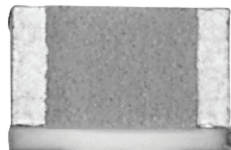




## ESCC (e) 4001/023 Qualified High Precision (5 ppm, 0.01 %), Thin Film Chip Resistors



Vishay Sfernice Thin Film division holds ESCC QML qualification (ESCC technology flow qualification).

These High-Rel. components are ideal for low noise and precision applications, superior stability, low temperature coefficient of resistance, and low voltage coefficient, Vishay Sfernice's precision thin film wraparound resistors exceed requirements of MIL-PRF-55342G characteristics Y ( $\pm 10$  ppm/°C).

### FEATURES

HALOGEN  
**FREE**

- Load life stability at  $\pm 70$  °C for 2000 h:  
0.15 % under Pn
- Low temperature coefficient down to  $\pm 5$  ppm/°C
- Very low noise ( $< -35$  dB) and voltage coefficient ( $< 0.01$  ppm/V)
- Resistance range:  $10 \Omega$  to  $3 \text{ M}\Omega$  (depending on size)
- Laser trimmed tolerances to  $\pm 0.01$  %
- TCR in lot tracking  $\leq 5$  ppm/°C
- Termination: Thin film technology
- SnPb terminations over nickel barrier
- ESCC 4001 (generic specifications)
- ESCC 4001/023 (detailed specifications)
- ESCC qualified
- SMD wraparound chip resistor
- Operating temperature range:  $-65$  °C to  $+155$  °C
- From 0402 to 2010
- Material categorization: For definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)

### STANDARD ELECTRICAL SPECIFICATIONS

| MODEL        | SIZE | ESCC<br>VARIANT<br>NUMBER | RESISTANCE<br>RANGE<br>$\Omega$ | RATED<br>POWER<br>AT $+70$ °C<br>(Pn)<br>W <sup>(1)</sup> | LIMITING<br>ELEMENT<br>VOLTAGE<br>(UL)<br>V <sup>(1)</sup> | INSULATION<br>VOLTAGE<br>(U <sub>i</sub> )<br>V | TOLERANCE<br>$\pm$ %  | TEMPERATURE<br>COEFFICIENT<br>$\pm$ ppm/°C |
|--------------|------|---------------------------|---------------------------------|-----------------------------------------------------------|------------------------------------------------------------|-------------------------------------------------|-----------------------|--------------------------------------------|
| PHR 0402 (e) | 0402 | 13 and 14                 | 10 to 150K                      | 0.05                                                      | 30                                                         | 50                                              | 0.01, 0.02, 0.05, 0.1 | 5, 10, 25                                  |
| PHR 0603 (e) | 0603 | 01 and 05                 | 10 to 500K                      | 0.1                                                       | 35                                                         | 100                                             | 0.01, 0.02, 0.05, 0.1 | 5, 10, 25                                  |
| PHR 0805 (e) | 0805 | 02 and 06                 | 10 to 750K                      | 0.125                                                     | 75                                                         | 200                                             | 0.01, 0.02, 0.05, 0.1 | 5, 10, 25                                  |
| PHR 1206 (e) | 1206 | 03 and 07                 | 10 to 3.5M                      | 0.25                                                      | 100                                                        | 300                                             | 0.01, 0.02, 0.05, 0.1 | 5, 10, 25                                  |
| PHR 2010 (e) | 2010 | 04 and 08                 | 10 to 6M                        | 0.50                                                      | 150                                                        | 300                                             | 0.01, 0.02, 0.05, 0.1 | 5, 10, 25                                  |

#### Note

<sup>(1)</sup> Limiting voltages and power rating are already derated (for maximum ratings admissible, refer to P chip: [www.vishay.com/cod?53017](http://www.vishay.com/cod?53017)).

