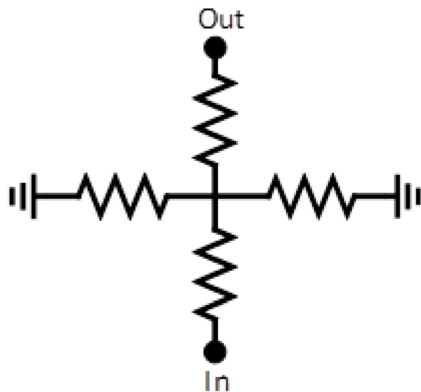
Product Overview

The ASU0001 family of fixed resistive attenuators are integrated circuits comprising thin film resistors and through-die vias that provide excellent attenuation flatness from low frequency to 30 GHz. These attenuators are available from 0 to 5 dB (see Table 2). The ASU0001 attenuator family is optimized for surface mounting on co-planar waveguide or microstrip printed circuit boards. Bond wires or ribbons are used to connect the input and output ports of the attenuators to the external circuit transmission lines. Connection to ground is accomplished by through-die vias to the die backside metallization. The dice are attached using eutectic solder or conductive epoxy and can operate over a temperature range of –40°C to 85°C. The absolute maximum ratings for the ASU0001 attenuators are provided in Table 1 and the electrical specifications are shown in Table 2. Typical performance characteristics are illustrated in Figures 2. Data Gathered Using Ground-to-Signal-to-Ground Probes on Die.

Key Features

1. Fixed value, absorptive devices
2. Available attenuation values range from 0 to 5 dB
3. Suitable for use to 30 GHz
4. Enhanced power handling: 1 W
5. Die Size: 0.566 x 0.526 x 0.1 mm

Functional Block Diagram



Applications

Level adjustment in radios

ASU0001 Series Absolute Maximum Ratings

Parameter	Min.	Typ.	Max.	Units
Frequency Range	0.1	-	40	GHz
Input Power	-	-	1	W
Power Dissipation @ 25 °C	-	-	1	W
Operating Temperature	-40	-	85	°C
Input/Output Return Loss	13.6	-	22	dB

ELECTROSTATIC SENSITIVE DEVICE OBSERVE HANDLING PRECAUTIONS

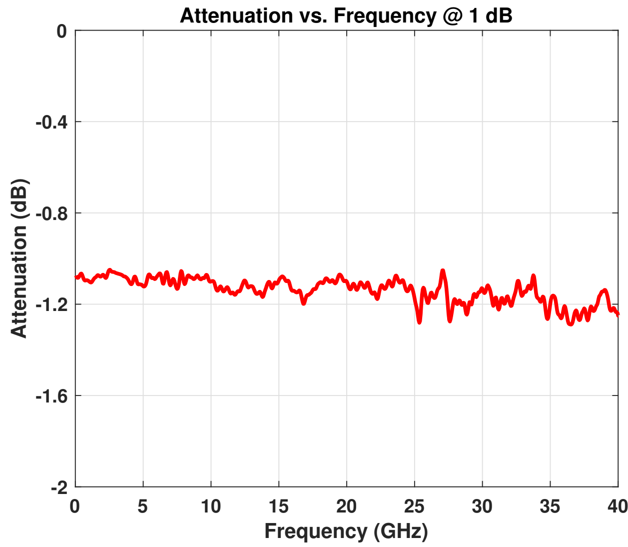
ASU0001 Electrical Specifications

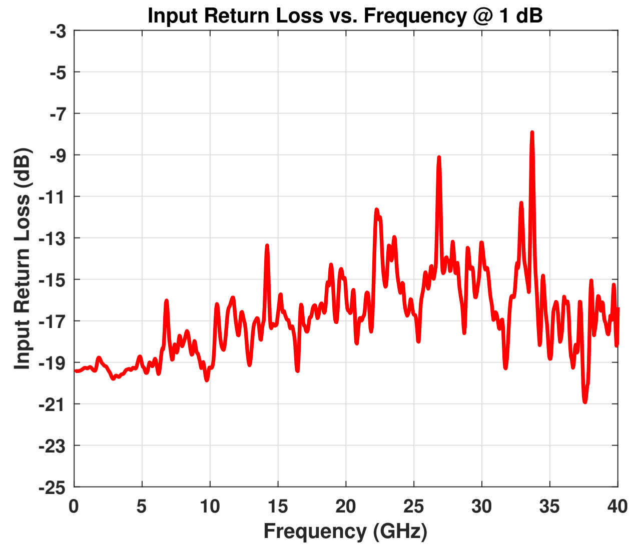
Part	Attenuation (dB)	Tolerance @ Center (Center) (dB)	Attenuation Flatness DC–12 GHz (dB)	Attenuation Flatness 12–26 GHz (dB)	Attenuation Flatness 26–33 GHz (dB)	Attenuation Flatness 33–40 GHz (dB)	Min. Return Loss DC–12 GHz (dB)	Min. Return Loss 12–26 GHz (dB)	Min. Return Loss 26–33 GHz (dB)	Min. Return Loss 33–40 GHz (dB)
ASU0001-1	1	±0.115(1.165)	±0.046	±0.081	±0.081	±0.09	17	14.6	14.3	15
ASU0001-2	2	±0.25(1.75)	±0.05	±0.125	±0.125	±0.135	13	12	12.2	13.1
ASU0001-3	3	±0.2(2.8)	±0.02	±0.07	±0.065	±0.1	17.3	15.8	15.8	17
ASU0001-5	5	±0.3(4.7)	±0.025	±0.1	±0.07	±0.34	22	21.8	21.7	19

