Vectrawave
RF & Millimeter Wave MMIC Design

8 to 10.5GHz - 40W
GaN/SiC Power Amplifier

VM088Q

General Description

The VM088Q is a packaged power amplifier developed on 250nm GaN/SiC process and is internally matched through 50Ω RF accesses. It can provide an output power up to 40W and associated power added efficiency of 35% in pulsed mode.

The VM088Q is offered a plastic 48 leads 7x7 QFN designed to a surface mount design board. The VM088Q integrates the VM088D VectraWave HPA.

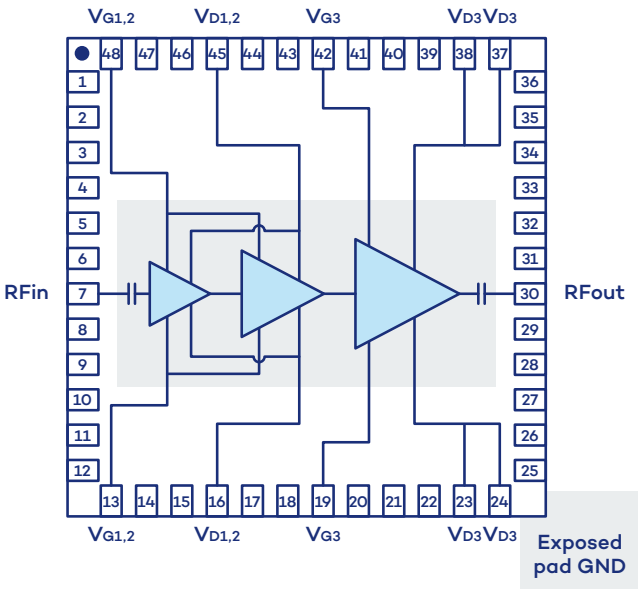
Features

Frequency range	**8 – 10.5GHz**
Output Power	**>46dBm @Pin = 23dBm**
PAE	**35% @Pin = 23dBm**
Linear Gain	**29dB**
DC bias	**V_D = +28V, I_{DQ} = 350mA, V_G = -2.35V (Typical)**
Plastic QFN	**7 x 7 (mm) 48leads**

Applications

- Radar
- Test and Measurement

Pins Assignement & Functional Block Diagram



Function	Pin n°	Function	Pin n°
NC	1 to 6	NC	25 to 29
RFin	7	RFout	30
NC	8 to 12	NC	31 to 36
$V_{G1,2}$	13	V_{D3}	37, 38
NC	14, 15	NC	39 to 41
$V_{D1,2}$	16	V_{G3}	42
NC	17, 18	NC	43, 44
V_{G3}	19	$V_{D1,2}$	45
NC	20 to 22	NC	46, 47
V_{D3}	23, 24	$V_{G1,2}$	48

Electrical Specifications

Test conditions: unless otherwise noted
- T_{amb} = +25°C
- V_D = +28V
- I_{DQ} = 350mA (V_G=-2.35V Typ.)
- Pulsed mode (pulse width: 30µs, duty cycle: 10%)

Symbol	Parameter	Min	Typ	Max	Unit
F	Frequency range	8.0		10.5	GHz
G	Linear gain		29		dB
S11	Input return loss		-8.5		dB
S22	Output return loss		-9.5		dB
Pout	Output power (@Pin=25dBm)		46		dBm
PAE	Associated Power Added Efficiency (@Pin=25dBm)		34		%
I_D	Associated Drain current (@Pin=25dBm)		4.3		A
V_D	Drain voltage		28		V

Recommended Operating Conditions

Symbol	Parameter	Value	Unit
V_D	Drain voltage	28	V
I_{DQ}	Drain quiescent current	350	mA
V_G	Gate voltage	-2.35 (Typ.)	V

Absolute Maximum Ratings

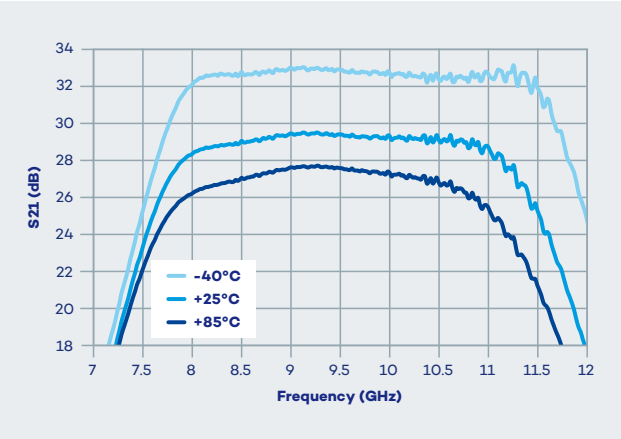
Symbol	Parameter	Value	Unit
V_D	Drain bias voltage	35	V
I_D	Drain bias current	8	A
V_G	Gate bias voltage	-10 to -2	V
Pin	Maximum peak input power overdrive	30	dBm
Tj	Junction temperature	225	°C
Ta	Operating temperature range	-40/+85	°C
Tstg	Storage temperature range	-55/+150	°C

