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 = 26 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.

Datasheet Revision: April 4, 2025

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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.

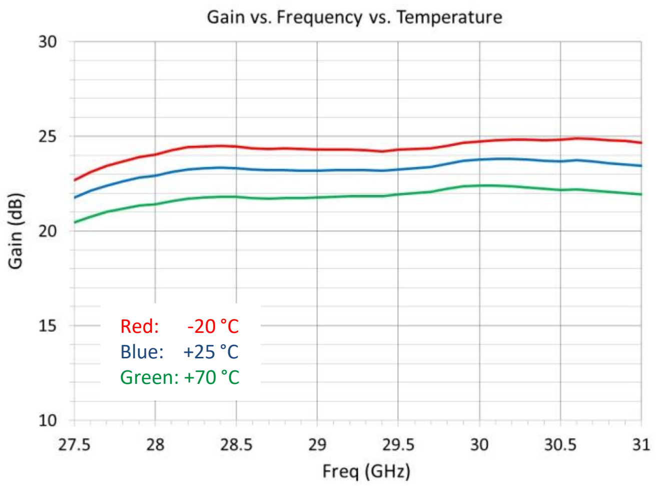
Recommended Quiescent Operating Condition

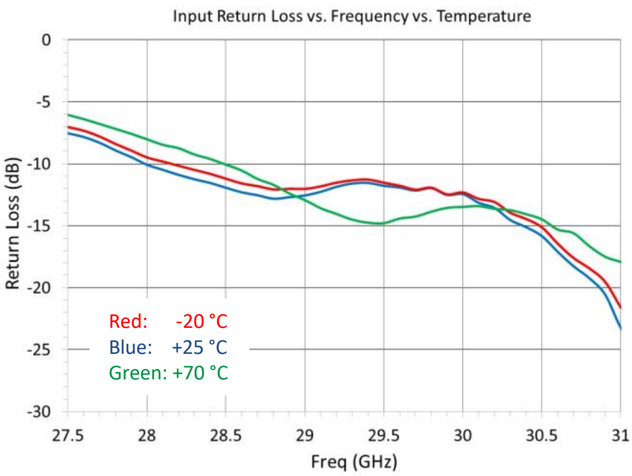
Parameter	Value	Unit
Drain Voltage (Vd)	20 - 27	V
Drain Current (Id1)	up to 140	mA
Drain Current (Id2)	up to 160	mA
Drain Current (Id3)	up to 550	mA
Gate Voltage (Vg) (Typical Range)	-5.5 to -3.5	V

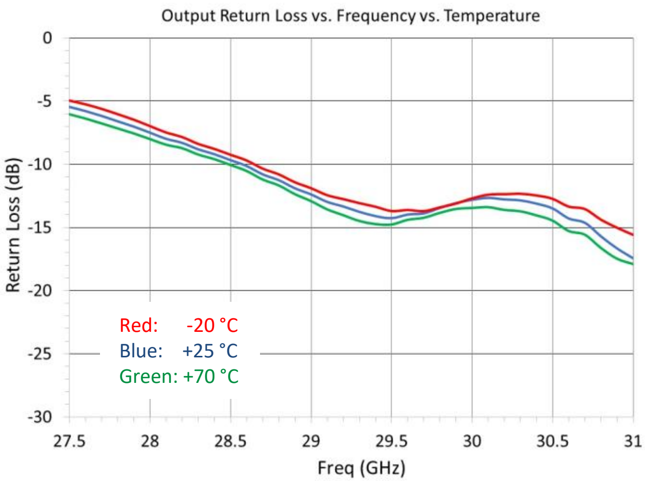
Gate voltage will vary based on desired current per stage

Small Signal Performance

Test Condition: Vd = 26 V, Idq = 0.5 A, (CW Performance, Typical Performance at 25°C)







