

# Cascadable Silicon Bipolar MMIC Amplifiers

## Technical Data

### MSA-0370

#### Features

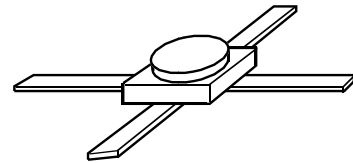
- **Cascadable 50 Ω Gain Block**
- **3 dB Bandwidth:**  
DC to 2.8 GHz
- **12.0 dB Typical Gain at 1.0 GHz**
- **10.0 dBm Typical P<sub>1dB</sub> at 1.0 GHz**
- **Unconditionally Stable (k>1)**
- **Hermetic Gold-ceramic Microstrip Package**

#### Description

The MSA-0370 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.

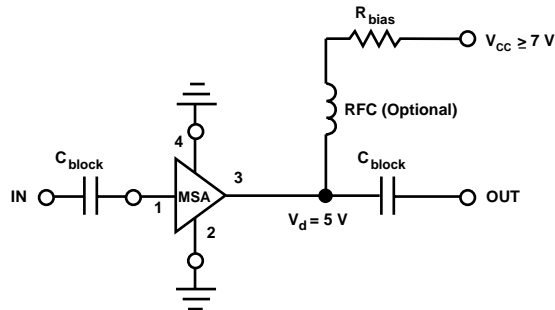
The MSA-series is fabricated using HP's 10 GHz  $f_T$ , 25 GHz  $f_{MAX}$ , silicon bipolar MMIC process which uses nitride self-alignment, ion implantation, and gold metallization to

#### 70 mil Package



achieve excellent performance, uniformity and reliability. The use of an external bias resistor for temperature and current stability also allows bias flexibility.

#### Typical Biasing Configuration



## MSA-0370 Absolute Maximum Ratings

Parameter	Absolute Maximum <sup>[1]</sup>
Device Current	80 mA
Power Dissipation <sup>[2,3]</sup>	425 mW
RF Input Power	+13 dBm
Junction Temperature	200°C
Storage Temperature	-65 to 200°C

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

$$\theta_{jc} = 125^{\circ}\text{C/W}$$

### Notes:

1. Permanent damage may occur if any of these limits are exceeded.
2.  $T_{\text{CASE}} = 25^{\circ}\text{C}$ .
3. Derate at 8 mW/°C for  $T_{\text{C}} > 147^{\circ}\text{C}$ .
4. The small spot size of this technique results in a higher, though more accurate determination of  $\theta_{jc}$  than do alternate methods. 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$ ) $f = 0.1 \text{ GHz}$	dB	11.5	12.5	13.5
$\Delta G_{\text{P}}$	Gain Flatness $f = 0.1 \text{ to } 1.8 \text{ GHz}$	dB		$\pm 0.6$	$\pm 1.0$
$f_{3 \text{ dB}}$	3 dB Bandwidth	GHz		2.8	
VSWR	Input VSWR $f = 0.1 \text{ to } 3.0 \text{ GHz}$			1.8:1	
	Output VSWR $f = 0.1 \text{ to } 3.0 \text{ GHz}$			1.8:1	
NF	50 $\Omega$ Noise Figure $f = 1.0 \text{ GHz}$	dB		6.0	
$P_{1 \text{ dB}}$	Output Power at 1 dB Gain Compression $f = 1.0 \text{ GHz}$	dBm		10.0	
$\text{IP}_3$	Third Order Intercept Point $f = 1.0 \text{ GHz}$	dBm		23.0	
$t_{\text{D}}$	Group Delay $f = 1.0 \text{ GHz}$	psec		125	
$V_{\text{d}}$	Device Voltage	V	4.5	5.0	5.5
$dV/dT$	Device Voltage Temperature Coefficient	mV/°C		-8.0	

### Notes:

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-0370 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	.13	-179	12.6	4.27	176	-18.6	.118	2	.09	-14
0.2	.13	-180	12.6	4.25	171	-18.3	.121	2	.10	-29
0.4	.12	-180	12.5	4.21	162	-18.4	.121	4	.12	-52
0.6	.11	-178	12.4	4.17	154	-18.2	.123	6	.14	-70
0.8	.11	-174	12.3	4.11	146	-17.8	.129	8	.17	-82
1.0	.10	-168	12.2	4.06	137	-17.7	.130	8	.20	-92
1.5	.11	-149	11.7	3.85	116	-17.1	.140	11	.24	-114
2.0	.16	-147	11.1	3.57	96	-16.2	.155	11	.27	-134
2.5	.22	-151	10.3	3.27	82	-15.6	.167	14	.27	-146
3.0	.28	-160	9.3	2.91	65	-15.2	.174	11	.27	-159
3.5	.33	-169	8.2	2.58	48	-14.5	.188	7	.26	-163
4.0	.36	-177	7.1	2.27	34	-14.3	.192	3	.25	-162
5.0	.38	163	5.1	1.81	9	-13.8	.203	-5	.23	-153
6.0	.39	132	3.4	1.48	-14	-13.5	.213	-13	.24	-160

