

### Product Description

The Nxbeam NPA2040-DE is a Ka-band high power amplifier MMIC fabricated in 0.2um GaN HEMT on SiC. The MMIC operates from 27.5 to 31 GHz and provides an average of 10 W saturated output power, 31% PAE, and 24.5 dB of linear gain. The NPA2040-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 Infrastructure
- Point-to-Point/Multipoint Digital Radios

### Key Features

- Frequency: 27.5 – 31 GHz
- Linear Gain (Ave.): 24.5 dB
- Psat (Ave.): 10 W
- PAE (Ave.): 31%
- Chip Dimensions: 3.675 x 1.375 x 0.1 mm

### Electrical Specifications

Test Condition: Vd = 24 V, Idq = 0.720 A, CW Performance in Fixture, Typical Performance at 25°C

Parameter		Min	Typical	Max	Unit
Frequency		27.5		31	GHz
Gain (Small Signal)	27.5 GHz		24.0		dB
	29 GHz		24.1		
	31 GHz		24.3		
Output Power (at Psat, Pin=20.5 dBm)	27.5 GHz		39.7		dBm
	29 GHz		40.4		
	31 GHz		39.8		
PAE (at Psat, Pin=20.5 dBm)	27.5 GHz		29.0		%
	29 GHz		32.0		
	31 GHz		30.0		
Power Gain (at Psat, Pin=20.5 dBm)	27.5 GHz		19.5		dB
	29 GHz		18.6		
	31 GHz		19.6		
Input Return Loss	27.5 GHz		8		dB
	29 GHz		12		
	31 GHz		20		
Output Return Loss	27.5 GHz		10		dB
	29 GHz		9		
	31 GHz		14		

### Maximum Quiescent Bias

Parameter	Max	Unit
Drain Voltage (Vd1, Vd2, Vd3)	28	V
Drain Current (Id1)	140	mA
Drain Current (Id2)	160	mA
Drain Current (Id3)	550	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)		350	mA
Drain Current (Id2)		400	mA
Drain Current (Id3)		1400	mA
Gate Voltage (Vg1, Vg2, Vg3)	-8	0	V

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

### Recommended Quiescent Operating Condition

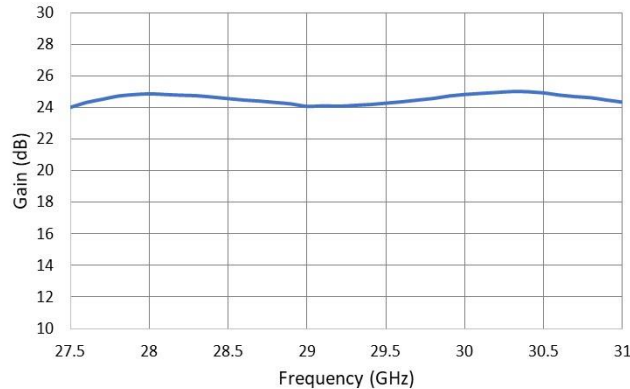
Parameter	Value	Unit
Drain Voltage (Vd)	20 - 28	V
Drain Current (Id1)	up to 140	mA
Drain Current (Id2)	up to 160	mA
Drain Current (Id3)	up to 550	mA
Gate Voltage (Vg) (Typical Range)	-5.5 to -3.5	V

Gate voltage will vary based on desired current per stage

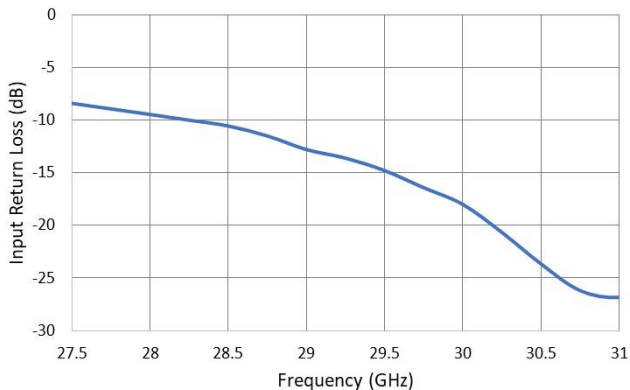
### Small Signal Performance

Test Condition: Vd = 24 V, Idq = 0.720 A, (CW Performance in Fixture, Typical Performance at 25°C)

