ICONIC RF

a Microchip company

2.7-3.5GHz 70W GaN PA MMIC

ICP0349P

Description

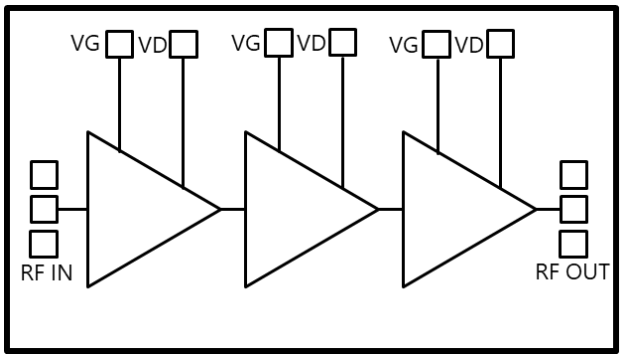
ICONICRF's ICP0349 is a 2 stage power amplifier, 50 ohm matched with integrated DC blocking capacitors packaged in a plastic QFN. Fabricated using a GaN on SiC process, ICP0349P operates from 2.7-3.5GHz with over 48dBm output power and 60% PAE. ICP0349 is well suited to both commercial and defense radar applications.

Features

- Frequency Range: 2.7-3.5GHz
- Pout: 48 dBm @ 24dBm Pin
- PAE: 60 %
- Small Signal Gain: 26.5dB
- Bias: VD=28V IDQ=200mA
- Technology: GaN on SiC
- Lead-free and RoHS compliant
- Package Dimensions: 7.0 x 7.0 x 0.85 mm

Applications

Image



Electrical Specifications | V_D=28V, I_{DQ}=200mA ,T_A=25ºC, Pulsed=10% (pulse = 100us/1ms)

Parameter	Conditions	Min	Typ	Max	Units
Frequency		2.7		3.5	GHz
Output Power @ P_{sat}	Pin=24dBm	48	48.5		dBm
PAE @ P_{sat}	Pin=24dBm		60		%
Drain Current @ Psat	Pin=24dBm		4.0		A
Small Signal Gain			26.5		dB
Input Return Loss			12		dB
Output Return Loss			5		dB

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Absolute Maximum Ratings

Parameter	Absolute Maximum
Drain Voltage (V_D)	40.0V
Gate Voltage Range (V_G)	-5 to 0V
Gate Current (IG)	5mA
Drain Current (CW) T_A=25ºC	4.3A
Power Dissipation (CW) T_A=25ºC Power Dissipation (CW) T_A=85ºC	104W 73W
CW Input Power 50ohm, T_A=25ºC	+27dBm
Channel Temperature	275°C
Storage Temperature	-65°C to +150°C
Input Power VSWR (2:1), V_D=20V, I_{DQ}=84mA V_D=24V, I_{DQ}=84mA	20dBm
Reflow Profile	260°C

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 V_D=28V, I_{DQ}=1A, P_{Diss}=28W (DC,CW)	1.81ºC/W

Notes

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

Ordering Information

Part No.	Description
ICP0349PP7-1-300I	7x7mm QFN Package
ICP0349P-1-501U	Evaluation Board with SMA connectors

Bias-Up Procedure

1. Set V_G=-5V
2. Set V_D to 28V
3. Adjust V_G positive until I_D quiescent is 200mA
4. Limit I_D to 7A
5. Apply RF Signal

Bias-down Procedure

1. Turn off R_F
2. Turn off V_D, allow drain capacitor 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.

Moisture Sensitivity Level

Level 3 (IPC/JEDEC J-STD-020)

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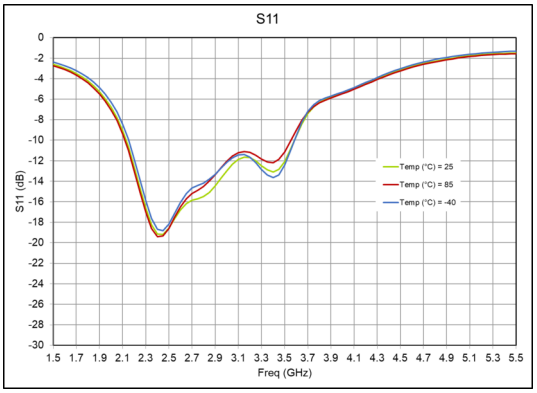
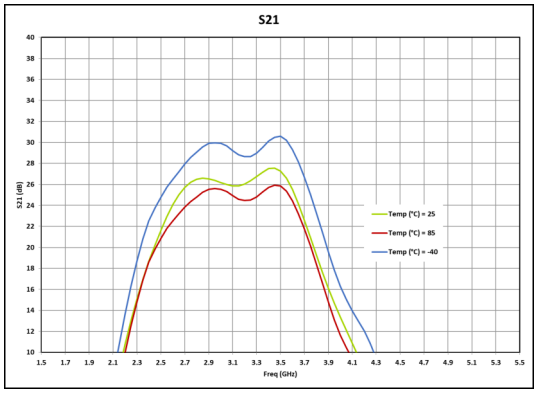
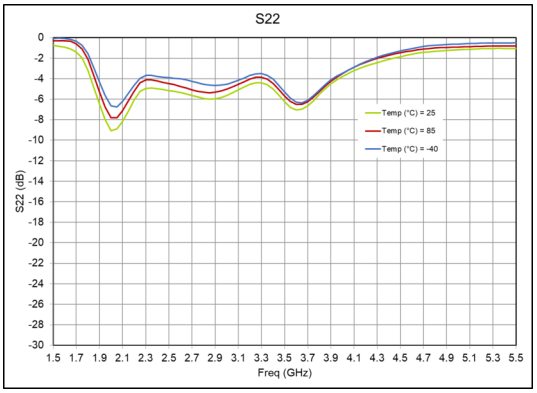
Typical Performance

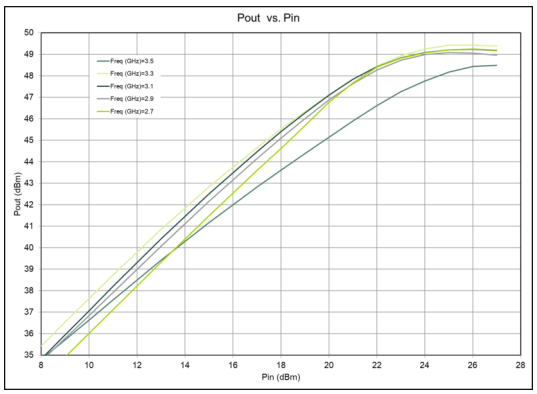
S-Parameter Performance | Test Conditions unless otherwise stated | V_D=*28V*, I_{DQ}=*200mA*, T_A=*-40ºC, 25ºC, 85ºC*

