

# Cascadable Silicon Bipolar MMIC Amplifier

## Technical Data

### MSA-0505

#### Features

- **Cascadable 50  $\Omega$  Gain Block**
- **High Output Power:**  
18.0 dBm Typical  $P_{1\text{ dB}}$  at 1.0 GHz
- **Low Distortion:**  
29.0 dBm Typical  $IP_3$  at 1.0 GHz
- **7.0 dB Typical Gain at 1.0 GHz**
- **Surface Mount Plastic Package**
- **Tape-and-Reel Packaging Option Available<sup>(1)</sup>**

#### Note:

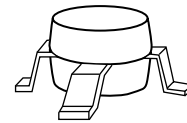
1. Refer to PACKAGING section "Tape-and-Reel Packaging for Semiconductor Devices."

#### Description

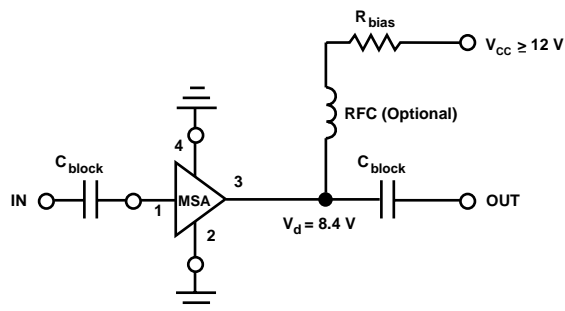
The MSA-0505 is a high performance medium power silicon bipolar Monolithic Microwave Integrated Circuit (MMIC) housed in a low cost, surface mount package. This MMIC is designed for use as a general purpose 50  $\Omega$  gain block. Typical applications include narrow and broad band IF and RF amplifiers in commercial systems.

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.

#### 05 Plastic Package



#### Typical Biasing Configuration



## MSA-0505 Absolute Maximum Ratings

| Parameter                          | Absolute Maximum <sup>[1]</sup> |
|------------------------------------|---------------------------------|
| Device Current                     | 135 mA                          |
| Power Dissipation <sup>[2,3]</sup> | 1.5 W                           |
| RF Input Power                     | +25 dBm                         |
| Junction Temperature               | 200°C                           |
| Storage Temperature                | -65 to 150°C                    |

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

$$\theta_{jc} = 85^{\circ}\text{C/W}$$

#### Notes:

1. Permanent damage may occur if any of these limits are exceeded.
2.  $T_{\text{CASE}} = 25^{\circ}\text{C}$ .
3. Derate at 11.8 mW/°C for  $T_{\text{C}} > 73^{\circ}\text{C}$ .
4. 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: $I_{\text{d}} = 80 \text{ mA}$ , $Z_{\text{o}} = 50 \Omega$ | Units              | Min. | Typ.       | Max. |
|-----------------------|---|--------------------|------|------------|------|
| P <sub>1</sub> dB     | Output Power at 1 dB Gain Compression   | f = 0.5 GHz        |      | 19.0       |      |
|                       |   | f = 1.0 GHz        | 16.0 | 18.0       |      |
| G <sub>P</sub>        | Power Gain ( $ S_{21} ^2$ )   | f = 0.5 GHz        |      | 7.5        |      |
|                       |   | f = 1.0 GHz        | 6.0  | 7.0        |      |
| $\Delta G_{\text{P}}$ | Gain Flatness   | f = 0.1 to 1.5 GHz |      | $\pm 0.75$ |      |
| f <sub>3</sub> dB     | 3 dB Bandwidth <sup>[2]</sup>   |                    |      | 2.3        |      |
| VSWR                  | Input VSWR  | f = 0.1 to 1.5 GHz |      | 1.6:1      |      |
|                       | Output VSWR   | f = 0.1 to 1.5 GHz |      | 2.0:1      |      |
| IP <sub>3</sub>       | Third Order Intercept Point   | f = 1.0 GHz        |      | 29.0       |      |
| NF                    | 50 $\Omega$ Noise Figure  | f = 1.0 GHz        |      | 6.5        |      |
| t <sub>D</sub>        | Group Delay   | f = 1.0 GHz        |      | 190        |      |
| V <sub>d</sub>        | Device Voltage  |                    | 6.7  | 8.4        | 10.1 |
| dV/dT                 | Device Voltage Temperature Coefficient  |                    |      | -16.0      |      |

#### Notes:

1. The recommended operating current range for this device is 60 to 100 mA. Typical performance as a function of current is on the following page.
2. Referenced from 0.1 GHz Gain (G<sub>P</sub>).

## Part Number Ordering Information

| Part Number  | No. of Devices | Container |
|--------------|----------------|-----------|
| MSA-0505-TR1 | 500            | 7" Reel   |
| MSA-0505-STR | 10             | Strip     |

For more information, see "Tape and Reel Packaging for Semiconductor Devices".

