HEWLETT® PACKARD

0.5–6 GHz Low Noise Gallium Arsenide FET

Technical Data

ATF-21170

Features

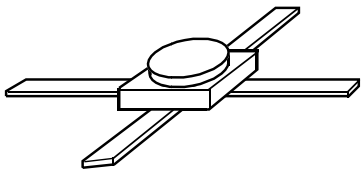
- **Low Noise Figure:** 0.9 dB Typical at 4 GHz
- **High Associated Gain:** 13.0 dB Typical at 4 GHz
- **High Output Power:** 23.0 dBm Typical $P_{1\,dB}$ at 4 GHz
- **Hermetic Gold-Ceramic Microstrip Package**

Description

The ATF-21170 is a high performance gallium arsenide Schottky-barrier-gate field effect transistor housed in a hermetic, high reliability package. This device is designed for use in low noise or medium power amplifier applications in the 0.5-6 GHz frequency range.

This GaAs FET device has a nominal 0.3 micron gate length with a total gate periphery of 750 microns. Proven gold based metallization systems and nitride passivation assure a rugged, reliable device.

70 mil Package



Electrical Specifications, T_A = 25°C

Symbol	Parameters and Test Conditions		Units	Min.	Typ.	Max.
NF_O	Optimum Noise Figure: V_{DS} = 3 V, I_{DS} = 20 mA	f = 2.0 GHz	dB		0.6	
		f = 4.0 GHz	dB		0.9	1.1
		f = 6.0 GHz	dB		1.2	
G_A	Gain @ NF_O: V_{DS} = 3 V, I_{DS} = 20 mA	f = 2.0 GHz	dB		16.0	
		f = 4.0 GHz	dB	12.0	13.0	
		f = 6.0 GHz	dB		10.0	
$P_{1\,dB}$	Power Output @ 1 dB Gain Compression: V_{DS} = 5 V, I_{DS} = 80 mA	f = 4.0 GHz	dBm		23.0	
$G_{1\,dB}$	1 dB Compressed Gain: V_{DS} = 5 V, I_{DS} = 80 mA	f = 4.0 GHz	dB		13.0	
g_m	Transconductance: V_{DS} = 3 V, V_{GS} = 0 V		mmho	70	120	
I_{DSS}	Saturated Drain Current: V_{DS} = 3 V, V_{GS} = 0 V		mA	80	120	200
V_P	Pinch-off Voltage: V_{DS} = 3 V, I_{DS} = 1 mA		V	-3.0	-1.5	-0.8

ATF-21170 Absolute Maximum Ratings

Symbol	Parameter	Units	Absolute Maximum[1]
V_{DS}	Drain-Source Voltage	V	+7
V_{GS}	Gate-Source Voltage	V	-4
V_{GD}	Gate-Drain Voltage	V	-8
I_{DS}	Drain Current	mA	I_{DSS}
P_T	Power Dissipation [2,3]	mW	600
T_{CH}	Channel Temperature	°C	175
T_{STG}	Storage Temperature	°C	-65 to +175

Thermal Resistance:	$\theta_{jc} = 250°C/W; T_{CH} = 150°C$
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 mW/°C for $T_{CASE} > 25°C$.
4. The small spot size of this technique results in a higher, though more accurate determination of θ_{jc} than do alternate methods. See MEASUREMENTS section for more information.

ATF-21170 Noise Parameters: $V_{DS} = 3\ V, I_{DS} = 20\ mA$

Freq. GHz	NF_O dB	Γ_{opt}		$R_N/50$
		Mag	Ang	
0.5	0.4	.93	17	.90
1.0	0.5	.85	35	.70
2.0	0.6	.70	70	.46
4.0	0.9	.59	148	.14
8.0	1.2	.54	-177	.09

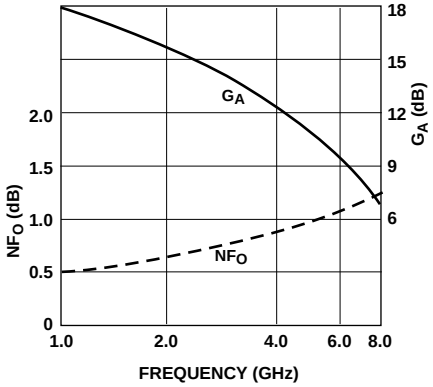


Figure 1. Optimum Noise Figure and Associated Gain vs. Frequency. V_{DS} = 3V, I_{DS} = 20 mA, T_A = 25°C.

