

# NESG2101M05

## Data Sheet

NPN SiGe RF Transistor for Medium Output Power Amplification (125 mW)  
 Flat-Lead 4-Pin Thin-Type Super Minimold (M05)

R09DS0036EJ0300  
 Rev. 3.00  
 Jun 20, 2012

### FEATURES

- The device is an ideal choice for medium output power, high-gain amplification and low distortion, low noise, high-gain amplification  
 $P_{O(1\text{ dB})} = 21\text{ dBm TYP. @ } V_{CE} = 3.6\text{ V, } I_{CQ} = 10\text{ mA, } f = 2\text{ GHz}$   
 $NF = 0.6\text{ dB TYP., } G_a = 19.0\text{ dB TYP. @ } V_{CE} = 2\text{ V, } I_C = 7\text{ mA, } f = 1\text{ GHz}$
- Maximum stable power gain: MSG = 17.0 dB TYP. @  $V_{CE} = 3\text{ V, } I_C = 50\text{ mA, } f = 2\text{ GHz}$
- High breakdown voltage technology for SiGe Tr. adopted:  $V_{CEO}$  (absolute maximum ratings) = 5.0 V
- Flat-lead 4-pin thin-type super minimold (M05) package

<R>

### ORDERING INFORMATION

| Part Number    | Order Number     | Package                                                            | Quantity          | Supplying Form                                                                                                                                                |
|----------------|------------------|--------------------------------------------------------------------|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| NESG2101M05    | NESG2101M05-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> |
| NESG2101M05-T1 | NESG2101M05-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 ( $T_A = +25^\circ\text{C}$ )

| Parameter                    | Symbol                    | Ratings     | Unit             |
|------------------------------|---------------------------|-------------|------------------|
| Collector to Base Voltage    | $V_{CBO}$                 | 13.0        | V                |
| Collector to Emitter Voltage | $V_{CEO}$                 | 5.0         | V                |
| Emitter to Base Voltage      | $V_{EBO}$                 | 1.5         | V                |
| Collector Current            | $I_C$                     | 100         | mA               |
| Total Power Dissipation      | $P_{tot}$ <sup>Note</sup> | 500         | mW               |
| Junction Temperature         | $T_j$                     | 150         | $^\circ\text{C}$ |
| Storage Temperature          | $T_{stg}$                 | -65 to +150 | $^\circ\text{C}$ |

Note: Mounted on  $38\text{ cm}^2 \times 0.4\text{ mm}$  (t) polyimide 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> = 50 mA, f = 2 GHz                                                                             | 14   | 17   | –    | GHz  |
| Insertion Power Gain               | S <sub>21e</sub> <sup>2</sup>     | V <sub>CE</sub> = 3 V, I <sub>C</sub> = 50 mA, f = 2 GHz                                                                             | 11.5 | 13.5 | –    | dB   |
| Noise Figure (1)                   | NF                                | V <sub>CE</sub> = 2 V, I <sub>C</sub> = 10 mA, f = 2 GHz,<br>Z <sub>S</sub> = Z <sub>Sopt</sub> , Z <sub>L</sub> = Z <sub>Lopt</sub> | –    | 0.9  | 1.2  | dB   |
| Noise Figure (2)                   | NF                                | V <sub>CE</sub> = 2 V, I <sub>C</sub> = 7 mA, f = 1 GHz,<br>Z <sub>S</sub> = Z <sub>Sopt</sub> , Z <sub>L</sub> = Z <sub>Lopt</sub>  | –    | 0.6  | –    | dB   |
| Associated Gain (1)                | G <sub>a</sub>                    | V <sub>CE</sub> = 2 V, I <sub>C</sub> = 10 mA, f = 2 GHz,<br>Z <sub>S</sub> = Z <sub>Sopt</sub> , Z <sub>L</sub> = Z <sub>Lopt</sub> | 11.0 | 13.0 | –    | dB   |
| Associated Gain (2)                | G <sub>a</sub>                    | V <sub>CE</sub> = 2 V, I <sub>C</sub> = 7 mA, f = 1 GHz,<br>Z <sub>S</sub> = Z <sub>Sopt</sub> , Z <sub>L</sub> = Z <sub>Lopt</sub>  | –    | 19.0 | –    | 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                                                                                 | –    | 0.4  | 0.5  | pF   |
| Maximum Stable Power Gain          | MSG <sup>Note 3</sup>             | V <sub>CE</sub> = 3 V, I <sub>C</sub> = 50 mA, f = 2 GHz                                                                             | 14.5 | 17.0 | –    | dB   |
| Gain 1 dB Compression Output Power | P <sub>O</sub> (1 dB)             | V <sub>CE</sub> = 3.6 V, I <sub>Cq</sub> = 10 mA, f = 2 GHz                                                                          | –    | 21   | –    | dBm  |
| Linear Gain                        | G <sub>L</sub>                    | V <sub>CE</sub> = 3.6 V, I <sub>Cq</sub> = 10 mA, f = 2 GHz                                                                          | –    | 15   | –    | dB   |

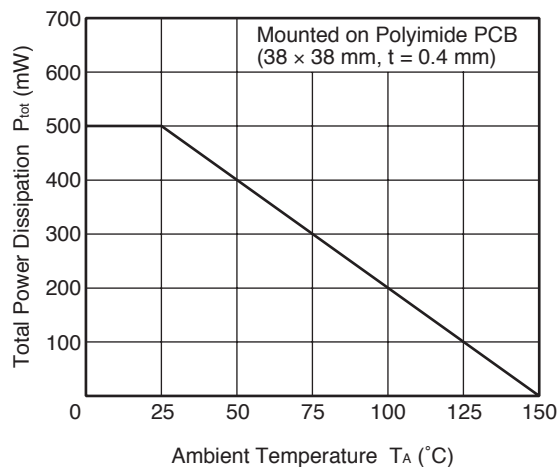
- Notes 1. Pulse measurement: PW ≤ 350 μs, Duty Cycle ≤ 2%
2. Collector to base capacitance when the emitter grounded
3.  $MSG = \left| \frac{S_{21}}{S_{12}} \right|$

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

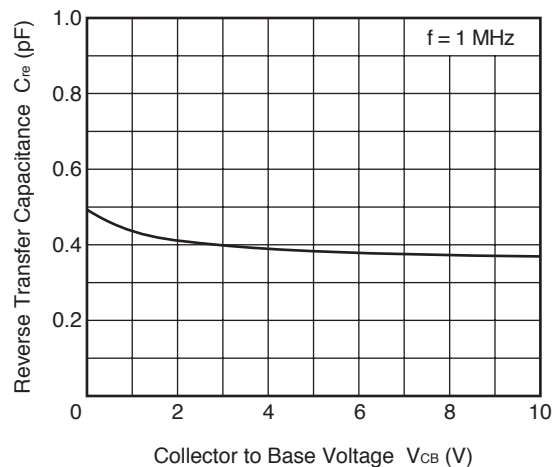
|                       |            |
|-----------------------|------------|
| Rank                  | FB/YFB     |
| Marking               | T1J        |
| h <sub>FE</sub> Value | 130 to 260 |

