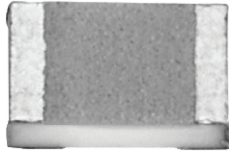


ESCC (e) 4001/023 Qualified R Failure Rate High Precision (10 ppm/°C, 0.05 %) Thin Film Chip Resistors



LINKS TO ADDITIONAL RESOURCES



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

These HiRel 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 (± 10 ppm/°C).

FEATURES

**HALOGEN
FREE**

- Load life stability at ± 70 °C for 2000 h: 0.25 % under Pn
- Temperature coefficient to: 10 ppm/°C
- Very low noise (< -35 dB) and voltage coefficient (< 0.01 ppm/V)
- Resistance range: 100 Ω to 3.01 M Ω (depending on size)
- Tolerances down to 0.05 %
- SnPb terminations over nickel barrier
- ESCC 4001 (generic specification)
- ESCC 4001/023 (detail specification)
- ESCC qualified
- R failure rate (0.01 % per 1000 h)
- SMD wraparound chip resistor
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

STANDARD ELECTRICAL SPECIFICATIONS

| MODEL | SIZE | ESCC VARIANT NUMBER | RESISTANCE RANGE Ω | RATED POWER AT +70 °C (Pn) W | LIMITING ELEMENT VOLTAGE (UL) V | INSULATION VOLTAGE (U _i) V | TOLERANCE \pm % | TEMPERATURE COEFFICIENT \pm ppm/°C |
|---------------|------|---------------------|---------------------------|------------------------------|---------------------------------|--|-------------------|--------------------------------------|
| PFRR 0402 (e) | 0402 | 15 | 100 to 150K | 0.05 | 40 | 50 | 0.05, 0.1 | 10, 25 |
| PFRR 0603 (e) | 0603 | 09 | 100 to 500K | 0.1 | 50 | 100 | 0.05, 0.1 | 10, 25 |
| PFRR 0805 (e) | 0805 | 10 | 100 to 750K | 0.125 | 100 | 200 | 0.05, 0.1 | 10, 25 |
| PFRR 1206 (e) | 1206 | 11 | 100 to 3.5M | 0.25 | 150 | 300 | 0.05, 0.1 | 10, 25 |
| PFRR 2010 (e) | 2010 | 12 | 100 to 6M | 0.50 | 200 | 300 | 0.05, 0.1 | 10, 25 |

CLIMATIC SPECIFICATIONS

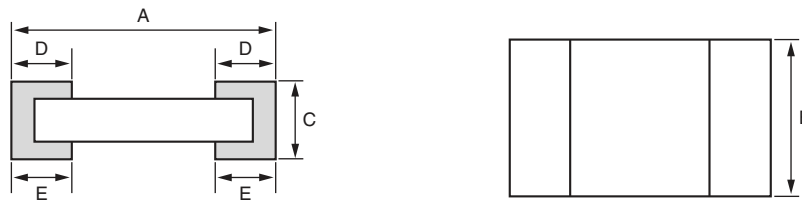
| | |
|---|------------------------|
| Operating temperature range | -55 °C; +155 °C |
| Soldering temperature (T _{sol}) | 260 °C, immersion 10 s |

MECHANICAL SPECIFICATIONS

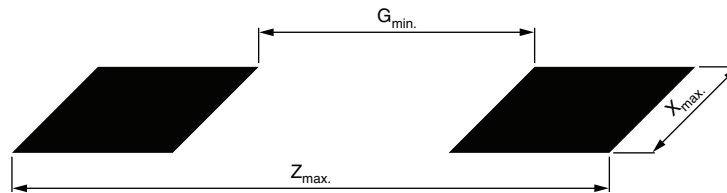
| | |
|--------------------|---|
| Substrate material | Alumina |
| Technology | Thin Film |
| Film | Nickel Chromium with mineral passivation |
| Protection | Epoxy and Silicon |
| Terminations | B type: SnPb over nickel barrier for solder reflow |

