

SILICON TRANSISTOR 2SC5180

NPN EPITAXIAL SILICON TRANSISTOR IN SUPER MINI-MOLD PACKAGE FOR LOW-NOISE MICROWAVE AMPLIFICATION

FEATURES

- Low current consumption and high gain
 |S_{21e}|² = 12 dB TYP. @ VcE = 2 V, Ic = 7 mA, f = 2 GHz
 |S_{21e}|² = 11 dB TYP. @ VcE = 1 V, Ic = 5 mA, f = 2 GHz
- Supper Mini-Mold package

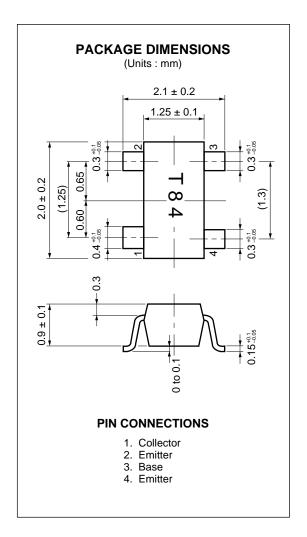
ORDERING INFORMATION

PART NUMBER	QUANTITY	ARRANGEMENT
2SC5180-T1	3 000 units/reel	Embossed tape, 8 mm wide, pins No. 3 (base) and No. 4 (emitter) facing the perforations
2SC5180-T2	3 000 units/leel	Embossed tape, 8 mm wide, pins No. 1 (collector) and No. 2 (emitter) facing the perforations

* Contact your NEC sales representatives to order samples for evaluation (available in batches of 50).

ABSOLUTE MAXIMUM RATINGS (TA = 25 $^{\circ}$ C)

Collector to Base Voltage	Vсво	5	V
Collector to Emitter Voltage	VCEO	3	V
Emitter to Base Voltage	VEBO	2	V
Collector Current	Ic	10	mΑ
Total Power Dissipation	Рт	30	mW
Junction Temperature	T_{j}	150	°C
Storage Temperature	T _{stg}	-65 to +150	°C



Caution; This transistor uses high-frequency technology. Be careful not to allow excessive current to flow through the transistor, including static electricity.



ELECTRICAL CHARACTERISTICS (TA = 25 °C)

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	CONDITIONS
Collector Cutoff Current	Ісво			100	nA	Vcb = 5 V, IE = 0
Emitter Cutoff Current	ІЕВО			100	nA	VEB = 1 V, IC = 0
DC Current Gain	hfe	70		140		VcE = 2 V, Ic = 7 mA*1
Insertion Power Gain (1)	S _{21e} ²	10	12		dB	VcE = 2 V, Ic = 7 mA, f = 2 GHz
Insertion Power Gain (2)	S _{21e} ²	8.5	11		dB	VcE = 1 V, $Ic = 5 mA$, $f = 2 GHz$
Noise Figure (1)	NF		1.5	2.0	dB	Vce = 2 V, Ic = 3 mA, f = 2 GHz
Noise Figure (2)	NF		1.5	2.0	dB	Vce = 1 V, Ic = 3 mA, f = 2 GHz
Gain Bandwidth Product (1)	fτ	12	15.5		GHz	VcE = 2 V, $Ic = 7 mA$, $f = 2 GHz$
Gain Bandwidth Product (2)	fτ	10	13		GHz	Vce = 1 V, Ic = 5 mA, f = 2 GHz
Feedback Capacitance	Cre		0.3	0.5	pF	Vcb = 2 V, IE = 0 mA, f = 1 MHz*2

^{* 1 :} Measured with pulses : Pulse width \leq 350 μ s, duty cycle \leq 2 %, pulsed

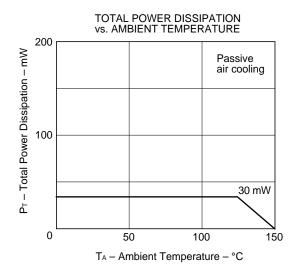
hee class

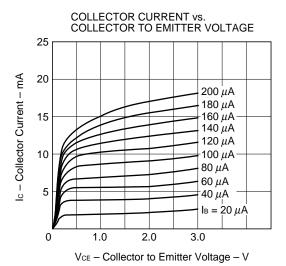
Class	FB
Marking	T84
hfe	70 to 140

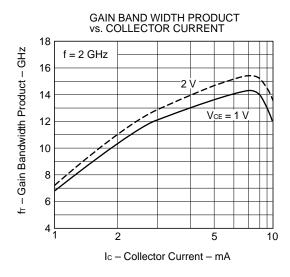
2

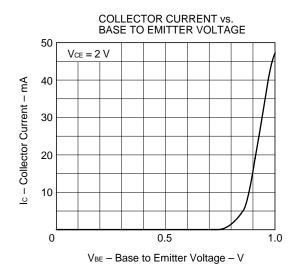
^{* 2 :} Measured with a three-terminal bridge. The emitter and case terminal are connected to the guard terminal of the bridge.

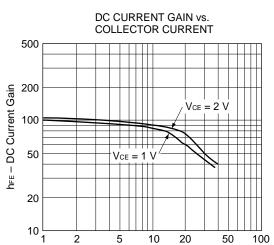
CHARACTERISTICS CURVES (TA = 25 °C)



