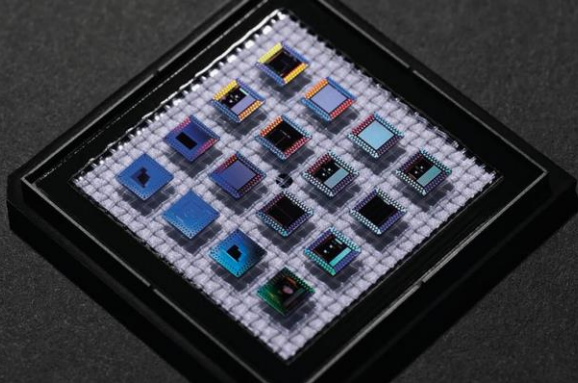




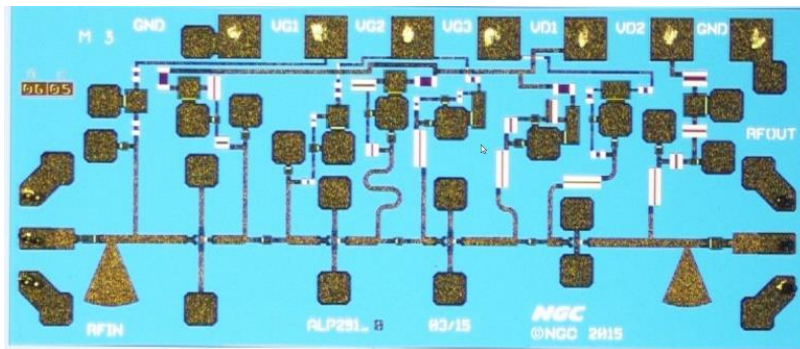
ALP291

71 – 86 GHz

InP Low Noise Amplifier

PRODUCT DESCRIPTION

The ALP291 is an E-band low noise amplifier MMIC fabricated in 0.1um InP HEMT. This part is ideally suited for communications. The MMIC operates from 71 to 86 GHz and provides greater than 24 dB of gain with an average noise figure of 2.7 dB. The small die size allows for extremely compact packaging. To ensure rugged and reliable operation, HEMT devices are fully passivated. Both bond pad and backside metallization are Ti/Au, which is compatible with conventional die attach, thermocompression and thermosonic wire bonding assembly techniques



X= 1.9 mm; Y= 0.85 mm

APPLICATIONS

- Point-to-Point Digital Radios
- Point-to-Multipoint Digital Radios
- SatCom Terminals

PRODUCT FEATURES

- Linear gain: 24 - 25 dB, typical
- Noise Figure: 2.5 – 2.9 dB, typical
- Average NF (71-86 GHz): 2.7 dB, typical
- PIdB : 3 dBm (Est.)
- Microstrip Topology MMIC, In-line Input & Output
- 0.1 um InP HEMT Process
- 3 mil substrate
- DC Power: 25 mW
- Die Size 1.6 sq. mm

EXPORT INFORMATION

ECCN: 5A991.g

HTS (Schedule B) code: 8542.33.0000



www.ngc.com

www.ngc.com/what-we-do/microelectronics-space-park/

Phone: (310) 814-5000 • Fax: (310) 812-7011 • Email: asmps.sales@ngc.com

Approved for Public Release: NG24-1211. © 2024 Northrop Grumman Systems Corporation

© Northrop Grumman Systems Corporation
Preliminary Information: The data contained in this document describes new products in the sampling or preproduction phase of development and is for information only. Northrop Grumman reserves the right to change without notice the characteristics data and other specifications as they apply to this product. The product represented by this datasheet is subject to the U.S. Export Law as contained in the EAR regulations.

