

General Purpose PHEMT Chip



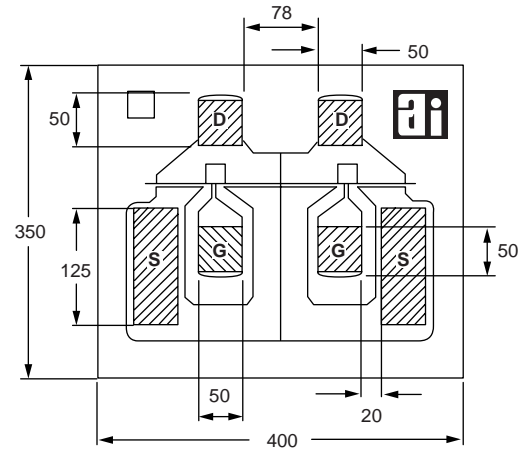
AFP02N8-000

Features

- Low Noise Figure, 1.25 dB @ 4 GHz
- High Associated Gain, 15.0 dB @ 4 GHz
- High MAG, > 18 dB @ 4 GHz
- 0.7 μm Ti/Pd/Au Gates
- Passivated Surface

Description

The AFP02N8-000 general purpose PHEMT chip has excellent gain and noise performance through X band, making it suitable for a wide range of commercial and military applications. The device employs 0.7 μm Ti/Pd/Au gates and surface passivation to ensure a rugged, reliable part.



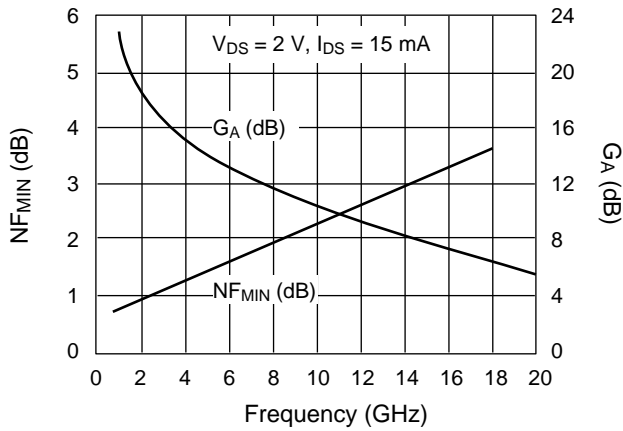
Absolute Maximum Ratings

| Characteristic | Value |
|--------------------------------------|------------------|
| Drain to Source Voltage (V_{DS}) | 6 V |
| Gate to Source Voltage (V_{GS}) | -3 V |
| Drain Current (I_{DS}) | I_{DSS} |
| Gate Current (I_{GS}) | 10 μA |
| Total Power Dissipation (P_T) | 300 mW |
| Storage Temperature (T_{ST}) | -65 to +150°C |
| Channel Temperature (T_{CH}) | 175°C |