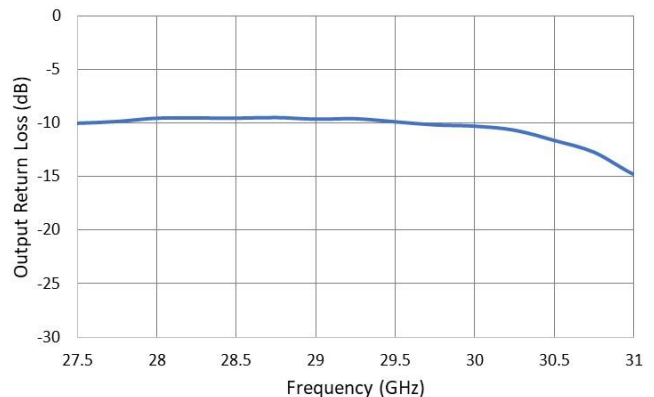
Gain vs. Frequency



Input Return Loss vs. Frequency



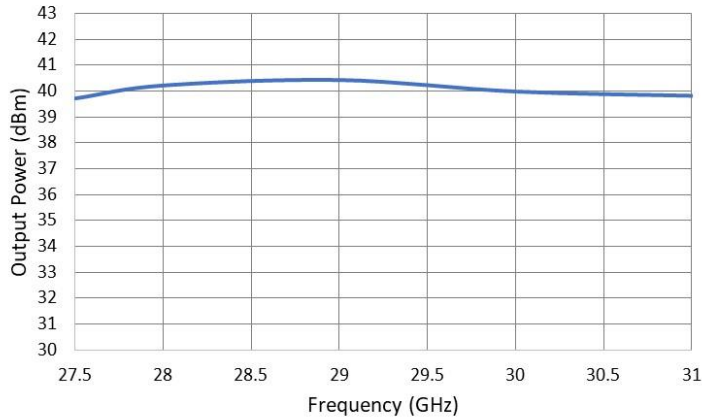
Output Return Loss vs. Frequency



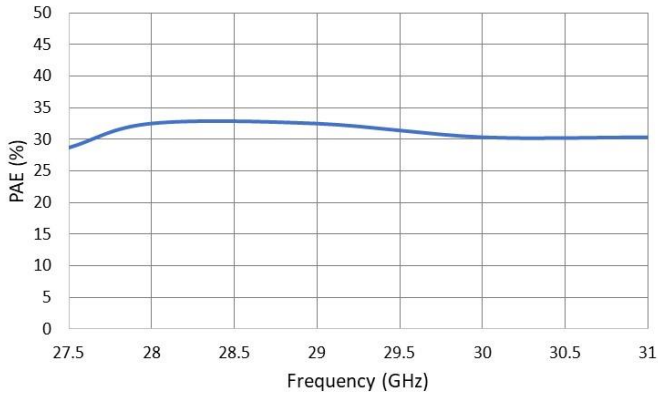
### Large Signal Performance

Test Condition:  $V_d = 26.5$  V,  $I_{dq} = 0.720$  A,  $P_{in} = 20.5$  dBm ( $P_{sat}$ )  
 (CW Performance in Fixture, Typical Performance at 25°C)

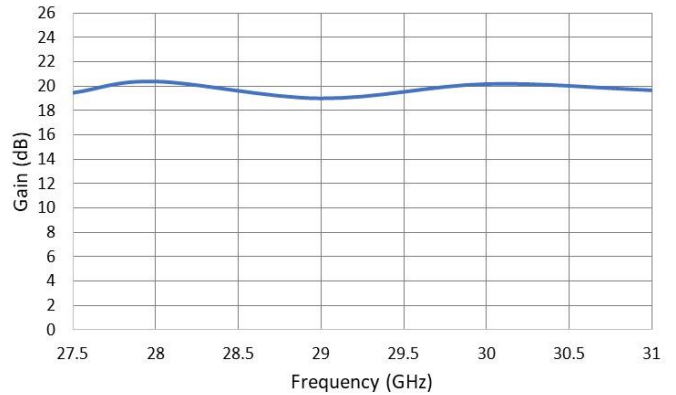
Output Power vs. Frequency (at 20.5 dBm Pin)



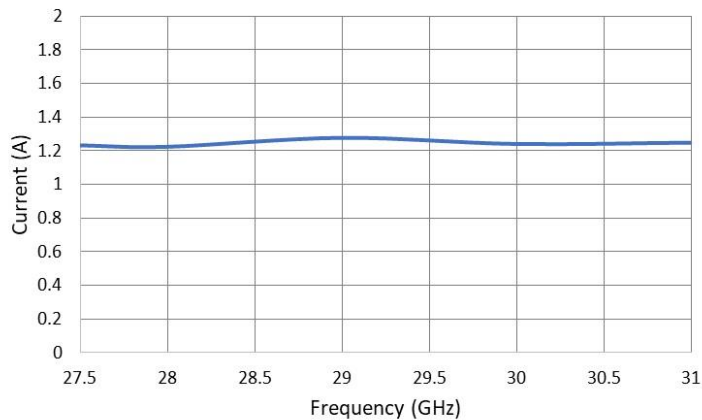
PAE vs. Frequency (at 20.5 dBm Pin)



