PRELIMINARY DATA SHEET

NEC

HETERO JUNCTION FIELD EFFECT TRANSISTOR

NE428M01

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

DESCRIPTION

The NE428M01 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, TVRO and another commercial systems.

FEATURES

- Super Low Noise Figure & High Associated Gain
  NF = 0.9 dB TYP., G_a = 8.5 dB TYP. at f = 12 GHz
- 6pin super minimold package
- Gate Width: Wg = 200μm

ORDERING INFORMATION

PART NUMBER	PACKAGE	SUPPLYING FORM	MARKING
NE428M01-T1	6 pin super minimold	Embossed tape 8 mm wide. 1, 2, 3 pins face to perforation side of the tape	V71

ABSOLUTE MAXIMUM RATINGS (T_A = 25 °C)

Drain to Source Voltage	V_{DS}	4.0	V
Gate to Source Voltage	V_{GS}	–3.0	V
Drain Current	I_D	I_{DSS}	mA
Gate Current	I_G	100	μA
Total Power Dissipation	P_{tot}	125	mW
Channel Temperature	T_{ch}	125	°C
Storage Temperature	T_{stg}	–65 to +125	°C

The information in this document is subject to change without notice.

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RECOMMENDED OPERATING CONDITION (T_A = 25 °C)

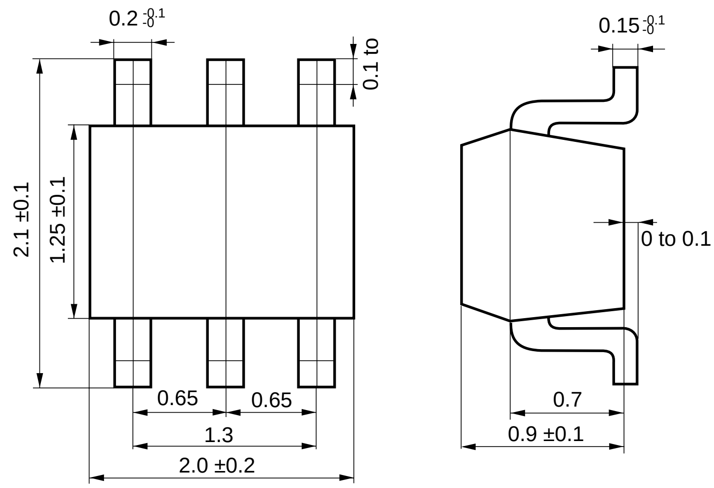
CHARACTERLSTIC	SYMBOL	MIN.	TYP.	MAX.	Unit
Drain to Source Voltage	V_{DS}		2	3	V
Drain Current	I_D		10	20	mA
Input Power	P_{in}			+5	dBm

ELECTRICAL CHARACTERISTICS (T_A = 25 °C)

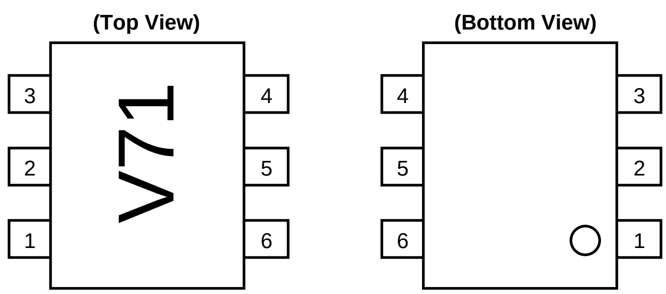
PARAMETER	SYMBOL	MIN.	TYP.	MAX.	Unit	TEST CONDITIONS	
Gate to Source Leak Current	I_{GSO}		0.5	10	μA	V_{GS} = −3 V	
Saturated Drain Current	I_{DSS}	20	60	90	mA	V_{DS} = 2 V, V_{GS} = 0 V	
Gate to Source Cutoff Voltage	$V_{GS(off)}$	−0.2	−0.7	−2.0	V	V_{DS} = 2 V, I_D = 100 μA	
Transconductance	g_m	45	60		mS	V_{DS} = 2 V, I_D = 10 mA	
Noise Figuer	NF		0.9	1.2	dB	f = 12 GHz	V_{DS} = 2 V I_D = 10 mA
			0.4			f = 4 GHz	
Associated Gain	G_a	7.0	8.5		dB	f = 12 GHz	
			15.0			f = 4 GHz	

PACKAGE DIMENSIONS

6 pin super minimold (unit: mm)



