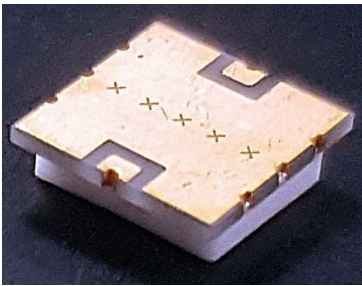


KX104

30 W, 8.0 GHz,
GaN HEMT
Transistor

DESCRIPTION

The KX104 is a gallium nitride (GaN) High Electron Mobility Transistor (HEMT) transistor in a Surface-Mount Technology (SMT) package for high reliability applications. This transistor offers superior properties compared to silicon or gallium arsenide, including higher breakdown voltage, higher saturated electron drift velocity, and higher thermal conductivity. GaN HEMTs offer greater power density and wider bandwidths compared to Si and GaAs transistors.



FEATURES

- ✓ High Small Signal Gain: 17 dB @ 4 GHz.
- ✓ High Output Power: 30W P_{SAT} .
- ✓ High Breakdown Voltage, Efficiency and Temperature Operation.

APPLICATIONS

- ✓ Microwave Radios
- ✓ Military Radios
- ✓ VSAT
- ✓ Telecom Infrastructure
- ✓ Test Equipment

ELECTRICAL CHARACTERISTICS (-40 to 85°C)

Parameter	Symbol	Conditions	Min	Typical	Max	Units
Small Signal Gain	G_{SS}	$V_{DD} = 28 \text{ V}, I_{DQ} = 200 \text{ mA}$		16.5		dB
Saturated Power Output ¹	P_{SAT}	$V_{DS} = 28 \text{ V}, I_{DQ} = 200 \text{ mA}$		30		W
Drain Efficiency ²	η	$V_{DS} = 28 \text{ V}, I_{DQ} = 200 \text{ mA},$ $P_{SAT} = 30 \text{ W}$		65		%
Output Mismatch Stress	VSWR	$V_{DS} = 28 \text{ V}, I_{DQ} = 200 \text{ mA},$ $P_{OUT} = 30 \text{ W CW}$			10:1	

1. P_{SAT} is defined as $I_G = 0.7 \text{ mA}$.

2. Drain Efficiency = P_{OUT}/P_{DC} .

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OPERATING CHARACTERISTICS (-40 TO +85°C)¹