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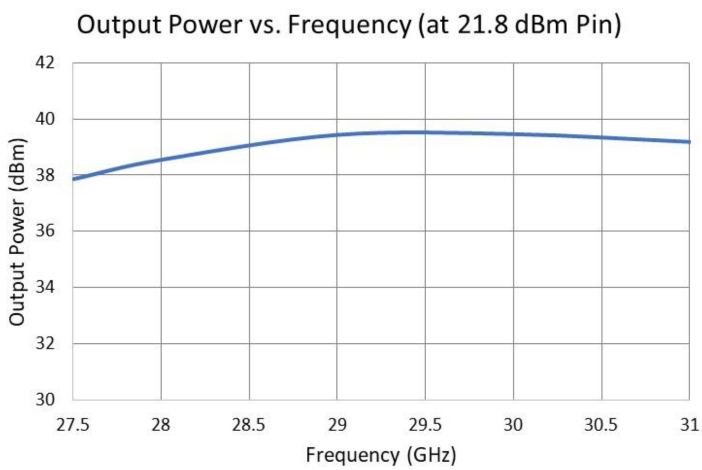
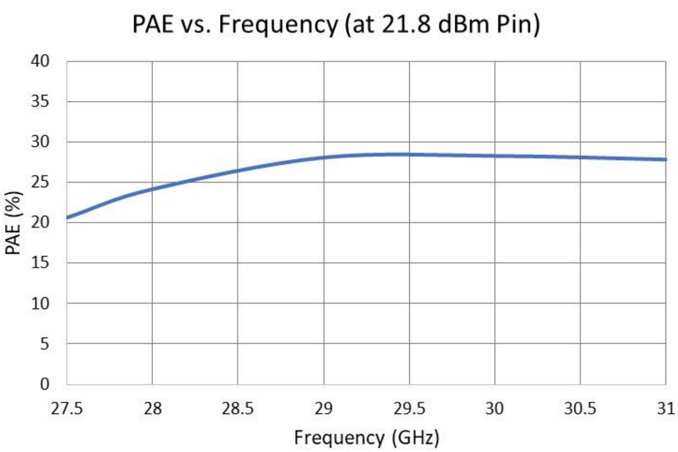
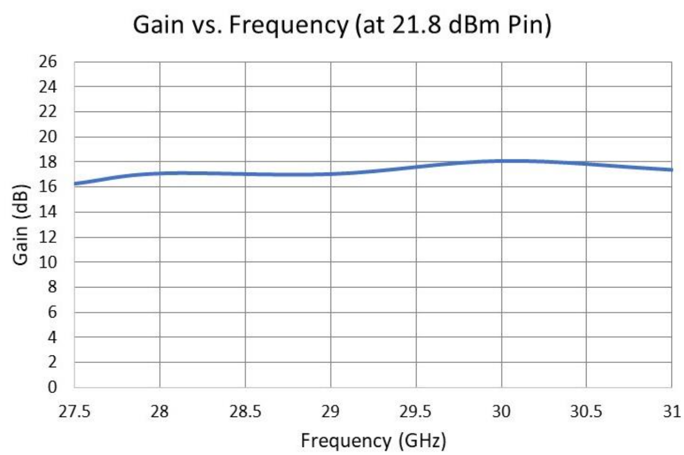
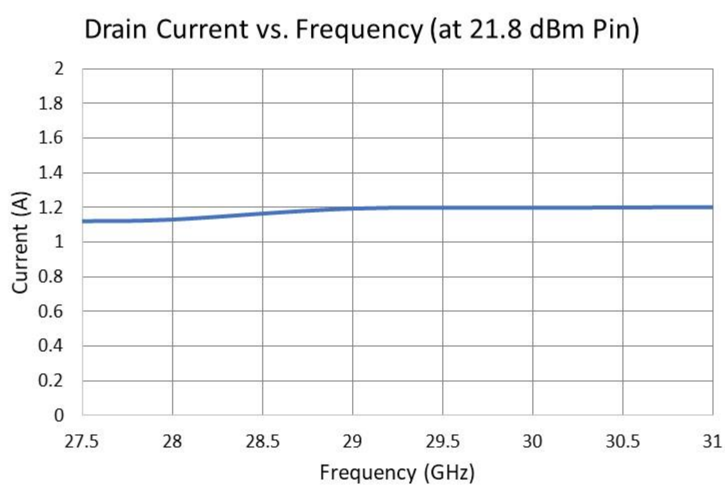
Large Signal Performance

