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# NESG2031M05

## Data Sheet

NPN SiGe RF Transistor for Low Noise, High-Gain Amplification  
 Flat-Lead 4-Pin Thin-Type Super Minimold (M05)

R09DS0035EJ0400  
 Rev. 4.00  
 Jun 20, 2012

### FEATURES

- The device is an ideal choice for low noise, high-gain at low current amplifications.
  - ☒ NF = 0.8 dB TYP., Ga = 17.0 dB TYP. @ V<sub>CE</sub> = 2 V, I<sub>C</sub> = 5 mA, f = 2 GHz
  - ☒ NF = 1.3 dB TYP., G<sub>a</sub> = 10.0 dB TYP. @ V<sub>CE</sub> = 2 V, I<sub>C</sub> = 5 mA, f = 5.2 GHz
- Maximum stable power gain: MSG = 21.5 dB TYP. @ V<sub>CE</sub> = 3 V, I<sub>C</sub> = 20 mA, f = 2 GHz
- High breakdown voltage technology for SiGe Tr. adopted: V<sub>CEO</sub> (absolute maximum ratings) = 5.0 V
- Flat-lead 4-pin thin-type super minimold (M05) package

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### ORDERING INFORMATION

Part Number	Order Number	Package	Quantity	Supplying Form
NESG2031M05	NESG2031M05-A	Flat-lead 4-pin thin-type super minimold (M05, 2012 PKG) (Pb-Free)	50 pcs (Non reel)	<ul style="list-style-type: none"> <li>• 8 mm wide embossed taping</li> <li>• Pin 3 (Collector), Pin 4 (Emitter) face the perforation side of the tape</li> </ul>
NESG2031M05-T1	NESG2031M05-T1-A		3 kpcs/reel	

**Remark** To order evaluation samples, please contact your nearby sales office.  
 Unit sample quantity is 50 pcs.

### ABSOLUTE MAXIMUM RATINGS (T<sub>A</sub> = +25°C)

Parameter	Symbol	Ratings	Unit
Collector to Base Voltage	V <sub>CBO</sub>	13.0	V
Collector to Emitter Voltage	V <sub>CEO</sub>	5.0	V
Emitter to Base Voltage	V <sub>EBO</sub>	1.5	V
Collector Current	I <sub>C</sub>	35	mA
Total Power Dissipation	P <sub>tot</sub> <sup>Note</sup>	175	mW
Junction Temperature	T <sub>j</sub>	150	°C
Storage Temperature	T <sub>stg</sub>	-65 to +150	°C

Note: Mounted on 1.08 cm<sup>2</sup> × 1.0 mm (t) glass epoxy PCB

### CAUTION

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

The mark <R> shows major revised points.

The revised points can be easily searched by copying an "<R>" in the PDF file and specifying it in the "Find what:" field.

<R> **ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = +25°C)**

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
DC Characteristics						
Collector Cut-off Current	I <sub>CBO</sub>	V <sub>CB</sub> = 5 V, I <sub>E</sub> = 0	–	–	100	nA
Emitter Cut-off Current	I <sub>EBO</sub>	V <sub>EB</sub> = 1 V, I <sub>C</sub> = 0	–	–	100	nA
DC Current Gain	h <sub>FE</sub> <sup>Note 1</sup>	V <sub>CE</sub> = 2 V, I <sub>C</sub> = 5 mA	130	190	260	–
RF Characteristics						
Gain Bandwidth Product	f <sub>T</sub>	V <sub>CE</sub> = 3 V, I <sub>C</sub> = 20 mA, f = 2 GHz	20	25	–	GHz
Insertion Power Gain	$\left  \frac{S_{21}}{S_{12}} \right ^2$	V <sub>CE</sub> = 3 V, I <sub>C</sub> = 20 mA, f = 2 GHz	16.0	18.0	–	dB
Noise Figure (1)	NF	V <sub>CE</sub> = 2 V, I <sub>C</sub> = 5 mA, f = 2 GHz, Z <sub>S</sub> = Z <sub>Sopt</sub> , Z <sub>L</sub> = Z <sub>Lopt</sub>	–	0.8	1.1	dB
Noise Figure (2)	NF	V <sub>CE</sub> = 2 V, I <sub>C</sub> = 5 mA, f = 5.2 GHz, Z <sub>S</sub> = Z <sub>Sopt</sub> , Z <sub>L</sub> = Z <sub>Lopt</sub>	–	1.3	–	dB
Associated Gain (1)	G <sub>a</sub>	V <sub>CE</sub> = 2 V, I <sub>C</sub> = 5 mA, f = 2 GHz, Z <sub>S</sub> = Z <sub>Sopt</sub> , Z <sub>L</sub> = Z <sub>Lopt</sub>	15.0	17.0	–	dB
Associated Gain (2)	G <sub>a</sub>	V <sub>CE</sub> = 2 V, I <sub>C</sub> = 5 mA, f = 5.2 GHz, Z <sub>S</sub> = Z <sub>Sopt</sub> , Z <sub>L</sub> = Z <sub>Lopt</sub>	–	10.0	–	dB
Reverse Transfer Capacitance	C <sub>re</sub> <sup>Note 2</sup>	V <sub>CB</sub> = 2 V, I <sub>E</sub> = 0, f = 1 MHz	–	0.15	0.25	pF
Maximum Stable Power Gain	MSG <sup>Note 3</sup>	V <sub>CE</sub> = 3 V, I <sub>C</sub> = 20 mA, f = 2 GHz	19.0	21.5	–	dB
Gain 1 dB Compression Output Power	P <sub>O</sub> (1 dB)	V <sub>CE</sub> = 3 V, I <sub>C</sub> = 20 mA, f = 2 GHz, Z <sub>S</sub> = Z <sub>Sopt</sub> , Z <sub>L</sub> = Z <sub>Lopt</sub>	–	13	–	dBm
3rd Order Intermodulation Distortion Output Intercept Point	OIP <sub>3</sub>	V <sub>CE</sub> = 3 V, I <sub>C</sub> = 20 mA, f = 2 GHz, Z <sub>S</sub> = Z <sub>Sopt</sub> , Z <sub>L</sub> = Z <sub>Lopt</sub>	–	23	–	dBm

