

# 2–16 GHz Low Noise Gallium Arsenide FET

## Technical Data

### ATF-13336

#### Features

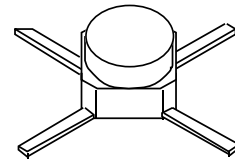
- **Low Noise Figure:**  
1.4 dB Typical at 12 GHz
- **High Associated Gain:**  
9.0 dB Typical at 12 GHz
- **High Output Power:**  
17.5 dBm Typical  $P_{1\text{dB}}$  at 12 GHz
- **Cost Effective Ceramic Microstrip Package**
- **Tape-and-Reel Packaging Option Available<sup>[1]</sup>**

#### Description

The ATF-13336 is a high performance gallium arsenide Schottky-barrier-gate field effect transistor housed in a cost effective microstrip package. Its premium noise figure makes this device appropriate for use in 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 250 microns. Proven gold based metallization systems and nitride passivation assure a rugged, reliable device.

#### 36 micro-X Package



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

Symbol	Parameters and Test Conditions	Units	Min.	Typ.	Max.
NF <sub>O</sub>	Optimum Noise Figure: $V_{DS} = 2.5\text{ V}$ , $I_{DS} = 20\text{ mA}$	$f = 8.0\text{ GHz}$		1.2	1.6
		$f = 12.0\text{ GHz}$		1.4	
		$f = 14.0\text{ GHz}$		1.6	
G <sub>A</sub>	Gain @ NF <sub>O</sub> : $V_{DS} = 2.5\text{ V}$ , $I_{DS} = 20\text{ mA}$	$f = 8.0\text{ GHz}$		11.5	8.0
		$f = 12.0\text{ GHz}$		9.0	
		$f = 14.0\text{ GHz}$		7.5	
P <sub>1dB</sub>	Power Output @ 1 dB Gain Compression: $V_{DS} = 4\text{ V}$ , $I_{DS} = 40\text{ mA}$	$f = 12.0\text{ GHz}$		17.5	
G <sub>1dB</sub>	1 dB Compressed Gain: $V_{DS} = 4\text{ V}$ , $I_{DS} = 40\text{ mA}$	$f = 12.0\text{ GHz}$		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-13336 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	°C	-65 to +175

**Thermal Resistance:**  $\theta_{jc} = 400^{\circ}\text{C}/\text{W}$ ;  $T_{CH} = 150^{\circ}\text{C}$   
**Liquid Crystal Measurement:** 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</sub> TEMPERATURE = 25°C.
3. Derate at 2.5mW/°C for T<sub>CASE</sub> > 85°C.
4. Storage above +150°C may tarnish the leads of this package difficult to solder into a circuit. After a device has been soldered into a circuit, it may be safely stored up to 175°C.
4. 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.

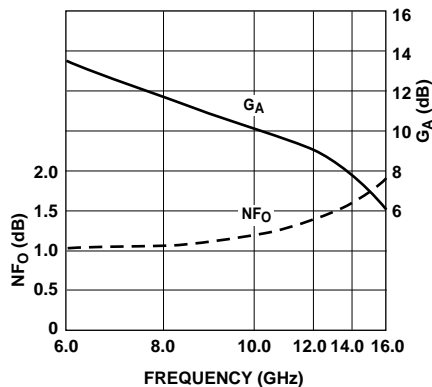
## Part Number Ordering Information

Part Number	Devices Per Reel	Reel Size
ATF-13336-TR1	1000	7"
ATF-13336-STR	10	strip

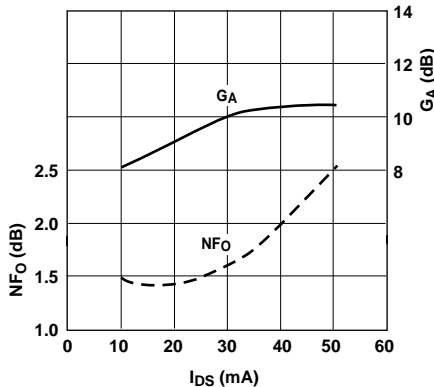
## ATF-13336 Noise Parameters: V<sub>DS</sub> = 2.5 V, I<sub>DS</sub> = 20 mA

