10 W GaN Power Amplifier
6 - 18 GHz

MAAP-011422-DIE
Rev. V2

Features

- Gain: 20 dB
- Output Power: 41.5 dBm @ 12 GHz
- PAE: 33%
- Power Supply: 12 V, 3.5 A @ 12 GHz
- Input & Output Matched: 50 Ω
- Die Size: 4160 x 3100 x 100 µm
- RoHS* Compliant

Applications

- Radar
- SATCOM

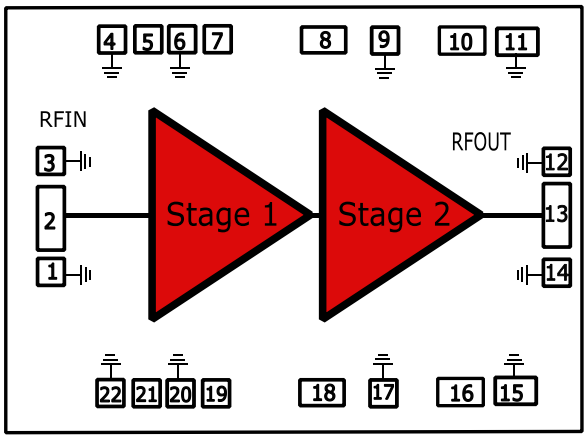
Description

MAAP-011422-DIE is a 10 W high-performance GaN Power Amplifier MMIC designed to operate from 6 to 18 GHz and is offered in bare die form. It is fully matched across the frequency band.

The MAAP-011422-DIE has 41 dBm of output power and 33% PAE and can be used an a power amplifier stage. This device is ideally suited to satellite communication and radar applications.

The MAAL-011422-DIE is manufactured using a high performance 100 nm gate length GaN on Si HEMT power technology (D01GH). The MMIC uses gold bonding pads and backside metallization and is fully protected with silicon nitride passivation to obtain the highest level of reliability.

Block Diagram



Pad Configuration

Pad #	Function
1,3,4,6,9,11,12,14,15,17, 20,22	Ground
2	Input RF
5	Gate Voltage Stage 1 North
7	Gate Voltage Stage 2 North
8	Drain Voltage Stage 1 North
10	Drain Voltage Stage 2 North
13	Output RF
16	Drain Voltage Stage 2 South
18	Drain Voltage Stage 1 South
19	Gate Voltage Stage 2 South
21	Gate Voltage Stage 1 South

Ordering Information

Part Number	Package
MAAP-011422-DIE	Bare die
MAAP-011422-SB2	Evaluation Board

* Restrictions on Hazardous Substances, compliant to current RoHS EU directive.

Electrical Specifications:
Freq. = 6 - 18 GHz, $VD_{1,2}$ = 12 V, Quiscent Bias Currents (ID_1 = 350 mA, ID_2 = 640 mA), T_A = + 25°C with a duty cycle of 1% (pulse mode)

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Drain Voltage $V_{D1A,D2A}$ and $V_{D1B,2B}$	—	V	—	12	—
Drain Current $I_{D1,D2}$	At Saturated Power @ 12 GHz	A	—	3	—
Small Signal Gain	8 - 16 GHz	dB	17	20	—
Small Signal Gain	6 - 8 GHz and 16 - 18 GHz	dB	15	18	—
Saturated Power	8 - 16 GHz	dBm	39	40.5	—
Saturated Power	6 - 8 GHz and 16 - 18 GHz	dBm	38	39.5	—
Power Added Efficiency	—	%	—	33	—
Input Reflection Coefficient	—	dB	—	-10	—
Output Reflection Coefficient	—	dB	—	-13	—

Recommended Operating Conditions

Parameter	Unit
Voltage Bias	12 V
Quiescent Current	1 A
Junction Temperature	+200°C
Operating Temperature	-40°C to +85°C
Storage Temperature	-40°C to +150°C

Absolute Maximum Ratings[1,2,3,4]

Parameter	Absolute Maximum
Drain Voltage	+20 V
Gate Voltage	-3 V to 0 V
Breakdown Voltage	+50 V
Input Power	30 dBm
Junction Temperature	200°C
Storage Temperature	-40°C to 150°C
Assembly Temperature	300°C per 60 seconds