Notes: 1. Pulse measurement: PW ≤ 350 μs, Duty Cycle ≤ 2%  
 2. Collector to base capacitance when the emitter grounded

$$3. \text{MSG} = \left| \frac{S_{21}}{S_{12}} \right|$$

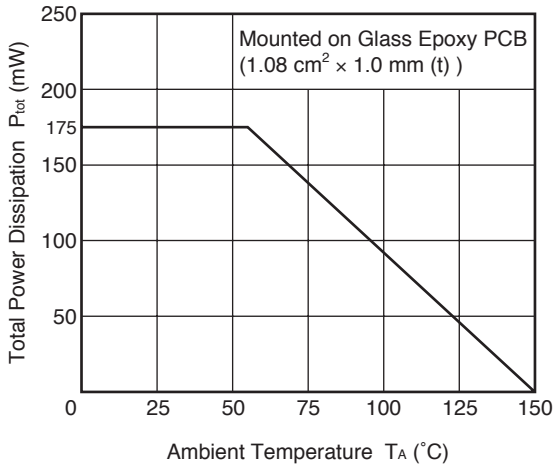
**h<sub>FE</sub> CLASSIFICATION**

Rank	FB/YFB
Marking	T1H
h <sub>FE</sub> Value	130 to 260

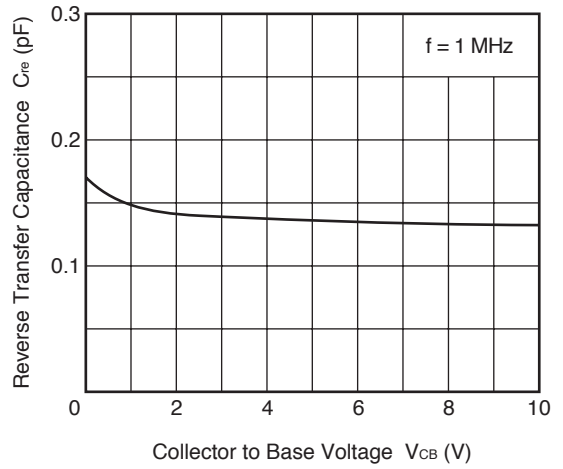


**TYPICAL CHARACTERISTICS (T<sub>A</sub> = +25°C, unless otherwise specified)**

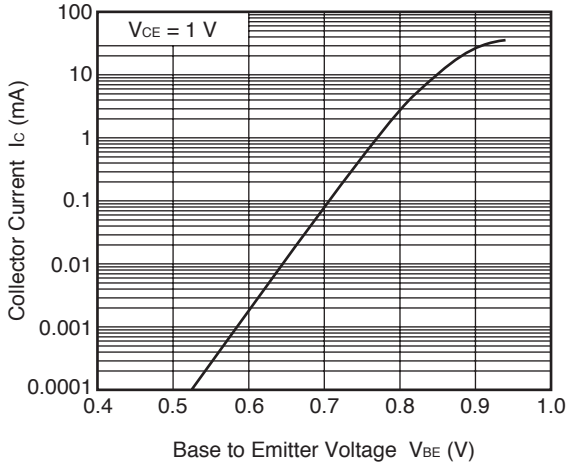
**TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE**



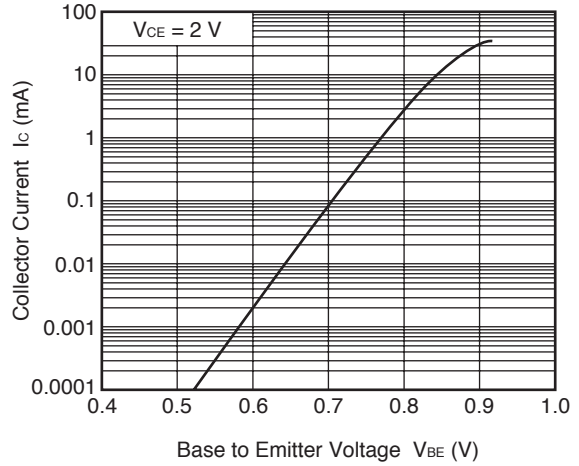
**REVERSE TRANSFER CAPACITANCE vs. COLLECTOR TO BASE VOLTAGE**



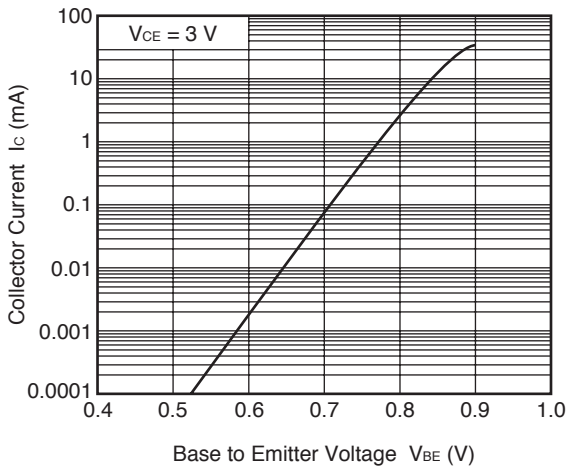
**COLLECTOR CURRENT vs. BASE TO EMITTER VOLTAGE**



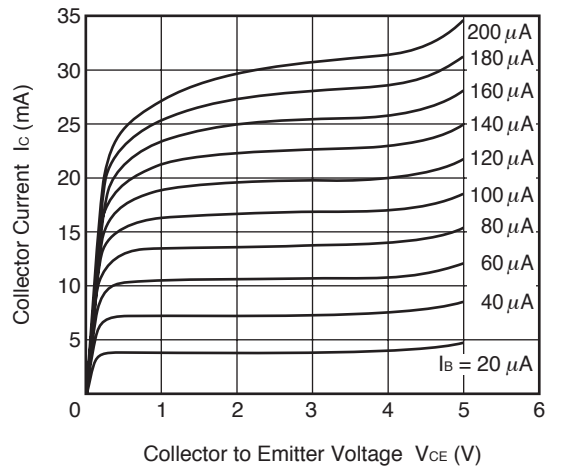
**COLLECTOR CURRENT vs. BASE TO EMITTER VOLTAGE**



