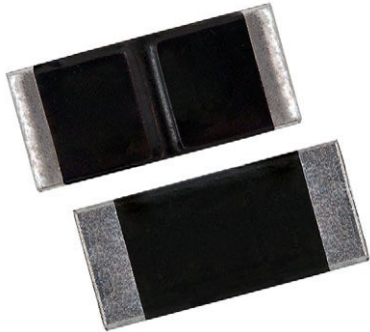


# Power Metal Plate™ Current Sense Resistors, Low Value (10 mΩ to 500 mΩ), Surface-Mount, High Power



## FEATURES

- 2010 and 2512 size package
- Ideal for all types of current sensing and pulse applications including switching and linear power supplies, instruments, power amplifiers, shunts, power inverters, and battery management
- Proprietary processing technique produces low resistance values (10 mΩ to 500 mΩ)
- Solid metal manganese-copper and nickel-chromium-aluminum alloy resistive element with low TCR (< 20 ppm/°C)
- Very low inductance 0.5 nH to 5 nH
- Low thermal EMF (< 3 μV/°C)
- Sulfur resistance by construction that is unaffected by high sulfur environments
- AEC-Q200 qualified <sup>(1)</sup>
- PATENT(S): [www.vishay.com/patents](http://www.vishay.com/patents)
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)

 AUTOMOTIVE  
GRADE

**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**  
**GREEN**  
(5-2008)

## LINKS TO ADDITIONAL RESOURCES



### Notes

- Follow link to Overview of Automotive Grade Products for more details: [www.vishay.com/doc?49924](http://www.vishay.com/doc?49924)
- “SMD Current Sense: AEC-Q200 vs. Vishay Qualification” technical note: [www.vishay.com/doc?30416](http://www.vishay.com/doc?30416)
- (1) Flame retardance test may not be applicable to some resistor technologies

## STANDARD ELECTRICAL SPECIFICATIONS

| GLOBAL MODEL | SIZE | POWER RATING <sup>(1)</sup><br>W | TOLERANCE<br>% | RESISTANCE VALUE RANGE<br>Ω | WEIGHT (typical)<br>g/1000 pieces |
|--------------|------|----------------------------------|----------------|-----------------------------|-----------------------------------|
| WFMA2010     | 2010 | 3.0 at 70 °C                     | ± 1.0          | 0.010 to 0.0329             | 32                                |
| WFMA2010     | 2010 | 2.0 at 110 °C                    | ± 1.0          | 0.010 to 0.0329             | 32                                |
| WFMB2010     | 2010 | 3.0 at 70 °C                     | ± 1.0          | 0.033 to 0.500              | 32                                |
| WFMB2010     | 2010 | 2.0 at 110 °C                    | ± 1.0          | 0.033 to 0.500              | 32                                |
| WFMA2512     | 2512 | 4.0 at 70 °C                     | ± 1.0          | 0.010 to 0.0329             | 41                                |
| WFMA2512     | 2512 | 3.0 at 95 °C                     | ± 1.0          | 0.010 to 0.0329             | 41                                |
| WFMB2512     | 2512 | 4.0 at 70 °C                     | ± 1.0          | 0.033 to 0.500              | 41                                |
| WFMB2512     | 2512 | 3.0 at 95 °C                     | ± 1.0          | 0.033 to 0.500              | 41                                |

### Notes

- “Thermal Management for Surface-Mount Devices” white paper: [www.vishay.com/doc?30380](http://www.vishay.com/doc?30380)
- (1) Terminal temperature

## GLOBAL PART NUMBER INFORMATION

Global Part Numbering Example: WFMB2512R5000FEA

|                            |                               |                         |   |                             |   |  |   |   |   |   |   |   |   |   |   |  |  |
|----------------------------|-------------------------------|-------------------------|---|-----------------------------|---|--|---|---|---|---|---|---|---|---|---|--|--|
| W                          | F                             | M                       | B   | 2                           | 5   | 1  | 2 | R | 5 | 0 | 0 | 0 | F | E | A |  |  |
| GLOBAL MODEL<br>(3 digits) | ELEMENT MATERIAL<br>(1 digit) | CASE SIZE<br>(4 digits) | RESISTANCE VALUE <sup>(1)</sup><br>(5 digits) | TOLERANCE CODE<br>(1 digit) | PACKAGING CODE <sup>(2)</sup><br>(2 digits) | SPECIAL <sup>(3)</sup><br>(2 digits)       |   |   |   |   |   |   |   |   |   |  |  |
| WFM                        | A = CuMn<br>B = NiCrAl        | 2010<br>2512            | R = decimal<br>R0100 = 0.01 Ω                 | F = ± 1.0 %<br>J = ± 5.0 %  | EA =<br>lead (Pb)-free,<br>tape / reel      | Dash numbers<br>1 thru 99<br>as applicable |   |   |   |   |   |   |   |   |   |  |  |

