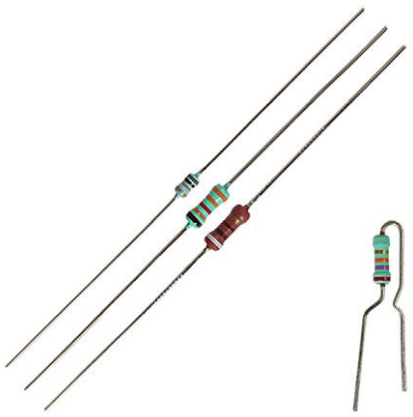
Standard Metal Film Leaded Resistors



FEATURES

- Small size (SFR16S: 0204, SFR25 / SFR25H: 0207)
- Low noise (max. 1.5 µV/V for $R > 1$ MΩ)
- Compatible to both lead (Pb)-free and lead containing soldering processes
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Pb-free

RoHS COMPLIANT

HALOGEN FREE

APPLICATIONS

- General purpose resistors

A homogeneous film of metal alloy is deposited on a high grade ceramic body. After a helical groove has been cut in the resistive layer, tinned connecting leads of electrolytic copper are welded to the end-caps.

The resistors are coated with a colored lacquer (light-blue for type SFR16S; light-green for type SFR25 and red-brown for type SFR25H) which provides electrical, mechanical, and climatic protection. The encapsulation is resistant to all cleaning solvents in accordance with IEC 60068-2-45.

TECHNICAL SPECIFICATIONS

DESCRIPTION	SFR16S	SFR25	SFR25H
DIN size	0204	0207	0207
Resistance range	1 Ω to 3 MΩ; jumper (0 Ω)	0.22 Ω to 10 MΩ; jumper (0 Ω)	0.22 Ω to 10 MΩ
Resistance tolerance	± 5 %; ± 1 %		
Temperature coefficient	± 250 ppm/K; ± 100 ppm/K		
Rated dissipation, P_{70}	0.5 W	0.4 W	0.5 W
Thermal resistance	170 K/W	200 K/W	150 K/W
Operating voltage, $U_{max.}$ AC/DC	200 V	250 V	350 V
Operating temperature range	-55 °C to 155 °C		
Permissible film temperature	155 °C		
Max. resistance change at rated dissipation $\lvert\Delta R/R$ max.$\rvert$, after 1000 h	± (2 % R + 0.05 Ω)		

Note

- R value is measured with probe distance of 24 mm ± 1 mm using 4-terminal method.

For technical questions, contact: filmresistorsleaded@vishay.com

THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

TEMPERATURE COEFFICIENT AND RESISTANCE RANGE

TYPE	TOLERANCE	TCR	RESISTANCE	E-SERIES
SFR16S	± 5 %	± 250 ppm/K	1 Ω to ≤ 4.7 Ω	E24
		± 100 ppm/K	4.7 Ω to 100 kΩ	
		± 250 ppm/K	> 100 kΩ to 3 MΩ	
	± 1 %	± 100 ppm/K	5.6 Ω to 100 kΩ	E24; E96
		± 250 ppm/K	> 100 kΩ to 976 kΩ	
	Jumper (0 Ω)	-	≤ 30 mΩ; $I_{max.}$ = 3 A	-
SFR25, SFR25H	± 5 %	± 250 ppm/K	0.22 Ω to 4.7 Ω	E24
		± 100 ppm/K	> 4.7 Ω to 1 MΩ	
		± 250 ppm/K	> 1 MΩ to 10 MΩ	
	± 1 %	± 250 ppm/K	1 Ω to 4.7 Ω	E24; E96
		± 100 ppm/K	> 4.7 Ω to 1 MΩ	
		± 250 ppm/K	> 1 MΩ to 10 MΩ	
	Jumper (0 Ω) (1)	-	≤ 30 mΩ; $I_{max.}$ = 5 A	-

Note

(1) Jumper is only available for SFR25.

