

Cascadable Silicon Bipolar MMIC Amplifier

Technical Data

MSA-0304

Features

- **Cascadable 50 Ω Gain Block**
- **3 dB Bandwidth:**
DC to 1.6 GHz
- **11.0 dB Typical Gain at
1.0 GHz**
- **10.0 dBm Typical P_{1 dB} at
1.0 GHz**
- **Unconditionally Stable
(k>1)**
- **Low Cost Plastic Package**

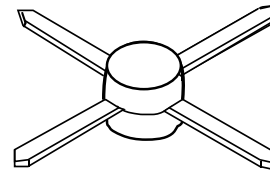
Description

The MSA-0304 is a high performance silicon bipolar Monolithic Microwave Integrated Circuit (MMIC) housed in a low cost

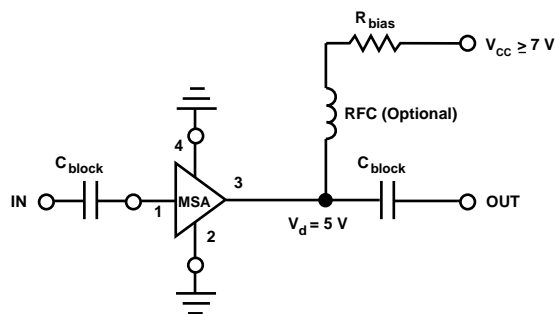
plastic package. This MMIC is designed for use as a general purpose 50 Ω gain block. Typical applications include narrow and broad band IF and RF amplifiers in industrial and military applications.

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.

04A Plastic Package



Typical Biasing Configuration



MSA-0304 Absolute Maximum Ratings

| Parameter | Absolute Maximum ^[1] |
|------------------------------------|---------------------------------|
| Device Current | 70 mA |
| Power Dissipation ^[2,3] | 400 mW |
| RF Input Power | +13 dBm |
| Junction Temperature | 150°C |
| Storage Temperature | -65 to 150°C |

Thermal Resistance^[2,4]:

$$\theta_{jc} = 100^{\circ}\text{C}/\text{W}$$

Notes:

1. Permanent damage may occur if any of these limits are exceeded.
2. $T_{\text{CASE}} = 25^{\circ}\text{C}$.
3. Derate at 10 mW/°C for $T_{\text{C}} > 110^{\circ}\text{C}$.
4. See MEASUREMENTS section "Thermal Resistance" for more information.

Electrical Specifications^[1], $T_{\text{A}} = 25^{\circ}\text{C}$

| Symbol | Parameters and Test Conditions: $I_{\text{d}} = 35 \text{ mA}$, $Z_0 = 50 \Omega$ | Units | Min. | Typ. | Max. |
|--------------------|--|-------|------|----------------------|------|
| GP | Power Gain ($ S_{21} ^2$) f = 0.1 GHz f = 0.5 GHz f = 1.0 GHz | dB | 10.0 | 12.5 12.0 11.0 | |
| ΔGP | Gain Flatness f = 0.1 to 1.3 GHz | dB | | ± 1.0 | |
| $f_3 \text{ dB}$ | 3 dB Bandwidth | GHz | | 1.6 | |
| VSWR | Input VSWR f = 0.1 to 3.0 GHz | | | 1.3:1 | |
| | Output VSWR f = 0.1 to 3.0 GHz | | | 1.6:1 | |
| NF | 50 Ω Noise Figure f = 1.0 GHz | dB | | 6.0 | |
| $P_{1 \text{ dB}}$ | Output Power at 1 dB Gain Compression f = 1.0 GHz | dBm | | 10.0 | |
| IP ₃ | Third Order Intercept Point f = 1.0 GHz | dBm | | 23.0 | |
| t_{D} | Group Delay f = 1.0 GHz | psec | | 150 | |
| V_{d} | Device Voltage | V | 4.5 | 5.0 | 5.5 |
| dV/dT | Device Voltage Temperature Coefficient | mV/°C | | -8.0 | |

Note:

1. The recommended operating current range for this device is 20 to 50 mA. Typical performance as a function of current is on the following page.

MSA-0304 Typical Scattering Parameters ($Z_0 = 50 \Omega$, $T_A = 25^\circ\text{C}$, $I_d = 35 \text{ mA}$)

