X-Band Limiter/Low Noise Amplifier 8.5 –12.0 GHz

MA01503D

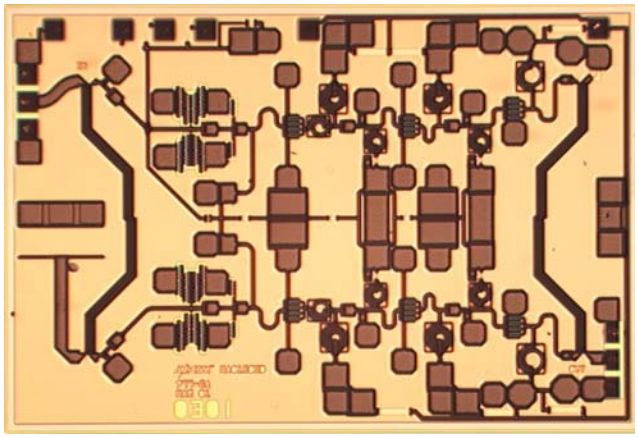
Features

- 8.5 to 12.0 GHz Operation
- 10 Watt CW On-chip Limiter
- Balanced Design –Excellent Return Loss
- Self-Aligned MSAG® MESFET Process

Primary Applications

- Weather Radar
- Airborne Radar

8.5-12.0 GHz GaAs MMIC Amplifier



Description

The MA01503D is a balanced 3-stage low noise amplifier with on-chip, receiver protecting 10 Watt limiter. This product is fully matched to 50 ohms on both the input and output.

Each device is 100% RF tested on wafer to ensure performance compliance. The part is fabricated using M/A-COM's repeatable, high performance and highly reliable GaAs Multifunction Self-Aligned Gate (MSAG®) MESFET Process. This process features silicon oxi-nitride passivation and poly-imide scratch protection.

Electrical Characteristics: T_B = 25°C[1], Z_0 = 50Ω, V_{DD} = 5V, V_{GG} = -5V

Parameter	Symbol	Minimum	Typical	Maximum	Units
Bandwidth	f	8.5		12.0	GHz
Small Signal Gain	Gn	17	19	23	dB
1-dB Compression Point	P1dB		20		dBm
Input Return Loss	IRL	13	18		dB
Output Return Loss	ORL	13	20		dB
Noise Figure	NF		2.7	3.5	dB
Drain Current	I_{DD}		190	240	mA
Gate Current	I_{GG}		4	10	mA
Input Third Order Intercept Point	ITOI		8		dBm
Drain Current (Max at Pin= 10W)	I_{DMAX}		60+I_{DD}		mA
Power Handling (CW up to 30 minutes)	P_{RF}		10		W

1. T_B = MMIC Base Temperature

Maximum Operating Conditions [1]

Parameter	Symbol	Absolute Maximum	Units
Input Power	P_{IN}	15	Watts
Drain Supply Voltage	V_{DD}	8.0	V
Gate Supply Voltage	V_{GG}	-6.0	V
Quiescent Drain Current (No RF)	I_{DQ}	450	mA
Quiescent DC Power Dissipated (No RF)	P_{DISS}	3.6	W
Junction Temperature	T_j	150	°C
Storage Temperature	T_{STG}	-55 to +150	°C

1. Operation outside of these ranges may reduce product reliability. Operation at other than the typical values may result in performance outside the guaranteed limits.

Recommended Operating Conditions

Characteristic	Symbol	Min	Typ	Max	Unit
Drain Voltage	V_{DD}	4.0	5.0	6.0	V
Gate Voltage	V_{GG}	-5.5	-5.0	-4.5	V
Junction Temperature	T_J			150	°C
MMIC Base Temperature	T_B			Note 2	°C

2. Maximum MMIC Base Temperature = 150°C — 22.1 °C/W * V_{DD} * I_{DQ}

Operating Instructions

This device is static sensitive. Please handle with care. To operate the device, follow these steps.

1. Apply V_{GG} = -5 V, V_{DD}= 0 V.
2. Ramp V_{DD} to desired voltage, typically 5 V.
3. Adjust V_{GG} to set I_{DQ}, (approximately @ –5 V).
4. Set RF input.
5. Power down sequence in reverse. Turn gate voltage off last.