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

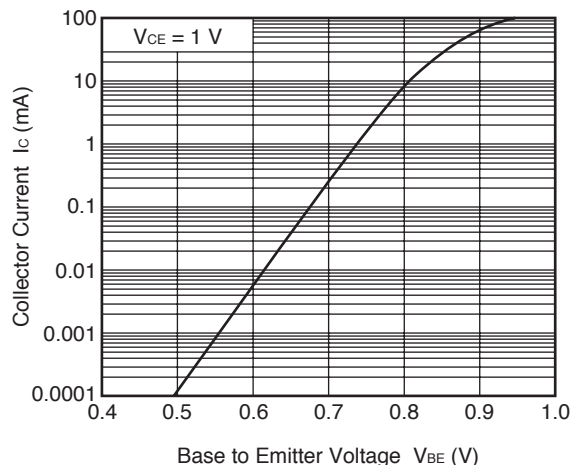
TOTAL POWER DISSIPATION  
vs. AMBIENT TEMPERATURE



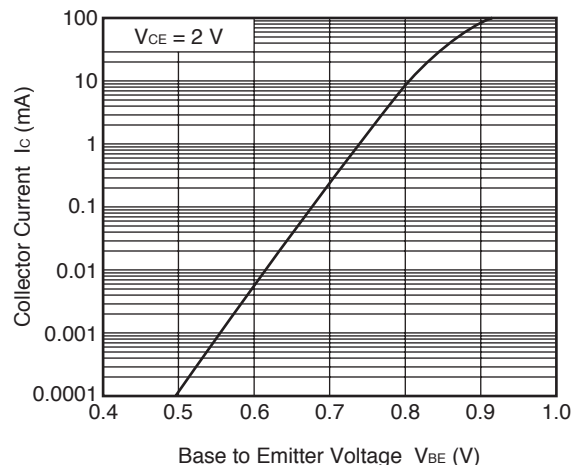
REVERSE TRANSFER CAPACITANCE  
vs. COLLECTOR TO BASE VOLTAGE



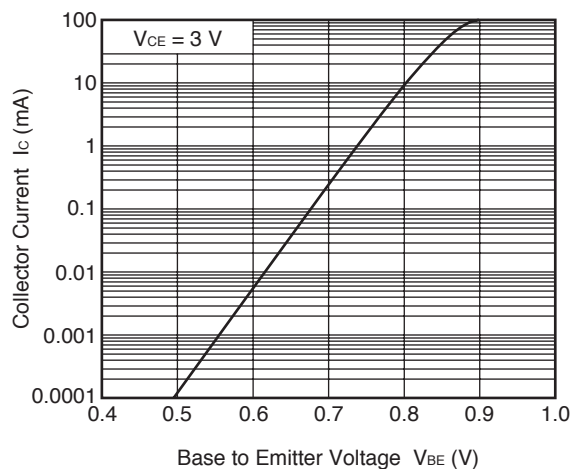
COLLECTOR CURRENT vs.  
BASE TO EMITTER VOLTAGE



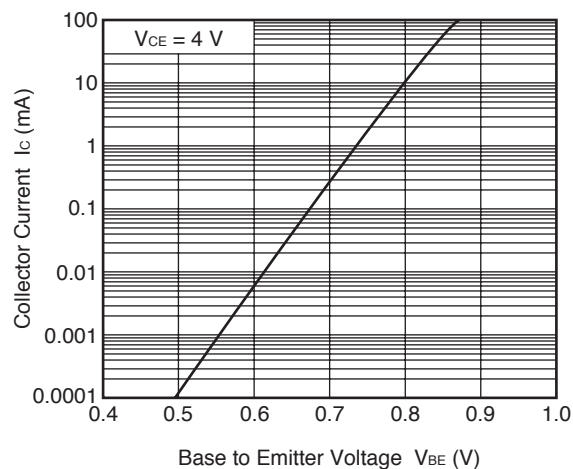
COLLECTOR CURRENT vs.  
BASE TO EMITTER VOLTAGE



COLLECTOR CURRENT vs.  
BASE TO EMITTER VOLTAGE

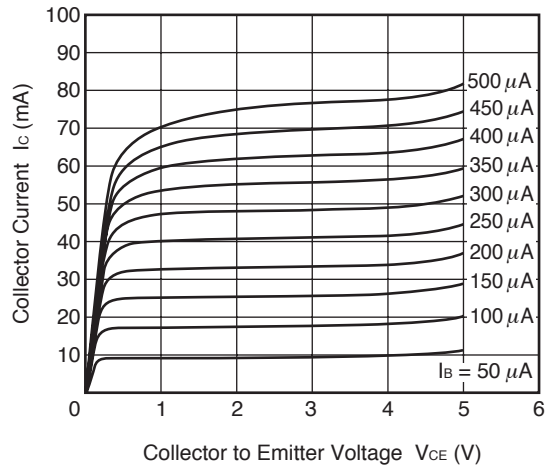


COLLECTOR CURRENT vs.  
BASE TO EMITTER VOLTAGE

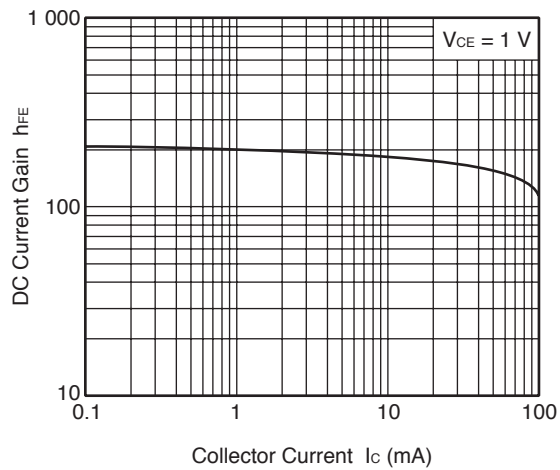


**Remark** The graph indicates nominal characteristics.

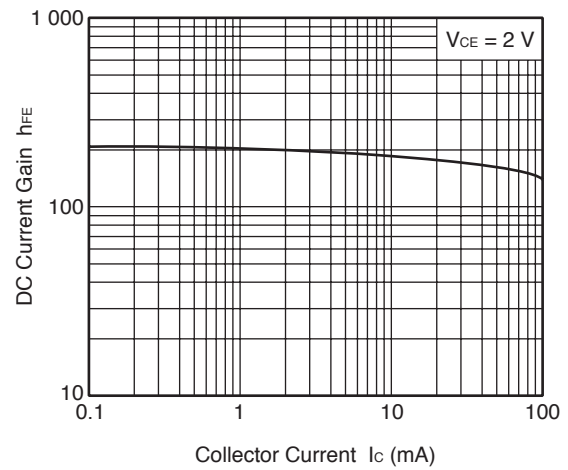
COLLECTOR CURRENT vs.  
COLLECTOR TO EMITTER VOLTAGE



