

Product Overview

ICONICRF's ICP1747P is a packaged 3 stage MMIC power amplifier fabricated using GaN on SiC technology. ICP1747P operates from 14-18GHz with 47 dBm output power, 25% PAE and 22 dB small signal gain. ICP1747P is well suited to a variety of Test and Measurement and Aerospace & Defense applications.

Key Features

- **Frequency Range: 14-18GHz**
- **P_{out}: 47dBm @27dBm P_{in}**
- **PAE: 25% @27dBm P_{in}**
- **Small Signal Gain: 22dB**
- **Bias: V_D=28V I_{DQ}=450mA**
- **Technology: GaN on SiC**
- **Lead-free and RoHS compliant**
- **Pulsed or CW operation**
- **Package Dimensions: 10mm x 20mm**

Applications

- Test & Measurement
- Aerospace & Defense
- Communications

Electrical Specifications

Parameter	Min.	Typ.	Max.	Units	Conditions ⁽¹⁾
Frequency	14		18	GHz	
Output Power at P _{sat}		47		dBm	P _{in} = 27dBm
Power Added Efficiency, PAE at P _{sat}		25		%	P _{in} = 27dBm
Small Signal Gain, S ₂₁		22		dB	
Input Return Loss		8		dB	
Output Return Loss		8		dB	

Note: (1) Test conditions unless otherwise stated V_D=28V, I_{DQ}=450mA, T_A=25°C, Pulsed 10% (100µs/1ms)

Functional Block Diagram

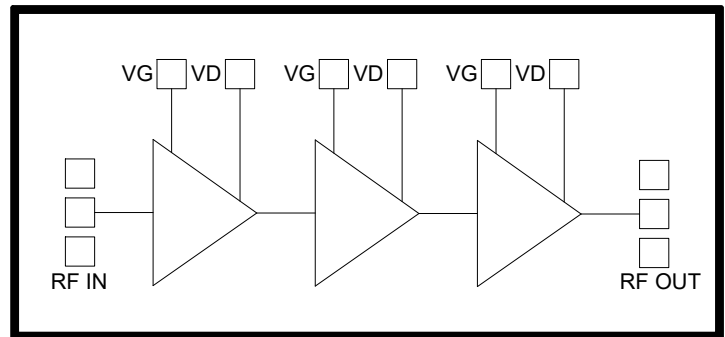


Table of Contents

Product Overview.....	1
1. Electrical Specification.....	3
1.1. Absolute Maximum Ratings.....	3
1.2. Small Signal Performance.....	3
1.3. Large Signal Performance.....	4
2. Mechanical Drawing.....	7
3. Application Circuit.....	8
4. Evaluation Board.....	9
5. Other considerations.....	10
6. Ordering, Shipping, and Handling.....	11
Microchip Information.....	12
The Microchip Website.....	12
Product Change Notification Service.....	12
Customer Support.....	12
Microchip Devices Code Protection Feature.....	12
Legal Notice.....	12
Trademarks.....	13
Quality Management System.....	14
Worldwide Sales and Service.....	15

1. Electrical Specification

1.1 Absolute Maximum Ratings

Parameter	Absolute Maximum
Drain to Gate Voltage (V_{DG})	32V
CW Input Power	+31dBm
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: $V_D=28V$, $I_{DQ}=450mA$

