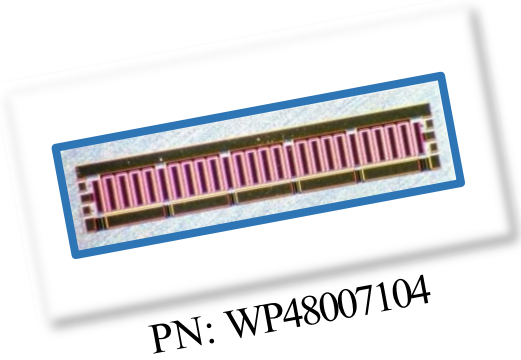
WAVE PIA IC DESIGN

WP48007104

104W, 48V GaN HEMT Die



PN: WP48007104

The WP48007104 is a 104W gallium nitride (GaN) High Electron Mobility Transistor (HEMT). This GaN HEMT is a wideband transistor optimized for 5.8GHz 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

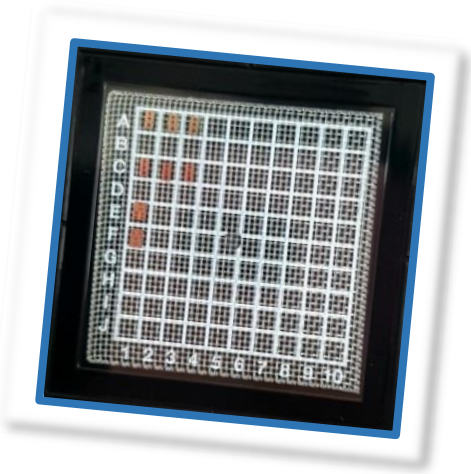
- Up to 8 GHz Operation
- 14.0 dB Typical Small Signal Gain @ 3.5 GHz
- 104 W Typical Psat @5.8GHz
- 48V Operation
- High Breakdown Voltage
- High Breakdown Voltage
- High Efficiency
- Reliability Monitoring Supporting

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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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}=600mA
Saturated Power Output	P_{SAT}	104	W	V_{DD}=48V, I_{DQ}=600mA
Drain Efficiency	η	>60	%	V_{DD}=48V, I_{DQ}=600mA
Intermodulation Distortion	IM3	<-30	dBc	V_{DD}=48V, I_{DQ}=600mA
Output Mismatch Stress	VSWR	10:1	ψ	

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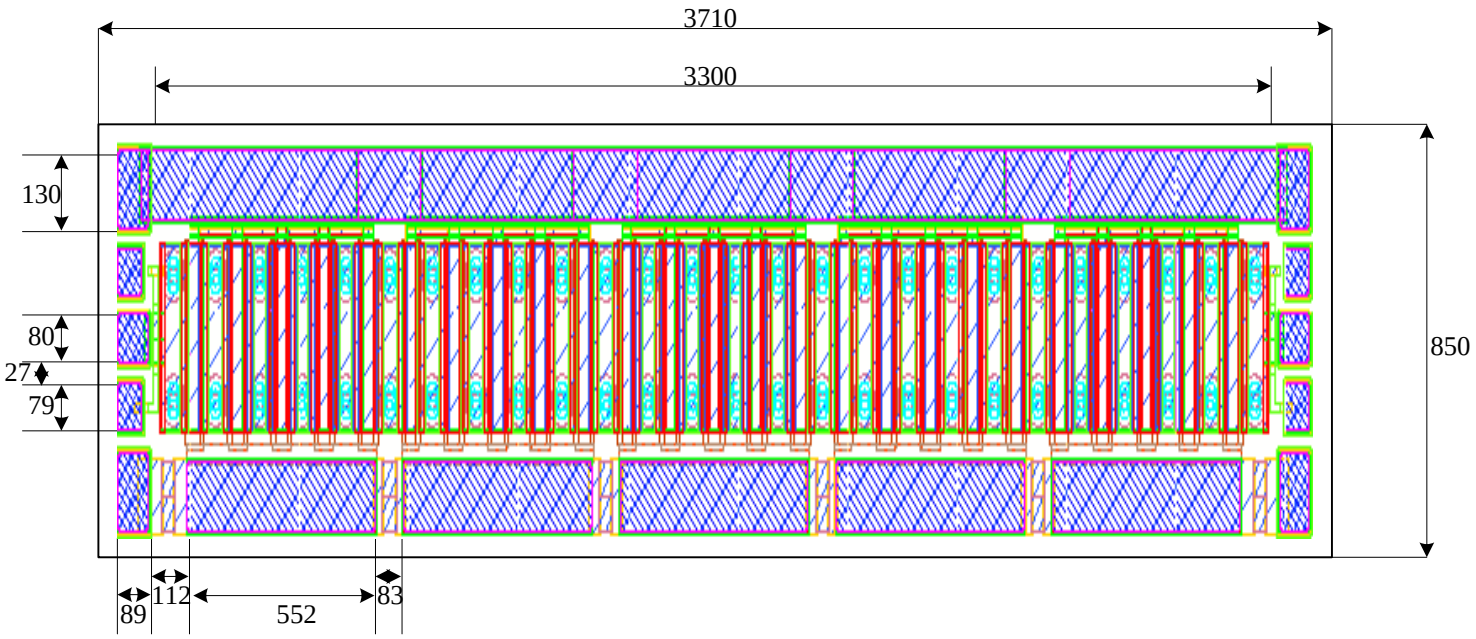
DIE Dimensions (units in microns)



