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

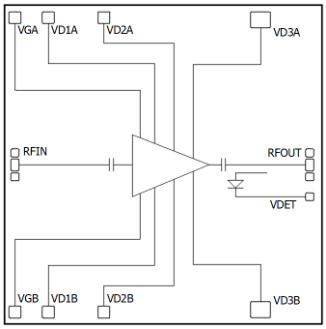
- X-band multifunction radar
- Point-to-Point Radio

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 Is 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
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.

SuperApex, LLC
2801 Lakeside Drive, Suite 208, Bannockburn, IL 60015, USA
Tel: 1-847-505-8319, 1-847-573-9866
E-mail: sales@superapexco.com
Website: www.superapexco.com

Absolute Maximum Ratings

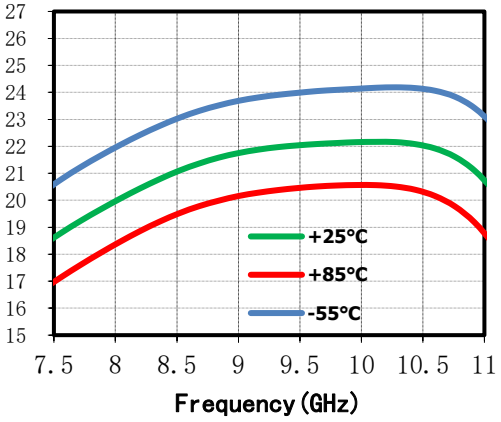
Maximum Input Power	+24dBm	Operating Temperature (Backside)	-55℃~+85℃
Channel Temperature	165℃	Storage Temperature	-55℃~+150℃
Maximum VD Supply	+8V	VG Range	-1.5V(Pinch-off) ~-0.5V

Typical Performance Curve

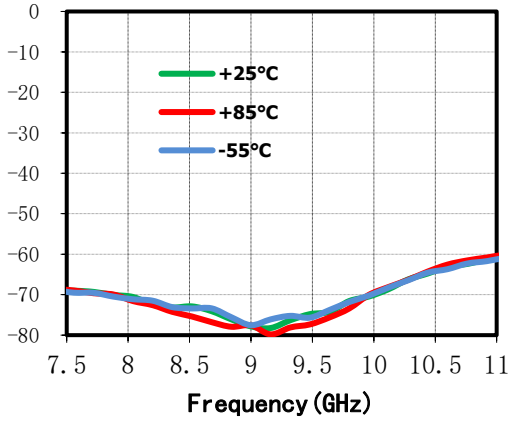
The following data are obtained from SAC3143 evaluation board