Typical Small Signal Characteristics (V_{DD}=5V, V_{GG}=-5V)

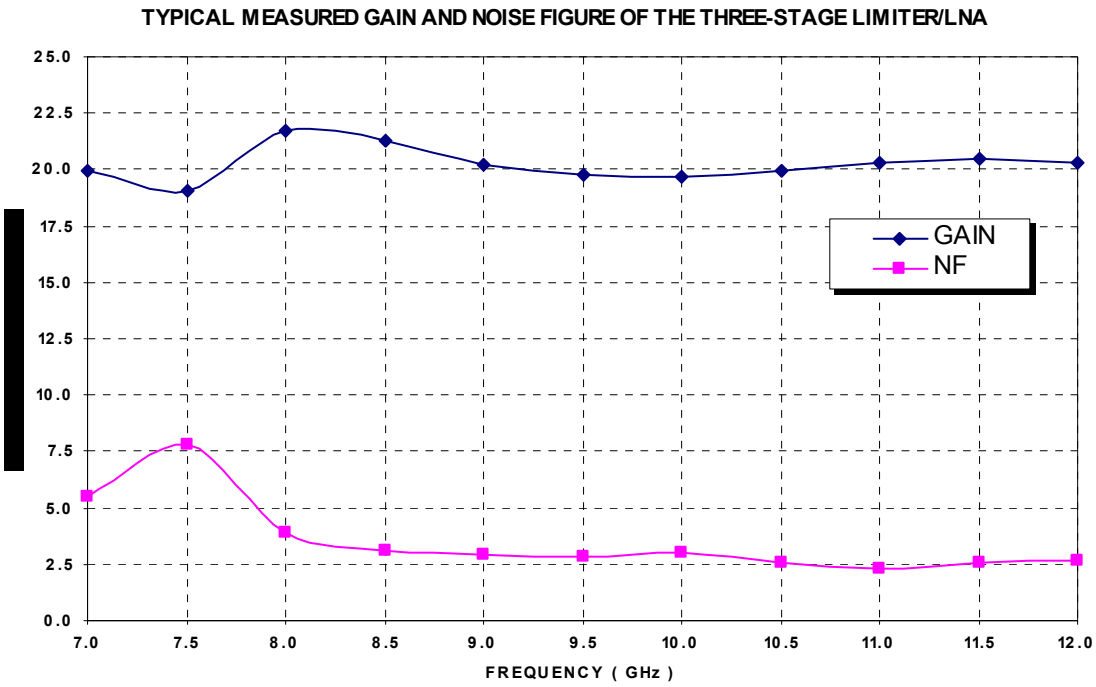


Figure 1. Small Signal Gain and Noise Figure

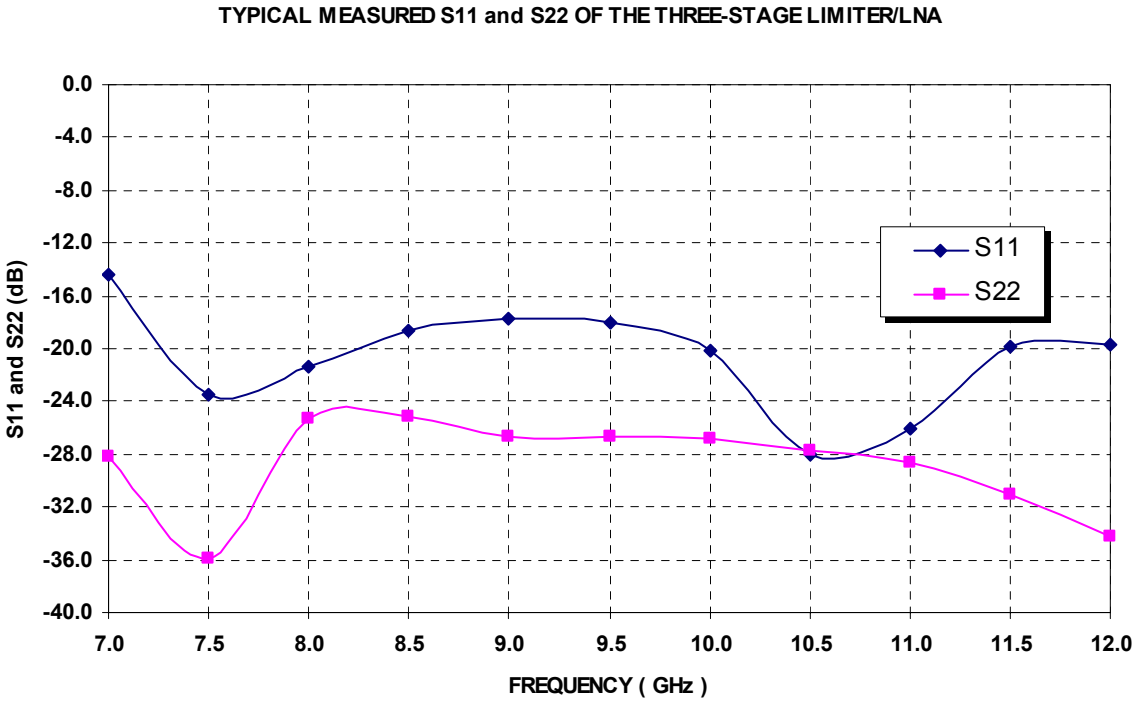


Figure 2. Input and Output Match

Specifications subject to change without notice.

