

## High Stability - High Temperature (230 °C) Thin Film Wraparound Chip Resistors, Sulfur Resistant



### INTRODUCTION

For applications such as down hole applications, the need for parts able to withstand very severe conditions (temperature as high as 215 °C powered or up to 230 °C un-powered) has led Vishay Sfernice to push out the limit of the thin film technology.

Designers might read the application note: Power Dissipation Considerations in High Precision Vishay Sfernice Thin Film Chip Resistors and Arrays (P, PRA etc...) (High Temperature Application) [www.vishay.com/doc?53047](http://www.vishay.com/doc?53047) in conjunction with this datasheet to help them to properly design their PCBs and get the best performances of the PHT.

Vishay Sfernice R&D engineers will be willing to support any customer design considerations.

### FEATURES

- Operating temperature range: -55 °C; +215 °C
- Storage temperature: -55 °C; +230 °C
- Gold terminations (< 1 µm thick)
- 5 sizes available (0402, 0603, 0805, 1206, 2010); other sizes upon request
- Temperature coefficient down to 15 ppm (-55 °C; +215 °C)
- Tolerance down to 0.01 %
- Load life stability: 0.35 % max. after 2000 h at 220 °C (ambient) at Pn
- Shelf life stability: 0.7 % typ. (1 % max.) after 15 000 h at 230 °C
- SMD wraparound
- TCR remains constant after long term storage at 230 °C (15 000 h)
- Sulfur resistant (per ASTM B809-95 humid vapor test)
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**  
**GREEN**  
(5-2008)

### STANDARD ELECTRICAL SPECIFICATIONS

MODEL	SIZE	RESISTANCE RANGE Ω	RATED POWER <sup>(1)(2)</sup> $P_{215\text{ °C}}$ W	LIMITING ELEMENT VOLTAGE V	TOLERANCE <sup>(2)</sup> ± %	TEMPERATURE COEFFICIENT <sup>(3)</sup> ± ppm/°C
PHT0402	0402	10 to 130K	0.0189	50	0.01, 0.02, 0.05, 0.1, 0.5, 1	10, 15, 25, 30, 50, 55
PHT0603	0603	10 to 320K	0.0375	75	0.01, 0.02, 0.05, 0.1, 0.5, 1	10, 15, 25, 30, 50, 55
PHT0805	0805	10 to 720K	0.06	150	0.01, 0.02, 0.05, 0.1, 0.5, 1	10, 15, 25, 30, 50, 55
PHT1206	1206	10 to 2.7M	0.1	200	0.01, 0.02, 0.05, 0.1, 0.5, 1	10, 15, 25, 30, 50, 55
PHT2010	2010	10 to 7.5M	0.2 <sup>(4)</sup>	300	0.01, 0.02, 0.05, 0.1, 0.5, 1	10, 15, 25, 30, 50, 55

#### Notes

- (1) For power handling improvement, please refer to application note 53047: "Power Dissipation Considerations in High Precision Vishay Sfernice Thin Film Chip Resistors and Arrays (High Temperature Applications)" [www.vishay.com/doc?53047](http://www.vishay.com/doc?53047) and consult Vishay Sfernice
- (2) See Table 2 on next page
- (3) See Table 1 on next page
- (4) It is possible to dissipate up to 0.3 W, but there will be an additional drift of 0.1 % after load life

### CLIMATIC SPECIFICATIONS

Operating temperature range	-55 °C; +215 °C
Storage temperature range	-55 °C; +230 °C

### PERFORMANCE VS. HUMID SULFUR VAPOR

Test conditions	50 °C ± 2 °C, 85 % ± 4 % RH, exposure time 500 h
Test results	Resistance drift < (0.05 % R + 0.05 Ω), no corrosion products observed

### MECHANICAL SPECIFICATIONS

Substrate	Alumina
Resistive Element	Nichrome (NiCr)
Passivation	Silicon nitride (Si <sub>3</sub> N <sub>4</sub> )
Protection	Epoxy + silicone
Terminations	Gold (< 1 µm) over nickel barrier

