SBB4089Z

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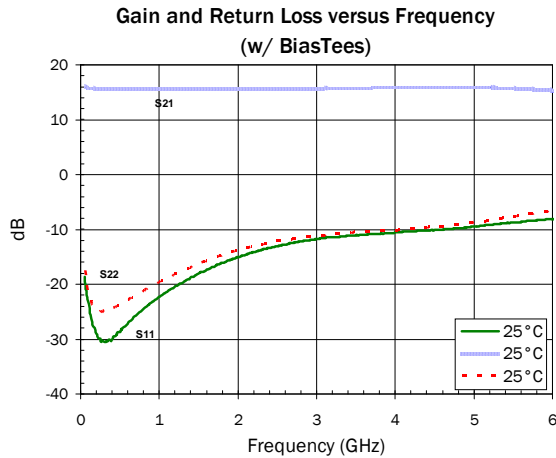## ACTIVE BIAS InGaP HBT MMIC AMPLIFIER

Package: SOT-89

Product Description

RFMD's SBB4089Z 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 SBB4089Z does not require a dropping resistor as compared to typical Darlington amplifiers. The SBB4089Z product is designed for high linearity 5V gain block applications that require small size and minimal external components. It is internally matched to 50Ωs.

Features

- $OIP_3 = 35.2$ dBm at 1950 MHz
- $P_{1dB} = 19.3$ dBm at 1950 MHz
- Single Fixed 5V Supply
- Robust 1000V ESD, Class 1C
- Patented Thermal Design & Bias Circuit
- Low Thermal Resistance

Applications

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

Optimum Technology Matching® Applied

	Technology
☐	GaAs HBT
☐	GaAs MESFET
✓	InGaP HBT
☐	SiGe BiCMOS
☐	Si BiCMOS
☐	SiGe HBT
☐	GaAs pHEMT
☐	Si CMOS
☐	Si BJT
☐	GaN HEMT
☐	RF MEMS

Gain and Return Loss versus Frequency (w/ BiasTees)

Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
Small Signal Gain	14.0	15.0	17.0	dB	850 MHz
	14.0	15.5	17.0	dB	1950 MHz
	13.5	15.5	17.5	dB	2000 MHz
Output Power at 1dB Compression		19.0		dBm	850 MHz
	18.0	19.5		dBm	1950 MHz
Output Third Order Intercept Point		39.0		dBm	850 MHz
	33.0	35.0		dBm	1950 MHz
Return Loss		4500		MHz	Minimum 10dB
Input Return Loss	10.0	17.5		dB	1950 MHz
Output Return Loss	10.0	17.5		dB	1950 MHz
Reverse Isolation		18.5		dB	1950 MHz
Noise Figure		4.5	5.5	dB	1950 MHz
Device Operating Voltage		5.0	5.25	V	
Device Operating Current	72.0	80.0	92.0	mA	
Thermal Resistance		69.9		°C/W	junction - lead

Test Conditions: $V_D = 5V$ $I_D = 80$ mA Typ. OIP_3 Tone Spacing = 1MHz, P_{OUT} per tone = 0dBm $T_L = 25$°C, $Z_S = Z_L = 50$Ω, Tested with Bias Tees

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Absolute Maximum Ratings

Parameter	Rating	Unit
Device Current (I_D)	100	mA
Max Device Voltage (VD)	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 +85	°C
Storage Temp	+150	°C
ESD Rating - Human Body Model (HBM)	Calss 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.
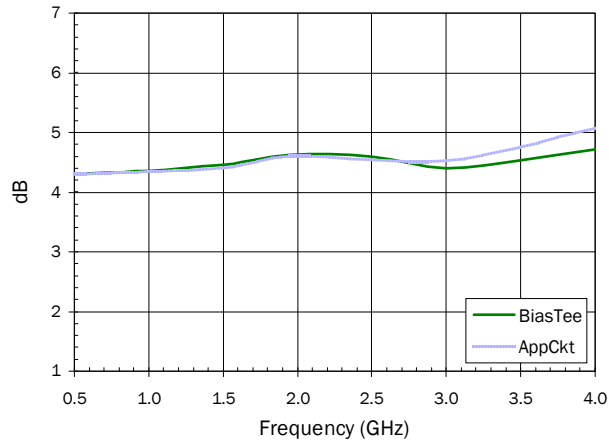Bias Conditions should also satisfy the following expression:
$I_D V_D < (T_J - T_L) / R_{TH}$, j-l and $T_L = T_{LEAD}$