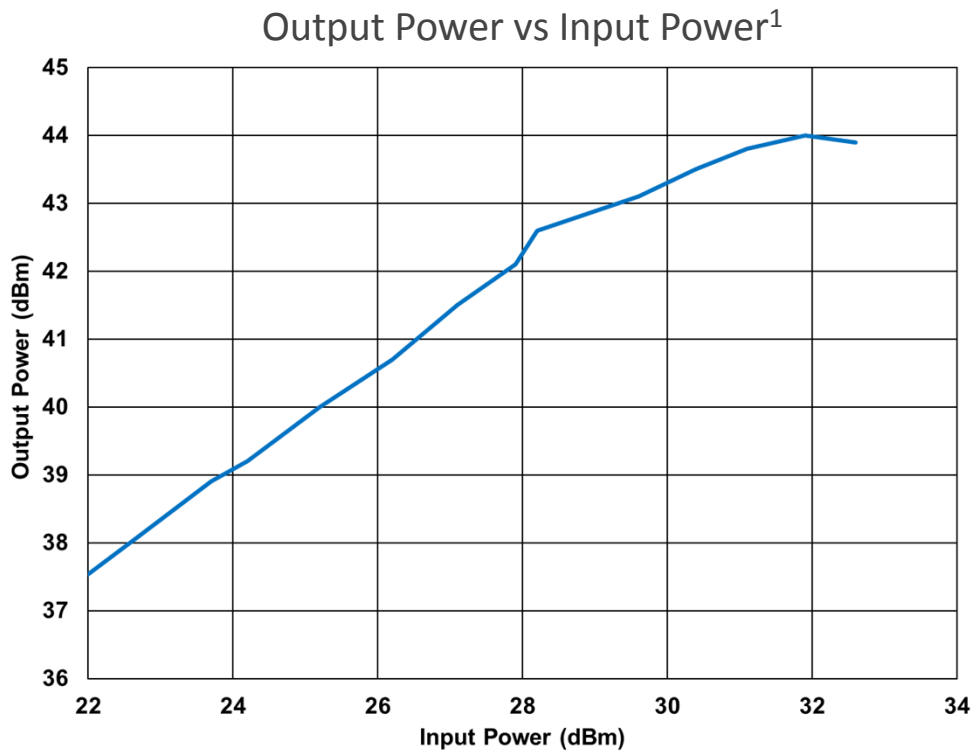
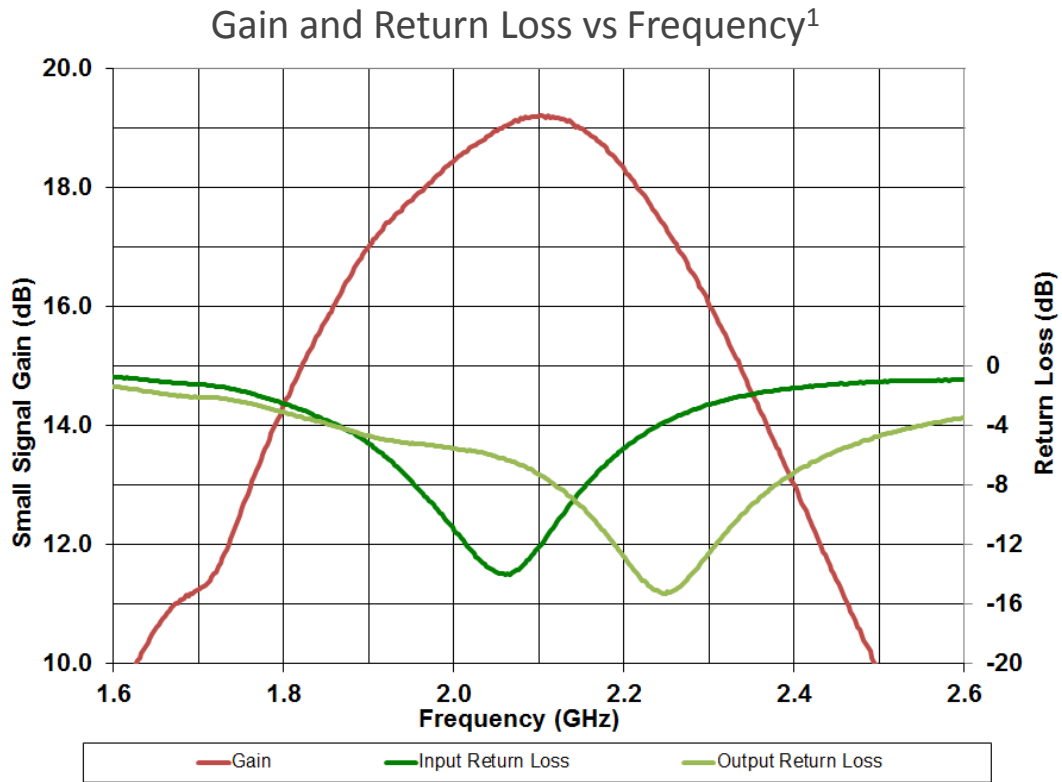
Parameter	Symbol	Conditions	Min	Typical	Max	Units
Gate Threshold Voltage	$V_{GS(TH)}$	$V_{DS} = 10 \text{ V}, I_D = 7.2 \text{ mA}$	-3.6	-3.0	-2.4	V
Gate Quiescent Voltage	$V_{GS(Q)}$	$V_{DS} = 28 \text{ V}, I_{DQ} = 200 \text{ mA}$		-2.7		V
Drain-Source Breakdown Voltage	V_{BD}	$V_{GS} = -8 \text{ V}, I_D = 7.2 \text{ mA}$	120			V
On Resistance	R_{ON}	$V_{DS} = 0.1 \text{ V}$	0.26	0.33	0.41	Ω
Input Capacitance	C_{GS}	$V_{DS} = 28 \text{ V}, V_{GS} = -8 \text{ V}, f = 1 \text{ MHz}$		7.3		pF
Output Capacitance	C_{DS}	$V_{DS} = 28 \text{ V}, V_{GS} = -8 \text{ V}, f = 1 \text{ MHz}$		2.2		pF
Feedback Capacitance	C_{GD}	$V_{DS} = 28 \text{ V}, V_{GS} = -8 \text{ V}, f = 1 \text{ MHz}$		0.37		pF

