NEC

ULTRA LOW NOISE PSEUDOMORPHIC HJ FET (SPACE QUALIFIED)

NE24283B

FEATURES

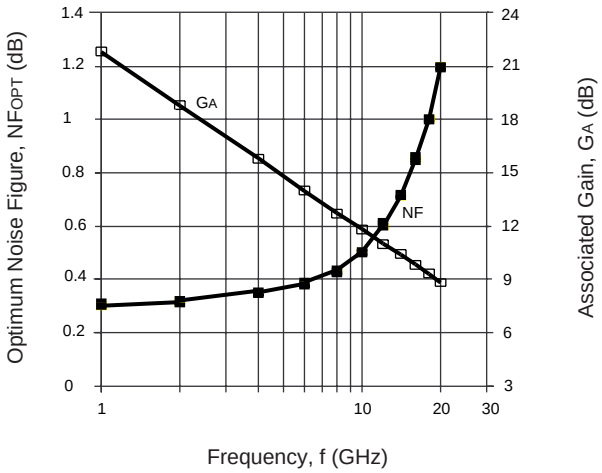
- **VERY LOW NOISE FIGURE:** 0.6 dB TYP at 12 GHz
- **HIGH ASSOCIATED GAIN:** 11.0 dB TYP at 12 GHz
- **GATE LENGTH:** 0.25 µm
- **GATE WIDTH:** 200 µm
- **HERMETIC METAL/CERAMIC PACKAGE**

DESCRIPTION

The NE24283B is a pseudomorphic Hetero-Junction FET that uses the junction between Si-doped AlGaAs and undoped InGaAs to create very high mobility electrons. The device features mushroom shaped TiAl gates for decreased gate resistance and improved power handling capabilities. The mushroom gate also results in lower noise figure and high associated gain. This device is housed in a solder sealed hermetic, metal ceramic package for high reliability in space applications.

NEC's stringent quality assurance and test procedures assure the highest reliability and performance.

NOISE FIGURE & ASSOCIATED GAIN vs. FREQUENCY
V_{DS} = 2 V, I_{DS} = 10 mA



ELECTRICAL CHARACTERISTICS (T_A = 25°C)

PART NUMBER PACKAGE OUTLINE			NE24283B 83B		
SYMBOLS	**PARAMETERS AND CONDITIONS**	**UNITS**	**MIN**	**TYP**	**MAX**
NF_{OPT}[1]	Optimum Noise Figure at V_{DS} = 2 V, I_{DS} = 10 mA f = 4 GHz f = 12 GHz	 dB dB		 0.35 0.6	 0.7
G_A[1]	Associated Gain at V_{DS} = 2 V, I_{DS} = 10 mA f = 4 GHz f = 12 GHz	 dB dB	 10.0	 16.0 11.0	
P_{1dB}	Output Power at 1 dB Gain Compression Point, f = 12 GHz V_{DS} = 2 V, I_{DS} = 10 mA V_{DS} = 2 V, I_{DS} = 20 mA	 dBm dBm		 9.5 11.0	
G_{1dB}	Gain at P_{1dB}, f = 12 GHz V_{DS} = 2 V, I_{DS} = 10 mA V_{DS} = 2 V, I_{DS} = 20 mA	 dB dB		 11.8 12.8	
I_{DSS}	Saturated Drain Current at V_{DS} = 2 V, V_{GS} = 0 V	mA	15	40	70
V_P	Pinch-off Voltage at V_{DS} = 2 V, I_{DS} = 100 µA	V	-2.0	-0.8	-0.2
g_m	Transconductance at V_{DS} = 2 V, I_{DS} = 10 mA	mS	45	60	
I_{GSO}	Gate to Source Leakage Current at V_{GS} = -3 V	µA		0.5	10
$R_{TH\ (CH-A)}$	Thermal Resistance (Channel-to-Ambient)	°C/W		750	
$R_{TH\ (CH-C)}$	Thermal Resistance (Channel-to-Case)	°C/W			350

Note:
1. Typical values of noise figures and associated gain 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 of the production line as a "go-no-go" screening tuned for the "generic" type but not for each specimen.

ABSOLUTE MAXIMUM RATINGS[1] (T_A = 25°C)

SYMBOLS	PARAMETERS	UNITS	RATINGS
V_{DS}	Drain to Source Voltage	V	4.0
V_{GSO}	Gate to Source Voltage	V	–3.0
I_{DS}	Drain Current	mA	I_{DSS}
I_{GRF}	Gate Current	µA	100
T_{CH}	Channel Temperature	°C	175
T_{STG}	Storage Temperature	°C	-65 to +175
P_T	Total Power Dissipation	mW	165

Note:
1. Operation in excess of any one of these conditions may result in permanent damage.