Test Condition: Vd = 26 V, Idq = 0.5 A, Pin = 21.8 dBm
(CW Performance, Typical Performance at 25°C)









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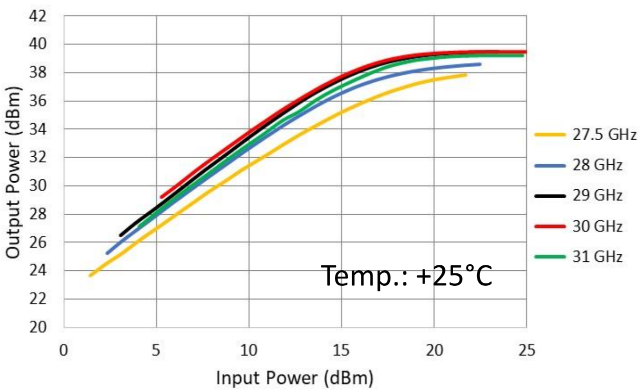
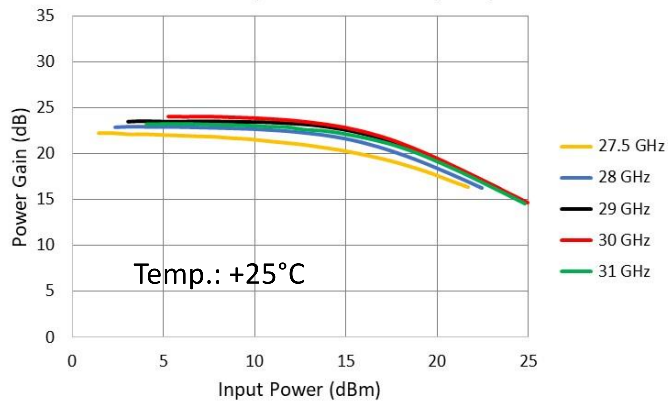
Large Signal Performance

Test Condition: Vd = 26 V, Idq = 0.5 A at 25°C, CW Performance

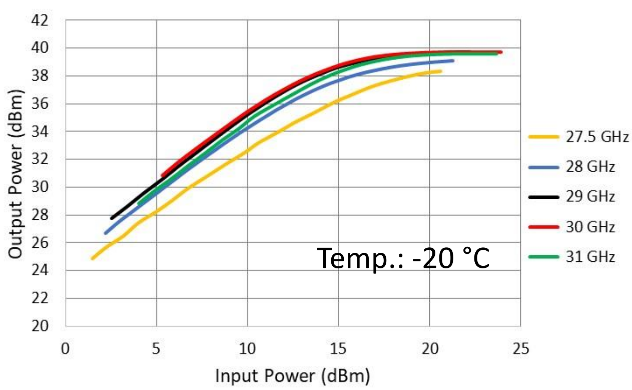
Output Power vs. Input Power vs. Frequency



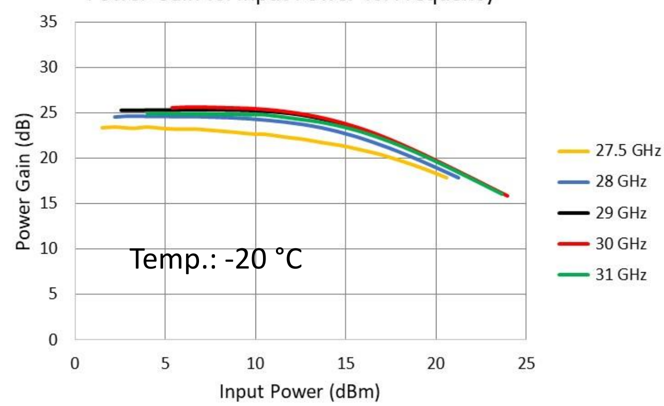
Power Gain vs. Input Power vs. Frequency



