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SBB4089Z

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

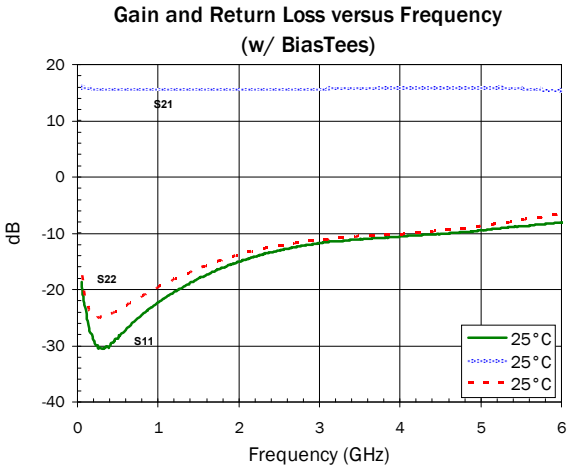
Package: SOT-89

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.

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

- OIP_3=35.2dBm at 1950MHz
- P_{1dB}=19.3dBm at 1950MHz
- 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

Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
Small Signal Gain	14.0	15.0	17.0	dB	850MHz
	14.0	15.5	17.0	dB	1950MHz
	13.5	15.5	17.5	dB	2000MHz
Output Power at 1dB Compression		19.0		dBm	850MHz
	18.0	19.5		dBm	1950MHz
Output Third Order Intercept Point		39.0		dBm	850MHz
	33.0	35.0		dBm	1950MHz
Return Loss		4500		MHz	Minimum 10dB
Input Return Loss	10.0	17.5		dB	1950MHz
Output Return Loss	10.0	17.5		dB	1950MHz
Reverse Isolation		18.5		dB	1950MHz
Noise Figure		4.5	5.5	dB	1950MHz
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=80mA Typ. OIP_3 Tone Spacing=1MHz, P_{OUT} per tone=0dBm 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 (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.

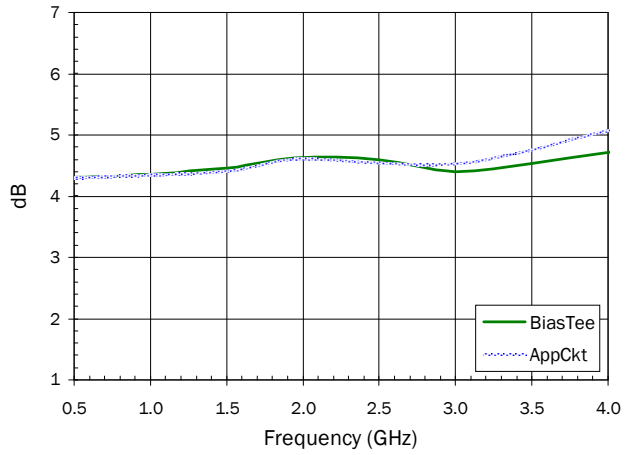
RoHS status based on EUDirective2002/95/EC (at time of this document revision).

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

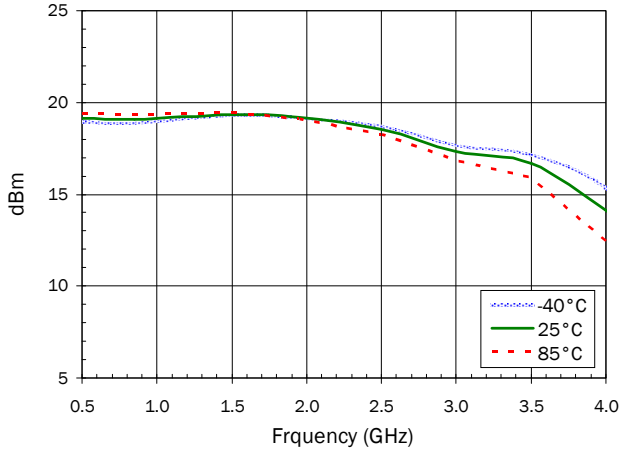
Parameter	Unit	50 MHz	100 MHz	200 MHz	500 MHz	850 MHz	1950 MHz	2500 MHz	3500 MHz	4000 MHz
Small Signal Gain	dB	16.3	15.7	15.7	15.6	15.6	15.5	15.5	15.5	15.0
Output Third Order Intercept Point	dBm	38.7	40.6	39.7	38.8	39.3	35.2	32.8	29.1	26.1
Output Power at 1dB Compression	dBm	18.5	18.7	19	19.2	19.1	19.2	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

