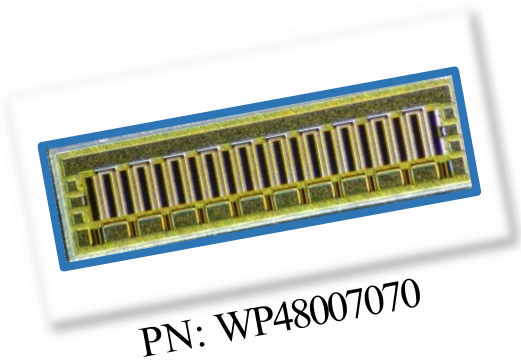
WAVE PIA IC DESIGN

WP48007070

70W, 48V GaN HEMT Die



PN: WP48007070

The WP48007070 is a 70W 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

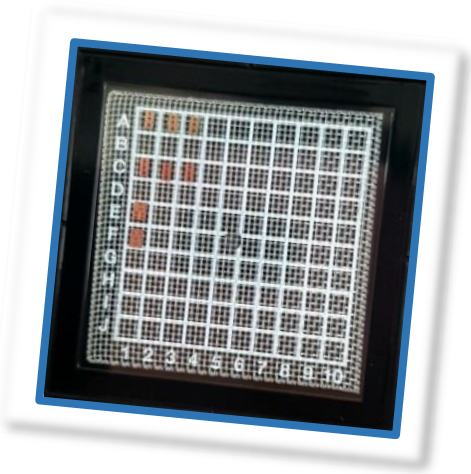
- Up to 8 GHz Operation
- 14.0 dB Typical Small Signal Gain @ 3.5 GHz
- 70 W Typical Psat @5.8GHz
- 48V Operation
- High Breakdown Voltage
- High Breakdown Voltage
- High Efficiency
- Reliability Monitoring Supporting

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}	>13	dB	V_{DD}=48V, I_{DQ}=450mA
Saturated Power Output	P_{SAT}	75	W	V_{DD}=48V, I_{DQ}=450mA
Drain Efficiency	η	>60	%	V_{DD}=48V, I_{DQ}=450mA
Intermodulation Distortion	IM3	<-30	dBc	V_{DD}=48V, I_{DQ}=450mA
Output Mismatch Stress	VSWR	10:1	ψ	

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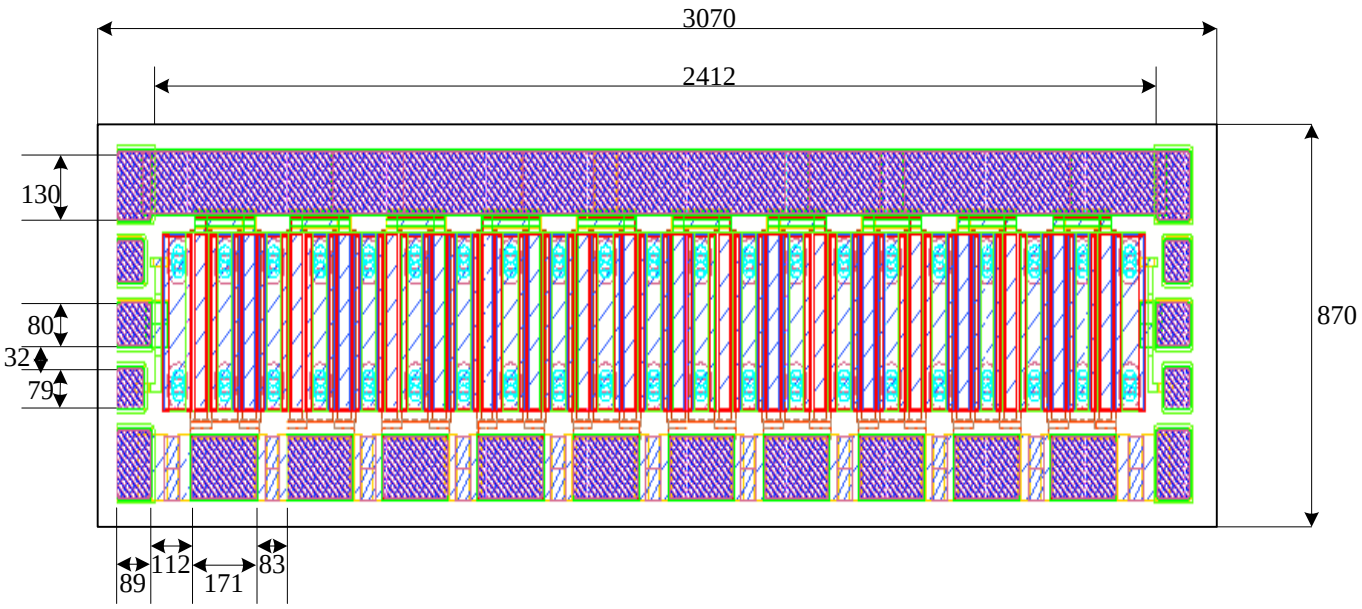
DIE Dimensions (units in microns)