1. All operating characteristics are guaranteed over full performance temperature range but not tested.

ABSOLUTE MAXIMUM RATINGS

Characteristic	Conditions	Symbol	Rating	Units
Drain-Source voltage	25°C	V_{DSS}	84	VDC
Gate-Source voltage	25°C	V_{GS}	-10/+2	VDC
Storage temperature			-65/+150	°C
Operating junction temperature			225	°C
Maximum Forward Gate Current	25°C	I_{DMAX}	7.0	mA
Maximum Drain Current	25°C	I_{DMAX}	3.0	A
Thermal resistance, Junction to Case		$R_{\theta JC}$	2.97	°C/W
ESD sensitivity (HBM)	JEDEC JESD22/A114-D		1A/250V	

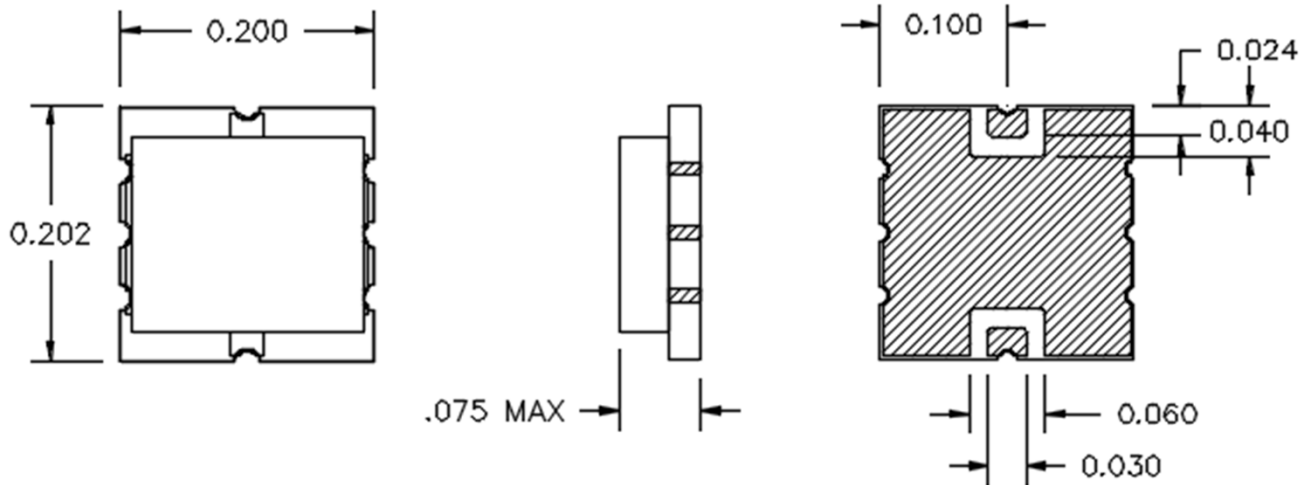
TYPICAL PERFORMANCE (+25 °C)



