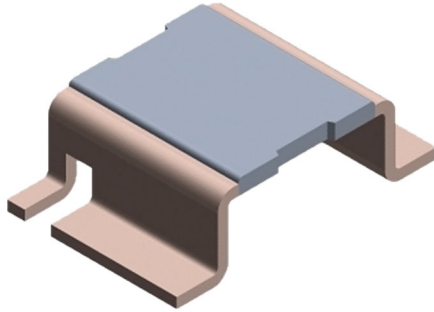


# Power Metal Strip® Resistors, Very High Power (to 12 W), Low Value (Down to 0.0002 Ω), Surface Mount



## FEATURES

- High power to foot print size ratio
- 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 0.0002 Ω
- Sulfur resistance by construction that is unaffected by high sulfur environments
- Specially selected and stabilized materials allow for high power rating (to 12 W)
- 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
- 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)

## LINKS TO ADDITIONAL RESOURCES



### Note

- <sup>(1)</sup> Flame retardance test may not be applicable to some resistor technologies

| STANDARD ELECTRICAL SPECIFICATIONS |      |   |                  |                                |  |                                      |
|------------------------------------|------|---|------------------|--------------------------------|--|--------------------------------------|
| GLOBAL MODEL                       | SIZE | POWER RATING<br>$P_{70\text{ }^\circ\text{C}}$<br>W | TOLERANCE<br>± % | RESISTANCE VALUE<br>RANGE<br>Ω | RESISTANCE VALUES<br>CURRENTLY AVAILABLE <sup>(1)</sup><br>Ω | WEIGHT<br>(typical)<br>g/1000 pieces |
| WSLP4026                           | 4026 | 5.0   | 1.0, 5.0         | 1.3m to 5m                     | 1.3m, 2m, 3m, 4m, 5m   | 420                                  |
| WSLP4026                           | 4026 | 7.0   | 1.0, 5.0         | 0.5m to 1m                     | 0.5m, 0.7m, 1m   | 420                                  |
| WSLP4026                           | 4026 | 10.0  | 1.0, 5.0         | 0.3m                           | 0.3m   | 420                                  |
| WSLP4026                           | 4026 | 12.0  | 1.0, 5.0         | 0.2m                           | 0.2m   | 420                                  |

### Notes

- Qualified to AEC-Q200 rev. D
  - Power rating depends on the max. temperature at the solder point, component placement density and the substrate material
  - Part marking: model, value, tolerance, date code
- <sup>(1)</sup> Other values may be available, contact factory

| GLOBAL PART NUMBER INFORMATION  |   |   |  |   |   |   |   |                             |   |   |   |   |   |   |   |  |  |
|---|---|---|--|---|---|---|---|-----------------------------|---|---|---|---|---|---|---|--|--|
| Global Part Numbering Example: <b>WSLP4026L5000FEA</b> (WSLP4026, 0.0005 Ω, ± 1 %)                            |   |   |  |   |   |   |   |                             |   |   |   |   |   |   |   |  |  |
| (visit <a href="http://www.vishay.net">www.vishay.net</a> Vishay Dale parts numbering manual for all options) |   |   |  |   |   |   |   |                             |   |   |   |   |   |   |   |  |  |
| W   | S | L | P  | 4 | 0 | 2 | 6 | L                           | 5 | 0   | 0 | 0 | F | E   | A |  |  |
| GLOBAL MODEL<br>(8 digits)  |   |   | RESISTANCE VALUE<br>(5 digits)   |   |   |   |   | TOLERANCE CODE<br>(1 digit) |   | PACKAGING CODE <sup>(1)</sup><br>(2 digits)                   |   |   |   | SPECIAL <sup>(2)</sup><br>(up to 2 digits)                      |   |  |  |
| WSLP4026  |   |   | L = mΩ<br>L5000 = 0.0005 Ω<br>L7000 = 0.0007 Ω<br>L1000 = 0.0010 Ω<br>L2000 = 0.0020 Ω |   |   |   |   | F = ± 1.0 %<br>J = ± 5.0 %  |   | EA = lead (Pb)-free, tape / reel<br>EK = lead (Pb)-free, bulk |   |   |   | (dash number)<br>(up to 2 digits)<br>from 1 to 99 as applicable |   |  |  |