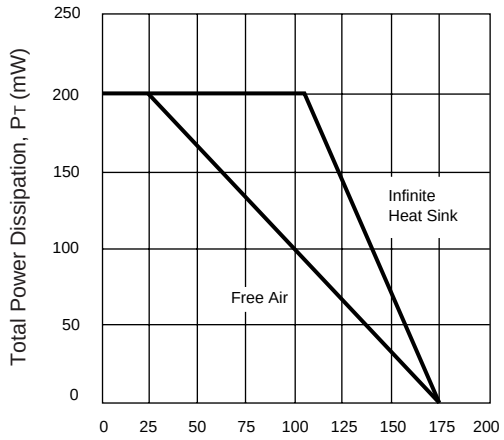
TYPICAL NOISE PARAMETERS (T_A = 25°C)

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

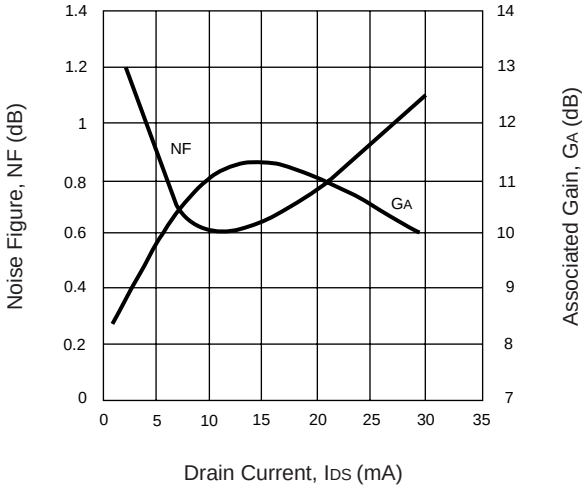
FREQ. (GHz)	NF_{OPT} (dB)	G_A (dB)	Γ_{OPT} MAG	Γ_{OPT} ANG	Rn/50
1	0.30	22.0	0.88	13	0.33
2	0.31	19.0	0.82	30	0.31
4	0.35	16.0	0.73	57	0.26
6	0.38	14.0	0.67	83	0.20
8	0.43	12.5	0.63	105	0.13
10	0.50	11.5	0.57	128	0.09
12	0.60	11.0	0.52	156	0.06
14	0.71	10.3	0.46	-176	0.05
16	0.85	9.8	0.40	-155	0.04
18	1.00	9.2	0.36	-134	0.04
20	1.20	9.0	0.33	-109	0.05

TYPICAL PERFORMANCE CURVES (T_A = 25°C)

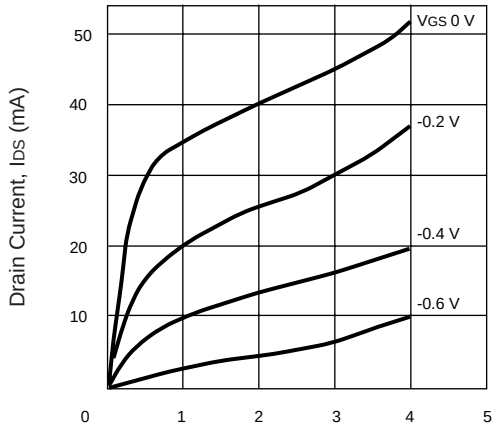
TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE



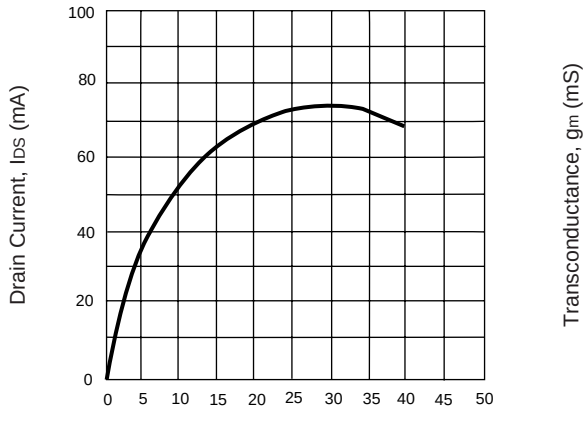
NOISE FIGURE AND ASSOCIATED GAIN vs. DRAIN CURRENT
V_{DS} = 2 V, f = 12 GHz