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

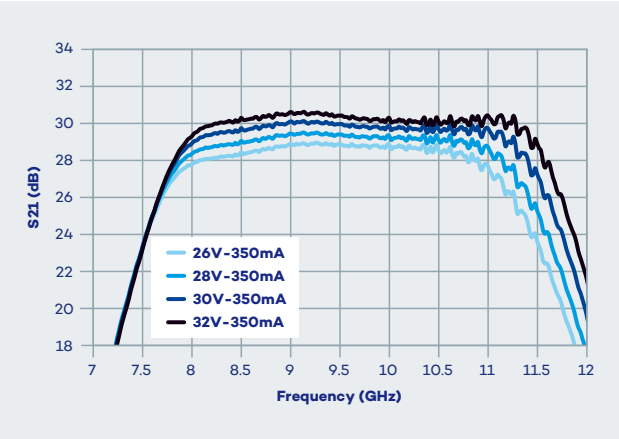
Typical Performance
(Small signal / Board Measurement)

Test conditions: unless otherwise noted
- Reference plane: connector access
- V_D = +28V
- I_{DQ} = 350mA (V_G = -2.35V Typ.)
- Pin = -20dBm

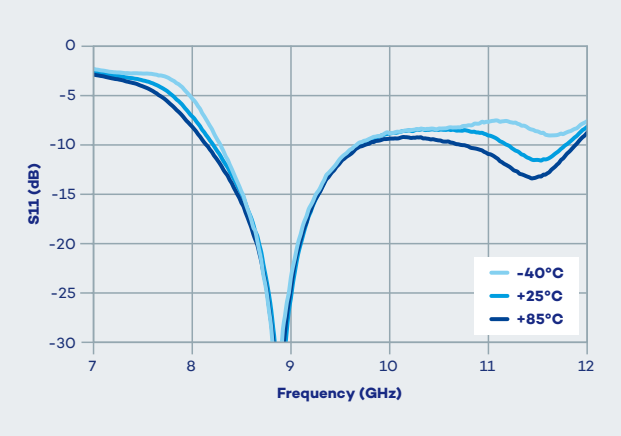
Gain vs Frequency vs Temperature



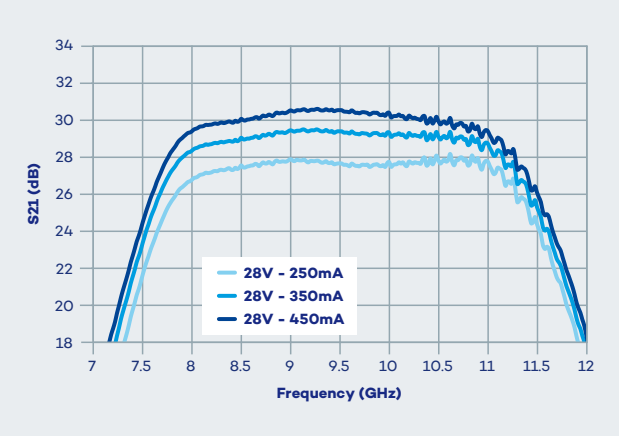
Gain vs Frequency vs V_D



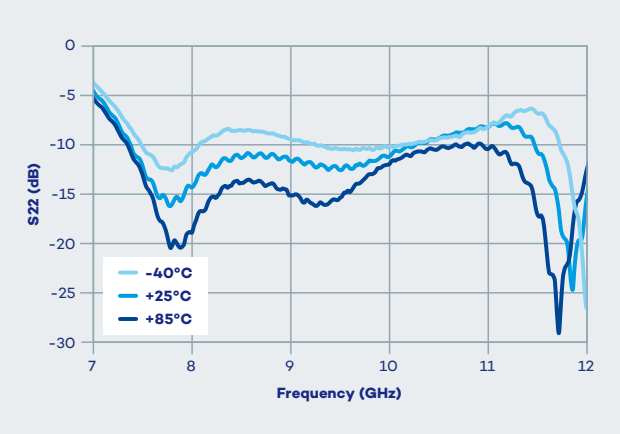
Input Return Loss vs Frequency vs Temperature