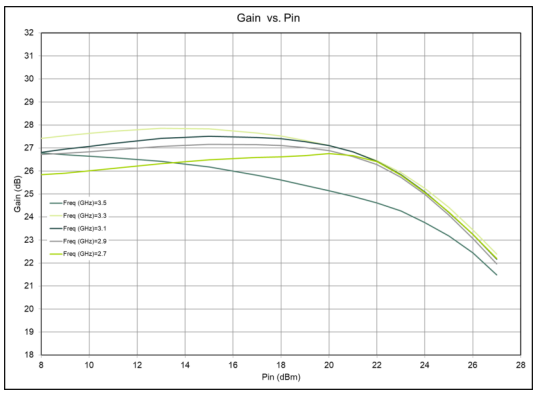


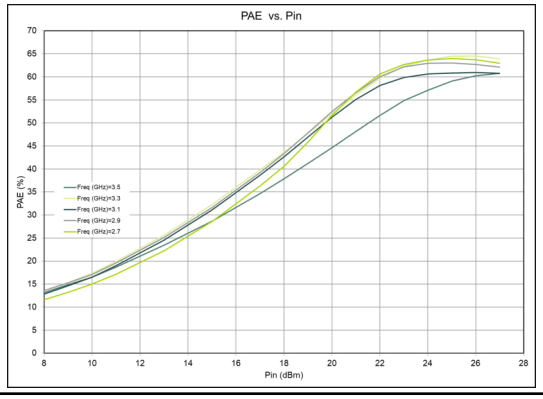


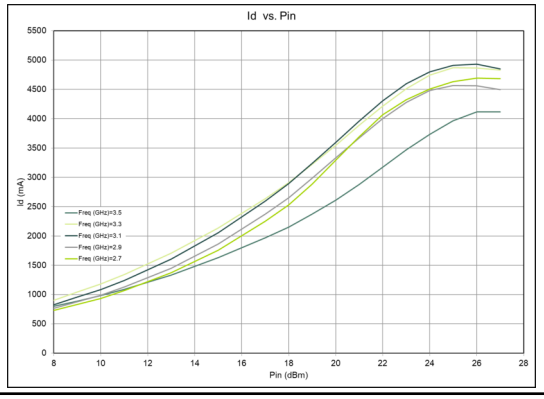


Power Performance | Test Conditions unless otherwise stated | V_D=*28V*, I_{DQ}=*200mA*, T_A=*25ºC*, Pulsed (*100µs/1ms*)









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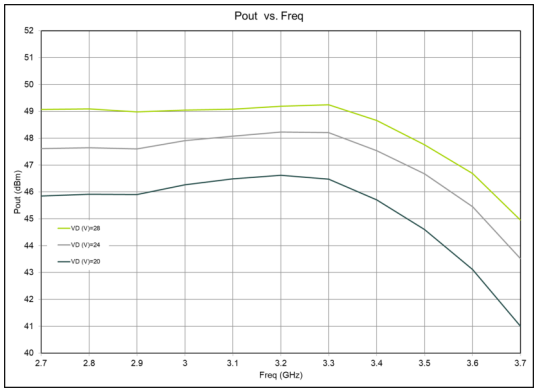
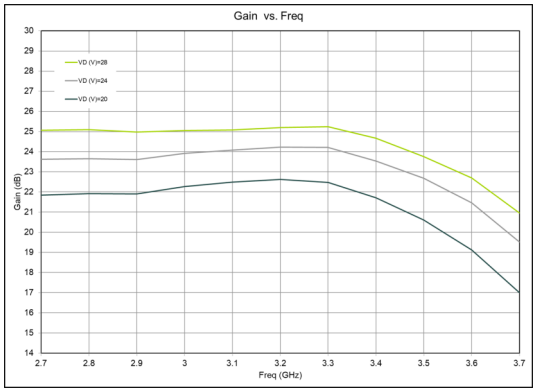
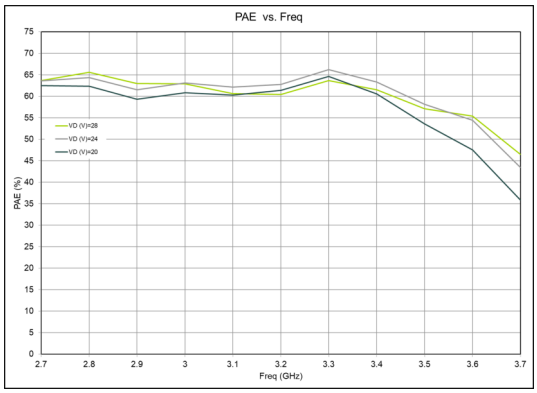
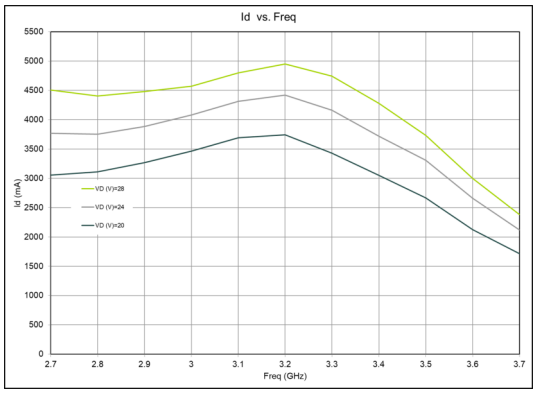
Power Performance vs. Frequency| Test Conditions unless otherwise stated | P_{IN}=*24dBm,* I_{DQ}=*200mA,* T_A=*25ºC,* Pulsed (*100µs/1ms*)

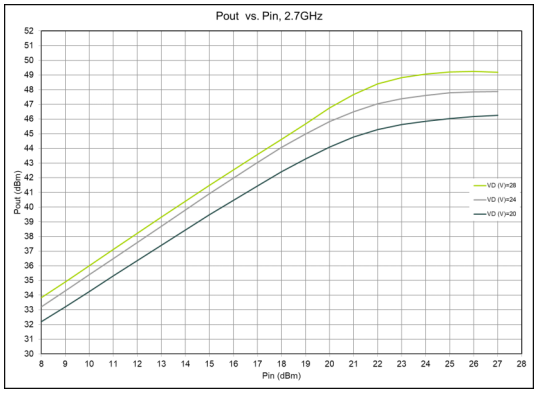


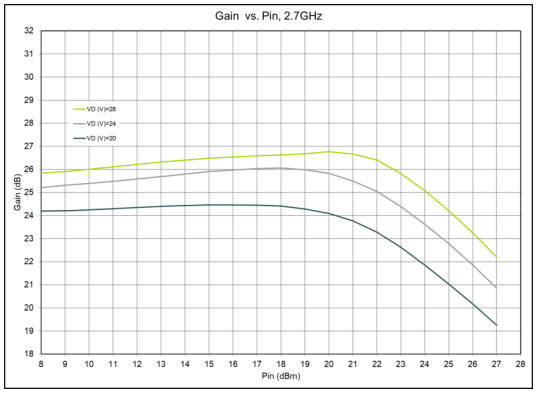


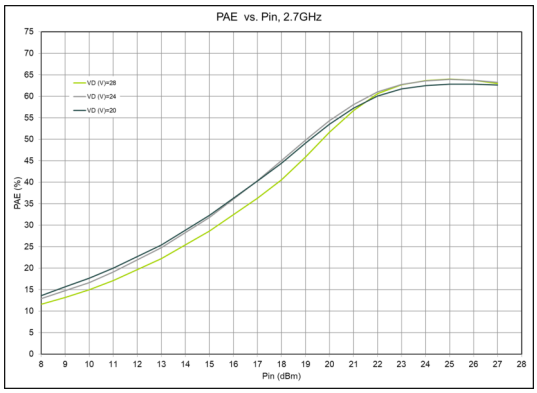


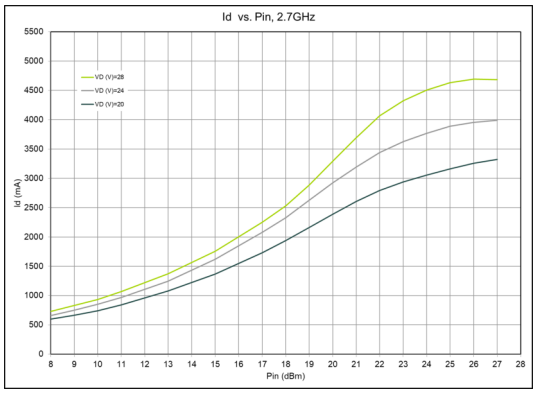


Power Performance | Test Conditions unless otherwise stated | V_D=*20V, 24V, 28V,* I_{DQ}=*200mA,* T_A=*25ºC,* Pulsed (*100µs/1ms*)