QUALIFIED OHMIC RANGE: MAX. VALUE

| PFRR0402 | PFRR0603 | PFRR0805 | PFRR1206 | PFRR2010 |
|----------------|----------------|----------------|--------------|-----------------|
| 100 k Ω | 261 k Ω | 301 k Ω | 1 M Ω | 3.01 M Ω |

DIMENSIONS in millimeters


| VARIANT NUMBER | STYLE | A | | B | | C | | D | | E | |
|----------------|-------|------|------|------|------|------|------|------|------|------|------|
| | | Min. | Max. | Min. | Max. | Min. | Max. | Min. | Max. | Min. | Max. |
| 09 | 0603 | 1.39 | 2.16 | 0.62 | 1.01 | 0.25 | 1.02 | 0.17 | 0.51 | 0.25 | 0.51 |
| 10 | 0805 | 1.78 | 2.55 | 1.14 | 1.53 | 0.25 | 1.02 | 0.17 | 0.51 | 0.25 | 0.51 |
| 11 | 1206 | 2.87 | 3.64 | 1.47 | 1.86 | 0.25 | 1.02 | 0.17 | 0.51 | 0.25 | 0.51 |
| 12 | 2010 | 4.95 | 5.72 | 2.41 | 2.8 | 0.25 | 1.02 | 0.35 | 0.85 | 0.35 | 0.85 |
| 15 | 0402 | 0.87 | 1.64 | 0.47 | 0.86 | 0.25 | 1.02 | 0.09 | 0.38 | 0.12 | 0.38 |

LAND PATTERN DIMENSIONS in millimeters


| CHIP SIZE | 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 |

Note

- Suggested land pattern: According to IPC-7351

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 $2 U_L$ whichever is less - duration 2 s



| GLOBAL PART NUMBER INFORMATION | | | | | | | | | | | | | | | |
|--|---|------------------------------------|---|--|---|---|---|------------------------------|---|-----------------------------|---|--|---|---|---|
| New Global Part Numbering: PFRR0603Y1003BBT (preferred part number format) | | | | | | | | | | | | | | | |
| P | F | R | R | 0 | 6 | 0 | 3 | Y | 1 | 0 | 0 | 3 | B | B | T |
| TYPE | | TCR | | OHMIC VALUE | | | | TOLERANCE | | TERMINATION | | PACKAGING | | | |
| PFRR0402 PFRR0603 PFRR0805 PFRR1206 PFRR2010 | | Y = ± 10 ppm/°C E = ± 25 ppm/°C | | The first three digits are significant figures and the last digit specifies the number of zeros to follow. Example: 3901 = 3900 Ω 1004 = 1 MΩ | | | | W = ± 0.05 % B = ± 0.10 % | | B: SnPb over nickel barrier | | For more information see Codification of Packaging table | | | |

| CODIFICATION OF PACKAGING | |
|--|--|
| CODE 18 | PACKAGING |
| WAFFLE PACK | |
| W | 100 min., 1 mult |
| WA | 100 min., 100 mult (available only in size 1206) |
| PLASTIC TAPE (in standard for all sizes) | |
| 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) |
| PAPER TAPE (Available for 0402, 0603, 0805 and 1206. Please consult Vishay Sfernice for 2010 size.) | |
| PT | 100 min., 1 mult |
| PA | 100 min., 100 mult |
| PB | 250 min., 250 mult |
| PC | 500 min., 500 mult |
| PD (not available for size 0402) | 1000 min., 1000 mult |
| PE (not available for size 0402) | 2500min., 2500 mult |
| PF (not available for size 0402) | Full tape (quantity depending on size of chips) |

