# THIN FILM RESISTORS

## High Reliability Products


Vishay Sfernice

### FEATURES

- CECC qualified
- ESCC qualified (Space level and R Failure Rate)
- ESCC QML qualification
- Products to Source Control Drawing

### APPLICATIONS

- Space (satellites, launcher, International Space Station)
- Aeronautics
- Military

# Vishay Sfernice Products for Aeronautics/Military/Space (AMS) Applications

This Selector Guide provides an overview of Vishay Sfernice resistive products for aeronautics/military/space (AMS) applications and includes tables showing actual device photos and key specifications. These device summary tables are offered in two sections. The Qualified Products table lists resistive products which are qualified according to the following standards:

- ESCC
- ESCC with Failure Rate
- CECC (European military standard, refers to IEC standards for parts qualification testing)
- Vishay Sfernice/Thin Film division is EN9100 certified

The details of these testing specifications are provided in a table on page 7.

The tables on pages 4 through 6 list commercial bare chip and bare network devices which can be upgraded for space applications according to customer specifications.

# European Standards for Space Products

European Space Agency (ESA) standards encompass both generic and detailed specifications for electronic components. The generic specifications describe manufacturing processes, testing, and procurement. Detailed specifications apply these generic standards to a particular family of products.

Traditionally there have been two levels of European Preferred Part List (EPPL) within the ESA system: EPPL Level 1, which encompassed fully qualified products or products which have undergone an evaluation by a national space agency; and EPPL Level 2, which encompasses products that have been qualified by a space customer. ESA also maintains a Qualified Product List (QPL) and Qualified Manufacturer List (QML).

Vishay Sfernice is represented on both the QPL and QML and is also the first manufacturer of passive electronic components to be added to the new category of ESCC / QML ESCC Technology Flow Qualified Manufacturer.

Shipments of Vishay Sfernice AMS products normally include the following documents:

- COC (space COC for space level and failure rate)
- Data documentation (space level only)
- Chart II and Chart III test results summary (space level only)
- Results of additional testing specified by customer
- Lot Validation Test (LVT) results (LVT 1, LVT2 and LVT3 levels are offered) if required by customer (not mandatory)

Pre-cap inspection and final inspection can be performed by the end customer or at the factory upon request.

| MODEL | CHPHR | CHPFR | LHR | PFRR |
|---|---|---|---|---|
| |  |  |  |  |
| **Type** | Wraparound | Wraparound | Wraparound | Wraparound |
| **Specification** | ESCC 4001/026 | ESCC 4001/026 | To be defined | ESCC 4001/023 |
| **Standard** | ESA | ESA | ESA | ESA |
| **Logos** | | | | |
| **Listed in EPPL** | EPPL Level 1 | | | |
| **ESCC QML Certified** | | | | Yes |
| **Variants** | 01 to 05 | 06 to 10 | | 09 to 12 |
| **Sizes** | 0603 / 0805 / 1206 / 2010 / 2512 | 0603 / 0805 / 1206 / 2010 / 2512 | 0603 to 2010 (2512 under development) | 0603 / 0805 / 1206 / 2010 |
| **Resistance Range** | 1R to 10M | 1R to 10M | 0R100 to 9R99 | 100R to 3M01 |
| **Stability Class** | | | | 0.25 |
| **Power Rating @ 70 °C** | 100 mW to 800 mW | 100 mW to 800 mW | 100 mW to 500 mW | 100 mW to 500 mW |
| **Maximum Voltage** | 50 V to 300 V | 50 V to 300 V | 50 V | 50 V to 200 V |
| **Tolerance** | 1 % to 5 % | 1 % to 5 % | 1 % to 20 % | 0.05 % to 0.1 % |
| **Tolerance Ratio** | | | | |
| **Temperature Coefficient** | 100 ppm/°C and 200 ppm/°C | 100 ppm/°C and 200 ppm/°C | 50 ppm/°C to 300 ppm/°C | 10 ppm/°C and 25 ppm/°C |
| **Load Life Stability (2000 h @ 70 °C @ Pn)** | 1 % | R Failure Rate | 0.5 % at 70 °C 2000 h @ Pn | R Failure Rate |
| **Operating Temperature Range** | - 55 °C; + 155 °C | - 55 °C; + 155 °C | - 55 °C; + 155 °C | - 55 °C; + 155 °C |
| **Storage Temperature Range** | - 55 °C; + 155 °C | - 55 °C; + 155 °C | - 55 °C; + 155 °C | - 55 °C; + 155 °C |
| **Special Feature** | High-temperature storage: 1.5 % | | | |
| **Comments** | | Specification and qualification ongoing (Q4 2010) | ESA evaluation ongoing | |

