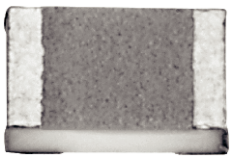
# High Stability - High Temperature (230 °C) Thin Film Wraparound Chip Resistors



## 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 0.05 %
- 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
- 0.02 % upon request
- TCR remains constant after long term storage at 230 °C (15 000 h)
- Material categorization: For definitions of compliance please see www.vishay.com/doc?99912

Pb-free

RoHS COMPLIANT

GREEN (5-2008)

## 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 leaded 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 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.

## STANDARD ELECTRICAL SPECIFICATIONS

| MODEL | SIZE | RESISTANCE RANGE Ω | RATED POWER (1)(2) $P_{215\,°C}$ W | LIMITING ELEMENT VOLTAGE V | TOLERANCE ± % | TEMPERATURE COEFFICIENT (3) ± ppm/°C |
|---|---|---|---|---|---|---|
| PHT0402 | 0402 | 10 to 150K | 0.0189 | 50 | 0.05, 0.1, 0.5, 1 | 10, 15, 25, 30, 50, 55 |
| PHT0603 | 0603 | 10 to 500K | 0.0375 | 75 | 0.05, 0.1, 0.5, 1 | 10, 15, 25, 30, 50, 55 |
| PHT0805 | 0805 | 10 to 750K | 0.06 | 150 | 0.05, 0.1, 0.5, 1 | 10, 15, 25, 30, 50, 55 |
| PHT1206 | 1206 | 10 to 3.5M | 0.1 | 200 | 0.05, 0.1, 0.5, 1 | 10, 15, 25, 30, 50, 55 |
| PHT2010 | 2010 | 10 to 7.5M | 0.2 (4) | 300 | 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 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 |

## MECHANICAL SPECIFICATIONS

| | |
|---|---|
| Substrate | Alumina |
| Resistive Element | Nichrome (NiCr) |
| Passivation | Silicon nitride ($Si_3N_4$) |
| Protection | Epoxy + Silicone |
| Terminations | Gold (< 1 µm) over nickel barrier |

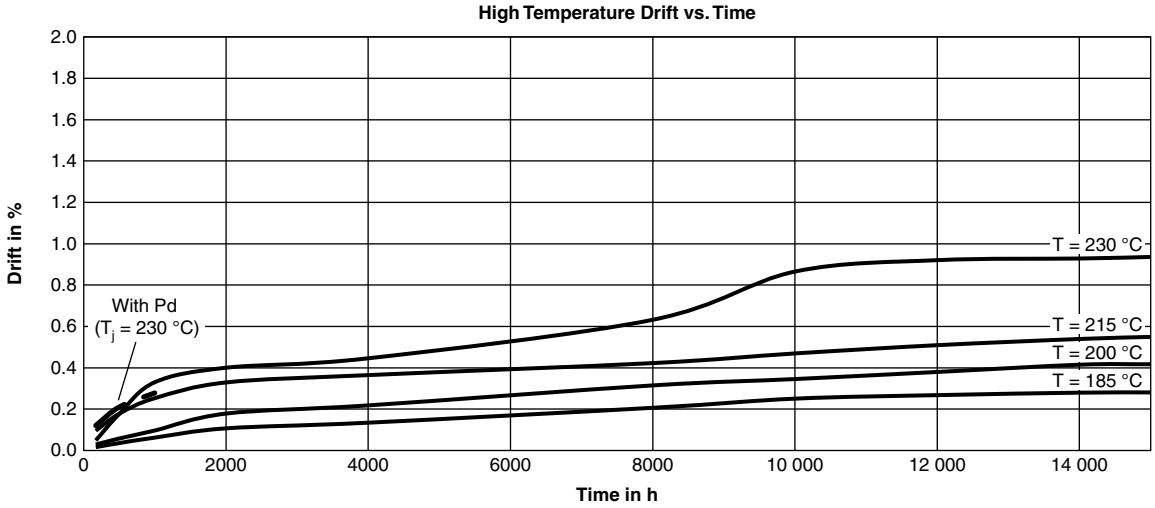
**Note**

- 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 | | | |
|---|---|---|---|
| SERIES | RANGE (Ω) | TOL. (± %) | TCR CODE |
| 0402 | From **10R** to 90K | 0.05; 0.1; 0.5; 1 | Y; E; H |
| | From > 90K to **130K** | 0.05; 0.1; 0.5; 1 | E; H |
| 0603 | From **10R** to 210K | 0.05; 0.1; 0.5; 1 | Y; E; H |
| | From > 210K to **320K** | 0.05; 0.1; 0.5; 1 | E; H |
| 0805 | From **10R** to 480K | 0.05; 0.1; 0.5; 1 | Y; E; H |
| | From > 480K to **720K** | 0.05; 0.1; 0.5; 1 | E; H |
| 1206 | From **10R** to 1M8 | 0.05; 0.1; 0.5; 1 | Y; E; H |
| | From > 1M8 to **2M7** | 0.05; 0.1; 0.5; 1 | E; H |
| 2010 | From **10R** to 5M | 0.05; 0.1; 0.5; 1 | Y; E; H |
| | From > 5M to **7M5** | 0.05; 0.1; 0.5; 1 | E; H |

