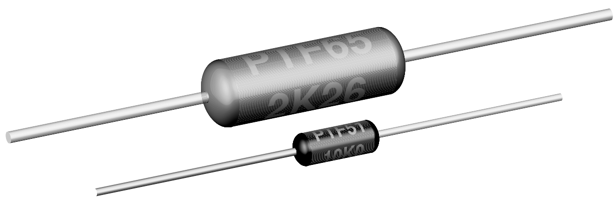
Metal Film Resistors, Axial, High Precision, High Stability



FEATURES

- Extremely low temperature coefficient of resistance
- Very low noise and voltage coefficient
- Very good high frequency characteristics
- Can replace wirewound bobbins
- Proprietary epoxy coating provides superior moisture protection
- For surface mount product, see Vishay Dale's PSF datasheet (www.vishay.com/doc?30162)
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Pb-free Available

e3

RoHS* Available

Note

* 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.

STANDARD ELECTRICAL SPECIFICATIONS

GLOBAL MODEL	HISTORICAL MODEL	POWER RATING (3) $P_{85\,°C}$ W	LIMITING ELEMENT VOLTAGE MAX. (1) V	TEMPERATURE COEFFICIENT ± ppm/°C	TOLERANCE ± %	RESISTANCE RANGE Ω
PTF51	PTF-51	0.05	200	5, 10, 15	0.02, 0.05, 0.1, 0.25, 0.5, 1	15 to 100K
PTF56	PTF-56	0.125	300	5, 10, 15	0.01, 0.02, 0.05, 0.1, 0.25, 0.5, 1	15 to 500K
PTF65	PTF-65	0.25	500	5, 10, 15	0.05, 0.1, 0.25, 0.5, 1	15 to 1M

Notes

- DSCC has created a drawing to support the need for a precision axial-leaded product. Vishay Dale is listed as a resource on this drawing as follows:

DSCC DRAWING NUMBER	VISHAY DALE MODEL	POWER RATING $P_{85\,°C}$ W	RESISTANCE RANGE Ω	TOLERANCE ± %	TEMPERATURE COEFFICIENT ± ppm/°C	MAXIMUM WORKING VOLTAGE (1) V
89088	PTF56..31, PTF56..32 (2)	0.100	15 to 100K	0.01, 0.05, 0.1, 0.5, 1	5, 10	200
90038	PTF65..16, PTF65..14 (2)	0.250	15 to 100K	0.05, 0.1, 0.5, 1	5, 10	200

This drawing can be viewed at: www.landandmaritime.dla.mil/Programs/MilSpec/ListDwgs.aspx?DocTYPE=DSCCdwg

(1) Continuous working voltage shall be $\sqrt{P \times R}$ or maximum working voltage, whichever is less.

(2) Hot solder dipped leads.

(3) For operation of the PTF resistors at higher power ratings, see the Load Life Shift Due to Power and Derating table. This table gives a summary of the effects of using the PTF product at the more common combinations of power rating and case size, as well as quantifies the load life stability under those conditions.

TEMPERATURE COEFFICIENT CODES

GLOBAL TC CODE	HISTORICAL TC CODE	TEMPERATURE COEFFICIENT
Z	T-16	5 ppm/°C
Y	T-13	10 ppm/°C
X	T-10	15 ppm/°C

GLOBAL PART NUMBER INFORMATION

New Global Part Numbering: PTF5620K500BYRE (preferred part numbering format)

P	T	F	5	6	2	0	K	5	0	0	B	Y	R	E			

GLOBAL MODEL	RESISTANCE VALUE	TOLERANCE CODE	TEMP. COEFFICIENT	PACKAGING	SPECIAL
PTF51 **PTF56** **PTF65**	**R** = Ω **K** = kΩ **M** = MΩ **15R000** = 15 Ω **500K00** = 500 kΩ **1M0000** = 1.0 MΩ	**T** = ± 0.01 % (1) **Q** = ± 0.02 % (1) **A** = ± 0.05 % **B** = ± 0.1 % **C** = ± 0.25 % **D** = ± 0.5 % **F** = ± 1 %	**Z** = 5 ppm **Y** = 10 ppm **X** = 15 ppm **0** = special	**EK** = lead (Pb)-free, bulk **EA** = lead (Pb)-free, T/R (full) **EB** = lead (Pb)-free, T/R (1000 pieces) **BF** = tin/lead, bulk **RE** = tin/lead, T/R (full) **R6** = tin/lead, T/R (1000 pieces)	Blank = standard (Dash number) (Up to 3 digits) From **1 to 999** as applicable

Historical Part Number example: PTF-5620K5BT-13R36 (will continue to be accepted)

PTF-56	20K5	B	T-13	R36
HISTORICAL MODEL	RESISTANCE VALUE	TOLERANCE CODE	TEMP. COEFFICIENT	PACKAGING

Notes

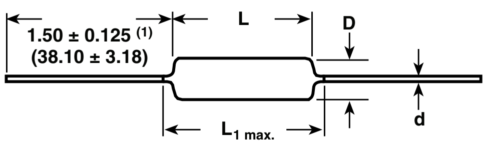
- For additional information on packaging, refer to the Through-Hole Resistor Packaging document (www.vishay.com/doc?31544).

