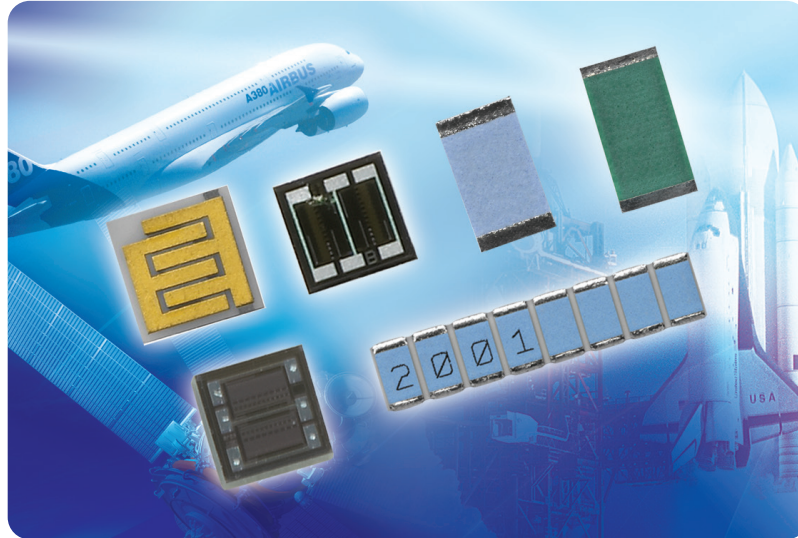


Thin Film Resistors, High Reliability Products



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 EN 9100 certified

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

The tables on pages 5 and 6 list commercial bare chip and bare network devices which can be upgraded for space applications according to customer specifications.

RESOURCES

- For technical questions contact sferthinfilm@vishay.com
- Sales contacts: www.vishay.com/doc?99914





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.



THIN FILM RESISTORS








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MODEL	<u>CHPHR</u>	<u>CHPFR</u>	<u>LHR</u>	<u>PFRR</u>
				
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 at 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 at 70 °C at P _n)	1 %	R failure rate	0.5 % at 70 °C 2000 h at P _n	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.

THIN FILM RESISTORS

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




MODEL	<u>PHR</u>	<u>PZHR</u>	<u>RV</u>	<u>PRA HR</u>
				
Type	Wraparound	Wraparound	Wraparound	Wraparound Network
Specification	ESCC 4001/023	TBD	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 at 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 absolute, 3 ppm/°C ratio
Load Life Stability (2000 h at 70 °C at P _n)	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: <ul style="list-style-type: none"> • 0603: 30 mΩ (1.5 A max.) • 0805: 20 mΩ (2.7 A max.) • 1206: 25 mΩ (3.2 A max.) • 2010: 25 mΩ (5.7 A max.) • 2512: 25 mΩ (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.



THIN FILM RESISTORS

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MODEL	CS 22	CS 33	RMK 22N	RMK 33N	RMK 408N, 508N, 48N, 816N, 914N
					
Type	Bare Chip	Bare Network	Bare Chip	Bare Network	Bare network
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
Resistance Range	10K to 10M	10K to 5M	50R to 300K	1K to 250K	500R to 200K
Power Rating at 70 °C	50 mW	125 mW	50 mW	50 mW	125 mW to 250 mW
Maximum Voltage	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 %
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
Temperature Coefficient Ratio		5 ppm/°C		2 ppm/°C	2 ppm/°C
Load Life Stability (2000 h at 70 °C at P _n)	0.10 %	0.1 % typical	0.03 % typical	0.03 % typical	0.03 % typical
Operating Temperature Range	-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
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.



THIN FILM RESISTORS

Vishay Sfernice

MODEL	RMK 55N , RMK 515N	RSK 22N	RSK 33N	TA 22	TA 33
Type	Bare Chip	Bare Chip	Bare Network	Bare Chip	Bare Network
Sizes	50 mil x 50 mil, 150 mil x 50 mil	20 mil x 20 mil	30 mil x 30 mil	20 mil x 20 mil	30 mil x 30 mil
Resistance Range	1K to 750K, 1K to 2M	10R to 500K	10R to 500K	10R to 1M	50R to 500K
Power Rating at 70 °C	125 mW to 250 mW	50 mW	250 mW	50 mW	125 mW
Maximum Voltage	100 V	100 V	100 V	50 V	50 V
Absolute Tolerance	0.01 % to 1 %	0.1 % to 1 %	0.5 % to 2 %	0.5 % to 2 %	0.5 % to 2 %
Tolerance Ratio			0.05 % to 0.5 %		0.50 %
Absolute Temperature Coefficient	10 ppm/°C	25 ppm/°C	25 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 at 70 °C at Pn)	0.03 %	0.05 % typical	0.03 % typical	0.07 % typical	0.07 % typical
Operating Temperature Range	-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
Special Feature			Unequal values upon request		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				



THIN FILM RESISTORS

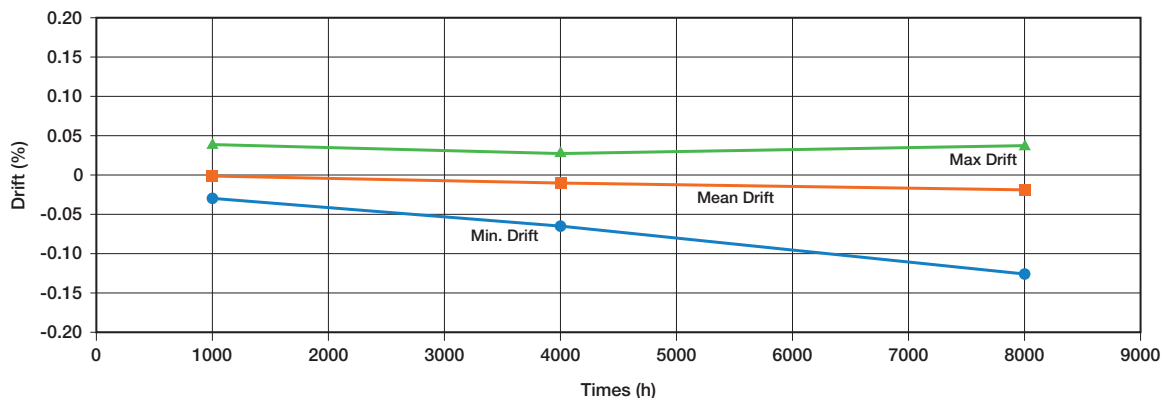
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Specification	CECC	Periodicity of Testing	ESCC QML, ESCC Failure Rate Qualified Parts	Periodicity of Testing	ESCC Qualified Parts	Periodicity of Testing
End of Production Tests						
Overload	Yes	Group B	Yes	All lots	Yes	All lots
Burn In	/		/		Yes	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 %



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