



# HETERO JUNCTION FIELD EFFECT TRANSISTOR

## NE3509M04

### L TO S BAND LOW NOISE AMPLIFIER N-CHANNEL HJ-FET

#### FEATURES

- Super low noise figure and high associated gain  
NF = 0.4 dB TYP.,  $G_a = 17.5$  dB TYP. @  $f = 2$  GHz,  $V_{DS} = 2$  V,  $I_D = 10$  mA
- Flat-lead 4-pin thin-type super minimold (M04) package

#### APPLICATIONS

- Satellite radio (SDARS, DMB, etc.) antenna LNA
- GPS antenna LNA
- Low noise amplifier for microwave communication system

#### ORDERING INFORMATION

Part Number	Order Number	Package	Quantity	Marking	Supplying Form
NE3509M04	NE3509M04-A	Flat-lead 4-pin thin-type super minimold (M04) (Pb-Free)	50 pcs (Non reel)	V80	• 8 mm wide embossed taping • Pin 1 (Source), Pin 2 (Drain) face the perforation side of the tape
NE3509M04-T2	NE3509M04-T2-A		3 kpcs/reel		
NE3509M04-T2B	NE3509M04-T2B-A		15 kpcs/reel		

**Remark** To order evaluation samples, contact your nearby sales office.

Part number for sample order: NE3509M04-A

#### 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	$I_G$	200	$\mu\text{A}$
Total Power Dissipation	$P_{tot}$ <sup>Note</sup>	150	mW
Channel Temperature	$T_{ch}$	+150	$^{\circ}\text{C}$
Storage Temperature	$T_{stg}$	-65 to +150	$^{\circ}\text{C}$

**Note** Mounted on  $1.08\text{ cm}^2 \times 1.0\text{ mm}$  (t) glass epoxy PCB

**Caution:** Observe precautions when handling because these devices are sensitive to electrostatic discharge

The information in this document is subject to change without notice. Before using this document, please confirm that this is the latest version.

**RECOMMENDED OPERATING CONDITIONS ( $T_A = +25^\circ\text{C}$ )**

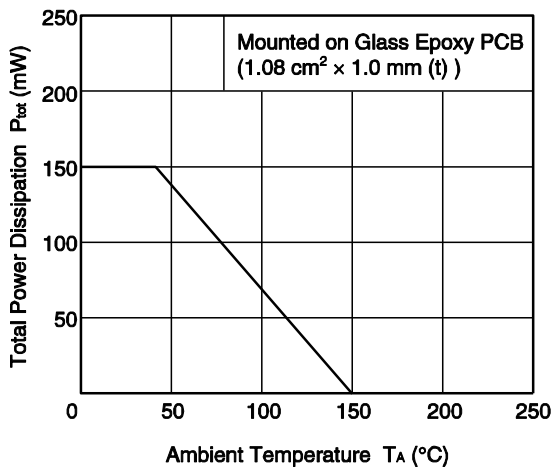
Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Drain to Source Voltage	$V_{DS}$	–	2	3	V
Drain Current	$I_D$	–	10	20	mA
Input Power	$P_{in}$	–	–	0	dBm

**ELECTRICAL CHARACTERISTICS ( $T_A = +25^\circ\text{C}$ , unless otherwise specified)**

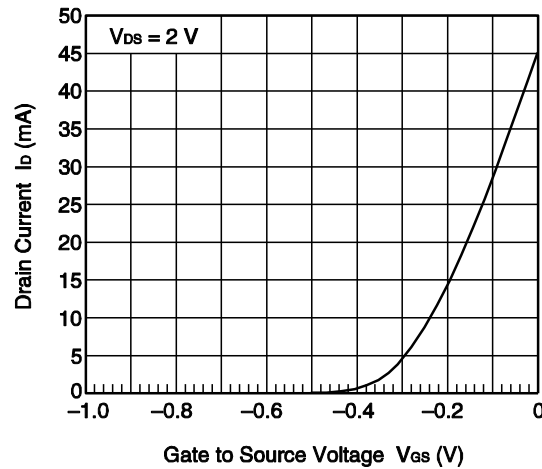
Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Gate to Source Leak Current	$I_{GSO}$	$V_{GS} = -3\text{ V}$	–	0.5	10	$\mu\text{A}$
Saturated Drain Current	$I_{DSS}$	$V_{DS} = 2\text{ V}, V_{GS} = 0\text{ V}$	30	45	60	mA
Gate to Source Cutoff Voltage	$V_{GS(off)}$	$V_{DS} = 2\text{ V}, I_D = 50\text{ }\mu\text{A}$	–0.25	–0.5	–0.75	V
Transconductance	$g_m$	$V_{DS} = 2\text{ V}, I_D = 10\text{ mA}$	80	–	–	mS
Noise Figure	NF	$V_{DS} = 2\text{ V}, I_D = 10\text{ mA}, f = 2\text{ GHz}$	–	0.4	0.7	dB
Associated Gain	$G_a$		16	17.5	–	dB
Gain 1 dB Compression Output Power	$P_{O(1\text{ dB})}$	$V_{DS} = 2\text{ V}, I_D = 10\text{ mA (Non-RF)},$ $f = 2\text{ GHz}$	–	11	–	dBm

