

# Ka-Band Power GaAs MESFET

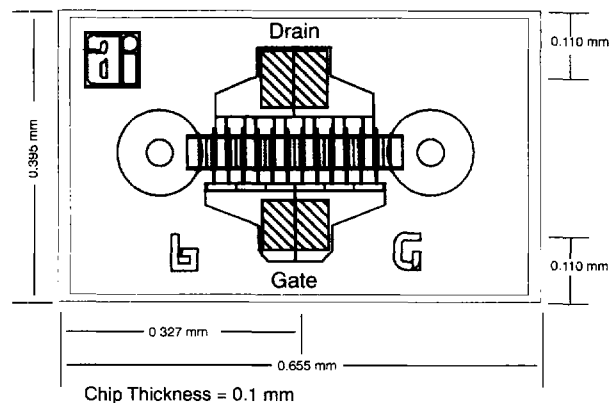


AFM06P2-00

## Features

- 22.5 dBm Output Power at 18 GHz
- High Associated Gain, 9 dB at 18 GHz
- High Power Added Efficiency, 23%
- Broadband Operation, DC-40 GHz
- 0.25  $\mu\text{m}$  Ti/Pt/Au Gates
- Passivated Surface
- Through-Substrate Via Hole Grounding

## Chip Layout



## Description

Alpha's AFM06P2-00 is a high performance power GaAs MESFET chip having a gate length of 0.25  $\mu\text{m}$  and a total gate periphery of 600  $\mu\text{m}$ . The device has excellent gain and power performance through 40 GHz making it suitable for a wide range of commercial and military applications in oscillator and

amplifier circuits. The device employs Ti/Pt/Au gate metallization and surface passivation to ensure a rugged reliable part. Through-substrate via holes are incorporated into the chip to facilitate low inductance grounding of the source for improved high frequency and high gain performance.

## Electrical Specifications

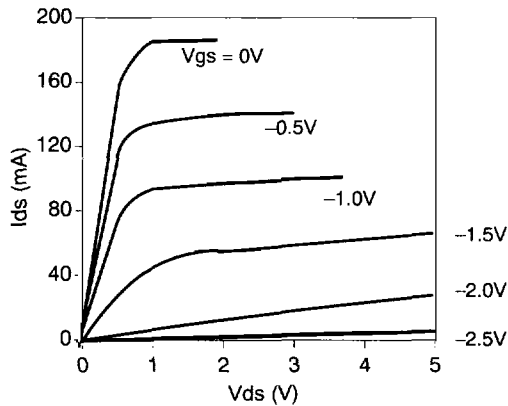
| Parameter                        | Symbol       | Test Conditions                            | Value |      |      | Unit         |
|----------------------------------|--------------|--|-------|------|------|--------------|
|                                  |              |  | Min.  | Typ. | Max. |              |
| Saturated Drain Current          | $I_{dss}$    | $V_{ds} = 2V, V_{gs} = 0V$                 | 130   | 200  | 270  | mA           |
| Transconductance                 | $g_m$        |  | 90    | 120  | -    | mS           |
| Pinch-Off Voltage                | $V_p$        | $V_{ds} = 5V, I_{ds} = 1.5 mA$             | 1     | 3    | 5    | -V           |
| Gate to Drain Breakdown Voltage  | $V_{bgd}$    | $I_{gd} = 600 \mu A$                       | 8     | 12   | -    | -V           |
| Output Power at 1 dB Compression | P1dB         | $V_{ds} = 5V, I_{ds} = 100 mA, f = 18 GHz$ | -     | 22.5 | -    | dBm          |
| Gain at 1 dB Compression         | G1dB         |  | -     | 9    | -    | dB           |
| Power Added Efficiency           | $\eta_{add}$ |  | -     | 23   | -    | %            |
| Output Power at 1 dB Compression | P1dB         | $V_{ds} = 5V, I_{ds} = 100 mA, f = 30 GHz$ | -     | 22   | -    | dBm          |
| Gain at 1 dB Compression         | G1dB         |  | -     | 4.5  | -    | dB           |
| Power Added Efficiency           | $\eta_{add}$ |  | -     | 15   | -    | %            |
| Thermal Resistance               | $R_{th}$     | $T_{base} = +25^\circ C$                   | -     | -    | 160  | $^\circ C/W$ |

