

HETERO JUNCTION FIELD EFFECT TRANSISTOR

NE429M01

C to Ku BAND SUPER LOW NOISE AMPLIFIER

N-CHANNEL HJ-FET

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 DBS, TVRO and another commercial systems.

FEATURES

- Super low noise figure & High associated gain
NF = 0.9 dB TYP., $G_a = 10$ dB TYP. @ $f = 12$ GHz
- 6-pin super minimold package
- Gate width: $W_g = 200\mu\text{m}$

ORDERING INFORMATION

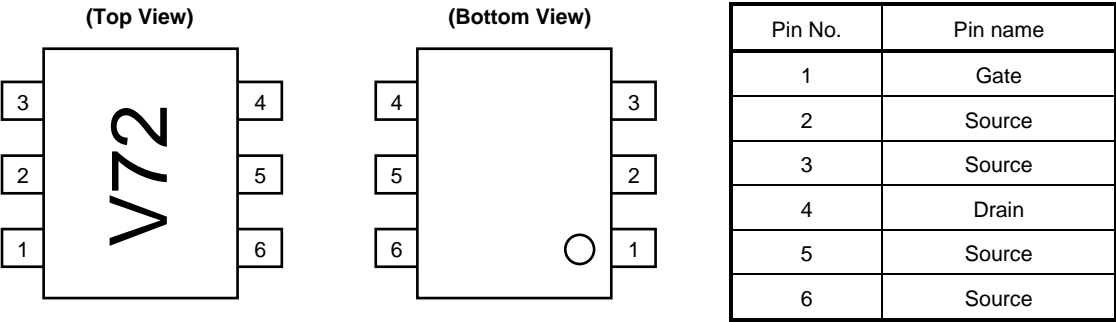
| Part Number | Package | Marking | Supplying Form |
|-------------|----------------------|---------|--|
| NE429M01-T1 | 6-pin super minimold | V72 | Embossed tape 8 mm wide. 1, 2, 3 pins face to perforation side of the tape Qty 3 kpcs/reel |

ABSOLUTE MAXIMUM RATINGS ($T_A = +25^\circ\text{C}$)

| Parameter | Symbol | Ratings | Unit |
|-------------------------|-----------|-------------|------------------|
| 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 | $^\circ\text{C}$ |
| Storage Temperature | T_{stg} | -65 to +125 | $^\circ\text{C}$ |

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Not all devices/types available in every country. Please check with local NEC representative for availability and additional information.

