



# ULTRA LOW NOISE Ku-BAND HETERO JUNCTION FET

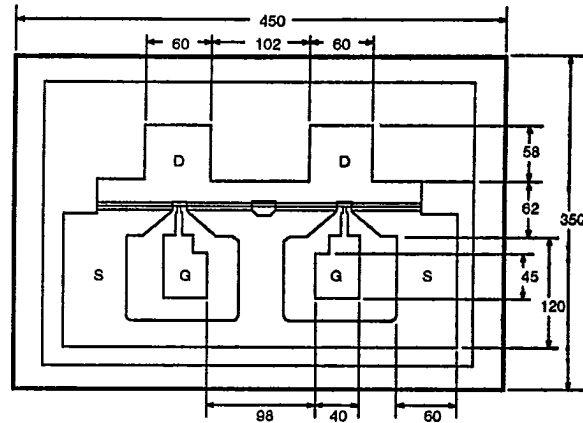
**NE20300**  
**NE20383A**

## FEATURES

- **LOW NOISE FIGURE**  
1.25 dB TYP at  $f = 12$  GHz
- **HIGH ASSOCIATED GAIN**  
10 dB TYP at  $f = 12$  GHz
- **n+ AlGaAs/UNDOPED GaAs HETERO-STRUCTURE**
- **GATE LENGTH:**  $L_g = 0.3 \mu\text{m}$
- **GATE WIDTH:**  $W_g = 280 \mu\text{m}$
- **MESFET COMPATIBLE**

## OUTLINE DIMENSIONS

NE20300 (CHIP)  
(Units in  $\mu\text{m}$ )

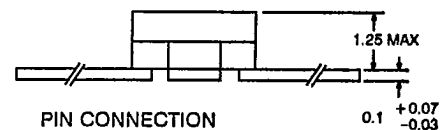
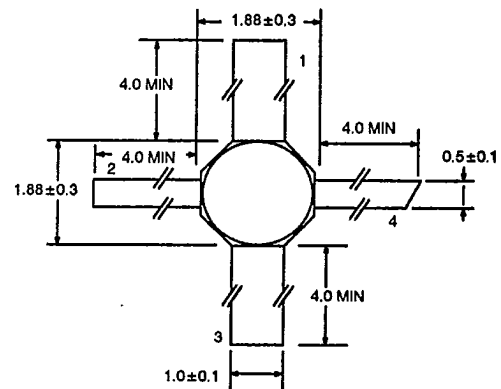


Chip Thickness: 140  $\mu\text{m}$

## DESCRIPTION AND APPLICATIONS

The NE203 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 NE203 has a 40% larger gate width than the NE202, offering a higher  $P_{1dB}$ . The device also has excellent compatibility to MESFET bias conditions operating at  $V_{DS} = 3$  V.

OUTLINE 83A  
(Units in mm)



### PIN CONNECTION

1. Source
2. Drain
3. Source
4. Gate

## ABSOLUTE MAXIMUM RATINGS (TA = 25°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	70
$I_G$	Gate Current	$\mu\text{A}$	10
$P_T$	Total Power Dissipation	mW	200
$T_{CH}$	Channel Temperature	°C	175
$T_{STG}$	Storage Temperature	°C	-65 to +175

