ICONIC RF

a MICROCHIP company

23-31GHz 5W GaN PA MMIC

ICP2637P

Product Overview

ICONICRF's ICP2637P is a three stage MMIC power amplifier in a 5x5mm QFN package, fabricated using GaN on SiC technology. The PA operates from 23-31GHz with 37dBm output power, 25% PAE and 23dB small signal gain. The die has integrated DC blocking capacitors and is matched to 50ohms on the RF input and output ports. The operating frequency provides flexible operation for a variety of applications including satellite and 5G. The ICP2637P is 100% DC and RF tested on-wafer to ensure compliance with electrical specifications.

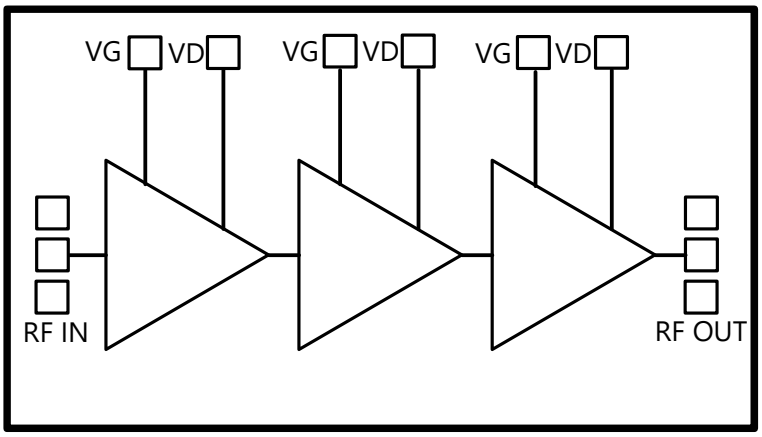
Key Features

- Frequency Range: 23-31GHz
- Pout: 37 dBm @ 19dBm Pin
- PAE: 25 %
- Small Signal Gain: 23dB
- Bias: VD=28V IDQ=84mA
- Technology: GaN on SiC
- Lead-free and RoHS compliant
- Package: = 5mm x 5mm 32 Lead QFN
- Integrated Power Detector

Applications

- 5G
- Satellite Communications
- Aerospace & Defense

Functional Block Diagram



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

Parameter	Conditions	Min	Typ	Max	Units
Frequency		23		31	GHz
Output Power @ P_{sat}	Pin=19dBm		37		dBm
PAE @ P_{sat}	Pin=19dBm		25		%
Small Signal Gain			23		dB
Input Return Loss			10		dB
Output Return Loss			7		dB
I_{DQ}			84		mA
V_{GS}			2.04		V
ID drive	Pout 37dBm		1200		mA

Absolute Maximum Ratings

Parameter	Absolute Maximum
Drain Voltage (V_D)	30.0V
Gate Voltage Range (V_G)	-5 to 0V
Gate Current	4.2mA
Drain Current (CW) T_A=25ºC	1.5A
CW Input Power 50ohm, T_A=25ºC	+24dBm
Channel Temperature	275°C
Storage Temperature	-65°C to +150°C
Input Power VSWR (2:1) V_D=28V, I_{DQ}=84mA V_D=24V, I_{DQ}=84mA	20dBm

Exceeding any one or combination of these limits may cause permanent damage to this device.
ICONIC RF does not recommend sustained operation near these survivability limits.

Thermal and Reliability

Parameter	Value
Thermal Resistance	TBC C/W

Notes

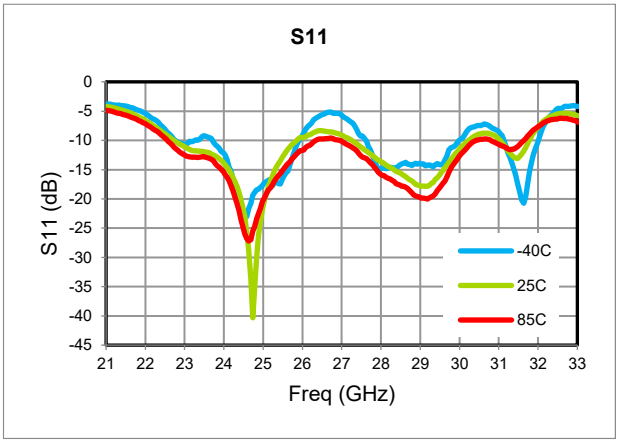
1. Package soldered to PCB
2. Thermal resistance calculated using IR measurement of the channel temperature to the top of the PCB.
3. Temperature at the base of the PCB maintained at 70°C

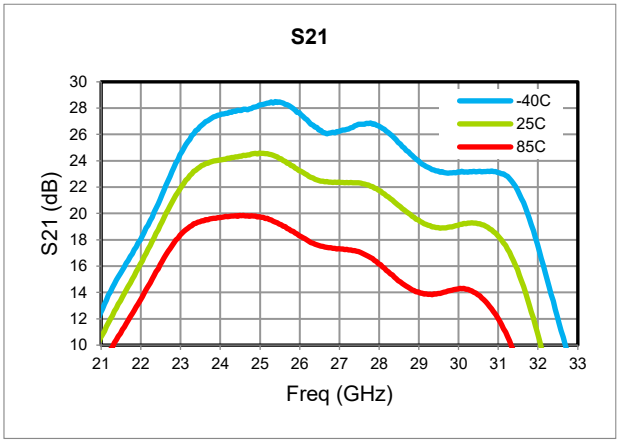
Ordering Information

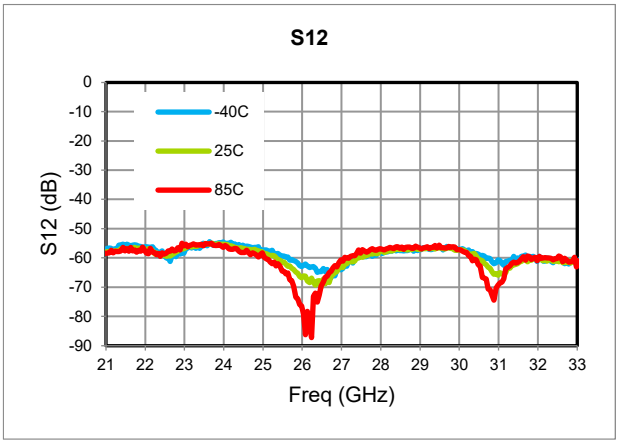
Part No.	Description
ICP2637-1-351I	5x5 32 Lead QFN Package
ICP2637-2-505U	Evaluation Board with 2.4mm connectors

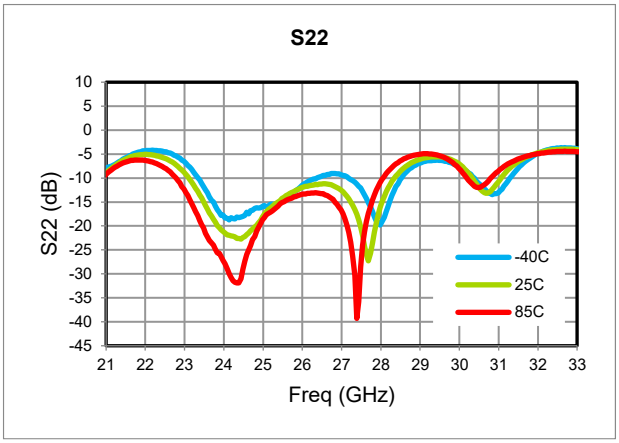
Typical Performance

S-Parameter Performance | Test Conditions unless otherwise stated | V_D=28V, I_D=84mA, T_A=-40ºC, 25ºC, +85ºC

