MICROCHIP

ICP1044P

7.9-11GHz 30W GaN PA MMIC

Product Overview

ICONICRF's ICP1044P is a 3 stage MMIC power amplifier in a 6x6mm QFN package, fabricated using GaN on SiC technology. ICP1044P operates from 7.9-11GHz delivering 30W of output power, with a typical PAE of 38% across the band. ICP1044P is well suited to commercial and defence applications.

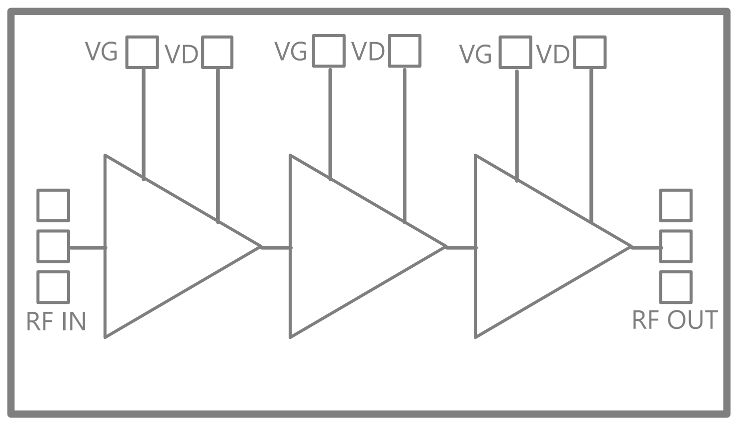
Key Features

- **Frequency Range: 7.9-11GHz**
- **Pout: 44dBm Pulsed (100µs, 10%)**
- **PAE: 38%**
- **Small Signal Gain: 31dB**
- **Bias: V_{DQ}=28V, I_{DQ}=175mA**
- **Technology: GaN on SiC**
- **Lead-free and RoHS compliant**
- **Package Size: 6mm x 6mm, 40 Lead QFN**
- **Integrated Power Detector**

Applications

- Commercial Radar
- Satellite Communications
- Aerospace & Defence

Functional Block Diagram



Electrical Specifications

Parameter	Min.	Typ.	Max.	Units	Conditions(1)
Frequency	7.9		11	GHz	
Saturated Output Power, P_{sat}		44		dBm	P_{in}=18dBm
Power Added Efficiency, PAE		38		%	P_{in}=18dBm
Small Signal Gain, S_{21}		31		dB	
Input Return Loss		10		dB	
Output Return Loss		6		dB	

Note: (1) Test conditions unless otherwise stated V_{DQ}=28V, I_{DQ}=175mA, T_A=25°C, Pulsed 100µs, 10%

Absolute Maximum Ratings

Parameter	Absolute Maximum
Drain Voltage (V_{DG})	40V
Power Dissipation (CW)	TBC
CW Input Power	TBC
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.

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

DISCLAIMER

All information herein is subject to change without notice

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1. Typical RF Performance

1.1 Typical Pulsed Power Performance

Test conditions: V_{DQ}=28V, I_{DQ}=175mA, T_A=25°C (Pulse: 100µs / 10%)

