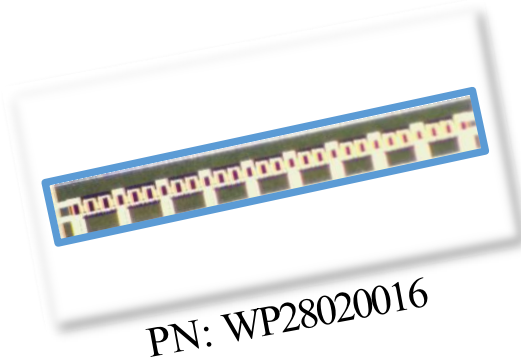




# WP28020016

## 16W, 28V GaN HEMT Die



The WP28020016 is a 16W gallium nitride (GaN) High Electron Mobility Transistor (HEMT). This GaN HEMT is a wideband transistor optimized for 16GHz operation in a user-friendly device for high bandwidth applications. Gallium nitride (GaN) HEMT is a device optimized for ku-band applications. GaN HEMT resistance is only 1/10 that of silicon transistors, making it capable of switching frequencies faster for greater energy efficiency. In addition, we're no EL Issue.

### Features

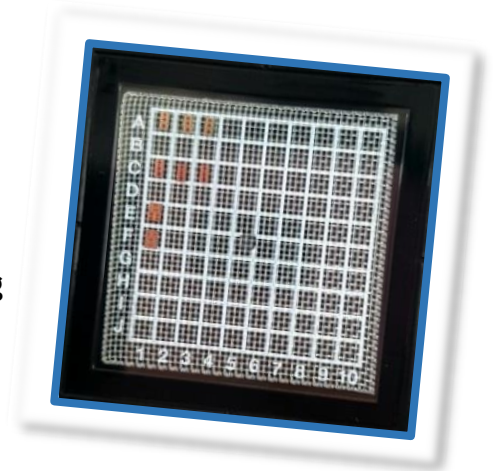
- Up to 20 GHz Operation
- 10.0 dB Typical Small Signal Gain @ 16 GHz
- 16 W Typical Psat @16GHz
- 28V Operation
- High Breakdown Voltage
- High Breakdown Voltage
- High Efficiency
- Reliability Monitoring Supporting

