Vectrawave
RF & Millimeter Wave MMIC Design

2 to 18GHz - 10W
GaN/SiC WideBand Power Amplifier

VM209F

General Description

VM209F is a packaged 10W Gallium Nitride (GaN) wideband 2-18GHz 3 stages amplifier. It's designed specifically with high power gain greater than 21dB.

It is manufactured with a 150nm pHEMT GaN process and is especially suited for radar applications.

The device contains internal DC block and internal drain bias, therefore, no need for external bias-tee.

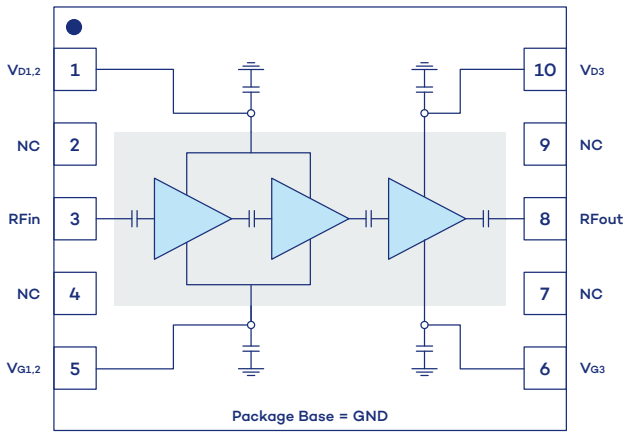
Features

Frequency range	**2 – 18GHz**
Output Power	**40dBm @Pin = 18dBm**
PAE	**20% @Pin = 18dBm**
Power Gain	**21dB @Pin = 18dBm**
Linear Gain	**28dB**
50 Ohm, AC coupled RF input and output	
DC bias	**V_D = +28V, I_{DQ} = 1.12A, V_G = -1.72V (Typical)**
Copper composite base to reduce thermal resistance	
Flange Package	**11.43 x 17.32 x 3.15 (mm)**

Applications

- Radar
- Test and Measurement

Pins Assignement & Functional Block Diagram



Function	Pin number
$V_{D1, 2}$	1
RF in	3
$V_{G1, 2}$	5
V_{G3}	6
RF out	8
V_{D3}	10

Electrical Specifications

Test conditions: unless otherwise noted
- Tested on EVB @ Room Temperature
- Reference plane : Flange Access
- Room Temperature = +25°C
- V_D = +28V
- I_{DQ} = 1.12A (V_G=-1.72V Typ.)
- CW

Symbol	Parameter	Min	Typ	Max	Unit
F	Frequency range	2		18	GHz
Temp	Temperature	-40		+85	°C
V_D	Drain voltage		28		V
I_{DQ}	Drain current		1.12		A
G	Linear gain		28		dB
S11	Input return loss		-14	-8	dB
S22	Output return loss		-10		dB
Pout	Output power (@Pin=18dBm)	39.5	40		dBm
PAE	Associated Power Added Efficiency (@Pin=18dBm)		20		%
PG	Large Signal Gain (@Pin=18dBm)	21			dB
Flat	Gain Flatness		+/-1		dB
I_D	Drain Current (@Pin=18dBm)		1.8		A
	Input and Output Matching		50		Ω

Recommended Operating Conditions

Symbol	Parameter	Value	Unit
V_D	Drain voltage	28	V
I_{DQ}	Drain quiescent current	1.12	A
V_G	Gate voltage	-1.72 (Typ.)	V

Absolute Maximum Ratings

Symbol	Parameter	Value	Unit
V_D	Drain bias voltage	35	V
I_D	Drain bias current	2.4	A
Pin	Maximum peak input power overdrive	22	dBm
Tj	Junction Temperature	-	°C
Ta	Operating temperature range	-40/+85	°C
Tstg	Storage temperature range	-55/+150	°C

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

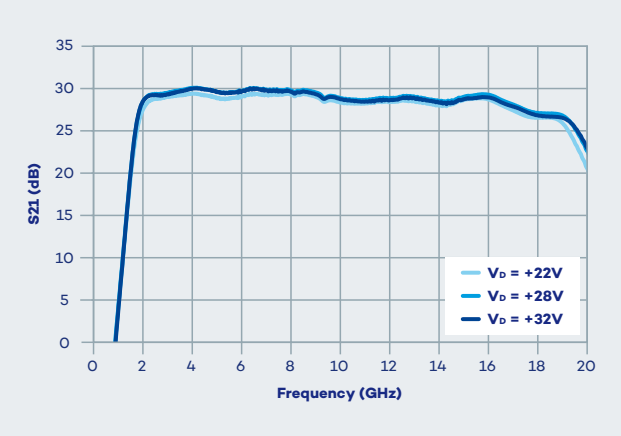
Thermal Information

A heatsink equipped with a fan is used to manage thermal cooling.
On standard test condition (V_D = 28V / I_{DQ} = 1.12A / RF OFF) : Tbase is estimated around 35°C more than room temperature used as instruction.

