SNA-686

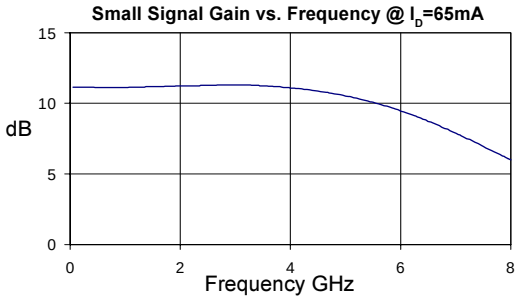
DC-6 GHz, Cascadable GaAs HBT MMIC Amplifier

NGA-686 Recommended for New Designs

Product Description

Sirenza Microdevices' SNA-686 is a high performance Gallium Arsenide Heterojunction Bipolar Transistor MMIC Amplifier. A Darlington configuration is utilized for broadband performance up to 6 GHz. The heterojunction increases breakdown voltage and minimizes leakage current between junctions. Cancellation of emitter junction non-linearities results in higher suppression of intermodulation products. Typical IP3 at 850 MHz with 65mA is 34 dBm.

These unconditionally stable amplifiers provide 11 dB of gain and 17.7 dBm of 1dB compressed power and require only a single positive voltage supply. Only 2 DC-blocking capacitors, a bias resistor and an optional inductor are needed for operation.



Product Features

- **High Output IP3: 34 dBm @ 850 MHz**
- **Cascadable 50 Ohm Gain Block**
- **Patented GaAs HBT Technology**
- **Operates From Single Supply**

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		17.6 17.7 17.4	
IP_3	Third Order Intercept Point	850 MHz 1950 MHz 2400 MHz	dBm dBm dBm		34.0 32.1 30.0	
S_{21}	Small Signal Gain	850 MHz 1950 MHz 2400 MHz	dB dB dB	10	11.1 11.2 11.3	12.2
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	
V_D	Device Operating Voltage		V	4.8	5.3	5.8
R_{TH}, j-l	Thermal Resistance (junction - lead)		° C/W		261	

Test Conditions: V_S = 8 V, R_{BIAS} = 43 Ohms, I_D = 65 mA Typ., T_L = 25ºC, OIP_3 Tone Spacing = 1 MHz, Pout per tone = 0 dBm, $Z_S = Z_L$ = 50 Ohms

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Absolute Maximum Ratings

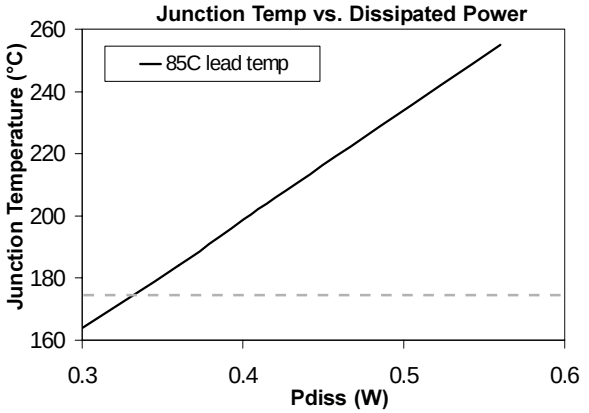
Operation of this device above any one of these parameters may cause permanent damage.

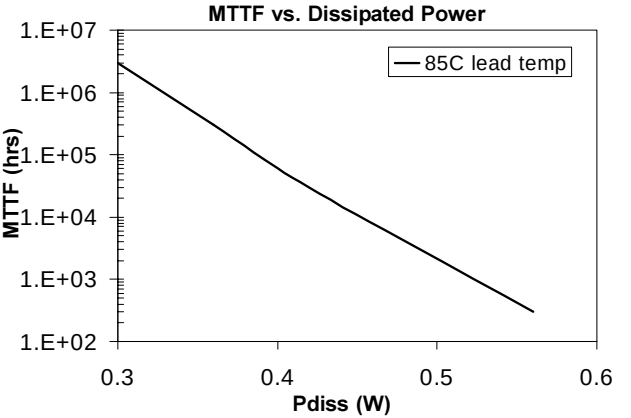
Bias Conditions should also satisfy the following expression: $I_D V_D$ (max) < (T_J - T_{OP})/Rth, j-l

