NEC

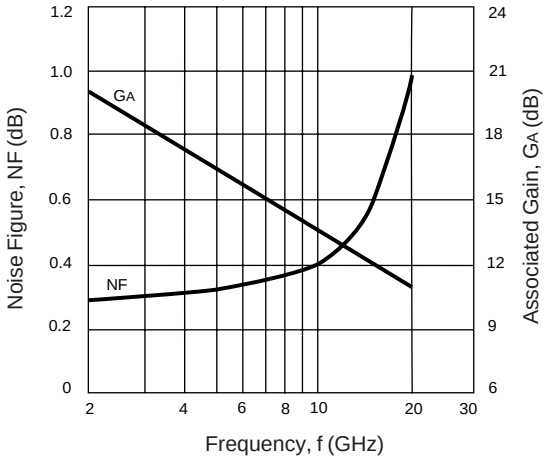
ULTRA LOW NOISE PSEUDOMORPHIC HJ FET

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.

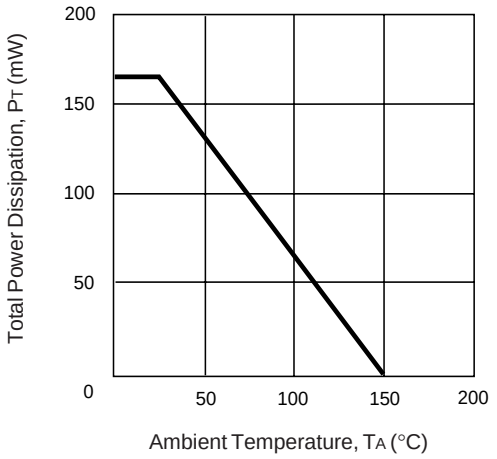
TYPICAL NOISE PARAMETERS (T_A = 25°C)

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

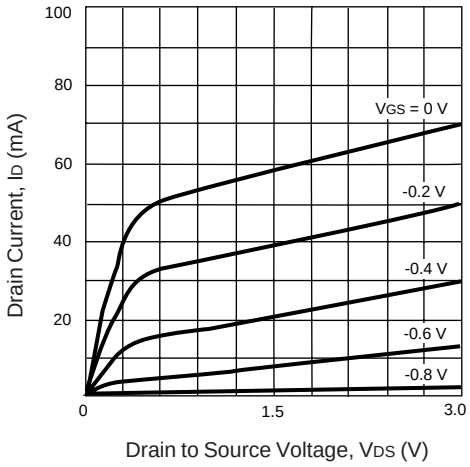
FREQ. (GHz)	NF_{OPT} (dB)	G_A (dB)	Γ_{OPT} MAG	Γ_{OPT} ANG	Rn/50
2	0.29	20.0	0.86	22	0.27
4	0.30	18.3	0.76	45	0.25
6	0.33	16.5	0.69	70	0.18
8	0.36	15.0	0.63	96	0.11
10	0.40	13.6	0.59	122	0.08
12	0.45	12.5	0.54	147	0.04
14	0.54	12.0	0.48	171	0.04
16	0.68	11.8	0.40	-165	0.05
18	0.85	11.5	0.31	-144	0.06

TYPICAL PERFORMANCE CURVES (T_A = 25°C)

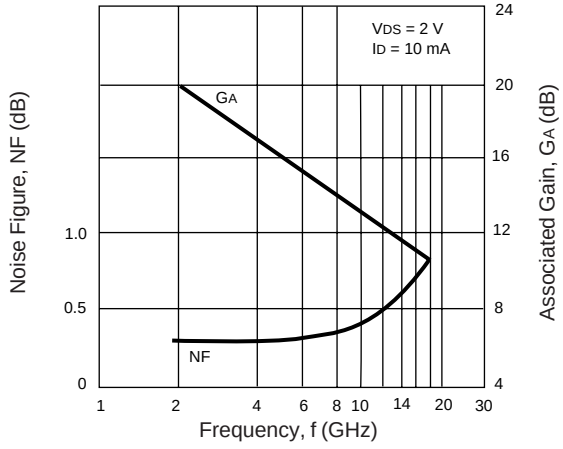
TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE



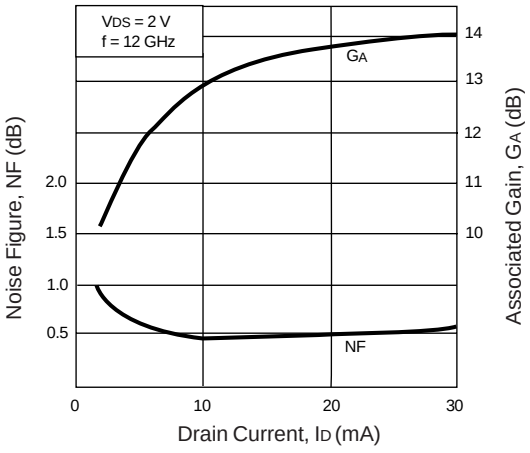
DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE



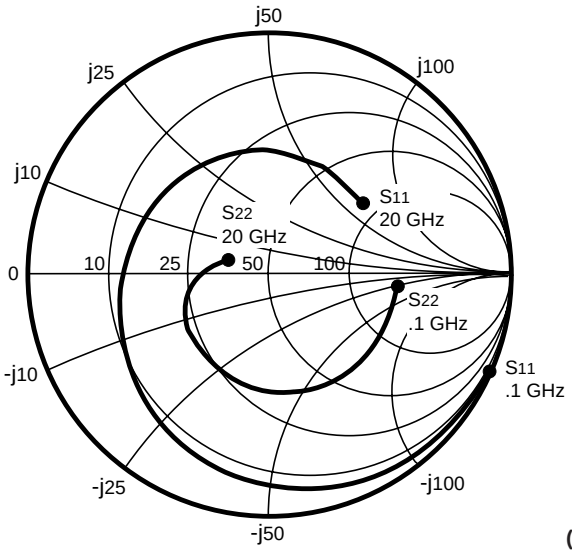
NOISE FIGURE AND ASSOCIATED GAIN vs. FREQUENCY