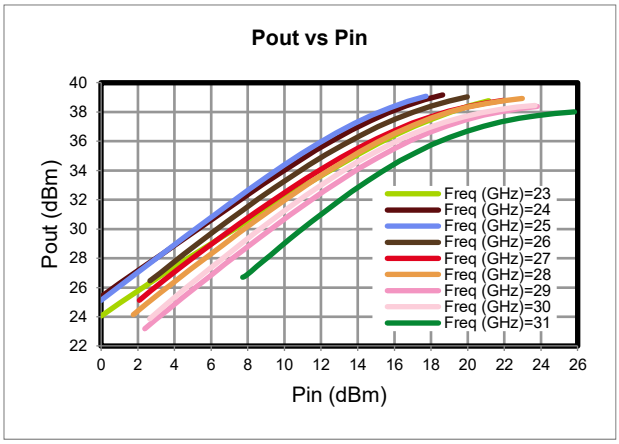


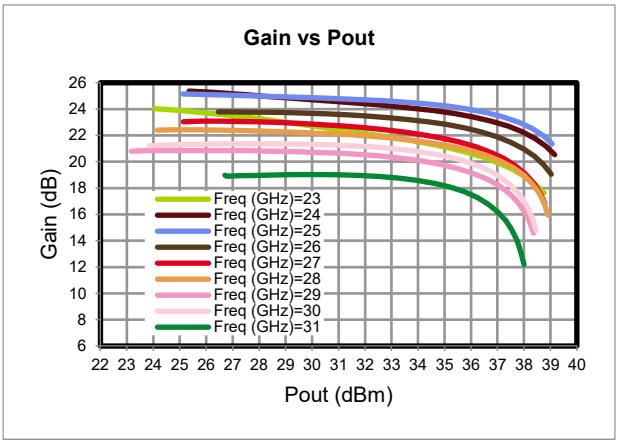


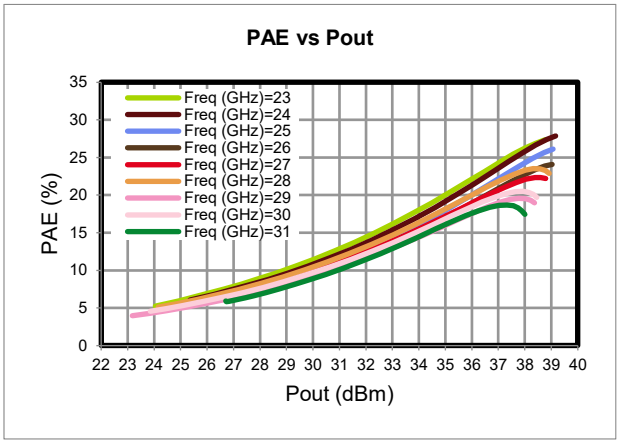


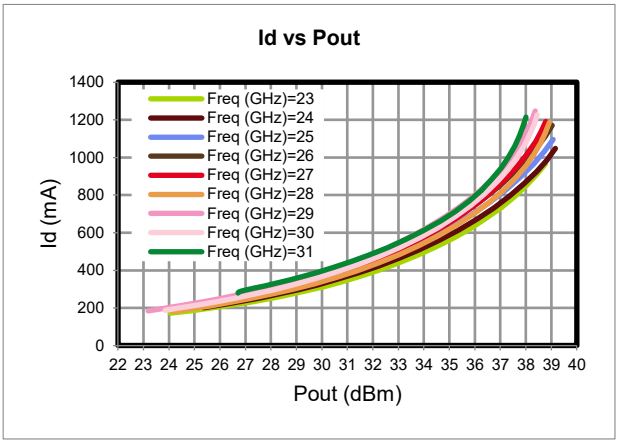


Power Performance | Test Conditions unless otherwise stated | V_D=28V, I_D=84mA, T_A=25°C, CW

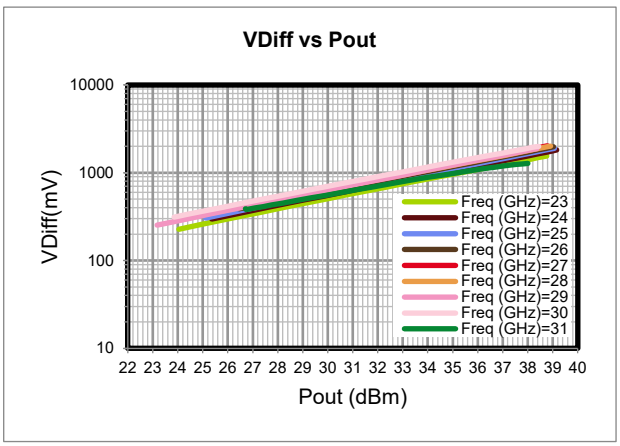


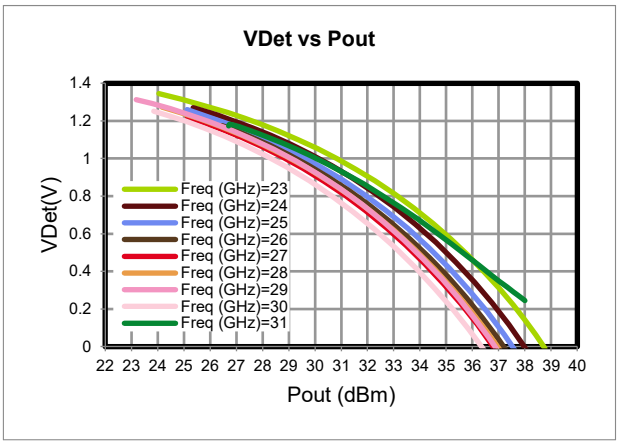




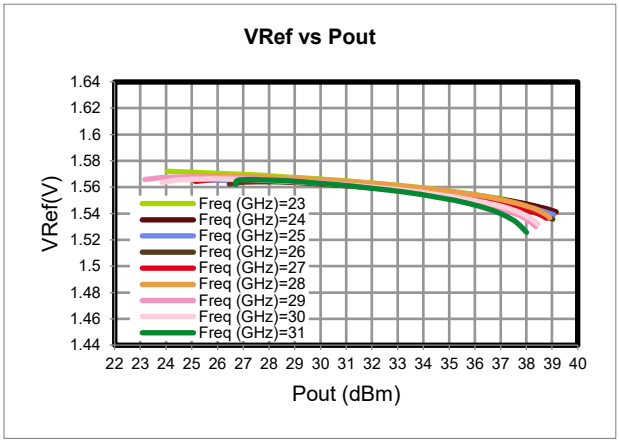


Detector performance | Test Conditions unless otherwise stated | V_S=28V, I_D=84mA, T_A=25°C, CW, V_{Diff}=V_{Ref} -V_{Det}