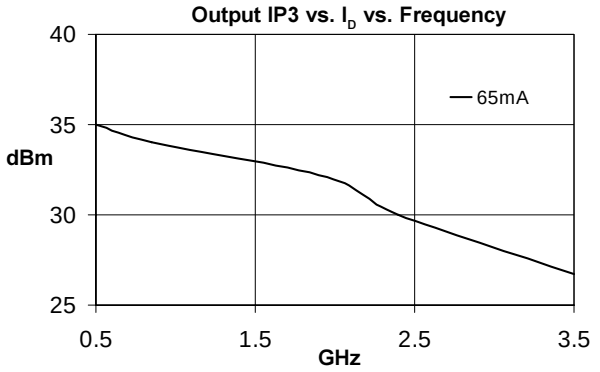
Parameter	Value	Unit
Supply Current	120	mA
Operating Temperature	-40 to +85	C
Maximum Input Power	16	dBm
Storage Temperature Range	-40 to +150	C
Operating Junction Temperature	+175	C

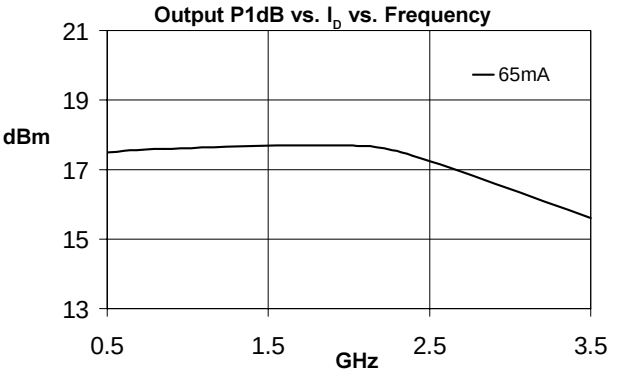
Parameter	Typical 25°C	Unit	Test Condition (I_D = 65 mA, unless otherwise noted)
500 MHz			
Gain	11.1	dB	
Noise Figure	7.2	dB	Z_S = 50 Ohms
Output IP3	35.0	dBm	Tone spacing = 1 MHz, Pout per tone = 0 dBm
Output P1dB	17.5	dBm	
Input Return Loss	25.2	dB	
Isolation	16.2	dB	
850 MHz			
Gain	11.1	dB	
Noise Figure	7.3	dB	Z_S = 50 Ohms
Output IP3	34.0	dBm	Tone spacing = 1 MHz, Pout per tone = 0 dBm
Output P1dB	17.6	dBm	
Input Return Loss	22.3	dB	
Isolation	16.3	dB	
1950 MHz			
Gain	11.2	dB	
Noise Figure	7.3	dB	Z_S = 50 Ohms
Output IP3	32.1	dBm	Tone spacing = 1 MHz, Pout per tone = 0 dBm
Output P1dB	17.7	dBm	
Input Return Loss	19.6	dB	
Isolation	16.5	dB	
2400 MHz			
Gain	11.3	dB	
Output IP3	30.0	dBm	Tone spacing = 1 MHz, Pout per tone = 0 dBm
Output P1dB	17.4	dBm	
Input Return Loss	18.4	dB	
Isolation	16.6	dB	

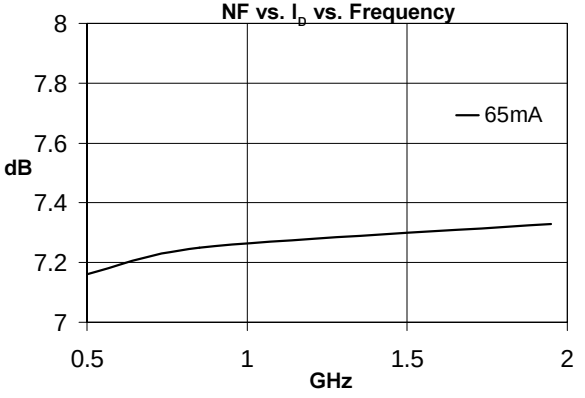
***NOTE:** While the SNA-686 can be operated at different bias currents, 65 mA is the recommended bias for lower junction temperature and longer life. This reflects typical operating conditions which we have found to be an optimal balance between high IP3 and MTTF. In general, MTTF is improved to more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