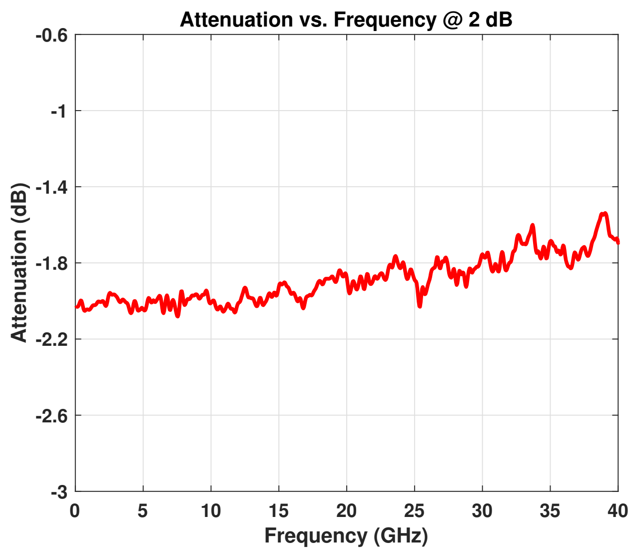
TOP = +25 °C, Z0=50 Ω, Unless Otherwise Noted:
Flatness is defined as the maximum deviation from the mean value of attenuation over the specified frequency range.

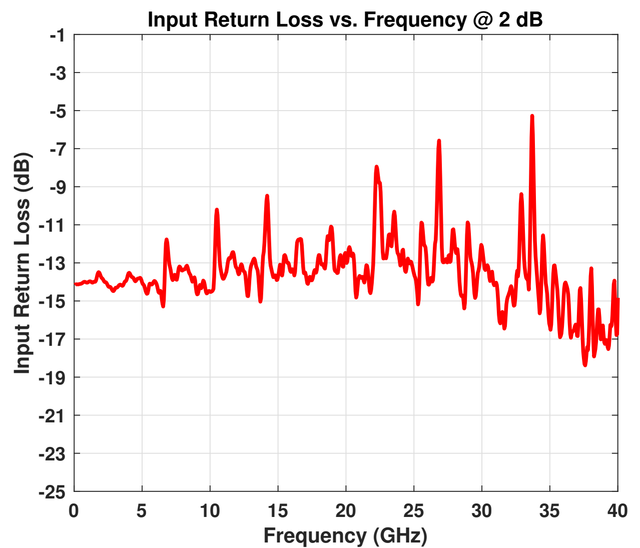
Typical Performance Curves

TOP = +25 °C, Z0=50 Ω, Unless Otherwise Noted. Data Gathered Using Ground-to-Signal-to-Ground Probes on Die



