ Thin Film Professional (AEC-Q200 Compliant) TC15 / 10 WFxxF& W_Q Series (E192+E24 series)

| Series No. | WF25F&W_Q | WF20F&W_Q | WF10F&W_Q | WF12F&W_Q | WF08F&W_Q | WF06F&W_Q | WF04F&W_Q |
|------------------------------------|---|------------|------------|-------------|-------------|-------------|-------------|
| Size | 2512(6432) | 2010(5025) | 1210(3225) | 1206 (3216) | 0805 (2012) | 0603 (1608) | 0402 (1005) |
| Resistance Tolerance | ±1%, ±0.5%, ±0.25%, ±0.1%, ±0.05%, ±0.02% | | | | | | |
| Resistance Range | 10~ 1.5MΩ | 10~ 1MΩ | 10~ 600KΩ | 4.7~ 500KΩ | 4.7~ 400KΩ | 4.7~ 150KΩ | 10~ 60KΩ |
| TCR (ppm/°C) | ±15 / 10 ppm/°C | | | | | | |
| Max. dissipation @ Tamb=70°C | 1W | 3/4W | 2/5W | 1/4W | 1/8W | 1/10W | 1/10W |
| Max. Operating Voltage (DC or RMS) | 200V | 200V | 200V | 200V | 150V | 75V | 50V |
| Operating Temperature | -55 ~ +155°C | | | | | | |
| Basic Specification | JIS C5201-1 / IEC 60115-1 / AEC-Q200 | | | | | | |

■ Thin Film Professional (AEC-Q200 Compliant) TC5 WFxxZ_Q Series (E192+E24 series)

| Series No. | WF25Z_Q | WF20Z_Q | WF10Z_Q | WF12Z_Q | WF08Z_Q | WF06Z_Q | WF04Z_Q |
|------------------------------------|---|------------|------------|-------------|-------------|-------------|-------------|
| Size | 2512(6432) | 2010(5025) | 1210(3225) | 1206 (3216) | 0805 (2012) | 0603 (1608) | 0402 (1005) |
| Resistance Tolerance | ±1%, ±0.5%, ±0.25%, ±0.1%, ±0.05%, ±0.02% | | | | | | |
| Resistance Range | 10~ 600KΩ | 10~ 360KΩ | 10~ 150KΩ | 4.7~ 150KΩ | 4.7~ 100KΩ | 4.7~ 50KΩ | 10~ 10KΩ |
| TCR (ppm/°C) | ±5 ppm/°C | | | | | | |
| Max. dissipation @ Tamb=70°C | 1W | 3/4W | 2/5W | 1/4W | 1/8W | 1/10W | 1/10W |
| Max. Operating Voltage (DC or RMS) | 200V | 200V | 200V | 200V | 150V | 75V | 50V |
| Operating Temperature | -55 ~ +155°C | | | | | | |
| Basic Specification | JIS C5201-1 / IEC 60115-1 / AEC-Q200 | | | | | | |

■ Thin Film Professional (AEC-Q200 Compliant) TC3 WFxxB_Q Series (E192+E24 series)

| Series No. | WF25B_Q | WF20B_Q | WF10B_Q | WF12B_Q | WF08B_Q | WF06B_Q | WF04B_Q |
|------------------------------------|---|------------|------------|-------------|-------------|-------------|-------------|
| Size | 2512(6432) | 2010(5025) | 1210(3225) | 1206 (3216) | 0805 (2012) | 0603 (1608) | 0402 (1005) |
| Resistance Tolerance | ±1%, ±0.5%, ±0.25%, ±0.1%, ±0.05%, ±0.02% | | | | | | |
| Resistance Range | 10~ 600KΩ | 10~ 360KΩ | 10~ 150KΩ | 4.7~ 120KΩ | 4.7~ 80KΩ | 4.7~ 40KΩ | 10~ 8KΩ |
| TCR (ppm/°C) | ±3 ppm/°C | | | | | | |
| Max. dissipation @ Tamb=70°C | 1W | 3/4W | 2/5W | 1/4W | 1/8W | 1/10W | 1/10W |
| Max. Operating Voltage (DC or RMS) | 200V | 200V | 200V | 200V | 150V | 75V | 50V |
| Operating Temperature | -55 ~ +155°C | | | | | | |
| Basic Specification | JIS C5201-1 / IEC 60115-1 / AEC-Q200 | | | | | | |

■ Thin Film Professional (AEC-Q200 Compliant) TC2 WFxxC_Q Series (E192+E24 series)

| Series No. | WF25C_Q | WF20C_Q | WF10C_Q | WF12C_Q | WF08C_Q | WF06C_Q | WF04C_Q |
|------------------------------------|---|------------|------------|-------------|-------------|-------------|-------------|
| Size | 2512(6432) | 2010(5025) | 1210(3225) | 1206 (3216) | 0805 (2012) | 0603 (1608) | 0402 (1005) |
| Resistance Tolerance | ±1%, ±0.5%, ±0.25%, ±0.1%, ±0.05%, ±0.02% | | | | | | |
| Resistance Range | 10~ 600KΩ | 10~ 360KΩ | 10~ 150KΩ | 4.7~ 120KΩ | 4.7~ 80KΩ | 4.7~ 40KΩ | 10~ 8KΩ |
| TCR (ppm/°C) | ±2 ppm/°C | | | | | | |
| Max. dissipation @ Tamb=70°C | 1W | 3/4W | 2/5W | 1/4W | 1/8W | 1/10W | 1/10W |
| Max. Operating Voltage (DC or RMS) | 200V | 200V | 200V | 200V | 150V | 75V | 50V |
| Operating Temperature | -55 ~ +155°C | | | | | | |
| Basic Specification | JIS C5201-1 / IEC 60115-1 / AEC-Q200 | | | | | | |

Detail specification please refer to specific data sheets

■ Thin Film Anti-Sulfuration Chip Resistor: SF Series

■ Feature

1. SMD metal film resistor
2. High reliability and stability of 0.5% and below per customer request
3. High performance of TCR: 25 & 15ppm/°C and below per customer request
4. Low current noise
5. Sulfuration resistant against ASTM B-809
6. RoHS compliant and Lead free.

■ Application

1. Farming and industrial Equipment
2. Medical equipment
3. Measuring instrument
4. Communication device.

■ Thin Film Anti-Sulfuration- SF Series TC50 / 25 SFxxT & U Series (E192+E24 series)

| Series No. | SF25T&U | SF20T&U | SF10T&U | SF12T&U | SF08T&U | SF06T&U | SF04T&U |
|------------------------------------|--|------------|------------|------------|------------|------------|------------|
| Size | 2512(6432) | 2010(5025) | 1210(3225) | 1206(3216) | 0805(2012) | 0603(1608) | 0402(1005) |
| Resistance Tolerance | ±1%, ±0.5%, ±0.25%, ±0.1%, ±0.05%* | | | | | | |
| Resistance Range | 1~3MΩ | 4.7~3MΩ | 4.7~2.5MΩ | 1~2.5MΩ | 4.7~2MΩ | 4.7~ 1MΩ | 10 ~ 255KΩ |
| TCR (ppm/°C) | ±50 /25 ppm/°C | | | | | | |
| Max. dissipation @ Tamb=70°C | 3/4W | 1/2W | 1/4W | 1/8W | 1/10W | 1/16W | 1/16W |
| Max. Operating Voltage (DC or RMS) | 200V | 200V | 200V | 200V | 150V | 75V | 50V |
| Operating Temperature | -55 ~ +155°C | | | | | | |
| Basic Specification | JIS C5201-1 / IEC 60115-1 / ASTM B-809 | | | | | | |

