NEC

SUPER LOW NOISE PSEUDOMORPHIC HJ FET

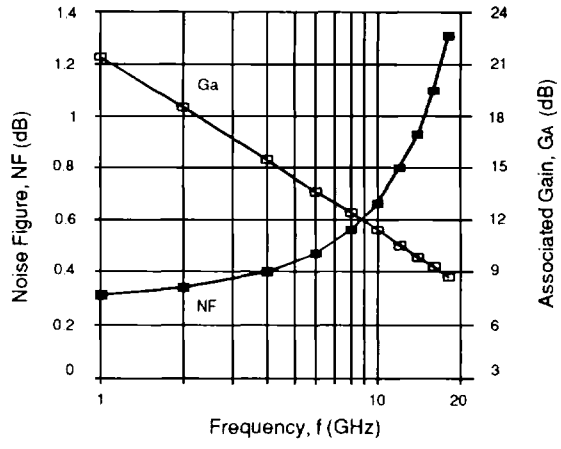
NE42484A

1

FEATURES

- **VERY LOW NOISE FIGURE:** 0.8 dB typical at 12 GHz
- **HIGH ASSOCIATED GAIN:** 10.5 dB Typical at 12 GHz
- **L_G = 0.35 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 NE42484A 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 ensure the highest reliability and performance.

ELECTRICAL CHARACTERISTICS (T_A = 25°C)

	PART NUMBER PACKAGE OUTLINE		NE42484A 84AS		
SYMBOLS	PARAMETERS AND CONDITIONS	UNITS	MIN	TYP	MAX
NF_{OPT}[1]	Optimum Noise Figure, V_{DS} = 2.0 V, I_{DS} = 10 mA, f = 12 GHz	dB		0.8	1.2
G_A[1]	Associated Gain, V_{DS} = 2.0 V, I_{DS} = 10 mA, f = 12 GHz	dB	9.0	10.5	
P_{1dB}	Output Power at 1 dB Gain Compression Point, f = 12 GHz V_{DS} = 2.0 V, I_{DS} = 10 mA V_{DS} = 2.0 V, I_{DS} = 20 mA	 dBm dBm		 9.7 10.2	
G_{1dB}	Gain at P_{1dB}, f = 12 GHz V_{DS} = 2.0 V, I_{DS} = 10 mA V_{DS} = 2.0 V, I_{DS} = 20 mA	 dB dB		 10.3 10.5	
I_{DSS}	Saturated Drain Current, V_{DS} = 2.0 V, V_{GS} = 0 V	mA	15	40	70
V_P	Pinch-off Voltage, V_{DS} = 2.0 V, I_{DS} = 0.1 mA	V	-2.0	-0.8	-0.2
g_m	Transconductance, V_{DS} = 2.0 V, I_D = 10 mA	mS	45	60	
I_{GSO}	Gate to Source Leakage Current, V_{GS} = -3.0 V	µA		0.5	10.0
$R_{TH(CH-A)}$	Thermal Resistance (Channel to Ambient)	°C/W		750	
$R_{TH(CH-C)}$[2]	Thermal Resistance (Channel to Case)	°C/W			350

Notes:
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 for each specimen.
2. R_{TH} (channel to case) for package mounted on an infinite heat sink.

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 (RF Drive)	μA	200
P_{IN}	RF Input (CW)	dBm	15
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.

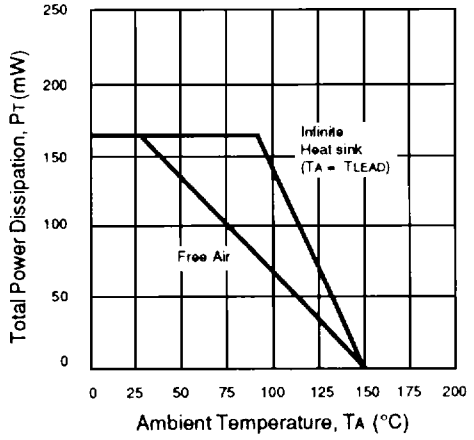
TYPICAL NOISE PARAMETERS (T_A = 25°C)

