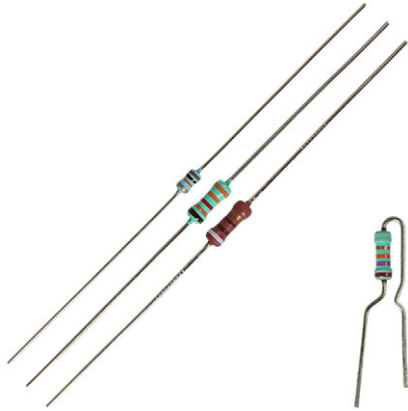




**THE DATASHEET OF  
SFR25H0001008JA500**



## Standard Metal Film Leaded Resistors



### FEATURES

- Small size (SFR16S: 0204, SFR25 / SFR25H: 0207)
- Low noise (max. 1.5  $\mu\text{V/V}$  for  $R > 1 \text{ M}\Omega$ )
- Compatible to both lead (Pb)-free and lead containing soldering processes
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



**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   | 5.1 $\Omega$ to 3 $\text{M}\Omega$                | 0.22 $\Omega$ to 10 $\text{M}\Omega$ | 0.22 $\Omega$ to 10 $\text{M}\Omega$ |
| Resistance tolerance   | $\pm 5 \%$ ; $\pm 1 \%$                           |                                      |                                      |
| Temperature coefficient  | $\pm 250 \text{ ppm/K}$ ; $\pm 100 \text{ ppm/K}$ |                                      |                                      |
| 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, $U_{\text{max}}$ AC/DC                                      | 200 V   | 250 V                                | 350 V                                |
| Operating temperature range  | -55 $^{\circ}\text{C}$ to +155 $^{\circ}\text{C}$ |                                      |                                      |
| Permissible film temperature   | 155 $^{\circ}\text{C}$                            |                                      |                                      |
| Max. resistance change at rated dissipation [ $\Delta R/R$ max.], after 1000 h | $\pm (2 \% R + 0.05 \Omega)$                      |                                      |                                      |

### Note

- $R$  value is measured with probe distance of 24 mm  $\pm$  1 mm using 4-terminal method



| TEMPERATURE COEFFICIENT AND RESISTANCE RANGE |           |             |                    |          |
|--|-----------|-------------|--------------------|----------|
| TYPE   | TOLERANCE | TCR         | RESISTANCE         | E-SERIES |
| SFR16S                                       | ± 5 %     | ± 100 ppm/K | 5.1 Ω to 100 kΩ    | E24      |
|  |           | ± 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 |          |
| 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    |          |

| 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                | 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 114 mm x 260 mm |
|               | R5                | 5000     | Taped acc. to IEC 60286-1 on a reel           |       |         | 93 mm x 300 mm x 298 mm |
|               | A1                | 1000     | Taped acc. to IEC 60286-1 fan-folded in a box |       |         | 78 mm x 31 mm x 260 mm  |
|               | N4 <sup>(1)</sup> | 4000     | Taped acc. to IEC 60286-2 fan-folded in a box | -     | 12.7 mm | 45 mm x 262 mm x 330 mm |

