SBB5089Z

50MHz to 6000MHz, CASCADABLE ACTIVE BIAS InGaP HBT MMIC AMPLIFIER

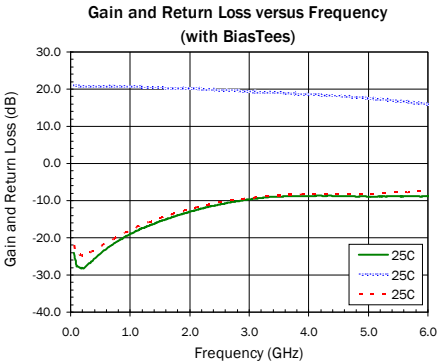
Package: SOT-89

Product Description

RFMD's SBB5089Z is a high performance InGaP HBT MMIC amplifier utilizing a Darlington configuration with an active bias network. The active bias network provides stable current over temperature and process Beta variations. Designed to run directly from a 5V supply, the SBB5089Z does not require a dropping resistor as compared to typical Darlington amplifiers. The SBB5089Z product is designed for high linearity 5V gain block applications that require small size and minimal external components. It is internally matched to 50Ω.

Optimum Technology Matching® Applied

- ☐ GaAs HBT
- ☐ GaAs MESFET
- ☑ InGaP HBT
- ☐ SiGe BiCMOS
- ☐ Si BiCMOS
- ☐ SiGe HBT
- ☐ GaAs pHEMT
- ☐ Si CMOS
- ☐ Si BJT
- ☐ GaN HEMT
- ☐ RF MEMS



Features

- Wideband Flat Gain to 4GHz: ±1.1dB
- P_{1dB}=20.4dBm at 1950MHz
- Single Fixed 5V Supply
- Robust 1000V ESD, Class 1C
- Patented Thermal Design and Bias Circuit
- Low Thermal Resistance

Applications

- PA Driver Amplifier
- Cellular, PCS, GSM, UMTS
- Wideband Intrumentation
- Wireless Data, Satellite Terminals

Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
Small Signal Gain	19.0	20.5	22.0	dB	850MHz
	18.3	19.0	21.5	dB	1950MHz
	14.5	15.5	17.5	dB	6000MHz
Output Power at 1dB Compression		20.5		dBm	850MHz
	19.0	20.0		dBm	1950MHz
Third Order Intercept Point		38.5		dBm	850MHz
	33.0	35.0		dBm	1950MHz
Bandwidth		3000		MHz	Min. 10dB return loss (typ.)
Input Return Loss	10.0	13.0		dB	1950MHz
Output Return Loss	10.0	14.0		dB	1950MHz
Reverse Isolation		23.3		dB	1950MHz
Noise Figure		3.9	4.9	dB	1950MHz
Device Operating Voltage	4.75	5.0	5.25	V	
Device Operating Current	60.0	75.0	92.0	mA	
Thermal Resistance		69.9		°C/W	junction - lead

Test Conditions: V_D=5V, I_D=75mA Typ., OIP_3 Tone Spacing=1MHz, P_{OUT} per tone=-dBm, T_L=25°C, Z_S=Z_L=50Ω, Tested with Bias Tees

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Absolute Maximum Ratings

Parameter	Rating	Unit
Device Current (I_D)	100	mA
Max Device Voltage (V_D)	5.5	V
Max RF Input Power	24	dBm
Max Operating Dissipated Power	0.55	W
Junction Temp (T_J)	+150	°C
Operating Temp Range (T_L)	-40 to +105	°C
Storage Temp Range	-40 to +150	°C
ESD Rating - Human Body Model (HBM)	Class 1C	
Moisture Sensitivity Level	MSL2	

Operation of this device beyond any one of these limits may cause permanent damage. For reliable continuous operation, the device voltage and current must not exceed the maximum operating values specified in the table on page one.

Bias Conditions should also satisfy the following expression:
$I_D V_D < (T_J - T_L) / R_{TH}$, j-l and $T_L = T_{LEAD}$

Caution! ESD sensitive device.

