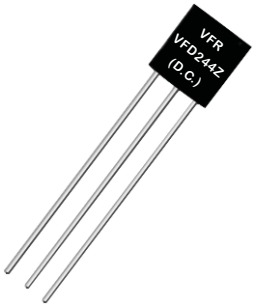
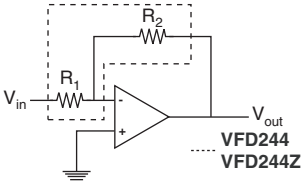
Bulk Metal® Foil Technology Ultra High Precision Z-Foil Voltage Divider Resistors with TCR Tracking to 0.1 ppm/°C, Power Coefficient Tracking of 5 ppm at Rated Power, and Tolerance Match to 0.005 % (50 ppm)



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

Pb-free Available

RoHS* COMPLIANT

- Temperature coefficient of resistance (TCR): absolute: ± 0.05 ppm/°C typical (0 °C to + 60 °C) ± 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 Ω to 100 kΩ per resistive element
- Power coefficient tracking "ΔR 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 μV_{RMS}/V of applied voltage (< - 40 dB)
- Thermal EMF: 0.05 µV/°C typical
- Voltage coefficient: < 0.1 ppm/V
- Non-inductive: < 0.08 µH
- 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
- 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 Ω to < 100 kΩ	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 Ω to 100 kΩ	± 0.2 ppm/°C ± 1.8 ppm/°C	± 0.005 %	0.005 %	0.5 ppm/°C	1.5 ppm/°C
	100 Ω to 500 Ω		± 0.005 %	0.01 %	1.0 ppm/°C	2.0 ppm/°C
	50 Ω to 100 Ω	± 0.2 ppm/°C ± 2.3 ppm/°C	± 0.01 %	0.02 %	1.5 ppm/°C	2.5 ppm/°C
	25 Ω to 50 Ω	± 0.2 ppm/°C ± 2.8 ppm/°C	± 0.01 %	0.02 %	2.0 ppm/°C	3.0 ppm/°C
	10 Ω to 25 Ω	± 0.2 ppm/°C ± 3.3 ppm/°C	± 0.02 %	0.04 %	2.5 ppm/°C	3.5 ppm/°C
	5 Ω to 10 Ω	± 0.2 ppm/°C ± 3.8 ppm/°C	± 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?

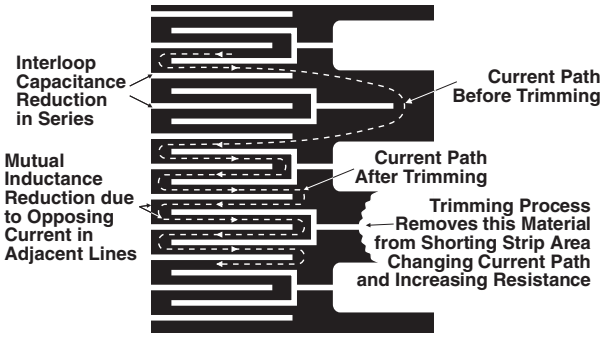
Depending on technology differences, some resistors may increase in value with an increase in temperature (+TCR) while others will decrease in value with an increase in temperature (-TCR), or, they may not change in value at the same rate. Other temperature effects, such as self heating due to the application 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^2R 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.

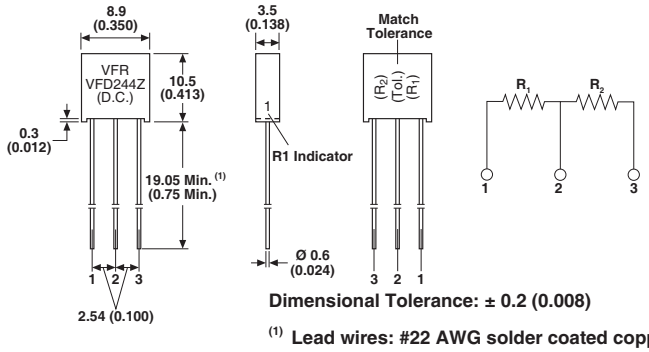
FIGURE 1 - TRIMMING TO VALUES (conceptual illustration)



Note: Foil shown in black, etched spaces in white

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

Model VFD244Z and Schematic (2)



Dimensional Tolerance: ± 0.2 (0.008)