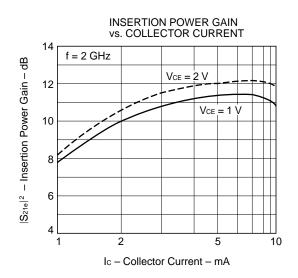


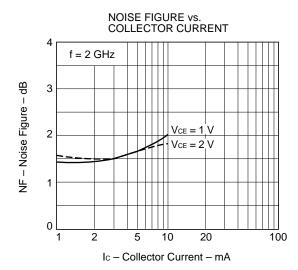


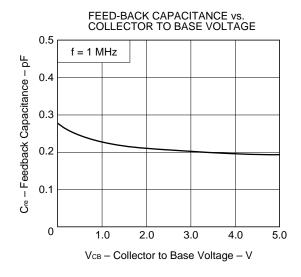




Ic - Collector Current - mA









S-PARAMETER

5-I ANAMETEN									
VcE = 1 V, Ic = 1 m	A, Zo = 50 9	Ω							
FREQUENCY	;	S11	S	21	S	12	S	22	
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG	
600.00	0.916	-28.0	3.247	147.1	0.074	65.6	0.960	-21.2	
800.00	0.816	-36.9	3.092	136.2	0.111	58.6	0.887	-26.2	
1000.00	0.741	-47.1	2.929	125.5	0.140	54.4	0.810	-32.8	
1200.00	0.691	-55.8	2.864	116.5	0.158	52.2	0.788	-39.3	
1400.00	0.628	-63.3	2.762	109.6	0.179	48.2	0.744	-44.5	
1600.00	0.558	-72.3	2.590	100.9	0.195	44.8	0.692	-49.2	
1800.00	0.508	-80.9	2.505	93.4	0.199	43.7	0.647	-54.7	
2000.00	0.444	-87.8	2.293	88.1	0.196	39.5	0.602	-58.2	
2200.00	0.386	-94.3	2.111	81.8	0.201	35.8	0.575	-61.2	
Vce = 1 V, Ic = 3 m	A, Zo = 50 Q	Ω							
FREQUENCY	;	S11	S	21	S	12	S22		
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG	
600.00	0.694	-43.6	6.614	129.7	0.063	57.9	0.819	-30.4	
800.00	0.557	-54.5	5.730	117.1	0.090	54.4	0.707	-35.6	
1000.00	0.463	-63.1	5.054	106.4	0.113	52.6	0.609	-41.1	
1200.00	0.394	-70.7	4.628	99.0	0.125	54.2	0.575	-45.5	
1400.00	0.325	-78.9	4.123	92.2	0.143	52.5	0.526	-48.8	
1600.00	0.269	-88.2	3.744	84.3	0.157	51.5	0.478	-52.5	
1800.00	0.226	-96.9	3.488	79.4	0.160	52.5	0.441	-57.0	
2000.00	0.181	-103.5	3.085	75.5	0.166	50.8	0.412	-57.9	
2200.00	0.146	-111.9	2.776	70.5	0.174	48.1	0.401	-60.0	
2200.00									
Vce = 1 V, Ic = 5 m		Ω							
	A, Zo = 50 Q	Ω S11	S	21		12	S	22	
VcE = 1 V, Ic = 5 m	A, Zo = 50 Q		S MAG	21 ANG		12 ANG	S MAG	22 ANG	
VcE = 1 V, Ic = 5 m FREQUENCY	A, Zo = 50 <u>s</u>	S11			S				
Vce = 1 V, lc = 5 m FREQUENCY MHz	A, Zo = 50 S MAG	S11 ANG	MAG	ANG	S [.] MAG	ANG	MAG	ANG	
Vce = 1 V, lc = 5 m FREQUENCY MHz 600.00	MAG 0.556	ANG –51.5	MAG 7.925	ANG 120.8	S [.] MAG 0.055	ANG 57.5	MAG 0.729	ANG -33.5	
VcE = 1 V, Ic = 5 m FREQUENCY MHz 600.00 800.00	MAG 0.556 0.430	ANG -51.5 -61.6	MAG 7.925 6.573	ANG 120.8 108.7	MAG 0.055 0.083	ANG 57.5 55.0	MAG 0.729 0.614	ANG -33.5 -37.4	
Vce = 1 V, Ic = 5 m FREQUENCY MHz 600.00 800.00 1000.00	MAG 0.556 0.430 0.338	ANG -51.5 -61.6 -68.2	MAG 7.925 6.573 5.644	ANG 120.8 108.7 98.8	MAG 0.055 0.083 0.102	ANG 57.5 55.0 54.0	MAG 0.729 0.614 0.527	ANG -33.5 -37.4 -41.0	
Vce = 1 V, lc = 5 m FREQUENCY MHz 600.00 800.00 1000.00 1200.00	MAG 0.556 0.430 0.338 0.271	ANG -51.5 -61.6 -68.2 -75.3	MAG 7.925 6.573 5.644 5.047	ANG 120.8 108.7 98.8 92.4	MAG 0.055 0.083 0.102 0.117	ANG 57.5 55.0 54.0 57.7	MAG 0.729 0.614 0.527 0.498	ANG -33.5 -37.4 -41.0 -44.6	
Vce = 1 V, lc = 5 m FREQUENCY MHz 600.00 800.00 1000.00 1200.00 1400.00	MAG 0.556 0.430 0.338 0.271 0.217	ANG -51.5 -61.6 -68.2 -75.3 -84.1	MAG 7.925 6.573 5.644 5.047 4.409	ANG 120.8 108.7 98.8 92.4 86.0	MAG 0.055 0.083 0.102 0.117 0.133	ANG 57.5 55.0 54.0 57.7 56.5	MAG 0.729 0.614 0.527 0.498 0.451	ANG -33.5 -37.4 -41.0 -44.6 -47.5	
Vce = 1 V, lc = 5 m FREQUENCY MHz 600.00 800.00 1000.00 1200.00 1400.00 1600.00	MAG 0.556 0.430 0.338 0.271 0.217 0.171	ANG -51.5 -61.6 -68.2 -75.3 -84.1 -94.6	MAG 7.925 6.573 5.644 5.047 4.409 3.985	ANG 120.8 108.7 98.8 92.4 86.0 78.8	SMAG 0.055 0.083 0.102 0.117 0.133 0.148	ANG 57.5 55.0 54.0 57.7 56.5 55.9	MAG 0.729 0.614 0.527 0.498 0.451 0.414	ANG -33.5 -37.4 -41.0 -44.6 -47.5 -50.0	
Vce = 1 V, lc = 5 m FREQUENCY MHz 600.00 800.00 1000.00 1200.00 1400.00 1600.00 1800.00	MAG 0.556 0.430 0.338 0.271 0.217 0.171 0.137	ANG -51.5 -61.6 -68.2 -75.3 -84.1 -94.6 -104.4	MAG 7.925 6.573 5.644 5.047 4.409 3.985 3.674	ANG 120.8 108.7 98.8 92.4 86.0 78.8 74.9	MAG 0.055 0.083 0.102 0.117 0.133 0.148 0.155	ANG 57.5 55.0 54.0 57.7 56.5 55.9 57.4	MAG 0.729 0.614 0.527 0.498 0.451 0.414 0.382	ANG -33.5 -37.4 -41.0 -44.6 -47.5 -50.0 -53.9	
