CEL

# NPN SILICON GERMANIUM RF TRANSISTOR
# NESG2021M16

## NPN SiGe RF TRANSISTOR FOR LOW NOISE, HIGH-GAIN AMPLIFICATION 6-PIN LEAD-LESS MINIMOLD (M16, 1208 PKG)

### FEATURES

- The device is an ideal choice for low noise, high-gain at low current amplifications
  NF = 0.9 dB TYP., $G_a$ = 18.0 dB TYP. @ $V_{CE}$ = 2 V, $I_C$ = 3 mA, f = 2 GHz
  NF = 1.3 dB TYP., $G_a$ = 10.0 dB TYP. @ $V_{CE}$ = 2 V, $I_C$ = 3 mA, f = 5.2 GHz
- Maximum stable power gain: MSG = 22.5 dB TYP. @ $V_{CE}$ = 3 V, $I_C$ = 10 mA, f = 2 GHz
- High breakdown voltage technology for SiGe Tr. adopted: $V_{CEO}$ (absolute maximum ratings) = 5.0 V
- 6-pin lead-less minimold (M16, 1208 PKG)

### <R> ORDERING INFORMATION

| Part Number | Order Number | Package | Quantity | Supplying Form |
|---|---|---|---|---|
| NESG2021M16 | NESG2021M16-A | 6-pin lead-less minimold (M16, 1208 PKG) (Pb-Free) | 50 pcs (Non reel) | • 8 mm wide embossed taping<br>• Pin 1 (Collector), Pin 6 (Emitter) face the perforation side of the tape |
| NESG2021M16-T3 | NESG2021M16-T3-A | | 10 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°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 | $I_C$ | 35 | mA |
| Total Power Dissipation | $P_{tot}$ Note | 175 | mW |
| Junction Temperature | $T_j$ | 150 | °C |
| Storage Temperature | $T_{stg}$ | −65 to +150 | °C |

**Note** Mounted on 1.08 $cm^2$ × 1.0 mm (t) glass epoxy PCB

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



Document No. PU10393EJ03V0DS (3rd edition)
Date Published September 2009 NS

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.

## ELECTRICAL CHARACTERISTICS ($T_A$ = +25°C)

| Parameter | Symbol | Test Conditions | MIN. | TYP. | MAX. | Unit |
|---|---|---|---|---|---|---|
| DC Characteristics | | | | | | |
| Collector Cut-off Current | $I_{CBO}$ | $V_{CB}$ = 5 V, $I_E$ = 0 mA | – | – | 100 | nA |
| Emitter Cut-off Current | $I_{EBO}$ | $V_{EB}$ = 1 V, $I_C$ = 0 mA | – | – | 100 | nA |
| DC Current Gain | $h_{FE}$ Note 1 | $V_{CE}$ = 2 V, $I_C$ = 5 mA | 130 | 190 | 260 | – |
| RF Characteristics | | | | | | |
| Gain Bandwidth Product | $f_T$ | $V_{CE}$ = 3 V, $I_C$ = 10 mA, f = 2 GHz | 20 | 25 | – | GHz |
| Insertion Power Gain | $\|S_{21e}\|^2$ | $V_{CE}$ = 3 V, $I_C$ = 10 mA, f = 2 GHz | 17.0 | 19.0 | – | dB |
| Noise Figure (1) | NF | $V_{CE}$ = 2 V, $I_C$ = 3 mA, f = 2 GHz, $Z_S = Z_{Sopt}$, $Z_L = Z_{Lopt}$ | – | 0.9 | 1.2 | dB |
| Noise Figure (2) | NF | $V_{CE}$ = 2 V, $I_C$ = 3 mA, f = 5.2 GHz, $Z_S = Z_{Sopt}$, $Z_L = Z_{Lopt}$ | – | 1.3 | – | dB |
| Associated Gain (1) | $G_a$ | $V_{CE}$ = 2 V, $I_C$ = 3 mA, f = 2 GHz, $Z_S = Z_{Sopt}$, $Z_L = Z_{Lopt}$ | 15.0 | 18.0 | – | dB |
| Associated Gain (2) | $G_a$ | $V_{CE}$ = 2 V, $I_C$ = 3 mA, f = 5.2 GHz, $Z_S = Z_{Sopt}$, $Z_L = Z_{Lopt}$ | – | 10.0 | – | dB |
| Reverse Transfer Capacitance | $C_{re}$ Note 2 | $V_{CB}$ = 2 V, $I_E$ = 0 mA, f = 1 MHz | – | 0.1 | 0.2 | pF |
| Maximum Stable Power Gain | MSG Note 3 | $V_{CE}$ = 3 V, $I_C$ = 10 mA, f = 2 GHz | 20.0 | 22.5 | – | dB |
| Gain 1 dB Compression Output Power | $P_{O\ (1\ dB)}$ | $V_{CE}$ = 3 V, $I_{C\ (set)}$ = 12 mA (RF OFF), f = 2 GHz, $Z_S = Z_{Sopt}$, $Z_L = Z_{Lopt}$ | – | 9 | – | dBm |
| Output 3rd Order Intercept Point | $OIP_3$ | $V_{CE}$ = 3 V, $I_{C\ (set)}$ = 12 mA (RF OFF), f = 2 GHz, $Z_S = Z_{Sopt}$, $Z_L = Z_{Lopt}$ | – | 17 | – | dBm |

