

## The Future COTS Bulk Metal® Foil Resistors are Already Here with Flexible Terminations System and Load-Life Stability of 0.005% (50 ppm)

### FEATURES AND BENEFITS

- Temperature coefficient of resistance (TCR):  
±0.2 ppm/°C typical (-55°C to +125°C, +25°C ref.)
- Tolerance: to ±0.01%
- Power coefficient of resistance “ΔR due to self heating:”  
5 ppm at rated power
- Electrostatic discharge (ESD) at least to 25 kV
- Load-life stability: ±0.005% (70°C, 2000 h)
- Resistance range: 5 Ω to 80 kΩ (for higher and lower values, please contact us)
- Bulk Metal Foil resistors are not restricted to standard values; we can supply specific “as required” values at no extra cost or delivery (e.g., 1K01234 vs. 1 k)
- Power rating: to 600 mW at +70°C
- Thermal stabilization time: <1 s (within 10 ppm of steady state value)
- Non inductive, non capacitive design
- Current noise: 0.010 μVRMS/V of applied voltage (<-40 dB)
- Voltage coefficient: <0.1 ppm/V
- Low harmonic distortion, linear behavior
- Non hot spot design
- Inductive: <0.08 μH
- Terminal finishes available: lead (Pb)-free, tin/lead alloy, or silver

### INTRODUCTION

When mounted on a board that is bent or flexed either during the manufacturing process or in the field, resistors can develop cracks that affect their electrical performances. The Flex Series is a surface-mount, multi-featured precision resistor that incorporates a unique flexible terminations system. Integrated with the latest



Flexible terminations assure minimal stress transference from the PCB due to a difference in thermal coefficient of expansions (TCE).

generation of Bulk Metal® Foil technology, Z Foil, the Flex Series' flexible terminations system is designed to establish pliability while maintaining terminal strength, solderability, stability, and electrical specifications.

The flexible terminations absorb board stresses, thereby preventing external stresses from reaching the resistance element.

### Why choose the Flex Series

- Provides superior flex performance compared to standard terminations systems
- Flexible terminations isolate resistor body from PCB stresses
- Superior flex performance up to several mm

### Stress checklist:

1. Where is the resistor going to be placed? Around big or heavy components? Solution: Flex Series.
2. Are you intending to place the resistor close to the PCB edges or corners? (Stress can occur due to bending or CTE difference.) Solution: Flex Series.
3. Will the PCB be exposed to high levels of boards flexure during assembly or mounting? Solution: Flex Series.

**Table 1 – Tolerance and TCR vs. Resistance Value (-55°C to +125°C, +25°C Ref.)**

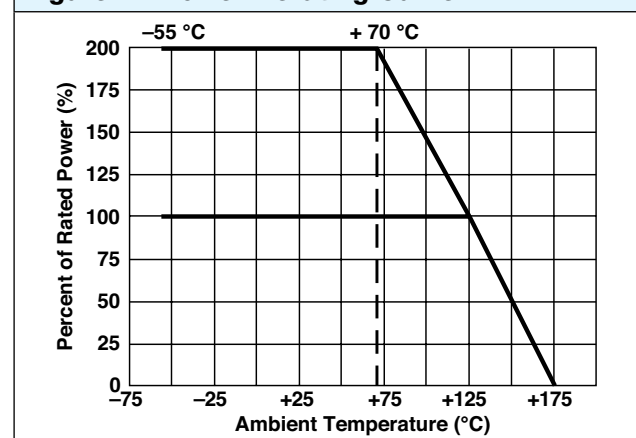
Value (Ω)	Standard Tolerance <sup>(1)</sup> (%)	Typical TCR and Max. Spread <sup>(1)</sup> (ppm/°C)
50 Ω to 80 kΩ	±0.01%	±0.2 ±1.8
20 Ω to <50 Ω	±0.02%	±0.2 ±2.8
10 Ω to <20 Ω	±0.05%	±0.2 ±4.8
5 Ω to <10 Ω	±0.1%	±0.2 ±6.8

**Note**  
<sup>(1)</sup> For values <5 Ω and tighter performance, contact us.

### Note

\* 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.