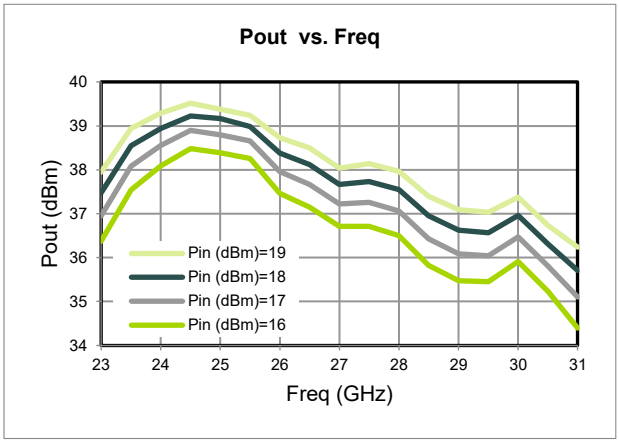


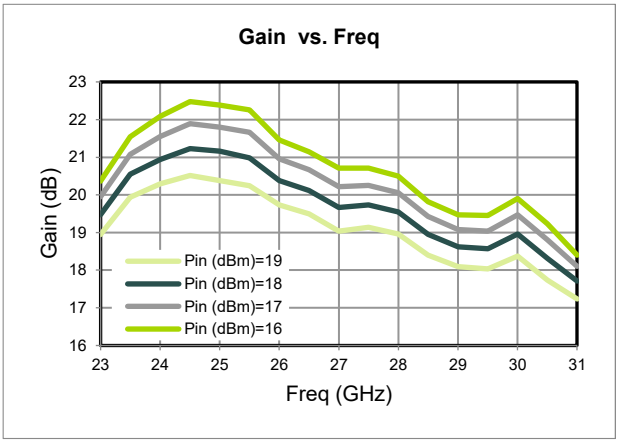


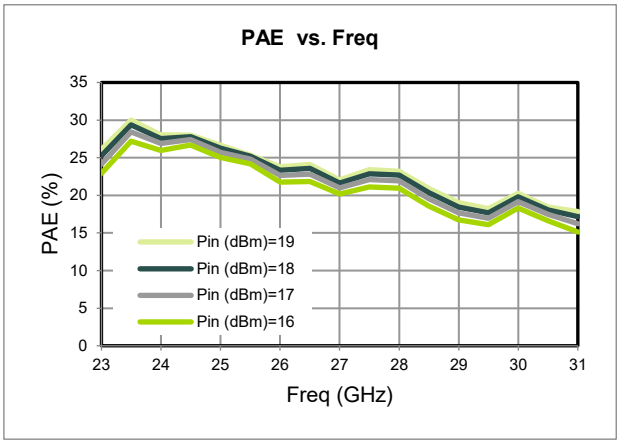
Detector performance | Test Conditions unless otherwise stated | V_S=28V, I_D=84mA, T_A=25°C, CW, V_{Diff}=V_{Ref} -V_{Det}

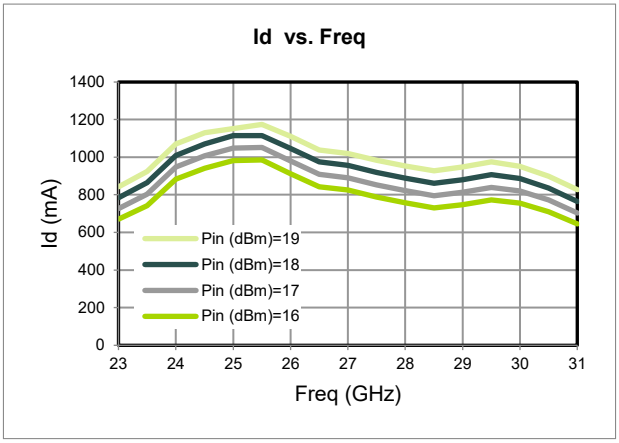


Power Performance vs Frequency | Test Conditions unless otherwise stated | Pin=16-19dBm ,V_D=28V, I_D=84mA, T_A=25°C, CW

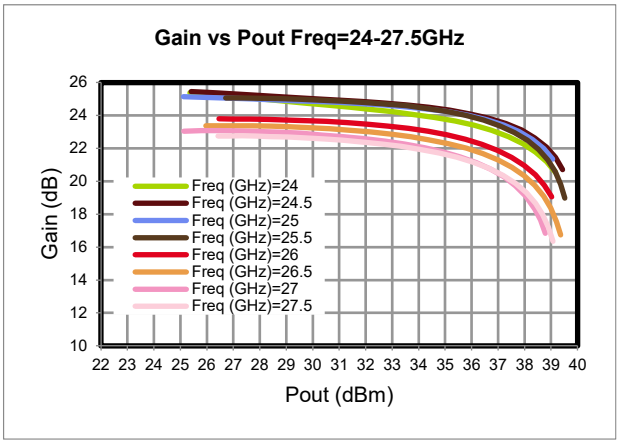


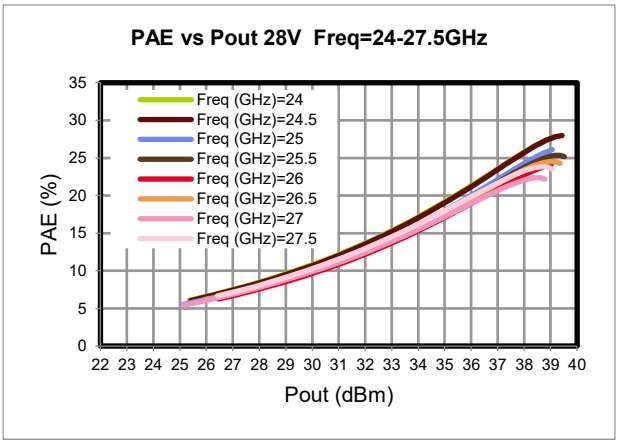


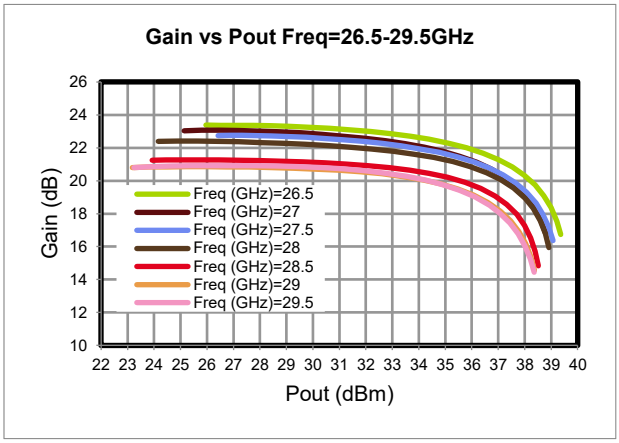


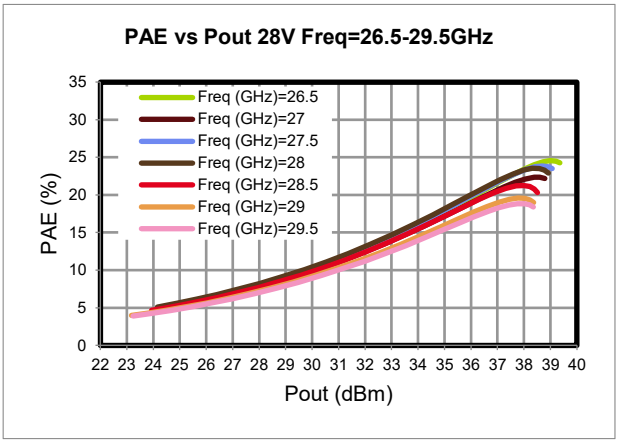


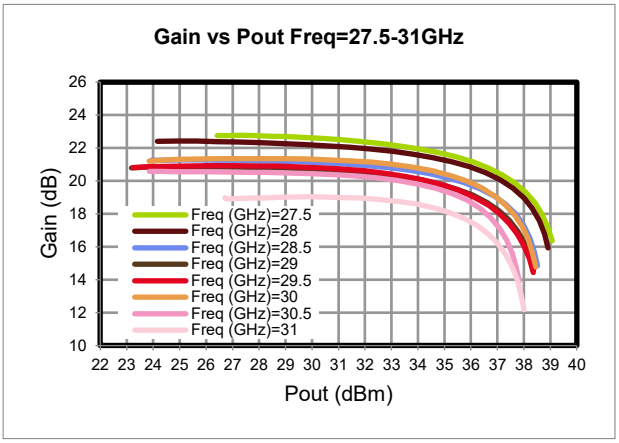
Performance 5G Bands | Test Conditions unless otherwise stated | V_D=28V, I_D=84mA, T_A=25ºC, CW

