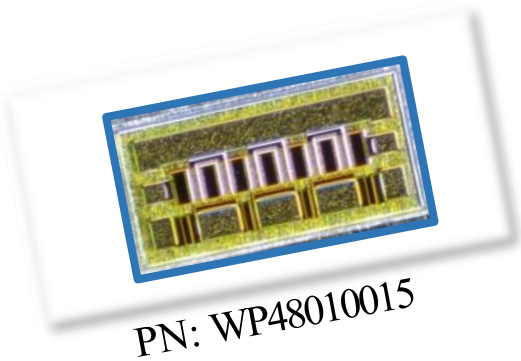
WAVE PIA IC DESIGN

WP48010015

15W, 48V GaN HEMT Die



PN: WP48010015

The WP48010015 is a 15W gallium nitride (GaN) High Electron Mobility Transistor (HEMT). This GaN HEMT is a wideband transistor optimized for X-band 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

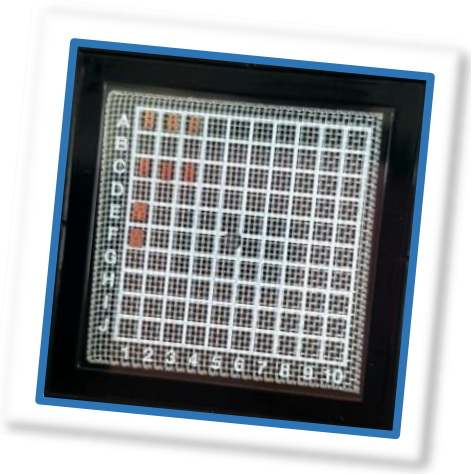
- Up to 10 GHz Operation
- 10 dB Typical Small Signal Gain @ 8.15 GHz
- 15 W Typical Psat @8.15GHz
- 48V Operation
- High Breakdown Voltage
- High Breakdown Voltage
- High Efficiency
- Reliability Monitoring Supporting

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 = 8.15 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}	10.1	dB	V_{DD}=48V, I_{DQ}=100mA
Saturated Power Output	P_{SAT}	15	W	V_{DD}=48V, I_{DQ}=100mA
Drain Efficiency	η	>40	%	V_{DD}=48V, I_{DQ}=100mA
Intermodulation Distortion	IM3	<-30	dBc	V_{DD}=48V, I_{DQ}=100mA
Output Mismatch Stress	VSWR	10:1	ψ	

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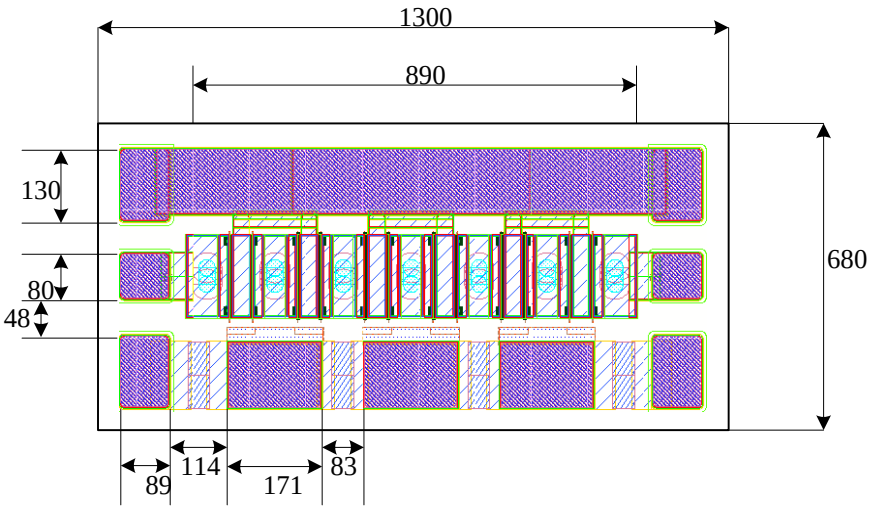
DIE Dimensions (units in microns)



