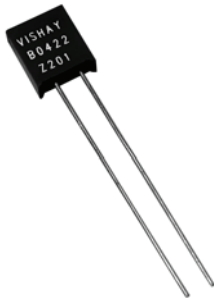


Models 303143 and 303143L (Ultra High Precision Fixed Resistor Z-Foil Z201), Screen/Test Flow as modified from S-311-P813 Proposed by NASA



INTRODUCTION

The 303143 (0.150" lead spacing) and 303143L (0.200" lead spacing) Bulk Metal® Z-Foil resistors represent the 3rd in a series of ultra-precision resistors since the first Bulk Metal Foil resistor was introduced by Vishay in 1962. Each represents an improvement on the earlier model. The TCR slope of the 303143 and 303143L is 0.2 ppm/°C (- 55 °C to + 125 °C, + 25 °C ref.) and is an order of magnitude better than the original S102C. The Bulk Metal Z-Foil resistor is the ultimate choice in the most demanding analog applications.

The Z-Foil technology provides a significant reduction of the resistive component's sensitivity to ambient temperature variations (TCR) and applied power changes (PCR). Designers can now guarantee a high degree of stability and accuracy in fixed-resistor applications using solutions based on Vishay's revolutionary Z-Foil technology.

Our application engineering department is available to advise and to make recommendations.

FEATURES

- Temperature coefficient of resistance (TCR):
± 0.05 ppm/°C typical (0 °C to + 60 °C)
± 0.2 ppm/°C typical (- 55 °C to + 125 °C, + 25 °C ref.)
- 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 %
- Load life stability: to ± 0.005 % at 70 °C, 2000 h at rated power
- Resistance range: 10 Ω to 100 kΩ
- Electrostatic discharge (ESD) up to 25 000 V
- Non-inductive, non-capacitive design
- Rise time: 1.0 ns effectively no ringing
- Current noise: 0.010 μV_{RMS}/V of applied voltage (< - 40 dB)
- Thermal EMF: 0.1 μV/°C max.
0.05 μV/°C typical
- Voltage coefficient: < 0.1 ppm/V
- Non-inductive: 0.08 μH
- Terminal finish: tin/lead alloy
- Maximum working voltage: 245 V
- Drop in replacement for S102C/K
- Matched sets are available per request
- For prototype units, append a "U" to the model number (example: 303143U). These units include only the 100 % screening requirements (table 4, page 4). For more information, please contact foil@vishaypg.com

TABLE 1 - TOLERANCE AND TCR VS. RESISTANCE

VALUE	TIGHTEST ABSOLUTE TOLERANCES	TYPICAL TCR AND MAXIMUM SPREAD - 55 °C TO + 125 °C (+ 25 °C ref.)
100 Ω to 100 kΩ	± 0.005 %	± 0.2 ± 0.6 ppm/°C
80 Ω to < 100 Ω	± 0.005 %	± 0.2 ± 0.8 ppm/°C
50 Ω to < 80 Ω	± 0.005 %	± 0.2 ± 1.0 ppm/°C
25 Ω to < 50 Ω	± 0.01 %	± 0.2 ± 1.3 ppm/°C
10 Ω to < 25 Ω	± 0.05 %	± 0.2 ± 1.6 ppm/°C

FIGURE 1 - POWER DERATING CURVE

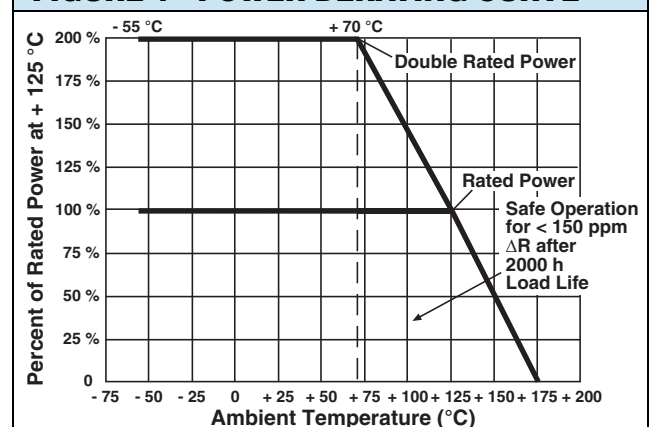


FIGURE 2 - TRIMMING TO VALUES
(conceptual illustration)

