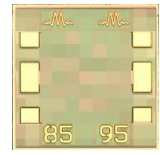
# 1 Device Overview




Die

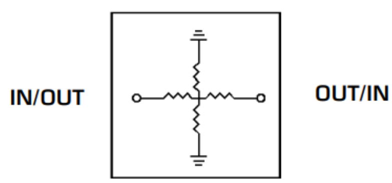
## 1.1 General Description

The ATNXX-0067CH is a family of precision GaAs MMIC fixed attenuators. These attenuators are an ideal solution for attenuating a signal and they can be used in a wide range of applications. They are ideal for test equipment's protection and signal overload prevention in various RF systems. A 50-ohm match is maintained over the entire operating frequency range. Attenuation values range from 0dB to 10dB with 1dB steps. ATN-67CH-KIT is an evaluation kit with 5 units of each value.

## 1.2 Features

- 0dB to 10dB attenuation values in 1dB steps
- Excellent Return Loss
- S2P data available

## 1.3 Functional Block Diagram




## 1.4 Part Ordering Options[1]

| Part Number | Attenuation Value (dB) | Description | Package | Green Status | Product Lifecycle | Export Classification |
|---|---|---|---|---|---|---|
| **ATN00-0067CH** | 0 | Wire bondable die | CH | RoHS | Active | EAR99 |
| **ATN01-0067CH** | 1 | | | | | |
| **ATN02-0067CH** | 2 | | | | | |
| **ATN03-0067CH** | 3 | | | | | |
| **ATN04-0067CH** | 4 | | | | | |
| **ATN05-0067CH** | 5 | | | | | |
| **ATN06-0067CH** | 6 | | | | | |
| **ATN07-0067CH** | 7 | | | | | |
| **ATN08-0067CH** | 8 | | | | | |
| **ATN09-0067CH** | 9 | | | | | |
| **ATN10-0067CH** | 10 | | | | | |
| **ATN-67CH-KIT** | 0 – 10 | Evaluation Kit with 5 of each ATNXX-0067CH | KIT | | | |

[1] Refer to our website for a list of definitions for terminology presented in this table.

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## Table of Contents



**Revision History**

| Revision Code | Revision Date | Comment |
|---|---|---|
| - | May 2023 | Datasheet Initial Release |

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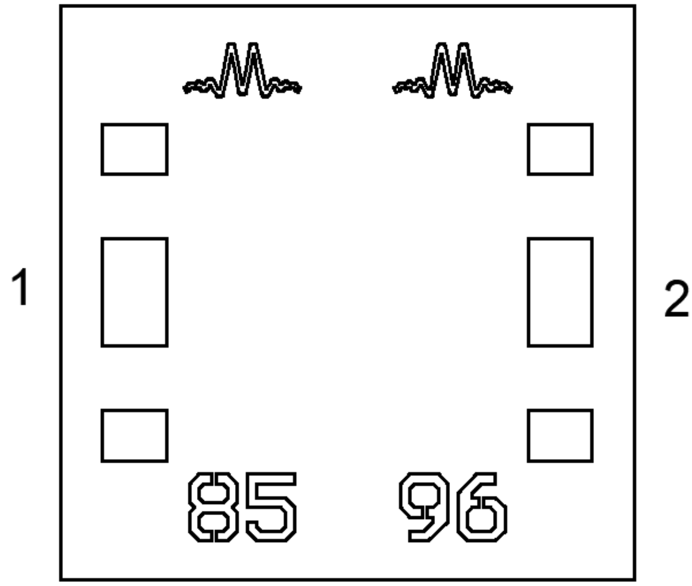
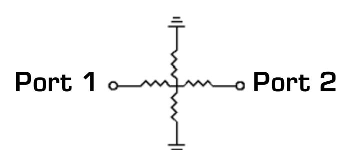
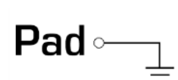
# 2 Port Configurations and Functions

## 2.1 Port Diagram

A top-down view of the ATNXX-0067CH package outline drawing is shown below. The MMIC attenuators are symmetrical allowing Port 1 or Port 2 to be used as the input.




