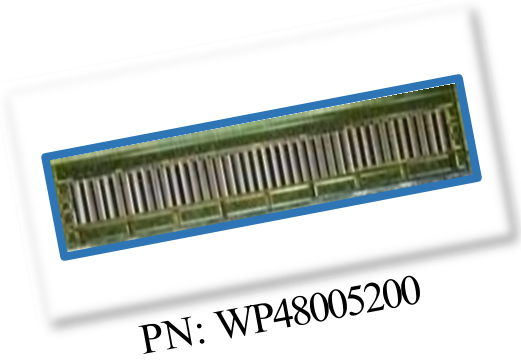
WAVE PIA IC DESIGN

WP48005200

200W, 48V GaN HEMT Die



PN: WP48005200

The WP48005200 is a 200W gallium nitride (GaN) High Electron Mobility Transistor (HEMT). This GaN HEMT is a wideband transistor optimized for 3.5GHz operation in a user-friendly device for high bandwidth applications. Gallium nitride (GaN) HEMT is a device optimized for 5G. GaN HEMT resistance is only 1/10 that of silicon transistors, making it capable of switching frequencies faster for greater energy efficiency.

Features

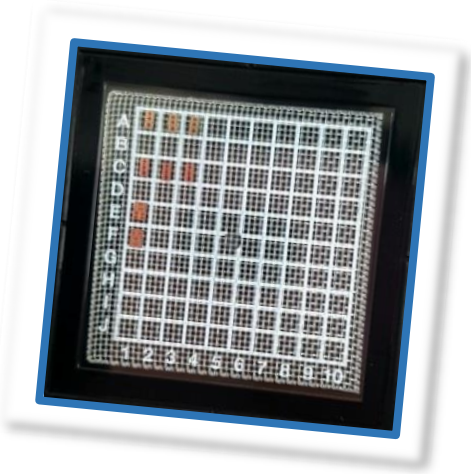
- Up to 8 GHz Operation
- 14.0 dB Typical Small Signal Gain @ 3.5 GHz
- 200 W Typical Psat @3.5GHz
- 48V Operation
- High Breakdown Voltage
- High Breakdown Voltage
- High Efficiency
- Reliability Monitoring Supporting

Applications

- U/VHF Amplifiers
- Broadband Amplifiers
- Base Station Communications
- Drone, UAV
- WiMAX, LTE, WCDMA, GSM
- WPT, V2X
- Radar application

Packaging Information

- Bare die are shipped in Wafer-level with Expander Ring or Gel-Pak® containers.
- Possible UV Curing for Wafer-level with dicing saw



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• Application Support: platune@wavepia.com

Absolute Maximum Ratings (not simultaneous) at 25˚C

Parameter	Parameter	Typical Value	Units	Conditions
Threshold voltage @ Id=1mA/mm, Vd=10V	V_{to}	-3.4	V	25°C
Breakdown voltage @ Id=1mA/mm	V_{DG}	160	V	25°C
Drain-source current, Id @ Vd=10V, Vg=0	I_{dss}	800	mA/mm	25°C
Operating Junction Temperature	T_J	225	°C	
Storage Temperature	T_{STG}	-65, +150	°C	
Thermal Resistance, Junction to Case (packaged)	$R_{\theta JC}$		°C/W	
Thermal Resistance, Junction to Case (die only)	$R_{\theta JC}$		°C/W	
Mounting Temperature (30 seconds)	T_S	320	°C	30 seconds

Electrical Characteristics (Frequency = 3.5 GHz unless otherwise stated; TC = 25˚C)