1. Exceeding any one or combination of these limits may cause permanent damage to this device.
2. MACOM does not recommend sustained operation near these survivability limits.
3. Operating at nominal conditions with $T_J \leq$ +200°C will ensure MTTF > 1 x 10^7 hours.
4. Junction Temperature (T_J) = T_C + Θjc * (V * I)
   a) For T_C = +20°C,
   R_{TH} = 6 °C /W @ Saturated Power

Handling Procedures

Please observe the following precautions to avoid damage:

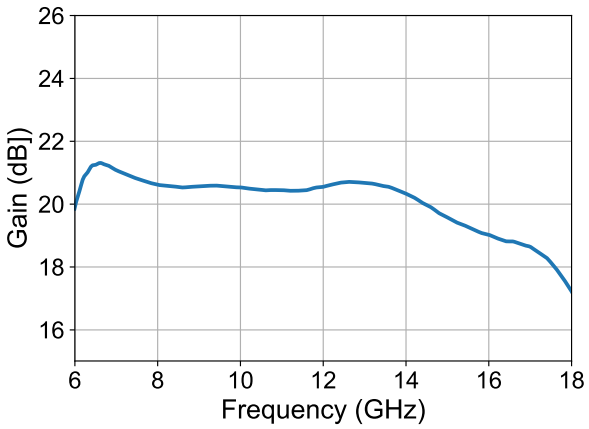
Static Sensitivity

These electronic devices are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these devices.

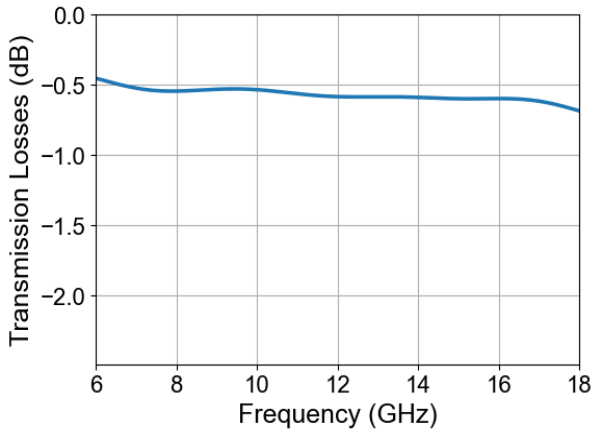
Typical Performance Curves probed measured on wafer

S-parameters with 0.1nH assumed Wirebond

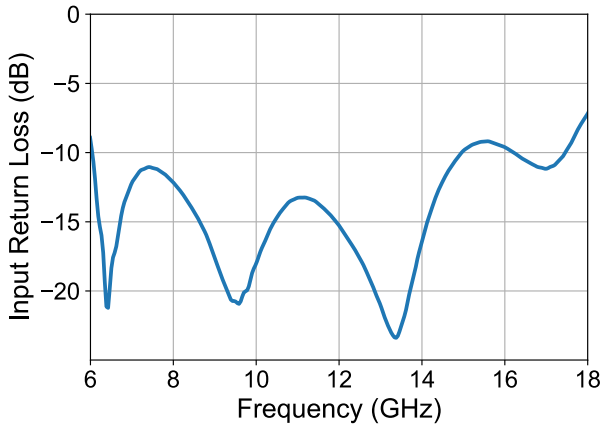
Gain over Frequency



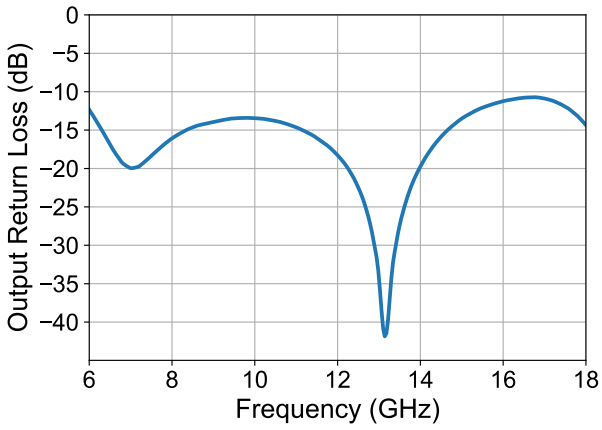
RF access line & connector Losses over Frequency



