

MSA-0611

Cascadable Silicon Bipolar MMIC Amplifier



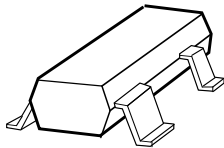
Data Sheet

Description

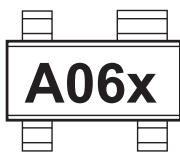
The MSA-0611 is a low cost silicon bipolar Monolithic Microwave Integrated Circuit (MMIC) housed in the surface mount plastic SOT-143 package. This MMIC is designed for use as a general purpose 50Ω gain block. Typical applications include narrow and broad band IF and RF amplifiers in commercial and industrial 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.

SOT-143 Package



Pin Connections and Package Marking



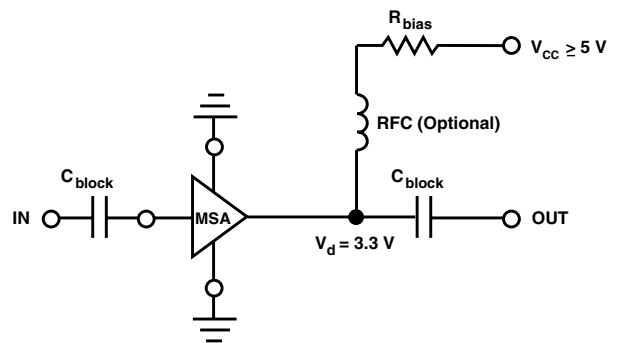
Notes:

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

Features

- Cascadable 50Ω Gain Block
- 3 dB Bandwidth: DC to 0.7 GHz
- High Gain: 18.0 dB Typical at 0.5 GHz
- Low Noise Figure: 3.0 dB Typical at 0.5 GHz
- Low Cost Surface Mount Plastic Package
- Tape-and-Reel Packaging Option Available
- Lead-free Option Available

Typical Biasing Configuration



MSA-0611 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 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 $T_{\text{C}} > 87^{\circ}\text{C}$.

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

| Symbol | Parameters and Test Conditions: $I_{\text{d}} = 16 \text{ mA}$, $Z_0 = 50 \Omega$ | Units | Min. | Typ. | Max. |
|-----------------------|--|-------|------|--------------|------|
| G_{p} | Power Gain ($ S_{21} ^2$) f = 0.1 GHz f = 0.5 GHz | dB | 16.0 | 19.5 18.0 | |
| ΔG_{p} | Gain Flatness f = 0.1 to 0.5 GHz | dB | | ± 0.8 | |
| $f_{3 \text{ dB}}$ | 3 dB Bandwidth | GHz | | 0.7 | |
| VSWR | Input VSWR f = 0.1 to 1.5 GHz | | | 1.6:1 | |
| | Output VSWR f = 0.1 to 1.5 GHz | | | 1.5:1 | |
| NF | 50 Ω Noise Figure f = 0.5 GHz | dB | | 3.0 | |
| $P_{1 \text{ dB}}$ | Output Power at 1 dB Gain Compression f = 0.5 GHz | dBm | | 2.0 | |
| IP_3 | Third Order Intercept Point f = 0.5 GHz | dBm | | 14.0 | |
| t_{D} | Group Delay f = 0.5 GHz | psec | | 225 | |
| V_{d} | Device Voltage $T_{\text{C}} = 25^{\circ}\text{C}$ | V | 2.6 | 3.3 | 4.0 |
| dV/dT | Device Voltage Temperature Coefficient | mV/°C | | -8.0 | |

Note:

1. The recommended operating current range for this device is 12 to 20 mA. Typical gain performance as a function of current is on the following page.

Ordering Information

| Part Numbers | No. of Devices | Comments |
|---------------|----------------|----------|
| MSA-0611-BLK | 100 | Bulk |
| MSA-0611-BLKG | 100 | Bulk |
| MSA-0611-TR1 | 3000 | 7" Reel |
| MSA-0611-TR1G | 3000 | 7" Reel |
| MSA-0611-TR2 | 10000 | 13" Reel |
| MSA-0611-TR2G | 10000 | 13" Reel |

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

MSA-0611 Typical Scattering Parameters ($Z_0 = 50 \Omega$, $T_A = 25^\circ\text{C}$, $I_d = 16 \text{ mA}$)

