

FEATURES

- High f_T
 $f_T = 5.5 \text{ GHz TYP.}$
- $|S_{21e}|^2 = 10.0 \text{ dB TYP. @} f = 1.0 \text{ GHz, } V_{CE} = -10 \text{ V, } I_C = -15 \text{ mA}$
- High speed switching characteristics
- Equivalent NPN transistor is the NE02133 / 2SC2351.
- Alternative of the 2SA1424.

ABSOLUTE MAXIMUM RATINGS (T_A = 25 °C)

Parameter	Symbol	Rating	Unit
Collector to Base Voltage	V_{CB0}	-20	V
Collector to Emitter Voltage	V_{CE0}	-12	V
Emitter to Base Voltage	V_{EB0}	-3.0	V
Collector Current	I_C	-50	mA
Total Power Dissipation	P_T	200	mW
Junction Temperature	T_j	150	°C
Storage Temperature	T_{stg}	-65 to +150	°C

ELECTRICAL CHARACTERISTICS (T_A = 25 °C)

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Collector Cutoff Current	I_{CB0}	$V_{CB} = -10\text{ V}$			-0.1	μA
Emitter Cutoff Current	I_{EB0}	$V_{EB} = -2\text{ V}$			-0.1	μA
DC Current Gain	h_{FE}	$V_{CE} = -10\text{ V}, I_C = -15\text{ mA}$	20	40	100	
Gain Bandwidth Product	f_T	$V_{CE} = -10\text{ V}, I_C = -15\text{ mA}$	4.0	5.5		GHz
Collector Capacitance	C_{re}^*	$V_{CB} = -10\text{ V}, I_E = 0, f = 1\text{ MHz}$		0.5	1	pF
Insertion Power Gain	$ S_{21e} ^2$	$V_{CE} = -10\text{ V}, I_C = -15\text{ mA}, f = 1.0\text{ GHz}$	8.0	10.0		dB
Noise Figure	NF	$V_{CE} = -10\text{ V}, I_C = -3.0\text{ mA}, f = 1\text{ GHz}$		2.0	3	dB

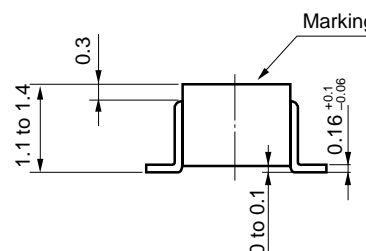
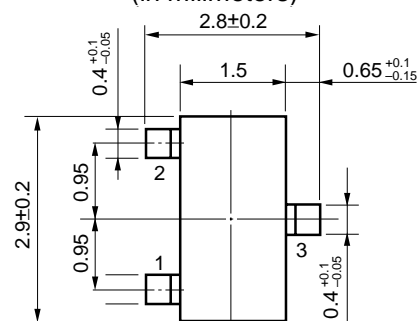
* Measured by a 3-terminal bridge. Emitter and Case should be connected to the guard terminal.

h_{FF} Classification

Rank	FB
Marking	T93
h_{FE}	20 to 100

PACKAGE DIMENSIONS

(in milimeters)



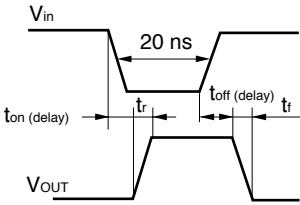
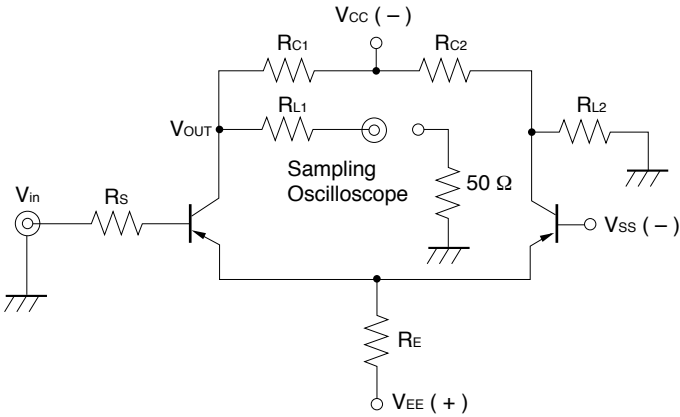
PIN CONNECTIONS

