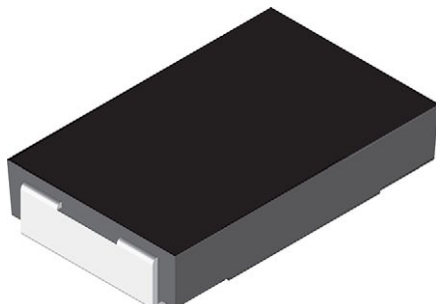


# Power Metal Strip® Resistors, Low Value (Down to 0.001 Ω), Surface Mount



## 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

**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)

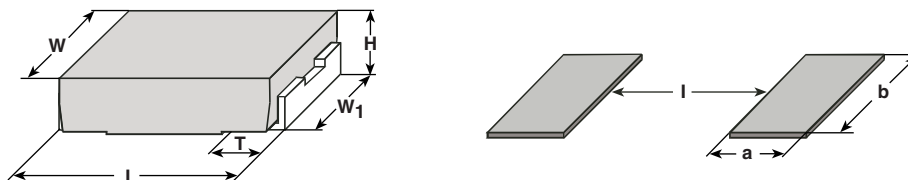
|              |   |   |                                                                                                         |   |   |                                           |   |   |                                                                                                                            |   |   |                                                                 |  |
|--------------|---|---|---------------------------------------------------------------------------------------------------------|---|---|-------------------------------------------|---|---|----------------------------------------------------------------------------------------------------------------------------|---|---|-----------------------------------------------------------------|--|
| 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>                 |

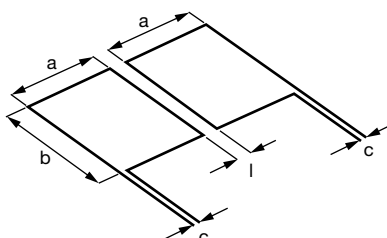
**DIMENSIONS** in inches (millimeters)

**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)

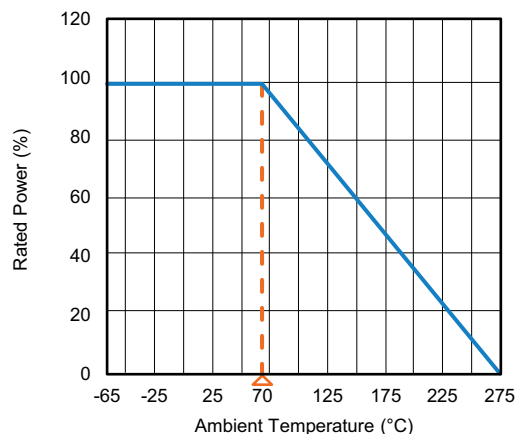
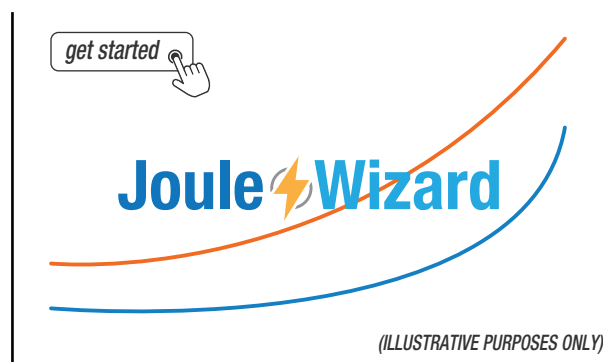
| MODEL      | DIMENSIONS                       |                                 |                                 |                                 |                                 | SOLDER PAD DIMENSIONS |                 |                 |
|------------|----------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|-----------------------|-----------------|-----------------|
|            | 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

**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> |



## Disclaimer

ALL PRODUCT, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, "Vishay"), disclaim any and all liability for any errors, inaccuracies or incompleteness contained in any datasheet or in any other disclosure relating to any product.

Vishay makes no warranty, representation or guarantee regarding the suitability of the products for any particular purpose or the continuing production of any product. To the maximum extent permitted by applicable law, Vishay disclaims (i) any and all liability arising out of the application or use of any product, (ii) any and all liability, including without limitation special, consequential or incidental damages, and (iii) any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.

Statements regarding the suitability of products for certain types of applications are based on Vishay's knowledge of typical requirements that are often placed on Vishay products in generic applications. Such statements are not binding statements about the suitability of products for a particular application. It is the customer's responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application. Parameters provided in datasheets and / or specifications may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated for each customer application by the customer's technical experts. Product specifications do not expand or otherwise modify Vishay's terms and conditions of purchase, including but not limited to the warranty expressed therein.

Hyperlinks included in this datasheet may direct users to third-party websites. These links are provided as a convenience and for informational purposes only. Inclusion of these hyperlinks does not constitute an endorsement or an approval by Vishay of any of the products, services or opinions of the corporation, organization or individual associated with the third-party website. Vishay disclaims any and all liability and bears no responsibility for the accuracy, legality or content of the third-party website or for that of subsequent links.

Vishay products are not designed for use in life-saving or life-sustaining applications or any application in which the failure of the Vishay product could result in personal injury or death unless specifically qualified in writing by Vishay. Customers using or selling Vishay products not expressly indicated for use in such applications do so at their own risk. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay. Product names and markings noted herein may be trademarks of their respective owners.