**COLLECTOR CURRENT vs. BASE TO EMITTER VOLTAGE**

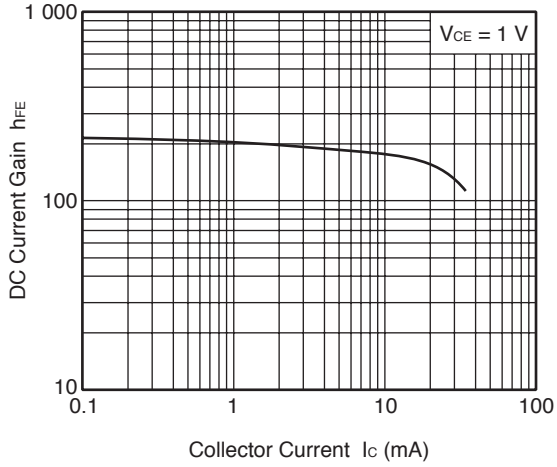


**COLLECTOR CURRENT vs. COLLECTOR TO EMITTER VOLTAGE**

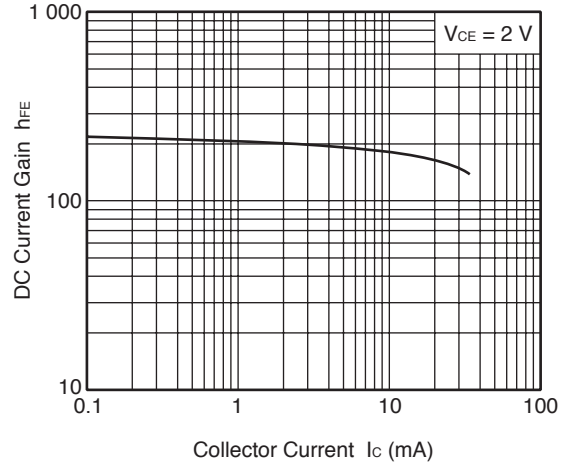


**Remark** The graph indicates nominal characteristics.

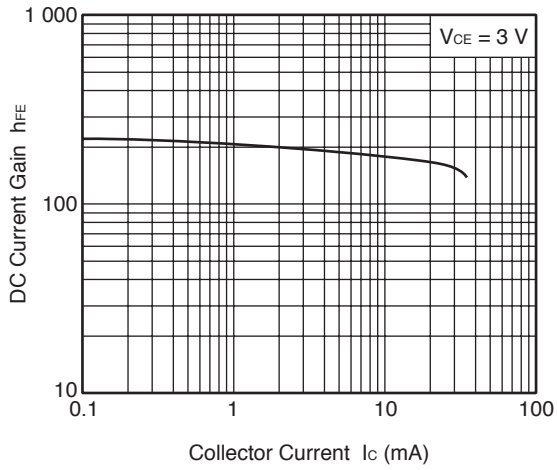
DC CURRENT GAIN vs.  
COLLECTOR CURRENT



DC CURRENT GAIN vs.  
COLLECTOR CURRENT

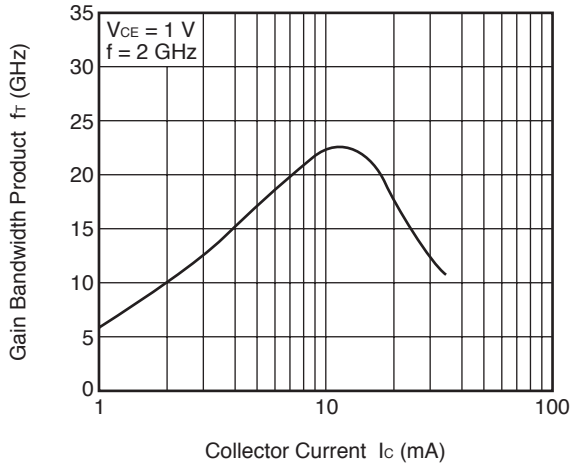


DC CURRENT GAIN vs.  
COLLECTOR CURRENT

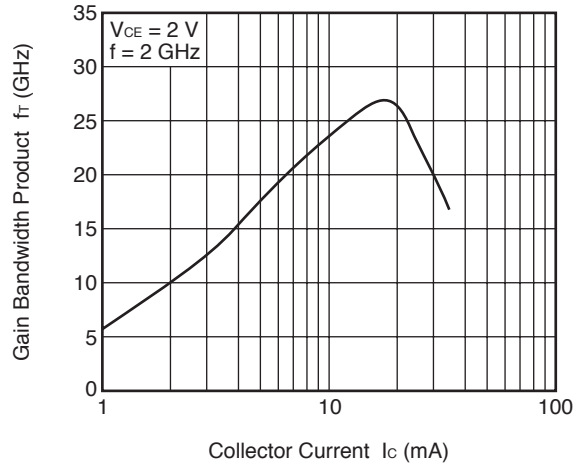


**Remark** The graph indicates nominal characteristics.

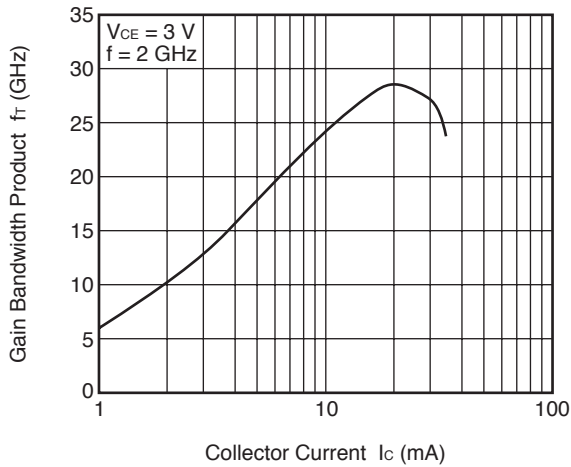
GAIN BANDWIDTH PRODUCT vs. COLLECTOR CURRENT



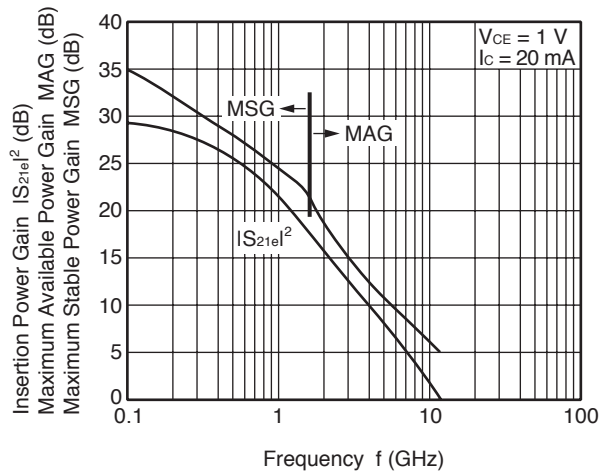
GAIN BANDWIDTH PRODUCT vs. COLLECTOR CURRENT