**TYPICAL CHARACTERISTICS ( $T_A = +25^\circ\text{C}$ , unless otherwise specified)**

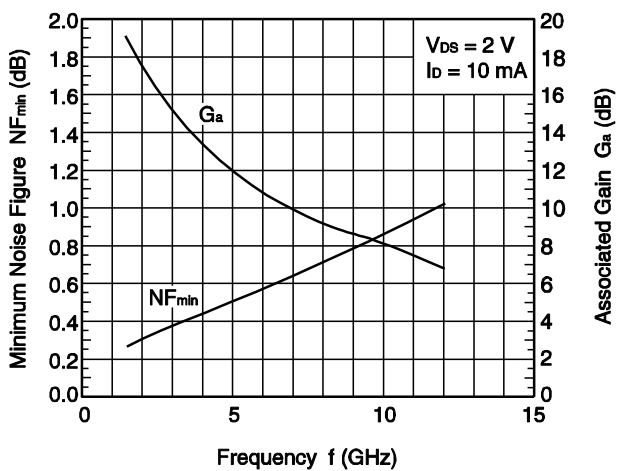
**TOTAL POWER DISSIPATION  
vs. AMBIENT TEMPERATURE**



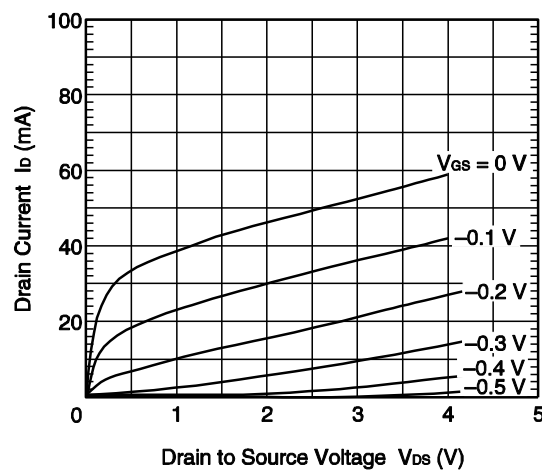
**DRAIN CURRENT vs.  
GATE TO SOURCE VOLTAGE**



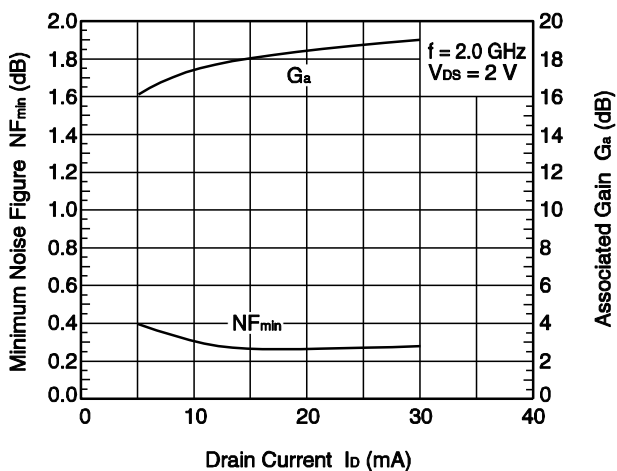
**MINIMUM NOISE FIGURE,  
ASSOCIATED GAIN vs. FREQUENCY**



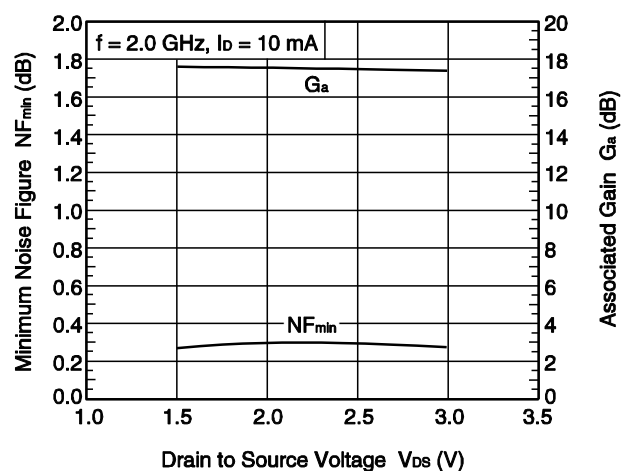
**DRAIN CURRENT vs.  
DRAIN TO SOURCE VOLTAGE**