## 2.2 Port Functions

| Port | Function | Description | Equivalent Circuit |
|---|---|---|---|
| Port 1 | Input/Output | Port 1 and port 2 are DC connected to each other and ground through a T-network of resistors. |  |
| Port 2 | Input/Output | | |
| Pad | Ground | CH package ground path is provided through the substrate and ground bond pads. |  |

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# 3 Specifications

## 3.1 Absolute Maximum Ratings

The Absolute Maximum Ratings indicate limits beyond which damage may occur to the device. If these limits are exceeded, the device may be inoperable or have a reduced lifetime.

| Parameter | Maximum Rating | Units |
|---|---|---|
| DC Current at any Port | 100 | mA |
| RF Power Handling at any Port | 2 | W |
| Operating Temperature | -55 to +100 | °C |
| Storage Temperature | -65 to +125 | ºC |

## 3.2 Package Information

| Parameter | Details | Rating |
|---|---|---|
| ESD | Human Body Model (HBM), per MIL-STD-750, Method 1020 | 1A |

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## 3.3 Electrical Specifications

The electrical specifications apply at $T_A$=+25°C in a 50Ω system. Typical data shown is for the filter in a CH package with a sine wave input applied to port 1.

Min and Max limits are guaranteed at $T_A$=+25°C. All bare die are 100% DC tested and visually inspected.

| ATN00-0067CH | Frequency (GHz) | Typical Value |
|---|---|---|
| Insertion Loss (dB) | DC – 67 | 0 |
| Attenuation Accuracy (dB) | DC – 35 | ±0.1 |
| | 35 – 67 | ±0.6 |
| Return Loss (dB) | DC – 35 | 32 |
| | 35 – 67 | 33 |
| Impedance (Ω) | DC – 67 | 50 |

| ATN01-0067CH | Frequency (GHz) | Typical Value |
|---|---|---|
| Insertion Loss (dB) | DC – 67 | 1 |
| Attenuation Accuracy (dB) | DC – 35 | ±0.2 |
| | 35 – 67 | ±0.7 |
| Return Loss (dB) | DC – 35 | 30 |
| | 35 – 67 | 33 |
| Impedance (Ω) | DC – 67 | 50 |

| ATN02-0067CH | Frequency (GHz) | Typical Value |
|---|---|---|
| Insertion Loss (dB) | DC – 67 | 2 |
| Attenuation Accuracy (dB) | DC – 35 | ±0.2 |
| | 35 – 67 | ±0.6 |
| Return Loss (dB) | DC – 35 | 32 |
| | 35 – 67 | 35 |
| Impedance (Ω) | DC – 67 | 50 |

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| ATN03-0067CH | Frequency (GHz) | Typical Value |
|---|---|---|
| Insertion Loss (dB) | DC – 67 | 3 |
| Attenuation Accuracy (dB) | DC – 35 | ±0.2 |
| | 35 – 67 | ±0.6 |
| Return Loss (dB) | DC – 35 | 34 |
| | 35 – 67 | 37 |
| Impedance (Ω) | DC – 67 | 50 |

| ATN04-0067CH | Frequency (GHz) | Typical Value |
|---|---|---|
| Insertion Loss (dB) | DC – 67 | 4 |
| Attenuation Accuracy (dB) | DC – 35 | ±0.2 |
| | 35 – 67 | ±0.4 |
| Return Loss (dB) | DC – 35 | 34 |
| | 35 – 67 | 36 |
| Impedance (Ω) | DC – 67 | 50 |

| ATN05-0067CH | Frequency (GHz) | Typical Value |
|---|---|---|
| Insertion Loss (dB) | DC – 67 | 5 |
| Attenuation Accuracy (dB) | DC – 35 | ±0.2 |
| | 35 – 67 | ±0.3 |
| Return Loss (dB) | DC – 35 | 35 |
| | 35 – 67 | 37 |
| Impedance (Ω) | DC – 67 | 50 |

| ATN06-0067CH | Frequency (GHz) | Typical Value |
|---|---|---|
| Insertion Loss (dB) | DC – 67 | 6 |
| Attenuation Accuracy (dB) | DC – 67 | ±0.2 |
| Return Loss (dB) | DC – 35 | 35 |
| | 35 – 67 | 38 |
| Impedance (Ω) | DC – 67 | 50 |