Overall die size 3710 x 850 (+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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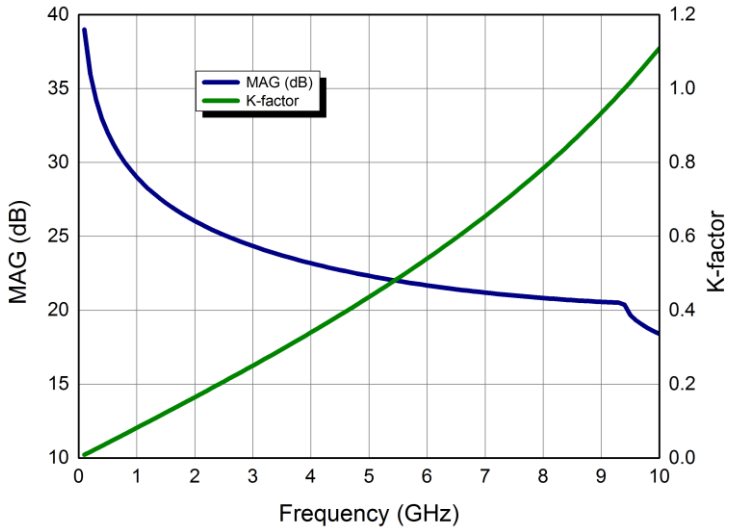
Typical Performance

Simulated Maximum Available Gain (MAG) and K Factor of the WP48007104

V_{DD} = 48 V, I_{DQ} = 600 mA

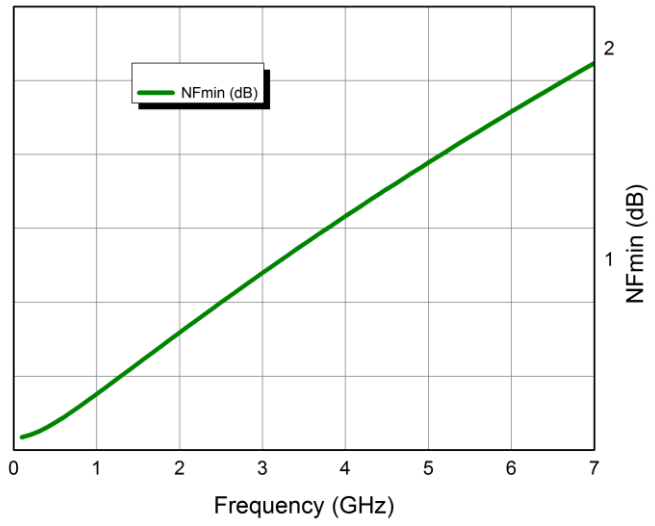


Intrinsic die parameters - reference planes at centers of gate and drain bonding pads. No wire bonds assumed.

Typical Performance

Simulated Minimum Noise Figure of the WP48007104

V_{DD} = 48 V, I_{DQ} = 600 mA



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Typical Die S-Parameters

(Small Signal, V_{DS} = 48 V, I_{DQ} = 600 mA, magnitude / angle)

