# **RF Transistor for Low Noise Amplifier**

# 12 V, 100 mA, $f_T = 10$ GHz typ.

This RF transistor is designed for low noise amplifier applications. MCPH package is suitable for use under high temperature environment because it has superior heat radiation characteristics. This RF transistor is AEC-Q101 qualified and PPAP capable for automotive applications.

#### **Features**

- Low-noise Use: NF = 1.2 dB typ. (f = 1 GHz)
- High Cut-off Frequency:  $f_T = 10$  GHz typ.  $(V_{CE} = 5 \text{ V})$
- High Gain:  $|S21e|^2 = 17 \text{ dB typ.}$  (f = 1 GHz)
- MCPH4 Package is Pin-compatible with SC-82FL
- AEC-Q101 Qualified and PPAP Capable
- These Devices are Pb–Free, Halogen Free/BFR Free and are RoHS Compliant

#### **Typical Applications**

- Low Noise Amplifier for Digital Radio
- Low Noise Amplifier for TV
- Low Noise Amplifier for FM Radio
- RF Amplifier for UHF Application

#### **MAXIMUM RATINGS** at $T_A = 25$ °C

Rating	Symbol	Value	Unit
Collector to Base Voltage	$V_{CBO}$	20	V
Collector to Emitter Voltage	$V_{CEO}$	12	V
Emitter to Base Voltage	V <sub>EBO</sub>	2	V
Collector Current	I <sub>C</sub>	100	mA
Collector Dissipation	P <sub>C</sub>	450	mW
Operating Junction and Storage Temperature	T <sub>J</sub> , T <sub>stg</sub>	–55 to +150	°C

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.



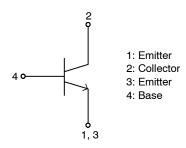
## ON Semiconductor®

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SC-82FL MCPH4 CASE 419AR

# ELECTRICAL CONNECTION NPN



### MARKING DIAGRAM



GQ = Specific Device Code XX = Lot Number

#### **ORDERING INFORMATION**

Device	Package	Shipping <sup>†</sup>
NSVF4015SG4T1G	SC-82FL (Pb-Free)	3000 / Tape & Reel

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specification Brochure, BRD8011/D.

Table 1. ELECTRICAL CHARACTERISTICS at T<sub>A</sub> = 25°C (Note 1)

			Value			
Parameter	Symbol	Conditions	Min	Тур	Max	Unit
Collector Cutoff Current	I <sub>CBO</sub>	V <sub>CB</sub> = 5 V, I <sub>E</sub> = 0 A			1.0	μΑ
Emitter Cutoff Current	I <sub>EBO</sub>	V <sub>EB</sub> = 1 V, I <sub>C</sub> = 0 A			1.0	μΑ
DC Current Gain	h <sub>FE</sub>	V <sub>CE</sub> = 5 V, I <sub>C</sub> = 50 mA	60		150	
Gain-Bandwidth Product	f <sub>T</sub>	V <sub>CE</sub> = 5 V, I <sub>C</sub> = 30 mA	8	10		GHz
Forward Transfer Gain	S21e   <sup>2</sup>	$V_{CE} = 5 \text{ V}, I_{C} = 30 \text{ mA}, f = 1 \text{ GHz}$	14	17		dB
Noise Figure	NF	V <sub>CE</sub> = 5 V, I <sub>C</sub> = 10 mA, f = 1 GHz		1.2	1.8	dB

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

1. Pay attention to handling since it is liable to be affected by static electricity due to the high–frequency process adopted.