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| ATN07-0067CH | Frequency (GHz) | Typical Value |
|---|---|---|
| Insertion Loss (dB) | DC – 67 | 7 |
| Attenuation Accuracy (dB) | DC – 67 | ±0.2 |
| Return Loss (dB) | DC – 35 | 44 |
| | 35 – 67 | 33 |
| Impedance (Ω) | DC – 67 | 50 |

| ATN08-0067CH | Frequency (GHz) | Typical Value |
|---|---|---|
| Insertion Loss (dB) | DC – 67 | 8 |
| Attenuation Accuracy (dB) | DC – 67 | ±0.2 |
| Return Loss (dB) | DC – 35 | 42 |
| | 35 – 67 | 37 |
| Impedance (Ω) | DC – 67 | 50 |

| ATN09-0067CH | Frequency (GHz) | Typical Value |
|---|---|---|
| Insertion Loss (dB) | DC – 67 | 9 |
| Attenuation Accuracy (dB) | DC – 67 | ±0.2 |
| Return Loss (dB) | DC – 35 | 40 |
| | 35 – 67 | 38 |
| Impedance (Ω) | DC – 67 | 50 |

| ATN10-0067CH | Frequency (GHz) | Typical Value |
|---|---|---|
| Insertion Loss (dB) | DC – 67 | 10 |
| Attenuation Accuracy (dB) | DC – 67 | ±0.2 |
| Return Loss (dB) | DC – 35 | 36 |
| | 35 – 67 | 38 |
| Impedance (Ω) | DC – 67 | 50 |

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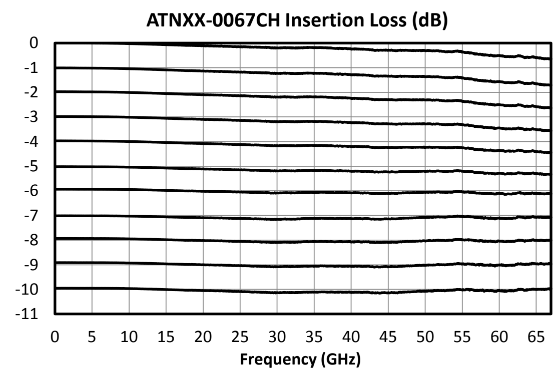
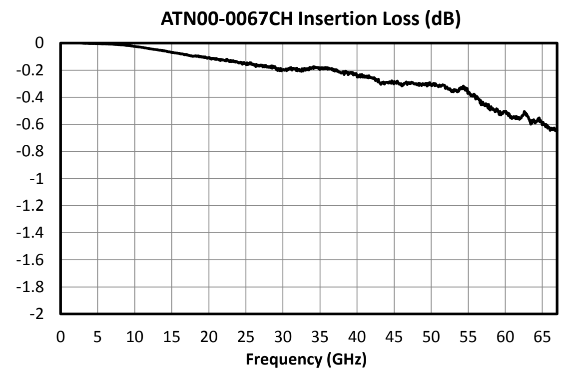
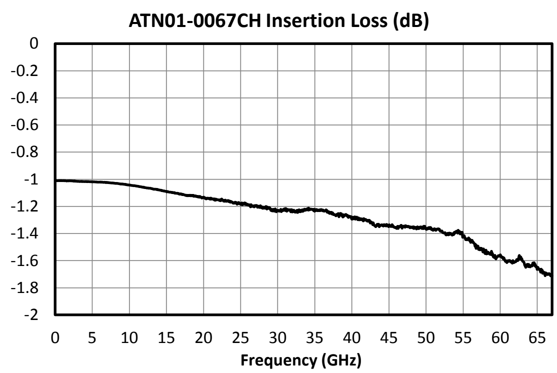
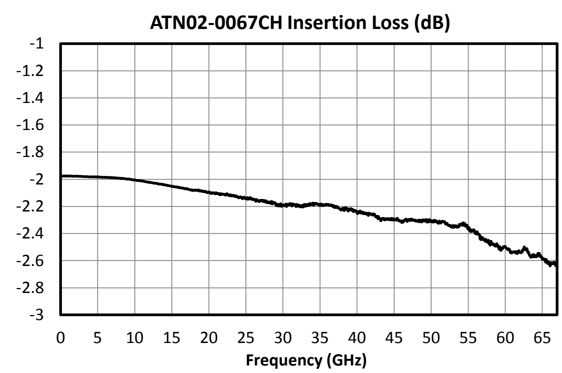
## 3.4 Typical Performance Plots[2]