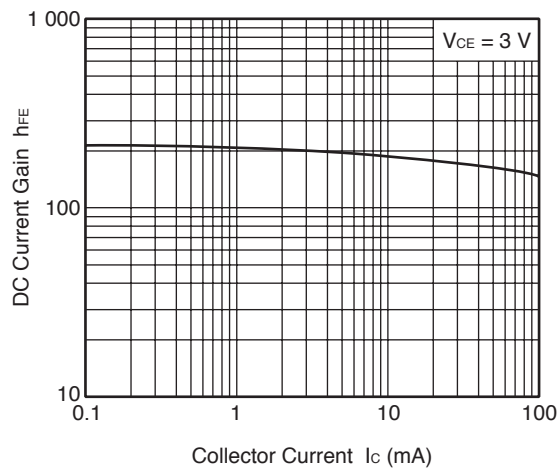
DC CURRENT GAIN vs.  
COLLECTOR CURRENT



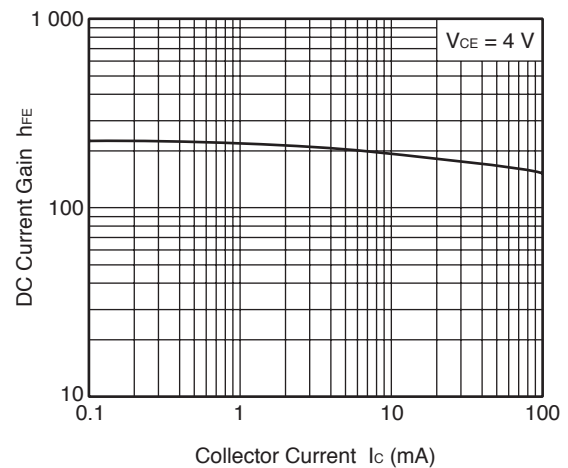
DC CURRENT GAIN vs.  
COLLECTOR CURRENT



DC CURRENT GAIN vs.  
COLLECTOR CURRENT

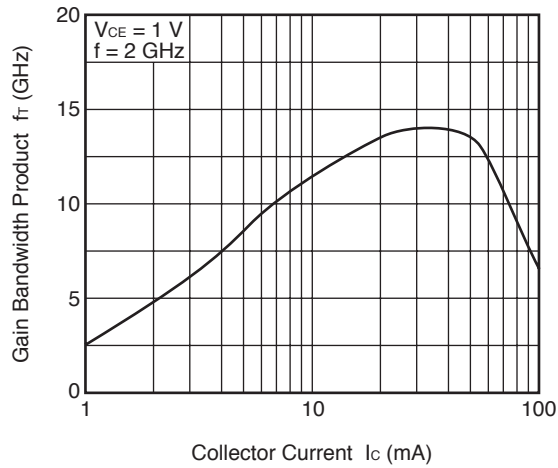


DC CURRENT GAIN vs.  
COLLECTOR CURRENT

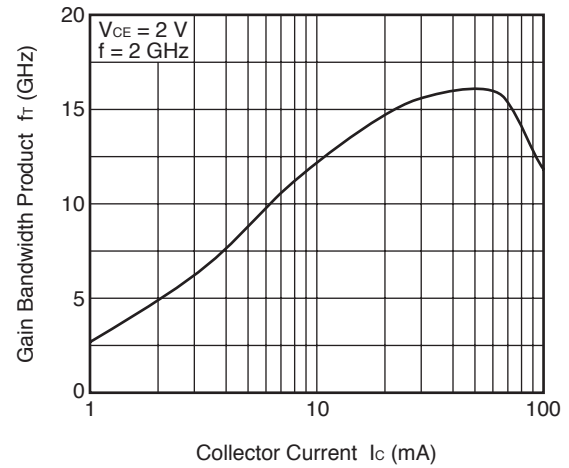


**Remark** The graph indicates nominal characteristics.

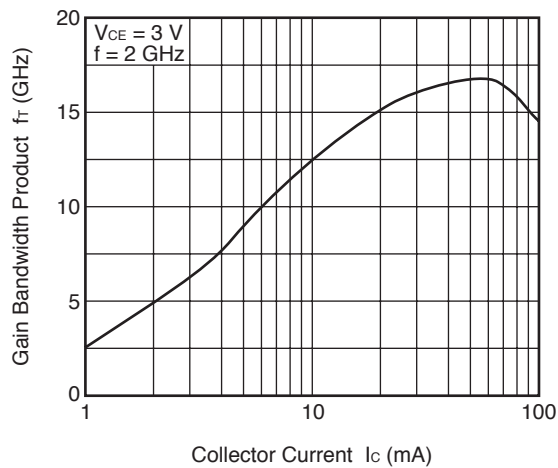
GAIN BANDWIDTH PRODUCT  
vs. COLLECTOR CURRENT



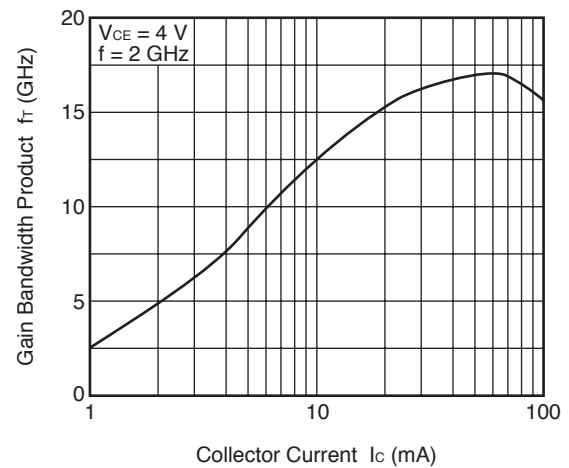
GAIN BANDWIDTH PRODUCT  
vs. COLLECTOR CURRENT



