9 -11 GHz 70W GaN PA MMIC

ICP1048P

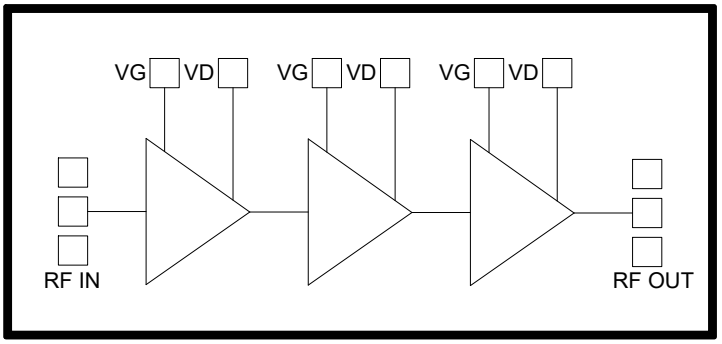
Product Overview

ICONICRF's ICP1048P is a three stage MMIC power amplifier in flange package, fabricated using GaN on SiC technology. ICP1048P operates from 8.5 — 11GHz with 48.5dBm output power, 35% PAE and 23dB small signal gain. ICP1048 is well suited to a variety of Communication Infrastructure and Aerospace & Defense applications

Key Features

- **Frequency Range: 8.5 - 11GHz**
- **P_{out}: 48.5dBm @ 26dBm P_{in}**
- **PAE: 35%**
- **Small Signal Gain: 23dB**
- **Bias: V_D=28V, I_{DQ}=360mA**
- **Technology: GaN on SiC**
- **Lead-free and RoHS compliant**
- **Flange Package**

Functional Block Diagram



Applications

- Communication Infrastructure
- Aerospace & Defense

Electrical Specifications

Parameter	Min.	Typ.	Max.	Units	Conditions(1)
Frequency	8.5		11	GHz	
Output Power at P_{sat}		48.5		dBm	P_{in} = 26dBm
Power Added Efficiency, PAE at P_{sat}		35		%	P_{in} = 26dBm
Small Signal Gain, S_{21}		23		dB	
Input Return Loss		10		dB	
Output Return Loss		6		dB	
I_{DQ}		360		mA	

Note: (1) Test conditions unless otherwise stated V_D = 28V, I_{DQ} = 360mA, T_A = 25°C, Pulsed 10% (100µs/1ms)

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1. Electrical Specification

1.1 Absolute Maximum Ratings

Parameter	Absolute Maximum
Drain Voltage (V_D)	30V
Gate Voltage (V_G)	-5 to 0V
Channel Temperature	275°C
Storage Temperature	-65°C to +150°C

Note:
Exceeding any one or combination of these limits may cause permanent damage to this device.

Microchip Technology Inc. does not recommend sustained operation near these survivability limits.

