

# 2–16 GHz Low Noise Gallium Arsenide FET

## Technical Data

### ATF-13736

#### Features

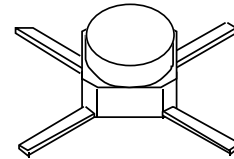
- **Low Noise Figure:**  
1.8 dB Typical at 12 GHz
- **High Associated Gain:**  
9.0 dB Typical at 12 GHz
- **High Output Power:**  
17.5 dB Typical at 12 GHz
- **Cost Effective Ceramic Microstrip Package**
- **Tape-and-Reel Packaging Option Available<sup>[1]</sup>**

#### Description

The ATF-13736 is a high performance gallium arsenide Schottky-barrier-gate field effect transistor housed in a cost effective microstrip package. Its noise figure makes this device appropriate for use in the gain stages of low noise amplifiers operating in the 2-16 GHz frequency range.

This GaAs FET device has a nominal 0.3 micron gate length with a total gate periphery of

#### 36 micro-X Package



250 microns. Proven gold based metallization systems and nitride passivation assure a rugged, reliable device.

#### Electrical Specifications, $T_A = 25^\circ\text{C}$

Symbol	Parameters and Test Conditions	Units	Min.	Typ.	Max.	
NF <sub>O</sub>	Optimum Noise Figure: $V_{DS} = 2.5\text{ V}$ , $I_{DS} = 20\text{ mA}$	$f = 8.0\text{ GHz}$	dB	1.5	2.2	
		$f = 12.0\text{ GHz}$	dB	1.8		
		$f = 14.0\text{ GHz}$	dB	2.1		
G <sub>A</sub>	Gain @ NF <sub>O</sub> : $V_{DS} = 2.5\text{ V}$ , $I_{DS} = 20\text{ mA}$	$f = 8.0\text{ GHz}$	dB	8.0	11.5	
		$f = 12.0\text{ GHz}$	dB		9.0	
		$f = 14.0\text{ GHz}$	dB		7.0	
P <sub>1dB</sub>	Power Output @ 1 dB Gain Compression: $V_{DS} = 4\text{ V}$ , $I_{DS} = 40\text{ mA}$	$f = 12.0\text{ GHz}$	dBm	17.5		
G <sub>1dB</sub>	1 dB Compressed Gain: $V_{DS} = 4\text{ V}$ , $I_{DS} = 40\text{ mA}$	$f = 12.0\text{ GHz}$	dB	8.5		
g <sub>m</sub>	Transconductance: $V_{DS} = 2.5\text{ V}$ , $V_{GS} = 0\text{ V}$		mmho	25	55	
I <sub>DSS</sub>	Saturated Drain Current: $V_{DS} = 2.5\text{ V}$ , $V_{GS} = 0\text{ V}$		mA	40	50	90
V <sub>P</sub>	Pinch-off Voltage: $V_{DS} = 2.5\text{ V}$ , $I_{DS} = 1\text{ mA}$		V	-4.0	-1.5	-0.5

#### Note:

1. Refer to PACKAGING section "Tape-and-Reel Packaging for Surface Mount Semiconductors".

## ATF-13736 Absolute Maximum Ratings

Symbol	Parameter	Units	Absolute Maximum <sup>[1]</sup>
V <sub>DS</sub>	Drain-Source Voltage	V	+5
V <sub>GS</sub>	Gate-Source Voltage	V	-4
V <sub>GD</sub>	Gate-Drain Voltage	V	-6
I <sub>DS</sub>	Drain Current	mA	I <sub>DSS</sub>
P <sub>T</sub>	Power Dissipation <sup>[2,3]</sup>	mW	225
T <sub>CH</sub>	Channel Temperature	°C	175
T <sub>STG</sub>	Storage Temperature <sup>[4]</sup>	°C	-65 to +175

<b>Thermal Resistance:</b>	$\theta_{jc} = 400^{\circ}\text{C}/\text{W}; T_{CH} = 150^{\circ}\text{C}$
<b>Liquid Crystal Measurement:</b>	1 $\mu\text{m}$ Spot Size <sup>[5]</sup>

### Notes:

1. Permanent damage may occur if any of these limits are exceeded.
2. T<sub>CASE TEMPERATURE</sub> = 25°C.
3. Derate at 2.5 mW/°C for T<sub>CASE</sub> > 85°C.
4. Storage above +150°C may tarnish the leads of this package making it difficult to solder into a circuit. After a device has been soldered into a circuit, it may be safely stored up to 175°C.
5. The small spot size of this technique results in a higher, though more accurate determination of  $\theta_{jc}$  than do alternate methods. See MEASUREMENTS section for more information.