Figure 1-1. S_{21} vs Freq

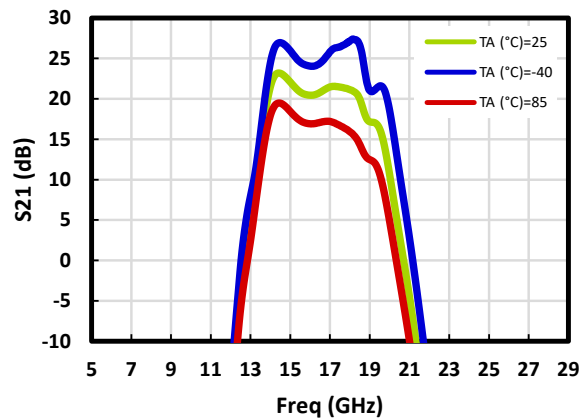


Figure 1-2. S_{11} vs Freq

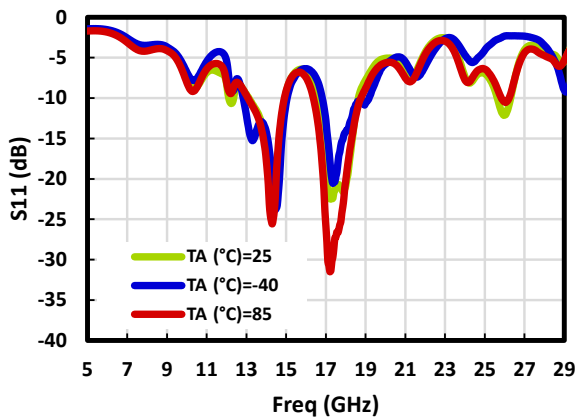
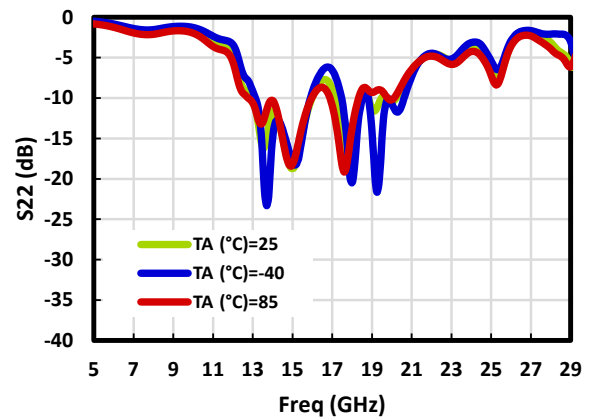


Figure 1-3. S_{22} vs Freq



1.3 Large Signal Performance

Typical Pulsed Power Data

Test conditions: $V_D=28V$, $I_{DQ}=450mA$, $T_A=25^\circ C$, Pulsed 10% (100 μs /1ms)

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

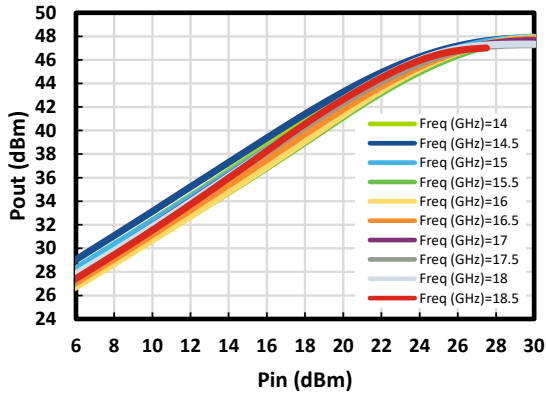


Figure 1-5. Gain vs. P_{out}

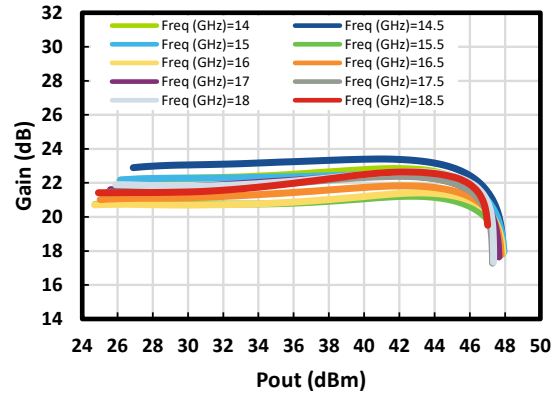


Figure 1-6. PAE vs. P_{out}

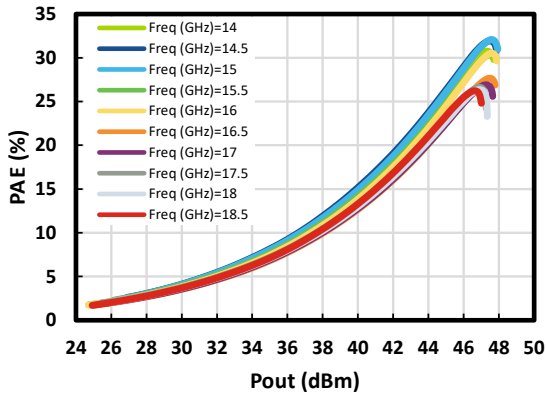


Figure 1-7. I_D vs. P_{out}

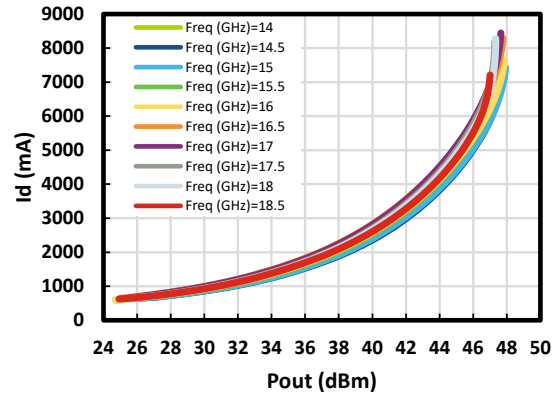


Figure 1-8. P_{out} vs. Freq.