**NORTHROP
GRUMMAN**

ALP291

71 – 86 GHz

InP Low Noise Amplifier

ABSOLUTE MAXIMUM RATINGS

Parameter	Value	Unit
Drain Voltage	1.3	V
Gate Voltage Range*	-0.7 to 0.4	V
Drain Current	18	mA
Forward Gate Current	0.12	mA
Reverse Gate Current	-0.3	mA

*V_{gd} max 2V

RECOMMENDED OPERATING CONDITIONS

Parameter	Value	Unit
Drain Voltage Range	1.3	V
Gate Voltage Range	-0.7 to 0.3	V
V _{d1} Drain Current	13.5	mA
V _{d2} Drain Current	6	mA

ELECTRICAL SPECIFICATIONS

Parameter	Min	Typical	Max	Unit
Operational Frequency	71		86	GHz
Small Signal S-Parameters				
Small Signal Linear Gain	25.5		29	dB
Gain Flatness			3.5	dB
Input Return Loss	-15		-9	dB
Output Return Loss	-33		-16	dB
Noise Figure				
Operational Frequency*	71		86	GHz
Noise Figure	2.3		3.2	dB

*Noise has been measured only up to 100 GHz

ALP291

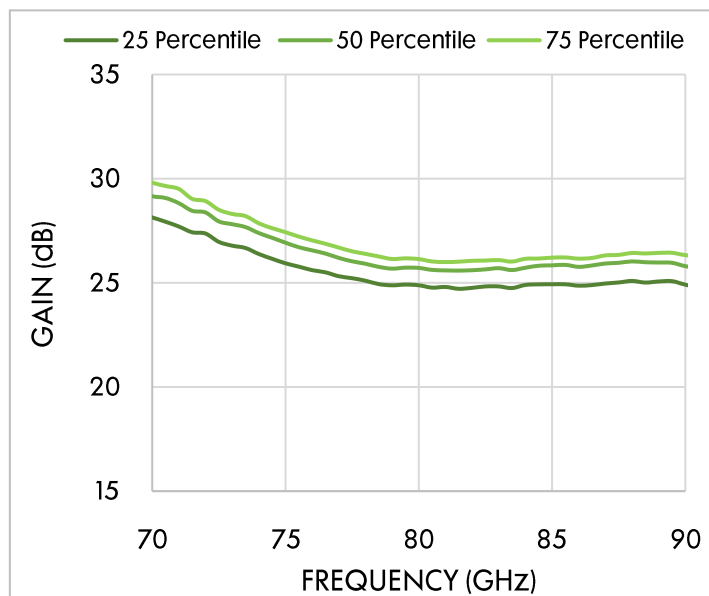
71 – 86 GHz

InP Low Noise Amplifier

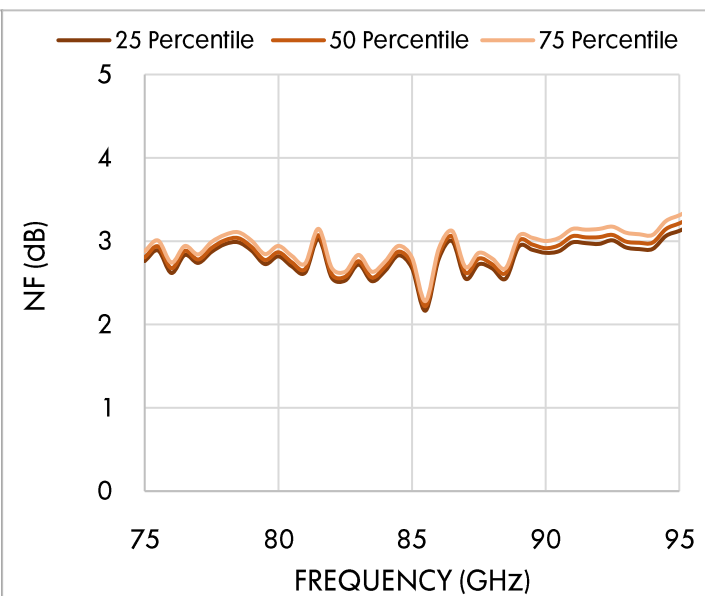
Pulsed On wafer measured Performance Characteristics (Typical Performance at 25°C)

