MMIC SURFACE MOUNT

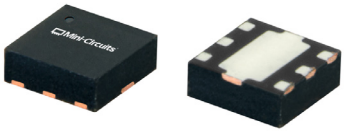
Fixed Attenuator

BAT-5+

50Ω DC to 60 GHz 1.5 W 5 dB

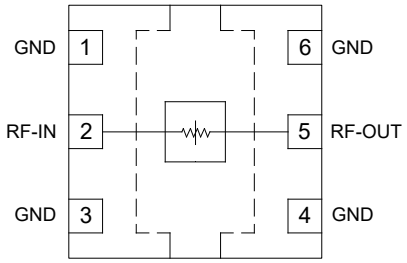
THE BIG DEAL

- Wideband, DC to 60 GHz
- High Power Handling, 1.5 W
- Excellent Return Loss, Typ. 23 dB
- 1.5x1.5 mm, 6-Lead QFN-Style Package



Generic photo used for illustration purposes only

FUNCTIONAL DIAGRAM



APPLICATIONS

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

PRODUCT OVERVIEW

BAT-5+ is a wideband, bidirectional, absorptive fixed attenuator fabricated using a highly reliable and repeatable GaAs semiconductor process. Operating from DC to 60 GHz, this model achieves outstanding attenuation accuracy and flatness while maintaining excellent return loss throughout the entire band. The model can handle input power up to 1.5 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.

REV. OR
ECO-023892
BAT-5+
MCL NY
241209

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ELECTRICAL SPECIFICATIONS[1,2] AT +25°C, 50Ω, UNLESS NOTED OTHERWISE

Parameter	Condition (GHz)	Min.	Typ.	Max.	Units
Frequency Range		0.01		60	GHz
Attenuation	0.01 - 10	4.4	5.0	5.5	dB
	10 - 20	4.3	5.0	5.8	
	20 - 30	4.3	5.1	5.9	
	30 - 40	3.4	5.1	6.8	
	40 - 50		4.9		
	50 - 60		4.7		
Input Return Loss	0.01 - 10		30		dB
	10 - 20		29		
	20 - 30		23		
	30 - 40		18		
	40 - 50		19		
	50 - 60		17		
Output Return Loss	0.01 - 10		30		dB
	10 - 20		29		
	20 - 30		23		
	30 - 40		18		
	40 - 50		19		
	50 - 60		17		

1. Tested on Mini-Circuits Characterization Test/Evaluation Board TB-BAT-5C+. See Figure 2. Board loss de-embedded to the device.
2. Bi-directional RF-IN and RF-OUT ports can be interchanged.

Fixed Attenuator

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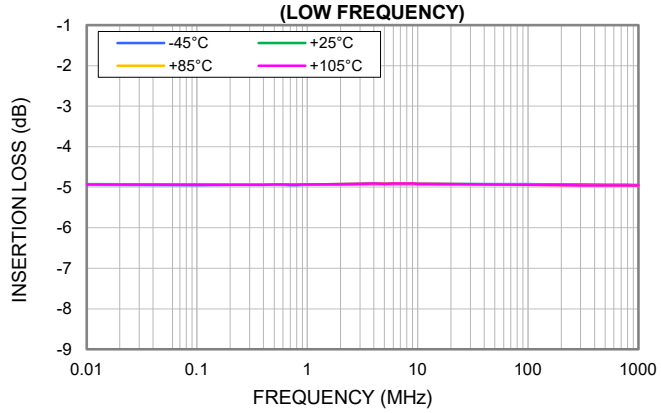
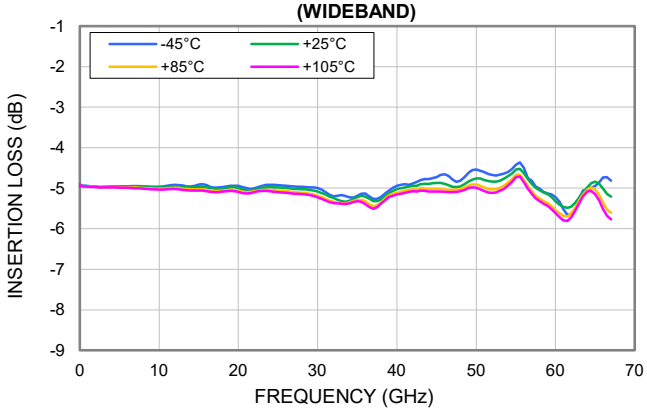
TYPICAL PERFORMANCE GRAPHS