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.
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RFMD Green: RoHS compliant per EU Directive 2002/95/EC, halogen free per IEC 61249-2-21, < 1000 ppm each of antimony trioxide in polymeric materials and red phosphorus as a flame retardant, and <2% antimony in solder.

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

Parameter	Unit	50 MHz	100 MHz	200 MHz	500 MHz	850 MHz	1950 MHz	2500 MHz	3500 MHz	4000 MHz
Small Signal Gain	dB	16.3	15.7	15.7	15.6	15.6	15.5	15.5	15.5	15.0
Output Third Order Intercept Point	dBm	38.7	40.6	39.7	38.8	39.3	35.2	32.8	29.1	26.1
Output Power at 1dB Compression	dBm	18.5	18.7	19	19.2	19.1	19.2	18.6	16.7	14.1
Input Return Loss	dB	11.2	16.3	22.4	25.1	29.9	19.4	17.6	14.9	21.3
Output Return Loss	dB	19.4	25.4	29.8	32.1	26.4	17.2	14.7	13.2	17.4
Reverse Isolation	dB	17.7	17.8	17.8	18.4	18.4	18.9	19.1	19.8	20.8
Noise Figure	dB	4.3	4.3	4.3	4.3	4.3	4.6	4.5	4.8	5.1

Test Conditions: VCC=5V, I_D=80mA Typ., OIP_3 Tone Spacing=1MHz, P_{OUT} per tone=0dBm, T_L=25°C, Z_S=Z_L=50Ω

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Noise Figure @ 25°C

P1dB versus Frequency with App. Ckt.

OIP3 versus Frequency with App. Ckt.

7628 Thorndike Road, Greensboro, NC 27409-9421 · For sales or technical support, contact RFMD at **(+1) 336-678-5570** or **customerservice@rfmd.com.**

