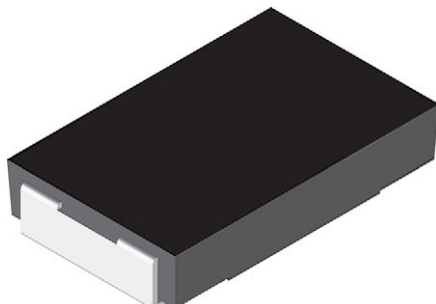


# Power Metal Strip® Resistors, Low Value (Down to 0.001 Ω), Surface Mount



## FEATURES

- Molded high temperature encapsulation
- All welded construction of the Power Metal Strip® resistors are ideal for all types of current sensing, voltage division and pulse applications
- Proprietary processing technique produces extremely low resistance values (down to 0.001 Ω)
- Sulfur resistance by construction that is unaffected by high sulfur environments
- Solid metal nickel-chrome or manganese-copper alloy resistive element with low TCR (< 20 ppm/°C)
- Very low inductance 0.5 nH to 5 nH
- Excellent frequency response to 50 MHz
- Low thermal EMF (< 3 μV/°C)
- AEC-Q200 qualified <sup>(1)</sup>
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)

AUTOMOTIVE  
GRADE

Pb-free  
Available

**RoHS\***

Available

**HALOGEN**
**FREE**

Available

**GREEN**

(5-2008)

Available

## LINKS TO ADDITIONAL RESOURCES



3D Models



Design Tools



Calculators

## Notes

- \* This datasheet provides information about parts that are RoHS-compliant and / or parts that are non-RoHS-compliant. For example, parts with lead (Pb) terminations are not RoHS-compliant. Please see the information / tables in this datasheet for details
- <sup>(1)</sup> Flame retardance test may not be applicable to some resistor technologies

## STANDARD ELECTRICAL SPECIFICATIONS

| GLOBAL MODEL | SIZE | POWER RATING<br>$P_{70^{\circ}\text{C}}$<br>W | RESISTANCE VALUE RANGE<br>Ω |              | WEIGHT<br>(typical)<br>g/1000 pieces |
|--------------|------|-----------------------------------------------|-----------------------------|--------------|--------------------------------------|
|              |      |                                               | TOL. ± 0.5 %                | TOL. ± 1.0 % |                                      |
| WSR2         | 4527 | 2.0                                           | 0.005 to 1.0                | 0.001 to 1.0 | 440                                  |
| WSR3         | 4527 | 3.0 <sup>(1)</sup>                            | 0.005 to 0.2                | 0.001 to 0.2 | 440                                  |

## Notes

- Qualified to AEC-Q200 rev. D
- Part marking: DALE, model, value, tolerance, date code
- <sup>(1)</sup> The WSR3 requires a minimum of 1050 sq. mil. circuit traces connecting to the recommended solder pad

## GLOBAL PART NUMBER INFORMATION

Global Part Numbering Example: WSR25L000FEA (visit [www.vishay.net](http://www.vishay.net) Vishay Dale parts numbering manual for all options)

|              |   |   |                                                                                                         |   |   |                                           |   |   |                                                                                                                            |   |   |                                                                 |  |
|--------------|---|---|---------------------------------------------------------------------------------------------------------|---|---|-------------------------------------------|---|---|----------------------------------------------------------------------------------------------------------------------------|---|---|-----------------------------------------------------------------|--|
| W            | S | R | 2                                                                                                       | 5 | L | 0                                         | 0 | 0 | F                                                                                                                          | E | A |                                                                 |  |
| GLOBAL MODEL |   |   | RESISTANCE VALUE <sup>(1)</sup>                                                                         |   |   | TOLERANCE CODE                            |   |   | PACKAGING CODE <sup>(2)</sup>                                                                                              |   |   | SPECIAL <sup>(3)</sup>                                          |  |
| WSR2<br>WSR3 |   |   | L = mΩ*<br>R = decimal<br>5L000 = 0.005 Ω<br>R0100 = 0.01 Ω<br>* Use "L" for resistance values < 0.01 Ω |   |   | D = ± 0.5 %<br>F = ± 1.0 %<br>J = ± 5.0 % |   |   | EA = lead (Pb)-free, tape/reel<br>EK = lead (Pb)-free, bulk<br>TA = tin/lead, tape/reel (R86)<br>BA = tin/lead, bulk (B43) |   |   | (dash number)<br>(up to 2 digits)<br>from 1 to 99 as applicable |  |

