

## General Description

The **VWA500052AA** is a distributed amplifier designed on a 0.15µm pHEMT process.

The device is capable of more than +21dBm of output power at saturation regime, up to 40GHz, and more than +17dBm of output power at 1 dB of gain compression, up to 34GHz. It provides more than 12dB of linear gain from DC to 44 GHz with a positive slope through 40GHz. This device can provide up to 11 dB gain up through 50GHz when operating with V<sub>D</sub>= 6V, with an excellent group delay. The Design has been optimized to provide high efficiency. The supply current is as low as 170mA when operating with V<sub>D</sub>= +6V.

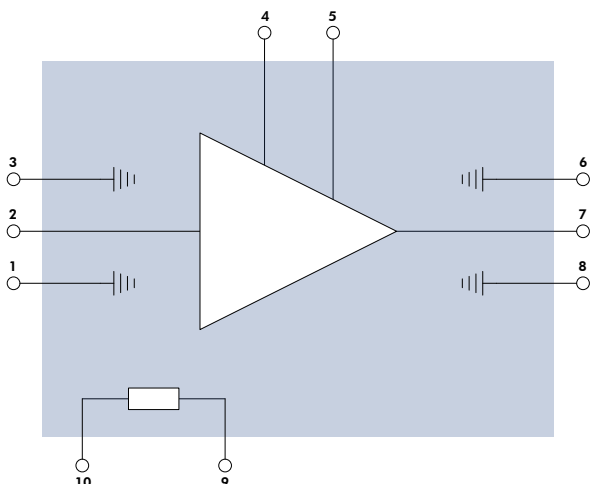
## Features

- Wideband Distributed amplifier pHEMT GaAs MMIC
- Wideband: DC to 44GHz.
- Flat group delay
- 50ΩRF Single ended input and output
- DC coupled In, DC coupled Out
- P<sub>1dB</sub> : +17dBm DC to 34GHz
- P<sub>SAT</sub> >+21dBm DC to 40 GHz
- Small signal gain : >12dB from 2 to 40GHz
- Power supply : 170mA @ +6V
- Chip size : 2.29 x 1.28 x 0.1 mm

## Applications

- Wide Band Amplifier
- Radar / ECM / ECCM
- Test and measurement
- Telecommunication format NRZ, PAM4, 56GBPS
- Broadband / datalink communication

## Pins Assignment & Functional Block Diagram



Symbol	Pad N°
RF In	2
V <sub>G2</sub>	4
V <sub>D_Load</sub>	5
V <sub>D</sub> & RF Out	7
V <sub>G1_A</sub>	9
V <sub>G1_B</sub>	10

## Electrical Specifications ( Test Under Probes )

**Test conditions unless otherwise noted:**

- $T_{amb.} = +25^{\circ}\text{C}$
- $V_D = +6\text{V}$
- $I_D = 170\text{mA}$
- $V_{G2} = +2.5\text{V}$

Symbol	Parameter	Min	Typ	Max	Unit
F	Frequency range	DC		40	Ghz
NF	Noise figure			4	dB
G	Small signal gain		12.5		dB
$\Delta G$	Average gain positive slope		0.0375		dB
S11	Input return loss		-10	-7	dB
S22	Output return loss		-18		dB
P1dB	Output P1dB from DC to 34GHz	17	18		dBm
$P_{SAT}$	Saturated output power		21		dBm
$I_D$	Drain current		170		mA

## Environmental parameters

Symbol	Parameter	Values	Unit
Top	Operating temperature range	-40/+85	$^{\circ}\text{C}$
Tstg	Storage temperature range	-55/+85	$^{\circ}\text{C}$

## Absolute Maximum Ratings

Symbol	Parameter	Min	Max	Unit
$V_D$	Drain bias voltage		9	V
$V_{G2}$	Gate control input access for second stage	-1	$V_D/2$	V
Pin	RF input power		18	dBm
Pcw	Continuous power dissipation		2	W
T process	Temperature process max 20 seconds		325	$^{\circ}\text{C}$

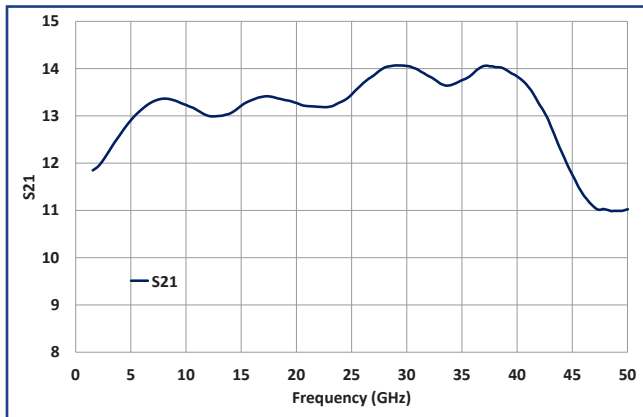
Operation of this device above any of these parameters may cause permanent damage.

