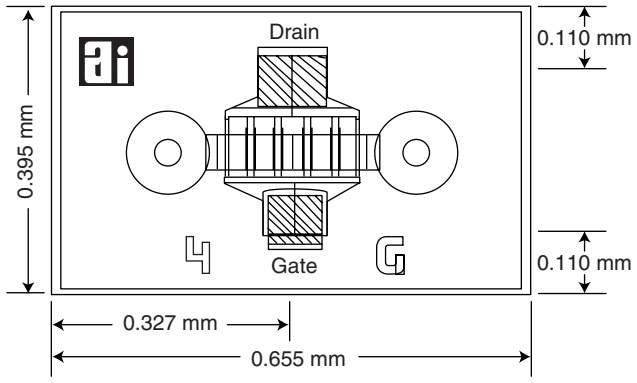
Ka Band Power GaAs MESFET Chip

AFM04P2-000

Features

- 21 dBm Output Power @ 18 GHz
- High Associated Gain, 9 dB @ 18 GHz
- High Power Added Efficiency, 25%
- Broadband Operation, DC–40 GHz
- 0.25 µm Ti/Pd/Au Gates
- Passivated Surface
- Through-Substrate Via Hole Grounding



Chip thickness = 0.1 mm.

Description

The AFM04P2-000 is a high performance power GaAs MESFET chip having a gate length of 0.25 µm and a total gate periphery of 400 µm. 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. It employs Ti/Pd/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.

Absolute Maximum Ratings

Characteristic	Value
Drain to Source Voltage (V_{DS})	6 V
Gate to Source Voltage (V_{GS})	-4 V
Drain Current (I_{DS})	I_{DSS}
Gate Current (I_{GS})	1 mA
Total Power Dissipation (P_T)	700 mW
Storage Temperature (T_{ST})	-65 to +150°C
Channel Temperature (T_{CH})	175°C

Electrical Specifications at 25°C

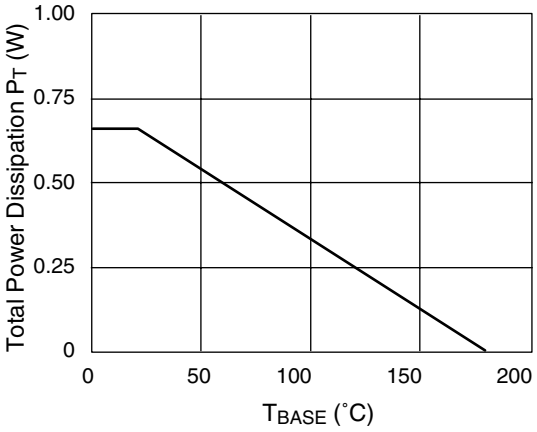
Parameter	Test Conditions	Min.	Typ.	Max.	Unit
Saturated Drain Current (I_{DSS})	V_{DS} = 2 V, V_{GS} = 0 V	90.0	140.0	190.0	mA
Transconductance (gm)		60.0	80.0		mS
Pinch-off Voltage (V_P)	V_{DS} = 5 V, I_{DS} = 1 mA	1.0	3.0	5.0	-V
Gate to Drain Breakdown Voltage (V_{bgd})	I_{GD} = -400 µA	8.0	12.0		-V
Output Power at 1 dB Compression ($P_{1\ dB}$)	V_{DS} = 5 V, I_{DS} = 70 mA, F = 18 GHz		21.0		dBm
Gain at 1 dB Compression ($G_{1\ dB}$)			9.0		dB
Power Added Efficiency (ηadd)			25.0		%
Output Power at 1 dB Compression ($P_{1\ dB}$)	V_{DS} = 5 V, I_{DS} = 70 mA, F = 30 GHz		20.0		dBm
Gain at 1 dB Compression ($G_{1\ dB}$)			5.0		dB
Power Added Efficiency (ηadd)			15.0		%
Thermal Resistance (Θ_{JC})	T_{BASE} = 25°C			250.0	°C/W

Typical S-Parameters (V_{DS} = 5 V, I_{DS} = 70 mA)

