Vectrawave
RF & Millimeter Wave MMIC Design

DC to 40GHz - 15dB
Medium Power Amplifier

VM062D

General Description

The VM062D is a distributed amplifier designed on a 0.15µm pHEMT process. The device is capable of more than +22dBm of output power at saturation regime, up to 40GHz. And more than +16dBm of output power at 1dB of gain compression, up to 40GHz.

It provides 15dB of linear gain from DC to 40GHz, with an excellent group delay. The design has been optimized to provide high efficiency.

The supply current is as low as 180mA when operating with VD = +6V. The die include a 50Ω transmission line for calibration system.

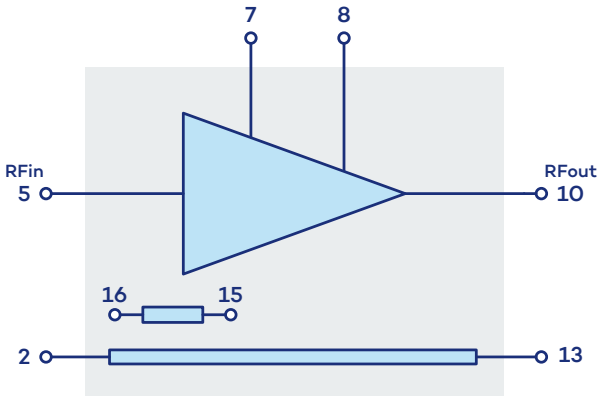
Features

Distributed amplifier pHEMT GaAs MMIC	
Wide band	**DC – 40GHz**
Flat group delay	
50ΩRF Single ended RF input and output	
DC coupled in, DC coupled out	
P1dB	**>+16dBm DC to 40GHz**
High output P_{SAT}	**>+22dBm DC to 40GHz**
Small signal gain	**>15dB 2GHz to 40GHz**
Power supply	**180mA @ +6V**
Chip size	**2.27 x 1.574 x 0.1 (mm)**

Applications

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

Pins Assignement & Functional Block Diagram



Function	Pin number
TL in	2
RF in	5
V_{G2}	7
V_{D_LOAD}	8
RF out	10
TL out	13
V_{G1_A}	15
V_{G1_B}	16

Electrical Specifications
(Test Under Probes)

Test conditions: unless otherwise noted
- T_{amb} = +25°C
- V_D = +6V
- I_D = 180mA
- V_{G2} = +2.5V

Symbol	Parameter	Min	Typ	Max	Unit
F	Frequency range	DC		40	GHz
G	Small signal gain		15		dB
ΔG	Small signal gain flatness		+/-0.5		dB
S11	Input return loss		-10		dB
S22	Output return loss		-13		dB
NF	Noise figure (@10GHz)			3	dB
P1dB	Output power @1dB compression	16	18		dBm
P_{SAT}	Saturated output power		22		dBm
I_D	Drain current		180		mA
V_D	Drain supply voltage		6		V

Environmental parameters

Symbol	Parameter	Min	Max	Unit
Top	Operating temperature range	-40	+85	°C
Tstg	Storage temperature range	-55	+85	°C

Absolute Maximum Ratings

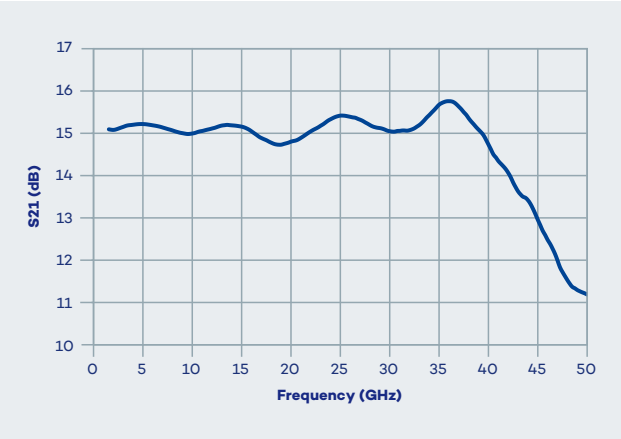
Symbol	Parameter	Min	Max	Unit
V_D	Drain bias voltage		9	V
V_{G2}	Gate control input access for second stage	-1	V_D/2	V
Pin	RF input power		18	dBm
Pcw	Continuous power dissipation (@85°)		2	W
Tprocess	Temperature process max 20 seconds		+325	°C