Gain vs Frequency vs I_{DQ}



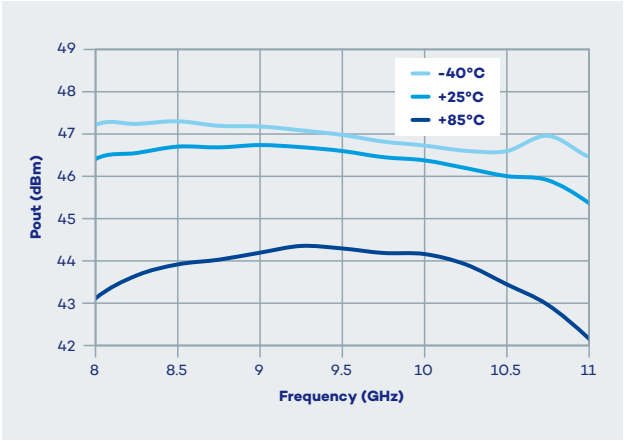
Output Return Loss vs Frequency vs Temperature



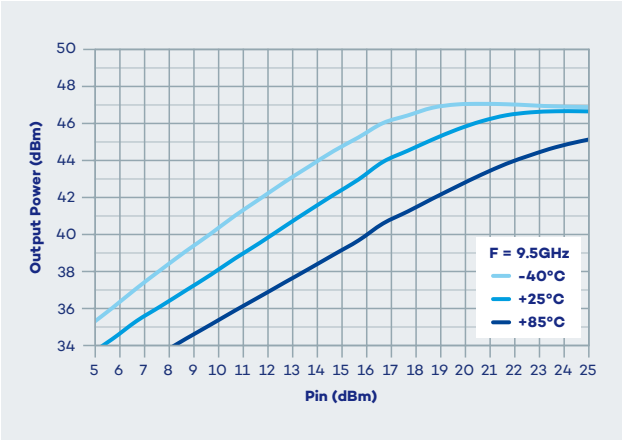
Typical Performance
(Large signal / Board Measurement)

Test conditions: unless otherwise noted
- Reference plane: component access
- V_D = +28V
- I_{DQ} = 350mA (V_G = -2.35V Typ.)
- Pin = +23dBm
- Pulsed mode (pulse width: 30µs, duty cycle: 10%)

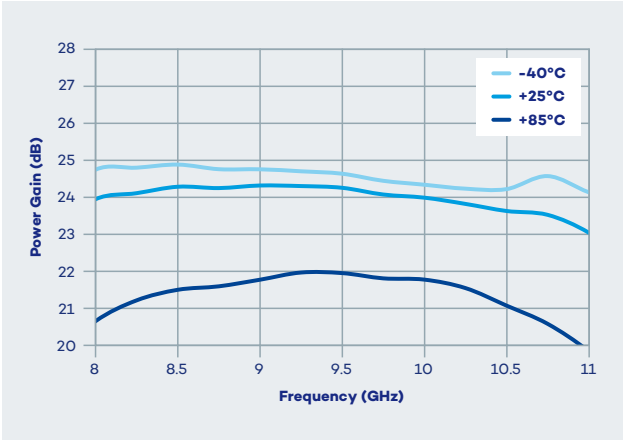
Output Power vs Frequency vs Temperature



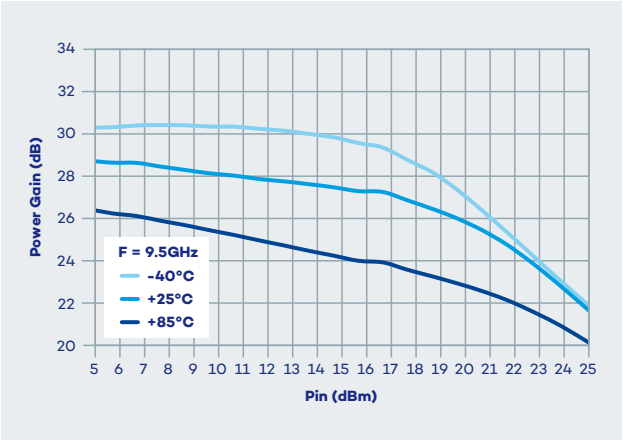
Output Power vs Input Power vs Temperature