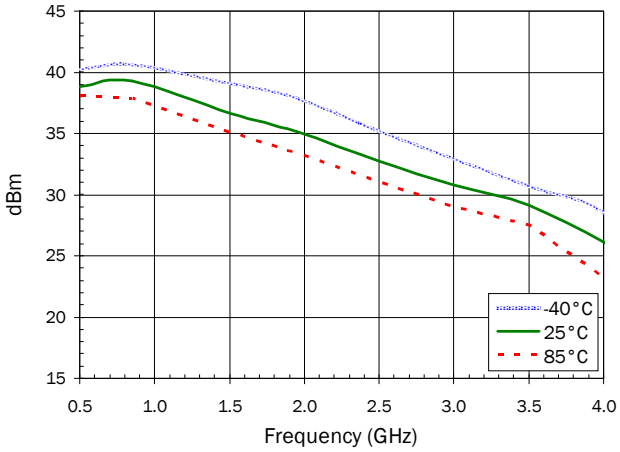
Noise Figure @ 25°C



P1dB versus Frequency with App. Ckt.

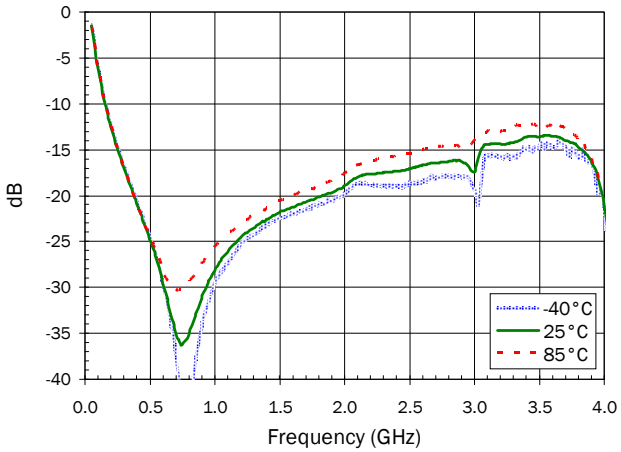


OIP3 versus Frequency with App. Ckt.