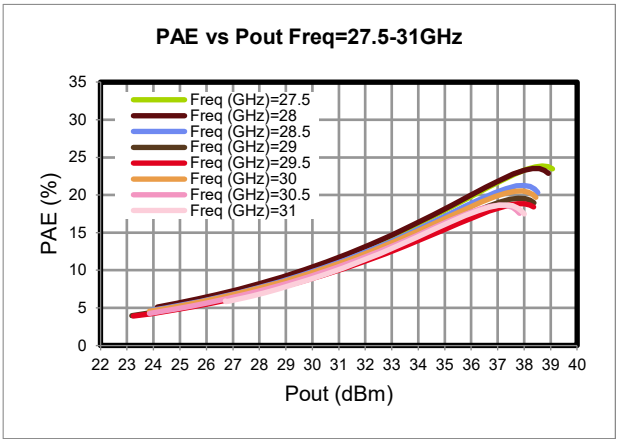




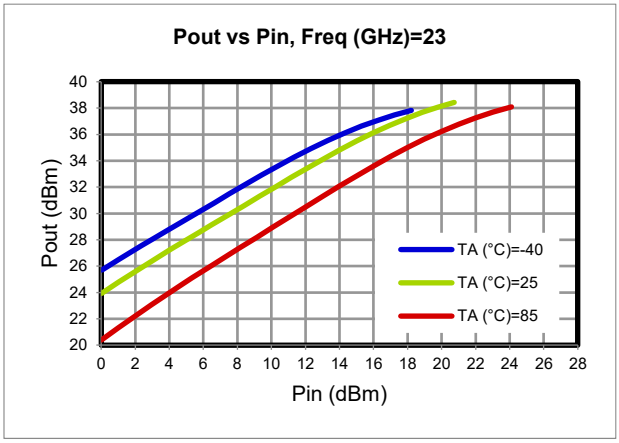


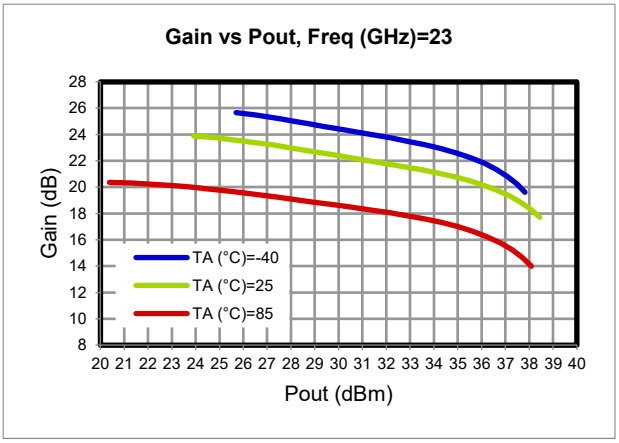


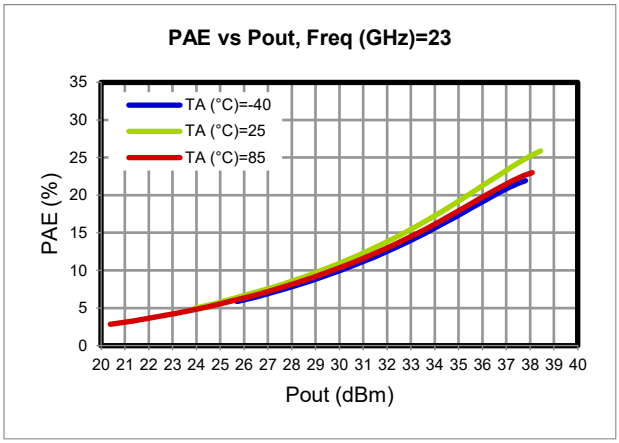


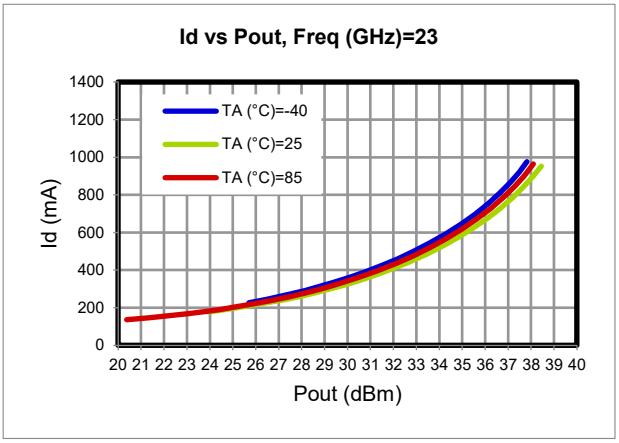


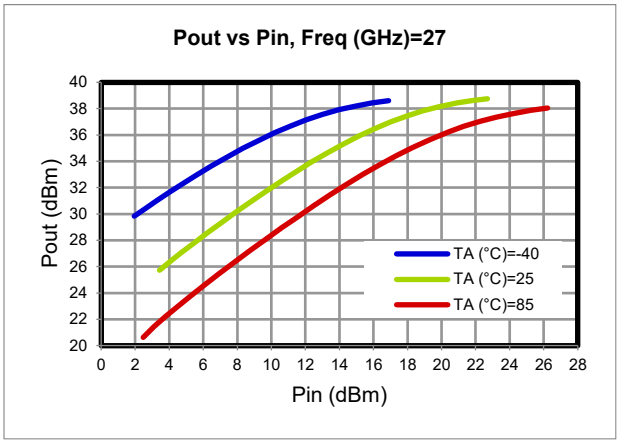
Power Performance | Test Conditions unless otherwise stated | V_D=*28V*, I_D=*84mA, CW Temperature=-40*°C, *+25*°C, *+85*°C

