Texas Components Corporation

USA Manufacturer of Precision Resistors featuring Bulk Metal® Foil*

TXH102Z

Hermetic Bulk Metal® Foil Resistor
for **Radial Lead Through Hole** Applications

(Optionally)

RoHS COMPLIANT

Hermetically Sealed Bulk Metal® Foil Precision Resistor

Ultra Low TCR; Ultra High Precision, Accuracy, and Stability

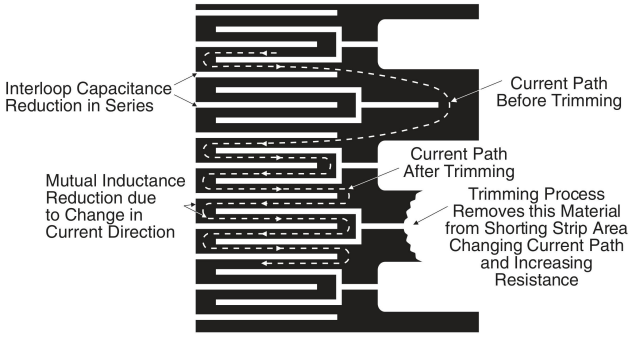
Resistors featuring **Bulk Metal® Foil** are renowned for their unique combination of **unmatched performance** in all major technical areas, including:

Temperature Coefficient of Resistance (TCR) | **Voltage Coefficient of Resistance (VCR)** | **Electrostatic Discharge (ESD)** | **Thermal Stabilization** | **Response Time**
Power Coefficient of Resistance (PCR) | **Thermal Electromotive Force (EMF)** | **Tolerance** | **Load Life Stability** | **Noise**

FEATURES & BENEFITS

Bulk Metal® Foil technology is the clear choice for applications that require high precision and high stability - eliminating the inter-parameter compromise inherent in all other types of precision resistors. **All important characteristics** - tolerance, long-term shelf life and load stability, temperature coefficient, noise, capacitance and inductance - **are optimum**, approaching in total performance the theoretical ideal (a straight, flat wire) thanks to proprietary ultra-fine photo-etching techniques. Because the metals used are not drawn, wound or mistreated in any way during the manufacturing process, **Bulk Metal® Foil** resistors maintain all of their design, physical and electrical characteristics, while the **temperature coefficient** of the resistor is **carefully controlled** through various proprietary compensation techniques that eliminate the effect of different coefficients of expansions for all of the materials combined for use in the resistor.

The new **Z-Foil** version of this **technology** takes this to a new level, by offering **TCR performance that is an order of magnitude better than previous generation models** – in addition to delivering **excellent load life stability**, **tight tolerance**, **fast response time**, **low current noise**, **low thermal EMF** and **low power and voltage coefficient**. Resistors made with **Z-Foil** are **virtually insensitive to common destabilizing factors** that can otherwise completely undermine the accuracy and usefulness of resistors made with other technologies. **The resistor element is a solid alloy that is inherently stable and noise free** which, along with the many other additional **Bulk Metal® Foil** benefits, **allows designers to guarantee the highest degree of accuracy and stability in fixed-resistor applications** and, in turn, **allows** for the production of **products** that **meet very challenging technical requirements** – products that would not be possible otherwise.



Note: Foil shown in black, etched spaces in white

Figure 1: Example **Bulk Metal® Foil** Circuit Diagram

SPECIFICATIONS

The model **TXH102Z** is a **hermetically sealed, silicone rubber filled** version of the molded TXZ100 and TXZ201 resistor. Hermetic sealing **eliminates the ingress of both oxygen** (which degrades resistors over long periods of time) **and moisture** which degrades resistors more quickly). These parts are made with glass-to-metal seal enclosures and employ Kovar eyelets, which allow the copper leads to pass through the enclosure to minimize thermal EMF from the lead junctions. The **rubber fill** between the metal housing and resistance element acts both as a **mechanical damper** and **thermal transfer** path. This design offers greater protection in harsher environments, and greater stability in all environments.

