

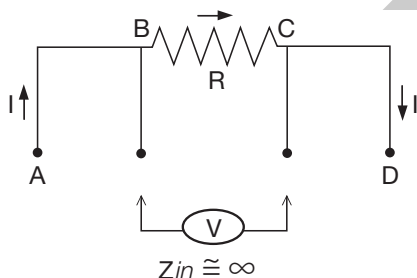
# Bulk Metal® Technology High Precision, Current Sensing, Power Surface Mount, Metal Strip Resistor with Improved Stability 0.05 %, Resistance Value from 10 mΩ, Rated Power to 1 W and TCR to 0 ± 15 ppm/°C



The CSM's series of low value current sense resistors provides power and precision in a four terminal, surface mount configuration. Its all welded construction is made up of a Bulk Metal® resistive element with plated copper terminations.

Vishay Foil Resistors' application engineering department is available to advise and make recommendations.

For non-standard technical requirements and special applications, please contact [foil@vishaypg.com](mailto:foil@vishaypg.com).



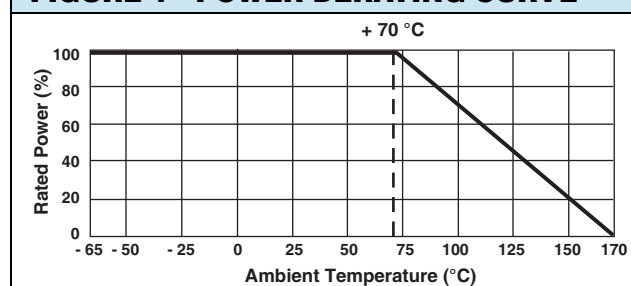
## FEATURES

- Temperature coefficient of resistance (TCR):  
(- 55 °C to + 125 °C, + 25 °C ref.)  
± 15 ppm/°C maximum  
± 10 ppm/°C maximum on special request
- Load life stability to ± 0.05 % (70 °C, 2000 h at rated power)
- Power rating: 1 W
- Resistance tolerance: ± 0.1 %
- Resistance range: 10 mΩ to 100 mΩ
- Vishay Foil resistors are not restricted to standard values, we can supply specific "as required" values at no extra cost or delivery (e.g. 10.2345 mΩ vs. 10 mΩ)
- Short time overload: ± 0.1 % typical
- Thermal EMF: < 3 μV/°C
- Maximum current: up to 10 A
- Surface mount configuration
- Four terminal (Kelvin) design: allows for precision accurate measurements
- Terminal finishes available: lead (Pb)-free, tin/lead alloy
- **Screening in accordance with EEE-INST002 available (Per MIL-PRF-55342 and MIL-PRF-49465; see datasheets of 303144 and 303145 )**
- Prototype quantities available in just 5 working days or sooner. For more information, please contact [foil@vishaypg.com](mailto:foil@vishaypg.com)
- For better performances please contact Application Engineering



RoHS\*  
COMPLIANT

**FIGURE 1 - POWER DERATING CURVE**



**TABLE 1 - PERFORMANCE SPECIFICATIONS**

PARAMETER	CSM2512S
Resistance Range	10 mΩ to 100 mΩ
Power Rating at 70 °C	1 W
Maximum Current	10 A
Maximum Working Voltage	$(P \times R)^{1/2}$
Tightest Tolerance	± 0.1 %
Temperature Coefficient Maximum (- 55 °C to + 125 °C, + 25 °C ref.)	± 15 ppm/°C, ± 10 ppm/°C is available
Operating Temperature Range	- 65 °C to + 170 °C
Weight (maximum)	0.09 g

\* Pb containing terminations are RoHS compliant, exemptions may apply

**ABOUT CSM** (Low Ohm Value 10 mΩ to 100 mΩ)

The CSM2512S series of low value current sense resistors provides power and precision in a four terminal, surface mount configuration. Its all welded construction is made up of a Bulk Metal<sup>®</sup> resistive element with plated copper terminations. For low value resistors in precision applications it is necessary to use four-terminal Kelvin connections to obtain a precise voltage drop across the resistive element.

