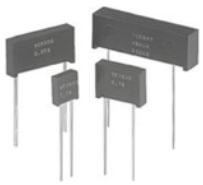
Texas Components Corporation

USA Manufacturer of Precision Resistors featuring Bulk Metal® Foil*

TXS Series

Bulk Metal® Foil Resistor

for **Radial Lead Through Hole** Applications



(Optionally) RoHS COMPLIANT, Pb lead-free

Ultra Low TCR; Ultra High Precision; Ultra High Stability

Resistors made with Bulk Metal® Foil are known for their unique combination of unmatched performance in all major technical areas:

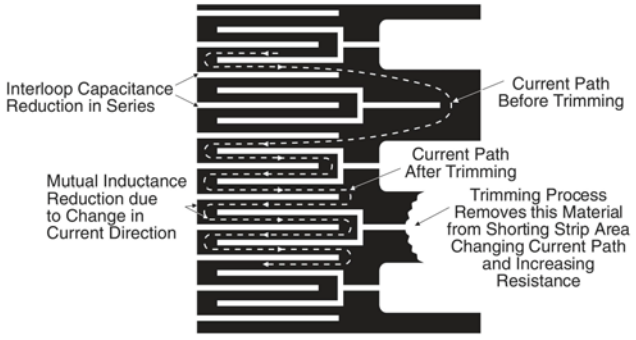
Temperature Coefficient of Resistance (TCR)
Power Coefficient of Resistance (PCR)
Voltage Coefficient of Resistance (VCR)
Tolerance
Thermal Stabilization
Load Life Stability
Response Time
Thermal Electromotive Force (EMF)
Electrostatic Discharge (ESD)
Noise

Bulk Metal® Foil technology outperforms all other resistor technologies today, making it the clear choice for applications that require high precision and high stability. This technology allows for the production of products to **meet very challenging technical requirements** – products that would not be possible otherwise. The **TXS series** of **Bulk Metal® Foil** resistors offers **very low TCR**, **excellent load life stability**, **tight tolerance**, **fast response time**, **low current noise**, **low thermal EMF** and **low power and voltage coefficient**, all in an encapsulated radial lead through hole design. The **TXS series** is **virtually insensitive to common destabilizing factors** that can completely undermine the accuracy and usefulness of other resistors. **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 (presented in the features section below) **allows designers to guarantee the highest degree of accuracy and stability in fixed-resistor applications**. For special applications and/or requirements, **our applications engineering department is on-site and available to help and advise**.

Table 1 – 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	**< ± 1 ppm/°C**	From 0.001%	**< 0.05 %**	0.0025% (25 ppm) 0.005% (50 ppm)	25,000V	< 1 second	-42db
Thin Film	± 5 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

FIGURE 1 - TRIMMING TO SPECIFIC VALUES
(a conceptual illustration of Bulk Metal® Foil)



Note: Foil shown in black, etched spaces in white

To achieve a precise resistance value, the **Bulk Metal® Foil** chip is **adjusted 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 the resistor**.

- **Bulk Metal® Foil resistors are not restricted to standard values**; specific custom values are available at no extra cost (e.g. 1K2345 vs 1K)

TXS100 FEATURES & SPECIFICATIONS

- **Temperature coefficient of resistance (TCR):** **± 1 ppm/°C** typical 10Ω to 100kΩ and **± 2 ppm/°C** typical 100kΩ to 250kΩ (-55 °C to +125 °C, +25 °C ref) See Table 2 for absolute values.
- **Rated power:** For 1Ω to 100kΩ; to **0.6 W** at +70 °C, 0.3 W at +125 °C; For > 100kΩ to 250kΩ; to **0.4 W** at +70 °C, 0.2 W at +125 °C; See Tables 5 and 6
- **Resistance tolerance:** to **± 0.005 %** (See Table 3)
- **Resistance range:** 1Ω to 250kΩ (not restricted to any standard values) (See Table 6 for values down to 0.25Ω and up to 1MΩ)
- **Exceptional load life stability:** **± 0.005 %** at +70 °C, 2000 h and ± 0.01 % at +70 °C, 10,000 h subject to applied power. See Table 4.
- **Power coefficient of (PCR)** or ΔR due to self heating: **± 5 ppm** at rated power
- **Voltage coefficient of resistance (VCR)**: **< 0.1 ppm/V** (essentially zero)
- **Max working voltage**: **300 V** (and ≤ $\sqrt{PxR}$) See Table 6 for higher values.
- **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 tracing to **± 0.5ppm/**°C
- **Terminal Finish:** tin/lead alloy std; Pb free (RoHS-compliant) is available
- **Higher values or power:** See our models TXS200, TXS300, TXS400, etc.
- Expedited **delivery in less than 1 week is possible**, even for custom values.