Note

<sup>(1)</sup> N4 packaging only available for SFR25 and SFR25H radial version



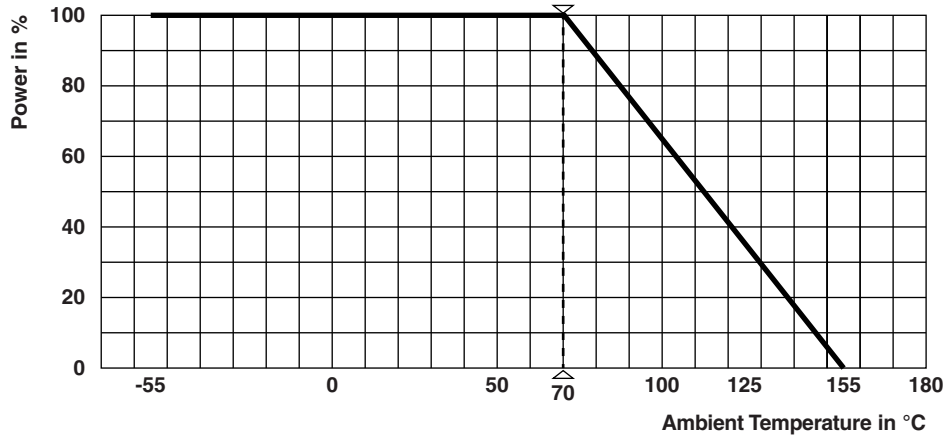
| PART NUMBER AND PRODUCT DESCRIPTION   |   |                |   |                      |                        |                              |   |
|---------------------------------------|---|----------------|---|----------------------|------------------------|------------------------------|---|
| PART NUMBER: SFR2500001001FA500       |   |                |   |                      |                        |                              |   |
| S                                     | F   | R              | 2   | 5                    | 0                      | 0                            |   |
|                                       |   |                | 0   |                      |                        |                              |   |
|                                       |   |                |   |                      | 1                      | 0                            |   |
|                                       |   |                |   |                      |                        | 0                            |   |
|                                       |   |                |   |                      |                        | 1                            |   |
|                                       |   |                |   |                      |                        | F                            |   |
|                                       |   |                |   |                      |                        | A                            |   |
|                                       |   |                |   |                      |                        | 5                            |   |
|                                       |   |                |   |                      |                        | 0                            |   |
|                                       |   |                |   |                      |                        | 0                            |   |
| TYPE                                  | VARIANT                                     | TCR / MATERIAL | RESISTANCE  |                      | TOLERANCE              | PACKAGING                    | SPECIAL   |
| SFR16S0<br>SFR2500<br>SFR25H0         | 0 = neutral<br>Z = value overflow (special) | 0 = standard   | <b>3 digit value</b><br><b>1 digit multiplier</b><br><b>MULTIPLIER</b><br>7 = *10 <sup>-3</sup> 2 = *10 <sup>2</sup><br>8 = *10 <sup>-2</sup> 3 = *10 <sup>3</sup><br>9 = *10 <sup>-1</sup> 4 = *10 <sup>4</sup><br>0 = *10 <sup>0</sup> 5 = *10 <sup>5</sup><br>1 = *10 <sup>1</sup> |                      | F = ± 1 %<br>J = ± 5 % | N4<br>A5<br>A1<br>R5         | The 2 digits are used for all special parts.<br>00 = standard |
| PRODUCT DESCRIPTION: SFR25 1 % A5 1K0 |   |                |   |                      |                        |                              |   |
| SFR25                                 |   | 1 %            |   | A5                   |                        | 1K0                          |   |
| TYPE                                  |   | TOLERANCE      |   | PACKAGING (1)        |                        | RESISTANCE VALUE             |   |
| SFR16S<br>SFR25<br>SFR25H             |   | ± 1 %<br>± 5 % |   | N4<br>A5<br>A1<br>R5 |                        | 47K = 47 kΩ<br>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

