

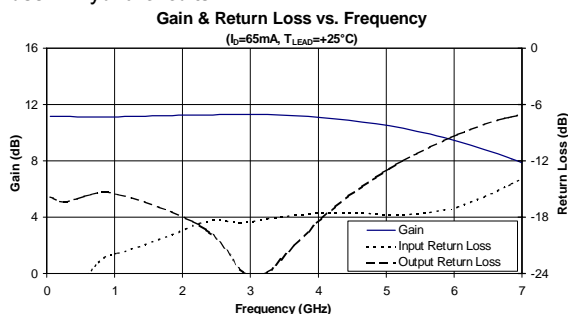


## Product Description

Sirenza Microdevices' SNA-686 is a GaAs HBT MMIC Amplifier housed in a low-cost, surface-mountable plastic package. The heterojunction increases breakdown voltage and minimizes leakage current between junctions. Cancellation of emitter junction non-linearities results in higher suppression of intermodulation products.

The use of an external resistor allows for bias flexibility and stability. These unconditionally stable amplifiers are designed for use as general purpose 50 ohm gain blocks.

Also available in chip form (SNA-600), its small size (0.38mm x 0.38mm) and gold metallization make it an ideal choice for use in hybrid circuits.



## SNA-686

### DC-6 GHz, Cascadable GaAs HBT MMIC Amplifier

**Not Recommended for New Designs**  
See Application Note AN-019 for Alternates



## Product Features

- Patented GaAs HBT Technology
- Cascadable 50 Ohm Gain Block
- 34 dBm Output IP3 @ 850 MHz
- Operates From Single Supply
- Low Cost Surface Mount Plastic Package

## Applications

- Cellular, PCS, CDPD, Wireless Data, SONET

Symbol	Parameter	Frequency	Units	Min.	Typ.	Max.
$P_{1dB}$	Output Power at 1dB Compression	850 MHz 1950 MHz 2400 MHz	dBm dBm dBm	15.7	17.6 17.7 17.4	
$IP_3$	Third Order Intercept Point	850 MHz 1950 MHz 2400 MHz	dBm dBm dBm	29.1	34.0 32.1 30.0	
$S_{21}$	Small Signal Gain	850 MHz 1950 MHz 2400 MHz	dB dB dB	10.0 10.1	11.1 11.2 11.3	12.2 12.3
Bandwidth	(Determined by $S_{11}$ , $S_{22}$ Values)		MHz		6000	
$VSWR_{IN}$	Input VSWR	DC-6000 MHz	-		1.3:1	
$VSWR_{OUT}$	Output VSWR	DC-6000 MHz	-		1.4:1	
$S_{12}$	Reverse Isolation	850 MHz 1950 MHz 2400 MHz	dB dB dB		16.3 16.5 16.6	
NF	Noise Figure	1950 MHz	dB		7.3	8.8
$V_D$	Device Operating Voltage		V	5.0	5.3	5.6
$I_D$	Device Operating Current		I	58	65	72
$R_{TH, J-I}$	Thermal Resistance (junction - lead)		$^\circ\text{C/W}$		261	

**Test Conditions:**  $V_S = 8\text{ V}$   $I_D = 65\text{ mA Typ.}$   $OIP_3$  Tone Spacing = 1 MHz,  $P_{out}$  per tone = 0 dBm  
 $R_{BIAS} = 43\text{ Ohms}$   $T_L = 25^\circ\text{C}$   $Z_S = Z_L = 50\text{ Ohms}$

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## Typical RF Performance at Key Operating Frequencies

Symbol	Parameter	Unit	Frequency (MHz)					
			100	500	850	1950	2400	3500
G	Small Signal Gain	dB	11.1	11.1	11.1	11.2	11.3	11.3
OIP <sub>3</sub>	Output Third Order Intercept Point	dBm		35.0	34.0	32.1	30.0	
P <sub>1dB</sub>	Output Power at 1dB Compression	dBm		17.5	17.6	17.7	17.4	
IRL	Input Return Loss	dB	29.5	25.2	22.3	19.6	18.4	17.9
ORL	Output Return Loss	dB	16.0	15.9	15.3	17.8	19.6	22.2
S <sub>12</sub>	Reverse Isolation	dB	16.2	16.2	16.3	16.5	16.6	17.0
NF	Noise Figure	dB		7.2	7.3	7.3		
Test Conditions: V <sub>S</sub> = 8v R <sub>BIAS</sub> = 43 Ohms			I <sub>D</sub> = 65mA Typ. T <sub>L</sub> = 25°C		OIP3 Tone Spacing = 1 MHz, Pout per tone = 0 dBm Z <sub>S</sub> = Z <sub>L</sub> = 50 Ohms			