■ Thin Film Anti-Sulfuration- SF Series TC50 / 25 SFxx Q & R (Power) Series (E192+E24 series)

| Series No. | SF25Q&R | SF20Q&R | SF10Q&R | SF12Q&R | SF08Q&R | SF06Q&R | SF04Q&R |
|------------------------------------|--|------------|--------------|------------|------------|------------|-------------|
| Size | 2512(6432) | 2010(5025) | 1210(3225) | 1206(3216) | 0805(2012) | 0603(1608) | 0402(1005) |
| Resistance Tolerance | ±1%, ±0.5%, ±0.25%, ±0.1%, ±0.05%* | | | | | | |
| Resistance Range | 1Ω ~ 3MΩ | 4.7Ω ~ 3MΩ | 4.7Ω ~ 2.5MΩ | 1Ω ~ 2.5MΩ | 4.7Ω~ 2MΩ | 4.7Ω~ 1MΩ | 10Ω ~ 255KΩ |
| TCR (ppm/°C) | ±50 /25 ppm/°C | | | | | | |
| Max. dissipation @ Tamb=70°C | 1W | 3/4W | 2/5W | 1/4W | 1/8W | 1/10W | 1/10W |
| Max. Operating Voltage (DC or RMS) | 200V | 200V | 200V | 200V | 150V | 75V | 50V |
| Operating Temperature | -55 ~ +155°C | | | | | | |
| Basic Specification | JIS C5201-1 / IEC 60115-1 / ASTM B-809 | | | | | | |

■Thin Film Anti-Sulfuration- SF Series TC10 SFxxW Series (E192+E24 series)

| Series No. | SF06W | SF04W |
|------------------------------------|--|------------|
| Size | 0603(1608) | 0402(1005) |
| Resistance Tolerance | ±1%, ±0.5%, ±0.25%, ±0.1%, ±0.05%* | |
| Resistance Range | 10Ω ~100KΩ | 100Ω ~20KΩ |
| TCR (ppm/°C) | ±10 ppm/°C | |
| Max. dissipation @ Tamb=70°C | 1/10W | 1/16W |
| Max. Operating Voltage (DC or RMS) | 75V | 25V |
| Operating Temperature | -55 ~ +155°C | |
| Basic Specification | JIS C5201-1 / IEC 60115-1 / ASTM B-809 | |

Detail specification please refer to specific data sheets

■ Thin Film Anti-Sulfuration (ASTM B-809 & Under Oil 105°C+3.5% Sulfur power 500 hours): SF_A Series

■ Feature

1. SMD metal film resistor
2. High reliability and stability of 0.5% and below per customer request
3. High performance of TCR: 15 ppm/°C and below per customer request
4. Low current noise
5. RoHS compliant and lead free
6. Sulfuration resistant Oil 105°C+3.5% Sulfur powder x 500hrs

■ Application

1. Automotive
2. Medical equipment
3. Measuring instrument
4. Communication device
5. Computer
6. Printer

■Thin Film Anti-Sulfuration TC50 / 25 SFxxT & U_A Series (E192+E24 series)

| Series No. | SF25T&U_A | SF20T&U_A | SF10T&U_A | SF12T&U_A | SF08T&U_A | SF06T&U_A | SF04T&U_A |
|------------------------------------|---|------------|--------------|------------|------------|------------|------------|
| Size | 2512(6432) | 2010(5025) | 1210(3225) | 1206(3216) | 0805(2012) | 0603(1608) | 0402(1005) |
| Resistance Tolerance | ±1%, ±0.5%, ±0.25%, ±0.1%, ±0.05%* | | | | | | |
| Resistance Range | 1Ω ~ 3MΩ | 4.7Ω ~ 3MΩ | 4.7Ω ~ 2.5MΩ | 1 ~ 2.5MΩ | 4.7~ 2MΩ | 4.7~ 1MΩ | 10~ 255KΩ |
| TCR (ppm/°C) | ±50 / 25 ppm/°C | | | | | | |
| Max. dissipation @ Tamb=70°C | 3/4W | 1/2W | 1/4W | 1/8W | 1/10W | 1/16W | 1/16W |
| Max. Operating Voltage (DC or RMS) | 200V | 200V | 200V | 200V | 150V | 75V | 50V |
| Operating Temperature | -55 ~ +155°C | | | | | | |
| Basic Specification | JIS C5201-1 / IEC 60115-1 / ASTM B-809 / AEC-Q200 | | | | | | |

■ Thin Film Anti-Sulfuration TC50 / 25 SFxxQ & R_A (Power) Series (E192+E24 series)

| Series No. | SF25Q&R_A | SF20Q&R_A | SF10Q&R_A | SF12Q&R_A | SF08Q&R_A | SF06Q&R_A | SF04Q&R_A |
|------------------------------------|---|------------|--------------|------------|------------|------------|------------|
| Size | 2512(6432) | 2010(5025) | 1210(3225) | 1206(3216) | 0805(2012) | 0603(1608) | 0402(1005) |
| Resistance Tolerance | ±1%, ±0.5%, ±0.25%, ±0.1%, ±0.05%* | | | | | | |
| Resistance Range | 1Ω ~ 3MΩ | 4.7Ω ~ 3MΩ | 4.7Ω ~ 2.5MΩ | 1 ~ 2.5MΩ | 4.7~ 2MΩ | 4.7~ 1MΩ | 10~ 255KΩ |
| TCR (ppm/°C) | ±50 / 25 ppm/°C | | | | | | |
| Max. dissipation @ Tamb=70°C | 1W | 3/4W | 2/5W | 1/4W | 1/8W | 1/10W | 1/10W |
| Max. Operating Voltage (DC or RMS) | 200V | 200V | 200V | 200V | 150V | 75V | 50V |
| Operating Temperature | -55 ~ +155°C | | | | | | |
| Basic Specification | JIS C5201-1 / IEC 60115-1 / ASTM B-809 / AEC-Q200 | | | | | | |

■ Thin Film Anti-Sulfuration Chip Resistor (AEC-Q200/ASTM-B809-95*): SF_Q Series

■ Feature

1. SMD metal film resistor
2. High reliability and stability of 0.5% and below per customer request
3. High performance of TCR: 15 ppm/°C and below per customer request
4. Low current noise
5. RoHS compliant and lead free
6. AEC-Q200 compliant.
7. Sulfuration resistant against ASTM B-809-95*.