Exceeding any one or a combination of the Absolute Maximum Rating conditions may cause permanent damage to the device. Extended application of Absolute Maximum Rating conditions to the device may reduce device reliability. Specified typical performance or functional operation of the device under Absolute Maximum Rating conditions is not implied.

RoHS status based on EUDirective2002/95/EC (at time of this document revision).

Typical Performance at Key Operating Frequencies (0.5GHz to 3.5GHz Application Circuit)

Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
Small Signal Gain		21.1		dB	50MHz
		20.9		dB	100MHz
		20.8		dB	200MHz
		20.8		dB	500MHz
		20.8		dB	850MHz
		20.1		dB	1950MHz
		19.8		dB	2500MHz
		18.7		dB	3500MHz
		17.8		dB	4000MHz
Output Third Order Intercept Point		36		dBm	50MHz
		37.8		dBm	100MHz
		37.5		dBm	200MHz
		38.6		dBm	500MHz
		39.2		dBm	850MHz
		34.9		dBm	1950MHz
		32.8		dBm	2500MHz
		29.4		dBm	3500MHz
		26.8		dBm	4000MHz
Output Power at 1dB Compression		19.4		dBm	50MHz
		19.7		dBm	100MHz
		20		dBm	200MHz
		20.5		dBm	500MHz
		20.4		dBm	850MHz
		20.4		dBm	1950MHz
		19.4		dBm	2500MHz
		16.9		dBm	3500MHz
		14.7		dBm	4000MHz

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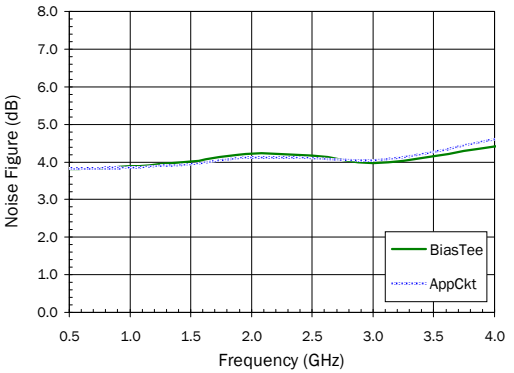
Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
Input Return Loss		11.3		dB	50MHz
		17.4		dB	100MHz
		24.3		dB	200MHz
		27.2		dB	500MHz
		22.7		dB	850MHz
		14.6		dB	1950MHz
		12.9		dB	2500MHz
		10.6		dB	3500MHz
		11.6		dB	4000MHz
Output Return Loss		15.9		dB	50MHz
		21.7		dB	100MHz
		30.4		dB	200MHz
		31.8		dB	500MHz
		21.5		dB	850MHz
		13.5		dB	1950MHz
		12.0		dB	2500MHz
		13.5		dB	3500MHz
		27.5		dB	4000MHz
Reverse Isolation		17.4		dB	50MHz
		17.5		dB	100MHz
		17.5		dB	200MHz
		22.7		dB	500MHz
		22.8		dB	850MHz
		23.4		dB	1950MHz
		23.7		dB	2500MHz
		24.7		dB	3500MHz
		25.7		dB	4000MHz
Noise Figure		4.4		dB	50MHz
		4.4		dB	100MHz
		4.3		dB	200MHz
		3.8		dB	500MHz
		3.8		dB	850MHz
		4.1		dB	1950MHz
		4.1		dB	2500MHz
		4.3		dB	3500MHz
		4.6		dB	4000MHz

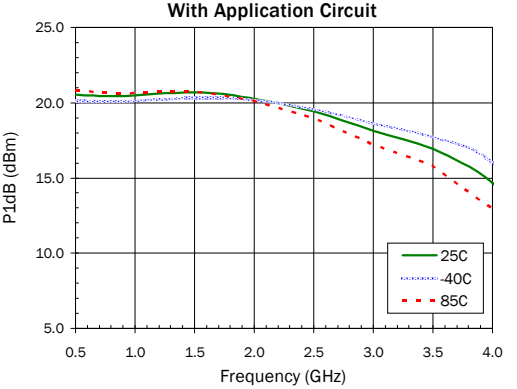
Test Conditions: V_{CC}=5V, I_D=75mA Typ., OIP_3 Tone Spacing=1MHz, P_{OUT} per tone=0dBm, T_L=25°C, Z_S=Z_L=50Ω

