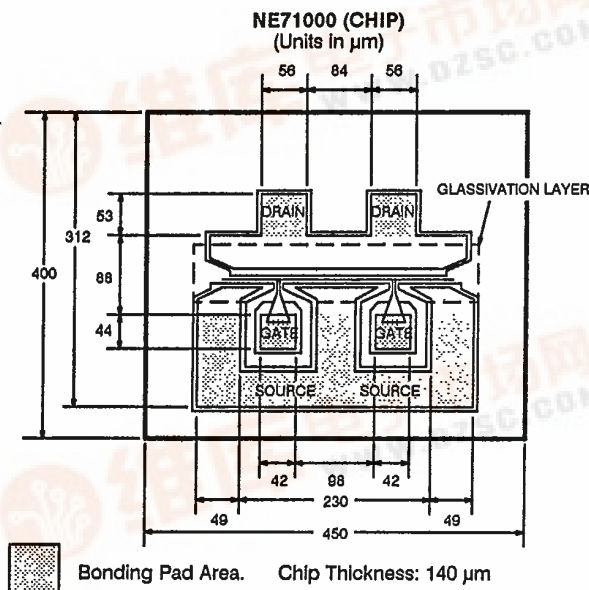


NEC[®]**LOW NOISE
Ku-K BAND GaAs MESFET****NE710
SERIES****FEATURES**

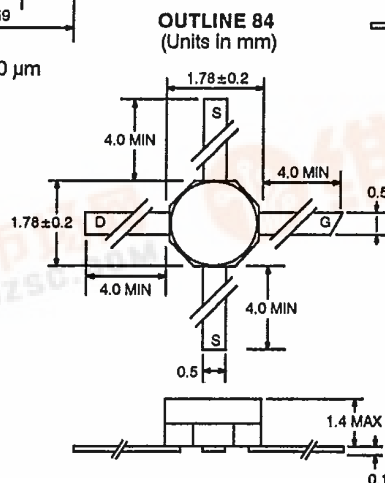
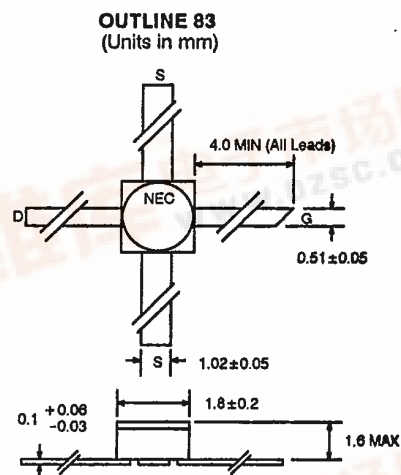
- VERY HIGH f_{MAX} : 90 GHz
- LOW NOISE FIGURE
- HIGH ASSOCIATED GAIN
- 0.3 MICRON RECESSED GATE
- N+ CONTACT LAYER (Triple Epitaxial Technology)
- PROVEN RELIABILITY AND STABILITY

OUTLINE DIMENSIONS**DESCRIPTION AND APPLICATIONS**

The NE710 series features a low noise figure and high associated gain thru K-band by employing a recessed 0.3 micron gate and triple epitaxial technology.

The device is available in chip form (NE71000). The surface of the device, except for the bonding pads, is passivated with SiO_2 and SiN_4 for scratch protection as well as surface stabilization. The NE71083 is a low cost device for industrial and military applications, and the NE71084 is a low cost device for consumer applications.

Several versions of NE71083 and NE71084 are available. Noise figure and gain of the NE71083 and NE71084 are specified at 12 GHz. The noise figure and gain of the NE71083-06, -07, -08 and the NE71084-06, -08 are specified at 4 GHz.



PERFORMANCE SPECIFICATIONS (T_A = 25°C)