| Freq. GHz | S_{11} | | S_{21} | | | S_{12} | | | S_{22} | |
|--------------|----------|-----|----------|------|-----|----------|------|-----|----------|------|
| | Mag | Ang | dB | Mag | Ang | dB | Mag | Ang | Mag | Ang |
| 0.1 | .10 | 173 | 12.5 | 4.24 | 173 | -18.5 | .120 | 3 | .12 | -13 |
| 0.2 | .10 | 162 | 12.5 | 4.21 | 167 | -18.2 | .123 | 4 | .12 | -24 |
| 0.4 | .09 | 142 | 12.2 | 4.08 | 153 | -18.0 | .125 | 7 | .13 | -46 |
| 0.6 | .08 | 127 | 11.9 | 3.93 | 141 | -17.8 | .128 | 10 | .15 | -64 |
| 0.8 | .07 | 110 | 11.5 | 3.76 | 130 | -17.3 | .136 | 14 | .16 | -78 |
| 1.0 | .06 | 92 | 11.1 | 3.58 | 118 | -16.8 | .144 | 16 | .17 | -91 |
| 1.5 | .03 | 58 | 10.0 | 3.15 | 93 | -15.5 | .169 | 19 | .19 | -117 |
| 2.0 | .03 | 175 | 8.8 | 2.76 | 71 | -14.1 | .197 | 18 | .20 | -139 |
| 2.5 | .05 | 163 | 7.8 | 2.46 | 55 | -13.2 | .218 | 18 | .21 | -158 |
| 3.0 | .12 | 148 | 6.8 | 2.20 | 38 | -12.2 | .246 | 15 | .22 | -174 |
| 3.5 | .19 | 129 | 5.9 | 1.98 | 20 | -11.2 | .275 | 7 | .24 | 171 |
| 4.0 | .26 | 110 | 5.0 | 1.77 | 3 | -10.6 | .296 | 1 | .26 | 158 |
| 5.0 | .44 | 77 | 3.0 | 1.41 | -28 | -9.9 | .319 | -15 | .29 | 128 |
| 6.0 | .63 | 52 | 0.4 | 1.05 | -56 | -10.2 | .310 | -31 | .37 | 94 |

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

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

(unless otherwise noted)

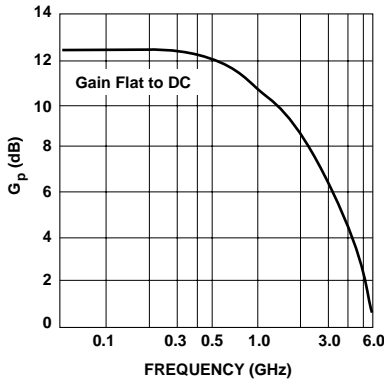


Figure 1. Typical Power Gain vs. Frequency, $T_A = 25^\circ\text{C}$, $I_d = 35 \text{ mA}$.

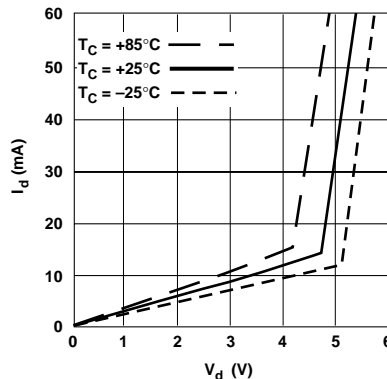


Figure 2. Device Current vs. Voltage.

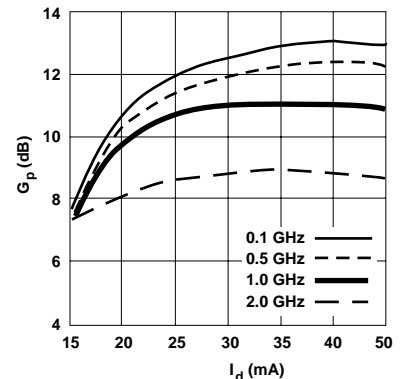


Figure 3. Power Gain vs. Current.

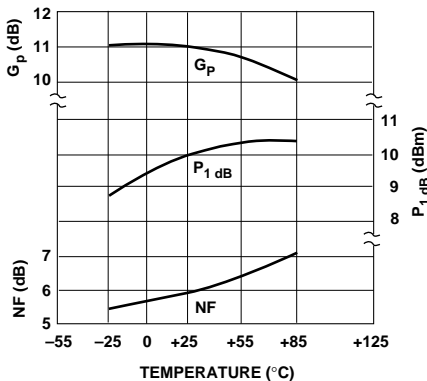


Figure 4. Output Power at 1 dB Gain Compression, NF and Power Gain vs. Case Temperature, $f = 1.0 \text{ GHz}$, $I_d = 35 \text{ mA}$.

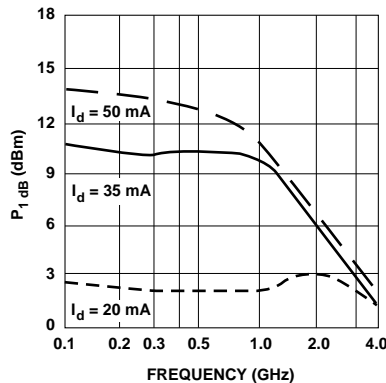


Figure 5. Output Power at 1 dB Gain Compression vs. Frequency.

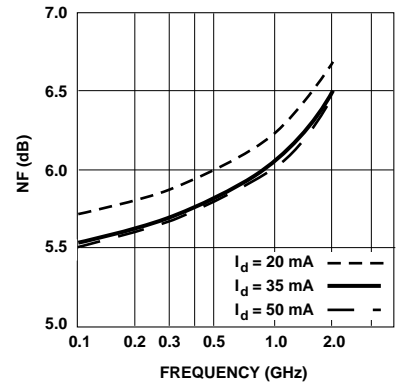


Figure 6. Noise Figure vs. Frequency.

04A Plastic Package Dimensions

