PRELIMINARY DATA SHEET

NEC

HETERO JUNCTION FIELD EFFECT TRANSISTOR

NE24283B

C to Ku BAND SUPER LOW NOISE AMPLIFIER
N-CHANNEL HJ-FET

DESCRIPTION

The NE24283B is a Herero Junction FET that utilizes the hetero junction to create high mobility electrons.

FEATURES

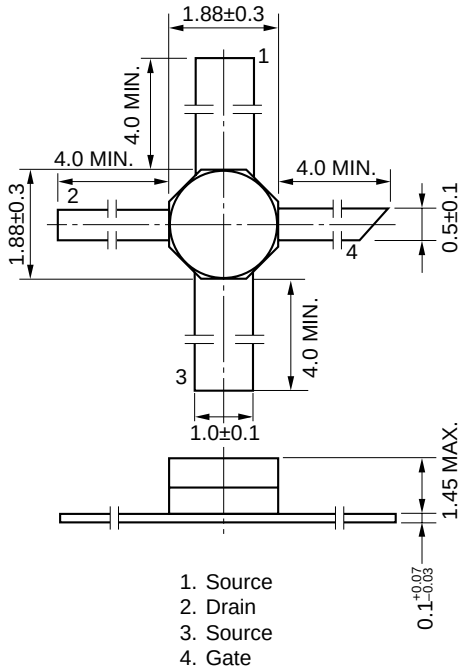
- Super Low Noise Figure & High Associated Gain
  NF = 0.6 dB TYP., Ga = 11.0 dB TYP. at f = 12 GHz
- Gate Length : $L_g \leq 0.25$ μm
- Gate Width : $W_g = 200$ μm
- Hermetic sealed ceramic package
- High reliability

ABSOLUTE MAXIMUM RATINGS (T_A = 25 °C)

Drain to Source Voltage	V_{DS}	4.0	V
Gate to Source Voltage	V_{GS}	–3.0	V
Drain Current	I_D	I_{DSS}	mA
Gate Current	I_G	100	μA
Total Power Dissipation	P_{tot}	165	mW
Channel Temperature	T_{ch}	175	°C
Storage Temperature	T_{stg}	–65 to +175	°C

PACKAGE DIMENSIONS

(Unit : mm)



RECOMMENDED OPERATING CONDITION (T_A = 25 °C)

CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	Unit
Drain to Source Voltage	V_{DS}		2	3	V
Drain Current	I_D		10	20	mA
Input Power	P_{in}			0	dBm

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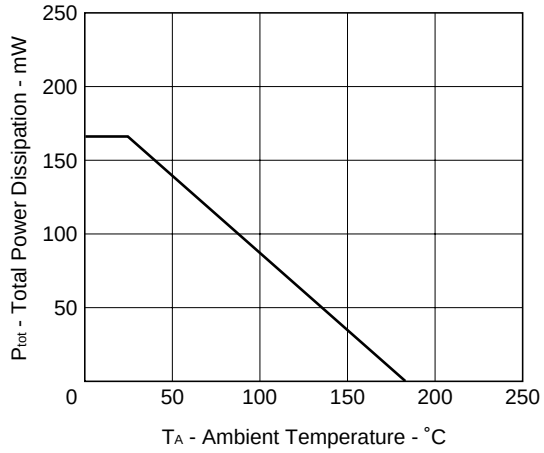
ELECTRICAL CHARACTERISTICS (T_A = 25 °C)