PART NUMBER AND PRODUCT DESCRIPTION

PART NUMBER: SFR2500001001FA500

S	F	R	2	5	0	0	0	0	1	0	0	1	F	A	5	0	0

TYPE	VARIANT	TCR/MATERIAL	RESISTANCE	TOLERANCE	PACKAGING	SPECIAL
SFR16S0 **SFR2500** **SFR25H0**	**0** = neutral **Z** = value overflow (special)	**0** = standard **Z** = jumper	**3 digit value** **1 digit multiplier** MULTIPLIER **7** = $*10^{-3}$ **2** = $*10^{2}$ **8** = $*10^{-2}$ **3** = $*10^{3}$ **9** = $*10^{-1}$ **4** = $*10^{4}$ **0** = $*10^{0}$ **5** = $*10^{5}$ **1** = $*10^{1}$ **Z** = 0000	**F** = ± 1 % **J** = ± 5 % **Z** = jumper	**N4** **A5** **A1** **R5**	The 2 digits are used for all special parts. **00** = standard

PRODUCT DESCRIPTION: SFR25 1 % A5 1K0

SFR25	1 %	A5	1K0
TYPE	TOLERANCE	PACKAGING (1)	RESISTANCE VALUE
SFR16S **SFR25** **SFR25H**	**± 1 %** **± 5 %**	**N4** **A5** **A1** **R5**	**47K** = 47 kΩ **51R1** = 51.1 Ω

Notes

- The products can be ordered using either the PRODUCT DESCRIPTION or the PART NUMBER.

(1) N4 packaging indicates SFR25 and SFR25H radial version.

For technical questions, contact: filmresistorsleaded@vishay.com

THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

PACKAGING						
TYPE	CODE	QUANTITY	PACKAGING STYLE	WIDTH	PITCH	DIMENSIONS
SFR16S	A5	5000	Taped acc. to IEC 60286-1 fan-folded in a box	52 mm	5 mm	75 mm x 73 mm x 270 mm
	R5	5000	Taped acc. to IEC 60286-1 on a reel			92 mm x 278 mm x 278 mm
	A1 (1)	1000	Taped acc. to IEC 60286-1 fan-folded in a box			75 mm x 28 mm x 262 mm
SFR25, SFR25H	A5	5000	Taped acc. to IEC 60286-1 fan-folded in a box	52 mm	5 mm	75 mm x 98 mm x 270 mm
	R5	5000	Taped acc. to IEC 60286-1 on a reel			93 mm x 300 mm x 298 mm
	A1 (1)	1000	Taped acc. to IEC 60286-1 fan-folded in a box			75 mm x 28 mm x 262 mm
	N4 (2)	4000	Taped acc. to IEC 60286-2 fan-folded in a box	-	12.7 mm	45 mm x 262 mm x 330 mm

Notes

(1) A1 packaging only available for resistors with ± 5 % tolerance.

(2) N4 packaging only available for SFR25 and SFR25H radial version.

