SILICON TRANSISTOR

2SC5012

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 = 9 GHz TYP.)
- Low Noise, High Gain
- Low Voltage Operation

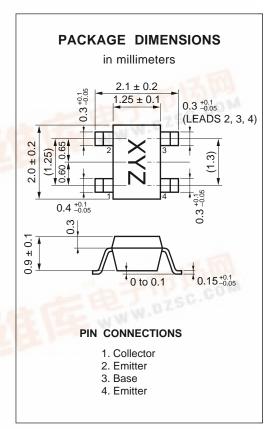
ORDERING INFORMATION

PART NUMBER	QUANTITY	PACKING STYLE
2SC5012-T1	3 Kpcs/Reel.	Embossed tape 8 mm wide. Pin 3 (Base), Pin 4 (Emitter) face to perforation side of the tape.
2SC5012-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.: 2SC5012)

ABSOLUTE MAXIMUM RATINGS (TA = 25 °C)

Collector to Base Voltage	Vсво	20	V
Collector to Emitter Voltage	Vceo	10	V
Emitter to Base Voltage	VEBO	1.5	V
Collector Current	Ic	65	mΑ
Total Power Dissipation	Pτ	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	V _{EB} = 1 V, I _C = 0
DC Current Gain	hfe	50	100	250		VcE = 8 V, Ic = 20 mA*1
Gain Bandwidth Product	f⊤		9.0		GHz	VcE = 8 V, Ic = 20 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	13	15		dB	VcE = 8 V, Ic = 20 mA, f = 1.0 GHz
Noise Figure	NF		1.2	2.5	dB	VcE = 8 V, Ic = 7 mA, f = 1.0 GHz

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

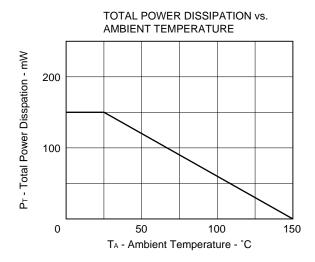
hFE Classification

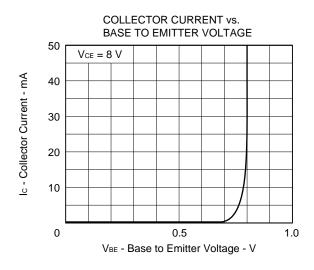
Rank	EB	FB	GB
Marking	R36	R37	R38
hfE	50 to 100	80 to 160	125 to 250

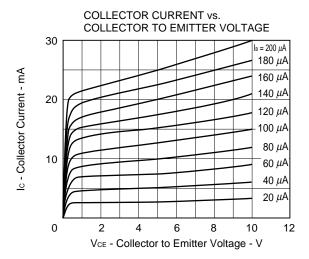
^{*2} Measured with 3 terminals bridge, Emitter and Case should be grounded.

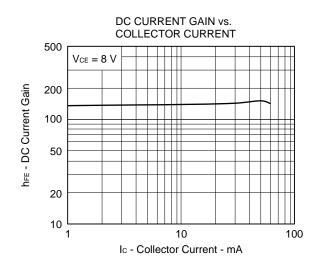
NEC

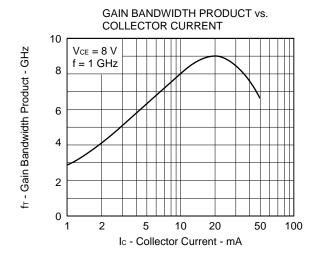
TYPICAL CHARACTERISTICS (TA = 25 °C)

