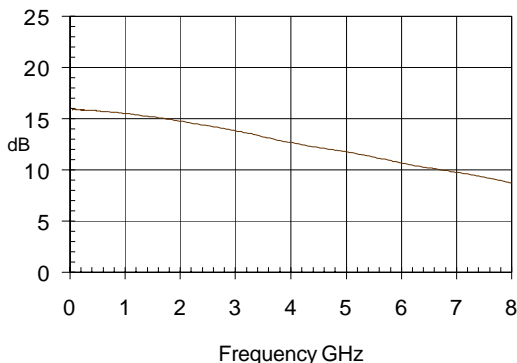


## Product Description

Stanford Microdevices' NGA-286 is a high performance Gallium Arsenide Heterojunction Bipolar Transistor MMIC Amplifier. Designed with InGaP process technology for improved reliability, 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.

Small Signal Gain vs. Frequency



## NGA-286

### DC-6000 MHz, Cascadable GaAs HBT MMIC Amplifier



### Product Features

- High Gain: 14.8dB at 1950MHz
- Cascadable 50 ohm: 1.3:1 VSWR
- Patented GaAs HBT Technology
- Operates from Single Supply
- Low Thermal Resistance Package
- Unconditionally Stable

### Applications

- Cellular, PCS, CDPD
- Wireless Data, SONET

Symbol	Parameters: Test Conditions: $Z_0 = 50 \text{ Ohms}$ , $I_D = 50 \text{ mA}$ , $T = 25^\circ\text{C}$		Units	Min.	Typ.	Max.
$P_{1dB}$	Output Power at 1dB Compression	f = 850 MHz f = 1950 MHz f = 2400 MHz	dBm dBm dBm		15.2 15.2 15.5	
$IP_3$	Third Order Intercept Point Power out per tone = 0 dBm	f = 850 MHz f = 1950 MHz f = 2400 MHz	dBm dBm dBm		32.0 31.4 30.9	
$S_{21}$	Small Signal Gain	f = 850 MHz f = 1950 MHz f = 2400 MHz	dB dB dB		15.6 14.8 14.4	
Bandwidth	3dB Bandwidth		MHz		3800	
$S_{11}$	Input VSWR	f = DC - 6000 MHz	-		1.3:1	
$S_{22}$	Output VSWR	f = DC - 6000 MHz	-		1.3:1	
$S_{12}$	Reverse Isolation	f = 850 MHz f = 1950 MHz f = 2400 MHz	dB dB dB		18.8 18.7 18.6	
NF	Noise Figure	f = 2000 MHz	dB		3.4	
$V_D$	Device Voltage		V		4.0	
$R_{th,j-l}$	Thermal Resistance (junction - lead)		$^\circ\text{C/W}$		120	

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### Absolute Maximum Ratings

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

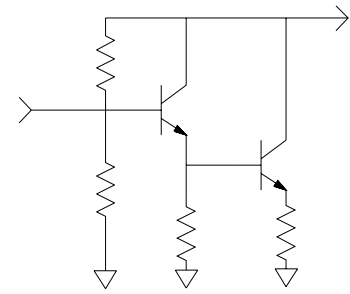
Bias Conditions should also satisfy the following expression:  $I_D V_D (\text{max}) < (T_J - T_{OP})/R_{\theta j-l}$

Parameter	Value	Unit
Supply Current	110	mA
Device Voltage	6.0	V
Operating Temperature	-40 to +85	°C
Maximum Input Power	+10	dBm
Storage Temperature Range	-40 to +150	°C
Operating Junction Temperature	+150	°C