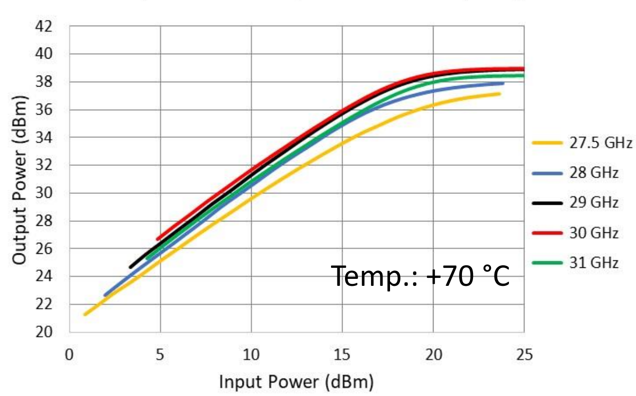
Output Power vs. Input Power vs. Frequency



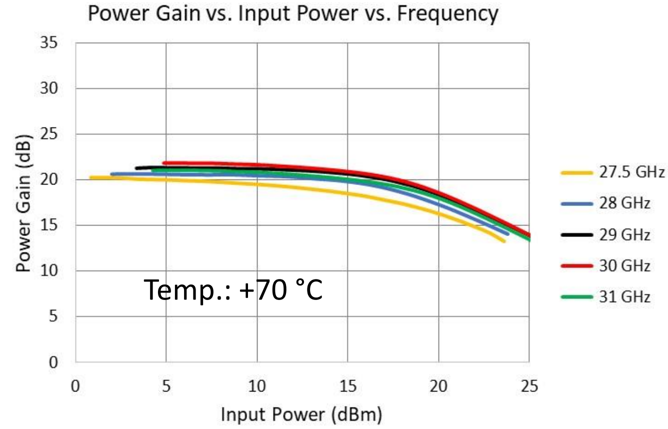
Power Gain vs. Input Power vs. Frequency