GAIN BANDWIDTH PRODUCT  
vs. COLLECTOR CURRENT

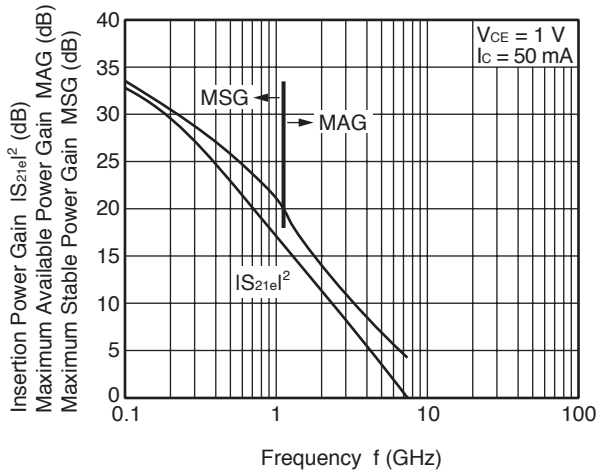


GAIN BANDWIDTH PRODUCT  
vs. COLLECTOR CURRENT

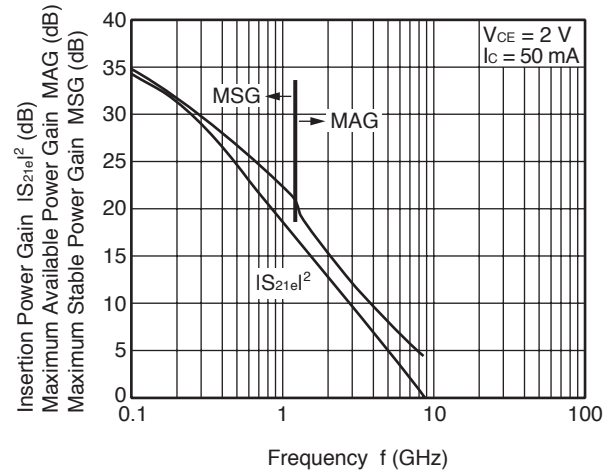


**Remark** The graph indicates nominal characteristics.

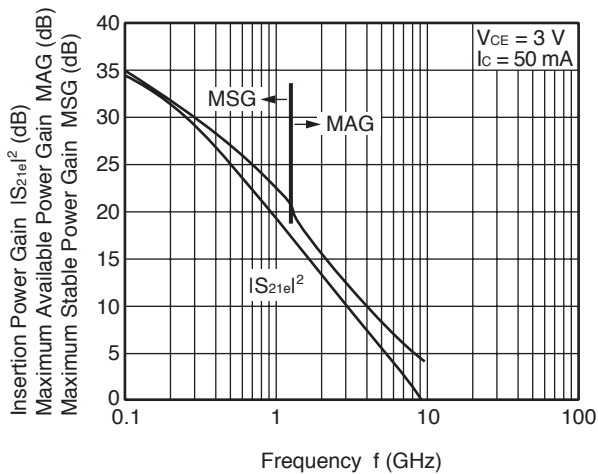
INSERTION POWER GAIN,  
MAG, MSG vs. FREQUENCY



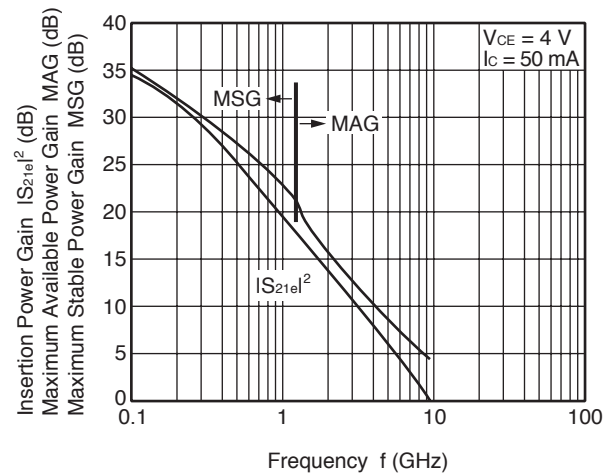
INSERTION POWER GAIN,  
MAG, MSG vs. FREQUENCY



INSERTION POWER GAIN,  
MAG, MSG vs. FREQUENCY

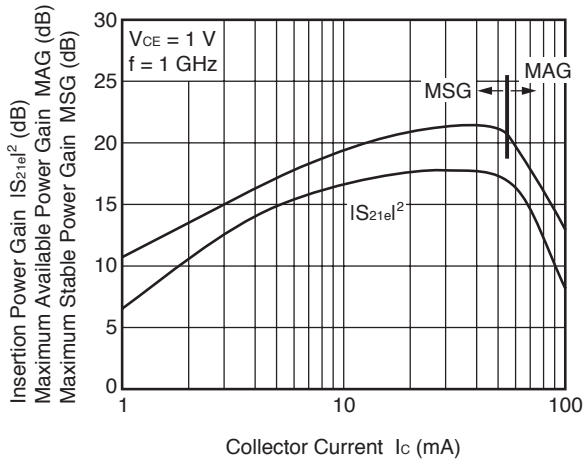


INSERTION POWER GAIN,  
MAG, MSG vs. FREQUENCY

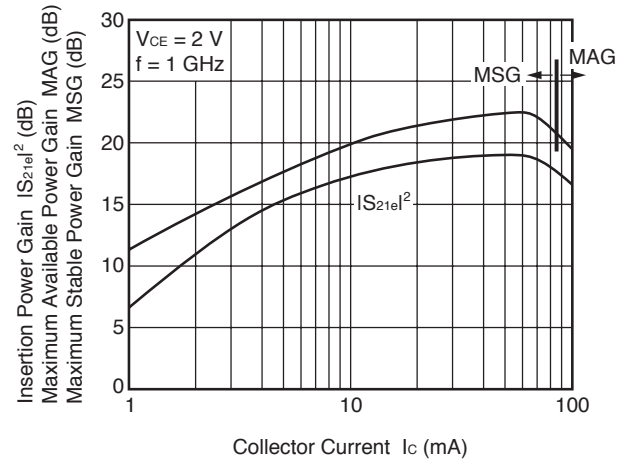


**Remark** The graph indicates nominal characteristics.

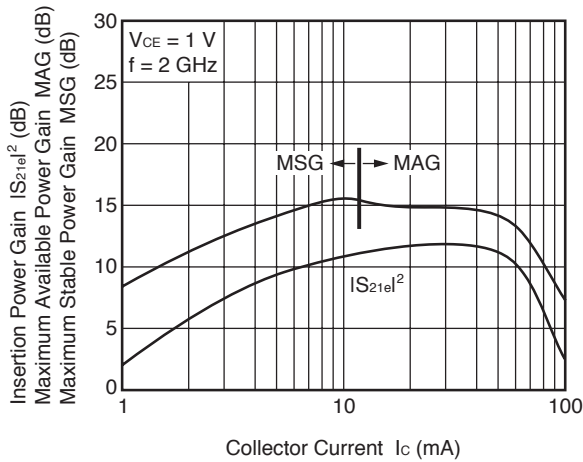
INSERTION POWER GAIN, MAG, MSG  
vs. COLLECTOR CURRENT



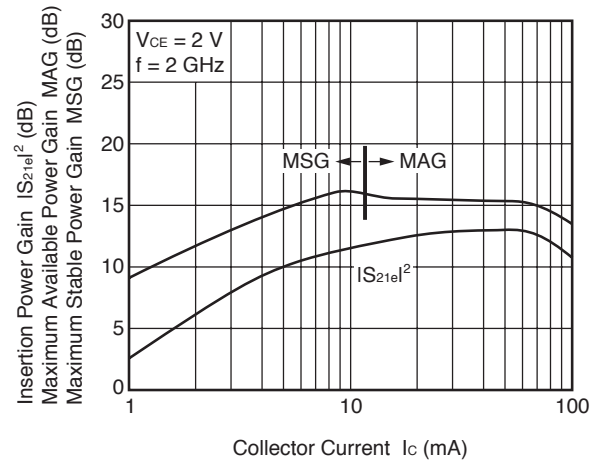
INSERTION POWER GAIN, MAG, MSG  
vs. COLLECTOR CURRENT