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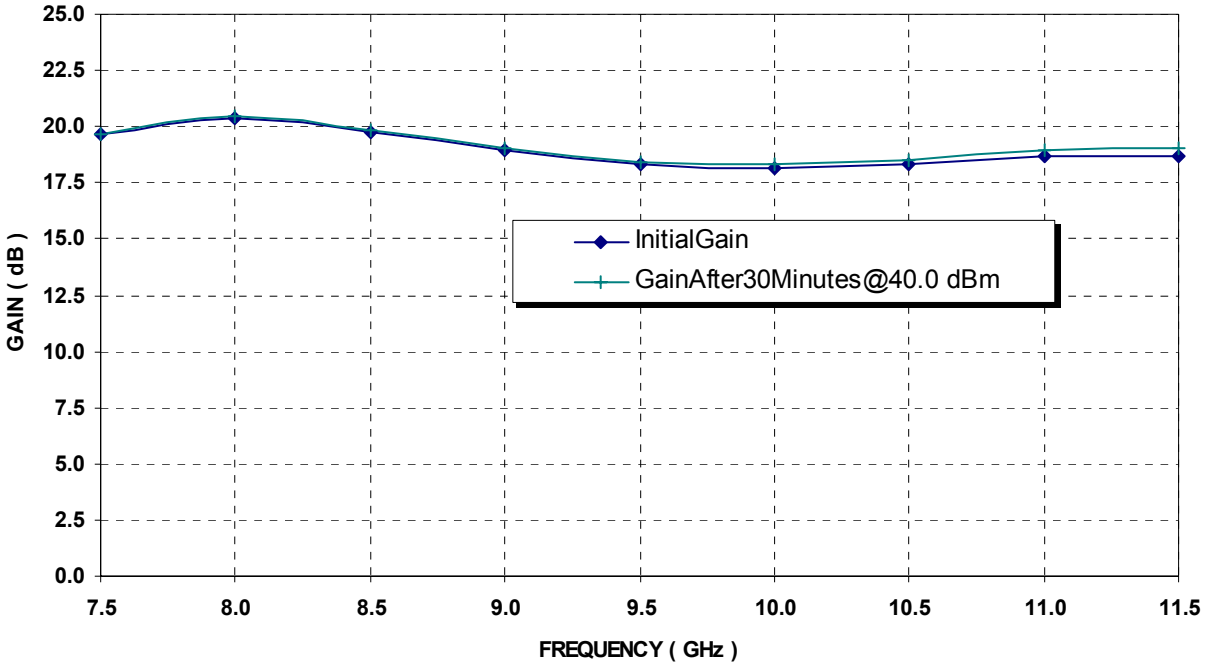
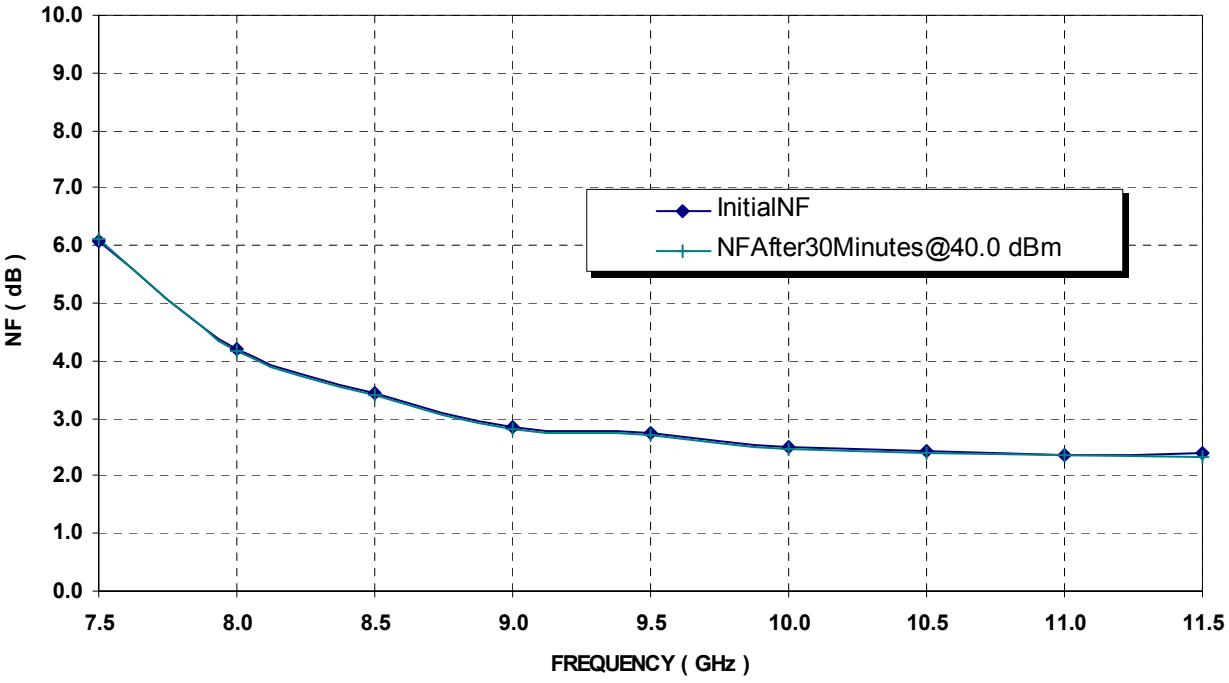
TYPICAL MEASURED GAIN OF THE LIMITER/LNA TESTED BEFORE AND AFTER 30 MINUTES EXPOSURE with 40 dBm CW Power



