MMA142AA GaAs pHEMT MMIC Low Noise Amplifier Datasheet

Product Overview

MMA142AA is a self-biased (requiring only a single positive supply, using on-chip choke), gallium arsenide (GaAs) monolithic microwave integrated circuit (MMIC) pseudomorphic high-electron mobility transistor (pHEMT) distributed amplifier die that operates between 1 GHz and 34 GHz. It is ideal for test instrumentation, defense, and space applications. The amplifier provides a 1 dB positive gain slope with a typical gain of 15 dB, 3 dB noise figure, 16 dBm of output power at 1 dB gain compression, and 28 dBm output IP3 at 18 GHz. The MMA142AA amplifier features RF I/Os that are internally matched to 50 Ω, which allows for easy integration into multi-chip modules (MCMs).

The following illustration shows the functional block diagram for the MMA142AA device.

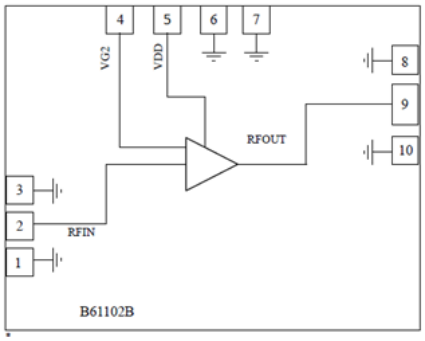


Figure 1 • MMA142AA Block Diagram

Applications

The MMA0142AA device is designed for the following applications:

- Test and measurement instrumentation
- Electronic warfare (EW), electronic countermeasures (ECM), and electronic counter-countermeasures (ECCM)
- Military and space
- Telecom infrastructure
- Wideband microwave radios
- Microwave and millimeter-wave communication systems

Key Features

The following are key features of the MMA0142AA device:

- Frequency range: 1 GHz to 34 GHz
- Gain: 14 dB with +0.5dB slope
- High Output IP3: 28 dBm at 18 GHz
- Low noise figure : 3 dB at 20 Ghz
- Self biased positive supply: 6 V, 70 mA
- 50 Ω matched I/O
- Compact die size: 3 mm × 1.35 mm × 0.1 mm

Electrical Specifications

This section details the electrical specifications for the MMA142AA device.

Absolute Maximum Ratings

The following table shows the absolute maximum ratings of the MMA142AA device at 25 °C unless otherwise specified. Exceeding one or any of the maximum ratings potentially could cause damage or latent defects to the device.

Table 1 • Absolute Maximum Ratings

Parameter	Condition
Drain bias (V_{DD})	+8 V
RF input power (Pin)	+26 dBm
Channel temperature	150 °C
DC power dissipation (85 °C)	2 W
Thermal resistance	32 °C/W
Storage temperature	–65 °C to +150 °C
Operating temperature	–55 °C to +85 °C

Typical Electrical Performance

The following table lists the typical electrical performance of the MMA142AA device.

Table 2 • Typical Electrical Performance

Parameter	Frequency Range	Min	Typ	Max	Units
Operational frequency range		1		34	GHz
Gain	1.5 GHz–10 GHz	12.5	14		dB
	10 GHz–20 GHz	12.5	14		dB
	20 GHz–30 GHz	13.5	15		dB
Gain flatness *0.1 dB/GHz upslope subtracted	1 GHz–4 GHz		±0.5		dB
	14 GHz–32 GHz		±1		dB
Noise figure	1.5 GHz–10 GHz		4	7	dB
	10 GHz–20 GHz		3	3.5	dB

Parameter	Frequency Range	Min	Typ	Max	Units
	20 GHz–30 GHz		3.5	5	dB
Input return loss	1.5 GHz–10 GHz		–20	–16	dB
	10 GHz–20 GHz		–20	–17	dB
	20 GHz–30 GHz		–20	–17	dB
Output return loss	1.5 GHz–10 GHz		–13	–10	dB
	10 GHz–20 GHz		–13	–10	dB
	20 GHz–30 GHz		–12	–8	dB
P1dB	1.5 GHz–10 GHz	16	17		dBm
	10 GHz–20 GHz	15	16		dBm
	20 GHz–30 GHz	13	14.5		dBm
OIP3	1.5 GHz–10 GHz		29		dBm
	10 GHz–20 GHz		28		dBm
	20 GHz–30 GHz		26		dBm
V_{DD} (drain voltage supply)			6		V
I_{DD} (drain current)			70		mA

Typical Performance Curves

The following graphs show the typical performance curves of the MMA142AA device at 25 °C, unless otherwise indicated.

