THE DATASHEET OF

MSA-3186-TR1

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MSA-3111, MSA-3186

Silicon Bipolar RFIC Amplifiers

Data Sheet

Description

The MSA-31XX series are high performance silicon bipolar RFIC amplifiers designed to be cascadable in 50 Ω systems. The stability factor of K > 1 contributes to easy cascading in numerous narrow and broadband IF and RF commercial and industrial applications.

The MODAMP MSA series is fabricated using a 10 GHz f_T, 25 GHz F_{MAX}, silicon bipolar RFIC process which utilizes nitride self-alignment, ion implantation, and gold metallization to achieve excellent uniformity, performance, and reliability. The use of an external bias resistor for temperature and current stability also allows bias flexibility.

Package options include the industry standard plastic surface mount SOT-143 package and the 85 mil surface mountable plastic microstripline package.

Features

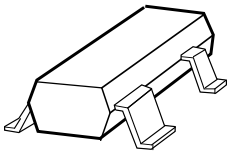
MSA-3111

- Surface Mount SOT-143 Package
- 3 dB Bandwidth: DC to 0.5 GHz
- 18.4 dB Gain at 1 GHz
- 3.5 dB NF at 1 GHz
- Lead-free Option Available

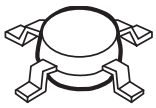
MSA-3186

- Surface Mount Plastic Microstrip Package
- 3 dB Bandwidth: DC to 0.5 GHz
- 18.7 dB Gain at 1 GHz
- 3.5 dB NF at 1 GHz
- Lead-free Option Available

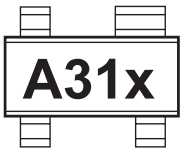
MSA-3111



MSA-3186



Pin Connections and Package Marking



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

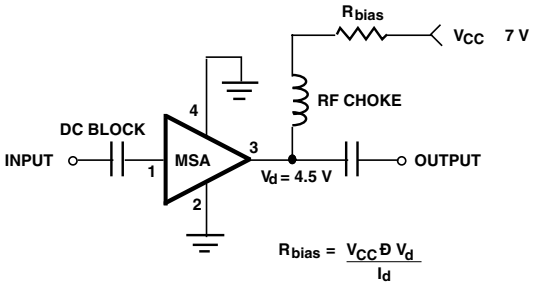
Absolute Maximum Ratings[1]

Parameter	MSA-3111	MSA-3186
Device Current	50 mA	60 mA
Power Dissipation[2,3]	250 mW[3a]	325 mW[3c]
RF Input Power	+13 dBm	+13 dBm
Junction Temperature	150°C	150°C
Storage Temperature	-65 to 150°C	-65 to 150°C

Thermal Resistance: θ_{jc}	500°C/W	115°C/W

Notes:
1. Permanent damage may occur if any of these limits are exceeded.
2. T_{CASE} = 25°C.
3a. Derate at 2.0 mW/°C for T_C > 25°C.
b. Derate at 6.5 mW/°C for T_C > 149°C.
c. Derate at 8.7 mW/°C for T_C > 112°C.

