

Cascadable Silicon Bipolar MMIC Amplifier

Technical Data

MSA-1104

Features

- **High Dynamic Range**
Cascadable 50 Ω or 75 Ω
Gain Block
- **3 dB Bandwidth:**
50 MHz to 1.3 GHz
- **17.5 dBm Typical $P_{1\text{ dB}}$ at**
0.5 GHz
- **12 dB Typical 50 Ω Gain at**
0.5 GHz
- **3.6 dB Typical Noise Figure**
at 0.5 GHz
- **Low Cost Plastic Package**

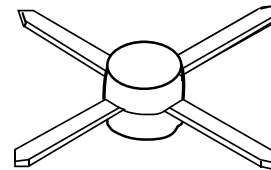
Description

The MSA-1104 is a high performance silicon bipolar Monolithic Microwave Integrated Circuit (MMIC) housed in a low cost

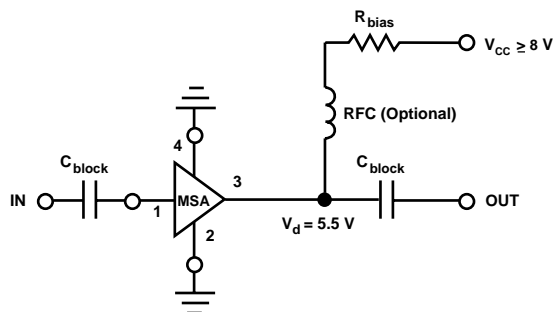
plastic package. This MMIC is designed for high dynamic range in either 50 or 75 Ω systems by combining low noise figure with high IP₃. Typical applications include narrow and broadband linear amplifiers in commercial and industrial systems.

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.

04A Plastic Package



Typical Biasing Configuration



MSA-1104 Absolute Maximum Ratings

| Parameter | Absolute Maximum ^[1] |
|------------------------------------|---------------------------------|
| Device Current | 80 mA |
| Power Dissipation ^[2,3] | 550 mW |
| RF Input Power | +1 dBm |
| Junction Temperature | 150°C |
| Storage Temperature | -65 to 150°C |

Thermal Resistance^{[2,4]:}

$$\theta_{jc} = 115^{\circ}\text{C/W}$$

Notes:

1. Permanent damage may occur if any of these limits are exceeded.
2. $T_{\text{CASE}} = 25^{\circ}\text{C}$.
3. Derate at $8.7 \text{ mW}/^{\circ}\text{C}$ for $T_{\text{C}} > 87^{\circ}\text{C}$.
4. See MEASUREMENTS section "Thermal Resistance" for more information.

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

| Symbol | Parameters and Test Conditions: $I_{\text{d}} = 60 \text{ mA}$, $Z_{\text{o}} = 50 \Omega$ | Units | Min. | Typ. | Max. | |
|-----------------------|---|--------------------|-------|------|-----------|-----|
| G _P | Power Gain ($ S_{21} ^2$) | f = 0.05 GHz | | | 12.7 | |
| | | f = 0.5 GHz | dB | 10.0 | 12.0 | |
| | | f = 1.0 GHz | dB | | 10.5 | |
| ΔG_{P} | Gain Flatness | f = 0.1 to 1.0 GHz | dB | | ± 1.0 | |
| f _{3 dB} | 3 dB Bandwidth ^[2] | | GHz | | 1.3 | |
| VSWR | Input VSWR | f = 0.1 to 1.0 GHz | | | 1.5:1 | |
| | Output VSWR | f = 0.1 to 1.0 GHz | | | 1.7:1 | |
| NF | 50 Ω Noise Figure | f = 0.5 GHz | dB | | 3.6 | |
| P _{1 dB} | Output Power at 1 dB Gain Compression | f = 0.5 GHz | dBm | | 17.5 | |
| IP ₃ | Third Order Intercept Point | f = 0.5 GHz | dBm | | 30 | |
| t _D | Group Delay | f = 0.5 GHz | psec | | 200 | |
| V _d | Device Voltage | | V | 4.4 | 5.5 | 6.6 |
| dV/dT | Device Voltage Temperature Coefficient | | mV/°C | | -8.0 | |

Notes:

1. The recommended operating current range for this device is 40 to 70 mA. Typical performance as a function of current is on the following page.
2. Referenced from 50 MHz gain (G_P).

