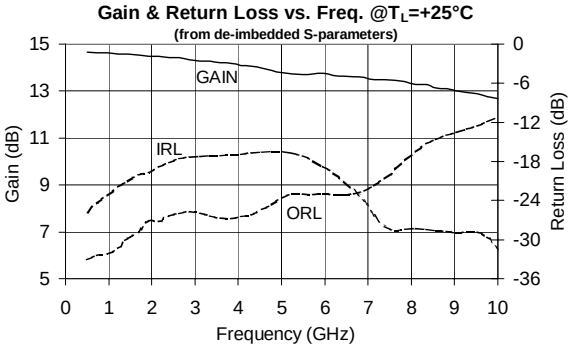
NGA-489

0.5-10 GHz, Cascadable InGaP/GaAs HBT MMIC Amplifier

Product Description

Stanford Microdevices' NGA-489 is a high performance InGaP/GaAs Heterojunction Bipolar Transistor MMIC Amplifier. A Darlington configuration designed with InGaP process technology provides broadband performance up to 10 GHz with excellent thermal perfomance. The heterojunction increases breakdown voltage and minimizes leakage current between junctions. Cancellation of emitter junction non-linearities results in higher suppression of intermodulation products. At 850 Mhz and 65mA , the NGA-489 typically provides +38.0 dBm output IP3, 14.8 dB of gain, and +17.2 dBm of 1dB compressed power using a single positive voltage supply. Only 2 DC-blocking capacitors, a bias resistor and an optional RF choke are required for operation.



Product Features

- **High Gain : 14.5 dB at 1950 MHz**
- **Cascadable 50 Ohm**
- **Patented InGaP Technology**
- **Operates From Single Supply**
- **Low Thermal Resistance Package**

Applications

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

Symbol	Parameter	Units	Frequency	Min.	Typ.	Max.
G	Small Signal Gain	dB dB dB	850 MHz 1950 MHz 2400 MHz	13.5	14.8 14.5 14.2	16.0
P_{1dB}	Output Power at 1dB Compression	dBm dBm	850 MHz 1950 MHz		17.2 17.0	
OIP_3	Output Third Order Intercept Point	dBm dBm	850 MHz 1950 MHz		38.0 37.0	
Bandwidth	Determined by Return Loss (<-10dB)	MHz			10000	
IRL	Input Return Loss	dB	1950 MHz		19.7	
ORL	Output Return Loss	dB	1950 MHz		27.0	
NF	Noise Figure	dB	1950 MHz		4.2	
V_D	Device Voltage	V		3.6	4.0	4.4
R_{Th}	Thermal Resistance	°C/W			145	

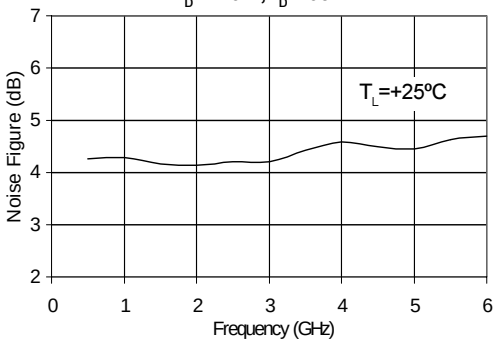
Test Conditions: V_S = 8 V, I_D = 65 mA Typ., OIP_3 Tone Spacing = 1 MHz, Pout per tone = 0 dBm; R_{BIAS} = 62 Ohms, T_L = 25ºC, $Z_S = Z_L$ = 50 Ohms

Typical RF Performance at Key Operating Frequencies

Symbol	Parameter	Unit	Frequency (MHz) 500	850	1950	2400	3500
G	Small Signal Gain	dB	14.6	14.8	14.5	14.4	14.2
OIP_3	Output Third Order Intercept Point	dBm	37.6	38.0	37.0	34.9	31.7
P_{1dB}	Output Power at 1dB Compression	dBm	17.2	17.2	17.0	16.7	15.8
IRL	Input Return Loss	dB	26.0	24.0	19.7	18.0	17.0
ORL	Output Return Loss	dB	33.0	32.0	27.0	26.0	27.0
S_{12}	Reverse Isolation	dB	18.3	18.3	18.6	18.7	19.0
NF	Noise Figure	dB	4.3	4.3	4.2	4.2	4.4

Test Conditions: V_S = 8 V, R_{BIAS} = 62 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

