Capabilities of CZA-Series Surface-Mount Chip Attenuator

By Ray Lehman

INTRODUCTION

An attenuator is a device used, mostly in the telecommunication industry, to reduce the amplitude of a signal without appreciably distorting its waveform. Attenuators are usually passive devices, and the degree of attenuation may be fixed, continuously adjustable, or incrementally adjustable.

Fixed attenuators, such as the CZA series, are often called pads. The input and output impedances of an electrical attenuator are usually matched to the impedances of the signal source and the load, respectively.

The attenuator is used in the RF area of the mobile phone and in base stations, typically between the voltage controlled oscillator (VCO) output and the power amplifier (PA) input as a matching component.

The use of a fixed attenuator, such as the CZA series, reduces the required board space, component count, and component placement costs. A single CZA component will replace three or more discrete devices that would otherwise be required to perform the same function. In addition, the use of a single component delivers improved performance as a result of superior tolerance matching and temperature tracking compared to implementations with individual devices.

CZA CAPABILITIES

Standard Values of Impedance

The nominal impedance is specified in ohms, and should match the nominal impedance of the system for maximum accuracy. 50 Ω is the standard value of nominal impedance for the CZA04, and 50 Ω, 75 Ω, 100 Ω, 300 Ω, and 600 Ω are the standard values of nominal impedance for the CZA06.

Range of Attenuation

The attenuation range is the magnitude of total attenuation, in decibels, that is provided by the attenuator. The CZA products can be supplied with values of insertion loss between 1 dB and 20 dB.

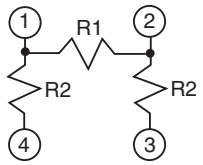
Resistance Values

The calculation for the circuit design of this part is: $R_1 = (Z(A^2 - 1)) / (2A)$ and $R_2 = (Z(A + 1)) / (A - 1)$

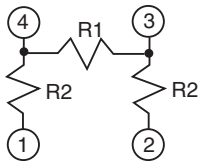
Where: $A = 10^{dB/20}$
dB = Attenuation
Z = Line impedance

Type of Configuration

The type of configuration available on the CZA series is the unbalanced π type.



CZA04 Schematic



CZA06 Schematic

APPLICATION NOTE

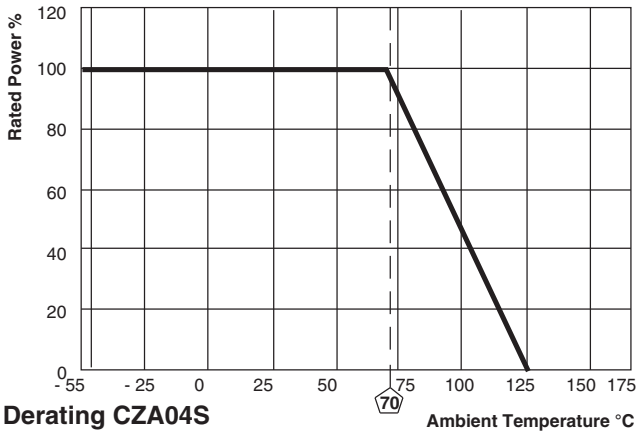
Capabilities of CZA-Series Surface-Mount Chip Attenuator

Frequency Range

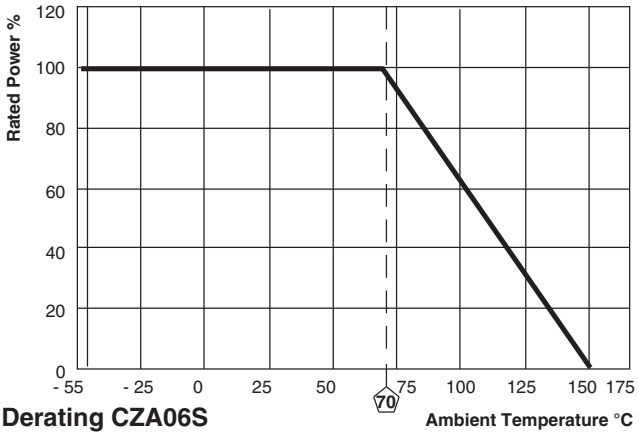
The frequency range is the frequency spectrum over which the attenuator will work within the specified accuracy. The CZA series can be used with a frequency range of DC to 3 GHz.

Power Rating

The power rating is the maximum continuous full-load power, in W, that may be applied to the attenuator at an ambient temperature of 70 °C. The maximum power rating for the CZA04 is 0.04 W, and the maximum power rating for the CZA06 is 0.075 W. For operation at temperatures above 70 °C, the power rating should be derated in accordance with the power derating graphs.



