

To all our customers

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Renesas Technology Corp.  
Customer Support Dept.  
April 1, 2003

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# 2SC4784

Silicon NPN Epitaxial

**RENESAS**

ADE-208-1121A (Z)  
2nd. Edition  
Mar. 2001

## Application

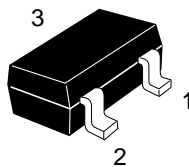
VHF / UHF wide band amplifier

## Features

- High gain bandwidth product  
 $f_T = 10 \text{ GHz Typ.}$
- High gain, low noise figure  
 $PG = 15.0 \text{ dB Typ, NF} = 1.2 \text{ dB Typ at } f = 900 \text{ MHz}$

## Outline

CMPAK



1. Emitter
2. Base
3. Collector

Note: Marking is "YA-".

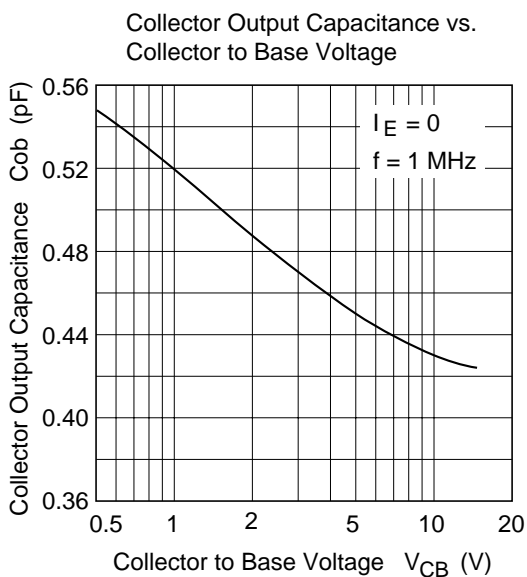
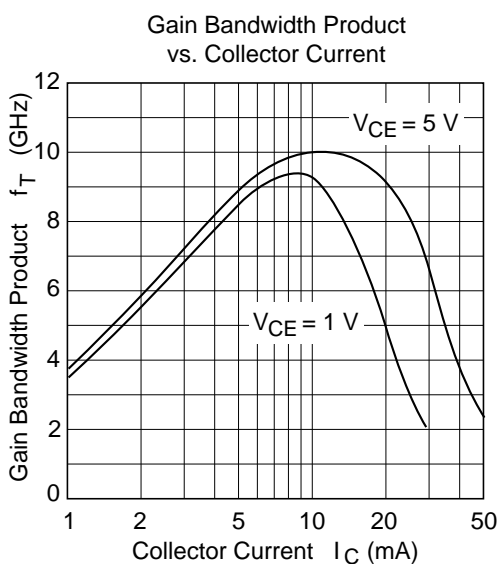
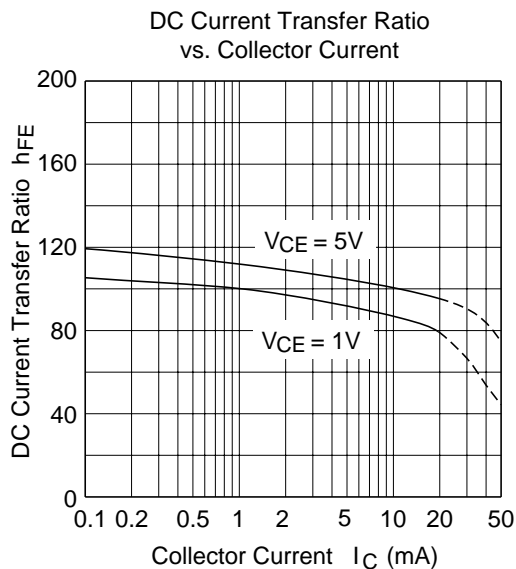
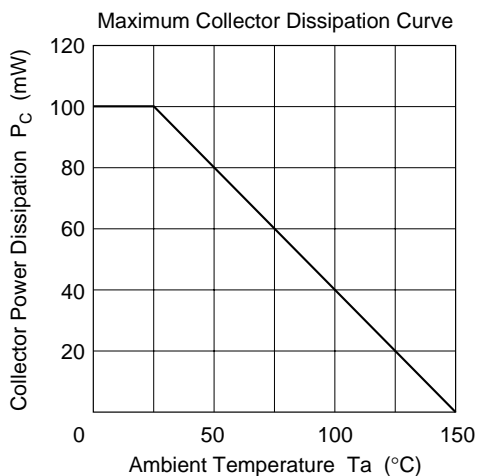
Attention: This is electrostatic sensitive device.

