Limitations of Potential Pulsing on Thick Film Flat Chip Resistors

KSE types RK73B, RK73H and SR73

Surface mount rectangular flat chip resistors are susceptible to failure under some high voltage conditions. In circuitry where there is a possibility of transient potentials, considerable high voltage may be applied to a resistor for a short period of time. This bulletin is intended to aid the Design Engineer in determining a "safe" potential level for flat chip resistors in pulse applications.

For Pulse Power limitations of KOA thick film chip resistors, please refer to the graph, fig. 1. Power below that specified on the graph will, generally, not cause any significant degradation of the resistor, but note that the resistance value may vary slightly due to repeated pulsing over a long period of time. The circuit designer should also be cognizant of the fact that the pulse voltage is limited even under the conditions on which the graph, fig. 1, is based. The maximum peak pulse voltage for a KOA thick film chip resistor is the lessor of (A) or (B) below.

(A)

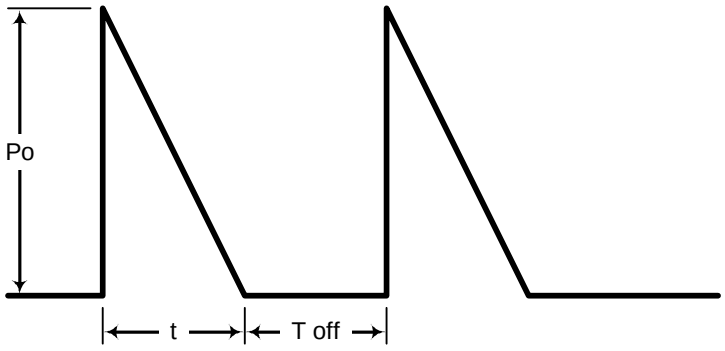
$$V_{peak} = \sqrt{Po \times R}$$

Where, "Po" is the pulse limit power taken from the graph, "R" is the resistor value in ohms.

(B)

1E	(0402)	Size	100V
1J	(0603)	Size	100V
2A	(0805)	Size	300V
2B	(1206)	Size	400V
2E	(1210)	Size	400V
2H	(2010)	Size	400V
3A	(2512)	Size	400V

The peak power is defined as the maximum power dissipated at any point in time regardless of the waveform shape.



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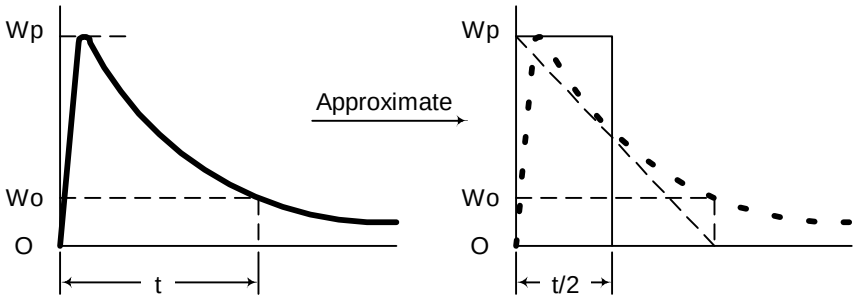
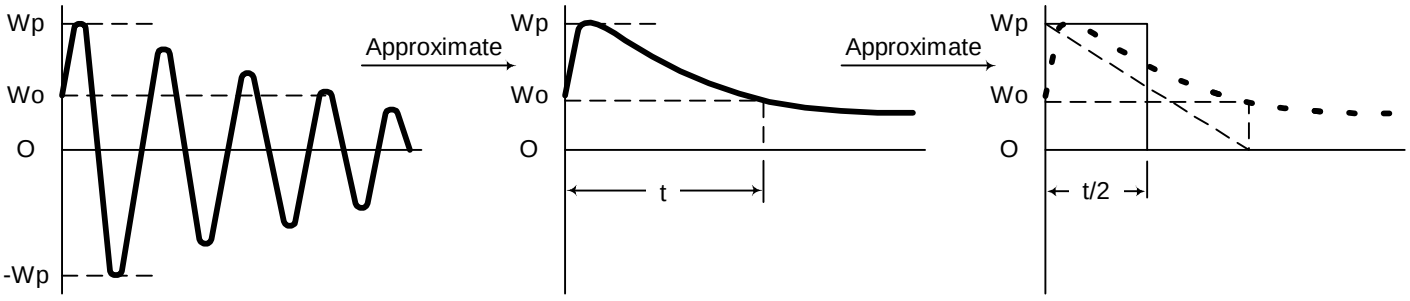
The pulse waveform, if other than a square wave, must first be converted to an approximated square wave as shown on the right.