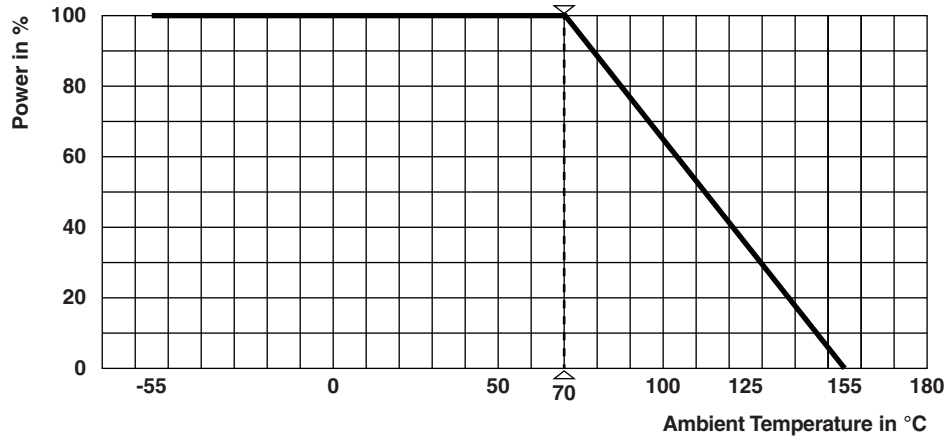
MARKING

The nominal resistance and tolerance are marked on the resistor using four or five colored bands in accordance with IEC 60062, marking codes for resistors and capacitors.

For technical questions, contact: filmresistorsleaded@vishay.com

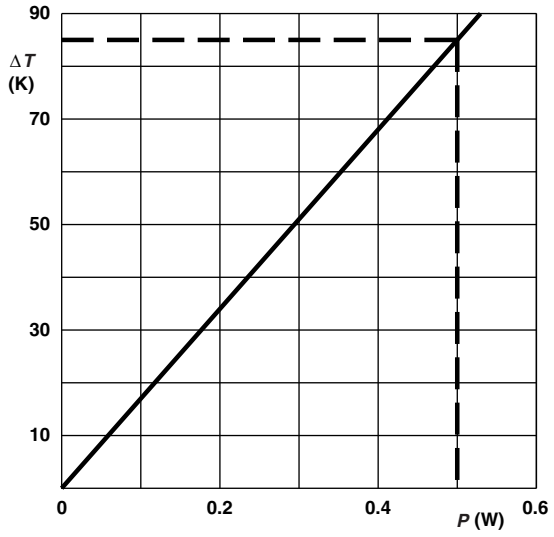
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

FUNCTIONAL PERFORMANCE

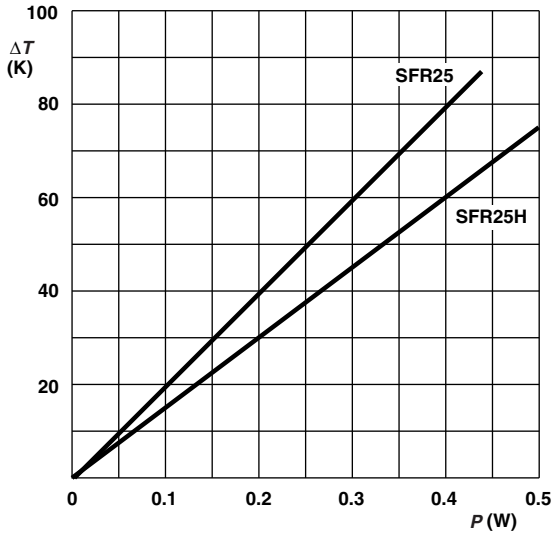


Derating

Maximum dissipation ($P_{max.}$) in percentage of rated power as a function of the ambient temperature (T_{amb})



