HEWLETT PACKARD

T-74-09-01

Silicon Bipolar Monolithic Amplifiers

Technical Data

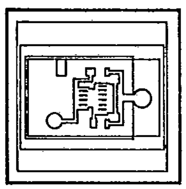
HPMA-2100
HPMA-2135

Features

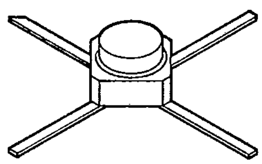
HPMA-2100
- **3 dB Bandwidth: DC to 0.6 GHz**
- **20.5 dB Gain at 1 GHz**
- **Unconditionally Stable (k > 1)**
- **Cascadable 50 Ω Gain Block**

HPMA-2135
- **3 dB Bandwidth: DC to 0.6 GHz**
- **20.5 dB Gain at 1 GHz**
- **Unconditionally Stable (k > 1)**
- **Cascadable 50 Ω Gain Block**
- **Metal/Ceramic Microstrip Package**

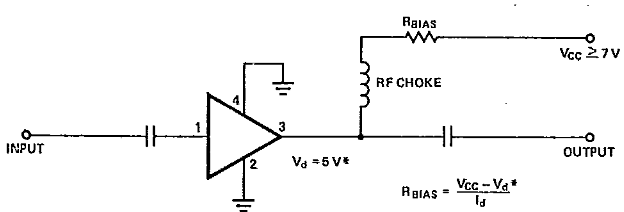
CHIP OUTLINE HPMA-2100



HPMA-2135



Typical Biasing Configuration



Description

The HPMA-2100 is a silicon monolithic single-stage feedback amplifier chip. Series and shunt feedback is used to achieve high uniformity from amplifier to amplifier. The device is ideally suited as a 50 ohm building block in narrow and broadband RF amplifier applications. Use of an optional external limiting resistor allows for biasing flexibility.

The device is manufactured using ion implantation and self-alignment techniques and has gold metallization and nitride passivation for high reliability.

The HPMA-2100 chip is also supplied as the HPMA-2135 in the HPAC-100X, a rugged metal/ceramic microstrip package.

Ordering Information

See page 16-2.

Absolute Maximum Ratings*

T_A = 25°C

Symbol	Parameter	Value	
		HPMA-2100	HPMA-2135[1,2]
I_d	Device Current	50 mA	60 mA
P_t	Total Device Dissipation	325 mW	325 mW
P_{in}	RF Input Power	+20 dBm	+20 dBm
T_j	Junction Temperature	200°C	200°C
T_{stg}	Storage Temperature	-65°C to +200°C	-65°C to +150°C

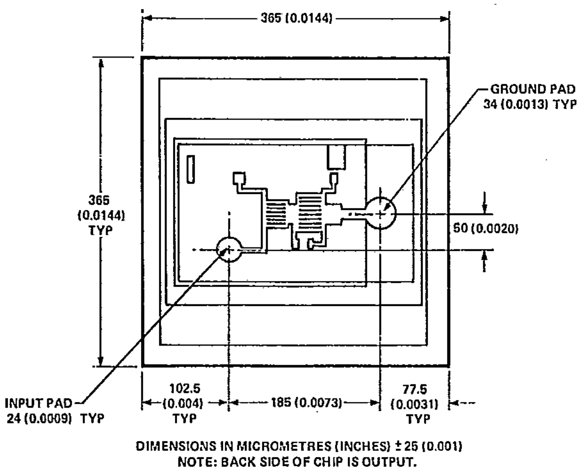
*Operation in excess of any one of these conditions may result in permanent damage to this device.

Notes:
1. Thermal resistance θ_{jc} = 90°C/W. Derate at 11.1 mW/°C for T_c > 171°C.
2. Maximum soldering temperature is 260°C for 5 seconds.

