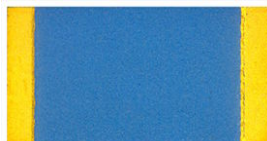


# High Stability - High Temperature (230 °C) Thin Film Wraparound Chip Resistors, Sulfur Resistant



## 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 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](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)



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(5-2008)

## STANDARD ELECTRICAL SPECIFICATIONS

| MODEL   | SIZE | RESISTANCE RANGE<br>Ω | RATED POWER <sup>(1)(2)</sup><br>P <sub>215 °C</sub><br>W | LIMITING ELEMENT VOLTAGE<br>V | TOLERANCE <sup>(2)</sup><br>± % | TEMPERATURE COEFFICIENT <sup>(3)</sup><br>± 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

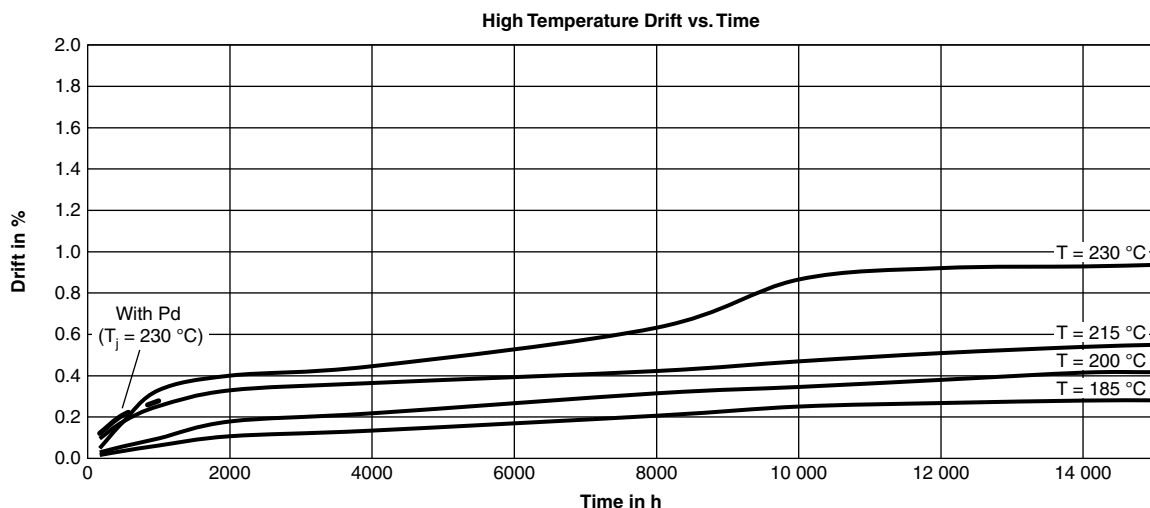
- For other terminations, please consult

**TABLE 1 - TEMPERATURE COEFFICIENT**

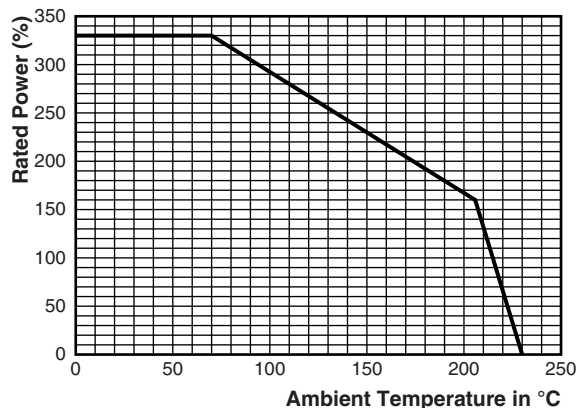
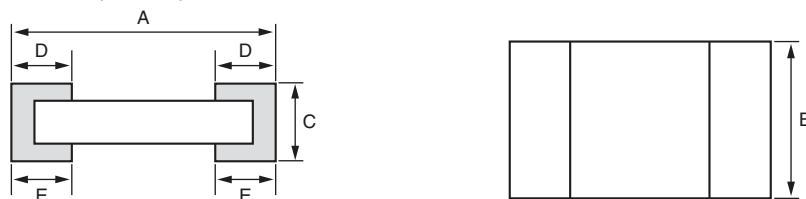
|   |           |                 |
|---|-----------|-----------------|
| Y | 10 ppm/°C | -55 °C; +155 °C |
|   | 15 ppm/°C | -55 °C; +215 °C |
| E | 25 ppm/°C | -55 °C; +155 °C |
|   | 30 ppm/°C | -55 °C; +215 °C |
| H | 50 ppm/°C | -55 °C; +155 °C |
|   | 55 ppm/°C | -55 °C; +215 °C |