SFR16S Hot-spot temperature rise (ΔT) as a function of dissipated power

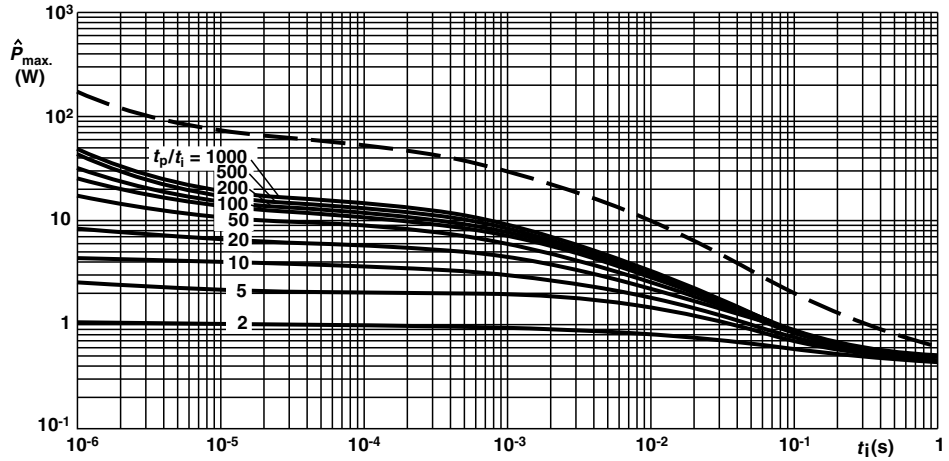


SFR25/SFR25H Hot-spot temperature rise (ΔT) as a function of dissipated power

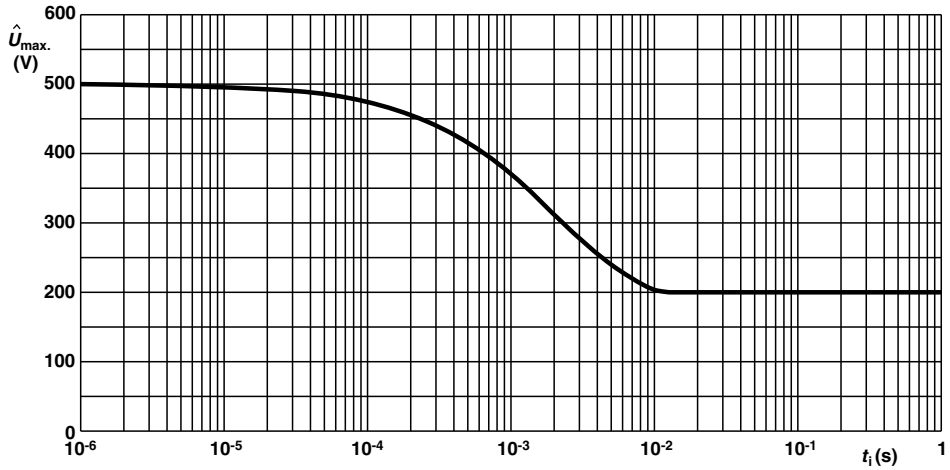
Note

- The maximum permissible hot-spot temperature is 155 °C.

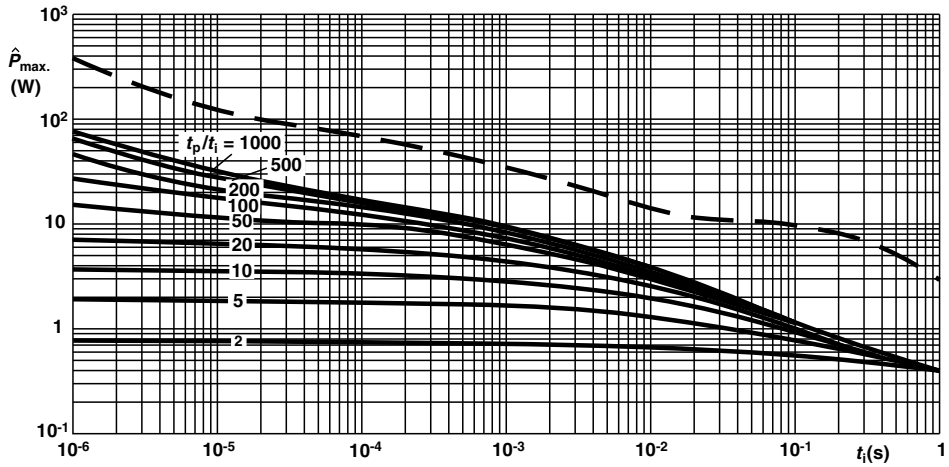
For technical questions, contact: filmresistorsleaded@vishay.com
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000



SFR16S Pulse on a regular basis; maximum permissible peak pulse power ($\hat{P}_{max.}$) as a function of pulse duration (t_i)

