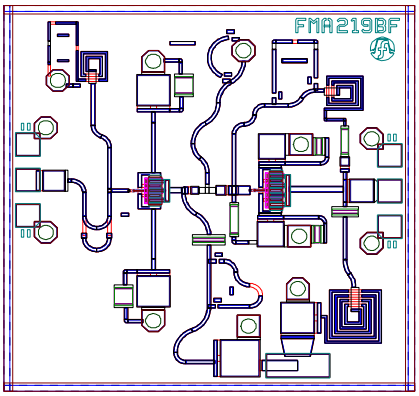
- PERFORMANCE
  - ♦ 7.0 – 11.0 GHz Operating Bandwidth
  - ♦ 1.5 dB Noise Figure
  - ♦ 21 dB Small-Signal Gain
  - ♦ 12 dBm Output Power
  - ♦ +3V Single Bias Supply
  - ♦ DC De-coupled Input and Output Ports



- DESCRIPTION AND APPLICATIONS

The FMA219 is a 2-stage, reactively matched pHEMT low-noise MMIC amplifier designed for use over the 7.0 to 11.0 GHz bandwidth. The amplifier requires a single +3V supply and one off-chip component for supply de-coupling. Both the input and output ports are DC de-coupled. Grounding of the amplifier is provided by plated thru-vias to the bottom of the die, no additional ground is required.

Typical applications include low-noise front end amplifiers, and general gain block utilizations in X-band. The amplifier is unconditionally stable over all load states (-45 to +85°C), and conditionally stable if the input port is open-circuited.

- ELECTRICAL SPECIFICATIONS AT 22°C

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Operating Frequency Bandwidth	BW	V_{DD} = +3 V I_{DD} = I_{OP}	7		11	GHz
Small Signal Gain	S_{21}	V_{DD} = +3 V I_{DD} = I_{OP}	19	21	23	dB
Operating Current	I_{OP}	No RF input	50	65	85	mA
Small Signal Gain Flatness	ΔS_{21}	V_{DD} = +3 V I_{DD} = I_{OP}		±0.5	±0.8	
Noise Figure	NF	V_{DD} = +3 V, I_{DD} = I_{OP}		1.5	1.7	dB
3rd-Order Intermodulation Distortion	IMD	V_{DD} = +3 V, I_{DD} = I_{OP} P_{OUT} = +1.5 dBm SCL		-47		dBc
Power at 1dB Compression	P_{1dB}	V_{DD} = +3 V	11.5	12.5		dBm
Input Return Loss	S_{11}	V_{DD} = +3 V I_{DD} = I_{OP}		-7	-3	dB
Output Return Loss	S_{22}	V_{DD} = +3 V I_{DD} = I_{OP}		-16	-10	dB
Reverse Isolation	S_{12}	V_{DD} = +3 V I_{DD} = I_{OP}		-40	-30	dB

ABSOLUTE MAXIMUM RATINGS[1]

Parameter	Symbol	Test Conditions	Min	Max	Units
Supply Voltage	V_{DD}	For any operating current		6	V
Supply Current	I_{DD}	For V_{DD} < 5V		100	mA
RF Input Power	P_{IN}	For standard bias conditions		-5	dBm
Storage Temperature	T_{STG}	Non-Operating Storage	-40	150	ºC
Total Power Dissipation	P_{TOT}	See De-Rating Note below		600	mW
Gain Compression	Comp.	Under any bias conditions		5	dB
Simultaneous Combination of Limits[2]		2 or more Max. Limits		80	%

[1] $T_{Ambient}$ = 22°C unless otherwise noted [2] Users should avoid exceeding 80% of 2 or more Limits simultaneously

Notes:

- Operating conditions that exceed the Absolute Maximum Ratings will result in permanent damage to the device.
- Total Power Dissipation defined as: $P_{TOT} \equiv (P_{DC} + P_{IN}) - P_{OUT}$, where:
  P_{DC}: DC Bias Power
  P_{IN}: RF Input Power
  P_{OUT}: RF Output Power
- Total Power Dissipation to be de-rated as follows above 22°C:
  P_{TOT}= 0.6 - (0.004W/°C) x $T_{CARRIER}$
  where $T_{CARRIER}$ = *carrier or heatsink temperature above 22°C*
  (coefficient of de-rating formula is the Thermal Conductivity)

Example: For a 55°C carrier temperature: P_{TOT} = 0.6 - (0.004 x (55 – 22)) = 0.47W

- **For optimum heatsinking eutectic die attach is recommended; conductive epoxy die attach is acceptable with some degradation in thermal de-rating performance (P_{TOT} = 550mW)**
- *Note on Thermal Resistivity:* The nominal value of 250°C/W is stated for the input stage, which will reach temperature limits before the output stage. The aggregate MMIC thermal resistivity is approximately 175°C/W.

