

- Small Signal/Low Noise FETs

FEATURES

- **VERY HIGH f_{MAX}:** 80 GHz
- **LOW NOISE FIGURE**
0.7 dB, GA = 14 dB at 4 GHz
1.2 dB, GA = 11 dB at 8 GHz
1.8 dB, GA = 9.5 dB at 12 GHz
2.5 dB, GA = 7.5 dB at 18 GHz
- **0.5 MICRON RECESSED GATE**
- **PROVEN RELIABILITY AND STABILITY**
- **SPACE QUALIFIED**

DESCRIPTION AND APPLICATIONS

The NE137 features low noise figure and high associated gain thru 18 GHz by employing a recessed 0.5 micron gate.

The device is available as a chip (NE13700) and in a hermetically sealed package (NE13783). The chip's gate and channel are glassivated with a thin layer of SiO₂ for mechanical protection only. The NE13783 is a low cost packaged device for industrial, military and space applications. The NE13783-4 is selected for NF_{OPT} performance at 4 GHz. The NE13783S is selected for NF_{OPT} performance at 12 GHz.

PERFORMANCE SPECIFICATIONS (T_A = 25°C)

PART NUMBER EIAJ ¹ REGISTERED NUMBER PACKAGE OUTLINE			NE13700 00 (CHIP)			NE13783 2SK280 83			NE13783-4 ² 83			NE13783S 83		
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		80			80			80			80	
MAG	Maximum Available Gain ³ at V _{DS} = 3 V, I _{DS} = 30 mA, f = 8 GHz f = 12 GHz f = 18 GHz	dB dB dB		16 11 8			16 11 8			16 11 8			16 11 8	
N _{F_{OPT}}	Optimum Noise Figure ⁴ at V _{DS} = 3 V, I _{DS} = 10 mA, f = 4 GHz f = 8 GHz f = 12 GHz f = 18 GHz	dB dB dB dB		0.7 1.2 1.8 2.5	2.3 ⁵		0.7 1.2 1.8	2.3		0.7 1.2 1.8	0.8		0.7 1.2 1.6	1.8
GA	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	dB dB dB dB	8 ⁵	14 11 9.5 7.5		8	14 11 9			14 11 9		8.5	14 11 9.5	
P _{1 dB}	Output Power at 1 dB Compression Point at V _{DS} = 4 V, I _{DS} = 30 mA, f = 12 GHz	dBm		15			15			15			15	

Notes:

1. Electronic Industrial Association of Japan.
2. NE13783-4 is tested for N_{F_{OPT}} at 4 GHz. The standard NE13783 is not tested at 4 GHz.
3. Gain Calculations: $MAG = \frac{|S_{21}|}{|S_{12}|} (K \pm \sqrt{K^2 - 1})$, $K = \frac{1 + |\Delta|^2 - |S_{11}|^2 - |S_{22}|^2}{2|S_{12}| |S_{21}|}$, $\Delta = S_{11} S_{22} - S_{21} S_{12}$
4. 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.
5. RF performance is determined by packaging and testing 10 samples per wafer; wafer rejection criteria for standard devices is 2 rejects for 10 samples.

ELECTRICAL CHARACTERISTICS (TA = 25°C)

PART NUMBER EIAJ ¹ REGISTERED NUMBER PACKAGE OUTLINE			NE13700 00 (CHIP)			NE13783 2SK280 83		
SYMBOLS	PARAMETERS AND CONDITIONS	UNITS	MIN	TYP	MAX	MIN	TYP	MAX
IDSS	Drain Current at VDS = 3 V, VGS = 0	mA	20	50	100	20	50	100
VP	Pinch-off Voltage at VDS = 3 V, IDS = 0.1 mA	V	-0.5	-1.1	-6	-0.5	-1.1	-6
gm	Transconductance at VDS = 3 V, IDS = 10 mA	mS	20	45	100	20	45	100
IGS	Gate to Source Leakage Current at VGS = -5 V	μA		1	10		1	10
RTH	Thermal Resistance (Channel-to-Ambient)	°C/W			190 ²			450
PT	Total Power Dissipation	mW			400 ^{2,3}			270 ⁴

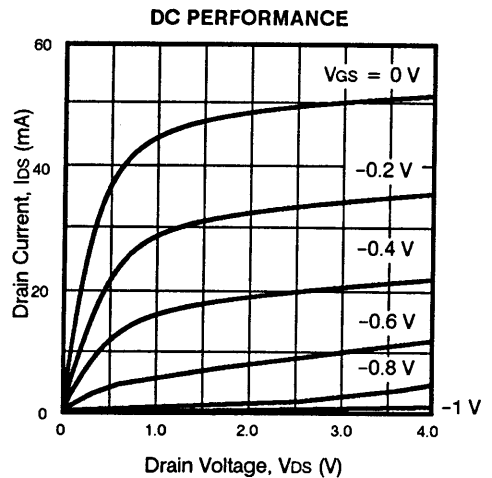
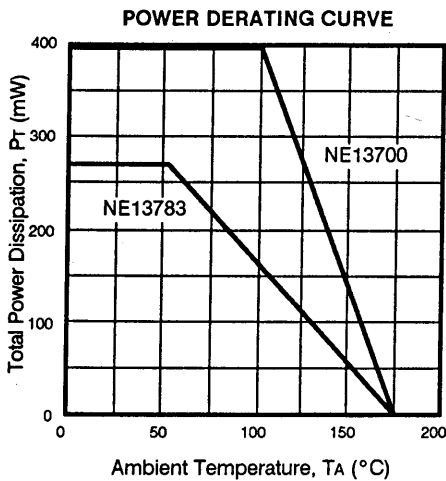
Notes:

1. Electronic Industrial Association of Japan.
2. RTH (channel to case) for chips mounted on a copper heatsink.
3. TA = 100°C
4. TA = 50°C

