# NPA2040-SM

## 27.5 – 31 GHz GaN 8 W Power Amplifier

## Product Description

The Nxbeam NPA2040-SM is a Ka-band high power amplifier fabricated in 0.2um GaN HEMT on SiC in a QFN package. The amplifier operates from 27.5 to 31 GHz and provides an average of 8 W saturated output power, 25% PAE, and 22 dB of linear gain. The QFN is designed for easy system integration with RF input and output ports matched to 50 ohms.

## Applications

- Ka-band Satellite Communications
- 5G Infrastructure
- Point-to-Point/Multipoint Digital Radios

## Key Features

- Frequency: 27.5 – 31 GHz
- Linear Gain (Ave.): 22 dB
- Psat (Ave.): 8 W
- PAE (Ave.): 25%

## Electrical Specifications

Test Condition: Vd = 27 V, Idq = 0.5 A, CW Performance, Typical Performance at 25°C

| Parameter | | Min | Typical | Max | Unit |
|---|---|---|---|---|---|
| Frequency | | 27.5 | | 31 | GHz |
| Gain (Small Signal) | 27.5 GHz | | 20.8 | | dB |
| | 29 GHz | | 22.5 | | |
| | 31 GHz | | 23.0 | | |
| Output Power (at Psat, Pin=23.3 dBm) | 27.5 GHz | | 38.2 | | dBm |
| | 29 GHz | | 39.6 | | |
| | 31 GHz | | 38.3 | | |
| PAE (at Psat, Pin=23.3 dBm) | 27.5 GHz | | 22.0 | | % |
| | 29 GHz | | 28.0 | | |
| | 31 GHz | | 27.0 | | |
| Power Gain (at Psat, Pin=23.3 dBm) | 27.5 GHz | | 15.2 | | dB |
| | 29 GHz | | 15.6 | | |
| | 31 GHz | | 16.8 | | |
| Input Return Loss | 27.5 GHz | | 6 | | dB |
| | 29 GHz | | 25 | | |
| | 31 GHz | | 14 | | |
| Output Return Loss | 27.5 GHz | | 8 | | dB |
| | 29 GHz | | 12 | | |
| | 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.

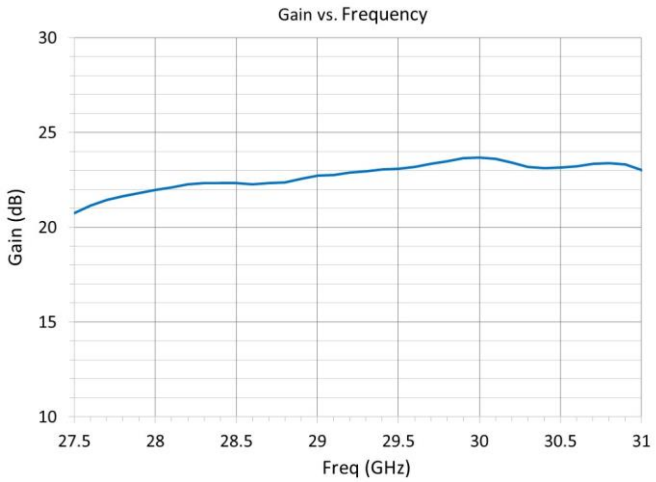
## Recommended Quiescent Operating Condition

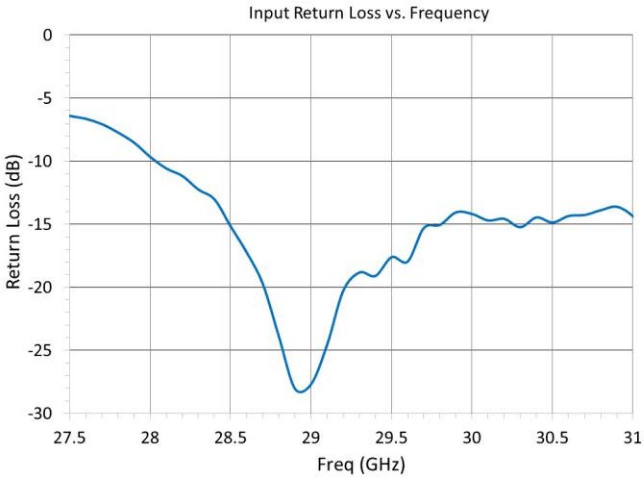
| Parameter | Value | Unit |
|---|---|---|
| Drain Voltage (Vd) | 20 - 27 | V |
| Drain Current (Id1) | up to 140 | mA |
| Drain Current (Id2) | up to 160 | mA |
| Drain Current (Id3) | up to 550 | mA |
| Gate Voltage (Vg) (Typical Range) | -5.5 to -3.5 | V |