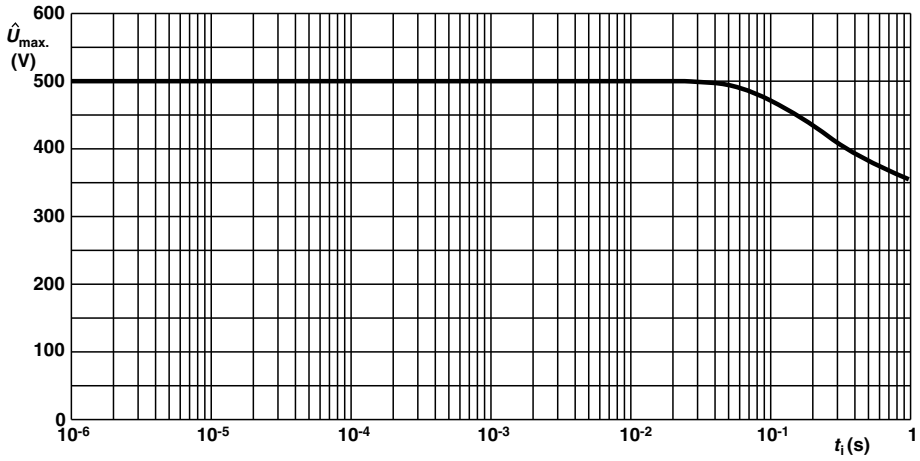


SFR16S Pulse on a regular basis; maximum permissible peak pulse voltage ($\hat{U}_{max.}$) as a function of pulse duration (t_i)

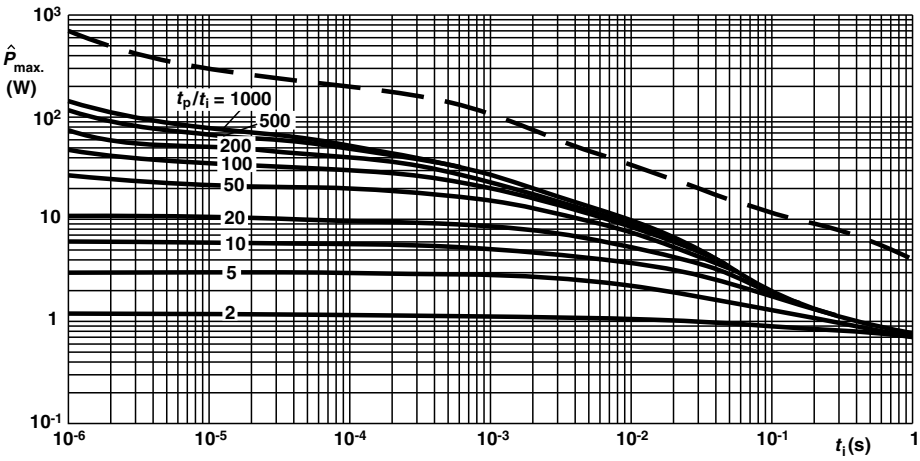


SFR25 Pulse on a regular basis; maximum permissible peak pulse power ($\hat{P}_{max.}$) as a function of pulse duration (t_i)

