

0.5–12 GHz Low Noise Gallium Arsenide FET

Technical Data

ATF-10100

Features

- **Low Noise Figure:**
0.5 dB Typical at 4 GHz
- **Low Bias:**
 $V_{DS} = 2\text{ V}, I_{DS} = 25\text{ mA}$
- **High Associated Gain:**
14.0 dB Typical at 4 GHz
- **High Output Power:**
21.0 dBm Typical $P_{1\text{ dB}}$ at 4 GHz

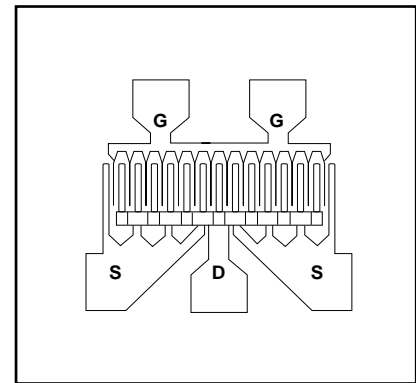
Description

The ATF-10100 is a high performance gallium arsenide Schottky-barrier-gate field effect transistor

chip. Its premium noise figure makes this device appropriate for use in the first stage of low noise amplifiers operating in the 0.5-12 GHz frequency range.

This GaAs FET device has a nominal 0.3 micron gate length interconnects between drain fingers. Total gate periphery is 500 microns. Proven gold based metallization systems and nitride passivation assure a rugged, reliable device.

Chip Outline



Electrical Specifications, $T_A = 25^\circ\text{C}$

Symbol	Parameters and Test Conditions ^[1]	Units	Min.	Typ.	Max.
NF _O	Optimum Noise Figure: $V_{CE} = 2\text{ V}, I_{DS} = 25\text{ mA}$	f = 2.0 GHz	dB	0.4	0.7
		f = 4.0 GHz	dB	0.55	
		f = 6.0 GHz	dB	0.8	
G _A	Gain @ NF _O ; $V_{DS} = 2\text{ V}, I_{DS} = 25\text{ mA}$	f = 2.0 GHz	dB	12.0	17.0
		f = 4.0 GHz	dB		14.0
		f = 6.0 GHz	dB		12.0
P _{1 dB}	Power Output @ 1 dB Gain Compression $V_{DS} = 4\text{ V}, I_{DS} = 70\text{ mA}$	f = 4.0 GHz	dBm	21.0	
G _{1 dB}	1 dB Compressed Gain: $V_{DS} = 4\text{ V}, I_{DS} = 70\text{ mA}$	f = 4.0 GHz	dB	15.0	
g _m	Transconductance: $V_{DS} = 2\text{ V}, V_{GS} = 0\text{ V}$	mmho	80	140	
I _{DSS}	Saturated Drain Current: $V_{DS} = 2\text{ V}, V_{GS} = 0\text{ V}$	mA	70	130	180
V _P	Pinchoff Voltage: $V_{DS} = 2\text{ V}, I_{DS} = 1\text{ mA}$	V	-3.0	-1.3	-0.8

Note:

1. RF performance is determined by packaging and testing 10 devices per wafer.

ATF-10100 Absolute Maximum Ratings

Symbol	Parameter	Units	Absolute Maximum ^[1]
V _{DS}	Drain-Source Voltage	V	+5
V _{GS}	Gate-Source Voltage	V	-4
V _{GD}	Gate-Drain Voltage	V	-7
I _{DS}	Drain Current	mA	I _{DSS}
P _T	Power Dissipation ^[2,3]	mW	430
T _{CH}	Channel Temperature	°C	175
T _{STG}	Storage Temperature ^[4]	°C	-65 to +175

Thermal Resistance: $\theta_{jc} = 225^\circ\text{C/W}; T_{CH} = 150^\circ\text{C}$
Liquid Crystal Measurement: 1 μm Spot Size^[4]

Notes:

- Permanent damage may occur if any of these limits are exceeded.
- T_{CASE TEMPERATURE} = 25°C.
- Derate at 4.4 mW/°C for T_{CASE} > 78°C.
- The small spot size of this technique results in a higher, though more accurate determination of θ_{jc} than do alternate methods. See APPLICATIONS PRIMER IIIA for more information.