For performances versus ohmic range, please refer to the product datasheet

# QUALIFIED PRODUCTS

| MODEL | PHR | PZHR | RV | PRAHR |
|---|---|---|---|---|
| |  |  |  |  |
| **Type** | Wraparound | Wraparound | Wraparound | Wraparound network |
| **Specification** | ESCC 4001/023 | To be defined | CECC 40401-010 | ESCC 4001/025 |
| **Standard** | ESA | ESA | CECC | ESA |
| **Logos** | | | | |
| **Listed in EPPL** | EPPL Level 1 | | N/A | EPPL Level 1 |
| **ESCC QML Certified** | Yes | | | Yes |
| **Variants** | 01 to 08 | | | 01 to 32 |
| **Sizes** | 0603 / 0805 / 1206 / 2010 | 0603 / 0805 / 0402 1206 / 2010 / 2512 | 0505 / 0603 / 0805 / 1206 | 100, 135, 182 |
| **Resistance Range** | 10R to 3M | 0R00 | 100R to 1M | 100R to 1M |
| **Stability Class** | 0.15 | N/A | | |
| **Power Rating @ 70 °C** | 100 mW to 500 mW | 70 mW to 1000 mW | 125 mW to 330 mW | 100 mW (per resistor) |
| **Maximum Voltage** | 35 V to 100 V | | 50 V to 75 V | 35 V to 100 V |
| **Tolerance** | 0.01 % to 0.1 % | N/A | 0.1 % to 5 % | 0.1 % to 1 % |
| **Tolerance Ratio** | | N/A | N/A | 0.05 % to 0.1 % |
| **Temperature Coefficient** | 5 ppm/°C to 25 ppm/°C | N/A | 10 ppm/°C and 25 ppm/°C | 10 ppm/°C abs 3 ppm/°C ratio |
| **Load Life Stability (2000 h @ 70 °C @ Pn)** | 0.02 % typical | | 0.05 % typical | 0.02 % on ratio |
| **Operating Temperature Range** | - 55 °C; + 155 °C | - 55 °C; + 155 °C | - 55 °C; + 155 °C | - 55 °C; + 155 °C |
| **Storage Temperature Range** | - 55 °C; + 155 °C | - 55 °C; + 155 °C | - 55 °C; + 155 °C | - 55 °C; + 155 °C |
| **Special Feature** | High-temperature storage: 0.15 % | Jumper-ohmic value guaranteed over full temperature range:<br>• 0603: 30 mR (1.5 A max)<br>• 0805: 20 mR (2.7 A max)<br>• 1206: 25 mR (3.2 A max)<br>• 2010: 25 mR (5.7 A max)<br>• 2512: 25 mR (6.3 A max) | | 2 to 8 resistors - unequal values available and qualified: CNW |
| **Comments** | 0402 ongoing | ESA specification and qualification ongoing (parts conform to MIL-PRF 32159) | | |

For performances versus ohmic range, please refer to the product datasheet

# SUITABLE FOR SPACE APPLICATIONS

## (to customer's specifications)

| MODEL | CS22 | CS33 | RMK22N | RMK33N | RMK48 / 408 | RMK55N<br>RMK515N |
|---|---|---|---|---|---|---|
| |  |  |  |  |  |  |
| **Type** | Bare Chip | Bare Network | Bare Chip | Bare Network | Bare network | Bare Chip |
| **Sizes** | 20 mil x 20 mil | 30 mil x 30 mil | 20 mil x 20 mil | 30 mil x 30 mil | 8 to 16 terminals | 50 mil x 50 mil<br>150 mil x 50 mil |
| **Resistance Range** | 10K to 10M | 10K to 5M | 50R to 300K | 1K to 250K | 500R to 200K | 1K to 750K<br>1K to 2M |
| **Power Rating @ 70 °C** | 50 mW | 125 mW | 50 mW | 50 mW | 125 mW to 250 mW | 125 mW to 250 mW |
| **Maximum Voltage** | 100 V | 100 V | 100 V | 100 V | 100 V | 100 V |
| **Absolute Tolerance** | 0.5 % to 2 % | 0.5 % to 2 % | 0.1 % to 1 % | 0.1 % to 1 % | 0.1 % to 1 % | 0.01 % to 1 % |
| **Tolerance Ratio** | | 0.50 % | | 0.01 % to 0.1 % | 0.01 % to 0.05 % | |
| **Absolute Temperature Coefficient** | 100 ppm/°C (50 ppm upon request) | 100 ppm/°C | 5 ppm/°C typical | 10 ppm/°C | 10 ppm/°C | 10 ppm/°C |
| **Temperature Coefficient Ratio** | | 5 ppm/°C | | 2 ppm/°C | 2 ppm/°C | |
| **Load Life Stability (2000 h @ 70 °C @Pn)** | 0.10 % | 0.1 % typical | 0.03 % typical | 0.03 % typical | 0.03 % typical | 0.03 % |
| **Operating temperature range** | - 55 °C; + 155 °C | - 55 °C; + 155 °C | - 55 °C; + 155 °C | - 55 °C; + 155 °C | - 55 °C; + 155 °C | - 55 °C; + 155 °C |
| **Storage Temperature Range** | - 55 °C; + 155 °C | - 55 °C; + 155 °C | - 55 °C; + 155 °C | - 55 °C; + 155 °C | - 55 °C; + 155 °C | - 55 °C; + 155 °C |
| **Special Feature** | | Unequal values upon request | | Unequal values upon request | | |
| **Qualification** | | | | | | |
| **Custom Part Number** | | CN | | CN | CN | |
| **Comments** | Customer Specifications need to be reviewed by Vishay Sfernice before approval for use in space applications | | | | | |