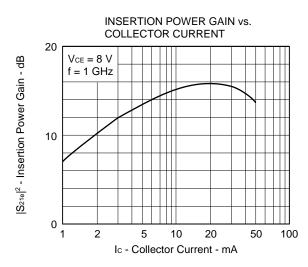


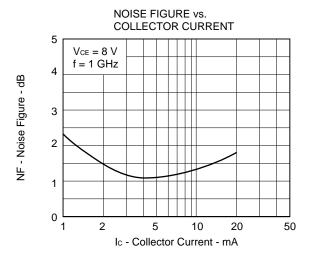


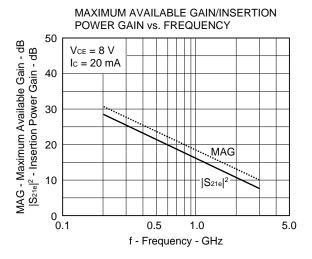


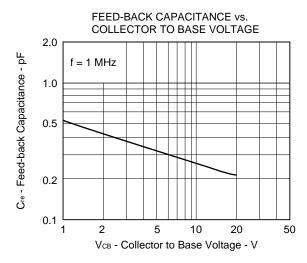














S-PARAMETER

Vce = 8 V, Ic = 20 mA

FREQUENCY	S	S ₁₁	S	21	S	12	S	22
f (MHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100.00 200.00	.589 .486	-57.8 -95.2	34.077 24.310	143.4 121.8	.016 .022	60.0 56.3	.826 .644	-22.7 -30.4
300.00	.436	-119.1	18.108	109.7	.028	59.4	.543	-32.3
400.00	.411	-137.1	14.077	101.8	.031	48.4	.470	-31.9
500.00	.395	-149.6	11.600	95.5	.037	56.9	.430	-32.1
600.00	.398	-158.1	9.826	91.1	.040	60.9	.412	-31.9
700.00 800.00	.395 .397	-166.5 -172.9	8.540 7.482	86.9	.045	63.1	.388 .372	-30.4 -31.3
900.00	.401	-172.9 -179.1	6.693	83.1 80.0	.051 .057	57.9 66.1	.360	-31.3 -32.8
1000.00	.407	175.4	6.069	76.6	.061	61.4	.358	-31.8
1100.00	.407	170.1	5.483	73.9	.066	59.3	.342	-33.2
1200.00	.407	167.6	5.019	71.3	.069	59.3	.334	-34.8
1300.00	.420	162.3	4.644	68.9	.076	61.8	.317	-36.0
1400.00 1500.00	.412 .433	160.0 156.2	4.338 4.052	66.1 63.4	.077 .083	61.2 58.7	.330 .313	-37.3 -39.0
1600.00	.432	153.4	3.777	61.2	.088	61.4	.310	-39.0 -41.4
1700.00	.455	151.2	3.579	58.8	.096	60.0	.297	-41.7
1800.00	.456	146.7	3.373	56.5	.099	59.3	.296	-42.1
1900.00	.453	145.9	3.208	54.8	.101	60.4	.311	-44.8
2000.00 2100.00	.463 .475	143.2 141.0	3.061 2.917	52.5 49.8	.106 .116	59.9 56.0	.298 .287	-49.9 -49.5
2200.00	.475	138.6	2.801	49.6 47.2	.110	59.9	.303	-49.5 -53.3
2300.00	.481	136.8	2.676	45.2	.125	55.2	.290	-58.2
2400.00	.497	133.4	2.573	43.4	.125	55.8	.268	-56.8
2500.00	.502	132.5	2.469	40.7	.132	54.0	.273	-59.7
2600.00	.511	130.8	2.403	38.9	.147	52.8	.290	-59.6
2700.00 2800.00	.508 .504	129.1 126.7	2.306 2.228	37.2 33.8	.146 .147	54.3 50.0	.269 .271	–67.5 –71.7
2900.00	.509	125.7	2.146	32.5	.159	51.0	.273	-66.7
3000.00	.514	123.0	2.068	29.6	.161	46.5	.289	-73.2
$V_{CE} = 3 \text{ V. Ic} = 5 \text{ mA}$								
Vce = 3 V, Ic = 5 mA	S	S _{1.1}	S	24	S	12	S	22
$V_{CE} = 3 \text{ V, } I_{C} = 5 \text{ mA}$ $FREQUENCY$ $f (MHz)$	S MAG	S ₁₁ ANG	S: MAG	21 ANG	S MAG	12 ANG	S MAG	22 ANG
FREQUENCY f (MHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
FREQUENCY f (MHz) 100.00	MAG .826	ANG -29.5	MAG 14.854	ANG 160.0	MAG .024	ANG 78.6	MAG .953	ANG -13.4
FREQUENCY f (MHz)	MAG .826 .752	ANG	MAG	ANG 160.0 142.7	MAG .024 .039	78.6 62.0	MAG	ANG -13.4 -24.2
FREQUENCY f (MHz) 100.00 200.00 300.00 400.00	.826 .752 .682 .627	-29.5 -56.0 -77.7 -95.2	MAG 14.854 13.074 11.233 9.484	ANG 160.0 142.7 129.3 119.1	.024 .039 .051 .059	78.6 62.0 54.3 48.6	MAG .953 .850 .754 .664	-13.4 -24.2 -31.9 -36.2
FREQUENCY f (MHz) 100.00 200.00 300.00 400.00 500.00	MAG .826 .752 .682 .627 .575	ANG -29.5 -56.0 -77.7 -95.2 -111.1	MAG 14.854 13.074 11.233 9.484 8.193	ANG 160.0 142.7 129.3 119.1 110.4	.024 .039 .051 .059	78.6 62.0 54.3 48.6 45.3	MAG .953 .850 .754 .664 .586	-13.4 -24.2 -31.9 -36.2 -39.3
FREQUENCY f (MHz) 100.00 200.00 300.00 400.00 500.00 600.00	MAG .826 .752 .682 .627 .575	ANG -29.5 -56.0 -77.7 -95.2 -111.1 -122.6	MAG 14.854 13.074 11.233 9.484 8.193 7.199	160.0 142.7 129.3 119.1 110.4 104.1	.024 .039 .051 .059 .066	78.6 62.0 54.3 48.6 45.3 41.2	MAG .953 .850 .754 .664 .586 .531	-13.4 -24.2 -31.9 -36.2 -39.3 -41.7
FREQUENCY f (MHz) 100.00 200.00 300.00 400.00 500.00 600.00 700.00	MAG .826 .752 .682 .627 .575 .555 .536	-29.5 -56.0 -77.7 -95.2 -111.1 -122.6 -134.3	MAG 14.854 13.074 11.233 9.484 8.193 7.199 6.411	ANG 160.0 142.7 129.3 119.1 110.4 104.1 98.1	.024 .039 .051 .059 .066 .071	78.6 62.0 54.3 48.6 45.3 41.2 40.8	MAG .953 .850 .754 .664 .586 .531 .492	ANG -13.4 -24.2 -31.9 -36.2 -39.3 -41.7 -42.3
FREQUENCY f (MHz) 100.00 200.00 300.00 400.00 500.00 600.00	MAG .826 .752 .682 .627 .575	ANG -29.5 -56.0 -77.7 -95.2 -111.1 -122.6	MAG 14.854 13.074 11.233 9.484 8.193 7.199	160.0 142.7 129.3 119.1 110.4 104.1	.024 .039 .051 .059 .066	78.6 62.0 54.3 48.6 45.3 41.2	MAG .953 .850 .754 .664 .586 .531	-13.4 -24.2 -31.9 -36.2 -39.3 -41.7
FREQUENCY f (MHz) 100.00 200.00 300.00 400.00 500.00 600.00 700.00 800.00 900.00 1000.00	MAG .826 .752 .682 .627 .575 .555 .536 .524 .517 .512	ANG -29.5 -56.0 -77.7 -95.2 -111.1 -122.6 -134.3 -142.8 -150.5 -158.6	MAG 14.854 13.074 11.233 9.484 8.193 7.199 6.411 5.683 5.136 4.702	ANG 160.0 142.7 129.3 119.1 110.4 104.1 98.1 92.9 88.9 84.5	MAG .024 .039 .051 .059 .066 .071 .075 .078 .083 .083	78.6 62.0 54.3 48.6 45.3 41.2 40.8 39.9 41.8 43.4	MAG .953 .850 .754 .664 .586 .531 .492 .452 .425 .411	-13.4 -24.2 -31.9 -36.2 -39.3 -41.7 -42.3 -45.0 -45.4 -45.3
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 .826 .752 .682 .627 .575 .555 .536 .524 .517 .512 .504	ANG -29.5 -56.0 -77.7 -95.2 -111.1 -122.6 -134.3 -142.8 -150.5 -158.6 -164.5	MAG 14.854 13.074 11.233 9.484 8.193 7.199 6.411 5.683 5.136 4.702 4.293	ANG 160.0 142.7 129.3 119.1 110.4 104.1 98.1 92.9 88.9 84.5 80.9	MAG .024 .039 .051 .059 .066 .071 .075 .078 .083 .083	78.6 62.0 54.3 48.6 45.3 41.2 40.8 39.9 41.8 43.4 41.0	MAG .953 .850 .754 .664 .586 .531 .492 .452 .452 .411 .395	ANG -13.4 -24.2 -31.9 -36.2 -39.3 -41.7 -42.3 -45.0 -45.4 -45.3 -47.5