Part Number Ordering Information

Part Number	Devices Per Tray
ATF-10100-GP3	50

ATF-10100 Noise Parameters: V_{DS} = 2 V, I_{DS} = 25 mA

Freq. GHz	NF _O dB	Γ_{opt}		R _N /50
		Mag	Ang	
1.0	0.4	0.78	13	0.40
2.0	0.4	0.55	27	0.29
4.0	0.55	0.39	65	0.22
6.0	0.8	0.41	105	0.16
8.0	1.0	0.46	144	0.10

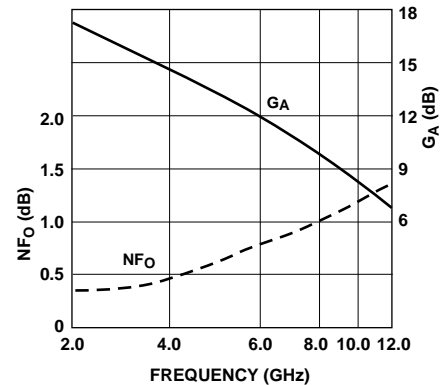


Figure 1. Optimum Noise Figure and Associated Gain vs. Frequency.
V_{DS} = 2V, I_{DS} = 25 mA, T_A = 25°C.

ATF-10100 Typical Performance, T_A = 25°C

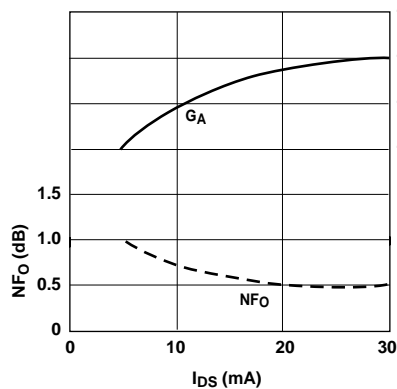


Figure 2. Optimum Noise Figure and Associated Gain vs. I_{DS}.
V_{DS} = 2V, f = 4.0 GHz.

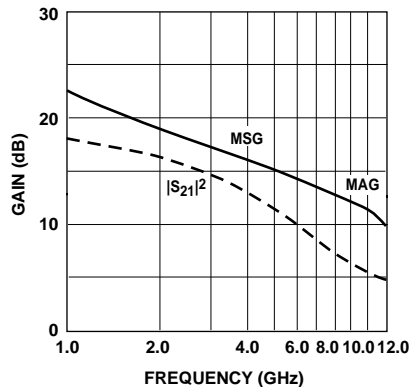


Figure 3. Insertion Power Gain, Maximum Available Gain and Maximum Stable Gain vs. Frequency.
V_{DS} = 2 V, I_{DS} = 25 mA.

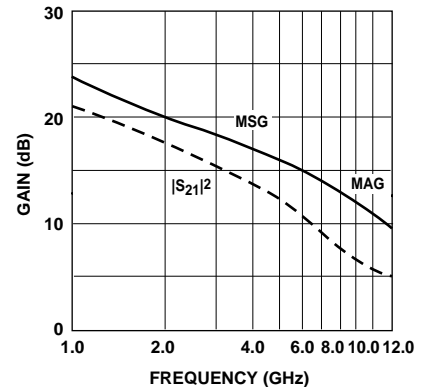


Figure 4. Insertion Power Gain, Maximum Available Gain and Maximum Stable Gain vs. Frequency.
V_{DS} = 4 V, I_{DS} = 70 mA.

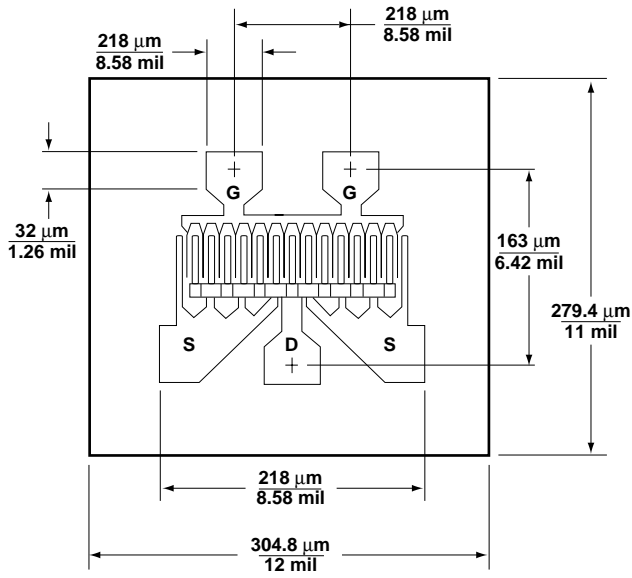
Typical Scattering Parameters, Common Source, $Z_O = 50 \Omega$, $T_A = 25^\circ\text{C}$, $V_{DS} = 2\text{V}$, $I_{DS} = 25\text{mA}$