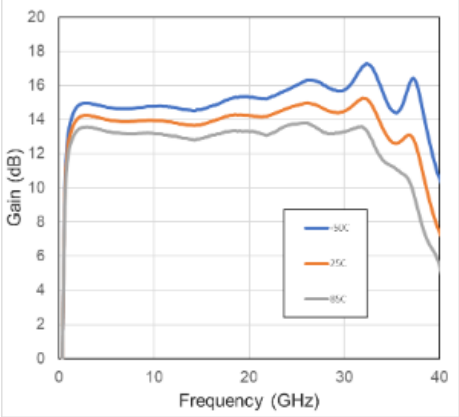


Figure 2 • Gain vs. Temperature

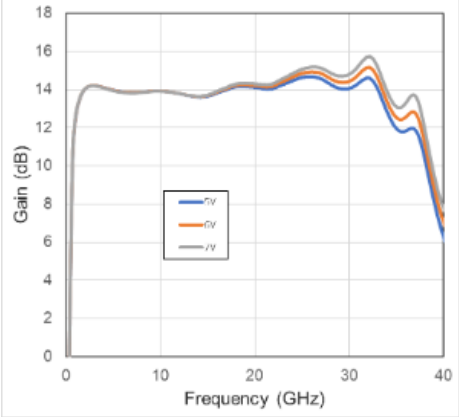


Figure 3 • Gain vs. Drain Voltage

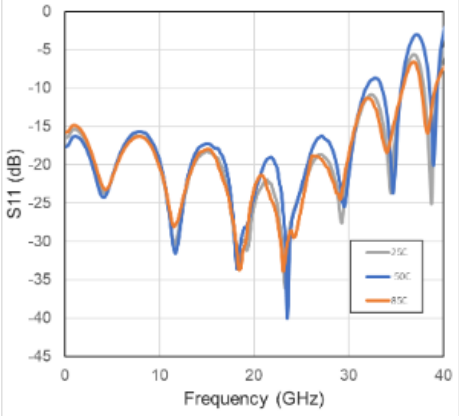


Figure 4 • S11 vs. Temperature

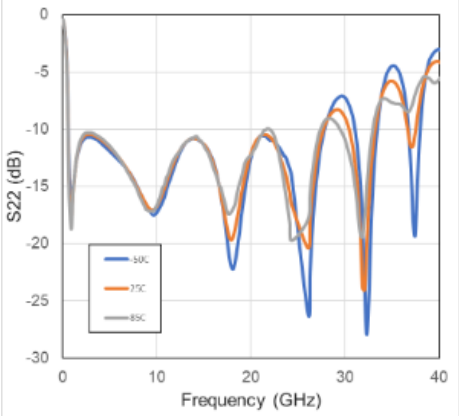


Figure 5 • S22 vs. Temperature

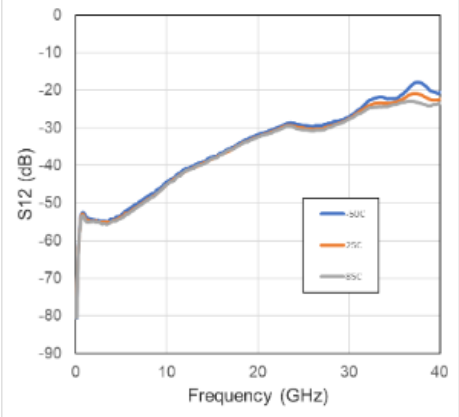


Figure 6 • S12 vs. Temperature

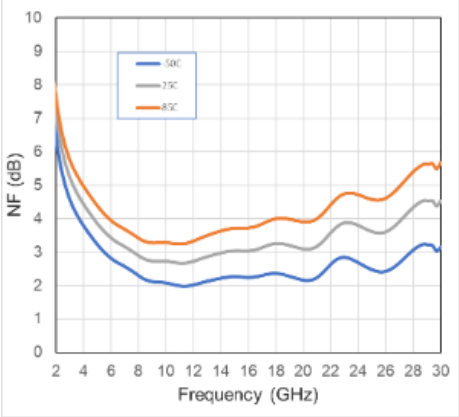


Figure 7 • Noise Figure vs. Temp

