Wideband Amplifier, TWA, 1 W GaN
1 - 40 GHz

MAAP-011420-DIE
Rev. V1

Features

- Gain: 15 dB
- Output Power: 30 dBm
- Power Supply:
  - External VDD: 18 V
  - VG2: 9 V
  - IDD: 220 mA
- 50Ω Input & Output Matched
- Die Size: 2.07 mm x 1.31 mm x 0.1 mm
- RoHS* Compliant

Applications

- Defense
- Instrumentation

Description

The MAAP-011420-DIE is a 1 W high-performance GaN Travelling Wave Amplifier MMIC designed to operate from 1 to 40 GHz and is offered in bare die form. It is fully matched across the frequency band.

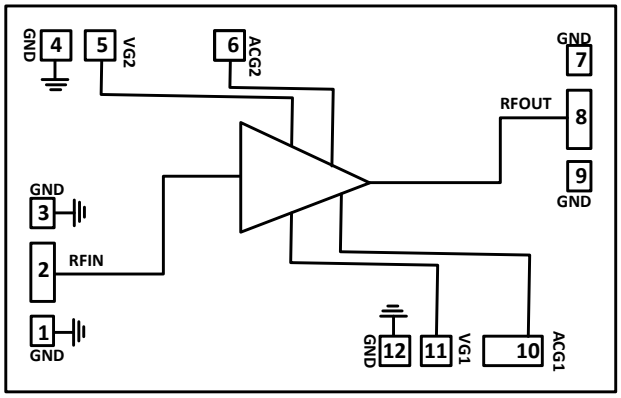
The MAAP-011420-DIE has 30 dBm of output power and can be used an a power amplifier wide band. This device is ideally suited to satellite communication and radar applications.

The MAAP-011420-DIE is manufactured using a high performance 100 nm gate length GaN on Si HEMT power technology (D01GH). This MMIC uses gold bonding pads and backside metallization and is fully protected with silicon nitride passivation to obtain the highest level of reliability.

Ordering Information

Part Number	Package
MAAP-011420-DIE	Bare die
MAAP-011420-SB2	Evaluation Board

Block Diagram



Pad Configuration

Pad #	Function	Function
1,3,4,7,9,12	GND	Ground
2	RF_{IN}	RF Input
5	VG2	Common Gate Supply
8	RF_{OUT}	RF Output
10	ACG1	Additional Capacitance to Ground
11	VG1	Common Gate Supply

Electrical Specifications: Freq. = 1 - 40 GHz, VDD = 18 V, VG2 = 9 V, Quiescent Bias Current (IDD = 220 mA), T_A = +25°C

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Drain Voltage (VDD)	—	V	16	18	20
Common Gate Supply (VG2)	—	V	8	9	11
Drain Current (IDD)	—	mA	190	220	250
Small Signal Gain	1 - 37 GHz 37 - 40 GHz	dB	11 9	14 12	19 17
Saturated Power	1 - 20 GHz 20 - 40 GHz	dBm	26 23	30 26	33 28
Input Reflection Coefficient	—	dB	—	-10	—
Output Reflection Coefficient	—	dB	—	-13	—

Recommended Operating Conditions

Parameter	Typical
Voltage Bias	18 V
Quiescient Current	0.22 A
Junction Temperature[1]	+120°C to +200°C
Operating Temperature	-40°C to +85°C
Storage Temperature	-40°C to +150°C

1. Make sure that junction temperature is below 200°C.

Absolute Maximum Ratings[2,3]

Parameter	Absolute Maximum
Drain Voltage	+20 V
Gate Voltage	-3 V to 0 V
Breakdown Voltage	+50 V
Input Power	+30 dBm
Junction Temperature[4,5]	+200°C
Storage Temperature	-40°C to +150°C
Assembly Temperature	300°C , 60 seconds

2. Exceeding any one or combination of these limits may cause permanent damage to this device.
3. MACOM does not recommend sustained operation near these survivability limits.
4. Operating at nominal conditions with $T_J \leq$ +200°C will ensure MTTF > 1 x 10^7 hours.
5. Junction Temperature (T_J) = T_C + Θjc * (V * I)
   a) For T_C = +20°C
   R_{TH} = 65 °C /W @ P_{SAT} = 5 dBm
   T_J = 116.4°C
   a) For T_C = +85°C
   R_{TH} = 65 °C /W @ P_{SAT} = 5 dBm
   T_J = 142.2°C

