NEC

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

NE429M01

FEATURES

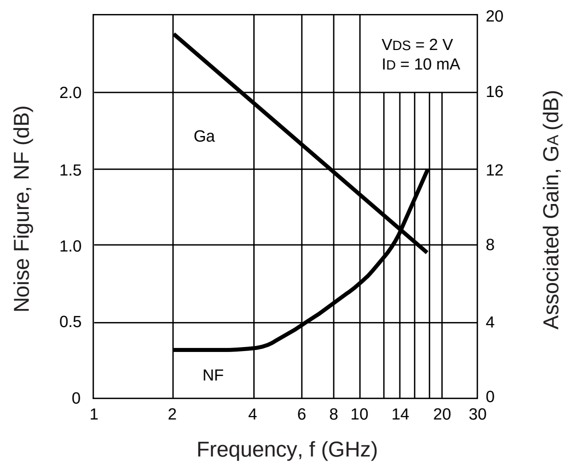
- **LOW NOISE FIGURE & HIGH ASSOCIATED GAIN:** NF = 0.9 dB TYP, G_A = 10 dB TYP at f = 12 GHz
- **6 PIN SUPER MINIMOLD PACKAGE**
- **GATE WIDTH:** Wg = 200µm

DESCRIPTION

The NE429M01 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 second and third stage low noise amplifiers in DBS, TVRO and other commercial systems.

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

NOISE FIGURE & ASSOCIATED GAIN vs. FREQUENCY



RECOMMENDED OPERATING CONDITIONS (T_A = 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 (T_A = 25°C)

PART NUMBER PACKAGE OUTLINE					NE429M01 M01		
SYMBOLS	PARAMETERS AND CONDITIONS			UNITS	MIN	TYP	MAX
NF	Noise Figure at	f = 12 GHz,	VDS = 2 V I_D = 10 mA	dB		0.9	1.2
		f = 4 GHz				0.4	
G_A	Associated Gain at	f = 12 GHz,		dB	9	10	
		f = 4 GHz				15.0	
Gm	Transconductance at V_{DS} = 2 V, I_D = 10 mA			mS	45	60	
I_{DSS}	Saturated Drain Current at V_{DS} = 2 V, V_{GS} = 0 V			mA	20	60	90
$V_{GS\,(OFF)}$	Gate to Source Cutoff Voltage at V_{DS} = 2 V, I_D = 100 µA			V	-0.2	-0.7	-2.0
I_{GSO}	Gate to Source Leak Current at V_{GS} = -3 V			µA		0.5	10

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_D	Drain Current	mA	I_{DSS}
I_G	Gate Current	µA	100
P_{TOT}	Total Power Dissipation	mW	125
T_{CH}	Channel Temperature	°C	125
T_{STG}	Storage Temperature	°C	-65 to +125

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

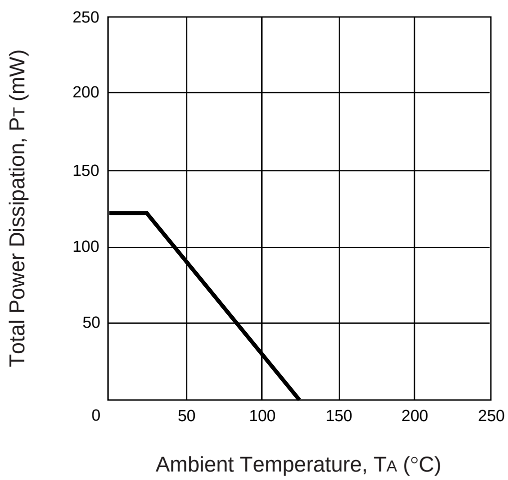
TYPICAL NOISE PARAMETERS (T_A = 25°C)

