

PRELIMINARY DATA SHEET

NEC

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

NE425S01

FEATURES

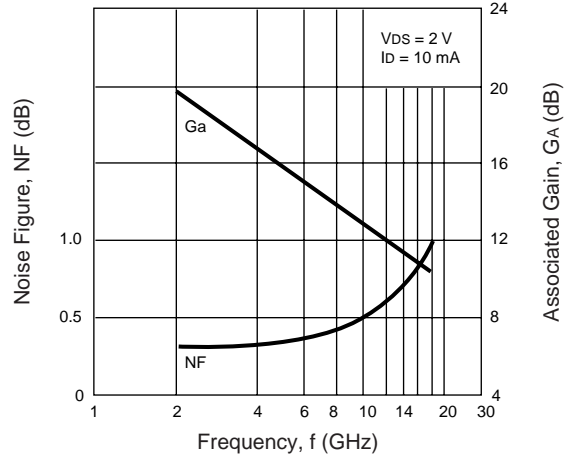
- **SUPER LOW NOISE FIGURE:**
0.60 dB TYP at 12 GHz
- **HIGH ASSOCIATED GAIN:**
12.0 dB TYP at $f = 12$ GHz
- **GATE LENGTH:** $\leq 0.20 \mu\text{m}$
- **GATE WIDTH:** $200 \mu\text{m}$
- **LOW COST PLASTIC PACKAGE**

DESCRIPTION

The NE425S01 is a Hetero-Junction FET that utilizes the hetero junction to create high mobility electrons. Its excellent low noise and high associated gain make it suitable for DBS and other commercial applications.

NEC's stringent quality assurance and test procedures assure the highest reliability and performance.

NOISE FIGURE & ASSOCIATED GAIN vs. FREQUENCY



RECOMMENDED OPERATING CONDITIONS (TA = 25°C)

SYMBOLS	CHARACTERISTICS	UNITS	MIN	TYP	MAX
V _{DS}	Drain to Source Voltage	V		2	3
I _D	Drain Current	mA		10	20
P _{in}	Input Power	dBm			0

ELECTRICAL CHARACTERISTICS (TA = 25°C)

PART NUMBER PACKAGE OUTLINE			NE425S01 S01		
SYMBOLS	PARAMETERS AND CONDITIONS	UNITS	MIN	TYP	MAX
NF ¹	Noise Figure, V _{DS} = 2 V, I _D = 10 mA, f = 12 GHz	dB		0.60	0.80
GA ¹	Associated Gain, V _{DS} = 2 V, I _D = 10 mA, f = 12 GHz	dB	10.5	12.0	
g _m	Transconductance, V _{DS} = 2 V, I _D = 10 mA	mS	45	60	
I _{DSS}	Saturated Drain Current, V _{DS} = 2 V, V _{GS} = 0 V	mA	20	60	90
V _{GS(off)}	Gate to Source Cutoff Voltage, V _{DS} = 2 V, I _D = 100 μA	V	-0.2	-0.7	-2.0
I _{GSO}	Gate to Source Leak Current, V _{GS} = -3 V	μA		0.5	10

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.

California Eastern Laboratories

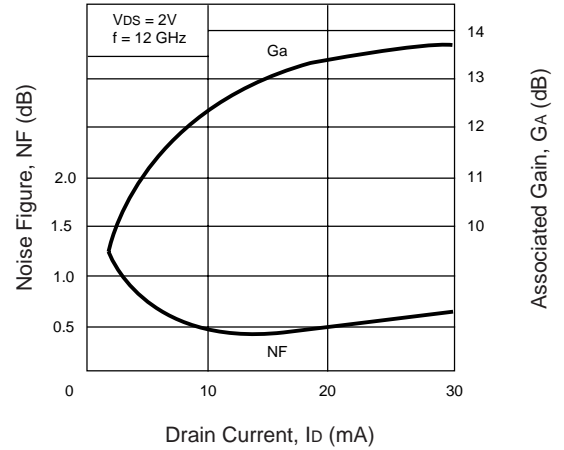
ABSOLUTE MAXIMUM RATINGS¹ (T_A = 25°C)

SYMBOLS	PARAMETERS	UNITS	RATINGS
V _{DS}	Drain to Source Voltage	V	4.0
V _{GS}	Gate to Source Voltage	V	-3.0
I _D	Drain Current	mA	I _{DSS}
I _G	Gate Current	μA	100
P _T	Total Power Dissipation	mW	165
T _{CH}	Channel Temperature	°C	125
T _{stg}	Storage Temperature	°C	-65 to +125

Note:

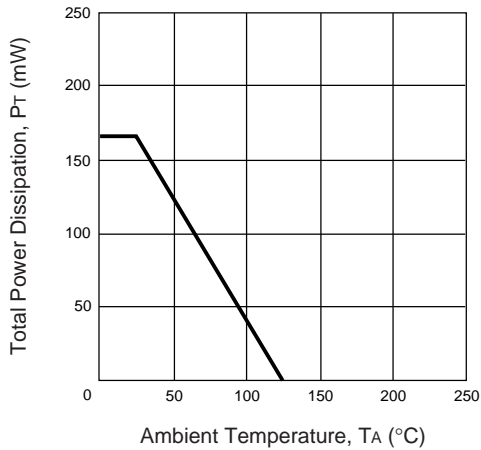
1. Operation in excess of any one of these parameters may result in permanent damage.