MSA-1104 Typical Scattering Parameters ($Z_0 = 50 \Omega$, $T_A = 25^\circ\text{C}$, $I_d = 60 \text{ mA}$)

| Freq. GHz | S_{11} | | S_{21} | | | S_{12} | | | S_{22} | | k |
|--------------|----------|------|----------|------|-----|----------|------|-----|----------|------|------|
| | Mag | Ang | dB | Mag | Ang | dB | Mag | Ang | Mag | Ang | |
| .0005 | .76 | -22 | 19.3 | 9.19 | 167 | -24.4 | .060 | 54 | .77 | -22 | 0.48 |
| .005 | .20 | -79 | 13.7 | 4.83 | 164 | -16.5 | .149 | 12 | .21 | -83 | 0.96 |
| .025 | .05 | -78 | 12.8 | 4.35 | 174 | -16.2 | .154 | 2 | .06 | -101 | 1.07 |
| .050 | .04 | -75 | 12.7 | 4.31 | 174 | -16.4 | .151 | 2 | .05 | -136 | 1.09 |
| .100 | .04 | -81 | 12.6 | 4.29 | 171 | -16.4 | .152 | 2 | .05 | -137 | 1.09 |
| .200 | .04 | -93 | 12.6 | 4.24 | 164 | -16.3 | .153 | 3 | .07 | -135 | 1.09 |
| .300 | .06 | -105 | 12.4 | 4.18 | 156 | -16.2 | .155 | 4 | .10 | -136 | 1.08 |
| .400 | .07 | -115 | 12.3 | 4.11 | 148 | -16.0 | .158 | 5 | .12 | -139 | 1.07 |
| .500 | .09 | -124 | 12.1 | 4.01 | 141 | -15.8 | .162 | 6 | .15 | -144 | 1.06 |
| .600 | .11 | -132 | 11.8 | 3.91 | 134 | -15.6 | .166 | 7 | .17 | -150 | 1.06 |
| .700 | .13 | -140 | 11.6 | 3.80 | 126 | -15.4 | .170 | 7 | .19 | -156 | 1.05 |
| .800 | .15 | -147 | 11.3 | 3.68 | 120 | -15.2 | .174 | 7 | .22 | -161 | 1.04 |
| .900 | .16 | -154 | 11.0 | 3.56 | 113 | -14.9 | .180 | 7 | .24 | -168 | 1.03 |
| 1.000 | .18 | -161 | 10.7 | 3.43 | 106 | -14.7 | .184 | 6 | .26 | -173 | 1.03 |
| 1.500 | .28 | 171 | 9.1 | 2.85 | 77 | -13.5 | .211 | 2 | .35 | 163 | 0.99 |
| 2.000 | .37 | 149 | 7.6 | 2.39 | 52 | -13.0 | .224 | -5 | .43 | 140 | 0.99 |
| 2.500 | .45 | 133 | 6.1 | 2.02 | 33 | -12.7 | .231 | -10 | .47 | 125 | 1.02 |
| 3.000 | .52 | 118 | 4.6 | 1.69 | 14 | -12.6 | .234 | -16 | .50 | 112 | 1.05 |

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

Typical Performance, $T_A = 25^\circ\text{C}$, $Z_0 = 50 \Omega$

(unless otherwise noted)

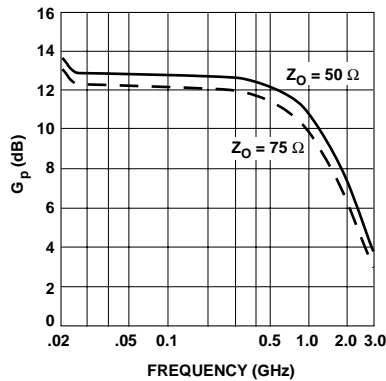


Figure 1. Typical Power Gain vs. Frequency, $I_d = 60 \text{ mA}$.

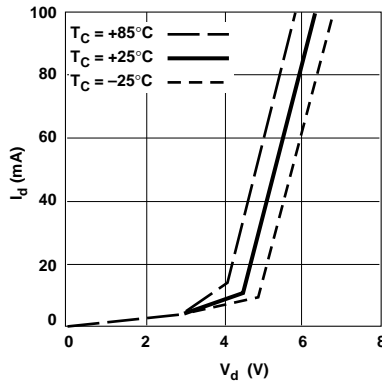


Figure 2. Device Current vs. Voltage.