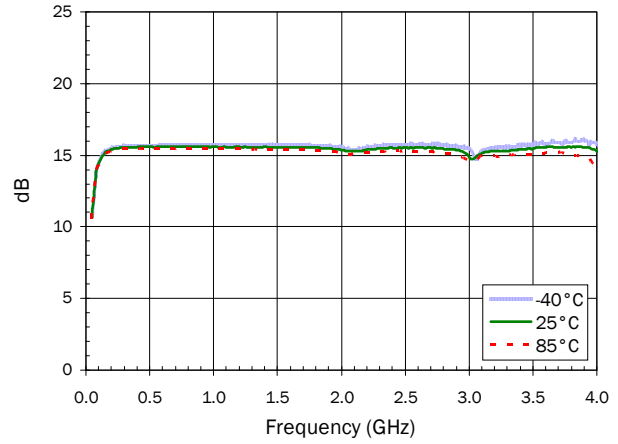# SBB4089Z

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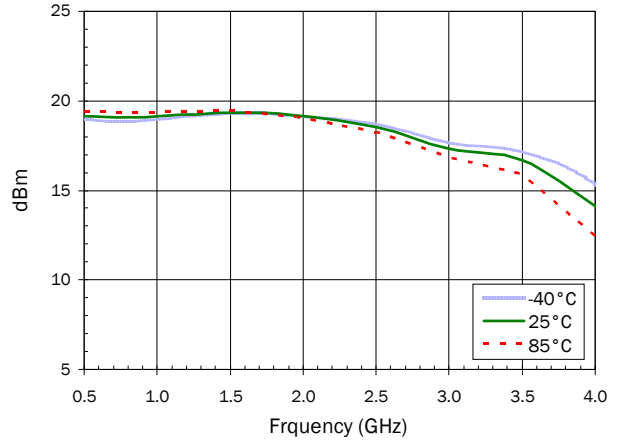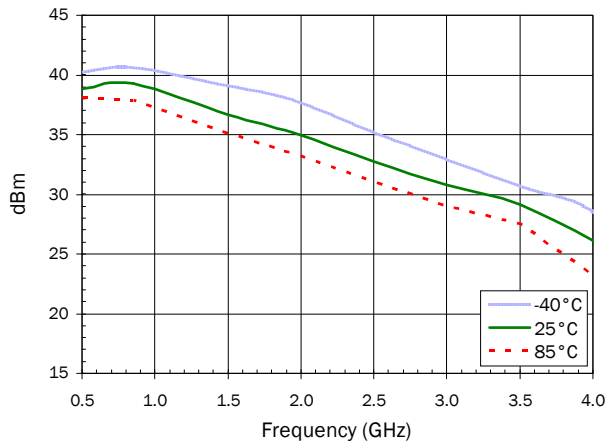
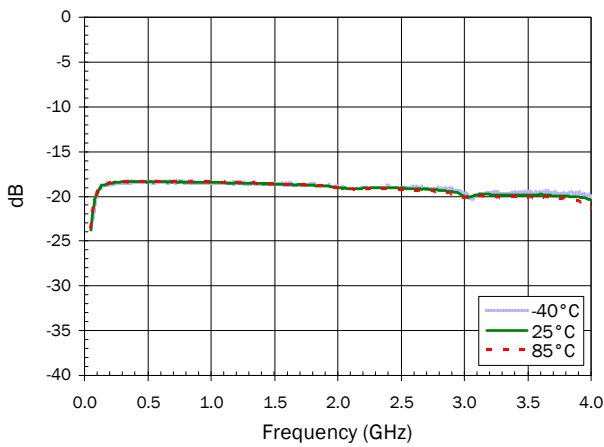## 0.5GHz to 3.5GHz Application Circuit S-Parameters over Temperature
