SAC5001Q6

GaN MMIC Power Amplifier
0.05GHz~2GHz 38dBm

Rev 1.0

Features

- Frequency: 0.05~2GHz
- Small Signal Gain: 13dB
- Output Power: 38dBm
- PAE: 33%
- IM_3: -25dBc@Pout/Tone 32dBm
- Package Size: 6mm×6mm×1.2mm
- Supply Voltage: +24V/-Vg

Typical Applications

- Point-to-Point Radios
- SATCOM

General Description

SAC5001Q6 is a high linearity power amplifier operates from 0.05–2GHz and provides 6W of saturated output power with 10dB of large signal gain and greater than 30% power-added efficiency, no external matching is required to achieve full-band operation.

Electrical Performance

T_{BASE}=23℃, V_D=+24V, I_{DQ}=60mA, Z_0=50Ω, CW

Parameter	Min.	Typ.	Max.	Units
Frequency Range	0.05	—	2	GHz
Small Signal Gain	10	13	—	dB
Power Gain	—	10	—	dB
Reverse Isolation	—	30	—	dB
VSWRi	—	1.7	—	:1
Output Power	—	38	—	dBm
Drain Voltage (V_D)	—	24	—	V
Gate Current	—	1	5	mA
Supply Current (I_D)*	—	—	1.2	A

*Adjust Vg between -2.8V to -1.5V to achieve I_{DQ}= 60mA, and typical Vg voltage is -2.4V

Absolute Maximum Ratings

Maximum Input Power	+31dBm	Operating Temperature (T_{BASE})	-55℃~+85℃
Channel Temperature	230℃	Storage Temperature	-55℃~+180℃
Maximum V_D	+32V	V_G Range	-5V~-1.5V
Mounting Temperature	310℃,50s		

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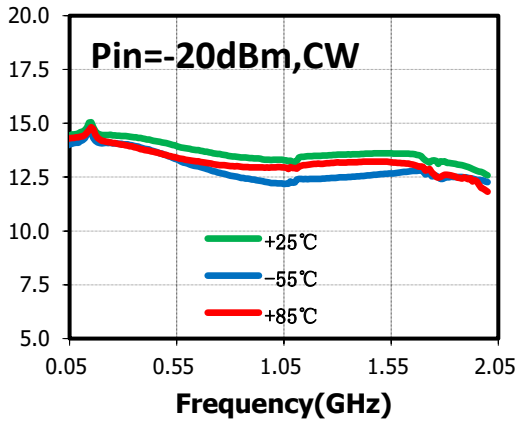
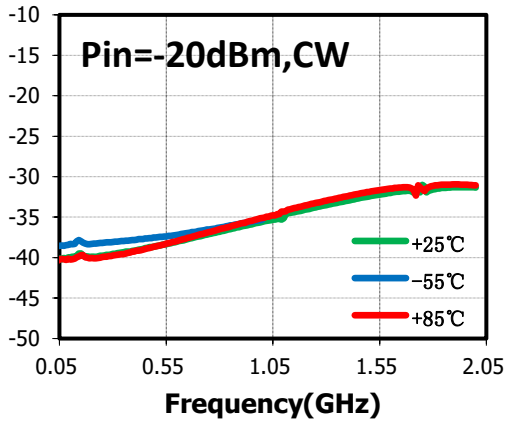
Typical Performance Curve

The following data was tested using the SAC5001Q6 evaluation board, V_D=+24V, I_{DQ}=60mA, T_{BASE}=+23℃, C_{Block}=1000pF