#### Note

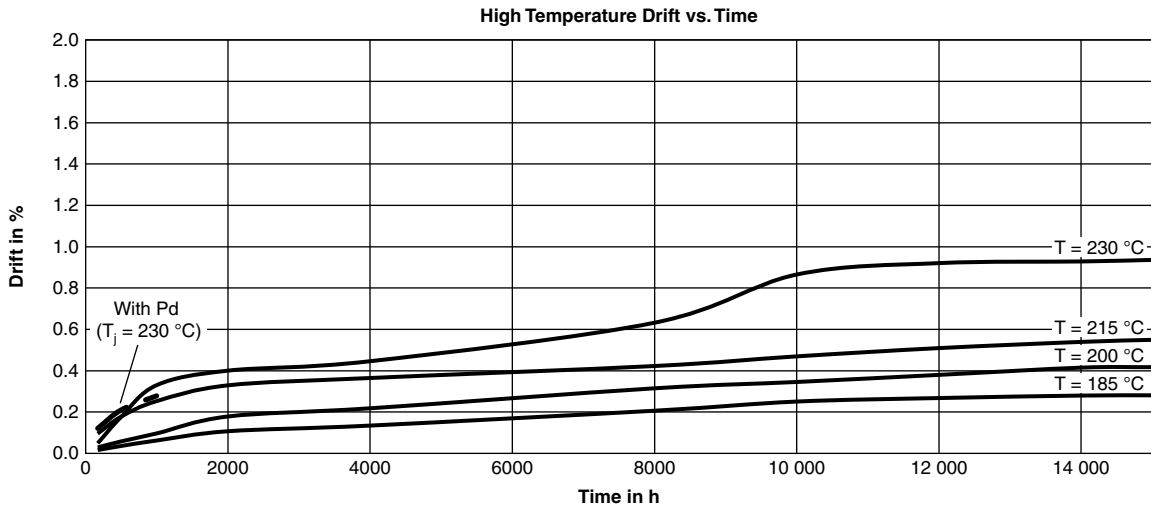
- For other terminations, please consult



TABLE 1 - TEMPERATURE COEFFICIENT		
Y	10 ppm/°C	-55 °C; +155 °C
	15 ppm/°C	-55 °C; +215 °C
E	25 ppm/°C	-55 °C; +155 °C
	30 ppm/°C	-55 °C; +215 °C
H	50 ppm/°C	-55 °C; +155 °C
	55 ppm/°C	-55 °C; +215 °C

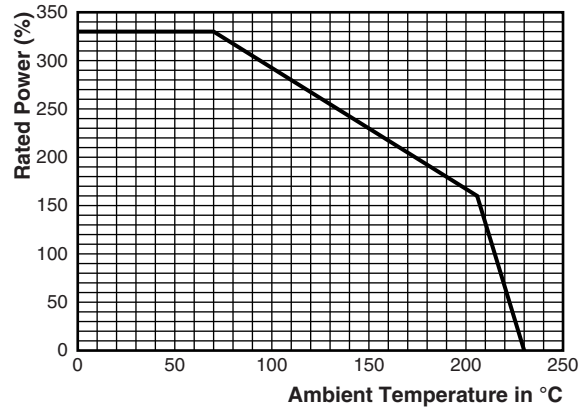
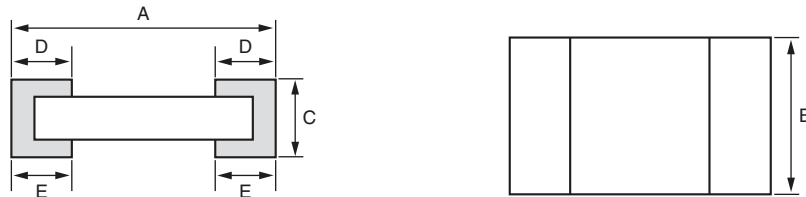
TABLE 2 - BEST TOLERANCE AND TCR VS. OHMIC VALUE			
SERIES	RANGE (Ω)	TOL. (± %)	TCR CODE
0402	10 to < 100	0.05; 0.1; 0.5; 1	Y; E; H
	100 to < 90K	0.01; 0.02; 0.05; 0.1; 0.5; 1	Y; E; H
	90K to 130K	0.01; 0.02; 0.05; 0.1; 0.5; 1	E; H
0603	10 to < 100	0.05; 0.1; 0.5; 1	Y; E; H
	100 to < 210K	0.01; 0.02; 0.05; 0.1; 0.5; 1	Y; E; H
	210K to 320K	0.01; 0.02; 0.05; 0.1; 0.5; 1	E; H
0805	10 to < 100	0.05; 0.1; 0.5; 1	Y; E; H
	100 to < 480K	0.01; 0.02; 0.05; 0.1; 0.5; 1	Y; E; H
	480K to 720K	0.01; 0.02; 0.05; 0.1; 0.5; 1	E; H
1206	10 to < 100	0.05; 0.1; 0.5; 1	Y; E; H
	100 to < 1.8M	0.01; 0.02; 0.05; 0.1; 0.5; 1	Y; E; H
	1.8M to 2.7M	0.01; 0.02; 0.05; 0.1; 0.5; 1	E; H
2010	10 to < 100	0.05; 0.1; 0.5; 1	Y; E; H
	100 to < 5M	0.01; 0.02; 0.05; 0.1; 0.5; 1	Y; E; H
	5M to 7.5M	0.01; 0.02; 0.05; 0.1; 0.5; 1	E; H

PHT STABILITY CURVE

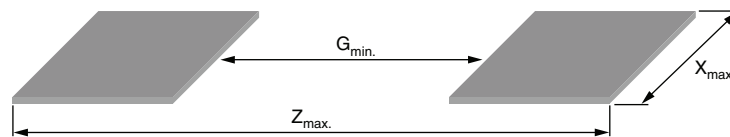


Note

- Stability will be dependent on resistivity of resistor. Above curves are worst case.