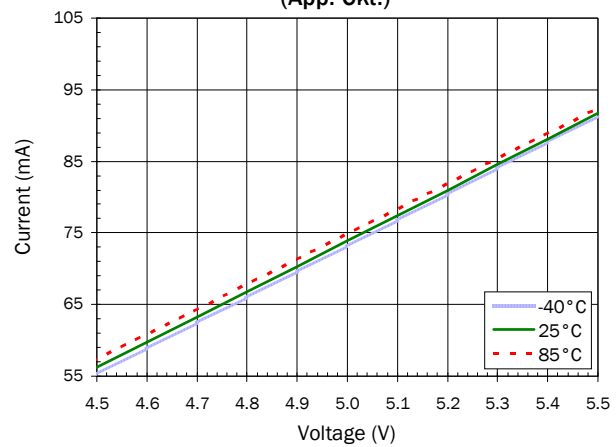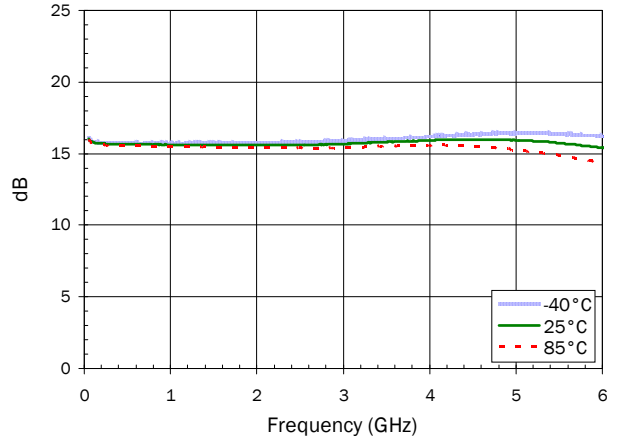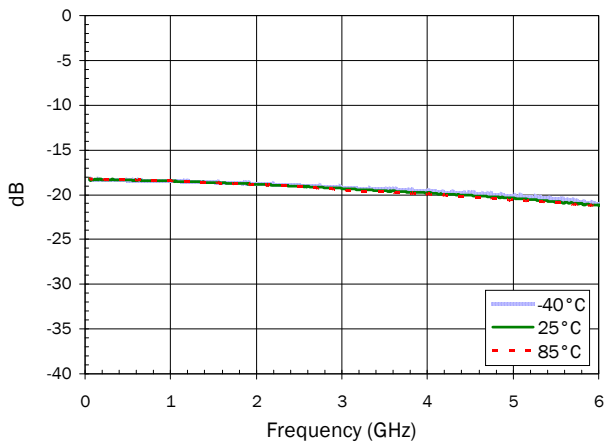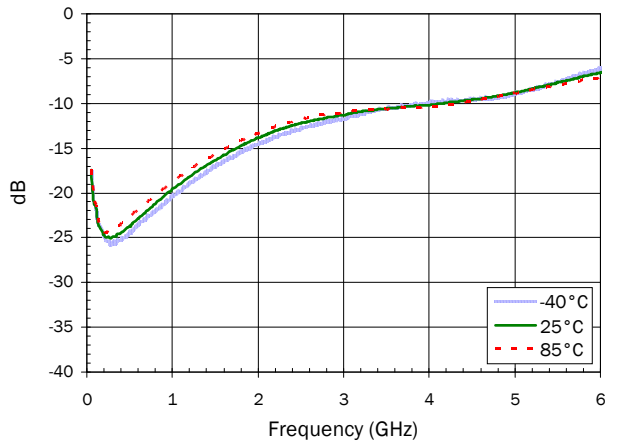
S11 versus Frequency
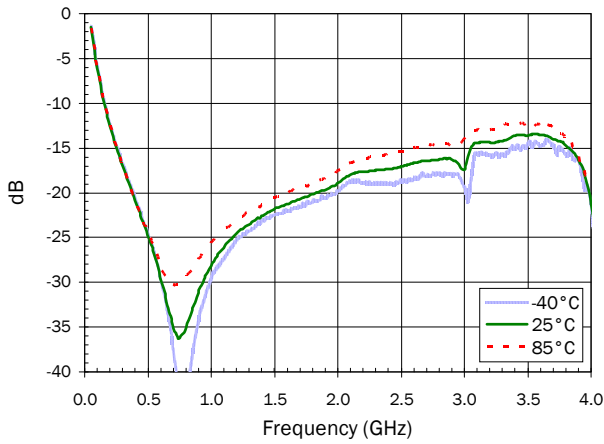
S21 versus Frequency

