

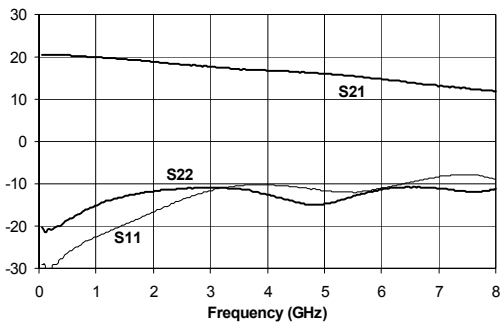


## Product Description

Sirenza Microdevices' SBW-5089 is a high performance InGaP/GaAs Heterojunction Bipolar Transistor MMIC Amplifier. A Darlington configuration designed with InGaP process technology provides broadband performance up to 8 GHz with excellent thermal performance. The heterojunction increases breakdown voltage and minimizes leakage current between junctions. Cancellation of emitter junction non-linearities results in higher suppression of intermodulation products. Only a single positive supply voltage, DC-blocking capacitors, a bias resistor, and an optional RF choke are required for operation.

Gain & Return Loss Vs. Frequency

See App Circuit Page 6



## Preliminary Data Sheet

# SBW-5089

## DC-8 GHz, Cascadable InGaP/GaAs HBT MMIC Amplifier



### Product Features

- Wideband Flat Gain to 3GHz: +/-1.4dB
  - P1dB = 13.4 @ 6GHz
  - Input / Output VSWR < 2:3 to 8GHz
  - Operates From Single Supply
  - Low Thermal Resistance
  - Darlington Configuration
- ### Applications
- Wideband Instrumentation
  - Fiber Optic Driver
  - OC-48
  - Basestation
  - SAT COM

Symbol	Parameter	Units	Frequency	Min.	Typ.	Max.
G	Small Signal Gain (PC board and connector losses de-embedded)	dB	850 MHz 3000 MHz 4200 MHz 6000 MHz	19.3 17.0 16.2 14.5	20.3 18.0 17.2 15.5	21.3 19.0 18.2 16.5
P <sub>1dB</sub>	Output Power at 1dB Compression	dBm	850 MHz 1950 MHz	18.4	20.1 19.4	
OIP <sub>3</sub>	Output Third Order Intercept Point	dBm	850 MHz 1950 MHz	32.0	35.5 34.0	
P <sub>out</sub>	Output Power @ -45dBc ACP IS-95 9 Forward Channels	dBm	1950MHz		13.0	
Bandwidth	Determined by Return Loss (>10dB)	MHz			6000	
IRL	Worst case Input Return Loss	dB	DC-6000MHz	7	10	
ORL	Worst case Output Return Loss	dB	DC-6000MHz	8	11	
NF	Noise Figure	dB	1950 MHz		3.9	4.4
V <sub>D</sub>	Device Operating Voltage	V		4.5	4.9	5.3
I <sub>D</sub>	Device Operating Current	mA		72	80	88
R <sub>TH, j-l</sub>	Thermal Resistance (junction to lead)	°C/W			97	
<b>Test Conditions:</b> V <sub>S</sub> = 8 V      I <sub>D</sub> = 80 mA Typ.      OIP <sub>3</sub> Tone Spacing = 1 MHz, P <sub>out</sub> per tone = 0 dBm R <sub>BIAS</sub> = 39 Ohms      T <sub>L</sub> = 25°C      Z <sub>S</sub> = Z <sub>L</sub> = 50 Ohms						

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**Preliminary Data Sheet**  
**SBW-5089 Wideband DC-8 GHz MMIC Amplifier**

**Typical RF Performance at Key Operating Frequencies**

Symbol	Parameter	Unit	Frequency (MHz)					
			500	850	1950	2400	3500	5800*
G	Small Signal Gain	dB	20.5	20.3	19.1	18.7	17.3	15.1
OIP <sub>3</sub>	Output Third Order Intercept Point	dBm	36.5	35.5	34.0	33.0	30.5	25.5
P <sub>1dB</sub>	Output Power at 1dB Compression	dBm	20.2	20.1	19.4	19.4	17.5	13.4
IRL	Input Return Loss	dB	26	26	19	15	12	12.5
ORL	Output Return Loss	dB	19	17.5	12	11	10.5	10.9
S <sub>21</sub>	Reverse Isolation	dB	22	23	23	23	23	23
NF	Noise Figure	dB	3.6	3.6	3.9	3.9	4.1	4.3

