ULTRA LOW NOISE PSEUDOMORPHIC HJ FET

NE32984D

FEATURES

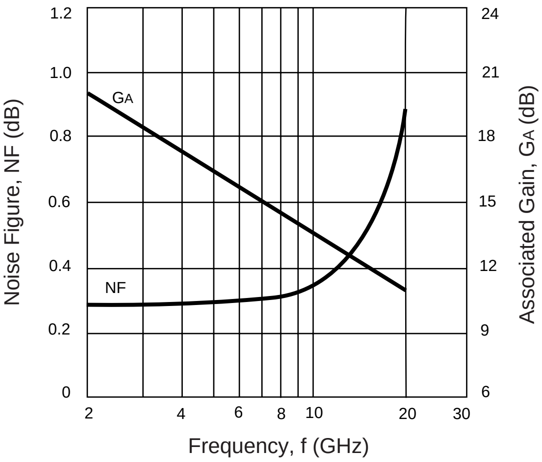
- **VERY LOW NOISE FIGURE:**
  0.40 dB Typical at 12 GHz
- **HIGH ASSOCIATED GAIN:**
  12.5 dB Typical at 12 GHz
- **$L_G \leq 0.20$ µm, $W_G = 200$ µm**
- **LOW COST METAL CERAMIC PACKAGE**
- **TAPE & REEL PACKAGING OPTION AVAILABLE**

DESCRIPTION

The NE32984D 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 an epoxy-sealed, metal/ceramic package and is intended for high volume consumer and industrial 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		NE32984D 84D		
SYMBOLS	**PARAMETERS AND CONDITIONS**	**UNITS**	**MIN**	**TYP**	**MAX**
NF[1]	Optimum Noise Figure, $V_{DS} = 2$ V, $I_{DS} = 10$ mA, f = 12 GHz	dB		0.40	0.50
G_A[1]	Associated Gain, $V_{DS} = 2$ V, $I_{DS} = 10$ mA, f = 12 GHz	dB	11.0	12.5	
I_{DSS}	Saturated Drain Current, $V_{DS} = 2$ V, $V_{GS} = 0$ V	mA	20	60	90
V_P	Pinch-off Voltage, $V_{DS} = 2$ V, $I_{DS} = 100$ µA	V	-0.2	-0.7	-2.0
g_m	Transconductance, $V_{DS} = 2$ V, $I_D = 10$ mA	mS	45	60	
I_{GSO}	Gate to Source Leakage Current, $V_{GS} = -3$ V	µA		0.5	10.0
$R_{TH\,(CH\text{-}A)}$	Thermal Resistance (Channel to Ambient)	°C/W		750	
$R_{TH\,(CH\text{-}C)}$	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 on the production line as a "go-no-go" screening tuned for the "generic" type but not each specimen.

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

SYMBOLS	PARAMETERS	UNITS	RATINGS
V_{DS}	Drain to Source Voltage	V	4.0
V_{GS}	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	150
T_{STG}	Storage Temperature	°C	-65 to +150
P_T	Total Power Dissipation	mW	165

Note:

1. Operation in excess of any one of these parameters may result in permanent damage.

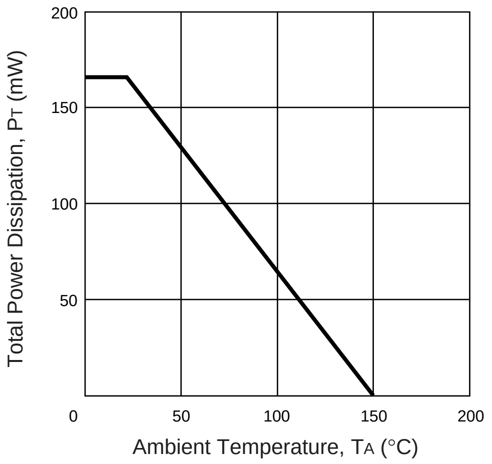
NOISE PARAMETERS

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

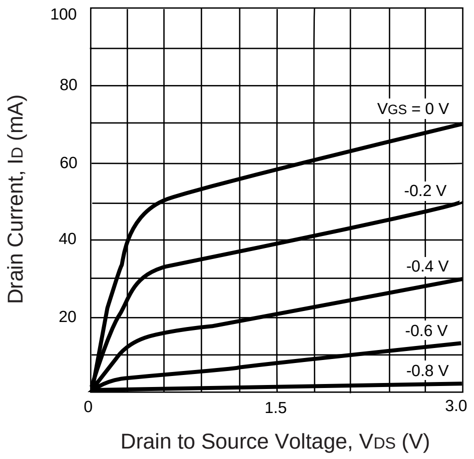
FREQ. (GHz)	NFMIN. (dB)	GA (dB)	Γopt		Rn/50
			MAG	ANG	
2.0	0.29	20.0	0.85	20	0.30
4.0	0.30	18.3	0.75	41	0.28
6.0	0.31	16.5	0.68	63	0.20
8.0	0.34	15.0	0.61	86	0.13
10.0	0.37	13.6	0.56	111	0.09
12.0	0.40	12.5	0.52	137	0.05
14.0	0.49	12.0	0.47	164	0.04
16.0	0.63	11.8	0.40	-168	0.04
18.0	0.81	11.5	0.31	-139	0.07

TYPICAL PERFORMANCE CURVES (T_A = 25°C)

