HEWLETT PACKARD

Silicon Bipolar Monolithic Amplifiers

Technical Data

HPMA-2111
HPMA-2185
HPMA-2186

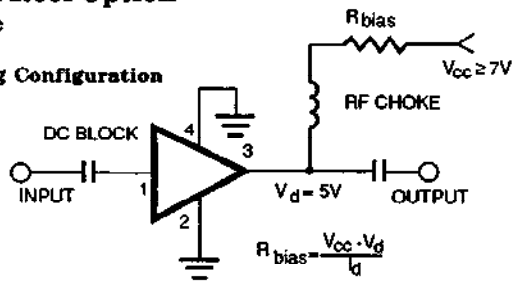
Features

HPMA-2111
- 3 dB Bandwidth: DC to 0.5 GHz
- 18.5 dB Gain Typical at 1 GHz
- Cascadable 50 Ohm Gain Block
- Low Cost Surface Mount Plastic Package
- Tape and Reel Option Available

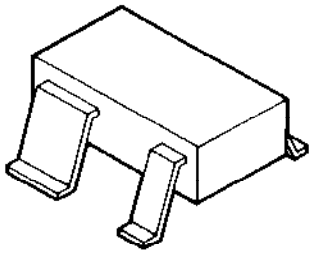
HPMA-2185
- 3 dB Bandwidth: DC to 0.5 GHz
- 18.6 dB Gain Typical at 1 GHz
- Cascadable 50 Ohm Gain Block

HPMA-2186
- 3 dB Bandwidth: DC to 0.5 GHz
- 18.6 dB Gain Typical at 1 GHz
- Cascadable 50 Ohm Gain Block
- Low Cost Surface Mount Plastic Package
- Tape and Reel Option Available

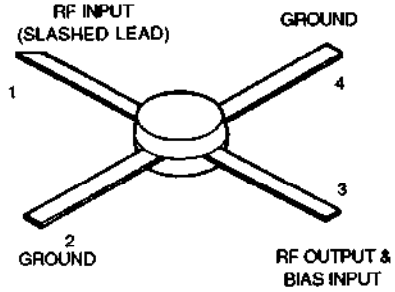
Typical Biasing Configuration



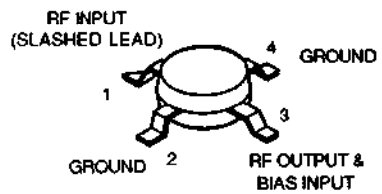
HPMA-2111



HPMA-2185



HPMA-2186



Description

The HPMA-2111/2185/2186 are silicon monolithic single-stage feedback amplifiers. 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-2111 is supplied in a plastic surface mount SOT -143 package, and as the HPMA-2185 in the HPAC-85, a low cost plastic microstrip package. The HPMA-2186 has the leads formed suitable for surface mount applications. Tape and reel options are also available for the HPMA-2111 and the HPMA-2186.

Absolute Maximum Ratings*

T_A = 25 °C

Symbol	Parameter	Value	
		HPMA-2111[1],[3]	HPMA-2185[2],[3] HPMA-2186[2],[3]
I_d	Device Current	50 mA	60 mA
P_t	Total Device Dissipation	250 mW	325 mW
P_{in}	RF Input Power	+20 dBm	+20 dBm
T_j	Junction Temperature	150 °C	150 °C
T_{stg}	Storage Temperature	−65 to +150 °C	−65 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. A θ_{JC} of 120 °C/W for HPMA-2185 and 125 °C/W for HPMA-2186 should be used for derating and junction temperature calculations: $T_J = (P_D \times \theta_{JC}) + T_C$
3. Maximum soldering temperature at 260 °C for 5 seconds

Electrical Specifications, T_A = 25 °C

Symbol	Parameters / Test Conditions I_d = 29 mA, Z_o = 50 ohms	Units	HPMA-2111			HPMA-2185			HPMA-2186		
			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	23.5	25.0 22.3 18.5		23.5	25.0 22.5 18.6		23.5	25.0 22.5 18.6	
ΔG	Gain Flatness f=0.1 to 0.3 GHz	dB		±0.7			±0.7			±0.7	
F_{3dB}	3 dB Bandwidth	GHz		0.5			0.5			0.5	
VSWR	Input VSWR f=0.1 to 3.0 GHz			1.6:1			1.5:1			1.9:1	
	Output VSWR f=0.1 to 3.0 GHz			1.3:1			1.5:1			1.3:1	
P_{1dB}	Output Power @ 1dB Compression f=1.0 GHz	dBm		9.0			9.0			9.0	
NF	50 Ohm Noise Figure f=1.0 GHz	dB		4.3			4.3			4.3	
IP_3	Third Order Intercept Point f=1.0 GHz	dBm		20.0			23.0			23.0	
t_d	Group Delay f=1.0 GHz	psec.		130			130			130	
V_d	Device Voltage	Volts	4.0	5.0	6.0	4.0	5.0	6.0	4.0	5.0	6.0
I_d	Normal Operating Current	mA		29			29			29	
dV/dT	Device Voltage Temperature Coefficient	mV/C		−7.2			−7.2			−7.2	

