



# DATA SHEET

## HETERO JUNCTION FIELD EFFECT TRANSISTOR NE3510M04

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

#### FEATURES

- Low noise figure and high associated gain  
NF = 0.45 dB TYP.,  $G_a = 16$  dB TYP. @  $f = 4$  GHz,  $V_{DS} = 2$  V,  $I_D = 15$  mA  
NF = 0.35 dB TYP.,  $G_a = 19$  dB TYP. @  $f = 2$  GHz,  $V_{DS} = 2$  V,  $I_D = 10$  mA (Reference only)
- Flat-lead 4-pin thin-type super minimold (M04) package

#### APPLICATIONS

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

#### ORDERING INFORMATION

Part Number	Order Number	Package	Quantity	Marking	Supplying Form
NE3510M04	NE3510M04-A	Flat-lead 4-pin thin-type super minimold (M04) (Pb-Free)	50 pcs (Non reel)	V81	• 8 mm wide embossed taping • Pin 1 (Source), Pin 2 (Drain) face the perforation side of the tape
NE3510M04-T2	NE3510M04-T2-A		3 kpcs/reel		

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

Part number for sample order: NE3510M04-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	$I_G$	140	$\mu\text{A}$
Total Power Dissipation	$P_{tot}^{Note}$	125	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 ( $T_A = +25^\circ\text{C}$ )**

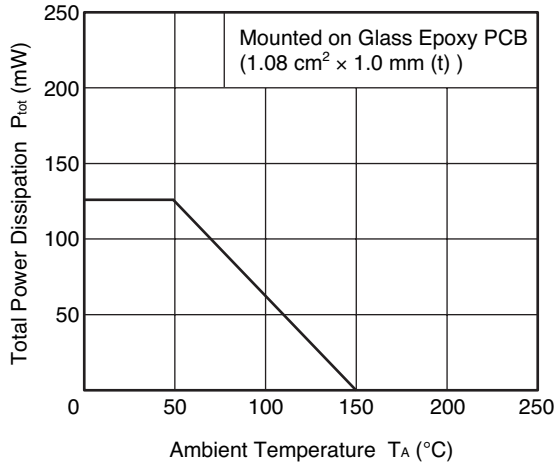
Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Drain to Source Voltage	$V_{DS}$	-	2	3	V
Drain Current	$I_D$	-	15	30	mA
Input Power	$P_{in}$	-	-	0	dBm

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

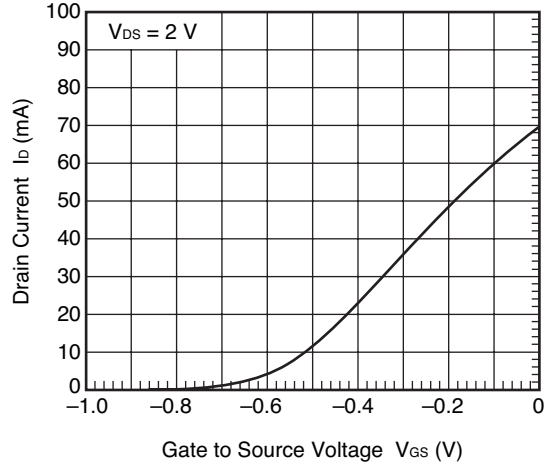
Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Gate to Source Leak Current	$I_{GSO}$	$V_{GS} = -3\text{ V}$	-	0.5	10	$\mu\text{A}$
Saturated Drain Current	$I_{DSS}$	$V_{DS} = 2\text{ V}, V_{GS} = 0\text{ V}$	42	70	97	mA
Gate to Source Cutoff Voltage	$V_{GS(off)}$	$V_{DS} = 2\text{ V}, I_D = 100\ \mu\text{A}$	-0.35	-0.7	-1.10	V
Transconductance	$g_m$	$V_{DS} = 2\text{ V}, I_D = 15\text{ mA}$	70	-	-	mS
Noise Figure	NF	$V_{DS} = 2\text{ V}, I_D = 15\text{ mA}, f = 4\text{ GHz}$	-	0.45	0.65	dB
Associated Gain	$G_a$		14.5	16	-	dB
Gain 1 dB Compression Output Power	$P_{O(1\text{ dB})}$	$V_{DS} = 2\text{ V}, I_D = 15\text{ mA (Non-RF)},$ $f = 4\text{ GHz}$	-	+11	-	dBm