S12 versus Frequency

S22 versus Frequency
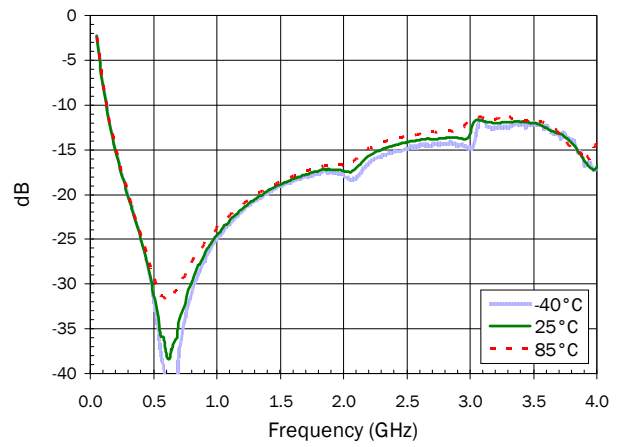
I_D versus Temperature
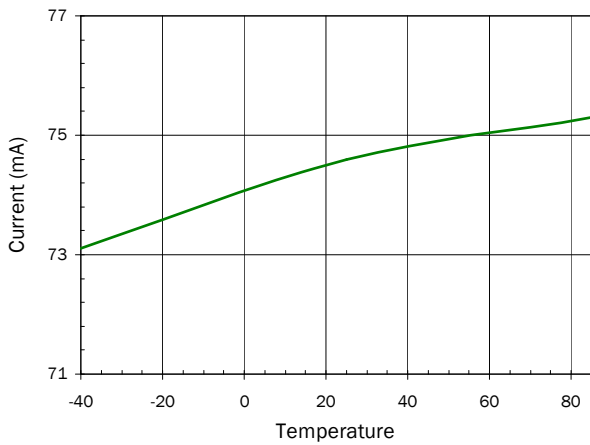
Current versus Voltage Over Temp. (App. Ckt.)