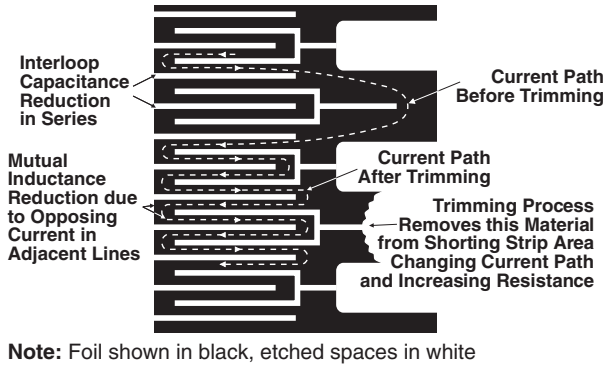


FIGURE 3 - TYPICAL RESISTANCE/TEMPERATURE CURVE

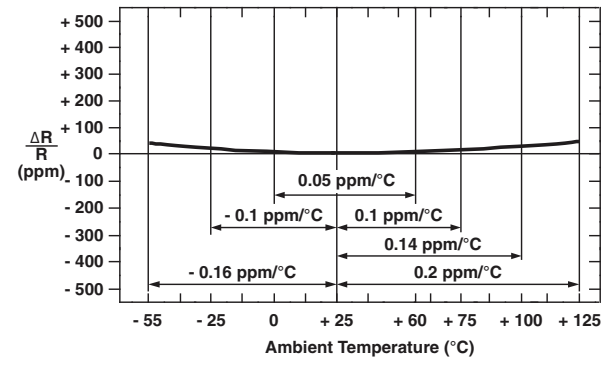
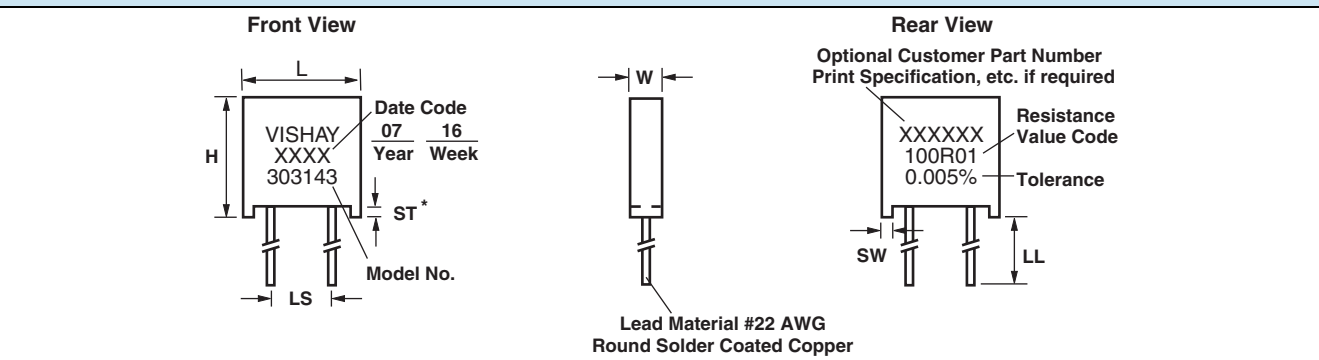


FIGURE 4 - STANDARD IMPRINTING AND DIMENSIONS



* 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.

		LS	W	L	H	ST	SW	LL
303143	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						
303143L	Inches	0.200 ± 0.005	2.67 ± 0.25	7.62 ± 0.25	8.28 ± 0.25	0.254 min	1.02 ± 0.13	25.4 ± 3.18
	mm	5.08 ± 0.13						

TABLE 2 - SPECIFICATIONS

Stability	
Load Life at 2000 h	± 0.005 % max. ΔR at 0.1 W/+ 70 °C ± 0.015 % max. ΔR at 0.3 W/+ 125 °C
Load Life at 10 000 h	± 0.01 % max. ΔR at 0.05 W/+ 125 °C ± 0.05 % max. ΔR at 0.3 W/+ 125 °C

