HEWLETT PACKARD

Silicon Bipolar Monolithic Amplifiers

Technical Data

HPMA-0200
HPMA-0211
HPMA-0235

Features

HPMA-0200

- **3 dB Bandwidth: DC to 2.7 GHz**
- **12.5 dB Gain at 1 GHz**
- **Unconditionally Stable (k > 1)**
- **Cascadable 50 Ω Gain Block**

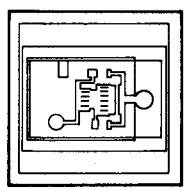
HPMA-0211

- **3 dB Bandwidth: DC to 2.4 GHz**
- **11.6 dB Gain at 1 GHz**
- **Unconditionally Stable (k > 1)**
- **Cascadable 50 Ω Gain Block**
- **Low Cost Surface Mount Plastic Package**
- **Tape and Reel Options Available**

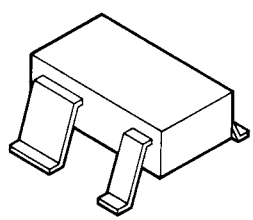
HPMA-0235

- **3 dB Bandwidth: DC to 2.7 GHz**
- **12 dB Gain at 1 GHz**
- **Unconditionally Stable (k > 1)**
- **Cascadable 50 Ω Gain Block**
- **Metal/Ceramic Microstrip Package**

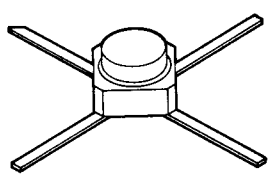
Chip Outline HPMA-0200



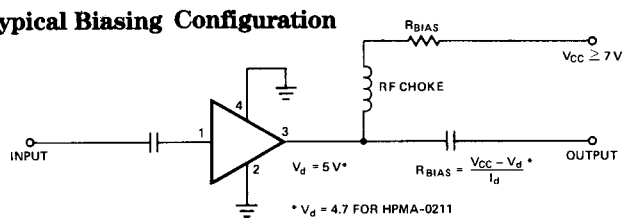
HPMA-0211



HPMA-0235



Typical Biasing Configuration



Description

The HPMA-0200 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-0200 chip is also supplied as the HPMA-0211 in a plastic surface mount package and as the HPMA-0235 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-0200	HPMA-0211[1,3]	HPMA-0235[2,3]
I_d	Device Current	60 mA	50 mA	60 mA
P_t	Total Device Dissipation	325 mW	250 mW	325 mW
P_{in}	RF Input Power	+20 dBm	+20 dBm	+20 dBm
T_j	Junction Temperature	200°C	150°C	200°C
T_{stg}	Storage Temperature	-65°C to +200°C	-65°C to +150°C	-65°C to +150°C

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

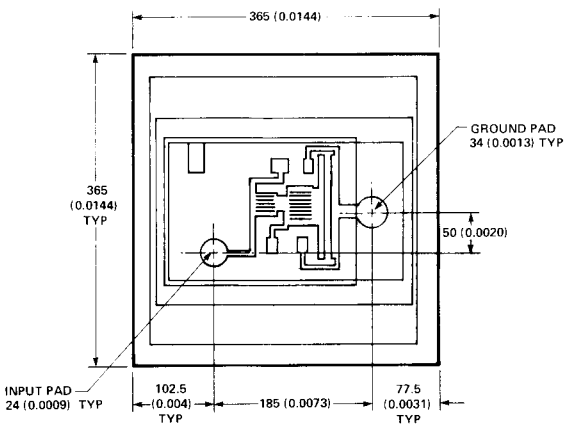
Notes:

1. A θ_{ja} of 500°C/W should be used for derating and junction temperature calculations: $T_j = (P_d \times \theta_{ja}) + T_A$
2. Thermal resistance θ_{jc} = 90°C/W. Derate at 11.1 mW/°C for T_c > 171°C.
3. Maximum soldering temperature is 260°C for 5 seconds.