#### **TYPICAL CHARACTERISTICS**

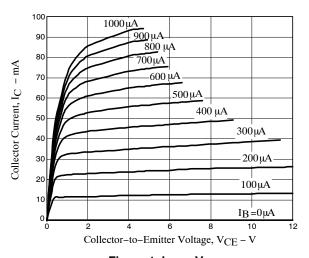


Figure 1.  $I_{\text{C}}$  vs.  $V_{\text{CE}}$ 

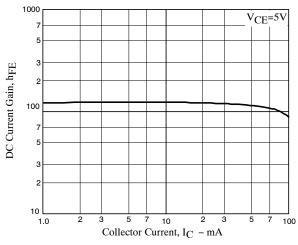


Figure 3. h<sub>FE</sub> vs. I<sub>C</sub>

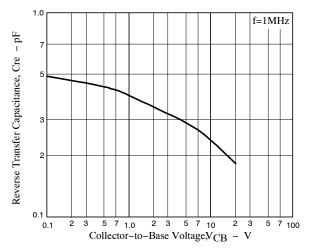


Figure 5. Cre vs.  $V_{CB}$ 

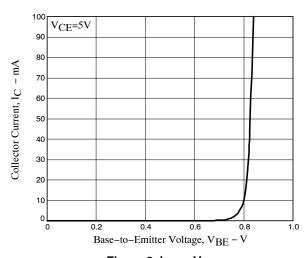


Figure 2.  $I_{\mbox{\scriptsize C}}$  vs.  $V_{\mbox{\scriptsize BE}}$ 

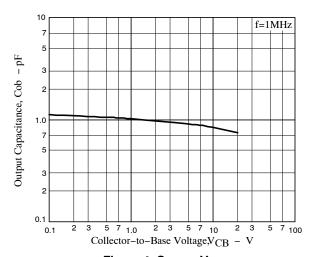


Figure 4.  $C_{ob}$  vs.  $V_{CB}$ 

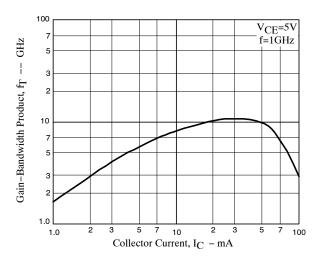


Figure 6.  $f_T$  vs.  $I_C$ 

## **TYPICAL CHARACTERISTICS**

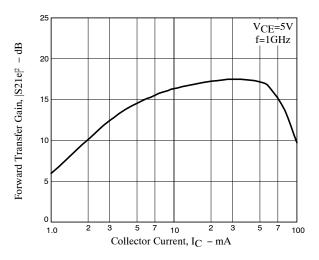


Figure 7. |S21e|2 vs. I<sub>C</sub>

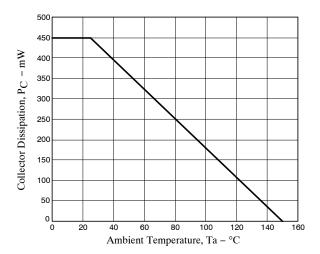


Figure 9.  $P_C$  vs.  $T_A$ 

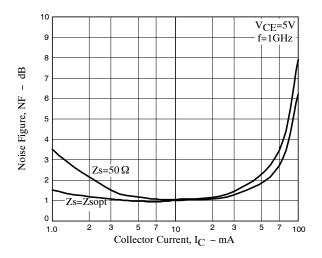


Figure 8. NF vs. I<sub>C</sub>

S Parameters	(Common er	mitter)						
CE=3V, IC=1	0mA							
Freq(MHz)	S11	∠S11	S21	∠S21	S12	∠ S12	S22	∠S22
100	0.763	-38.0	22.980	155.3	0.018	71.5	0.923	-22.7
200	0.733	-71.8	20.122	135.9	0.031	58.6	0.798	-40.2
300	0.702	-98.5	17.019	121.3	0.038	50.6	0.703	-53.5
400	0.690	-116.5	14.110	110.7	0.043	46.3	0.626	-62.9
500	0.701	-127.2	12.307	103.5	0.048	45.0	0.592	-67.4
600	0.679	-137.1	10.431	97.5	0.050	43.7	0.531	-72.0
700	0.663	-145.1	8.949	92.7	0.052	43.6	0.484	-75.2
800	0.651	-152.1	7.848	88.4	0.054	43.9	0.446	-78.7
900	0.646	-157.6	6.993	84.8	0.057	44.0	0.422	-81.6
1000	0.639	-162.3	6.272	81.9	0.059	45.1	0.404	-84.4
1200	0.635	-170.2	5.211	76.5	0.063	47.1	0.375	-88.7
1400	0.634	-176.5	4.462	71.7	0.068	49.1	0.362	-92.4
1600	0.633	177.9	3.907	67.3	0.073	51.2	0.352	-95.9
1800	0.636	173.2	3.463	63.4	0.079	52.7	0.351	-99.0
2000	0.637	169.1	3.122	59.5	0.085	54.3	0.352	-102.3
2200	0.637	164.9	2.838	55.8	0.091	55.5	0.356	-105.2
2400	0.638	161.0	2.604	52.1	0.098	56.5	0.364	-108.1
2600	0.639	157.3	2.413	48.7	0.105	57.2	0.372	-111.1
2800	0.642	153.7	2.244	45.1	0.112	57.9	0.384	-113.5
3000	0.641	150.0	2.095	41.8	0.120	57.8	0.396	-116.2

CE=3V, IC=3 Freq(MHz)	S11	∠S11	S21	∠S21	S12	∠ S12	S22	∠S22
100	0.542	-76.9	42.437	142.3	0.013	63.9	0.801	-36.2
200	0.542	-118.2	30.735	119.6	0.013	53.9	0.602	-56.8
300	0.588	-138.6	22.677	106.5	0.020	52.3	0.505	-69.3
400	0.626	-150.0	17.506	98.4	0.024	53.8	0.303	-77.9
500	0.635	-155.0	14.522	92.7	0.027	55.6	0.423	-79.8
600	0.630	-161.3	12.035	88.5	0.031	57.8	0.423	-83.6
700	0.627	-166.4	10.249	85.2	0.033	59.8	0.350	-86.9
800	0.626	-170.9	8.902	82.2	0.038	61.3	0.330	-90.4
900	0.627	-174.7	7.888	79.5	0.042	62.3	0.327	-93.2
1000	0.626	-174.7	7.046	77.3	0.043	63.4	0.314	-95.2
1200	0.629	176.7	5.835	73.1	0.049	65.4	0.303	-100.4
1400	0.631	170.7	4.976	69.2	0.065	66.2	0.287	-100.4
1600	0.633	167.7	4.344	65.6	0.003	66.5	0.282	-105.8
1800	0.637	163.9	3.854	62.0	0.073	66.8	0.280	-100.9
2000	0.638	160.5	3.474	58.7	0.090	66.6	0.287	-112.5
2200	0.638	156.8	3.160	55.5	0.090	66.5	0.287	-112.3
2400	0.640	153.5	2.900	52.2	0.108	65.8	0.302	-117.3
2600	0.640	150.2	2.684	49.0	0.108	65.2	0.302	-117.5
2800	0.642	146.9	2.499	45.9	0.117	64.3	0.312	-121.6
3000	0.640	143.6	2.337	42.8	0.123	63.6	0.324	-121.8
CE=3V, IC=5 Freq(MHz)	S11	∠S11	S21	∠S21	S12	∠ S12	S22	∠S22
100	0.514	-110.3	43.067	133.3	0.011	59.0	0.700	-40.9
200	0.607	-141.4	29.221	112.3	0.016	53.1	0.495	-58.9
300	0.642	-154.9	20.818	101.0	0.019	55.3	0.417	-68.7
400	0.657	-162.5	15.865	94.1	0.023	58.5	0.376	-75.5
500	0.660	-165.8	13.033	88.9	0.027	61.4	0.360	-75.7
600	0.659	-170.3	10.812	85.3	0.030	64.0	0.330	-78.7
700	0.658	-174.3	9.213	82.3	0.034	66.1	0.307	-81.5
800	0.660	-177.8	7.995	79.5	0.038	67.8	0.291	-84.5
900	0.663	179.2	7.097	77.1	0.042	68.6	0.284	-87.1
1000	0.662	176.6	6.333	74.8	0.046	69.6	0.277	-89.7
1200	0.666	172.0	5.247	70.8	0.055	70.9	0.268	-93.7
1400	0.670	167.9	4.475	67.0	0.063	71.3	0.269	-97.1
1600	0.673	164.1	3.897	63.4	0.072	71.5	0.270	-100.2
1800	0.676	160.6	3.469	59.9	0.080	71.4	0.275	-103.3
0000	0.678	157.5	3.113	56.5	0.089	71.0	0.284	-106.5
2000	0.679	154.1	2.836	53.1	0.098	70.4	0.293	-109.3
2000				40.0	0.107	69.8	0.304	111 0
	0.681	150.9	2.598	49.8	0.107	07.0	0.304	-111.9
2200	0.681 0.682	150.9 147.8	2.598 2.404	46.6	0.116	68.9	0.316	-111.9 -114.4
2200 2400					-			

