

MSA-2111

Cascadable Silicon Bipolar MMIC Amplifier



Data Sheet

Description

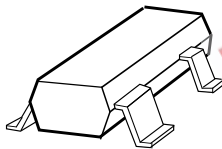
The MSA-2111 is a low cost silicon bipolar Monolithic Microwave Integrated Circuit (MMIC) housed in a surface mount plastic SOT-143 package. This MMIC is designed for use as a general purpose 50 Ω gain block. Typical applications include narrow and broad band IF and RF amplifiers in commercial and industrial applications.

The MSA-series is fabricated using Avago'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.

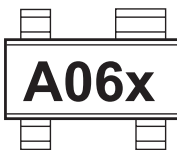
Features

- Cascadable 50 Ω Gain Block
- Medium Power: 10 dBm at 900 MHz
- High Gain: 16.5 dB Typical at 900 MHz
- Low Noise Figure: 3.3 dB Typical at 900 MHz
- Low Cost Surface Mount Plastic Package
- Tape-and-Reel Packaging Option Available
- Lead-free Option Available

SOT-143 Package



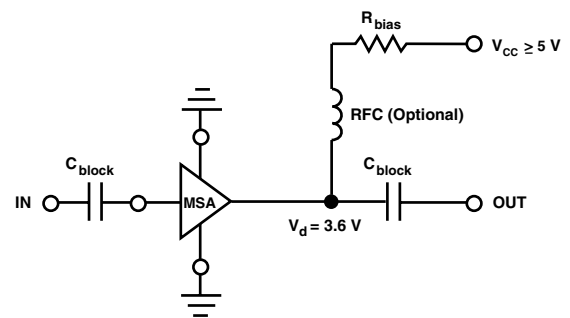
Pin Connections and Package Marking



Notes:

Top View. Package Marking provides orientation and identification. "x" is the date code.

Typical Biasing Configuration



MSA-2111 Absolute Maximum Ratings

| Parameter | Absolute Maximum ^[1] |
|------------------------------------|---------------------------------|
| Device Current | 40 mA |
| Power Dissipation ^[2,3] | 125 mW |
| RF Input Power | +13 dBm |
| Junction Temperature | 150°C |
| Storage Temperature | -65°C to 150°C |

| |
|--|
| Thermal Resistance^[2]: $\theta_{jc} = 505^{\circ}\text{C}/\text{W}$ |
|--|

Notes:

1. Permanent damage may occur if any of these limits are exceeded.
2. $T_{\text{CASE}} = 25^{\circ}\text{C}$.
3. Derate at 2.0 mW/°C for $T_{\text{C}} > 85^{\circ}\text{C}$.

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

| Symbol | Parameters and Test Conditions: $I_{\text{d}} = 29 \text{ mA}$, $Z_0 = 50 \Omega$ | Units | Min. | Typ. | Max. |
|-----------------------|--|-------|------|-----------|------|
| G_{P} | Power Gain ($ S_{21} ^2$) $f = 900 \text{ MHz}$ | dB | 16.0 | 17.5 | |
| ΔG_{P} | Gain Flatness $f = 0.1 \text{ to } 0.3 \text{ GHz}$ | dB | | ± 0.5 | |
| $f_{3 \text{ dB}}$ | 3 dB Bandwidth $f = 0.1 \text{ to } 2.5 \text{ GHz}$ | GHz | | 0.5 | |
| VSWR | Input VSWR $f = 0.1 \text{ to } 2.5 \text{ GHz}$ | | | 1.8:1 | |
| | Output VSWR $f = 0.1 \text{ to } 2.5 \text{ GHz}$ | | | 1.8:1 | |
| NF | 50 Ω Noise Figure $f = 900 \text{ MHz}$ | dB | | 3.3 | |
| $P_{1 \text{ dB}}$ | Output Power at 1 dB Gain Compression $f = 900 \text{ MHz}$ | dBm | | 10 | |
| IP_3 | Third Order Intercept Point $f = 900 \text{ MHz}$ | dBm | | 20 | |
| t_{D} | Group Delay $f = 900 \text{ MHz}$ | psec | | 158 | |
| V_{d} | Device Voltage | V | 2.9 | 3.6 | 4.3 |
| dV/dT | Device Voltage Temperature Coefficient | mV/°C | | -8.0 | |

Notes:

1. The recommended operating current range for this device is 12 to 35 mA. Typical gain performance as a function of current is on the following page.

