SILICON TRANSISTOR

2SC5015

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

FEATURES

- Small Package
- WWW.BZSC.COM High Gain Bandwidth Product (f⊤ = 12 GHz TYP.)
- Low Noise, High Gain
- Low Voltage Operation

ORDERING INFORMATION

PART NUMBER	QUANTITY	PACKING STYLE
2SC5015-T1	3 Kpcs/Reel.	Embossed tape 8 mm wide. Pin3 (Base), Pin4 (Emitter) face to perforation side of the tape.
2SC5015-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.: 2SC5014)

in millimeters 2.1 ± 0.2 1.25 ± 0.1 $0.3^{\,+0.1}_{\,-0.05}$ (LEADS 2, 3, 4) 2.0 ± 0.2 $0.4^{+0.1}_{-0.05}$ 0.9 ± 0.1 PIN CONNECTIONS 1. Collector 2. Emitter 3. Base 4. Emitter

PACKAGE DIMENSIONS

ABSOLUTE MAXIMUM RATINGS (TA = 25 °C)

Collector to Base Voltage	Vсво	9	V
Collector to Emitter Voltage	Vceo	6	V
Emitter to Base Voltage	Vево	2	V
Collector Current	Ic	30	mΑ
Total Power Dissipation	P⊤	150	mW
Junction Temperature	Ti	150	° C
Storage Temperature	Tstg	-65 to + 150	° C



Caution: Electrostatic Sensitive Device



ELECTRICAL CHARACTERISTICS (T_A = 25 °C)

CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITION
Collector Cutoff Current	Ісво			0.1	μΑ	Vcb = 5 V, IE = 0
Emitter Cutoff Current	ІЕВО			0.1	μΑ	V _{EB} = 1 V, I _C = 0
DC Current Gain	hfe	75		150		Vce = 3 V, Ic = 10 mA*1
Gain Bandwidth Product	f⊤		12		GHz	Vce = 3 V, Ic = 10 mA
Feed-back Capacitance	Cre		0.3	0.5	pF	VcB = 3 V, IE = 0, f = 1 MHz*2
Insertion Power Gain	S _{21e} ²	9	11		dB	VcE = 3 V, lc = 10 mA, f = 2.0 GHz
Noise Figure	NF		1.5	2.5	dB	VcE = 3 V, lc = 3 mA, f = 2.0 GHz

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

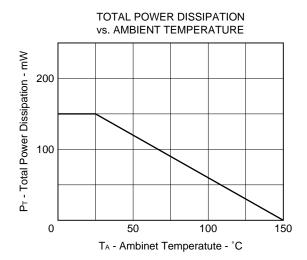
hfe Classification

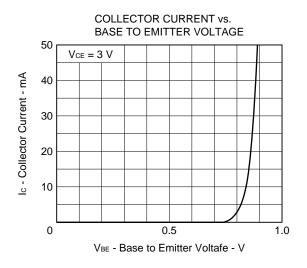
Rank	КВ
Marking	T83
hfe	75 to 150

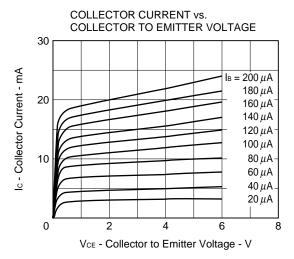
^{*2} Measured with 3 terminals bridge, Emitter and Case should be grounded.

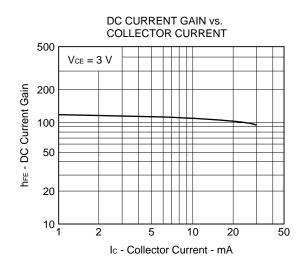
NEC

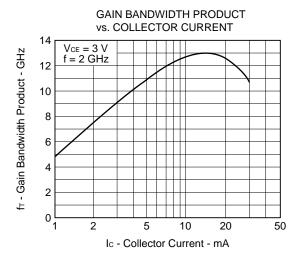
TYPICAL CHARACTERISTICS (TA = 25 °C)