Overall die size 3070 x 870 (+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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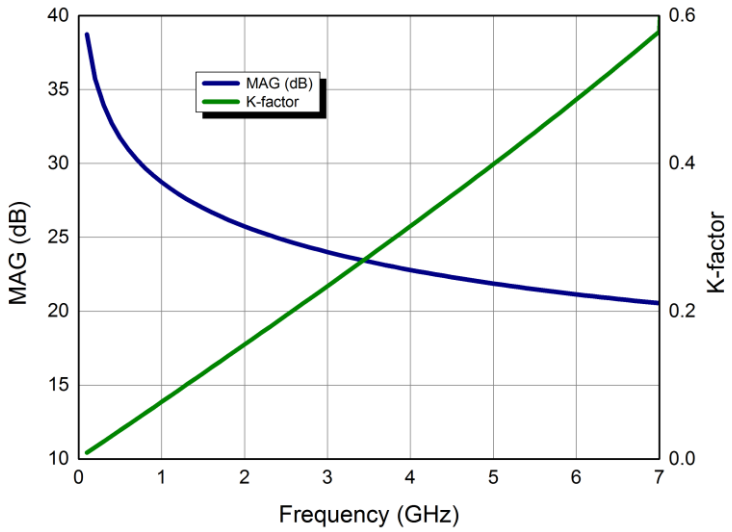
Typical Performance

Simulated Maximum Available Gain (MAG) and K Factor of the WP48007070

V_{DD} = 48 V, I_{DQ} = 450 mA

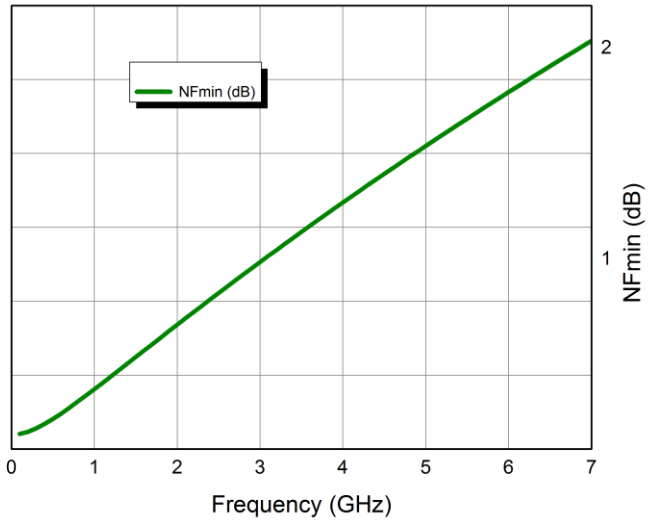


Intrinsic die parameters - reference planes at centers of gate and drain bonding pads. No wire bonds assumed.

