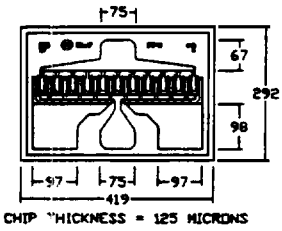
MwT - A9

18 GHz High Gain, Low Noise GaAs FET

MicroWave Technology 4268 Solar Way Fremont, CA 94538 510-651-6700 FAX 510-651-2208



MwT-A9

FEATURES

- +24.5 dBm OUTPUT POWER AT 12 GHz
- 9 dB SMALL SIGNAL GAIN AT 12 GHz
- 1.6 dB NOISE FIGURE AT 12 GHz
- 0.3 MICRON REFRACTORY METAL / GOLD GATE
- 750 MICRON GATE WIDTH
- CHOICE OF CHIP AND THREE PACKAGE TYPES

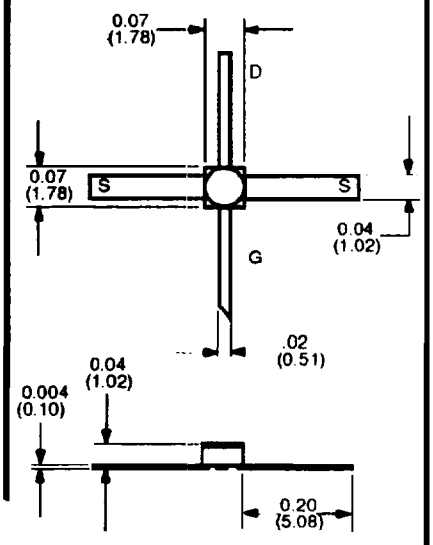
DESCRIPTION

The MwT-A9 is a GaAs MESFET device whose nominal quarter-micron gate length and 750 micron gate width make it ideally suited to applications requiring high-gain in the 500 MHz to 18 GHz frequency range with moderate power output while exhibiting a low noise figure. The chip is produced using MwT's reliable metal system and all devices are screened to insure reliability. All chips are passivated using MwT's patented "Diamond-Like Carbon" process for durability with no degradation in performance. Designers can use MwT's unique BIN selection feature to choose devices from narrow Idss ranges, insuring consistent circuit operation.

RF SPECIFICATIONS AT Ta = 25°C

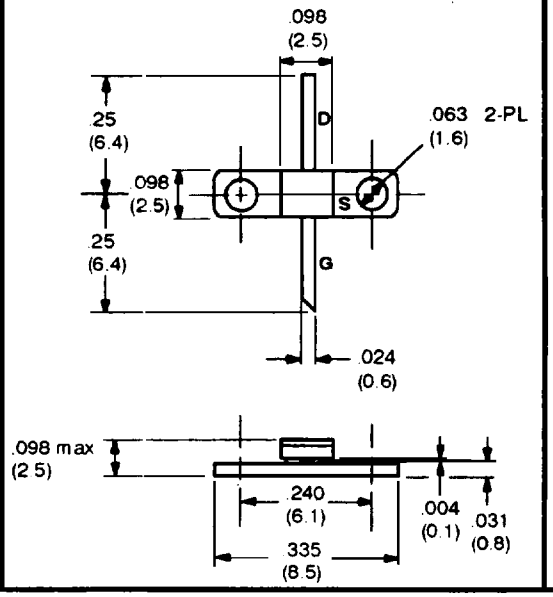
				MwT-A9GN MwT-A970GN MwT-A971GN MwT-A973GN			MwT-A9SN MwT-A970SN MwT-A971SN MwT-A973SN			MwT-A9HN MwT-A970HN MwT-A971HN MwT-A973HN		
SYMBOL	PARAMETERS AND CONDITIONS	FREQ	UNITS	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX
NFopt	Optimum Noise Figure VDS = 3.0 V IDS = 15 mA	12 GHz	dB		2.0	2.5		1.7	2.0		1.6	1.9
GA	Gain at Optimum Noise Figure VDS = 3.0 V IDS = 15 mA	12 GHz	dB	5.5	6.5		5.8	6.5		5.8	6.5	
P1dB	Output Power at 1dB Compression VDS=5.0V IDS= 0.6 IDSS	12 GHz	dBm		22.0		21.0	23.0		23.0	24.5	
SSG	Small Signal Gain VDS=5.0V IDS=0.6 IDSS	12 GHz	dB		9.0		8.0	9.0		8.0	9.0	

