HEWLETT® PACKARD

Cascadable Silicon Bipolar MMIC Amplifier

Technical Data

MSA-0420

Features

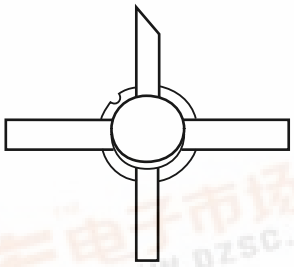
- **Cascadable 50 Ω Gain Block**
- **3 dB Bandwidth:** DC to 4.0 GHz
- **8.5 dB Typical Gain at 1.0 GHz**
- **16.0 dBm Typical $P_{1\ dB}$ at 1.0 GHz**
- **Unconditionally Stable (k>1)**
- **Hermetic Metal/Beryllia Microstrip Package**

Description

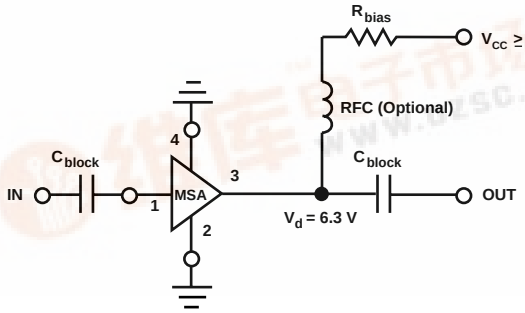
The MSA-0420 is a high performance silicon bipolar Monolithic Microwave Integrated Circuit (MMIC) housed in a hermetic, high reliability package. This MMIC is designed for use as a general purpose 50 Ω gain block. Typical applications include narrow and broad band IF and RF amplifiers in industrial and military applications.

The MSA-series is fabricated using HP's 10 GHz f_T, 25 GHz f_{MAX}, silicon bipolar MMIC process which uses nitride self-alignment, ion implantation, and gold metallization to achieve excellent performance, uniformity and reliability. The use of an external bias resistor for temperature and current stability also allows bias flexibility.

200 mil BeO Package



Typical Biasing Configuration



MSA-0420 Absolute Maximum Ratings

Parameter	Absolute Maximum[1]
Device Current	120 mA
Power Dissipation[2,3]	850 mW
RF Input Power	+13 dBm
Junction Temperature	200°C
Storage Temperature	–65 to 200°C

Thermal Resistance[2,4]:
$\theta_{jc} = 40°C/W$

Notes:
1. Permanent damage may occur if any of these limits are exceeded.
2. $T_{CASE} = 25°C$.
3. Derate at 25 mW/°C for $T_C > 166°C$.
4. The small spot size of this technique results in a higher, though more accurate determination of q_{jc} than do alternate methods. See MEASUREMENTS section "Thermal Resistance" for more information.

Electrical Specifications[1], $T_A = 25°C$

Symbol	Parameters and Test Conditions: $I_d = 90$ mA, $Z_O = 50\ \Omega$		Units	Min.	Typ.	Max.
G_P	Power Gain ($\|S_{21}\|^2$)	f = 0.1 GHz	dB	7.5	8.5	9.5
ΔG_P	Gain Flatness	f = 0.1 to 2.5 GHz	dB		±0.6	±1.0
$f_{3\ dB}$	3 dB Bandwidth		GHz		4.3	
VSWR	Input VSWR	f = 0.1 to 2.5 GHz			1.7:1	
	Output VSWR	f = 0.1 to 2.5 GHz			1.8:1	
NF	50 Ω Noise Figure	f = 1.0 GHz	dB		6.5	
$P_{1\ dB}$	Output Power at 1 dB Gain Compression	f = 1.0 GHz	dBm	14.0	16.0	
IP_3	Third Order Intercept Point	f = 1.0 GHz	dBm		30.0	
t_D	Group Delay	f = 1.0 GHz	psec		140	
V_d	Device Voltage		V	5.7	6.3	6.9
dV/dT	Device Voltage Temperature Coefficient		mV/°C		–8.0	

Note:
1. The recommended operating current range for this device is 40 to 110 mA. Typical performance as a function of current is on the following page.

