SAC5003CR7

GaN MMIC Power Amplifier
8GHz~12GHz 45.5dBm

Rev 1.1

Features

- Frequency: 8GHz~12GHz
- Small Signal Gain: 29dB
- Output Power: 45.5dBm
- PAE: 30%
- Package: Metal-Ceramic-Package (CR7)
- Supply Voltage: +28V/-Vg

Typical Applications

- Point-to-Point Radios
- Weather Radar

General Description

SAC5003CR7 is a X-band power amplifier delivering 45.5dBm with 30% power added efficiency from 8GHz to 12GHz. No external matching is required to achieve full X-band operation.

Electrical Performance

T_{BASE}=23℃, V_D=+28V, I_{DQ}=2.3A, Z_0=50Ω, T=1mS, Duty Cycle=10%

Parameter	Min.	Typ.	Max.	Units
Frequency Range	8	—	12	GHz
Small Signal Gain	—	29	—	dB
Power Gain	—	17	—	dB
Reverse Isolation	—	50	—	dB
RF Input Port Return Loss	—	-12	—	dB
Output Power	—	45.5	—	dBm
Drain Voltage (V_D)	—	28	—	V
Gate Current	—	2	16	mA
Supply Current (I_D)*	—	—	6	A

*Adjust Vg between -2.5V to -1.5V to achieve I_{DQ}= 2.3A, and typical Vg voltage is -2V

Absolute Maximum Ratings

Maximum Input Power	+30dBm	Operating Temperature (T_{BASE})	-55℃~+85℃
Channel Temperature	230℃	Storage Temperature	-55℃~+180℃
Maximum V_D	+32V	V_G Range	-5V~-1 V
Mounting Temperature	320℃,30s		

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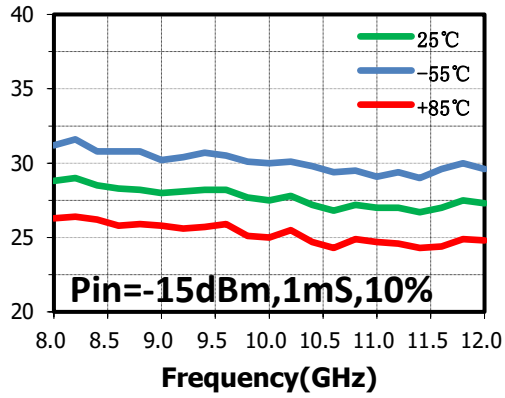
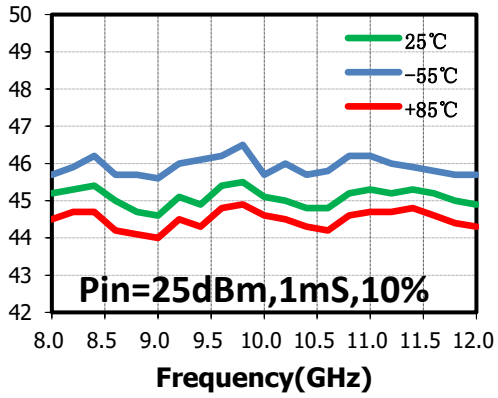
Typical Performance Curve

The following curves are taken from SAC5003CR7 evaluation board. De-embedding operation has been Implemented. V_D=+28V, I_{DQ}=2.3A, T_{BASE}=+25℃, Pulse Operation