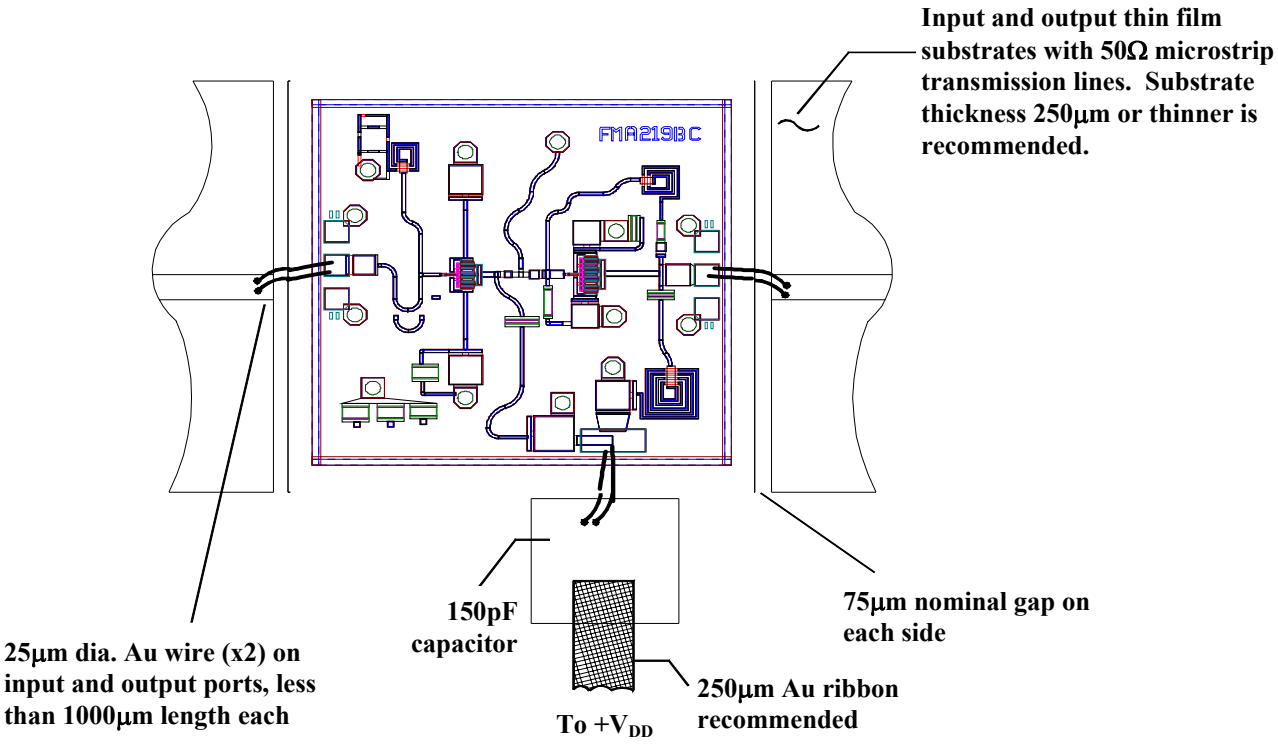
HANDLING PRECAUTIONS

To avoid damage to the devices care should be exercised during handling. Proper Electrostatic Discharge (ESD) precautions should be observed at all stages of storage, handling, assembly, and testing. These devices should be treated as Class 1A per ESD-STM5.1-1998, Human Body Model. Further information on ESD control measures can be found in MIL-STD-1686 and MIL-HDBK-263.

APPLICATIONS NOTES & DESIGN DATA

Applications Notes are available from your local Filtronic Sales Representative or directly from the factory.

