XX1000-BD

Active Doubler
7.5-25.0/15.0-50.0 GHz

Rev. V1
Mimix Broadband

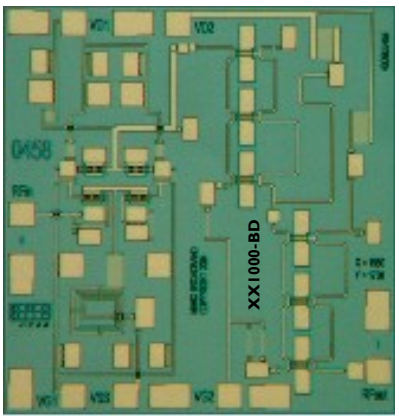
Features

- Excellent Broadband Mixer Driver
- Single Ended Fed Doubler with Distributed Buffer Amplifier
- Excellent LO Driver for M/A-COM Tech Receivers
- +15 dBm Output Drive
- 100% On-Wafer RF, DC and Output Power Testing
- 100% Visual Inspection to MIL-STD-883 Method 2010
- RoHS* Compliant and 260°C Reflow Compatible

Description

M/A-COM Tech's single ended fed (no external balun required) 7.5-25.0/15.0-50.0 GHz GaAs MMIC doubler has a +15.0 dBm output drive and is an excellent LO doubler that can be used to drive fundamental mixer devices. It is also well suited to drive M/A-COM Tech's XR1002 receiver device. This MMIC uses M/A-COM Tech's GaAs PHEMT device model technology, and is based upon electron beam lithography to ensure high repeatability and uniformity. The chip has surface passivation to protect and provide a rugged part with backside via holes and gold metallization to allow either a conductive epoxy or eutectic solder die attach process. This device is well suited for Millimeter-wave Point-to-Point Radio, LMDS, SATCOM and VSAT applications.

Chip Device Layout



Absolute Maximum Ratings[1]

Parameter	Absolute Max.
Supply Voltage (Vd)	+6.0 VDC
Supply Voltage (Vss)	-6.0 VDC
Supply Current (Id)	300 mA
Supply Current (Iss)	60 mA
Gate Bias Voltage (Vg)	+0.3 VDC
Input Power (RF Pin)	+12.0 dBm
Storage Temperature (Tstg)	-65 °C to +165 °C
Operating Temperature (Ta)	-55 °C to MTTF Table[1]
Channel Temperature (Tch)	MTTF Table[1]

(1) Channel temperature directly affects a device's MTTF. Channel temperature should be kept as low as possible to maximize lifetime.

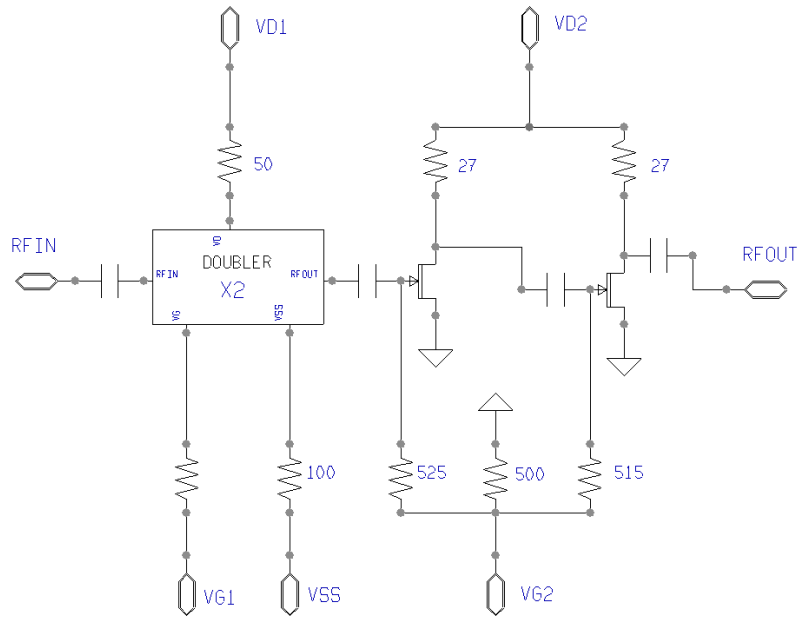
Ordering Information

Part Number	Package
XX1000-BD-000V	vacuum release gel paks
XX1000-BD-EV1	evaluation board