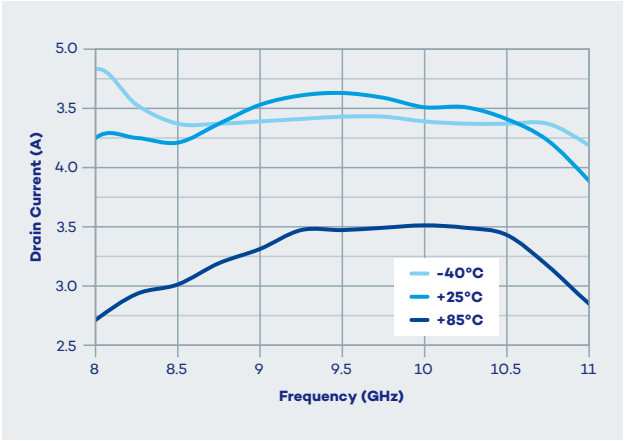
Power Gain vs Frequency vs Temperature



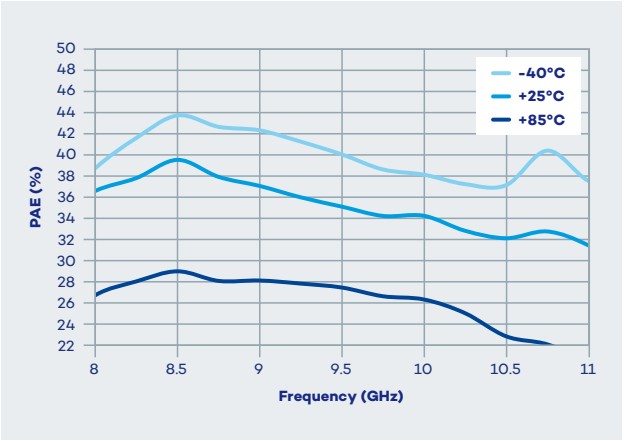
Gain vs Input Power vs Temperature



Drain Current vs Frequency vs Temperature



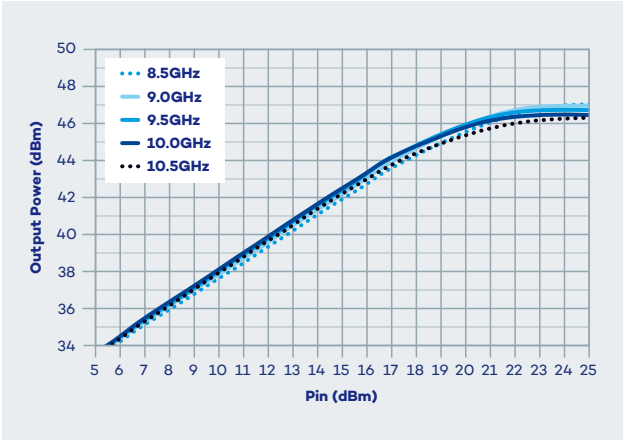
PAE vs Frequency vs Temperature



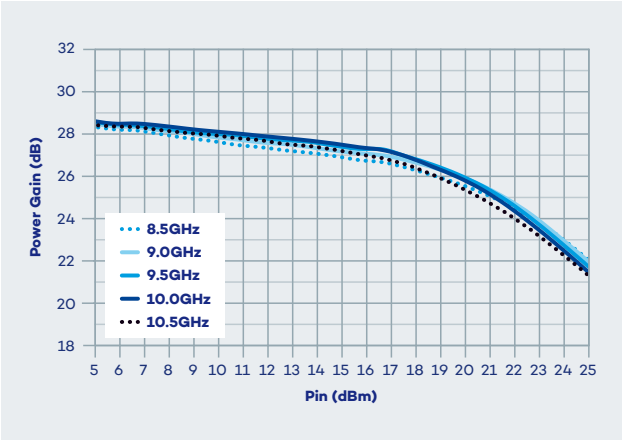
Typical Performance
(Large signal / Board Measurement)

Test conditions: unless otherwise noted
- Reference plane: component access
- V_D = +28V
- I_{DQ} = 350mA (V_G = -2.35V Typ.)
- T_{amb} = +25°C
- Pulsed mode (pulse width: 30µs, duty cycle: 10%)

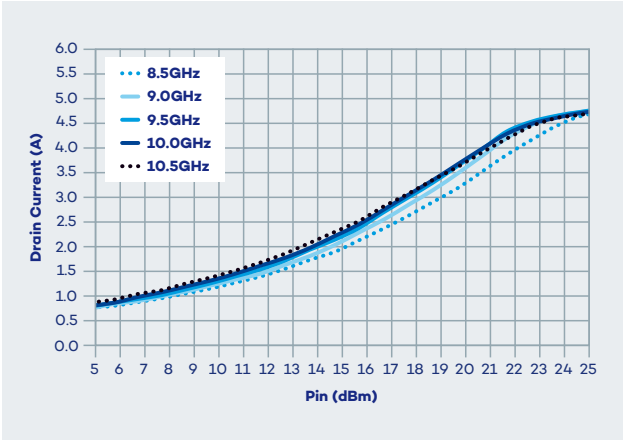
Output Power vs Input Power vs Frequency



