

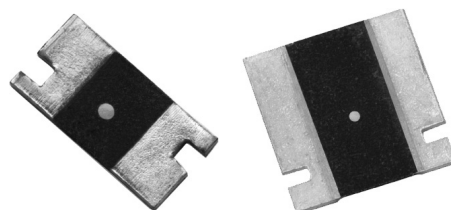


# THE DATASHEET OF Y14870R00500B9R

**Bulk Metal® Technology High Precision, Current Sensing,  
 Power Surface Mount, Metal Strip Resistor**  
**with Resistance Value from 2 mΩ, Rated Power up to 3 W**  
**and TCR to 0±15 ppm/°C Maximum**

**FEATURES**

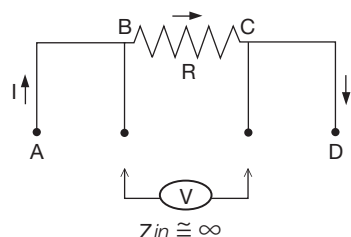
- Temperature coefficient of resistance: ±15 ppm/°C max. (–55°C to +125°C, +25°C ref.);
- Power rating: up to 3 W
- Resistance tolerance to: ±0.1%
- Resistance range: 2 mΩ to 200 mΩ
- CSM Series resistors are not restricted to standard values, specific “as required” values can be supplied at no extra cost or delivery (e.g., 2.34 mΩ vs. 2 mΩ)
- Load life stability to ±0.2% (70°C, 2000 h at rated power)
- Short time overload: ±0.1% typical
- Maximum current: up to 38 A
- Proprietary processing techniques produce low TCR, tight tolerance and improve stability
- Low inductance <5 nH
- Solderable terminations
- Excellent frequency response to 50 MHz
- **Screening in accordance with EEE-INST002 available (per MIL-PRF-55342 and MIL-PRF-49465; see 303415 and 303416 datasheets)**
- Terminal finishes available: lead (Pb)-free, tin/lead alloy
- Quick prototype quantities available, please contact: [foil@vpgsensors.com](mailto:foil@vpgsensors.com)
- For better performance please contact: application engineering



**RoHS\***  
 COMPLIANT

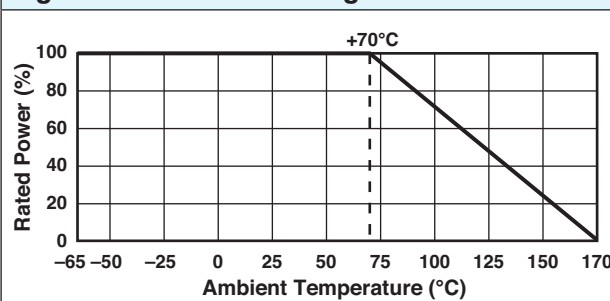
**INTRODUCTION**

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



Four terminal (Kelvin) design: allows for precise and accurate measurements.

**Figure 1 – Power Derating Curve**



**Notes**

- \* 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.

**Table 1 – Specifications**

PARAMETER	CSM2512	CSM3637
Resistance Range	5 mΩ to 200 mΩ	2 mΩ to 100 mΩ
Power Rating at 70°C	1 W	3 W (2 mΩ to 10 mΩ) 2 W (>10 mΩ to 100 mΩ)
Maximum Current <sup>(1)</sup>	14 A	38 A
Tolerance	±0.5% (5 mΩ to <10 mΩ) ±0.1% (10 mΩ to 200 mΩ)	±0.5% (2 mΩ to <20 mΩ) ±0.1% (20 mΩ to 100 mΩ)
Temperature Coefficient Max. (–55°C to +125°C, +25°C Ref.)	±15 ppm/°C	±15 ppm/°C
Operating Temperature Range	–65°C to +170°C	
Maximum Working Voltage	$(P \times R)^{1/2}$	
Weight (Maximum)	0.09 g	0.44 g

**Notes**

<sup>(1)</sup> Maximum current for a given resistance value is calculated using  $I = \sqrt{P/R}$

**ABOUT CSM** (Low Ohm Value 2 mΩ to 200 mΩ)

New high-precision Bulk Metal® surface-mount Power Metal Strip® resistor of 2 mΩ to 200 mΩ that features an improved load-life stability of ±0.2% at +70°C for 2000 h at rated power, an absolute TCR of ±15 ppm/°C maximum from –55°C to +125°C, +25°C ref., and a tolerance of ±0.1%.

Typical current sensing resistors offer a load-life stability of ≥ 1% through a 2000 h workload. The improved resistance stability of the CSM Series makes it ideal for tightened-stability voltage division and precision current sensing applications in switching linear power supplies, power amplifiers, measurement instrumentation, bridge networks, and medical and test equipment. In addition, the CSM Series complies with EEE-INST-002 (MIL-PRF 55342 and MIL-PRF 49465) for military and space applications.

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 CSM Series.