Typical Biasing Configuration



Electrical Specifications, T_A = 25°C

I_D = 29 mA, Z_o = 50 Ω

Symbol	Parameters and Test Conditions	Units	MSA-3111 Min.	MSA-3111 Typ.	MSA-3111 Max.	MSA -3186 Min.	MSA -3186 Typ.	MSA -3186 Max.
G_P	Power Gain ($\|S_{21}\|^2$) f = 0.1 GHz f = 0.5 GHz f = 1.0 GHz	dB	23.5	24.4 22.4 18.4		23.5	24.6 22.3 18.7	
ΔG_P	Gain Flatness f = 0.1 to 0.3 GHz	dB		±0.5			±0.5	
f_{3dB}	3 dB Bandwidth	GHz		0.5			0.5	
VSWR	Input VSWR f = 0.1 to 3.0 GHz			1.2:1			1.2:1	
	Output VSWR f = 0.1 to 3.0 GHz			1.2:1			1.4:1	
P_{1dB}	Power Output @ 1 dB Gain Compression: f = 1.0 GHz	dBm		9.0			9.0	
NF	50 Ω Noise Figure f = 1.0 GHz	dB		3.5			3.5	
IP_3	Third Order Intercept Point f = 1.0 GHz	dBm		23			21	
t_d	Group Delay f = 1.0 GHz	psec		130			130	
V_D	Device Voltage T_C = 25°C	V	4.0	4.5	6.0	4.0	4.7	6.0
dV/dT	Device Voltage Temperature Coefficient	mV/°C		-9.6			-9.6	

Typical Performance for MSA-3111

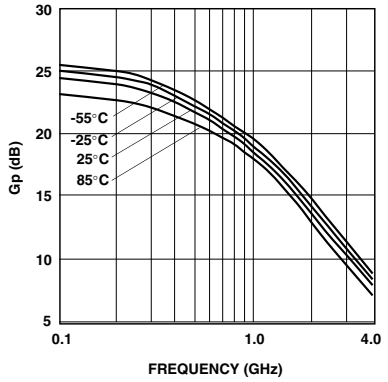


Figure 1. Power Gain vs. Frequency at Four Temperatures, $I_D = 29$ mA.

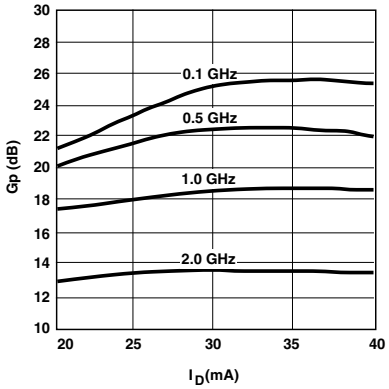


Figure 2. Power Gain vs. Current at 25°C.

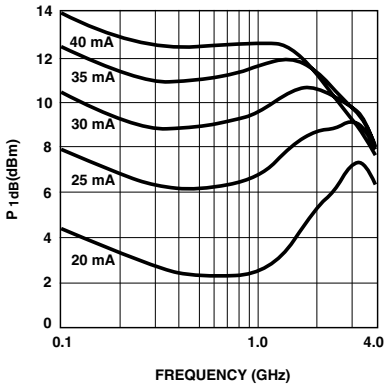


Figure 3. Typical P_{1dB} vs. Frequency at 25°C.

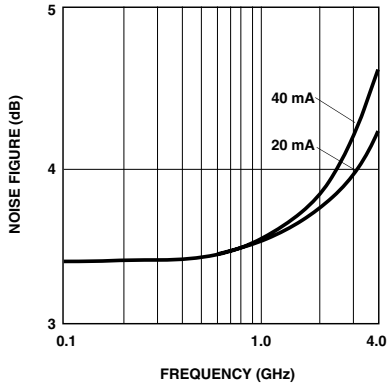


Figure 4. Noise Figure vs. Frequency at $I_D = 29$ mA.

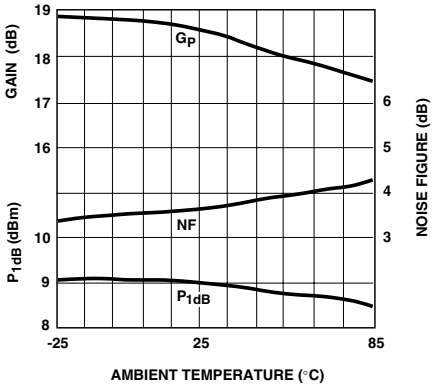


Figure 5. Power Gain, Noise Figure, and P_{1dB} vs. Temperature at 1 GHz and $I_D = 29$ mA.

