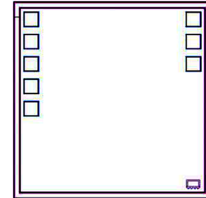
MMIC

Wideband Double Balanced Mixer Die MDB-24H-D+

Level 15 (LO Power 15dBm) 5-21.5 GHz



The Big Deal

- Wide bandwidth, 5-21.5 GHz
- High L-I Isolation, 44 dB typ
- Useable as Up & Down Converter

Product Overview

MDB-24H-D+ is an advanced wideband frequency mixer die fabricated using InGaP HBT technology with integrated LO and RF Baluns. It has repeatable performance making it suitable for volume production.

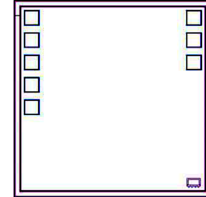
Key Features

Feature	Advantages
Double Balanced	Results in excellent LO-RF (21-35 dB typical) & LO-IF (28-44 dB typical) Isolations minimizing need for external filtering
Wide Bandwidth, 5 to 21.5 GHz	Useful in wideband systems or in in several narrowband systems. Reducing inventory
Wide IF Bandwidth DC-5 GHz	Usable in first and second down converter applications. IF as low as DC enables use in phase detector applications.
Unpackaged die	Enables users to integrate it directly into hybrid.

Wideband Double Balanced Mixer Die MDB-24H-D+

Level 15 (LO Power 15dBm) 5-21.5 GHz

Product Features
- Wide bandwidth 5 to 21.5 GHz
- High L-I Isolation, 44 dB typ. at 15 GHz
- Useable as Up & Down Converter



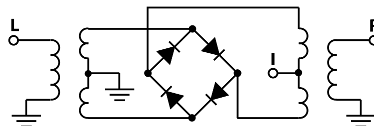
Typical Applications
- Satellite up and down converters
- Defense radar & communication
- VSAT
- Line of sight links
- Federal fixed service
- WiFi
- ISM

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

Ordering Information: Refer to Last Page

General Description
MDB-24H-D+ is an advanced wideband frequency mixer die fabricated using InGaP HBT technology with inte-grated LO and RF Baluns. It has repeatable performance making it suitable for volume production.

Simplified Schematic and Pad description



Pad	Description
RF-IN	RF input pad
LO-IN	LO input pad
IF-OUT	IF output pad
GND	Connect to Ground

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

Electrical Specifications[1] at 25°C, unless noted

Parameter	Condition (GHz)	Min.	Typ.	Max.	Units
RF Frequency Range		5		21.5	GHz
LO Frequency Range		5		21.5	GHz
IF Frequency Range		DC		5	GHz
LO Power			+15		dBm
Conversion Loss (at IF=30 MHz)	5		6.9		dB
	10		9.0		
	15		7.9		
	20		9.4		
	21.5		10.3		
LO-RF Isolation	5		28		
	10		33		
	15		35		
	20		21		
	21.5		25		
LO-IF Isolation	5		28		dB
	10		36		
	15		44		
	20		36		
	21.5		39		
RF-IF Isolation	5		10		dB
	10		15		
	15		22		
	20		22		
	21.5		21		
Input at 1dB Compression	5-21.5		10		dBm
Input IP3	5		14		dBm
	10		21		
	15		23		
	20		24		
	21.5		23		
Noise Figure	5		6.9		dB
Thermal Resistance (junction-to-ground lead)			105		°C/W

1. Die performance measured in industry standard 4x4mm, 24-lead package. See Characterization Test Circuit, Figure 1.

Absolute Maximum Ratings[2]

Parameter	Ratings
Operating Temperature	-40°C to 85°C
RF Power	21 dBm
LO Power	21 dBm
IF Current	30 mA

2. Permanent damage may occur if any of these limits are exceeded.
Electrical maximum ratings are not intended for continuous normal operation.

Characterization Test Circuit

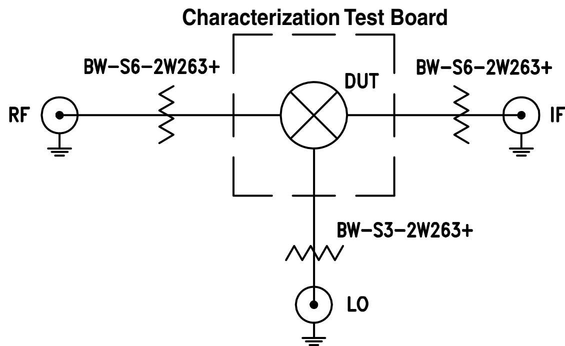


Figure 1A.
Block Diagram of Test Circuit used for die characterization of Conversion Loss, Isolations (LO-RF, LO-IF, RF-IF) and Return Loss (LO, RF, IF).

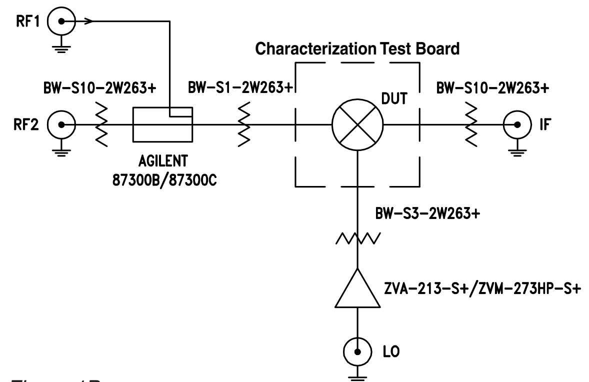


Figure 1B.
Block Diagram of Test Circuit used for die characterization of Input IP3.