Input Return Loss over Frequency

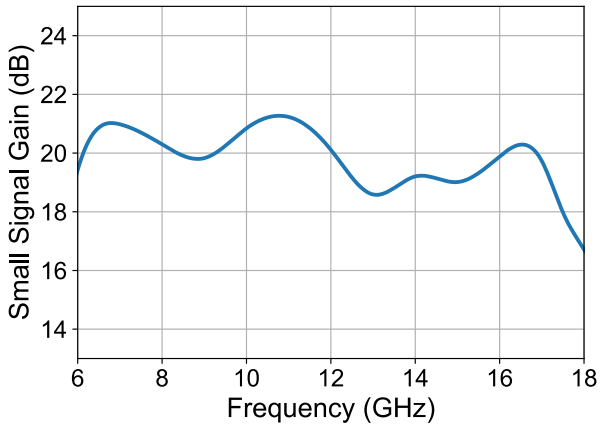


Output Return Loss over Frequency

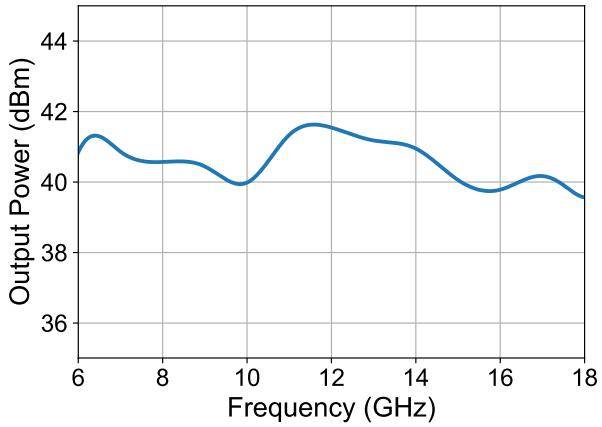


Typical Performance Curves probed measured on-wafer

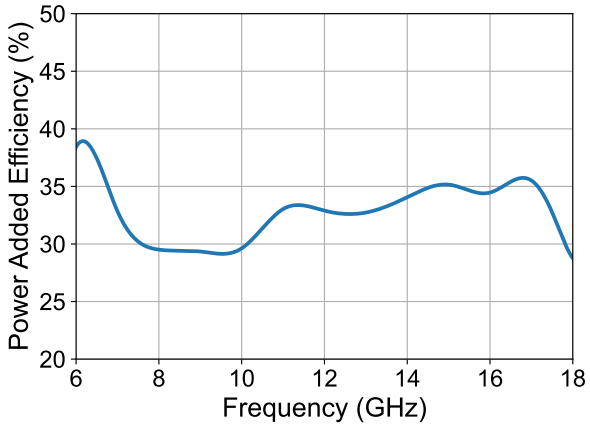
Small Signal Gain over Frequency



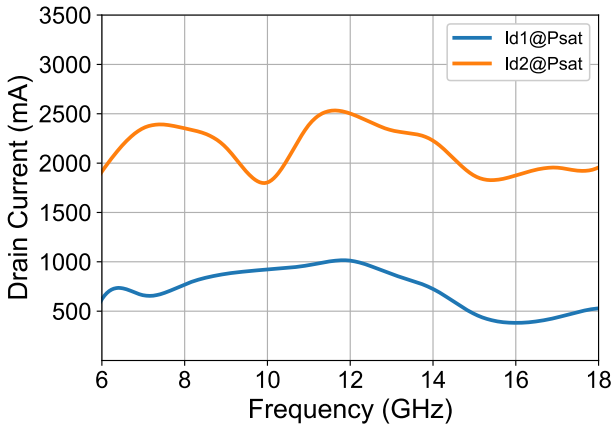
Saturated Power over Frequency



Power Added Efficiency over Frequency



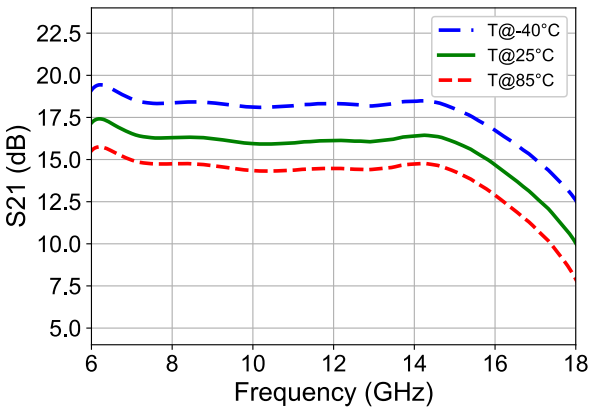
DC Current at Saturated Power over Frequency