MwT-A970

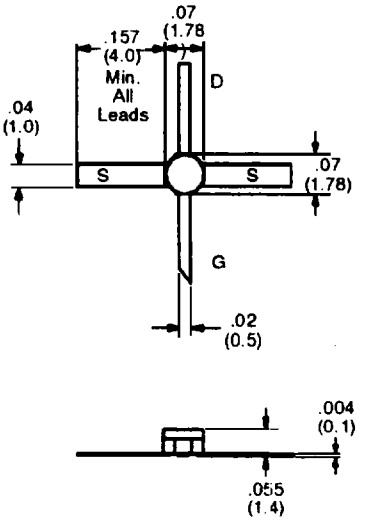


[(Units in Inches and (mm)]

MwT-A971



MwT-A973



MAVS017

MwT-A9
18 GHz High Power GaAs FET

DC SPECIFICATIONS AT Ta = 25 °C

SYMBOL	PARAMETERS AND CONDITIONS	UNITS	MIN	TYP	MAX
Idss	Saturated Drain Current Vds = 4.0 V VGS = 0.0 V	mA	78		282
Gm	Transconductance Vds = 2.0 V VGS = 0.0 V	mS	95	120	
Vp	Pinch-off Voltage Vds = 3.0 V IDS = 5.0 mA	V		-2.0	- 5.0
BVGSO	Gate-to-Source Breakdown Voltage Igs = -1.0 mA	V	-5.0	-12.0	
BVGDO	Gate-to-Drain Breakdown Voltage Igd = -1.0 mA	V	-6.0	-12.0	
Rth	Thermal Resistance MwT-9 Chip, 971 MwT-970, 973	°C/W		70 175*	

* Overall Rth depend on case mounting

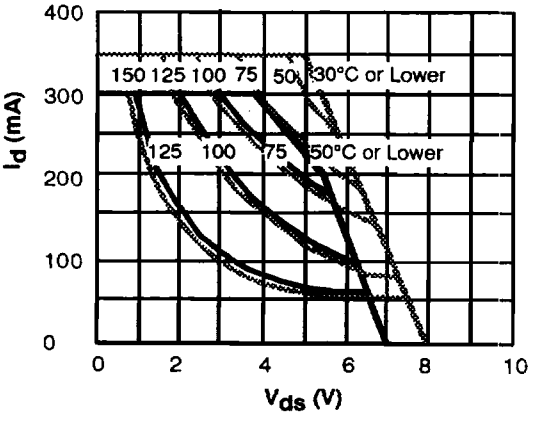
MAXIMUM RATINGS AT Ta = 25 ° C

SYMBOL	PARAMETER	UNITS	CONT MAX[1]	ABSOLUTE MAX[2]
VDS	Drain to Source Voltage	V	See Safe Operating Limits	
Tch	Channel Temperature	°C	+150	+175
Tst	Storage Temperature	°C	-65 to +150	+175
Pin	RF Input Power	mW	300	650

NOTES: 1. Exceeding any one of these limits in continuous operation may reduce the mean-time-to-failure below the design goals.
2. Exceeding any one of these limits may cause permanent damage.

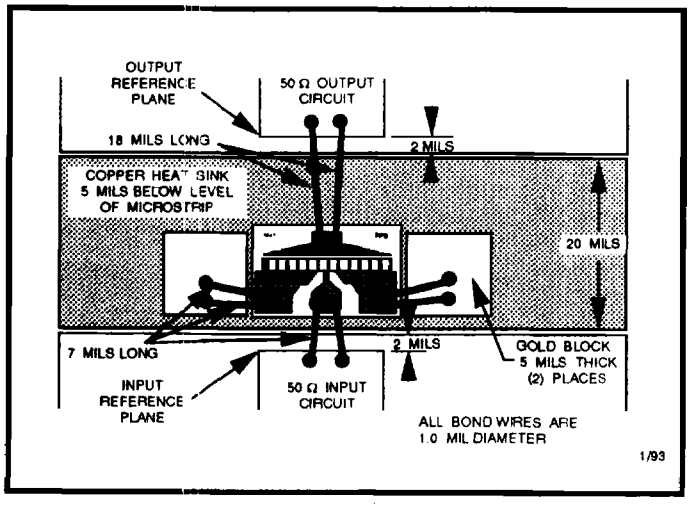
SAFE OPERATING LIMITS
vs. Case Temperature