Overall die size 1300 x 680 (+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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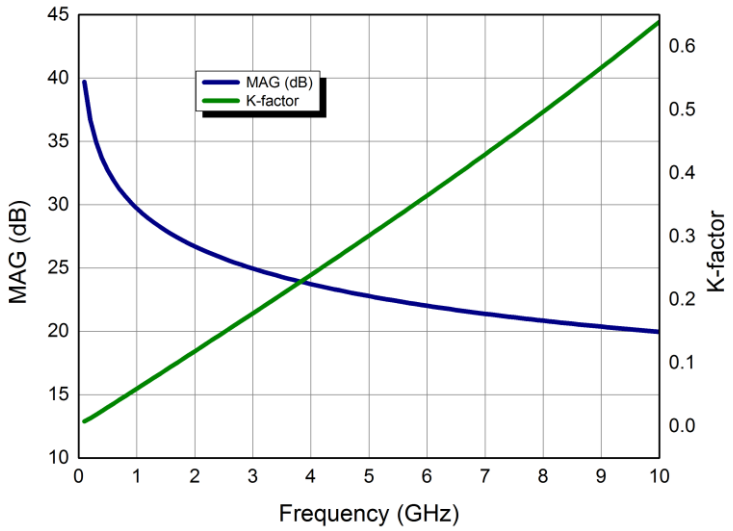
Typical Performance

Simulated small-signal gain (S21) and K Factor of the WP48010015

V_{DD} = 48 V, I_{DQ} = 100 mA

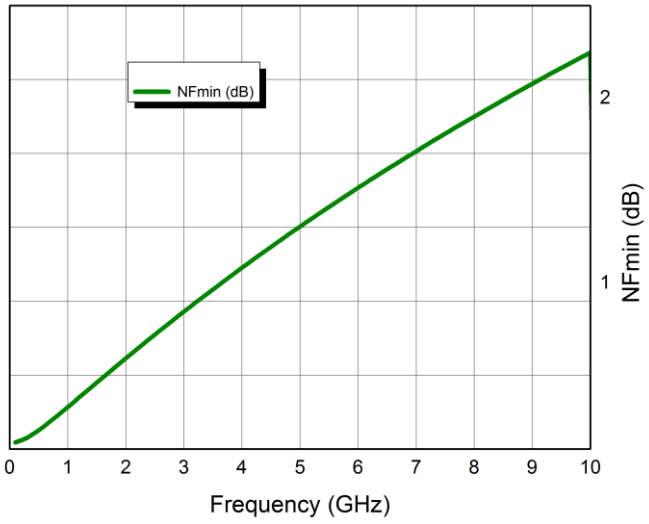


Intrinsic die parameters - reference planes at centers of gate and drain bonding pads. No wire bonds assumed.

Typical Performance

Simulated Minimum Noise Figure of the WP48010015

V_{DD} = 48 V, I_{DQ} = 100 mA



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Typical Die S-Parameters

(Small Signal, V_{DS} = 48 V, I_{DQ} = 100 mA, magnitude / angle)