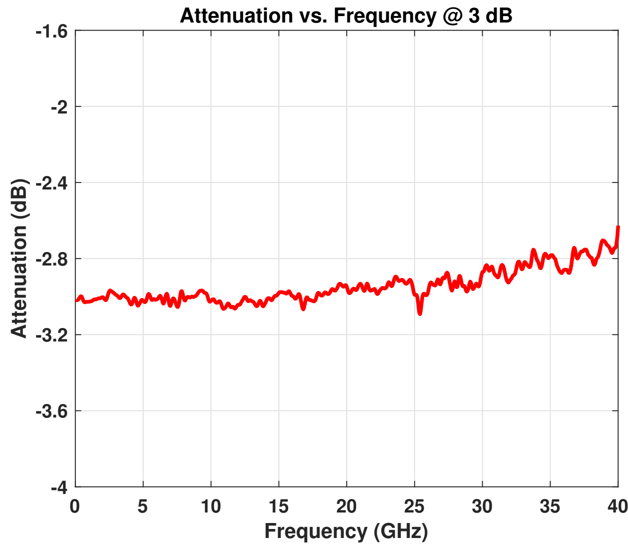


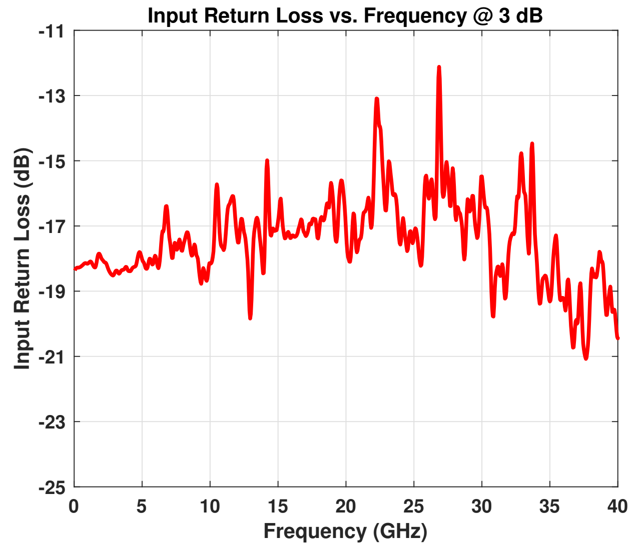


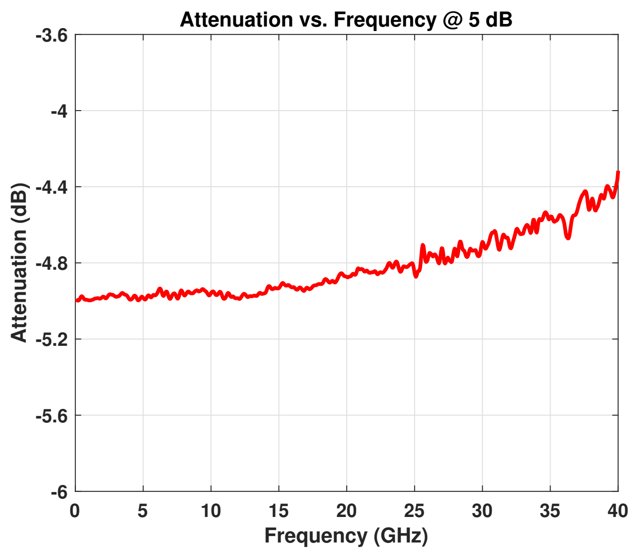


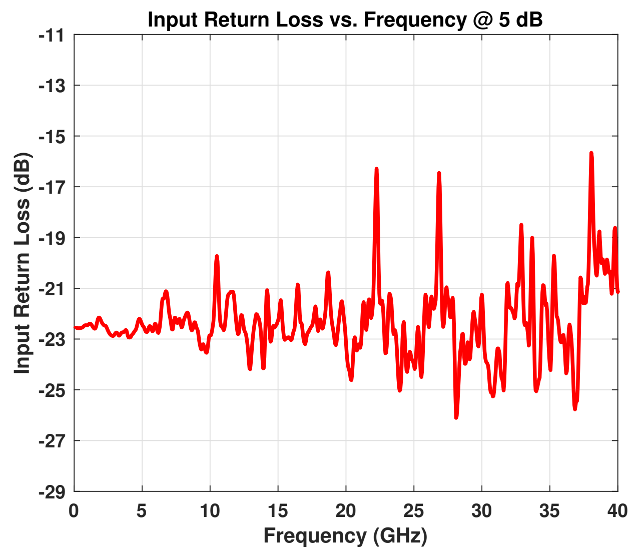
Typical Performance Curves

TOP = +25 °C, Z0=50 Ω, Unless Otherwise Noted. Data Gathered Using Ground-to-Signal-to-Ground Probes on Die

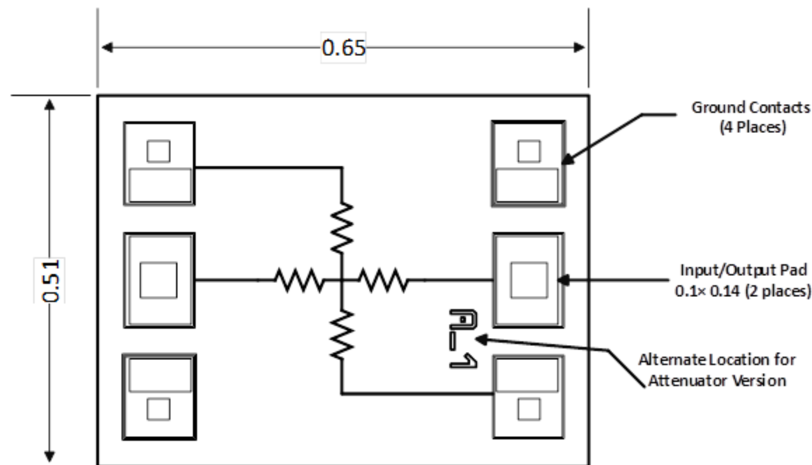








Mechanical Information



NOTES:

1. ALL DIMENSIONS IN MILLIMETERS
2. DIE THICKNESS IS 100 µm
3. TYPICAL BOND PAD IS 0.01 mm2
4. BACKSIDE METALLIZATION: GOLD
5. BACKSIDE METAL IS GROUND
6. BOND PAD METALLIZATION: GOLD
7. NO CONNECTION REQUIRED FOR UNLABELED BOND PADS
8. Die Size: OVERALL DIE SIZE ±50 µm

Mounting and Bonding Techniques for Millimeter wave GaAs MMICs

The die should be attached directly to the ground plane eutectically or with conductive epoxy. 50 Ohm Microstrip transmission lines on 0.127mm (5 mil) thick alumina thin film substrates are recommended for bringing RF to and from the chip (Figure 1). If 0.254mm (10 mil) thick alumina thin film substrates must be used, the die should be raised 0.150mm (6 mils) so that the surface of the die is coplanar with the surface of the substrate. One way to accomplish this is to attach the 0.102mm (4 mil) thick die to a 0.150mm (6 mil) thick molybdenum heat spreader (moly-tab) which is then attached to the ground plane (Figure 2). Microstrip substrates should be brought as close to the die as possible in order to minimize bond wire length. Typical die-to-substrate spacing is 0.076mm (3 mils)

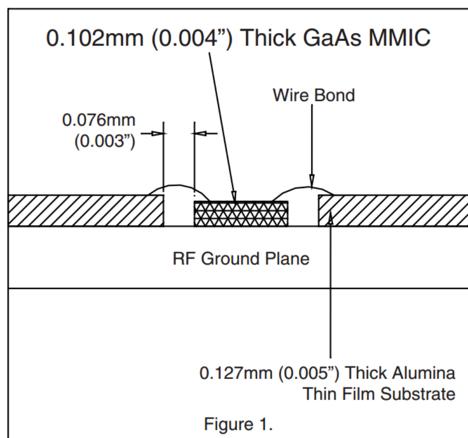


Figure 1.

Handling Precautions

Follow these precautions to avoid permanent damage.

Storage: All bare dies are placed in either Waffle or Gel based ESD protective containers, and then sealed in an ESD protective bag for shipment. Once the sealed ESD protective bag has been opened, all die should be stored in a dry nitrogen environment.

Cleanliness: Handle the chips in a clean environment. DO NOT attempt to clean the chip using liquid cleaning systems. Static Sensitivity: Follow ESD precautions to protect against >± 250V ESD strikes.

Transients: Suppress instrument and bias supply transients while bias is applied. Use shielded signal and bias cables to minimize inductive pick-up.

General Handling: Handle the chip along the edges with a vacuum collet or with a sharp pair of bent tweezers. The surface of the chip has fragile air bridges and should not be touched with vacuum collet, tweezers, or fingers.

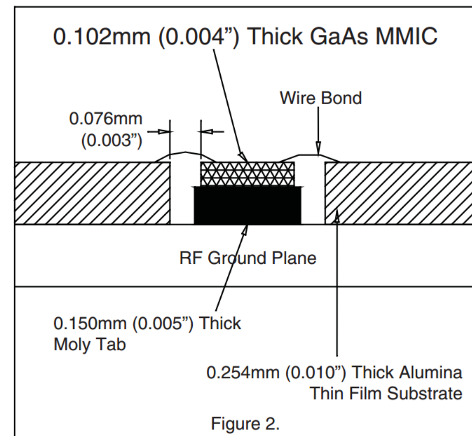


Figure 2.

Mounting

The chip is back-metallized and can be die mounted with AuSn eutectic preforms or with electrically conductive epoxy. The mounting surface should be clean and flat.

Eutectic Die Attach: A 80/20 gold tin preform is recommended with a work surface temperature of 255 °C and a tool temperature of 265 °C. When hot 90/10 nitrogen/hydrogen gas is applied, tool tip temperature should be 290 °C. DO NOT expose the chip to a temperature greater than 320 °C for more than 20 seconds. No more than 3 seconds of scrubbing should be required for attachment.

Epoxy Die Attach: Apply a minimum amount of epoxy to the mounting surface so that a thin epoxy fillet is observed around the perimeter of the chip once it is placed into position. Cure epoxy per the manufacturer's schedule.

Wire Bonding

Ball or wedge bond with 0.025 mm (1 mil) diameter pure gold wire is recommended. Thermosonic wirebonding with a nominal stage temperature of 150 °C and a ball bonding force of 40 to 50 grams or wedge bonding force of 18 to 22 grams is recommended. Use the minimum level of ultrasonic energy to achieve reliable wirebonds. Wirebonds should be started on the chip and terminated on the package or substrate. All bonds should be as short as possible <0.5 mm (20 mils).

Contact Information

For the latest specifications, additional product information:
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Email: info@abba-semi.com