NEC

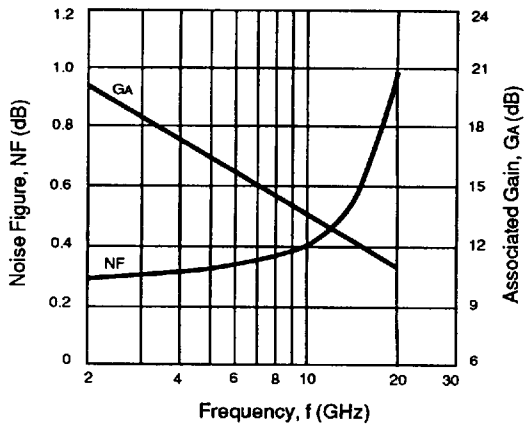
ULTRA LOW NOISE PSEUDOMORPHIC HJ FET

NE32584C

FEATURES

- **VERY LOW NOISE FIGURE:**
  0.45 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**

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



DESCRIPTION

The NE32584C 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.

ELECTRICAL CHARACTERISTICS (T_A = 25°C)

PART NUMBER PACKAGE OUTLINE			NE32584C 84C		
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		0.45	0.55
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	-2.0	-0.7	-0.2
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
$R_{TH(CH-A)}$	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 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.

TYPICAL NOISE PARAMETERS (T_A = 25°C)

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

FREQ. (GHz)	NF_{OPT} (dB)	G_A (dB)	Γ_{OPT} MAG	Γ_{OPT} ANG	Rn/50
2	0.29	20.0	0.86	22	0.27
4	0.30	18.3	0.76	45	0.25
6	0.33	16.5	0.69	70	0.18
8	0.36	15.0	0.63	96	0.11
10	0.40	13.6	0.59	122	0.08
12	0.45	12.5	0.54	147	0.04
14	0.54	12.0	0.48	171	0.04
16	0.68	11.8	0.40	-165	0.05
18.0	0.85	11.5	0.31	-144	0.06

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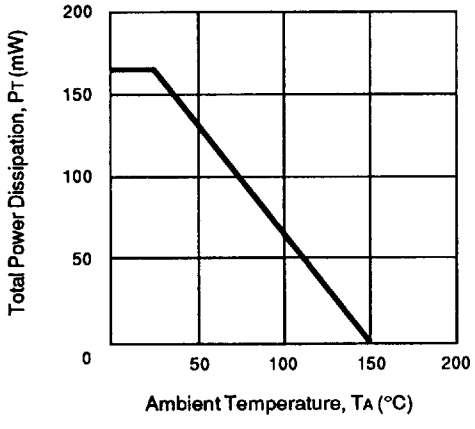
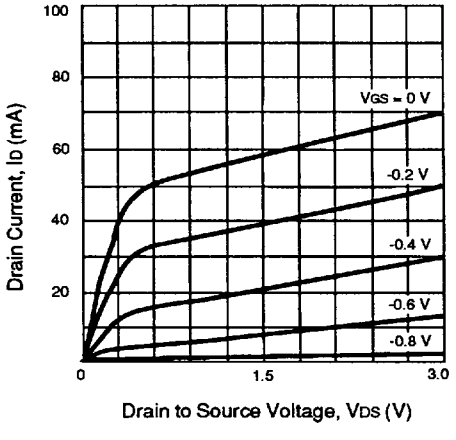
TYPICAL PERFORMANCE CURVES (T_A = 25°C)

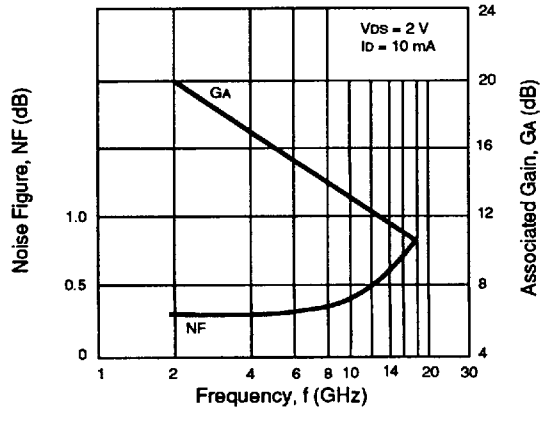
TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE



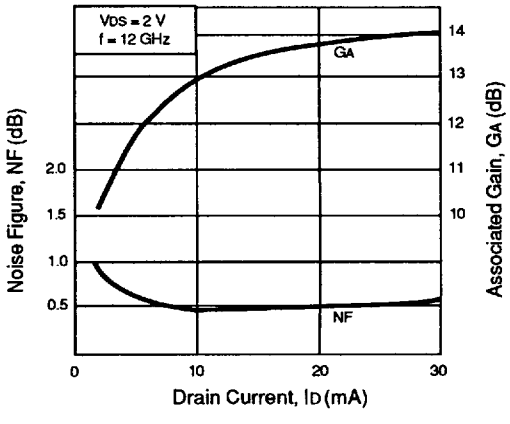
DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE



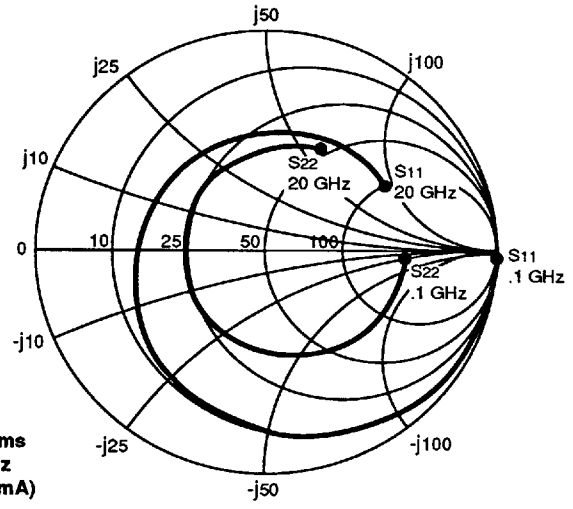
NOISE FIGURE AND ASSOCIATED GAIN vs. FREQUENCY