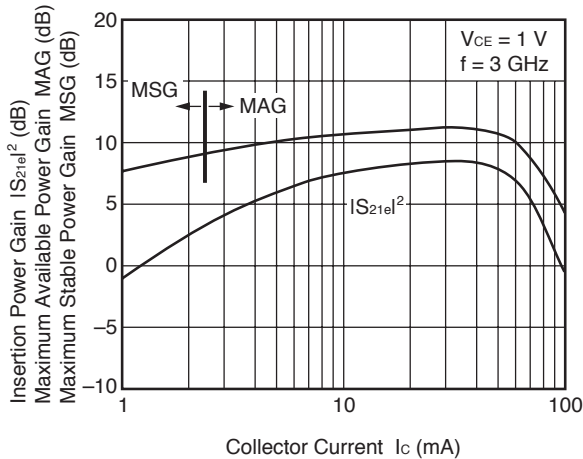
INSERTION POWER GAIN, MAG, MSG  
vs. COLLECTOR CURRENT



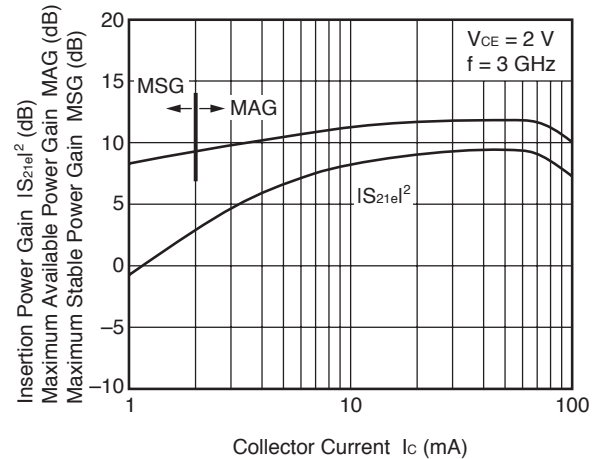
INSERTION POWER GAIN, MAG, MSG  
vs. COLLECTOR CURRENT



INSERTION POWER GAIN, MAG, MSG  
vs. COLLECTOR CURRENT

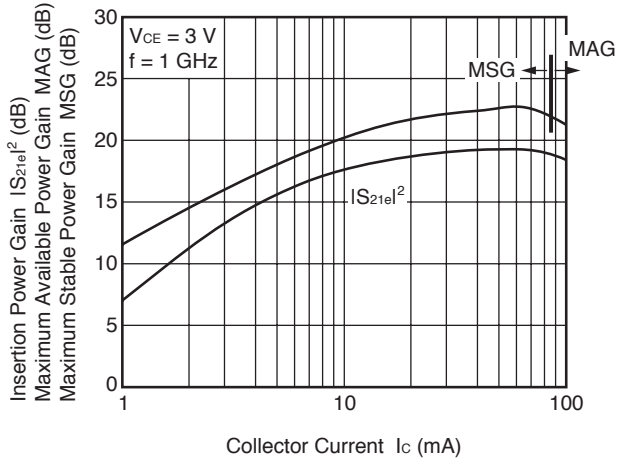


INSERTION POWER GAIN, MAG, MSG  
vs. COLLECTOR CURRENT

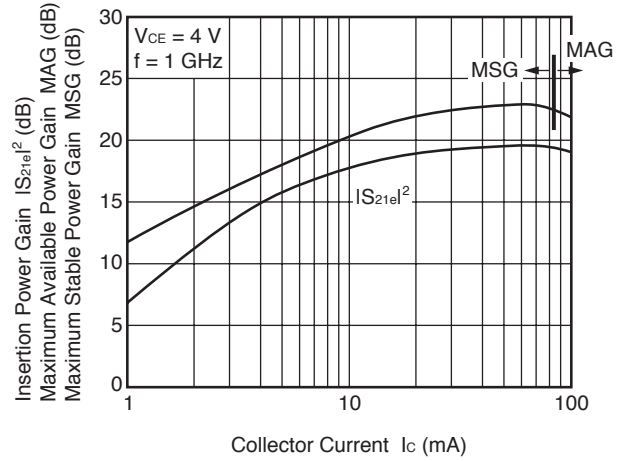


**Remark** The graph indicates nominal characteristics.

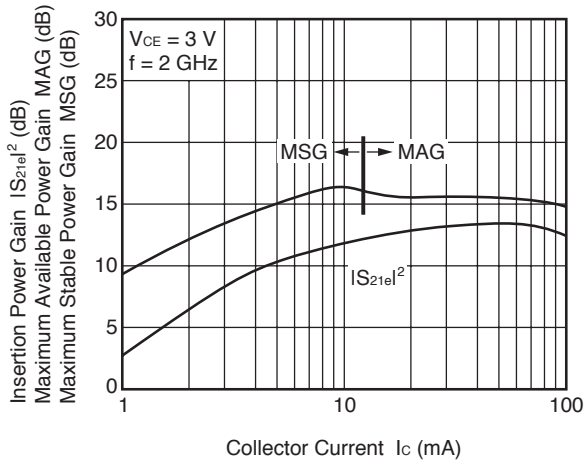
INSERTION POWER GAIN, MAG, MSG  
vs. COLLECTOR CURRENT



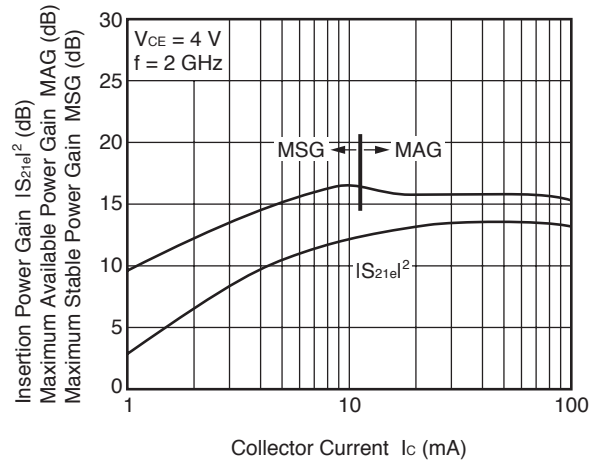
INSERTION POWER GAIN, MAG, MSG  
vs. COLLECTOR CURRENT



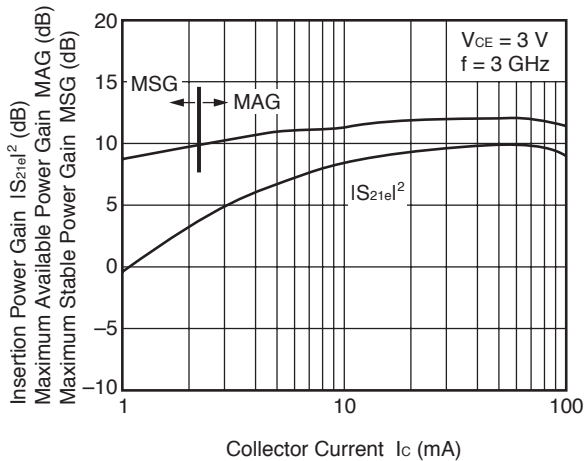
INSERTION POWER GAIN, MAG, MSG  
vs. COLLECTOR CURRENT