For performances versus ohmic range, please refer to the product datasheet

# SUITABLE FOR SPACE APPLICATIONS

## (to customer's specifications)

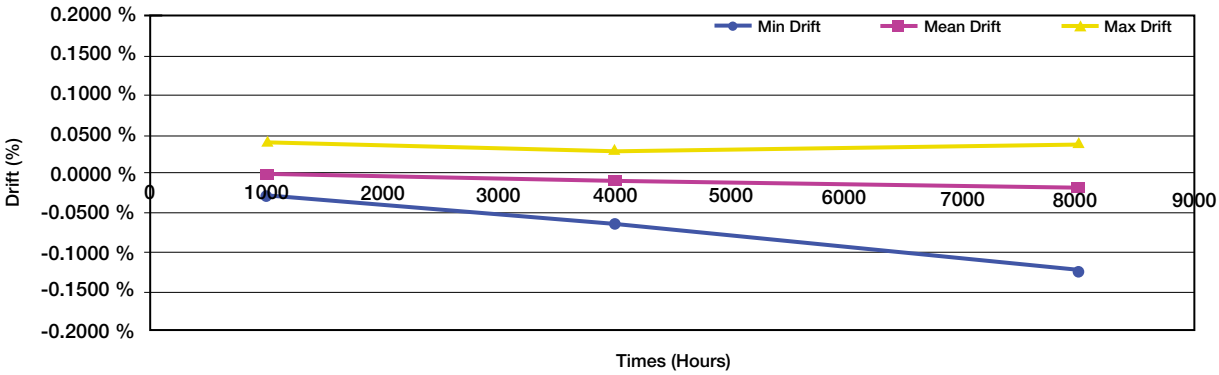
| MODEL | RSK22N | RSK33N | S (A, B, C) | TA22 | TA33 |
|---|---|---|---|---|---|
| |  |  |  |  |  |
| **Type** | Bare Chip | Bare Network | Bare chip | Bare Chip | Bare Network |
| **Sizes** | 20 mil x 20 mil | 30 mil x 30 mil | 1.5 x 1.5; 3 x 3; 5 x 5 | 20 mil x 20 mil | 30 mil x 30 mil |
| **Resistance Range** | 10R to 500K | 10R to 500K | 0R05 to 1R | 10R to 1M | 50R to 500K |
| **Power Rating @ 70 °C** | 50 mW | 250 mW | 500 mW to 6 W | 50 mW | 125 mW |
| **Maximum Voltage** | 100 V | 100 V | N/A | 50 V | 50 V |
| **Absolute Tolerance** | 0.1 % to 1 % | 0.5 % to 2 % | 1 % to 5 % | 0.5 % to 2 % | 0.5 % to 2 % |
| **Tolerance Ratio** | | 0.05 % to 0.5 % | | | 0.50 % |
| **Absolute Temperature Coefficient** | 25 ppm/°C | 25 ppm/°C | 100 ppm/°C | 100 ppm/°C (50 ppm upon request) | 100 ppm/°C |
| **Temperature Coefficient Ratio** | | 5 ppm/°C | | | 5 ppm/°C |
| **Load Life Stability (2000 h @ 70 °C @ Pn)** | 0.05 % typical | 0.03 % typical | 0.10 % | 0.07 % typical | 0.07 % typical |
| **Operating Temperature Range** | - 55 °C; + 155 °C | - 55 °C; + 155 °C | - 55 °C; + 125 °C | - 55 °C; + 155 °C | - 55 °C; + 155 °C |
| **Storage Temperature Range** | - 55 °C; + 155 °C | - 55 °C; + 155 °C | - 55 °C; + 155°C | - 55 °C; + 155 °C | - 55 °C; + 155 °C |
| **Special Feature** | | Unequal values upon request | Current sensor | | Unequal values upon request |
| **Qualification** | | | | | |
| **Custom Part Number** | | CN | | | CN |
| **Comments** | Customer Specifications need to be reviewed by Vishay Sfernice before approval for use in space applications | | | | |