**Typical S-Parameters (Vds = 5V, Ids = 120 mA)**

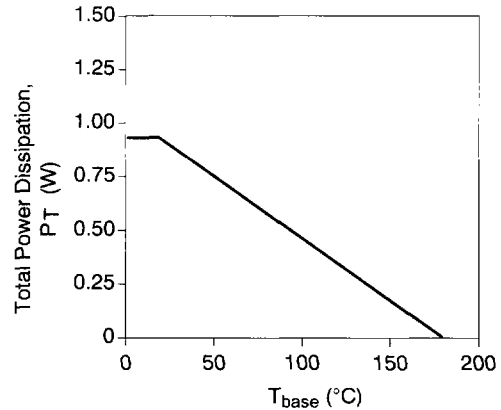
| Freq (GHz) | S11   |          | S21   |         | S12   |        | S22   |          | k     | MAG (dB) |
|------------|-------|----------|-------|---------|-------|--------|-------|----------|-------|----------|
|            | Mag   | Ang      | Mag   | Ang     | Mag   | Ang    | Mag   | Ang      |       |          |
| 2.00000    | 0.943 | -63.246  | 7.140 | 136.768 | 0.031 | 53.027 | 0.340 | -48.993  | 0.160 | 23.563   |
| 3.00000    | 0.905 | -86.534  | 6.080 | 120.394 | 0.040 | 39.817 | 0.340 | -66.574  | 0.240 | 21.828   |
| 4.00000    | 0.876 | -104.502 | 5.155 | 107.124 | 0.045 | 29.754 | 0.346 | -69.967  | 0.321 | 20.614   |
| 5.00000    | 0.856 | -118.460 | 4.405 | 96.076  | 0.047 | 21.969 | 0.360 | -90.387  | 0.403 | 19.690   |
| 6.00000    | 0.843 | -129.538 | 3.807 | 86.566  | 0.048 | 15.797 | 0.368 | -98.818  | 0.486 | 18.953   |
| 7.00000    | 0.835 | -138.558 | 3.328 | 68.138  | 0.049 | 10.797 | 0.399 | -105.932 | 0.569 | 18.348   |
| 8.00000    | 0.830 | -146.091 | 2.940 | 60.490  | 0.048 | 6.688  | 0.423 | -112.160 | 0.643 | 17.841   |
| 9.00000    | 0.827 | -152.503 | 2.619 | 63.4278 | 0.048 | 3.296  | 0.448 | -117.776 | 0.693 | 17.410   |
| 10.00000   | 0.825 | -158.149 | 2.352 | 56.818  | 0.046 | 0.510  | 0.473 | -122.953 | 0.825 | 17.041   |
| 11.00000   | 0.825 | -163.140 | 2.125 | 50.572  | 0.045 | -1.735 | 0.499 | -127.805 | 0.913 | 16.721   |
| 12.00000   | 0.825 | -167.642 | 1.931 | 44.626  | 0.044 | -3.476 | 0.524 | -132.404 | 1.000 | 16.350   |
| 13.00000   | 0.826 | -171.656 | 1.672 | 38.937  | 0.042 | -4.733 | 0.549 | -136.801 | 1.088 | 14.889   |
| 14.00000   | 0.828 | -175.561 | 1.615 | 33.471  | 0.051 | -5.512 | 0.564 | -141.028 | 1.174 | 13.447   |
| 15.00000   | 0.390 | -169.110 | 1.485 | 28.206  | 0.039 | -5.818 | 0.598 | -145.111 | 1.257 | 12.715   |
| 16.00000   | 0.832 | 177.551  | 1.370 | 23.122  | 0.038 | -5.654 | 0.621 | -149.064 | 1.336 | 12.105   |
| 17.00000   | 0.834 | 167.439  | 1.267 | 18.206  | 0.037 | -5.028 | 0.643 | -152.901 | 1.408 | 11.581   |
| 18.00000   | 0.837 | 171.378  | 1.175 | 13.447  | 0.036 | -3.962 | 0.664 | -156.631 | 1.471 | 11.124   |
| 19.00000   | 0.839 | 168.496  | 1.091 | 8.837   | 0.035 | -2.492 | 0.685 | -160.260 | 1.521 | 10.724   |
| 20.00000   | 0.842 | 165.727  | 1.016 | 4.369   | 0.034 | -0.675 | 0.704 | -163.695 | 1.556 | 10.373   |
| 21.00000   | 0.845 | 163.057  | 0.947 | 0.036   | 0.033 | 1.413  | 0.722 | -167.239 | 1.574 | 10.066   |
| 22.00000   | 0.847 | 160.476  | 0.884 | -4.65   | 0.033 | 3.678  | 0.740 | -160.596 | 1.572 | 9.800    |
