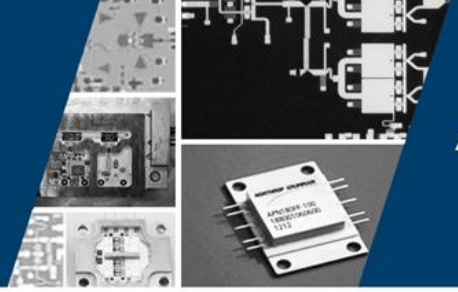
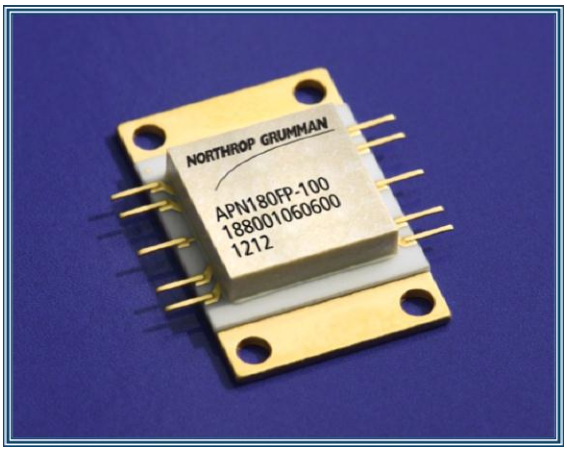
APN180FP
27-31 GHz Flange Mount GaN Power Amplifier



NORTHROP GRUMMAN

Advance Datasheet

Revision: May 2013



Product Features

- RF frequency: 27 to 31 GHz
- Linear Gain: 20 dB typ.
- Psat: 39 dBm typ.
- 0.2um GaN HEMT Process
- DC Power: 28 VDC @ 720 mA

Applications

- Point-to-Point Digital Radios
- Point-to-Multipoint Digital Radios
- SATCOM Terminals

Product Description

The APN180FP is a two-stage 8 Watt GaN HEMT power amplifier designed for use in SATCOM terminals and terrestrial point-to-point digital radios. Conveniently packaged in a leaded ceramic flanged package, the AFN180FP is easy to handle and assemble using traditional soldering techniques, while avoiding bare die handling, attachment and ribbon bonding.

Performance Characteristics (Ta = 25°C)

Specification	Min	Typ	Max	Unit
Frequency	27		31	GHz
Linear Gain	18	20		dB
Input Return Loss				dB
Output Return Loss				dB
P1dB		37		dBm
Psat		39		dBm
PAE @ Psat		26		%
Vd1, Vd2=Vd2a		28		V
Vg1		-3.5		V
Vg2		-3.5		V
Id1		144		mA
Id2+Id2a		576		mA

Absolute Maximum Ratings (Ta = 25°C)

Parameter	Min	Max	Unit
Vd1, Vd2	20	28	V
Id1		TBD	mA
Id2		TBD	mA
Vg1, Vg2	-5	0	V
Input drive level		TBD	dBm
Assy. Temperature (TBD seconds)		400	deg. C