### Notes

- (1) Power Metal Plate™ marking ([www.vishay.com/doc?30327](http://www.vishay.com/doc?30327)); WSL decade values ([www.vishay.com/doc?30117](http://www.vishay.com/doc?30117))
- (2) Packaging code: EB (lead (Pb)-free) is a non-standard packaging code designating 1000 piece reels. This non-standard packaging code is identical to our standard EA (lead (Pb)-free), except that it has a package quantity of 1000 pieces
- (3) Follow link for customization capabilities: [www.vishay.com/doc?48614](http://www.vishay.com/doc?48614)

**PATENT(S):** [www.vishay.com/patents](http://www.vishay.com/patents)

This Vishay product is protected by one or more United States and international patents.

| TECHNICAL SPECIFICATIONS   |        |       |                          |       |
|--|--------|-------|--------------------------|-------|
| PARAMETER  | UNIT   | MODEL | RESISTOR CHARACTERISTICS |       |
|  |        |       | 2010                     | 2512  |
| Temperature coefficient<br>(20 °C to 60 °C)<br>(element only) <sup>(1)</sup>           | ppm/°C | All   | < 20                     |       |
| Operating temperature range  | °C     | All   | -65 to +170              |       |
| Maximum working voltage <sup>(3)</sup>   | V      | All   | $(P \times R)^{1/2}$     |       |
| Maximum terminal temperature   | °C     | All   | 110                      | 95    |
| Temperature coefficient<br>(-55 °C to +150 °C)<br>(including terminals) <sup>(2)</sup> | ppm/°C | WFMA  | ± 110                    | ± 110 |
|  |        | WFMB  | ± 50                     | ± 50  |
| Temperature coefficient<br>(20 °C to 60 °C)<br>(including terminals) <sup>(2)</sup>    | ppm/°C | WFMA  | ± 30                     | ± 40  |
|  |        | WFMB  | ± 20                     | ± 20  |

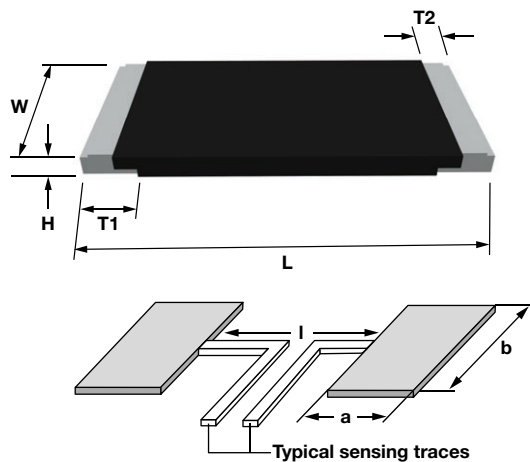
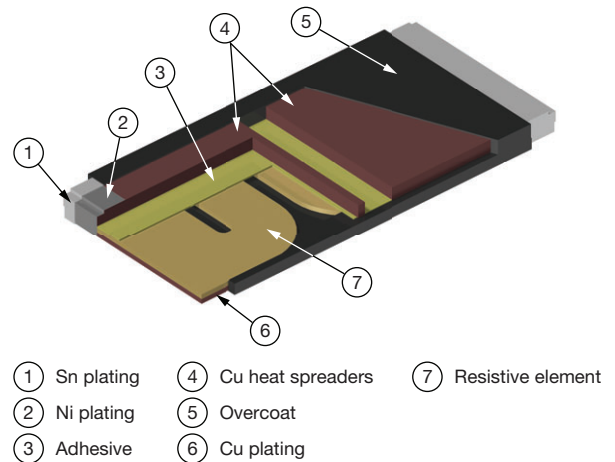
**Notes**

- “Temperature Coefficient of Resistance for Current Sensing” white paper: [www.vishay.com/doc?30405](http://www.vishay.com/doc?30405)

(1) Element TCR - only applies to the alloy used for the resistor element

(2) Component TCR - total TCR that includes the TCR effects of the resistor element and the copper terminal

