

# Cascadable Silicon Bipolar MMIC Amplifier

## Technical Data

MSA-0304

### Features

- **Cascadable 50 Ω Gain Block**
- **3 dB Bandwidth:**  
DC to 1.6 GHz
- **11.0 dB Typical Gain at 1.0 GHz**
- **10.0 dBm Typical P<sub>1 dB</sub> at 1.0 GHz**
- **Unconditionally Stable (k>1)**
- **Low Cost Plastic Package**

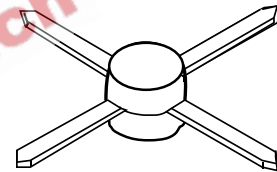
### Description

The MSA-0304 is a high performance silicon bipolar Monolithic Microwave Integrated Circuit (MMIC) housed in a low cost

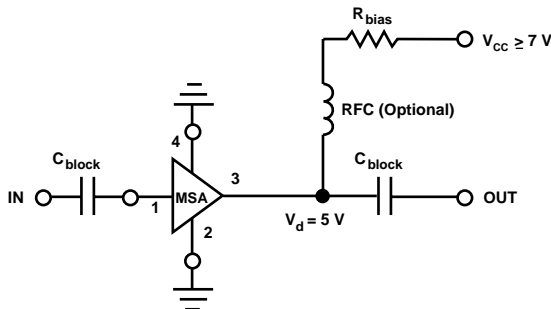
plastic package. This MMIC is designed for use as a general purpose 50 Ω gain block. Typical applications include narrow and broad band IF and RF amplifiers in industrial and military applications.

The MSA-series is fabricated using HP's 10 GHz f<sub>T</sub>, 25 GHz f<sub>MAX</sub>, 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-0304 Absolute Maximum Ratings

Parameter	Absolute Maximum <sup>[1]</sup>
Device Current	70 mA
Power Dissipation <sup>[2,3]</sup>	400 mW
RF Input Power	+13 dBm
Junction Temperature	150°C
Storage Temperature	-65 to 150°C

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

$$\theta_{jc} = 100^{\circ}\text{C}/\text{W}$$

#### Notes:

1. Permanent damage may occur if any of these limits are exceeded.
2.  $T_{\text{CASE}} = 25^{\circ}\text{C}$ .
3. Derate at 10 mW/°C for  $T_{\text{C}} > 110^{\circ}\text{C}$ .
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: $I_{\text{d}} = 35 \text{ mA}$ , $Z_{\text{o}} = 50 \Omega$	Units	Min.	Typ.	Max.
$G_{\text{P}}$	Power Gain ( $ S_{21} ^2$ ) f = 0.1 GHz f = 0.5 GHz f = 1.0 GHz	dB	10.0	12.5 12.0 11.0	
$\Delta G_{\text{P}}$	Gain Flatness f = 0.1 to 1.3 GHz	dB		$\pm 1.0$	
$f_{3 \text{ dB}}$	3 dB Bandwidth	GHz		1.6	
VSWR	Input VSWR f = 0.1 to 3.0 GHz			1.3:1	
	Output VSWR f = 0.1 to 3.0 GHz			1.6:1	
NF	50 $\Omega$ Noise Figure f = 1.0 GHz	dB		6.0	
$P_{1 \text{ dB}}$	Output Power at 1 dB Gain Compression f = 1.0 GHz	dBm		10.0	
$IP_3$	Third Order Intercept Point f = 1.0 GHz	dBm		23.0	
$t_{\text{D}}$	Group Delay f = 1.0 GHz	psec		150	
$V_{\text{d}}$	Device Voltage	V	4.5	5.0	5.5
$dV/dT$	Device Voltage Temperature Coefficient	mV/°C		-8.0	

#### Note:

1. The recommended operating current range for this device is 20 to 50 mA. Typical performance as a function of current is on the following page.