Absolute Maximum
Continuous Maximum

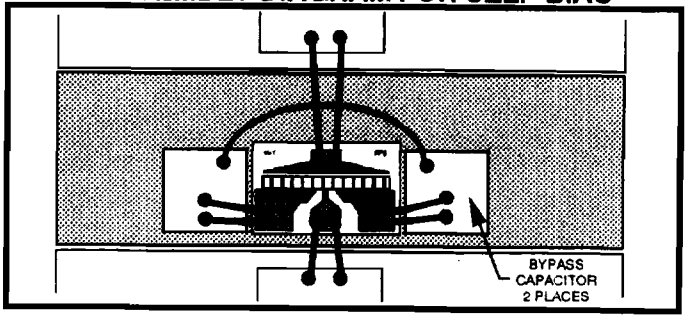


RECOMMENDED ASSEMBLY CONFIGURATION

Shown below is the assembly and bonding configuration used for S-Parameter measurements of the MwT-A9 Chip and is recommended for optimum performance. For self-bias applications the gold blocks may be replaced by capacitors. Contact MwT for additional applications information.

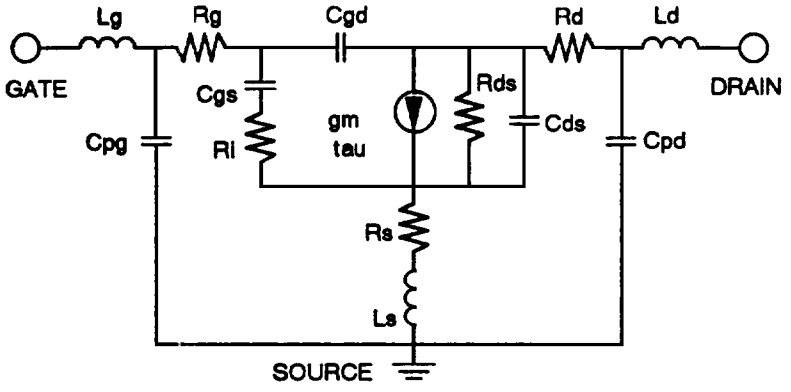


ASSEMBLY DIAGRAM FOR SELF-BIAS



MwT-A9
18 GHz High Gain, Low Noise GaAs FET

DEVICE EQUIVALENT CIRCUIT MODEL



PARAMETER		VALUE
Gate Bond Wire Inductance	Lg	.12 nH
Gate Pad Capacitance	Cpg	.04 pF
Gate Resistance	Rg	1.1 Ω
Gate-Source Capacitance	Cgs	.769 pF
Channel Resistance	Ri	.114 Ω
Gate-Drain Capacitance	Cgd	.093 pF
Transconductance	gm	116 mS
Transit time	tau	4.24 psec
Source Resistance	Rs	.16 Ω
Source Inductance	Ls	.037 nH
Drain-Source Resistance	Rds	158 Ω
Drain-Source Capacitance	Cds	.128 pF
Drain Resistance	Rd	.59 Ω
Drain Pad Capacitance	Cpd	.011 pF
Drain Inductance	Ld	.25 nH

BIN SELECTION

Every MwT-A9 wafer produced is 100% DC probed, binned by Idss in 12 ma increments, and sample devices are evaluated for RF performance. Users may select devices from 18 Idss bins to insure consistent matched performance in the circuit. The shaded bins are typically available in smaller quantity and caution is advised before designing these bins into high production applications. Availability in three visual grades insures the most economical solution for the application.

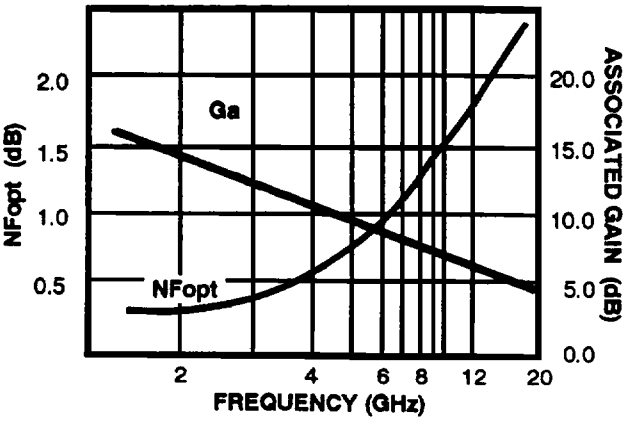
BIN #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
IDSS (mA)	78-90	90-102	102-114	114-126	126-139	138-150	150-162	162-174	174-186	186-199	198-210	210-222	222-234	234-246	246-258	258-270	270-282	282-294