### Absolute Maximum Ratings

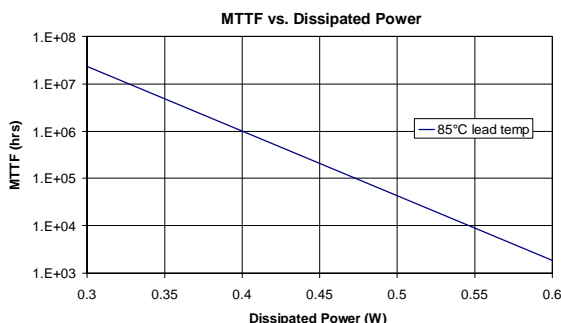
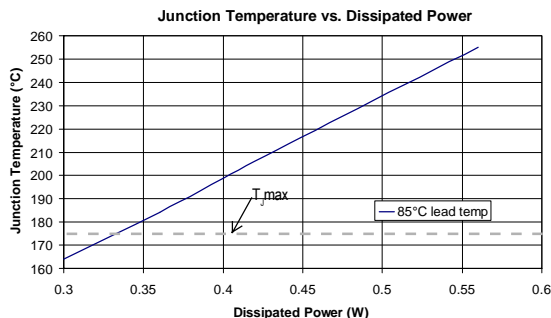
Operation of this device beyond any one of these limits may cause permanent damage. For reliable continuous operation, the device voltage and current must not exceed the maximum operating values specified in the table on page one.

Bias Conditions should also satisfy the following expression:

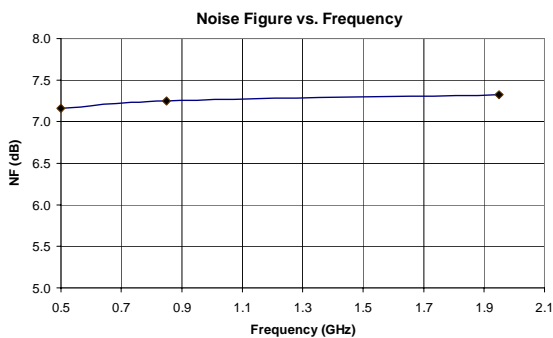
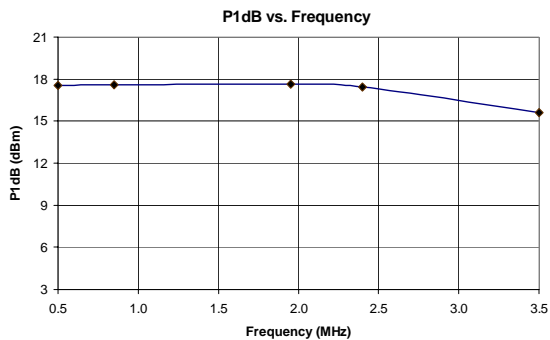
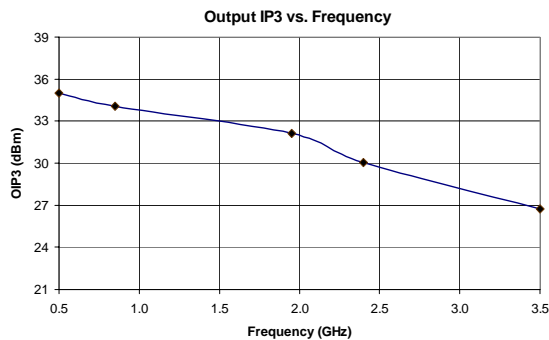
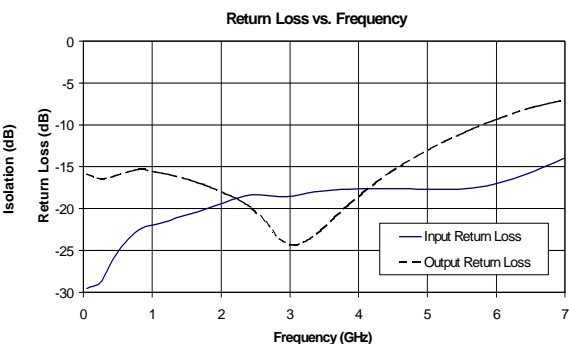
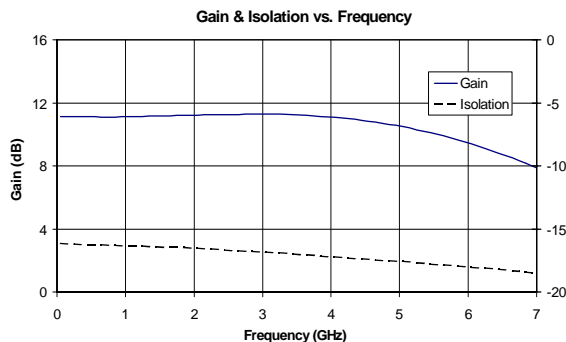
$$I_D V_D < (T_J - T_L) / R_{TH}, j-l$$

