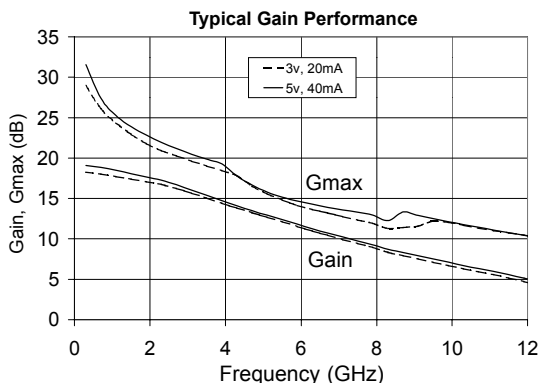


## Product Description

Sirenza Microdevices' SPF-2086TK is a high performance 0.25 $\mu$ m pHEMT Gallium Arsenide FET with Schottky barrier gates. This 300 $\mu$ m device is ideally biased at 3V,20mA for lowest noise performance and battery powered requirements. At 5V,40mA the device delivers excellent output TOI of 32 dBm. It provides ideal performance as driver stages in many commercial, industrial and military LNA applications.



## SPF-2086TK

### Low Noise pHEMT GaAs FET 0.1 - 6 GHz Operation



## Product Features

- 22 dB G<sub>max</sub> at 1.9 GHz
- 0.4 dB F<sub>MIN</sub> at 1.9 GHz
- +32 dBm Output IP3
- +20 dBm Output Power at 1dB Compression

## Applications

- LNA for Analog and Digital Wireless Systems
- 3G, Cellular, PCS
- Fixed Wireless, Pager Systems
- Driver Stage for low power applications

Symbol	Device Characteristics, T = 25°C V <sub>DS</sub> =3V, I <sub>DD</sub> =20mA (unless otherwise noted)	Test Condition [1] = 100% Tested	Units	Min.	Typ.	Max.
G <sub>max</sub>	Maximum Available Gain Z <sub>S</sub> =Z <sub>S</sub> *, Z <sub>L</sub> =Z <sub>L</sub> *	f = 0.9 GHz f = 1.9 GHz f = 4.0 GHz f = 6.0 GHz	dB dB dB dB	- - - -	25.2 21.8 18.7 13.5	- - - -
S <sub>21</sub>	Insertion Gain Z <sub>S</sub> =Z <sub>L</sub> = 50 Ohms	f = 1.9 GHz [1]	dB	16.0	17.7	19.4
F <sub>MIN</sub>	Minimum Noise Figure Z <sub>S</sub> =Γ <sub>OPT</sub> , Z <sub>L</sub> =Z <sub>LOPT</sub>	f = 1 GHz f = 2 GHz f = 4 GHz f = 6 GHz	dB dB dB dB	- - - -	0.3 0.4 0.5 0.7	- - - -
OIP3	Output Third Order Intercept Point Z <sub>S</sub> =Z <sub>SOPT</sub> , Z <sub>L</sub> =Z <sub>LOPT</sub>	V <sub>DS</sub> =5.0V, I <sub>DD</sub> =40mA V <sub>DS</sub> =3.0V, I <sub>DD</sub> =20mA	dBm dBm	- -	32 28	- -
P1dB	Output 1dB Compression Point Z <sub>S</sub> =Z <sub>SOPT</sub> , Z <sub>L</sub> =Z <sub>LOPT</sub>	V <sub>DS</sub> =5.0V, I <sub>DD</sub> =40mA V <sub>DS</sub> =3.0V, I <sub>DD</sub> =20mA	dBm dBm	- -	20 15	- -
I <sub>DSS</sub>	Saturated Drain Current V <sub>DS</sub> = V <sub>DSP</sub> , V <sub>GS</sub> = 0V		mA	30	85	140
g <sub>m</sub>	Transconductance: V <sub>DS</sub> = V <sub>DSP</sub> , V <sub>GS</sub> = -0.25V		mS	-	112	-
V <sub>P</sub>	Pinch-Off Voltage: V <sub>DS</sub> = 2.0V, I <sub>DS</sub> = 150 $\mu$ A	[1]	V	-1.5	-1.0	-0.5
BV <sub>GS</sub>	Gate-to-Source Breakdown Voltage I <sub>GS</sub> = 0.3mA, drain open	[1]	V	-	-17	-8
BV <sub>GD</sub>	Gate-to-Drain Breakdown Voltage I <sub>GD</sub> = 0.3mA, V <sub>GS</sub> = -3.0V	[1]	V	-	-17	-8
R <sub>th</sub>	Thermal Resistance, junction-to-lead		°C/W	-	110	-

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**Absolute Maximum Ratings**

Operation of this device beyond any one of these parameters may cause permanent damage.