Wp: Peak Power
Wo: Rated Power
t: Time to attenuate down to the rated power



Wp: Peak Power
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The following design rules determine if derating of the Pulse Limit Power (Po) obtained from the graph is required for repetitive pulse applications

Notes:

1. Graph pulse power (Po) is for ambient operating temperatures of 70°C or less. For ambient operating temperatures greater than 70°C, pulse power (Po) or (Pm) must be further derated by 1.25% per °C above 70°C in accordance with the power derating schedule of the resistor.

2. If derated pulse power (Pm) is calculated to be less than the resistor's rated continuous power, the resistor's rated wattage should be used.

1. If $T_{off} \leq 4u$ Sec, or $T_{off} \leq 5m$ Sec and $(T_{off}/t) \leq 1$, then the peak power is treated as continuous power and, therefore, Pm = the resistor's rated wattage.

2. If T_{off} is $\geq 4u$ Sec, but is $\leq 100u$ Sec, and $(T_{off}/t) \leq 700$, then $Pm = Po \times .01 \times (T_{off}/t)^{0.7}$.

3. If T_{off} is > 100u Sec and $(T_{off}/t) \leq 200$, then $Pm = Po \times .01 \times (T_{off}/t)^{0.85}$.

4. If $T_{off} > 4u$ Sec but is $\leq 100u$ Sec, and $(T_{off}/t) > 700$, or T_{off} is > 100u Sec and $(T_{off}/t) > 200$, then Pm = Po as obtained from the pulse power graph.

Where:	Pm =	Derated Pulse Power (W)
	Po =	Pulse Power from graph below (W)
	T_{off} =	Off time between pulses (sec)
	t =	Pulse width (sec)

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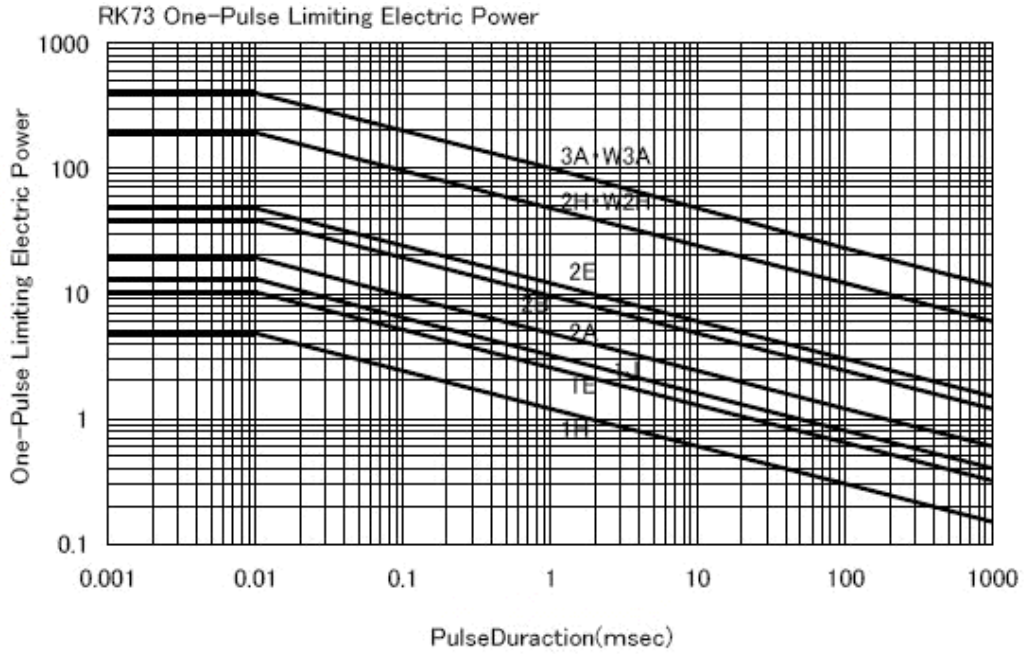

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