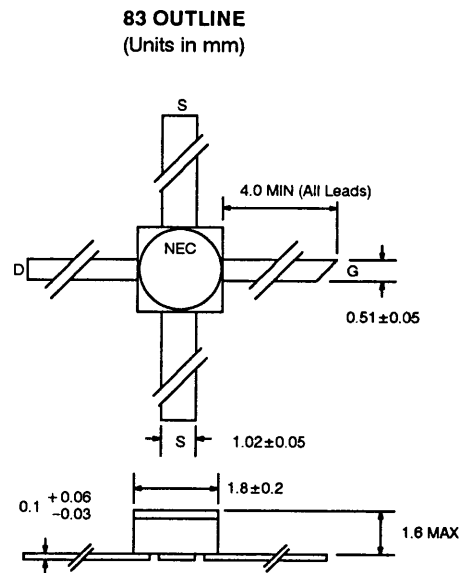
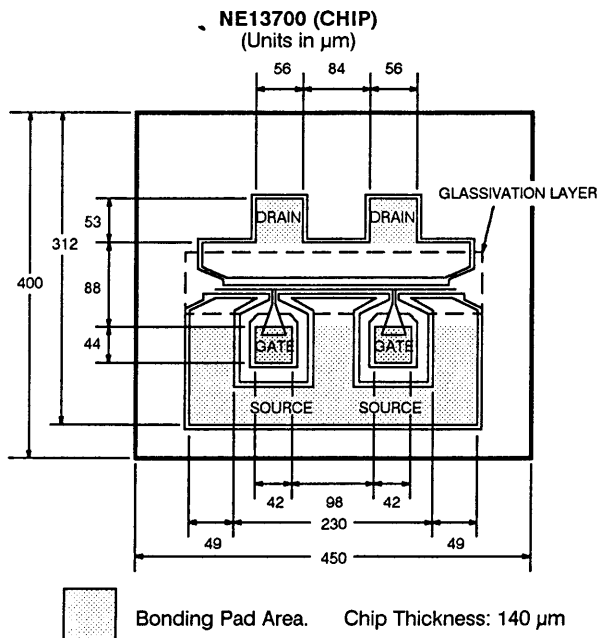
ABSOLUTE MAXIMUM RATINGS (TA = 25°C)

SYMBOLS	PARAMETERS	UNITS	RATINGS
VDS	Drain to Source Voltage	V	5
VGS	Gate to Source Voltage	V	-6
IDS	Drain Current	mA	100
PIN	RF Input Power	mW	40
TCH	Channel Temperature	°C	175
TSTG	Storage Temperature	°C	-65 to +175

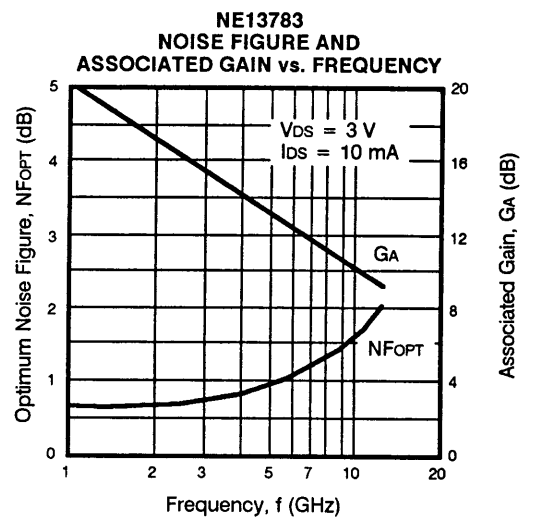
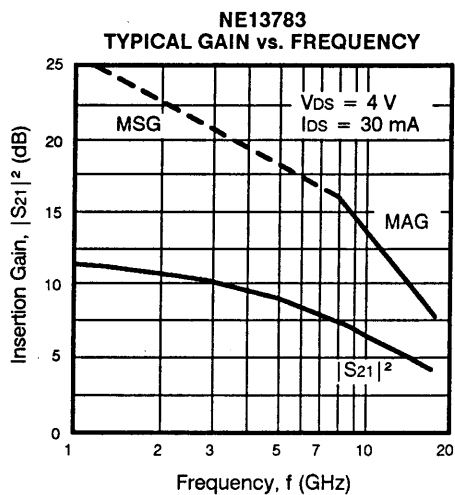
TYPICAL DEVICE CHARACTERISTICS (TA = 25°C)



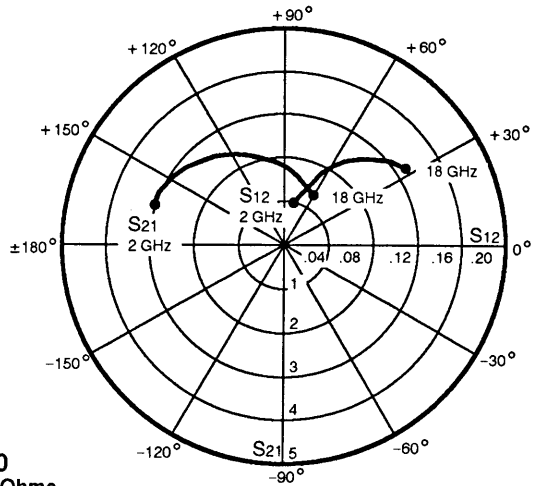
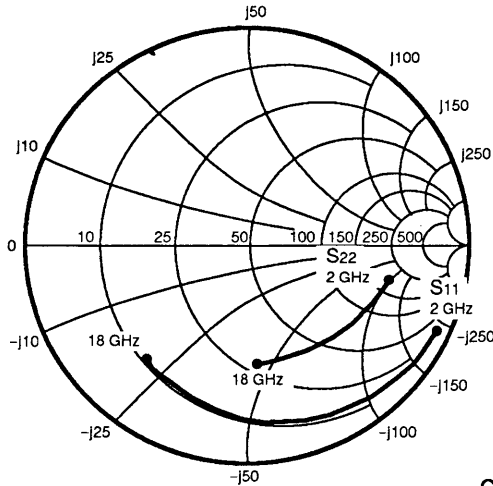
OUTLINE DIMENSIONS



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



TYPICAL COMMON SOURCE SCATTERING PARAMETERS



NE13700
Coordinates in Ohms
Frequency in GHz
(V_{DS} = 3 V, I_{DS} = 10 mA)

S-MAGN AND ANGLES:

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

FREQUENCY (MHz)