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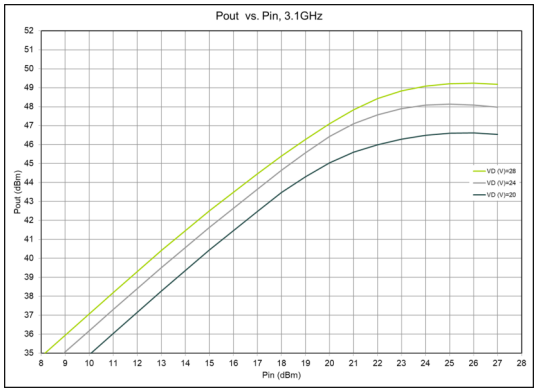
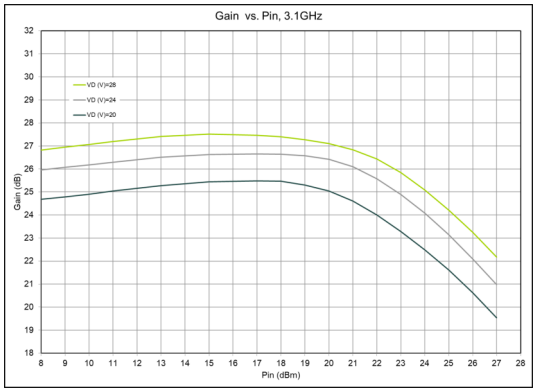
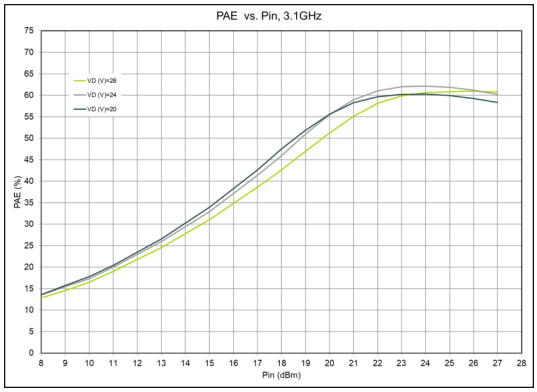
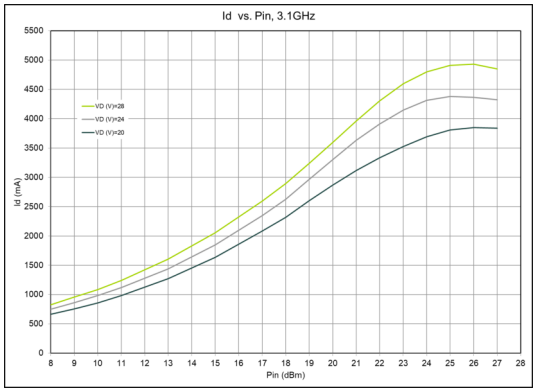
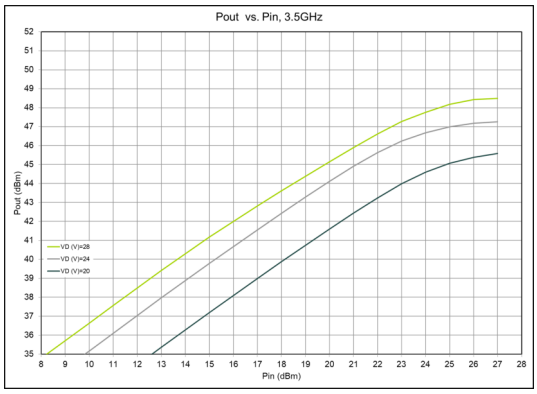
Power Performance | Test Conditions unless otherwise stated | V_D=*20V, 24V, 28V,* I_{DQ}=*200mA,* T_A=*25ºC,* Pulsed (*100µs/1ms*)