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

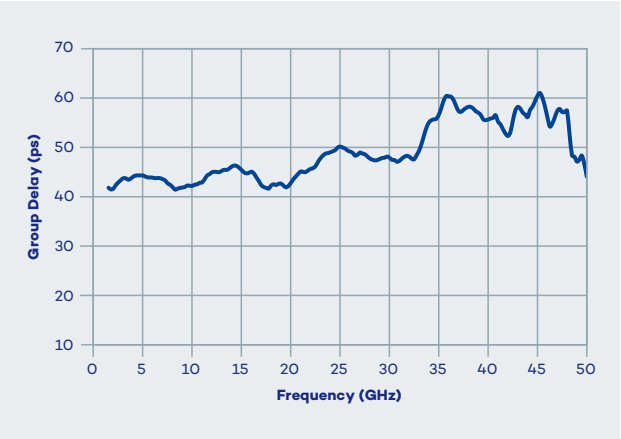
Typical Performance
(Test Under Probes)

Test conditions: unless otherwise noted
- T_{amb} = +25°C
- V_D = +6V
- I_D = 180mA
- V_{G2} = +2.5V

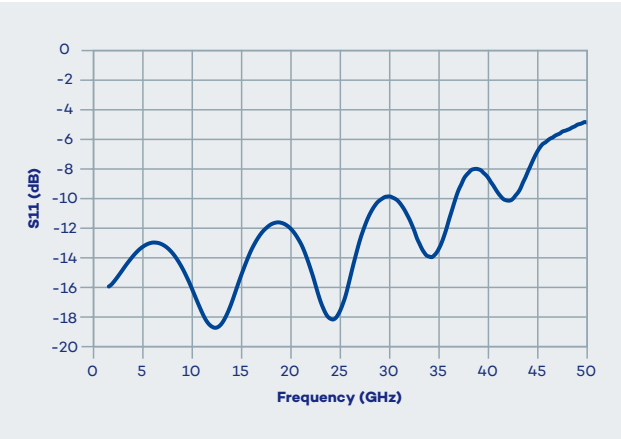
Small Signal Gain vs Frequency



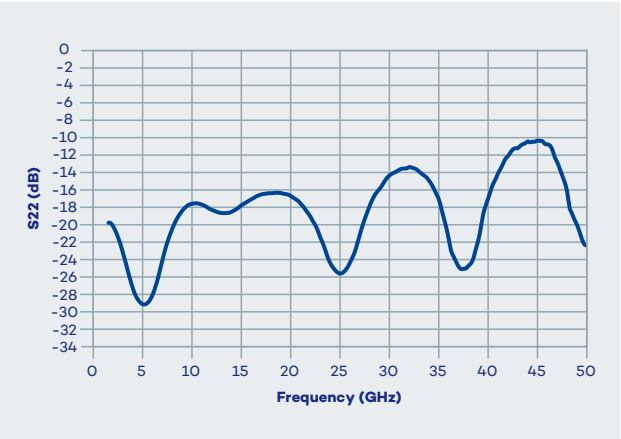
Group Delay vs Frequency



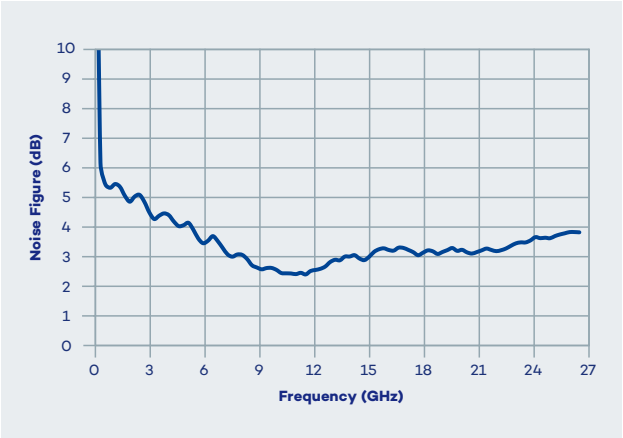
Input Return Loss vs Frequency



Output Return Loss vs Frequency



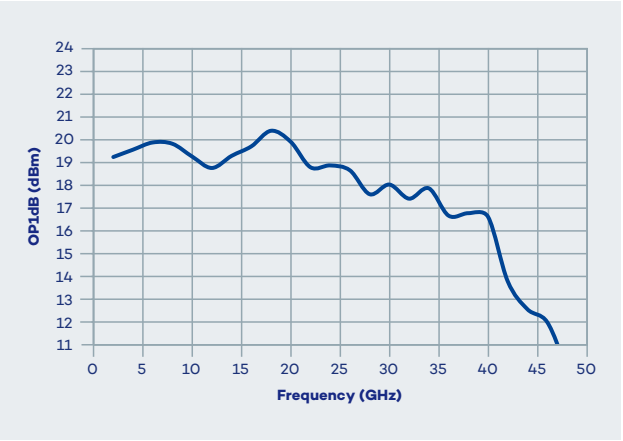
Noise Figure vs Frequency



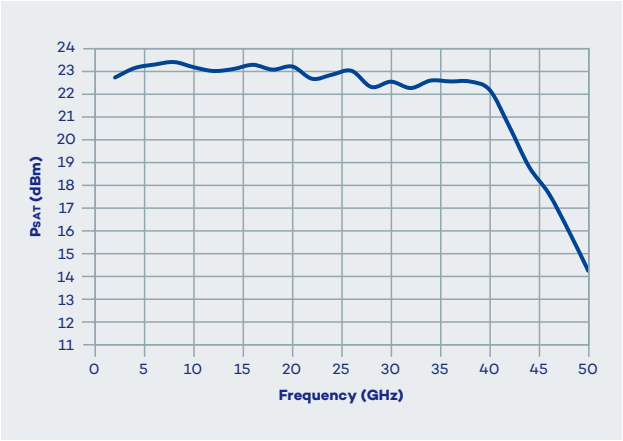
Typical Performance
(Test Under Probes)

Test conditions: unless otherwise noted
- T_{amb} = +25°C
- V_D = +6V
- I_D = 180mA
- V_{G2} = +2.5V