**Typical Performances (Test Under Probes)**

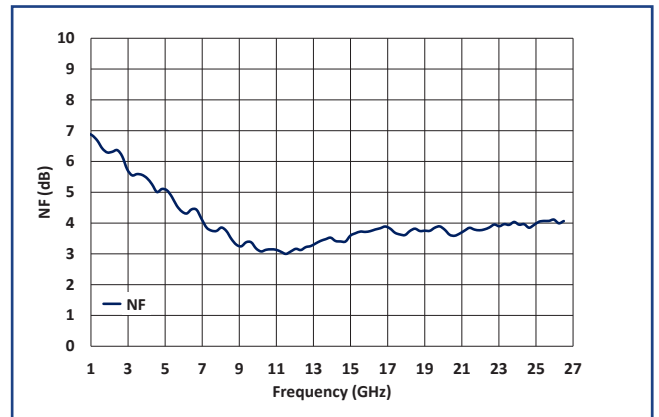
Test conditions unless otherwise noted:

- $T_{amb.} = +25^{\circ}C$
- $V_D = +6V$
- $I_D = 170mA$
- $V_{G2} = +2.5V$

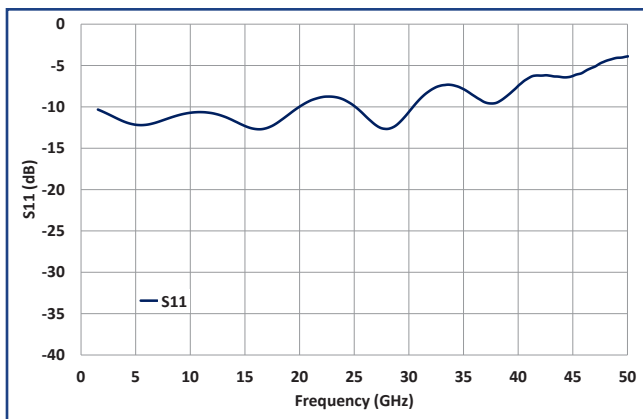
**Small Signal Gain**



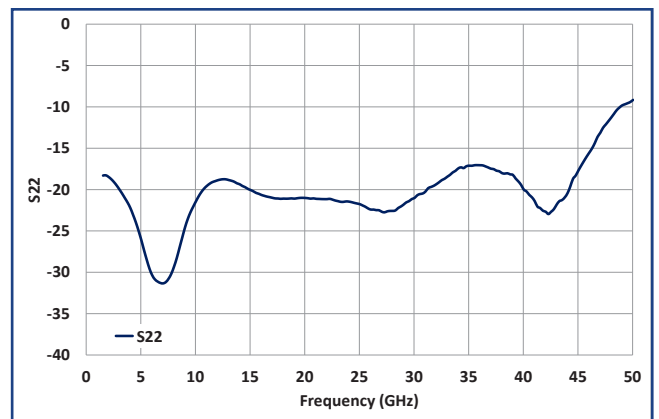
