ICONIC RF

a MICROCHIP company

32-38GHz 5W GaN PA MMIC

ICP3537

Description

ICONICRF's ICP3537 is a 3 stage MMIC power amplifier in bare die form, fabricated using GaN on SiC technology. ICP3537 operates from 32-38GHz with >37dBm output power, >18% PAE and 18dB tsmall signal gain. ICP3537 is well suited to a variety of Test and Measurement and Aerospace & Defense applicarions.

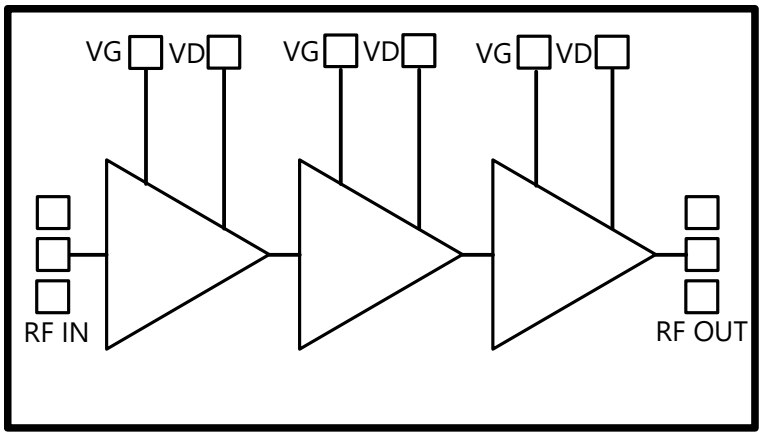
Features

- Frequency Range: 32-38GHz
- Pout: 38 dBm @ 24dBm Pin
- Typical PAE: 18 %
- Small Signal Gain: 18dB
- Bias: V_D=28V I_{DQ}=84mA
- Technology: GaN on SiC
- Lead-free and RoHS compliant
- Die Size = 3.5 mm x 1.78 mm

Applications

- Test and Measurement
- Satellite
- Aerospace & Defense

Functional Block Diagram



Electrical Specifications | Test Conditions unless otherwise stated | V_D=*28V,* I_D=*84mA, TA*=25 °C, Pulsed

Parameter	Conditions	Min	Typ	Max	Units
Frequency		32		38	GHz
Output Power @ P_{sat}	Pin=24dBm	37	38		dBm
Gain @ Psat	Pin=24dBm		20		dB
PAE @ P_{sat}	Pin=24dBm	17	20		%
Drain Current P_{sat}	Pin=24dBm	500		1500	mA
Gate Voltage (V_G) for I_{DQ}		-1.7		-2.2	V
Gate Current	Pin=24dBm	-2		10	mA
Small Signal Gain			18		dB
Input Return Loss			15		dB
Output Return Loss			10		dB
Recommended operating Voltage		20	24	28	V

Absolute Maximum Ratings

Parameter	Absolute Maximum
Drain Voltage (V_D)	30.0V
Gate Voltage Range (V_G)	-5 to 0V
Drain Current (CW) T_A=25ºC	3.0A
Power Dissipation (CW) T_A=25ºC Power Dissipation (CW) T_A=85ºC	68W 51W
CW Input Power 50ohm, T_A=25ºC	+29dBm
Channel Temperature	275°C
Storage Temperature	-65°C to +150°C
Input Power VSWR (2:1), V_D=24V, I_{DQ}=84mA V_D=28V, I_{DQ}=84mA	20dBm
Eutectic Die Attach Temperature (30s)	320°C

ICONIC RF does not recommend sustained operation near these survivability limits.

Thermal and Reliability

Parameter	Value
Thermal Resistance	3.7 ºC/W

Notes

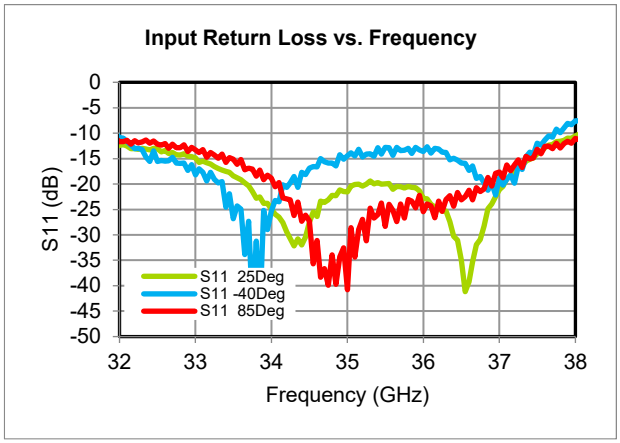
1. Assumes silver sintered epoxy attach (15um thick) mounted on CuMo carrier.
2. Base temperature is assumed at the top of the CuMo carrier
3. Thermal resistance calculated using IR measurement of the channel temperature.