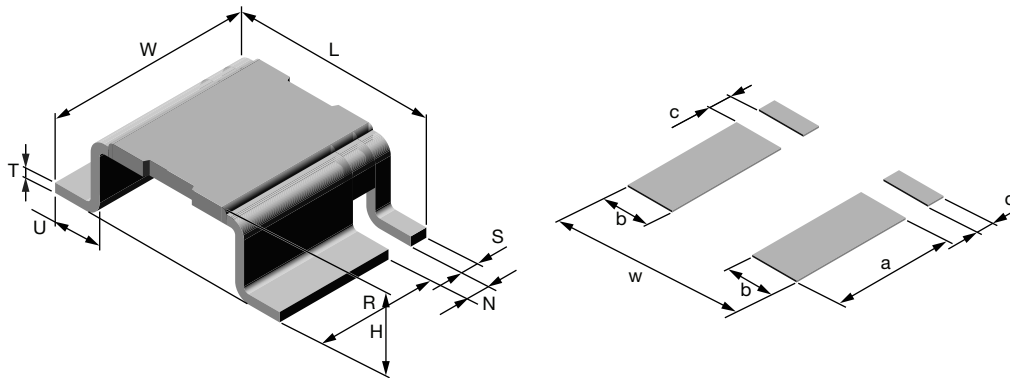
### Notes

- <sup>(1)</sup> Packaging code: EB (lead (Pb)-free) is a non-standard packaging code designating 1000 piece reels. The non-standard packaging code is identical to our standard EA (lead (Pb)-free), except that it is a package quantity of 1000 pieces
- <sup>(2)</sup> Follow link for customization capabilities: [www.vishay.com/doc?48163](http://www.vishay.com/doc?48163)

| TECHNICAL SPECIFICATIONS  |        |                                   |
|---|--------|-----------------------------------|
| PARAMETER   | UNIT   | RESISTOR CHARACTERISTICS          |
| Component temperature coefficient (including terminal) <sup>(1)</sup><br>TCR measured from 0 °C to 150 °C | ppm/°C | ± 75 for 0.5 mΩ to 5 mΩ           |
|   |        | ± 110 for 0.3 mΩ; ± 75 for 0.2 mΩ |
| Element TCR <sup>(2)</sup>  | ppm/°C | < 20                              |
| Operating temperature range   | °C     | -65 to +170                       |
| Maximum working voltage <sup>(3)</sup>  | V      | $(P \times R)^{1/2}$              |

**Notes**

- (1) Component TCR - total TCR that includes the TCR effects of the resistor element and the copper terminal
- (2) Element TCR - only applies to the alloy used for the resistor element
- (3) 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?30316](http://www.vishay.com/doc?30316)
- Surface mount solder profile recommendations: [www.vishay.com/doc?31052](http://www.vishay.com/doc?31052)

| MODEL    | DIMENSIONS                    |  |                        |                |                              |                               |                               |                                |
|----------|-------------------------------|--|------------------------|----------------|------------------------------|-------------------------------|-------------------------------|--------------------------------|
|          | L                             | W  | H                      | R (REF.)       | S                            | T                             | U                             | N                              |
| WSLP4026 | 0.400 ± 0.008<br>(10.1 ± 0.2) | 0.260 + 0.012/- 0.008<br>(6.6 + 0.3/- 0.2) | Please see table below | 0.198<br>(5.0) | 0.028 ± 0.004<br>(0.7 ± 0.1) | 0.016 ± 0.002<br>(0.4 ± 0.15) | 0.078 ± 0.006<br>(2.0 ± 0.15) | 0.039 ± 0.006<br>(0.99 ± 0.15) |

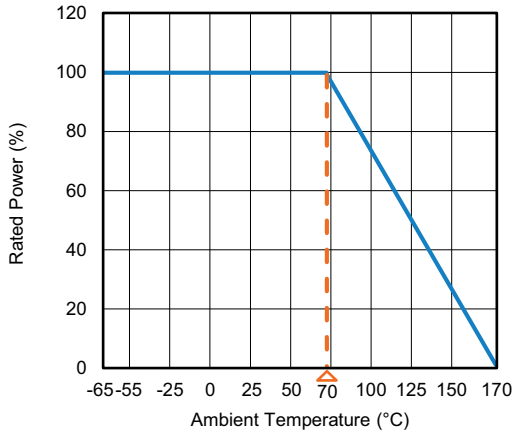
| MODEL    | SOLDER PAD DIMENSIONS |              |              |              |               |
|----------|-----------------------|--------------|--------------|--------------|---------------|
|          | a                     | b            | c            | d            | w             |
| WSLP4026 | 0.223 (5.66)          | 0.105 (2.67) | 0.027 (0.69) | 0.039 (0.99) | 0.423 (10.74) |