PIN CONNECTIONS



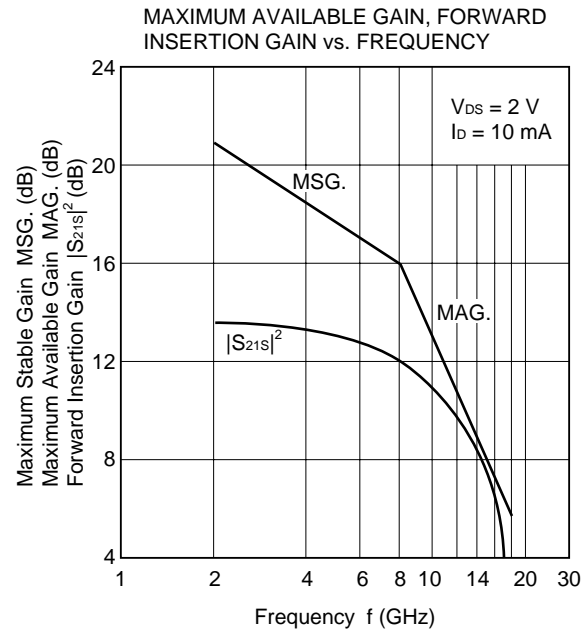
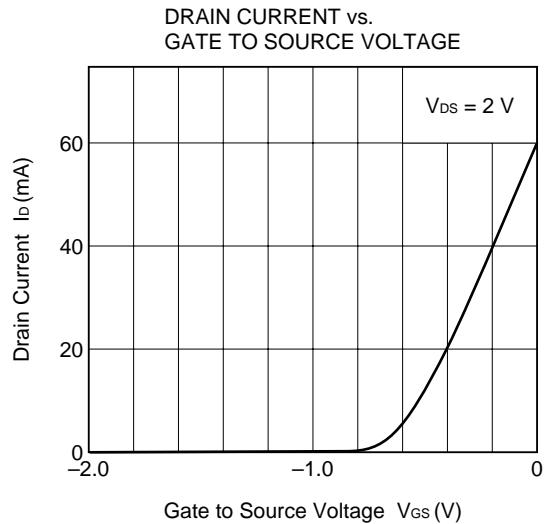
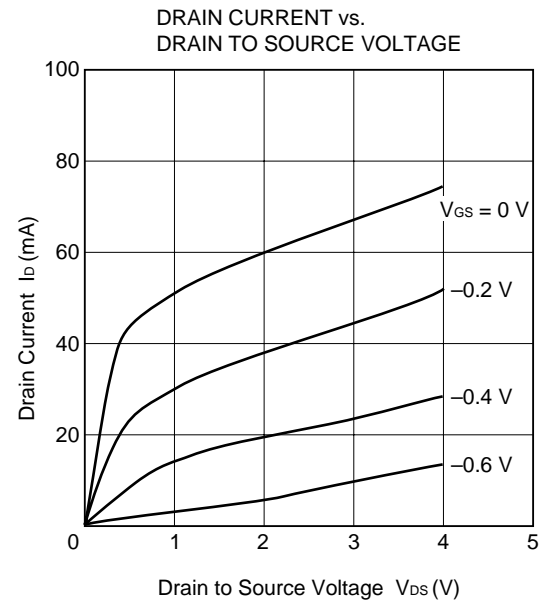
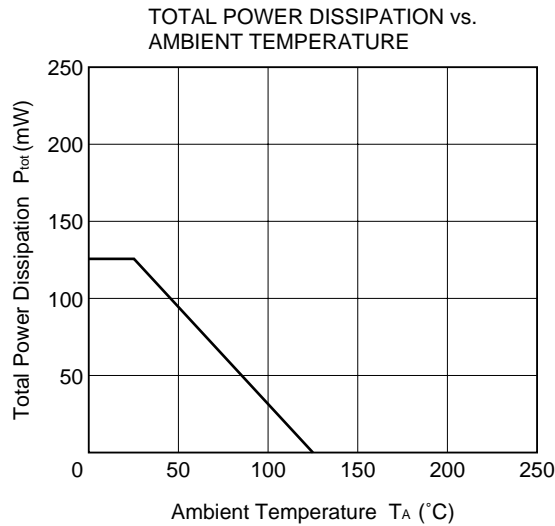
RECOMMENDED OPERATING CONDITION (TA = +25 °C)

| Parameter | Symbol | MIN. | TYP. | MAX. | Unit |
|-------------------------|-----------------|------|------|------|------|
| Drain to Source Voltage | V _{DS} | 1 | 2 | 3 | V |
| Drain Current | I _D | 5 | 10 | 20 | mA |
| Input Power | P _{in} | – | – | 0 | dBm |

ELECTRICAL CHARACTERISTICS (TA = +25 °C)

| Parameter | Symbol | Test Conditions | | MIN. | TYP. | MAX. | Unit |
|-------------------------------|----------------------|--|---|------|------|------|------|
| Gate to Source Leak Current | I _{GSO} | V _{GS} = –3 V | | – | 0.5 | 10 | μA |
| Saturated Drain Current | I _{DSS} | V _{DS} = 2 V, V _{GS} = 0 V | | 20 | 60 | 90 | mA |
| Gate to Source Cutoff Voltage | V _{GS(off)} | V _{DS} = 2 V, I _D = 100 μA | | –0.2 | –0.7 | –2.0 | V |
| Transconductance | g _m | V _{DS} = 2 V, I _D = 10 mA | | 45 | 60 | – | mS |
| Noise Figure | NF | f = 12 GHz | V _{DS} = 2 V I _D = 10 mA | – | 0.9 | 1.2 | dB |
| | | f = 4 GHz | | – | 0.4 | – | |
| Associated Gain | G _a | f = 12 GHz | | 9.0 | 10 | – | dB |
| | | f = 4 GHz | | – | 15.0 | – | |