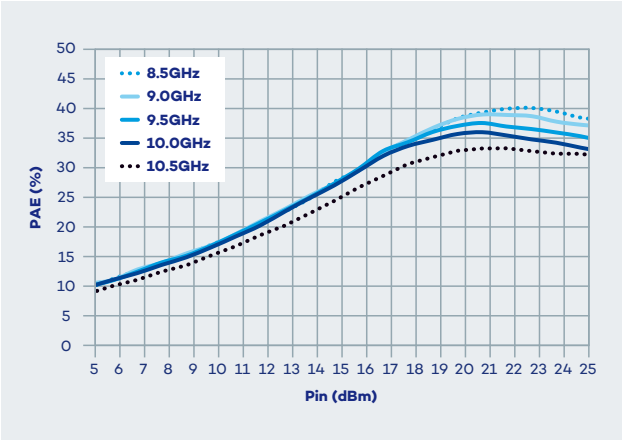
Gain vs Input Power vs Frequency



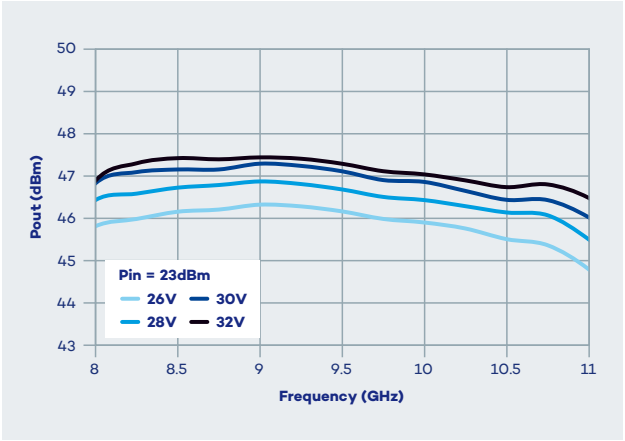
Drain Current vs Input Power vs Frequency



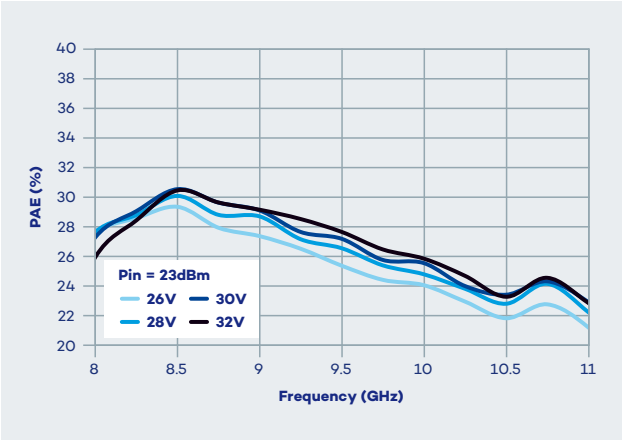
PAE vs Input Power vs Frequency



Output Power vs Frequency vs V_D



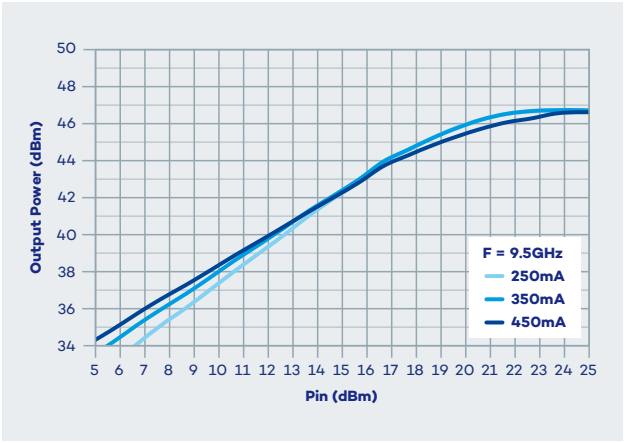
PAE vs Frequency vs V_D



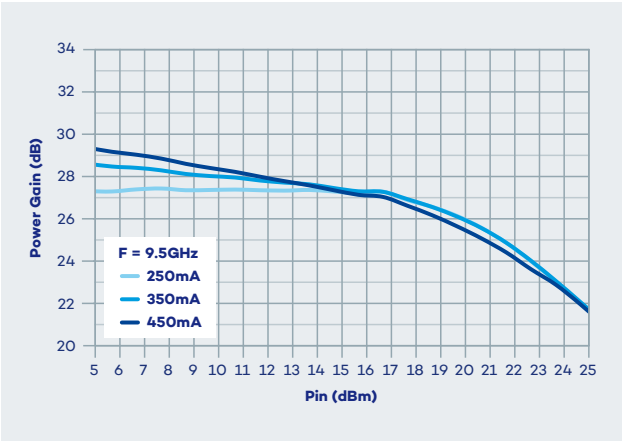
Typical Performance
(Large signal / Board Measurement)