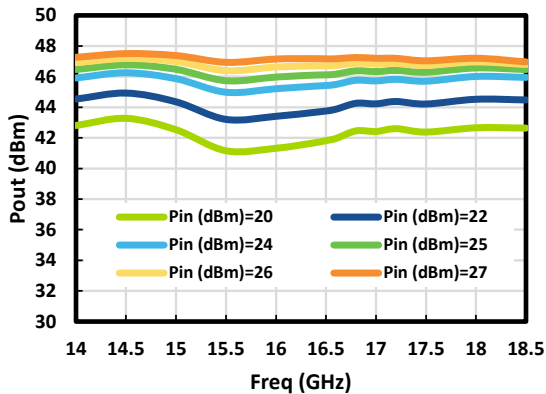
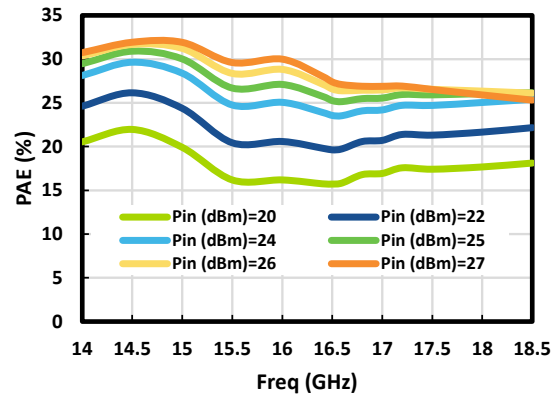


Figure 1-9. PAE vs. Freq.



Typical Pulsed Power Data

Test conditions: $V_D=28V$, $I_{DQ}=450mA$, $T_A=85^\circ C$, Pulsed 10% (100 μs /1ms)

