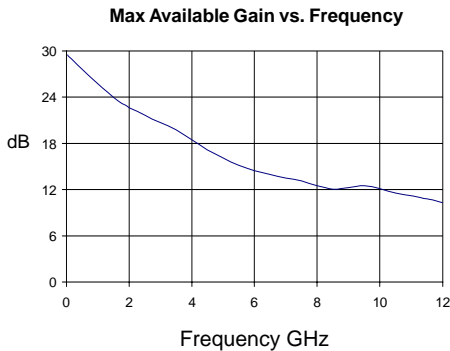


Product Description

Stanford Microdevices' SPF-2086T is a high performance PHEMT Gallium Arsenide FET utilizing 0.25 micron long by 300 micron wide Schottky barrier gates.

This device is ideally biased at $V_{ds}=3V$ and $I_d=20mA$ for lowest noise performance and battery powered requirements. At 5V, 40mA the device delivers excellent IP3 of 32 dBm. It provides ideal performance as driver stages in many commercial, industrial and military LNA applications.



SPF-2086T

0.1 GHz - 12 GHz Low Noise PHEMT GaAs FET



Product Features

- High Gain: 20 dB at 1900 MHz
- +20 dBm Output Power at P1dB
- Low Noise Figure: 0.4 dB NF at 1900 MHz
- Low Current Draw: 20 mA typ. at 3.0V

Applications

- LNA for Cellular, PCS, CDPD
- Wireless Data, SONET
- Driver Stage for low power applications

| SYMBOL | PARAMETERS | TEST CONDITIONS: $Z_o = 50 \Omega$, $T = 25^\circ C$ | UNITS | MIN. | TYP. | MAX. |
|-------------------------|---|--|----------------------|------|------------------------------|------|
| Bandwidth | Note : Bandwidth determined by limited gain performance | | GHz | 0.1 | | 12.0 |
| P_{1dB} | Output Power at 1dB Compression f = 1 GHz to 12 GHz | $V_{DS} = 5V, I_b = 40 mA$ $V_{DS} = 3V, I_b = 20 mA$ | dBm dBm | | 20.0 15.0 | |
| OIP₃ | Output Third Order Intercept Point f = 1 GHz to 12 GHz | $V_{DS} = 5V, I_b = 40 mA$ $V_{DS} = 3V, I_b = 20 mA$ | dBm dBm | | 32 28 | |
| NF_{OPT} | Optimum Noise Figure | f = 1 GHz f = 2 GHz f = 4 GHz f = 6 GHz $V_{DS} = 3V, I_b = 20 mA$ | dB dB dB dB | | 0.28 0.44 0.54 0.70 | |
| GA | Associated Gain | f = 1 GHz f = 2 GHz f = 4 GHz f = 6 GHz $V_{DS} = 3V, I_b = 20 mA$ | dB dB dB dB | | 23.1 17.8 13.9 12.2 | |
| I_{DSS} | Drain Saturation Current | $V_{DS} = 2V, V_{GS} = 0V$ | mA | 30 | 85 | 140 |
| V_P | Pinch - off Voltage | $V_{DS} = 2V, I_{DS} = 1mA$ | V | | -1.0 | |
| G_M | Transconductance | $V_{DS} = 2V, I_{DS} = 20mA$ | mmho | | 100 | |
| V_{BGS} | Gate to Source Breakdown Voltage | | V | | -17 | -8 |
| V_{BDS} | Drain to Source Breakdown Voltage | | V | | -17 | -8 |

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Absolute Maximum Ratings

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

Bias Conditions should also satisfy the following expression: $I_D V_D (\text{max}) < (T_J - T_{OP})/T_L$

| Parameter | Symbol | Value | Unit |
|--------------------------------------|-------------------|-------------|------|
| Drain-Source Voltage | V _{DS} | +7 | V |
| Gate-Source Voltage | V _{GS} | -7 | V |
| Drain Current | I _D | 85 | mA |
| Forward Gate Current | I _{BSF} | 10 | mA |
| RF Input Power | P _{IN} | +20 | dBm |
| Operating Temperature | T _{OP} | -40 to +85 | °C |
| Storage Temperature Range | T _S | -65 to +150 | °C |
| Channel Temperature | T _{CH} | +150 | °C |
| Thermal Resistance (lead - junction) | T _L | 110 | °C/W |
| Power Dissipation | P _{DISS} | 400 | mW |

