

# Cascadable Silicon Bipolar MMIC Amplifier

## Technical Data

### MSA-0711

#### Features

- **Cascadable 50  $\Omega$  Gain Block**
- **3 dB Bandwidth:**  
DC to 1.9 GHz
- **12.0 dB Typical Gain at 1.0 GHz**
- **Unconditionally Stable ( $k > 1$ )**
- **Low Cost Surface Mount Plastic Package**
- **Tape-and-Reel Packaging Option Available<sup>[1]</sup>**

#### Note:

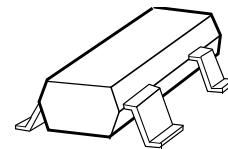
1. Refer to PACKAGING section "Tape-and-Reel Packaging for Surface Mount Semiconductors".

#### Description

The MSA-0711 is a low cost silicon bipolar Monolithic Microwave Integrated Circuit (MMIC) housed in the surface mount plastic SOT-143 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 and industrial applications.

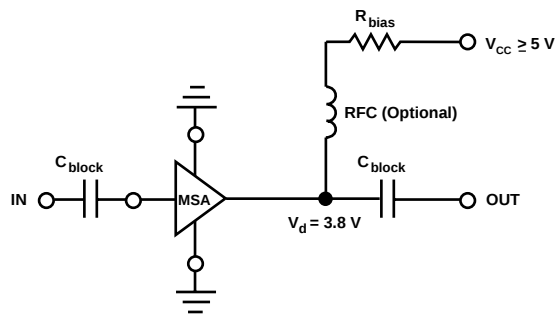
The MSA-series is fabricated using HP's 10 GHz  $f_T$ , 25 GHz  $f_{MAX}$ , silicon bipolar MMIC process which uses nitride self-alignment, ion implantation, and gold metalli-

#### SOT-143 Package



zation to achieve excellent performance, uniformity and reliability. The use of an external bias resistor for temperature and current stability also allows bias flexibility.

#### Typical Biasing Configuration



## MSA-0711 Absolute Maximum Ratings

| Parameter                          | Absolute Maximum <sup>[1]</sup> |
|------------------------------------|---------------------------------|
| Device Current                     | 50 mA                           |
| Power Dissipation <sup>[2,3]</sup> | 175 mW                          |
| RF Input Power                     | +13 dBm                         |
| Junction Temperature               | 150°C                           |
| Storage Temperature                | -65 to 150°C                    |

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

$$\theta_{jc} = 505^{\circ}\text{C/W}$$

#### Notes:

1. Permanent damage may occur if any of these limits are exceeded.
2.  $T_{\text{CASE}} = 25^{\circ}\text{C}$ .
3. Derate at 2.0 mW/°C for  $T_{\text{C}} > 62^{\circ}\text{C}$ .
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: $I_{\text{d}} = 22 \text{ mA}$ , $Z_{\text{o}} = 50 \Omega$ | Units | Min. | Typ.         | Max. |
|-----------------------|---------------------------------------------------------------------------------------------|-------|------|--------------|------|
| $G_{\text{P}}$        | Power Gain ( $ S_{21} ^2$ )<br>f = 0.1 GHz<br>f = 1.0 GHz                                   | dB    | 10.0 | 13.0<br>12.0 |      |
| $\Delta G_{\text{P}}$ | Gain Flatness<br>f = 0.1 to 1.3 GHz                                                         | dB    |      | $\pm 0.8$    |      |
| $f_{3 \text{ dB}}$    | 3 dB Bandwidth                                                                              | GHz   |      | 3.2          |      |
| VSWR                  | Input VSWR<br>f = 0.1 to 2.0 GHz                                                            |       |      | 1.5:1        |      |
|                       | Output VSWR<br>f = 0.1 to 2.0 GHz                                                           |       |      | 1.5:1        |      |
| NF                    | 50 $\Omega$ Noise Figure<br>f = 1.0 GHz                                                     | dB    |      | 5.0          |      |
| $P_{1 \text{ dB}}$    | Output Power at 1 dB Gain Compression<br>f = 1.0 GHz                                        | dBm   |      | 5.5          |      |
| $\text{IP}_3$         | Third Order Intercept Point<br>f = 1.0 GHz                                                  | dBm   |      | 18.0         |      |
| $t_{\text{D}}$        | Group Delay<br>f = 1.0 GHz                                                                  | psec  |      | 145          |      |
| $V_{\text{d}}$        | Device Voltage<br>$T_{\text{C}} = 25^{\circ}\text{C}$                                       | V     | 3.0  | 3.8          | 4.6  |
| $\text{dV/dT}$        | Device Voltage Temperature Coefficient                                                      | mV/°C |      | -7.0         |      |