### Applications

- ku-band Amplifiers
- Broadband Amplifiers
- Base Station Communications
- Drone, UAV
- Satellite Communications
- 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



## Absolute Maximum Ratings (not simultaneous) at 25 °C

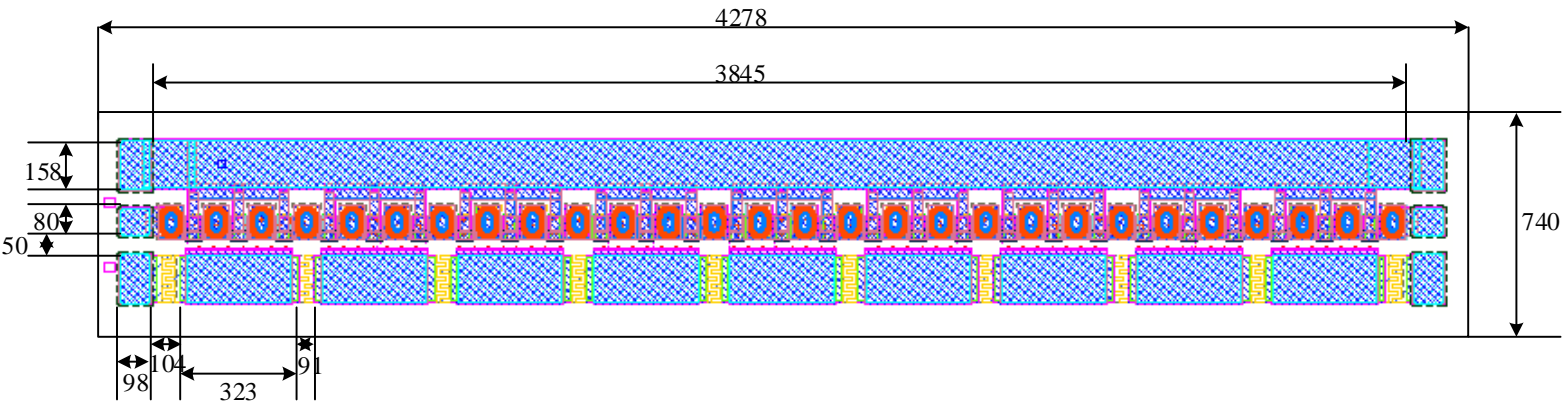
Parameter	Parameter	Typical Value	Units	Conditions
Threshold voltage @ Id=1mA/mm, Vd=10V	V <sub>to</sub>	-3.4	V	25°C
Breakdown voltage @ Id=1mA/mm	V <sub>DG</sub>	>100	V	25°C
Drain-source current, Id @ Vd=10V, Vg=0	I <sub>dss</sub>	880	mA/mm	25°C
Operating Junction Temperature	T <sub>J</sub>	225	°C	
Storage Temperature	T <sub>STG</sub>	-65, +150	°C	
Thermal Resistance, Junction to Case (packaged)	R <sub>θJC</sub>		°C/W	
Thermal Resistance, Junction to Case (die only)	R <sub>θJC</sub>		°C/W	
Mounting Temperature (30 seconds)	T <sub>S</sub>	320	°C	30 seconds