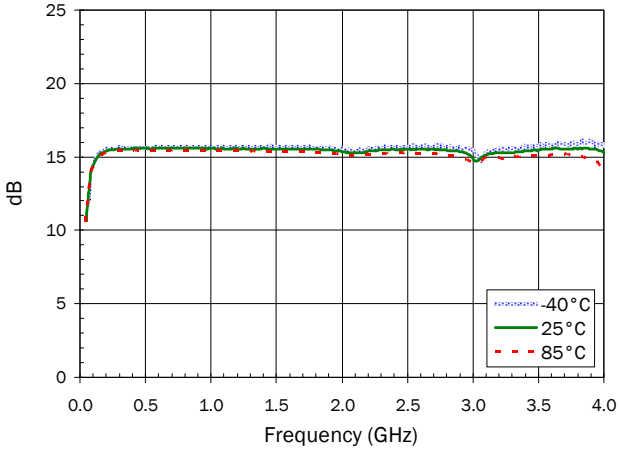


0.5GHz to 3.5GHz Application Circuit S-Parameters over Temperature

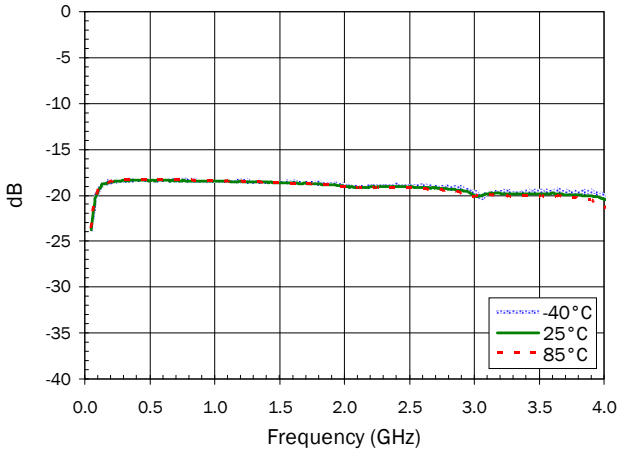
S11 versus Frequency



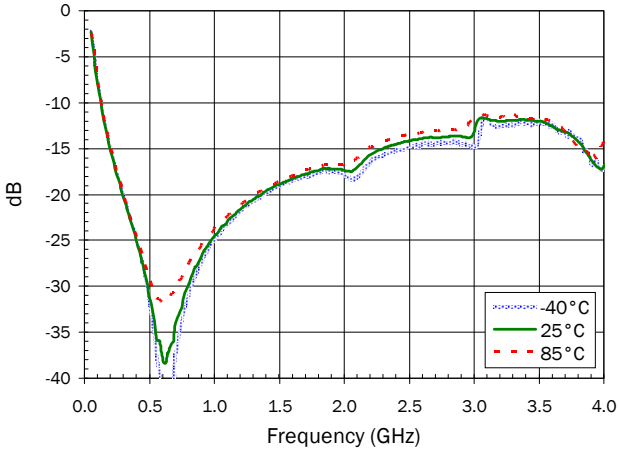
S21 versus Frequency



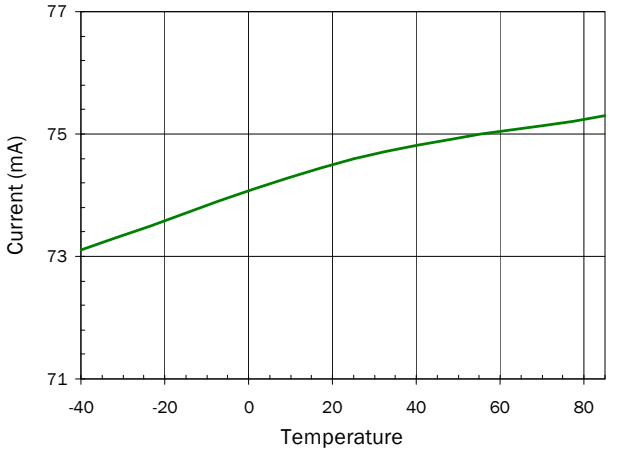
S12 versus Frequency



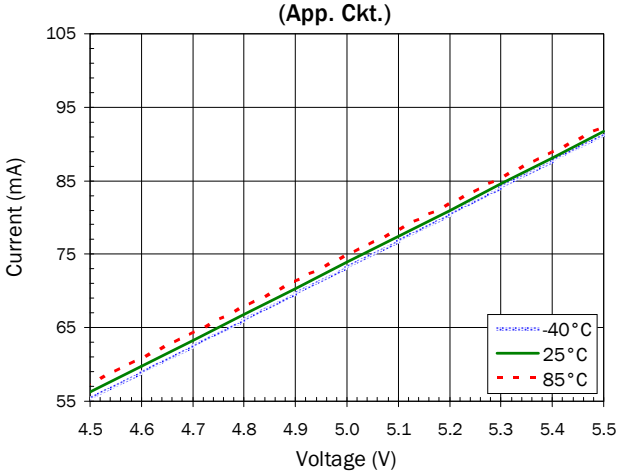
S22 versus Frequency



I_D versus Temperature

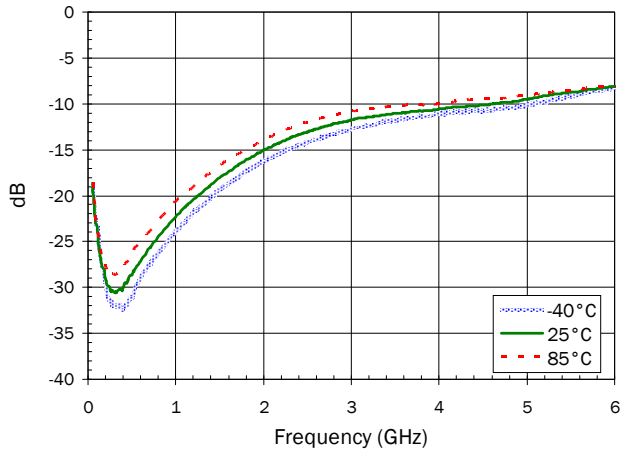


Current versus Voltage Over Temp. (App. Ckt.)