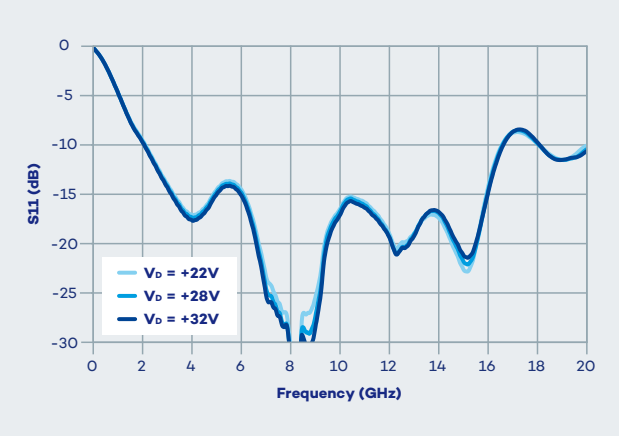
Typical Performance
(Small signal / Board Measurement)

Test conditions: unless otherwise noted
- Reference plane: EVB Connector Access
- V_D = +28V
- I_{DQ} = 1.12A (V_G = -1.72V Typ.)
- Tested on EVB @ Room Temperature

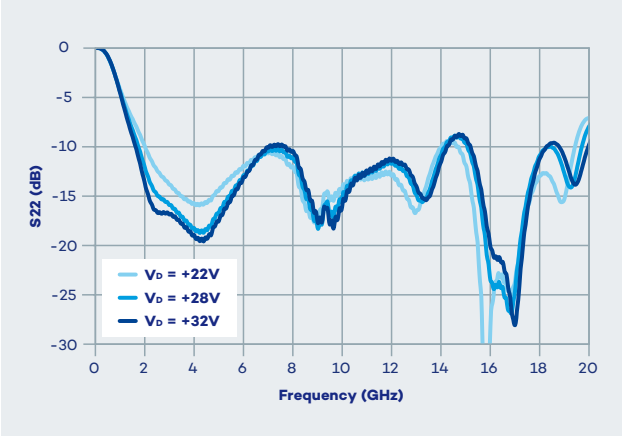
Gain vs Frequency vs V_D



Input Return Loss vs V_D



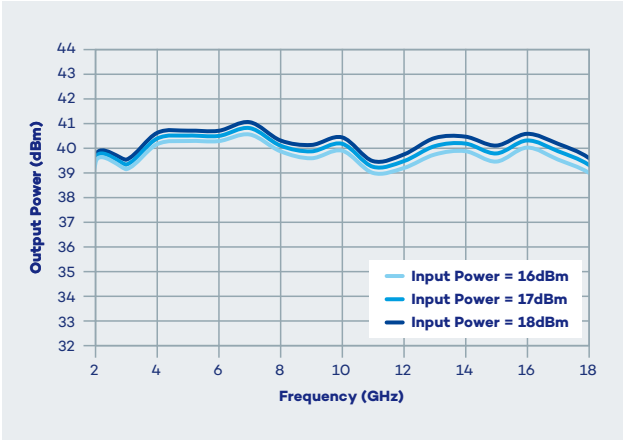
Output Return Loss vs V_D



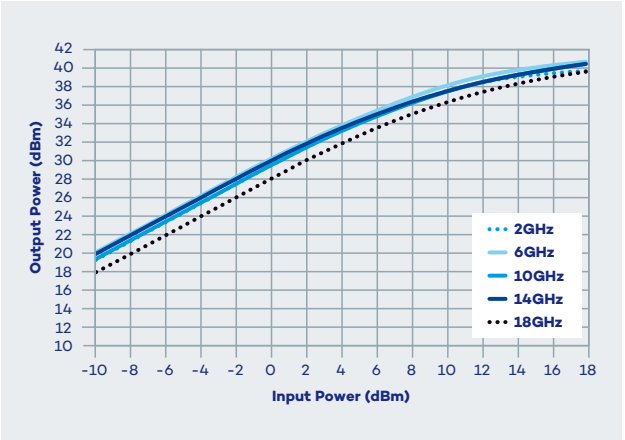
Typical Performance
(Large signal / Board Measurement)