Figure 1-1. P_{OUT} vs Frequency

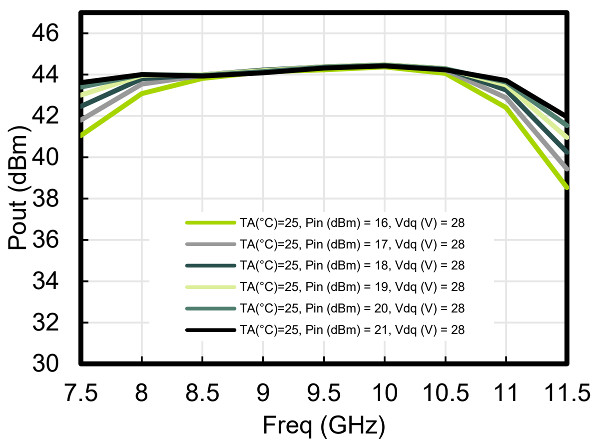


Figure 1-2. Gain vs Frequency

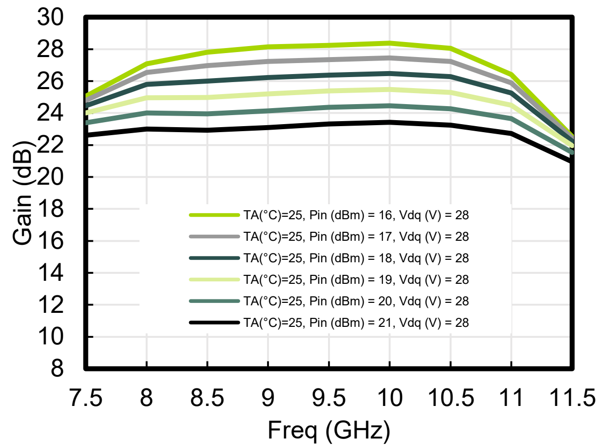


Figure 1-3. PAE vs Frequency

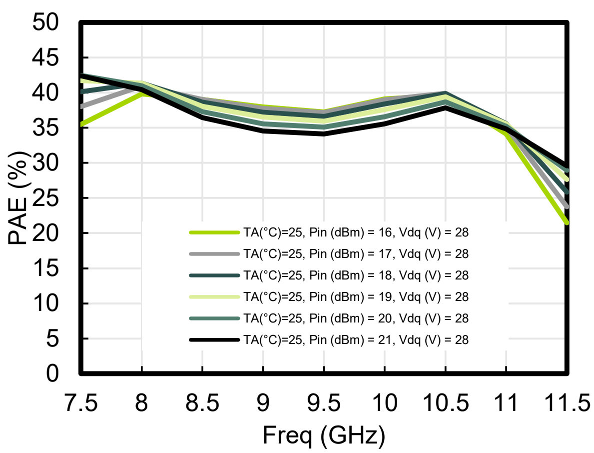
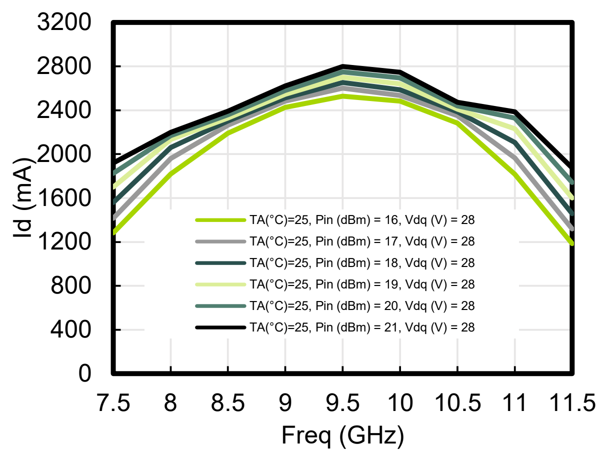


Figure 1-4. I_D vs Frequency



Test conditions: V_{DQ}=28V, I_{DQ}=175mA, T_A=25°C (Pulse: 100µs / 10%)