**POWER DERATING CURVE**

**DIMENSIONS** in millimeters (inches)


CASE SIZE	A		C	D/E	
	MAX. TOL. +0.152 (+0.006)	MAX. TOL. +0.127 (+0.005)		NOMINAL	TOLERANCE
	MIN. TOL. -0.152 (-0.006)	MIN. TOL. -0.127 (-0.005)			
	NOMINAL	NOMINAL			
0402	1.00 (0.039)	0.60 (0.024)	Termination N: 0.5 (0.02) ± 0.127 (0.005)	0.25 (0.010)	0.1 (0.004)
0603	1.52 (0.060)	0.85 (0.033)		0.38 (0.015)	0.13 (0.005)
0805	1.91 (0.075)	1.27 (0.050)		0.40 (0.016)	
1206	3.06 (0.120)	1.60 (0.063)		0.48 (0.019)	
2010	5.08 (0.200)	2.54 (0.100)		Termination G: 0.4 (0.016) ± 0.051 (0.002)	

**SUGGESTED LAND PATTERN (TO IPC-7351A)**


CHIP SIZE	DIMENSIONS (in millimeter)		
	Z <sub>max.</sub>	G <sub>min.</sub>	X <sub>max.</sub>
0402	1.55	0.15	0.73
0603	2.37	0.35	0.98
0805	2.76	0.74	1.40
1206	3.91	1.85	1.73
2010	5.93	3.71	2.67

**Caution:**

Performances obtained with following mounting conditions:

PCB: polyimide

Solder paste: PbSnAg (93.5/5/1.5)

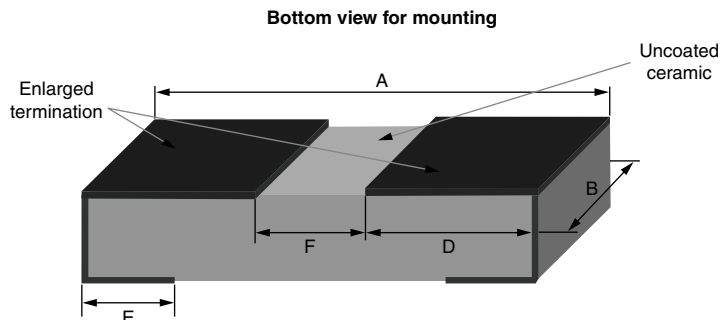
**POPULAR OPTIONS**

It is recommended to consult Vishay Sfernice for availability first.

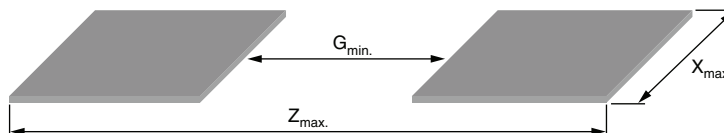
**Option: Enlarged terminations:**

For stringent and special power dissipation requirements, the thermal resistance between the resistive layer and the solder joint can be reduced using enlarged terminations chip resistors which are soldered on large and thick copper pads acting as heatsink (see application note: 53048 "Power Dissipation in High Precision Vishay Sfernice Chip Resistors and Arrays (P Thin Film, PRA Arrays, CHP Thick Film)" [www.vishay.com/doc?53048](http://www.vishay.com/doc?53048)).

Option to order: 0063 (applies to size 1206 / 2010).

**DIMENSIONS** (Option 0063) in millimeters


CASE SIZE	A	B	E	D	F		
	MAX. TOL. +0.152 MIN. TOL. -0.152	MAX. TOL. +0.127 MIN. TOL. -0.127	MAX. TOL. +0.13 MIN. TOL. -0.13	MAX. TOL. +0.13 MIN. TOL. -0.13	NOMINAL	MIN.	MAX.
	NOMINAL	NOMINAL	NOMINAL	NOMINAL			
1206	3.06	1.60	0.40	1.215	0.63	0.50	0.76
2010	5.08	2.54	0.48	2.25			

**SUGGESTED LAND PATTERN** (Option 0063)


CHIP SIZE	DIMENSIONS (in millimeter)		
	Z <sub>max.</sub>	G <sub>min.</sub>	X <sub>max.</sub>
1206	3.91	0.50	1.73
2010	5.93		2.67



**PACKAGING**

ESD packaging available: waffle-pack and plastic tape and reel (low conductivity). Paper tape available in standard (for size 0402) and upon request (ESD only) (for sizes 0603, 0805, and 1206).