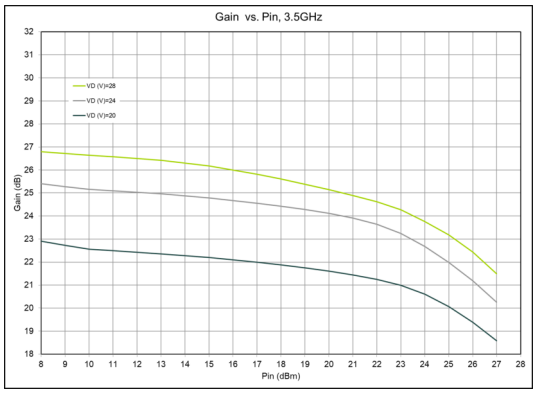


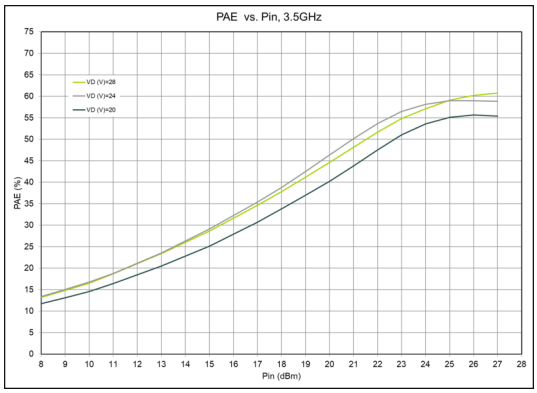


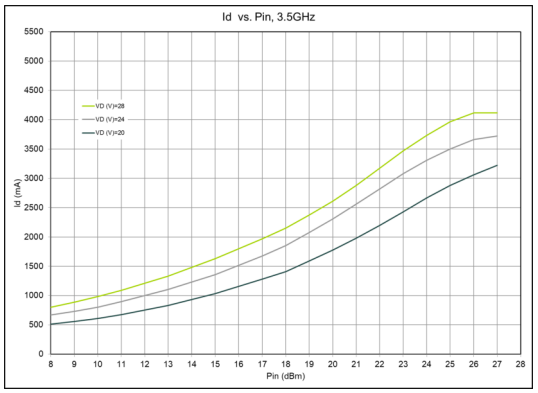












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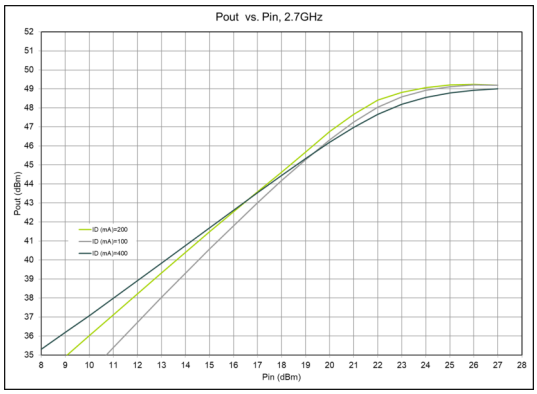
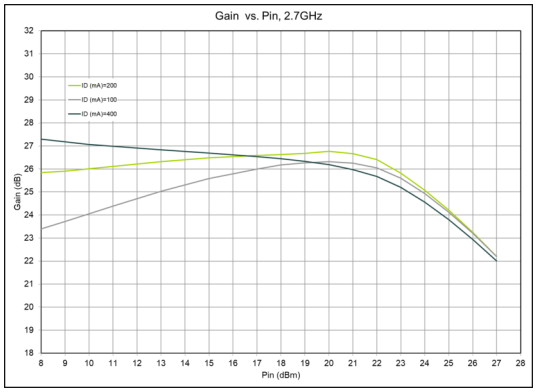
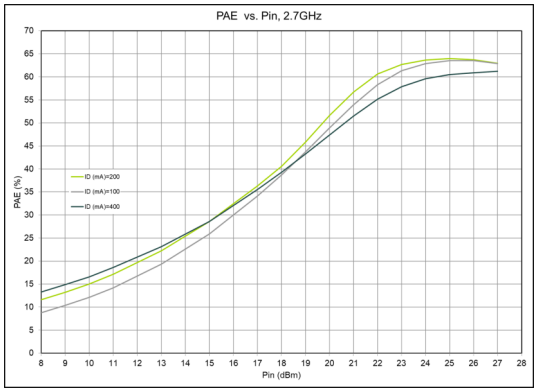
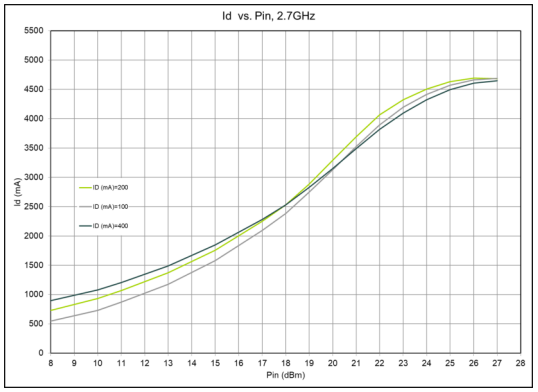
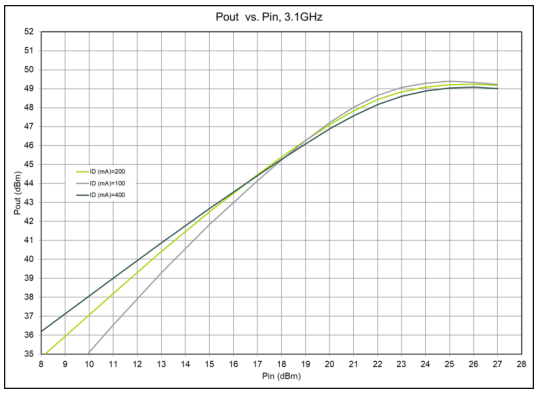
Power Performance | Test Conditions unless otherwise stated | V_D=*28V*, I_{DQ}=*100mA, 200mA, 400mA*, T_A=*25ºC*, Pulsed (*100µs/1ms*)

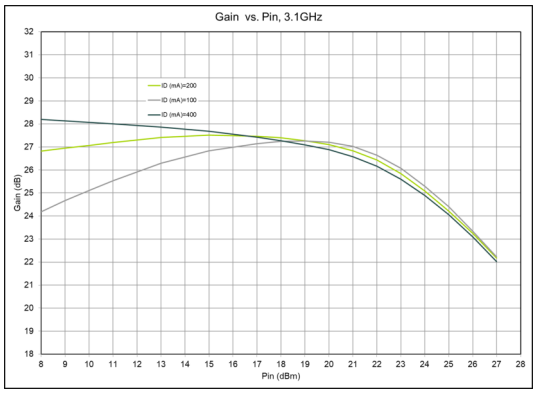


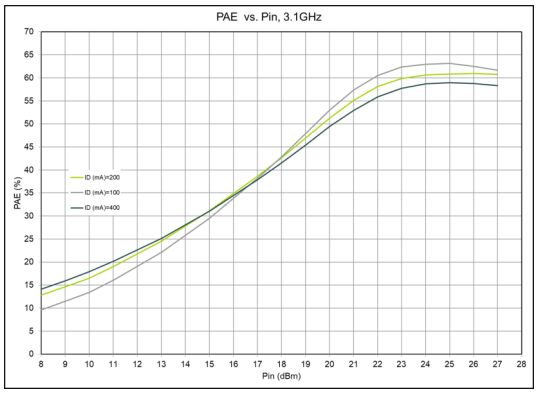


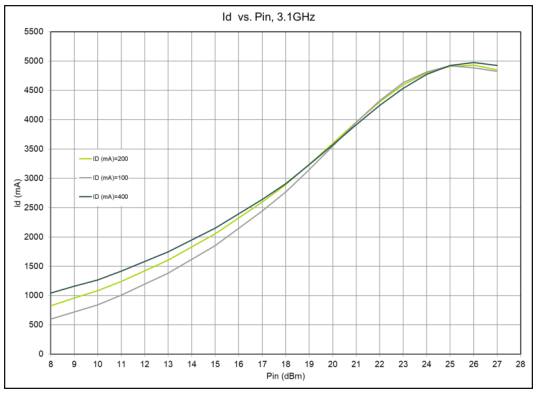












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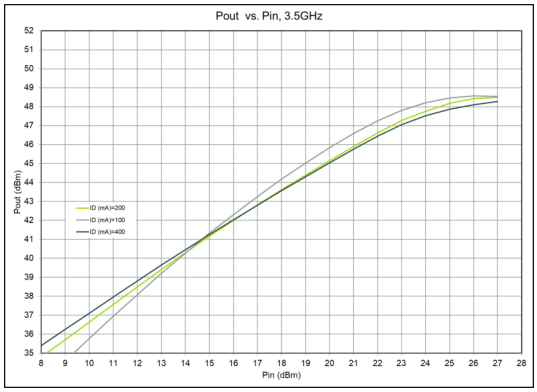
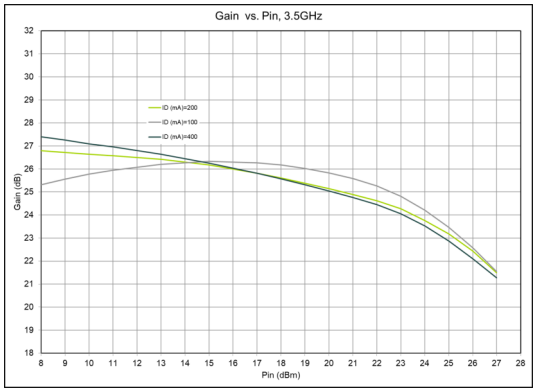
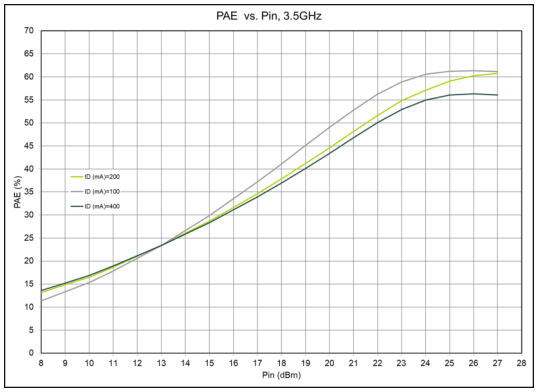
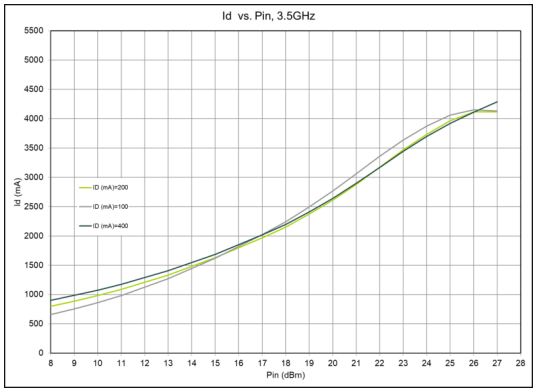
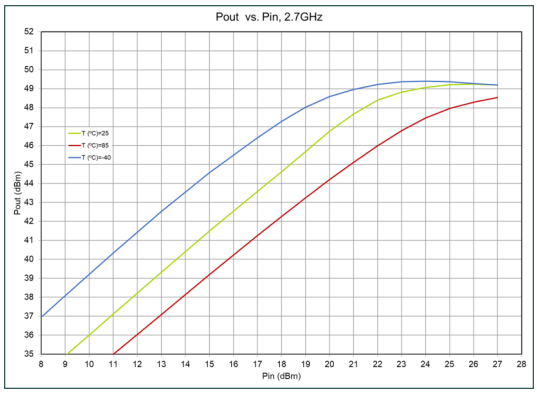


