# NE3513M04

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Rev.1.00
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N-Channel GaAs HJ-FET, X to Ku Band Low Noise and High-Gain

## FEATURES

- Low noise figure and high associated gain:
  NF = 0.45 dB TYP., $G_a$ = 13 dB TYP. @$V_{DS}$ = 2 V, $I_D$ = 10 mA, f = 12 GHz
  NF = 0.5 dB TYP., $G_a$ = 12 dB TYP. @$V_{DS}$ = 2 V, $I_D$ = 6 mA, f = 12 GHz (Reference Value)
- Flat-lead 4-pin thin-type super minimold (M04) package

## APPLICATIONS

- DBS LNB gain-stage, Mix-stage
- Low noise amplifier for microwave communication system

## ORDERING INFORMATION

| Part Number | Order Number | Package | Quantity | Marking | Supplying Form |
|---|---|---|---|---|---|
| NE3513M04-T2 | NE3513M04-T2-A | Flat-lead 4-pin thin-type super minimold (M04) (Pb-Free) | 3 kpcs/reel | V84 | • Embossed tape 8 mm wide<br>• Pin 1 (Source), Pin 2 (Drain) face the perforation side of the tape |
| NE3513M04-T2B | NE3513M04-T2B-A | | 15 kpcs/reel | | |

**Remark** To order evaluation samples, please contact your nearby sales office.
Part number for sample order: NE3513M04

## ABSOLUTE MAXIMUM RATINGS ($T_A$ = +25°C, unless otherwise specified)

| 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 | $I_G$ | 80 | μA |
| Total Power Dissipation Note | $P_{tot}$ | 125 | mW |
| Channel Temperature | $T_{ch}$ | +125 | °C |
| Storage Temperature | $T_{stg}$ | –65 to +125 | °C |

Note: Mounted on 1.08 $cm^2$ × 1.0 mm (t) glass epoxy PWB

**CAUTION**

Observe precautions when handling because these devices are sensitive to electrostatic discharge.

## RECOMMENDED OPERATING RANGE ($T_A$ = +25°C, unless otherwise specified)

| Parameter | Symbol | MIN. | TYP. | MAX. | Unit |
|---|---|---|---|---|---|
| Drain to Source Voltage | $V_{DS}$ | +1 | +2 | +3 | V |
| Drain Current | $I_D$ | 3 | 10 | 15 | mA |
| Input Power | $P_{in}$ | – | – | 0 | dBm |

## ELECTRICAL CHARACTERISTICS ($T_A$ = +25°C, unless otherwise specified)

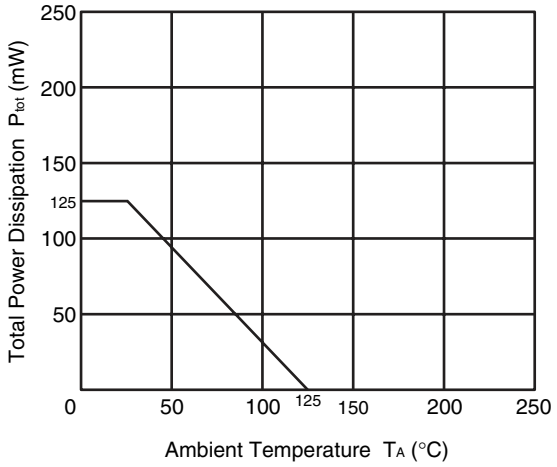
| Parameter | Symbol | Test Conditions | MIN. | TYP. | MAX. | Unit |
|---|---|---|---|---|---|---|
| Gate to Source Leak Current | $I_{GSO}$ | $V_{GS}$ = –3.0 V | – | 0.5 | 10 | μA |
| Saturated Drain Current | $I_{DSS}$ | $V_{DS}$ = 2 V, $V_{GS}$ = 0 V | 15 | 30 | 60 | mA |
| Gate to Source Cut-off Voltage | $V_{GS (off)}$ | $V_{DS}$ = 2 V, $I_D$ = 100 μA | –0.2 | –0.5 | –1.3 | V |
| Transconductance | gm | $V_{DS}$ = 2 V, $I_D$ = 10 mA | 50 | 65 | – | mS |
| Noise Figure | NF | $V_{DS}$ = 2 V, $I_D$ = 10 mA, f = 12 GHz | – | 0.45 | 0.65 | dB |
| Associated Gain | $G_a$ | | 11.5 | 13 | – | dB |

