# SNA-586

## DC-5 GHz, Cascadable GaAs HBT MMIC Amplifier

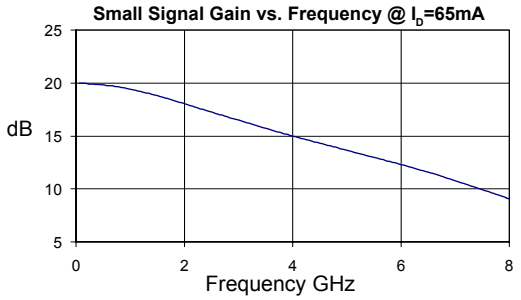
**NGA-586 Recommended for New Designs**



## Product Description

Stanford Microdevices' SNA-586 is a high performance Gallium Arsenide Heterojunction Bipolar Transistor MMIC Amplifier. A Darlington configuration is utilized for broadband performance up to 5 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 32.5 dBm.

These unconditionally stable amplifiers provide 18 dB of gain and 18.4 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. This MMIC is an ideal choice for wireless applications such as cellular, PCS, CDPD, wireless data and SONET.




## Product Features

- **High Output IP3: 32.5 dBm @ 850 MHz**
- **Cascadable 50 Ohm Gain Block**
- **Patented GaAs HBT Technology**
- **Operates From Single Supply**

## Applications

- **Cellular, PCS, CDPD, Wireless Data, SONET**

**Electrical Specifications**

| Symbol | Parameters: Test Conditions: $Z_0$ = 50 Ohms, $I_D$ = 65mA, T = 25°C | | Units | Min. | Typ. | Max. |
|---|---|---|---|---|---|---|
| $P_{1dB}$ | Output Power at 1dB Compression | f = 850 MHz<br>f = 1950 MHz<br>f = 2400 MHz | dBm<br>dBm<br>dBm | | 17.6<br>18.4<br>18.4 | |
| $IP_3$ | Third Order Intercept Point<br>Power out per tone = 0 dBm | f = 850 MHz<br>f = 1950 MHz<br>f = 2400 MHz | dBm<br>dBm<br>dBm | | 32.5<br>31.6<br>31.6 | |
| $S_{21}$ | Small Signal Gain | f = 850 MHz<br>f = 1950 MHz<br>f = 2400 MHz | dB<br>dB<br>dB | 17.6 | 19.6<br>18.1<br>17.4 | |
| Bandwidth | (Determined by $S_{11}$, $S_{22}$ Values) | | MHz | | 5000 | |
| $S_{11}$ | Input VSWR | f = DC-5000 MHz | - | | 1.4:1 | |
| $S_{22}$ | Output VSWR | f = DC-5000 MHz | - | | 1.4:1 | |
| $S_{12}$ | Reverse Isolation | f = 850 MHz<br>f = 1950 MHz<br>f = 2400 MHz | dB<br>dB<br>dB | | 22.3<br>21.6<br>21.3 | |
| NF | Noise Figure, $Z_S$ = 50 Ohms | f = 1950 MHz | dB | | 4.0 | |
| $V_D$ | Device Voltage | | V | 4.4 | 4.9 | 5.4 |
| Rth,j-l | Thermal Resistance (junction - lead) | | ° C/W | | 254 | |

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## Absolute Maximum Ratings

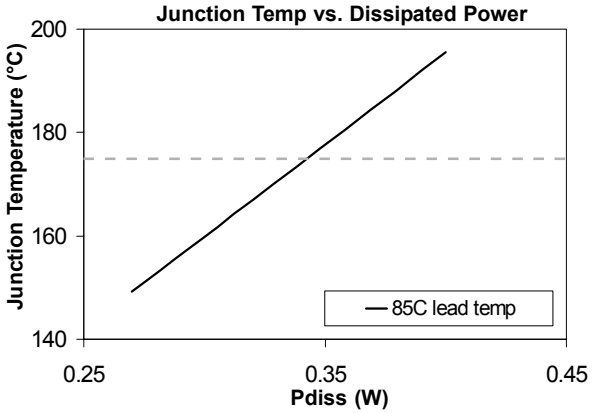
Operation of this device above any one of these parameters may cause permanent damage.