Figure 1-10. P_{out} vs. P_{in}

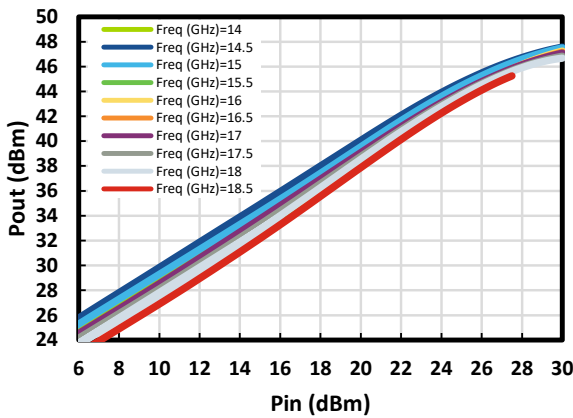


Figure 1-11. Gain vs. P_{out}

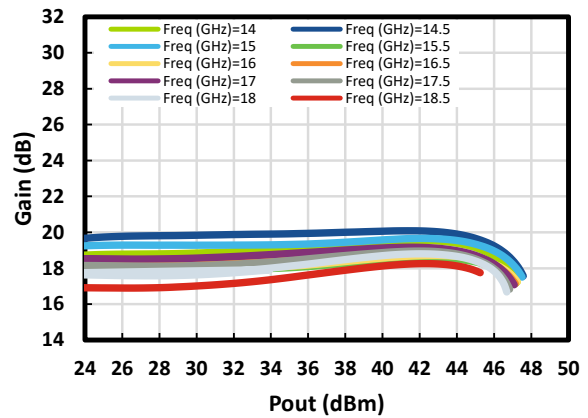


Figure 1-12. PAE vs. P_{out}

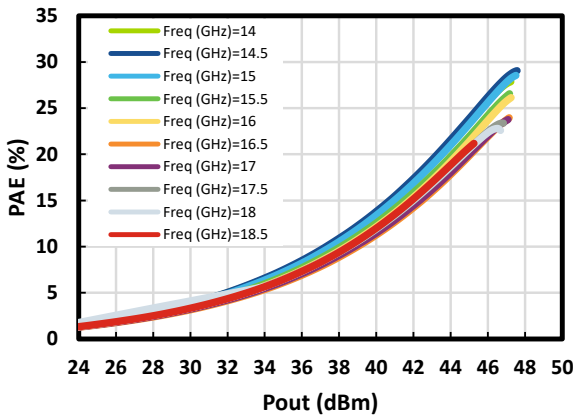


Figure 1-13. I_D vs. P_{out}

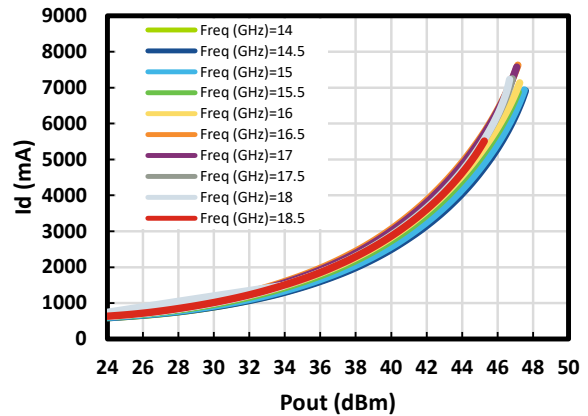


Figure 1-14. P_{out} vs. Freq.

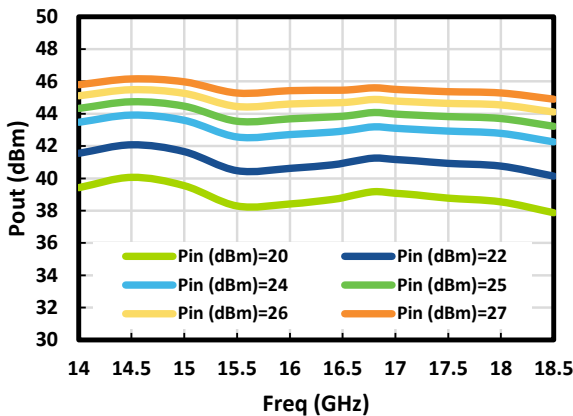
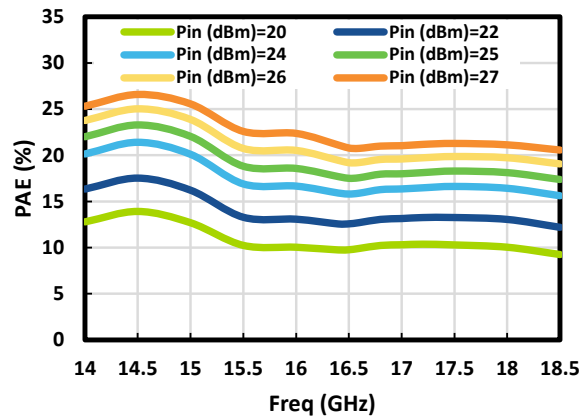


Figure 1-15. PAE vs. Freq.



Typical Pulsed Power Data

Test conditions: $V_D=28V$, $I_{DQ}=450mA$, $T_A=-40^{\circ}C$, Pulsed 10% (100 μ s/1ms)