1: Emitter
2: Base
3: Collector Marking: T93

SWITCHING CHARACTERISTICS

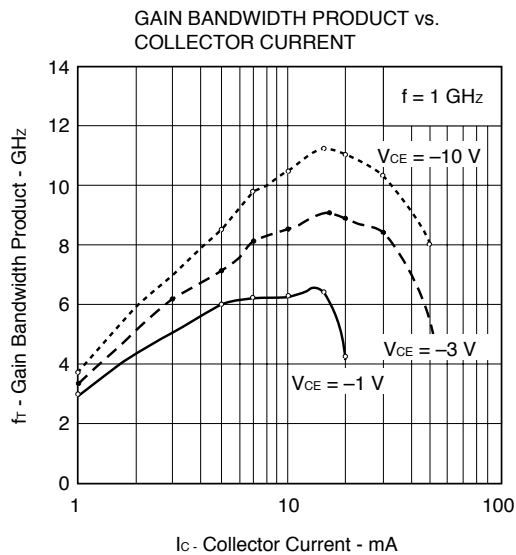
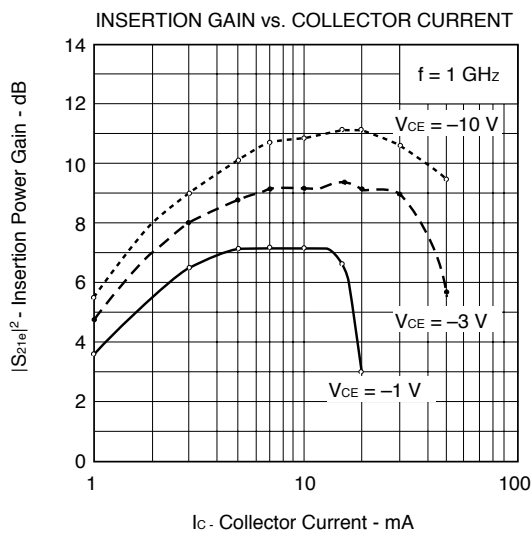
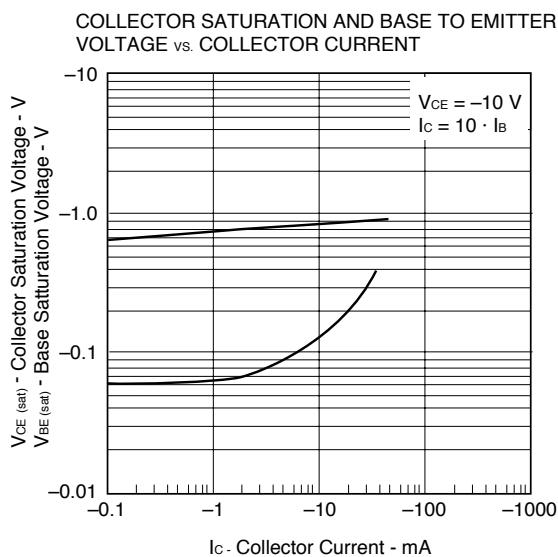
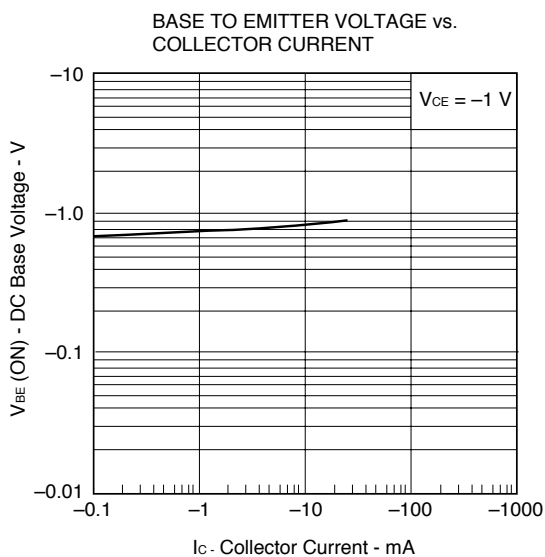
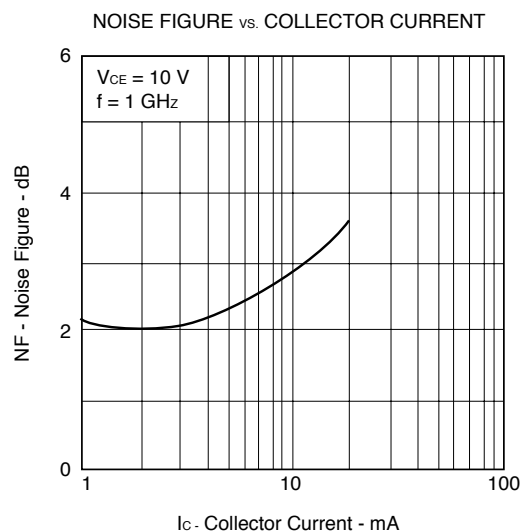
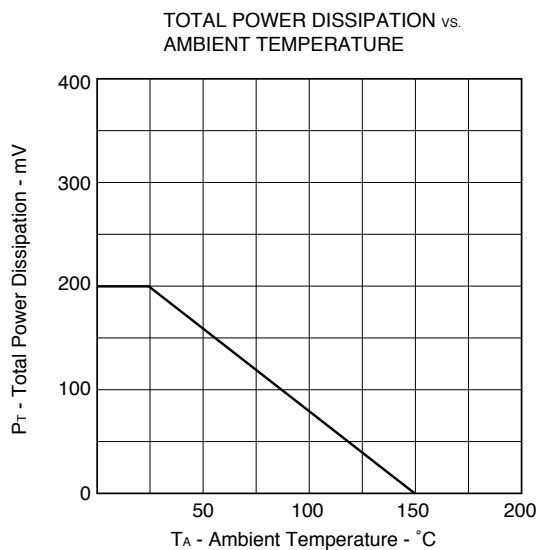
Parameter	Symbol	$V_{in} = 1\text{ V}$	Unit
		TYP	
Turn-on Delay Time	$t_{on} \text{ (delay)}$	1.10	ns
Rise Time	t_r	0.77	ns
Turn off Delay Time	$t_{off} \text{ (delay)}$	0.40	ns
Fall Time	t_f	0.79	ns