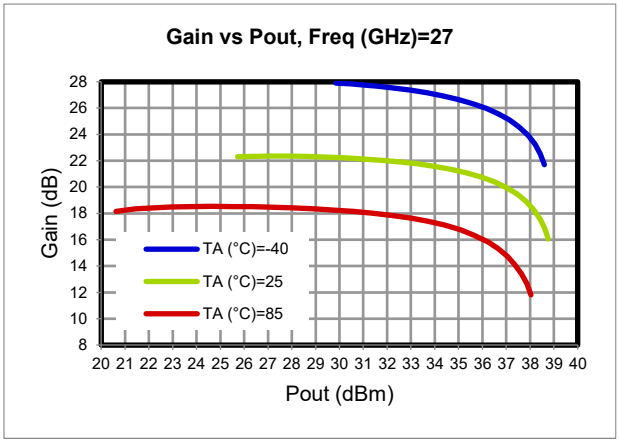












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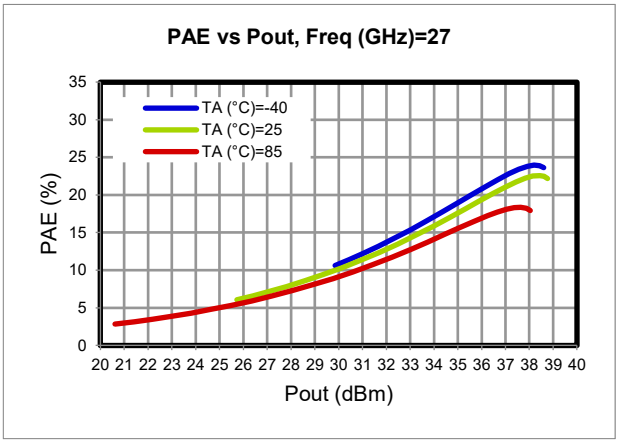
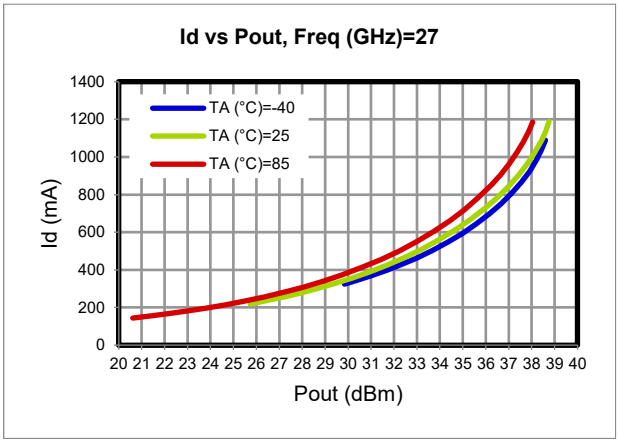
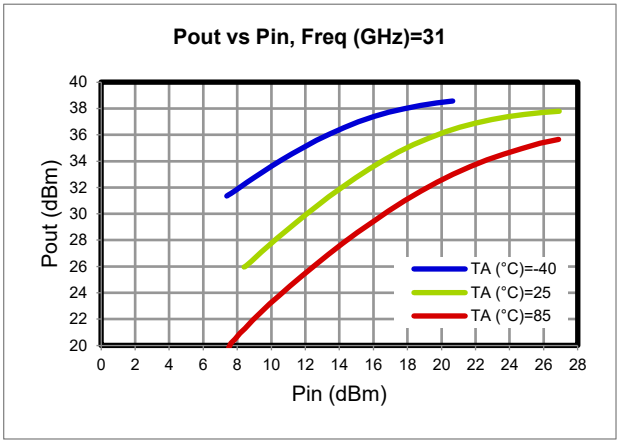
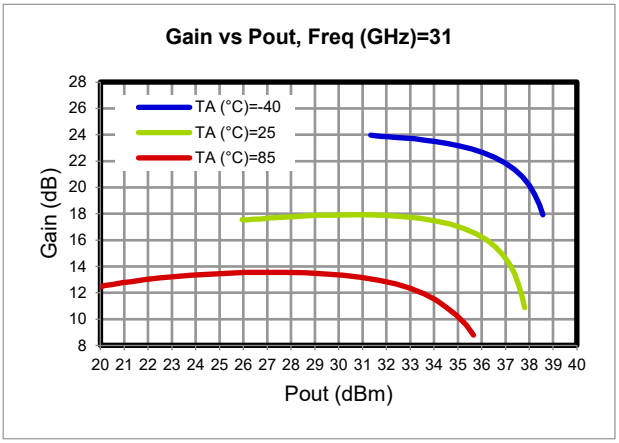
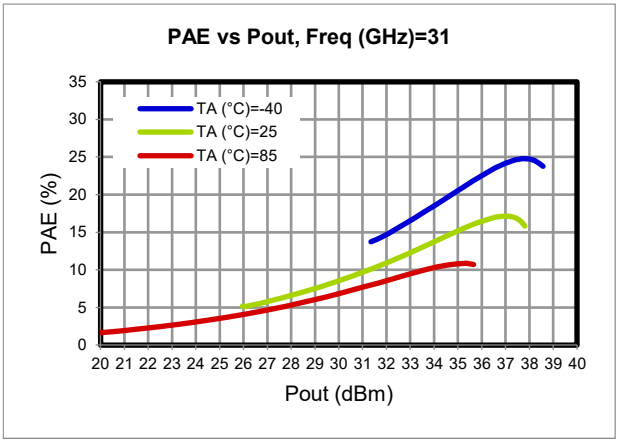
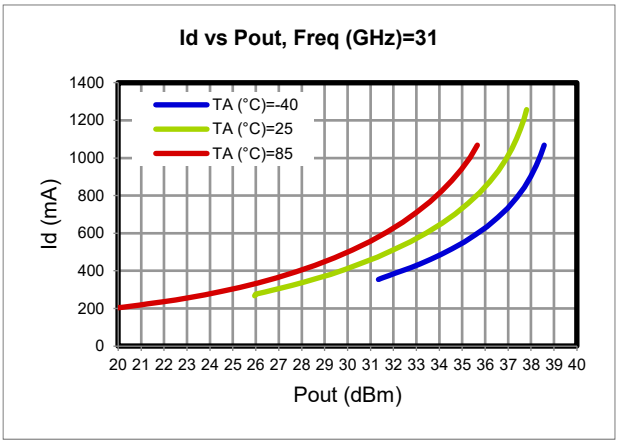




