

**NEW!**  
Four Section  
Models

# Reflectionless Band Pass Filter Die

**XBF-D-Series**

50Ω      15.5 to 20.5 GHz

## The Big Deal

- High Stopband rejection, up to 77 dB
- Patented design terminates stopband signals
- Stop band up to 40 GHz
- Excellent repeatability through IPD\* process



## Product Overview

Mini-Circuits' XBF-D-Series are GaAs MMIC reflectionless filters which includes 4-sections, giving you ultra-high rejection in the stopband – up to 77 dB! Reflectionless filters employ a patented filter topology which absorbs and terminates stopband signals internally rather than reflecting them back to the source. This new capability enables unique applications for filter circuits beyond those suited to traditional approaches. Traditional filters are reflective in the stopband, sending signals back to the source at 100% power.

These reflections interact with neighboring components and often result in intermodulation and other interferences. By eliminating stopband reflections, reflectionless filters can readily be paired with sensitive devices and used in applications that otherwise require circuits such as isolation amplifiers or attenuators.

Key Features	Advantages
Choice of BW 15.5 - 16.5 GHz 17.5 - 18.5 GHz 19.5 - 20.5 GHz	Three different models to cover the band XBF-183-D+ XBF-183-D+ XBF-24-D+
Easy integration with sensitive reflective components, e.g. mixers, multipliers	Reflectionless filters absorb unwanted signals, preventing reflections back to the source. This reduces generation of additional unwanted signals without the need for extra components like attenuators, improving system dynamic range and saving board space.
High stopband rejection, up to 77 dB	Ideal for applications where suppression of strong spurious signals and intermodulation products is needed.
Enables stable integration of wideband amplifiers	Because reflectionless filters maintain good impedance in the stop band; they can be integrated with high gain, wideband amplifiers without the risk of creating instabilities in these out of band regions.
Cascadable	Reflectionless filters can be cascaded in multiple sections to provide sharper and higher attenuation, while also preventing any standing waves that could affect pass band signals.
Excellent power handling in a tiny surface mount device up to 0.5W in passband	High power handling extends the usability of these filters to the transmit path for inter-stage filtering.
Unpackaged die	Enables the user to integrate the filter directly into hybrids
Excellent repeatability of RF performance	Through semiconductor IPD process, X-series filters are inherently repeatable for large volume production.
Operating temperature up to 105°C	Suitable for operation close to high power components.

\*IPD – Integrated Passive Device, is a GaAs semiconductor process



# Reflectionless Band Pass Filter Die

## XBF-183-D+

50Ω 17.5 to 18.5 GHz

### Features

- Match to 50Ω in the stop band, eliminates undesired reflections
- Cascadable
- Excellent stopband rejection, 50 dB typ.
- Temperature stable, up to 105°C
- Protected by US Patents 8,392,495; 9,705,467, additional patent pending
- Protected by China Patent 201080014266.1
- Protected by Taiwan Patent I581494

### Applications

- Transmitters & Receivers
- Harmonic Rejection
- Spurious Rejection

### General Description

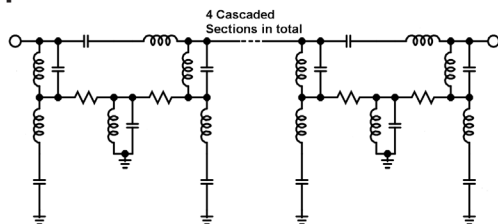
Mini-Circuits' XBF-183-D+ four-section reflectionless filter Die employs a novel filter topology which absorbs and terminates stop band signals internally rather than reflecting them back to the source. This new capability enables unique applications for filter circuits beyond those suited to traditional approaches. Traditional filters are reflective in the stop band, sending signals back to the source at 100% of the power level. These reflections interact with neighboring components and often result in inter-modulation and other interferences. Reflectionless filters eliminate stop band reflections, allowing them to be paired with sensitive devices and used in applications that otherwise require circuits such as isolation amplifiers or attenuators.