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S-Parameters over Temperature (Bias Tee)

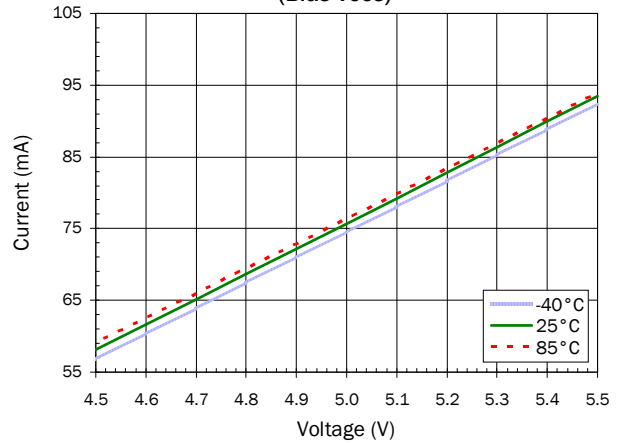### S11 versus Frequency
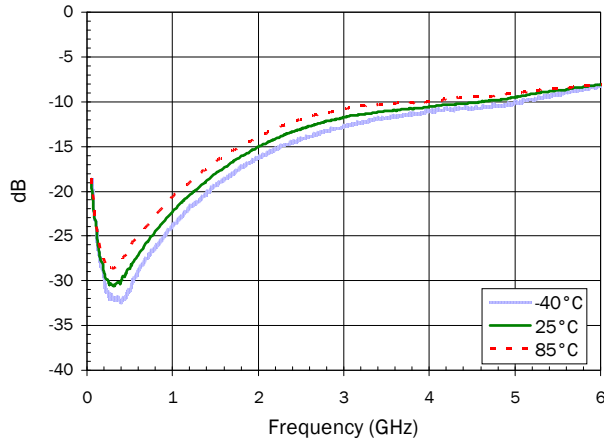
S21 versus Frequency

S12 versus Frequency

S22 versus Frequency

I_D versus Temperature
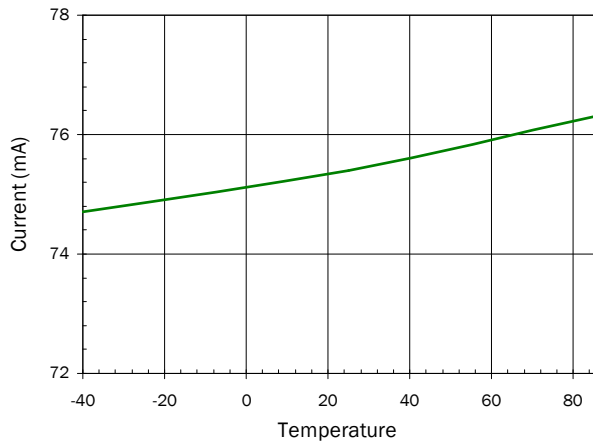
Current versus Voltage Over Temp.
(Bias Tees)