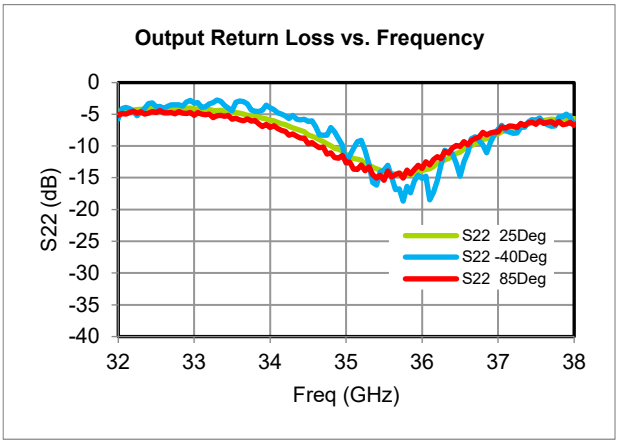
Ordering Information

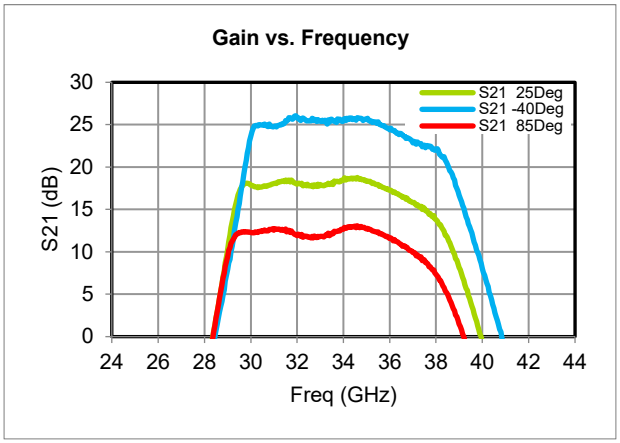
Part No.	Description
ICP3537-1-110I	Bare die in Gel-Pack trays
EV79H92A	ICP3537-1-505U Evaluation Board with 2.4mm connectors

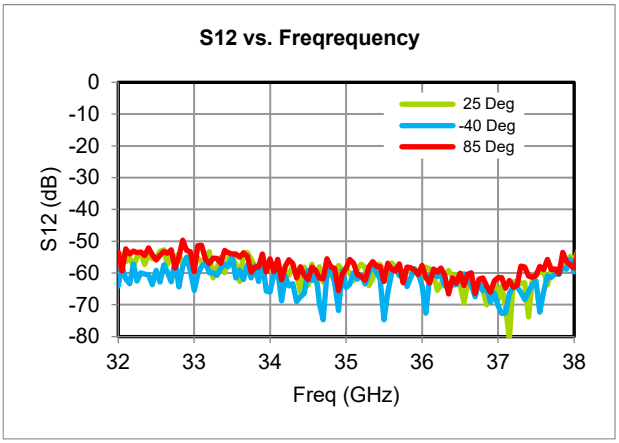
Performance Data

Typical Small Signal Data | Test conditions unless otherwise stated V_D=28V, I_{DQ}=84mA ,TA=25 °C, 10% Duty Cycle [100µs/1ms]

