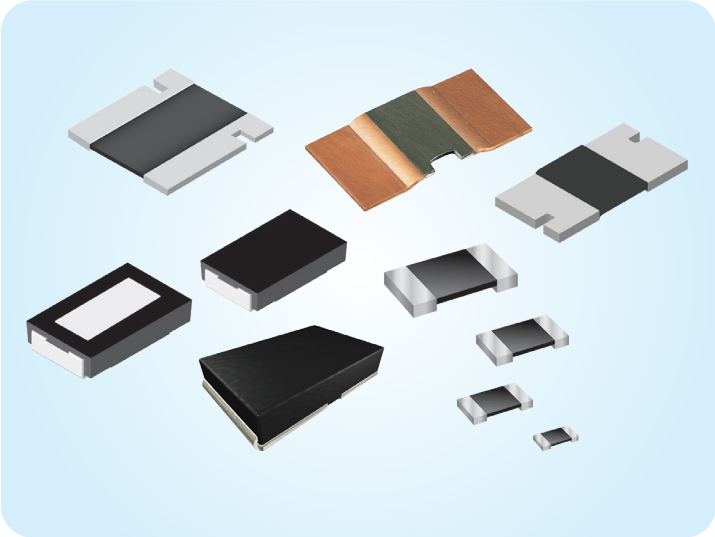
CURRENT SENSE POWER METAL STRIP® RESISTORS
Selector Guide

INTRODUCTION



Vishay's Power Metal Strip current sensing resistors combine superior performance in high temperature applications with a wide range of package sizes and a choice of resistance values from 0.0002 Ω to 1 Ω. These patented, state of the art products deliver overload capabilities equivalent to wirewound devices and temperature coefficients as low as 30 ppm/°C.

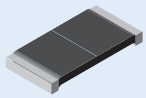
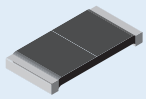
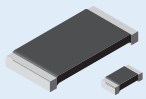
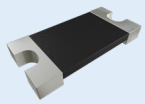
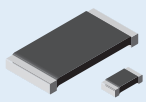
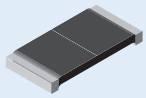
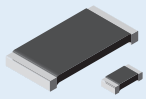
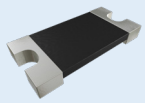
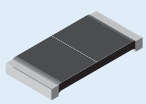
Current sensing Power Metal Strip resistors allow control circuitry to monitor the level of current in a circuit by translating current into a voltage that can be monitored easily. The devices work by resisting the current flow in a circuit to a calibrated level, thus allowing a voltage drop to be detected and monitored by control circuitry. The low resistance values of Power Metal Strip resistors allow this function to be carried out with exceptional efficiency.

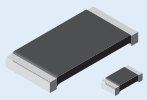
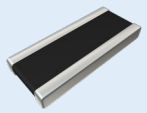
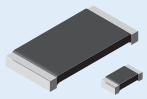
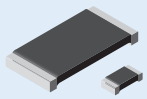
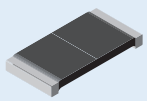
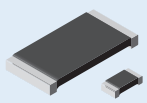
RESOURCES