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

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

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

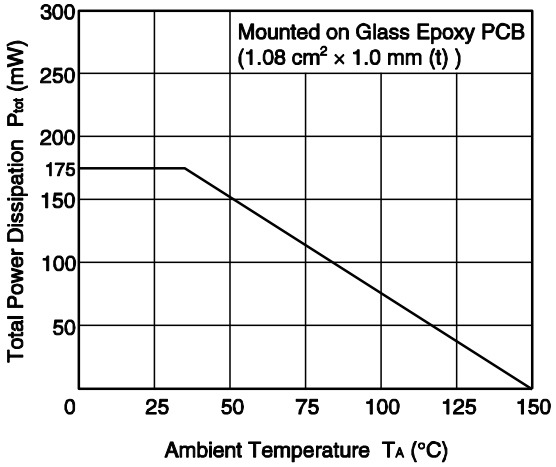
## $h_{FE}$ CLASSIFICATION

<R>

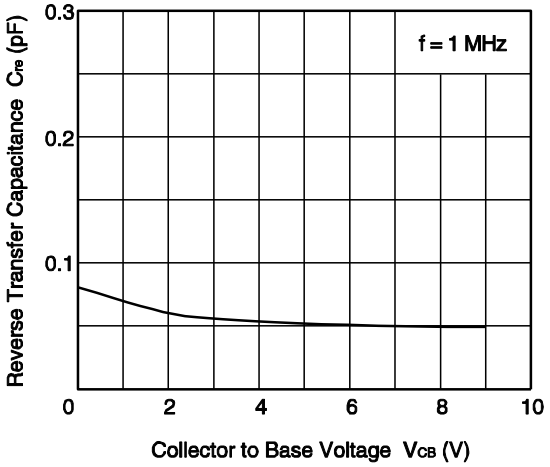
| Rank | FB/YFB |
|---|---|
| Marking | zE |
| $h_{FE}$ Value | 130 to 260 |

<R> **TYPICAL CHARACTERISTICS ($T_A$ = +25°C, unless otherwise specified)**

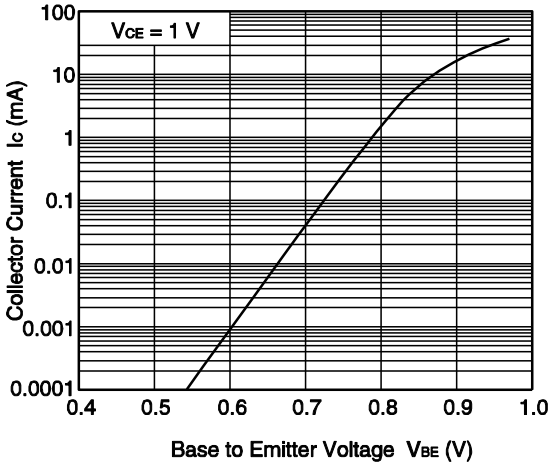
TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE



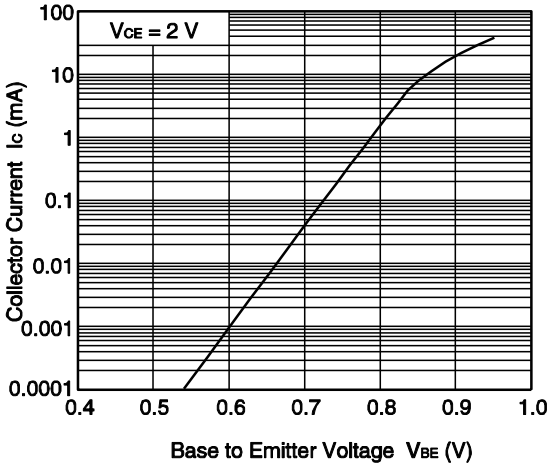

REVERSE TRANSFER CAPACITANCE vs. COLLECTOR TO BASE VOLTAGE



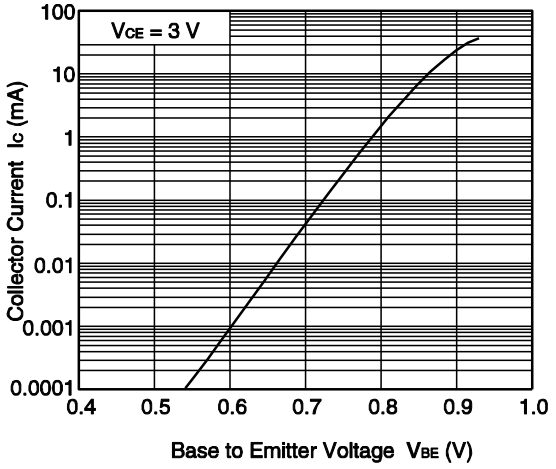

COLLECTOR CURRENT vs. BASE TO EMITTER VOLTAGE



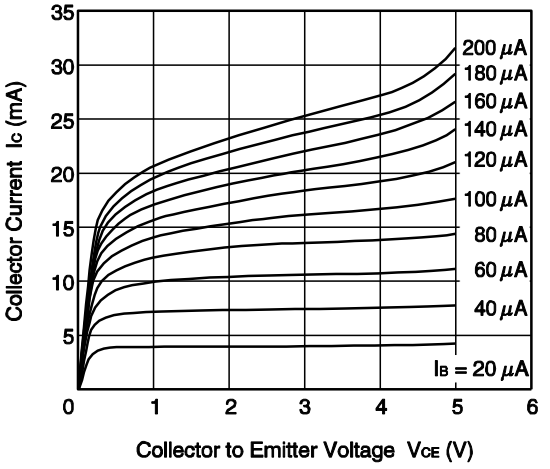

COLLECTOR CURRENT vs. BASE TO EMITTER VOLTAGE




COLLECTOR CURRENT vs. BASE TO EMITTER VOLTAGE

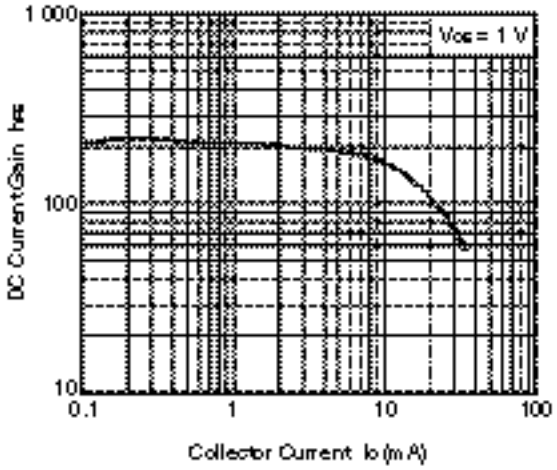



COLLECTOR CURRENT vs. COLLECTOR TO EMITTER VOLTAGE

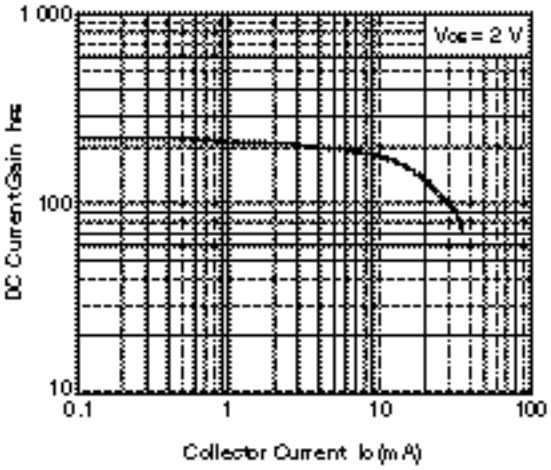



**Remark** The graphs indicate nominal characteristics.

DC CURRENT GAIN vs.
COLLECTOR CURRENT




DC CURRENT GAIN vs.
COLLECTOR CURRENT




DC CURRENT GAIN vs.
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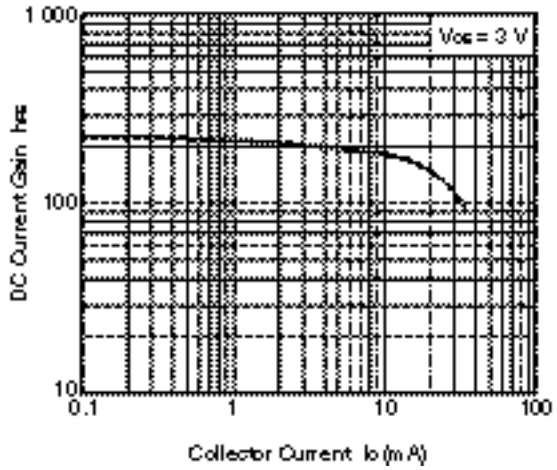


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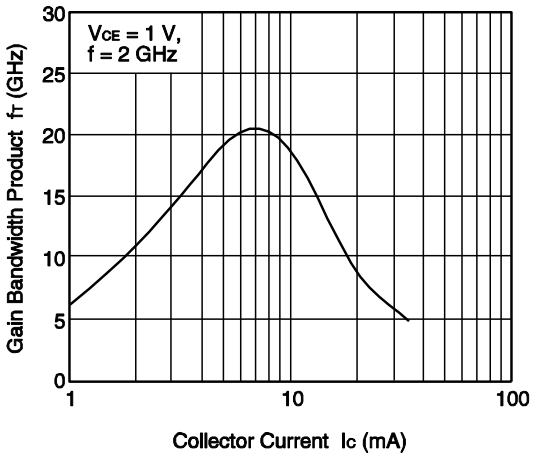
GAIN BANDWIDTH PRODUCT vs. COLLECTOR CURRENT