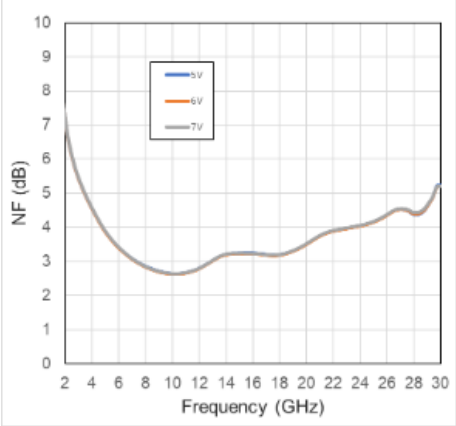


Figure 8 • Noise Figure vs. Drain Voltage

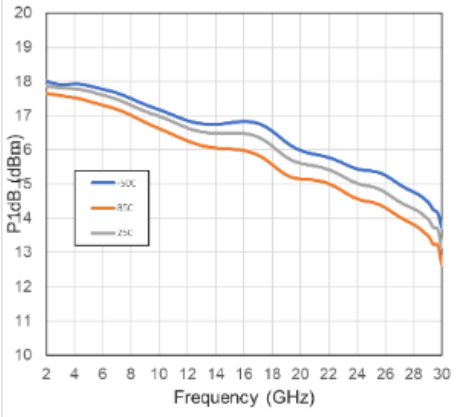


Figure 9 • P1dB vs. Temperature

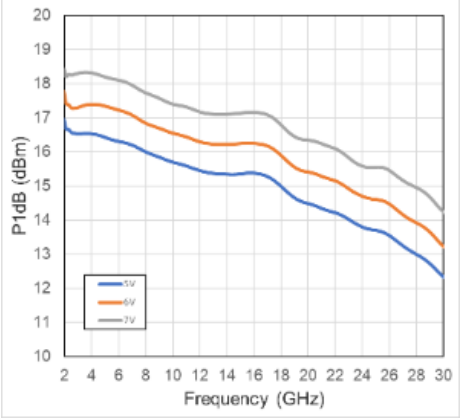


Figure 10 • P1dB vs. Drain Voltage

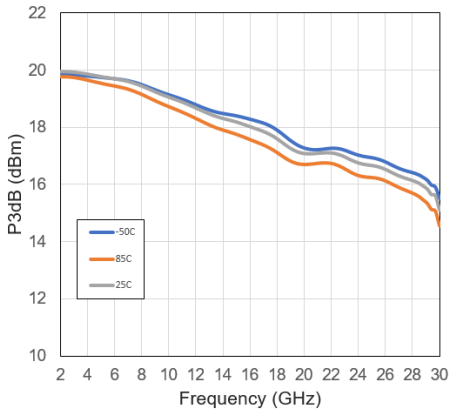


Figure 11 • P3dB vs. Temperature

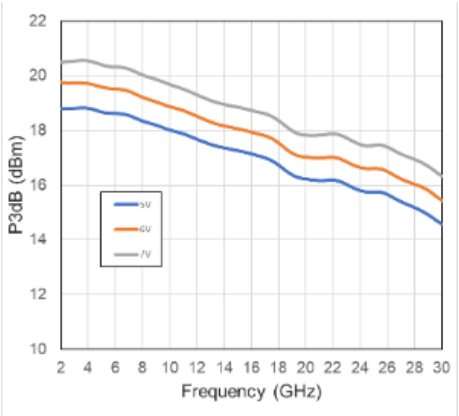


Figure 12 • P3dB vs. Drain Voltage

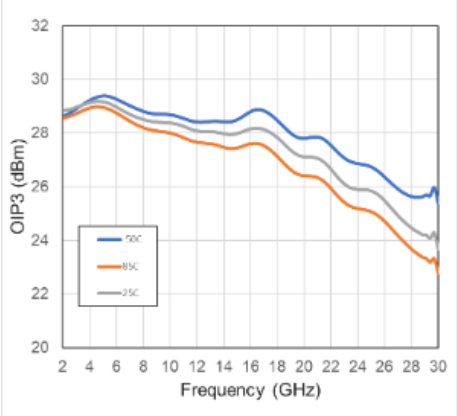


Figure 13 • OIP3 vs. Temperature