Vce = 1 V, lc = 5 m FREQUENCY MHz 600.00 800.00 1000.00 1200.00 1400.00 1600.00 1800.00 2000.00	MAG 0.556 0.430 0.338 0.271 0.217 0.171 0.137 0.100 0.079	ANG -51.5 -61.6 -68.2 -75.3 -84.1 -94.6 -104.4 -114.7 -125.3	MAG 7.925 6.573 5.644 5.047 4.409 3.985 3.674 3.229	ANG 120.8 108.7 98.8 92.4 86.0 78.8 74.9 71.4	MAG 0.055 0.083 0.102 0.117 0.133 0.148 0.155 0.162	ANG 57.5 55.0 54.0 57.7 56.5 55.9 57.4 55.7	MAG 0.729 0.614 0.527 0.498 0.451 0.414 0.382 0.361	ANG -33.5 -37.4 -41.0 -44.6 -47.5 -50.0 -53.9 -55.0	
VcE = 1 V, lc = 5 m FREQUENCY MHz 600.00 800.00 1000.00 1200.00 1400.00 1600.00 1800.00 2000.00 2200.00	MAG 0.556 0.430 0.338 0.271 0.217 0.171 0.137 0.100 0.079 A, Zo = 50 G	ANG -51.5 -61.6 -68.2 -75.3 -84.1 -94.6 -104.4 -114.7 -125.3	MAG 7.925 6.573 5.644 5.047 4.409 3.985 3.674 3.229 2.897	ANG 120.8 108.7 98.8 92.4 86.0 78.8 74.9 71.4	MAG 0.055 0.083 0.102 0.117 0.133 0.148 0.155 0.162	ANG 57.5 55.0 54.0 57.7 56.5 55.9 57.4 55.7 53.0	MAG 0.729 0.614 0.527 0.498 0.451 0.414 0.382 0.361 0.357	ANG -33.5 -37.4 -41.0 -44.6 -47.5 -50.0 -53.9 -55.0	
Vce = 1 V, lc = 5 m FREQUENCY MHz 600.00 800.00 1000.00 1200.00 1400.00 1600.00 1800.00 2000.00 2200.00 Vce = 1 V, lc = 7 m	MAG 0.556 0.430 0.338 0.271 0.217 0.171 0.137 0.100 0.079 A, Zo = 50 G	ANG -51.5 -61.6 -68.2 -75.3 -84.1 -94.6 -104.4 -114.7 -125.3	MAG 7.925 6.573 5.644 5.047 4.409 3.985 3.674 3.229 2.897	ANG 120.8 108.7 98.8 92.4 86.0 78.8 74.9 71.4 66.9	SMAG 0.055 0.083 0.102 0.117 0.133 0.148 0.155 0.162 0.173	ANG 57.5 55.0 54.0 57.7 56.5 55.9 57.4 55.7 53.0	MAG 0.729 0.614 0.527 0.498 0.451 0.414 0.382 0.361 0.357	ANG -33.5 -37.4 -41.0 -44.6 -47.5 -50.0 -53.9 -55.0 -57.2	
Vce = 1 V, lc = 5 m FREQUENCY MHz 600.00 800.00 1000.00 1200.00 1400.00 1600.00 1800.00 2000.00 2200.00 Vce = 1 V, lc = 7 m FREQUENCY	MAG 0.556 0.430 0.338 0.271 0.217 0.171 0.137 0.100 0.079 A, Zo = 50 G	ANG -51.5 -61.6 -68.2 -75.3 -84.1 -94.6 -104.4 -114.7 -125.3	MAG 7.925 6.573 5.644 5.047 4.409 3.985 3.674 3.229 2.897	ANG 120.8 108.7 98.8 92.4 86.0 78.8 74.9 71.4 66.9 21 ANG 114.4	MAG 0.055 0.083 0.102 0.117 0.133 0.148 0.155 0.162 0.173	ANG 57.5 55.0 54.0 57.7 56.5 55.9 57.4 55.7 53.0	MAG 0.729 0.614 0.527 0.498 0.451 0.414 0.382 0.361 0.357	ANG -33.5 -37.4 -41.0 -44.6 -47.5 -50.0 -53.9 -55.0 -57.2	
Vce = 1 V, lc = 5 m FREQUENCY MHz 600.00 800.00 1000.00 1200.00 1400.00 1800.00 2000.00 2200.00 Vce = 1 V, lc = 7 m FREQUENCY MHz 600.00 800.00	MAG 0.556 0.430 0.338 0.271 0.217 0.171 0.137 0.100 0.079 A, Zo = 50 G MAG 0.455 0.335	ANG -51.5 -61.6 -68.2 -75.3 -84.1 -94.6 -104.4 -114.7 -125.3 ANG -57.2 -67.4	MAG 7.925 6.573 5.644 5.047 4.409 3.985 3.674 3.229 2.897 S MAG 8.518 6.873	ANG 120.8 108.7 98.8 92.4 86.0 78.8 74.9 71.4 66.9 21 ANG 114.4 103.1	MAG 0.055 0.083 0.102 0.117 0.133 0.148 0.155 0.162 0.173 SAMAG 0.051 0.075	ANG 57.5 55.0 54.0 57.7 56.5 55.9 57.4 55.7 53.0 12 ANG 56.0 55.1	MAG 0.729 0.614 0.527 0.498 0.451 0.414 0.382 0.361 0.357 S. MAG 0.657 0.557	ANG -33.5 -37.4 -41.0 -44.6 -47.5 -50.0 -53.9 -55.0 -57.2 22 ANG -34.1 -36.6	
Vce = 1 V, lc = 5 m FREQUENCY MHz 600.00 800.00 1000.00 1200.00 1400.00 1800.00 2000.00 2200.00 Vce = 1 V, lc = 7 m FREQUENCY MHz 600.00 800.00 1000.00	MAG 0.556 0.430 0.338 0.271 0.217 0.171 0.137 0.100 0.079 A, Zo = 50 G MAG 0.455 0.335 0.252	ANG -51.5 -61.6 -68.2 -75.3 -84.1 -94.6 -104.4 -114.7 -125.3 ANG -57.2	MAG 7.925 6.573 5.644 5.047 4.409 3.985 3.674 3.229 2.897 S MAG 8.518	ANG 120.8 108.7 98.8 92.4 86.0 78.8 74.9 71.4 66.9 21 ANG 114.4 103.1 93.9	SAMAG 0.055 0.083 0.102 0.117 0.133 0.148 0.155 0.162 0.173 SAMAG 0.051 0.075 0.095	ANG 57.5 55.0 54.0 57.7 56.5 55.9 57.4 55.7 53.0 12 ANG 56.0 55.1 56.7	MAG 0.729 0.614 0.527 0.498 0.451 0.414 0.382 0.361 0.357 S. MAG 0.657 0.557 0.480	ANG -33.5 -37.4 -41.0 -44.6 -47.5 -50.0 -53.9 -55.0 -57.2 22 ANG -34.1 -36.6 -39.2	