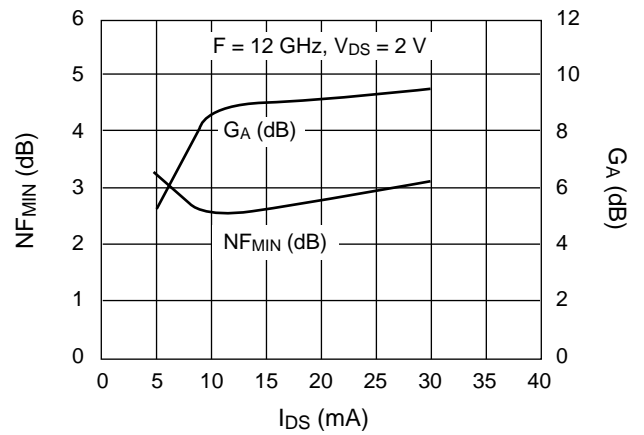
Electrical Specifications at 25°C

| Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|--|--|------|------|------|------|
| Saturated Drain Current (I_{DSS}) | $V_{DS} = 2 \text{ V}, V_{GS} = 0 \text{ V}$ | 25.0 | 45.0 | 90.0 | mA |
| Transconductance (g_m) | $V_{DS} = 2 \text{ V}, I_{DS} = 15 \text{ mA}$ | 40.0 | 55.0 | | mS |
| Pinch-off Voltage (V_P) | $V_{DS} = 2 \text{ V}, I_{DS} = 0.3 \text{ mA}$ | -0.2 | -0.6 | -2.0 | V |
| Gate to Source Breakdown Voltage (V_{bgs}) | $I_{GS} = -200 \mu\text{A}$ | -4.0 | -6.0 | | V |
| Noise Figure (NF) | $V_{DS} = 2 \text{ V}, I_{DS} = 15 \text{ mA}, F = 4 \text{ GHz}$ | | 1.25 | 1.75 | dB |
| Associated Gain (G_A) | | 14.0 | 15.0 | | dB |
| Noise Figure (NF) | $V_{DS} = 2 \text{ V}, I_{DS} = 15 \text{ mA}, F = 12 \text{ GHz}$ | | 2.6 | 3.0 | dB |
| Associated Gain (G_A) | | 8.5 | 9.4 | | dB |

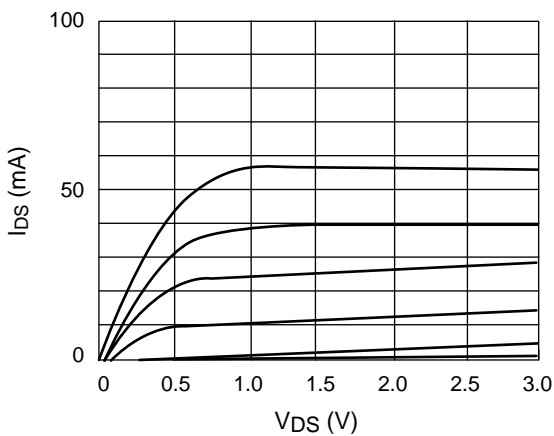
Typical Performance Data



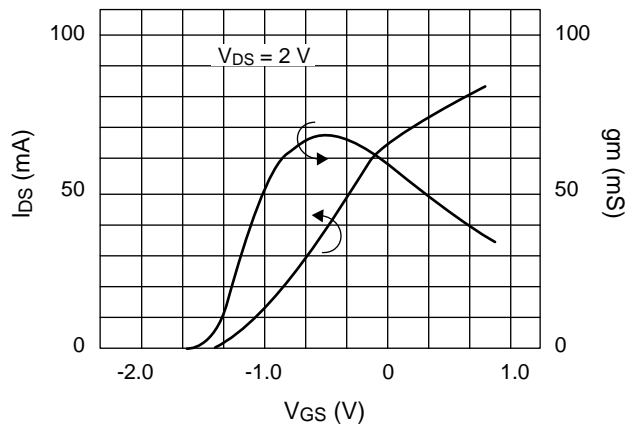
RF Minimum Noise Figure (NF_{MIN}) and Associated Gain (G_A) vs. Frequency (GHz)



RF Minimum Noise Figure (NF_{MIN}) and Associated Gain (G_A) vs. Drain Current (I_{DS})



DC Drain Current (I_{DS}) vs. Drain Voltage (V_{DS}) as a Function of Gate to Source Voltage (V_{GS})



DC Drain Current (I_{DS}) and Transconductance (g_m) vs. Gate to Source Voltage (V_{GS})

Typical Noise Parameters

($V_{DS} = 2\text{ V}$, $I_{DS} = 15\text{ mA}$)