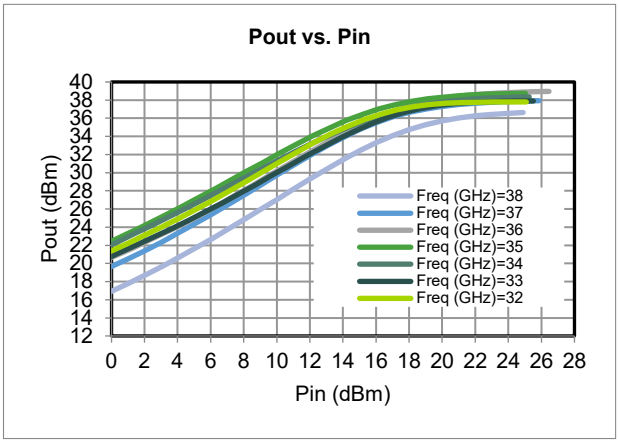


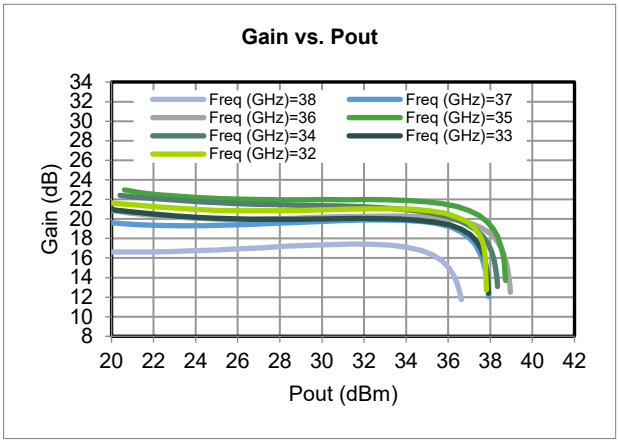


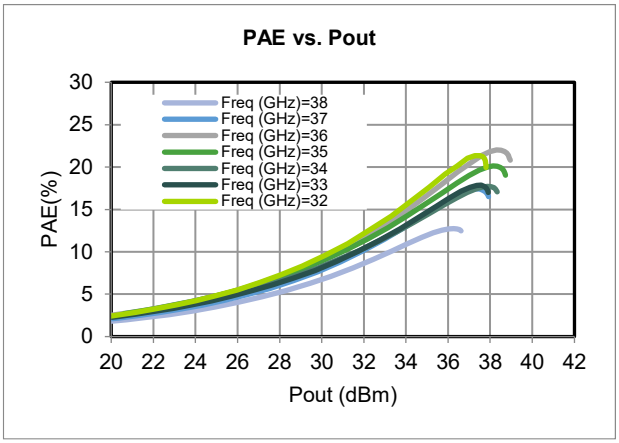


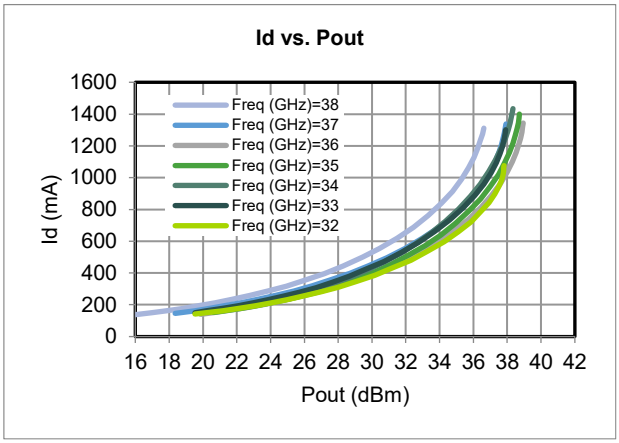


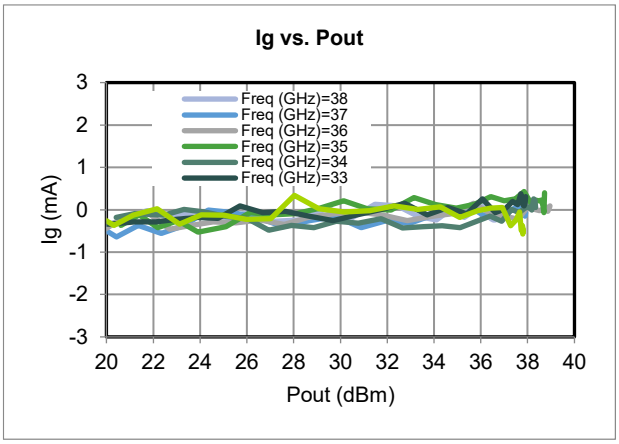
Typical Large Signal Data, 10% Pulse | Test conditions unless otherwise stated V_D=28V, I_{DQ}=84mA ,TA=25 °C [100µs/1ms]