**Test Conditions:** V<sub>s</sub> = 8 V    I<sub>D</sub> = 80 mA Typ.    OIP<sub>3</sub> Tone Spacing = 1 MHz, P<sub>out</sub> per tone = 0dBm  
R<sub>BIAS</sub> = 39 Ohms    T<sub>L</sub> = 25°C    Z<sub>s</sub> = Z<sub>L</sub> = 50 Ohms    Basic Application Circuit

\*NOTE: 5.8GHz data measured with tuned app circuit

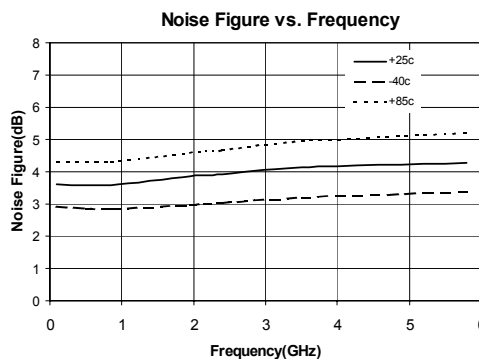
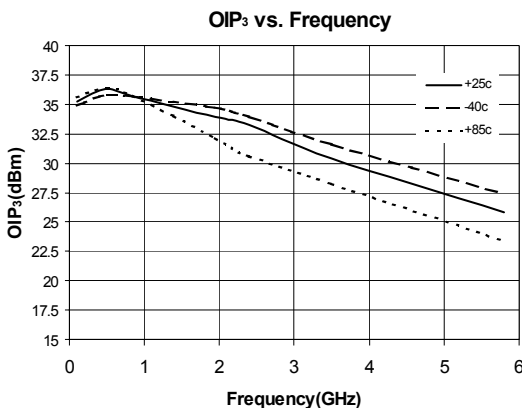
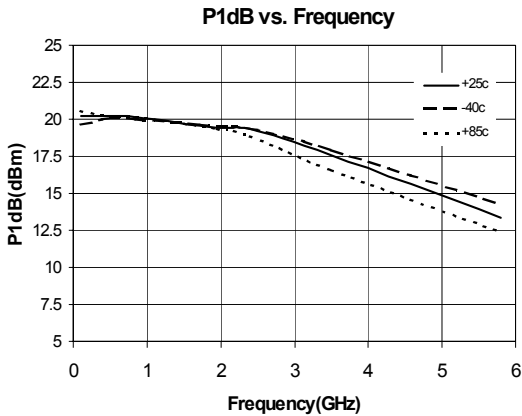
**Absolute Maximum Ratings**

Parameter	Absolute Limit
Max. Device Current (I <sub>b</sub> )	130 mA
Max. Device Voltage (V <sub>D</sub> )	6 V
Max. RF Input Power	+17 dBm
Max Operating Dissipated Power	0.65 W
Max. Junction Temp. (T <sub>J</sub> )	+150°C
Operating Temp. Range (T <sub>J</sub> )	-40°C to +85°C
Max. Storage Temp.	+150°C
ESD	Class 1C

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:

$$I_b V_D < (T_J - T_L) / R_{TH} \quad T_L = T_{LEAD}$$

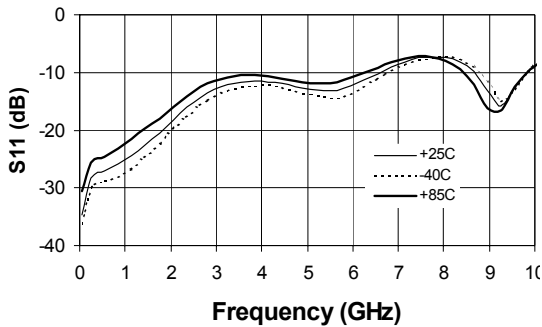




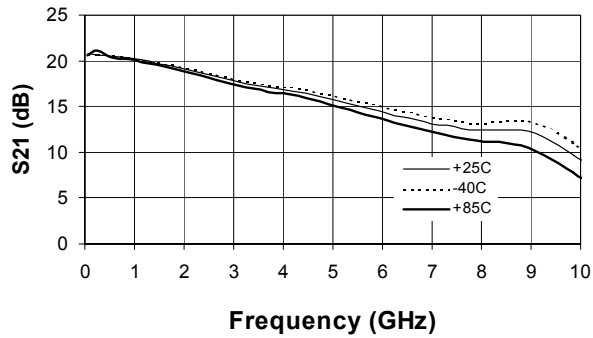
**Preliminary Data Sheet**  
**SBW-5089 Wideband DC-8 GHz MMIC Amplifier**