Electrical Specifications, T_A = 25°C

Symbol	Parameters/Test Conditions: I_d = 25 mA, Z_o = 50 Ω	Units	HPMA-0200			HPMA-0211			HPMA-0235		
			Min.	Typ.	Max.	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		12.5 12.4 12.0		 10.0	12.5 12.0 11.5		11.5	12.5 12.4 12.0	13.5
ΔG	Gain Flatness f = 0.1 to 1.6 GHz	dB		±0.6	±1.0		±0.7			±0.6	±1.0
f_{3dB}	3 dB Bandwidth	GHz		2.7			2.4			2.7	
VSWR	Input VSWR f = 0.1 to 3.0 GHz			1.5:1			1.3:1			1.5:1	
	Output VSWR f = 0.1 to 3.0 GHz			1.5:1			1.5:1			1.5:1	
P_{1dB}	Output Power @ 1 dB Compression f = 1.0 GHz	dB		5.0			5.0			5.0	
NF	50 Ohm Noise Figure f = 1.0 GHz	dB		6.0			6.0			6.0	
IP_3	Third Order Intercept Point f = 1.0 GHz	dBm		20.0			18.0			20.0	
t_D	Group Delay f = 1.0 GHz	psec.		125			130			125	
V_d	Device Voltage	Volts	4.5	5.0	5.5	3.9	4.7	5.5	4.5	5.0	5.5
I_d	Normal Operating Current Range	mA		25			25			25	
dV/dT	Device Voltage Temperature Coefficient	mV/°C		-7.0			-6.5			-7.0	

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.



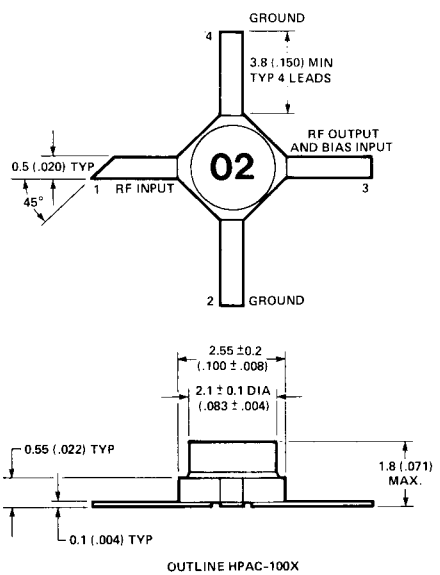
DIMENSIONS IN MICROMETRES (INCHES) ± 25 (0.001)
NOTE: BACK SIDE OF CHIP IS OUTPUT

CHIP OUTLINE HPMA-0200

Recommended Die Attach and Bonding Procedures

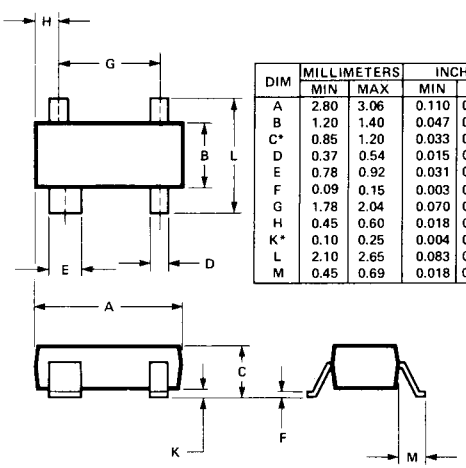
Eutectic Die Attach at a stage temperature of 410 ± 10°C under an N_2 ambient. Chip should be lightly scrubbed using a tweezer or collet and eutectic should flow within five seconds.

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).



OUTLINE HPAC-100X

HPMA-0235



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	2.80	3.06	0.110	0.120
B	1.20	1.40	0.047	0.055
C*	0.85	1.20	0.033	0.047
D	0.37	0.54	0.015	0.021
E	0.78	0.92	0.031	0.036
F	0.09	0.15	0.003	0.006
G	1.78	2.04	0.070	0.080
H	0.45	0.60	0.018	0.024
K*	0.10	0.25	0.004	0.010
L	2.10	2.65	0.083	0.104
M	0.45	0.69	0.018	0.027

Outline 143

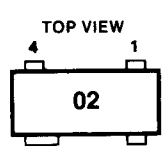
*LOW PROFILE also available,
with C min/max of 0.89/1.04 millimeters, 0.035/0.041 inches;
with K min/max of 0.013/0.10 millimeters, 0.0005/0.004 inches.