TABLE 3 - ENVIRONMENTAL PERFORMANCE COMPARISON

	MIL-PRF-55182 CHAR J	VISHAY 303143, 303143L	
		MAXIMUM ΔR	TYPICAL ΔR
Test Group I Thermal Shock Short Time Overload	$\pm 0.2\%$ $\pm 0.2\%$	$\pm 0.01\%$ (100 ppm) $\pm 0.03\%$ (300 ppm)	$\pm 0.002\%$ (20 ppm) $\pm 0.003\%$ (30 ppm)
Test Group II Resistance Temperature Characteristic Low Temperature Storage Low Temperature Operation Terminal Strength	± 25 ppm/°C $\pm 0.15\%$ $\pm 0.15\%$ $\pm 0.2\%$	see table 1 $\pm 0.01\%$ (100 ppm) $\pm 0.01\%$ (100 ppm) $\pm 0.01\%$ (100 ppm)	± 0.05 ppm/°C (0 °C to + 60 °C) $\pm 0.002\%$ (20 ppm) $\pm 0.002\%$ (20 ppm) $\pm 0.002\%$ (20 ppm)
Test Group III DWV Resistance to Solder Heat Moisture Resistance	$\pm 0.15\%$ $\pm 0.1\%$ $\pm 0.4\%$	$\pm 0.01\%$ (100 ppm) $\pm 0.01\%$ (100 ppm) $\pm 0.02\%$ (200 ppm)	$\pm 0.002\%$ (20 ppm) $\pm 0.005\%$ (50 ppm) $\pm 0.01\%$ (100 ppm)
Test Group IV Shock Vibration	$\pm 0.2\%$ $\pm 0.2\%$	$\pm 0.01\%$ (100 ppm) $\pm 0.01\%$ (100 ppm)	$\pm 0.002\%$ (20 ppm) $\pm 0.002\%$ (20 ppm)
Test Group V Life Test at 0.3 W/+ 125 °C 2000 h 10 000 h	$\pm 0.5\%$ $\pm 2.0\%$	$\pm 0.015\%$ (150 ppm) $\pm 0.05\%$ (500 ppm)	$\pm 0.01\%$ (100 ppm) $\pm 0.03\%$ (300 ppm)
Test Group Va Life Test at 0.6 W (2 x Rated Power)/+ 70 °C, 2000 h	$\pm 0.5\%$	$\pm 0.015\%$ (150 ppm)	$\pm 0.01\%$ (100 ppm)
Test Group VI High Temperature Exposure	$\pm 2.0\%$	$\pm 0.05\%$ (500 ppm)	$\pm 0.02\%$ (200 ppm)
Test Group VII Voltage Coefficient	0.005 %/V	< 0.00001 %/V	< 0.00001 %/V

STANDARD MEASUREMENT (at room temperature)

Standard Test Conditions:

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

NOTES

- For unqualified pre-flight or prototype units, use models # 303143U, 303143LU which include only the 100 % screening requirements
- Measurement error allowed for ΔR limits: 0.01 Ω

TABLE 4 - SCREENING AND ENVIRONMENTAL TESTS

Group A	
Subgroup 1	100 % RC record - in tolerance Thermal shock (MIL-STD-202 method 107 condition F-1) 25 x, - 65 °C, + 150 °C Overload (+ 25 °C, 6.25 x rated power, 5 s) RC record - in tolerance, $\Delta R = 0.03 \%$ Power conditioning (+ 125 °C, 0.3 W, 100 h, not to exceed 245 V) RC record - in tolerance, $\Delta R = 0.05 \%$ Visual inspection Final inspection - PDA - 5 % on $\Delta R = 0.05 \%$
Subgroup 2	6 pieces, any value, electrical rejects allowed Solderability
Subgroup 3	3 pieces, any value, non destructive Mechanical/dimensional evaluation
Final Group A inspection	
Group B	
Subgroup 1	13 pieces or 100 %, any value, zero rejects allowed TCR (MIL-STD-202 method 304 with the following exceptions) <ul style="list-style-type: none"> - must maintain temperature for 30 min to 45 min before measurement - first test temperatures, + 25 °C, - 15 °C, - 55 °C - second test temperatures, + 25 °C, + 65 °C, + 125 °C - + 25 °C to be used as reference reading
Subgroup 2	8 pieces, any value, zero rejects allowed Resistance to solvents
Group C	
Group A and B testing required	
Subgroup 1	12 pieces (6 of the highest value, 6 of the lowest value), 0 rejects Life - (+ 125 °C, 0.3 W, not to exceed max. voltage 245 V, 10 000 h) RC record at 250 h, 500 h, 1000 h, 2000 h, 4000 h, 6000 h, 8000 h, and 10 000 h Maximum ΔR - 0.015 % for 2000 h, 0.05 % for 10 000 h
Subgroup 2	10 pieces (5 high, 5 low), 1 reject allowed Resistance to soldering heat (conditions A and C), max. $\Delta R = 0.01 \%$ Moisture resistance, max. $\Delta R = 0.02 \%$ <ul style="list-style-type: none"> DWV (300 V_{RMS}, 100 V/s, 1 min, $\Delta R = 0.01 \%$) Insulation resistance (500 V_{DC}, 2 min, 100 MΩ)
Subgroup 3	12 pieces (6 high, 6 low), 1 reject allowed Dielectric withstanding voltage (DWV) (MIL-STD-202 method 301) <ul style="list-style-type: none"> - 300 V_{RMS}, 100 V/s, 1 min (with special fixture requirements) RC record - $\Delta R = 0.01 \%$ Insulation resistance (MIL-STD-202 method 302) <ul style="list-style-type: none"> - same fixture requirements as DWV - 500 V_{DC}, 2 min - 10 000 MΩ min. Low temperature storage (LTS) (- 65 °C, 24 h, 0 W) Low temperature operation (LTO) (- 65 °C, 45 min, rated V, not to exceed P) RC record - $\Delta R = 0.01 \%$ for both LTS and LTO Terminal strength (MIL-STD-202 method 211) <ul style="list-style-type: none"> Pull test (condition A, 2 lbf, 5 s to 10 s) Twist test (condition D) RC record - $\Delta R = 0.01 \%$