ATF-21170 Typical Performance, T_A = 25°C

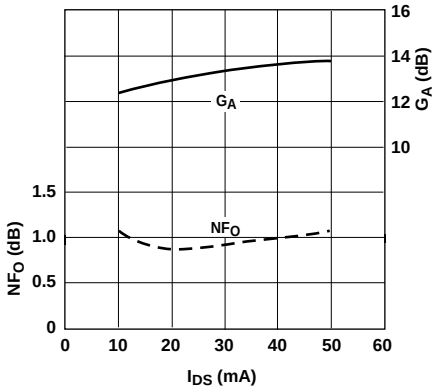


Figure 2. Optimum Noise Figure and Associated Gain vs. I_{DS}. V_{DS} = 3V, f = 4.0 GHz.

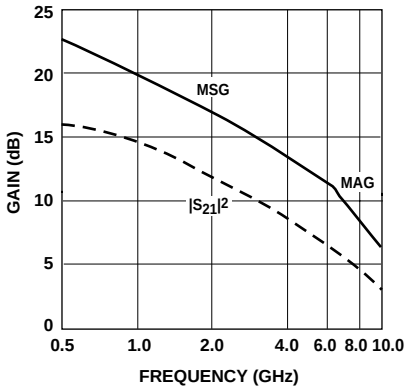


Figure 3. Insertion Power Gain, Maximum Available Gain and Maximum Stable Gain vs. Frequency. V_{DS} = 3 V, I_{DS} = 20 mA.

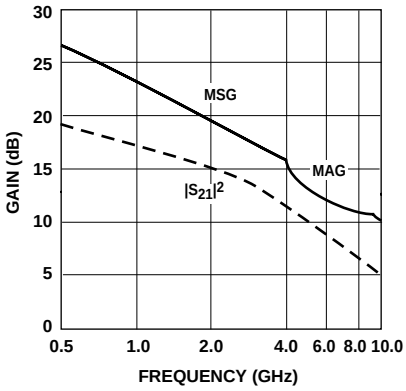


Figure 4. Insertion Power Gain, Maximum Available Gain and Maximum Stable Gain vs. Frequency. V_{DS} = 5 V, I_{DS} = 80 mA.

Typical Scattering Parameters, Common Emitter, $Z_O = 50\ \Omega, T_A = 25°C, V_{DS} = 3\ V, I_{DS} = 20\ mA$

Freq.	S_{11}		S_{21}			S_{12}			S_{22}	
GHz	Mag.	Ang.	dB	Mag.	Ang.	dB	Mag.	Ang.	Mag.	Ang.
0.5	.96	-31	15.5	5.93	157	-29.4	.034	72	.46	-23
1.0	.91	-55	14.2	5.14	137	-24.3	.061	56	.42	-42
2.0	.82	-95	12.1	4.05	106	-20.4	.096	36	.39	-70
3.0	.74	-123	10.2	3.23	82	-19.5	.106	21	.35	-91
4.0	.70	-147	8.8	2.74	61	-18.7	.116	9	.33	-109
5.0	.65	-170	7.3	2.33	41	-18.2	.123	-1	.30	-127
6.0	.64	167	6.3	2.07	22	-17.7	.131	-10	.29	-145
7.0	.65	146	5.4	1.86	4	-17.5	.134	-17	.26	-167
8.0	.66	126	4.5	1.67	-13	-17.0	.141	-28	.26	164
9.0	.66	107	3.4	1.48	-30	-16.6	.148	-39	.26	140
10.0	.67	87	2.2	1.29	-47	-16.2	.155	-50	.25	114

Typical Scattering Parameters, Common Emitter, $Z_O = 50\ \Omega, T_A = 25°C, V_{DS} = 5\ V, I_{DS} = 80\ mA$

Freq.	S_{11}		S_{21}			S_{12}			S_{22}	
GHz	Mag.	Ang.	dB	Mag.	Ang.	dB	Mag.	Ang.	Mag.	Ang.
0.5	.95	-43	18.3	8.24	149	-32.4	.024	67	.49	-17
1.0	.89	-64	17.4	7.28	133	-29.9	.032	59	.46	-26
2.0	.78	-106	14.6	5.36	101	-25.2	.055	44	.40	-45
3.0	.69	-133	12.4	4.18	79	-23.4	.068	34	.38	-60
4.0	.64	-160	10.7	3.42	56	-22.7	.073	31	.36	-81
5.0	.60	175	9.1	2.85	37	-21.7	.082	24	.35	-100
6.0	.61	154	7.9	2.47	18	-20.4	.095	19	.33	-115
7.0	.61	136	6.9	2.22	2	-19.3	.108	12	.31	-132
8.0	.63	120	6.2	2.05	-14	-17.9	.127	7	.27	-152
9.0	.64	102	5.3	1.85	-32	-16.6	.148	0	.27	-179
10.0	.64	86	4.5	1.68	-48	-15.3	.172	-13	.29	165

A model for this device is available in the DEVICE MODELS section.

70 mil Package Dimensions