Handling Procedures

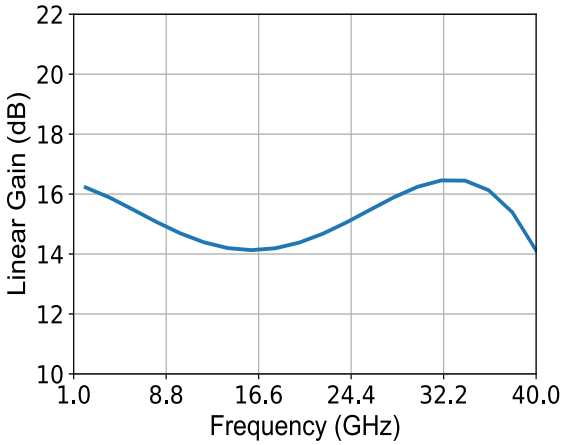
Please observe the following precautions to avoid damage:

Static Sensitivity

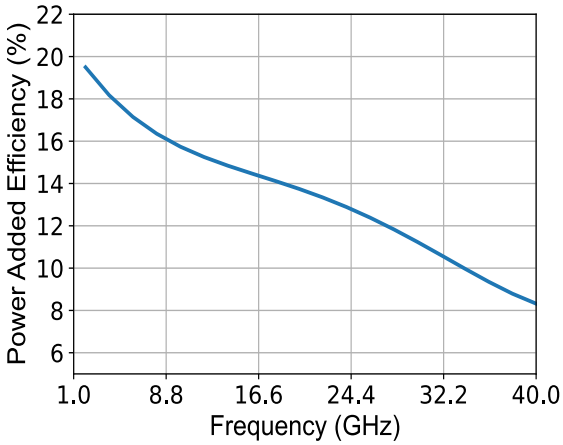
These electronic devices are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these devices.

Typical Performance Curves: T_c = 25°C During on Wafer Measurements using Probe Cards: S-Parameters with 0.1 nH Assumed Wirebond

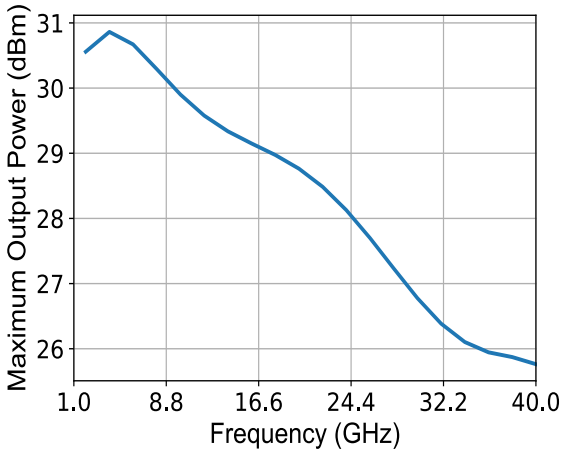
Small Signal Gain over Frequency



Power Added Efficiency over Frequency

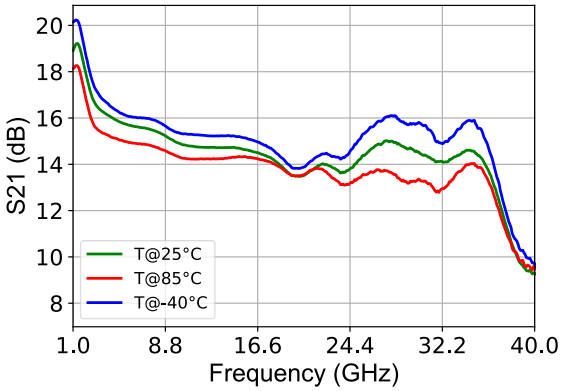


Saturated Power over Frequency

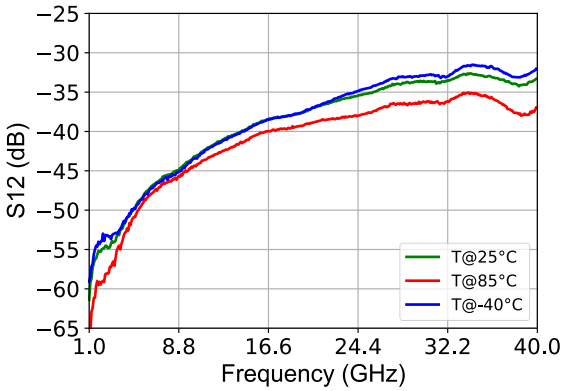


Typical Performance Curves: using Connectorized PCB with De-Embedding at Different Temperatures: S-Parameters in CW at PCB level with De-Embedding