In these applications, the contact resistance and the terminal resistance may have the same order of magnitude or be even greater than that of the element resistance itself. Thus, significant error is introduced because the high temperature coefficient of resistance of the leads and the contact resistance are unavoidably incorporated into the measurements when the current sense resistor has only two leads.

Because the ability to measure low values to tolerances of 0.1% or tighter is a concern to both the manufacturer and the user, many situations require coordination of measurement standards between both parties. Coordination is often accomplished by exchange of serialized units with recorded readings to align measurement practices and specific reference standards. The problem is compounded when high-precision current sensors under moderate to high power experience self-heating (Joule effect) which causes the in-service resistance value to be different from that obtained using low current measurement equipment. Therefore, the measurement conditions must be defined and accepted at the time of spec preparation—that is, resistance value as determined by specified current and measured IR-drop following a specified period of stabilization.

Measurement equipment is available from a number of sources with varying stated accuracies. Traditional passive current sensors and shunts generate heat under power, which changes their resistance, and thus their voltage output. The CSM's low absolute TCR reduces errors due to temperature gradients, thus reducing a major source of uncertainty in current measurement. The CSM can withstand unconventional environmental conditions, including the extremely high temperatures and radiation-rich environments of down-hole oil exploration and well logging, or the deep-sea underwater repeaters in cross-ocean communications. The stability of the CSM can be further enhanced by post-manufacturing operations (PMO), such as temperature cycling, short-time overload, and accelerated load life which are uniquely applicable to Bulk Metal<sup>®</sup> Foil resistors. The device features a low thermal electromotive force (EMF) that is critical in many precision applications. Thermal EMF in DC applications induces a voltage offset in the resistor that is equivalent to adding a small battery into the circuit.

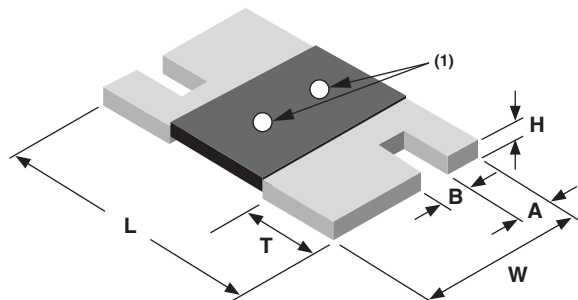
The CSM's all-welded construction is a Bulk Metal<sup>®</sup> resistive element with welded copper terminations, plated for soldering. The terminations make a true continuous contact with the resistive layer along the entire side of the resistive

element, thereby minimizing temperature variations. Also, the resistor element is designed to uniformly dissipate power without creating hot spots, and the welded terminations material is compatible with the element material. These design factors result in a very low thermal-EMF (<3 μV/°C) resistor, because in addition to the low thermal EMF compatibility of the metals, the uniformity and thermal efficiency of the design minimizes the temperature differential across the resistor, thereby assuring low thermal EMF generation at the leads. This further reduces the "battery effect" exhibited by most current-sensing or voltage-reference resistors. Thus, the parasitic voltage generated at the junction of two dissimilar metals, which is especially important in low-value current-sensing resistors, is minimized, while the pure current-to-voltage conversion is protected from such interference in DC applications.

