



Chipsmall Limited consists of a professional team with an average of over 10 year of expertise in the distribution of electronic components. Based in Hongkong, we have already established firm and mutual-benefit business relationships with customers from,Europe,America and south Asia,supplying obsolete and hard-to-find components to meet their specific needs.

With the principle of “Quality Parts,Customers Priority,Honest Operation,and Considerate Service”,our business mainly focus on the distribution of electronic components. Line cards we deal with include Microchip,ALPS,ROHM,Xilinx,Pulse,ON,Everlight and Freescale. Main products comprise IC,Modules,Potentiometer,IC Socket,Relay,Connector.Our parts cover such applications as commercial,industrial, and automotives areas.

We are looking forward to setting up business relationship with you and hope to provide you with the best service and solution. Let us make a better world for our industry!



## Contact us

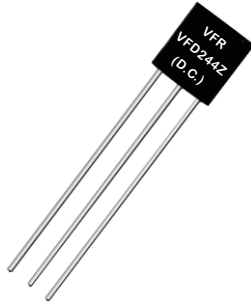
Tel: +86-755-8981 8866 Fax: +86-755-8427 6832

Email & Skype: info@chipsmall.com Web: www.chipsmall.com

Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China



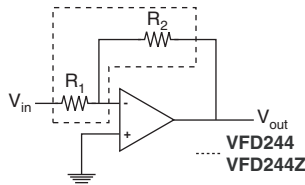
## Bulk Metal® Foil Technology Ultra High Precision Z-Foil Voltage Divider Resistors with TCR Tracking to 0.1 ppm/°C, Power Coefficient Tracking of 5 ppm at Rated Power, and Tolerance Match to 0.005 % (50 ppm)



Vishay Foil resistors are not restricted to standard values/ratios; specific “as requested” values/ratios can be supplied at no extra cost or delivery (e.g. 1K2345 vs. 1K)

### APPLICATIONS

- Instrumentation amplifiers
- Bridge networks
- Differential amplifiers
- Military
- Space
- Medical
- Automatic test equipment
- Down-hole (high temperature)



### FEATURES

- Temperature coefficient of resistance (TCR): absolute:  $\pm 0.05$  ppm/°C typical (0 °C to + 60 °C)  $\pm 0.2$  ppm/°C typical (- 55 °C to + 125 °C, + 25 °C ref.)  
TCR tracking: 0.1 ppm/°C typical
- Tolerance: absolute and matching to 0.005 % (50 ppm)
- Resistance range: 1  $\Omega$  to 100 k $\Omega$  per resistive element
- Power coefficient tracking “ $\Delta R$  due to self heating”: 5 ppm at rated power
- Power rating: up to 1 W at 70 °C, for the entire package, divided proportionally between the two values
- Load life ratio stability: < 0.005 % (50 ppm) 1 W at 70 °C for 2000 h
- Maximum working voltage: 350 V
- Electrostatic discharge (ESD) up to 25 000 V
- Non-inductive, non-capacitive design
- Rise time: 1 ns effectively no ringing
- Current noise: 0.010  $\mu\text{V}_{\text{RMS}}/\text{V}$  of applied voltage (< - 40 dB)
- Thermal EMF: 0.05  $\mu\text{V}/\text{°C}$  typical
- Voltage coefficient: < 0.1 ppm/V
- Non-inductive: < 0.08  $\mu\text{H}$
- Non hot spot design
- Thermal stabilization time < 1 s (nominal value achieved within 10 ppm of steady state value)
- Terminal finish: lead (Pb)-free or tin/lead alloy
- Compliant to RoHS directive 2002/95/EC
- Prototype quantities available in just 5 working days or sooner. For more information, please contact [foil@vpgsensors.com](mailto:foil@vpgsensors.com)
- For better performances please contact us



**TABLE 1 - RATED POWER PER ELEMENT**

RESISTANCE ELEMENT VALUE	MAXIMUM POWER RATING AT 70 °C PER ENTIRE PACKAGE	MAXIMUM POWER RATING AT 125 °C PER ENTIRE PACKAGE
1 $\Omega$ to < 100 k $\Omega$	1 W (not exceed 0.6 W per element)	0.5 W (not exceed 0.3 W per element)