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

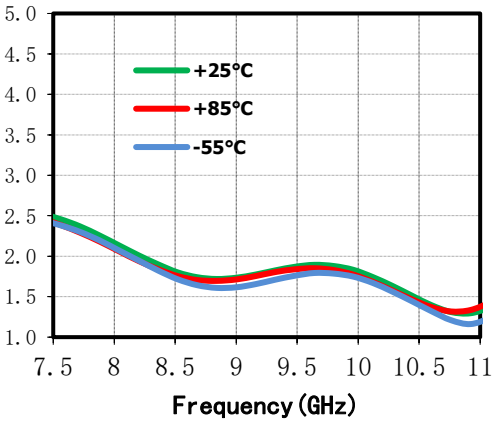
Small Signal Gain(dB) vs.Temperature



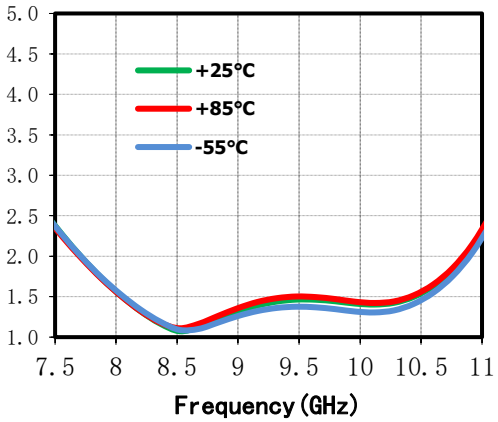
Isolation(dB) vs.Temperature



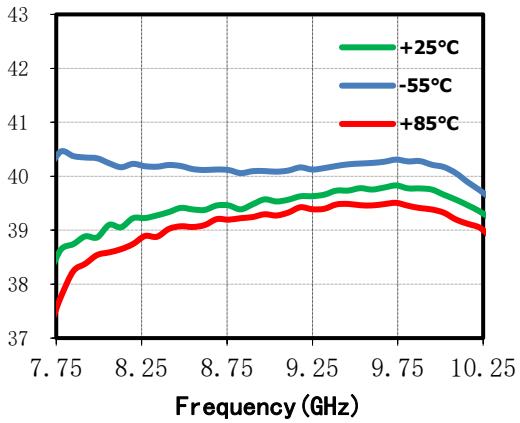
Input VSWR(:1) vs.Temperature



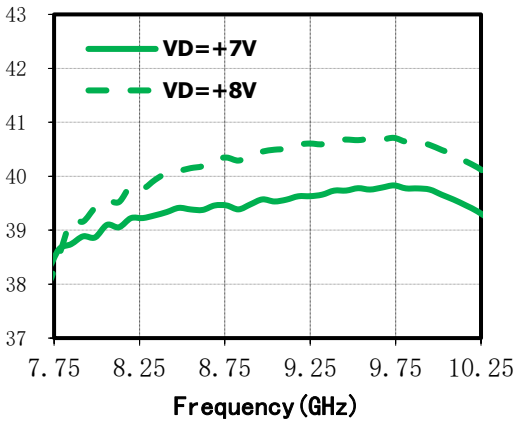
