



Mini-Circuits

MMIC SURFACE MOUNT

Fixed Attenuator

BAT-0+

50Ω DC to 60 GHz 2 W 0 dB

THE BIG DEAL

- Wideband, DC to 60 GHz
- High Power Handling, 2 W
- Excellent Return Loss, Typ. 20 dB
- 1.5x1.5 mm, 6-Lead QFN-Style Package

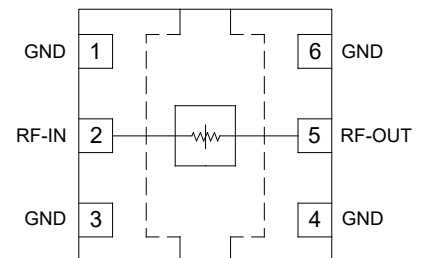
APPLICATIONS

- Test & Measurement Equipment
- Satellite Communications
- Radar, EW, and ECM Defense Systems
- Telecom Infrastructure
- 5G sub-6 GHz and mmW



Generic photo used for illustration purposes only

FUNCTIONAL DIAGRAM



PRODUCT OVERVIEW

BAT-0+ is a wideband, bidirectional, 0 dB fixed attenuator fabricated using a highly reliable and repeatable GaAs semiconductor process. Operating from DC to 60 GHz, this model is suitable for use as a through line and can be interchanged on a PCB with any other BAT attenuation value. The model can handle input power up to 2 W, making it an ideal choice for a wide range of applications such as Test & Measurement, Satellite Communications, Radar, EW, ECM Defense Systems, Telecom Infrastructure, and 5G.

KEY FEATURES

Features	Advantages
Wideband Operation, DC to 60 GHz	Flat attenuation response from DC to 60 GHz supports a wide array of applications including Test & Measurement Equipment, Satellite Communications, Radar, EW, ECM Defense Systems, & 5G applications.
Excellent Return Loss	Low Return Loss minimizes reflections and enables flexibility to implement anywhere within wideband signal chains.
1.5x1.5 mm 6-Lead QFN-Style Package	Small footprint saves space in dense layouts while providing low inductance and excellent thermal contact to the PCB. Industry-standard packaging allows for ease of assembly in high-volume manufacturing processes.

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ELECTRICAL SPECIFICATIONS^{1,2} AT +25°C, 50Ω, UNLESS NOTED OTHERWISE

Parameter	Condition (GHz)	Min.	Typ.	Max.	Units
Frequency Range		DC		60	GHz
Attenuation	0.01 - 10		0.05	0.6	dB
	10 - 20		0.13	0.9	
	20 - 30		0.28	1.1	
	30 - 40		0.32	1.3	
	40 - 50		0.42		
	50 - 60		0.52		
Input Return Loss	0.01 - 10		34		dB
	10 - 20		26		
	20 - 30		20		
	30 - 40		21		
	40 - 50		22		
	50 - 60		24		
Output Return Loss	0.01 - 10		34		dB
	10 - 20		26		
	20 - 30		20		
	30 - 40		21		
	40 - 50		22		
	50 - 60		24		

1. Tested on Mini-Circuits Characterization Test/Evaluation Board TB-BAT-0C+. See Figure 2. Board loss de-embedded to the device.

2. Bi-directional RF-IN and RF-OUT ports can be interchanged.



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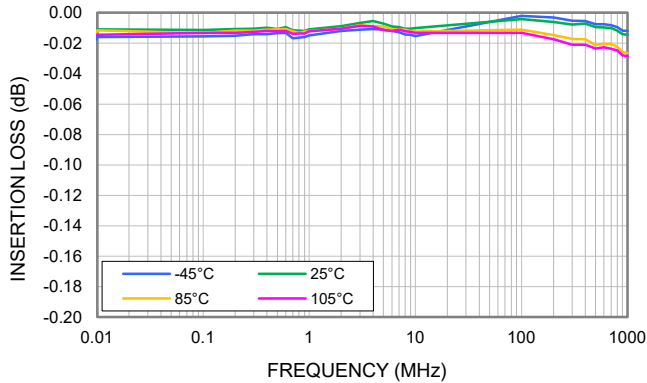
Fixed Attenuator