**TABLE 2 - MODEL VFD244Z SPECIFICATIONS**

MODEL	RESISTANCE VALUES	ABSOLUTE TCR (- 55 °C to + 125 °C, + 25 °C ref.)	TOLERANCE		TCR TRACKING (MAX.)	
		TYPICAL AND MAX. SPREAD	ABSOLUTE	MATCH	SAME VALUES	DIFFERENT VALUES
VFD244Z	500 $\Omega$ to 100 k $\Omega$	$\pm 0.2$ ppm/°C $\pm 1.8$ ppm/°C	$\pm 0.005$ %	0.005 %	0.5 ppm/°C	1.5 ppm/°C
	100 $\Omega$ to 500 $\Omega$		$\pm 0.005$ %	0.01 %	1.0 ppm/°C	2.0 ppm/°C
	50 $\Omega$ to 100 $\Omega$	$\pm 0.2$ ppm/°C $\pm 2.3$ ppm/°C	$\pm 0.01$ %	0.02 %	1.5 ppm/°C	2.5 ppm/°C
	25 $\Omega$ to 50 $\Omega$	$\pm 0.2$ ppm/°C $\pm 2.8$ ppm/°C	$\pm 0.01$ %	0.02 %	2.0 ppm/°C	3.0 ppm/°C
	10 $\Omega$ to 25 $\Omega$	$\pm 0.2$ ppm/°C $\pm 3.3$ ppm/°C	$\pm 0.02$ %	0.04 %	2.5 ppm/°C	3.5 ppm/°C
	5 $\Omega$ to 10 $\Omega$	$\pm 0.2$ ppm/°C $\pm 3.8$ ppm/°C	$\pm 0.05$ %	0.05 %	3.0 ppm/°C	4.0 ppm/°C

\* Pb containing terminations are not RoHS compliant, exemptions may apply

## INTRODUCTION

The VFD244Z voltage divider is based on the latest generation of Bulk Metal Z-Foil technology which is the most recommended solution for ultra high precision, stability and reliable voltage division.

The four fundamental factors determining how “ideal” a precision divider and network will be:

1. Initial resistance matching - or how closely the absolute resistance value of same value resistors can be matched.
2. Initial ratio matching - or how accurately a specified ratio between resistors of different values will be ( a corollary of how precisely the value of individual resistors can be controlled).
3. Tracking in operation - or how precisely the initial ratios are maintained under a wide range of operating conditions (temperature, humidity, load, etc.)
4. Fast response without ringing - or ability of the divider, network to react to rapid switching without blocking the circuit. This depends on the inductance and capacitance of the network, as well as of the individual resistors in the network.

VFR VFD244Z with the Z-Foil technology is designed and manufactured to eliminate 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 performances the theoretical ideal, straight wire.

The VFD244Z maintain all its design, physical and electrical characteristics. These factors are both measurable and predictable before, during and after manufacture.

### Why is the absolute TCR of each resistors is more important the initial TCR tracking?

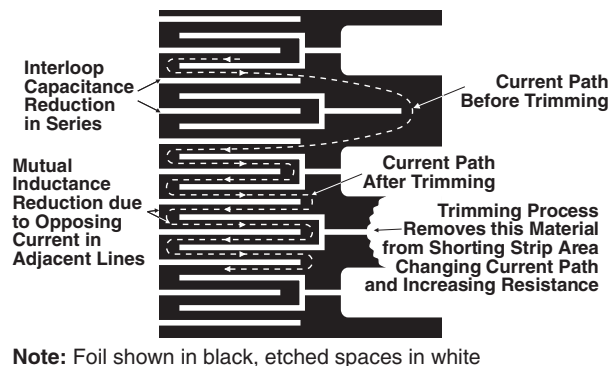
Depending on technology differences, some resistors may increase in value with an increase in temperature (+TCR) while others will decrease in value with an increase in temperature (-TCR), or, they may not change in value at the same rate. Other temperature effects, such as self heating due to the application of power can add to the ambient temperature effects. An example of these effects can be seen with two resistors with different TCR characteristics are used around an operation amplifier. The amplification ratio will be affected by the differential TCR of the resistors and will be compounded by the self heating effects of the I<sup>2</sup>R differences of the feedback vs. the sense resistor.

Good design practice would be to use fundamentally low TCR networks in this application since this would minimize both varying temperature and self heating effects.

