

To our customers,

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## Old Company Name in Catalogs and Other Documents

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On April 1<sup>st</sup>, 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 1<sup>st</sup>, 2010  
Renesas Electronics Corporation

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

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# NPN SILICON RF TRANSISTOR

## NE661M05

### NPN SILICON RF TRANSISTOR FOR LOW CURRENT, LOW-NOISE, HIGH-GAIN AMPLIFICATION FLAT-LEAD 4-PIN THIN-TYPE SUPER MINIMOLD (M05)

#### FEATURES

- Low noise and high gain with low collector current  
NF = 1.2 dB TYP. @  $V_{CE} = 2\text{ V}$ ,  $I_C = 2\text{ mA}$ ,  $f = 2\text{ GHz}$
- Maximum stable power gain : MSG = 22.0 dB TYP. @  $V_{CE} = 2\text{ V}$ ,  $I_C = 5\text{ mA}$ ,  $f = 2\text{ GHz}$
- $f_T = 25\text{ GHz}$  technology
- Flat-lead 4-pin thin-type super minimold (M05) package

#### ORDERING INFORMATION

| Part Number | Quantity          | Supplying Form                                                                                                                                                    |
|-------------|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| NE661M05    | 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> |
| NE661M05-T1 | 3 kpcs/reel       |                                                                                                                                                                   |

**Remark** To order evaluation samples, 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    | $V_{CBO}$                 | 15          | V                |
| Collector to Emitter Voltage | $V_{CEO}$                 | 3.3         | V                |
| Emitter to Base Voltage      | $V_{EBO}$                 | 1.5         | V                |
| Collector Current            | $I_C$                     | 12          | mA               |
| Total Power Dissipation      | $P_{tot}$ <sup>Note</sup> | 39          | mW               |
| Junction Temperature         | $T_j$                     | 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.

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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 mA                                                  | –    | –    | 100  | nA   |
| Emitter Cut-off Current                                     | I <sub>EBO</sub>                  | V <sub>EB</sub> = 1 V, I <sub>C</sub> = 0 mA                                                  | –    | –    | 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                                                  | 50   | 70   | 100  | –    |
| RF Characteristics                                          |                                   |                                                                                               |      |      |      |      |
| Gain Bandwidth Product                                      | f <sub>T</sub>                    | V <sub>CE</sub> = 3 V, I <sub>C</sub> = 10 mA, f = 2 GHz                                      | 20.0 | 25.0 | –    | GHz  |
| Insertion Power Gain                                        | S <sub>21e</sub>   <sup>2</sup>   | V <sub>CE</sub> = 2 V, I <sub>C</sub> = 5 mA, f = 2 GHz                                       | 14.0 | 17.0 | –    | dB   |
| Noise Figure                                                | NF                                | V <sub>CE</sub> = 2 V, I <sub>C</sub> = 2 mA, f = 2 GHz,<br>Z <sub>S</sub> = Z <sub>opt</sub> | –    | 1.2  | 1.5  | dB   |
| Reverse Transfer Capacitance                                | C <sub>re</sub> <sup>Note 2</sup> | V <sub>CB</sub> = 2 V, I <sub>E</sub> = 0 mA, f = 1 MHz                                       | –    | 0.08 | 0.12 | pF   |
| Maximum Stable Power Gain                                   | MSG <sup>Note 3</sup>             | V <sub>CE</sub> = 2 V, I <sub>C</sub> = 5 mA, f = 2 GHz                                       | –    | 22.0 | –    | dB   |
| Gain 1 dB Compression Output power                          | P <sub>O</sub> (1 dB)             | V <sub>CE</sub> = 2 V, I <sub>C</sub> = 5 mA, f = 2 GHz                                       | –    | 5.0  | –    | dBm  |
| 3rd Order Intermodulation Distortion Output Intercept Point | OIP <sub>3</sub>                  | V <sub>CB</sub> = 2 V, I <sub>C</sub> = 5 mA, f = 2 GHz                                       | –    | 15.0 | –    | dBm  |