SIZE	MOQ	NUMBER OF PIECES PER PACKAGE		TAPE WIDTH
		WAFFLE PACK 2" x 2"	TAPE AND REEL MIN. MAX.	
0402	100	100	100	8 mm
0603				
0805				
1206		140	4000	
2010		60	2000	8 mm <sup>(1)</sup>

**Note**

<sup>(1)</sup> 12 mm on request

**PACKAGING RULES**

**Waffle Pack**

Can be filled up to maximum quantity indicated in the table here above, taking into account the minimum order quantity. When quantity ordered exceeds maximum quantity of a single waffle pack, the waffle packs are stacked up on the top of each other and closed by one single cover.

**To get "not stacked up" waffle pack in case of ordered quantity > maximum number of pieces per package: Please consult Vishay Sfernice for specific ordering code.**

**Tape and Reel**

Can be filled up to maximum quantity indicated in the table here above, taking into account the minimum order quantity. When quantity ordered is between the MOQ and the maximum reel capacity, only one reel is provided.

**When several reels are needed for ordered quantity within MOQ and maximum reel capacity: please consult Vishay Sfernice for specific ordering code.**

GLOBAL PART NUMBER INFORMATION																	
Global Part Numbering: PHT1206Y1001BGT063																	
P	H	T	1	2	0	6	Y	1	0	0	1	B	G	T	0	6	3
GLOBAL MODEL	SIZE	TCR	VALUE			TOLERANCE	TERMINATION	PACKAGING	OPTION								
PHT	0402 0603 0805 1206 2010	Y E H	The first three digits are significant figures and the last digit specifies the number of zeros to follow, R designates decimal point  10R0 = 10 Ω 3901 = 3900 Ω 1004 = 1 MΩ			L = 0.01 % P = 0.02 % W = 0.05 % B = 0.1 % D = 0.5 % F = 1 %	G = gold N = tin/silver <sup>(1)</sup>	For more information see codification of Packaging table	Leave blank if no option								

**Note**

<sup>(1)</sup> For usage at temperatures up to 200 °C maximum N (tin/silver termination are available upon request)

CODIFICATION OF PACKAGING	
CODE 18	PACKAGING
<b>WAFFLE PACK</b>	
W	100 min., 1 mult
WA	100 min., 100 mult (available only on size 1206)
<b>PLASTIC TAPE (in standard for all sizes except 0402)</b>	
T	100 min., 1 mult
TA	100 min., 100 mult
TB	250 min., 250 mult
TC	500 min., 500 mult
TD	1000 min., 1000 mult
TE	2500min., 2500 mult
TF	Full tape (quantity depending on size of chips)
<b>PAPER TAPE (in standard for 0402, option for other sizes)</b>	
PT	100 min., 1 mult
PA	100 min., 100 mult
PB	250 min., 250 mult
PC	500 min., 500 mult
PD	1000 min., 1000 mult
PE	2500min., 2500 mult
PF	Full tape (quantity depending on size of chips)



## Disclaimer

ALL PRODUCT, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE.

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

Vishay makes no warranty, representation or guarantee regarding the suitability of the products for any particular purpose or the continuing production of any product. To the maximum extent permitted by applicable law, Vishay 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.

Statements regarding the suitability of products for certain types of applications are based on Vishay's knowledge of typical requirements that are often placed on Vishay products in generic applications. Such statements are not binding statements about the suitability of products for a particular application. 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. Parameters provided in datasheets and/or specifications may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated for each customer application by the customer's technical experts. Product specifications do not expand or otherwise modify Vishay's terms and conditions of purchase, including but not limited to the warranty expressed therein.

Except as expressly indicated in writing, Vishay products are not designed for use in medical, life-saving, or life-sustaining applications or for any other application in which the failure of the Vishay product could result in personal injury or death. Customers using or selling Vishay products not expressly indicated for use in such applications do so at their own risk. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay. Product names and markings noted herein may be trademarks of their respective owners.

## Material Category Policy

**Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as RoHS-Compliant fulfill the definitions and restrictions defined under Directive 2011/65/EU of The European Parliament and of the Council of June 8, 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (EEE) - recast, unless otherwise specified as non-compliant.**

**Please note that some Vishay documentation may still make reference to RoHS Directive 2002/95/EC. We confirm that all the products identified as being compliant to Directive 2002/95/EC conform to Directive 2011/65/EU.**

**Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as Halogen-Free follow Halogen-Free requirements as per JEDEC JS709A standards. Please note that some Vishay documentation may still make reference to the IEC 61249-2-21 definition. We confirm that all the products identified as being compliant to IEC 61249-2-21 conform to JEDEC JS709A standards.**