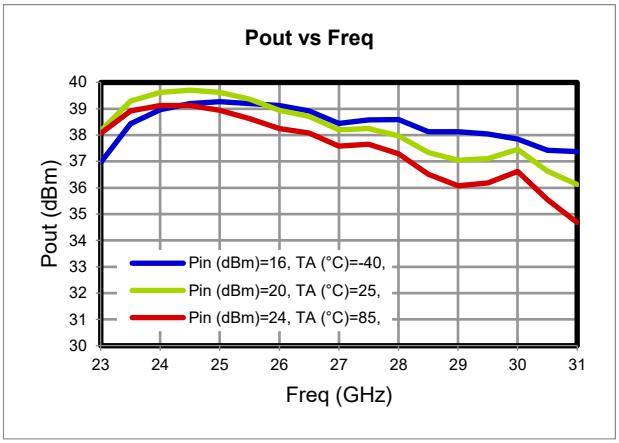


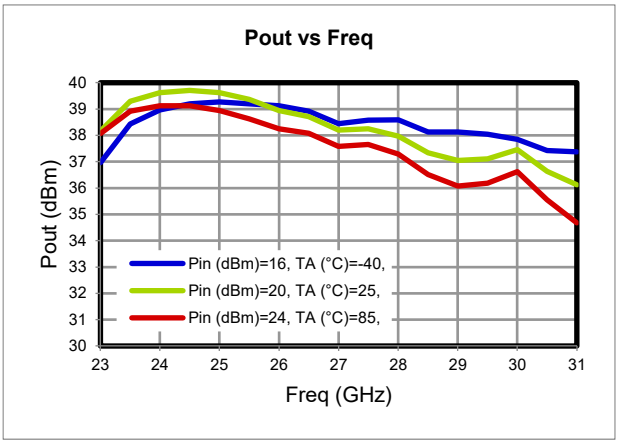


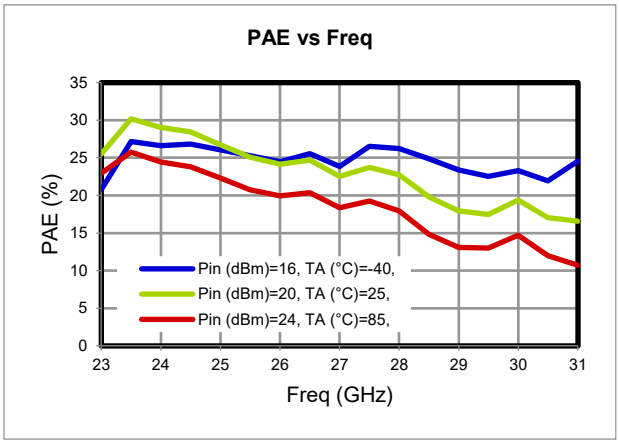


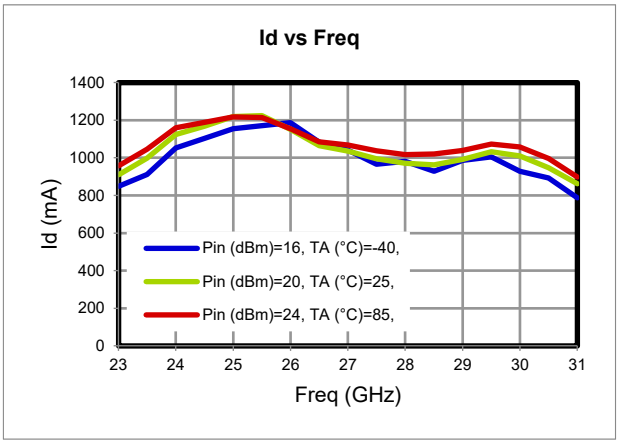


Power Performance vs Freq | Test Conditions unless otherwise stated | V_D=28V, I_D=84mA, CW Temperature=-40°C, +25°C, +85°C

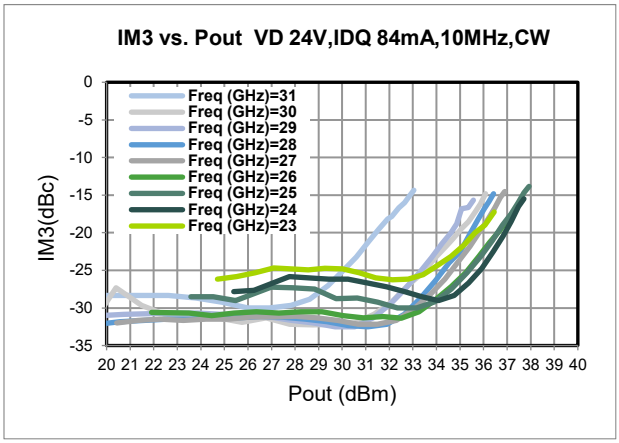




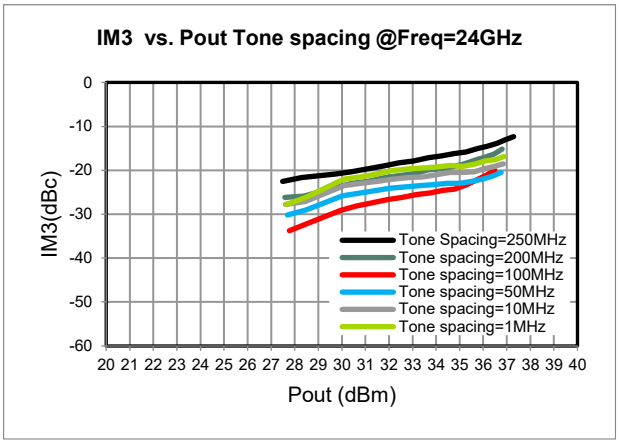


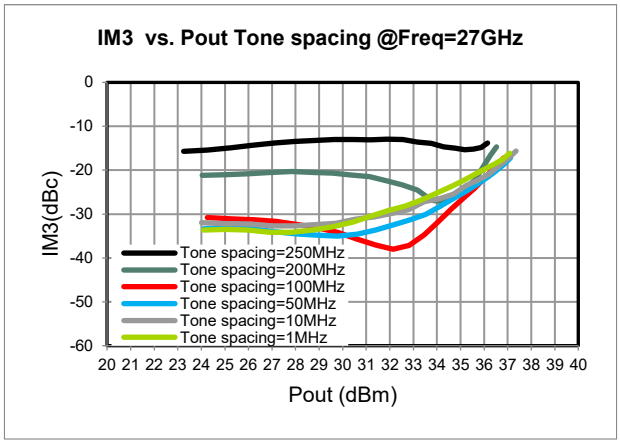


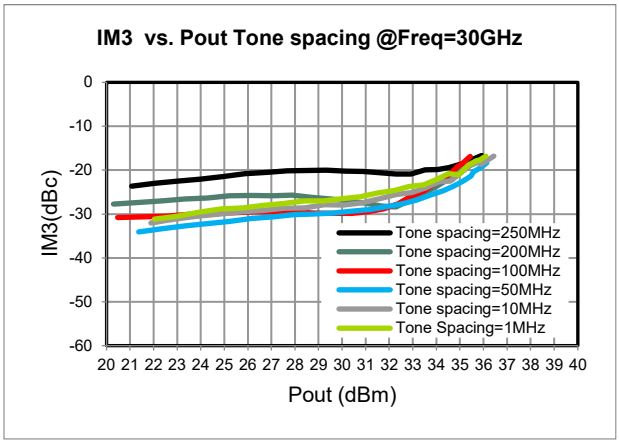
Linearity IM3 vs Pout | Test Conditions unless otherwise stated | V_D=24V, I_D=84mA, CW Temperature=+25°C



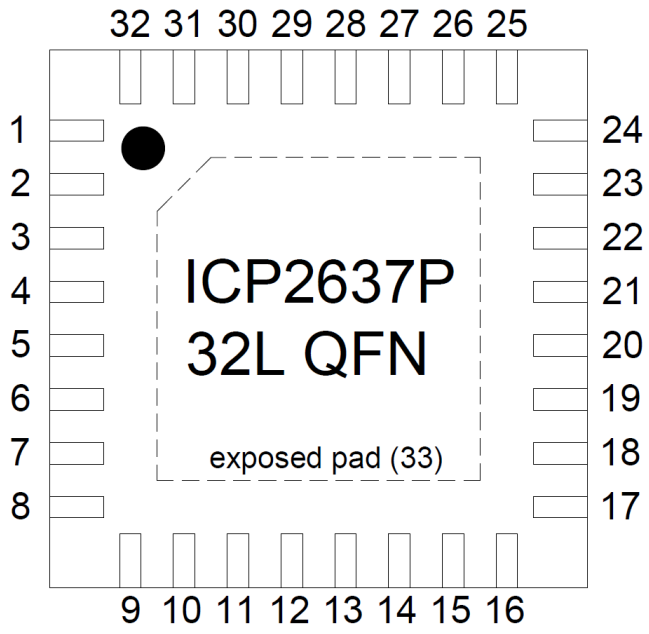
Linearity IM3 vs Pout | Test Conditions unless otherwise stated | V_D=*28V*, I_D=*84mA, CW Temperature=+25°C, Tone Spacing=1-250MHz*