## STANDARD CHARACTERISTICS FOR REFERENCE ($T_A$ = +25°C, unless otherwise specified)

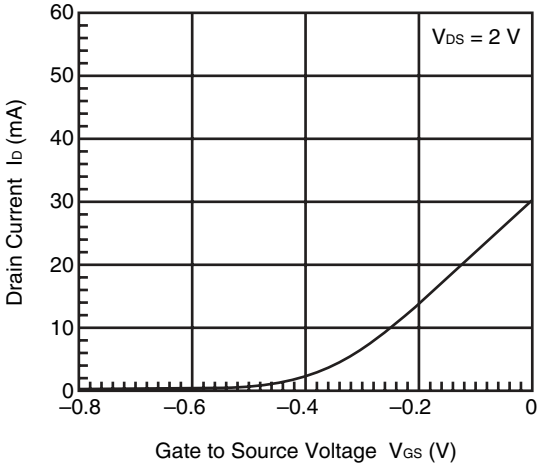
| Parameter | Symbol | Test Conditions | Reference Value | Unit |
|---|---|---|---|---|
| Noise Figure | NF | $V_{DS}$ = 2 V, $I_D$ = 6 mA, f = 12 GHz | 0.5 | dB |
| Associated Gain | $G_a$ | | 12 | dB |

## TYPICAL CHARACTERISTICS ($T_A$ = +25°C, unless otherwise specified)

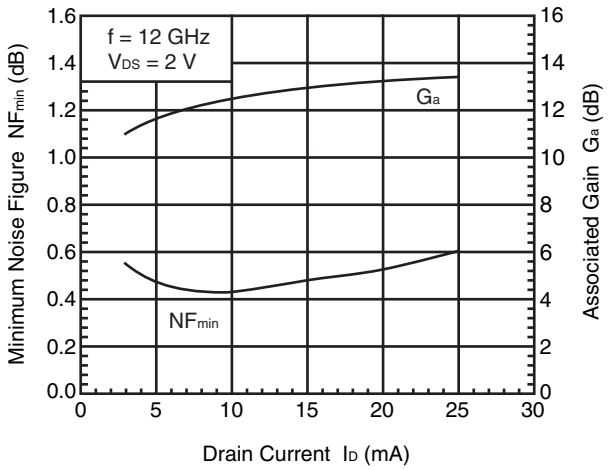
TOTAL POWER DISSIPATION
vs. AMBIENT TEMPERATURE