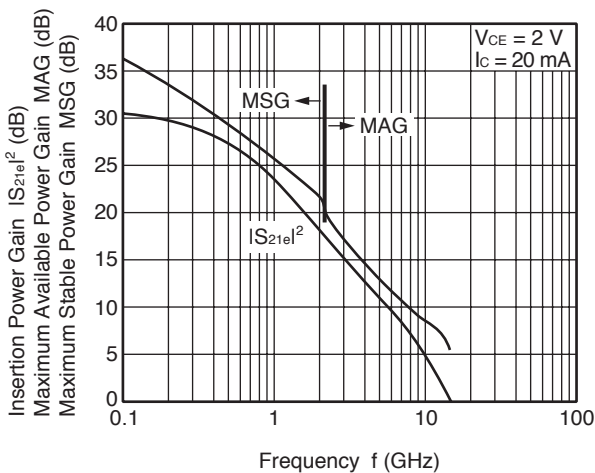
GAIN BANDWIDTH PRODUCT vs. COLLECTOR CURRENT



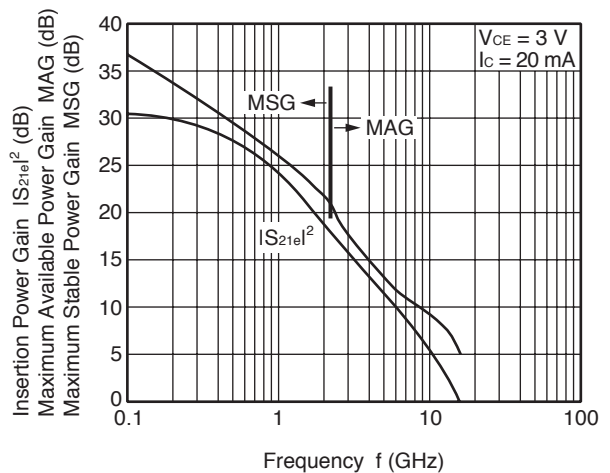
INSERTION POWER GAIN, MAG, MSG vs. FREQUENCY



INSERTION POWER GAIN, MAG, MSG vs. FREQUENCY

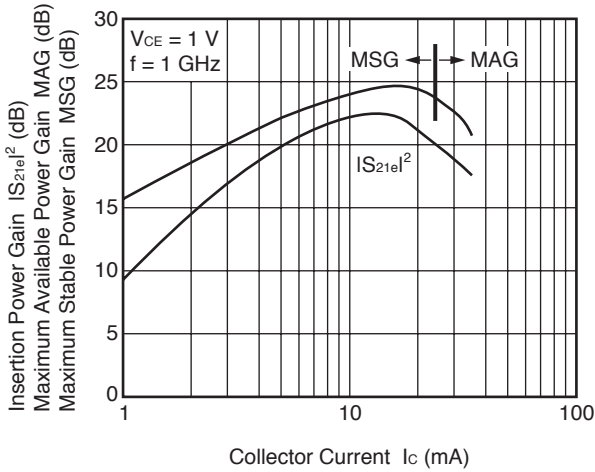


INSERTION POWER GAIN, MAG, MSG vs. FREQUENCY

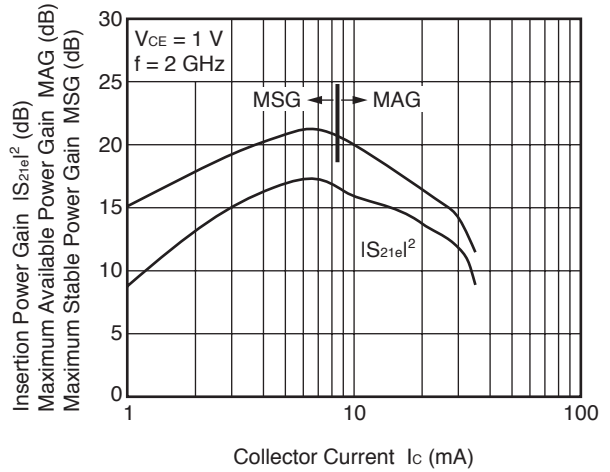


**Remark** The graph indicates nominal characteristics.

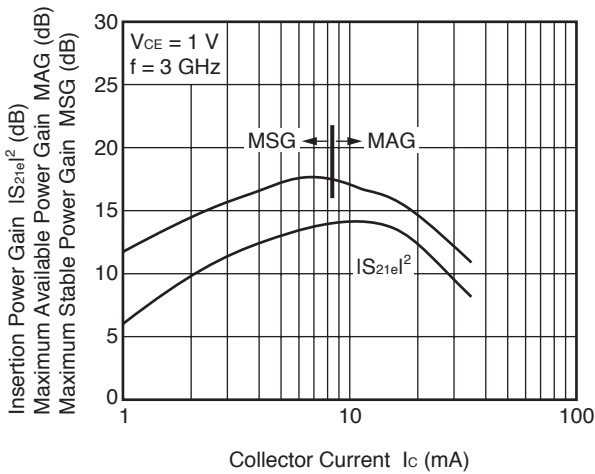
INSERTION POWER GAIN, MAG, MSG vs. COLLECTOR CURRENT



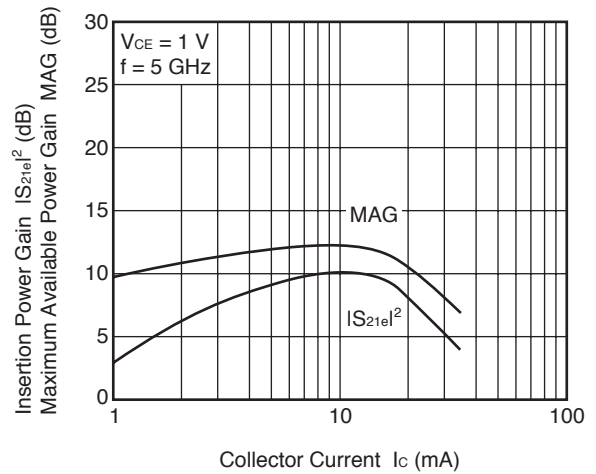
INSERTION POWER GAIN, MAG, MSG vs. COLLECTOR CURRENT