Test conditions: Bias Tee, Id=80mA, Vsup ply=8V, 39ohm drop resistor  
 Basic App Circuit page 5

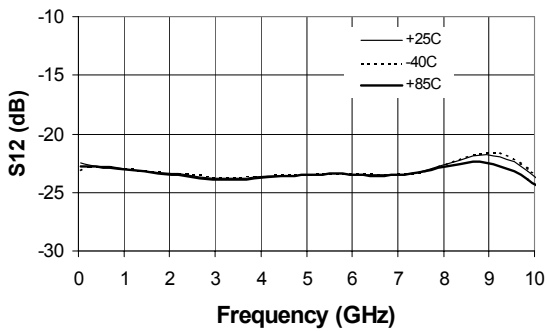
**$|S_{11}|$  vs. Frequency**



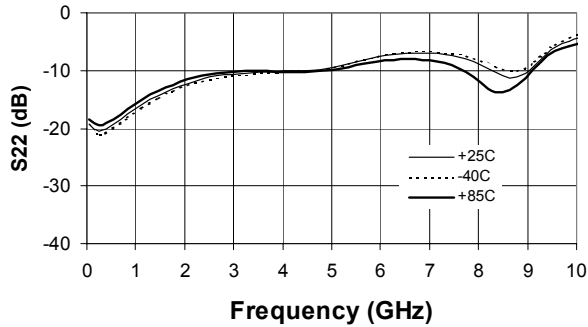
**$|S_{21}|$  vs. Frequency**



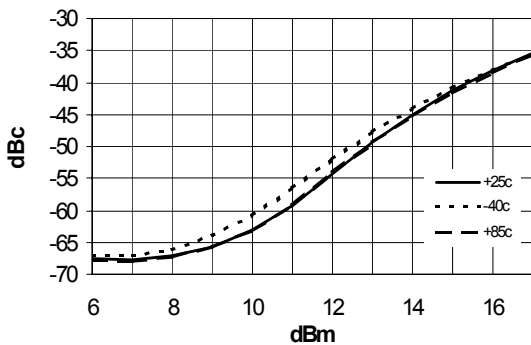
**$|S_{12}|$  vs. Frequency**



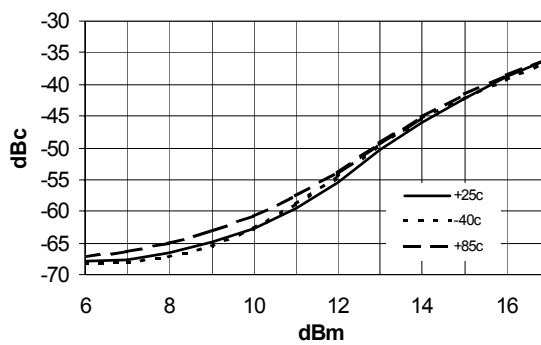
**$|S_{22}|$  vs. Frequency**



**IS-95 @ 850MHz**  
 Adj. Channel Pwr. vs. Channel output Pwr.



**IS-95 @ 1950MHz**  
 Adj. Channel Pwr. vs. Channel Output Power

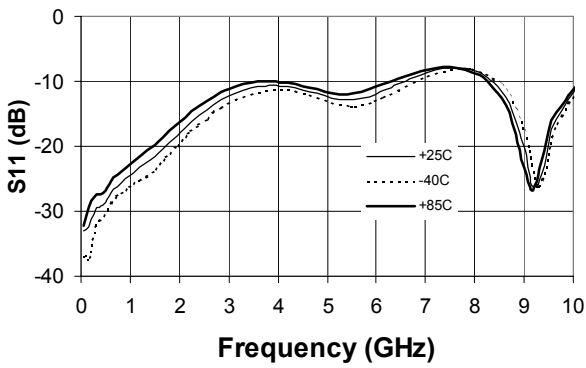




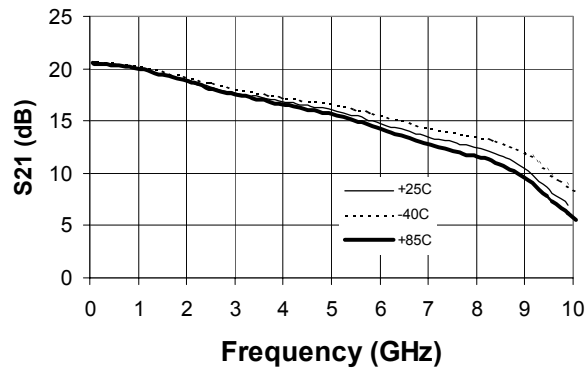
**Preliminary Data Sheet**  
**SBW-5089 Wideband DC-8 GHz MMIC Amplifier**