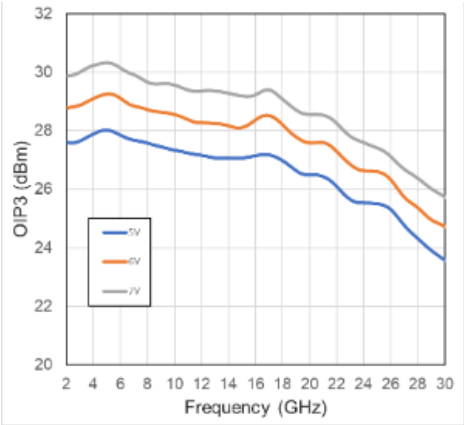


Figure 14 • OIP3 vs. Drain Voltage

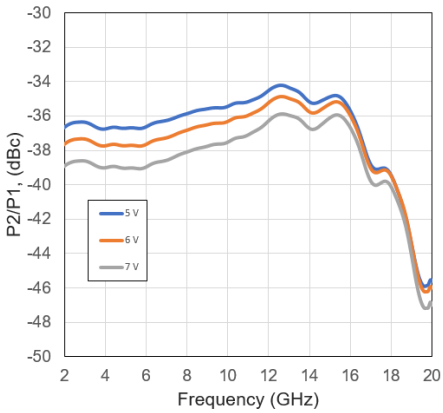


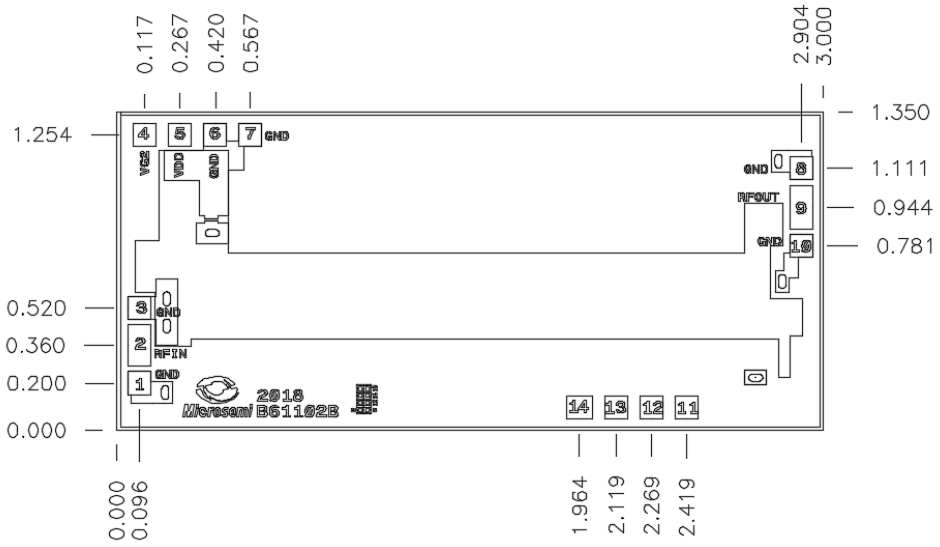
Figure 15 • Second Harmonic vs. Drain Voltage

Chip Outline Drawing, Die Packaging, Bond Pad, and Assembly Information

The following table lists the die package information for the MMA142AA device. For additional packaging information, contact your Microsemi sales representative.