### MSA-0304 Typical Scattering Parameters ( $Z_0 = 50 \Omega$ , $T_A = 25^\circ\text{C}$ , $I_d = 35 \text{ mA}$ )

Freq. GHz	$S_{11}$		$S_{21}$			$S_{12}$			$S_{22}$	
	Mag	Ang	dB	Mag	Ang	dB	Mag	Ang	Mag	Ang
0.1	.10	173	12.5	4.24	173	-18.5	.120	3	.12	-13
0.2	.10	162	12.5	4.21	167	-18.2	.123	4	.12	-24
0.4	.09	142	12.2	4.08	153	-18.0	.125	7	.13	-46
0.6	.08	127	11.9	3.93	141	-17.8	.128	10	.15	-64
0.8	.07	110	11.5	3.76	130	-17.3	.136	14	.16	-78
1.0	.06	92	11.1	3.58	118	-16.8	.144	16	.17	-91
1.5	.03	58	10.0	3.15	93	-15.5	.169	19	.19	-117
2.0	.03	175	8.8	2.76	71	-14.1	.197	18	.20	-139
2.5	.05	163	7.8	2.46	55	-13.2	.218	18	.21	-158
3.0	.12	148	6.8	2.20	38	-12.2	.246	15	.22	-174
3.5	.19	129	5.9	1.98	20	-11.2	.275	7	.24	171
4.0	.26	110	5.0	1.77	3	-10.6	.296	1	.26	158
5.0	.44	77	3.0	1.41	-28	-9.9	.319	-15	.29	128
6.0	.63	52	0.4	1.05	-56	-10.2	.310	-31	.37	94

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

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

(unless otherwise noted)

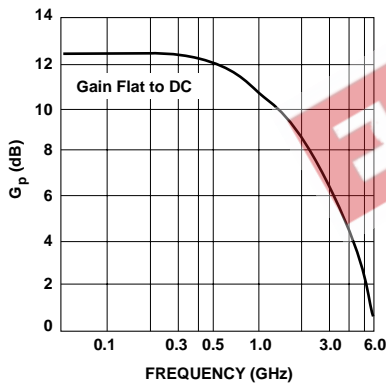


Figure 1. Typical Power Gain vs. Frequency,  $T_A = 25^\circ\text{C}$ ,  $I_d = 35 \text{ mA}$ .

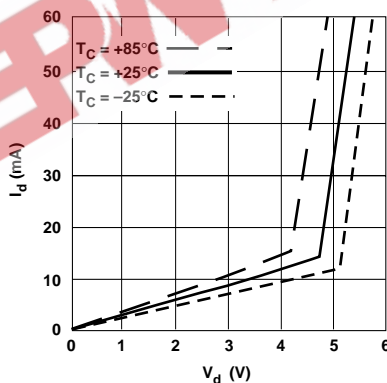


Figure 2. Device Current vs. Voltage.

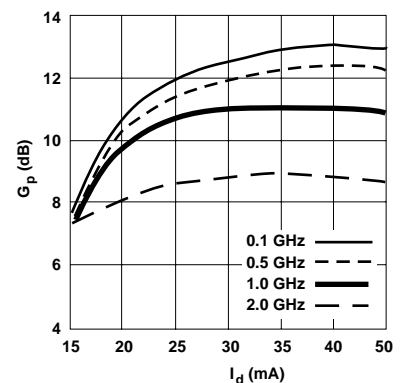


Figure 3. Power Gain vs. Current.

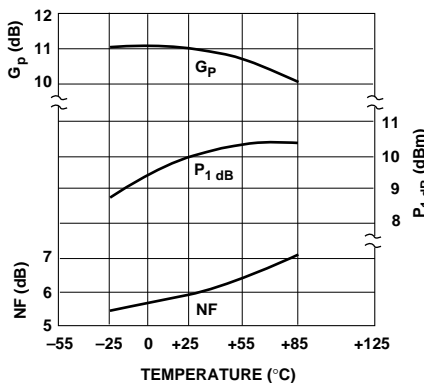


Figure 4. Output Power at 1 dB Gain Compression, NF and Power Gain vs. Case Temperature,  $f = 1.0 \text{ GHz}$ ,  $I_d = 35 \text{ mA}$ .

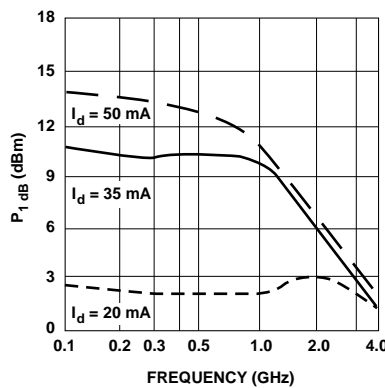


Figure 5. Output Power at 1 dB Gain Compression vs. Frequency.

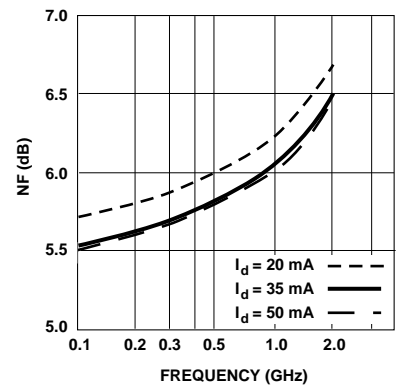


Figure 6. Noise Figure vs. Frequency.

## 04A Plastic Package Dimensions

