SAC3143

GaAs MMIC Power Amplifier
8GHz~10GHz 39dBm

Rev 1.0

Features

- Frequency：8GHz~10GHz
- Small Signal Gain:21dB
- Output P_{-1}dB:39dBm CW
- PAE：32%@OP_{-1}dB, f=9GHz
- IM3: -24dBc, 33dBm/Tone@9.35GHz
- Die size:4.2mm×4.2mm×0.1mm
- Supply Voltage: +7V/-Vg
- Package: Bare Die

Typical Applications

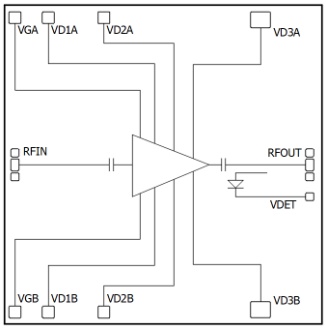
- X-band multifunction radar
- Point-to-Point Radio

General Description

SAC3143 is a X-band GaAs MMIC power amplifier. SAC3143 provides 21dB of gain, and 39dBm of output power for 1 dB compression and more than 30% PAE@OP_{-1}dB,9GHz from a +7V supply.

The chip has surface passivation for protection and backside via holes and gold metallization to allow a conductive epoxy die attach process, It's ideal for Point-to-Point radio and multifunction radar applications

Functional Diagram



Electrical Performance

T_A=25℃, V_D=+7V, I_{DQ}=3.5A, Z_0=50Ω, CW

Parameter	Min.	Typ.	Max.	Units
Frequency Range	8	—	10	GHz
Small Signal Gain	17	21	—	dB
Gain Flatness	—	±1	—	dB
Reverse Isolation	—	-65	—	dB
VSWRi	—	1.7	2.4	:1
Power-Added Efficiency	—	30	—	%
Output P_{-1}dB	38.5	39	—	dBm
IM_3*	—	24	—	dBc
Drain Voltage (VD)	7	—	8	V
Gate Current	—	4	35	mA

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Supply Current (ID)***	—	—	5.25	A
Thermal Resistance **	—	2.88	—	℃/W

* Pout/Tone=33dBm, fc=9.35GHz, Δf=5MHz

** Measurement taken at Pout = OP_{-1}dB, IR method. 100% DC power is dissipated on the device the thermal resistance is 3.02 ℃/W

*** Adjust Vg between -1V to -0.6V to achieve I_{DQ}= 3.5A typical.

Absolute Maximum Ratings

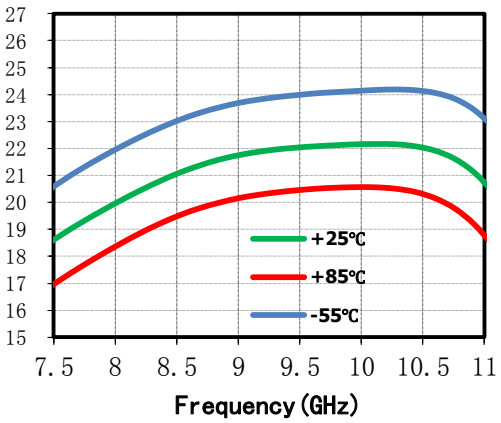
Maximum Input Power	+24dBm	Operating Temperature (Backside)	-55℃~+85℃
Channel Temperature	165℃	Storage Temperature	-55℃~+150℃
Maximum VD Supply	+8V	VG Range	-1.5V(Pinch-off) ~-0.5V

Typical Performance Curve

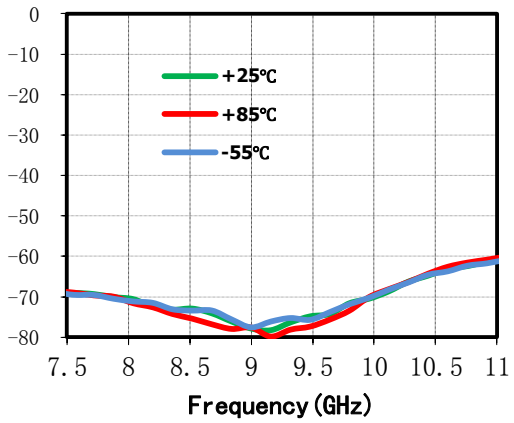
The following data are obtained from SAC3143 evaluation board

