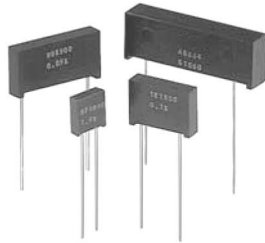


Bulk Metal® Foil Technology High-Performance Aerospace and Instrumentation Resistors



Product may not
be to scale

Bulk Metal® Foil (BMF) Technology outperforms all other resistor technologies available today for applications that require high precision and high stability.

This technology has been pioneered and developed by VISHAY, products based on this technology are the most suitable for a wide range of applications. BMF technology allows us to produce customer orientated products designed to satisfy challenging and specific technical requirements.

Model S Series made from BMF offers extremely low TCR, excellent load life stability, tight tolerance, fast response time, low current noise, low thermal EMF and low voltage coefficient, all in one resistor.

The S Series is virtually insensitive to destabilizing factors. The resistor element is a solid alloy that displays the desirable bulk properties of its parent material, thus it is inherently stable and noise free.

Bulk Metal® Foil S Series are the modern generation of precision resistors, their design gives you a unique combination of characteristics found in no other single resistor- and they're all standard.

Our Application Engineering Department is prepared to advise and to make recommendation for non-standard technical requirements and special applications, please contact us.

FEATURES

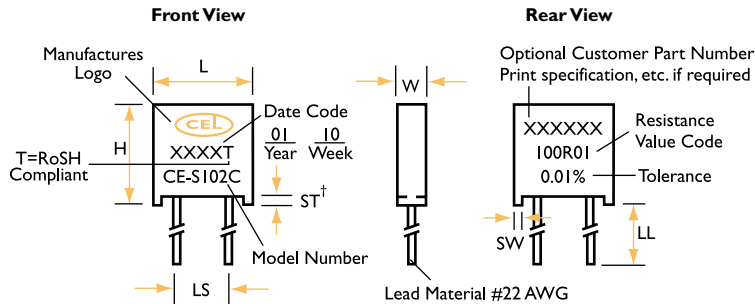
- Very low Temperature Coefficient of Resistance (TCR):*
 - 55°C to + 125°C, 25°C Ref
 - CE-S102C Series: ± 2 ppm/°C nominal
 ± 4.5 ppm/°C maximum
 - CE-S102K Series: ± 1 ppm/°C nominal,
 ± 2.5 ppm/°C maximum
- Very Low TCR Tracking: to 0.5 ppm/°C
- Excellent Load Life Stability: to $\pm 0.005\%$ at 70°C, 2000hrs
- Very Tight Tolerance: $\pm 0.005\%$
- Resistance Range: 0.5 Ω to 1M Ω
- Excellent Shelf Life Stability: to Maximum 0.0025 %, 1year
- High Rated Power: to 2W at +125°C
- Low Voltage Coefficient: (see table 2)
- Non Inductive: (see table 2)
- Low Current Noise: (see table 2) “Noise Free Component”
- Rise/Decay Time: (see table 2)
- Low Thermal EMF: (see table 2)
- Terminal Finishes Available:
 - RoHS compliant
 - Tin/Lead Alloy
- * For values below 50 Ω please contact our Application Engineering department

APPLICATIONS

- High Precision Amplifiers
- High Precision Instrumentation
- Medical and Test Equipment
- Industrial
- Audio (High End Stereo Equipment)
- EB Applications (electron beam scanning and recording equipment, electron microscopes)
- Military, Airborne
- Measurement Instrumentation

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FIGURE 1 - STANDARD IMPRINTING AND DIMENSIONS



†The standoffs shall be so located as to give a lead clearance of 0.25mm 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.