Parameter	Parameter	Typical Value	Units	Conditions
DC Characteristics				
Ohmic contact resistance	RC	0.3	Ohm-mm	25°C
Maximum Drain-source current, Id @ Vd=10V, Vg=1V (1X125μm device)	I_{dmax}	1000	mA/mm	25°C
Max. trans-conductance, @ Vd=10V, Vg=-4V ~ -1V (1X125μm device)	GM_PEAK	290	mS/mm	25°C
Maximum Drain-source current, Id @ Vd=10V, Vg=1V (1X125μm device)	I_{dmax}	1000	mA/mm	25°C
RF Characteristics				
Small Signal Gain	G_{SS}	>12	dB	V_{DD}=48V, I_{DQ}=1000mA
Saturated Power Output	P_{SAT}	200	W	V_{DD}=48V, I_{DQ}=1000mA
Drain Efficiency	η	>55	%	V_{DD}=48V, I_{DQ}=1000mA
Intermodulation Distortion	IM3	<-30	dBc	V_{DD}=48V, I_{DQ}=1000mA
Output Mismatch Stress	VSWR	10:1	ψ	

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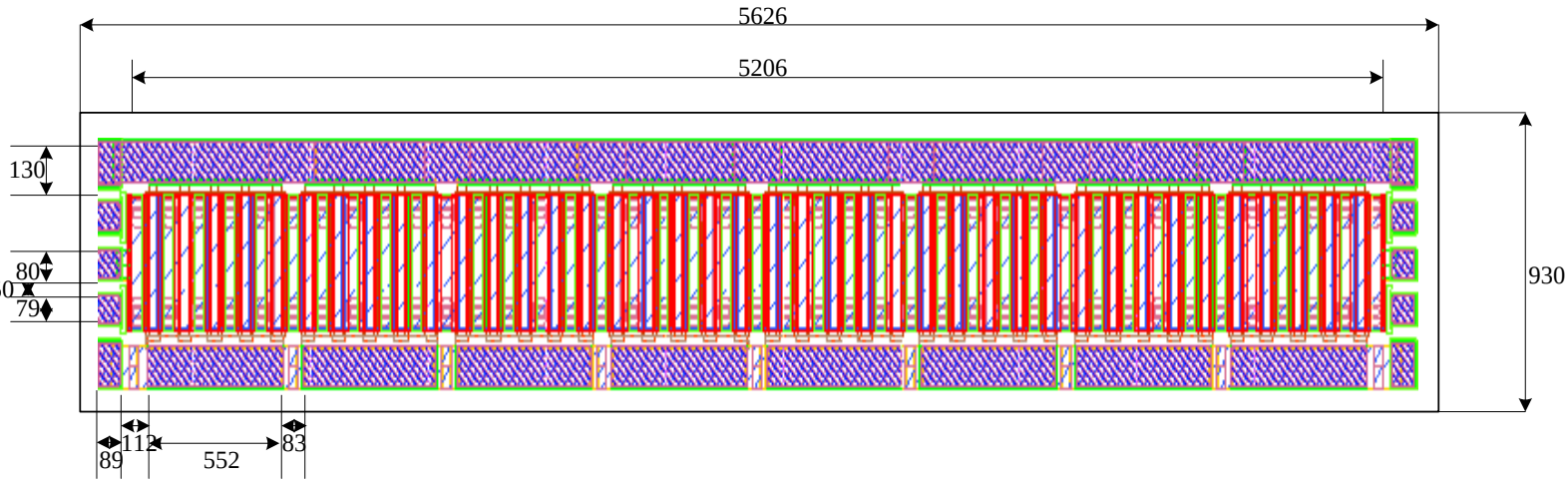
DIE Dimensions (units in microns)



Overall die size 5626 x 930 (+0/-50) microns, die thickness 100 (+/- 10) microns.
All Gate and Drain pads must be wire bonded for electrical connection.

Assembly Notes:

- Recommended solder is AuSn (80/20) solder. Refer to Wavepia's guide for the Eutectic Die Bond Procedure
- Vacuum collet is the preferred method of pick-up.
- The backside of the die is the Source (ground) contact.
- Die back side gold plating is 5 microns thick minimum.
- Thermosonic ball or wedge bonding are the preferred connection methods.
- Gold wire must be used for connections.