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

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

(unless otherwise noted)

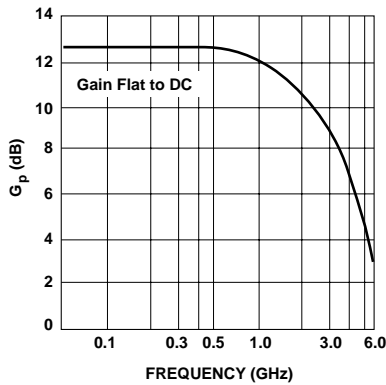


Figure 1. Typical Power Gain vs. Frequency,  $T_A = 25^\circ\text{C}$ ,  $I_d = 35 \text{ mA}$ .

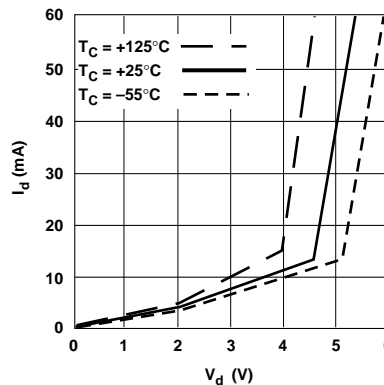


Figure 2. Device Current vs. Voltage.

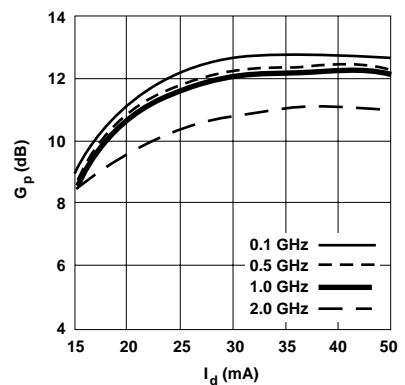


Figure 3. Power Gain vs. Current.

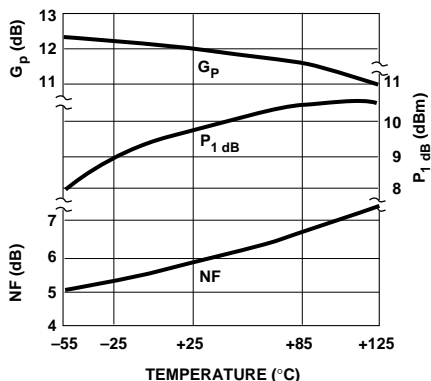


Figure 4. Output Power at 1 dB Gain Compression, NF and Power Gain vs. Mounting Surface Temperature,  $f = 1.0 \text{ GHz}$ ,  $I_d = 35 \text{ mA}$ .

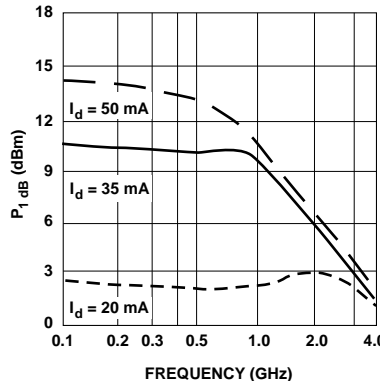


Figure 5. Output Power at 1 dB Gain Compression vs. Frequency.

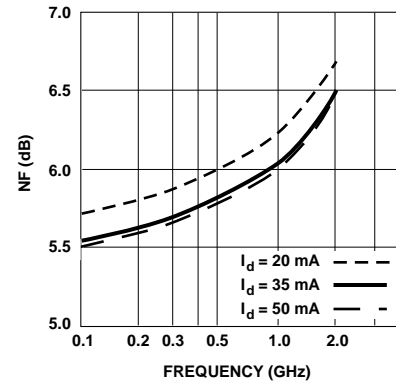


Figure 6. Noise Figure vs. Frequency.

# 70 mil Package Dimensions