CE=3V, IC=8		1	les: ·		1		1 m	
Freq(MHz)	S11	∠S11	S21	∠S21	S12	∠ S12	S22	∠S22
100	0.662	-146.8	29.622	120.5	0.011	47.5	0.455	-44.8
200	0.751	-164.0	16.762	102.8	0.014	46.9	0.315	-52.9
300	0.774	-171.2	11.369	94.2	0.017	52.5	0.288	-57.1
400	0.783	-175.6	8.549	88.9	0.019	58.6	0.279	-61.3
500	0.778	-178.0	6.977	84.2	0.023	62.0	0.283	-61.0
600	0.778	179.0	5.801	81.0	0.027	66.0	0.272	-62.9
700	0.778	176.3	4.965	78.3	0.030	68.6	0.265	-65.2
800	0.780	173.9	4.316	75.7	0.034	70.2	0.260	-68.0
900	0.782	171.6	3.846	73.3	0.038	71.9	0.263	-70.7
1000	0.782	169.6	3.439	71.0	0.042	73.0	0.263	-73.7
1200	0.787	166.0	2.860	66.6	0.051	74.5	0.268	-78.5
1400	0.789	162.5	2.454	62.4	0.059	75.3	0.278	-83.1
1600	0.792	159.2	2.139	58.4	0.068	75.7	0.288	-87.5
1800	0.796	156.0	1.912	54.5	0.077	75.7	0.300	-91.7
2000	0.797	153.1	1.721	50.8	0.086	75.4	0.314	-96.1
2200	0.797	149.9	1.569	47.1	0.095	75.0	0.328	-100.0
2400	0.799	146.8	1.436	43.4	0.105	74.1	0.343	-103.8
2600	0.800	143.8	1.331	39.9	0.115	73.4	0.359	-107.4
2800	0.801	140.6	1.238	36.5	0.125	72.2	0.377	-110.9
3000	0.799	137.4	1.157	33.3	0.135	71.1	0.394	-114.4
CE=5V, IC=1 Freq(MHz)	S11	∠S11	S21	∠S21	S12	∠ S12	S22	∠S22
100	0.771	-35.8	23.180	156.3	0.016	72.7	0.933	-20.3
200	0.741	-68.2	20.484	137.3	0.028	60.4	0.820	-36.2
300	0.706	-94.4	17.503	122.8	0.035	53.0	0.722	-48.5
400	0.691	-112.7	14.633	444.0				
500	0.501		1	111.9	0.040	48.5	0.656	-57.3
200	0.701	-123.8	12.817	111.9 104.7	0.040 0.044	48.5 47.2	0.656 0.622	
600	0.701							-57.3
		-123.8	12.817	104.7	0.044	47.2	0.622	-57.3 -61.7
600	0.677 0.659	-123.8 -133.9 -142.2	12.817 10.891 9.349	104.7 98.4 93.5	0.044 0.047 0.049	47.2 46.0 45.5	0.622 0.560 0.513	-57.3 -61.7 -66.0 -68.9
600 700	0.677	-123.8 -133.9	12.817 10.891	104.7 98.4	0.044 0.047	47.2 46.0	0.622 0.560	-57.3 -61.7 -66.0
600 700 800	0.677 0.659 0.646	-123.8 -133.9 -142.2 -149.5	12.817 10.891 9.349 8.209	98.4 93.5 89.1	0.044 0.047 0.049 0.051	47.2 46.0 45.5 45.7	0.622 0.560 0.513 0.474	-57.3 -61.7 -66.0 -68.9 -72.0
600 700 800 900	0.677 0.659 0.646 0.640	-123.8 -133.9 -142.2 -149.5 -155.2	12.817 10.891 9.349 8.209 7.315	104.7 98.4 93.5 89.1 85.3	0.044 0.047 0.049 0.051 0.053	47.2 46.0 45.5 45.7 46.1	0.622 0.560 0.513 0.474 0.449	-57.3 -61.7 -66.0 -68.9 -72.0 -74.7
600 700 800 900 1000	0.677 0.659 0.646 0.640 0.633	-123.8 -133.9 -142.2 -149.5 -155.2 -160.1	12.817 10.891 9.349 8.209 7.315 6.557	104.7 98.4 93.5 89.1 85.3 82.3	0.044 0.047 0.049 0.051 0.053 0.055	47.2 46.0 45.5 45.7 46.1 46.9	0.622 0.560 0.513 0.474 0.449 0.428	-57.3 -61.7 -66.0 -68.9 -72.0 -74.7 -77.4
600 700 800 900 1000 1200	0.677 0.659 0.646 0.640 0.633 0.628	-123.8 -133.9 -142.2 -149.5 -155.2 -160.1 -168.2	12.817 10.891 9.349 8.209 7.315 6.557 5.459	104.7 98.4 93.5 89.1 85.3 82.3 76.8	0.044 0.047 0.049 0.051 0.053 0.055 0.060	47.2 46.0 45.5 45.7 46.1 46.9 49.0	0.622 0.560 0.513 0.474 0.449 0.428 0.399	-57.3 -61.7 -66.0 -68.9 -72.0 -74.7 -77.4 -81.4