**ELECTRICAL CHARACTERISTICS** (TA = 25°C)

PART NUMBER PACKAGE OUTLINE			NE20300 00 (CHIP)			NE20383A 83A		
SYMBOLS	PARAMETERS AND CONDITIONS	UNITS	MIN	TYP	MAX	MIN	TYP	MAX
I <sub>DSX</sub>	Drain to Source Leakage Current at V <sub>DS</sub> = 4 V, V <sub>GS</sub> = -2 V	μA			100			100
I <sub>DSS</sub>	Saturated Drain Current at V <sub>DS</sub> = 3 V, V <sub>GS</sub> = 0	mA	15	35	70	15	35	70
V <sub>GS (OFF)</sub>	Gate to Source Leakage Current at V <sub>GS</sub> = -3 V	V	-0.3	-0.8	-2.0	-0.3	-0.8	-2
I <sub>GSO</sub>	Gate to Source Cutoff Voltage at V <sub>DS</sub> = 3 V, I <sub>DS</sub> = 100 μA	μA		1	10		1	10
g <sub>m</sub>	Transconductance at V <sub>DS</sub> = 3 V, I <sub>D</sub> = 12 mA	mS	40	55		40	55	
NF	Noise Figure at V <sub>DS</sub> = 3 V, I <sub>D</sub> = 12 mA, f = 12 GHz	dB		1.25	1.4		1.25	1.4
GA	Associated Gain at V <sub>DS</sub> = 3 V, I <sub>D</sub> = 12 mA, f = 12 GHz	dB	9.5	10		9.5	10	
P <sub>1dB</sub>	Output Power at 1 dB Gain Compression Point V <sub>DS</sub> = 3 V, I <sub>DS</sub> = 12 mA, f = 12 GHz	dBm		13			13	

**NE20300 TYPICAL NOISE PARAMETERS\***

FREQ. (GHz)	NF <sub>MIN</sub> (dB)	GA (dB)	Γ <sub>OPT**</sub>		Rn/50
			(MAG)	(ANG)	
2	0.35	20.5	0.79	26	0.40
4	0.40	16.5	0.71	53	0.31
6	0.50	14.0	0.67	76	0.25
8	0.65	12.5	0.62	94	0.20
10	0.85	11.0	0.56	109	0.17
12	1.15	10.0	0.51	124	0.15
14	1.40	9.0	0.47	134	0.13
16	1.65	8.0	0.44	143	0.11
18	1.95	7.5	0.42	153	0.09
20	2.15	7.0	0.40	161	0.08

**NE20383A TYPICAL NOISE PARAMETERS\***

FREQ. (GHz)	NF <sub>MIN</sub> (dB)	GA (dB)	Γ <sub>OPT**</sub>		Rn/50
			(MAG)	(ANG)	
2	0.35	19.0	0.70	27	0.41
4	0.40	15.5	0.68	58	0.30
6	0.50	13.5	0.66	82	0.27
8	0.65	12.0	0.58	107	0.22
10	0.85	10.5	0.56	135	0.18
12	1.20	9.5	0.39	156	0.16
14	1.40	9.0	0.31	178	0.14
16	1.70	8.0	0.25	-159	0.11
18	2.00	7.5	0.22	-139	0.09

\* V<sub>DS</sub> = 3 V, I<sub>D</sub> = 12 mA

\*\* Γ<sub>OPT</sub> includes bond wires.

Bond wires used during testing:

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

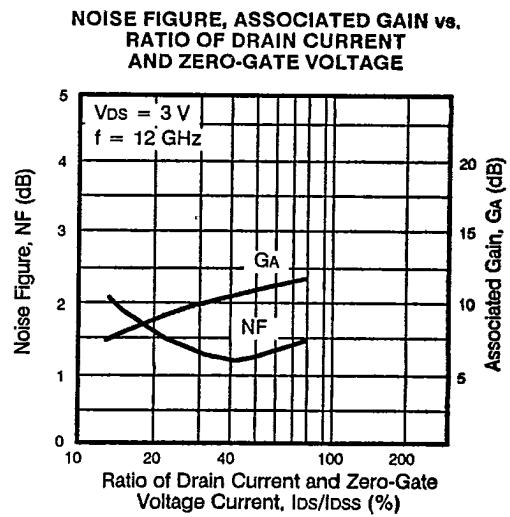
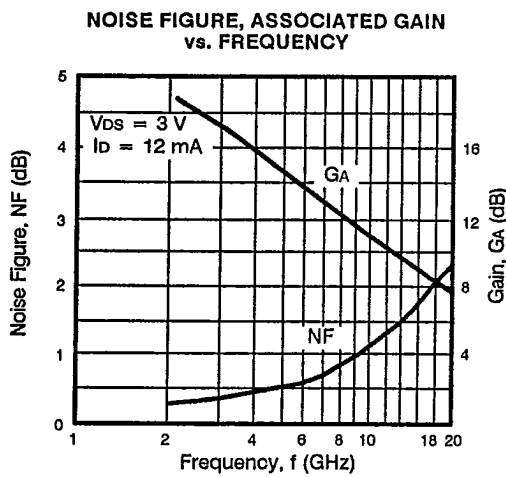
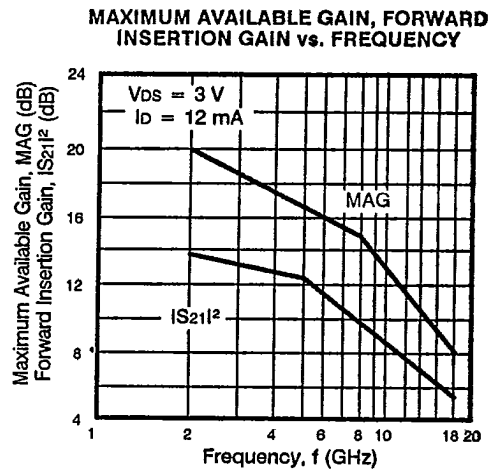
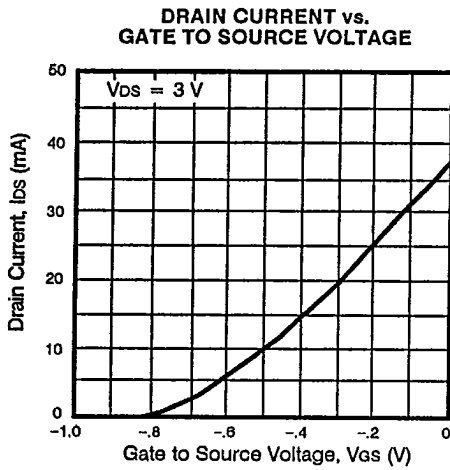
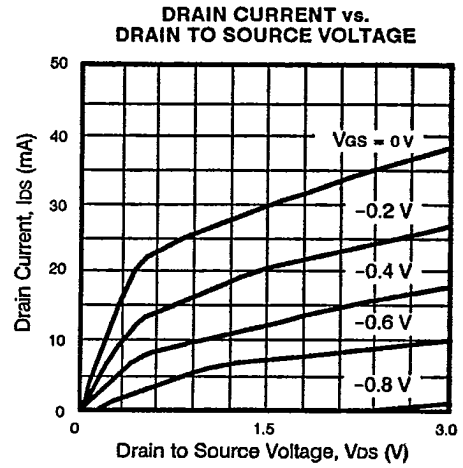
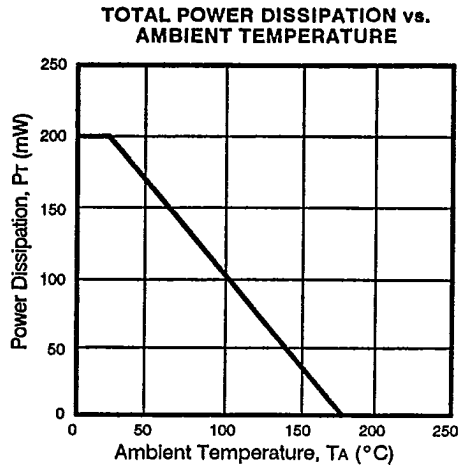
Drain: 2 wires total, 1 per bond pad, 0.01" long each wire.

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

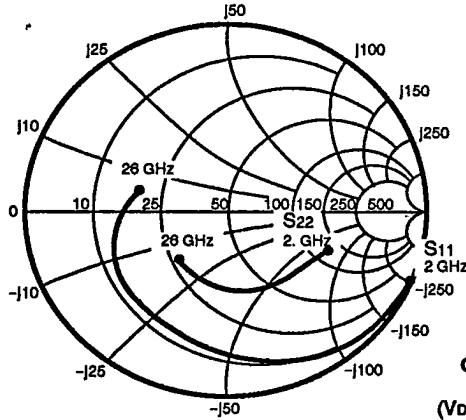
Wire: 0.0008" diameter, gold.