Output Power vs. Input Power vs. Frequency



Power Gain vs. Input Power vs. Frequency



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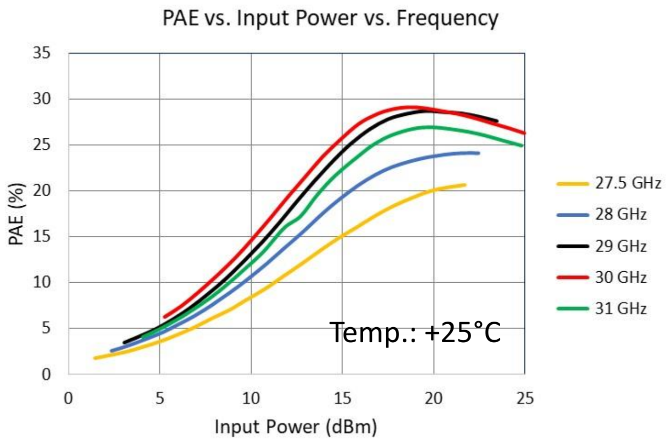
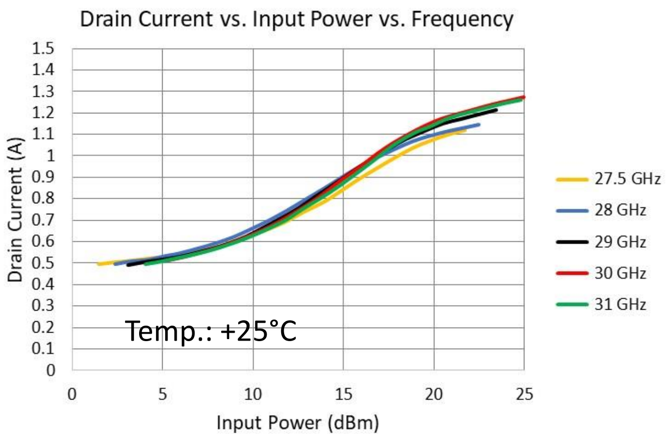
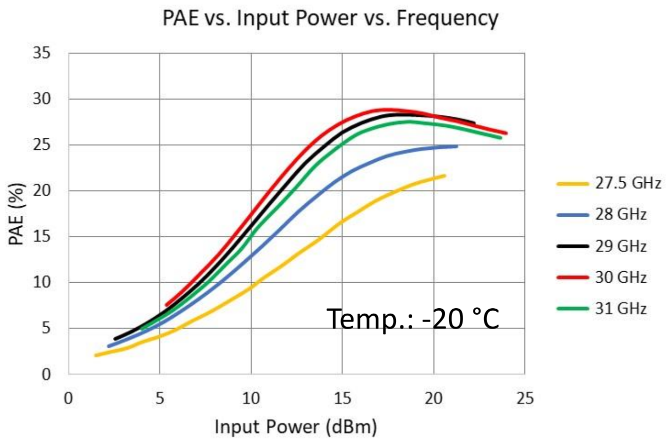
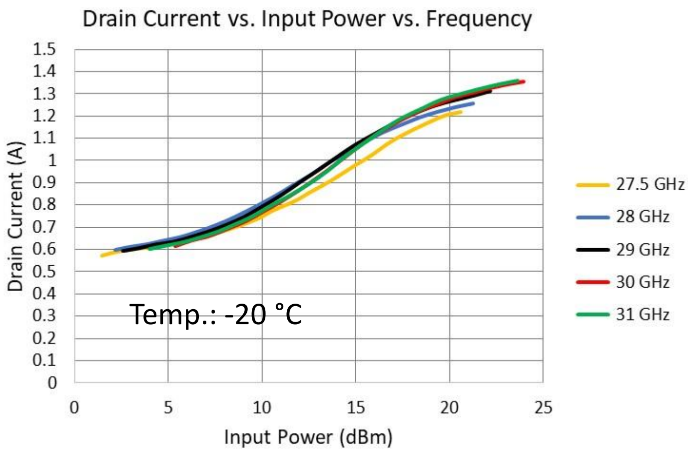
Large Signal Performance

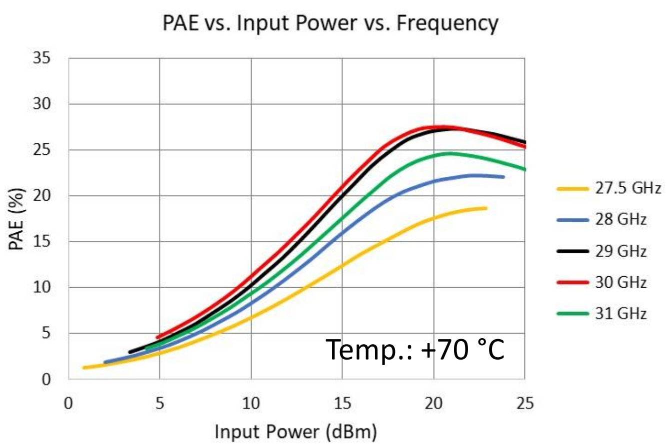
Test Condition: Vd = 26 V, Idq = 0.5 A at 25°C, CW Performance