TYPICAL CHARACTERISTICS (T_A = +25 °C)



Gain Calculations

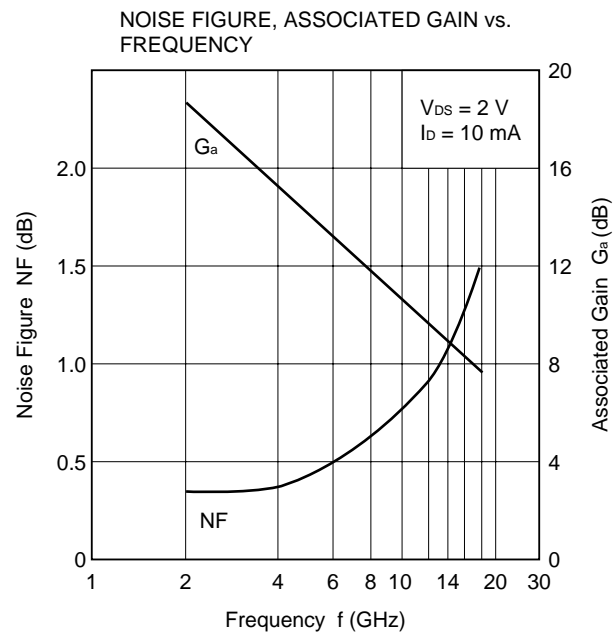
$$MSG. = \frac{|S_{21}|}{|S_{12}|}$$

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

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

$$(K \pm \sqrt{K^2 - 1})$$

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



★ S-PARAMETERS

MAG. AND ANG.

