Hittite
MICROWAVE CORPORATION

HMC263

GaAs MMIC LOW NOISE AMPLIFIER 24 - 36 GHz

FEBRUARY 2001

v01.05.00

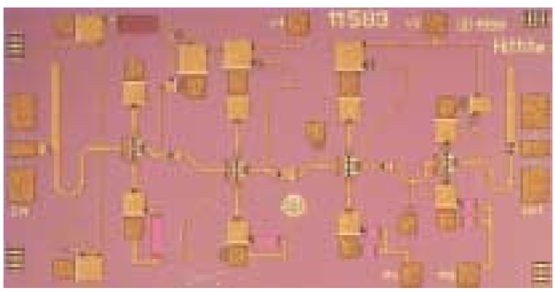
Features

EXCELLENT NOISE FIGURE : 2.3 dB

STABLE GAIN vs. TEMPERATURE: 23dB ± 2.0 dB

SINGLE SUPPLY : +3V @ 46 mA

SMALL SIZE: 1.32 mm x 2.49 mm



General Description

The HMC263 chip is a GaAs MMIC Low Noise Amplifier (LNA) which covers the frequency range of 24 to 36 GHz. The chip can easily be integrated into Multi-Chip Modules (MCMs) due to its small (3.29 mm^2) size. The chip utilizes a GaAs PHEMT process offering 23 dB gain from a single bias supply of + 3V @ 46 mA with a noise figure of 2.3 dB. This LNA can be used in millimeterwave point-to-point radios, Local Multi-Point Distribution Systems (LMDS), VSAT, and other SATCOM applications. All data is with the chip in a 50 ohm test fixture connected via 0.025 mm (1 mil) diameter wire bonds of minimal length 0.31 mm (<12 mils). The HMC263 may be used in conjunction with HMC259, HMC264, or HMC265 mixers to realize a millimeterwave system receiver.

Guaranteed Performance, Vdd = +3V, -55 to +85 deg C

Parameter	Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	Units
Frequency Range		24 - 27			27 - 32			32 - 36		GHz
Gain	20	25		17	23		15	21		dB
Noise Figure		2.5	3.9		2.3	3.7		2.6	4.3	dB
Input Return Loss	4	7		4	9		5	8		dB
Output Return Loss	11	16		11	16		8	12		dB
Reverse Isolation	38	45		38	45		38	45		dB
Output Power for 1dB Compression (P1dB)	-2	3		2	6		3	7		dBm
Saturated Output Power (Psat)	0	5		4	8		6	10		dBm
Output Third Order Intercept (IP3)	5	10		7	13		9	14		dBm
Supply Voltage (Vdd)	2.75	3.0	3.25	2.75	3.0	3.25	2.75	3.0	3.25	Vdc
Supply Current (Idd)(@Vdd= +3.0V)		46	58		46	58		46	58	mA

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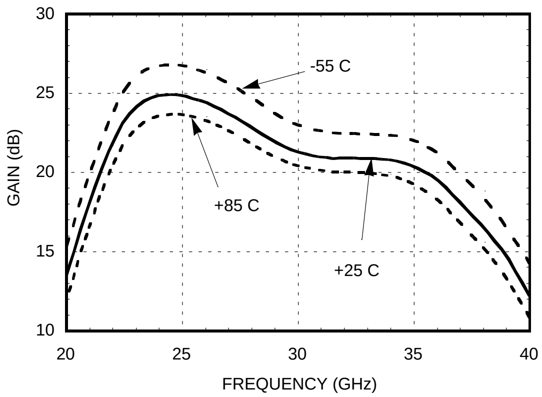
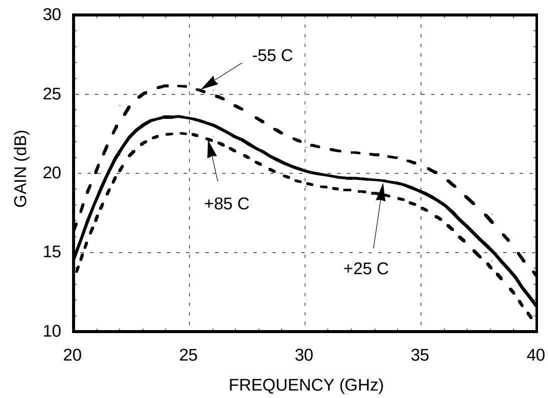
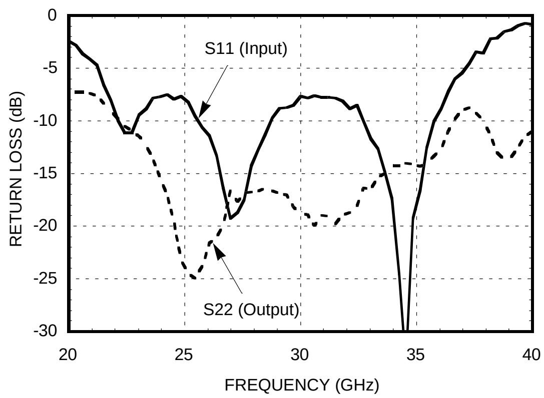
Gain vs. Temperature @ Vdd = +3V