| Freq. GHz | S_{11} | | S_{21} | | | S_{12} | | | S_{22} | | k |
|-----------|----------|------|----------|------|-----|----------|------|-----|----------|------|------|
| | Mag | Ang | dB | Mag | Ang | dB | Mag | Ang | Mag | Ang | |
| 0.1 | .04 | -176 | 19.6 | 9.53 | 170 | -23.0 | .071 | 6 | .04 | -57 | 1.07 |
| 0.2 | .03 | -163 | 19.3 | 9.25 | 160 | -22.7 | .073 | 10 | .07 | -82 | 1.07 |
| 0.3 | .03 | -149 | 18.9 | 8.79 | 150 | -22.8 | .072 | 14 | .09 | -97 | 1.10 |
| 0.4 | .04 | -132 | 18.5 | 8.38 | 141 | -21.9 | .080 | 17 | .11 | -111 | 1.07 |
| 0.5 | .05 | -127 | 18.0 | 7.96 | 133 | -21.6 | .083 | 21 | .13 | -122 | 1.07 |
| 0.6 | .07 | -123 | 17.3 | 7.33 | 125 | -21.2 | .087 | 23 | .15 | -131 | 1.07 |
| 0.8 | .10 | -129 | 16.2 | 6.46 | 111 | -19.7 | .103 | 25 | .17 | -147 | 1.04 |
| 1.0 | .13 | -139 | 15.0 | 5.64 | 98 | -19.0 | .112 | 28 | .18 | -160 | 1.06 |
| 1.5 | .22 | -164 | 12.5 | 4.22 | 73 | -17.1 | .139 | 25 | .19 | 175 | 1.07 |
| 2.0 | .31 | 171 | 10.1 | 3.20 | 53 | -16.1 | .157 | 21 | .19 | 160 | 1.13 |
| 2.5 | .39 | 158 | 8.1 | 2.55 | 42 | -15.4 | .169 | 22 | .20 | 153 | 1.19 |
| 3.0 | .45 | 144 | 6.3 | 2.07 | 28 | -15.0 | .178 | 18 | .19 | 150 | 1.26 |
| 3.5 | .50 | 132 | 4.7 | 1.72 | 16 | -14.6 | .185 | 15 | .16 | 152 | 1.33 |
| 4.0 | .52 | 121 | 3.4 | 1.48 | 4 | -14.1 | .197 | 11 | .14 | 166 | 1.37 |

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

(unless otherwise noted)

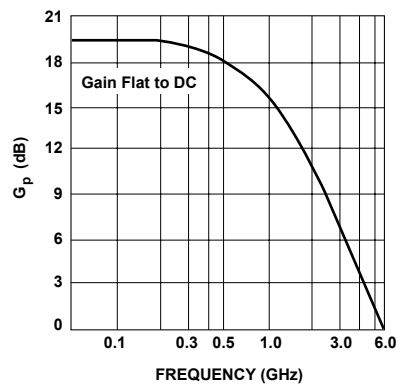


Figure 1. Power Gain vs. Frequency, $T_A = 25 \text{ C}$, $I_d = 16 \text{ mA}$.

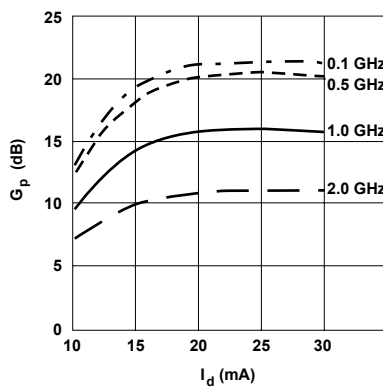


Figure 2. Power Gain vs. Current.

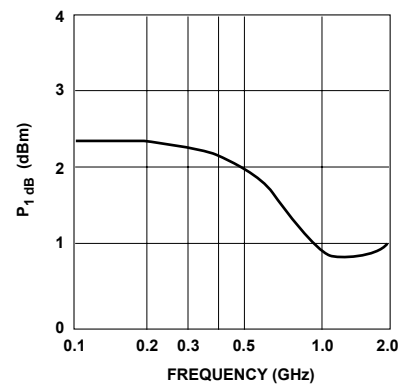


Figure 3. Output Power @ 1 dB Gain Compression vs. Frequency, $I_d = 16 \text{ mA}$.

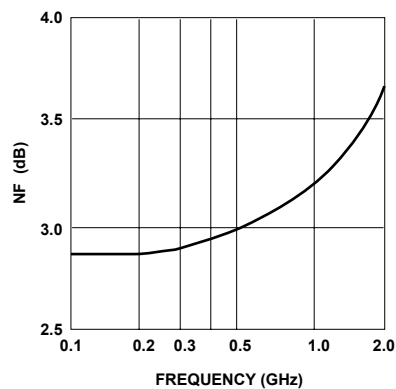
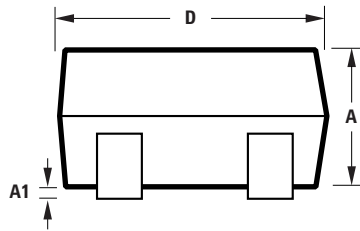
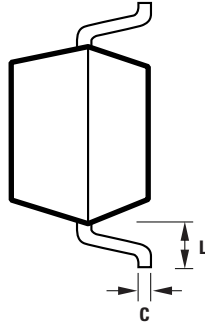
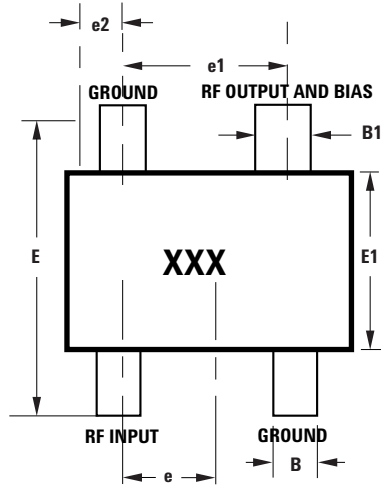


Figure 4. Noise Figure vs. Frequency, $I_d = 16 \text{ mA}$.

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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