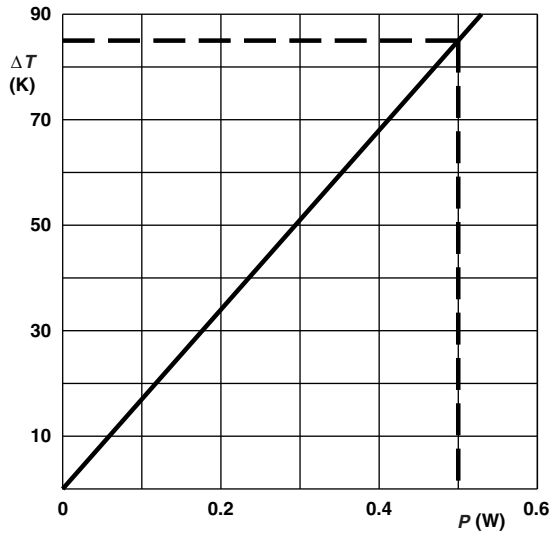


## FUNCTIONAL PERFORMANCE

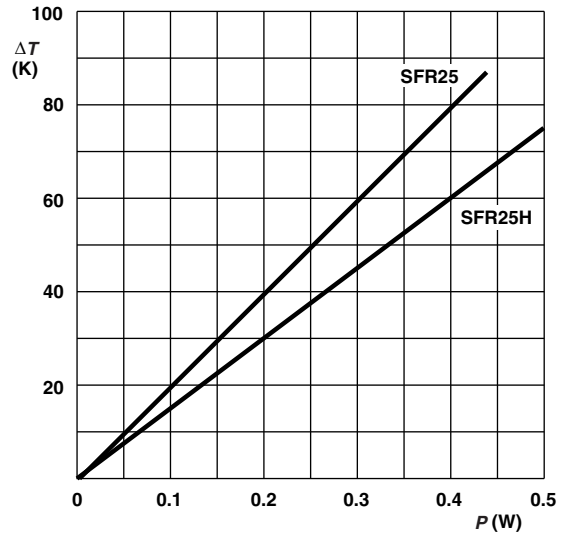


### Derating

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



SFR16S Hot-spot temperature rise ( $\Delta T$ ) as a function of dissipated power



SFR25/SFR25H Hot-spot temperature rise ( $\Delta T$ ) as a function of dissipated power

### Note

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



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 ( $t_i$ )



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 ( $t_i$ )



**TESTS PROCEDURES AND REQUIREMENTS**

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

- EN 60115-1, generic specification
- IEC 60068-2-xx, test methods

The table presents only the most important tests, for the full test schedule refer to the documents listed above. However, some additional tests and a number of improvements against those minimum requirements have been included. The tests are carried out under standard atmospheric conditions in accordance with IEC 60068-1, 4.3, whereupon the following values are applied:

Temperature: 15 °C to 35 °C

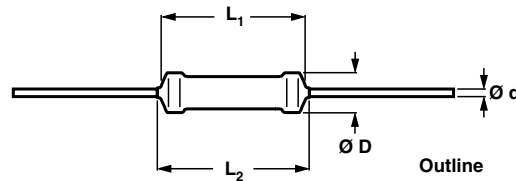
Relative humidity: 25 % to 75 %

Air pressure: 86 kPa to 106 kPa (860 mbar to 1060 mbar)

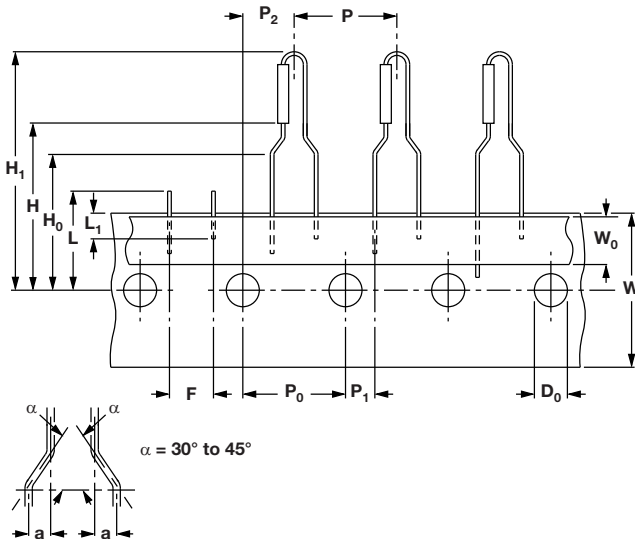
A climatic category LCT/ UCT / 56 is applied, defined by the lower category temperature (LCT = -55 °C), the upper category temperature (UCT = 155 °C), and the duration of exposure in the damp heat, steady state test (56 days). The components are mounted for testing on printed circuit boards in accordance with IEC 60115-1, 5.5 unless otherwise specified.