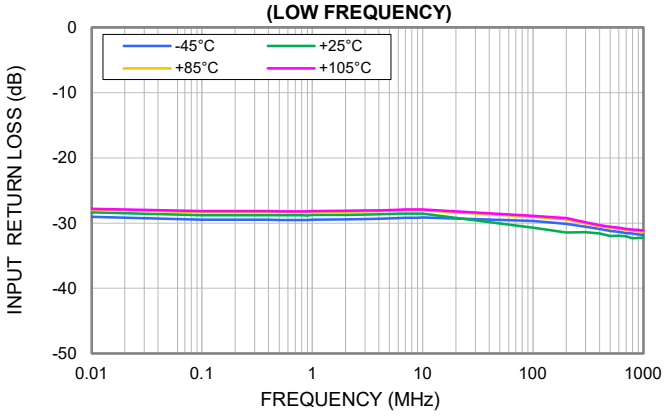
INSERTION LOSS vs. TEMPERATURE
(LOW FREQUENCY)



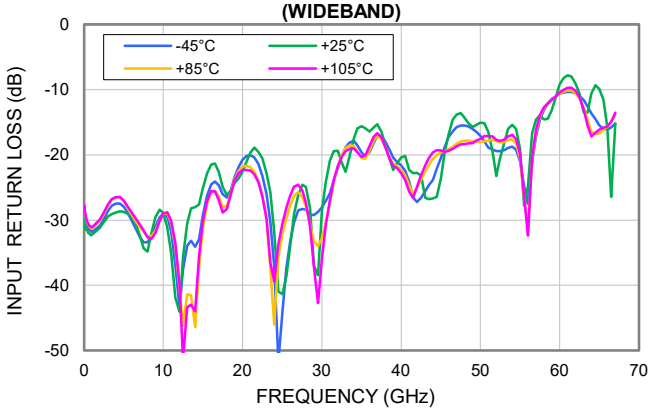
INSERTION LOSS vs. TEMPERATURE
(WIDEBAND)



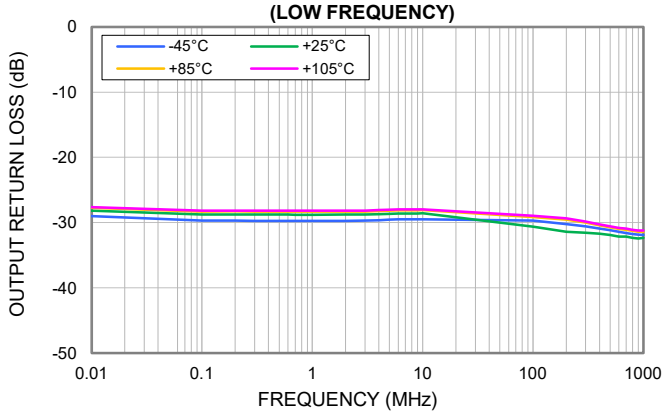
INPUT RETURN LOSS vs. TEMPERATURE
(LOW FREQUENCY)



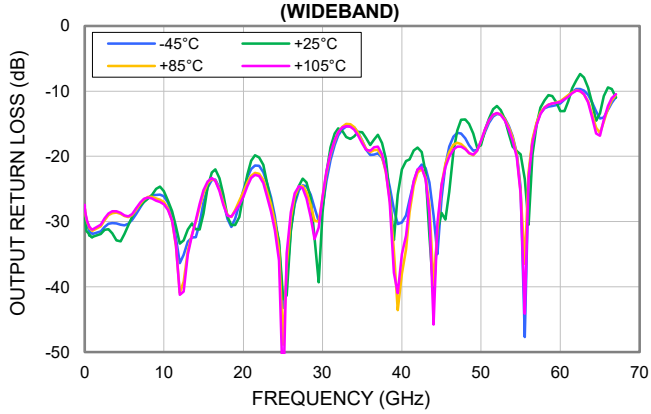
INPUT RETURN LOSS vs. TEMPERATURE
(WIDEBAND)



OUTPUT RETURN LOSS vs.TEMPERATURE
(LOW FREQUENCY)



OUTPUT RETURN LOSS vs.TEMPERATURE
(WIDEBAND)



ABSOLUTE MAXIMUM RATINGS[3]

Parameter	Ratings
Operating Temperature	-45°C to +105°C
Storage Temperature	-65°C to +150°C
RF Input Power[4]	1.5 W

3. Permanent damage may occur if any of these limits are exceeded.
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

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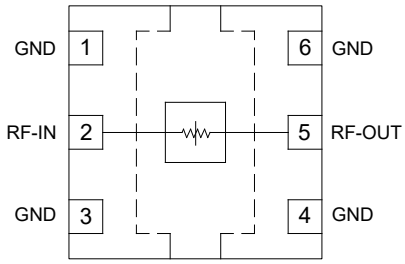

Figure 1. BAT-5+ Functional Diagram

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

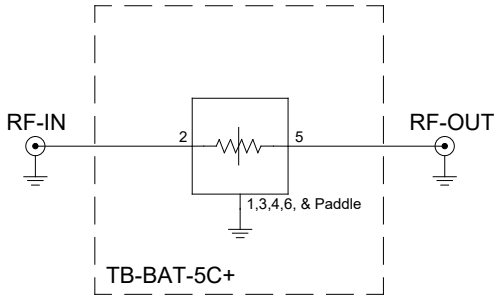

Figure 2. BAT-5+ Characterization and Application Circuit.