VD = + 7V, I_{DQ} = 3.5A, CW, T_A = + 25℃

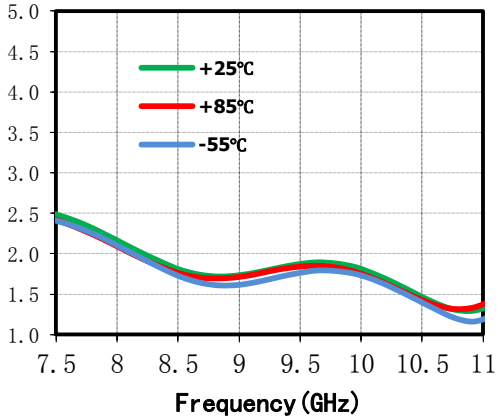
Small Signal Gain(dB) vs.Temperature



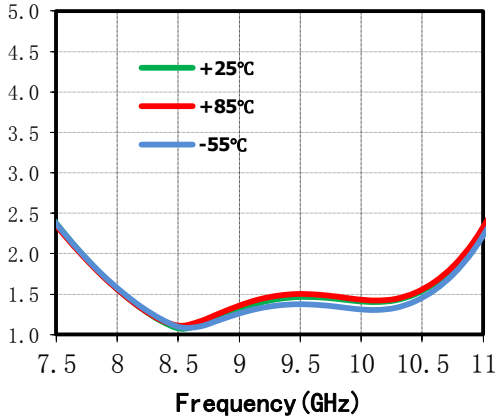
Isolation(dB) vs.Temperature



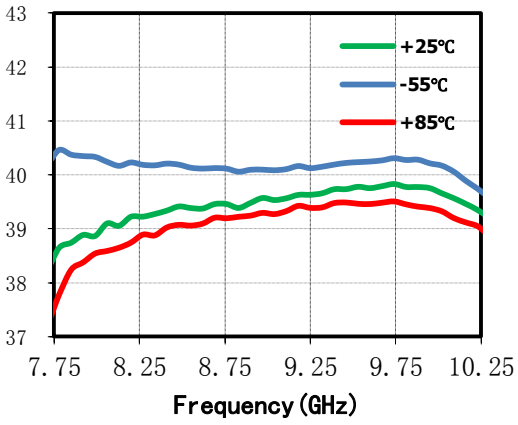
Input VSWR(:1) vs.Temperature



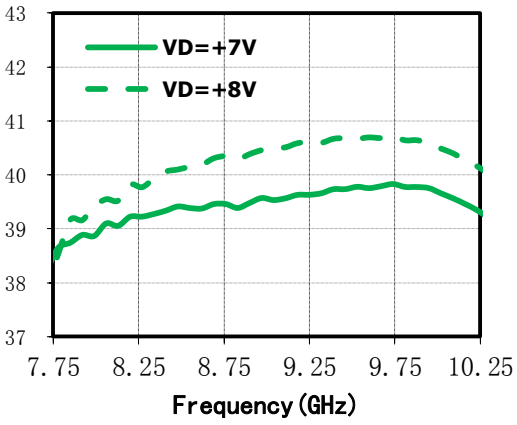
Output VSWR(:1) vs.Temperature



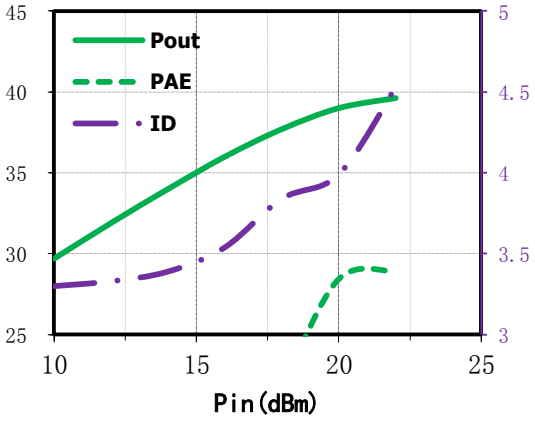
OP-1dB (dBm) vs. Temperature