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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
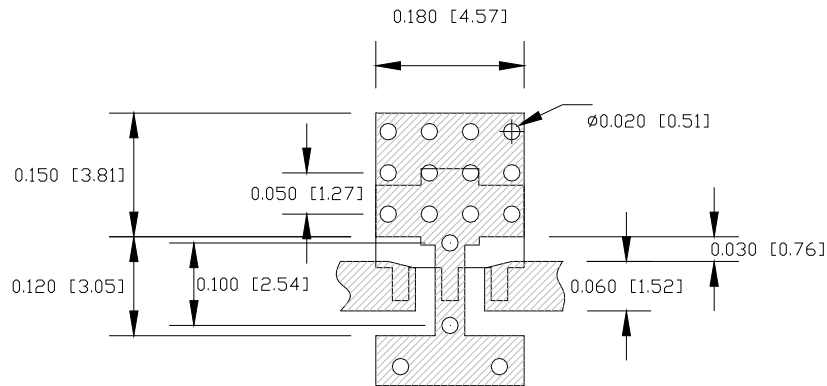
Package Drawing

Dimensions in inches (millimeters)
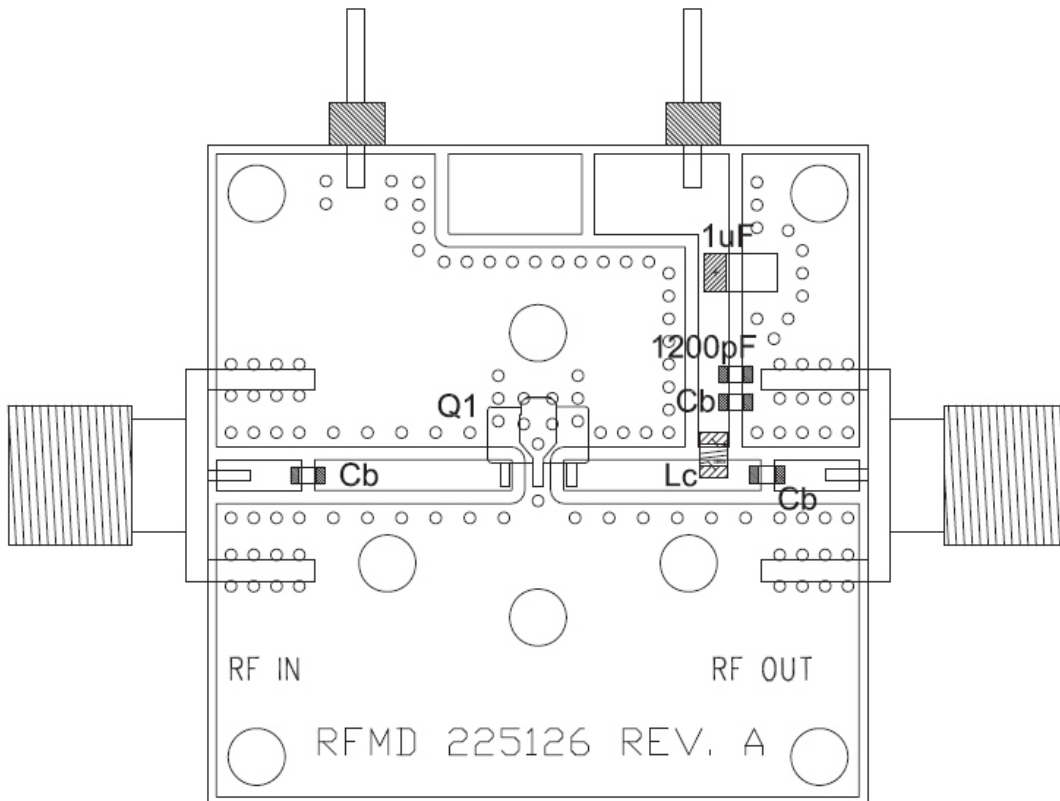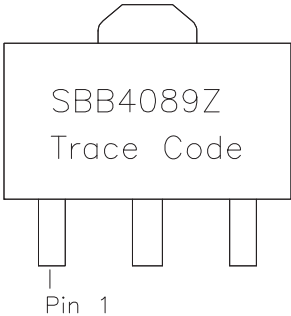Refer to drawing posted at www.rfmd.com for tolerances.
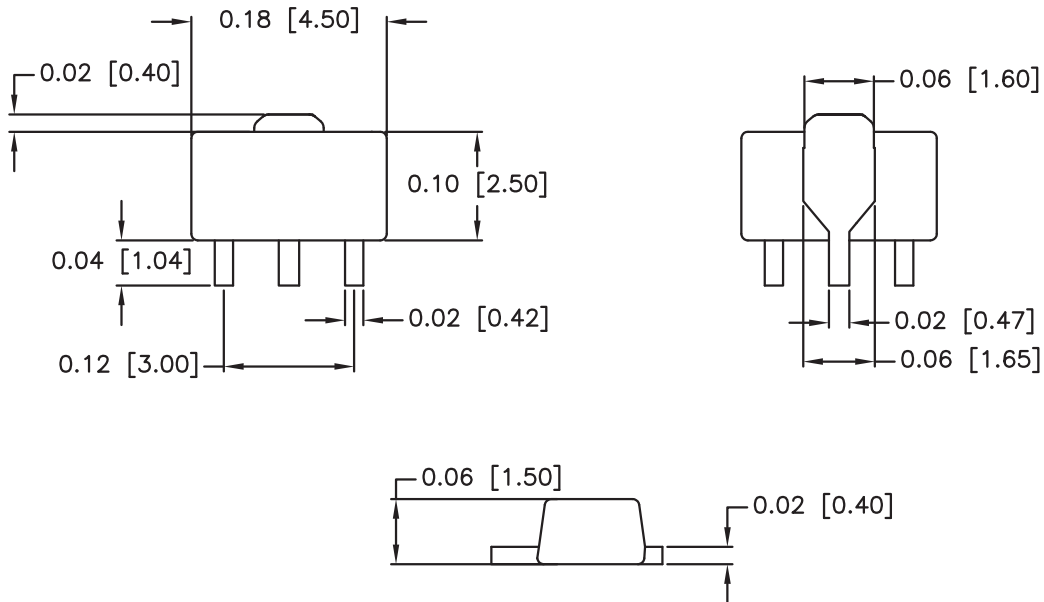
Application Schematic
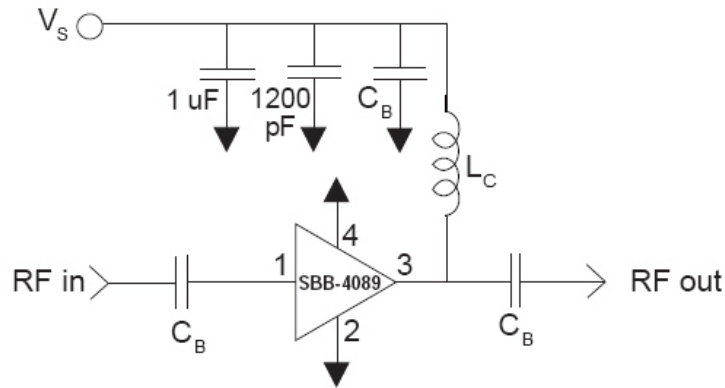
Reference Designator	Frequency (MHz) 500 to 3500
C_B	68 pF
L_C	82 nH 0805CS

Note: For frequencies under 500 MHz make the following changes:
CB = .1 uF
LC = 330 nH

Evaluation Board Layout and Bill of Materials

SBB4089Z

Package Marking

SBB4089Z
Trace Code

Pin 1

Ordering Information

Ordering Code	Description
SBB4089Z	7" Reel with 1000 pieces
SBB4089ZSQ	Sample Bag with 25 pieces
SBB4089ZSR	7" Reel with 100 pieces
SBB4089ZPCK1	1 Evaluation Board (500MHz to 3500MHz) with 5-piece Sample Bag

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