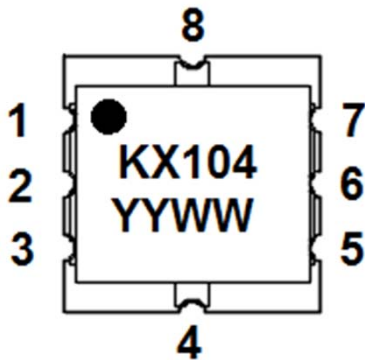
1. Gain and power data from device in application board

KX104 | GaN HEMT Transistor, 30 W, 8.0 GHz

OUTLINE:



DEVICE MARKING/PIN OUT:



PIN	Designation	PIN	Designation
1	SOURCE	5	SOURCE
2	SOURCE	6	SOURCE
3	SOURCE	7	SOURCE
4	GATE	8	DRAIN

PACKAGE NOTES:

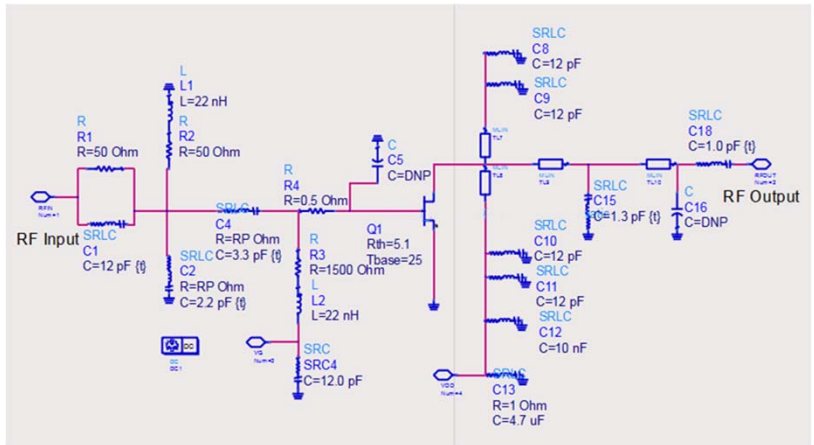
- Lid: White Ceramic
- Base: Aluminum Nitride
- Mounting Surface Finish: Gold over Nickel over Copper

ADDITIONAL NOTES:

- Maximum reflow temperature: 265°C for 60 – 90 seconds
- Package base is the transistor source

KX104 | GaN HEMT Transistor, 30 W, 8.0 GHz

EVALUATION BOARD:



Qty	Reference Designator	Description	Digikey Part Number	Manufacturer
2	J1,J2	SMA Edge Launch Connector	931-1175-ND	
1	J3	0.1" DC Header, 8 Positions		
1	U1	KCB306 Power Amplifier	N/A	
5	C1,C8,C9,C10,C11	12pF, 0402, 100V, 5%	490-7300-1-ND	Murata
1	C2	2.2pF, 0402, 50V, +/-0.1pF	712-1279-1-ND	Johanson
1	C4	3.3pF, 0402, 50V, +/-0.1pF	712-1283-1-ND	Johanson
2	L1, L2	FIXED IND 22NH 350MA 420 MOHM	490-2627-1-ND	Murata
2	R1, R2	RES SMD 49.9 OHM 1% 1/10W 0402	P49.9LCT-ND	Panasonic
1	R4	RES SMD 0.5 OHM 1% 1/8W 0402	CSR0402FKR500CT-ND	Stackpole Electronics
1	R3	RES SMD 1.5K OHM 1% 1/10W 0402	P1.50KLCT-ND	Panasonic
1	C15	CAP CER 1.3PF 200V NP0 0402	1284-1108-1-ND	American Technical Ceramics
1	C18	1.0pF, 0402, 100V, +/-0.1pF	399-8599-6-ND	Kemet
1	C12	10nF, 0402, 50V	490-4516-1-ND	Murata
1	C13	Do not populate		
1	C19	4.7uF, 2312, 50V, +/-20%	478-9430-1-ND	AVX
6	C5,C6,C7,C14,C16,C17	Do not populate		