■ Application

1. Automotive
2. Medical equipment
3. Measuring instrument
4. Communication device
5. Computer
6. Printer

■ Thin Film Anti-Sulfuration (AEC-Q200 Compliant & ASTM B-809) TC50 / 25 SFxxT & U_Q Series (E192+E24 series)

| Series No. | SF25T&U_Q | SF20T&U_Q | SF10T&U_Q | SF12T&U_Q | SF08T&U_Q | SF06T&U_Q | SF04T&U_Q |
|------------------------------------|---|------------|------------|------------|------------|------------|------------|
| Size | 2512(6432) | 2010(5025) | 1210(3225) | 1206(3216) | 0805(2012) | 0603(1608) | 0402(1005) |
| Resistance Tolerance | ±1% , ±0.5% , ±0.25% , ±0.1% , ±0.05%* | | | | | | |
| Resistance Range | 10~1.5MΩ | 10 ~1.5MΩ | 10~1MΩ | 10 ~ 1MΩ | 10~ 1MΩ | 4.7~ 330KΩ | 10~ 100KΩ |
| TCR (ppm/°C) | ±50 / 25 ppm/°C | | | | | | |
| Max. dissipation @ Tamb=70°C | 3/4W | 1/2W | 1/4W | 1/8W | 1/10W | 1/16W | 1/16W |
| Max. Operating Voltage (DC or RMS) | 200V | 200V | 200V | 200V | 100V | 50V | 50V |
| Operating Temperature | -55 ~ +155°C | | | | | | |
| Basic Specification | JIS C5201-1 / IEC 60115-1 / ASTM B-809 / AEC-Q200 | | | | | | |

■ Thin Film Anti-Sulfuration (AEC-Q200 Compliant & ASTM B-809) TC50 / 25 SFxxQ & R_Q (Power) Series (E192+E24 series)

| Series No. | SF25Q&R_Q | SF20Q&R_Q | SF10Q&R_Q | SF12Q&R_Q | SF08Q&R_Q | SF06Q&R_Q | SF04Q&R_Q |
|------------------------------------|---|------------|------------|------------|------------|------------|------------|
| Size | 2512(6432) | 2010(5025) | 1210(3225) | 1206(3216) | 0805(2012) | 0603(1608) | 0402(1005) |
| Resistance Tolerance | ±1% , ±0.5% , ±0.25% , ±0.1% , ±0.05%* | | | | | | |
| Resistance Range | 10~1.5MΩ | 10 ~1.5MΩ | 10~1MΩ | 10 ~ 1MΩ | 10~ 1MΩ | 4.7~ 330KΩ | 10~ 100KΩ |
| TCR (ppm/°C) | ±50 / 25 ppm/°C | | | | | | |
| Max. dissipation @ Tamb=70°C | 1W | 3/4W | 2/5W | 1/4W | 1/8W | 1/10W | 1/10W |
| Max. Operating Voltage (DC or RMS) | 200V | 200V | 200V | 200V | 150V | 75V | 50V |
| Operating Temperature | -55 ~ +155°C | | | | | | |
| Basic Specification | JIS C5201-1 / IEC 60115-1 / ASTM B-809 / AEC-Q200 | | | | | | |

■ Thin Film Anti-Sulfuration (AEC-Q200 Compliant & ASTM B-809) TC15 / 10 SFxxF & W_Q Series (E192+E24 series)

| Series No. | SF25F&W_Q | SF20F&W_Q | SF10F&W_Q | SF12F&W_Q | SF08F&W_Q | SF06F&W_Q | SF04F&W_Q |
|------------------------------------|---|------------|------------|------------|------------|------------|------------|
| Size | 2512(6432) | 2010(5025) | 1210(3225) | 1206(3216) | 0805(2012) | 0603(1608) | 0402(1005) |
| Resistance Tolerance | ±1% , ±0.5% , ±0.25% , ±0.1% , ±0.05%* | | | | | | |
| Resistance Range | 10 ~1.5MΩ | 10 ~900KΩ | 10~400KΩ | 10~300KΩ | 10~200KΩ | 10~ 100KΩ | 10~ 20KΩ |
| TCR (ppm/°C) | ±15 /10 ppm/°C | | | | | | |
| Max. dissipation @ Tamb=70°C | 1W | 3/4W | 2/5W | 1/4W | 1/8W | 1/10W | 1/10W |
| Max. Operating Voltage (DC or RMS) | 200V | 200V | 200V | 200V | 150V | 75V | 50V |
| Operating Temperature | -55 ~ +155°C | | | | | | |
| Basic Specification | JIS C5201-1 / IEC 60115-1 / ASTM B-809 / AEC-Q200 | | | | | | |

■ Thin Film Anti-Sulfuration (AEC-Q200 Compliant & ASTM B-809) TC5 SFxxZ_Q Series (E192+E24 series)

| Series No. | SF25Z_Q | SF20Z_Q | SF10Z_Q | SF12Z_Q | SF08Z_Q | SF06Z_Q | SF04Z_Q |
|------------------------------------|---|------------|------------|------------|------------|------------|------------|
| Size | 2512(6432) | 2010(5025) | 1210(3225) | 1206(3216) | 0805(2012) | 0603(1608) | 0402(1005) |
| Resistance Tolerance | ±1% , ±0.5% , ±0.25% , ±0.1% , ±0.05%* | | | | | | |
| Resistance Range | 4.7~600KΩ | 4.7~360KΩ | 4.7~150KΩ | 4.7~150KΩ | 4.7~100KΩ | 4.7~ 50KΩ | 10~ 10KΩ |
| TCR (ppm/°C) | ±5 ppm/°C | | | | | | |
| Max. dissipation @ Tamb=70°C | 1W | 3/4W | 2/5W | 1/4W | 1/8W | 1/10W | 1/10W |
| Max. Operating Voltage (DC or RMS) | 200V | 200V | 200V | 250V | 150V | 75V | 50V |
| Operating Temperature | -55 ~ +155°C | | | | | | |
| Basic Specification | JIS C5201-1 / IEC 60115-1 / ASTM B-809 / AEC-Q200 | | | | | | |

Detail specification please refer to specific data sheets

■ TaN Thin Film Chip Resistor (Auto Grade/AEC-Q200/ASTM B-809): MF Series

■ Feature

1. SMD TaN thin film resistor
2. Special passivation layer on resistive file
3. AEC-Q200 qualified
4. Products with lead free terminations meet RoHS requirements
5. Sulfur resistant (per ASTM B809-95 humid vapor test)
6. Laser trimmed to any value.

■ Application

1. Professional Industrial equipment
2. Automotive
3. Medical equipment
4. Measuring instrument
5. Industrial Equipment.

■ TaN Thin Film (Auto Grade/AEC-Q200 & ASTM B-809) TC25 / 50 MFxxQ & R Series (E192+E24 series)

| Series No. | MF12Q&R | MF08Q&R | MF06Q&R | MF04Q&R |
|--|---|-----------------------------|-----------------------------|----------------------------|
| Size | 1206(3216) | 0805(2012) | 0603(1608) | 0402(1005) |
| Resistance Tolerance | $\pm 1\%$, $\pm 0.5\%$, $\pm 0.25\%$, $\pm 0.1\%$, $\pm 0.05\%$ | | | |
| Resistance Range | 10 Ω ~ 1M Ω | 10 Ω ~ 350K Ω | 40 Ω ~ 130K Ω | 40 Ω ~ 35K Ω |
| TCR (ppm/°C) | ± 25 ppm/°C | | | |
| Max. dissipation at T _{amb} =85°C | 0.4W | 0.2W | 0.15W | 0.063W |
| Max. Operating Voltage (DC or RMS) | 200V | 100V | 75V | 50V |
| Operating Temperature | -55 ~ +155°C | | | |
| Basic Specification | JIS C5201-1 / IEC 60115-1 / AEC Q200 / ASTM B-809 | | | |