Note: The recommended operating current range for the HPMA-2185/86 is 20 mA to 40 mA.
The recommended operating current range for the HPMA-2111 is 20 mA to 35 mA.

HPMA-2111 Typical S-Parameters

Z_O = 50 Ohms, T_A = 25°C, I_d = 29 mA

Freq. 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	0.08	-16	24.9	17.54	167	-27.0	0.044	9	0.11	-25
200	0.08	-31	24.4	16.67	154	-26.6	0.047	17	0.11	-48
300	0.08	-45	23.8	15.51	143	-25.9	0.051	25	0.12	-68
400	0.08	-57	23.1	14.24	133	-25.1	0.055	30	0.12	-85
500	0.09	-66	22.3	12.98	125	-24.3	0.061	34	0.12	-99
600	0.09	-75	21.5	11.82	117	-23.5	0.067	37	0.11	-11
700	0.10	-83	20.7	10.80	110	-22.7	0.073	39	0.11	-120
800	0.10	-89	19.9	9.89	104	-22.0	0.079	40	0.10	-127
900	0.10	-95	19.2	9.07	98	-21.3	0.086	41	0.10	-134
1000	0.11	-100	18.5	8.38	93	-20.7	0.092	41	0.09	-139
1500	0.14	-122	15.5	5.95	73	-18.3	0.155	40	0.05	-146
2000	0.16	-142	13.2	4.54	56	-16.6	0.147	36	0.03	-84
2500	0.19	-162	11.4	3.69	44	-15.5	0.167	33	0.07	-53
3000	0.22	175	9.7	3.06	31	-14.8	0.182	28	0.11	-53
3500	0.26	153	8.2	2.58	19	-14.2	0.194	24	0.15	-59
4000	0.31	134	6.9	2.22	7	-13.8	0.204	21	0.18	-68
4500	0.37	118	5.7	1.92	-3	-13.5	0.212	18	0.21	-79
5000	0.44	104	4.5	1.68	-14	-13.1	0.221	16	0.22	-92

