SILICON TRANSISTOR

2SC5013

HIGH FREQUENCY LOW NOISE AMPLIFIER NPN SILICON EPITAXIAL TRANSISTOR 4 PINS SUPER MINI MOLD

FEATURES

- Small Package
- WWW.DZSC.COM High Gain Bandwidth Product (f_T = 10 GHz TYP.)
- Low Noise, High Gain
- Low Voltage Operation

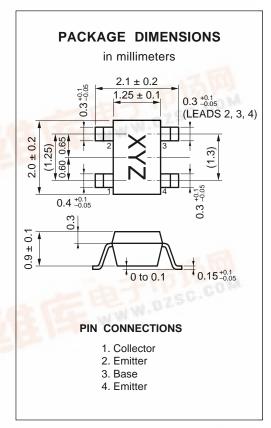
ORDERING INFORMATION

PART NUMBER	QUANTITY	PACKING STYLE
2SC5013-T1	3 Kpcs/Reel.	Embossed tape 8 mm wide. Pin3 (Base), Pin4 (Emitter) face to perforation side of the tape.
2SC5013-T2	3 Kpcs/Reel.	Embossed tape 8 mm wide. Pin1 (Collector), Pin2 (Emitter) face to perforation side of the tape.

* Please contact with responsible NEC person, If you require evaluation sample. Unit sample quantity shall be 50 pcs. (Part No.: 2SC5013)

ABSOLUTE MAXIMUM RATINGS (TA = 25 °C)

Collector to Base Voltage	Vсво	20	V
Collector to Emitter Voltage	Vceo	10	V
Emitter to Base Voltage	Vево	1.5	V
Collector Current	Ic	35	mΑ
Total Power Dissipation	Рт	150	mW
Junction Temperature	T_{j}	150	°C
Storage Temperature	Tstg	-65 to +150	°C







ELECTRICAL CHARACTERISTICS (TA = 25 °C)

CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITION
Collector Cutoff Current	Ісво			1.0	μΑ	Vcb = 10 V, IE = 0
Emitter Cutoff Current	ІЕВО			1.0	μΑ	VEB = 1 V, Ic = 0
DC Current Gain	hfe	50	100	250		VcE = 6 V, Ic = 10 mA*1
Gain Bandwidth Product	f⊤		10		GHz	VcE = 6 V, Ic = 10 mA
Feed back Capacitance	Cre		0.25	0.8	pF	VCB = 10 V, IE = 0, f = 1 MHz*2
Insertion Power Gain	S _{21e} ²	7.5	9.5		dB	VcE = 6 V, Ic = 10 mA, f = 2.0 GHz
Noise Figure	NF		1.8	3.0	dB	VcE = 6 V, Ic = 5 mA, f = 2.0 GHz

^{*1} Pulse Measurement; PW \leq 350 μ s, Duty Cycle \leq 2 % Pulsed.

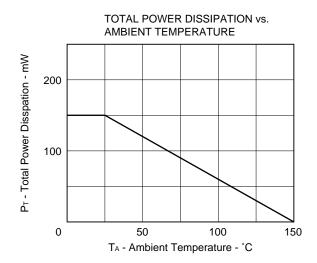
hFE Classification

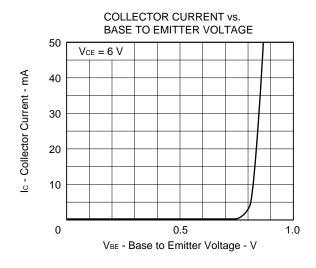
Rank	EB	FB	GB
Marking	R46	R47	R48
hfE	50 to 100	80 to 160	125 to 250

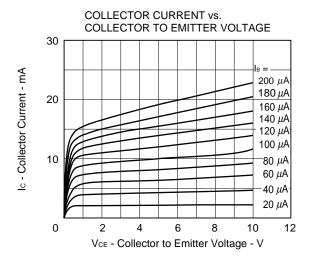
^{*2} Measured with 3 terminals bridge, Emitter and Case should be grounded.

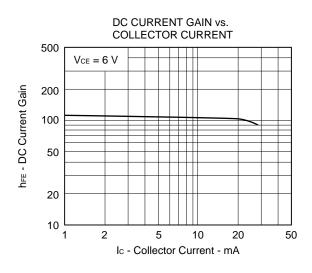
NEC

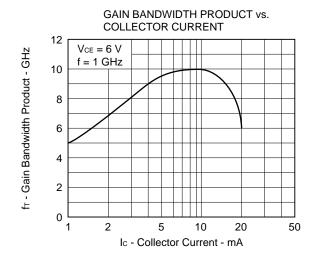
TYPICAL CHARACTERISTICS (TA = 25 °C)