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 .826 .752 .682 .627 .575 .555 .536 .524 .517 .512 .504 .501	ANG -29.5 -56.0 -77.7 -95.2 -111.1 -122.6 -134.3 -142.8 -150.5 -158.6 -164.5 -169.3	MAG 14.854 13.074 11.233 9.484 8.193 7.199 6.411 5.683 5.136 4.702 4.293 3.925	ANG 160.0 142.7 129.3 119.1 110.4 104.1 98.1 92.9 88.9 84.5 80.9 77.7	MAG .024 .039 .051 .059 .066 .071 .075 .078 .083 .083 .086 .093	78.6 62.0 54.3 48.6 45.3 41.2 40.8 39.9 41.8 43.4 41.0 41.8	MAG .953 .850 .754 .664 .586 .531 .492 .452 .452 .411 .395 .382	-13.4 -24.2 -31.9 -36.2 -39.3 -41.7 -42.3 -45.0 -45.4 -45.3 -47.5 -47.8
FREQUENCY f (MHz) 100.00 200.00 300.00 400.00 500.00 600.00 700.00 800.00 900.00 1100.00 1100.00 1200.00 1300.00	MAG .826 .752 .682 .627 .575 .555 .536 .524 .517 .512 .504 .501	ANG -29.5 -56.0 -77.7 -95.2 -111.1 -122.6 -134.3 -142.8 -150.5 -158.6 -164.5 -169.3 -175.3	MAG 14.854 13.074 11.233 9.484 8.193 7.199 6.411 5.683 5.136 4.702 4.293 3.925 3.661	ANG 160.0 142.7 129.3 119.1 110.4 104.1 98.1 92.9 88.9 84.5 80.9 77.7 74.4	MAG .024 .039 .051 .059 .066 .071 .075 .078 .083 .083 .086 .093 .096	78.6 62.0 54.3 48.6 45.3 41.2 40.8 39.9 41.8 43.4 41.0 41.8 42.2	MAG .953 .850 .754 .664 .586 .531 .492 .452 .425 .411 .395 .382 .361	ANG -13.4 -24.2 -31.9 -36.2 -39.3 -41.7 -42.3 -45.0 -45.4 -45.3 -47.5 -47.8 -49.4
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 .826 .752 .682 .627 .575 .555 .536 .524 .517 .512 .504 .501	ANG -29.5 -56.0 -77.7 -95.2 -111.1 -122.6 -134.3 -142.8 -150.5 -158.6 -164.5 -169.3	MAG 14.854 13.074 11.233 9.484 8.193 7.199 6.411 5.683 5.136 4.702 4.293 3.925	ANG 160.0 142.7 129.3 119.1 110.4 104.1 98.1 92.9 88.9 84.5 80.9 77.7	MAG .024 .039 .051 .059 .066 .071 .075 .078 .083 .083 .086 .093	78.6 62.0 54.3 48.6 45.3 41.2 40.8 39.9 41.8 43.4 41.0 41.8	MAG .953 .850 .754 .664 .586 .531 .492 .452 .452 .411 .395 .382	-13.4 -24.2 -31.9 -36.2 -39.3 -41.7 -42.3 -45.0 -45.4 -45.3 -47.5 -47.8
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 1600.00	MAG .826 .752 .682 .627 .575 .536 .524 .517 .512 .504 .501 .505 .504 .512	ANG -29.5 -56.0 -77.7 -95.2 -111.1 -122.6 -134.3 -142.8 -150.5 -158.6 -164.5 -169.3 -175.3 -178.9 175.0 171.4	MAG 14.854 13.074 11.233 9.484 8.193 7.199 6.411 5.683 5.136 4.702 4.293 3.925 3.661 3.424 3.204 3.009	ANG 160.0 142.7 129.3 119.1 110.4 104.1 98.1 92.9 88.9 84.5 80.9 77.7 74.4 71.3 68.1 65.2	MAG .024 .039 .051 .059 .066 .071 .075 .078 .083 .083 .086 .093 .096 .093	78.6 62.0 54.3 48.6 45.3 41.2 40.8 39.9 41.8 43.4 41.0 41.8 42.2 43.2 42.0 41.1	MAG .953 .850 .754 .664 .586 .531 .492 .452 .425 .411 .395 .382 .361 .351 .331	ANG -13.4 -24.2 -31.9 -36.2 -39.3 -41.7 -42.3 -45.0 -45.4 -45.3 -47.5 -47.8 -49.4 -50.2 -52.6 -53.0
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	MAG .826 .752 .682 .627 .575 .555 .536 .524 .517 .512 .504 .501 .501 .501 .505 .504 .512	ANG -29.5 -56.0 -77.7 -95.2 -111.1 -122.6 -134.3 -142.8 -150.5 -158.6 -164.5 -169.3 -175.3 -178.9 175.0 171.4 167.9	MAG 14.854 13.074 11.233 9.484 8.193 7.199 6.411 5.683 5.136 4.702 4.293 3.925 3.661 3.424 3.204 3.009 2.858	ANG 160.0 142.7 129.3 119.1 110.4 104.1 98.1 92.9 88.9 84.5 80.9 77.7 74.4 71.3 68.1 65.2 62.6	MAG .024 .039 .051 .059 .066 .071 .075 .078 .083 .083 .086 .093 .096 .103 .110	78.6 62.0 54.3 48.6 45.3 41.2 40.8 39.9 41.8 43.4 41.0 41.8 42.2 43.2 42.0 41.1 44.3	MAG .953 .850 .754 .664 .586 .531 .492 .452 .425 .411 .395 .382 .361 .351 .331 .330 .319	-13.4 -24.2 -31.9 -36.2 -39.3 -41.7 -42.3 -45.0 -45.4 -45.3 -47.5 -47.8 -49.4 -50.2 -52.6 -53.0 -54.7
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 .826 .752 .682 .627 .575 .555 .536 .524 .517 .512 .504 .501 .505 .504 .512 .530 .529	ANG -29.5 -56.0 -77.7 -95.2 -111.1 -122.6 -134.3 -142.8 -150.5 -158.6 -164.5 -169.3 -175.3 -178.9 175.0 171.4 167.9 164.3	MAG 14.854 13.074 11.233 9.484 8.193 7.199 6.411 5.683 5.136 4.702 4.293 3.925 3.661 3.424 3.204 3.009 2.858 2.698	ANG 160.0 142.7 129.3 119.1 110.4 104.1 98.1 92.9 88.9 84.5 80.9 77.7 74.4 71.3 68.1 65.2 62.6 60.0	MAG .024 .039 .051 .059 .066 .071 .075 .078 .083 .083 .086 .093 .096 .093 .099 .103 .110 .110	78.6 62.0 54.3 48.6 45.3 41.2 40.8 39.9 41.8 43.4 41.0 41.8 42.2 43.2 42.0 41.1 44.3 43.8	MAG .953 .850 .754 .664 .586 .531 .492 .452 .425 .411 .395 .382 .361 .351 .331 .330 .319 .332	ANG -13.4 -24.2 -31.9 -36.2 -39.3 -41.7 -42.3 -45.0 -45.4 -45.3 -47.5 -47.8 -49.4 -50.2 -52.6 -53.0 -54.7 -56.5