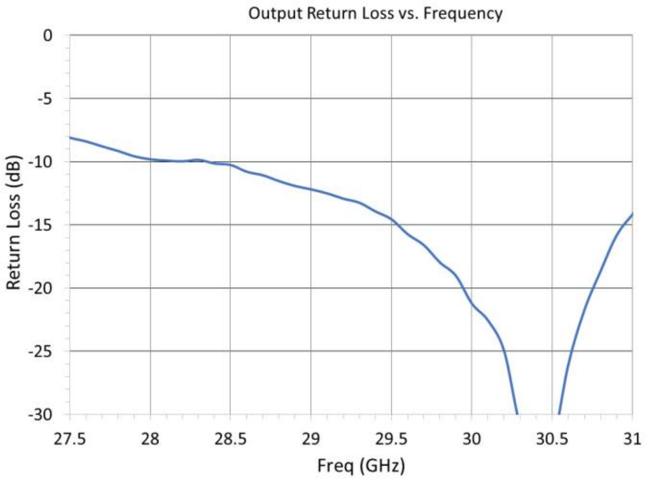
Gate voltage will vary based on desired current per stage

## Small Signal Performance

Test Condition: Vd = 27 V, Idq = 0.5 A, (CW Performance, Typical Performance at 25°C)

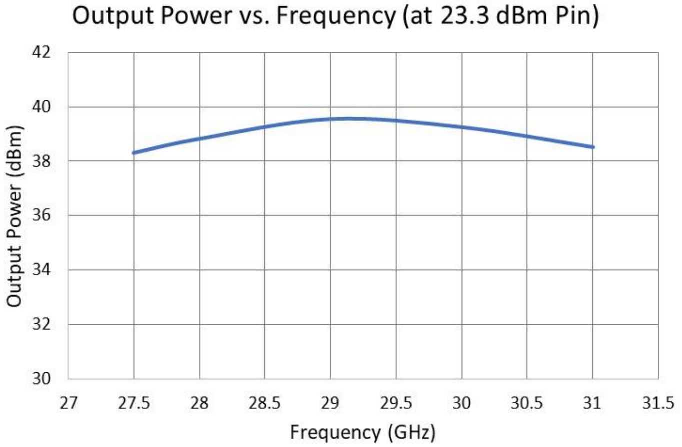


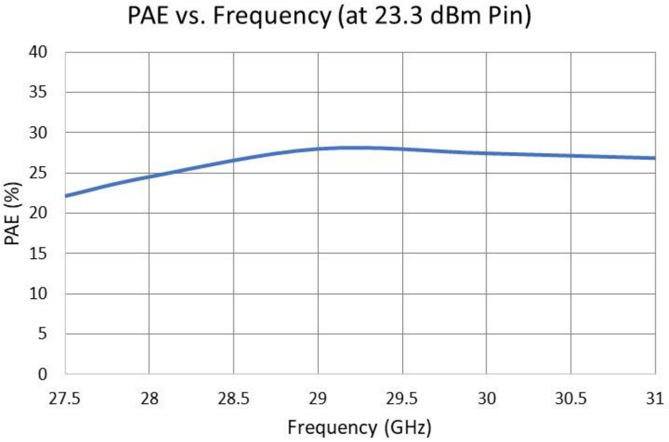


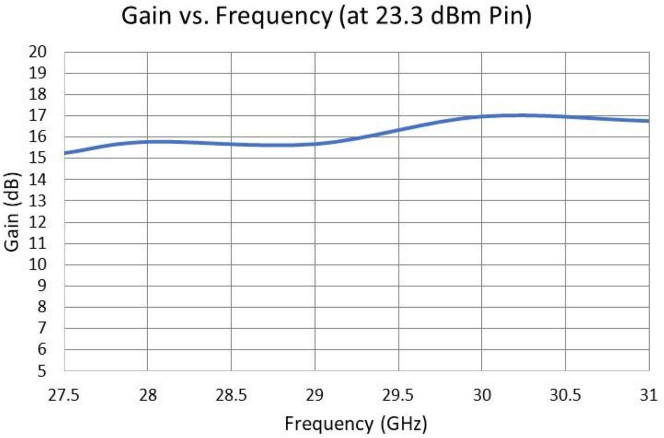


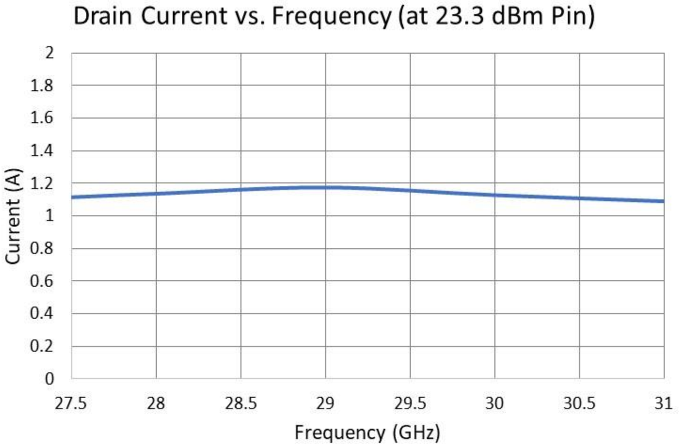
## Large Signal Performance

Test Condition: Vd = 27 V, Idq = 0.5 A, Pin = 23.3 dBm (Psat)
(CW Performance, Typical Performance at 25°C)