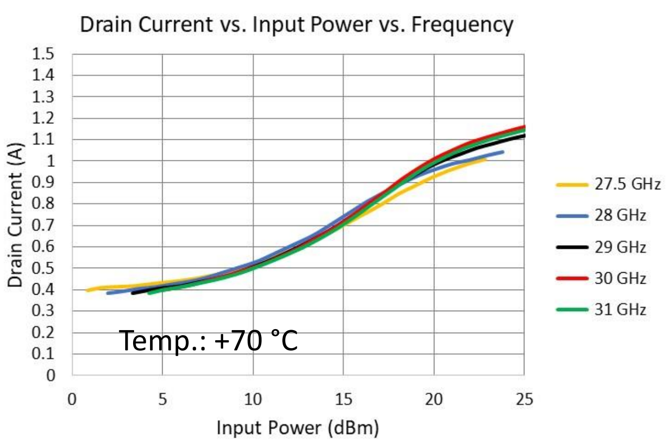












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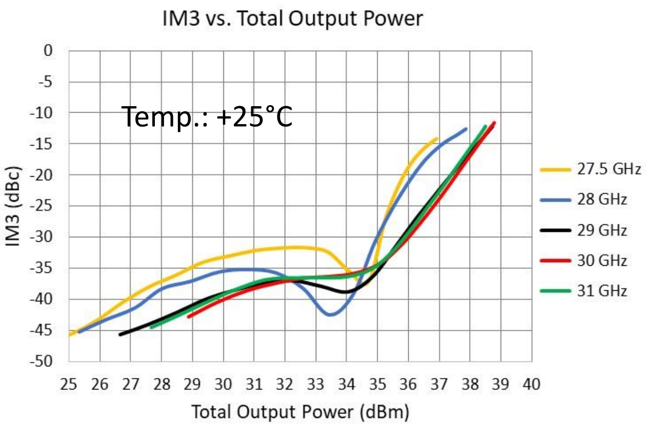
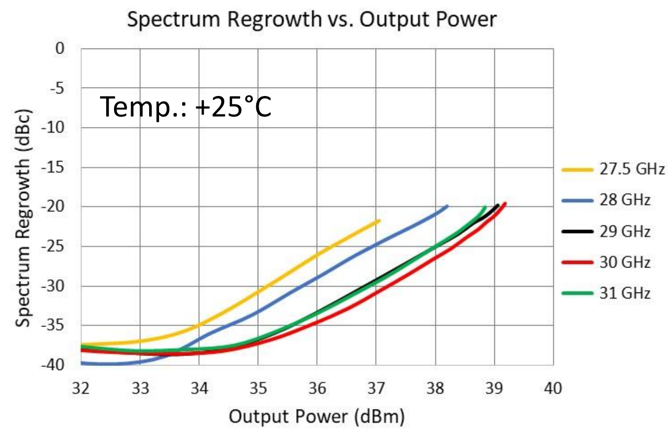
2-Tone Linearity Performance vs. Temperature

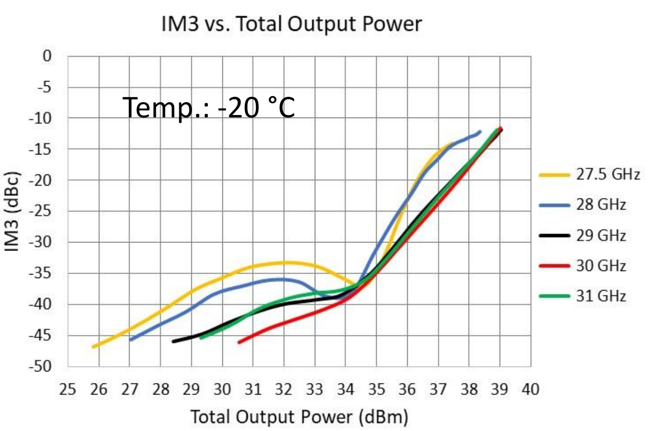
Test Condition: Vd = 26 V, Idq = 0.5 A at 25°C
10 MHz Tone Spacing