TYPICAL MEASURED NOISE FIGURE OF THE LIMITER/LNA TESTED BEFORE AND AFTER 30 MINUTES EXPOSURE with 40 dBm CW Power



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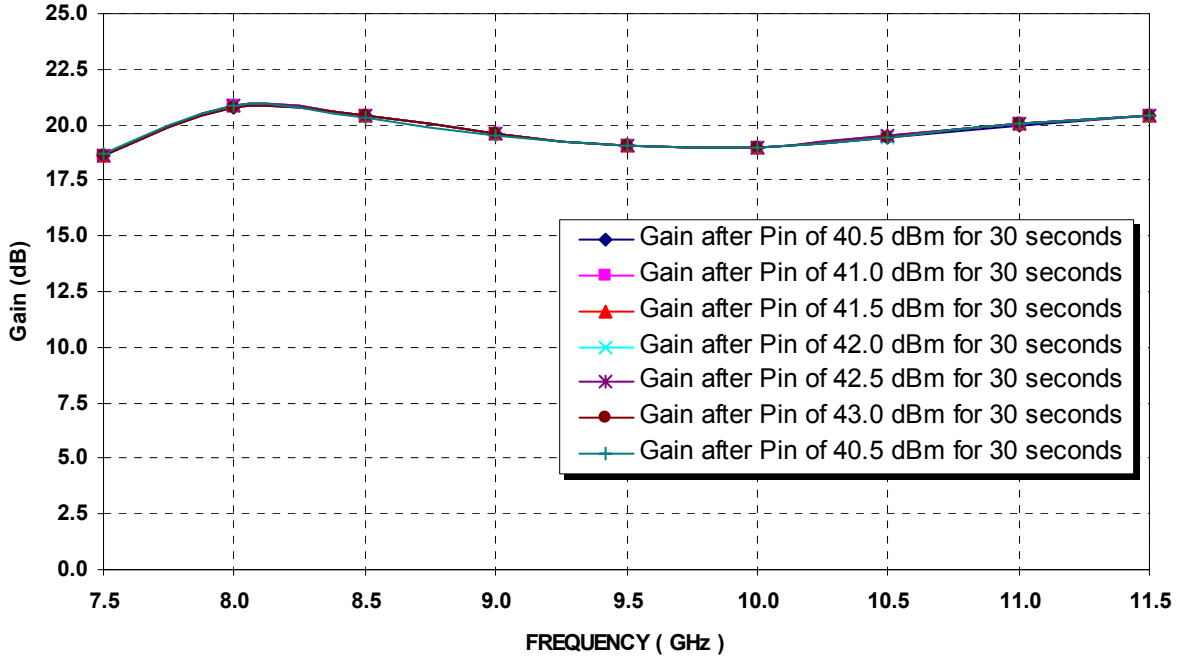