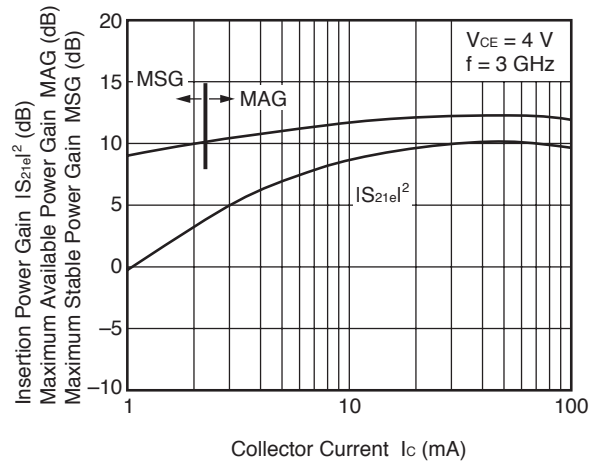
INSERTION POWER GAIN, MAG, MSG  
vs. COLLECTOR CURRENT



INSERTION POWER GAIN, MAG, MSG  
vs. COLLECTOR CURRENT



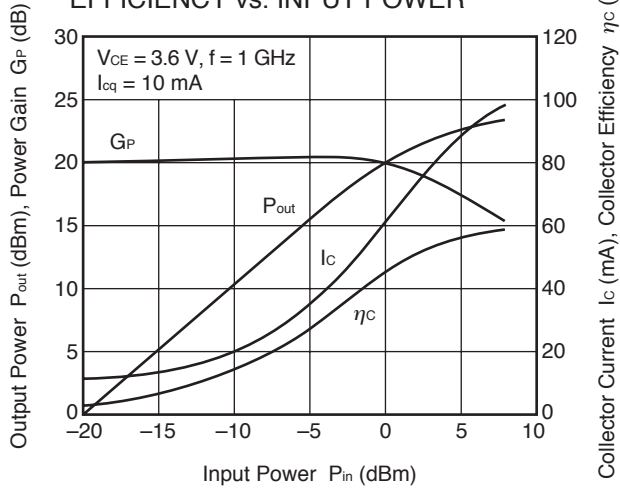
INSERTION POWER GAIN, MAG, MSG  
vs. COLLECTOR CURRENT



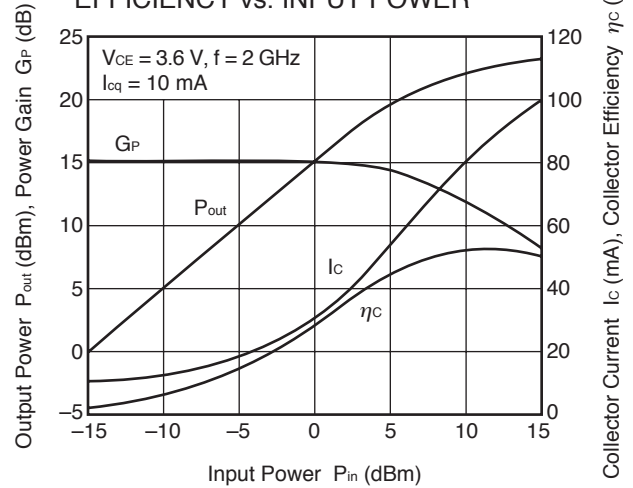
**Remark** The graph indicates nominal characteristics.



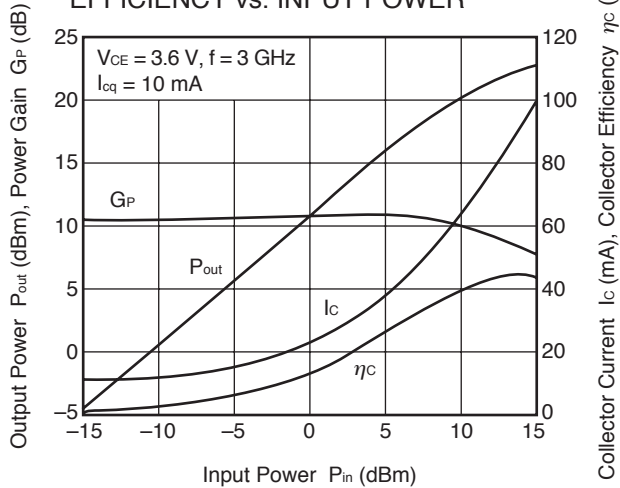
OUTPUT POWER, POWER GAIN,  
COLLECTOR CURRENT, COLLECTOR  
EFFICIENCY vs. INPUT POWER



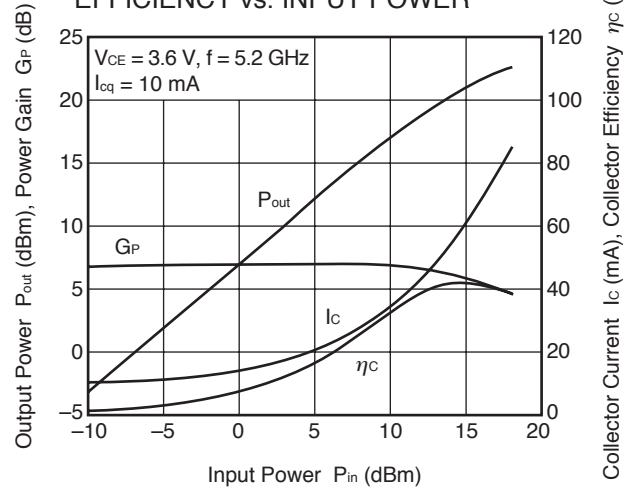
OUTPUT POWER, POWER GAIN,  
COLLECTOR CURRENT, COLLECTOR  
EFFICIENCY vs. INPUT POWER