600 700 800 900 1000 1200 1400	0.677 0.659 0.646 0.640 0.633 0.628 0.625	-123.8 -133.9 -142.2 -149.5 -155.2 -160.1 -168.2 -174.7	12.817 10.891 9.349 8.209 7.315 6.557 5.459 4.663	104.7 98.4 93.5 89.1 85.3 82.3 76.8 71.9	0.044 0.047 0.049 0.051 0.053 0.055 0.060 0.064	47.2 46.0 45.5 45.7 46.1 46.9 49.0 51.0	0.622 0.560 0.513 0.474 0.449 0.428 0.399 0.385	-57.3 -61.7 -66.0 -68.9 -72.0 -74.7 -77.4 -81.4 -84.9
600 700 800 900 1000 1200 1400 1600	0.677 0.659 0.646 0.640 0.633 0.628 0.625	-123.8 -133.9 -142.2 -149.5 -155.2 -160.1 -168.2 -174.7 179.5	12.817 10.891 9.349 8.209 7.315 6.557 5.459 4.663 4.086	104.7 98.4 93.5 89.1 85.3 82.3 76.8 71.9 67.5	0.044 0.047 0.049 0.051 0.053 0.055 0.060 0.064 0.069	47.2 46.0 45.5 45.7 46.1 46.9 49.0 51.0 53.3	0.622 0.560 0.513 0.474 0.449 0.428 0.399 0.385 0.373	-57.3 -61.7 -66.0 -68.9 -72.0 -74.7 -77.4 -81.4 -84.9 -88.4
600 700 800 900 1000 1200 1400 1600 1800	0.677 0.659 0.646 0.640 0.633 0.628 0.625 0.625	-123.8 -133.9 -142.2 -149.5 -155.2 -160.1 -168.2 -174.7 179.5 174.7	12.817 10.891 9.349 8.209 7.315 6.557 5.459 4.663 4.086 3.616	104.7 98.4 93.5 89.1 85.3 82.3 76.8 71.9 67.5 63.5	0.044 0.047 0.049 0.051 0.053 0.055 0.060 0.064 0.069 0.075	47.2 46.0 45.5 45.7 46.1 46.9 49.0 51.0 53.3 54.8	0.622 0.560 0.513 0.474 0.449 0.428 0.399 0.385 0.373 0.372	-57.3 -61.7 -66.0 -68.9 -72.0 -74.7 -77.4 -81.4 -84.9 -88.4 -91.5
600 700 800 900 1000 1200 1400 1600 1800 2000	0.677 0.659 0.646 0.640 0.633 0.628 0.625 0.625 0.627	-123.8 -133.9 -142.2 -149.5 -155.2 -160.1 -168.2 -174.7 179.5 174.7 170.5	12.817 10.891 9.349 8.209 7.315 6.557 5.459 4.663 4.086 3.616 3.260	104.7 98.4 93.5 89.1 85.3 82.3 76.8 71.9 67.5 63.5 59.5	0.044 0.047 0.049 0.051 0.053 0.055 0.060 0.064 0.069 0.075 0.080	47.2 46.0 45.5 45.7 46.1 46.9 49.0 51.0 53.3 54.8 56.6	0.622 0.560 0.513 0.474 0.449 0.428 0.399 0.385 0.373 0.372 0.372	-57.3 -61.7 -66.0 -68.9 -72.0 -74.7 -77.4 -81.4 -84.9 -88.4 -91.5 -94.9
600 700 800 900 1000 1200 1400 1600 1800 2000 2200	0.677 0.659 0.646 0.640 0.633 0.628 0.625 0.625 0.627 0.628	-123.8 -133.9 -142.2 -149.5 -155.2 -160.1 -168.2 -174.7 179.5 174.7 170.5 166.2	12.817 10.891 9.349 8.209 7.315 6.557 5.459 4.663 4.086 3.616 3.260 2.960	104.7 98.4 93.5 89.1 85.3 82.3 76.8 71.9 67.5 63.5 59.5 55.7	0.044 0.047 0.049 0.051 0.053 0.055 0.060 0.064 0.069 0.075 0.080 0.086	47.2 46.0 45.5 45.7 46.1 46.9 49.0 51.0 53.3 54.8 56.6 57.9	0.622 0.560 0.513 0.474 0.449 0.428 0.399 0.385 0.373 0.372 0.372	-57.3 -61.7 -66.0 -68.9 -72.0 -74.7 -77.4 -81.4 -84.9 -88.4 -91.5 -94.9 -98.0
600 700 800 900 1000 1200 1400 1600 1800 2000 2200 2400	0.677 0.659 0.646 0.640 0.633 0.628 0.625 0.625 0.627 0.628 0.628 0.628	-123.8 -133.9 -142.2 -149.5 -155.2 -160.1 -168.2 -174.7 179.5 174.7 170.5 166.2 162.2	12.817 10.891 9.349 8.209 7.315 6.557 5.459 4.663 4.086 3.616 3.260 2.960 2.715	104.7 98.4 93.5 89.1 85.3 82.3 76.8 71.9 67.5 63.5 59.5 55.7 52.0	0.044 0.047 0.049 0.051 0.053 0.055 0.060 0.064 0.069 0.075 0.080 0.086 0.093	47.2 46.0 45.5 45.7 46.1 46.9 49.0 51.0 53.3 54.8 56.6 57.9 58.9	0.622 0.560 0.513 0.474 0.449 0.428 0.399 0.385 0.373 0.372 0.372 0.376 0.383	-57.3 -61.7 -66.0 -68.9 -72.0 -74.7 -77.4 -81.4 -84.9 -88.4 -91.5 -94.9 -98.0 -101.1