- For technical questions contact ww2bresistors@vishay.com

POWER METAL STRIP® RESISTORS

Vishay Dale

Product	Power rating (See Datasheet)	Resistance Range (Ω)	TCR (ppm/°K)	Tolerances	Dimensions	Applications
WSL0603 	0.1 W	0.01 to 0.1	± 75	0.5 % to 1 %	L = 0.060 in (1.52 mm) W = 0.030 in (0.76 mm) H = 0.013 in (0.33 mm)	• Cell phone battery fuel gages • Disk drive motor controls • DC/DC converters in cell phones, pagers
WSL0805 	0.125 W	0.005 to 0.0069 0.007 to 0.2	± 110 ± 75	0.5 % to 1 %	L = 0.080 in (2.03 mm) W = 0.050 in (1.27 mm) H = 0.013 in (0.33 mm)	
WSL0603-18 	0.2 W	0.01 to 0.1	± 75	0.5 % to 1 %	L = 0.060 in (1.52 mm) W = 0.030 in (0.76 mm) H = 0.013 in (0.33 mm)	
WSK1206 	0.25 W	0.01 to 0.05	± 35	0.1 %, 0.25 % 0.5 %, 1 %	L = 0.126 in (3.20 mm) W = 0.063 in (1.60 mm) H = 0.025 in (0.635 mm)	
WSL0805-18 	0.25 W	0.005 to 0.0069 0.007 to 0.2	± 110 ± 75	0.1 %, 0.5 %, 1 %	L = 0.080 in (2.03 mm) W = 0.050 in (1.27 mm) H = 0.013 in (0.33 mm)	
WSL1206 	0.25 W	0.001 to 0.0029 0.003 to 0.0049 0.005 to 0.0069 0.007 to 0.2	± 275 ± 150 ± 110 ± 75	1 % 1 % 0.5 %, 1 % 0.5 %, 1 %	L = 0.126 in (3.20 mm) W = 0.063 in (1.60 mm) H = 0.025 in (0.64 mm)	• Li-ion battery management • DC/DC converters in switching power supplies • VRMs in notebooks PCs • Disk drive motor controls • Automotive controls for body and powertrain
WSLP0603 	0.4 W	0.01 to 0.1	± 75	0.5 % to 1 %	L = 0.060 in (1.52 mm) W = 0.030 in (0.76 mm) H = 0.013 in (0.33 mm)	
WSK1206-18 	0.5 W	0.001 to 0.05	± 35	0.1 % 0.25 % 0.5 %, 1 %	L = 0.126 in (3.20 mm) W = 0.063 in (1.60 mm) H = 0.025 in (0.64 mm)	
WSL2010 	0.5 W	0.001 to 0.0029 0.003 to 0.0049 0.005 to 0.0069 0.007 to 0.5	± 275 ± 150 ± 110 ± 75	1 % 1 % 0.5 %, 1 % 0.5 %, 1 %	L = 0.200 in (5.08 mm) W = 0.100 in (2.54 mm) H = 0.025 in (0.64 mm)	

Product	Power rating (See Datasheet)	Resistance Range (Ω)	TCR (ppm/°K)	Tolerances	Dimensions	Applications
WSLP0805 	0.5 W	0.01 to 0.05	± 75	0.5 %, 1 %	L = 0.080 in (2.03 mm) W = 0.050 in (1.27 mm) H = 0.013 in (0.33 mm)	• Li-ion battery management • DC/DC converters in switching power supplies • VRMs in notebooks PCs • Disk drive motor controls • Automotive controls for body and powertrain
WSKW0612 	1.0 W	0.0005 to 0.005	± 150 ± 75 ± 50	1 %, 5 %	L = 0.060 in (1.50 mm) W = 0.120 in (3.05 mm) H = 0.018 in (0.457mm)	
WSL0612 	1.0 W	0.00075 to 0.005	± 250 ± 150	1 %, 5 %	L = 0.120 in (3.05 mm) W = 0.060 in (1.50 mm) H = 0.015 in (0.381 mm)	
WSLP1206 	1.0 W	0.001 to 0.0029 0.003 to 0.0049 0.005 to 0.0069 0.007 to 0.05	± 275 ± 150 ± 110 ± 75	1 % 1 % 0.5 %, 1 % 0.5 %, 1 %	L = 0.126 in (3.20 mm) W = 0.063 in (1.60 mm) H = 0.025 in (0.64 mm)	
WSLP0805-18 	1.0 W	0.005 to 0.01	± 110 ± 75	1 %, 5 %	L = 0.080 in (2.03 mm) W = 0.050 in (1.27 mm) H = 0.013 in (0.330 mm)	
WSL2010-18 	1.0 W	0.001 to 0.0029 0.003 to 0.0049 0.005 to 0.0069 0.007 to 0.5	± 275 ± 150 ± 110 ± 75	1 % 1 % 0.5 %, 1 % 0.5 %, 1 %	L = 0.200 in (5.08 mm) W = 0.100 in (2.54 mm) H = 0.025 in (0.64 mm)	
WSL2512 	1.0 W	0.0005 to 0.00099 0.001 to 0.0029 0.003 to 0.0049 0.005 to 0.0069 0.007 to 0.5	± 400 ± 275 ± 150 ± 110 ± 75	1 % 1 % 1 % 0.5 %, 1 % 0.5 %, 1 %	L = 0.250 in (6.35 mm) W = 0.125 in (3.18 mm) H = 0.025 in (0.64 mm)	