TYPICAL NOISE PARAMETERS

MwT-A9 Chip: VDS = 3.0 V, IDS = 25 mA

FREQUENCY MHz	NF MIN dB	GAMMA OPT MAG	GAMMA OPT ANGLE	Rn/50
1000	0.30	0.85	4.5	0.19
2000	0.33	0.69	36.8	0.18
4000	0.62	0.56	73.4	0.19
6000	0.93	0.52	106.3	0.19
10000	1.48	0.57	152.0	0.17
12000	1.73	0.61	167.3	0.17
16000	2.19	0.68	-169.8	0.16
18000	2.40	0.71	-160.8	0.15

NOISE FIGURE AND ASSOCIATED GAIN VS. FREQUENCY



TYPICAL COMMON SOURCE SCATTERING PARAMETERS

MwT-A9 CHIP BIASED FOR LOW NOISE FIGURE: VDS = 3.0 V, IDS = 28 mA

FREQUENCY (GHz)	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
1.00	.95	-40.1	6.19	152.4	.04	66.4	.30	-33.5
2.00	.90	-72.0	5.27	132.3	.08	50.7	.27	-63.4
3.00	.86	-97.5	4.41	115.0	.09	38.6	.25	-87.9
4.00	.83	-116.1	3.66	102.0	.10	29.6	.23	-108.0
5.00	.82	-130.5	3.12	91.2	.11	23.8	.23	-124.6
6.00	.82	-141.4	2.72	81.8	.11	18.5	.23	-137.3
7.00	.81	-150.5	2.39	73.4	.11	14.4	.23	-148.3
8.00	.81	-157.8	2.12	66.0	.11	11.1	.24	-158.1
9.00	.81	-163.3	1.92	59.6	.11	7.7	.25	-166.7
10.00	.83	-170.3	1.77	52.6	.11	4.8	.27	-174.8
12.00	.82	-179.4	1.48	40.3	.10	2.7	.30	173.2
14.00	.82	174.2	1.28	29.3	.10	2.8	.33	164.2
16.00	.84	169.2	1.14	19.4	.10	-1.4	.38	156.7
18.00	.86	163.4	1.02	8.2	.10	-3.9	.43	149.4
20.00	.86	157.4	.91	-2.3	.10	-5.2	.48	142.7
22.00	.83	155.4	.81	-9.6	.10	-8.7	.52	138.3
24.00	.83	153.6	.74	-18.2	.10	-11.2	.56	135.1
26.00	.82	148.7	.69	-30.1	.10	-11.0	.64	136.6

MwT-A9 CHIP BIASED FOR GAIN & POWER: VDS = 5.0 V, IDS =.5 IDSS = 90 mA

FREQUENCY (GHz)	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
1.00	.94	-45.4	7.85	149.6	.03	64.6	.39	-25.6
2.00	.89	-79.7	6.47	128.5	.06	49.1	.33	-46.1
3.00	.86	-105.6	5.26	111.1	.07	37.9	.28	-62.0
4.00	.83	-123.7	4.30	98.4	.07	30.3	.24	-74.6
5.00	.82	-137.1	3.63	87.9	.07	26.7	.21	-85.9
6.00	.82	-147.4	3.15	78.8	.08	22.9	.20	-95.9
7.00	.82	-155.7	2.75	70.6	.08	20.2	.19	-105.9
8.00	.82	-162.3	2.44	63.3	.08	18.4	.19	-116.2
9.00	.83	-167.5	2.20	56.8	.08	16.6	.19	-127.0
10.00	.85	-173.8	2.02	50.0	.07	14.9	.20	-137.3
12.00	.84	177.7	1.70	37.5	.07	18.1	.23	-153.4
14.00	.84	171.8	1.47	26.0	.08	21.3	.27	-167.1
16.00	.87	167.2	1.31	15.3	.08	18.4	.33	-179.1
18.00	.89	161.4	1.17	3.3	.08	17.9	.38	170.4
20.00	.88	155.4	1.03	-7.7	.08	18.6	.45	160.5
22.00	.86	153.5	.92	-15.8	.09	15.2	.52	154.3
24.00	.86	151.6	.82	-25.7	.09	10.5	.55	148.1
26.00	.85	146.6	.76	-38.0	.09	10.0	.64	148.0