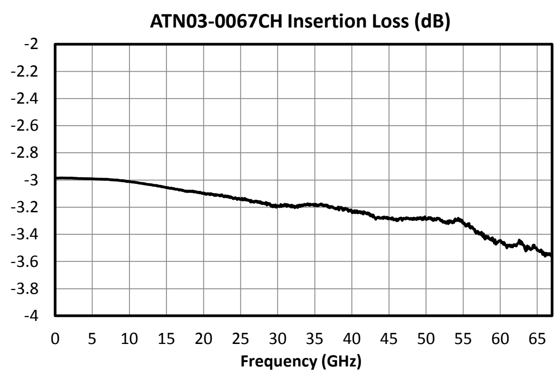
### 3.4.1 Insertion Loss

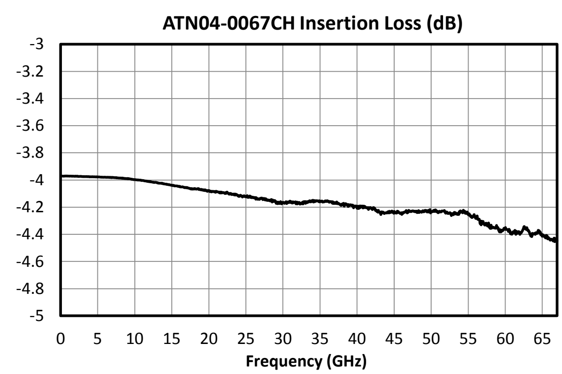



[2] Measurements performed on bare die. For performance variation with bond wire lengths, see section 3.4.3 Variation with Bondwires.

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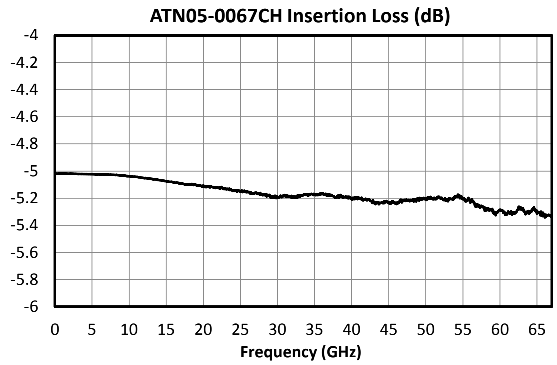