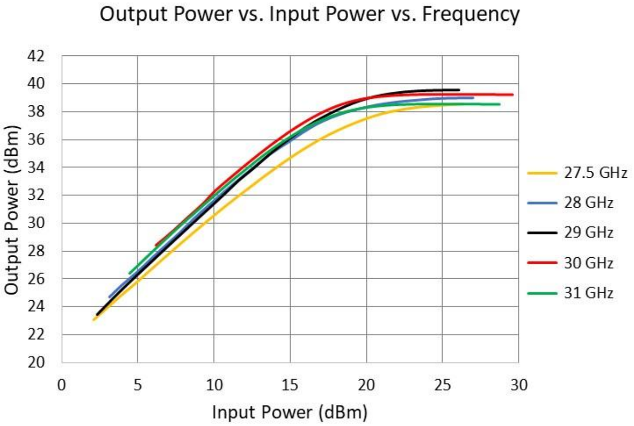


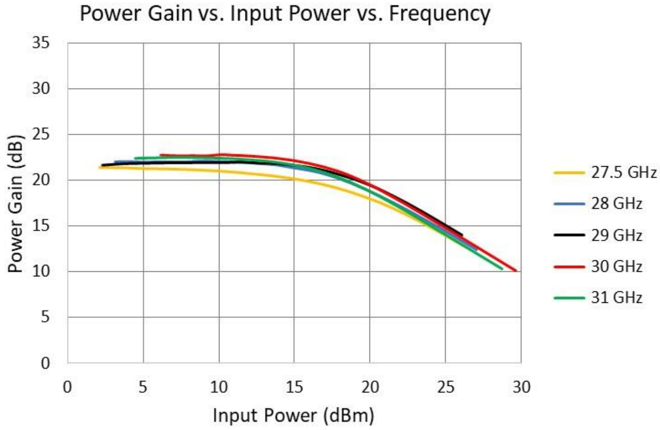


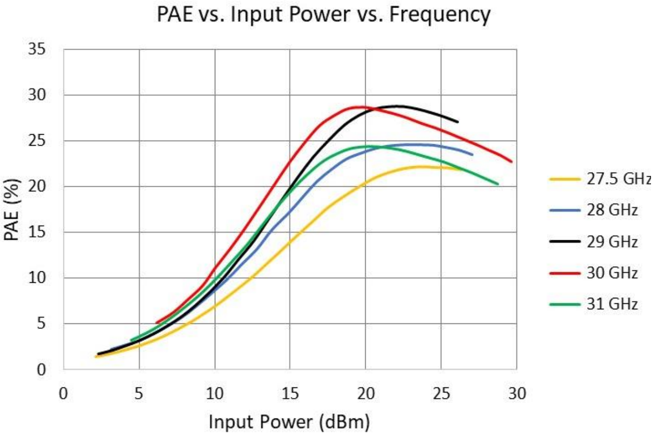


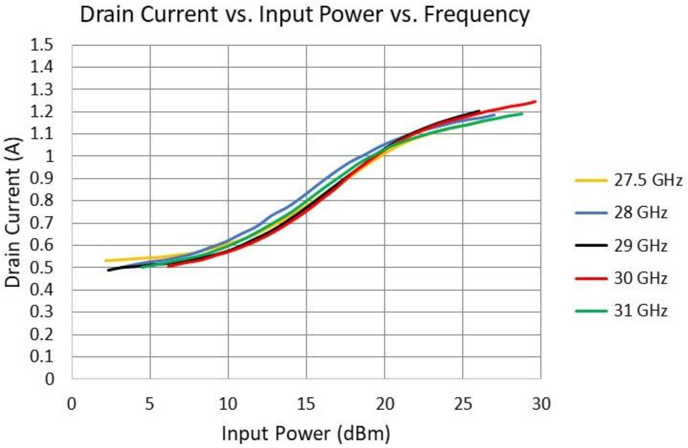
## Large Signal Performance

Test Condition: Vd = 27 V, Idq = 0.5 A,
(CW Performance, Typical Performance at 25°C)



