Nxbeam™ Preliminary

NPA2004-DE

25 – 27.5 GHz GaN 40 W Power Amplifier

Product Description

The Nxbeam NPA2004-DE is a Ka-band high power amplifier MMIC fabricated in 0.2um GaN HEMT on SiC. The MMIC operates from 25 to 27.5 GHz and provides 40 W saturated output power, 34% PAE, and 24 dB of linear gain. The NPA2004-DE comes in die form with RF input and output matched to 50 Ω with DC blocking capacitors for easy system integration. The HEMT devices are fully passivated for reliable operation. Bond pad and backside metallization are Au-based for compatibility with eutectic die attachment methods.

Applications

- Ka-band Satellite Communications
- 5G mmWave (n257)
- Point-to-Point/Multipoint Digital Radios

Key Features

- Frequency: 25 – 27.5 GHz
- Linear Gain: 24 dB
- Psat: 40 W
- PAE: 34%
- Chip Dimensions: 5.0 x 4.0 x 0.1 mm

Electrical Specifications

Test Condition: Vd = 26 V , Idq = 2.1 A

Parameter	Min	Typical	Max	Unit
Frequency	25		27.5	GHz
Gain (Small Signal)		24		dB
Output Power (at Psat, Pin=26 dBm, at 27.5 GHz)		46		dBm
PAE (at Psat, Pin=26 dBm, at 27.5 GHz)		34		%
Power Gain (at Psat, Pin=26 dBm, at 27.5 GHz)		20		dB
Input Return Loss			-8	dB
Output Return Loss			-4	dB

Maximum Quiescent Bias

Parameter	Max	Unit
Drain Voltage (Vd1, Vd2, Vd3)	28	V
Drain Current (Id1)	240	mA
Drain Current (Id2)	592	mA
Drain Current (Id3)	2368	mA

Maximum quiescent bias represents the operational bias used during reliability life testing. Biasing the part at or below this bias ensures reliability will be bound by the published reliability results.

Absolute Maximum Ratings (Temp. = 25°C)

Parameter	Min	Max	Unit
Drain Voltage (Vd1, Vd2, Vd3)		28	V
Drain Current (Id1)		600	mA
Drain Current (Id2)		1480	mA
Drain Current (Id3)		5920	mA
Gate Voltage (Vg1, Vg2, Vg3)	-8	0	V

Absolute maximum ratings represent the maximum current under power saturation conditions.

Recommended Quiescent Operating Condition

Parameter	Value	Unit
Drain Voltage (Vd)	20 - 28	V
Drain Current (Id1)	up to 240	mA
Drain Current (Id2)	up to 592	mA
Drain Current (Id3)	up to 2368	mA
Gate Voltage (Vg) (Typical Range)	-4	V

Gate voltage will vary based on desired current per stage

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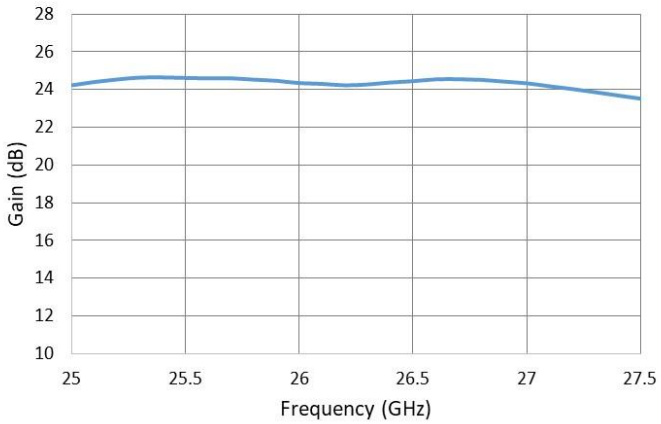
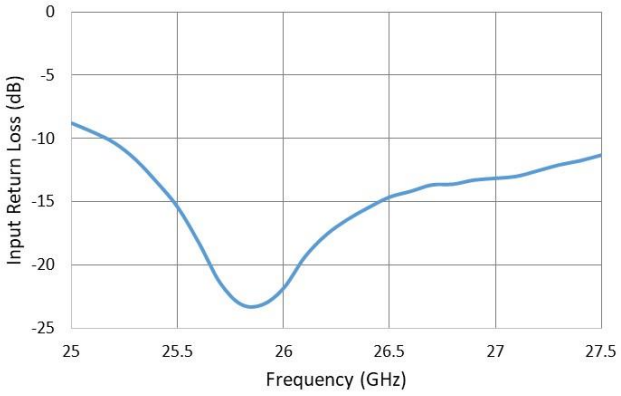
Small Signal Performance