| Freq. (GHz) | NF _{MIN} (dB) | Γ_{opt} | | R _N /50 | G _A (dB) |
|----------------|---------------------------|----------------|---------|--------------------|---------------------|
| | | Mag. | Ang. | | |
| 1 | 0.70 | 0.88 | 13.30 | 0.01 | 23.00 |
| 2 | 0.88 | 0.78 | 27.30 | 0.13 | 18.30 |
| 4 | 1.22 | 0.62 | 53.60 | 0.27 | 15.35 |
| 6 | 1.59 | 0.52 | 77.60 | 0.31 | 13.22 |
| 8 | 1.95 | 0.46 | 99.40 | 0.31 | 11.67 |
| 10 | 2.30 | 0.44 | 119.20 | 0.29 | 10.30 |
| 12 | 2.63 | 0.44 | 136.90 | 0.25 | 9.24 |
| 14 | 3.00 | 0.46 | 152.80 | 0.21 | 8.25 |
| 16 | 3.35 | 0.50 | 166.90 | 0.17 | 7.49 |
| 18 | 3.70 | 0.54 | 179.30 | 0.15 | 6.59 |
| 20 | 4.00 | 0.57 | -169.90 | 0.16 | 5.46 |
| 22 | 4.37 | 0.59 | -160.60 | 0.20 | 5.05 |
| 24 | 4.73 | 0.60 | -152.70 | 0.28 | 4.85 |
| 26 | 5.10 | 0.57 | -146.20 | 0.39 | 4.86 |

Both noise and S-parameters include bond wires. Two gate bond wires and two drain wires are each approximately 325 μm (13 mil) long. Four source bond wires (2 each side) are each approximately 200 μm (8 mil) long. All wire is 17 μm (0.7 mil) diameter gold.

Typical S-Parameters ($V_{DS} = 2\text{ V}$, $I_{DS} = 10\text{ mA}$)

| Freq. (GHz) | S ₁₁ | | S ₂₁ | | S ₁₂ | | S ₂₂ | | k | S ₂₁ (dB) | MAG/ MSG (dB) |
|----------------|-----------------|---------|-----------------|--------|-----------------|-------|-----------------|--------|-------|-------------------------|------------------|
| | Mag. | Ang. | Mag. | Ang. | Mag. | Ang. | Mag. | Ang. | | | |
| 2 | 0.946 | -37.71 | 3.892 | 150.07 | 0.041 | 67.60 | 0.739 | -15.73 | 0.216 | 11.803 | 19.774 |
| 3 | 0.909 | -54.69 | 3.615 | 138.06 | 0.057 | 58.11 | 0.714 | -22.39 | 0.273 | 11.162 | 18.022 |
| 4 | 0.866 | -70.13 | 3.322 | 126.96 | 0.068 | 50.39 | 0.688 | -27.24 | 0.350 | 10.428 | 16.889 |
| 5 | 0.830 | -84.40 | 3.016 | 116.85 | 0.078 | 42.85 | 0.658 | -32.95 | 0.426 | 9.589 | 15.873 |
| 6 | 0.801 | -96.78 | 2.747 | 108.11 | 0.084 | 36.92 | 0.640 | -37.16 | 0.494 | 8.777 | 15.146 |
| 7 | 0.776 | -107.46 | 2.504 | 100.24 | 0.088 | 32.24 | 0.621 | -40.57 | 0.577 | 7.973 | 14.542 |
| 8 | 0.760 | -117.10 | 2.285 | 93.26 | 0.091 | 28.30 | 0.607 | -44.11 | 0.643 | 7.178 | 13.998 |
| 9 | 0.746 | -125.45 | 2.098 | 86.79 | 0.093 | 25.09 | 0.599 | -47.10 | 0.715 | 6.436 | 13.533 |
| 10 | 0.733 | -131.77 | 1.937 | 81.28 | 0.095 | 22.67 | 0.589 | -50.14 | 0.795 | 5.743 | 13.094 |
| 11 | 0.723 | -138.16 | 1.805 | 75.95 | 0.096 | 20.83 | 0.589 | -52.95 | 0.855 | 5.130 | 12.742 |
| 12 | 0.714 | -143.64 | 1.687 | 70.89 | 0.097 | 19.25 | 0.585 | -55.52 | 0.929 | 4.542 | 12.403 |
| 13 | 0.702 | -148.82 | 1.586 | 66.16 | 0.097 | 17.91 | 0.583 | -58.82 | 1.014 | 4.006 | 11.418 |
| 14 | 0.696 | -153.98 | 1.502 | 61.42 | 0.098 | 16.87 | 0.581 | -61.53 | 1.071 | 3.533 | 10.232 |
| 15 | 0.689 | -158.65 | 1.424 | 56.91 | 0.098 | 16.14 | 0.577 | -64.16 | 1.152 | 3.070 | 9.259 |
| 16 | 0.681 | -163.77 | 1.359 | 52.41 | 0.098 | 15.37 | 0.579 | -67.35 | 1.214 | 2.664 | 8.625 |
| 17 | 0.671 | -168.77 | 1.300 | 47.92 | 0.099 | 15.16 | 0.574 | -70.36 | 1.291 | 2.279 | 7.944 |
| 18 | 0.666 | -173.79 | 1.243 | 43.61 | 0.099 | 14.58 | 0.570 | -73.60 | 1.367 | 1.889 | 7.373 |