Test conditions: unless otherwise noted
- Reference plane: component access
- V_D = +28V
- T_{amb} = +25°C
- Pulsed mode (pulse width: 30µs, duty cycle: 10%)

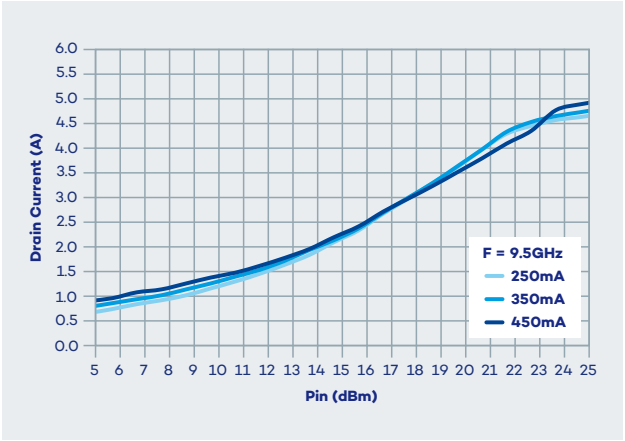
Output Power vs Input Power vs I_{DQ}



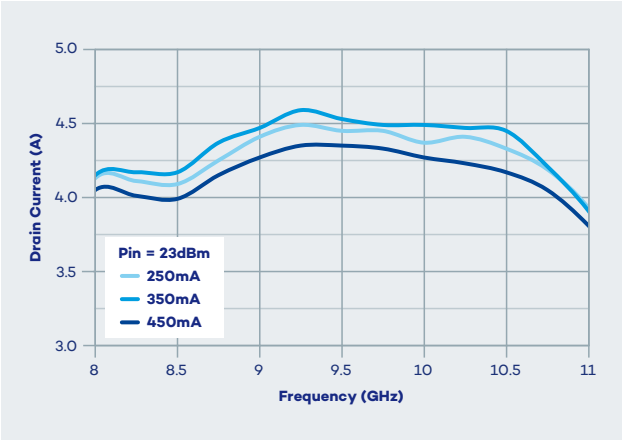
Gain vs Input Power vs I_{DQ}



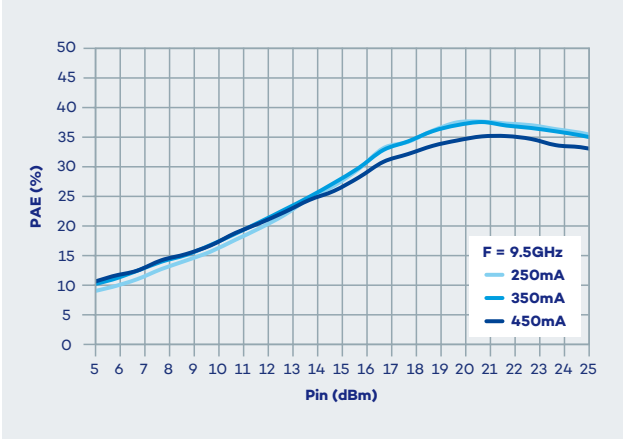
Drain Current vs Input Power vs I_{DQ}



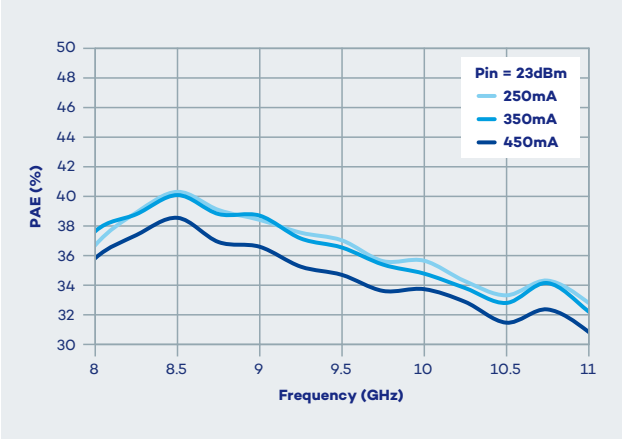
Drain Current vs Frequency vs I_{DQ}



PAE vs Input Power vs I_{DQ}

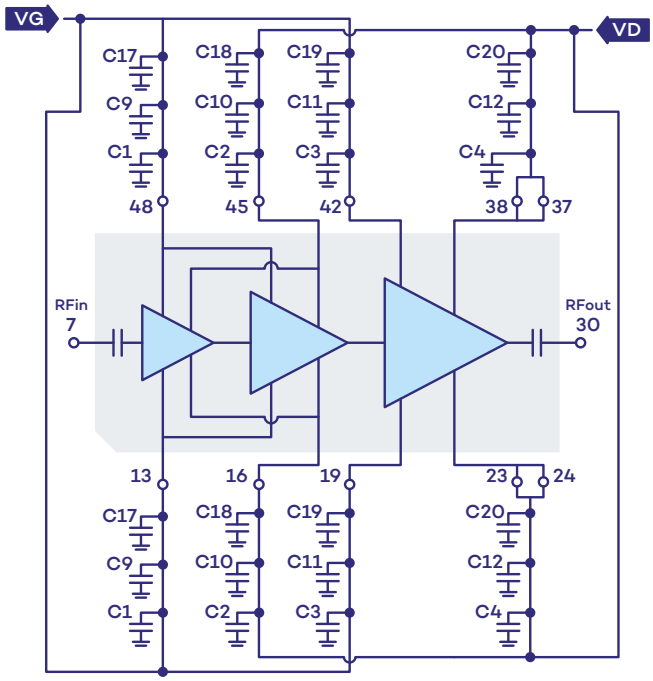


PAE vs Frequency vs I_{DQ}



Application circuit

- C1 to C8 = 10nF (50V/0402) close to the QFN pins
- C9, C11, C13, C14 = 1µF (16V/0402)
- C10, C12, C14, C16 = 1µF (50V/0603)
- C17, C19, C21, C23 = 100µF (16V/0805)
- C18, C20, C22, C24 = 10µF (Aluminum /50V)



Bias-up procedure

1. Apply V_G = -3V
2. Apply V_D = +28V
3. Adjust V_G to obtain the specificied I_{DQ} = 350 mA (V_G = -2.35V Typ.)
4. Apply RF signal in pulsed mode