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	MAG .826 .752 .682 .627 .575 .555 .536 .524 .517 .512 .504 .501 .501 .505 .504 .512 .530 .529 .529	ANG -29.5 -56.0 -77.7 -95.2 -111.1 -122.6 -134.3 -142.8 -150.5 -158.6 -164.5 -169.3 -175.3 -178.9 175.0 171.4 167.9 164.3 161.1	MAG 14.854 13.074 11.233 9.484 8.193 7.199 6.411 5.683 5.136 4.702 4.293 3.925 3.661 3.424 3.204 3.009 2.858 2.698 2.579	ANG 160.0 142.7 129.3 119.1 110.4 104.1 98.1 92.9 88.9 84.5 80.9 77.7 74.4 71.3 68.1 65.2 65.6 60.0 57.7	MAG .024 .039 .051 .059 .066 .071 .075 .078 .083 .083 .086 .093 .096 .093 .103 .110 .110 .113	78.6 62.0 54.3 48.6 45.3 41.2 40.8 39.9 41.8 43.4 41.0 41.8 42.2 43.2 42.0 41.1 44.3 43.8 43.5	MAG .953 .850 .754 .664 .586 .531 .492 .452 .425 .411 .395 .382 .361 .351 .331 .330 .319 .332 .315	-13.4 -24.2 -31.9 -36.2 -39.3 -41.7 -42.3 -45.0 -45.4 -45.3 -47.5 -47.8 -49.4 -50.2 -52.6 -53.0 -54.7 -56.5 -58.4
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 .826 .752 .682 .627 .575 .555 .536 .524 .517 .512 .504 .501 .505 .504 .512 .530 .529 .529 .543 .536	ANG -29.5 -56.0 -77.7 -95.2 -111.1 -122.6 -134.3 -142.8 -150.5 -158.6 -164.5 -169.3 -175.3 -178.9 175.0 171.4 167.9 164.3 161.1 158.3 153.8	MAG 14.854 13.074 11.233 9.484 8.193 7.199 6.411 5.683 5.136 4.702 4.293 3.925 3.661 3.424 3.204 3.009 2.858 2.698 2.579 2.455 2.325	ANG 160.0 142.7 129.3 119.1 110.4 104.1 98.1 92.9 88.9 84.5 80.9 77.7 74.4 71.3 68.1 65.2 62.6 60.0 57.7 54.6 51.0	MAG .024 .039 .051 .059 .066 .071 .075 .078 .083 .083 .086 .093 .096 .093 .103 .110 .110 .113 .118 .122	78.6 62.0 54.3 48.6 45.3 41.2 40.8 39.9 41.8 43.4 41.0 41.8 42.2 43.2 42.0 41.1 44.3 43.8 43.5 43.8	MAG .953 .850 .754 .664 .586 .531 .492 .452 .425 .411 .395 .382 .361 .351 .331 .330 .319 .332 .315 .318 .318	ANG -13.4 -24.2 -31.9 -36.2 -39.3 -41.7 -42.3 -45.0 -45.4 -45.3 -47.5 -47.8 -49.4 -50.2 -52.6 -53.0 -54.7 -56.5 -58.4 -61.3 -64.0
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 .826 .752 .682 .627 .575 .555 .536 .524 .517 .512 .504 .501 .501 .505 .504 .512 .530 .529 .529 .529 .543 .536 .552	ANG -29.5 -56.0 -77.7 -95.2 -111.1 -122.6 -134.3 -142.8 -150.5 -158.6 -164.5 -169.3 -175.3 -178.9 175.0 171.4 167.9 164.3 161.1 158.3 153.8 151.0	MAG 14.854 13.074 11.233 9.484 8.193 7.199 6.411 5.683 5.136 4.702 4.293 3.925 3.661 3.424 3.204 3.009 2.858 2.698 2.579 2.455 2.325 2.217	ANG 160.0 142.7 129.3 119.1 110.4 104.1 98.1 92.9 88.9 84.5 80.9 77.7 74.4 71.3 68.1 65.2 62.6 60.0 57.7 54.6 51.0 48.0	MAG .024 .039 .051 .059 .066 .071 .075 .078 .083 .083 .086 .093 .096 .093 .100 .110 .1113 .118 .122 .128	78.6 62.0 54.3 48.6 45.3 41.2 40.8 39.9 41.8 43.4 41.0 41.8 42.2 43.2 42.0 41.1 44.3 43.8 43.5 43.8 45.0 42.4	MAG .953 .850 .754 .664 .586 .531 .492 .452 .425 .411 .395 .382 .361 .351 .331 .330 .319 .332 .315 .318 .318 .313	ANG -13.4 -24.2 -31.9 -36.2 -39.3 -41.7 -42.3 -45.0 -45.4 -45.3 -47.5 -47.8 -49.4 -50.2 -52.6 -53.0 -54.7 -56.5 -58.4 -61.3 -64.0 -67.8
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 2200.00 2300.00	MAG .826 .752 .682 .627 .575 .555 .536 .524 .517 .512 .504 .501 .505 .504 .512 .530 .529 .529 .543 .536 .552 .552	ANG -29.5 -56.0 -77.7 -95.2 -111.1 -122.6 -134.3 -142.8 -150.5 -158.6 -164.5 -169.3 -175.3 -175.3 -178.9 175.0 171.4 167.9 164.3 161.1 158.3 153.8 151.0 149.3	MAG 14.854 13.074 11.233 9.484 8.193 7.199 6.411 5.683 5.136 4.702 4.293 3.925 3.661 3.424 3.204 3.009 2.858 2.698 2.579 2.455 2.325 2.217 2.119	ANG 160.0 142.7 129.3 119.1 110.4 104.1 98.1 92.9 88.9 84.5 80.9 77.7 74.4 71.3 68.1 65.2 62.6 60.0 57.7 54.6 51.0 48.0 46.0	MAG .024 .039 .051 .059 .066 .071 .075 .078 .083 .083 .086 .093 .096 .093 .099 .103 .110 .110 .113 .118 .122 .128 .130	78.6 62.0 54.3 48.6 45.3 41.2 40.8 39.9 41.8 43.4 41.0 41.8 42.2 43.2 42.0 41.1 44.3 43.8 43.5 43.8 43.5 43.8	MAG .953 .850 .754 .664 .586 .531 .492 .452 .425 .411 .395 .382 .361 .351 .330 .319 .332 .315 .318 .313	ANG -13.4 -24.2 -31.9 -36.2 -39.3 -41.7 -42.3 -45.0 -45.4 -45.3 -47.5 -47.8 -49.4 -50.2 -52.6 -53.0 -54.7 -56.5 -58.4 -61.3 -64.0 -67.8 -67.7
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 2200.00 2300.00 2400.00	MAG .826 .752 .682 .627 .575 .536 .524 .517 .512 .504 .501 .505 .504 .512 .530 .529 .529 .543 .536 .552 .552 .554	ANG -29.5 -56.0 -77.7 -95.2 -111.1 -122.6 -134.3 -142.8 -150.5 -158.6 -164.5 -169.3 -175.3 -175.3 -178.9 175.0 171.4 167.9 164.3 161.1 158.3 153.8 151.0 149.3 145.6	MAG 14.854 13.074 11.233 9.484 8.193 7.199 6.411 5.683 5.136 4.702 4.293 3.925 3.661 3.424 3.204 3.009 2.858 2.698 2.579 2.455 2.325 2.217 2.119 2.057	ANG 160.0 142.7 129.3 119.1 110.4 104.1 98.1 92.9 88.9 84.5 80.9 77.7 74.4 71.3 68.1 65.2 62.6 60.0 57.7 54.6 51.0 48.0 46.0 44.4	MAG .024 .039 .051 .059 .066 .071 .075 .078 .083 .083 .086 .093 .096 .093 .103 .110 .110 .113 .118 .122 .128 .130 .135	78.6 62.0 54.3 48.6 45.3 41.2 40.8 39.9 41.8 43.4 41.0 41.8 42.2 43.2 42.0 41.1 44.3 43.8 43.5 43.5 43.8 45.0 42.4 41.5 42.6	MAG .953 .850 .754 .664 .586 .531 .492 .452 .425 .411 .395 .382 .361 .351 .331 .330 .319 .332 .315 .318 .313 .300 .294 .288	ANG -13.4 -24.2 -31.9 -36.2 -39.3 -41.7 -42.3 -45.0 -45.4 -45.3 -47.5 -47.8 -49.4 -50.2 -52.6 -53.0 -54.7 -56.5 -58.4 -61.3 -64.0 -67.8 -67.7 -69.6