MSA-0420 Typical Scattering Parameters (Z_O = 50 Ω, T_A = 25°C, I_d = 90 mA)

Freq. GHz	S_{11}		S_{21}			S_{12}			S_{22}	
	Mag	Ang	dB	Mag	Ang	dB	Mag	Ang	Mag	Ang
0.1	.25	177	8.6	2.70	175	–16.4	.151	1	.03	–30
0.2	.25	173	8.6	2.69	170	–16.5	.150	1	.04	–59
0.4	.24	167	8.6	2.69	159	–16.5	.150	–1	.07	–79
0.6	.22	160	8.5	2.67	149	–16.4	.152	–2	.10	–92
0.8	.21	154	8.5	2.66	139	–16.3	.154	–2	.13	–99
1.0	.20	148	8.3	2.60	129	–16.1	.156	–3	.16	–109
1.5	.14	136	8.1	2.54	104	–15.6	.166	–4	.22	–124
2.0	.10	136	7.9	2.48	80	–14.8	.181	–6	.25	–139
2.5	.08	161	7.4	2.34	62	–14.3	.193	–5	.28	–147
3.0	.10	178	7.0	2.24	39	–13.7	.206	–11	.31	–157
3.5	.13	176	6.6	2.13	18	–12.6	.233	–18	.34	–167
4.0	.14	163	5.9	1.97	–3	–11.9	.253	–25	.36	–176
4.5	.14	133	5.3	1.83	–23	–11.3	.273	–33	.37	174
5.0	.16	91	4.5	1.69	–343	–10.5	.299	–43	.37	162

A model for this device is available in the DEVICE MODELS section.

Typical Performance, T_A = 25°C

(unless otherwise noted)

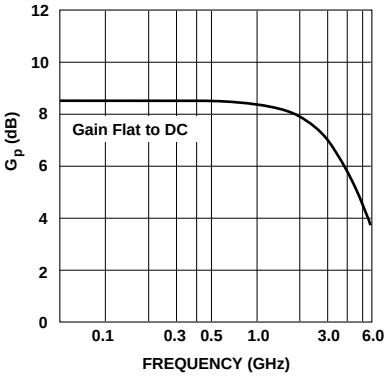


Figure 1. Typical Power Gain vs. Frequency, T_A = 25°C, I_d = 90 mA.

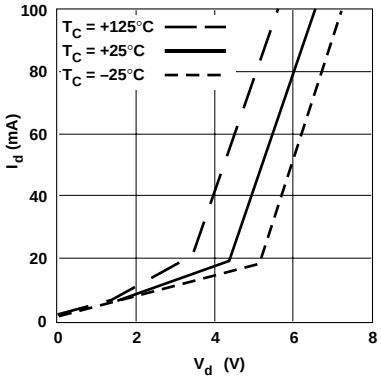


Figure 2. Device Current vs. Voltage.

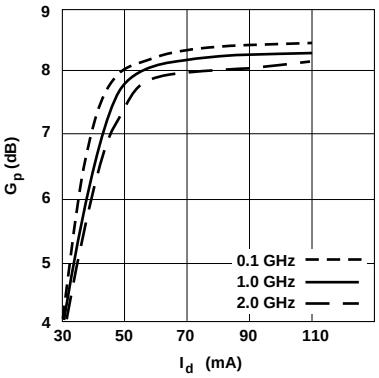


Figure 3. Power Gain vs. Current.

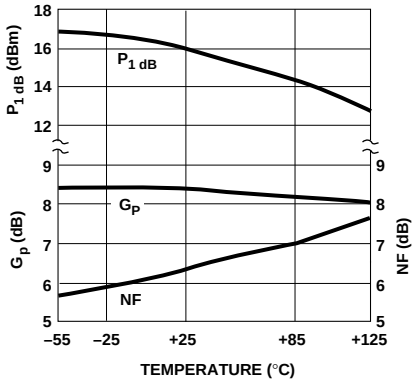


Figure 4. Output Power at 1 dB Gain Compression, NF and Power Gain vs. Case Temperature, f = 1.0 GHz, I_d=90mA.

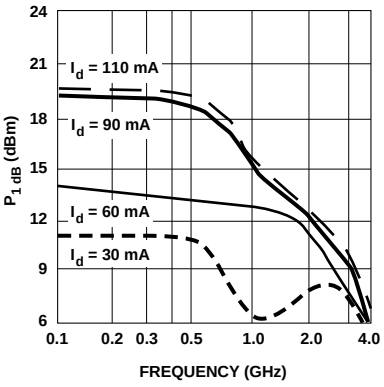


Figure 5. Output Power at 1 dB Gain Compression vs. Frequency.

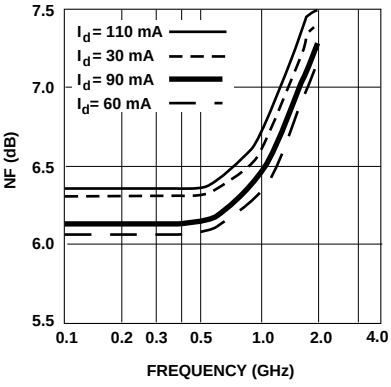


Figure 6. Noise Figure vs. Frequency.

200 mil BeO Package Dimensions