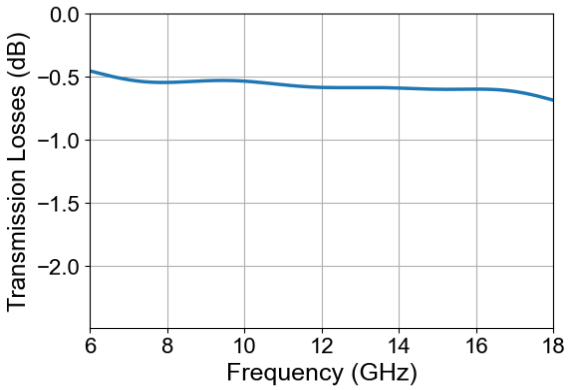
Typical performance

S-parameters in CW at PCB level with De-Embedding at different temperature

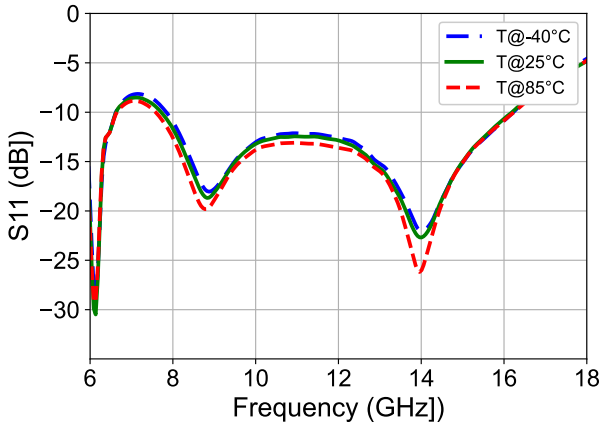
Gain over Frequency



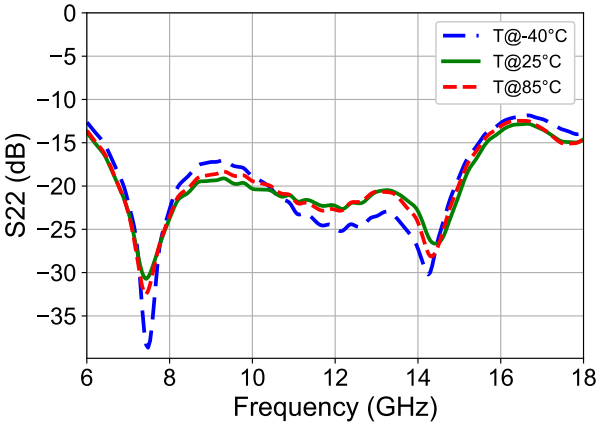
RF access line & connector Losses over Frequency