**Notes 1.** Pulse measurement: PW ≤ 350 μs, Duty Cycle ≤ 2%

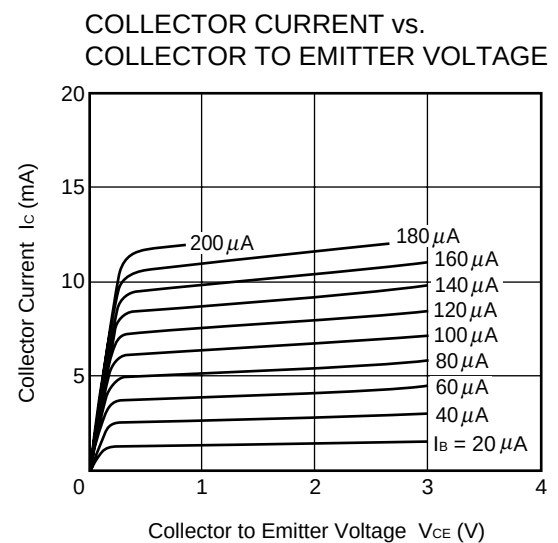
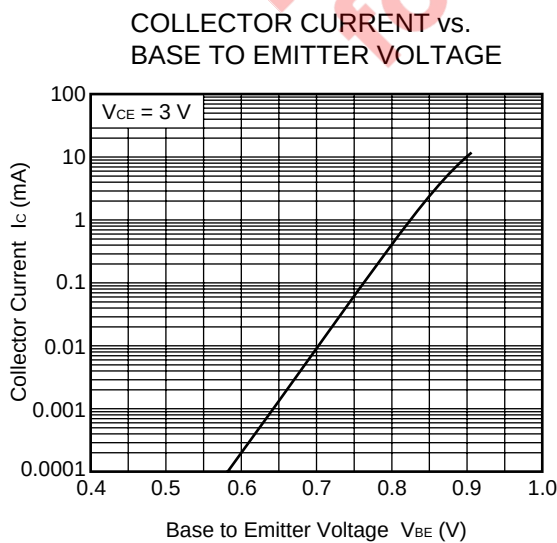
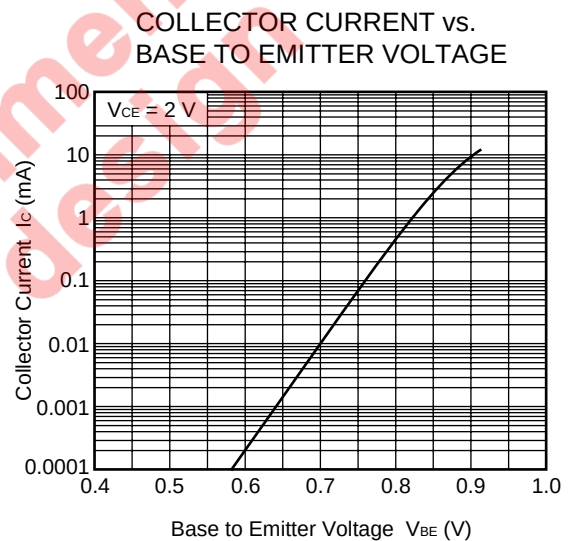
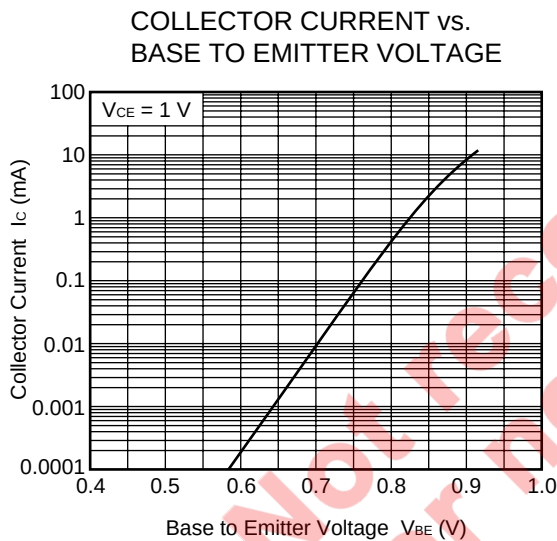
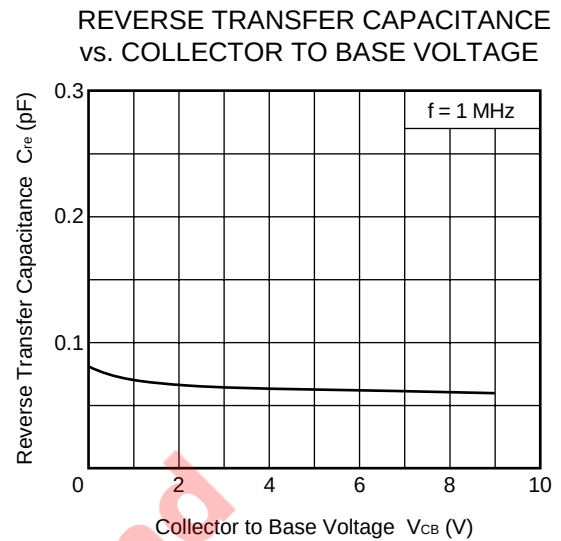
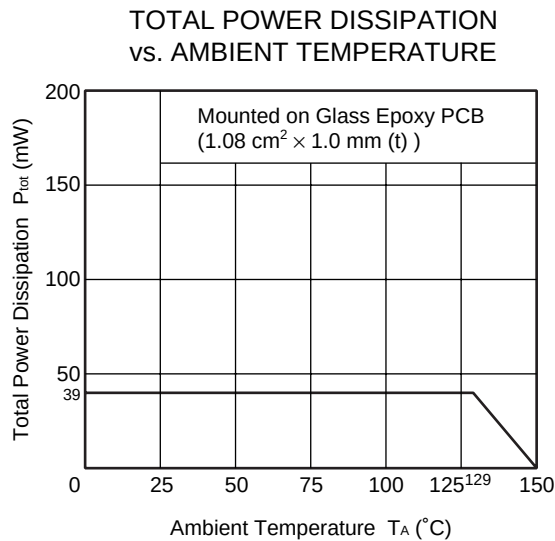
**2.** Collector to base capacitance when the emitter grounded