NOISE FIGURE AND ASSOCIATED GAIN vs. DRAIN CURRENT



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



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

NE32584C
V_{DS} = 2 V, I_{DS} = 10 mA

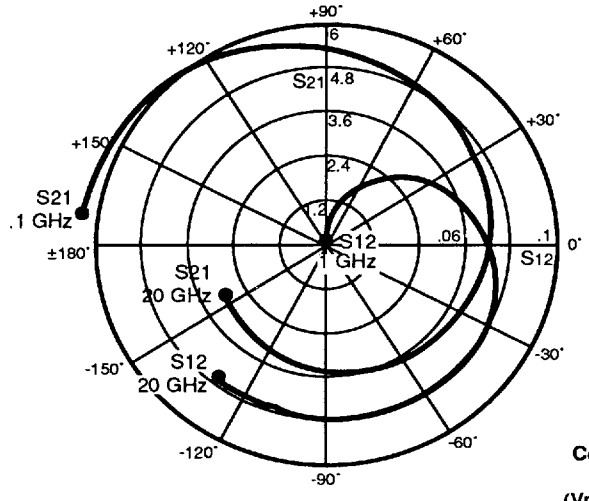
FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}		K	MAG
(GHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG		(dB)
0.1	0.999	-2.1	5.961	178.5	0.002	90.0	0.609	-2.2	0.03	34.7
0.2	0.999	-3.7	5.221	175.8	0.004	88.4	0.596	-3.1	0.03	31.2
0.5	0.998	-8.4	5.172	171.0	0.007	82.5	0.592	-7.6	0.06	28.7
1.0	0.992	-17.3	5.152	161.6	0.014	76.4	0.587	-15.1	0.10	25.7
2.0	0.969	-33.6	5.054	144.3	0.027	64.9	0.573	-29.8	0.19	22.7
3.0	0.934	-50.0	4.911	127.1	0.038	53.5	0.553	-44.2	0.29	21.1
4.0	0.883	-65.6	4.742	110.2	0.048	42.4	0.525	-58.5	0.41	19.9
5.0	0.840	-81.5	4.588	93.6	0.055	31.7	0.493	-73.1	0.50	19.2
6.0	0.788	-97.3	4.416	77.6	0.061	21.8	0.459	-88.0	0.60	18.6
7.0	0.742	-112.4	4.258	61.9	0.065	13.2	0.433	-103.1	0.69	18.1
8.0	0.691	-127.2	4.058	46.7	0.067	5.1	0.413	-117.7	0.81	17.8
9.0	0.656	-141.6	3.940	31.7	0.069	-1.9	0.396	-131.8	0.88	17.6
10.0	0.607	-158.3	3.844	15.8	0.071	-9.3	0.375	-147.0	0.98	17.3
11.0	0.562	-176.1	3.767	0.6	0.073	-16.8	0.356	-164.7	1.06	15.6
12.0	0.533	163.5	3.644	-15.5	0.074	-24.6	0.352	175.3	1.12	14.8
13.0	0.526	143.6	3.511	-31.7	0.075	-32.7	0.367	156.8	1.13	14.5
14.0	0.525	124.0	3.365	-47.7	0.076	-41.2	0.389	140.8	1.13	14.3
15.0	0.536	105.8	3.253	-64.9	0.077	-51.3	0.409	125.3	1.10	14.4
16.0	0.545	86.5	3.135	-82.4	0.078	-63.6	0.431	108.4	1.07	14.4
17.0	0.566	68.0	2.980	-100.8	0.076	-76.6	0.460	92.2	1.06	14.5
18.0	0.583	52.0	2.803	-117.8	0.074	-89.8	0.492	79.3	1.04	14.5
19.0	0.585	39.2	2.625	-135.3	0.072	-105.2	0.519	70.2	1.07	14.0
20.0	0.584	30.1	2.521	-152.3	0.072	-122.1	0.525	63.2	1.10	13.5

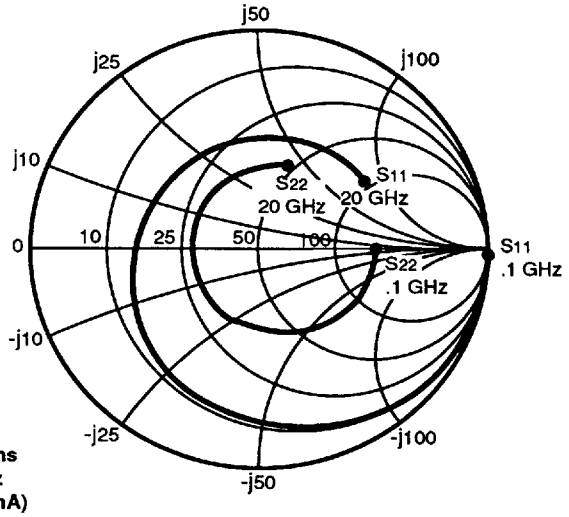
Note:
1. Gain Calculation:

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

MAG = Maximum Available Gain
MSG = Maximum Stable Gain

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





Coordinates in Ohms
Frequency in GHz
(VDS = 2 V, IDS = 20 mA)

