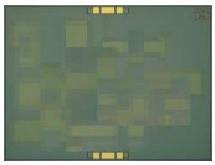
1 Device Overview



Die

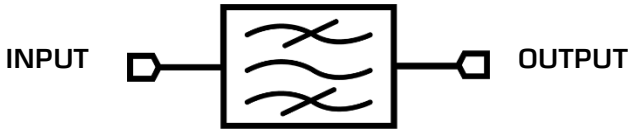
1.1 General Description

The MFBB-0000XCH family of passive MMIC bandpass filter die are an ideal solution for small form factor, high rejection filtering. Passive GaAs MMIC technology allows production of smaller filter constructions that replace larger form factor circuit board constructions. Tight fabrication tolerances allow for less unit to unit variation than traditional filter technologies. The MFBB-0000XCH is available as a wire bondable chip. Low unit to unit variation allows for accurate simulations using the provided S2P file taken from measured production units.

1.2 Features

- Excellent Return Loss
- High Stop Band Suppression
- Wide Stop Band with Fast Roll-Off
- S2P data available

1.3 Functional Block Diagram



1.4 Part Ordering Options[1]

Part Number	1dBc Passband (GHz)	Description	Package	Green Status	Product Lifecycle	Export Classification
MFBB-00001CH	14.60 – 15.65	Wire bondable die	CH	RoHS	Active	EAR99
MFBB-00002CH	20.25 – 23.25					

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

Table of Contents

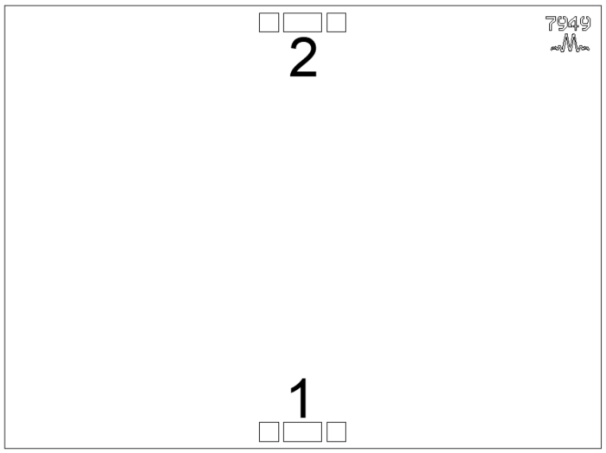
Revision History

Revision Code	Revision Date	Comment
-	July 2022	Datasheet Initial Release
A	September 2022	DC Current Handling Added

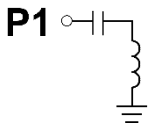
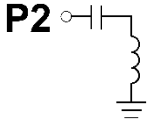
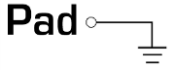
2 Port Configurations and Functions

2.1 Port Diagram

A top-down view of the MFBB-0000XCH package outline drawing is shown below. The MMIC bandpass filters 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 is DC open to ground for the CH package.	
Port 2	Input/Output	Port 2 is DC open to ground for the CH package.	
Pad	Ground	CH package ground path is provided through the substrate and ground bond pads.	

3 Specifications

3.1 Absolute Maximum Ratings

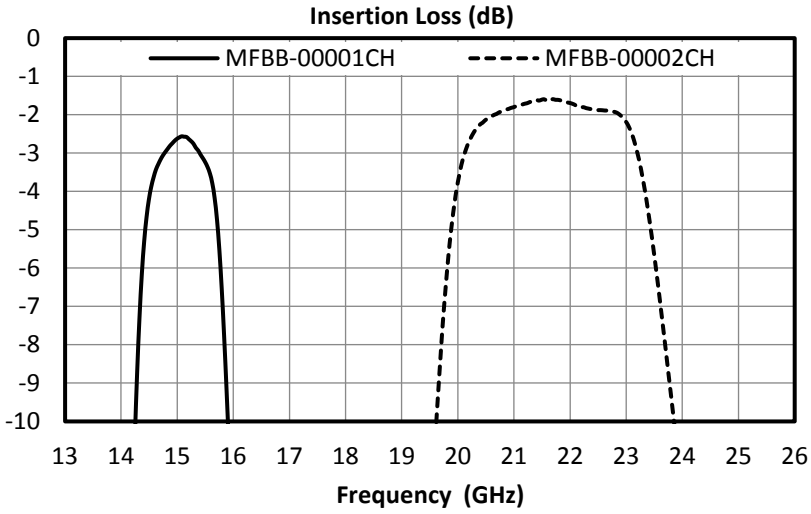
The Absolute Maximum Ratings indicate limits beyond which damage may occur to the device. If these limits are exceeded, the device may be inoperable or have a reduced lifetime.