(1) Historical tolerance codes were BB for 0.01 % and BC for 0.02 %.

TECHNICAL SPECIFICATIONS

PARAMETER	UNIT	PTF51	PTF56	PTF65
Rated Dissipation at 85 °C	W	0.05	0.125	0.25
Limiting Element Voltage	V≅	200	300	500
Insulation Voltage (1 Min)	V_{eff}	> 500	> 500	> 500
Thermal Resistance	K/W	< 1300	< 520	260
Terminal Strength, Axial	N	> 150	> 50	> 50
Insulation Resistance	Ω	$\geq 10^{11}$	$\geq 10^{11}$	$\geq 10^{11}$
Category Temperature Range	°C	-55 to +150	-55 to +150	-55 to +150
Failure Rate	10^{-9}/h	< 1	< 1	< 1
Weight (Max.)	g	0.11	0.35	0.75

DIMENSIONS



GLOBAL MODEL	DIMENSIONS in inches (millimeters)			
	L	D	$L_{1\ max.}$	d
PTF51	0.150 ± 0.020 (3.81 ± 0.51)	0.070 ± 0.010 (1.78 ± 0.25)	0.200 (5.08)	0.016 (0.41)
PTF56	0.250 ± 0.031 (6.35 ± 0.79)	0.091 ± 0.009 (2.31 ± 0.23)	0.300 (7.62)	0.025 (0.64)
PTF65	0.375 ± 0.062 (9.53 ± 1.57)	0.145 ± 0.016 (3.68 ± 0.41)	0.475 (12.07)	0.025 (0.64)

Note

(1) Lead length for product in bulk pack. For product supplied in tape and reel, the actual lead length would be based on the body size, tape spacing and lead trim.

PERFORMANCE

TEST	CONDITIONS OF TEST	TEST RESULTS (TYPICAL TEST LOTS)
Life (at Standard Power Ratings)	MIL-PRF-55182 Paragraph 4.8.18 1000 h rated power at +85 °C	≤ ± 0.04 %
Thermal Shock	Mil-STD-202, Method 107 -55 °C to +85 °C	≤ ± 0.02 %
Short Time Overload	MIL-R-10509, Paragraph 4.7.6	≤ ± 0.01 %
Low Temperature Operation	MIL-PRF-55182, Methods 4.8.10	≤ ± 0.02 %
Moisture	MIL-PRF-55182, Paragraph 4.8.15	≤ ± 0.08 %
Resistance to Soldering Heat	MIL-STD-202, Methods 210	≤ ± 0.02 %
Damp Heat IEC 60068-2-3	56 days at 40 °C and 92 % RH	≤ ± 0.08 %
Dielectric Withstanding Voltage	MIL-STD-202, Methods 301 and 105	≤ ± 0.01 %

MATERIAL SPECIFICATIONS

Element	Precision deposited nickel chrome alloy with controlled annealing
Encapsulation	Specially formulated epoxy compounds. Coated construction
Core	Fire-cleanded high purity ceramic
Termination	Standard lead material is solder-coated copper. Solderable and weldable per MIL-STD-1276, Type C.

MARKING

Temperature coefficient: T10 = 15 ppm, T13 = 10 ppm, T16 = 5 ppm
Tolerance: F = 1 %, D = 0.5 %, C = 0.25 %, B = 0.1 %, A = 0.05 %, BC = 0.02 %, BB = 0.01 %

PTF51: (3 lines)

PTF51	Style and size
37K4	Value
BC T13	Tolerance and TC

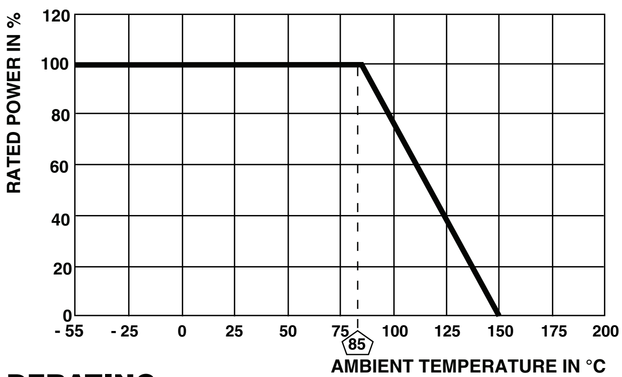
PTF56, PTF65: (4 lines)

