HEWLETT PACKARD

Silicon Bipolar Monolithic Amplifiers

Technical Data

HPMA-0400
HPMA-0435

Features

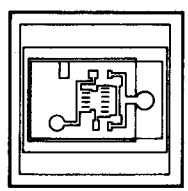
HPMA-0400

- **3 dB Bandwidth: DC to 4.2 GHz**
- **8.3 dB Gain at 1 GHz**
- **Unconditionally Stable (k > 1)**
- **Cascadable 50 Ω Gain Block**

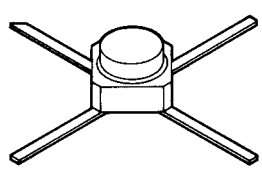
HPMA-0435

- **3 dB Bandwidth: DC to 3.8 GHz**
- **8.3 dB Gain at 1 GHz**
- **Unconditionally Stable (k > 1)**
- **Cascadable 50 Ω Gain Block**
- **Metal/Ceramic Microstrip Package**

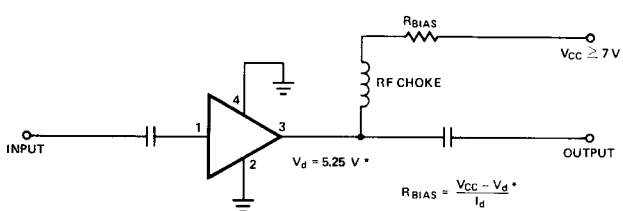
CHIP OUTLINE HPMA-0400



HPMA-0435



Typical Biasing Configuration



Description

The HPMA-0400 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-0400 is also supplied as the HPMA-0435 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-0400	HPMA-0435[1,2]
I_d	Device Current	100 mA	100 mA
P_t	Total Device Dissipation	575 mW	575 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

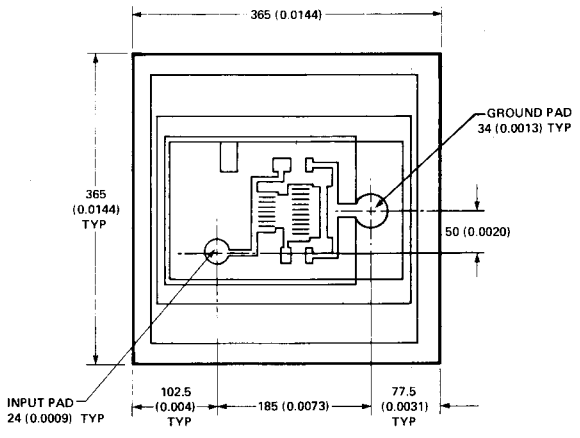
*Operation in excess of any one of these conditions may result in permanent damage to this device.

Notes:
1. Thermal resistance θ_{jc} = 140°C/W. Derate at 7.1 mW/°C for T_c > 108°C.
2. Maximum soldering temperature is 260°C for 5 seconds.

Electrical Specifications, T_A = 25°C

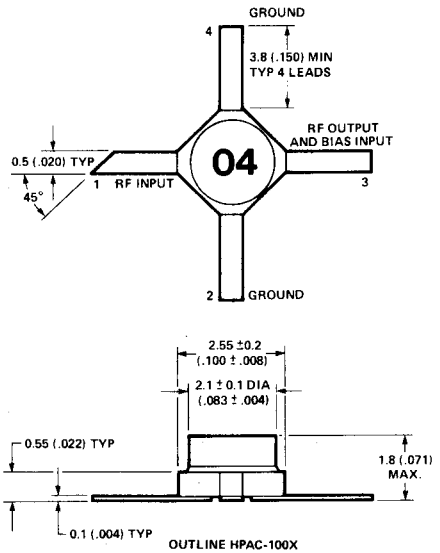
Symbol	Parameters/Test Conditions: I_d = 50 mA, Z_0 = 50 Ω		Units	HPMA-0400			HPMA-0435		
				Min.	Typ.	Max.	Min.	Typ.	Max.
G	Small Signal Gain ($\|S_{21}\|^2$)	f = 0.1 GHz f = 0.5 GHz f = 1.0 GHz	dB		8.5 8.5 8.3		7.5	8.5 8.5 8.3	9.5
ΔG	Gain Flatness	f = 0.1 to 2.5 GHz	dB		±0.6			±0.6	±1.0
$f_{3\,dB}$	3 dB Bandwidth		GHz		4.2			4.2	
VSWR	Input VSWR	f = 0.1 to 3.0 GHz			1.5:1			1.5:1	
	Output VSWR	f = 0.1 to 3.0 GHz			1.5:1			1.5:1	
$P_{1\,dB}$	Output Power @ 1 dB Compression	f = 1.0 GHz	dB		12.5			12.5	
NF	50 Ohm Noise Figure	f = 1.0 GHz	dB		6.5			6.5	
IP_3	Third Order Intercept Point	f = 1.0 GHz	dBm		25.0			25.0	
t_D	Group Delay	f = 1.0 GHz	psec.		105			105	
V_d	Device Voltage		Volts	4.75	5.25	5.75	4.75	5.25	5.75
I_d	Normal Operating Current Range		mA		50			50	
dV/dT	Device Voltage Temperature Coefficient		mV/°C		-6.3			-6.3	

Note: The recommended operating current range for these devices is 30 mA to 70 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-0400