Noise parameters, at typical operating frequencies

Note: Measurements at higher frequencies are currently in development

Bias V_{ds}=3.0V, I_{ds}=20mA

| FREQ GHz | G _{OPT} | G _{OPT} ANG | NF _{MIN} dB | r _N W | G _A dB |
|----------|------------------|----------------------|----------------------|------------------|-------------------|
| 1.0 | 0.74 | 17 | 0.28 | 0.22 | 23.1 |
| 2.0 | 0.69 | 31 | 0.44 | 0.18 | 17.8 |
| 4.0 | 0.54 | 84 | 0.54 | 0.09 | 13.9 |
| 6.0 | 0.28 | 179 | 0.70 | 0.05 | 12.2 |

Bias V_{ds}=5.0V, I_{ds}=40mA

| FREQ GHz | G _{OPT} | G _{OPT} ANG | NF _{MIN} dB | r _N W | G _A dB |
|----------|------------------|----------------------|----------------------|------------------|-------------------|
| 1.0 | 0.76 | 19 | 0.34 | 0.27 | 23.9 |
| 2.0 | 0.67 | 36 | 0.55 | 0.23 | 19.1 |
| 4.0 | 0.47 | 93 | 0.75 | 0.11 | 15.0 |
| 6.0 | 0.31 | -170 | 1.04 | 0.06 | 12.9 |

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

| Freq GHz | S11 | S11 Ang | S21 dB | S21 | S21 Ang | S12 dB | S12 | S12 Ang | S22 | S22 Ang |
|----------|------|---------|--------|-----|---------|--------|------|---------|------|---------|
| 0.05 | 0.98 | -0.63 | 18.1 | 8.0 | 179.6 | -36.6 | 0.01 | 128.4 | 0.65 | -1.7 |
| 0.1 | 0.98 | -2.8 | 17.5 | 7.5 | 177.6 | -49.5 | 0.00 | 100.7 | 0.63 | -1.9 |
| 0.5 | 0.97 | -15.3 | 17.5 | 7.5 | 165.5 | -38.5 | 0.01 | 85.6 | 0.62 | -9.5 |
| 1.0 | 0.96 | -29.8 | 17.3 | 7.3 | 152.0 | -32.9 | 0.02 | 69.1 | 0.61 | -18.9 |
| 1.5 | 0.93 | -44.5 | 17.1 | 7.2 | 138.8 | -29.7 | 0.03 | 62.1 | 0.59 | -27.4 |
| 2.0 | 0.88 | -60.8 | 17.0 | 7.0 | 124.7 | -27.4 | 0.04 | 53.3 | 0.55 | -37.3 |