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

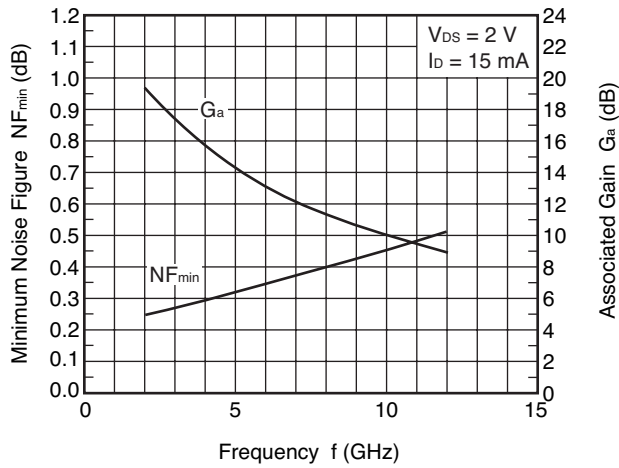
**TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE**



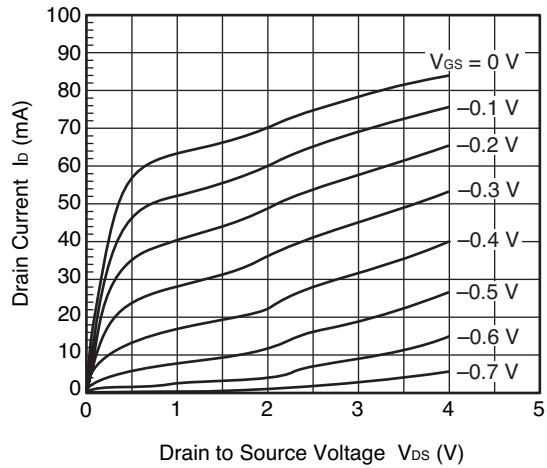
**DRAIN CURRENT vs. GATE TO SOURCE VOLTAGE**



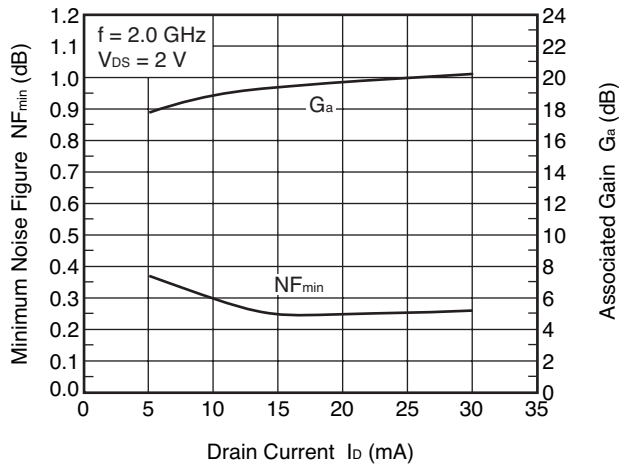
**MINIMUM NOISE FIGURE, ASSOCIATED GAIN vs. FREQUENCY**



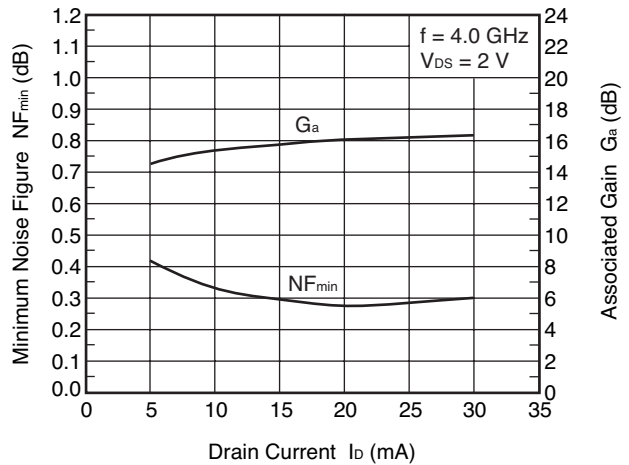
**DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE**