### CLIMATIC SPECIFICATIONS

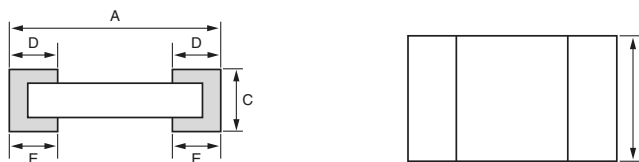
|                                           |                          |
|-------------------------------------------|--------------------------|
| Operating temperature range               | $-65$ °C; $+155$ °C      |
| Soldering temperature (T <sub>sol</sub> ) | $260$ °C, immersion 10 s |

### MECHANICAL SPECIFICATIONS

|                    |                                                                                                 |
|--------------------|-------------------------------------------------------------------------------------------------|
| Substrate material | Alumina                                                                                         |
| Technology         | Thin Film                                                                                       |
| Film               | <b>Nickel Chromium</b> with mineral passivation                                                 |
| Protection         | Epoxy and silicone                                                                              |
| Terminations       | <b>B type:</b> SnPb over nickel barrier for solder reflow <sup>(3)</sup><br><b>G type:</b> Gold |

#### Note

<sup>(2)</sup> For B terminations use recommended reflow profile #1 as per Application Note "Guidelines for Vishay Sfernice Resistive and Inductive Components" (document number: 52029)

**DIMENSIONS** in millimeters

| VARIANT<br>NUMBER | STYLE | DIMENSIONS |      |      |      |      |      |      |      |      |      |
|-------------------|-------|------------|------|------|------|------|------|------|------|------|------|
|                   |       | A          |      | B    |      | C    |      | D    |      | E    |      |
|                   |       | MIN.       | MAX. | MIN. | MAX. | MIN. | MAX. | MIN. | MAX. | MIN. | MAX. |
| 01, 05            | 0603  | 1.39       | 2.16 | 0.62 | 1.01 | 0.25 | 1.02 | 0.17 | 0.51 | 0.25 | 0.51 |
| 02, 06            | 0805  | 1.78       | 2.55 | 1.14 | 1.53 | 0.25 | 1.02 | 0.17 | 0.51 | 0.25 | 0.51 |
| 03, 07            | 1206  | 2.87       | 3.64 | 1.47 | 1.86 | 0.25 | 1.02 | 0.17 | 0.51 | 0.25 | 0.51 |
| 04, 08            | 2010  | 4.95       | 5.72 | 2.41 | 2.8  | 0.25 | 1.02 | 0.35 | 0.85 | 0.35 | 0.85 |
| 13, 14            | 0402  | 0.87       | 1.64 | 0.47 | 0.86 | 0.25 | 1.02 | 0.09 | 0.38 | 0.12 | 0.38 |

**TRACEABILITY DEFINITIONS**

The two major traceability elements are defined as:

- The primary process lot number named Front End lot (FE lot). One “FE lot” is composed of several wafers issued from the same thin film deposition sequence.
- The date code named Batch Number (BN). The “BN” is defined after completion of the end of production testing sequence. The lot homogeneity is given by the “FE lot” and not by the “BN”.

According to the applied rules validated by the ESCC through the product qualification, the following situations are agreed:

- Parts coming from different “FE lot” might have the same “BN”.
- A maximum of two different “BN” might be applied to the same “FE lot” to enable the use of overruns from a previous PO.
- Unless requested / approved by the customer the “BN” will be 2 years old maximum.

**SPECIFIC TRACEABILITY REQUIREMENTS**

The following specific requirements have to be treated as:

- A customer who requires “Lot Homogeneity” has to mention it on the PO as “SINGLE PRODUCTION LOT”.
- A customer who requires “Lot Homogeneity” in addition to a “Single Batch Number” has to mention it on the PO as “SINGLE PRODUCTION LOT AND OPTION R0101”.

**END OF PRODUCTION TESTING**

Mandatory testing performed at the end of the production process:

- 100 % overload: Voltage  $\sqrt{(6.25 P_n \times R_n)}$  or 2 UL whichever is less - duration 2 s
- 100 % burn in: 168 h at  $P_n$  at 70 °C

**OPTIONS****LOT VALIDATION TESTING**

For procurement of qualified components, lot validation testing is not required and shall only be performed if specifically stipulated in the purchase order.