- ASSEMBLY DRAWING

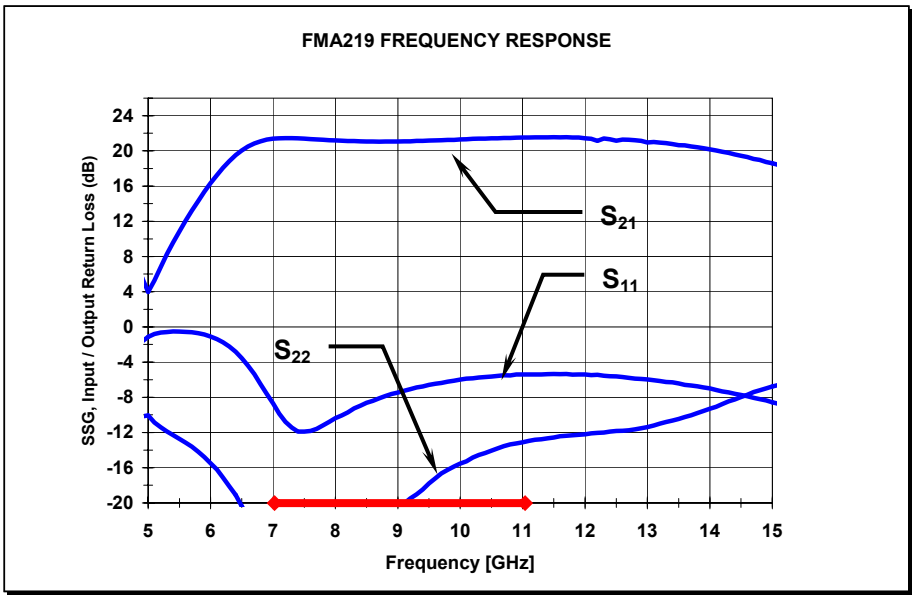


Notes:

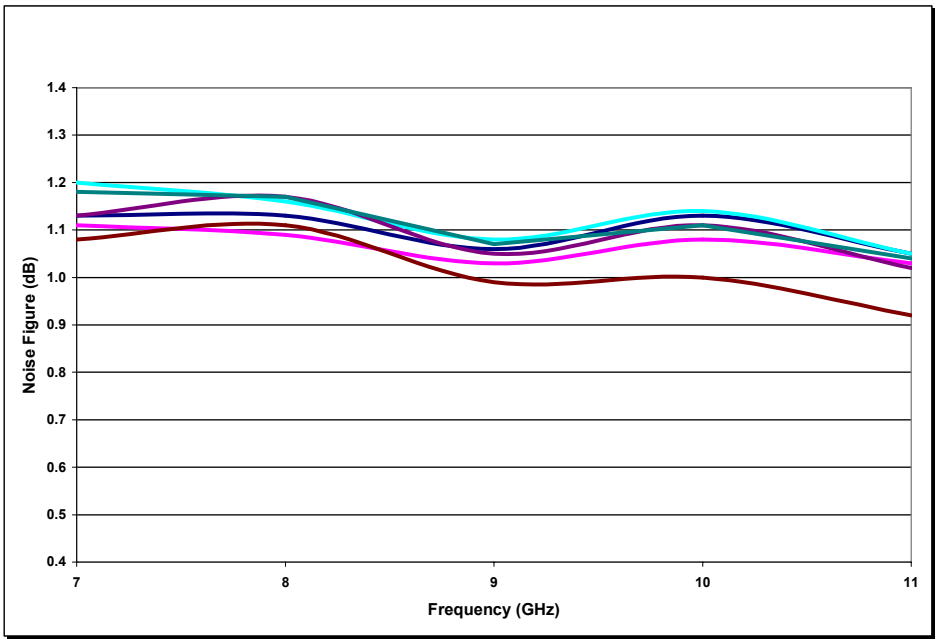
- Recommended lead bond technique is thermocompression wedge bonding with 0.001" (25µm) diameter wire. The bond tool force shall be 35-38 gram. Bonding stage temperature shall be 230-240°C, heated tool (150-160°C) is recommended. Ultrasonic or thermosonic bonding is ***not*** recommended.
- The recommended die attach is conductive epoxy, following the manufacturer's recommended curing procedure.
- For eutectic die attach the maximum time at 280-300°C is 60 seconds, and should be kept to a minium.
- The supply de-coupling capacitor (150 pF recommended value) should be placed as close to the MMIC as practical.

All information and specifications subject to change without notice.

- TYPICAL RF PERFORMANCE (V_{DD} = +3V, I_{DD} = I_{OP})