### Key parameters, at typical operating frequencies:

Parameter	Typical 25°C	Unit	Test Condition
			( $I_b = 50\text{mA}$ , unless otherwise noted)
<b>500 MHz</b>			
Gain	15.8	dB	Tone spacing = 1 MHz, Pout per tone = 0dBm
Output IP3	31.8	dBm	
Output P1dB	15.3	dBm	
Input Return Loss	21.0	dB	
Isolation	18.8	dB	
<b>850 MHz</b>			
Gain	15.6	dB	Tone spacing = 1 MHz, Pout per tone = 0dBm
Output IP3	32.0	dBm	
Output P1dB	15.2	dBm	
Input Return Loss	20.0	dB	
Isolation	18.8	dB	
<b>1950 MHz</b>			
Gain	14.8	dB	Tone spacing = 1 MHz, Pout per tone = 0dBm
Output IP3	31.4	dBm	
Output P1dB	15.2	dBm	
Input Return Loss	17.1	dB	
Isolation	18.7	dB	
<b>2400 MHz</b>			
Gain	14.4	dB	Tone spacing = 1 MHz, Pout per tone = 0dBm
Output IP3	30.9	dBm	
Output P1dB	15.5	dBm	
Input Return Loss	16.0	dB	
Isolation	18.6	dB	

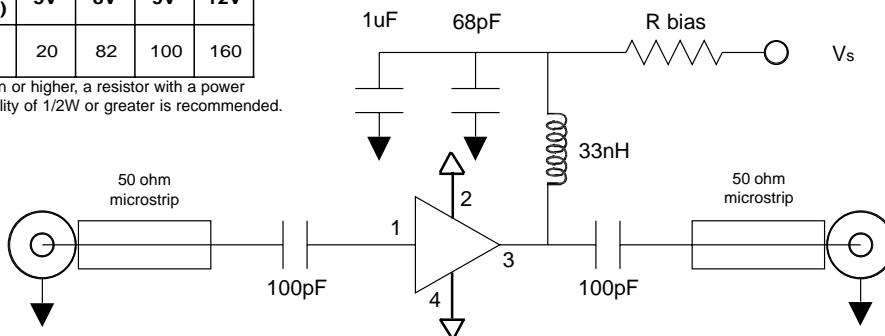
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Pin #	Function	Description	Device Schematic
1	RF IN	RF input pin. This pin requires the use of an external DC blocking capacitor chosen for the frequency of operation.	
2	GND	Connection to ground. For best performance use via holes (as close to ground 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.	
4	GND	Same as Pin 2.	

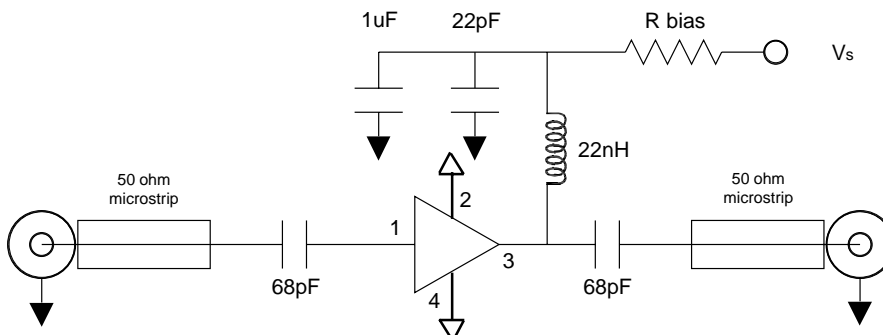
**Application Schematic for Operation at 850 MHz**

Recommended Bias Resistor Values				
Supply Voltage(Vs)	5V	8V	9V	12V
Rbias (Ohms)	20	82	100	160

For 9V operation or higher, a resistor with a power handling capability of 1/2W or greater is recommended.



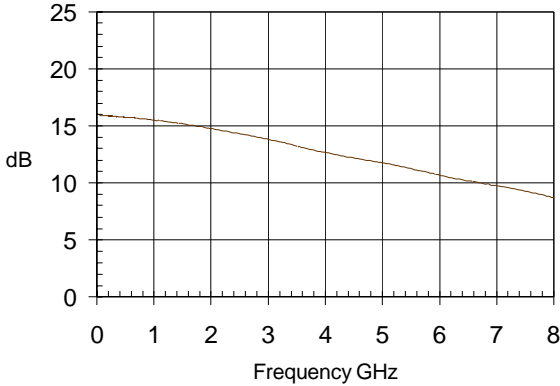
**Application Schematic for Operation at 1950 MHz**



