SAC3165QP4

GaN MMIC Power Amplifier
30kHz~12GHz 32dBm

Rev 1.2

Features

- Frequency: 30kHz~12GHz
- Small Signal Gain: 12dB
- Output Power: 32dBm
- Drain Efficiency: 45%@6GHz
- Package Size: QFN 4mm×4mm×1.1mm
- Supply Voltage: +28V/-Vg

Typical Applications

- Point-to-Point Radios

General Description

SAC3165QP4 is a broadband power amplifier operates from 30kHz~12GHz and provides 32dBm of saturated output power with 9dB of large signal gain.

Electrical Performance

T_{BASE}=23℃, V_D=+28V, I_{DQ}=120mA, Z_0=50Ω, CW

Parameter	Min.	Typ.	Max.	Units
Frequency Range	0.00003	—	12	GHz
Small Signal Gain	8	12	—	dB
Power Gain	—	9	—	dB
Reverse Isolation	—	32	—	dB
VSWRi	—	1.7	3	:1
Output Power	31	32	—	dBm
Drain Voltage (V_D)	—	28	—	V
Gate Current	—	—	5	mA
Supply Current (I_D)*	—	—	1	A

*Adjust Vg between -2.8V to -1.5V to achieve I_{DQ}= 120mA, and typical Vg voltage is -2.1V

Absolute Maximum Ratings

Maximum Input Power	+29dBm	Operating Temperature (T_{BASE})	-55℃~+85℃
Channel Temperature	230℃	Storage Temperature	-55℃~+180℃
Maximum V_D	+35V	V_G Range	-4V~-1.5V
Mounting Temperature	260℃,20s		

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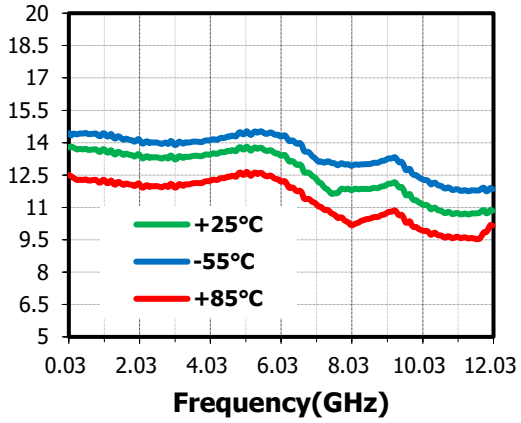
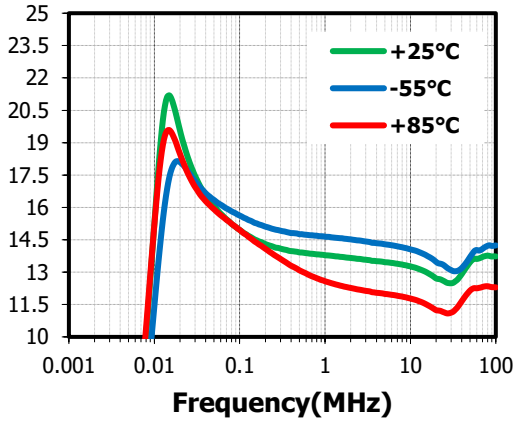
Typical Performance Curve

The following data was tested using SAC3165QP4 evaluation board, V_D=+28V, I_{DQ}=120mA, T_{BASE}=+23℃, Application Circuit 1(30KHz~12GHz), Data de-embedding to device pin locations