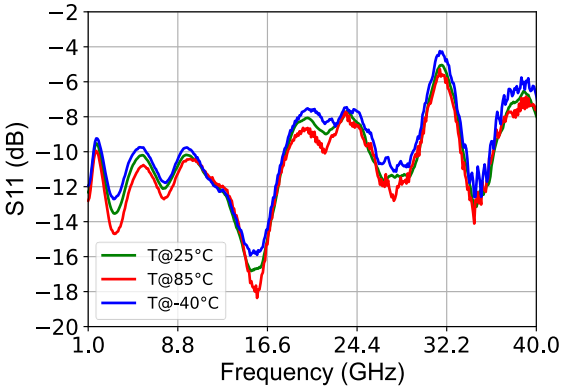
Gain over Frequency



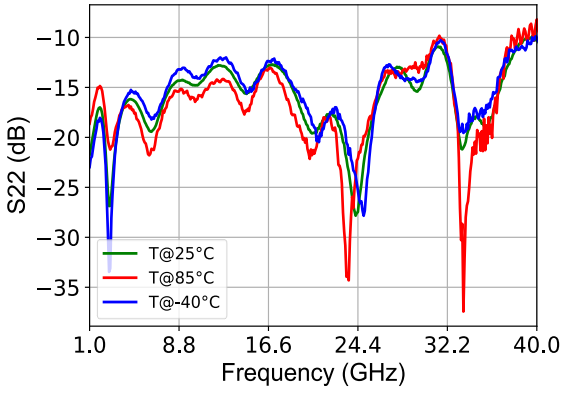
Isolation over Frequency



Input Return Loss over Frequency



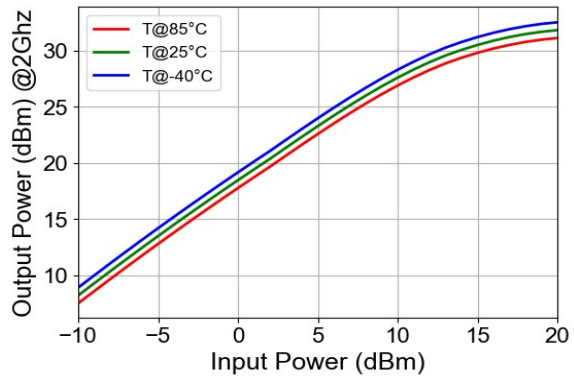
Output Return Loss over Frequency



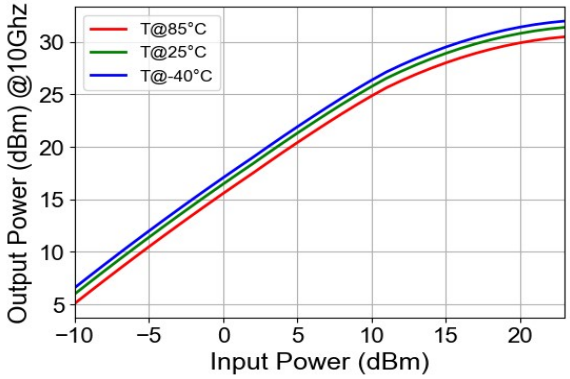
Typical performance

Power measurement in CW at PCB level without Embedding at different temperature

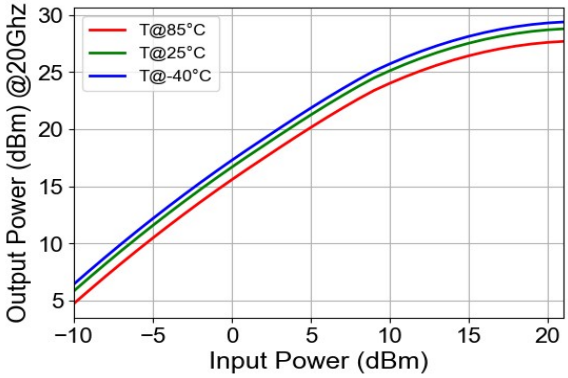
Output Power over Input Power @2GHz



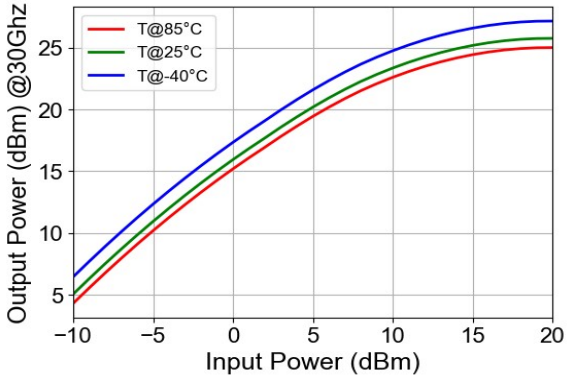