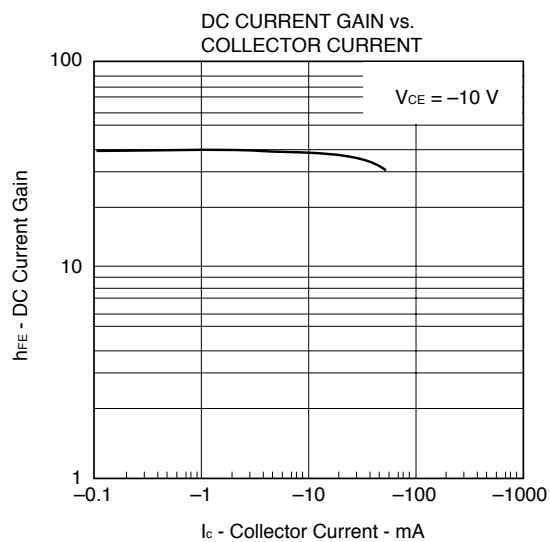
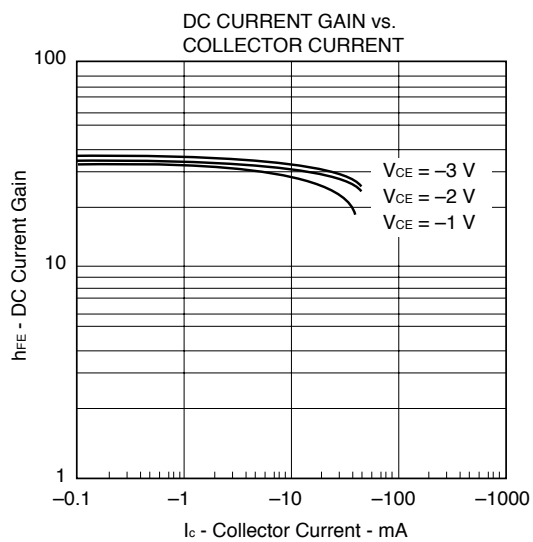
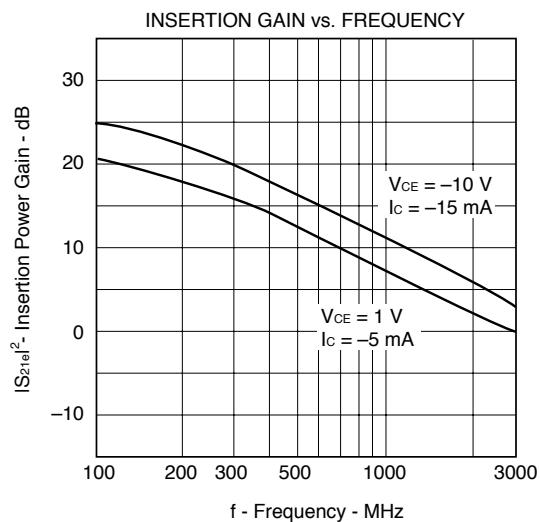
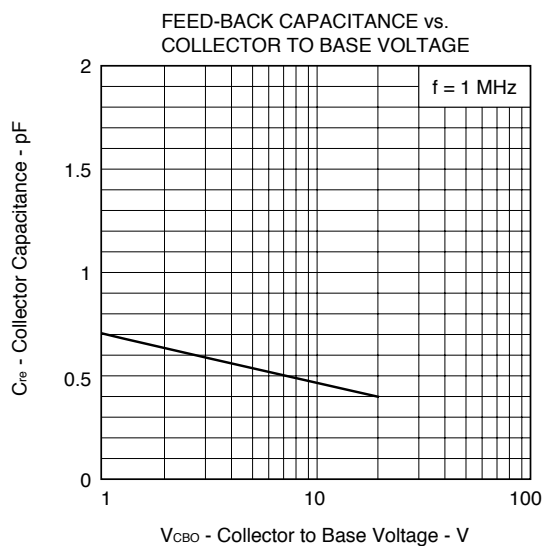
SWITCHING TIME MEASUREMENT CIRCUIT