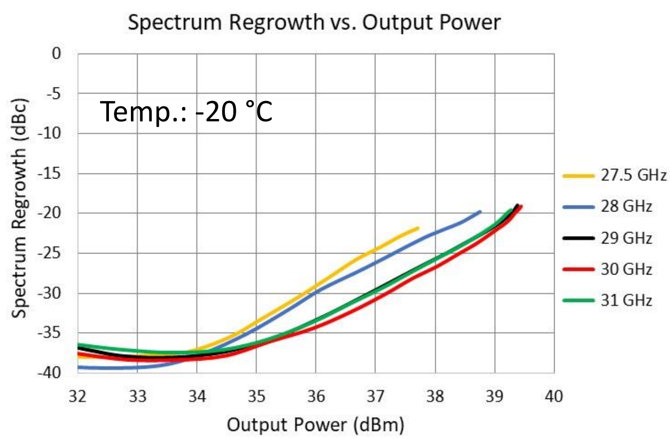
Spectral Regrowth Performance vs. Temperature

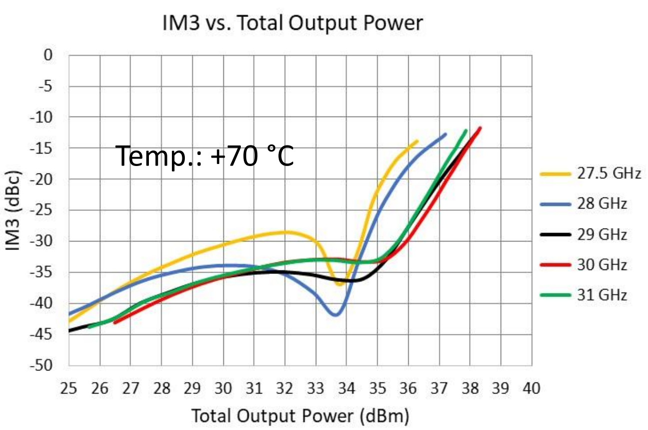
Test Condition: Vd = 26 V, Idq = 0.5 A at 25°C
QPSK, 10 MSPS, Alpha = 0.2