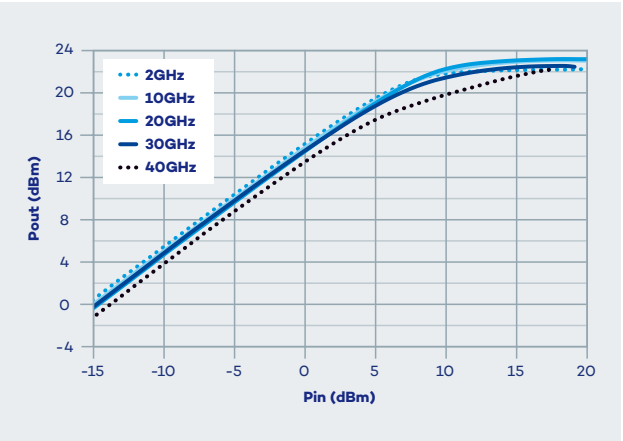
Output P1dB vs Frequency



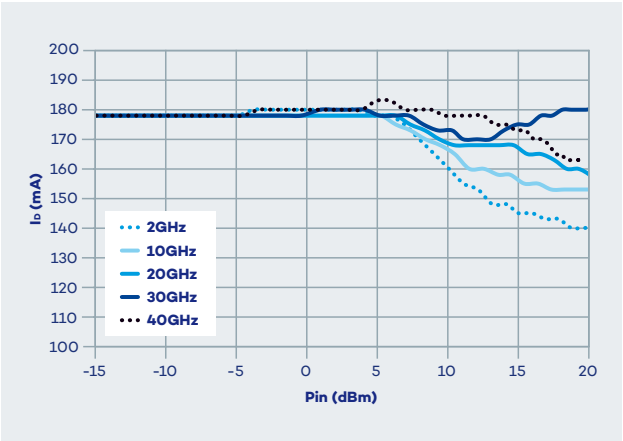
Saturated Output Power vs Frequency



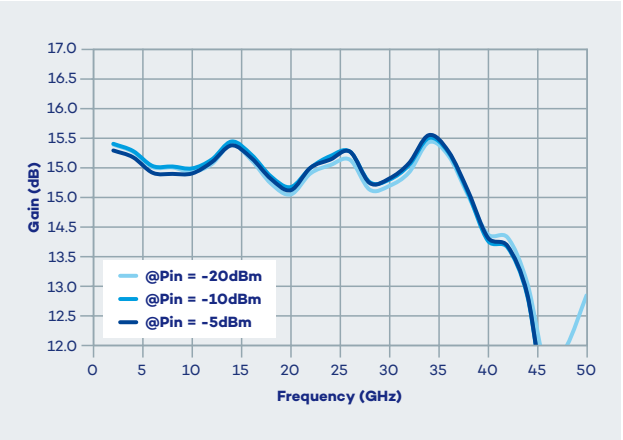
Pout vs Pin vs Frequency



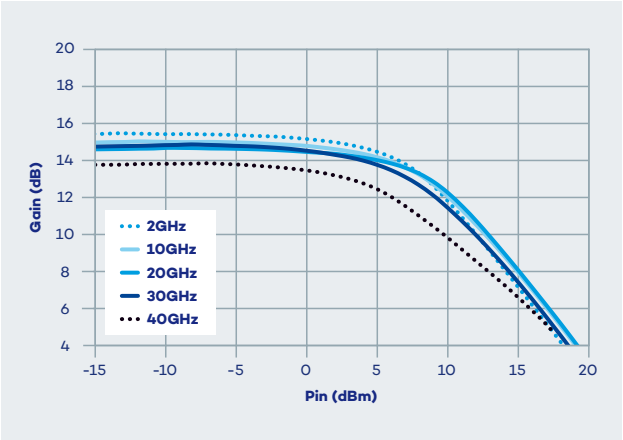
I_D vs Pin vs Frequency



Gain vs Frequency vs Pin



Gain vs Pin vs Frequency



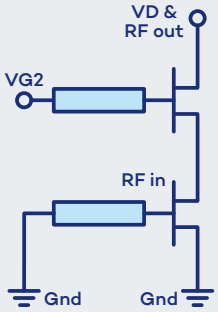
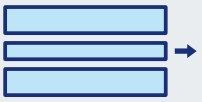
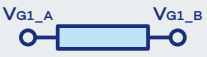
Bias-up procedure

1. Apply V_D = +6V
2. Apply V_{G2} = +2.5V
3. Apply RF signal

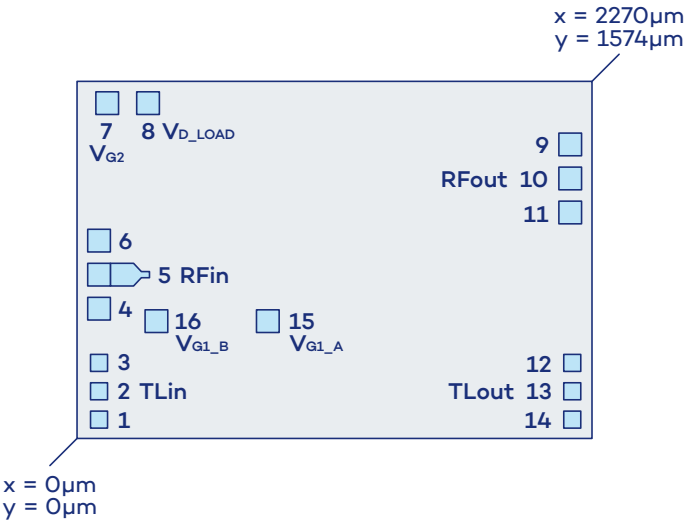
Bias-down procedure

1. Turn off RF signal
2. Reduce V_{G2} to 0V
3. Reduce V_D to 0V

Access description

Pin number	Name	Description	Electrical interface
2	TL in	RF 50Ω line input	
5	RF in	RF Amplifier input, this access is DC coupled and internally matched to 50Ω.	
7	V_{G2}	Drain termination load decoupling access. This access must be connected to a MIM 100pF or 1000pF capacitor, with a low serial inductance bonding wire (the serial inductance impacts the Output return loss)	
8	V_{D_LOAD}	Drain termination load decoupling access. This access must be connected to a MIM 100pF or 1000pF capacitor, with a low serial inductance bonding wire (the serial inductance impacts the Output return loss)	
10	RF out	HF Amplifier output, this access is DC coupled and internally matched to 50Ω. It is also used to bias the drain current (I_D), by using a wide bandwidth external Bias-T structure.	
13	TL out	RF 50Ω line output	
15	VG_{1_A}	Gate control input access for first stage distributed amplifier structure. Unused for nominal biasing conditions.	
16	VG_{1_B}	Gate control output access for first stage distributed amplifier structure. Unused for nominal biasing conditions.	
Die Bottom	Gnd	Die must be connected to HF and DC Ground	