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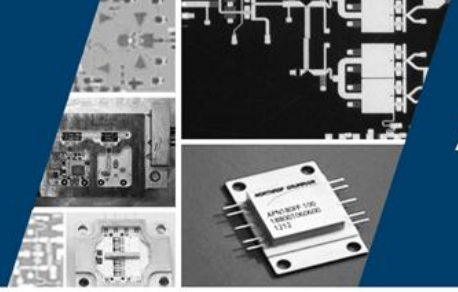
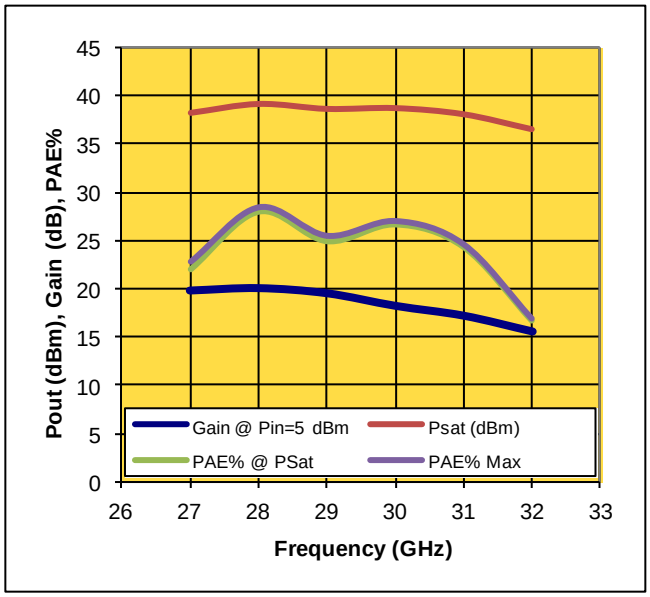
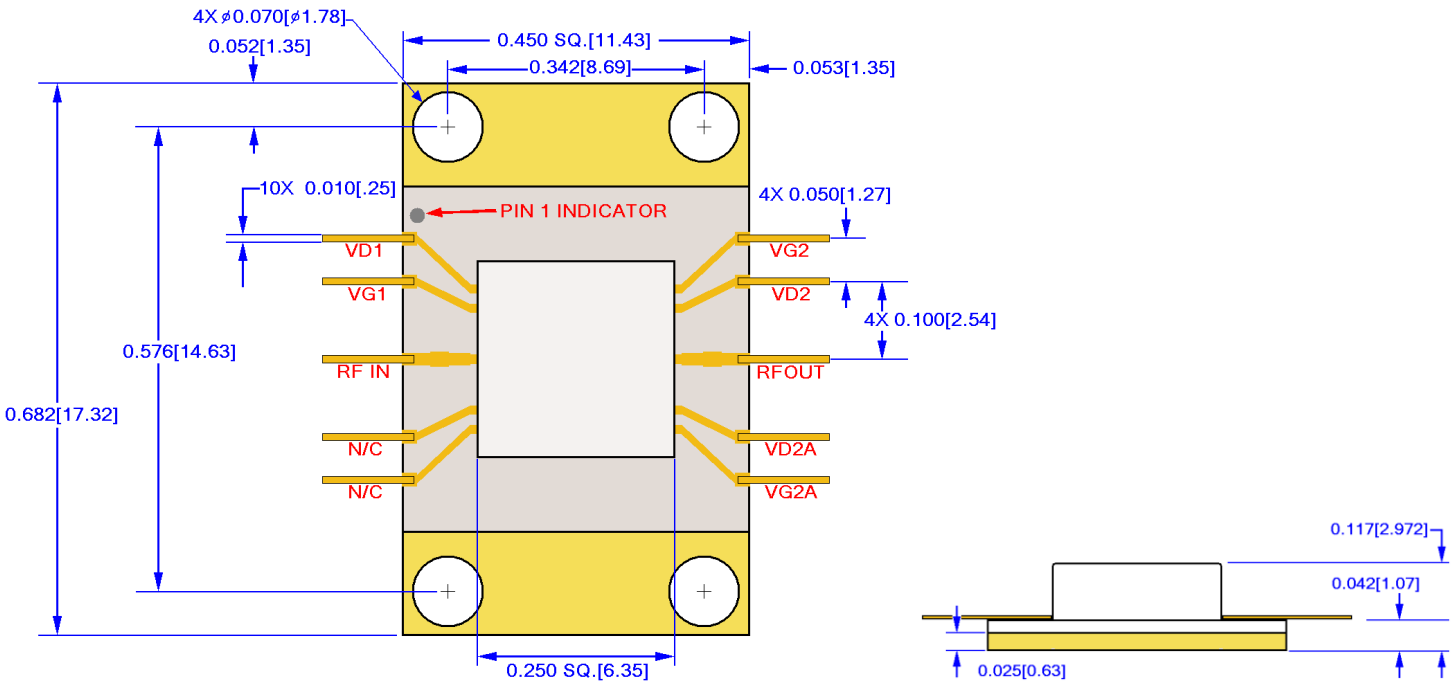


Measured CW Performance Characteristics (Typical Performance at 25°C)
Id1 = 144 mA, Id2 + Id2a = 576 mA

Power vs. Frequency @ 28 V



Flanged Package Dimensions and Pin Locations



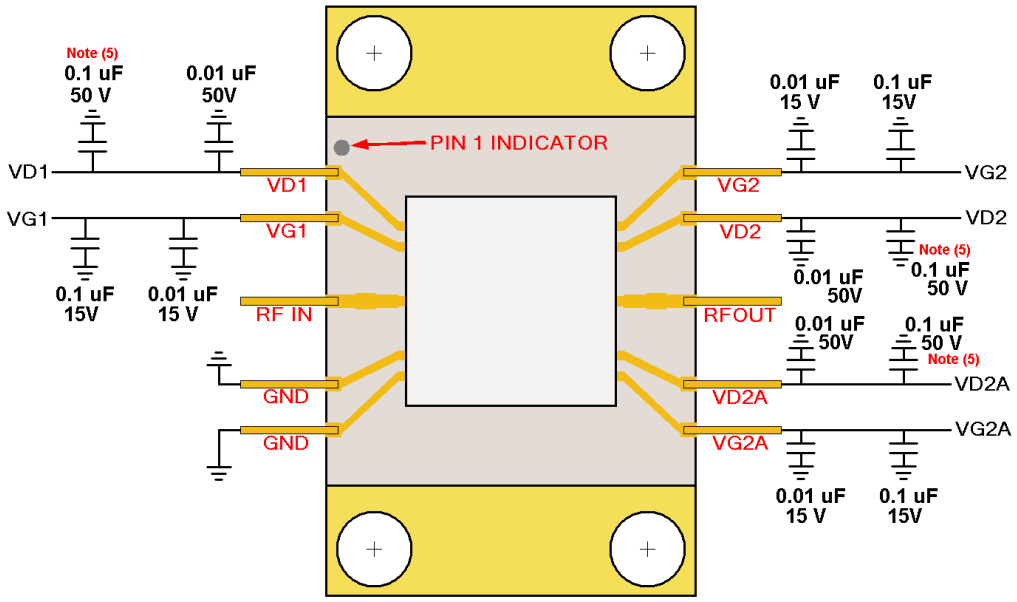
Biasing/De-Biasing Details:

Bias for 1st stage is from top. The 2nd stage must be biased from both top and bottom simultaneously.

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
e. 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
f. Repeat de-bias procedure for each amplifier stage

Suggested External Capacitor Arrangement



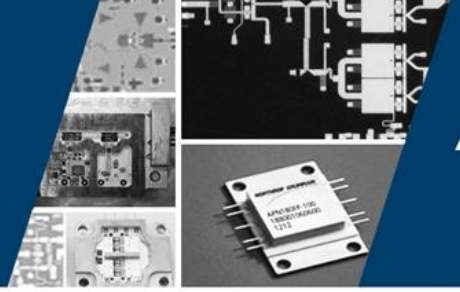
Assembly Notes

1. The APN180FP already contains 100pF and 10 ohm resistors that are recommended for use in our APN180 MMIC assembly notes.
2. Part can be must be biased from both sides as shown above.
3. Please refer to the Northrop Grumman “GaN Chip Handling Application Note” revision May 2012 or later.
4. The Die’s Vg1A and Vd1A ports do not serve any function and should be grounded.
5. 0.1 uF capacitors are required on the drain if the power supply line is not clean.
   DO NOT use the 0.1 uF drain capacitors if you intend to drain pulse these parts.

Assembly Processes

Mounting APN180FP packages onto circuit boards.
APN180 FP packages feature leads attached to an alumina ceramic body with one of the strongest ceramic to metal joints available. One element required for operation at high frequency is the use of fine geometry leads. Fine geometry leads are not as robust, and it is possible to exceed the yield or tensile strength even with small hand tools. Even though firmly attached, EXTRA care in handling is essential.

- Check all fixtures used for assembly, for lead form, and for test to be sure that parts are not subjected to unnecessary physical stress.
- Check that fixtures allow for proper tolerance accumulation.
- Check that test sockets are easy to load, and not likely to torque or twist the leads.
- For packages that mount with screws, be sure that the package is attached to a flat surface.
- Unused leads should be grounded (Vg1A and Vd1A).
- Do not over-torque mounting screws.
- Do not use conductive gaskets or shims under the package.
- Do not use test fixtures or sockets that may produce a sharp lifting force to lift the lead directly adjacent to the package.
- If packages must be removed after solder attach, do not pry the leads up so that the force lifting the lead from the board is also lifting the lead from the package. Use a probe to press down on the lead-to-package joint, and lift the lead when the solder is fluid.



Screws for Mounting APN180FP packages

Product Name	Length, min	Diameter	Thread Pitch	Thread Tolerance	Material	Torque, in-oz
Socket Head Cap Screw, English	1/8"	0	80	Class 3A	Type 316 Stainless Steel	1.0
Socket Head Cap Screw, English	1/8"	2	56	Class 3A	Type 316 Stainless Steel	2.0
Socket Head Cap Screw, Metric	6 mm	M1.6	0.35 mm	4g6g	Type 316 Stainless Steel	1.0
Socket Head Cap Screw, Metric	6 mm	M2.5	0.45 mm	4g6g	Type 316 Stainless Steel	2.0

1. Mounting surface should be tapped for close tolerance fit of inner to external thread.
2. Mounting surface must be flat.
3. Any bending or deformation of the package during mounting is likely to damage the ceramic. To avoid this:
   3.1. Insert all mounting screws for a given package and tighten all finger tight.
   3.2. Begin tightening screws on opposite corners of the package to 1/3 torque
   3.3. Tighten following same screw position pattern to 2/3 torque
   3.4. Tighten following same screw position pattern to full torque
4. The use of ground or thermal pads under the package is NOT recommended.
5. The use of low tack, ductile adhesives to improve grounding and thermal performance has not been investigated. Please contact us if you are considering this mounting approach

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