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

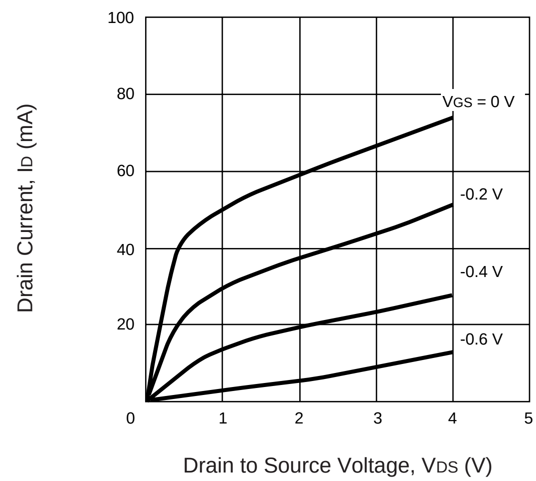
FREQ. (GHz)	NF_{MIN} (dB)	G_A (dB)	Γ_{OPT} MAG	Γ_{OPT} ANG	Rn/50
4	0.40	15.5	0.51	75	0.18
6	0.49	13.9	0.49	103	0.11
8	0.60	12.5	0.44	145	0.06
10	0.74	11.3	0.32	-162	0.06
12	0.90	10.0	0.23	-73	0.16
14	1.08	08.9	0.45	-5	0.36
16	1.30	07.8	0.60	42	0.58
18	1.53	06.8	0.76	78	0.68

TYPICAL PERFORMANCE CURVES (T_A = 25°C)

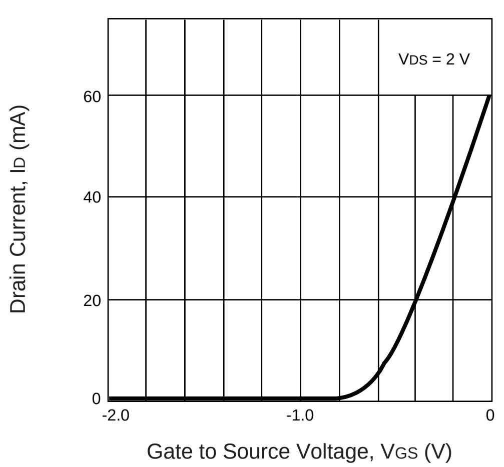
TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE



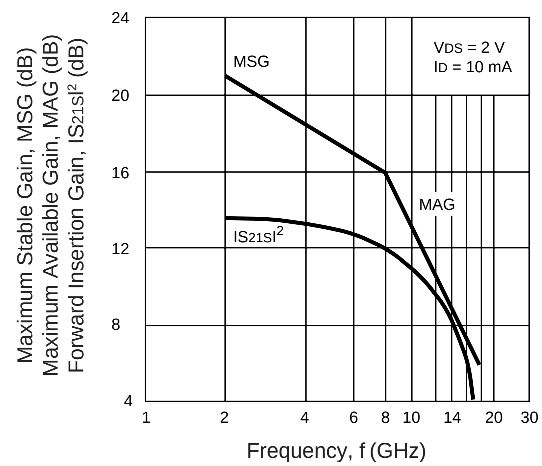
DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE



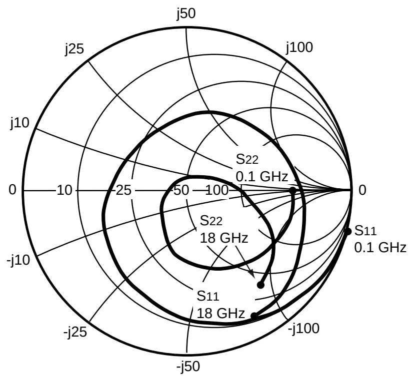
DRAIN CURRENT vs. GATE TO SOURCE VOLTAGE



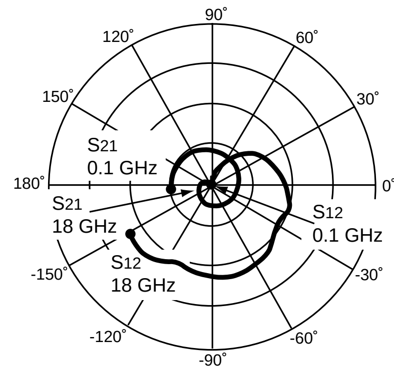
MAXIMUM AVAILABLE GAIN, FORWARD INSERTION GAIN vs. FREQUENCY



TYPICAL SCATTERING PARAMETERS (T_A = 25°C)