#### Note:

1. The recommended operating current range for this device is 15 to 30 mA. Typical performance as a function of current is on the following page.

## Part Number Ordering Information

| Part Number  | No. of Devices | Container      |
|--------------|----------------|----------------|
| MSA-0711-TR1 | 3000           | 7" Reel        |
| MSA-0711-BLK | 100            | Antistatic Bag |

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

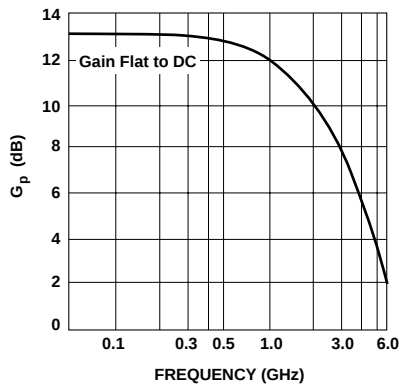
# MSA-0711 Typical Scattering Parameters ( $Z_0 = 50\ \Omega$ , $T_A = 25^\circ\text{C}$ , $I_d = 22\ \text{mA}$ )

| Freq.<br>GHz | $S_{11}$ |      | $S_{21}$ |      |     | $S_{12}$ |      |     | $S_{22}$ |      |
|--------------|----------|------|----------|------|-----|----------|------|-----|----------|------|
|              | Mag      | Ang  | dB       | Mag  | Ang | dB       | Mag  | Ang | Mag      | Ang  |
| 0.1          | .03      | 1    | 13.0     | 4.47 | 174 | -18.6    | .118 | 1   | .19      | -8   |
| 0.2          | .04      | 1    | 12.9     | 4.42 | 168 | -18.5    | .119 | 2   | .19      | -18  |
| 0.4          | .04      | -4   | 12.8     | 4.38 | 157 | -18.4    | .120 | 4   | .19      | -36  |
| 0.6          | .05      | -19  | 12.6     | 4.28 | 146 | -18.1    | .125 | 9   | .19      | -52  |
| 0.8          | .07      | -32  | 12.3     | 4.14 | 135 | -17.7    | .130 | 10  | .20      | -68  |
| 1.0          | .08      | -44  | 12.0     | 3.99 | 123 | -17.4    | .135 | 12  | .19      | -82  |
| 1.5          | .13      | -88  | 10.9     | 3.52 | 98  | -16.1    | .157 | 13  | .19      | -113 |
| 2.0          | .18      | -130 | 9.8      | 3.08 | 75  | -15.2    | .173 | 8   | .18      | -138 |
| 2.5          | .25      | -155 | 8.6      | 2.68 | 61  | -14.7    | .184 | 9   | .18      | -151 |
| 3.0          | .32      | -178 | 7.2      | 2.30 | 42  | -14.7    | .185 | 5   | .17      | -158 |
| 3.5          | .38      | 165  | 5.8      | 1.96 | 26  | -14.8    | .181 | 3   | .17      | -150 |
| 4.0          | .42      | 152  | 4.5      | 1.68 | 12  | -14.7    | .184 | 1   | .20      | -142 |

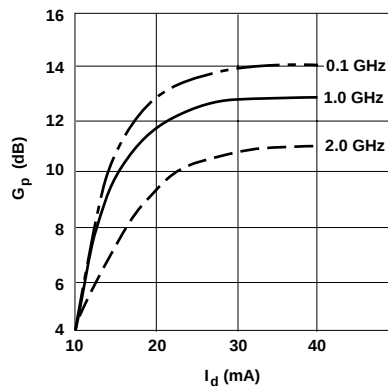
A model for this device is available in the DEVICE MODELS section.