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

Parameter	Parameter	Typical Value	Units	Conditions
<b>DC Characteristics</b>				
Ohmic contact resistance	RC	0.4	Ohm-mm	25°C
Maximum Drain-source current, Id @ Vd=10V, Vg=1V (1X125µm device)	I <sub>dmax</sub>	1050	mA/mm	25°C
Max. trans-conductance, @ Vd=10V, Vg=-4V ~ -1V (1X125µm device)	GM_PEAK	340	mS/mm	25°C
Maximum Drain-source current, Id @ Vd=10V, Vg=1V (1X125µm device)	I <sub>dmax</sub>	1000	mA/mm	25°C
<b>RF Characteristics</b>				
Small Signal Gain	G <sub>SS</sub>	>10	dB	V <sub>DD</sub> =28V, I <sub>DQ</sub> =260mA
Saturated Power Output	P <sub>SAT</sub>	16	W	V <sub>DD</sub> =28V, I <sub>DQ</sub> =260mA
Drain Efficiency	η	>20	%	V <sub>DD</sub> =28V, I <sub>DQ</sub> =260mA
Intermodulation Distortion	IM3	<-30	dBc	V <sub>DD</sub> =28V, I <sub>DQ</sub> =260mA
Output Mismatch Stress	VSWR	10:1	ψ	



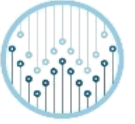
**DIE Dimensions (units in microns)**



Overall die size 4278 x 740 (+0/-50) microns, die thickness 100 (+/- 10) microns.  
All Gate and Drain pads must be wire bonded for electrical connection.

**Assembly Notes:**

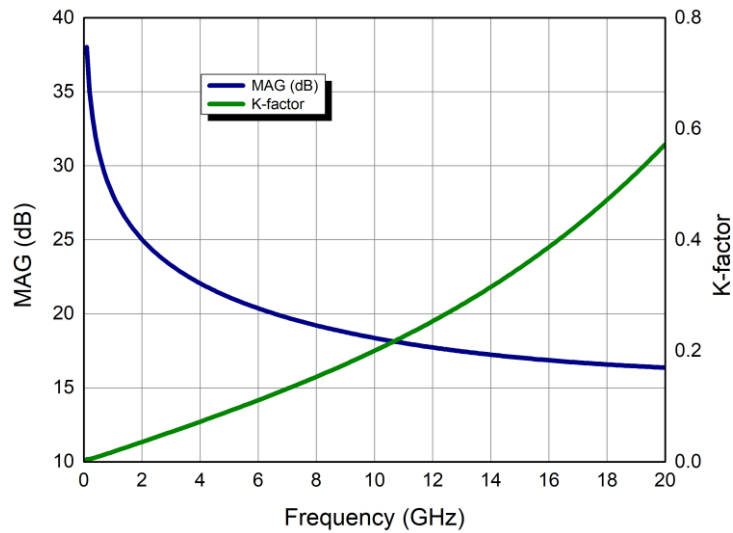
- Recommended solder is AuSn (80/20) solder. Refer to Wavepia's guide for the Eutectic Die Bond Procedure
- Vacuum collet is the preferred method of pick-up.
- The backside of the die is the Source (ground) contact.
- Die back side gold plating is 5 microns thick minimum.
- Thermosonic ball or wedge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



