0.5–12 GHz Low Noise Gallium Arsenide FET

Technical Data

ATF-10100

Features

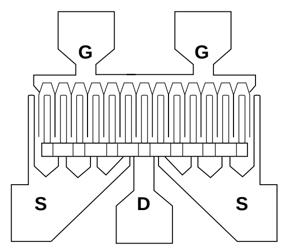
- **Low Noise Figure:** 0.5 dB Typical at 4 GHz
- **Low Bias:** V_{DS} = 2 V, I_{DS} = 25 mA
- **High Associated Gain:** 14.0 dB Typical at 4 GHz
- **High Output Power:** 21.0 dBm Typical $P_{1\,dB}$ at 4 GHz

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°C

Symbol	Parameters and Test Conditions[1]		Units	Min.	Typ.	Max.
NF_O	Optimum Noise Figure: V_{CE} = 2 V, I_{DS} = 25 mA	f = 2.0 GHz f = 4.0 GHz f = 6.0 GHz	dB dB dB		0.4 0.55 0.8	0.7
G_A	Gain @ NF_O; V_{DS} = 2 V, I_{DS} = 25 mA	f = 2.0 GHz f = 4.0 GHz f = 6.0 GHz	dB dB dB	12.0	17.0 14.0 12.0	
$P_{1\,dB}$	Power Output @ 1 dB Gain Compression V_{DS} = 4 V, I_{DS} = 70 mA	f = 4.0 GHz	dBm		21.0	
$G_{1\,dB}$	1 dB Compressed Gain: V_{DS} = 4 V, I_{DS} = 70 mA	f = 4.0 GHz	dB		15.0	
g_m	Transconductance: V_{DS} = 2 V, V_{GS} = 0 V		mmho	80	140	
I_{DSS}	Saturated Drain Current: V_{DS} = 2 V, V_{GS} = 0 V		mA	70	130	180
V_P	Pinchoff Voltage: V_{DS} = 2 V, I_{DS} = 1 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:	θ_{jc} = 225°C/W; T_{CH} = 150°C
Liquid Crystal Measurement:	1 µm Spot Size[4]

Notes:
1. Permanent damage may occur if any of these limits are exceeded.
2. $T_{CASE\ TEMPERATURE}$ = 25°C.
3. Derate at 4.4 mW/°C for T_{CASE} > 78°C.
4. 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} Mag	Γ_{opt} Ang	$R_N/50$
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

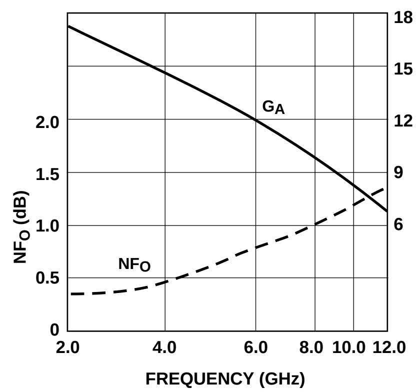


Figure 1. Optimum Noise Figure and Associated Gain vs. Frequency. V_{DS} = 2 V, I_{DS} = 25 mA, T_A = 25°C.

ATF-10100 Typical Performance, T_A = 25°C

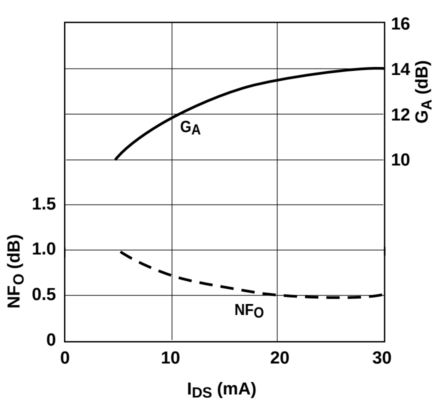


Figure 2. Optimum Noise Figure and Associated Gain vs. I_{DS}. V_{DS} = 2 V, f = 4.0 GHz.

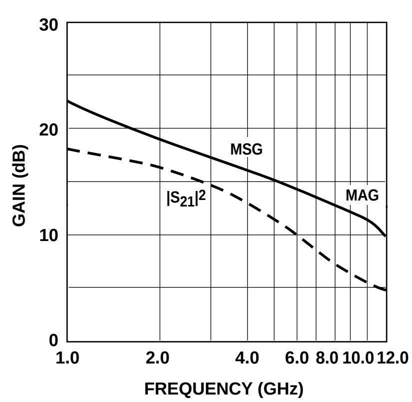


Figure 3. Insertion Power Gain, Maximum Available Gain and Maximum Stable Gain vs. Frequency. V_{DS} = 2 V, I_{DS} = 25 mA.

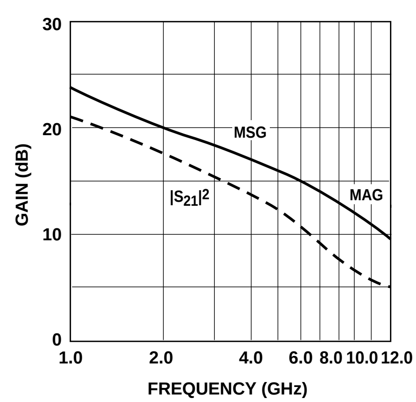


Figure 4. Insertion Power Gain, Maximum Available Gain and Maximum Stable Gain vs. Frequency. V_{DS} = 4 V, I_{DS} = 70 mA.

Typical Scattering Parameters, Common Source, Z_O = 50 Ω, T_A = 25°C, V_{DS} = 2 V, I_{DS} = 25 mA

Freq.	S_{11}		S_{21}			S_{12}			S_{22}	
MHz	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 Ω, T_A = 25°C, V_{DS} = 4 V, I_{DS} = 70 mA

Freq.	S_{11}		S_{21}			S_{12}			S_{22}	
MHz	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

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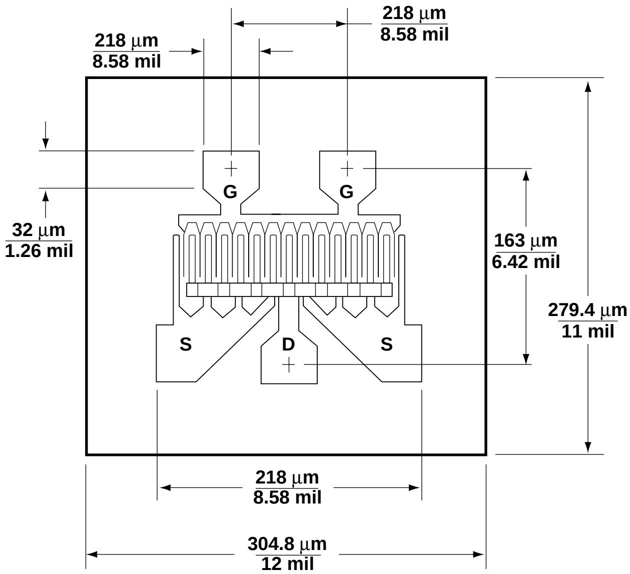
ATF-10100 Chip Dimensions



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

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Data subject to change.

5965-8702E (11/99)