Test conditions: unless otherwise noted
- Reference plane : Flange Access
- **V_D = +28V**
- I_{DQ} = 1.12A (V_G = -1.72V Typ.)
- Pin=18dBm
- Tested on EVB @ Room Temperature
- CW

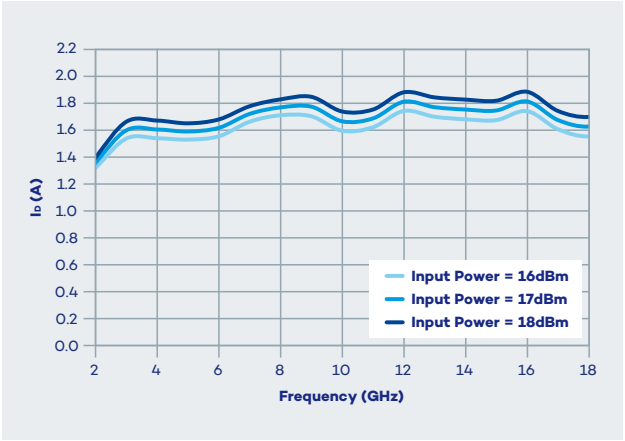
Output Power vs Frequency vs Input Power



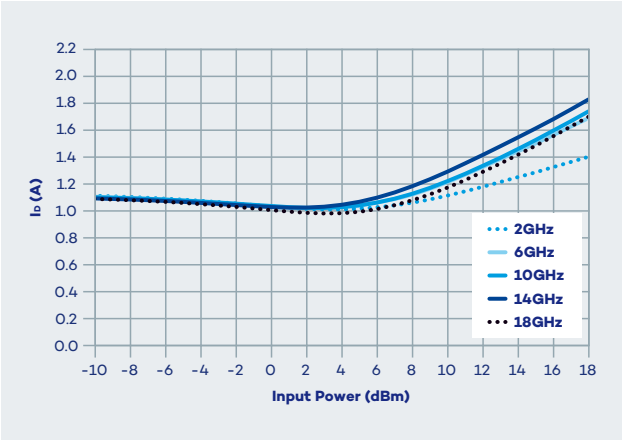
Output Power vs Input Power vs Frequency



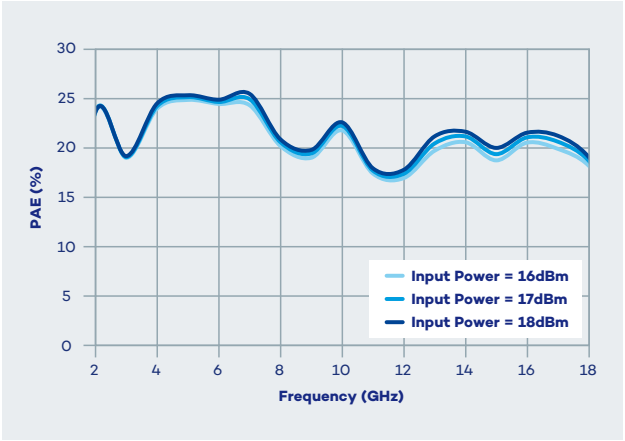
Drain Current vs Frequency vs Input Power



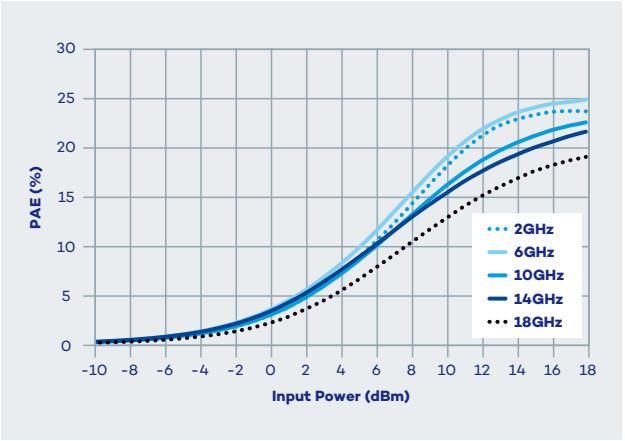
Drain Current vs Input Power vs Frequency



