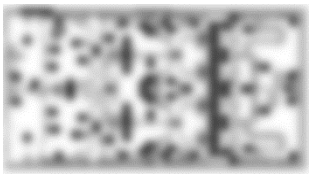
NPA1020-DE

12.5 – 14.5 GHz GaN 15 W Power Amplifier

Product Description

The Nxbeam NPA1020-DE is a Ku-band high power amplifier MMIC fabricated in 0.2um GaN HEMT on SiC. This part is ideally suited for Ku-band satellite communications applications. The MMIC operates from 12.5 to 14.5 GHz and provides 15 W saturated output power, 35% PAE, and 25 dB of linear gain.

The NPA1020-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.



Key Features

- Frequency: 12.5 – 14.5 GHz
- Linear Gain (Ave.): 25 dB
- Psat: 15 W
- PAE (Ave.): 35%
- Chip Dimensions: 4.775 x 2.575 x 0.1 mm

Electrical Specifications

Test Condition: Vd = 26 V, Idq = 0.33 A, CW Performance in Fixture, Typical Performance at 25°C

Parameter		Min	Typical	Max	Unit
Frequency		12.5		14.5	GHz
Gain (Small Signal)	12.5 GHz		25.8		dB
	13.5 GHz		27.0		
	14.5 GHz		26.7		
Output Power (at Psat, Pin=18 dBm)	13.5 GHz		42.1		dBm
	14.0 GHz		42.0		
PAE (at Psat, Pin=18 dBm)	13.5 GHz		35.2		%
	14.0 GHz		35.3		
Power Gain (at Psat, Pin=18 dBm)	13.5 GHz		18.1		dB
	14.5 GHz		18.1		
Input Return Loss	12.5 GHz		16		dB
	13.5 GHz		18		
	14.5 GHz		9		
Output Return Loss	12.5 GHz		11		dB
	13.5 GHz		19		
	14.5 GHz		13		

Absolute Maximum Ratings (Temp. = 25°C)

Parameter	Min	Max	Unit
Drain Voltage (Vd1, Vd2, Vd3)		28	V
Drain Current (Id1)		280	mA
Drain Current (Id2)		880	mA
Drain Current (Id3)		2160	mA
Gate Voltage (Vg1, Vg2, Vg3)	-8	0	V
Assembly Temperature (30 seconds)		320	°C

Recommended Operating Condition

Parameter	Value	Unit
Drain Voltage (Vd)	20 - 28	V
Drain Current (Idq)	up to 1.3	A
Gate Voltage (Vg) (Typical)	-3.8	V

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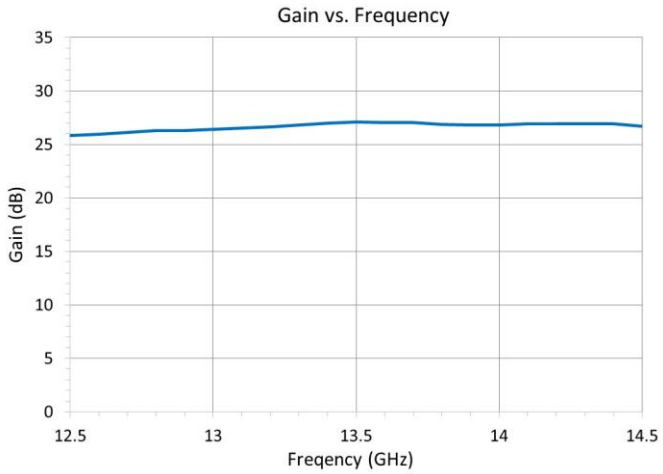
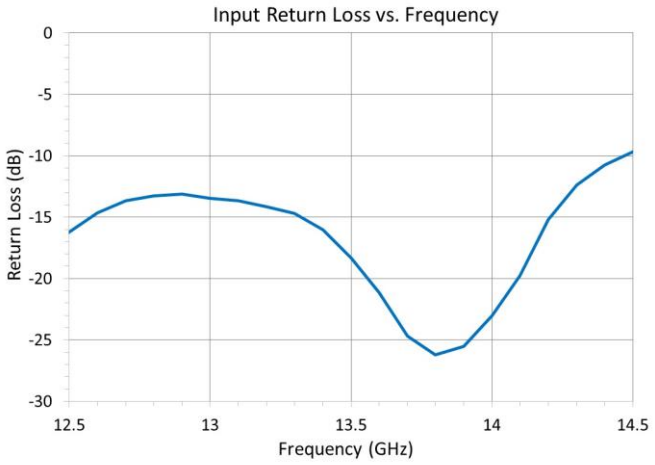
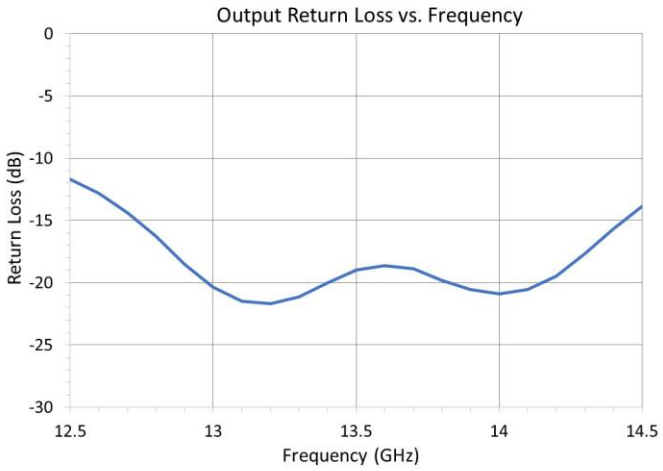
Small Signal Performance