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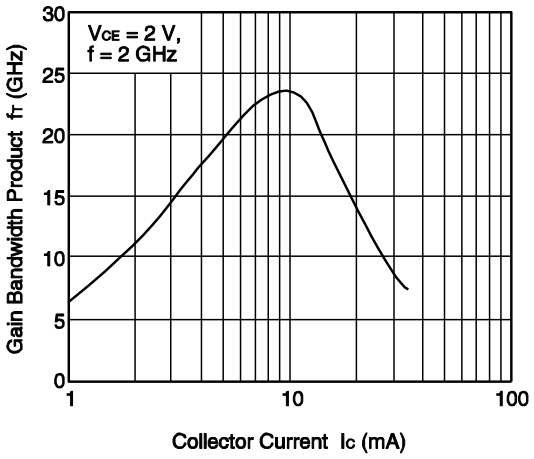
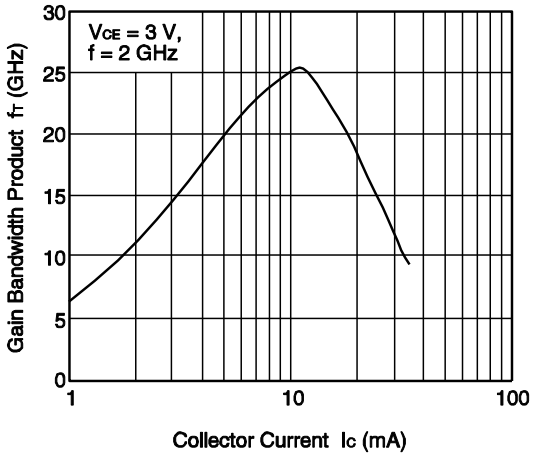
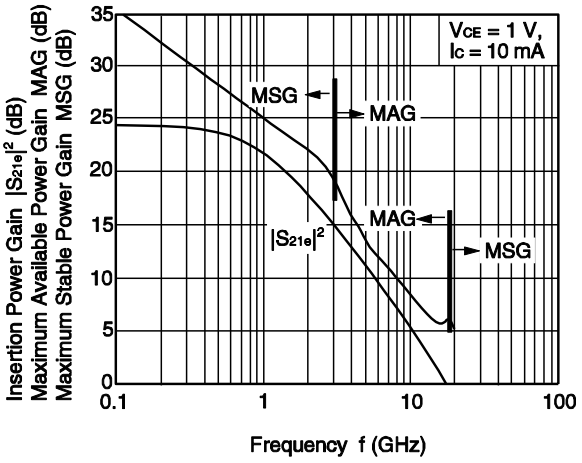



GAIN BANDWIDTH PRODUCT vs. COLLECTOR CURRENT




INSERTION POWER GAIN, MAG, MSG vs. FREQUENCY

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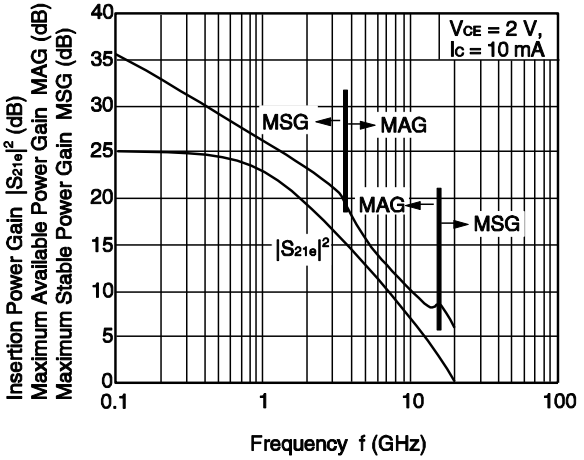


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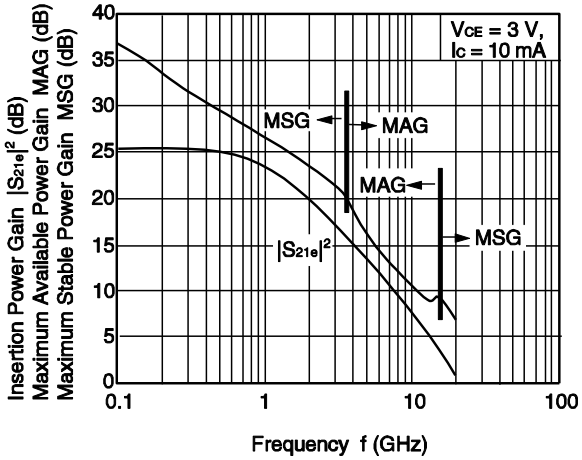


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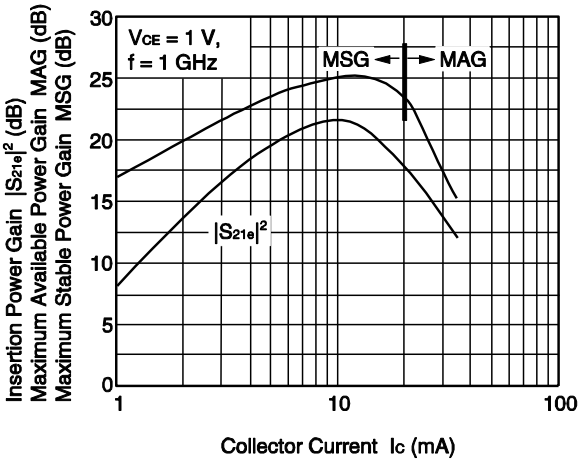