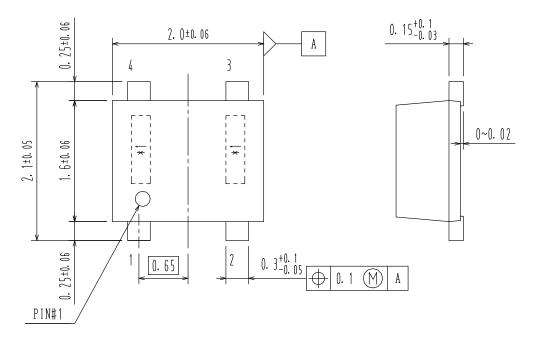
CE=5V, IC=3 Freq(MHz)	S11	∠S11	S21	∠S21	S12	∠ S12	S22	∠S22
100	0.542	-70.6	43.013	144.3	0.012	66.3	0.826	-31.8
200		-70.6		121.4		56.3		
300	0.577	-112.5	32.303	107.8	0.018 0.022	55.0	0.636 0.539	-50.4 -61.6
400			24.068			55.5	-	-69.3
	0.611	-146.5 -151.9	18.636	99.4 93.6	0.025		0.478 0.454	-69.3
500 600			15.457		0.029 0.033	57.7 59.6		-71.4
	0.614	-158.6	12.813	89.2		61.5	0.410	<u> </u>
700	0.611	-164.1	10.898	85.6	0.036		0.376	-77.5
800	0.610	-168.7	9.470	82.5	0.039	62.9	0.351	-80.5
900	0.611	-172.7	8.381	79.8	0.043	64.1	0.337	-83.2
1000	0.610	-176.0	7.487	77.5	0.047	65.3	0.324	-85.8
1200	0.612	178.3	6.186	73.2	0.054	66.8	0.306	-89.7
1400	0.615	173.4	5.277	69.2	0.062	67.7	0.299	-93.1
1600	0.617	169.0	4.596	65.6	0.070	68.2	0.296	-96.3
1800	0.620	165.1	4.085	62.0	0.078	68.6	0.297	-99.3
2000	0.622	161.6	3.669	58.7	0.086	68.4	0.301	-102.5
2200	0.622	158.0	3.344	55.5	0.095	68.3	0.307	-105.1
2400	0.625	154.6	3.065	52.1	0.103	67.8	0.316	-107.9
2600	0.625	151.3	2.835	48.8	0.112	67.2	0.326	-110.5
2800 3000	0.628	148.0 144.6	2.638 2.464	45.7 42.6	0.120 0.129	66.5 65.6	0.339 0.352	-113.0 -115.5
CE=5V, IC=5 Freq(MHz)	S11	∠S11	S21	∠S21	S12	∠ S12	S22	∠S22
100	0.479	-97.2	42.927	137.2	0.010	63.4	0.761	-35.0
200	0.566	-132.9	32.978	115.4	0.015	56.7	0.560	-51.6
300	0.603	-148.8	23.718	103.2	0.018	58.0	0.485	-60.6
400	0.620	-157.8	18.120	95.7	0.021	60.4	0.427	-66.9
500	0.625	1/1/	14.000					-00.9
	0.025	-161.4	14.893	90.4	0.025	63.7	0.410	-68.0
600	0.624	-161.4	12.324	90.4 86.4	0.025 0.029	63.7 66.0	0.410 0.375	
								-68.0
600	0.624	-166.7 -171.0	12.324	86.4	0.029	66.0	0.375	-68.0 -70.7 -73.2
600 700	0.624 0.624	-166.7	12.324 10.482	86.4 83.2	0.029 0.032	66.0 68.0	0.375 0.348	-68.0 -70.7
600 700 800	0.624 0.624 0.626	-166.7 -171.0 -174.8	12.324 10.482 9.088	86.4 83.2 80.4	0.029 0.032 0.036	66.0 68.0 69.2	0.375 0.348 0.328	-68.0 -70.7 -73.2 -75.9 -78.4
600 700 800 900	0.624 0.624 0.626 0.628	-166.7 -171.0 -174.8 -178.1	12.324 10.482 9.088 8.053	86.4 83.2 80.4 77.9	0.029 0.032 0.036 0.040	66.0 68.0 69.2 70.4	0.375 0.348 0.328 0.317	-68.0 -70.7 -73.2 -75.9 -78.4
600 700 800 900 1000	0.624 0.624 0.626 0.628 0.628	-166.7 -171.0 -174.8 -178.1 179.1	12.324 10.482 9.088 8.053 7.184	86.4 83.2 80.4 77.9 75.6	0.029 0.032 0.036 0.040 0.044	66.0 68.0 69.2 70.4 70.9	0.375 0.348 0.328 0.317 0.308	-68.0 -70.7 -73.2 -75.9 -78.4 -80.9
600 700 800 900 1000 1200	0.624 0.624 0.626 0.628 0.628 0.633	-166.7 -171.0 -174.8 -178.1 179.1 174.2	12.324 10.482 9.088 8.053 7.184 5.943	86.4 83.2 80.4 77.9 75.6 71.5	0.029 0.032 0.036 0.040 0.044 0.052	66.0 68.0 69.2 70.4 70.9 72.2	0.375 0.348 0.328 0.317 0.308 0.295	-68.0 -70.7 -73.2 -75.9 -78.4 -80.9 -84.6
600 700 800 900 1000 1200 1400	0.624 0.624 0.626 0.628 0.628 0.633 0.636	-166.7 -171.0 -174.8 -178.1 179.1 174.2 169.8	12.324 10.482 9.088 8.053 7.184 5.943 5.061	86.4 83.2 80.4 77.9 75.6 71.5 67.7	0.029 0.032 0.036 0.040 0.044 0.052 0.060	66.0 68.0 69.2 70.4 70.9 72.2 72.7	0.375 0.348 0.328 0.317 0.308 0.295 0.292	-68.0 -70.7 -73.2 -75.9 -78.4 -80.9 -84.6 -88.2
600 700 800 900 1000 1200 1400 1600	0.624 0.624 0.626 0.628 0.628 0.633 0.636 0.640	-166.7 -171.0 -174.8 -178.1 179.1 174.2 169.8 165.9	12.324 10.482 9.088 8.053 7.184 5.943 5.061 4.407	86.4 83.2 80.4 77.9 75.6 71.5 67.7 64.1	0.029 0.032 0.036 0.040 0.044 0.052 0.060 0.069	66.0 68.0 69.2 70.4 70.9 72.2 72.7	0.375 0.348 0.328 0.317 0.308 0.295 0.292 0.292	-68.0 -70.7 -73.2 -75.9 -78.4 -80.9 -84.6 -88.2 -91.5
600 700 800 900 1000 1200 1400 1600 1800	0.624 0.624 0.626 0.628 0.628 0.633 0.636 0.640	-166.7 -171.0 -174.8 -178.1 179.1 174.2 169.8 165.9 162.3	12.324 10.482 9.088 8.053 7.184 5.943 5.061 4.407 3.917	86.4 83.2 80.4 77.9 75.6 71.5 67.7 64.1 60.6	0.029 0.032 0.036 0.040 0.044 0.052 0.060 0.069	66.0 68.0 69.2 70.4 70.9 72.2 72.7 72.7 72.6	0.375 0.348 0.328 0.317 0.308 0.295 0.292 0.292 0.295	-68.0 -70.7 -73.2 -75.9 -78.4 -80.9 -84.6 -88.2 -91.5 -94.7 -98.1
600 700 800 900 1000 1200 1400 1600 1800 2000	0.624 0.624 0.626 0.628 0.628 0.633 0.636 0.640 0.643 0.645	-166.7 -171.0 -174.8 -178.1 179.1 174.2 169.8 165.9 162.3 159.1	12.324 10.482 9.088 8.053 7.184 5.943 5.061 4.407 3.917 3.518	86.4 83.2 80.4 77.9 75.6 71.5 67.7 64.1 60.6 57.2	0.029 0.032 0.036 0.040 0.044 0.052 0.060 0.069 0.077	66.0 68.0 69.2 70.4 70.9 72.2 72.7 72.7 72.6 72.3	0.375 0.348 0.328 0.317 0.308 0.295 0.292 0.292 0.295 0.301	-68.0 -70.7 -73.2 -75.9 -78.4 -80.9 -84.6 -88.2 -91.5 -94.7 -98.1 -101.1
600 700 800 900 1000 1200 1400 1600 1800 2000 2200	0.624 0.624 0.626 0.628 0.628 0.633 0.636 0.640 0.643 0.645 0.646	-166.7 -171.0 -174.8 -178.1 179.1 174.2 169.8 165.9 162.3 159.1 155.6	12.324 10.482 9.088 8.053 7.184 5.943 5.061 4.407 3.917 3.518 3.202	86.4 83.2 80.4 77.9 75.6 71.5 67.7 64.1 60.6 57.2 54.0	0.029 0.032 0.036 0.040 0.044 0.052 0.060 0.069 0.077 0.086 0.094	66.0 68.0 69.2 70.4 70.9 72.2 72.7 72.7 72.6 72.3 71.8	0.375 0.348 0.328 0.317 0.308 0.295 0.292 0.292 0.292 0.301 0.309	-68.0 -70.7 -73.2 -75.9 -78.4 -80.9 -84.6 -88.2 -91.5
600 700 800 900 1000 1200 1400 1600 1800 2000 2200 2400	0.624 0.624 0.626 0.628 0.628 0.633 0.636 0.640 0.643 0.645 0.646 0.648	-166.7 -171.0 -174.8 -178.1 179.1 174.2 169.8 165.9 162.3 159.1 155.6 152.4	12.324 10.482 9.088 8.053 7.184 5.943 5.061 4.407 3.917 3.518 3.202 2.931	86.4 83.2 80.4 77.9 75.6 71.5 67.7 64.1 60.6 57.2 54.0	0.029 0.032 0.036 0.040 0.044 0.052 0.060 0.069 0.077 0.086 0.094	66.0 68.0 69.2 70.4 70.9 72.2 72.7 72.7 72.6 72.3 71.8 71.1	0.375 0.348 0.328 0.317 0.308 0.295 0.292 0.292 0.295 0.301 0.309 0.319	-68.0 -70.7 -73.2 -75.9 -78.4 -80.9 -84.6 -88.2 -91.5 -94.7 -98.1 -101.1 -104.0