| MODEL    | RESISTANCE VALUE (mΩ) | THERMAL RESISTANCE <sup>(1)</sup> (°C/W) | ELEMENT MATERIAL           | HEIGHT H                    |
|----------|-----------------------|--|----------------------------|-----------------------------|
| WSLP4026 | 0.2                   | 3  | Mn-Cu-Sn                   | 0.150 ± 0.008 (3.81 ± 0.2)  |
|          | 0.3                   | 4  | Mn-Cu                      | 0.141 ± 0.008 (3.58 ± 0.2)  |
|          | 0.5                   | 6  | Mn-Cu                      | 0.116 ± 0.008 (2.95 ± 0.2)  |
|          | 0.7                   | 8  | Mn-Cu                      | 0.111 ± 0.008 (2.82 ± 0.2)  |
|          | 1.0                   | 10                                       | Mn-Cu                      | 0.1055 ± 0.008 (2.68 ± 0.2) |
|          | 1.3                   | 11                                       | Ni-Cr                      | 0.119 ± 0.008 (3.02 ± 0.2)  |
|          | 2.0                   | 16                                       | Ni-Cr                      | 0.114 ± 0.008 (2.9 ± 0.2)   |
|          | 3.0                   | 19                                       | Ni-Cr                      | 0.110 ± 0.008 (2.79 ± 0.2)  |
|          | 4.0                   | 22                                       | Ni-Cr                      | 0.110 ± 0.008 (2.79 ± 0.2)  |
| 5.0      | 38                    | Ni-Cr                                    | 0.110 ± 0.008 (2.79 ± 0.2) |                             |

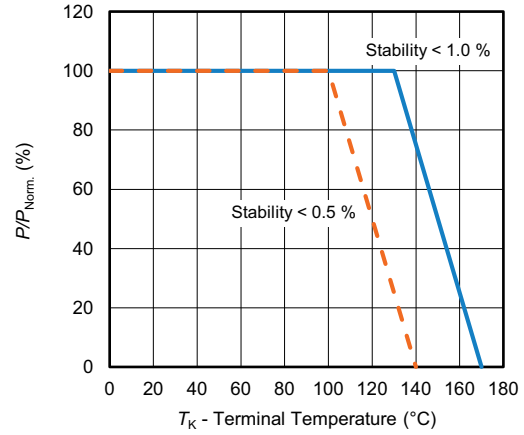
**Note**

- (1) The full power rating of Power Metal Strip resistors are dependent upon the ability of the circuit board to dissipate the heat energy created in the resistance element. It is recommended to follow common design practices for power semiconductors that ensure the junction temperature is maintained within thermal limits by using large pad surfaces, thermal vias, heavier copper weights, internal layers as well as other thermal spreading features. The thermal resistance values provided function in the same manner as junction to terminal temperature

