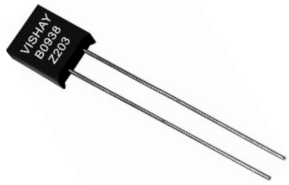
Ultra High Precision Z1-Foil Resistor for Metrology and Laboratory with TCR of 0.5 ppm/°C Maximum, Tolerance to 0.005 % (50 ppm) and Load Life Stability of 0.005 % (50 ppm), + 70 °C for 10 000 h

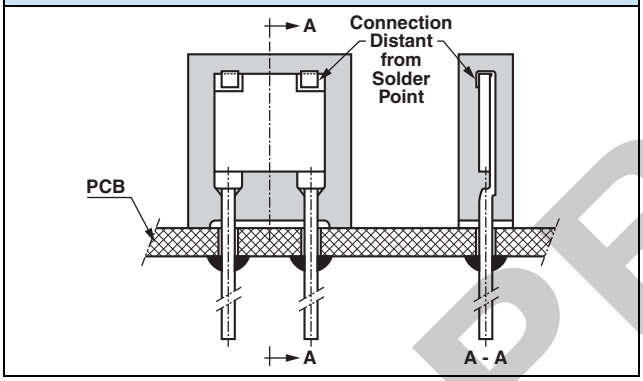
INDUSTRY BREAKTHROUGH



Z203 resistors are not restricted to standard values or minimum order quantity, and can be supplied from 1 unit with as-required values (e.g. 9.997 kΩ vs. 10 kΩ) at no extra cost or delivery time.

Our application engineering department is available to advise and to make recommendations. For non-standard technical requirements and special applications, please contact us.

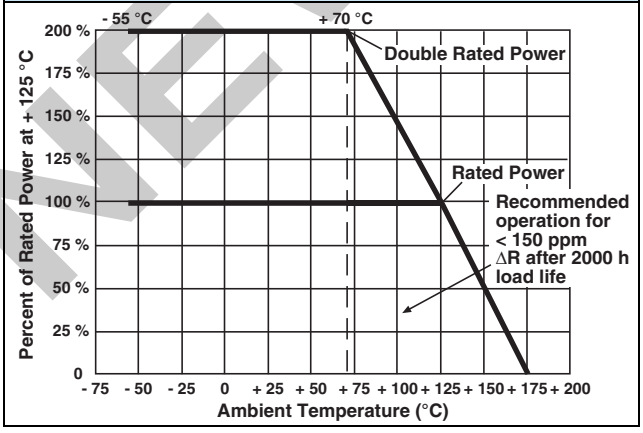
FIGURE 1 - Z203 ON A PC BOARD (1)



Note

(1) The leads on the Z203 connect to the Bulk Metal® Foil resistive element at the top of the package using solder-free, all welded construction. This high-reliability enhancement protects the terminations from initial board-assembly and subsequent board flexation stresses. The welded construction completely eliminates the possibility of latent failures due to solder reflow and solder-starved internal connections.

FIGURE 2 - POWER DERATING CURVE



FEATURES

- Temperature coefficient of resistance (TCR): ± 0.5 ppm/°C maximum (+ 25 °C to + 125 °C)
- Power coefficient of resistance "ΔR due to self heating": ± 5 ppm at rated power
- Rated power: 0.6 W at 70 °C
  0.3 W at 125 °C
- Resistance tolerance: to ± 0.005 % (50 ppm)
- **Load life stability: to ± 0.005 % (50 ppm) at 70 °C, 10 000 h at 0.15 W**
- Resistance range: 10 Ω to 100 kΩ
- Vishay Foil resistors are not restricted to standard values; specific "as-required" values can be supplied at no extra cost or delivery (e.g. 1K2345 vs. 1K)
- Electrostatic discharge (ESD) up to 25 000 V
- Non-inductive, non-capacitive design
- Rise time: 1 ns, effectively no ringing
- Current noise: 0.010 μV_{RMS}/V of applied voltage (< - 40 dB)
- Thermal EMF: 0.1 μV/°C max.
- Thermal stabilization time < 1 s (nominal value achieved within 10 ppm of steady state value)
- Voltage coefficient: < 0.1 ppm/V
- Non-inductive: 0.08 μH
- Terminal finish: lead (Pb)-free or tin/lead alloy
- Maximum working voltage: 300 V
- Drop in replacement for S102C/K
- Matched sets are available per request
- Prototype quantities available in just 5 working days or sooner. For more information, please contact foil@vishaypg.com
- For better performances please contact us
- Compliant to RoHS directive 2002/95/EC