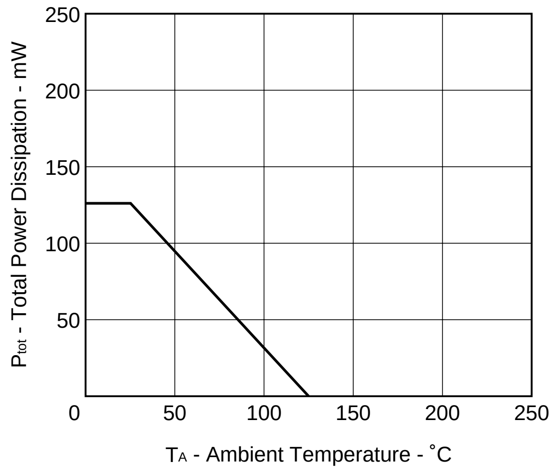
PIN CONNECTIONS



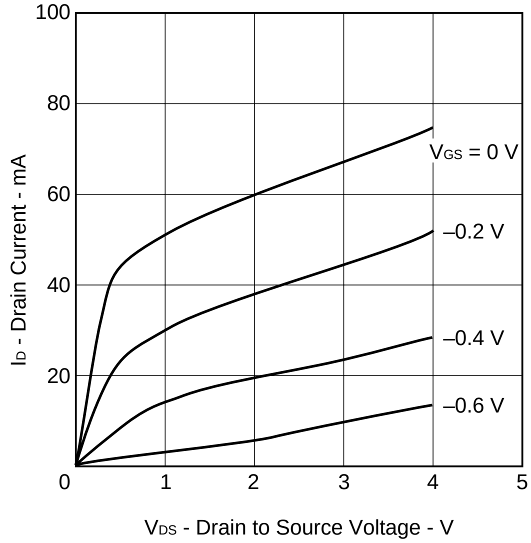
Pin NO.	Pin name
1	Gate
2	Source
3	Source
4	Drain
5	Source
6	Source

TYPICAL CHARACTERISTICS (T_A = 25 °C)

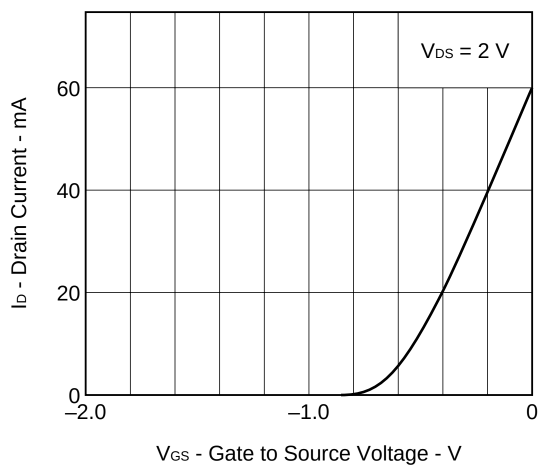
TOTAL POWER DISSIPATION vs.
AMBIENT TEMPERATURE



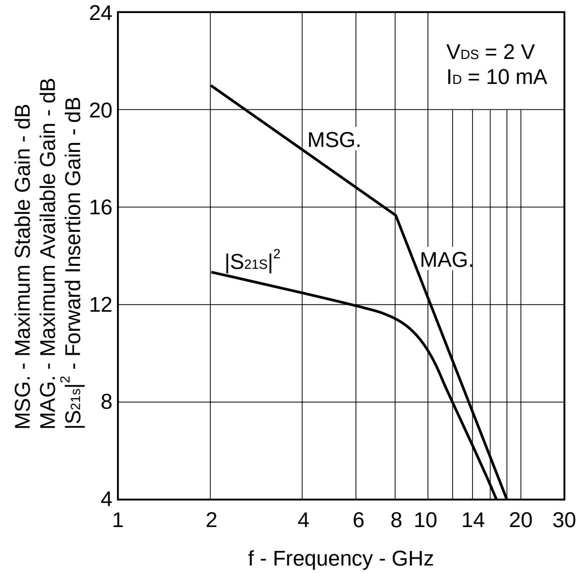
DRAIN CURRENT vs.
DRAIN TO SOURCE VOLTAGE



