

Ka Band Power GaAs MESFET Chip



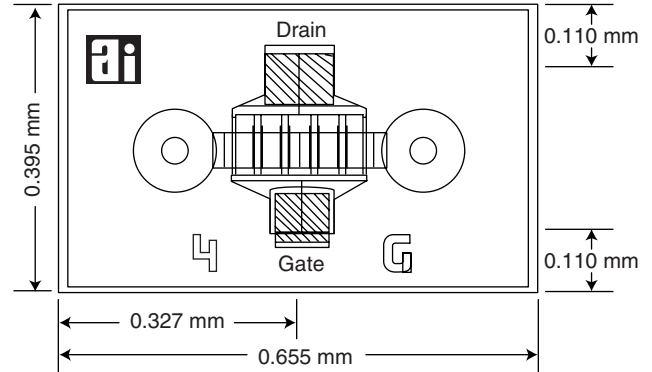
AFM04P2-000

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

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.



Chip thickness = 0.1 mm.

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

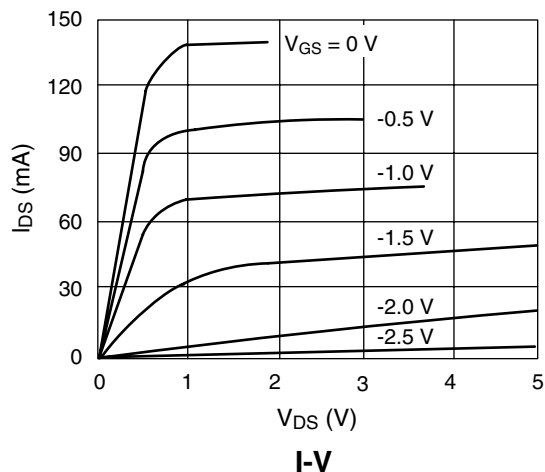
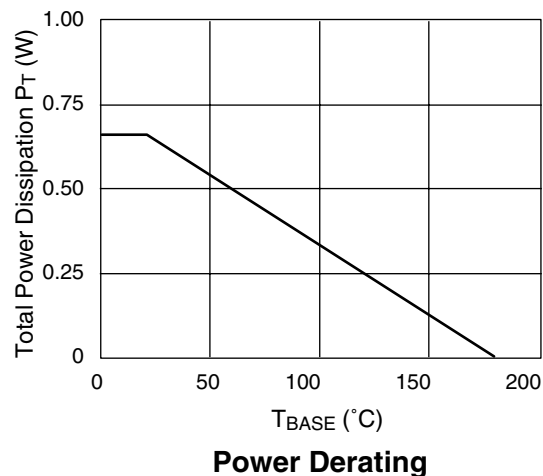
Parameter	Test Conditions	Min.	Typ.	Max.	Unit
Saturated Drain Current (I_{DSS})	$V_{DS} = 2 \text{ V}, V_{GS} = 0 \text{ V}$	90.0	140.0	190.0	mA
Transconductance (g_m)		60.0	80.0		mS
Pinch-off Voltage (V_P)	$V_{DS} = 5 \text{ V}, I_{DS} = 1 \text{ mA}$	1.0	3.0	5.0	-V
Gate to Drain Breakdown Voltage (V_{bgd})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

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

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



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
DELTA	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
I _S	Diode saturation current	A	0.563e-12
N	Diode ideality factor		1.1000
I _{BO}	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