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

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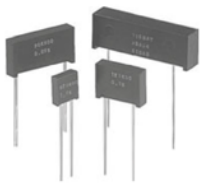

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FIGURE 2 – RESISTANCE/TEMPERATURE CURVE(S)
[STATISTICALLY COMBINED]

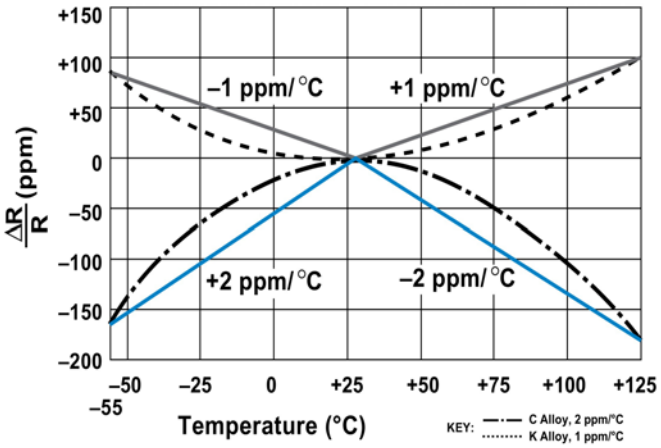


FIGURE 3 – POWER DERATING CURVE

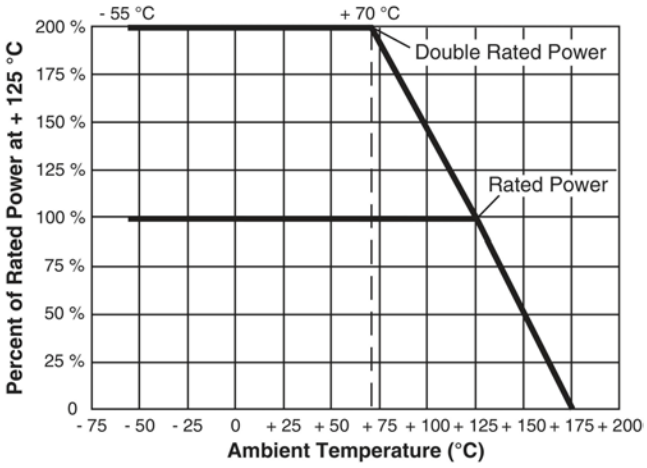


TABLE 2 – TCR BY RESISTANCE RANGE

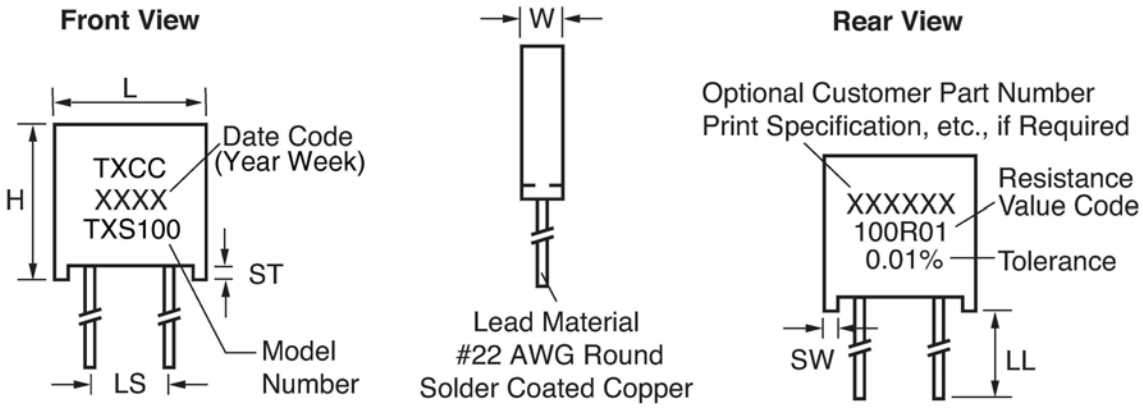
RESISTANCE VALUE (Ω)	TYPICAL TCR (& MAX SPREAD)
> 100kΩ-250kΩ [1]	± 2.0 (± 2.5) (ppm/°C) [2]
80Ω-100kΩ	± 1.0 (± 2.5) (ppm/°C)
50Ω-80Ω	± 1.0 (± 3.5) (ppm/°C)
10Ω-50Ω	± 1.0 (± 4.5) (ppm/°C)
1Ω-10Ω	± 2.2 (± 6.0) (ppm/°C)

1) Resistance values greater than 150kΩ are available only by special order.
2) Applies to TXS100 if >100kΩ. Applies also to the TXS200 if >200kΩ, the TXS300 if >300kΩ, and the TXS400 if >400kΩ.

TABLE 3 – AVAILABLE TOLERANCES BY RESISTANCE RANGE

RESISTANCE VALUE (Ω)	AVAILABLE TOLERANCES (%)	CODE
≥ 80Ω	±0.005%	V
≥ 25Ω	±0.01%	T
≥ 12Ω	±0.02%	Q
≥ 5Ω	±0.05%	A
≥ 2Ω	±0.1%	B
≥ 2Ω	±0.25%	C
≥ 1Ω	±0.5%	D
≥ 0.25Ω	±1.0%	F

FIGURE 4 – 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. SW max = 0.055 inches, or 1.40 mm.