**Figure 1 – Power Derating Curve**



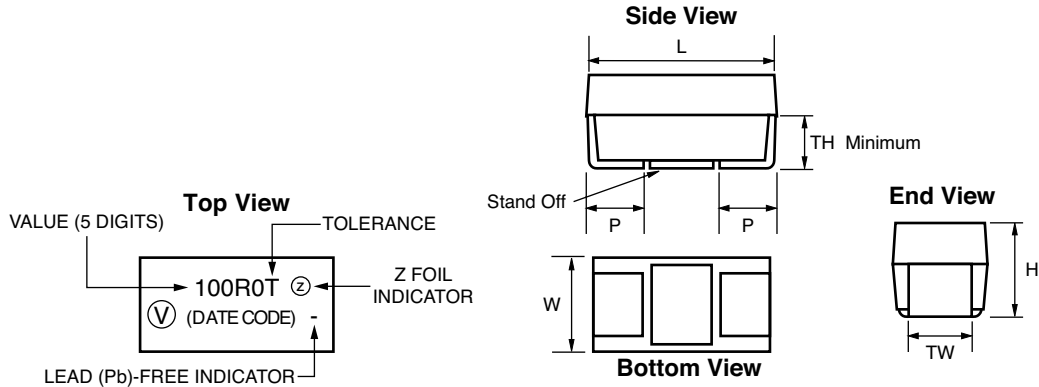
### Table 2—Specifications

Parameters	Specifications			
	Flex-1		Flex-2	
Resistance Range	5 Ω to 33 kΩ		5 Ω to 80 kΩ	
Rated Power	5 Ω to 10 kΩ 0.250 W at 70°C 0.125 W at 125°C	10 kΩ to 33 kΩ 0.160 W at 70°C 0.08 W at 125°C	5 Ω to 30 kΩ 0.6 W at 70°C 0.3 W at 125°C	30 kΩ to 80 kΩ 0.4 W at 70°C 0.2 W at 125°C
Weight	0.1143 g		0.244 g	
Packaging	Bulk (loose), waffle pack or tape and reel, per EIA-481-1			

### Table 3—Performances

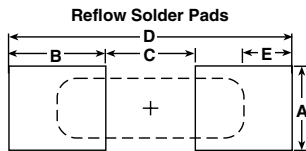
Test	Conditions		Maximum Limit <sup>(1)</sup>	
	Flex-1	Flex-2		
Max. Working Voltage	73 V	180 V	—	
Max. Operating Temperature	+175°C (see Figure 1)		—	
Working Temperature Range	-55°C to +125°C (MIL range)		—	
Thermal Shock	-65°C to +150°C; 30 min; 5 cycles		R > 100 Ω: ±0.02% (200 ppm) R ≤ 100 Ω: ±0.03% (300 ppm)	
Short Time Overload	6.25 x rated power; 5 s		±0.01% (100 ppm)	
Low Temperature Operation	-65°C, 24 h (no load); 45 min at rated power		±0.01% (100 ppm)	
Dielectric Withstanding Voltage	Atmospheric pressure; AC 200 V; 1 min		±0.01% (100 ppm)	
Insulation Resistance	DC 100 V; 1 min		over 10 000 MΩ	
Resistance to Soldeing Heat	260°C for 10 s		±0.03% (300 ppm)	
Moisture Resistance	+65°C to -10°C; 90% to 98% RH; rated power; 240 h		±0.03% (300 ppm)	
Shock	100 G; Sawtooth		±0.01% (100 ppm)	
Vibration, High Frequency	10~2000~10 Hz; 20 G; X, Y, Z each 2.5 h		±0.01% (100 ppm)	
Load Life Stability (2000 h)	0.04 W at +70°C 0.25 W at +70°C 0.125 W at +125°C	0.1 W at +70°C 0.6 W at +70°C 0.3 W at +125°C	Flex 1 0.005%, typical 0.02%, typical 0.05%, max	Flex 2 0.005%, typical 0.015%, typical 0.05%, max
High Temperature Exposure	175°C; no load 2000 h		±0.1% (1000 ppm)	
<b>Note</b> <sup>(1)</sup> As shown +0.01 Ω to allow for measurement errors at low values.				