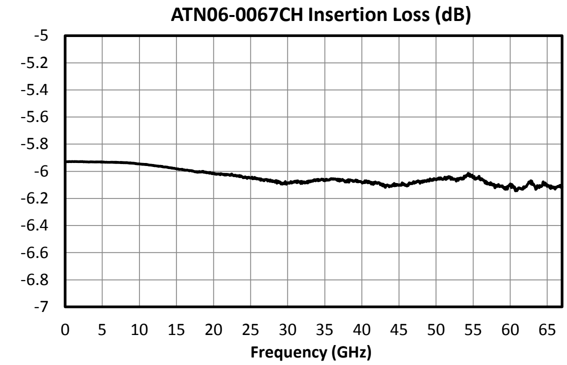


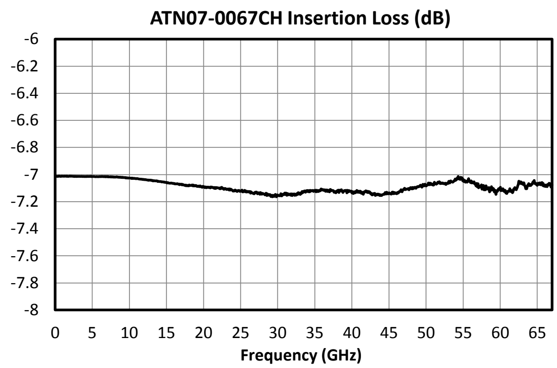


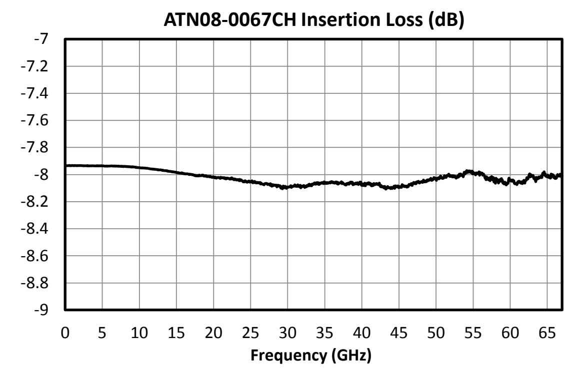


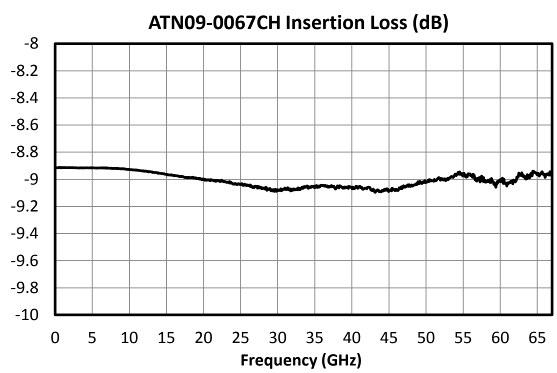


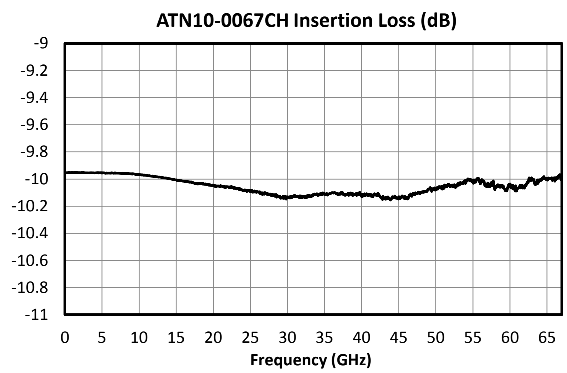


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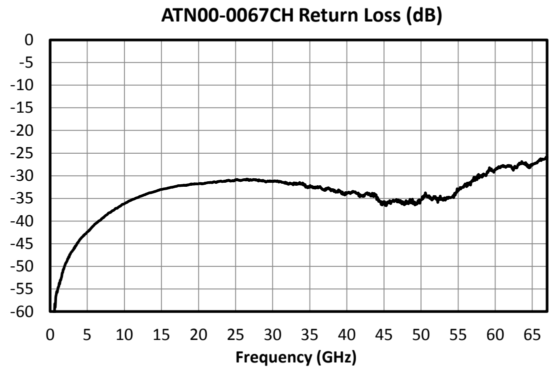
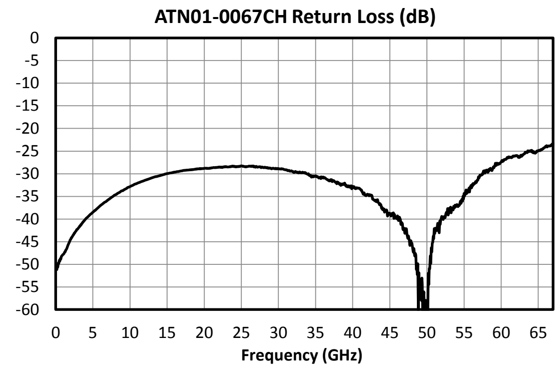
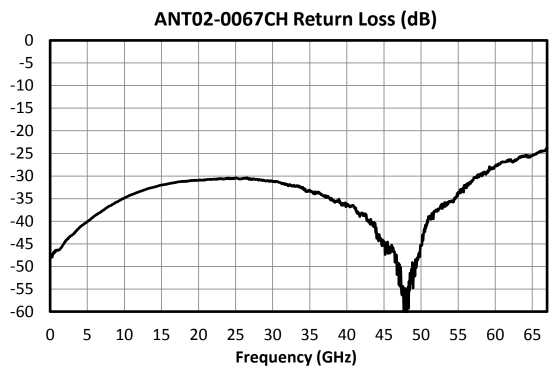
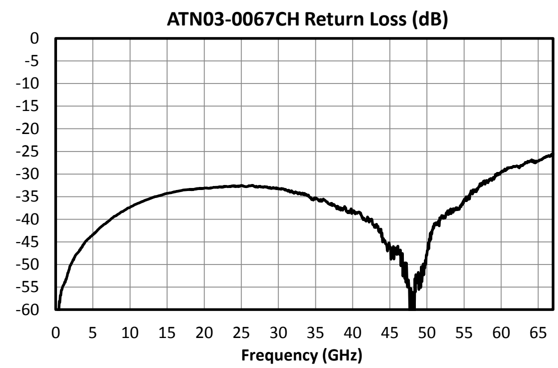
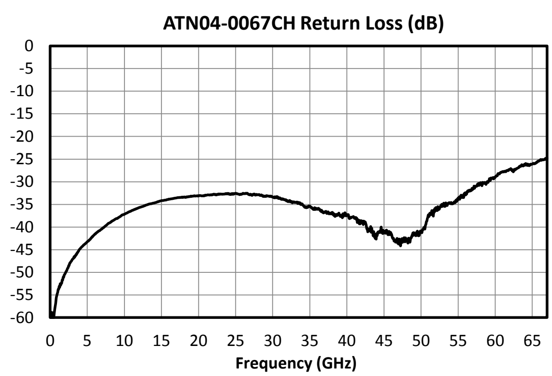
### 3.4.2 Return Loss