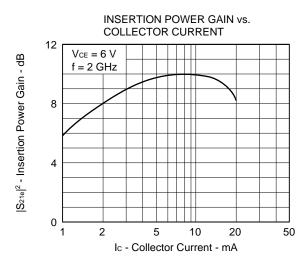


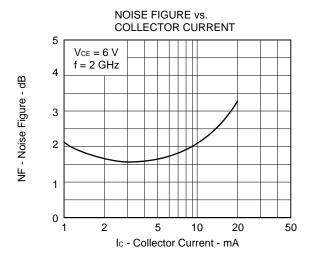


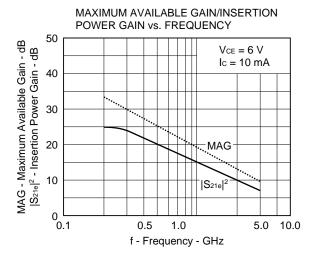


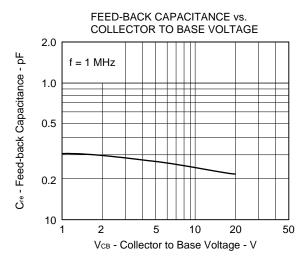














S-PARAMETER

Vce = 6 V, Ic = 10 mA

FREQUENCY	S	S ₁₁	Sa	21	S	12	S	22
f (MHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100.00 200.00	.728 .616	-26.9 -50.1	21.563 18.401	157.7 139.3	.013 .023	86.3 69.9	.946 .851	−11.0 −18.5
300.00	.522	-68.0	15.357	126.0	.029	57.4	.766	-23.2
400.00	.441	-83.2	12.718	116.3	.037	58.4	.694	-24.8
500.00 600.00	.376 .341	-96.2 -107.8	10.893 9.466	108.2 102.5	.039 .047	62.0 63.0	.637 .602	-26.0 -27.0
700.00	.310	-118.1	8.396	97.2	.049	60.6	.579	-27.3
800.00 900.00	.286 .266	−127.0 −138.1	7.434 6.707	92.5 88.7	.054 .056	60.1 58.1	.556 .541	-28.3 -28.3
1000.00	.261	-146.1	6.128	84.7	.065	59.9	.529	-29.2
1100.00	.252	-154.5	5.578	81.6	.067	63.0	.516	-29.5
1200.00 1300.00	.249 .243	-160.1 -168.7	5.111 4.769	78.4 75.6	.073 .073	60.2 57.3	.506 .494	-31.0 -31.7
1400.00	.241	-173.0	4.467	72.5	.082	56.5	.488	-33.7
1500.00 1600.00	.253 .251	-179.5 174.3	4.183 3.932	69.6 67.1	.085 .094	59.6 56.7	.474 .471	-34.3 -36.3
1700.00	.269	170.9	3.731	64.7	.093	58.2	.464	-36.5
1800.00	.266	164.5	3.536	62.0	.098	59.3	.466	-38.0 40.0
1900.00 2000.00	.269 .285	161.6 158.2	3.372 3.233	60.0 57.1	.100 .116	56.7 56.2	.457 .451	-40.0 -42.0
2100.00	.289	154.8	3.071	55.4	.117	57.0	.449	-44.3
2200.00 2300.00	.300 .298	150.6 149.3	2.935 2.812	52.3 50.8	.120 .128	58.5 57.4	.445 .440	-46.0 -47.1
2400.00	.293	144.6	2.720	48.4	.127	57.1	.432	-47.0
2500.00	.315	143.0	2.623	45.8	.137	55.1	.425	-52.2 50.4
2600.00 2700.00	.326 .327	138.8 137.8	2.542 2.435	43.9 42.4	.144 .151	54.7 50.4	.419 .419	-50.4 -54.7
2800.00	.320	136.4	2.376	39.4	.158	53.9	.427	-57.6
2900.00 3000.00	.327 .337	135.1 129.1	2.285 2.218	37.9 34.6	.161 .160	48.7 50.1	.425 .419	-60.2 -61.9
Vce = 3 V, Ic = 5 mA								
FREQUENCY		S ₁₁	Sa		S		S	
	S MAG	S ₁₁ ANG	S2 MAG	21 ANG	S MAG	12 ANG	S MAG	ANG
FREQUENCY f (MHz) 100.00	MAG .836	ANG -17.9	MAG 13.996	ANG 164.7	MAG .015	ANG 73.5	MAG .971	ANG -8.3
FREQUENCY f (MHz) 100.00 200.00	MAG .836 .768	ANG -17.9 -34.4	MAG 13.996 12.918	ANG 164.7 150.7	MAG .015 .025	73.5 72.7	MAG .971 .918	ANG -8.3 -15.1
FREQUENCY f (MHz) 100.00 200.00 300.00 400.00	.836 .768 .692 .614	ANG -17.9 -34.4 -48.4 -61.2	MAG 13.996 12.918 11.709 10.317	ANG 164.7 150.7 138.9 129.2	.015 .025 .038 .044	73.5 72.7 66.8 60.2	MAG .971 .918 .862 .793	-8.3 -15.1 -20.5 -23.9
FREQUENCY f (MHz) 100.00 200.00 300.00 400.00 500.00	MAG .836 .768 .692 .614 .535	ANG -17.9 -34.4 -48.4 -61.2 -72.4	MAG 13.996 12.918 11.709 10.317 9.260	ANG 164.7 150.7 138.9 129.2 120.2	MAG .015 .025 .038 .044 .051	73.5 72.7 66.8 60.2 55.8	.971 .918 .862 .793 .731	-8.3 -15.1 -20.5 -23.9 -27.1
FREQUENCY f (MHz) 100.00 200.00 300.00 400.00	.836 .768 .692 .614	ANG -17.9 -34.4 -48.4 -61.2	MAG 13.996 12.918 11.709 10.317	ANG 164.7 150.7 138.9 129.2 120.2 113.8	.015 .025 .038 .044 .051	73.5 72.7 66.8 60.2 55.8 55.6	MAG .971 .918 .862 .793	-8.3 -15.1 -20.5 -23.9
FREQUENCY f (MHz) 100.00 200.00 300.00 400.00 500.00 600.00 700.00 800.00	MAG .836 .768 .692 .614 .535 .490 .435 .398	ANG -17.9 -34.4 -48.4 -61.2 -72.4 -82.3 -92.9 -100.8	MAG 13.996 12.918 11.709 10.317 9.260 8.326 7.553 6.791	ANG 164.7 150.7 138.9 129.2 120.2 113.8 107.6 102.1	MAG .015 .025 .038 .044 .051 .056 .063 .065	73.5 72.7 66.8 60.2 55.8 55.6 55.6 58.1	MAG .971 .918 .862 .793 .731 .684 .658 .614	-8.3 -15.1 -20.5 -23.9 -27.1 -29.1 -30.6 -32.6
FREQUENCY f (MHz) 100.00 200.00 300.00 400.00 500.00 600.00 700.00 800.00 900.00	MAG .836 .768 .692 .614 .535 .490 .435 .398 .362	ANG -17.9 -34.4 -48.4 -61.2 -72.4 -82.3 -92.9 -100.8 -110.0	MAG 13.996 12.918 11.709 10.317 9.260 8.326 7.553 6.791 6.194	ANG 164.7 150.7 138.9 129.2 120.2 113.8 107.6 102.1 97.7	MAG .015 .025 .038 .044 .051 .056 .063 .065 .070	73.5 72.7 66.8 60.2 55.8 55.6 55.6 58.1 54.7	MAG .971 .918 .862 .793 .731 .684 .658 .614 .591	-8.3 -15.1 -20.5 -23.9 -27.1 -29.1 -30.6 -32.6
FREQUENCY f (MHz) 100.00 200.00 300.00 400.00 500.00 600.00 700.00 800.00 900.00 1000.00	MAG .836 .768 .692 .614 .535 .490 .435 .398 .362 .333 .318	ANG -17.9 -34.4 -48.4 -61.2 -72.4 -82.3 -92.9 -100.8 -110.0 -118.3 -126.0	MAG 13.996 12.918 11.709 10.317 9.260 8.326 7.553 6.791 6.194 5.724 5.263	ANG 164.7 150.7 138.9 129.2 120.2 113.8 107.6 102.1 97.7 93.2 89.6	MAG .015 .025 .038 .044 .051 .056 .063 .065 .070 .074	73.5 72.7 66.8 60.2 55.8 55.6 55.6 54.7 54.2 55.3	MAG .971 .918 .862 .793 .731 .684 .658 .614 .591 .567	ANG -8.3 -15.1 -20.5 -23.9 -27.1 -29.1 -30.6 -32.6 -32.8 -33.4 -34.7
FREQUENCY f (MHz) 100.00 200.00 300.00 400.00 500.00 600.00 700.00 800.00 900.00 1000.00 1100.00 1200.00	MAG .836 .768 .692 .614 .535 .490 .435 .398 .362 .333 .318 .297	ANG -17.9 -34.4 -48.4 -61.2 -72.4 -82.3 -92.9 -100.8 -110.0 -118.3 -126.0 -133.4	MAG 13.996 12.918 11.709 10.317 9.260 8.326 7.553 6.791 6.194 5.724 5.263 4.837	ANG 164.7 150.7 138.9 129.2 120.2 113.8 107.6 102.1 97.7 93.2 89.6 85.7	MAG .015 .025 .038 .044 .051 .056 .063 .065 .070 .074 .079	73.5 72.7 66.8 60.2 55.8 55.6 55.6 54.7 54.2 55.3 53.9	MAG .971 .918 .862 .793 .731 .684 .658 .614 .591 .567 .548	-8.3 -15.1 -20.5 -23.9 -27.1 -29.1 -30.6 -32.6 -32.8 -33.4 -34.7 -35.6
FREQUENCY f (MHz) 100.00 200.00 300.00 400.00 500.00 600.00 700.00 800.00 900.00 1000.00	MAG .836 .768 .692 .614 .535 .490 .435 .398 .362 .333 .318	ANG -17.9 -34.4 -48.4 -61.2 -72.4 -82.3 -92.9 -100.8 -110.0 -118.3 -126.0	MAG 13.996 12.918 11.709 10.317 9.260 8.326 7.553 6.791 6.194 5.724 5.263	ANG 164.7 150.7 138.9 129.2 120.2 113.8 107.6 102.1 97.7 93.2 89.6	MAG .015 .025 .038 .044 .051 .056 .063 .065 .070 .074	73.5 72.7 66.8 60.2 55.8 55.6 55.6 54.7 54.2 55.3	MAG .971 .918 .862 .793 .731 .684 .658 .614 .591 .567	ANG -8.3 -15.1 -20.5 -23.9 -27.1 -29.1 -30.6 -32.6 -32.8 -33.4 -34.7