**Table 4—Dimensions** in Inches (Millimeters)



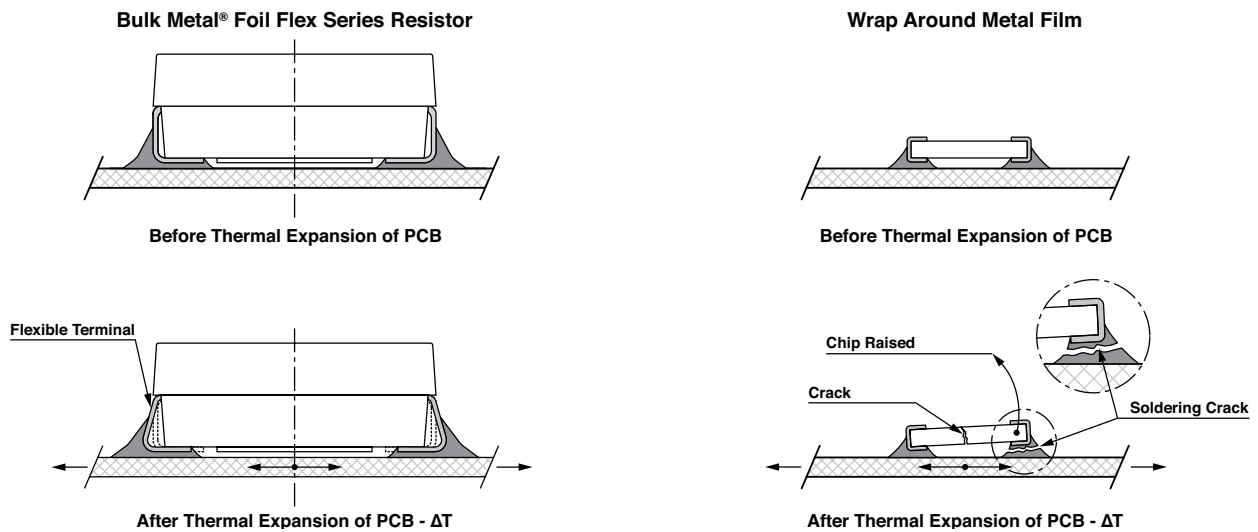
Model	L	W	H	P	TW	TH Minimum
Flex-1	0.236 ±0.012 (5.99 ±0.30)	0.126 ±0.012 (3.20 ±0.30)	0.098 ±0.012 (2.49 ±0.30)	0.051 ±0.012 (1.30 ±0.30)	0.087 ±0.004 (2.21 ±0.10)	0.039 (0.99)
Flex-2	0.287 ±0.012 (7.29 ±0.30)	0.170 ±0.012 (4.32 ±0.30)	0.110 ±0.012 (2.79 ±0.30)	0.051 ±0.012 (1.30 ±0.30)	0.095 ±0.004 (2.41 ±0.10)	0.039 (0.99)

**Table 5—Recommended Mounting Pad Geometries** in Inches (Millimeters)

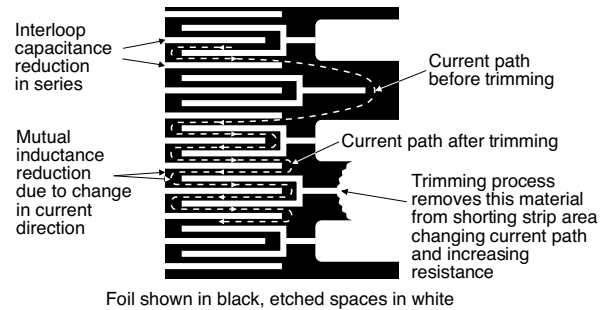


Model	Method	A Min	B Ref	C Ref	D ± 0.04 (± 1.02)	E Ref
Flex-1	Reflow	0.110 (2.79)	0.106 (2.69)	0.124 (3.15)	0.337 (8.55)	0.050 (1.27)
Flex-2		0.118 (3.00)		0.175 (4.45)		