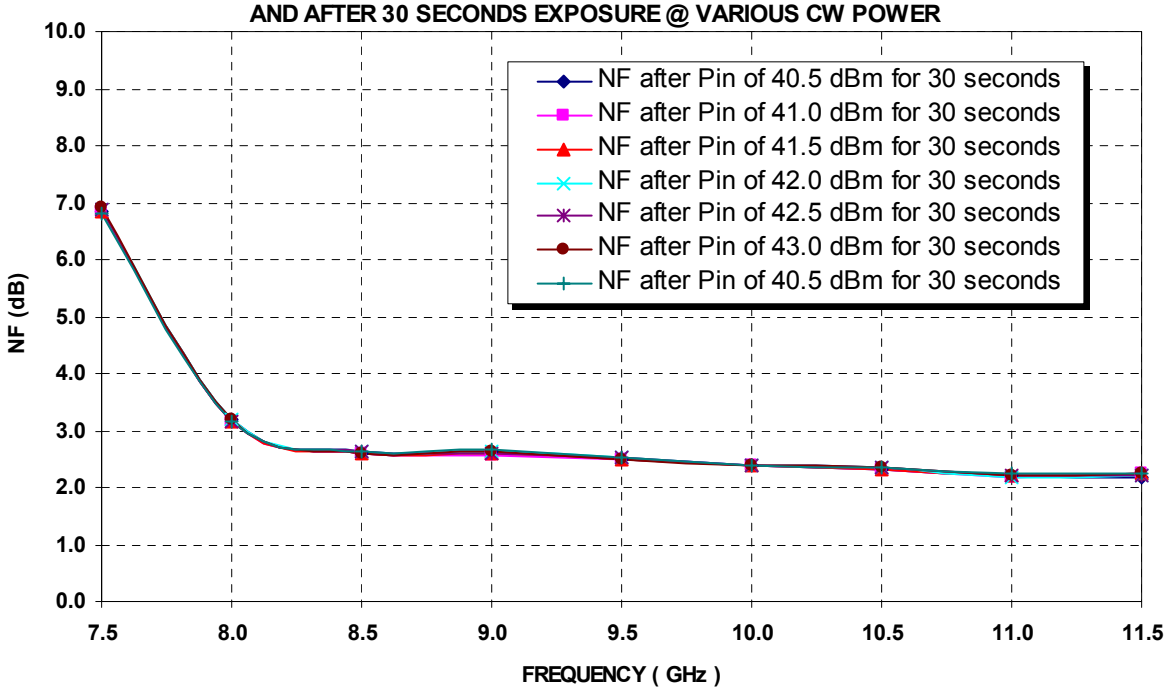
TYPICAL MEASURED GAIN OF THE THREE-STAGE LIMITER/LNA TESTED BEFORE AND AFTER 30 SECONDS EXPOSURE @ VARIOUS CW POWER