PAE vs Frequency vs Input Power



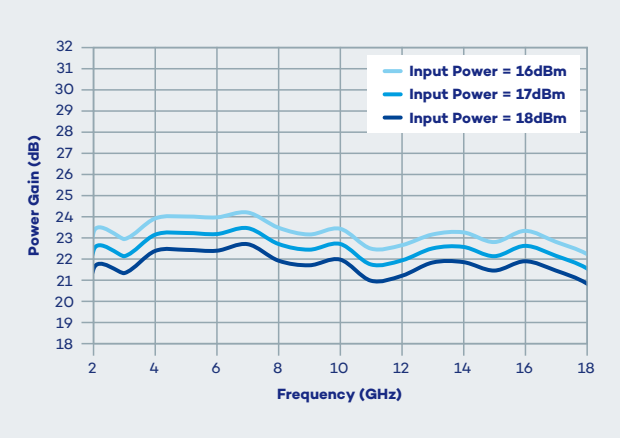
PAE vs Input Power vs Frequency



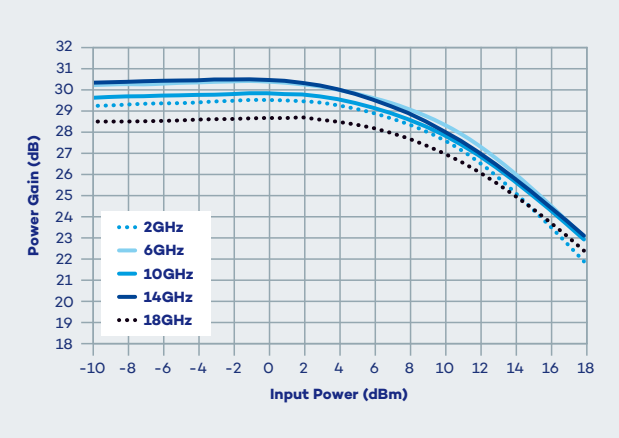
Typical Performance
(Large signal / Board Measurement)

Test conditions: unless otherwise noted
- Reference plane : Flange Access
- **V_D = +28V**
- I_{DQ} = 1.12A (V_G = -1.72V Typ.)
- Pin=18dBm
- Tested on EVB @ Room Temperature
- CW

Power Gain vs Frequency vs Input Power



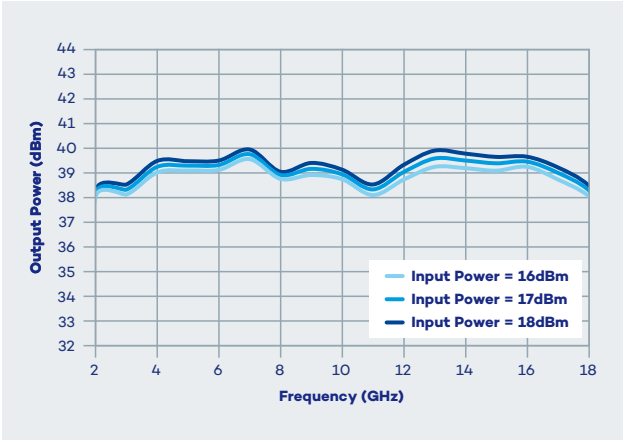
Power Gain vs Input Power vs Frequency



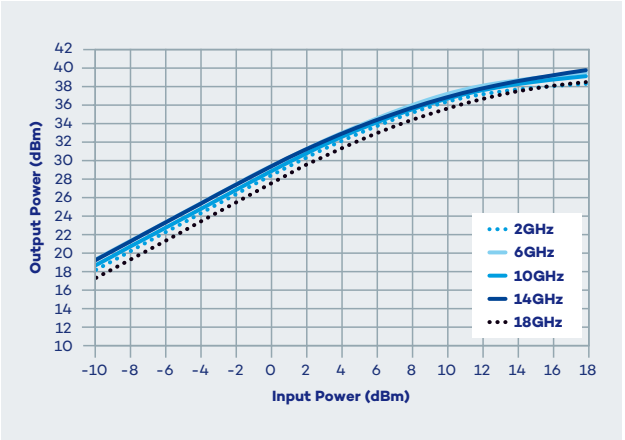
• Typical Performance
(Large signal / Board Measurement)

Test conditions: unless otherwise noted
- Reference plane : Flange Access
- **V_D = +22V**
- I_{DQ} = 1.12A (V_G = -1.72V Typ.)
- Pin=18dBm
- Tested on EVB @ Room Temperature
- CW