Output VSWR(:1) vs.Temperature



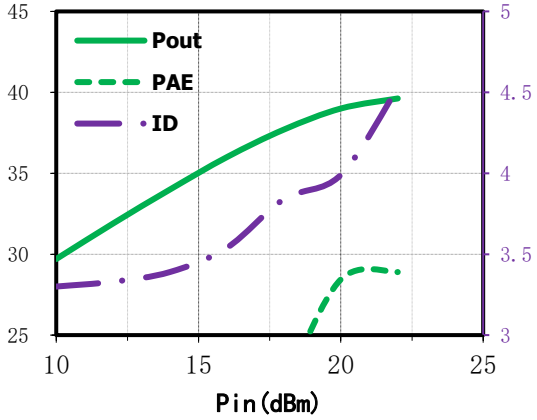
OP-1dB (dBm) vs. Temperature



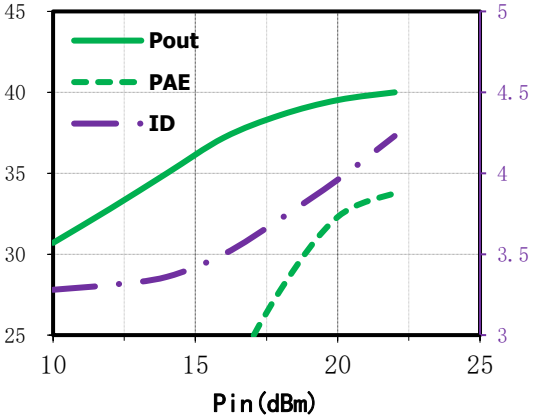
OP-1dB (dBm) vs. Bias



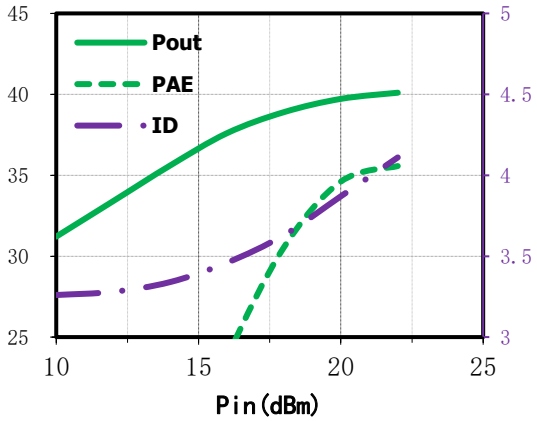
Pout (dBm)、PAE (%)、ID(A) vs. Pin,f=8GHz



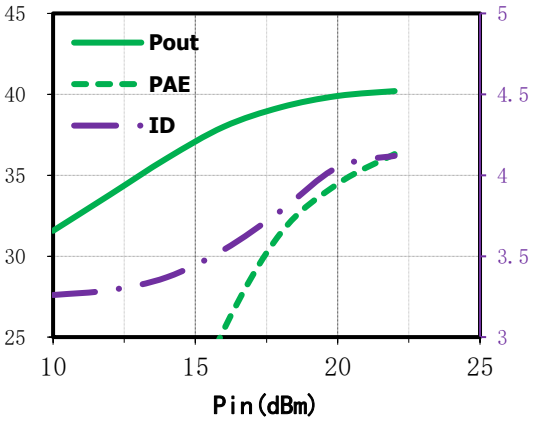
Pout (dBm)、PAE (%)、ID(A) vs. Pin,f=8.5GHz