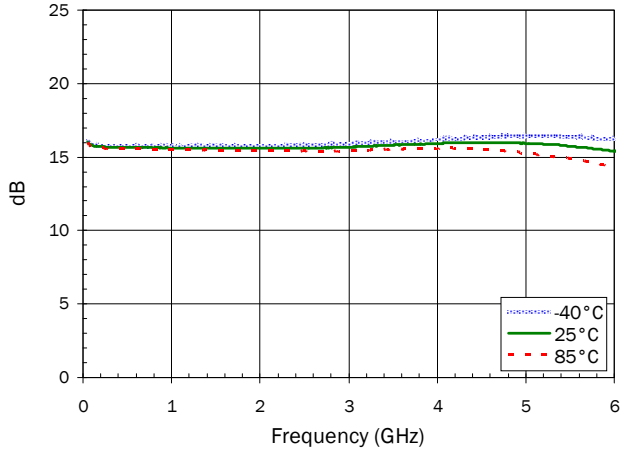


S-Parameters over Temperature (Bias Tee)

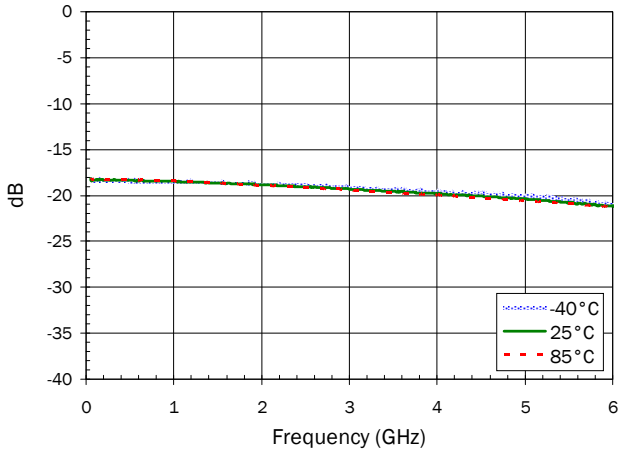
S11 versus Frequency



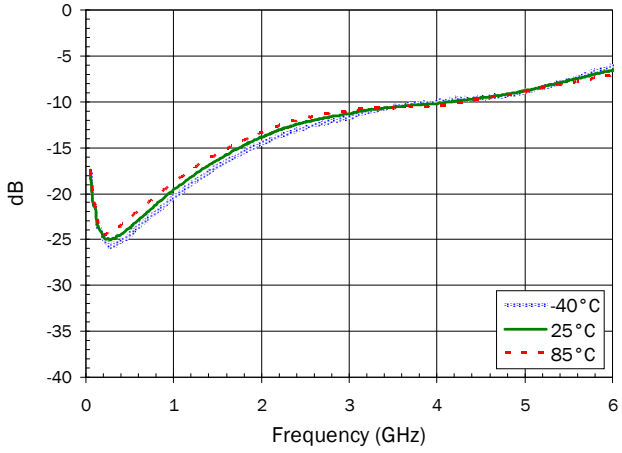
S21 versus Frequency



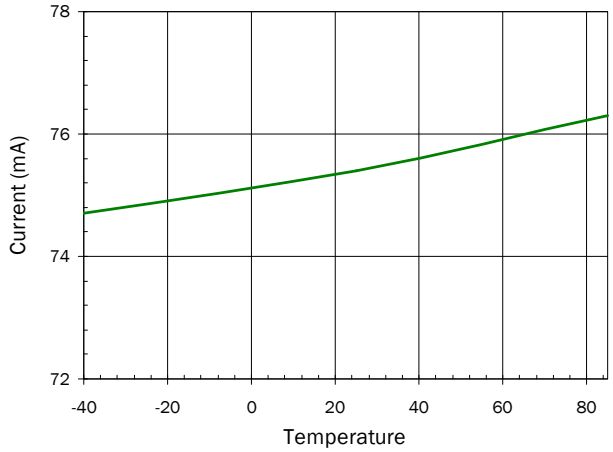
S12 versus Frequency



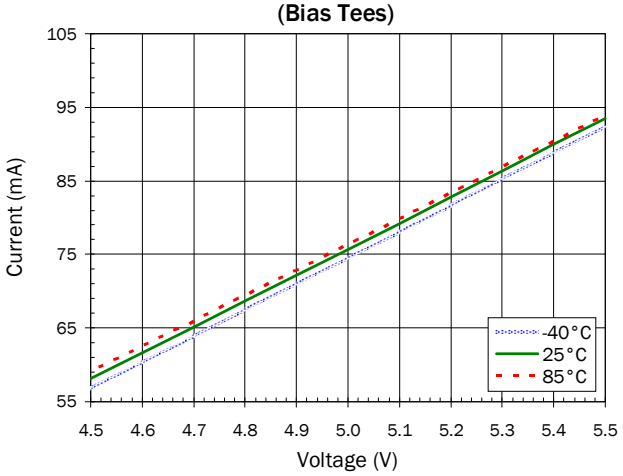
S22 versus Frequency



I_D versus Temperature

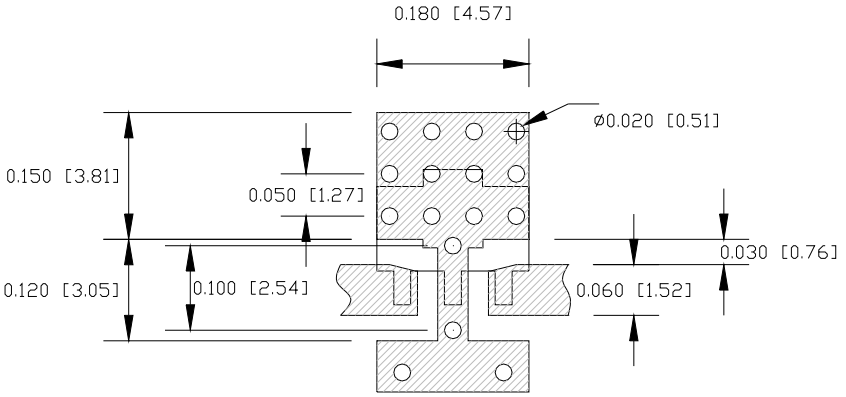


Current versus Voltage Over Temp. (Bias Tees)



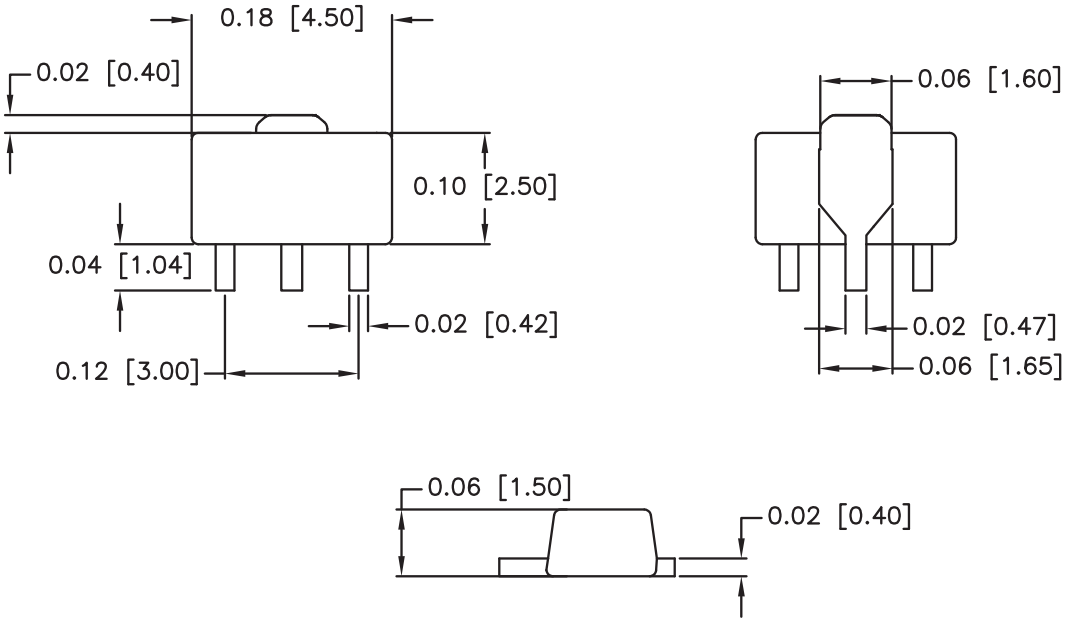
Pin	Function	Description