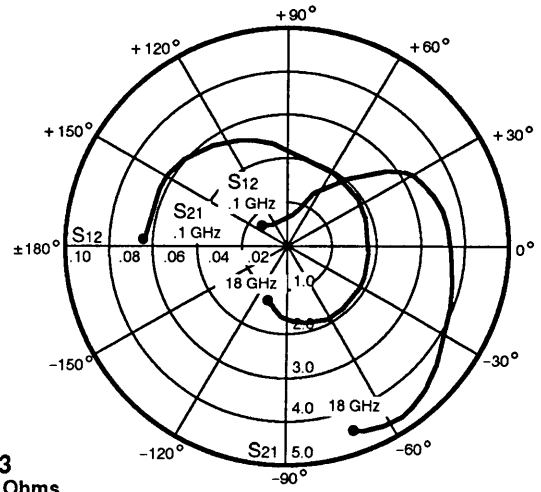
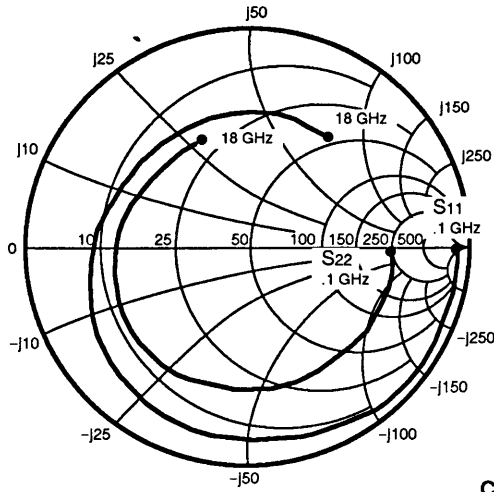
	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
2000	.97	-24	3.02	159	.04	77	.71	-14
3000	.94	-36	2.92	149	.06	69	.70	-20
4000	.91	-48	2.75	138	.07	63	.69	-26
5000	.87	-57	2.64	130	.08	57	.66	-31
6000	.85	-66	2.48	123	.09	55	.66	-36
7000	.81	-74	2.37	115	.10	50	.62	-40
8000	.78	-81	2.23	109	.11	45	.60	-43
9000	.76	-89	2.07	103	.11	43	.59	-47
10000	.73	-96	1.97	97	.12	40	.61	-51
11000	.72	-104	1.88	90	.12	37	.55	-55
12000	.71	-109	1.76	85	.12	36	.54	-59
13000	.70	-114	1.70	80	.12	33	.53	-64
14000	.68	-110	1.62	78	.12	35	.53	-68
15000	.68	-124	1.53	71	.12	31	.53	-73
16000	.67	-126	1.46	68	.13	30	.54	-77
17000	.64	-130	1.42	63	.12	32	.55	-80
18000	.65	-133	1.32	60	.13	33	.57	-82

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

2000	.95	-26	3.57	157	.04	76	.66	-14
3000	.93	-40	3.53	147	.05	69	.65	-20
4000	.89	-52	3.23	136	.06	62	.63	-26
5000	.86	-63	3.08	127	.07	56	.60	-31
6000	.83	-71	2.88	121	.08	55	.59	-36
7000	.80	-80	2.70	113	.09	50	.58	-40
8000	.78	-87	2.58	108	.09	47	.57	-42
9000	.75	-95	2.31	101	.09	44	.56	-46
10000	.73	-102	2.23	96	.10	42	.54	-49
11000	.68	-109	2.07	88	.10	41	.51	-52
12000	.70	-116	2.01	84	.10	39	.48	-56
13000	.70	-122	1.84	78	.10	37	.49	-64
14000	.74	-126	1.83	77	.11	40	.51	-70
15000	.68	-129	1.01	68	.10	36	.52	-74
16000	.67	-130	1.62	68	.12	36	.53	-75
17000	.61	-134	1.53	61	.12	38	.51	-76
18000	.65	-136	1.48	57	.11	40	.54	-73



TYPICAL COMMON SOURCE SCATTERING PARAMETERS



NE13783
Coordinates in Ohms
Frequency in GHz
(V_{DS} = 3 V, I_{DS} = 10 mA)

S-MAGN AND ANGLES:

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

FREQUENCY (MHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
100	1.00	-3	3.07	176	.01	134	.74	-2
500	.99	-11	3.14	167	.01	76	.74	-7
1000	.99	-24	3.05	159	.01	79	.75	-17
1500	.98	-35	2.97	147	.02	60	.74	-23
2000	.97	-44	2.95	137	.03	52	.75	-32
4000	.88	-76	2.40	108	.06	33	.66	-56
6000	.84	-100	2.14	80	.07	19	.68	-76
8000	.77	-124	1.93	54	.07	6	.66	-93
10000	.68	-147	1.80	32	.07	-4	.63	-108
12000	.58	180	1.72	1	.07	-14	.60	-125
14000	.54	134	1.60	-28	.08	-27	.53	-150
16000	.61	87	1.21	-63	.09	-41	.48	167
18000	.65	49	1.15	-102	.09	-68	.50	109

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

100	1.00	-3	3.83	176	.02	58	.69	-3
500	.99	-14	3.92	166	.01	75	.69	-6
1000	.99	-25	3.80	158	.01	76	.70	-16
1500	.97	-37	3.69	146	.02	61	.70	-23
2000	.97	-48	3.64	135	.02	64	.70	-32
4000	.89	-80	3.02	105	.04	38	.62	-55
6000	.81	-103	2.62	78	.05	25	.63	-73
8000	.73	-127	2.29	51	.06	16	.63	-90
10000	.64	-148	2.15	29	.06	11	.61	-104
12000	.52	178	2.10	-2	.07	4	.58	-119
14000	.50	131	1.99	-32	.09	-9	.52	-141
16000	.57	84	1.90	-66	.11	-24	.44	179
18000	.64	46	1.59	-104	.11	-54	.44	118

FEATURES

- **LOW NOISE FIGURE:**
1 dB TYP at $f = 12$ GHz (NE202XX)
1.2 dB TYP at $f = 12$ GHz (NE202XX-1.4)
1.8 dB TYP at $f = 18$ GHz (NE20248)
- **HIGH ASSOCIATED GAIN:**
12 dB TYP at $f = 12$ GHz (NE20283A)
9 dB TYP at $f = 18$ GHz (NE20248)
- **n+ AlGaAs/UNDOPED GaAs HETERO-JUNCTION STRUCTURE**
- **GATE LENGTH:** $L_g = 0.3$ microns
- **GATE WIDTH:** $W_g = 200$ microns
- **PASSIVATION ON CHIP FOR HIGH RELIABILITY**

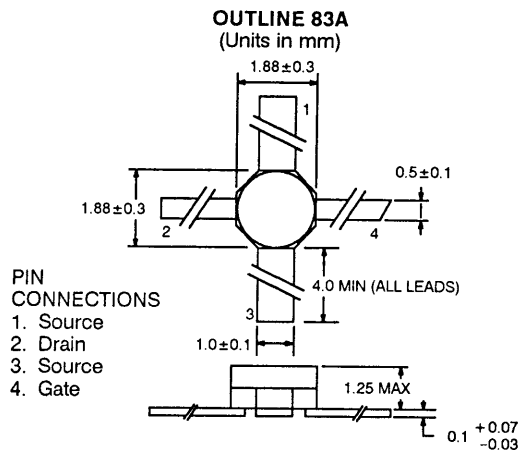
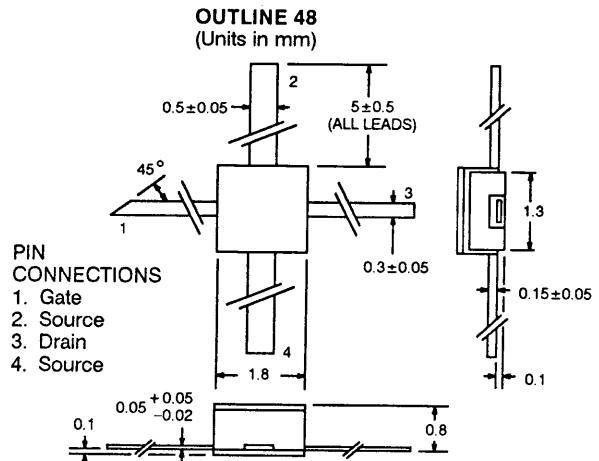
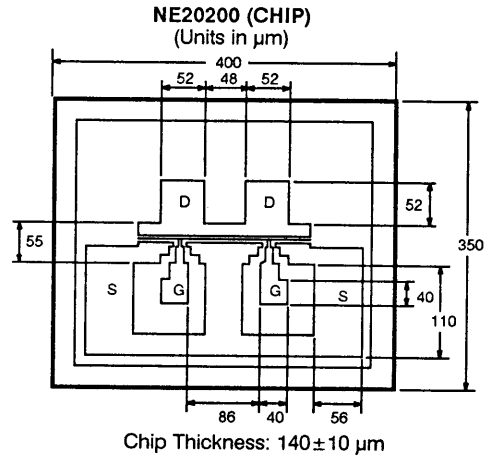
DESCRIPTION