HPMA-0211

Package Characteristics

Lead Material ..... Alloy 42
Lead Finish ..... HPMA-0235: Tin, 100%
HPMA-0211: Tin-Lead, 60-40%
Min. Lead Strength (SOT only) ..... 2 pounds pull
Typical Package Inductance (SOT only) ..... 2 nH
Typical Package Capacitance ..... 0.08 pF (opposite leads)
(SOT only)

Package Lead Code Identification



Marking: White — Standard Profile
Low Profile (Suffix L)

HPMA-0211
Typical S-Parameters, $Z_o = 50\Omega$, $T_A = 25°C$, $I_d = 25$ mA

Frequency (MHz)	S_{11}		S_{21}			S_{12}			S_{22}	
	Mag.	Ang.	dB	Mag.	Ang.	dB	Mag.	Ang.	Mag.	Ang.
100	0.03	160	12.3	4.10	175	-18.2	0.123	1	0.18	-6
200	0.03	141	12.2	4.08	170	-18.2	0.123	3	0.18	-13
300	0.03	121	12.2	4.06	165	-18.1	0.124	4	0.18	-20
400	0.03	104	12.1	4.04	160	-18.1	0.125	5	0.18	-26
500	0.04	88	12.1	4.00	155	-18.0	0.126	6	0.18	-31
600	0.04	73	12.0	3.97	150	-17.9	0.127	7	0.18	-37
700	0.05	60	12.0	3.93	145	-17.8	0.129	8	0.18	-42
800	0.05	48	11.8	3.89	140	-17.7	0.131	9	0.18	-47
900	0.06	36	11.7	3.85	135	-17.5	0.133	10	0.18	-52
1000	0.07	26	11.6	3.80	131	-17.4	0.136	10	0.18	-56
1500	0.10	-17	10.9	3.52	108	-16.6	0.149	13	0.19	-70
2000	0.12	-51	10.1	3.20	87	-15.8	0.162	12	0.19	-76
2500	0.13	-82	9.2	2.89	70	-15.3	0.172	12	0.20	-75
3000	0.14	-118	8.2	2.58	52	-15.0	0.178	9	0.21	-74
3500	0.15	-159	7.2	2.30	36	-14.9	0.180	7	0.24	-76
4000	0.19	163	6.2	2.04	20	-14.9	0.180	6	0.27	-81
4500	0.25	136	5.2	1.81	6	-14.8	0.182	7	0.30	-90
5000	0.33	116	4.1	1.60	-7	-14.6	0.187	8	0.32	-101

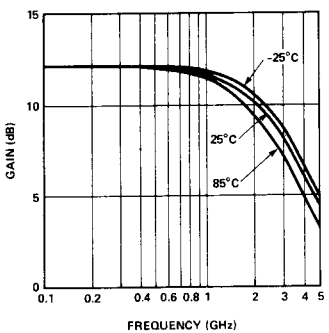


Figure 1. Typical Small Signal Gain vs. Frequency at Three Temperatures

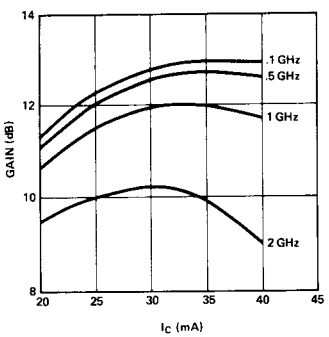


Figure 2. Typical Small Signal Gain vs. I_d at 25°C

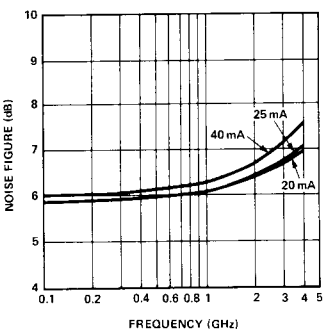


Figure 3. Typical Noise Figure vs. Frequency at 25°C

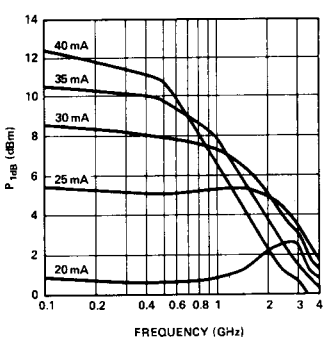


Figure 4. Typical P_{1dB} vs. Frequency at 25°C

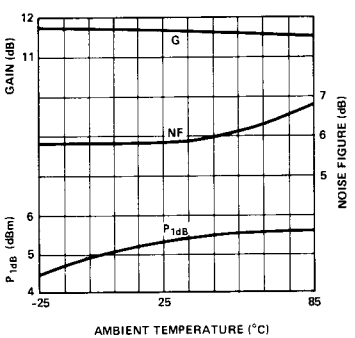


Figure 5. Small Signal Gain, Noise Figure and P_{1dB} vs. Temperature at 1 GHz and I_d = 25 mA