Typical S-Parameters ($V_{DS} = 2\text{ V}$, $I_{DS} = 30\text{ mA}$)

| Freq. (GHz) | S_{11} | | S_{21} | | S_{12} | | S_{22} | | k | S_{21} (dB) | MAG/ MSG (dB) |
|----------------|----------|---------|----------|--------|----------|-------|----------|--------|------|------------------|------------------|
| | Mag. | Ang. | Mag. | Ang. | Mag. | Ang. | Mag. | Ang. | | | |
| 2 | 0.942 | -41.56 | 4.452 | 148.27 | 0.034 | 67.38 | 0.630 | -16.20 | 0.27 | 12.97 | 21.17 |
| 3 | 0.904 | -59.91 | 4.086 | 135.96 | 0.047 | 58.52 | 0.606 | -22.82 | 0.33 | 12.23 | 19.39 |
| 4 | 0.863 | -76.17 | 3.703 | 124.86 | 0.056 | 51.14 | 0.585 | -27.90 | 0.42 | 11.37 | 18.20 |
| 5 | 0.829 | -90.97 | 3.328 | 114.87 | 0.064 | 44.47 | 0.559 | -33.10 | 0.50 | 10.44 | 17.16 |
| 6 | 0.804 | -103.55 | 3.007 | 106.34 | 0.069 | 39.39 | 0.545 | -37.24 | 0.58 | 9.56 | 16.39 |
| 7 | 0.783 | -114.26 | 2.717 | 98.74 | 0.072 | 35.51 | 0.530 | -40.37 | 0.68 | 8.68 | 15.77 |
| 8 | 0.770 | -123.73 | 2.467 | 92.01 | 0.075 | 32.58 | 0.522 | -43.96 | 0.74 | 7.84 | 15.17 |
| 9 | 0.759 | -131.90 | 2.253 | 85.83 | 0.076 | 30.08 | 0.517 | -47.08 | 0.83 | 7.06 | 14.72 |
| 10 | 0.747 | -138.10 | 2.075 | 80.51 | 0.078 | 28.62 | 0.509 | -50.12 | 0.92 | 6.34 | 14.25 |
| 11 | 0.741 | -144.38 | 1.928 | 75.43 | 0.079 | 27.69 | 0.512 | -52.73 | 0.98 | 5.70 | 13.88 |
| 12 | 0.731 | -149.68 | 1.797 | 70.53 | 0.080 | 27.07 | 0.512 | -55.37 | 1.07 | 5.09 | 11.96 |
| 13 | 0.721 | -154.66 | 1.684 | 65.99 | 0.082 | 26.39 | 0.510 | -58.89 | 1.14 | 4.53 | 10.86 |
| 14 | 0.716 | -159.81 | 1.594 | 61.39 | 0.084 | 26.21 | 0.509 | -61.45 | 1.19 | 4.05 | 10.17 |
| 15 | 0.711 | -164.36 | 1.508 | 57.05 | 0.085 | 26.37 | 0.508 | -64.01 | 1.25 | 3.57 | 9.45 |
| 16 | 0.703 | -169.44 | 1.437 | 52.71 | 0.086 | 26.37 | 0.511 | -67.45 | 1.32 | 3.15 | 8.86 |
| 17 | 0.696 | -174.29 | 1.371 | 48.36 | 0.088 | 26.51 | 0.507 | -70.47 | 1.38 | 2.74 | 8.26 |
| 18 | 0.690 | -179.19 | 1.308 | 44.18 | 0.090 | 26.72 | 0.504 | -73.67 | 1.44 | 2.33 | 7.69 |