■ TaN Thin Film (Auto Grade/AEC-Q200 & ASTM B-809) TC15 / 10 MFxxF & W Series (E192+E24 series)

| Series No. | MF12F&W | MF08F&W | MF06F&W | MF04F&W |
|--|---|-----------------------------|-----------------------------|----------------------------|
| Size | 1206(3216) | 0805(2012) | 0603(1608) | 0402(1005) |
| Resistance Tolerance | $\pm 1\%$, $\pm 0.5\%$, $\pm 0.25\%$, $\pm 0.1\%$, $\pm 0.05\%$ | | | |
| Resistance Range | 10 Ω ~ 1M Ω | 10 Ω ~ 350K Ω | 40 Ω ~ 130K Ω | 40 Ω ~ 35K Ω |
| TCR (ppm/°C) | ± 25 ppm/°C | | | |
| Max. dissipation at T _{amb} =85°C | 0.4W | 0.2W | 0.15W | 0.063W |
| Max. Operating Voltage (DC or RMS) | 200V | 100V | 75V | 50V |
| Operating Temperature | -55 ~ +155°C | | | |
| Basic Specification | JIS C5201-1 / IEC 60115-1 / AEC Q200 / ASTM B-809 | | | |

Detail specifications please refer to specific data sheets.

■ Thin Film Low Ohmic Current Sensor: WW Series

■ Feature

1. SMD metal film resistor
2. High reliability and stability.
3. High performance of TCR.
4. Power Rating up to 2W.

■ Application

1. Current sensor
2. Medical equipment
3. Measuring instrument
4. Communication device
5. Printer.

■ Low Ohmic Thin Film Current Sensor TC100 / 75 – WWxxF & G & H Series (E96+E24 series)

| Series No. | WW25 | | WW20 | | WW12 | | |
|-----------------------|--------------|-----------|------------|-----------|------------|------|-----------|
| Code | F | G | F | G | H | F | G |
| Size | 2512(6432) | | 2010(5025) | | 1210(3225) | | |
| Resistance Tolerance | ± 0.5%, ± 1% | | | | | | |
| Resistance Range | 101m-900mΩ | 21m-900mΩ | 101m-900mΩ | 21m-900mΩ | 101m-900mΩ | | 21m-900mΩ |
| TCR (ppm/°C) | ± 75 | ± 100 | ± 75 | ± 100 | ± 75 | ± 75 | ± 100 |
| Power | 2W | | 1W | | 1W | 1/2W | |
| Operating Temperature | -55 ~ +155°C | | | | | | |

| Series No. | WW08 | | WW06 | | WW04 | |
|-----------------------|---------------|-----------|------------|-----------|------------|-----------|
| Code | F | G | F | G | F | G |
| Size | 1206(3216) | | 0805(2012) | | 0603(1608) | |
| Resistance Tolerance | ± 0.5% , ± 1% | | | | | |
| Resistance Range | 101m-900mΩ | 21m-900mΩ | 101m-900mΩ | 21m-900mΩ | 101m-900mΩ | 21m-900mΩ |
| TCR (ppm/°C) | ± 75 | ± 100 | ± 75 | ± 100 | ± 75 | ± 100 |
| Power | 1/4W | | 1/8W | | 1/10W | |
| Operating Temperature | -55 ~ +155°C | | | | | |

■ **Thin Film High Power (Low TCR/Tight Tolerance) Current Sensor: TTL Series**

■ **Feature**

1. High power rating with low TCR.
2. Extra low resistance and high precision
3. High component and equipment reliability
4. Low resistances applied to current sensing
5. RoHS compliant & Halogen Free.
6. Suitable for lead free soldering.

■ **Application**

1. Current sensor
2. Medical equipment
3. Measuring instrument
4. Communication device
5. Power supply
6. Printer.

■ **High Power Thin Film Current Sensor TC 350/ 150/ 100/ 75/ 50 – TTLxxG, H, I, J, K, M, P & Q Series (E96+E24 series)**

| Series No. | TTL25 | | TTL20 | | TTL12 | | | | TTL08 | | |
|-----------------------|----------------------------|----|----------------|----|------------|------|------|----|------------|------|------|
| Code | P | Q | P | Q | J | K | M | P | J | K | M |
| Size | 2512(6432) | | 2010(5025) | | 1206(3216) | | | | 0805(2012) | | |
| Resistance Tolerance | ± 0.5%(>10mΩ), ± 1% , ± 5% | | | | | | | | | | |
| Resistance Range | 5m-20mΩ | | 5m-20mΩ | | 5m-20mΩ | | | | 5m-20mΩ | | |
| TCR (ppm/°C) | ±50 ,±75 ,±100 | | ±50 ,±75 ,±100 | | ± 75 | | | | ± 75 | | |
| Power | 1W | 2W | 1W | 2W | 1/4W | 1/3W | 1/2W | 1W | 1/4W | 1/3W | 1/2W |
| Operating Temperature | -55 ~ +155°C | | | | | | | | | | |

| Series No. | TTL06 | | | | TTL04 | | | | | TTL02 | | | | |
|-----------------------|----------------------------|------|------|------|------------|------|------|------|------|------------|------|------|------|------|
| Code | I | J | K | M | H | I | J | K | M | G | H | I | J | K |
| Size | 0603(1608) | | | | 0402(1005) | | | | | 0201(1603) | | | | |
| Resistance Tolerance | ± 0.5%(>10mΩ), ± 1% , ± 5% | | | | | | | | | | | | | |
| Resistance Range | 5m-20mΩ | | | | 2.5m-20mΩ | | | | | 5m-20mΩ | | | | |
| TCR (ppm/°C) | ± 75 | | | | ± 150 | | | | | ± 350 | | | | |
| Power | 1/5W | 1/4W | 1/3W | 1/2W | 1/8W | 1/5W | 1/4W | 1/3W | 1/2W | 1/10W | 1/8W | 1/5W | 1/4W | 1/3W |
| Operating Temperature | -55 ~ +155°C | | | | | | | | | | | | | |

■ **Thin Film High Power Ultra Low Ohmic Current Sensor: TTU Series**

■ **Feature**

1. Extra high power rating and low TCR.
2. Extra low resistance and high precision
3. High component and equipment reliability
4. Low resistances applied to current sensing
5. RoHS compliant & Halogen Free.
6. Suitable for lead free soldering.