Figure 1-16. P_{out} vs. P_{in}

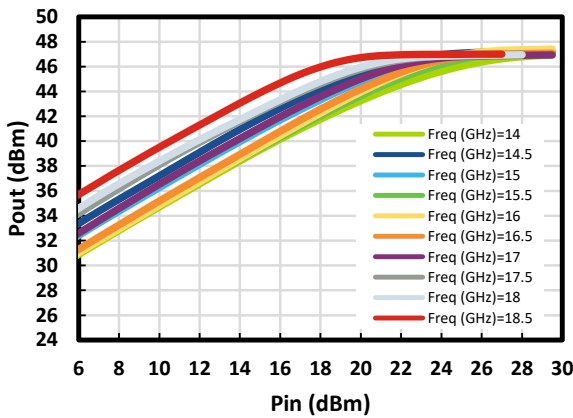


Figure 1-17. Gain vs. P_{out}

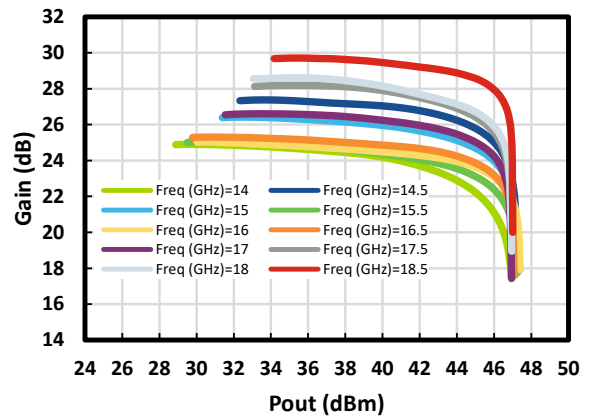


Figure 1-18. PAE vs. P_{out}

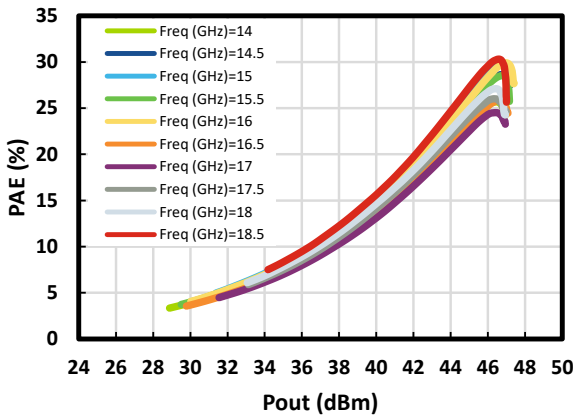


Figure 1-19. I_D vs. P_{out}

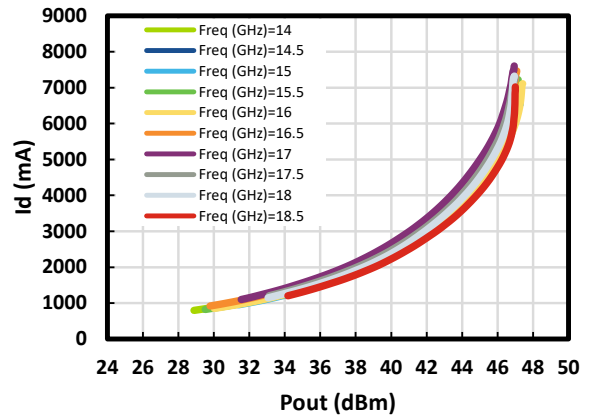


Figure 1-20. P_{out} vs. Freq.

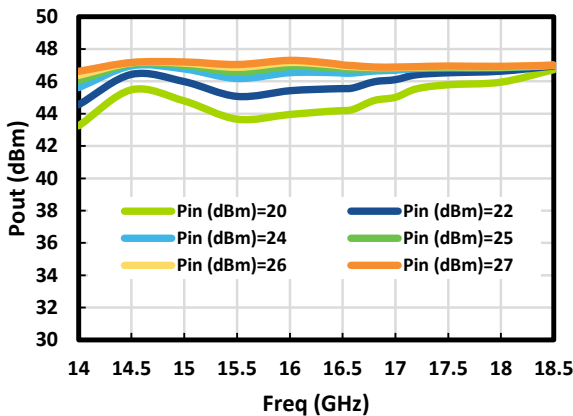
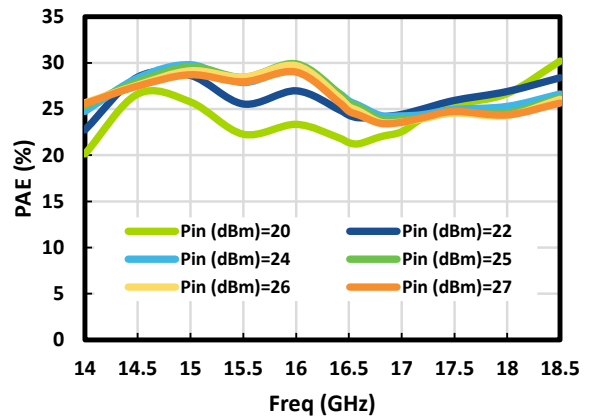
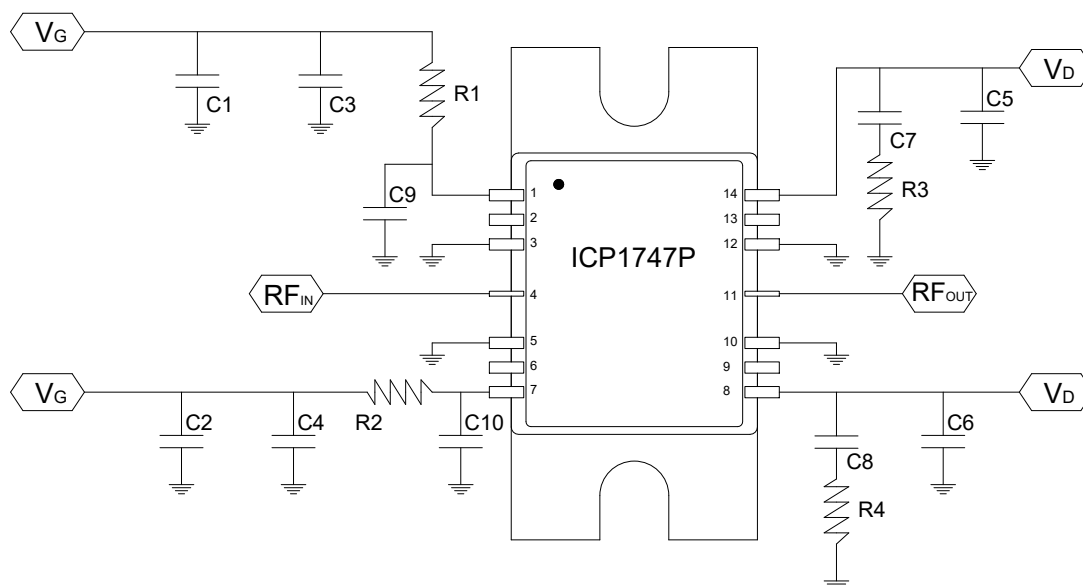