For procurement of unqualified components, lot validation testing shall be performed as stipulated in the purchase order. The need for lot validation testing shall be determined by the orderer.

When lot validation testing is required, it shall consist of the performance of one or more of the tests or subgroup test sequences of chart F4 indicated in the ESA Generic Specification ESCC 4001. The testing to be performed and the sample size shall be as stipulated in the purchase order. When procurement of more than one component type is involved from a family, range or series, the selection of representative samples shall also be stipulated in the purchase order.

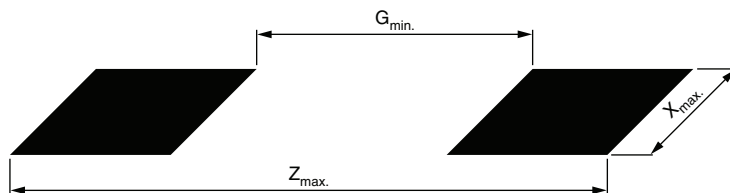
Lot validation testing will be composed of one LVT charges and LVT samples:

- Lot validation test charges has to be ordered separately on purchase order.
- Lot validation samples have to be ordered separately on purchase order.

**FINAL INSPECTION**

If requested by the orderer a final inspection can be performed on site.

Final inspection has to be stipulated separately on purchase order.

**LAND PATTERN** in millimeters


| CHIP SIZE | $Z_{max.}$ | $G_{min.}$ | $X_{max.}$ |
|-----------|------------|------------|------------|
| 0402      | 1.55       | 0.15       | 0.73       |
| 0603      | 2.37       | 0.35       | 0.98       |
| 0705/0805 | 2.76       | 0.74       | 1.40       |
| 1206      | 3.91       | 1.85       | 1.73       |
| 2010      | 5.93       | 3.71       | 2.67       |

**Note**

- Suggested land pattern: According to IPC-7351A

**QUALIFIED OHMIC RANGE <sup>(1)</sup>**

| MODEL | ESCC VARIANT          | OHMIC RANGE ( $\Omega$ ) | TOLERANCE (%)            |
|-------|-----------------------|--------------------------|--------------------------|
| PHR   | 01 to 08 and 13 to 14 | 10 to < 50               | 0.1                      |
|       |                       | 50 to < 100              | 0.05 and 0.1             |
|       |                       | 100 to < 250             | 0.02, 0.05 and 0.1       |
|       |                       | $\geq 250$               | 0.01, 0.02, 0.05 and 0.1 |

**QUALIFIED OHMIC RANGE <sup>(1)</sup>**

| MODEL | ESCC VARIANT          | OHMIC RANGE ( $\Omega$ ) | TEMPERATURE COEFFICIENT (ppm/°C) | ESCC CODE |
|-------|-----------------------|--------------------------|----------------------------------|-----------|
| PHR   | 01 to 08 and 13 to 14 | 10 to < 20               | E: 25 (-55 °C; +155 °C)          | 2         |
|       |                       | 20 to < 50               | E: 25 (-55 °C; +155 °C)          | 2         |
|       |                       |                          | Y: 10 (-55 °C; +155 °C)          | 1         |
|       |                       |                          | Z: 5 (+22 °C; +70 °C)            | 0         |
| PHR   | 01 to 08 and 13 to 14 | $\geq 50$                | E: 25 (-55 °C; +155 °C)          | 2         |
|       |                       |                          | Y: 10 (-55 °C; +155 °C)          | 1         |
|       |                       |                          | Z: 5 (+22 °C; +70 °C)            | 0         |
|       |                       |                          | C: 5 (-55 °C; +155 °C)           | 9         |

**QUALIFIED OHMIC RANGE: MAX. VALUE <sup>(1)</sup>**

| PHR 0402                                 | PHR 0603                                  | PHR 0805       | PHR 1206     | PHR 2010     |
|------------------------------------------|-------------------------------------------|----------------|--------------|--------------|
| 100 k $\Omega$ (67 k $\Omega$ for TCR C) | 200 k $\Omega$ (160 k $\Omega$ for TCR C) | 250 k $\Omega$ | 1 M $\Omega$ | 3 M $\Omega$ |

**Note**

- <sup>(1)</sup> For values, TCR, tolerance outside of qualified range: Please consult.

