

# Cascadable Silicon Bipolar MMIC Amplifier

## Technical Data

**MSA-0204**

### Features

- **Cascadable 50 Ω Gain Block**
- **3 dB Bandwidth:**  
DC to 1.8 GHz
- **11.0 dB Typical Gain at  
1.0 GHz**
- **Unconditionally Stable  
( $k > 1$ )**
- **Low Cost Plastic Package**

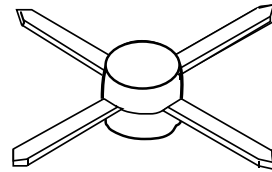
### Description

The MSA-0204 is a high performance silicon bipolar Monolithic Microwave Integrated Circuit (MMIC) housed in a low cost plastic package. This MMIC is

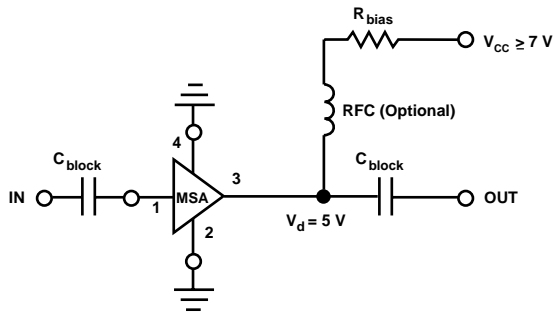
designed for use as a general purpose 50 Ω gain block. Typical applications include narrow and broad band IF and RF amplifiers in commercial and industrial applications.

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.

### 04A Plastic Package



### Typical Biasing Configuration



## MSA-0204 Absolute Maximum Ratings

Parameter	Absolute Maximum <sup>[1]</sup>
Device Current	60 mA
Power Dissipation <sup>[2,3]</sup>	325 mW
RF Input Power	+13 dBm
Junction Temperature	150°C
Storage Temperature	-65 to 150°C

### Thermal Resistance<sup>[2,4]</sup>:

$$\theta_{jc} = 90^{\circ}\text{C/W}$$

#### Notes:

1. Permanent damage may occur if any of these limits are exceeded.
2.  $T_{\text{CASE}} = 25^{\circ}\text{C}$ .
3. Derate at  $11.1 \text{ mW/}^{\circ}\text{C}$  for  $T_{\text{C}} > 121^{\circ}\text{C}$ .
4. See MEASUREMENTS section "Thermal Resistance" for more information.

## Electrical Specifications<sup>[1]</sup>, $T_{\text{A}} = 25^{\circ}\text{C}$

Symbol	Parameters and Test Conditions: $I_{\text{d}} = 25 \text{ mA}$ , $Z_{\text{O}} = 50 \Omega$	Units	Min.	Typ.	Max.
$G_{\text{P}}$	Power Gain ( $ S_{21} ^2$ ) $f = 0.1 \text{ GHz}$ $f = 0.5 \text{ GHz}$ $f = 1.0 \text{ GHz}$	dB	10.0	12.5 12.0 11.0	
$\Delta G_{\text{P}}$	Gain Flatness $f = 0.1 \text{ to } 1.4 \text{ GHz}$	dB		$\pm 1.0$	
$f_{3 \text{ dB}}$	3 dB Bandwidth	GHz		1.8	
VSWR	Input VSWR $f = 0.1 \text{ to } 3.0 \text{ GHz}$			1.3:1	
	Output VSWR $f = 0.1 \text{ to } 3.0 \text{ GHz}$			1.3:1	
NF	50 $\Omega$ Noise Figure $f = 1.0 \text{ GHz}$	dB		6.5	
$P_{1 \text{ dB}}$	Output Power at 1 dB Gain Compression $f = 1.0 \text{ GHz}$	dBm		4.5	
$\text{IP}_3$	Third Order Intercept Point $f = 1.0 \text{ GHz}$	dBm		17.0	
$t_{\text{D}}$	Group Delay $f = 1.0 \text{ GHz}$	psec		150	
$V_{\text{d}}$	Device Voltage	V	4.5	5.0	5.5
$dV/dT$	Device Voltage Temperature Coefficient	mV/ $^{\circ}\text{C}$		-8.0	

#### Note:

1. The recommended operating current range for this device is 18 to 40 mA. Typical performance as a function of current is on the following page.

