



## Power Metal Strip® Resistors, Low Value (Down to 0.0005 Ω), Surface-Mount



### LINKS TO ADDITIONAL RESOURCES



### FEATURES

- 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 0.0005 Ω)
- Sulfur resistance by construction that is unaffected by high sulfur environments
- Very low inductance 0.5 nH to 5 nH
- 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)



Available



Available



Available



Available

### 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 $P_{70\text{ }^{\circ}\text{C}}$<br>W | RESISTANCE VALUE RANGE Ω <sup>(2)</sup> |               | WEIGHT (typical)<br>g/1000 pieces |
|--------------|------|----------------------------------------------------|-----------------------------------------|---------------|-----------------------------------|
|              |      |                                                    | TOL. ± 0.5 %                            | TOL. ± 1.0 %  |                                   |
| WSL0603      | 0603 | 0.1                                                | 0.01 to 0.1                             | 0.01 to 0.1   | 1.9                               |
| WSL0805      | 0805 | 0.125                                              | 0.005 to 0.2                            | 0.005 to 0.2  | 4.8                               |
| WSL1206      | 1206 | 0.25                                               | 0.005 to 0.2                            | 0.0005 to 0.2 | 16.2                              |
| WSL2010      | 2010 | 0.5                                                | 0.004 to 0.5                            | 0.001 to 0.5  | 38.9                              |
| WSL2512      | 2512 | 1.0 <sup>(1)</sup>                                 | 0.003 to 0.5                            | 0.0005 to 0.5 | 63.6                              |
| WSL2816      | 2816 | 2.0                                                | 0.003 to 0.1                            | 0.002 to 0.1  | 118                               |

### Notes

- Part marking: value; tolerance: due to resistor size limitations some resistors will be marked with only the resistance value
- Qualified to AEC-Q200 rev. D
- <sup>(1)</sup> For values above 0.1 Ω derate linearly to 80 % rated power at 0.5 Ω
- <sup>(2)</sup> WSL1206 0.0005 Ω to 0.00099 Ω is only available with 2 % tolerance (G tolerance code)

### GLOBAL PART NUMBER INFORMATION

Global Part Numbering Example: WSL25124L000FEA (visit [www.vishay.net](http://www.vishay.net) Vishay Dale parts numbering manual for all options)

W S L 2 5 1 2 4 L 0 0 0 F E A

| GLOBAL MODEL<br>(7 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>(up to 2 digits) |
|----------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|-------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|
| WSL0603<br>WSL0805<br>WSL1206<br>WSL2010<br>WSL2512<br>WSL2816 | L = mΩ*<br>R = decimal<br>5L000 = 0.005 Ω<br>R0100 = 0.01 Ω<br><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>EH = lead (Pb)-free, tape / reel (WSL2816)<br><br>TA = tin / lead, tape / reel (R86)<br>TG = tin / lead, tape / reel (RT1, for WSL0603 and WSL0805)<br>TH = tin / lead, tape / reel (RJ9, WSL2816)<br>SB = tin / lead, tape / reel for <a href="#">DLA drawings</a> | (dash number) from 1 to 99 as applicable   |

### Notes

- Per PCN-DR-00009-2022-REV-0, WSL marking will be removed effective March 1st, 2023
- <sup>(1)</sup> WSL 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))
- <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)



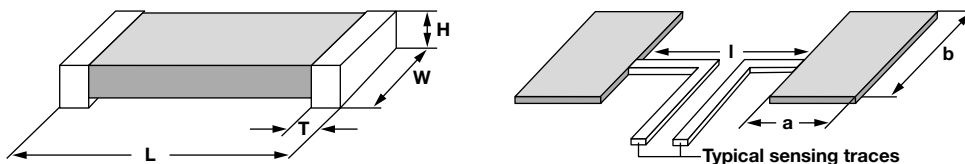
# **TECHNICAL SPECIFICATIONS**

| PARAMETER                                                                                                          | UNIT   | WSL RESISTOR CHARACTERISTICS |                             |         |         |         |         |
|--------------------------------------------------------------------------------------------------------------------|--------|------------------------------|-----------------------------|---------|---------|---------|---------|
|                                                                                                                    |        | WSL0603 <sup>(1)</sup>       | WSL0805                     | WSL1206 | WSL2010 | WSL2512 | WSL2816 |
| Component temperature coefficient<br>(including terminal) <sup>(2)</sup><br>TCR measured from<br>-55 °C to +155 °C | ppm/°C | ± 75 for 50 mΩ to 100 mΩ     | ± 75 for 7 mΩ to 500 mΩ     |         |         |         |         |
|                                                                                                                    |        | ± 110 for 10 mΩ to 49 mΩ     | ± 110 for 5 mΩ to 6.9 mΩ    |         |         |         |         |
|                                                                                                                    |        | -                            | ± 150 for 3 mΩ to 4.9 mΩ    |         |         |         |         |
|                                                                                                                    |        | -                            | ± 275 for 1 mΩ to 2.9 mΩ    |         |         |         |         |
|                                                                                                                    |        | -                            | ± 400 for 0.5 mΩ to 0.99 mΩ |         |         |         |         |
| Element TCR <sup>(3)</sup>                                                                                         | ppm/°C | < 20                         |                             |         |         |         |         |
| Operating temperature range                                                                                        | °C     | -65 to +170                  |                             |         |         |         |         |
| Maximum working voltage <sup>(4)</sup>                                                                             | V      | $(P \times R)^{1/2}$         |                             |         |         |         |         |