The CSM's all-welded construction is composed of a Bulk Metal® resistive element with welded copper terminations, plated for soldering. The terminations make true ohmic 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.

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.

**Notes**

\* 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. Please see the information /tables in this datasheet for details.

Additionally, the overall system cost is often reduced when a knowledgeable designer concentrates costs in a few exceptionally stable components whose proven minimal-deviation 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.

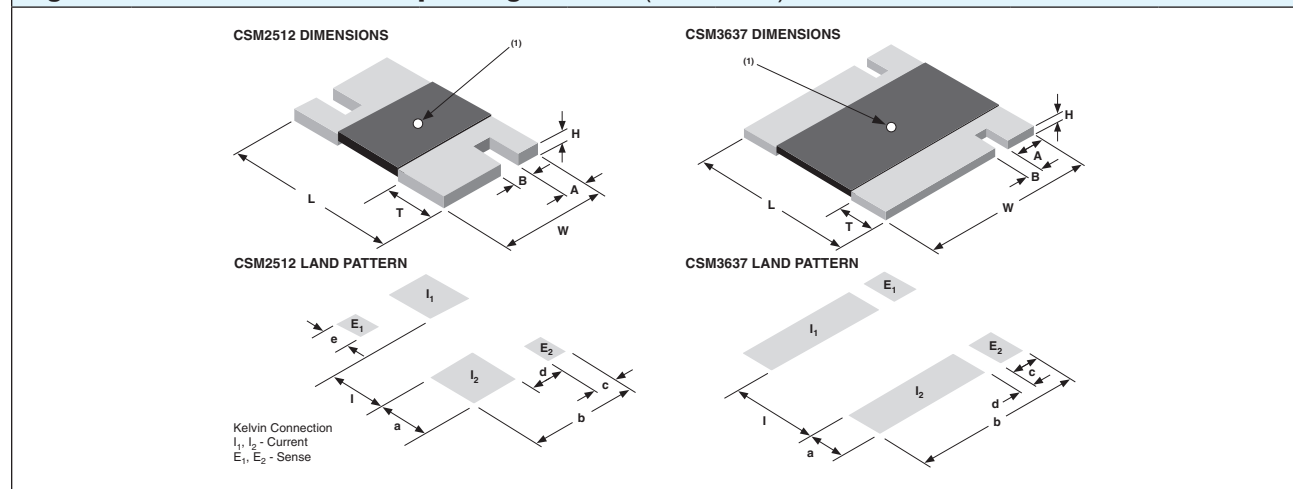
Designers often unnecessarily pay for tighter tolerances than required simply to accommodate the resistance stability shifts they know to be imminent in an application due to the large application-related changes in the components they selected. Selection of a high-stability component like the CSM in these applications eliminates the need for shift allowance due to “planned instability” and allows the use of looser initial tolerances than would be necessary with current-sensing resistors based on other technologies.

### The Key Applications

Applications requiring accuracy and repeatability under stress conditions such as the following:

- Switching and linear power supplies
- Precision current-sensing
- Power management systems
- Feedback circuits
- Power amplifiers
- Measurement instrumentation
- Precision instrumentation amplifiers
- Medical and automatic test equipment
- Satellites and aerospace systems
- Commercial and Military avionics
- Test and measurement equipment
- Electronic scales

**Figure 2 – Dimensions and Imprinting in inches (millimeters)**



### Dimensions – Tolerances $\pm 0.010$ ( $\pm 0.254$ ),\* $\pm 0.015$ ( $\pm 0.381$ )

MODEL	RESISTANCE RANGE (mΩ)	L	W	H	T	A	B
CSM2512	5 to 200	0.250 (6.350)	0.125 (3.175)	0.025 (0.635)	0.031 (0.8)	0.030 (0.762)	0.032 (0.813)
CSM3637	2 to 100	0.360 (9.144)	0.370 (9.398)	0.031 (0.8)	0.086 (2.184)	0.061 (1.549)	0.032 (0.813)

### Land Pattern Dimensions – Tolerances $\pm 0.003$ ( $\pm 0.076$ )

MODEL	RANGE	a	b	c	d	e	l
CSM2512	0R005 to 0R2	0.065 (1.65)	0.145 (3.68)	0.045 (1.14)	0.021 (0.53)	0.055 (1.39)	0.160 (4.06)
CSM3637	0R002 to 0R1	0.168 (4.27)	0.390 (9.91)	0.066 (1.68)	0.024 (0.610)	–	0.074 (1.88)
		0.116 (2.95)	0.390 (9.91)	0.066 (1.68)	0.024 (0.610)	–	0.178 (4.52)