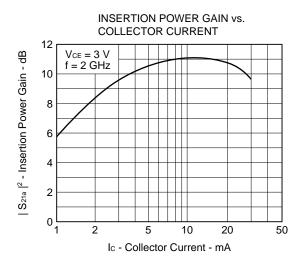


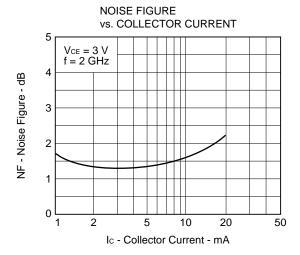


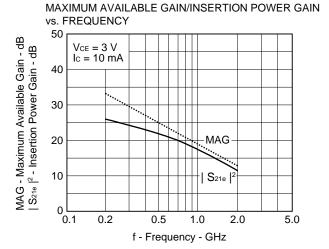


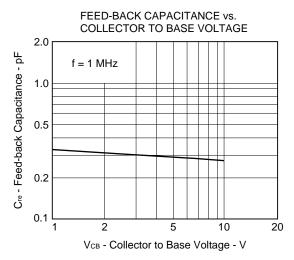












S-PARAMETER

5-PARAIVIETER								
VcE = 3 V, Ic = 10 mA								
		_	_		_		_	
FREQUENCY		S ₁₁	S2		S		S	22
f (MHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100.00	.727	-22.0	22.084	159.4	.011	87.5	.934	-13.1
200.00	.640	-42.3	19.220	142.1	.029	70.7	.832	-24.3
300.00	.537	-57.8	16.333	129.2	.041	69.4	.735	-31.7
400.00	.452	-70.0	13.716	119.6	.046	60.9	.642	-35.6
500.00	.374	-82.3	11.834	111.2	.051	59.6	.562	-39.2
600.00	.332	-91.0	10.355	105.6	.060	61.7	.520	-40.7
	.293			100.2				
700.00		-101.5	9.190		.066	61.0	.479	-42.0
800.00	.255	-109.0	8.182	95.6	.072	61.3	.443	-44.4
900.00	.231	-119.1	7.376	91.9	.076	60.5	.413	-44.0
1000.00	.211	-128.8	6.751	87.9	.086	61.2	.394	-43.9
1100.00	.200	-136.1	6.171	84.9	.095	62.6	.376	-45.7
1200.00	.184	-143.4	5.658	81.7	.099	58.8	.363	-47.1
1300.00	.184	-154.3	5.286	79.0	.103	60.1	.342	-48.3
1400.00	.180	-162.4	4.932	76.2	.111	54.6	.332	-48.3
1500.00	.174	-171.5	4.630	73.3	.115	56.8	.310	-51.6
1600.00	.180	-178.4	4.347	70.9	.123	58.2	.303	-53.2
1700.00	.192	176.8	4.128	68.7	.131	54.1	.292	-51.8
1800.00	.193	169.1	3.914	66.0	.132	55.6	.292	-54.2
1900.00	.191	165.2	3.734	64.0	.139	51.7	.285	-55.3
2000.00	.209	161.0	3.561	61.1	.151	53.8	.281	-60.1
2100.00	.212	154.0	3.386	59.3	.154	51.9	.268	-61.0
2200.00	.219	148.1	3.242	56.7	.165		.267	-64.1
						50.8		
2300.00	.230	147.0	3.117	54.9	.169	49.2	.259	-63.5
2400.00	.230	141.3	2.986	53.0	.172	51.0	.240	-66.9
2500.00	.243	140.6	2.891	50.2	.186	48.5	.239	-68.9
2600.00	.254	135.8	2.790	48.6	.188	47.7	.249	-67.8
2700.00	.247	135.4	2.703	47.4	.193	47.9	.242	-73.3
2800.00	.251	132.3	2.610	44.0	.203	45.5	.237	-75.5
2900.00	.254	131.9	2.525	42.6	.207	44.0	.232	-77.9
3000.00	.269	123.9	2.435	40.5	.213	42.1	.236	-82.2
Vc= 3 V Ic = 5 mA								
VcE = 3 V, Ic = 5 mA		•						
FREQUENCY		S ₁₁	S2		S			22
	MAG	S ₁₁ ANG	S2 MAG	an ANG	S MAG	12 ANG	S MAG	²² ANG
FREQUENCY	MAG .854	ANG		ANG	MAG			ANG
FREQUENCY f (MHz) 100.00	.854	ANG -15.0	MAG 13.962	ANG 166.0	MAG .014	ANG 83.0	MAG .966	ANG -9.2
FREQUENCY f (MHz) 100.00 200.00	.854 .795	ANG -15.0 -29.7	MAG 13.962 13.063	ANG 166.0 152.7	MAG .014 .033	ANG 83.0 76.1	MAG .966 .917	ANG -9.2 -17.9
FREQUENCY f (MHz) 100.00 200.00 300.00	.854 .795 .724	ANG -15.0 -29.7 -41.9	MAG 13.962 13.063 11.975	ANG 166.0 152.7 141.5	MAG .014 .033 .046	ANG 83.0 76.1 71.1	MAG .966 .917 .856	ANG -9.2 -17.9 -25.0
FREQUENCY f (MHz) 100.00 200.00 300.00 400.00	.854 .795 .724 .648	ANG -15.0 -29.7 -41.9 -53.1	MAG 13.962 13.063 11.975 10.690	ANG 166.0 152.7 141.5 132.1	MAG .014 .033 .046 .054	ANG 83.0 76.1 71.1 65.0	MAG .966 .917 .856 .785	ANG -9.2 -17.9 -25.0 -30.0
FREQUENCY f (MHz) 100.00 200.00 300.00	.854 .795 .724	ANG -15.0 -29.7 -41.9	MAG 13.962 13.063 11.975	ANG 166.0 152.7 141.5	MAG .014 .033 .046	ANG 83.0 76.1 71.1	MAG .966 .917 .856	ANG -9.2 -17.9 -25.0
FREQUENCY f (MHz) 100.00 200.00 300.00 400.00	.854 .795 .724 .648 .569	ANG -15.0 -29.7 -41.9 -53.1	MAG 13.962 13.063 11.975 10.690	ANG 166.0 152.7 141.5 132.1	MAG .014 .033 .046 .054 .063	ANG 83.0 76.1 71.1 65.0	MAG .966 .917 .856 .785	ANG -9.2 -17.9 -25.0 -30.0 -34.8
FREQUENCY f (MHz) 100.00 200.00 300.00 400.00 500.00 600.00	.854 .795 .724 .648 .569	ANG -15.0 -29.7 -41.9 -53.1 -63.9 -72.9	MAG 13.962 13.063 11.975 10.690 9.702 8.789	ANG 166.0 152.7 141.5 132.1 123.1 116.6	MAG .014 .033 .046 .054 .063	ANG 83.0 76.1 71.1 65.0 62.7 58.8	MAG .966 .917 .856 .785 .711	ANG -9.2 -17.9 -25.0 -30.0 -34.8 -38.4
FREQUENCY f (MHz) 100.00 200.00 300.00 400.00 500.00 600.00 700.00	.854 .795 .724 .648 .569 .516	ANG -15.0 -29.7 -41.9 -53.1 -63.9 -72.9 -81.9	MAG 13.962 13.063 11.975 10.690 9.702 8.789 8.009	ANG 166.0 152.7 141.5 132.1 123.1 116.6 110.2	MAG .014 .033 .046 .054 .063 .070	ANG 83.0 76.1 71.1 65.0 62.7 58.8 55.8	MAG .966 .917 .856 .785 .711 .656	ANG -9.2 -17.9 -25.0 -30.0 -34.8 -38.4 -40.8
FREQUENCY f (MHz) 100.00 200.00 300.00 400.00 500.00 600.00 700.00 800.00	.854 .795 .724 .648 .569 .516 .457	ANG -15.0 -29.7 -41.9 -53.1 -63.9 -72.9 -81.9 -88.9	MAG 13.962 13.063 11.975 10.690 9.702 8.789 8.009 7.240	ANG 166.0 152.7 141.5 132.1 123.1 116.6 110.2 104.7	MAG .014 .033 .046 .054 .063 .070 .078	ANG 83.0 76.1 71.1 65.0 62.7 58.8 55.8 54.3	MAG .966 .917 .856 .785 .711 .656 .611	ANG -9.2 -17.9 -25.0 -30.0 -34.8 -38.4 -40.8 -44.1
FREQUENCY f (MHz) 100.00 200.00 300.00 400.00 500.00 600.00 700.00 800.00 900.00	.854 .795 .724 .648 .569 .516 .457 .411	ANG -15.0 -29.7 -41.9 -53.1 -63.9 -72.9 -81.9 -88.9 -96.5	MAG 13.962 13.063 11.975 10.690 9.702 8.789 8.009 7.240 6.634	ANG 166.0 152.7 141.5 132.1 123.1 116.6 110.2 104.7 100.2	MAG .014 .033 .046 .054 .063 .070 .078 .085	ANG 83.0 76.1 71.1 65.0 62.7 58.8 55.8 54.3 55.3	MAG .966 .917 .856 .785 .711 .656 .611 .562	ANG -9.2 -17.9 -25.0 -30.0 -34.8 -38.4 -40.8 -44.1 -45.7
FREQUENCY f (MHz) 100.00 200.00 300.00 400.00 500.00 600.00 700.00 800.00	.854 .795 .724 .648 .569 .516 .457 .411 .374	ANG -15.0 -29.7 -41.9 -53.1 -63.9 -72.9 -81.9 -88.9	MAG 13.962 13.063 11.975 10.690 9.702 8.789 8.009 7.240 6.634 6.145	ANG 166.0 152.7 141.5 132.1 123.1 116.6 110.2 104.7 100.2 95.6	MAG .014 .033 .046 .054 .063 .070 .078	ANG 83.0 76.1 71.1 65.0 62.7 58.8 55.8 54.3 55.3 52.9	MAG .966 .917 .856 .785 .711 .656 .611 .562 .525	ANG -9.2 -17.9 -25.0 -30.0 -34.8 -38.4 -40.8 -44.1 -45.7 -46.6
FREQUENCY f (MHz) 100.00 200.00 300.00 400.00 500.00 600.00 700.00 800.00 900.00	.854 .795 .724 .648 .569 .516 .457 .411	ANG -15.0 -29.7 -41.9 -53.1 -63.9 -72.9 -81.9 -88.9 -96.5	MAG 13.962 13.063 11.975 10.690 9.702 8.789 8.009 7.240 6.634	ANG 166.0 152.7 141.5 132.1 123.1 116.6 110.2 104.7 100.2	MAG .014 .033 .046 .054 .063 .070 .078 .085	ANG 83.0 76.1 71.1 65.0 62.7 58.8 55.8 54.3 55.3	MAG .966 .917 .856 .785 .711 .656 .611 .562	ANG -9.2 -17.9 -25.0 -30.0 -34.8 -38.4 -40.8 -44.1 -45.7
FREQUENCY f (MHz) 100.00 200.00 300.00 400.00 500.00 600.00 700.00 800.00 900.00 1000.00	.854 .795 .724 .648 .569 .516 .457 .411 .374 .331	ANG -15.0 -29.7 -41.9 -53.1 -63.9 -72.9 -81.9 -88.9 -96.5 -105.0 -111.5	MAG 13.962 13.063 11.975 10.690 9.702 8.789 8.009 7.240 6.634 6.145 5.664	ANG 166.0 152.7 141.5 132.1 123.1 116.6 110.2 104.7 100.2 95.6 91.9	MAG .014 .033 .046 .054 .063 .070 .078 .085 .094 .095	ANG 83.0 76.1 71.1 65.0 62.7 58.8 55.8 54.3 55.3 52.9 53.3	MAG .966 .917 .856 .785 .711 .656 .611 .562 .525 .500	ANG -9.2 -17.9 -25.0 -30.0 -34.8 -38.4 -40.8 -44.1 -45.7 -46.6 -48.0
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	.854 .795 .724 .648 .569 .516 .457 .411 .374 .331 .310	ANG -15.0 -29.7 -41.9 -53.1 -63.9 -72.9 -81.9 -88.9 -96.5 -105.0 -111.5 -118.1	MAG 13.962 13.063 11.975 10.690 9.702 8.789 8.009 7.240 6.634 6.145 5.664 5.207	ANG 166.0 152.7 141.5 132.1 123.1 116.6 110.2 104.7 100.2 95.6 91.9 88.1	MAG .014 .033 .046 .054 .063 .070 .078 .085 .094 .095 .102	ANG 83.0 76.1 71.1 65.0 62.7 58.8 55.8 55.3 55.3 52.9 53.3 50.6	MAG .966 .917 .856 .785 .711 .656 .611 .562 .525 .500 .468	ANG -9.2 -17.9 -25.0 -30.0 -34.8 -38.4 -40.8 -44.1 -45.7 -46.6 -48.0 -50.0