■ **Application**

1. Current sensor
2. Medical equipment
3. Measuring instrument
4. Communication device
5. Power supply
6. Printer.

■ **Ultra Low Ohmic / High Power Current Sensor TC100 – TTUxx S & Q Series (E96+E24 series)**

| Series No. | TTU25 | TTU12 |
|-----------------------|--------------|-------------|
| Code | S | Q |
| Size | 2512(6432) | 1206(3216) |
| Resistance Tolerance | ±1%, ±5% | |
| Resistance Range | 0.5mΩ | 1m, 2m, 3mΩ |
| TCR (ppm/°C) | ±100 | |
| Power | 3W | 2W |
| Operating Temperature | -55 ~ +155°C | |

■ **Ultra Low Ohmic / High Power Current Sensor TC 50 – TTUxx Q, R & S Series (E96+E24 series)**

| Series No. | TTU25 | | |
|-----------------------|--------------------------------------|---------------------------|---------------------------------------|
| Code | Q | R | S |
| Size | 2512(6432) | | |
| Resistance Tolerance | $\pm 1\%$, $\pm 5\%$ | | |
| Resistance Range | 6.5m, 7m, 7.5m, 8m, 9m, 10m Ω | 4m, 4.5m, 5m, 6m Ω | 1m, 1.5m, 2m, 2.5m, 3m, 3.5m Ω |
| TCR (ppm/°C) | ± 50 | | |
| Power | 2W | 2.5W | 3W |
| Operating Temperature | -55 ~ +170°C | | |

■ MELF Thin Film Resistor: WM Series (AEC-Q200)

■ Feature

1. SMD enabled structure thin film resistor
2. High reliability and stability of $\pm 0.5\%$ and below per customer request
3. Power rating up to 1Watt.
4. Best in class pulse load capability.

■ Application

1. Medical equipment
2. Measuring instrument
3. Power / Meter Converter.

■ MELF Thin Film Resistor (AEC-Q200 Compliant) TC50 / 25 WMxxB & C Series (E192+E24 series)

| Series No. | WM07B | WM07C | WM04B | WM04C |
|------------------------------------|---------------------------|------------|---------------|------------|
| Size code | 0207 (6123) | | 0204 (3715) | |
| Resistance Tolerance | ±1%, ±0.5%, ±0.25%, ±0.1% | | | |
| Resistance Range | 0.2 ~ 1MΩ | 10 ~ 1MΩ | 0.2~ 1MΩ | 10 ~ 1MΩ |
| TCR (ppm/°C) | ±50 ppm/°C | ±25 ppm/°C | ±50 ppm/°C | ±25 ppm/°C |
| Max. dissipation at Tamb=70°C | 1/2W | | 1/4W | |
| Max. Operating Voltage (DC or RMS) | 300V | | 200V | |
| Operating Temperature | - 55 ~ +155 °C | | | |

■ MELF Thin Film Resistor (AEC-Q200 Compliant) TC50 / 25 WMxxN & O (Power) Series (E192+E24 series)

| Series No. | WM07N | WM07O | WM04N | WM04O |
|------------------------------------|---------------------------|------------|---------------|------------|
| Size code | 0207 (6123) | | 0204 (3715) | |
| Resistance Tolerance | ±1%, ±0.5%, ±0.25%, ±0.1% | | | |
| Resistance Range | 0.2~ 1MΩ | 10 ~ 1MΩ | 0.2~ 1MΩ | 10 ~ 1MΩ |
| TCR (ppm/°C) | ±50 ppm/°C | ±25 ppm/°C | ±50 ppm/°C | ±25 ppm/°C |
| Max. dissipation at Tamb=70°C | 1W | | 2/5W | |
| Max. Operating Voltage (DC or RMS) | 350V | | 200V | |
| Operating Temperature | - 55 ~ +155 °C | | | |

■ MELF Thin Film Resistor (AEC-Q200 Compliant) TC15 /10 WMxxD & E Series (E192+E24 series)

| Series No. | WM07D | WM07E | WM04D | WM04E |
|------------------------------------|---------------------------|------------|---------------|------------|
| Size code | 0207 (6123) | | 0204 (3715) | |
| Resistance Tolerance | ±1%, ±0.5%, ±0.25%, ±0.1% | | | |
| Resistance Range | 49.9~ 250KΩ | 49.9~ 25KΩ | 49.9~ 250KΩ | 49.9~ 25KΩ |
| TCR (ppm/°C) | ±15 ppm/°C | ±10 ppm/°C | ±15 ppm/°C | ±10 ppm/°C |
| Max. dissipation at Tamb=70°C | 1/2W | | 1/4W | |
| Max. Operating Voltage (DC or RMS) | 300V | | 200V | |
| Operating Temperature | - 55 ~ +155 °C | | | |

■ MELF Thin Film Resistor (AEC-Q200 Compliant) TC15 /10 WMxxP & Q (Power) Series (E192+E24 series)

| Series No. | WM07P | | WM07Q | WM04P | WM04Q |
|------------------------------------|---------------------------|------------|-------------|---------------|-------|
| Size code | 0207 (6123) | | | 0204 (3715) | |
| Resistance Tolerance | ±1%, ±0.5%, ±0.25%, ±0.1% | | | | |
| Resistance Range | 49.9~ 250KΩ | 49.9~ 25KΩ | 49.9~ 250KΩ | 49.9~ 25KΩ | |
| TCR (ppm/°C) | ±15 ppm/°C | ±10 ppm/°C | ±15 ppm/°C | ±10 ppm/°C | |
| Max. dissipation at Tamb=70°C | 1W | | | 2/5W | |
| Max. Operating Voltage (DC or RMS) | 350V | | | 200V | |
| Operating Temperature | - 55 ~ +155 °C | | | | |

■ MELF Thin Film Resistor Jumper WM07X & WM04X

| Series No. | WM07X | WM04X |
|------------------------------------|-----------------------------|---------------|
| Size code | 0207 (6123) | 0204 (3715) |
| Resistance Tolerance | $\pm 5\%$ | |
| Resistance Range | 0 Ω (<15m Ω) | |
| TCR (ppm/°C) | - | |
| Max. dissipation at Tamb=70°C | Jumper 4A | Jumper 2A |
| Max. Operating Voltage (DC or RMS) | 300V | 200V |
| Operating Temperature | - 55 ~ +155 °C | |

Detail specification please refer to specific data sheets

■ MELF Precision Thin Film Resistor: WM_Q Series (AEC-Q200)

■ Feature

1. SMD enabled structure thin film resistor
2. High reliability and stability of $\pm 0.3\%$ and below per customer request
3. Power rating up to 1Watt.
4. Best in class pulse load capability.
5. AEC-Q200 Compliant

■ Application

1. Medical equipment
2. Measuring instrument
3. Power / Meter Converter.
4. Communication device

■ MELF Precision Thin Film Resistor (AEC-Q200 Compliant) TC50 / 25 WMxxB & C_Q Series (E192+E24 series)

| Series No. | WM07B_Q | WM07C_Q | WM04B_Q | WM04C_Q |
|------------------------------------|---------------------------|------------|---------------|------------|
| Size code | 0207 (6123) | | 0204 (3715) | |
| Resistance Tolerance | ±1%, ±0.5%, ±0.25%, ±0.1% | | | |
| Resistance Range | 0.2 ~ 1MΩ | 10 ~ 1MΩ | 0.2~ 1MΩ | 10 ~ 1MΩ |
| TCR (ppm/°C) | ±50 ppm/°C | ±25 ppm/°C | ±50 ppm/°C | ±25 ppm/°C |
| Max. dissipation at Tamb=70°C | 1/2W | | 1/4W | |
| Max. Operating Voltage (DC or RMS) | 300V | | 200V | |
| Operating Temperature | - 55 ~ +155 °C | | | |