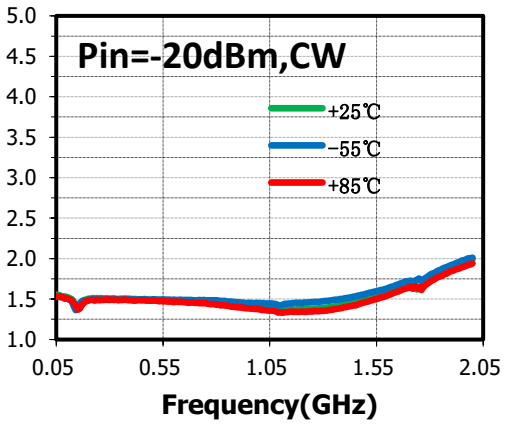
Small Signal Gain(dB) vs.Frequency



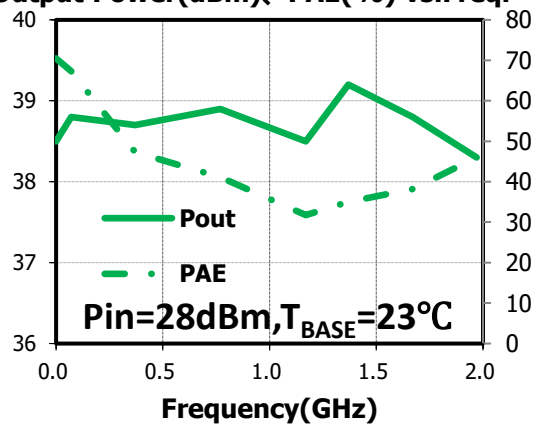
Isolation(dB) vs.Frequency



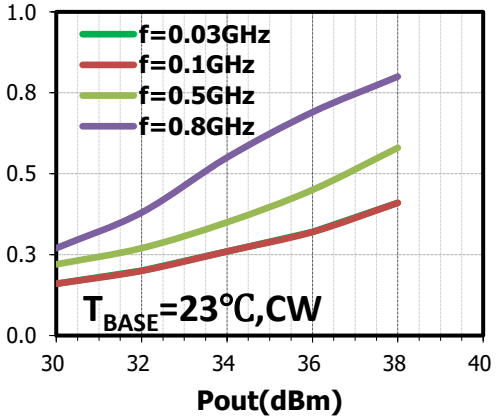
RF Input VSWR(:1) vs.Frequency



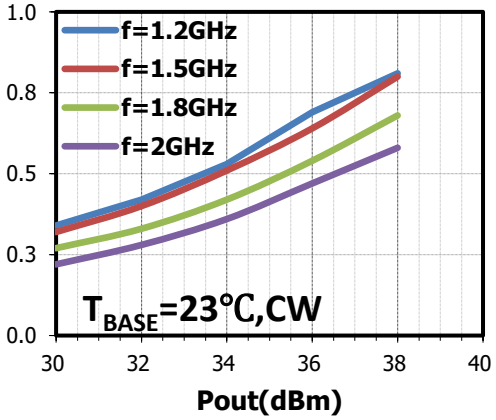
Output Power(dBm)、PAE(%) vs.Freq.



