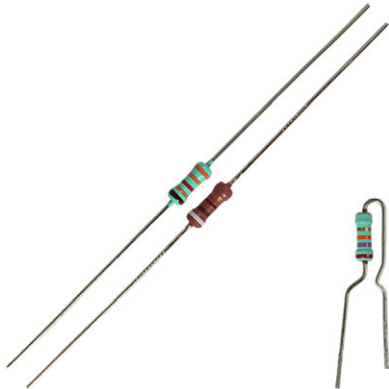


## Standard Metal Film Leaded Resistors



### FEATURES

- Small size (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-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	SFR25	SFR25H
DIN size	0207	0207
Resistance range	1.0 $\Omega$ to 10 $\text{M}\Omega$	1.0 $\Omega$ 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, $P_{70}$	0.4 W	0.5 W
Thermal resistance	200 K/W	150 K/W
Operating voltage, $U_{\text{max}}$ AC/DC	250 V	350 V
Operating temperature range	$-55 \text{ }^\circ\text{C}$ to $+155 \text{ }^\circ\text{C}$	
Permissible film temperature	155 $^\circ\text{C}$	
Max. resistance change at rated dissipation $[\Delta R/R \text{ max.}]$ , 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
SFR25, SFR25H	± 5 %	± 250 ppm/K	1.0 Ω to 4.7 Ω	E24
		± 100 ppm/K	> 4.7 Ω to 1 MΩ	
		± 250 ppm/K	> 1 MΩ to 10 MΩ	
	± 1 %	± 100 ppm/K	10 Ω to 1 MΩ	E24; E96

PACKAGING						
TYPE	CODE	QUANTITY	PACKAGING STYLE	WIDTH	PITCH	DIMENSIONS
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	0	1	0	0	1	F	A	5	0	0
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

<b>TYPE</b> SFR2500 SFR25H0	<b>VARIANT</b> 0 = neutral Z = value overflow (special)	<b>TCR / MATERIAL</b> 0 = standard	<b>RESISTANCE</b> 3 digit value 1 digit multiplier MULTIPLIER 7 = *10 <sup>-3</sup> 2 = *10 <sup>2</sup> 8 = *10 <sup>-2</sup> 3 = *10 <sup>3</sup> 9 = *10 <sup>-1</sup> 4 = *10 <sup>4</sup> 0 = *10 <sup>0</sup> 5 = *10 <sup>5</sup> 1 = *10 <sup>1</sup>	<b>TOLERANCE</b> F = ± 1 % J = ± 5 %	<b>PACKAGING</b> N4 A5 A1 R5	<b>SPECIAL</b> The 2 digits are used for all special parts. 00 = standard
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**PRODUCT DESCRIPTION: SFR25 1 % A5 1K0**