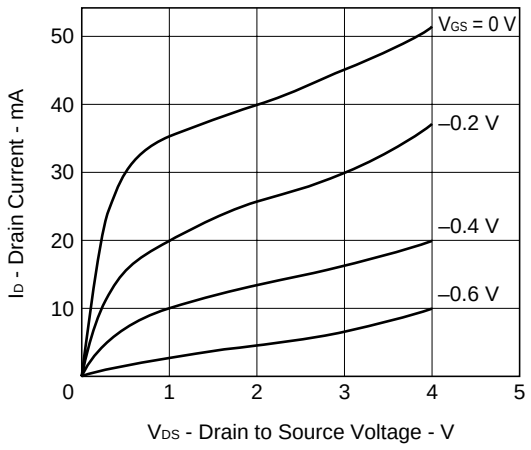
CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITIONS
Gate to Source Leak Current	I_{GSO}		0.5	10	μA	V_{GS} = –3 V
Gate to Drain Leak Current	I_{GDO}		0.5	10	μA	V_{GD} = –3 V
Saturated Drain Current	I_{DSS}	15	40	70	mA	V_{DS} = 2 V, V_{GS} = 0 V
Gate to Source Cutoff Voltage	$V_{GS(off)}$	–0.2	–0.8	–2.0	V	V_{DS} = 2 V, I_D = 100 μA
Transconductance	g_m	45	60		mS	V_{DS} = 2 V, I_D = 10 mA
Noise Figure	NF		0.6	0.7	dB	V_{DS} = 2 V, I_D = 10 mA, f = 12 GHz
Associated Gain	Ga	10.0	11.0		dB	

TYPICAL CHARACTERISTICS (T_A = 25 °C)

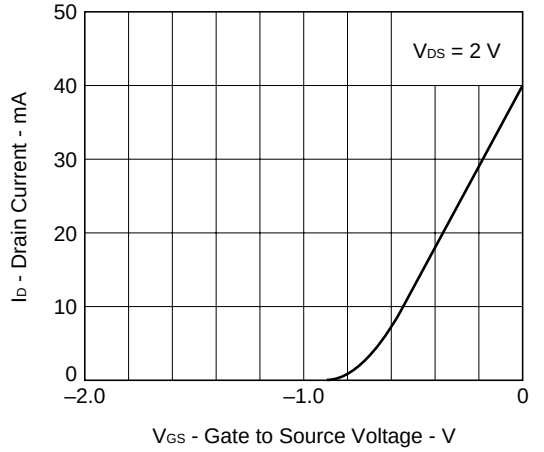
TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE



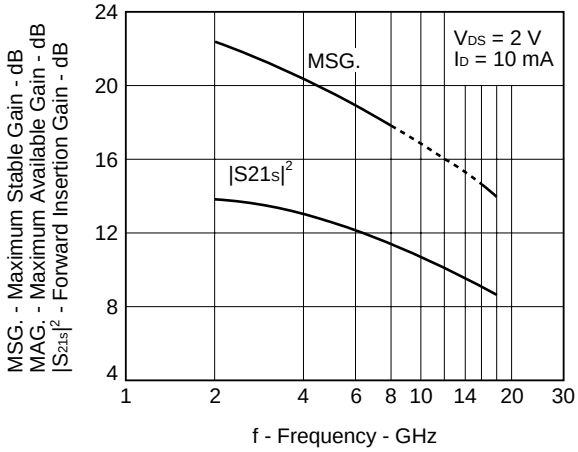
DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE



DRAIN CURRENT vs. GATE TO SOURCE VOLTAGE



MAXIMUM AVAILABLE GAIN, FORWARD INSERTION GAIN vs. FREQUENCY

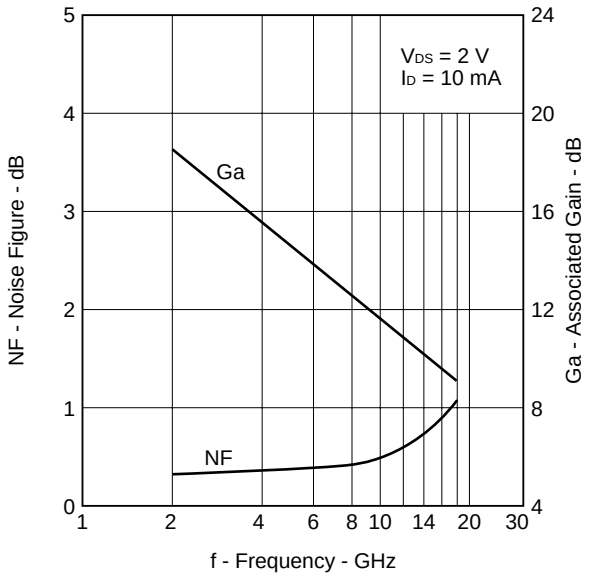


Gain Calculations

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

$$MAG. = \frac{|S_{21}|}{|S_{12}|}\ (K \pm \sqrt{K^2 - 1}) \qquad \Delta = S_{11} \cdot S_{22} - S_{21} \cdot S_{12}$$

NOISE FIGURE, ASSOCIATED GAIN vs. FREQUENCY



S-Parameters

MAG. AND ANG.