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

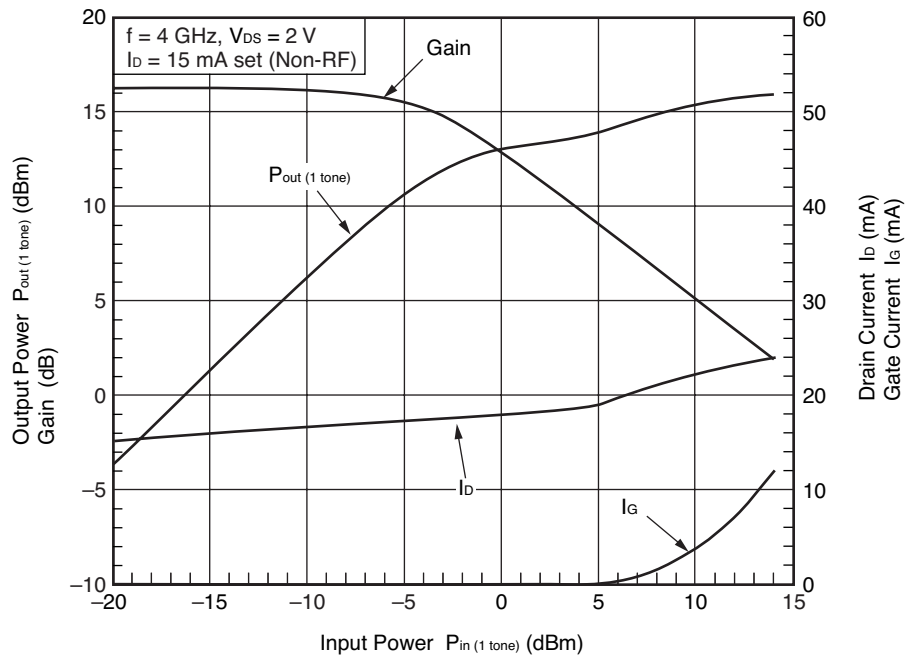


**MINIMUM NOISE FIGURE, ASSOCIATED GAIN vs. DRAIN CURRENT**

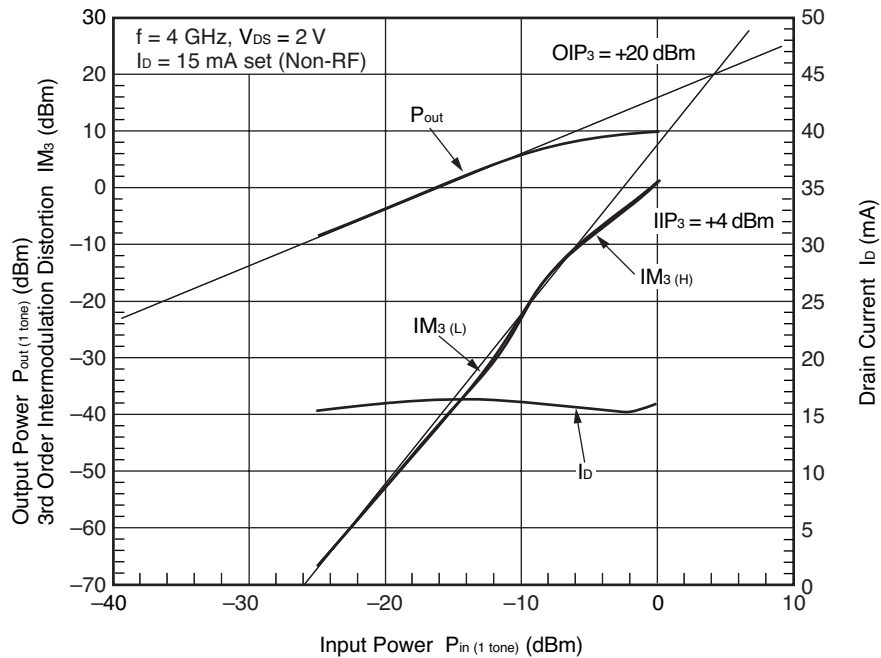


**Remark** The graphs indicate nominal characteristics.

OUTPUT POWER, GAIN, DRAIN CURRENT, GATE CURRENT vs. INPUT POWER



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



**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.

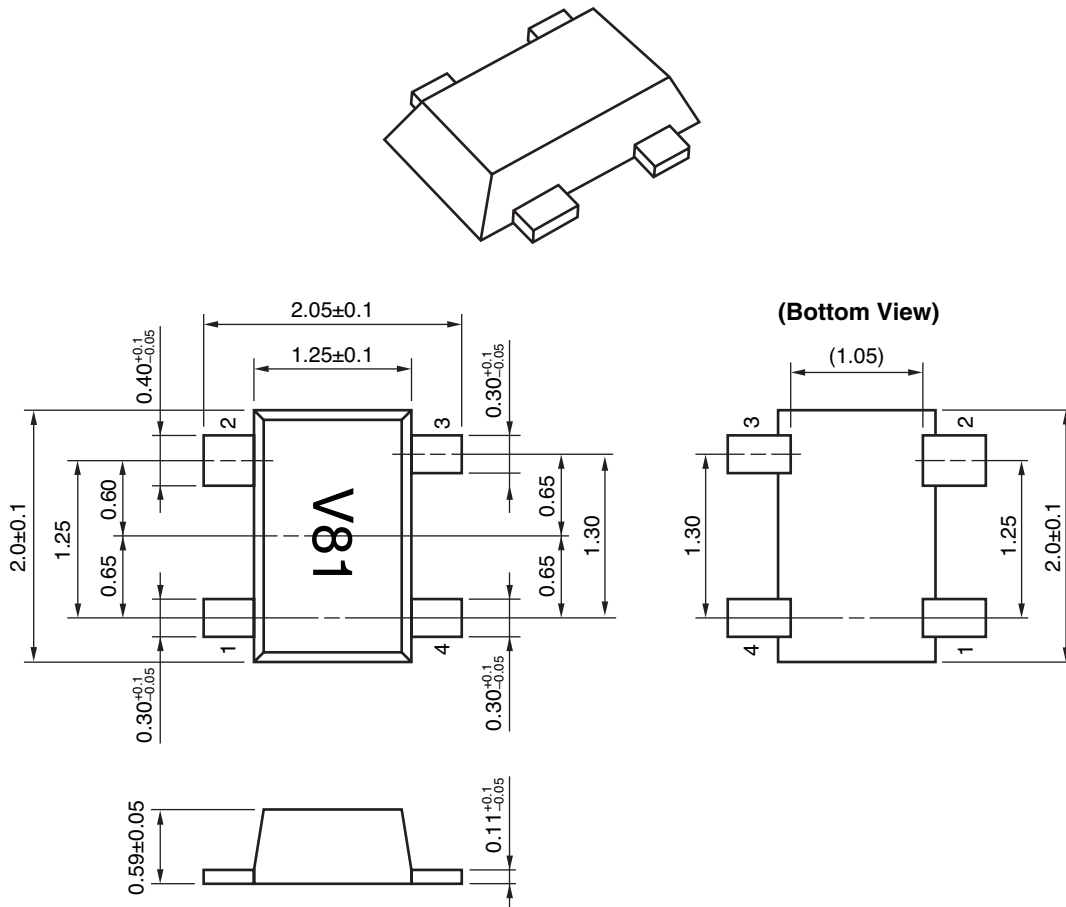
Click here to download S-parameters.

[RF and Microwave] → [Device Parameters]

URL <http://www.ncsd.necel.com/microwave/index.html>

**PACKAGE DIMENSIONS**

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

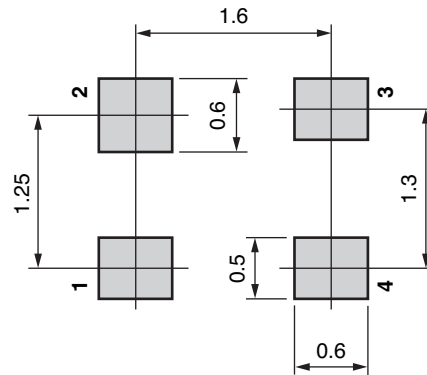


**PIN CONNECTIONS**

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

**MOUNTING PAD DIMENSIONS (REFERENCE ONLY)**

**FLAT-LEAD 4-PIN THIN-TYPE SUPER MINIMOLD (M04) PACKAGE (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).**



- **The information in this document is current as of July, 2007. The information is subject to change without notice. For actual design-in, refer to the latest publications of NEC Electronics data sheets or data books, etc., for the most up-to-date specifications of NEC Electronics products. Not all products and/or types are available in every country. Please check with an NEC Electronics sales representative for availability and additional information.**
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**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.