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 .826 .752 .682 .627 .575 .555 .536 .524 .517 .512 .504 .501 .501 .505 .504 .512 .530 .529 .529 .543 .536 .525 .536 .524 .536 .552 .548 .560	ANG -29.5 -56.0 -77.7 -95.2 -111.1 -122.6 -134.3 -142.8 -150.5 -158.6 -164.5 -169.3 -175.3 -178.9 175.0 171.4 167.9 164.3 161.1 158.3 153.8 151.0 149.3 145.6 143.8	MAG 14.854 13.074 11.233 9.484 8.193 7.199 6.411 5.683 5.136 4.702 4.293 3.925 3.661 3.424 3.009 2.858 2.698 2.579 2.455 2.325 2.217 2.119 2.057 1.969	ANG 160.0 142.7 129.3 119.1 110.4 104.1 98.1 92.9 88.9 84.5 80.9 77.7 74.4 71.3 68.1 65.2 62.6 60.0 57.7 54.6 51.0 48.0 46.0 44.4 41.0	MAG .024 .039 .051 .059 .066 .071 .075 .078 .083 .083 .086 .093 .096 .093 .110 .110 .113 .118 .122 .128 .130 .135 .137	78.6 62.0 54.3 48.6 45.3 41.2 40.8 39.9 41.8 43.4 41.0 41.8 42.2 43.2 42.0 41.1 44.3 43.8 43.5 43.8 45.0 42.4 41.5 42.6 44.7	MAG .953 .850 .754 .664 .586 .531 .492 .452 .425 .411 .395 .382 .361 .351 .331 .330 .319 .332 .315 .318 .313 .300 .294 .288 .290	ANG -13.4 -24.2 -31.9 -36.2 -39.3 -41.7 -42.3 -45.0 -45.4 -45.3 -47.5 -47.8 -49.4 -50.2 -52.6 -53.0 -54.7 -56.5 -58.4 -61.3 -64.0 -67.8 -67.8 -67.8
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 2200.00 2300.00 2400.00 2500.00 2600.00 2700.00	MAG .826 .752 .682 .627 .575 .555 .536 .524 .517 .512 .504 .501 .501 .505 .504 .512 .530 .529 .529 .543 .536 .552 .552 .548 .560 .572 .572	ANG -29.5 -56.0 -77.7 -95.2 -111.1 -122.6 -134.3 -142.8 -150.5 -158.6 -164.5 -169.3 -175.3 -178.9 175.0 171.4 167.9 164.3 161.1 158.3 153.8 151.0 149.3 145.6 143.8 140.8 138.3	MAG 14.854 13.074 11.233 9.484 8.193 7.199 6.411 5.683 5.136 4.702 4.293 3.925 3.661 3.424 3.204 3.009 2.858 2.698 2.579 2.455 2.325 2.217 2.119 2.057 1.969 1.913 1.832	ANG 160.0 142.7 129.3 119.1 110.4 104.1 98.1 92.9 88.9 84.5 80.9 77.7 74.4 71.3 68.1 65.2 62.6 60.0 57.7 54.6 51.0 48.0 46.0 441.0 38.9 37.3	MAG .024 .039 .051 .059 .066 .071 .075 .078 .083 .083 .086 .093 .096 .093 .103 .110 .113 .118 .122 .128 .130 .135 .137 .140 .149	78.6 62.0 54.3 48.6 45.3 41.2 40.8 39.9 41.8 43.4 41.0 41.8 42.2 42.0 41.1 44.3 43.8 43.5 43.8 45.0 42.4 41.5 42.6 44.7 41.9 40.6	MAG .953 .850 .754 .664 .586 .531 .492 .452 .425 .411 .395 .382 .361 .351 .331 .330 .319 .332 .315 .318 .313 .300 .294 .288 .290 .279 .291	ANG -13.4 -24.2 -31.9 -36.2 -39.3 -41.7 -42.3 -45.0 -45.4 -45.3 -47.5 -47.8 -49.4 -50.2 -52.6 -53.0 -54.7 -56.5 -58.4 -61.3 -64.0 -67.8 -67.7 -69.6 -75.0 -75.0 -78.0
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 2300.00 2400.00 2500.00 2600.00 2700.00 2800.00	MAG .826 .752 .682 .627 .575 .555 .536 .524 .517 .512 .504 .501 .505 .504 .512 .530 .529 .543 .536 .552 .548 .560 .572 .572 .562	ANG -29.5 -56.0 -77.7 -95.2 -111.1 -122.6 -134.3 -142.8 -150.5 -158.6 -164.5 -169.3 -175.3 -178.9 175.0 171.4 167.9 164.3 161.1 158.3 153.8 151.0 149.3 145.6 143.8 140.8 138.3 136.4	MAG 14.854 13.074 11.233 9.484 8.193 7.199 6.411 5.683 5.136 4.702 4.293 3.925 3.661 3.424 3.204 3.009 2.858 2.698 2.579 2.455 2.325 2.217 2.119 2.057 1.969 1.913 1.832 1.775	ANG 160.0 142.7 129.3 119.1 110.4 104.1 98.1 92.9 88.9 84.5 80.9 77.7 74.4 71.3 68.1 65.2 62.6 60.0 57.7 54.6 51.0 48.0 46.0 44.4 41.0 38.9 37.3 34.4	MAG .024 .039 .051 .059 .066 .071 .075 .078 .083 .083 .086 .093 .096 .093 .103 .110 .113 .118 .122 .128 .130 .135 .137 .140 .149 .153	78.6 62.0 54.3 48.6 45.3 41.2 40.8 39.9 41.8 43.4 41.0 41.8 42.2 43.2 42.0 41.1 44.3 43.8 43.5 43.8 45.0 42.4 41.5 42.6 44.7 41.9 40.6 42.9	MAG .953 .850 .754 .664 .586 .531 .492 .452 .425 .411 .395 .382 .361 .351 .331 .330 .319 .332 .315 .318 .313 .300 .294 .288 .290 .279 .291 .290	ANG -13.4 -24.2 -31.9 -36.2 -39.3 -41.7 -42.3 -45.0 -45.4 -45.3 -47.5 -47.8 -49.4 -50.2 -52.6 -53.0 -54.7 -66.5 -61.3 -64.0 -67.8 -67.7 -69.6 -78.0 -78.0 -82.7
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 .826 .752 .682 .627 .575 .555 .536 .524 .517 .512 .504 .501 .501 .505 .504 .512 .530 .529 .529 .543 .536 .552 .552 .548 .560 .572 .572	ANG -29.5 -56.0 -77.7 -95.2 -111.1 -122.6 -134.3 -142.8 -150.5 -158.6 -164.5 -169.3 -175.3 -178.9 175.0 171.4 167.9 164.3 161.1 158.3 153.8 151.0 149.3 145.6 143.8 140.8 138.3	MAG 14.854 13.074 11.233 9.484 8.193 7.199 6.411 5.683 5.136 4.702 4.293 3.925 3.661 3.424 3.204 3.009 2.858 2.698 2.579 2.455 2.325 2.217 2.119 2.057 1.969 1.913 1.832	ANG 160.0 142.7 129.3 119.1 110.4 104.1 98.1 92.9 88.9 84.5 80.9 77.7 74.4 71.3 68.1 65.2 62.6 60.0 57.7 54.6 51.0 48.0 46.0 441.0 38.9 37.3	MAG .024 .039 .051 .059 .066 .071 .075 .078 .083 .083 .086 .093 .096 .093 .103 .110 .113 .118 .122 .128 .130 .135 .137 .140 .149	78.6 62.0 54.3 48.6 45.3 41.2 40.8 39.9 41.8 43.4 41.0 41.8 42.2 42.0 41.1 44.3 43.8 43.5 43.8 45.0 42.4 41.5 42.6 44.7 41.9 40.6	MAG .953 .850 .754 .664 .586 .531 .492 .452 .425 .411 .395 .382 .361 .351 .331 .330 .319 .332 .315 .318 .313 .300 .294 .288 .290 .279 .291	ANG -13.4 -24.2 -31.9 -36.2 -39.3 -41.7 -42.3 -45.0 -45.4 -45.3 -47.5 -47.8 -49.4 -50.2 -52.6 -53.0 -54.7 -56.5 -58.4 -61.3 -64.0 -67.8 -67.7 -69.6 -75.0 -75.0 -78.0