$V_{in} = 1\text{ V}, V_{BB} = -0.5\text{ V}, R_{C1} = R_{C2}$						
R_S (Ω)	R_C (Ω)	R_{L1} (Ω)	R_{L2} (Ω)	R_E (Ω)	V_{EE} (V)	V_{CC} (V)
160	1 k	200	250	2.7 k	27	26.3

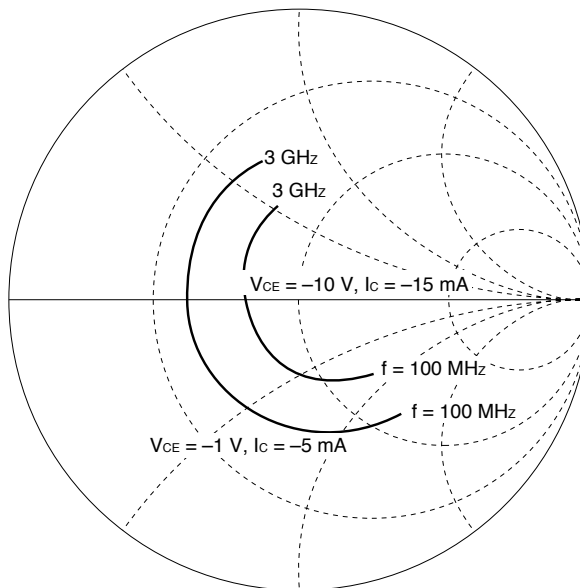
TYPICAL CHARACTERISTICS



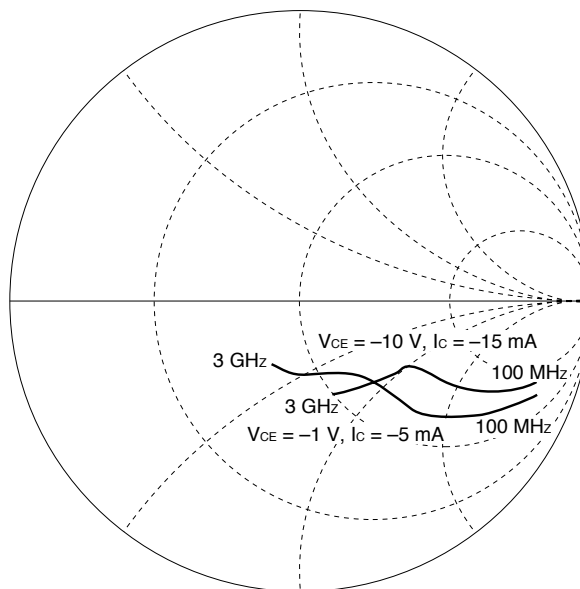


S-PARAMETER

S11



S22



S-PARAMETER(V_{CE} = 1 V, I_C = 5 mA, Z_o = 50 Ω)