**Absolute Maximum Ratings** ( $T_a = 25^\circ\text{C}$ )

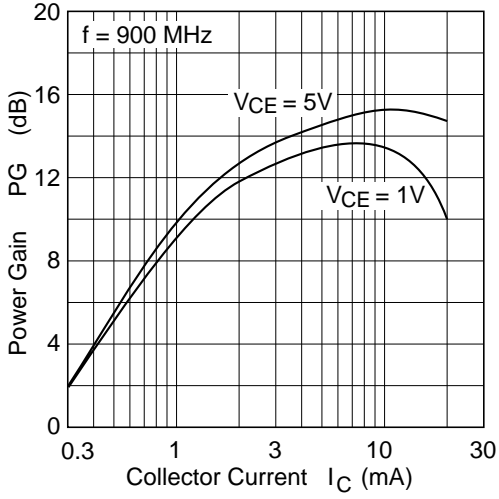
Item	Symbol	Ratings	Unit
Collector to base voltage	$V_{CBO}$	15	V
Collector to emitter voltage	$V_{CEO}$	8	V
Emitter to base voltage	$V_{EBO}$	1.5	V
Collector current	$I_C$	20	mA
Collector power dissipation	$P_C$	100	mW
Junction temperature	$T_j$	150	$^\circ\text{C}$
Storage temperature	$T_{stg}$	-55 to +150	$^\circ\text{C}$

**Electrical Characteristics** ( $T_a = 25^\circ\text{C}$ )

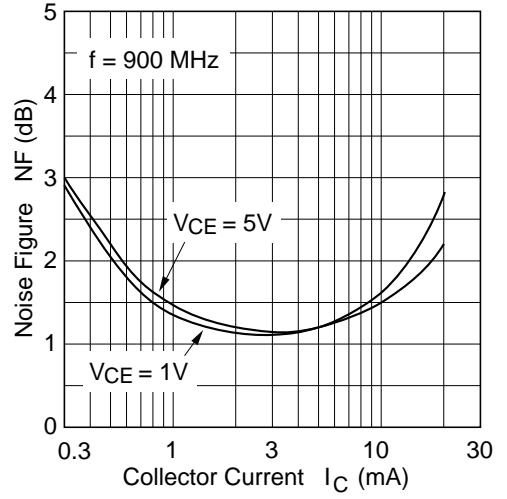
Item	Symbol	Min	Typ	Max	Unit	Test conditions
Collector cutoff current	$I_{CBO}$	—	—	10	$\mu\text{A}$	$V_{CB} = 15\text{ V}, I_E = 0$
	$I_{CEO}$	—	—	1	mA	$V_{CE} = 8\text{ V}, R_{BE} =$
Emitter cutoff current	$I_{EBO}$	—	—	10	$\mu\text{A}$	$V_{EB} = 1.5\text{ V}, I_C = 0$
DC current transfer ratio	$h_{FE}$	50	120	250		$V_{CE} = 5\text{ V}, I_C = 10\text{ mA}$
Collector output capacitance	$C_{ob}$	—	0.45	0.8	pF	$V_{CB} = 5\text{ V}, I_E = 0, f = 1\text{ MHz}$
Gain bandwidth product	$f_T$	7.0	10.0	—	GHz	$V_{CE} = 5\text{ V}, I_C = 10\text{ mA}$
Power gain	PG	12.0	15.0	—	dB	$V_{CE} = 5\text{ V}, I_C = 10\text{ mA},$ $f = 900\text{ MHz}$
Noise figure	NF	—	1.2	2.5	dB	$V_{CE} = 5\text{ V}, I_C = 5\text{ mA},$ $f = 900\text{ MHz}$