Typical Performance

Simulated Minimum Noise Figure of the WP48007070

V_{DD} = 48 V, I_{DQ} = 450 mA



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Typical Die S-Parameters

(Small Signal, V_{DS} = 48 V, I_{DQ} = 450 mA, magnitude / angle)

Frequency	Mag S11	Ang S11	Mag S21	Ang S21	Mag S12	Ang S12	Mag S22	Ang S22
100MHz	0.965666	-103.347	57.93143	126.1001	0.007761	36.21454	0.507722	-150.652
200MHz	0.952597	-136.79	34.06968	108.1486	0.009128	18.37754	0.592949	-161.971
300MHz	0.949065	-150.335	23.53849	100.071	0.009459	10.41444	0.615511	-166.376
400MHz	0.947827	-157.443	17.86247	95.15514	0.00957	5.613052	0.625325	-168.382
500MHz	0.947376	-161.778	14.34743	91.60005	0.009608	2.172457	0.631407	-169.349
600MHz	0.947281	-164.682	11.96312	88.75025	0.009612	-0.56285	0.636223	-169.788
700MHz	0.947383	-166.756	10.2405	86.31414	0.009598	-2.88445	0.640644	-169.93
800MHz	0.94761	-168.307	8.937358	84.14337	0.009571	-4.94069	0.645027	-169.896
900MHz	0.947927	-169.507	7.916496	82.15497	0.009536	-6.81455	0.64953	-169.754
1000MHz	0.948314	-170.461	7.094565	80.29915	0.009493	-8.55583	0.654223	-169.546
1100MHz	0.948759	-171.237	6.418067	78.54437	0.009444	-10.196	0.65913	-169.299
1200MHz	0.949252	-171.879	5.851122	76.86981	0.00939	-11.756	0.664254	-169.033
1300MHz	0.949787	-172.419	5.368778	75.26125	0.009331	-13.2499	0.669584	-168.759
1400MHz	0.950358	-172.878	4.953152	73.70869	0.009268	-14.6879	0.675104	-168.487
1500MHz	0.950961	-173.274	4.591098	72.20493	0.009201	-16.077	0.680791	-168.223
1600MHz	0.95159	-173.619	4.272732	70.74466	0.00913	-17.4226	0.686622	-167.971
1700MHz	0.952243	-173.922	3.990487	69.32392	0.009057	-18.7286	0.692573	-167.735
1800MHz	0.952916	-174.19	3.738465	67.93968	0.00898	-19.9981	0.698618	-167.515
1900MHz	0.953606	-174.43	3.512004	66.58957	0.008901	-21.2334	0.704735	-167.315
2000MHz	0.954309	-174.646	3.30737	65.27172	0.008819	-22.4365	0.7109	-167.134
2100MHz	0.955023	-174.842	3.121534	63.98461	0.008735	-23.6087	0.717092	-166.973
2200MHz	0.955746	-175.02	2.952015	62.727	0.00865	-24.7514	0.723291	-166.831
2300MHz	0.956474	-175.183	2.796758	61.49782	0.008563	-25.8657	0.729478	-166.709
2400MHz	0.957205	-175.334	2.654049	60.29617	0.008474	-26.9524	0.735638	-166.605
2500MHz	0.957937	-175.474	2.522443	59.12123	0.008385	-28.0123	0.741754	-166.519
2600MHz	0.95867	-175.604	2.400715	57.9723	0.008294	-29.0462	0.747814	-166.451
2700MHz	0.959399	-175.726	2.287818	56.8487	0.008203	-30.0547	0.753804	-166.398
2800MHz	0.960125	-175.841	2.182852	55.74982	0.008111	-31.0384	0.759715	-166.361
2900MHz	0.960845	-175.949	2.085037	54.67506	0.008019	-31.998	0.765538	-166.338
3000MHz	0.961559	-176.052	1.993696	53.62388	0.007926	-32.9339	0.771264	-166.329
3100MHz	0.962264	-176.15	1.908236	52.59571	0.007833	-33.8468	0.776887	-166.332
3200MHz	0.962961	-176.243	1.828135	51.59005	0.007741	-34.7371	0.782401	-166.347
3300MHz	0.963648	-176.332	1.752932	50.60636	0.007648	-35.6053	0.787803	-166.372
3400MHz	0.964325	-176.417	1.68222	49.64414	0.007556	-36.4521	0.793087	-166.408
3500MHz	0.96499	-176.499	1.615635	48.70289	0.007464	-37.2778	0.798252	-166.452
3600MHz	0.965643	-176.579	1.552851	47.78211	0.007373	-38.0829	0.803297	-166.505
3700MHz	0.966285	-176.655	1.493578	46.88131	0.007282	-38.868	0.808218	-166.565
3800MHz	0.966914	-176.729	1.437551	46	0.007191	-39.6336	0.813016	-166.632
3900MHz	0.96753	-176.801	1.384535	45.13771	0.007102	-40.3801	0.817692	-166.705