**+RoHS Compliant**  
The +Suffix identifies RoHS Compliance. See our web site for RoHS Compliance methodologies and qualifications

Ordering Information: Refer to Last Page

### Simplified Schematic and Pad description



### Bonding Pad Position



Pad#	Description
2	RF-IN
5	RF-OUT
1,3,4,6	Ground
Die bottom	Ground

Note: 1. Bond Pad material - Gold  
2. Bottom of Die - Gold plated

Dimensions in μm, Typical

L1	L2	L3	L4	L5	H1	H2	H3	H4	H5	Thickness	Bond pad size
80	2370	2470	2570	2650	80	550	650	750	1300	100	78 X 78

**Electrical Specifications<sup>1</sup> at 25°C**

Parameter	F#	Frequency (MHz)	Min.	Typ.	Max.	Unit
<b>Pass Band</b>	Insertion Loss	F2-F3	17500 - 18500	4.3		dB
	VSWR	F2-F3	17500 - 18500	1.9		:1
<b>Stop Band, Lower</b>	Rejection	DC-F1	DC - 9000	77		dB
	VSWR	DC-F1	DC - 9000	1.2		:1
<b>Stop Band, Upper</b>	Rejection	F4-F5	27000 - 32000	50		dB
		F5-F6	32000 - 40000	51		dB
	VSWR	F4-F5	27000 - 32000	1.5		:1
		F5-F6	32000 - 40000	1.2		:1

<sup>1</sup> Measured on die using MPI titan series 100µm pitch GSG probe.

**Absolute Maximum Ratings<sup>4</sup>**

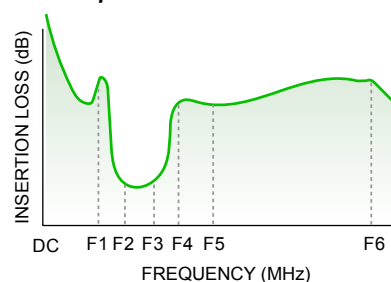
Parameter	Ratings
Operating Temperature	-55°C to +105°C
RF Power Input, Passband (F2-F3) <sup>2</sup>	0.5W at 25°C
RF Power Input, Stopband (DC-F2, F3-F6) <sup>3</sup>	0.16W at 25°C

<sup>2</sup> Passband rating derates linearly to 0.25W at 105°C ambient

<sup>3</sup> Stopband rating derates linearly to 0.08W at 105°C ambient

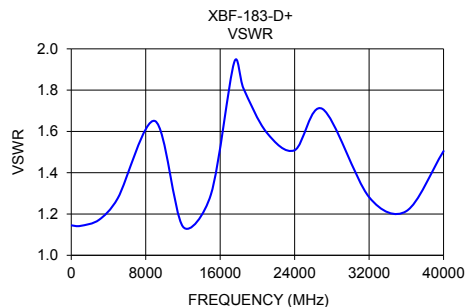
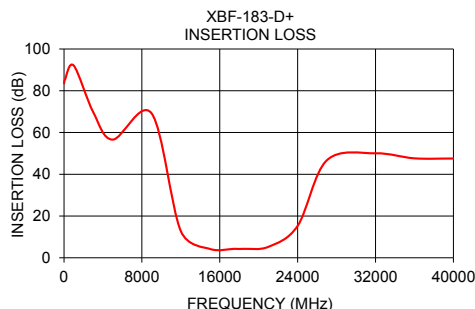
<sup>4</sup> Permanent damage may occur if any of these limits are exceeded.

**Specification Definition**

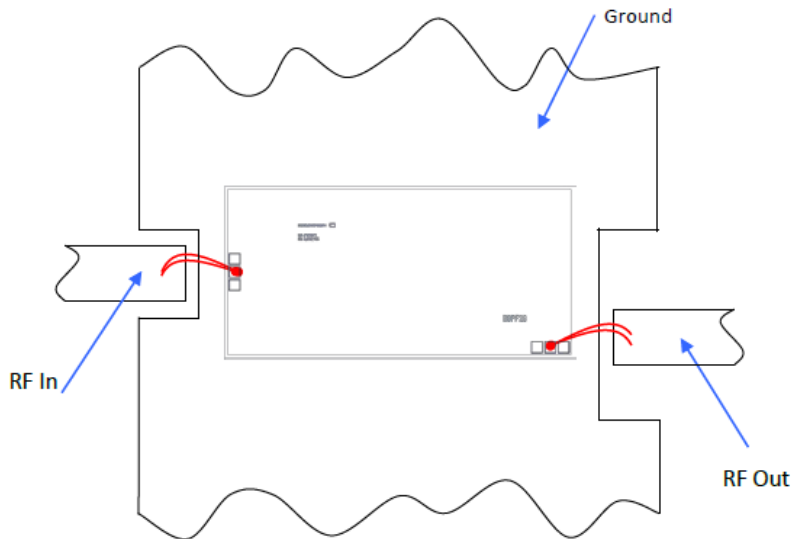


**Typical Performance Data at 25°C**

Frequency (MHz)	Insertion Loss (dB)	VSWR (:1)
10	83.55	1.14
100	85.36	1.14
1000	92.05	1.14
3000	69.77	1.17
5000	56.59	1.28
9000	69.15	1.65
12000	12.78	1.14
15000	4.23	1.29
17500	4.30	1.93
18500	4.30	1.81
21000	5.27	1.59
24000	15.31	1.51
27000	46.71	1.71
32000	50.04	1.28
36000	47.63	1.21
40000	47.55	1.50



## Assembly Diagram



Note: Ground bond wires are optional.

