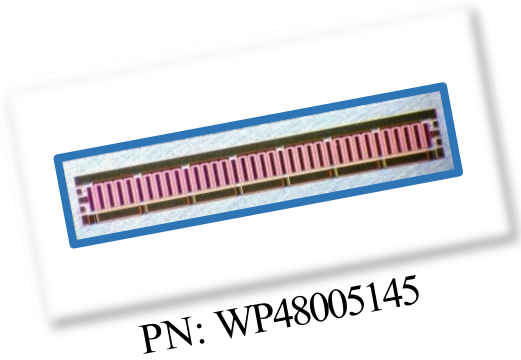
WAVE PIA IC DESIGN

WP48005145

145W, 48V GaN HEMT Die



PN: WP48005145

The WP48005145 is a 145W 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

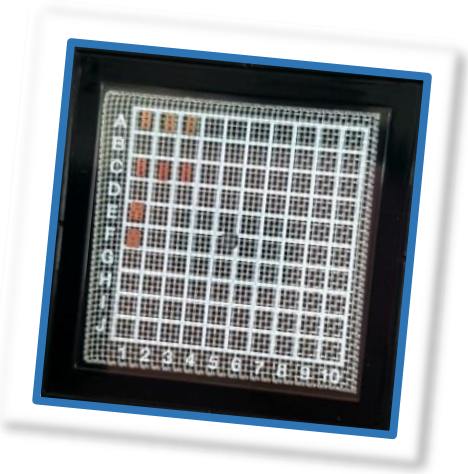
- Up to 8 GHz Operation
- 14.0 dB Typical Small Signal Gain @ 3.5 GHz
- 145 W Typical Psat @3.5GHz
- 48V Operation
- High Breakdown Voltage
- High Breakdown Voltage
- High Efficiency
- Reliability Monitoring Supporting

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}=300mA
Saturated Power Output	P_{SAT}	145	W	V_{DD}=48V, I_{DQ}=300mA
Drain Efficiency	η	>60	%	V_{DD}=48V, I_{DQ}=300mA
Intermodulation Distortion	IM3	<-30	dBc	V_{DD}=48V, I_{DQ}=300mA
Output Mismatch Stress	VSWR	10:1	ψ	

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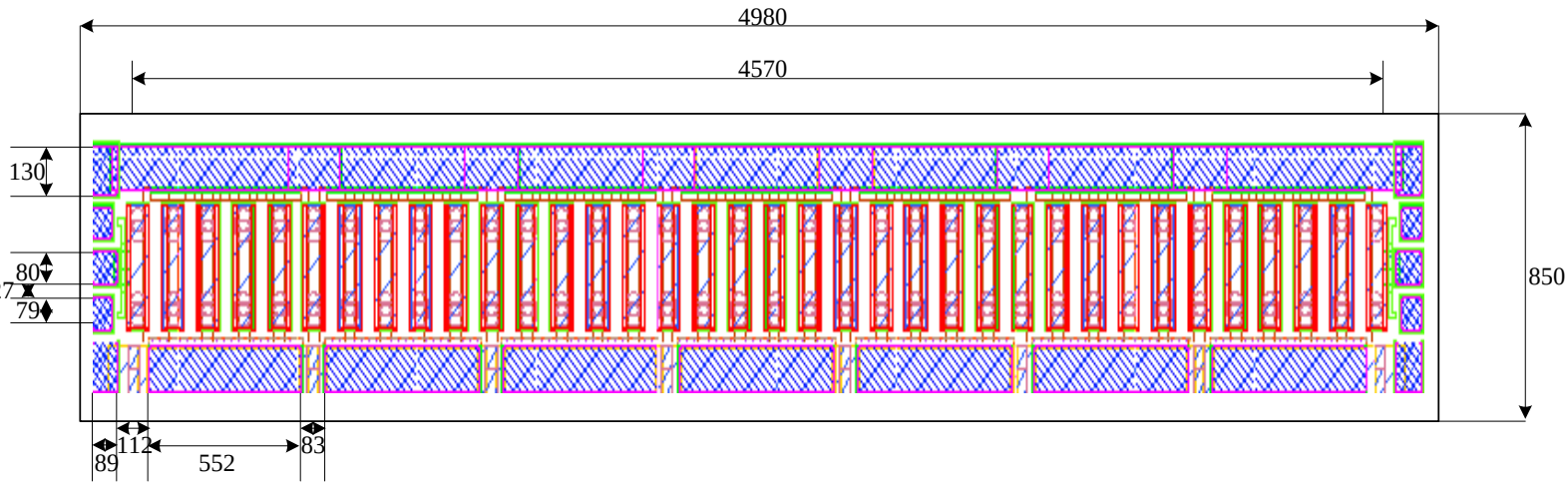
DIE Dimensions (units in microns)