Test Condition: Vd = 26 V, Idq = 0.33 A, (CW Performance in Fixture, Typical Performance at 25°C)







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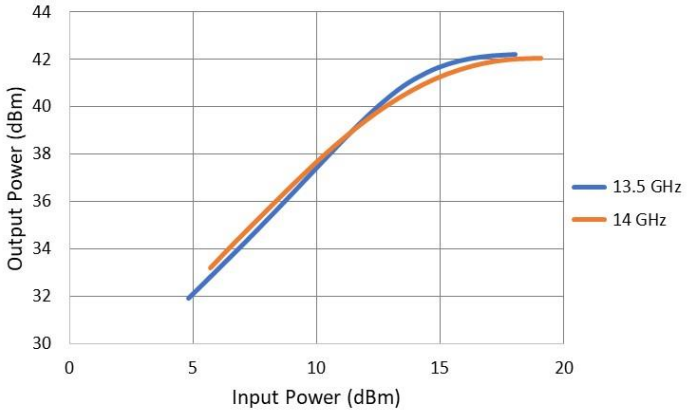
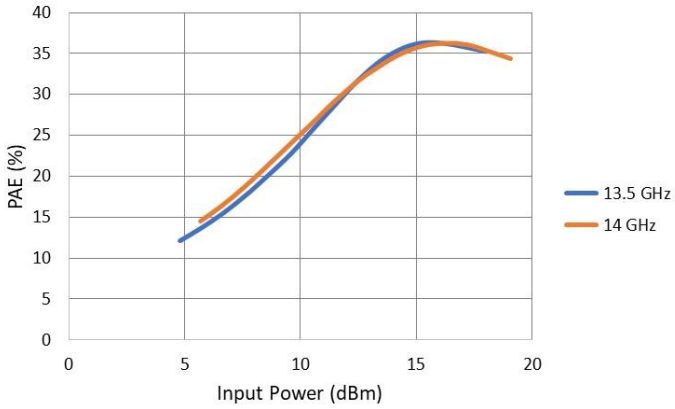
Large Signal Performance

Test Condition: Vd = 26 V, Idq = 0.33 A,
(CW Performance in Fixture, Typical Performance at 25°C)

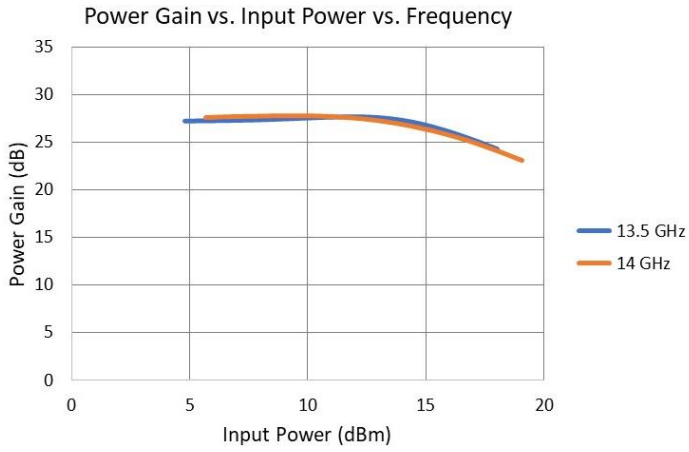
Output Power vs. Input Power vs. Frequency