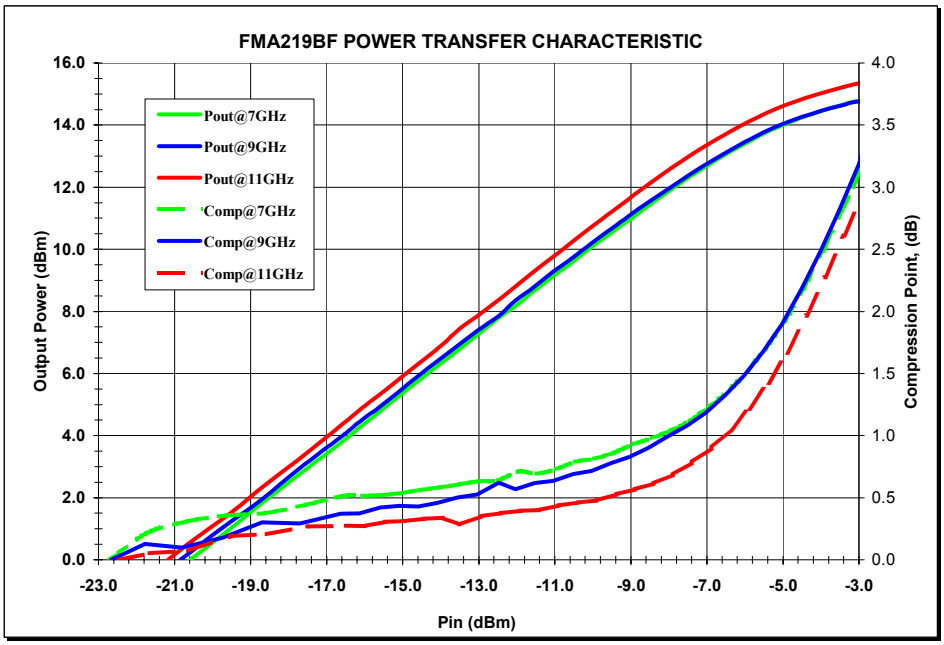
- TYPICAL NOISE FIGURE PERFORMANCE



➢ Multiple traces show typical die variation across a 150mm (6 in.) wafer.

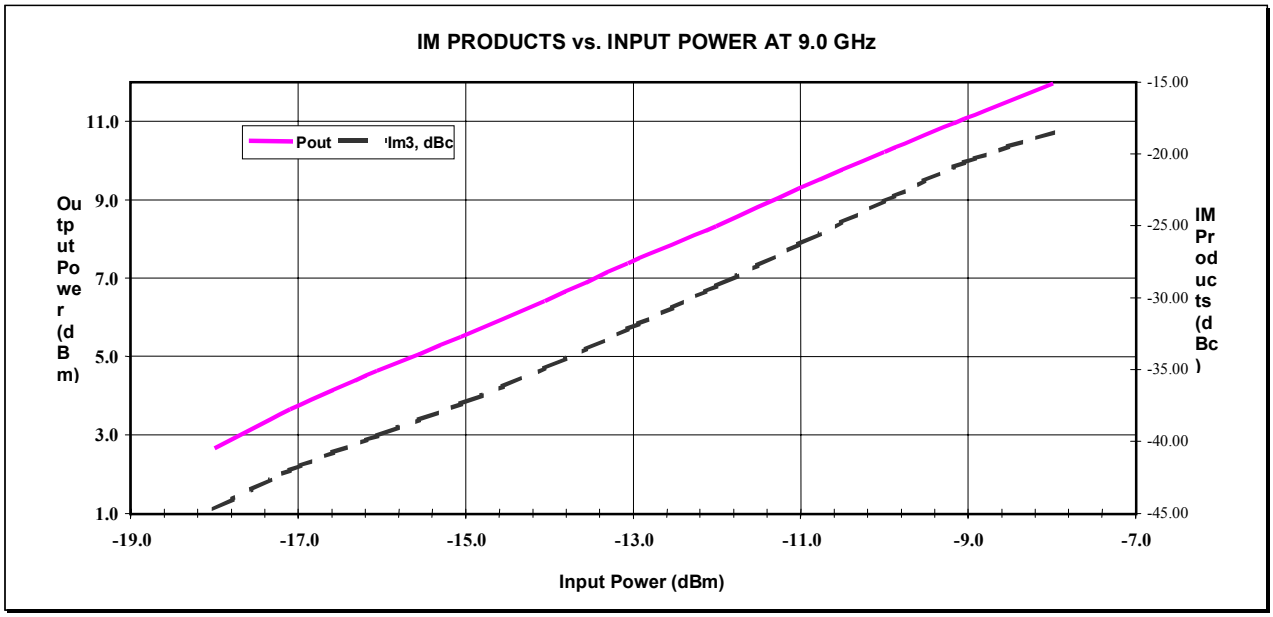
Note: Effect of typical bondwire inductance (25 µm dia., 1000 µm length, 2 ea. on input and output ports) is less than 0.5 dB decrease in S_{21} (11GHz), and no measurable effect on noise figure.

- POWER TRANSFER CHARACTERISTIC



- TYPICAL 3RD–ORDER INTERMODULATION PERFORMANCE

FMA219



➢ Equivalent output IP3 performance exceeds 24 dBm, input IP3 is typically ≥ +2 dBm.