- **Resistance range:** 10Ω to 100kΩ (not restricted to any standard values)
- **Rated power: 0.6 W** at +70 °C, 0.3 W at +125 °C
- **Resistance tolerance:** to **± 0.005 %** (See Table 2)
- **Temperature coefficient of resistance (TCR): ± 0.2 ppm/°C** nominal; -55 °C to +125 °C, +25 °C ref; ± 0.05 ppm/°C min to ± 1.8 ppm/°C max (See Table 1)
- **Exceptional load life stability: ± 0.005 %** at +70 °C, 2000 h and ± 0.015 % at +70 °C, 10,000 h subject to applied power. (See Table 4; Load life stability, can be improved even more through in-house stabilization)
- **Shelf life stability: 2 ppm** for at least **6 years** (unaffected by humidity)
- **Hermeticity:** 10-7 atmospheric cc/s maximum (silicone rubber fill)
- **Power coefficient of resistance (PCR): ± 5 ppm** at rated power (ΔR due to self heating)
- **Voltage coefficient of resistance (VCR): < 0.1 ppm/V**
- **Max working voltage: 300 V** (and ≤ $\sqrt{PxR}$)
- **Electrostatic discharge (ESD)**: at least to 25 kV
- **Capacitance:** 0.5 pF typical; 1.0 pF max (non-capacitive design)
- **Inductance:** < 0.08 µH typical; 0.1 µH max; (non-inductive design)
- **Rise time:** 1.0 ns at 1kΩ (effectively no ringing)
- **Current noise:** 0.010 µV RMS/Volt of Applied Voltage (< -40 dB)
- **Thermal EMF:** 0.05 µV/°C typical (0.10 µV/°C max) and 1 µV/W (µV/°C relates to EMF due to ΔT wrt to leads and µV/watt due to the applied power)
- **Thermal stabilization time:** < 1 s (nominal value achieved within 10 ppm of steady state value)
- **Total accumulated ΔR over life (EOL):** to **± 0.05 %** (an order of magnitude better than any other technology)
- **Matched sets are available by special request:** TCR tracking to **± 0.5ppm/**°C
- **Terminal Finish:** tin/lead alloy std; Pb free (RoHS-compliant) is available
- **Bulk Metal® Foil resistors are not restricted to standard values**; specific custom values are available at no extra cost (e.g. 1K2345 vs 1K).
- Expedited **delivery in less than 1 week is possible**, even for custom values.
- **Lifetime warranty** (excluding damage or abuse)
- Made in the USA!

*Bulk Metal® Foil is a registered trademark of Vishay Precision Group, Inc. (VPG)

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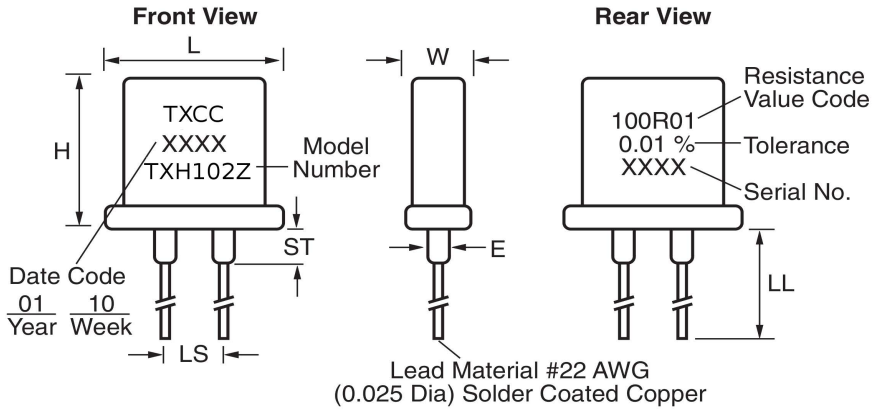
FIGURE 2 – STANDARD IMPRINTING AND DIMENSIONS



The standoffs (ST) are designed to insure there is a clearance between the resistor body and the circuit board such that flux and other contaminants can be cleaned/cleared from under the body and between the leads after the soldering process is complete.

Inches	Average Weight 1.4 grams	W: 0.185 max	L: 0.435 max	H: 0.450 max [1]	LL: 1.000 ± 0.125	LS: 0.150 ± 0.005 [2]	ST: 1.000 max	E: 0.070 max
Millimeters		W: 4.70 max	L: 11.05 max	H: 11.43 max	LL: 25.4 ± 3.18	LS: 3.81 ± 0.025	ST: 2.54 max	E: 1.78 max

Notes: (1) Other heights available. (2) 0.200" (5.08 mm) lead spacing is available

FIGURE 3 – NOMINAL RESISTANCE/TEMPERATURE CURVE
[STATISTICALLY COMBINED; PRODUCTION SPECTRUM CENTERLINE]

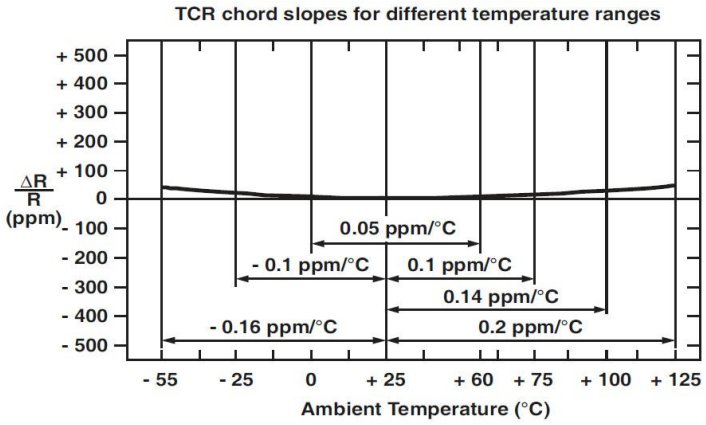


FIGURE 4 – POWER DERATING CURVE

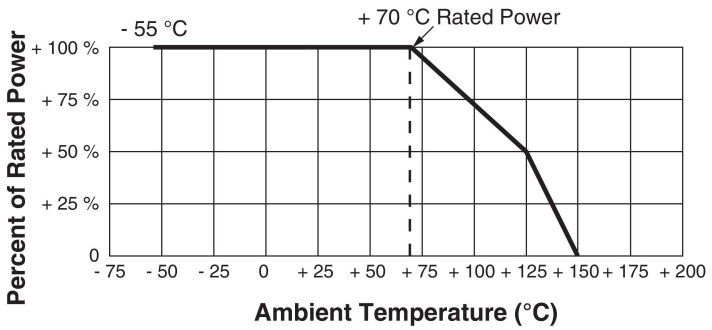


TABLE 1 – TCR BY RESISTANCE RANGE (Z-FOIL)