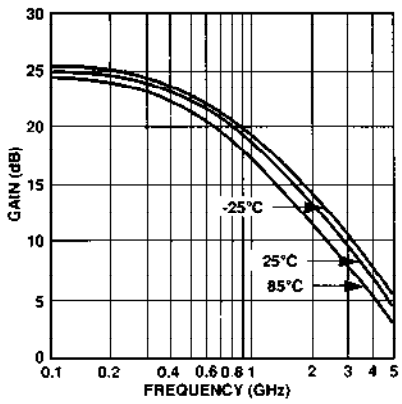


Figure 1. Typical Small Signal Gain vs. Frequency at Three Temperatures

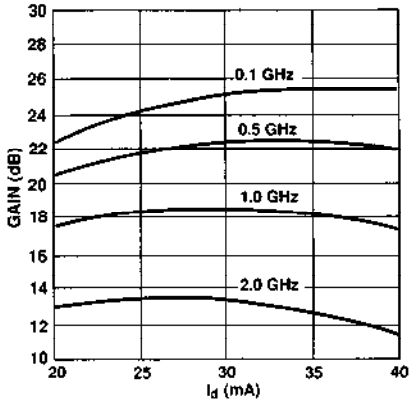


Figure 2. Typical Small Signal Gain vs. I_d at 25°C

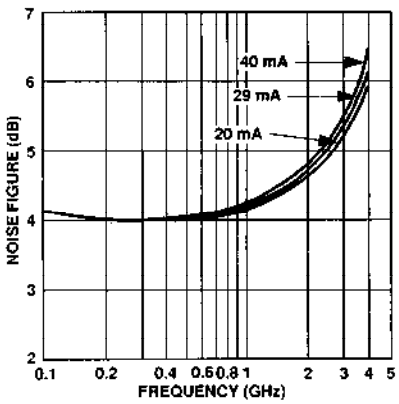


Figure 3. Typical Noise Figure vs. Frequency at 25°C

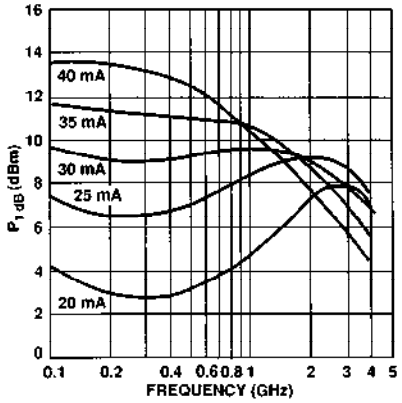


Figure 4. Typical $P_{1\ dB}$ vs. Frequency at 25°C

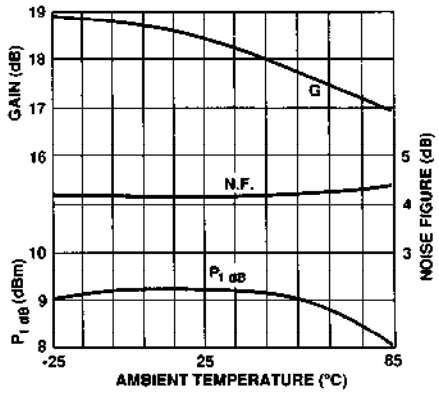


Figure 5. Small Signal Gain, Noise Figure and $P_{1\ dB}$ vs. Temperature at 1 GHz and I_d = 29 mA.

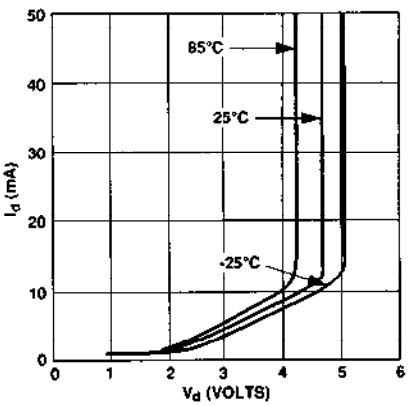


Figure 6. I_d vs. V_d at Three Temperatures

HPMA-2185 Typical S-Parameters

Z_O = 50 Ohms, T_A = 25°C, I_d = 29 mA

Freq.	S_{11}		S_{21}			S_{12}			S_{22}	
MHz	Mag.	Ang.	(dB)	Mag.	Ang.	(dB)	Mag.	Ang.	Mag.	Ang.
100	0.06	-29	25.4	18.57	166	-27.8	0.041	10	0.09	-45
200	0.07	-54	24.9	17.67	154	-27.3	0.043	17	0.17	-43
300	0.08	-74	24.2	16.25	143	-26.6	0.047	24	0.17	-45
400	0.09	-89	23.5	15.03	133	-25.9	0.051	29	0.12	-61
500	0.14	-105	22.6	13.42	124	-25.1	0.056	34	0.13	-60
600	0.10	-91	21.9	12.44	118	-24.3	0.061	37	0.21	-72
700	0.11	-101	21.1	11.29	111	-23.6	0.066	38	0.09	-88
800	0.12	-104	20.3	10.31	105	-22.9	0.072	40	0.13	-95
900	0.13	-109	19.5	9.40	100	-22.2	0.077	41	0.12	-109
1,000	0.13	-115	18.7	8.63	96	-21.7	0.083	42	0.08	-78
1,500	0.15	-130	16.0	6.27	76	-19.2	0.110	41	0.06	-104
2,000	0.18	-148	13.8	4.87	60	-17.5	0.134	38	0.05	-103
2,500	0.21	-163	11.6	3.82	47	-16.3	0.154	34	0.08	-41
3,000	0.21	176	9.8	3.10	34	-15.4	0.169	30	0.11	-83
3,500	0.25	160	8.6	2.69	24	-14.7	0.184	26	0.13	-70
4,000	0.29	146	7.4	2.35	13	-14.1	0.198	23	0.16	-78
4,500	0.33	128	6.4	2.10	3	-13.6	0.209	19	0.21	-85
5,000	0.38	117	5.4	1.86	-7	-13.1	0.222	17	0.22	-94

