

# 2–18 GHz Low Noise Gallium Arsenide FET

## Technical Data

### ATF-13100

#### Features

- **Low Noise Figure:**  
1.1 dB Typical at 12 GHz
- **High Associated Gain:**  
9.5 dB Typical at 12 GHz
- **High Output Power:**  
17.5 dBm Typical  $P_{1\text{ dB}}$  at 12 GHz

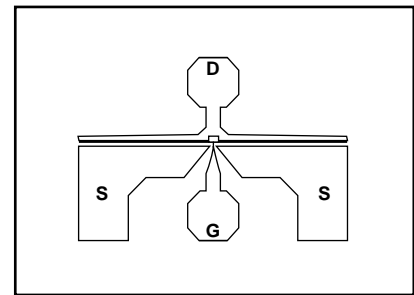
#### Description

The ATF-13100 is a high performance gallium arsenide Schottky-barrier-gate field effect transistor chip. This device is designed for use in low noise, wideband amplifier and oscillator applications in the 2-18 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.

The recommended mounting procedure is to die attach at a stage temperature of 300°C using a gold-tin preform under forming gas. Assembly can be preformed with either wedge or ball bonding using 0.7 mil gold wire. See also “Chip Use” in the APPLICATIONS section.

#### Chip Outline



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

Symbol	Parameters and Test Conditions <sup>[1]</sup>	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		0.8	1.2
		$f = 12.0\text{ GHz}$	dB		1.1	
		$f = 15.0\text{ GHz}$	dB		1.5	
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	9.0	12.0	
		$f = 12.0\text{ GHz}$	dB		9.5	
		$f = 15.0\text{ GHz}$	dB		8.0	
P <sub>1 dB</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>1 dB</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	30	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>	Pinchoff Voltage: $V_{DS} = 2.5\text{ V}$ , $I_{DS} = 1\text{ mA}$		V	-3.0	-1.5	-0.8

#### Note:

1. RF performance is determined by assembling and testing 10 samples per wafer.

## ATF-13100 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:**  $\theta_{jc} = 250^\circ\text{C/W}$ ;  $T_{CH} = 150^\circ\text{C}$   
**Liquid Crystal Measurement:** 1  $\mu\text{m}$  Spot Size<sup>[4]</sup>

### Notes:

1. Permanent damage may occur if any of these limits are exceeded.
2.  $T_{\text{MOUNTING SURFACE}} = 25^\circ\text{C}$ .
3. Derate at 4 mW/°C for  $T_{\text{MOUNTING SURFACE}} > 119^\circ\text{C}$ .
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.

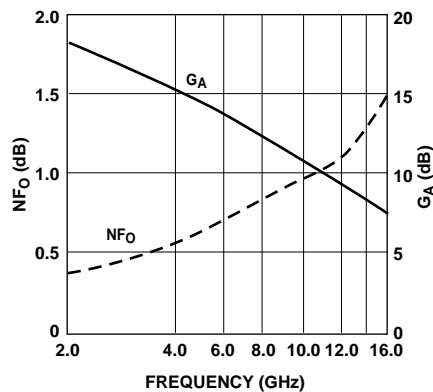
## Part Number Ordering Information

Part Number	Devices Per Tray
ATF-13100-GP3	50

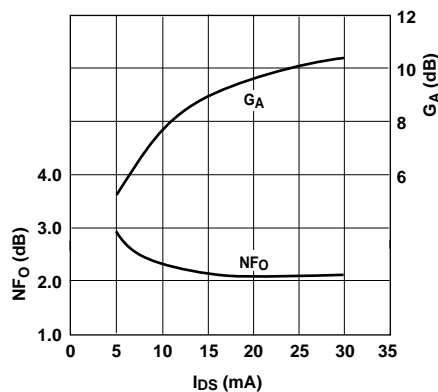
## ATF-13100 Noise Parameters: V<sub>DS</sub> = 2.5 V, I<sub>DS</sub> = 20 mA

Freq. GHz	NF <sub>O</sub> dB	$\Gamma_{\text{opt}}$		R <sub>N</sub> /50
		Mag	Ang	
4.0	0.4	0.60	30	0.32
6.0	0.7	0.32	68	0.21
8.0	0.8	0.25	102	0.15
12.0	1.1	0.23	-165	0.09
16.0	1.5	0.32	-112	0.21

## ATF-13100 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.



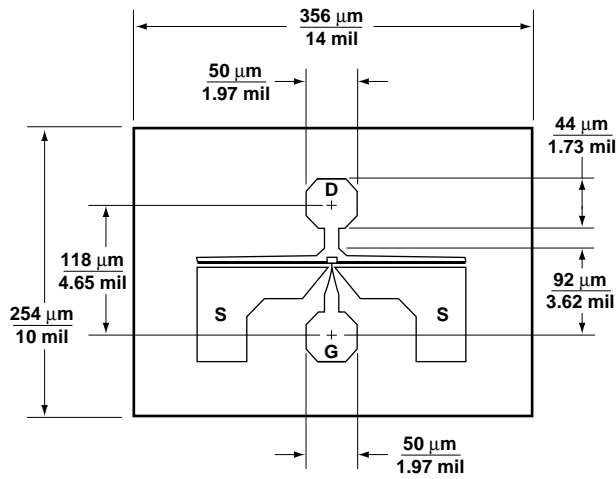
**Figure 2. Optimum Noise Figure and Associated Gain vs. I<sub>DS</sub>.**  
V<sub>DS</sub> = 2.5V, f = 12.0 GHz.

**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	-27	13.4	4.68	153	-26.9	.045	75	.55	-16
3.0	.92	-41	13.4	4.65	140	-23.6	.066	67	.52	-24
4.0	.85	-58	13.1	4.54	126	-21.4	.085	59	.49	-33
5.0	.79	-76	12.9	4.40	113	-19.8	.102	50	.44	-41
6.0	.73	-95	12.4	4.19	100	-18.7	.116	42	.38	-48
7.0	.68	-113	12.0	3.97	87	-18.0	.126	34	.30	-54
8.0	.63	-132	11.4	3.71	75	-17.5	.134	25	.24	-64
9.0	.62	-151	10.9	3.51	63	-17.1	.140	18	.18	-75
10.0	.59	-167	10.3	3.27	53	-16.8	.144	11	.13	-84
11.0	.59	173	9.7	3.07	40	-16.5	.149	2	.08	-104
12.0	.57	155	9.0	2.83	30	-16.5	.150	-9	.02	160
13.0	.60	136	8.6	2.69	19	-16.4	.151	-16	.08	106
14.0	.64	116	7.9	2.47	7	-16.4	.151	-25	.15	103
15.0	.67	98	7.1	2.26	-6	-16.4	.152	-34	.23	100
16.0	.73	83	5.8	1.96	-16	-16.9	.143	-40	.31	90
17.0	.77	72	4.6	1.70	-26	-17.0	.141	-45	.36	82
18.0	.80	63	3.5	1.50	-35	-17.4	.135	-48	.40	72

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

**ATF-13100 Chip Dimensions**



Note: Die thickness is 4.5 mil, and backside metallization is 200 Å Ti and 2000 Å Au.