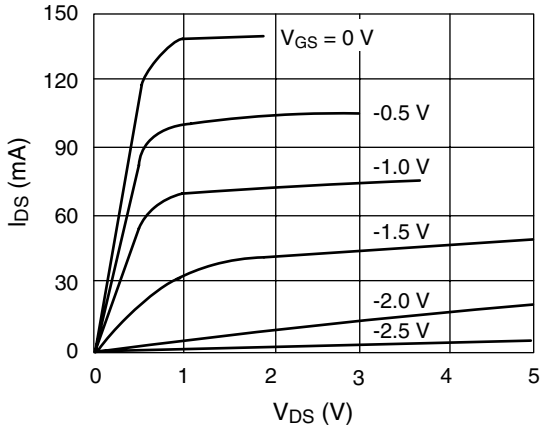
Freq. (GHz)	S_{11}		S_{21}		S_{12}		S_{22}		k	MAG (dB)
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.		
2	0.969	-37.191	5.040	153.579	0.029	68.605	0.550	-18.296	0.100	22.364
3	0.958	-54.069	4.740	141.521	0.041	59.064	0.533	-26.529	0.150	20.613
4	0.935	-69.318	4.398	130.518	0.051	50.587	0.514	-33.959	0.200	19.278
5	0.913	-82.889	4.050	120.568	0.058	43.171	0.497	-40.630	0.250	18.247
6	0.893	-94.881	3.719	111.573	0.064	36.722	0.482	-46.663	0.299	17.658
7	0.877	-105.468	3.415	103.398	0.068	31.107	0.471	-52.183	0.349	17.104
8	0.863	-114.843	31.420	95.911	0.071	26.196	0.462	-57.310	0.398	16.464
9	0.852	-123.189	2.898	88.991	0.073	21.873	0.456	-62.138	0.447	15.986
10	0.843	-130.670	2.683	82.540	0.074	18.042	0.453	-66.738	0.496	15.566
11	0.836	-137.422	2.492	67.477	0.075	14.624	0.452	-71.161	0.544	15.193
12	0.831	-143.563	2.322	70.736	0.076	11.558	0.453	-75.442	0.593	14.858
13	0.826	-149.188	2.171	65.267	0.076	8.796	0.455	-79.606	0.641	14.447
14	0.823	-154.374	2.036	60.027	0.076	6.302	0.459	-83.671	0.688	14.285
15	0.821	-159.187	1.914	54.985	0.065	4.047	0.464	-87.648	0.735	14.037
16	0.819	-163.679	1.805	50.114	0.074	2.007	0.470	-91.546	0.781	13.811
17	0.818	-167.895	1.605	45.393	0.074	0.167	0.477	-95.372	0.827	13.063
18	0.817	171.872	1.615	40.805	0.073	-1.486	0.484	-99.129	0.872	13.412
19	0.817	-175.369	1.532	36.335	0.072	-2.961	0.492	-102.821	0.916	13.235
20	0.817	-179.221	1.456	31.973	0.071	-4.266	0.501	-106.451	0.959	13.071
21	0.818	177.359	1.386	27.760	0.060	-5.405	0.510	-110.021	1.001	12.753
22	0.819	174.083	1.321	23.535	0.069	-6.382	0.520	-113.533	1.041	11.534
23	0.820	170.936	1.261	19.445	0.068	-7.201	0.530	-116.989	1.069	10.915
24	0.821	167.905	1.205	15.343	0.067	-7.863	0.540	-120.389	1.116	10.431
25	0.822	164.969	1.512	11.498	0.066	-8.371	0.551	-123.737	1.150	10.024
26	0.824	162.148	1.103	6.633	0.065	-8.728	0.561	-127.031	1.181	9.671
27	0.825	159.403	1.057	3.836	0.064	-8.937	0.572	-130.275	1.210	9.358
28	0.826	156.737	1.013	0.105	0.063	-9.004	0.583	-133.468	1.235	9.080
29	0.829	154.144	0.972	-3.563	0.062	-8.937	0.594	-136.612	1.256	8.830
30	0.831	151.618	0.922	-7.169	0.062	-8.740	0.605	-139.606	1.273	8.604
31	0.833	149.155	0.895	-10.714	0.061	-8.427	0.616	-142.754	1.285	8.403
32	0.835	146.649	0.860	-14.200	0.061	-8.010	0.627	-145.754	1.292	8.222
33	0.836	144.398	0.826	-17.627	0.061	-7.502	0.638	-148.608	1.294	8.061
34	0.838	142.097	0.794	-20.996	0.061	-6.920	0.648	-151.615	1.291	7.920
35	0.840	139.845	0.764	-24.308	0.061	-6.281	0.659	-154.477	1.283	7.797
36	0.842	137.637	0.734	-27.563	0.061	-5.604	0.670	-157.293	1.270	7.694
37	0.844	135.472	0.706	-30.761	0.061	-4.907	0.680	-160.065	1.251	7.611
38	0.846	133.347	0.679	-33.903	0.061	-4.209	0.690	-162.693	1.228	6.550
39	0.848	131.261	0.653	-36.988	0.062	-3.525	0.700	-165.477	1.202	7.513
40	0.850	129.211	0.628	-40.017	0.063	-2.874	0.710	-168.117	1.171	7.504

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 Performance Data



Power Derating



I-V

TOM-2 Model Parameters

Parameter	Description	Unit	Default
BETA	Transconductance Coefficient	A/V^2	0.09464
V_{PO}	Pinch-off voltage	V	-1.8760
U	Mobility degradation fitting parameter	/V	0.3599
GAMA	Slope parameter of pinch-off voltage		0.03458
Q	Power law parameter		1.6560
NG	Subthreshold slope gate parameter		0.6025
ND	Subthreshold slope drain parameter		0.6050
DELT	Slope of drain characteristics in the saturated region	/A, V	0.5633
ALFA	Slope of drain characteristics in the linear region	/V	1.9400
T	Channel transmit-time delay	pS	6.4330
C_{GSO}	Gate-source Schottky barrier capacitance at V_{GS} = 0	pF	0.4232
C_{GDO}	Gate-drain Schottky barrier capacitance at V_{GS} = 0	pF	0.03138
V_{BI}	Built-in barrier potential	V	1.200
IS	Diode saturation current	A	0.563e-12
N	Diode ideality factor		1.1000
IBO	Breakdown saturation current	A	1.000e-16
NR	Breakdown ideality factor		10.0
V_{BD}	Breakdown voltage	V	20.00
RG	Gate terminal resistance	Ω	1.0000
RD	Drain terminal resistance	Ω	2.0000
RS	Source terminal resistance	Ω	0.8000
LG	Gate lead inductance	nH	0.5572
LD	Drain lead inductance	nH	0.2279
LS	Source lead inductance	nH	0.03532
CDS	Drain-source capacitance	pF	0.1555
RDSD	Channel trapping resistance	Ω	107.99
CDSD	Low frequency trapping resistance	nF	12.03
CGE	Gate-source electrode capacitance	fF	7.7240
CDE	Drain-source electrode capacitance	fF	9.4390