FREQUENCY f (MHz) 100.00 200.00 300.00 400.00 500.00 600.00 700.00 800.00 900.00 1100.00 1200.00 1300.00 1400.00 1500.00	MAG .836 .768 .692 .614 .535 .490 .435 .398 .362 .333 .318 .297 .281 .275 .263	ANG -17.9 -34.4 -48.4 -61.2 -72.4 -82.3 -92.9 -100.8 -110.0 -118.3 -126.0 -133.4 -141.4 -147.5 -155.9	MAG 13.996 12.918 11.709 10.317 9.260 8.326 7.553 6.791 6.194 5.724 5.263 4.837 4.538 4.256 4.004	ANG 164.7 150.7 138.9 129.2 120.2 113.8 107.6 102.1 97.7 93.2 89.6 85.7 82.5 79.4 76.0	MAG .015 .025 .038 .044 .051 .056 .063 .065 .070 .074 .079 .084 .085 .090 .099	73.5 72.7 66.8 60.2 55.8 55.6 55.6 54.7 54.2 55.3 53.9 53.3 52.0 50.6	MAG .971 .918 .862 .793 .731 .684 .658 .614 .591 .567 .548 .542 .516 .509 .488	-8.3 -15.1 -20.5 -23.9 -27.1 -30.6 -32.6 -32.8 -33.4 -34.7 -35.6 -36.7 -37.9 -38.2
FREQUENCY f (MHz) 100.00 200.00 300.00 400.00 500.00 600.00 700.00 800.00 1000.00 1100.00 1200.00 1300.00 1400.00 1500.00 1600.00	MAG .836 .768 .692 .614 .535 .490 .435 .398 .362 .333 .318 .297 .281 .275 .263 .268	ANG -17.9 -34.4 -48.4 -61.2 -72.4 -82.3 -92.9 -100.8 -110.0 -118.3 -126.0 -133.4 -141.4 -147.5 -155.9 -162.3	MAG 13.996 12.918 11.709 10.317 9.260 8.326 7.553 6.791 6.194 5.724 5.263 4.837 4.538 4.256 4.004 3.770	ANG 164.7 150.7 138.9 129.2 120.2 113.8 107.6 102.1 97.7 93.2 89.6 85.7 82.5 79.4 76.0 73.3	MAG .015 .025 .038 .044 .051 .056 .063 .065 .070 .074 .079 .084 .085 .090 .099	73.5 72.7 66.8 60.2 55.8 55.6 55.6 58.1 54.7 54.2 55.3 53.9 53.3 52.0 50.6 49.4	MAG .971 .918 .862 .793 .731 .684 .658 .614 .591 .567 .548 .542 .516 .509 .488 .491	ANG -8.3 -15.1 -20.5 -23.9 -27.1 -29.1 -30.6 -32.8 -33.4 -34.7 -35.6 -36.7 -37.9 -38.2 -39.3
FREQUENCY f (MHz) 100.00 200.00 300.00 400.00 500.00 600.00 700.00 800.00 1000.00 1100.00 1200.00 1300.00 1400.00 1500.00 1600.00 1700.00	MAG .836 .768 .692 .614 .535 .490 .435 .398 .362 .333 .318 .297 .281 .275 .263 .268 .277 .267	ANG -17.9 -34.4 -48.4 -61.2 -72.4 -82.3 -92.9 -100.8 -110.0 -118.3 -126.0 -133.4 -141.4 -147.5 -155.9 -162.3 -169.6 -174.9	MAG 13.996 12.918 11.709 10.317 9.260 8.326 7.553 6.791 6.194 5.724 5.263 4.837 4.538 4.256 4.004 3.770 3.597 3.407	ANG 164.7 150.7 138.9 129.2 120.2 113.8 107.6 102.1 97.7 93.2 89.6 85.7 82.5 79.4 76.0 73.3 70.7 67.7	MAG .015 .025 .038 .044 .051 .056 .063 .065 .070 .074 .079 .084 .085 .090 .099 .105 .109	73.5 72.7 66.8 60.2 55.8 55.6 55.6 54.7 54.2 55.3 53.9 53.3 52.0 50.6 49.4 49.9 51.2	MAG .971 .918 .862 .793 .731 .684 .658 .614 .591 .567 .548 .542 .516 .509 .488 .491 .484	ANG -8.3 -15.1 -20.5 -23.9 -27.1 -29.1 -30.6 -32.6 -32.8 -33.4 -34.7 -35.6 -36.7 -37.9 -38.2 -39.3 -40.0 -41.7
FREQUENCY f (MHz) 100.00 200.00 300.00 400.00 500.00 600.00 700.00 800.00 1000.00 1100.00 1200.00 1300.00 1400.00 1500.00 1600.00 1700.00 1800.00 1900.00	MAG .836 .768 .692 .614 .535 .490 .435 .398 .362 .333 .318 .297 .281 .275 .263 .268 .277 .267	ANG -17.9 -34.4 -48.4 -61.2 -72.4 -82.3 -92.9 -100.8 -110.0 -118.3 -126.0 -133.4 -141.4 -147.5 -155.9 -162.3 -169.6 -174.9 -179.5	MAG 13.996 12.918 11.709 10.317 9.260 8.326 7.553 6.791 6.194 5.724 5.263 4.837 4.538 4.256 4.004 3.770 3.597 3.407 3.244	ANG 164.7 150.7 138.9 129.2 120.2 113.8 107.6 102.1 97.7 93.2 89.6 85.7 82.5 79.4 76.0 73.3 70.7 67.7 65.6	MAG .015 .025 .038 .044 .051 .056 .063 .065 .070 .074 .079 .084 .085 .090 .099 .099 .105 .109 .112	73.5 72.7 66.8 60.2 55.8 55.6 55.6 55.3 53.9 53.3 52.0 50.6 49.4 49.9 51.2 50.2	MAG .971 .918 .862 .793 .731 .684 .658 .614 .591 .567 .548 .542 .516 .509 .488 .491 .484 .475 .468	ANG -8.3 -15.1 -20.5 -23.9 -27.1 -29.1 -30.6 -32.6 -32.8 -34.7 -35.6 -36.7 -37.9 -38.2 -39.3 -40.0 -41.7 -43.4
FREQUENCY f (MHz) 100.00 200.00 300.00 400.00 500.00 600.00 700.00 800.00 1000.00 1100.00 1200.00 1300.00 1400.00 1500.00 1600.00 1700.00 1800.00 1900.00 2000.00 2100.00	MAG .836 .768 .692 .614 .535 .490 .435 .398 .362 .333 .318 .297 .281 .275 .263 .268 .277 .267 .267 .262 .276 .273	ANG -17.9 -34.4 -48.4 -61.2 -72.4 -82.3 -92.9 -100.8 -110.0 -118.3 -126.0 -133.4 -141.4 -147.5 -155.9 -162.3 -169.6 -174.9 -179.5 175.7 169.3	MAG 13.996 12.918 11.709 10.317 9.260 8.326 7.553 6.791 6.194 5.724 5.263 4.837 4.538 4.256 4.004 3.770 3.597 3.407 3.244 3.118 2.967	ANG 164.7 150.7 138.9 129.2 120.2 113.8 107.6 102.1 97.7 93.2 89.6 85.7 82.5 79.4 76.0 73.3 70.7 67.7 65.6 62.3 59.5	MAG .015 .025 .038 .044 .051 .056 .063 .065 .070 .074 .079 .084 .085 .090 .099 .105 .109 .112 .119 .120	73.5 72.7 66.8 60.2 55.8 55.6 55.6 55.3 53.9 53.3 52.0 50.6 49.4 49.9 51.2 50.2 51.9 50.4	MAG .971 .918 .862 .793 .731 .684 .658 .614 .591 .567 .548 .542 .516 .509 .488 .491 .484 .475 .468 .460 .453	ANG -8.3 -15.1 -20.5 -23.9 -27.1 -29.1 -30.6 -32.6 -32.8 -33.4 -34.7 -35.6 -36.7 -37.9 -38.2 -39.3 -40.0 -41.7 -43.4 -46.6 -47.4
FREQUENCY f (MHz) 100.00 200.00 300.00 400.00 500.00 600.00 700.00 800.00 1000.00 1100.00 1200.00 1300.00 1400.00 1500.00 1600.00 1700.00 1800.00 1900.00 2000.00 2100.00 2200.00	MAG .836 .768 .692 .614 .535 .490 .435 .398 .362 .333 .318 .297 .281 .275 .263 .268 .277 .267 .262 .276 .273 .283	ANG -17.9 -34.4 -48.4 -61.2 -72.4 -82.3 -92.9 -100.8 -110.0 -118.3 -126.0 -133.4 -141.4 -147.5 -155.9 -162.3 -169.6 -174.9 -179.5 175.7 169.3 164.4	MAG 13.996 12.918 11.709 10.317 9.260 8.326 7.553 6.791 6.194 5.724 5.263 4.837 4.538 4.256 4.004 3.770 3.597 3.407 3.244 3.118 2.967 2.837	ANG 164.7 150.7 138.9 129.2 120.2 113.8 107.6 102.1 97.7 93.2 89.6 85.7 82.5 79.4 76.0 73.3 70.7 67.7 65.6 62.3 59.5 56.5	MAG .015 .025 .038 .044 .051 .056 .063 .065 .070 .074 .079 .084 .085 .090 .099 .105 .109 .112 .119 .120 .127	73.5 72.7 66.8 60.2 55.8 55.6 55.6 58.1 54.7 54.2 55.3 53.9 53.3 52.0 50.6 49.4 49.9 51.2 50.2 51.9 50.4 47.6	MAG .971 .918 .862 .793 .731 .684 .658 .614 .591 .567 .548 .542 .516 .509 .488 .491 .484 .475 .468 .460 .453 .446	ANG -8.3 -15.1 -20.5 -23.9 -27.1 -29.1 -30.6 -32.6 -32.8 -33.4 -34.7 -35.6 -36.7 -37.9 -38.2 -39.3 -40.0 -41.7 -43.4 -46.6 -47.4 -49.3