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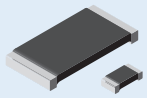
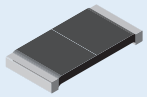
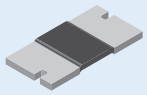
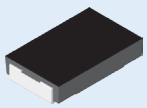
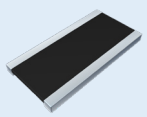
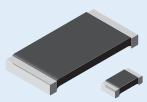
WSLT2010-18 	1.0 W	0.01 to 0.5	± 75	0.5 %, 1 %	L = 0.200 in (5.08 mm) W = 0.100 in (2.54 mm) H = 0.025 in (0.64 mm)	• High temperature (+275 °C) • Automotive controls for body and powertrain • Down-hole oil well monitoring / testing
WSLT2512 	1.0 W	0.01 to 0.5	± 75	0.5 %, 1 %	L = 0.250 in (6.35 mm) W = 0.125 in (3.18 mm) H = 0.025 in (0.64 mm)	
WSK2512 	1.0 W	0.0005 to 0.00099 0.001 to 0.0029 0.003 to 0.0049 0.005 to 0.0099 0.01 to 0.2	± 350 ± 250 ± 75 ± 35 ± 35	1 % 0.5 %, 1 % 0.5 %, 1 % 0.5 %, 1 % 0.1 %, 0.5 %, 1 %	L = 0.250 in (6.35 mm) W = 0.125 in (3.18 mm) H = 0.025 in (0.64 mm)	• DC/DC converters in switching power supplies • VRMs in notebooks, desktop PCs • Instrumentation
WSR2 	2.0 W	0.001 to 0.0019 0.002 to 0.0029 0.003 to 0.0039 0.004 to 0.0049 0.005 to 0.0099 0.010 to 1.0	± 750 ± 600 ± 450 ± 300 ± 110 ± 75	1 % 1 % 1 % 1 % 0.5 %, 1 % 0.5 %, 1 %	L = 0.455 in (11.56 mm) W = 0.275 in (6.98 mm) H = 0.095 in (2.41 mm)	• DC/DC converters in switching power supplies • VRMs in notebooks, desktop PCs • Instrumentation • Automotive controls for body and powertrain
WSR3	3.0 W	0.001 to 0.0019 0.002 to 0.0029 0.003 to 0.0039 0.004 to 0.0049 0.005 to 0.0099 0.010 to 0.2	± 750 ± 600 ± 450 ± 300 ± 110 ± 75	1 % 1 % 1 % 1 % 0.5 %, 1 % 0.5 %, 1 %	L = 0.455 in (11.56 mm) W = 0.275 in (6.98 mm) H = 0.095 in (2.41 mm)	
WSL1020 	2.0 W	0.001 to 0.006	± 175	0.5 %, 1 %, 5 %	L = 0.200 in (5.08 mm) W = 0.060 in (1.50 mm) H = 0.015 in (0.381 mm)	• Li-ion battery management DC/DC converters in switching power supplies • VRMs in notebooks PCs • Disk drive motor controls • Automotive controls for body and powertrain
WSLP1206-18 	2.0 W	0.005 to 0.012	± 110 / ± 75	1 %, 5 %	L = 0.126 in (3.20 mm) W = 0.063 in (1.60 mm) H = 0.025 in (0.635 mm)	• Li-ion battery management • DC/DC converters in switching power supplies • VRMs in notebooks PCs • Disk drive motor controls • Automotive controls for body and powertrain