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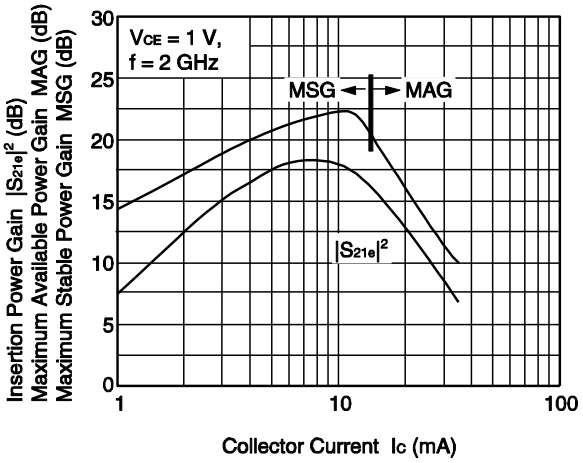


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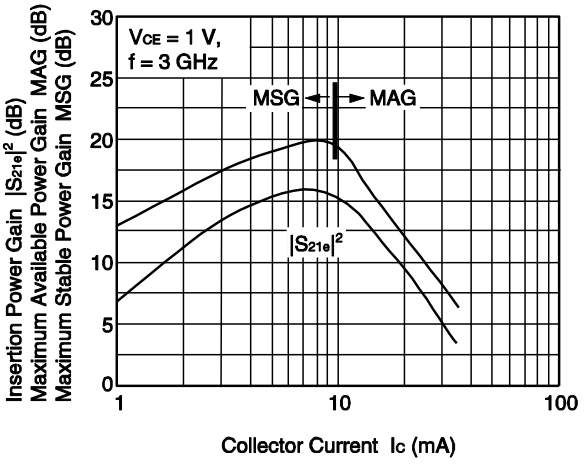


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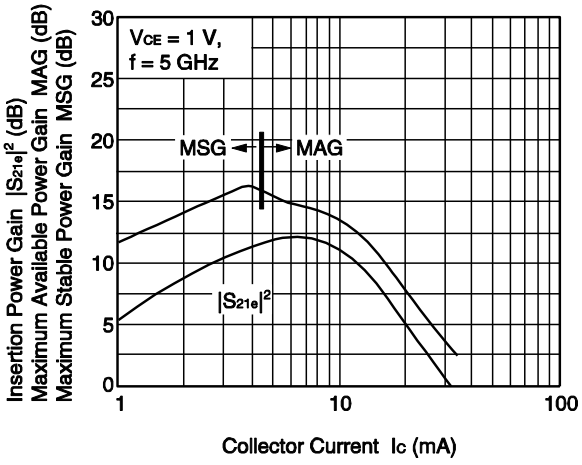


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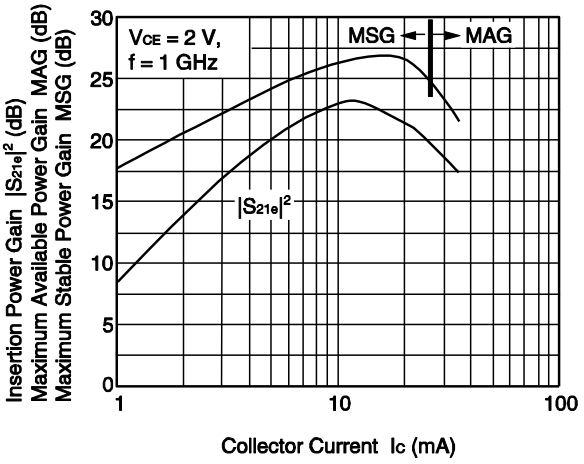


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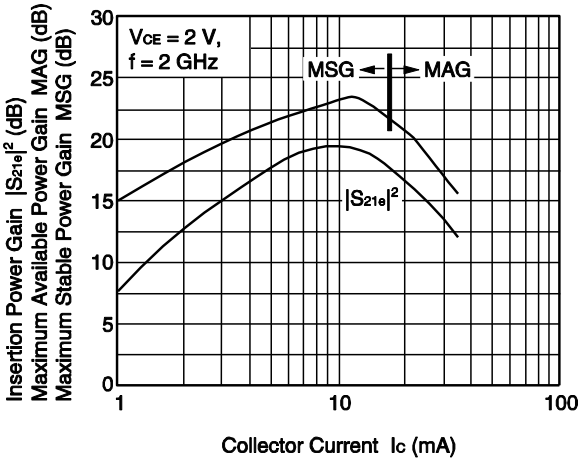


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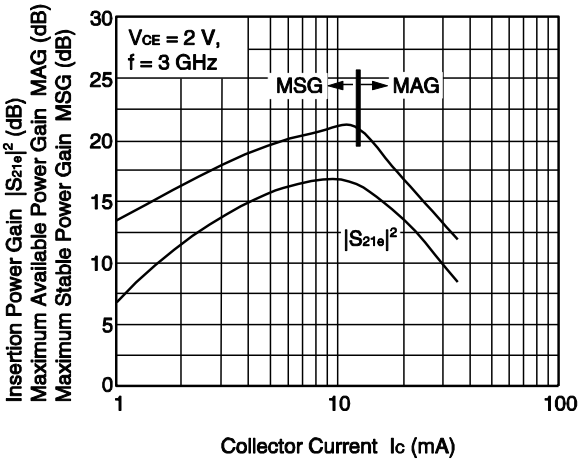