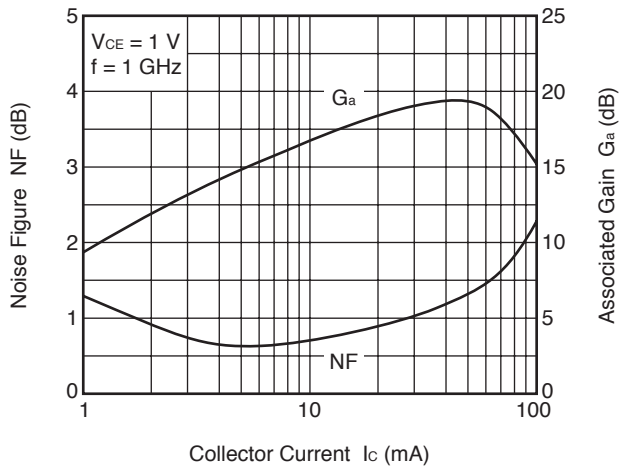
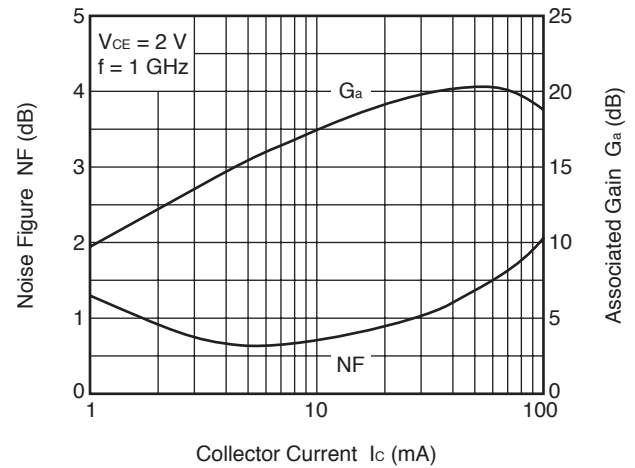
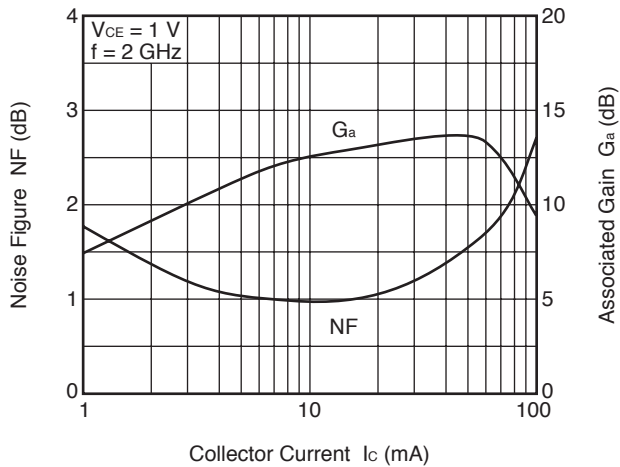
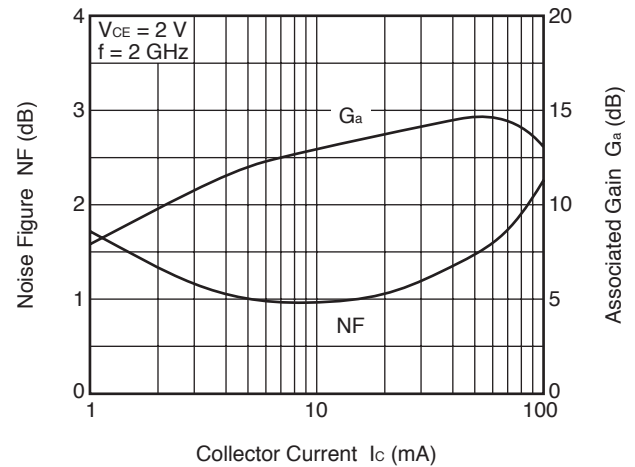
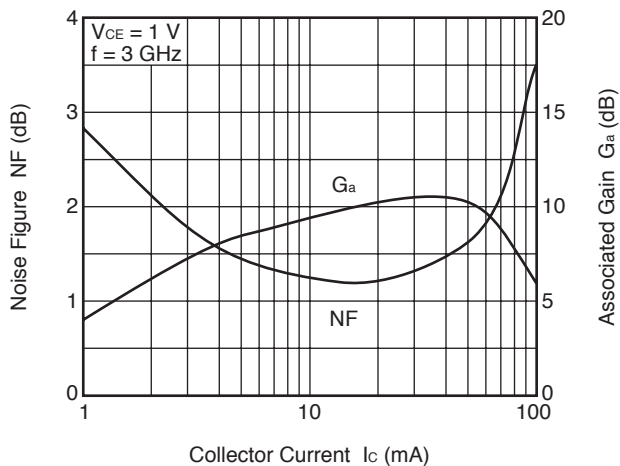
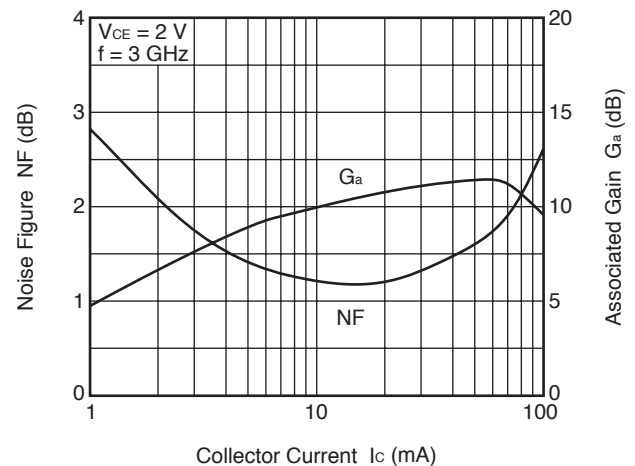
OUTPUT POWER, POWER GAIN,  
COLLECTOR CURRENT, COLLECTOR  
EFFICIENCY vs. INPUT POWER