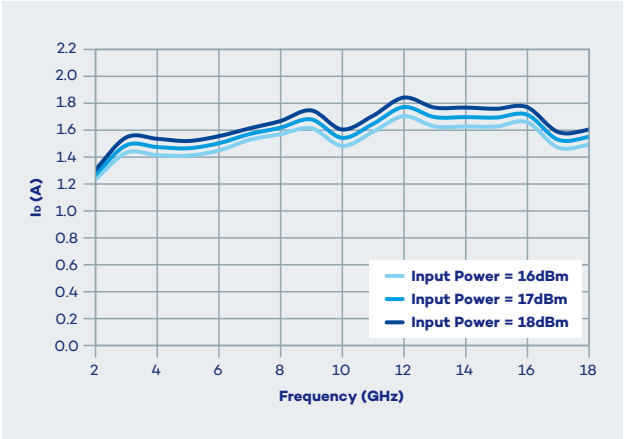
Output Power vs Frequency vs Input Power



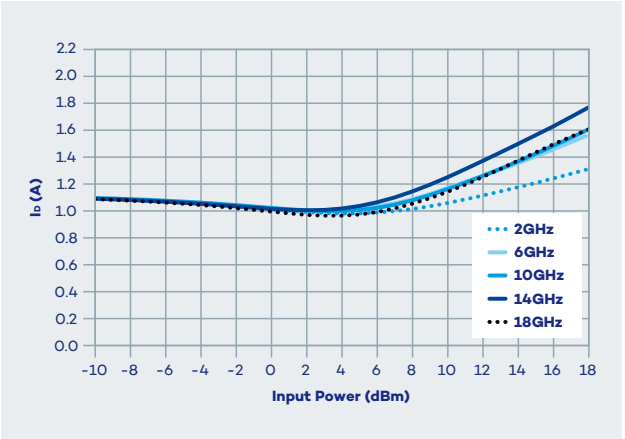
Output Power vs Input Power vs Frequency



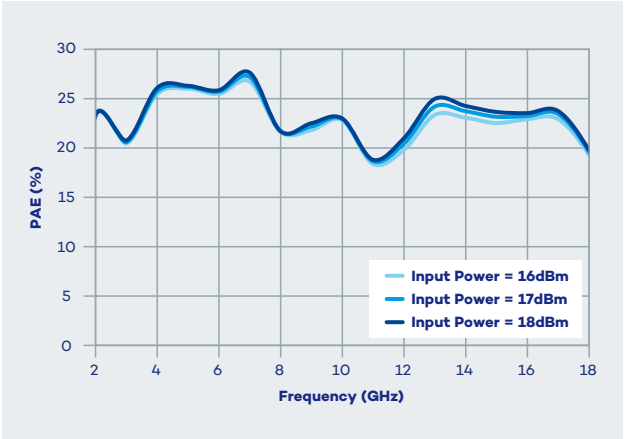
Drain Current vs Frequency vs Input Power



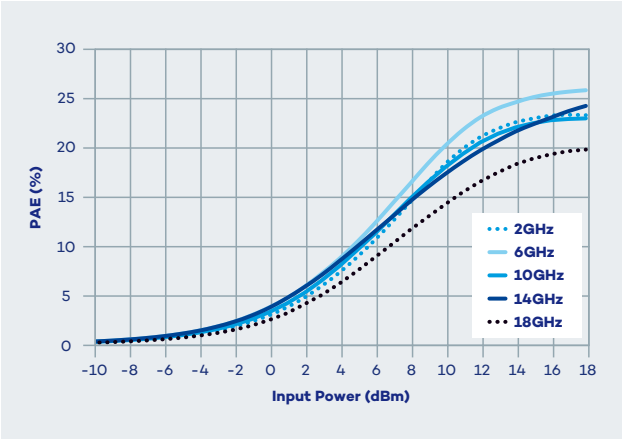
Drain Current vs Input Power vs Frequency



PAE vs Frequency vs Input Power



PAE vs Input Power vs Frequency



Typical Performance
(Large signal / Board Measurement)