| TEST PROCEDURES AND REQUIREMENTS |   |                                       |   |  |                                 |                                  |                    |                    |
|----------------------------------|---|---------------------------------------|---|--|---------------------------------|----------------------------------|--------------------|--------------------|
| IEC 60115-1 CLAUSE               | IEC 60068-2 TEST METHOD                                     | TEST                                  | PROCEDURE   | REQUIREMENTS PERMISSIBLE CHANGE ( $\Delta R_{max}$ )   |                                 |                                  |                    |                    |
| 5.6                              | -   | Resistance                            | -   | $\pm 5 \%$ ; $\pm 1 \%$  |                                 |                                  |                    |                    |
| 6.2                              | -   | Temperature coefficient of resistance | At (20 / -55 / 20) °C and (20 / 155 / 20) °C  | $\pm 250$ ppm/K; $\pm 100$ ppm/K   |                                 |                                  |                    |                    |
| 6.6                              | -   | Current noise                         | IEC 60195   | < 68 k $\Omega$  | 68 k $\Omega$ to 100 k $\Omega$ | > 100 k $\Omega$ to 1 M $\Omega$ | > 1 M $\Omega$     |                    |
|                                  |   |                                       |   | <b>SFR16S</b>  | $\leq 0.1 \mu V/V$              | $\leq 0.5 \mu V/V$               | $\leq 1.5 \mu V/V$ | $\leq 1.5 \mu V/V$ |
|                                  |   |                                       |   | <b>SFR25, SFR25H</b>   | $\leq 0.1 \mu V/V$              | $\leq 0.1 \mu V/V$               | $\leq 0.1 \mu V/V$ | $\leq 1.5 \mu V/V$ |
| 8.1                              | -   | Short term overload                   | Room temperature; $P = 6.25 \times P_n$ ; (voltage not more than 2 x limiting voltage); 5 s   | $\pm (0.25 \% R + 0.05 \Omega)$  |                                 |                                  |                    |                    |
| 9.5                              | 21 (Ua1)<br>21 (Ub)<br>21 (Uc)                              | Robustness of terminations            | Tensile, bending, and torsion   | $\pm (0.25 \% R + 0.05 \Omega)$  |                                 |                                  |                    |                    |
| 11.1                             | 20 (Ta)   | Solderability                         | at +235 °C; 2 s; solder bath method; SnPb40   | Good tinning ( $\geq 95 \%$ covered); no damage  |                                 |                                  |                    |                    |
|                                  |   |                                       | at +245 °C; 3 s; solder bath method; SnAg3Cu0.5   |  |                                 |                                  |                    |                    |
| 11.2                             | 20 (Tb)   | Resistance to soldering heat          | Unmounted components (260 $\pm$ 5) °C; (10 $\pm$ 1) s   | $\pm (0.25 \% R + 0.05 \Omega)$  |                                 |                                  |                    |                    |
| 10.1                             | 14 (Na)   | Rapid change of temperature           | 30 min at -55 °C and 30 min at +155 °C; 5 cycles  | $\pm (0.25 \% R + 0.05 \Omega)$  |                                 |                                  |                    |                    |
| 9.9                              | 27 (Ea)   | Bump                                  | 3 x 1500 bumps in 3 directions; 40 g  | $\pm (0.25 \% R + 0.05 \Omega)$ ; no damage  |                                 |                                  |                    |                    |
| 9.11                             | 6 (Fc)  | Vibration                             | 10 sweep cycles per direction; 10 Hz to 2000 Hz 1.5 mm or 200 m/s <sup>2</sup>  | $\pm (0.25 \% R + 0.05 \Omega)$ ; no damage  |                                 |                                  |                    |                    |
| 10.3                             | 2 (Bb)<br>30 (Db)<br>1 (Ab)<br>13 (M)<br>30 (Db)<br>30 (Db) | Climatic sequence:                    | 155 °C; 16 h<br>55 °C; 24 h;<br>90 % to 100 % RH; 1 cycle<br>-55 °C; 2 h<br>8.5 kPa; 2 h; 15 °C to 35 °C<br>55 °C; 5 days;<br>95 % to 100 % RH; 5 cycles<br>apply rated power for 1 min |  |                                 |                                  |                    |                    |
| 10.3.4.2                         |   | Dry heat                              |   |  |                                 |                                  |                    |                    |
| 10.3.4.3                         |   | Damp heat, cyclic                     |   |  |                                 |                                  |                    |                    |
| 10.3.4.4                         |   | Cold                                  |   |  |                                 |                                  |                    |                    |
| 10.3.4.5                         |   | Low air pressure                      |   |  |                                 |                                  |                    |                    |
| 10.3.4.6                         |   | Damp heat, cyclic                     |   |  |                                 |                                  |                    |                    |
| 10.3.4.7                         |   | DC load                               |   |  |                                 |                                  |                    |                    |
|                                  |   |                                       | <b>SFR16S, SFR25, SFR25H</b>  | $\pm (1 \% R + 0.05 \Omega)$ ; no visible damage<br>$\pm (1 \% R + 0.05 \Omega)$ ; no visible damage<br>$\pm 2 \% R$ ; no visible damage |                                 |                                  |                    |                    |

