Agilent Technologies
Innovating the HP Way

0.5–6 GHz General Purpose Gallium Arsenide FET

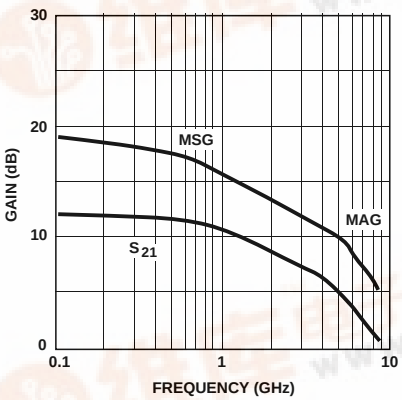
Technical Data

ATF-21186

Features

- **Low Noise Figure:**
  0.5 dB Typ. @ 2 GHz
- **High Output Power:**
  19 dBm Typ. P_{1dB} @ 2 GHz
- **High MSG:**
  13.5 dB Typ. @ 2 GHz
- **Low Cost Surface Mount Plastic Package**
- **Tape-and-Reel Packaging Option Available[1]**

Note:
1. Refer to "Tape-and-Reel Packaging for Surface Mount Semiconductors".

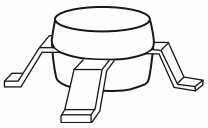


ATF-21186 Insertion Power Gain, Maximum Available Gain, and Maximum Stable Gain vs. Frequency. V_{DS} = 2 V, I_{DS} = 15 mA.

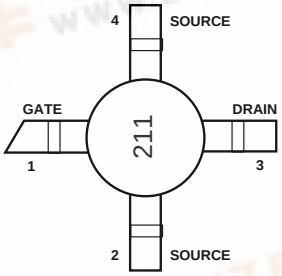
Description

Agilent's ATF-21186 is a low cost Gallium Arsenide Schottky barrier-gate field effect transistor housed in a surface mount plastic package. This general purpose device is designed for use in low noise amplifiers, gain stages, driver amplifiers, and oscillators operating over the VHF, UHF, and microwave frequency ranges. High gain with two volt operation makes this part attractive for low voltage, battery operated systems. The low noise figure is appropriate for commercial systems demanding good sensitivity, such as GPS receiver front-ends and MMDS television receivers. The output power is sufficient for use as the driver stage in many hand-held transceivers operating in the 900 MHz through 2.4 GHz bands, including in cellular phones, PCN, and ISM band spread spectrum applications.

85 mil Plastic Surface Mount Package



Pin Configuration



This GaAs FET device has a nominal 0.3 micron gate length using airbridge interconnects between drain fingers. Total gate periphery is 750 microns. Proven gold based metallization systems and nitride passivation assure a rugged, reliable device.

ATF-21186 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	-6
I_{DS}	Drain Current	mA	I_{DSS}
P_T	Power Dissipation[2,3]	mW	400
T_{CH}	Channel Temperature	°C	150
T_{STG}	Storage Temperature	°C	-65 to +150

Thermal Resistance[2]: θ_{jc} = 225°C/W

Notes:
1. Operation of this device above any one of these parameters may cause permanent damage.
2. T_{CASE} = 25ºC (T_{CASE} is defined to be the temperature at the ends of pins 2 and 4 where they contact the circuit board).
3. Derate at 4.4 mW/ºC for T_C > 60ºC.

ATF-21186 Electrical Specifications, T_A = 25°C

Symbol	Parameters and Test Conditions		Units	Min.	Typ.	Max.
NF_o	Optimum Noise Figure V_{DS} = 2 V, I_{DS} = 15 mA	f = 1 GHz f = 2 GHz f = 4 GHz	dB		0.4 0.5 0.6	 0.75
G_A	Associated Gain V_{DS} = 2 V, I_{DS} = 15 mA	f = 1 GHz f = 2 GHz f = 4 GHz	dB	 12.0 	14.2 12.6 9.1	
$P_{1\ dB}$	Power at 1 dB Gain Compression V_{DS} = 3 V, I_{DS} = 70 mA	f = 1 GHz f = 2 GHz f = 4 GHz	dBm	 	19.0 19.0 18.0	
$G_{1\ dB}$	1 dB Compressed Gain V_{DS} = 3 V, I_{DS} = 70 mA	f = 1 GHz f = 2 GHz f = 4 GHz	dB	 	18.0 14.0 8.5	
g_m	Transconductance	V_{DS} = 3 V, V_{GS} = 0 V	mS	70	120	
I_{DSS}	Saturated Drain Current	V_{DS} = 3 V, V_{GS} = 0 V	mA	80	120	200
V_P	Pinchoff Voltage	V_{DS} = 3 V, I_{DS} = 1 mA	V	-3.0	-1.5	-0.8