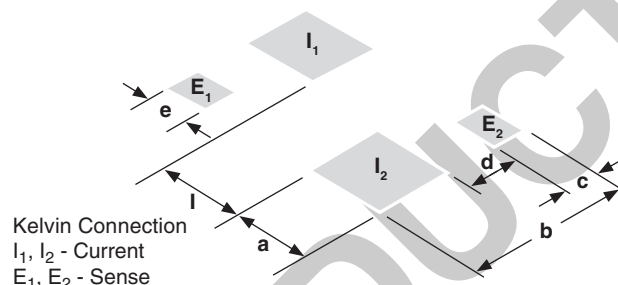
The stability problems associated with analog circuits are very pervasive, but knowledgeable selection of a few high-quality resistors, networks, or trimming potentiometers in critical locations can greatly improve circuit performance, long-term application-related performance, as well as the designer's peace-of-mind. Additionally, the overall system cost is often reduced when a knowledgeable designer concentrates costs in a few exceptionally stable components with minimal deviation and whose load and environmental stability can often eliminate the necessity of additional compensating circuitry or temperature-controlling systems. The higher reliability and better overall system performances also achieve excellent product results in the field, enhancing market acceptance and product reputation. Designers often unnecessarily pay for tighter tolerances than required simply to accommodate the resistance stability shifts they know to be imminent in an application due to the large application-related changes in the components they selected. Selection of a high-stability component like the CSM in these applications eliminates the need for shift allowance due to "planned instability" and allows the use of looser initial tolerances than would otherwise be necessary.

**FIGURE 2 - DIMENSIONS AND IMPRINTING** in inches (millimeters)

**CSM2512S DIMENSIONS**



**CSM2512S LAND PATTERN**



**DIMENSIONS - TOLERANCES  $\pm 0.010$  ( $\pm 0.254$ ), \*  $\pm 0.015$  ( $\pm 0.381$ )**

RESISTANCE RANGE ( $\Omega$ )	L	W	H	T	A	B
0.01 to 0.1	0.250 (6.350)	0.125 (3.175)	0.025 (0.635)	0.030 (0.762)	0.030 (0.762)*	0.032 (0.813)*

**LAND PATTERN DIMENSIONS - TOLERANCES  $\pm 0.003$  ( $\pm 0.076$ )**

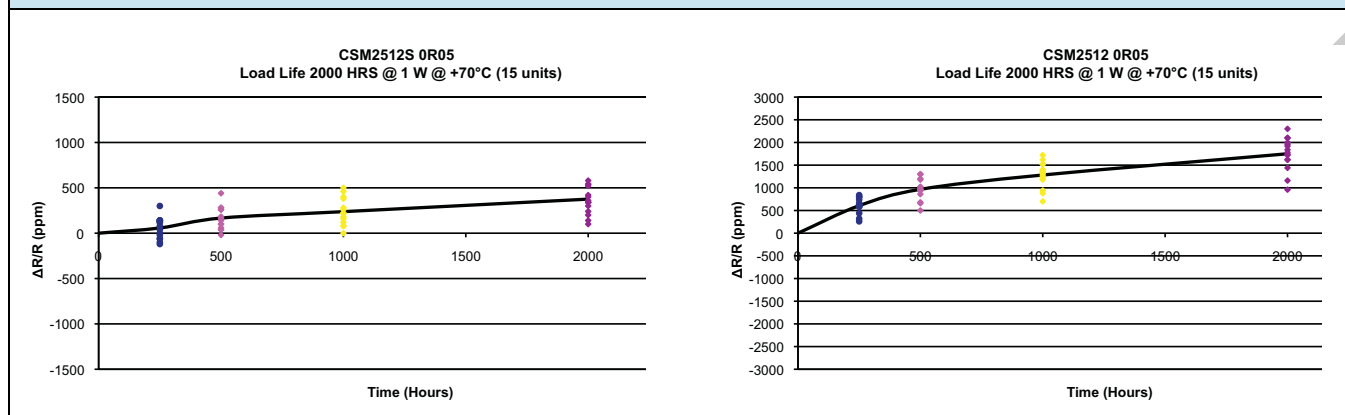
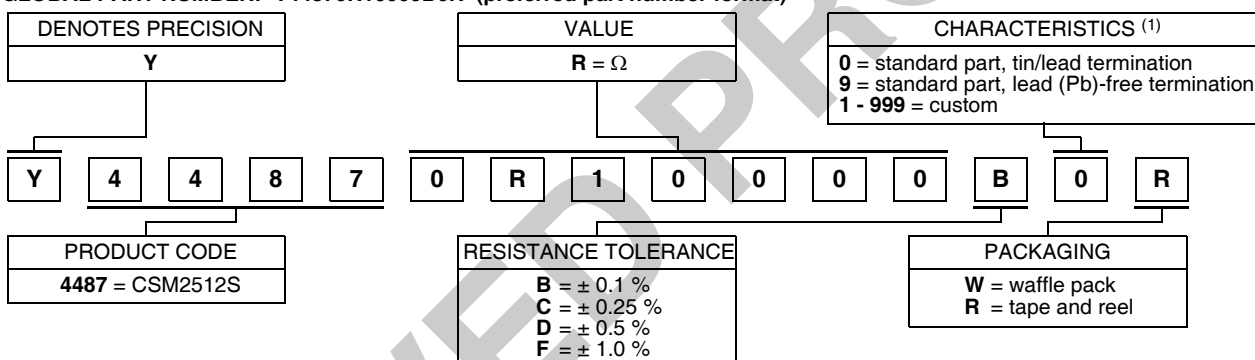
RESISTANCE RANGE ( $\Omega$ )	I	b	e	a	c	d
0.01 to 0.1	0.160 (4.06)	0.145 (3.68)	0.055 (1.39)	0.065 (1.65)	0.045 (1.14)	0.021 (0.53)