Overall die size 4980 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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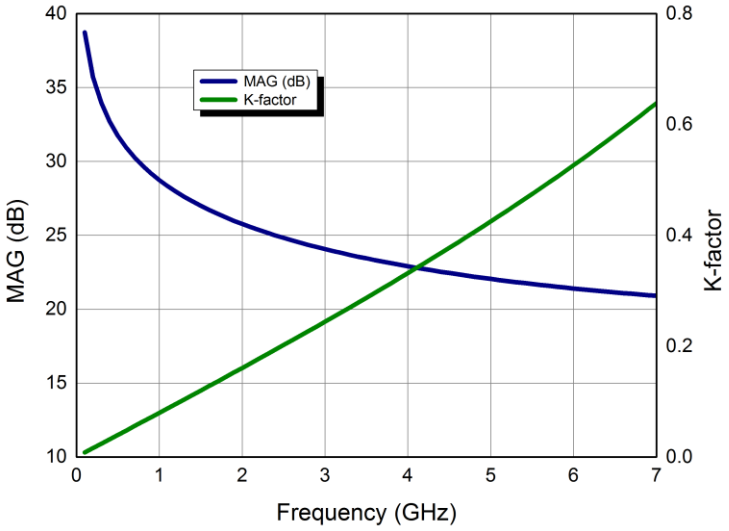
Typical Performance

Simulated Maximum Available Gain (MAG) and K Factor of the WP48005145

V_{DD} = 48 V, I_{DQ} = 750 mA

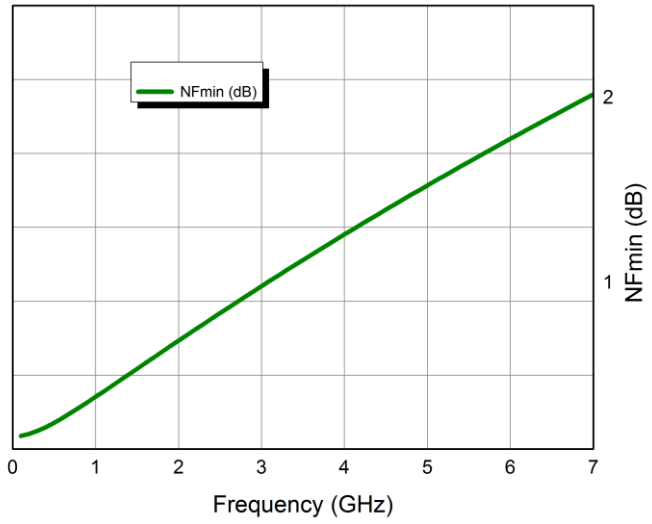


Intrinsic die parameters - reference planes at centers of gate and drain bonding pads. No wire bonds assumed.

Typical Performance

Simulated Minimum Noise Figure of the WP48005145

V_{DD} = 48 V, I_{DQ} = 750 mA



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Typical Die S-Parameters

(Small Signal, V_{DS} = 48 V, I_{DQ} = 750 mA, magnitude / angle)

