

To our customers,

Old Company Name in Catalogs and Other Documents

On April 1st, 2010, NEC Electronics Corporation merged with Renesas Technology Corporation, and Renesas Electronics Corporation took over all the business of both companies. Therefore, although the old company name remains in this document, it is a valid Renesas Electronics document. We appreciate your understanding.

Renesas Electronics website: <http://www.renesas.com>

April 1st, 2010
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (<http://www.renesas.com>)

Send any inquiries to <http://www.renesas.com/inquiry>.

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(Note 2) “Renesas Electronics product(s)” means any product developed or manufactured by or for Renesas Electronics.

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., Ga = 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

<R>

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

ABSOLUTE MAXIMUM RATINGS (T_A = +25°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	μA
Total Power Dissipation	P _{tot} ^{Note}	150	mW
Channel Temperature	T _{ch}	+150	°C
Storage Temperature	T _{stg}	−65 to +150	°C

Note Mounted on 1.08 cm² × 1.0 mm (t) glass epoxy PCB

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

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Not all products and/or types are available in every country. Please check with an NEC Electronics sales representative for availability and additional information.

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

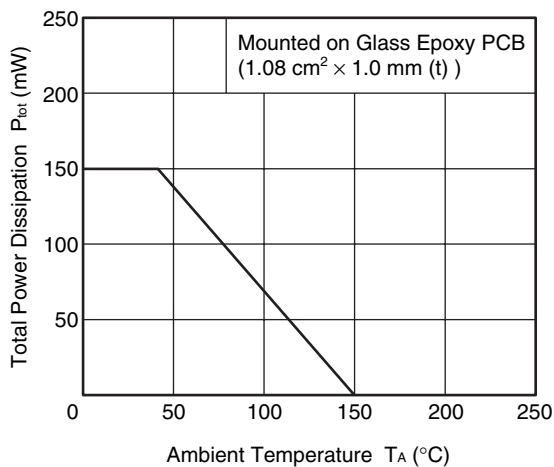
Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Drain to Source Voltage	V_{DS}	–	2	3	V
Drain Current	I_D	–	10	20	mA
Input Power	P_{in}	–	–	0	dBm

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

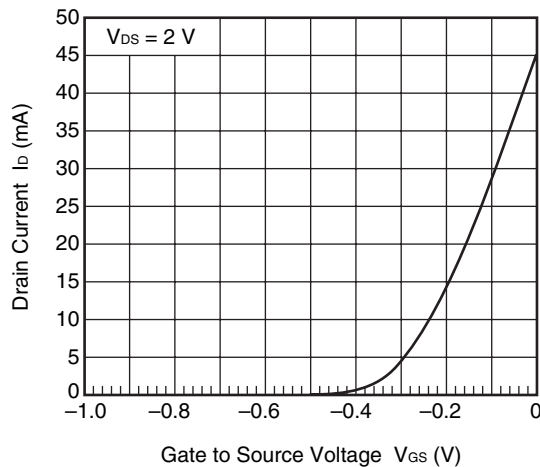
Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Gate to Source Leak Current	I_{GSO}	$V_{GS} = -3\text{ V}$	–	0.5	10	μA
Saturated Drain Current	I_{DSS}	$V_{DS} = 2\text{ V}, V_{GS} = 0\text{ V}$	30	45	60	mA
Gate to Source Cutoff Voltage	$V_{GS(off)}$	$V_{DS} = 2\text{ V}, I_D = 50\text{ }\mu\text{A}$	–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)

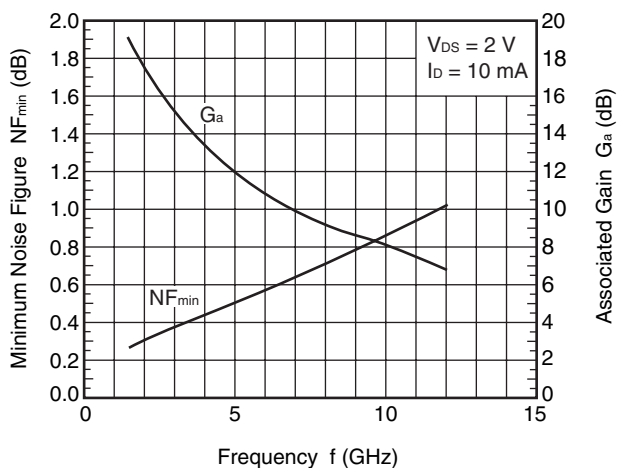
**TOTAL POWER DISSIPATION
vs. AMBIENT TEMPERATURE**