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	.854 .795 .724 .648 .569 .516 .457 .411 .374 .331 .310 .277	ANG -15.0 -29.7 -41.9 -53.1 -63.9 -72.9 -81.9 -88.9 -96.5 -105.0 -111.5 -118.1 -126.8	MAG 13.962 13.063 11.975 10.690 9.702 8.789 8.009 7.240 6.634 6.145 5.664 5.207 4.898	ANG 166.0 152.7 141.5 132.1 123.1 116.6 110.2 104.7 100.2 95.6 91.9 88.1 84.8	MAG .014 .033 .046 .054 .063 .070 .078 .085 .094 .095 .102 .108	ANG 83.0 76.1 71.1 65.0 62.7 58.8 55.8 54.3 55.3 52.9 53.3 50.6 51.5	MAG .966 .917 .856 .785 .711 .656 .611 .562 .525 .500 .468 .453 .425	ANG -9.2 -17.9 -25.0 -30.0 -34.8 -38.4 -40.8 -44.1 -45.7 -46.6 -48.0 -50.0 -51.2
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	.854 .795 .724 .648 .569 .516 .457 .411 .374 .331 .310 .277 .260 .249	ANG -15.0 -29.7 -41.9 -53.1 -63.9 -72.9 -81.9 -88.9 -96.5 -105.0 -111.5 -118.1 -126.8 -134.2	MAG 13.962 13.063 11.975 10.690 9.702 8.789 8.009 7.240 6.634 6.145 5.664 5.207 4.898 4.595	ANG 166.0 152.7 141.5 132.1 123.1 116.6 110.2 104.7 100.2 95.6 91.9 88.1 84.8 81.6	MAG .014 .033 .046 .054 .063 .070 .078 .085 .094 .095 .102 .108 .112	ANG 83.0 76.1 71.1 65.0 62.7 58.8 55.8 54.3 55.3 52.9 53.3 50.6 51.5 52.3	MAG .966 .917 .856 .785 .711 .656 .611 .562 .525 .500 .468 .453 .425	ANG -9.2 -17.9 -25.0 -30.0 -34.8 -38.4 -40.8 -44.1 -45.7 -46.6 -48.0 -50.0 -51.2 -52.6
FREQUENCY f (MHz) 100.00 200.00 300.00 400.00 500.00 600.00 700.00 800.00 900.00 11000.00 1100.00 1200.00 1300.00 1400.00 1500.00	.854 .795 .724 .648 .569 .516 .457 .411 .374 .331 .310 .277 .260 .249	ANG -15.0 -29.7 -41.9 -53.1 -63.9 -72.9 -81.9 -88.9 -96.5 -105.0 -111.5 -118.1 -126.8 -134.2 -143.5	MAG 13.962 13.063 11.975 10.690 9.702 8.789 8.009 7.240 6.634 6.145 5.664 5.207 4.898 4.595 4.329	ANG 166.0 152.7 141.5 132.1 123.1 116.6 110.2 104.7 100.2 95.6 91.9 88.1 84.8 81.6 78.3	MAG .014 .033 .046 .054 .063 .070 .078 .085 .094 .095 .102 .108 .112 .119	ANG 83.0 76.1 71.1 65.0 62.7 58.8 55.8 54.3 55.3 52.9 53.3 50.6 51.5 52.3 50.2	MAG .966 .917 .856 .785 .711 .656 .611 .562 .525 .500 .468 .453 .425 .411	ANG -9.2 -17.9 -25.0 -30.0 -34.8 -38.4 -40.8 -44.1 -45.7 -46.6 -48.0 -50.0 -51.2 -52.6 -54.8
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	.854 .795 .724 .648 .569 .516 .457 .411 .374 .331 .310 .277 .260 .249	ANG -15.0 -29.7 -41.9 -53.1 -63.9 -72.9 -81.9 -88.9 -96.5 -105.0 -111.5 -118.1 -126.8 -134.2	MAG 13.962 13.063 11.975 10.690 9.702 8.789 8.009 7.240 6.634 6.145 5.664 5.207 4.898 4.595	ANG 166.0 152.7 141.5 132.1 123.1 116.6 110.2 104.7 100.2 95.6 91.9 88.1 84.8 81.6	MAG .014 .033 .046 .054 .063 .070 .078 .085 .094 .095 .102 .108 .112 .119	ANG 83.0 76.1 71.1 65.0 62.7 58.8 55.8 54.3 55.3 52.9 53.3 50.6 51.5 52.3	MAG .966 .917 .856 .785 .711 .656 .611 .562 .525 .500 .468 .453 .425 .411	ANG -9.2 -17.9 -25.0 -30.0 -34.8 -38.4 -40.8 -44.1 -45.7 -46.6 -48.0 -50.0 -51.2 -52.6
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	.854 .795 .724 .648 .569 .516 .457 .411 .374 .331 .310 .277 .260 .249 .232	ANG -15.0 -29.7 -41.9 -53.1 -63.9 -72.9 -81.9 -88.9 -96.5 -105.0 -111.5 -118.1 -126.8 -134.2 -143.5 -150.4	MAG 13.962 13.063 11.975 10.690 9.702 8.789 8.009 7.240 6.634 6.145 5.664 5.207 4.898 4.595 4.329 4.085	ANG 166.0 152.7 141.5 132.1 123.1 116.6 110.2 104.7 100.2 95.6 91.9 88.1 84.8 81.6 78.3 75.4	MAG .014 .033 .046 .054 .063 .070 .078 .085 .094 .095 .102 .108 .112 .119 .121	ANG 83.0 76.1 71.1 65.0 62.7 58.8 55.8 54.3 55.3 52.9 53.3 50.6 51.5 52.3 50.2 48.7	MAG .966 .917 .856 .785 .711 .656 .611 .562 .525 .500 .468 .453 .425 .411	ANG -9.2 -17.9 -25.0 -30.0 -34.8 -38.4 -40.8 -44.1 -45.7 -46.6 -48.0 -50.0 -51.2 -52.6 -54.8 -55.2
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 1400.00 1500.00 1600.00 1700.00	.854 .795 .724 .648 .569 .516 .457 .411 .374 .331 .310 .277 .260 .249 .232 .232	ANG -15.0 -29.7 -41.9 -53.1 -63.9 -72.9 -81.9 -88.9 -96.5 -105.0 -111.5 -118.1 -126.8 -134.2 -143.5 -150.4 -158.5	MAG 13.962 13.063 11.975 10.690 9.702 8.789 8.009 7.240 6.634 6.145 5.664 5.207 4.898 4.595 4.329 4.085 3.892	ANG 166.0 152.7 141.5 132.1 123.1 116.6 110.2 104.7 100.2 95.6 91.9 88.1 84.8 81.6 78.3 75.4 72.7	MAG .014 .033 .046 .054 .063 .070 .078 .085 .094 .095 .102 .108 .112 .119 .121 .133 .134	ANG 83.0 76.1 71.1 65.0 62.7 58.8 55.8 54.3 55.3 52.9 53.3 50.6 51.5 52.3 50.2 48.7 46.4	MAG .966 .917 .856 .785 .711 .656 .611 .562 .525 .500 .468 .453 .425 .411 .386 .378	ANG -9.2 -17.9 -25.0 -30.0 -34.8 -38.4 -40.8 -44.1 -45.7 -46.6 -48.0 -50.0 -51.2 -52.6 -54.8 -55.2 -57.5
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	.854 .795 .724 .648 .569 .516 .457 .411 .374 .331 .277 .260 .249 .232 .232 .234	ANG -15.0 -29.7 -41.9 -53.1 -63.9 -72.9 -81.9 -88.9 -96.5 -105.0 -111.5 -118.1 -126.8 -134.2 -143.5 -150.4 -158.5 -164.6	MAG 13.962 13.063 11.975 10.690 9.702 8.789 8.009 7.240 6.634 6.145 5.664 5.207 4.898 4.595 4.329 4.085 3.892 3.678	ANG 166.0 152.7 141.5 132.1 123.1 116.6 110.2 104.7 100.2 95.6 91.9 88.1 84.8 81.6 78.3 75.4 72.7 69.8	MAG .014 .033 .046 .054 .063 .070 .078 .085 .094 .095 .102 .108 .112 .119 .121 .133 .134 .140	ANG 83.0 76.1 71.1 65.0 62.7 58.8 55.8 54.3 55.3 52.9 53.3 50.6 51.5 52.3 50.2 48.7 46.4 47.9	MAG .966 .917 .856 .785 .711 .656 .611 .562 .525 .500 .468 .453 .425 .411 .386 .378	ANG -9.2 -17.9 -25.0 -30.0 -34.8 -38.4 -40.8 -44.1 -45.7 -46.6 -48.0 -50.0 -51.2 -52.6 -54.8 -55.2 -57.5 -58.6
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 1800.00	.854 .795 .724 .648 .569 .516 .457 .411 .374 .331 .310 .277 .260 .249 .232 .232 .234 .216	ANG -15.0 -29.7 -41.9 -53.1 -63.9 -72.9 -81.9 -88.9 -96.5 -105.0 -111.5 -118.1 -126.8 -134.2 -143.5 -150.4 -158.5 -164.6 -171.3	MAG 13.962 13.063 11.975 10.690 9.702 8.789 8.009 7.240 6.634 6.145 5.664 5.207 4.898 4.595 4.329 4.085 3.892 3.678 3.514	ANG 166.0 152.7 141.5 132.1 123.1 116.6 110.2 104.7 100.2 95.6 91.9 88.1 84.8 81.6 78.3 75.4 72.7 69.8 67.6	MAG .014 .033 .046 .054 .063 .070 .078 .085 .094 .095 .102 .108 .112 .119 .121 .133 .134 .140 .145	ANG 83.0 76.1 71.1 65.0 62.7 58.8 55.8 54.3 55.3 52.9 53.3 50.6 51.5 52.3 50.2 48.7 46.4 47.9 45.5	MAG .966 .917 .856 .785 .711 .656 .611 .562 .525 .500 .468 .453 .425 .411 .386 .378 .360 .359	ANG -9.2 -17.9 -25.0 -30.0 -34.8 -38.4 -40.8 -44.1 -45.7 -46.6 -48.0 -50.0 -51.2 -52.6 -54.8 -55.2 -57.5 -58.6 -60.4
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 1800.00 1900.00	.854 .795 .724 .648 .569 .516 .457 .411 .374 .331 .310 .277 .260 .249 .232 .232 .234 .216 .211	ANG -15.0 -29.7 -41.9 -53.1 -63.9 -72.9 -81.9 -88.9 -96.5 -105.0 -111.5 -118.1 -126.8 -134.2 -143.5 -150.4 -158.5 -164.6 -171.3 -176.6	MAG 13.962 13.063 11.975 10.690 9.702 8.789 8.009 7.240 6.634 6.145 5.664 5.207 4.898 4.595 4.329 4.085 3.892 3.678 3.514 3.368	ANG 166.0 152.7 141.5 132.1 123.1 116.6 110.2 104.7 100.2 95.6 91.9 88.1 84.8 81.6 78.3 75.4 72.7 69.8 67.6 64.5	MAG .014 .033 .046 .054 .063 .070 .078 .085 .094 .095 .102 .108 .112 .119 .121 .133 .134 .140 .145 .151	ANG 83.0 76.1 71.1 65.0 62.7 58.8 55.8 54.3 55.3 52.9 53.3 50.6 51.5 52.3 50.2 48.7 46.4 47.9 45.5 46.0	MAG .966 .917 .856 .785 .711 .656 .611 .562 .525 .500 .468 .453 .425 .411 .386 .378 .360 .359 .343	ANG -9.2 -17.9 -25.0 -30.0 -34.8 -38.4 -40.8 -44.1 -45.7 -46.6 -48.0 -50.0 -51.2 -52.6 -54.8 -55.2 -57.5 -58.6 -60.4 -63.1