Freq. MHz	S_{11}		S_{21}			S_{12}			S_{22}	
	Mag.	Ang.	dB	Mag.	Ang.	dB	Mag.	Ang.	Mag.	Ang.
1.0	.93	-46	17.7	7.63	148	-25.5	.053	64	.33	-56
2.0	.83	-78	15.6	6.08	127	-21.4	.085	52	.31	-63
3.0	.78	-94	13.9	4.97	114	-19.8	.102	45	.30	-72
4.0	.72	-104	12.4	4.18	103	-18.7	.116	41	.29	-80
5.0	.70	-120	11.2	3.65	92	-17.9	.127	36	.25	-90
6.0	.68	-139	10.0	3.18	80	-17.6	.132	31	.19	-113
7.0	.71	-157	8.6	2.69	69	-17.5	.133	25	.18	-156
8.0	.72	168	7.4	2.35	60	-17.5	.133	22	.20	-178
9.0	.71	-177	6.5	2.12	53	-17.4	.135	19	.22	174
10.0	.70	175	6.0	1.99	46	-16.9	.143	17	.22	169
11.0	.70	167	5.5	1.88	38	-16.6	.148	15	.23	164
12.0	.70	162	5.0	1.77	31	-16.3	.154	13	.24	153
13.0	.70	159	4.5	1.68	25	-15.8	.162	11	.26	143
14.0	.70	155	4.1	1.61	20	-15.5	.168	10	.28	133
15.0	.73	149	3.9	1.56	14	-15.0	.177	8	.30	123
16.0	.77	138	3.2	1.45	5	-14.7	.184	6	.32	119
17.0	.76	134	1.8	1.23	0	-14.4	.190	5	.35	114
18.0	.77	134	1.3	1.16	-1	-13.9	.201	4	.38	106

Typical Scattering Parameters, Common Source, $Z_O = 50 \Omega$, $T_A = 25^\circ\text{C}$, $V_{DS} = 4\text{V}$, $I_{DS} = 70\text{mA}$

Freq. MHz	S_{11}		S_{21}			S_{12}			S_{22}	
	Mag.	Ang.	dB	Mag.	Ang.	dB	Mag.	Ang.	Mag.	Ang.
1.0	.87	-60	20.6	10.72	136	-26.4	.048	55	.33	-59
2.0	.74	-96	17.5	7.50	113	-23.5	.067	43	.29	-66
3.0	.72	-112	15.2	5.77	101	-22.2	.078	39	.28	-69
4.0	.67	-122	13.4	4.68	91	-21.3	.086	38	.27	-72
5.0	.67	-137	12.0	3.97	81	-20.6	.093	36	.24	-77
6.0	.68	-154	10.5	3.36	70	-20.3	.097	35	.17	-95
7.0	.73	-168	9.0	2.81	61	-20.1	.099	33	.13	-127
8.0	.74	-177	7.7	2.44	54	-19.8	.102	31	.12	-159
9.0	.75	175	6.8	2.19	47	-19.6	.105	31	.12	-165
10.0	.75	166	6.2	2.04	39	-18.9	.113	29	.13	-171
11.0	.75	156	5.6	1.90	32	-18.4	.120	27	.13	-177
12.0	.74	150	5.1	1.79	25	-17.9	.128	26	.14	173
13.0	.74	148	4.6	1.69	19	-16.9	.143	25	.15	166
14.0	.75	145	4.2	1.62	14	-16.2	.155	24	.17	154
15.0	.76	140	3.9	1.57	9	-15.7	.164	21	.21	142
16.0	.77	135	3.2	1.45	-1	-15.5	.168	18	.24	133
17.0	.79	130	1.8	1.23	-6	-15.3	.171	18	.28	125
18.0	.80	125	1.3	1.16	-6	-14.4	.191	18	.32	117

ATF-10100 Chip Dimensions



Note: Die thickness is 4.5 mil, and backside metallization is 200 Å Ti and 2000 Å Au.