| TEST PROCEDURES AND REQUIREMENTS |                         |  |  |  |
|----------------------------------|-------------------------|--|--|--|
| IEC 60115-1 CLAUSE               | IEC 60068-2 TEST METHOD | TEST   | PROCEDURE  | REQUIREMENTS PERMISSIBLE CHANGE ( $\Delta R_{max}$ ) |
| 10.4                             | 78 (Cab)                | Damp heat (steady state)                               | $(40 \pm 2) ^\circ\text{C}$ ; 56 days;<br>$(93 \pm 3) \% \text{RH}$                                    | $\pm (2 \% R + 0.05 \Omega)$                         |
| 7.1                              |                         | Endurance at the rated temperature $70 ^\circ\text{C}$ | $U = \sqrt{P_{70} \times R}$ or $U = U_{max}$ ;<br>1.5 h on; 0.5 h off<br>$70 ^\circ\text{C}$ ; 1000 h | $\pm (2 \% R + 0.05 \Omega)$                         |

**DIMENSIONS**


| DIMENSIONS - Leded resistor types, mass and relevant physical dimensions |                             |                 |                 |                      |           |
|--|-----------------------------|-----------------|-----------------|----------------------|-----------|
| TYPE   | $\varnothing D_{max.}$ (mm) | $L_1$ max. (mm) | $L_2$ max. (mm) | $\varnothing d$ (mm) | MASS (mg) |
| SFR16S   | 1.9                         | 3.5             | 4.1             | $0.45 \pm 0.05$      | 102       |
| SFR25  | 2.5                         | 6.5             | 7.5             | $0.58 \pm 0.05$      | 205       |
| SFR25H   | 2.5                         | 6.5             | 7.5             | $0.58 \pm 0.05$      | 205       |

**SFR25, SFR25H WITH RADIAL TAPING**


| DIMENSIONS in millimeters                       |       |                   |
|---|-------|-------------------|
| Pitch of components                             | P     | $12.7 \pm 1.0$    |
| Feed-hole pitch                                 | $P_0$ | $12.7 \pm 0.2$    |
| Feed-hole center to lead at topside at the tape | $P_1$ | $3.85 \pm 0.5$    |
| Feed-hole center to body center                 | $P_2$ | $6.35 \pm 1.0$    |
| Lead-to-lead distance                           | F     | $4.8 + 0.7 / - 0$ |
| Tape width                                      | W     | $18.0 \pm 0.5$    |
| Minimum hold down tape width                    | $W_0$ | 5.5               |
| Maximum component height                        | $H_1$ | 29                |
| Lead wire clinch height                         | $H_0$ | $16.5 \pm 0.5$    |
| Height of component from tape center            | H     | $19.5 \pm 1$      |
| Feed-hole diameter                              | $D_0$ | $4.0 \pm 0.2$     |
| 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](http://www.vishay.com/doc?28721))

**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.



**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 to 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 ammpack was: 2322 181 43562.

| <b>HISTORICAL 12NC - Resistor type and packaging</b> |        |                       |                |                |                   |
|--|--------|-----------------------|----------------|----------------|-------------------|
| 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....    |



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