ATF-21186 Typical Performance, T_A = 25°C

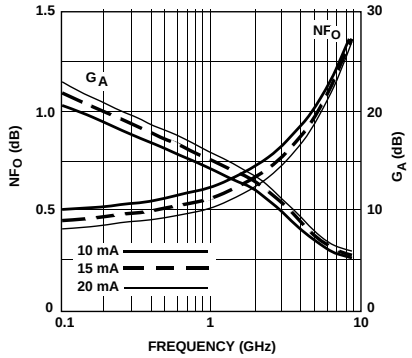


Figure 1. ATF-21186 Optimum Noise Figure and Associated Gain vs. Frequency and I_{DS}, V_{DS} = 2 V.

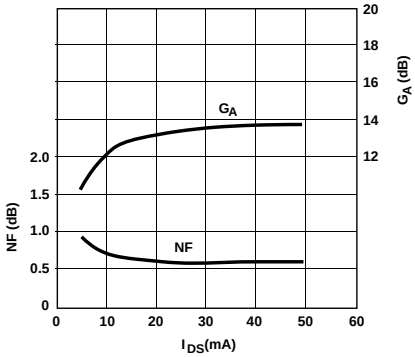


Figure 2. ATF-21186 Optimum Noise Figure and Associated Gain vs. I_{DS}, f = 2 GHz, V_{DS} = 2 V.

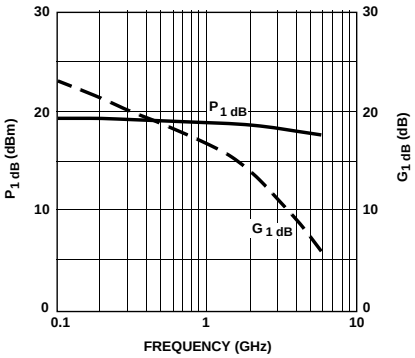


Figure 3. ATF-21186 Power Output at 1 dB Compression and 1 dB Compressed Gain vs. Frequency. V_{DS} = 3 V, I_{DS} = 70 mA.

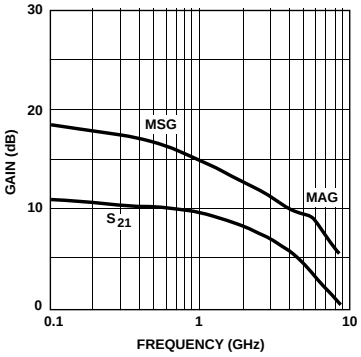


Figure 4. ATF-21186 Insertion Power Gain, Maximum Available Gain, and Maximum Stable Gain vs. Frequency. V_{DS} = 2 V, I_{DS} = 10 mA.

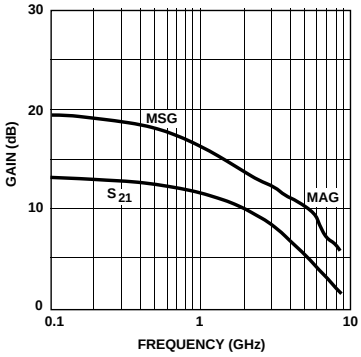


Figure 5. ATF-21186 Insertion Power Gain, Maximum Available Gain, and Maximum Stable Gain vs. Frequency. V_{DS} = 2 V, I_{DS} = 20 mA.