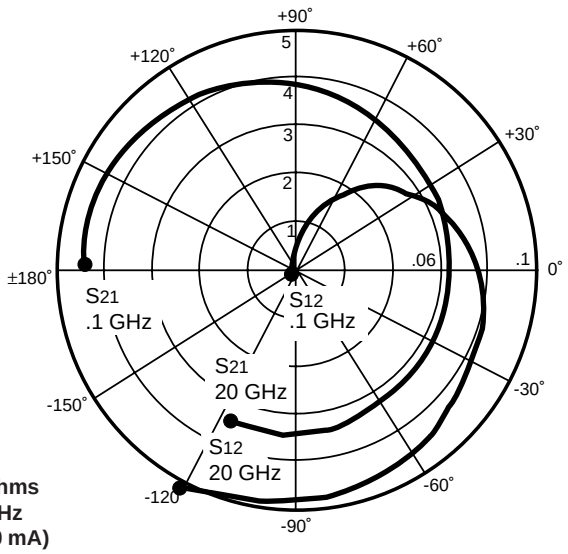


NOISE FIGURE AND ASSOCIATED GAIN vs. DRAIN CURRENT



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

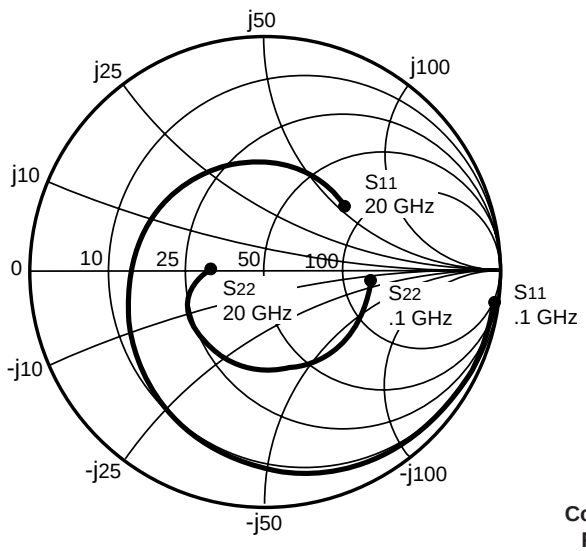
FREQUENCY	S11		S21		S12		S22		K	MAG
(GHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG		(dB)
0.100	0.999	-1.7	4.410	177.9	0.000	-173.3	0.528	-1.2	0.023	41.673
0.200	1.001	-3.1	4.431	176.5	0.003	85.4	0.525	-2.7	-0.027	31.694
0.500	1.000	-7.9	4.443	171.7	0.006	82.2	0.524	-6.4	0.030	28.695
1.000	0.995	-15.7	4.424	163.7	0.013	79.1	0.523	-12.7	0.081	25.319
2.000	0.977	-30.9	4.352	148.3	0.025	69.9	0.518	-25.0	0.171	22.407
3.000	0.954	-45.8	4.273	133.1	0.037	58.9	0.511	-36.9	0.249	20.625
4.000	0.922	-60.8	4.169	118.0	0.047	48.8	0.501	-48.7	0.334	19.479
5.000	0.881	-75.4	4.014	103.3	0.056	38.3	0.486	-60.2	0.439	18.554
6.000	0.842	-89.5	3.878	89.0	0.062	29.9	0.475	-71.3	0.522	17.962
7.000	0.805	-103.0	3.737	75.6	0.068	20.7	0.466	-81.3	0.600	17.400
8.000	0.769	-115.9	3.611	62.3	0.073	12.6	0.460	-90.3	0.675	16.943
9.000	0.739	-128.4	3.499	49.6	0.076	5.5	0.457	-98.6	0.737	16.631
10.000	0.711	-141.4	3.446	36.9	0.080	-2.5	0.451	-106.6	0.783	16.342
11.500	0.659	-162.1	3.351	17.5	0.083	-13.9	0.431	-119.2	0.894	16.061
12.000	0.642	-169.1	3.318	11.1	0.084	-18.0	0.425	-123.4	0.930	15.966
13.000	0.619	177.0	3.291	-2.0	0.085	-26.2	0.415	-131.7	0.980	15.879
14.000	0.598	162.8	3.266	-15.4	0.087	-34.7	0.409	-139.8	1.012	15.065
15.000	0.578	148.2	3.264	-29.0	0.089	-43.8	0.404	-147.9	1.036	14.474
16.000	0.559	131.6	3.297	-43.3	0.092	-55.2	0.389	-156.8	1.051	14.162
17.000	0.539	112.7	3.363	-58.3	0.094	-67.6	0.361	-166.5	1.074	13.873
18.000	0.525	91.2	3.410	-74.6	0.097	-81.9	0.324	-177.1	1.089	13.642
19.000	0.506	67.8	3.462	-92.5	0.098	-97.7	0.282	173.3	1.133	13.264
20.000	0.480	42.1	3.441	-111.3	0.102	-116.8	0.218	162.7	1.189	12.651

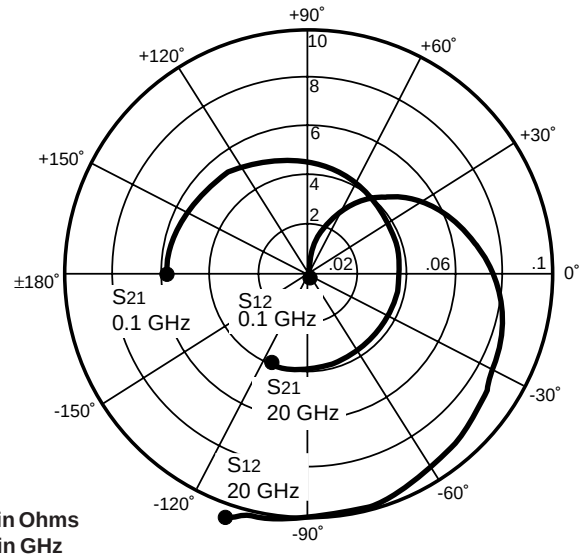
Note:
1. Gain Calculation:

$$MAG = \frac{|S_{21}|}{|S_{12}|}\left(K \pm \sqrt{K^2 - 1}\right).$$ When K ≤ 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

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





Coordinates in Ohms
Frequency in GHz
(V_{DS} = 2 V, I_{DS} = 20 mA)