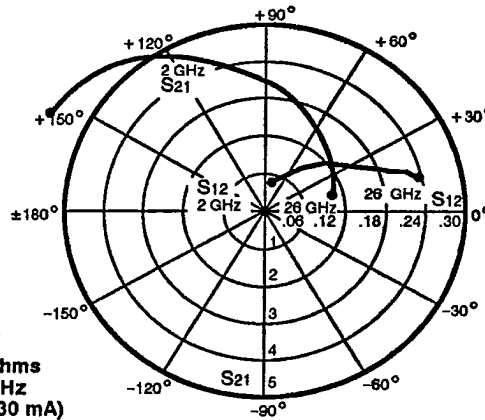
TYPICAL PERFORMANCE CHARACTERISTICS (TA = 25°C)



TYPICAL COMMON SOURCE SCATTERING PARAMETERS



NE20300\*  
Coordinates in Ohms  
Frequency in GHz  
(V<sub>DS</sub> = 3 V, I<sub>DS</sub> = 30 mA)



S-MAGN AND ANGLES:  
V<sub>DS</sub> = 3 V, I<sub>DS</sub> = 12 mA

FREQUENCY (MHz)	S11	S21	S12	S22
2000	.96 -30	4.83 155	.049 70	.58 -23
3000	.93 -44	4.59 144	.069 63	.56 -34
4000	.88 -56	4.30 133	.087 56	.54 -43
5000	.84 -68	4.02 123	.101 49	.51 -52
6000	.80 -77	3.72 114	.112 46	.49 -58
7000	.76 -86	3.45 107	.121 39	.47 -65
8000	.73 -95	3.26 99	.128 35	.45 -71
9000	.69 -103	3.02 92	.131 31	.44 -77
10000	.67 -110	2.88 86	.138 29	.43 -83
11000	.65 -118	2.72 79	.143 25	.42 -89
12000	.63 -125	2.59 73	.146 22	.41 -94
13000	.62 -131	2.45 67	.147 19	.40 -98
14000	.60 -137	2.33 62	.148 17	.39 -102
15000	.59 -142	2.23 57	.150 16	.39 -104
16000	.58 -147	2.15 52	.154 15	.40 -107
17000	.57 -151	2.07 48	.154 15	.40 -110
18000	.55 -155	2.02 43	.161 14	.40 -113
19000	.53 -158	1.91 40	.157 14	.39 -113
20000	.52 -161	1.86 36	.168 14	.40 -115
21000	.52 -164	1.78 33	.173 14	.40 -118
22000	.51 -169	1.76 29	.172 13	.40 -121
23000	.50 -172	1.66 25	.177 13	.41 -125
24000	.49 -177	1.59 21	.182 13	.41 -128
25000	.47 -179	1.56 19	.187 13	.38 -131
26000	.46 174	1.52 13	.187 10	.38 -136

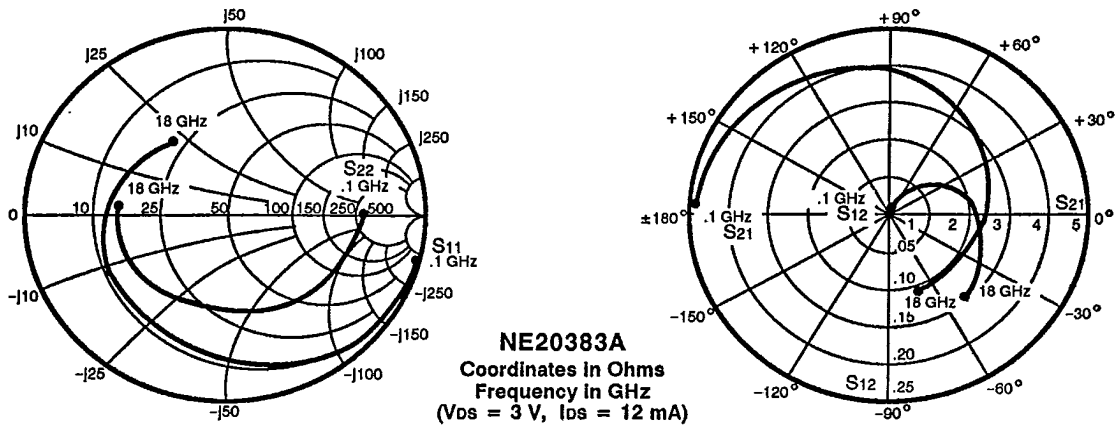
V<sub>DS</sub> = 3 V, I<sub>DS</sub> = 30 mA