(1) **Lead wires: #22 AWG solder coated copper,**

(2) **Each resistor contains 2 chips of two resistive elements**

FIGURE 3 - POWER DERATING CURVE VFD244Z

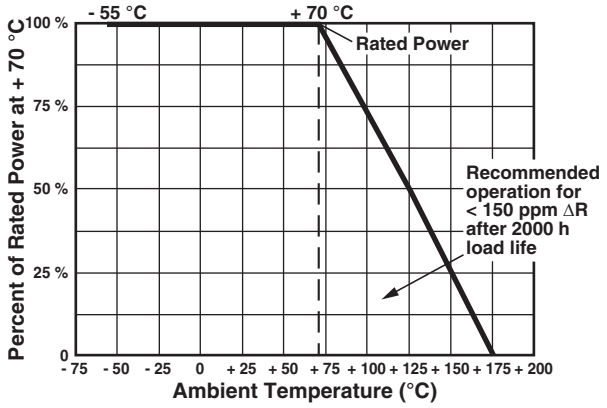
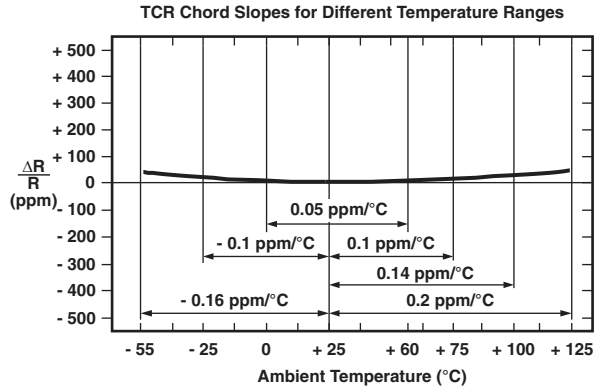


FIGURE 4 - TYPICAL RESISTANCE/ TEMPERATURE CURVE

(for more details see table 2)

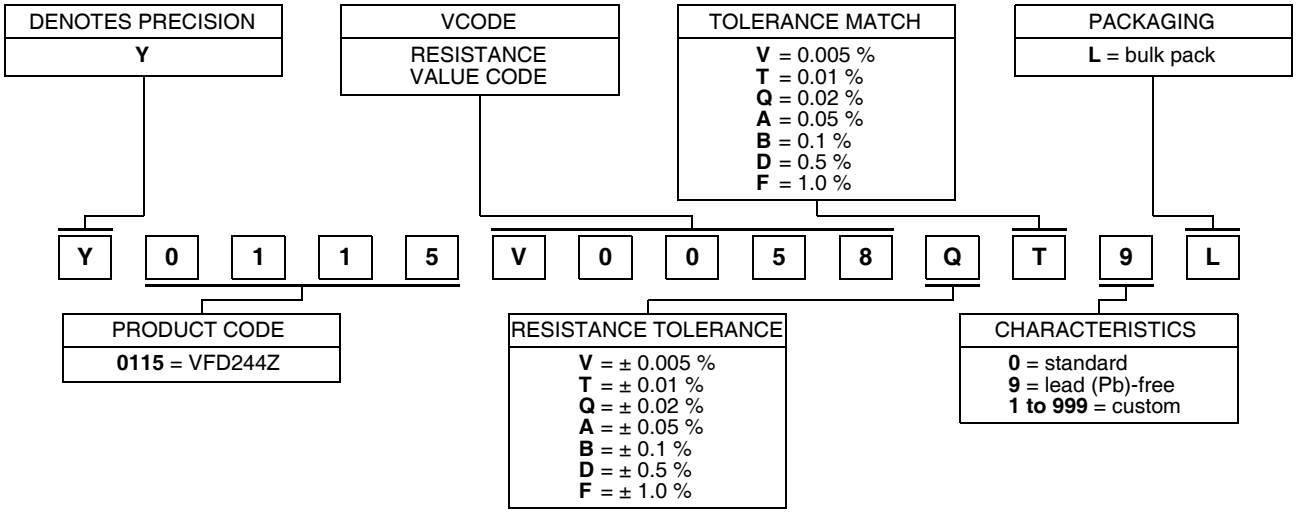


Note:

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

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)

VFD244Z	T	2K/20K	TCR0.2	Q	T	B
MODEL	TERMINATION	OHMIC VALUE	TCR CHARACTERISTIC	ABSOLUTE TOLERANCE	TOLERANCE MATCH	PACKAGING
VFD244Z	**T** = lead (Pb)-free **None** = tin/lead alloy	R_1 = 2 kΩ R_2 = 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

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