FREQUENCY f (MHz) 100.00 200.00 300.00 400.00 500.00 600.00 700.00 800.00 1000.00 1100.00 1200.00 1300.00 1400.00 1500.00 1600.00 1700.00 1800.00 1900.00 2000.00 2100.00	MAG .836 .768 .692 .614 .535 .490 .435 .398 .362 .333 .318 .297 .281 .275 .263 .268 .277 .267 .267 .262 .276 .273	ANG -17.9 -34.4 -48.4 -61.2 -72.4 -82.3 -92.9 -100.8 -110.0 -118.3 -126.0 -133.4 -141.4 -147.5 -155.9 -162.3 -169.6 -174.9 -179.5 175.7 169.3	MAG 13.996 12.918 11.709 10.317 9.260 8.326 7.553 6.791 6.194 5.724 5.263 4.837 4.538 4.256 4.004 3.770 3.597 3.407 3.244 3.118 2.967	ANG 164.7 150.7 138.9 129.2 120.2 113.8 107.6 102.1 97.7 93.2 89.6 85.7 82.5 79.4 76.0 73.3 70.7 67.7 65.6 62.3 59.5	MAG .015 .025 .038 .044 .051 .056 .063 .065 .070 .074 .079 .084 .085 .090 .099 .105 .109 .112 .119 .120 .127 .129	73.5 72.7 66.8 60.2 55.8 55.6 55.6 55.3 53.9 53.3 52.0 50.6 49.4 49.9 51.2 50.2 51.9 50.4	MAG .971 .918 .862 .793 .731 .684 .658 .614 .591 .567 .548 .542 .516 .509 .488 .491 .484 .475 .468 .460 .453	ANG -8.3 -15.1 -20.5 -23.9 -27.1 -29.1 -30.6 -32.6 -32.8 -33.4 -34.7 -35.6 -36.7 -37.9 -38.2 -39.3 -40.0 -41.7 -43.4 -46.6 -47.4
FREQUENCY f (MHz) 100.00 200.00 300.00 400.00 500.00 600.00 700.00 800.00 1000.00 1100.00 1200.00 1300.00 1400.00 1500.00 1600.00 1700.00 1800.00 1900.00 2000.00 2100.00 2200.00 2300.00 2400.00 2500.00	MAG .836 .768 .692 .614 .535 .490 .435 .398 .362 .333 .318 .297 .281 .275 .263 .268 .277 .267 .262 .276 .273 .283 .291 .283 .302	ANG -17.9 -34.4 -48.4 -61.2 -72.4 -82.3 -92.9 -100.8 -110.0 -118.3 -126.0 -133.4 -141.4 -147.5 -155.9 -162.3 -169.6 -174.9 -179.5 175.7 169.3 164.4 161.1 155.3 153.1	MAG 13.996 12.918 11.709 10.317 9.260 8.326 7.553 6.791 6.194 5.724 5.263 4.837 4.538 4.256 4.004 3.770 3.597 3.407 3.244 3.118 2.967 2.837 2.726 2.635 2.538	ANG 164.7 150.7 138.9 129.2 120.2 113.8 107.6 102.1 97.7 93.2 89.6 85.7 82.5 79.4 76.0 73.3 70.7 67.7 65.6 62.3 59.5 56.5 54.5 52.3 49.3	MAG .015 .025 .038 .044 .051 .056 .063 .065 .070 .074 .079 .084 .085 .090 .099 .105 .109 .112 .119 .120 .127 .129 .135 .138	73.5 72.7 66.8 60.2 55.8 55.6 55.6 58.1 54.7 54.2 55.3 53.9 53.3 52.0 50.6 49.4 49.9 51.2 50.2 51.9 50.4 47.6 49.7 50.6 50.0	MAG .971 .918 .862 .793 .731 .684 .658 .614 .591 .567 .548 .542 .516 .509 .488 .491 .484 .475 .468 .460 .453 .446 .441 .431 .429	ANG -8.3 -15.1 -20.5 -23.9 -27.1 -30.6 -32.6 -32.8 -33.4 -34.7 -35.6 -36.7 -37.9 -38.2 -39.3 -40.0 -41.7 -43.4 -46.6 -47.4 -49.3 -50.5 -51.1 -53.9
FREQUENCY f (MHz) 100.00 200.00 300.00 400.00 500.00 600.00 700.00 800.00 1000.00 1100.00 1200.00 1300.00 1400.00 1500.00 1600.00 1700.00 1800.00 1900.00 2000.00 2100.00 2200.00 2300.00 2400.00 2500.00	MAG .836 .768 .692 .614 .535 .490 .435 .398 .362 .333 .318 .297 .281 .275 .263 .268 .277 .267 .262 .276 .273 .283 .291 .283 .302 .304	ANG -17.9 -34.4 -48.4 -61.2 -72.4 -82.3 -92.9 -100.8 -110.0 -118.3 -126.0 -133.4 -141.4 -147.5 -155.9 -162.3 -169.6 -174.9 -179.5 175.7 169.3 164.4 161.1 155.3 153.1 148.2	MAG 13.996 12.918 11.709 10.317 9.260 8.326 7.553 6.791 6.194 5.724 5.263 4.837 4.538 4.256 4.004 3.770 3.597 3.407 3.244 3.118 2.967 2.837 2.726 2.635 2.538 2.458	ANG 164.7 150.7 138.9 129.2 120.2 113.8 107.6 102.1 97.7 93.2 89.6 85.7 82.5 79.4 76.0 73.3 70.7 67.7 65.6 62.3 59.5 56.5 54.5 552.3 49.3 47.3	MAG .015 .025 .038 .044 .051 .056 .063 .065 .070 .074 .079 .084 .085 .090 .099 .105 .109 .112 .119 .120 .127 .129 .135 .138 .143	73.5 72.7 66.8 60.2 55.8 55.6 55.6 58.1 54.7 54.2 55.3 53.9 53.3 52.0 50.6 49.4 49.9 51.2 50.2 51.9 50.4 47.6 49.7 50.6 50.0 49.1	MAG .971 .918 .862 .793 .731 .684 .658 .614 .591 .567 .548 .542 .516 .509 .488 .491 .484 .475 .468 .460 .453 .446 .441 .431 .429 .426	ANG -8.3 -15.1 -20.5 -23.9 -27.1 -30.6 -32.6 -32.8 -33.4 -34.7 -35.6 -36.7 -37.9 -38.2 -39.3 -40.0 -41.7 -43.4 -46.6 -47.4 -49.3 -50.5 -51.1 -53.9 -53.3
FREQUENCY f (MHz) 100.00 200.00 300.00 400.00 500.00 600.00 700.00 800.00 1000.00 1100.00 1200.00 1300.00 1400.00 1500.00 1600.00 1700.00 1800.00 1900.00 2000.00 2100.00 2200.00 2300.00 2400.00 2500.00 2600.00 2700.00 2800.00	MAG .836 .768 .692 .614 .535 .490 .435 .398 .362 .333 .318 .297 .281 .275 .263 .268 .277 .267 .262 .276 .273 .283 .291 .283 .304 .313 .304	ANG -17.9 -34.4 -48.4 -61.2 -72.4 -82.3 -92.9 -100.8 -110.0 -118.3 -126.0 -133.4 -141.4 -147.5 -155.9 -162.3 -169.6 -174.9 -179.5 175.7 169.3 164.4 161.1 155.3 153.1 148.2 145.8 143.9	MAG 13.996 12.918 11.709 10.317 9.260 8.326 7.553 6.791 6.194 5.724 5.263 4.837 4.538 4.256 4.004 3.770 3.597 3.244 3.118 2.967 2.837 2.726 2.635 2.538 2.458 2.365 2.296	ANG 164.7 150.7 138.9 129.2 120.2 113.8 107.6 102.1 97.7 93.2 89.6 85.7 82.5 79.4 76.0 73.3 70.7 67.7 65.6 62.3 59.5 56.5 54.5 52.3 49.3 47.3 45.9 42.6	MAG .015 .025 .038 .044 .051 .056 .063 .065 .070 .074 .079 .084 .085 .090 .099 .105 .109 .112 .119 .120 .127 .129 .135 .138 .143 .147 .156	73.5 72.7 66.8 60.2 55.8 55.6 55.6 55.3 53.9 53.3 52.0 50.6 49.4 49.9 51.2 50.2 51.9 50.4 47.6 49.7 50.6 50.0 49.1 47.8 45.9	MAG .971 .918 .862 .793 .731 .684 .658 .614 .591 .567 .548 .542 .516 .509 .488 .491 .484 .475 .468 .460 .453 .446 .441 .431 .429 .426 .418 .436	ANG -8.3 -15.1 -20.5 -23.9 -27.1 -29.1 -30.6 -32.8 -32.8 -34.7 -35.6 -36.7 -37.9 -38.2 -39.3 -40.0 -41.7 -43.4 -46.6 -47.4 -49.3 -50.5 -51.1 -53.9 -53.3 -57.4 -60.7
FREQUENCY f (MHz) 100.00 200.00 300.00 400.00 500.00 600.00 700.00 800.00 1000.00 1100.00 1200.00 1300.00 1400.00 1500.00 1600.00 1700.00 1800.00 1900.00 2000.00 2100.00 2200.00 2300.00 2400.00 2500.00 2600.00 2700.00	MAG .836 .768 .692 .614 .535 .490 .435 .398 .362 .333 .318 .297 .281 .275 .263 .268 .277 .262 .276 .273 .283 .291 .283 .302 .304 .313	ANG -17.9 -34.4 -48.4 -61.2 -72.4 -82.3 -92.9 -100.8 -110.0 -118.3 -126.0 -133.4 -141.4 -147.5 -155.9 -162.3 -169.6 -174.9 -179.5 175.7 169.3 164.4 161.1 155.3 153.1 148.2 145.8	MAG 13.996 12.918 11.709 10.317 9.260 8.326 7.553 6.791 6.194 5.724 5.263 4.837 4.538 4.256 4.004 3.770 3.597 3.407 3.244 3.118 2.967 2.837 2.726 2.635 2.538 2.458 2.365	ANG 164.7 150.7 138.9 129.2 120.2 113.8 107.6 102.1 97.7 93.2 89.6 85.7 82.5 79.4 76.0 73.3 70.7 67.7 65.6 62.3 59.5 56.5 54.5 52.3 49.3 47.3 45.9	MAG .015 .025 .038 .044 .051 .056 .063 .065 .070 .074 .079 .084 .085 .090 .099 .105 .109 .112 .119 .120 .127 .129 .135 .138 .143 .147	73.5 72.7 66.8 60.2 55.8 55.6 55.6 55.3 53.9 53.3 52.0 50.6 49.4 49.9 51.2 50.2 51.9 50.4 47.6 49.7 50.0 49.1 47.8	MAG .971 .918 .862 .793 .731 .684 .658 .614 .591 .567 .548 .542 .516 .509 .488 .491 .484 .475 .468 .460 .453 .446 .441 .431 .429 .426 .418	ANG -8.3 -15.1 -20.5 -23.9 -27.1 -30.6 -32.6 -32.8 -34.7 -35.6 -36.7 -37.9 -38.2 -39.3 -40.0 -41.7 -43.4 -46.6 -47.4 -49.3 -50.5 -51.1 -53.9 -53.3 -57.4