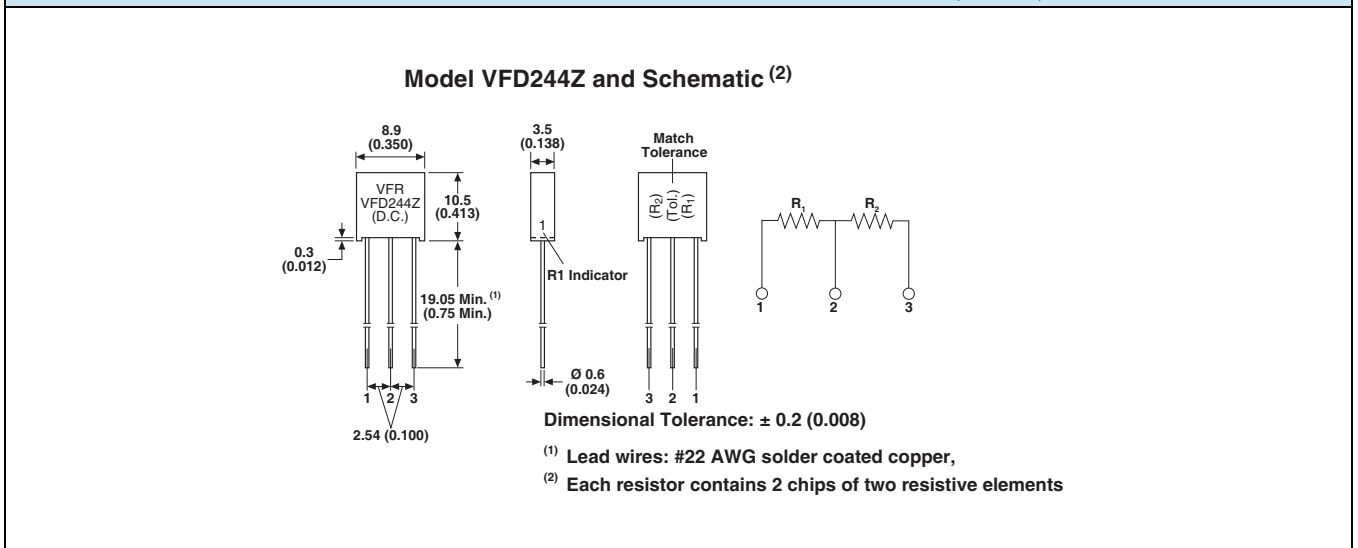
This could not be accomplished with high TCR resistors, even with good tracking.

Our application engineering department is available to advise and make recommendations. For non-standard technical requirements and special applications. Please contact us.

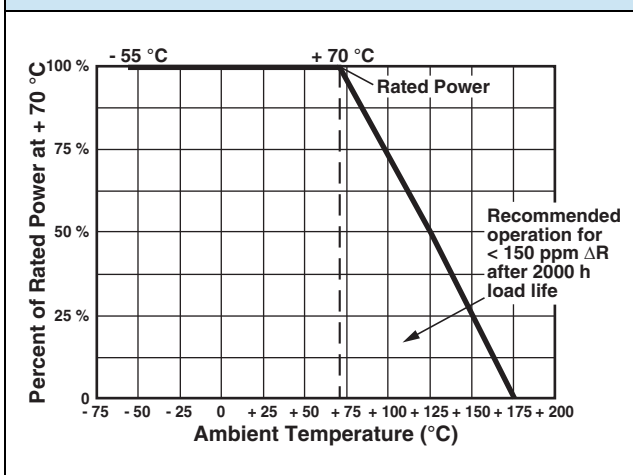
**FIGURE 1 - TRIMMING TO VALUES** (conceptual illustration)



**FIGURE 2 - STANDARD PRINTING AND DIMENSIONS** in millimeters (inches)



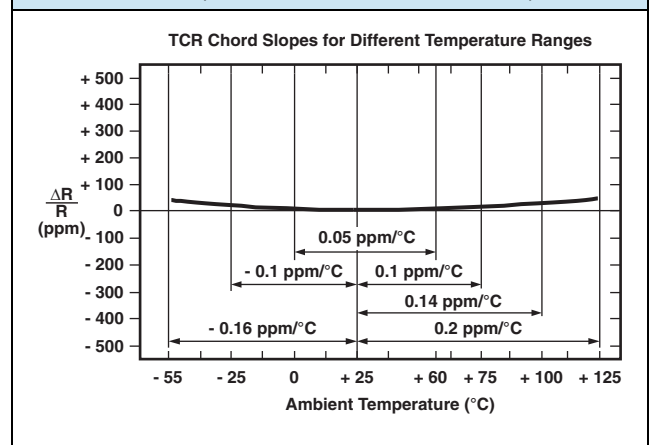
**FIGURE 3 - POWER DERATING CURVE  
VFD244Z**



