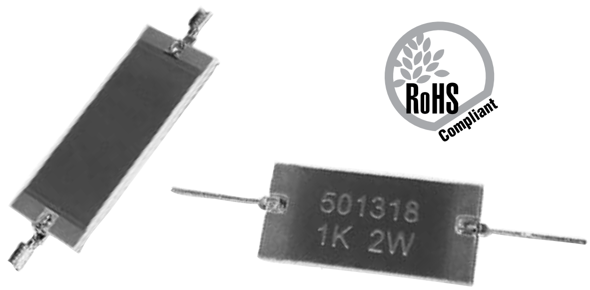
TFS Series

Surge Capable
Thick Film Non Inductive



FEATURES

- Appropriate for medical surge protection applications
- Ideal to replace standard carbon composition resistors
- Custom dimensions, values, tolerances and characteristics available

The TFS Series has been specifically developed to absorb large amounts of energy by efficient use of its compact mass. Ideal for medical surge protection applications, these thick film resistors offer non-inductive performance in an axial package.

Uses include power supply conversion, electron microscopes, X-ray systems, high-resolution CRT displays, and geophysical instrument related products.

SERIES SPECIFICATIONS

Type	U (KV)	Energy* (J)	Power (W)
TFSA	3	6	0.5
TFSB	3.5	9	0.5
TFSC	4	11	0.75
TFSD	7	33	1
TFSE	7	44	1.5
TFSF	11	55	2

*Published energy rating is for 10ms pulse. For shorter pulses energy rating has to be derated according to Max. Individual Pulse Rating chart and Single Pulse Energy Rating considerations.

CHARACTERISTICS

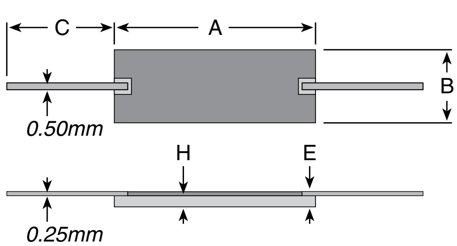
Resistive Element	Thick Film
Encapsulation	Screen Printed Glass
Resistance Value	100Ω up to 100KΩ
Temperature Coefficient	100ppm/°C
Tolerance	1%, 2%, 5%, 10%
Operating Temperature	-55°C to +200°C
Test	VDE 0750 (Pulse Duration 10 msec)

Notes

- Momentary overload capability is 5 times rated power for 1 second or 2 times rated power for 5 seconds. Always verify designs with pulse and surge conditions through thorough testing of the design at maximum operating temperature and maximum pulse loading (or some margin above maximum pulse loading).
- Damage to the resistor by excessive pulse loading is generally indicated by an increasing resistance of the resistor.
- Energy ratings are based on single pulses (at least 1 minute between pulses).
- For multiple pulse applications the energy pulse rating should be reduced and the average power should not exceed the nominal power rating of the selected model.
- See Single Pulse Energy section for more information

DIMENSIONS

mm



Type	Watts	A	B	C	H	E
TFSA	0.5	9	5.5	10	0.7	1.1
TFSB	0.5	11	5.5	10	0.7	1.1
TFSC	0.75	13	5.5	10	0.7	1.1
TFSD	1	21	8	10	0.9	1.3
TFSE	1.5	21	10.5	10	0.9	1.3
TFSF	2	26	10.5	10	0.9	1.3

(continued)

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SINGLE PULSE ENERGY RATING

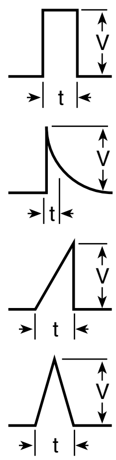
Although Ohmite's TFS Series resistors have been specially designed and developed to absorb much more energy than standard resistors, pulses and transients require special consideration since they cause an instantaneous temperature rise in the resistor film. This application note can guide you through these considerations.

For applications with transients, pulses or surges the following must be considered:

1. Do not exceed the normal rated operating voltage of the device.
2. Using the figure at right, estimate the energy (E_a) and the pulse duration (t_a) for a single pulse in your application.
3. Calculate the energy ratio in percent (E_r) between the nominal energy rating of the model you have chosen (see table) and the single pulse energy in your application (E_a from step 2) using the formula:

$$E_r = \frac{E_a}{E_{nominal}} \times 100$$

4. Refer to the Pulse Chart. On this chart find the point where the energy ratio (E_r), found at step 3, and time (t_a) coincide. Qualify that this point falls below the maximum pulse energy curve. If the point is above the curve a bigger model should be chosen.