S-PARAMETER

Vce = 3 V, Ic = 3 mA

FREQUENCY	9	S ₁₁	S	91	S	12	S	22
f (MHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100.00	.902	-13.0	9.558	168.7	.014	84.4	.979	-6.1
200.00	.902 .851	-13.0 -26.2	9.556	157.3	.028	74.3	.954	–0.1 –11.7
300.00	.802	-37.4	8.623	147.3	.039	69.7	.919	-16.7
400.00	.740	-48.4	7.924	138.3	.047	62.4	.870	-20.8
500.00	.673	-58.7	7.396	129.6	.059	58.6	.820	-24.6
600.00	.628	-68.1	6.856	122.9	.064	56.0	.777	-27.4
700.00 800.00	.570 .525	–77.1 –85.5	6.376 5.838	116.2 110.2	.069	53.7 52.2	.741 .698	-29.3 -32.1
900.00	.476	-65.5 -94.0	5.406	105.2	.075 .079	52.2 51.0	.671	-32.1 -33.0
1000.00	.444	-101.0	5.065	100.2	.086	48.3	.650	-34.5
1100.00	.414	-108.1	4.698	96.0	.088	48.0	.621	-35.7
1200.00	.382	-115.4	4.347	91.6	.095	47.4	.606	-37.3
1300.00	.362	-123.1	4.108	88.0	.097	47.5	.584	-38.4
1400.00	.347	-129.7	3.874	84.3	.098	45.7	.570	-39.5
1500.00 1600.00	.331 .323	-136.8 -144.1	3.663 3.457	80.7 77.5	.100 .103	45.9 44.4	.543 .540	-40.5 -41.8
1700.00	.325	-151.0	3.312	74.7	.107	46.4	.525	-42.7
1800.00	.311	-156.6	3.143	71.5	.113	44.2	.523	-44.8
1900.00	.299	-161.8	3.009	68.8	.114	46.4	.515	-46.4
2000.00	.316	-169.4	2.883	65.2	.118	44.7	.504	-47.9
2100.00	.303	-176.8	2.746	62.4	.123	45.6	.492	-50.0
2200.00 2300.00	.311 .308	179.4 173.8	2.636 2.539	59.0 57.0	.125 .128	43.0 44.0	.488 .486	-51.8 -52.1
2400.00	.298	169.7	2.446	54.5	.120	45.1	.470	-53.4
2500.00	.319	164.0	2.371	51.4	.141	42.7	.468	-55.8
2600.00	.323	161.0	2.291	49.2	.139	43.4	.463	-56.2
2700.00	.320	158.3	2.203	47.5	.143	42.6	.462	-58.9
2800.00	.318	155.2	2.146	44.2	.149	42.2	.469	-62.4
2900.00 3000.00	.339 .322	152.9 146.3	2.066 1.987	42.5 39.1	.150 .162	42.5 41.3	.457 .458	-63.6 -66.6
3000.00	.522	140.5	1.507	39.1	.102	41.5	.430	-00.0
Vce = 3 V, Ic = 1 mA								
Vce = 3 V, Ic = 1 mA FREQUENCY	S	511	Sz	21	S	12	S	22
,	S MAG	S ₁₁ ANG	S: MAG	ANG	S MAG	12 ANG	S MAG	ANG
FREQUENCY f (MHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
FREQUENCY f (MHz) 100.00	MAG .971	ANG -7.4	MAG 3.546	ANG 173.5	MAG .019	ANG 84.5	MAG .998	ANG -3.3
FREQUENCY f (MHz)	MAG	ANG -7.4 -15.4	MAG 3.546 3.498	ANG 173.5 166.3	MAG	ANG	MAG .998 .986	ANG -3.3 -6.9
FREQUENCY f (MHz) 100.00 200.00 300.00 400.00	.971 .950 .937 .910	-7.4 -15.4 -22.4 -29.7	MAG 3.546 3.498 3.464 3.348	ANG 173.5 166.3 159.7 153.4	MAG .019 .031 .045 .058	84.5 75.8 76.2 67.5	MAG .998 .986 .983 .962	-3.3 -6.9 -9.9 -13.2
FREQUENCY f (MHz) 100.00 200.00 300.00 400.00 500.00	.971 .950 .937 .910 .877	-7.4 -15.4 -22.4 -29.7 -36.9	MAG 3.546 3.498 3.464 3.348 3.321	ANG 173.5 166.3 159.7 153.4 146.0	MAG .019 .031 .045 .058 .071	84.5 75.8 76.2 67.5 67.2	MAG .998 .986 .983 .962 .946	-3.3 -6.9 -9.9 -13.2 -16.6
FREQUENCY f (MHz) 100.00 200.00 300.00 400.00 500.00 600.00	MAG .971 .950 .937 .910 .877 .858	-7.4 -15.4 -22.4 -29.7 -36.9 -44.0	MAG 3.546 3.498 3.464 3.348 3.321 3.232	ANG 173.5 166.3 159.7 153.4 146.0 140.7	MAG .019 .031 .045 .058 .071 .082	84.5 75.8 76.2 67.5 67.2 62.3	MAG .998 .986 .983 .962 .946	-3.3 -6.9 -9.9 -13.2 -16.6 -19.3
FREQUENCY f (MHz) 100.00 200.00 300.00 400.00 500.00 600.00 700.00	.971 .950 .937 .910 .877 .858 .822	-7.4 -15.4 -22.4 -29.7 -36.9 -44.0 -51.3	MAG 3.546 3.498 3.464 3.348 3.321 3.232 3.187	ANG 173.5 166.3 159.7 153.4 146.0 140.7 134.4	.019 .031 .045 .058 .071 .082	84.5 75.8 76.2 67.5 67.2 62.3 58.1	MAG .998 .986 .983 .962 .946 .928 .909	-3.3 -6.9 -9.9 -13.2 -16.6 -19.3 -21.9
FREQUENCY f (MHz) 100.00 200.00 300.00 400.00 500.00 600.00 700.00 800.00	MAG .971 .950 .937 .910 .877 .858 .822 .792	-7.4 -15.4 -22.4 -29.7 -36.9 -44.0 -51.3 -58.1	MAG 3.546 3.498 3.464 3.348 3.321 3.232 3.187 3.054	ANG 173.5 166.3 159.7 153.4 146.0 140.7 134.4 128.3	MAG .019 .031 .045 .058 .071 .082 .090 .102	84.5 75.8 76.2 67.5 67.2 62.3 58.1 56.1	MAG .998 .986 .983 .962 .946 .928 .909	ANG -3.3 -6.9 -9.9 -13.2 -16.6 -19.3 -21.9 -25.5
FREQUENCY f (MHz) 100.00 200.00 300.00 400.00 500.00 600.00 700.00	.971 .950 .937 .910 .877 .858 .822	-7.4 -15.4 -22.4 -29.7 -36.9 -44.0 -51.3	MAG 3.546 3.498 3.464 3.348 3.321 3.232 3.187	ANG 173.5 166.3 159.7 153.4 146.0 140.7 134.4	.019 .031 .045 .058 .071 .082	84.5 75.8 76.2 67.5 67.2 62.3 58.1	MAG .998 .986 .983 .962 .946 .928 .909	-3.3 -6.9 -9.9 -13.2 -16.6 -19.3 -21.9
FREQUENCY f (MHz) 100.00 200.00 300.00 400.00 500.00 600.00 700.00 800.00 900.00 1000.00	MAG .971 .950 .937 .910 .877 .858 .822 .792 .751 .718	-7.4 -15.4 -22.4 -29.7 -36.9 -44.0 -51.3 -58.1 -65.0 -71.4 -78.2	MAG 3.546 3.498 3.464 3.348 3.321 3.232 3.187 3.054 2.949 2.867 2.750	ANG 173.5 166.3 159.7 153.4 146.0 140.7 134.4 128.3 122.9 117.5 112.7	MAG .019 .031 .045 .058 .071 .082 .090 .102 .110 .116 .122	84.5 75.8 76.2 67.5 67.2 62.3 58.1 56.1 50.7 48.6 45.0	MAG .998 .986 .983 .962 .946 .928 .909 .884 .852 .845 .813	-3.3 -6.9 -9.9 -13.2 -16.6 -19.3 -21.9 -25.5 -27.2 -29.7 -32.3
FREQUENCY f (MHz) 100.00 200.00 300.00 400.00 500.00 600.00 700.00 800.00 900.00 1000.00 1100.00	MAG .971 .950 .937 .910 .877 .858 .822 .792 .751 .718 .686 .649	-7.4 -15.4 -22.4 -29.7 -36.9 -44.0 -51.3 -58.1 -65.0 -71.4 -78.2 -84.4	MAG 3.546 3.498 3.464 3.348 3.321 3.232 3.187 3.054 2.949 2.867 2.750 2.620	ANG 173.5 166.3 159.7 153.4 146.0 140.7 134.4 128.3 122.9 117.5 112.7 107.1	MAG .019 .031 .045 .058 .071 .082 .090 .102 .110 .116 .122 .131	84.5 75.8 76.2 67.5 67.2 62.3 58.1 56.1 50.7 48.6 45.0 42.7	MAG .998 .986 .983 .962 .946 .928 .909 .884 .852 .845 .813 .793	-3.3 -6.9 -9.9 -13.2 -16.6 -19.3 -21.9 -25.5 -27.2 -29.7 -32.3 -34.2