### MSA-0204 Typical Scattering Parameters ( $Z_0 = 50 \Omega$ , $T_A = 25^\circ\text{C}$ , $I_d = 25 \text{ mA}$ )

Freq. GHz	$S_{11}$		$S_{21}$			$S_{12}$			$S_{22}$	
	Mag	Ang	dB	Mag	Ang	dB	Mag	Ang	Mag	Ang
0.1	.12	170	12.5	4.20	174	-18.5	.119	2	.12	-7
0.2	.12	160	12.4	4.16	168	-18.5	.119	4	.12	-14
0.4	.11	140	12.2	4.05	156	-18.1	.124	6	.12	-29
0.6	.11	121	11.9	3.93	144	-17.9	.127	8	.12	-42
0.8	.10	104	11.6	3.78	134	-17.6	.132	12	.12	-52
1.0	.10	84	11.2	3.62	123	-17.0	.142	14	.13	-61
1.5	.09	42	10.2	3.22	99	-16.1	.157	16	.12	-79
2.0	.07	16	9.1	2.86	77	-14.8	.181	15	.11	-96
2.5	.05	17	8.2	2.57	63	-13.9	.202	16	.09	-115
3.0	.02	96	7.3	2.32	46	-13.2	.220	13	.08	-141
3.5	.08	112	6.5	2.12	29	-12.4	.239	7	.09	-167
4.0	.14	100	5.7	1.93	12	-11.8	.258	0	.11	171
5.0	.35	72	4.0	1.58	-22	-11.2	.276	-15	.17	120
6.0	.59	51	1.6	1.20	-54	-11.3	.272	-33	.32	80

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

### Typical Performance, $T_A = 25^\circ\text{C}$

(unless otherwise noted)

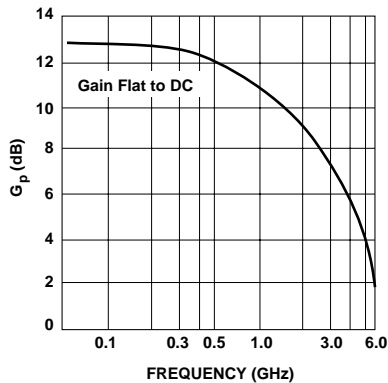


Figure 1. Typical Power Gain vs. Frequency,  $T_A = 25^\circ\text{C}$ ,  $I_d = 25 \text{ mA}$ .

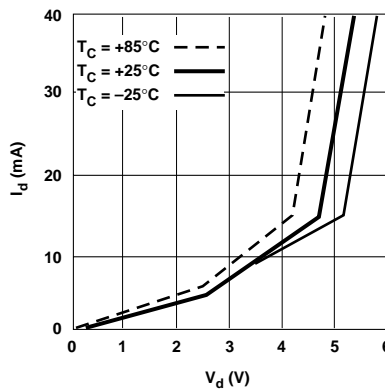


Figure 2. Device Current vs. Voltage.

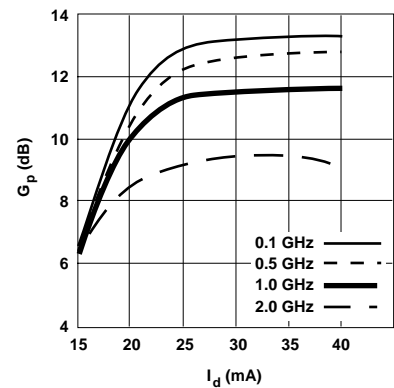


Figure 3. Power Gain vs. Current.

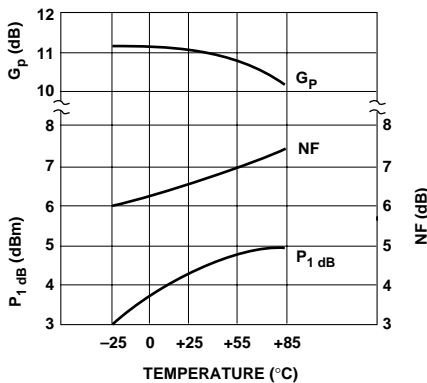


Figure 4. Output Power at 1 dB Gain Compression, NF and Power Gain vs. Case Temperature,  $f = 1.0 \text{ GHz}$ ,  $I_d = 25 \text{ mA}$ .

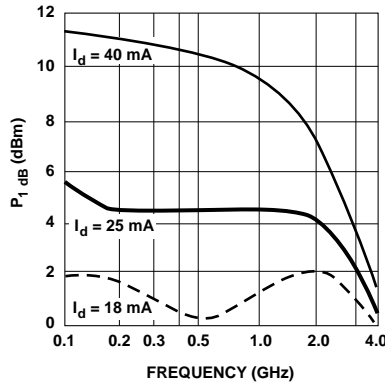


Figure 5. Output Power at 1 dB Gain Compression vs. Frequency.

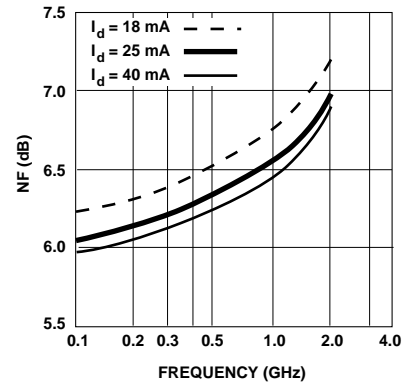


Figure 6. Noise Figure vs. Frequency.

## 04A Plastic Package Dimensions