**Note**

(1) White dots indicate top side of part for mounting purposes

**TABLE 2 - CSM2512S PERFORMANCE SPECIFICATIONS**

TEST	CONDITIONS	MIL-PRF-49465B $\Delta R$ LIMITS	TYPICAL $\Delta R$ LIMITS	MAXIMUM $\Delta R$ LIMITS
Thermal Shock	- 55 °C to + 150 °C, 1000 cycles, 15 min at each extreme	$\pm (0.5 \% + 0.0005R)$	0.1 %	0.2 %
Load Life Stability	2000 h, 70 °C at rated power	$\pm (1.0 \% + 0.0005R)$	0.05 %	0.2 %
Bias Humidity	85 °C, 85 % humidity 10 % bias, 1000 h	$\pm (0.5 \% + 0.0005R)$	0.05 %	0.2 %
Short Time Overload	5 x rated power for 5 s	$\pm (0.5 \% + 0.0005R)$	0.1 %	0.2 %
High Temperature Exposure	1000 h, 170 °C	$\pm (1.0 \% + 0.0005R)$	0.2 %	0.3 %
Low Temperature Storage	MIL-PRF-49465	$\pm (0.5 \% + 0.0005R)$	0.05 %	0.1 %
Moisture resistance	MIL-STD-202, method 106, 0 % power, 7a and 7b not required	$\pm (0.5 \% + 0.0005R)$	0.02 %	0.05 %
Shock	100 g, 6 ms	$\pm (0.1 \% + 0.0005R)$	0.02 %	0.05 %
Vibration	(10 Hz to 2000 Hz) 20 g	$\pm (0.1 \% + 0.0005R)$	0.02 %	0.05 %
Resistance to Soldering Heat	10 s to 12 s at + 260 °C	$\pm (0.25 \% + 0.0005R)$	0.05 %	0.1 %
Solderability	MIL-STD-202	95 % coverage	-	

**FIGURE 3 - LOAD LIFE RESULTS OF CSM2512S VS. CSM2512****TABLE 3 - GLOBAL PART NUMBER INFORMATION****NEW GLOBAL PART NUMBER: Y44870R10000B0R (preferred part number format)**

FOR EXAMPLE: ABOVE GLOBAL ORDER Y4487 0R10000 B 0 R:

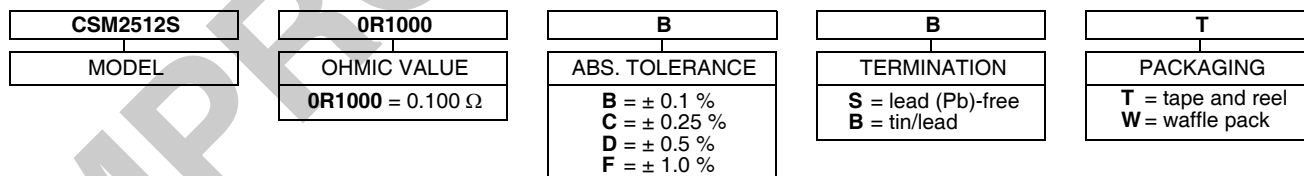
TYPE: CSM2512S

VALUE: 100.0 mΩ

ABSOLUTE TOLERANCE: ± 0.1 %

TERMINATION: standard tin/lead

PACKAGING: tape and reel

**HISTORICAL PART NUMBER: CSM2512S 0R1000 B B T (will continue to be used)****Note**<sup>(1)</sup> For non-standard requests, please contact application engineering.

## Disclaimer

ALL PRODUCTS, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE.

Vishay Precision Group, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, "Vishay Precision Group"), disclaim any and all liability for any errors, inaccuracies or incompleteness contained herein or in any other disclosure relating to any product.

The product specifications do not expand or otherwise modify Vishay Precision Group's terms and conditions of purchase, including but not limited to, the warranty expressed therein.

Vishay Precision Group makes no warranty, representation or guarantee other than as set forth in the terms and conditions of purchase. **To the maximum extent permitted by applicable law, Vishay Precision Group disclaims (i) any and all liability arising out of the application or use of any product, (ii) any and all liability, including without limitation special, consequential or incidental damages, and (iii) any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.**

Information provided in datasheets and/or specifications may vary from actual results in different applications and performance may vary over time. Statements regarding the suitability of products for certain types of applications are based on Vishay Precision Group's knowledge of typical requirements that are often placed on Vishay Precision Group products. It is the customer's responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application.

No license, express, implied, or otherwise, to any intellectual property rights is granted by this document, or by any conduct of Vishay Precision Group.

The products shown herein are not designed for use in life-saving or life-sustaining applications unless otherwise expressly indicated. Customers using or selling Vishay Precision Group products not expressly indicated for use in such applications do so entirely at their own risk and agree to fully indemnify Vishay Precision Group for any damages arising or resulting from such use or sale. Please contact authorized Vishay Precision Group personnel to obtain written terms and conditions regarding products designed for such applications.

Product names and markings noted herein may be trademarks of their respective owners.



**Стандарт  
Электрон  
Связь**

Мы молодая и активно развивающаяся компания в области поставок электронных компонентов. Мы поставляем электронные компоненты отечественного и импортного производства напрямую от производителей и с крупнейших складов мира.

Благодаря сотрудничеству с мировыми поставщиками мы осуществляем комплексные и плановые поставки широчайшего спектра электронных компонентов.

Собственная эффективная логистика и склад в обеспечивает надежную поставку продукции в точно указанные сроки по всей России.

Мы осуществляем техническую поддержку нашим клиентам и предпродажную проверку качества продукции. На все поставляемые продукты мы предоставляем гарантию .

Осуществляем поставки продукции под контролем ВП МО РФ на предприятия военно-промышленного комплекса России , а также работаем в рамках 275 ФЗ с открытием отдельных счетов в уполномоченном банке. Система менеджмента качества компании соответствует требованиям ГОСТ ISO 9001.

Минимальные сроки поставки, гибкие цены, неограниченный ассортимент и индивидуальный подход к клиентам являются основой для выстраивания долгосрочного и эффективного сотрудничества с предприятиями радиоэлектронной промышленности, предприятиями ВПК и научно-исследовательскими институтами России.

С нами вы становитесь еще успешнее!

**Наши контакты:**

**Телефон:** +7 812 627 14 35

**Электронная почта:** [sales@st-electron.ru](mailto:sales@st-electron.ru)

**Адрес:** 198099, Санкт-Петербург,  
Промышленная ул, дом № 19, литера Н,  
помещение 100-Н Офис 331