TYPICAL COMMON SOURCE SCATTERING PARAMETERS

MwT-A970 BIASED FOR LOW NOISE FIGURE: VDS = 3.0 V, IDS = 30 mA

FREQUENCY (GHz)	S11 MAG	S11 ANG	S21 MAG	S21 ANG	S12 MAG	S12 ANG	S22 MAG	S22 ANG
1.00	.94	-40.8	4.29	148.5	.04	69.2	.23	-39.7
2.00	.85	-72.3	3.60	123.9	.06	53.9	.24	-61.6
3.00	.77	-95.4	3.06	105.0	.08	46.5	.23	-69.7
4.00	.69	-117.2	2.71	87.7	.09	38.2	.19	-76.5
5.00	.63	-138.6	2.48	72.8	.10	32.5	.14	-82.3
6.00	.66	-164.6	2.37	55.0	.18	26.5	.11	-121.2
8.00	.72	143.2	1.90	19.1	.13	-3.0	.23	147.7
10.00	.77	111.8	1.49	-12.2	.13	-21.9	.31	135.9
12.00	.86	88.3	1.34	-39.3	.12	-37.0	.34	121.0
14.00	.81	65.6	1.24	-71.8	.15	-58.7	.37	98.7
16.00	.64	33.5	1.02	-107.0	.15	-84.5	.34	77.5
18.00	.52	5.9	.90	-128.0	.18	-86.9	.29	79.8
20.00	.41	-23.1	.96	-166.6	.26	-137.4	.25	69.8

MwT-A970 BIASED FOR GAIN & POWER: VDS = 5.0 V, IDS = 0.5 IDSS = 107 mA

FREQUENCY (GHz)	S11 MAG	S11 ANG	S21 MAG	S21 ANG	S12 MAG	S12 ANG	S22 MAG	S22 ANG
1.00	.91	-48.0	6.59	143.4	.03	65.8	.39	-30.6
2.00	.79	-82.8	5.18	117.0	.05	51.9	.37	-48.4
3.00	.70	-106.9	4.18	98.0	.06	48.3	.36	-55.6
4.00	.62	-129.7	3.58	81.2	.07	42.6	.32	-60.4
5.00	.57	-151.5	3.20	67.1	.07	42.2	.28	-62.1
6.00	.61	-176.4	3.04	49.8	.09	41.5	.25	-80.4
8.00	.70	134.5	2.41	14.7	.11	12.3	.20	-161.0
10.00	.76	106.6	1.88	-17.2	.11	-6.2	.32	170.1
12.00	.85	83.8	1.66	-44.0	.11	-14.4	.39	150.5
14.00	.79	61.1	1.50	-76.9	.14	-38.6	.46	123.8
16.00	.62	27.8	1.23	-113.7	.15	-66.0	.47	96.5
18.00	.50	-0.8	.99	-135.1	.18	-69.8	.45	89.8
20.00	.38	-31.3	1.05	-171.5	.25	-120.9	.44	71.6

MwT-A971 BIASED FOR LOW NOISE FIGURE: VDS = 3.0 V, IDS = 30 mA

FREQUENCY (GHz)	S11 MAG	S11 ANG	S21 MAG	S21 ANG	S12 MAG	S12 ANG	S22 MAG	S22 ANG
1.00	.94	-51.9	5.80	142.6	.04	57.8	.32	-47.0
2.00	.86	-88.1	4.49	115.6	.06	35.9	.29	-81.0
3.00	.81	-110.9	3.54	96.8	.08	22.3	.29	-102.1
4.00	.78	-126.7	2.96	81.6	.08	11.5	.31	-114.8
5.00	.76	-139.5	2.61	68.0	.09	2.5	.33	-122.8
6.00	.74	-153.1	2.42	53.6	.10	-7.1	.34	-131.0
8.00	.72	171.0	2.24	21.4	.12	-32.1	.27	-156.2
10.00	.76	131.4	2.00	-12.4	.12	-53.8	.19	155.3
12.00	.82	104.1	1.76	-43.5	.14	-73.2	.26	121.6
14.00	.79	84.8	1.60	-72.4	.15	-92.2	.29	113.6
16.00	.66	54.2	1.47	-110.0	.18	-114.8	.17	103.8
18.00	.60	11.1	1.28	-147.4	.20	-130.4	.11	89.3
20.00	.59	-28.3	1.09	170.6	.30	-168.1	.14	144.1