**POPULAR OPTIONS**
**OPTION 0041**

Production according to ESCC 4001/023 for: Cases, ohmic values, tolerance or TCR outside of qualified range. Please consult Vishay Sfernice for feasibility.

**PACKAGING**

Two types of packaging are available: Waffle-pack and tape and reel.

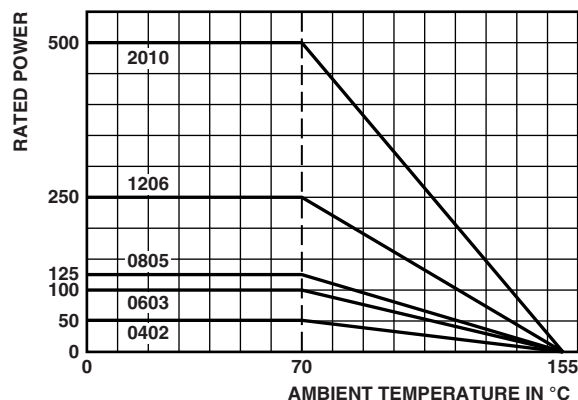
| SIZE | NUMBER OF PIECES PER PACKAGE |                              | TAPE WIDTH |
|------|------------------------------|------------------------------|------------|
|      | WAFFLE PACK 2" x 2"          | TAPE AND REEL <sup>(3)</sup> |            |
|      |                              | MIN.                         | MAX.       |
| 0402 | 100                          | 50                           | 5000       |
| 0603 |                              |                              | 4000       |
| 0805 |                              |                              |            |
| 1206 | 140                          | 50                           | 2000       |
| 2010 | 60                           |                              |            |

**Note**

- <sup>(2)</sup> MoQ: 50 pieces

**EXTENDED FEATURES**

You may consult Vishay Sfernice for chip sizes, ohmic values and tolerances outside of the qualified range.

**POWER DERATING CURVE**




| PERFORMANCE                                                          |                                                                |                                              |                                    |                                                  |
|----------------------------------------------------------------------|----------------------------------------------------------------|----------------------------------------------|------------------------------------|--------------------------------------------------|
| TEST                                                                 | CONDITIONS                                                     | REQUIREMENTS                                 |                                    | TYPICAL                                          |
|                                                                      |                                                                | ESA/SCC 4001/023                             | MIL-PRF-55342G                     |                                                  |
| Short time overload                                                  | $U = \sqrt{(6.25 P_n \times R_n)}$<br>$U_{max.} < 2 U_L - 2 s$ | $\pm 0.05 \% + (0.05 \Omega \times 100/R_n)$ | 0.10 %                             | $\pm 0.01 \%$                                    |
| Rapid temperature change                                             | -55 °C / +155 °C 5 cycles<br>CEI 66-2-14 Test Na               | $\pm 0.05 \% + (0.05 \Omega \times 100/R_n)$ | 0.1 %<br>(for 100 cycles)          | $\pm 0.01 \%$<br>$\pm 0.015 \%$ (for 500 cycles) |
| Soldering<br>(thermal shock)                                         | 260 °C / 10 s<br>CEI 68-2-20 A Test T6<br>(met. 1A)            | $\pm 0.05 \% + (0.05 \Omega \times 100/R_n)$ | -                                  | $\pm 0.005 \%$                                   |
| Terminal strength:<br>adhesion bend strength<br>of end plated facing | CEI 115-1 Clause 4.32<br>CEI 115-1 Clause 4.33                 | $\pm 0.05 \% + (0.05 \Omega \times 100/R_n)$ | -                                  | $\pm 0.01 \%$                                    |
| Climatic sequence                                                    | CEI 67-2-1 / CEI 68-2-2<br>CEI 67-2-13 / CEI 68-2-30           | $\pm 0.10 \% + (0.05 \Omega \times 100/R_n)$ | -                                  | $\pm 0.02 \%$<br>Insulation resistance > 1 GΩ    |
| Load life                                                            | 2000 h Pn at +70 °C<br>90' / 30' cycle                         | $\pm 0.15 \% + (0.05 \Omega \times 100/R_n)$ | 0.5 %                              | $\pm 0.02 \%$<br>Insulation resistance > 1 GΩ    |
| High temperature exposure                                            | 2000 h Pn at +155 °C<br>CEI 68-2-20A Test B                    | $\pm 0.15 \% + (0.05 \Omega \times 100/R_n)$ | $\pm 0.10 \%$<br>(duration 1000 h) | $\pm 0.05 \%$<br>Insulation resistance > 1 GΩ    |