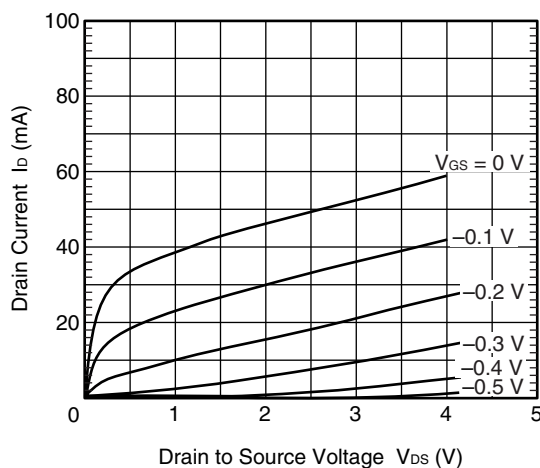
**DRAIN CURRENT vs.
GATE TO SOURCE VOLTAGE**



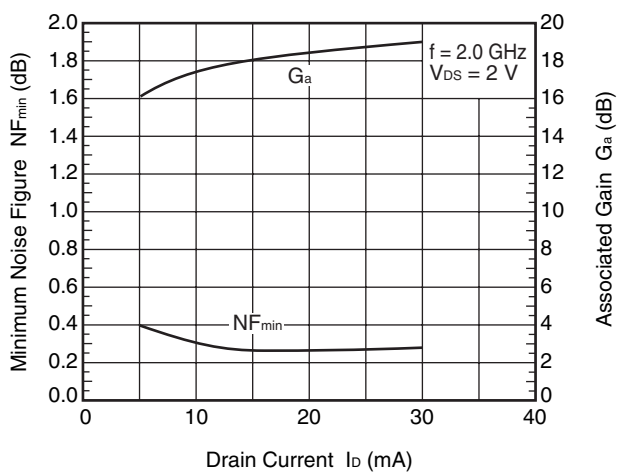
**MINIMUM NOISE FIGURE,
ASSOCIATED GAIN vs. FREQUENCY**



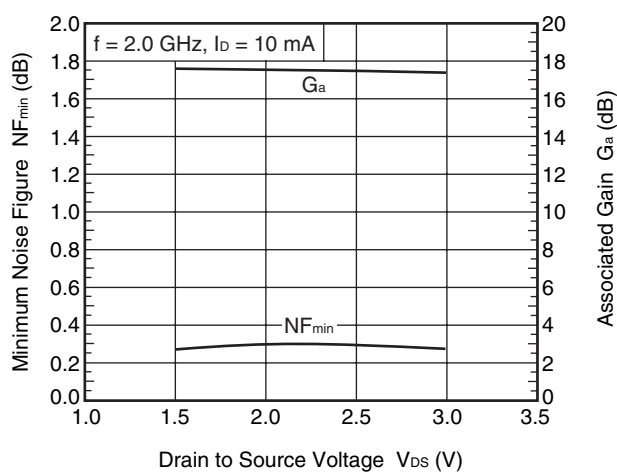
**DRAIN CURRENT vs.
DRAIN TO SOURCE VOLTAGE**