$V_{DS} = 2\text{ V}$, $I_D = 10\text{ mA}$

| FREQUENCY MHz | S ₁₁ | | S ₂₁ | | S ₁₂ | | S ₂₂ | |
|------------------|-----------------|----------------|-----------------|----------------|-----------------|----------------|-----------------|----------------|
| | MAG. | ANG. (deg.) | MAG. | ANG. (deg.) | MAG. | ANG. (deg.) | MAG. | ANG. (deg.) |
| 2000 | 0.939 | -33.5 | 4.728 | 146.1 | 0.040 | 69.6 | 0.597 | -22.6 |
| 2500 | 0.916 | -42.1 | 4.643 | 138.0 | 0.049 | 63.3 | 0.571 | -28.5 |
| 3000 | 0.889 | -50.7 | 4.546 | 130.0 | 0.055 | 59.2 | 0.557 | -34.1 |
| 3500 | 0.856 | -58.1 | 4.405 | 122.7 | 0.062 | 54.4 | 0.535 | -39.4 |
| 4000 | 0.822 | -65.2 | 4.279 | 115.1 | 0.066 | 50.2 | 0.510 | -44.7 |
| 4500 | 0.790 | -71.6 | 4.165 | 108.4 | 0.071 | 46.5 | 0.488 | -48.9 |
| 5000 | 0.768 | -77.9 | 4.099 | 102.2 | 0.075 | 41.6 | 0.478 | -53.8 |
| 5500 | 0.736 | -84.2 | 4.024 | 95.9 | 0.080 | 37.9 | 0.459 | -56.9 |
| 6000 | 0.709 | -91.2 | 4.013 | 89.3 | 0.082 | 36.9 | 0.441 | -61.0 |
| 6500 | 0.679 | -99.0 | 4.018 | 82.5 | 0.086 | 32.2 | 0.418 | -65.5 |
| 7000 | 0.651 | -109.1 | 4.007 | 74.7 | 0.091 | 27.4 | 0.386 | -71.9 |
| 7500 | 0.626 | -120.5 | 3.978 | 66.7 | 0.097 | 23.4 | 0.341 | -78.7 |
| 8000 | 0.598 | -132.6 | 3.940 | 58.6 | 0.099 | 17.0 | 0.296 | -86.2 |
| 8500 | 0.576 | -144.9 | 3.862 | 50.2 | 0.097 | 12.1 | 0.252 | -94.9 |
| 9000 | 0.551 | -157.4 | 3.775 | 42.3 | 0.100 | 6.6 | 0.212 | -106.2 |
| 9500 | 0.527 | -169.6 | 3.686 | 34.2 | 0.102 | 1.2 | 0.185 | -121.8 |
| 10000 | 0.504 | 177.7 | 3.585 | 25.6 | 0.101 | -6.1 | 0.166 | -139.1 |
| 10500 | 0.494 | 163.6 | 3.475 | 17.8 | 0.101 | -12.3 | 0.155 | -157.3 |
| 11000 | 0.495 | 149.1 | 3.367 | 9.4 | 0.098 | -16.5 | 0.149 | 178.4 |
| 11500 | 0.529 | 134.8 | 3.282 | 0.5 | 0.096 | -22.3 | 0.148 | 158.4 |
| 12000 | 0.563 | 120.1 | 3.167 | -8.6 | 0.095 | -30.6 | 0.165 | 134.2 |
| 12500 | 0.608 | 106.2 | 3.011 | -18.5 | 0.092 | -38.8 | 0.194 | 109.4 |
| 13000 | 0.637 | 95.3 | 2.773 | -27.7 | 0.085 | -46.3 | 0.237 | 91.2 |
| 13500 | 0.645 | 86.6 | 2.562 | -35.9 | 0.079 | -50.2 | 0.279 | 80.9 |
| 14000 | 0.668 | 78.8 | 2.398 | -43.8 | 0.072 | -54.7 | 0.321 | 76.2 |
| 14500 | 0.689 | 70.0 | 2.231 | -52.3 | 0.073 | -60.3 | 0.372 | 74.3 |
| 15000 | 0.702 | 63.1 | 2.028 | -59.7 | 0.072 | -71.7 | 0.411 | 71.4 |
| 15500 | 0.713 | 57.1 | 1.917 | -66.9 | 0.067 | -79.5 | 0.427 | 71.5 |
| 16000 | 0.743 | 51.9 | 1.772 | -75.6 | 0.065 | -81.8 | 0.462 | 69.3 |
| 16500 | 0.766 | 46.1 | 1.633 | -83.4 | 0.064 | -83.1 | 0.500 | 62.6 |
| 17000 | 0.785 | 41.7 | 1.508 | -92.0 | 0.063 | -90.1 | 0.533 | 57.5 |
| 17500 | 0.802 | 37.4 | 1.335 | -101.3 | 0.059 | -104.7 | 0.580 | 50.0 |
| 18000 | 0.814 | 34.3 | 1.140 | -108.9 | 0.053 | -106.3 | 0.596 | 43.2 |