Derating CZA04S



Derating CZA06S

Temperature Range

CZA attenuators are capable of satisfactory operation within the temperature range of -55 °C to +125 °C for the CZA04, and -55 °C to +150 °C for the CZA06.

Stability

Under normal ambient conditions, the attenuation value will not change more than 0.3 dB. The change after prolonged exposure to humid conditions will also not exceed 0.3 dB.

Standard Tolerance of Insertion Loss

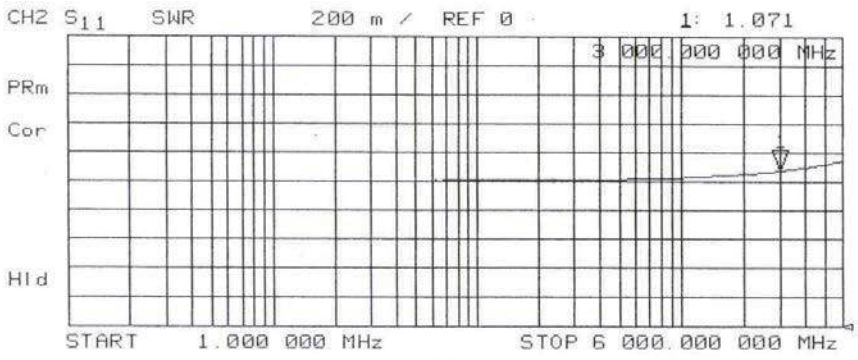
The tolerance of the insertion loss is dependent on the nominal value. For values between 1 dB and 5 dB, the standard tolerance is 0.3 dB. For values between 6 dB and 20 dB, the standard tolerance is 0.5 dB.

Standing-Wave Ratio

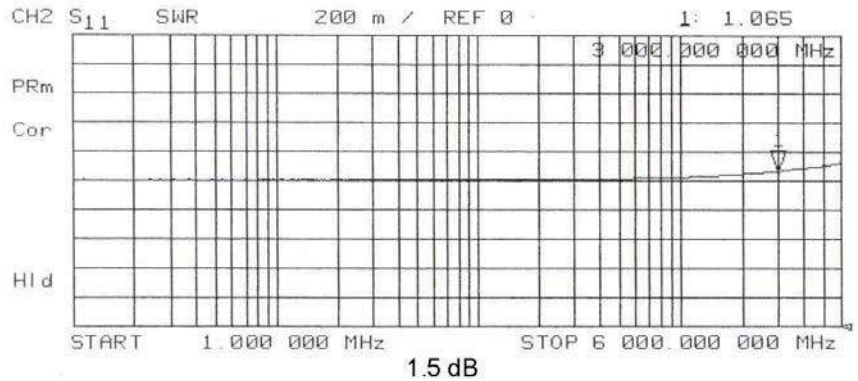
The standing-wave ratio (SWR) is a mathematical expression of the non-uniformity of an electromagnetic field on a transmission line. Usually, SWR is defined as the ratio of the maximum RF voltage to the minimum RF voltage. This is also known as the voltage standing-wave ratio (VSWR). Under ideal conditions, the RF voltage on a signal transmission line is the same at all points on the line, excepting for power losses caused by electrical resistance in the line wires and imperfections in the dielectric material separating the line conductors. The ideal VSWR is therefore 1:1. The CZA series has a maximum SWR of 1:1.2.

Capabilities of CZA-Series Surface-Mount Chip Attenuator

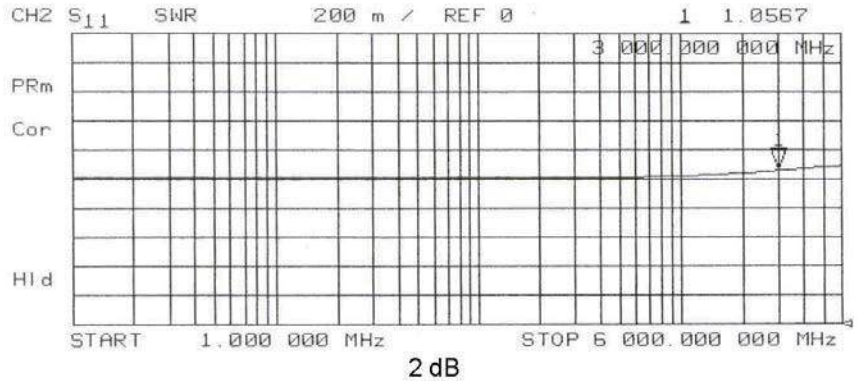
Following are charts for SWR vs frequency for various CZA06S decibel rating:



1 dB



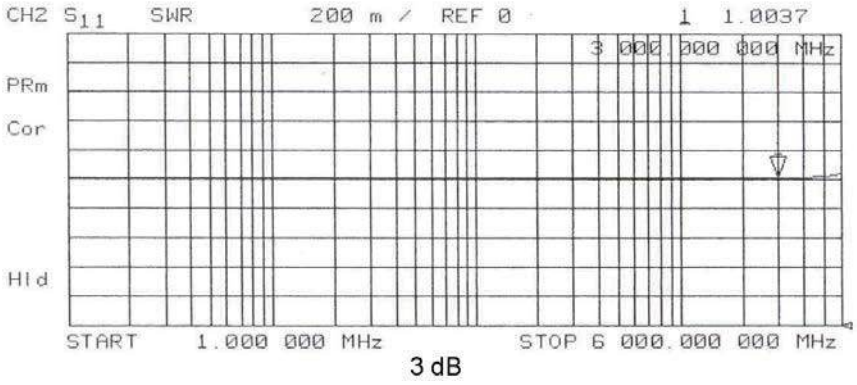
1.5 dB



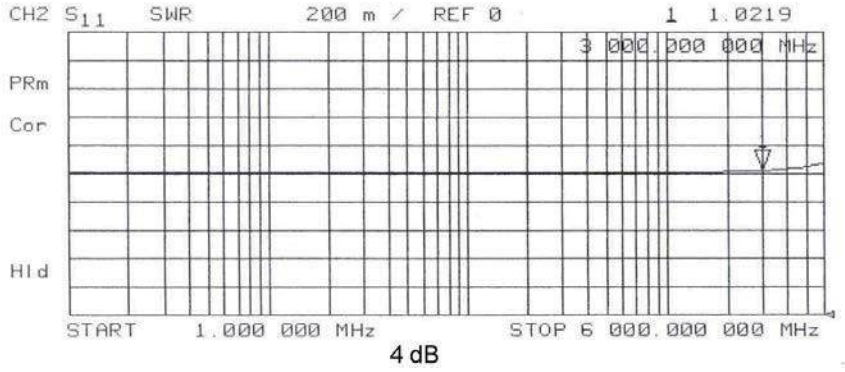
2 dB

APPLICATION NOTE

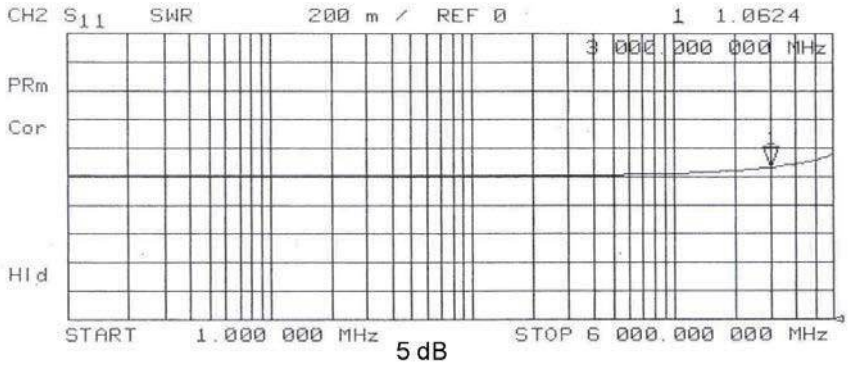
Capabilities of CZA-Series Surface-Mount Chip Attenuator



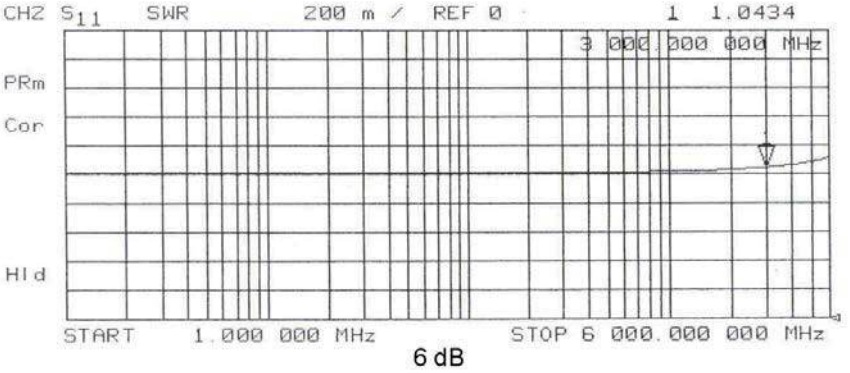
3 dB



4 dB



5 dB



6 dB

APPLICATION NOTE