Frequency	Mag S11	Ang S11	Mag S21	Ang S21	Mag S12	Ang S12	Mag S22	Ang S22
100MHz	0.998403	-12.7	29.56339	172.668	0.003162	82.77226	0.635383	-6.2934
200MHz	0.99475	-25.0924	28.97599	165.5135	0.006198	75.722	0.626143	-12.4194
300MHz	0.989235	-36.9124	28.06967	158.6872	0.009005	68.99997	0.612017	-18.237
400MHz	0.982523	-47.9669	26.93162	152.2958	0.01152	62.71285	0.594525	-23.6484
500MHz	0.975262	-58.1432	25.65166	146.3977	0.013715	56.91894	0.575218	-28.6034
600MHz	0.967977	-67.4008	24.30796	141.0089	0.015594	51.63443	0.555426	-33.0925
700MHz	0.961029	-75.754	22.96044	136.1151	0.017184	46.84483	0.536147	-37.1358
800MHz	0.954627	-83.2528	21.65035	131.6827	0.018516	42.51673	0.518042	-40.7707
900MHz	0.948866	-89.9671	20.40315	127.669	0.019629	38.60732	0.501494	-44.0428
1000MHz	0.943763	-95.9744	19.23246	124.0284	0.020556	35.07102	0.48668	-46.999
1100MHz	0.939289	-101.353	18.14365	120.7166	0.021329	31.86348	0.473636	-49.684
1200MHz	0.935395	-106.175	17.13684	117.6926	0.021974	28.94374	0.462312	-52.138
1300MHz	0.932018	-110.51	16.20896	114.9197	0.022513	26.27516	0.452607	-54.3961
1400MHz	0.929097	-114.416	15.35521	112.3658	0.022964	23.82555	0.444397	-56.4884
1500MHz	0.926574	-117.946	14.57	110.003	0.023342	21.56702	0.437552	-58.44
1600MHz	0.924396	-121.146	13.84752	107.8071	0.02366	19.47553	0.431938	-60.2719
1700MHz	0.922518	-124.056	13.18208	105.7577	0.023926	17.53045	0.427432	-62.0016
1800MHz	0.920898	-126.71	12.56835	103.837	0.024149	15.7141	0.423919	-63.6433
1900MHz	0.919502	-129.139	12.00135	102.0299	0.024335	14.01132	0.421294	-65.2089
2000MHz	0.918301	-131.367	11.47658	100.3234	0.02449	12.40912	0.419463	-66.7081
2100MHz	0.917269	-133.418	10.98996	98.70617	0.024619	10.89629	0.418341	-68.1489
2200MHz	0.916385	-135.31	10.53785	97.1687	0.024724	9.46321	0.417852	-69.5378
2300MHz	0.915631	-137.06	10.11697	95.70263	0.024809	8.101531	0.41793	-70.8804
2400MHz	0.91499	-138.684	9.724405	94.30071	0.024876	6.804027	0.418514	-72.1811
2500MHz	0.91445	-140.193	9.357548	92.95667	0.024928	5.56441	0.419552	-73.4438
2600MHz	0.913998	-141.6	9.014081	91.66502	0.024966	4.377194	0.420997	-74.6716
2700MHz	0.913625	-142.913	8.69193	90.42095	0.024992	3.237579	0.422806	-75.8673
2800MHz	0.913323	-144.142	8.389246	89.22025	0.025007	2.141347	0.424941	-77.0332
2900MHz	0.913084	-145.294	8.104374	88.0592	0.025012	1.084787	0.42737	-78.1711
3000MHz	0.9129	-146.376	7.835832	86.93453	0.025009	0.064619	0.430061	-79.2829
3100MHz	0.912768	-147.395	7.582289	85.84334	0.024997	-0.92206	0.432988	-80.3701
3200MHz	0.912682	-148.355	7.34255	84.78302	0.024978	-1.87783	0.436125	-81.4339
3300MHz	0.912636	-149.262	7.115539	83.7513	0.024953	-2.805	0.439452	-82.4755
3400MHz	0.912629	-150.12	6.900285	82.74612	0.024922	-3.70561	0.442949	-83.4959
3500MHz	0.912656	-150.932	6.695911	81.76563	0.024885	-4.5815	0.446596	-84.4962
3600MHz	0.912714	-151.703	6.501623	80.80818	0.024843	-5.43433	0.450378	-85.4771
3700MHz	0.9128	-152.435	6.316701	79.87229	0.024796	-6.26558	0.45428	-86.4394
3800MHz	0.912912	-153.131	6.14049	78.95662	0.024745	-7.07659	0.458289	-87.3838
3900MHz	0.913049	-153.795	5.972393	78.05996	0.02469	-7.86857	0.462391	-88.3111

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Typical Die S-Parameters

(Small Signal, V_{DS} = 48 V, I_{DQ} = 100 mA, magnitude / angle)