1	RF IN	RF input pin. This pin requires the use of an external DC blocking capacitor chosen for the frequency of operation.
2, 4	GND	Connection to ground. Use via holes for best performance to reduce lead inductance as close to ground leads as possible
3	RF OUT/BIAS	RF output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

Suggested PCB Pad Layout

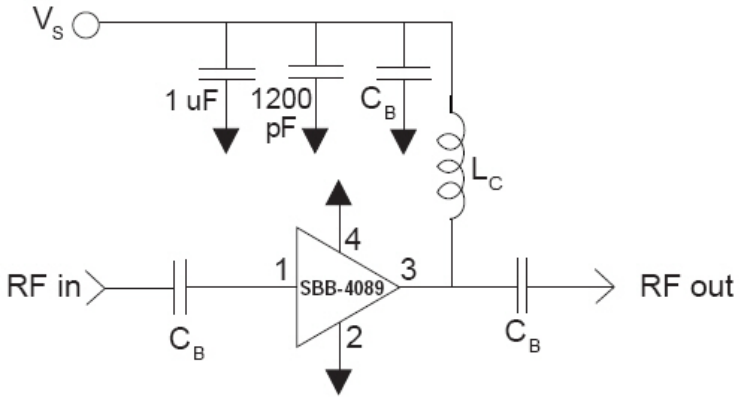


Package Drawing

Dimensions in inches (millimeters)
Refer to drawing posted at www.rfmd.com for tolerances.