## Typical Performance

Simulated Maximum Available Gain (MAG) and K Factor of the WP28020016

$$V_{DD} = 28 \text{ V}, I_{DQ} = 260 \text{ mA}$$



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 WP28020016

$$V_{DD} = 28 \text{ V}, I_{DQ} = 260 \text{ mA}$$

**Under construction**



## Typical Die S-Parameters

(Small Signal,  $V_{DS} = 28\text{ V}$ ,  $I_{DQ} = 260\text{ mA}$ , magnitude / angle)

Frequency	Mag S11	Ang S11	Mag S21	Ang S21	Mag S12	Ang S12	Mag S22	Ang S22
1000MHz	0.905779	-159.701	12.46321	90.21882	0.019607	1.508682	0.604761	-160.576
1100MHz	0.90579	-161.364	11.32734	88.50447	0.019599	-0.07333	0.608274	-161.304
1200MHz	0.905944	-162.744	10.37295	86.92996	0.019575	-1.51571	0.611748	-161.843
1300MHz	0.906208	-163.905	9.559709	85.46514	0.01954	-2.84851	0.615242	-162.239
1400MHz	0.906562	-164.895	8.858325	84.08838	0.019495	-4.09334	0.618792	-162.527
1500MHz	0.906991	-165.746	8.247066	82.78374	0.019442	-5.2661	0.622418	-162.732
1600MHz	0.907483	-166.486	7.709469	81.53925	0.019382	-6.37872	0.626131	-162.873
1700MHz	0.908029	-167.133	7.232845	80.34578	0.019315	-7.44032	0.629936	-162.964
1800MHz	0.908623	-167.703	6.807259	79.19625	0.019243	-8.45796	0.633834	-163.016
1900MHz	0.909259	-168.209	6.424829	78.08507	0.019165	-9.4372	0.637823	-163.039
2000MHz	0.909933	-168.66	6.079217	77.00783	0.019083	-10.3825	0.641898	-163.04
2100MHz	0.910641	-169.065	5.765276	75.96095	0.018996	-11.2973	0.646054	-163.023
2200MHz	0.911379	-169.43	5.47878	74.94155	0.018905	-12.1845	0.650285	-162.995
2300MHz	0.912144	-169.76	5.216228	73.94725	0.018811	-13.0466	0.654582	-162.958
2400MHz	0.912934	-170.06	4.974695	72.97609	0.018713	-13.8855	0.658938	-162.915
2500MHz	0.913745	-170.335	4.751719	72.02644	0.018612	-14.7027	0.663346	-162.869
2600MHz	0.914575	-170.587	4.545212	71.09691	0.018508	-15.4997	0.667799	-162.823
2700MHz	0.915423	-170.818	4.353394	70.18635	0.018401	-16.2776	0.672287	-162.776
2800MHz	0.916286	-171.032	4.174734	69.29377	0.018292	-17.0374	0.676804	-162.732
2900MHz	0.917161	-171.23	4.007912	68.41831	0.01818	-17.7799	0.681343	-162.69
3000MHz	0.918048	-171.414	3.851781	67.55924	0.018066	-18.5059	0.685896	-162.652
3100MHz	0.918945	-171.586	3.705342	66.71591	0.01795	-19.216	0.690457	-162.618
3200MHz	0.919849	-171.747	3.567716	65.88775	0.017832	-19.9108	0.695019	-162.589
3300MHz	0.92076	-171.898	3.438134	65.07426	0.017712	-20.5907	0.699576	-162.565
3400MHz	0.921676	-172.04	3.315912	64.27499	0.017591	-21.2563	0.704123	-162.546
3500MHz	0.922595	-172.173	3.200446	63.48954	0.017468	-21.9078	0.708653	-162.533
3600MHz	0.923516	-172.3	3.091196	62.71755	0.017344	-22.5457	0.713163	-162.525
3700MHz	0.924438	-172.42	2.987681	61.95867	0.017219	-23.1703	0.717647	-162.523
3800MHz	0.92536	-172.535	2.88947	61.2126	0.017093	-23.7819	0.722101	-162.526
3900MHz	0.926281	-172.643	2.796173	60.47904	0.016967	-24.3808	0.726521	-162.534
4000MHz	0.9272	-172.747	2.70744	59.75774	0.016839	-24.9672	0.730903	-162.548
4100MHz	0.928115	-172.847	2.622955	59.04844	0.016711	-25.5414	0.735245	-162.567
4200MHz	0.929026	-172.942	2.542429	58.3509	0.016582	-26.1037	0.739543	-162.592
4300MHz	0.929933	-173.034	2.465601	57.66489	0.016453	-26.6541	0.743794	-162.621
4400MHz	0.930833	-173.123	2.392233	56.99019	0.016324	-27.193	0.747996	-162.654
4500MHz	0.931728	-173.208	2.322107	56.32659	0.016194	-27.7206	0.752146	-162.692
4600MHz	0.932615	-173.29	2.255023	55.67389	0.016064	-28.237	0.756244	-162.735
4700MHz	0.933495	-173.37	2.190798	55.0319	0.015934	-28.7425	0.760287	-162.781
4800MHz	0.934367	-173.447	2.129263	54.40042	0.015805	-29.2372	0.764274	-162.831



