

17.0-27.0 GHz GaAs MMIC Vector Modulator

June 2001 – Rev 6/06/01

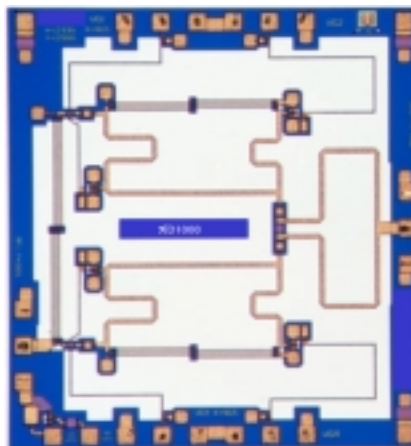
Features

- X 17.0–27.0 GHz Frequency Range
- X 8.0 dB Typical Insertion Loss
- X Continuous Phase Control
- X Control Voltage from –1.5 to 0 VDC
- X 2.33 mm X 2.50 mm Die Size
- X 100% On-Wafer RF, DC and Insertion Loss Testing
- X 100% Visual Inspection to MIL-STD-883 Method 2010

General Description

Mimix Broadband's 17.0–27.0 GHz GaAs MMIC vector modulator has a typical insertion loss of 8.0 dB. The phase shifter uses cold FETs as control elements and can provide any required phase shift. This MMIC uses Mimix Broadband's 0.15 μ m GaAs PHEMT device model lithography, 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

Supply Voltage (Vd)	N/A
Supply Current (Id)	N/A
Gate Bias Voltage (Vg)	+0.3 VDC
Input Power (Pin)	0 dBm
Storage Temperature (Tstg)	–65 to +165 °C
Operating Temperature (Ta)	–55 to +75 °C
Channel Temperature (Tch)	N/A
Thermal Resistance (θ_{jc})	N/A

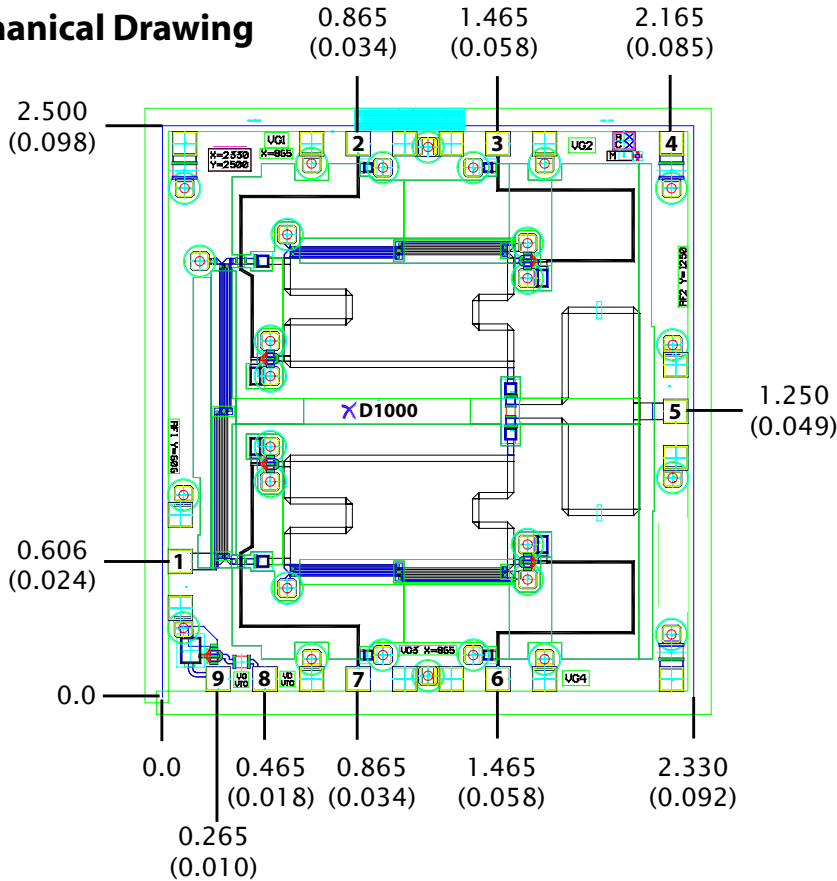
Electrical Characteristics (Ambient Temperature T = 25° C)

Parameter	Units	Min.	Typ.	Max.
Frequency Range RF/LO (f) IF=DC–2.0 GHz	GHz	17.0	–	27.0
Input Return Loss (S11)	dB	–	8.0	–
Output Return Loss (S22)	dB	–	8.0	–
Insertion Loss (S21)	dB	–	8.0	–
Gate Bias Voltage (Vg1,2,3,4)	VDC	–2.0	–1.5/0	+0.3

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Mechanical Drawing



Units: millimeters (inches) Bond pad dimensions are shown to center of bond pad.

