# Cascadable Silicon Bipolar MMIC Amplifier

## Technical Data

**MSA-0285**

### Features

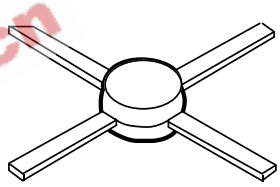
- **Cascadable 50 Ω Gain Block**
- **3 dB Bandwidth:** DC to 2.6 GHz
- **12.0 dB Typical Gain at 1.0 GHz**
- **Unconditionally Stable (k>1)**
- **Low Cost Plastic Package**

### Description

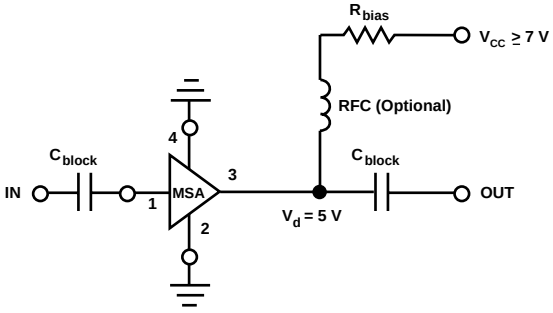
The MSA-0285 is a high performance silicon bipolar Monolithic Microwave Integrated Circuit (MMIC) housed in a low cost plastic package. This MMIC is designed for use as a general purpose 50 Ω gain block. Typical applications include narrow and broad band IF and RF amplifiers in industrial and military 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 metallization to achieve excellent performance, uniformity and reliability. The use of an external bias resistor for temperature and current stability also allows bias flexibility.

### 85 Plastic Package



### Typical Biasing Configuration



## MSA-0285 Absolute Maximum Ratings

| Parameter | Absolute Maximum[1] |
|---|---|
| Device Current | 60 mA |
| Power Dissipation[2,3] | 325 mW |
| RF Input Power | +13 dBm |
| Junction Temperature | 150°C |
| Storage Temperature | –65 to 150°C |

**Thermal Resistance[2,4]:**
$\theta_{jc} = 95°C/W$

**Notes:**
1. Permanent damage may occur if any of these limits are exceeded.
2. $T_{CASE} = 25°C$.
3. Derate at 10.5 mW/°C for $T_C > 119°C$.
4. See MEASUREMENTS section "Thermal Resistance" for more information.

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

| Symbol | Parameters and Test Conditions: $I_d = 25$ mA, $Z_O = 50\ \Omega$ | | Units | Min. | Typ. | Max. |
|---|---|---|---|---|---|---|
| $G_P$ | Power Gain ($\|S_{21}\|^2$) | f = 0.1 GHz<br>f = 1.0 GHz | dB | <br>10.0 | 12.5<br>12.0 | |
| $\Delta G_P$ | Gain Flatness | f = 0.1 to 1.6 GHz | dB | | ±0.6 | |
| $f_{3\ dB}$ | 3 dB Bandwidth | | GHz | | 2.6 | |
| VSWR | Input VSWR | f = 0.1 to 3.0 GHz | | | 1.3:1 | |
| | Output VSWR | f = 0.1 to 3.0 GHz | | | 1.4:1 | |
| NF | 50 Ω Noise Figure | f = 1.0 GHz | dB | | 6.5 | |
| $P_{1\ dB}$ | Output Power at 1 dB Gain Compression | f = 1.0 GHz | dBm | | 4.5 | |
| $IP_3$ | Third Order Intercept Point | f = 1.0 GHz | dBm | | 17.0 | |
| $t_D$ | Group Delay | f = 1.0 GHz | psec | | 125 | |
| $V_d$ | Device Voltage | | V | 4.0 | 5.0 | 6.0 |
| dV/dT | Device Voltage Temperature Coefficient | | mV/°C | | –8.0 | |

**Note:**
1. The recommended operating current range for this device is 18 to 40 mA. Typical performance as a function of current is on the following page.