PART NUMBER EIAJ ¹ REGISTERED NUMBER PACKAGE OUTLINE		NE71000 CHIP		NE71083 2SK406 83		NE71083-06 2SK406-06 83		NE71083-07 2SK406-07 83		NE71083-08 2SK406-08 83		NE71084 2SK609 84		NE71084-06 2SK609-06 84		NE71084-08 2SK609-08 84	
SYMBOLS	PARAMETERS AND CONDITIONS	UNITS	MIN	TYP	MAX	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			90	
MAG	Maximum Available Gain ² at V _{DS} = 3 V, I _{DS} = 20 mA f = 4 GHz f = 8 GHz f = 12 GHz f = 18 GHz	dB dB dB dB		17 15 12 8.5			17 15 12 8.5						16.5			16.5	
N _{FOPT}	Optimum Noise Figure ³ at V _{DS} = 3 V, I _{DS} = 10 mA f = 4 GHz f = 8 GHz f = 12 GHz f = 18 GHz f = 26 GHz	dB dB dB dB dB		0.6 1 1.5 2.1 3.5			0.6 1 1.5 1.8		0.7		0.8		0.45 1.6 1.8		0.6	0.6	0.8
G _A	Associated Gain at Optimum Noise Figure at V _{DS} = 3 V, I _{DS} = 10 mA f = 4 GHz f = 8 GHz f = 12 GHz f = 18 GHz f = 26 GHz	dB dB dB dB dB		13 11 9 7 5.5		11.5 8	13 11 9					13 8	14 9		13	14	14
P _{1dB}	Output Power at 1 dB Compression Point at V _{DS} = 3 V, I _{DS} = 10 mA f = 4 GHz f = 12 GHz	dBm dBm		14.5			14.5 14.5						14.5			14.5	

Notes:

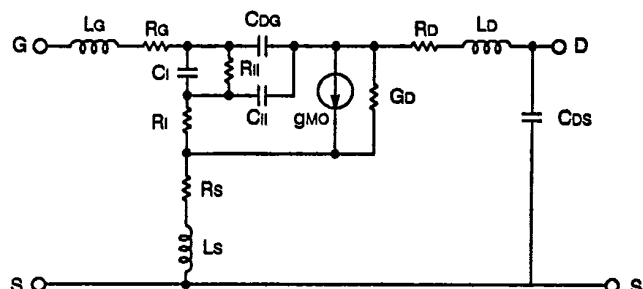
- Electronic Industrial Association of Japan.
- Gain Calculations: $MAG = \frac{|S_{21}|}{|S_{12}|} \sqrt{K^2 - 1}$, $K = \frac{1 + |\Delta|^2 - |S_{11}|^2 - |S_{22}|^2}{2|S_{12}| |S_{21}|}$, $\Delta = S_{11}S_{22} - S_{21}S_{12}$
- Typical values of noise figures are those obtained when 50% of the devices 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.

NE710 SERIES**ELECTRICAL CHARACTERISTICS** ($T_A = 25^\circ\text{C}$)

PART NUMBER EIAJ ¹ REGISTERED NUMBER PACKAGE OUTLINE			NE71000 CHIP			NE71083 2SK406 83			NE71084 2SK609 84		
SYMBOLS	PARAMETERS AND CONDITIONS	UNITS	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX
I_{DS}	Drain Current at $V_{DS} = 3\text{ V}$, $V_{GS} = 0$	mA	20	40	120	20	40	120	20	40	120
V_P	Pinch-off Voltage at $V_{DS} = 3\text{ V}$, $I_{DS} = 0.1\text{ mA}$	V	-0.5	-1.1	-3.5	-0.5	-1.1	-3.5	-0.5	-1.1	-3.5
g_m	Transconductance at $V_{DS} = 3\text{ V}$, $I_{DS} = 10\text{ mA}$	mS	20	50	100	20	50	100	20	50	100
I_{AS}	Gate to Source Leakage Current at $V_{GS} = -5\text{ V}$	μA		1	10		1	10		1	10
R_{TH}	Thermal Resistance (Channel-to-Case)	$^\circ\text{C/W}$			190 ²			450			450
P_T	Total Power Dissipation	mW			400			270			270

Notes:

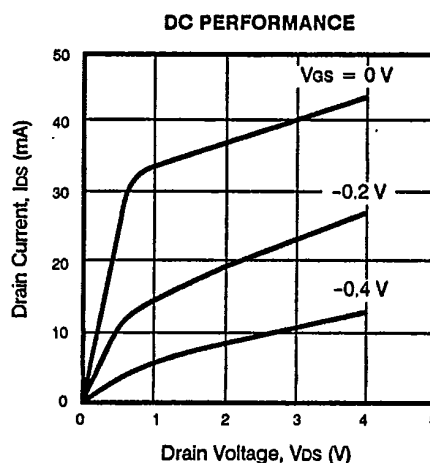
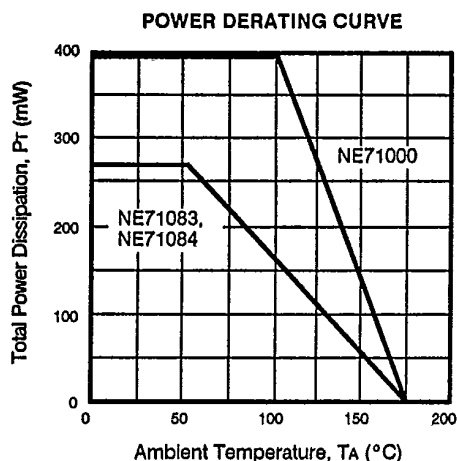
1. Electronic Industrial Association of Japan.
2. R_{TH} for chip mounted on a copper heatsink.