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

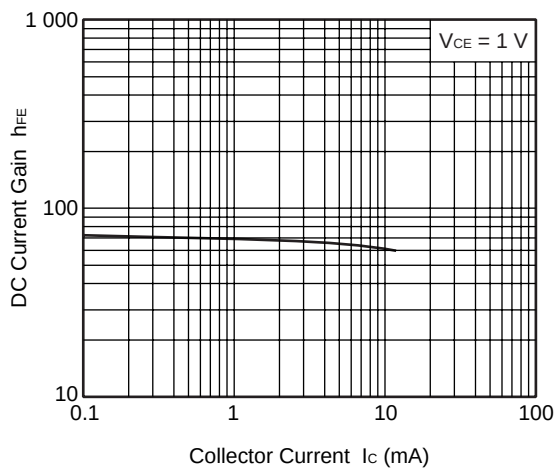
h<sub>FE</sub> CLASSIFICATION

|                       |           |
|-----------------------|-----------|
| Rank                  | FB        |
| Marking               | T81       |
| h <sub>FE</sub> Value | 50 to 100 |

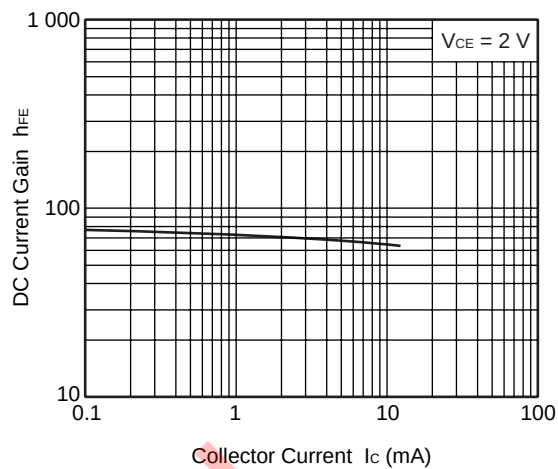
★ TYPICAL CHARACTERISTICS ( $T_A = +25^\circ\text{C}$ , unless otherwise specified)