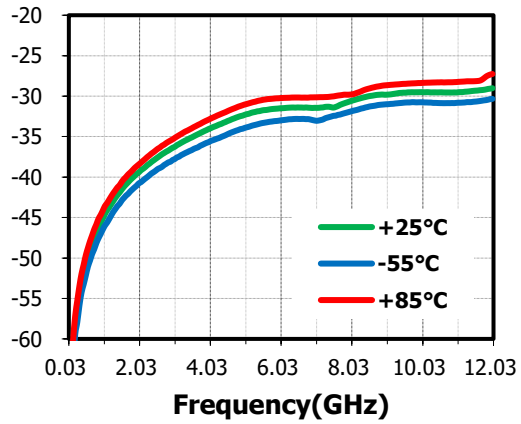
Small Signal Gain(dB) vs.Temperature



Small Signal Gain(dB) vs.Temperature



Reverse Isolation(dB) vs.Temperature



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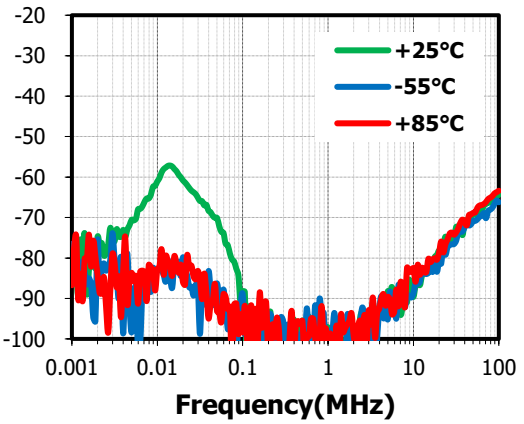
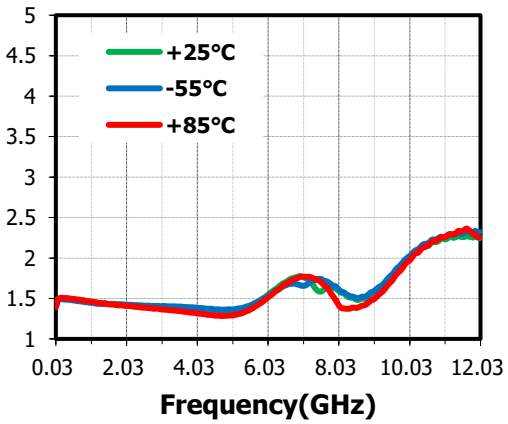


Input VSWR(:1) vs.Temperature



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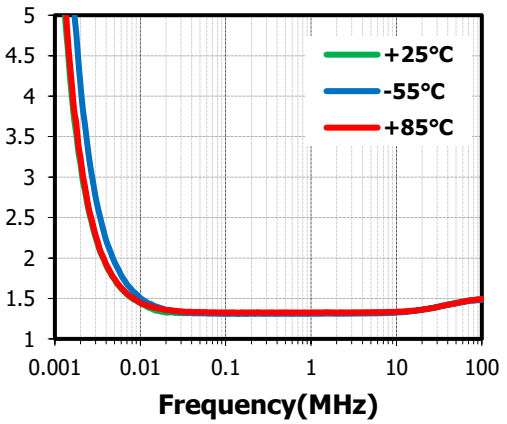
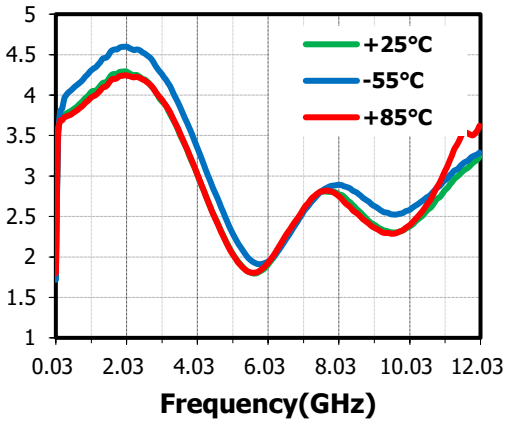