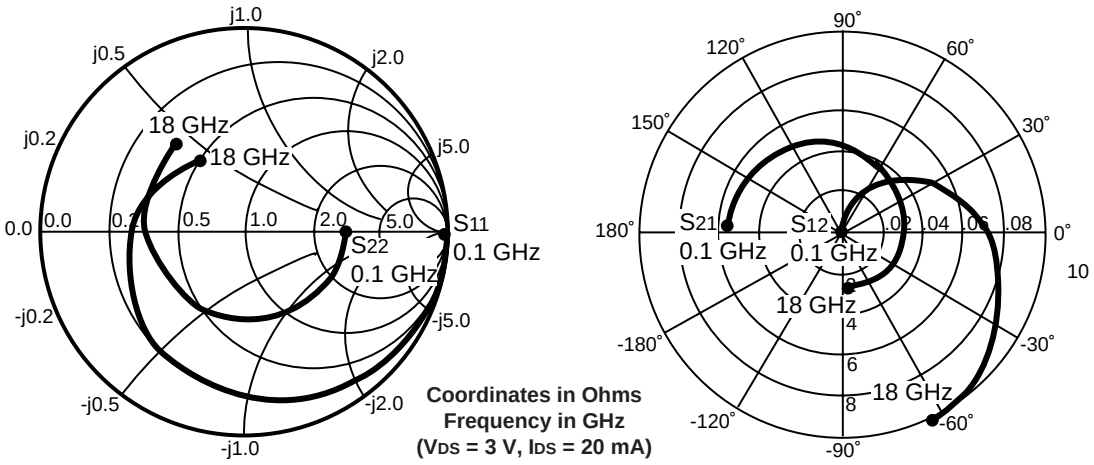
DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE



TRANSCONDUCTANCE AND DRAIN CURRENT vs. GATE TO SOURCE VOLTAGE
V_{DS} = 2 V



TYPICAL COMMON SOURCE SCATTERING PARAMETERS (T_A = 25°C)