1.2 Small Signal Performance

Typical Power Data over Temperature

Test conditions: V_D=28V, I_{DQ}=360mA

Figure 1-1. S_{21} vs Freq

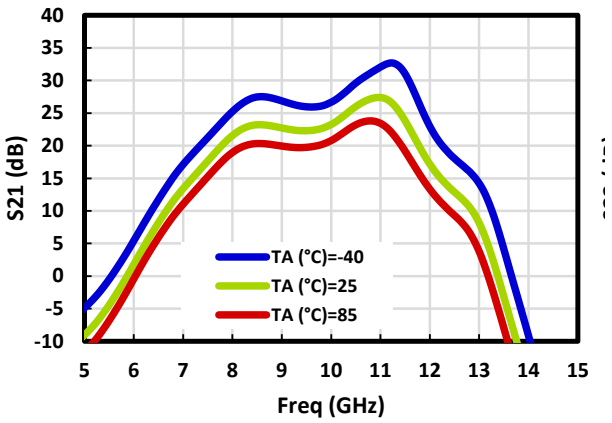


Figure 1-2. S_{11} vs Freq

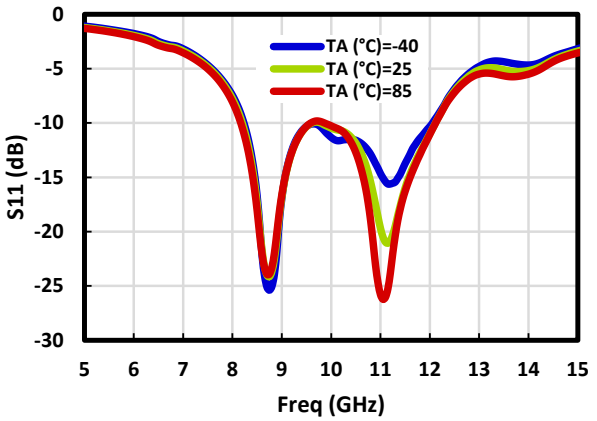
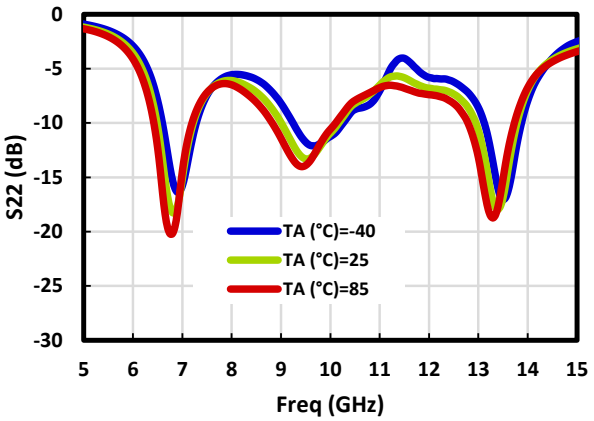


Figure 1-3. S_{22} vs Freq



1.3 Large Signal Performance

Typical Pulsed Power Data

Test conditions: V_D=28V, I_{DQ}=360mA, T_A=25°C, Pulsed 10% (100µs/1ms)