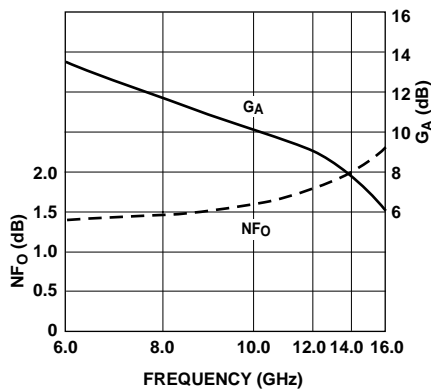
## Part Number Ordering Information

Part Number	Devices Per Reel	Reel Size
ATF-13736-TR1	1000	7"
ATF-13736-STR	10	strip

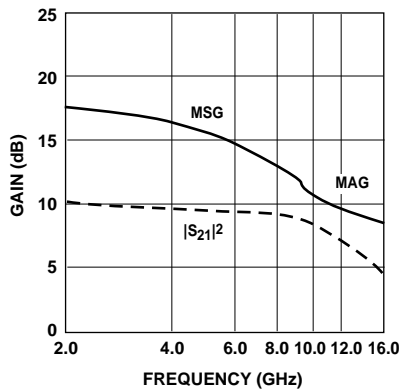
## ATF-13736 Noise Parameters: V<sub>DS</sub> = 2.5 V, I<sub>DS</sub> = 20 mA

Freq. GHz	NF <sub>O</sub> dB	$\Gamma_{opt}$		R <sub>N</sub> /50
		Mag	Ang	
4.0	1.1	.71	102	.10
6.0	1.3	.55	147	.07
8.0	1.5	.46	-144	.19
12.0	1.8	.50	-40	.88
14.0	2.1	.52	-2	1.17

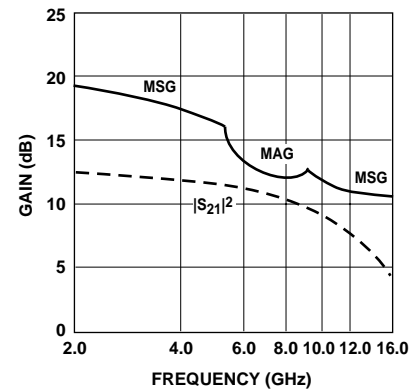
## ATF-13736 Typical Performance, T<sub>A</sub> = 25°C



**Figure 1. Optimum Noise Figure and Associated Gain vs. Frequency.**  
V<sub>DS</sub> = 2.5V, I<sub>DS</sub> = 20 mA, T<sub>A</sub> = 25°C.



**Figure 2. Insertion Power Gain, Maximum Available Gain and Maximum Stable Gain vs. Frequency.**  
V<sub>DS</sub> = 2.5 V, I<sub>DS</sub> = 20 mA.



**Figure 3. Insertion Power Gain, Maximum Available Gain and Maximum Stable Gain vs. Frequency.**  
V<sub>DS</sub> = 2.5 V, I<sub>DS</sub> = 20 mA.