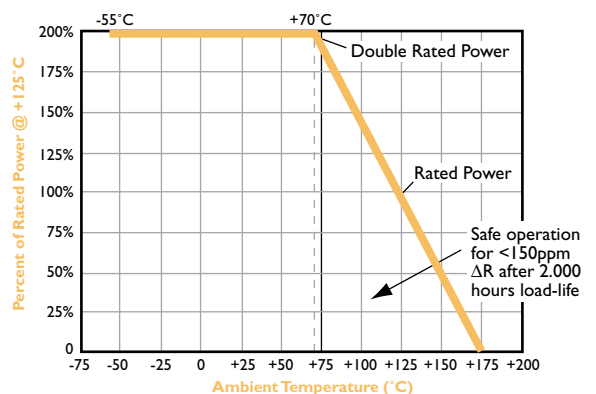
TABLE I - MODEL SELECTION

MODEL NUMBER	RESISTANCE RANGE (Ω)	MAXIMUM WORKING VOLTAGE ¹	AMBIENT POWER RATING ² @+70°C @+125°C	AVERAGE WEIGHT IN GRAMS	DIMENSIONS		TIGHTEST TOLERANCE% VS. LOWEST RESISTANCE VALUE Ω
					mm	*F mm	
CE-S102C	1 to 150K	300	0.6 W up to 100K 0.3 W	0.6	W: 2.67 ± 0.25 L: 7.62 ± 0.25 H: 8.28 ± 0.25 ST: 0.254 Minimum SW: 1.02 ± 0.13 LL: 25.4 ± 3.18 LS: 3.81 ± 0.13		± 0.005 / 50
CE-S102K	1 to 100K		0.4 W over 100K 0.2 W				
S104D (S104F*)	1 to 500K	350	1.0 W up to 200K 0.5 W	1.4	W: 4.06 Maximum L: 14.61 Maximum H: 10.49 Maximum ST: 0.889 ± 0.13 SW: 1.27 ± 0.13 LL: 25.4 ± 3.18 LS: 10.16 ± 0.51	(3.51) (14.35) (10.49)	± 0.01 / 25
S104K	1 to 300K		0.6 W over 200K 0.3 W				± 0.02 / 12
S105D (S105F*)	1 to 750K	350	1.5 W up to 300K 0.75 W	1.9	W: 4.06 Maximum L: 20.83 Maximum H: 10.49 Maximum ST: 0.889 ± 0.13 SW: 1.27 ± 0.13 LL: 25.4 ± 3.18 LS: 16.51 ± 0.51	(3.51) (22.61) (10.49)	± 0.05 / 5 ± 0.1 / 2
S 105K	1 to 500K		0.8 W over 300K 0.4 W			(17.78 +0.51)	± 0.5 / 1
S106D	0.5 to 1M	500	2.0 W up to 400K 1.0 W	4.0	W: 6.60 Maximum L: 30.48 Maximum H: 10.49 Maximum ST: 0.889 ± 0.13 SW: 1.27 ± 0.13 LL: 25.4 ± 3.18 LS: 22.86 ± 0.51		
S106K	0.5 to 600K		1.0 W over 400K 0.5 W				

* S104F and S105F have different package dimensions (see last column). All other specifications are the same.
5.08mm lead spacing available - specify CE-S102J for CE-S102C, and CE-S102L for CE-S102K.
Note its minor outline dimensions variations:

mm	
W:	2.49 Maximum
L:	7.49 Maximum
H:	8.00 Maximum
ST:	0.254 Minimum
LL:	22.23 Minimum
LS:	5.08 ± 0.076

FIGURE 2 - POWER DERATING CURVE "S" SERIES



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TABLE 2 - "S" SERIES SPECIFICATIONS⁵

Stability¹ Load Life at 2,000 hours.	± 0.015% ± 0.005%	Maximum ΔR @ 0.3W/+ 125°C Maximum ΔR @ 0.1W/+ 70°C
Load Life at 10,000 hours.	± 0.05% ± 0.01%	Maximum ΔR @ 0.3W/+ 125°C Maximum ΔR @ 0.05W/+ 125°C
Shelf Life Stability	± 0.0025% ± 0.005%	Maximum ΔR after 1 year Maximum ΔR after 3 years
Current Noise	0.010μV	(RMS)/Volt of applied voltage (-40dB)
High Frequency Operation Rise/Decay Time Inductance (L) ² Capacitance (C)	1.0ns at 1KΩ 0.1μH maximum; 0.08μH typical 1.0pF maximum; 0.5pF typical	
Voltage Coefficient	< 0.1ppm/V ³	
Thermal EMF⁴	0.1μV/°C 1μV/watt	Maximum; 0.05μV/°C typical (Model CE-S102C)

1. Load life ΔR Maximum can be reduced by 80% through an optional burn-in procedure.
2. Inductance (L) due mainly to the leads.
3. The resolution limit of existing test equipment (within the measurement capability of the equipment, or "essentially zero.")
4. μV/°C relates to EMF due to lead temperature difference and μV/watt due to power applied to the resistor.