**Noise Figure**



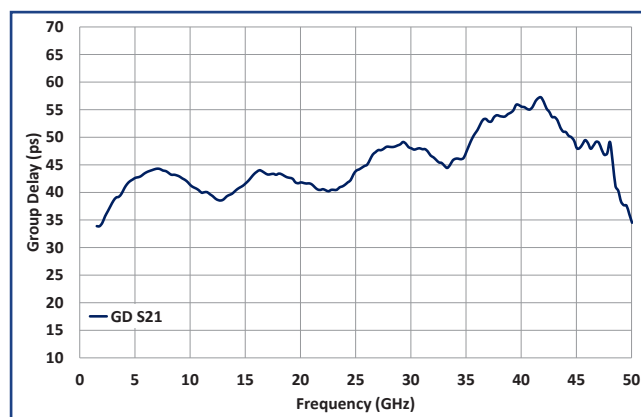
**Input Return Loss**



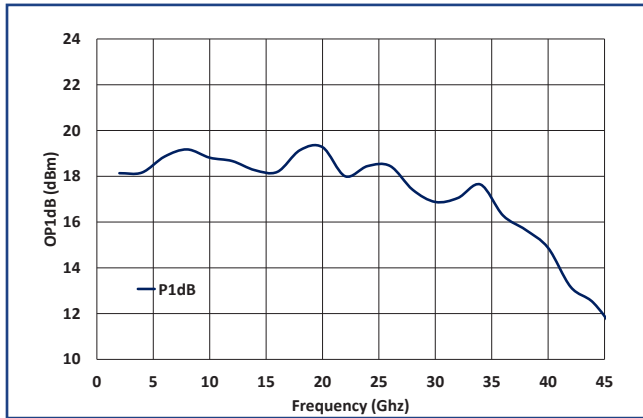
**Output Return Loss**



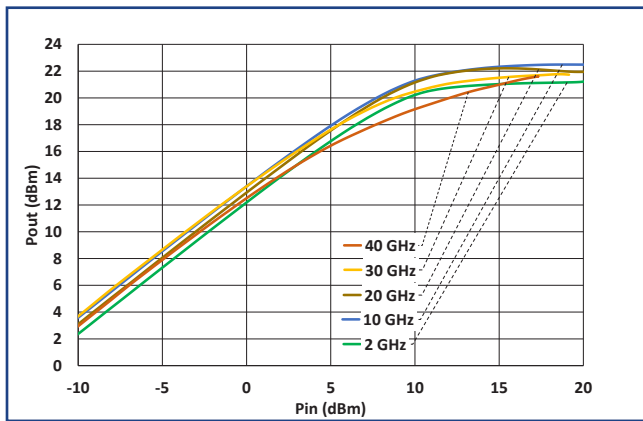
**Group Delay**



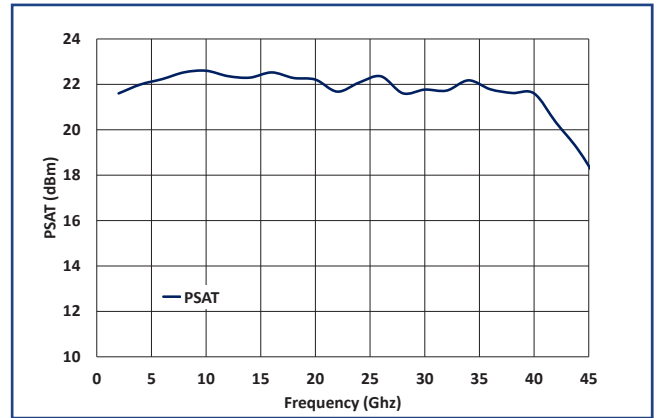
Output P1dB



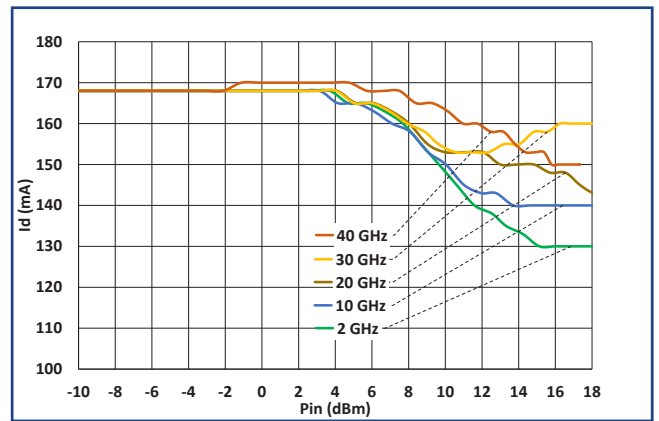
Output Power VS Input Power for various Frequency