f MHz	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100	0.527	- 47.1	10.5	149.	0.0359	70.6	0.881	- 21.1
200	0.468	- 83.4	8.37	128.	0.0584	58.7	0.716	- 34.2
300	0.427	- 109	6.63	114.	0.0729	53.6	0.586	- 40.9
400	0.407	- 128	5.36	104.	0.0835	52.1	0.503	- 44.3
500	0.393	- 143	4.46	96.6	0.0930	52.1	0.443	- 45.8
600	0.388	- 154	3.82	90.2	0.100	53.1	0.401	- 46.7
700	0.386	- 164	3.34	84.9	0.109	53.3	0.373	- 47.7
800	0.388	- 172	2.96	80.1	0.118	54.4	0.351	- 49.1
900	0.392	- 179	2.67	75.8	0.128	55.6	0.332	- 50.1
1000	0.394	174	2.43	71.6	0.137	56.4	0.319	- 51.4
1100	0.399	169	2.24	68.1	0.147	56.9	0.306	- 53.2
1200	0.405	163	2.07	64.6	0.158	57.2	0.298	- 54.5
1300	0.410	159	1.93	61.3	0.168	57.6	0.289	- 57.0
1400	0.416	154	1.81	58.0	0.179	57.7	0.280	- 59.3
1500	0.422	150	1.71	54.9	0.190	57.7	0.274	- 61.2
1600	0.431	147	1.62	52.0	0.201	57.7	0.267	- 64.4
1700	0.438	143	1.54	49.3	0.213	57.5	0.262	- 66.7
1800	0.445	140	1.47	46.6	0.224	57.2	0.259	- 70.3
1900	0.451	136	1.41	44.1	0.236	56.8	0.252	- 73.6
2000	0.460	133	1.35	41.5	0.248	56.3	0.247	- 76.3
2100	0.465	130	1.30	39.2	0.261	55.7	0.243	- 80.2
2200	0.473	127	1.26	36.9	0.273	55.1	0.239	- 84.4
2300	0.481	125	1.21	34.8	0.286	54.3	0.234	- 87.2
2400	0.487	122	1.17	32.5	0.299	53.3	0.235	- 91.9
2500	0.493	119	1.14	30.6	0.312	52.6	0.230	- 95.9

S-PARAMETER(V_{CE} = 3 V, I_C = 5 mA, Z_o = 50 Ω)

f MHz	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100	0.558	– 37.1	11.0	153.	0.0288	74.3	915	– 16.3
200	0.485	– 67.9	9.13	133.	0.0467	83.0	784	– 27.0
300	0.423	– 92.5	7.48	119.	0.0611	58.1	670	– 33.0
400	0.381	– 111	6.21	109.	0.0703	56.5	590	– 36.0
500	0.353	– 127	5.18	101.	0.0801	56.1	531	– 37.4
600	0.339	– 140	4.47	95.1	0.0880	56.7	490	– 38.1
700	0.329	– 151	3.92	89.9	0.0938	57.5	461	– 33.8
800	0.325	– 160	3.48	84.9	0.104	57.9	438	– 39.8
900	0.325	– 169	3.14	80.7	0.113	58.7	419	– 40.4
1000	0.326	– 176	2.87	76.9	0.122	59.5	408	– 41.6
1100	0.330	177	2.64	73.0	0.131	60.5	393	– 42.8
1200	0.335	170	2.44	69.6	0.140	61.2	386	– 44.0
1300	0.339	165	2.28	66.5	0.150	61.3	377	– 45.9
1400	0.345	160	2.13	63.3	0.160	61.9	366	– 47.5
1500	0.351	155	2.01	60.2	0.170	61.9	362	– 49.0
1600	0.360	151	1.90	57.4	0.181	61.8	354	– 51.0
1700	0.366	147	1.81	54.6	0.191	61.8	349	– 53.0
1800	0.374	143	1.72	52.0	0.202	61.7	344	– 55.5
1900	0.382	140	1.65	49.5	0.213	61.3	337	– 58.1
2000	0.390	137	1.58	47.0	0.223	61.0	334	– 60.4
2100	0.396	133	1.52	44.6	0.233	60.4	328	– 63.0
2200	0.404	130	1.46	42.4	0.243	60.2	321	– 65.9
2300	0.413	127	1.41	40.2	0.251	59.4	318	– 68.3
2400	0.418	125	1.36	38.0	0.273	58.9	314	– 72.1
2500	0.427	122	1.32	35.9	0.255	58.2	303	– 74.8