Electrical Specifications: 7.5-25 GHz (fin) (Ambient Temperature T = 25°C)

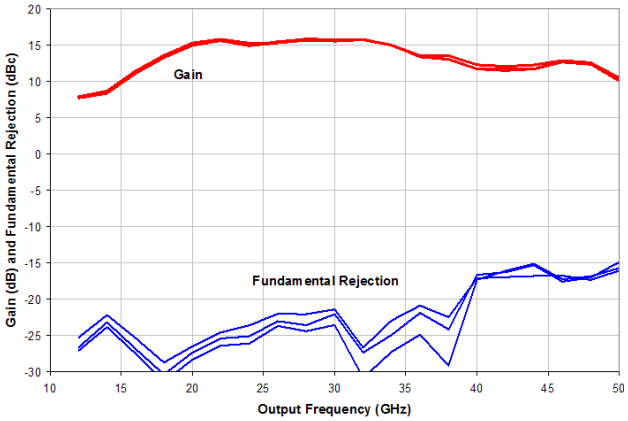
Parameter	Units	Min.	Typ.	Max.
Output Frequency Range (fout)	GHz	15.0	-	50.0
Input Return Loss (S11)	dB	-	TBD	-
Output Return Loss (S22)	dB	-	12.0	-
Harmonic Gain (fout)	dB	-	13	-
Fundamental Rejection (fin)	dBc	-	20	-
Saturated Output Powre (Psat)	dBm	-	+15	-
RF Input Power (RF Pin)	dBm	-10.0	-	+10.0
Output Power at +0.0 dBm Pin (Pout)	dBm	-	+13.0	-
Drain Bias Voltage (Vd1,2)	VDC	-	+5.0	+5.5
Gate Bias Voltage (Vg1)	VDC	-1.2	-0.6	+0.1
Gate Bias Voltage (Vg2)	VDC	-1.2	0.0	+0.1
Drain Supply Current (Id1,2) (Vd=5.0 V, Vg1=-0.6 V, Vg2=0.0 V Typical)	mA	-	220	250
Source Voltage (Vss)	VDC	-5.5	-5.0	-2.0
Source Current (Iss)	mA	25	50	60

Block Diagram & Schematics

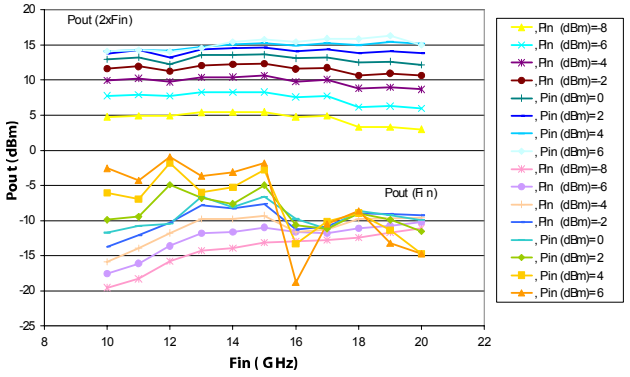


Typical Performance Curves

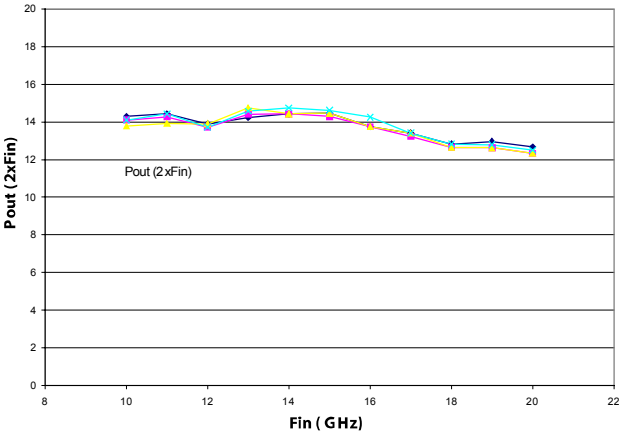
Harmonic Gain and Fundamental Rejection vs Output Freq.
Pin = 0 dBm



