Cascadable Silicon Bipolar MMIC Amplifier

Technical Data

MSA-0800

Features

- **Usable Gain to 6.0 GHz**
- **High Gain:**
  32.5 dB Typical at 0.1 GHz
  23.5 dB Typical at 1.0 GHz
- **Low Noise Figure:**
  3.0 dB Typical at 1.0 GHz

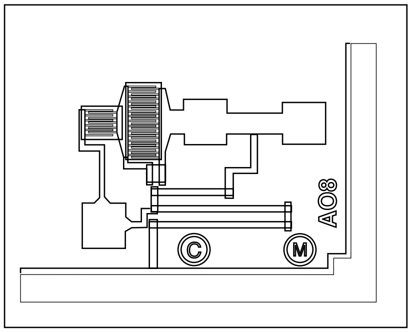
Description

The MSA-0800 is a high performance silicon bipolar Monolithic Microwave Integrated Circuit (MMIC) chip. This MMIC is designed for use as a general purpose 50 Ω gain block above 0.5 GHz and can be used as a high gain transistor below this frequency. Typical applications include narrow and broad band IF and RF amplifiers in commercial, 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.

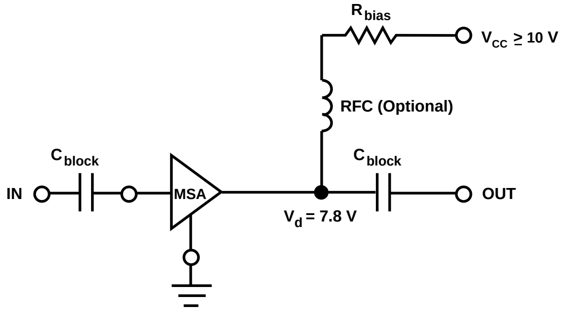
The recommended assembly procedure is gold-eutectic die attach at 400°C and either wedge or ball bonding using 0.7 mil gold wire.[1] See APPLICATIONS section, "Chip Use".

Chip Outline[1]



Note:
1. Refer to the APPLICATIONS section "Silicon MMIC Chip Use" for additional information.

Typical Biasing Configuration



MSA-0800 Absolute Maximum Ratings

Parameter	Absolute Maximum[1]
Device Current	80 mA
Power Dissipation[2,3]	750 mW
RF Input Power	+13 dBm
Junction Temperature	200°C
Storage Temperature	200°C

Thermal Resistance[2,4]:
θ_{jc} = 70°C/W

Notes:
1. Permanent damage may occur if any of these limits are exceeded.
2. $T_{Mounting\ Surface}$ (T_{MS}) = 25°C.
3. Derate at 14.3 mW/°C for $T_{Mounting\ Surface}$ > 148°C.
4. The small spot size of this technique results in a higher, though more accurate determination of θ_{jc} than do alternate methods. See MEASURE-

Electrical Specifications[1], T_A = 25°C

Symbol	Parameters and Test Conditions[2]: I_d = 36 mA, Z_O = 50 Ω		Units	Min.	Typ.	Max.
G_P	Power Gain ($\|S_{21}\|^2$)	f = 0.1 GHz f = 1.0 GHz f = 4.0 GHz	dB		32.5 23.5 11.0	
VSWR	Input VSWR	f = 1.0 to 3.0 GHz			2.0:1	
	Output VSWR	f = 1.0 to 3.0 GHz			1.9:1	
NF	50 Ω Noise Figure	f = 1.0 GHz	dB		3.0	
$P_{1\ dB}$	Output Power at 1 dB Gain Compression	f = 1.0 GHz	dBm		12.5	
IP_3	Third Order Intercept Point	f = 1.0 GHz	dBm		27.0	
t_D	Group Delay	f = 1.0 GHz	psec		125	
V_d	Device Voltage		V	7.0	7.8	8.4
dV/dT	Device Voltage Temperature Coefficient		mV/°C		–17.0	

Notes:
1. The recommended operating current range for this device is 20 to 40 mA. Typical performance as a function of current is on the following page.
2. RF performance of the chip is determined by packaging and testing 10 devices per wafer in a dual ground configuration.

Part Number Ordering Information

Part Number	Devices Per Tray
MSA-0800-GP4	100

MSA-0800 Typical Scattering Parameters[1] (Z_O = 50 Ω, T_A = 25°C, I_d = 36 mA)

Freq. GHz	S_{11}		S_{21}			S_{12}			S_{22}		k
	Mag	Ang	dB	Mag	Ang	dB	Mag	Ang	Mag	Ang	
0.1	.65	–17	32.6	42.50	163	–36.9	.014	39	.64	–20	0.80
0.2	.61	–31	31.7	38.59	148	–34.1	.020	47	.59	–39	0.68
0.4	.50	–54	29.6	30.22	126	–31.0	.028	52	.49	–68	0.63
0.6	.43	–70	27.5	23.64	113	–28.5	.038	52	.40	–90	0.69
0.8	.38	–81	25.6	19.05	103	–26.7	.046	53	.35	–106	0.75
1.0	.34	–95	24.2	16.27	93	–25.4	.054	55	.30	–120	0.80
1.5	.31	–110	20.9	11.12	78	–23.6	.066	53	.23	–142	0.88
2.0	.32	–124	18.3	8.22	66	–22.6	.075	53	.17	–158	0.98
2.5	.33	–129	16.3	6.52	61	–20.7	.092	57	.13	–162	1.00
3.0	.34	–138	14.4	5.24	54	–20.3	.097	54	.07	–165	1.11
3.5	.36	–146	12.8	4.36	45	–19.0	.112	50	.07	–140	1.11
4.0	.36	–155	11.3	3.68	37	–18.3	.122	49	.10	–96	1.16
5.0	.35	177	8.7	2.73	23	–17.2	.138	43	.15	–75	1.28
6.0	.43	150	6.3	2.07	10	–16.6	.148	35	.15	–81	1.40

