

# Mini-Circuits®

## Fixed Attenuators/Terminations

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Fixed attenuators are found in a wide variety of electronic equipment **for extending the dynamic range of measuring equipment**, for preventing signal overload in transmitters and receivers, and for impedance matching to reduce the effects of improper input/output terminations of oscillators, amplifiers and test setups.

The important parameters associated with fixed attenuators include the amount of attenuation, the flatness over a specified frequency range, VSWR, average and peak power-handling capability, size and height, and performance over a given temperature range. Average power limit decreases linearly as temperature increases and burnout will result (or calibration will be altered) if average power limit is exceeded.

Mini-Circuits' fixed attenuators, packaged in rugged plug-in and connector models, are available in both 50- and 75-ohm models ranging from 1 to 40 dB spanning DC to 1500 MHz.

## Definition of Terms

### fixed attenuator

A device used to reduce power levels of a signal by a **fixed amount with little or no reflections**. The output signal is attenuated relative to the input signal while the input and output impedance is maintained close to 50 ohms (or 75 ohms) over the specified bandwidth. Hence, this device is often used to improve interstage matching in a circuit.

### flatness

**The total variation in attenuation over the specified frequency range.** Flatness generally becomes worse at higher frequencies where attenuation starts to increase with increasing frequency.

### vswr

Voltage-standing-wave ratio is a measure of **the deviation from 50 ohms or 75 ohms of the input and output impedance**. A VSWR of 1.0:1 represents a perfect 50-ohm or 75-ohm match. A VSWR slightly greater than 1.0:1 represents a slight impedance mismatch, implying a small amount of **signal reflection**.

### termination

An ideal load of impedance  $Z_0$ , when connected to the end of a transmission line whose characteristic impedance is also  $Z_0$  will **absorb all power** in the transmission line traveling toward the load.

## **maximum rf power**

The amount of power that can be applied to an attenuator or load which does not result in excessive heating of the attenuator or load.

## **return loss**

The minimum return loss the termination exhibits when used for terminating a transmission line it is designed to match. For an attenuator, return loss is measured at one port when the other port is terminated in 50- or 75-ohms for which it is designed.

# **Most Often Asked Questions**

***Q. Many of MCL's fixed attenuators are specified up to 1500 MHz. How will they perform at higher frequencies?***

**A.** With the exception of the 75-ohm models, most fixed attenuators perform reasonably well above 2000 MHz. Please refer to data pages for actual performance characteristics.

***Q. What internal design configuration is used in the fixed attenuators and are they symmetrical?***

**A.** Both  $\pi$  and T type configurations are used and both are symmetrical. Hence, the input and output are interchangeable.

***Q. Are surface-mount packages available?***

**A.** Yes. Consult the factory to discuss your application and the parameters of surface-mount packages.

***Q. What is the difference between the flatness spec and the deviation on the nominal attenuation spec?***

**A.** The nominal or average value of attenuation of a particular attenuator is guaranteed to be within the nominal spec window, and is measured at the low frequency end of the band. The flatness spec only refers to variation of attenuation across the specified bandwidth.

***Q. Can Mini-Circuits' provide terminations at different impedances upon request?***

**A.** The impedance of Mini-Circuits' terminations are either 50- or 75-ohms. Other impedances are not available.