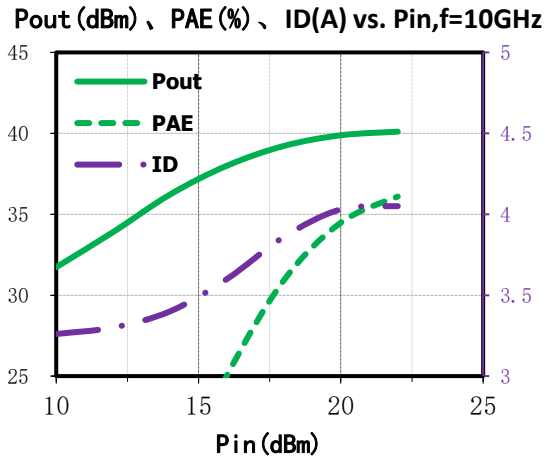


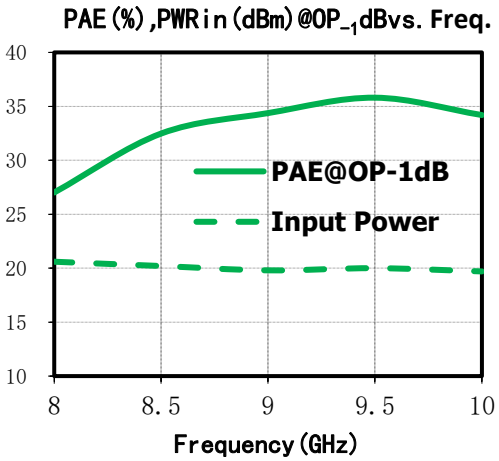
Pout (dBm)、PAE (%)、ID(A) vs. Pin,f=9GHz

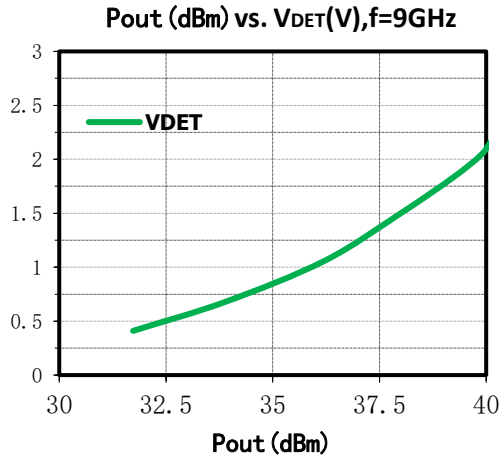


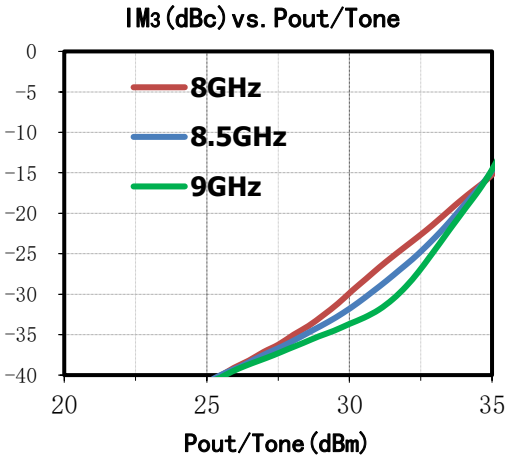
Pout (dBm)、PAE (%)、ID(A) vs. Pin,f=9.5GHz

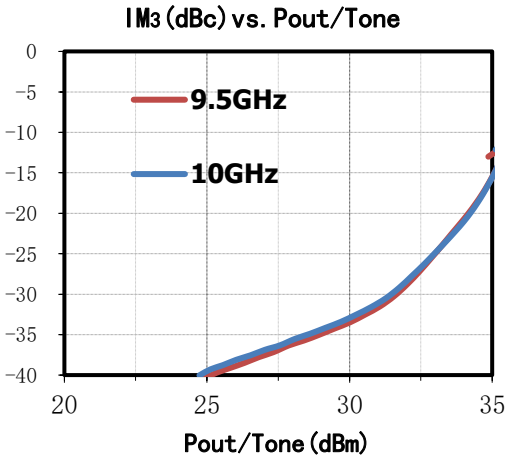


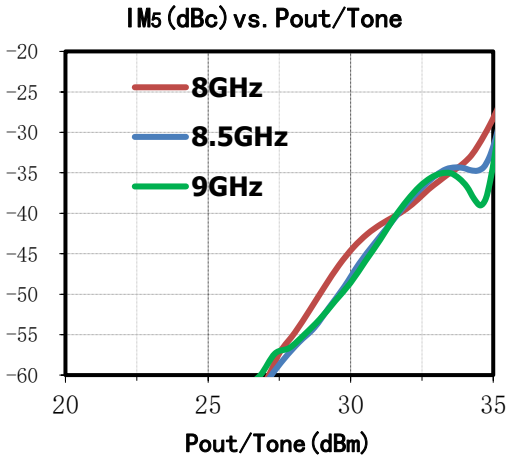

Pout (dBm) 、 PAE (%) 、 ID(A) vs. Pin,f=10GHz
Pout
PAE
ID
45
40
35
30
25
5
4.5
4
3.5
3
10
15
20
25
Pin (dBm)


PAE (%) ,PWRin (dBm) @OP_1dBvs. Freq.
PAE@OP-1dB
Input Power
40
35
30
25
20
15
10
8
8.5
9
9.5
10
Frequency (GHz)

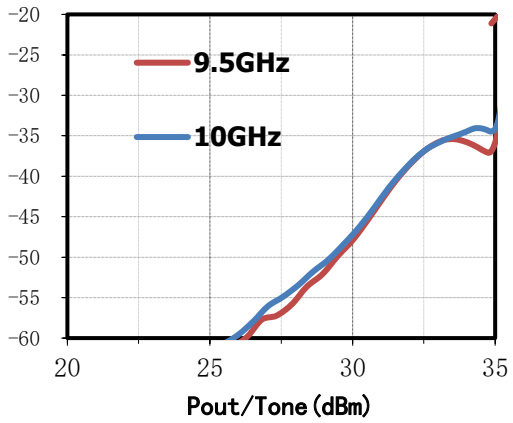

Pout (dBm) vs. VDET(V),f=9GHz
VDET
3
2.5
2
1.5
1
0.5
0
30
32.5
35
37.5
40
Pout (dBm)