Frequency	Mag S11	Ang S11	Mag S21	Ang S21	Mag S12	Ang S12	Mag S22	Ang S22
100MHz	0.967509	-133.448	44.70958	111.3019	0.00599	21.44743	0.707258	-168.099
200MHz	0.963456	-155.674	23.71574	98.78584	0.006354	9.076837	0.740463	-172.942
300MHz	0.962686	-163.593	15.97483	93.32661	0.006419	3.763125	0.748182	-174.475
400MHz	0.962523	-167.602	12.00504	89.79449	0.006431	0.376556	0.751904	-175.049
500MHz	0.962574	-170.01	9.595284	87.05576	0.006423	-2.21659	0.75467	-175.23
600MHz	0.962734	-171.612	7.976637	84.72289	0.006405	-4.40382	0.757249	-175.219
700MHz	0.962965	-172.75	6.813447	82.62868	0.006381	-6.35235	0.759895	-175.103
800MHz	0.963252	-173.599	5.936254	80.68974	0.006351	-8.14553	0.762704	-174.929
900MHz	0.963583	-174.255	5.25037	78.86019	0.006316	-9.82924	0.765711	-174.723
1000MHz	0.963954	-174.777	4.698777	77.11296	0.006278	-11.4306	0.768922	-174.5
1100MHz	0.964359	-175.201	4.245101	75.43117	0.006235	-12.9663	0.772331	-174.271
1200MHz	0.964794	-175.552	3.865054	73.80391	0.006189	-14.4475	0.775924	-174.042
1300MHz	0.965257	-175.848	3.541801	72.22389	0.00614	-15.8813	0.779683	-173.819
1400MHz	0.965742	-176.101	3.263306	70.68607	0.006087	-17.2727	0.783588	-173.605
1500MHz	0.966248	-176.32	3.020737	69.18694	0.006032	-18.6254	0.787619	-173.402
1600MHz	0.966772	-176.512	2.807466	67.72394	0.005975	-19.9418	0.791755	-173.213
1700MHz	0.96731	-176.681	2.61842	66.2952	0.005916	-21.2237	0.795976	-173.037
1800MHz	0.96786	-176.833	2.44965	64.89929	0.005854	-22.4727	0.800262	-172.876
1900MHz	0.968419	-176.969	2.298038	63.53512	0.005791	-23.6897	0.804594	-172.729
2000MHz	0.968986	-177.093	2.161084	62.20177	0.005726	-24.8758	0.808955	-172.598
2100MHz	0.969557	-177.207	2.036762	60.89851	0.00566	-26.0316	0.813328	-172.481
2200MHz	0.970131	-177.311	1.923411	59.62466	0.005593	-27.1577	0.817698	-172.379
2300MHz	0.970707	-177.408	1.819657	58.37963	0.005525	-28.2548	0.822052	-172.291
2400MHz	0.971281	-177.499	1.72435	57.16287	0.005456	-29.3234	0.826378	-172.215
2500MHz	0.971853	-177.585	1.636523	55.97383	0.005386	-30.3641	0.830663	-172.153
2600MHz	0.972421	-177.665	1.555354	54.812	0.005316	-31.3773	0.834899	-172.103
2700MHz	0.972984	-177.742	1.480139	53.67685	0.005245	-32.3635	0.839077	-172.064
2800MHz	0.97354	-177.815	1.410274	52.56786	0.005175	-33.3234	0.84319	-172.035
2900MHz	0.97409	-177.885	1.345235	51.48451	0.005104	-34.2573	0.847232	-172.017
3000MHz	0.974631	-177.952	1.284565	50.42625	0.005034	-35.1658	0.851197	-172.008
3100MHz	0.975164	-178.016	1.227864	49.39256	0.004963	-36.0494	0.85508	-172.008
3200MHz	0.975687	-178.079	1.17478	48.38288	0.004893	-36.9087	0.85888	-172.016
3300MHz	0.9762	-178.139	1.125002	47.39668	0.004823	-37.7442	0.862592	-172.031
3400MHz	0.976703	-178.198	1.078253	46.4334	0.004754	-38.5564	0.866215	-172.053
3500MHz	0.977195	-178.255	1.034288	45.49249	0.004685	-39.346	0.869747	-172.081
3600MHz	0.977676	-178.311	0.992886	44.57339	0.004616	-40.1133	0.873188	-172.115
3700MHz	0.978146	-178.365736	0.95385	43.67556	0.004548	-40.8589	0.876537	-172.155
3800MHz	0.978604	-178.419106	0.917	42.79844	0.004481	-41.5835	0.879795	-172.199
3900MHz	0.979051	-178.471386	0.882176	41.94149	0.004415	-42.2875	0.882961	-172.247