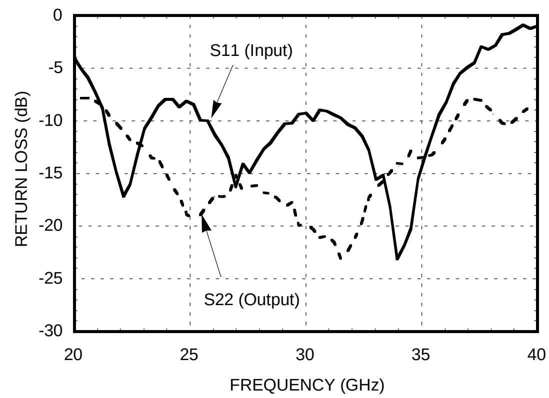
Gain vs. Temperature @ Vdd = +5V



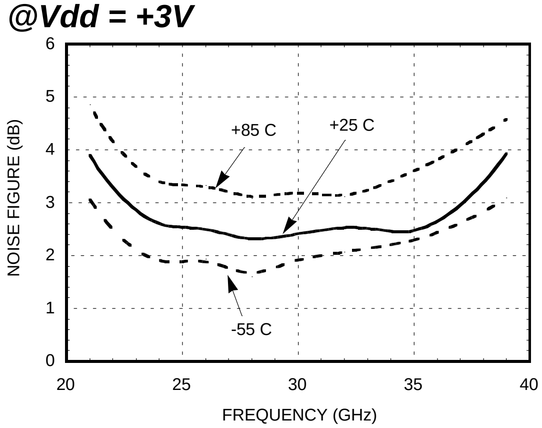
Return Loss @ Vdd = +3V



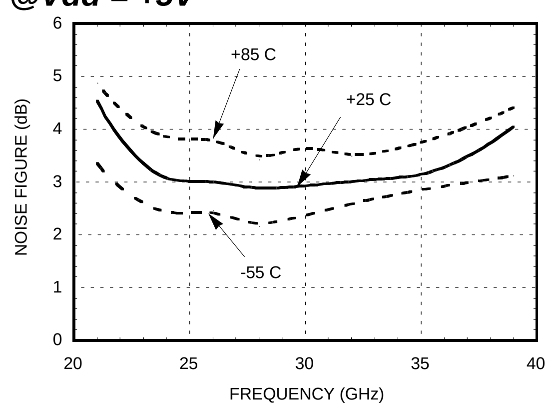
Return Loss @ Vdd = +5V



Noise Figure vs Temperature @Vdd = +3V



Noise Figure vs Temperature @Vdd = +5V



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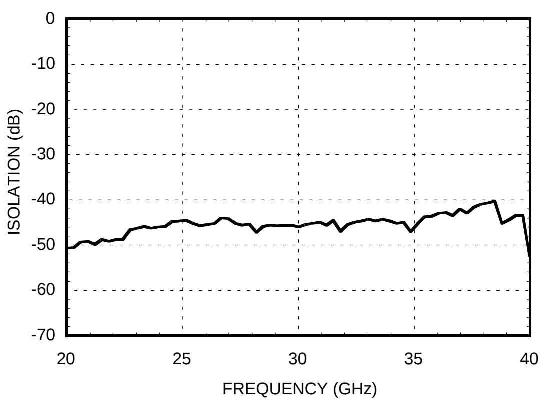
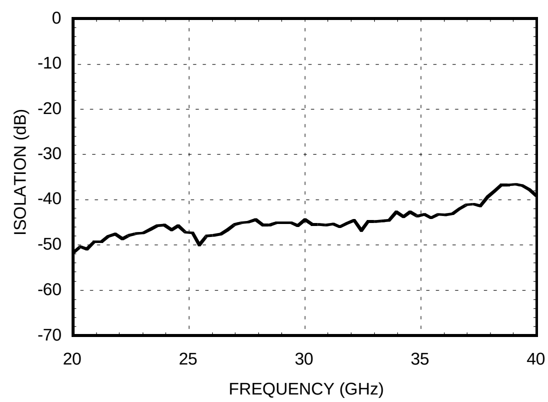