2000	.96 -34	5.94 153	.045 69	.53 -26
3000	.91 -49	5.54 140	.062 62	.50 -36
4000	.86 -62	5.11 130	.077 56	.48 -45
5000	.81 -74	4.71 120	.089 49	.45 -54
6000	.76 -83	4.30 111	.099 46	.43 -60
7000	.72 -93	3.96 104	.106 40	.41 -66
8000	.69 -102	3.70 96	.112 37	.40 -73
9000	.66 -110	3.41 90	.115 34	.38 -78
10000	.64 -117	3.24 84	.121 33	.39 -85
11000	.62 -125	3.04 77	.126 28	.38 -91
12000	.60 -132	2.87 71	.129 26	.37 -95
13000	.59 -138	2.70 66	.130 25	.36 -99
14000	.58 -144	2.57 60	.134 23	.36 -102
15000	.56 -149	2.44 56	.136 22	.36 -106
16000	.55 -153	2.35 51	.142 22	.37 -108
17000	.55 -158	2.25 47	.145 22	.37 -110
18000	.53 -161	2.19 42	.151 21	.36 -113
19000	.52 -163	2.06 39	.154 23	.35 -113
20000	.51 -166	2.00 36	.163 22	.36 -115
21000	.50 -169	1.93 33	.166 21	.38 -117
22000	.49 -172	1.90 29	.174 20	.38 -120
23000	.48 -177	1.80 25	.176 19	.37 -124
24000	.47 177	1.70 21	.176 18	.37 -128
25000	.44 175	1.67 20	.186 18	.35 -131
26000	.44 168	1.62 14	.186 16	.35 -135

\*SEE NOTES ON PG 5.



**TYPICAL COMMON SOURCE SCATTERING PARAMETERS**



**NE20383A**  
Coordinates in Ohms  
Frequency in GHz  
(V<sub>DS</sub> = 3 V, I<sub>DS</sub> = 12 mA)

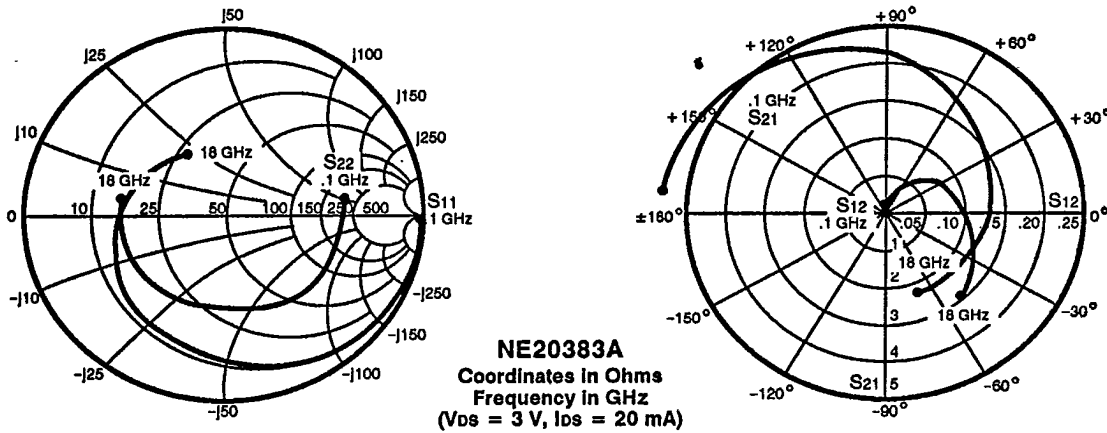
**S-MAGN AND ANGLES:**  
V<sub>DS</sub> = 3 V, I<sub>DS</sub> = 12 mA