500MHz to 3.5GHz Application Circuit

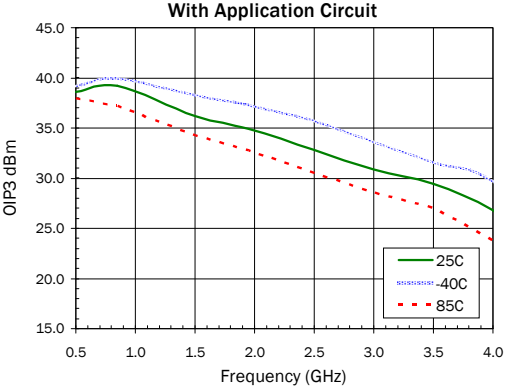
Noise Figure at 25°C



P1dB versus Frequency
With Application Circuit



OIP3 versus Frequency
With Application Circuit



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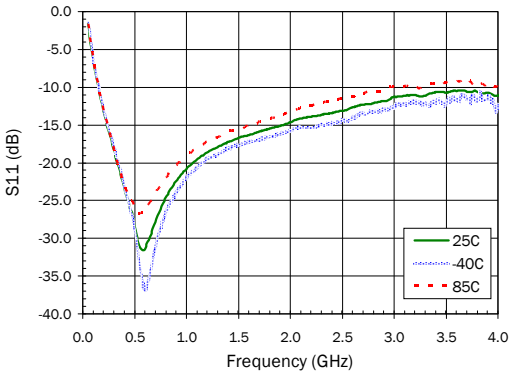
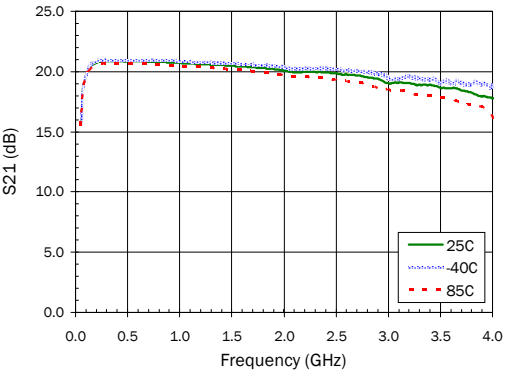
0.5GHz to 3.5GHz Application Circuit S-Parameters Over Temperature