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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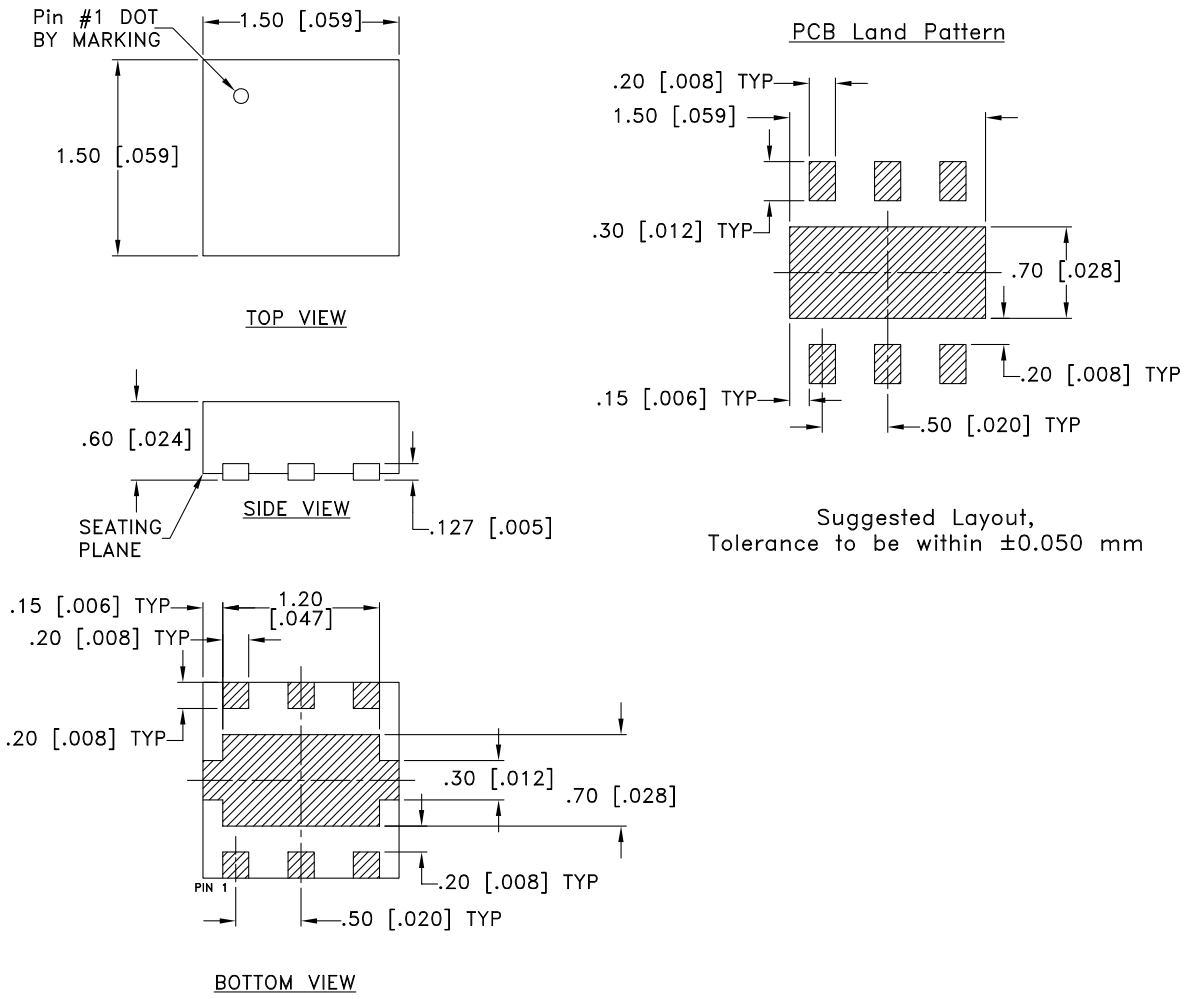
CASE STYLE DRAWING



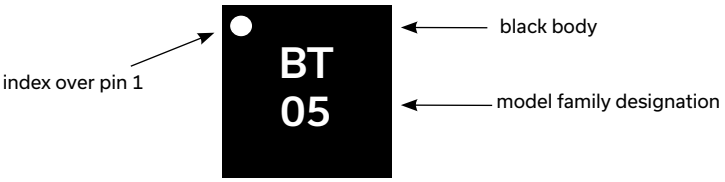
NOTES:

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-5C+ Gerber File
Environmental Ratings	ENV08T1

Notes

A. 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.

B. Electrical specifications and performance data contained in this specification document are based on Mini-Circuits' applicable established test performance criteria and measurement instructions.

C. 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 https://www.minicircuits.com/terms/viewterm.html