Ordering Information

| Part Numbers | No. of Devices | Comments |
|---------------|----------------|----------|
| MSA-2111-BLK | 100 | Bulk |
| MSA-2111-BLKG | 100 | Bulk |
| MSA-2111-TR1 | 3000 | 7" Reel |
| MSA-2111-TR1G | 3000 | 7" Reel |
| MSA-2111-TR2 | 10000 | 13" Reel |
| MSA-2111-TR2G | 10000 | 13" Reel |

Note: Order part number with a "G" suffix if lead-free option is desired.

MSA-2111 Typical Scattering Parameters ($Z_0 = 50 \Omega$, $T_A = 25^\circ\text{C}$, $I_d = 29 \text{ mA}$)

| Freq. GHz | S_{11} | | S_{21} | | | S_{12} | | | S_{22} | | k |
|--------------|----------|------|----------|------|-----|----------|------|-----|----------|------|------|
| | Mag | Ang | dB | Mag | Ang | dB | Mag | Ang | Mag | Ang | |
| 0.1 | .28 | 171 | 23.0 | 14.1 | 167 | -26.0 | .050 | 9 | .27 | 177 | 1.03 |
| 0.2 | .26 | 163 | 22.5 | 13.4 | 156 | -25.5 | .053 | 18 | .27 | 175 | 1.03 |
| 0.3 | .24 | 156 | 21.9 | 12.5 | 145 | -24.9 | .057 | 25 | .26 | 173 | 1.03 |
| 0.4 | .21 | 152 | 21.2 | 11.5 | 136 | -24.0 | .063 | 30 | .26 | 171 | 1.03 |
| 0.5 | .18 | 149 | 20.5 | 10.6 | 128 | -23.4 | .068 | 35 | .24 | 170 | 1.03 |
| 0.6 | .15 | 148 | 19.7 | 9.7 | 120 | -22.6 | .074 | 38 | .24 | 169 | 1.03 |
| 0.7 | .13 | 148 | 19.0 | 8.9 | 114 | -21.8 | .081 | 40 | .22 | 169 | 1.04 |
| 0.8 | .11 | 152 | 18.3 | 8.2 | 108 | -21.1 | .088 | 42 | .21 | 169 | 1.04 |
| 0.9 | .09 | 158 | 17.6 | 7.6 | 102 | -20.4 | .095 | 43 | .20 | 168 | 1.04 |
| 1.0 | .07 | 169 | 16.9 | 7.0 | 98 | -19.9 | .101 | 44 | .19 | 169 | 1.05 |
| 1.5 | .08 | -123 | 14.0 | 5.0 | 79 | -17.3 | .136 | 45 | .10 | 179 | 1.06 |
| 2.0 | .11 | -124 | 11.8 | 3.9 | 63 | -15.5 | .167 | 42 | .06 | -147 | 1.08 |
| 2.5 | .15 | -167 | 10.1 | 3.2 | 56 | -14.3 | .193 | 43 | .06 | -177 | 1.10 |
| 3.0 | .27 | 158 | 8.3 | 2.6 | 43 | -13.5 | .211 | 38 | .12 | 149 | 1.13 |
| 3.5 | .38 | 145 | 6.8 | 2.2 | 32 | -13.1 | .222 | 34 | .16 | 145 | 1.14 |
| 4.0 | .46 | 135 | 5.6 | 1.9 | 21 | -12.6 | .234 | 30 | .17 | 144 | 1.14 |

Typical Performance, $T_A = 25^\circ\text{C}$
(unless otherwise noted)

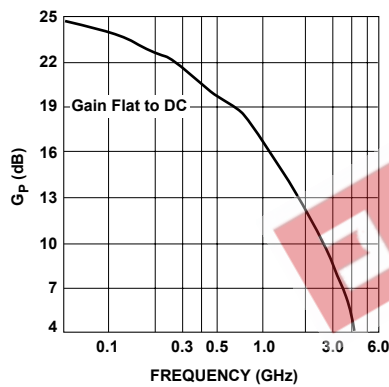


Figure 1. Power Gain vs. Frequency, $I_d = 29 \text{ mA}$.