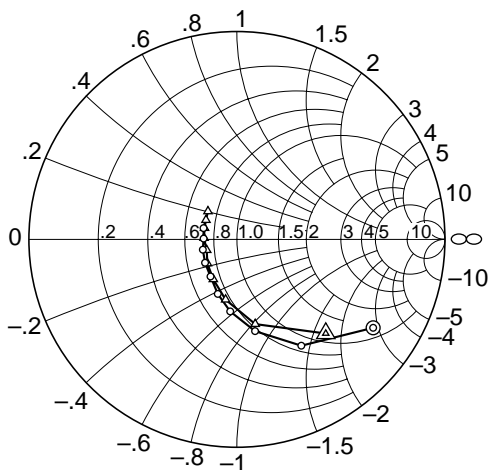
Power Gain vs. Collector Current



Noise Figure vs. Collector Current

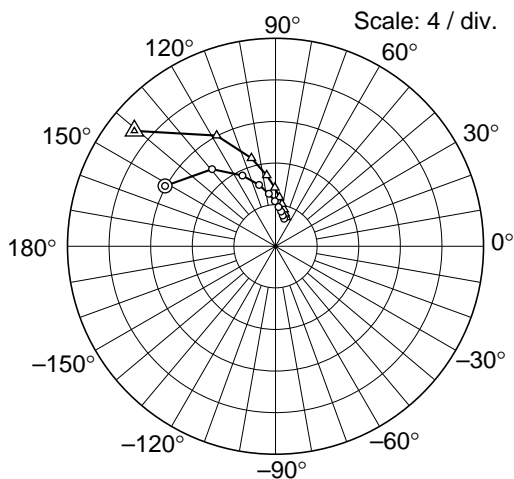


S11 Parameter vs. Frequency



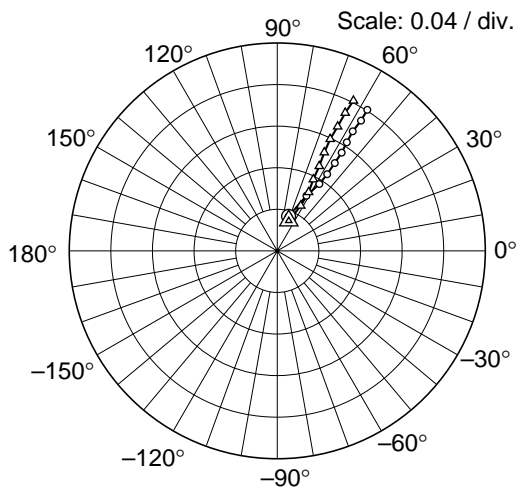
Condition:  $V_{CE} = 5\text{ V}$ ,  $Z_o = 50\ \Omega$   
 200 to 2000 MHz (200 MHz step)  
 ○ — ○ ( $I_C = 5\text{ mA}$ )  
 △ — △ ( $I_C = 10\text{ mA}$ )

S21 Parameter vs. Frequency



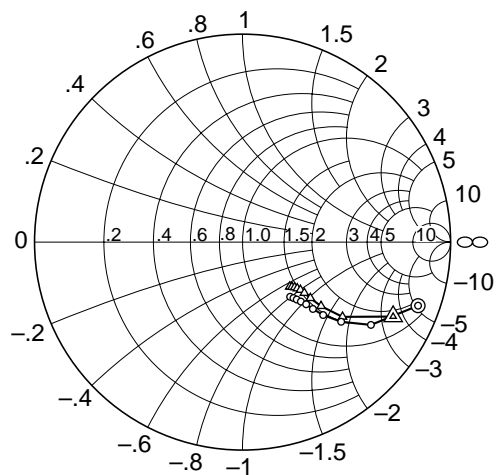
Condition:  $V_{CE} = 5\text{ V}$ ,  $Z_o = 50\ \Omega$   
 200 to 2000 MHz (200 MHz step)  
 ○ — ○ ( $I_C = 5\text{ mA}$ )  
 △ — △ ( $I_C = 10\text{ mA}$ )

S12 Parameter vs. Frequency



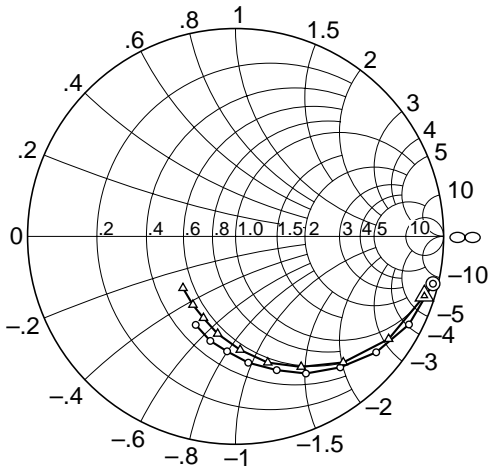
Condition:  $V_{CE} = 5\text{ V}$ ,  $Z_o = 50\ \Omega$   
 200 to 2000 MHz (200 MHz step)  
 ○ — ○ ( $I_C = 5\text{ mA}$ )  
 △ — △ ( $I_C = 10\text{ mA}$ )