Frequency	Mag S11	Ang S11	Mag S21	Ang S21	Mag S12	Ang S12	Mag S22	Ang S22
100MHz	0.966451	-115.355	54.80452	120.2714	0.006897	30.42056	0.59824	-159.811
200MHz	0.957718	-144.844	30.74865	104.3057	0.007738	14.60403	0.661279	-167.802
300MHz	0.955657	-156.101	20.98563	97.35368	0.007921	7.801237	0.676724	-170.734
400MHz	0.954997	-161.911	15.85165	93.07822	0.007976	3.675007	0.683447	-172.013
500MHz	0.954808	-165.433	12.70458	89.9283	0.007988	0.674357	0.687738	-172.589
600MHz	0.954833	-167.789	10.58092	87.35637	0.007981	-1.74825	0.691259	-172.811
700MHz	0.954983	-169.472	9.051238	85.12231	0.007962	-3.83293	0.694585	-172.836
800MHz	0.955215	-170.731	7.89626	83.10495	0.007935	-5.70083	0.69795	-172.744
900MHz	0.95551	-171.708	6.99265	81.23691	0.007902	-7.41933	0.701454	-172.582
1000MHz	0.955856	-172.488	6.265802	79.47794	0.007863	-9.02866	0.70514	-172.377
1100MHz	0.956245	-173.123	5.667981	77.80267	0.007819	-10.5542	0.709022	-172.148
1200MHz	0.95667	-173.651	5.167242	76.19443	0.007771	-12.0126	0.713097	-171.907
1300MHz	0.957128	-174.097	4.741405	74.64187	0.00772	-13.4152	0.717357	-171.664
1400MHz	0.957615	-174.479	4.374595	73.13706	0.007665	-14.7699	0.721786	-171.423
1500MHz	0.958128	-174.81	4.055151	71.67433	0.007606	-16.0823	0.726365	-171.19
1600MHz	0.958662	-175.099	3.774318	70.24953	0.007545	-17.3567	0.731076	-170.968
1700MHz	0.959215	-175.355	3.525391	68.85956	0.007481	-18.5961	0.7359	-170.758
1800MHz	0.959785	-175.584	3.303151	67.50209	0.007414	-19.8028	0.740815	-170.563
1900MHz	0.960369	-175.79	3.103474	66.1753	0.007345	-20.9787	0.745803	-170.383
2000MHz	0.960965	-175.976	2.923057	64.87776	0.007274	-22.125	0.750845	-170.219
2100MHz	0.96157	-176.147	2.759223	63.6083	0.007201	-23.2431	0.755923	-170.071
2200MHz	0.962182	-176.303	2.609778	62.366	0.007127	-24.3338	0.761022	-169.939
2300MHz	0.962799	-176.448	2.472909	61.15002	0.007051	-25.398	0.766124	-169.823
2400MHz	0.963419	-176.583	2.347101	59.95969	0.006974	-26.4362	0.771217	-169.723
2500MHz	0.96404	-176.709	2.231078	58.79436	0.006896	-27.4492	0.776287	-169.637
2600MHz	0.964662	-176.827	2.123759	57.65349	0.006816	-28.4375	0.781322	-169.566
2700MHz	0.965282	-176.939	2.02422	56.53655	0.006737	-29.4015	0.786312	-169.509
2800MHz	0.965899	-177.045	1.931667	55.44303	0.006656	-30.3418	0.791247	-169.464
2900MHz	0.966511	-177.146	1.845413	54.37245	0.006575	-31.2589	0.79612	-169.432
3000MHz	0.967119	-177.243	1.76486	53.32436	0.006494	-32.1532	0.800922	-169.412
3100MHz	0.96772	-177.336	1.689485	52.29829	0.006413	-33.0251	0.805647	-169.403
3200MHz	0.968314	-177.425	1.618829	51.2938	0.006331	-33.875	0.810291	-169.404
3300MHz	0.9689	-177.511	1.552486	50.31043	0.00625	-34.7035	0.814849	-169.414
3400MHz	0.969477	-177.594	1.490097	49.34775	0.006168	-35.5109	0.819316	-169.433
3500MHz	0.970045	-177.674	1.431341	48.4053	0.006087	-36.2977	0.823691	-169.461
3600MHz	0.970604	-177.753	1.375932	47.48264	0.006006	-37.0643	0.827971	-169.496
3700MHz	0.971153	-177.829	1.323613	46.57934	0.005926	-37.8111	0.832155	-169.538
3800MHz	0.971691	-177.903	1.274153	45.69496	0.005846	-38.5386	0.83624	-169.586
3900MHz	0.972218	-177.976	1.227343	44.82905	0.005766	-39.2471	0.840227	-169.641

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Typical Die S-Parameters

(Small Signal, V_{DS} = 48 V, I_{DQ} = 600 mA, magnitude / angle)