TABLE 3 - ORDERING INFORMATION

Specify Charcroft S Series resistors as follows:
Example:

CE-S102C MODEL NO.	T = RoHS compliant None = Tin/Lead alloy TERMINATION	250R00 RESISTANCE VALUE	V = ± 0.005% T = ± 0.01% Q = ± 0.02% A = ± 0.05% B = ± 0.1% C = ± 0.25% D = ± 0.5% F = ± 1.0% TOLERANCE	TR = Tape & Reel (CE-S102 only) None = Bulk (loose) PACKAGING
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Resistance Value, in ohms, is expressed by a series of 6 characters, 5 of which represent significant digits while the 6th is a dual purpose letter that designates both the multiplier and the location of the comma or decimal.

RESISTANCE RANGE 10 Ω to <1KΩ 1K Ω to 100KΩ	LETTER DESIGNATOR R K	MULTIPLIER FACTOR x 1 x 10 ³	EXAMPLE 100R01 = 100.01Ω 5K2310 = 5,231Ω
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For example: CE-S102CT 250R00V - Model: CE-S102C; Termination: RoHS compliant; Value: 250 Ω; Tolerance: 0.005% Packaging: Bulk

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TABLE 4 - ENVIRONMENTAL PERFORMANCE COMPARISON

	MIL-PRF-55182 CHAR J	S-SERIES MAXIMUM ΔR	S-SERIES TYPICAL ΔR
Test Group I Thermal Shock Overload	± 0.2% ± 0.2%	± 0.01% ± 0.01%	± 0.002% ± 0.003%
Test Group II Resistance Temperature Characteristic	± 25ppm/°C	+ 4.5ppm/°C	
Low Temp Storage	± 0.15%	± 0.01%	± 0.005%
Low Temp Operation	± 0.15%	± 0.01%	± 0.005%
Terminal Strength	± 0.2%	± 0.01%	± 0.002%
Test Group III DWV	± 0.15%	± 0.01%	± 0.005%
Resistance to Solder Heat	± 0.1%	± 0.01%	± 0.002%
Moisture Resistance	± 0.4%	± 0.05%	± 0.02%
Test Group IV Shock	± 0.2%	± 0.01%	± 0.002%
Vibration	± 0.2%	± 0.01%	± 0.002%
Test Group V Life Test @ 0.3 W/+125°C			
2,000 Hours	± 0.5%	± 0.015%	± 0.01%
10,000 Hours	± 2.0%	± 0.05%	± 0.03%
Test Group Va +70°C Power Rating	± 0.5%	±0.1%	± 0.05%
Test Group VI High Temperature Exposure	± 2.0%	± 0.1%	± 0.05%
Test Group VII Voltage Coefficient	0.005%/V	< 0.00001%/V	< 0.00001%/V

STANDARD OPERATIONS & TEST CONDITIONS

A. Standard Test Operations:

By 100% Inspection

- Short-time overload (6.25 x rated power for 5 seconds)
- Resistance – tolerance check
- Visual and mechanical

By Sample Inspection

- TCR
- Environmental tests per Table 3 on a quarterly basis to establish performance by similarity.

B. Standard Test Conditions:

- Lead test point: 12.7 mm from resistor body
- Temperature: + 22°C ± 2°C
- Relative humidity: per MIL-Std-202

IMPROVED PERFORMANCE TESTING

The preceding information is based on product directly off the production line. Improved performance (meaning increased time stability with load and other stresses) is available through factory conducted "Improved Performance Testing". The test routine is usually tailored to the users stability objectives and product that has been screened can be brought down to a potential load life of less than 50ppm.

Various screen test routines are available and all anticipated stresses must be taken into account before settling on one specific test routine. Our Applications Engineering Department is prepared to discuss and recommend appropriate routines given the full spectrum of anticipated stresses and stability requirements.