Test Condition: Vd = 26 V, Idq = 2.1 A, (CW Performance in Fixture, Typical Performance at 25°C)

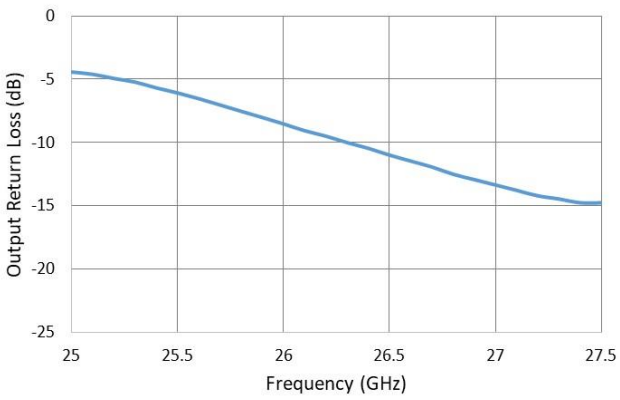
Gain vs. Frequency



Input Return Loss vs. Frequency



Output Return Loss vs. Frequency



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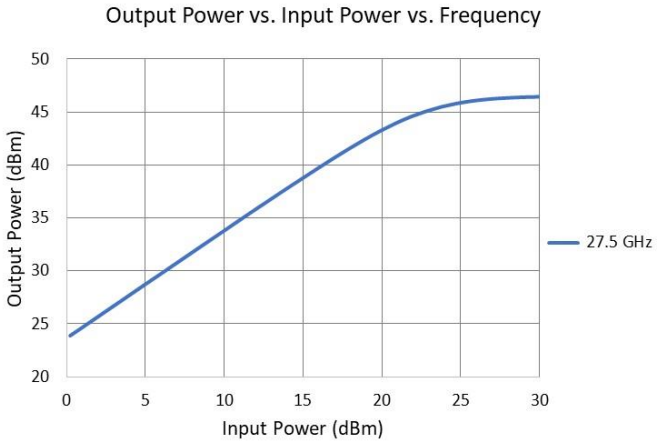
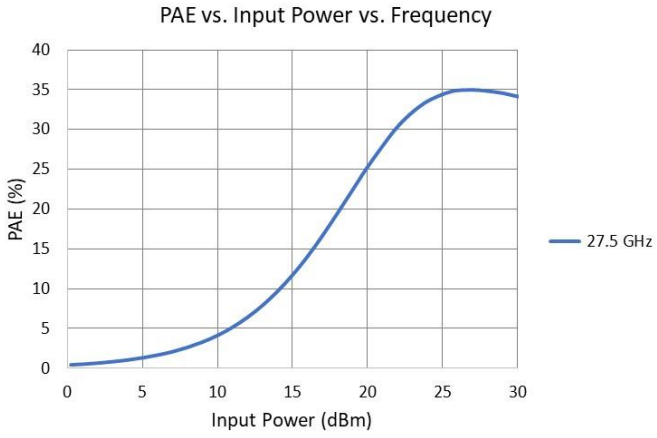
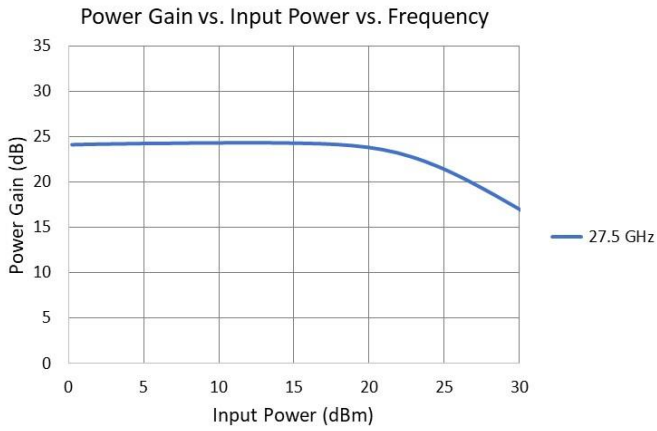
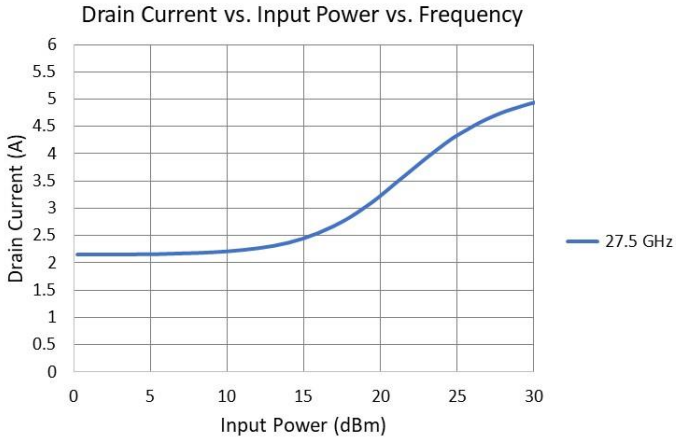
Large Signal Performance