Output VSWR(:1) vs.Temperature



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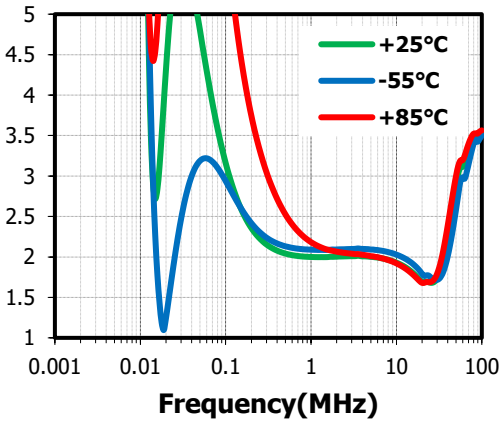
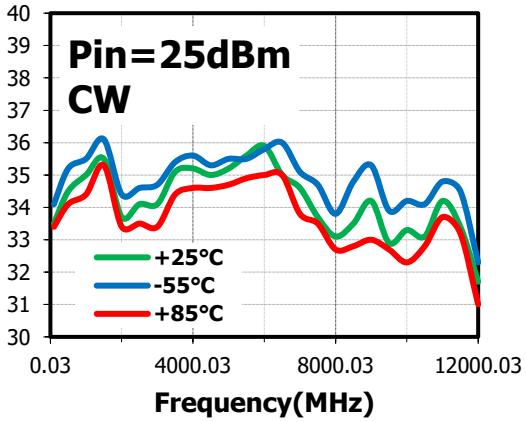


Output Power(dBm) vs.Temperature



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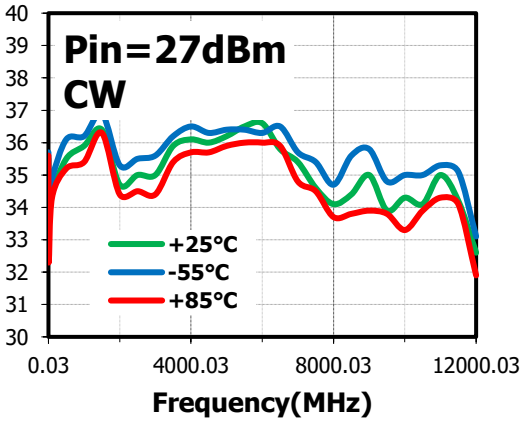
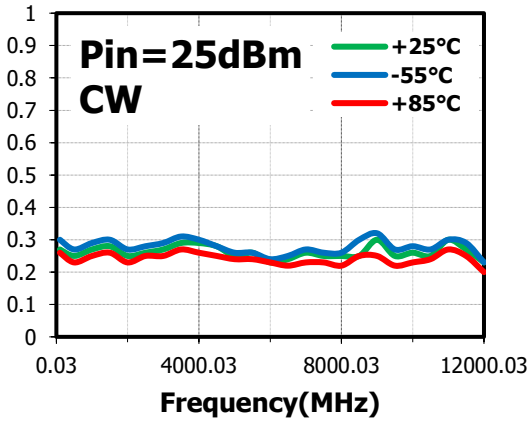
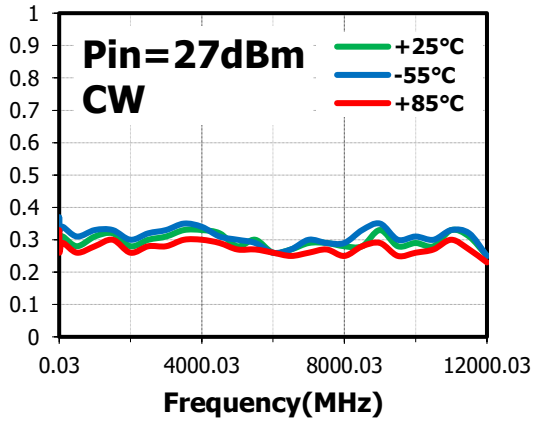
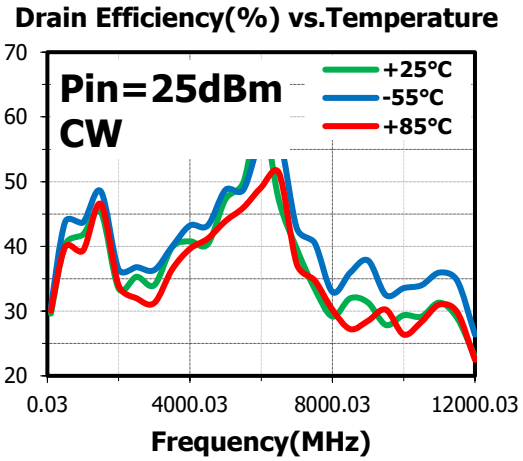