NE32584C
V_{DS} = 2 V, I_{DS} = 20 mA

FREQUENCY	S11		S21		S12		S22		K	MAG
(GHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG		(dB)
0.100	1.002	-1.6	5.582	178.0	0.002	33.9	0.458	-1.4	0.240	34.458
0.200	1.001	-3.3	5.602	176.3	0.003	91.6	0.454	-2.7	-0.070	32.712
0.500	1.000	-8.3	5.603	171.3	0.006	82.6	0.454	-6.3	0.029	29.703
1.000	0.993	-16.4	5.568	163.0	0.012	79.4	0.453	-12.4	0.107	26.665
2.000	0.970	-32.2	5.443	146.9	0.022	71.2	0.447	-24.4	0.222	23.934
3.000	0.941	-47.6	5.298	131.3	0.033	60.8	0.441	-35.9	0.311	22.056
4.000	0.902	-62.8	5.119	115.9	0.043	51.3	0.432	-47.3	0.405	20.757
5.000	0.852	-77.6	4.881	101.0	0.050	42.2	0.419	-58.3	0.529	19.895
6.000	0.807	-91.8	4.673	86.6	0.057	34.0	0.411	-68.8	0.613	19.137
7.000	0.765	-105.2	4.464	73.2	0.062	26.1	0.405	-78.2	0.697	18.573
8.000	0.724	-117.9	4.277	59.8	0.067	18.2	0.403	-86.5	0.776	18.051
9.000	0.691	-130.1	4.116	47.2	0.071	12.1	0.404	-94.2	0.829	17.632
10.000	0.661	-142.8	4.019	34.6	0.075	4.6	0.404	-101.4	0.870	17.291
11.000	0.623	-156.1	3.910	21.7	0.079	-2.8	0.397	-109.1	0.929	16.945
12.000	0.591	-170.0	3.824	9.2	0.082	-10.9	0.388	-117.1	0.977	16.687
13.000	0.567	176.5	3.775	-3.8	0.085	-19.1	0.384	-124.9	1.004	16.105
14.000	0.547	162.6	3.729	-17.0	0.086	-27.7	0.384	-132.5	1.037	15.197
15.000	0.527	148.5	3.710	-30.5	0.090	-36.6	0.385	-140.2	1.037	14.973
16.000	0.511	132.4	3.723	-44.5	0.092	-48.0	0.378	-149.0	1.049	14.721
17.000	0.493	113.6	3.785	-59.2	0.095	-59.8	0.356	-158.3	1.051	14.616
18.000	0.480	92.1	3.825	-75.2	0.098	-73.7	0.324	-168.1	1.060	14.411
19.000	0.465	68.5	3.878	-92.7	0.099	-89.5	0.290	-176.6	1.090	14.102
20.000	0.447	42.6	3.848	-111.2	0.103	-107.8	0.233	174.3	1.127	13.554

Note:

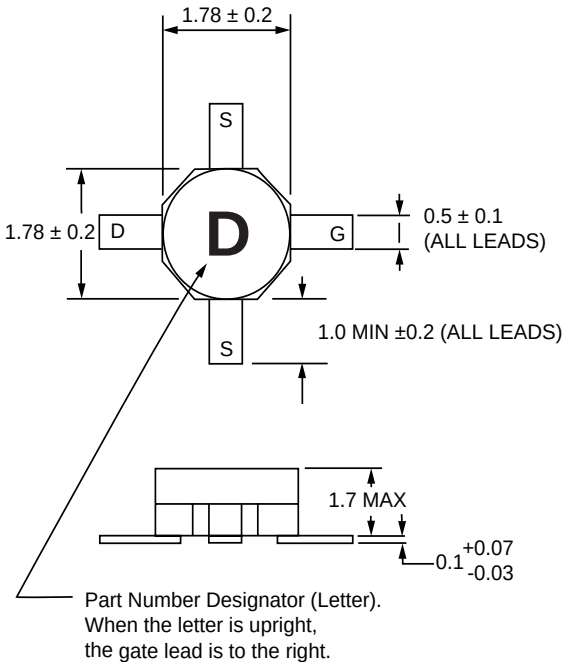
1. Gain Calculation:

$$MAG = \frac{|S_{21}|}{|S_{12}|}\left(K \pm \sqrt{K^2 - 1}\right).$$ When K ≤ 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
NE32584C-S	Bulk up to 1K	1.0 mm	84C
NE32584C-T1	1K/Reel	1.0 mm	84C
NE32584C-SL	Bulk up to 1K	1.7 mm	84C-SL