

# MSA-0436

## Cascadable Silicon Bipolar MMIC Amplifiers

**Avago**  
TECHNOLOGIES

### Data Sheet

#### Description

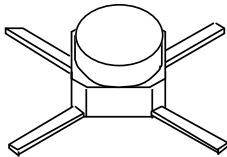
The MSA-0436 is a high performance silicon bipolar Monolithic Microwave Integrated Circuit (MMIC) housed in a cost effective, microstrip package. This MMIC is designed for use as a general purpose  $50\Omega$  gain block. Typical applications include narrow and broad band IF and RF amplifiers in industrial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

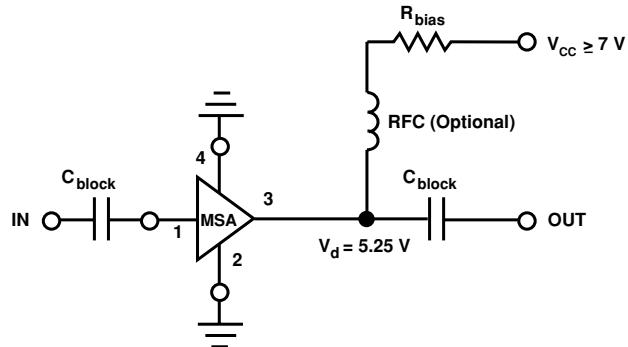
#### Features

- Cascadable  $50\Omega$  Gain Block
- 3 dB Bandwidth: DC to 3.8 GHz
- 12.5 dBm Typical  $P_{1\text{dB}}$  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.  $T_{CASE} = 25^\circ\text{C}$ .
3. Derate at  $7.1 \text{ mW}/^\circ\text{C}$  for  $T_C > 109^\circ\text{C}$ .
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>, $T_A = 25^\circ\text{C}$

Symbol	Parameters and Test Conditions: $I_d = 50 \text{ mA}$ , $Z_0 = 50 \Omega$	Units	Min.	Typ.	Max.
$G_P$	Power Gain ( $ S_{21} ^2$ )	dB	7.5	8.5	9.5
$\Delta G_P$	Gain Flatness	dB		$\pm 0.6$	$\pm 1.0$
$f_{3 \text{ dB}}$	3 dB Bandwidth	GHz		3.8	
VSWR	Input VSWR			1.4:1	
	Output VSWR			1.9:1	
NF	$50 \Omega$ Noise Figure	dB		6.5	
$P_{1 \text{ dB}}$	Output Power at 1 dB Gain Compression	dBm		12.5	
IP <sub>3</sub>	Third Order Intercept Point	dBm		25.5	
$t_D$	Group Delay	psec		125	
$V_d$	Device Voltage	V	4.75	5.25	5.75
$dV/dT$	Device Voltage Temperature Coefficient	mV/°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

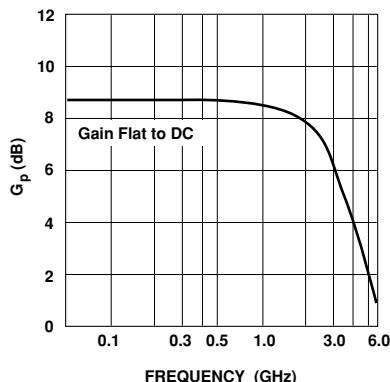
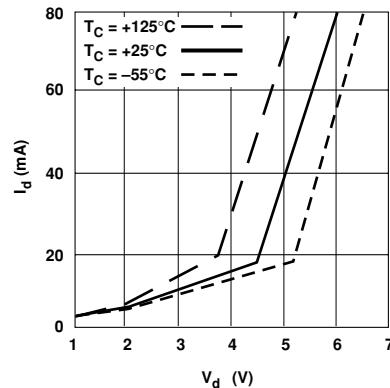
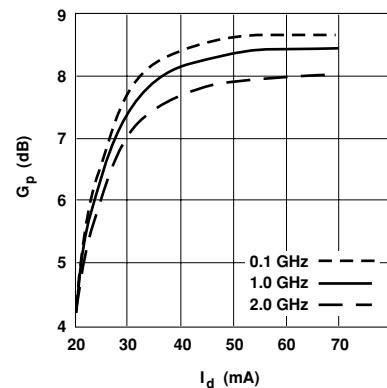
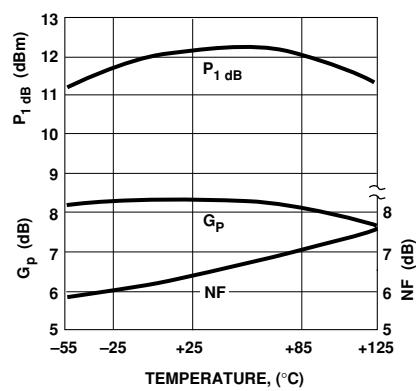
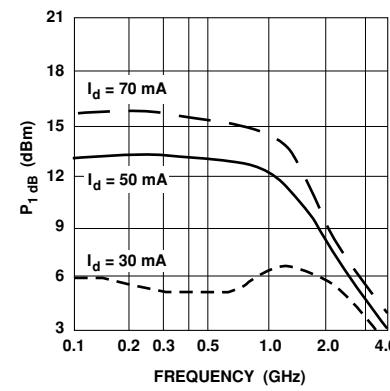
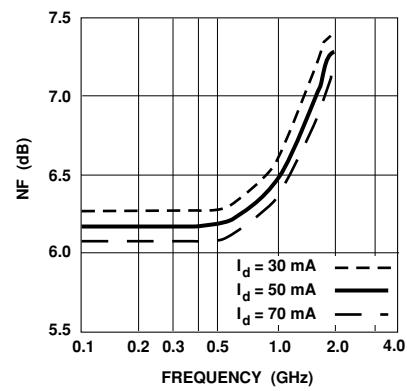
Part Numbers	No. of Devices	Comments
MSA-0436-BLKG	100	Bulk
MSA-0436-TR1G	1000	7" Reel

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

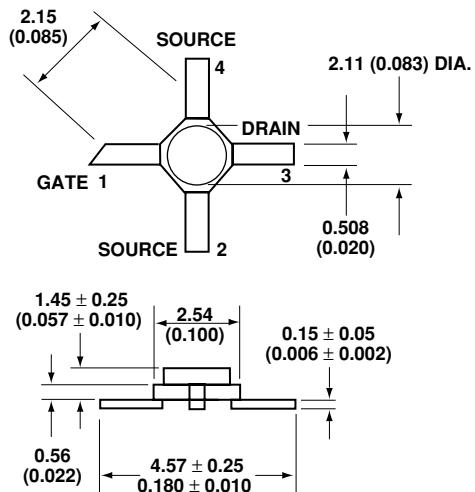
Freq. GHz	S <sub>11</sub>		S <sub>21</sub>			S <sub>12</sub>			S <sub>22</sub>	
	Mag	Ang	dB	Mag	Ang	dB	Mag	Ang	Mag	Ang
0.1	.08	175	8.5	2.67	175	-16.4	.151	1	.20	-10
0.2	.08	172	8.5	2.68	170	-16.3	.153	2	.20	-16
0.4	.07	171	8.5	2.67	161	-16.4	.151	3	.20	-33
0.6	.07	166	8.5	2.66	151	-16.2	.155	6	.21	-45
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 =  $\pm 0.005$   
mm .xx =  $\pm 0.13$

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