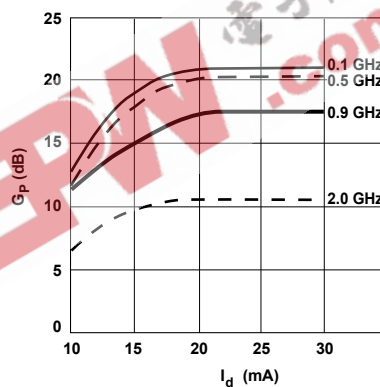


Figure 2. Power Gain vs. Current.

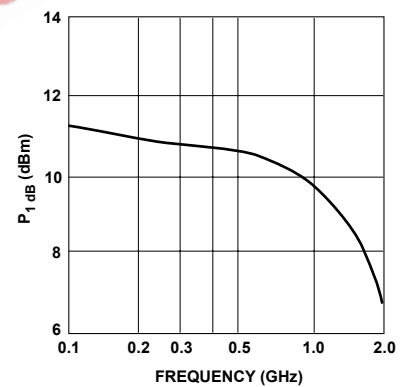


Figure 3. Output Power at 1 dB Gain Compression vs. Frequency, $I_d = 29 \text{ mA}$.

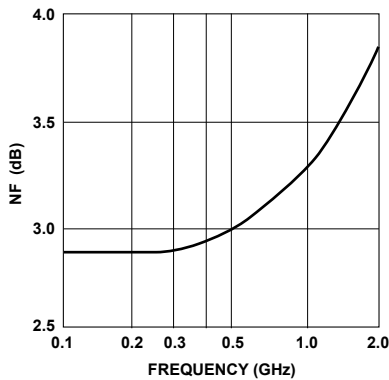
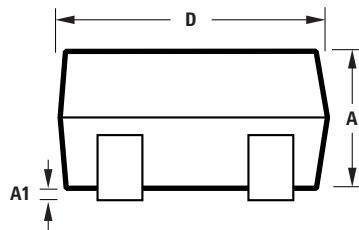
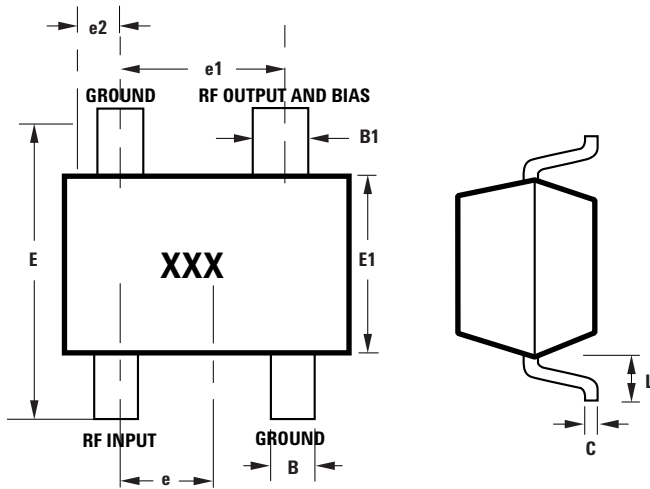


Figure 4. Noise Figure vs. Frequency, $I_d = 29 \text{ mA}$.

SOT-143 Package Dimensions



| SYMBOL | DIMENSIONS (mm) | |
|--------|-----------------|-------|
| | MIN. | MAX. |
| A | 0.79 | 1.097 |
| A1 | 0.013 | 0.10 |
| B | 0.36 | 0.54 |
| B1 | 0.76 | 0.92 |
| C | 0.086 | 0.152 |
| D | 2.80 | 3.06 |
| E1 | 1.20 | 1.40 |
| e | 0.89 | 1.02 |
| e1 | 1.78 | 2.04 |
| e2 | 0.45 | 0.60 |
| E | 2.10 | 2.65 |
| L | 0.45 | 0.69 |

Notes:
 XXX-package marking
 Drawings are not to scale

For product information and a complete list of distributors, please go to our web site: www.avagotech.com

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