HEWLETT PACKARD

ATF-35076, -35176, -35376
2-18 GHz Low Noise Pseudomorphic HEMT

Features

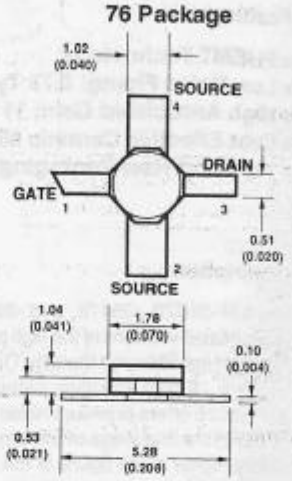
- PHEMT Technology
- Low Noise Figure: 0.75 Typical at 12 GHz
- High Associated Gain: 11 dB Typical at 12 GHz
- Cost Effective Ceramic Microstrip Package
- Tape-and-Reel Packaging Option Available[1]

Description

The ATF-35076, -35176, and -35376 are noise performance differentiated versions of the high performance ATF-35 Pseudomorphic High Electron Mobility Transistor (PHEMT), housed in the Style 76 cost effective, ceramic microstrip package. The ATF-35076 offers premium noise figure and is an ideal choice for use in the first stage of extremely low noise cascades. The slightly higher noise figure of the ATF-35176 makes it appropriate for use in the second stage of premium cascades or as the first stage in amplifiers that have less critical noise requirements. The moderate noise performance of the ATF-35376 makes this part suitable for second stage use in low noise cascades. Although developed for use in Ku band DBS systems, these devices are also appropriate for use in C band TVRO LNAs or other low noise amplifiers operating in the 2 to 18 GHz frequency range.

These GaAs PHEMT devices have a nominal 0.25 micron gate length with a total gate periphery of 200 microns. Proven gold based metallization systems and nitride passivation assure rugged, reliable devices.

76 Package



DIMENSIONS ARE IN MILLIMETERS (INCHES)

Typical Noise Parameters: V_{DS} = 1.5 V, I_{DS} = 10 mA

FREQ GHz	ATF-35076 NF_O dB	ATF-35176 NF_O dB	ATF-35376 NF_O dB	Γ_{OPT} MAG	Γ_{OPT} ANG	R_N/Z_O -
2.0	.13	.14	.17	.82	23	.23
4.0	.25	.28	.33	.74	43	.19
6.0	.38	.43	.50	.62	69	.13
8.0	.50	.57	.67	.57	89	.10
10.0	.63	.71	.83	.51	115	.07
12.0	.75	.85	1.00	.44	140	.05
14.0	.88	.99	1.17	.42	164	.04

Γ_{OPT} and R_N/Z_O apply equally to the ATF-35076, ATF-35176, and ATF-35376.

Electrical Specifications, T_A = 25°C

Symbol	Parameters and Test Conditions		Product	Unit	Min.	Typ.	Max.
NF_O	Optimum Noise Figure: V_{DS} = 1.5 V, I_{DS} = 10 mA	f = 4.0 GHz	ATF-35076	dB		0.25	
		f = 12 GHz		dB		0.75	0.80
G_A	Gain @ NF_O: V_{DS} = 1.5 V, I_{DS} = 10 mA	f = 4.0 GHz		dB		16.0	
		f = 12 GHz		dB	10.0	11.0	
NF_O	Optimum Noise Figure: V_{DS} = 1.5 V, I_{DS} = 10 mA	f = 4.0 GHz	ATF-35176	dB		0.30	
		f = 12 GHz		dB		0.85	0.90
G_A	Gain @ NF_O: V_{DS} = 1.5 V, I_{DS} = 10 mA	f = 4.0 GHz		dB		16.0	
		f = 12 GHz		dB	10.0	11.0	
NF_O	Optimum Noise Figure: V_{DS} = 1.5 V, I_{DS} = 10 mA	f = 4.0 GHz	ATF-35376	dB		0.40	
		f = 12 GHz		dB		1.0	1.2
G_A	Gain @ NF_O: V_{DS} = 1.5 V, I_{DS} = 10 mA	f = 4.0 GHz		dB		15.0	
		f = 12 GHz		dB	9.5	10.0	
g_m	Transconductance: V_{DS} = 1.5 V, V_{GS} = 0 V			mS	40	65	
I_{dss}	Saturated Drain Current: V_{DS} = 1.5 V, V_{GS} = 0 V			mA	20	50	70
V_P	Pinchoff Voltage: V_{DS} = 1.5 V, I_{DS} = 1 mA			V	-2.0	-0.4	