$$E = \frac{V^2 t}{R}$$

$$E = \frac{1}{2}CV^2$$
$$t = RC$$

$$E = \frac{V^2 t}{3R}$$

$$E = \frac{V^2 t}{3R}$$

E = Energy (joules)
t = Time (seconds)
V = Voltage (volts)
R = Resistance (ohms)
C = Capacitance (farads)

Example

A 1μF capacitor is charged to 3.5kV and model TFSC, 1KOhm has been selected. Model TFSC is rated for 4kV, so the peak voltage of 3.5kV is acceptable.

$$E_a = \frac{1}{2}CV^2 = 6.1\text{J}$$

$$t_a = R\,C = 1\text{ ms}$$

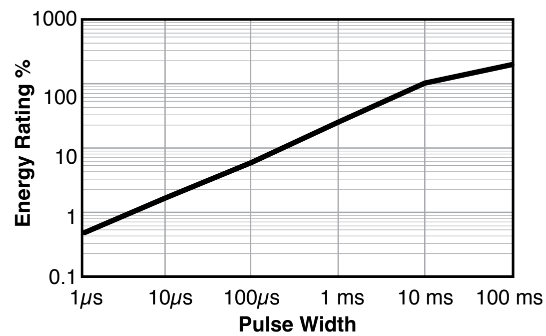
$$E_r = \frac{6.1\text{J}}{11\text{J}} \times 100 = 55\%$$

According to the pulse chart, an energy ratio of 55% for a pulse width of 1ms falls well above the energy curve. The limit is actually located around 25-30%. Model TFSC cannot be used for this application.

A bigger model should be chosen, for example TFSD. Model TFSD, 1KOhm, can be used for this application because we have an energy ratio E_r of 18%, which is below the energy curve.

$$E_r = \frac{6.1\text{J}}{33\text{J}} \times 100 = 18\%$$

Maximum Individual Pulse Rating



ORDERING INFORMATION

RoHS Compliant

T F S A 1 0 0 K J E

Series	Energy Rating	Ohm Value	Tolerance
	joules A = 6 D = 33 B = 9 E = 44 C = 11 F = 55	Example: 100R = 100Ω 2K40 = 2400Ω	F = 1% G = 2% J = 5% K = 10%

Standard Part Numbers for TFS Series

Ohms	Tol.	6 Joules 0.5 Watts	9 Joules 0.5 Watts	11 Joules 0.75 Watts	33 Joules 1 Watts	44 Joules 1.5 Watts	55 Joules 2 Watts
100	1%	TFSA100RFE					
100	5%		TFSB100RJE		TFSD100RJE		TFSF100RJE
220	1%	TFSA220RFE					
270	5%	TFSA270RJE		TFSC270RJE	TFSD270RJE		TFSF270RJE
470	1%	TFSA470RFE					
470	5%		TFSB470RJE			TFSE470RJE	
680	5%	TFSA680RJE		TFSC680RJE		TFSE680RJE	TFSF680RJE
750	5%		TFSB750RJE		TFSD750RJE		TFSF750RJE
1,000	1%	TFSA1K00FE					
1,000	5%	TFSA1K00JE	TFSB1K00JE	TFSC1K00JE	TFSD1K00JE	TFSE1K00JE	TFSF1K00JE
1,500	5%	TFSA1K50JE		TFSC1K50JE	TFSD1K50JE		TFSF1K50JE
2,200	1%	TFSA2K20FE					
2,700	5%		TFSB2K70JE			TFSE2K70JE	
4,700	1%	TFSA4K70FE					
4,700	5%	TFSA4K70JE		TFSC4K70JE	TFSD4K70JE		
4,990	1%	TFSA4K99FE					
5,000	5%	TFSA75K0JE					
6,800	5%		TFSB6K80JE			TFSE6K80JE	
10,000	1%	TFSA10K0FE					
10,000	5%	TFSA10K0JE	TFSB10K0JE	TFSC10K0JE	TFSD10K0JE		TFSF10K0JE
16,000	5%						TFSF16K0JE
20,000	1%	TFSA20K0FE					TFSF20K0JE
20,000	5%		TFSB20K0JE		TFSD20K0JE		
22,000	1%	TFSA22K0FE					
27,000	5%	TFSA27K0JE		TFSC27K0JE		TFSE27K0JE	
47,000	1%	TFSA47K0FE					
50,000	5%	TFSA50K0JE					TFSF51K0JE
51,000	5%		TFSB51K0JE	TFSC51K0JE	TFSD51K0JE		
75,000	5%					TFSE75K0JE	
100,000	1%	TFSA100KFE					
100,000	5%		TFSB100KJE	TFSC100KJE	TFSD100KJE		TFSF100KJE

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