Vce = 1 V, lc = 5 m FREQUENCY MHz 600.00 800.00 1000.00 1200.00 1400.00 1800.00 2000.00 2200.00 Vce = 1 V, lc = 7 m FREQUENCY MHz 600.00 800.00	MAG 0.556 0.430 0.338 0.271 0.217 0.171 0.137 0.100 0.079 A, Zo = 50 G MAG 0.455 0.335	ANG -51.5 -61.6 -68.2 -75.3 -84.1 -94.6 -104.4 -114.7 -125.3 ANG -57.2 -67.4	MAG 7.925 6.573 5.644 5.047 4.409 3.985 3.674 3.229 2.897 S MAG 8.518 6.873	ANG 120.8 108.7 98.8 92.4 86.0 78.8 74.9 71.4 66.9 21 ANG 114.4 103.1	MAG 0.055 0.083 0.102 0.117 0.133 0.148 0.155 0.162 0.173 SAMAG 0.051 0.075	ANG 57.5 55.0 54.0 57.7 56.5 55.9 57.4 55.7 53.0 12 ANG 56.0 55.1	MAG 0.729 0.614 0.527 0.498 0.451 0.414 0.382 0.361 0.357 S. MAG 0.657 0.557	ANG -33.5 -37.4 -41.0 -44.6 -47.5 -50.0 -53.9 -55.0 -57.2 22 ANG -34.1 -36.6	
Vce = 1 V, lc = 5 m FREQUENCY MHz 600.00 800.00 1000.00 1200.00 1400.00 1800.00 2000.00 2200.00 Vce = 1 V, lc = 7 m FREQUENCY MHz 600.00 800.00 1000.00	MAG 0.556 0.430 0.338 0.271 0.217 0.171 0.137 0.100 0.079 A, Zo = 50 G MAG 0.455 0.335 0.252	ANG -51.5 -61.6 -68.2 -75.3 -84.1 -94.6 -104.4 -114.7 -125.3 ANG -57.2 -67.4 -73.2	MAG 7.925 6.573 5.644 5.047 4.409 3.985 3.674 3.229 2.897 S MAG 8.518 6.873 5.825	ANG 120.8 108.7 98.8 92.4 86.0 78.8 74.9 71.4 66.9 21 ANG 114.4 103.1 93.9	SAMAG 0.055 0.083 0.102 0.117 0.133 0.148 0.155 0.162 0.173 SAMAG 0.051 0.075 0.095	ANG 57.5 55.0 54.0 57.7 56.5 55.9 57.4 55.7 53.0 12 ANG 56.0 55.1 56.7	MAG 0.729 0.614 0.527 0.498 0.451 0.414 0.382 0.361 0.357 S. MAG 0.657 0.557 0.480	ANG -33.5 -37.4 -41.0 -44.6 -47.5 -50.0 -53.9 -55.0 -57.2 22 ANG -34.1 -36.6 -39.2	
Vce = 1 V, lc = 5 m FREQUENCY MHz 600.00 800.00 1000.00 1200.00 1400.00 1800.00 2000.00 2200.00 Vce = 1 V, lc = 7 m FREQUENCY MHz 600.00 800.00 1000.00 1200.00	MAG 0.556 0.430 0.338 0.271 0.217 0.171 0.137 0.100 0.079 A, Zo = 50 G MAG 0.455 0.335 0.252 0.194	ANG -51.5 -61.6 -68.2 -75.3 -84.1 -94.6 -104.4 -114.7 -125.3 ANG -57.2 -67.4 -73.2 -80.5	MAG 7.925 6.573 5.644 5.047 4.409 3.985 3.674 3.229 2.897 S MAG 8.518 6.873 5.825 5.131	ANG 120.8 108.7 98.8 92.4 86.0 78.8 74.9 71.4 66.9 21 ANG 114.4 103.1 93.9 88.3	MAG 0.055 0.083 0.102 0.117 0.133 0.148 0.155 0.162 0.173 SA MAG 0.051 0.075 0.095 0.113	ANG 57.5 55.0 54.0 57.7 56.5 55.9 57.4 55.7 53.0 ANG 56.0 55.1 56.7 59.7	MAG 0.729 0.614 0.527 0.498 0.451 0.414 0.382 0.361 0.357 S. MAG 0.657 0.557 0.480 0.453 0.417 0.385	ANG -33.5 -37.4 -41.0 -44.6 -47.5 -50.0 -53.9 -55.0 -57.2 22 ANG -34.1 -36.6 -39.2 -41.8	
Vce = 1 V, lc = 5 m FREQUENCY MHz 600.00 800.00 1000.00 1200.00 1400.00 1800.00 2000.00 2200.00 Vce = 1 V, lc = 7 m FREQUENCY MHz 600.00 800.00 1000.00 1200.00 1400.00	MAG 0.556 0.430 0.338 0.271 0.217 0.171 0.137 0.100 0.079 A, Zo = 50 G MAG 0.455 0.335 0.252 0.194 0.148	ANG -51.5 -61.6 -68.2 -75.3 -84.1 -94.6 -104.4 -114.7 -125.3 ANG -57.2 -67.4 -73.2 -80.5 -91.1	MAG 7.925 6.573 5.644 5.047 4.409 3.985 3.674 3.229 2.897 S MAG 8.518 6.873 5.825 5.131 4.447	ANG 120.8 108.7 98.8 92.4 86.0 78.8 74.9 71.4 66.9 21 ANG 114.4 103.1 93.9 88.3 82.0	MAG 0.055 0.083 0.102 0.117 0.133 0.148 0.155 0.162 0.173 SA MAG 0.051 0.075 0.095 0.113 0.129	ANG 57.5 55.0 54.0 57.7 56.5 55.9 57.4 55.7 53.0 12 ANG 56.0 55.1 56.7 59.7 58.7	MAG 0.729 0.614 0.527 0.498 0.451 0.414 0.382 0.361 0.357 S. MAG 0.657 0.557 0.480 0.453 0.417	ANG -33.5 -37.4 -41.0 -44.6 -47.5 -50.0 -53.9 -55.0 -57.2 22 ANG -34.1 -36.6 -39.2 -41.8 -44.6	
Vce = 1 V, lc = 5 m FREQUENCY MHz 600.00 800.00 1000.00 1200.00 1400.00 1800.00 2000.00 2200.00 Vce = 1 V, lc = 7 m FREQUENCY MHz 600.00 800.00 1000.00 1200.00 1400.00 1600.00	MAG 0.556 0.430 0.338 0.271 0.217 0.171 0.137 0.100 0.079 A, Zo = 50 G MAG 0.455 0.335 0.252 0.194 0.148 0.114	ANG -51.5 -61.6 -68.2 -75.3 -84.1 -94.6 -104.4 -114.7 -125.3 ANG -57.2 -67.4 -73.2 -80.5 -91.1 -105.9	MAG 7.925 6.573 5.644 5.047 4.409 3.985 3.674 3.229 2.897 S MAG 8.518 6.873 5.825 5.131 4.447 4.018	ANG 120.8 108.7 98.8 92.4 86.0 78.8 74.9 71.4 66.9 21 ANG 114.4 103.1 93.9 88.3 82.0 75.3	SAMAG 0.055 0.083 0.102 0.117 0.133 0.148 0.155 0.162 0.173 SAMAG 0.051 0.075 0.095 0.113 0.129 0.145	ANG 57.5 55.0 54.0 57.7 56.5 55.9 57.4 55.7 53.0 12 ANG 56.0 55.1 56.7 59.7 58.7 58.7	MAG 0.729 0.614 0.527 0.498 0.451 0.414 0.382 0.361 0.357 S. MAG 0.657 0.557 0.480 0.453 0.417 0.385	ANG -33.5 -37.4 -41.0 -44.6 -47.5 -50.0 -53.9 -55.0 -57.2 22 ANG -34.1 -36.6 -39.2 -41.8 -44.6 -46.8	

