



**LOW NOISE
Ku-K BAND GaAs MESFET**

**NE760
SERIES**

FEATURES

- **LOW NOISE FIGURE**
NF = 1.6 dB TYP at f = 12 GHz
- **HIGH ASSOCIATED GAIN**
GA = 9 dB TYP at f = 12 GHz
- **GATE LENGTH:** L_g = 0.3 μm
- **GATE WIDTH:** W_g = 280 μm
- **ION IMPLANTATION**
- **AVAILABILITY:** Chip, Hermetic Package, Low Cost Package

DESCRIPTION AND APPLICATIONS

The NE76000 provides a low noise figure and high associated gain thru K-Band. The NE760 devices are fabricated by Ion implantation for improved RF and DC performance, reliability, and uniformity. These devices feature a recessed 0.3 micron gate and triple epitaxial technology.

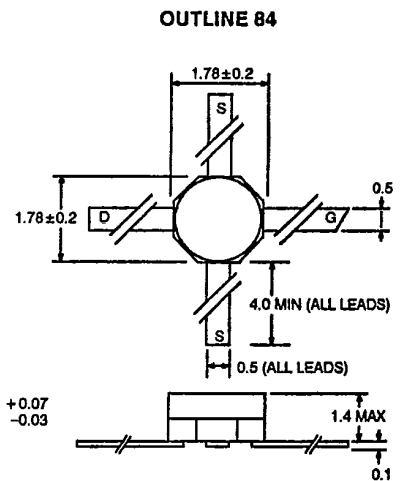
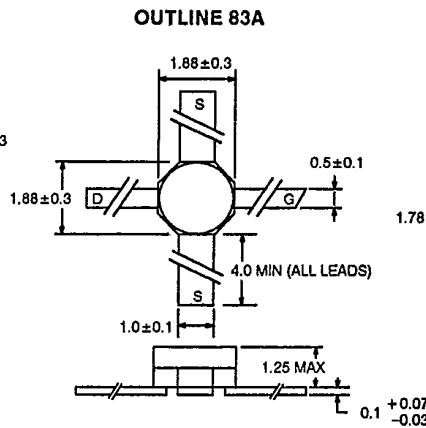
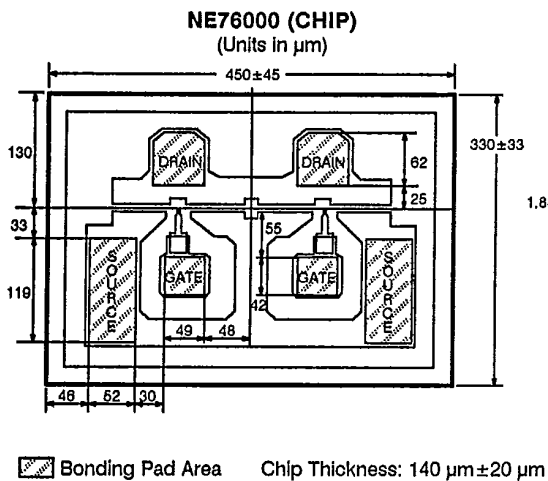
The surface of the device, except for bonding pads, is passivated with SiO₂ and SiN₄ for scratch protection as well as surface stability.

The device is available in chip form (NE76000) and packages. The NE76083A for industrial and military and the NE76084 for low cost consumer applications.

ABSOLUTE MAXIMUM RATINGS (T_A = 25°C)

SYMBOLS	PARAMETERS	UNITS	RATINGS
V _{DS}	Drain to Source Voltage	V	5
V _{GD0}	Gate to Drain Voltage	V	-5
V _{GS0}	Gate to Source Voltage	V	-3
I _{DS}	Drain Current	mA	50
P _{IN}	RF Input (CW)	dBm	+15
T _{CH}	Channel Temperature	°C	175
T _{STG}	Storage Temperature	°C	-65 to +175

OUTLINE DIMENSIONS (Units in mm)



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ELECTRICAL SPECIFICATIONS (T_A = 25°C)