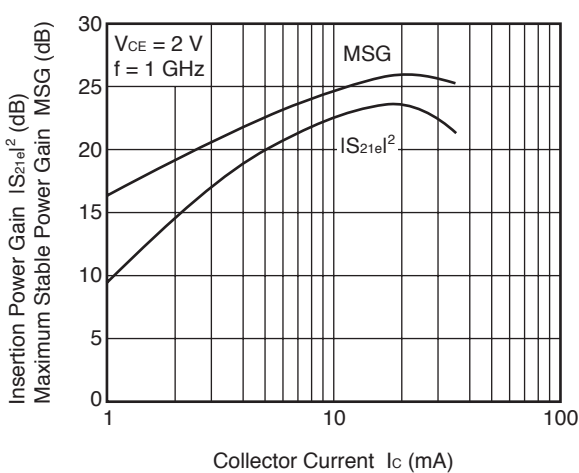
INSERTION POWER GAIN, MAG, MSG vs. COLLECTOR CURRENT



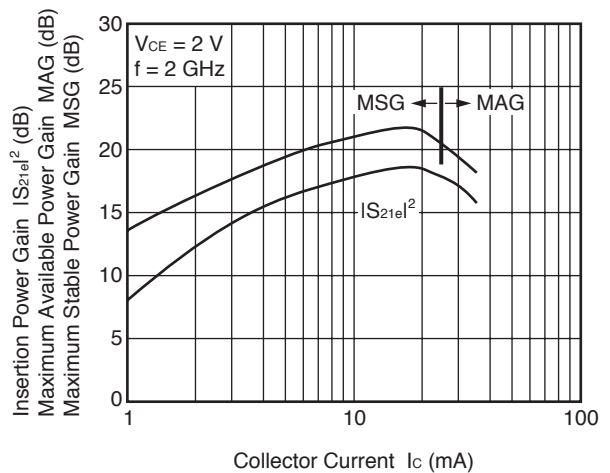
INSERTION POWER GAIN, MAG, MSG vs. COLLECTOR CURRENT



INSERTION POWER GAIN, MSG vs. COLLECTOR CURRENT

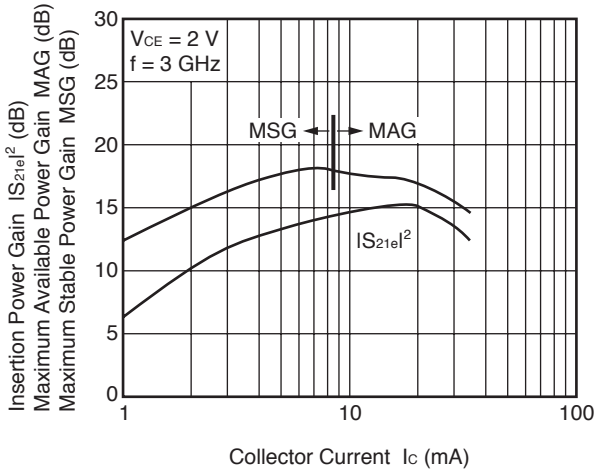


INSERTION POWER GAIN, MAG, MSG vs. COLLECTOR CURRENT

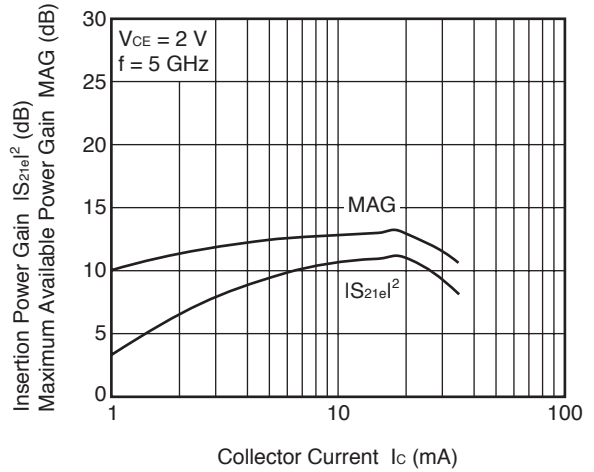


**Remark** The graph indicates nominal characteristics.

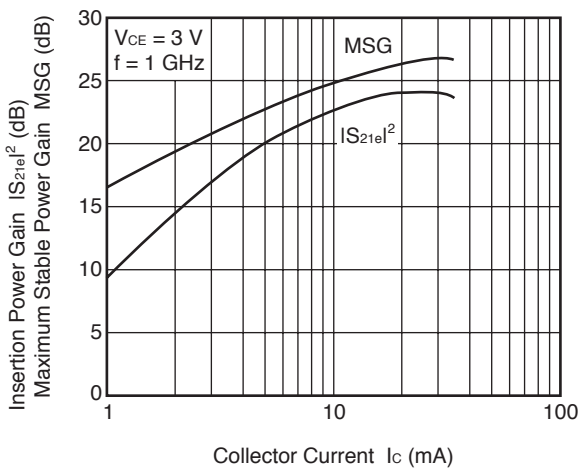
INSERTION POWER GAIN, MAG, MSG  
vs. COLLECTOR CURRENT



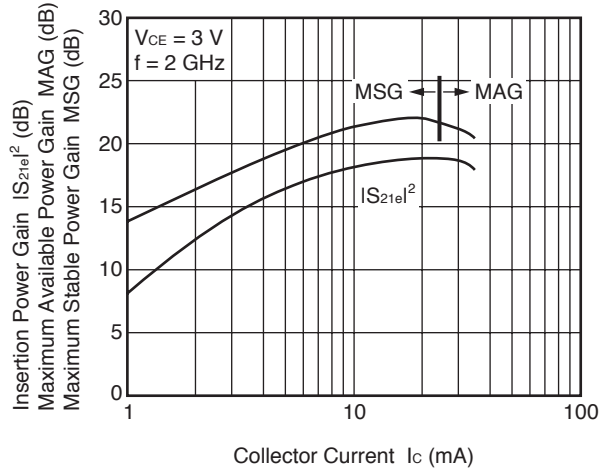
INSERTION POWER GAIN, MAG  
vs. COLLECTOR CURRENT