Gain vs. Frequency (at 20.5 dBm Pin)



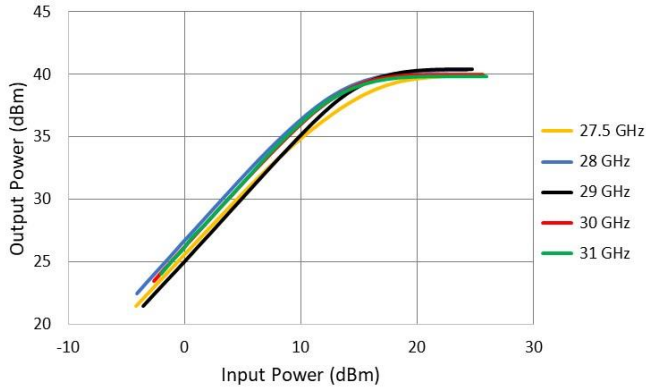
Drain Current vs. Frequency (at 20.5 dBm Pin)



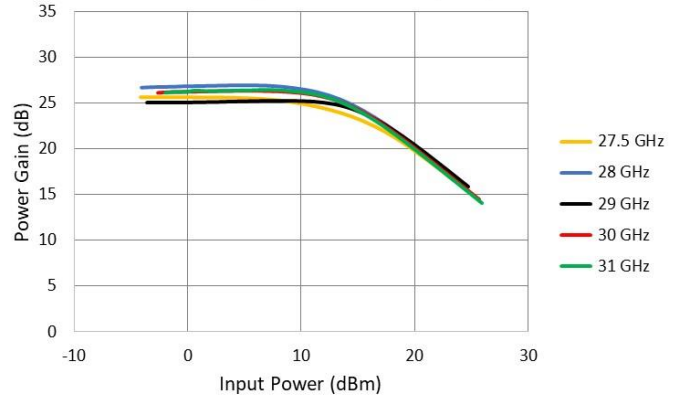
### Large Signal Performance

Test Condition:  $V_d = 26.5\text{ V}$ ,  $I_{dq} = 0.720\text{ A}$ ,  
(CW Performance in Fixture, Typical Performance at 25°C)

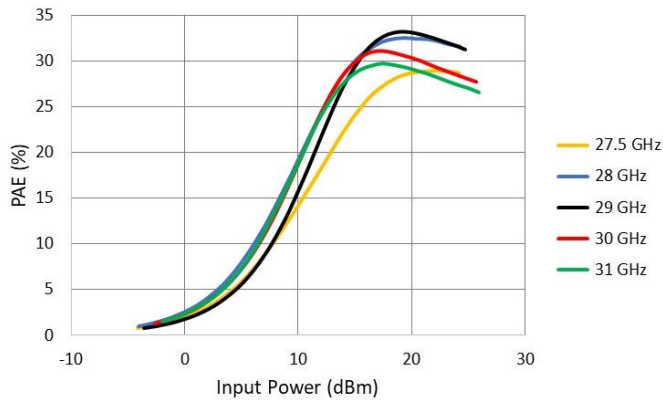
Output Power vs. Input Power vs. Frequency



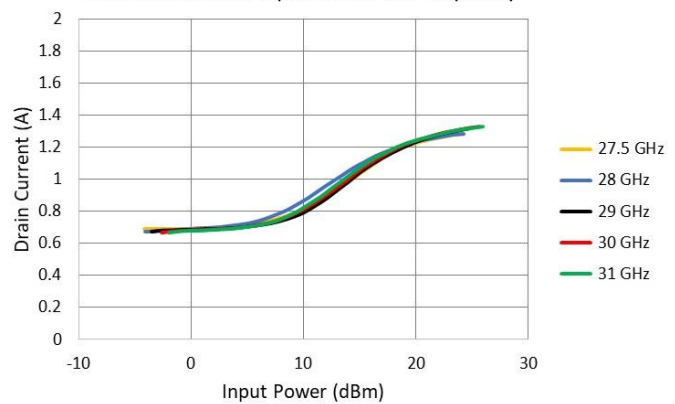
Power Gain vs. Input Power vs. Frequency