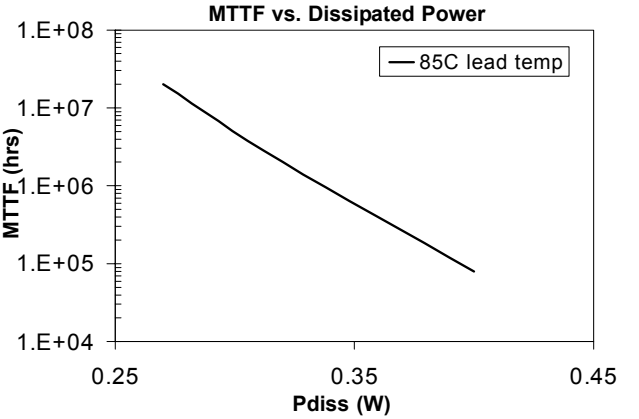
Bias Conditions should also satisfy the following expression: $I_D V_D$ (max) < ($T_J$ - $T_{OP}$)/Rth, j-l

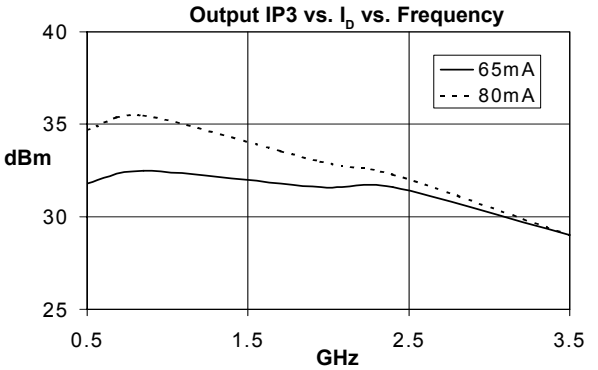
| Parameter | Value | Unit |
|---|---|---|
| Supply Current | 110 | mA |
| Operating Temperature | -40 to +85 | C |
| Maximum Input Power | 16 | dBm |
| Storage Temperature Range | -40 to +150 | C |
| Operating Junction Temperature | +175 | C |

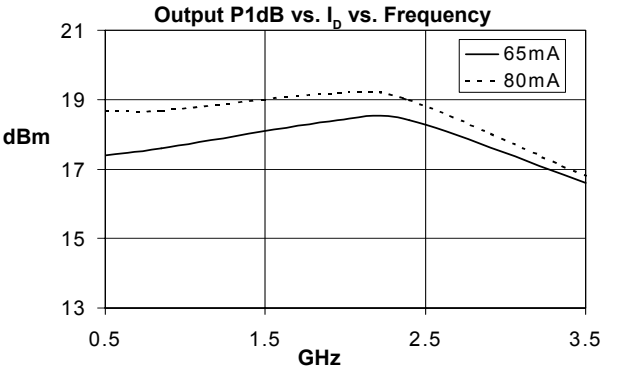
| Parameter | Typical 25°C | Unit | Test Condition ($I_D$ = 65 mA, unless otherwise noted) |
|---|---|---|---|
| **500 MHz** | | | |
| Gain | 19.8 | dB | |
| Noise Figure | 3.9 | dB | $Z_S$ = 50 Ohms |
| Output IP3 | 31.8 | dBm | Tone spacing = 1 MHz, Pout per tone = 0 dBm |
| Output P1dB | 17.4 | dBm | |
| Input Return Loss | 14.1 | dB | |
| Isolation | 22.5 | dB | |
| **850 MHz** | | | |
| Gain | 19.6 | dB | |
| Noise Figure | 4.0 | dB | $Z_S$ = 50 Ohms |
| Output IP3 | 32.5 | dBm | Tone spacing = 1 MHz, Pout per tone = 0 dBm |
| Output P1dB | 17.6 | dBm | |
| Input Return Loss | 15.6 | dB | |
| Isolation | 22.3 | dB | |
| **1950 MHz** | | | |
| Gain | 18.1 | dB | |
| Noise Figure | 4.0 | dB | $Z_S$ = 50 Ohms |
| Output IP3 | 31.6 | dBm | Tone spacing = 1 MHz, Pout per tone = 0 dBm |
| Output P1dB | 18.4 | dBm | |
| Input Return Loss | 16.6 | dB | |
| Isolation | 21.6 | dB | |
| **2400 MHz** | | | |
| Gain | 17.4 | dB | |
| Output IP3 | 31.6 | dBm | Tone spacing = 1 MHz, Pout per tone = 0 dBm |
| Output P1dB | 18.4 | dBm | |
| Input Return Loss | 16.8 | dB | |
| Isolation | 21.3 | dB | |