## Typical Die S-Parameters

(Small Signal,  $V_{DS} = 28\text{ V}$ ,  $I_{DQ} = 260\text{ mA}$ , magnitude / angle)

Frequency	Mag S11	Ang S11	Mag S21	Ang S21	Mag S12	Ang S12	Mag S22	Ang S22
4900MHz	0.93523	-173.523	2.070263	53.77927	0.015675	-29.7213	0.768203	-162.885
5000MHz	0.936084	-173.595	2.013655	53.16826	0.015545	-30.1949	0.772073	-162.943
5100MHz	0.936929	-173.667	1.959306	52.56722	0.015416	-30.6584	0.775885	-163.003
5200MHz	0.937764	-173.736	1.907092	51.97596	0.015287	-31.1117	0.779636	-163.067
5300MHz	0.938589	-173.803	1.8569	51.39433	0.015159	-31.5551	0.783326	-163.134
5400MHz	0.939404	-173.869	1.808625	50.82215	0.015031	-31.9888	0.786956	-163.203
5500MHz	0.940208	-173.934	1.762166	50.25925	0.014903	-32.4129	0.790525	-163.275
5600MHz	0.941001	-173.997	1.717432	49.70548	0.014776	-32.8276	0.794032	-163.349
5700MHz	0.941784	-174.058	1.674337	49.16066	0.014649	-33.233	0.797478	-163.425
5800MHz	0.942555	-174.119	1.6328	48.62465	0.014524	-33.6292	0.800864	-163.503
5900MHz	0.943315	-174.178	1.592747	48.09728	0.014398	-34.0165	0.804188	-163.583
6000MHz	0.944064	-174.237	1.554106	47.5784	0.014274	-34.3949	0.807451	-163.664
6100MHz	0.944802	-174.294	1.516812	47.06787	0.01415	-34.7647	0.810655	-163.748
6200MHz	0.945528	-174.35	1.480802	46.56551	0.014027	-35.1259	0.813798	-163.832
6300MHz	0.946243	-174.405	1.446017	46.0712	0.013905	-35.4787	0.816882	-163.918
6400MHz	0.946947	-174.459	1.412404	45.58479	0.013784	-35.8232	0.819908	-164.005
6500MHz	0.947639	-174.513	1.379909	45.10613	0.013663	-36.1597	0.822876	-164.093
6600MHz	0.94832	-174.566	1.348484	44.63507	0.013543	-36.4881	0.825786	-164.182
6700MHz	0.948989	-174.617	1.318083	44.17149	0.013425	-36.8087	0.82864	-164.271
6800MHz	0.949647	-174.668	1.288662	43.71524	0.013307	-37.1215	0.831437	-164.361
6900MHz	0.950294	-174.719	1.260179	43.26619	0.01319	-37.4267	0.83418	-164.452
7000MHz	0.95093	-174.768	1.232596	42.8242	0.013074	-37.7245	0.836868	-164.544
7100MHz	0.951555	-174.817	1.205875	42.38914	0.012959	-38.0149	0.839503	-164.636
7200MHz	0.952169	-174.865	1.179982	41.96089	0.012845	-38.2981	0.842086	-164.728
7300MHz	0.952772	-174.913	1.154883	41.53932	0.012732	-38.5741	0.844616	-164.82
7400MHz	0.953364	-174.96	1.130546	41.1243	0.012619	-38.8432	0.847096	-164.913
7500MHz	0.953946	-175.006	1.106941	40.71571	0.012508	-39.1054	0.849525	-165.006
7600MHz	0.954517	-175.052	1.08404	40.31344	0.012398	-39.3608	0.851906	-165.098
7700MHz	0.955078	-175.097	1.061816	39.91735	0.012289	-39.6096	0.854238	-165.191
7800MHz	0.955629	-175.142	1.040243	39.52733	0.012181	-39.8518	0.856523	-165.284
7900MHz	0.95617	-175.186	1.019295	39.14328	0.012074	-40.0876	0.858761	-165.377
8000MHz	0.956701	-175.229041	0.99895	38.76508	0.011967	-40.317	0.860954	-165.469
8100MHz	0.957222	-175.272007	0.979185	38.39261	0.011862	-40.5402	0.863103	-165.562
8200MHz	0.957734	-175.314459	0.959979	38.02578	0.011758	-40.7573	0.865207	-165.654
8300MHz	0.958236	-175.35641	0.941312	37.66446	0.011655	-40.9683	0.867269	-165.745
8400MHz	0.958728	-175.39787	0.923163	37.30857	0.011553	-41.1734	0.869289	-165.837
8500MHz	0.959212	-175.438848	0.905515	36.95799	0.011451	-41.3727	0.871268	-165.928
8600MHz	0.959687	-175.479356	0.88835	36.61264	0.011351	-41.5661	0.873206	-166.019
8700MHz	0.960152	-175.519	0.87165	36.2724	0.011252	-41.754	0.875105	-166.109