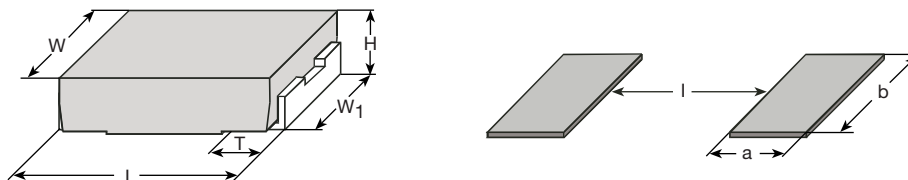
## Notes

- <sup>(1)</sup> WSR marking ([www.vishay.com/doc?30327](http://www.vishay.com/doc?30327))
- <sup>(2)</sup> Packaging code: EB (lead (Pb)-free) and TB (tin / lead) are non-standard packaging codes designating 1000 piece reels. These non-standard packaging codes are identical to our standard EA (lead (Pb)-free) and TA (tin / lead), except that they have a package quantity of 1000 pieces
- <sup>(3)</sup> Follow link for customization capabilities: [www.vishay.com/doc?48163](http://www.vishay.com/doc?48163)

## TECHNICAL SPECIFICATIONS

| PARAMETER                                                     | UNIT            | WSR2 AND WSR3 RESISTOR CHARACTERISTICS |
|---------------------------------------------------------------|-----------------|----------------------------------------|
| Temperature coefficient<br>TCR measured from -55 °C to 150 °C | ppm/°C          | ± 75 for 0.010 Ω to 1.0 Ω              |
|                                                               |                 | ± 110 for 0.005 Ω to 0.0099 Ω          |
|                                                               |                 | ± 300 for 0.004 Ω to 0.0049 Ω          |
|                                                               |                 | ± 450 for 0.003 Ω to 0.0039 Ω          |
|                                                               |                 | ± 600 for 0.002 Ω to 0.0029 Ω          |
|                                                               |                 | ± 750 for 0.001 Ω to 0.0019 Ω          |
| Element TCR                                                   | ppm/°C          | < 20                                   |
| Dielectric withstanding voltage                               | V <sub>AC</sub> | > 500                                  |
| Insulation resistance                                         | Ω               | > 10 <sup>9</sup>                      |
| Operating temperature range                                   | °C              | -65 to +275                            |
| Maximum working voltage                                       | V               | (P × R) <sup>1/2</sup>                 |

## DIMENSIONS in inches (millimeters)



### Notes

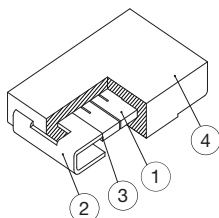
- 3D models available: [www.vishay.com/doc?30336](http://www.vishay.com/doc?30336)
- Surface mount solder profile recommendations: [www.vishay.com/doc?31052](http://www.vishay.com/doc?31052)

| MODEL      | DIMENSIONS                       |                                 |                                 |                                 |                                 | SOLDER PAD DIMENSIONS |                 |                 |
|------------|----------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|-----------------------|-----------------|-----------------|
|            | L                                | H                               | T                               | W                               | W <sub>1</sub>                  | a                     | b               | l               |
| WSR2, WSR3 | 0.455 ± 0.032<br>(11.56 ± 0.813) | 0.095 ± 0.005<br>(2.41 ± 0.127) | 0.100 ± 0.010<br>(2.54 ± 0.254) | 0.275 ± 0.005<br>(6.98 ± 0.127) | 0.215 ± 0.005<br>(5.46 ± 0.127) | 0.155<br>(3.94)       | 0.230<br>(5.84) | 0.205<br>(5.21) |

### Note

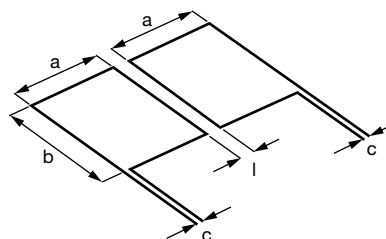
- Sensing locations are based on the construction of the part; terminals are wrapped from the outside to underneath. These options place the sensing location nearest the temperature stable resistance element, which minimizes contact resistance and optimizes TCR

## CONSTRUCTION WSR2

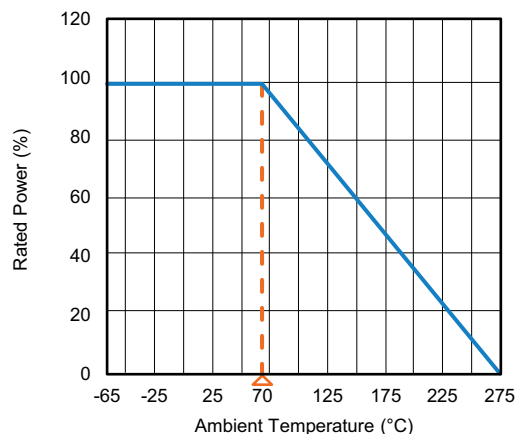
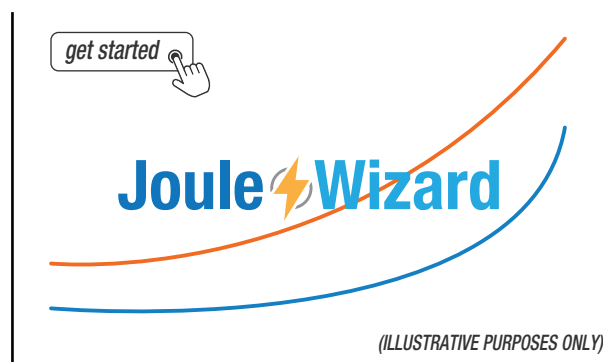


