1. Description

- The M3509B is low noise amplifier fabricated on GaAs p-HEMT MMIC process. It operates over 17-22GHz and provides 23.5dB gain with 1dB positive slope and achieves 1.2dB noise figure. It also provides power down mode in each channel. It can be biased from a single positive supply of 3V.

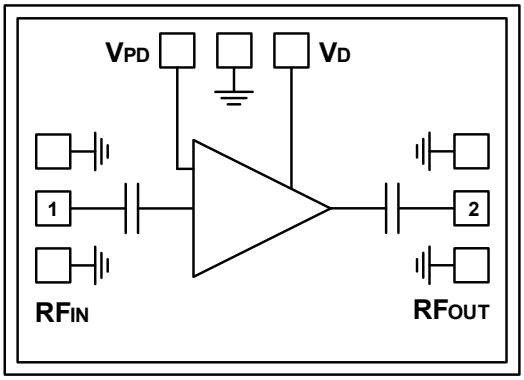


Figure 1. M3509B Functional Block Diagram

2. Applications

- Satellite Communication
- Radar Modules

3. Features[1]

- Frequency Range: 17-22GHz
- Typical Gain: 23.5dB, 1dB positive slope
- Noise Figure: 1.2dB
- Input/Output Return Loss: -12dB/-15dB
- Output P_{-1dB}: -3dBm
- Single Positive Supply: +3V (I_{DQ}=7mA)
- Power Down Control Voltage: 0V/+3.3V
- 50Ohm Matched Input/Output
- Die Size: 1.30 x 0.95 x 0.10mm

[1] On-wafer Test

4. Brief Typical Performance

Table 1. Brief Typical Performance

Parameter	17-22GHz	Units
Small-Signal Gain	23.5	dB
Noise Figure	1.2	dB
Input Return Loss	-12	dB
Output Return Loss	-15	dB
Output P_{-1dB}	-3	dBm
Power Consumption	21	mW

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5. Absolute Maximum Ratings

Table 2. Absolute Maximum Ratings

Parameter	Symbol	Rating	Units
Operating Voltage Range	V_D	0 ~ +6	V
Maximum Input Power	P_{IN}	16	dBm
Storage Temperature Range	T_{STG}	- 55 ~ 150	°C

6. Recommended Operating Conditions

Table 3. Recommended Operating Conditions

Parameter	Min.	Typ.	Max.	Units
Operating Temperature Range	-55	25	125	°C
Supply Voltage, V_D	-	3	-	V
Supply Current, I_{DQ}	-	7	-	mA

7. RF Characteristics (V_D=3V, V_{PD}=3.3V, T_C = 25˚C)

Table 4. RF Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Units
Small-Signal Gain	Gain	22.8	23.5	24	dB
Noise Figure	NF	-	1.2	1.3	dB
Input Return Loss	RL_{IN}	-17	-12	-10	dB
Output Return Loss	RL_{OUT}	-18	-15	-11	dB
Output Power for 1dB Compression	OP_{-1dB}	-	-3	-	dBm

• Typical performance at these conditions: Temp=25°C, V_D=3V, V_{PD}=3.3V, P_{IN}=-40dBm, 50Ohm system.