| Specification | CECC | Periodicity of Testing | ESCC QML, ESCC Failure Rate Qualified Parts | Periodicity of Testing | ESCC Qualified Parts | Periodicity of Testing |
|---|---|---|---|---|---|---|
| | End of Production Tests | | | | | |
| Overload | Yes | Group B | Yes | All lots | Yes | All lots |
| Burn In | / | | / | | Yes | All lots |
| | Main Tests: Periodic tests (CECC, ESCC FR, and ESCC QML) or qualification/VOQ (ESA) | | | | | |
| Solderability | Yes | 3 months | Yes | 3 months | Yes | 12 months |
| TC | Yes | 12 months | Yes | 3 months | Yes | 24 months |
| Bending | Yes | 3 months | Yes | 3 months | Yes | 24 months |
| Rapid Change of Temperature | Yes | 3 months | Yes | 3 months | Yes | 24 months |
| Climatic Sequence | Yes | 3 months | Yes | 3 months | Yes | 24 months |
| Resistance to Soldering Heat | Yes | 3 months | Yes | 3 months | Yes | 24 months |
| Very High Temperature | Yes (155 °C) | 36 months | Yes (155 °C) | 12 months | Yes (155 °C) | 12 months |
| Load Life (1000 h) | Yes | 3 months | Yes | 3 months | Yes | |
| Load Life (2000 h) | / | | / | | Yes | 12 months or LVT2 |
| Load Life (8000 h) | / | | Yes | 15 months | / | |
| Damp Heat Steady State | Yes (10 days) | 12 months | / | 12 months | / | |

## Final Results of Drift After 8000 Hours

**Type : P0603 to P2010**
**Values : 100 Ω to 1.5 MΩ**

| Time | 1000 | 4000 | 8000 |
|---|---|---|---|
| Min Drift | -0.0279 % | -0.0638 % | -0.1240 % |
| Mean Drift | -0.0008 % | -0.0088 % | -0.0180 % |
| Max Drift | 0.0416 % | 0.0312 % | 0.0401 % |



**SEMICONDUCTORS:**
Rectifiers • High-Power Diodes and Thyristors • Small-Signal Diodes • Zener and Suppressor Diodes • FETs • Optoelectronics • ICs • Modules

**PASSIVE COMPONENTS:**
Resistive Products • Magnetics • Capacitors

One of the World's Largest Manufacturers of
**Discrete Semiconductors and Passive Components**

## WORLDWIDE SALES CONTACTS

### THE AMERICAS

**UNITED STATES**
VISHAY AMERICAS
ONE GREENWICH PLACE
SHELTON, CT 06484
UNITED STATES
PH: +1-402-563-6866
FAX: +1-402-563-6296

### ASIA

**SINGAPORE**
VISHAY INTERTECHNOLOGY ASIA PTE LTD.
37A TAMPINES STREET 92 #07-00
SINGAPORE 528886
PH: +65-6788-6668
FAX: +65-6788-0988

**P.R. CHINA**
VISHAY CHINA CO., LTD.
15D, SUN TONG INFOPORT PLAZA
55 HUAI HAI WEST ROAD
SHANGHAI 200030
P.R. CHINA
PH: +86-21-5258 5000
FAX: +86-21-5258 7979

**JAPAN**
VISHAY JAPAN CO., LTD.
SHIBUYA PRESTIGE BLDG. 4F
3-12-22, SHIBUYA
SHIBUYA-KU
TOKYO 150-0002
JAPAN
PH: +81-3-5466-7150
FAX: +81-3-5466-7160

### EUROPE

**GERMANY**
VISHAY ELECTRONIC GMBH
GEHEIMRAT-ROSENTHAL-STR. 100
95100 SELB
GERMANY
PH: +49-9287-71-0
FAX: +49-9287-70435

**FRANCE**
VISHAY S.A.
199, BLVD DE LA MADELEINE
06003 NICE, CEDEX 1
FRANCE
PH: +33-4-9337-2727
FAX: +33-4-9337-2726

**UNITED KINGDOM**
VISHAY LTD.
SUITE 6C, TOWER HOUSE
ST. CATHERINE'S COURT
SUNDERLAND ENTERPRISE PARK
SUNDERLAND SR5 3XJ
UNITED KINGDOM
PH: +44-191-516-8584
FAX: +44-191-549-9556

Build Vishay into your Design

VMN-SG2135-1007

www.vishay.com