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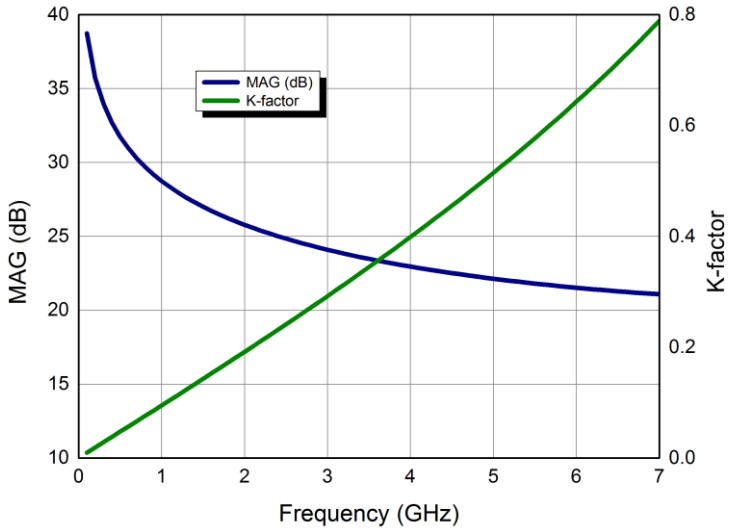
Typical Performance

Simulated Maximum Available Gain(MAG) and K Factor of the WP48005200

V_{DD} = 48 V, I_{DQ} = 1000 mA

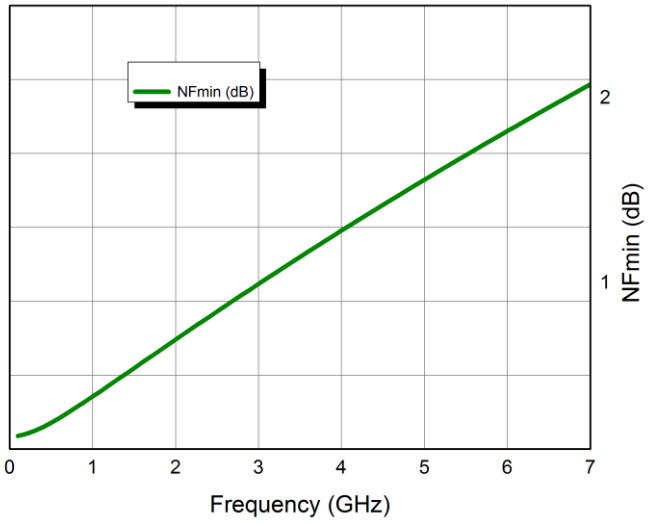


Intrinsic die parameters - reference planes at centers of gate and drain bonding pads. No wire bonds assumed.

Typical Performance

Simulated Minimum Noise Figure of the WP48080400

V_{DD} = 48 V, I_{DQ} = 1000 mA



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Typical Die S-Parameters

(Small Signal, V_{DS} = 48 V, I_{DQ} = 1000 mA, magnitude / angle)