FREQUENCY (MHz)	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
100	1.00	-2	4.70	177	.001	25	.64	-1
200	1.00	-4	4.68	175	.001	76	.64	-3
300	1.00	-7	4.65	173	.002	85	.64	-4
400	.99	-9	4.62	171	.005	85	.64	-6
500	.99	-11	4.59	169	.007	84	.64	-8
600	.98	-13	4.55	167	.010	82	.64	-9
700	.98	-15	4.51	165	.012	81	.64	-11
800	.97	-17	4.48	163	.015	79	.64	-12
900	.97	-19	4.45	161	.018	77	.64	-14
1000	.96	-21	4.42	159	.021	76	.64	-16
2000	.94	-40	4.27	142	.041	62	.62	-31
3000	.90	-57	3.97	124	.057	50	.59	-46
4000	.86	-75	3.77	106	.070	38	.57	-60
5000	.79	-91	3.43	91	.078	27	.54	-74
6000	.75	-105	3.21	75	.085	18	.52	-86
7000	.71	-119	2.98	62	.088	10	.52	-97
8000	.68	-130	2.77	50	.091	4	.51	-106
9000	.65	-141	2.59	37	.093	-3	.52	-115
10000	.63	-152	2.43	26	.093	-6	.52	-125
11000	.61	-161	2.28	15	.093	-12	.52	-133
12000	.57	-172	2.22	2	.098	-19	.52	-141
13000	.54	180	2.12	-8	.099	-22	.52	-148
14000	.50	171	2.03	-19	.103	-27	.51	-155
15000	.48	161	2.00	-32	.107	-33	.51	-163
16000	.45	150	1.98	-40	.116	-36	.51	-172
17000	.43	139	1.95	-54	.119	-45	.51	-179
18000	.39	127	1.95	-66	.132	-53	.51	169

**\*NE20300**

- S-parameters include bond wires.
- Gate: 2 wires total, 1 per bond pad, 0.013" long each wire.
- Drain: 2 wires total, 1 per bond pad, 0.011" long each wire.
- Source: 4 wires total, 2 per side, 0.013" long each wire.
- Wire: 0.0008" diameter gold.

**TYPICAL COMMON SOURCE SCATTERING PARAMETERS**



**S-MAGN AND ANGLES:**

V<sub>DS</sub> = 3 V, I<sub>DS</sub> = 20 mA  
FREQUENCY (MHz)

	S <sub>11</sub>	S <sub>21</sub>	S <sub>12</sub>	S <sub>22</sub>				
100	1.00	-2	5.73	177	.001	37	.60	-1
200	1.00	-5	5.70	175	.001	72	.60	-3
300	1.00	-7	5.66	173	.002	85	.60	-5
400	.99	-9	5.62	171	.004	86	.60	-6
500	.99	-12	5.57	168	.006	84	.60	-8
600	.98	-14	5.53	166	.008	83	.60	-9
700	.98	-16	5.48	164	.011	81	.59	-11
800	.97	-18	5.44	162	.013	79	.59	-13
900	.96	-20	5.40	160	.016	78	.59	-14
1000	.96	-22	5.36	158	.019	76	.59	-16
2000	.93	-42	5.13	140	.037	63	.57	-32
3000	.88	-60	4.74	122	.052	51	.54	-46
4000	.83	-78	4.42	104	.064	39	.51	-60
5000	.76	-95	3.99	89	.072	30	.49	-74
6000	.71	-109	3.70	73	.078	22	.47	-85
7000	.67	-122	3.41	59	.082	14	.47	-96
8000	.63	-134	3.14	48	.085	9	.46	-105
9000	.61	-144	2.93	34	.088	2	.47	-114
10000	.58	-155	2.72	25	.091	-1	.48	-123
11000	.56	-163	2.54	13	.092	-6	.49	-131
12000	.53	-174	2.47	1	.098	-13	.49	-139
13000	.49	178	2.35	-10	.101	-16	.49	-145
14000	.46	169	2.26	-21	.106	-22	.49	-152
15000	.43	160	2.20	-33	.112	-28	.49	-160
16000	.41	149	2.18	-42	.122	-33	.49	-169
17000	.38	138	2.14	-55	.125	-42	.50	-178
18000	.35	127	2.13	-68	.138	-51	.50	173