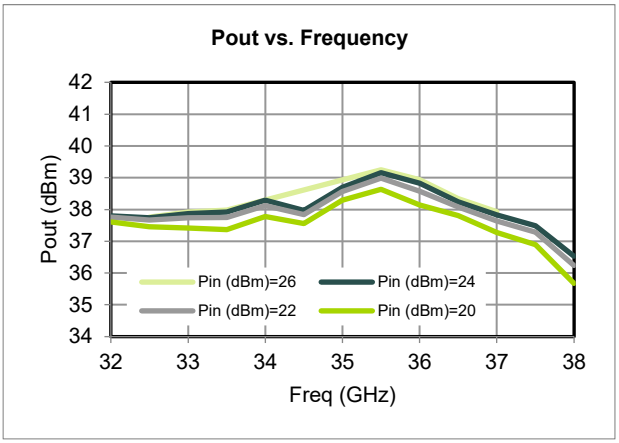


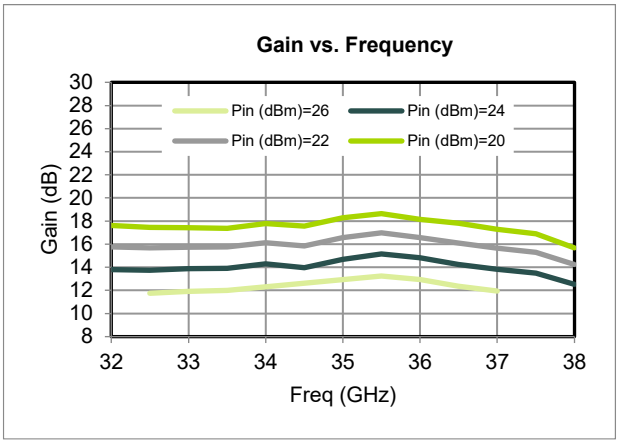


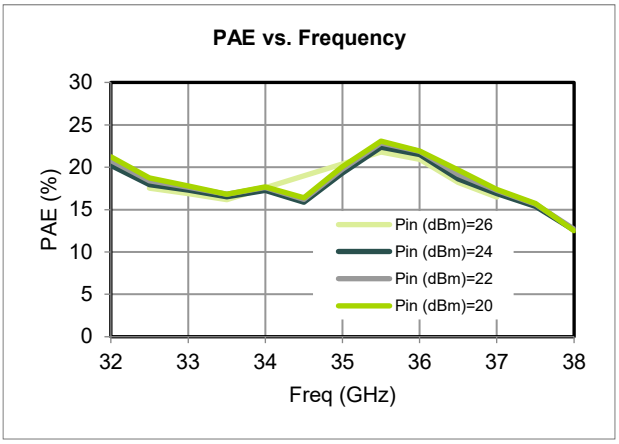


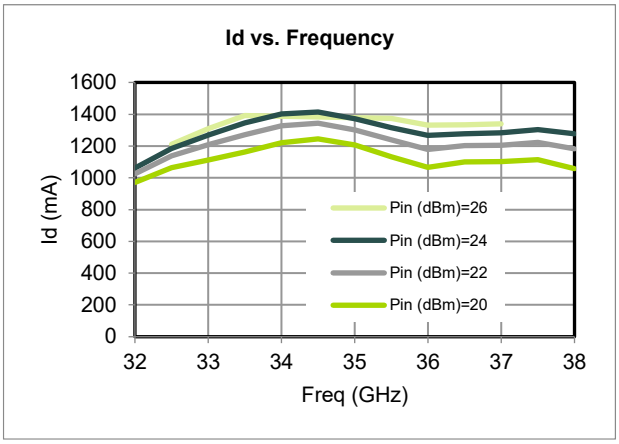


Typical Large Signal Data, 10% pulse | Test conditions unless otherwise stated V_D=28V, I_{DQ}=84mA ,TA=25 °C, [100µs/1ms]









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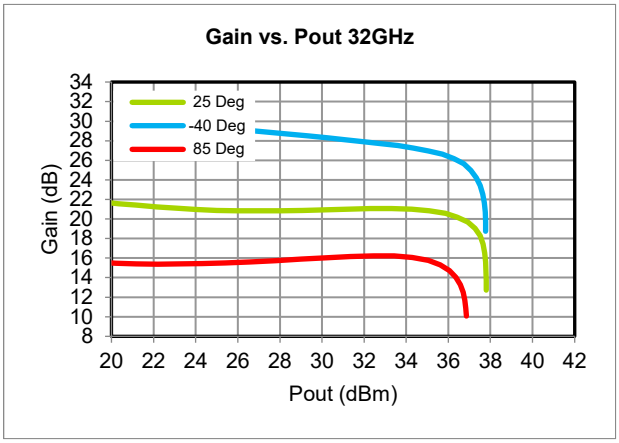