Coordinates in Ohms
Frequency in GHz
V_D = 2 V, I_D = 10 mA



NE429M01
V_D = 2 V, I_D = 10 mA

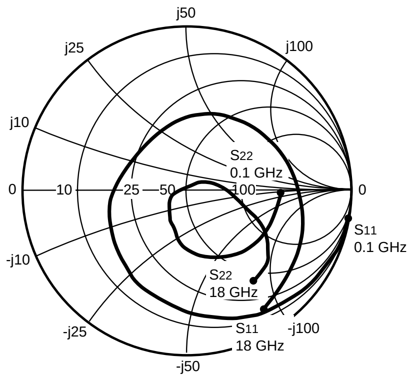
FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}		K	MAG[1]
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG		(dB)
0.10	0.982	-2.14	4.900	-177.84	0.002	94.35	0.672	-4.14	0.78	33.58
0.20	1.010	-4.40	4.877	177.56	0.004	89.08	0.653	-4.62	-0.33	30.46
0.30	0.998	-6.76	4.897	174.60	0.007	86.66	0.658	-5.82	0.00	28.72
0.40	1.003	-8.93	4.886	171.79	0.009	84.86	0.655	-7.25	-0.05	27.47
0.50	1.000	-11.11	4.889	169.18	0.011	83.12	0.654	-8.80	0.00	26.49
0.70	0.996	-15.62	4.883	164.26	0.015	79.72	0.651	-11.86	0.05	25.05
1.00	0.986	-22.48	4.871	157.12	0.022	74.92	0.646	-16.52	0.12	23.52
1.50	0.964	-33.57	4.820	145.49	0.032	67.11	0.635	-24.55	0.20	21.78
2.00	0.935	-44.86	4.763	133.93	0.042	59.32	0.621	-32.56	0.29	20.56
2.50	0.900	-56.20	4.667	122.48	0.051	51.51	0.601	-40.56	0.37	19.63
3.00	0.861	-67.56	4.581	111.29	0.059	43.82	0.579	-48.42	0.44	18.90
3.50	0.816	-78.99	4.479	100.31	0.066	36.04	0.555	-55.92	0.53	18.34
4.00	0.771	-90.21	4.370	89.78	0.071	28.96	0.533	-62.72	0.61	17.89
5.00	0.689	-112.75	4.151	69.25	0.080	15.19	0.488	-76.19	0.75	17.13
6.00	0.610	-136.59	3.969	48.83	0.087	2.67	0.441	-90.01	0.86	16.57
7.00	0.531	-163.37	3.820	28.06	0.096	-10.97	0.386	-104.67	0.97	16.02
8.00	0.436	165.44	3.578	7.38	0.095	-25.82	0.303	-115.82	1.20	13.04
9.00	0.415	133.42	3.388	-12.82	0.096	-34.66	0.247	-127.66	1.30	12.21
10.00	0.445	103.02	3.201	-33.13	0.102	-44.86	0.192	-145.09	1.28	11.80
11.00	0.505	74.83	3.014	-54.66	0.109	-57.45	0.129	-173.19	1.21	11.62
12.00	0.567	47.77	2.766	-77.12	0.113	-71.51	0.072	120.41	1.21	11.14
13.00	0.636	22.87	2.466	-99.21	0.114	-85.96	0.126	43.77	1.21	10.59
14.00	0.698	1.64	2.176	-120.21	0.110	-99.30	0.217	17.32	1.22	10.13
15.00	0.746	-14.52	1.932	-142.45	0.106	-111.31	0.316	2.73	1.18	9.99
16.00	0.785	-27.89	1.700	-165.80	0.108	-119.26	0.428	-12.20	1.09	10.16
17.00	0.836	-44.21	1.370	165.68	0.117	-131.99	0.600	-29.09	0.83	10.67
18.00	0.860	-60.80	0.918	149.32	0.118	-147.67	0.710	-51.26	0.90	8.92

Note:
1. Gain Calculation:

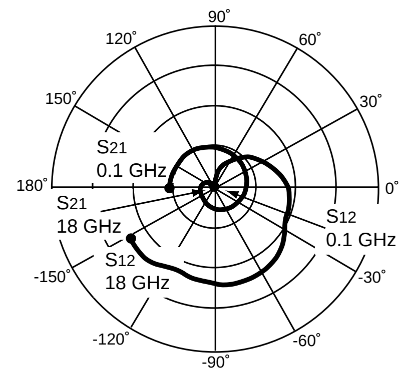
$$MAG = \frac{|S_{21}|}{|S_{12}|}\left(K \pm \sqrt{K^2 - 1}\right).$$ When K ≤ 1, MAG is undefined and MSG values are used. $$MSG = \frac{|S_{21}|}{|S_{12}|}, \quad K = \frac{1 + |\Delta|^2 - |S_{11}|^2 - |S_{22}|^2}{2\,|S_{12}\,S_{21}|}, \quad \Delta = S_{11}\,S_{22} - S_{21}\,S_{12}$$