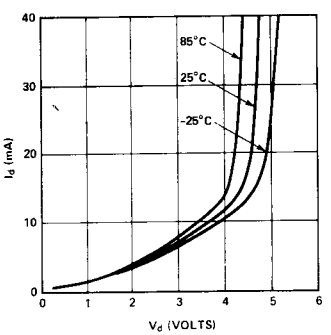


Figure 6. I_d vs V_d at Three Temperatures

HPMA-0235
Typical S-Parameters, $Z_o = 50\Omega$, $T_A = 25°C$, $I_d = 25$ mA

Frequency (MHz)	S_{11}		S_{21}			S_{12}			S_{22}	
	Mag.	Ang.	dB	Mag.	Ang.	dB	Mag.	Ang.	Mag.	Ang.
100	0.03	167	12.4	4.17	175	-18.3	0.122	1	0.18	-6
200	0.03	151	12.4	4.15	171	-18.3	0.122	2	0.18	-11
300	0.03	137	12.4	4.15	166	-18.2	0.123	2	0.18	-17
400	0.03	122	12.3	4.14	162	-18.2	0.123	3	0.17	-22
500	0.04	106	12.3	4.12	157	-18.1	0.124	4	0.17	-27
600	0.04	91	12.3	4.11	153	-18.1	0.125	5	0.17	-32
700	0.04	76	12.2	4.09	148	-18.0	0.127	5	0.17	-36
800	0.04	62	12.2	4.07	144	-17.9	0.128	6	0.17	-41
900	0.04	48	12.1	4.04	139	-17.8	0.129	6	0.17	-46
1000	0.05	35	12.1	4.01	134	-17.7	0.131	7	0.17	-50
1500	0.08	-20	11.7	3.82	112	-17.0	0.141	7	0.16	-66
2000	0.12	-61	11.0	3.55	90	-16.4	0.151	6	0.16	-75
2500	0.16	-93	10.2	3.23	72	-16.0	0.158	5	0.17	-76
3000	0.20	-121	9.2	2.88	53	-15.9	0.161	2	0.20	-80
3500	0.23	-145	8.1	2.53	36	-15.9	0.160	-1	0.24	-87
4000	0.26	-166	6.9	2.20	20	-16.0	0.158	-2	0.29	-96
4500	0.29	175	5.7	1.92	6	-16.1	0.156	-2	0.35	-107
5000	0.32	159	4.6	1.70	-7	-16.1	0.157	-1	0.40	-118