**TABLE 2 - BEST TOLERANCE AND TCR VS. OHMIC VALUE**

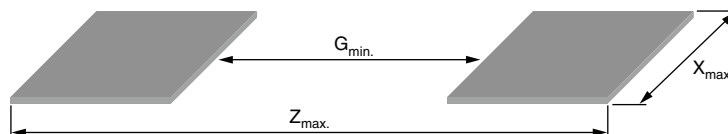
| SERIES | RANGE (Ω)     | TOL. (± %)                    | TCR CODE |
|--------|---------------|-------------------------------|----------|
| 0402   | 10 to < 100   | 0.05; 0.1; 0.5; 1             | Y; E; H  |
|        | 100 to < 90K  | 0.01; 0.02; 0.05; 0.1; 0.5; 1 | Y; E; H  |
|        | 90K to 130K   | 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                                                            | 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      | TOLERANCE    |
|           | NOMINAL                                                      | NOMINAL                                                      |                                                                                                         |              |              |
| 0402      | 1.00 (0.039)                                                 | 0.60 (0.024)                                                 | Termination N:<br>0.5 (0.02)<br>± 0.127 (0.005)<br><br>Termination G:<br>0.4 (0.016)<br>± 0.051 (0.002) | 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)                                                 |                                                                                                         |              |              |

**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

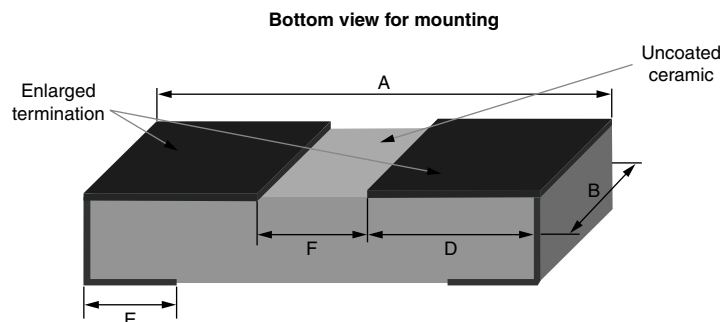
It is recommended to consult Vishay Sfernice for availability first.

### 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)).

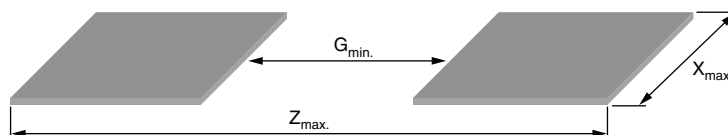
Option to order: 0063 (applies to size 1206 / 2010).

## DIMENSIONS (Option 0063) in millimeters



| CASE SIZE | A                                          | B                                          | E                                        | D                                        | F       |      |      |
|-----------|--------------------------------------------|--------------------------------------------|------------------------------------------|------------------------------------------|---------|------|------|
|           | MAX. TOL.<br>+0.152<br>MIN. TOL.<br>-0.152 | MAX. TOL.<br>+0.127<br>MIN. TOL.<br>-0.127 | MAX. TOL.<br>+0.13<br>MIN. TOL.<br>-0.13 | MAX. TOL.<br>+0.13<br>MIN. TOL.<br>-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 <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<br>2" x 2"       | TAPE AND REEL |      |                     |
|      |     |                              | MIN.          | MAX. |                     |
| 0402 | 100 | 100                          | 100           | 5000 | 8 mm                |
| 0603 |     |                              |               |      |                     |
| 0805 |     |                              |               | 4000 |                     |
| 1206 |     | 140                          |               |      |                     |
| 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<br>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<br>significant figures and<br>the last digit specifies<br>the number of zeros to<br>follow, R designates<br>decimal point<br><br>10R0 = 10 Ω<br>3901 = 3900 Ω<br>1004 = 1 MΩ |   |   |   |   | L = 0.01 %<br>P = 0.02 %<br>W = 0.05 %<br>B = 0.1 %<br>D = 0.5 %<br>F = 1 % |   |   | G = gold<br>N = tin/silver (1) |   | For more<br>information see<br>codification of<br>Packaging table |   | Leave blank<br>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)  |



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