Saturated Output Power



Drain Current VS Input Power for various Frequency



**Biasing procedure**

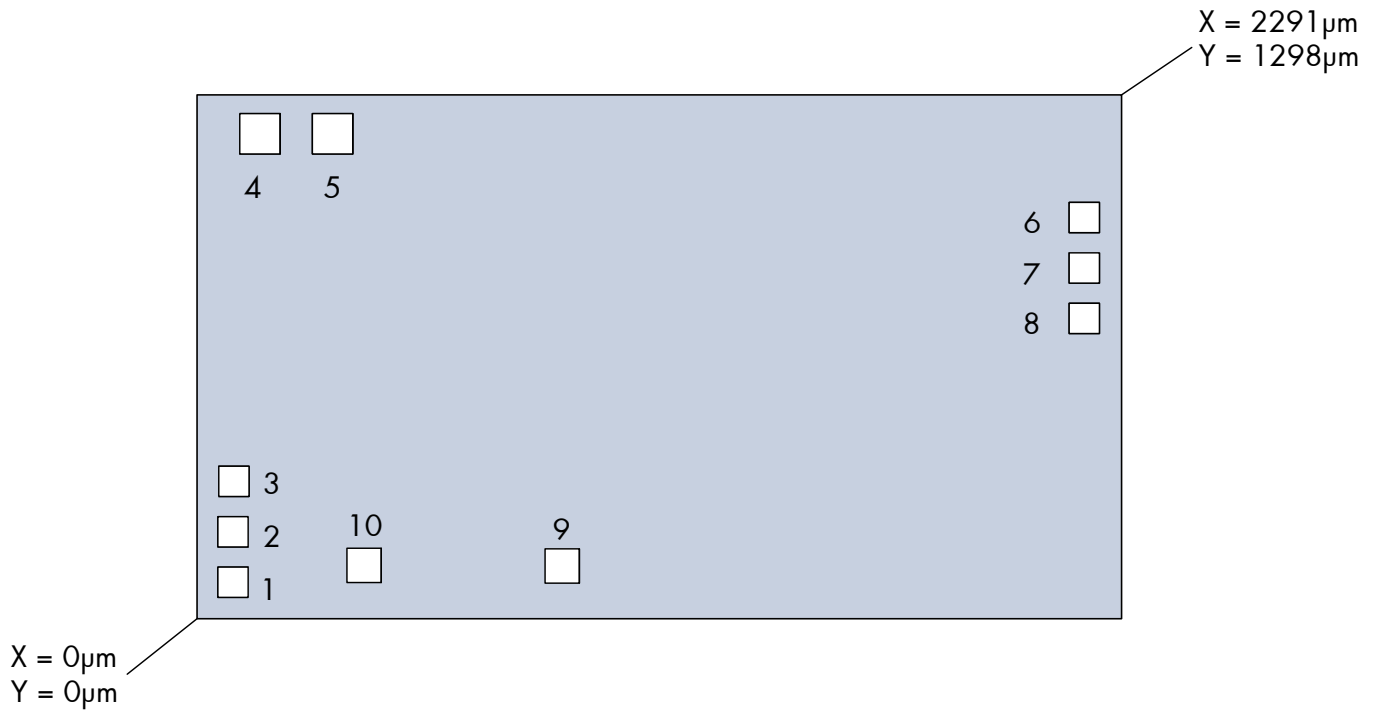
**Switch on**

1. Set  $V_D$  to +6V
2. Set  $V_{G2}$  to +2.5V
3. Turn RF Input ON

**Switch off**

1. Turn RF Input OFF
2. Decrease  $V_{G2}$  to 0V
3. Decrease  $V_D$  to 0V

## Die Layout



## Pinout and Bonding Pad Coordinates

Die Pin Out				
Pad	X (µm)	Y (µm)	Size (µm x µm)	Function
1	89	90	75x75	GND
2	89	215	75x75	RF In
3	91	340	75x75	GND
4	158	1201	100x100	V <sub>G2</sub>
5	336	1201	100x100	V <sub>D_Load</sub>
6	2198	994	75x75	GND
7	2198	869	75x75	RF Out
8	2198	744	75x75	GND
9	905	131	100x100	V <sub>G1_A</sub>
10	415	131	100x100	V <sub>G1_B</sub>