Pb-free Available

RoHS* COMPLIANT

TABLE 1 - TOLERANCE AND TCR VS. RESISTANCE

VALUE	STANDARD TOLERANCE (%)	TYP. TCR AND MAX. SPREAD (ppm/°C) (+ 25 °C to + 125 °C)	TYP. TCR AND MAX. SPREAD (ppm/°C) (- 55 °C to + 25 °C)
100 Ω to 100 kΩ	± 0.005 %	± 0.2 ± 0.3	± 0.2 ± 1.8
80 Ω to < 100 Ω	± 0.005 %	± 0.2 ± 0.4	± 0.2 ± 2.0
50 Ω to < 80 Ω	± 0.01 %	± 0.2 ± 0.6	± 0.2 ± 2.3
25 Ω to < 50 Ω	± 0.01 %	± 0.2 ± 0.8	± 0.2 ± 2.6
10 Ω to < 25 Ω	± 0.02 %	± 0.2 ± 1.0	± 0.2 ± 2.8

* Pb containing terminations are RoHS compliant, exemptions may apply

ABOUT Z203

Vishay's new generation of metrology ultra-high precision Z-Foil resistor features new orders of accuracy, stability and fast thermal stabilization in sizes small enough for permanent assembly in operational equipment. This is, place metrology-grade resistors right into the equipment as on-board reference standards. Vishay's Z203 unit offers an immediate answer to many resistor applications currently believed unsolvable, and opens entirely new areas of design where the use of resistors had not been considered.

Applications include:

- Secondary standards
- Feedback devices for operational amplifiers
- Precision voltage dividers
- Meter multipliers
- Precision bridge resistors
- Decade voltage dividers

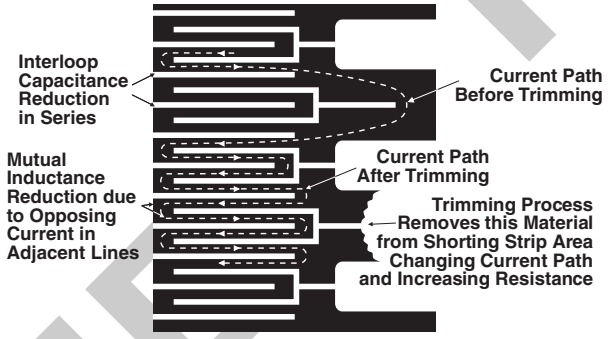
The performance of Vishay's Z203 resistor cannot be equaled by any conventional resistor technologies, or by bulky units now used as standards. As shown by the specifications on table 2 and 3, there is no compromise between precision and speed (as in wirewound units) or between speed and the combination of excellent precision, stability and TCR (as with conventional deposited films).

The Z203 is the result of a unique concept in resistor manufacturing. A proprietary new generation of the Bulk Metal® Z-Foil element with known and controllable properties is applied to a special ceramic substrate. A resistive pattern is then photoetched by an ultra-fine technique developed by Vishay. The device's etched planar construction results in the extremely low and reproducible reactance needed for high-frequency and pulse applications.

Z203 is uniquely enhanced by post manufacturing operations (PMO) exercised after the manufacturing cycle has been completed. Some of these exercises are a standard part of the manufacturing cycle and are only repeated during the PMO cycle to gain added stability or confidence in the product. The foil resistor load-life curve shows an increase in resistance from the first load application, but flattens out to no further change after the first few hundred hours of loading. This knee in the load-life curve is reduced significantly by a special accelerated load-life operation performed by Vishay, resulting in a flat response immediately after installation. Other resistive devices show a continuous change when subjected to these same stresses and are driven out of tolerance.

The optional PMO for this product includes the combination of thermal shock, power shot and special burn-in.