S22 Parameter vs. Frequency



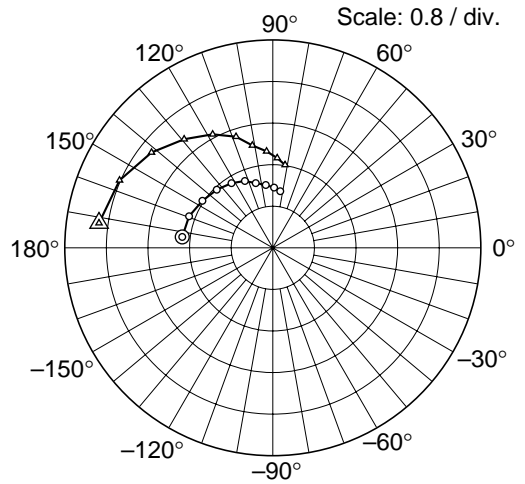
Condition:  $V_{CE} = 5\text{ V}$ ,  $Z_o = 50\ \Omega$   
 200 to 2000 MHz (200 MHz step)  
 ○ — ○ ( $I_C = 5\text{ mA}$ )  
 △ — △ ( $I_C = 10\text{ mA}$ )

S11 Parameter vs. Frequency



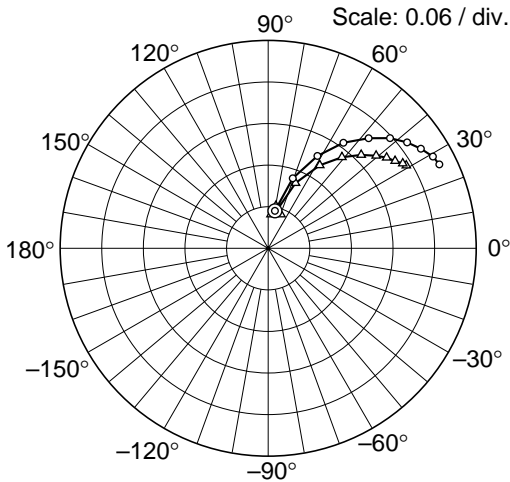
Condition:  $V_{CE} = 1\text{ V}$ ,  $Z_o = 50\ \Omega$   
 200 to 2000 MHz (200 MHz step)  
 ○ — ○ ( $I_C = 0.5\text{ mA}$ )  
 △ — △ ( $I_C = 1\text{ mA}$ )

S21 Parameter vs. Frequency



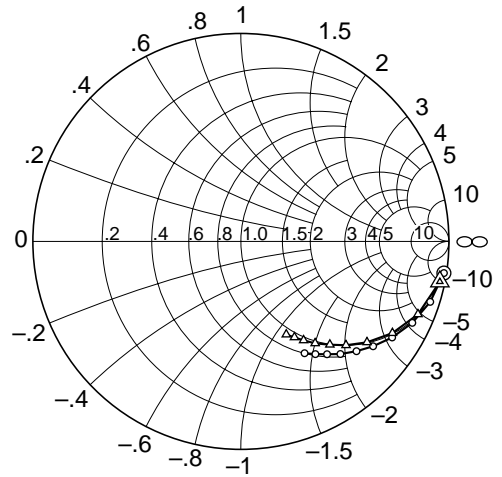
Condition:  $V_{CE} = 1\text{ V}$ ,  $Z_o = 50\ \Omega$   
 200 to 2000 MHz (200 MHz step)  
 ○ — ○ ( $I_C = 0.5\text{ mA}$ )  
 △ — △ ( $I_C = 1\text{ mA}$ )

S12 Parameter vs. Frequency



Condition:  $V_{CE} = 1\text{ V}$ ,  $Z_o = 50\ \Omega$   
 200 to 2000 MHz (200 MHz step)  
 ○ — ○ ( $I_C = 0.5\text{ mA}$ )  
 △ — △ ( $I_C = 1\text{ mA}$ )