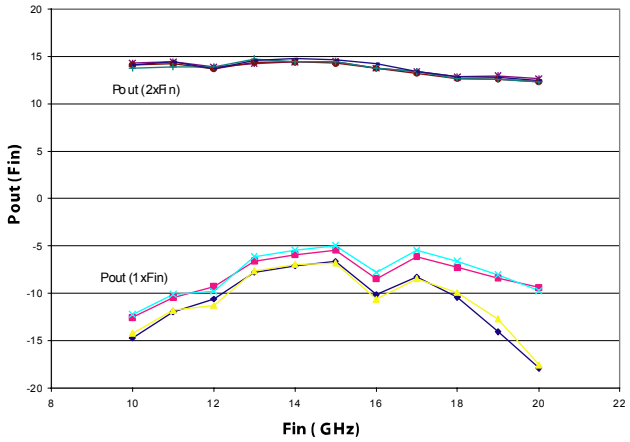
XX1000-BD: Pout (2xFin) and Pout (Fin) vs. Fin (GHz)
Pin = -8 to +6 dBm



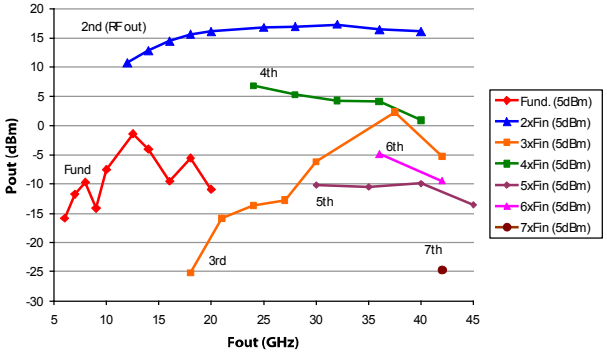
XX1000-BD_4_samples: Pout (2xFin) vs. Fin (GHz)
Pin=0dBm, VD1=5V, VG1=-0.6V, VSS=-5V, VD2=5V ~150mA, VG2=open



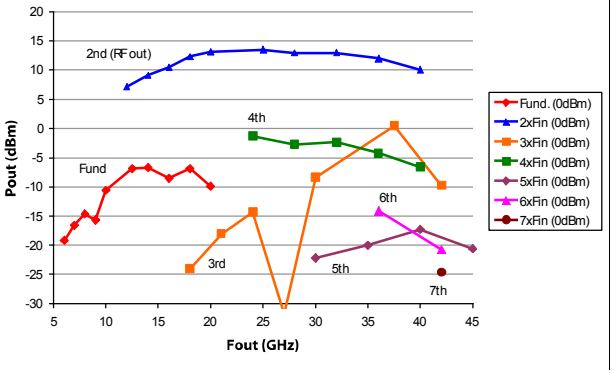
XX1000-BD_4_samples: Pout (Fin) vs. Fin (GHz)
Pin=0dBm, VD1=5V, VG1=-0.6V, VSS=-5V, VD2=5V ~150mA, VG2=open



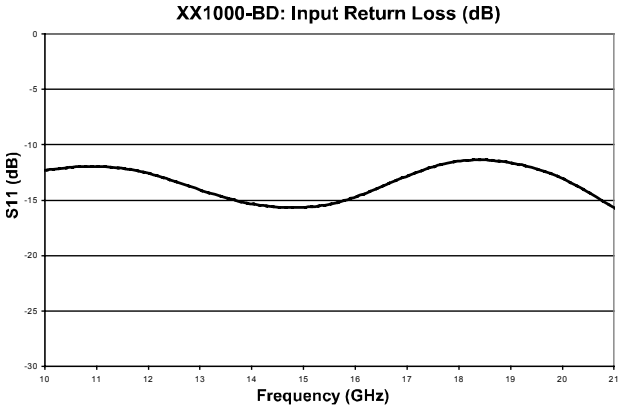
Harmonic Products, Pin = +5 dBm (Fin = 6 - 20 GHz)