KX104 | GaN HEMT Transistor, 30 W, 8.0 GHz

S-PARAMETER DATA: ($V_{DS} = 28V$, $I_{DQ} = 200mA$)

FREQ	S11 Mag dB	S11 Angle	S21 Mag dB	S21 Angle	S12 Mag dB	S12 Angle	S22 Mag dB	S22 Angle
0.1	-0.220	-71.690	34.644	142.293	-36.845	53.571	-7.991	-96.396
0.2	-0.764	-115.981	30.883	116.811	-34.592	29.428	-6.163	-133.763
0.3	-0.973	-136.901	27.940	104.258	-34.023	18.206	-5.644	-148.711
0.4	-1.063	-148.955	25.660	96.243	-33.818	11.524	-5.425	-156.729
0.5	-1.108	-156.925	23.824	90.258	-33.733	6.880	-5.300	-161.775
0.6	-1.132	-162.720	22.294	85.343	-33.701	3.315	-5.211	-165.296
0.7	-1.146	-167.233	20.984	81.059	-33.696	0.395	-5.138	-167.945
0.8	-1.153	-170.931	19.840	77.179	-33.708	-2.107	-5.070	-170.056
0.9	-1.157	-174.081	18.826	73.574	-33.732	-4.316	-5.004	-171.820
1.0	-1.159	-176.847	17.914	70.166	-33.764	-6.308	-4.938	-173.352
1.1	-1.159	-179.337	17.085	66.906	-33.803	-8.131	-4.871	-174.727
1.2	-1.159	178.379	16.327	63.760	-33.847	-9.816	-4.803	-175.996
1.3	-1.157	176.251	15.628	60.705	-33.896	-11.382	-4.735	-177.192
1.4	-1.155	174.242	14.980	57.723	-33.948	-12.846	-4.665	-178.341
1.5	-1.152	172.325	14.375	54.804	-34.003	-14.216	-4.595	-179.462
1.6	-1.149	170.480	13.809	51.937	-34.060	-15.499	-4.524	179.433
1.7	-1.146	168.691	13.278	49.116	-34.119	-16.700	-4.454	178.333
1.8	-1.143	166.945	12.777	46.334	-34.179	-17.821	-4.384	177.232
1.9	-1.140	165.232	12.304	43.588	-34.239	-18.866	-4.315	176.122
2.0	-1.138	163.545	11.856	40.873	-34.300	-19.836	-4.246	175.000
2.1	-1.135	161.876	11.431	38.185	-34.359	-20.731	-4.179	173.862
2.2	-1.133	160.219	11.027	35.524	-34.417	-21.552	-4.113	172.707
2.3	-1.130	158.571	10.642	32.884	-34.472	-22.300	-4.049	171.531
2.4	-1.129	156.925	10.276	30.265	-34.524	-22.975	-3.987	170.335
2.5	-1.127	155.280	9.927	27.665	-34.573	-23.577	-3.926	169.115
2.6	-1.126	153.631	9.594	25.081	-34.616	-24.108	-3.868	167.873
2.7	-1.125	151.975	9.276	22.511	-34.654	-24.567	-3.812	166.606
2.8	-1.125	150.311	8.973	19.954	-34.685	-24.958	-3.758	165.315
2.9	-1.126	148.634	8.683	17.407	-34.708	-25.281	-3.706	164.000
3.0	-1.126	146.945	8.405	14.870	-34.723	-25.538	-3.657	162.658
3.1	-1.128	145.239	8.141	12.340	-34.727	-25.734	-3.610	161.291
3.2	-1.130	143.516	7.888	9.817	-34.721	-25.871	-3.566	159.898
3.3	-1.132	141.772	7.646	7.297	-34.704	-25.954	-3.524	158.479
3.4	-1.135	140.007	7.416	4.780	-34.673	-25.989	-3.485	157.033
3.5	-1.139	138.219	7.196	2.264	-34.629	-25.981	-3.448	155.559
3.6	-1.143	136.406	6.986	-0.253	-34.570	-25.938	-3.413	154.057
3.7	-1.148	134.566	6.785	-2.772	-34.496	-25.867	-3.381	152.528
3.8	-1.154	132.698	6.594	-5.295	-34.406	-25.776	-3.351	150.969
3.9	-1.160	130.799	6.412	-7.823	-34.299	-25.675	-3.323	149.380
4.0	-1.167	128.869	6.239	-10.359	-34.176	-25.573	-3.298	147.761