Thickness: 0.100 (0.004) (for reference only), Backside is ground, Bond Pad/Backside Metallization: Gold

All Bond Pads are 0.100 x 0.100 (0.004 x 0.004).

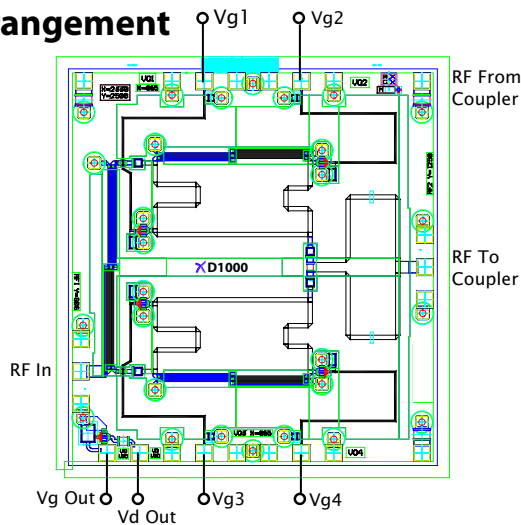
Bond Pad #1 (RF In)
Bond Pad #2 (Vg1)
Bond Pad #3 (Vg2)

Bond Pad #4 (50 ohm)
Bond Pad #5 (RF Coupler)

Bond Pad #6 (Vg4)
Bond Pad #7 (Vg3)

Bond Pad #8 (Vd Out)
Bond Pad #9 (Vg Out)

Bias Arrangement



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Page 2 of 3

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Handling and Assembly Information

CAUTION! – Mimix Broadband MMIC Products contain *gallium arsenide (GaAs)* which can be hazardous to the human body and the environment. For safety, observe the following procedures:

- Do not ingest.
- Do not alter the form of this product into a gas, powder, or liquid through burning, crushing, or chemical processing as these by products are dangerous to the human body if inhaled, ingested, or swallowed.
- Observe government laws and company regulations when discarding this product. This product must be discarded in accordance with methods specified by applicable hazardous waste procedures.

ESD – Gallium Arsenide (GaAs) devices are susceptible to electrostatic and mechanical damage. Die are supplied in antistatic containers, which should be opened in cleanroom conditions at an appropriately grounded anti-static workstation. Devices need careful handling using correctly designed collets, vacuum pickups or, with care, sharp tweezers.

Die Attachment – GaAs Products from Mimix Broadband are 0.100 mm (0.004) thick and have vias through to the backside to enable grounding to the circuit. Microstrip substrates should be brought as close to the die as possible. The mounting surface should be clean and flat. If using conductive epoxy, recommended epoxies are Ablestick 84-1LMI or 84-1LMIT cured in a nitrogen atmosphere per manufacturer's cure schedule. Apply epoxy sparingly to avoid getting any on to the top surface of the die. An epoxy fillet should be visible around the total die periphery. If eutectic mounting is preferred, then a fluxless gold-tin (AuSn) preform, approximately 0.001² thick, placed between the die and the attachment surface should be used. A die bonder that utilizes a heated collet and provides scrubbing action to ensure total wetting to prevent void formation in a nitrogen atmosphere is recommended. The gold-tin eutectic (80% Au 20% Sn) has a melting point of approximately 280°C (Note: Gold Germanium should be avoided). The work station temperature should be 310°C ± 10°C. Exposure to these extreme temperatures should be kept to minimum. The collet should be heated, and the die pre-heated to avoid excessive thermal shock. Avoidance of air bridges and force impact are critical during placement.

Wire Bonding – Windows in the surface passivation above the bond pads are provided to allow wire bonding to the die's gold bond pads. The recommended wire bonding procedure uses 0.076 mm x 0.013 mm (0.003 x 0.0005) 99.99% pure gold ribbon with 0.5–2% elongation to minimize RF port bond inductance. Gold 0.025 mm (0.001) diameter wedge or ball bonds are acceptable for DC Bias connections. Aluminum wire should be avoided. Thermo-compression bonding is recommended though thermosonic bonding may be used providing the ultrasonic content of the bond is minimized. Bond force, time and ultrasonics are all critical parameters. Bonds should be made from the bond pads on the die to the package or substrate. All bonds should be as short as possible.