## Assembly and Handling Procedure

- 1. Storage**  
Dice should be stored in a dry nitrogen purged desiccators or equivalent.
- 2. ESD**  
MMIC Gallium Arsenide (GaAs) filter dice are susceptible to electrostatic and mechanical damage. Die are supplied in antistatic protected material, which should be opened in clean room conditions at an appropriately grounded anti-static workstation. Devices need careful handling using correctly designed collets, vacuum pickup tips or sharp antistatic tweezers to deter ESD damage to dice.
- 3. Die Attach**  
The Die mounting surface must be clean and flat. Using conductive silver filled epoxy, recommended epoxies are DieMat DM6030Hk-PT/H579/H579 or Ablestik 84-1LMISR4. Apply sufficient epoxy to meet required epoxy bond line thickness, epoxy fillet height and epoxy coverage around total Die periphery. Parts shall be cured in a nitrogen filled atmosphere per manufacturer's cure condition. It is recommended to use antistatic Die pick up tools only.
- 4. Wire Bonding**  
Bond pad openings in the surface passivation above the bond pads are provided to allow wire bonding to the dice gold bond pads. Thermosonic bonding is used with minimized ultrasonic content. Bond force, time, ultrasonic power and temperature are all critical parameters. Suggested wire is pure gold, 1 mil diameter. Bonds must be made from the bond pads on the Die to the package or substrate. All bond wires should be kept as short as low as reasonable to minimize performance degradation due to undesirable series inductance.



# MMIC Reflectionless Band Pass Filter Die

# XBF-183-D+

## Typical Performance Data

Test Condition @ Temperature = +25°C

FREQ.	INSERTION LOSS	INPUT RETURN LOSS	OUTPUT RETURN LOSS
(MHz)	(dB)	(dB)	(dB)
10	83.55	23.40	25.14
50	86.15	23.41	25.14
100	85.36	23.43	25.16
200	88.13	23.45	25.18
300	94.32	23.45	25.20
400	91.74	23.48	25.23
500	91.19	23.49	25.25
600	90.63	23.50	25.25
700	98.35	23.51	25.26
800	93.25	23.53	25.27
900	92.65	23.53	25.26
1000	92.05	23.54	25.24
2000	80.51	23.20	24.43
3000	69.77	22.01	22.60
4000	61.70	20.18	20.43
5000	56.59	18.31	18.37
6000	54.16	16.35	16.48
7000	55.28	14.57	14.86
8000	64.16	13.09	13.71
9000	69.15	12.20	13.28
10000	68.76	12.82	14.55
11000	31.94	19.78	20.56
12000	12.78	32.12	23.76
13000	6.73	19.63	19.98
14000	4.90	18.73	21.81
15000	4.23	17.85	18.15
16000	4.10	14.26	13.16
17000	4.24	11.36	10.44
17500	4.30	10.77	9.94
17600	4.31	10.73	9.91
17700	4.32	10.72	9.90
17800	4.33	10.72	9.92
17900	4.33	10.77	9.97
18000	4.33	10.84	10.05
18100	4.33	10.96	10.14
18200	4.33	11.09	10.26
18300	4.32	11.28	10.41
18400	4.31	11.49	10.60
18500	4.30	11.76	10.82
19000	4.23	13.96	12.55
20000	4.37	21.79	17.36
21000	5.27	13.88	12.80
22000	6.67	13.59	12.56
23000	9.45	16.84	14.97
24000	15.31	15.11	13.86
25000	25.78	14.12	13.07
26000	40.18	12.16	11.78
27000	46.71	11.65	11.98
28000	48.36	12.10	13.13
29000	52.88	13.11	14.89
30000	51.66	14.46	17.25
31000	51.25	16.18	20.20
32000	50.04	18.17	23.38
33000	51.60	20.20	24.96
34000	51.79	21.92	23.99
35000	49.88	22.32	22.06
36000	47.63	21.52	20.29
37000	50.82	19.96	18.84
38000	51.38	18.29	17.68
39000	50.52	16.56	16.50
40000	47.55	13.92	14.95