FIGURE 3 - TRIMMING TO VALUES
(conceptual illustration)



Note: Foil shown in black, etched spaces in white

FIGURE 4 - TYPICAL RESISTANCE/ TEMPERATURE CURVE Z-FOIL

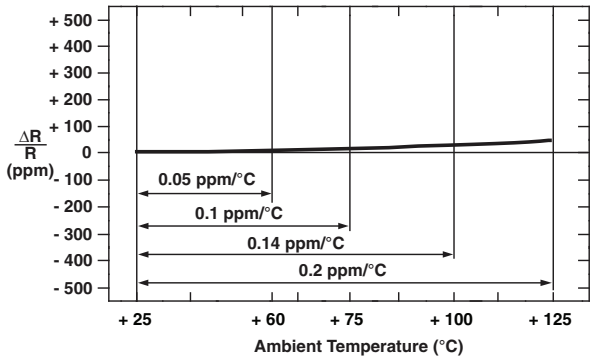
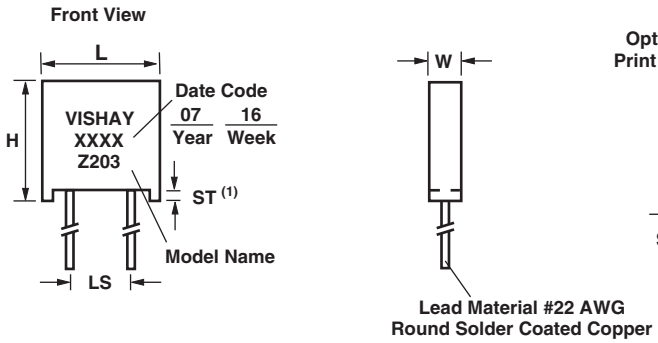


FIGURE 5 - STANDARD IMPRINTING AND DIMENSIONS



		LS	W	L	H	ST	SW	LL
Z203	inches	0.150 ± 0.005	0.105 ± 0.010	0.300 ± 0.010	0.326 ± 0.010	0.010 min	0.035 ± 0.01	1.000 ± 0.125
	mm	3.81 ± 0.13	2.67 ± 0.25	7.62 ± 0.25	8.28 ± 0.25	0.254 min	1.02 ± 0.13	25.4 ± 3.18
Z203L	inches	0.200 ± 0.005						
	mm	5.08 ± 0.13						

Note

(1) The standoffs shall be so located as to give a lead clearance of 0.010" minimum between the resistor body and the printed circuit board when the standoffs are seated on the printed circuit board. This is to allow for proper cleaning of flux and other contaminants from the unit after all soldering processes

TABLE 2 - Z203 SPECIFICATIONS

Load Life Stability	TYPICAL	MAXIMUM
0.3 W at + 125 °C/0.6 W at + 70 °C		
2000 h	± 0.005 % (50 ppm)	± 0.015 % (150 ppm)
10 000 h	± 0.015 % (150 ppm)	± 0.05 % (500 ppm)
0.15 W at + 70 °C		
2000 h	± 0.002 % (20 ppm)	± 0.01 % (100 ppm)
10 000 h	± 0.005 % (50 ppm)	± 0.015 % (150 ppm)