S-PARAMETER

Vce = 3 V, Ic = 3 mA

VCE = 3 V, IC = 3 IIIA								
FREQUENCY	S	S11	S	.1	S	12	S	22
f (MHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
, ,								
100.00	.887	-22.8	9.939	164.2	.024	78.7	.973	-9.8
200.00	.836 .782	-44.6 -63.0	9.201 8.316	149.5 137.2	.044	67.2 57.2	.912 .847	–18.1 –25.2
300.00 400.00	.762 .724	-63.0 -79.7	7.309	137.2	.060 .068	57.2 52.2	.647 .772	-25.2 -29.6
500.00	.666	-75.7 -95.1	6.543	117.6	.078	47.5	.697	-34.0
600.00	.642	-107.2	5.870	110.6	.086	40.1	.640	-36.8
700.00	.610	-119.1	5.313	104.0	.091	36.8	.607	-38.3
800.00	.592	-128.2	4.760	98.2	.092	36.4	.563	-40.8
900.00	.579	-137.4	4.349	93.5	.094	34.7	.535	-42.0
1000.00	.563	-145.9	4.007	88.5	.096	32.8	.510	-42.4
1100.00 1200.00	.556 .546	–153.1 –158.5	3.677 3.364	84.4 80.6	.100 .099	32.5 32.1	.488 .475	-43.9 -46.0
1300.00	.545	-165.0	3.157	76.9	.103	33.0	.473	-40.0 -47.0
1400.00	.544	-169.5	2.960	73.6	.100	32.3	.449	-49.1
1500.00	.543	-176.2	2.775	69.9	.103	30.6	.427	-50.0
1600.00	.552	-179.9	2.605	66.8	.104	32.8	.424	-51.1
1700.00	.561	175.7	2.487	63.7	.105	32.6	.414	-52.3
1800.00	.561	171.1	2.349	60.9	.113	32.6	.411	-55.0
1900.00 2000.00	.561 .580	168.6 164.0	2.237 2.138	58.4 55.0	.111 .120	32.9 33.7	.406 .397	–57.3 –60.1
2100.00	.569	159.2	2.130	51.3	.120	33.7	.403	-62.3
2200.00	.572	156.0	1.936	48.1	.119	34.7	.395	-64.7
2300.00	.574	152.8	1.860	46.0	.121	34.6	.386	-66.2
2400.00	.580	150.6	1.797	43.5	.117	37.4	.382	-67.8
2500.00	.594	147.6	1.727	40.2	.126	35.5	.382	-71.4
2600.00	.596	144.7	1.668	38.4	.132	36.2	.371	-71.6
2700.00 2800.00	.604 .584	142.5 140.3	1.612 1.567	36.6 33.1	.129 .137	38.1 38.3	.373 .378	-76.4 -78.8
2900.00	.603	138.6	1.506	31.9	.137	36.4	.379	-76.6 -79.6
3000.00	.594	135.0	1.432	28.6	.147	37.3	.380	-84.5
VcE = 3 V, Ic = 1 mA								
Vce = 3 V, Ic = 1 mA FREQUENCY	S	S ₁₁	Sa	1	S	12	S	22
	S MAG	S ₁₁ ANG	S2 MAG	ang	S MAG	12 ANG	S MAG	222 ANG
FREQUENCY f (MHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
FREQUENCY f (MHz) 100.00	MAG .968	ANG -14.4	MAG 3.598	ANG 169.7	MAG .025	ANG 77.5	MAG .987	ANG -4.9
FREQUENCY f (MHz) 100.00 200.00	MAG .968 .942	ANG -14.4 -29.1	MAG 3.598 3.497	ANG 169.7 159.2	MAG .025 .047	ANG 77.5 75.0	MAG .987 .971	ANG -4.9 -9.9
FREQUENCY f (MHz) 100.00 200.00 300.00	MAG .968 .942 .918	ANG -14.4 -29.1 -42.4	MAG 3.598 3.497 3.370	ANG 169.7 159.2 149.6	.025 .047 .072	77.5 75.0 65.0	.987 .971 .952	-4.9 -9.9 -14.3
FREQUENCY f (MHz) 100.00 200.00 300.00 400.00	.968 .942 .918 .882	ANG -14.4 -29.1	MAG 3.598 3.497 3.370 3.169	ANG 169.7 159.2 149.6 140.6	.025 .047 .072 .085	77.5 75.0 65.0 57.8	MAG .987 .971 .952 .918	-4.9 -9.9 -14.3 -18.4
FREQUENCY f (MHz) 100.00 200.00 300.00	MAG .968 .942 .918	ANG -14.4 -29.1 -42.4 -55.8	MAG 3.598 3.497 3.370	ANG 169.7 159.2 149.6	.025 .047 .072	77.5 75.0 65.0	.987 .971 .952	-4.9 -9.9 -14.3
FREQUENCY f (MHz) 100.00 200.00 300.00 400.00 500.00 600.00 700.00	MAG .968 .942 .918 .882 .838 .825 .789	-14.4 -29.1 -42.4 -55.8 -68.1 -79.9 -90.8	MAG 3.598 3.497 3.370 3.169 3.015 2.850 2.702	ANG 169.7 159.2 149.6 140.6 131.3 124.0 116.6	.025 .047 .072 .085 .101 .114	77.5 75.0 65.0 57.8 51.5 46.3 41.6	.987 .971 .952 .918 .882 .848 .823	-4.9 -9.9 -14.3 -18.4 -22.2 -25.2 -28.0
FREQUENCY f (MHz) 100.00 200.00 300.00 400.00 500.00 600.00 700.00 800.00	MAG .968 .942 .918 .882 .838 .825 .789 .770	-14.4 -29.1 -42.4 -55.8 -68.1 -79.9 -90.8 -100.8	MAG 3.598 3.497 3.370 3.169 3.015 2.850 2.702 2.505	ANG 169.7 159.2 149.6 140.6 131.3 124.0 116.6 109.4	MAG .025 .047 .072 .085 .101 .114 .122 .132	77.5 75.0 65.0 57.8 51.5 46.3 41.6 35.5	.987 .971 .952 .918 .882 .848 .823 .788	-4.9 -9.9 -14.3 -18.4 -22.2 -25.2 -28.0 -31.1
FREQUENCY f (MHz) 100.00 200.00 300.00 400.00 500.00 600.00 700.00 800.00 900.00	MAG .968 .942 .918 .882 .838 .825 .789 .770 .740	ANG -14.4 -29.1 -42.4 -55.8 -68.1 -79.9 -90.8 -100.8 -109.9	MAG 3.598 3.497 3.370 3.169 3.015 2.850 2.702 2.505 2.352	ANG 169.7 159.2 149.6 140.6 131.3 124.0 116.6 109.4 103.7	MAG .025 .047 .072 .085 .101 .114 .122 .132 .138	77.5 75.0 65.0 57.8 51.5 46.3 41.6 35.5 31.4	MAG .987 .971 .952 .918 .882 .848 .823 .788	ANG -4.9 -9.9 -14.3 -18.4 -22.2 -25.2 -28.0 -31.1 -32.8
FREQUENCY f (MHz) 100.00 200.00 300.00 400.00 500.00 600.00 700.00 800.00 900.00 1000.00	MAG .968 .942 .918 .882 .838 .825 .789 .770 .740 .722	ANG -14.4 -29.1 -42.4 -55.8 -68.1 -79.9 -90.8 -100.8 -109.9 -119.0	MAG 3.598 3.497 3.370 3.169 3.015 2.850 2.702 2.505 2.352 2.225	ANG 169.7 159.2 149.6 140.6 131.3 124.0 116.6 109.4 103.7 97.6	MAG .025 .047 .072 .085 .101 .114 .122 .132 .138 .138	77.5 75.0 65.0 57.8 51.5 46.3 41.6 35.5 31.4 26.9	MAG .987 .971 .952 .918 .882 .848 .823 .788 .757	ANG -4.9 -9.9 -14.3 -18.4 -22.2 -25.2 -28.0 -31.1 -32.8 -34.8
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 .968 .942 .918 .882 .838 .825 .789 .770 .740 .722 .703	ANG -14.4 -29.1 -42.4 -55.8 -68.1 -79.9 -90.8 -100.8 -109.9 -119.0 -127.3	MAG 3.598 3.497 3.370 3.169 3.015 2.850 2.702 2.505 2.352 2.225 2.077	ANG 169.7 159.2 149.6 140.6 131.3 124.0 116.6 109.4 103.7 97.6 92.5	MAG .025 .047 .072 .085 .101 .114 .122 .132 .138 .138 .139	77.5 75.0 65.0 57.8 51.5 46.3 41.6 35.5 31.4 26.9 25.8	MAG .987 .971 .952 .918 .882 .848 .823 .788 .7557 .747	ANG -4.9 -9.9 -14.3 -18.4 -22.2 -25.2 -28.0 -31.1 -32.8 -34.8 -37.2
FREQUENCY f (MHz) 100.00 200.00 300.00 400.00 500.00 600.00 700.00 800.00 900.00 1000.00	MAG .968 .942 .918 .882 .838 .825 .789 .770 .740 .722 .703 .692 .678	ANG -14.4 -29.1 -42.4 -55.8 -68.1 -79.9 -90.8 -100.8 -109.9 -119.0 -127.3 -134.3 -142.1	MAG 3.598 3.497 3.370 3.169 3.015 2.850 2.702 2.505 2.352 2.225 2.077 1.930 1.831	ANG 169.7 159.2 149.6 140.6 131.3 124.0 116.6 109.4 103.7 97.6 92.5 87.2 82.6	MAG .025 .047 .072 .085 .101 .114 .122 .132 .138 .138 .139 .144 .146	77.5 75.0 65.0 57.8 51.5 46.3 41.6 35.5 31.4 26.9	MAG .987 .971 .952 .918 .882 .848 .823 .788 .757 .747 .720 .703 .682	ANG -4.9 -9.9 -14.3 -18.4 -22.2 -25.2 -28.0 -31.1 -32.8 -34.8 -37.2 -39.2 -40.6
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	MAG .968 .942 .918 .882 .838 .825 .789 .770 .740 .722 .703 .692 .678	ANG -14.4 -29.1 -42.4 -55.8 -68.1 -79.9 -90.8 -100.8 -109.9 -119.0 -127.3 -134.3 -142.1 -147.6	MAG 3.598 3.497 3.370 3.169 3.015 2.850 2.702 2.505 2.352 2.225 2.077 1.930 1.831 1.740	ANG 169.7 159.2 149.6 140.6 131.3 124.0 116.6 109.4 103.7 97.6 92.5 87.2 82.6 78.2	MAG .025 .047 .072 .085 .101 .114 .122 .132 .138 .138 .138 .139 .144 .146 .141	77.5 75.0 65.0 57.8 51.5 46.3 41.6 35.5 31.4 26.9 25.8 23.0 18.7 17.1	MAG .987 .971 .952 .918 .882 .848 .823 .788 .757 .747 .720 .703 .682 .681	ANG -4.9 -9.9 -14.3 -18.4 -22.2 -25.2 -28.0 -31.1 -32.8 -34.8 -37.2 -39.2 -40.6 -43.0