5



$V_{CE} = 1 \text{ V}, \text{ Ic} = 10 \text{ m}$	A, Zo = 50	Ω								
FREQUENCY	S	S11	S	21	S	12	5	S22		
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG		
600.00	0.359	-65.9	8.500	108.9	0.048	54.8	0.603	-33.1		
800.00	0.255	-78.2	6.731	98.1	0.071	56.3	0.516	-34.4		
1000.00	0.177	-83.8	5.648	89.6	0.090	56.8	0.449	-35.9		
1200.00	0.127	-96.6	4.927	84.4	0.109	61.7	0.431	-38.2		
1400.00	0.098	-115.6	4.251	78.2	0.125	61.4	0.400	-40.5		
1600.00	0.081	-141.9	3.839	71.9	0.143	61.2	0.377	-42.8		
1800.00	0.072	-162.7	3.504	68.8	0.150	62.1	0.351	-46.1		
2000.00	0.070	170.9	3.072	65.8	0.157	60.3	0.338	-47.5		
2200.00	0.074	157.1	2.748	61.5	0.167	57.2	0.342	-50.4		
Vce = 2 V, Ic = 1 mA	A, Zo = 50 Ω	2								
FREQUENCY	S	S11	S	21	S ²	12	9	S22		
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG		
600.00	0.927	-26.3	3.263	148.6	0.065	64.5	0.968	-19.5		
800.00	0.827	-34.2	3.122	138.1	0.101	59.7	0.903	-24.1		
1000.00	0.758	-43.7	2.962	127.7	0.129	54.9	0.828	-30.3		
1200.00	0.712	-52.2	2.910	118.9	0.146	54.2	0.808	-36.5		
1400.00	0.653	-59.1	2.825	112.3	0.165	50.6	0.769	-41.3		
1600.00	0.581	-67.5	2.657	103.8	0.181	47.3	0.723	-46.0		
1800.00	0.530	-75.7	2.578	96.3	0.185	46.0	0.673	-51.3		
2000.00	0.469	-82.1	2.368	91.0	0.184	41.5	0.630	-54.7		
2200.00	0.410	-87.5	2.184	84.7	0.188	38.2	0.607	-57.4		
Vce = 2 V, Ic = 3 mA	A, Zo = 50 Ω	2								
			S21		S12			S22		
FREQUENCY	S	511	S	21	S ²	12	5	522		
FREQUENCY MHz	MAG	ANG	S MAG	21 ANG	S ² MAG	12 ANG	MAG	S22 ANG		
MHz	MAG	ANG -39.7	MAG	ANG	MAG	ANG	MAG	ANG		
MHz 600.00	MAG 0.727	ANG -39.7 -49.7	MAG 6.761 5.910	ANG 131.7	MAG 0.057	ANG 58.1 55.8	MAG 0.841	ANG -27.8 -32.4		
MHz 600.00 800.00 1000.00	MAG 0.727 0.587	ANG -39.7	MAG 6.761	ANG 131.7 119.4	MAG 0.057 0.084	ANG 58.1	MAG 0.841 0.737	ANG -27.8		
MHz 600.00 800.00	MAG 0.727 0.587 0.490	ANG -39.7 -49.7 -57.4	MAG 6.761 5.910 5.229	ANG 131.7 119.4 108.8	MAG 0.057 0.084 0.104	ANG 58.1 55.8 54.2	MAG 0.841 0.737 0.645	ANG -27.8 -32.4 -37.5		
MHz 600.00 800.00 1000.00 1200.00	MAG 0.727 0.587 0.490 0.425	ANG -39.7 -49.7 -57.4 -64.5	MAG 6.761 5.910 5.229 4.812	ANG 131.7 119.4 108.8 101.3	MAG 0.057 0.084 0.104 0.120	ANG 58.1 55.8 54.2 55.7	MAG 0.841 0.737 0.645 0.608	ANG -27.8 -32.4 -37.5 -41.8		
MHz 600.00 800.00 1000.00 1200.00 1400.00	MAG 0.727 0.587 0.490 0.425 0.354	ANG -39.7 -49.7 -57.4 -64.5 -70.8	MAG 6.761 5.910 5.229 4.812 4.314	ANG 131.7 119.4 108.8 101.3 94.8	MAG 0.057 0.084 0.104 0.120 0.135	ANG 58.1 55.8 54.2 55.7 55.3	MAG 0.841 0.737 0.645 0.608 0.562	ANG -27.8 -32.4 -37.5 -41.8 -45.1		
MHz 600.00 800.00 1000.00 1200.00 1400.00 1600.00	MAG 0.727 0.587 0.490 0.425 0.354 0.295	ANG -39.7 -49.7 -57.4 -64.5 -70.8 -78.5	MAG 6.761 5.910 5.229 4.812 4.314 3.919	ANG 131.7 119.4 108.8 101.3 94.8 86.9	MAG 0.057 0.084 0.104 0.120 0.135 0.148	ANG 58.1 55.8 54.2 55.7 55.3 54.1	MAG 0.841 0.737 0.645 0.608 0.562 0.517	ANG -27.8 -32.4 -37.5 -41.8 -45.1 -48.3		
MHz 600.00 800.00 1000.00 1200.00 1400.00 1600.00 1800.00	MAG 0.727 0.587 0.490 0.425 0.354 0.295 0.251	ANG -39.7 -49.7 -57.4 -64.5 -70.8 -78.5 -85.1	MAG 6.761 5.910 5.229 4.812 4.314 3.919 3.662	ANG 131.7 119.4 108.8 101.3 94.8 86.9 81.8	MAG 0.057 0.084 0.104 0.120 0.135 0.148 0.151	58.1 55.8 54.2 55.7 55.3 54.1 54.8	MAG 0.841 0.737 0.645 0.608 0.562 0.517 0.478	ANG -27.8 -32.4 -37.5 -41.8 -45.1 -48.3 -52.4		
MHz 600.00 800.00 1000.00 1200.00 1400.00 1600.00 1800.00 2000.00	MAG 0.727 0.587 0.490 0.425 0.354 0.295 0.251 0.203 0.167	ANG -39.7 -49.7 -57.4 -64.5 -70.8 -78.5 -85.1 -89.4 -93.9	MAG 6.761 5.910 5.229 4.812 4.314 3.919 3.662 3.243	ANG 131.7 119.4 108.8 101.3 94.8 86.9 81.8 77.9	MAG 0.057 0.084 0.104 0.120 0.135 0.148 0.151 0.156	ANG 58.1 55.8 54.2 55.7 55.3 54.1 54.8 52.9	MAG 0.841 0.737 0.645 0.608 0.562 0.517 0.478 0.449	ANG -27.8 -32.4 -37.5 -41.8 -45.1 -48.3 -52.4 -53.6		