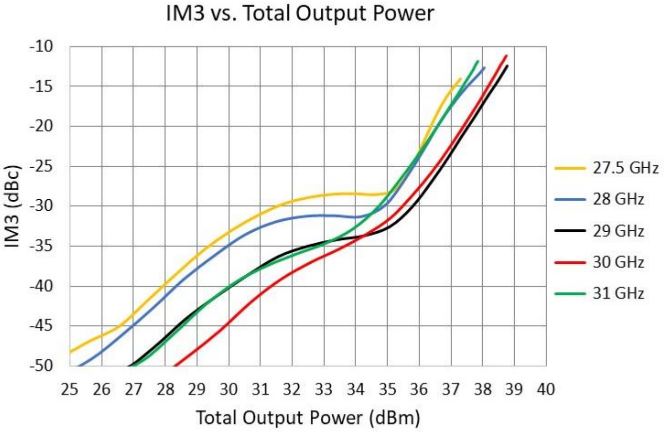






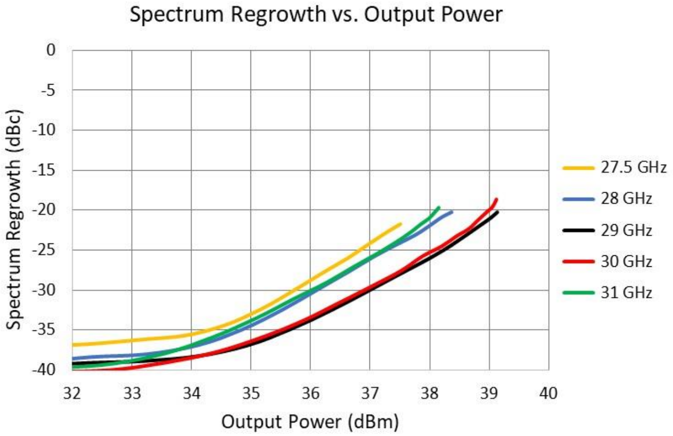
## 2-Tone Linearity Performance

Test Condition: Vd = 27 V, Idq = 0.5 A
10 MHz Tone Spacing



## Spectral Regrowth Performance

Test Condition: Vd = 27 V, Idq = 0.5 A
QPSK, 10 MSPS, Alpha = 0.2



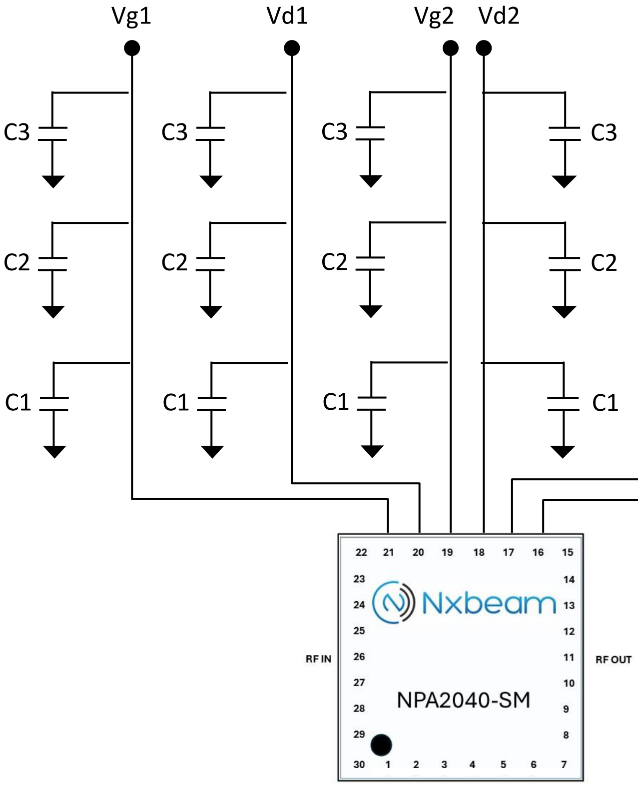
## Connection and Off-Chip Components

The following diagram shows the recommended off-chip components. The off-chip components should be located as close to the part as possible. Please consult with Nxbeam on other off-chip network variations.

| Pad Num. | Function |
|---|---|
| 1 | NC |
| 2 | NC |
| 3 | NC |
| 4 | NC |
| 5 | NC |
| 6 | NC |
| 7 | GND |
| 8 | NC |
| 9 | NC |
| 10 | GND |