IM3 (dBc) vs. Pout/Tone
8GHz
8.5GHz
9GHz
0
-5
-10
-15
-20
-25
-30
-35
-40
20
25
30
35
Pout/Tone (dBm)

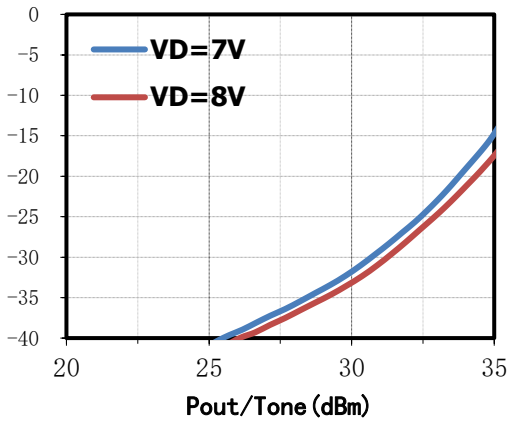

IM3 (dBc) vs. Pout/Tone
9.5GHz
10GHz
0
-5
-10
-15
-20
-25
-30
-35
-40
20
25
30
35
Pout/Tone (dBm)


IM5 (dBc) vs. Pout/Tone
8GHz
8.5GHz
9GHz
-20
-25
-30
-35
-40
-45
-50
-55
-60
20
25
30
35
Pout/Tone (dBm)