FREQUENCY f (MHz) 100.00 200.00 300.00 400.00 500.00 600.00 700.00 800.00 900.00 1000.00 1100.00 1200.00 1300.00	MAG .971 .950 .937 .910 .877 .858 .822 .792 .751 .718 .686 .649 .623	-7.4 -15.4 -22.4 -29.7 -36.9 -44.0 -51.3 -58.1 -65.0 -71.4 -78.2 -84.4 -91.2	MAG 3.546 3.498 3.464 3.348 3.321 3.232 3.187 3.054 2.949 2.867 2.750 2.620 2.543	ANG 173.5 166.3 159.7 153.4 146.0 140.7 134.4 128.3 122.9 117.5 112.7 107.1 102.7	MAG .019 .031 .045 .058 .071 .082 .090 .102 .110 .116 .122 .131 .128	84.5 75.8 76.2 67.5 67.2 62.3 58.1 56.1 50.7 48.6 45.0 42.7 42.4	MAG .998 .986 .983 .962 .946 .928 .909 .884 .852 .845 .813 .793 .767	-3.3 -6.9 -9.9 -13.2 -16.6 -19.3 -21.9 -25.5 -27.2 -29.7 -32.3 -34.2 -36.0
FREQUENCY f (MHz) 100.00 200.00 300.00 400.00 500.00 600.00 700.00 800.00 900.00 1100.00 1200.00 1300.00 1400.00	MAG .971 .950 .937 .910 .877 .858 .822 .792 .751 .718 .686 .649 .623 .592	-7.4 -15.4 -22.4 -29.7 -36.9 -44.0 -51.3 -58.1 -65.0 -71.4 -78.2 -84.4 -91.2 -97.1	MAG 3.546 3.498 3.464 3.348 3.321 3.232 3.187 3.054 2.949 2.867 2.750 2.620 2.543 2.449	ANG 173.5 166.3 159.7 153.4 146.0 140.7 134.4 128.3 122.9 117.5 112.7 107.1 102.7 98.2	MAG .019 .031 .045 .058 .071 .082 .090 .102 .110 .116 .122 .131 .128 .137	84.5 75.8 76.2 67.5 67.2 62.3 58.1 56.1 50.7 48.6 45.0 42.7 42.4 37.2	MAG .998 .986 .983 .962 .946 .928 .909 .884 .852 .845 .813 .793 .767	-3.3 -6.9 -9.9 -13.2 -16.6 -19.3 -21.9 -25.5 -27.2 -29.7 -32.3 -34.2 -36.0 -38.7
FREQUENCY f (MHz) 100.00 200.00 300.00 400.00 500.00 600.00 700.00 800.00 900.00 1100.00 1200.00 1300.00 1400.00 1500.00	MAG .971 .950 .937 .910 .877 .858 .822 .792 .751 .718 .686 .649 .623 .592 .565	-7.4 -15.4 -22.4 -29.7 -36.9 -44.0 -51.3 -58.1 -65.0 -71.4 -78.2 -84.4 -91.2 -97.1 -104.0	3.546 3.498 3.464 3.348 3.321 3.232 3.187 3.054 2.949 2.867 2.750 2.620 2.543 2.449 2.362	ANG 173.5 166.3 159.7 153.4 146.0 140.7 134.4 128.3 122.9 117.5 112.7 107.1 102.7 98.2 93.5	MAG .019 .031 .045 .058 .071 .082 .090 .102 .110 .116 .122 .131 .128 .137 .136	84.5 75.8 76.2 67.5 67.2 62.3 58.1 56.1 50.7 48.6 45.0 42.7 42.4 37.2 33.7	.998 .986 .983 .962 .946 .928 .909 .884 .852 .845 .813 .793 .767 .758	-3.3 -6.9 -9.9 -13.2 -16.6 -19.3 -21.9 -25.5 -27.2 -29.7 -32.3 -34.2 -36.0 -38.7 -40.0
FREQUENCY f (MHz) 100.00 200.00 300.00 400.00 500.00 600.00 700.00 800.00 900.00 1100.00 1200.00 1300.00 1400.00	MAG .971 .950 .937 .910 .877 .858 .822 .792 .751 .718 .686 .649 .623 .592	-7.4 -15.4 -22.4 -29.7 -36.9 -44.0 -51.3 -58.1 -65.0 -71.4 -78.2 -84.4 -91.2 -97.1	MAG 3.546 3.498 3.464 3.348 3.321 3.232 3.187 3.054 2.949 2.867 2.750 2.620 2.543 2.449	ANG 173.5 166.3 159.7 153.4 146.0 140.7 134.4 128.3 122.9 117.5 112.7 107.1 102.7 98.2	MAG .019 .031 .045 .058 .071 .082 .090 .102 .110 .116 .122 .131 .128 .137	84.5 75.8 76.2 67.5 67.2 62.3 58.1 56.1 50.7 48.6 45.0 42.7 42.4 37.2	MAG .998 .986 .983 .962 .946 .928 .909 .884 .852 .845 .813 .793 .767	-3.3 -6.9 -9.9 -13.2 -16.6 -19.3 -21.9 -25.5 -27.2 -29.7 -32.3 -34.2 -36.0 -38.7
FREQUENCY f (MHz) 100.00 200.00 300.00 400.00 500.00 600.00 700.00 800.00 1000.00 1100.00 1200.00 1300.00 1400.00 1500.00 1600.00 1700.00 1800.00	MAG .971 .950 .937 .910 .877 .858 .822 .792 .751 .718 .686 .649 .623 .592 .565 .542 .524 .508	ANG -7.4 -15.4 -22.4 -29.7 -36.9 -44.0 -51.3 -58.1 -65.0 -71.4 -78.2 -84.4 -91.2 -97.1 -104.0 -110.2 -117.6 -122.9	MAG 3.546 3.498 3.464 3.348 3.321 3.232 3.187 3.054 2.949 2.867 2.750 2.620 2.543 2.449 2.362 2.259 2.219 2.117	ANG 173.5 166.3 159.7 153.4 146.0 140.7 134.4 128.3 122.9 117.5 112.7 107.1 102.7 98.2 93.5 89.2 85.9 81.6	MAG .019 .031 .045 .058 .071 .082 .090 .102 .110 .116 .122 .131 .128 .137 .136 .140 .147 .148	84.5 75.8 76.2 67.5 67.2 62.3 58.1 56.1 50.7 48.6 45.0 42.7 42.4 37.2 33.7 32.8 29.5 28.3	MAG .998 .986 .983 .962 .946 .928 .909 .884 .852 .845 .813 .793 .767 .758 .729 .715 .703 .692	-3.3 -6.9 -9.9 -13.2 -16.6 -19.3 -21.9 -25.5 -27.2 -29.7 -32.3 -34.2 -36.0 -38.7 -40.0 -41.5 -43.2 -45.5
FREQUENCY f (MHz) 100.00 200.00 300.00 400.00 500.00 600.00 700.00 800.00 1000.00 1100.00 1200.00 1300.00 1400.00 1500.00 1600.00 1700.00 1800.00	MAG .971 .950 .937 .910 .877 .858 .822 .792 .751 .718 .686 .649 .623 .592 .565 .542 .508 .483	ANG -7.4 -15.4 -22.4 -29.7 -36.9 -44.0 -51.3 -58.1 -65.0 -71.4 -78.2 -84.4 -91.2 -97.1 -104.0 -110.2 -117.6 -122.9 -127.9	MAG 3.546 3.498 3.464 3.348 3.321 3.232 3.187 3.054 2.949 2.867 2.750 2.620 2.543 2.449 2.362 2.259 2.219 2.117 2.043	ANG 173.5 166.3 159.7 153.4 146.0 140.7 134.4 128.3 122.9 117.5 112.7 107.1 102.7 98.2 93.5 89.2 85.9 81.6 78.3	MAG .019 .031 .045 .058 .071 .082 .090 .102 .110 .116 .122 .131 .128 .137 .136 .140 .147 .148 .140	84.5 75.8 76.2 67.5 67.2 62.3 58.1 56.1 50.7 48.6 45.0 42.7 42.4 37.2 33.7 32.8 29.5 28.3 30.1	MAG .998 .986 .983 .962 .946 .928 .909 .884 .852 .845 .813 .793 .767 .758 .729 .715 .703 .692 .674	ANG -3.3 -6.9 -9.9 -13.2 -16.6 -19.3 -21.9 -25.5 -27.2 -29.7 -32.3 -34.2 -36.0 -38.7 -40.0 -41.5 -43.2 -45.5 -47.2