BAT-0+

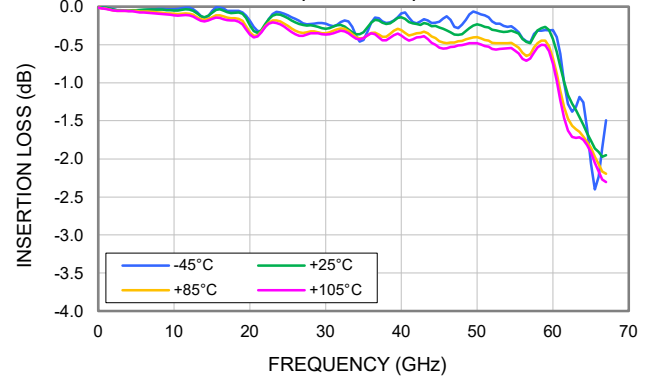
50Ω DC to 60 GHz 2 W 0 dB

TYPICAL PERFORMANCE GRAPHS

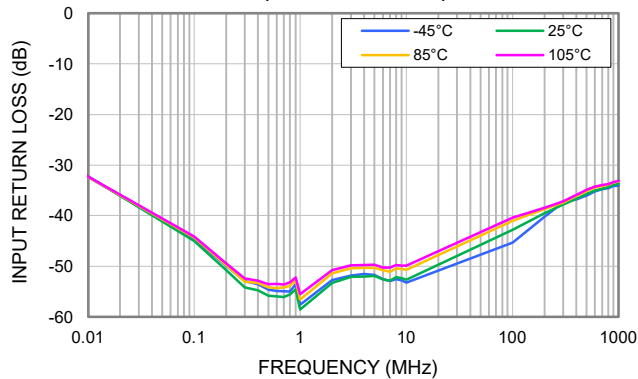
**INSERTION LOSS vs. TEMPERATURE
(LOW FREQUENCY)**



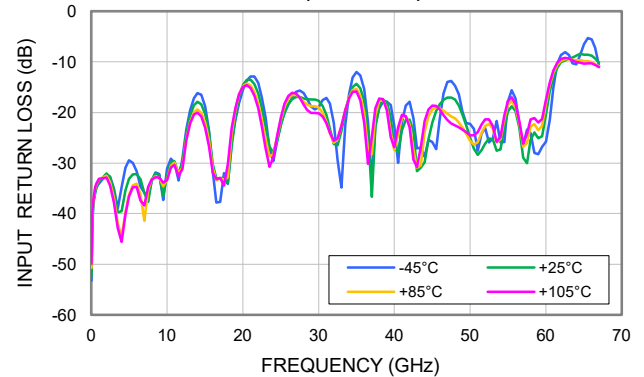
**INSERTION LOSS vs. TEMPERATURE
(WIDEBAND)**



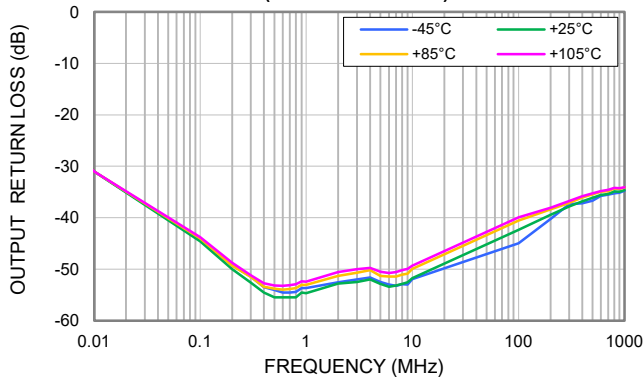
**INPUT RETURN LOSS vs. TEMPERATURE
(LOW FREQUENCY)**



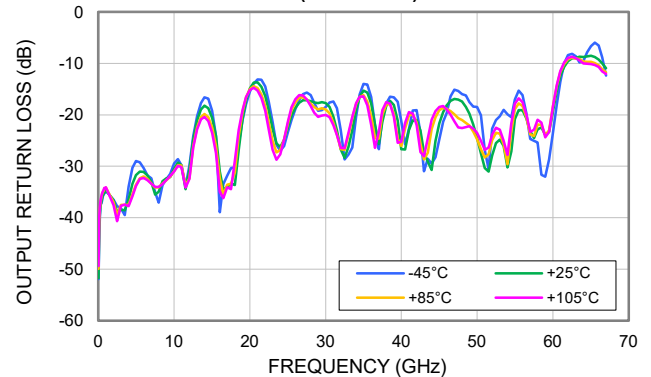
**INPUT RETURN LOSS vs. TEMPERATURE
(WIDEBAND)**



**OUTPUT RETURN LOSS vs. TEMPERATURE
(LOW FREQUENCY)**



**OUTPUT RETURN LOSS vs. TEMPERATURE
(WIDEBAND)**



ABSOLUTE MAXIMUM RATINGS³

Parameter	Ratings
Operating Temperature	-45°C to +105°C
Storage Temperature	-65°C to +150°C
RF Input Power ⁴	2 W

3. Permanent damage may occur if any of these limits are exceeded. Maximum ratings are not intended for continuous normal operation.