Figure 1-4. P_{out} vs. P_{in}

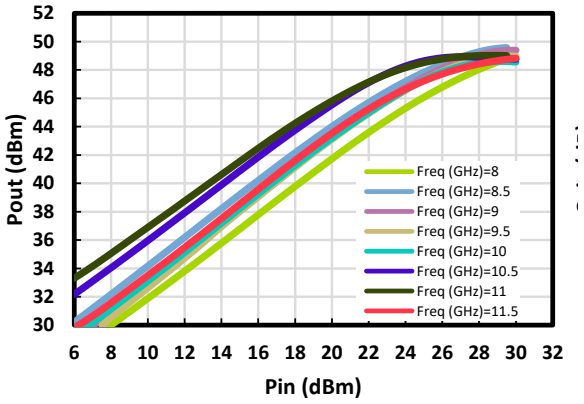


Figure 1-5. Gain vs. P_{out}

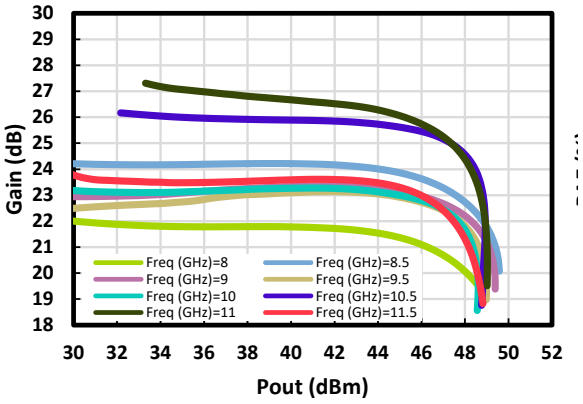


Figure 1-6. PAE vs. P_{out}

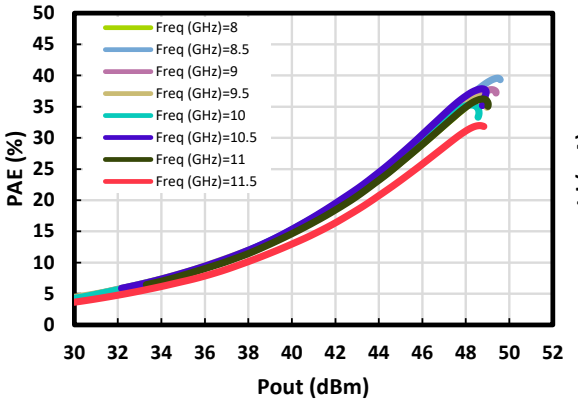


Figure 1-7. I_D vs. P_{out}

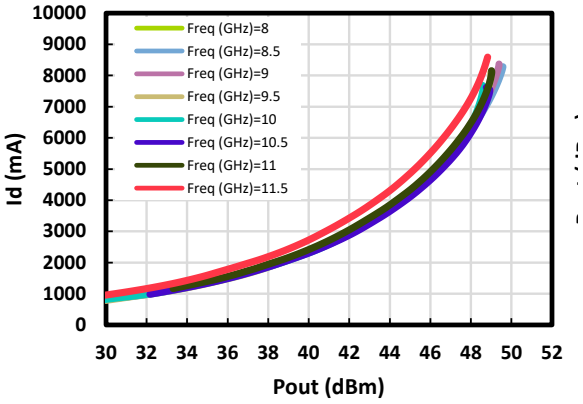


Figure 1-8. P_{out} vs. Freq

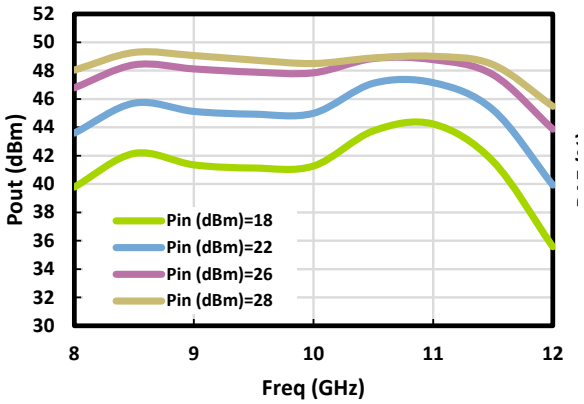
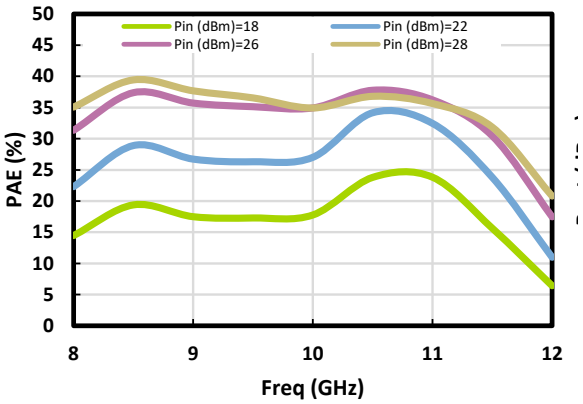


Figure 1-9. PAE vs. Freq



Typical Pulsed Power Data over T_A Conditions

Test conditions: V_D=28V, I_{DQ}=360mA, T_A=25°C, Pulsed 10% (100µs/1ms)