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

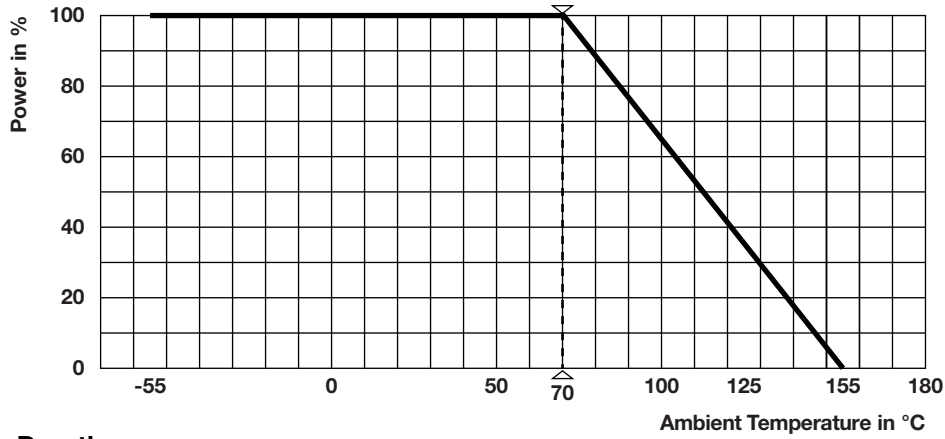
**Notes**

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

<sup>(1)</sup> N4 packaging indicates SFR25 and SFR25H radial version

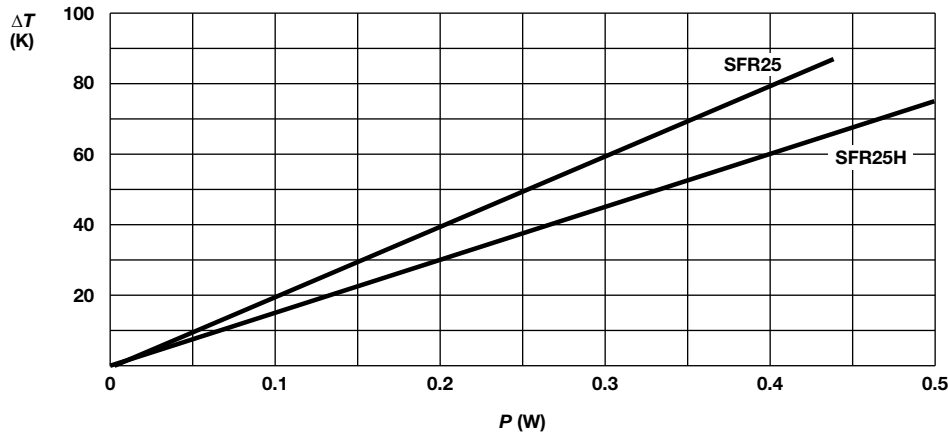


## FUNCTIONAL PERFORMANCE



### Derating

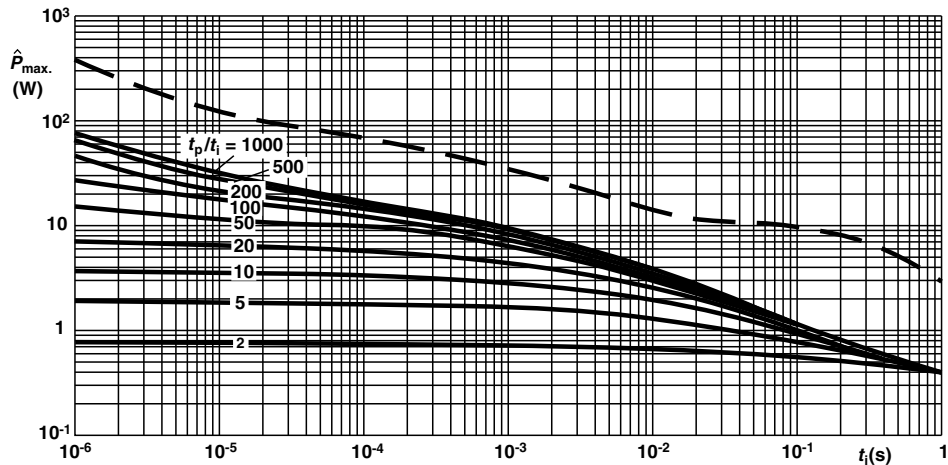
Maximum dissipation ( $P_{max}$ ) in percentage of rated power as a function of the ambient temperature ( $T_{amb}$ )



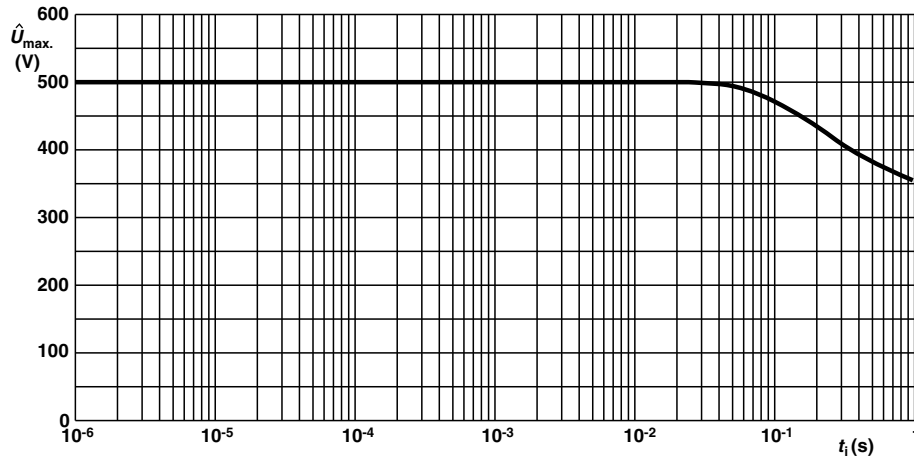
SFR25/SFR25H Hot-spot temperature rise ( $\Delta T$ ) as a function of dissipated power

### Note

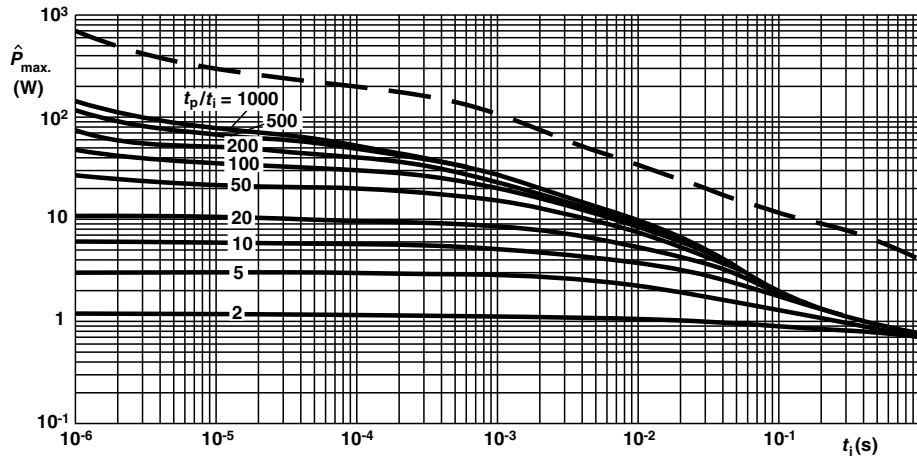
- The maximum permissible hot-spot temperature is 155 °C