The NE202 is a Hetero Junction FET that utilizes the hetero-junction between Si-doped AlGaAs and undoped GaAs to create high mobility electrons. Its excellent low noise and high associated gain make it suitable for satellite communications and commercial systems. The NE202 is available in two versions, NE202XX for high performance low noise applications and the NE202XX-1.4 for gain stage applications. The device is available in chip and two Hermetic Packages.

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

SYMBOLS	PARAMETERS	UNITS	RATINGS
V_{ds}	Drain to Source Voltage	V	4
V_{gs}	Gate to Source Voltage	V	-3
I_{ds}	Drain Current	mA	60
PT	Total Power Dissipation	mW	200
T_{CH}	Channel Temperature	$^\circ\text{C}$	175
T_{STG}	Storage Temperature	$^\circ\text{C}$	-65 to +175
I_g	Gate Current	μA	10

OUTLINE DIMENSIONS



NE202 SERIES

ELECTRICAL CHARACTERISTICS (TA = 25°C)

PART NUMBER PACKAGE OUTLINE			NE20200 ¹ 00 (CHIP)			NE20200-1.4 ¹ 00 (CHIP)			NE20248 48			NE20283A 83A			NE20283A-1.4 83A		
SYMBOLS	PARAMETERS AND CONDITIONS	UNITS	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX
I _{DSX}	Drain to Source Leakage Current at V _{DS} = 4 V, V _{GS} = -3 V	μA			100			100			100			100			100
I _{DSS}	Saturated Drain Current at V _{DS} = 2 V, V _{GS} = 0	mA	12	30	60	12	30	60	12	30	60	12	30	60	12	30	60
I _{GSO}	Gate to Source Leakage Current at V _{GS} = -3 V, I _{DS} = 0	μA		1	10		1	10		1	10		1	10		1	10
V _{GS (OFF)}	Gate to Source Cutoff Voltage at V _{DS} = 2 V, I _{DS} = 100 μA	V	-0.3	-0.8	-2	-0.3	-0.8	-2	-0.3	-0.8	-2	-0.3	-0.8	-2	-0.3	-0.8	-2
g _M	Transconductance at V _{DS} = 2 V, I _{DS} = 10 mA	mS	30	45	70	30	45	70	30	45	70	30	45	70	30	45	70
NF	Noise Figure ² at V _{DS} = 2 V, I _{DS} = 10 mA, f = 12 GHz f = 18 GHz	dB dB		1	1.2		1.2	1.4		1.6	1.8		1	1.2		1.2	1.4
GA	Associated Gain at V _{DS} = 2 V, I _{DS} = 10 mA, f = 12 GHz f = 18 GHz	dB dB	11	12		10	11		7.5	9		11	12		10	11	
P _{1dB}	Power Output at 1 dB Gain Compression, V _{DS} = 2 V, I _{DS} = 10 mA, f = 12 GHz	dBm		9			9			9			9			9	
R _{TH}	Thermal Resistance (Channel-to-Ambient)	°C/W			260 ³			260 ³						700			700

Notes:

- RF performance is determined by packaging and testing 10 chips per wafer; wafer rejection criteria for standard devices is 2 rejects for 10 samples.
- 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} (channel to case) for chip mounted on copper heat sink.

NE20200 TYPICAL NOISE PARAMETERS*

FREQ. (GHz)	NF _{OPT} (dB)	GA (dB)	Γ _{OPT} **		Rn/50
			(MAG)	(ANG)	
1	0.30	23.7	0.82	8	0.75
2	0.30	20.5	0.80	15	0.60
4	0.37	17.2	0.74	31	0.55
6	0.52	15.3	0.70	44	0.50
8	0.68	13.9	0.66	58	0.45
10	0.84	12.9	0.62	72	0.42
12	1.00	12.0	0.58	86	0.40
14	1.15	11.3	0.54	98	0.38
16	1.31	10.7	0.51	110	0.36
18	1.47	10.1	0.48	122	0.34
20	1.63	9.6	0.46	132	0.32
22	1.82	9.1	0.44	141	0.30
24	2.03	8.6	0.42	148	0.27
26	2.22	8.0	0.42	156	0.25
28	2.43	7.5	0.42	161	0.22
30	2.70	6.9	0.41	167	0.20

NE20283A TYPICAL NOISE PARAMETERS*

FREQ. (GHz)	NF _{OPT} (dB)	GA (dB)	Γ _{OPT}		Rn/50
			(MAG)	(ANG)	
2	0.35	20.5	0.76	29	0.77
4	0.40	17.2	0.76	57	0.60
6	0.50	15.3	0.70	82	0.41
8	0.70	13.9	0.61	110	0.28
10	0.90	12.9	0.55	141	0.14
12	1.10	12	0.50	168	0.10
14	1.20	11	0.46	-161	0.09
16	1.35	10	0.44	-137	0.07
18	1.50	8.5	0.43	-113	0.05

*V_{DS} = 2 V, I_{DS} = 10 mA

** Γ_{OPT} includes bond wires.

Bond wires used during testing:

Gate: 2 wires total, 1 per bond pad, 0.013" long each wire.

Drain: 2 wires total, 1 per bond pad, 0.015" long each wire.

