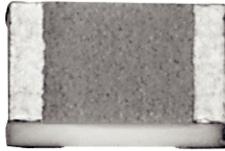


## ESCC (e) 4001/023 Qualified R Failure Rate High Precision (10 ppm/°C, 0.05 %) Thin Film Chip Resistors



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 ( $\pm 10$  ppm/°C).

### FEATURES

**HALOGEN  
FREE**

- Load life stability at  $\pm 70$  °C for 2000 h: 0.25 % under Pr
- Temperature coefficient to: 10 ppm/°C
- Very low noise ( $< -35$  dB) and voltage coefficient ( $< 0.01$  ppm/V)
- Resistance range: 100  $\Omega$  to 3.01 M $\Omega$  (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](http://www.vishay.com/doc?99912)

### STANDARD ELECTRICAL SPECIFICATIONS

MODEL	SIZE	ESCC VARIANT NUMBER	RESISTANCE RANGE $\Omega$	RATED POWER AT +70 °C (Pr) W	LIMITING ELEMENT VOLTAGE (UL) V	INSULATION VOLTAGE (U <sub>i</sub> ) V	TOLERANCE $\pm$ %	TEMPERATURE COEFFICIENT $\pm$ ppm/°C
PFRR 0402 (e)	0402	15	100 to 150K	0.05	30	50	0.05, 0.1	10, 25
PFRR 0603 (e)	0603	09	100 to 261K	0.1	50	100	0.05, 0.1	10, 25
PFRR 0805 (e)	0805	10	100 to 301K	0.125	100	200	0.05, 0.1	10, 25
PFRR 1206 (e)	1206	11	100 to 1M	0.25	150	300	0.05, 0.1	10, 25
PFRR 2010 (e)	2010	12	100 to 3.01M	0.50	200	300	0.05, 0.1	10, 25

### CLIMATIC SPECIFICATIONS

Operating temperature range	- 55 °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 Silicon
Terminations	<b>B type:</b> SnPb over nickel barrier for solder reflow

### QUALIFIED OHMIC RANGE: MAX. VALUE

PFRR0402	PFRR0603	PFRR0805	PFRR1206	PFRR2010
100 k $\Omega$	200 k $\Omega$	250 k $\Omega$	1 M $\Omega$	3 M $\Omega$

DIMENSIONS in millimeters									
VARIANT NUMBER	STYLE	A		B		C		D/E	
		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
09	0603	1.368	1.672	0.723	0.977	0.373	0.627	0.25	0.51
10	0805	1.758	2.062	1.143	1.397	0.373	0.627	0.25	0.51
11	1206	2.908	3.212	1.473	1.727	0.373	0.627	0.27	0.53
12	2010	4.898	5.232	2.413	2.667	0.373	0.627	0.35	0.61
15	0402	0.848	1.152	0.473	0.727	0.373	0.627	0.15	0.35

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
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-7351

**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		T: For tape and reel (leave blank for waffle pack)			

**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)

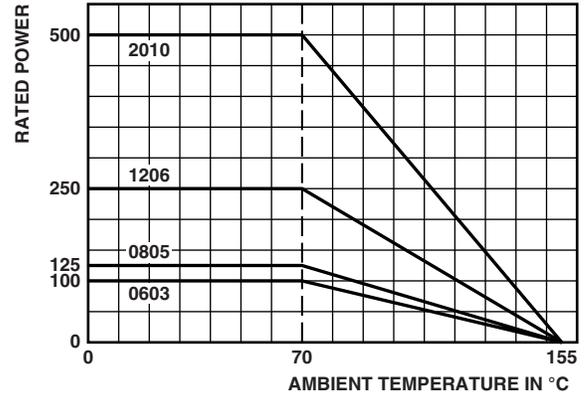
TEMPERATURE COEFFICIENT	ESCC CODE	PFRR CODE
10 ppm/°C (- 55 °C; + 155 °C)	1	Y
25 ppm/°C (- 55 °C; + 155 °C)	2	E

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	100	100	5000	8 mm	
0603					
0805					
1206					4000
2010					

**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	$\pm 0.25 \% + (0.05 \Omega \times 100/Rn)$ $1 \% + (0.05 \Omega \times 100/Rn)$	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



## 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.

Except as expressly indicated in writing, Vishay products are not designed for use in medical, life-saving, or life-sustaining applications or for any other application in which the failure of the Vishay product could result in personal injury or death. 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.

## Material Category Policy

**Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as RoHS-Compliant fulfill the definitions and restrictions defined under Directive 2011/65/EU of The European Parliament and of the Council of June 8, 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (EEE) - recast, unless otherwise specified as non-compliant.**

**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.**

**Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as Halogen-Free follow Halogen-Free requirements as per JEDEC JS709A standards. Please note that some Vishay documentation may still make reference to the IEC 61249-2-21 definition. We confirm that all the products identified as being compliant to IEC 61249-2-21 conform to JEDEC JS709A standards.**