Figure 1-5. P_{OUT} vs P_{IN}

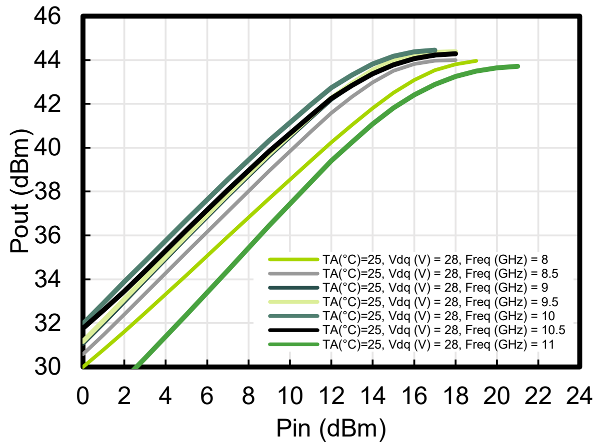


Figure 1-6. Gain vs P_{OUT}

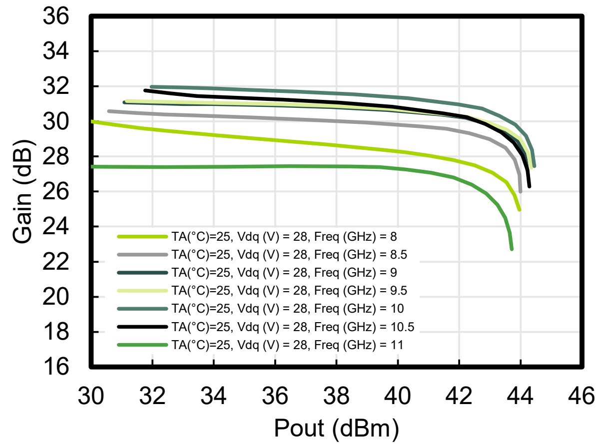


Figure 1-7. PAE vs P_{OUT}

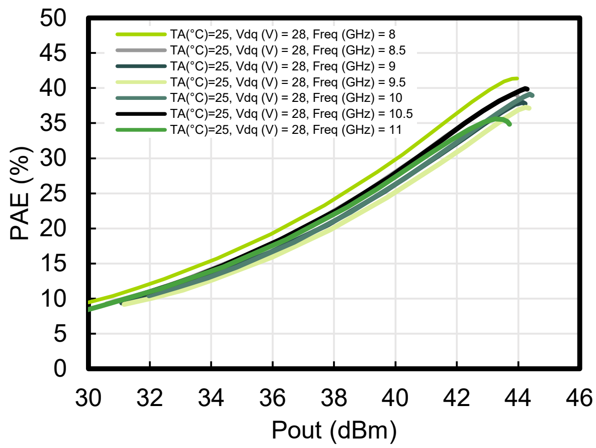


Figure 1-8. I_D vs P_{OUT}

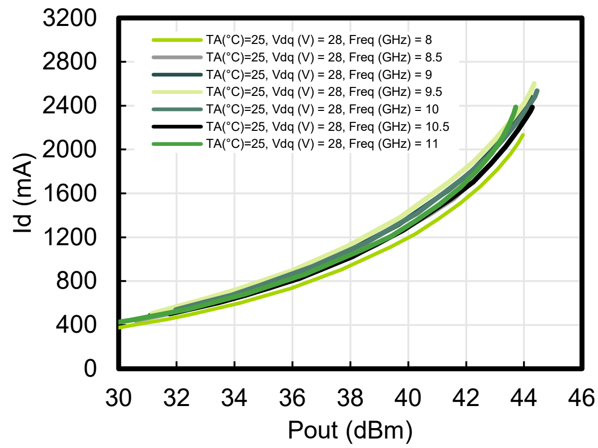
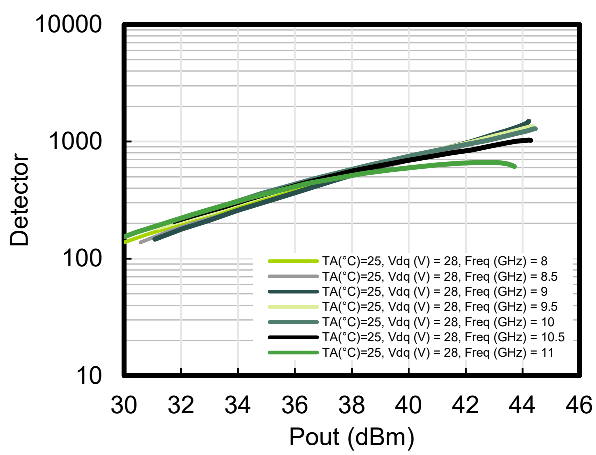


Figure 1-9. Detector vs P_{OUT}



Test conditions: V_{DQ}=28V, I_{DQ}=175mA, Freq.=9.5GHz (Pulse: 100µs / 10%)