8. Typical Performance Curve

■ Small-signal Characteristics Curve

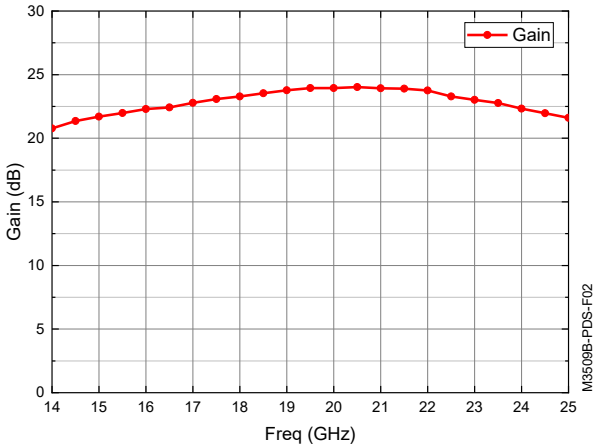


Figure 2. Small-signal Gain Characteristics

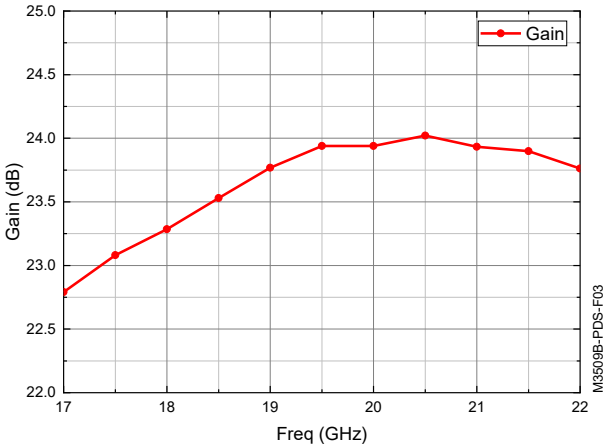


Figure 3. Small-signal Gain Characteristics

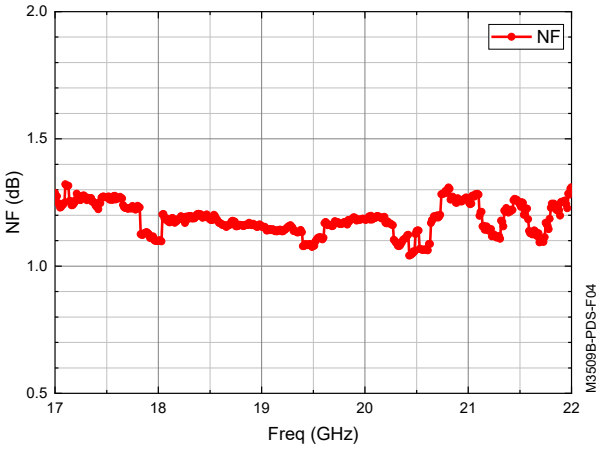


Figure 4. Noise Figure Characteristics

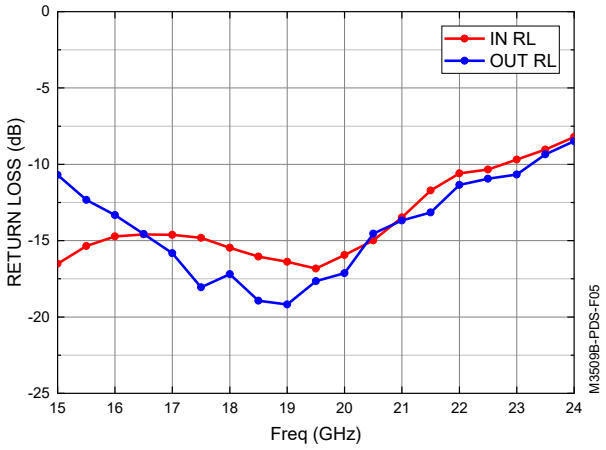


Figure 5. Input\Output Return Loss Characteristics

■ Power Characteristics Curve

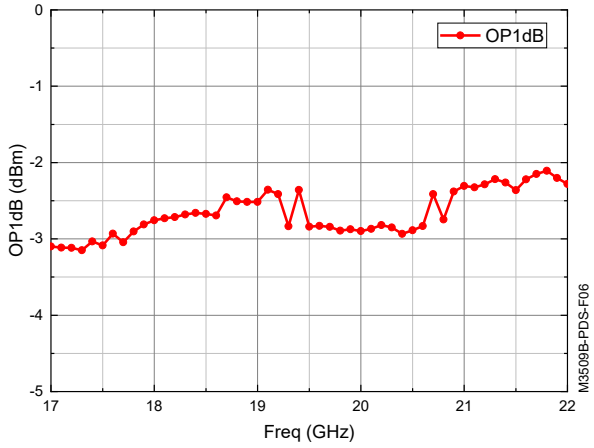
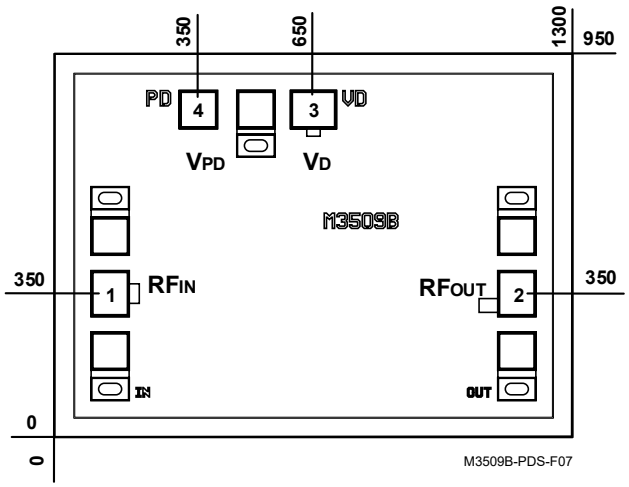


Figure 6. OP-1dB Characteristics

9. Outline Dimensions



- Dimensions shown in micrometre

Figure 7. M3509B Outline Dimensions

Table 5. Pad Description

Pad	Symbol	Description
1	RF_{IN}	RF Input. 50ohm. DC blocking capacitor is not required.
2	RF_{OUT}	RF Output. 50ohm. DC blocking capacitor is not required.
3	V_D	Supply Voltage. External bypass capacitors are required, refer to Figure 9.
4	V_{PD}	Power Down Control Voltage. Power is off when 0V, refer to Table 6.