FREQUENCY f (MHz) 100.00 200.00 300.00 400.00 500.00 600.00 700.00 800.00 1000.00 1100.00 1200.00 1300.00 1500.00 1600.00 1700.00 1800.00 1900.00 2000.00	MAG .971 .950 .937 .910 .877 .858 .822 .792 .751 .718 .686 .649 .623 .592 .565 .542 .508 .483 .481	ANG -7.4 -15.4 -22.4 -29.7 -36.9 -44.0 -51.3 -58.1 -65.0 -71.4 -78.2 -84.4 -91.2 -97.1 -104.0 -110.2 -117.6 -122.9 -135.3	MAG 3.546 3.498 3.464 3.348 3.321 3.232 3.187 3.054 2.949 2.867 2.750 2.620 2.543 2.449 2.362 2.259 2.219 2.117 2.043 1.989	ANG 173.5 166.3 159.7 153.4 146.0 140.7 134.4 128.3 122.9 117.5 112.7 107.1 102.7 98.2 93.5 89.2 85.9 81.6 78.3 74.0	MAG .019 .031 .045 .058 .071 .082 .090 .102 .110 .116 .122 .131 .128 .137 .136 .140 .147 .148 .140 .147	84.5 75.8 76.2 67.5 67.2 62.3 58.1 56.1 50.7 48.6 45.0 42.7 42.4 37.2 33.7 32.8 29.5 28.3 30.1 28.4	MAG .998 .986 .983 .962 .946 .928 .909 .884 .852 .845 .813 .793 .767 .758 .729 .715 .703 .692 .674	-3.3 -6.9 -9.9 -13.2 -16.6 -19.3 -21.9 -25.5 -27.2 -29.7 -32.3 -34.2 -36.0 -38.7 -40.0 -41.5 -43.2 -45.5 -47.2 -49.0
FREQUENCY f (MHz) 100.00 200.00 300.00 400.00 500.00 600.00 700.00 800.00 1000.00 1100.00 1200.00 1300.00 1400.00 1500.00 1600.00 1700.00 1800.00 1900.00 2000.00 2100.00	MAG .971 .950 .937 .910 .877 .858 .822 .792 .751 .718 .686 .649 .623 .592 .565 .542 .524 .508 .483 .481	-7.4 -15.4 -22.4 -29.7 -36.9 -44.0 -51.3 -58.1 -65.0 -71.4 -78.2 -84.4 -91.2 -97.1 -104.0 -110.2 -117.6 -122.9 -135.3 -141.6	MAG 3.546 3.498 3.464 3.348 3.321 3.232 3.187 3.054 2.949 2.867 2.750 2.620 2.543 2.449 2.362 2.259 2.219 2.117 2.043 1.989 1.901	ANG 173.5 166.3 159.7 153.4 146.0 140.7 134.4 128.3 122.9 117.5 112.7 107.1 102.7 98.2 93.5 89.2 85.9 81.6 78.3 74.0 70.1	MAG .019 .031 .045 .058 .071 .082 .090 .102 .110 .116 .122 .131 .128 .137 .136 .140 .147 .148 .140 .147 .145	84.5 75.8 76.2 67.5 67.2 62.3 58.1 56.1 50.7 48.6 45.0 42.7 42.4 37.2 33.7 32.8 29.5 28.3 30.1 28.4 25.9	MAG .998 .986 .983 .962 .946 .928 .909 .884 .852 .845 .813 .793 .767 .758 .729 .715 .703 .692 .674 .667	-3.3 -6.9 -9.9 -13.2 -16.6 -19.3 -21.9 -25.5 -27.2 -29.7 -32.3 -34.2 -36.0 -38.7 -40.0 -41.5 -43.2 -45.5 -47.2 -49.0 -51.0
FREQUENCY f (MHz) 100.00 200.00 300.00 400.00 500.00 600.00 700.00 800.00 1000.00 1100.00 1200.00 1300.00 1400.00 1500.00 1600.00 1700.00 1800.00 1900.00 2000.00 2100.00 2200.00	MAG .971 .950 .937 .910 .877 .858 .822 .792 .751 .718 .686 .649 .623 .592 .565 .542 .524 .508 .483 .481 .453 .445	ANG -7.4 -15.4 -22.4 -29.7 -36.9 -44.0 -51.3 -58.1 -65.0 -71.4 -78.2 -84.4 -91.2 -97.1 -104.0 -110.2 -117.6 -122.9 -135.3	MAG 3.546 3.498 3.464 3.348 3.321 3.232 3.187 3.054 2.949 2.867 2.750 2.620 2.543 2.449 2.362 2.259 2.219 2.117 2.043 1.989 1.901 1.850	ANG 173.5 166.3 159.7 153.4 146.0 140.7 134.4 128.3 122.9 117.5 112.7 107.1 102.7 98.2 93.5 89.2 85.9 81.6 78.3 74.0 70.1 65.9	MAG .019 .031 .045 .058 .071 .082 .090 .102 .110 .116 .122 .131 .128 .137 .136 .140 .147 .148 .140 .147 .145 .145	84.5 75.8 76.2 67.5 67.2 62.3 58.1 56.1 50.7 48.6 45.0 42.7 42.4 37.2 33.7 32.8 29.5 28.3 30.1 28.4 25.9 25.6	MAG .998 .986 .983 .962 .946 .928 .909 .884 .852 .845 .813 .793 .767 .758 .729 .715 .703 .692 .674 .667 .652 .642	-3.3 -6.9 -9.9 -13.2 -16.6 -19.3 -21.9 -25.5 -27.2 -29.7 -32.3 -34.2 -36.0 -38.7 -40.0 -41.5 -43.2 -45.5 -47.2 -49.0
FREQUENCY f (MHz) 100.00 200.00 300.00 400.00 500.00 600.00 700.00 800.00 1000.00 1100.00 1200.00 1300.00 1400.00 1500.00 1600.00 1700.00 1800.00 1900.00 2000.00 2100.00	MAG .971 .950 .937 .910 .877 .858 .822 .792 .751 .718 .686 .649 .623 .592 .565 .542 .524 .508 .483 .481	ANG -7.4 -15.4 -22.4 -29.7 -36.9 -44.0 -51.3 -58.1 -65.0 -71.4 -78.2 -84.4 -91.2 -97.1 -104.0 -110.2 -117.6 -122.9 -127.9 -135.3 -141.6 -147.4	3.546 3.498 3.464 3.348 3.321 3.232 3.187 3.054 2.949 2.867 2.750 2.620 2.543 2.449 2.362 2.259 2.219 2.117 2.043 1.989 1.901 1.850 1.791 1.722	ANG 173.5 166.3 159.7 153.4 146.0 140.7 134.4 128.3 122.9 117.5 112.7 107.1 102.7 98.2 93.5 89.2 85.9 81.6 78.3 74.0 70.1	MAG .019 .031 .045 .058 .071 .082 .090 .102 .110 .116 .122 .131 .128 .137 .136 .140 .147 .148 .140 .147 .145	84.5 75.8 76.2 67.5 67.2 62.3 58.1 56.1 50.7 48.6 45.0 42.7 42.4 37.2 33.7 32.8 29.5 28.3 30.1 28.4 25.9	MAG .998 .986 .983 .962 .946 .928 .909 .884 .852 .845 .813 .793 .767 .758 .729 .715 .703 .692 .674 .667	ANG -3.3 -6.9 -9.9 -13.2 -16.6 -19.3 -21.9 -25.5 -27.2 -29.7 -32.3 -34.2 -36.0 -38.7 -40.0 -41.5 -43.2 -45.5 -47.2 -49.0 -51.0 -52.6
FREQUENCY f (MHz) 100.00 200.00 300.00 400.00 500.00 600.00 700.00 800.00 1000.00 1100.00 1200.00 1300.00 1400.00 1500.00 1600.00 1700.00 1800.00 1900.00 2000.00 2100.00 2200.00 2300.00 2400.00 2500.00	MAG .971 .950 .937 .910 .877 .858 .822 .792 .751 .718 .686 .649 .623 .592 .565 .542 .508 .483 .481 .453 .445 .445 .445	ANG -7.4 -15.4 -22.4 -29.7 -36.9 -44.0 -51.3 -58.1 -65.0 -71.4 -78.2 -84.4 -91.2 -97.1 -104.0 -110.2 -117.6 -122.9 -135.3 -141.6 -147.4 -152.3 -157.1 -163.5	3.546 3.498 3.464 3.348 3.321 3.232 3.187 3.054 2.949 2.867 2.750 2.620 2.543 2.449 2.362 2.259 2.219 2.117 2.043 1.989 1.901 1.850 1.791 1.722 1.691	ANG 173.5 166.3 159.7 153.4 146.0 140.7 134.4 128.3 122.9 117.5 112.7 107.1 102.7 98.2 93.5 89.2 85.9 81.6 78.3 74.0 70.1 65.9 63.4 60.3 56.6	MAG .019 .031 .045 .058 .071 .082 .090 .102 .110 .116 .122 .131 .128 .137 .136 .140 .147 .148 .140 .147 .145 .145 .145 .145 .148	84.5 75.8 76.2 67.5 67.2 62.3 58.1 56.1 50.7 48.6 45.0 42.7 42.4 37.2 33.7 32.8 29.5 28.3 30.1 28.4 25.9 25.6 24.4 25.6 25.9	MAG .998 .986 .983 .962 .946 .928 .909 .884 .852 .845 .813 .793 .767 .758 .729 .715 .703 .692 .674 .667 .652 .642 .636 .630 .619	ANG -3.3 -6.9 -9.9 -13.2 -16.6 -19.3 -21.9 -25.5 -27.2 -29.7 -32.3 -34.2 -36.0 -38.7 -40.0 -41.5 -43.2 -45.5 -47.2 -49.0 -51.0 -52.6 -54.4 -56.3 -58.8