Test conditions: unless otherwise noted
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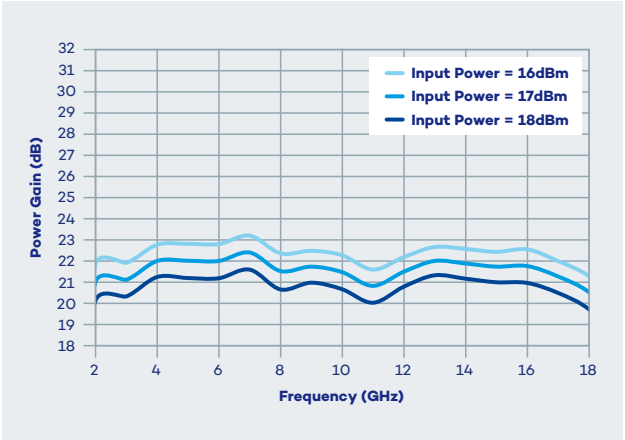
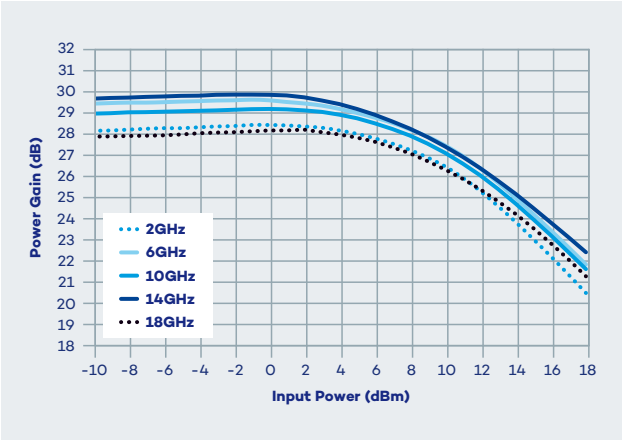
- **V_D = +22V**
- I_{DQ} = 1.12A (V_G = -1.72V Typ.)
- Pin=18dBm
- Tested on EVB @ Room Temperature
- CW