RESISTANCE VALUE (Ω)	NOMINAL/TYPICAL TCR (& MAX SPREAD aka TCR Tolerance across full temperature range) (ppm/°C)
> 100Ω	± 0.2 (± 0.6)
80Ω to < 100Ω	± 0.2 (± 0.8)
50Ω to < 80Ω	± 0.2 (± 1.0)
25Ω to < 50Ω	± 0.2 (± 1.3)
10Ω to < 25Ω	± 0.2 (± 1.6)

TABLE 2 – AVAILABLE TOLERANCES BY RESISTANCE RANGE

RESISTANCE VALUE (Ω)	AVAILABLE TOLERANCES (%)	CODE	SIGNIFICANT DIGITS
≥ 80Ω	±0.005%	V	6
≥ 25Ω	±0.01%	T	5
≥ 10Ω	±0.02%	Q	
≥ 5Ω	±0.05%	A	
≥ 2Ω	±0.1%	B	4
≥ 2Ω	±0.25%	C	
≥ 1Ω	±0.5%	D	
≥ 0.25Ω	±1.0%	F	3

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Table 3 – The Best Available Performance Characteristics of Different Resistor Technologies

Technology	Temperature Coefficient of Resistance (TCR) -55ºC to +125ºC, +25ºC ref.	Initial Tolerance	Accumulated End of Life Tolerance	Load Life Stability at +70ºC, Rated Power at 2000 Hours and then at 10,000 Hours	ESD (V)	Thermal Stabilization	Noise (dB)
Bulk Metal® Foil	< ± 0.2 ppm/°C	From 0.001%	< 0.05 %	0.0025% (25 ppm) 0.005% (50 ppm)	25,000V	< 1 second	-42db
Thin Film	± 2 ppm/ °C	From 0.01%	< 0.4 %	0.05% (500 ppm) 0.15% (1500 ppm)	2,500V	> minutes	-20db
Thick Film	± 50 ppm/ °C	From 0.5%	< 5 %	0.5% (5000 ppm) 2% (20,000 ppm)	2,000V	> minutes	+20db
Wirewound	± 3 ppm/ °C	From 0.005%	< 0.5 %	0.05% (500 ppm) 0.15% (1500 ppm)	25,000V	> minutes	-35db

TABLE 4 – TXH102Z LOAD LIFE STABILITY SPECIFICATIONS/EXAMPLES (power and temperature dependent)*

Power & Temperature	Max ΔR @ 2000 hours	Max ΔR @ 10,000 hours
0.1 Watts @ +70 °C	± 0.005% (50 ppm)	± 0.01% (100 ppm)
0.3 Watts @ +125 °C	± 0.015% (150 ppm)	± 0.05% (500 ppm)

* **PRE/POST MANUFACTURING OPERATIONS (PMO) FOR IMPROVED END OF LIFE:** Load life stability can be improved by 80% using specialized treatments. 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 pre/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, whereas they may be may be harmful to other resistor 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. Bulk Metal Foil resistors are inherently stable as manufactured, but these PMO methods, which are only of value on Bulk Metal Foil resistors, can improve performance by amounts that are small but significant when compared to the very tight tolerances. Users are encouraged to contact our applications engineering for assistance in choosing the PMO operations that are right for their application.

TABLE 5 – TXH102Z QUICK SPECIFICATIONS

MODEL	RESISTANCE RANGE (Ω)	MAX WORKING VOLTAGE	POWER RATING		HERMETIC CASE FILL MATERIAL
			at +70 °C	at +125 °C	
TXH102Z	10Ω to 100KΩ	300 V (and ≤ $\sqrt{PxR}$)	0.6 W	0.3 W	Silicone rubber

TABLE 6 – HOW TO ORDER THE CORRECT PART NUMBER

MODEL	LEAD SPACING	COMPLIANCE	RESISTANCE VALUE	TOLERANCE	PACKAGING
TXH102Z	0.15" = D 0.20" = L	Standard = D RoHS = T	10Ω to 100KΩ (R = Ω , K = KΩ, and M=MΩ)	0.005% to 1.0% (see Table 3 for codes)	Bulk Pack = B
A 20,001 ohm resistor with 0.15" leads, at 0.005% tolerance, in bulk pack would be ordered as: **TXH102Z-D-D-20K0010-V-B**					
A 15.3 ohm resistor with 0.20" leads, at 0.5% tolerance, in bulk pack would be ordered as: **TXH102Z-L-D-15R3000-D-B**					

For more information about this subject or this product line, please **call** us at (+1) **713-468-3882** or **email** us at resistorinfo@texascomponents.com

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Made in the USA!