**DERATING - AMBIENT TEMPERATURE**



**DERATING - TERMINAL TEMPERATURE**



Example: WSLP4026 0.0005  $\Omega$ , 0.001  $\Omega$

**PULSE CAPABILITY**



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



| PERFORMANCES                            |                 |   |   |
|---|-----------------|---|---|
| DESCRIPTION                             | AEC TEST NUMBER | TEST CONDITIONS   | LIMIT                                   |
| High temperature exposure               | 3               | MIL-STD-202, Method 108, 2000 h at T = 170 °C at 0 % power, measurements at 24 h ± 2 h  | ± (1.0 %)                               |
| Temperature cycling                     | 4               | JESD22 Method JA104, -55 °C to 150 °C, dwell time = 15 min, 2000 cycles; measurement at 24 h ± 2 h after test   | ± (0.5 %)                               |
| Moisture resistance                     | 6               | MIL-STD-202, Method 106, t = 24 h/cycle<br>Note: steps 7a and 7b not required, 0% power, no polarization test, 65 °C, measurement at 24 h ± 2 h after test  | ± (0.5 %)                               |
| Biased humidity                         | 7               | MIL-STD-202, Method 103, 2000 h 85 °C/85 % RH<br>Note: specified conditions: 10 % of rated power, measurement at 24 h ± 2 h   | ± (0.5 %)                               |
| Operational life 125 °C                 | 8               | MIL-STD-202 Method 108 (ambient 125 °C)   | ± (1.0 %)                               |
| Resistance to solvents                  | 12              | MIL-STD-202, Method 215<br>aqueous wash chemical- OKEM clean or equivalent  | Marking remains legible                 |
| Mechanical shock                        | 13              | MIL-STD-202, Method 213   | ± (0.5 %)                               |
| Vibration                               | 14              | MIL-STD-202, Method 204, condition D  | ± (0.5 %)                               |
| Resistance to soldering heat            | 15              | MIL-STD-202, Method 210, condition K, no preheat of samples, initial readings taken after mounting, final readings taken after 3 more heat cycles<br>Note: maximum temperature is 260 °C                            | ± (0.5 %)                               |
| Electrostatic discharge                 | 17              | AEC-Q200-002  | ± (1.0 %)                               |
| Lead (Pb)-free functional solderability | 18              | J-STD-002, Method S1, 4 h at 155 °C dry heat, mount on PCB, max. reflow temperature at 260 °C; no electrical test 50x mag   | 95 % coverage                           |
| Electrical characterization             | 19              | RTC at -65 °C and 170 °C  | Refer to Technical Specifications table |
| Board flex                              | 21              | AEC-Q200-005, 2 mm min, 60 s min. holding time  | ± (1.0 %)                               |
| Terminal strength                       | 22              | AEC-Q200-006, force of 1.8 kg for 60 s  | ± (1.0 %)                               |
| Flame retardance                        | 24              | AEC-Q200-001  | Per AEC-Q200-001 (1)                    |
| 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 %)                               |
| Low temperature operation               |                 | -65 °C for 24 h   | ± (0.5 %)                               |

Notes

- Full qualification data available upon request at [ww2bresistors@vishay.com](mailto:ww2bresistors@vishay.com)
- (1) Flame retardance requires the application of 9 V for 1 h on a low resistance value current sense resistor, which causes the device to be substantially overpowered. The Power Metal Strip® technology does not fuse as a thick film resistor would under these conditions, resulting in temperatures that exceeds 350 °C for > 10 s

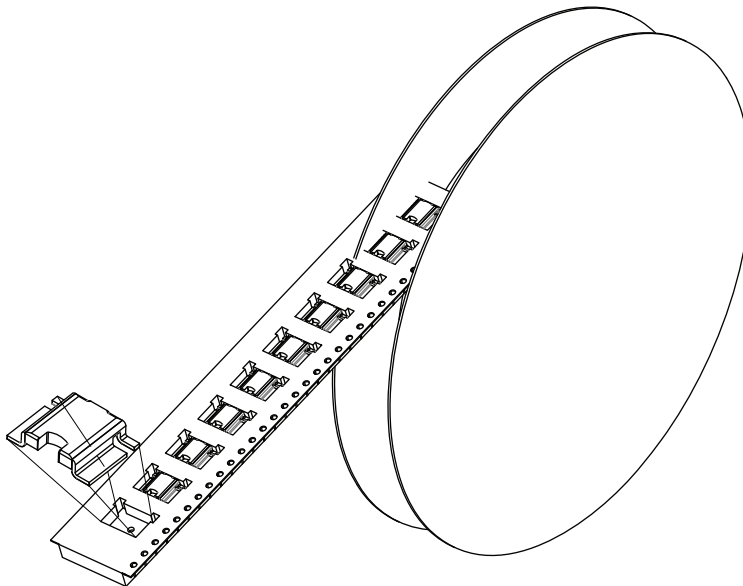


| PACKAGING |                          |              |             |      |
|-----------|--------------------------|--------------|-------------|------|
| MODEL     | REEL                     |              |             |      |
|           | TAPE WIDTH               | DIAMETER     | PIECES/REEL | CODE |
| WSLP4026  | 24 mm / embossed plastic | 330 mm / 13" | 1500        | EA   |

Notes

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

REEL ORIENTATION



| 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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