MAG = Maximum Available Gain
MSG = Maximum Stable Gain

TYPICAL SCATTERING PARAMETERS (T_A = 25°C)



Coordinates in Ohms
Frequency in GHz
V_D = 2 V, I_D = 20 mA



NE429M01
V_D = 2 V, I_D = 20 mA

FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}		K	MAG[1]
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG		(dB)
0.10	0.982	-2.20	5.790	-178.01	0.002	93.64	0.596	-4.93	0.85	34.53
0.20	1.011	-4.60	5.757	177.21	0.004	89.44	0.579	-4.93	-0.36	31.61
0.30	0.998	-7.07	5.777	174.12	0.006	86.62	0.583	-5.96	0.02	29.84
0.40	1.002	-9.37	5.759	171.26	0.008	85.19	0.579	-7.27	-0.04	28.60
0.50	1.000	-11.65	5.758	168.55	0.010	83.46	0.578	-8.74	0.01	27.63
0.70	0.994	-16.37	5.742	163.42	0.014	80.33	0.576	-11.62	0.07	26.18
1.00	0.982	-23.53	5.709	155.97	0.020	75.74	0.571	-16.07	0.15	24.63
1.50	0.956	-35.07	5.619	143.84	0.029	68.41	0.559	-23.77	0.25	22.87
2.00	0.921	-46.77	5.510	131.89	0.038	61.10	0.545	-31.45	0.35	21.62
2.50	0.880	-58.44	5.370	120.15	0.046	53.81	0.527	-39.04	0.44	20.66
3.00	0.834	-70.04	5.217	108.74	0.054	46.60	0.507	-46.50	0.53	19.88
3.50	0.785	-81.61	5.051	97.66	0.060	39.48	0.485	-53.49	0.62	19.26
4.00	0.736	-92.87	4.880	87.11	0.065	32.95	0.466	-59.73	0.71	18.75
5.00	0.647	-115.55	4.577	66.54	0.074	20.24	0.427	-72.12	0.85	17.89
6.00	0.566	-139.51	4.323	46.30	0.082	8.60	0.389	-84.92	0.95	17.20
7.00	0.489	-166.61	4.106	25.87	0.091	-4.50	0.340	-98.57	1.04	15.33
8.00	0.399	161.49	3.811	5.64	0.093	-18.50	0.266	-107.49	1.24	13.18
9.00	0.386	129.24	3.590	-14.05	0.097	-27.40	0.218	-117.34	1.29	12.46
10.00	0.424	99.45	3.377	-33.89	0.105	-38.43	0.164	-132.62	1.25	12.07
11.00	0.490	72.08	3.173	-54.99	0.114	-51.95	0.096	-157.01	1.18	11.90
12.00	0.558	45.73	2.909	-76.97	0.119	-66.79	0.031	102.19	1.16	11.46
13.00	0.633	21.36	2.595	-98.56	0.121	-82.17	0.120	24.21	1.15	10.95
14.00	0.697	0.40	2.300	-119.05	0.117	-96.32	0.213	6.22	1.15	10.54
15.00	0.746	-15.60	2.055	-141.00	0.114	-109.24	0.304	-4.62	1.13	10.42
16.00	0.784	-28.77	1.827	-164.15	0.114	-118.58	0.405	-16.62	1.05	10.68
17.00	0.834	-44.87	1.494	166.73	0.122	-131.79	0.576	-30.52	0.82	10.89
18.00	0.859	-61.33	0.993	149.79	0.121	-147.21	0.698	-52.20	0.88	9.14