Parameter	Absolute Limit
Max. Device Current (I <sub>D</sub> )	120 mA
Max. Device Voltage (V <sub>D</sub> )	7 V
Max. RF Input Power	+16 dBm
Max. Junction Temp. (T <sub>J</sub> )	+175°C
Operating Temp. Range (T <sub>L</sub> )	-40°C to +85°C
Max. Storage Temp.	+150°C

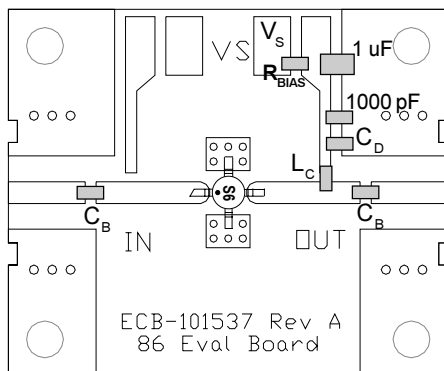
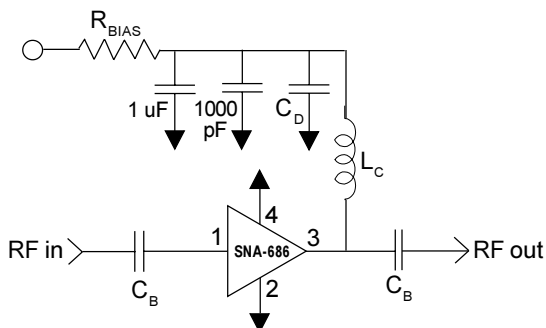
**NOTE:** While the SNA-686 can be operated at different bias currents, 65 mA is the recommended bias for lower junction temperature and longer life. This reflects typical operating conditions which we have found to be an optimal balance between high IP3 and MTTF. In general, MTTF is improved to more than 100,000 hours when biasing at 65 mA and operating up to 85°C ambient temperature.



## Typical RF Performance ( $V_{DS} = 5.3V$ , $I_{DS} = 65mA$ , $T_{LEAD} = 25^{\circ}C$ )

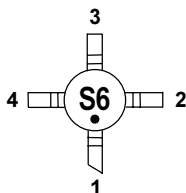


## Typical Application Circuit



## Part Identification Marking

The part will be marked with an "S6" 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>b</sub>=65mA

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

Supply Voltage(V <sub>S</sub> )	8 V	9 V	12 V	15 V
R <sub>BIAS</sub>	43 Ω	56 Ω	100 Ω	150 Ω

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

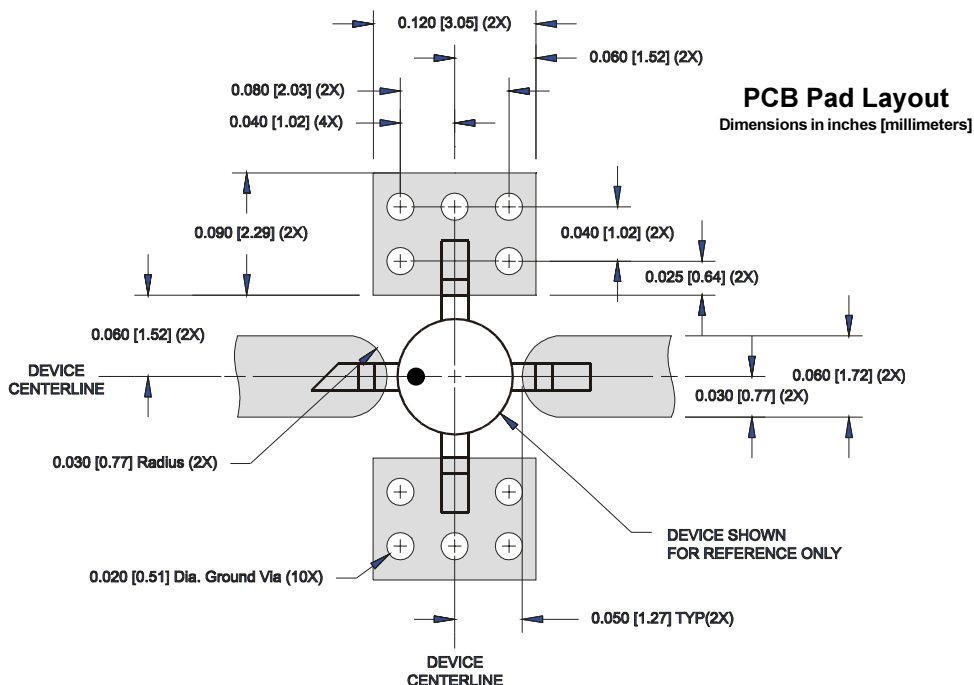
## Mounting Instructions

1. Use a large ground pad area under device pins 2 and 4 with many plated through-holes as shown.
2. We recommend 1 or 2 ounce copper. Measurements 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. For optimum RF performance, use via holes as close to ground leads as possible to reduce lead inductance.
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
SNA-686	7"	1000



## Nominal Package Dimensions

**Dimensions in inches [millimeters]**

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