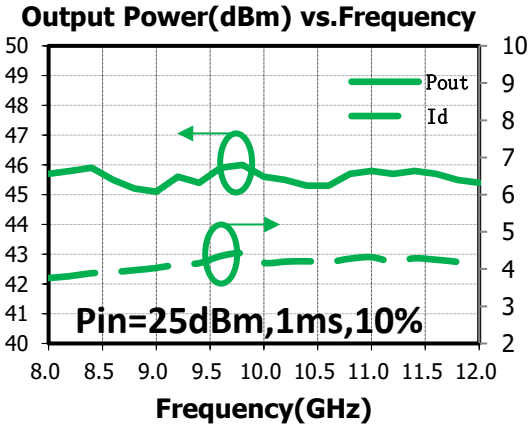
Small Signal Gain(dB) vs.Frequency



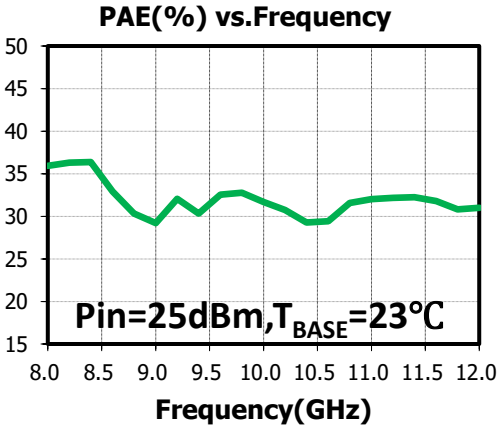
Output Power(dBm) vs.Frequency



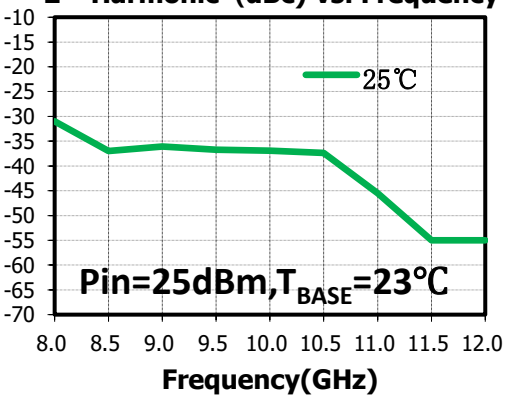
Output Power(dBm) vs.Frequency



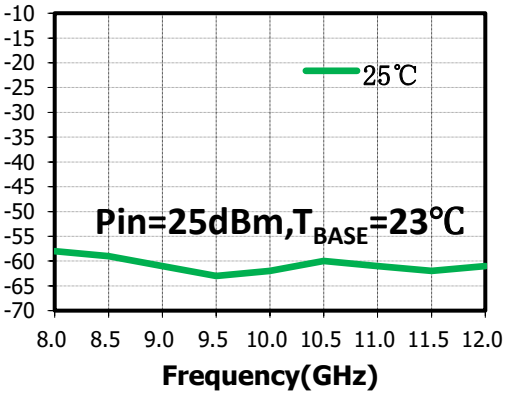
PAE(%) vs.Frequency

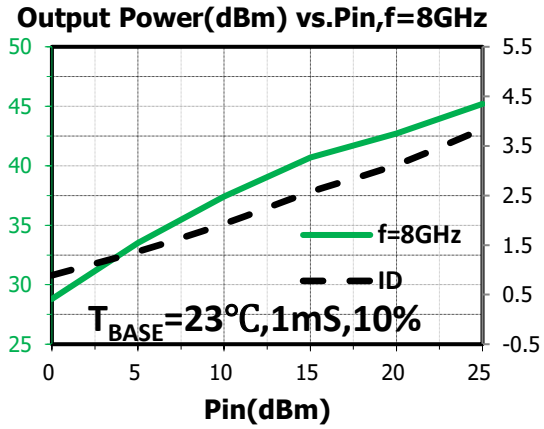


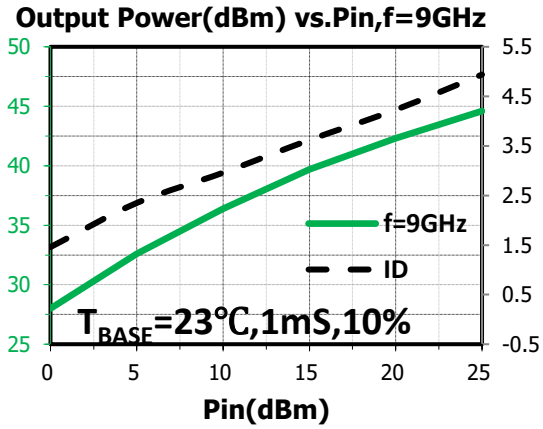
2nd Harmonic (dBc) vs. Frequency

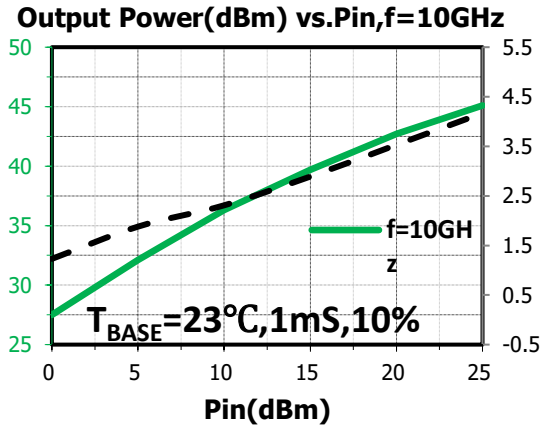


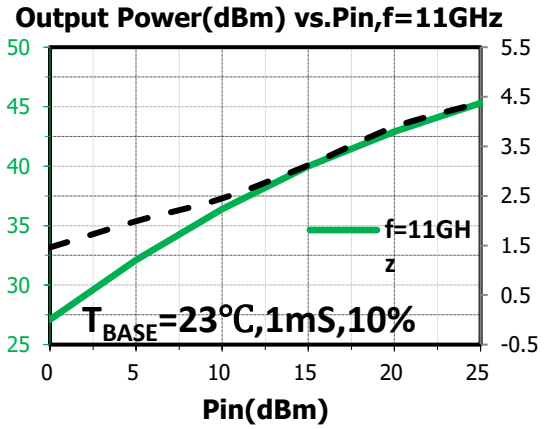