Power Gain vs Frequency vs Input Power

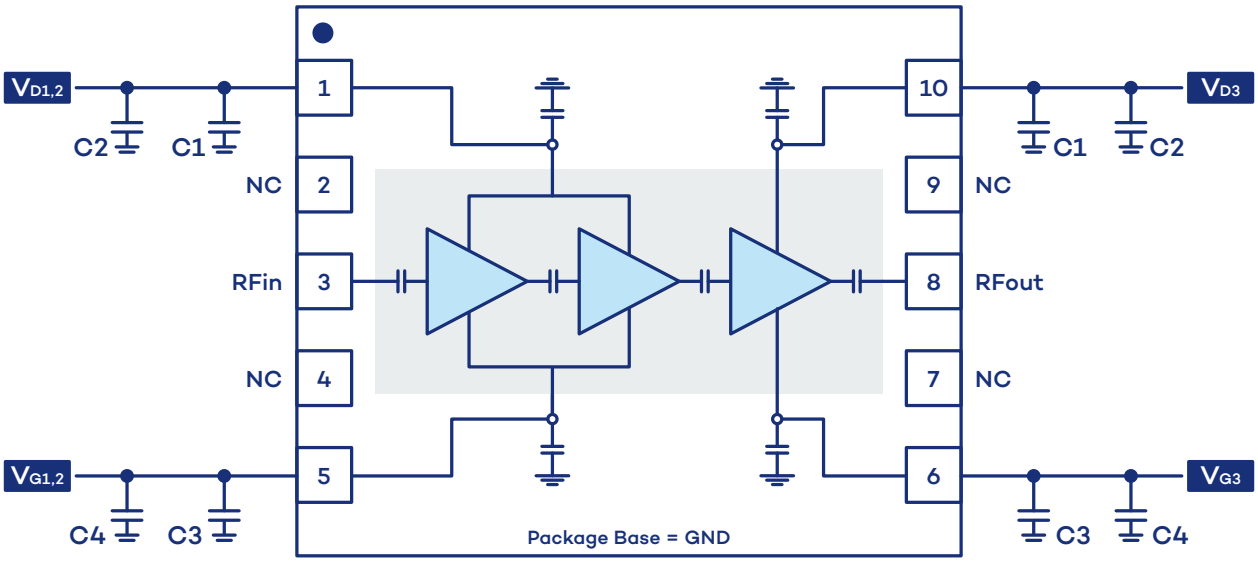


Power Gain vs Input Power vs Frequency



Application circuit

- C1 = 1µF
- C2 = 10µF
- C3 = 1µF
- C4 = 100µF



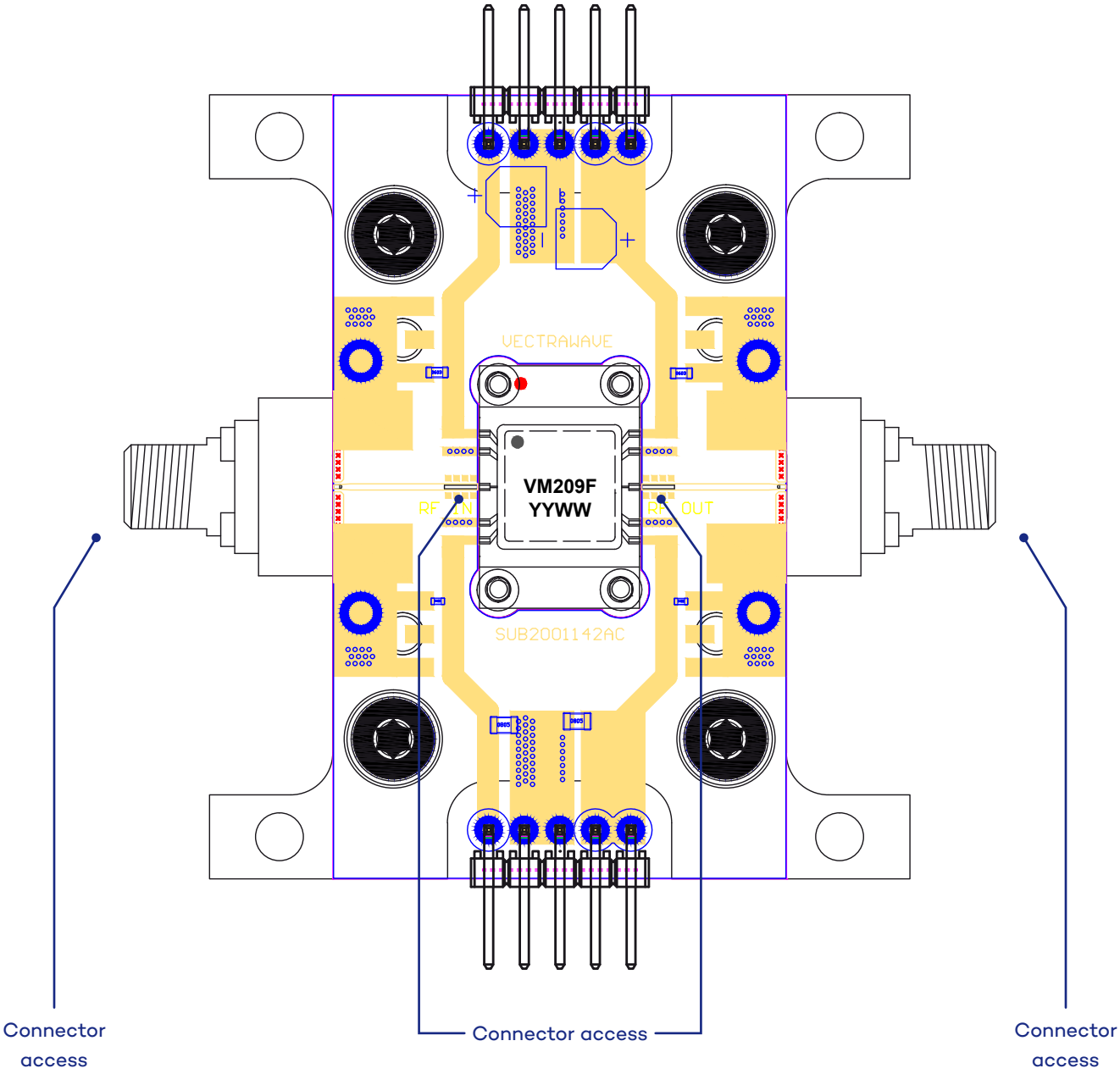
Bias-up procedure

1. Apply V_G = -3V
2. Apply V_D = +28V
3. Increase V_G to obtain the specificied I_{DQ} = 1.12A
4. Apply RF signal

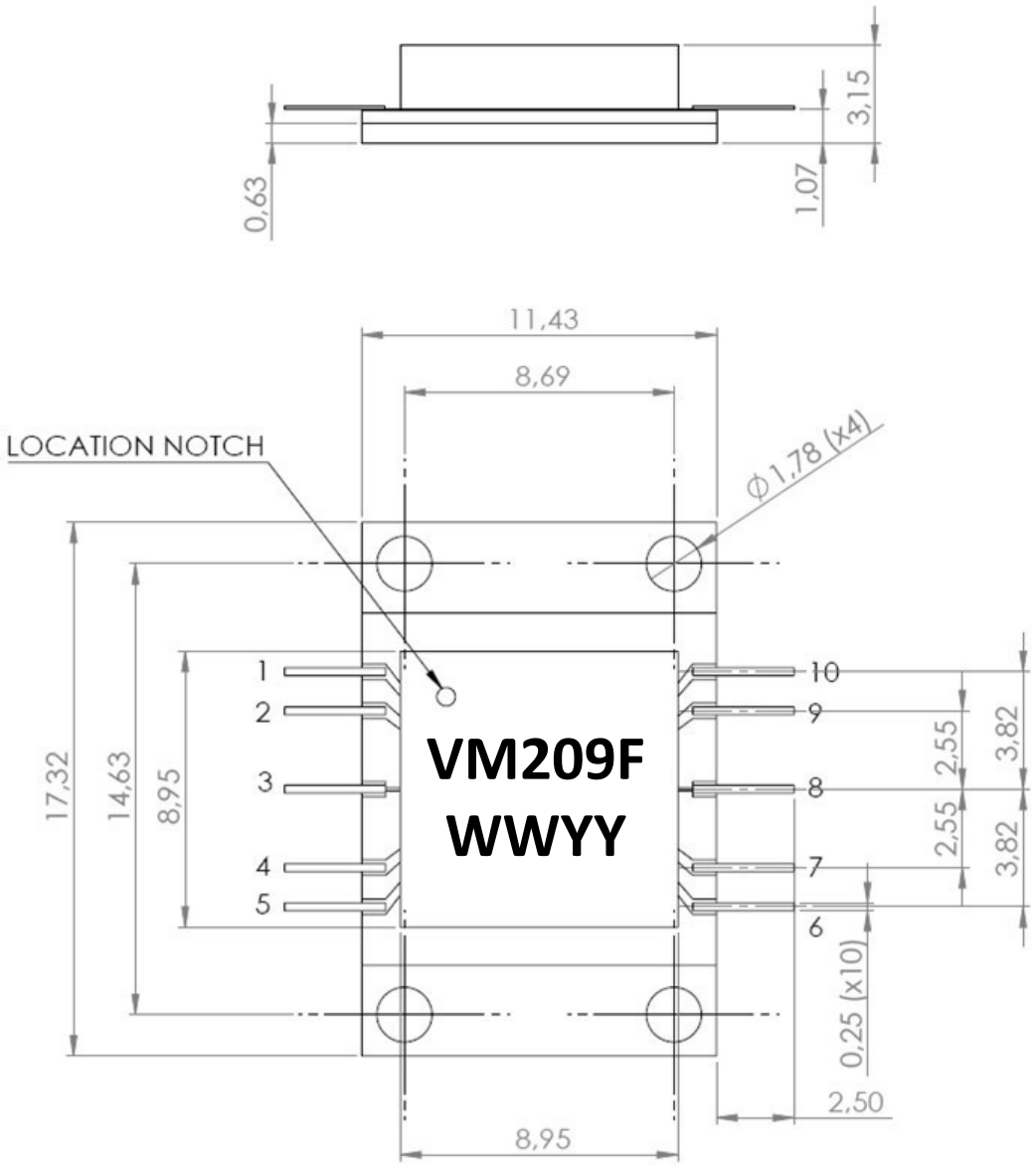
Bias-down procedure

1. Turn off RF signal
2. Reduce V_G to -3V
3. Reduce V_D to +28V
4. Turn off power supply

• Evaluation Board (EVB) Layout Assembly



• PinOut and mechanical drawing



Function	Pin number
$V_{D1, 2}$	1
NC	2
RF in	3
NC	4
$V_{G1,2}$	5

Function	Pin number
V_{G3}	6
NC	7
RF out	8
NC	9
V_{D3}	10

Ordering information

Product Code	Parameter
VM209F	2 to 18GHz - 10W GaN/SiC Power Amplifier in Flange Package

Associated Material

- Packaged die
- Die Evaluation Board (die EVB)
- Packaged die Evaluation Board (packaged die EVB)
- Mechanical files (DXF)
- Measurents files (S2P)

Product Compliance Information

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

ESD Sensitivy Rating
Test: Human Body Model (HBM)
Std: JEDEC Standard JESD22-A114

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).

Other attributes
- Lead Free
- Halogen Free (Chlorine, Bromine)
- Antimony Free
- TBBP-A (C15H12Br402) Free
- PFOS Free
- SVHC Free

Contact information

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

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