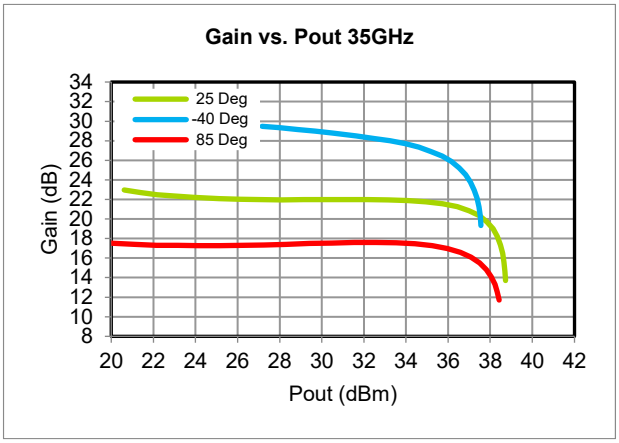

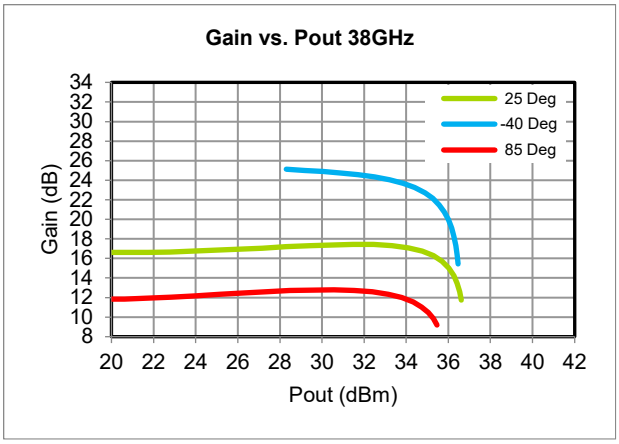

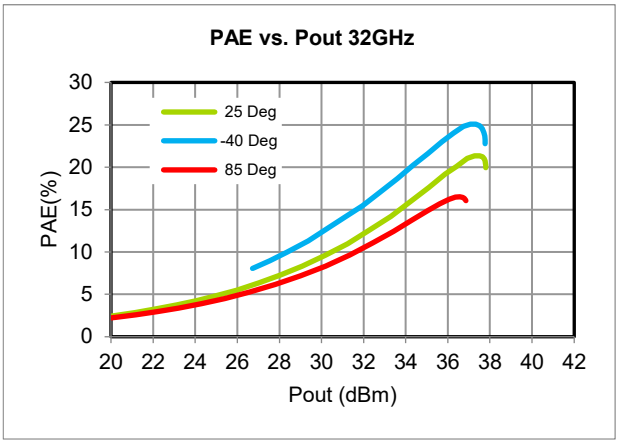

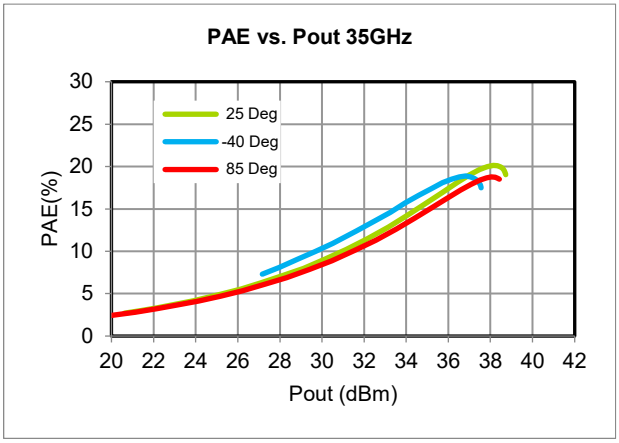

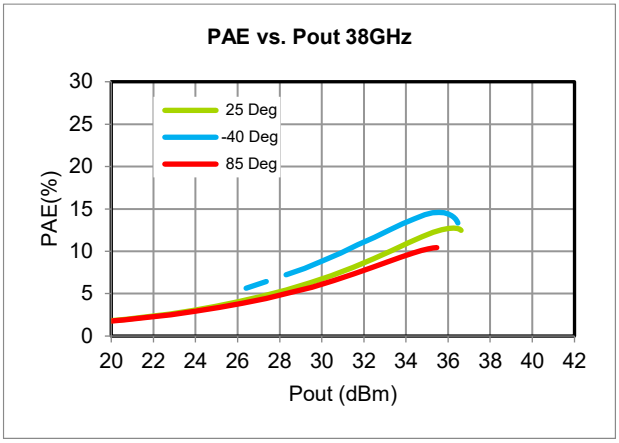

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