I_{Drain}(A) vs.P_{OUT}



I_{Drain}(A) vs.P_{OUT}



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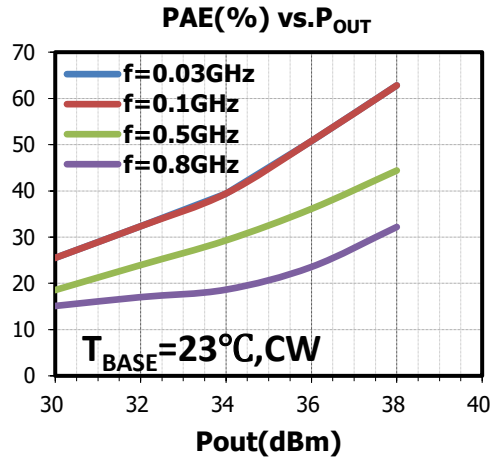
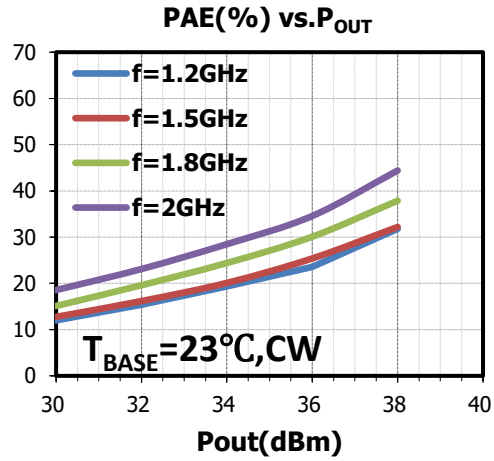
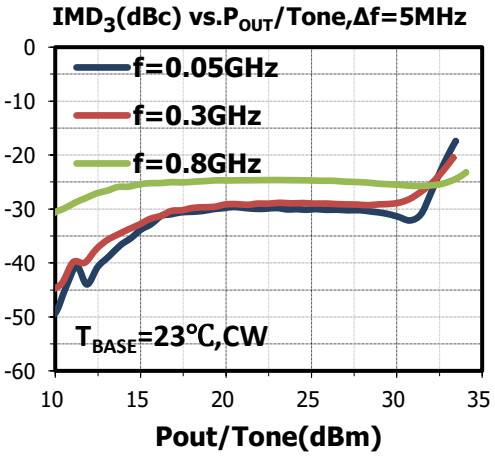
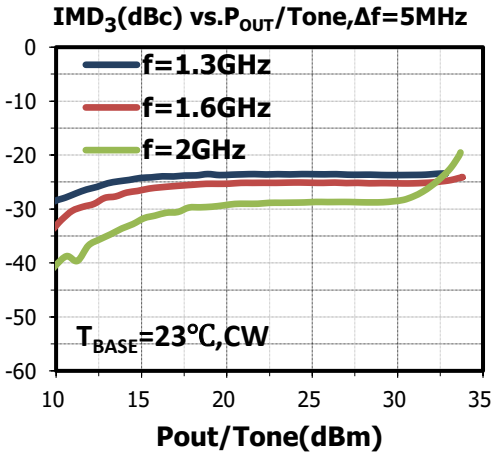
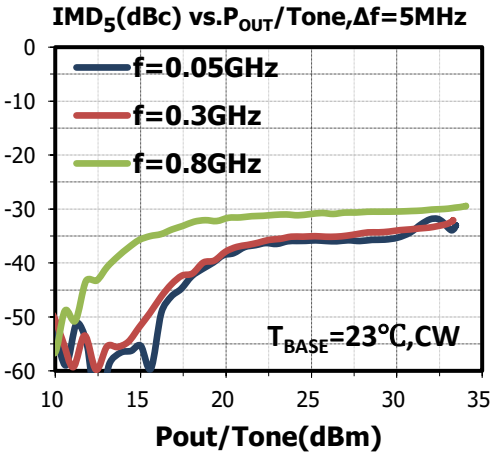
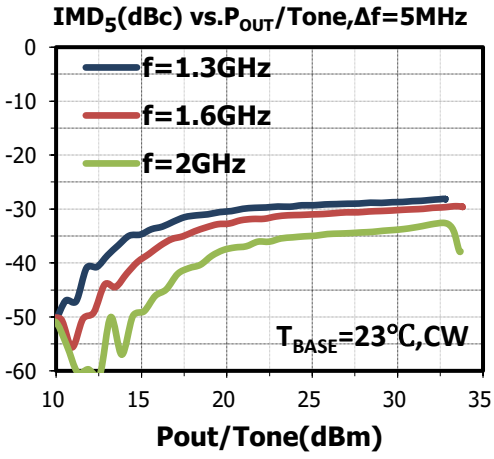

PAE(%) vs.POUT
f=0.03GHz
f=0.1GHz
f=0.5GHz
f=0.8GHz
TBASE=23°C,CW
Pout(dBm)

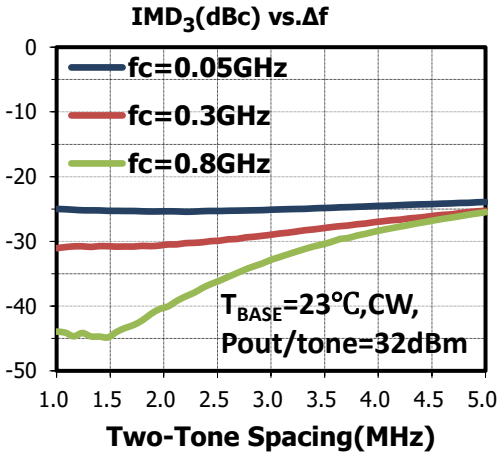

PAE(%) vs.POUT
f=1.2GHz
f=1.5GHz
f=1.8GHz
f=2GHz
TBASE=23°C,CW
Pout(dBm)

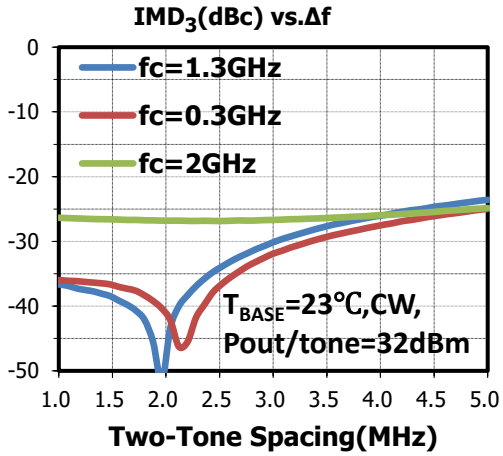

IMD3(dBc) vs.POUT/Tone,Δf=5MHz
f=0.05GHz
f=0.3GHz
f=0.8GHz
TBASE=23°C,CW
Pout/Tone(dBm)