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

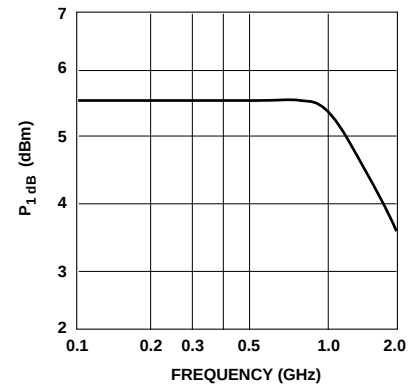
(unless otherwise noted)



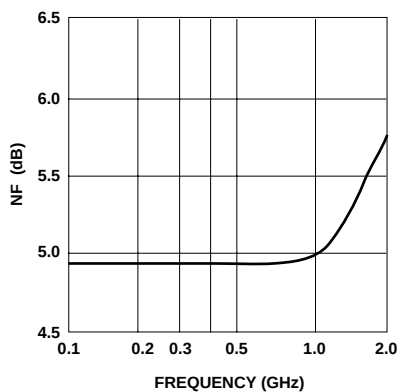
**Figure 1. Power Gain vs. Frequency,**  
 $I_d = 22\ \text{mA}$ .



**Figure 2. Power Gain vs. Current.**

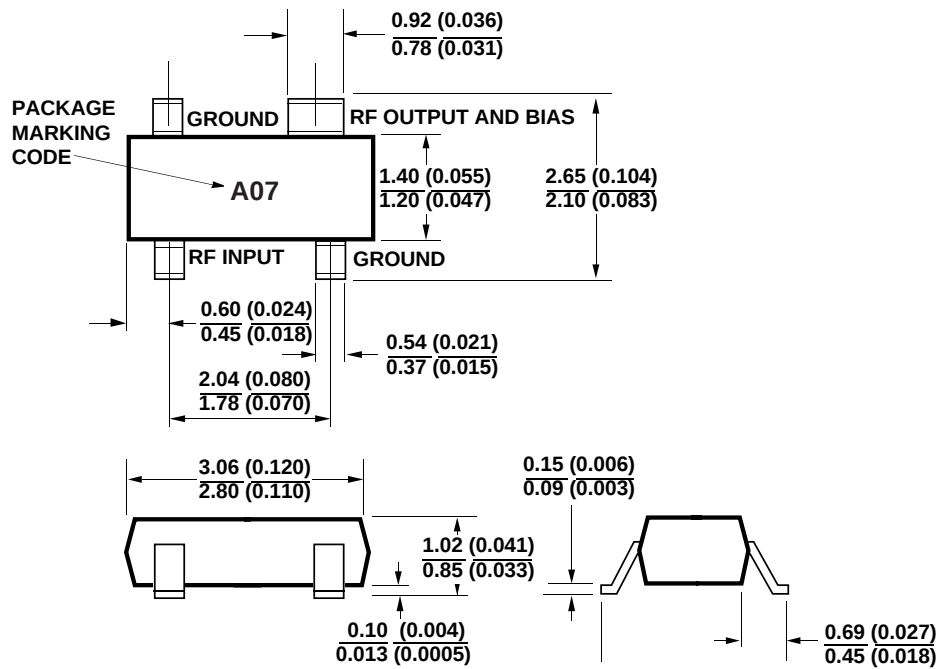


**Figure 3. Output Power at 1 dB Gain Compression vs. Frequency,**  
 $I_d = 22\ \text{mA}$ .



**Figure 4. Noise Figure vs. Frequency,**  
 $I_d = 22\ \text{mA}$ .

## SOT-143 Package Dimensions



DIMENSIONS ARE IN MILLIMETERS (INCHES)