TABLE 4 - SCREENING AND ENVIRONMENTAL TESTS

Subgroup 4	9 pieces (any value), 0 rejects Shock (method 213, condition I - 100G, 6 ms, sawtooth), $\Delta R = 0.01\%$ Vibration (method 204, condition D, 10 Hz to 2 kHz, 20G), $\Delta R = 0.01\%$
Subgroup 5	5 pieces (any value), 0 rejects High temperature exposure (2000 h, + 175 °C, 0 W) RC record - $\Delta R = 0.05\%$

TABLE 5 - QUALIFICATION (10R TO 100K) (when required)

Group 1	Group A
Group 2	Group B
Group 3	10 pieces (equally divided between highest and lowest values), 1 reject TCR (per group B conditions) Low temperature storage (LTS) Low temperature operation (LTO) RC record - $\Delta R = 0.01\%$ for LTS and LTO Terminal strength (per group C conditions) Pull test (condition A, 2 lbs, 5 s to 10 s) Twist test (condition D) RC record - $\Delta R = 0.01\%$
Group 4	12 pieces (equally divided between highest and lowest values), 1 reject Dielectric withstanding voltage (DWV) (MIL-STD-202 method 301) - 300 V _{RMS} , 100 V/s, 1 min RC record - $\Delta R = 0.01\%$ Insulation resistance (MIL-STD-202 method 302) - 10 000 M Ω min. - 500 V _{DC} , 2 min Resistance to soldering heat ($\Delta R = 0.01\%$) Moisture resistance ($\Delta R = 0.05\%$) DWV (300 V, 1 min, $\Delta R = 0.01\%$) Insulation resistance (500 V _{DC} , 2 min, 100 M Ω)
Group 5	10 pieces (equally divided between highest and lowest values), 1 reject Shock - (100G, 6 ms, sawtooth condition I), $\Delta R = 0.01\%$ Vibration - (10 Hz to 2 kHz, condition D), $\Delta R = 0.01\%$
Group 6	10 pieces (equally divided between highest and lowest values), 1 reject Solderability Resistance to solvents
Group 7	10 pieces (equally divided between highest and lowest values), 1 reject High temperature exposure (2000 h, + 175 °C, 0 W), $\Delta R = 0.05\%$
Group 8	50 pieces (equally divided between highest and lowest values), 0 reject Life - (+ 125 °C, 0.3 W, not to exceed max. voltage 245 V, 10 000 h) RC record at 250 h, 500 h, 1000 h, 2000 h, 4000 h, 6000 h, 8000 h, and 10 000 h Maximum ΔR - 0.015 % for 2000 h, 0.05 % for 10 000 h
Group 9	30 pieces (high/low) Thermal shock - 100 cycles, - 65 °C to + 150 °C, $\Delta R = 0.035\%$
Group 10	10 pieces (highest value only) Voltage coefficient ($\Delta R = 1$ ppm/V)

PART NUMBER IDENTIFICATION

Model #	303143 ⁽¹⁾	303143L ⁽²⁾
Base Model	Z201	Z201
Value Range (Space Applications)	10 Ω to 100 kΩ	10 Ω to 100 kΩ

Part Number:

{Model} - {Value} - {Tolerance} - {Termination} - {Packaging}

Absolute Tolerance	Code
0.005 %	V
0.01 %	T
0.02 %	Q
0.05 %	A
0.1 %	B
0.25 %	C
0.5 %	D
1.0 %	F

Termination	Code
Tin/lead	B

Packaging	Code
Bulk	L

Example: 303143 - 8K023 - VBL

Z201, 8.023 kΩ, 0.005 %, tin/lead termination, bulk pack

Notes

⁽¹⁾ For unqualified pre-flight or prototype units, use model #303143U which includes only the 100 % screening requirements

⁽²⁾ 0.200" (5.08 mm) lead spacing available - specify 303143L



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