3rd Harmonic(dBc) vs. Frequency

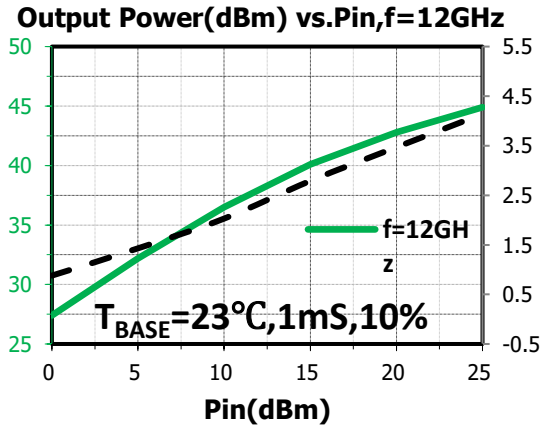



Output Power(dBm) vs.Pin,f=8GHz
50
45
40
35
30
25
5.5
4.5
3.5
2.5
1.5
0.5
-0.5
0
5
10
15
20
25
Pin(dBm)
f=8GHz
ID
TBASE=23℃,1mS,10%


Output Power(dBm) vs.Pin,f=9GHz
50
45
40
35
30
25
5.5
4.5
3.5
2.5
1.5
0.5
-0.5
0
5
10
15
20
25
Pin(dBm)
f=9GHz
ID
TBASE=23℃,1mS,10%

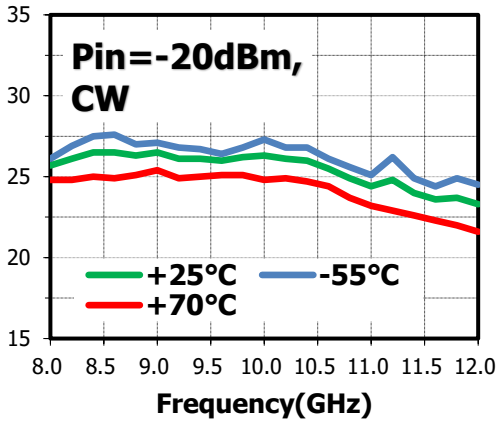

Output Power(dBm) vs.Pin,f=10GHz
50
45
40
35
30
25
5.5
4.5
3.5
2.5
1.5
0.5
-0.5
0
5
10
15
20
25
Pin(dBm)
f=10GHz
TBASE=23℃,1mS,10%