Noise Figure vs. Frequency
V_D= 4.0 V, I_D= 65 mA



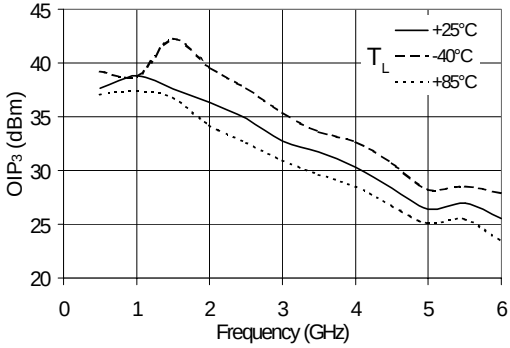
Absolute Maximum Ratings

Parameter	Absolute Limit
Max. Device Current (I_D)	100 mA
Max. Device Voltage (V_D)	6 V
Max. RF Input Power	+15 dBm
Max. Junction Temp. (T_J)	+150°C
Operating Temp. Range (T_L)	-40°C to +85°C
Max. Storage Temp.	+150°C

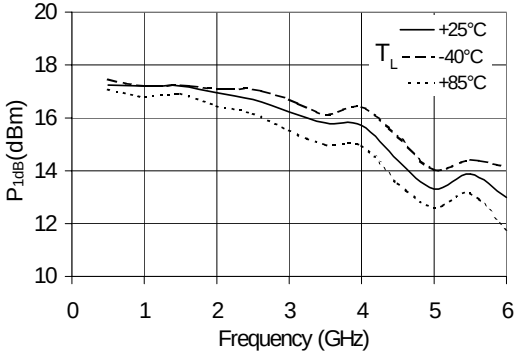
Operation of this device beyond any one of these limits may cause permanent damage.

Bias Conditions should also satisfy the following expression: $I_D V_D$ (max) < $(T_J - T_L)/R_{th}$

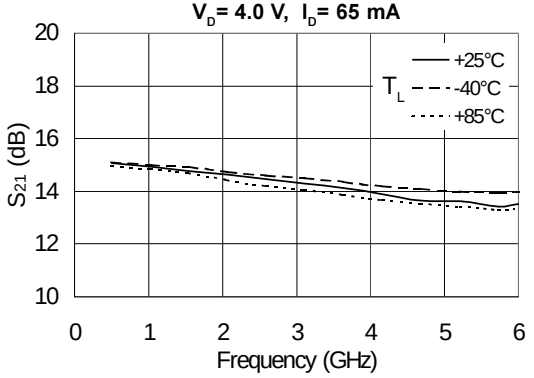
OIP_3 vs. Frequency
V_D= 4.0 V, I_D= 65 mA



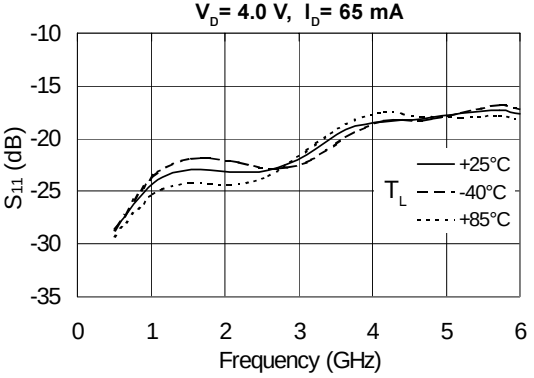
P_{1dB} vs. Frequency
V_D= 4.0 V, I_D= 65 mA



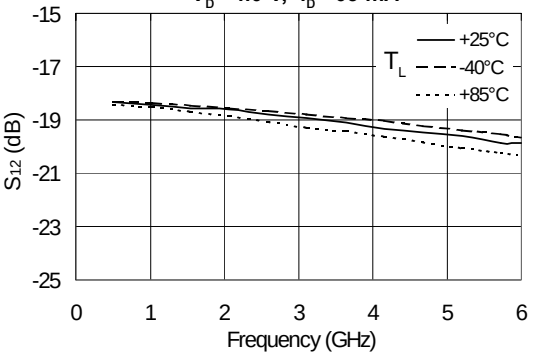
S_{21} vs. Frequency
V_D= 4.0 V, I_D= 65 mA