Figure 1-10. P_{OUT} vs P_{IN}

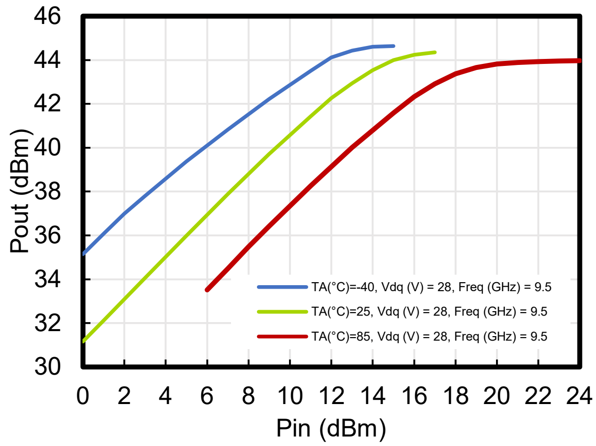


Figure 1-11. Gain vs P_{OUT}

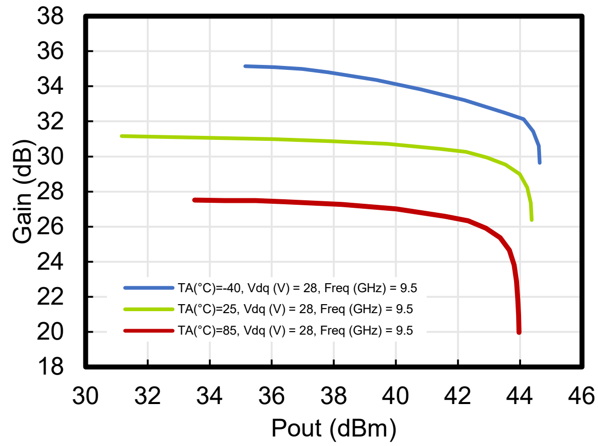


Figure 1-12. PAE vs P_{OUT}

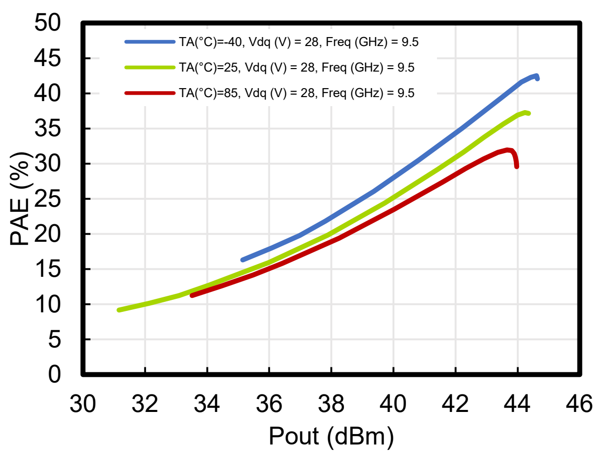
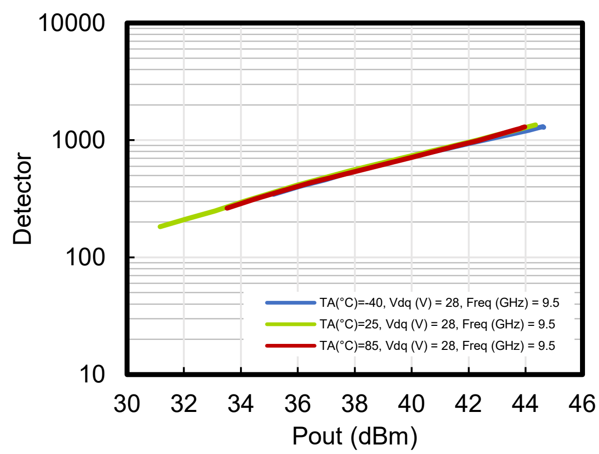


Figure 1-13. Detector vs P_{OUT}



Test conditions: V_{DQ}=28V, I_{DQ}=175mA (Pulse: 100µs / 10%)

