

# MSA-0436

## Cascadable Silicon Bipolar MMIC Amplifiers



### Data Sheet

#### Description

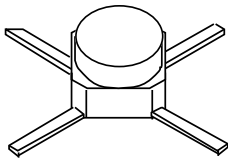
The MSA-0436 is a high performance silicon bipolar Monolithic Microwave Integrated Circuit (MMIC) housed in a cost effective, microstrip package. This MMIC is designed for use as a general purpose  $50\Omega$  gain block. Typical applications include narrow and broad band IF and RF amplifiers in industrial and military applications.

The MSA-series is fabricated using Avago'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.

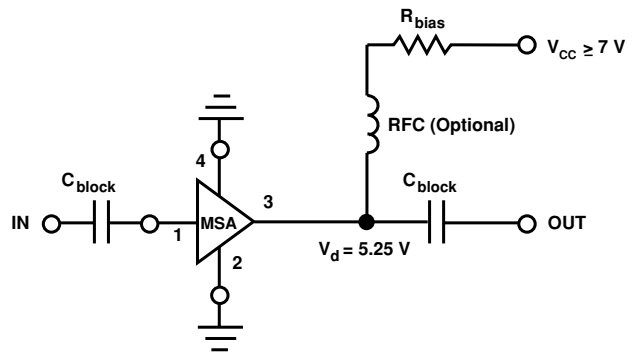
#### Features

- Cascadable  $50\Omega$  Gain Block
- 3 dB Bandwidth: DC to 3.8 GHz
- 12.5 dBm Typical  $P_{1dB}$  at 1.0 GHz
- 8.5 dB Typical Gain at 1.0 GHz
- Unconditionally Stable ( $k > 1$ )
- Cost Effective Ceramic Microstrip Package

#### 36 micro-X Package



#### Typical Biasing Configuration



### MSA-0436 Absolute Maximum Ratings

Parameter	Absolute Maximum <sup>[1]</sup>
Device Current	100 mA
Power Dissipation <sup>[2,3]</sup>	650 mW
RF Input Power	+13 dBm
Junction Temperature	150°C
Storage Temperature <sup>[4]</sup>	–65 to 150°C

### Thermal Resistance<sup>[2,5]:</sup>

$$\theta_{jc} = 140^{\circ}\text{C/W}$$

#### Notes:

1. Permanent damage may occur if any of these limits are exceeded.
2.  $T_{\text{CASE}} = 25^{\circ}\text{C}$ .
3. Derate at  $7.1 \text{ mW}/^{\circ}\text{C}$  for  $T_{\text{C}} > 109^{\circ}\text{C}$ .
4. Storage above  $+150^{\circ}\text{C}$  may tarnish the leads of this package making it difficult to solder into a circuit.
5. The small spot size of this technique results in a higher, though more accurate determination of  $q_{jc}$  than do alternate methods.

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

Symbol	Parameters and Test Conditions: $I_{\text{d}} = 50 \text{ mA}$ , $Z_0 = 50 \Omega$	Units	Min.	Typ.	Max.
$G_{\text{P}}$	Power Gain ( $ S_{21} ^2$ ) $f = 0.1 \text{ GHz}$	dB	7.5	8.5	9.5
$\Delta G_{\text{P}}$	Gain Flatness $f = 0.1 \text{ to } 2.5 \text{ GHz}$	dB		$\pm 0.6$	$\pm 1.0$
$f_{3 \text{ dB}}$	3 dB Bandwidth	GHz		3.8	
VSWR	Input VSWR $f = 0.1 \text{ to } 2.5 \text{ GHz}$			1.4:1	
	Output VSWR $f = 0.1 \text{ to } 2.5 \text{ GHz}$			1.9:1	
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		12.5	
$\text{IP}_3$	Third Order Intercept Point $f = 1.0 \text{ GHz}$	dBm		25.5	
$t_{\text{D}}$	Group Delay $f = 1.0 \text{ GHz}$	psec		125	
$V_{\text{d}}$	Device Voltage	V	4.75	5.25	5.75
$\text{dV/dT}$	Device Voltage Temperature Coefficient	mV/ $^{\circ}\text{C}$		–8.0	

#### Note:

1. The recommended operating current range for this device is 30 to 70 mA. Typical performance as a function of current is on the following page.

