THE DATASHEET OF

ATF-36077-TR1

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ATF-36077

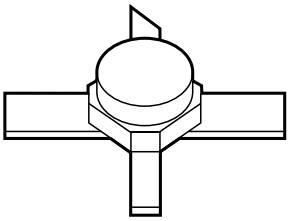
2–18 GHz Ultra Low Noise Pseudomorphic HEMT

Data Sheet

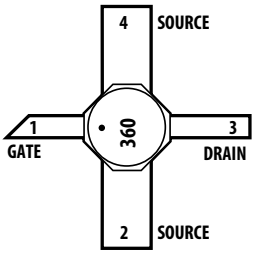
Description

Avago Technologies' ATF-36077 is an ultra-low-noise Pseudomorphic High Electron Mobility Transistor (PHEMT), packaged in a low parasitic, surface-mountable ceramic package. Properly matched, this transistor will provide typical 12 GHz noise figures of 0.5 dB, or typical 4 GHz noise figures of 0.3 dB. Additionally, the ATF-36077 has very low noise resistance, reducing the sensitivity of noise performance to variations in input impedance match, making the design of broadband low noise amplifiers much easier. The premium sensitivity of the ATF-36077 makes this device the ideal choice for use in the first stage of extremely low noise cascades. The repeatable performance and consistency make it appropriate for use in Ku-band Direct Broad-cast Satellite (DBS) Television systems, C-band Television Receive Only (TVRO) LNAs, or other low noise amplifiers operating in the 2-18 GHz frequency range.

77 Package



Pin Configuration



Features

- **PHEMT Technology**
- **Ultra-Low Noise Figure:**
  0.5 dB Typical at 12 GHz
  0.3 dB Typical at 4 GHz
- **High Associated Gain:**
  12 dB Typical at 12 GHz
  17 dB Typical at 4 GHz
- **Low Parasitic Ceramic Microstrip Package**
- **Tape-and-Reel Packing Option Available**

Applications

- **12 GHz DBS LNB (Low Noise Block)**
- **4 GHz TVRO LNB (Low Noise Block)**
- **Ultra-Sensitive Low Noise Amplifiers**

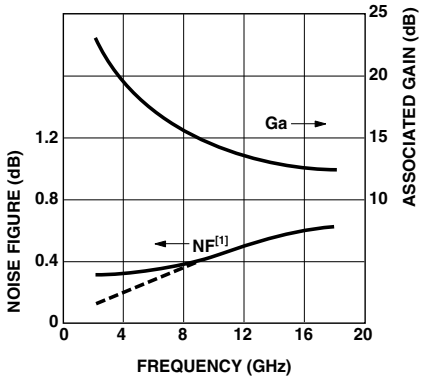


Figure 1. ATF-36077 Optimum Noise Figure and Associated Gain vs. Frequency for V_{DS} = 1.5 V, I_D = 10 mA.

This GaAs PHEMT device has a nominal 0.2 micron gate length with a total gate periphery (width) of 200 microns. Proven gold based metalization systems and nitride passivation assure rugged, reliable devices.

Note: 1. See Noise Parameter Table.

ATF-36077 Absolute Maximum Ratings

Symbol	Parameter	Units	Absolute Maximum[1]
V_{DS}	Drain – Source Voltage	V	+3
V_{GS}	Gate – Source Voltage	V	-3
V_{GD}	Gate-Drain Voltage	V	-3.5
I_D	Drain Current	mA	I_{dss}
P_T	Total Power Dissipation[3]	mW	180
$P_{in\ max}$	RF Input Power	dBm	+10
T_{ch}	Channel Temperature	°C	150
T_{STG}	Storage Temperature	°C	-65 to 150

Thermal Resistance[2,3]: $\theta_{ch\text{-}c}$ = 60°C/W

Notes:
1. Operation of this device above any one of these parameters may cause permanent damage.
2. Measured at P_{diss} = 15 mW and T_{ch} = 100°C.
3. Derate at 16.7 mW/°C for T_C > 139°C.