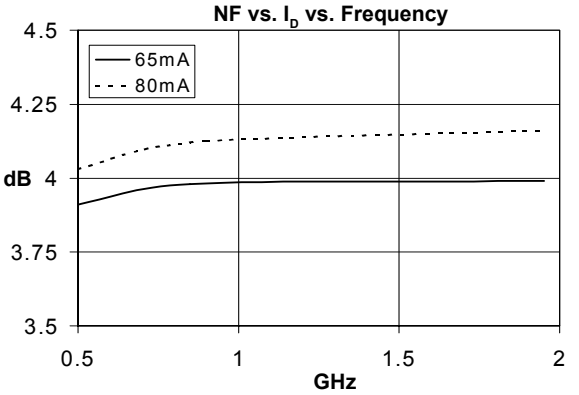
***NOTE:** While the SNA-586 can be operated at different bias currents, 65 mA is the recommended bias for lower junction temperature and longer life. This reflects typical operating conditions which we have found to be an optimal balance between high IP3 and MTTF. In general, MTTF is improved to more than 100,000 hours when biasing at 65 mA and operating up to 85°C ambient temperature.

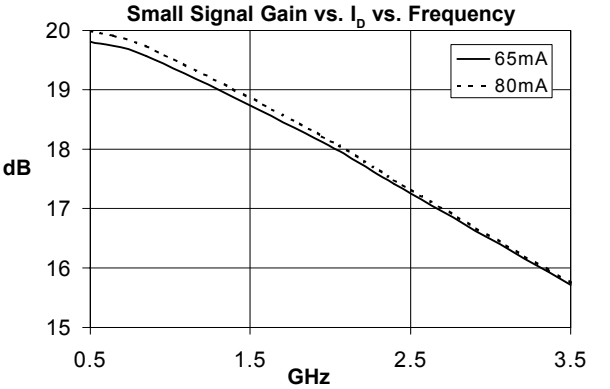

Junction Temp vs. Dissipated Power
Junction Temperature (°C)
200
180
160
140
0.25
0.35
0.45
Pdiss (W)
85C lead temp


MTTF vs. Dissipated Power
MTTF (hrs)
1.E+08
1.E+07
1.E+06
1.E+05
1.E+04
0.25
0.35
0.45
Pdiss (W)
85C lead temp


Output IP3 vs. I_D vs. Frequency
dBm
40
35
30
25
0.5
1.5
2.5
3.5
GHz
65mA
80mA


Output P1dB vs. I_D vs. Frequency
dBm
21
19
17
15
13
0.5
1.5
2.5
3.5
GHz
65mA
80mA