## MSA-0285 Typical Scattering Parameters ($Z_O$ = 50 Ω, $T_A$ = 25°C, $I_d$ = 25 mA)

| Freq. GHz | $S_{11}$ | | $S_{21}$ | | | $S_{12}$ | | | $S_{22}$ | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Mag | Ang | dB | Mag | Ang | dB | Mag | Ang | Mag | Ang |
| 0.1 | .10 | 174 | 12.6 | 4.25 | 175 | –18.6 | .118 | 2 | .14 | –7 |
| 0.2 | .10 | 168 | 12.5 | 4.22 | 171 | –18.5 | .119 | 3 | .13 | –12 |
| 0.4 | .10 | 157 | 12.4 | 4.17 | 161 | –18.3 | .122 | 6 | .14 | –26 |
| 0.6 | .09 | 143 | 12.3 | 4.10 | 153 | –18.3 | .121 | 7 | .14 | –38 |
| 0.8 | .08 | 132 | 12.1 | 4.03 | 144 | –18.0 | .126 | 11 | .14 | –48 |
| 1.0 | .08 | 122 | 11.9 | 3.95 | 135 | –17.5 | .133 | 12 | .14 | –60 |
| 1.5 | .04 | 95 | 11.4 | 3.70 | 115 | –17.0 | .142 | 16 | .13 | –85 |
| 2.0 | .02 | 117 | 10.6 | 3.40 | 95 | –16.0 | .158 | 17 | .12 | –110 |
| 2.5 | .05 | –173 | 9.9 | 3.11 | 82 | –15.0 | .177 | 20 | .12 | –128 |
| 3.0 | .12 | –175 | 8.9 | 2.78 | 65 | –14.7 | .185 | 19 | .11 | –148 |
| 3.5 | .16 | 179 | 7.9 | 2.49 | 49 | –14.0 | .199 | 14 | .10 | –145 |
| 4.0 | .21 | 169 | 6.9 | 2.22 | 35 | –13.7 | .207 | 11 | .10 | –134 |
| 5.0 | .28 | 139 | 5.0 | 1.77 | 9 | –13.0 | .224 | 4 | .12 | –118 |
| 6.0 | .41 | 100 | 3.0 | 1.42 | –16 | –12.9 | .226 | –5 | .09 | –154 |

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

## Typical Performance, $T_A$ = 25°C

(unless otherwise noted)

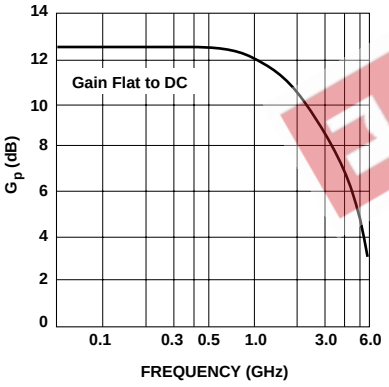



**Figure 1. Typical Power Gain vs. Frequency, $T_A$ = 25°C, $I_d$ = 25 mA.**

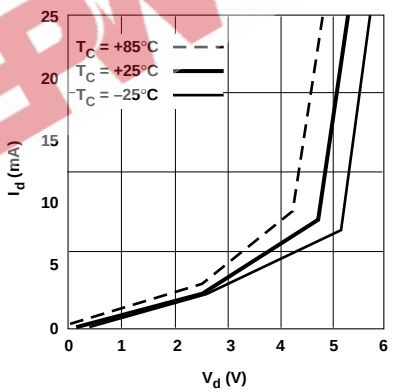



**Figure 2. Device Current vs. Voltage.**

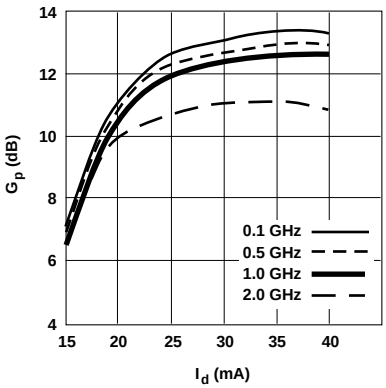



**Figure 3. Power Gain vs. Current.**

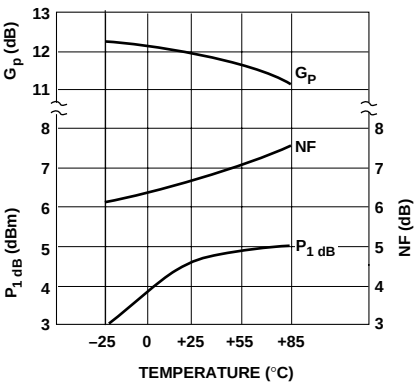



**Figure 4. Output Power at 1 dB Gain Compression, NF and Power Gain vs. Case Temperature, f = 1.0 GHz, $I_d$=25mA.**

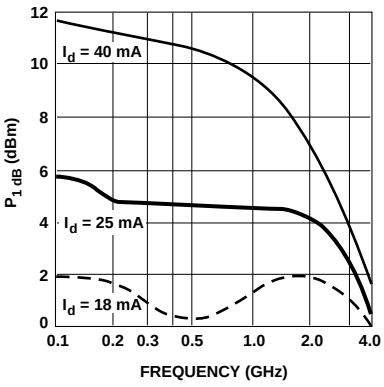



**Figure 5. Output Power at 1 dB Gain Compression vs. Frequency.**

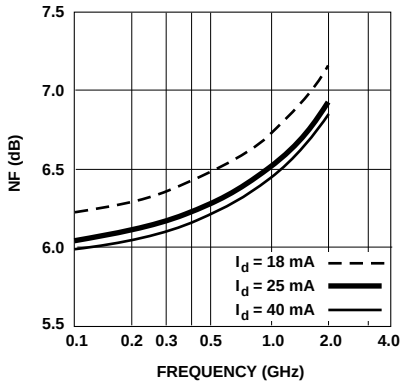



**Figure 6. Noise Figure vs. Frequency.**

## 85 Plastic Package Dimensions