Contact WAVEPIA to receive this s-parameter file in “.s2p” format at [platune@wavepia.com](mailto:platune@wavepia.com)



## Typical Die S-Parameters

(Small Signal,  $V_{DS} = 28\text{ V}$ ,  $I_{DQ} = 260\text{ mA}$ , magnitude / angle)

Frequency	Mag S11	Ang S11	Mag S21	Ang S21	Mag S12	Ang S12	Mag S22	Ang S22
8800MHz	0.96061	-175.558992	0.855399	35.93718	0.011154	-41.9362	0.876965	-166.199
8900MHz	0.961058	-175.598139	0.839583	35.60689	0.011057	-42.113	0.878788	-166.289
9000MHz	0.961498	-175.636849	0.824185	35.28143	0.01096	-42.2843	0.880573	-166.378
9100MHz	0.96193	-175.675129	0.809192	34.96072	0.010865	-42.4503	0.882323	-166.467
9200MHz	0.962354	-175.712989	0.79459	34.64467	0.010771	-42.6111	0.884037	-166.555
9300MHz	0.96277	-175.75	0.780365	34.33318	0.010677	-42.7667	0.885716	-166.642
9400MHz	0.963178	-175.787471	0.766506	34.02617	0.010585	-42.9172	0.887362	-166.729
9500MHz	0.963579	-175.824108	0.753	33.72357	0.010493	-43.0627	0.888975	-166.816
9600MHz	0.963972	-175.860352	0.739836	33.42528	0.010402	-43.2033	0.890555	-166.901
9700MHz	0.964358	-175.896208	0.727002	33.13123	0.010313	-43.339	0.892103	-166.987
9800MHz	0.964736	-175.932	0.714489	32.84134	0.010224	-43.4698	0.893621	-167.071
9900MHz	0.965108	-175.966782	0.702284	32.55552	0.010136	-43.596	0.895108	-167.155
10000MHz	0.965472	-176.001512	0.69038	32.27372	0.010049	-43.7174	0.896566	-167.239
11000MHz	0.96583	-176.035879	0.678766	31.99584	0.009963	-43.8343	0.897995	-167.322
11100MHz	0.966181	-176.069887	0.667433	31.72183	0.009878	-43.9466	0.899396	-167.404
11200MHz	0.966526	-176.103543	0.656373	31.45161	0.009794	-44.0544	0.900769	-167.485
11300MHz	0.966864	-176.137	0.645576	31.1851	0.00971	-44.1578	0.902115	-167.566
11400MHz	0.967196	-176.169819	0.635036	30.92225	0.009627	-44.2569	0.903435	-167.647
11500MHz	0.967522	-176.20245	0.624743	30.66298	0.009546	-44.3516	0.904729	-167.726
11600MHz	0.967842	-176.235	0.614692	30.40724	0.009465	-44.4421	0.905997	-167.805
11700MHz	0.968156	-176.266719	0.604873	30.15495	0.009385	-44.5283	0.907241	-167.883
11800MHz	0.968464	-176.298368	0.595281	29.90605	0.009305	-44.6104	0.908461	-167.961
11900MHz	0.968767	-176.3297	0.585909	29.66049	0.009227	-44.6884	0.909658	-168.038
12000MHz	0.969064	-176.360719	0.57675	29.41821	0.009149	-44.7624	0.910831	-168.114
12100MHz	0.969356	-176.39143	0.567798	29.17914	0.009072	-44.8323	0.911982	-168.19
12200MHz	0.969642	-176.421837	0.559047	28.94323	0.008996	-44.8983	0.913112	-168.265
12300MHz	0.969924	-176.452	0.550491	28.71042	0.008921	-44.9603	0.914219	-168.34
12400MHz	0.9702	-176.481757	0.542125	28.48067	0.008846	-45.0185	0.915306	-168.413
12500MHz	0.970471	-176.511278	0.533942	28.2539	0.008773	-45.0729	0.916372	-168.486
12600MHz	0.970737	-176.541	0.525939	28.03008	0.0087	-45.1235	0.917418	-168.559
12700MHz	0.970999	-176.569464	0.51811	27.80915	0.008627	-45.1703	0.918444	-168.631
12800MHz	0.971256	-176.598137	0.510449	27.59107	0.008556	-45.2134	0.919451	-168.702
12900MHz	0.971508	-176.626536	0.502953	27.37577	0.008485	-45.2528	0.92044	-168.772
13000MHz	0.971756	-176.654663	0.495617	27.16322	0.008415	-45.2886	0.92141	-168.842
13100MHz	0.972	-176.682523	0.488436	26.95336	0.008345	-45.3208	0.922362	-168.912
13200MHz	0.972239	-176.71012	0.481406	26.74616	0.008277	-45.3494	0.923297	-168.98
13300MHz	0.972474	-176.737458	0.474523	26.54156	0.008208	-45.3744	0.924215	-169.048
13400MHz	0.972705	-176.764539	0.467783	26.33953	0.008141	-45.396	0.925116	-169.116
13500MHz	0.972931	-176.791368	0.461183	26.14001	0.008074	-45.4141	0.926	-169.183





## Typical Die S-Parameters

(Small Signal,  $V_{DS} = 28\text{ V}$ ,  $I_{DQ} = 260\text{ mA}$ , magnitude / angle)