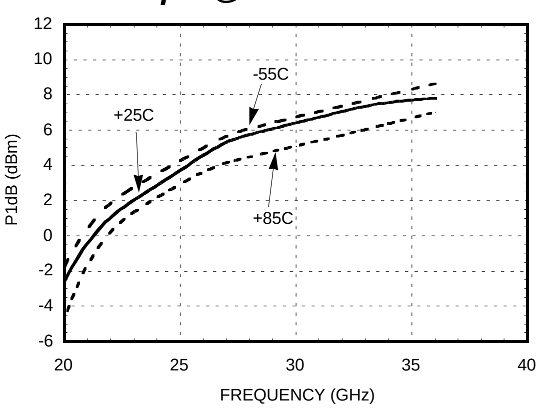
Isolation @ Vdd = +3V



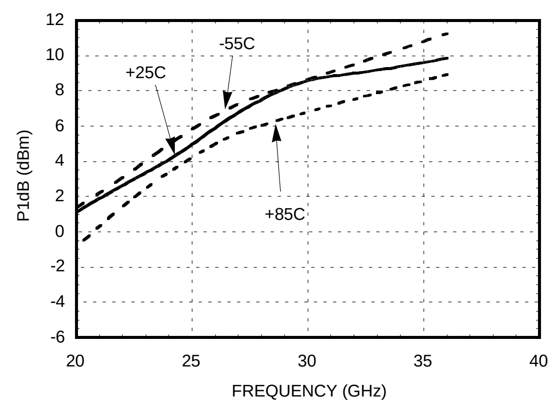
Isolation @ Vdd = +5V



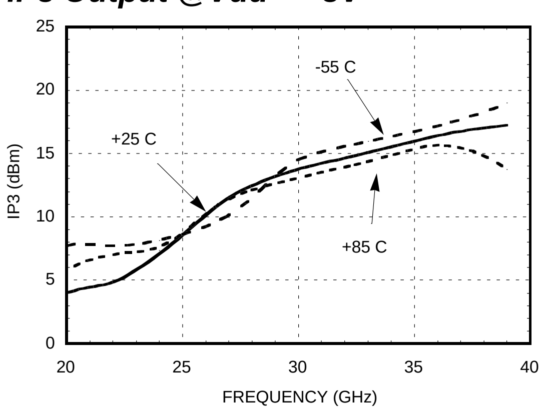
P1dB Output@ Vdd = +3V



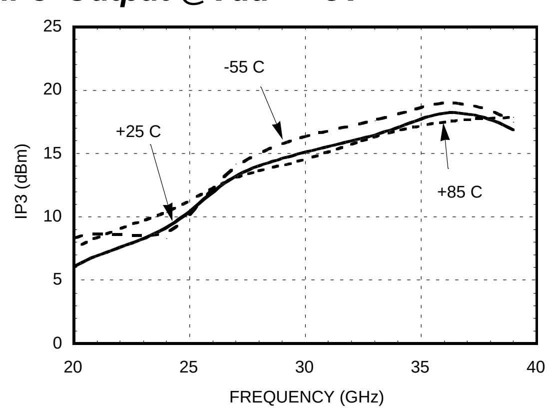
P1dB Output@ Vdd = +5V



IP3 Output @Vdd = +3V



IP3 Output @Vdd = +5V



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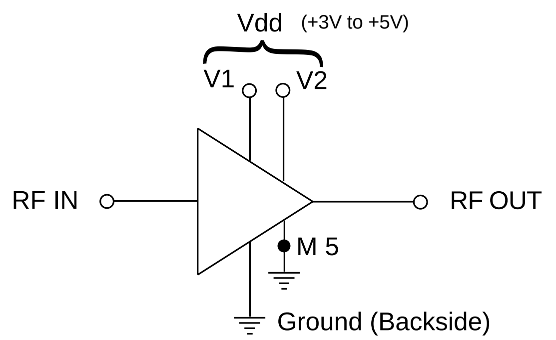
Schematic