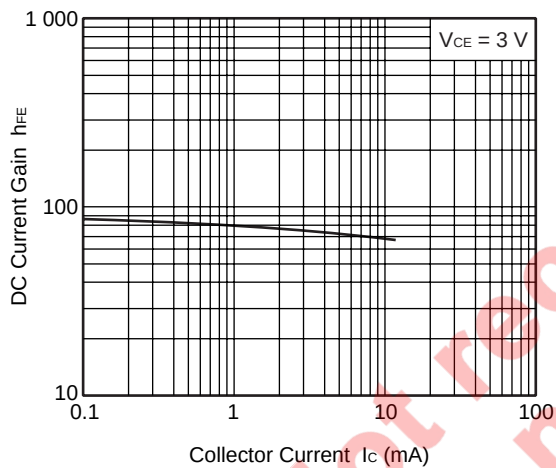
DC CURRENT GAIN vs.  
COLLECTOR CURRENT



DC CURRENT GAIN vs.  
COLLECTOR CURRENT

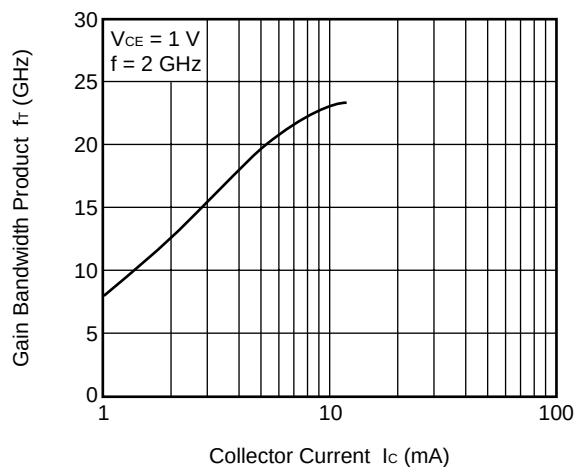


DC CURRENT GAIN vs.  
COLLECTOR CURRENT

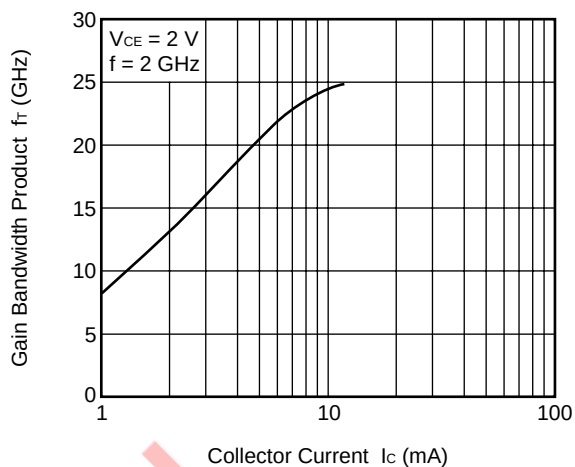


Not recommended  
for new design

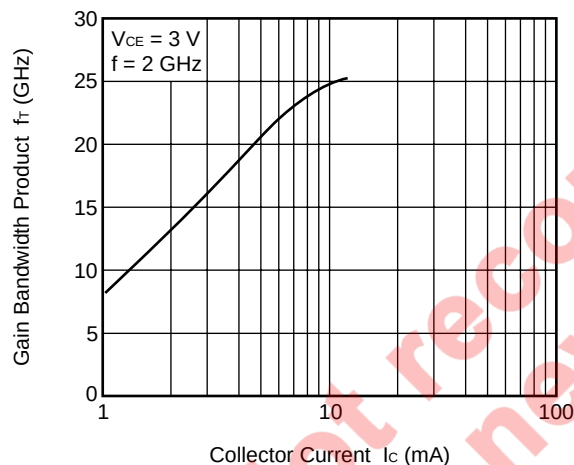
GAIN BANDWIDTH PRODUCT  
vs. COLLECTOR CURRENT



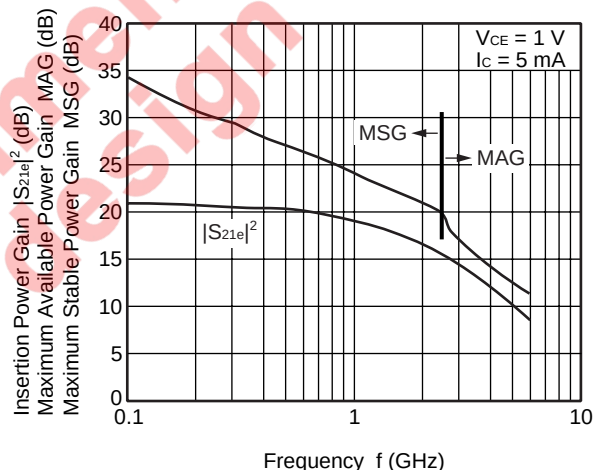
GAIN BANDWIDTH PRODUCT  
vs. COLLECTOR CURRENT



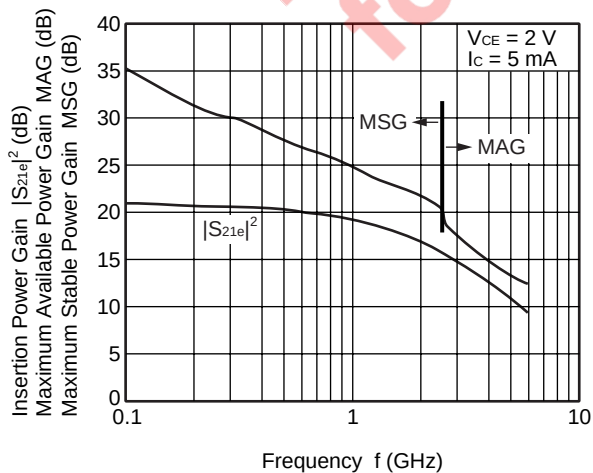
GAIN BANDWIDTH PRODUCT  
vs. COLLECTOR CURRENT



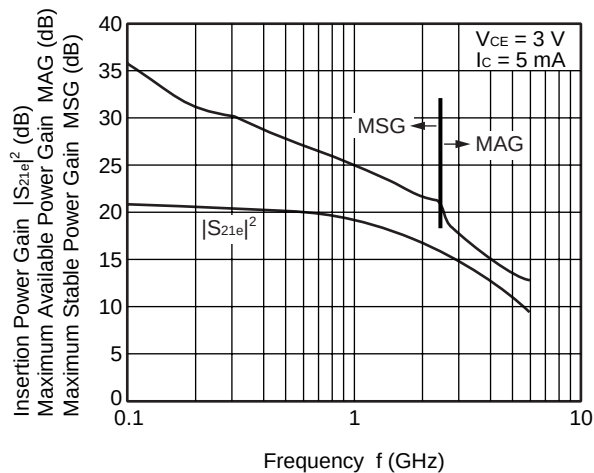
INSERTION POWER GAIN,  
MAG, MSG vs. FREQUENCY



