# MSA-0836

Cascadable Silicon Bipolar MMIC Amplifier

## Data Sheet

### Description

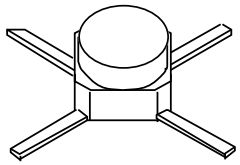
The MSA-0836 is a high performance silicon bipolar Monolithic Microwave Integrated Circuit (MMIC) housed in a cost effective, microstrip package. This MMIC is designed for use as a general purpose 50Ω gain block above 0.5 GHz and can be used as a high gain transistor below this frequency. Typical applications include narrow and moderate band IF and RF amplifiers in commercial and industrial 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.

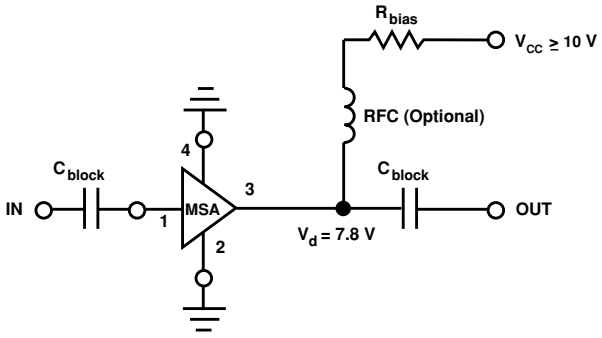
### Features

- Usable Gain to 6.0 GHz
- High Gain:
  32.5 dB Typical at 0.1 GHz
  23.0 dB Typical at 1.0 GHz
- Low Noise Figure: 3.0 dB Typical at 1.0 GHz
- Cost Effective Ceramic Microstrip Package

### 36 micro-X Package



### Typical Biasing Configuration



## MSA-0836 Absolute Maximum Ratings

| Parameter | Absolute Maximum[1] |
|---|---|
| Device Current | 80 mA |
| Power Dissipation[2,3] | 750 mW |
| RF Input Power | +13 dBm |
| Junction Temperature | 150°C |
| Storage Temperature[4] | –65°C to 150°C |

**Thermal Resistance[2,5]:**
$\theta_{jc}$ = 175°C/W

**Notes:**
1. Permanent damage may occur if any of these limits are exceeded.
2. $T_{CASE}$ = 25°C.
3. Derate at 5.7 mW/°C for $T_C$ > 69°C.
4. Storage above +150°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 $\theta_{jc}$ than do alternate methods.

## Electrical Specifications[1], $T_A$ = 25°C

| Symbol | Parameters and Test Conditions: $I_d$ = 36 mA, $Z_O$ = 50 Ω | | Units | Min. | Typ. | Max. |
|---|---|---|---|---|---|---|
| $G_P$ | Power Gain ($\|S_{21}\|^2$) | f = 0.1 GHz<br>f = 1.0 GHz<br>f = 4.0 GHz | dB | 22.0 | 32.5<br>23.0<br>10.5 | 25.0 |
| VSWR | Input VSWR | f = 1.0 to 3.0 GHz | | | 2.0:1 | |
| | Output VSWR | f = 1.0 to 3.0 GHz | | | 1.5:1 | |
| NF | 50 Ω Noise Figure | f = 1.0 GHz | dB | | 3.0 | |
| $P_{1\ dB}$ | Output Power at 1 dB Gain Compression | f = 1.0 GHz | dBm | | 12.5 | |
| $IP_3$ | Third Order Intercept Point | f = 1.0 GHz | dBm | | 27.0 | |
| $t_D$ | Group Delay | f = 1.0 GHz | psec | | 125 | |
| $V_d$ | Device Voltage | | V | 7.0 | 7.8 | 8.4 |
| dV/dT | Device Voltage Temperature Coefficient | | mV/°C | | –17.0 | |

**Note:**
1. The recommended operating current range for this device is 20 to 40 mA. Typical performance as a function of current is on the following page.

## Ordering Information

| Part Numbers | No. of Devices | Comments |
|---|---|---|
| MSA-0836-BLKG | 100 | Bulk |
| MSA-0836-TR1G | 1000 | 7" Reel |

## MSA-0836 Typical Scattering Parameters[1] ($Z_0$ = 50 Ω, $T_A$ = 25°C, $I_d$ = 36 mA)

| Freq. GHz | $S_{11}$ | | $S_{21}$ | | | $S_{12}$ | | | $S_{22}$ | | k |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mag | Ang | dB | Mag | Ang | dB | Mag | Ang | Mag | Ang | |
| 0.1 | .63 | –17 | 32.5 | 42.02 | 161 | –37.7 | .013 | 55 | .63 | –19 | 0.72 |
| 0.2 | .58 | –33 | 31.5 | 37.52 | 145 | –33.7 | .021 | 47 | .56 | –37 | 0.73 |
| 0.4 | .49 | –56 | 29.1 | 28.50 | 119 | –29.7 | .033 | 54 | .42 | –66 | 0.72 |
| 0.6 | .40 | –70 | 26.7 | 21.54 | 103 | –27.9 | .040 | 55 | .32 | –84 | 0.78 |
| 0.8 | .35 | –80 | 24.6 | 17.01 | 92 | –26.0 | .050 | 53 | .24 | –98 | 0.85 |
| 1.0 | .33 | –89 | 22.9 | 13.98 | 82 | –24.9 | .057 | 52 | .18 | –107 | 0.89 |
| 1.5 | .30 | –111 | 19.5 | 9.45 | 64 | –22.1 | .079 | 51 | .09 | –126 | 0.95 |
| 2.0 | .30 | –133 | 16.9 | 7.03 | 48 | –20.2 | .098 | 44 | .07 | –141 | 0.99 |
| 2.5 | .32 | –150 | 14.9 | 5.53 | 39 | –19.2 | .110 | 42 | .06 | –166 | 1.04 |
| 3.0 | .34 | –170 | 13.2 | 4.56 | 26 | –18.3 | .122 | 36 | .06 | –106 | 1.06 |
| 3.5 | .38 | 175 | 11.7 | 3.86 | 14 | –17.5 | .133 | 32 | .08 | –100 | 1.08 |
| 4.0 | .39 | 162 | 10.5 | 3.33 | 2 | –16.7 | .146 | 27 | .12 | –101 | 1.08 |
| 5.0 | .41 | 132 | 7.9 | 2.47 | –21 | –15.6 | .165 | 19 | .21 | –113 | 1.10 |
| 6.0 | .52 | 95 | 5.8 | 1.94 | –45 | –14.6 | .187 | 7 | .20 | –149 | 1.05 |