(3) Maximum working voltage - the WFM is not voltage sensitive, but is limited by power / energy dissipation and is also not ESD sensitive

**DIMENSIONS**

**CONSTRUCTION OUTLINE (1)**

**Notes**

- 3D models available: [www.vishay.com/doc?30401](http://www.vishay.com/doc?30401)

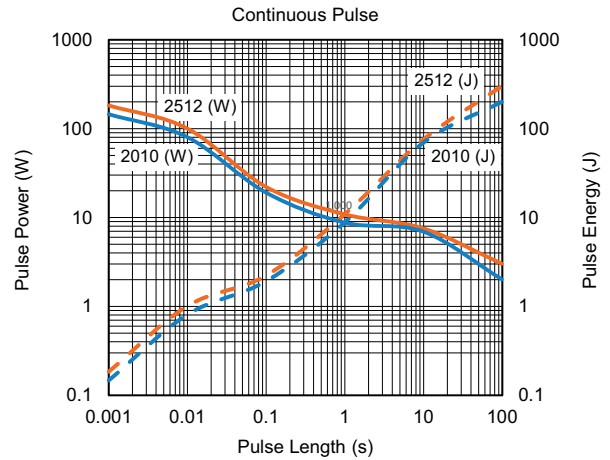
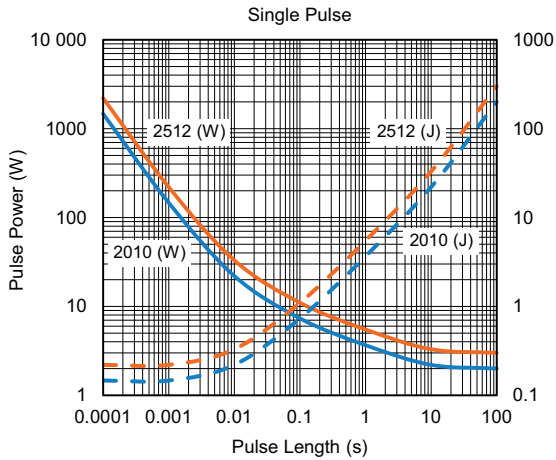
• Surface mount solder profile recommendations: [www.vishay.com/doc?31052](http://www.vishay.com/doc?31052)

(1) For construction advantages and performance details refer to “Did You Know?”: [www.vishay.com/doc?48567](http://www.vishay.com/doc?48567)

| CASE SIZE | RESISTANCE RANGE (mΩ) | DIMENSIONS in inches (millimeters) |                                |                                |                                |                                | SOLDER PAD DIMENSIONS in inches (millimeters) |                 |                 |
|-----------|-----------------------|------------------------------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|---|-----------------|-----------------|
|           |                       | L                                  | W                              | H                              | T1                             | T2                             | a   | b               | l               |
| 2010      | 10 to 500             | 0.200 ± 0.008<br>(5.08 ± 0.20)     | 0.100 ± 0.008<br>(2.54 ± 0.20) | 0.020 ± 0.006<br>(0.50 ± 0.15) | 0.028 ± 0.008<br>(0.70 ± 0.20) | 0.016 ± 0.006<br>(0.40 ± 0.15) | 0.049<br>(1.25)                               | 0.118<br>(3.00) | 0.138<br>(3.50) |
| 2512      | 10 to 500             | 0.250 ± 0.012<br>(6.35 ± 0.30)     | 0.125 ± 0.008<br>(3.18 ± 0.20) | 0.020 ± 0.006<br>(0.50 ± 0.15) | 0.035 ± 0.008<br>(0.90 ± 0.20) | 0.020 ± 0.008<br>(0.50 ± 0.20) | 0.061<br>(1.55)                               | 0.142<br>(3.60) | 0.173<br>(4.40) |

| PRODUCT  | RESISTANCE RANGE (Ω) | THERMAL RESISTANCE (°C/W) | ALLOY |
|----------|----------------------|---------------------------|-------|
| WFMA2010 | 0.01 to 0.0329       | < 30                      | Mn-Cu |
| WFMB2010 | 0.033 to 0.5         | < 55                      | Ni-Cr |
| WFMA2512 | 0.01 to 0.0329       | < 25                      | Mn-Cu |
| WFMB2512 | 0.033 to 0.5         | < 40                      | Ni-Cr |