Die thickness = 100µm

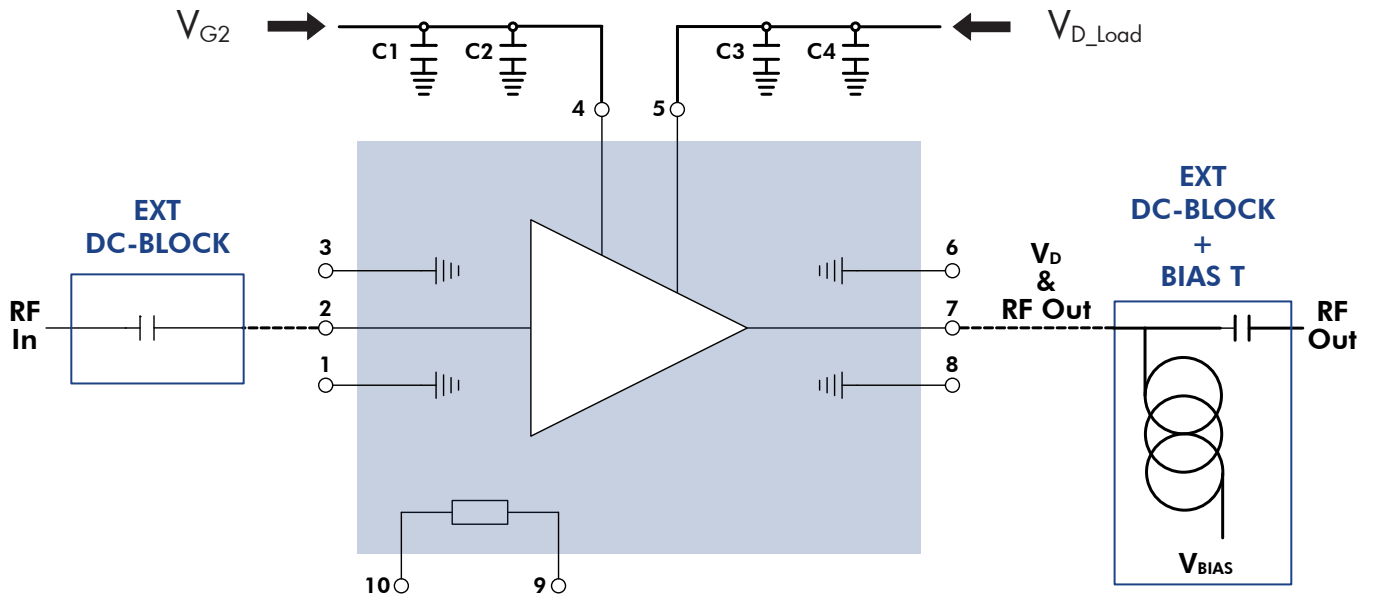
Die bottom must be connected to ground (RF and DC)

**Access Description**

Pin Number	Name	Description	Electrical interface
2	RF In	RF Amplifier input, this access is AC coupled and internally matched to 50Ω.	
4	V <sub>G2</sub>	Gate control input access for second stage distributed amplifier structure. Apply +2.5V for nominal biasing conditions.	
5	V <sub>D_Load</sub>	Drain termination load decoupling access. For lower frequency applications, this access can be connected to a MIM 100pF or 1000pF capacitor, with a low inductance connection.	
7	RF Out	RF Amplifier output, this access is DC coupled and internally matched to 50Ω. It is also used to feed the drain current (I <sub>D</sub> ), by using a wide bandwidth external Bias-T structure.	
9	V <sub>G1_A</sub>	Gate control input access for first stage distributed amplifier structure. Unused for nominal biasing conditions.	
10	V <sub>G1_B</sub>	Gate control output access for first stage distributed amplifier structure. Unused for nominal biasing conditions.	
Die Bottom	GND	Die must be connected to RF and DC Ground	

## Application Circuit

- C1, C4: 1 $\mu$ F
- C2, C3: 1nF capacitors are MIM type and must be placed as close as possible to the die access.



**Ordering Information**

Product Code	Definition
VWA 5000052AA	DC To 44GHz / 12dB Gain / 21dBm P <sub>SAT</sub>

**Associated Material**

Material	Status
Packaged die	Contact factory
Die Evaluation Board (die EVB)	Contact factory
Packaged die Evaluation Board (packaged die EVB)	Contact factory
Mechanical files (DXF)	Contact factory
Measuments files (S2P)	Contact factory

**Product Compliance Information**

**Solderability :**

Use only AuSn (80/20) solder and limit exposure to temperature above 300 °C TO 3 - 4 minutes, maximum

**ESD Sensitivity Rating :**

Test : Human Body Model (HBM)  
 Standard : JEDEC Standard JESD22-A114



**CAUTION ! ESD-Sensitive device**

**RoHS-Compliance :**

This part is compliant with EU 2011/65/EU RoHS directive (Restrictions on the Use of Certain Hazardous Substances in Electrical and Electronic Equipment).

This product also has the following attributes:

- Lead Free
- Halogen Free (Chlorine, Bromine)
- Antimony Free
- TBBP-A (C15H12Br4O2) Free
- PFOS Free
- SVHC Free

**Contact Information**

For the latest specifications, additional product information, worldwide sales and distribution locations, and information about Vectrawave:

Vectrawave SA  
 5, rue Louis de Broglie  
 22 300 Lannion  
 France

[www.vectrawave.com](http://www.vectrawave.com)  
 Email sales: [contact\\_sales@vectrawave.com](mailto:contact_sales@vectrawave.com)  
 Tel sales:+33 (0)2 57 63 00 20

**Represented by** .....