PART NUMBER PACKAGE OUTLINE			NE76000 CHIP			NE76083A 83A			NE76084 ⁵ 84			NE76084-2.4 ⁵ 84		
SYMBOLS	PARAMETERS AND CONDITIONS	UNITS	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX
f _{MAX}	Maximum Frequency of Oscillation at V _{DS} = 3 V, I _{DS} = 30 mA	GHz		90			90			90			90	
MAG	Maximum Available Gain ¹ at V _{DS} = 3 V, I _{DS} = 20 mA, f = 4 GHz f = 12 GHz	dB		17 12			17 12							
NFOPT	Optimum Noise Figure ² at V _{DS} = 3 V, I _{DS} = 10 mA, f = 4 GHz f = 12 GHz	dB		0.6 1.6	1.8 ⁴		0.6 1.6	0.7 1.8		1.6 1.8			1.8 2.4	
GA	Associated Gain V _{DS} = 3 V, I _{DS} = 10 mA, f = 4 GHz f = 12 GHz	dB	8	13.0 ⁴ 9		11.5 8	13.0 9		8	9			8	9
P _{1dB}	Output Power at 1 dB Compression V _{DS} = 3 V, I _{DS} = 10 mA, f = 12 GHz	dBm		14.5			14.5				14.5			14.5
I _{DSS}	Drain Current at V _{DS} = 3 V, V _{GS} = 0	mA	15	30	50	15	30	50	15	30	50	15	30	50
V _P	Pinch-off Voltage at V _{DS} = 3 V, I _{DS} = 0.1 mA	V	-3	-0.8	-0.5	-3	-0.8	-0.5	-3	-0.8	-0.5	-3	-0.8	-0.5
g _m	Transconductance V _{DS} = 3 V, I _{DS} = 10 mA	mS	30	40	70	30	40	70	30	40	70	30	40	70
I _{GSO}	Gate to Source Leakage Current V _{GS} = -4 V	μA		1	10		1	10		1	10		1	10
R _{TH}	Thermal Resistance (Channel to Ambient)	°C/W			190 ³			625			625			625
P _T	Total Power Dissipation	mW			500			240			240			240

Notes:

1. Gain Calculations: $MAG = \frac{|S_{21}|}{|S_{12}|} (K \pm \sqrt{K^2 - 1})$, $K = \frac{1 + |\Delta|^2 - |S_{11}|^2 - |S_{22}|^2}{2|S_{12}||S_{21}|}$, $\Delta = S_{11}S_{22} - S_{21}S_{12}$. When $K \leq 1$, $MAG = MSG$.

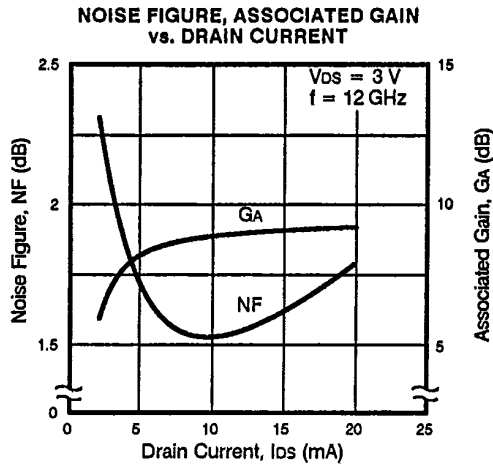
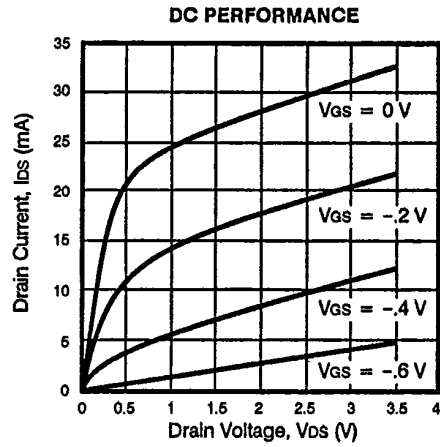
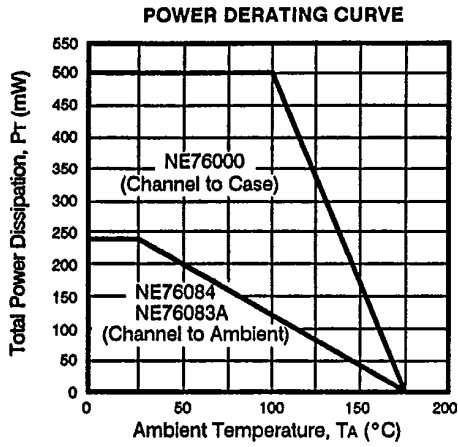
MAG = Maximum Available Gain
MSG = Maximum Stable Gain