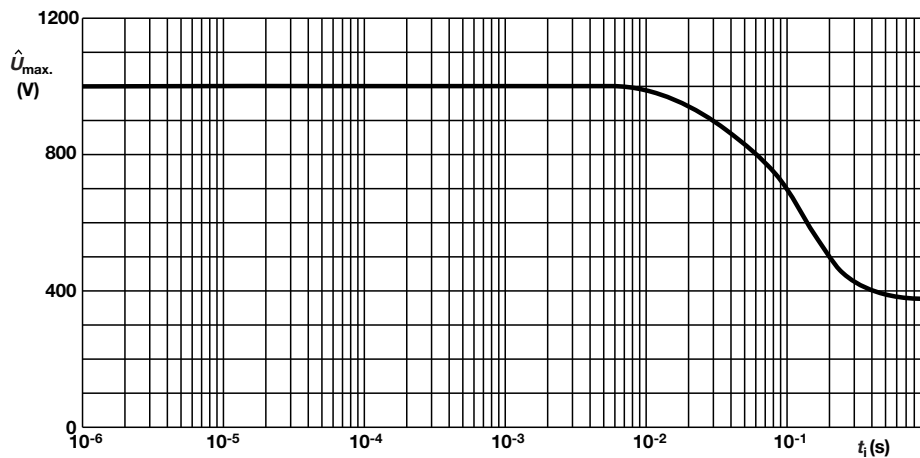
SFR25 Pulse on a regular basis; maximum permissible peak pulse power ( $\hat{P}_{max}$ ) as a function of pulse duration ( $t_i$ )



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

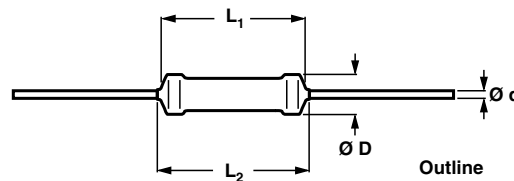
Relative humidity: 25 % to 75 %

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

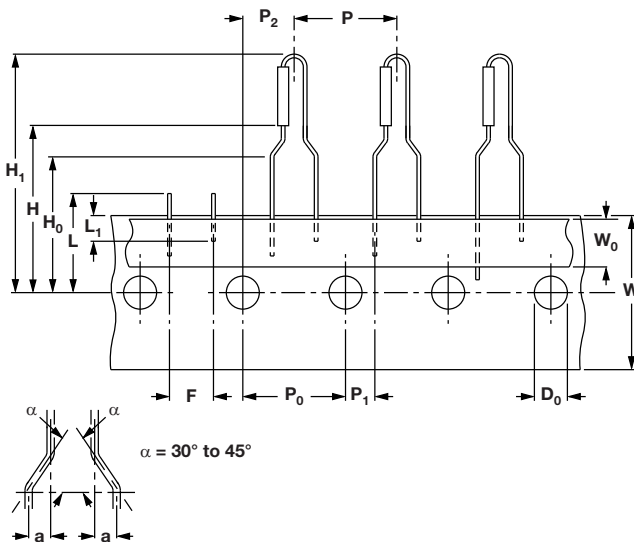
A climatic category LCT/ UCT / 56 is applied, defined by the lower category temperature (LCT = -55 °C), the upper category temperature (UCT = 155 °C), and the duration of exposure in the damp heat, steady state test (56 days). The components are mounted for testing on printed circuit boards in accordance 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	$\pm 250 \text{ ppm/K} ; \pm 100 \text{ ppm/K}$			
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 $\Omega$
				$\leq 0.1 \mu\text{V/V}$	$\leq 0.1 \mu\text{V/V}$	$\leq 0.1 \mu\text{V/V}$	$\leq 1.5 \mu\text{V/V}$
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) 21 (Ub) 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) 30 (Db) 1 (Ab) 13 (M) 30 (Db)	Climatic sequence:	155 °C; 16 h 55 °C; 24 h; 90 % to 100 % RH; 1 cycle -55 °C; 2 h 1 h; (1 $\pm$ 0.1) kPa; 15 °C to 35 °C 55 °C; 5 days; 95 % to 100 % RH; 5 cycles apply rated power for 1 min	$\pm (1 \% R + 0.05 \Omega)$ ; no visible damage $\pm 2 \% R$ ; no visible damage			
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					

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; $(93 \pm 3) \% \text{RH}$	$\pm (2 \% R + 0.05 \Omega)$
7.1		Endurance at the rated temperature $70 ^\circ\text{C}$	$U = \sqrt{P_{70} \times R}$ or $U = U_{max}$ ; 1.5 h on; 0.5 h off $70 ^\circ\text{C}$ ; 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)
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 snapped 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
SFR25	± 5 %	..06 184 03...	..22 181 53...	..22 181 43...	..22 181 63...
	± 1 %	-	-	..22 188 2...	..06 181 8....
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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