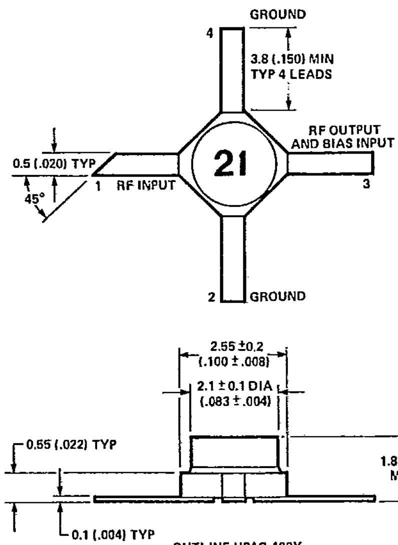
Electrical Specifications, T_A = 25°C

Symbol	Parameters/Test Conditions: I_d = 29 mA, Z_o = 50 Ω	Units	HPMA-2100			HPMA-2135		
			Min.	Typ.	Max.	Min.	Typ.	Max.
G	Small Signal Gain ($\|S_{21}\|^2$) f = 0.1 GHz f = 0.5 GHz f = 1.0 GHz	dB		25.0 23.2 19.7		23.5	25.0 23.2 19.7	26.5
ΔG	Gain Flatness f = 0.1 to 0.3 GHz	dB		±0.5			±0.5	±1.0
$f_{3\,dB}$	3 dB Bandwidth	GHz		0.6			0.6	
VSWR	Input VSWR f = 0.1 to 2.5 GHz			1.7:1			1.7:1	
	Output VSWR f = 0.1 to 2.5 GHz			1.2:1			1.2:1	
$P_{1\,dB}$	Output Power @ 1 dB Compression f = 1.0 GHz	dB		9.0			9.0	
NF	50 Ohm Noise Figure f = 1.0 GHz	dB		4.0			4.0	
IP_3	Third Order Intercept Point f = 1.0 GHz	dBm		23.0			23.0	
t_D	Group Delay f = 1.0 GHz	psec.		150			150	
V_d	Device Voltage	Volts	4.5	5.0	5.5	4.5	5.0	5.5
I_d	Normal Operating Current Range	mV		29			29	
dV/dT	Device Voltage Temperature Coefficient	mV/°C		-7.2			-7.2	

Note: The recommended operating current range for these devices is 20 mA to 40 mA. Typical performance as a function of current is shown on the following pages.



CHIP OUTLINE HPMA-2100



OUTLINE HPAC-100X
HPMA-2135

Recommended Die Attach and Bonding Procedures

Eutectic Die Attach at a stage temperature of 410 ± 10°C under an N_2 ambient. Chip should be lightly scrubbed using a tweezer or collet and eutectic should flow within five seconds.

Thermocompression Wire Bond at a stage temperature of 310 ± 10°C, using a tip force of 30 ± 5 grams with 0.7 or 1.0 mil gold wire. A one mil minimum wire clearance at the passivation edge is recommended. (Ultrasonic bonding is not recommended).

HPMA-2135 Typical Performance Parameters @ T_A = 25°C

Frequency (MHz)	Linear Phase Deviation (Deg.)	Relative Phase (Deg.)	Gain Deviation (dB)	Group Delay (ns)	Input VSWR	Output VSWR
100	-19.2	0	0	0.32	1.1	1.2
200	-13.0	-11.6	-0.37	0.32	1.1	1.2
300	-7.4	-22.4	-0.88	0.30	1.1	1.2
400	-3.2	-32.0	-1.50	0.27	1.2	1.2
500	0.1	-40.7	-2.19	0.24	1.2	1.1
600	2.6	-48.5	-2.91	0.22	1.2	1.1
700	4.3	-55.6	-3.63	0.20	1.2	1.1
800	5.3	-61.9	-4.35	0.18	1.2	1.1
900	6.2	-68.1	-5.08	0.17	1.3	1.1
1000	6.0	-73.3	-5.74	0.14	1.3	1.1
1500	1.4	-95.4	-8.74	0.11	1.4	1.1
2000	-8.0	-112.6	-11.22	0.09	1.6	1.1
2500	-22.3	-125.1	-13.20	0.08	1.7	1.2
3000	-35.8	-138.3	-15.01	0.07	1.8	1.4
3500	-50.7	-150.1	-16.59	0.06	1.9	1.5
4000	-66.4	-161.1	-17.99	0.06	2.0	1.6
4500	-82.8	-171.4	-19.23	0.06	2.0	1.8
5000	-99.5	-181.4	-20 33	0.06	2.1	1.9