Parameter	Filter Part Number	Maximum Rating	Units
Port 1 DC Current	MFBB-00001CH	1000	mA
	MFBB-00002CH	400	
Port 2 DC Current	MFBB-00001CH	1000	mA
	MFBB-00002CH	400	
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	N/A

3.3 Passband Comparison



Part Number	1dBc Cutoff Low (GHz)	1dBc Cutoff High (GHz)
MFBB-00001CH	14.60	15.65
MFBB-00002CH	20.25	23.25

3.4 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.

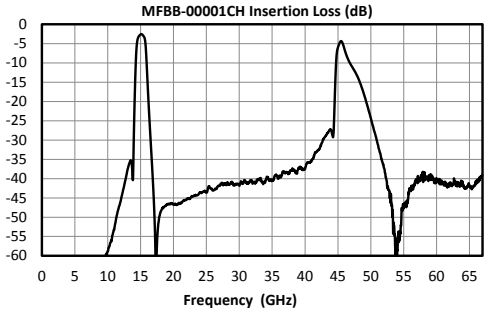
Min and Max limits are guaranteed at T_A=+25°C. All bare die are 100% DC tested and visually inspected.

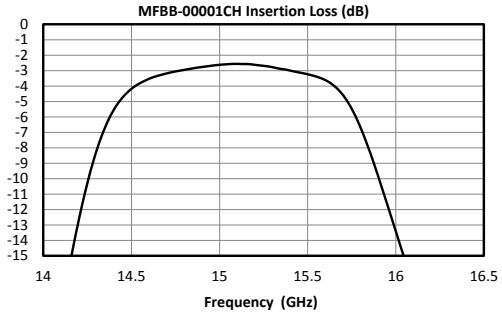
MFBB-00001CH	Frequency (GHz)	Min	Typ.	Max
Center Frequency, f_c (GHz)			15.10	
1dBc Passband (GHz)			14.60 – 15.65	
3dBc Passband (GHz)			14.45 – 15.80	
Insertion Loss @ f_c (dB)	15.10		2.57	
Passband Return Loss (dB)	14.60 – 15.60		23.70	
Stopband Suppression (dB)	DC – 11.50	40	79	
	18.00 – 40.00	30	41	
Group Delay (ps)			591	
Impedance (Ω)			50	

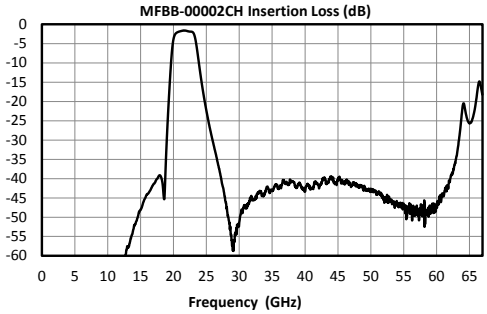
MFBB-00002CH	Frequency (GHz)	Min	Typ.	Max
Center Frequency, f_c (GHz)			21.75	
1dBc Passband (GHz)			20.25 – 23.25	
3dBc Passband (GHz)			19.95 – 23.45	
Insertion Loss @ f_c (dB)	21.75		1.60	
Passband Return Loss (dB)	20.25 – 23.45		16.75	
Stopband Suppression (dB)	DC – 15.00	40	82	
	28.00 – 62.00	30	67	
Group Delay (ps)			272	
Impedance (Ω)			50	