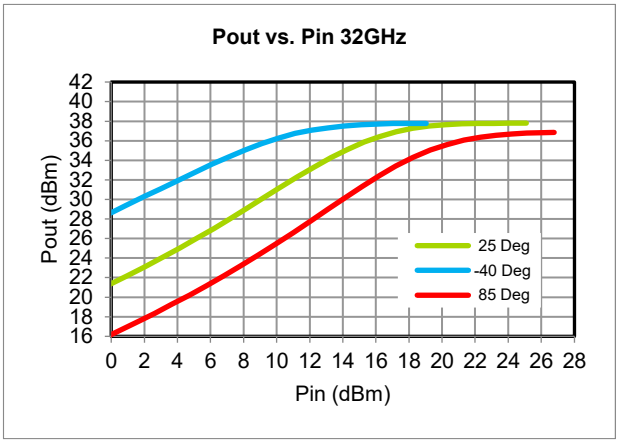
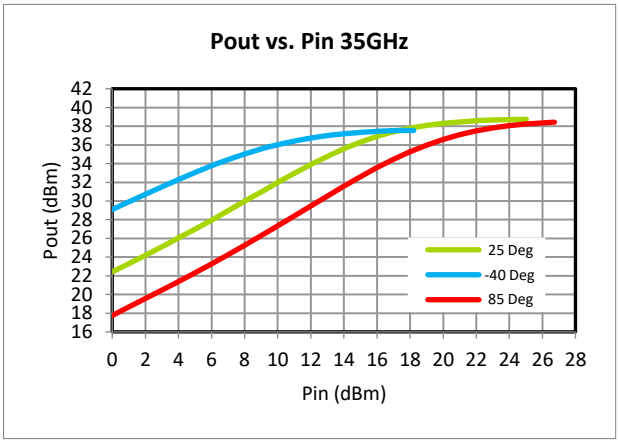
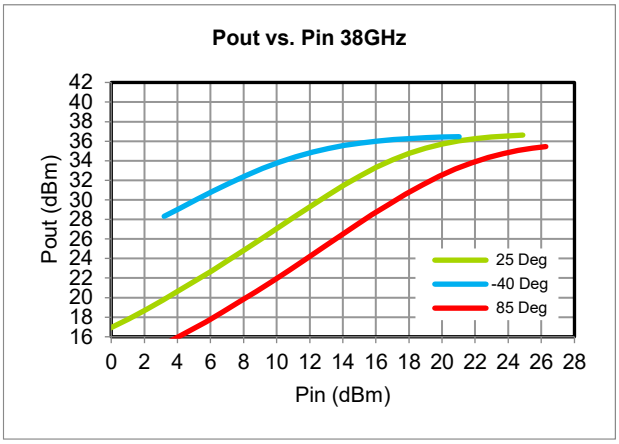
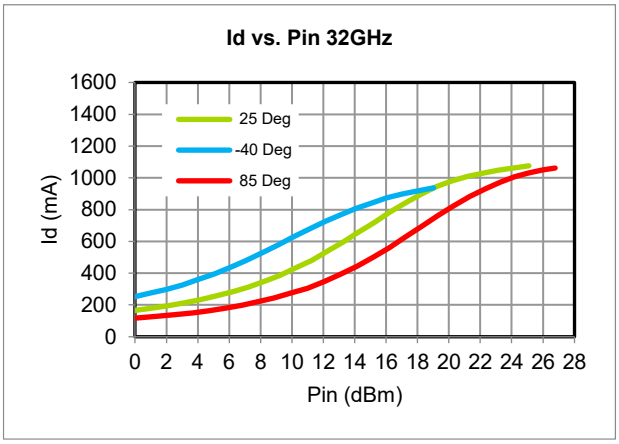
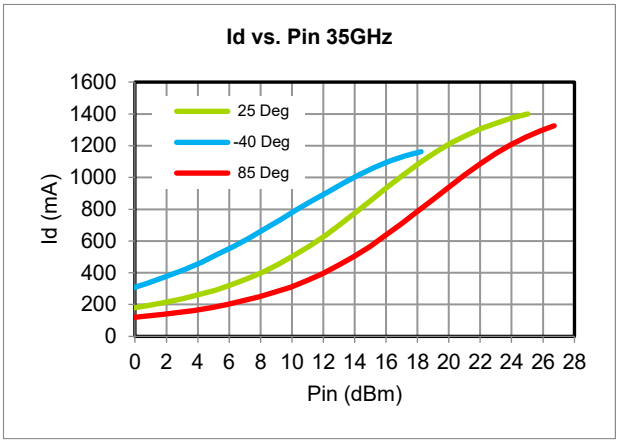
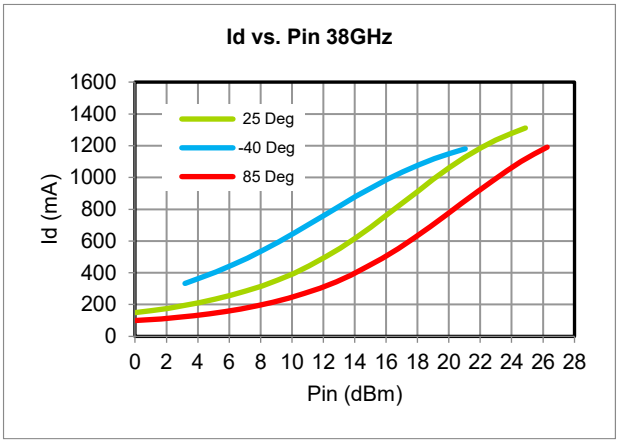