■ MELF Precision Thin Film Resistor (AEC-Q200 Compliant) TC50 / 25 WMxxN & O_Q (Power) Series (E192+E24 series)

| Series No. | WM07N_Q | WM07O_Q | WM04N_Q | WM04O_Q |
|------------------------------------|---------------------------|------------|---------------|------------|
| Size code | 0207 (6123) | | 0204 (3715) | |
| Resistance Tolerance | ±1%, ±0.5%, ±0.25%, ±0.1% | | | |
| Resistance Range | 0.2 ~ 1MΩ | 10 ~ 1MΩ | 0.2~ 1MΩ | 10 ~ 1MΩ |
| TCR (ppm/°C) | ±50 ppm/°C | ±25 ppm/°C | ±50 ppm/°C | ±25 ppm/°C |
| Max. dissipation at Tamb=70°C | 1W | | 2/5W | |
| Max. Operating Voltage (DC or RMS) | 350V | | 200V | |
| Operating Temperature | - 55 ~ +155 °C | | | |

■ MELF Precision Thin Film Resistor (AEC-Q200 Compliant) TC15 /10 WMxxD & E_Q Series (E192+E24 series)

| Series No. | WM07D_Q | WM07E_Q | WM04D_Q | WM04E_Q |
|------------------------------------|---------------------------|------------|-------------|---------------|
| Size code | 0207 (6123) | | | 0204 (3715) |
| Resistance Tolerance | ±1%, ±0.5%, ±0.25%, ±0.1% | | | |
| Resistance Range | 49.9~ 250KΩ | 49.9~ 25KΩ | 49.9~ 250KΩ | 49.9~ 25KΩ |
| TCR (ppm/°C) | ±15 ppm/°C | ±10 ppm/°C | ±15 ppm/°C | ±10 ppm/°C |
| Max. dissipation at Tamb=70°C | 1/2W | | | 1/4W |
| Max. Operating Voltage (DC or RMS) | 300V | | | 200V |
| Operating Temperature | - 55 ~ +155 °C | | | |

■ MELF Precision Thin Film Resistor (AEC-Q200 Compliant) TC15 /10 WMxxP & Q_Q (Power) Series (E192+E24 series)

| Series No. | WM07P_Q | WM07Q | WM04P | WM04Q |
|------------------------------------|---------------------------|------------|---------------|------------|
| Size code | 0207 (6123) | | 0204 (3715) | |
| Resistance Tolerance | ±1%, ±0.5%, ±0.25%, ±0.1% | | | |
| Resistance Range | 49.9~ 250KΩ | 49.9~ 25KΩ | 49.9~ 250KΩ | 49.9~ 25KΩ |
| TCR (ppm/°C) | ±15 ppm/°C | ±10 ppm/°C | ±15 ppm/°C | ±10 ppm/°C |
| Max. dissipation at Tamb=70°C | 1W | | 2/5W | |
| Max. Operating Voltage (DC or RMS) | 350V | | 200V | |
| Operating Temperature | - 55 ~ +155 °C | | | |

Detail specification please refer to specific data sheets

■ MELF High Reliability Thin Film Resistor: MM Series (AEC-Q200)

■ Feature

1. SMD enabled structure thin film resistor
2. AEC-Q200 Compliant with high stability
3. Products with lead free terminations meet RoHS requirements
4. Best in class pulse load capability
5. +/-0.1% is upon the customer request.

■ Application

1. Medical equipment
2. Measuring instrument
3. Communication device
- 4..Automotive electronics

■ MELF High Reliability Thin Film Resistor (AEC-Q200 Compliant) TC50 / 25 MMxxB & C Series (E192+E24 series)

| Series No. | MM07B | MM07C | MM04B | MM04C |
|------------------------------------|---------------------------|------------|---------------|------------|
| Size code | 0207 (6123) | | 0204 (3715) | |
| Resistance Tolerance | ±1%, ±0.5%, ±0.25%, ±0.1% | | | |
| Resistance Range | 11 ~ 100KΩ | | 10 ~ 50KΩ | |
| TCR (ppm/°C) | ±50 ppm/°C | ±25 ppm/°C | ±50 ppm/°C | ±25 ppm/°C |
| Max. dissipation at Tamb=70°C | 1/2W | | 1/4W | |
| Max. Operating Voltage (DC or RMS) | 350V | | 200V | |
| Operating Temperature | - 55 ~ +155 °C | | | |

■ MELF High Reliability Thin Film Resistor (AEC-Q200 Compliant) TC50 / 25 MMxxN & O (Power) Series (E192+E24 series)

| Series No. | WM07N | MM07O | MM04N | MM04O |
|------------------------------------|---------------------------|------------|---------------|------------|
| Size code | 0207 (6123) | | 0204 (3715) | |
| Resistance Tolerance | ±1%, ±0.5%, ±0.25%, ±0.1% | | | |
| Resistance Range | 11 ~ 100KΩ | | 10 ~ 50KΩ | |
| TCR (ppm/°C) | ±50 ppm/°C | ±25 ppm/°C | ±50 ppm/°C | ±25 ppm/°C |
| Max. dissipation at Tamb=70°C | 1W | | 2/5W | |
| Max. Operating Voltage (DC or RMS) | 350V | | 200V | |
| Operating Temperature | - 55 ~ +155 °C | | | |

■ 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/(T2-T1)×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%: ΔR/Rmax. (1%+0.05Ω) ±1%: ΔR/Rmax. (0.5%+0.05Ω) no visible damage | < 50mΩ |
| Solderability 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%: ΔR/Rmax. (1%+0.05Ω) ±1%: ΔR/Rmax. (0.5%+0.05Ω) no visible damage | < 50mΩ |
| High Temperature Exposure MIL-STD-202 Method 108 | 1000+48/-0 hours; without load in a temperature chamber controlled 155°C±3°C | ±5%: ΔR/Rmax. (2%+0.1Ω) ±1%: ΔR/Rmax. (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%: ΔR/Rmax. (1%+0.05Ω) ±1%: ΔR/Rmax. (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%: ΔR/Rmax. (2%+0.1Ω) ±1%: ΔR/Rmax. (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°Cat and 90~95% relative humidity, 1.5 hours on and 0.5 hours off | ±5%: ΔR/Rmax. (2%+0.1Ω) ±1%: ΔR/Rmax. (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%: ΔR/Rmax. (2%+0.1Ω) ±1%: ΔR/Rmax. (1%+0.1Ω) no visible damage | < 50mΩ |
| 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 | |

■ Test and Requirements

■ 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 | $\Delta R/R$ max. $\pm(1\%+0.005\Omega)$ no visible damage |
| Solderability 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 | $\Delta R/R$ max. $\pm(1\%+0.005\Omega)$ 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 | $\Delta R/R$ max. $\pm(3\%+0.005\Omega)$ 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 | $\Delta R/R$ max. $\pm(1\%+0.005\Omega)$ 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 5seconds | $\Delta R/R$ max. $\pm(2\%+0.005\Omega)$ 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°Cat and 90~95% relative humidity, 1.5 hours on and 0.5 hours off | $\Delta R/R$ max. $\pm(3\%+0.005\Omega)$ 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 | $\Delta R/R$ max. $\pm(3\%+0.005\Omega)$ no visible damage |
| 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 |