Figure 1-10. P_{out} vs. P_{in}, Freq=8GHz

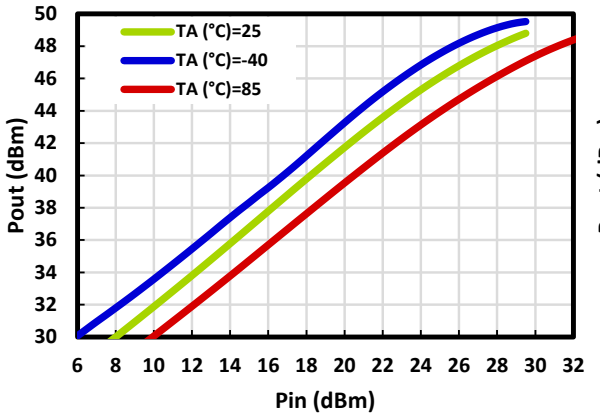


Figure 1-11. P_{out} vs. P_{in}, Freq=9GHz

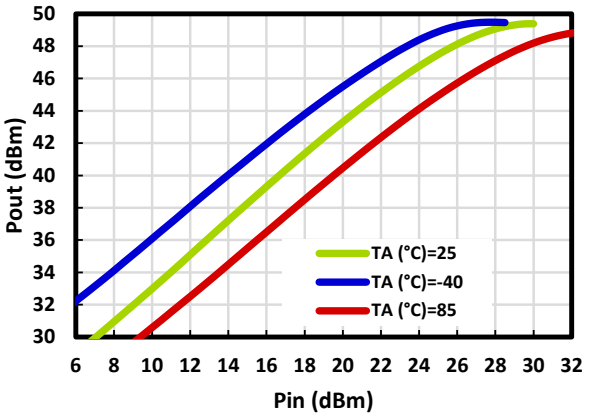


Figure 1-12. P_{out} vs. P_{in}, Freq=10GHz

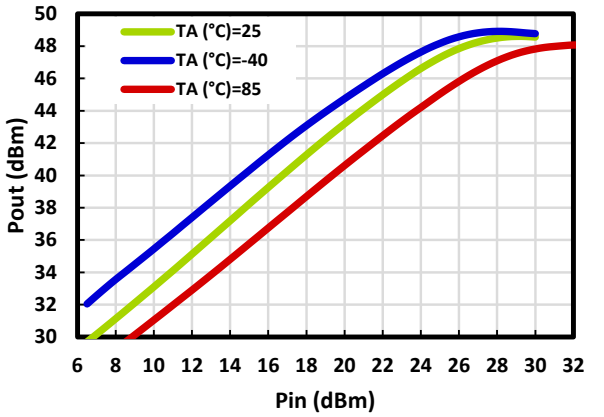


Figure 1-13. P_{out} vs. P_{in}, Freq=11GHz

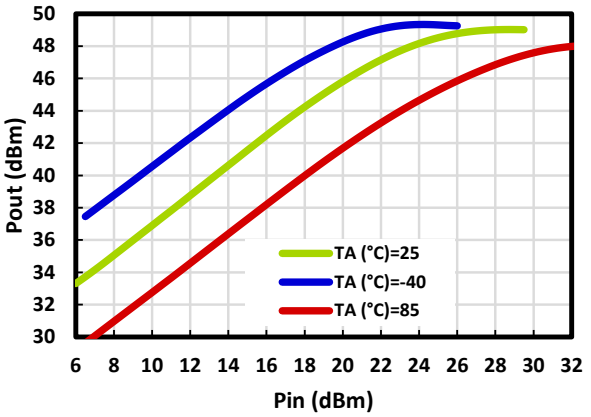


Figure 1-14. P_{out} vs. Freq

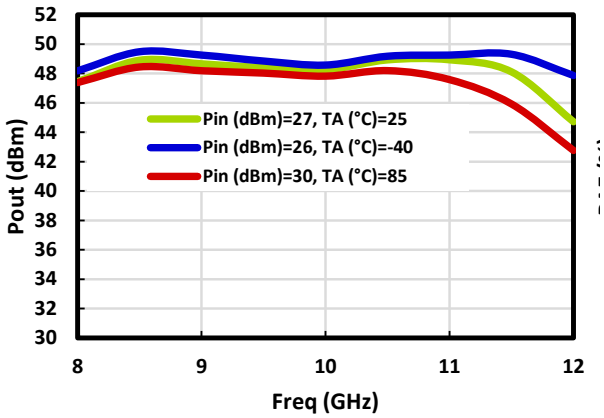
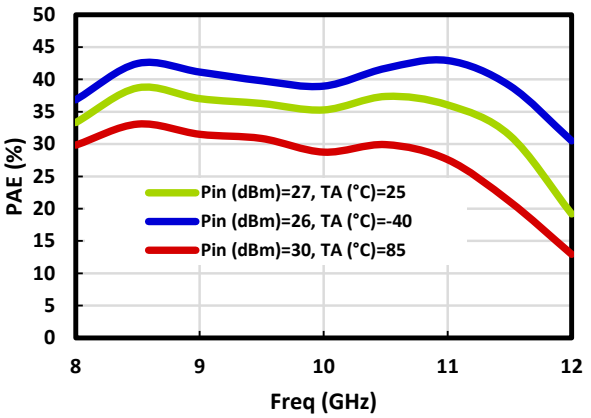
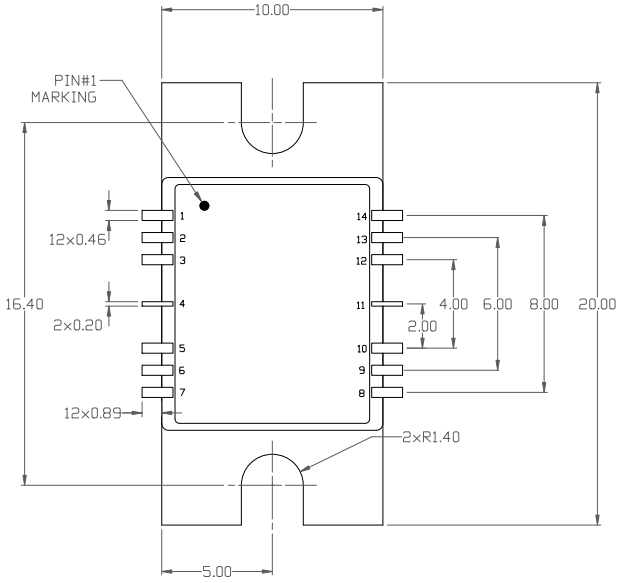