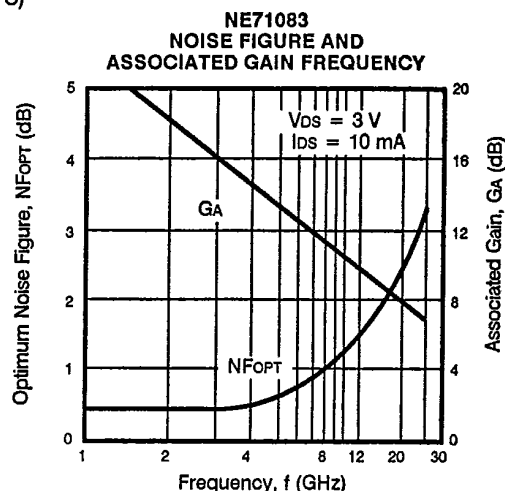
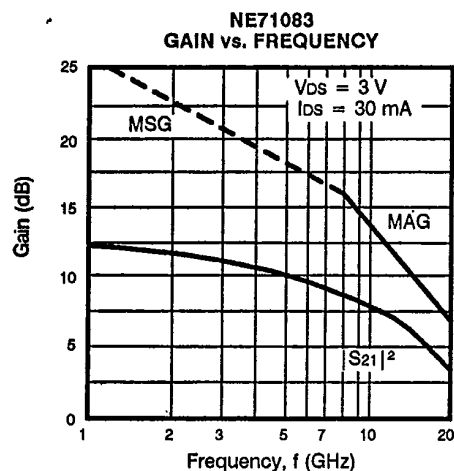
EQUIVALENT CIRCUIT

COMPONENT	VALUE
L_g	0.005 nH
R_g	2.00 Ω
C_i	0.28 pF
R_i	1.6 Ω
C_{ii}	0.064 pF
R_{ii}	1 M Ω
R_s	1.5 Ω
L_s	0.001 nH
C_{dg}	0.033 pF
R_d	1.5 Ω
L_d	0.005 nH
C_{ds}	0.03 pF
g_{mo}	48.0 mS
G_d	1.5 mS

ABSOLUTE MAXIMUM RATINGS ($T_A = 25^\circ\text{C}$)

SYMBOLS	PARAMETERS	UNITS	RATINGS
V_{DS}	Drain to Source Voltage	V	5
V_{GS}	Gate to Source Voltage	V	-6
I_{DS}	Drain Current	mA	120
P_{IN}	RF Input Power	mW	40
T_{CH}	Channel Temperature	$^\circ\text{C}$	175
T_{STG}	Storage Temperature	$^\circ\text{C}$	-65 to +175

TYPICAL DEVICE CHARACTERISTICS ($T_A = 25^\circ\text{C}$)

TYPICAL PERFORMANCE CHARACTERISTICS ($T_A = 25^\circ\text{C}$)

TYPICAL NOISE PARAMETERS

NE71000 $V_{DS} = 3\text{ V}$, $I_{DS} = 10\text{ mA}$

FREQUENCY (GHz)	MIN NF (dB)	Γ_{OPT}	$Rn/50\ \Omega$
1.0	0.50	.90 $\angle$ 12	0.57
2.0	0.55	.85 $\angle$ 21	0.51
4.0	0.60	.75 $\angle$ 40	0.44
6.0	0.80	.69 $\angle$ 55	0.38
8.0	1.00	.62 $\angle$ 70	0.33
10.0	1.30	.56 $\angle$ 85	0.28
12.0	1.60	.52 $\angle$ 99	0.24
14.0	1.90	.49 $\angle$ 114	0.20
16.0	2.20	.47 $\angle$ 127	0.18
18.0	2.50	.45 $\angle$ 140	0.16