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 1800.00	.854 .795 .724 .648 .569 .516 .457 .411 .374 .331 .310 .277 .260 .249 .232 .232 .234 .216	ANG -15.0 -29.7 -41.9 -53.1 -63.9 -72.9 -81.9 -88.9 -96.5 -105.0 -111.5 -118.1 -126.8 -134.2 -143.5 -150.4 -158.5 -164.6 -171.3	MAG 13.962 13.063 11.975 10.690 9.702 8.789 8.009 7.240 6.634 6.145 5.664 5.207 4.898 4.595 4.329 4.085 3.892 3.678 3.514 3.368 3.207	ANG 166.0 152.7 141.5 132.1 123.1 116.6 110.2 104.7 100.2 95.6 91.9 88.1 84.8 81.6 78.3 75.4 72.7 69.8 67.6	MAG .014 .033 .046 .054 .063 .070 .078 .085 .094 .095 .102 .108 .112 .119 .121 .133 .134 .140 .145	ANG 83.0 76.1 71.1 65.0 62.7 58.8 55.8 54.3 55.3 52.9 53.3 50.6 51.5 52.3 50.2 48.7 46.4 47.9 45.5	MAG .966 .917 .856 .785 .711 .656 .611 .562 .525 .500 .468 .453 .425 .411 .386 .378 .360 .359	ANG -9.2 -17.9 -25.0 -30.0 -34.8 -38.4 -40.8 -44.1 -45.7 -46.6 -48.0 -50.0 -51.2 -52.6 -54.8 -55.2 -57.5 -58.6 -60.4
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 1900.00 2000.00	.854 .795 .724 .648 .569 .516 .457 .411 .374 .331 .310 .277 .260 .249 .232 .232 .234 .216 .211 .230	ANG -15.0 -29.7 -41.9 -53.1 -63.9 -72.9 -81.9 -88.9 -96.5 -105.0 -111.5 -118.1 -126.8 -134.2 -143.5 -150.4 -158.5 -164.6 -171.3 -176.6 174.1	MAG 13.962 13.063 11.975 10.690 9.702 8.789 8.009 7.240 6.634 6.145 5.664 5.207 4.898 4.595 4.329 4.085 3.892 3.678 3.514 3.368 3.207	ANG 166.0 152.7 141.5 132.1 123.1 116.6 110.2 104.7 100.2 95.6 91.9 88.1 84.8 81.6 78.3 75.4 72.7 69.8 67.6 64.5 62.2	MAG .014 .033 .046 .054 .063 .070 .078 .085 .094 .095 .102 .108 .112 .119 .121 .133 .134 .140 .145 .151	ANG 83.0 76.1 71.1 65.0 62.7 58.8 55.8 54.3 55.3 52.9 53.3 50.6 51.5 52.3 50.2 48.7 46.4 47.9 45.5 46.0 46.4	MAG .966 .917 .856 .785 .711 .656 .611 .562 .525 .500 .468 .453 .425 .411 .386 .378 .360 .359 .343	ANG -9.2 -17.9 -25.0 -30.0 -34.8 -38.4 -40.8 -44.1 -45.7 -46.6 -48.0 -50.0 -51.2 -52.6 -54.8 -55.2 -57.5 -58.6 -60.4 -63.1 -64.7
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	.854 .795 .724 .648 .569 .516 .457 .411 .374 .331 .310 .277 .260 .249 .232 .232 .234 .216 .211 .230 .224	ANG -15.0 -29.7 -41.9 -53.1 -63.9 -72.9 -81.9 -88.9 -96.5 -105.0 -111.5 -118.1 -126.8 -134.2 -143.5 -150.4 -158.5 -164.6 -171.3 -176.6 174.1 168.9	MAG 13.962 13.063 11.975 10.690 9.702 8.789 8.009 7.240 6.634 6.145 5.664 5.207 4.898 4.595 4.329 4.085 3.892 3.678 3.514 3.368 3.207 3.064	ANG 166.0 152.7 141.5 132.1 123.1 116.6 110.2 104.7 100.2 95.6 91.9 88.1 84.8 81.6 78.3 75.4 72.7 69.8 67.6 64.5 62.2 59.2	MAG .014 .033 .046 .054 .063 .070 .078 .085 .094 .095 .102 .108 .112 .119 .121 .133 .134 .140 .145 .151 .161	ANG 83.0 76.1 71.1 65.0 62.7 58.8 55.8 54.3 55.3 52.9 53.3 50.6 51.5 52.3 50.2 48.7 46.4 47.9 45.5 46.0 46.4 45.9	MAG .966 .917 .856 .785 .711 .656 .611 .562 .525 .500 .468 .453 .425 .411 .386 .378 .360 .359 .343 .336 .319	ANG -9.2 -17.9 -25.0 -30.0 -34.8 -38.4 -40.8 -44.1 -45.7 -46.6 -48.0 -50.0 -51.2 -52.6 -54.8 -55.2 -57.5 -58.6 -60.4 -63.1 -64.7 -66.7
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	.854 .795 .724 .648 .569 .516 .457 .411 .374 .331 .277 .260 .249 .232 .232 .234 .216 .211 .230 .224 .227	ANG -15.0 -29.7 -41.9 -53.1 -63.9 -72.9 -81.9 -88.9 -96.5 -105.0 -111.5 -118.1 -126.8 -134.2 -143.5 -150.4 -158.5 -164.6 -171.3 -176.6 174.1 168.9 165.3	MAG 13.962 13.063 11.975 10.690 9.702 8.789 8.009 7.240 6.634 6.145 5.664 5.207 4.898 4.595 4.329 4.085 3.892 3.678 3.514 3.368 3.207 3.064 2.942	ANG 166.0 152.7 141.5 132.1 123.1 116.6 110.2 104.7 100.2 95.6 91.9 88.1 84.8 81.6 78.3 75.4 72.7 69.8 67.6 64.5 62.2 59.2 57.3	MAG .014 .033 .046 .054 .063 .070 .078 .085 .094 .095 .102 .108 .112 .119 .121 .133 .134 .140 .145 .151 .161 .166 .168	ANG 83.0 76.1 71.1 65.0 62.7 58.8 55.8 54.3 55.3 52.9 53.3 50.6 51.5 52.3 50.2 48.7 46.4 47.9 45.5 46.0 46.4 45.9 44.3	MAG .966 .917 .856 .785 .711 .656 .611 .562 .525 .500 .468 .453 .425 .411 .386 .378 .360 .359 .343 .336 .319 .317	ANG -9.2 -17.9 -25.0 -30.0 -34.8 -38.4 -40.8 -44.1 -45.7 -46.6 -50.0 -51.2 -52.6 -54.8 -55.2 -57.5 -58.6 -60.4 -63.1 -64.7 -66.7 -67.4
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 1700.00 1800.00 1900.00 2100.00 2200.00 2300.00 2400.00	.854 .795 .724 .648 .569 .516 .457 .411 .374 .331 .277 .260 .249 .232 .232 .234 .216 .211 .230 .224 .227 .229	ANG -15.0 -29.7 -41.9 -53.1 -63.9 -72.9 -81.9 -88.9 -96.5 -105.0 -111.5 -118.1 -126.8 -134.2 -143.5 -150.4 -158.5 -164.6 -171.3 -176.6 174.1 168.9 165.3 158.8	MAG 13.962 13.063 11.975 10.690 9.702 8.789 8.009 7.240 6.634 6.145 5.664 5.207 4.898 4.595 4.329 4.085 3.892 3.678 3.514 3.368 3.207 3.064 2.942 2.838	ANG 166.0 152.7 141.5 132.1 123.1 116.6 110.2 104.7 100.2 95.6 91.9 88.1 84.8 81.6 78.3 75.4 72.7 69.8 67.6 64.5 62.2 59.2 57.3 55.3	MAG .014 .033 .046 .054 .063 .070 .078 .085 .094 .095 .102 .108 .112 .119 .121 .133 .134 .140 .145 .151 .161 .166 .168 .174	ANG 83.0 76.1 71.1 65.0 62.7 58.8 55.8 55.3 52.9 53.3 50.6 51.5 52.3 50.2 48.7 46.4 47.9 45.5 46.0 46.4 45.9 44.3	MAG .966 .917 .856 .785 .711 .656 .611 .562 .525 .500 .468 .453 .425 .411 .386 .378 .360 .359 .343 .336 .319 .317	ANG -9.2 -17.9 -25.0 -30.0 -34.8 -38.4 -40.8 -44.1 -45.7 -46.6 -50.0 -51.2 -52.6 -54.8 -55.2 -57.5 -58.6 -60.4 -63.1 -64.7 -66.7 -67.4 -68.4
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 2100.00 2200.00 2300.00 2400.00 2500.00	.854 .795 .724 .648 .569 .516 .457 .411 .374 .331 .277 .260 .249 .232 .232 .234 .216 .211 .230 .224 .227 .229 .230	ANG -15.0 -29.7 -41.9 -53.1 -63.9 -72.9 -81.9 -88.9 -96.5 -105.0 -111.5 -118.1 -126.8 -134.2 -143.5 -150.4 -158.5 -164.6 -171.3 -176.6 174.1 168.9 165.3 158.8	MAG 13.962 13.063 11.975 10.690 9.702 8.789 8.009 7.240 6.634 6.145 5.664 5.207 4.898 4.595 4.329 4.085 3.892 3.678 3.514 3.368 3.207 3.064 2.942 2.838 2.742	ANG 166.0 152.7 141.5 132.1 123.1 116.6 110.2 104.7 100.2 95.6 91.9 88.1 84.8 81.6 78.3 75.4 72.7 69.8 67.6 64.5 62.2 59.2 57.3 55.3 52.5	MAG .014 .033 .046 .054 .063 .070 .078 .085 .094 .095 .102 .108 .112 .119 .121 .133 .134 .140 .145 .151 .161 .166 .168 .174 .181	ANG 83.0 76.1 71.1 65.0 62.7 58.8 55.8 55.3 52.9 53.3 50.6 51.5 52.3 50.2 48.7 46.4 47.9 45.5 46.0 46.4 45.9 44.3 44.3	MAG .966 .917 .856 .785 .711 .656 .611 .562 .525 .500 .468 .453 .425 .411 .386 .378 .360 .359 .343 .336 .319 .317 .314 .291 .290	ANG -9.2 -17.9 -25.0 -30.0 -34.8 -38.4 -40.8 -44.1 -45.7 -46.6 -48.0 -50.0 -51.2 -52.6 -54.8 -55.2 -57.5 -58.6 -60.4 -63.1 -64.7 -66.7 -66.7 -66.4 -71.4
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 1700.00 1800.00 1900.00 2100.00 2200.00 2300.00 2400.00	.854 .795 .724 .648 .569 .516 .457 .411 .374 .331 .277 .260 .249 .232 .232 .234 .216 .211 .230 .224 .227 .229	ANG -15.0 -29.7 -41.9 -53.1 -63.9 -72.9 -81.9 -88.9 -96.5 -105.0 -111.5 -118.1 -126.8 -134.2 -143.5 -150.4 -158.5 -164.6 -171.3 -176.6 174.1 168.9 165.3 158.8	MAG 13.962 13.063 11.975 10.690 9.702 8.789 8.009 7.240 6.634 6.145 5.664 5.207 4.898 4.595 4.329 4.085 3.892 3.678 3.514 3.368 3.207 3.064 2.942 2.838	ANG 166.0 152.7 141.5 132.1 123.1 116.6 110.2 104.7 100.2 95.6 91.9 88.1 84.8 81.6 78.3 75.4 72.7 69.8 67.6 64.5 62.2 59.2 57.3 55.3	MAG .014 .033 .046 .054 .063 .070 .078 .085 .094 .095 .102 .108 .112 .119 .121 .133 .134 .140 .145 .151 .161 .166 .168 .174	ANG 83.0 76.1 71.1 65.0 62.7 58.8 55.8 55.3 52.9 53.3 50.6 51.5 52.3 50.2 48.7 46.4 47.9 45.5 46.0 46.4 45.9 44.3	MAG .966 .917 .856 .785 .711 .656 .611 .562 .525 .500 .468 .453 .425 .411 .386 .378 .360 .359 .343 .336 .319 .317	ANG -9.2 -17.9 -25.0 -30.0 -34.8 -38.4 -40.8 -44.1 -45.7 -46.6 -50.0 -51.2 -52.6 -54.8 -55.2 -57.5 -58.6 -60.4 -63.1 -64.7 -66.7 -67.4 -68.4