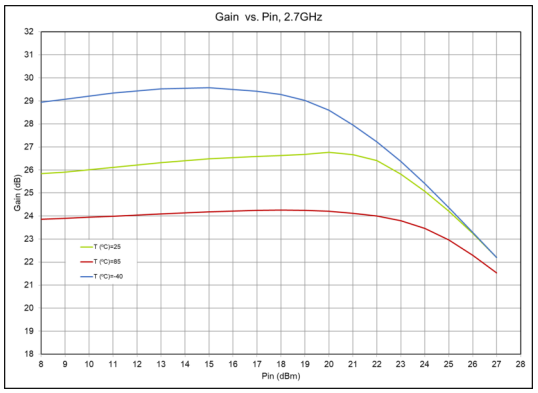


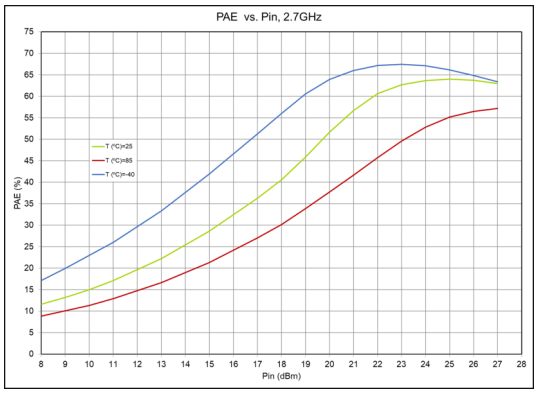


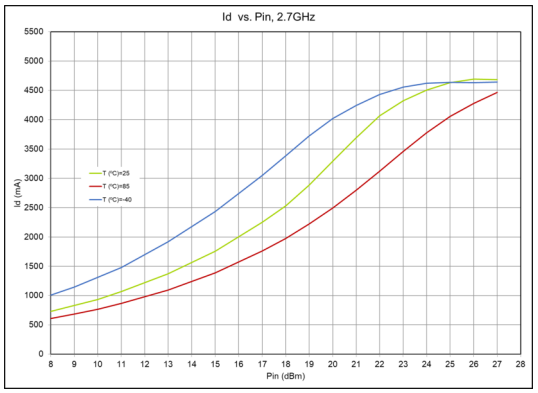


Power Performance | Test Conditions unless otherwise stated | V_D=*28V*, I_{DQ}=*200mA*, T_A=*-40ºC, 25ºC, 85ºC*, Pulsed (*100µs/1ms*)









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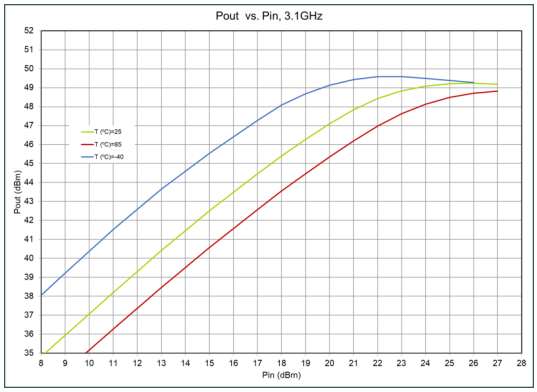