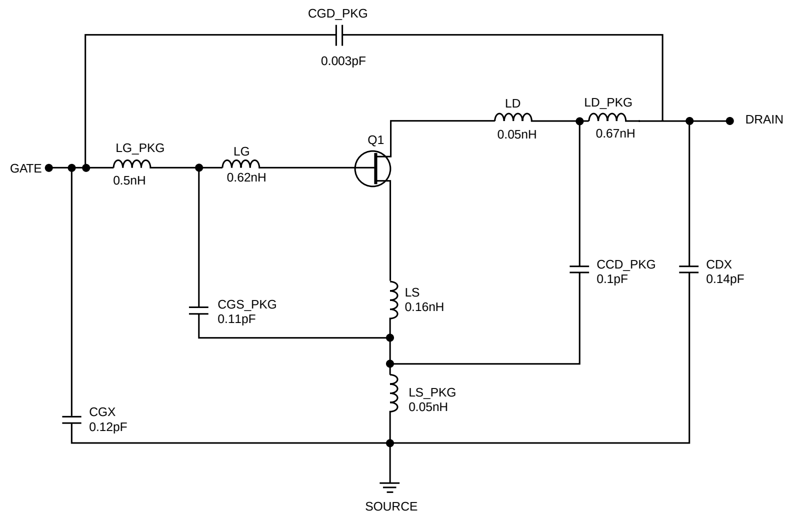
Note:
1. Gain Calculation:

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

NONLINEAR MODEL

SCHEMATIC



FET NONLINEAR MODEL PARAMETERS (1)

Parameters	Q1	Parameters	Q1
VTO	-0.8515	RG	2.2
VTOSC	0	RD	2
ALPHA	3.2	RS	1
BETA	0.0715	RGMET	0
GAMMA	0.087	KF	0
GAMMADC	0.09	AF	1
Q	2	TNOM	27
DELTA	1.1	XTI	3
VBI	0.8	EG	1.43
IS	1e-14	VTOTC	0
N	1	BETATCE	0
RIS	0	FFE	1
RID	0		
TAU	4e-12		
CDS	0.07e-12		
RDB	5000		
CBS	1e-10		
CGSO	0.4e-12		
CGDO	0.04e-12		
DELTA 1	0.3		
DELTA 2	0.2		
FC	0.5		
VBR	Infinity		

(1) Series IV Libra TOM Model

UNITS

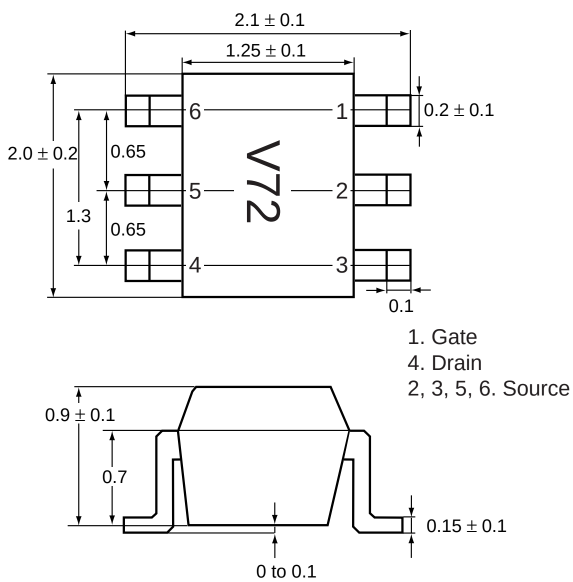
Parameter	Units
time	seconds
capacitance	farads
inductance	henries
resistance	ohms
voltage	volts
current	amps

MODEL RANGE

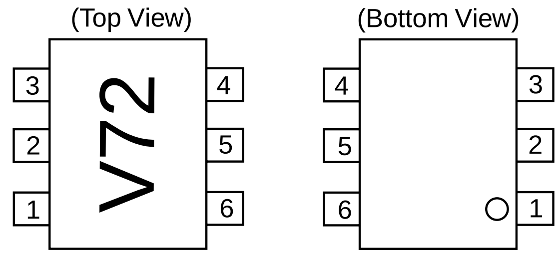
Frequency: 0.5 to 15 GHz
Bias: V_{DS} = 1 V to 3 V, I_D = 10 mA to 30 mA
I_{DSS} = 58 mA @ V_{GS} = 0 V, V_{DS} = 2 V
Noise: NF_{min} @ V_{DS} = 2 V, I_D = 10 mA,
4 to 12 GHz
Date: 4/98

OUTLINE DIMENSIONS (Units in mm)

PACKAGE OUTLINE M01



PIN CONNECTIONS



Pin NO.	Pin Name
1	Gate
2	Source
3	Source
4	Drain
5	Source
6	Source

ORDERING INFORMATION

PART NUMBER	PACKAGING
NE429M01-T1	6 pin super minimold

Note:
Embossed Tape 8 mm wide. 1, 2, & 3 pins face to perforation side of the tape.

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