| 23.00000   | 0.850 | 157.974  | 0.826 | -8.238  | 0.033 | 6.018  | 0.756 | -173.869 | 1.551 | 9.574    |
| 24.00000   | 0.852 | 155.545  | 0.773 | -12.188 | 0.034 | 8.333  | 0.722 | -177.061 | 1.513 | 9.387    |
| 25.00000   | 0.855 | 153.182  | 0.725 | -16.016 | 0.034 | 10.535 | 0.786 | 179.825  | 1.460 | 9.240    |
| 26.00000   | 0.857 | 150.880  | 0.680 | -19.727 | 0.035 | 12.552 | 0.800 | 176.688  | 1.935 | 9.138    |
| 27.00000   | 0.860 | 148.635  | 0.638 | -23.321 | 0.036 | 14.335 | 0.813 | 163.824  | 1.321 | 9.087    |
| 28.00000   | 0.862 | 146.443  | 0.600 | -26.802 | 0.037 | 15.855 | 0.825 | 160.933  | 1.243 | 9.101    |
| 29.00000   | 0.864 | 144.301  | 0.564 | -30.171 | 0.039 | 17.104 | 0.837 | 168.112  | 1.162 | 9.208    |
| 30.00000   | 0.866 | 142.207  | 0.531 | -33.429 | 0.040 | 18.085 | 0.847 | 165.360  | 1.081 | 9.482    |
| 31.00000   | 0.868 | 140.157  | 0.500 | -36.569 | 0.042 | 18.811 | 0.857 | 162.674  | 1.002 | 10.501   |
| 32.00000   | 0.870 | 138.151  | 0.471 | -39.621 | 0.043 | 19.303 | 0.867 | 160.052  | 0.926 | 10.367   |
| 33.00000   | 0.872 | 136.185  | 0.444 | -42.556 | 0.045 | 19.582 | 0.875 | 157.494  | 0.854 | 9.943    |
| 34.00000   | 0.874 | 134.259  | 0.419 | -45.387 | 0.047 | 19.671 | 0.884 | 154.997  | 0.785 | 9.523    |
| 35.00000   | 0.876 | 132.371  | 0.395 | -48.112 | 0.048 | 19.594 | 0.891 | 152.560  | 0.721 | 9.109    |
| 36.00000   | 0.878 | 130.519  | 0.373 | -50.734 | 0.050 | 19.370 | 0.898 | 150.818  | 0.661 | 8.701    |
| 37.00000   | 0.869 | 128.603  | 0.352 | -53.252 | 0.052 | 19.020 | 0.905 | 147.859  | 0.605 | 8.299    |
| 38.00000   | 0.881 | 126.920  | 0.333 | -55.667 | 0.054 | 18.561 | 0.911 | 145.592  | 0.553 | 6.904    |
| 39.00000   | 0.883 | 125.171  | 0.314 | -56.968 | 0.056 | 18.008 | 0.917 | 143.378  | 0.505 | 6.516    |
| 40.00000   | 0.884 | 123.453  | 0.297 | -60.185 | 0.057 | 17.375 | 0.923 | 141.216  | 0.461 | 7.133    |

(S-parameters include the effects of two 0.8 mil diameter bond wires, each 10 mil long, to each of the gate and drain terminals.)

**Typical I-V Curves**



**Power Derating Curve**



**Absolute Extreme Ratings (Ambient Temperature = + 25 °C)**

| Parameter               | Symbol | Rating      | Unit |
|-------------------------|--------|-------------|------|
| Drain to Source Voltage | Vds    | 6           | V    |
| Gate to Source Voltage  | Vgs    | -4          | V    |
| Drain Current           | Ids    | Idss        | -    |
| Gate Current            | Igs    | 1           | mA   |
| Total Power Dissipation | Pt     | 1.1         | W    |
| Channel Temperature     | Tch    | 175         | °C   |
| Storage Temperature     | Tst    | -65 to +150 | °C   |