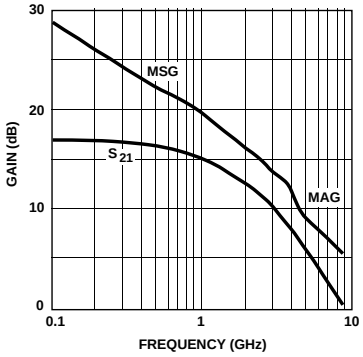


Figure 6. ATF-21186 Insertion Power Gain, Maximum Available Gain, and Maximum Stable Gain vs. Frequency. V_{DS} = 3 V, I_{DS} = 70 mA.

ATF-21186 Typical Scattering Parameters,

Common Source, Z_o = 50 Ω, V_{DS} = 2 V, I_{DS} = 10 mA

Freq.	S_{11}		S_{21}			S_{12}			S_{22}		K	G_{max}[1]
(GHz)	Mag.	Ang.	dB	Mag.	Ang.	dB	Mag.	Ang.	Mag.	Ang.	—	(dB)
0.5	0.961	-25	11.12	3.599	157	-25.85	0.051	71	0.376	-25	0.22	18.5
1.0	0.910	-49	10.60	3.388	137	-20.36	0.096	57	0.360	-50	0.27	15.5
1.5	0.851	-73	9.96	3.149	118	-17.66	0.131	43	0.339	-73	0.33	13.8
2.0	0.794	-95	9.27	2.906	100	-16.03	0.158	31	0.314	-95	0.40	12.6
2.5	0.743	-118	8.53	2.671	83	-15.04	0.177	19	0.291	-118	0.47	11.8
3.0	0.694	-139	7.71	2.429	67	-14.52	0.188	9	0.272	-143	0.57	11.1
3.5	0.659	-160	6.85	2.201	52	-14.29	0.193	-1	0.270	-169	0.66	10.6
4.0	0.643	180	5.97	1.989	37	-14.29	0.193	-9	0.290	167	0.75	10.1
4.5	0.643	161	5.05	1.789	24	-14.38	0.191	-17	0.324	148	0.83	9.7
5.0	0.658	143	4.12	1.606	11	-14.66	0.185	-24	0.367	133	0.90	9.4
5.5	0.682	128	3.16	1.438	-1	-14.94	0.179	-29	0.410	121	0.95	9.0
6.0	0.707	115	2.19	1.286	-12	-15.29	0.172	-34	0.453	111	1.00	8.7
6.5	0.735	104	1.25	1.155	-23	-15.55	0.167	-38	0.490	102	1.02	7.5
7.0	0.758	95	0.32	1.038	-33	-15.81	0.162	-41	0.526	94	1.05	6.7
7.5	0.780	86	-0.59	0.934	-42	-15.97	0.159	-44	0.559	85	1.08	6.0
8.0	0.801	77	-1.49	0.842	-51	-16.08	0.157	-47	0.595	78	1.08	5.6

Note:

1. G_{max} = MAG for K ≥ 1 and G_{max} = MSG for K < 1

ATF-21186 Typical Noise Parameters,

Common Source, Z_o = 50 Ω, V_{DS} = 2 V, I_D = 10 mA

Frequency	F_{min}	Γ_{opt}		$R_n/50$	G_a
GHz	dB	Mag.	Ang.	—	dB
0.5	0.37	0.95	11	1.738	13.8
1.0	0.41	0.89	25	0.819	12.3
1.5	0.45	0.84	42	0.553	11.4
2.0	0.49	0.79	60	0.387	11.1
2.5	0.53	0.74	79	0.265	10.4
3.0	0.57	0.71	100	0.179	10.0
3.5	0.61	0.68	120	0.111	9.2
4.0	0.65	0.66	142	0.057	8.7
4.5	0.69	0.64	162	0.028	7.9
5.0	0.73	0.65	-175	0.021	7.4
5.5	0.77	0.68	-155	0.042	7.1
6.0	0.81	0.73	-139	0.095	6.6
6.5	0.85	0.77	-123	0.202	6.4
7.0	0.89	0.81	-111	0.362	6.1
7.5	0.93	0.84	-98	0.596	5.8
8.0	0.97	0.86	-88	0.873	5.4