NOISE FIGURE, ASSOCIATED GAIN vs. DRAIN CURRENT

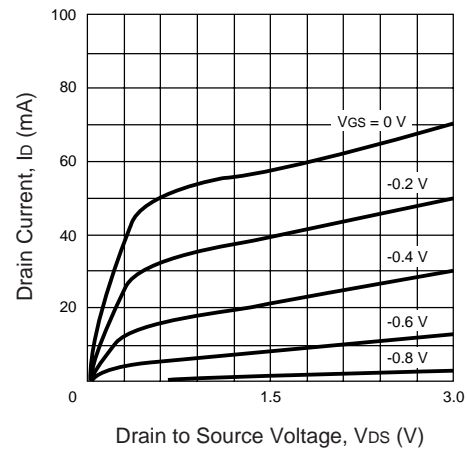


TYPICAL PERFORMANCE CURVES (T_A = 25°C)

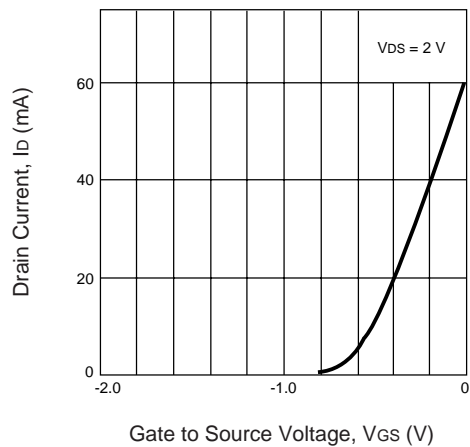
TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE



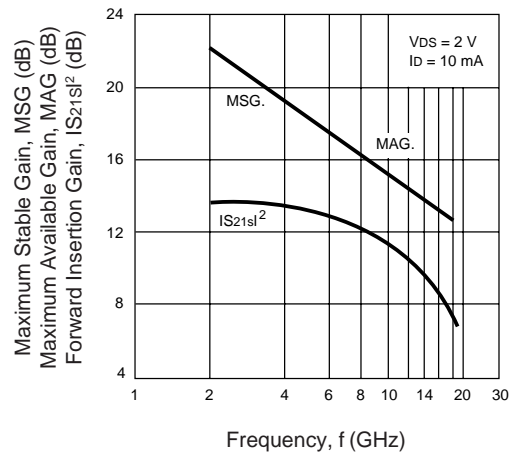
DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE



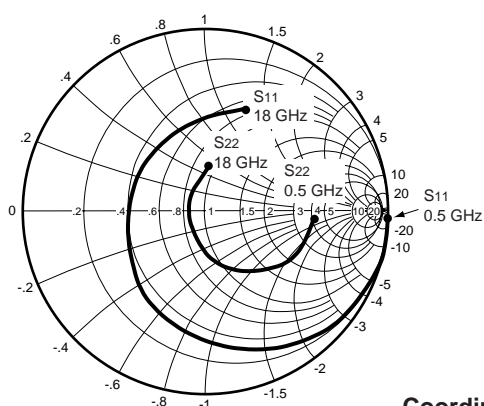
DRAIN CURRENT vs. GATE TO SOURCE VOLTAGE