T-74-09-01

HPMA-2135 Typical S-Parameters, Z_o = 50 Ω, T_A = 25°C, I_d = 29 mA

Frequency (MHz)	S_{11} Mag.	S_{11} Ang.	S_{21} dB	S_{21} Mag.	S_{21} Ang.	S_{12} dB	S_{12} Mag.	S_{12} Ang.	S_{22} Mag.	S_{22} Ang.
100	0.06	-10	25.5	18.72	168	-27.5	0.042	8	0.09	-18
200	0.06	-18	25.1	17.95	156	-27.1	0.044	15	0.09	-34
300	0.07	-29	24.6	16.91	145	-26.6	0.047	21	0.09	-50
400	0.07	-39	23.9	15.75	136	-26.0	0.050	26	0.08	-66
500	0.08	-48	23.3	14.55	127	-25.3	0.055	30	0.07	-80
600	0.09	-58	22.5	13.38	119	-24.6	0.059	33	0.06	-93
700	0.10	-66	21.8	12.33	112	-23.9	0.064	35	0.05	-106
800	0.11	-74	21.1	11.34	106	-23.2	0.069	36	0.04	-118
900	0.12	-82	20.4	10.44	100	-22.6	0.074	37	0.03	-133
1000	0.13	-88	19.7	9.67	94	-22.0	0.080	38	0.02	-146
1500	0.18	-116	16.7	6.84	72	-19.7	0.103	37	0.02	50
2000	0.22	-137	14.2	5.14	55	-18.2	0.123	33	0.07	5
2500	0.26	-155	12.3	4.10	43	-17.2	0.138	30	0.11	-17
3000	0.29	-172	10.4	3.32	29	-16.5	0.150	26	0.15	-37
3500	0.31	-173	8.9	2.77	18	-16.0	0.159	23	0.20	-55
4000	0.33	-159	7.5	2.36	7	-15.5	0.167	20	0.24	-70
4500	0.34	146	6.2	2.04	-4	-15.1	0.175	17	0.28	-85
5000	0.36	134	5.1	1.80	-14	-14.8	0.183	14	0.32	-98

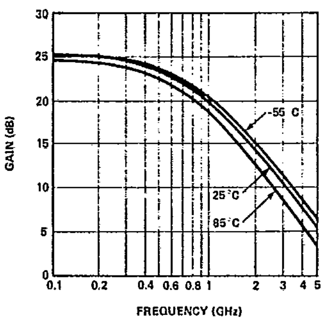


Figure 1. Typical Small Signal Gain vs. Frequency at Three Temperatures

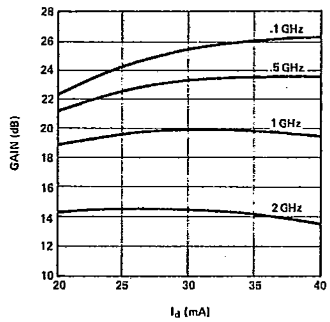


Figure 2. Typical Small Signal Gain vs. I_d at 25°C

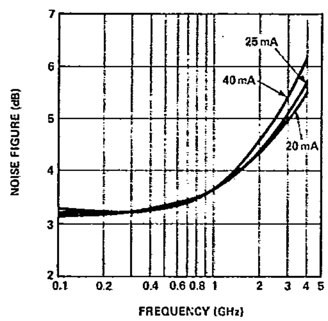


Figure 3. Typical Noise Figure vs. Frequency at 25°C

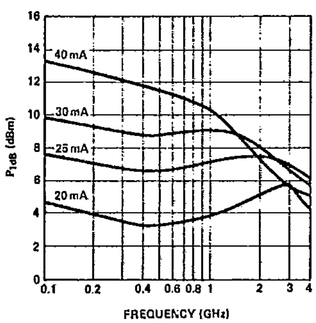


Figure 4. Typical P_{1dB} vs. Frequency at 25°C

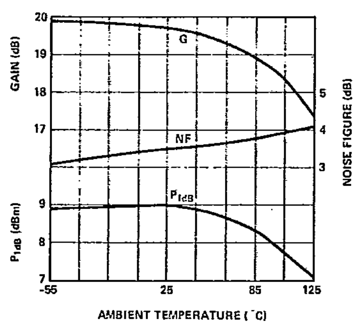


Figure 5. Small Signal Gain, Noise Figure and P_{1dB} vs. Temperature at 1 GHz and I_d = 29 mA

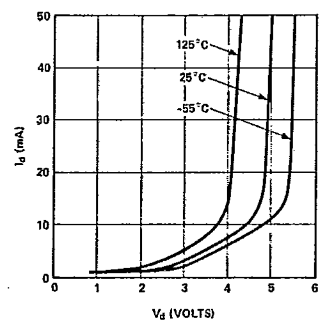


Figure 6. I_d vs. V_d at Three Temperatures