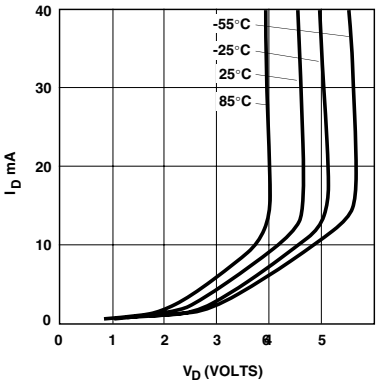


Figure 6. I_D vs. V_D at Four Temperatures.

Typical Scattering Parameters at $T_A = 25°C$, for MSA-3111

$I_D = 29$ mA, $Z_o = 50\ \Omega$

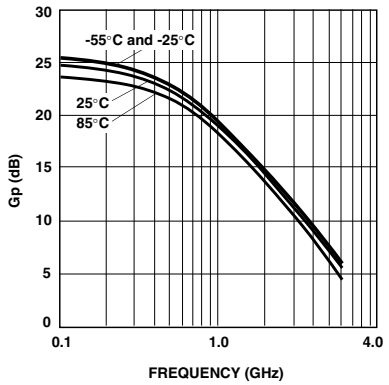
Frequency	S_{11}		S_{21}			S_{12}			S_{22}	
(GHz)	Mag.	Ang.	(dB)	Mag.	Ang.	(dB)	Mag.	Ang.	Mag.	Ang.
0.1	0.05	3	24.4	16.53	167	-27.0	0.045	9	0.10	-23
0.2	0.06	4	24.0	15.83	156	-26.5	0.047	16	0.10	-41
0.3	0.07	-4	23.4	14.78	146	-26.0	0.050	23	0.10	-59
0.4	0.07	-8	22.7	13.59	136	-25.3	0.054	28	0.11	-72
0.5	0.07	-12	22.0	12.53	128	-24.6	0.059	33	0.11	-84
0.6	0.07	-18	21.1	11.41	121	-23.9	0.064	36	0.11	-94
0.7	0.07	-22	20.4	10.47	114	-23.1	0.070	39	0.11	-100
0.8	0.08	-26	19.7	9.63	109	-22.4	0.076	41	0.11	-106
0.9	0.08	-32	19.0	8.89	104	-21.7	0.082	42	0.11	-111
1.0	0.08	-35	18.4	8.27	99	-21.1	0.088	43	0.11	-114
1.5	0.08	-59	15.6	5.99	80	-18.5	0.118	44	0.11	-123
2.0	0.10	-79	13.4	4.69	65	-16.6	0.148	42	0.10	-122
2.5	0.10	-104	11.8	3.88	52	-15.2	0.175	38	0.11	-118
3.0	0.10	-129	10.4	3.31	39	-14.1	0.198	33	0.12	-114
3.5	0.12	-163	9.3	2.91	27	-13.2	0.219	28	0.12	-117
4.0	0.15	164	8.2	2.58	16	-12.6	0.236	23	0.13	-125
4.5	0.21	140	7.4	2.34	4	-12.1	0.250	18	0.13	-136
5.0	0.29	121	6.5	2.10	-7	-11.7	0.260	14	0.14	-148
5.5	0.36	109	5.6	1.90	-18	-11.3	0.271	10	0.17	-158
6.0	0.42	98	4.6	1.70	-28	-11.0	0.282	7	0.21	-165

Ordering Information

Part Numbers	No. of Devices	Comments
MSA-3111-BLK	100	Bulk
MSA-3111-BLKG	100	Bulk
MSA-3111-TR1	3000	7" Reel
MSA-3111-TR1G	3000	7" Reel
MSA-3111-TR2	10000	13" Reel
MSA-3111-TR2G	10000	13" Reel

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

Typical Performance for MSA-3186



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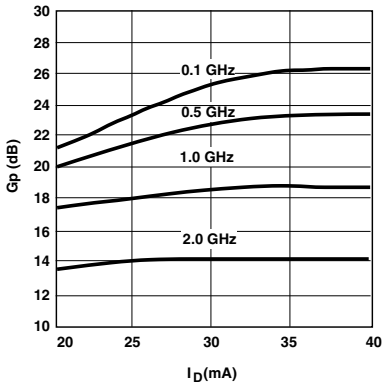


Figure 2. Power Gain vs. Current at 25°C.