- Typical values of noise figures are those obtained when 50% of the devices from a large number of lots were individually measured in a circuit with the input individually tuned to obtain the minimum value. Maximum values are criteria established on the production line as a "go-no-go" screening test with the fixture tuned for the "generic" type but not for each specimen.
- R_{TH} for chip mounted on a copper heatsink.
- RF performance is determined by packaging and testing 10 samples per wafer; wafer rejection criteria for standard devices is 2 rejects for 10 samples.
- Package type 84 recommended for use below 13 GHz. Refer to NE76083A for use above 13 GHz.



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TYPICAL PERFORMANCE CHARACTERISTICS (TA = 25°C)



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NE76000 TYPICAL NOISE PARAMETERS¹

FREQ. (GHz)	NF _{OPT} (dB)	G _A (dB)	Γ _{OPT}		R _n /50
			(MAG)	(ANG)	
1	0.50	20	.84	12	.69
2	0.55	17	.76	25	.63
4	0.60	14.0	.70	45	.49
6	0.80	12	.64	65	.41
8	1.00	11	.60	83	.36
10	1.30	10	.56	99	.32
12	1.60	9	.52	114	.27
14	1.90	8.5	.49	125	.23
16	2.20	7.9	.48	135	.20
18	2.50	7.3	.47	145	.18

Γ_{opt} . includes bond wires.

Bond wires used during testing.

Gate: 2 wires total, 1 per bond pad, 0.0139" long each wire.

Drain: 2 wires total, 1 per bond pad, 0.0115" long each wire.

Sources: 4 wires total, 2 per side, 0.0066" long each wire.

Wire: 0.0007" diameter, gold.

NE76083A TYPICAL NOISE PARAMETERS¹(V_{DS} = 3 V, I_{DS} = 10 mA)

FREQ. (GHz)	NF _{OPT} (dB)	G _A (dB)	Γ _{OPT}		R _n /50
			(MAG)	(ANG)	
1	0.50	20	.92	16	.69
2	0.55	17	.86	35	.64
4	0.60	14	.73	73	.55
6	0.80	12	.62	109	.47
8	1.00	11	.55	138	.39
10	1.30	10	.48	168	.27
12	1.60	9	.46	-161	.24
14	1.90	8.4	.42	-133	.22
16	2.30	7.8	.40	-105	.19
18	2.60	7.2	.38	-69	.17

NE76084 TYPICAL NOISE PARAMETERS¹(V_{DS} = 3 V, I_{DS} = 10 mA)