KX104 | GaN HEMT Transistor, 30 W, 8.0 GHz

S-PARAMETERS (CONT'D): (Small Signal, $V_{DS} = 28V$, $I_{DQ} = 200mA$)

FREQ	S11 Mag dB	S11 Angle	S21 Mag dB	S21 Angle	S12 Mag dB	S12 Angle	S22 Mag dB	S22 Angle
4.1	-1.174	126.905	6.074	-12.904	-34.035	-25.479	-3.275	146.111
4.2	-1.182	124.907	5.918	-15.458	-33.878	-25.404	-3.255	144.429
4.3	-1.191	122.873	5.769	-18.025	-33.704	-25.356	-3.236	142.714
4.4	-1.200	120.800	5.628	-20.606	-33.513	-25.347	-3.220	140.965
4.5	-1.210	118.688	5.493	-23.202	-33.307	-25.385	-3.205	139.181
4.6	-1.220	116.534	5.366	-25.814	-33.085	-25.478	-3.193	137.361
4.7	-1.231	114.339	5.246	-28.445	-32.848	-25.635	-3.183	135.503
4.8	-1.243	112.099	5.131	-31.096	-32.597	-25.864	-3.174	133.607
4.9	-1.255	109.813	5.023	-33.768	-32.334	-26.169	-3.167	131.671
5.0	-1.267	107.481	4.920	-36.464	-32.059	-26.559	-3.162	129.694
5.1	-1.280	105.100	4.823	-39.183	-31.773	-27.036	-3.159	127.674
5.2	-1.293	102.670	4.731	-41.929	-31.477	-27.605	-3.157	125.610
5.3	-1.306	100.189	4.643	-44.701	-31.173	-28.270	-3.157	123.501
5.4	-1.320	97.656	4.560	-47.502	-30.862	-29.032	-3.158	121.344
5.5	-1.334	95.070	4.481	-50.333	-30.544	-29.894	-3.160	119.139
5.6	-1.348	92.431	4.405	-53.195	-30.221	-30.857	-3.163	116.883
5.7	-1.362	89.736	4.333	-56.089	-29.894	-31.922	-3.168	114.575
5.8	-1.376	86.986	4.263	-59.015	-29.563	-33.088	-3.173	112.213
5.9	-1.389	84.180	4.196	-61.976	-29.231	-34.356	-3.179	109.796
6.0	-1.402	81.318	4.131	-64.972	-28.897	-35.724	-3.186	107.323
6.1	-1.415	78.399	4.067	-68.003	-28.563	-37.192	-3.193	104.791
6.2	-1.428	75.425	4.005	-71.070	-28.229	-38.758	-3.200	102.199
6.3	-1.439	72.394	3.943	-74.173	-27.897	-40.420	-3.207	99.545
6.4	-1.450	69.309	3.881	-77.313	-27.567	-42.178	-3.214	96.829
6.5	-1.460	66.169	3.820	-80.490	-27.239	-44.029	-3.221	94.049
6.6	-1.468	62.976	3.757	-83.703	-26.915	-45.971	-3.227	91.204
6.7	-1.476	59.732	3.693	-86.953	-26.596	-48.001	-3.233	88.293
6.8	-1.481	56.438	3.628	-90.239	-26.282	-50.117	-3.237	85.316
6.9	-1.486	53.097	3.560	-93.560	-25.973	-52.316	-3.240	82.272
7.0	-1.488	49.711	3.490	-96.915	-25.670	-54.595	-3.241	79.160
7.1	-1.489	46.283	3.416	-100.304	-25.374	-56.952	-3.241	75.982
7.2	-1.488	42.816	3.339	-103.724	-25.086	-59.382	-3.238	72.737
7.3	-1.485	39.313	3.257	-107.175	-24.805	-61.883	-3.234	69.427
7.4	-1.480	35.779	3.171	-110.654	-24.533	-64.451	-3.226	66.054
7.5	-1.472	32.218	3.080	-114.160	-24.270	-67.083	-3.216	62.618
7.6	-1.462	28.634	2.984	-117.689	-24.016	-69.774	-3.203	59.122
7.7	-1.451	25.031	2.882	-121.240	-23.772	-72.521	-3.186	55.570
7.8	-1.437	21.414	2.773	-124.810	-23.538	-75.319	-3.167	51.964
7.9	-1.420	17.788	2.658	-128.396	-23.314	-78.163	-3.143	48.309
8.0	-1.402	14.159	2.536	-131.994	-23.101	-81.051	-3.116	44.608