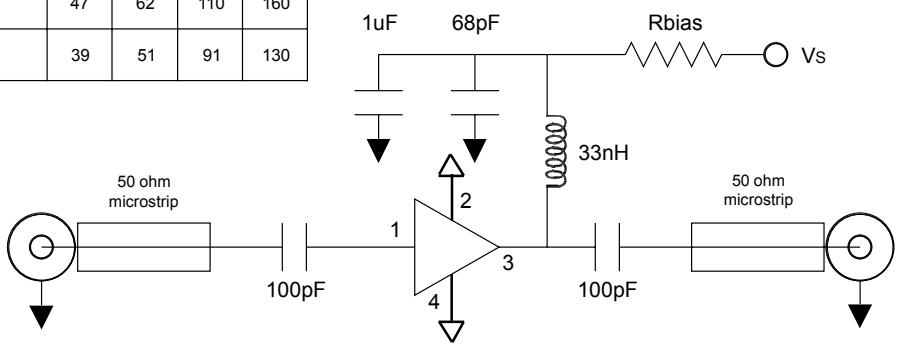

NF vs. I_D vs. Frequency
dB
4.5
4.25
4
3.75
3.5
0.5
1
1.5
2
GHz
65mA
80mA


Small Signal Gain vs. I_D vs. Frequency
dB
20
19
18
17
16
15
0.5
1.5
2.5
3.5
GHz
65mA
80mA

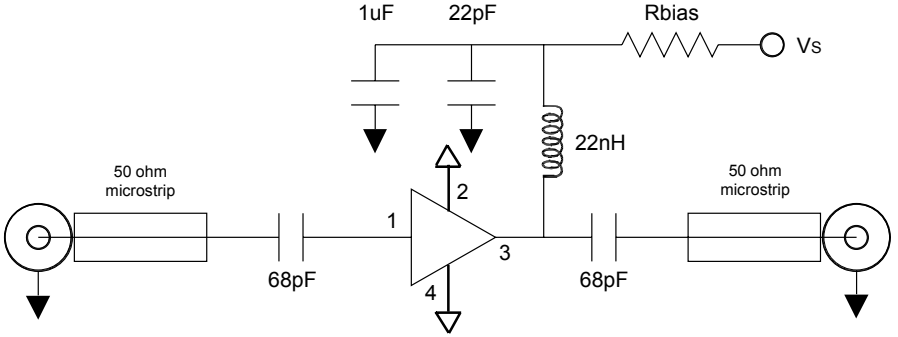
| Pin # | Function | Description |
|---|---|---|
| 1 | RF IN | RF input pin. This pin requires the use of an external DC blocking capacitor chosen for the frequency of operation. |
| 2 | GND | Connection to ground. Use via holes for best performance to reduce lead inductance. Place vias as close to ground 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. |

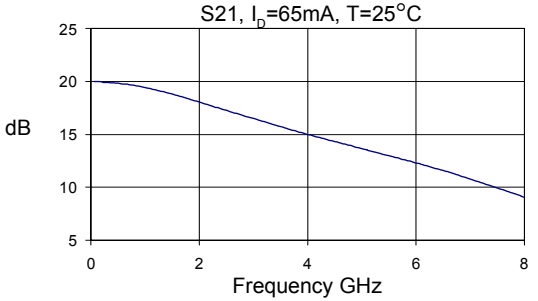
## Application Schematic for Operation at 850 MHz

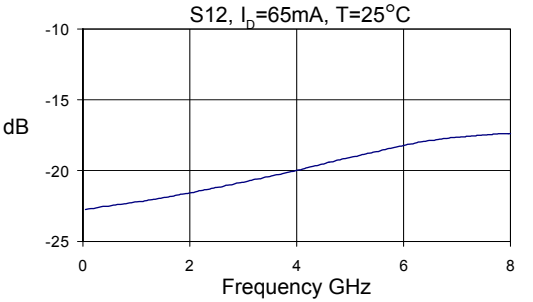
| Recommended Bias Resistor Values | | | | |
|---|---|---|---|---|
| Supply Voltage(Vs) | 8V | 9V | 12V | 15V |
| Rbias (Ohms) @ 65 mA | 47 | 62 | 110 | 160 |
| Rbias (Ohms) @ 80 mA | 39 | 51 | 91 | 130 |