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

FREQ. (GHz)	NF_{OPT} (dB)	G_A (dB)	Γ_{OPT} MAG	Γ_{OPT} ANG	Rn/50
1.0	0.31	21.4	0.78	10	0.43
2.0	0.34	18.5	0.76	28	0.38
4.0	0.40	15.5	0.72	58	0.28
6.0	0.47	13.6	0.65	84	0.21
8.0	0.56	12.4	0.57	113	0.15
10.0	0.66	11.4	0.50	141	0.10
12.0	0.80	10.5	0.44	173	0.09
14.0	0.93	9.8	0.39	-157	0.08
16.0	1.10	9.3	0.36	-125	0.08
18.0	1.31	8.7	0.35	-90	0.08

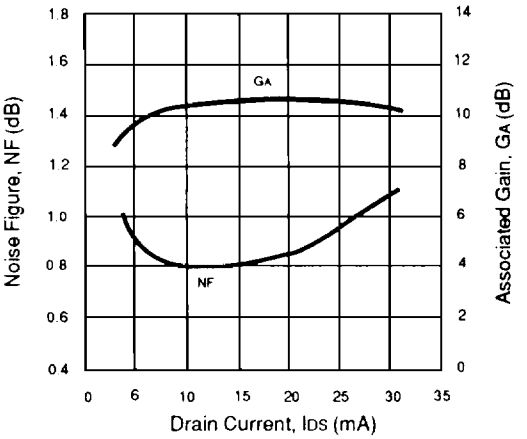
TYPICAL PERFORMANCE CURVES (T_A = 25°C)

TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE[1]

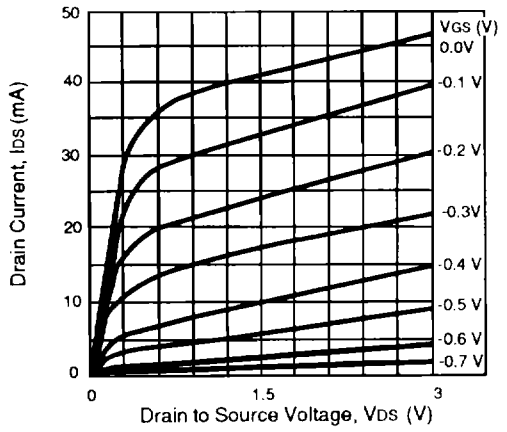


Note
1. If P_T exceeds the Free Air Value, reliable operation can be assured by measuring the worst-case temperature, $T_{(LEAD)}$, at the lead where heat flow is maximum (usually the source lead) and limiting T_A, P_T or $R_{TH\ (CKT)}$

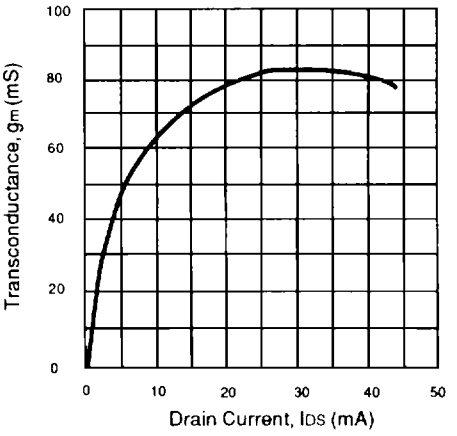
NOISE FIGURE AND ASSOCIATED GAIN vs. DRAIN CURRENT V_{DS} = 2 V, f = 12 GHz



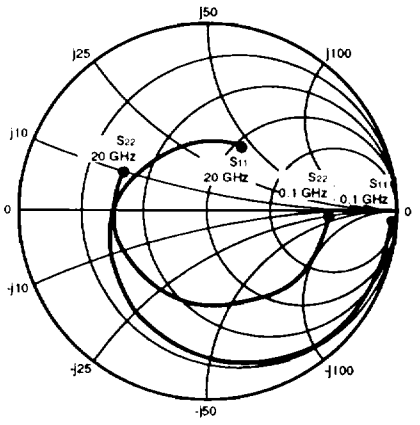
DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE

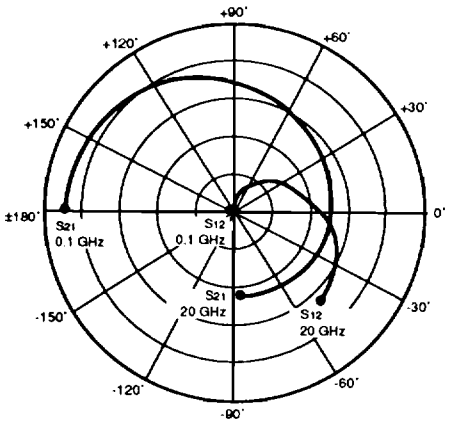


TRANSCONDUCTANCE vs. DRAIN CURRENT V_{DS} = 2.0 V



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





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

FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}		K	MAG[1]
(GHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG		(dB)
0.1	0.999	-1.800	4.433	178.300	0.002	88.300	0.651	-1.300	0.073	33.457
0.2	0.999	-3.500	4.417	176.600	0.003	87.100	0.651	-2.400	0.055	31.680
0.5	0.997	-9.100	4.401	170.900	0.009	83.500	0.651	-6.300	0.066	26.893
1.0	0.988	-18.500	4.345	161.800	0.017	78.700	0.652	-12.800	0.110	24.075
2.0	0.962	-35.500	4.245	145.000	0.032	67.100	0.634	-24.300	0.212	21.227
3.0	0.921	-52.100	4.071	128.500	0.046	57.300	0.612	-34.900	0.320	19.469
4.0	0.873	-67.400	3.859	113.500	0.057	49.000	0.591	-45.000	0.418	18.306
5.0	0.820	-82.100	3.663	99.100	0.066	40.800	0.566	-55.200	0.523	17.443
6.0	0.763	-96.000	3.447	85.200	0.072	34.800	0.542	-64.700	0.642	16.801
7.0	0.716	-108.900	3.243	72.300	0.078	28.300	0.522	-74.500	0.737	16.189
8.0	0.675	-120.400	3.072	60.600	0.082	24.200	0.511	-82.800	0.818	15.736
9.0	0.637	-131.400	2.918	48.700	0.087	21.000	0.510	-91.300	0.869	15.256
10.0	0.599	-142.700	2.808	37.100	0.091	16.200	0.509	-99.300	0.927	14.894
11.0	0.554	-154.500	2.718	25.500	0.097	12.800	0.502	-107.900	0.973	14.475
12.0	0.512	-167.300	2.627	14.000	0.102	8.400	0.489	-116.700	1.033	12.996
13.0	0.483	179.300	2.567	2.400	0.108	4.300	0.479	-126.100	1.045	12.464
14.0	0.453	166.100	2.511	-8.800	0.116	0.800	0.473	-135.600	1.037	12.176
15.0	0.426	152.000	2.462	-20.400	0.125	-5.000	0.484	-146.300	0.996	12.944
16.0	0.398	136.300	2.418	-32.700	0.134	-11.500	0.496	-157.700	0.959	12.564
17.0	0.381	117.400	2.380	-45.400	0.142	-19.300	0.503	-169.200	0.927	12.243
18.0	0.380	97.200	2.342	-58.600	0.151	-27.600	0.499	179.100	0.896	11.906
19.0	0.390	79.000	2.301	-72.300	0.158	-35.500	0.493	167.000	0.873	11.633
20.0	0.399	60.600	2.233	-85.900	0.164	-46.200	0.487	153.000	0.871	11.340

Note:
1. Gain Calculations:

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

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

V_{DS} = 2 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)
0.1	0.999	-2.000	5.247	177.900	0.002	89.300	0.579	-1.700	0.059	34.189
0.2	0.999	-3.800	5.244	176.400	0.003	88.400	0.577	-2.600	0.038	32.425
0.5	0.997	-9.600	5.224	170.500	0.008	85.300	0.578	-6.100	0.054	28.149
1.0	0.987	-19.300	5.151	160.700	0.015	78.200	0.578	-12.500	0.143	25.358
2.0	0.952	-36.900	4.964	143.600	0.029	69.000	0.564	-23.700	0.264	22.334
3.0	0.904	-53.700	4.689	127.000	0.042	59.900	0.544	-34.000	0.386	20.478
4.0	0.849	-69.200	4.409	111.600	0.052	53.100	0.525	-43.600	0.498	19.283
5.0	0.789	-83.900	4.130	97.300	0.061	46.100	0.503	-52.700	0.617	18.306
6.0	0.730	-97.600	3.850	83.800	0.068	40.200	0.482	-61.700	0.735	17.530
7.0	0.681	-110.400	3.602	70.700	0.075	34.700	0.467	-70.900	0.820	16.815
8.0	0.636	-121.700	3.389	59.300	0.080	30.700	0.459	-79.100	0.899	16.270
9.0	0.597	-132.400	3.203	47.600	0.086	27.800	0.463	-87.300	0.938	15.711
10.0	0.558	-143.300	3.067	36.400	0.094	22.400	0.464	-94.900	0.964	15.136
11.0	0.516	-155.000	2.946	25.200	0.101	18.900	0.463	-103.500	0.989	14.649
12.0	0.475	-167.700	2.844	13.700	0.110	13.300	0.455	-111.600	1.010	13.515
13.0	0.446	179.000	2.764	2.500	0.116	8.800	0.447	-121.300	1.022	12.852
14.0	0.415	166.000	2.695	-8.500	0.124	3.600	0.441	-130.900	1.025	12.411
15.0	0.392	151.700	2.639	-19.900	0.134	-2.600	0.454	-142.200	0.976	12.943
16.0	0.364	136.100	2.585	-31.900	0.143	-10.300	0.468	-153.000	0.947	12.571
17.0	0.348	117.300	2.542	-44.300	0.152	-18.400	0.475	-164.800	0.914	12.233
18.0	0.351	96.900	2.503	-57.400	0.160	-26.900	0.471	-177.200	0.887	11.943
19.0	0.366	78.600	2.455	-70.500	0.168	-35.700	0.468	171.300	0.855	11.647
20.0	0.375	60.600	2.377	-83.800	0.172	-46.100	0.457	157.400	0.868	11.405

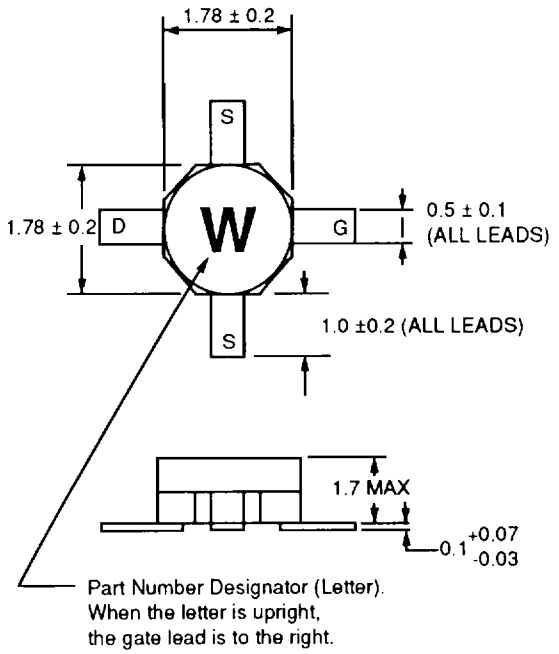
Note:
1. Gain Calculations:

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

OUTLINE 84AS



ORDERING INFORMATION[1]

PART NUMBER	AVAILABILITY	PACKAGE
NE42484AS	Bulk up to 1 K	84AS
NE42484A-T1	1K/Reel	84AS

Note:
Not available in long lead, 84A package.