Test Condition: Vd = 26 V, Idq = 2.1 A,
(CW Performance in Fixture, Typical Performance at 25°C)



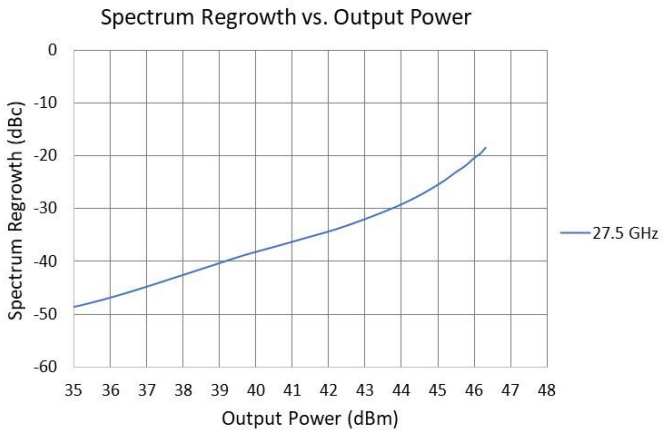






Spectral Regrowth Performance

(QPSK, 10 MSPS, Alpha=0.2), Typical Performance at 25°C,



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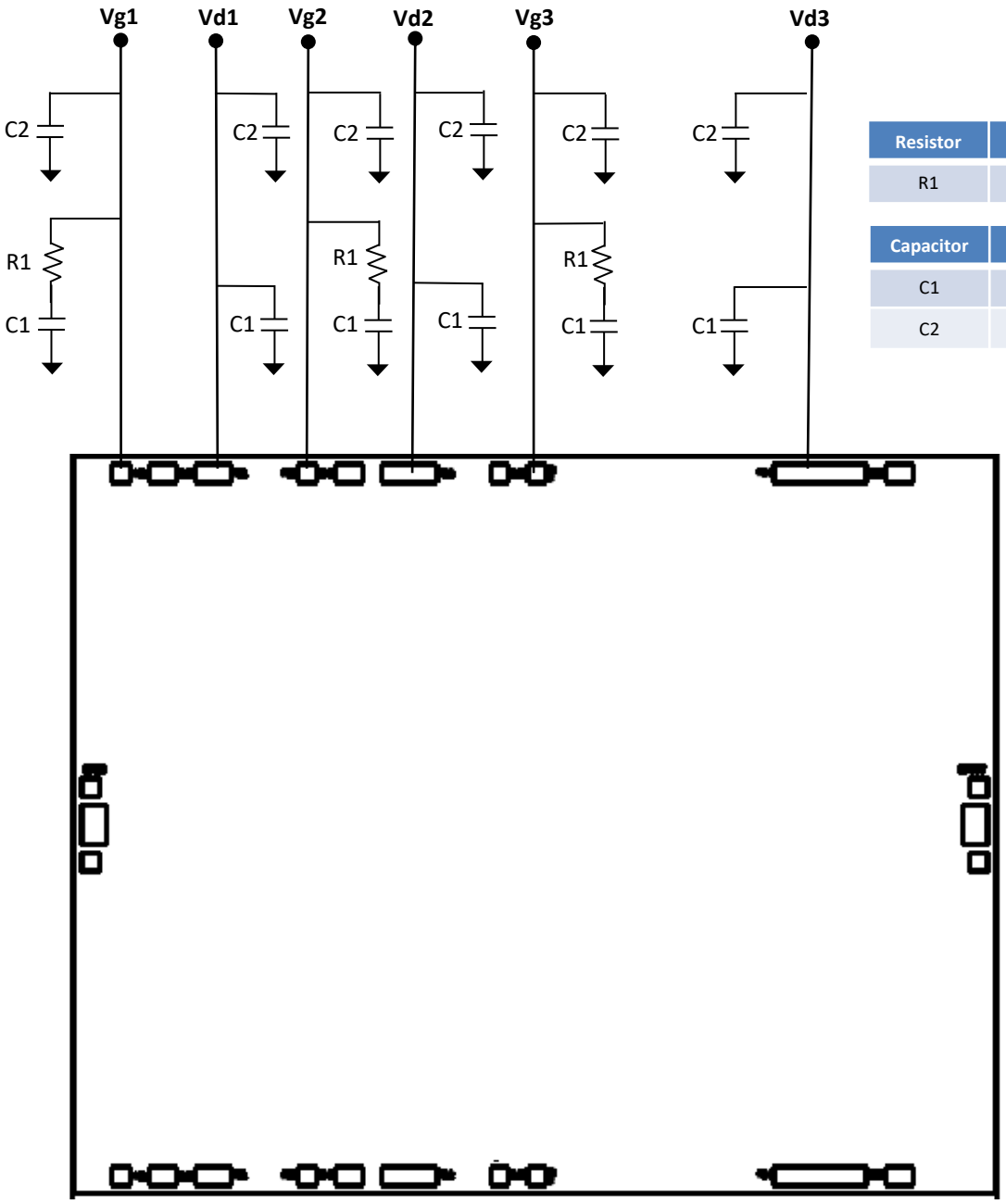
Suggested Off-Chip Components