Frequency	Mag S11	Ang S11	Mag S21	Ang S21	Mag S12	Ang S12	Mag S22	Ang S22
100MHz	0.97264	-148.39	34.19395	103.951	0.004581	14.10993	0.799177	-173.862
200MHz	0.971165	-163.855	17.5602	94.6859	0.004705	5.003872	0.813221	-176.336
300MHz	0.970955	-169.161	11.74846	90.44071	0.00472	0.91771	0.816596	-177.009
400MHz	0.970977	-171.822	8.806139	87.50589	0.004717	-1.85804	0.818522	-177.198
500MHz	0.971092	-173.415	7.028843	85.10633	0.004704	-4.09848	0.820207	-177.195
600MHz	0.971263	-174.473	5.837753	82.98172	0.004687	-6.0639	0.821946	-177.099
700MHz	0.971478	-175.224	4.982812	81.02095	0.004665	-7.86537	0.82383	-176.956
800MHz	0.971728	-175.784	4.338468	79.16918	0.00464	-9.55776	0.825887	-176.787
900MHz	0.97201	-176.217	3.834801	77.39656	0.004611	-11.1709	0.828124	-176.606
1000MHz	0.972321	-176.562	3.429798	75.68573	0.004579	-12.7221	0.830534	-176.42
1100MHz	0.972657	-176.842	3.096698	74.02609	0.004545	-14.2219	0.833104	-176.236
1200MHz	0.973015	-177.075	2.81765	72.41092	0.004507	-15.6772	0.835821	-176.056
1300MHz	0.973394	-177.272	2.580292	70.83585	0.004468	-17.0921	0.838667	-175.884
1400MHz	0.973789	-177.441	2.375791	69.29793	0.004426	-18.4697	0.841626	-175.72
1500MHz	0.9742	-177.588	2.197666	67.79519	0.004382	-19.8119	0.84468	-175.567
1600MHz	0.974624	-177.717	2.041057	66.32622	0.004336	-21.1202	0.847813	-175.424
1700MHz	0.975057	-177.831	1.902244	64.89	0.004289	-22.3954	0.851008	-175.293
1800MHz	0.975499	-177.935	1.778332	63.48578	0.00424	-23.6384	0.85425	-175.173
1900MHz	0.975947	-178.028	1.667032	62.11293	0.00419	-24.8497	0.857523	-175.065
2000MHz	0.9764	-178.114	1.566513	60.77095	0.004139	-26.0299	0.860815	-174.968
2100MHz	0.976854	-178.193	1.475288	59.45936	0.004087	-27.1794	0.864111	-174.882
2200MHz	0.97731	-178.266	1.392139	58.17774	0.004035	-28.2986	0.867402	-174.807
2300MHz	0.977765	-178.335	1.316055	56.92563	0.003981	-29.388	0.870677	-174.743
2400MHz	0.978218	-178.4	1.246194	55.7026	0.003927	-30.4479	0.873925	-174.688
2500MHz	0.978667	-178.461	1.181843	54.5082	0.003873	-31.4788	0.877139	-174.643
2600MHz	0.979113	-178.52	1.1224	53.34194	0.003818	-32.4812	0.880312	-174.607
2700MHz	0.979553	-178.576	1.067345	52.20333	0.003764	-33.4555	0.883437	-174.58
2800MHz	0.979987	-178.63	1.016234	51.09186	0.003709	-34.4023	0.886509	-174.56
2900MHz	0.980414	-178.682	0.968682	50.007	0.003654	-35.322	0.889524	-174.548
3000MHz	0.980834	-178.731815	0.92435	48.94818	0.0036	-36.2152	0.892477	-174.542
3100MHz	0.981246	-178.780571	0.882945	47.91486	0.003545	-37.0824	0.895365	-174.543
3200MHz	0.981649	-178.828019	0.844206	46.90645	0.003491	-37.9242	0.898188	-174.55
3300MHz	0.982044	-178.874298	0.807904	45.92236	0.003437	-38.7411	0.900941	-174.563
3400MHz	0.98243	-178.919527	0.773835	44.96201	0.003384	-39.5338	0.903625	-174.58
3500MHz	0.982806	-178.963808	0.741816	44.0248	0.003331	-40.3028	0.906238	-174.602
3600MHz	0.983173	-179.007227	0.711684	43.11014	0.003279	-41.0486	0.908781	-174.628
3700MHz	0.983531	-179.049859	0.683294	42.21741	0.003227	-41.7718	0.911252	-174.658
3800MHz	0.98388	-179.091766	0.656513	41.34604	0.003176	-42.4731	0.913653	-174.692
3900MHz	0.984219	-179.133003	0.631222	40.49542	0.003125	-43.153	0.915983	-174.728