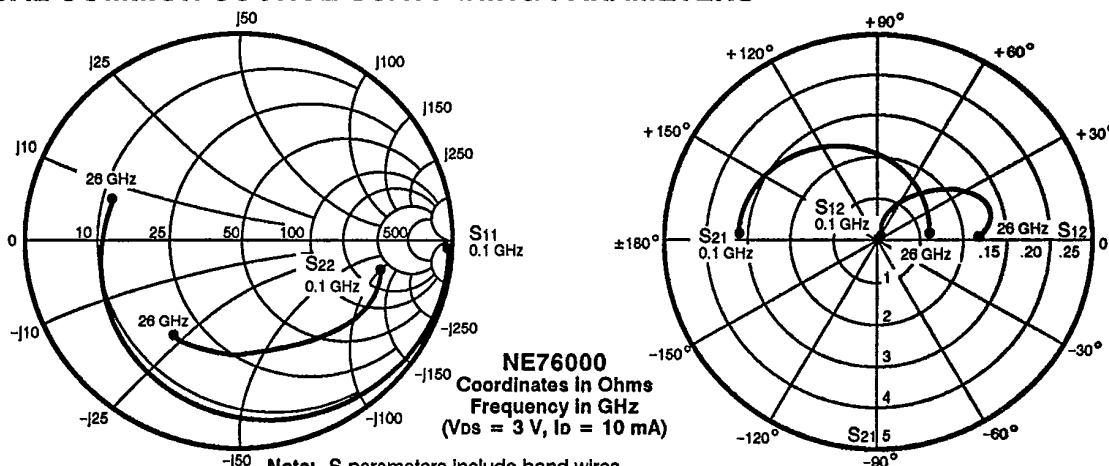
FREQ. (GHz)	NF _{OPT} (dB)	G _A (dB)	Γ _{OPT}		R _n /50
			(MAG)	(ANG)	
1	0.50	20	.93	11	.58
2	0.55	17	.88	31	.51
4	0.60	14	.72	69	.46
6	0.80	12	.60	107	.37
8	1.00	11	.52	148	.32
10	1.30	10	.46	-175	.26
12	1.60	9	.45	-138	.21

Notes:

1. Typical values of noise figures are those obtained when 50% of the devices from a large number of lots were individually measured in a circuit with the input individually tuned to obtain the minimum value. Maximum values are criteria established on the production line as a "go-no-go" screening test with the fixture tuned for the "generic" type but not for each specimen.

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TYPICAL COMMON SOURCE SCATTERING PARAMETERS



Note: S-parameters include bond wires.

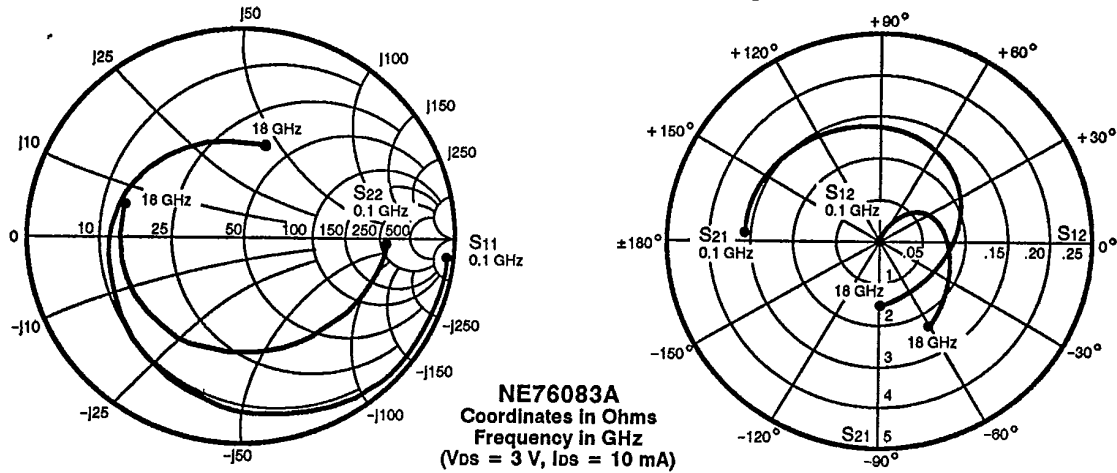
- Gate: Total 2 wire (s), 1 per bond pad, 0.0139" (354 μm) long each wire.
- Drain: Total 2 wire (s), 1 per bond pad, 0.0115" (291 μm) long each wire.
- Source: Total 4 wire (s), 2 per side, 0.0066" (168 μm) long each wire.
- Wire: 0.0007" (17.8 μm) Diameter, Gold.