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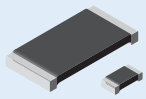
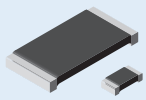
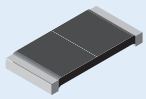
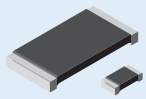
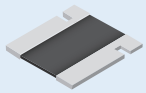
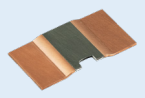
WSLP2010 	2.0 W	0.001 to 0.0029 0.003 to 0.0049 0.005 to 0.0069 0.007 to 0.01	± 275 ± 150 ± 110 ± 75	1 % 1 % 0.5 %, 1 % 0.5 %, 1 %	L = 0.200 in (5.08 mm) W = 0.100 in (2.54 mm) H = 0.025 in (0.635 mm)	• Li-ion battery management • DC/DC converters in switching power supplies • VRMs in notebooks, desktop PCs • Automotive controls for body and powertrain
WSL2512-18 	2.0 W	0.0005 to 0.00099 0.001 to 0.0029 0.003 to 0.0049 0.005 to 0.0069 0.007 to 0.04	± 400 ± 275 ± 150 ± 110 ± 75	1 % 0.5 %, 1 % 0.5 %, 1 % 0.5 %, 1 %	L = 0.250 in (6.35 mm) W = 0.125 in (3.18 mm) H = 0.025 in (0.64 mm)	• Li-ion battery management • DC/DC converters in switching power supplies • VRMs in notebooks, desktop PCs • Automotive controls for body and powertrain
WSL2816 	2.0 W	0.002 to 0.0029 0.003 to 0.0049 0.005 to 0.0069 0.007 to 0.1	± 275 ± 150 ± 110 ± 75	1 % 0.5 %, 1 % 0.5 %, 1 % 0.5 %, 1 %	L = 0.280 in (7.10 mm) W = 0.165 in (4.20 mm) H = 0.020 in (0.50 mm)	
WSLP2512 	3.0 W	0.0005 to 0.00099 0.001 to 0.0029 0.003 to 0.0049 0.005 to 0.0069 0.007 to 0.01	± 400 ± 275 ± 150 ± 110 ± 75	1 % 1 % 0.5 %, 1 % 0.5 %, 1 % 0.5 %, 1 %	L = 0.250 in (6.35 mm) W = 0.125 in (3.18 mm) H = 0.025 in (0.64 mm)	• Li-ion battery management • DC/DC converters in switching power supplies • VRMs in notebooks PCs • Disk drive motor controls • Automotive controls for body and powertrain
WSL3637 	3.0 W	0.001 to 0.0029 0.003 to 0.01	± 75 ± 50	0.5 %, 1 % 0.5 %, 1 %	L = 0.360 in (9.14 mm) W = 0.370 in (9.40 mm) H = 0.025 in (0.64 mm)	• DC/DC converters in switching power supplies • VRMs in notebooks, desktop PCs • Automotive controls for EHPS / EPS / EPAS and brushless DC motors
WSLT3921 	3.0 W	0.0002 0.0005, 0.001 0.0015, 0.004	± 150 ± 150 ± 50	1 %, 5 %	L = 0.394 in (10.0 mm) W = 0.205 in (5.20 mm) H = 0.020 in (0.50 mm)	• High temperature (+275 °C) • Automotive controls for EHPS / EPS / EPAS and brushless DC motors • Down-hole oil well monitoring / testing