| 2.5 | 0.82 | -78.5 | 16.8 | 6.9 | 110.6 | -25.6 | 0.05 | 43.0 | 0.51 | -48.4 |
| 3.0 | 0.76 | -95.9 | 16.3 | 6.6 | 97.1 | -24.3 | 0.06 | 33.5 | 0.47 | -58.4 |
| 3.5 | 0.71 | -112.1 | 15.8 | 6.2 | 84.5 | -23.6 | 0.07 | 26.0 | 0.45 | -67.0 |
| 4.0 | 0.66 | -125.6 | 15.3 | 5.8 | 73.4 | -23.1 | 0.07 | 18.7 | 0.43 | -73.6 |
| 4.5 | 0.62 | -139.8 | 14.7 | 5.4 | 62.3 | -22.6 | 0.07 | 11.8 | 0.40 | -80.5 |
| 5.0 | 0.58 | -155.6 | 14.1 | 5.1 | 51.0 | -22.1 | 0.08 | 4.4 | 0.37 | -89.0 |
| 5.5 | 0.56 | -172.3 | 13.6 | 4.8 | 39.6 | -21.9 | 0.08 | -2.3 | 0.33 | -100.2 |
| 6.0 | 0.55 | 170.3 | 12.9 | 4.4 | 28.7 | -21.5 | 0.08 | -9.3 | 0.30 | -112.5 |
| 6.5 | 0.55 | 155.9 | 12.2 | 4.1 | 18.3 | -21.6 | 0.08 | -14.8 | 0.27 | -124.9 |
| 7.0 | 0.55 | 143.2 | 11.6 | 3.8 | 8.6 | -21.5 | 0.08 | -19.9 | 0.26 | -135.6 |
| 7.5 | 0.55 | 131.8 | 11.1 | 3.6 | -0.5 | -21.2 | 0.09 | -25.7 | 0.24 | -146.6 |
| 8.0 | 0.56 | 121.3 | 10.5 | 3.4 | -9.8 | -20.9 | 0.09 | -30.5 | 0.23 | -158.7 |
| 8.5 | 0.56 | 111.0 | 9.9 | 3.1 | -18.2 | -21.2 | 0.09 | -34.1 | 0.22 | -169.0 |
| 9.0 | 0.58 | 101.9 | 9.4 | 3.0 | -26.8 | -20.8 | 0.09 | -38.7 | 0.23 | 179.1 |
| 9.5 | 0.59 | 94.5 | 8.9 | 2.8 | -35.1 | -20.7 | 0.09 | -45.1 | 0.24 | 166.9 |
| 10.0 | 0.60 | 88.7 | 8.5 | 2.6 | -43.2 | -20.5 | 0.09 | -48.3 | 0.25 | 155.7 |
| 10.5 | 0.59 | 83.2 | 8.1 | 2.5 | -50.8 | -20.3 | 0.10 | -53.4 | 0.27 | 147.4 |
| 11.0 | 0.58 | 77.0 | 7.7 | 2.4 | -58.7 | -20.0 | 0.10 | -58.3 | 0.29 | 139.2 |
| 11.5 | 0.59 | 70.0 | 7.3 | 2.3 | -66.3 | -20.0 | 0.10 | -61.6 | 0.30 | 134.6 |
| 12.0 | 0.60 | 63.6 | 6.9 | 2.2 | -73.6 | -20.1 | 0.10 | -68.4 | 0.30 | 129.7 |