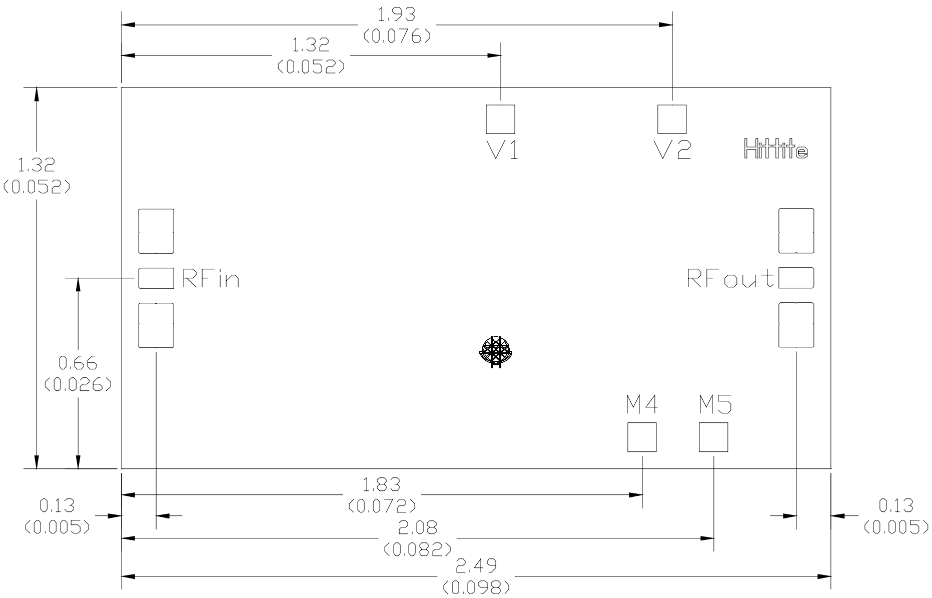


Absolute Maximum Ratings

Supply Voltage (Vdd= V1 = V2)	+5.5 Vdc
Input Power (RFin)(Vdd=+3V)	-5 dBm
Channel Temperature (Tc)	175 °C
Thermal Resistance (Θjc) (Channel Backside)	130 °C/W
Storage Temperature	-65 to +150 °C
Operating Temperature	-55 to +85 °C

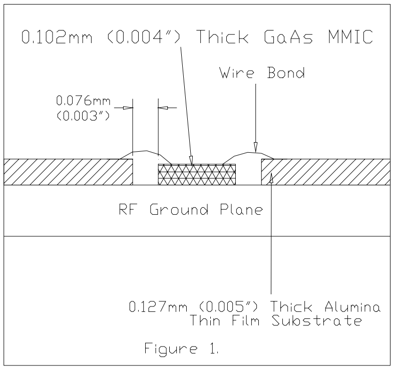
NOTE: Connect V1 & V2 to Vdd via a 100pF single layer chip bypass capacitor. Place the capacitor no further than 0.762 mm (30mils) from the HMC263. Connect M5 to RF ground. M4 should not be connected to bias or ground. See page 1-26 for biasing options.

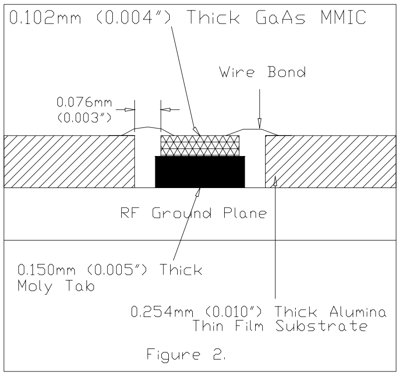
Outline *(See Die Handling, Mounting, Bonding Note Page 1 - 19)*



ALL DIMENSION IN MILLIMETERS (INCHES)
ALL TOLERANCES ARE ±0.025 (0.001)
DIE THICKNESS IS 0.100 (0.004) BACKSIDE IS GROUND
BOND PADS ARE 0.100 (0.004) SQUARE
BOND PAD SPACING, CTR-CTR: 0.150 (0.006)
BACKSIDE METALLIZATION : GOLD
BOND PAD METALLIZATION : GOLD

MIC Assembly Techniques for HMC263





Mounting & Bonding Techniques for Millimeterwave GaAs MMICs

The die should be attached directly to the ground plane eutectically or with conductive epoxy (see HMC general Handling, Mounting, Bonding Note).

