SPF-2086T

Low Noise pHEMT GaAs FET

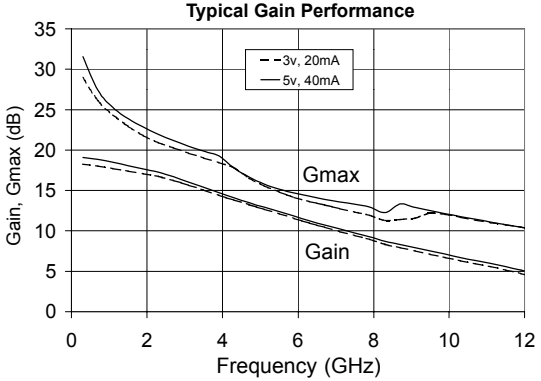
0.1 - 12 GHz Operation



Product Description

Sirenza Microdevices' SPF-2086T is a high performance 0.25µm pHEMT Gallium Arsenide FET with Schottky barrier gates. This 300µm 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.

Typical Gain Performance



Product Features

- **22 dB Gmax at 1.9 GHz**
- **0.4 dB F_{MIN} 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_{DS}=3V, I_{DQ}=20mA (unless otherwise noted)	Test Condition [1] = 100% Tested	Units	Min.	Typ.	Max.
Gmax	Maximum Available Gain $Z_S=Z_S^*$, $Z_L=Z_L^*$	f = 0.9 GHz f = 1.9 GHz f = 4.0 GHz [1] f = 12.0 GHz [1]	dB dB dB dB	- - 16.8 8.4	25.2 21.8 18.7 9.3	- - - -
S_{21}	Insertion Gain $Z_S=Z_L$= 50 Ohms	f = 1.9 GHz [1]	dB	16.0	17.7	19.4
F_{MIN}	Minimum Noise Figure $Z_S=\Gamma_{OPT}$, $Z_L=Z_{LOPT}$	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 $Z_S=Z_{SOPT}$, $Z_L=Z_{LOPT}$	V_{DS}=5.0V, I_{DQ}=40mA V_{DS}=3.0V, I_{DQ}=20mA	dBm dBm	- -	32 28	- -
P1dB	Output 1dB Compression Point $Z_S=Z_{SOPT}$, $Z_L=Z_{LOPT}$	V_{DS}=5.0V, I_{DQ}=40mA V_{DS}=3.0V, I_{DQ}=20mA	dBm dBm	- -	20 15	- -
I_{DSS}	Saturated Drain Current V_{DS} = V_{DSP}, V_{GS}= 0V		mA	30	85	140
g_m	Tranconductance: V_{DS} = V_{DSP}, V_{GS}= -0.25V		mS	-	112	-
V_P	Pinch-Off Voltage: V_{DS} = 2.0V, I_{DS} = 150µA	[1]	V	-1.5	-1.0	-0.5
BV_{GS}	Gate-to-Source Breakdown Voltage I_{GS} = 0.3mA, drain open	[1]	V	-	-17	-8
BV_{GD}	Gate-to-Drain Breakdown Voltage I_{GD} = 0.3mA, V_{GS} = -3.0V	[1]	V	-	-17	-8
Rth	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 experssions:

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

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	|Gopt|	Gopt Ang	r_N W	G_A 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	|Gopt|	Gopt Ang	r_N W	G_A 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 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 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.

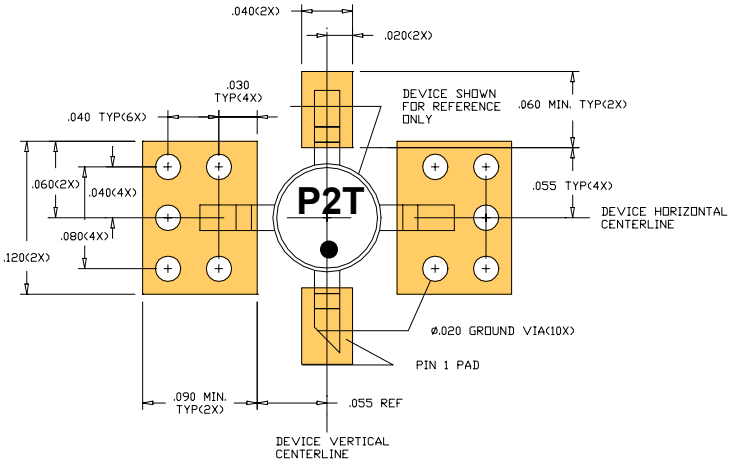
Part Number Ordering Information

Part Number	Reel Size	Devices/Reel
SPF-2086T	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