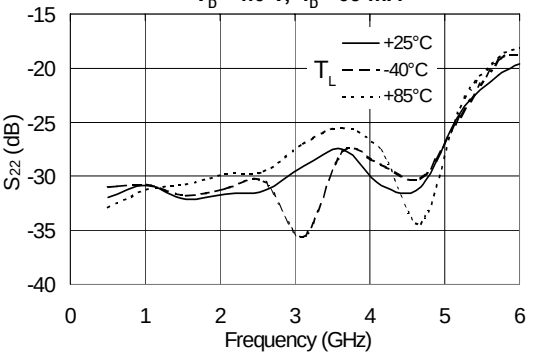
S_{11} vs. Frequency
V_D= 4.0 V, I_D= 65 mA



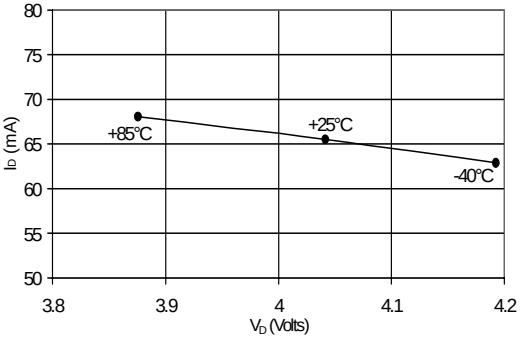
S_{12} vs. Frequency
V_D= 4.0 V, I_D= 65 mA



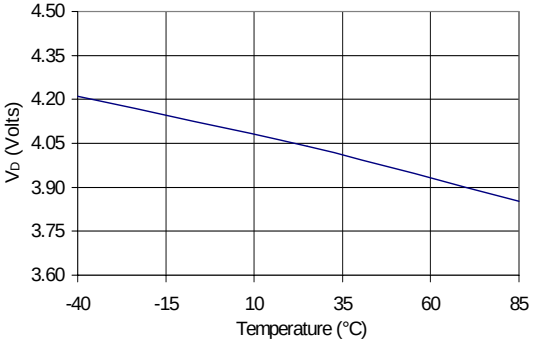
S_{22} vs. Frequency
V_D= 4.0 V, I_D= 65 mA



V_D vs. I_D over Temperature for fixed
V_S= 8 V, R_{BIAS}= 62 ohms *

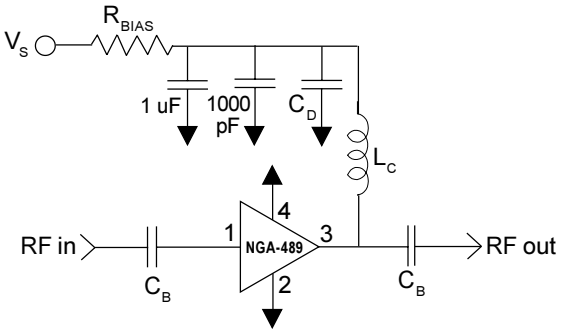


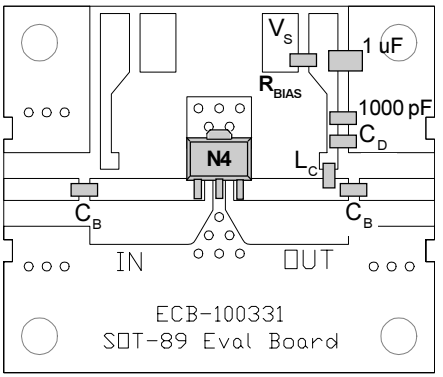
V_D vs. Temperature for Constant I_D = 65 mA



* Note: In the applications circuit on page 4, R_{BIAS} compensates for voltage and current variation over temperature.

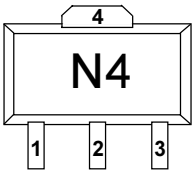
NGA-489 Basic Application Circuit





Part Identification Marking

The part will be marked with an "N4" designator on the top surface of the package.



For package dimensions, refer to outline drawing at www.stanfordmicro.com

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_B	220 pF	100 pF	68 pF	56 pF	39 pF
C_D	100 pF	68 pF	22 pF	22 pF	15 pF
L_C	68 nH	33 nH	22 nH	18 nH	15 nH

Recommended Bias Resistor Values for I_D=65mA				
Supply Voltage (V_S)	6 V	8 V	10 V	12 V
R_{BIAS}	30 Ω	62 Ω	91 Ω	120 Ω
Note: R_{BIAS} 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	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.
4	GND	Sames as Pin 2

Part Number Ordering Information

Part Number	Reel Size	Devices/Reel
NGA-489	7"	1000