APN279
16-20.5 GHz
GaN Power Amplifier

Applications
▪ Point-to-Point Radio
▪ Multipoint Digital Radios
▪ Commercial SatCom

Product Description
The APN279 monolithic GaN HEMT amplifier is a broadband, two-stage power device, designed for use in Point-to-Point and Multipoint Digital Radios, Commercial SatCom. To ensure rugged and reliable operation, HEMT devices are fully passivated. Both bond pad and backside metallization are Au-based that is compatible with epoxy and eutectic die attach methods.

Applications
▪ Point-to-Point Radio
▪ Multipoint Digital Radios
▪ Commercial SatCom

Product Features
▪ RF Frequency: 16 to 20.5 GHz
▪ Linear gain: 19 dB, typical
▪ OP1dB: 36 dBm, typical
▪ Psat: 41.5 dBm, typical
▪ PAE: >34% @ Psat
▪ DC Power: 20 Vdc at 712 mA
▪ Size: 4490 um x 3730 um
▪ Technology: 0.20 um GaN HEMT

Performance Characteristics (Ta = 25°C)

<table>
<thead>
<tr>
<th>Specification</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
</tr>
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<tbody>
<tr>
<td>Frequency</td>
<td>16</td>
<td>19</td>
<td>20.5</td>
<td>GHz</td>
</tr>
<tr>
<td>Linear Gain</td>
<td>4</td>
<td>5</td>
<td></td>
<td>dB</td>
</tr>
<tr>
<td>Input Return Loss</td>
<td>4</td>
<td>5</td>
<td></td>
<td>dB</td>
</tr>
<tr>
<td>Output Return Loss</td>
<td>4</td>
<td>5</td>
<td></td>
<td>dB</td>
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<tr>
<td>P1dB (Pulsed)*</td>
<td>38</td>
<td></td>
<td></td>
<td>dBm</td>
</tr>
<tr>
<td>P1dB (CW)**</td>
<td></td>
<td></td>
<td></td>
<td>dBm</td>
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<tr>
<td>Psat (Pulsed)*</td>
<td>38</td>
<td>41.5</td>
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<td>dBm</td>
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<tr>
<td>Psat (CW)**</td>
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<td>dBm</td>
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<tr>
<td>PAE @ Psat</td>
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<td></td>
<td></td>
<td>%</td>
</tr>
<tr>
<td>Vd1, Vd1a, Vd2, Vd2a</td>
<td>20</td>
<td></td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Vg1, Vg1a, Vg2, Vg2a</td>
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<td></td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Id1+ Id1a</td>
<td>200</td>
<td></td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>Id2+Id2a</td>
<td>512</td>
<td></td>
<td></td>
<td>mA</td>
</tr>
</tbody>
</table>

* On –Wafer
** Fixture

Absolute Maximum Ratings (Ta = 25°C)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
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</thead>
<tbody>
<tr>
<td>Vd1, Vd1a, Vd2, Vd2a</td>
<td>20</td>
<td>28</td>
<td>V</td>
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<tr>
<td>Id1+ Id1a</td>
<td>300</td>
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<td>mA</td>
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<tr>
<td>Id2+Id2a</td>
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<td>mA</td>
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<td>V</td>
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<td>dBm</td>
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Approved for Public Release: Northrop Grumman Case 17-1503, 07/31
APN279
16-20.5 GHz
GaN Power Amplifier

Measured On-Wafer Performance Characteristics (Typical Performance at 25°C)
Vd1, Vd1a, Vd2, Vd2a = 20 V, Id1 + Id1a = 200mA, Id2 + Id2a = 512mA*

* Pulsed-Power On-Wafer

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Die Size and Bond Pad Locations (Not to Scale)

X = 4490 ± 25 µm
Y = 3730 ± 25 µm
DC Bond Pad = 100 x 100 ± 0.5 µm
RF Bond Pad = 100 x 100 ± 0.5 µm
Chip Thickness = 101 ± 5 µm

Biasing/De-Biasing Details:
APN279 must be biased the top and bottom of the die.

Listed below are some guidelines for GaN device testing and wire bonding:

a. Limit positive gate bias (G-S or G-D) to < 1V
b. Know your devices’ breakdown voltages
c. Use a power supply with both voltage and current limit.
d. With the power supply off and the voltage and current levels at minimum, attach the ground lead to your test fixture.
   i. Apply negative gate voltage (~5 V) to ensure that all devices are off
   ii. Ramp up drain bias to ~10 V
   iii. Gradually increase gate bias voltage while monitoring drain current until 20% of the operating current is achieved
   iv. Ramp up drain to operating bias
   v. Gradually increase gate bias voltage while monitoring drain current until the operating current is achieved

To safely de-bias GaN devices, start by debiasing output amplifier stages first (if applicable):

i. Gradually decrease drain bias to 0 V.
ii. Gradually decrease gate bias to 0 V.
iii. Turn off supply voltages

Repeat de-bias procedure for each amplifier stage.
Recommended Assembly Notes
1. Bypass caps should be 100 pF (approximately) ceramic (single-layer) placed no farther than 30 mils from the amplifier.
2. Best performance obtained from use of <10 mil (long) by 3 by 0.5 mil ribbons on input and output.
3. Part must be biased from both sides as indicated.
4. The 0.1μF, 50V capacitors are not needed if the drain supply line is clean. If Drain Pulsing of the device is to be used, do NOT use the 0.1μF, 50V Capacitors.

Mounting Processes
Most Northrop Grumman Aerospace Systems (NGAS) GaN IC chips have a gold backing and can be mounted successfully using either a conductive epoxy or AuSn attachment. NGAS recommends the use of AuSn for high power devices to provide a good thermal path and a good RF path to ground. Maximum recommended temp during die attach is 320°C for 30 seconds.

Note: Many of the NGAS parts do incorporate airbridges, so caution should be used when determining the pick up tool.

CAUTION: THE IMPROPER USE OF AuSn ATTACHMENT CAN CATASTROPHICALLY DAMAGE GaN CHIPS.

PLEASE ALSO REFER TO OUR “GaN Chip Handling Application Note” BEFORE HANDLING, ASSEMBLING OR BIASING THESE MMICS!