KX104 | GaN HEMT Transistor, 30 W, 8.0 GHz

S-PARAMETERS (CONT'D): (Small Signal, $V_{DS} = 28V$, $I_{DQ} = 200mA$)

FREQ	S11 Mag dB	S11 Angle	S21 Mag dB	S21 Angle	S12 Mag dB	S12 Angle	S22 Mag dB	S22 Angle
8.1	-1.382	10.530	2.406	-135.601	-22.900	-83.976	-3.086	40.867
8.2	-1.360	6.907	2.269	-139.215	-22.709	-86.935	-3.052	37.091
8.3	-1.336	3.296	2.125	-142.830	-22.530	-89.922	-3.014	33.285
8.4	-1.310	-0.300	1.973	-146.444	-22.363	-92.933	-2.972	29.456
8.5	-1.283	-3.875	1.813	-150.052	-22.207	-95.963	-2.928	25.610
8.6	-1.255	-7.424	1.644	-153.650	-22.063	-99.007	-2.880	21.753
8.7	-1.226	-10.944	1.468	-157.236	-21.930	-102.061	-2.828	17.892
8.8	-1.196	-14.430	1.284	-160.803	-21.809	-105.118	-2.774	14.034
8.9	-1.166	-17.878	1.092	-164.350	-21.699	-108.176	-2.718	10.184
9.0	-1.135	-21.285	0.892	-167.871	-21.600	-111.229	-2.659	6.351
9.1	-1.103	-24.647	0.684	-171.364	-21.513	-114.272	-2.598	2.540
9.2	-1.072	-27.961	0.470	-174.824	-21.436	-117.302	-2.535	-1.244
9.3	-1.041	-31.225	0.248	-178.248	-21.369	-120.315	-2.471	-4.993
9.4	-1.010	-34.436	0.019	-178.367	-21.313	-123.306	-2.407	-8.704
9.5	-0.979	-37.592	-0.216	-175.024	-21.266	-126.272	-2.341	-12.370
9.6	-0.949	-40.692	-0.458	-171.727	-21.228	-129.210	-2.275	-15.988
9.7	-0.920	-43.735	-0.705	-168.477	-21.199	-132.116	-2.209	-19.553
9.8	-0.892	-46.718	-0.957	-165.277	-21.179	-134.988	-2.144	-23.061
9.9	-0.864	-49.641	-1.214	-162.129	-21.166	-137.823	-2.079	-26.511
10.0	-0.837	-52.505	-1.475	-159.034	-21.161	-140.619	-2.014	-29.899