FREQUENCY f (MHz) 100.00 200.00 300.00 400.00 500.00 600.00 700.00 800.00 1000.00 1100.00 1200.00 1300.00 1400.00 1500.00 1600.00 1700.00 1800.00 1900.00 2000.00 2300.00 2400.00 2500.00 2600.00	MAG .971 .950 .937 .910 .877 .858 .822 .792 .751 .718 .686 .649 .623 .592 .565 .542 .508 .483 .481 .453 .445 .445 .445 .445 .445	ANG -7.4 -15.4 -22.4 -29.7 -36.9 -44.0 -51.3 -58.1 -65.0 -71.4 -78.2 -84.4 -91.2 -97.1 -104.0 -110.2 -117.6 -122.9 -135.3 -141.6 -147.4 -152.3 -157.1 -163.5 -169.2	3.546 3.498 3.464 3.348 3.321 3.232 3.187 3.054 2.949 2.867 2.750 2.620 2.543 2.449 2.362 2.259 2.219 2.117 2.043 1.989 1.901 1.850 1.791 1.722 1.691 1.642	ANG 173.5 166.3 159.7 153.4 146.0 140.7 134.4 128.3 122.9 117.5 112.7 107.1 102.7 98.2 93.5 89.2 85.9 81.6 78.3 74.0 70.1 65.9 63.4 60.3 56.6 53.7	MAG .019 .031 .045 .058 .071 .082 .090 .102 .110 .116 .122 .131 .128 .137 .136 .140 .147 .148 .140 .147 .145 .145 .145 .145 .148 .148	84.5 75.8 76.2 67.5 67.2 62.3 58.1 56.1 50.7 48.6 45.0 42.7 42.4 37.2 33.7 32.8 29.5 28.3 30.1 28.4 25.9 25.6 24.4 25.9 22.1	MAG .998 .986 .983 .962 .946 .928 .909 .884 .852 .845 .813 .793 .767 .758 .729 .715 .703 .692 .674 .667 .652 .642 .636 .630 .619 .609	ANG -3.3 -6.9 -9.9 -13.2 -16.6 -19.3 -21.9 -25.5 -27.2 -29.7 -32.3 -34.2 -36.0 -38.7 -40.0 -41.5 -43.2 -45.5 -47.2 -49.0 -51.0 -52.6 -54.4 -56.3 -58.8 -58.5
FREQUENCY f (MHz) 100.00 200.00 300.00 400.00 500.00 600.00 700.00 800.00 1000.00 1100.00 1200.00 1300.00 1400.00 1500.00 1600.00 1700.00 1800.00 1900.00 2000.00 2100.00 2300.00 2400.00 2500.00 2600.00 2700.00	MAG .971 .950 .937 .910 .877 .858 .822 .792 .751 .718 .686 .649 .623 .592 .565 .542 .508 .483 .481 .453 .445 .445 .445 .445 .445 .445	ANG -7.4 -15.4 -22.4 -29.7 -36.9 -44.0 -51.3 -58.1 -65.0 -71.4 -78.2 -84.4 -91.2 -97.1 -104.0 -110.2 -117.6 -122.9 -127.9 -135.3 -141.6 -147.4 -152.3 -157.1 -163.5 -169.2 -172.0	MAG 3.546 3.498 3.464 3.348 3.321 3.232 3.187 3.054 2.949 2.867 2.750 2.620 2.543 2.449 2.362 2.259 2.219 2.117 2.043 1.989 1.901 1.850 1.791 1.722 1.691 1.642 1.577	ANG 173.5 166.3 159.7 153.4 146.0 140.7 134.4 128.3 122.9 117.5 112.7 107.1 102.7 98.2 93.5 89.2 85.9 81.6 78.3 74.0 70.1 65.9 63.4 60.3 56.6 53.7 51.8	MAG .019 .031 .045 .058 .071 .082 .090 .102 .110 .116 .122 .131 .128 .137 .136 .140 .147 .148 .140 .147 .145 .145 .145 .145 .154 .148 .148 .148	84.5 75.8 76.2 67.5 67.2 62.3 58.1 56.1 50.7 48.6 45.0 42.7 42.4 37.2 33.7 32.8 29.5 28.3 30.1 28.4 25.9 25.6 24.4 25.9 25.6 22.1 22.3	MAG .998 .986 .983 .962 .946 .928 .909 .884 .852 .845 .813 .793 .767 .758 .729 .715 .703 .692 .674 .667 .652 .642 .636 .630 .619 .609	ANG -3.3 -6.9 -9.9 -13.2 -16.6 -19.3 -21.9 -25.5 -27.2 -29.7 -32.3 -34.2 -36.0 -38.7 -40.0 -41.5 -43.2 -45.5 -47.2 -49.0 -51.0 -52.6 -54.4 -56.3 -58.8 -58.5 -61.9
FREQUENCY f (MHz) 100.00 200.00 300.00 400.00 500.00 600.00 700.00 800.00 1000.00 1100.00 1200.00 1300.00 1400.00 1500.00 1600.00 1700.00 1800.00 2000.00 2100.00 2300.00 2400.00 2500.00 2600.00 2700.00 2800.00	MAG .971 .950 .937 .910 .877 .858 .822 .792 .751 .718 .686 .649 .623 .592 .565 .542 .508 .483 .481 .453 .445 .445 .425 .436 .419 .430 .416	ANG -7.4 -15.4 -22.4 -29.7 -36.9 -44.0 -51.3 -58.1 -65.0 -71.4 -78.2 -84.4 -91.2 -97.1 -104.0 -110.2 -117.6 -122.9 -135.3 -141.6 -147.4 -152.3 -157.1 -163.5 -169.2 -172.0 -176.9	MAG 3.546 3.498 3.464 3.348 3.321 3.232 3.187 3.054 2.949 2.867 2.750 2.620 2.543 2.449 2.362 2.259 2.219 2.117 2.043 1.989 1.901 1.850 1.791 1.722 1.691 1.642 1.577 1.552	ANG 173.5 166.3 159.7 153.4 146.0 140.7 134.4 128.3 122.9 117.5 112.7 107.1 102.7 98.2 93.5 89.2 85.9 81.6 78.3 74.0 70.1 65.9 63.4 60.3 56.6 53.7 51.8 47.7	MAG .019 .031 .045 .058 .071 .082 .090 .102 .110 .116 .122 .131 .128 .137 .136 .140 .147 .145 .145 .145 .145 .145 .1448 .148 .148 .148 .148 .148 .148	84.5 75.8 76.2 67.5 67.2 62.3 58.1 56.1 50.7 48.6 45.0 42.7 42.4 37.2 33.7 32.8 29.5 28.3 30.1 28.4 25.9 25.6 24.4 25.9 25.6 25.9 22.1 22.3 22.6	MAG .998 .986 .983 .962 .946 .928 .909 .884 .852 .845 .813 .793 .767 .758 .729 .715 .703 .692 .674 .667 .652 .642 .636 .630 .619 .609 .610	ANG -3.3 -6.9 -9.9 -13.2 -16.6 -19.3 -21.9 -25.5 -27.2 -29.7 -32.3 -34.2 -36.0 -38.7 -40.0 -41.5 -43.2 -45.5 -47.2 -49.0 -51.0 -52.6 -54.4 -56.3 -58.8 -58.5 -61.9 -64.8
FREQUENCY f (MHz) 100.00 200.00 300.00 400.00 500.00 600.00 700.00 800.00 1000.00 1100.00 1200.00 1300.00 1400.00 1500.00 1600.00 1700.00 1800.00 1900.00 2000.00 2100.00 2300.00 2400.00 2500.00 2600.00 2700.00	MAG .971 .950 .937 .910 .877 .858 .822 .792 .751 .718 .686 .649 .623 .592 .565 .542 .508 .483 .481 .453 .445 .445 .445 .445 .445 .445	ANG -7.4 -15.4 -22.4 -29.7 -36.9 -44.0 -51.3 -58.1 -65.0 -71.4 -78.2 -84.4 -91.2 -97.1 -104.0 -110.2 -117.6 -122.9 -127.9 -135.3 -141.6 -147.4 -152.3 -157.1 -163.5 -169.2 -172.0	MAG 3.546 3.498 3.464 3.348 3.321 3.232 3.187 3.054 2.949 2.867 2.750 2.620 2.543 2.449 2.362 2.259 2.219 2.117 2.043 1.989 1.901 1.850 1.791 1.722 1.691 1.642 1.577	ANG 173.5 166.3 159.7 153.4 146.0 140.7 134.4 128.3 122.9 117.5 112.7 107.1 102.7 98.2 93.5 89.2 85.9 81.6 78.3 74.0 70.1 65.9 63.4 60.3 56.6 53.7 51.8	MAG .019 .031 .045 .058 .071 .082 .090 .102 .110 .116 .122 .131 .128 .137 .136 .140 .147 .148 .140 .147 .145 .145 .145 .145 .154 .148 .148 .148	84.5 75.8 76.2 67.5 67.2 62.3 58.1 56.1 50.7 48.6 45.0 42.7 42.4 37.2 33.7 32.8 29.5 28.3 30.1 28.4 25.9 25.6 24.4 25.9 25.6 22.1 22.3	MAG .998 .986 .983 .962 .946 .928 .909 .884 .852 .845 .813 .793 .767 .758 .729 .715 .703 .692 .674 .667 .652 .642 .636 .630 .619 .609	ANG -3.3 -6.9 -9.9 -13.2 -16.6 -19.3 -21.9 -25.5 -27.2 -29.7 -32.3 -34.2 -36.0 -38.7 -40.0 -41.5 -43.2 -45.5 -47.2 -49.0 -51.0 -52.6 -54.4 -56.3 -58.8 -58.5 -61.9

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