TYPICAL COMMON SOURCE SCATTERING PARAMETERS

MwT-A971 BIASED FOR GAIN & POWER: VDS = 5.0 V, IDS = 0.5 IDSS = 120 mA

FREQUENCY (GHz)	S11 MAG	S11 ANG	S21 MAG	S21 ANG	S12 MAG	S12 ANG	S22 MAG	S22 ANG
1.00	.93	-58.2	7.30	141.9	.03	55.3	.36	-36.0
2.00	.85	-96.3	5.52	112.9	.05	34.3	.33	-65.8
3.00	.80	-119.2	4.26	93.5	.05	22.4	.32	-85.5
4.00	.77	-135.0	3.51	78.1	.06	12.5	.34	-98.6
5.00	.75	-147.8	3.07	64.2	.06	5.8	.37	-107.4
6.00	.74	-161.7	2.82	49.6	.06	-2.1	.39	-115.8
8.00	.73	161.9	2.56	17.1	.08	-23.3	.34	-136.2
10.00	.78	123.9	2.25	-16.2	.08	-41.0	.26	-172.2
12.00	.84	97.9	1.98	-46.9	.10	-57.8	.32	147.6
14.00	.79	77.9	1.74	-76.1	.11	-75.3	.39	130.8
16.00	.65	46.6	1.58	-112.6	.15	-96.9	.31	113.8
18.00	.59	4.8	1.33	-148.2	.18	-112.8	.26	83.6
20.00	.58	-30.4	1.19	171.2	.29	-152.5	.18	83.4

MwT-A973 BIASED FOR LOW NOISE FIGURE: VDS = 3.0 V, IDS = 30 mA

FREQUENCY (GHz)	S11 MAG	S11 ANG	S21 MAG	S21 ANG	S12 MAG	S12 ANG	S22 MAG	S22 ANG
1.00	.94	-40.5	4.55	149.1	.04	69.7	.23	-35.9
2.00	.85	-72.6	3.86	124.5	.07	54.6	.22	-60.9
3.00	.75	-97.0	3.29	105.2	.09	46.4	.20	-75.3
4.00	.66	-121.3	2.92	87.4	.10	37.4	.18	-89.1
5.00	.60	-146.7	2.65	71.5	.11	30.6	.15	-101.5
6.00	.62	-176.4	2.47	53.5	.13	22.5	.14	-133.1
8.00	.75	133.0	1.90	18.4	.14	-3.6	.20	139.4
10.00	.83	106.4	1.43	-9.7	.14	-19.5	.30	110.4
12.00	.92	86.8	1.23	-33.6	.13	-29.9	.39	98.1
14.00	.86	65.5	1.14	-60.1	.16	-45.8	.43	88.1
16.00	.73	36.9	.91	-89.7	.15	-62.7	.39	66.6
18.00	.67	13.7	.78	-101.5	.18	-57.6	.34	45.8
20.00	.62	-6.3	.80	-129.9	.21	-91.6	.36	29.5

MwT-A973 BIASED FOR GAIN & POWER: VDS = 5.0 V, IDS = 109 mA

FREQUENCY (GHz)	S11 MAG	S11 ANG	S21 MAG	S21 ANG	S12 MAG	S12 ANG	S22 MAG	S22 ANG
1.00	.91	-47.7	6.79	144.2	.03	66.1	.38	-27.6
2.00	.79	-83.4	5.40	117.8	.05	52.6	.34	-46.2
3.00	.68	-109.1	4.40	98.4	.06	47.8	.32	-56.5
4.00	.60	-135.0	3.75	80.8	.07	41.0	.29	-65.2
5.00	.54	-161.3	3.31	65.6	.08	38.2	.26	-70.3
6.00	.59	170.8	3.05	48.6	.09	34.8	.24	-86.2
8.00	.74	125.6	2.34	15.4	.11	11.5	.14	-153.7
10.00	.82	102.7	1.79	-12.7	.11	-4.1	.21	151.1
12.00	.92	83.8	1.54	-37.2	.12	-9.6	.34	127.4
14.00	.86	62.1	1.37	-65.0	.15	-28.1	.43	113.5
16.00	.73	32.9	1.10	-95.9	.16	-46.4	.43	90.4
18.00	.68	9.8	.88	-109.9	.19	-43.9	.39	70.3
20.00	.62	-11.8	.90	-138.2	.23	-78.6	.44	51.0