ATF-21186 Typical Scattering Parameters,

Common Source, Z_o = 50 Ω, V_{DS} = 2 V, I_{DS} = 15 mA

Freq.	S_{11}		S_{21}			S_{12}			S_{22}		K	G_{max}[1]
(GHz)	Mag.	Ang.	dB	Mag.	Ang.	dB	Mag.	Ang.	Mag.	Ang.	—	(dB)
0.5	0.957	-27	12.56	4.248	156	-26.38	0.048	71	0.303	-28	0.22	19.5
1.0	0.898	-53	11.95	3.959	136	-21.11	0.088	57	0.291	-57	0.29	16.5
1.5	0.833	-77	11.19	3.627	116	-18.42	0.120	44	0.277	-82	0.37	14.8
2.0	0.772	-100	10.37	3.300	99	-16.89	0.143	32	0.261	-106	0.45	13.6
2.5	0.721	-123	9.52	2.992	82	-15.86	0.161	22	0.251	-132	0.53	12.7
3.0	0.675	-145	8.59	2.689	66	-15.34	0.171	12	0.247	-158	0.63	12.0
3.5	0.646	-165	7.65	2.413	51	-15.04	0.177	3	0.261	177	0.73	11.3
4.0	0.636	175	6.71	2.164	37	-14.90	0.180	-4	0.292	156	0.81	10.8
4.5	0.642	156	5.74	1.936	24	-14.90	0.180	-11	0.334	139	0.88	10.3
5.0	0.660	139	4.76	1.730	11	-14.99	0.178	-17	0.380	125	0.94	9.9
5.5	0.685	124	3.78	1.545	0	-15.09	0.176	-23	0.424	114	0.98	9.4
6.0	0.712	112	2.80	1.380	-11	-15.24	0.173	-27	0.466	106	1.01	8.5
6.5	0.739	102	1.86	1.239	-21	-15.39	0.170	-32	0.502	97	1.03	7.6
7.0	0.762	92	0.94	1.114	-31	-15.49	0.168	-36	0.537	89	1.04	6.9
7.5	0.783	84	0.04	1.005	-40	-15.55	0.167	-39	0.567	81	1.06	6.3
8.0	0.803	75	-0.84	0.908	-49	-15.60	0.166	-44	0.601	74	1.06	5.9

Note:

1. G_{max} = MAG for K ≥ 1 and G_{max} = MSG for K < 1

ATF-21186 Typical Noise Parameters,

Common Source, Z_o = 50 Ω, V_{DS} = 2 V, I_D = 15 mA

Frequency	F_{min}	Γ_{opt}		$R_n/50$	G_a
GHz	dB	Mag.	Ang.	—	dB
0.5	0.35	0.950	13	1.633	15.8
1.0	0.39	0.870	27	0.639	14.2
1.5	0.43	0.810	45	0.420	13.4
2.0	0.46	0.760	63	0.302	12.6
2.5	0.50	0.710	82	0.209	11.7
3.0	0.54	0.670	102	0.138	10.8
3.5	0.57	0.635	121	0.088	9.8
4.0	0.61	0.614	143	0.047	9.1
4.5	0.64	0.605	165	0.025	8.5
5.0	0.68	0.612	-172	0.022	8.0
5.5	0.72	0.650	-152	0.042	7.6
6.0	0.75	0.696	-136	0.088	7.2
6.5	0.79	0.742	-121	0.174	7.0
7.0	0.83	0.782	-109	0.301	6.6
7.5	0.86	0.810	-96	0.471	6.3
8.0	0.90	0.840	-86	0.715	6.0