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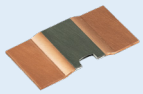
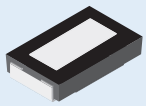
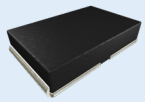
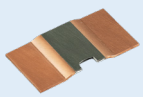
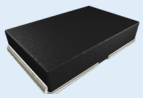
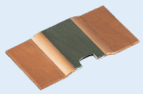
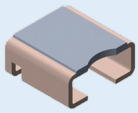
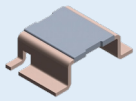
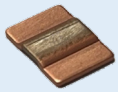
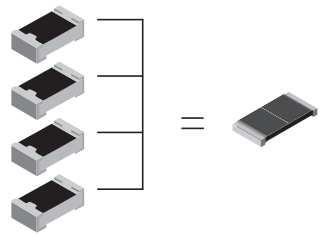
WSKP0612 	5.0 W	0.0005 to 0.005	-300 /+50	1 %	L = 0.060 in (1.50 mm) W = 0.120 in (3.05 mm) H = 0.018 in (0.457mm)	• DC/DC converter in switching power supplies • VRMs in notebook / desktop PCs • Instrumentation • Automotive controls for body and powertrain
WSLT5931 	5.0 W	0.0003, 0.0005 0.001, 0.002 0.003	± 175 ± 75 ± 75	1 %, 5 %	L = 0.591 in (15.0 mm) W = 0.305 in (7.75 mm) H = 0.020 in (0.50 mm)	• High temperature (+275 °C) • Automotive controls for EHPS / EPS / EPAS and brushless DC motors • Down-hole oil well monitoring / testing
WSR5 	5.0 W	0.001 to 0.0019 0.002 to 0.0029 0.003 to 0.0039 0.004 to 0.0049 0.005 to 0.0099 0.01 to 0.3	± 750 ± 600 ± 450 ± 300 ± 110 ± 75	1 % 1 % 1 % 1 % 1 % 0.5 %, 1 %	L = 0.455 in (11.56 mm) W = 0.275 in (6.98 mm) H = 0.095 in (2.41 mm)	• DC/DC converters in switching power supplies • VRMs in notebooks, desktop PCs • Instrumentation • Automotive controls for body and powertrain
WSHM2818 	7.0 W	0.001 to 0.00599 0.006 to 0.1	± 200 ± 75	1 %, 5 %	L = 0.280 in (7.10 mm) W = 0.180 in (4.60 mm) H = 0.059 in (1.50 mm) max.	• DC/DC converters in switching power supplies • VRMs in notebooks, desktop PCs • Automotive controls for EHPS / EPS / EPAS and brushless DC motors
WSK1216 	8.0 W	0.0002 to 0.002	< 35	1 %	L = 0.150 in (3.81 mm) W = 0.122 in (3.10 mm) H = 0.075 in (1.9 mm)	• Li-ion battery management • Automotive controls for body and powertrain • Brushless DC motor controls • Inverter controls for HVAC, White goods
WSLF2512 	10.0 W	0.0003 to 0.0005	± 200	1 %, 5 %	L = 0.250 in (6.35 mm) W = 0.120 in (3.05 mm) H = 0.0138 in (0.35 mm)	• Li-ion battery management • Automotive controls for body and powertrain Brushless DC motor controls • Inverter controls for HVAC, white goods

Product	Power rating (See Datasheet)	Resistance Range (Ω)	TCR (ppm/°K)	Tolerances	Dimensions	Applications
WSHP2818 	10.0 W	0.001 to 0.00599 0.006 to 0.1	± 200 ± 75	1 %, 5 %	L = 0.280 in (7.10 mm) W = 0.180 in (4.60 mm) H = 0.059 in (1.50 mm) max.	• DC/DC converters in switching power supplies • VRMs in notebooks, desktop PCs • Automotive controls for EHPS / EPS / EPAS and brushless DC motors
WSLP3921 	9.0 W	0.0001 to 0.004	± 50	1 %, 5 %	L = 0.394 in (10.0 mm) W = 0.205 in (5.20 mm) H = 0.020 in (0.50 mm)	• DC/DC converters in switching power supplies • VRMs in notebooks, desktop PCs • Automotive controls for EHPS / EPS / EPAS and brushless DC motors
WSLP5931	15.0 W	0.0001 to 0.003	± 75	1 %, 5 %	L = 0.591 in (15.0 mm) W = 0.305 in (7.75 mm) H = 0.020 in (0.50 mm)	
WSLP2726 	12 W	0.0002 to 0.005	± 75	1 %, 5 %	L = 0.272 in (6.9 mm) W = 0.260 in (6.6 mm) H = 0.117 in (3.0 mm)	• DC/DC converter in switching power supplies • Instrumentation • Automotive controls for EHPS / EPS / EPAS and brushless DC motors
WSLP4026 	12 W	0.0002 to 0.005	± 75	1 %, 5 %	L = 0.400 in (10.1 mm) W = 0.260 in (6.6 mm) H = see datasheet	
WSLF3222 	12.0 W (P100 °C)	0.00015 0.0002 to 0.0005	± 250 ± 200	1 %	L = 0.311 in (7.9 mm) W = 0.220 in (5.60 mm) H = see datasheet	• DC/DC converter in switching power supplies • Inverter control for bLDC motor drives • Automotive controls for EHPS / EPS / EPaS