Test conditions: Bias Tee,  $I_d=80\text{mA}$ ,  $V_{\text{supply}}=8\text{V}$ , 39ohm drop resistor  
 Tuned Circuit Application with broadband bias tee page 6

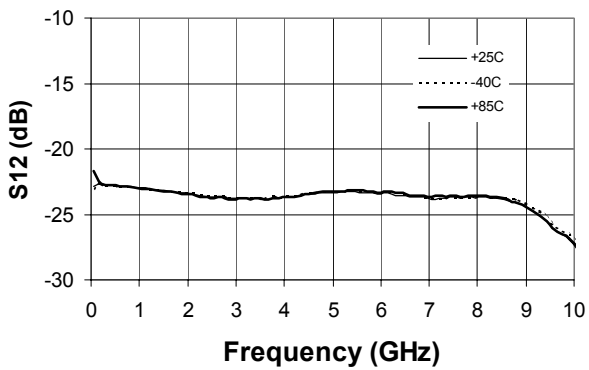
**$|S_{11}|$  vs. Frequency**



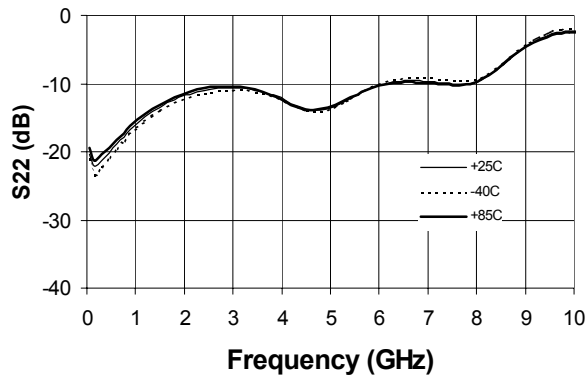
**$|S_{21}|$  vs. Frequency**



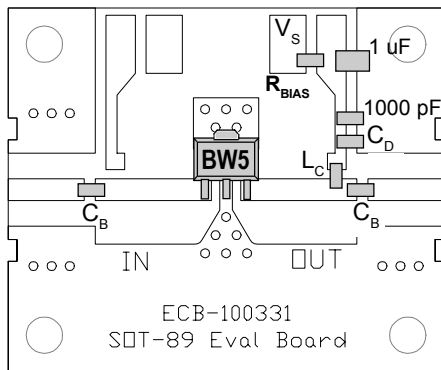
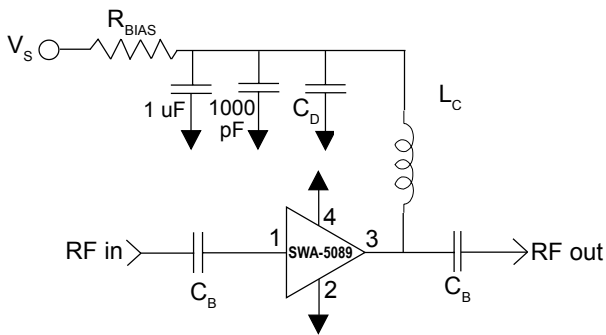
**$|S_{12}|$  vs. Frequency**



**$|S_{22}|$  vs. Frequency**

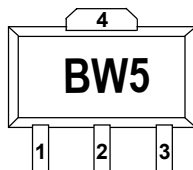


**Basic Application Circuit (no tuning elements)**



**Part Identification Marking**

The part will be marked with an "BW5" designator on the top surface of the package.



**Caution: ESD sensitive**

Appropriate precautions in handling, packaging and testing devices must be observed.

**Application Circuit Element Values**

Reference Designator	Frequency (Mhz)				
	500	850	1950	2400	3500
C <sub>B</sub>	220 pF	100 pF	68 pF	56 pF	39 pF
C <sub>D</sub>	100 pF	68 pF	22 pF	22 pF	15 pF
L <sub>C</sub>	68 nH	33 nH	22 nH	18 nH	15 nH

**Recommended Bias Resistor Values for I<sub>D</sub>=80mA**

$$R_{BIAS} = (V_S - V_D) / I_D$$

Supply Voltage (V <sub>S</sub> )	7.5 V	8 V	10 V	12 V
R <sub>BIAS</sub>	33 Ω	39 Ω	68 Ω	91 Ω

Note: R<sub>BIAS</sub> provides DC bias stability over temperature.