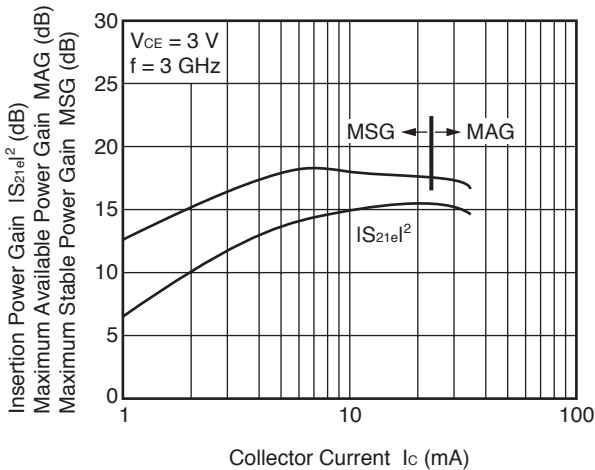
INSERTION POWER GAIN, MSG  
vs. COLLECTOR CURRENT



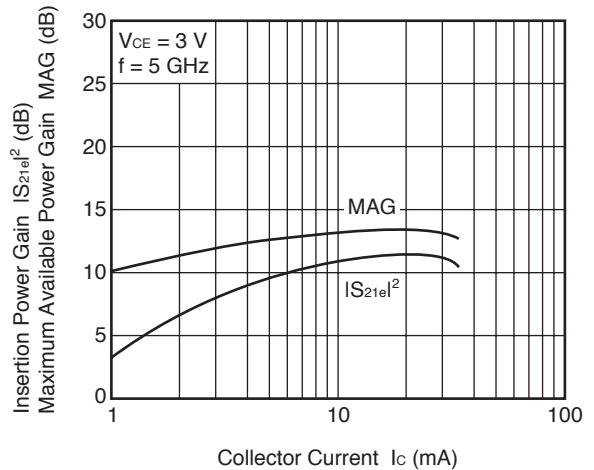
INSERTION POWER GAIN, MAG, MSG  
vs. COLLECTOR CURRENT



INSERTION POWER GAIN, MAG, MSG  
vs. COLLECTOR CURRENT



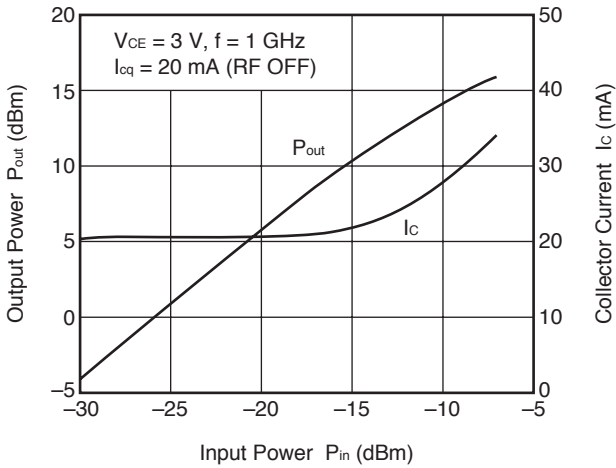
INSERTION POWER GAIN, MAG  
vs. COLLECTOR CURRENT



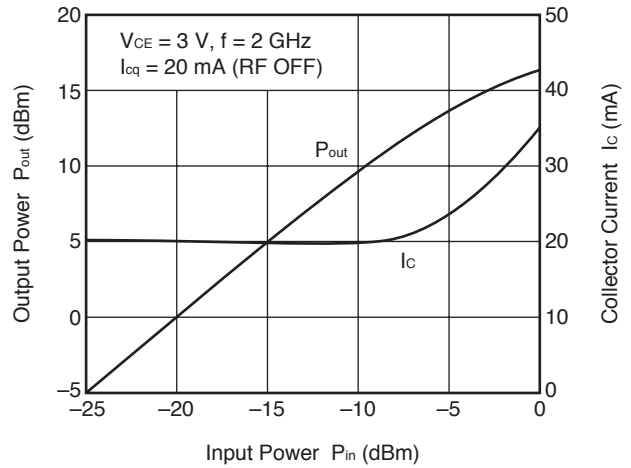
**Remark** The graph indicates nominal characteristics.



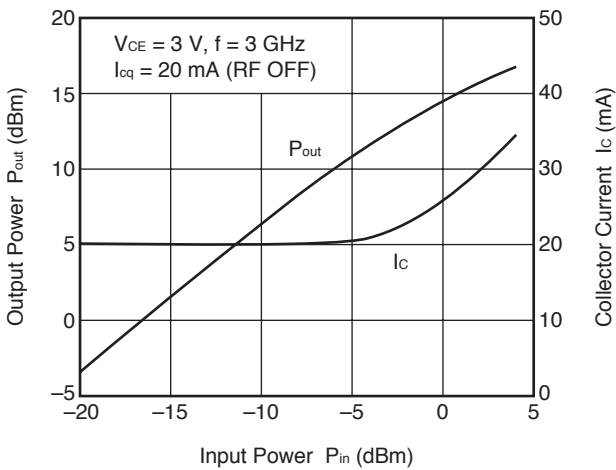
OUTPUT POWER, COLLECTOR CURRENT vs. INPUT POWER



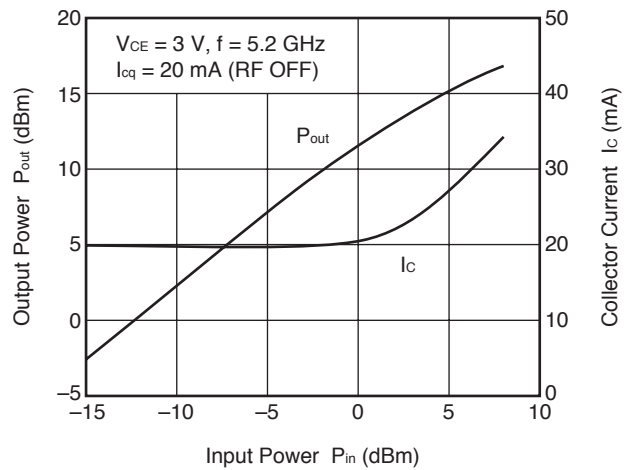
OUTPUT POWER, COLLECTOR CURRENT vs. INPUT POWER