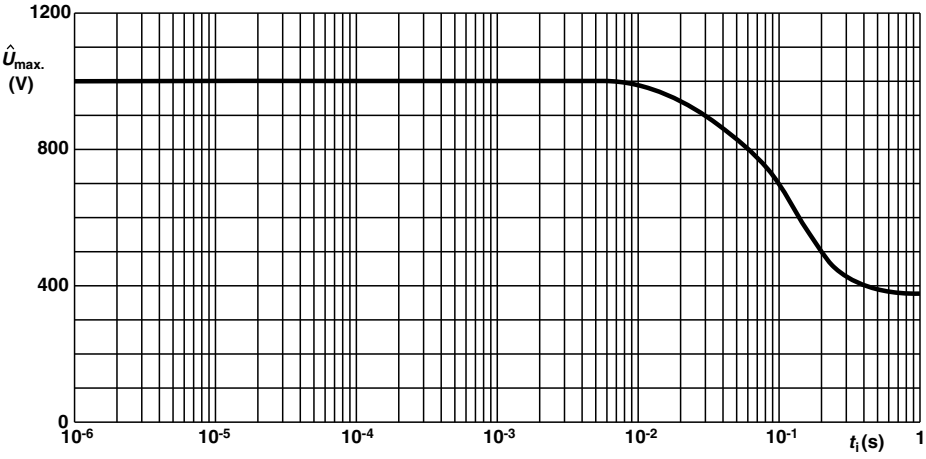
For technical questions, contact: filmresistorsleaded@vishay.com
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000



SFR25 Pulse on a regular basis; maximum permissible peak pulse voltage ($\hat{U}_{max.}$) as a function of pulse duration (t_i)



SFR25H Pulse on a regular basis; maximum permissible peak pulse power ($\hat{P}_{max.}$) as a function of pulse duration (t_i)



SFR25H Pulse on a regular basis; maximum permissible peak pulse voltage ($\hat{U}_{max.}$) as a function of pulse duration (t_i)

For technical questions, contact: filmresistorsleaded@vishay.com
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

TESTS PROCEDURES AND REQUIREMENTS

All tests are carried out in accordance with the following specifications:

- EN 60115-1, generic specification (includes tests)

The test and requirements table contains only the most important tests. For the full test schedule refer to the documents listed above.

The tests are carried out in accordance with IEC 60068-2-xx test method and under standard atmospheric conditions in accordance with IEC 60068-1, 5.3.

Unless otherwise specified the following values apply:

- Temperature: 15 °C to 35 °C
- Relative humidity: 45 % to 75 %
- Air pressure: 86 kPa to 106 kPa (860 mbar to 1060 mbar).

For performing some of the tests, the components are mounted on a test board in accordance with IEC 60115-1, 4.31. In test procedures and requirements table, only the tests and requirements are listed with reference to the relevant clauses of IEC 60115-1 and IEC 60068-2-xx test methods. A short description of the test procedure is also given.