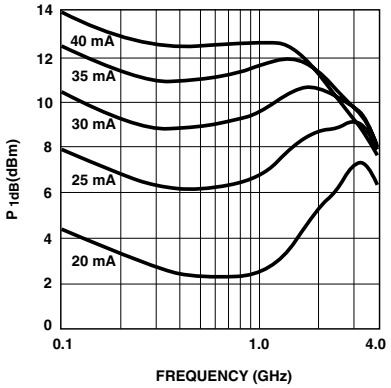


Figure 3. Typical P_{1dB} vs. Frequency at 25°C.

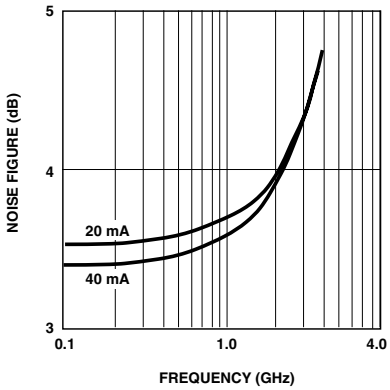
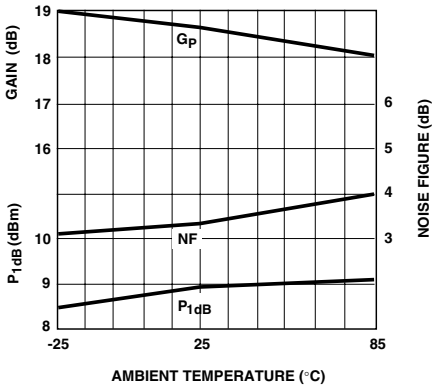


Figure 4. Noise Figure vs. Frequency at $I_D = 29$ mA.



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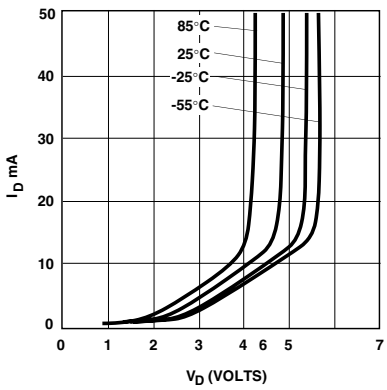


Figure 6. I_D vs. V_D at Four Temperatures.