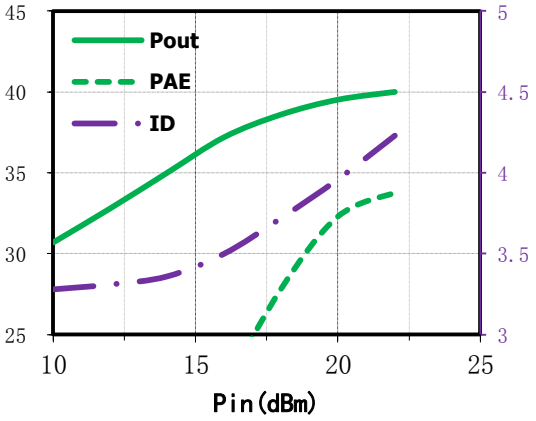
OP-1dB (dBm) vs. Bias



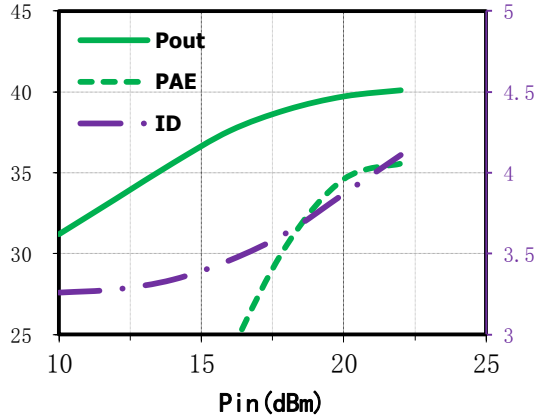
Pout (dBm)、PAE (%)、ID(A) vs. Pin,f=8GHz



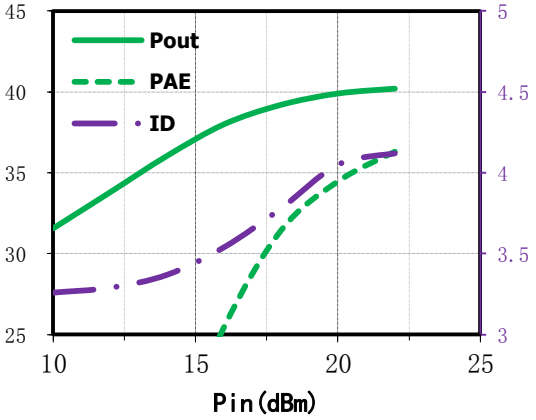
Pout (dBm)、PAE (%)、ID(A) vs. Pin,f=8.5GHz



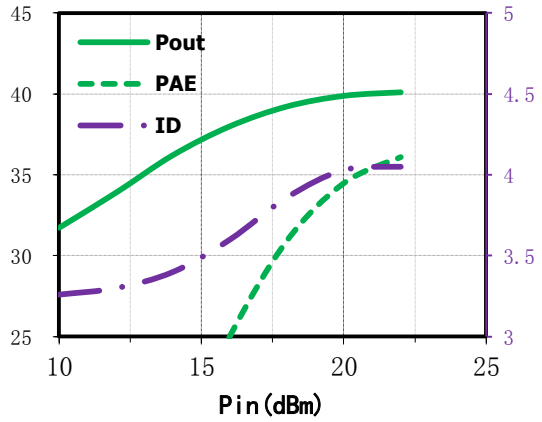
Pout (dBm)、PAE (%)、ID(A) vs. Pin,f=9GHz



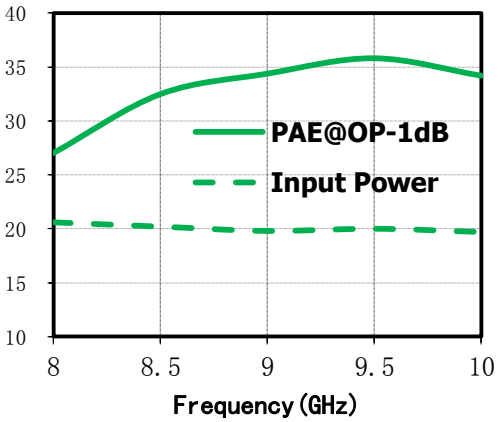
Pout (dBm)、PAE (%)、ID(A) vs. Pin,f=9.5GHz