NE32584C
VDS = 2 V, IDS = 20 mA

FREQUENCY	S11		S21		S12		S22		K	MAG
(GHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG		(dB)
0.1	0.999	-2.1	7.994	178.6	0.002	90.0	0.513	-2.3	0.03	36.0
0.2	0.999	-3.6	6.719	176.5	0.003	88.9	0.511	-2.9	0.03	33.5
0.5	0.999	-8.8	6.280	170.67	0.006	83.6	0.505	-7.4	0.03	30.2
1.0	0.989	-17.7	6.247	161.2	0.012	78.4	0.501	-14.6	0.13	27.2
2.0	0.963	-34.4	6.101	143.5	0.024	66.4	0.487	-28.9	0.24	24.1
3.0	0.924	-51.2	5.901	125.8	0.034	55.5	0.468	-42.6	0.35	22.4
4.0	0.872	-67.0	5.656	109.1	0.043	45.2	0.441	-56.3	0.47	21.2
5.0	0.822	-82.8	5.418	92.2	0.050	35.5	0.410	-70.4	0.57	20.3
6.0	0.770	-98.4	5.163	76.7	0.056	26.1	0.376	-84.4	0.67	19.6
7.0	0.720	-113.4	4.940	60.9	0.061	17.8	0.355	-98.9	0.76	19.1
8.0	0.671	-128.3	4.723	45.7	0.065	10.0	0.337	-113.2	0.84	18.6
9.0	0.626	-142.4	4.551	31.1	0.069	2.5	0.322	-126.9	0.92	18.2
10.0	0.579	-158.8	4.415	15.9	0.073	-5.7	0.299	-141.8	0.99	17.8
11.0	0.535	-177.0	4.290	0.6	0.077	-13.8	0.280	-159.8	1.04	16.2
12.0	0.506	163.1	4.142	-15.0	0.079	-22.7	0.275	178.9	1.08	15.4
13.0	0.500	143.4	3.996	-31.0	0.080	-32.0	0.287	159.2	1.09	15.1
14.0	0.499	124.9	3.835	-47.0	0.082	42.1	0.308	143.2	1.09	14.9
15.0	0.505	106.9	3.740	-63.7	0.082	-53.1	0.324	127.9	1.08	14.9
16.0	0.519	88.1	3.596	-80.9	0.082	-65.8	0.343	111.0	1.07	14.8
17.0	0.532	69.4	3.435	-98.7	0.082	-79.8	0.367	94.9	1.06	14.8
18.0	0.548	54.8	3.254	-116.0	0.081	-93.4	0.392	82.7	1.05	14.7
19.0	0.551	42.9	3.082	-133.5	0.078	-109.3	0.408	74.6	1.10	14.0
20.0	0.555	33.2	2.922	-151.1	0.077	-126.6	0.412	70.3	1.18	13.3

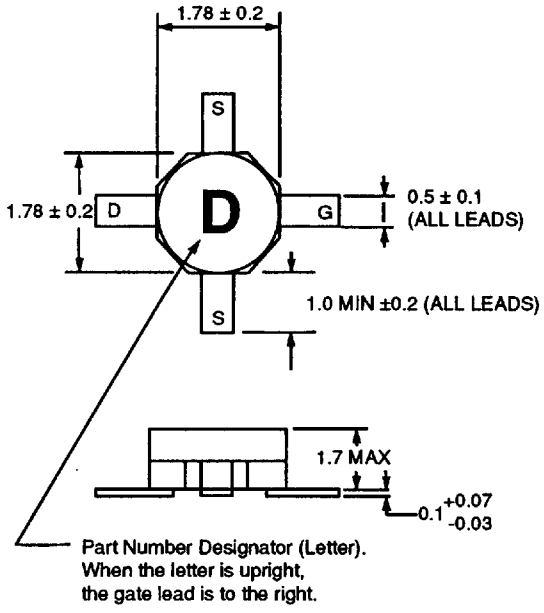
Note:
1. Gain Calculation:

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

MAG = Maximum Available Gain
MSG = Maximum Stable Gain

OUTLINE DIMENSIONS (Units in mm)

PACKAGE OUTLINE 84C



ORDERING INFORMATION

PART NUMBER	AVAILABILITY	LEAD LENGTH	PACKAGE OUTLINE
NE32484C-S	Bulk up to 1K	1.0 mm	84C
NE32484C-T1	1K/Reel	1.0 mm	84C
NE32584C-SL	Bulk up to 1K	1.7 mm	84C-SL