50 Ohm Microstrip transmission lines on 0.127mm (5 mil) thick alumina thin film substrates are recommended for bringing RF to and from the chip (Figure 1). If 0.254mm (10 mil) thick alumina thin film substrates must be used, the die should be raised 0.150mm (6 mils) so that the surface of the die is coplanar with the surface of the substrate. One way to accomplish this is to attach the 0.102mm (4 mil) thick die to a 0.150mm (6 mil) thick molybdenum heat spreader (moly-tab) which is then attached to the ground plane (Figure 2).

Microstrip substrates should brought as close to the die as possible in order to minimize bond wire length. Typical die-to-substrate spacing is 0.076mm to 0.152 mm (3 to 6 mils).

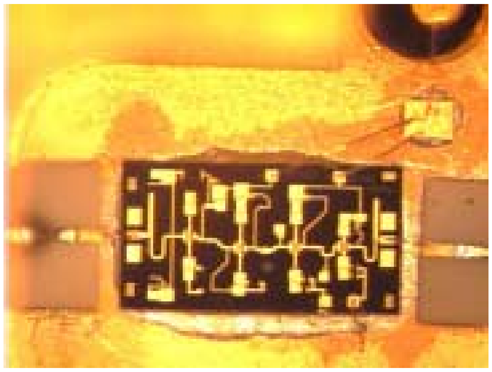


***Figure 3**: Typical HMC263 Assembly*

An RF bypass capacitor should be used on the Vdd input. A 100 pF single layer capacitor (mounted eutectically or by conductive epoxy) placed no further than 0.762mm (30 Mils) from the chip is recommended. The photo in figure 3 shows a typical assembly for the HMC263 MMIC chip.

Chip Biasing Options

This chip is self-biased, and performance flexibility is provided by the access to M5 pad (M4 pad is always not connected). We propose two standard biasing schemes:

1) To Achieve Low Noise and Low Current Consumption
M5 not connected and Vdd = +3V *Yields:*
Idd = 37 mA,
P1dB = +3 dBm,
NF = 2.2 dB typical @ 28 GHz

2) To Achieve Low Noise and High RF Output Power:
M5 Grounded and Vdd= +3V Yields:
Idd = 46 mA,
P1dB = +6 dBm,
NF = 2.2 dB typical @ 28 GHz

Option 2 biasing scheme is used for HMC263 data sheet specifications.

Handling Precautions

Follow these precautions to avoid permanent damage.
Cleanliness: Handle the chips in a clean environment. DO NOT attempt to clean the chip using liquid cleaning systems.
Static Sensitivity: Follow ESD precautions to protect against ESD strikes (*see page 8 - 2*).
Transients: Suppress instrument and bias supply transients while bias is applied. Use shielded signal and bias cables to minimize inductive pick-up.
General Handling: Handle the chip along the edges with a vacuum collet or with a sharp pair of bent tweezers. The surface of the chip has fragile air bridges and should not be touched with vacuum collet, tweezers, or fingers.

Mounting

The chip is back-metallized and can be die mounted with AuSn eutectic preforms or with electrically conductive epoxy. The mounting surface should be clean and flat.

Eutectic Die Attach:
A 80/20 gold tin preform is recommended with a work surface temperature of 255 deg. C and a tool temperature of 265 deg. C. When hot 90/10 nitrogen/hydrogen gas is applied, tool tip temperature should be 290 deg. C.
DO NOT expose the chip to a temperature greater than 320 deg. C for more than 20 seconds. No more than 3 seconds of scrubbing should be required for attachment.

Epoxy Die Attach:
Apply a minimum amount of epoxy to the mounting surface so that a thin epoxy fillet is observed around the perimeter of the chip once it is placed into position.
Cure epoxy per the manufacturer's schedule.

Wire Bonding

Ball or wedge bond with 0.025 mm (1 mil) diameter pure gold wire. Thermosonic wirebonding with a nominal stage temperature of 150 deg. C and a ball bonding force of 40 to 50 grams or wedge bonding force of 18 to 22 grams is recommended. Use the minimum level of ultrasonic energy to achieve reliable wirebonds. Wirebonds should be started on the chip and terminated on the package or substrate. All bonds should be as short as possible <0.31 mm (12 mils).