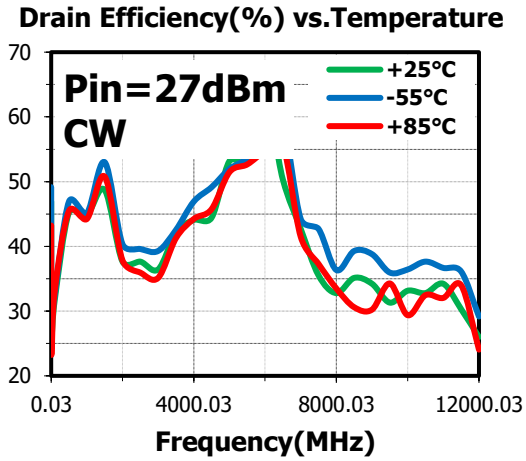
IDrain(A) vs.Temperature



IDrain(A) vs.Temperature



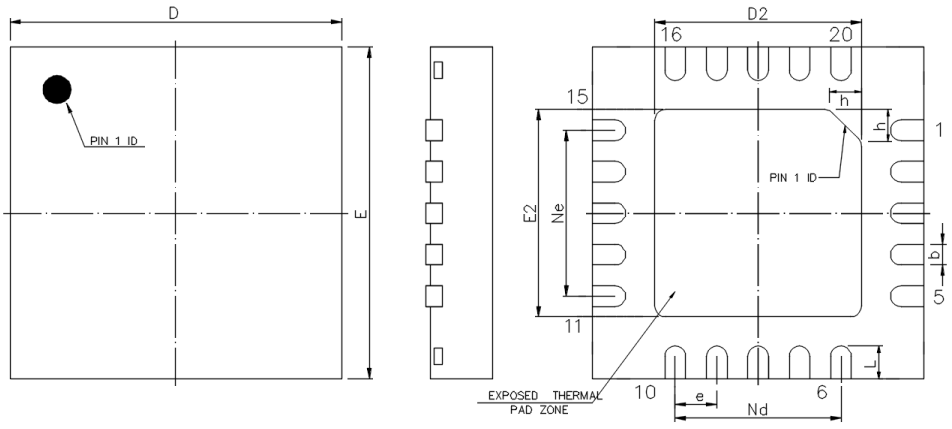




Thermal Resistance

Parameter	Conditions	Value	Unit
θ_{JC1}	V_D=+28V, T_{BASE}=+70℃, Pin=+27dBm, CW, f=6GHz	6.7	℃/W

Outline Drawing

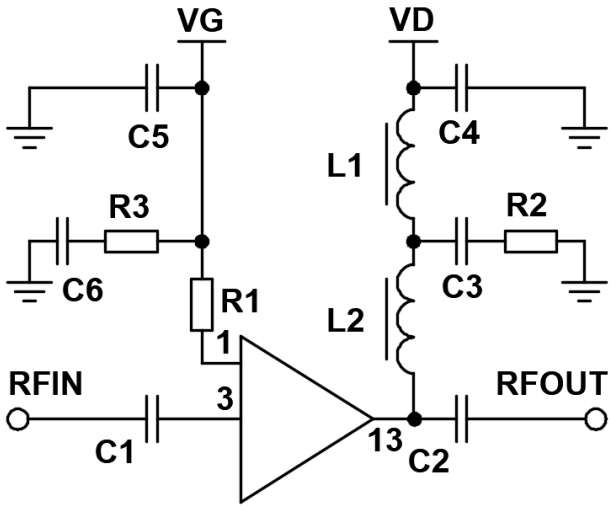


SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	0.70	1.1	1.40
A1	--	0.02	0.05
b	0.20	0.25	0.30
c		0.203REF	
D	3.90	4.00	4.10
D2	2.55	2.65	2.75
e		0.50BSC	
Ne		2.00BSC	
Nd		2.00BSC	
E	3.90	4.00	4.10
E2	2.55	2.65	2.75
L	0.35	0.40	0.45
h	0.35	0.40	0.45