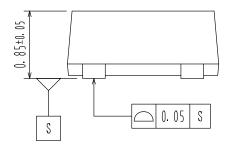
CE=5V, IC=8								
Freq(MHz)	S11	∠S11	S21	∠S21	S12	∠ S12	S22	∠S22
100	0.558	-133.0	39.014	127.8	0.009	54.5	0.618	-33.7
200	0.671	-155.6	23.364	107.6	0.012	52.6	0.457	-41.5
300	0.704	-165.1	16.107	97.6	0.014	57.5	0.415	-45.4
400	0.718	-170.7	12.150	91.5	0.017	62.9	0.395	-49.0
500	0.716	-173.4	9.907	86.7	0.021	66.8	0.385	-50.4
600	0.717	-177.0	8.214	83.3	0.024	69.5	0.378	-52.4
700	0.718	179.9	7.015	80.4	0.028	72.5	0.364	-54.4
800	0.720	177.1	6.091	77.8	0.031	73.9	0.354	-57.0
900	0.723	174.5	5.413	75.3	0.035	75.7	0.351	-59.7
1000	0.723	172.3	4.829	72.9	0.039	76.8	0.346	-62.4
1200	0.728	168.3	4.009	68.8	0.047	78.1	0.343	-67.0
1400	0.731	164.7	3.423	64.7	0.055	78.9	0.347	-71.8
1600	0.735	161.2	2.987	60.8	0.063	78.9	0.352	-76.2
1800	0.738	157.9	2.662	57.1	0.072	79.1	0.359	-80.6
2000	0.740	155.0	2.393	53.5	0.081	78.7	0.369	-85.3
2200	0.741	151.7	2.179	50.0	0.090	78.2	0.379	-89.5
2400	0.743	148.6	1.993	46.4	0.099	77.4	0.391	-93.5
2600	0.744	145.6	1.843	43.0	0.109	76.5	0.404	-97.4
2800	0.746	142.4	1.716	39.6	0.119	75.4	0.418	-101.3
3000	0.744	139.2	1.601	36.3	0.129	74.2	0.433	-105.1
CE=8V, IC=1 Freq(MHz)	S11	∠S11	S21	∠S21	S12	∠ S12	S22	∠S22
100	0.784	-33.9	22.973	157.1	0.014	73.5	0.941	-18.1
200	0.754	-64.8	20.491	138.6	0.025	62.4	0.839	-32.6
300	0.715	-90.5	17.690	124.1		77.0	0.500	
400	0.697	_		127.1	0.032	55.0	0.739	-44.1
	0.077	-109.0	14.905	113.1	0.032	55.0	0.739	-44.1 -52.2
500	0.704	-109.0 -120.4	14.905 13.108					
500 600				113.1	0.037	50.3	0.685	-52.2
	0.704	-120.4	13.108	113.1 105.8	0.037 0.041	50.3 49.3	0.685 0.652	-52.2 -56.5
600	0.704 0.678 0.659	-120.4 -130.9	13.108 11.176	113.1 105.8 99.3	0.037 0.041 0.044	50.3 49.3 47.7	0.685 0.652 0.591	-52.2 -56.5 -60.6
600 700	0.704 0.678	-120.4 -130.9 -139.5	13.108 11.176 9.599	113.1 105.8 99.3 94.2	0.037 0.041 0.044 0.046	50.3 49.3 47.7 47.3	0.685 0.652 0.591 0.544	-52.2 -56.5 -60.6 -63.3
600 700 800	0.704 0.678 0.659 0.645	-120.4 -130.9 -139.5 -146.9	13.108 11.176 9.599 8.439	113.1 105.8 99.3 94.2 89.7	0.037 0.041 0.044 0.046 0.048	50.3 49.3 47.7 47.3 47.3	0.685 0.652 0.591 0.544 0.504	-52.2 -56.5 -60.6 -63.3 -66.1
600 700 800 900	0.704 0.678 0.659 0.645 0.638	-120.4 -130.9 -139.5 -146.9 -152.9	13.108 11.176 9.599 8.439 7.523	113.1 105.8 99.3 94.2 89.7 85.8	0.037 0.041 0.044 0.046 0.048 0.050	50.3 49.3 47.7 47.3 47.3 47.5	0.685 0.652 0.591 0.544 0.504 0.478	-52.2 -56.5 -60.6 -63.3 -66.1 -68.7
600 700 800 900 1000	0.704 0.678 0.659 0.645 0.638 0.629	-120.4 -130.9 -139.5 -146.9 -152.9 -158.0	13.108 11.176 9.599 8.439 7.523 6.746	113.1 105.8 99.3 94.2 89.7 85.8 82.7	0.037 0.041 0.044 0.046 0.048 0.050 0.052	50.3 49.3 47.7 47.3 47.3 47.5 48.6	0.685 0.652 0.591 0.544 0.504 0.478 0.457	-52.2 -56.5 -60.6 -63.3 -66.1 -68.7 -71.2
600 700 800 900 1000 1200	0.704 0.678 0.659 0.645 0.638 0.629 0.623	-120.4 -130.9 -139.5 -146.9 -152.9 -158.0 -166.3	13.108 11.176 9.599 8.439 7.523 6.746 5.618	113.1 105.8 99.3 94.2 89.7 85.8 82.7 77.1	0.037 0.041 0.044 0.046 0.048 0.050 0.052 0.056	50.3 49.3 47.7 47.3 47.3 47.5 48.6 50.5	0.685 0.652 0.591 0.544 0.504 0.478 0.457 0.427	-52.2 -56.5 -60.6 -63.3 -66.1 -68.7 -71.2 -75.0