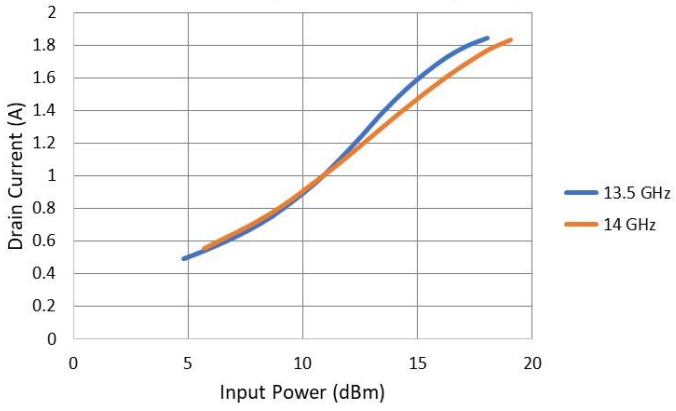
PAE vs. Input Power vs. Frequency



Power Gain vs. Input Power vs. Frequency



Drain Current vs. Input Power vs. Frequency



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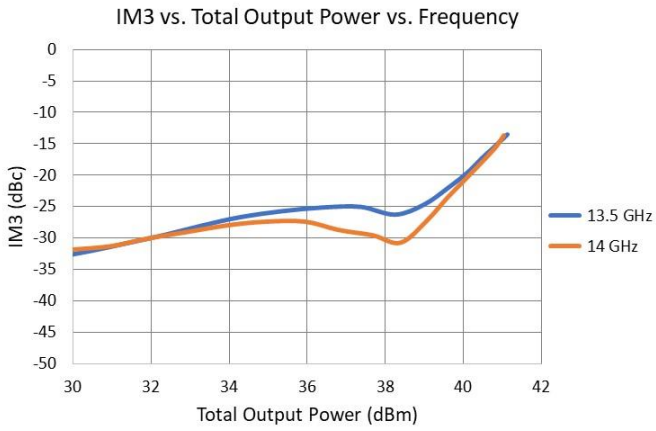
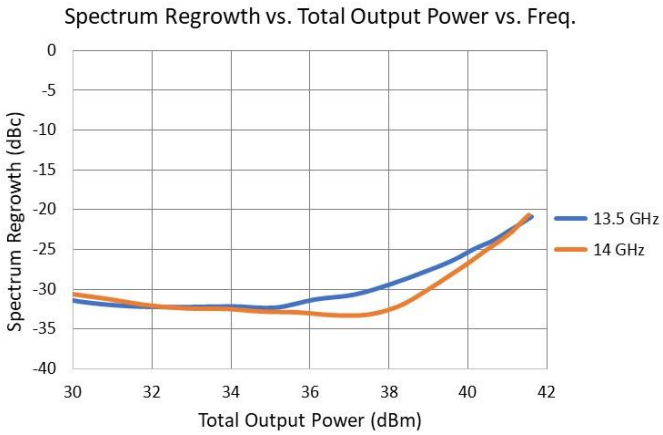
2-Tone Linearity Performance vs. Temperature