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

FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}	
MHz	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
2000	.998	–36.8	5.158	143.9	.028	69.0	.533	–26.4
2500	.983	–40.5	4.882	138.6	.033	67.3	.601	–33.5
3000	.936	–51.2	4.757	128.0	.038	58.7	.573	–40.3
3500	.927	–57.0	4.531	122.0	.040	56.5	.590	–43.9
4000	.922	–63.2	4.341	115.7	.045	53.1	.594	–47.0
4500	.861	–68.4	4.117	108.6	.047	48.9	.589	–50.7
5000	.822	–71.6	3.938	103.2	.049	46.9	.590	–53.6
5500	.784	–74.1	3.803	97.8	.051	46.4	.583	–56.3
6000	.792	–79.8	3.796	92.3	.054	42.4	.569	–59.1
6500	.766	–84.9	3.784	86.5	.057	41.0	.556	–62.5
7000	.737	–91.2	3.776	80.3	.060	38.7	.544	–66.2
7500	.707	–99.5	3.755	73.3	.064	35.1	.517	–71.5
8000	.675	–107.9	3.712	66.0	.064	31.0	.495	–77.4
8500	.652	–116.5	3.630	58.8	.065	27.1	.478	–84.0
9000	.639	–124.9	3.540	51.7	.067	24.3	.468	–91.4
9500	.628	–132.1	3.429	45.1	.068	21.4	.463	–97.9
10000	.612	–138.0	3.301	38.8	.067	18.3	.469	–103.5
10500	.604	–142.9	3.201	33.4	.067	15.2	.474	–107.1
11000	.590	–146.6	3.115	28.5	.064	14.8	.480	–110.2
11500	.576	–150.5	3.091	23.4	.062	14.6	.497	–111.7
12000	.570	–155.0	3.084	18.3	.062	15.9	.509	–114.4
12500	.568	–160.6	3.087	12.3	.066	18.2	.529	–118.6
13000	.571	–167.7	3.067	5.4	.069	16.4	.531	–125.0
13500	.570	–175.5	3.017	–1.4	.070	12.7	.531	–131.9
14000	.575	177.4	2.950	–7.9	.070	10.9	.526	–137.6
14500	.578	171.2	2.888	–14.3	.072	12.2	.533	–143.7
15000	.587	165.9	2.839	–20.5	.071	12.2	.552	–149.1
15500	.599	162.6	2.816	–26.5	.072	15.7	.583	–154.7
16000	.605	158.3	2.796	–33.5	.077	16.1	.623	–161.0
16500	.610	152.5	2.794	–40.6	.086	13.3	.636	–167.7
17000	.616	145.3	2.800	–48.2	.090	10.5	.660	–173.2
17500	.620	137.5	2.784	–56.2	.098	6.5	.682	179.9
18000	.626	128.6	2.736	–64.7	.105	3.7	.703	171.4