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 dB | S21 | S21 Ang | S12 dB | S12 | S12 Ang | S22 | S22 Ang |
|----------|------|---------|--------|------|---------|--------|------|---------|------|---------|
| 0.05 | 0.98 | -1.86 | 19.65 | 9.60 | 179.14 | -40.82 | 0.01 | 142.41 | 0.71 | -1.49 |
| 0.1 | 0.98 | -4.00 | 19.10 | 9.02 | 176.80 | -36.44 | 0.02 | 61.47 | 0.69 | -2.62 |
| 0.5 | 0.97 | -18.55 | 18.96 | 8.87 | 161.63 | -37.38 | 0.01 | 79.13 | 0.68 | -9.34 |
| 1.0 | 0.91 | -36.03 | 18.56 | 8.47 | 144.43 | -32.60 | 0.02 | 71.00 | 0.67 | -18.30 |
| 1.5 | 0.83 | -53.20 | 18.07 | 8.00 | 128.44 | -29.87 | 0.03 | 63.42 | 0.64 | -26.15 |
| 2.0 | 0.73 | -71.95 | 17.55 | 7.54 | 112.38 | -27.40 | 0.04 | 54.26 | 0.59 | -34.49 |
| 2.5 | 0.64 | -92.56 | 16.96 | 7.05 | 97.04 | -26.34 | 0.05 | 47.80 | 0.55 | -43.18 |
| 3.0 | 0.55 | -112.96 | 16.17 | 6.44 | 83.23 | -25.06 | 0.06 | 41.17 | 0.50 | -50.95 |
| 3.5 | 0.48 | -132.70 | 15.36 | 5.86 | 70.22 | -24.16 | 0.06 | 37.08 | 0.48 | -57.59 |
| 4.0 | 0.43 | -149.99 | 14.56 | 5.34 | 58.99 | -23.47 | 0.07 | 32.76 | 0.46 | -62.62 |
| 4.5 | 0.39 | -168.89 | 13.80 | 4.90 | 47.91 | -23.06 | 0.07 | 29.04 | 0.45 | -67.90 |
| 5.0 | 0.37 | 170.67 | 13.08 | 4.51 | 36.91 | -22.34 | 0.08 | 24.62 | 0.42 | -74.58 |
| 5.5 | 0.39 | 151.15 | 12.40 | 4.17 | 26.18 | -22.01 | 0.08 | 19.33 | 0.39 | -83.97 |
| 6.0 | 0.43 | 133.82 | 11.66 | 3.83 | 15.61 | -21.32 | 0.09 | 18.60 | 0.35 | -94.51 |
| 6.5 | 0.47 | 120.89 | 10.95 | 3.53 | 5.92 | -20.84 | 0.09 | 13.36 | 0.32 | -106.08 |
| 7.0 | 0.50 | 109.89 | 10.32 | 3.28 | -3.54 | -20.30 | 0.10 | 9.52 | 0.30 | -117.05 |
| 7.5 | 0.53 | 100.36 | 9.71 | 3.06 | -12.65 | -19.72 | 0.10 | 5.73 | 0.28 | -128.64 |
| 8.0 | 0.57 | 91.25 | 9.16 | 2.87 | -21.88 | -19.26 | 0.11 | 2.09 | 0.26 | -141.74 |
| 8.5 | 0.58 | 83.43 | 8.46 | 2.65 | -29.75 | -18.90 | 0.11 | -0.23 | 0.25 | -153.53 |
| 9.0 | 0.63 | 77.13 | 8.02 | 2.52 | -38.37 | -18.03 | 0.13 | -4.45 | 0.26 | -170.20 |
| 9.5 | 0.67 | 71.39 | 7.47 | 2.36 | -47.01 | -17.60 | 0.13 | -9.47 | 0.27 | 172.54 |
| 10.0 | 0.69 | 66.40 | 6.96 | 2.23 | -55.30 | -17.07 | 0.14 | -14.49 | 0.28 | 156.88 |
| 10.5 | 0.70 | 61.12 | 6.54 | 2.12 | -63.20 | -16.58 | 0.15 | -19.18 | 0.31 | 144.39 |
| 11.0 | 0.71 | 55.86 | 6.07 | 2.01 | -71.42 | -16.38 | 0.15 | -24.29 | 0.33 | 132.64 |
| 11.5 | 0.73 | 50.24 | 5.56 | 1.90 | -79.06 | -16.01 | 0.16 | -29.38 | 0.35 | 123.63 |
| 12.0 | 0.75 | 45.32 | 5.02 | 1.78 | -86.27 | -15.60 | 0.17 | -33.41 | 0.36 | 113.26 |