S-MAGN AND ANGLES:
V_{DS} = 3 V, I_D = 10 mA

FREQUENCY (GHz)

FREQUENCY (GHz)	S ₁₁	S ₂₁	S ₁₂	S ₂₂	k ¹	MAG ¹
0.05	0.99 -1	3.32 180	0.001 89	0.68 -1	0.15	35.2
0.10	0.99 -2	3.30 179	0.002 87	0.68 -1	0.10	32.2
0.20	0.99 -3	3.29 178	0.004 86	0.68 -2	0.10	29.2
0.50	0.99 -7	3.28 175	0.009 85	0.68 -3	0.05	25.6
1.0	0.99 -14	3.27 169	0.02 81	0.67 -8	.05	21.9
2.0	0.99 -27	3.19 158	0.04 74	0.67 -16	.08	19.1
3.0	0.97 -39	3.08 148	0.06 66	0.66 -23	.13	17.3
4.0	0.95 -50	2.95 138	0.07 59	0.64 -30	.18	16.1
5.0	0.92 -61	2.81 129	0.09 51	0.62 -36	.24	15.2
6.0	0.89 -70	2.67 120	0.09 47	0.60 -42	.30	14.5
7.0	0.87 -78	2.55 113	0.10 41	0.59 -47	.34	13.9
8.0	0.86 -87	2.45 104	0.11 36	0.58 -53	.38	13.5
9.0	0.83 -96	2.33 97	0.11 30	0.57 -58	.45	13.1
10.0	0.81 -104	2.24 90	0.12 29	0.57 -63	.45	12.7
11.0	0.80 -112	2.16 83	0.13 23	0.56 -68	.48	12.3
12.0	0.77 -120	2.08 76	0.13 19	0.56 -73	.52	12.0
13.0	0.75 -128	2.00 70	0.13 16	0.55 -77	.56	11.9
14.0	0.74 -135	1.93 63	0.13 12	0.55 -81	.59	11.6
15.0	0.73 -141	1.85 58	0.13 9	0.55 -85	.62	11.4
16.0	0.72 -147	1.80 53	0.13 6	0.55 -88	.65	11.3
17.0	0.71 -152	1.73 47	0.13 5	0.55 -91	.72	11.3
18.0	0.70 -155	1.65 43	0.13 3	0.55 -94	.80	11.0
19.0	0.69 -159	1.57 38	0.12 2	0.55 -96	.97	11.1
20.0	0.68 -162	1.53 35	0.12 4	0.55 -99	.99	11.0
21.0	0.67 -166	1.49 30	0.12 5	0.55 -102	1.02	10.0
22.0	0.67 -171	1.46 26	0.12 4	0.55 -107	1.09	9.3
23.0	0.65 -176	1.41 21	0.12 5	0.55 -111	1.13	8.7
24.0	0.64 178	1.39 16	0.12 5	0.55 -116	1.08	8.9
25.0	0.63 171	1.32 11	0.12 5	0.55 -120	1.17	7.9
26.0	0.62 164	1.29 7	0.12 4	0.55 -123	1.18	7.6

TYPICAL COMMON SOURCE SCATTERING PARAMETERS



S-MAGN AND ANGLES:

V_{DS} = 3 V, I_{DS} = 10 mA

FREQUENCY (GHz)