■ Test and Requirements

■ For MF Series (Auto Grade/ AEC-Q200/ Thin Film)

| Test | Procedure / Test Method | Requirements |
|--|--|--|
| | | Resistor |
| Electrical Characteristics IEC 60115-1 4.8 | <p>- DC resistance values measurement - Temperature Coefficient of Resistance (T.C.R) Natural resistance change per change in degree centigrade.</p> $\frac{R_2 - R_1}{R_1(t_2 - t_1)} \times 10^6$ <p>(ppm/°C) t1: 20°C+5°C/-1°C</p> <p>R1 : Resistance at reference temperature (20°C+5°C/-1°C) R2 : Resistance at test temperature (-55°C or +125°C)</p> | Within the specified tolerance |
| Short time overload (S.T.O.L) IEC60115-1 4.13 | Permanent resistance change after a 5second application of a voltage 2.5 times RCWV or the maximum overload voltage specified in the above list, whichever is less. | R/R max. ±(0.1%+0.02) |
| Resistance to soldering heat(R.S.H) AEC-Q200-15 | Un-mounted chips completely immersed for 10±1second in a SAC solder bath at 260°C ±5°C | no visible damage R/R max. ±(0.1%+0.02) |
| Solderability IEC 60068-2-58 | Un-mounted chips completely immersed for 2±0.5 second in a SAC solder bath at 235°C ±5°C | good tinning (>95% covered) no visible damage |
| Temperature cycling JESD22 method JA-104 | 1000 cycles, -55°C ~ +125°C, dwell time 5~10min | R/R max. ±(0.1%+0.02) |
| | 1000 cycles, -55°C ~ +155°C, dwell time 5~10min | R/R max. ±(0.2%+0.02) |
| Bias Humidity AEC-Q200-7 | 1000 +48/-0 hours, loaded with 10% rated power in humidity chamber controller at +85°C/ 85%RH | R/R max. (0.1%+0.02) |
| Load Life IEC60115-1 4.25 | 1000 +48/-0 hours, loaded with RCWV or Vmax in chamber controller 85 ±2°C, 1.5 hours on and 0.5 hours off | R/R max. (0.1%+0.02) |
| Operational Life AEC Q200-8 MIL-STD-202-108 | 1000 hours at 125±2°C, loaded with rated power continuously | R/R max. (0.1%+0.02) |
| High Temperature Exposure AEC-Q200-3 | 1000 hours @ 125°C, un-powered | R/R max. (0.1%+0.02) |
| | 1000 hours @ 155°C, un-powered | R/R max. ±(0.15%+0.02) |
| Moisture Resistance AEC-Q200-6 MIL-STD-202 Method 106 | 65□2□C, 80~100% RH, 10 cycles, 24 hours/ cycle | R/R max. (0.1%+0.02) |
| Mechanical Shock MIL-STD-202 Method 213 | 1/2 Sine Pulse / 1500g Peak / Velocity 15.4ft/sec | R/R max. (0.1%+0.02) |
| Vibration MIL-STD-202 Method 204 | 5 g's for 20 min, 12 cycles each of 3 orientations | R/R max. (0.1%+0.02) |
| Terminal strength AEC-Q200-6 | 1 kg for 60 s | No broken |
| Board flex AEC-Q200-21 | Bending 2mm for 60 sec | R/R max. (0.1%+0.02) |
| Flower of sulfur ASTM-B809-95 | 105±2°C, duration 1000hours. | 0402 ΔR/R max. ±(0.2%+0.02Ω) Others ΔR/R max. ±(0.1%+0.02Ω) |

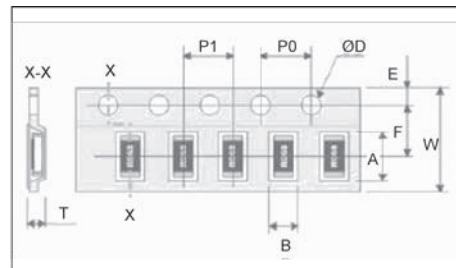
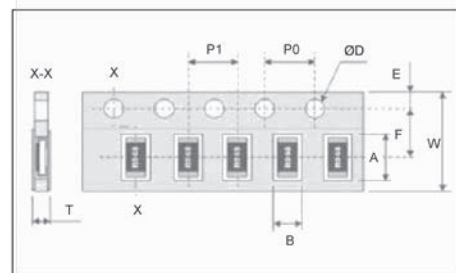
■ Packing on Tape and Reel: All specifications are in accordance with IEC 60286-3

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

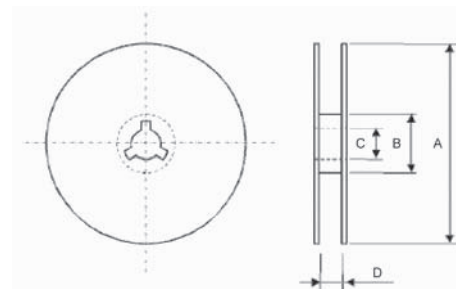
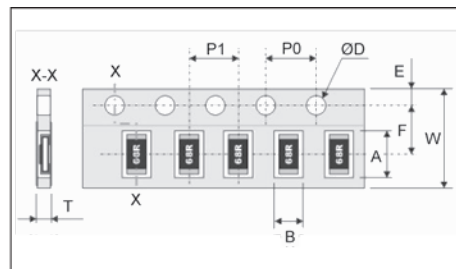


■ Plastic Tape Specifications for WR, WF, WW, WM Series of Chip-R

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 | | |

| Component Size | 0207 (6123) | 0204 (3715) |
|----------------|-------------|-------------|
| A | 6.15±0.10 | 3.65±0.10 |
| B | 2.40±0.10 | 1.55±0.10 |
| W | 12.00±0.30 | 8.00±0.30 |
| F | 5.50±0.05 | 3.50±0.05 |
| E | 1.75±0.10 | 1.75±0.10 |
| P1 | 4.00±0.10 | 4.00±0.10 |
| P0 | 4.00±0.10 | 4.00±0.10 |
| ΦD | Φ1.50±0.1 | Φ1.50±0.1 |
| T | 2.70±0.10 | 1.8±0.10 |



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

Unit: mm

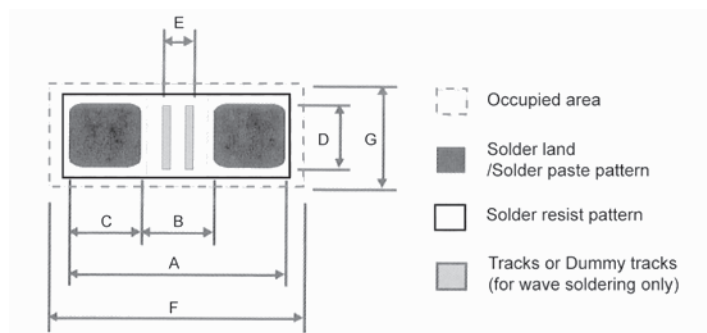
| Reel/Tape | A | B | C | D |
|------------------------|-------------|-------------|-----------|-------------|
| 7" reel for 8mm tape | Φ178.0±0.20 | Φ60.0±1.00 | 13.0±0.20 | 9.00±0.50 |
| 7" reel for 12mm tape | | | | 12.4±2.0/-0 |
| 10" reel for 8mm tape | Φ254.0±2.00 | Φ100.0±1.00 | 13.0±0.20 | 9.00±0.50 |
| 10" reel for 12mm tape | Φ254.0±2.00 | Φ100.0±1.00 | 13.0±0.20 | 12.4±2.0/-0 |
| 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, WM Series and WA, WT, TA 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 |
| 01005 | 20,000 pcs | 7" reel |
| WA06X, WA06Y | 5,000 pcs | 7" reel |
| 2512, 2010, WW12N, WW12M, WW12J, WW12K | 4,000 pcs | 7" reel |
| WM0207 | 3,000 pcs | 7" reel |
| WM0204 | 2,000 pcs | 7" reel |
| 1218 | 3,000 pcs | 10" reel |
| 1210, 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: 50,000pcs/ G: 70,000 pcs | 13" reel |
| 0402 | H: 50,000pcs/ G: 70,000 pcs | 13" reel |
| WA04X, WA04Y | 40,000 pcs | 13" reel |
| 1210, 1206, 0805, 0603, WA06X, | 20,000 pcs | 13" reel |