AMP. Parameters

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

FREQUENCY MHz	Gumax. dB	Gamax. dB	$\|S_{21}\|^2$ dB	$\|S_{12}\|^2$ dB	K	Delay ns	Mason's U dB	G_1 dB	G_2 dB
2000			14.25	–31.17	.00	.029			1.45
2500	30.31		13.77	–29.61	.05	.029		14.60	1.94
3000	24.32		13.55	–28.30	.24	.059		9.04	1.73
3500	23.52		13.12	–27.88	.25	.033		8.53	1.86
4000	22.87		12.75	–27.03	.26	.035		8.23	1.89
4500	20.01		12.29	–26.57	.48	.040		5.87	1.85
5000	18.65		11.91	–26.13	.60	.030	29.742	4.89	1.86
5500	17.55		11.60	–25.84	.72	.030	25.981	4.14	1.80
6000	17.58		11.59	–25.27	.68	.030	29.585	4.29	1.70
6500	17.01		11.56	–24.94	.74	.032	29.554	3.84	1.61
7000	16.47		11.54	–24.48	.78	.035	29.787	3.41	1.53
7500	15.85		11.49	–23.89	.83	.039	28.629	3.01	1.35
8000	15.26		11.39	–23.89	.91	.040	24.750	2.64	1.22
8500	14.73		11.20	–23.69	.97	.040	23.667	2.40	1.12
9000	14.33		10.98	–23.45	.98	.039	24.569	2.28	1.07
9500	13.93	16.42	10.70	–23.37	1.01	.037	24.136	2.18	1.05
10000	13.49	15.22	10.37	–23.50	1.08	.035	22.226	2.03	1.08
10500	13.18	14.70	10.11	–23.48	1.12	.030	21.350	1.97	1.11
11000	12.87	14.05	9.87	–23.94	1.22	.027	19.699	1.86	1.14
11500	12.79	13.88	9.80	–24.16	1.26	.028	19.375	1.75	1.23
12000	12.79	13.98	9.78	–24.19	1.25	.029	19.822	1.71	1.30
12500	12.91	14.68	9.79	–23.65	1.11	.033	22.831	1.69	1.43
13000	12.88	15.37	9.73	–23.17	1.03	.038	26.286	1.71	1.44
13500	12.73	15.43	9.59	–23.04	1.02	.038	26.055	1.70	1.44
14000	12.55	15.16	9.40	–23.08	1.03	.036	23.752	1.74	1.41
14500	12.43		9.21	–22.87	.98	.035	23.346	1.77	1.45
15000	12.47		9.06	–22.93	.93	.034	23.133	1.83	1.58
15500	12.73		8.99	–22.80	.81	.034	24.359	1.93	1.80
16000	13.04		8.93	–22.23	.64	.039		1.98	2.13
16500	13.20		8.92	–21.34	.52	.039		2.02	2.25
17000	13.50		8.94	–20.93	.42	.042		2.07	2.48
17500	13.71		8.89	–20.18	.32	.045		2.10	2.72
18000	13.87		8.74	–19.61	.24	.047		2.16	2.96

Noise Parameters

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

Freq. (GHz)	NFmin. (dB)	Ga (dB)	Γopt.		$R_n/50$
			MAG.	ANG. (deg.)	
2.0	0.31	18.5	0.88	24	0.35
4.0	0.33	16.1	0.77	48	0.30
6.0	0.38	14.2	0.68	71	0.23
8.0	0.43	12.5	0.59	95	0.16
10.0	0.51	11.7	0.53	120	0.11
12.0	0.60	11.0	0.48	146	0.06
14.0	0.74	10.1	0.46	173	0.05
16.0	0.90	9.4	0.45	–157	0.06
18.0	1.10	9.0	0.47	–126	0.12

RECOMMENDED SOLDERING CONDITIONS

The following conditions (see table below) must be met when soldering this product.

Please consult with our sales offices in case other soldering process is used, or in case soldering is done under different conditions.

<TYPES OF SURFACE MOUNT DEVICE>

For more details, refer to our document "SEMICONDUCTOR DEVICE MOUNTING TECHNOLOGY MANUAL" (C10535E)

Soldering process	Soldering conditions	Symbol
Partial heating method	Terminal temperature: 230 °C or below, Flow time: 10 seconds or below, Exposure limit[Note]: None	

Note Exposure limit before soldering after dry-pack package is opened.
Storage conditions: 25 °C and relative humidity at 65 % or less.

Caution Do not apply more than a single process at once, except for "Partial heating method".

PRECAUTION Avoid high static voltage and electric fields, because this device is Hetero Junction field effect transistor with shottky barrier gate.

Caution

The Great Care must be taken in dealing with the devices in this guide.
The reason is that the material of the devices is GaAs (Gallium Arsenide), which is designated as harmful substance according to the law concerned.
Keep the law concerned and so on, especially in case of removal.

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