Output Power(dBm) vs.Pin,f=11GHz
50
45
40
35
30
25
5.5
4.5
3.5
2.5
1.5
0.5
-0.5
0
5
10
15
20
25
Pin(dBm)
f=11GHz
TBASE=23℃,1mS,10%

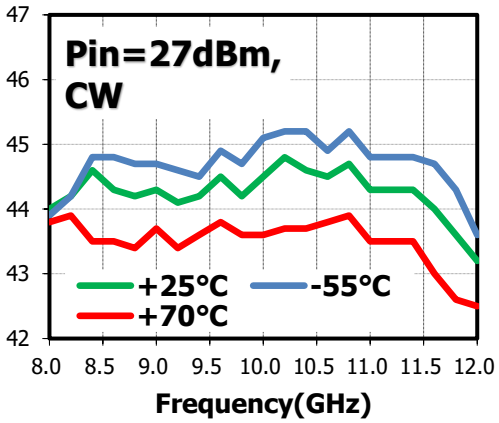

Output Power(dBm) vs.Pin,f=12GHz
50
45
40
35
30
25
5.5
4.5
3.5
2.5
1.5
0.5
-0.5
0
5
10
15
20
25
Pin(dBm)
f=12GHz
TBASE=23℃,1mS,10%

The following curves are taken from SAC5003CR7 evaluation board. De-embedding operation has been Implemented. V_D=+28V, I_{DQ}=2.3A, T_{BASE}=+25℃, CW Operation, SAC5003CR7 is soldered onto the copper heatsink