■ Footprint Design



■ Footprint Design for WRxx, WFxx, WWxx Series

| 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 | 0.90 | 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 |

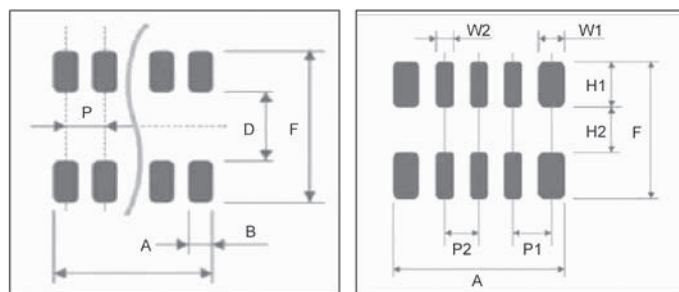
| Size | Wave Soldering | | | | | | | Processing Number & Dimensions of dummy tracks | Placement Accuracy |
|------|----------------|------|------|------|------|------|------|--|--------------------|
| | A | B | C | D | E | F | G | | |
| 0603 | 2.70 | 0.90 | 0.90 | 0.80 | 0.15 | 3.40 | 1.90 | 1× (0.15 × 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

| Symbol | 0603x4 array | 0603x2 array | 0402x4 array | 0402x2 array | 0402x8 array | WA02A | WA02B |
|--------|----------------|----------------|-----------------|-----------------|-----------------|---------------|---------------|
| A | 3.0+0.10/-0.05 | 1.5+0.10/-0.05 | 1.80±0.05 | 1.20±0.05 | 3.85±0.05 | 1.40±0.05 | 0.80±0.05 |
| B | 0.45±0.05 | 0.45±0.05 | 0.30±0.05 | 0.40 +0/-0.05 | 0.28 +0/-0.05 | 0.20 +0/-0.05 | 0.30 +0/-0.05 |
| D | 0.80±0.10 | 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 |
| P | 0.8 | 1.0 | 0.5 | 0.65 | 0.5 | 0.4 | 0.5 |
| F | 1.90±0.20 | 1.80±0.20 | 1.3 +0.20/-0.10 | 1.3 +0.20/-0.10 | 1.90±0.20 | 0.9±0.10 | 0.9±0.10 |

■ Footprint Design for 10P8R Network Resistor

| 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

1. 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.
2. To store products with following condition:
Temperature :5 to 40°C
Humidity :20 to 70% relative humidity
3. Caution:
 - a. 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
 - b. To store products on the shelf and avoid exposure to moisture.
 - c. Don't expose products to excessive shock, vibration, direct sunlight and so on

■ Precaution of Soldering

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

■ Mounting

1. Imperfect adjustment of mounting machine may cause the cracks, the chipping and the alignment error. Check and inspect the mounting machine in advance.
2. 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.
3. Adjust the bottom dead point of dispenser away from the board when you apply adhesive.
4. Confirm that the products are corresponding to flow soldering when you perform it.
5. Pay attention to the amount of solder because improper amount of solder place large stress on the products and cause cracks or malfunctions.

■ Washing

1. 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.
2. Confirm the reliability in advance when using no washing solder, water or soluble agent.
3. Wash thoroughly after soldering to remove ionic substances like sweat and salinity.
4. The ultrasonic washing may destruct the products due to resonance by vibration. High hydraulic pressure may also damage the products.
5. 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.

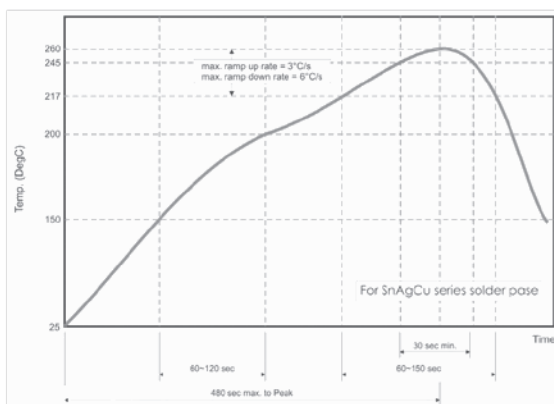


Fig. 1 Recommended IR reflow soldering profile for SMT process with SnAgCu series solder paste

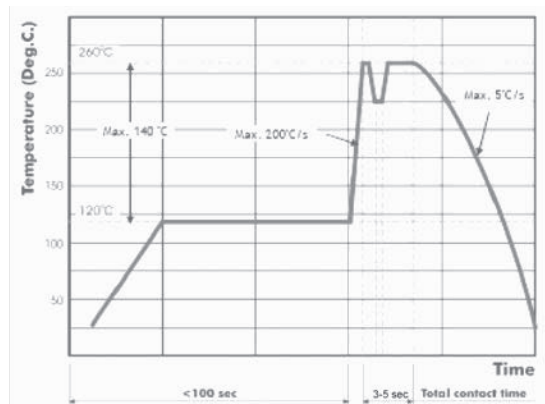


Fig. 2 Recommended wave soldering profile for SMT process with SnAgCu series solder

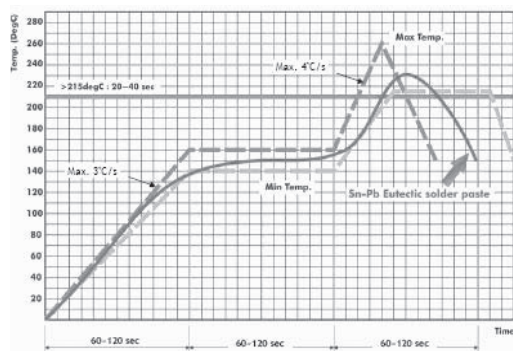


Fig. 3 Recommended reflow soldering profile for SMT process with eutectic SnPb solder paste.

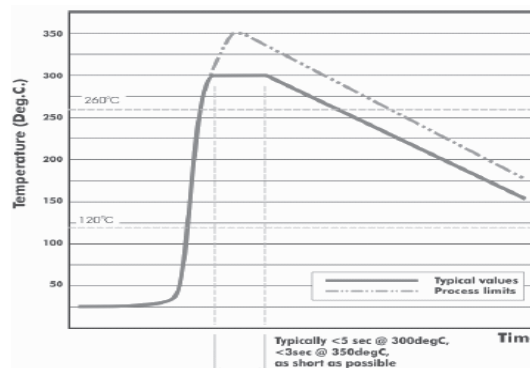


Fig. 4 Recommended soldering profile by manual with SnAgCu series solder material

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