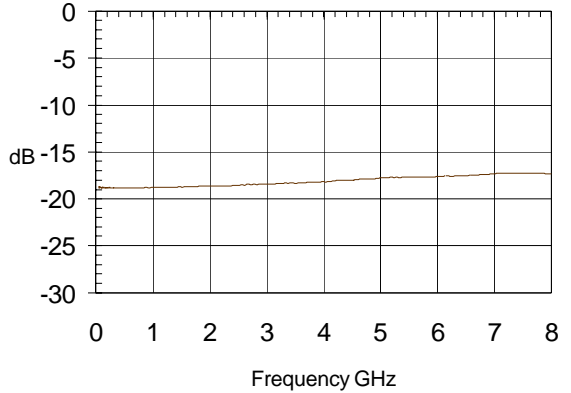
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### S-parameters over frequency, at 25°C

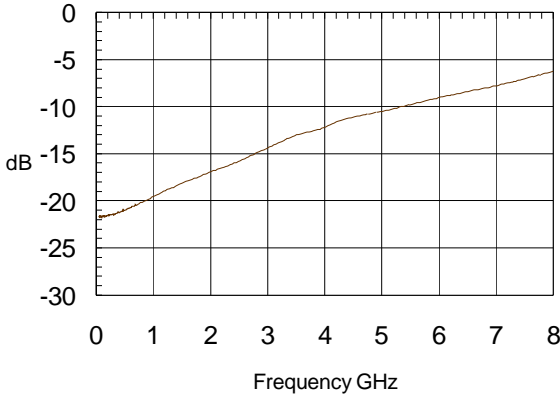
S21,  $I_D=50\text{mA}$ ,  $T=25^\circ\text{C}$



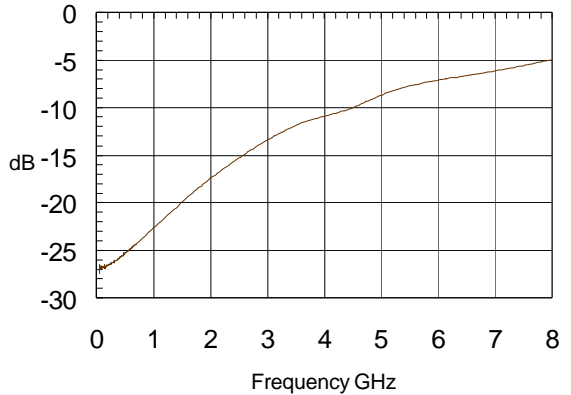
S12,  $I_D=50\text{mA}$ ,  $T=25^\circ\text{C}$



S11,  $I_D=50\text{mA}$ ,  $T=25^\circ\text{C}$



S22,  $I_D=50\text{mA}$ ,  $T=25^\circ\text{C}$



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**Typical S-Parameters,  $I_D = 50mA$  ( No external matching, de-embedded to device leads)**