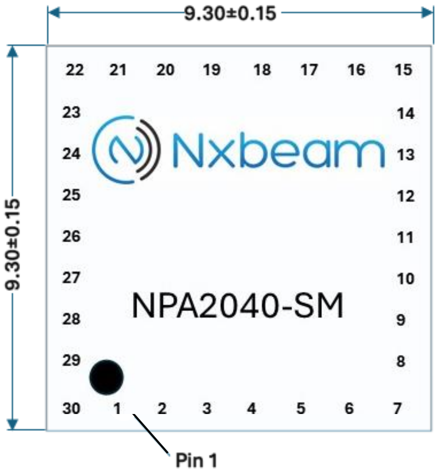
| Pad Num. | Function |
|---|---|
| 11 | RF OUT |
| 12 | GND |
| 13 | NC |
| 14 | NC |
| 15 | GND |
| 16 | Vd3 |
| 17 | Vg3 |
| 18 | Vd2 |
| 19 | Vg2 |
| 20 | Vd1 |

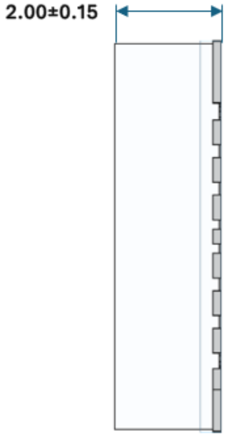
| Pad Num. | Function |
|---|---|
| 21 | Vg1 |
| 22 | GND |
| 23 | NC |
| 24 | NC |
| 25 | GND |
| 26 | RF IN |
| 27 | GND |
| 28 | NC |
| 29 | NC |
| 30 | GND |

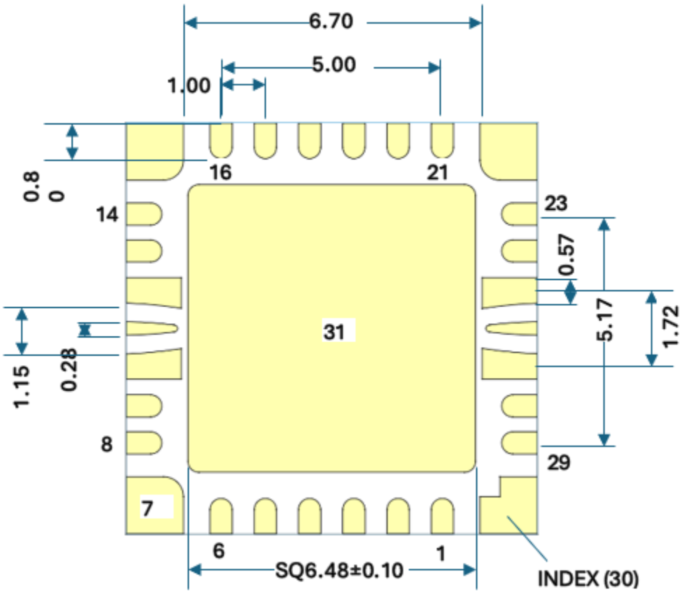


| Capacitor | Value |
|---|---|
| C1 | 0.01 µF |
| C2 | 1 µF |
| C3 | 10 µF |

## Dimensions
(all dimensions in mm)







## 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**

## Important Information

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