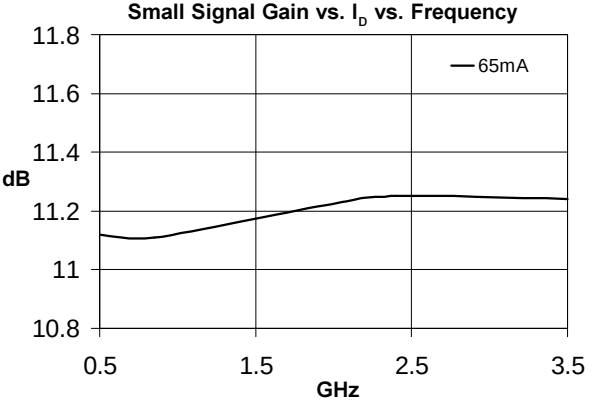

Junction Temp vs. Dissipated Power
85C lead temp
Junction Temperature (°C)
260
240
220
200
180
160
0.3
0.4
0.5
0.6
Pdiss (W)


MTTF vs. Dissipated Power
85C lead temp
MTTF (hrs)
1.E+07
1.E+06
1.E+05
1.E+04
1.E+03
1.E+02
0.3
0.4
0.5
0.6
Pdiss (W)


Output IP3 vs. I_D vs. Frequency
65mA
dBm
40
35
30
25
0.5
1.5
2.5
3.5
GHz


Output P1dB vs. I_D vs. Frequency
65mA
dBm
21
19
17
15
13
0.5
1.5
2.5
3.5
GHz

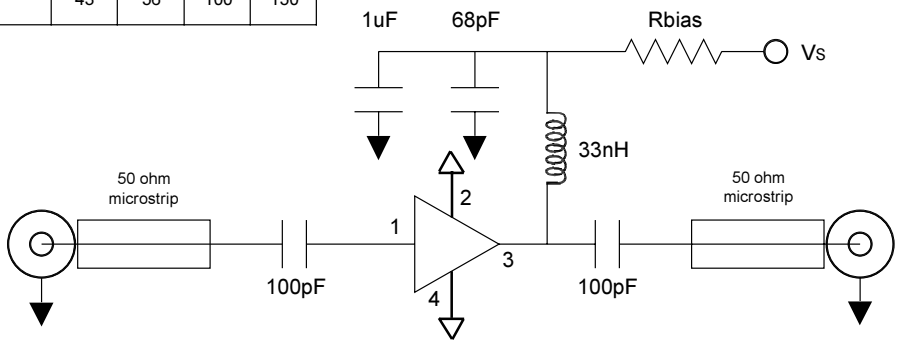

NF vs. I_D vs. Frequency
65mA
dB
8
7.8
7.6
7.4
7.2
7
0.5
1
1.5
2
GHz


Small Signal Gain vs. I_D vs. Frequency
65mA
dB
11.8
11.6
11.4
11.2
11
10.8
0.5
1.5
2.5
3.5
GHz

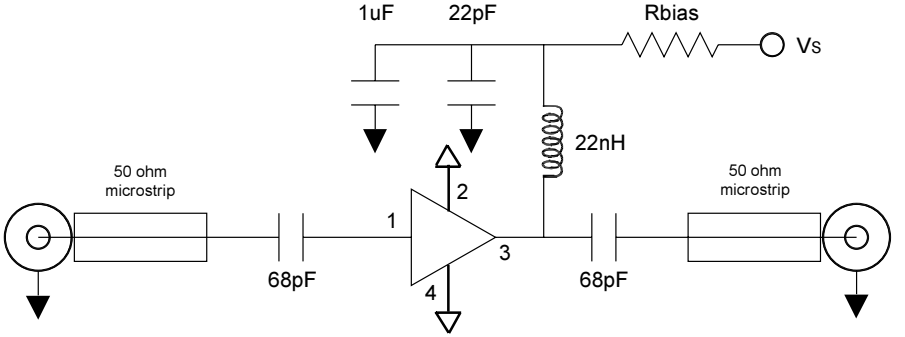
Pin #	Function	Description
1	RF IN	RF input pin. This pin requires the use of an external DC blocking capacitor chosen for the frequency of operation.
2	GND	Connection to ground. Use via holes for best performance to reduce lead inductance. Place vias as close to ground leads as possible.
3	RF OUT/Vcc	RF output and bias pin. Bias should be supplied to this pin through an external series resistor and RF choke inductor. Because DC biasing is present on this pin, a DC blocking capacitor should be used in most applications (see application schematic). The supply side of the bias network should be well bypassed.
4	GND	Same as Pin 2.