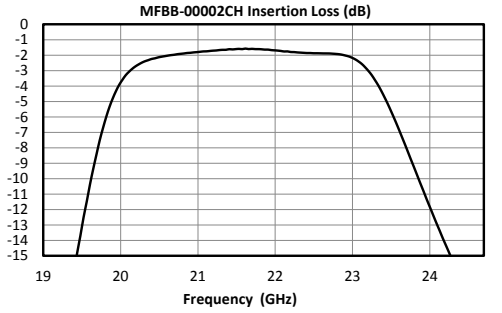
3.5 Typical Performance Plots

3.5.1 Insertion Loss

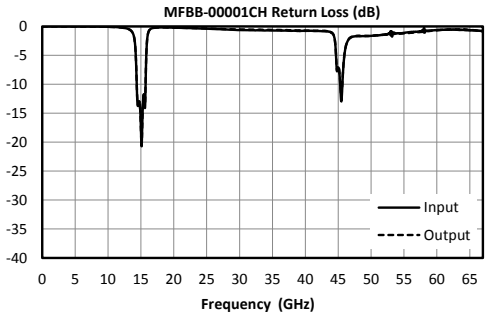


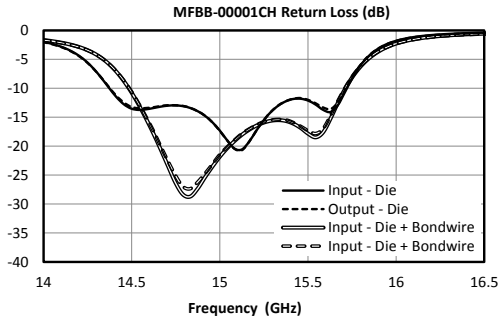


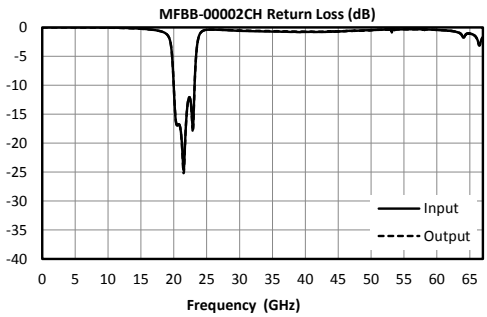


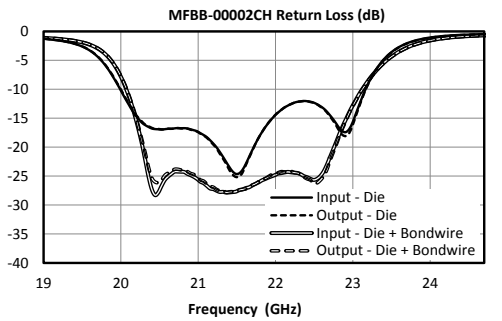


3.5.2 Return Loss[2]



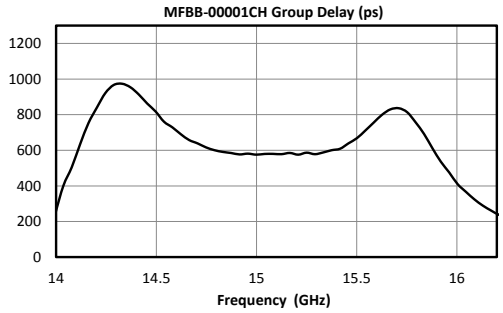


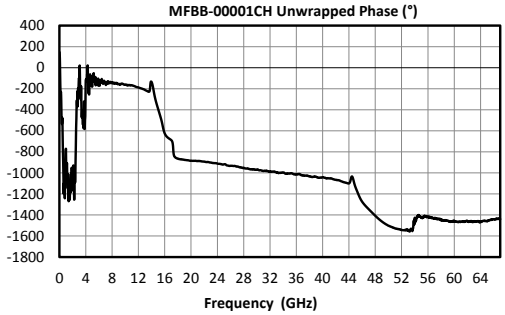


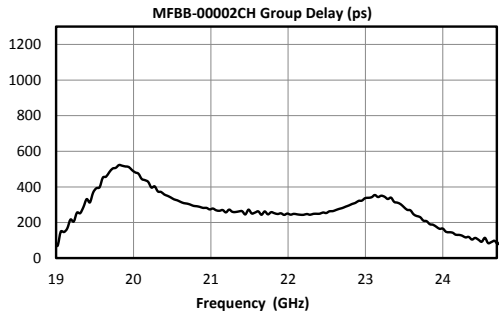


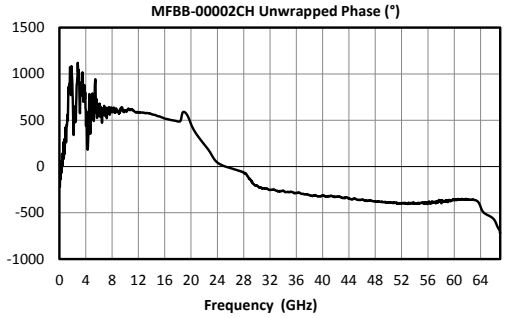
[2] Measurements performed on bare die. To show performance improvement with bond wires, inductance was added to these measurements in simulation per the table on the next page.