Table 6. Power Down Mode Truth Table

V_D	V_{PD}	RF_{IN}	RF_{OUT}
3V	3.3V	ON	ON
3V	0V	OFF	OFF
0V	3.3V	OFF	OFF
0V	0V	OFF	OFF

10. Assembly Information

■ Assembly Diagram

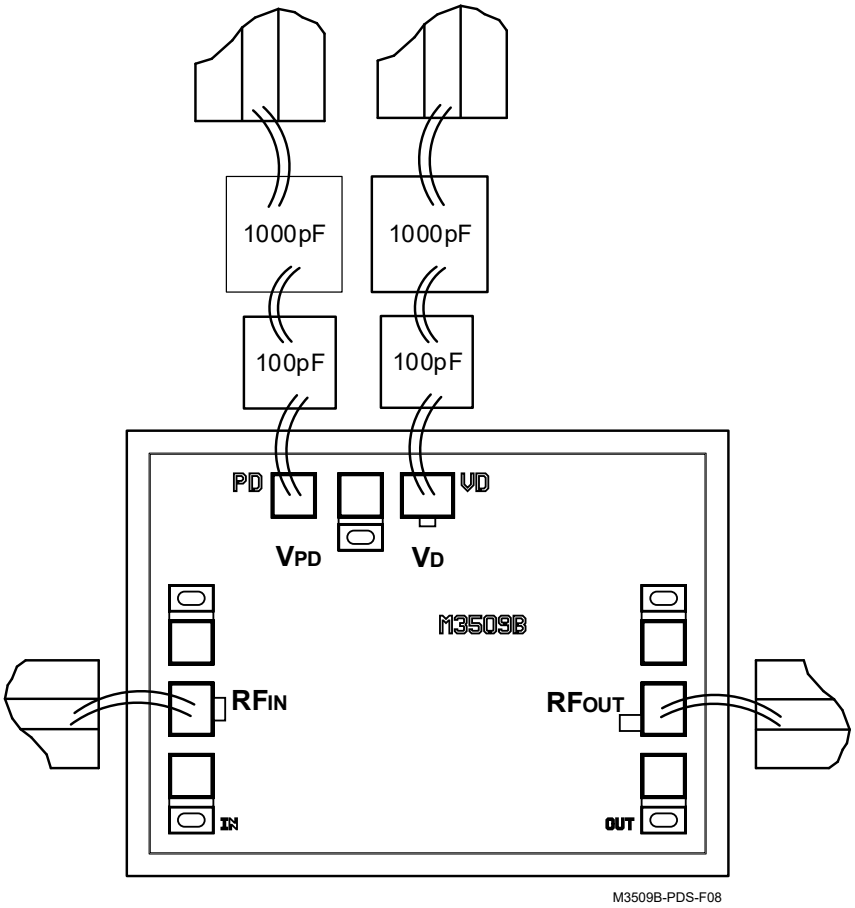


Figure 8. M3509B Assembly Diagram

- **Eutectic Die Attach:** It is best to use an 80% Au/20% Sn preform. Do not expose the chip to a temperature greater than 300°C for more than 30sec.
- **Wire Bonding:** RF bonds made with 1mil gold wire are recommended for the RF ports. Keep all bonds as short as possible, less than 0.35mm.

11. Handling Precautions

■ Storage

All bare dies ship in either Waffle or Gel Pak, which is an ESD protective container, and then sealed in an ESD protective bag. After opening the sealed ESD protective bag, all dies must be stored in a dry nitrogen environment.

■ Cleanliness

Handle the dies in a clean environment. Never use liquid cleaning systems to clean the dies.

- **ESD Caution**

  ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore proper ESD precautions should be taken to avoid performance degradation or loss of functionality.



12. Contact Information

For the latest specifications, additional product information, technical support and sales support, please contact:

- **Email:** RF.support@raytrontek.com
- **Web:** www.raytrontek.com

13. Disclaimer

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