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

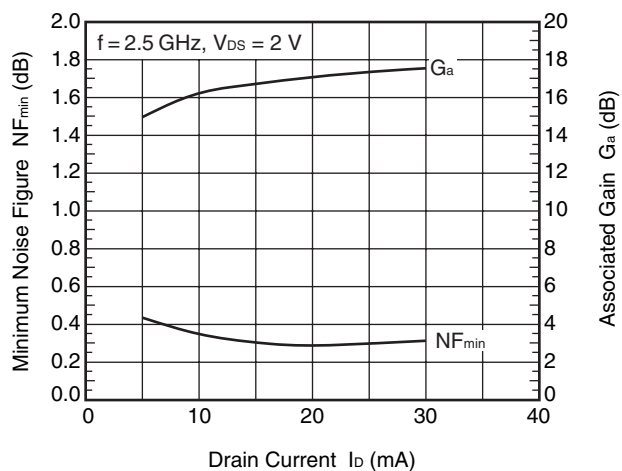


**MINIMUM NOISE FIGURE, ASSOCIATED GAIN
vs. DRAIN TO SOURCE VOLTAGE**

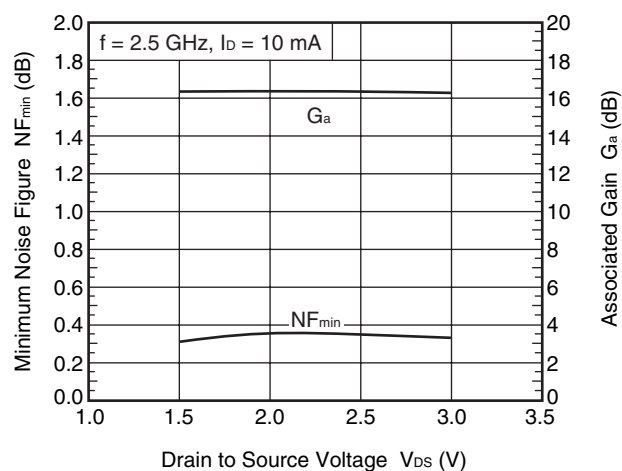


Remark The graphs indicate nominal characteristics.

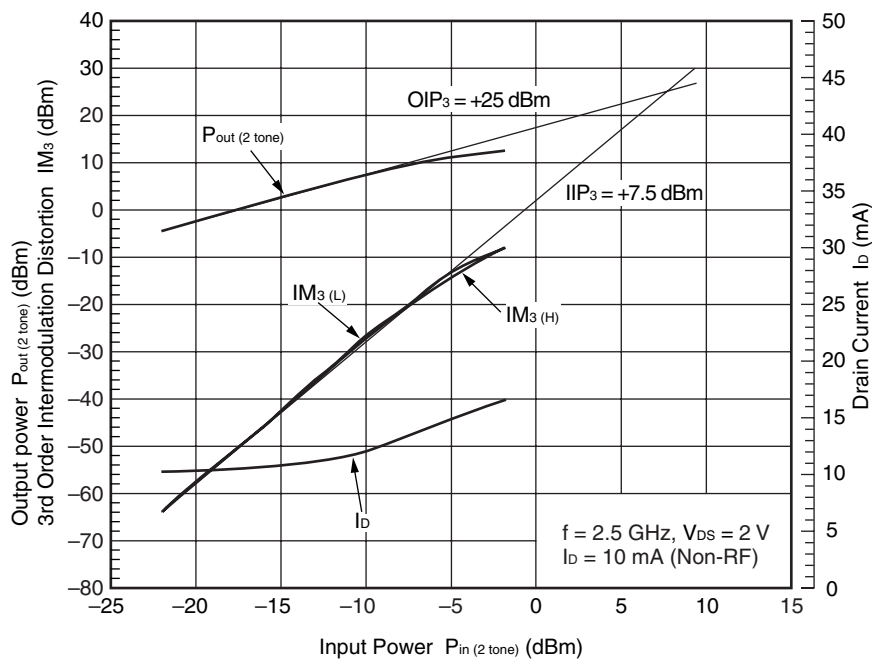
MINIMUM NOISE FIGURE,
ASSOCIATED GAIN vs. DRAIN CURRENT



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.