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★ AMP. PARAMETERS

 $V_{DS} = 2\text{ V}$, $I_D = 10\text{ mA}$

| FREQUENCY MHz | GUmax dB | GAmax dB | $ S_{21} ^2$ dB | $ S_{12} ^2$ dB | K | Delay ns | Mason's U dB | G1 dB | G2 dB |
|------------------|-------------|-------------|--------------------|--------------------|------|-------------|-----------------|----------|----------|
| 2000 | 24.65 | | 13.49 | -28.05 | 0.28 | 0.045 | 30.977 | 9.24 | 1.91 |
| 2500 | 22.98 | | 13.34 | -26.28 | 0.34 | 0.045 | 28.134 | 7.92 | 1.72 |
| 3000 | 21.55 | | 13.15 | -25.19 | 0.38 | 0.044 | 29.097 | 6.79 | 1.61 |
| 3500 | 20.08 | | 12.88 | -24.16 | 0.45 | 0.041 | 26.443 | 5.74 | 1.46 |
| 4000 | 18.83 | | 12.63 | -23.67 | 0.53 | 0.042 | 24.821 | 4.89 | 1.31 |
| 4500 | 17.83 | | 12.39 | -22.94 | 0.59 | 0.038 | 23.707 | 4.26 | 1.18 |
| 5000 | 17.25 | | 12.25 | -22.49 | 0.63 | 0.034 | 22.719 | 3.87 | 1.13 |
| 5500 | 16.50 | | 12.09 | -21.93 | 0.69 | 0.035 | 21.774 | 3.39 | 1.03 |
| 6000 | 16.04 | | 12.07 | -21.76 | 0.73 | 0.037 | 23.007 | 3.03 | 0.94 |
| 6500 | 15.60 | | 12.08 | -21.30 | 0.77 | 0.038 | 22.393 | 2.69 | 0.83 |
| 7000 | 15.16 | | 12.06 | -20.81 | 0.80 | 0.043 | 22.558 | 2.40 | 0.70 |
| 7500 | 14.69 | | 11.99 | -20.30 | 0.82 | 0.044 | 23.290 | 2.16 | 0.54 |
| 8000 | 14.24 | | 11.91 | -20.13 | 0.87 | 0.045 | 21.787 | 1.93 | 0.40 |
| 8500 | 13.77 | | 11.74 | -20.25 | 0.94 | 0.047 | 20.820 | 1.75 | 0.29 |
| 9000 | 13.31 | | 11.54 | -20.01 | 0.99 | 0.044 | 20.035 | 1.57 | 0.20 |
| 9500 | 12.90 | 14.49 | 11.33 | -19.80 | 1.03 | 0.045 | 19.527 | 1.42 | 0.15 |
| 10000 | 12.48 | 13.54 | 11.09 | -19.91 | 1.10 | 0.048 | 18.251 | 1.27 | 0.12 |
| 10500 | 12.14 | 13.01 | 10.82 | -19.92 | 1.15 | 0.043 | 17.588 | 1.21 | 0.11 |
| 11000 | 11.87 | 12.56 | 10.55 | -20.15 | 1.21 | 0.046 | 17.140 | 1.22 | 0.10 |
| 11500 | 11.84 | 12.51 | 10.32 | -20.35 | 1.22 | 0.049 | 17.344 | 1.42 | 0.10 |
| 12000 | 11.79 | 12.42 | 10.01 | -20.42 | 1.21 | 0.051 | 17.372 | 1.66 | 0.12 |
| 12500 | 11.74 | 12.27 | 9.57 | -20.73 | 1.23 | 0.055 | 17.250 | 2.00 | 0.17 |
| 13000 | 11.37 | 11.68 | 8.86 | -21.43 | 1.34 | 0.051 | 15.992 | 2.26 | 0.25 |
| 13500 | 10.86 | 11.00 | 8.17 | -22.01 | 1.48 | 0.045 | 14.752 | 2.33 | 0.35 |
| 14000 | 10.64 | 10.73 | 7.60 | -22.90 | 1.59 | 0.044 | 14.134 | 2.57 | 0.47 |
| 14500 | 10.41 | 10.56 | 6.97 | -22.73 | 1.53 | 0.047 | 14.250 | 2.80 | 0.65 |
| 15000 | 9.90 | 10.19 | 6.14 | -22.83 | 1.53 | 0.041 | 13.739 | 2.95 | 0.81 |
| 15500 | 9.61 | 10.00 | 5.65 | -23.48 | 1.60 | 0.040 | 13.276 | 3.08 | 0.87 |
| 16000 | 9.51 | 10.05 | 4.97 | -23.75 | 1.53 | 0.048 | 13.699 | 3.49 | 1.05 |
| 16500 | 9.35 | 9.90 | 4.26 | -23.84 | 1.49 | 0.044 | 13.763 | 3.84 | 1.25 |
| 17000 | 9.17 | 9.97 | 3.57 | -23.99 | 1.41 | 0.048 | 14.262 | 4.15 | 1.45 |
| 17500 | 8.77 | 9.96 | 2.51 | -24.61 | 1.36 | 0.051 | 14.537 | 4.48 | 1.78 |
| 18000 | 7.76 | 8.62 | 1.14 | -25.57 | 1.66 | 0.042 | 11.758 | 4.72 | 1.91 |