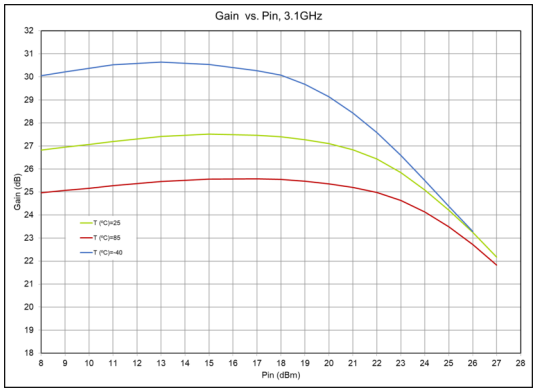

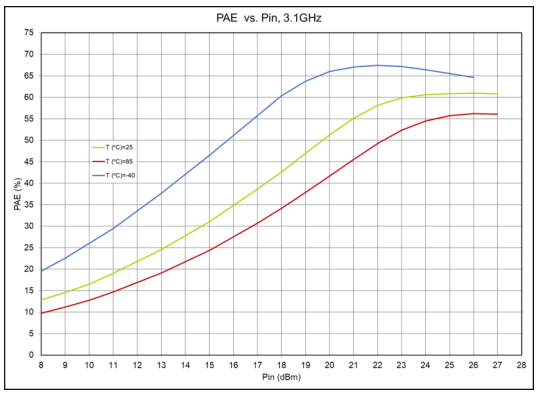

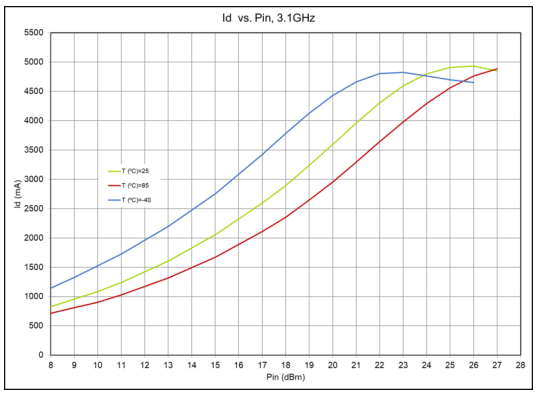

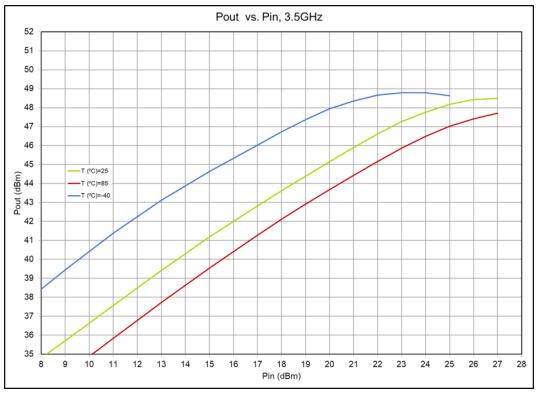

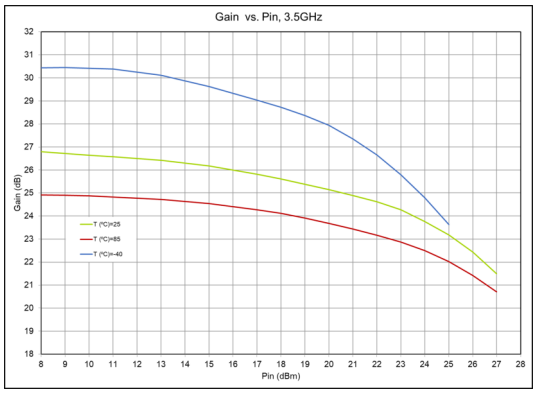

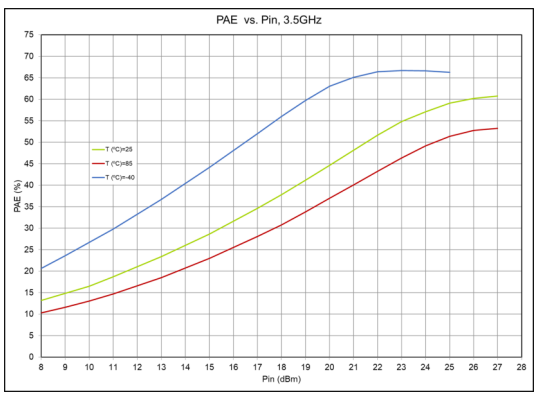

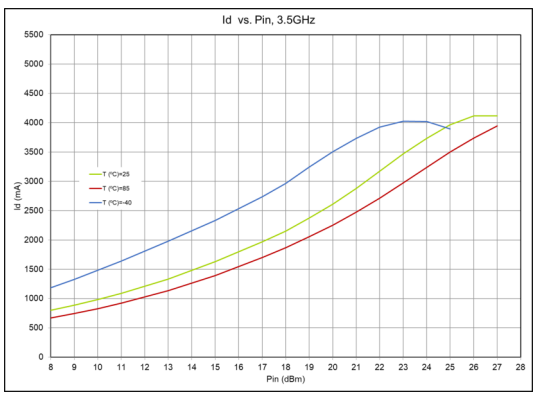

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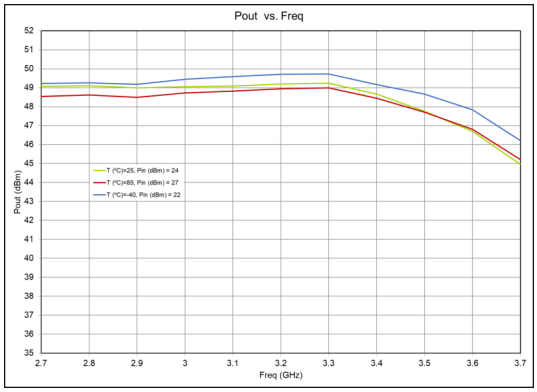
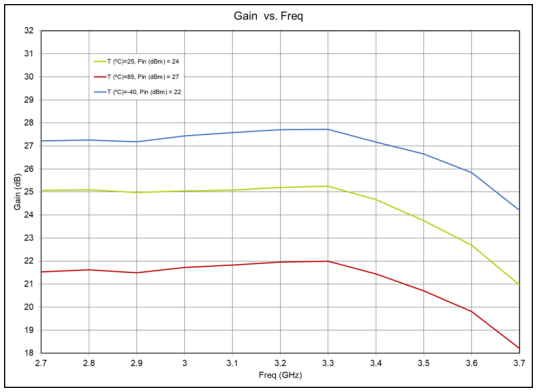
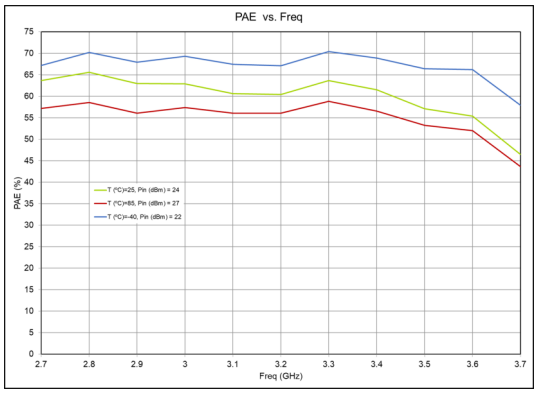
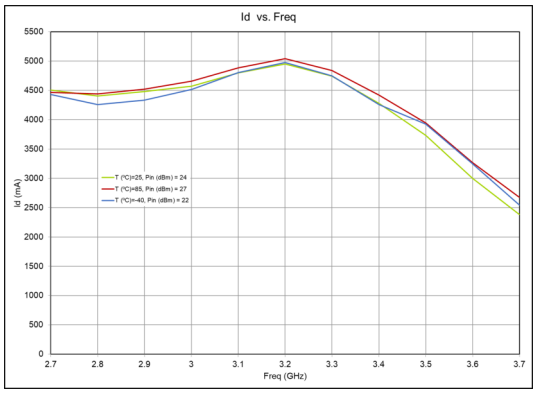
Power Performance vs. Frequency| Test Conditions unless otherwise stated | V_D=*28V*, I_{DQ}=*200mA*, T_A=*-40ºC, 25ºC, 85ºC,* Pulsed (*100µs/1ms*)









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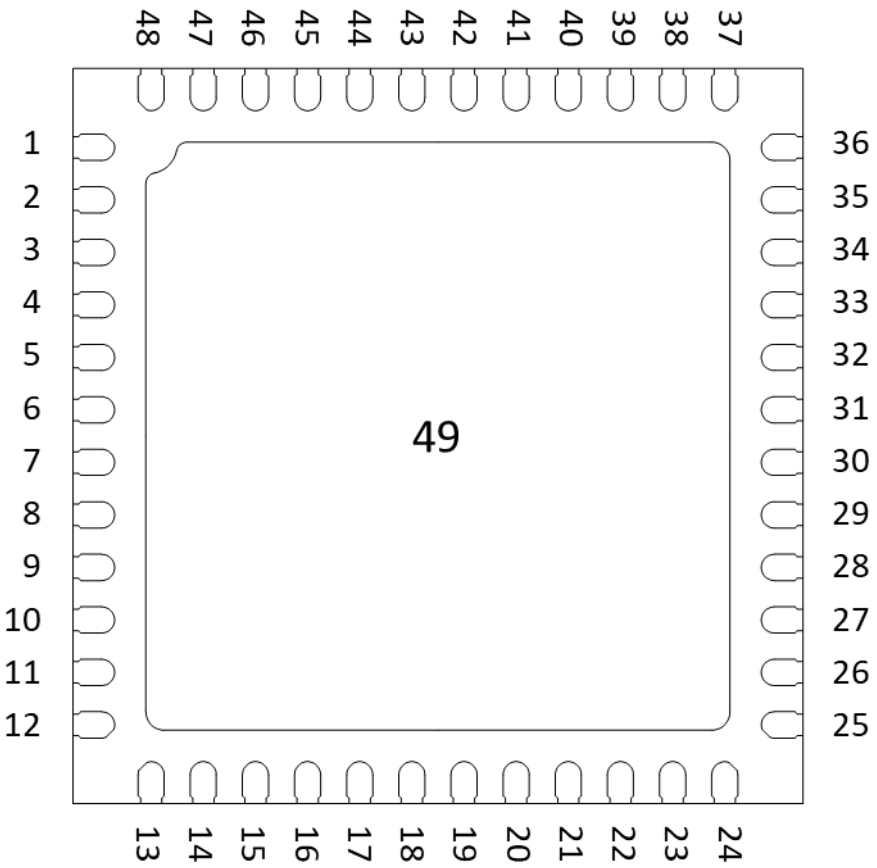
Pinout