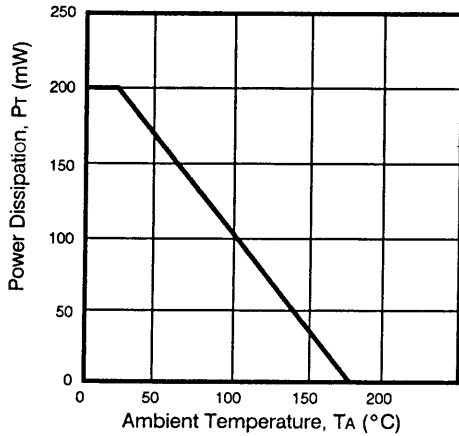
Source: 4 wires total, 2 per side, 0.007" long each wire.

Noise parameters from 1 to 18 GHz are measured.

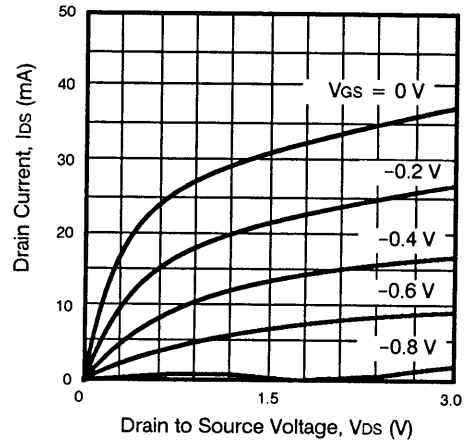
Noise parameters from 20 to 30 GHz are interpolated.

TYPICAL PERFORMANCE CHARACTERISTICS (TA = 25°C)

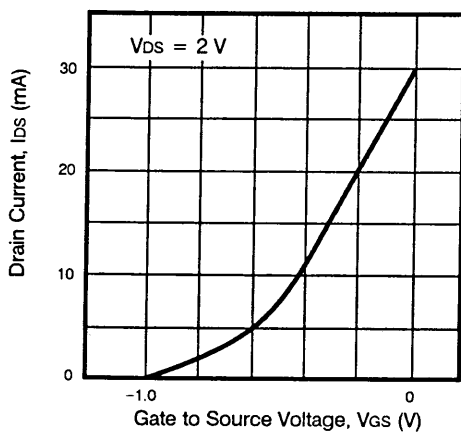
TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE



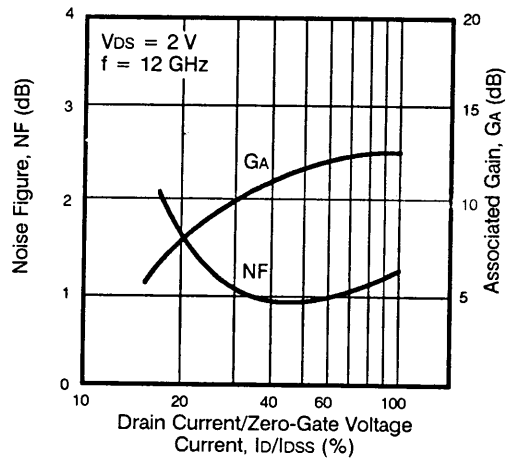
DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE



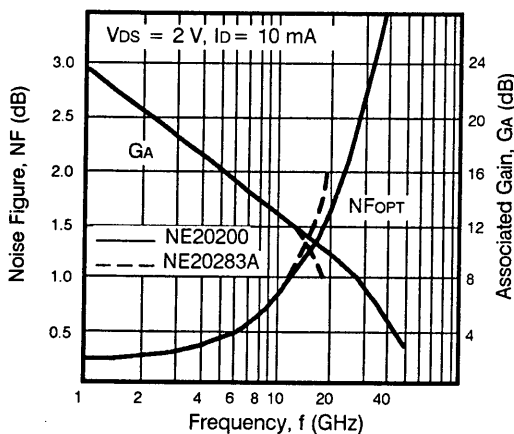
DRAIN CURRENT vs. GATE TO SOURCE VOLTAGE



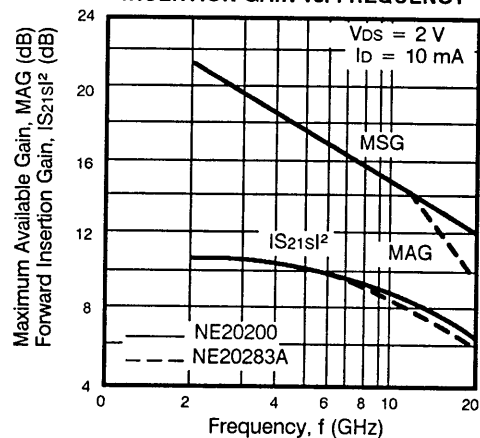
NOISE FIGURE, ASSOCIATED GAIN vs. RATIO OF DRAIN CURRENT AND ZERO-GATE VOLTAGE



NOISE FIGURE, ASSOCIATED GAIN vs. FREQUENCY



MAXIMUM AVAILABLE GAIN*, FORWARD INSERTION GAIN vs. FREQUENCY

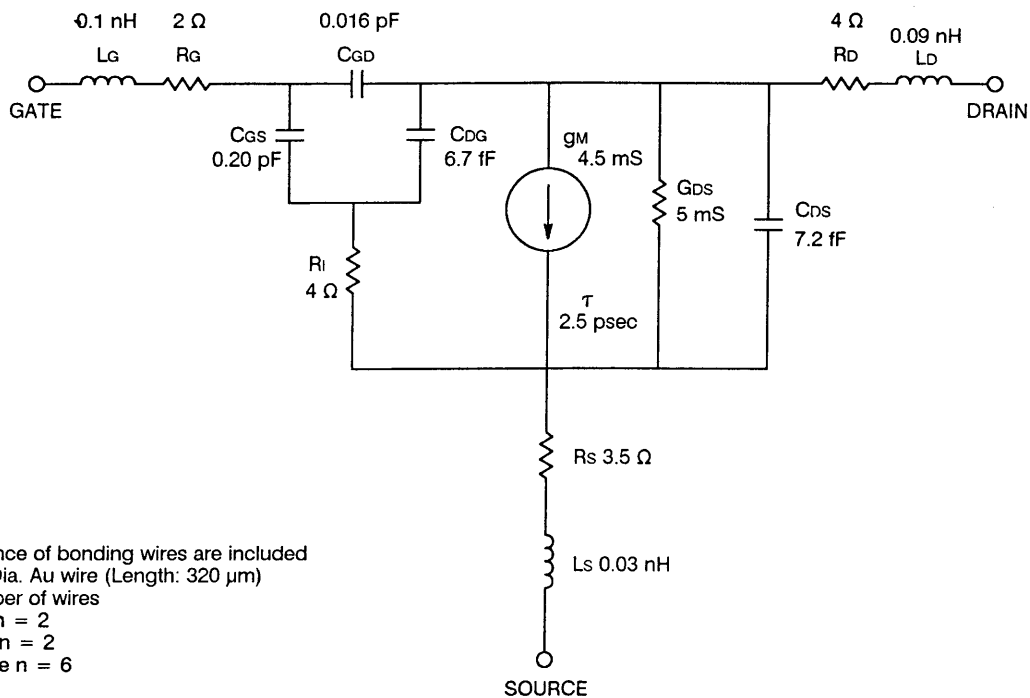


*Gain Calculations: $MAG = \frac{|S_{21}|}{|S_{12}|} (K - \sqrt{K^2 - 1})$. When $K \leq 1$, $MAG = MSG$