Figure 1-21. PAE vs. Freq.



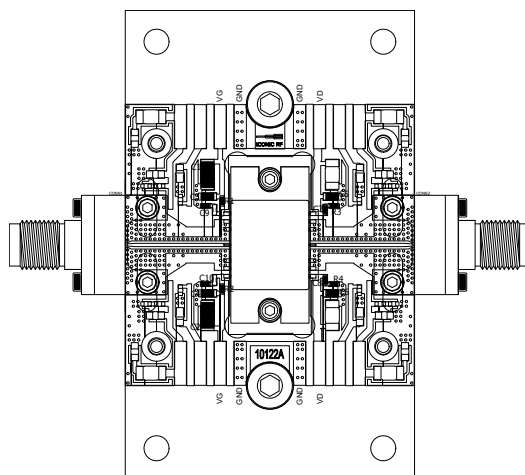
3. Application Circuit



Bill of materials

Component ID	Value	Details	Manufacturer Part No.
C1, C2	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, 0402	Various
R1, R2	5.1Ohm	5.1Ohm Resistor, 0402	Various
R3, R4	0Ohm	0Ohm Resistor, 0402	Various

4. Evaluation Board



PCB Fabrication

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

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

5. Other considerations

Assembly Guidance

The package must be bolted to a thermally conductive base plate and the pins aligned with the PCB tracks. For optimum thermal transfer use an electrically conductive thermal compound before fixing the package.

Solderability

Its recommended to manually solder the leads to the PCB using a no-clean solder. This avoids washing the part after soldering.

Components are compatible lead-free solder with a temperature of 260°C

For optimum RF and thermal performance IconicRF recommends the die assembly base plate is adequately bolted to an forced air heat sink using a thermal graphite interface pad (Graphite Interface Material GCSP-017-G 17µm thick) for optimal heat transfer.

There are many variables of the second level assembly between the die base plate and heat sink that IconicRF are unable to control and the following guidance is provided as information only. Fixing bolts should be provided as close to the die as possible to ensure a optimum pressure between the base plate and the heat sink.

The bolting screws used to attach the PCB assembly to the heat sink must include washers and be tightened with a suitable tightening pattern to ensure a uniform pressure. It is advised all surfaces be cleaned and be free of grease and dust prior to fully aligning the assembly with all screws located and tightened to finger tight. Further torquing of the screws must be achieved in multiple phases using a star shaped pattern to a recommended torque of 2.5N/m.

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 450mA
4. Limit I_D to 10A
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
ICP1747-1-451I	Ceramic flange package
EV32R61A	Evaluation board with SMA Connectors (ICP1747-1-451I PCB Assembly)

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