Pad No	Function	Description
1-5, 8-12, 14, 16, 18-22, 24-29, 32-37, 39-43, 45, 47	NC	Not connected. Can be grounded
49	GND	Ground Connection
6, 7	RFIN	RF input, 50 ohm, DC blocked
13, 48	V_{G1}	1st stage gate bias, decoupling and bypass caps required, must be biased from both pins (V_{G1} and V_{G2} can be tied together in application)
15, 46	V_{D1}	1st stage drain voltage, decoupling and bypass caps required, must be biased from both pins (V_{D1} and V_{D2} can be tied together in application)
17, 44	V_{G2}	2nd stage gate bias, decoupling and bypass caps required, must be biased from both pins (V_{G1} and V_{G2} can be tied together in application)
23, 38	V_{D2}	2nd stage drain voltage, decoupling and bypass caps required, must be biased from both pins (V_{D1} and V_{D2} can be tied together in application)
30, 31	RFOUT	RF output, 50 ohm, DC blocked, pin is DC grounded

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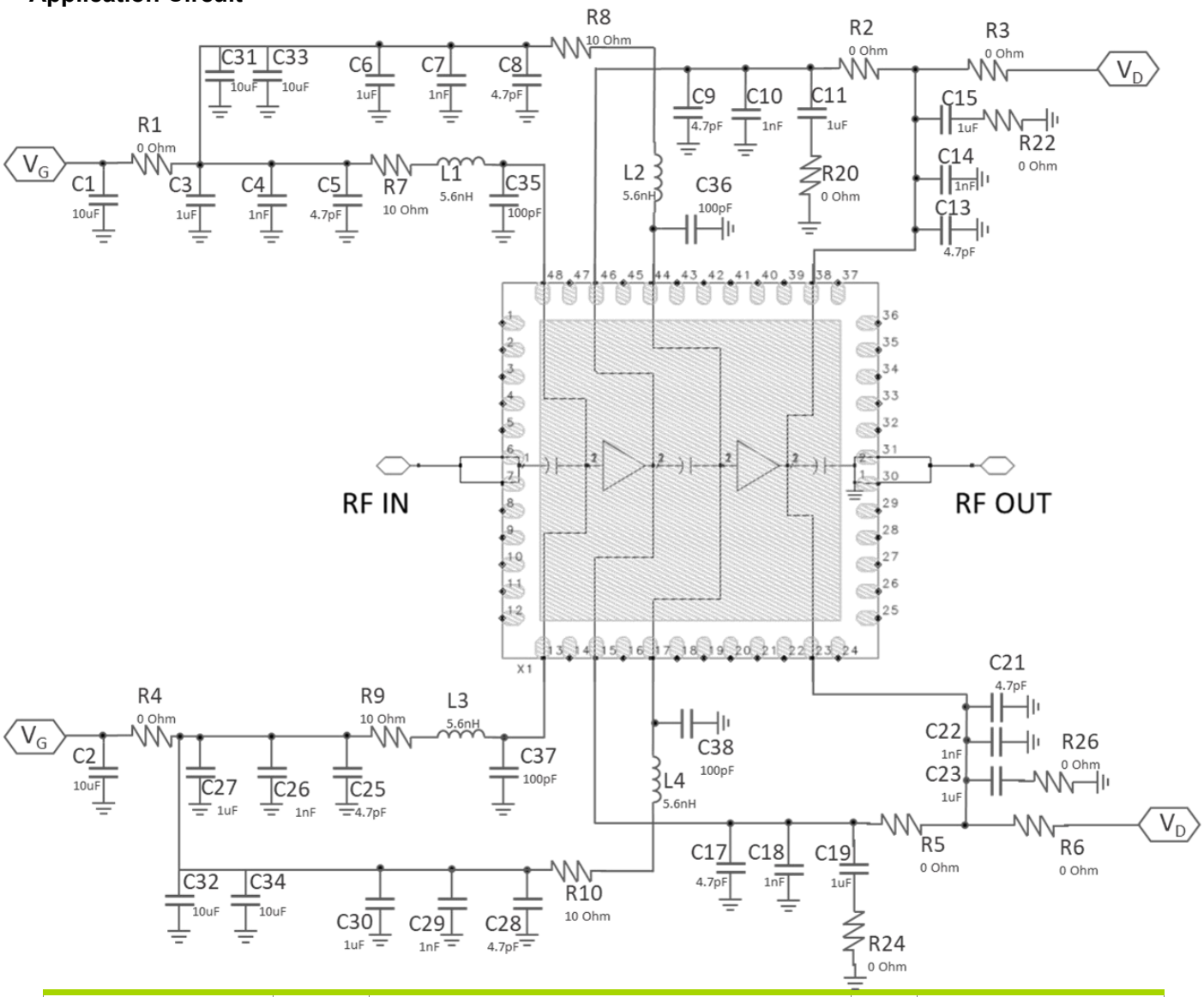
Application Circuit



Component ID	Value	Details	Qty	Manufacturer Part No.
C1, C2	10uF	10uF Capacitor 1206	2	Various
C31 - C34	10uF	10uF Capacitor 0603	4	Various
C3, C6, C11, C15, C19, C23, C27, C30	1uF	1uF Capacitor 0402, X8R, 50V	10	Various
C4, C7, C10, C14,C18, C22, C26, C29	1nF	1nF Capacitor 0402, C0G, 50V	8	Various
C35 - C38	100pF	100pF Capacitor 0402, C0G, 50V	4	Various
C5, C8, C9, C13, C17, C21, C25, C28	4.7pF	4.7pF Capacitor 0402, C0G, 50V	8	Various
L1 - L4	5.6nH	5.6nH Inductor 0402	4	Various
R7 - R10	10ohm	10ohm Resistor 0402	4	Various
R20, R22, R24, R26	0ohm	0ohm Resistor 0402 (link)	6	Various
R1, R2, R3, R4, R5, R6	0ohm	0ohm Resistor 2010 (link)	6	Various