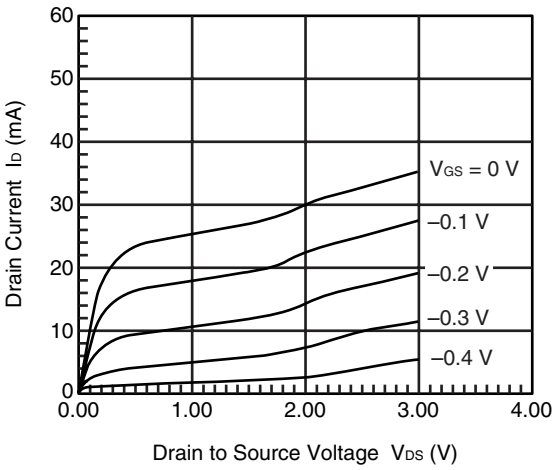

DRAIN CURRENT vs.
GATE TO SOURCE VOLTAGE



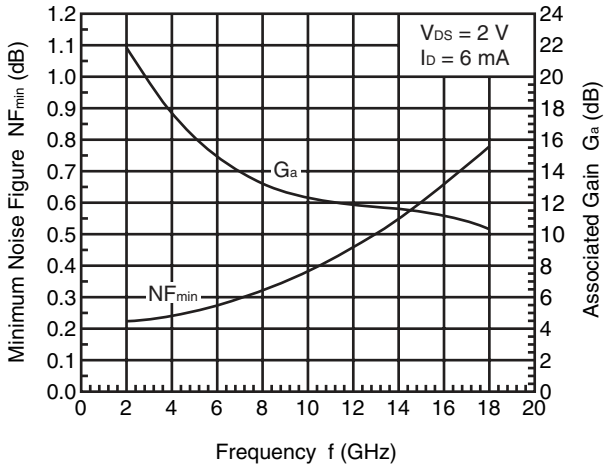

MINIMUM NOISE FIGURE,
ASSOCIATED GAIN vs. DRAIN CURRENT



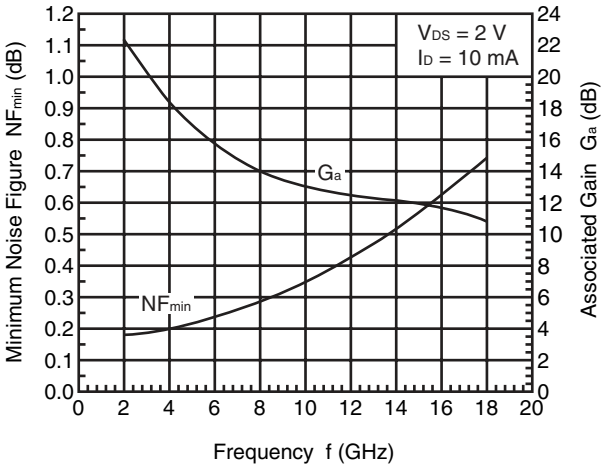

DRAIN CURRENT vs.
DRAIN TO SOURCE VOLTAGE




MINIMUM NOISE FIGURE,
ASSOCIATED GAIN vs. FREQUENCY




MINIMUM NOISE FIGURE,
ASSOCIATED GAIN vs. FREQUENCY




**Remark** The graphs indicate nominal characteristics.

## S-PARAMETERS

S-parameters/Noise-parameters are provided on our web site in a form (S2P) that enables direct import to a microwave circuit simulator without keyboard input.
Click here to download S-parameters.

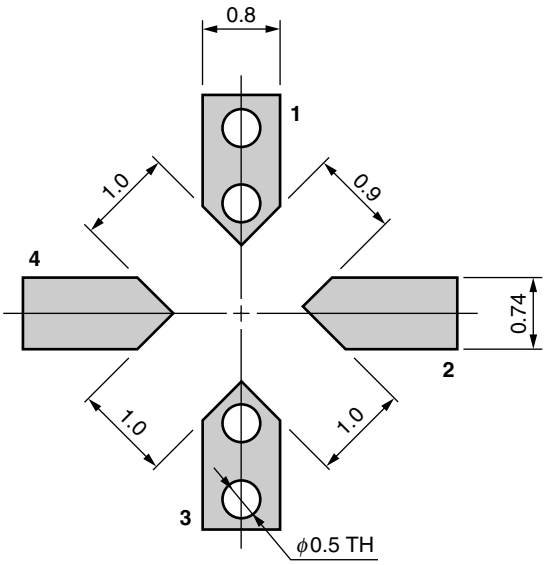
[RF and Microwave] → [Device Parameters]