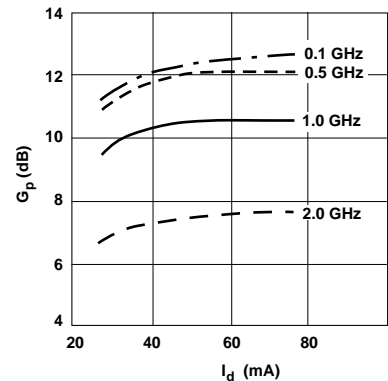


Figure 3. Power Gain vs. Current.

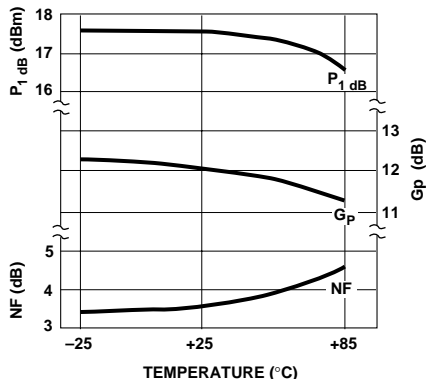


Figure 4. Output Power at 1 dB Gain Compression, Noise Figure and Power Gain vs. Case Temperature, $f = 0.5 \text{ GHz}$, $I_d = 60 \text{ mA}$.

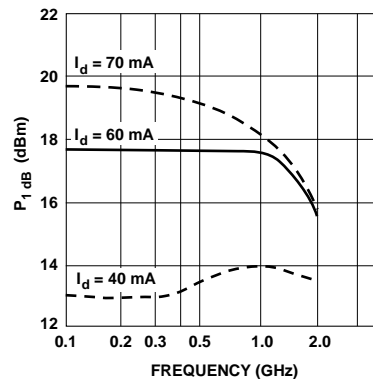


Figure 5. Output Power at 1 dB Gain Compression vs. Frequency.

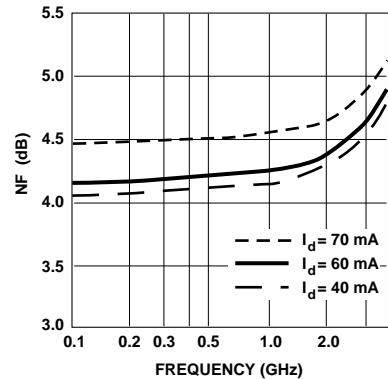
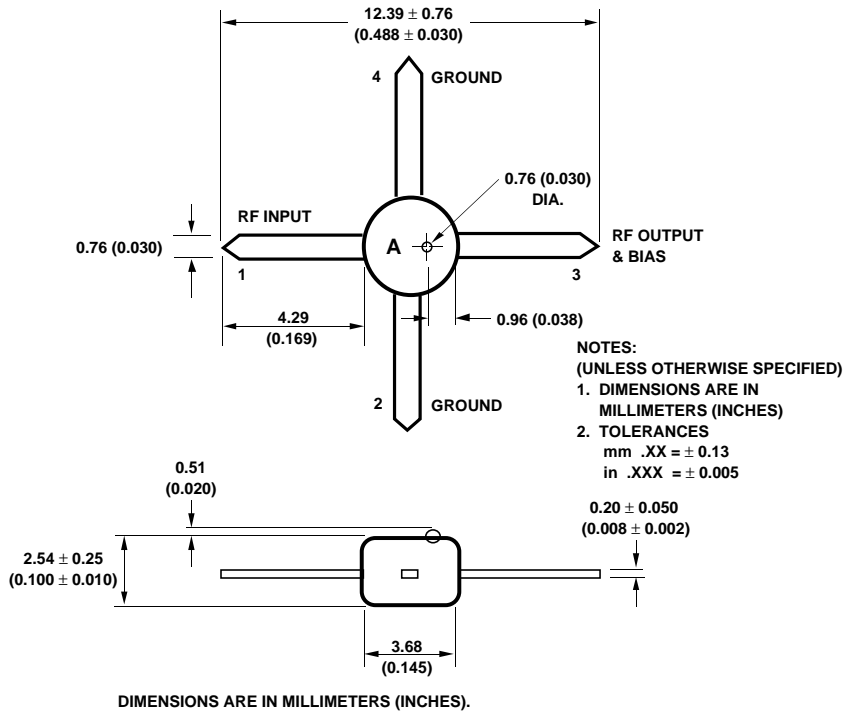


Figure 6. Noise Figure vs. Frequency.

04A Plastic Package Dimensions



For technical assistance or the location of your nearest Hewlett-Packard sales office, distributor or representative call:

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