Note : De-embedded to device pins



Caution: ESD sensitive
Appropriate precautions in handling, packaging and testing devices must be observed.

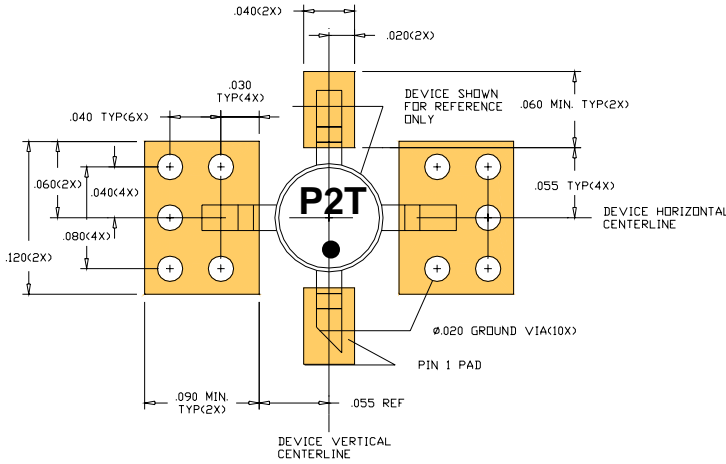
Part Number Ordering Information

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

Part Symbolization

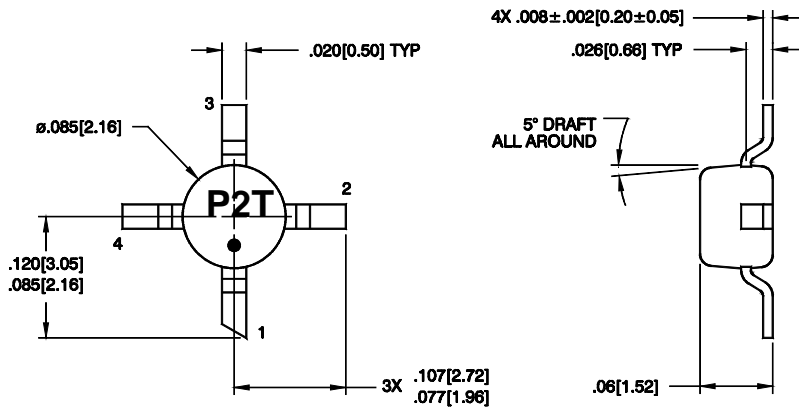
The part will be symbolized with a "P2T" designator on the top surface of the package.

PCB Pad Layout



| Pin Designation | |
|-----------------|--------|
| 1 | Gate |
| 2 | Source |
| 3 | Drain |
| 4 | Source |

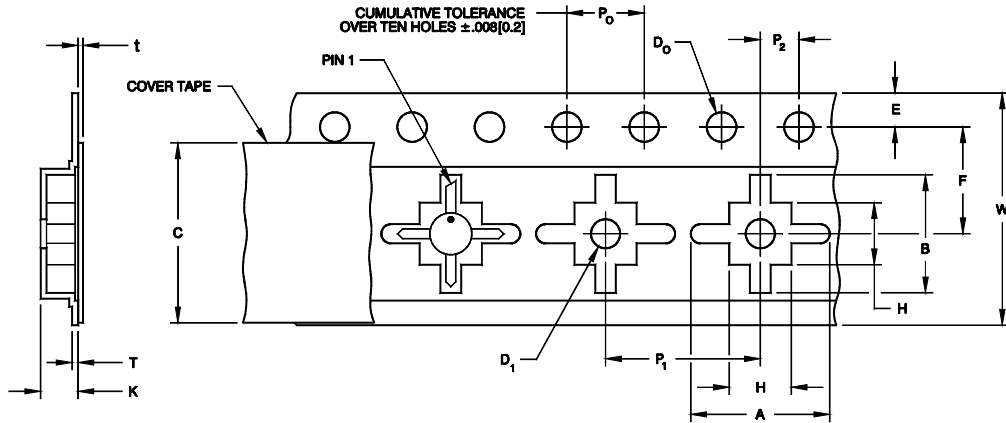
Package Dimensions



Component Tape and Reel Packaging

Tape Dimensions

For 86 Outline



| DESCRIPTION | | SYMBOL | SIZE (MM) |
|---------------------|--|----------------|--------------|
| Cavity | Length | A | 6.10 ± 0.10 |
| | Width | B | 6.20 ± 0.10 |
| | Socket | H | 3.10 ± 0.10 |
| | Depth | K | 2.00 ± 0.10 |
| | Pitch | P | 8.00 ± 0.10 |
| | Bottom Hole diameter | D ₁ | 1.50 min. |
| Perforation | Diameter | D ₀ | 1.50 ± 0.10 |
| | Pitch | P ₀ | 4.00 ± 0.10 |
| | Position | E | 1.75 ± 0.10 |
| Cover Tape | Width | C | 9.10 ± 0.25 |
| | Tape Thickness | t | 0.05 ± 0.01 |
| Carrier Tape | Width | W | 12.00 ± 0.30 |
| | Tape Thickness | T | 0.30 ± 0.05 |
| Distance | Cavity to Perforation (Width Direction) | F | 5.50 ± 0.05 |
| | Cavity to Perforation (Length Direction) | P ₂ | 2.00 ± 0.05 |