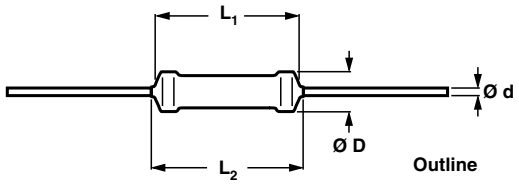
TEST PROCEDURES AND REQUIREMENTS

IEC 60115-1 CLAUSE	IEC 60068-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS PERMISSIBLE CHANGE ($\Delta R_{max.}$)				
4.5	-	Resistance	-	± 5 %; ± 1 %				
4.8	-	Temperature coefficient	At (20 / -55 / 20) °C and (20 / 155 / 20) °C	± 250 ppm/K; ± 100 ppm/K				
4.12	-	Noise	IEC 60195		< 68 kΩ	68 kΩ to 100 kΩ	> 100 kΩ to 1 MΩ	> 1 MΩ
				SFR16S	≤ 0.1 µV/V	≤ 0.5 µV/V	≤ 1.5 µV/V	≤ 1.5 µV/V
				SFR25, SFR25H	≤ 0.1 µV/V	≤ 0.1 µV/V	≤ 0.1 µV/V	≤ 1.5 µV/V
4.13	-	Short time overload	Room temperature; $P = 6.25 \times P_n$; (voltage not more than 2 x limiting voltage); 5 s	± (0.25 % R + 0.05 Ω)				
4.16	21 (Ua1) 21 (Ub) 21 (Uc)	Robustness of terminations	Tensile, bending, and torsion	± (0.25 % R + 0.05 Ω)				
4.17	20 (Ta)	Solderability	at +235 °C; 2 s; solder bath method; SnPb40 at +245 °C; 3 s; solder bath method; SnAg3Cu0.5	Good tinning (≥ 95 % covered); no damage				
4.18	20 (Tb)	Resistance to soldering heat	Unmounted components (260 ± 5) °C; (10 ± 1) s	± (0.25 % R + 0.05 Ω)				
4.19	14 (Na)	Rapid change of temperature	30 min at -55 °C and 30 min at +155 °C; 5 cycles	± (0.25 % R + 0.05 Ω)				
4.20	29 (Eb)	Bump	3 x 1500 bumps in 3 directions; 40 g	± (0.25 % R + 0.05 Ω); no damage				
4.22	6 (Fc)	Vibration	10 sweep cycles per direction; 10 Hz to 2000 Hz 1.5 mm or 200 m/s^2	± (0.25 % R + 0.05 Ω); no damage				
4.23		Climatic sequence:						
4.23.2	2 (Ba)	Dry heat	155 °C; 16 h					
4.23.3	30 (Db)	Damp heat, cyclic	55 °C; 24 h; 90 % to 100 % RH; 1 cycle					
4.23.4	1 (Aa)	Cold	-55 °C; 2 h					
4.23.5	13 (M)	Low air pressure	8.5 kPa; 2 h; 15 °C to 35 °C					
4.23.6	30 (Db)	Damp heat, cyclic	55 °C; 5 days; 95 % to 100 % RH; 5 cycles	**SFR16S, SFR25, SFR25H**	± (1 % R + 0.05 Ω); no visible damage ± (1 % R + 0.05 Ω); no visible damage			
4.23.7		DC load	apply rated power for 1 min		± 2 % R; no visible damage			

For technical questions, contact: filmresistorsleaded@vishay.com
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

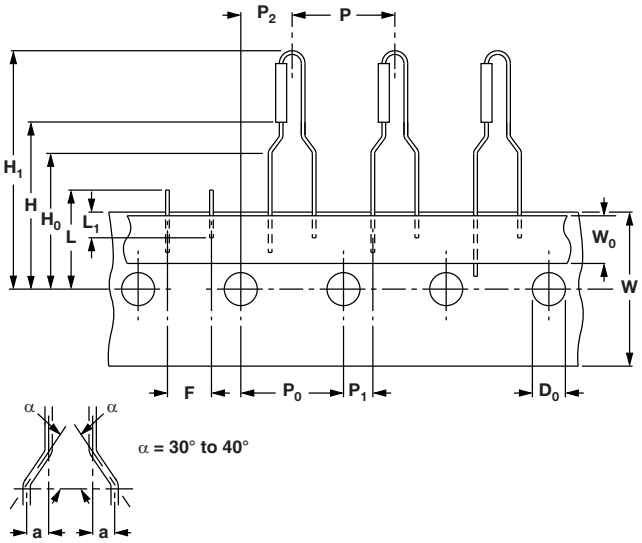
TEST PROCEDURES AND REQUIREMENTS				
IEC 60115-1 CLAUSE	IEC 60068-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS PERMISSIBLE CHANGE ($\Delta R_{max.}$)
4.24	78 (Cab)	Damp heat (steady state)	(40 ± 2) °C; 56 days; (93 ± 3) % RH	± (2 % R + 0.05 Ω)
4.25.1		Endurance (at 70 °C)	$U = \sqrt{P_{70} \times R}$ or $U = U_{max.}$; 1.5 h on; 0.5 h off 70 °C; 1000 h	± (2 % R + 0.05 Ω)

DIMENSIONS



DIMENSIONS - Leaded resistor types, mass and relevant physical dimensions					
TYPE	Ø $D_{max.}$ (mm)	$L_{1\ max.}$ (mm)	$L_{2\ max.}$ (mm)	Ø d (mm)	MASS (mg)
SFR16S	1.9	3.5	4.1	0.45 ± 0.05	102
SFR25	2.5	6.5	7.5	0.58 ± 0.05	205
SFR25H	2.5	6.5	7.5	0.58 ± 0.05	205