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NOISE PARAMETERS

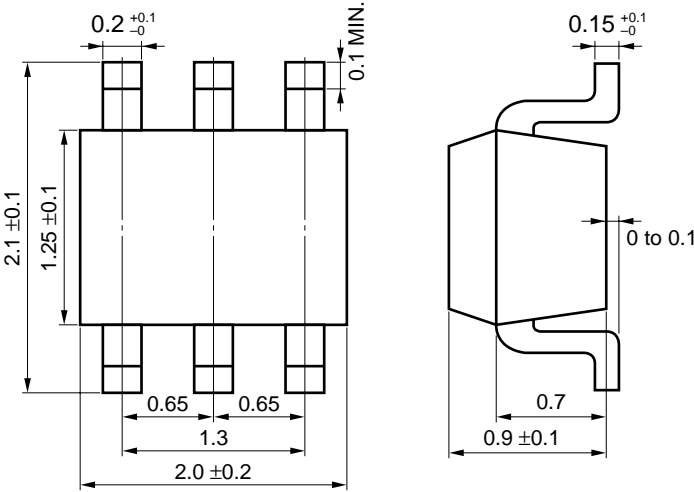
$V_{DS} = 2\text{ V}$, $I_D = 10\text{ mA}$

| Freq. (GHz) | NF _{min.} (dB) | G _a (dB) | $\Gamma_{opt.}$ | | R _n /50 |
|-------------|-------------------------|---------------------|-----------------|-------------|--------------------|
| | | | MAG. | ANG. (deg.) | |
| 4.0 | 0.40 | 15.5 | 0.51 | 75 | 0.18 |
| 6.0 | 0.49 | 13.9 | 0.49 | 103 | 0.11 |
| 8.0 | 0.60 | 12.5 | 0.44 | 145 | 0.06 |
| 10.0 | 0.74 | 11.3 | 0.32 | -162 | 0.06 |
| 12.0 | 0.90 | 10.0 | 0.23 | -73 | 0.16 |
| 14.0 | 1.08 | 8.9 | 0.45 | -5 | 0.36 |
| 16.0 | 1.30 | 7.8 | 0.60 | 42 | 0.58 |
| 18.0 | 1.53 | 6.8 | 0.76 | 78 | 0.68 |

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

PACKAGE DIMENSIONS

6 PIN SUPER MINIMOLD (UNIT: mm)



PRECAUTION

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

RECOMMENDED SOLDERING CONDITIONS

This product should be soldered under the following recommended conditions. For soldering methods and conditions other than those recommended below, contact your NEC sales representative.

| Soldering Method | Soldering Conditions | Recommended Condition Symbol |
|------------------|---|------------------------------|
| Infrared Reflow | Package peak temperature: 235 °C or below Time: 30 seconds or less (at 210 °C) Count: 3, Exposure limit: None ^{Note} | IR35-00-3 |
| VPS | Package peak temperature: 215 °C or below Time: 40 seconds or less (at 200 °C) Count: 3, Exposure limit: None ^{Note} | VP15-00-3 |
| Wave Soldering | Soldering bath temperature: 260 °C or below Time: 10 seconds or less Count: 1, Exposure limit: None ^{Note} | WS60-00-1 |
| Partial Heating | Pin temperature: 300 °C Time: 3 seconds or less (per side of device) Exposure limit: None ^{Note} | — |

Note After opening the dry pack, keep it in a place below 25 °C and 65 % RH for the allowable storage period.

Caution Do not use different soldering methods together (except for partial heating).

For details of recommended soldering conditions for surface mounting, refer to information document **SEMICONDUCTOR DEVICE MOUNTING TECHNOLOGY MANUAL (C10535E)**.

[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.

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