NE24283B
V_{DS} = 3 V, I_{DS} = 20 mA

FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}		K	MAG[1]
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG		(dB)
0.10	0.999	-1.9	5.596	177.8	0.001	89.7	0.494	-1.1	0.134	37.479
0.20	0.999	-3.8	5.570	176.0	0.002	88.4	0.493	-2.7	0.066	34.448
0.50	0.998	-9.5	5.550	170.2	0.005	86.5	0.493	-6.7	0.043	30.453
1.00	0.989	-18.8	5.497	160.9	0.010	78.0	0.490	-13.3	0.170	27.401
1.50	0.976	-27.8	5.405	151.8	0.015	73.2	0.485	-19.8	0.243	25.567
2.00	0.960	-36.7	5.304	142.9	0.021	68.7	0.482	-26.1	0.290	24.024
2.50	0.940	-45.3	5.188	134.1	0.025	62.7	0.477	-32.4	0.376	23.171
3.00	0.920	-53.6	5.048	125.6	0.030	57.7	0.471	-38.5	0.430	22.260
3.50	0.900	-61.6	4.899	117.3	0.033	53.4	0.466	-44.5	0.491	21.716
4.00	0.878	-69.7	4.749	109.2	0.037	48.8	0.459	-50.2	0.547	21.084
4.50	0.852	-77.4	4.580	101.4	0.041	44.7	0.452	-55.9	0.612	20.481
5.00	0.828	-84.5	4.411	93.6	0.043	40.0	0.444	-61.7	0.698	20.111
5.50	0.806	-91.6	4.255	86.3	0.046	37.6	0.438	-67.6	0.741	19.661
6.00	0.784	-97.9	4.150	79.4	0.048	33.7	0.430	-73.9	0.801	19.368
6.50	0.769	-104.3	4.022	72.2	0.051	29.6	0.425	-79.9	0.829	18.969
7.00	0.753	-110.3	3.883	65.3	0.053	26.3	0.423	-85.9	0.869	18.649
7.50	0.739	-115.8	3.757	58.5	0.055	23.2	0.425	-91.8	0.899	18.345
8.00	0.728	-121.3	3.644	52.0	0.055	20.9	0.428	-97.1	0.945	18.212
8.50	0.710	-126.7	3.537	45.6	0.059	18.4	0.432	-102.4	0.950	17.778
9.00	0.692	-131.7	3.448	39.3	0.062	15.5	0.435	-107.3	0.974	17.452
9.50	0.675	-136.3	3.391	32.9	0.064	11.5	0.436	-112.1	1.010	16.621
10.00	0.661	-141.0	3.319	26.8	0.066	8.7	0.437	-116.9	1.035	15.875
10.50	0.644	-146.5	3.269	20.4	0.067	5.6	0.435	-122.4	1.075	15.214
11.00	0.623	-152.1	3.209	13.7	0.071	2.8	0.431	-128.6	1.085	14.778
1.50	0.604	-158.0	3.161	7.2	0.073	-1.7	0.428	-135.3	1.115	14.301
12.00	0.586	-163.6	3.101	0.9	0.076	-4.7	0.426	-142.6	1.124	13.963
12.50	0.573	-169.2	3.047	-5.6	0.078	-8.6	0.432	-150.2	1.125	13.764
13.00	0.559	-174.9	2.992	-12.3	0.079	-12.4	0.441	-157.5	1.139	13.520
13.50	0.547	179.7	2.936	-19.0	0.081	-16.3	0.452	-164.1	1.135	13.358
14.00	0.535	174.7	2.880	-25.7	0.083	-20.9	0.467	-170.1	1.130	13.209
14.50	0.524	169.8	2.832	-32.5	0.085	-24.6	0.480	-175.8	1.122	13.102
15.00	0.511	164.4	2.806	-39.2	0.088	-29.1	0.490	178.1	1.102	13.090
15.50	0.498	158.6	2.777	-46.2	0.091	-33.8	0.497	171.4	1.088	13.040
16.00	0.481	152.4	2.752	-53.4	0.093	-39.6	0.500	164.1	1.098	12.804
16.50	0.463	145.9	2.727	-60.9	0.097	-45.5	0.505	155.8	1.082	12.738
17.00	0.445	138.9	2.702	-68.8	0.099	-50.9	0.512	146.7	1.080	12.639
17.50	0.425	131.8	2.663	-76.5	0.102	-56.6	0.525	137.7	1.064	12.621
18.00	0.409	125.1	2.602	-84.2	0.102	-63.8	0.546	129.4	1.069	12.461

Note:

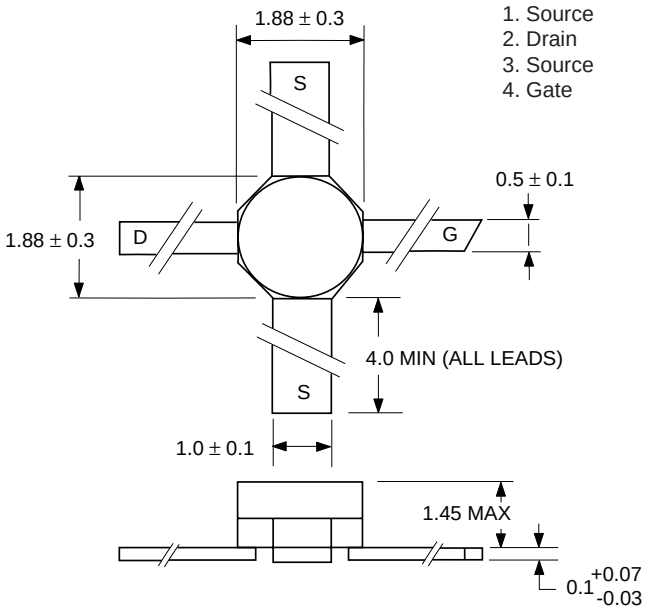
1. Gain Calculations:

$$MAG = \frac{|S_{21}|}{|S_{12}|}\left(K \pm \sqrt{K^2 - 1}\right).$$ When $K \le 1$, MAG is undefined and MSG values are used. $$MSG = \frac{|S_{21}|}{|S_{12}|}, \quad K = \frac{1 + |\Delta|^2 - |S_{11}|^2 - |S_{22}|^2}{2\,|S_{12}\,S_{21}|}, \quad \Delta = S_{11}\,S_{22} - S_{21}\,S_{12}$$

MAG = Maximum Available Gain
MSG = Maximum Stable Gain

OUTLINE DIMENSIONS (Units in mm)

PACKAGE OUTLINE 83B



ORDERING INFORMATION

PART NUMBER	AVAILABILITY	PACKAGE OUTLINE
NE24283B	Bulk	83B