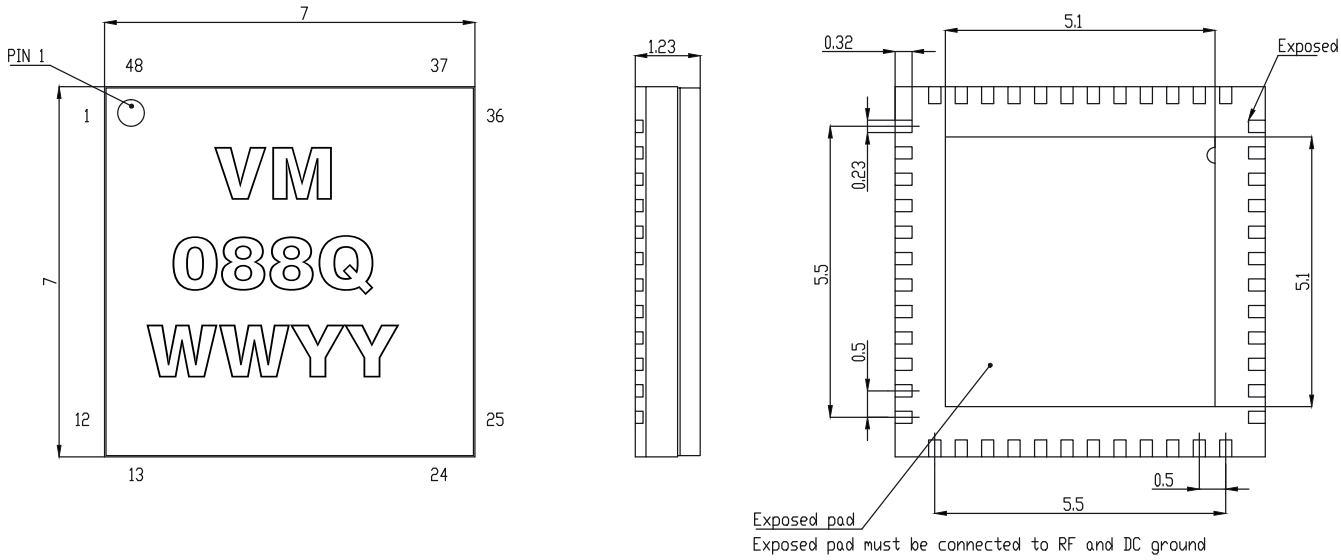
Bias-down procedure

1. Turn off RF signal
2. Reduce V_G = -3V
3. Apply V_D = 0V
4. Turn off power supply

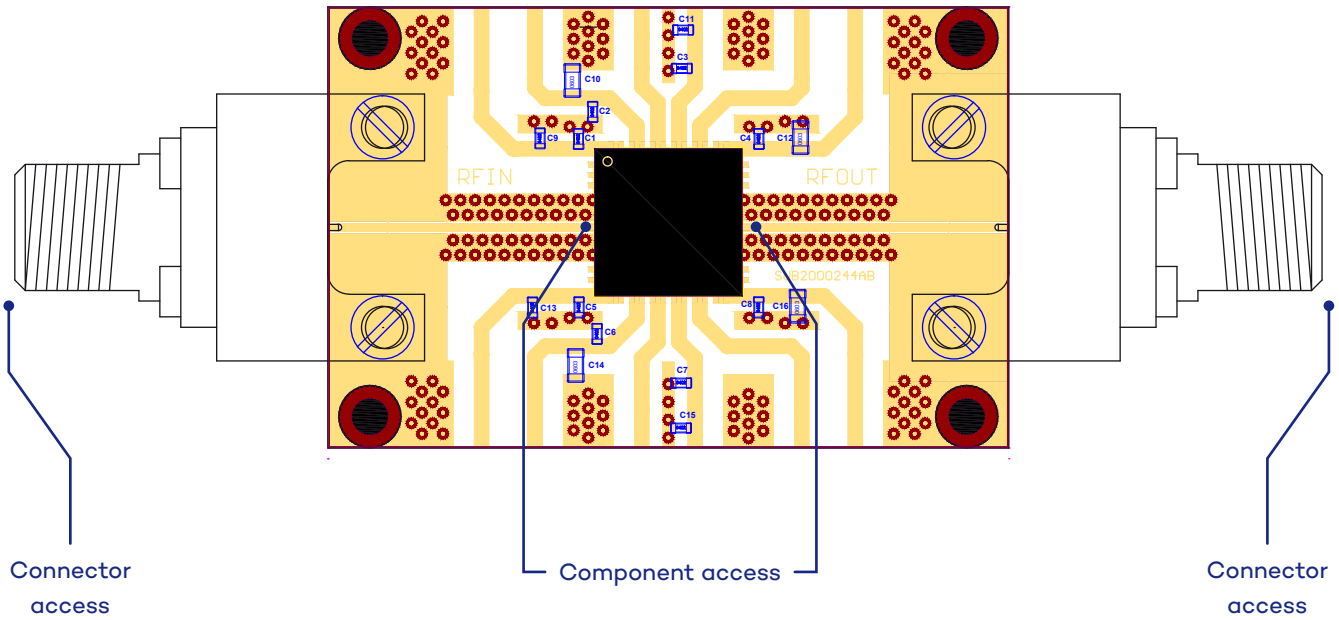
Pin description

Pin number	Name	Description	Electrical interface
7	RF in	Amplifier input, this access is AC coupled and internally matched to 50 Ohms	
13, 19, 42, 48	$V_{G1, 2}$, V_{G3}	HPA Gate biasing input accesses	
16, 23, 24, 37, 38, 45	$V_{D1, 2}$, V_{D3}	HPA Drain biasing input accesses	
30	RF out	Amplifier output, this access is AC coupled and internally matched to 50 Ohms	
Exposed Pad	Gnd	Die must be connected to RF and DC Ground	

• Mechanical drawing



• Evaluation Board (EVB) Layout Assembly



Ordering information

Product Code	Parameter
VM088Q	8 to 10.5GHz - 40W GaN/SiC Power Amplifier QFN 7mmx7mm 48 leads

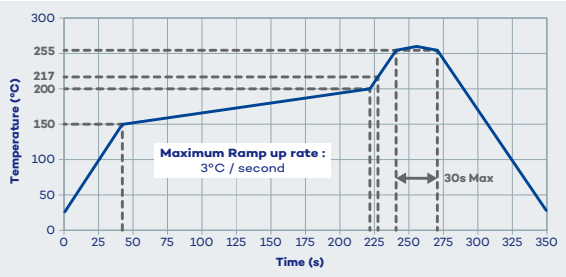
Associated Material

- Evaluation Board
- Mechanical files (DXF)

Product Compliance Information

Solderability

Solder Stencil thickness: 127µm
Solder: SAC 305 (ROHS)
Temperature profile example: maximum recommended reflow profile (leadfree)



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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