DRAIN CURRENT vs.
GATE TO SOURCE VOLTAGE



MAXIMUM AVAILABLE GAIN, FORWARD
INSERTION GAIN vs. FREQUENCY



Gain Calculations

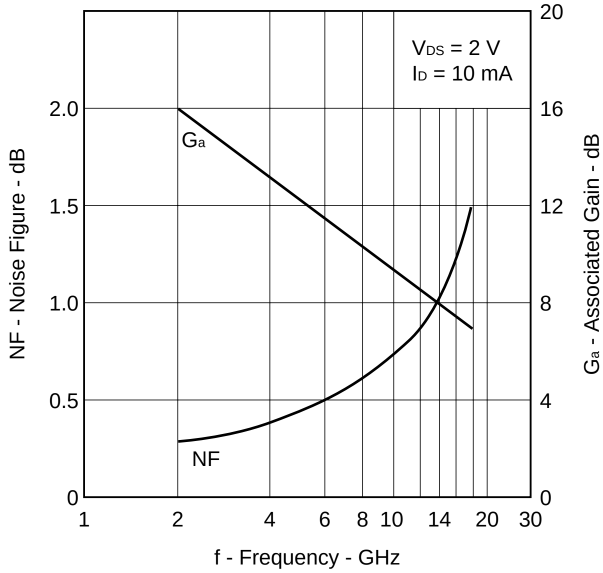
$$MSG. = \frac{|S_{21}|}{|S_{12}|}$$

$$K = \frac{1 + |\Delta|^2 - |S_{11}|^2 - |S_{22}|^2}{2\,|S_{12}|\,|S_{21}|}$$

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

$$\Delta = S_{11} \bullet S_{22} - S_{21} \bullet S_{12}$$

NOISE FIGURE, ASSOCIATED GAIN vs. FREQUENCY



S-PARAMETER

MAG. AND ANG.

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

FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}	
MHz	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
2000	.936	–44.2	4.727	132.8	.035	59.1	.592	–32.5
2500	.910	–54.9	4.622	121.8	.044	52.0	.578	–40.0
3000	.880	–65.3	4.522	110.7	.051	45.4	.558	–47.2
3500	.843	–75.2	4.403	100.2	.057	39.1	.538	–54.0
4000	.810	–84.6	4.281	90.0	.063	31.5	.515	–60.7
4500	.773	–94.6	4.179	79.8	.068	24.8	.491	–67.1
5000	.739	–104.5	4.080	69.8	.073	19.2	.473	–73.6
5500	.707	–114.4	4.012	60.1	.076	12.8	.455	–80.2
6000	.678	–123.3	3.956	50.5	.081	7.5	.433	–86.2
6500	.642	–132.9	3.924	40.5	.086	1.3	.422	–94.5
7000	.605	–143.7	3.890	30.0	.091	–4.8	.405	–103.6
7500	.565	–155.7	3.843	19.3	.097	–13.1	.383	–112.5
8000	.530	–169.7	3.788	8.1	.102	–20.3	.352	–121.2
8500	.494	175.5	3.712	–3.1	.105	–28.0	.319	–130.0
9000	.459	160.9	3.633	–14.1	.109	–35.7	.283	–140.1
9500	.427	145.4	3.546	–25.4	.113	–43.7	.249	–152.5
10000	.394	130.1	3.451	–36.3	.117	–51.6	.215	–168.1
10500	.373	112.8	3.354	–47.4	.119	–60.0	.184	172.9
11000	.364	93.5	3.261	–58.5	.122	–68.0	.160	152.4
11500	.380	73.4	3.167	–70.2	.125	–75.8	.141	128.2
12000	.415	52.8	3.090	–82.3	.129	–86.2	.139	100.2
12500	.451	34.8	2.950	–95.1	.131	–96.0	.150	68.9
13000	.474	19.5	2.780	–107.3	.129	–106.6	.167	42.7
13500	.495	7.1	2.593	–119.4	.129	–116.2	.187	22.8
14000	.510	–5.0	2.424	–130.6	.128	–124.1	.209	10.8
14500	.535	–17.7	2.275	–142.9	.133	–134.7	.252	1.8
15000	.557	–30.3	2.118	–154.3	.135	–145.4	.269	–6.5
15500	.574	–40.2	1.991	–165.4	.133	–156.9	.289	–12.0
16000	.596	–46.8	1.860	–179.0	.131	–165.8	.327	–13.6
16500	.620	–53.9	1.674	169.6	.132	–174.6	.376	–24.3
17000	.632	–61.0	1.549	156.5	.132	174.4	.414	–30.5
17500	.630	–67.9	1.369	142.7	.135	162.8	.464	–36.1
18000	.637	–75.8	1.164	130.1	.129	151.8	.504	–43.7