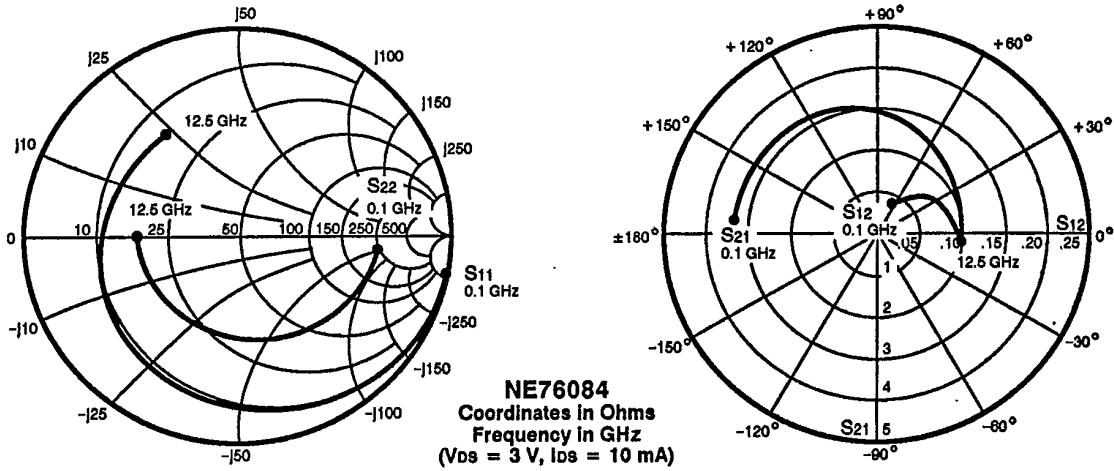
FREQUENCY (GHz)	S ₁₁	S ₂₁	S ₁₂	S ₂₂	k ¹	MAG ¹
0.1	0.99 -2	3.22 178	0.001 87	0.65 -1	0.20	35.1
0.2	0.99 -4	3.20 177	0.002 85	0.65 -3	0.12	32.0
0.5	0.99 -11	3.18 170	0.007 80	0.65 -8	0.05	26.6
1.0	0.99 -20	3.15 160	0.02 78	0.65 -15	0.10	22.7
2.0	0.97 -40	3.05 142	0.04 62	0.64 -29	0.17	18.8
3.0	0.93 -59	2.95 123	0.05 48	0.62 -43	0.32	17.7
4.0	0.89 -78	2.80 106	0.07 37	0.61 -56	0.36	16.02
5.0	0.84 -96	2.65 89	0.07 25	0.59 -69	0.53	15.8
6.0	0.80 -114	2.48 73	0.08 14	0.57 -81	0.62	14.9
7.0	0.76 -130	2.30 58	0.08 4	0.56 -93	0.83	14.6
8.0	0.74 -145	2.15 44	0.08 -2	0.56 -103	0.85	14.3
9.0	0.72 -158	2.03 31	0.08 -9	0.56 -112	0.95	14.0
10.0	0.68 -172	1.94 17	0.08 -16	0.56 -121	1.11	11.8
11.0	0.66 173	1.85 4	0.09 -21	0.56 -130	1.06	11.6
12.0	0.64 158	1.77 -10	0.09 -27	0.55 -140	1.05	11.5
13.0	0.64 145	1.71 -23	0.09 -32	0.55 -150	1.19	10.1
14.0	0.63 132	1.65 -35	0.09 -34	0.55 -159	1.23	9.7
15.0	0.60 120	1.61 -48	0.10 -42	0.56 -168	1.19	9.4
16.0	0.56 104	1.58 -63	0.11 -50	0.56 -177	1.20	8.8
17.0	0.54 86	1.56 -77	0.11 -59	0.54 173	1.31	8.2
18.0	0.55 70	1.54 -91	0.12 -67	0.53 164	1.20	8.3

V_{DS} = 3 V, I_{DS} = 30 mA

0.1	0.99 -2	4.45 178	0.001 90	0.59 -1	0.14	36.4
0.2	0.99 -5	4.41 176	0.002 88	0.59 -3	0.06	33.4
0.5	0.99 -13	4.38 169	0.004 86	0.59 -7	0.32	30.4
1.0	0.99 -22	4.35 159	0.02 79	0.59 -15	0.07	23.4
2.0	0.95 -43	4.17 140	0.03 64	0.58 -29	0.26	21.4
3.0	0.90 -64	3.93 121	0.04 50	0.56 -42	0.43	19.9
4.0	0.85 -83	3.68 103	0.05 41	0.55 -55	0.52	18.7
5.0	0.79 -102	3.42 86	0.06 29	0.53 -67	0.66	17.6
6.0	0.74 -120	3.15 70	0.07 22	0.52 -79	0.72	16.5
7.0	0.71 -136	2.90 55	0.07 13	0.51 -90	0.86	16.2
8.0	0.68 -151	2.68 42	0.07 9	0.51 -100	0.97	15.8
9.0	0.65 -164	2.51 28	0.07 3	0.52 -109	1.09	13.6
10.0	0.62 -177	2.38 15	0.08 -1	0.52 -118	1.07	13.1
11.0	0.59 168	2.26 2	0.08 -6	0.52 -126	1.19	11.9
12.0	0.57 153	2.14 -11	0.09 -12	0.52 -135	1.15	11.4
13.0	0.57 140	2.06 -24	0.09 -18	0.52 -145	1.18	11.0
14.0	0.56 128	1.98 -37	0.10 -21	0.52 -154	1.12	10.9
15.0	0.53 115	1.93 -50	0.10 -30	0.54 -163	1.17	10.3
16.0	0.49 100	1.87 -64	0.11 -40	0.54 -172	1.19	9.7
17.0	0.48 82	1.84 -78	0.12 -49	0.54 179	1.12	9.8
18.0	0.49 67	1.81 -92	0.13 -60	0.52 170	1.10	9.6