Figure 1-14. P_{OUT} vs Frequency

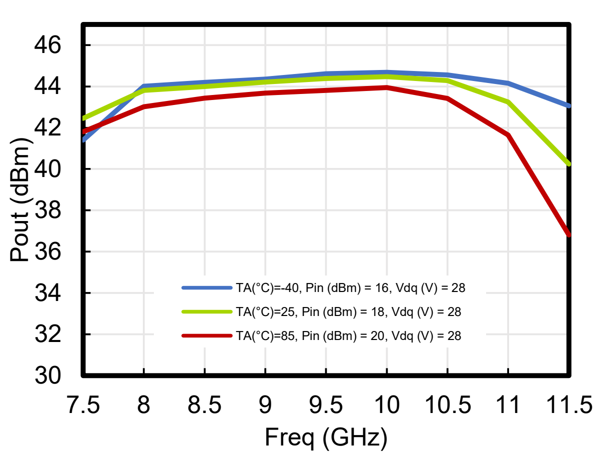
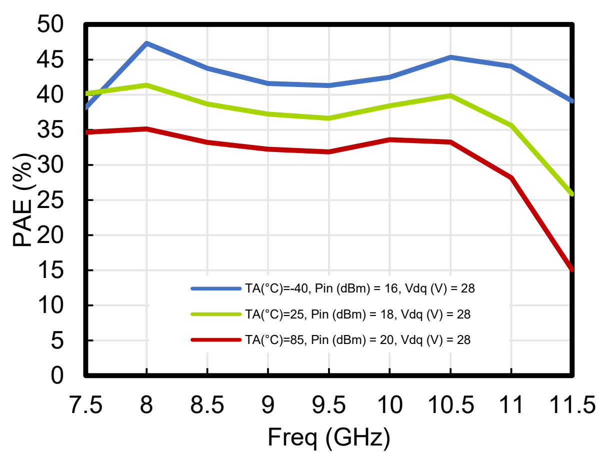
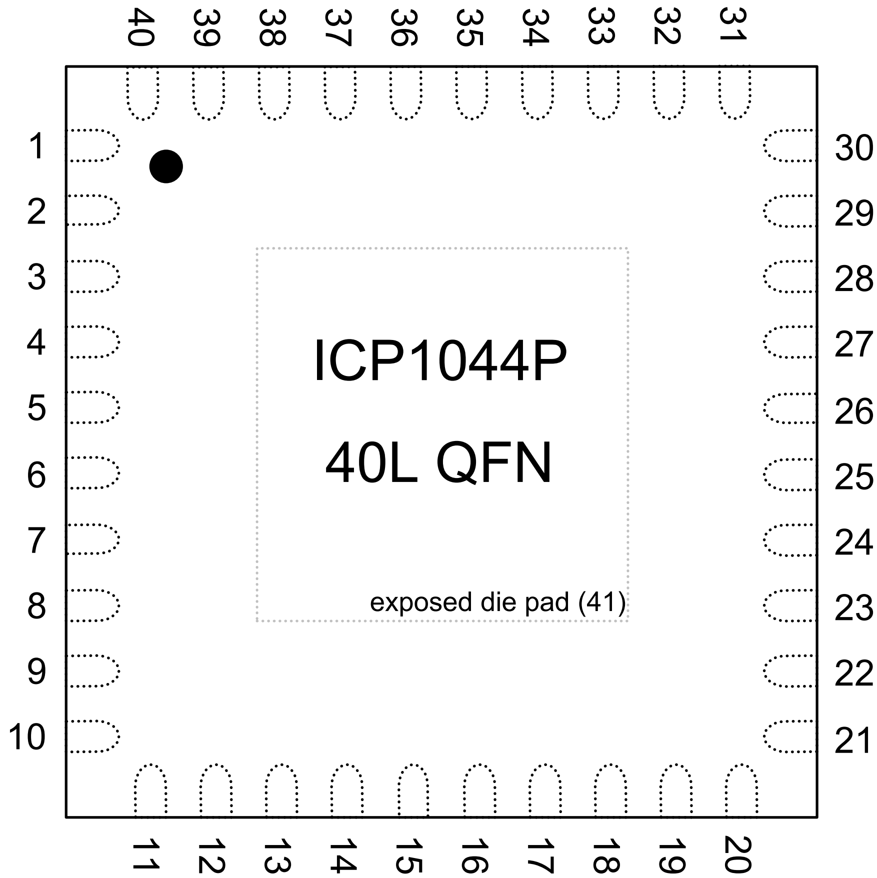