Pin Function

Pin No.	Description	Pin No.	Description
1	Gate	15	GND
2	GND	16	GND
3	RFIN (DC Coupled)	17	GND
4	GND	18	GND
5	GND	19	GND
6	GND	20	GND
7	GND		
8	GND		
9	GND		
10	GND		
11	GND		
12	GND		
13	RFOUT/Drain feed		
14	GND		

Application Circuit 1



1.Connect the remaining pins to ground

2.Resistor R2 may become hot and requires proper heat dissipation

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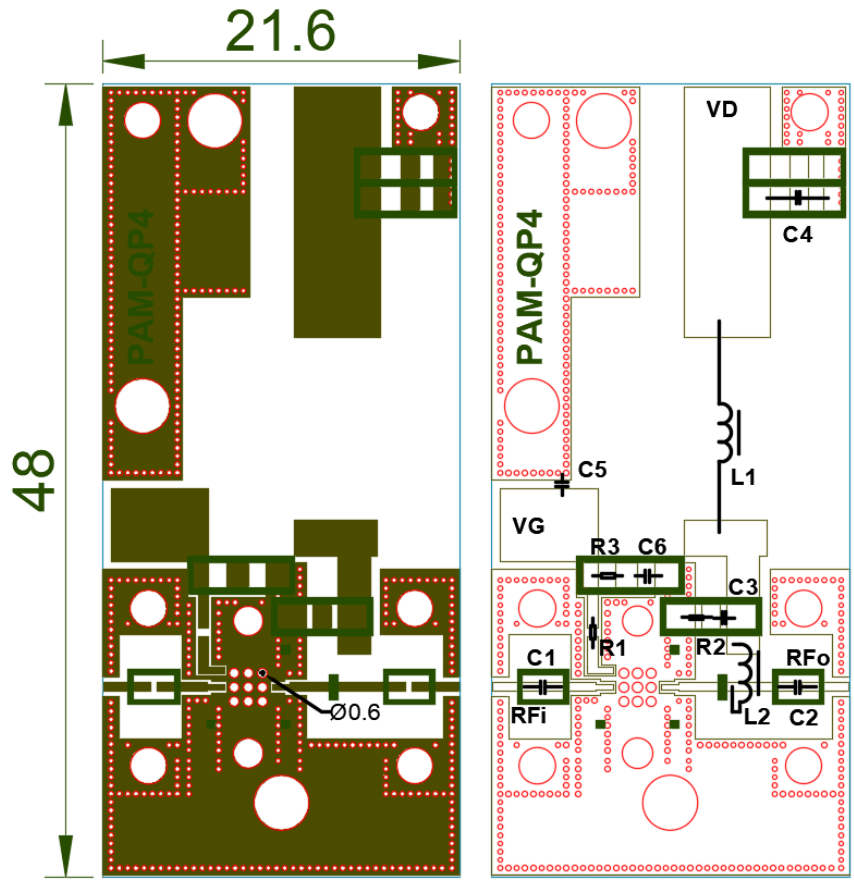
Components List

Reference Des.	Value	Part Number	Manuf.	Size
C1、C2	1μF	GRM155R61H105KE05D	Murata	0402
C6	0.47μF	—	—	0805
R1	5.1Ω	—	—	0603
R2	200Ω	—	—	0805
L1	1mH	YPRH1508-102M	YJYCOIN	YPRH1508
L2	900nH	1008AF-901	Coilcraft	1008
C5	22μF	—	—	0805
R3	6.8 Ω	—	—	0805
C3	8200pF	—	—	0805
C4	22μF	—	—	1812

SAC3165QP4 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 SAC3165QP4 is used for RF grounding and heat dissipation. For best heat dissipation, copper-filled vias are highly recommended, SAC3165QP4 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 a 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. SAC3165QP4 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	Jan 02, 2026	First Release
1.1	Feb 28, 2026	Updated Components List C1、C2’s part number
1.2	Mar 20, 2026	Updated Application Circuit 1

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