Die Layout & Pin Out



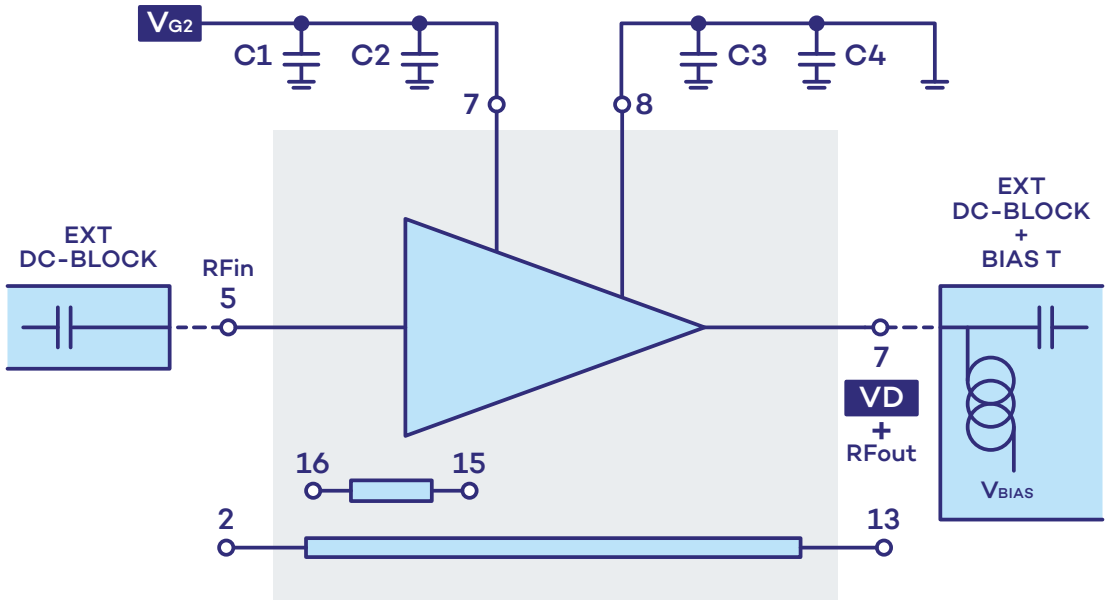
- Die size = 2270µm x 1574µm
- Die thickness = 100µm
- Die size tolerance = 50µm

Pad number	Pad center X (µm)	Pad center Y (µm)	Size (µm x µm)	Name	Function
1	97	83	75 x 75	Gnd	
2	97	208	75 x 75	TLin	TL Input
3	97	333	75 x 75	Gnd	
4	97	572	100 x 100	Gnd	
5	97	722	100 x 100	RFin	RF Input
6	97	872	100 x 100	Gnd	
7	133	1478	100 x 100	V_{G2}	Gate Bias
8	313	1478	100 x 100	V_{D_LOAD}	
9	2174	1296	100 x 100	Gnd	
10	2174	1146	100 x 100	RFout	RF Output
11	2174	996	100 x 100	Gnd	
12	2183	333	75 x 75	Gnd	
13	2183	208	75 x 75	TLout	TL Output
14	2183	83	75 x 75	Gnd	
15	841	517	100 x 100	V_{G1_A}	Gate Bias
16	350	517	100 x 100	V_{G1_B}	Gate Bias

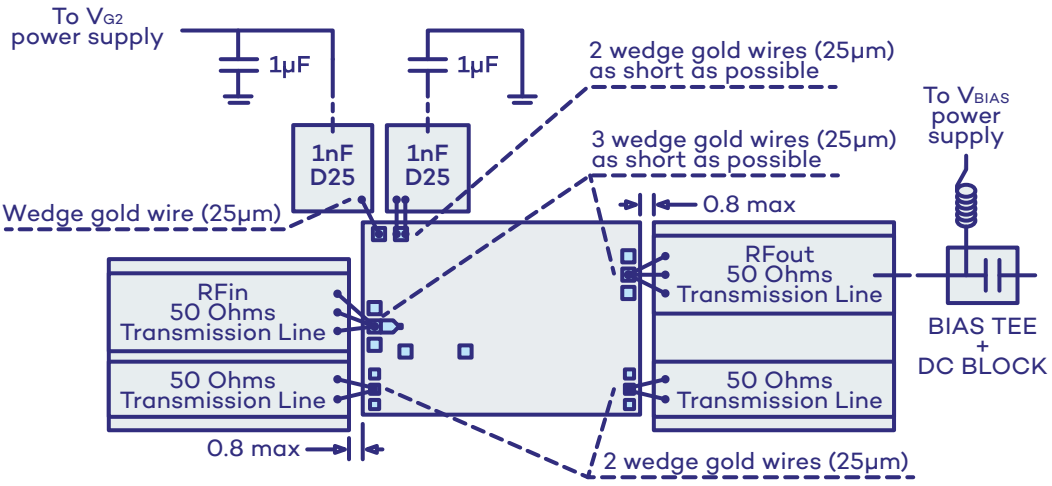
- Die bottom must be connected to ground (RF and DC)

Application circuit

- C1 and C4 = 1µF
- C2 and C3 = 1nF capacitors are MIM type and must be placed as close as possible to the die access.



Typical Assembly Diagram



Ordering information

Product Code	Parameter
VM062D	DC to 40GHz 15dB Gain - 22dBm P_{SAT} Medium Power Amplifier

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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