Figure 1-15. PAE vs Frequency



2. Pinout



Pad No.	Function	Description
1-4, 6-11, 13, 15, 18-25, 27-31, 36, 38-41	GND	Ground connection
5	RF_{IN}	RF input, 50 ohm, DC blocked
12	$V_{G1-2}^{(1)}$	1st and 2nd stage gate bias, decoupling and bypass caps required
14	$V_{G3}^{(1)}$	3rd stage gate bias, decoupling and bypass caps required
37	$V_{D1-2}^{(2)}$	1st and 2nd stage drain voltage, decoupling and bypass caps required
16, 17, 34, 35	$V_{D3}^{(2)}$	3rd stage drain voltage, decoupling and bypass caps required
33	$V_{DET}^{(3)}$	Detector circuit voltage output
32	$V_{REF}^{(3)}$	Detector circuit reference voltage output
26	RF_{OUT}	RF output, 50 ohm, DC blocked

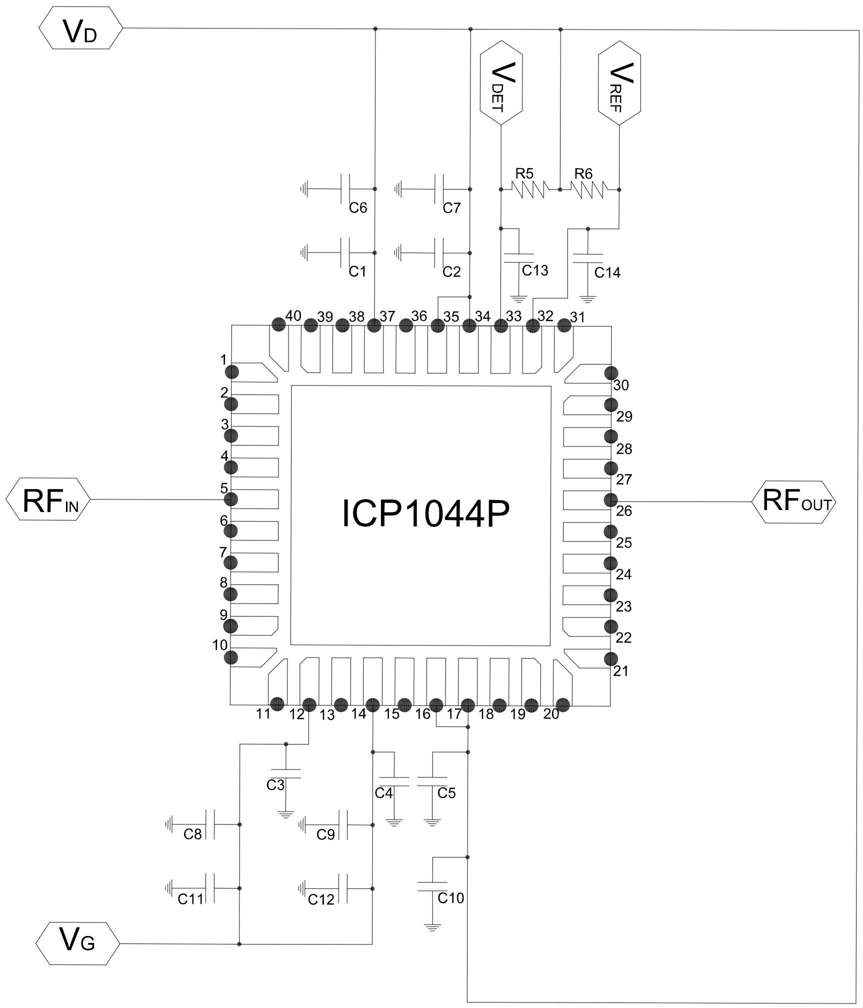
Note:

(1) $V_{G1\text{ -}2}$ and V_{G3} can be connected together in application.

(2) $V_{D1\text{ -}2}$ and V_{D3} can be connected together in application.