NE71083 $V_{DS} = 3\text{ V}$, $I_{DS} = 10\text{ mA}$

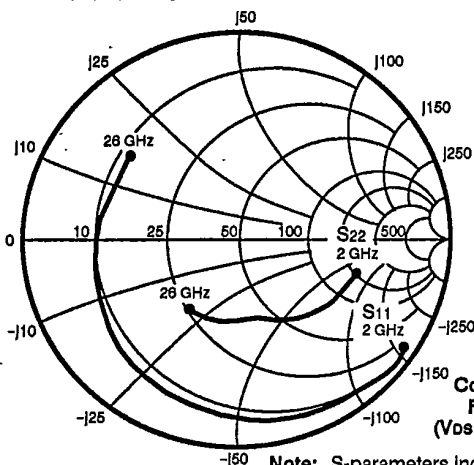
FREQUENCY (GHz)	MIN NF (dB)	Γ_{OPT}	$Rn/50\ \Omega$
1.0	0.45	.90 $\angle$ 17	0.65
2.0	0.55	.84 $\angle$ 40	0.57
4.0	0.60	.72 $\angle$ 79	0.48
6.0	0.80	.62 $\angle$ 112	0.39
8.0	1.00	.56 $\angle$ 143	0.33
10.0	1.35	.50 $\angle$ 168	0.28
12.0	1.60	.46 $\angle$ -165	0.24
14.0	1.90	.43 $\angle$ -140	0.20
16.0	2.10	.40 $\angle$ -112	0.18
18.0	2.70	.40 $\angle$ -84	0.16

NE71084 $V_{DS} = 3\text{ V}$, $I_{DS} = 10\text{ mA}$

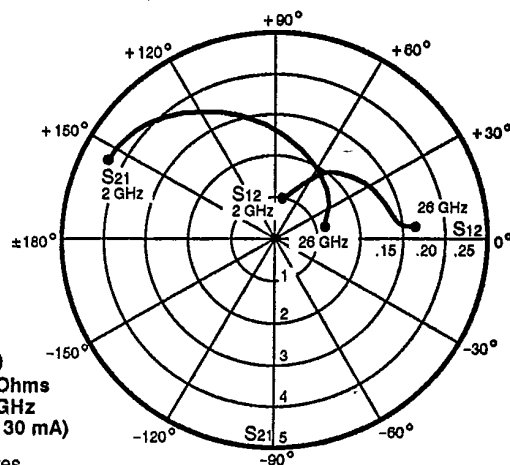
FREQUENCY (GHz)	MIN NF (dB)	Γ_{OPT}	$Rn/50\ \Omega$
1.0	0.50	.90 $\angle$ 17	0.50
2.0	0.55	.85 $\angle$ 37	0.47
4.0	0.60	.71 $\angle$ 85	0.43
6.0	0.80	.61 $\angle$ 127	0.35
8.0	1.00	.54 $\angle$ 165	0.30
10.0	1.30	.52 $\angle$ -158	0.25
12.0	1.60	.51 $\angle$ -124	0.20

3

TYPICAL COMMON SOURCE SCATTERING PARAMETERS



NE71000
Coordinates in Ohms
Frequency in GHz
(V_{DS} = 3 V, I_{DS} = 30 mA)



Note: S-parameters include bond wires.

Gate: Total 2 wire (s), 1 per bond pad, 0.015" long each wire.
Drain: Total 2 wire (s), 1 per bond pad, 0.011" long each wire.
Source: Total 4 wire (s), 2 per side, 0.008" long each wire.
Wire: 0.0008" Diameter, Gold.

S-MAGN AND ANGLES:

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

FREQUENCY (GHz)