OUTPUT POWER, COLLECTOR CURRENT vs. INPUT POWER

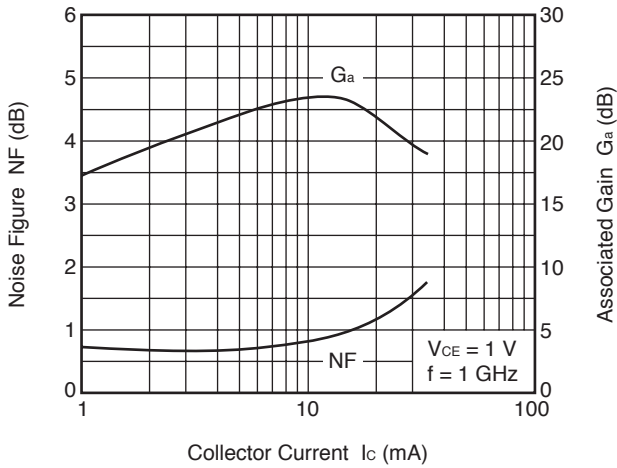


OUTPUT POWER, COLLECTOR CURRENT vs. INPUT POWER

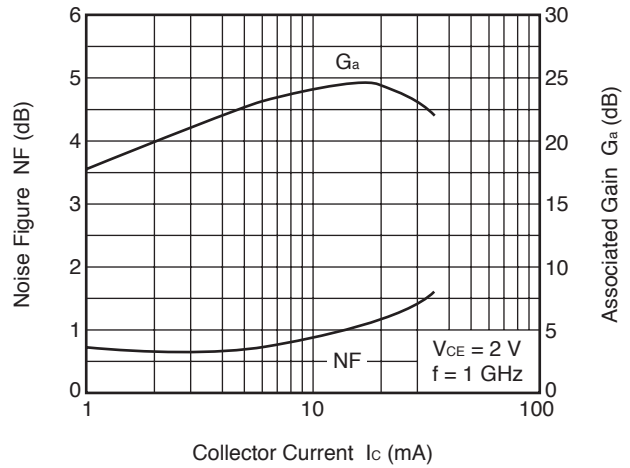


**Remark** The graph indicates nominal characteristics.

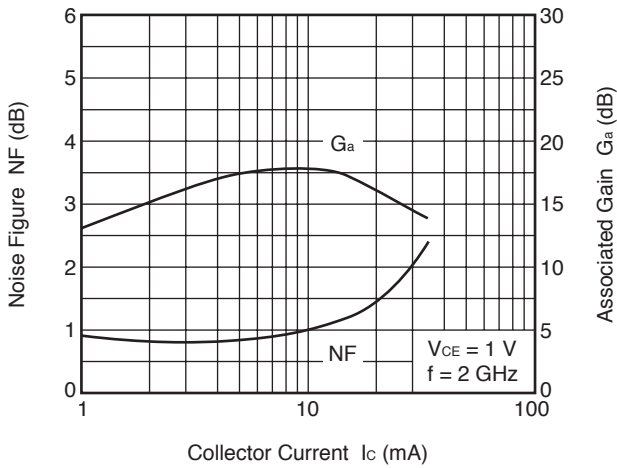
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



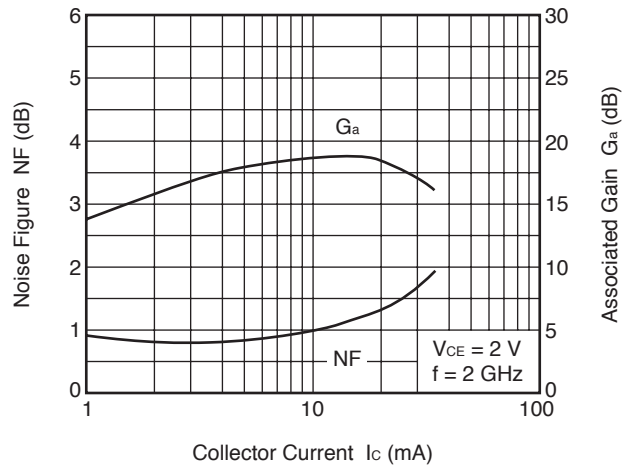
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



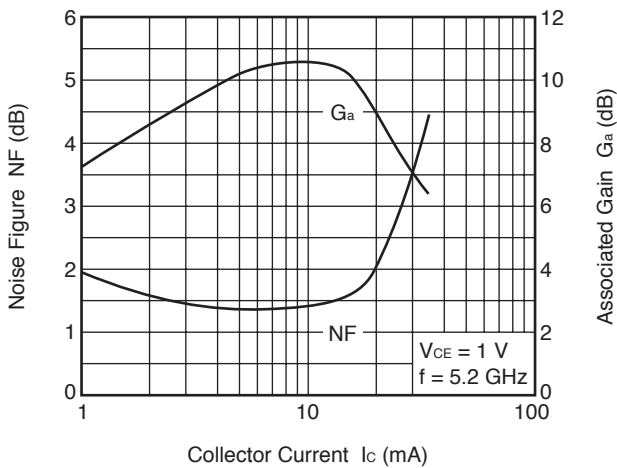
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



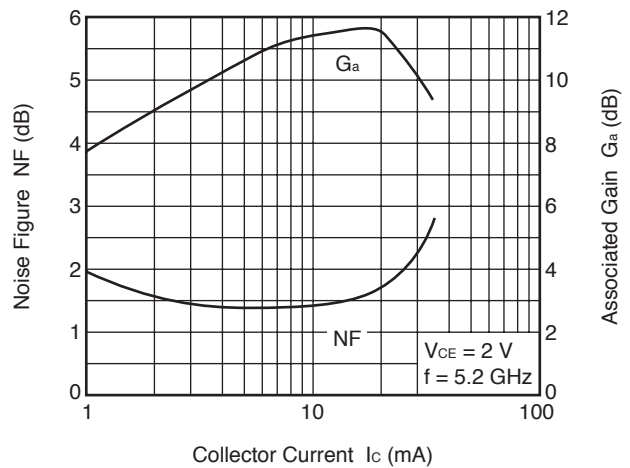
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT

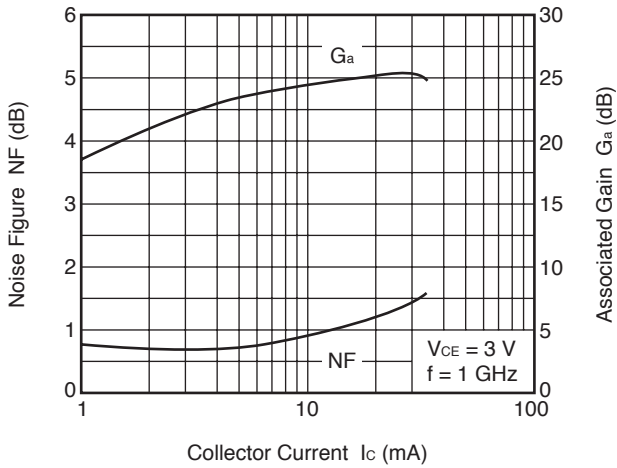


NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT

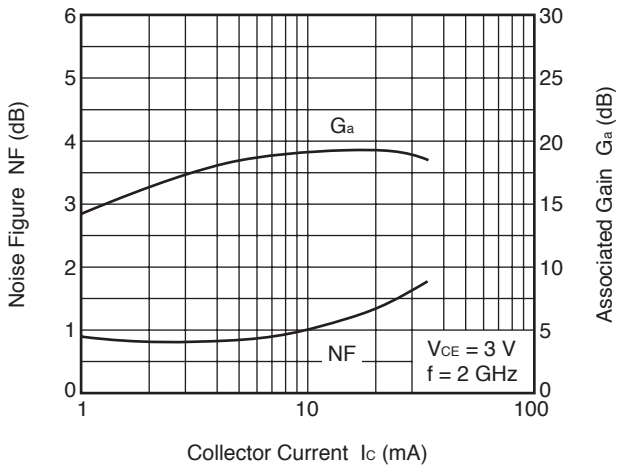


**Remark** The graph indicates nominal characteristics.

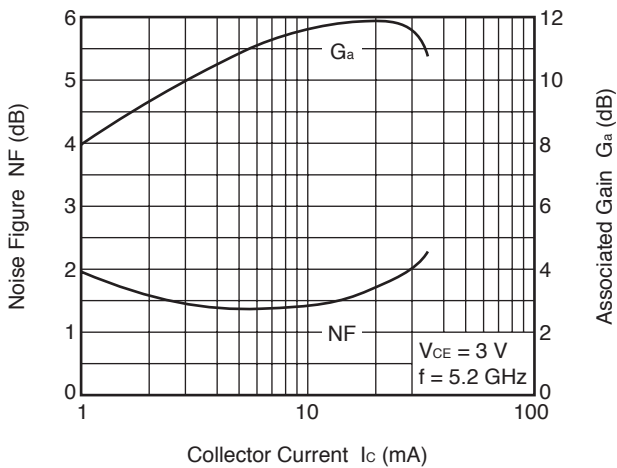
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



**Remark** The graphs indicate nominal characteristics.

## S-PARAMETERS

<R> S-parameters and noise parameters are provided on our web site in a form (S2P) that enables direct import of the parameters to microwave circuit simulators without the need for keyboard inputs.

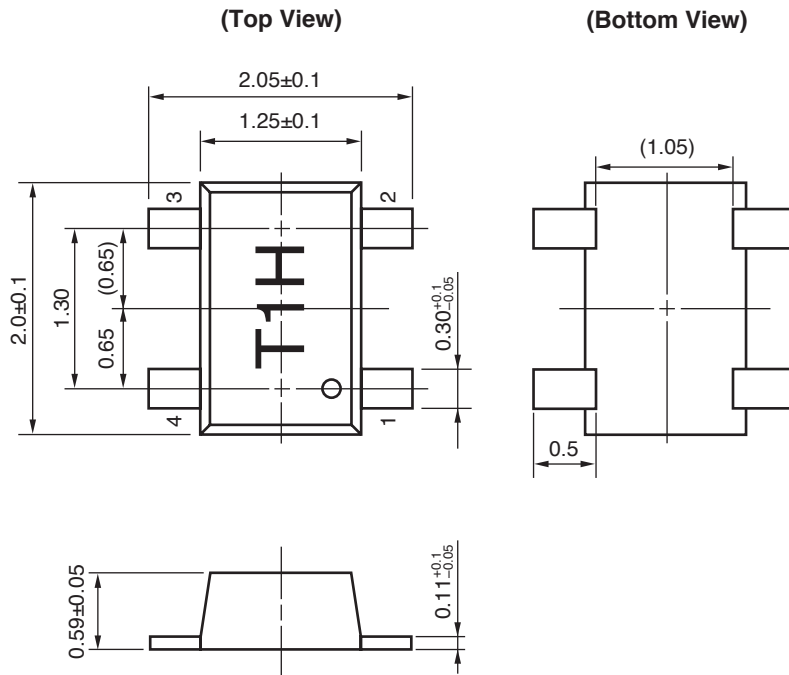
Click here to download S-parameters.

[Products] → [RF Devices] → [Device Parameters]

URL <http://www.renesas.com/products/microwave/>

**PACKAGE DIMENSIONS**

<R> **FLAT-LEAD 4-PIN THIN-TYPE SUPER MINIMOLD (M05, 2012 PKG) (UNIT: mm)**



**PIN CONNENTION**

- 1. Base
- 2. Emitter
- 3. Collector
- 4. Emitter

**Remark** ( ) : Reference value



<b>Revision History</b>	<b>NESG2031M05 Data Sheet</b>
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Rev.	Date	Description	
		Page	Summary
-	Sep 2004	-	Previous No. : PU10189EJ03V0DS
4.00	Jun 20, 2012	p.1	Modification of <b>ORDERING INFORMATION</b>
		p.2	Modification of <b>ELECTRICAL CHARACTERISTICS</b>
			Modification of <b>h<sub>FE</sub> CLASSIFICATION</b>
		p.11	Modification of <b>S-PARAMETERS</b>
		p.12	Modification of <b>PACKAGE DIMENSIONS</b>

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