**MINIMUM NOISE FIGURE,  
ASSOCIATED GAIN vs. DRAIN CURRENT**

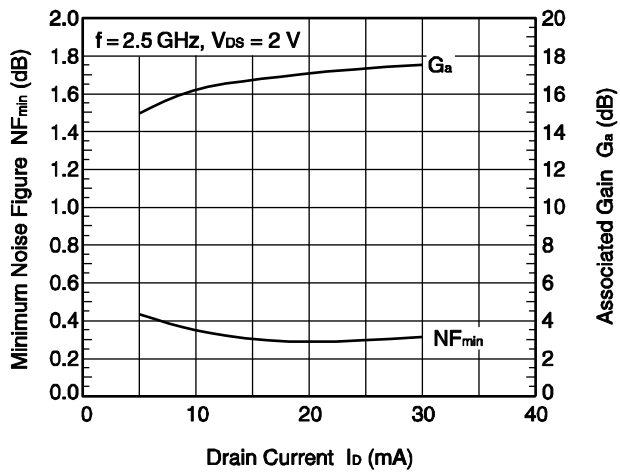


**MINIMUM NOISE FIGURE, ASSOCIATED GAIN  
vs. DRAIN TO SOURCE VOLTAGE**

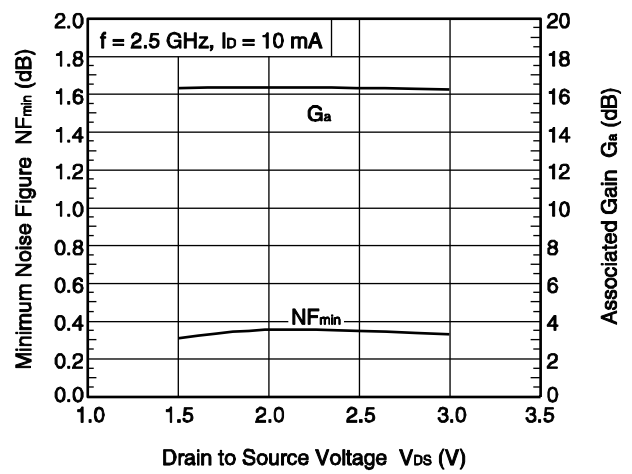


**Remark** The graphs indicate nominal characteristics.

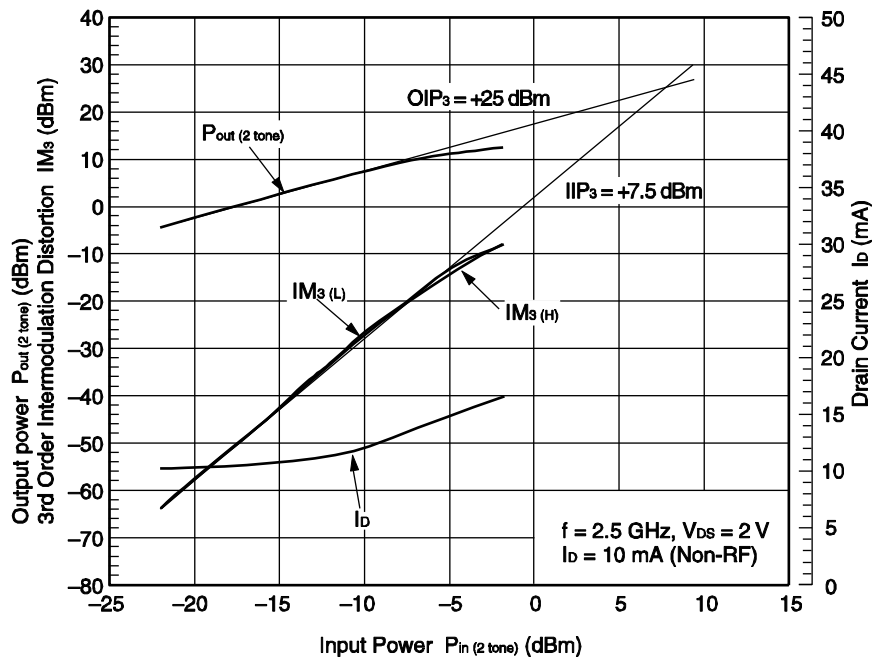
MINIMUM NOISE FIGURE,  
ASSOCIATED GAIN vs. DRAIN CURRENT



MINIMUM NOISE FIGURE, ASSOCIATED GAIN  
vs. DRAIN TO SOURCE VOLTAGE



OUTPUT POWER,  $IM_3$ , DRAIN CURRENT  
vs. INPUT POWER



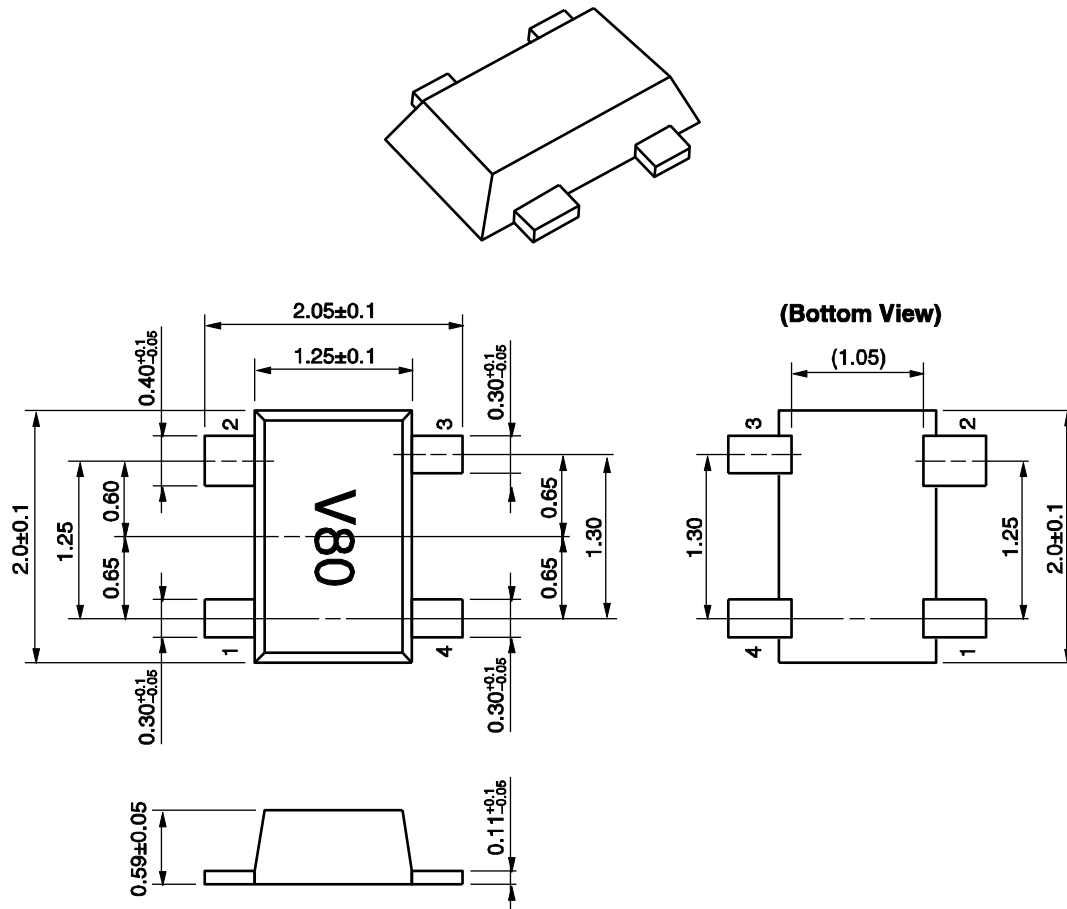
**Remark** The graphs indicate nominal characteristics.

**S-PARAMETERS**

- S-parameters and noise parameters are provided on our Web site in a format (S2P) that enables the direct import of the parameters to microwave circuit simulators without the need for keyboard inputs.
- Click here to download S-parameters.
- [RF and Microwave] ® [Device Parameters]
- URL <http://www.necel.com/microwave/en/>

**PACKAGE DIMENSIONS**

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

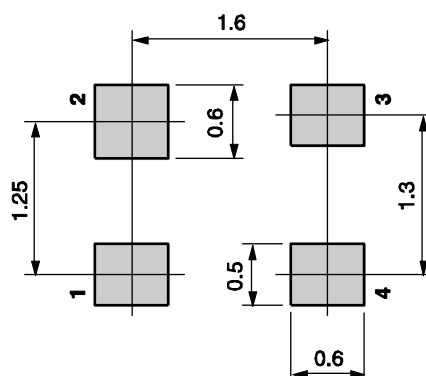


**PIN CONNECTIONS**

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

**MOUNTING PAD DIMENSIONS (REFERENCE ONLY)**

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



**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) : 260°C or below Time at peak temperature : 10 seconds or less Time at temperature of 220°C or higher : 60 seconds or less Preheating time at 120 to 180°C : 120±30 seconds Maximum number of reflow processes : 3 times Maximum chlorine content of rosin flux (% mass) : 0.2%(Wt.) or below	IR260
Partial Heating	Peak temperature (terminal temperature) : 350°C or below Soldering time (per side of device) : 3 seconds or less Maximum chlorine content of rosin flux (% mass) : 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).

GaAs vapor and powder are hazardous to human health if inhaled or ingested, so please observe the following points.

- 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.
  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.
  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.
- Do not burn, destroy, cut, crush, or chemically dissolve the product.
- Do not lick the product or in any way allow it to enter the mouth.

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