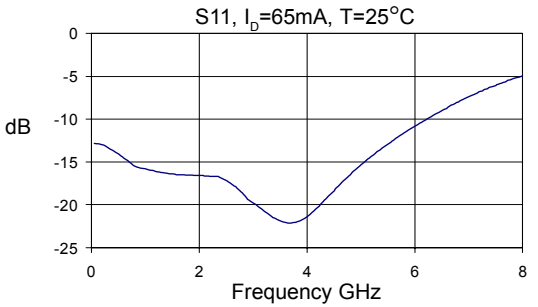


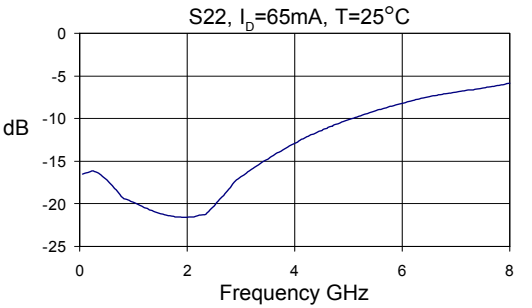

## Application Schematic for Operation at 1950 MHz

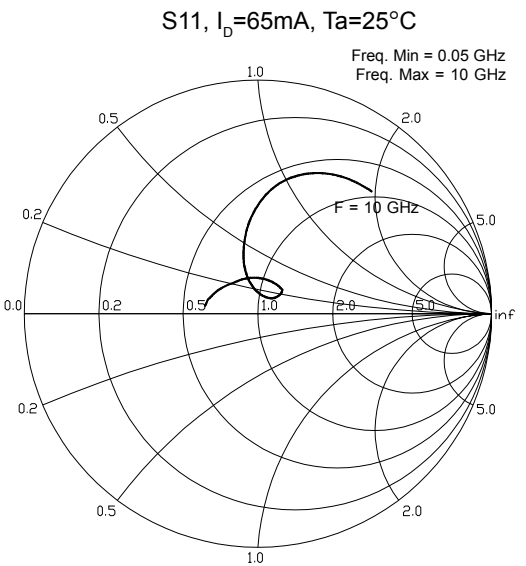


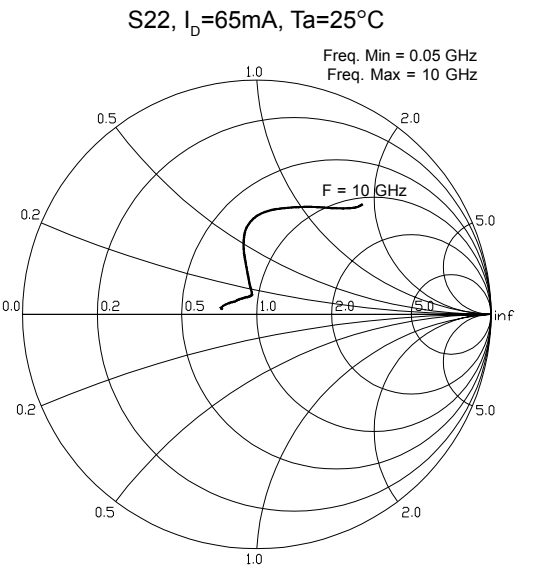

S21, $I_D$=65mA, T=25°C
dB
25
20
15
10
5
0
2
4
6
8
Frequency GHz


S12, $I_D$=65mA, T=25°C
dB
-10
-15
-20
-25
0
2
4
6
8
Frequency GHz

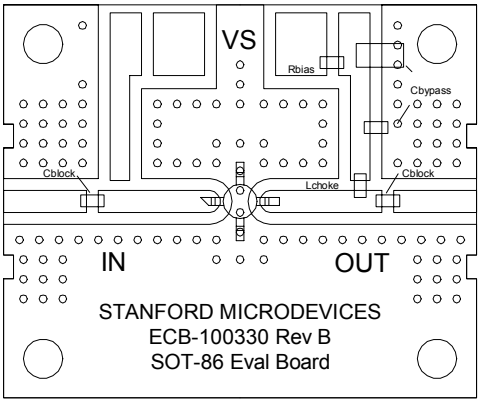

S11, $I_D$=65mA, T=25°C
dB
0
-5
-10
-15
-20
-25
0
2
4
6
8
Frequency GHz


S22, $I_D$=65mA, T=25°C
dB
0
-5
-10
-15
-20
-25
0
2
4
6
8
Frequency GHz


S11, $I_D$=65mA, Ta=25°C
Freq. Min = 0.05 GHz
Freq. Max = 10 GHz
F = 10 GHz
0.0
0.2
0.5
1.0
2.0
5.0
inf


S22, $I_D$=65mA, Ta=25°C
Freq. Min = 0.05 GHz
Freq. Max = 10 GHz