Frequency	Mag S11	Ang S11	Mag S21	Ang S21	Mag S12	Ang S12	Mag S22	Ang S22
4000MHz	0.913207	-154.427	5.811868	77.18121	0.024631	-8.64262	0.466576	-89.2218
4100MHz	0.913385	-155.031	5.658418	76.31936	0.024569	-9.39973	0.470834	-90.1164
4200MHz	0.913582	-155.608	5.511589	75.47352	0.024503	-10.1408	0.475154	-90.9955
4300MHz	0.913795	-156.16	5.370964	74.64285	0.024434	-10.8667	0.479528	-91.8597
4400MHz	0.914025	-156.69	5.23616	73.8266	0.024362	-11.5782	0.483949	-92.7094
4500MHz	0.914269	-157.197	5.106827	73.02408	0.024288	-12.2758	0.488408	-93.5449
4600MHz	0.914526	-157.684	4.982639	72.23464	0.024211	-12.9604	0.4929	-94.3669
4700MHz	0.914795	-158.152	4.863299	71.45771	0.024131	-13.6325	0.497417	-95.1755
4800MHz	0.915076	-158.602	4.748531	70.69275	0.02405	-14.2925	0.501955	-95.9714
4900MHz	0.915367	-159.035	4.638079	69.93927	0.023966	-14.9411	0.506507	-96.7547
5000MHz	0.915667	-159.453	4.531706	69.19679	0.02388	-15.5786	0.511069	-97.5258
5100MHz	0.915977	-159.855	4.429194	68.46491	0.023793	-16.2054	0.515637	-98.2851
5200MHz	0.916294	-160.244	4.330338	67.74322	0.023704	-16.8221	0.520206	-99.0328
5300MHz	0.916619	-160.619	4.23495	67.03136	0.023613	-17.4289	0.524773	-99.7694
5400MHz	0.916951	-160.981	4.142852	66.32899	0.02352	-18.0261	0.529333	-100.495
5500MHz	0.917289	-161.332	4.05388	65.63579	0.023426	-18.6142	0.533885	-101.21
5600MHz	0.917632	-161.672	3.96788	64.95146	0.023331	-19.1934	0.538423	-101.914
5700MHz	0.917981	-162.001	3.884709	64.27574	0.023234	-19.7639	0.542947	-102.609
5800MHz	0.918334	-162.32	3.804233	63.60835	0.023136	-20.326	0.547453	-103.293
6000MHz	0.918692	-162.629	3.726326	62.94906	0.023037	-20.8801	0.551939	-103.968
6100MHz	0.919053	-162.929	3.65087	62.29763	0.022937	-21.4262	0.556403	-104.633
6200MHz	0.919417	-163.221	3.577753	61.65385	0.022836	-21.9646	0.560843	-105.29
6300MHz	0.919785	-163.505	3.506873	61.01752	0.022734	-22.4955	0.565257	-105.937
6400MHz	0.920155	-163.78	3.438132	60.38844	0.022631	-23.0192	0.569643	-106.575
6500MHz	0.920528	-164.049	3.371436	59.76643	0.022527	-23.5357	0.574	-107.205
6600MHz	0.920902	-164.31	3.3067	59.15132	0.022423	-24.0453	0.578326	-107.826
6700MHz	0.921279	-164.564	3.243842	58.54294	0.022318	-24.5482	0.58262	-108.439
6800MHz	0.921656	-164.812	3.182784	57.94115	0.022212	-25.0444	0.586882	-109.044
6900MHz	0.922035	-165.054	3.123454	57.34579	0.022105	-25.5341	0.591109	-109.641
7000MHz	0.922414	-165.29	3.065782	56.75672	0.021998	-26.0175	0.595301	-110.23
7100MHz	0.922794	-165.52	3.009702	56.17381	0.021891	-26.4947	0.599457	-110.811
7200MHz	0.923175	-165.745	2.955154	55.59692	0.021783	-26.9658	0.603576	-111.385
7300MHz	0.923555	-165.965	2.902079	55.02595	0.021674	-27.4309	0.607658	-111.952
7400MHz	0.923936	-166.18	2.85042	54.46075	0.021566	-27.8903	0.611702	-112.512
7500MHz	0.924316	-166.39	2.800125	53.90124	0.021457	-28.3439	0.615708	-113.064
7600MHz	0.924696	-166.596	2.751144	53.34729	0.021347	-28.7918	0.619674	-113.61
7700MHz	0.925075	-166.797	2.703429	52.7988	0.021237	-29.2343	0.623601	-114.149
7800MHz	0.925454	-166.994	2.656935	52.25567	0.021127	-29.6714	0.627488	-114.681
7900MHz	0.925832	-167.187	2.611618	51.71781	0.021017	-30.1031	0.631335	-115.207

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