Absolute Maximum Ratings

Parameter	Symbol	Absolute Maximum[1]
Drain-Source Voltage	V_{DS}	+4 V
Gate-Source Voltage	V_{GS}	-3 V
Drain Current	I_D	I_{dss}
Total Power Dissipation [2,3]	P_T	225 mW
RF Input Power	$P_{IN\ max}$	+10 dBm
Channel Temperature	T_{CH}	150°C
Storage Temperature	T_{STG}	-65 to 150°C

Thermal Resistance [2]: θ_{jc}=325 °C/W; T_{CH}=150°C
Liquid Crystal Measurement: 1 μm Spot Size [4]

Notes:
1. Operation of this device above any one of these limits may cause permanent damage.
2. T_{case} = 25°C
3. Derate at 3.2 mW/ °C for T_C>102°C
4. The small spot size of this technique results in a higher, though more accurate determination of θ_{jc} than alternate methods.

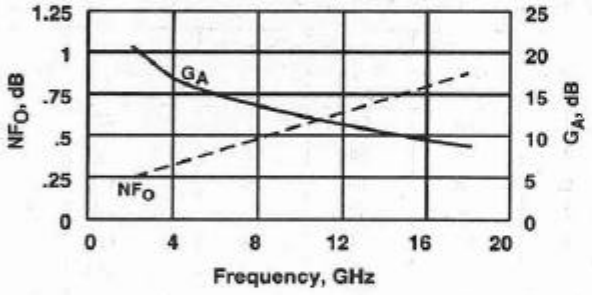
Part Number Order Information

Part Number	Devices Per Reel	Reel Size
ATF-35076-TR1	1000	7"
ATF-35076-TR2	4000	13"
ATF-35076-STR	1	strip
ATF-35176-TR1	1000	7"
ATF-35176-TR2	4000	13"
ATF-35176-STR	1	strip
ATF-35376-TR1	1000	7"
ATF-35376-TR2	4000	13"
ATF-35376-STR	1	strip

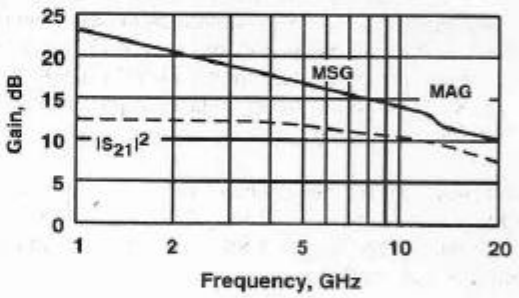
For more information, see "Tape and Reel Packaging for Semiconductor Devices", page 14-14.

Typical Performance, T_A = 25°C, (Unless otherwise noted)

Noise Figure and Associated Gain vs. Frequency (ATF-35076)
V_{DS} = 1.5 V, I_{DS} = 10 mA



Insertion Power Gain, Maximum Available Gain and Maximum Stable Gain vs. Frequency
V_{DS} = 1.5 V, I_{DS} = 10 mA



Typical Scattering Parameters: Common Source, Z_o = 50 Ω

T_A = 25°C, V_{DS} = 1.5 V, I_{DS} = 10 mA

Freq.	S_{11}		S_{21}			S_{12}			S_{22}	
GHz	Mag	Ang	dB	Mag	Ang	dB	Mag	Ang	Mag	Ang
2.0	.98	-31	12.69	4.10	149	-29.11	.035	67	.49	-24
3.0	.95	-43	12.13	4.04	137	-25.85	.051	59	.47	-33
4.0	.92	-60	12.06	4.01	122	-23.48	.067	48	.45	-45
5.0	.88	-76	11.84	3.91	106	-21.94	.080	36	.41	-58
6.0	.83	-92	11.51	3.76	91	-20.82	.091	26	.38	-70
7.0	.79	-108	11.22	3.64	77	-20.00	.100	16	.35	-83
8.0	.76	-119	10.95	3.53	67	-19.33	.108	10	.32	-90
9.0	.73	-134	10.66	3.41	53	-18.86	.114	0	.29	-102
10.0	.70	-149	10.32	3.28	39	-18.42	.120	-10	.27	-114
11.0	.66	-164	10.01	3.17	26	-18.20	.123	-20	.24	-127
12.0	.63	-179	9.75	3.07	13	-17.86	.128	-29	.22	-139
13.0	.61	166	9.57	3.01	09	-17.79	.129	-39	.20	-150
14.0	.60	155	9.37	2.94	-83	-17.65	.131	-43	.16	-158
15.0	.59	140	9.17	2.88	-22	-17.52	.133	-54	.14	-170
16.0	.57	124	8.91	2.79	-35	-17.46	.134	-65	.11	178
17.0	.55	108	8.82	2.76	-50	-17.20	.138	-76	.07	166
18.0	.54	88	8.77	2.75	-64	-17.02	.141	-89	.04	131