S-PARAMETER(V_{CE} = 10 V, I_C = 5 mA, Z_o = 50 Ω)

f MHz	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100	0.529	- 28.8	11.3	156.	0.0234	75.4	0.939	- 12.8
200	0.548	- 53.5	9.70	138.	0.0412	67.4	0.836	- 21.7
300	0.463	- 73.9	8.20	124.	0.0530	62.1	0.739	- 27.2
400	0.400	- 91.4	6.94	114.	0.0620	59.7	0.666	- 29.9
500	0.349	- 106	5.86	106.	0.0712	58.9	0.608	- 31.4
600	0.316	- 119	5.09	100.	0.0793	59.8	0.567	- 31.9
700	0.292	- 131	4.49	94.6	0.0860	59.6	0.539	- 32.7
800	0.277	- 141	4.00	89.7	0.0938	60.4	0.516	- 33.5
900	0.267	- 152	3.63	85.4	0.101	61.3	0.498	- 34.2
1000	0.261	- 160	3.31	81.5	0.109	61.9	0.485	- 35.1
1100	0.259	- 169	3.04	77.9	0.117	62.8	0.472	- 35.9
1200	0.260	- 177	2.82	74.5	0.125	63.2	0.463	- 36.9
1300	0.263	176	2.63	71.3	0.133	63.9	0.455	- 38.4
1400	0.267	169	2.46	68.2	0.143	64.4	0.448	- 39.5
1500	0.272	164	2.32	65.3	0.152	64.5	0.440	- 40.8
1600	0.280	159	2.20	62.5	0.161	64.6	0.434	- 42.5
1700	0.286	154	2.09	59.8	0.171	64.9	0.428	- 44.1
1800	0.293	149	1.99	57.3	0.191	64.8	0.423	- 46.0
1900	0.300	145	1.90	54.8	0.192	64.4	0.417	- 47.8
2000	0.308	141	1.82	52.3	0.201	64.5	0.413	- 49.7
2100	0.315	138	1.75	49.9	0.212	63.9	0.408	- 51.9
2200	0.325	134	1.68	47.6	0.223	63.8	0.402	- 54.3
2300	0.333	131	1.63	45.5	0.235	63.2	0.397	- 56.1
2400	0.341	128	1.57	43.3	0.246	62.7	0.395	- 58.7
2500	0.348	125	1.52	41.2	0.258	62.1	0.388	- 61.0

S-PARAMETER(V_{CE} = 10 V, I_C = 15 mA, Z₀ = 50 Ω)

f MHz	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100	0.354	– 46.6	17.87	147.	0.0190	74.6	866	– 18.3
200	0.290	– 81.8	13.45	125.	0.0317	70.0	708	– 26.9
300	0.247	– 107	10.35	113.	0.0420	68.4	601	– 29.8
400	0.226	– 126	8.294	104.	0.0518	68.3	539	– 30.5
500	0.215	– 141	6.799	97.8	0.0626	69.8	497	– 30.2
600	0.210	– 154	5.805	92.4	0.0720	70.8	470	– 30.1
700	0.208	– 164	5.050	88.1	0.0820	71.0	450	– 30.2
800	0.211	– 172	4.475	84.1	0.0919	70.9	435	– 30.6
900	0.215	179	4.008	80.5	0.102	70.9	423	– 31.1
1000	0.218	172	3.647	77.2	0.112	70.7	415	– 32.2
1100	0.225	166	3.345	74.2	0.121	70.9	405	– 32.9
1200	0.232	160	3.086	71.1	0.133	70.3	400	– 34.2
1300	0.237	156	2.871	68.4	0.143	70.2	394	– 35.7
1400	0.244	151	2.685	65.7	0.153	69.7	386	– 36.8
1500	0.251	147	2.532	63.2	0.165	69.2	381	– 38.4
1600	0.261	143	2.392	60.5	0.174	68.7	376	– 39.9
1700	0.268	140	2.265	58.2	0.185	68.0	373	– 41.6
1800	0.276	137	2.155	55.7	0.196	67.3	366	– 43.7
1900	0.284	134	2.059	53.5	0.207	66.5	360	– 45.7
2000	0.292	131	1.974	51.1	0.219	65.8	356	– 47.5
2100	0.299	128	1.897	49.0	0.230	65.1	350	– 49.7
2200	0.308	125	1.826	46.9	0.242	64.2	345	– 51.8
2300	0.317	123	1.763	44.7	0.252	63.3	341	– 53.8
2400	0.324	121	1.697	42.7	0.264	62.4	337	– 56.7
2500	0.332	119	1.646	40.7	0.276	61.5	331	– 58.8

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