(3) Applications requiring power detector may use pins 32 and 33, otherwise pins should be NC or Ground

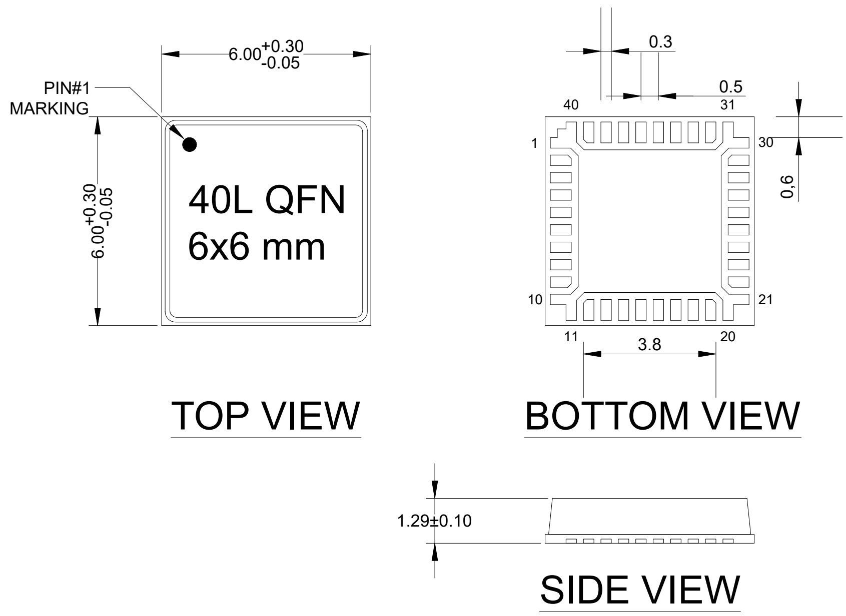
3. Application Circuit



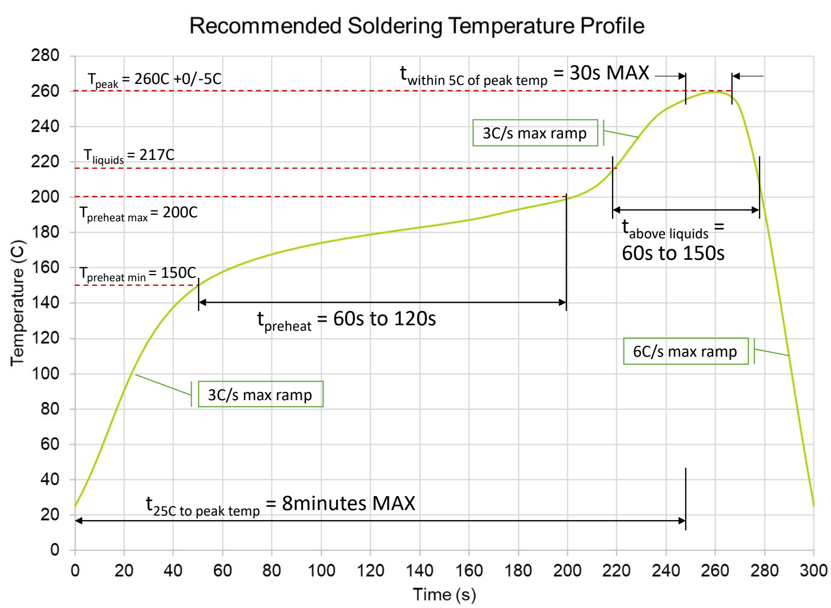
Component ID	Value	Details	Qty	Manufacturer Part No.
C1-C5, C13(1), C14(1)	1000pF	1000pF CAP 0402, C0G, 50V	9	Various
C6-C10	10nF	10nF CAP 0603, C0G, 50V	5	Various
C11, C12	1μF	1μF CAP 0805, C0G, 50V	2	Various
R5(1), R6(1)	100kΩ	100kΩ RES 0402	4	Various

Note: (1) Applications requiring power detector may use either pin numbers 33 and 32. Otherwise pins 33 and 32 should be NC or ground and components R5, R6, C13 & C14 are not required