$V_d = 1.3 \text{ V}$, $I_{d1} = 13.5 \text{ mA}$, $I_{d2} = 6 \text{ mA}$. *

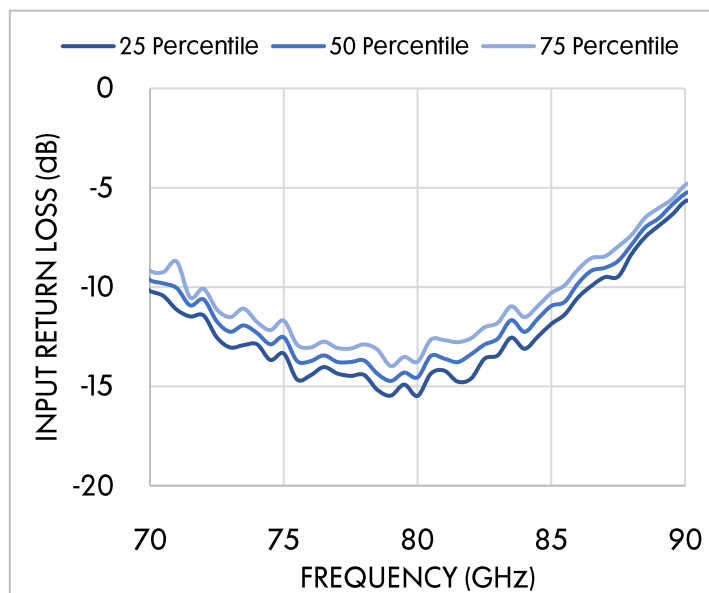
Gain vs. Frequency



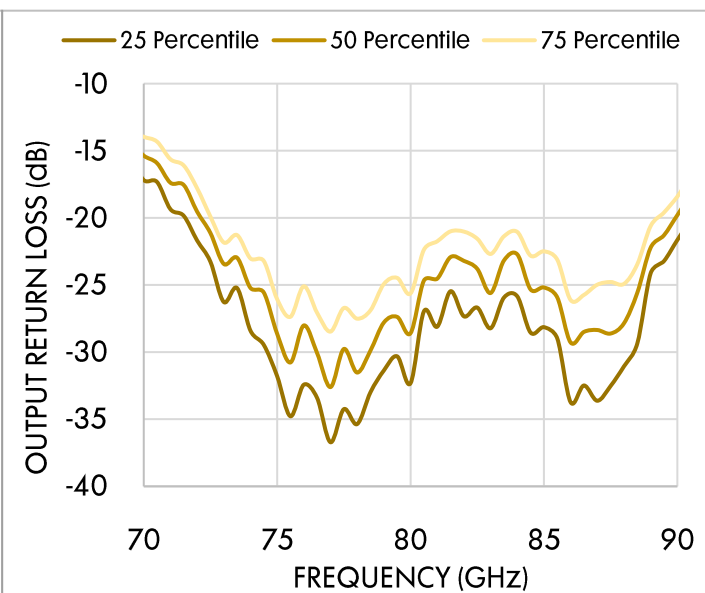
Noise vs. Frequency



Input Return Loss vs. Frequency



Output Return Loss vs. Frequency



Page 3

www.ngc.com

www.ngc.com/what-we-do/microelectronics-space-park/

Phone: (310) 814-5000 • Fax: (310) 812-7011 • Email: asmps.sales@ngc.com

Approved for Public Release: NG24-1211. © 2024 Northrop Grumman Systems Corporation

* Pulsed-power on-wafer

© Northrop Grumman Systems Corporation

Preliminary Information: The data contained in this document describes new products in the sampling or preproduction phase of development and is for information only. Northrop Grumman reserves the right to change without notice the characteristics data and other specifications as they apply to this product. The product represented by this datasheet is subject to the U.S. Export Law as contained in the EAR regulations.