3.5.3 Group Delay and Unwrapped Phase









Filter Name	Number of Bondwires	Bondwire Length (um)	Bondwire Diameter (mil)	Bondwire Inductance (pH)
MFBB-00001CH	1	300	1	166
MFBB-00002CH	2	350	1	96

4 Die Mounting Recommendations

4.1 Mounting and Bonding Recommendations

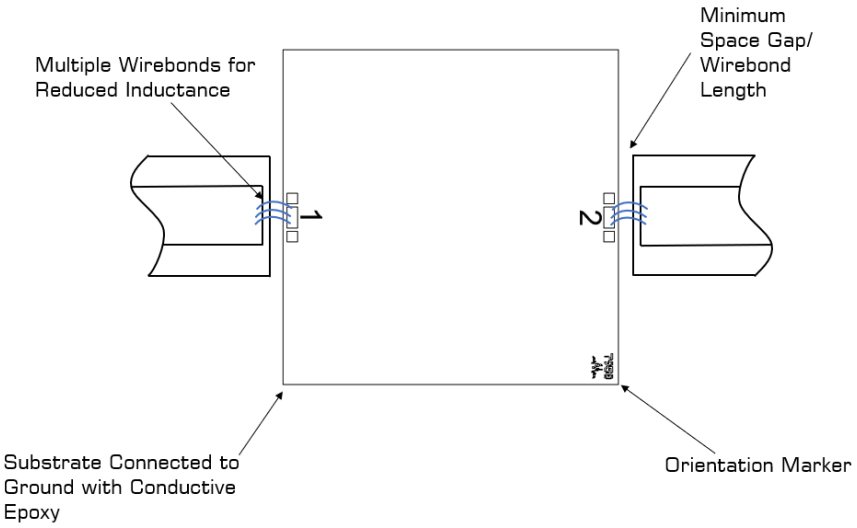
Marki MMICs should be attached directly to a ground plane with conductive epoxy. The ground plane electrical impedance should be as low as practically possible. This will prevent resonances and permit the best possible electrical performance. Datasheet performance is only guaranteed in an environment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



4.3 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.

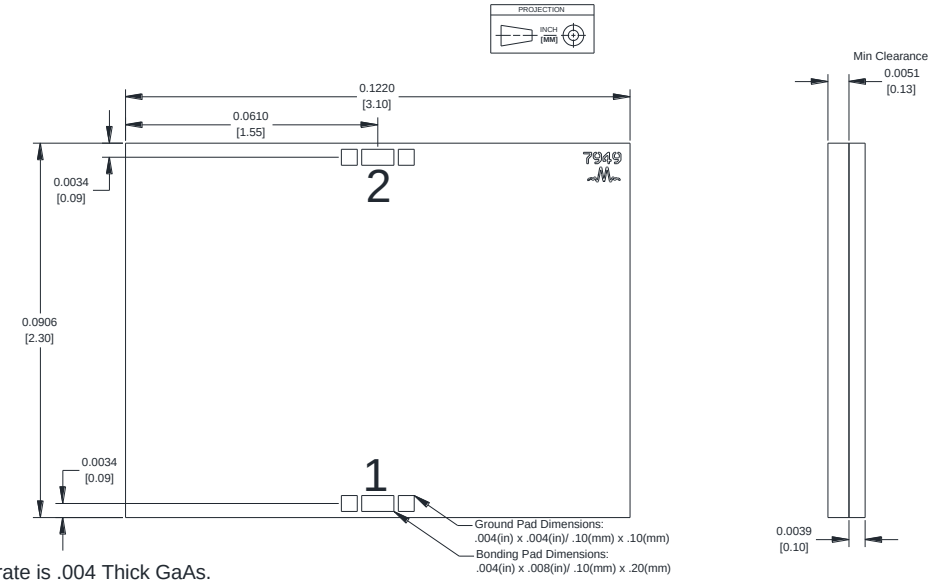
Static Sensitivity

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



Notes:

1. CH substrate is .004 Thick GaAs.
2. I/O trace is 5 microns Au. Ground is 4 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.

Part Number	Die Number
MFBB-00001CH	7948
MFBB-00002CH	7949