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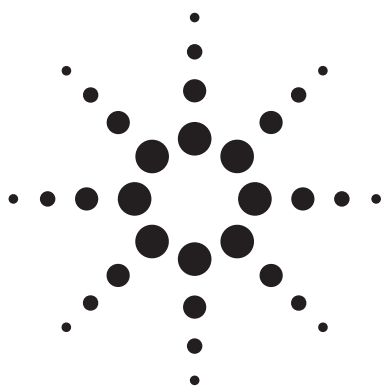
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Agilent MSA-0370 Cascadable Silicon Bipolar MMIC Amplifiers

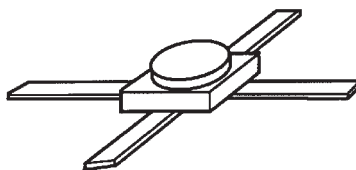
Data Sheet

Description

The MSA-0370 is a high performance silicon bipolar Monolithic Microwave Integrated Circuit (MMIC) housed in a hermetic, high reliability 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 Agilent'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.

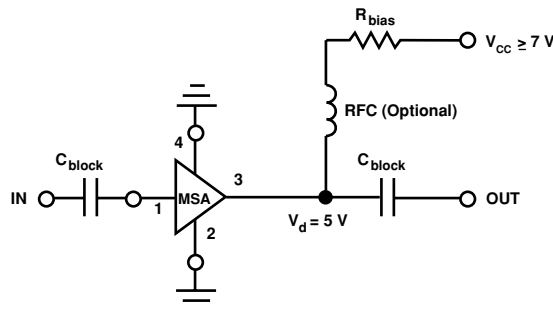
70 mil Package



Features

- Cascadable 50 Ω Gain Block
- 3 dB Bandwidth:
DC to 2.8 GHz
- 12.0 dB Typical Gain at
1.0 GHz
- 10.0 dBm Typical P_{1dB} at
1.0 GHz
- Unconditionally Stable
($k > 1$)
- Hermetic Gold-ceramic
Microstrip Package

Typical Biasing Configuration



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MSA-0370 Absolute Maximum Ratings

Parameter	Absolute Maximum ^[1]
Device Current	80 mA
Power Dissipation ^[2,3]	425 mW
RF Input Power	+13 dBm
Junction Temperature	200°C
Storage Temperature	–65 to 200°C

Thermal Resistance^[2,4]:

$$\theta_{jc} = 125^{\circ}\text{C/W}$$

Notes:

1. Permanent damage may occur if any of these limits are exceeded.
2. $T_{\text{CASE}} = 25^{\circ}\text{C}$.
3. Derate at $8 \text{ mW}/^{\circ}\text{C}$ for $T_{\text{C}} > 147^{\circ}\text{C}$.
4. The small spot size of this technique results in a higher, though more accurate determination of θ_{jc} than do alternate methods.

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.
G_{P}	Power Gain ($ S_{21} ^2$) $f = 0.1 \text{ GHz}$	dB	11.5	12.5	13.5
ΔG_{P}	Gain Flatness $f = 0.1 \text{ to } 1.8 \text{ GHz}$	dB		± 0.6	± 1.0
$f_{3 \text{ dB}}$	3 dB Bandwidth	GHz		2.8	
VSWR	Input VSWR $f = 0.1 \text{ to } 3.0 \text{ GHz}$			1.8:1	
	Output VSWR $f = 0.1 \text{ to } 3.0 \text{ GHz}$			1.8:1	
NF	50 Ω Noise Figure $f = 1.0 \text{ GHz}$	dB		6.0	
$P_{1 \text{ dB}}$	Output Power at 1 dB Gain Compression $f = 1.0 \text{ GHz}$	dBm		10.0	
IP_3	Third Order Intercept Point $f = 1.0 \text{ GHz}$	dBm		23.0	
t_{D}	Group Delay $f = 1.0 \text{ GHz}$	psec		125	
V_{d}	Device Voltage	V	4.5	5.0	5.5
dV/dT	Device Voltage Temperature Coefficient	$\text{mV}/^{\circ}\text{C}$		–8.0	

Notes:

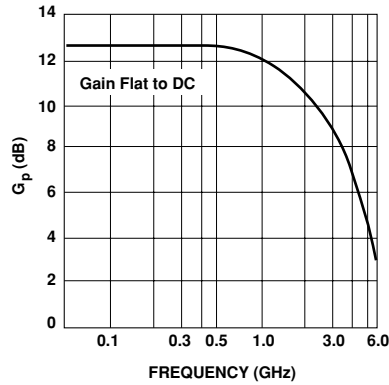
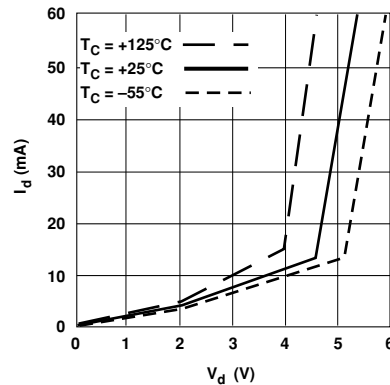
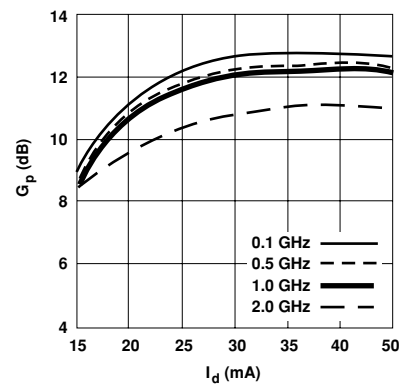
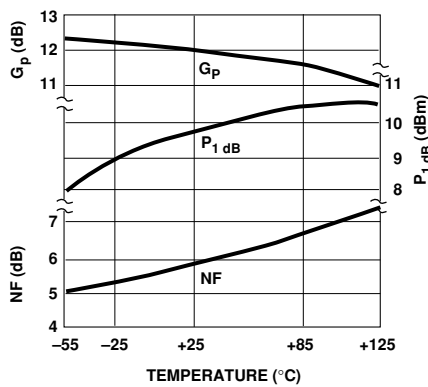
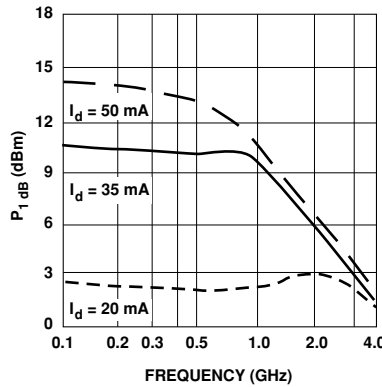
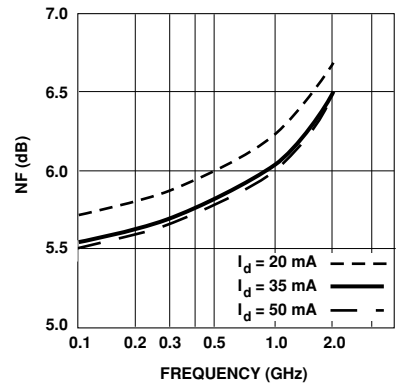
1. The recommended operating current range for this device is 20 to 50 mA. Typical performance as a function of current is on the following page.

MSA-0370 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	.13	-179	12.6	4.27	176	-18.6	.118	2	.09	-14
0.2	.13	-180	12.6	4.25	171	-18.3	.121	2	.10	-29
0.4	.12	-180	12.5	4.21	162	-18.4	.121	4	.12	-52
0.6	.11	-178	12.4	4.17	154	-18.2	.123	6	.14	-70
0.8	.11	-174	12.3	4.11	146	-17.8	.129	8	.17	-82
1.0	.10	-168	12.2	4.06	137	-17.7	.130	8	.20	-92
1.5	.11	-149	11.7	3.85	116	-17.1	.140	11	.24	-114
2.0	.16	-147	11.1	3.57	96	-16.2	.155	11	.27	-134
2.5	.22	-151	10.3	3.27	82	-15.6	.167	14	.27	-146
3.0	.28	-160	9.3	2.91	65	-15.2	.174	11	.27	-159
3.5	.33	-169	8.2	2.58	48	-14.5	.188	7	.26	-163
4.0	.36	-177	7.1	2.27	34	-14.3	.192	3	.25	-162
5.0	.38	163	5.1	1.81	9	-13.8	.203	-5	.23	-153
6.0	.39	132	3.4	1.48	-14	-13.5	.213	-13	.24	-160

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. Mounting Surface 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.

Part Numbers	No. of Devices	Comments
MSA-0370	10	Bulk

The drawing shows a cross-sectional view of a 1.5W GaN HEMT power amplifier package. The package is mounted on a substrate. Key features and dimensions include:

- RF INPUT:** A circular pad on the left side of the package.
- RF OUTPUT AND BIAS:** A circular pad on the right side of the package.
- GROUND:** Two rectangular pads, one above and one below the RF pads.
- Dimensions:**
 - Top left: $.040 \pm .002$ (width), 1.02 (height)
 - Top right: $.020 \pm .008$ (width), $.508$ (height)
 - Bottom left: $.004 \pm .002$ (width), $.10 \pm .05$ (height)
 - Bottom center: $.070 \pm .007$ (width), 1.78 (height)
 - Bottom right: $.035 \pm .009$ (width), $.035 \pm .009$ (height)
 - Bottom width: $.495 \pm .030$ (width), $12.57 \pm .76$ (length)

Notes:
 (unless otherwise specified)
 1. Dimensions are in mm
 2. Tolerances
 in .xxx = ± 0.005
 mm .xx = ± 0.13

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