MTTF is inversely proportional to the device junction temperature. For junction temperature and MTTF considerations the operating conditions should also satisfy the following expressions:

$$P_{DC} - P_{OUT} < (T_J - T_L) / R_{TH}$$

where:

- $P_{DC}$  =  $I_{DS} * V_{DS}$  (W)
- $P_{OUT}$  = RF Output Power (W)
- $T_J$  = Junction Temperature (°C)
- $T_L$  = Lead Temperature (pin 4) (°C)
- $R_{TH}$  = Thermal Resistance (°C/W)

Parameter	Symbol	Value	Unit
Drain Current	$I_{DS}$	$I_{DSS}$	mA
Forward Gate Current	$I_{GSF}$	0.3	mA
Reverse Gate Current	$I_{GSR}$	0.3	mA
Drain-to-Source Voltage	$V_{DS}$	+7	V
Gate-to-Drain Voltage	$V_{GD}$	-8	V
Gate-to-Source Voltage	$V_{GS}$	<-5 or >0	V
RF Input Power	$P_{IN}$	100	mW
Operating Temperature	$T_{OP}$	-40 to +85	°C
Storage Temperature Range	$T_{stor}$	-40 to +150	°C
Power Dissipation	$P_{DISS}$	600	mW
Channel Temperature	$T_J$	+150	°C

**Noise parameters, at typical operating frequencies**

**Bias  $V_{DS}=3.0V, I_{DS}=20mA$**

FREQ GHz	FMIN dB	G <sub>OPT</sub>	G <sub>OPT</sub> ANG	$r_N$ W	G <sub>A</sub> dB
1.0	0.28	0.74	17	0.22	23.1
2.0	0.44	0.69	31	0.18	17.8
4.0	0.54	0.54	84	0.09	13.9
6.0	0.70	0.28	179	0.05	12.2

**Bias  $V_{DS}=5.0V, I_{DS}=40mA$**

FREQ GHz	FMIN dB	G <sub>OPT</sub>	G <sub>OPT</sub> ANG	$r_N$ W	G <sub>A</sub> dB
1.0	0.34	0.76	19	0.27	23.9
2.0	0.55	0.67	36	0.23	19.1
4.0	0.75	0.47	93	0.11	15.0
6.0	1.04	0.31	-170	0.06	12.9

**Scattering Parameters:**
**Typical S-parameters  $V_{DS}=3.0V$ ,  $I_{DS}=20\text{ mA}$** 

Freq GHz	S11	S11 Ang	S21	S21 Ang	S12	S12 Ang	S22	S22 Ang
0.5	0.97	-17.5	8.07	162.9	0.01	55.5	0.66	-10.0
1.0	0.92	-34.2	7.76	146.1	0.03	72.8	0.64	-18.9
1.5	0.85	-50.9	7.40	130.4	0.04	62.9	0.61	-27.5
2.0	0.76	-69.2	7.06	114.9	0.05	52.7	0.57	-36.6
2.5	0.67	-89.6	6.67	99.4	0.06	45.3	0.51	-46.7
3.0	0.58	-109.6	6.16	85.3	0.06	39.6	0.47	-55.4
3.5	0.51	-128.5	5.64	72.4	0.07	33.2	0.44	-62.2
4.0	0.46	-146.4	5.16	60.5	0.08	27.3	0.42	-68.0
4.5	0.42	-165.0	4.74	49.3	0.08	23.0	0.39	-73.9
5.0	0.40	175.1	4.37	38.2	0.09	18.9	0.36	-81.1
5.5	0.41	155.0	4.04	27.3	0.09	14.6	0.32	-90.9
6.0	0.44	137.1	3.71	16.7	0.10	9.5	0.29	-102.9
6.5	0.48	123.1	3.43	6.6	0.10	5.3	0.26	-115.7
7.0	0.51	111.6	3.18	-2.9	0.10	1.2	0.23	-128.5
7.5	0.54	101.5	2.96	-11.9	0.11	-2.1	0.21	-141.7
8.0	0.57	91.8	2.75	-21.0	0.11	-5.6	0.20	-156.2
8.5	0.60	83.7	2.55	-29.5	0.12	-9.3	0.19	-170.9
9.0	0.63	77.5	2.40	-37.4	0.12	-13.0	0.20	172.1
9.5	0.66	71.4	2.26	-45.8	0.13	-17.5	0.22	154.7
10.0	0.69	66.3	2.13	-54.0	0.14	-22.1	0.24	140.5
10.5	0.70	61.1	2.02	-62.0	0.14	-26.8	0.27	128.5
11.0	0.71	55.7	1.92	-69.9	0.15	-30.9	0.29	119.0
11.5	0.72	50.1	1.81	-77.4	0.15	-35.0	0.31	109.5
12.0	0.75	45.0	1.70	-84.6	0.16	-39.7	0.33	99.8
12.5	0.76	40.3	1.60	-91.7	0.16	-44.1	0.35	90.3
13.0	0.77	36.4	1.51	-98.6	0.16	-47.5	0.39	81.2
13.5	0.77	32.9	1.47	-106.0	0.17	-51.7	0.43	75.0