$MSG = \frac{|S_{21}|}{|S_{12}|}$, $K = \frac{1 + |\Delta|^2 - |S_{11}|^2 - |S_{22}|^2}{2|S_{12}| |S_{21}|}$, $\Delta = S_{11} S_{22} - S_{21} S_{12}$

NE202 SERIES

NE20200 EQUIVALENT CIRCUIT



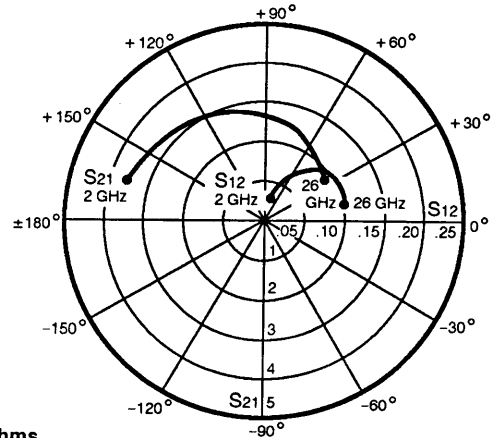
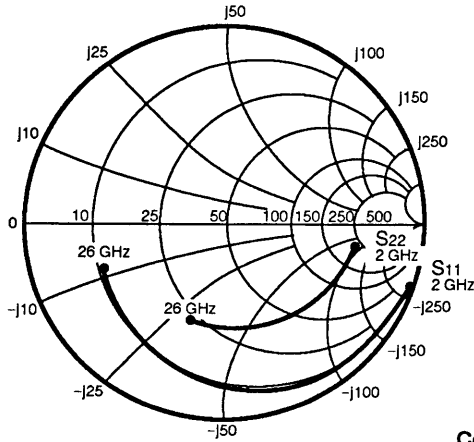
$I_{DS} = 10 \text{ mA}$
 $V_{DS} = 2 \text{ V}$
 $L_G = 0.3 \mu\text{m}$
 $W_G = 200 \mu\text{m}$

Note: Inductance of bonding wires are included
 20 μm Dia. Au wire (Length: 320 μm)
 n: Number of wires
 Gate n = 2
 Drain n = 2
 Source n = 6

RECOMMENDED DIE ATTACHING AND BONDING CONDITIONS FOR THE NE20200 AND NE20200-1.4

- | | |
|--|---|
| 1) Die Attaching:
Solder : AuSn
Temperature : $300 \pm 10^\circ\text{C}$
Atmosphere : N ₂
Within 10 seconds | 2) Bonding:
Wire : 20 μm diameter gold
Method : Thermocompression Bonding
Temperature : $260 \pm 10^\circ\text{C}$
Atmosphere : N ₂
Within 5 minutes |
|--|---|

TYPICAL COMMON SOURCE SCATTERING PARAMETERS



NE20200
Coordinates in Ohms
Frequency in GHz
(V_{DS} = 2 V, I_{DS} = 10 mA)

S-MAGN AND PHASE:

V_{DS} = 2 V, I_{DS} = 10 mA

FREQUENCY (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
2.00	.99	-19	3.47	164	.03	77	.67	-11
3.00	.97	-28	3.40	156	.04	73	.66	-16
4.00	.96	-37	3.33	148	.05	67	.65	-21
5.00	.94	-46	3.23	140	.06	60	.63	-26
6.00	.92	-53	3.11	133	.06	61	.63	-30
7.00	.91	-61	3.02	126	.07	53	.62	-35
8.00	.89	-69	2.96	119	.08	49	.60	-40
9.00	.86	-76	2.84	113	.08	47	.59	-45
10.00	.85	-83	2.79	107	.09	44	.58	-50
11.00	.83	-90	2.73	100	.10	38	.58	-56
12.00	.81	-97	2.67	94	.10	34	.57	-61
13.00	.80	-103	2.60	88	.11	30	.57	-66
14.00	.78	-110	2.52	82	.11	25	.56	-70
15.00	.77	-115	2.45	76	.11	23	.55	-74
16.00	.76	-120	2.38	71	.11	20	.55	-76
17.00	.74	-125	2.31	66	.10	18	.54	-79
18.00	.73	-129	2.24	61	.11	17	.53	-80
19.00	.70	-133	2.13	58	.10	17	.52	-82
20.00	.70	-135	2.08	54	.10	17	.53	-84
21.00	.69	-138	2.04	52	.10	16	.53	-85
22.00	.69	-140	2.01	46	.10	16	.53	-87
23.00	.69	-145	1.90	42	.09	15	.52	-90
24.00	.67	-149	1.85	39	.10	16	.52	-96
25.00	.64	-154	1.84	36	.10	15	.50	-104
26.00	.62	-160	1.77	33	.10	15	.51	-107

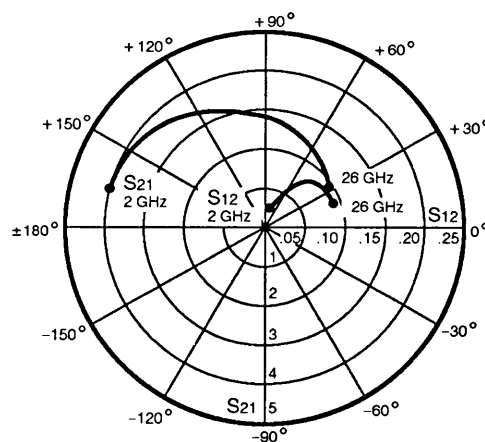
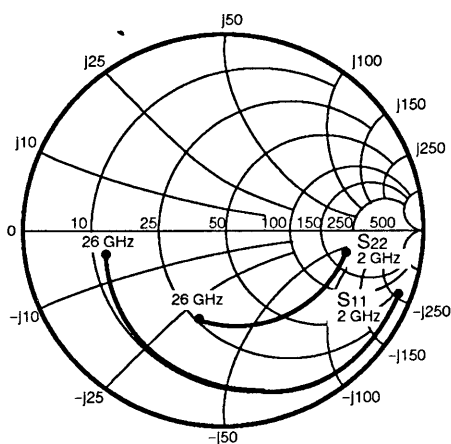
Note: Bond wires are not de-embedded.