### Note

(1) White dot indicates top side of part for mounting purposes

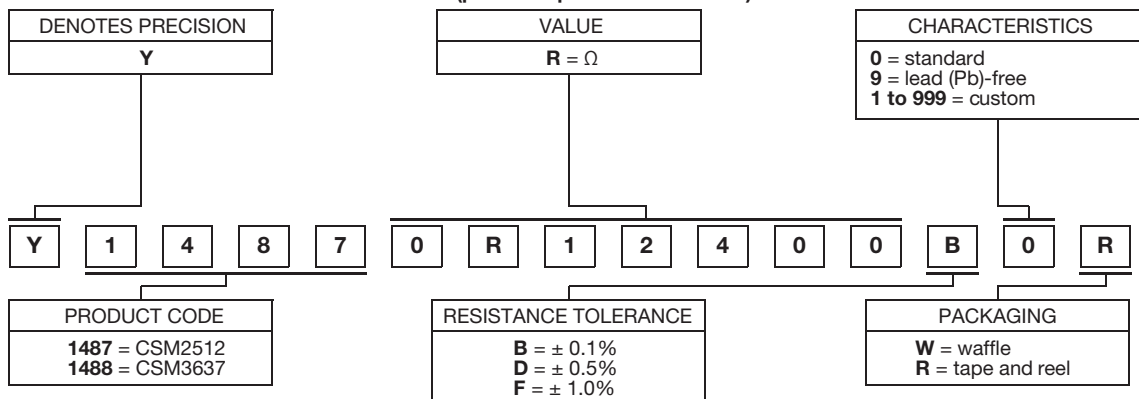
**Table 2 – CSM Series Performance Specifications**

TEST	CONDITIONS	MIL-PRF-49465 $\Delta R$ LIMITS	CSM2512/CSM3637	
			TYPICAL $\Delta R$ LIMITS <sup>(1)</sup>	MAXIMUM $\Delta R$ LIMITS <sup>(1)</sup>
<b>Thermal Shock</b>	–55°C to +150°C, 1000 cycles, 15 min at each extreme	$\pm(0.5\%+0.0005R)$	0.1%	0.3%
<b>Load Life Stability</b>	2000 h, 70°C at rated power	$\pm(1.0\%+0.0005R)$	0.2%	1.0%
<b>Bias Humidity</b>	+85°C, 85% humidity 10% bias, 1000 h	$\pm(0.5\%+0.0005R)$	0.05%	0.2%
<b>Short Time Overload</b>	5 x rated power for 5 s <sup>(2)</sup>	$\pm(0.5\%+0.0005R)$	0.1%	0.5%
<b>High Temperature Exposure</b>	1000 h, 170°C	$\pm(1.0\%+0.0005R)$	0.2%	0.3%
<b>Low Temperature Storage</b>	–55°C for 24 h	$\pm(0.5\%+0.0005R)$	0.05%	0.2%
<b>Moisture Resistance</b>	MIL-STD-202, method 106, 0 power, 7a and 7b not required	$\pm(0.5\%+0.0005R)$	0.02%	0.05%
<b>Shock</b>	100 g, 6 ms, 5 pulses	$\pm(0.1\%+0.0005R)$	0.02%	0.05%
<b>Vibration</b>	(10 Hz to 2000 Hz) 20 g	$\pm(0.1\%+0.0005R)$	0.02%	0.05%
<b>Resistance to Soldering Heat</b>	10 s to 12 s at +260°C	$\pm(0.25\%+0.0005R)$	0.05%	0.05%
<b>Solderability</b>	MIL-STD-202	95% coverage	–	–

**Note**<sup>(1)</sup> Measurement error allowed for  $\Delta R$  limits: 0.0005  $\Omega$ .<sup>(2)</sup> Maximum current should not be exceeded (see table 1)

**Table 3 – Global Part Number Information<sup>(1)</sup>**

**NEW GLOBAL PART NUMBER: Y14870R12400B0R (preferred part number format)**



FOR EXAMPLE: ABOVE GLOBAL ORDER Y1487 0R12400 B 0 R:

TYPE: CSM2512

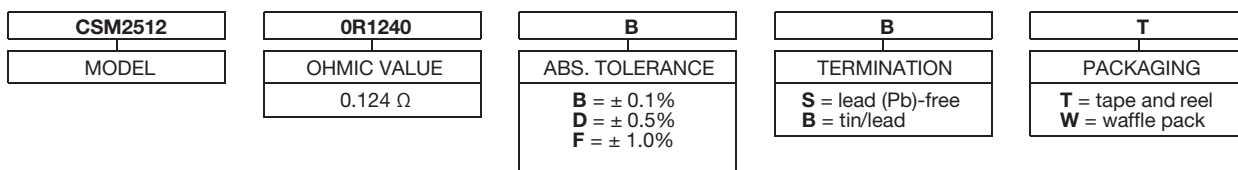
VALUE: 124.0 m $\Omega$

ABSOLUTE TOLERANCE:  $\pm 0.1\%$

TERMINATION: standard tin/lead

PACKAGING: tape and reel

**HISTORICAL PART NUMBER: CSM2512 0R1240 B B T (will continue to be used)**



**Note**

<sup>(1)</sup> For non-standard requests, please contact application engineering.