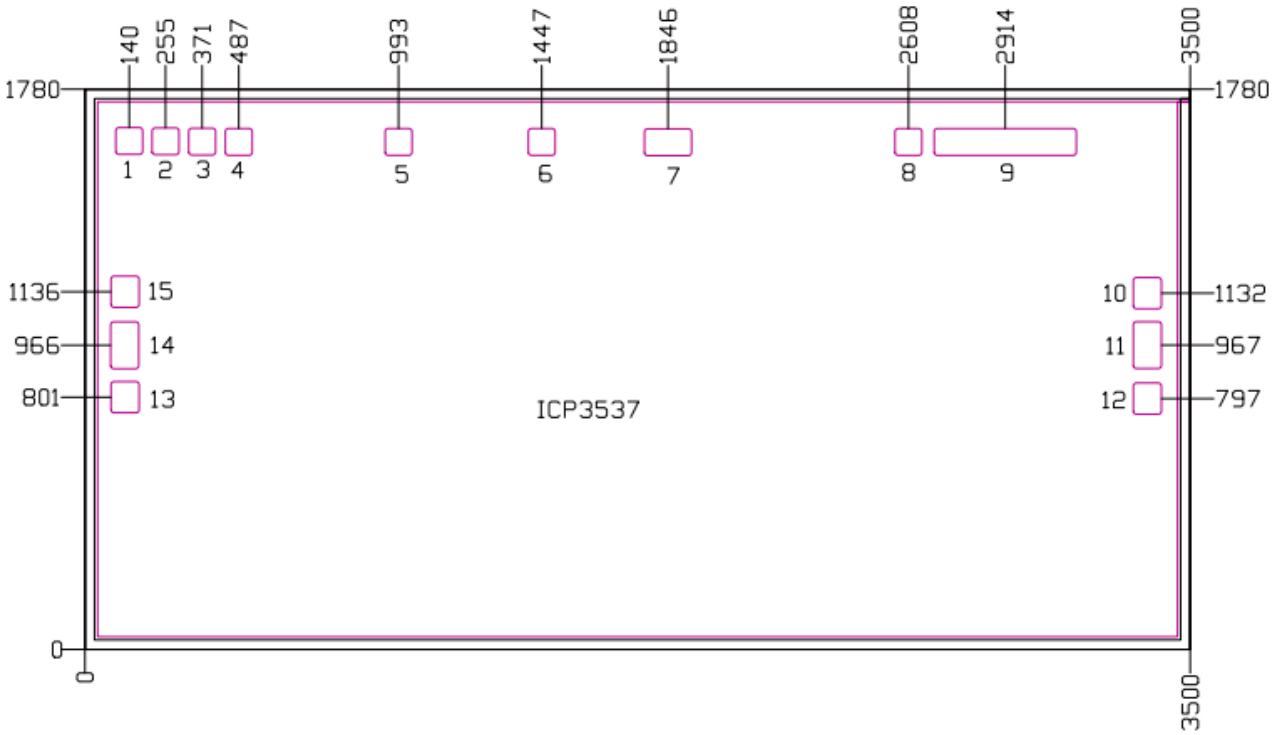








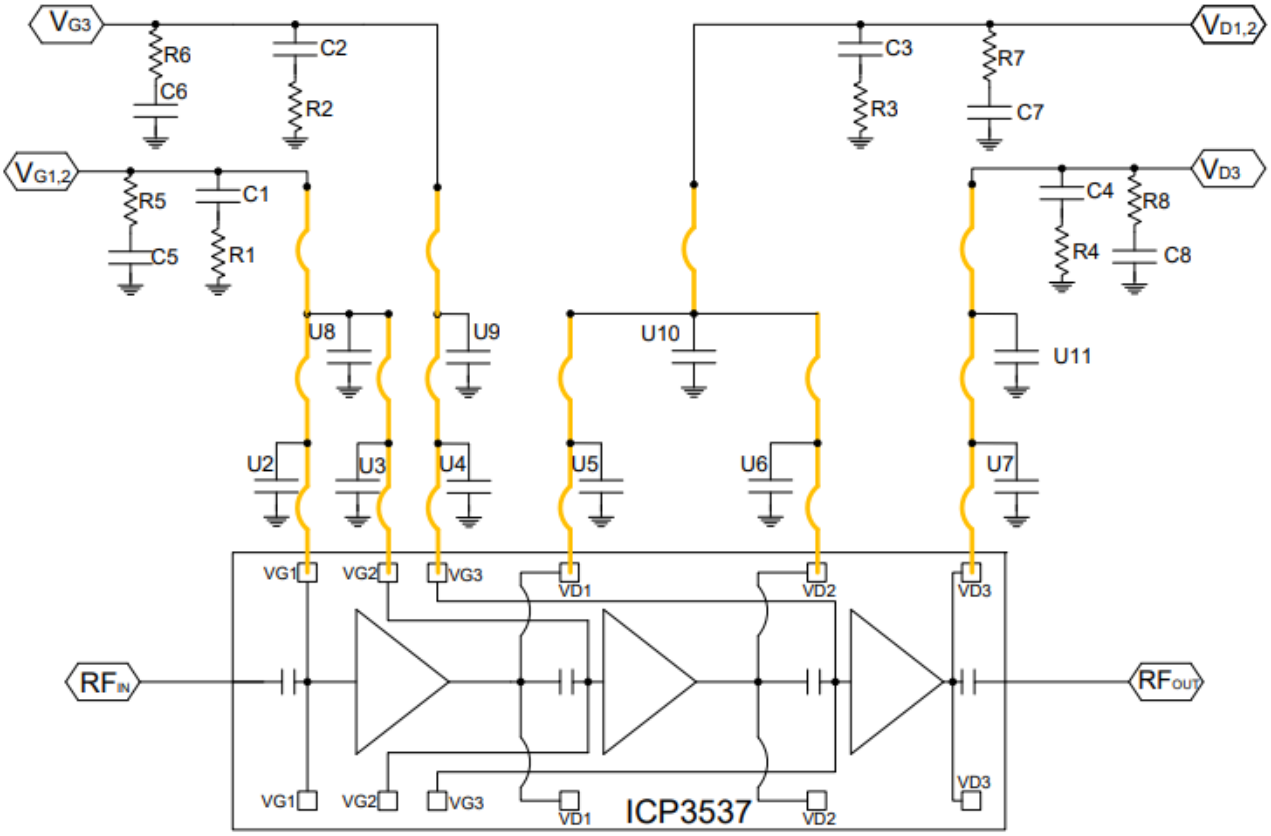
Mechanical Drawing



Units: mm
Thickness: 100um
Backside is RF and DC ground

Pad No	Pad Size	Function	Description
1,6,8,10,12,13,15	85x85	Ground	Ground
2	85x85	VG1	First stage north gate bias, decoupling and bypass caps required
3	85x85	VG2	Second stage gate bias, decoupling and bypass caps required
4	85x85	VG3	Third stage gate bias, decoupling and bypass caps required
5	85x85	VD1	First stage north drain voltage, decoupling and bypass caps required
7	150x85	VD2	Second stage drain voltage, decoupling and bypass caps required
9	450x85	VD3	Third stage drain voltage, decoupling and bypass caps required
14	80x150	RFIN	50 ohm RF output, DC blocked, pad is DC grounded
28	80x150	RFOUT	50 ohm RF input, DC blocked