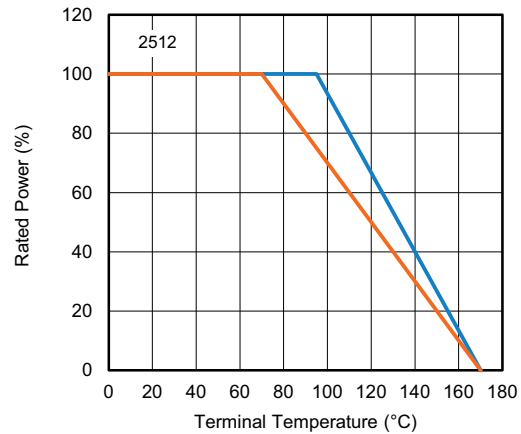
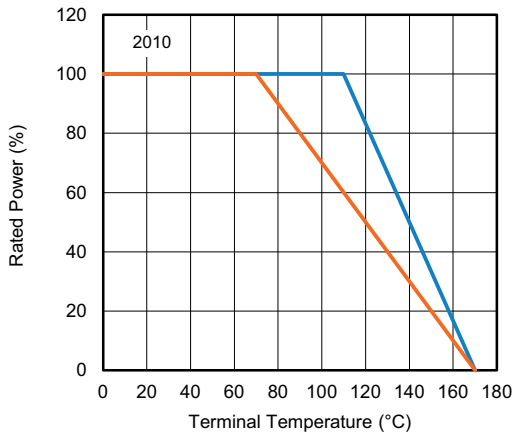
**PULSE ENERGY AND POWER VS. TIME**



**Notes**

- Data is valid for 33 mΩ. Other resistance values require separate testing
- Continuous pulse chart is tested using a square wave pulse of 10 % duty cycle, not exceeding 0.5 % resistance change

**DERATING - TERMINAL TEMPERATURE**



| PERFORMANCE               |  |             |                                    |         |
|---------------------------|--|-------------|------------------------------------|---------|
| TEST                      | CONDITIONS OF TEST   | TEST LIMITS | TYPICAL PERFORMANCE <sup>(1)</sup> |         |
|                           |  |             | CuMn                               | NiCr    |
| Thermal shock             | -55 °C to +150 °C, 2000 cycles, 15 min at each extreme         | ± 0.5 %     | -0.3 %                             | +0.15 % |
| Low temperature storage   | -65 °C for 24 h  | ± 0.1 %     | ± 0.5 %                            | +0.05 % |
| High temperature exposure | 2000 h at +170 °C  | ± 1.0 %     | -0.18 %                            | +0.15 % |
| Bias humidity             | +85 °C, 85 % RH, 10 % power, 1000 h                            | ± 0.5 %     | +0.1 %                             | +0.05 % |
| Mechanical shock          | 100 g's for 6 ms, 5 pulses                                     | ± 0.2 %     | ± 0.5 %                            | ± 0.5 % |
| Vibration                 | Frequency varied 10 Hz to 2000 Hz in 1 min, 3 directions, 12 h | ± 0.2 %     | ± 0.5 %                            | ± 0.5 % |
| Load life                 | 2000 h at maximum terminal temperature at rated power          | ± 0.7 %     | -0.1 %                             | +0.1 %  |
| Resistance to solder heat | +260 °C solder, 10 s to 12 s dwell, 25 mm/s emergence          | ± 0.3 %     | +0.15 %                            | ± 0.5 % |
| Moisture resistance       | MIL-STD-202, method 106, 0 % power, 7b not required            | ± 0.3 %     | +0.1 %                             | +0.05 % |

**Note**

<sup>(1)</sup> Typical performance is based on summary statistics from qualification data. Performance may vary based on application operating conditions



| PACKAGING |                          |             |             |      |
|-----------|--------------------------|-------------|-------------|------|
| MODEL     | REEL                     |             |             |      |
|           | TAPE WIDTH               | DIAMETER    | PIECES/REEL | CODE |
| WFMA2010  | 12 mm / embossed plastic | 178 mm / 7" | 4000        | EA   |
| WFMB2010  | 12 mm / embossed plastic | 178 mm / 7" | 4000        | EA   |
| WFMA2512  | 12 mm / embossed plastic | 178 mm / 7" | 2000        | EA   |
| WFMB2512  | 12 mm / embossed plastic | 178 mm / 7" | 2000        | EA   |

**Notes**

- Embossed carrier tape per EIA-481
- Additional packaging details at [www.vishay.com/doc?20051](http://www.vishay.com/doc?20051)



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