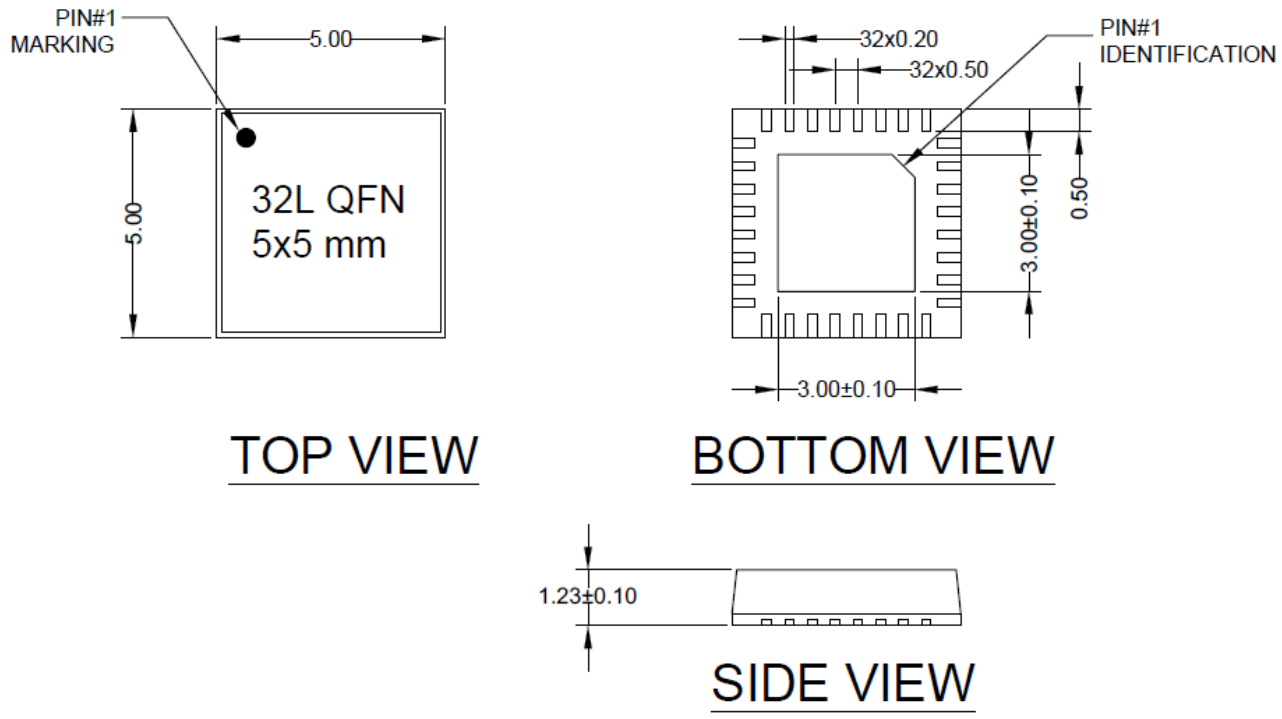
Mechanical Drawing

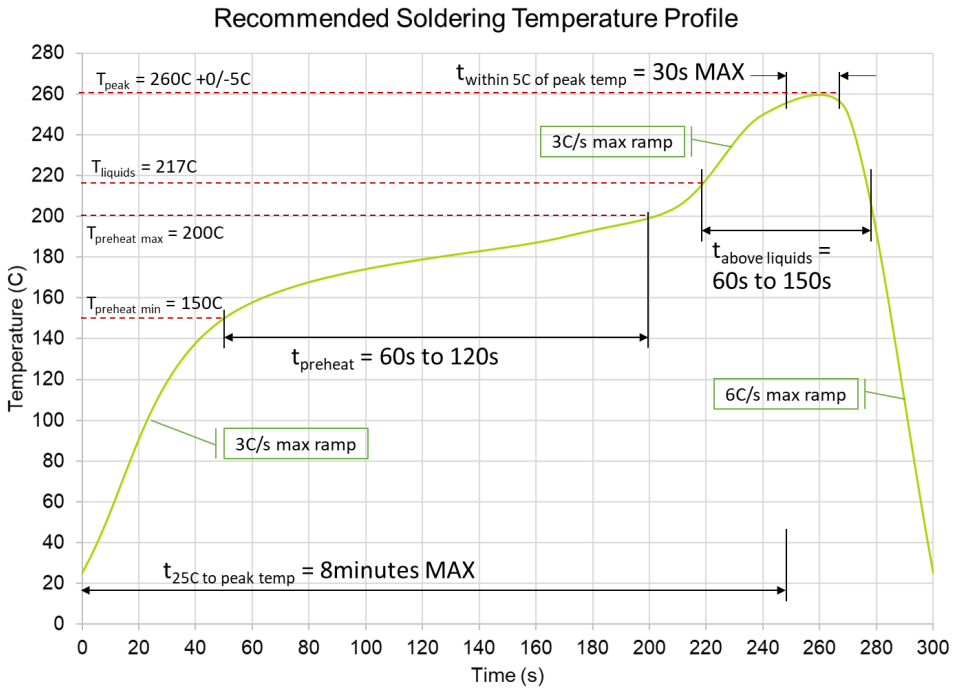


Pad No	Function	Description
5,6,7,11-15,20,30,31	NC	No connection in package, recommend to ground on PCB
1,2,4,8,9,16,17 24,25,32,33	GND	Ground
21,23	NC	No connection in package, must ground on PCB
3	RFIN	RF Input,50Ohm,DC blocked
10	V_{G1-3}	First, second and third stage gate bias, decoupling and bypass caps required
18	V_{DET}	Detector circuit voltage output
19	V_{REF}	Detector circuit reference voltage output
22	RFOUT	RF Output,50Ohm,DC blocked
26,27	V_{D3} (1)	Third stage drain voltage, decoupling and bypass caps required
28	V_{D2} (1)	Second stage drain voltage, decoupling and bypass caps required
29	V_{D1} (1)	First stage drain voltage, decoupling and bypass caps required

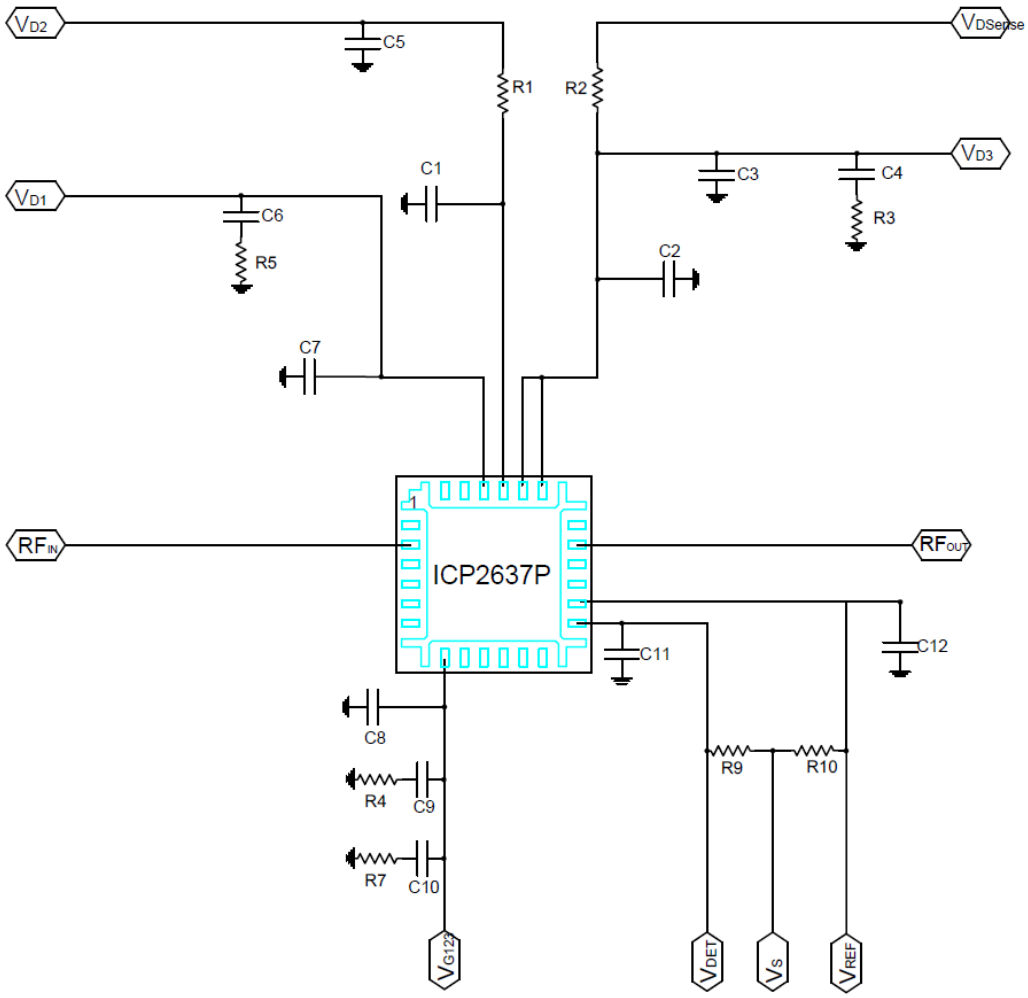
(1) V_{D1} ,V_{D2} ,V_{D3} can be connected together in application.