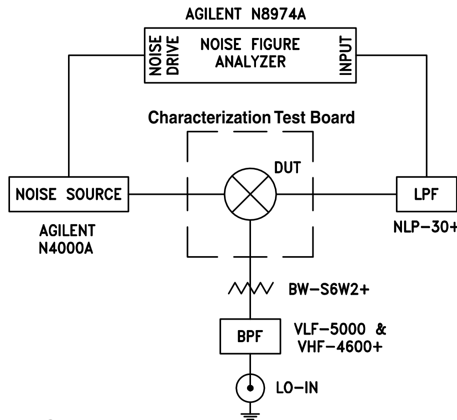


Figure 1C.
Block Diagram of Test Circuit used for die characterization of Noise Figure.

Figure 1. Block Diagram of Test Circuit used for die characterization. (DUT in MCLP package soldered on Mini-Circuits Characterization test board).
Conversion Loss, Isolations; L-R, L-I & R-I are measured using R&S ZVA 24 microwave network analyzer.
Input IP3 is measured Agilent MXA N9020A spectrum Analyzer and PSG E8257D Signal Generators.
NF is measured using Agilent's N8974A NF Analyzer

Conditions (Down Converter):
1. Conversion Loss, Isolations (L-R, L-I & R-I): RF= 0 dBm, LO=+15 dBm, IF=30 MHz
2. Output IP3 (OIP3): Two tones, spaced 1 MHz apart, 0 dBm/tone at output.
3. Noise Figure: LO=+15 dBm

Die Layout

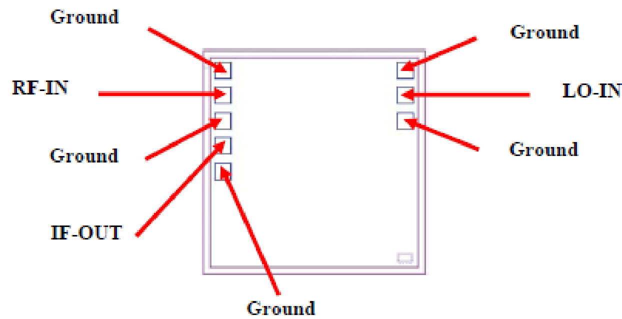


Fig 2. Die Layout

Bonding Pad Position

(Dimensions in µm, Typical)

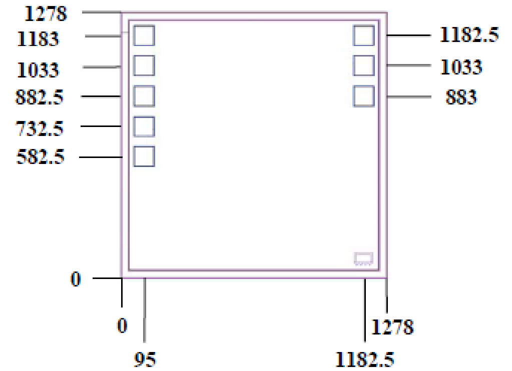


Fig 3. Bonding Pad Positions

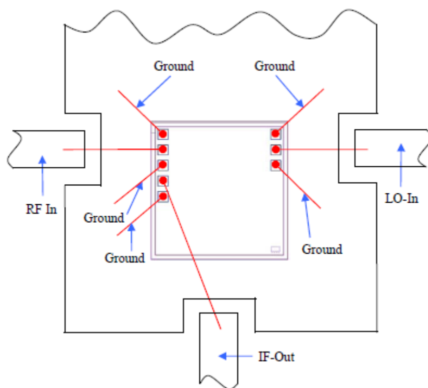
Critical Dimensions

Parameter	Values
Die Thickness, um	100
Die Width, um	1278
Die Length, um	1278
Bond Pad Size (RF In), um	100x100
Bond Pad Size (IF_Out), um	100x100
Bond Pad Size (LO_In), um	100x100
Bond Pad Size (Ground pad), um	100x100

Assembly and Handling Procedure

1. Storage
   Dice should be stored in a dry nitrogen purged desiccators or equivalent.
2. ESD
   MMIC HBT mixer 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 worksta tion. 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 manufac turer'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.

Assembly Diagram



Note: Ground bond wires are optional.

Recommended Wire Length, Typical

Wire	Wire Length (mm)	Wire Loop Height (mm)
GROUND	1.20	0.15
RF In	1.20	0.15
IF-Out	1.60	0.15
LO-In	1.20	0.15

Additional Detailed Technical Information

additional information is available on our dash board.

Performance Data	Data Table
	Swept Graphs
Case Style	Die
Die Ordering and packaging information	Quantity, Package — Model No. Small, Gel - Pak: 10,50,100 KGD* — MDB-24H-DG+ Medium†, Partial wafer: KGD*<1085 — MDB-24H-DP+ Large†, Full Wafer — MDB-24H-DF+ †*Available upon request contact sales representative* Refer to AN-60-067
Environmental Ratings	ENV-80

*Known Good Dice ("KGD") means that the dice in question have been subjected to Mini-Circuits DC test performance criteria and measurement instructions and that the parametric data of such dice fall within a predefined range. While DC testing is not definitive, it does help to provide a higher degree of confidence that dice are capable of meeting typical RF electrical parameters specified by Mini-Circuits.

ESD Rating**

Human Body Model (HBM): Class 1A (250 to <500V) in accordance with ANSI/ESD STM 5.1 - 2001

** Tested in industry standard 24-lead, 4x4mm MCLP package.

Additional 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.

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