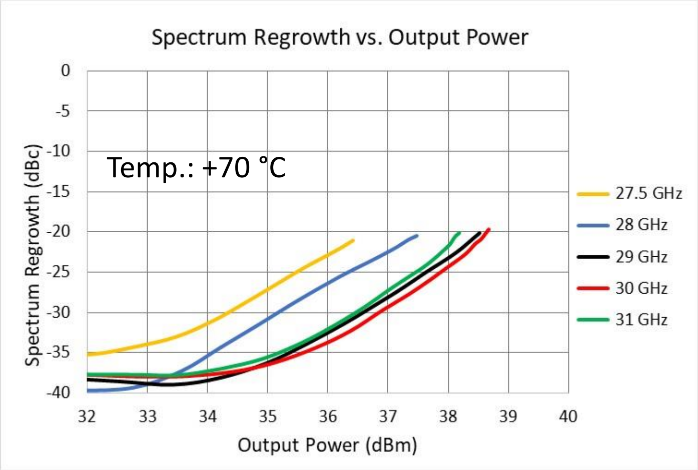












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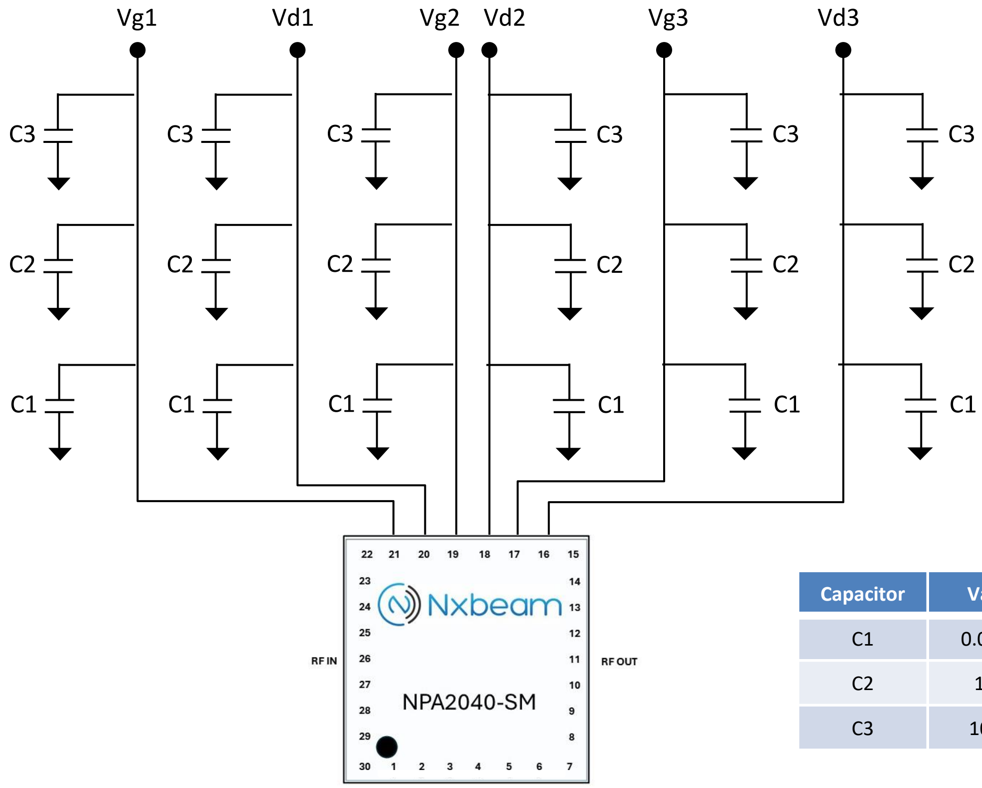
Connection and Off-Chip Components

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

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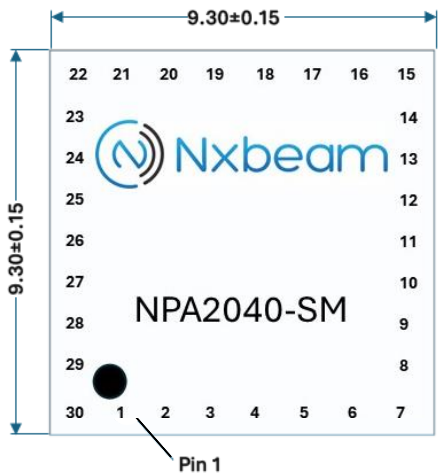
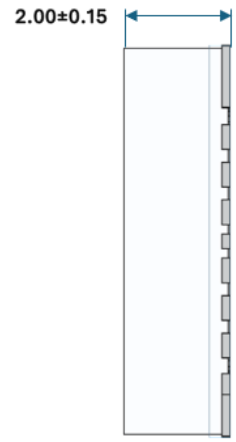
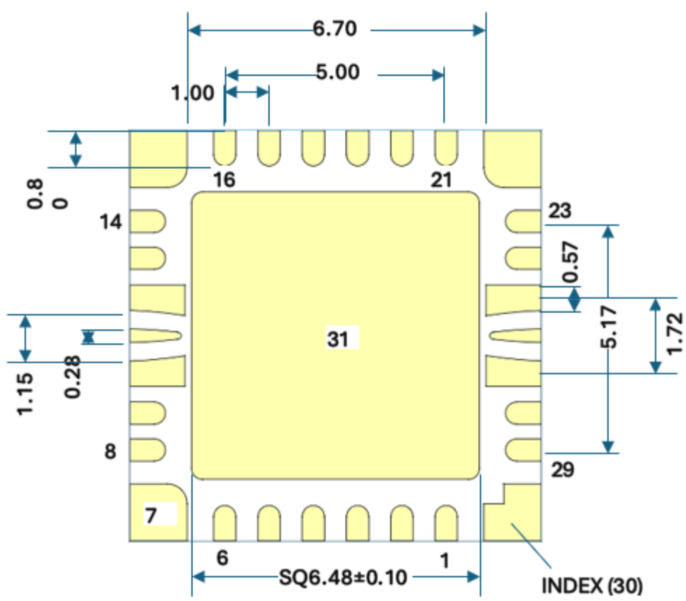
Dimensions
(all dimensions in mm)







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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

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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