**NORTHROP
GRUMMAN**

ALP291

71 – 86 GHz

InP Low Noise Amplifier

DIE SIZE AND BOND PAD LOCATIONS

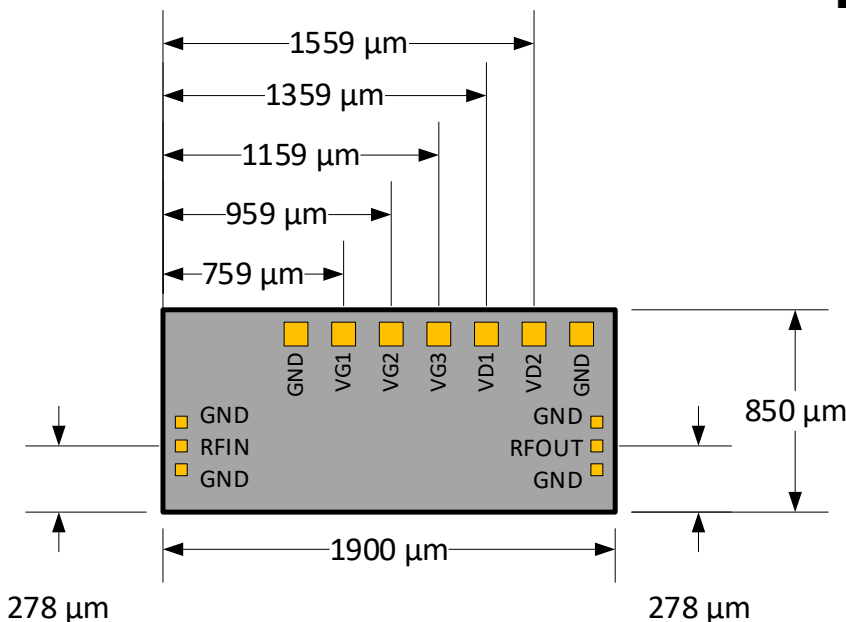
$X = 1900 \mu\text{m} \pm 25 \mu\text{m}$

$Y = 850 \pm 25 \mu\text{m}$

DC Bond Pad = $100 \times 100 \pm 0.5 \mu\text{m}$

RF Bond Pad = $50 \times 50 \pm 0.5 \mu\text{m}$

Chip Thickness = $75 \pm 5 \mu\text{m}$



BIASING/DE-BIASING DETAILS:

Bias up sequence:

- Set all drain and gate voltages to 0V
- Set $V_{g1} = V_{g2} = V_{g3}$ to -0.7V and check to make sure there is no gate current. High gate current indicates leaky devices.
- Increase V_{d1} and V_{d2} to +0.4V and check to make sure there are no oscillations.
- If no oscillations are evident, increase V_{d1} and V_{d2} voltage to recommended value (1.3V).
- Adjust V_{g1} to realize the desired I_{d1} (4.5mA)
- Adjust V_{g2} to realize the desired I_{d1} (13.5mA)
- Adjust V_{g3} to realize the desired I_{d2} (6mA)

Bias down sequence:

- Set $V_{g1} = V_{g2} = V_{g3}$ to -0.7V
- Set $V_{d1} = V_{d2}$ to 0V
- Set $V_{g1} = V_{g2} = V_{g3}$ to 0V