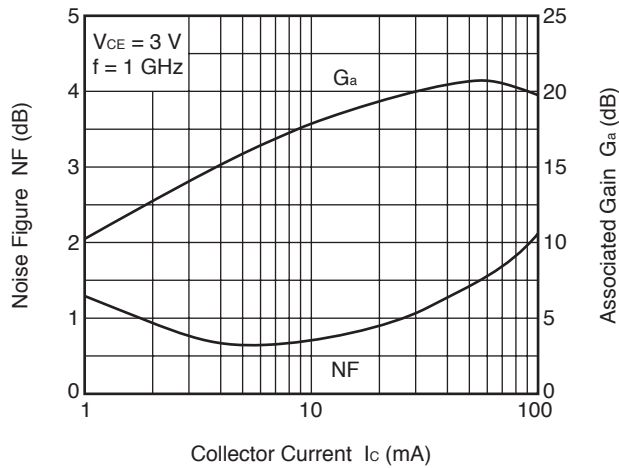
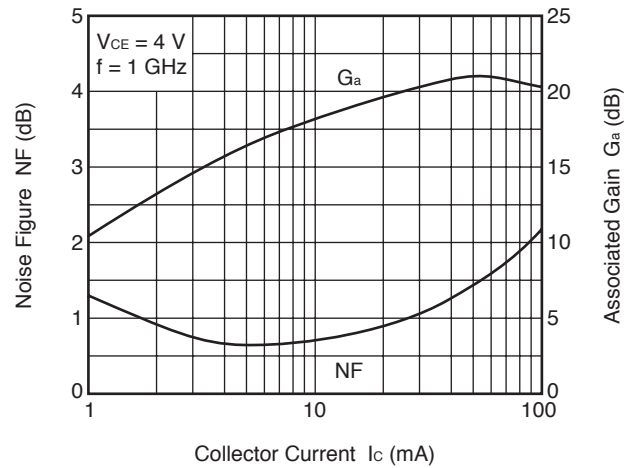
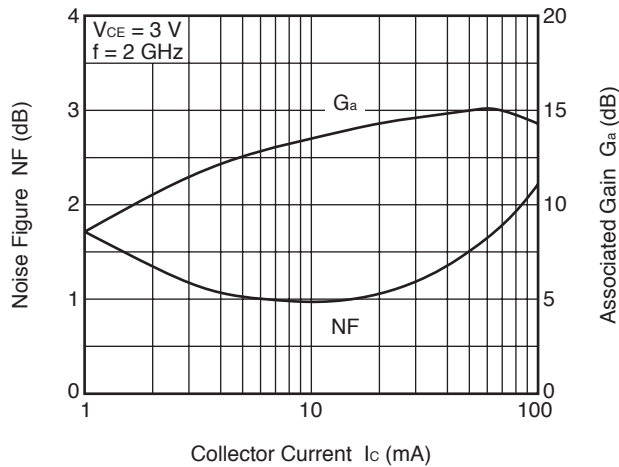
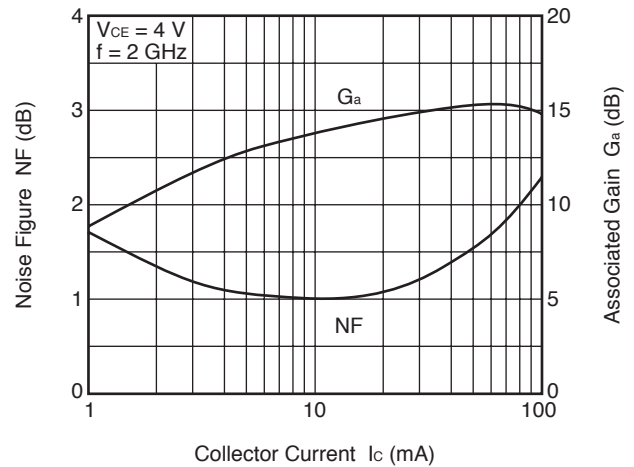
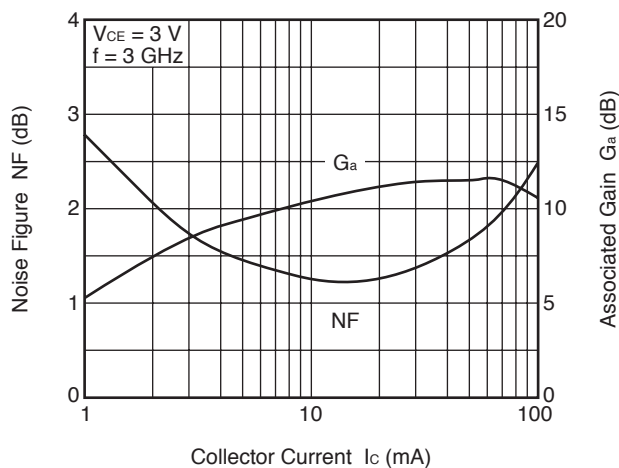
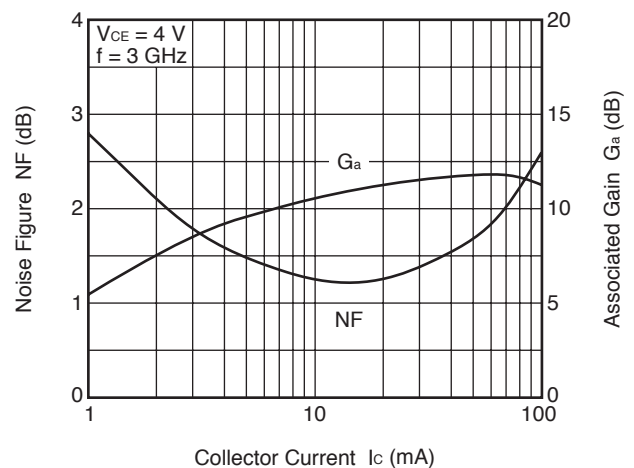
OUTPUT POWER, POWER GAIN,  
COLLECTOR CURRENT, COLLECTOR  
EFFICIENCY vs. INPUT POWER



**Remark** The graph indicates nominal characteristics.

NOISE FIGURE, ASSOCIATED GAIN  
vs. COLLECTOR CURRENTNOISE FIGURE, ASSOCIATED GAIN  
vs. COLLECTOR CURRENTNOISE FIGURE, ASSOCIATED GAIN  
vs. COLLECTOR CURRENTNOISE FIGURE, ASSOCIATED GAIN  
vs. COLLECTOR CURRENTNOISE FIGURE, ASSOCIATED GAIN  
vs. COLLECTOR CURRENTNOISE FIGURE, ASSOCIATED GAIN  
vs. COLLECTOR CURRENT

**Remark** The graphs indicate nominal characteristics.

NOISE FIGURE, ASSOCIATED GAIN  
vs. COLLECTOR CURRENTNOISE FIGURE, ASSOCIATED GAIN  
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vs. COLLECTOR CURRENTNOISE FIGURE, ASSOCIATED GAIN  
vs. COLLECTOR CURRENT

**Remark** The graphs indicate nominal characteristics.

**<R> S-PARAMETERS**

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.

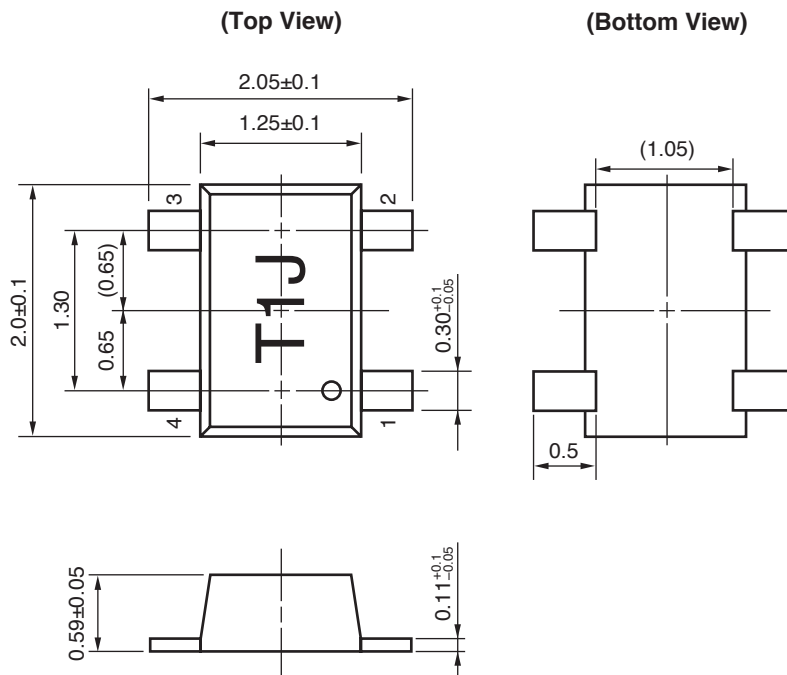
Click here to download S-parameters.

[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>NESG2101M05 Data Sheet</b> |
|-------------------------|-------------------------------|

| Rev. | Date         | Description |                                                      |
|------|--------------|-------------|------------------------------------------------------|
|      |              | Page        | Summary                                              |
| –    | Mar 2003     | –           | Previous No. : PU10190EJ02V0DS                       |
| 3.00 | 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.12        | Modification of <b>S-PARAMETERS</b>                  |
|      |              | p.13        | Modification of <b>PACKAGE DIMENSIONS</b>            |

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