AMP. PARAMETERS

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

FREQUENCY MHz	GUmax dB	GAmax dB	$\lvert S_{21}\rvert^2$ dB	$\lvert S_{12}\rvert^2$ dB	K	Delay ns	Mason's U dB	G1 dB	G2 dB
2000	24.46		13.49	–29.04	.34	.061	30.832	9.10	1.87
2500	22.73		13.30	–27.18	.40	.061	30.097	7.66	1.77
3000	21.21		13.11	–25.80	.46	.062	29.996	6.48	1.62
3500	19.74		12.87	–24.87	.55	.059	27.787	5.39	1.48
4000	18.61		12.63	–24.03	.63	.057	25.078	4.64	1.34
4500	17.57		12.42	–23.31	.70	.057	23.717	3.95	1.20
5000	16.74		12.21	–22.75	.76	.056	23.408	3.43	1.10
5500	16.08		12.07	–22.36	.82	.054	22.721	3.01	1.01
6000	15.52		11.95	–21.87	.86	.053	22.682	2.67	.90
6500	15.04		11.87	–21.35	.89	.055	22.854	2.31	.85
7000	14.55		11.80	–20.87	.92	.058	23.299	1.98	.78
7500	14.05		11.69	–20.28	.95	.060	23.563	1.67	.69
8000	13.57		11.57	–19.86	.98	.062	22.340	1.43	.57
8500	13.07	14.40	11.39	–19.61	1.03	.062	21.290	1.21	.47
9000	12.60	13.61	11.21	–19.23	1.07	.061	20.522	1.03	.36
9500	12.15	12.96	11.00	–18.96	1.11	.063	19.654	.87	.28
10000	11.70	12.38	10.76	–18.66	1.15	.060	18.783	.73	.21
10500	11.31	11.90	10.51	–18.48	1.18	.062	18.006	.65	.15
11000	11.00	11.53	10.27	–18.29	1.21	.062	17.518	.62	.11
11500	10.78	11.30	10.01	–18.06	1.21	.065	17.461	.68	.09
12000	10.70	11.28	9.80	–17.77	1.17	.067	18.035	.82	.09
12500	10.48	11.01	9.40	–17.67	1.17	.071	17.734	.99	.10
13000	10.11	10.49	8.88	–17.82	1.22	.068	16.410	1.11	.12
13500	9.65	9.95	8.28	–17.78	1.26	.067	15.352	1.22	.15
14000	9.19	9.42	7.69	–17.87	1.32	.062	14.225	1.31	.19
14500	8.89	9.17	7.14	–17.55	1.28	.068	14.205	1.46	.29
15000	8.46	8.78	6.52	–17.37	1.28	.063	13.739	1.61	.33
15500	8.09	8.50	5.98	–17.52	1.29	.062	13.309	1.73	.38
16000	7.78	8.48	5.39	–17.63	1.25	.076	13.420	1.90	.49
16500	7.25	8.10	4.48	–17.57	1.23	.063	12.979	2.11	.66
17000	6.83	8.01	3.80	–17.58	1.20	.073	13.037	2.21	.82
17500	5.98	7.47	2.73	–17.42	1.19	.076	12.310	2.20	1.05
18000	4.85	6.22	1.32	–17.77	1.31	.070	9.852	2.26	1.27

NOISE PARAMETER

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

Freq. (GHz)	$NF_{min.}$ (dB)	G_a (dB)	$\Gamma_{opt.}$		$R_n/50$
			MAG.	ANG. (deg.)	
4.0	0.40	15.0	0.51	75	0.18
6.0	0.49	13.0	0.48	103	0.13
8.0	0.60	11.3	0.43	142	0.06
10.0	0.74	9.7	0.31	−162	0.06
12.0	0.90	8.5	0.21	−76	0.14
14.0	1.08	7.6	0.38	−8	0.30
16.0	1.30	6.8	0.54	44	0.48
18.0	1.53	5.8	0.60	72	0.73

RECOMMENDED SOLDERING CONDITIONS

The following conditions (see table below) must be met when soldering this product.

Please consult with our sales offices in case other soldering process is used, or in case soldering is done under different conditions.

<TYPES OF SURFACE MOUNT DEVICE>

For more details, refer to our document **"SEMICONDUCTOR DEVICE MOUNTING TECHNOLOGY MANUAL" (C10535E).**

Soldering process	Soldering conditions	Symbol
VPS	Package peak temperature: 215 °C, Time: 40 seconds MAX. (200 °C MIN.), Number of times: 2, Number of days: not limited*****	VP15-00-2
Wave soldering	Soldering bath temperature: 260 °C MAX., Time: 10 seconds MAX., Number of times: 1, Number of days: not limited*****	WS60-00-1
Infrared ray reflow	Peak package's surface temperature: 230 °C below, Reflow time: 30 seconds or below (210 °C or higher), Number of reflow process: 2, Exposure limit*****: None	IR30-00-2
Partial heating method	Terminal temperature: 230 °C or below, Flow time: 10 seconds or below, Exposure limit*****: None	

***** Exposure limit before soldering after dry-pack package is opened.
Storage conditions: 25 °C and relative humidity at 65 % or less.

Note Do not apply more than a single process at once, except for "Partial heating method".

PRECAUTION **Avoid high static voltage and electric fields, because this device is Hetero Junction field effect transistor with shottky barrier gate.**

[MEMO]

[MEMO]

CAUTION

The Great Care must be taken in dealing with the devices in this guide.
The reason is that the material of the devices is GaAs (Gallium Arsenide), which is designated as harmful substance according to the law concerned.
Keep the law concerned and so on, especially in case of removal.