Subject: Compliance with EU Directives

CEL certifies, to its knowledge, that semiconductor and laser products detailed below are compliant with the requirements of European Union (EU) Directive 2002/95/EC Restriction on Use of Hazardous Substances in electrical and electronic equipment (RoHS) and the requirements of EU Directive 2003/11/EC Restriction on Penta and Octa BDE.

CEL Pb-free products have the same base part number with a suffix added. The suffix –A indicates that the device is Pb-free. The –AZ suffix is used to designate devices containing Pb which are exempted from the requirement of RoHS directive (\*). In all cases the devices have Pb-free terminals. All devices with these suffixes meet the requirements of the RoHS directive.

This status is based on CEL’s understanding of the EU Directives and knowledge of the materials that go into its products as of the date of disclosure of this information.

Restricted Substance per RoHS	Concentration Limit per RoHS (values are not yet fixed)	Concentration contained in CEL devices	
		-A	-AZ
Lead (Pb)	< 1000 PPM	Not Detected	(*)
Mercury	< 1000 PPM	Not Detected	
Cadmium	< 100 PPM	Not Detected	
Hexavalent Chromium	< 1000 PPM	Not Detected	
PBB	< 1000 PPM	Not Detected	
PBDE	< 1000 PPM	Not Detected	

If you should have any additional questions regarding our devices and compliance to environmental standards, please do not hesitate to contact your local representative.

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