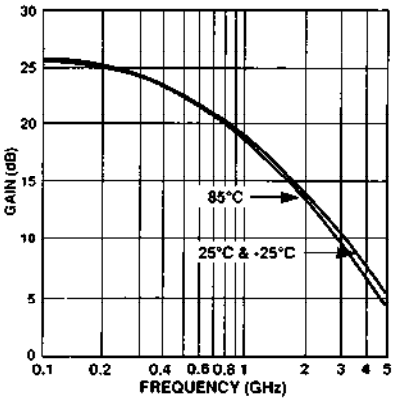


Figure 7. Typical Small Signal Gain vs. Frequency at Three Temperatures

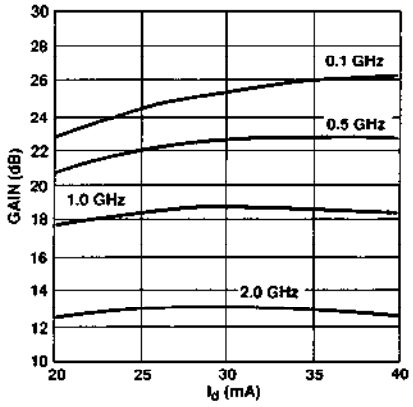


Figure 8. Typical Small Signal Gain vs. I_d at 25°C

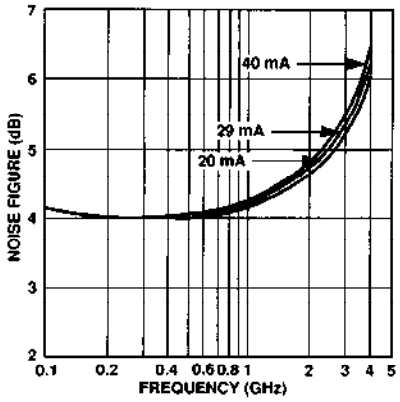


Figure 9. Typical Noise Figure vs. Frequency at 25°C

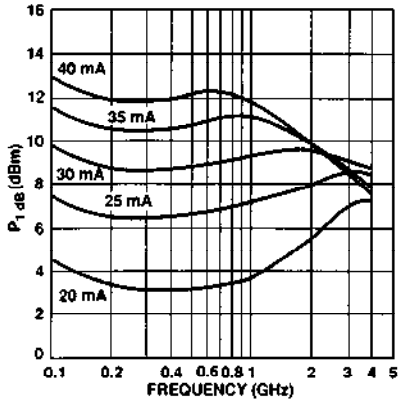


Figure 10. Typical $P_{1\ dB}$ vs. Frequency at 25°C

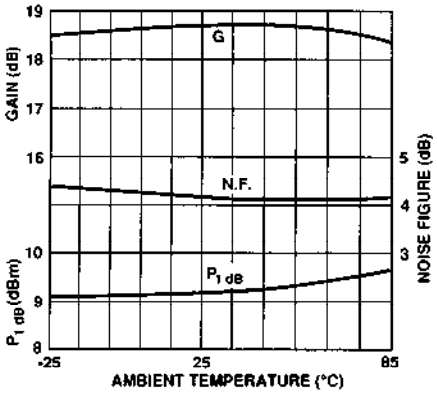


Figure 11. Small Signal Gain, Noise Figure and $P_{1\ dB}$ vs. Temperature at 1 GHz and I_d = 29 mA.

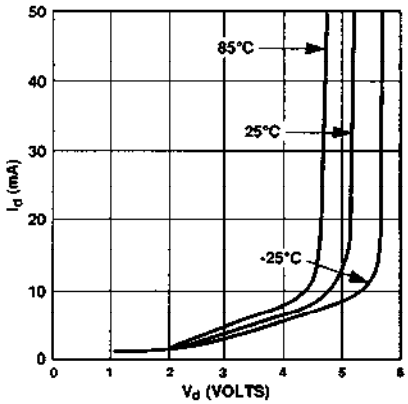


Figure 12. I_d vs. V_d at Three Temperatures

HPMA-2186 Typical S-Parameters

Z_O = 50 Ohms, T_A = 25°C, I_d = 29 mA

Freq. 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	-20	25.5	18.79	165	-27.7	0.041	10	0.11	-27
200	0.07	-41	24.9	17.66	152	-27.1	0.044	18	0.14	-40
300	0.07	-62	24.2	16.25	141	-26.4	0.048	25	0.13	-49
400	0.07	-78	23.5	14.88	130	-25.6	0.052	29	0.11	-65
500	0.10	-91	22.5	13.35	121	-24.7	0.058	33	0.10	-68
600	0.09	-86	21.7	12.19	114	-23.9	0.064	36	0.13	-79
700	0.09	-98	20.9	11.08	107	-23.1	0.070	38	0.07	-99
800	0.10	-105	20.1	10.10	101	-22.4	0.076	39	0.09	-107
900	0.10	-114	19.3	9.20	95	-21.7	0.082	40	0.08	-128
1,000	0.11	-122	18.6	8.47	90	-21.1	0.088	40	0.05	-124
1,500	0.14	-156	15.7	6.10	68	-18.6	0.118	37	0.05	162
2,000	0.20	178	13.4	4.67	51	-16.9	0.144	31	0.07	129
2,500	0.26	157	11.4	3.71	35	-15.6	0.165	25	0.08	96
3,000	0.31	136	9.6	3.01	20	-14.9	0.180	18	0.08	107
3,500	0.37	120	8.2	2.56	7	-14.3	0.193	12	0.09	94
4,000	0.44	107	6.9	2.21	-5	-13.9	0.203	7	0.09	97
4,500	0.51	94	5.7	1.92	-18	-13.5	0.211	1	0.10	104
5,000	0.59	85	4.6	1.70	-30	-13.1	0.221	-3	0.13	112