Mechanical Drawing





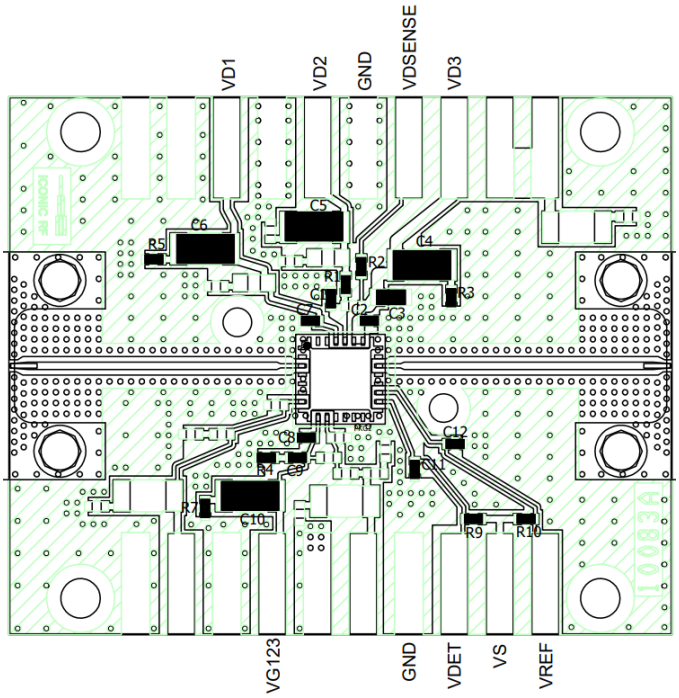
Application Circuit



Bill of Materials

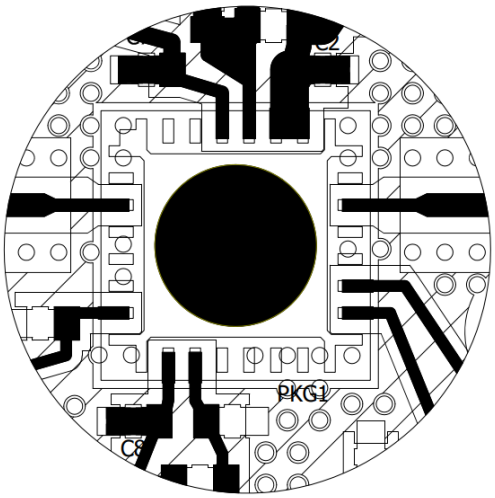
Assembly Reference	Value	Description	Manufacturer Part No.
Package		RJR 5x5mm AQFN	
C1,C2,C7	100pF	0402 size Capacitors	Various
C3	10nF	0603 size Capacitors	Various
C8	100nF	0402 size Capacitors	Various
C9	1uF	0402 size Capacitors	Various
C11,C12	1000pF	0402 size Capacitors	Various
C4,C5,C6,C10	10uF	1206 size Capacitors	Various
R1,R4	0Ohm	0402,Zero Ohm Resistor	Various
R2	10KOhms	0402,10K Ohm Resistor	Various
R3,R5,R7	5.1Ohms	0402 size5.1 Ohms Resistor	Various

Assembly Drawing



PCB Fabrication

For optimal thermal transfer of heat between the package and the external heat sink a solid copper coin is recommended below the package ground area. The coin insert must be planar on both sides and the ground area over plated to ensure appropriate flatness.



PCB Construction	Material	Dimensions
METAL1_TOP	Cu + ENIG	0.5oz plated to 1oz(1.4mil)
DIELECTRIC	RO4003C	8mil
METAL2	Cu	0.5oz (0.7mil)
PREPREG	HIGH Tg 370HR	6mil
METAL3	Cu	0.5oz(0.7mil)
PREPREG	HIGH Tg 370HR	6mil
METAL4 BOTTOM	Cu +ENIG	0.5oz plated to 1oz(1.4mil)

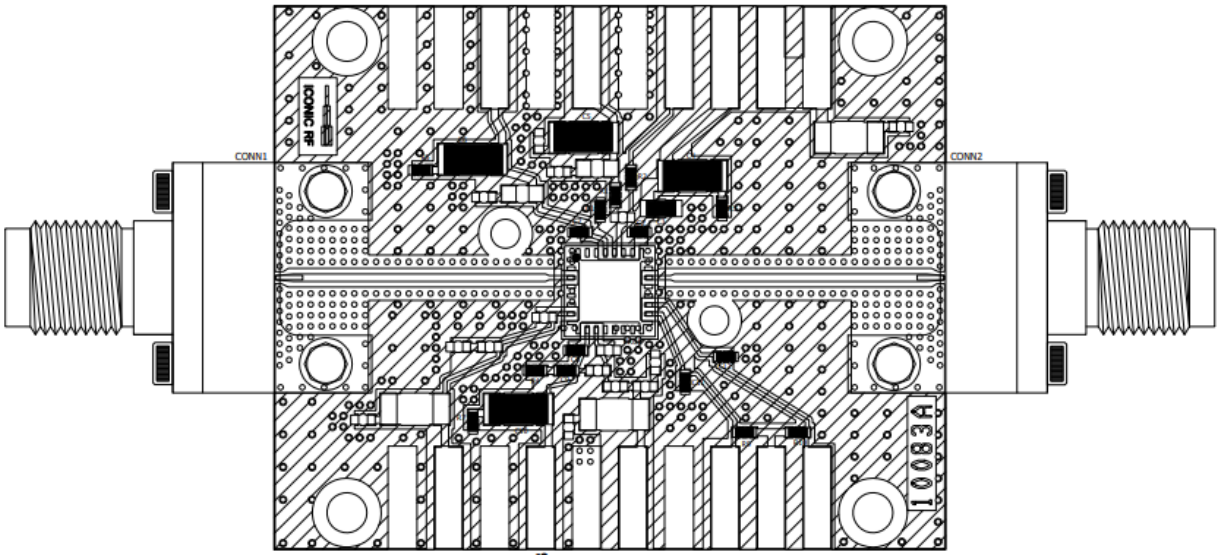
Key Features	Dimensions
VIA DRILL	0.3mm
VIA PLATING	15um
Cu COIN	
COIN DIAMETER	3.0mm
COIN OVERPLATED	
50 Ohm LINE WIDTH	420um

Assembly Guidance continued.

For optimum RF and thermal performance IconicRF recommends the PCB is screwed to a copper heat spreader that is then 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 for the PCB should be provided as close to the package as possible to ensure a optimum pressure between the PCB 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 28V
3. Adjust V_G positive until I_D quiescent is 84mA
4. Limit I_D to 1.6A
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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