Technical Information

Very Low Ohmic Value (0.2 mΩ to 1 Ω)

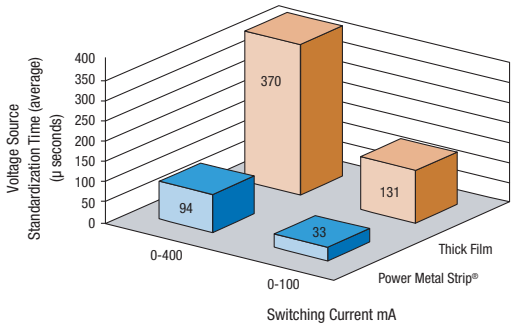
To maximize energy conversion efficiency and minimize power consumption, current sense resistors should be of the lowest resistance value possible (typically below 25 mΩ). The single Power Metal Strip resistor can achieve the same low ohmic values for which four to six conventional cermet chips or two or more conventional thin film chips are required.



Multiple Chip Single Power Metal Strip®

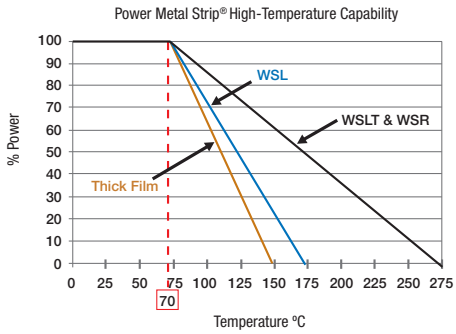
Tight Tolerance (1 % Standard, 0.5 % and 0.1 % Available)

For maximizing the sensing performance and saving energy, the tolerance of the sense resistor must be ± 1 % or tighter. A 1 % tolerance allows designers to use a narrow resistance window when specifying sensing voltages. Another advantage of a 1 % or better tolerance is reduced response time to switching currents. The chart to the right shows that it takes a comparable thick film resistor almost three times longer than the Power Metal Strip to stabilize it's sensing voltage.



High Temperature Capability (Up to +275 °C)

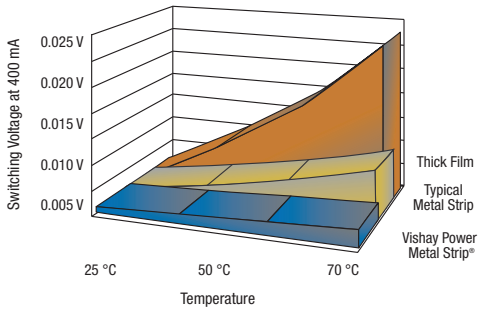
When used in industrial and automotive applications, components may be exposed to high temperatures. The current sensing resistor must be capable of operating in high temperature conditions with a minimal reduction (derating) of rated power. The Vishay Dale WSL (maximum temperature of 170 °C) and WSLT / WSR (maximum temperature of 275 °C) type resistors will withstand high temperatures much better than cermet chips. The chart to the right provides a high temperature comparison for these device types.



Low Temperature Coefficient of Resistance (TCR) (Down to 30 ppm/°C)

The low TCR of Vishay Power Metal Strip resistors minimizes the resistance change caused by self heating and high temperature environments.

This chart illustrates the voltage of a 30 ppm/°C Vishay Power Metal Strip resistor compared to a typical 100 ppm/°C metal strip and 700 ppm/°C thick film chip.