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Typical Die S-Parameters

(Small Signal, V_{DS} = 48 V, I_{DQ} = 450 mA, magnitude / angle)

Frequency	Mag S11	Ang S11	Mag S21	Ang S21	Mag S12	Ang S12	Mag S22	Ang S22
4000MHz	0.968132	-176.871	1.334314	44.29396	0.007013	-41.1079	0.822244	-166.784
4100MHz	0.968722	-176.939	1.286694	43.46829	0.006925	-41.8176	0.826674	-166.868
4200MHz	0.969298	-177.005	1.241496	42.66024	0.006837	-42.5096	0.830983	-166.956
4300MHz	0.969861	-177.069	1.19856	41.86934	0.006751	-43.1844	0.835173	-167.048
4400MHz	0.970411	-177.132	1.157736	41.09517	0.006666	-43.8423	0.839245	-167.144
4500MHz	0.970947	-177.194	1.118889	40.33726	0.006581	-44.4839	0.843202	-167.243
4600MHz	0.97147	-177.254	1.081894	39.59521	0.006498	-45.1096	0.847044	-167.345
4700MHz	0.97198	-177.313	1.046637	38.86857	0.006415	-45.7198	0.850776	-167.449
4800MHz	0.972477	-177.37	1.01301	38.15694	0.006334	-46.3148	0.854398	-167.555
4900MHz	0.972961	-177.426901	0.980917	37.45992	0.006253	-46.8952	0.857914	-167.663
5000MHz	0.973433	-177.482343	0.950267	36.77709	0.006174	-47.4612	0.861326	-167.772
5100MHz	0.973892	-177.53676	0.920976	36.10808	0.006096	-48.0134	0.864637	-167.883
5200MHz	0.974339	-177.590197	0.892967	35.4525	0.006019	-48.552	0.867849	-167.994
5300MHz	0.974774	-177.6427	0.866167	34.80998	0.005942	-49.0774	0.870965	-168.107
5400MHz	0.975197	-177.694307	0.840509	34.18017	0.005867	-49.5901	0.873988	-168.219
5500MHz	0.975609	-177.745056	0.81593	33.5627	0.005793	-50.0902	0.876921	-168.333
5600MHz	0.97601	-177.794981	0.792373	32.95724	0.005721	-50.5783	0.879765	-168.446
5700MHz	0.9764	-177.844113	0.769782	32.36345	0.005649	-51.0546	0.882524	-168.56
5800MHz	0.976779	-177.892481	0.748106	31.78101	0.005578	-51.5194	0.8852	-168.673
6000MHz	0.977148	-177.940113	0.727299	31.20959	0.005508	-51.973	0.887796	-168.787
6100MHz	0.977506	-177.987034	0.707315	30.6489	0.00544	-52.4158	0.890315	-168.9
6200MHz	0.977855	-178.033268	0.688114	30.09863	0.005372	-52.8481	0.892758	-169.012
6300MHz	0.978194	-178.078837	0.669654	29.55849	0.005305	-53.2701	0.895128	-169.125
6400MHz	0.978524	-178.123762	0.651901	29.0282	0.00524	-53.6821	0.897428	-169.236
6500MHz	0.978844	-178.168063	0.634818	28.50749	0.005175	-54.0844	0.899659	-169.347
6600MHz	0.979156	-178.21176	0.618374	27.99609	0.005112	-54.4773	0.901825	-169.458
6700MHz	0.97946	-178.254869	0.602539	27.49375	0.005049	-54.8609	0.903926	-169.567
6800MHz	0.979755	-178.297408	0.587283	27.00021	0.004987	-55.2356	0.905966	-169.676
6900MHz	0.980042	-178.339394	0.572578	26.51522	0.004927	-55.6016	0.907946	-169.784
7000MHz	0.925	-172.711	2.17	43.625	0.018	-38.173	0.678	-132.405

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