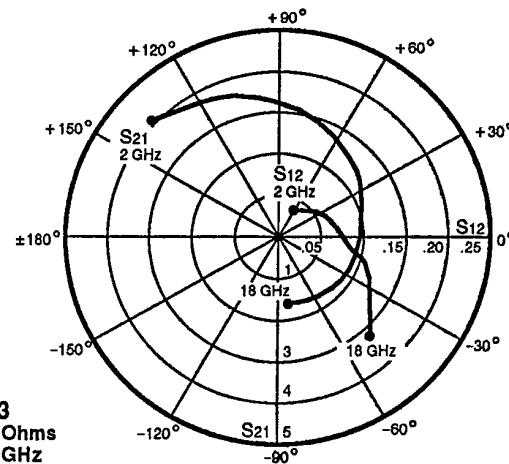
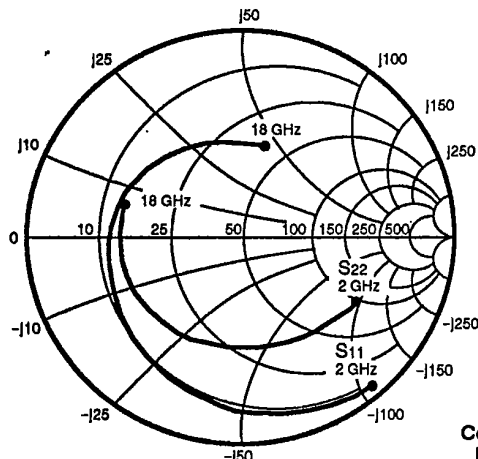
	S ₁₁	S ₂₁	S ₁₂	S ₂₂
2.0	.98 -29	3.23 157	.06 72	.65 -16
3.0	.94 -43	3.14 145	.08 65	.64 -24
4.0	.92 -57	3.00 135	.10 56	.60 -32
5.0	.90 -70	2.84 125	.12 49	.59 -38
6.0	.89 -80	2.67 117	.14 43	.58 -44
7.0	.87 -91	2.53 108	.15 36	.57 -50
8.0	.84 -100	2.39 99	.16 30	.54 -55
9.0	.83 -107	2.23 92	.16 26	.54 -58
10.0	.82 -116	2.12 86	.17 23	.53 -64
11.0	.78 -124	2.01 78	.17 18	.50 -67
12.0	.77 -130	1.92 72	.17 17	.50 -70
13.0	.74 -138	1.82 65	.18 13	.48 -74
14.0	.73 -146	1.73 59	.18 10	.47 -78
15.0	.71 -154	1.68 54	.19 6	.48 -83
16.0	.69 -161	1.60 47	.19 4	.47 -90
17.0	.67 -167	1.51 43	.19 -1	.47 -96
18.0	.67 -172	1.47 39	.19 -3	.47 -99
19.0	.66 -176	1.41 35	.18 -6	.46 -103
20.0	.66 180	1.37 31	.18 -8	.47 -104
21.0	.66 176	1.32 26	.17 -7	.47 -106
22.0	.65 171	1.27 22	.17 -8	.48 -107
23.0	.64 167	1.21 19	.17 -7	.47 -109
24.0	.63 162	1.19 15	.18 -7	.47 -112
25.0	.63 155	1.14 11	.18 -7	.47 -115
26.0	.64 148	1.10 6	.19 -9	.46 -123

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

	S ₁₁	S ₂₁	S ₁₂	S ₂₂
2.0	.97 -34	4.35 155	.05 70	.58 -18
3.0	.92 -50	4.14 142	.07 63	.56 -26
4.0	.90 -65	3.88 131	.09 55	.53 -35
5.0	.87 -79	3.61 121	.10 48	.51 -40
6.0	.87 -90	3.36 114	.12 42	.50 -47
7.0	.85 -101	3.14 105	.12 34	.49 -53
8.0	.81 -110	2.93 97	.12 30	.46 -57
9.0	.80 -118	2.71 89	.13 27	.46 -59
10.0	.80 -126	2.55 84	.13 24	.46 -65
11.0	.76 -134	2.40 77	.13 21	.43 -67
12.0	.74 -140	2.28 70	.13 20	.43 -70
13.0	.73 -148	2.14 64	.14 17	.41 -74
14.0	.71 -156	2.02 59	.14 16	.40 -78
15.0	.70 -163	1.94 54	.14 14	.42 -83
16.0	.69 -170	1.86 48	.15 12	.41 -90
17.0	.67 -176	1.74 44	.15 9	.41 -96
18.0	.66 -180	1.69 40	.15 6	.41 -99
19.0	.66 176	1.62 37	.15 5	.41 -103
20.0	.66 172	1.58 33	.15 5	.42 -104
21.0	.66 168	1.52 29	.14 5	.42 -106
22.0	.65 164	1.47 25	.15 5	.43 -106
23.0	.64 159	1.38 21	.14 7	.42 -109
24.0	.63 155	1.37 18	.16 8	.42 -111
25.0	.63 149	1.30 13	.16 8	.41 -114
26.0	.65 142	1.25 8	.17 4	.42 -122