FREQUENCY f (MHz) 100.00 200.00 300.00 400.00 500.00 600.00 700.00 800.00 1100.00 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	.854 .795 .724 .648 .569 .516 .457 .411 .374 .331 .277 .260 .249 .232 .232 .234 .216 .211 .230 .224 .227 .229 .230 .253 .250	ANG -15.0 -29.7 -41.9 -53.1 -63.9 -72.9 -81.9 -88.9 -96.5 -105.0 -111.5 -118.1 -126.8 -134.2 -143.5 -150.4 -158.5 -164.6 -171.3 -176.6 174.1 168.9 165.3 158.8 156.1	MAG 13.962 13.063 11.975 10.690 9.702 8.789 8.009 7.240 6.634 6.145 5.664 5.207 4.898 4.595 4.329 4.085 3.892 3.678 3.514 3.368 3.207 3.064 2.942 2.838 2.742 2.656	ANG 166.0 152.7 141.5 132.1 123.1 116.6 110.2 104.7 100.2 95.6 91.9 88.1 84.8 81.6 78.3 75.4 72.7 69.8 67.6 64.5 62.2 59.2 57.3 55.3 52.5 50.7	MAG .014 .033 .046 .054 .063 .070 .078 .085 .094 .095 .102 .108 .112 .119 .121 .133 .134 .140 .145 .151 .161 .166 .168 .174 .181 .184	ANG 83.0 76.1 71.1 65.0 62.7 58.8 55.8 54.3 55.3 52.9 53.3 50.6 51.5 52.3 50.2 48.7 46.4 47.9 45.5 46.0 46.4 45.9 44.3 44.3 44.3	MAG .966 .917 .856 .785 .711 .656 .611 .562 .525 .500 .468 .453 .425 .411 .386 .378 .360 .359 .343 .336 .319 .317 .314 .291 .290 .289	ANG -9.2 -17.9 -25.0 -30.0 -34.8 -38.4 -40.8 -44.1 -45.7 -46.6 -48.0 -50.0 -51.2 -52.6 -54.8 -55.2 -57.5 -58.6 -60.4 -63.1 -64.7 -66.7 -67.4 -68.4 -71.4 -69.8
FREQUENCY f (MHz) 100.00 200.00 300.00 400.00 500.00 600.00 700.00 800.00 1100.00 1100.00 1200.00 1300.00 1400.00 1500.00 1600.00 1700.00 1800.00 1200.00 2000.00 2100.00 2200.00 2300.00 2400.00 2500.00 2600.00 2700.00	.854 .795 .724 .648 .569 .516 .457 .411 .374 .331 .277 .260 .249 .232 .232 .234 .216 .211 .230 .224 .227 .229 .230 .253 .250 .248	ANG -15.0 -29.7 -41.9 -53.1 -63.9 -72.9 -81.9 -88.9 -96.5 -105.0 -111.5 -118.1 -126.8 -134.2 -143.5 -150.4 -158.5 -164.6 -171.3 -176.6 174.1 168.9 165.3 158.8 156.1 150.1	MAG 13.962 13.063 11.975 10.690 9.702 8.789 8.009 7.240 6.634 6.145 5.664 5.207 4.898 4.595 4.329 4.085 3.892 3.678 3.514 3.368 3.207 3.064 2.942 2.838 2.742 2.656 2.558	ANG 166.0 152.7 141.5 132.1 123.1 116.6 110.2 104.7 100.2 95.6 91.9 88.1 84.8 81.6 78.3 75.4 72.7 69.8 67.6 64.5 62.2 59.2 57.3 55.3 52.5 50.7 49.0	MAG .014 .033 .046 .054 .063 .070 .078 .085 .094 .095 .102 .108 .112 .119 .121 .133 .134 .140 .145 .151 .161 .166 .168 .174 .181 .184 .189	ANG 83.0 76.1 71.1 65.0 62.7 58.8 55.8 54.3 55.3 52.9 53.3 50.6 51.5 52.3 50.2 48.7 46.4 47.9 45.5 46.0 46.4 45.9 44.3 44.3 44.3 42.8 44.0 43.8	MAG .966 .917 .856 .785 .711 .656 .611 .562 .525 .500 .468 .453 .425 .411 .386 .378 .360 .359 .343 .336 .319 .317 .314 .291 .290 .289 .281	ANG -9.2 -17.9 -25.0 -30.0 -34.8 -38.4 -40.8 -44.1 -45.7 -46.6 -48.0 -50.0 -51.2 -52.6 -54.8 -55.2 -57.5 -58.6 -60.4 -63.1 -64.7 -66.7 -67.4 -68.4 -71.4 -69.8 -74.2
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 1700.00 1800.00 1900.00 2000.00 2100.00 2200.00 2300.00 2400.00 2500.00 2600.00 2700.00 2800.00	.854 .795 .724 .648 .569 .516 .457 .411 .374 .331 .277 .260 .249 .232 .232 .234 .216 .211 .230 .224 .227 .229 .230 .253 .250 .248	ANG -15.0 -29.7 -41.9 -53.1 -63.9 -72.9 -81.9 -88.9 -96.5 -105.0 -111.5 -118.1 -126.8 -134.2 -143.5 -150.4 -158.5 -164.6 -171.3 -176.6 174.1 168.9 165.3 158.8 156.1 150.1 149.2 145.7	MAG 13.962 13.063 11.975 10.690 9.702 8.789 8.009 7.240 6.634 6.145 5.664 5.207 4.898 4.595 4.329 4.085 3.892 3.678 3.514 3.368 3.207 3.064 2.942 2.838 2.742 2.656 2.558 2.484	ANG 166.0 152.7 141.5 132.1 123.1 116.6 110.2 104.7 100.2 95.6 91.9 88.1 84.8 81.6 78.3 75.4 72.7 69.8 67.6 64.5 62.2 59.2 57.3 55.3 55.5 50.7 49.0 45.9	MAG .014 .033 .046 .054 .063 .070 .078 .085 .094 .095 .102 .108 .112 .119 .121 .133 .134 .140 .145 .151 .166 .168 .174 .181 .184 .189 .195	ANG 83.0 76.1 71.1 65.0 62.7 58.8 55.8 54.3 55.3 52.9 53.3 50.6 51.5 52.3 50.2 48.7 46.4 47.9 45.5 46.0 46.4 45.9 44.3 44.3 44.3 42.8 44.0 43.8 40.9	MAG .966 .917 .856 .785 .711 .656 .611 .562 .525 .500 .468 .453 .425 .411 .386 .378 .360 .359 .343 .336 .319 .317 .314 .291 .290 .289 .281 .283	ANG -9.2 -17.9 -25.0 -30.0 -34.8 -38.4 -40.8 -44.1 -45.7 -46.6 -48.0 -50.0 -51.2 -52.6 -54.8 -55.2 -57.5 -58.6 -60.4 -63.1 -64.7 -66.7 -67.4 -68.4 -71.4 -69.8 -74.2 -77.3
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 2900.00	.854 .795 .724 .648 .569 .516 .457 .411 .374 .331 .277 .260 .249 .232 .232 .234 .216 .211 .230 .224 .227 .229 .230 .253 .250 .248 .254 .262	ANG -15.0 -29.7 -41.9 -53.1 -63.9 -72.9 -81.9 -88.9 -96.5 -105.0 -111.5 -118.1 -126.8 -134.2 -143.5 -150.4 -158.5 -164.6 -171.3 -176.6 174.1 168.9 165.3 158.8 156.1 149.2 145.7 143.7	MAG 13.962 13.063 11.975 10.690 9.702 8.789 8.009 7.240 6.634 6.145 5.664 5.207 4.898 4.595 4.329 4.085 3.892 3.678 3.514 3.368 3.207 3.064 2.942 2.838 2.742 2.656 2.558 2.484 2.405	ANG 166.0 152.7 141.5 132.1 123.1 116.6 110.2 104.7 100.2 95.6 91.9 88.1 84.8 81.6 78.3 75.4 72.7 69.8 67.6 64.5 62.2 59.2 57.3 55.3 52.5 50.7 49.0 45.9 44.2	MAG .014 .033 .046 .054 .063 .070 .078 .085 .094 .095 .102 .108 .112 .119 .121 .133 .134 .140 .145 .151 .161 .166 .168 .174 .181 .184 .189 .195 .203	ANG 83.0 76.1 71.1 65.0 62.7 58.8 55.8 54.3 55.3 52.9 53.3 50.6 51.5 52.3 50.2 48.7 46.4 47.9 45.5 46.0 46.4 45.9 44.3 44.3 44.3 42.8 44.0 43.8 40.9 39.8	MAG .966 .917 .856 .785 .711 .656 .611 .562 .525 .500 .468 .453 .425 .411 .386 .378 .360 .359 .343 .336 .319 .317 .314 .291 .290 .289 .281 .283 .276	ANG -9.2 -17.9 -25.0 -30.0 -34.8 -38.4 -40.8 -44.1 -45.7 -46.6 -48.0 -50.0 -51.2 -52.6 -54.8 -55.2 -57.5 -58.6 -60.4 -63.1 -64.7 -66.7 -67.4 -68.4 -71.4 -69.8 -74.2 -77.3 -77.7
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 2800.00	.854 .795 .724 .648 .569 .516 .457 .411 .374 .331 .277 .260 .249 .232 .232 .234 .216 .211 .230 .224 .227 .229 .230 .253 .250 .248	ANG -15.0 -29.7 -41.9 -53.1 -63.9 -72.9 -81.9 -88.9 -96.5 -105.0 -111.5 -118.1 -126.8 -134.2 -143.5 -150.4 -158.5 -164.6 -171.3 -176.6 174.1 168.9 165.3 158.8 156.1 150.1 149.2 145.7	MAG 13.962 13.063 11.975 10.690 9.702 8.789 8.009 7.240 6.634 6.145 5.664 5.207 4.898 4.595 4.329 4.085 3.892 3.678 3.514 3.368 3.207 3.064 2.942 2.838 2.742 2.656 2.558 2.484	ANG 166.0 152.7 141.5 132.1 123.1 116.6 110.2 104.7 100.2 95.6 91.9 88.1 84.8 81.6 78.3 75.4 72.7 69.8 67.6 64.5 62.2 59.2 57.3 55.3 55.5 50.7 49.0 45.9	MAG .014 .033 .046 .054 .063 .070 .078 .085 .094 .095 .102 .108 .112 .119 .121 .133 .134 .140 .145 .151 .166 .168 .174 .181 .184 .189 .195	ANG 83.0 76.1 71.1 65.0 62.7 58.8 55.8 54.3 55.3 52.9 53.3 50.6 51.5 52.3 50.2 48.7 46.4 47.9 45.5 46.0 46.4 45.9 44.3 44.3 44.3 42.8 44.0 43.8 40.9	MAG .966 .917 .856 .785 .711 .656 .611 .562 .525 .500 .468 .453 .425 .411 .386 .378 .360 .359 .343 .336 .319 .317 .314 .291 .290 .289 .281 .283	ANG -9.2 -17.9 -25.0 -30.0 -34.8 -38.4 -40.8 -44.1 -45.7 -46.6 -48.0 -50.0 -51.2 -52.6 -54.8 -55.2 -57.5 -58.6 -60.4 -63.1 -64.7 -66.7 -67.4 -68.4 -71.4 -69.8 -74.2 -77.3