- Gate: 2 wires total, 1 per bond pad, 0.013" long each wire.
- Drain: 2 wires total, 1 per bond pad, 0.015" long each wire.
- Source: 4 wires total, 2 per side, 0.007" long each wire.
- Wire: 0.0008": diameter, gold.

3

NE202 SERIES

TYPICAL COMMON SOURCE SCATTERING PARAMETERS



NE20200
Coordinates in Ohms
Frequency in GHz
($V_{DS} = 2\text{ V}$, $I_{DS} = 20\text{ mA}$)

S-MAGN AND PHASE:

$V_{DS} = 2\text{ V}$, $I_{DS} = 20\text{ mA}$

FREQUENCY (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
2.00	.98	-21	4.10	163	.02	76	.65	-11
3.00	.97	-30	3.99	155	.03	72	.64	-16
4.00	.95	-40	3.90	146	.04	67	.63	-21
5.00	.93	-49	3.76	138	.05	60	.61	-26
6.00	.91	-56	3.59	131	.06	62	.61	-29
7.00	.89	-65	3.47	125	.07	54	.60	-34
8.00	.87	-73	3.37	118	.07	50	.58	-40
9.00	.84	-80	3.23	111	.07	47	.56	-44
10.00	.83	-87	3.16	105	.08	45	.56	-49
11.00	.81	-94	3.07	98	.09	39	.56	-55
12.00	.79	-101	2.99	92	.09	35	.55	-60
13.00	.78	-108	2.89	86	.09	31	.54	-65
14.00	.76	-114	2.79	80	.10	28	.53	-69
15.00	.75	-120	2.70	75	.09	25	.53	-73
16.00	.73	-125	2.62	70	.10	24	.53	-75
17.00	.73	-129	2.54	66	.09	23	.53	-78
18.00	.70	-134	2.46	61	.09	21	.51	-78
19.00	.68	-137	2.33	57	.09	21	.51	-80
20.00	.68	-139	2.27	54	.09	24	.51	-82
21.00	.67	-142	2.22	51	.09	22	.52	-83
22.00	.67	-144	2.19	46	.09	23	.52	-85
23.00	.67	-149	2.06	42	.09	24	.51	-88
24.00	.64	-153	2.03	39	.09	22	.51	-94
25.00	.63	-158	2.00	36	.10	22	.49	-102
26.00	.61	-164	1.92	33	.10	23	.50	-105

Note: Bond wires are not de-embedded.

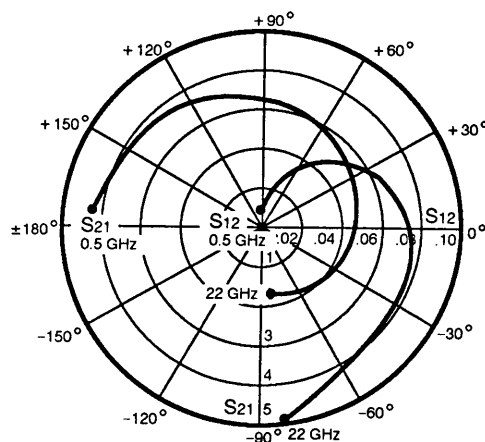
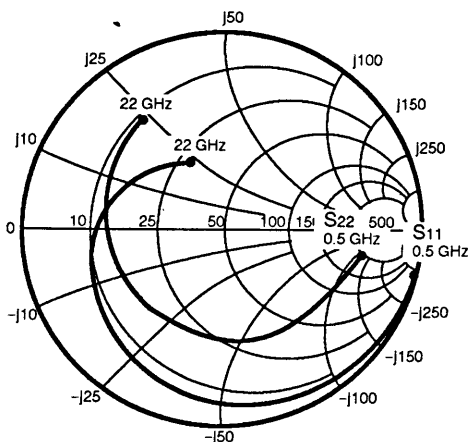
Gate: 2 wires total, 1 per bond pad, 0.013" long each wire.

Drain: 2 wires total, 1 per bond pad, 0.015" long each wire.

Source: 4 wires total, 2 per side, 0.007" long each wire.

Wire: 0.0008": diameter, gold.

TYPICAL COMMON SOURCE SCATTERING PARAMETERS



NE20248
Coordinates in Ohms
Frequency in GHz
(V_{DS} = 2 V, I_{DS} = 10 mA)

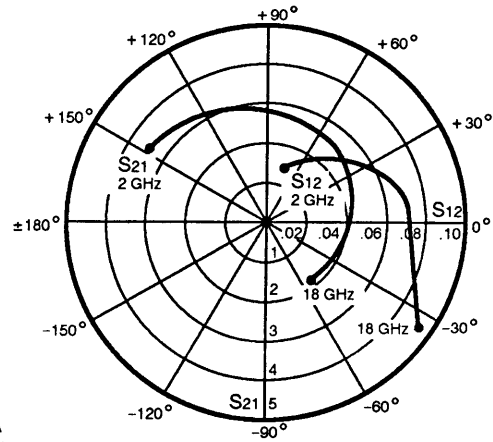
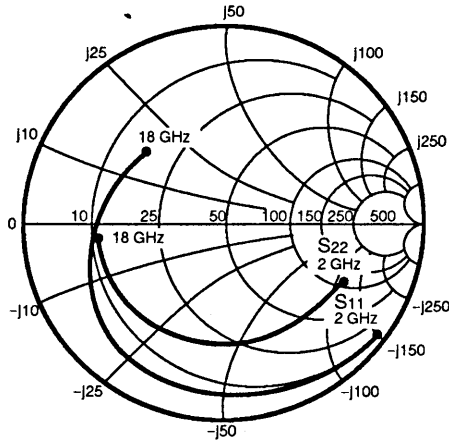
S-MAGN AND PHASE:
V_{DS} = 2 V, I_{DS} = 10 mA