Typical Scattering Parameters at $T_A = 25°C$, for MSA-3186

$I_D = 29$ mA, $Z_o = 50\ \Omega$

Frequency	S_{11}		S_{21}			S_{12}			S_{22}	
(GHz)	Mag.	Ang.	(dB)	Mag.	Ang.	(dB)	Mag.	Ang.	Mag.	Ang.
0.1	0.05	1	24.7	17.11	169	-27.3	0.043	7	0.09	-19
0.2	0.06	2	24.4	16.52	158	-27.0	0.045	14	0.09	-37
0.3	0.07	-2	23.9	15.72	149	-26.5	0.047	20	0.09	-52
0.4	0.07	-7	23.4	14.77	139	-26.0	0.050	24	0.K9	-67
0.5	0.07	-12	22.8	13.77	131	-25.4	0.054	29	0.09	-80
0.6	0.07	-21	22.1	12.79	124	-24.7	0.058	32	0.09	-92
0.7	0.07	-27	21.5	11.86	117	-24.1	0.063	34	0.09	-102
0.8	0.07	-33	20.9	11.03	111	-23.4	0.037	36	0.09	-111
0.9	0.08	-39	20.2	10.25	106	-22.8	0.072	38	0.09	-119
1.0	0.08	-44	19.6	9.55	101	-22.2	0.078	39	0.09	-127
1.5	0.08	-79	16.9	7.03	80	-19.7	0.104	39	0.10	-155
2.0	0.09	-116	14.8	5.52	63	-17.7	0.130	36	0.10	-171
2.5	0.11	-145	13.2	4.55	49	-16.3	0.153	31	0.09	176
3.0	0.15	-171	11.7	3.86	35	-15.2	0.175	25	0.10	162
3.5	0.19	166	10.5	3.34	22	-14.3	0.192	19	0.11	154
4.0	0.24	149	9.4	2.94	9	-13.7	0.207	13	0.12	152
4.5	0.29	134	8.3	2.61	-3	-13.2	0.219	7	0.13	148
5.0	0.35	120	7.4	2.34	-16	-12.8	0.228	1	0.15	141
5.5	0.41	107	6.4	2.08	-27	-12.5	0.236	-5	0.19	138
6.0	0.46	95	5.4	1.87	-39	-12.3	0.243	-10	0.24	137

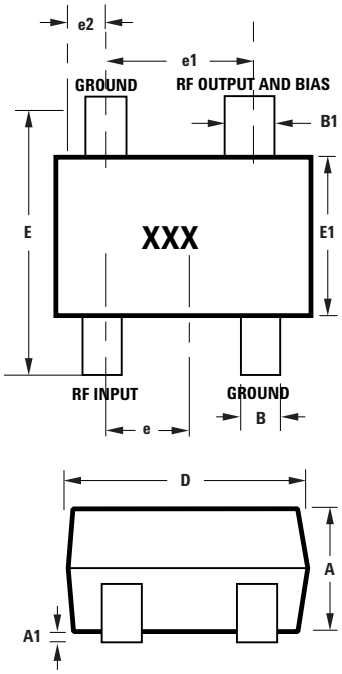
Ordering Information

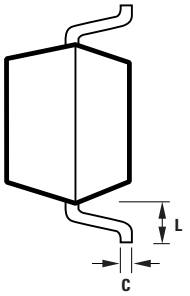
Part Numbers	No. of Devices	Comments
MSA-3186-BLK	100	Bulk
MSA-3186-BLKG	100	Bulk
MSA-3186-TR1	1000	7" Reel
MSA-3186-TR1G	1000	7" Reel
MSA-3186-TR2	4000	13" Reel
MSA-3186-TR2G	4000	13" Reel

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

Outline Drawings

SOT-143





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

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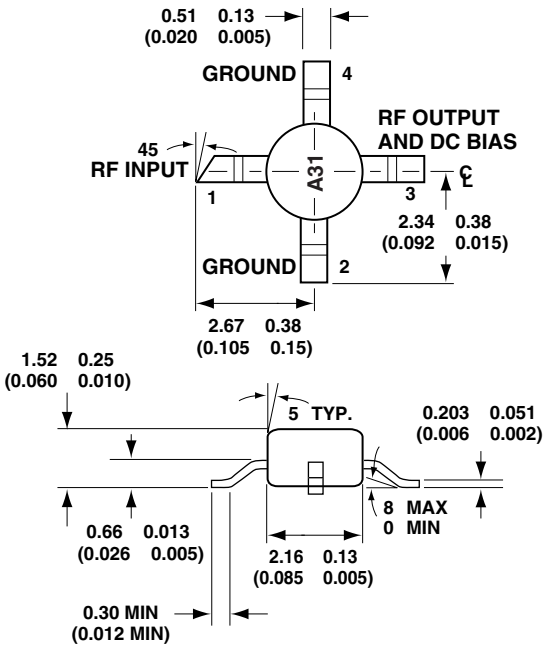

DIMENSIONS ARE IN MILLIMETERS (INCHES)

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