S-PARAMETER

VcE = 3 V, Ic = 3 mA	1							
FREQUENCY		S ₁₁	Sa	21	S	12	S	22
f (MHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100.00	.908	-11.7	9.519	169.3	.020	77.7	.984	-7.3
200.00	.872	-22.9	9.147	158.9	.036	74.3	.951	-13.7
300.00 400.00	.825 .767	–33.1 –42.7	8.721 8.085	149.4 141.0	.050 .061	68.7 66.4	.920 .866	-19.7 -24.9
500.00	.701	-52.2	7.623	132.2	.073	61.0	.813	-30.0
600.00	.656	-61.0	7.104	125.7	.082	57.4	.764	-33.9
700.00	.598	-69.4	6.670	119.0	.088	54.9	.721	-37.3
800.00	.551	-76.2	6.145	113.1	.097	52.4	.671	-41.2
900.00	.494	-84.0	5.719	108.0	.101	51.7	.631	-42.9
1000.00	.458	-90.7	5.371	102.9	.111	49.3	.602	-45.0
1100.00	.422	-97.4	5.005	98.6	.117	47.6	.570	-47.0 40.4
1200.00 1300.00	.388 .356	-104.1 -110.7	4.642 4.396	94.3 90.5	.118 .124	46.3 45.3	.538 .512	-49.4 -51.3
1400.00	.341	-110.7 -117.6	4.148	86.8	.124	42.6	.491	-51.3 -52.7
1500.00	.318	-124.9	3.933	83.0	.135	44.0	.463	-55.2
1600.00	.305	-132.3	3.713	79.8	.140	43.7	.445	-56.4
1700.00	.291	-140.3	3.563	77.0	.141	42.0	.430	-57.1
1800.00	.282	-145.0	3.382	73.6	.149	42.2	.424	-59.1
1900.00	.269	-151.9	3.234	71.2	.149	41.8	.413	-60.7
2000.00	.277	-160.1	3.108	67.7	.155	41.4	.401	-64.2
2100.00 2200.00	.262 .255	-167.5 -172.8	2.956 2.838	65.1 61.9	.162 .169	40.4 38.9	.386 .377	-65.3 -66.8
2300.00	.260	-172.6 -177.4	2.722	60.0	.169	38.1	.373	-68.2
2400.00	.249	175.5	2.635	57.5	.173	37.9	.352	-68.1
2500.00	.266	171.8	2.553	54.5	.182	38.2	.351	-71.9
2600.00	.263	164.2	2.459	52.0	.183	36.7	.347	-70.9
2700.00	.270	164.0	2.383	50.6	.192	36.7	.341	-75.1
2800.00	.272	159.9	2.323	47.5	.195	36.4	.337	-79.8
2900.00 3000.00	.278 .272	155.5 150.5	2.241 2.147	45.6 42.7	.193 .200	34.5 35.0	.316 .324	-78.4 -82.3
3000.00	.212	150.5	2.147	42.7	.200	33.0	.524	-02.3
Vo= - 3 V Io - 1 mΔ								
VCE = 3 V, IC = 1 mA		٥.,	9.		c	40	9	· no
FREQUENCY	9	S11 ANG	S2 MAG			12 ANG		S ₂₂
FREQUENCY f (MHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
FREQUENCY	9	ANG -6.3 -13.5						
FREQUENCY f (MHz) 100.00 200.00 300.00	MAG .973 .959 .947	ANG -6.3 -13.5 -19.7	MAG 3.521 3.484 3.458	ANG 173.9 167.3 161.2	MAG .015 .033 .055	ANG 82.1 83.0 79.6	MAG .991 .985 .981	ANG -3.5 -7.6 -11.3
FREQUENCY f (MHz) 100.00 200.00 300.00 400.00	MAG .973 .959 .947 .922	ANG -6.3 -13.5 -19.7 -26.2	MAG 3.521 3.484 3.458 3.360	ANG 173.9 167.3 161.2 155.2	MAG .015 .033 .055 .065	ANG 82.1 83.0 79.6 72.2	MAG .991 .985 .981 .962	ANG -3.5 -7.6 -11.3 -14.8
FREQUENCY f (MHz) 100.00 200.00 300.00 400.00 500.00	MAG .973 .959 .947 .922 .898	ANG -6.3 -13.5 -19.7 -26.2 -32.8	MAG 3.521 3.484 3.458 3.360 3.348	ANG 173.9 167.3 161.2 155.2 148.3	MAG .015 .033 .055 .065 .084	ANG 82.1 83.0 79.6 72.2 69.4	MAG .991 .985 .981 .962 .946	ANG -3.5 -7.6 -11.3 -14.8 -18.9
FREQUENCY f (MHz) 100.00 200.00 300.00 400.00 500.00 600.00	MAG .973 .959 .947 .922 .898 .878	ANG -6.3 -13.5 -19.7 -26.2 -32.8 -39.1	MAG 3.521 3.484 3.458 3.360 3.348 3.287	ANG 173.9 167.3 161.2 155.2 148.3 143.3	MAG .015 .033 .055 .065 .084 .100	ANG 82.1 83.0 79.6 72.2 69.4 63.5	MAG .991 .985 .981 .962 .946	ANG -3.5 -7.6 -11.3 -14.8 -18.9 -22.5
FREQUENCY f (MHz) 100.00 200.00 300.00 400.00 500.00 600.00 700.00	MAG .973 .959 .947 .922 .898 .878	ANG -6.3 -13.5 -19.7 -26.2 -32.8 -39.1 -45.9	MAG 3.521 3.484 3.458 3.360 3.348 3.287 3.248	ANG 173.9 167.3 161.2 155.2 148.3 143.3 137.3	MAG .015 .033 .055 .065 .084 .100	ANG 82.1 83.0 79.6 72.2 69.4 63.5 60.2	MAG .991 .985 .981 .962 .946 .925	ANG -3.5 -7.6 -11.3 -14.8 -18.9 -22.5 -25.5
FREQUENCY f (MHz) 100.00 200.00 300.00 400.00 500.00 600.00 700.00 800.00	MAG .973 .959 .947 .922 .898 .878 .848	ANG -6.3 -13.5 -19.7 -26.2 -32.8 -39.1 -45.9 -51.7	MAG 3.521 3.484 3.458 3.360 3.348 3.287 3.248 3.136	ANG 173.9 167.3 161.2 155.2 148.3 143.3 137.3 131.4	MAG .015 .033 .055 .065 .084 .100 .109	ANG 82.1 83.0 79.6 72.2 69.4 63.5 60.2 56.6	MAG .991 .985 .981 .962 .946 .925 .909	ANG -3.5 -7.6 -11.3 -14.8 -18.9 -22.5 -25.5 -29.5
FREQUENCY f (MHz) 100.00 200.00 300.00 400.00 500.00 600.00 700.00	MAG .973 .959 .947 .922 .898 .878	ANG -6.3 -13.5 -19.7 -26.2 -32.8 -39.1 -45.9	MAG 3.521 3.484 3.458 3.360 3.348 3.287 3.248	ANG 173.9 167.3 161.2 155.2 148.3 143.3 137.3	MAG .015 .033 .055 .065 .084 .100	ANG 82.1 83.0 79.6 72.2 69.4 63.5 60.2	MAG .991 .985 .981 .962 .946 .925	ANG -3.5 -7.6 -11.3 -14.8 -18.9 -22.5 -25.5
FREQUENCY f (MHz) 100.00 200.00 300.00 400.00 500.00 600.00 700.00 800.00 900.00	MAG .973 .959 .947 .922 .898 .878 .848 .822 .772 .752	ANG -6.3 -13.5 -19.7 -26.2 -32.8 -39.1 -45.9 -51.7 -58.0	MAG 3.521 3.484 3.458 3.360 3.348 3.287 3.248 3.136 3.040	ANG 173.9 167.3 161.2 155.2 148.3 143.3 137.3 131.4 126.1	MAG .015 .033 .055 .065 .084 .100 .109 .126	ANG 82.1 83.0 79.6 72.2 69.4 63.5 60.2 56.6 55.0	MAG .991 .985 .981 .962 .946 .925 .909 .875	ANG -3.5 -7.6 -11.3 -14.8 -18.9 -22.5 -25.5 -29.5 -32.4
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	MAG .973 .959 .947 .922 .898 .878 .848 .822 .772 .752 .708 .676	ANG -6.3 -13.5 -19.7 -26.2 -32.8 -39.1 -45.9 -51.7 -58.0 -64.0 -70.1 -76.4	MAG 3.521 3.484 3.458 3.360 3.348 3.287 3.248 3.136 3.040 2.980 2.879 2.749	ANG 173.9 167.3 161.2 155.2 148.3 143.3 137.3 131.4 126.1 120.9 116.1 110.5	MAG .015 .033 .055 .065 .084 .100 .109 .126 .134 .150 .158	ANG 82.1 83.0 79.6 72.2 69.4 63.5 60.2 56.6 55.0 50.0 46.1 43.5	MAG .991 .985 .981 .962 .946 .925 .909 .875 .847 .830 .801	ANG -3.5 -7.6 -11.3 -14.8 -18.9 -22.5 -25.5 -29.5 -32.4 -34.6 -38.1 -40.7
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	MAG .973 .959 .947 .922 .898 .878 .848 .822 .772 .752 .708 .676	ANG -6.3 -13.5 -19.7 -26.2 -32.8 -39.1 -45.9 -51.7 -58.0 -64.0 -70.1 -76.4 -82.4	MAG 3.521 3.484 3.458 3.360 3.348 3.287 3.248 3.136 3.040 2.980 2.879 2.749 2.690	ANG 173.9 167.3 161.2 155.2 148.3 143.3 137.3 131.4 126.1 120.9 116.1 110.5 106.0	MAG .015 .033 .055 .065 .084 .100 .109 .126 .134 .150 .158 .163	ANG 82.1 83.0 79.6 72.2 69.4 63.5 60.2 56.6 55.0 50.0 46.1 43.5 44.1	MAG .991 .985 .981 .962 .946 .925 .909 .875 .847 .830 .801 .776	ANG -3.5 -7.6 -11.3 -14.8 -18.9 -22.5 -25.5 -29.5 -32.4 -34.6 -38.1 -40.7 -43.5
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	MAG .973 .959 .947 .922 .898 .878 .848 .822 .772 .752 .708 .676 .644	ANG -6.3 -13.5 -19.7 -26.2 -32.8 -39.1 -45.9 -51.7 -58.0 -64.0 -70.1 -76.4 -82.4 -88.2	MAG 3.521 3.484 3.458 3.360 3.348 3.287 3.248 3.136 3.040 2.980 2.879 2.749 2.690 2.588	ANG 173.9 167.3 161.2 155.2 148.3 143.3 137.3 131.4 126.1 120.9 116.1 110.5 106.0 101.4	MAG .015 .033 .055 .065 .084 .100 .109 .126 .134 .150 .158 .163 .172	ANG 82.1 83.0 79.6 72.2 69.4 63.5 60.2 56.6 55.0 50.0 46.1 43.5 44.1 38.2	MAG .991 .985 .981 .962 .946 .925 .909 .875 .847 .830 .801 .776 .745	ANG -3.5 -7.6 -11.3 -14.8 -18.9 -22.5 -25.5 -29.5 -32.4 -34.6 -38.1 -40.7 -43.5 -46.8
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	MAG .973 .959 .947 .922 .898 .878 .848 .822 .772 .752 .708 .676 .644 .617	ANG -6.3 -13.5 -19.7 -26.2 -32.8 -39.1 -45.9 -51.7 -58.0 -64.0 -70.1 -76.4 -82.4 -88.2 -94.1	MAG 3.521 3.484 3.458 3.360 3.348 3.287 3.248 3.136 3.040 2.980 2.879 2.749 2.690 2.588 2.514	ANG 173.9 167.3 161.2 155.2 148.3 143.3 137.3 131.4 126.1 120.9 116.1 110.5 106.0 101.4 96.8	MAG .015 .033 .055 .065 .084 .100 .109 .126 .134 .150 .158 .163 .172 .176	ANG 82.1 83.0 79.6 72.2 69.4 63.5 60.2 56.6 55.0 50.0 46.1 43.5 44.1 38.2 36.3	MAG .991 .985 .981 .962 .946 .925 .909 .875 .847 .830 .801 .776 .745 .724	ANG -3.5 -7.6 -11.3 -14.8 -18.9 -22.5 -25.5 -29.5 -32.4 -34.6 -38.1 -40.7 -43.5 -46.8 -49.2