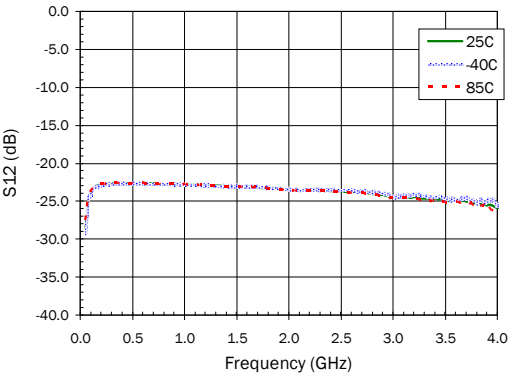
S11 versus Frequency



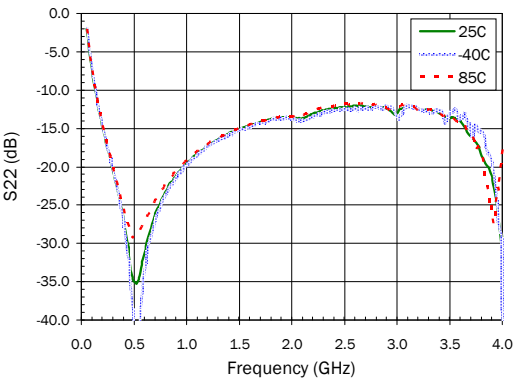
S21 versus Frequency



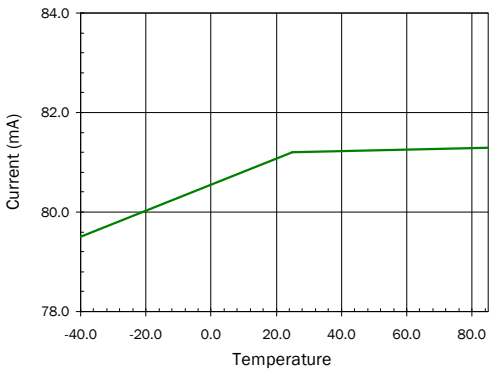
S12 versus Frequency



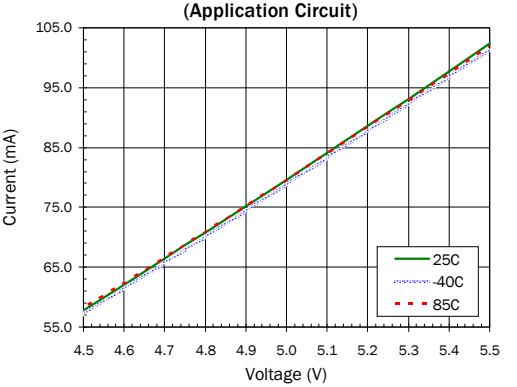
S22 versus Frequency



Id vs. Temperature (App. Ckt.)

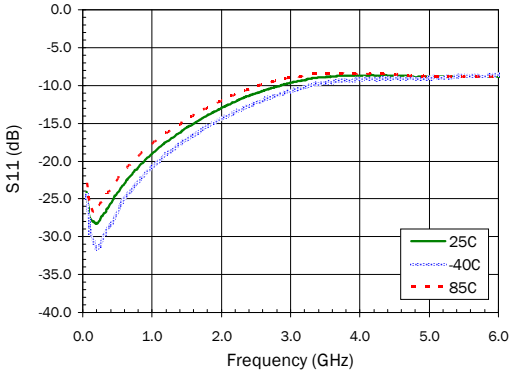


Current versus Voltage Over Temperature (Application Circuit)

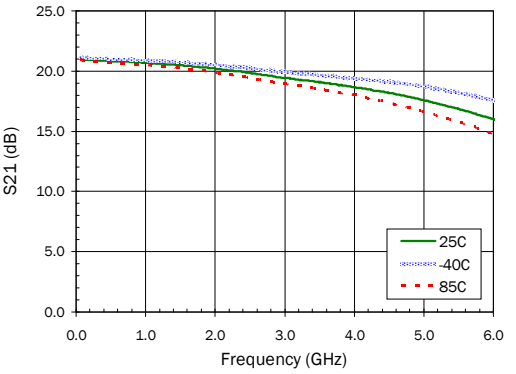


S-Parameters Over Temperature (Bias Tee)