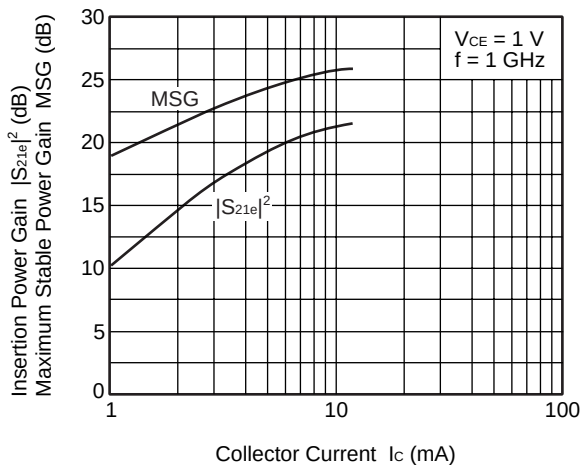
INSERTION POWER GAIN,  
MAG, MSG vs. FREQUENCY



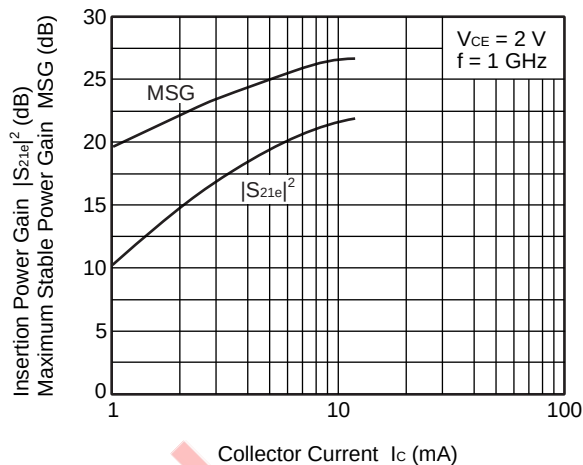
INSERTION POWER GAIN,  
MAG, MSG vs. FREQUENCY



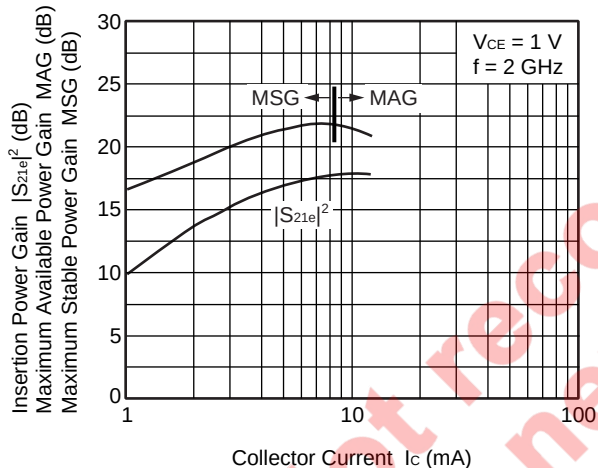
INSERTION POWER GAIN, MSG  
vs. COLLECTOR CURRENT



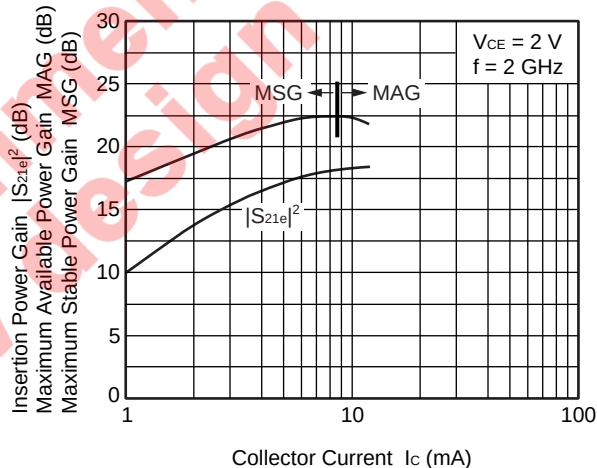
INSERTION POWER GAIN, MSG  
vs. COLLECTOR CURRENT