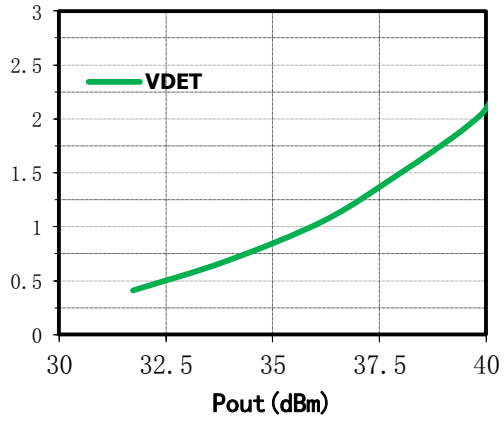
Pout (dBm)、PAE (%)、ID(A) vs. Pin,f=10GHz



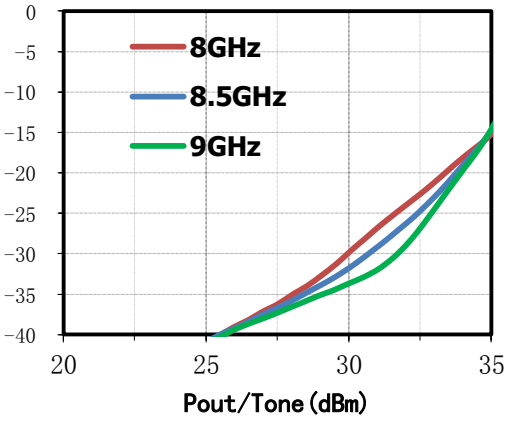
PAE (%),PWRin (dBm) @OP$_{-1}$dBvs. Freq.