4. Power derated to 1 W at +105°C.

ESD RATING

	Class	Voltage Range	Reference Standard
HBM	2	> 2000 V	ANSI/ESD STM 5.1 - 2001
CDM	C3	> 1000 V	ANSI/ESDA/JEDEC JS-002-2022



ESD HANDLING PRECAUTION: This device is designed to be Class 2 for HBM. Static charges may easily produce potentials higher than this with improper handling and can discharge into DUT and damage it. As a preventive measure Industry standard ESD handling precautions should be used at all times to protect the device from ESD damage.

MSL RATING

Moisture Sensitivity: MSL1 in accordance with IPC/JEDEC J-STD-020E /JEDEC J-STD-033C



FUNCTIONAL DIAGRAM

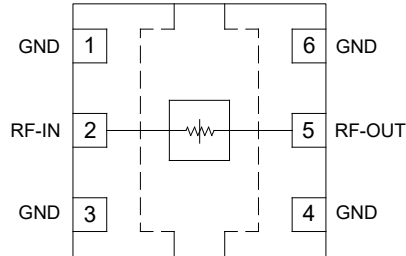


Figure 1. BAT-0+ Functional Diagram

PAD DESCRIPTION

Function	Pad #	Description (Refer to Figure 2)
RF-IN	2	RF-IN Pad connects to RF Input port.
RF-OUT	5	RF-OUT Pad connects to RF Output port.
GND	1, 3, 4, 6 & Paddle	Connects to ground.

CHARACTERIZATION TEST BOARD

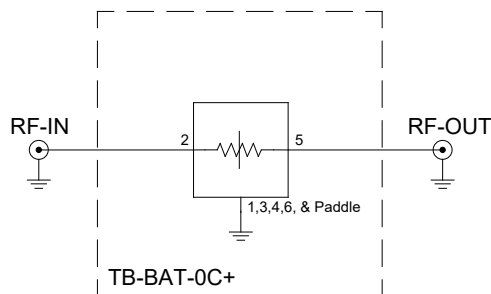


Figure 2. BAT-0+ Characterization and Application Circuit.

Electrical Parameters and Conditions

Insertion Loss and Return Loss are measured using N5247B PNA-X microwave network analyzer.

Conditions:

1. Insertion Loss and Return Loss: $P_{IN} = -5$ dBm



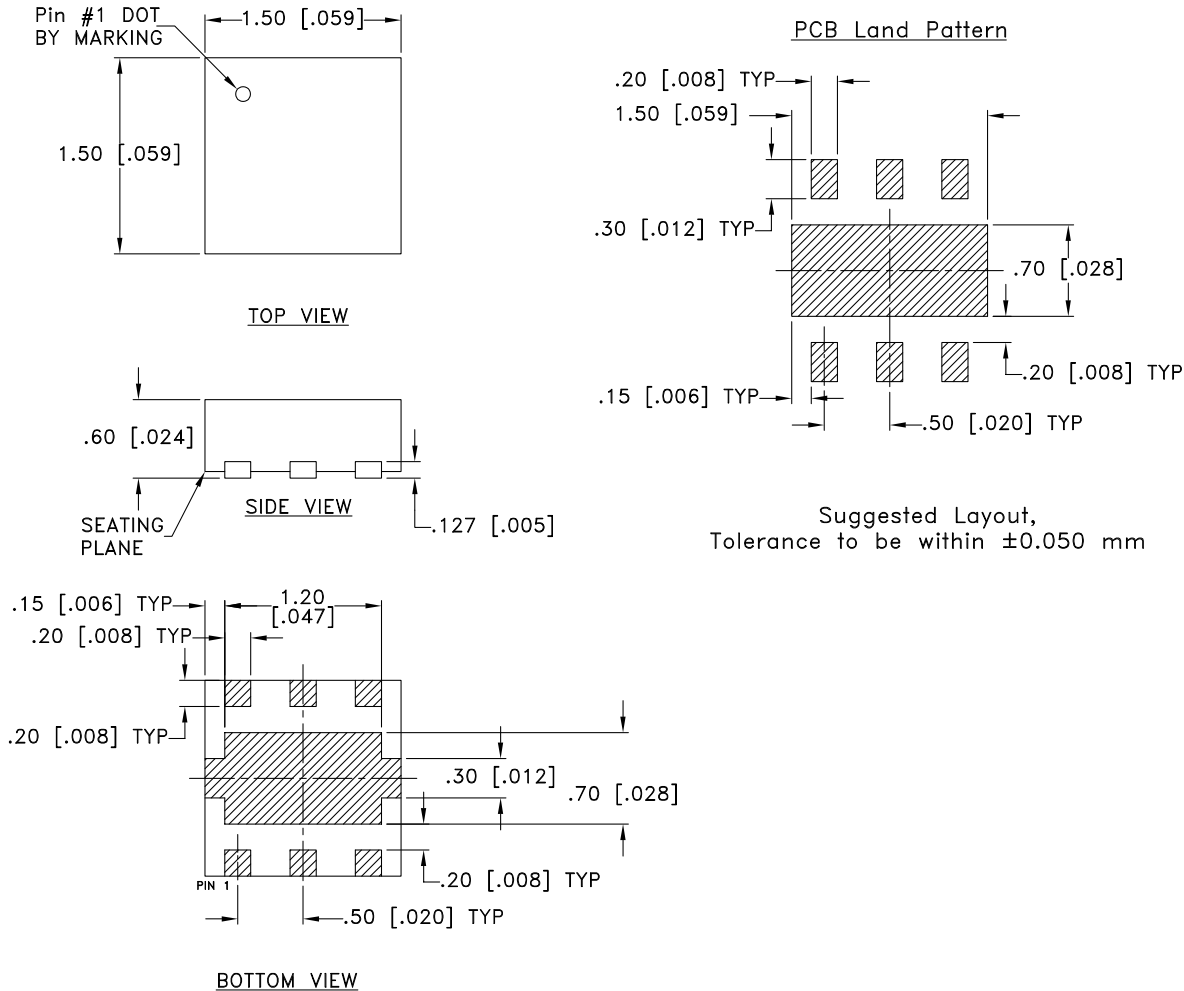
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CASE STYLE DRAWING



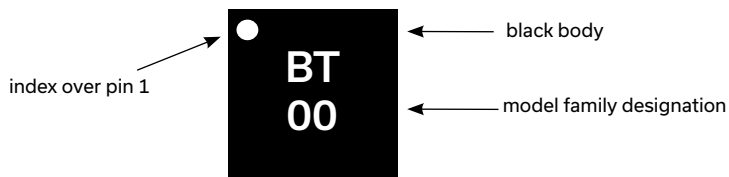
NOTES:

1. DENOTES METALLIZATION

Weight: .0036 grams

Dimensions are in mm [inches]. Tolerances: 2 Pl. ± 0.05 mm

PRODUCT MARKING



Marking may contain other features or characters for internal lot control





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ADDITIONAL DETAILED INFORMATION IS AVAILABLE ON OUR DASHBOARD [CLICK HERE](#)

Performance Data	Data Graphs S-Parameter (S2P Files) Data Set (.zip file)
Case Style	KC3009 Plastic package, exposed paddle, lead finish: Nickel-Palladium-Gold
RoHS Status	Compliant
Tape & Reel Standard quantities available on reel	F66 7" reels with 20, 50, 100, 200, 500, 1000, 2000, or 3000 devices
Suggested Layout for PCB Design	PL-801
Evaluation Board	TB-BAT-0C+ Gerber File
Environmental Ratings	ENV08T1

NOTES

- Performance and quality attributes and conditions not expressly stated in this specification document are intended to be excluded and do not form a part of this specification document.
- Electrical specifications and performance data contained in this specification document are based on Mini-Circuit's applicable established test performance criteria and measurement instructions.
- The parts covered by this specification document are subject to Mini-Circuits standard limited warranty and terms and conditions (collectively, "Standard Terms"); Purchasers of this part are entitled to the rights and benefits contained therein. For a full statement of the standard terms and the exclusive rights and remedies thereunder, please visit Mini-Circuits' website at www.minicircuits.com/terms/viewterm.html