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	MAG .973 .959 .947 .922 .898 .878 .848 .822 .772 .752 .708 .676 .644 .617 .579	ANG -6.3 -13.5 -19.7 -26.2 -32.8 -39.1 -45.9 -51.7 -58.0 -64.0 -70.1 -76.4 -82.4 -88.2 -94.1 -100.2	MAG 3.521 3.484 3.458 3.360 3.348 3.287 3.248 3.136 3.040 2.980 2.879 2.749 2.690 2.588 2.514 2.407	ANG 173.9 167.3 161.2 155.2 148.3 143.3 137.3 131.4 126.1 120.9 116.1 110.5 106.0 101.4 96.8 92.4	MAG .015 .033 .055 .065 .084 .100 .109 .126 .134 .150 .158 .163 .172 .176 .181 .186	ANG 82.1 83.0 79.6 72.2 69.4 63.5 60.2 56.6 55.0 50.0 46.1 43.5 44.1 38.2 36.3 33.2	MAG .991 .985 .981 .962 .946 .925 .909 .875 .847 .830 .801 .776 .745 .724 .696	ANG -3.5 -7.6 -11.3 -14.8 -18.9 -22.5 -25.5 -29.5 -32.4 -34.6 -38.1 -40.7 -43.5 -46.8 -49.2 -50.2
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	MAG .973 .959 .947 .922 .898 .878 .848 .822 .772 .752 .708 .676 .644 .617	ANG -6.3 -13.5 -19.7 -26.2 -32.8 -39.1 -45.9 -51.7 -58.0 -64.0 -70.1 -76.4 -82.4 -88.2 -94.1	MAG 3.521 3.484 3.458 3.360 3.348 3.287 3.248 3.136 3.040 2.980 2.879 2.749 2.690 2.588 2.514	ANG 173.9 167.3 161.2 155.2 148.3 143.3 137.3 131.4 126.1 120.9 116.1 110.5 106.0 101.4 96.8	MAG .015 .033 .055 .065 .084 .100 .109 .126 .134 .150 .158 .163 .172 .176	ANG 82.1 83.0 79.6 72.2 69.4 63.5 60.2 56.6 55.0 50.0 46.1 43.5 44.1 38.2 36.3	MAG .991 .985 .981 .962 .946 .925 .909 .875 .847 .830 .801 .776 .745 .724	ANG -3.5 -7.6 -11.3 -14.8 -18.9 -22.5 -25.5 -29.5 -32.4 -34.6 -38.1 -40.7 -43.5 -46.8 -49.2
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 1700.00 1800.00 1800.00	MAG .973 .959 .947 .922 .898 .878 .848 .822 .772 .752 .708 .676 .644 .617 .579 .559 .536 .509	ANG -6.3 -13.5 -19.7 -26.2 -32.8 -39.1 -45.9 -51.7 -58.0 -64.0 -70.1 -76.4 -82.4 -88.2 -94.1 -100.2 -106.6 -111.4 -117.1	MAG 3.521 3.484 3.458 3.360 3.348 3.287 3.248 3.136 3.040 2.980 2.879 2.749 2.690 2.588 2.514 2.407 2.369 2.278 2.201	ANG 173.9 167.3 161.2 155.2 148.3 143.3 137.3 131.4 126.1 120.9 116.1 110.5 106.0 101.4 96.8 92.4 89.1 84.9 81.5	MAG .015 .033 .055 .065 .084 .100 .109 .126 .134 .150 .158 .163 .172 .176 .181 .186 .188 .191 .192	ANG 82.1 83.0 79.6 72.2 69.4 63.5 60.2 56.6 55.0 50.0 46.1 43.5 44.1 38.2 36.3 33.2 31.7 30.5 28.4	MAG .991 .985 .981 .962 .946 .925 .909 .875 .847 .830 .801 .776 .745 .724 .696 .680 .651 .642	ANG -3.5 -7.6 -11.3 -14.8 -18.9 -22.5 -25.5 -29.5 -32.4 -34.6 -38.1 -40.7 -43.5 -46.8 -49.2 -50.2 -52.6 -54.9 -57.0
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 1900.00	MAG .973 .959 .947 .922 .898 .878 .848 .822 .772 .752 .708 .676 .644 .617 .579 .559 .536 .509 .490	ANG -6.3 -13.5 -19.7 -26.2 -32.8 -39.1 -45.9 -51.7 -58.0 -64.0 -70.1 -76.4 -82.4 -88.2 -94.1 -100.2 -106.6 -111.4 -117.1 -124.8	MAG 3.521 3.484 3.458 3.360 3.348 3.287 3.248 3.136 3.040 2.980 2.879 2.749 2.690 2.588 2.514 2.407 2.369 2.278 2.201 2.151	ANG 173.9 167.3 161.2 155.2 148.3 143.3 137.3 131.4 126.1 120.9 116.1 110.5 106.0 101.4 96.8 92.4 89.1 84.9 81.5 77.0	MAG .015 .033 .055 .065 .084 .100 .109 .126 .134 .150 .158 .163 .172 .176 .181 .186 .188 .191 .192 .195	ANG 82.1 83.0 79.6 72.2 69.4 63.5 60.2 56.6 55.0 50.0 46.1 43.5 44.1 38.2 36.3 33.2 31.7 30.5 28.4 27.2	MAG .991 .985 .981 .962 .946 .925 .909 .875 .847 .830 .801 .776 .745 .724 .696 .680 .651 .642 .624	ANG -3.5 -7.6 -11.3 -14.8 -18.9 -22.5 -25.5 -29.5 -32.4 -34.6 -38.1 -40.7 -43.5 -46.8 -49.2 -50.2 -52.6 -54.9 -57.0 -59.7
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 1800.00 1900.00 2000.00 2100.00	MAG .973 .959 .947 .922 .898 .878 .848 .822 .772 .752 .708 .676 .644 .617 .579 .559 .536 .509 .490 .478	ANG -6.3 -13.5 -19.7 -26.2 -32.8 -39.1 -45.9 -51.7 -58.0 -64.0 -70.1 -76.4 -82.4 -88.2 -94.1 -100.2 -106.6 -111.4 -117.1 -124.8 -129.6	MAG 3.521 3.484 3.458 3.360 3.348 3.287 3.248 3.136 3.040 2.980 2.879 2.749 2.690 2.588 2.514 2.407 2.369 2.278 2.201 2.151 2.071	ANG 173.9 167.3 161.2 155.2 148.3 143.3 137.3 131.4 126.1 120.9 116.1 110.5 106.0 101.4 96.8 92.4 89.1 84.9 81.5 77.0 73.5	MAG .015 .033 .055 .065 .084 .100 .109 .126 .134 .150 .158 .163 .172 .176 .181 .186 .188 .191 .192 .195 .198	ANG 82.1 83.0 79.6 72.2 69.4 63.5 60.2 56.6 55.0 50.0 46.1 43.5 44.1 38.2 36.3 33.2 31.7 30.5 28.4 27.2 25.4	MAG .991 .985 .981 .962 .946 .925 .909 .875 .847 .830 .801 .776 .745 .724 .696 .680 .651 .642 .624	ANG -3.5 -7.6 -11.3 -14.8 -18.9 -22.5 -25.5 -29.5 -32.4 -34.6 -38.1 -40.7 -43.5 -46.8 -49.2 -50.2 -52.6 -54.9 -57.0 -59.7 -62.2
FREQUENCY f (MHz) 100.00 200.00 300.00 400.00 500.00 600.00 700.00 800.00 1100.00 1200.00 1300.00 1400.00 1500.00 1500.00 1600.00 1700.00 1800.00 1900.00 2000.00 2100.00 2200.00	MAG .973 .959 .947 .922 .898 .878 .848 .822 .772 .752 .708 .676 .644 .617 .579 .559 .536 .509 .490 .478 .442	ANG -6.3 -13.5 -19.7 -26.2 -32.8 -39.1 -45.9 -51.7 -58.0 -64.0 -70.1 -76.4 -82.4 -88.2 -94.1 -100.2 -106.6 -111.4 -117.1 -124.8 -129.6 -136.7	MAG 3.521 3.484 3.458 3.360 3.348 3.287 3.248 3.136 3.040 2.980 2.879 2.749 2.690 2.588 2.514 2.407 2.369 2.278 2.201 2.151 2.071 2.001	ANG 173.9 167.3 161.2 155.2 148.3 143.3 137.3 131.4 126.1 120.9 116.1 110.5 106.0 101.4 96.8 92.4 89.1 84.9 81.5 77.0 73.5 69.4	MAG .015 .033 .055 .065 .084 .100 .109 .126 .134 .150 .158 .163 .172 .176 .181 .186 .188 .191 .192 .195 .198 .201	ANG 82.1 83.0 79.6 72.2 69.4 63.5 60.2 56.6 55.0 46.1 43.5 44.1 38.2 36.3 33.2 31.7 30.5 28.4 27.2 25.4 25.8	MAG .991 .985 .981 .962 .946 .925 .909 .875 .847 .830 .801 .776 .745 .724 .696 .680 .651 .642 .624 .611 .593 .575	ANG -3.5 -7.6 -11.3 -14.8 -18.9 -22.5 -25.5 -29.5 -32.4 -34.6 -38.1 -40.7 -43.5 -46.8 -49.2 -50.2 -52.6 -54.9 -57.0 -59.7 -62.2 -63.7
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 17700.00 1800.00 1900.00 2000.00 2200.00 2300.00	MAG .973 .959 .947 .922 .898 .878 .848 .822 .772 .752 .708 .676 .644 .617 .579 .559 .536 .509 .490 .478 .442 .423	ANG -6.3 -13.5 -19.7 -26.2 -32.8 -39.1 -45.9 -51.7 -58.0 -64.0 -70.1 -76.4 -82.4 -88.2 -94.1 -100.2 -106.6 -111.4 -117.1 -124.8 -129.6 -136.7 -140.8	MAG 3.521 3.484 3.458 3.360 3.348 3.287 3.248 3.136 3.040 2.980 2.879 2.749 2.690 2.588 2.514 2.407 2.369 2.278 2.201 2.151 2.001 1.938	ANG 173.9 167.3 161.2 155.2 148.3 143.3 137.3 131.4 126.1 120.9 116.1 110.5 106.0 101.4 96.8 92.4 89.1 84.9 81.5 77.0 73.5 69.4 67.1	MAG .015 .033 .055 .065 .084 .100 .109 .126 .134 .150 .158 .163 .172 .176 .181 .186 .188 .191 .192 .195 .198 .201 .203	ANG 82.1 83.0 79.6 72.2 69.4 63.5 60.2 56.6 55.0 46.1 43.5 44.1 38.2 36.3 33.2 31.7 30.5 28.4 27.2 25.4 25.8 23.5	MAG .991 .985 .981 .962 .946 .925 .909 .875 .847 .830 .801 .776 .745 .724 .696 .680 .651 .642 .624 .611 .593 .575	ANG -3.5 -7.6 -11.3 -14.8 -18.9 -22.5 -25.5 -29.5 -32.4 -34.6 -38.1 -40.7 -43.5 -46.8 -49.2 -50.2 -52.6 -54.9 -57.0 -59.7 -62.2 -63.7 -65.5