**Note : De-embedded to device pins**

**Scattering Parameters:**

**Typical S-parameters  $V_{DS}=5.0V, I_{DS}=40\text{ mA}$**

Freq GHz	S11	S11 Ang	S21	S21 Ang	S12	S12 Ang	S22	S22 Ang
0.5	0.97	-18.2	8.87	162.0	0.01	92.8	0.68	-9.5
1.0	0.91	-35.9	8.47	144.6	0.02	66.4	0.67	-18.1
1.5	0.83	-53.3	8.00	128.4	0.03	60.3	0.64	-26.2
2.0	0.74	-72.2	7.54	112.6	0.04	54.0	0.60	-34.5
2.5	0.64	-92.9	7.06	97.1	0.05	46.6	0.55	-43.3
3.0	0.55	-113.4	6.46	83.2	0.06	40.7	0.51	-50.9
3.5	0.48	-132.3	5.87	70.5	0.06	35.9	0.48	-57.2
4.0	0.43	-150.3	5.35	58.8	0.07	31.9	0.46	-62.6
4.5	0.39	-169.1	4.89	47.9	0.07	27.9	0.44	-68.1
5.0	0.37	170.9	4.50	37.0	0.08	25.5	0.42	-75.1
5.5	0.39	151.2	4.16	26.3	0.08	22.1	0.38	-84.3
6.0	0.43	134.3	3.83	15.9	0.09	17.2	0.35	-95.0
6.5	0.47	121.0	3.54	6.0	0.09	13.3	0.32	-106.2
7.0	0.50	110.1	3.29	-3.6	0.10	9.6	0.30	-117.6
7.5	0.53	100.4	3.07	-12.7	0.10	5.7	0.28	-129.3
8.0	0.56	91.3	2.86	-21.8	0.11	2.4	0.26	-141.5
8.5	0.59	83.3	2.66	-30.2	0.12	-0.8	0.25	-154.6
9.0	0.63	77.2	2.52	-38.3	0.13	-4.6	0.26	-170.3
9.5	0.66	71.5	2.38	-46.8	0.13	-9.5	0.27	172.9
10.0	0.69	66.6	2.24	-55.1	0.14	-14.2	0.29	157.4
10.5	0.70	61.3	2.12	-63.3	0.15	-19.5	0.31	144.0
11.0	0.71	55.7	2.01	-71.4	0.15	-24.4	0.33	133.5
11.5	0.73	50.2	1.90	-79.0	0.16	-29.2	0.35	123.1
12.0	0.75	45.0	1.78	-86.4	0.16	-33.8	0.36	112.6
12.5	0.77	40.3	1.67	-93.7	0.17	-37.9	0.38	102.0
13.0	0.77	36.3	1.58	-100.9	0.17	-42.2	0.42	91.7
13.5	0.78	32.7	1.53	-108.4	0.18	-46.7	0.46	83.7

**Note : De-embedded to device pins**



**Caution: ESD sensitive**

Appropriate precautions in handling, packaging and testing devices must be observed.

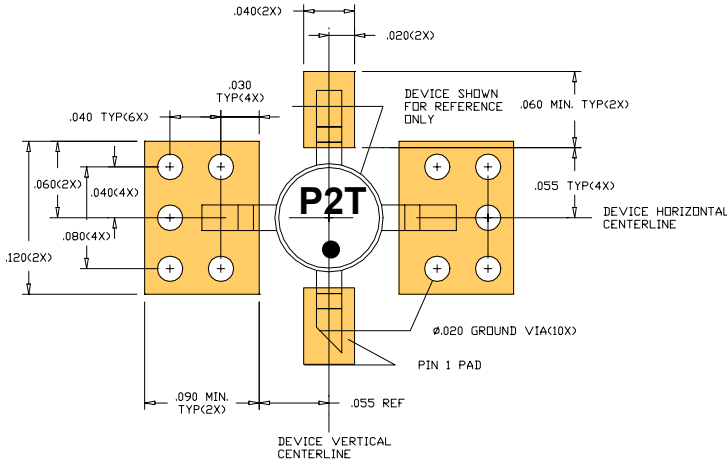
**Part Number Ordering Information**

Part Number	Reel Size	Devices/Reel
SPF-2086TK	7"	1000

**Part Symbolization**

The part will be symbolized with the "P2T" designator and a dot signifying pin 1 on the top surface of the package.

**PCB Pad Layout**



Pin Designation	
1	Gate
2	Source
3	Drain
4	Source

**Package Dimensions**