**Note:**

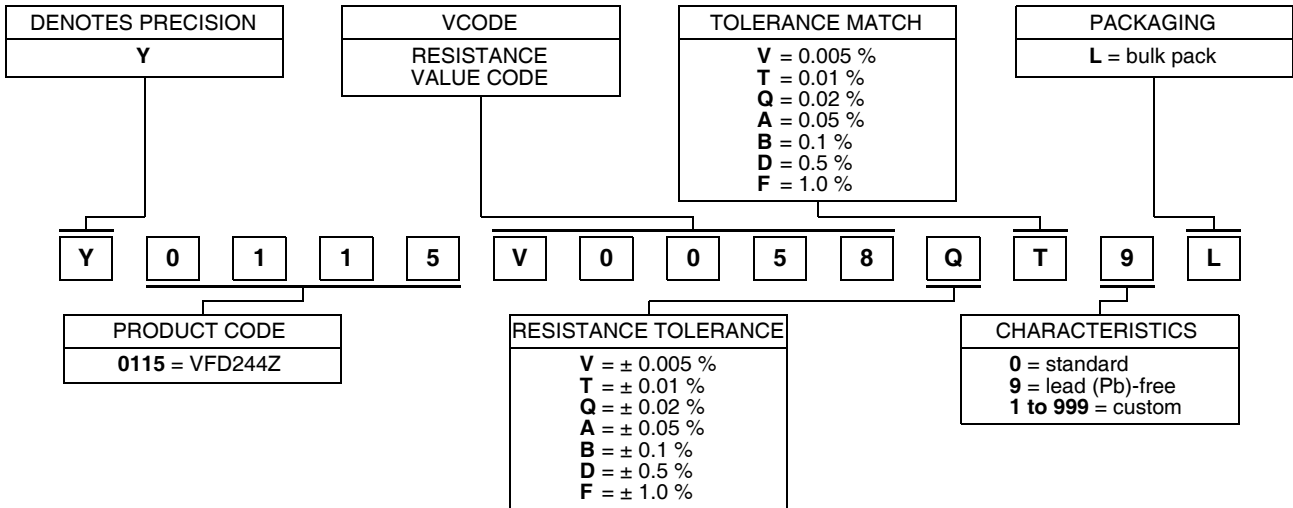
- Power is divided proportionally between the 2 values (see table 1)

**FIGURE 4 - TYPICAL RESISTANCE/  
TEMPERATURE CURVE**  
(for more details see table 2)



**TABLE 3 - GLOBAL PART NUMBER INFORMATION (1)**

NEW GLOBAL PART NUMBER: Y0115V0058QT9L (preferred part number format)



FOR EXAMPLE: ABOVE GLOBAL ORDER Y0115 V0058 Q T 9 L:

TYPE: VFD244Z  
 VALUES: 2K/20K  
 ABSOLUTE TOLERANCE: ± 0.02 %  
 TOLERANCE MATCH: 0.01 %  
 TERMINATION: lead (Pb)-free  
 PACKAGING: bulk pack

HISTORICAL PART NUMBER: VFD244ZT 2K/20K TCR0.2 Q T B (will continue to be used)

<b>VFD244Z</b>	<b>T</b>	<b>2K/20K</b>	<b>TCR0.2</b>	<b>Q</b>	<b>T</b>	<b>B</b>
MODEL	TERMINATION	OHMIC VALUE	TCR CHARACTERISTIC	ABSOLUTE TOLERANCE	TOLERANCE MATCH	PACKAGING
VFD244Z	T = lead (Pb)-free None = tin/lead alloy	R <sub>1</sub> = 2 kΩ R <sub>2</sub> = 20 kΩ		V = ± 0.005 % T = ± 0.01 % Q = ± 0.02 % A = ± 0.05 % B = ± 0.1 % D = ± 0.5 % F = ± 1.0 %	V = 0.005 % T = 0.01 % Q = 0.02 % A = 0.05 % B = 0.1 % D = 0.5 % F = 1.0 %	B = bulk pack

**Note**

(1) 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, "VPG"), 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 VPG's terms and conditions of purchase, including but not limited to, the warranty expressed therein.

VPG 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, VPG 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 VPG's knowledge of typical requirements that are often placed on VPG 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. You should ensure you have the current version of the relevant information by contacting VPG prior to performing installation or use of the product, such as on our website at [vpgsensors.com](http://vpgsensors.com).

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

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

Copyright Vishay Precision Group, Inc., 2014. All rights reserved.