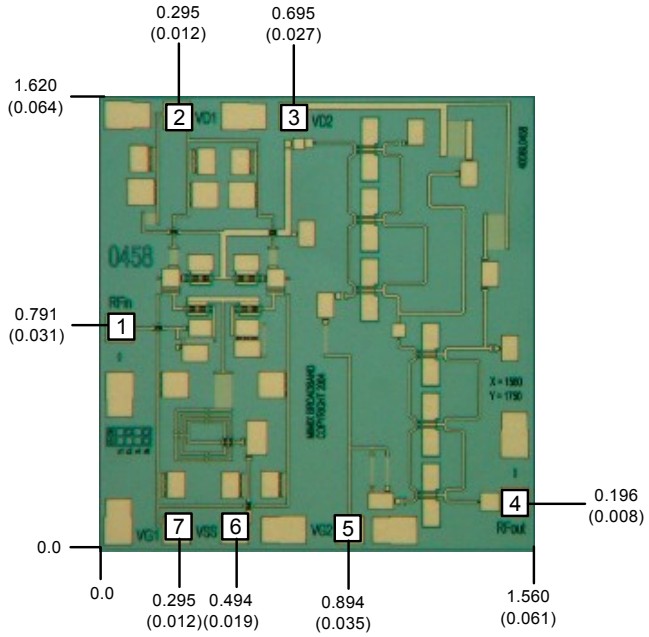
Harmonic Products, Pin = +0 dBm (Fin = 6 - 20 GHz)



Typical Performance Curves (cont.)



Mechanical Drawing

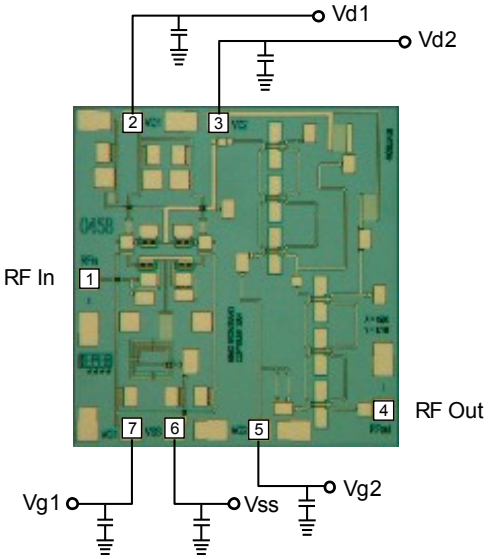


(Note: Engineering designator is 40DBL0458)

Units: millimeters (inches) Bond pad dimensions are shown to center of bond pad.
Thickness: 0.110 +/- 0.010 (0.0043 +/- 0.0004), Backside is ground, Bond Pad/Backside Metallization: Gold
All Bond Pads are 0.100 x 0.100 (0.004 x 0.004).
Bond pad centers are approximately 0.109 (0.004) from the edge of the chip.
Dicing tolerance: +/- 0.005 (+/- 0.0002). Approximate weight: 1.566 mg.

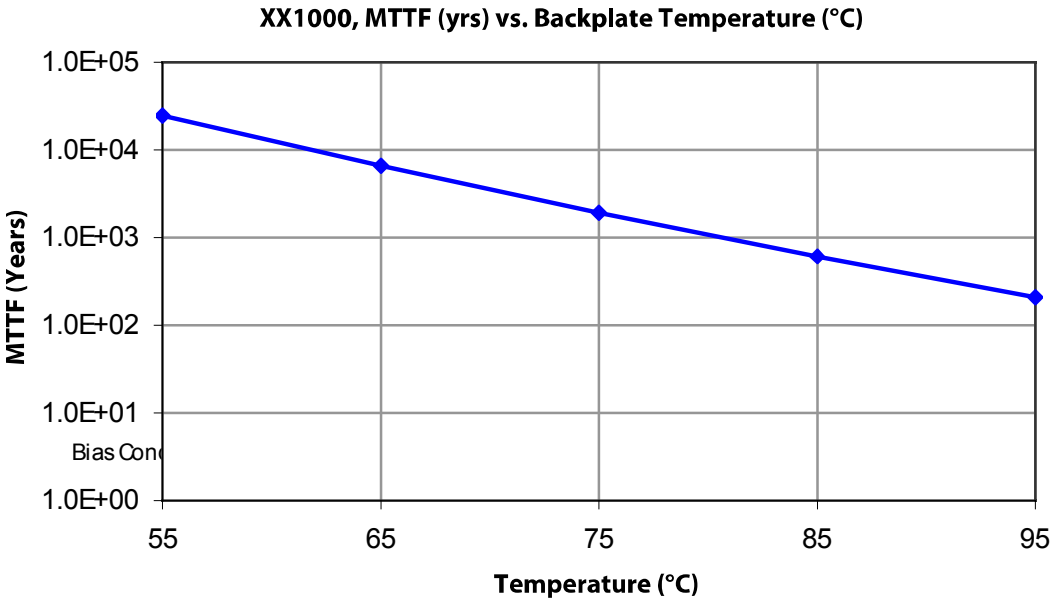
Bond Pad #1 (RF In)	Bond Pad #3 (Vd2)	Bond Pad #5 (Vg2)	Bond Pad #7 (Vg1)
Bond Pad #2 (Vd1)	Bond Pad #4 (RF Out)	Bond Pad #6 (Vss)	