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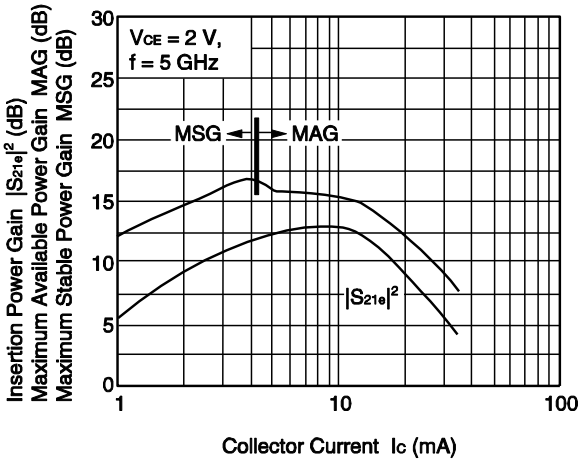


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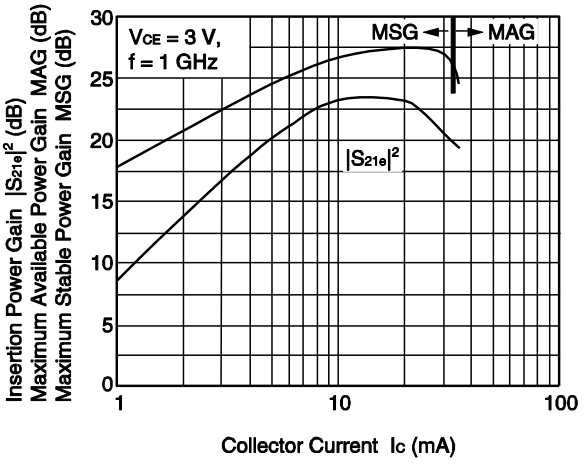


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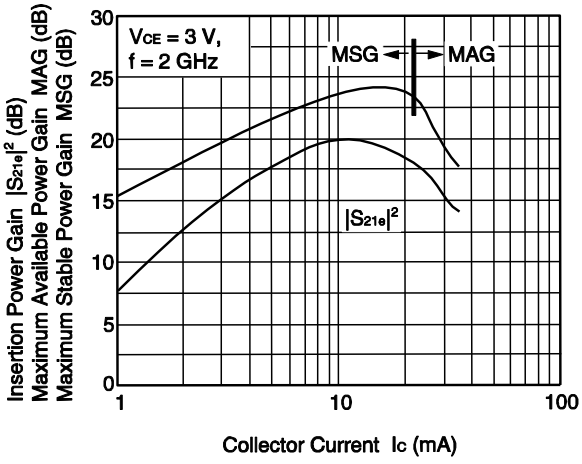


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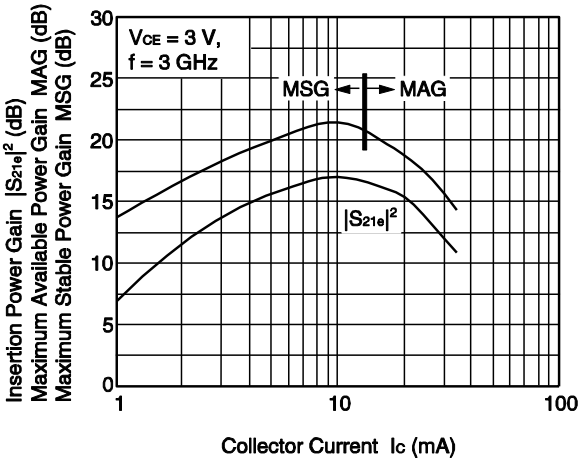


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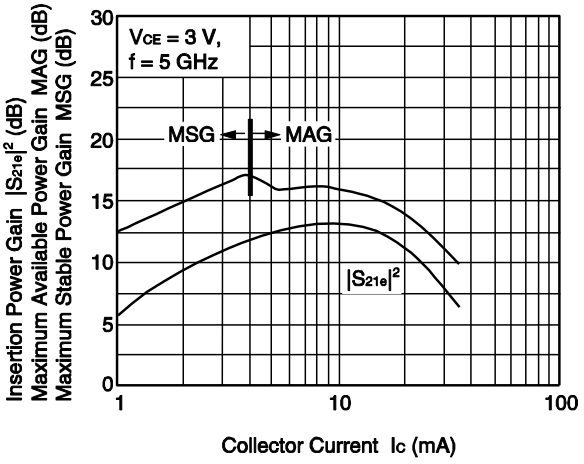
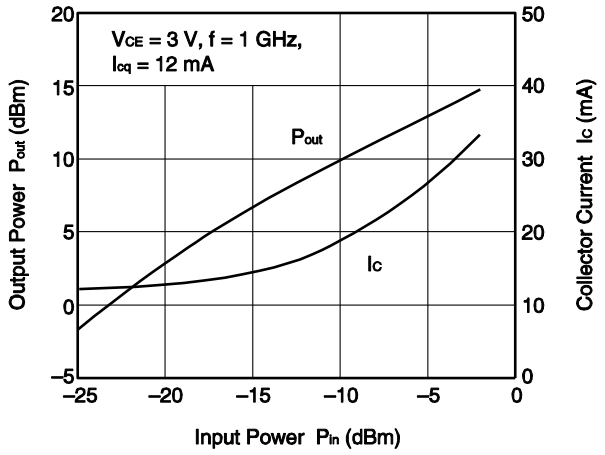



