

# Cascadable Silicon Bipolar MMIC Amplifier

## Technical Data

### MSA-0270

#### Features

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

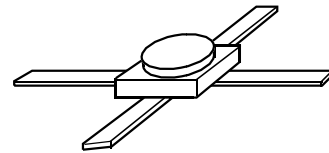
#### Description

The MSA-0270 is a high performance silicon bipolar Monolithic Microwave Integrated Circuit (MMIC) housed in a hermetic, high reliability package. This

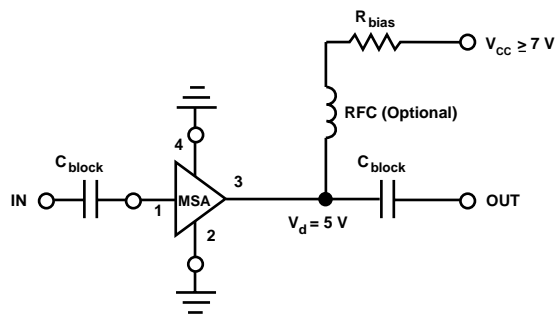
MMIC is designed for use as a general purpose 50 Ω gain block. Typical applications include narrow and broad band IF and RF amplifiers in industrial and military applications.

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.

#### 70 mil Package



#### Typical Biasing Configuration



## MSA-0270 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	200°C
Storage Temperature	-65 to 200°C

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

$$\theta_{jc} = 120^{\circ}\text{C/W}$$

### Notes:

1. Permanent damage may occur if any of these limits are exceeded.
2.  $T_{\text{CASE}} = 25^{\circ}\text{C}$ .
3. Derate at 8.3 mW/°C for  $T_{\text{C}} > 161^{\circ}\text{C}$ .
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: $I_{\text{d}} = 25 \text{ mA}$ , $Z_{\text{o}} = 50 \Omega$	Units	Min.	Typ.	Max.
$G_{\text{P}}$	Power Gain ( $ S_{21} ^2$ ) $f = 0.1 \text{ GHz}$	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 $f = 0.1 \text{ to } 3.0 \text{ GHz}$			1.4:1	
	Output VSWR $f = 0.1 \text{ to } 3.0 \text{ GHz}$			1.4:1	
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	
$IP_3$	Third Order Intercept Point $f = 1.0 \text{ GHz}$	dBm		17.0	
$t_{\text{D}}$	Group Delay $f = 1.0 \text{ GHz}$	psec		125	
$V_{\text{d}}$	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 18 to 40 mA. Typical performance as a function of current is on the following page.

### MSA-0270 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	.11	179	12.6	4.26	176	-18.4	.120	1	.12	-8
0.2	.11	174	12.6	4.24	171	-18.6	.117	3	.12	-15
0.4	.10	169	12.5	4.21	162	-18.4	.120	4	.13	-30
0.6	.09	165	12.4	4.17	154	-18.2	.123	5	.14	-44
0.8	.08	161	12.3	4.11	146	-18.2	.123	7	.14	-55
1.0	.06	161	12.2	4.05	137	-18.0	.126	9	.15	-64
1.5	.02	-150	11.7	3.85	116	-17.2	.138	11	.16	-84
2.0	.06	-110	11.1	3.57	96	-16.3	.153	11	.16	-102
2.5	.11	-112	10.3	3.27	82	-15.7	.165	14	.14	-106
3.0	.17	-134	9.3	2.92	65	-15.2	.174	12	.13	-114
3.5	.22	-147	8.2	2.56	48	-14.7	.185	6	.15	-111
4.0	.26	156	7.0	2.23	33	-14.3	.192	3	.19	-107
5.0	.28	179	4.7	1.72	8	-14.0	.199	-6	.27	-107
6.0	.30	143	3.0	1.41	-13	-13.8	.204	-14	.29	-119

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

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

(unless otherwise noted)

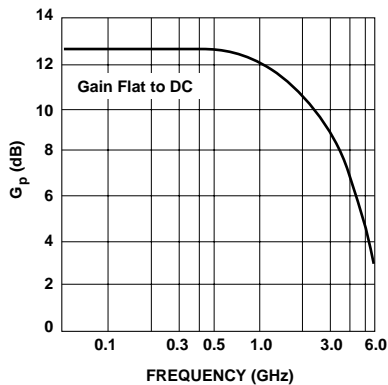


Figure 1. Typical Power Gain vs. Frequency,  $T_A = 25^\circ\text{C}$ ,  $I_d = 25 \text{ mA}$ .

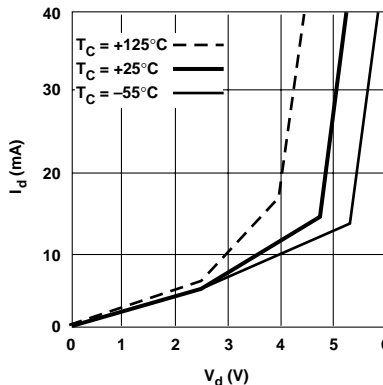


Figure 2. Device Current vs. Voltage.

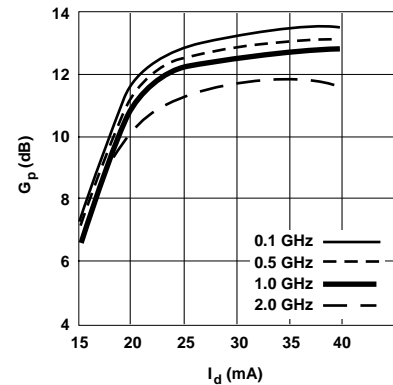


Figure 3. Power Gain vs. Current.

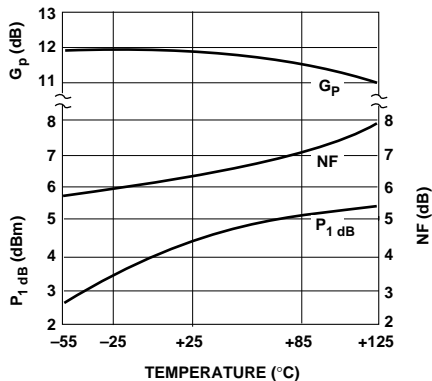


Figure 4. Output Power at 1 dB Gain Compression, NF and Power Gain vs. Mounting Surface Temperature,  $f = 1.0 \text{ GHz}$ ,  $I_d = 25 \text{ mA}$ .

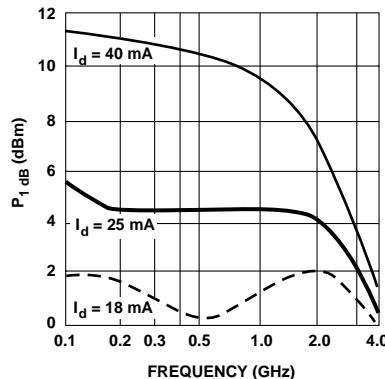


Figure 5. Output Power at 1 dB Gain Compression vs. Frequency.

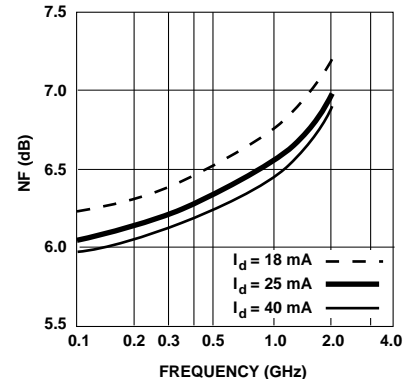


Figure 6. Noise Figure vs. Frequency.

# 70 mil Package Dimensions