SFR25, SFR25H WITH RADIAL TAPING



DIMENSIONS in millimeters		
Pitch of components	P	12.7 ± 1.0
Feed-hole pitch	P_0	12.7 ± 0.2
Feed-hole center to lead at topside at the tape	P_1	3.85 ± 0.5
Feed-hole center to body center	P_2	6.35 ± 1.0
Lead-to-lead distance	F	4.8 + 0.7 / - 0
Tape width	W	18.0 ± 0.5
Minimum hold down tape width	W_0	5.5
Maximum component height	H1	29
Lead wire clinch height	H_0	16.5 ± 0.5
Height of component from tape center	H	19.5 ± 1
Feed-hole diameter	D_0	4.0 ± 0.2
Maximum length of snipped lead	L	11.0
Minimum lead wire (tape portion) shortest lead	L_1	2.5

Note

- Please refer to document “Packaging” for more detail (www.vishay.com/doc?28721).

For technical questions, contact: filmresistorsleaded@vishay.com
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

HISTORICAL 12NC INFORMATION

- The resistors had a 12-digit numeric code starting with 23.
- The subsequent 6 digits for 1 % or 7 digits for 5 % indicated the resistor type and packaging.
- The remaining digits indicated the resistance value:
  - The first 3 digits for 1 % or 2 digits for 5 % indicated the resistance value.
  - The last digit indicated the resistance decade.

Resistance Decade for ± 5 % Tolerance

RESISTANCE DECADE	LAST DIGIT
0.10 Ω to 0.91 Ω	7
1 Ω to 9.1 Ω	8
10 Ω o 91 Ω	9
100 Ω to 910 Ω	1
1 kΩ to 9.1 kΩ	2
10 kΩ to 91 kΩ	3
100 kΩ to 910 kΩ	4
1 MΩ to 9.1 MΩ	5
= 10 MΩ	6

Resistance Decade for ± 1 % Tolerance

RESISTANCE DECADE	LAST DIGIT
1 Ω to 9.76 Ω	8
10 Ω to 97.6 Ω	9
100 Ω to 976 Ω	1
1 kΩ to 9.76 kΩ	2
10 kΩ to 97.6 kΩ	3
100 kΩ to 976 kΩ	4
1 MΩ to 9.76 MΩ	5
= 10 MΩ	6

12NC Example

The 12NC of a SFR25 resistor, value 5600 Ω ± 5 %, taped on a bandolier of 5000 units in ammopack was:
2322 181 43562.

HISTORICAL 12NC - Resistor type and packaging

TYPE	TOL.	23..			
		BANDOLIER IN AMMOPACK			BANDOLIER ON REEL
		RADIAL TAPED	STRAIGHT LEADS		STRAIGHT LEADS
		4000 UNITS	1000 UNITS	5000 UNITS	5000 UNITS
SFR16S	± 5 %	-	..22 187 73...	..22 187 53...	..06 187 23...
	± 1 %	-	-	..06 187 3...	..06 187 1....
	Jumper	-	-	..06 187 90013	..22 187 90346
SFR25	± 5 %	..06 184 03...	..22 181 53...	..22 181 43...	..22 181 63...
	± 1 %	-	-	..22 188 2...	..06 181 8....
	Jumper	-	..22 181 90018	..22 181 90019	..06 181 90011
SFR25H	± 5 %	..06 186 03...	..22 186 16...	..22 186 76...	..06 186 63...
	± 1 %	-	-	..22 186 3....	..06 186 8....

For technical questions, contact: filmresistorsleaded@vishay.com
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

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.

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.

© 2022 VISHAY INTERTECHNOLOGY, INC. ALL RIGHTS RESERVED