HPMA-0435

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-0435 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	0.5	0	0	0.11	1.1	1.5
200	0.4	-3.8	-0.02	0.11	1.1	1.5
300	0.4	-7.7	-0.01	0.11	1.1	1.5
400	0.2	-11.4	-0.01	0.10	1.1	1.5
500	0	-15.1	0	0.10	1.1	1.5
600	-0.1	-19.0	0.01	0.11	1.1	1.5
700	-0.2	-22.8	0.03	0.11	1.1	1.5
800	-0.3	-26.5	0.04	0.11	1.1	1.5
900	-0.1	-30.7	0.05	0.12	1.1	1.5
1000	-0.3	-34.4	0.07	0.10	1.0	1.5
1500	-0.1	-54.2	0.11	0.11	1.0	1.5
2000	0.6	-74.4	0.04	0.12	1.1	1.5
2500	-1.4	-92.0	-0.21	0.11	1.3	1.5
3000	-1.3	-111.7	-0.73	0.11	1.4	1.5
3500	-2.5	-130.1	-1.49	0.10	1.6	1.5
4000	-5.6	-146.5	-2.42	0.09	1.8	1.6
4500	-10.8	-161.0	-3.39	0.08	2.0	1.7
5000	-17.4	-174.0	-4.31	0.07	2.2	1.8

HPMA-0435 Typical S-Parameters, $Z_o = 50\Omega$, $T_A = 25°C$, $I_d = 50$ mA

Frequency (MHz)	S_{11}		S_{21}			S_{12}			S_{22}	
	Mag.	Ang.	dB	Mag.	Ang.	dB	Mag.	Ang.	Mag.	Ang.
100	0.06	177	8.2	2.56	176	-16.0	0.159	0	0.18	-6
200	0.06	173	8.2	2.55	172	-16.0	0.159	0	0.19	-11
300	0.06	170	8.2	2.56	168	-16.0	0.159	1	0.19	-17
400	0.05	166	8.2	2.56	164	-16.0	0.159	1	0.19	-22
500	0.05	162	8.2	2.56	160	-16.0	0.160	1	0.19	-28
600	0.04	160	8.2	2.56	156	-15.9	0.160	1	0.19	-33
700	0.04	157	8.3	2.56	152	-15.9	0.161	2	0.19	-38
800	0.03	155	8.3	2.56	148	-15.8	0.161	2	0.20	-42
900	0.03	154	8.3	2.57	144	-15.8	0.163	2	0.20	-48
1000	0.02	157	8.3	2.57	140	-15.7	0.163	2	0.20	-52
1500	0.03	-91	8.3	2.57	120	-15.4	0.170	2	0.21	-72
2000	0.09	-99	8.3	2.54	99	-14.9	0.177	1	0.22	-88
2500	0.15	-118	8.0	2.46	81	-14.5	0.183	1	0.22	-97
3000	0.21	-138	7.5	2.31	60	-14.2	0.187	-2	0.23	-105
3500	0.27	-158	6.7	2.11	41	-14.0	0.187	-5	0.25	-110
4000	0.31	-176	5.8	1.89	24	-14.0	0.186	-7	0.28	-116
4500	0.34	168	4.8	1.68	9	-14.0	0.183	-8	0.32	-123
5000	0.37	153	3.9	1.50	-5	-13.9	0.183	-9	0.37	-131

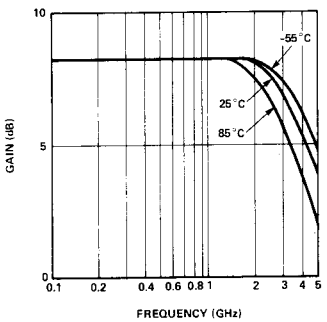


Figure 1. Typical Small Signal Gain vs. Frequency at Three Temperatures

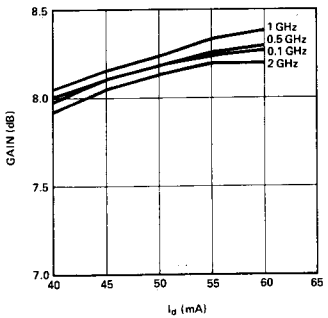


Figure 2. Typical Small Signal Gain vs. I_d at 25°C

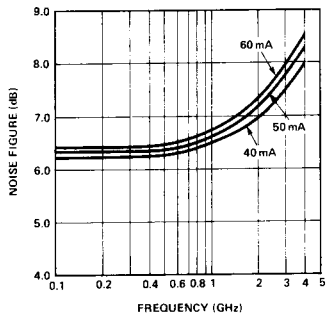


Figure 3. Typical Noise Figure vs. Frequency at 25°C

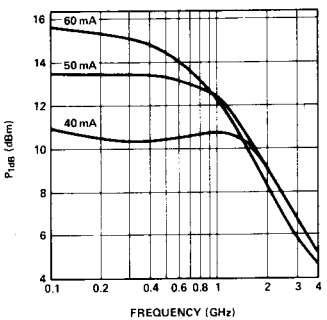


Figure 4. Typical P_{1dB} vs. Frequency at 25°C

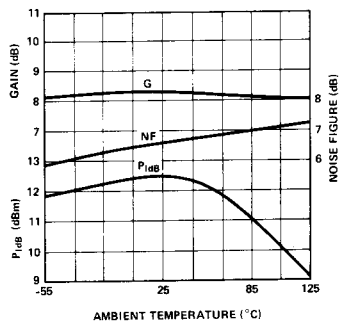


Figure 5. Small Signal Gain, Noise Figure and P_{1dB} vs. Temperature at 1 GHz and I_d = 50 mA

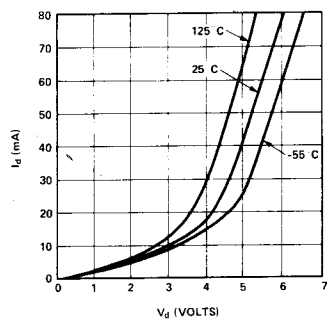


Figure 6. I_d vs V_d at Three Temperatures