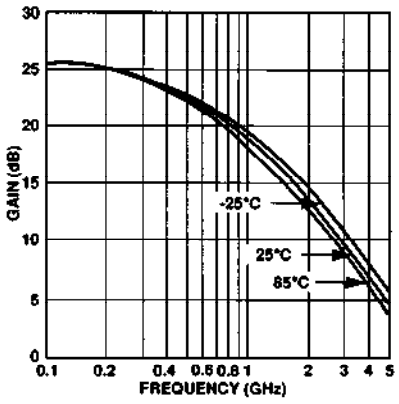


Figure 13. Typical Small Signal Gain vs. Frequency at Three Temperatures

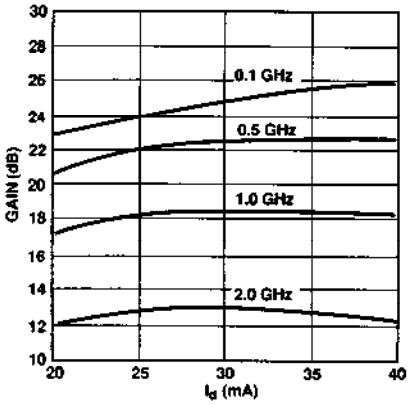


Figure 14. Typical Small Signal Gain vs. I_d at 25°C

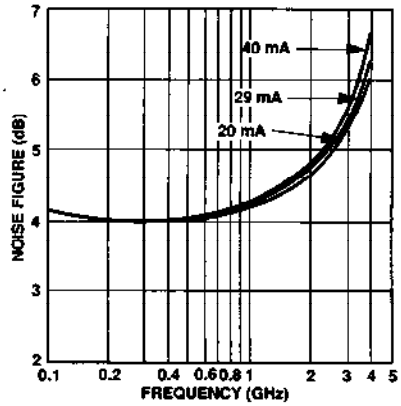


Figure 15. Typical Noise Figure vs. Frequency at 25°C

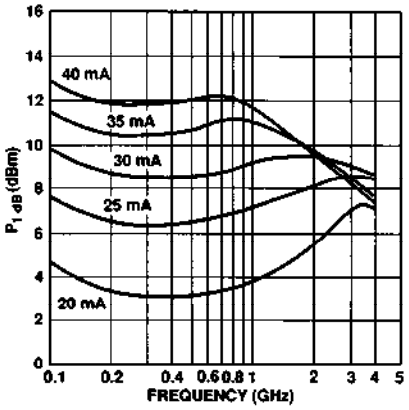


Figure 16. Typical $P_{1\ dB}$ vs. Frequency at 25°C

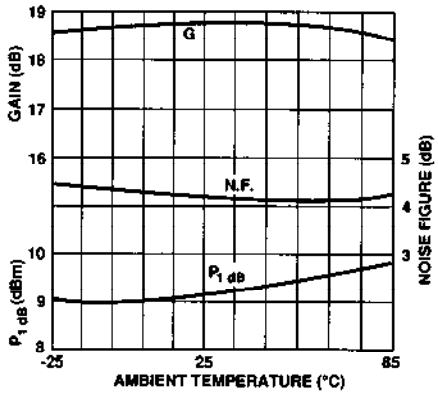


Figure 17. Small Signal Gain, Noise Figure and $P_{1\ dB}$ vs. Temperature at 1 GHz and I_d = 29 mA.