Note:

1. S-parameters are de-embedded from 70 mil package measured data using the package model found in the DEVICE MODELS section.

Typical Performance, T_A = 25°C

(unless otherwise noted)

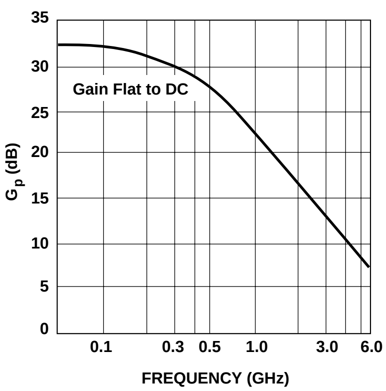


Figure 1. Typical Power Gain vs. Frequency, I_d = 36 mA.

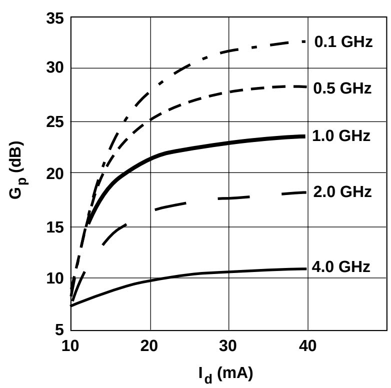


Figure 2. Power Gain vs. Current.

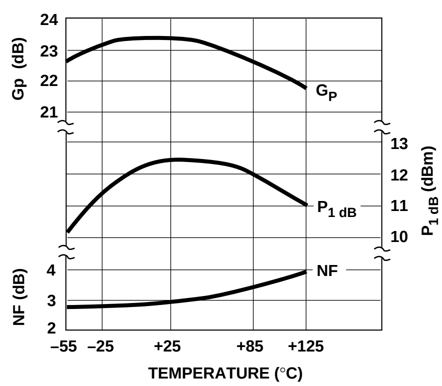


Figure 3. Output Power at 1 dB Gain Compression, NF and Power Gain vs. Mounting Surface Temperature, f = 1.0 GHz, I_d = 36 mA.

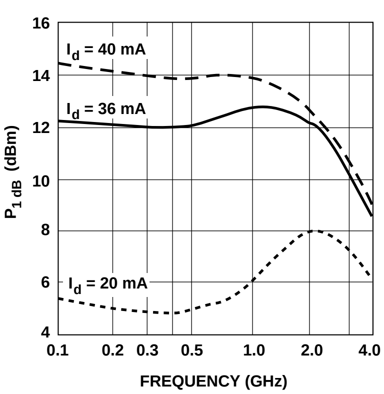


Figure 4. Output Power at 1 dB Gain Compression vs. Frequency.

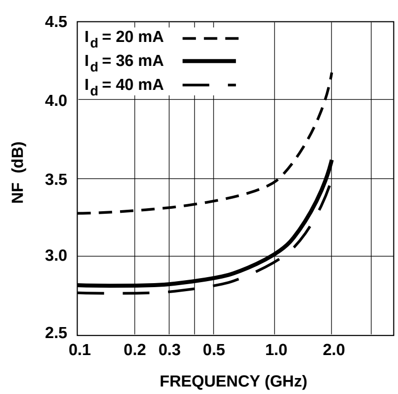
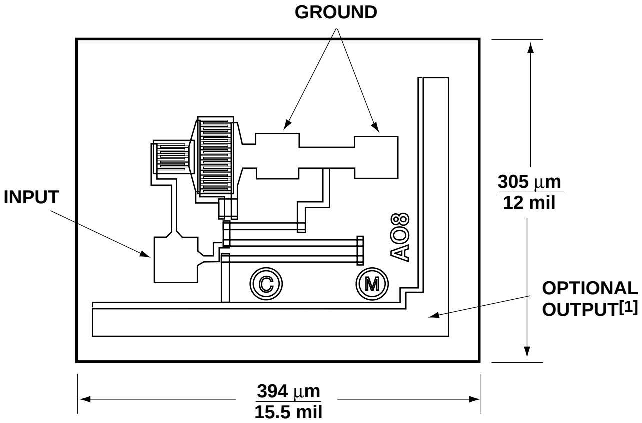


Figure 5. Noise Figure vs. Frequency.

MSA-0800 Chip Dimensions



Unless otherwise specified, tolerances are ±13 µm/±0.5 mils. Chip thickness is 114 µm/4.5 mil. Bond Pads are 41 µm/1.6 mil typical on each side. Note 1: Output contact is made by die attaching the backside of the die.