Freq GHz	S11		S21			S12			S22	
	mag	Ang	dB	mag	Ang	dB	mag	Ang	mag	Ang
0.05	0.084	178	15.9	6.244	178	-18.7	0.117	0	0.045	-179
0.10	0.082	174	15.9	6.238	177	-18.8	0.115	0	0.046	-176
0.20	0.084	168	15.9	6.209	174	-18.8	0.115	-1	0.047	-174
0.30	0.086	162	15.8	6.190	170	-18.8	0.115	-1	0.049	-171
0.40	0.087	156	15.8	6.164	167	-18.8	0.115	-1	0.051	-169
0.50	0.089	150	15.8	6.140	164	-18.8	0.115	-2	0.054	-168
0.60	0.092	145	15.7	6.109	161	-18.8	0.115	-2	0.057	-167
0.70	0.095	140	15.7	6.079	158	-18.8	0.115	-2	0.061	-166
0.80	0.098	135	15.6	6.031	155	-18.8	0.115	-3	0.065	-166
0.90	0.101	132	15.6	6.004	152	-18.8	0.115	-3	0.068	-166
1.00	0.105	128	15.5	5.966	149	-18.8	0.115	-4	0.073	-166
1.10	0.109	124	15.5	5.924	146	-18.8	0.115	-4	0.078	-166
1.20	0.113	121	15.4	5.876	143	-18.8	0.115	-4	0.084	-166
1.30	0.116	118	15.3	5.845	140	-18.8	0.115	-5	0.088	-166
1.40	0.120	115	15.3	5.793	137	-18.8	0.115	-5	0.094	-168
1.50	0.124	112	15.2	5.727	134	-18.7	0.116	-5	0.101	-169
1.60	0.128	109	15.1	5.680	131	-18.7	0.116	-6	0.108	-171
1.70	0.131	107	15.0	5.646	129	-18.7	0.116	-6	0.113	-172
1.80	0.134	105	14.9	5.574	126	-18.7	0.116	-6	0.120	-175
1.90	0.138	104	14.8	5.520	123	-18.7	0.117	-7	0.127	-176
2.00	0.143	101	14.8	5.464	120	-18.6	0.117	-7	0.135	-179
2.20	0.150	99	14.6	5.358	115	-18.6	0.117	-8	0.149	176
2.40	0.159	97	14.4	5.234	109	-18.6	0.118	-9	0.165	170
2.60	0.167	96	14.2	5.142	104	-18.5	0.118	-9	0.180	166
2.80	0.180	94	14.0	5.023	99	-18.5	0.119	-10	0.198	160
3.00	0.191	94	13.8	4.906	94	-18.4	0.120	-11	0.213	156
3.20	0.203	93	13.6	4.808	89	-18.4	0.120	-12	0.229	151
3.40	0.216	92	13.4	4.659	84	-18.3	0.121	-13	0.247	146
3.60	0.226	91	13.1	4.525	79	-18.3	0.122	-14	0.261	143
3.80	0.235	90	12.9	4.394	74	-18.3	0.122	-15	0.275	138
4.00	0.244	91	12.7	4.307	70	-18.2	0.123	-15	0.284	135
4.50	0.278	88	12.2	4.068	59	-18.0	0.126	-18	0.315	130
5.00	0.298	87	11.8	3.872	47	-17.8	0.129	-21	0.367	124
5.50	0.326	86	11.2	3.650	36	-17.7	0.131	-25	0.412	115
6.00	0.352	83	10.7	3.422	26	-17.6	0.132	-28	0.440	108
6.50	0.380	80	10.2	3.222	16	-17.5	0.133	-31	0.466	101
7.00	0.408	76	9.7	3.068	6	-17.3	0.136	-35	0.495	93
7.50	0.443	73	9.3	2.914	-4	-17.3	0.137	-39	0.525	86
8.00	0.487	70	8.7	2.715	-14	-17.4	0.135	-44	0.564	79