Inches	Typical Average Weight = 0.6 grams	W: 0.105 ± 0.010	L: 0.300 ± 0.010	H: 0.326 ± 0.010	LL: 1.000 ± 0.125	LS: 0.150 ± 0..005 [3]	ST: 0.010 min
Millimeters		W: 2.67 ± 0.25	L: 7.62 ± 0.25	H: 8.28 ± 0.25	LL: 25.4 ± 3.18	LS: 3.81 ± 0.013	ST: 0.254 min

3) Choose model TXS100L for a 0.200" lead spacing.

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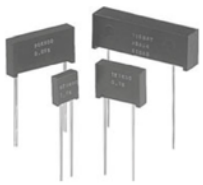

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TABLE 4 – TXS100 (≤ 100kΩ) LOAD LIFE STABILITY SPECIFICATIONS/EXAMPLES (power and temperature dependent)[4]

at 2,000 hours	0.1 Watts @ +70 °C	Max ΔR = ± 0.005% (50 ppm)
	0.3 Watts @ +125 °C	Max ΔR = ± 0.015% (150 ppm)
at 10,000 hours	0.05 Watts @ +125 °C	Max ΔR = ± 0.01% (100 ppm)
	0.3 Watts @ +125 °C	Max ΔR = ± 0.05% (500 ppm)

4) Load life stability can be improved by 80% via specialized post-manufacturing operations. Ask our applications engineering department for details.

TABLE 5 - SPECIFICATIONS

Model	RESISTANCE RANGE (Ω)	MAX WORKING VOLTAGE	AMBIENT POWER RATING			PACKAGING
			Ω	at +70 °C	at +125 °C	
TXS100 TXS100L	1Ω to 150kΩ, and up to 250kΩ[4]	300 V (and ≤ √PxR)	1Ω up to 100kΩ	0.6 W	0.3 W	Bulk Pack (Code = B)
			> 100kΩ to 250kΩ[5]	0.4 W	0.2 W	

5) Single chip values above 150kΩ (up to 250kΩ) are available only by special order and on a limited basis. For greater or smaller resistance values and/or higher power ratings, see models TXS200, TXS300, TXS400, etc.

TABLE 6 – MORE TXS SERIES MODELS

Model	Resistance Range	Power Rating at +70 °C / +125 °C	Max Voltage (and ≤ √PxR)	Typical Average Weight (grams)	W max inches (mm)	L max inches (mm)	H max inches (mm)	LS inches (mm)	LL max inches (mm)	ST min inches (mm)
TXS200	0.5Ω to 200kΩ	0.90 W / 0.45 W	350	1.4	0.138 (3.51)	0.565 (14.36)	0.413 (10.50)	0.400 ± 0.020 (10.16 ± 0.51)	1.125 (28.6)	0.030 (0.759)
	>200kΩ to 500kΩ	0.60 W / 0.30 W								
TXS300	0.33Ω to 300kΩ	1.20 W / 0.60 W	425	1.9	0.138 (3.51)	0.890 (22.61)	0.413 (10.50)	0.700 ± 0.050 (17.78 ± 1.27)	1.125 (28.6)	0.030 (0.759)
	> 300kΩ to 750kΩ	0.80 W / 0.40 W								
TXS400	0.25Ω to 400kΩ	1.50 W / 0.75 W	500	4.0	0.260 (6.61)	1.200 (30.50)	0.413 (10.50)	0.900 ± 0.020 (22.86 ± 0.51)	1.125 (28.6)	0.030 (0.759)
	>400kΩ to 1MΩ	1.00 W / 0.50 W								

TABLE 7 – HOW TO ORDER THE CORRECT PART NUMBER

MODEL	TERMINATIONS (Finish)	RESISTANCE VALUE	TOLERANCE (see Table 3)	PACKAGING
TXS100 TXS100L TXS200 TXS300 TXS400	TIN/LEAD (Std) (no code required)	.25Ω to 1MΩ (R = Ω , K = KΩ,, and M=MΩ) Always given as 6 characters	0.005% to 1.0%	All are provided in Bulk Pack
	LEAD FREE = T (add code to part number) Pb lead-free			

A 20,001 ohm resistor with lead free terminations, at a 0.005% tolerance, in bulk pack would be ordered as: **TXS100-T-20K0010-0.005%**

A 15.3 ohm resistor with standard terminations, at 0.5% tolerance, in bulk pack would be ordered as: **TXS100-15R3000-0.5%**

A 1.2W 250,000 ohm resistor with standard terminations, at a 0.01% tolerance, in bulk pack would be ordered as: **TXS300-250K000-0.01%**

A 1.5W 350,060 ohm resistor with standard terminations, at a 0.02% tolerance, in bulk pack would be ordered as: **TXS400-350K060-0.02%**

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