### MSA-0505 Typical Scattering Parameters ( $T_A = 25^\circ\text{C}$ , $I_d = 80\text{ mA}$ )

| Freq.<br>MHz | $S_{11}$ |      | $S_{21}$ |      |     | $S_{12}$ |      |     | $S_{22}$ |      | k    |
|--------------|----------|------|----------|------|-----|----------|------|-----|----------|------|------|
|              | Mag      | Ang  | dB       | Mag  | Ang | dB       | Mag  | Ang | Mag      | Ang  |      |
| 5            | .56      | -39  | 14.9     | 5.56 | 161 | -18.5    | .120 | 39  | .65      | -36  | 0.60 |
| 25           | .24      | -103 | 9.7      | 3.05 | 156 | -13.9    | .202 | 12  | .25      | -90  | 0.97 |
| 50           | .15      | -130 | 8.2      | 2.57 | 163 | -13.7    | .207 | 7   | .15      | -116 | 1.15 |
| 100          | .13      | -155 | 7.8      | 2.45 | 165 | -13.7    | .207 | 3   | .11      | -132 | 1.21 |
| 200          | .12      | -170 | 7.7      | 3.43 | 161 | -13.5    | .211 | 1   | .11      | -145 | 1.21 |
| 400          | .12      | 178  | 7.5      | 2.37 | 148 | -13.6    | .209 | -1  | .14      | -146 | 1.23 |
| 600          | .13      | 172  | 7.4      | 2.34 | 134 | -13.6    | .209 | -2  | .17      | -151 | 1.23 |
| 800          | .13      | 168  | 7.2      | 2.29 | 119 | -13.6    | .209 | -3  | .21      | -157 | 1.23 |
| 1000         | .14      | 166  | 7.0      | 2.24 | 105 | -13.4    | .213 | -4  | .25      | -164 | 1.21 |
| 1500         | .21      | 159  | 6.4      | 2.09 | 72  | -13.3    | .217 | -6  | .34      | 176  | 1.16 |
| 2000         | .30      | 148  | 5.2      | 1.82 | 42  | -13.1    | .222 | -9  | .42      | 159  | 1.12 |
| 2500         | .40      | 136  | 4.1      | 1.60 | 17  | -12.9    | .227 | -11 | .48      | 146  | 1.05 |
| 3000         | .52      | 121  | 2.7      | 1.36 | -7  | -12.6    | .234 | -16 | .55      | 133  | 0.92 |

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

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

(unless otherwise noted)

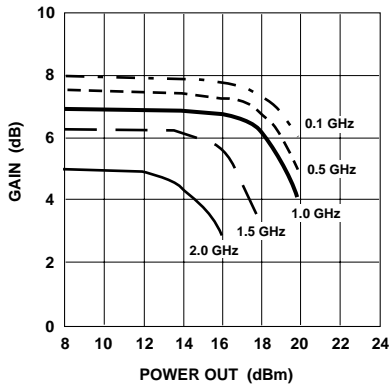


Figure 1. Typical Gain vs. Power Out,  $T_A = 25^\circ\text{C}$ ,  $I_d = 80\text{ mA}$ .

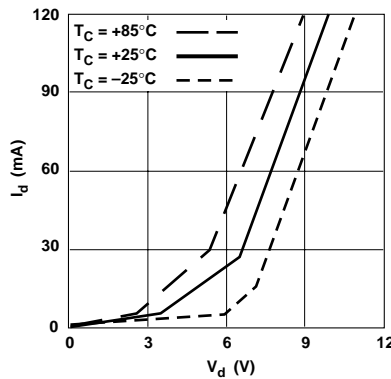


Figure 2. Device Current vs. Voltage.

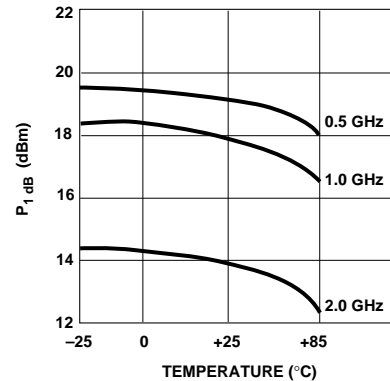


Figure 3. Output Power at 1 dB Gain Compression, vs. Case Temperature,  $I_d = 80\text{ mA}$ .

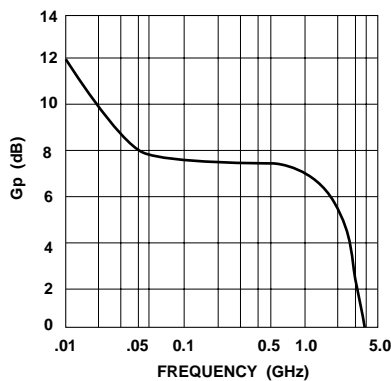


Figure 4. Gain vs. Frequency,  $I_d = 80\text{ to }100\text{ mA}$ .

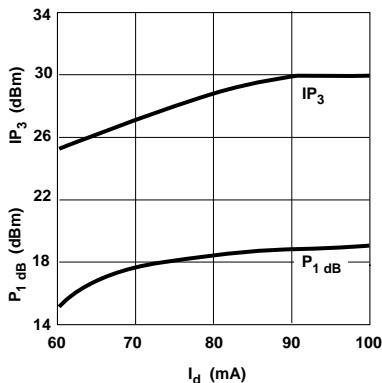


Figure 5. Output Power at 1 dB Gain Compression, Third Order Intercept vs. Case Temperature,  $f = 1.0\text{ GHz}$ .