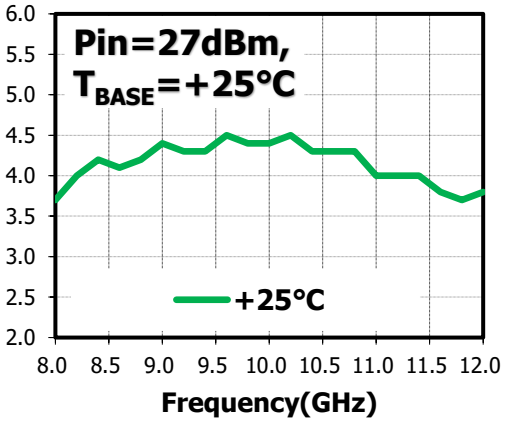
Small Signal Gain(dB) vs.Frequency



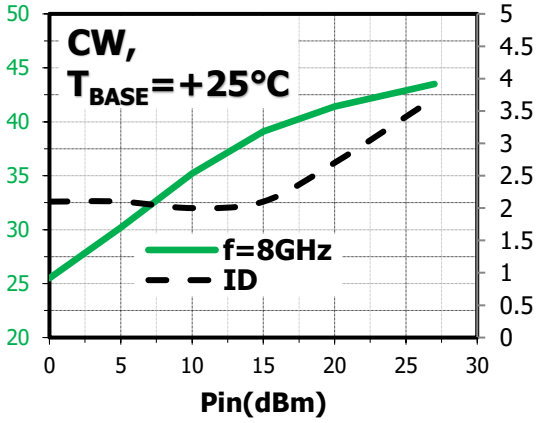
Output Power(dBm) vs.Frequency



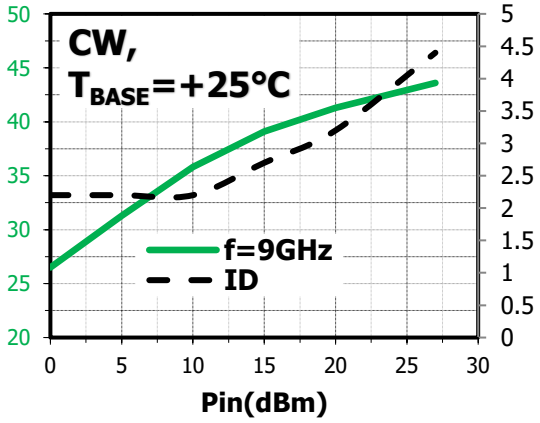
I_{Drain}(A) vs.Frequency



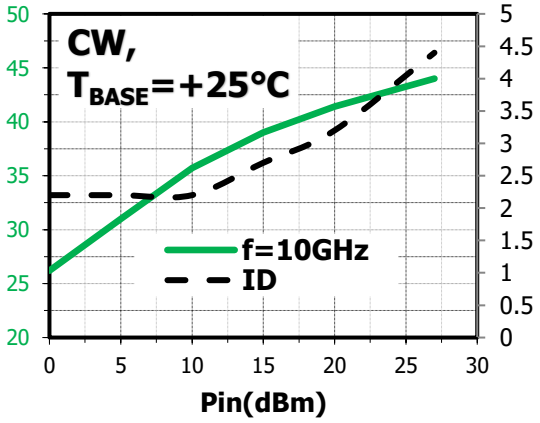
Output Power(dBm) vs.Pin,f=8GHz

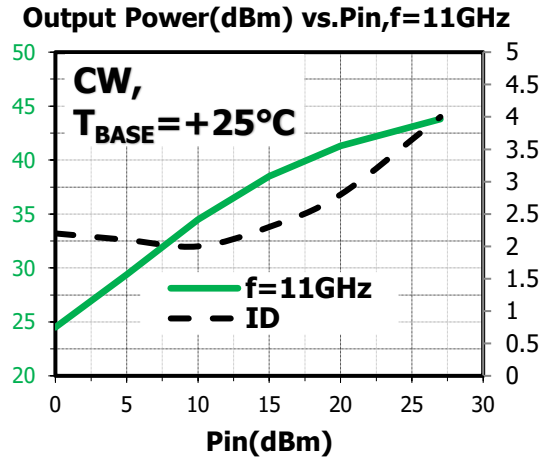


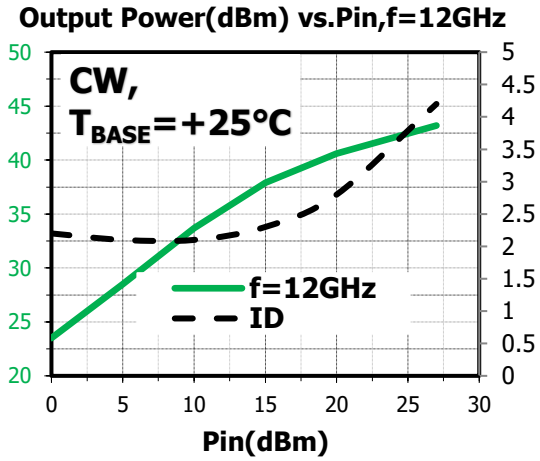
Output Power(dBm) vs.Pin,f=9GHz



Output Power(dBm) vs.Pin,f=10GHz





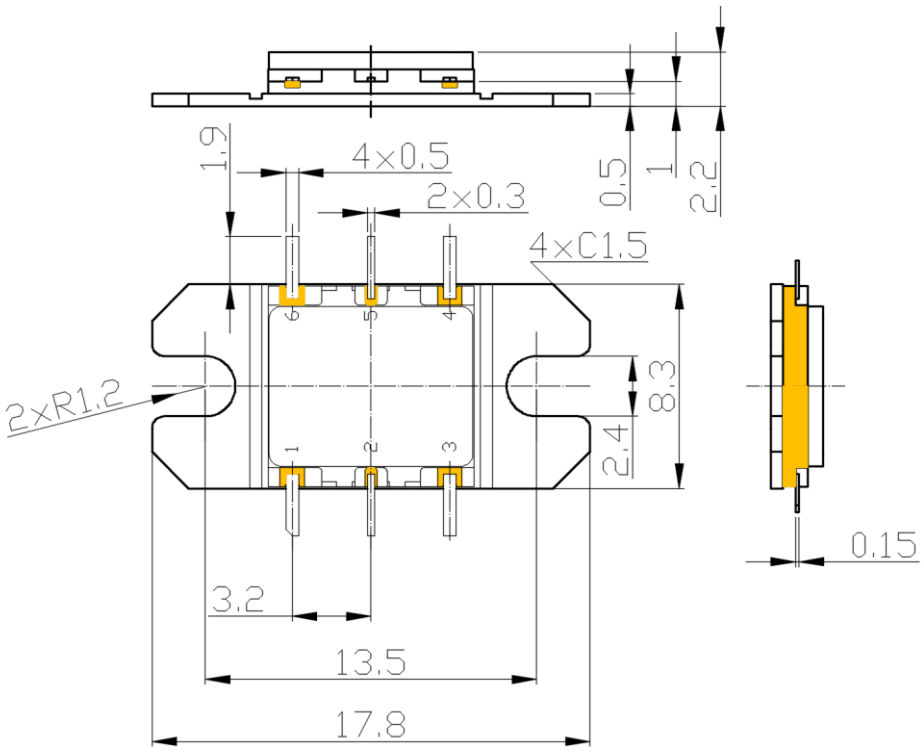


Thermal Resistance

Parameter	Conditions	Value	Unit
θ_{JC1}	V_D=+28V, T_{BASE}=+70°C, Pin=+25dBm, CW, f=10GHz	1.52	°C/W

Outline Drawing

(All dimensions in mm)



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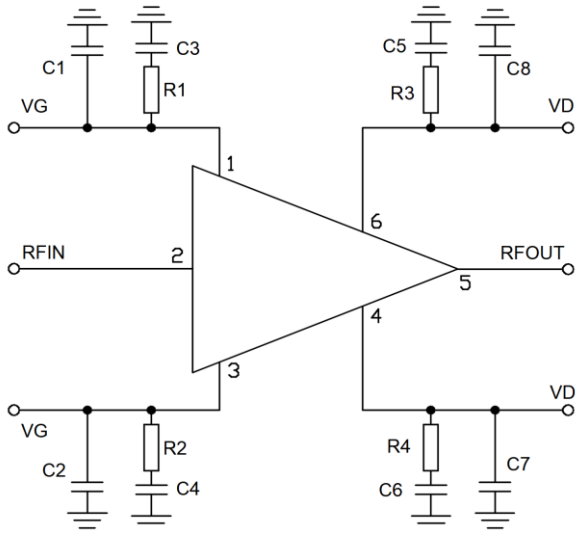
Pin Descriptions

Pin No.	Function	Pin No.	Function
1	Gate	4	Drain
2	RF input, AC Coupled	5	RF Output, AC Coupled
3	Gate	6	Drain

Application Circuit



BOM

Reference Des.	Value	Part Number	Manuf.	Size
C1, C2	0.47μF	—	—	0805
C3~C6	0.022μF	—	—	0603
C7, C8	0.22μF	—	—	0603
R1~R8	2.2Ω	—	—	0603

Notes

1. SAC5003CR7 requires VDx and VGx bias.
   Turn-on: Apply VGx, Apply VDx, Apply RFIN signal.
   Turn-off: Remove RFIN signal, Decrease VG to -5V(pinch-off), Decrease VD to 0 V;
2. The flange of package may be attached using screws, recommended torque for screw mounting is 10N-cm;
3. The surface finish of the heat sink should be better than 0.8μm, and the surface flatness must be better than 10 μm;
4. Silicon based heat sink compounds should not be used for the thermal conductive grease. They cause poor grounding of the source flange. contamination and long-term degradation of thermal resistance between the FET package and heat sink;
5. The chip is an Electrostatic Sensitive Device;
6. The maximum soldering temperature for device pins is 400 ℃/3s.

Revision History

Revision	Date	Comment
1.0	July 3, 2024	First Release
1.1	Sept. 23,2024	Added CW test data

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