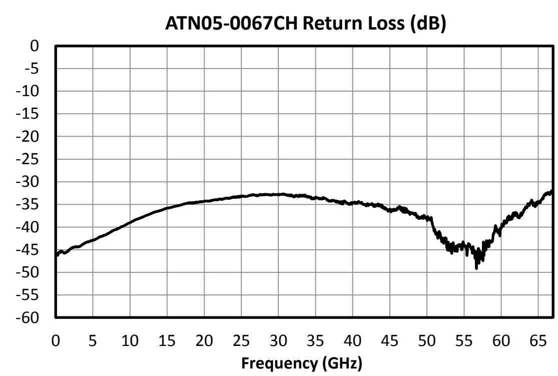


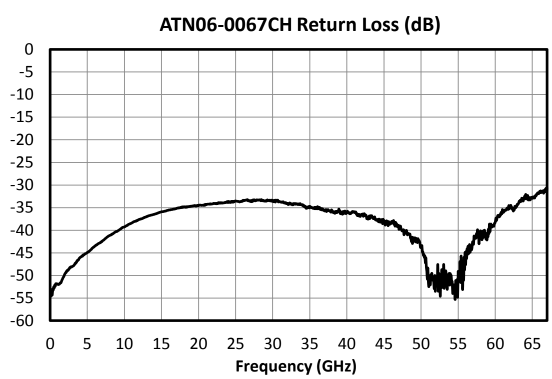



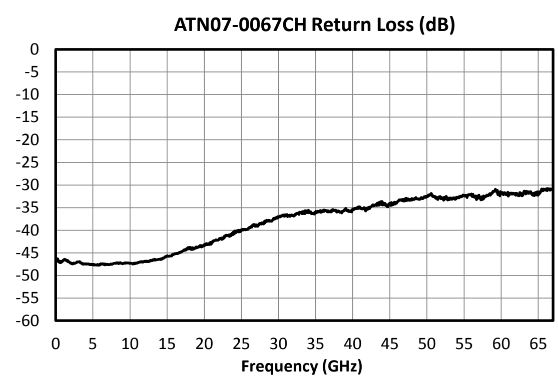

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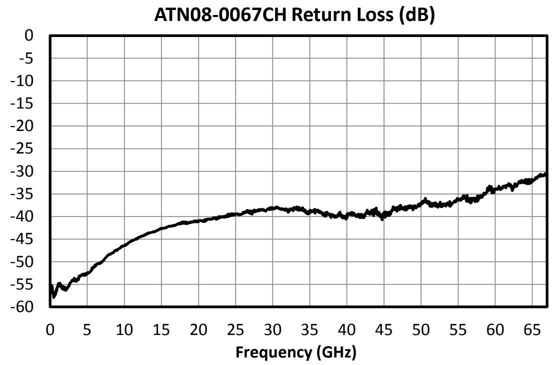
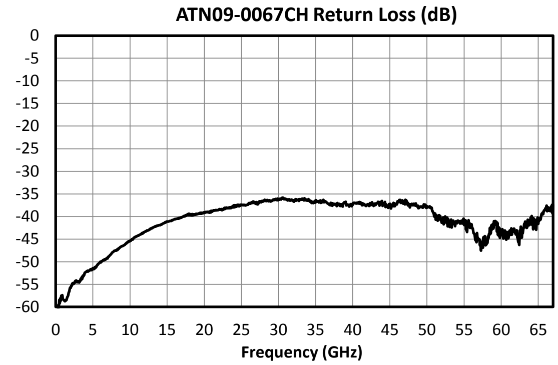
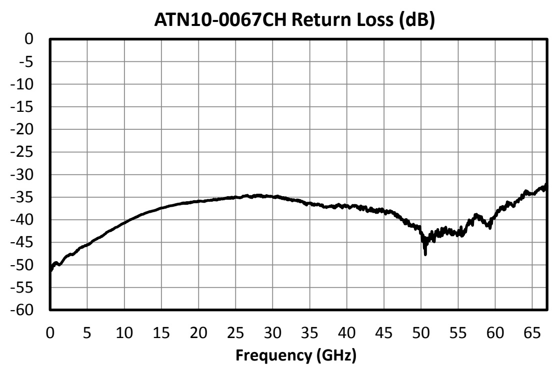
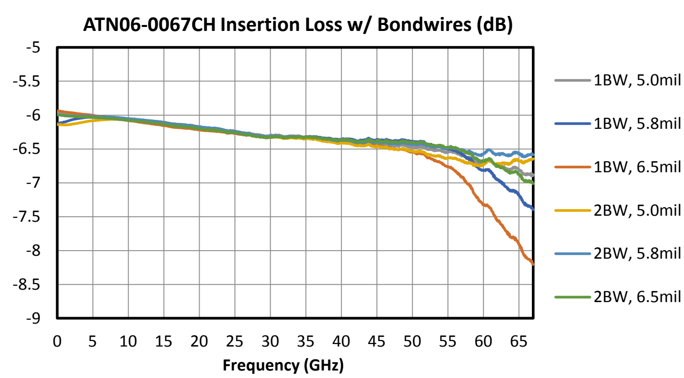


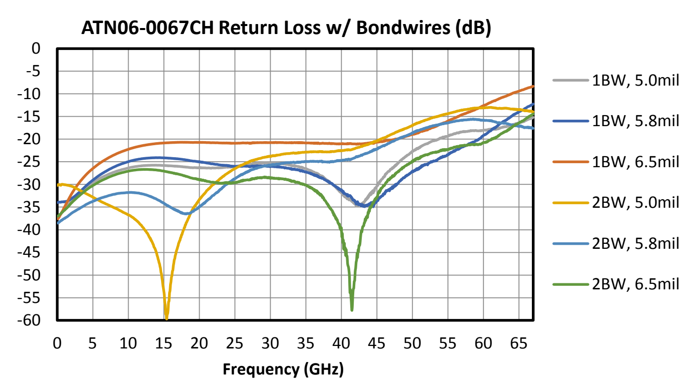




### 3.4.3 Variation With Bondwires

Typical variation with bondwire lengths is shown for ATN06-0067CH, however general trends with increasing bondwire lengths apply to all attenuators in the family.