PTF56	Style and size
49K9	Value
BB T16	Tolerance and TC
1211	4-digit date code

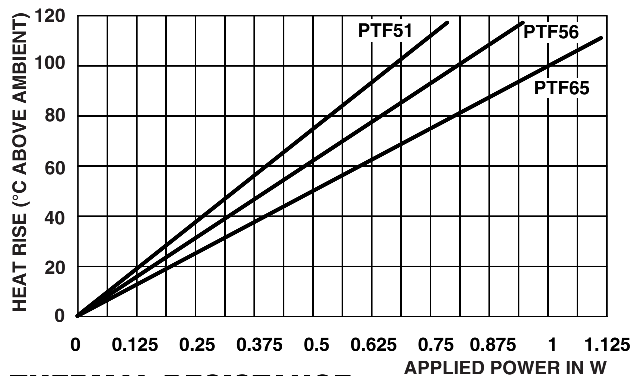
LOAD LIFE SHIFT DUE TO POWER AND DERATING (AT 85 °C)

The power rating for the PTF parts is tied to the derating temperature, the heat rise of the parts, and the ΔR for the load life performance. When the tables/graphs below are used together they show that when the parts are run at higher power ratings, the parts will run hotter, which has the potential of causing the resistance of the parts to shift more over the life of the part.

LOAD LIFE SHIFT VS. POWER RATING					
LOAD LIFE	**CONDITIONS OF TEST**	**MAXIMUM ΔR (TYPICAL TEST LOTS)**			
	MIL-PRF-55182 Paragraph 4.8.18 1000 h rated power at +85 °C	≤ ± 0.04 %	≤ ± 0.15 %	≤ ± 0.5 %	≤ ± 1.0 %
MODEL		**POWER RATING AT + 85 °C**			
PTF51		1/20 W	1/10 W	1/8 W	1/4 W
PTF56		1/8 W	-	1/4 W	1/2 W
PTF65		1/4 W	-	1/2 W	3/4 W



DERATING



THERMAL RESISTANCE

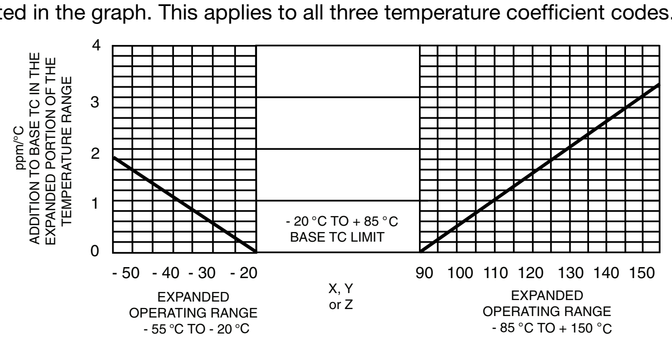
Example: When a PTF56 part is run at 1/8 W in a 70 °C ambient environment, the resistor will generate enough heat that the surface temperature of the part will reach about 17 °C over the ambient temperature, and over the life of the part this could cause the resistance value to shift up to ± 0.04 %.
If the same resistor was instead run at 1/4 W in a 70 °C environment, the element will heat up to about 30 °C over ambient, and over the life of the part the resistance value could shift roughly ± 0.5 %.
And if the resistor was run at its maximum power rating of 1/2 W in a 70 °C environment, it will heat up to about 61°C over ambient, and you could see the resistance value shift roughly ± 1 % over the life of the part.

TEMPERATURE COEFFICIENT OF RESISTANCE

Temperature coefficient (TC) of resistance is normally stated as the maximum amount of resistance change from the original +25 °C value as the ambient temperature increases or decreases. This is most commonly expressed in parts per million per degree centigrade (ppm/°C).

The resistance curve over the operating temperature range is usually a non-linear curve within predictable maximum limits. PTF resistors have a very unifom resistance temperature characteristic when measured over the operating range of -20 °C to +85 °C. The standard temperature coefficients available are
X = ± 15 ppm/°C, Y = ± 10 ppm/°C and Z = ± 5 ppm/°C.

Some applications of the PTF require operation beyond the specifications of -20 °C to +85 °C. The change in temperature coefficient of resistance is very small (less than ± 0.05 ppm/°C) over the expanded temperature range of -55 °C to +150 °C. Therefore, when operating outside the range -20 °C to +85 °C, the designer can plan for a worst case addition of ± 0.05 ppm/°C for each degree centigrade beyond either -20 °C or +85 °C as indicated in the graph. This applies to all three temperature coefficient codes.



Example: Assume the operating characteristics demand a temperature range from -55 °C to +125 °C. This requires a ± 35 °C Δ below -20 °C and a ± 40 °C Δ above +85 °C. The extreme Δ being ± 40 °C means that the worst case addition to the specified TC limit of ± 0.05 ppm/°C times ± 40 °C or ± 2 ppm/°C. Therefore, a Z which is characterized by a base TC limit of ± 5 ppm/°C over the temperature range of -20 °C to +85 °C will exhibit a maximum temperature coefficient of ± 7 ppm/°C over the expanded portion of the temperature range of -55 °C to +125 °C.

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