**Figure 2—Thermal Expansion**



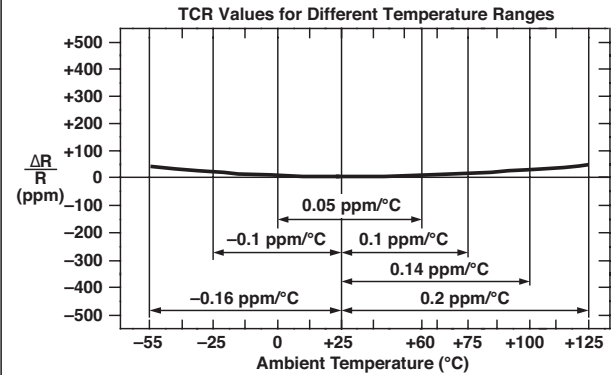
**Figure 3—Trimming to Values**  
(conceptual illustration)



**Note**

To acquire a precision resistance value, the Bulk Metal® Foil chip is trimmed by selectively removing built-in “shorting bars.” To increase the resistance in known increments, marked areas are cut, producing progressively smaller increases in resistance. This method reduces the effect of “hot spots” and improves the long-term stability of Bulk Metal Foil resistors.

**Figure 6—Typical TCR Curve Z Foil**

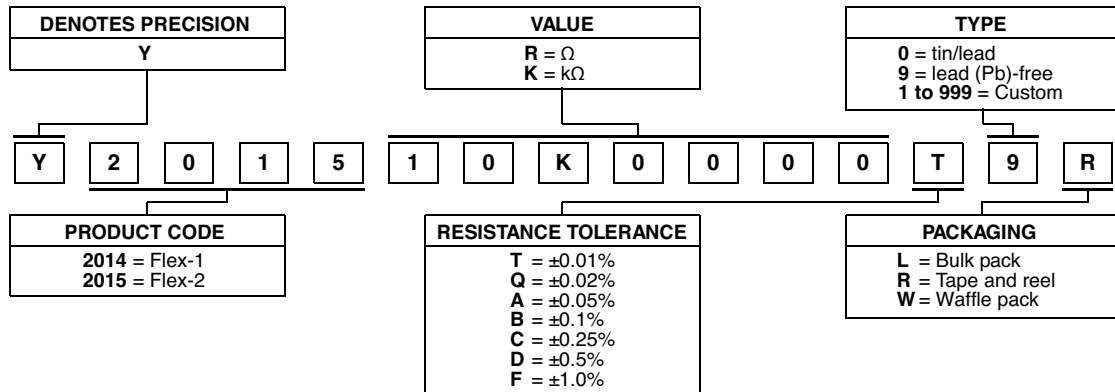


**Notes**

- For more details, see Table 1.
- The TCR values for <math><80 \Omega</math> are influenced by the termination composition and the result is deviation from this curve.

**Figure 5—Part Number Information**

GLOBAL PART NUMBER: Y201510K0000T9R



FOR EXAMPLE: ABOVE GLOBAL ORDER Y2015 10K0000 T 9 R:

- TYPE: Flex-2
- VALUE: 10.0 kΩ
- ABSOLUTE TOLERANCE: ±0.01%
- TERMINATION: Lead (Pb)-free
- PACKAGING: Tape and reel

PART DESCRIPTION: Flex-2 10K000 TCR0.2 T S T (will continue to be used)

Flex-2	10K000	TCR0.2	T	S	T
<b>MODEL</b>	<b>OHMIC VALUE</b>	<b>TCR CHARACTERISTIC</b>	<b>RESISTANCE TOLERANCE</b>	<b>TERMINATION</b>	<b>PACKAGING</b>
Flex-1 Flex-2	10.0 kΩ		T = ±0.01% Q = ±0.02% A = ±0.05% B = ±0.1% C = ±0.25% D = ±0.5% F = ±1.0%	S = Lead (Pb)-free B = Tin/Lead	B = Bulk pack T = Tape and reel W = Waffle pack

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