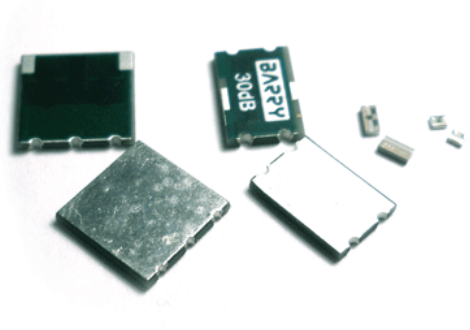
Barry Industries

High Power Attenuator Performance Over Frequency

Tech Note

Tuning, physical layout, power handling and design account for the performance of an attenuator. The combination of these factors enable circuit designers the ability to adjust power levels in the operation of their RF and Microwave circuit designs.



For thick film attenuator design, the resistors that make up the attenuator circuit are laser trimmed while monitoring the resistance values. This measurement is done at DC and may differ from the value needed at the desired frequency of operation.

For many attenuator designs the circuit is laid out as a PI network (Figure 1.) with two (2) shunt resistors connected by a series resistor. As attenuation values are increased the amount of power dissipated (as a percentage of input power) in these resistors shifts from the series resistor to the input shunt resistor. This power shift is reflected in most designs and with the design change, the slope of the attenuator (attenuation vs. frequency) is different for low, mid and high attenuation values.

Figure 2 shows how the typical attenuation response changes as the attenuation value increases.

Design layout will affect these slopes and power handling is usually the controlling element. For limited frequency applications where the attenuation value needs to be at a certain value, the DC attenuation is shifted to get the desired attenuation value.

Custom attenuators may affect the slope more than the standard catalog attenuators. For high attenuation values RF leakage across the chip is usually the limiting factor in the slope performance.

Figure 1. PI Attenuator Circuit

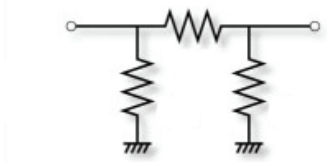
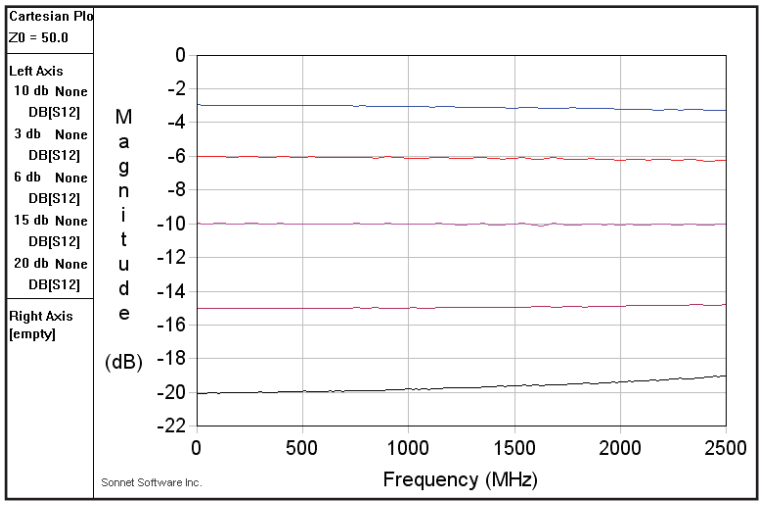


Figure 2. Typical Attenuator Frequency Response



Typical designs will have the following characteristics:

Attenuation Value (dB)	Frequency of Operation Low	Mid	High	Relative Slope Over Frequency
1	1.1dB	1.2dB	1.3dB	
2	2.1dB	2.2dB	2.3dB	
3	3.1dB	3.2dB	3.3dB	
4	4.1dB	4.2dB	4.3dB	
5	5.1dB	5.1dB	5.2dB	
6	6.0dB	6.1dB	6.2dB	
7	7.0dB	7.1dB	7.1dB	
8	8.0dB	8.1dB	8.1dB	
9	9.0dB	9.0dB	9.0dB	
10	10.0dB	10.0dB	10.0dB	

Attenuation Value (dB)	Frequency of Operation Low	Mid	High	Relative Slope Over Frequency	Less Attenuation / More Attenuation
11	11.0dB	11.0dB	11.0dB		
12	12.0dB	12.0dB	12.0dB		
13	13.0dB	12.9dB	12.9dB		
14	14.0dB	13.9dB	13.9dB		
15	15.0dB	14.9dB	14.8dB		
16	16.0dB	15.9dB	15.8dB		
17	17.0dB	16.9dB	16.7dB		
18	18.0dB	17.9dB	17.6dB		
19	19.0dB	18.9dB	18.6dB		
20	20.0dB	19.9dB	19.6dB		

Barry Industries maintains an ISO9001 Certified Quality Management System.

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PAGE 1 OF 1		