**Typical Scattering Parameters, Common Emitter,  $Z_O = 50 \Omega$ ,  $T_A = 25^\circ\text{C}$ ,  $V_{DS} = 2.5\text{V}$ ,  $I_{DS} = 20\text{mA}$**

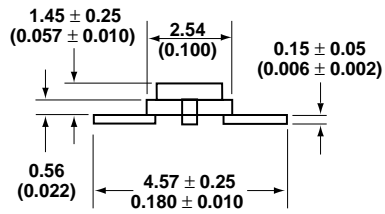
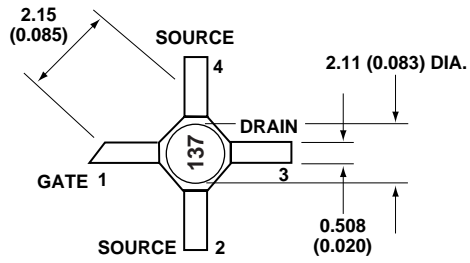
Freq. GHz	$S_{11}$		dB	$S_{21}$		dB	$S_{12}$		$S_{22}$	
	Mag.	Ang.		Mag.	Ang.		Mag.	Ang.	Mag.	Ang.
2.0	.94	-46	11.0	3.56	128	-26.4	.048	55	.59	-36
3.0	.86	-70	10.2	3.23	109	-25.2	.055	40	.57	-47
4.0	.84	-90	9.8	3.08	91	-23.1	.070	31	.56	-55
5.0	.77	-110	9.6	3.02	69	-20.9	.090	18	.52	-63
6.0	.68	-135	9.9	3.14	51	-19.3	.109	7	.47	-75
7.0	.59	-170	9.9	3.13	24	-18.0	.126	-12	.39	-92
8.0	.54	149	9.5	2.99	-1	-17.6	.132	-27	.30	-112
9.0	.56	112	8.8	2.75	-22	-16.9	.143	-43	.19	-121
10.0	.58	86	8.1	2.53	-43	-16.4	.152	-58	.11	-140
11.0	.60	63	7.6	2.41	-66	-16.5	.149	-73	.09	92
12.0	.64	39	7.0	2.24	-90	-17.1	.140	-81	.15	47
13.0	.68	20	6.4	2.08	-106	-17.6	.132	-90	.19	21
14.0	.70	9	6.0	1.99	-130	-18.0	.126	-97	.19	-3
15.0	.72	-1	5.2	1.83	-145	-18.2	.123	-111	.15	-26
16.0	.74	-17	4.6	1.70	-177	-18.4	.120	-129	.11	-34

**Typical Scattering Parameters, Common Emitter,  $Z_O = 50 \Omega$ ,  $T_A = 25^\circ\text{C}$ ,  $V_{DS} = 4\text{V}$ ,  $I_{DS} = 40\text{mA}$**

Freq. GHz	$S_{11}$		dB	$S_{21}$		dB	$S_{12}$		$S_{22}$	
	Mag.	Ang.		Mag.	Ang.		Mag.	Ang.	Mag.	Ang.
2.0	.88	-44	13.5	4.73	130	-26.4	.048	64	.67	-28
3.0	.76	-68	13.0	4.47	107	-24.9	.057	52	.61	-39
4.0	.68	-90	12.4	4.19	86	-22.5	.075	39	.57	-46
5.0	.56	-113	12.0	4.00	66	-21.0	.089	32	.52	-52
6.0	.42	-145	11.8	3.90	44	-19.8	.102	21	.44	-61
7.0	.37	161	11.5	3.74	20	-18.6	.117	9	.31	-75
8.0	.47	116	10.5	3.36	-3	-17.9	.128	-5	.17	-95
9.0	.57	90	9.4	2.96	-23	-17.2	.138	-19	.05	-143
10.0	.63	70	8.9	2.77	-41	-17.4	.135	-28	.06	128
11.0	.69	51	7.9	2.47	-63	-17.7	.131	-39	.17	100
12.0	.77	33	7.1	2.26	-82	-18.0	.126	-52	.26	75
13.0	.82	21	6.0	2.00	-101	-18.6	.118	-65	.35	62
14.0	.85	13	5.4	1.86	-117	-19.2	.110	-75	.39	54
15.0	.83	1	4.8	1.73	-134	-19.7	.104	-83	.41	49
16.0	.81	-17	4.4	1.65	-154	-19.8	.102	-103	.42	41

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

### 36 micro-X Package Dimensions



**Notes:**

1. Dimensions are in millimeters (inches)
2. Tolerances: in .xxx =  $\pm 0.005$   
mm .xx =  $\pm 0.13$