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Typical Die S-Parameters

(Small Signal, V_{DS} = 48 V, I_{DQ} = 700 mA, magnitude / angle)

Frequency	Mag S11	Ang S11	Mag S21	Ang S21	Mag S12	Ang S12	Mag S22	Ang S22
4000MHz	0.979487	-178.522658	0.849232	41.10416	0.004349	-42.9714	0.886037	-172.299
4100MHz	0.979911	-178.573	0.818035	40.28593	0.004284	-43.6358	0.889023	-172.355
4200MHz	0.980324	-178.622455	0.788464	39.48626	0.004219	-44.2812	0.891922	-172.413
4300MHz	0.980726	-178.671097	0.76041	38.70463	0.004156	-44.908	0.894733	-172.475
4400MHz	0.981116	-178.718969	0.733772	37.94054	0.004093	-45.5169	0.89746	-172.539
4500MHz	0.981496	-178.766112	0.708456	37.19348	0.004031	-46.1081	0.900103	-172.605
4600MHz	0.981865	-178.812566	0.684379	36.46296	0.00397	-46.6824	0.902665	-172.673
4700MHz	0.982224	-178.858365	0.661461	35.7485	0.00391	-47.24	0.905148	-172.743
4800MHz	0.982572	-178.903538	0.639632	35.04963	0.00385	-47.7815	0.907553	-172.814
4900MHz	0.98291	-178.948114	0.618824	34.36589	0.003792	-48.3073	0.909883	-172.886
5000MHz	0.983238	-178.992118	0.598976	33.69683	0.003734	-48.8178	0.91214	-172.96
5100MHz	0.983556	-179.035573	0.580031	33.04202	0.003677	-49.3135	0.914326	-173.034
5200MHz	0.983865	-179.078499	0.561937	32.40104	0.003621	-49.7947	0.916442	-173.109
5300MHz	0.984165	-179.120916	0.544645	31.77347	0.003566	-50.2619	0.918492	-173.185
5400MHz	0.984456	-179.16284	0.528108	31.15891	0.003512	-50.7154	0.920477	-173.261
5500MHz	0.984738	-179.20429	0.512285	30.55697	0.003458	-51.1555	0.922399	-173.338
5600MHz	0.985012	-179.24528	0.497137	29.96728	0.003405	-51.5828	0.92426	-173.414
5700MHz	0.985277	-179.286	0.482626	29.38946	0.003354	-51.9974	0.926062	-173.491
5800MHz	0.985535	-179.325935	0.468718	28.82318	0.003303	-52.3997	0.927808	-173.568
6000MHz	0.985785	-179.365627	0.455381	28.26807	0.003252	-52.7901	0.929498	-173.645
6100MHz	0.986027	-179.404911	0.442585	27.72381	0.003203	-53.1688	0.931136	-173.722
6200MHz	0.986262	-179.443799	0.430302	27.19007	0.003154	-53.5362	0.932722	-173.798
6300MHz	0.986491	-179.482301	0.418505	26.66654	0.003106	-53.8925	0.934259	-173.875
6400MHz	0.986712	-179.520428	0.407171	26.15293	0.003059	-54.2381	0.935748	-173.951
6500MHz	0.986927	-179.558189	0.396275	25.64894	0.003012	-54.5731	0.937191	-174.026
6600MHz	0.987135	-179.596	0.385797	25.15428	0.002967	-54.8979	0.938589	-174.102
6700MHz	0.987337	-179.632652	0.375715	24.66868	0.002922	-55.2126	0.939944	-174.177
6800MHz	0.987534	-179.669372	0.36601	24.19189	0.002877	-55.5176	0.941258	-174.251
6900MHz	0.987724	-179.705762	0.356665	23.72364	0.002833	-55.813	0.942531	-174.325
7000MHz	0.987909	-179.741831	0.347662	23.26368	0.00279	-56.0991	0.943766	-174.398

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