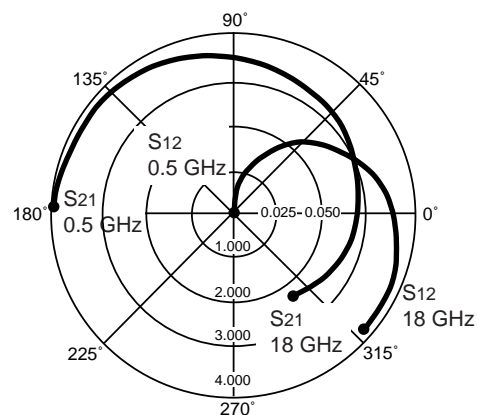
MAXIMUM AVAILABLE GAIN, FORWARD INSERTION GAIN vs. FREQUENCY



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



Coordinates in Ohms
Frequency in GHz
V_{ds} = 2 V, I_{ds} = 10 mA



V_{ds} = 2 V, I_d = 10 mA

FREQUENCY (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂		K	MAG ¹ (dB)
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG		
0.50	0.998	-6.25	4.353	172.87	0.006	85.38	0.581	-4.35	0.075	28.606
1.00	0.991	-12.36	4.325	166.07	0.013	81.34	0.577	-8.60	0.151	25.220
1.50	0.983	-18.30	4.304	159.56	0.019	77.34	0.571	-12.75	0.200	23.551
2.00	0.973	-24.28	4.300	152.97	0.025	73.13	0.565	-16.87	0.249	22.355
2.50	0.963	-30.28	4.268	146.39	0.030	68.91	0.556	-21.01	0.292	21.531
3.00	0.952	-36.31	4.253	139.87	0.036	65.00	0.546	-25.10	0.325	20.724
3.50	0.936	-42.52	4.228	133.14	0.042	60.80	0.535	-29.22	0.376	20.029
4.00	0.918	-48.91	4.205	126.39	0.047	56.72	0.522	-33.29	0.427	19.517
4.50	0.896	-55.17	4.159	119.62	0.052	52.48	0.506	-37.48	0.489	19.030
5.00	0.864	-61.77	4.099	112.65	0.056	48.56	0.487	-41.54	0.576	18.645
5.50	0.830	-68.21	4.038	105.96	0.060	44.48	0.466	-45.70	0.662	18.280
6.00	0.796	-74.65	3.970	99.70	0.064	40.77	0.445	-49.87	0.736	17.926
6.50	0.762	-81.27	3.888	93.42	0.067	37.05	0.424	-53.98	0.815	17.637
7.00	0.731	-87.80	3.825	87.11	0.070	33.52	0.404	-58.13	0.879	17.375
7.50	0.703	-94.41	3.769	81.02	0.073	30.04	0.384	-62.07	0.933	17.129
8.00	0.675	-101.21	3.708	75.10	0.076	26.89	0.367	-66.26	0.979	16.883
8.50	0.647	-107.84	3.660	68.76	0.078	23.80	0.351	-70.16	1.033	15.596
9.00	0.624	-114.92	3.623	62.69	0.081	20.66	0.334	-73.96	1.063	14.973
9.50	0.597	-122.27	3.586	56.50	0.083	17.61	0.317	-77.74	1.108	14.357
10.00	0.571	-130.41	3.532	49.97	0.085	14.41	0.296	-81.66	1.155	13.796
10.50	0.536	-138.75	3.484	43.60	0.088	11.15	0.275	-85.75	1.204	13.247
11.00	0.501	-147.71	3.434	37.56	0.089	7.98	0.249	-90.60	1.272	12.728
11.50	0.474	-157.02	3.329	31.21	0.091	4.74	0.222	-96.41	1.333	12.179
12.00	0.454	-167.49	3.263	25.00	0.092	1.38	0.196	-102.92	1.381	11.816
12.50	0.440	-178.22	3.208	18.95	0.093	-1.63	0.169	-111.44	1.417	11.536
13.00	0.432	170.87	3.156	13.02	0.094	-4.93	0.146	-122.20	1.442	11.314
14.00	0.430	149.21	3.051	-0.17	0.096	-11.35	0.115	-149.45	1.471	10.957
15.00	0.442	127.80	2.924	-13.75	0.098	-18.32	0.103	-175.83	1.491	10.603
16.00	0.466	106.73	2.770	-27.29	0.099	-25.93	0.119	-137.09	1.519	10.216
17.00	0.514	87.16	2.610	-40.28	0.100	-33.90	0.166	105.34	1.506	9.963
18.00	0.592	69.36	2.457	-53.68	0.100	-41.97	0.236	85.49	1.418	10.061

Note:

1. Gain Calculation:

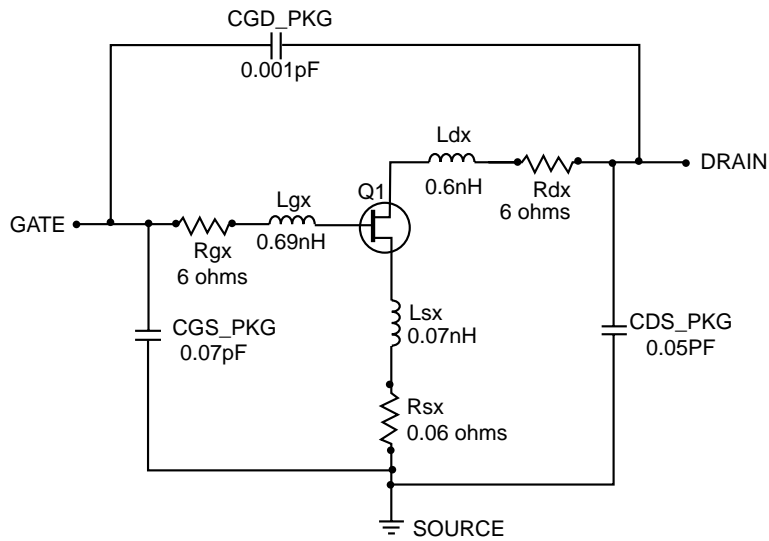
$$\text{MAG} = \frac{|S_{21}|}{|S_{12}|} \left(K \pm \sqrt{K^2 - 1} \right). \text{ When } K \leq 1, \text{ MAG is undefined and MSG values are used. } \text{MSG} = \frac{|S_{21}|}{|S_{12}|}, K = \frac{1 + |\Delta|^2 - |S_{11}|^2 - |S_{22}|^2}{2 |S_{12} S_{21}|}, \Delta = S_{11} S_{22} - S_{21} S_{12}$$

MAG = Maximum Available Gain

MSG = Maximum Stable Gain

NONLINEAR MODEL

SCHEMATIC



FET NONLINEAR MODEL PARAMETERS ⁽¹⁾

Parameters	Q1	Parameters	Q1
VTO	-0.8	RG	3
VTOSC	0	RD	2
ALPHA	8	RS	2
BETA	0.103	RGMET	0
GAMMA	0.092	KF	0
GAMMADC	0.08	AF	1
Q	2	TNOM	27
DELTA	1	XTI	3
VBI	0.715	EG	1.43
IS	3e-13	VTOTC	0
N	1.22	BETATCE	0
RIS	0	FFE	1
RID	0		
TAU	4e-12		
CDS	0.13e-12		
RDB	5000		
CBS	1e-9		
CGSO	0.3e-12		
CGDO	0.02e-12		
DELTA1	0.3		
DELTA2	0.1		
FC	0.5		
VBR	Infinity		

UNITS

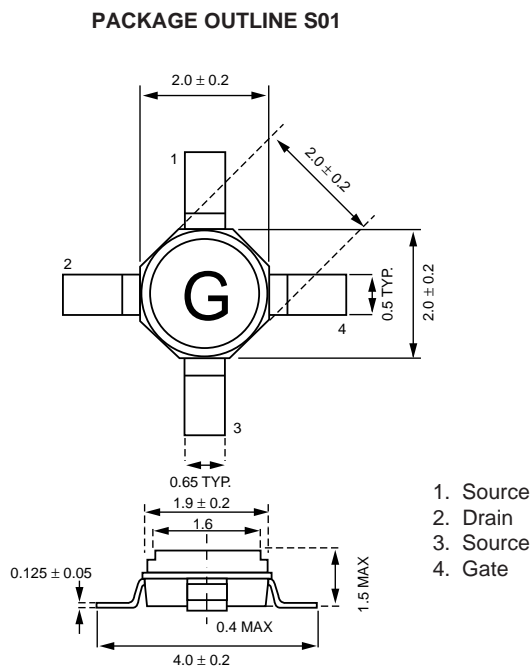
Parameter	Units
time	seconds
capacitance	farads
inductance	henries
resistance	ohms
voltage	volts
current	amps

MODEL RANGE

Frequency: 0.1 to 18 GHz
 Bias: $V_{ds} = 1\text{ V to }3\text{ V}$, $I_D = 5\text{ mA to }30\text{ mA}$
 $I_{DSS} = 59.9\text{ ma @ }V_{GS} = 0, V_{DS} = 2\text{ V}$
 Date: 2/98

(1) Series IV Libra TOM Model

OUTLINE DIMENSIONS (Units in mm)



TYPICAL NOISE PARAMETERS (T_A = 25°C)

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

FREQ. (GHz)	NF _{MIN} (dB)	G _A (dB)	Γ _{OPT}		R _n /50
			MAG	ANG	
2	0.31	18.35	0.93	14	0.38
4	0.34	16.31	0.80	29	0.33
6	0.40	14.56	0.65	48	0.25
8	0.45	13.28	0.49	72	0.18
10	0.52	12.33	0.36	102	0.11
12	0.60	11.11	0.27	139	0.08
14	0.72	10.40	0.24	-176	0.07
16	0.86	9.86	0.30	-122	0.10
18	1.00	9.63	0.47	-58	0.22

ORDERING INFORMATION

PART NUMBER	SUPPLY FORM	PACKAGE OUTLINE
NE425S01	Bulk	S01
NE425S01-T1	Tape & Reel 1000 pcs./reel	S01
NE425S01-T1B	Tape & Reel 4000 pcs./reel	S01

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