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 2200.00 2300.00 2400.00	MAG .973 .959 .947 .922 .898 .878 .848 .822 .772 .752 .708 .676 .644 .617 .579 .559 .536 .509 .490 .478 .442 .423 .429	ANG -6.3 -13.5 -19.7 -26.2 -32.8 -39.1 -45.9 -51.7 -58.0 -64.0 -70.1 -76.4 -82.4 -88.2 -94.1 -100.2 -106.6 -111.4 -117.1 -124.8 -129.6 -136.7 -140.8 -145.8	MAG 3.521 3.484 3.458 3.360 3.348 3.287 3.248 3.136 3.040 2.980 2.879 2.749 2.690 2.588 2.514 2.407 2.369 2.278 2.201 2.151 2.071 2.001 1.938 1.873	ANG 173.9 167.3 161.2 155.2 148.3 143.3 137.3 131.4 126.1 120.9 116.1 110.5 106.0 101.4 96.8 92.4 89.1 84.9 81.5 77.0 73.5 69.4 67.1 63.8	MAG .015 .033 .055 .065 .084 .100 .109 .126 .134 .150 .158 .163 .172 .176 .181 .186 .188 .191 .192 .195 .198 .201 .203 .202	ANG 82.1 83.0 79.6 72.2 69.4 63.5 60.2 56.6 55.0 50.0 46.1 43.5 44.1 38.2 36.3 33.2 31.7 30.5 28.4 27.2 25.4 25.8 23.5 21.3	MAG .991 .985 .981 .962 .946 .925 .909 .875 .847 .830 .801 .776 .745 .724 .696 .680 .651 .642 .624 .611 .593 .575 .565	ANG -3.5 -7.6 -11.3 -14.8 -18.9 -22.5 -25.5 -29.5 -32.4 -34.6 -38.1 -40.7 -43.5 -46.8 -49.2 -50.2 -52.6 -54.9 -57.0 -59.7 -62.2 -63.7 -65.5 -66.3
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 17700.00 1800.00 1900.00 2000.00 2200.00 2300.00	MAG .973 .959 .947 .922 .898 .878 .848 .822 .772 .752 .708 .676 .644 .617 .579 .559 .536 .509 .490 .478 .442 .423	ANG -6.3 -13.5 -19.7 -26.2 -32.8 -39.1 -45.9 -51.7 -58.0 -64.0 -70.1 -76.4 -82.4 -88.2 -94.1 -100.2 -106.6 -111.4 -117.1 -124.8 -129.6 -136.7 -140.8	MAG 3.521 3.484 3.458 3.360 3.348 3.287 3.248 3.136 3.040 2.980 2.879 2.749 2.690 2.588 2.514 2.407 2.369 2.278 2.201 2.151 2.001 1.938	ANG 173.9 167.3 161.2 155.2 148.3 143.3 137.3 131.4 126.1 120.9 116.1 110.5 106.0 101.4 96.8 92.4 89.1 84.9 81.5 77.0 73.5 69.4 67.1	MAG .015 .033 .055 .065 .084 .100 .109 .126 .134 .150 .158 .163 .172 .176 .181 .186 .188 .191 .192 .195 .198 .201 .203	ANG 82.1 83.0 79.6 72.2 69.4 63.5 60.2 56.6 55.0 46.1 43.5 44.1 38.2 36.3 33.2 31.7 30.5 28.4 27.2 25.4 25.8 23.5	MAG .991 .985 .981 .962 .946 .925 .909 .875 .847 .830 .801 .776 .745 .724 .696 .680 .651 .642 .624 .611 .593 .575	ANG -3.5 -7.6 -11.3 -14.8 -18.9 -22.5 -25.5 -29.5 -32.4 -34.6 -38.1 -40.7 -43.5 -46.8 -49.2 -50.2 -52.6 -54.9 -57.0 -59.7 -62.2 -63.7 -65.5
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 2100.00 2200.00 2300.00 2400.00 2500.00	MAG .973 .959 .947 .922 .898 .878 .848 .822 .772 .752 .708 .676 .644 .617 .579 .559 .536 .509 .490 .478 .442 .423 .429 .401	ANG -6.3 -13.5 -19.7 -26.2 -32.8 -39.1 -45.9 -51.7 -58.0 -64.0 -70.1 -76.4 -82.4 -88.2 -94.1 -100.2 -106.6 -111.4 -117.1 -124.8 -129.6 -136.7 -140.8 -145.8 -152.3	MAG 3.521 3.484 3.458 3.360 3.348 3.287 3.248 3.136 3.040 2.980 2.879 2.749 2.690 2.588 2.514 2.407 2.369 2.278 2.201 2.151 2.071 2.001 1.938 1.873 1.839	ANG 173.9 167.3 161.2 155.2 148.3 143.3 137.3 131.4 126.1 120.9 116.1 110.5 106.0 101.4 96.8 92.4 89.1 84.9 81.5 77.0 73.5 69.4 67.1 63.8 60.3	MAG .015 .033 .055 .065 .084 .100 .109 .126 .134 .150 .158 .163 .172 .176 .181 .186 .188 .191 .192 .195 .198 .201 .203 .202 .204	ANG 82.1 83.0 79.6 72.2 69.4 63.5 60.2 56.6 55.0 50.0 46.1 43.5 44.1 38.2 36.3 33.2 31.7 30.5 28.4 27.2 25.4 25.8 23.5 21.3 20.3	MAG .991 .985 .981 .962 .946 .925 .909 .875 .847 .830 .801 .776 .745 .724 .696 .680 .651 .642 .624 .611 .593 .575 .565 .536	ANG -3.5 -7.6 -11.3 -14.8 -18.9 -22.5 -25.5 -29.5 -32.4 -34.6 -38.1 -40.7 -43.5 -46.8 -49.2 -50.2 -52.6 -54.9 -57.0 -59.7 -62.2 -63.7 -65.5 -66.3 -69.0
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 2000.00 2100.00 2200.00 2300.00 2400.00 2500.00 2600.00 2700.00 2800.00	MAG .973 .959 .947 .922 .898 .878 .848 .822 .772 .752 .708 .676 .644 .617 .579 .559 .536 .509 .490 .478 .442 .423 .429 .401 .406 .388 .400 .385	ANG -6.3 -13.5 -19.7 -26.2 -32.8 -39.1 -45.9 -51.7 -58.0 -64.0 -70.1 -76.4 -82.4 -88.2 -94.1 -100.2 -106.6 -111.4 -117.1 -124.8 -129.6 -136.7 -140.8 -145.8 -152.3 -158.3 -161.7 -166.9	MAG 3.521 3.484 3.458 3.360 3.348 3.287 3.248 3.136 3.040 2.980 2.879 2.749 2.690 2.588 2.514 2.407 2.369 2.278 2.201 2.151 2.071 2.001 1.938 1.873 1.839 1.776 1.733 1.688	ANG 173.9 167.3 161.2 155.2 148.3 143.3 137.3 131.4 126.1 120.9 116.1 110.5 106.0 101.4 96.8 92.4 89.1 84.9 81.5 77.0 73.5 69.4 67.1 63.8 60.3 57.3 55.3 51.3	MAG .015 .033 .055 .065 .084 .100 .109 .126 .134 .150 .158 .163 .172 .176 .181 .186 .188 .191 .192 .195 .198 .201 .203 .202 .204 .201 .204 .203	ANG 82.1 83.0 79.6 72.2 69.4 63.5 60.2 56.6 55.0 50.0 46.1 43.5 44.1 38.2 36.3 33.2 31.7 30.5 28.4 27.2 25.4 25.8 23.5 21.3 20.6 20.6 19.0	MAG .991 .985 .981 .962 .946 .925 .909 .875 .847 .830 .801 .776 .745 .724 .696 .680 .651 .642 .624 .611 .593 .575 .565 .536 .540 .528 .521 .512	ANG -3.5 -7.6 -11.3 -14.8 -18.9 -22.5 -25.5 -29.5 -32.4 -34.6 -38.1 -40.7 -43.5 -46.8 -49.2 -50.2 -52.6 -54.9 -57.0 -59.7 -62.2 -63.7 -65.5 -66.3 -69.0 -68.7 -72.7 -75.5
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 2000.00 2100.00 2300.00 2400.00 2500.00 2600.00 2700.00	MAG .973 .959 .947 .922 .898 .878 .848 .822 .772 .752 .708 .676 .644 .617 .579 .559 .536 .509 .490 .478 .442 .423 .429 .401 .406 .388 .400	ANG -6.3 -13.5 -19.7 -26.2 -32.8 -39.1 -45.9 -51.7 -58.0 -64.0 -70.1 -76.4 -82.4 -88.2 -94.1 -100.2 -106.6 -111.4 -117.1 -124.8 -129.6 -136.7 -140.8 -145.8 -152.3 -158.3 -161.7	MAG 3.521 3.484 3.458 3.360 3.348 3.287 3.248 3.136 3.040 2.980 2.879 2.749 2.690 2.588 2.514 2.407 2.369 2.278 2.201 2.151 2.071 2.001 1.938 1.873 1.839 1.776 1.733	ANG 173.9 167.3 161.2 155.2 148.3 143.3 137.3 131.4 126.1 120.9 116.1 110.5 106.0 101.4 96.8 92.4 89.1 84.9 81.5 77.0 73.5 69.4 67.1 63.8 60.3 57.3 55.3	MAG .015 .033 .055 .065 .084 .100 .109 .126 .134 .150 .158 .163 .172 .176 .181 .186 .188 .191 .192 .195 .198 .201 .203 .202 .204 .201 .204	ANG 82.1 83.0 79.6 72.2 69.4 63.5 60.2 56.6 55.0 50.0 46.1 43.5 44.1 38.2 36.3 33.2 31.7 30.5 28.4 27.2 25.4 25.8 23.5 21.3 20.3 20.6 20.6	MAG .991 .985 .981 .962 .946 .925 .909 .875 .847 .830 .801 .776 .745 .724 .696 .680 .651 .642 .624 .611 .593 .575 .565 .536 .540 .528	ANG -3.5 -7.6 -11.3 -14.8 -18.9 -22.5 -25.5 -29.5 -32.4 -34.6 -38.1 -40.7 -43.5 -46.8 -49.2 -50.2 -52.6 -54.9 -57.0 -59.7 -62.2 -63.7 -65.5 -66.3 -69.0 -68.7 -72.7

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NEC devices are classified into the following three quality grades:

"Standard", "Special", and "Specific". The Specific quality grade applies only to devices developed based on a customer designated "quality assurance program" for a specific application. The recommended applications of a device depend on its quality grade, as indicated below. Customers must check the quality grade of each device before using it in a particular application.

Standard: Computers, office equipment, communications equipment, test and measurement equipment, audio and visual equipment, home electronic appliances, machine tools, personal electronic equipment and industrial robots

Special: Transportation equipment (automobiles, trains, ships, etc.), traffic control systems, anti-disaster systems, anti-crime systems, safety equipment and medical equipment (not specifically designed for life support)

Specific: Aircrafts, aerospace equipment, submersible repeaters, nuclear reactor control systems, life support systems or medical equipment for life support, etc.

The quality grade of NEC devices in "Standard" unless otherwise specified in NEC's Data Sheets or Data Books. If customers intend to use NEC devices for applications other than those specified for Standard quality grade, they should contact NEC Sales Representative in advance.

Anti-radioactive design is not implemented in this product.