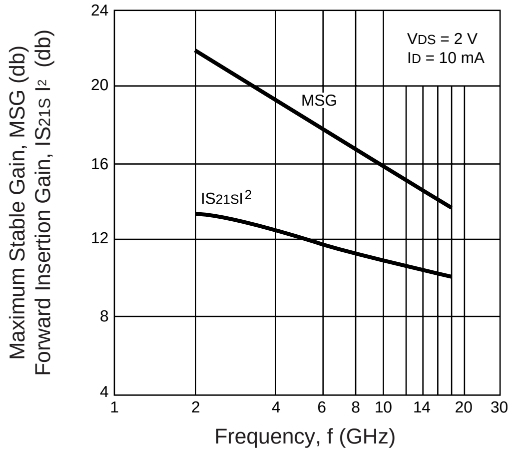
TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE



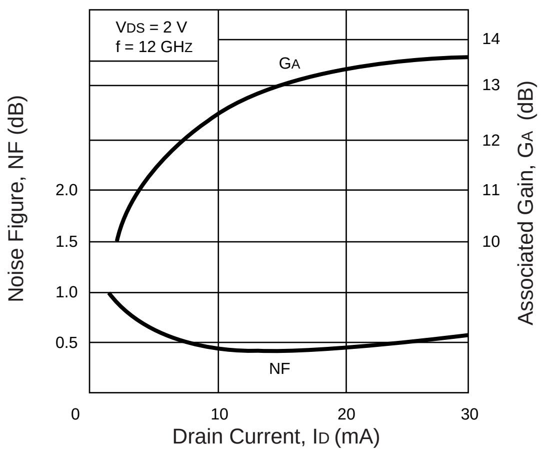
DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE



MAXIMUM STABLE GAIN AND FORWARD INSERTION GAIN vs. FREQUENCY



NOISE FIGURE AND ASSOCIATED GAIN vs. DRAIN CURRENT



TYPICAL SCATTERING PARAMETERS ($T_A = 25°C$)

NE32984D
V_{DS} = 2 V, I_D = 10 mA

FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}		K	MAG[1]
(GHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG		(dB)
2	.984	-26.4	4.583	146.9	.029	66.4	.549	-32.0	.13	22.0
3	.960	-39.3	4.480	130.6	.041	55.9	.520	-47.8	.22	20.4
4	.919	-52.8	4.332	114.3	.050	47.9	.481	-64.5	.31	19.4
5	.868	-64.5	4.141	98.8	.057	38.5	.447	-81.9	.45	18.6
6	.816	-75.5	3.923	84.4	.060	31.2	.418	-99.8	.58	18.2
7	.786	-85.7	3.786	70.8	.064	26.0	.396	-116.7	.63	17.7
8	.759	-95.9	3.659	57.1	.066	21.7	.382	-132.6	.69	17.4
9	.736	-106.3	3.547	43.1	.068	18.2	.374	-147.8	.75	17.2
10	.689	-116.2	3.375	30.1	.071	16.0	.368	-163.0	.86	16.8
11	.659	-125.6	3.264	17.5	.074	13.2	.370	-178.3	.91	16.4
12	.621	-135.5	3.217	4.9	.079	11.4	.374	167.4	.94	16.1
13	.590	-146.3	3.186	-8.0	.085	7.3	.391	155.0	.92	15.7
14	.554	-157.9	3.172	-21.3	.093	2.0	.406	143.2	.91	15.3
15	.522	-171.0	3.180	-35.2	.104	-5.5	.417	132.1	.86	14.9
16	.491	173.0	3.220	-49.9	.114	-12.6	.432	119.7	.82	14.5
17	.461	153.2	3.303	-65.6	.124	-23.3	.445	106.3	.78	14.3
18	.452	129.4	3.367	-83.4	.137	-36.4	.453	91.0	.72	13.9

Note:

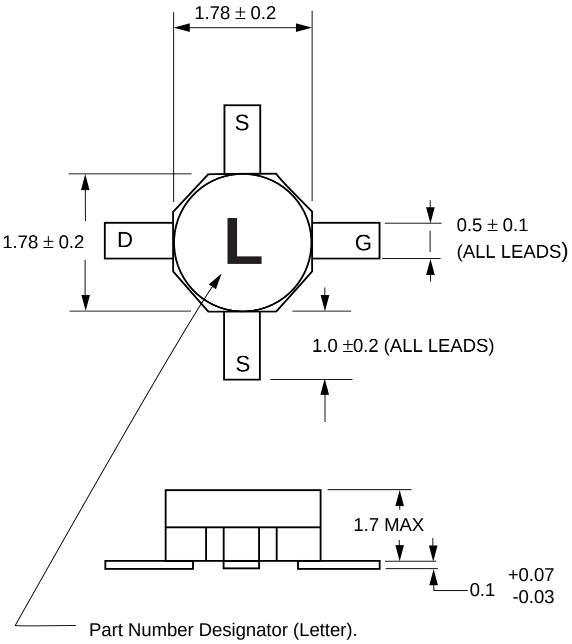
1. Gain calculation:

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

MAG = Maximum Available Gain
MSG = Maximum Stable Gain

OUTLINE DIMENSIONS (Units in mm)

PACKAGE OUTLINE 84D



Part Number Designator (Letter).
When the letter is upright,
the gate lead is to the right.

ORDERING INFORMATION

PART NUMBER	AVAILABILITY	LEAD LENGTH	PACKAGE OUTLINE
NE32984D-S	Bulk up to 1K	1.0 mm	84D
NE32984D-T1	1K/Reel	1.0 mm	84D

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