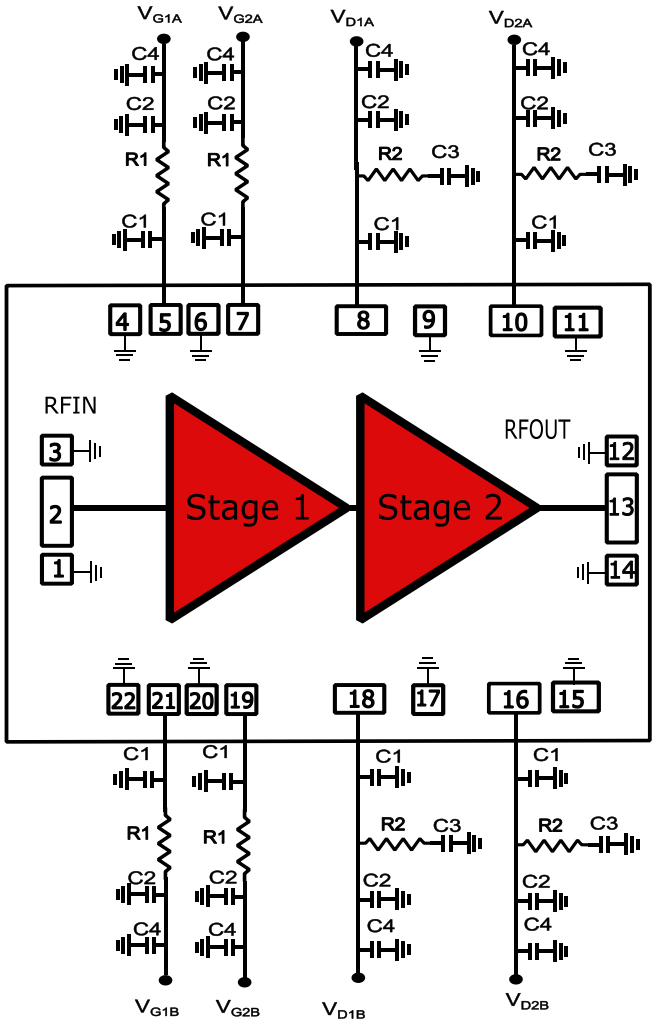
Input Return Loss over Frequency



Output Return Loss over Frequency



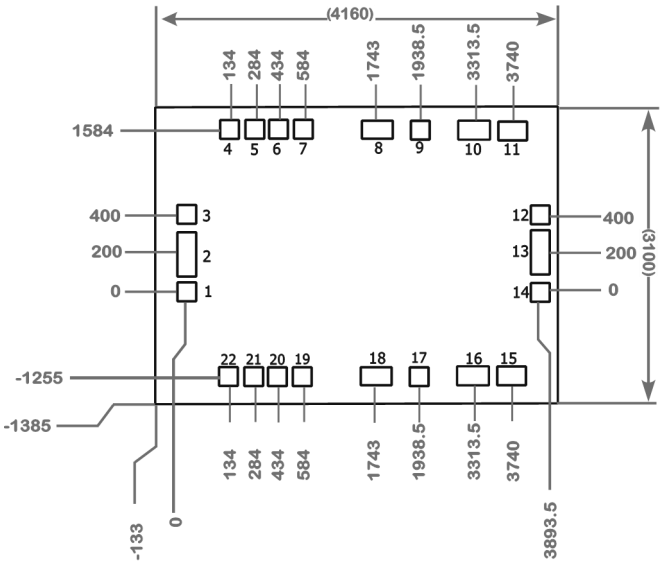
Functional Schematic



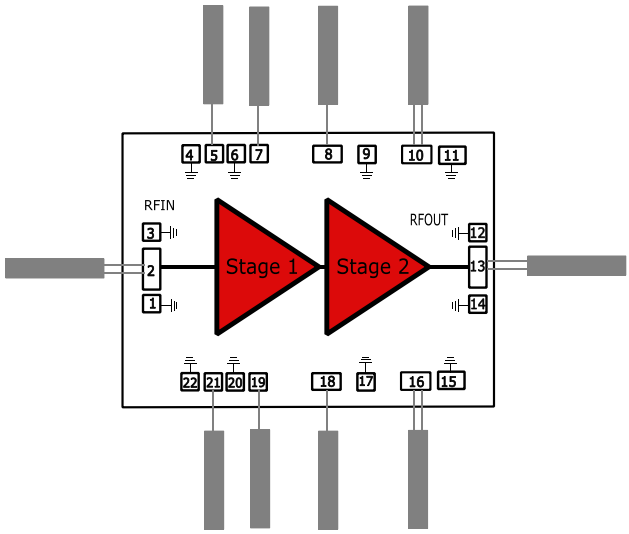
Parts List

Part	Value	Case Style	Manufacturer	Type	Manufacturer's Part #
C1	47 pF	0.381 mm	KYOCERA AVX	single layer capacitor	116RG470M100TT
C2	10 nF	1005 mm	KYOCERA AVX	SMD multi layer capacitor	0402YC103KAT2A
C3	100 nF	1005 mm	Murata	SMD multi layer capacitor	GRM155R70J104KA01D
C4	1 µF	1005 mm	Murata	SMD multi layer capacitor	GRM155R70G105KA12D
R1	68 Ω	1005 mm	PANASONIC	SMD resistor	ERA2VEB68R0X
R2	10 Ω	1005 mm	YAGEO	SMD resistor	RC0402JR-0710RL

Die Layout



Recommended Bonding Diagram



Pad Dimensions (µm)

Pad #	X	Y
1,3,12,14	102	97
2,13	102	147
4,5,6,7,9,17,19,20,21,22	97	97
8,18	167	97
10,16	397	137
11,15	350	137

Revision History

Rev	Date	Change description
V1	12/29/23	PTRR
V2	12/03/24	Production Release