The following diagram shows the recommended off-chip components. Bias must be applied from both sides of the chip for all drain connections and Vg3. The connection for Vg1 and Vg2 can be applied from either top or bottom. The off-chip components should be duplicated on the bottom side of the chip for connection required on both sides. All drain connections can be tied together to one source. All gate connections can be tied together to one source if desired.



Resistor	Value
R1	10 Ω

Capacitor	Value
C1	0.01 µF
C2	1 µF

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Assembly Process

- This product has gold backside metallization and can be mounted using either a high thermal conductive epoxy or AuSn eutectic die attachment.
- Nxbeam recommends the use of AuSn eutectic die attachment due to the high-power level of this product
- Maximum recommended temperature during die attachment is 320 °C for not more than 60 seconds.
- This product contains metal air bridges so caution should be taken when handling the die to avoid damage.

Bias Information

Bias-up Procedure:

1.) It is recommended that voltage and current limits are set on the voltage supply's prior to biasing the product.
2.) Ensure power supplies are properly grounded to the product test fixture.
3.) Apply a negative gate voltage of -7V to Vg1, Vg2, and Vg3 to ensure all devices are pinched off.
4.) Gradually increase the drain bias voltage (Vd1, Vd2, Vd3) to the desired bias level but not to exceed the maximum voltage of 28 V.
5.) Gradually increase the gate voltages (Vg1, Vg2, Vg3) while monitoring the drain current until the desired drain current in each stage is achieved.
6.) Apply RF signal.

Bias-down Procedure:

1.) Turn off RF signal.
2.) Gradually decrease Vg1, Vg2, and Vg3 down to -7 V.
3.) Gradually decrease the drain voltages (Vd1, Vd2, Vd3) down to 0 V.
4.) Gradually increase gate voltages (Vg1, Vg2, Vg3) to 0 V.
5.) Turn off supply voltages

ESD Sensitive Product

Export Information

This product is controlled by US law for export under the ECCN 3A001.b.2.c. The purchaser of this product, whether in the US or abroad, is responsible for compliance with all US laws regarding export, transfer, or re-transfer of this product. For more information, please refer to the Export Administration Regulations at https://www.bis.doc.gov/index.php. Nxbeam reminds you that it is your responsibility to ascertain your export compliance obligations and to comply with all applicable laws and regulations.

Important Information

Nxbeam Inc. reserves the right to update and change without notice the characteristic data and other specifications as they apply to this document. Customers should obtain and verify the most recent product information before placing orders. Nxbeam Inc. assumes no responsibility or liability whatsoever for the use of the information contained herein.

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