Figure 1-15. Gain vs. Freq



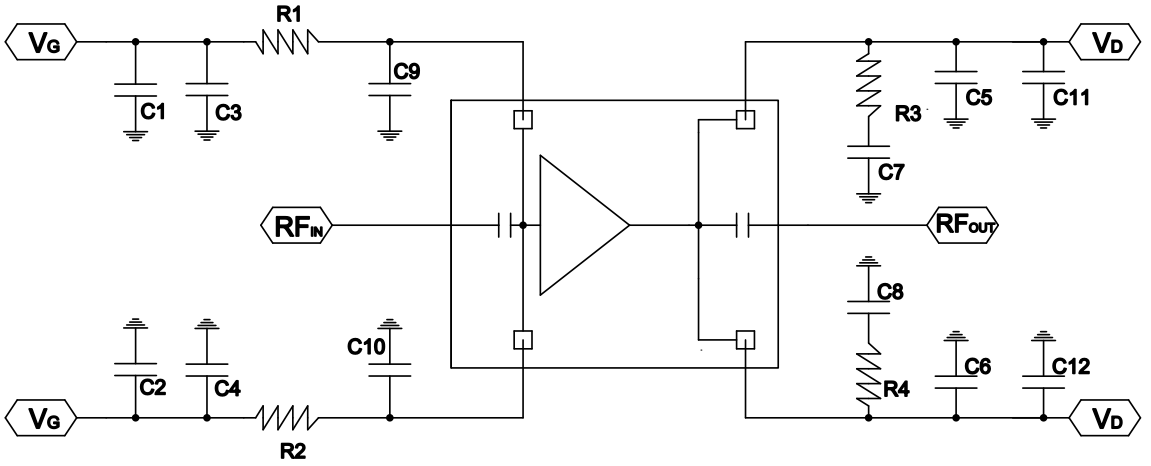
2. Mechanical Drawing



Units: mm

Pad No	Function	Description
1, 7	V_G	Gate bias, decoupling and bypass caps required. Bias must be applied to both pins
2, 6, 9, 13	No connect	Pin can be connected to ground or open circuit
3, 5, 10, 12	GND	Ground connection
4	RF_{IN}	50ohm RF input, DC blocked
8, 14	V_D	Drain bias, decoupling and bypass caps required. Bias must be applied to both pins
11	RF_{OUT}	50ohm RF output, DC blocked
Flange	GND	RF and DC ground