## **Notes**

- (1) Consult factory for detailed TCR performance across temperature range associated with PCN-DR-00003-2020 for WSL0603. TCR performance is improved for +25 °C to +155 °C
- (2) Component TCR - total TCR that includes the TCR effects of the resistor element and the copper terminal
- (3) Element TCR - only applies to the alloy used for the resistor element; refer to item 1 in the construction illustration on the following page
- (4) Maximum working voltage - the WSL is not voltage sensitive, but is limited by power / energy dissipation and is also not ESD sensitive

## **DIMENSIONS** in inches (millimeters)



## **Notes**

- 3D models available: [www.vishay.com/doc?30306](http://www.vishay.com/doc?30306)
- Surface mount solder profile recommendations: [www.vishay.com/doc?31052](http://www.vishay.com/doc?31052)

| MODEL                  | RESISTANCE RANGE (Ω) | DIMENSIONS                      |                                 |                                  |                                  | SOLDER PAD DIMENSIONS |                 |                 |
|------------------------|----------------------|---------------------------------|---------------------------------|----------------------------------|----------------------------------|-----------------------|-----------------|-----------------|
|                        |                      | L                               | W                               | H                                | T                                | a                     | b               | l               |
| WSL0603 <sup>(1)</sup> | 0.01 to 0.1          | 0.060 ± 0.010<br>(1.52 ± 0.254) | 0.030 ± 0.010<br>(0.76 ± 0.254) | 0.016 ± 0.005<br>(0.406 ± 0.127) | 0.015 ± 0.010<br>(0.381 ± 0.254) | 0.040<br>(1.01)       | 0.040<br>(1.01) | 0.020<br>(0.50) |
| WSL0805 <sup>(2)</sup> | 0.005 to 0.2         | 0.080 ± 0.010<br>(2.03 ± 0.254) | 0.050 ± 0.010<br>(1.27 ± 0.254) | 0.016 ± 0.005<br>(0.406 ± 0.127) | 0.015 ± 0.010<br>(0.381 ± 0.254) | 0.040<br>(1.02)       | 0.050<br>(1.27) | 0.020<br>(0.50) |
| WSL1206                | 0.0005 to 0.00099    | 0.126 ± 0.010<br>(3.20 ± 0.254) | 0.063 ± 0.010<br>(1.60 ± 0.254) | 0.025 ± 0.010<br>(0.635 ± 0.254) | 0.041 ± 0.010<br>(1.04 ± 0.254)  | 0.089<br>(2.26)       | 0.076<br>(1.93) | 0.023<br>(0.58) |
|                        | 0.001 to 0.0019      |                                 |                                 |                                  | 0.025 ± 0.010<br>(0.635 ± 0.254) | 0.086<br>(2.18)       | 0.076<br>(1.93) | 0.029<br>(0.74) |
|                        | 0.002 to 0.0059      |                                 |                                 |                                  |                                  | 0.070<br>(1.78)       | 0.076<br>(1.93) | 0.061<br>(1.55) |
|                        | 0.006 to 0.20        |                                 |                                 |                                  |                                  | 0.065<br>(1.65)       | 0.076<br>(1.93) | 0.071<br>(1.80) |
| WSL2010                | 0.001 to 0.0069      | 0.200 ± 0.010<br>(5.08 ± 0.254) | 0.100 ± 0.010<br>(2.54 ± 0.254) | 0.025 ± 0.010<br>(0.635 ± 0.254) | 0.058 ± 0.010<br>(1.47 ± 0.254)  | 0.093<br>(2.36)       | 0.120<br>(3.05) | 0.055<br>(1.40) |
|                        | 0.007 to 0.5         |                                 |                                 |                                  | 0.020 ± 0.010<br>(0.508 ± 0.254) | 0.055<br>(1.40)       | 0.120<br>(3.05) | 0.130<br>(3.30) |
| WSL2512                | 0.0005 to 0.00099    | 0.250 ± 0.010<br>(6.35 ± 0.254) | 0.125 ± 0.010<br>(3.18 ± 0.254) | 0.025 ± 0.010<br>(0.635 ± 0.254) | 0.107 ± 0.010<br>(2.72 ± 0.254)  | 0.120<br>(3.05)       | 0.145<br>(3.68) | 0.050<br>(1.27) |
|                        | 0.001 to 0.0049      |                                 |                                 |                                  | 0.087 ± 0.010<br>(2.21 ± 0.254)  |                       |                 | 0.125<br>(3.18) |
|                        | 0.005 to 0.0069      |                                 |                                 |                                  | 0.047 ± 0.010<br>(1.19 ± 0.254)  | 0.083<br>(2.11)       |                 |                 |
|                        | 0.007 to 0.5         |                                 |                                 |                                  | 0.030 ± 0.010<br>(0.762 ± 0.254) | 0.065<br>(1.65)       |                 | 0.160<br>(4.06) |
| WSL2816                | 0.002 to 0.00399     | 0.280 ± 0.010<br>(7.1 ± 0.254)  | 0.165 ± 0.010<br>(4.2 ± 0.254)  | 0.025 ± 0.010<br>(0.635 ± 0.254) | 0.098 ± 0.010<br>(2.49 ± 0.254)  | 0.135<br>(3.43)       | 0.185<br>(4.7)  | 0.060<br>(1.52) |
|                        | 0.004 to 0.1         |                                 |                                 |                                  | 0.062 ± 0.010<br>(1.57 ± 0.254)  | 0.096<br>(2.45)       |                 | 0.125<br>(3.20) |