ATF-36077 Electrical Specifications,

T_C = 25°C, Z_O = 50 Ω, V_{ds} = 1.5 V, I_{ds} = 10 mA, (unless otherwise noted).

Symbol	Parameters and Test Conditions		Units	Min.	Typ.	Max.
NF	Noise Figure[1]	f = 12.0 GHz	dB		0.5	0.6
G_A	Gain at NF[1]	f = 12.0 GHz	dB	11.0	12.0	
g_m	Transconductance	V_{DS} = 1.5 V, V_{GS} = 0 V	mS	50	55	
I_{dss}	Saturated Drain Current	V_{DS} = 1.5 V, V_{GS} = 0 V	mA	15	25	45
$V_{p\ 10\ \%}$	Pinch-off Voltage	V_{DS} = 1.5 V, I_{DS} = 10% of I_{dss}	V	-1.0	-0.35	-0.15

Note:
1. Measured in a fixed tuned environment with Γ source = 0.54 at 156°; Γ load = 0.48 at 167°.

ATF-36077 Characterization Information,

T_C = 25°C, Z_O = 50 Ω, V_{ds} = 1.5 V, I_{ds} = 10 mA, (unless otherwise noted).

Symbol	Parameters and Test Conditions		Units	Typ.
NF	Noise Figure (Tuned Circuit)	f = 4 GHz	dB	0.3[2]
		f = 12 GHz	dB	0.5
G_A	Gain at Noise Figure (Tuned Circuit)	f = 4 GHz	dB	17
		f = 12 GHz	dB	12
$S_{12\ off}$	Reverse Isolation	f = 12 GHz, V_{DS} = 1.5 V, V_{GS} = -2 V	dB	14
P_{1dB}	Output Power at 1 dB Gain Compression	f = 4 GHz	dBm	5
		f = 12 GHz	dBm	5
$V_{GS\ 10\ mA}$	Gate to Source Voltage for I_{DS} = 10 mA	V_{DS} = 1.5 V	V	-0.2

Note:
2. See noise parameter table.

ATF-36077 Typical Scattering Parameters,

Common Source, $Z_O = 50\ \Omega$, $V_{DS} = 1.5$ V, $I_D = 10$ mA

Freq.	S_{11}		S_{21}			S_{12}			S_{22}	
GHz	Mag.	Ang.	dB	Mag.	Ang.	dB	Mag.	Ang.	Mag.	Ang.
1.0	0.99	-17	14.00	5.010	163	-36.08	0.016	78	0.60	-14
2.0	0.97	-33	13.81	4.904	147	-30.33	0.030	66	0.59	-28
3.0	0.94	-49	13.53	4.745	132	-27.25	0.043	54	0.57	-41
4.0	0.90	-65	13.17	4.556	116	-25.32	0.054	43	0.55	-54
5.0	0.86	-79	12.78	4.357	102	-24.04	0.063	33	0.53	-66
6.0	0.82	-93	12.39	4.162	88	-23.17	0.069	24	0.50	-78
7.0	0.78	-107	12.00	3.981	75	-22.58	0.074	16	0.48	-89
8.0	0.75	-120	11.64	3.820	62	-22.17	0.078	8	0.46	-99
9.0	0.72	-133	11.32	3.682	49	-21.90	0.080	1	0.44	-109
10.0	0.69	-146	11.04	3.566	37	-21.71	0.082	-6	0.42	-119
11.0	0.66	-159	10.81	3.473	25	-21.57	0.083	-13	0.40	-129
12.0	0.63	-172	10.63	3.401	13	-21.44	0.085	-19	0.38	-139
13.0	0.61	175	10.50	3.349	1	-21.32	0.086	-25	0.37	-149
14.0	0.60	161	10.41	3.315	-12	-21.19	0.087	-32	0.35	-160
15.0	0.58	147	10.36	3.296	-24	-21.04	0.089	-39	0.33	-171
16.0	0.57	131	10.34	3.289	-37	-20.87	0.091	-47	0.31	177
17.0	0.56	114	10.34	3.289	-50	-20.69	0.092	-55	0.29	164
18.0	0.57	97	10.35	3.291	-64	-20.53	0.094	-65	0.26	148