**Mounting Instructions**

1. Solder the copper pad on the backside of the device package to the ground plane.
2. Use a large ground pad area with many plated through-holes as shown.
3. We recommend 1 or 2 ounce copper. Measurement for this data sheet were made on a 31 mil thick FR-4 board with 1 ounce copper on both sides.

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.

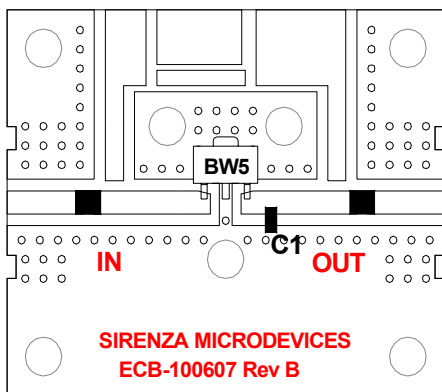
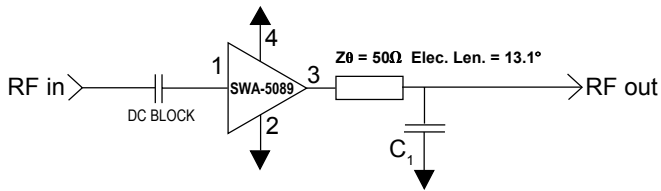
**Part Number Ordering Information**

Part Number	Reel Size	Devices/Reel
SBW-5089	7"	1000

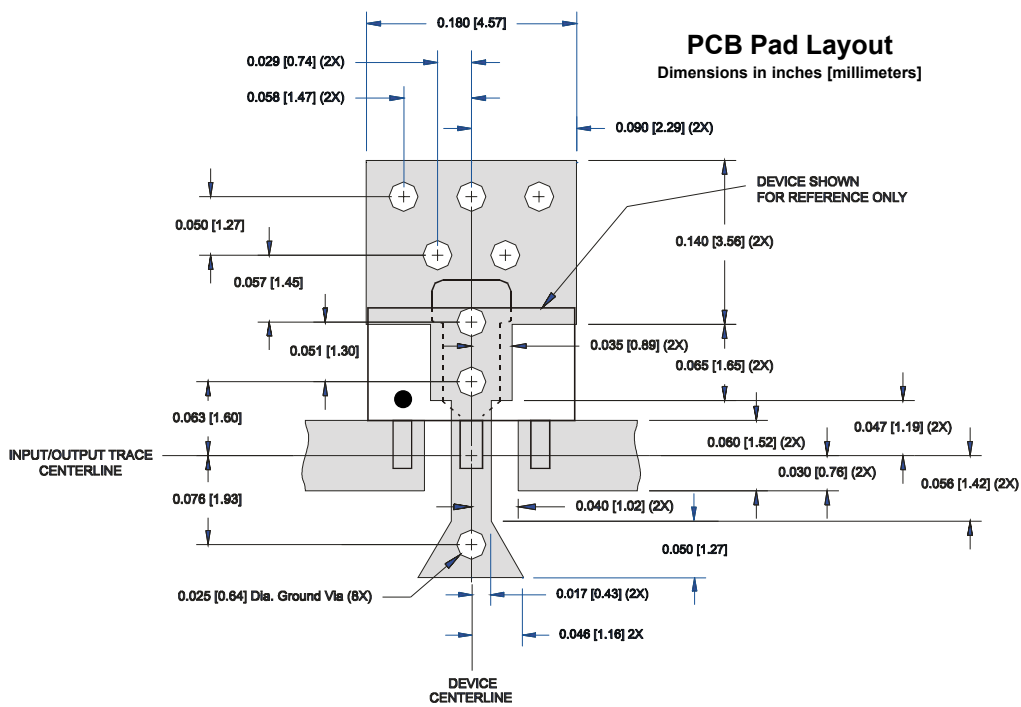


**Preliminary Data Sheet**  
**SBW-5089 Wideband DC-8 GHz MMIC Amplifier**

**Application Circuit with 5 - 8GHz tuning and broadband bias tee**



C1 = 0.1pF 0805 AVX  
Substrate Material = Getek ML200C,  
0.031" thick, Er = 4.2, 1oz. cladding



### Nominal Package Dimensions

Dimensions in inches [millimeters]

Refer to package drawing posted at [www.sirenza.com](http://www.sirenza.com) for tolerances.