Frequency	Mag S11	Ang S11	Mag S21	Ang S21	Mag S12	Ang S12	Mag S22	Ang S22
13600MHz	0.974996	-177.047	0.402075	24.27448	0.007443	-45.4096	0.93402	-169.818
13700MHz	0.975184	-177.071	0.396785	24.10007	0.007383	-45.3912	0.934747	-169.878
13800MHz	0.975368	-177.094851	0.391597	23.92772	0.007324	-45.3695	0.935461	-169.938
13900MHz	0.97555	-177.118699	0.386508	23.7574	0.007265	-45.3447	0.936162	-169.997
14000MHz	0.975728	-177.142339	0.381516	23.58909	0.007207	-45.3168	0.936852	-170.056
14100MHz	0.975904	-177.165774	0.376618	23.42274	0.007149	-45.2857	0.93753	-170.114
14200MHz	0.976076	-177.189007	0.371813	23.25833	0.007092	-45.2514	0.938196	-170.172
14300MHz	0.976246	-177.212041	0.367097	23.09584	0.007036	-45.2141	0.938851	-170.229
14400MHz	0.976413	-177.234877	0.362468	22.93522	0.00698	-45.1737	0.939495	-170.285
14500MHz	0.976577	-177.25752	0.357925	22.77645	0.006924	-45.1302	0.940128	-170.341
14600MHz	0.976739	-177.27997	0.353466	22.61951	0.00687	-45.0836	0.94075	-170.397
14700MHz	0.976898	-177.302232	0.349088	22.46436	0.006815	-45.0339	0.941362	-170.452
14800MHz	0.977054	-177.324308	0.34479	22.31097	0.006762	-44.9813	0.941964	-170.507
14900MHz	0.977208	-177.346199	0.340569	22.15933	0.006708	-44.9255	0.942556	-170.561
15000MHz	0.97736	-177.367909	0.336424	22.0094	0.006655	-44.8668	0.943139	-170.614
15100MHz	0.977509	-177.38944	0.332354	21.86116	0.006603	-44.805	0.943711	-170.667
15200MHz	0.977655	-177.410795	0.328355	21.71458	0.006551	-44.7403	0.944275	-170.72
15300MHz	0.9778	-177.431975	0.324428	21.56964	0.0065	-44.6725	0.944829	-170.772
15400MHz	0.977942	-177.452983	0.320569	21.42632	0.006449	-44.6017	0.945374	-170.824
15500MHz	0.978082	-177.473821	0.316778	21.28459	0.006399	-44.528	0.945911	-170.875
15600MHz	0.978219	-177.494492	0.313053	21.14443	0.006349	-44.4512	0.946439	-170.926
15700MHz	0.978355	-177.514998	0.309392	21.00581	0.0063	-44.3715	0.946958	-170.976
15800MHz	0.978488	-177.53534	0.305794	20.86872	0.006251	-44.2888	0.947469	-171.026
15900MHz	0.97862	-177.555522	0.302258	20.73313	0.006202	-44.2032	0.947972	-171.075
16000MHz	0.978749	-177.575545	0.298782	20.59901	0.006154	-44.1146	0.948467	-171.124
16100MHz	0.978876	-177.595	0.295365	20.46636	0.006107	-44.023	0.948955	-171.172
16200MHz	0.979002	-177.615122	0.292006	20.33515	0.006059	-43.9284	0.949434	-171.221
16300MHz	0.979125	-177.634681	0.288703	20.20535	0.006013	-43.8309	0.949907	-171.268
16400MHz	0.979247	-177.654	0.285455	20.07696	0.005966	-43.7304	0.950372	-171.315
16500MHz	0.979367	-177.673348	0.282261	19.94994	0.00592	-43.627	0.950829	-171.362
16600MHz	0.979485	-177.69246	0.27912	19.82429	0.005875	-43.5206	0.95128	-171.409
16700MHz	0.979601	-177.711	0.27603	19.69998	0.00583	-43.4113	0.951724	-171.455
16800MHz	0.979715	-177.730253	0.272991	19.57699	0.005785	-43.299	0.952161	-171.5
16900MHz	0.979828	-177.748936	0.270001	19.45531	0.005741	-43.1837	0.952591	-171.545
17000MHz	0.979939	-177.76748	0.26706	19.33491	0.005697	-43.0655	0.953015	-171.59
17100MHz	0.980049	-177.785886	0.264166	19.21579	0.005654	-42.9443	0.953433	-171.635
17200MHz	0.980157	-177.804156	0.261318	19.09792	0.005611	-42.8201	0.953844	-171.679
17300MHz	0.980263	-177.822293	0.258516	18.98129	0.005568	-42.6929	0.954249	-171.722
17400MHz	0.980368	-177.840297	0.255758	18.86588	0.005526	-42.5628	0.954648	-171.766

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