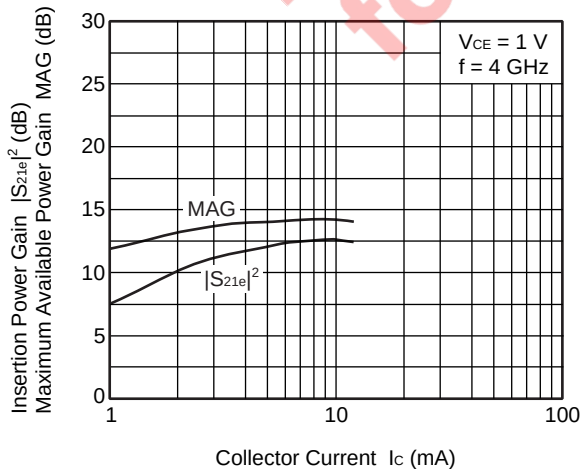
INSERTION POWER GAIN, MAG, MSG  
vs. COLLECTOR CURRENT



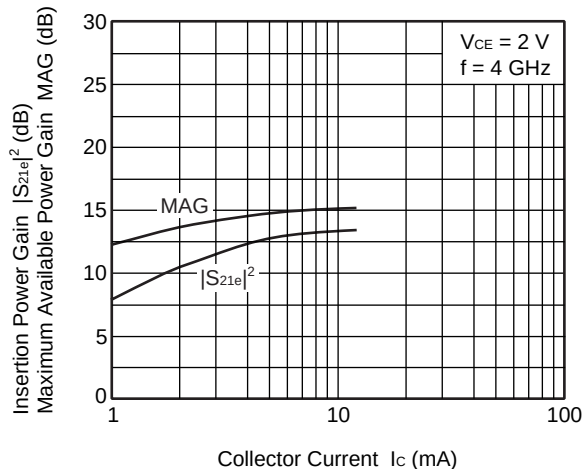
INSERTION POWER GAIN, MAG, MSG  
vs. COLLECTOR CURRENT



INSERTION POWER GAIN, MAG  
vs. COLLECTOR CURRENT

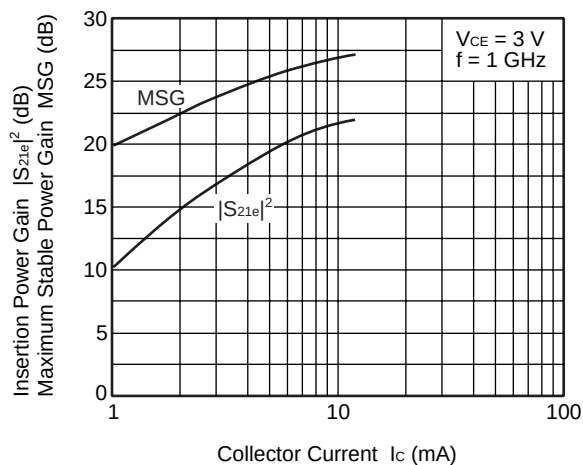


INSERTION POWER GAIN, MAG  
vs. COLLECTOR CURRENT

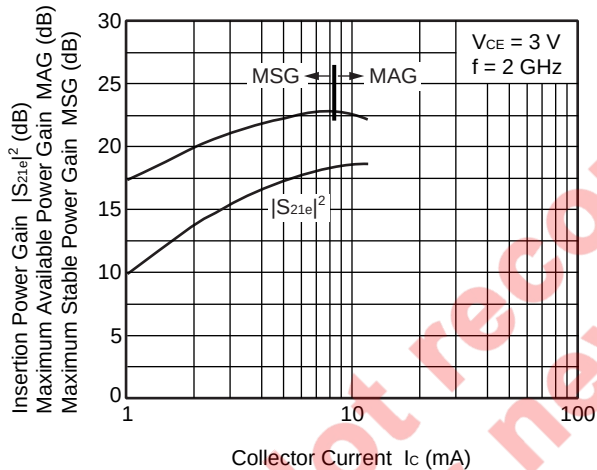




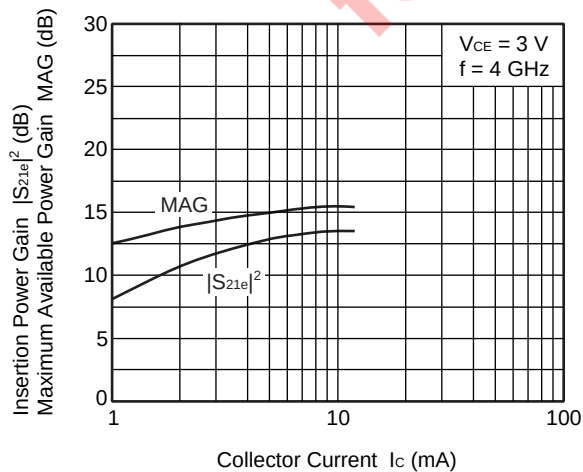
INSERTION POWER GAIN, MSG  
vs. COLLECTOR CURRENT