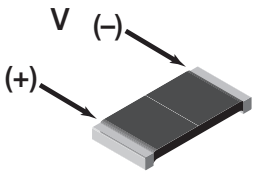


Low Thermal EMF (Below 3 µV/°C)

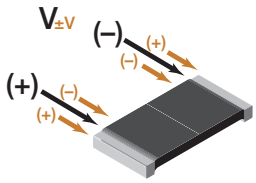
Dissimilar metals, in contact with each other, produce a small voltage. This voltage varies with temperature and is therefore called a “thermal EMF” or “thermocouple effect.” The rate of change of voltage with temperature from an intermetallic junction is a function of the metallic combination and the polarity of the voltage produced. Virtually all resistors have intermetallic combinations and it is presumed they will eventually be connected to copper as a final intermetallic junction (circuit trace). Hence, copper is the typical reference metal.

Thermal EMF is an important consideration in low-value resistors used in DC circuits. Thermal EMF can be large enough, when compared to the expected signal, that it can result in significant sensing errors. Vishay’s Power Metal Strip current sensing resistors utilize resistance materials that have low thermal EMF characteristics (below 3 µV/°C).

Metal Alloy	Thermal EMF vs. Copper µV/°C
Evanohm	+2
Cupron	-45
Manganin	-3
Zeranin	-1.3
Nickel	-22
Gold	+0.2
Silver	-0.2
Aluminum	-4



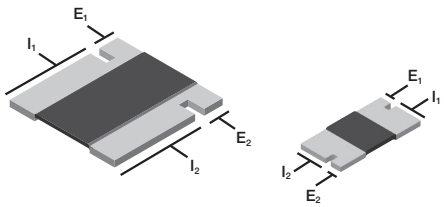
V = Voltage Drop
(no thermal EMF effect)



V ±V = Voltage Drop
(with (±V) thermal EMF effect)

Terminal Construction

At resistance levels down to 1 mΩ and tolerances of 1 % or larger, a two-terminal construction is typically acceptable. Where better accuracy is required, Vishay recommends the use of the four-terminal type such as the WSK0612, WSK1206, WSK2512, WSL2726, WSL3637, or WSL4026. The four-terminal construction reduces terminal resistance, copper terminal TCR, and solder joint TCR.



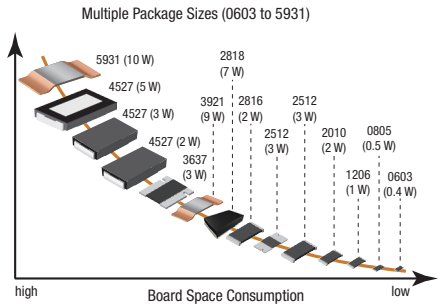
(E_1 & E_2 Voltage Connections, I_1 & I_2 Current Connections)

High Current Capability (More Than 220 A)

The maximum DC load current required by today’s applications is in excess of 200 A. Vishay’s Power Metal Strip current sensing resistors utilize solid metal resistance elements, which are capable of handling the highest load currents.

Multiple Package Sizes (0603 to 5931)

Vishay's Power Metal Strip resistors are available in more than 10 package sizes. Multiple package sizes give the customer the ability to minimize PCB space by utilizing a smaller component or lessen resistor temperature by utilizing a larger component for their current sense applications.



High Power Density (Up to 222 W/in²)

Vishay's Power Metal Strip resistors have evolved to "High Power" WSL…-18, WSLP, WSR3, WSR5, and WSHM2818 type resistors. With the higher power capacity of the standard WSL and WSR2 type resistor series, the WSL…-18, WSLP, WSR3, WSR5, and WSHM2818 series are intended for high power, current sensing applications. Specially selected materials and processing permit these high power ratings of up to 10 W. The WSL…-18, WSLP, WSR3, WSR5, and WSHM2818 resistors offer a high power to package size ratio while maintaining superior electrical characteristics. These high power ratings enable designers to use smaller PCBs, which in turn increases manufacturing speed and reduces raw material costs.