### Ordering Information

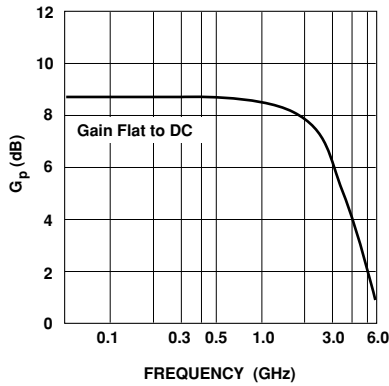
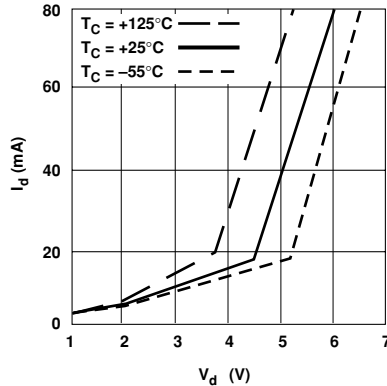
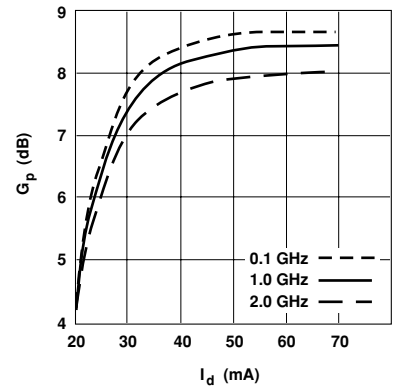
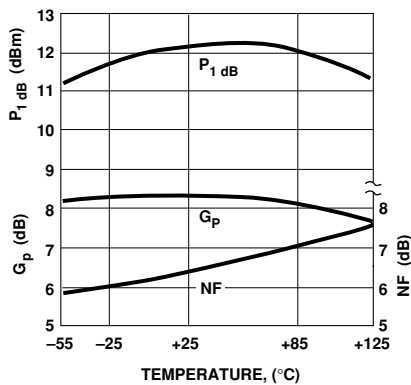
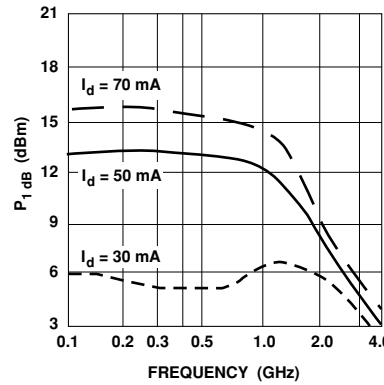
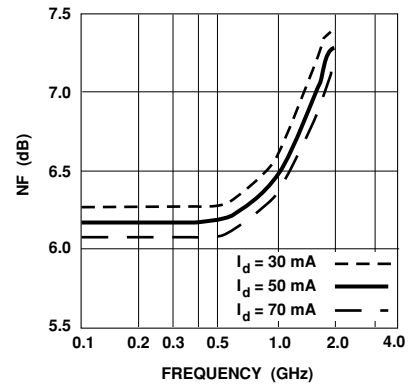
Part Numbers	No. of Devices	Comments
MSA-0436-BLKG	100	Bulk
MSA-0436-TR1G	1000	7" Reel

**MSA-0436 Typical Scattering Parameters ( $Z_0 = 50 \Omega$ ,  $T_A = 25^\circ\text{C}$ ,  $I_d = 50 \text{ mA}$ )**

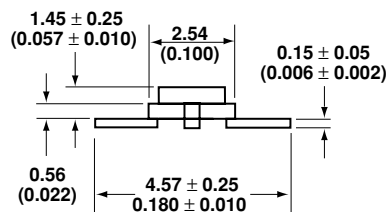
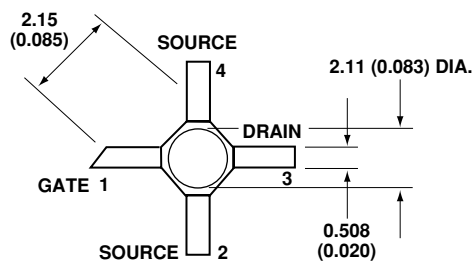
Freq. GHz	$S_{11}$		$S_{21}$			$S_{12}$			$S_{22}$	
	Mag	Ang	dB	Mag	Ang	dB	Mag	Ang	Mag	Ang
0.1	.08	175	8.5	2.67	175	-16.4	.151	1	.20	-10
0.2	.08	172	8.5	2.68	170	-16.3	.153	2	.20	-16
0.4	.07	171	8.5	2.67	161	-16.4	.151	3	.20	-33
0.6	.07	166	8.5	2.66	151	-16.2	.155	6	.21	-45
0.8	.05	169	8.4	2.64	142	-16.1	.156	8	.22	-57
1.0	.05	175	8.3	2.61	136	-16.0	.159	10	.24	-68
1.5	.04	-142	8.1	2.55	109	-15.0	.178	13	.26	-96
2.0	.09	-145	7.8	2.46	87	-14.2	.196	15	.28	-123
2.5	.14	-154	7.3	2.33	71	-13.1	.221	18	.31	-140
3.0	.22	-175	6.6	2.14	50	-12.5	.238	14	.33	-160
3.5	.28	170	5.8	1.94	32	-11.7	.260	9	.35	-173
4.0	.34	156	4.8	1.74	15	-11.3	.271	4	.34	-179
4.5	.37	140	3.9	1.57	-1	-10.7	.291	-2	.33	-171
5.0	.42	120	3.0	1.41	-16	-10.4	.302	-8	.32	-160

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

(unless otherwise noted)


**Figure 1. Typical Power Gain vs. Frequency,  $T_A = 25^\circ\text{C}$ ,  $I_d = 50 \text{ mA}$ .**

**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,  $f = 1.0 \text{ GHz}$ ,  $I_d = 50 \text{ mA}$ .**

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

**Figure 6. Noise Figure vs. Frequency.**

## 36 micro-X Package Dimensions



### Notes:

1. Dimensions are in millimeters (inches)
2. Tolerances: in .xxx = ± 0.005  
mm .xx = ± 0.13

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