T-31-25

TYPICAL COMMON SOURCE SCATTERING PARAMETERS



NE71083

Coordinates in Ohms

Frequency in GHz

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

S-MAGN AND ANGLES:

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

FREQUENCY (GHz)

	S ₁₁	S ₂₁	S ₁₂	S ₂₂
2.0	.96 -45	3.20 138	.05 59	.68 -31
3.0	.92 -64	2.95 121	.06 46	.66 -45
4.0	.88 -84	2.77 101	.07 33	.64 -59
5.0	.82 -102	2.56 86	.08 21	.61 -72
6.0	.79 -118	2.37 69	.09 11	.60 -84
7.0	.75 -134	2.20 54	.09 2	.60 -96
8.0	.73 -148	2.04 41	.09 -3	.60 -106
9.0	.71 -160	1.92 27	.09 -10	.60 -116
10.0	.68 -173	1.78 17	.09 -12	.60 -126
11.0	.67 -176	1.70 5	.09 -17	.61 -134
12.0	.64 -163	1.65 -9	.09 -22	.61 -143
13.0	.61 -152	1.56 -20	.09 -24	.61 -152
14.0	.59 -140	1.51 -31	.10 -27	.61 -160
15.0	.57 -128	1.47 -45	.10 -33	.61 -169
16.0	.54 -114	1.47 -54	.11 -35	.61 -178
17.0	.52 -99	1.45 -69	.12 -45	.60 -172
18.0	.50 -85	1.41 -81	.14 -52	.59 -160

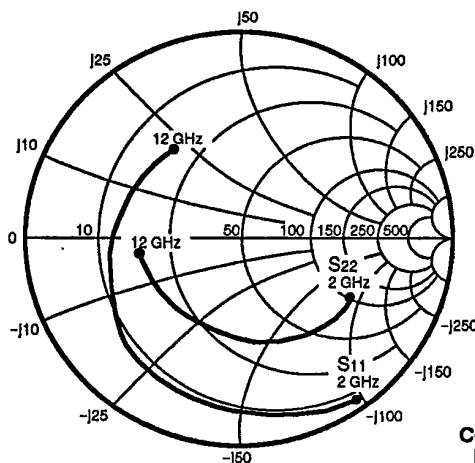
V_{DS} = 3 V, I_{DS} = 20 mA

	S ₁₁	S ₂₁	S ₁₂	S ₂₂
2.0	.95 -48	3.88 136	.04 59	.63 -32
3.0	.90 -68	3.52 119	.05 47	.61 -45
4.0	.85 -88	3.29 99	.07 35	.59 -59
5.0	.79 -106	2.98 84	.07 24	.56 -72
6.0	.76 -123	2.74 67	.08 16	.55 -84
7.0	.72 -138	2.53 52	.08 8	.55 -97
8.0	.70 -151	2.33 40	.08 4	.55 -107
9.0	.67 -164	2.17 26	.08 -2	.56 -117
10.0	.65 -176	2.01 16	.08 -3	.56 -128
11.0	.63 -173	1.92 4	.08 -7	.57 -136
12.0	.60 -160	1.84 -10	.09 -12	.57 -146
13.0	.57 -149	1.75 -21	.09 -15	.58 -155
14.0	.55 -137	1.69 -31	.10 -20	.58 -164
15.0	.53 -125	1.63 -45	.11 -26	.59 -173
16.0	.50 -111	1.64 -55	.12 -31	.59 -178
17.0	.48 -96	1.60 -69	.14 -42	.59 -167
18.0	.47 -82	1.58 -82	.15 -50	.59 -155