URL http://www2.renesas.com/microwave/

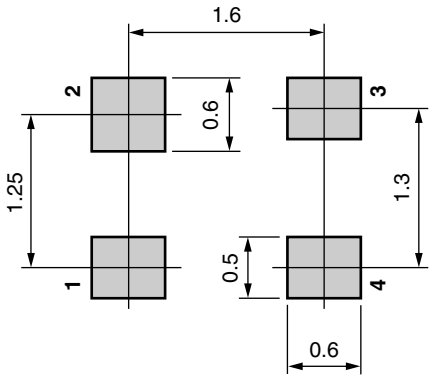
## MOUNTING PAD DIMENSIONS

### FLAT-LEAD 4-PIN THIN-TYPE SUPER MINIMOLD (M04) (UNIT: mm)

**-Reference 1-**



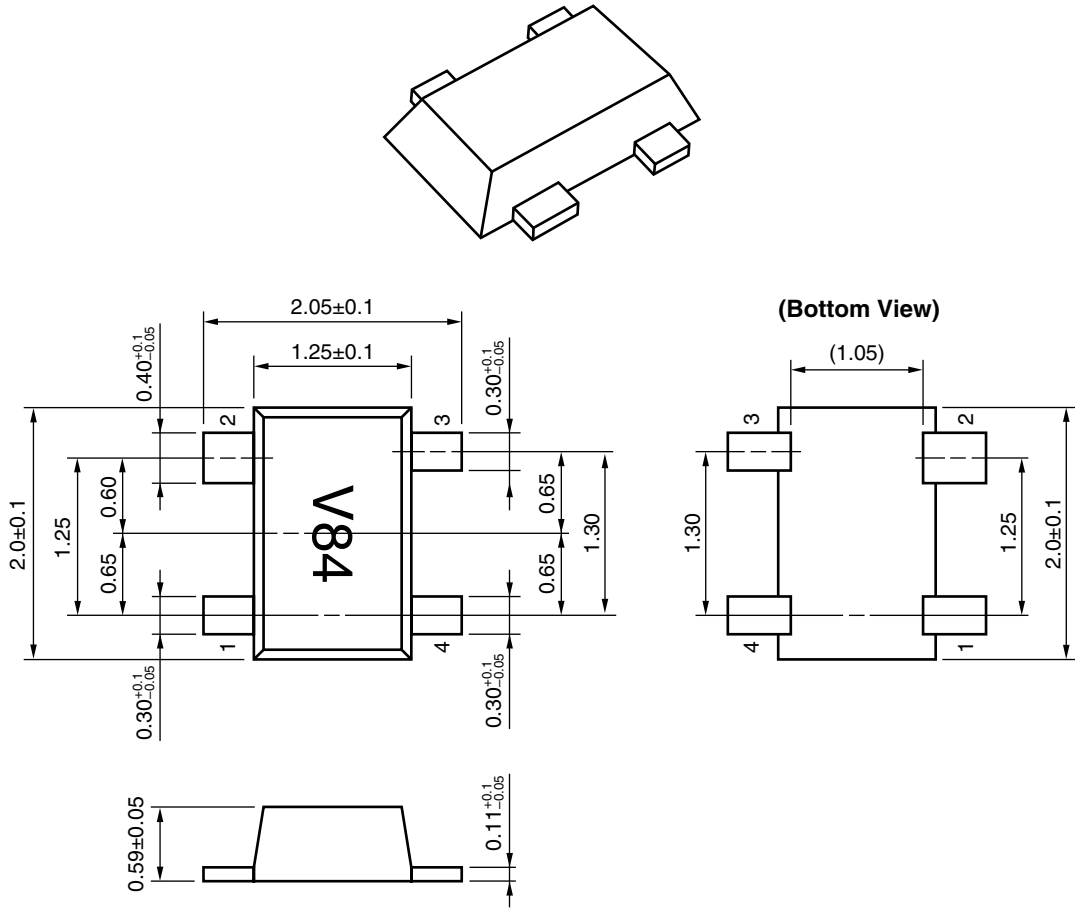

**-Reference 2-**




**Remark** The mounting pad layout in this document is for reference only.

# PACKAGE DIMENSIONS

## FLAT-LEAD 4-PIN THIN-TYPE SUPER MINIMOLD (M04) (UNIT: mm)




### PIN CONNECTIONS

1. Source
2. Drain
3. Source
4. Gate

## RECOMMENDED SOLDERING CONDITIONS

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

| Soldering Method | Soldering Conditions | | Condition Symbol |
|---|---|---|---|
| Infrared Reflow | Peak temperature (package surface temperature)<br>Time at peak temperature<br>Time at temperature of 220°C or higher<br>Preheating time at 120 to 180°C<br>Maximum number of reflow processes<br>Maximum chlorine content of rosin flux (% mass) | : 260°C or below<br>: 10 seconds or less<br>: 60 seconds or less<br>: 120±30 seconds<br>: 3 times<br>: 0.2% (Wt.) or below | IR260 |
| Partial Heating | Peak temperature (terminal temperature)<br>Soldering time (per side of device)<br>Maximum chlorine content of rosin flux (% mass) | : 350°C or below<br>: 3 seconds or less<br>: 0.2% (Wt.) or below | HS350 |

**CAUTION**

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

| | |
|---|---|
| **Caution** GaAs Products | This product uses gallium arsenide (GaAs).<br>GaAs vapor and powder are hazardous to human health if inhaled or ingested, so please observe the following points.<br>• Follow related laws and ordinances when disposing of the product. If there are no applicable laws and/or ordinances, dispose of the product as recommended below.<br>1. Commission a disposal company able to (with a license to) collect, transport and dispose of materials that contain arsenic and other such industrial waste materials.<br>2. Exclude the product from general industrial waste and household garbage, and ensure that the product is controlled (as industrial waste subject to special control) up until final disposal.<br>• Do not burn, destroy, cut, crush, or chemically dissolve the product.<br>• Do not lick the product or in any way allow it to enter the mouth. |

| Revision History | NE3513M04 Data Sheet |
|---|---|

| Rev. | Date | Description | |
|---|---|---|---|
| | | Page | Summary |
| 1.00 | Oct 18, 2011 | - | First edition issued |

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