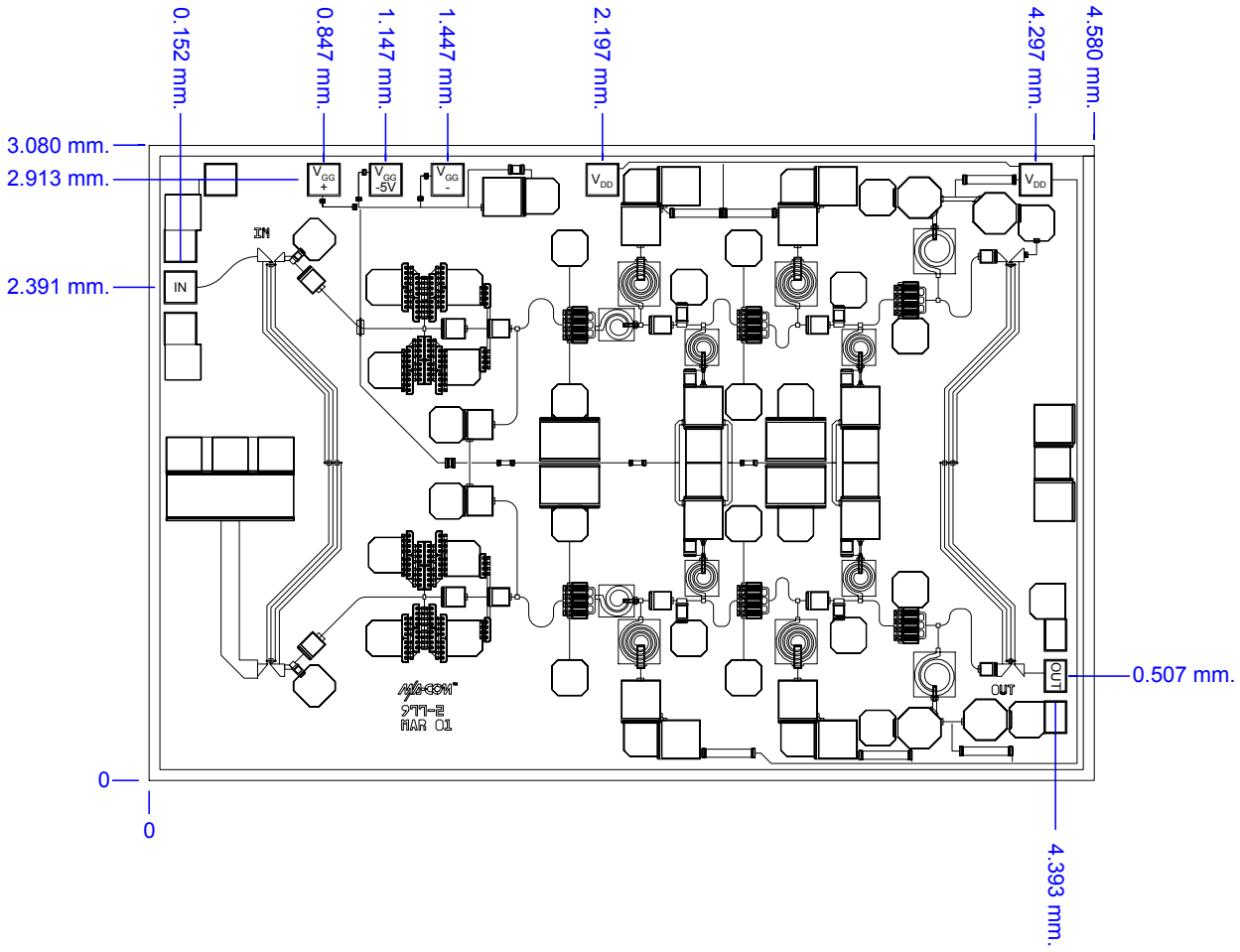


TYPICAL MEASURED NOISE FIGURE OF THE THREE-STAGE LIMITER/LNA TESTED BEFORE AND AFTER 30 SECONDS EXPOSURE @ VARIOUS CW POWER