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	MAG .968 .942 .918 .882 .838 .825 .789 .770 .740 .722 .703 .692 .678 .674	ANG -14.4 -29.1 -42.4 -55.8 -68.1 -79.9 -90.8 -100.8 -109.9 -119.0 -127.3 -134.3 -142.1 -147.6 -154.5	MAG 3.598 3.497 3.370 3.169 3.015 2.850 2.702 2.505 2.352 2.225 2.077 1.930 1.831 1.740 1.644	ANG 169.7 159.2 149.6 140.6 131.3 124.0 116.6 109.4 103.7 97.6 92.5 87.2 82.6 78.2 73.7	MAG .025 .047 .072 .085 .101 .114 .122 .132 .138 .138 .139 .144 .146 .141 .137	77.5 75.0 65.0 57.8 51.5 46.3 41.6 35.5 31.4 26.9 25.8 23.0 18.7 17.1	.987 .971 .952 .918 .882 .848 .823 .788 .757 .747 .720 .703 .682 .681	ANG -4.9 -9.9 -14.3 -18.4 -22.2 -25.2 -28.0 -31.1 -32.8 -34.8 -37.2 -39.2 -40.6 -43.0 -45.1
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 1600.00	MAG .968 .942 .918 .882 .838 .825 .789 .770 .740 .722 .703 .692 .678 .674 .662	ANG -14.4 -29.1 -42.4 -55.8 -68.1 -79.9 -90.8 -100.8 -109.9 -119.0 -127.3 -134.3 -142.1 -147.6 -154.5 -160.7	MAG 3.598 3.497 3.370 3.169 3.015 2.850 2.702 2.505 2.352 2.225 2.077 1.930 1.831 1.740 1.644 1.552	ANG 169.7 159.2 149.6 140.6 131.3 124.0 116.6 109.4 103.7 97.6 92.5 87.2 82.6 78.2 73.7 69.6	MAG .025 .047 .072 .085 .101 .114 .122 .132 .138 .138 .139 .144 .146 .141 .137 .136	77.5 75.0 65.0 57.8 51.5 46.3 41.6 35.5 31.4 26.9 25.8 23.0 18.7 17.1 15.1	MAG .987 .971 .952 .918 .882 .848 .823 .788 .757 .747 .720 .703 .682 .681 .655	ANG -4.9 -9.9 -14.3 -18.4 -22.2 -25.2 -28.0 -31.1 -32.8 -34.8 -37.2 -39.2 -40.6 -43.0 -45.1 -46.6
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 1600.00 1700.00	MAG .968 .942 .918 .882 .838 .825 .789 .770 .740 .722 .703 .692 .678 .674 .662 .665	ANG -14.4 -29.1 -42.4 -55.8 -68.1 -79.9 -90.8 -100.8 -109.9 -119.0 -127.3 -134.3 -142.1 -147.6 -154.5 -160.7 -166.6	MAG 3.598 3.497 3.370 3.169 3.015 2.850 2.702 2.505 2.352 2.225 2.077 1.930 1.831 1.740 1.644 1.552 1.502	ANG 169.7 159.2 149.6 140.6 131.3 124.0 116.6 109.4 103.7 97.6 92.5 87.2 82.6 78.2 73.7 69.6 66.0	MAG .025 .047 .072 .085 .101 .114 .122 .132 .138 .138 .139 .144 .146 .141 .137 .136 .137	77.5 75.0 65.0 57.8 51.5 46.3 41.6 35.5 31.4 26.9 25.8 23.0 18.7 17.1 15.1 13.0 12.0	MAG .987 .971 .952 .918 .882 .848 .823 .788 .757 .747 .720 .703 .682 .681 .655 .644	ANG -4.9 -9.9 -14.3 -18.4 -22.2 -25.2 -28.0 -31.1 -32.8 -34.8 -37.2 -39.2 -40.6 -43.0 -45.1 -46.6 -48.4
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 1600.00	MAG .968 .942 .918 .882 .838 .825 .789 .770 .740 .722 .703 .692 .678 .674 .662	ANG -14.4 -29.1 -42.4 -55.8 -68.1 -79.9 -90.8 -100.8 -109.9 -119.0 -127.3 -134.3 -142.1 -147.6 -154.5 -160.7	MAG 3.598 3.497 3.370 3.169 3.015 2.850 2.702 2.505 2.352 2.225 2.077 1.930 1.831 1.740 1.644 1.552	ANG 169.7 159.2 149.6 140.6 131.3 124.0 116.6 109.4 103.7 97.6 92.5 87.2 82.6 78.2 73.7 69.6	MAG .025 .047 .072 .085 .101 .114 .122 .132 .138 .138 .139 .144 .146 .141 .137 .136	77.5 75.0 65.0 57.8 51.5 46.3 41.6 35.5 31.4 26.9 25.8 23.0 18.7 17.1 15.1	MAG .987 .971 .952 .918 .882 .848 .823 .788 .757 .747 .720 .703 .682 .681 .655	ANG -4.9 -9.9 -14.3 -18.4 -22.2 -25.2 -28.0 -31.1 -32.8 -34.8 -37.2 -39.2 -40.6 -43.0 -45.1 -46.6
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 1500.00 1600.00 1700.00 1800.00 1900.00 2000.00	MAG .968 .942 .918 .882 .838 .825 .789 .770 .740 .722 .703 .692 .678 .674 .662 .665 .673 .666 .667	ANG -14.4 -29.1 -42.4 -55.8 -68.1 -79.9 -90.8 -100.8 -109.9 -119.0 -127.3 -134.3 -142.1 -147.6 -154.5 -160.7 -166.6 -171.6 -175.3 179.3	MAG 3.598 3.497 3.370 3.169 3.015 2.850 2.702 2.505 2.352 2.225 2.077 1.930 1.831 1.740 1.644 1.552 1.502 1.420 1.360 1.301	ANG 169.7 159.2 149.6 140.6 131.3 124.0 116.6 109.4 103.7 97.6 92.5 87.2 82.6 78.2 73.7 69.6 66.0 61.9 59.0 55.1	MAG .025 .047 .072 .085 .101 .114 .122 .132 .138 .139 .144 .146 .141 .137 .136 .137 .136 .128 .128	77.5 75.0 65.0 57.8 51.5 46.3 41.6 35.5 31.4 26.9 25.8 23.0 18.7 17.1 15.1 13.0 12.0 10.0 8.6	MAG .987 .971 .952 .918 .882 .848 .823 .788 .757 .747 .720 .703 .682 .681 .655 .644 .640 .641 .629 .626	ANG -4.9 -9.9 -14.3 -18.4 -22.2 -25.2 -28.0 -31.1 -32.8 -34.8 -37.2 -39.2 -40.6 -43.0 -45.1 -46.6 -48.4 -51.1 -53.3 -55.5
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 1500.00 1600.00 1700.00 1800.00 1900.00 1900.00 2000.00 2100.00	MAG .968 .942 .918 .882 .838 .825 .789 .770 .740 .722 .703 .692 .678 .674 .662 .665 .677 .6667	ANG -14.4 -29.1 -42.4 -55.8 -68.1 -79.9 -90.8 -109.9 -119.0 -127.3 -134.3 -142.1 -147.6 -154.5 -160.7 -166.6 -171.6 -175.3 179.3 173.9	MAG 3.598 3.497 3.370 3.169 3.015 2.850 2.702 2.505 2.352 2.225 2.077 1.930 1.831 1.740 1.644 1.552 1.502 1.420 1.360 1.301 1.245	ANG 169.7 159.2 149.6 140.6 131.3 124.0 116.6 109.4 103.7 97.6 92.5 87.2 82.6 78.2 73.7 69.6 66.0 61.9 59.0 55.1 50.8	MAG .025 .047 .072 .085 .101 .114 .122 .132 .138 .138 .139 .144 .146 .141 .137 .136 .137 .136 .137	77.5 75.0 65.0 57.8 51.5 46.3 41.6 35.5 31.4 26.9 25.8 23.0 18.7 17.1 15.1 12.0 10.0 10.0 8.6 9.4	MAG .987 .971 .952 .918 .882 .848 .823 .788 .757 .747 .720 .703 .682 .681 .655 .644 .640 .641 .629 .626 .616	ANG -4.9 -9.9 -14.3 -18.4 -22.2 -25.2 -28.0 -31.1 -32.8 -34.8 -37.2 -39.2 -40.6 -43.0 -45.1 -46.6 -48.4 -51.1 -53.3 -55.5 -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 2100.00 2200.00	MAG .968 .942 .918 .882 .838 .825 .789 .770 .740 .722 .703 .692 .678 .674 .662 .665 .673 .666 .667 .677 .671	ANG -14.4 -29.1 -42.4 -55.8 -68.1 -79.9 -90.8 -100.8 -109.9 -119.0 -127.3 -134.3 -142.1 -147.6 -154.5 -160.7 -166.6 -171.6 -175.3 179.3 173.9 169.5	MAG 3.598 3.497 3.370 3.169 3.015 2.850 2.702 2.505 2.352 2.225 2.077 1.930 1.831 1.740 1.644 1.552 1.502 1.420 1.360 1.301 1.245 1.182	ANG 169.7 159.2 149.6 140.6 131.3 124.0 116.6 109.4 103.7 97.6 92.5 87.2 82.6 78.2 73.7 69.6 66.0 61.9 59.0 55.1 50.8 46.7	MAG .025 .047 .072 .085 .101 .114 .122 .132 .138 .138 .139 .144 .146 .141 .137 .136 .137 .136 .128 .128 .124 .122 .116	77.5 75.0 65.0 57.8 51.5 46.3 41.6 35.5 31.4 26.9 25.8 23.0 18.7 17.1 15.1 13.0 10.0 10.0 10.0 8.6 9.4 7.5	MAG .987 .971 .952 .918 .882 .848 .823 .788 .757 .747 .720 .703 .682 .681 .655 .644 .640 .641 .629 .626 .616 .618	ANG -4.9 -9.9 -14.3 -18.4 -22.2 -25.2 -28.0 -31.1 -32.8 -34.8 -37.2 -40.6 -43.0 -45.1 -46.6 -48.4 -51.1 -53.3 -55.5 -58.8 -60.9