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

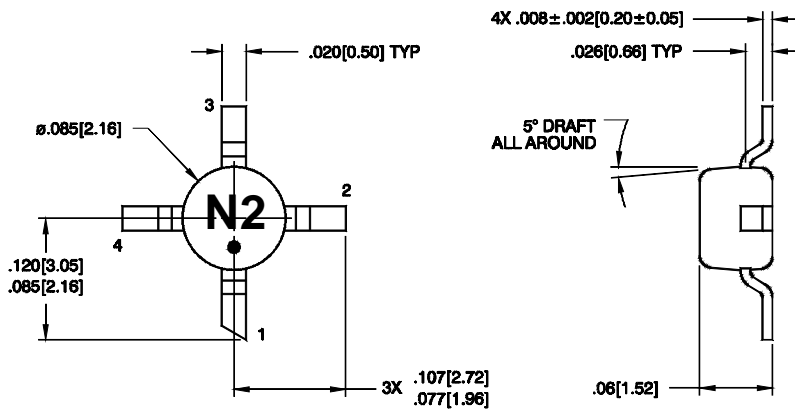
**Part Number Ordering Information**

Part Number	Reel Size	Devices/Reel
NGA-286	7"	1000

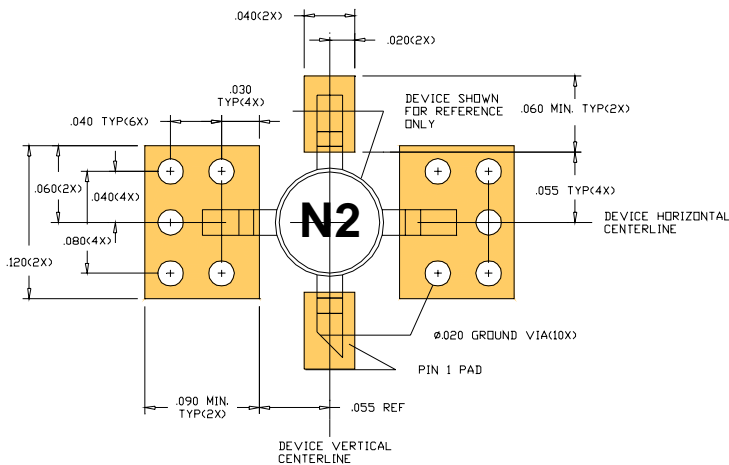
**Part Symbolization**

The part will be symbolized with a "N2" designator on the top surface of the package.

**Package Dimensions**



**PCB Pad Layout**

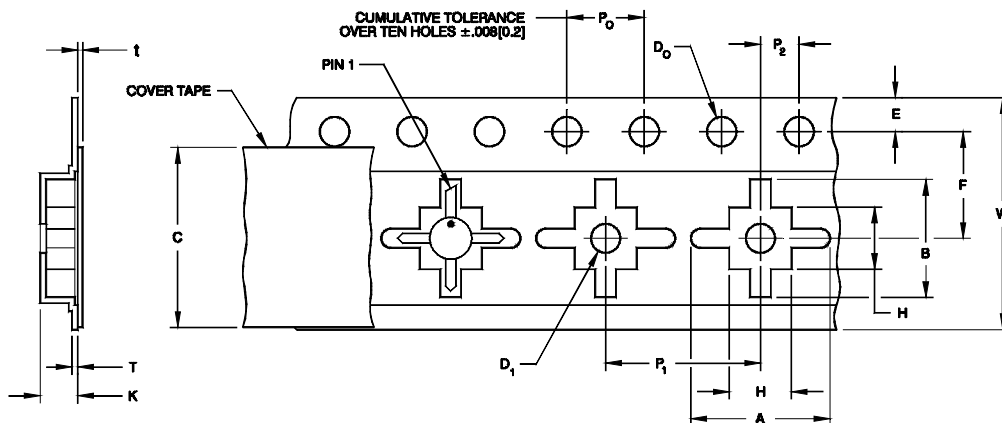


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## Component Tape and Reel Packaging

### Tape Dimensions

For 86 Outline



DESCRIPTION		SYMBOL	SIZE (MM)
<b>Cavity</b>	Length	A	6.10 ± 0.10
	Width	B	6.20 ± 0.10
	Socket	H	3.10 ± 0.10
	Depth	K	2.00 ± 0.10
	Pitch	P	8.00 ± 0.10
	Bottom Hole diameter	D <sub>1</sub>	1.50 min.
<b>Perforation</b>	Diameter	D <sub>0</sub>	1.50 ± 0.10
	Pitch	P <sub>0</sub>	4.00 ± 0.10
	Position	E	1.75 ± 0.10
<b>Cover Tape</b>	Width	C	9.10 ± 0.25
	Tape Thickness	t	0.05 ± 0.01
<b>Carrier Tape</b>	Width	W	12.00 ± 0.30
	Tape Thickness	T	0.30 ± 0.05
<b>Distance</b>	Cavity to Perforation (Width Direction)	F	5.50 ± 0.05
	Cavity to Perforation (Length Direction)	P <sub>2</sub>	2.00 ± 0.05

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