TYPICAL COMMON SOURCE SCATTERING PARAMETERS



S-MAGN AND ANGLES:
Vds = 3 V, Ids = 10 mA

FREQUENCY (GHz)	S ₁₁	S ₂₁	S ₁₂	S ₂₂	K ¹	MAG ¹
0.1	0.99 -2	3.42 177	0.001 88	0.66 -2	0.18	35.3
0.2	0.99 -4	3.40 176	0.002 86	0.66 -3	0.18	32.3
0.5	0.99 -11	3.38 170	0.007 84	0.66 -8	0.17	26.8
1.0	0.99 -20	3.36 160	0.02 76	0.65 -15	0.08	21.9
2.0	0.96 -41	3.31 141	0.04 64	0.63 -28	0.23	18.8
3.0	0.90 -62	3.12 121	0.06 49	0.60 -42	0.39	17.2
4.0	0.85 -81	2.92 103	0.07 37	0.58 -55	0.51	16.0
5.0	0.79 -101	2.78 87	0.08 29	0.54 -69	0.59	15.2
6.0	0.73 -120	2.54 69	0.09 18	0.51 -82	0.77	14.7
7.0	0.69 -139	2.46 53	0.09 10	0.49 -97	0.80	14.2
8.0	0.66 -157	2.27 39	0.09 5	0.47 -110	0.95	13.9
9.0	0.64 -174	2.14 26	0.10 -1	0.47 -124	0.97	13.4
10.0	0.62 167	1.97 10	0.10 -7	0.46 -139	1.11	11.1
11.0	0.60 150	1.85 4	0.11 -4	0.46 -156	1.09	10.5
12.0	0.61 133	1.71 -13	0.10 -13	0.47 -171	1.22	9.4
12.5	0.60 125	1.73 -19	0.11 -17	0.46 -180	1.15	9.6

Vds = 3 V, Ids = 30 mA

0.1	0.99 -3	4.91 177	0.001 88	0.59 -2	0.17	37.6
0.2	0.99 -5	4.87 176	0.001 86	0.58 -3	0.11	35.7
0.5	0.99 -13	4.81 169	0.00 84	0.58 -7	0.37	31.3
1.0	0.98 -24	4.77 159	0.02 76	0.58 -15	0.14	24.5
2.0	0.93 -48	4.65 137	0.04 64	0.55 -27	0.34	21.2
3.0	0.86 -71	4.28 117	0.05 52	0.52 -40	0.51	19.5
4.0	0.78 -92	3.89 98	0.06 42	0.49 -51	0.69	18.3
5.0	0.72 -114	3.60 82	0.07 34	0.46 -64	0.78	17.3
6.0	0.66 -133	3.20 64	0.07 27	0.44 -76	0.99	16.6
7.0	0.63 -154	3.02 49	0.08 19	0.42 -89	1.01	15.2
8.0	0.60 -171	2.73 35	0.08 17	0.41 -101	1.15	13.0
9.0	0.58 171	2.55 22	0.09 12	0.41 -115	1.14	12.4
10.0	0.57 153	2.32 7	0.09 6	0.40 -129	1.21	11.3
11.0	0.56 136	2.16 2	0.11 6	0.40 -147	1.15	10.7
12.0	0.57 121	1.97 -15	0.11 -3	0.41 -163	1.22	9.8
12.5	0.56 114	1.98 -19	0.12 -8	0.41 -172	1.16	9.9