TABLE 3 - ENVIRONMENTAL PERFORMANCE COMPARISON		
	VISHAY Z203	
	TYPICAL ΔR	MAXIMUM ΔR
Test Group I		
Thermal Shock, 5 x (- 65 °C to + 150 °C)	± 0.002 % (20 ppm)	± 0.01 % (100 ppm)
Short Time Overload, 5 s (6.25 x rated power)	± 0.003 % (30 ppm)	± 0.01 % (100 ppm)
Test Group II		
Resistance Temperature Characteristic	see table 1	see table 1
Low Temperature Storage (25 h at - 65 °C)	± 0.002 % (20 ppm)	± 0.01 % (100 ppm)
Low Temperature Operation (45 min, rated power at - 65 °C)	± 0.002 % (20 ppm)	± 0.01 % (100 ppm)
Terminal Strength	± 0.002 % (20 ppm)	± 0.01 % (100 ppm)
Test Group III		
DWV	± 0.002 % (20 ppm)	± 0.01 % (100 ppm)
Resistance to Solder Heat, 20 s at + 260 °C	± 0.005 % (50 ppm)	± 0.01 % (100 ppm)
Moisture Resistance	± 0.01 % (100 ppm)	± 0.05 % (500 ppm)
Test Group IV		
Shock	± 0.002 % (20 ppm)	± 0.01 % (100 ppm)
Vibration	± 0.002 % (20 ppm)	± 0.01 % (100 ppm)
Test Group V		
Life Test at 0.3 W/+ 125 °C		
2000 h	± 0.005 % (50 ppm)	± 0.015 % (150 ppm)
10 000 h	± 0.015 % (150 ppm)	± 0.05 % (500 ppm)
Test Group Va		
Life Test at 0.6 W (2 x Rated Power)/+ 70 °C, 2000 h	± 0.005 % (50 ppm)	± 0.015 % (150 ppm)
Test Group VI		
High Temperature Exposure, 2000 h at + 150 °C	± 0.05 % (500 ppm)	± 0.1 % (1000 ppm)
Test Group VII		
Voltage Coefficient	< 0.00001 %/V	< 0.00001 %/V

STANDARD MEASUREMENT (at room temperature)

Standard Test Conditions:

- Temperature: + 23 °C ± 2 °C
- Relative humidity: 35 % to 65 % RH
- Lead test point: 0.5" (12.7 mm) from resistor body

POST MANUFACTURING OPERATIONS (PMO) FOR IMPROVED END OF LIFE

Many analog applications can include requirements for performance under conditions of stress beyond the norm and over extended periods of time. This calls for more than just selecting a standard device and applying it to a circuit. The standard device may turn out to be all that is needed but an analysis of the projected service conditions should be made and it may well dictate a routine of stabilization known as post manufacturing operations or PMO. The PMO operations that will be discussed are only applicable to Bulk Metal Foil resistors. They stabilize Bulk Metal Foil resistors while they may be harmful to other types. Short time overload, accelerated load life, and temperature cycling are the three PMO methods that do the most to remove the anomalies down the road. Vishay Bulk Metal Foil resistors are inherently stable as manufactured. These PMO methods are only of value on Bulk Metal Foil resistors and they improve the performance by amounts that are small but significant when compared to the very tight tolerances. Users are encouraged to contact Vishay Foil applications engineering for assistance in choosing the PMO operations that are right for their application.

TABLE 4 - GLOBAL PART NUMBER INFORMATION (1)

NEW GLOBAL PART NUMBER: Y1445250R000V9L (preferred part number format)

DENOTES PRECISION	VALUE	CHARACTERISTICS
Y	**R** = Ω **K** = kΩ	**0** = standard **9** = lead (Pb)-free **1 to 999** = custom

Y	1	4	4	5	2	5	0	R	0	0	0	V	9	L

PRODUCT CODE	RESISTANCE TOLERANCE	PACKAGING
1445 = Z203 **1446** = Z203L (2)	**V** = ± 0.005 % **T** = ± 0.01 % **Q** = ± 0.02 % **A** = ± 0.05 % **B** = ± 0.1 % **C** = ± 0.25 % **D** = ± 0.5 % **F** = ± 1.0 %	**L** = bulk

FOR EXAMPLE: ABOVE GLOBAL ORDER Y1445 250R000 V 9 L:

TYPE: Z203
VALUE: 250.0 Ω
ABSOLUTE TOLERANCE: ± 0.005 %
TERMINATION: lead (Pb)-free
PACKAGING: bulk

HISTORICAL PART NUMBER: Z203T 250R00 V B (will continue to be used)

Z203	T	250R00	V	B
MODEL	TERMINATION	OHMIC VALUE	ABS. TOLERANCE	PACKAGING
Z203 **Z203L** (2)	**T** = lead (Pb)-free None = tin/lead	250.0 Ω	**V** = ± 0.005 % **T** = ± 0.01 % **Q** = ± 0.02 % **A** = ± 0.05 % **B** = ± 0.1 % **C** = ± 0.25 % **D** = ± 0.5 % **F** = ± 1.0 %	**B** = bulk

Notes

(1) For non-standard requests, please contact application engineering
(2) See figure 5

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