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# 4 Die Mounting Recommendations

## 4.1 Mounting and Bonding Recommendations

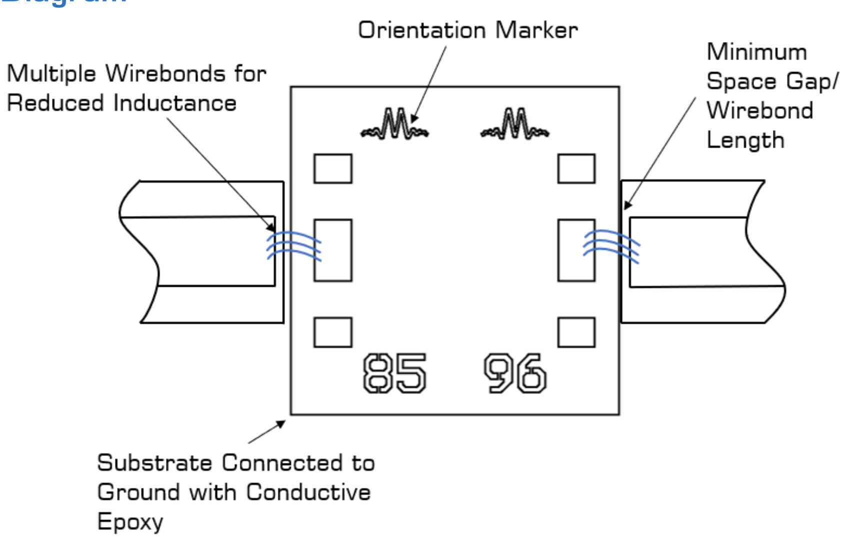
Marki MMICs should be attached directly to a ground plane with conductive epoxy. The ground plane electrical impedance should be as low as practically possible. This will prevent resonances and permit the best possible electrical performance. Datasheet performance is only guaranteed in an environment with a low electrical impedance ground.