MHz 600.00 800.00 1000.00 1200.00 1400.00 1600.00 1800.00 2000.00	MAG 0.727 0.587 0.490 0.425 0.354 0.295 0.251 0.203 0.167	ANG -39.7 -49.7 -57.4 -64.5 -70.8 -78.5 -85.1 -89.4 -93.9	MAG 6.761 5.910 5.229 4.812 4.314 3.919 3.662 3.243 2.924	ANG 131.7 119.4 108.8 101.3 94.8 86.9 81.8 77.9	MAG 0.057 0.084 0.104 0.120 0.135 0.148 0.151 0.156	58.1 55.8 54.2 55.7 55.3 54.1 54.8 52.9 50.9	MAG 0.841 0.737 0.645 0.608 0.562 0.517 0.478 0.449 0.441	ANG -27.8 -32.4 -37.5 -41.8 -45.1 -48.3 -52.4 -53.6		
MHz 600.00 800.00 1000.00 1200.00 1400.00 1600.00 2000.00 2200.00 VCE = 2 V, Ic = 5 mA	MAG 0.727 0.587 0.490 0.425 0.354 0.295 0.251 0.203 0.167	ANG -39.7 -49.7 -57.4 -64.5 -70.8 -78.5 -85.1 -89.4 -93.9	MAG 6.761 5.910 5.229 4.812 4.314 3.919 3.662 3.243 2.924	ANG 131.7 119.4 108.8 101.3 94.8 86.9 81.8 77.9 73.0	MAG 0.057 0.084 0.104 0.120 0.135 0.148 0.151 0.156 0.164	58.1 55.8 54.2 55.7 55.3 54.1 54.8 52.9 50.9	MAG 0.841 0.737 0.645 0.608 0.562 0.517 0.478 0.449 0.441	ANG -27.8 -32.4 -37.5 -41.8 -45.1 -48.3 -52.4 -53.6 -55.6		
MHz 600.00 800.00 1000.00 1200.00 1400.00 1600.00 1800.00 2000.00 VCE = 2 V, IC = 5 mA	MAG 0.727 0.587 0.490 0.425 0.354 0.295 0.251 0.203 0.167 Δ, Zo = 50 Ω	ANG -39.7 -49.7 -57.4 -64.5 -70.8 -78.5 -85.1 -89.4 -93.9	MAG 6.761 5.910 5.229 4.812 4.314 3.919 3.662 3.243 2.924	ANG 131.7 119.4 108.8 101.3 94.8 86.9 81.8 77.9 73.0	MAG 0.057 0.084 0.104 0.120 0.135 0.148 0.151 0.156 0.164	ANG 58.1 55.8 54.2 55.7 55.3 54.1 54.8 52.9 50.9	MAG 0.841 0.737 0.645 0.608 0.562 0.517 0.478 0.449 0.441	ANG -27.8 -32.4 -37.5 -41.8 -45.1 -48.3 -52.4 -53.6 -55.6		
MHz 600.00 800.00 1000.00 1200.00 1400.00 1600.00 2000.00 2200.00 VCE = 2 V, IC = 5 mA FREQUENCY MHz	MAG 0.727 0.587 0.490 0.425 0.354 0.295 0.251 0.203 0.167 A, Zo = 50 Ω MAG	ANG -39.7 -49.7 -57.4 -64.5 -70.8 -78.5 -85.1 -89.4 -93.9	MAG 6.761 5.910 5.229 4.812 4.314 3.919 3.662 3.243 2.924	ANG 131.7 119.4 108.8 101.3 94.8 86.9 81.8 77.9 73.0	MAG 0.057 0.084 0.104 0.120 0.135 0.148 0.151 0.156 0.164 SA	ANG 58.1 55.8 54.2 55.7 55.3 54.1 54.8 52.9 50.9	MAG 0.841 0.737 0.645 0.608 0.562 0.517 0.478 0.449 0.441	ANG -27.8 -32.4 -37.5 -41.8 -45.1 -48.3 -52.4 -53.6 -55.6		
MHz 600.00 800.00 1000.00 1200.00 1400.00 1600.00 2000.00 2200.00 VCE = 2 V, IC = 5 mA FREQUENCY MHz 600.00	MAG 0.727 0.587 0.490 0.425 0.354 0.295 0.251 0.203 0.167 A, Zo = 50 Ω MAG 0.592	ANG -39.7 -49.7 -57.4 -64.5 -70.8 -78.5 -85.1 -89.4 -93.9 ANG -46.3	MAG 6.761 5.910 5.229 4.812 4.314 3.919 3.662 3.243 2.924 S. MAG 8.189	ANG 131.7 119.4 108.8 101.3 94.8 86.9 81.8 77.9 73.0 21 ANG 122.9	MAG 0.057 0.084 0.104 0.120 0.135 0.148 0.151 0.156 0.164 SA	ANG 58.1 55.8 54.2 55.7 55.3 54.1 54.8 52.9 50.9	MAG 0.841 0.737 0.645 0.608 0.562 0.517 0.478 0.449 0.441	ANG -27.8 -32.4 -37.5 -41.8 -45.1 -48.3 -52.4 -53.6 -55.6 ANG -30.6		
MHz 600.00 800.00 1000.00 1200.00 1400.00 1800.00 2000.00 2200.00 VCE = 2 V, IC = 5 mA FREQUENCY MHz 600.00 800.00	MAG 0.727 0.587 0.490 0.425 0.354 0.295 0.251 0.203 0.167 A, Zo = 50 Ω S MAG 0.592 0.457	ANG -39.7 -49.7 -57.4 -64.5 -70.8 -78.5 -85.1 -89.4 -93.9 ANG -46.3 -55.1	MAG 6.761 5.910 5.229 4.812 4.314 3.919 3.662 3.243 2.924 S. MAG 8.189 6.849	ANG 131.7 119.4 108.8 101.3 94.8 86.9 81.8 77.9 73.0 21 ANG 122.9 110.9	MAG 0.057 0.084 0.104 0.120 0.135 0.148 0.151 0.156 0.164 SA MAG 0.052 0.074	ANG 58.1 55.8 54.2 55.7 55.3 54.1 54.8 52.9 50.9	MAG 0.841 0.737 0.645 0.608 0.562 0.517 0.478 0.449 0.441	ANG -27.8 -32.4 -37.5 -41.8 -45.1 -48.3 -52.4 -53.6 -55.6 ANG -30.6 -33.8		
MHz 600.00 800.00 1000.00 1200.00 1400.00 1600.00 1800.00 2200.00 VCE = 2 V, IC = 5 mA FREQUENCY MHz 600.00 800.00 1000.00	MAG 0.727 0.587 0.490 0.425 0.354 0.295 0.251 0.203 0.167 A, Zo = 50 Ω S MAG 0.592 0.457 0.369	ANG -39.7 -49.7 -57.4 -64.5 -70.8 -78.5 -85.1 -89.4 -93.9 ANG -46.3 -55.1 -60.0	MAG 6.761 5.910 5.229 4.812 4.314 3.919 3.662 3.243 2.924 S. MAG 8.189 6.849 5.900	ANG 131.7 119.4 108.8 101.3 94.8 86.9 81.8 77.9 73.0 21 ANG 122.9 110.9 101.1	MAG 0.057 0.084 0.104 0.120 0.135 0.148 0.151 0.156 0.164 SA MAG 0.052 0.074 0.096	ANG 58.1 55.8 54.2 55.7 55.3 54.1 54.8 52.9 50.9 22 ANG 59.4 56.6 54.1	MAG 0.841 0.737 0.645 0.608 0.562 0.517 0.478 0.449 0.441 MAG 0.763 0.655 0.564	ANG -27.8 -32.4 -37.5 -41.8 -45.1 -48.3 -52.4 -53.6 -55.6 ANG -30.6 -33.8 -37.6		