Frequency	Mag S11	Ang S11	Mag S21	Ang S21	Mag S12	Ang S12	Mag S22	Ang S22
4000MHz	0.972735	-178.047	1.182994	43.98119	0.005687	-39.9371	0.844115	-169.7
4100MHz	0.973241	-178.116	1.140936	43.15095	0.005608	-40.609	0.847905	-169.765
4200MHz	0.973735	-178.184	1.101011	42.33789	0.005531	-41.2633	0.851596	-169.834
4300MHz	0.974218	-178.251	1.063077	41.5416	0.005453	-41.9002	0.855191	-169.907
4400MHz	0.974691	-178.317	1.027004	40.76166	0.005377	-42.5203	0.858689	-169.983
4500MHz	0.975152	-178.381469	0.992673	39.99766	0.005301	-43.1238	0.862092	-170.063
4600MHz	0.975601	-178.445	0.959973	39.24919	0.005227	-43.7113	0.865401	-170.146
4700MHz	0.97604	-178.507598	0.928803	38.51585	0.005152	-44.2831	0.868618	-170.231
4800MHz	0.976468	-178.569255	0.899071	37.79724	0.005079	-44.8395	0.871745	-170.319
4900MHz	0.976885	-178.630041	0.87069	37.093	0.005007	-45.3809	0.874784	-170.409
5000MHz	0.977292	-178.69	0.843581	36.40273	0.004935	-45.9077	0.877736	-170.5
5100MHz	0.977688	-178.749173	0.817671	35.72606	0.004864	-46.4202	0.880603	-170.593
5200MHz	0.978074	-178.808	0.79289	35.06263	0.004794	-46.9188	0.883388	-170.687
5300MHz	0.978449	-178.8653	0.769175	34.4121	0.004725	-47.4038	0.886092	-170.783
5400MHz	0.978815	-178.922317	0.746467	33.7741	0.004657	-47.8756	0.888718	-170.879
5500MHz	0.979171	-178.979	0.724712	33.1483	0.00459	-48.3343	0.891267	-170.976
5600MHz	0.979517	-179.034398	0.703857	32.53438	0.004524	-48.7805	0.893742	-171.074
5700MHz	0.979854	-179.089512	0.683855	31.93201	0.004458	-49.2142	0.896145	-171.172
5800MHz	0.980182	-179.144037	0.664661	31.34087	0.004393	-49.636	0.898477	-171.27
6000MHz	0.980501	-179.197993	0.646234	30.76067	0.004329	-50.0459	0.900742	-171.369
6100MHz	0.980812	-179.2514	0.628533	30.19109	0.004266	-50.4443	0.90294	-171.468
6200MHz	0.981114	-179.304276	0.611522	29.63187	0.004204	-50.8315	0.905074	-171.567
6300MHz	0.981408	-179.356637	0.595167	29.0827	0.004143	-51.2077	0.907146	-171.666
6400MHz	0.981694	-179.408498	0.579435	28.54332	0.004083	-51.5732	0.909158	-171.765
6500MHz	0.981972	-179.459875	0.564296	28.01347	0.004023	-51.9281	0.911111	-171.863
6600MHz	0.982243	-179.510781	0.549722	27.49288	0.003964	-52.2728	0.913008	-171.961
6700MHz	0.982506	-179.56123	0.535684	26.9813	0.003906	-52.6074	0.91485	-172.059
6800MHz	0.982762	-179.611234	0.522158	26.4785	0.003849	-52.9322	0.916639	-172.157
6900MHz	0.983011	-179.660806	0.509121	25.98423	0.003792	-53.2473	0.918377	-172.254
7000MHz	0.983253	-179.709956	0.496549	25.49827	0.003737	-53.553	0.920064	-172.35
7100MHz	0.983489	-179.758696	0.48442	25.02039	0.003682	-53.8494	0.921704	-172.446
7200MHz	0.983719	-179.807037	0.472716	24.55038	0.003628	-54.1367	0.923297	-172.542
7300MHz	0.983942	-179.854987	0.461417	24.08803	0.003574	-54.4151	0.924845	-172.636
7400MHz	0.98416	-179.902558	0.450505	23.63313	0.003521	-54.6848	0.926349	-172.731
7500MHz	0.984371	-179.949759	0.439963	23.18549	0.003469	-54.9459	0.927812	-172.824
7600MHz	0.984577	-179.996597	0.429775	22.74492	0.003418	-55.1985	0.929233	-172.917
7700MHz	0.984778	179.956917	0.419925	22.31123	0.003367	-55.4429	0.930615	-173.009
7800MHz	0.984973	179.910776	0.4104	21.88425	0.003317	-55.6791	0.931958	-173.101
7900MHz	0.985163	179.864971	0.401186	21.4638	0.003268	-55.9073	0.933265	-173.192

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