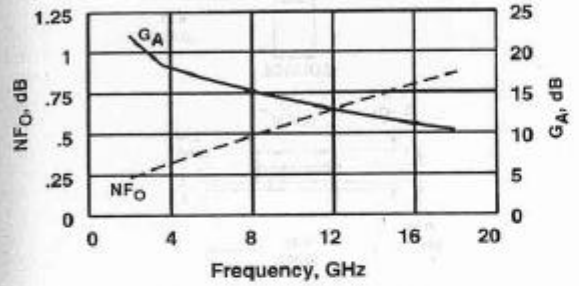
The above S parameter description applies equally to the ATF-35076, -35176, and -35376.

ATF-35 Series Pseudomorphic HEMT

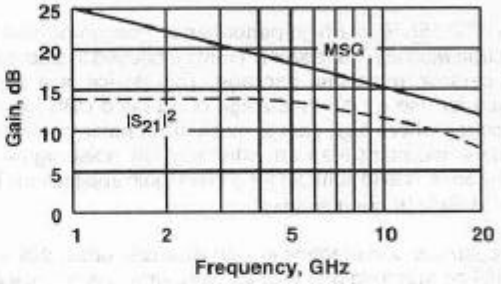
For the ATF-35 Series PHEMTs, increasing I_{ds} from 10 mA to 20 mA has the effect of increasing gain at 12 GHz by approximately 1 dB without significantly altering noise performance. Designers having the flexibility to operate at this higher bias current may want to take advantage of this feature. 20 mA S parameter data follows. Since device capacitances vary little with bias current, the 10 mA noise parameters may also be used to describe 20 mA noise performance.

Typical Performance, $T_A = 25°C$, (Unless otherwise noted)

Noise Figure and Associated Gain vs. Frequency (ATF-35076) $V_{DS} = 1.5$ V, $I_{DS} = 20$ mA



Insertion Power Gain and Maximum Stable Gain vs. Frequency $V_{DS} = 1.5$ V, $I_{DS} = 20$ mA



Typical Scattering Parameters: Common Source, $Z_o = 50\ \Omega$ $T_A = 25°C$, $V_{DS} = 1.5$ 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
2.0	.97	-33	13.89	4.95	147	-29.62	.033	68	.41	-24
3.0	.95	-45	13.76	4.88	135	-26.56	.047	60	.40	-33
4.0	.91	-62	13.57	4.77	119	-24.44	.060	50	.37	-45
5.0	.86	-79	13.20	4.57	103	-22.73	.073	38	.33	-57
6.0	.80	-95	12.75	4.34	88	-21.72	.082	28	.30	-69
7.0	.76	-110	12.34	4.14	74	-20.82	.091	19	.27	-82
8.0	.74	-121	12.07	4.01	65	-20.09	.099	14	.24	-90
9.0	.71	-135	11.75	3.87	51	-19.66	.104	5	.22	-102
10.0	.67	-150	11.35	3.70	37	-19.17	.110	-5	.20	-113
11.0	.62	-164	10.95	3.53	24	-18.86	.114	-14	.17	-123
12.0	.59	-178	10.63	3.40	11	-18.42	.120	-23	.15	-138
13.0	.57	167	10.47	3.34	-2	-18.20	.123	-33	.14	-152
14.0	.56	156	10.32	3.28	-9	-17.99	.126	-37	.12	-164
15.0	.54	140	10.10	3.20	-23	-17.92	.127	-47	.10	-173
16.0	.52	125	9.82	3.10	-37	-17.65	.131	-58	.06	-179
17.0	.49	107	9.70	3.05	-51	-17.39	.135	-70	.03	165
18.0	.50	88	9.72	3.06	-66	-17.08	.140	-82	.03	53

The above S parameter description applies equally to the ATF-35076, -35176, and -35376.