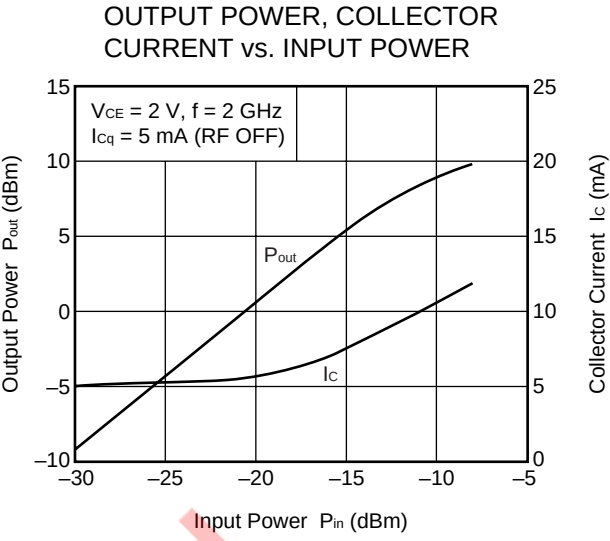
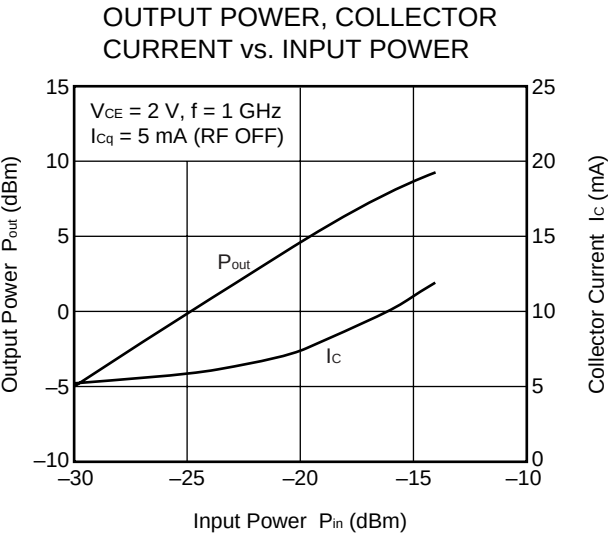


INSERTION POWER GAIN, MAG, MSG  
vs. COLLECTOR CURRENT



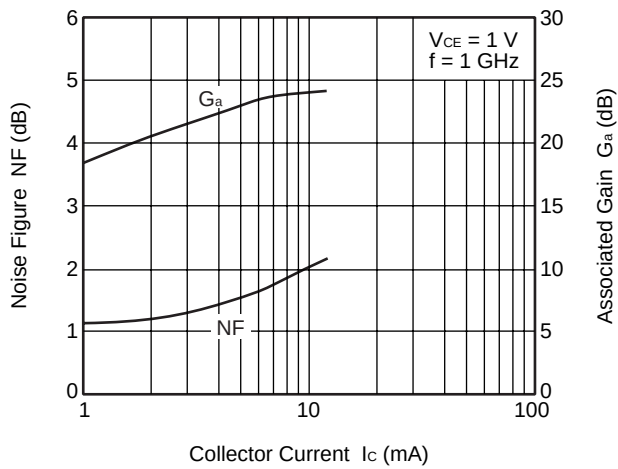
INSERTION POWER GAIN, MAG  
vs. COLLECTOR CURRENT