FREQUENCY (GHz)	S ₁₁	S ₂₁	S ₁₂	S ₂₂				
.50	1.00	-8	4.16	173	.007	85	.71	-10
1.00	1.00	-15	4.16	164	.013	76	.74	-17
1.50	.99	-23	4.01	156	.019	71	.68	-19
2.00	.98	-30	3.95	150	.025	69	.64	-23
2.50	.97	-37	3.95	143	.031	60	.63	-31
3.00	.96	-45	3.86	135	.036	54	.63	-38
3.50	.95	-52	3.77	128	.040	50	.63	-41
4.00	.94	-59	3.73	122	.045	46	.60	-45
4.50	.92	-67	3.68	115	.050	40	.58	-52
5.00	.90	-74	3.59	108	.054	35	.58	-60
5.50	.89	-80	3.51	101	.058	30	.58	-65
6.00	.87	-87	3.43	95	.061	28	.57	-69
6.50	.85	-94	3.35	88	.064	20	.55	-76
7.00	.84	-100	3.25	81	.066	15	.55	-83
7.50	.83	-105	3.15	76	.067	11	.55	-88
8.00	.81	-111	3.08	70	.069	8	.55	-91
8.50	.80	-116	3.01	64	.070	4	.53	-97
9.00	.79	-121	2.83	58	.072	1	.52	-103
9.50	.78	-126	2.86	53	.074	-3	.53	-109
10.00	.77	-131	2.81	47	.075	-6	.53	-114
10.50	.75	-136	2.75	41	.077	-10	.52	-120
11.00	.74	-141	2.68	36	.078	-14	.52	-127
11.50	.72	-145	2.61	30	.078	-18	.53	-133
12.00	.71	-150	2.56	24	.079	-21	.54	-138
12.50	.70	-154	2.50	19	.079	-25	.54	-143
13.00	.68	-159	2.44	13	.079	-28	.54	-148
13.50	.67	-163	2.38	8	.079	-31	.54	-154
14.00	.66	-167	2.33	3	.079	-34	.55	-159
14.50	.65	-171	2.28	-2	.080	-37	.56	-163
15.00	.64	-175	2.24	-7	.080	-39	.56	-169
15.50	.63	-179	2.21	-13	.081	-42	.57	-174
16.00	.61	177	2.17	-18	.083	-45	.58	-179
16.50	.60	173	2.13	-23	.083	-49	.60	176
17.00	.58	169	2.09	-28	.084	-52	.61	172
17.50	.57	164	2.06	-34	.085	-55	.62	167
18.00	.55	160	2.02	-39	.085	-59	.62	164
18.50	.54	157	1.96	-44	.084	-62	.62	161
19.00	.52	152	1.92	-50	.086	-64	.63	158
19.50	.51	149	1.88	-54	.088	-68	.63	154
20.00	.48	144	1.85	-60	.087	-72	.62	150
20.50	.46	141	1.82	-65	.087	-74	.62	147
21.00	.45	137	1.78	-70	.088	-76	.61	143
21.50	.44	134	1.72	-74	.087	-79	.63	144
22.00	.38	118	1.72	-81	.101	-83	.68	127



NE202 SERIES

TYPICAL COMMON SOURCE SCATTERING PARAMETERS

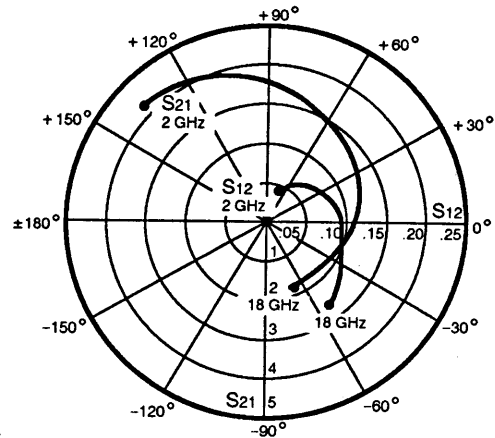
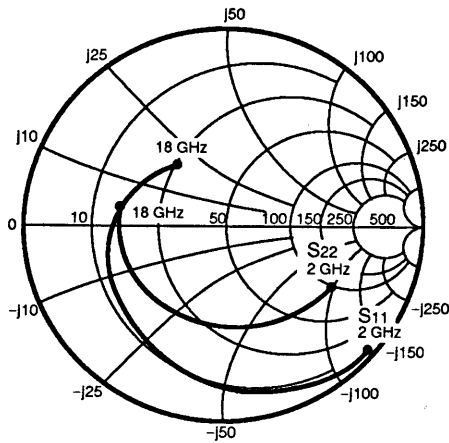


NE20283A
 Coordinates in Ohms
 Frequency in GHz
 ($V_{DS} = 2\text{ V}$, $I_{DS} = 10\text{ mA}$)

S-MAGN AND PHASE:
 $V_{DS} = 2\text{ V}$, $I_{DS} = 10\text{ mA}$
FREQUENCY (GHz)

FREQUENCY (GHz)	S_{11}		S_{21}		S_{12}		S_{22}	
2.00	.98	-34	3.55	148	.03	68	.65	-25
3.00	.94	-50	3.39	131	.04	55	.64	-37
4.00	.91	-65	3.22	116	.05	45	.63	-48
5.00	.88	-81	3.09	102	.06	34	.62	-60
6.00	.84	-95	2.91	87	.06	25	.61	-71
7.00	.82	-109	2.83	75	.07	18	.61	-81
8.00	.78	-120	2.63	62	.07	11	.60	-91
9.00	.76	-132	2.52	50	.07	5	.61	-100
10.00	.73	-144	2.36	40	.07	1	.61	-109
11.00	.71	-153	2.22	29	.07	-3	.61	-116
12.00	.69	-164	2.22	18	.07	-7	.62	-124
13.00	.66	-174	2.24	6	.08	-12	.62	-131
14.00	.62	176	2.09	-6	.07	-16	.61	-138
15.00	.60	166	2.01	-18	.08	-18	.61	-146
16.00	.58	156	2.00	-24	.08	-24	.62	-154
17.00	.55	145	2.00	-37	.08	-37	.63	-162
18.00	.51	133	2.00	-49	.09	-49	.63	-170

TYPICAL COMMON SOURCE SCATTERING PARAMETERS



NE20283A
 Coordinates in Ohms
 Frequency in GHz
 (V_{DS} = 2 V, I_{DS} = 20 mA)

S-MAGN AND PHASE:
 V_{DS} = 2 V, I_{DS} = 20 mA
 FREQUENCY (GHz)

FREQUENCY (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
2.00	.95	-40	4.31	140	.04	62	.61	-32
3.00	.90	-57	3.97	124	.06	50	.59	-46
4.00	.86	-75	3.77	106	.07	38	.57	-60
5.00	.79	-91	3.43	91	.08	27	.54	-74
6.00	.75	-105	3.21	75	.09	18	.52	-86
7.00	.71	-119	2.98	62	.09	10	.52	-97
8.00	.68	-130	2.77	50	.09	4	.51	-106
9.00	.65	-141	2.59	37	.09	-3	.52	-115
10.00	.63	-152	2.43	26	.09	-6	.52	-125
11.00	.61	-161	2.28	15	.09	-12	.52	-133
12.00	.57	-172	2.22	2	.10	-19	.52	-141
13.00	.54	180	2.12	-8	.10	-22	.52	-148
14.00	.50	171	2.03	-19	.10	-27	.51	-155
15.00	.48	161	2.00	-32	.11	-33	.51	-163
16.00	.45	150	1.98	-40	.12	-36	.51	-172
17.00	.43	139	1.95	-54	.12	-45	.51	-179
18.00	.39	127	1.95	-66	.13	-53	.51	-169

3