Application Schematic for Operation at 850 MHz

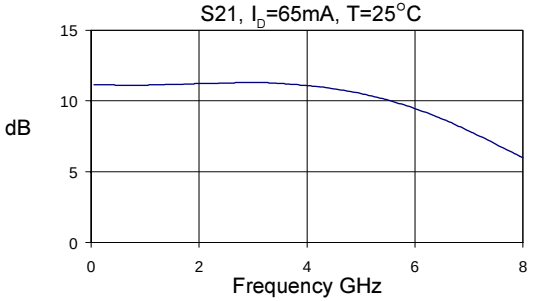
Recommended Bias Resistor Values				
Supply Voltage(Vs)	8V	9V	12V	15V
Rbias (Ohms) @ 65 mA	43	56	100	150



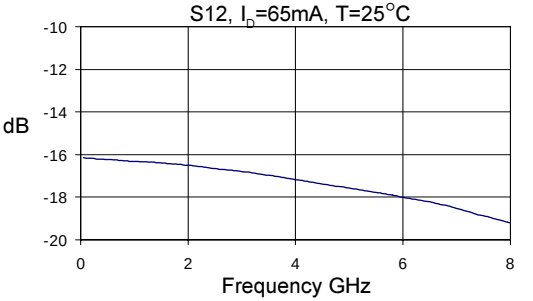
Application Schematic for Operation at 1950 MHz