ISO 9001 ISO 14001 AS 9100 CERTIFIED



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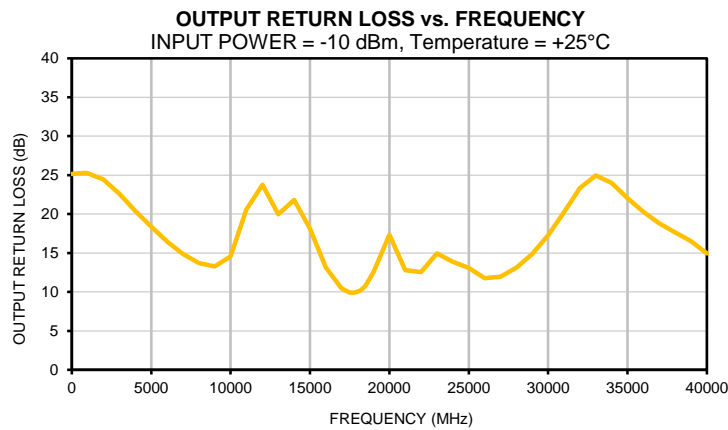
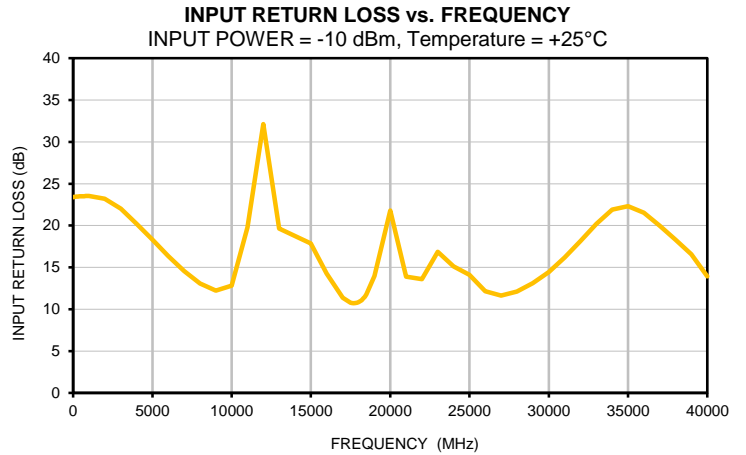
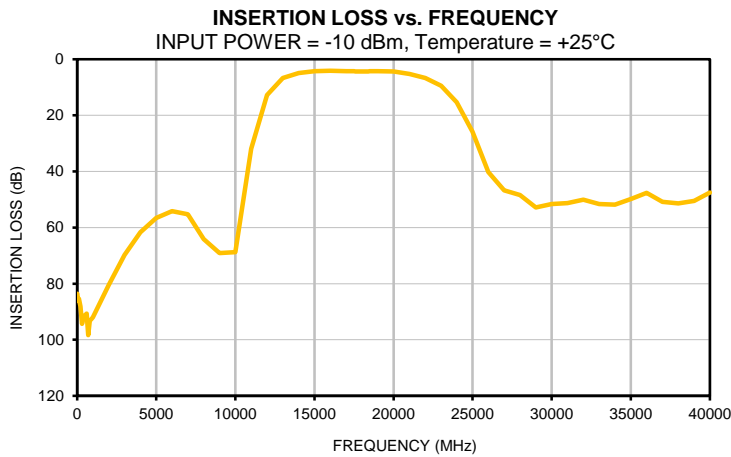


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IF/RF MICROWAVE COMPONENTS

REV. OR  
XBF-183-D+  
8/21/2018  
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## Typical Performance Curves



All Mini-Circuits products are manufactured under exacting quality assurance and control standards, and are capable of meeting published specifications after being subjected to any or all of the following physical and environmental test.

<b>Specification</b>	<b>Test/Inspection Condition</b>	<b>Reference/Spec</b>
Operating Temperature	-40° to 85° C or -40° to 105° C or -55° to 105° C or -45° to 105° C Ambient Environment	Refer to Individual Model Data Sheet
Storage Environment (Die)	-65° to 150°C	Individual Model Data Sheet
Storage Environment(Packaging)	-40° to 70°C and 40 to 60% humidity (In Factory Shipped Package)	