## **Notes**

- (1) PCN-DR-00003-2020 changed terminal height for WSL0603 from 0.013" ± 0.005" for clad construction to 0.016" ± 0.005" for welded construction
- (2) PCN-DR-00021-2021-REV-1 changed terminal height for WSL0805 from 0.013" ± 0.005" for clad construction to 0.016" ± 0.005" for welded construction

**DERATING****PULSE CAPABILITY**
[www.vishay.com/en/resistors/joulewizard/](http://www.vishay.com/en/resistors/joulewizard/)
**WELDED CONSTRUCTION**

- ① Resistive element: solid metal nickel-chrome or manganese-copper alloy resistive element with low TCR (< 20 ppm/°C)
- ② Plated terminal: solid copper, 100 % Sn (100 μ" min.) with 100 % Ni (20 μ" min.) under layer finish
- ③ Terminal / element weld
- ④ Silicone coating with ink print

| PERFORMANCE               |                                                                                                                                                                                                                     |                      |
|---------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| TEST                      | CONDITIONS OF TEST                                                                                                                                                                                                  | TEST LIMITS          |
| Thermal shock             | -55 °C to +150 °C, 1000 cycles, 15 min at each extreme                                                                                                                                                              | ± (0.5 % + 0.0005 Ω) |
| Short time overload       | Refer to link for short time overload performance and pulse capability;<br><a href="http://www.vishay.com/en/resistors/power-metal-strip-calculator/">www.vishay.com/en/resistors/power-metal-strip-calculator/</a> | ± (0.5 % + 0.0005 Ω) |
| Low temperature operation | -65 °C for 24 h                                                                                                                                                                                                     | ± (0.5 % + 0.0005 Ω) |
| High temperature exposure | 1000 h at + 170 °C                                                                                                                                                                                                  | ± (1.0 % + 0.0005 Ω) |
| Bias humidity             | +85 °C, 85 % RH, 10 % bias, 1000 h                                                                                                                                                                                  | ± (0.5 % + 0.0005 Ω) |
| Mechanical shock          | 100 g's for 6 ms, 5 pulses                                                                                                                                                                                          | ± (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) |
| Load life                 | 1000 h at rated power, + 70 °C, 1.5 h "ON", 0.5 h "OFF"                                                                                                                                                             | ± (1.0 % + 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) |
| Moisture resistance       | MIL-STD-202, method 106, 0 % power, 7a and 7b not required                                                                                                                                                          | ± (0.5 % + 0.0005 Ω) |

**Note**

- Contact [ww2bresistors@vishay.com](mailto:ww2bresistors@vishay.com) for application specific performance requirements or qualification data. Typical performance is better than stated test limits

| PACKAGING <sup>(1)</sup> |                          |             |             |      |
|--------------------------|--------------------------|-------------|-------------|------|
| MODEL                    | REEL                     |             |             |      |
|                          | TAPE WIDTH               | DIAMETER    | PIECES/REEL | CODE |
| WSL0603                  | 8 mm / punched paper     | 178 mm / 7" | 5000        | EA   |
| WSL0805                  | 8 mm / punched paper     | 178 mm / 7" | 5000        | EA   |
| WSL1206                  | 8 mm / embossed plastic  | 178 mm / 7" | 4000        | EA   |
| WSL2010                  | 12 mm / embossed plastic | 178 mm / 7" | 4000        | EA   |
| WSL2512                  | 12 mm / embossed plastic | 178 mm / 7" | 2000        | EA   |
| WSL2816                  | 12 mm / embossed plastic | 178 mm / 7" | 2000        | EH   |

**Notes**

- Embossed carrier tape per EIA-481
- <sup>(1)</sup> 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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