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	MAG .968 .942 .918 .882 .838 .825 .789 .770 .740 .722 .703 .692 .678 .674 .662 .665 .673 .666 .667 .677 .671 .673	ANG -14.4 -29.1 -42.4 -55.8 -68.1 -79.9 -90.8 -100.8 -109.9 -119.0 -127.3 -134.3 -142.1 -147.6 -154.5 -160.7 -166.6 -171.6 -175.3 179.3 179.3 173.9 169.5 166.2	MAG 3.598 3.497 3.370 3.169 3.015 2.850 2.702 2.505 2.352 2.225 2.077 1.930 1.831 1.740 1.644 1.552 1.502 1.420 1.360 1.301 1.245 1.182 1.145	ANG 169.7 159.2 149.6 140.6 131.3 124.0 116.6 109.4 103.7 97.6 92.5 87.2 82.6 78.2 73.7 69.6 66.0 61.9 59.0 55.1 50.8 46.7 44.5	MAG .025 .047 .072 .085 .101 .114 .122 .132 .138 .138 .139 .144 .146 .141 .137 .136 .137 .136 .128 .124 .122 .116 .118	77.5 75.0 65.0 57.8 51.5 46.3 41.6 35.5 31.4 26.9 25.8 23.0 18.7 17.1 13.0 12.0 10.0 10.0 8.6 9.4 7.5	MAG .987 .971 .952 .918 .882 .848 .823 .788 .757 .747 .720 .703 .682 .681 .655 .644 .640 .641 .629 .626 .616 .618 .613	ANG -4.9 -9.9 -14.3 -18.4 -22.2 -25.2 -28.0 -31.1 -32.8 -34.8 -37.2 -39.2 -40.6 -43.0 -45.1 -46.6 -48.4 -51.1 -53.3 -55.5 -58.8 -60.9 -63.4
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 1500.00 1600.00 1700.00 1800.00 1900.00 2000.00 2200.00 2300.00 2400.00	MAG .968 .942 .918 .882 .838 .825 .789 .770 .740 .722 .703 .692 .678 .674 .662 .665 .673 .666 .667 .677 .671 .673 .669	ANG -14.4 -29.1 -42.4 -55.8 -68.1 -79.9 -90.8 -100.8 -109.9 -119.0 -127.3 -134.3 -142.1 -147.6 -154.5 -160.7 -166.6 -171.6 -175.3 179.3 173.9 169.5 166.2 162.5	MAG 3.598 3.497 3.370 3.169 3.015 2.850 2.702 2.505 2.352 2.225 2.077 1.930 1.831 1.740 1.644 1.552 1.502 1.420 1.360 1.301 1.245 1.182 1.145 1.098	ANG 169.7 159.2 149.6 140.6 131.3 124.0 116.6 109.4 103.7 97.6 92.5 87.2 82.6 78.2 73.7 69.6 66.0 61.9 59.0 55.1 50.8 46.7 44.5 42.0	MAG .025 .047 .072 .085 .101 .114 .122 .138 .138 .139 .144 .146 .141 .137 .136 .137 .136 .128 .124 .122 .116 .118 .107	77.5 75.0 65.0 57.8 51.5 46.3 41.6 35.5 31.4 26.9 25.8 23.0 18.7 17.1 15.1 13.0 10.0 10.0 8.6 9.4 7.5 11.5 8.2	MAG .987 .971 .952 .918 .882 .848 .823 .788 .757 .747 .720 .703 .682 .681 .655 .644 .640 .641 .629 .626 .616 .618 .613	ANG -4.9 -9.9 -14.3 -18.4 -22.2 -25.2 -28.0 -31.1 -32.8 -34.8 -37.2 -39.2 -40.6 -43.0 -45.1 -46.6 -48.4 -51.1 -53.3 -55.5 -58.8 -60.9 -63.4 -65.8
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 2200.00 2300.00	MAG .968 .942 .918 .882 .838 .825 .789 .770 .740 .722 .703 .692 .678 .674 .662 .665 .673 .666 .667 .677 .671 .673	ANG -14.4 -29.1 -42.4 -55.8 -68.1 -79.9 -90.8 -100.8 -109.9 -119.0 -127.3 -134.3 -142.1 -147.6 -154.5 -160.7 -166.6 -171.6 -175.3 179.3 179.3 173.9 169.5 166.2	MAG 3.598 3.497 3.370 3.169 3.015 2.850 2.702 2.505 2.352 2.225 2.077 1.930 1.831 1.740 1.644 1.552 1.502 1.420 1.360 1.301 1.245 1.182 1.145	ANG 169.7 159.2 149.6 140.6 131.3 124.0 116.6 109.4 103.7 97.6 92.5 87.2 82.6 78.2 73.7 69.6 66.0 61.9 59.0 55.1 50.8 46.7 44.5	MAG .025 .047 .072 .085 .101 .114 .122 .132 .138 .138 .139 .144 .146 .141 .137 .136 .137 .136 .128 .124 .122 .116 .118	77.5 75.0 65.0 57.8 51.5 46.3 41.6 35.5 31.4 26.9 25.8 23.0 18.7 17.1 13.0 12.0 10.0 10.0 8.6 9.4 7.5	MAG .987 .971 .952 .918 .882 .848 .823 .788 .757 .747 .720 .703 .682 .681 .655 .644 .640 .641 .629 .626 .616 .618 .613	ANG -4.9 -9.9 -14.3 -18.4 -22.2 -25.2 -28.0 -31.1 -32.8 -34.8 -37.2 -39.2 -40.6 -43.0 -45.1 -46.6 -48.4 -51.1 -53.3 -55.5 -58.8 -60.9 -63.4
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 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 .968 .942 .918 .882 .838 .825 .770 .740 .722 .703 .692 .678 .674 .662 .665 .673 .666 .667 .677 .671 .673 .669 .683 .689 .695	ANG -14.4 -29.1 -42.4 -55.8 -68.1 -79.9 -90.8 -100.8 -109.9 -119.0 -127.3 -134.3 -142.1 -147.6 -154.5 -160.7 -166.6 -171.6 -175.3 179.3 173.9 169.5 166.2 162.5 159.6 155.6	MAG 3.598 3.497 3.370 3.169 3.015 2.850 2.702 2.505 2.352 2.225 2.077 1.930 1.831 1.740 1.644 1.552 1.502 1.420 1.360 1.301 1.245 1.182 1.145 1.098 1.057 1.030 .986	ANG 169.7 159.2 149.6 140.6 131.3 124.0 116.6 109.4 103.7 97.6 92.5 87.2 82.6 78.2 73.7 69.6 66.0 61.9 59.0 55.1 50.8 46.7 44.5 42.0 38.1 35.7 33.7	MAG .025 .047 .072 .085 .101 .114 .122 .132 .138 .139 .144 .146 .141 .137 .136 .137 .136 .128 .124 .122 .116 .118 .107 .106 .108	77.5 75.0 65.0 57.8 51.5 46.3 41.6 35.5 31.4 26.9 25.8 23.0 18.7 17.1 15.1 13.0 10.0 10.0 8.6 9.4 7.5 11.5 8.2 13.2	MAG .987 .971 .952 .918 .882 .848 .823 .788 .757 .747 .720 .703 .682 .681 .655 .644 .640 .641 .629 .626 .616 .618 .613 .607 .603 .596	ANG -4.9 -9.9 -14.3 -18.4 -22.2 -25.2 -28.0 -31.1 -32.8 -37.2 -39.2 -40.6 -43.0 -45.1 -46.6 -48.4 -51.1 -53.3 -55.5 -58.8 -60.9 -63.4 -65.8 -69.0 -69.5 -72.9
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 .968 .942 .918 .882 .838 .825 .789 .770 .740 .722 .703 .692 .678 .674 .662 .665 .673 .666 .667 .677 .671 .673 .673 .669 .683 .689 .689	ANG -14.4 -29.1 -42.4 -55.8 -68.1 -79.9 -90.8 -100.8 -109.9 -119.0 -127.3 -134.3 -142.1 -147.6 -154.5 -160.7 -166.6 -171.6 -175.3 179.3 173.9 169.5 166.2 162.5 159.6 155.6 155.6 152.4 149.7	MAG 3.598 3.497 3.370 3.169 3.015 2.850 2.702 2.505 2.352 2.225 2.077 1.930 1.831 1.740 1.644 1.552 1.502 1.420 1.360 1.301 1.245 1.182 1.145 1.098 1.057 1.030 986	ANG 169.7 159.2 149.6 140.6 131.3 124.0 116.6 109.4 103.7 97.6 92.5 87.2 82.6 78.2 73.7 69.6 66.0 61.9 59.0 55.1 50.8 46.7 44.5 42.0 38.1 35.7 33.7 29.9	MAG .025 .047 .072 .085 .101 .114 .122 .132 .138 .138 .139 .144 .146 .141 .137 .136 .137 .136 .128 .124 .122 .116 .118 .107 .106 .108 .108	77.5 75.0 65.0 57.8 51.5 46.3 41.6 35.5 31.4 26.9 25.8 23.0 18.7 17.1 15.1 13.0 10.0 10.0 8.6 9.4 7.5 11.5 8.2 13.2 14.1 18.2 16.0	MAG .987 .971 .952 .918 .882 .848 .823 .788 .757 .747 .720 .703 .682 .681 .655 .644 .640 .641 .629 .626 .616 .618 .613 .607 .603 .596 .599 .613	ANG -4.9 -9.9 -14.3 -18.4 -22.2 -25.2 -28.0 -31.1 -32.8 -34.8 -37.2 -39.2 -40.6 -43.0 -45.1 -46.6 -48.4 -51.1 -53.3 -55.5 -58.8 -60.9 -63.4 -65.8 -69.0 -69.5 -72.9 -77.4
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 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 .968 .942 .918 .882 .838 .825 .770 .740 .722 .703 .692 .678 .674 .662 .665 .673 .666 .667 .677 .671 .673 .669 .683 .689 .695	ANG -14.4 -29.1 -42.4 -55.8 -68.1 -79.9 -90.8 -100.8 -109.9 -119.0 -127.3 -134.3 -142.1 -147.6 -154.5 -160.7 -166.6 -171.6 -175.3 179.3 173.9 169.5 166.2 162.5 159.6 155.6	MAG 3.598 3.497 3.370 3.169 3.015 2.850 2.702 2.505 2.352 2.225 2.077 1.930 1.831 1.740 1.644 1.552 1.502 1.420 1.360 1.301 1.245 1.182 1.145 1.098 1.057 1.030 .986	ANG 169.7 159.2 149.6 140.6 131.3 124.0 116.6 109.4 103.7 97.6 92.5 87.2 82.6 78.2 73.7 69.6 66.0 61.9 59.0 55.1 50.8 46.7 44.5 42.0 38.1 35.7 33.7	MAG .025 .047 .072 .085 .101 .114 .122 .132 .138 .139 .144 .146 .141 .137 .136 .137 .136 .128 .124 .122 .116 .118 .107 .106 .106 .108	77.5 75.0 65.0 57.8 51.5 46.3 41.6 35.5 31.4 26.9 25.8 23.0 18.7 17.1 15.1 13.0 10.0 10.0 8.6 9.4 7.5 11.5 8.2 13.2	MAG .987 .971 .952 .918 .882 .848 .823 .788 .757 .747 .720 .703 .682 .681 .655 .644 .640 .641 .629 .626 .616 .618 .613 .607 .603 .596	ANG -4.9 -9.9 -14.3 -18.4 -22.2 -25.2 -28.0 -31.1 -32.8 -37.2 -39.2 -40.6 -43.0 -45.1 -46.6 -48.4 -51.1 -53.3 -55.5 -58.8 -60.9 -63.4 -65.8 -69.0 -69.5 -72.9

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