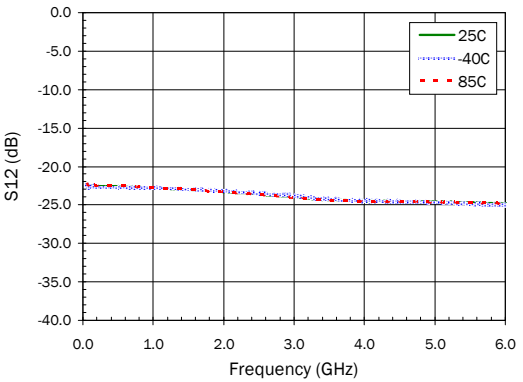
S11 versus Frequency



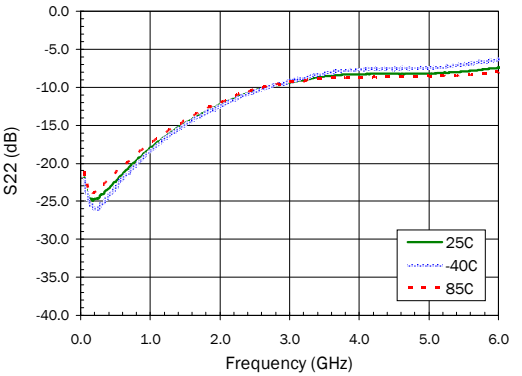
S21 versus Frequency



S12 versus Frequency



S22 versus Frequency



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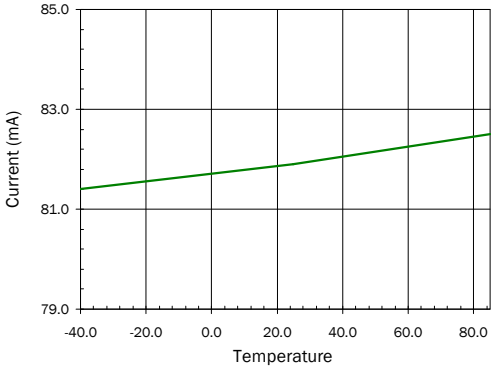
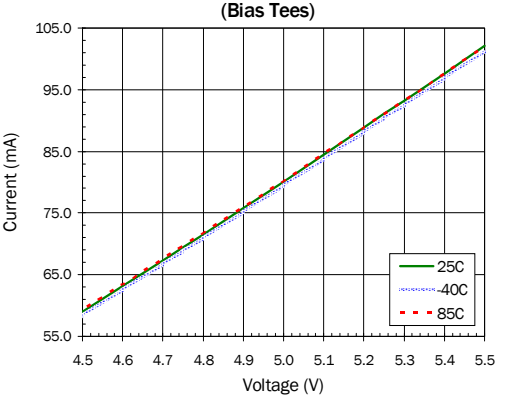
Device Current Over Temperature (Bias Tee)

Id vs. Temperature (Bias Tees)



Current versus Voltage Over Temperature (Bias Tees)



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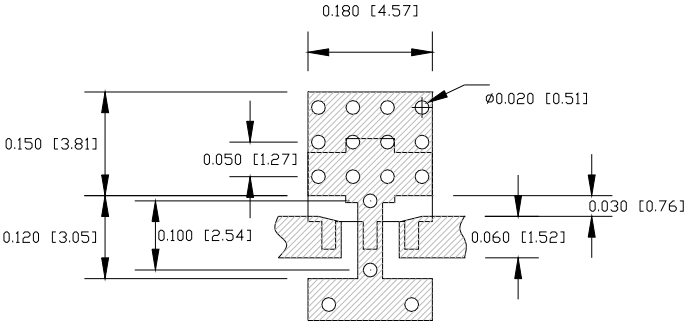
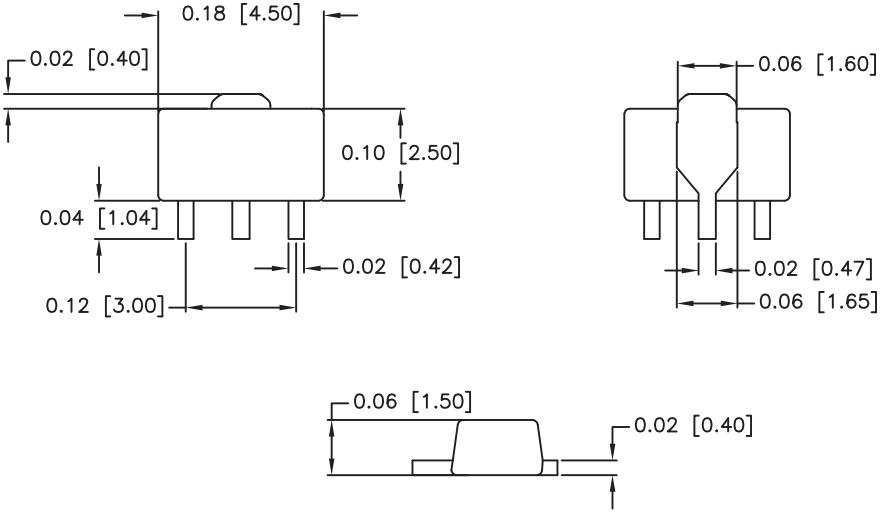
Pin	Function	Description
1	RF IN	RF input pin. This pin requires the use of an external DC blocking capacitor chosen for the frequency of operation.
2, 4	GND	Connection to ground. Use via holes for best performance to reduce lead inductance as close to ground leads as possible
3	RF OUT/ BIAS	RF output and bias pin. DC voltage is present on this pin, therefore a DC blocking capacitor is necessary for proper operation.