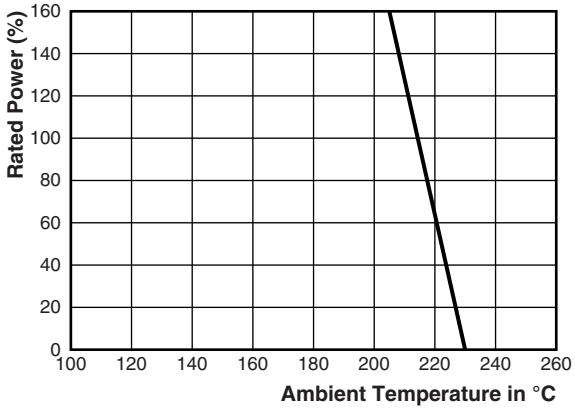
## PHT STABILITY CURVE



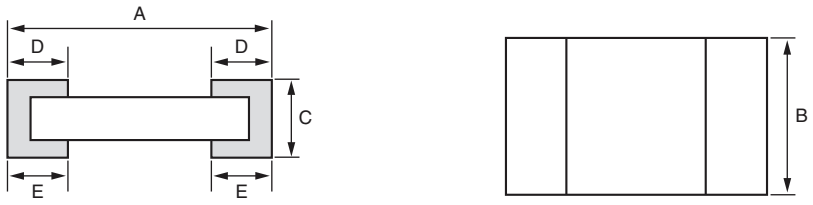

**Note**

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

## POWER DERATING CURVE

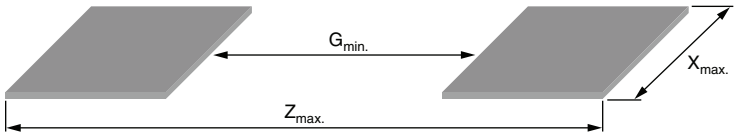


**DIMENSIONS** in millimeters (inches)




| CASE SIZE | A | B | C | D/E | |
|---|---|---|---|---|---|
| | MAX. TOL.<br>+ 0.152 (+ 0.006)<br>MIN. TOL.<br>- 0.152 (- 0.006) | MAX. TOL.<br>+ 0.127 (+ 0.005)<br>MIN. TOL.<br>- 0.127 (- 0.005) | | | |
| | NOMINAL | NOMINAL | | NOMINAL | NOMINAL |
| 0402 | 1.00 (0.039) | 0.60 (0.024) | 0.5 (0.02)<br>± 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) | | | |
| 1206 | 3.06 (0.120) | 1.60 (0.063) | | 0.40 (0.016) | |
| 2010 | 5.08 (0.200) | 2.54 (0.100) | | 0.48 (0.019) | |

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




| CHIP SIZE | DIMENSIONS (in millimeter) | | |
|---|---|---|---|
| | $Z_{max.}$ | $G_{min.}$ | $X_{max.}$ |
| 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.

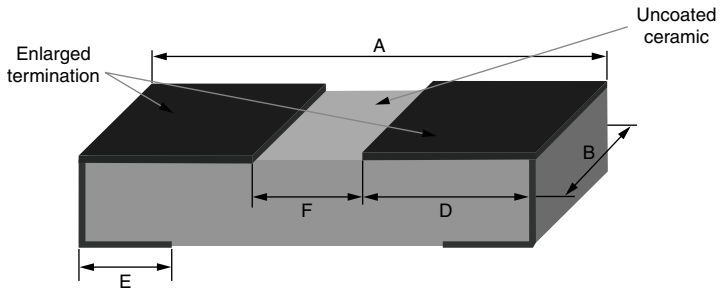
**Option: Enlarged terminations:**

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.

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

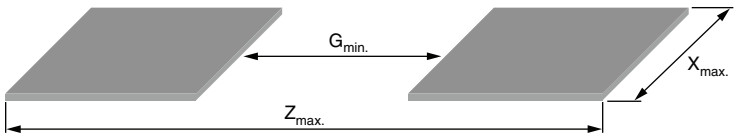
## DIMENSIONS (Option 0063) in millimeters

**Bottom view for mounting**




| 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 | NOMINAL | NOMINAL | NOMINAL | NOMINAL | MIN. | MAX. |
| 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) | | |
|---|---|---|---|
| | $Z_{max.}$ | $G_{min.}$ | $X_{max.}$ |
| 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 upon request (ESD only).

| SIZE | MOQ | NUMBER OF PIECES PER PACKAGE | | | TAPE WIDTH |
|---|---|---|---|---|---|
| | | WAFFLE PACK 2" × 2" | TAPE AND REEL | | |
| | | | MIN. | MAX. | |
| 0402 | 100 | 100 | 100 | 5000 | 8 mm |
| 0603 | | | | | |
| 0805 | | | | 4000 | |
| 1206 | | 140 | | | |
| 2010 | | 60 | | 2000 | 8 mm (1) |

**Note**

(1) 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**<br>**0603**<br>**0805**<br>**1206**<br>**2010** | **Y**<br>**E**<br>**H** | The first three digits are significant figures and the last digit specifies the number of zeros to follow, R designates decimal point<br><br>**10R0** = 10 Ω<br>**3901** = 3900 Ω<br>**1004** = 1 MΩ | **W** = 0.05 %<br>**B** = 0.1 %<br>**D** = 0.5 %<br>**F** = 1 % | **G** = Gold<br>**N** = Tin/silver (2) | **T** = Tape and reel<br>**Blank** = Waffle pack | Leave blank if no option |

**Note**

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

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