MHz 600.00 800.00 1000.00 1200.00 1400.00 1600.00 1800.00 2200.00 VCE = 2 V, IC = 5 mA FREQUENCY MHz 600.00 800.00 1000.00 1200.00	MAG 0.727 0.587 0.490 0.425 0.354 0.295 0.251 0.203 0.167 A, Zo = 50 Ω MAG 0.592 0.457 0.369 0.305	ANG -39.7 -49.7 -57.4 -64.5 -70.8 -78.5 -85.1 -89.4 -93.9 ANG -46.3 -55.1 -60.0 -66.2	MAG 6.761 5.910 5.229 4.812 4.314 3.919 3.662 3.243 2.924 S. MAG 8.189 6.849 5.900 5.303	ANG 131.7 119.4 108.8 101.3 94.8 86.9 81.8 77.9 73.0 21 ANG 122.9 110.9 101.1 94.7	MAG 0.057 0.084 0.104 0.120 0.135 0.148 0.151 0.156 0.164 Sf MAG 0.052 0.074 0.096 0.111	ANG 58.1 55.8 54.2 55.7 55.3 54.1 54.8 52.9 50.9 ANG 59.4 56.6 54.1 58.0	MAG 0.841 0.737 0.645 0.608 0.562 0.517 0.478 0.449 0.441 MAG 0.763 0.655 0.564 0.533	ANG -27.8 -32.4 -37.5 -41.8 -45.1 -48.3 -52.4 -53.6 -55.6 ANG -30.6 -33.8 -37.6 -40.7		
MHz 600.00 800.00 1000.00 1200.00 1400.00 1600.00 2000.00 2200.00 VCE = 2 V, IC = 5 mA FREQUENCY MHz 600.00 800.00 1000.00 1200.00 1400.00	MAG 0.727 0.587 0.490 0.425 0.354 0.295 0.251 0.203 0.167 A, Zo = 50 Ω MAG 0.592 0.457 0.369 0.305 0.249	ANG -39.7 -49.7 -57.4 -64.5 -70.8 -78.5 -85.1 -89.4 -93.9 ANG -46.3 -55.1 -60.0 -66.2 -72.3	MAG 6.761 5.910 5.229 4.812 4.314 3.919 3.662 3.243 2.924 S. MAG 8.189 6.849 5.900 5.303 4.651	ANG 131.7 119.4 108.8 101.3 94.8 86.9 81.8 77.9 73.0 21 ANG 122.9 110.9 101.1 94.7 88.4	MAG 0.057 0.084 0.104 0.120 0.135 0.148 0.151 0.156 0.164 SA MAG 0.052 0.074 0.096 0.111 0.126	ANG 58.1 55.8 54.2 55.7 55.3 54.1 54.8 52.9 50.9 2 ANG 59.4 56.6 54.1 58.0 58.2	MAG 0.841 0.737 0.645 0.608 0.562 0.517 0.478 0.449 0.441 MAG 0.763 0.655 0.564 0.533 0.495	ANG -27.8 -32.4 -37.5 -41.8 -45.1 -48.3 -52.4 -53.6 -55.6 ANG -30.6 -33.8 -37.6 -40.7 -43.3		
MHz 600.00 800.00 1000.00 1200.00 1400.00 1600.00 2000.00 2200.00 VCE = 2 V, IC = 5 mA FREQUENCY MHz 600.00 800.00 1200.00 1200.00 1400.00 1600.00	MAG 0.727 0.587 0.490 0.425 0.354 0.295 0.251 0.203 0.167 A, Zo = 50 Ω MAG 0.592 0.457 0.369 0.305 0.249 0.198	ANG -39.7 -49.7 -57.4 -64.5 -70.8 -78.5 -85.1 -89.4 -93.9 2 311 ANG -46.3 -55.1 -60.0 -66.2 -72.3 -79.2	MAG 6.761 5.910 5.229 4.812 4.314 3.919 3.662 3.243 2.924 S. MAG 8.189 6.849 5.900 5.303 4.651 4.202	ANG 131.7 119.4 108.8 101.3 94.8 86.9 81.8 77.9 73.0 21 ANG 122.9 110.9 101.1 94.7 88.4 81.2	MAG 0.057 0.084 0.104 0.120 0.135 0.148 0.151 0.156 0.164 SA MAG 0.052 0.074 0.096 0.111 0.126 0.139	ANG 58.1 55.8 54.2 55.7 55.3 54.1 54.8 52.9 50.9 2 ANG 59.4 56.6 54.1 58.0 58.2 58.2	MAG 0.841 0.737 0.645 0.608 0.562 0.517 0.478 0.449 0.441 MAG 0.763 0.655 0.564 0.533 0.495 0.460	ANG -27.8 -32.4 -37.5 -41.8 -45.1 -48.3 -52.4 -53.6 -55.6 ANG -30.6 -33.8 -37.6 -40.7 -43.3 -45.6		
MHz 600.00 800.00 1000.00 1200.00 1400.00 1600.00 2000.00 2200.00 VCE = 2 V, Ic = 5 mA FREQUENCY MHz 600.00 800.00 1200.00 1400.00 1400.00 1600.00 1800.00	MAG 0.727 0.587 0.490 0.425 0.354 0.295 0.251 0.203 0.167 A, Zo = 50 Ω MAG 0.592 0.457 0.369 0.305 0.249 0.198 0.160	ANG -39.7 -49.7 -57.4 -64.5 -70.8 -78.5 -85.1 -89.4 -93.9 ANG -46.3 -55.1 -60.0 -66.2 -72.3 -79.2 -85.2	MAG 6.761 5.910 5.229 4.812 4.314 3.919 3.662 3.243 2.924 S. MAG 8.189 6.849 5.900 5.303 4.651 4.202 3.888	ANG 131.7 119.4 108.8 101.3 94.8 86.9 81.8 77.9 73.0 21 ANG 122.9 110.9 101.1 94.7 88.4 81.2 77.2	MAG 0.057 0.084 0.104 0.120 0.135 0.148 0.151 0.156 0.164 Sf MAG 0.052 0.074 0.096 0.111 0.126 0.139 0.146	ANG 58.1 55.8 54.2 55.7 55.3 54.1 54.8 52.9 50.9 2 ANG 59.4 56.6 54.1 58.0 58.2 58.2 59.2	MAG 0.841 0.737 0.645 0.608 0.562 0.517 0.478 0.449 0.441 MAG 0.763 0.655 0.564 0.533 0.495 0.460 0.425	ANG -27.8 -32.4 -37.5 -41.8 -45.1 -48.3 -52.4 -53.6 -55.6 ANG -30.6 -33.8 -37.6 -40.7 -43.3 -45.6 -59.3		