600 700 800 900 1000 1200 1400	0.704 0.678 0.659 0.645 0.638 0.629 0.623 0.621	-120.4 -130.9 -139.5 -146.9 -152.9 -158.0 -166.3 -173.1	13.108 11.176 9.599 8.439 7.523 6.746 5.618 4.797	113.1 105.8 99.3 94.2 89.7 85.8 82.7 77.1 72.1	0.037 0.041 0.044 0.046 0.048 0.050 0.052 0.056 0.060	50.3 49.3 47.7 47.3 47.3 47.5 48.6 50.5 52.6	0.685 0.652 0.591 0.544 0.504 0.478 0.457 0.427 0.411	-52.2 -56.5 -60.6 -63.3 -66.1 -68.7 -71.2 -75.0 -78.5
600 700 800 900 1000 1200 1400 1600	0.704 0.678 0.659 0.645 0.638 0.629 0.623 0.621 0.620	-120.4 -130.9 -139.5 -146.9 -152.9 -158.0 -166.3 -173.1 -179.0	13.108 11.176 9.599 8.439 7.523 6.746 5.618 4.797 4.199	113.1 105.8 99.3 94.2 89.7 85.8 82.7 77.1 72.1 67.5	0.037 0.041 0.044 0.046 0.048 0.050 0.052 0.056 0.060 0.065	50.3 49.3 47.7 47.3 47.5 48.6 50.5 52.6 55.0	0.685 0.652 0.591 0.544 0.504 0.478 0.457 0.427 0.411 0.399	-52.2 -56.5 -60.6 -63.3 -66.1 -68.7 -71.2 -75.0 -78.5 -81.8
600 700 800 900 1000 1200 1400 1600 1800	0.704 0.678 0.659 0.645 0.638 0.629 0.623 0.621 0.620 0.622	-120.4 -130.9 -139.5 -146.9 -152.9 -158.0 -166.3 -173.1 -179.0 176.1	13.108 11.176 9.599 8.439 7.523 6.746 5.618 4.797 4.199 3.717	113.1 105.8 99.3 94.2 89.7 85.8 82.7 77.1 72.1 67.5 63.4	0.037 0.041 0.044 0.046 0.048 0.050 0.052 0.056 0.060 0.065 0.071	50.3 49.3 47.7 47.3 47.5 48.6 50.5 52.6 55.0 56.9	0.685 0.652 0.591 0.544 0.504 0.478 0.457 0.427 0.411 0.399 0.398	-52.2 -56.5 -60.6 -63.3 -66.1 -68.7 -71.2 -75.0 -78.5 -81.8 -85.2
600 700 800 900 1000 1200 1400 1600 1800 2000	0.704 0.678 0.659 0.645 0.638 0.629 0.623 0.621 0.620 0.622 0.623	-120.4 -130.9 -139.5 -146.9 -152.9 -158.0 -166.3 -173.1 -179.0 176.1 171.8	13.108 11.176 9.599 8.439 7.523 6.746 5.618 4.797 4.199 3.717 3.348	113.1 105.8 99.3 94.2 89.7 85.8 82.7 77.1 72.1 67.5 63.4 59.4	0.037 0.041 0.044 0.046 0.048 0.050 0.052 0.056 0.060 0.065 0.071 0.076	50.3 49.3 47.7 47.3 47.3 47.5 48.6 50.5 52.6 55.0 56.9 58.6	0.685 0.652 0.591 0.544 0.504 0.478 0.457 0.427 0.411 0.399 0.398 0.397	-52.2 -56.5 -60.6 -63.3 -66.1 -68.7 -71.2 -75.0 -78.5 -81.8 -85.2 -88.5
600 700 800 900 1000 1200 1400 1600 1800 2000 2200	0.704 0.678 0.659 0.645 0.638 0.629 0.623 0.621 0.620 0.622 0.623 0.623	-120.4 -130.9 -139.5 -146.9 -152.9 -158.0 -166.3 -173.1 -179.0 176.1 171.8 167.4	13.108 11.176 9.599 8.439 7.523 6.746 5.618 4.797 4.199 3.717 3.348 3.039	113.1 105.8 99.3 94.2 89.7 85.8 82.7 77.1 72.1 67.5 63.4 59.4 55.5	0.037 0.041 0.044 0.046 0.048 0.050 0.052 0.056 0.060 0.065 0.071 0.076 0.082	50.3 49.3 47.7 47.3 47.5 48.6 50.5 52.6 55.0 56.9 58.6 60.1	0.685 0.652 0.591 0.544 0.504 0.478 0.457 0.427 0.411 0.399 0.398 0.397 0.401	-52.2 -56.5 -60.6 -63.3 -66.1 -68.7 -71.2 -75.0 -78.5 -81.8 -85.2 -88.5 -91.7
600 700 800 900 1000 1200 1400 1600 1800 2000 2200 2400	0.704 0.678 0.659 0.645 0.638 0.629 0.623 0.621 0.620 0.622 0.623 0.623 0.623	-120.4 -130.9 -139.5 -146.9 -152.9 -158.0 -166.3 -173.1 -179.0 176.1 171.8 167.4 163.5	13.108 11.176 9.599 8.439 7.523 6.746 5.618 4.797 4.199 3.717 3.348 3.039 2.786	113.1 105.8 99.3 94.2 89.7 85.8 82.7 77.1 72.1 67.5 63.4 59.4 55.5 51.8	0.037 0.041 0.044 0.046 0.048 0.050 0.052 0.056 0.060 0.065 0.071 0.076 0.082 0.089	50.3 49.3 47.7 47.3 47.5 48.6 50.5 52.6 55.0 56.9 58.6 60.1 61.4	0.685 0.652 0.591 0.544 0.504 0.478 0.457 0.427 0.411 0.399 0.398 0.397 0.401 0.407	-52.2 -56.5 -60.6 -63.3 -66.1 -68.7 -71.2 -75.0 -78.5 -81.8 -85.2 -88.5 -91.7 -95.0