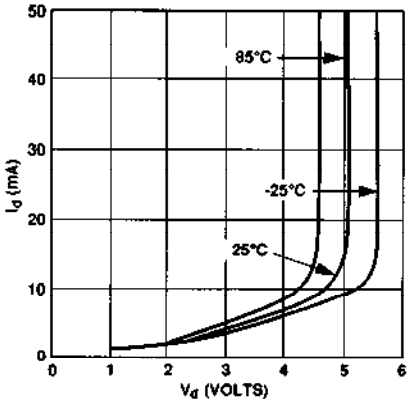


Figure 18. I_d vs. V_d at Three Temperatures

HPMA-2185

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	-21.0	0.0	0.00	0.35	1.1	1.2
200	-13.4	-12.5	-0.43	0.35	1.1	1.4
300	-7.6	-23.2	-1.16	0.30	1.2	1.4
400	-3.1	-32.6	-1.84	0.26	1.2	1.3
500	1.3	-41.8	-2.82	0.26	1.3	1.3
600	2.6	-47.9	-3.48	0.17	1.2	1.5
700	4.5	-54.7	-4.32	0.19	1.3	1.2
800	5.8	-60.8	-5.11	0.17	1.3	1.3
900	5.7	-65.6	-5.92	0.13	1.3	1.3
1,000	5.6	-70.4	-6.66	0.13	1.3	1.2
1,500	1.2	-90.3	-9.43	0.09	1.4	1.1
2,000	-7.6	-105.8	-11.63	0.10	1.4	1.1
2,500	-18.6	-119.1	-13.75	0.08	1.5	1.2
3,000	-30.2	-131.9	-15.55	0.07	1.5	1.3
3,500	-44.6	-141.8	-16.77	0.06	1.7	1.3
4,000	-57.7	-153.0	-17.94	0.06	1.8	1.4
4,500	-71.9	-163.1	-18.95	0.06	2.0	1.5
5,000	-86.1	-173.2	-20.00	0.06	2.2	1.6

HPMA-2186

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	-21.8	0.0	0.00	0.37	1.1	1.2
200	-13.8	-13.3	-0.54	0.37	1.1	1.3
300	-7.7	-24.7	-1.26	0.32	1.1	1.3
400	-2.8	-34.9	-2.03	0.28	1.2	1.2
500	0.9	-43.8	-2.97	0.25	1.2	1.2
600	2.9	-51.1	-3.76	0.20	1.2	1.3
700	4.7	-58.1	-4.59	0.20	1.2	1.2
800	5.7	-64.5	-5.39	0.18	1.2	1.2
900	5.9	-69.9	-6.20	0.15	1.2	1.2
1,000	5.6	-74.9	-6.92	0.14	1.2	1.1
1,500	1.2	-96.8	-9.78	0.11	1.3	1.1
2,000	-7.7	-114.3	-12.09	0.10	1.5	1.2
2,500	-18.3	-130.2	-14.09	0.09	1.7	1.2
3,000	-29.8	-145.1	-15.90	0.08	1.9	1.2
3,500	-43.4	-157.8	-17.31	0.07	2.2	1.2
4,000	-56.9	-170.7	-18.61	0.07	2.6	1.2
4,500	-71.0	-183.1	-19.80	0.07	3.1	1.2
5,000	-85.6	-194.8	-20.86	0.07	3.8	1.3