| ESCC/PHR CODIFICATION CORRESPONDANCE TABLES |       |           |              |
|---------------------------------------------|-------|-----------|--------------|
| VARIANT                                     | MODEL | CASE SIZE | TERMINATION  |
| 13                                          | PHR   | 0402      | B (tin/lead) |
| 01                                          |       | 0603      |              |
| 02                                          |       | 0805      |              |
| 03                                          |       | 1206      |              |
| 04                                          |       | 2010      |              |
| 14                                          |       | 0402      | G (gold)     |
| 05                                          |       | 0603      |              |
| 06                                          |       | 0805      |              |
| 07                                          |       | 1206      |              |
| 08                                          |       | 2010      |              |

| ESCC/PHR CODIFICATION CORRESPONDANCE TABLES |           |          |
|---------------------------------------------|-----------|----------|
| TEMPERATURE COEFFICIENT                     | ESCC CODE | PHR CODE |
| 5 ppm/°C (+22 °C; +70 °C)                   | 0         | Z        |
| 10 ppm/°C (-55 °C; +155 °C)                 | 1         | Y        |
| 25 ppm/°C (-55 °C; +155 °C)                 | 2         | E        |
| 5 ppm/°C (-55 °C; +155 °C)                  | 9         | C        |

| ESCC/PHR CODIFICATION CORRESPONDANCE TABLES |           |          |
|---------------------------------------------|-----------|----------|
| TOLERANCE                                   | ESCC CODE | PHR CODE |
| 0.1 %                                       | B         | B        |
| 0.05 %                                      | W         | W        |
| 0.02 %                                      | P         | P        |
| 0.01 %                                      | L         | L        |

**GLOBAL PART NUMBER INFORMATION**

LIMITED TO 18 DIGITS: If more digits are necessary a codification of some digits might be necessary

|                                                     |          |                                                                                                             |          |                                                                                                                                                                                                              |          |          |          |                                                              |          |                                           |          |                                                                         |          |                                |          |          |          |
|-----------------------------------------------------|----------|-------------------------------------------------------------------------------------------------------------|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|----------|----------|--------------------------------------------------------------|----------|-------------------------------------------|----------|-------------------------------------------------------------------------|----------|--------------------------------|----------|----------|----------|
| <b>P</b>                                            | <b>H</b> | <b>R</b>                                                                                                    | <b>0</b> | <b>6</b>                                                                                                                                                                                                     | <b>0</b> | <b>3</b> | <b>Y</b> | <b>1</b>                                                     | <b>0</b> | <b>0</b>                                  | <b>3</b> | <b>B</b>                                                                | <b>B</b> | <b>T</b>                       | <b>0</b> | <b>1</b> | <b>4</b> |
| TYPE                                                |          | TCR                                                                                                         |          | OHMIC<br>VALUE                                                                                                                                                                                               |          |          |          | TOLERANCE                                                    |          | TERMINATION                               |          | PACKAGING                                                               |          | OPTION                         |          |          |          |
| PHR0402<br>PHR0603<br>PHR0805<br>PHR1206<br>PHR2010 |          | Y = ± 10 ppm/°C<br>E = ± 25 ppm/°C<br>Z = 5 ppm/°C<br>(+22 °C; +70 °C)<br>C = 5 ppm/°C<br>(-55 °C; +155 °C) |          | The first three digits are<br>significant figures and the<br>last digit specifies the<br>number of zero to follow. R<br>designates decimal point.<br>Example:<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 = ± 0.10 % |          | B: SnPb over<br>nickel barrier<br>G: Gold |          | For more<br>information<br>see<br>Codification<br>of Packaging<br>table |          | Leave blank<br>if no<br>option |          |          |          |