F = 10 GHz
0.0
0.2
0.5
1.0
2.0
5.0
inf

# SNA-586 DC-5GHz Cascadable MMIC Amplifier




**Evaluation Board Layout**

### Part Number Ordering Information

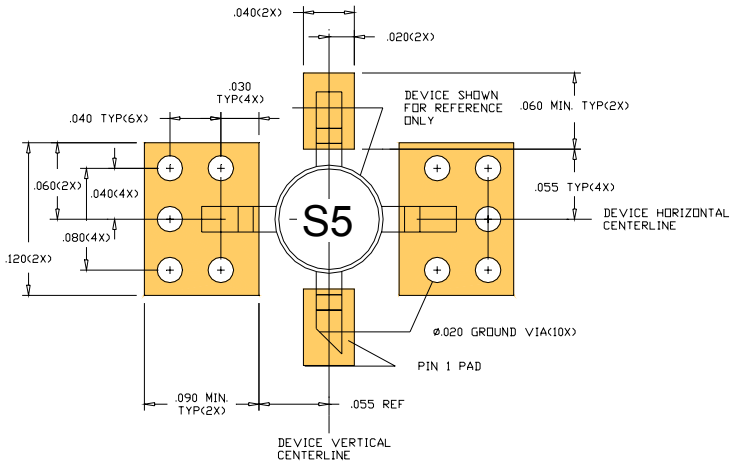
| Part Number | Reel Size | Devices/Reel |
|---|---|---|
| SNA-586 | 7" | 1000 |

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

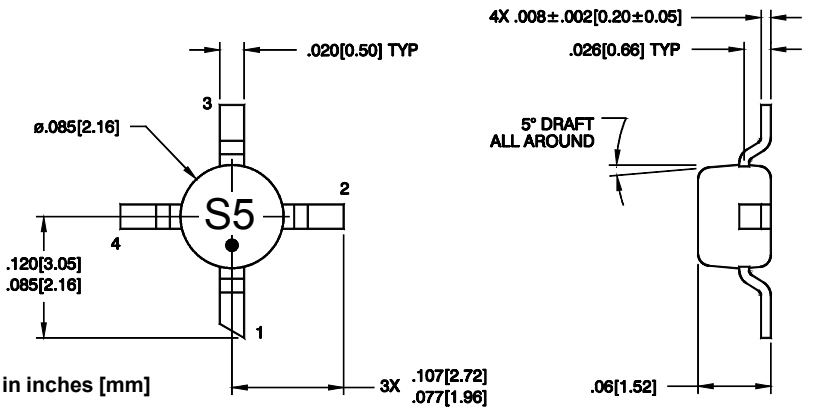
### Part Symbolization

The part will be symbolized with an "S5" designator on the top surface of the package.

### PCB Pad Layout




### Package Dimensions




**Dimensions are in inches [mm]**

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- Индивидуальный подход
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