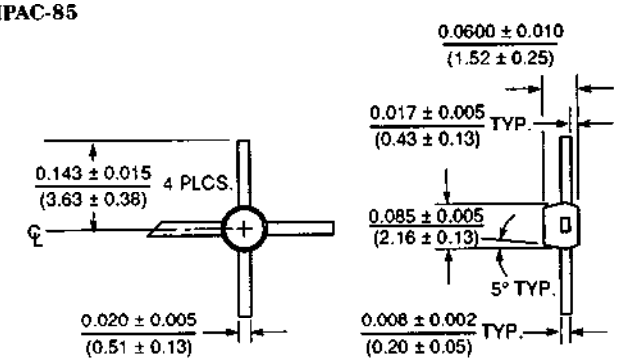
HPMA-2111

Typical Performance Parameters @ T_A = 25°C

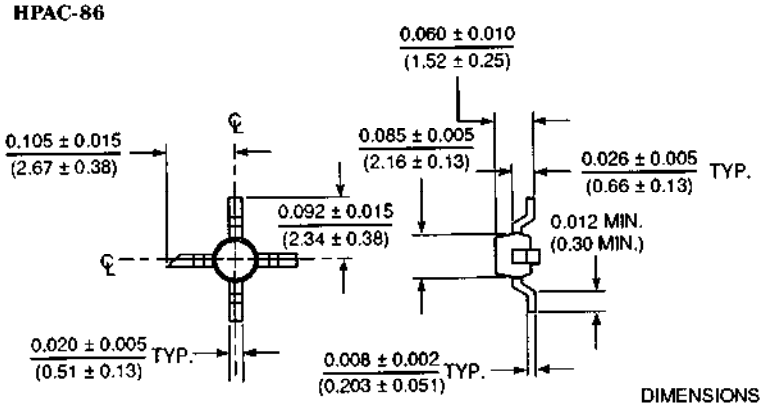
Frequency (MHz)	Linear Phase Deviation (Deg.)	Relative Phase (Deg.)	Gain Deviation (dB)	Group Delay (ns)	Input VSWR	Output VSWR
100	-21.2	0.0	0.00	0.35	1.2	1.3
200	-13.9	-12.4	-0.44	0.35	1.2	1.3
300	-7.7	-23.8	-1.07	0.32	1.2	1.3
400	-2.9	-33.6	-1.81	0.27	1.2	1.3
500	0.5	-42.2	2.62	0.24	1.3	1.3
600	3.1	-49.9	-3.43	0.21	1.2	1.3
700	4.7	-56.6	-4.21	0.19	1.2	1.2
800	5.7	-62.7	-4.98	0.17	1.2	1.2
900	6.3	-68.5	-5.73	0.16	1.2	1.2
1,000	6.1	-73.3	-6.42	0.13	1.2	1.2
1,500	1.1	-93.9	-9.40	0.10	1.3	1.2
2,000	-7.8	-110.6	-11.74	0.09	1.4	1.1
2,500	-21.5	-122.5	-13.53	0.08	1.5	1.2
3,000	-33.9	-135.7	-15.18	0.08	1.6	1.3
3,500	-47.1	-148.0	-16.64	0.07	1.7	1.4
4,000	-61.2	-159.5	-17.96	0.06	1.9	1.5
4,500	-76.0	-170.3	-19.20	0.06	2.2	1.5
5,000	-91.4	-180.4	-20.37	0.06	2.5	1.6

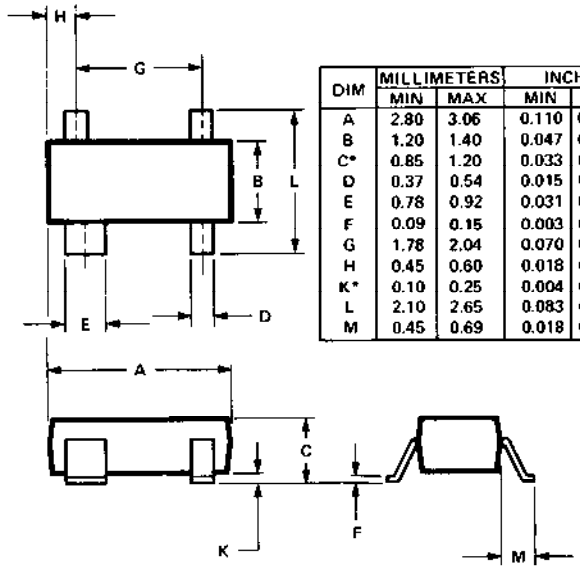
Package Dimensions

HPAC-85



HPAC-86





DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES 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.

DIMENSIONS ARE IN INCHES (MILLIMETERS)

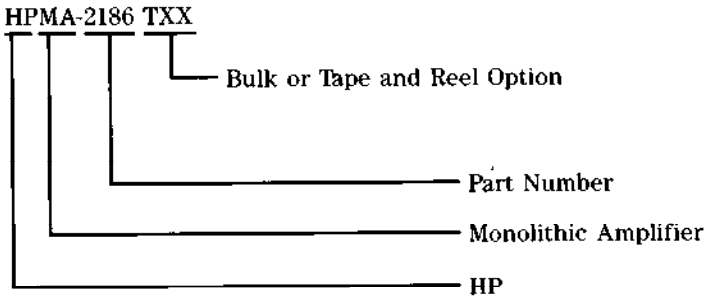
Ordering Information For HPMA-2186 only

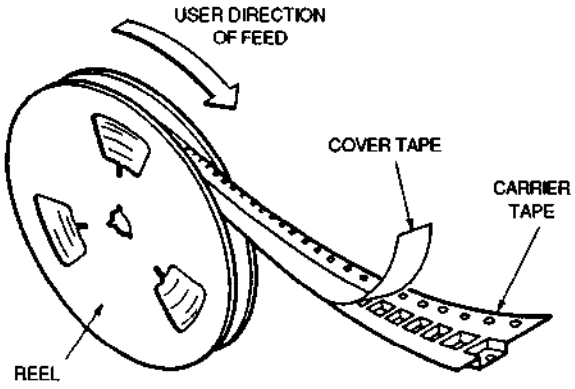
Option T00 = Bulk
Option T15 = Tape and Reel, See Figure 19.

Conforms to Electronic Industries Standard RS-481, "Taping of Surface Mounted Components for Automated Placement." Standard Quantity is 1,500 Devices/Reel.