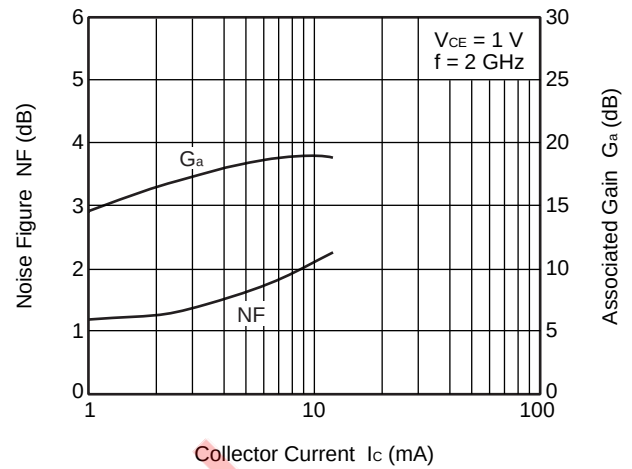


Not recommended for new design

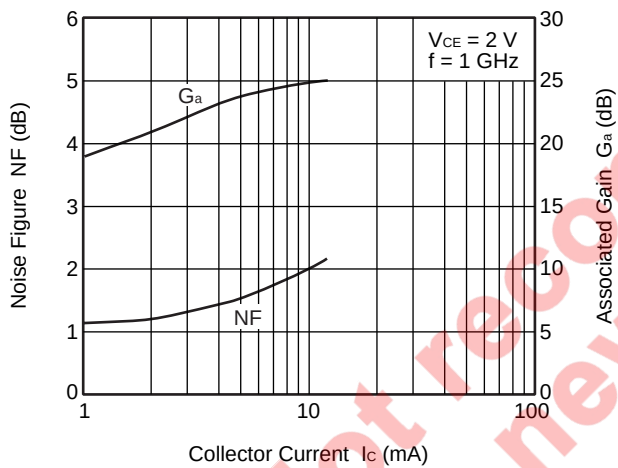
NOISE FIGURE, ASSOCIATED GAIN  
vs. COLLECTOR CURRENT



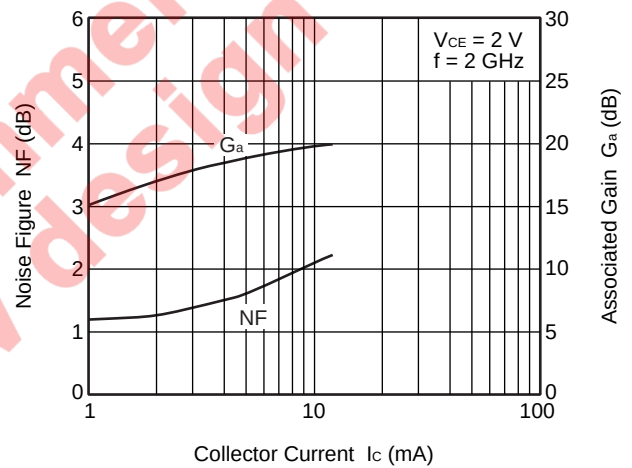
NOISE FIGURE, ASSOCIATED GAIN  
vs. COLLECTOR CURRENT



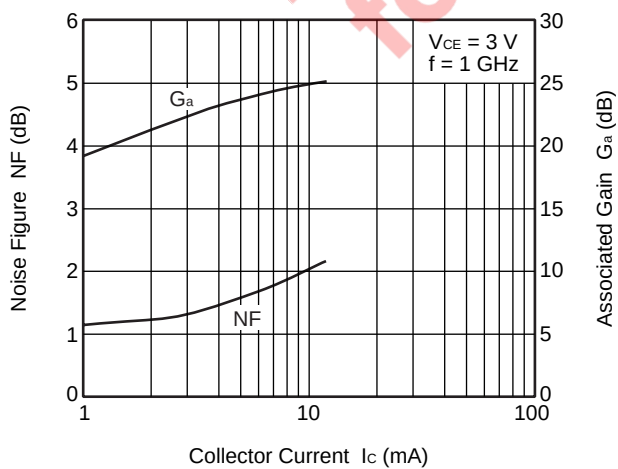
NOISE FIGURE, ASSOCIATED GAIN  
vs. COLLECTOR CURRENT



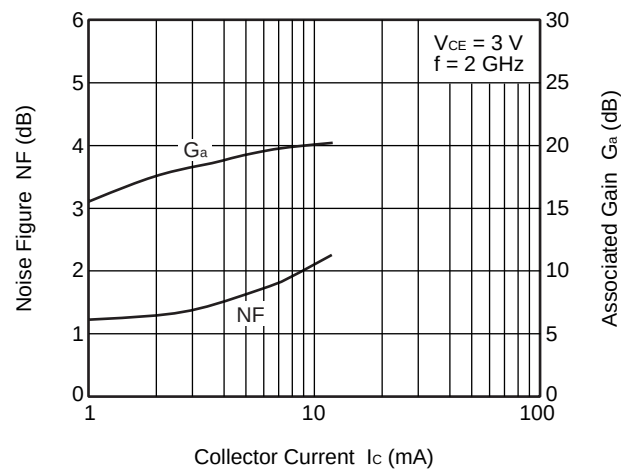
NOISE FIGURE, ASSOCIATED GAIN  
vs. COLLECTOR CURRENT



NOISE FIGURE, ASSOCIATED GAIN  
vs. COLLECTOR CURRENT



NOISE FIGURE, ASSOCIATED GAIN  
vs. COLLECTOR CURRENT



**Remark** The graphs indicate nominal characteristics.

**S-PARAMETERS**

S-parameters/Noise parameters are provided on the NEC Compound Semiconductor Devices Web site in a form (S2P) that enables direct import to a microwave circuit simulator without keyboard input.

Click here to download S-parameters.

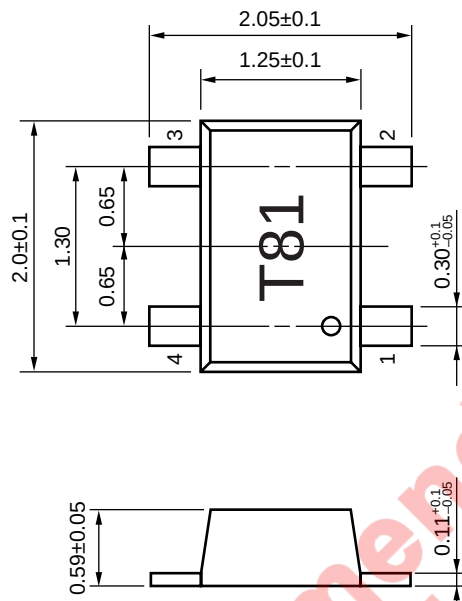
[RF and Microwave] → [Device Parameters]

URL <http://www.csd-nec.com/>

Not recommend  
for new design

PACKAGE DIMENSIONS

FLAT-LEAD 4-PIN THIN-TYPE SUPER MINIMOLD (M05) (UNIT: mm)



PIN CONNECTIONS

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

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M8E 00.4-0110

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