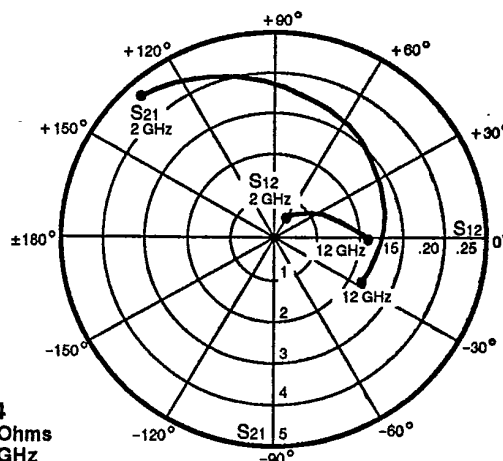
V_{DS} = 3 V, I_{DS} = 30 mA

	S ₁₁	S ₂₁	S ₁₂	S ₂₂
2.0	.95 -49	4.18 136	.04 59	.62 -31
3.0	.89 -70	3.78 118	.05 47	.60 -45
4.0	.84 -91	3.49 98	.06 35	.58 -58
5.0	.78 -109	3.15 83	.07 26	.55 -71
6.0	.74 -126	2.91 66	.07 17	.55 -82
7.0	.71 -141	2.66 51	.07 11	.55 -94
8.0	.68 -155	2.45 39	.08 6	.55 -104
9.0	.66 -168	2.27 25	.08 2	.56 -114
10.0	.63 -180	2.10 15	.08 1	.56 -123
11.0	.62 -169	2.00 3	.08 -3	.57 -131
12.0	.59 -156	1.93 -11	.09 -8	.57 -140
13.0	.56 -145	1.82 -22	.09 -10	.58 -149
14.0	.54 -133	1.75 -33	.10 -16	.58 -157
15.0	.52 -121	1.69 -47	.11 -22	.59 -165
16.0	.49 -107	1.67 -56	.12 -27	.59 -174
17.0	.47 -92	1.64 -70	.14 -38	.58 -176
18.0	.46 -78	1.61 -82	.15 -45	.58 -164

TYPICAL COMMON SOURCE SCATTERING PARAMETERS



NE71084
Coordinates in Ohms
Frequency in GHz
($V_{DS} = 3\text{ V}$, $I_{DS} = 30\text{ mA}$)



S-MAGN AND ANGLES:

$V_{DS} = 3\text{ V}$, $I_{DS} = 10\text{ mA}$

FREQUENCY (GHz)

	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
2.0	.94	-49	3.48	136	.04	59	.65	-31
3.0	.94	-70	3.36	118	.06	45	.64	-45
4.0	.86	-92	2.99	97	.07	33	.61	-61
5.0	.81	-108	2.71	82	.07	25	.57	-73
6.0	.79	-126	2.56	64	.08	15	.57	-86
7.0	.71	-142	2.40	48	.08	7	.53	-100
8.0	.66	-155	2.28	36	.08	4	.51	-110
9.0	.61	-171	2.19	23	.09	2	.49	-123
10.0	.59	-172	2.17	8	.09	-3	.48	-139
11.0	.57	-154	2.08	-9	.10	-11	.49	-157
12.0	.55	-137	1.94	-23	.10	-11	.51	-173

$V_{DS} = 3\text{ V}$, $I_{DS} = 20\text{ mA}$

	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
2.0	.93	-52	4.29	134	.04	60	.60	-31
3.0	.92	-75	4.03	115	.05	47	.59	-45
4.0	.83	-97	3.51	94	.06	35	.55	-60
5.0	.78	-113	3.16	79	.06	29	.52	-73
6.0	.75	-131	2.94	62	.07	21	.52	-85
7.0	.67	-147	2.74	47	.07	16	.49	-98
8.0	.62	-161	2.58	34	.08	14	.47	-108
9.0	.57	-176	2.47	21	.08	12	.44	-119
10.0	.56	-166	2.41	6	.09	8	.44	-135
11.0	.54	-148	2.30	-11	.10	-1	.46	-154
12.0	.52	-130	2.10	-24	.11	-3	.47	-169

$V_{DS} = 3\text{ V}$, $I_{DS} = 30\text{ mA}$

	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
2.0	.92	-54	4.67	133	.03	60	.59	-31
3.0	.90	-77	4.40	114	.05	47	.57	-45
4.0	.81	-100	3.83	93	.05	37	.54	-60
5.0	.75	-116	3.43	77	.06	31	.51	-72
6.0	.72	-134	3.19	60	.06	24	.51	-84
7.0	.65	-150	2.93	44	.07	19	.48	-96
8.0	.60	-164	2.75	32	.07	18	.46	-105
9.0	.55	-180	2.60	19	.08	16	.45	-118
10.0	.54	-163	2.52	4	.09	11	.44	-134
11.0	.53	-145	2.38	-12	.10	1	.46	-153
12.0	.50	-127	2.25	-26	.10	-1	.46	-168