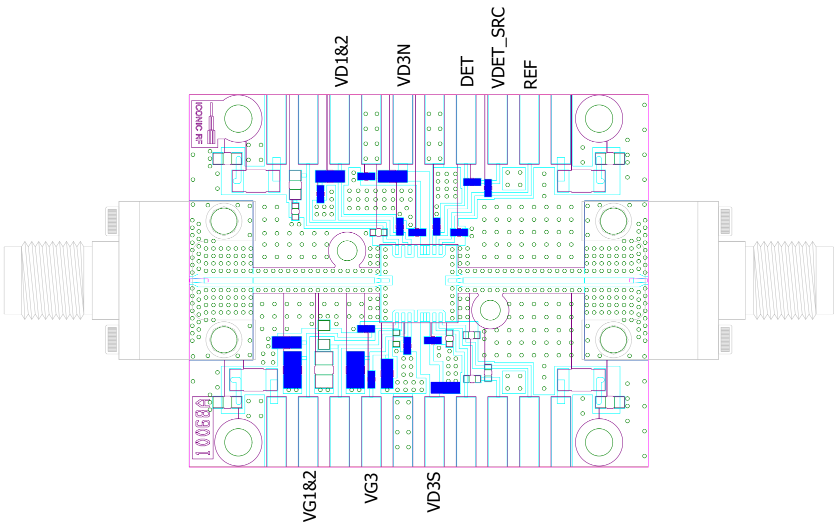
4. Mechanical Drawing

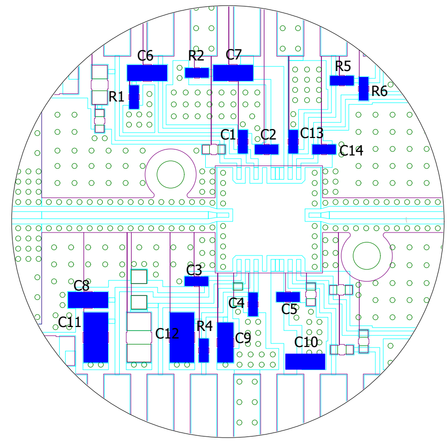


Units: mm



5. Evaluation Board





Evaluation board construction

- Board Size: 37mm x 30mm 4 layer PCB:
  - 1oz Cu, Au finish RO4003C 10mil
  - 0.5oz Cu 370HR 6mil
  - 0.5oz Cu 370HR 6mil
  - 1oz Cu, Au finish
  - Solid Copper Coin over plated
  - Via size: 0.3mm plated
- Baseplate: Solid copper 37mm x 50mm x 10mm, Au plated

Component ID	Value	Details	Qty	Manufacturer Part No.
C1-C5, C13(1), C14(1)	1000pF	1000pF CAP 0402, C0G, 50V	7	Various
C6-C10	10nF	10nF CAP 0603, C0G, 50V	5	Various
C11, C12	1µF	1µF CAP 0805, C0G, 50V	2	Various
R1-R4	0Ω	0Ω RES 0402	4	Various
R5(1), R6(1)	100kΩ	100kΩ RES 0402	2	Various

Note: (1) These components are used for the detector circuit on package pins 33 and 32. This circuit is optional and the components can be omited if the circuit is not required

6. 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 175mA
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

Solderability

Compatible with the latest version of J-STD-020 Lead free solder.

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.

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PART NO.	[X][(1)]	–X	/XX
Device	Tape and Reel	Temperature Range	Package

Device:	Device A, Device B, etc	
Tape and Reel Option:	Blank	= Standard packaging (tube or tray)
	T	= Tape and Reel[(1)]
Temperature Range:	I	= -40°C to +85°C (Industrial)
	E	= -40°C to +125°C (Extended)
Package:[(2)]	JQ	= UQFN
	P	= PDIP
	ST	= TSSOP
	SL	= SOIC-14
	SN	= SOIC-8
	RF	= UDFN
Pattern:	QTP, SQTP[SM] (Serial Quick Turn Programming capability), Code or Special Requirements (blank otherwise)	

- Device A - I/P Industrial temperature, PDIP package
- Device B - E/SS Extended temperature, SSOP package

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