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Typical Die S-Parameters

(Small Signal, V_{DS} = 48 V, I_{DQ} = 1000 mA, magnitude / angle)

Frequency	Mag S11	Ang S11	Mag S21	Ang S21	Mag S12	Ang S12	Mag S22	Ang S22
4000MHz	0.984549	-179.173617	0.607314	39.66498	0.003075	-43.812	0.918245	-174.768
4100MHz	0.984869	-179.214	0.584689	38.85413	0.003025	-44.4507	0.920438	-174.81
4200MHz	0.98518	-179.253	0.563258	38.06231	0.002976	-45.0696	0.922564	-174.854
4300MHz	0.985482	-179.292108	0.542941	37.28897	0.002928	-45.6693	0.924624	-174.9
4400MHz	0.985776	-179.330593	0.523662	36.53354	0.002881	-46.2503	0.926619	-174.948
4500MHz	0.98606	-179.368614	0.505352	35.79549	0.002834	-46.8131	0.928552	-174.998
4600MHz	0.986336	-179.406193	0.48795	35.07431	0.002788	-47.3582	0.930423	-175.049
4700MHz	0.986604	-179.443349	0.471397	34.36947	0.002742	-47.8861	0.932234	-175.102
4800MHz	0.986863	-179.480101	0.45564	33.68048	0.002697	-48.3972	0.933987	-175.155
4900MHz	0.987115	-179.516462	0.440629	33.00685	0.002653	-48.892	0.935683	-175.21
5000MHz	0.987359	-179.552448	0.426321	32.34811	0.00261	-49.371	0.937325	-175.265
5100MHz	0.987595	-179.588072	0.412672	31.70379	0.002567	-49.8346	0.938913	-175.321
5200MHz	0.987824	-179.623344	0.399643	31.07345	0.002525	-50.2831	0.94045	-175.377
5300MHz	0.988046	-179.658	0.387199	30.45667	0.002483	-50.717	0.941937	-175.434
5400MHz	0.98826	-179.692881	0.375306	29.853	0.002442	-51.1367	0.943376	-175.491
5500MHz	0.988468	-179.727165	0.363932	29.26206	0.002402	-51.5426	0.944768	-175.549
5600MHz	0.98867	-179.761138	0.35305	28.68345	0.002363	-51.9349	0.946115	-175.606
5700MHz	0.988865	-179.795	0.34263	28.11678	0.002324	-52.3141	0.947418	-175.664
5800MHz	0.989055	-179.828185	0.332649	27.56168	0.002286	-52.6805	0.94868	-175.722
6000MHz	0.989238	-179.861	0.323083	27.0178	0.002248	-53.0343	0.9499	-175.78
6100MHz	0.989416	-179.894	0.31391	26.4848	0.002211	-53.376	0.951082	-175.837
6200MHz	0.989588	-179.926623	0.305108	25.96234	0.002174	-53.7057	0.952226	-175.895
6300MHz	0.989755	-179.958895	0.296659	25.45009	0.002138	-54.0237	0.953333	-175.952
6400MHz	0.989917	-179.990908	0.288545	24.94776	0.002103	-54.3304	0.954405	-176.009
6500MHz	0.990073	179.977332	0.280749	24.45503	0.002068	-54.6259	0.955443	-176.067
6600MHz	0.990225	179.945819	0.273254	23.97162	0.002034	-54.9105	0.956449	-176.123
6700MHz	0.990373	179.914547	0.266046	23.49724	0.002	-55.1845	0.957423	-176.18
6800MHz	0.990516	179.883511	0.259111	23.03163	0.001967	-55.448	0.958367	-176.236
6900MHz	0.990654	179.8527	0.252436	22.57453	0.001935	-55.7012	0.959281	-176.292
7000MHz	0.990789	179.822123	0.246007	22.12568	0.001902	-55.9444	0.960167	-176.347

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