| GLOBAL PART NUMBER INFORMATION | | | | | | | | | | | | | | | |
|--------------------------------|---|---|---|--------------|---|--|---|---|---|------------------------------|---|------------------------------------|---|---|---|
| ESCC Code | | | | | | | | | | | | | | | |
| 4 | 0 | 0 | 1 | 0 | 2 | 3 | 0 | 9 | R | 1 | 0 | 0 | 3 | B | 1 |
| ESCC SPEC | | VARIANT | | FAILURE RATE | | OHMIC VALUE | | | | TOLERANCE | | TCR | | | |
| 4001023 | | 0402 = 15 0603 = 09 0805 = 10 1206 = 11 2010 = 12 | | R | | The first three digits are significant figures and the last digit specifies the number of zeros to follow. Example: 3901 = 3900 Ω 1004 = 1 MΩ | | | | W = ± 0.05 % B = ± 0.10 % | | 1 = ± 10 ppm/°C 2 = ± 25 ppm/°C | | | |



Vishay Sfernice thin film is the first passive manufacturer to hold the ESCC Technology Flow Qualification, official certificate is available on ESCIES web site <https://escies.org/ReadArticle?docId=727>.

This qualification open the door to a new concept at ESA: The Failure Rate option (similar to the one offered in the MIL system), for instance R failure rate: 0.01 % per 1000 h.

New specifications describing this new concept have been released by the ESA:

2544001: Requirements for the Technology Flow Qualification of Film Resistors
<https://escies.org/escc/specifications/2544001.pdf>

26000: Failure Rate Level Sampling Plans and Procedures
<https://escies.org/escc/specifications/26000.pdf>

21300: Terms, Definitions, Abbreviations, Symbols and Units
<https://escies.org/escc/specifications/21300.pdf>

21700: General Requirements for the Marking of the ESCC Components
<https://escies.org/escc/specifications/21700.pdf>

4001: Generic Specification Resistors Fixed Film
<https://escies.org/escc/specifications/4001.pdf>

4001023: Resistors, Fixed, Chip, Thin Film, Type PHR and PFRR
<https://escies.org/escc/specifications/4001023.pdf>

Parts are delivered with space C.O.C.

Parts undergo 100 % overload at end of production process.

ESCC/PFRR CODIFICATION CORRESPONDANCE TABLES

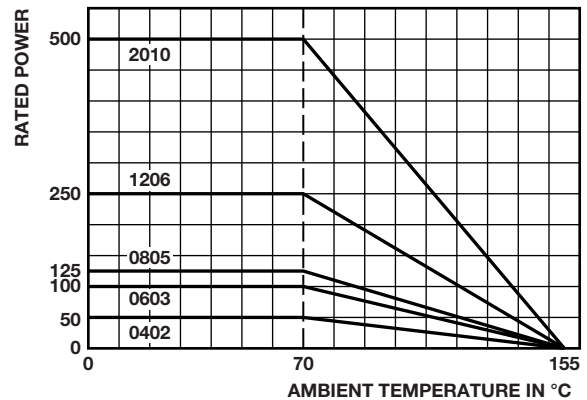
| VARIANT | MODEL | CASE SIZE | TERMINATION |
|---------|-------|-----------|--------------|
| 15 | PFRR | 0402 | B (tin/lead) |
| 09 | PFRR | 0603 | B (tin/lead) |
| 10 | PFRR | 0805 | B (tin/lead) |
| 11 | PFRR | 1206 | B (tin/lead) |
| 12 | PFRR | 1210 | B (tin/lead) |

| TEMPERATURE COEFFICIENT | ESCC CODE | PFRR CODE |
|-------------------------------|-----------|-----------|
| 10 ppm/°C (- 55 °C; + 155 °C) | 1 | Y |
| 25 ppm/°C (- 55 °C; + 155 °C) | 2 | E |

| TOLERANCE | MODEL | CASE SIZE |
|-----------|-------|-----------|
| 0.1 % | B | B |
| 0.05 % | W | W |

| 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 | | |
| | | MIN. | MAX. | |
| 0402 | 340 | 100 | 5000 | |
| 0603 | 100 | | 4000 | 8 mm |
| 0805 | | | | |
| 1206 | 140 | | | |
| 2010 | 60 | 2000 | 12 mm | |