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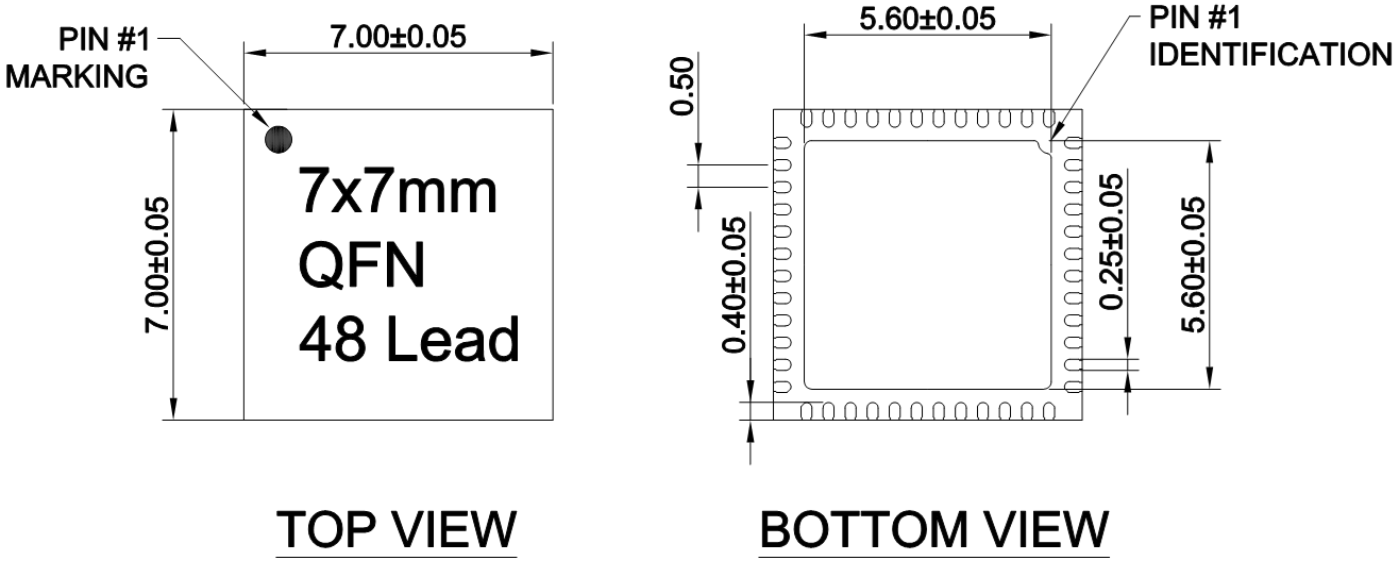
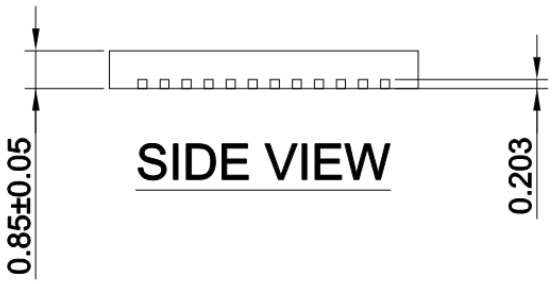
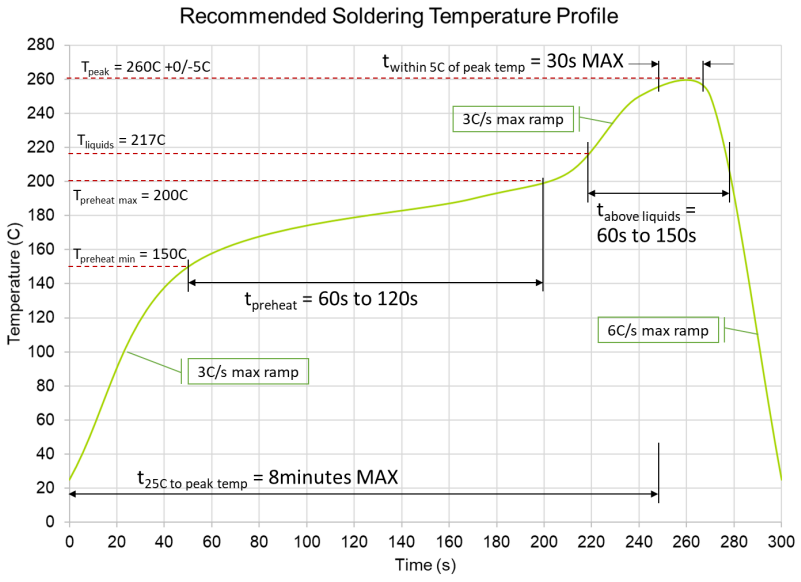
Mechanical Drawing





Units: mm



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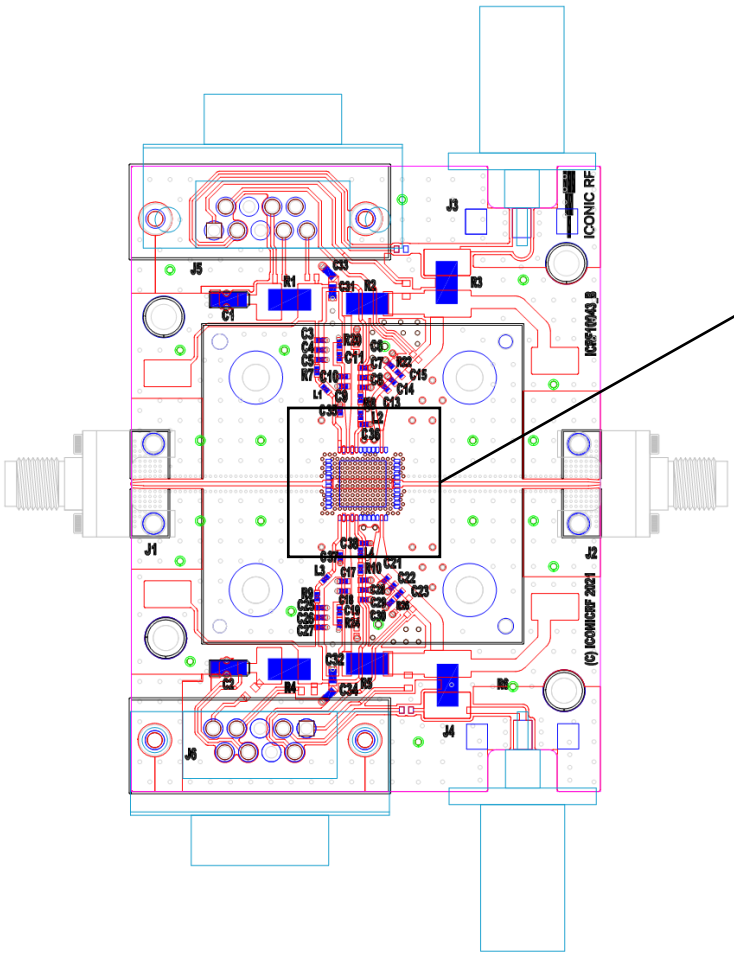
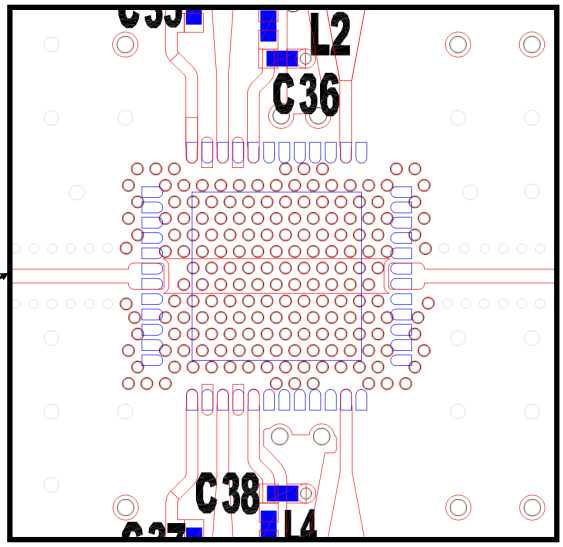
Evaluation Board





Evaluation board construction:

Board Size: 56mm X 75mm
PCB Material: RO4350 thickness 10mil
Recommended Copper Weight of 1oz
Via size 0.24mm plated to >50um thickness
Vias below the package must be Cu filled

Baseplate: Solid copper 56mm X 75mm x 9.9mm Thickness

Component ID	Value	Details	Qty	Manufacturer Part No.
J1, J2	n/a	HLT End Launch connector	2	CPSM-KF-01A
J3. J4	n/a	Amphenol BNC Panel Jack	2	112639
J5, J6	n/a	9way Dsub connector	2	Various
C1, C2	10uF	10uF Capacitor 1206	2	Various
C31 - C34	10uF	10uF Capacitor 0603	4	Various
C3, C6, C11, C15, C19, C23, C27, C30	1uF	1uF Capacitor 0402, X8R, 50V	10	Various
C4, C7, C10, C14,C18, C22, C26, C29	1nF	1nF Capacitor 0402, C0G, 50V	8	Various
C35 - C38	100pF	100pF Capacitor 0402, C0G, 50V	4	Various
C5, C8, C9, C13, C17, C21, C25, C28	4.7pF	4.7pF Capacitor 0402, C0G, 50V	8	Various
L1 - L4	5.6nH	5.6nH Inductor 0402	4	Various
R7 - R10	10ohm	10ohm Resistor 0402	4	Various
R20, R22, R24, R26	0ohm	0ohm Resistor 0402 (link)	6	Various
R1, R2, R3, R4, R5, R6	0ohm	0ohm Resistor 2010 (link)	6	Various

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