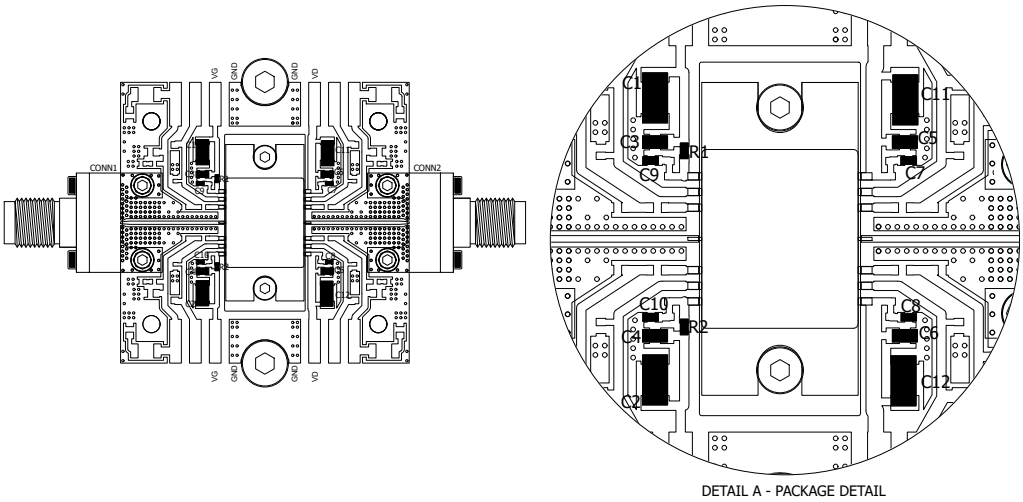
3. Application Circuit



Bill of materials

Component ID	Value	Details	Manufacturer Part No.
C1, C2, C11, C12	10uF	10uF Capacitor, 10%, 35V, 1206	Various
C3 - C6	1uF	1uF Capacitor, 10%, 35V, 0603	Various
C7, C8	10nF	10nF Capacitor,10%,50V,0402	Various
C9, C10	100nF	100nF Capacitor,10%,35V,0603	Various
R1, R2	5.1Ohms	5.1Ohm Resistor, 0402	Various
R3, R4	0Ohm	0Ohm Resistor,0402	Various

4. Evaluation Board



Evaluation board construction

Interconnect assembly Notes	Die attach using Eutectic
· Ball Bonding is preferred technique · Force, time and ultrasonic parameters are critical. · Aluminum wire bonding is not recommended. · Bond Wire diameter of 1mil is recommended.	· Flux-less gold-tin (AuSn) (80% Au, 20% Sn with a melting point of 280ºC) preform is preferred between the die and attached surface. · Recommended preform should be approximately 0.0012" thick. · Die bonder using heated collet with a temperature of 310ºC and die scrubbing should be used to ensure wetting and prevent formation of voids. · Exposure to extreme temperature should be kept to a minimum. · The optimum die attach environment is nitrogen atmosphere.

Die attach of component using adhesive	Re-flow Process
· Vacuum collets are preferred method of pickup. · Pickup method must consider the avoidance of die air bridges. · Die suitable for Eutectic and Epoxy die attach. · Where Epoxy is used, high thermal conductivity Silver Sintered Epoxy is recommended:- · Kyocera CT2700R7S · Namics H9889-1	· Maximum temperature 320ºC for 30 seconds. · Material matching for coefficient of thermal expansion is crucial for long-term reliability

PCB Construction	Details
Top & Bottom Layer	0.5oz Cu + ENEPIG
Electroless Nickel	3-6µm
Electroless Palladium	0.05-0.3µm
Immersion Gold	0.04-0.06µm

Key Features	Details
Dielectric	RO4003C
Overall Thickness	Approx 0.27mm
VIA Plating Thickness	>15µm

Note:
Optimum RF power performance achieved by minimizing output RF bond wire length.

5. Other considerations

Bias-up procedure

1. Set V_G to -5V
2. Set V_D to 28V
3. Adjust V_G positive until I_D quiescent is 360mA
4. Limit I_D to 3A
5. Apply RF signal

Bias-down procedure

1. Turn off RF
2. Turn off V_D, allow drain capacitors to discharge
3. Turn off V_G

6. Ordering, Shipping, and Handling

Handling Recommendations

Integrated circuits are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. It is recommended to follow all procedures and guidelines outlined in the Microsemi application note AN01: GaAs MMIC Handling and Die Attach Recommendations.

Ordering Information

For additional ordering information, contact your Microchip sales representative.

Part Number	Description
ICP1048-1-451I	Ceramic flange package
EV38P20A	ICP1048-2-501U EVB with SMA Connectors

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