ATF-36077 Typical "Off" Scattering Parameters,

Common Source, $Z_O = 50\ \Omega$, $V_{DS} = 1.5$ V, $I_D = 0$ mA, $V_{GS} = -2$ V

Freq.	S_{11}		S_{21}			S_{21}			S_{22}	
GHz	Mag.	Ang.	dB	Mag.	Ang.	dB	Mag.	Ang.	Mag.	Ang.
11.0	0.96	-139	-14.2	0.19	-43	-14.2	0.19	-43	0.97	-125
12.0	0.95	-152	-14.0	0.20	-56	-14.0	0.20	-56	0.97	-137
13.0	0.94	-166	-13.8	0.20	-69	-13.8	0.20	-68	0.96	-149

ATF-36077 Typical Noise Parameters,

Common Source, $Z_O = 50\ \Omega$, $V_{DS} = 1.5$ V, $I_D = 10$ mA

Freq. GHz	F_{min}[1] dB	Γ_{opt} Mag.	Γ_{opt} Ang.	R_n/Z_o -
1	0.30	0.95	12	0.40
2	0.30	0.90	25	0.20
4	0.30	0.81	51	0.17
6	0.30	0.73	76	0.13
8	0.37	0.66	102	0.09
10	0.44	0.60	129	0.05
12	0.50	0.54	156	0.03
14	0.56	0.48	-174	0.02
16	0.61	0.43	-139	0.05
18	0.65	0.39	-100	0.09

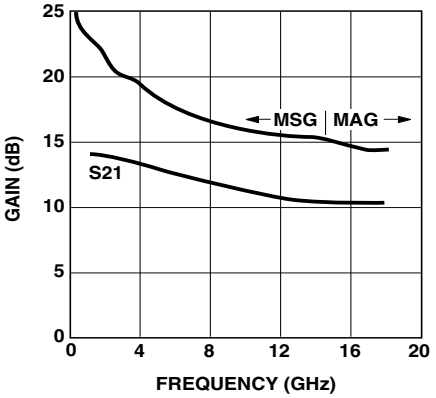
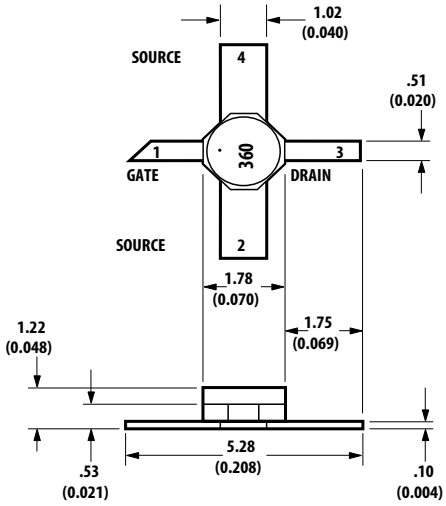


Figure 2. Maximum Available Gain, Maximum Stable Gain and Insertion Power Gain vs. Frequency. $V_{DS} = 1.5$ V, $I_D = 10$ mA.

Note:

1. The F_{min} values at 2,4, and 6 GHz have been adjusted to reflect expected circuit losses that will be encountered when matching to the optimum reflection coefficient (Γ_{opt}) at these frequencies. The theoretical F_{min} values for these frequencies are: 0.10 dB at 2 GHz, 0.20 dB at 4 GHz, and 0.29 dB at 6 GHz. Noise parameters are derived from associated s parameters, packaged device measurements at 12 GHz, and die level measurements from 6 to 18 GHz.

77 Package Dimensions



TYPICAL DIMENSIONS ARE IN MILLIMETERS (INCHES).

Part Number Ordering Information

Part Number	No. of Devices	Container
ATF-36077-TRI[2]	1000	7" Reel
ATF-36077-STR	100	strip

Note:

2. For more information, see "Tape and Reel Packaging for Semiconductor Devices," in "Communications Components" Designer's Catalog.

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