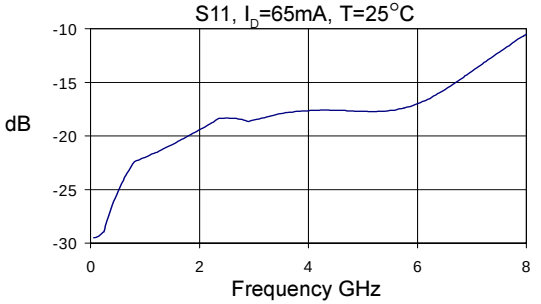
S21, I_D=65mA, T=25°C



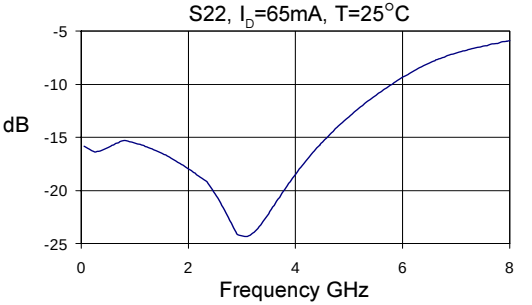
S12, I_D=65mA, T=25°C



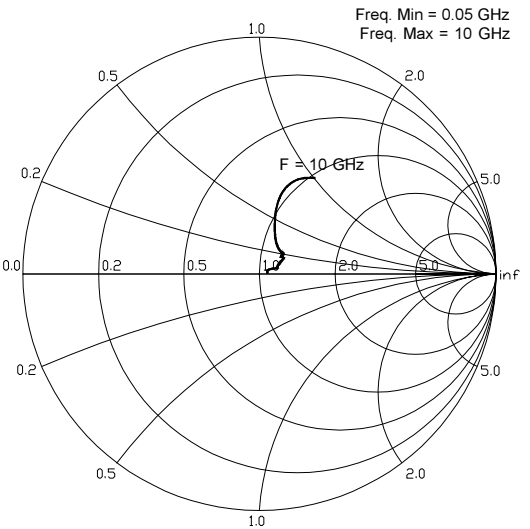
S11, I_D=65mA, T=25°C



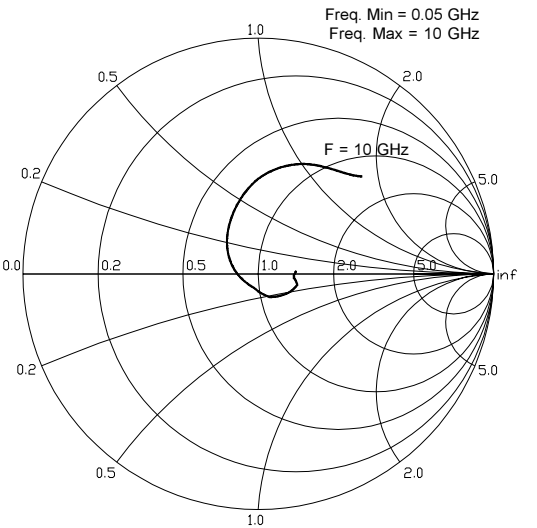
S22, I_D=65mA, T=25°C



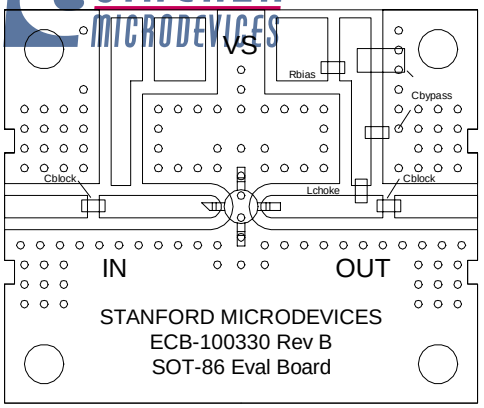
S11, I_D=65mA, Ta=25°C



S22, I_D=65mA, Ta=25°C



SNA-686 DC-6GHz Cascadable MMIC Amplifier



Evaluation Board Layout

Part Number Ordering Information

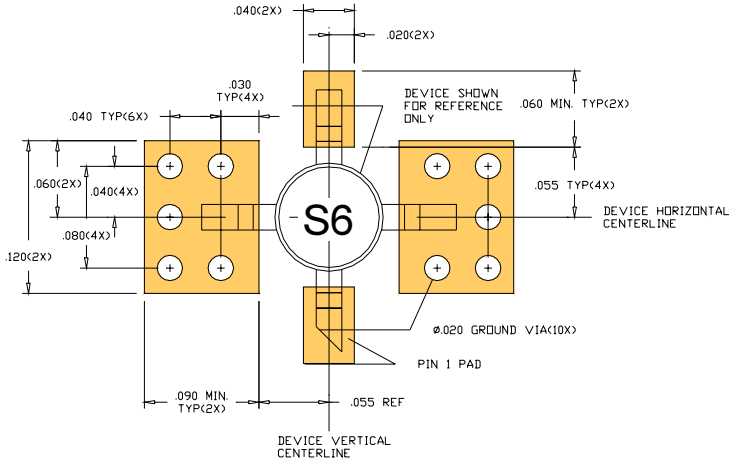
Part Number	Reel Size	Devices/Reel
SNA-686	7"	1000

Caution ESD Sensitive:
Appropriate precautions in handling, packaging and testing devices must be observed.

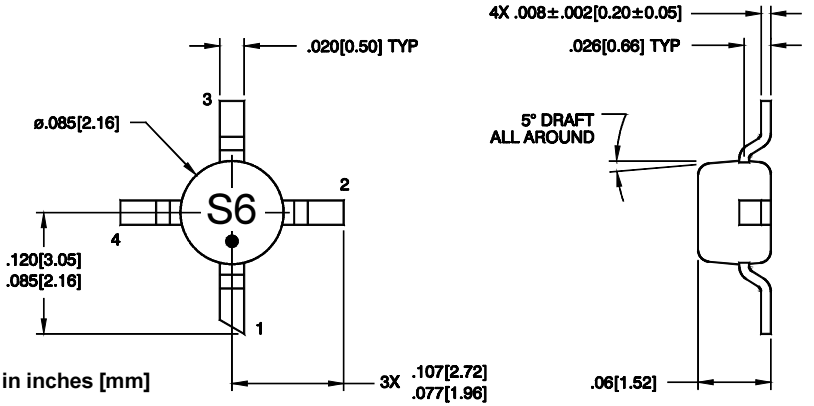
Part Symbolization

The part will be symbolized with an "S6" designator on the top surface of the package.

PCB Pad Layout



Package Dimensions



Dimensions are in inches [mm]