- ① Resistive element
- ② Plated terminal
- ③ Terminal / element weld
- ④ LCP mold with laser print

## TYPICAL SENSING LAYOUT



| a               | b               | c               | l               |
|-----------------|-----------------|-----------------|-----------------|
| 0.155<br>(3.94) | 0.230<br>(5.84) | 0.020<br>(0.51) | 0.205<br>(5.21) |

**DERATING**

**PULSE CAPABILITY**

[www.vishay.com/en/resistors/joulewizard/](http://www.vishay.com/en/resistors/joulewizard/)

| PERFORMANCE               |                                                                |                    |                    |
|---------------------------|----------------------------------------------------------------|--------------------|--------------------|
| TEST                      | CONDITIONS OF TEST                                             | TEST LIMITS        |                    |
|                           |                                                                | WSR2               | WSR3               |
| Thermal shock             | -55 °C to +150 °C, 1000 cycles, 15 min at each extreme         | ± 0.5 % + 0.0005 Ω | ± 0.5 % + 0.0005 Ω |
| Short time overload       | WSR2: 5x rated power for 5 s<br>WSR3: 4x rated power for 5 s   | ± 0.5 % + 0.0005 Ω | ± 2.0 % + 0.0005 Ω |
| Low temperature storage   | -65 °C for 24 h                                                | ± 0.5 % + 0.0005 Ω | ± 0.5 % + 0.0005 Ω |
| High temperature exposure | 1000 h at +275 °C                                              | ± 1.0 % + 0.0005 Ω | ± 1.0 % + 0.0005 Ω |
| Bias humidity             | +85 °C, 85 % RH, 10 % bias, 1000 h                             | ± 0.5 % + 0.0005 Ω | ± 0.5 % + 0.0005 Ω |
| Mechanical shock          | 100 g's for 6 ms, 5 pulses                                     | ± 0.5 % + 0.0005 Ω | ± 0.5 % + 0.0005 Ω |
| Vibration                 | Frequency varied 10 Hz to 2000 Hz in 1 min, 3 directions, 12 h | ± 0.5 % + 0.0005 Ω | ± 0.5 % + 0.0005 Ω |
| Load life                 | 1000 h at rated power, +70 °C, 1.5 h "ON", 0.5 h "OFF"         | ± 1.0 % + 0.0005 Ω | ± 2.0 % + 0.0005 Ω |
| Resistance to solder heat | +260 °C solder, 10 s to 12 s dwell, 25 mm/s emergence          | ± 0.5 % + 0.0005 Ω | ± 0.5 % + 0.0005 Ω |
| Moisture resistance       | MIL-STD-202, method 106, 0 % power, 7a and 7b not required     | ± 0.5 % + 0.0005 Ω | ± 0.5 % + 0.0005 Ω |

| PACKAGING <sup>(1)</sup> |                        |            |             |      |
|--------------------------|------------------------|------------|-------------|------|
| MODEL                    | REEL                   |            |             |      |
|                          | TAPE WIDTH             | DIAMETER   | PIECES/REEL | CODE |
| WSR2 and WSR3            | 24 mm/embossed plastic | 330 mm/13" | 1500        | EA   |

**Notes**

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

| LINKS TO RELATED DOCUMENTS                                |                                                                        |
|-----------------------------------------------------------|------------------------------------------------------------------------|
| <b>SELECTOR GUIDE</b>                                     |                                                                        |
| Overview of Automotive Grade Products                     | <a href="http://www.vishay.com/doc?49924">www.vishay.com/doc?49924</a> |
| <b>TECHNICAL NOTES</b>                                    |                                                                        |
| SMD Current Sense: AEC-Q200 vs. Vishay Qualification      | <a href="http://www.vishay.com/doc?30416">www.vishay.com/doc?30416</a> |
| MIL-PRF vs. AEC-Q200: Do You Know What You Are Getting?   | <a href="http://www.vishay.com/doc?11000">www.vishay.com/doc?11000</a> |
| <b>WHITE PAPER</b>                                        |                                                                        |
| Thermal Management for Surface-Mount Devices              | <a href="http://www.vishay.com/doc?30380">www.vishay.com/doc?30380</a> |
| Temperature Coefficient of Resistance for Current Sensing | <a href="http://www.vishay.com/doc?30405">www.vishay.com/doc?30405</a> |



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