Test Condition: Vd = 26 V, Idq = 0.33 A at 25°C
10 MHz Tone Spacing



Spectral Regrowth Performance vs. Temperature

Test Condition: Vd = 26 V, Idq = 0.33 A at 25°C
QPSK, 10 MSPS, Alpha = 0.2



Thermal Information

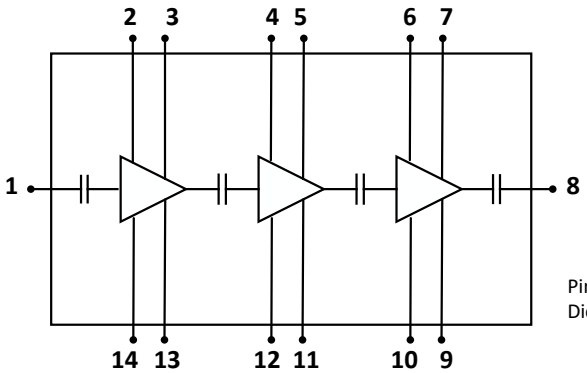
RF = Off

Parameter	Condition	Value	Unit
Thermal Resistance ($R_{\Theta JC}$)	RF=OFF	2.10	°C/W
Junction Temperature (Tj)	$T_{backside}$=80 °C, V_d=24 V, I_{dq}=0.33 A, P_{dis}=7.6 W	95	°C

RF = On, Peak Junction Temperature at Pin = 18 dBm, Psat

Parameter	Condition	Value	Unit
Thermal Resistance ($R_{\Theta JC}$)	P_{in}=18 dBm	2.92	°C/W
Junction Temperature (Tj)	$T_{backside}$=80 °C, V_d=24 V, I_d=1.86 A, P_{dis}=27.4 W	165	°C

Circuit Block Diagram



Pin number information detailed under Die Size and Bond Pad Information

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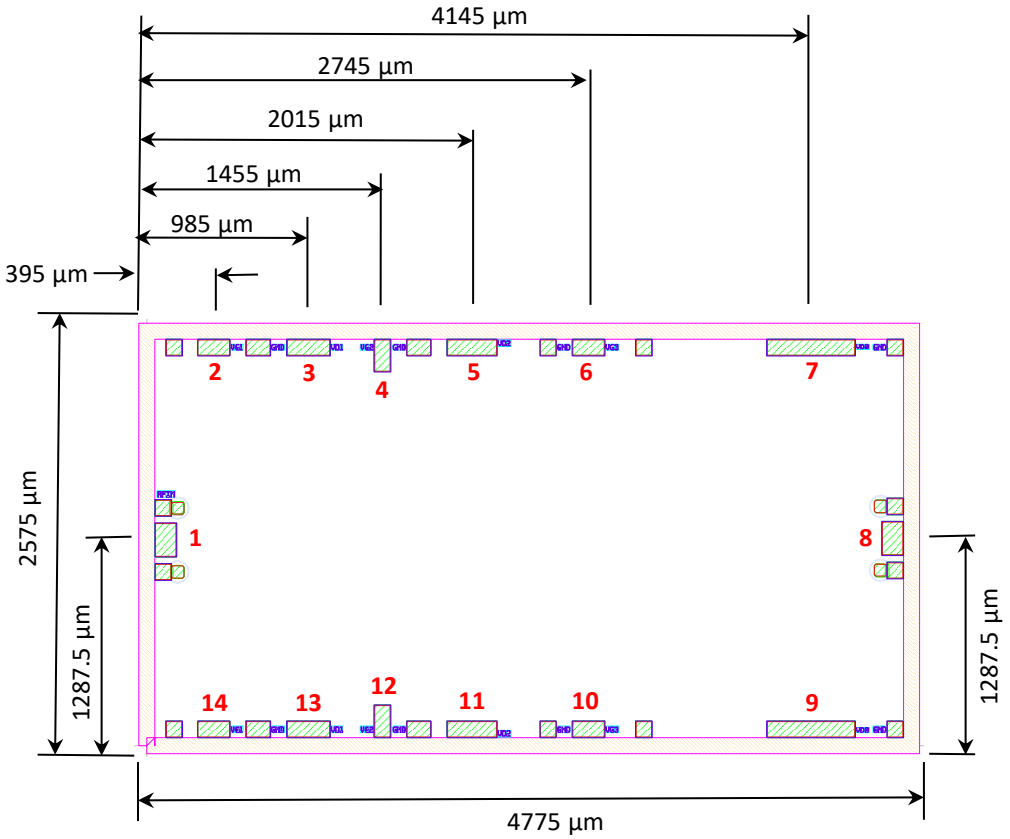
Die Size and Bond Pad Information

Chip Size = 4775 ±13 um x 2575 ±13 um
Chip Thickness = 100 um
Chip Backside metal is ground

RF Input/Output Pad Dimensions = 134 um x 208 um
DC Pad Dimensions:

- Vg1 = 200 um x 100 um
- Vg2 = 100 um x 200 um
- Vg3 = 200 um x 100 um
- Vd1 = 275 um x 100 um
- Vd2 = 310 um x 100 um
- Vd3 = 550 um x 100 um

Pad Num.	Function
1	RF in
2, 14	Vg1
3, 13	Vd1
4, 12	Vg2
5, 11	Vd2
6, 10	Vg3
7, 9	Vd3
8	RF out



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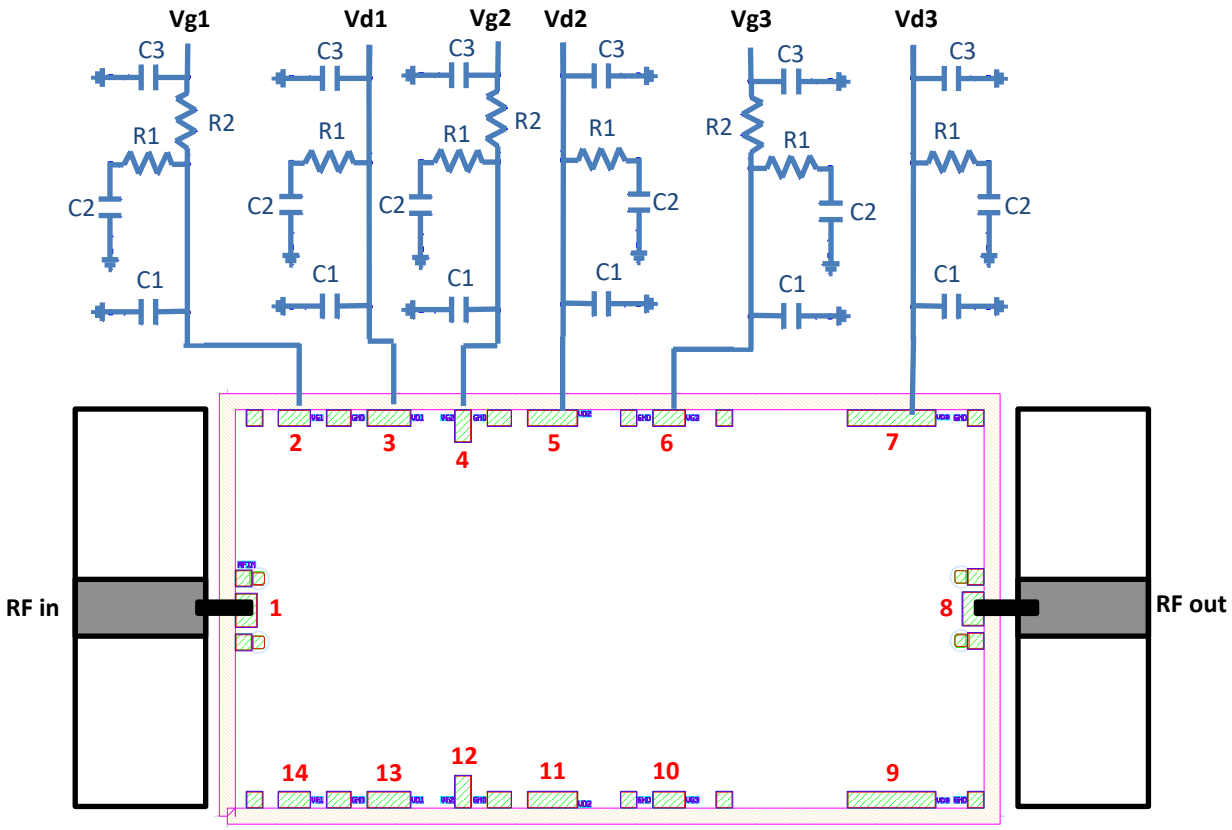
Suggested Off-Chip Components

The following diagram shows the recommended off-chip components to be used with the NPA1020-DE. It is recommended that the off-chip components be duplicated on both top and bottom sides of the chip, but it is not mandatory as the part can be biased from one side. The off-chip components should be located as close to the chip as possible. Please consult with Nxbeam on other off-chip network variations.



Off-Chip Component Values

Capacitor	Value
C1	100 pF
C2	0.01 µF
C3	1 µF

Resistor	Value
R1	10 Ω
R2	100 Ω

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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 30 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 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.b.2. 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.

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