POWER DERATING CURVE



EXTENDED FEATURES

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



| PERFORMANCE | | | | |
|---|---|--|------------------------------------|--|
| TEST | CONDITIONS | REQUIREMENTS | | TYPICAL |
| | | ESA/SCC 4001/023 | MIL-PRF-55342G | |
| Short time overload | $U = \sqrt{(6.25 Pr \times Rn)}$ $U_{max.} < 2 UL - 2 s$ | $\pm 0.05 \% + (0.05 \Omega \times 100/Rn)$ | 0.10 % | $\pm 0.01 \%$ |
| Rapid temperature change | - 55 °C/+ 155 °C 5 cycles CEI 66-2-14 Test Na | $\pm 0.05 \% + (0.05 \Omega \times 100/Rn)$ | 0.1 % (for 100 cycles) | $\pm 0.01 \%$ $\pm 0.015 \%$ (for 500 cycles) |
| Soldering (thermal shock) | 260 °C/10 s CEI 68-2-20 A Test T6 (met. 1A) | $\pm 0.05 \% + (0.05 \Omega \times 100/Rn)$ | - | $\pm 0.005 \%$ |
| Terminal strength: Adhesion bend strength of end plated facing | CEI 115-1 Clause 4.32 CEI 115-1 Clause 4.33 | $\pm 0.05 \% + (0.05 \Omega \times 100/Rn)$ | - | $\pm 0.01 \%$ |
| Climatic sequence | CEI 67-2-1/CEI 68-2-2 CEI 67-2-13/CEI 68-2-30 | $\pm 0.10 \% + (0.05 \Omega \times 100/Rn)$ | - | $\pm 0.02 \%$ Insulation resistance > 1 GΩ |
| Load life | 2000 h Pr at + 70 °C 90'/30' cycle 8000 h | $\pm 0.25 \% + (0.05 \Omega \times 100/Rn)$ 1 % + (0.05 Ω x 100/Rn) | 0.5 % | $\pm 0.05 \%$ (8000 h) Insulation resistance > 1 GΩ |
| High temperature exposure | 2000 h Pr at + 155 °C CEI 68-2-20A Test B | $\pm 0.15 \% + (0.05 \Omega \times 100/Rn)$ | $\pm 0.10 \%$ (duration 1000 h) | $\pm 0.05 \%$ Insulation resistance > 1 GΩ |

| CODIFICATION OPTIONS ON TWO DIGITS | |
|------------------------------------|-----------------|
| OPTION | OPTION 2 DIGITS |
| ... | ... |
| 0099 | 99 |
| 0100 | 0A |
| 0101 | 0B |
| 0102 | 0C |
| 0103 | 0D |
| 0104 | 0E |
| 0105 | 0F |
| ... | ... |
| 0124 | 0Y |
| 0125 | 0Z |
| 0126 | 1A |
| 0127 | 1B |
| 0128 | 1C |
| ... | ... |
| 0320 | 8M |
| 0321 | 8N |
| 0322 | 8O |
| 0323 | 8P |
| 0324 | 8Q |
| 0325 | 8R |
| ... | ... |

| CODIFICATION OF SIZES | |
|-----------------------|---------|
| CODE 18 | CODE 40 |
| 9 | 0402 |
| C | 0603 |
| D | 0805 |
| H | 1206 |
| J | 2010 |



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.

Hyperlinks included in this datasheet may direct users to third-party websites. These links are provided as a convenience and for informational purposes only. Inclusion of these hyperlinks does not constitute an endorsement or an approval by Vishay of any of the products, services or opinions of the corporation, organization or individual associated with the third-party website. Vishay disclaims any and all liability and bears no responsibility for the accuracy, legality or content of the third-party website or for that of subsequent links.

Vishay products are not designed for use in life-saving or life-sustaining applications or any application in which the failure of the Vishay product could result in personal injury or death unless specifically qualified in writing by Vishay. 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.