Freq. GHz	NF <sub>O</sub> dB	$\Gamma_{opt}$		R <sub>N</sub> /50
		Mag	Ang	
4.0	0.8	.63	93	.27
6.0	1.1	.47	138	.10
8.0	1.2	.40	-153	.20
12.0	1.4	.52	-45	.88
14.0	1.6	.57	-2	1.3

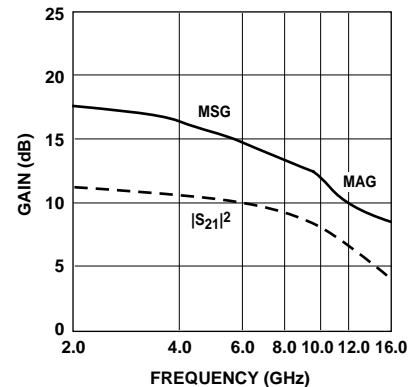
## ATF-13336 Typical Performance, T<sub>A</sub> = 25°C



**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. Optimum Noise Figure and Associated Gain vs. I<sub>DS</sub>.**  
V<sub>DS</sub> = 2.5V, f = 12.0 GHz.



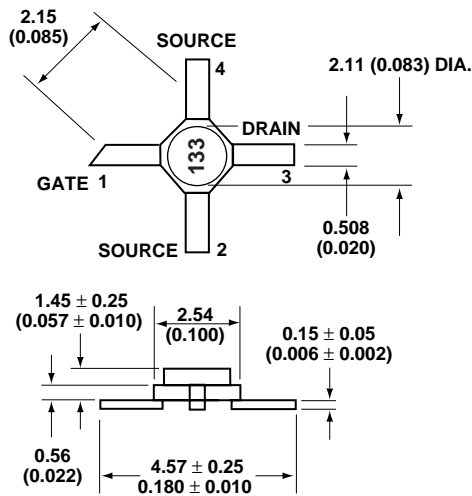
**Figure 3. Insertion Power Gain, Maximum Available Gain and Maximum Stable Gain vs. Frequency.**  
V<sub>DS</sub> = 2.5 V, I<sub>DS</sub> = 20 mA.

**Typical Scattering Parameters, Common Emitter,  $Z_0 = 50 \Omega$ ,  $T_A = 25^\circ\text{C}$ ,  $V_{DS} = 2.5\text{V}$ ,  $I_{DS} = 20\text{mA}$**

Freq. GHz	$S_{11}$		$S_{21}$			$S_{12}$			$S_{22}$	
	Mag.	Ang.	dB	Mag.	Ang.	dB	Mag.	Ang.	Mag.	Ang.
2.0	.96	-51	10.6	3.39	127	-27.1	.044	57	.61	-41
3.0	.88	-75	10.3	3.28	106	-23.4	.060	33	.58	-51
4.0	.86	-96	10.1	3.19	86	-22.6	.074	25	.57	-57
5.0	.79	-117	9.9	3.13	66	-20.6	.093	12	.54	-65
6.0	.69	-142	10.2	3.22	46	-18.9	.114	1	.49	-79
7.0	.60	-178	10.1	3.21	21	-17.6	.132	-18	.42	-97
8.0	.54	141	9.8	3.10	-4	-17.3	.137	-33	.31	-112
9.0	.56	103	8.9	2.80	-26	-16.7	.147	-48	.21	-121
10.0	.56	74	8.3	2.60	-48	-16.5	.150	-63	.09	-145
11.0	.58	44	7.6	2.39	-68	-16.8	.145	-78	.07	89
12.0	.63	20	6.7	2.17	-90	-17.5	.133	-95	.16	43
13.0	.65	3	6.0	2.00	-108	-18.3	.121	-107	.19	21
14.0	.66	-7	5.5	1.89	-126	-18.9	.114	-121	.19	-4
15.0	.70	-19	4.9	1.76	-144	-19.0	.112	-129	.16	-28
16.0	.72	-34	4.4	1.66	-175	-19.2	.110	-142	.14	-32

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 = ± 0.005  
mm .xx = ± 0.13