Suggested PCB Pad Layout



Nominal Package Dimensions

Dimensions in inches (millimeters)



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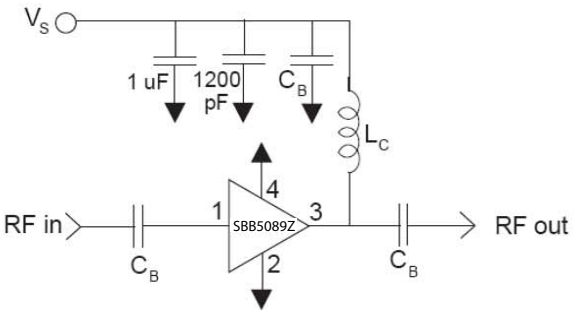
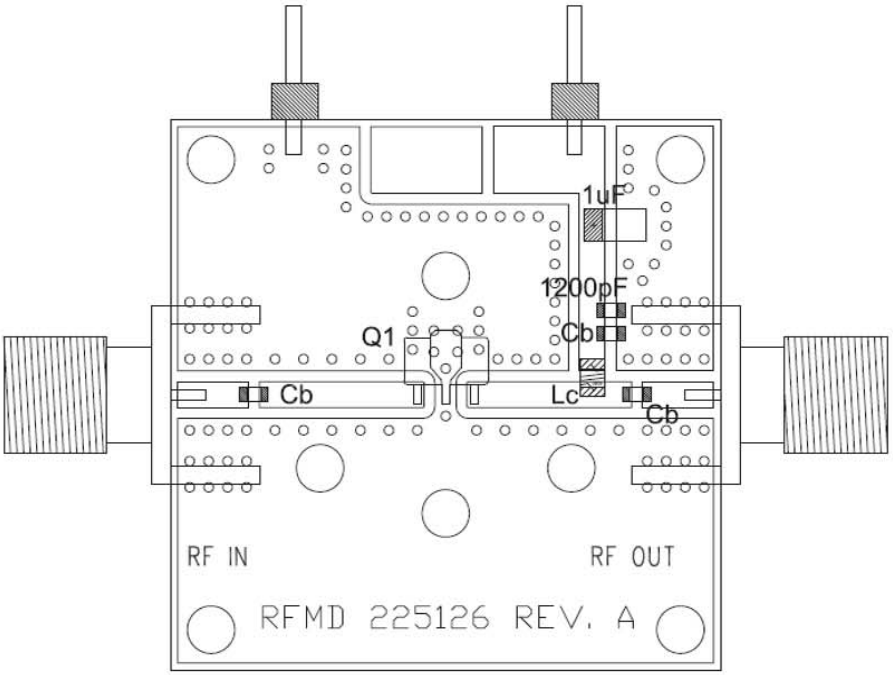
Application Schematic



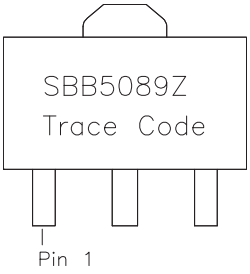
Reference Designator	Frequency (MHz) 500 to 3500
C_B	68 pF
L_C	82 nH 0805CS

Note: For frequencies under 500 MHz, make the following changes:
$C_{B=.1uF}$
$L_{C=330nH}$

Evaluation Board Layout



Package Marking



Ordering Information

Ordering Code	Description
SBB5089Z	7" Reel with 1000 pieces
SBB5089ZSQ	Sample Bag with 25 pieces
SBB5089ZSR	7" Reel with 100 pieces
SBB5089ZPCK1	500MHz to 3500MHz PCBA with 5-piece sample bag

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