ATF-21186 Typical Scattering Parameters,

Common Source, Z_o = 50 Ω, V_{DS} = 2 V, I_{DS} = 20 mA

Freq.	S_{11}		S_{21}			S_{12}			S_{22}		K	G_{max}[1]
(GHz)	Mag.	Ang.	dB	Mag.	Ang.	dB	Mag.	Ang.	Mag.	Ang.	—	(dB)
0.5	0.955	-29	13.44	4.698	156	-26.75	0.046	71	0.251	-32	0.23	20.1
1.0	0.888	-55	12.75	4.340	134	-21.51	0.084	57	0.246	-63	0.31	17.1
1.5	0.819	-80	11.91	3.938	115	-18.86	0.114	44	0.240	-91	0.40	15.4
2.0	0.756	-104	11.00	3.547	97	-17.33	0.136	33	0.233	-117	0.49	14.2
2.5	0.704	-127	10.07	3.186	80	-16.36	0.152	23	0.233	-143	0.58	13.2
3.0	0.662	-149	9.07	2.840	65	-15.76	0.163	14	0.242	-169	0.67	12.4
3.5	0.638	-170	8.07	2.532	50	-15.39	0.170	6	0.266	168	0.77	11.7
4.0	0.633	171	7.07	2.257	37	-15.19	0.174	-1	0.304	148	0.85	11.1
4.5	0.643	153	6.07	2.012	24	-15.14	0.175	-7	0.349	133	0.91	10.6
5.0	0.663	136	5.07	1.793	12	-15.09	0.176	-13	0.397	121	0.96	10.1
5.5	0.690	122	4.07	1.597	0	-15.14	0.175	-19	0.441	111	0.99	9.6
6.0	0.717	110	3.08	1.425	-10	-15.19	0.174	-24	0.482	103	1.01	8.4
6.5	0.744	100	2.14	1.280	-20	-15.24	0.173	-28	0.517	95	1.02	7.7
7.0	0.767	91	1.22	1.151	-29	-15.29	0.172	-33	0.550	87	1.04	7.1
7.5	0.788	83	0.34	1.040	-38	-15.29	0.172	-37	0.579	79	1.04	6.5
8.0	0.807	74	-0.54	0.940	-47	-15.34	0.171	-41	0.611	72	1.05	6.1

Note:

1. G_{max} = MAG for K ≥ 1 and G_{max} = MSG for K < 1

ATF-21186 Typical Noise Parameters,

Common Source, Z_o = 50 Ω, V_{DS} = 2 V, I_D = 20 mA

Frequency	F_{min}	Γ_{opt}		$R_n/50$	G_a
GHz	dB	Mag.	Ang.	—	dB
0.5	0.33	0.95	13	1.543	16.1
1.0	0.37	0.88	28	0.659	14.6
1.5	0.41	0.82	46	0.423	13.8
2.0	0.45	0.77	64	0.294	12.8
2.5	0.48	0.70	83	0.191	12.0
3.0	0.52	0.65	103	0.124	11.0
3.5	0.56	0.62	123	0.079	10.0
4.0	0.59	0.60	146	0.042	9.4
4.5	0.63	0.59	168	0.024	8.7
5.0	0.67	0.60	-170	0.023	8.2
5.5	0.70	0.64	-150	0.044	7.7
6.0	0.74	0.68	-134	0.089	7.3
6.5	0.78	0.73	-118	0.176	7.0
7.0	0.81	0.77	-107	0.289	6.6
7.5	0.85	0.80	-96	0.446	6.3
8.0	0.89	0.83	-84	0.654	5.9