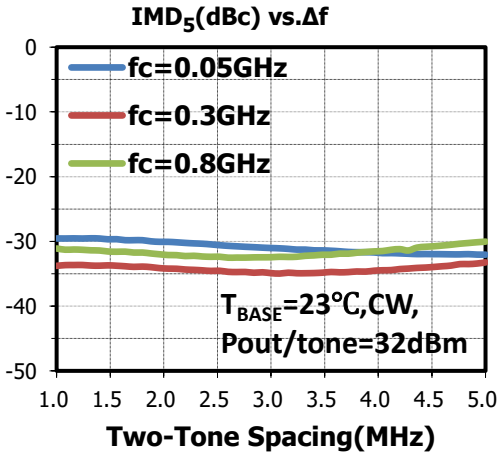

IMD3(dBc) vs.POUT/Tone,Δf=5MHz
f=1.3GHz
f=1.6GHz
f=2GHz
TBASE=23°C,CW
Pout/Tone(dBm)

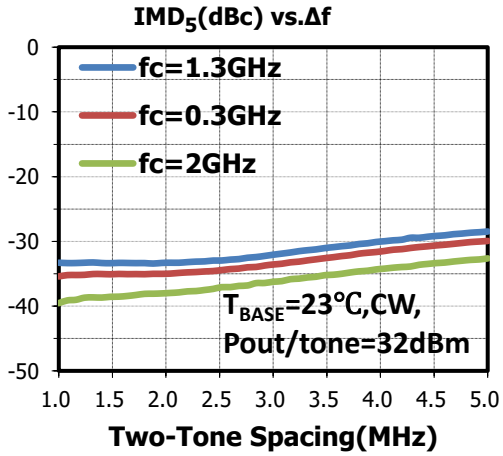

IMD5(dBc) vs.POUT/Tone,Δf=5MHz
f=0.05GHz
f=0.3GHz
f=0.8GHz
TBASE=23°C,CW
Pout/Tone(dBm)


IMD5(dBc) vs.POUT/Tone,Δf=5MHz
f=1.3GHz
f=1.6GHz
f=2GHz
TBASE=23°C,CW
Pout/Tone(dBm)









Thermal Resistance

Parameter	Conditions	Value	Unit
θ_{JC1}	V_D=+24V， T_{BASE}=+70℃， Pin=+28dBm, CW, f=1GHz	10.2	℃/W

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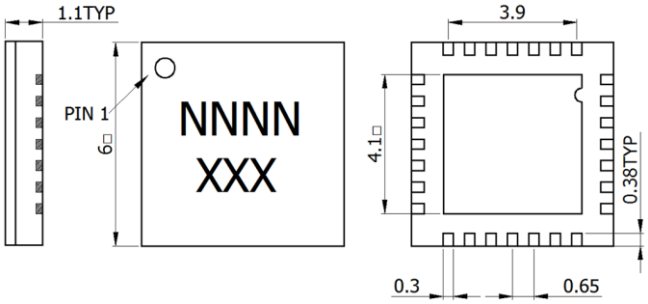
Outline Drawing

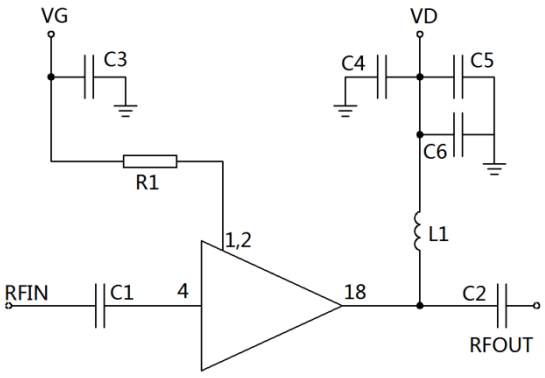
(mm)



Pin Function

Pin No.	Description	Pin No.	Description
1	Gate power supply	15	GND
2	Gate power supply	16	GND
3	GND	17	GND
4	RF IN	18	RF Output/Drain bias
5	GND	19	GND
6	GND	20	GND
7	GND	21	GND
8	GND	22	GND
9	GND	23	GND
10	GND	24	GND
11	GND	25	GND
12	GND	26	GND
13	GND	27	GND
14	GND	28	GND