Chip Outline Drawing

The following illustration shows the chip outline drawing for the MMA142AA device.



Die Package Information

The following table lists the die package information for the MMA142AA device. For additional packaging information, contact your Microsemi sales representative.

Table 3 • Die Package Information

Standard Format
Gel pack
50 pieces per pack

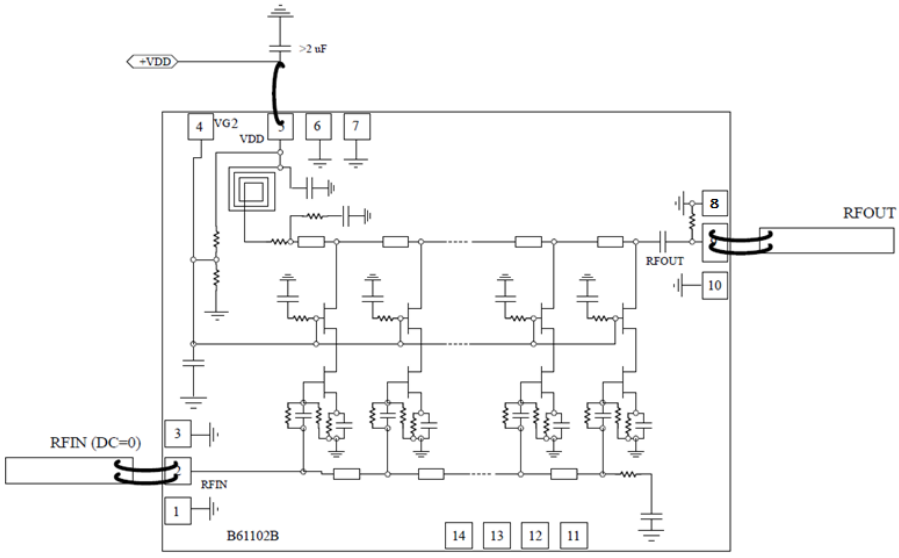
Bond Pad Information

The following table shows the bond pad information for the MMA142AA device.

Table 4 • Bond Pad Information

Pad Number	Pad Name	Pad Description
2	RF_{IN}	Matched 50 Ω, ground input
4	V_{G2}	Second gate (normally not used)
5	V_{DD}	V_{DD} supply
9	RF_{OUT}	Matched 50 Ω, DC decoupled
11, 12, 13, 14	NC	No connection
1, 3, 6, 7, 8, 10	Ground	

The following illustration shows the functional schematic for the MMA142AA device.



Assembly Diagram

The following illustration shows the assembly diagram for the MMA142AA device.

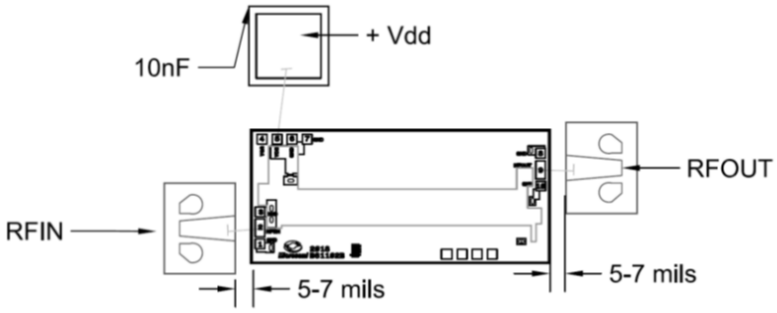


Figure 16 • Assembly Diagram

Handling Recommendations

Gallium arsenide integrated circuits are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. It is recommended to follow all procedures and guidelines outlined in the Microsemi application note AN01 GaAs MMIC Handling and Die Attach Recommendations .

Ordering Information

The following table lists the ordering information for the MMA142AA device.

Table 5 • Ordering Information

Part Number	Package
MMA142AA	Die

Microsemi
2355 W. Chandler Blvd.
Chandler, AZ 85224 USA

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