**Mounting** - To epoxy the chip, apply a minimum amount of conductive epoxy to the mounting surface so that a thin epoxy fillet is observed around the perimeter of the chip. Cure epoxy according to manufacturer instructions.

**Wire Bonding** - Ball or wedge bond with 0.025 mm (1 mil) diameter pure gold wire. 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. Bond wire inductance will improve return loss. Bondwire inductance in the range of 30pH to 200pH will improve performance.

**Circuit Considerations** – 50 Ω transmission lines should be used for all high frequency connections in and out of the chip. Wirebonds should be kept as short as possible, with multiple wirebonds recommended for higher frequency connections to reduce parasitic inductance. In circumstances where the chip more than .001" thinner than the substrate, a heat spreading spacer tab is optional to further reduce bondwire length and parasitic inductance.

## 4.2 Bonding Diagram

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## 4.4 Handling Precautions

**General Handling**
Chips should be handled with care using tweezers or a vacuum collet. Users should take precautions to protect chips from direct human contact that can deposit contaminants, like perspiration and skin oils on any of the chip's surfaces.

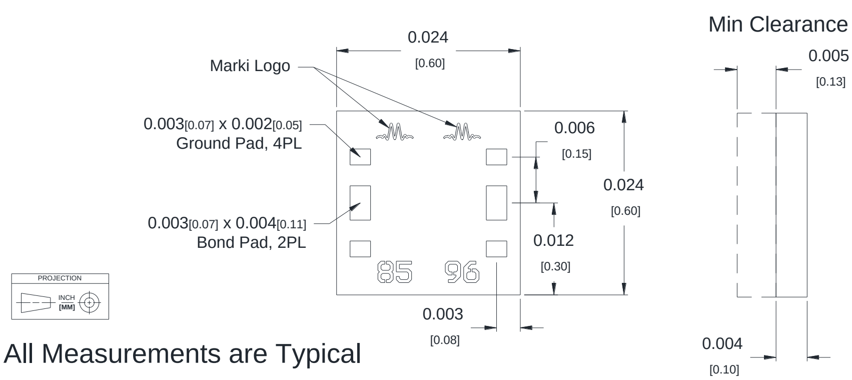
**Static Sensitivity**
GaAs MMIC devices are sensitive to ESD and should be handled, assembled, tested, and transported only in static protected environments.

**Cleaning and Storage**: Do not attempt to clean the chip with a liquid cleaning system or expose the bare chips to liquid. Once the ESD sensitive bags the chips are stored in are opened, chips should be stored in a dry nitrogen atmosphere.

# 5 Mechanical Data

## 5.1 CH Package Outline Drawing

| Part Number | Die Number |
|---|---|
| ATN00-0067CH | 8595 |
| ATN01-0067CH | 8596 |
| ATN02-0067CH | 8597 |
| ATN03-0067CH | 8598 |
| ATN04-0067CH | 8599 |
| ATN05-0067CH | 8600 |
| ATN06-0067CH | 8601 |
| ATN07-0067CH | 8602 |
| ATN08-0067CH | 8603 |
| ATN09-0067CH | 8604 |
| ATN10-0067CH | 8605 |




All Measurements are Typical

Notes:

1. CH substrate is .004 in Thick GaAs.
2. Traces are 5 microns Au.
3. Tolerance for X, Y dimensions is ± 0.002 in.
   Tolerance for Z dimension is ± 0.0005 in.
   Tolerance for pad location is ± 0.0001 in.

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