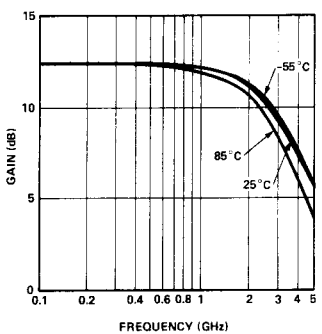


Figure 1. Typical Small Signal Gain vs. Frequency at Three Temperatures

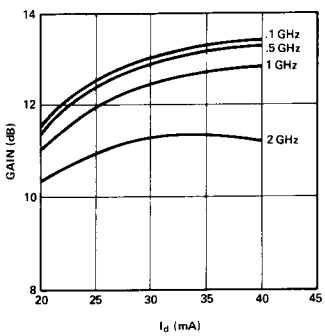


Figure 2. Typical Small Signal Gain vs. I_d at 25°C

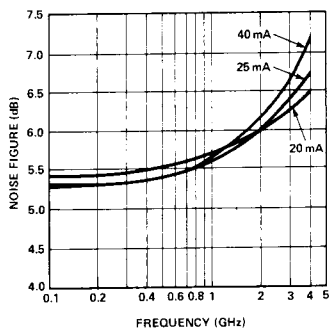


Figure 3. Typical Noise Figure vs. Frequency at 25°C

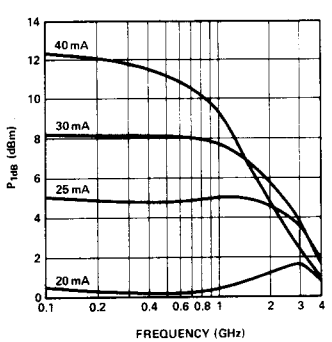


Figure 4. Typical P_{1dB} vs. Frequency at 25°C

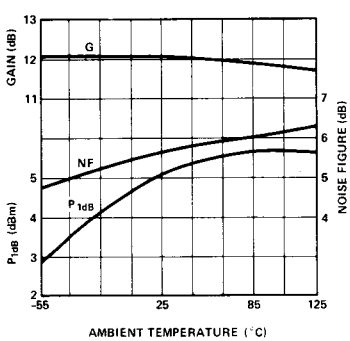


Figure 5. Small Signal Gain, Noise Figure and P_{1dB} vs. Temperature at 1 GHz and I_d = 25 mA

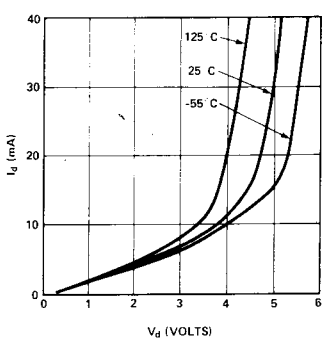


Figure 6. I_d vs V_d at Three Temperatures

HPMA-0211
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	-1.7	0	0	0.14	1.1	1.4
200	-1.4	-5	-0.04	0.14	1.1	1.4
300	-0.8	-10	-0.09	0.14	1.1	1.4
400	-0.5	-15	-0.13	0.14	1.1	1.4
500	-0.3	-20	-0.20	0.14	1.1	1.4
600	0.0	-25	-0.27	0.14	1.1	1.4
700	0.3	-30	-0.36	0.14	1.1	1.4
800	0.4	-35	-0.45	0.13	1.1	1.4
900	0.9	-40	-0.54	0.13	1.1	1.5
1000	0.9	-44	-0.66	0.13	1.1	1.5
1500	0.4	-67	-1.33	0.12	1.2	1.5
2000	-1.5	-88	-2.16	0.11	1.3	1.5
2500	-7.9	-105	-3.03	0.10	1.3	1.5
3000	-13.1	-123	-4.02	0.10	1.3	1.5
3500	-19.9	-139	-5.03	0.09	1.3	1.6
4000	-27.8	-155	-6.06	0.08	1.5	1.7
4500	-37.0	-169	-7.11	0.07	1.7	1.8
5000	-47.3	-181	-8.18	0.07	2.0	1.9

HPMA-0235
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	-0.4	0	0	0.13	1.1	1.4
200	-0.3	-4.6	-0.02	0.13	1.1	1.4
300	-0.1	-9.2	-0.04	0.13	1.1	1.4
400	-0.1	-13.7	-0.06	0.13	1.1	1.4
500	-0.1	-18.2	-0.09	0.13	1.1	1.4
600	-0.1	-22.8	-0.13	0.13	1.1	1.4
700	0	-27.3	-0.16	0.13	1.1	1.4
800	-0.1	-31.8	-0.21	0.13	1.1	1.4
900	0.3	-36.7	-0.27	0.14	1.1	1.4
1000	0.2	-41.0	-0.32	0.12	1.1	1.4
1500	0.2	-63.5	-0.75	0.13	1.2	1.4
2000	-0.5	-85.3	-1.39	0.12	1.3	1.4
2500	-4.9	-103.3	-2.20	0.11	1.4	1.4
3000	-8.2	-122.5	-3.22	0.11	1.5	1.5
3500	-13.3	-139.9	-4.34	0.09	1.6	1.6
4000	-20.2	-155.5	-5.54	0.08	1.7	1.8
4500	-28.9	-169.3	-6.72	0.07	1.8	2.1
5000	-38.7	-181.9	-7.79	0.07	1.9	2.3