Bias Arrangement



Bypass Capacitors - See App Note [2]

MTTF



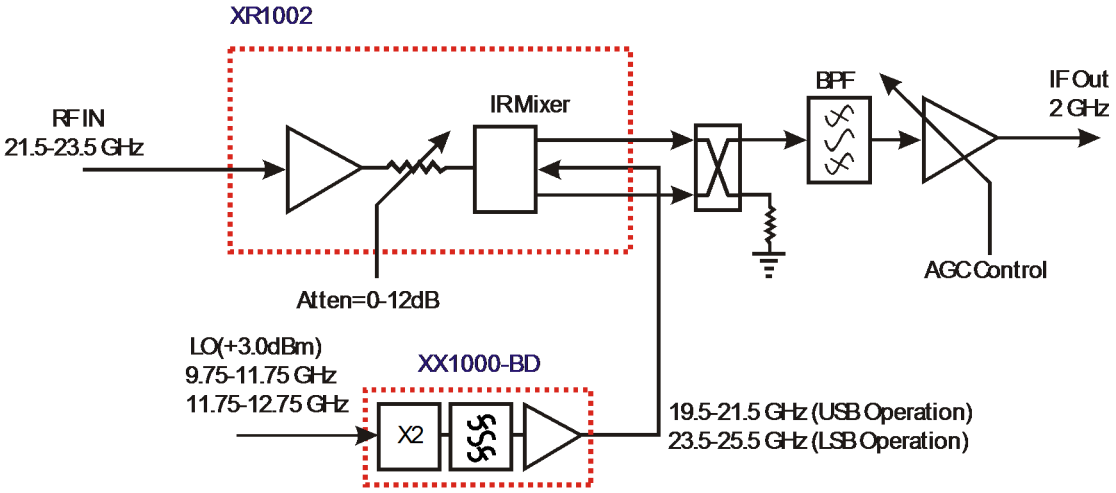
MTTF is calculated from accelerated life-time data of single devices and assumes isothermal back-plate.

Bias Conditions: Vd1,2 = 5.0V, Id1,2 = 220 mA, Vss = -5.0V, Iss = 50 mA

App Note [1] Biasing - It is recommended to separately bias each doubler stage with fixed voltages of Vd(1,2) =5.0V, Vss=-5.0V and Vg1=-0.6V. The typical DC currents are Id1=80mA, Id2=140mA and Iss=50mA. Vg2 can be used for active control biasing of Vd2, or it can be left open and Vd2 will self bias at approximately 140mA. Maximum output power is achieved with Vss=-5.0V and Iss=50mA but the device will operate with reduced bias to Vss=-2.0V and Iss=25mA. It is also recommended to use active biasing on Vd2 with Vg2 to keep the currents constant as the RF power and temperature vary; this gives the most reproducible results. Depending on the supply voltage available and the power dissipation constraints, the bias circuit may be a single transistor or a low power operational amplifier, with a low value resistor in series with the drain supply used to sense the current. The gate of the pHEMT is controlled to maintain correct drain current and thus drain voltage. The typical gate voltage for Vg2=-0.1V. Typically the gate is protected with Silicon diodes to limit the applied voltage. Also, make sure to sequence the applied voltage to ensure negative gate bias is available before applying the positive drain supply.

App Note [2] Bias Arrangement -
For Individual Stage Bias (Recommended for doubler applications) -- Each DC pad (Vd1, 2, Vss and Vg1, 2) needs to have DC bypass capacitance (~100-200 pF) as close to the device as possible. Additional DC bypass capacitance (~0.01 uF) is also recommended.

Typical Application



M/A-COM Tech MMIC-based 18.0-34.0 GHz Doubler/Receiver Block Diagram
(Changing LO and IF frequencies as required allows design to operate as high as 34 GHz)

Lead-Free Package Dimensions/Layout

Handling Procedures

Please observe the following precautions to avoid damage:

Static Sensitivity

Gallium Arsenide Integrated Circuits are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these class 2 devices.