S22 Parameter vs. Frequency



Condition:  $V_{CE} = 1\text{ V}$ ,  $Z_o = 50\ \Omega$   
 200 to 2000 MHz (200 MHz step)  
 ○ — ○ ( $I_C = 0.5\text{ mA}$ )  
 △ — △ ( $I_C = 1\text{ mA}$ )



**S Parameter** ( $V_{CE} = 5\text{ V}$ ,  $I_C = 5\text{ mA}$ ,  $Z_O = 50\ \Omega$ , Emitter Common)

Freq. (MHz)	S11		S21		S12		S22	
	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
100	0.850	-17.1	13.203	164.8	0.018	80.4	0.965	-10.5
200	0.781	-33.0	12.116	151.3	0.035	72.0	0.898	-19.9
300	0.689	-47.5	10.894	139.0	0.049	65.9	0.815	-27.5
400	0.598	-58.8	9.620	129.5	0.060	62.2	0.735	-32.8
500	0.523	-69.4	8.489	121.6	0.069	59.5	0.667	-36.4
600	0.450	-78.8	7.534	115.1	0.076	57.9	0.610	-38.9
700	0.394	-87.1	6.760	109.9	0.083	57.1	0.563	-40.6
800	0.348	-95.3	6.129	105.1	0.088	57.0	0.523	-42.1
900	0.306	-102.7	5.550	100.7	0.095	56.6	0.493	-42.7
1000	0.278	-109.3	5.113	97.4	0.101	56.8	0.467	-43.5
1100	0.243	-117.8	4.716	94.0	0.107	57.0	0.445	-44.2
1200	0.219	-125.4	4.342	91.0	0.113	56.8	0.428	-44.3
1300	0.203	-132.4	4.057	88.5	0.118	57.1	0.416	-45.1
1400	0.190	-143.7	3.804	85.9	0.124	57.4	0.401	-45.5
1500	0.167	-153.7	3.580	83.8	0.130	57.5	0.390	-45.9
1600	0.171	-163.2	3.391	81.1	0.136	57.8	0.380	-46.6
1700	0.161	-172.5	3.207	79.2	0.143	57.7	0.371	-47.0
1800	0.160	178.6	3.051	77.1	0.149	57.3	0.364	-47.6
1900	0.167	169.4	2.921	75.0	0.155	57.6	0.356	-48.3
2000	0.170	161.4	2.788	73.1	0.161	57.5	0.349	-48.9

## 2SC4784

S Parameter ( $V_{CE} = 5 \text{ V}$ ,  $I_C = 10 \text{ mA}$ ,  $Z_O = 50 \Omega$ , Emitter Common)

Freq. (MHz)	S11		S21		S12		S22	
	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
100	0.730	-25.1	20.636	158.3	0.017	77.3	0.929	-15.0
200	0.622	-46.7	17.551	140.7	0.031	69.3	0.808	-26.3
300	0.508	-64.4	14.512	127.1	0.041	64.0	0.689	-33.0
400	0.417	-77.8	12.064	118.0	0.049	62.8	0.600	-36.8
500	0.349	-89.5	10.223	111.0	0.057	62.1	0.534	-38.7
600	0.295	-100.6	8.803	105.3	0.064	62.1	0.487	-39.2
700	0.256	-110.7	7.735	101.0	0.070	62.9	0.451	-39.3
800	0.223	-120.6	6.899	97.1	0.077	63.4	0.423	-39.6
900	0.195	-129.7	6.178	93.5	0.084	63.6	0.403	-39.4
1000	0.183	-140.7	5.644	90.7	0.091	63.8	0.385	-39.5
1100	0.173	-151.8	5.167	88.0	0.098	64.3	0.372	-39.6
1200	0.154	-160.4	4.743	85.5	0.105	64.6	0.361	-39.6
1300	0.158	-171.4	4.423	83.5	0.112	64.5	0.353	-40.0
1400	0.158	177.6	4.121	81.4	0.119	64.8	0.345	-40.3
1500	0.157	165.9	3.866	79.1	0.126	64.7	0.338	-40.6
1600	0.165	160.7	3.648	77.0	0.133	64.2	0.332	-41.0
1700	0.172	154.4	3.460	75.1	0.141	64.1	0.327	-41.8
1800	0.176	147.9	3.277	73.7	0.148	63.9	0.321	-42.3
1900	0.187	140.9	3.129	71.6	0.155	63.7	0.317	-42.8
2000	0.194	136.0	2.982	69.8	0.162	63.2	0.312	-43.5