Mechanical Information

Chip Size: 4.580 x 3.080 x 0.125mm (181 x 122 x 5 mils)

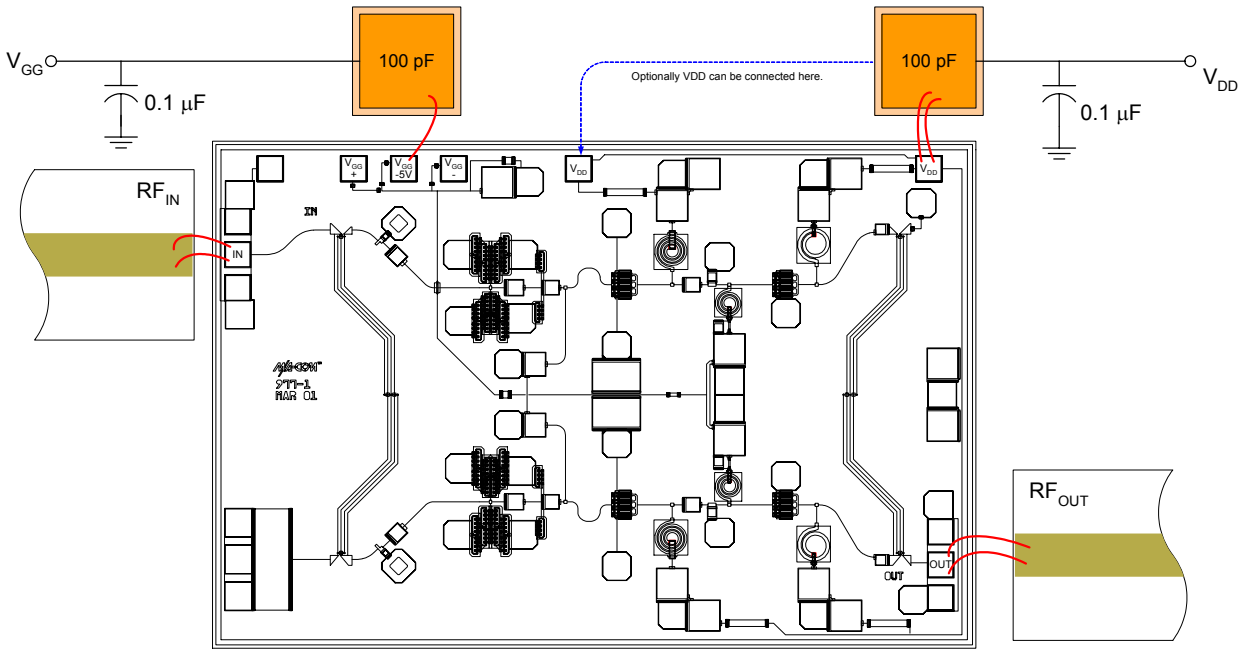


Bond Pad Dimensions

Pad	Size (µm)	Size (mils)
RF In and Out	150 x 150	6 x 6
DC Drain Supply Voltage VDD	150 x 150	6 x 6
DC Gate Supply Voltage VGG	150 x 150	6 x 6

X-Band 10W Limiter/ 3-stage LNA MA01503D

Assembly and Bonding Diagram



Recommended bonding diagram.
Support circuitry typical of MMIC characterization fixture for CW testing.
NOTE: Indicated VGG pad represents the nominal bias condition. The device current can be increased or decreased by bonding to either VGG+ or VGG– respectively.

Assembly Instructions:

Die attach: Use AuSn (80/20) 1-2 mil. preform solder. Limit time @ 300 °C to less than 5 minutes.

Wirebonding: Bond @ 160 °C using standard ball or thermal compression wedge bond techniques. For DC pad connections, use either ball or wedge bonds. For best RF performance, use wedge bonds of shortest length, although ball bonds are also acceptable.

Biasing Note: Must apply negative bias to V_{GG} before applying positive bias to V_{DD} to prevent damage to amplifier.