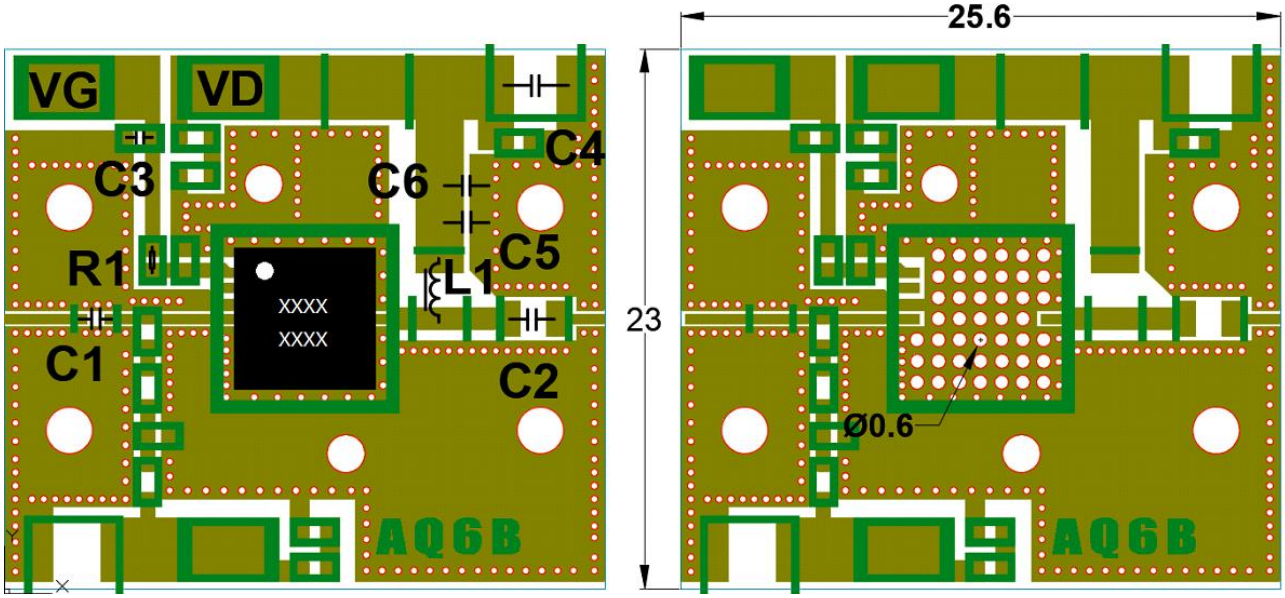
Assembly Diagram



Components List

Reference Des.	Value	Part Number	Manuf.	Size
C1、C6	1000pF		—	0402
C3	1μF	—	—	0402
C2	1000 pF			0805
C4	22μF			1210
C5	0.047μF	—	—	0402
L1	910nH	1008AF-901	Coilcraft	1008
R1	1Ω	—	—	0603

SAC5001Q6 Evaluation Board



The Evaluation board is a 2-layers board fabricated using Rogers 4350 t=0.254 and using best practices for high frequency RF design. The RF input and RF output traces have a 50 Ω characteristic impedance.

The bottom center pad of SAC5001Q6 is used for RF grounding and heat dissipation. For best heat dissipation, copper-filled vias are highly recommended, SAC5001Q6 is high power dissipation surface mount components and require a well-designed thermal mount. All the heat generated by the device is expected to be removed through the bottom heat slug with a low thermal resistance path to the chassis. The use of multiple copper-filled vias or solder-filled vias under the package's heat slug while using an indium foil between the PCB and chassis provides a low thermal resistance mount, Insufficient number of vias or insufficient solder filling will significantly affect the heat dissipation process of the device, and then reduce the performance or even damage the device.

Notes

1. SAC5001Q6 requires a positive drain voltage (VDx) and a negative gate voltage (VGx) bias. Before applying the positive drain voltage, it is necessary to ensure that the negative gate voltage has been applied. When turning off, it is necessary to ensure that the positive drain voltage is turned off before the negative gate voltage;
2. When using packaged products, try to use thin RF boards and increase the number of groundings vias at the bottom of the device to reduce grounding inductance;
3. Remove the vacuum packaging and bake at 125+/-5 ℃ for 6 hours before soldering.

Revision History

Revision	Date	Comment
1.0	May 11, 2024	First Release

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