PAE vs. Input Power vs. Frequency



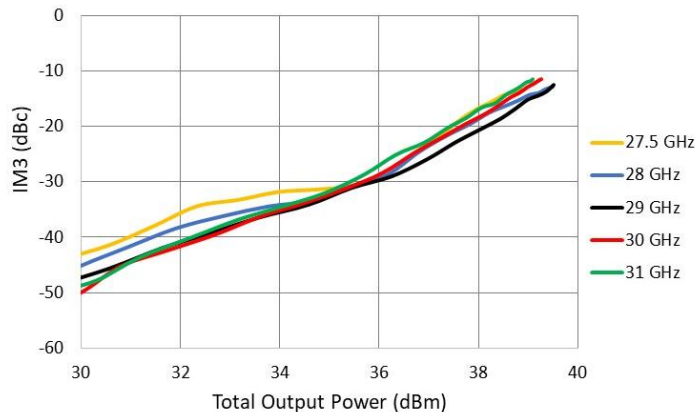
Drain Current vs. Input Power vs. Frequency



### 2-Tone Linearity Performance

10 MHz Tone Spacing, Test Condition:  $V_d = 26.5\text{ V}$ ,  $I_{dq} = 0.720\text{ A}$  ( $V_{g1}=V_{g2}=V_{g3}$ )  
CW Performance in Fixture, Typical Performance at 25°C,

IM3 vs. Total Output Power



### Die Size and Bond Pad Information

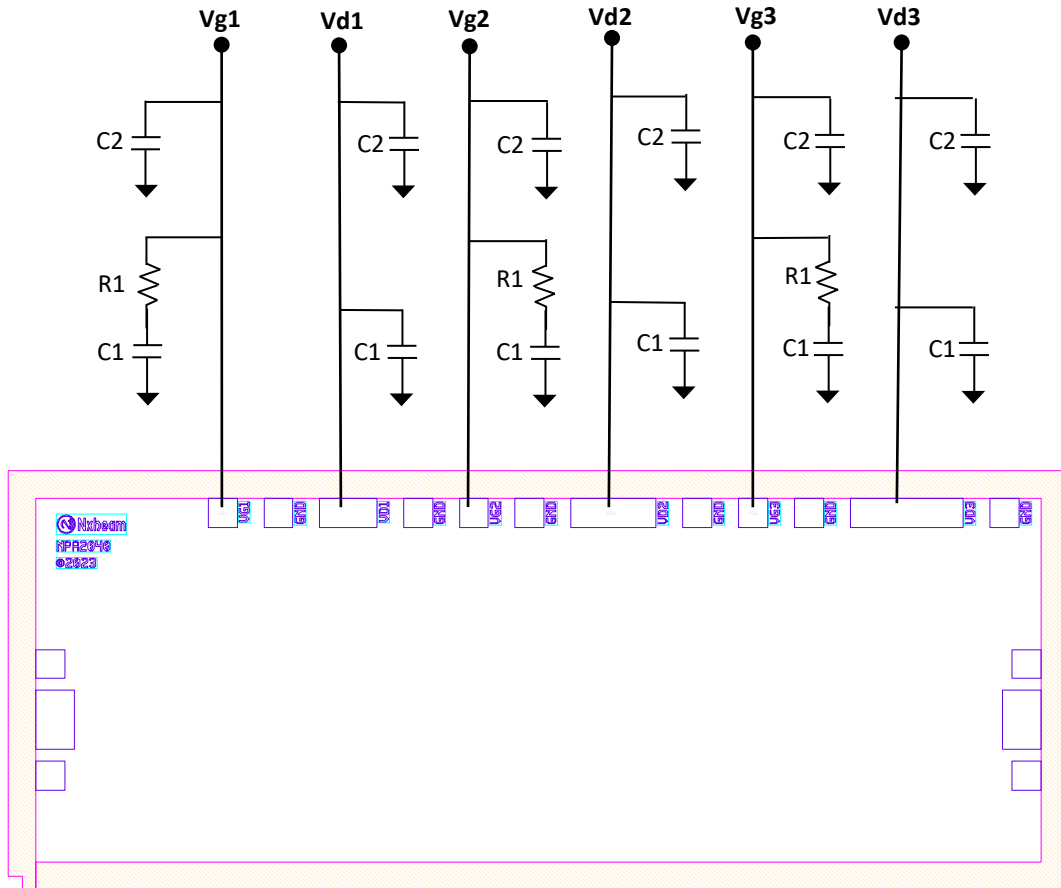
Chip Size = 3675 ±13 um x 1375 ±13 um  
 Chip Thickness = 100 um  
 Chip Backside metal is ground

Pad Num.	Function
1	RF in
2	Vg1
3	Vd1
4	Vg2
5	Vd2
6	Vg3
7	Vd3
8	RF out



### Suggested Off-Chip Components

The following diagram shows the recommended off-chip components. 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

### 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

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