ALP291

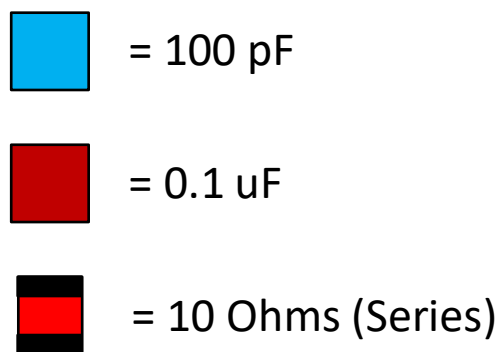
71 – 86 GHz

InP Low Noise Amplifier

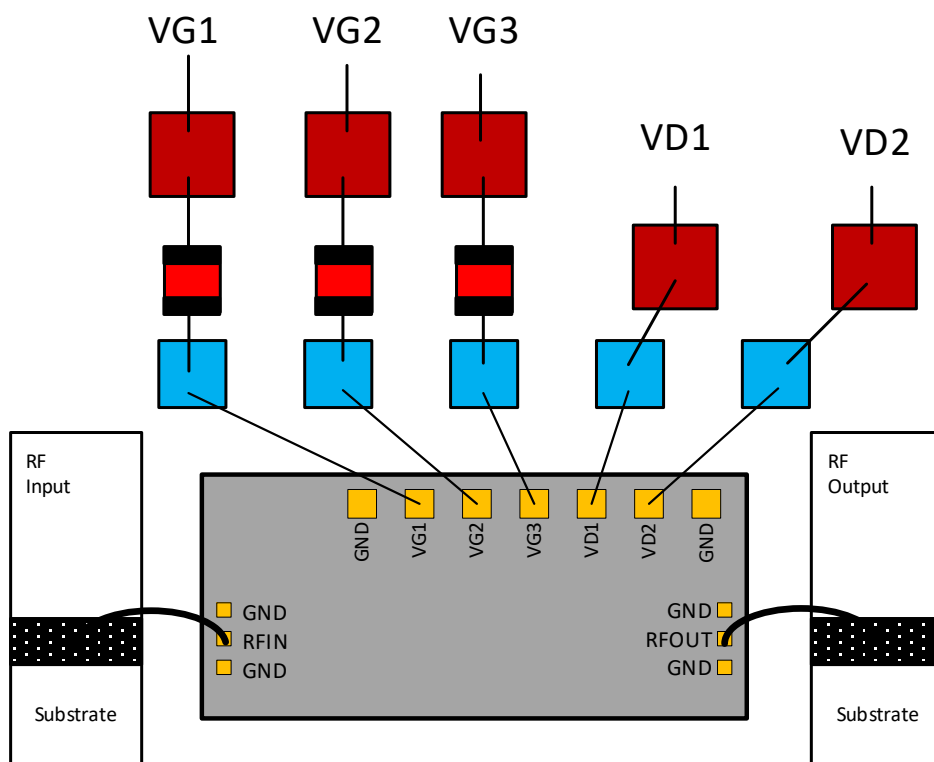
RECOMMENDED ASSEMBLY NOTES

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 <6 mil (long) by 1.5 by 0.5 mil ribbons on input and output.

GENERAL DIAGRAM SYMBOLS



SUGGESTED BONDING ARRANGEMENT



MOUNTING PROCESSES

Most NG InP IC chips have a gold backing and can be mounted successfully using either a conductive epoxy or AuSn attachment. NG recommends the use of conductive epoxy due to the reduced mechanical strain placed on the chip. The two most important factors when mounting these MMICs are to provide a good thermal path and a good RF path to ground. This should be considered when determining the method for attachment.

Note: Many of the NG 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 InP CHIPS.

PLEASE REFER TO OUR "GaAs & InP Chip Handling Application Note" BEFORE HANDLING, ASSEMBLING OR BIASING THESE MMICs!

Page 5

www.ngc.com

www.ngc.com/what-we-do/microelectronics-space-park/

Phone: (310) 814-5000 • Fax: (310) 812-7011 • Email: asmps.sales@ngc.com

Approved for Public Release: NG24-1211. © 2024 Northrop Grumman Systems Corporation

© Northrop Grumman Systems Corporation
Preliminary Information: The data contained in this document describes new products in the sampling or preproduction phase of development and is for information only. Northrop Grumman reserves the right to change without notice the characteristics data and other specifications as they apply to this product. The product represented by this datasheet is subject to the U.S. Export Law as contained in the EAR regulations.

**NORTHROP
GRUMMAN**