**S Parameter** ( $V_{CE} = 1\text{ V}$ ,  $I_C = 0.5\text{ mA}$ ,  $Z_O = 50\ \Omega$ , Emitter Common)

Freq. (MHz)	S11		S21		S12		S22	
	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
100	0.983	-6.8	1.755	173.2	0.027	84.6	0.995	-4.5
200	0.975	-13.4	1.721	166.6	0.055	79.9	0.987	-8.8
300	0.957	-20.2	1.722	159.4	0.082	75.0	0.974	-13.3
400	0.933	-26.9	1.706	152.9	0.107	70.6	0.956	-17.7
500	0.910	-33.2	1.629	146.3	0.130	66.2	0.937	-21.4
600	0.879	-39.5	1.597	139.8	0.151	61.9	0.913	-25.4
700	0.845	-45.8	1.553	134.0	0.170	58.1	0.890	-28.9
800	0.804	-51.4	1.528	128.1	0.187	54.4	0.862	-32.4
900	0.778	-57.3	1.475	122.6	0.203	51.1	0.838	-35.2
1000	0.739	-62.9	1.432	117.8	0.215	47.6	0.813	-38.4
1100	0.706	-68.6	1.392	112.7	0.227	44.9	0.790	-41.1
1200	0.671	-73.0	1.317	107.8	0.237	42.1	0.767	-43.5
1300	0.643	-78.5	1.286	104.8	0.245	39.7	0.745	-46.1
1400	0.609	-84.4	1.261	100.0	0.252	37.3	0.723	-48.5
1500	0.573	-88.6	1.215	96.4	0.258	35.3	0.702	-50.4
1600	0.553	-94.4	1.186	92.6	0.263	33.1	0.683	-52.6
1700	0.531	-100.1	1.158	88.8	0.267	31.1	0.667	-54.5
1800	0.516	-103.8	1.128	85.7	0.272	29.1	0.650	-56.5
1900	0.485	-109.6	1.098	82.5	0.273	27.7	0.634	-58.4
2000	0.466	-114.5	1.070	78.9	0.275	26.1	0.619	-60.3

## 2SC4784

S Parameter ( $V_{CE} = 1\text{ V}$ ,  $I_C = 1\text{ mA}$ ,  $Z_O = 50\ \Omega$ , Emitter Common)

Freq. (MHz)	S11		S21		S12		S22	
	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
100	0.962	-8.8	3.376	172.0	0.027	83.7	0.991	-5.9
200	0.950	-17.5	3.268	164.5	0.054	78.2	0.975	-11.4
300	0.919	-26.2	3.223	156.2	0.080	72.6	0.951	-17.2
400	0.885	-33.8	3.139	148.7	0.102	67.2	0.920	-22.4
500	0.839	-41.8	2.969	141.8	0.123	62.2	0.887	-26.8
600	0.797	-49.5	2.833	135.1	0.141	58.1	0.851	-31.2
700	0.748	-56.3	2.699	129.2	0.157	54.5	0.815	-35.1
800	0.701	-63.3	2.611	123.2	0.169	51.1	0.776	-38.7
900	0.664	-69.9	2.473	117.9	0.181	47.9	0.743	-41.8
1000	0.625	-75.7	2.363	113.1	0.190	45.2	0.710	-44.7
1100	0.577	-82.3	2.254	108.3	0.198	43.0	0.680	-47.3
1200	0.545	-87.7	2.109	104.2	0.205	40.7	0.655	-49.3
1300	0.515	-93.8	2.011	101.3	0.210	39.1	0.633	-51.8
1400	0.475	-100.5	1.946	97.0	0.215	37.5	0.606	-54.0
1500	0.446	-105.5	1.863	93.7	0.219	36.2	0.584	-55.7
1600	0.421	-111.6	1.800	90.1	0.222	34.6	0.563	-57.7
1700	0.403	-117.9	1.732	87.2	0.225	33.7	0.545	-59.2
1800	0.387	-122.1	1.663	84.4	0.229	32.2	0.528	-60.9
1900	0.366	-129.0	1.614	81.6	0.230	31.7	0.512	-62.7
2000	0.354	-135.7	1.554	78.6	0.232	31.0	0.498	-64.1



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