VcE = 2 V, Ic = 7 mA	A, Zo = 50 £	2							
FREQUENCY	S11		S21		S	12	S22		
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG	
600.00	0.489	-50.8	8.917	116.7	0.045	58.5	0.701	-31.1	
800.00	0.371	-58.8	7.266	105.4	0.070	57.0	0.601	-33.3	
1000.00	0.287	-62.3	6.166	96.2	0.090	57.4	0.523	-35.7	
1200.00	0.233	-67.2	5.456	90.6	0.106	61.2	0.501	-38.3	
1400.00	0.181	-72.6	4.743	84.5	0.122	62.0	0.465	-40.4	
1600.00	0.138	-80.1	4.283	77.7	0.137	61.2	0.436	-42.7	
1800.00	0.105	-86.5	3.937	74.2	0.143	62.8	0.404	-45.9	
2000.00	0.072	-91.2	3.456	71.1	0.149	60.2	0.389	-47.1	
2200.00	0.052	-93.0	3.097	66.9	0.159	57.3	0.391	-49.2	
VcE = 2 V, Ic = 10 m	nA, Zo = 50	Ω							
FREQUENCY	5	S11	S	21	S ²	12	S	22	
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG	
600.00	0.404	-55.4	9.236	111.8	0.039	55.3	0.660	-30.2	
800.00	0.298	-62.9	7.374	101.0	0.064	57.2	0.569	-31.4	
1000.00	0.221	-65.2	6.206	92.5	0.087	60.1	0.501	-33.0	
1200.00	0.169	-69.5	5.441	87.4	0.102	63.5	0.483	-35.3	
1400.00	0.128	-76.3	4.701	81.4	0.119	63.3	0.456	-37.4	
1600.00	0.089	-86.1	4.244	75.0	0.134	63.5	0.430	-39.5	
1800.00	0.062	-96.1	3.888	71.9	0.140	64.0	0.400	-42.5	
0000 00									
2000.00	0.035	-112.1	3.408	68.9	0.147	62.4	0.388	-43.8	

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