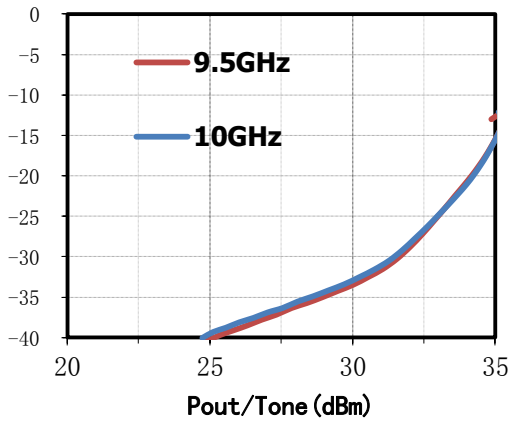
Pout (dBm) vs. V_{DET}(V),f=9GHz



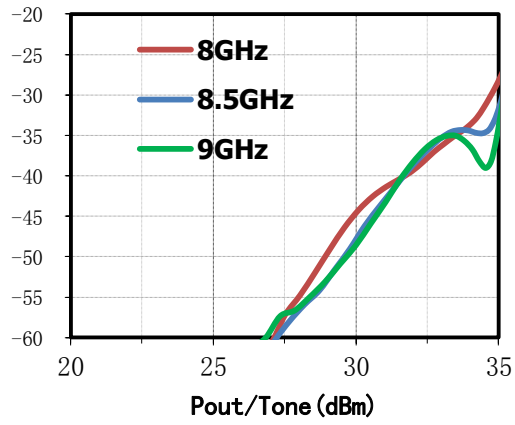
IM3 (dBc) vs. Pout/Tone



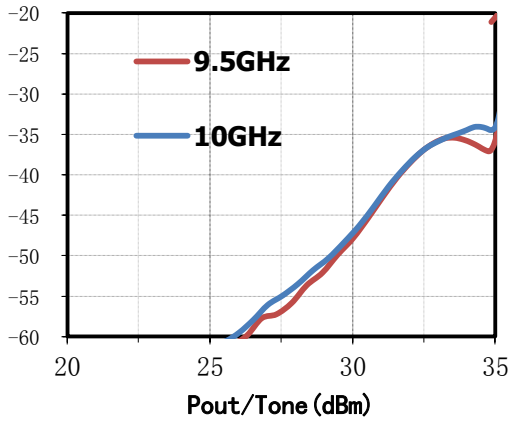
IM3 (dBc) vs. Pout/Tone



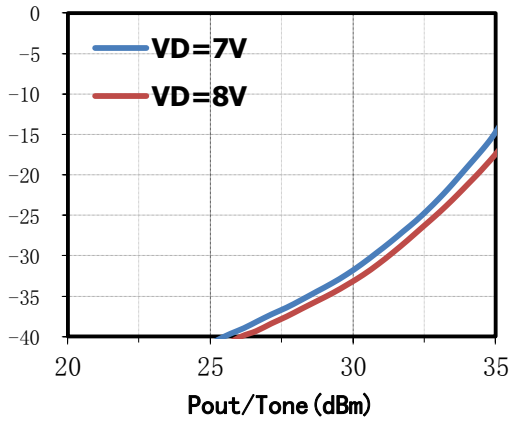
IM5 (dBc) vs. Pout/Tone



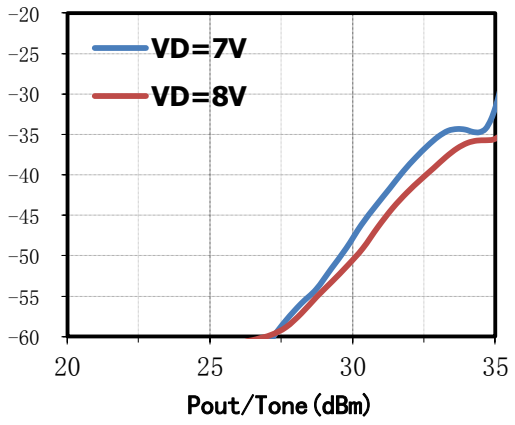
IM5 (dBc) vs. Pout/Tone



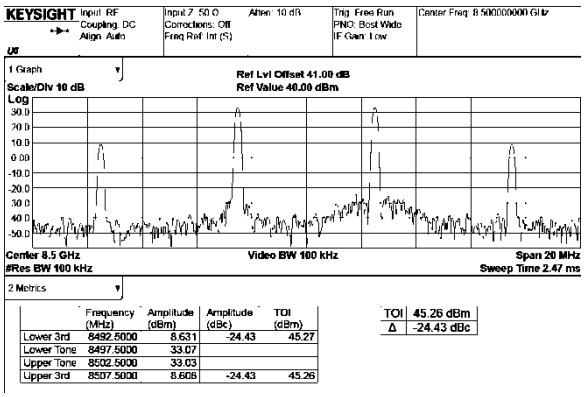
IM3 (dBc) vs. Bias, fc=8.5GHz



IM5 (dBc) vs. Bias, fc=8.5GHz

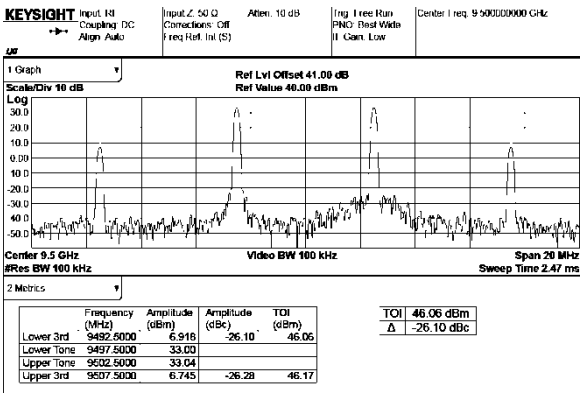


IM Spectrum, Pout/Tone=33dBm, fc=8.5GHz, Δf=5MHz



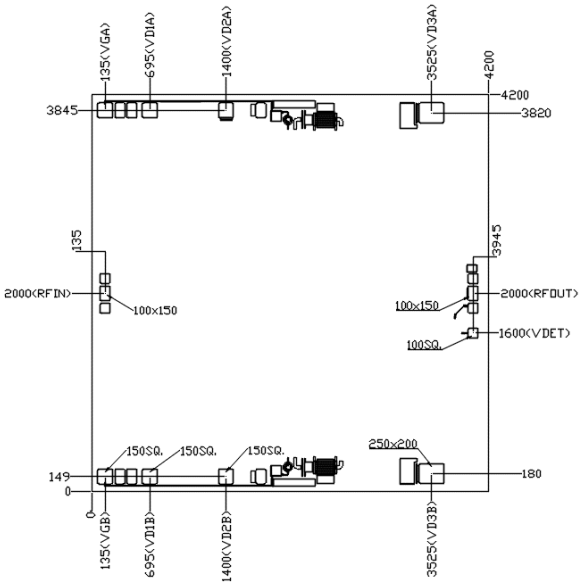
	Frequency (MHz)	Amplitude (dBm)	Amplitude (dBc)	TOI (dBm)
Lower 3rd	8492.5000	8.631	-24.43	45.27
Lower Tone	8497.5000	33.07		
Upper Tone	8502.5000	33.03		
Upper 3rd	8507.5000	8.608	-24.43	45.26