Output Power over Input Power @10GHz



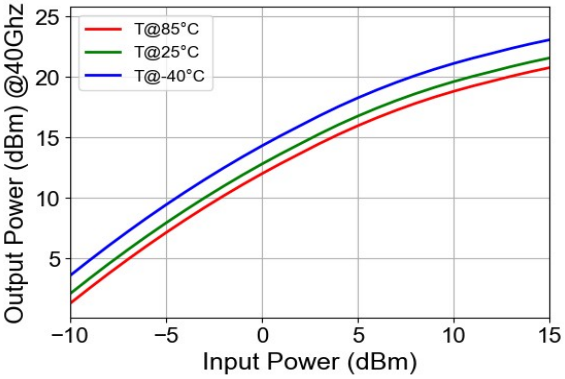
Output Power over Input Power @20GHz



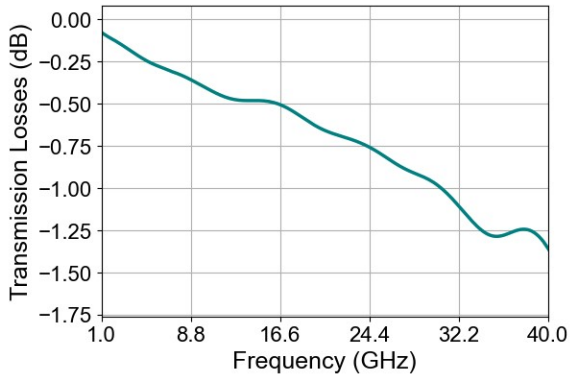
Output Power over Input Power @30GHz



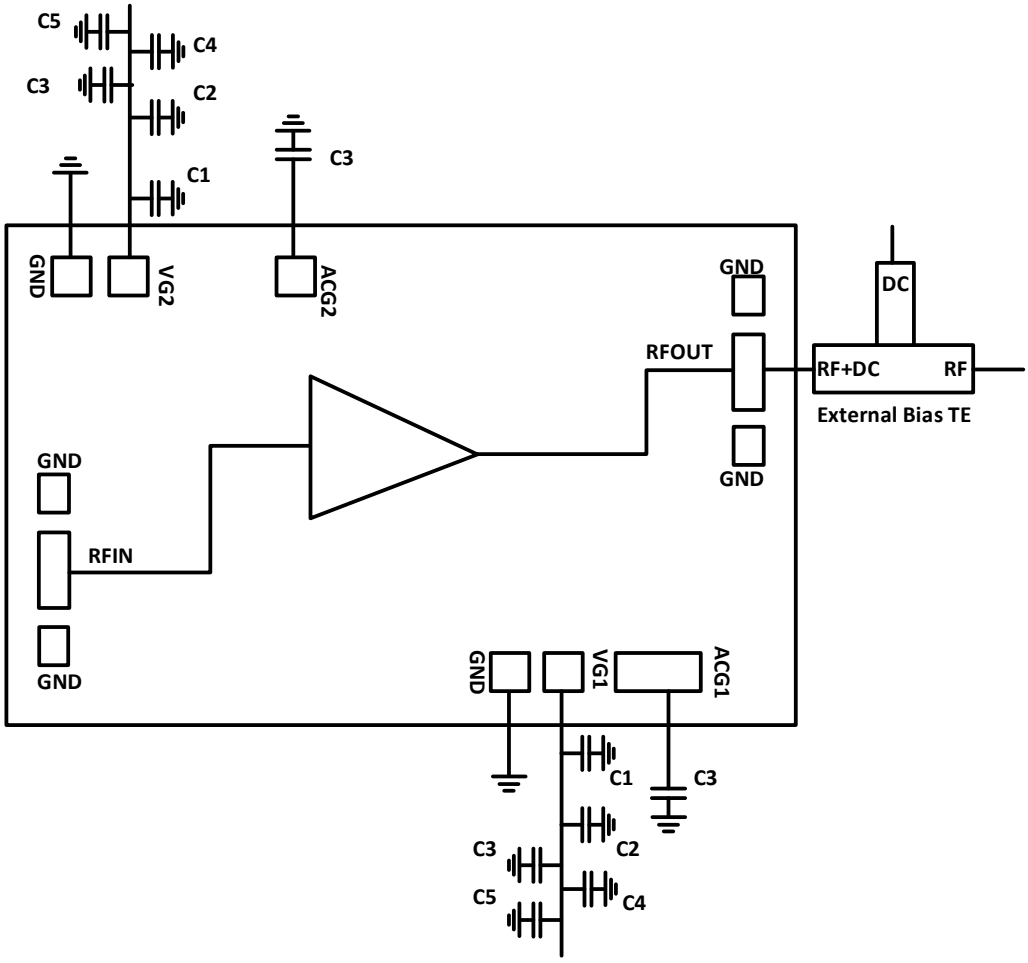
Output Power over Input Power @40GHz



RF access line & connector Losses over Frequency



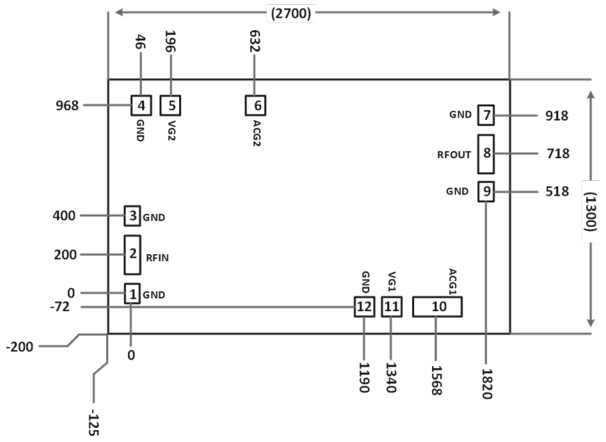
Functional Schematic



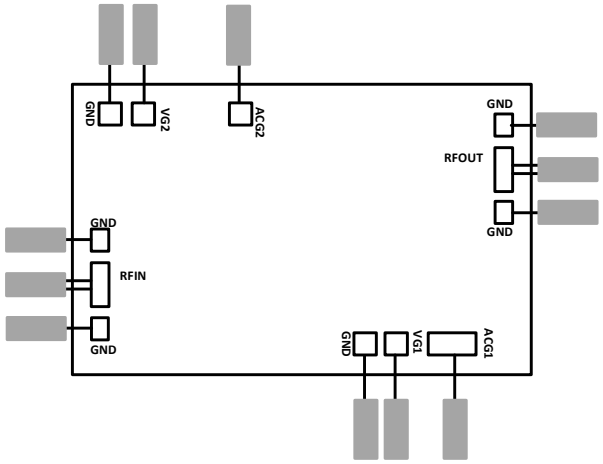
Parts List

Part	Value	Case Style	Manufacturer	type	Manufacturer's Part number
C1	47 pF	0.015mils	PRESIDIO	Single layer capacitor	116RG470M100TT
C2	100 pF	0402 INCH	Murata	SMD Multi Layer Capacitor	GRM0115C1E101JE01L
C3	100 nF	0402 INCH	Murata	SMD Multi Layer Capacitor	GRM155R70J104KA01D
C4	10 nF	0402 INCH	Murata	SMD Multi Layer Capacitor	GRT188R71E474KE13D
C5	1 µF	0402 INCH	Murata	SMD Multi Layer Capacitor	GRM155R70G105KA12D

Die Layout



Application Schematic



Pads Dimensions

Pad #	X	Y
1,3,4,9	80	100
2,8	80	200
4,5,6,11,12	100	100
10	260	100

Revision History

Rev	Date	Change Description
V1	4/5/24	Production Release