## Typical Performance, $T_A$ = 25°C

(unless otherwise noted)

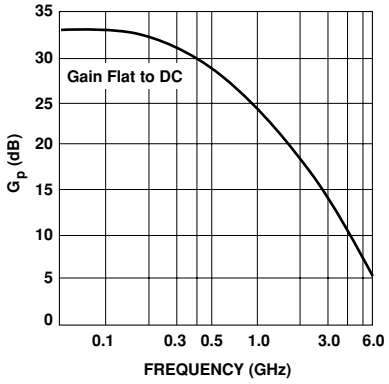



**Figure 1. Typical Power Gain vs. Frequency, $I_d$ = 36 mA.**

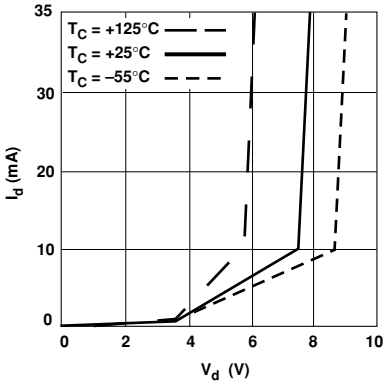



**Figure 2. Device Current vs. Voltage.**

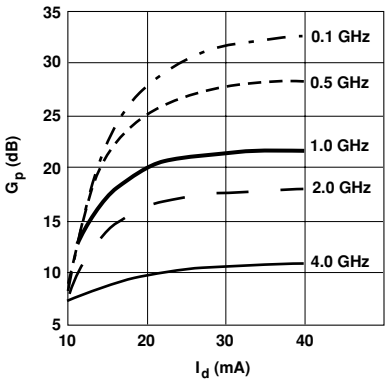



**Figure 3. Power Gain vs. Current.**

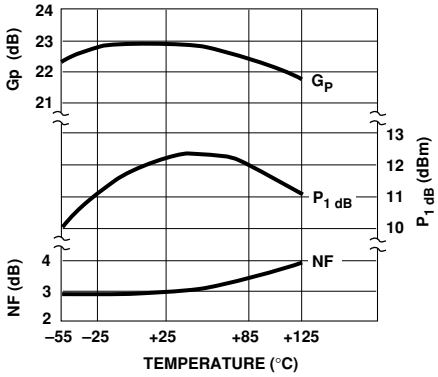



**Figure 4. Output Power at 1 dB Gain Compression, NF and Power Gain vs. Case Temperature, f = 1.0 GHz, $I_d$ = 36 mA.**

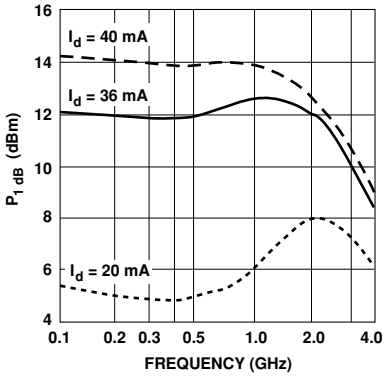



**Figure 5. Output Power at 1 dB Gain Compression vs. Frequency.**

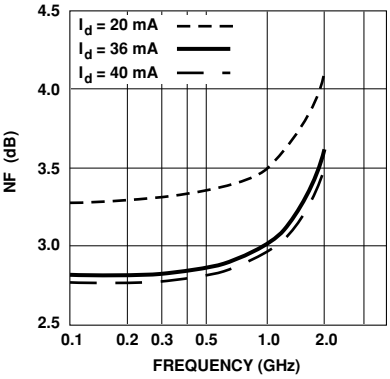
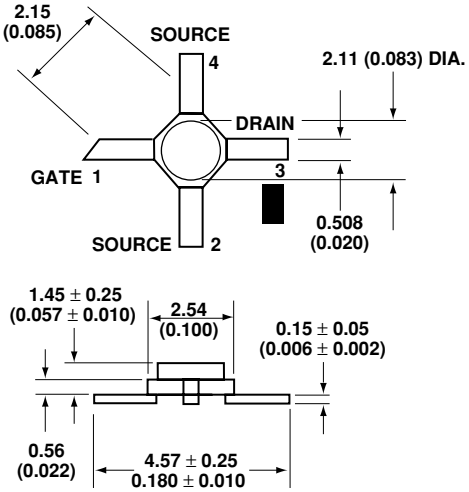



**Figure 6. Noise Figure vs. Frequency.**

## 36 micro-X Package Dimensions




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

For product information and a complete list of distributors, please go to our web site: **www.avagotech.com**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