ATF-21186 Typical Scattering Parameters,

Common Source, Z_o = 50 Ω, V_{DS} = 3 V, I_{DS} = 70 mA

Freq.	S_{11}		S_{21}			S_{12}			S_{22}		K	G_{max}[1]
(GHz)	Mag.	Ang.	dB	Mag.	Ang.	dB	Mag.	Ang.	Mag.	Ang.	—	(dB)
0.5	0.933	-34	17.12	7.181	152	-28.64	0.037	71	0.240	-34	0.28	22.9
1.0	0.841	-65	16.05	6.348	129	-23.74	0.065	57	0.222	-66	0.41	19.9
1.5	0.755	-92	14.80	5.493	109	-21.21	0.087	46	0.204	-93	0.53	18.0
2.0	0.688	-117	13.54	4.755	91	-19.74	0.103	38	0.188	-118	0.64	16.6
2.5	0.643	-140	12.33	4.135	75	-18.64	0.117	30	0.182	-145	0.73	15.5
3.0	0.613	-161	11.14	3.607	61	-17.92	0.127	23	0.186	-171	0.82	14.5
3.5	0.601	179	10.01	3.167	47	-17.33	0.136	17	0.209	165	0.91	13.7
4.0	0.608	161	8.94	2.799	35	-16.77	0.145	11	0.247	146	0.96	12.9
4.5	0.628	145	7.89	2.480	23	-16.36	0.152	6	0.293	131	0.99	12.1
5.0	0.657	130	6.85	2.201	11	-16.03	0.158	0	0.342	120	1.02	10.7
5.5	0.689	116	5.84	1.959	0	-15.76	0.163	-5	0.390	110	1.02	9.9
6.0	0.720	106	4.85	1.748	-10	-15.60	0.166	-11	0.434	103	1.03	9.2
6.5	0.750	96	3.90	1.567	-19	-15.39	0.170	-16	0.474	95	1.02	8.9
7.0	0.774	88	2.98	1.410	-29	-15.24	0.173	-21	0.510	87	1.01	8.4
7.5	0.797	80	2.08	1.271	-38	-15.09	0.176	-26	0.542	79	1.01	8.1
8.0	0.817	72	1.22	1.151	-46	-14.99	0.178	-31	0.578	72	1.00	8.1

Note:

1. G_{max} = MAG for K ≥ 1 and G_{max} = MSG for K < 1

ATF-21186 Typical Noise Parameters,

Common Source, Z_o = 50 Ω, V_{DS} = 3 V, I_D = 70 mA

Frequency	F_{min}	Γ_{opt}		$R_n/50$	G_a
GHz	dB	Mag.	Ang.	—	dB
0.5	0.40	0.94	16	1.510	19.5
1.0	0.44	0.84	34	0.565	18.0
1.5	0.49	0.74	53	0.322	16.5
2.0	0.54	0.67	72	0.223	15.0
2.5	0.59	0.61	92	0.153	13.7
3.0	0.63	0.57	115	0.098	12.7
3.5	0.68	0.55	137	0.060	11.7
4.0	0.73	0.54	162	0.034	11.0
4.5	0.78	0.55	-175	0.029	10.3
5.0	0.82	0.59	-155	0.045	9.6
5.5	0.87	0.63	-136	0.092	9.2
6.0	0.92	0.68	-121	0.167	8.7
6.5	0.97	0.73	-109	0.282	8.4
7.0	1.01	0.78	-98	0.466	8.0
7.5	1.06	0.82	-87	0.738	7.6
8.0	1.11	0.85	-78	1.089	7.3

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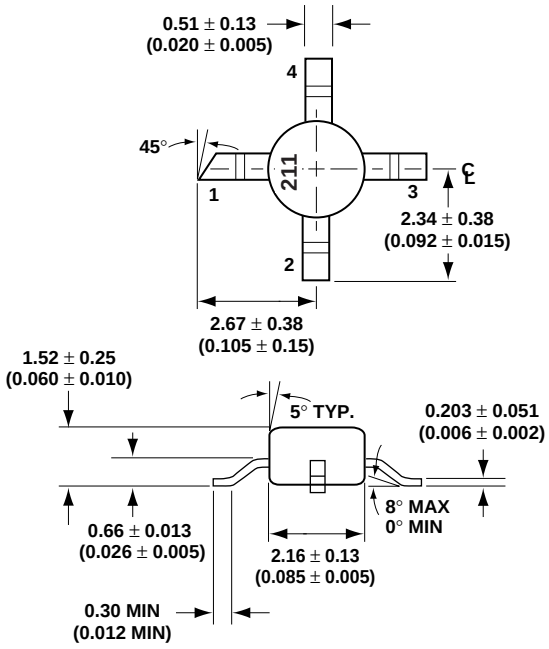
Part Number Ordering Information

Part Number	Devices per Reel	Reel Size
ATF-21186-TR1	1000	7"'
ATF-21186-STR	10	strip

85 mil Plastic Surface Mount Package Dimensions



DIMENSIONS ARE IN MILLIMETERS (INCHES)

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Data subject to change.

Obsoletes 5091-4862E
5965-8716E (11/99)