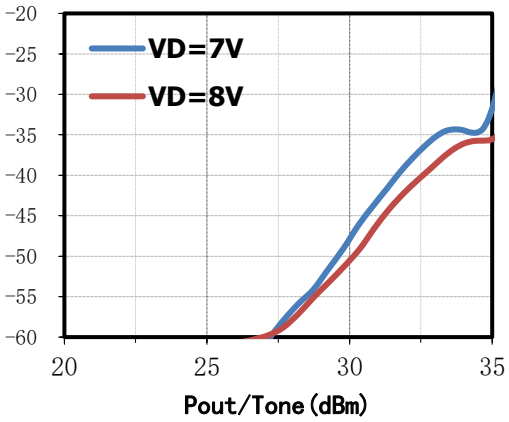
IM5 (dBc) vs. Pout/Tone



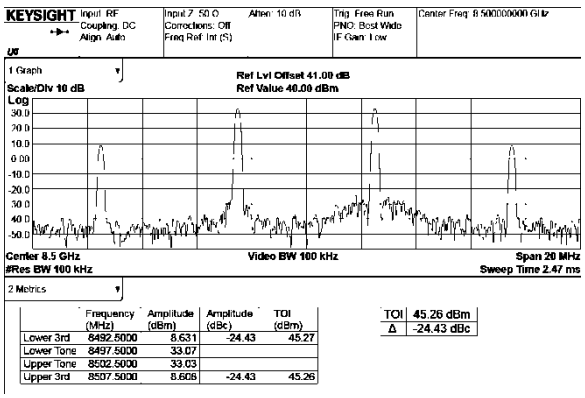
IM3 (dBc) vs. Bias, fc=8.5GHz



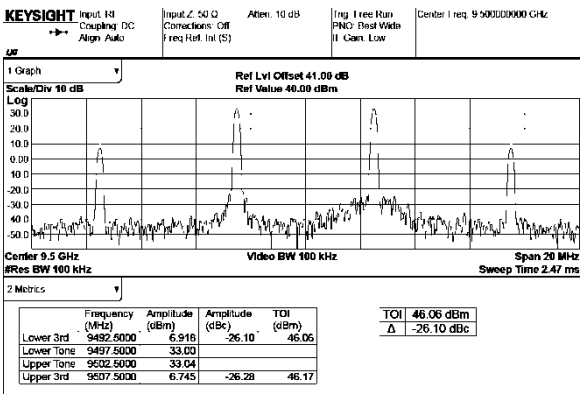
IM5 (dBc) vs. Bias, fc=8.5GHz



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

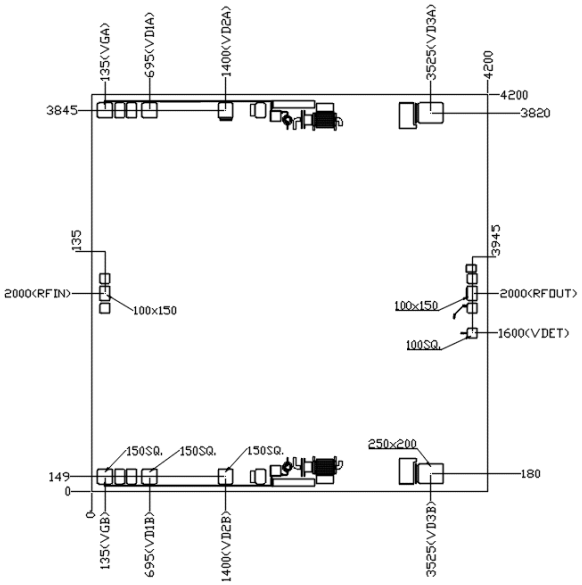


IM Spectrum, Pout/Tone=33dBm, fc=9.5GHz, Δf=5MHz

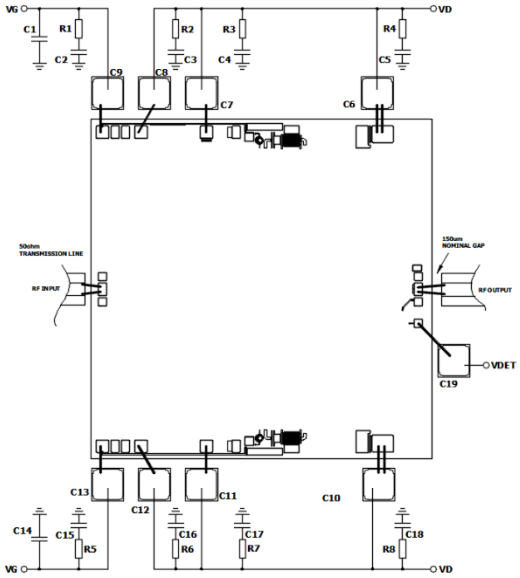


SuperApex, LLC
2801 Lakeside Drive, Suite 208, Bannockburn, IL 60015, USA
Tel: 1-847-505-8319, 1-847-573-9866
E-mail: sales@superapexco.com
Website: www.superapexco.com

Die Outline (μm)



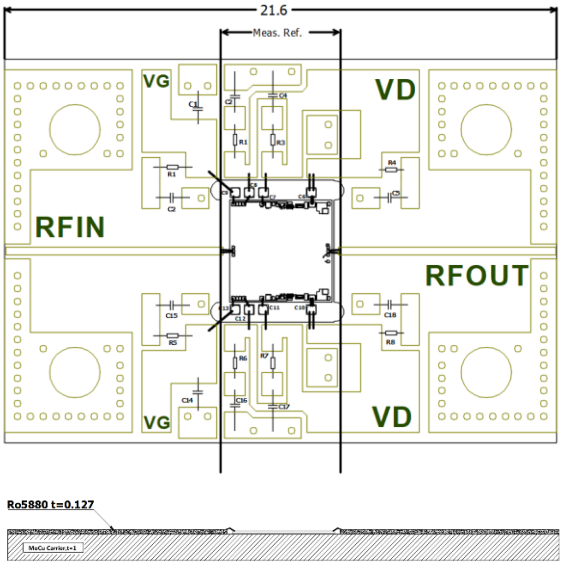
Assembly Diagram



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
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

SuperApex, LLC
2801 Lakeside Drive, Suite 208, Bannockburn, IL 60015, USA
Tel: 1-847-505-8319, 1-847-573-9866
E-mail: sales@superapexco.com
Website: www.superapexco.com