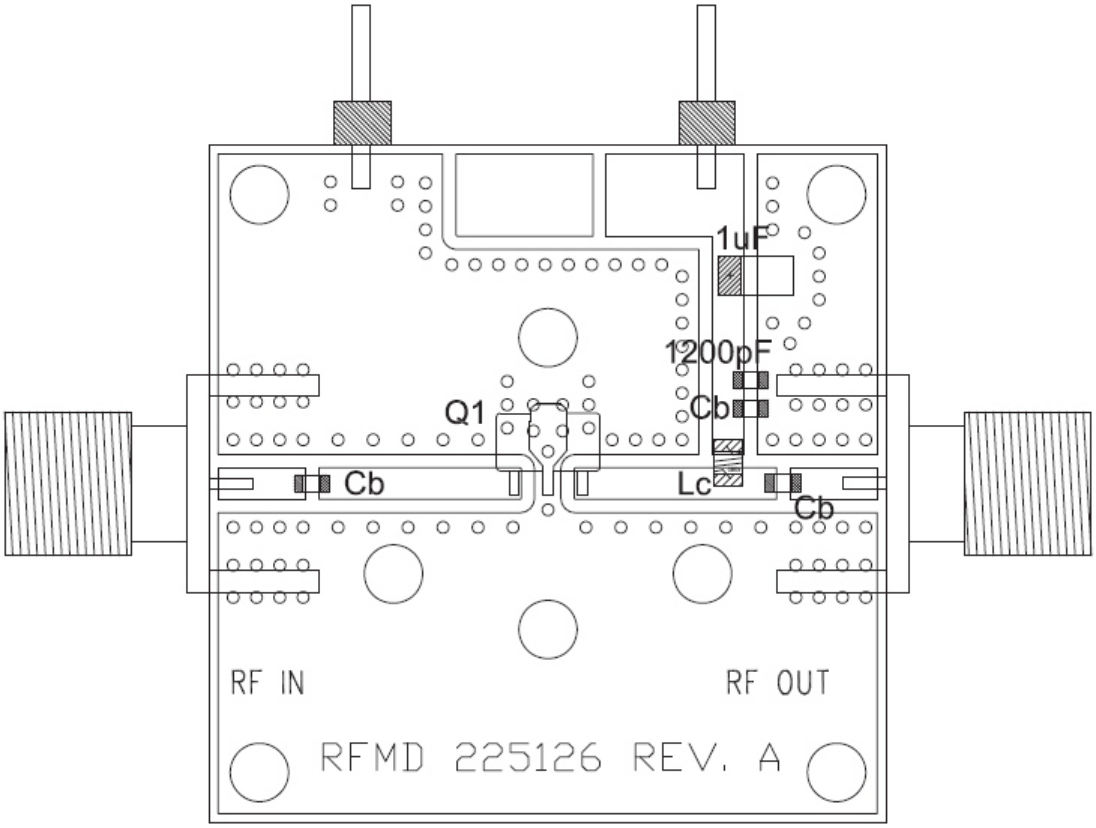
Application Schematic



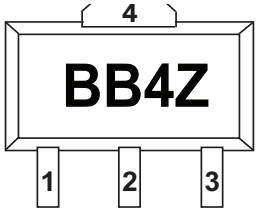
Reference Designator	Frequency (MHz) 500 to 3500
C_B	68pF
L_C	82nH 0805CS

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

Evaluation Board Layout and Bill of Materials



Part Identification



Lead Free

Alternate marking “SBB4089Z” on line 1 with Trace Code on line 2.

Ordering Information

Ordering Code	Description
SBB4089Z	7” Reel with 1000 pieces
SBB4089ZSQ	Sample Bag with 25 pieces
SBB4089ZSR	7” Reel with 100 pieces
SBB4089ZPCK	1 Evaluation Board (500MHz to 3500MHz) with 5-piece Sample Bag