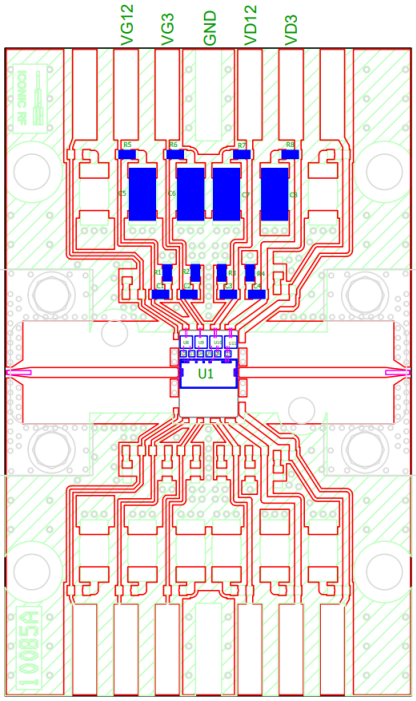
Application Circuit

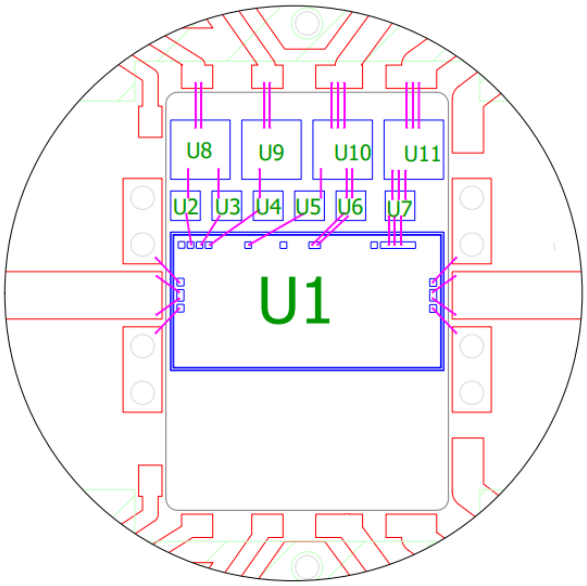


Bill of Materials

Assembly Reference	Value	Description
U1		32-38GHz MMIC
U2-U7	100pF	Johanson 100pF SLC Capacitor
U8-U11	10nF	10nF SLC Capacitor
C1,C2,C3,C4	10nF	10nF Capacitor,10%,50V,0402
C5,C6,C7,C8	10uF	10uF Capacitor,10%,50V,1206
R1-R8	5.1Ohms	5.1 Ohms Resistor,0402

Assembly Drawing





PCB Fabrication

PCB Construction	Material	Dimensions
METAL1_TOP	Cu + ENIG	1oz Cu plated Electroless Nickel 3-5µm
DIELECTRIC	RO6002	10mils (254µm)
METAL2_BOTTOM	Cu + ENIG	1oz Cu plated Electroless Nickel 3-5µm

Key Features	Dimensions
VIA Drill	0.3mm
VIA Plating Thickness	50-70um
50 Ohm Line Width	525um

Assembly Guidance

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

Interconnect assembly Notes

- 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.

Die attach of component using adhesive

- 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

Die attach using Eutectic

- 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.

Reflow Process

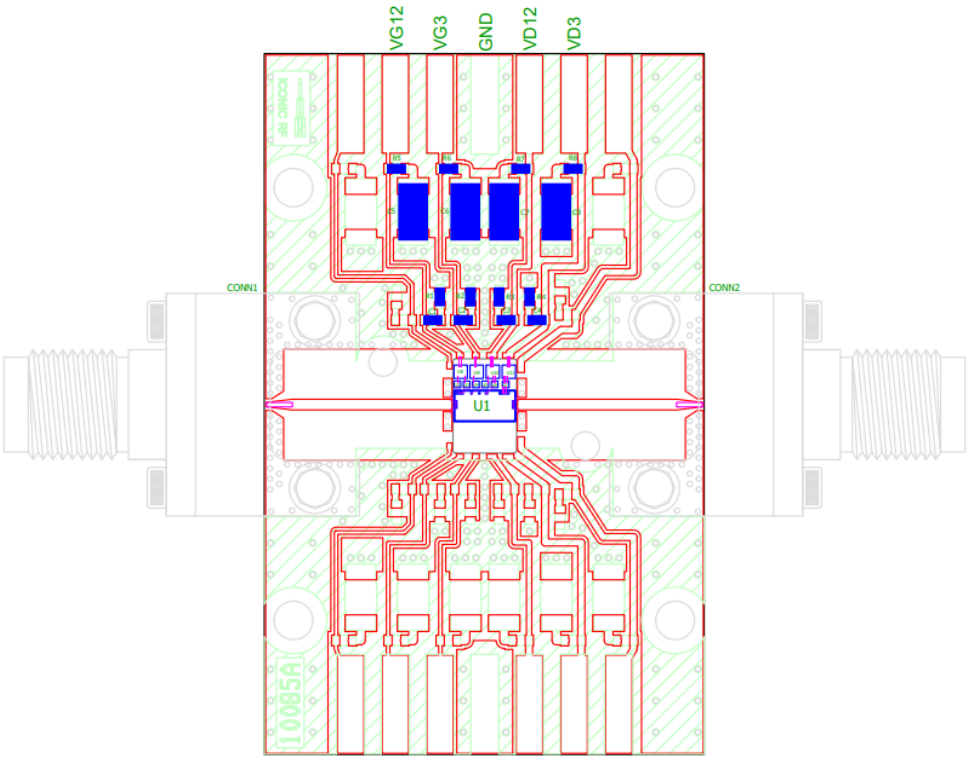
- Maximum temperature 320ºC for 30 seconds.
- Material matching for coefficient of thermal expansion is crucial for long-term reliability

Assembly Guidance continued.

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 170µm 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=-5V
2. Set V_D to 20-24V
3. Adjust V_G positive until I_D quiescent is 280mA
4. Limit I_D to 4.5A
5. Apply RF Signal

Bias-down Procedure

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

Handling Procedures

Please observe the following precautions to avoid damage:

Static Sensitivity

Integrated Circuits are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these devices. Class 1A HBM (250-500V) ESD Classification is anticipated.

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