IM Spectrum, Pout/Tone=33dBm, fc=9.5GHz, Δf=5MHz

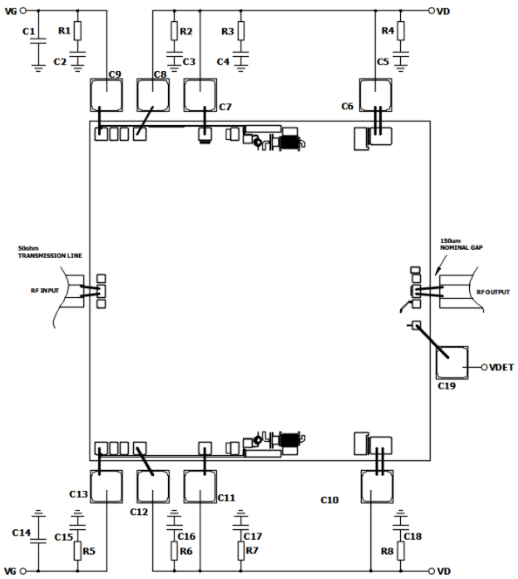


	Frequency (MHz)	Amplitude (dBm)	Amplitude (dBc)	TOI (dBm)
Lower 3rd	9492.5000	6.916	-26.10	46.06
Lower Tone	9497.5000	33.03		
Upper Tone	9502.5000	33.04		
Upper 3rd	9507.5000	6.745	-26.28	46.17

Die Outline(μm)



Assembly Diagram



BOM

Reference Des.	Value	Part Number	Manuf.	Size
C1、C14	10μF	—	—	0805
C6~C13、C19	100pF	—	ANY	SLC
C2~C5	0.47μF	—	—	0603
C15~C18	0.47μF	—	—	0603

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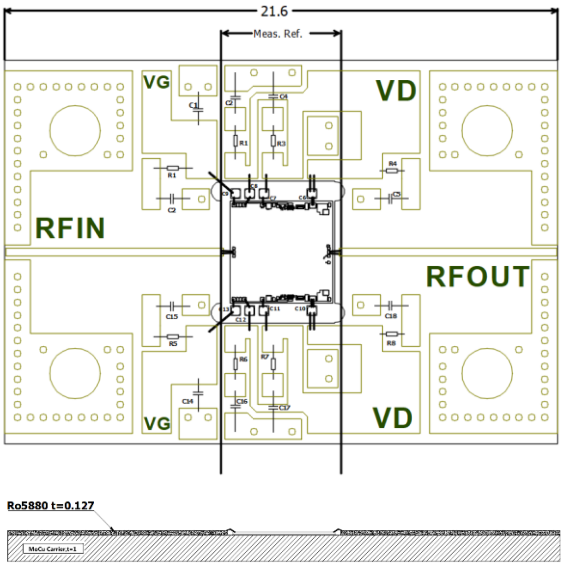
R1~R8	1Ω	—	—	0603

SAC3143 Evaluation board



Notes

1. SAC3143 is biased with a positive drain supply and negative gate supply. The recommended gate voltage is set to -0.6 to -0.9V when the drain voltage is set to 7V;
2. The back of chip is RF ground;
3. RF connections should be made as short as possible to reduce the inductive effect of the bond wire. Use of a 1 mil thermosonic wedge bonding is highly recommended as the loop height will be minimized;
4. Bypass SLCs should be placed as close as possible to the chip;
5. GaAs MMIC devices are susceptible to damage from Electrostatic Discharge. Proper precautions should be observed during handling, assembly and test;
6. The maximum spike voltage at drains(VDxx) should not exceed 8.5V.

Revision History

Revision	Date	Comment
1.0	Jul 23, 2021	First Release