Specify Part Number followed by Option Number

Example:





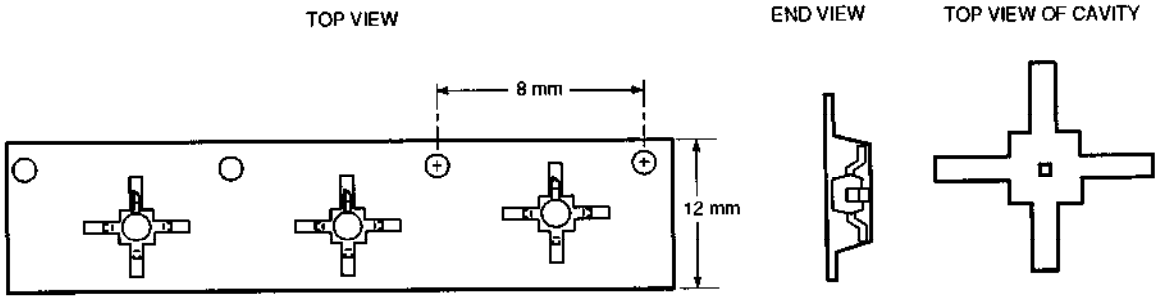


Figure 19. Option T15

Ordering Information For HPMA-2111 only

Standard Profile

Option T30 = Bulk
Option T31 = Tape and Reel, See Figure 20.
Option T32 = Tape and Reel, See Figure 21.

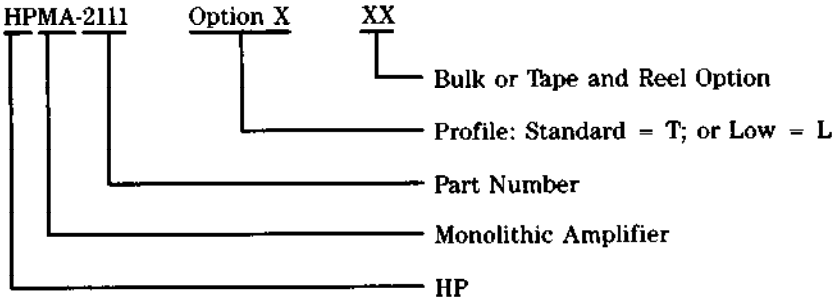
Low Profile

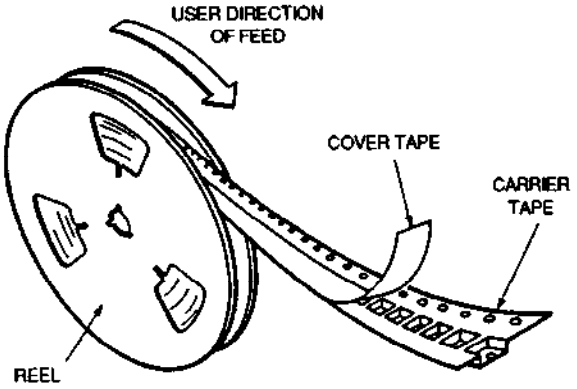
Option L30 = Bulk
Option L31 = Tape and Reel, See Figure 20.
Option L32 = Tape and Reel, See Figure 21.

Conforms to Electronic Industries Standard RS-481, "Taping of Surface Mounted Components for Automated Placement." Standard Quantity is 3,000 Devices/Reel.

Specify Part Number followed by Option Number

Example:





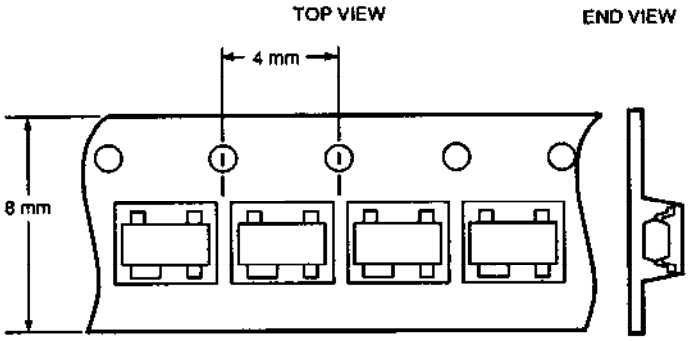


Figure 20. Options T31, L31

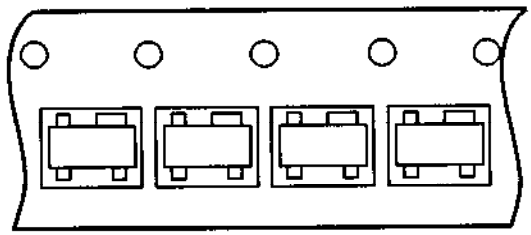


Figure 21. Options T32, L32

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