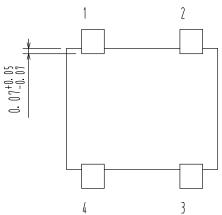
CE=8V, IC=3 Freq(MHz)	S11	∠S11	S21	∠S21	S12	∠ S12	S22	∠S22
100	0.556	-65.2	43.179	145.8	0.011		0.846	-28.0
200	0.578	-106.8		123.0	0.011	67.8 57.9	0.669	-44.6
300	0.578	-100.8	32.894 24.775	109.1	0.017	56.2	0.669	- <del>44</del> .6 -54.7
400	0.594	-129.7	19.256	109.1	0.021	57.0	0.584	-54.7
500	0.604	-142.8	15.997	94.4	0.024	59.0	0.312	-63.9
600	0.614		13.266	89.8	0.028	60.8	0.443	-66.9
700	0.603	-155.8 -161.6		86.1	0.031	62.5	0.443	-69.3
			11.285				-	
800	0.602	-166.5	9.802	82.9	0.037	64.2	0.382	-72.0
900	0.602	-170.7	8.672	80.0	0.041	65.4	0.366	-74.3
1000	0.600	-174.1	7.739	77.6	0.044	66.3	0.352	-76.7
1200	0.603	179.9	6.401	73.3	0.051	68.1	0.333	-80.3
1400	0.605	174.9	5.453	69.2	0.059	69.2	0.325	-83.7
1600	0.607	170.4	4.753	65.4	0.066	69.8	0.321	-87.0
1800	0.611	166.4	4.215	61.8	0.074	70.0	0.321	-90.2
2000	0.613	162.9	3.791	58.4	0.082	69.9	0.325	-93.4
2200	0.614	159.2	3.445	55.1	0.090	70.1	0.330	-96.5
2400	0.616	155.8	3.155	51.7	0.099	69.6	0.339	-99.4
2600	0.617	152.4	2.916	48.4	0.107	69.1	0.349	-102.4
2800	0.619	149.1	2.711	45.2	0.115	68.5	0.361	-105.3
3000	0.619	145.7	2.531	42.0	0.124	67.5	0.375	-108.2
CE=8V, IC=5		/011	Igoti	4001	IGIOL	(010	Igoal	4900
Freq(MHz)	S11	∠S11	S21	∠S21	S12	∠ S12	S22	∠S22
100	0.477	-88.8	42.926	139.6	0.009	65.5	0.793	-30.4
200	0.554	-127.0	34.154	117.2	0.014	59.2	0.603	-45.1
300	0.589	-144.5	24.758	104.4	0.017	59.1	0.529	-53.1
400	0.606	-154.4	18.954	96.6	0.020	61.9	0.478	-58.7
500	0.613	-158.4	15.585	91.2	0.024	64.8	0.453	-60.2
600	0.611	-164.1	12.888	87.0	0.027	67.3	0.416	-62.6
	0.611	-168.8	10054			CO 1	0.388	C10
700			10.954	83.7	0.031	69.1		-64.8
700 800	0.613	-172.8	9.503	83.7 80.7	0.031 0.034	70.4	0.366	-67.2
800 900	0.613 0.616	-172.8 -176.3	9.503 8.407	80.7 78.1		70.4 71.5	0.366 0.355	
800	0.613	-172.8	9.503	80.7	0.034	70.4	0.366	-67.2
800 900	0.613 0.616	-172.8 -176.3	9.503 8.407	80.7 78.1	0.034 0.038	70.4 71.5	0.366 0.355	-67.2 -69.5
800 900 1000	0.613 0.616 0.615	-172.8 -176.3 -179.2	9.503 8.407 7.494	80.7 78.1 75.7	0.034 0.038 0.042	70.4 71.5 72.3	0.366 0.355 0.343	-67.2 -69.5 -71.9
800 900 1000 1200	0.613 0.616 0.615 0.619	-172.8 -176.3 -179.2 175.7	9.503 8.407 7.494 6.192	80.7 78.1 75.7 71.6	0.034 0.038 0.042 0.049	70.4 71.5 72.3 73.7	0.366 0.355 0.343 0.329	-67.2 -69.5 -71.9 -75.5
800 900 1000 1200 1400	0.613 0.616 0.615 0.619 0.623	-172.8 -176.3 -179.2 175.7 171.2	9.503 8.407 7.494 6.192 5.272	80.7 78.1 75.7 71.6 67.7	0.034 0.038 0.042 0.049 0.057	70.4 71.5 72.3 73.7 74.1	0.366 0.355 0.343 0.329 0.324	-67.2 -69.5 -71.9 -75.5 -79.0
800 900 1000 1200 1400 1600	0.613 0.616 0.615 0.619 0.623 0.626	-172.8 -176.3 -179.2 175.7 171.2 167.2	9.503 8.407 7.494 6.192 5.272 4.586	80.7 78.1 75.7 71.6 67.7 64.0	0.034 0.038 0.042 0.049 0.057 0.065	70.4 71.5 72.3 73.7 74.1 74.5	0.366 0.355 0.343 0.329 0.324 0.323	-67.2 -69.5 -71.9 -75.5 -79.0 -82.4
800 900 1000 1200 1400 1600 1800	0.613 0.616 0.615 0.619 0.623 0.626 0.631	-172.8 -176.3 -179.2 175.7 171.2 167.2 163.5	9.503 8.407 7.494 6.192 5.272 4.586 4.071	80.7 78.1 75.7 71.6 67.7 64.0 60.4	0.034 0.038 0.042 0.049 0.057 0.065 0.073	70.4 71.5 72.3 73.7 74.1 74.5 74.4	0.366 0.355 0.343 0.329 0.324 0.323 0.325	-67.2 -69.5 -71.9 -75.5 -79.0 -82.4 -85.8
800 900 1000 1200 1400 1600 1800 2000	0.613 0.616 0.615 0.619 0.623 0.626 0.631 0.633	-172.8 -176.3 -179.2 175.7 171.2 167.2 163.5 160.2	9.503 8.407 7.494 6.192 5.272 4.586 4.071 3.658	80.7 78.1 75.7 71.6 67.7 64.0 60.4 57.0	0.034 0.038 0.042 0.049 0.057 0.065 0.073 0.081	70.4 71.5 72.3 73.7 74.1 74.5 74.4 74.0	0.366 0.355 0.343 0.329 0.324 0.323 0.325 0.331	-67.2 -69.5 -71.9 -75.5 -79.0 -82.4 -85.8 -89.4
800 900 1000 1200 1400 1600 1800 2000 2200	0.613 0.616 0.615 0.619 0.623 0.626 0.631 0.633 0.634	-172.8 -176.3 -179.2 175.7 171.2 167.2 163.5 160.2 156.7	9.503 8.407 7.494 6.192 5.272 4.586 4.071 3.658 3.322	80.7 78.1 75.7 71.6 67.7 64.0 60.4 57.0 53.7	0.034 0.038 0.042 0.049 0.057 0.065 0.073 0.081 0.090	70.4 71.5 72.3 73.7 74.1 74.5 74.4 74.0 73.7	0.366 0.355 0.343 0.329 0.324 0.323 0.325 0.331 0.337	-67.2 -69.5 -71.9 -75.5 -79.0 -82.4 -85.8 -89.4 -92.7
800 900 1000 1200 1400 1600 1800 2000 2200 2400	0.613 0.616 0.615 0.619 0.623 0.626 0.631 0.633 0.634 0.637	-172.8 -176.3 -179.2 175.7 171.2 167.2 163.5 160.2 156.7 153.5	9.503 8.407 7.494 6.192 5.272 4.586 4.071 3.658 3.322 3.041	80.7 78.1 75.7 71.6 67.7 64.0 60.4 57.0 53.7 50.3	0.034 0.038 0.042 0.049 0.057 0.065 0.073 0.081 0.090 0.099	70.4 71.5 72.3 73.7 74.1 74.5 74.4 74.0 73.7 73.0	0.366 0.355 0.343 0.329 0.324 0.323 0.325 0.331 0.337 0.347	-67.2 -69.5 -71.9 -75.5 -79.0 -82.4 -85.8 -89.4 -92.7 -95.9

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