**Note**

- Terminations B: Variants 01 / 03 / 05 / 07 and 13  
Terminations G: Variants 02 / 04 / 06 / 08 and 14

**GLOBAL PART NUMBER INFORMATION**

ESCC Code

|           |   |                                                                                             |   |                                                                                                                                                                                                  |   |   |                                                              |   |                                                                                                           |   |   |                                                     |   |   |   |
|-----------|---|---------------------------------------------------------------------------------------------|---|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---|--------------------------------------------------------------|---|-----------------------------------------------------------------------------------------------------------|---|---|-----------------------------------------------------|---|---|---|
| 4         | 0 | 0                                                                                           | 1 | 0                                                                                                                                                                                                | 2 | 3 | 0                                                            | 1 | 1                                                                                                         | 0 | 0 | 3                                                   | B | 1 | T |
| ESCC SPEC |   | VARIANT                                                                                     |   | OHMIC VALUE                                                                                                                                                                                      |   |   | TOLERANCE                                                    |   | TCR                                                                                                       |   |   | PACKAGING                                           |   |   |   |
| 4001023   |   | 13 or 14 = 0402<br>01 or 05 = 0603<br>02 or 06 = 0805<br>03 or 07 = 1206<br>04 or 08 = 2010 |   | The first three digits are significant figures and the last digit specifies the number of zero to follow. R designates decimal point.<br>Example:<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 = ± 0.10 % |   | 1 = ± 10 ppm/°C<br>0 = ± 5 ppm/°C (+22 °C; +70 °C)<br>2 = ± 25 ppm/°C<br>9 = ± 5 ppm/°C (-55 °C; +155 °C) |   |   | T = For tape and reel (leave blank for waffle pack) |   |   |   |

**CODIFICATION PACKAGING - Waffle Pack**

| CODE 18 | PACKAGING                                |
|---------|------------------------------------------|
| W       | 25 min. (100 min. for size 0402), 1 mult |
| WA      | 100 min., 100 mult <sup>(1)</sup>        |

**CODIFICATION PACKAGING - Plastic Tape <sup>(2)</sup>**

| CODE 18 | PACKAGING                                |
|---------|------------------------------------------|
| T       | 50 min. (100 min. for size 0402), 1 mult |
| TA      | 100 min., 100 mult                       |
| TB      | 250 min., 250 mult                       |
| TC      | 500 min., 500 mult                       |
| TD      | 1000 min., 1000 mult                     |
| TE      | 2500 min., 2500 mult                     |
| TF      | Full tape <sup>(3)</sup>                 |

**CODIFICATION PACKAGING - Paper Tape <sup>(2)</sup>**

| CODE 18 | PACKAGING                |
|---------|--------------------------|
| 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      | 2500 min., 2500 mult     |
| PF      | Full tape <sup>(3)</sup> |

**Notes**

- <sup>(1)</sup> Available only in size 1206.
- <sup>(2)</sup> Plastic tape in standard for all sizes except 0402. Paper tape in standard for size 0402 (option for other sizes. Availability to be checked with factory).
- <sup>(3)</sup> Qty. depending on size of chips.



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**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.**

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