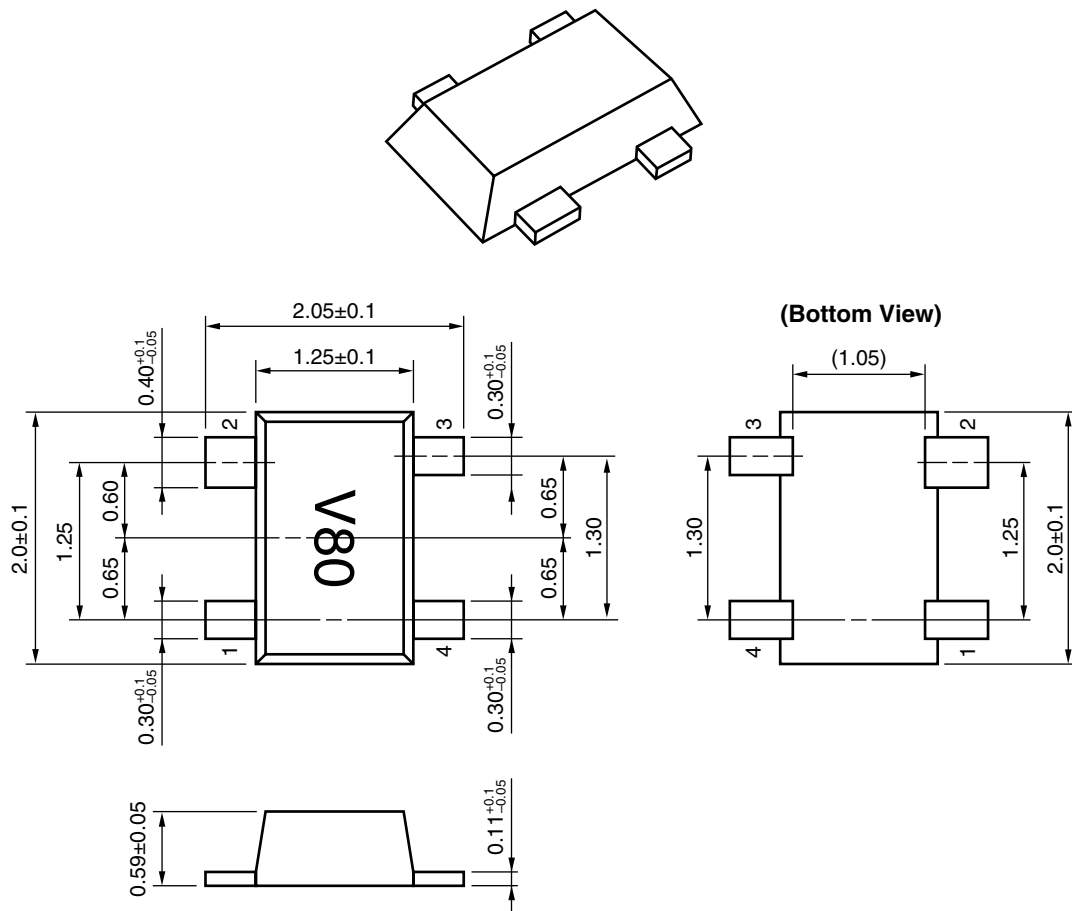
Click here to download S-parameters.

[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)

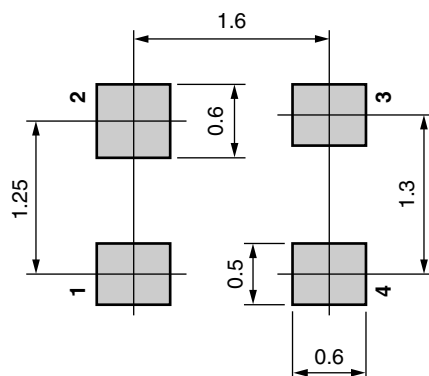


PIN CONNECTIONS

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
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

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

- **The information in this document is current as of October, 2008. 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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"Standard": Computers, office equipment, communications equipment, test and measurement equipment, audio and visual equipment, home electronic appliances, machine tools, personal electronic equipment and industrial robots.

"Special": Transportation equipment (automobiles, trains, ships, etc.), traffic control systems, anti-disaster systems, anti-crime systems, safety equipment and medical equipment (not specifically designed for life support).

"Specific": Aircraft, aerospace equipment, submersible repeaters, nuclear reactor control systems, life support systems and medical equipment for life support, etc.

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