**Remark** The graphs indicate nominal characteristics.

OUTPUT POWER, COLLECTOR CURRENT vs. INPUT POWER

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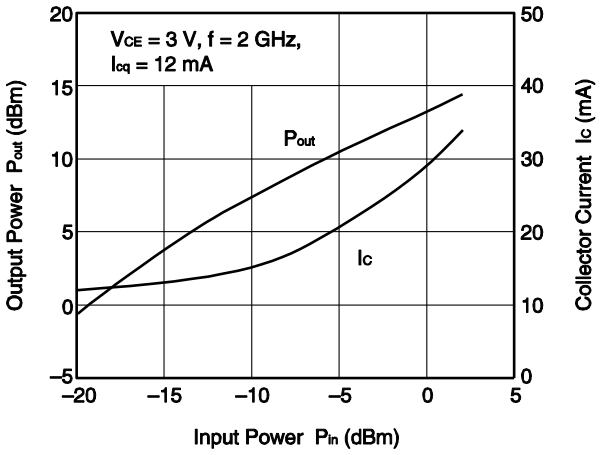


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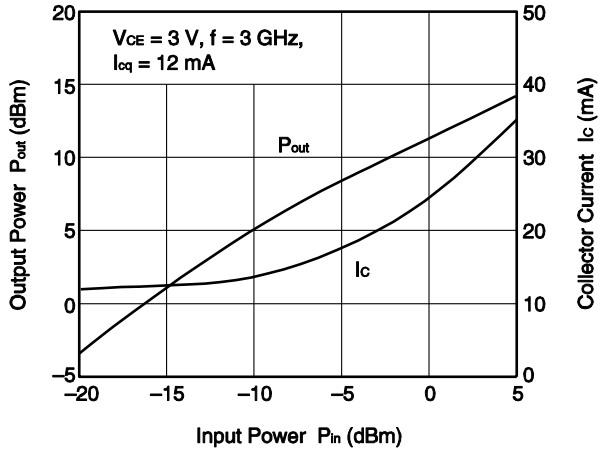


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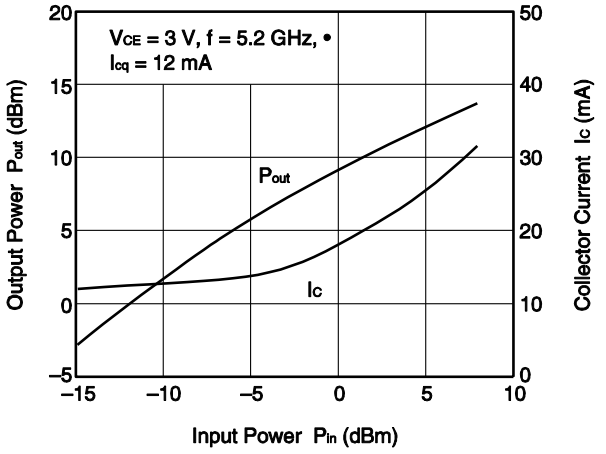


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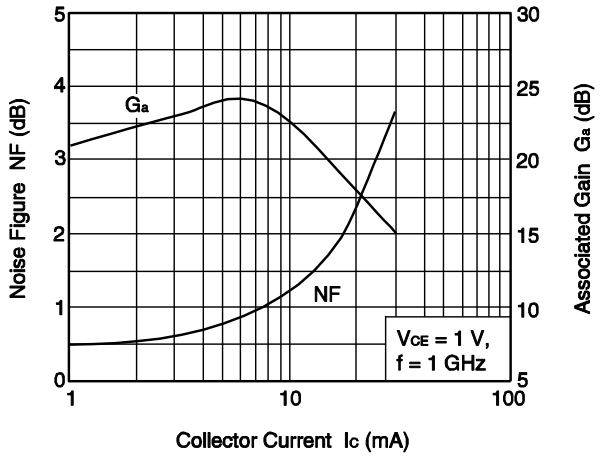
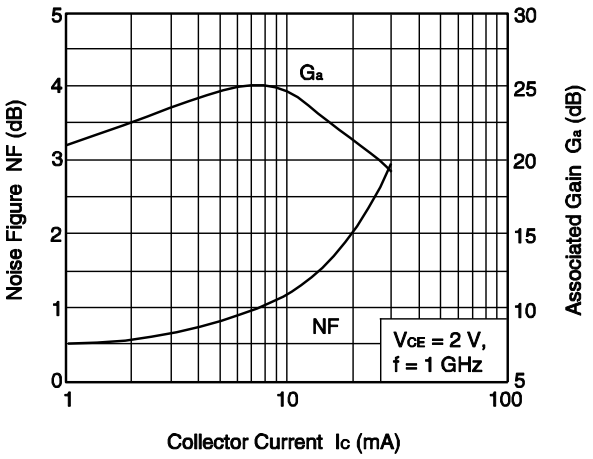
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT




NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT

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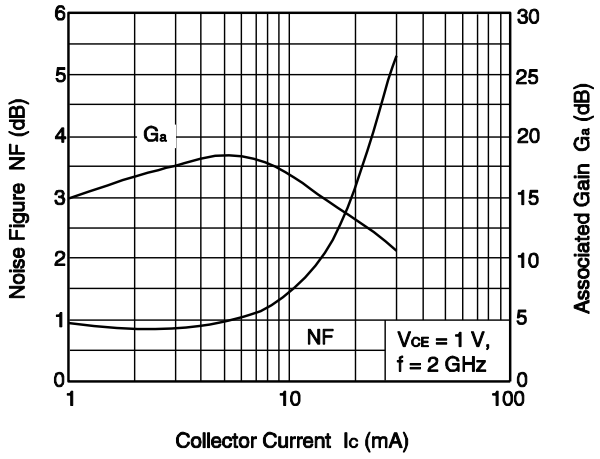


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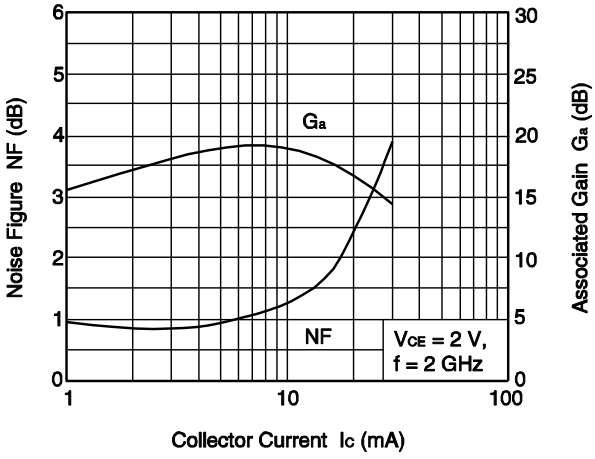
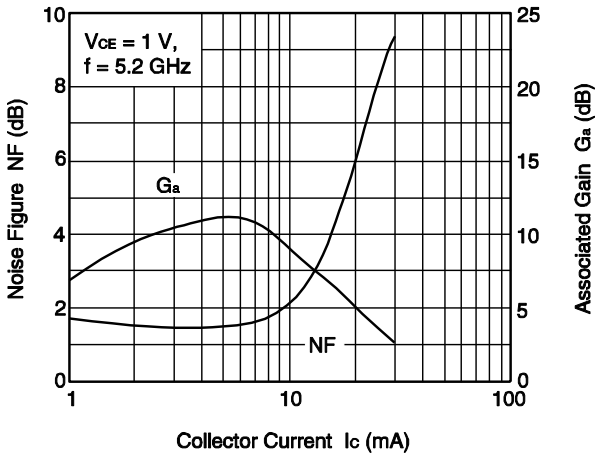



NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT

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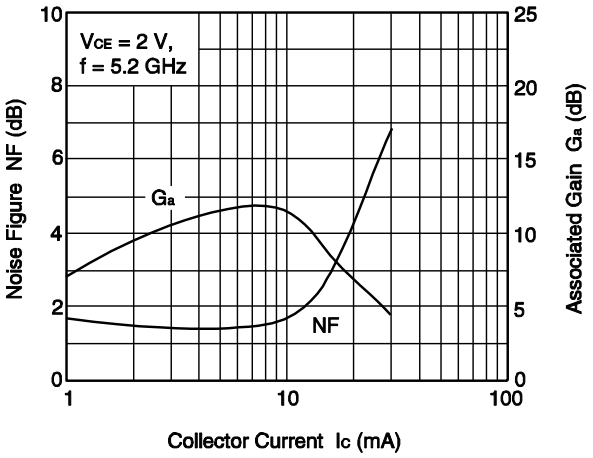


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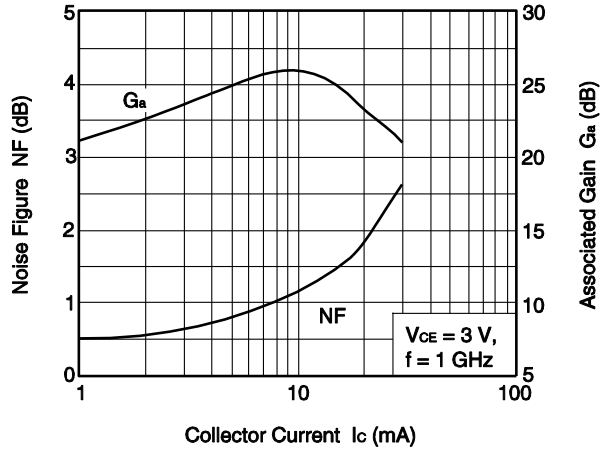
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT

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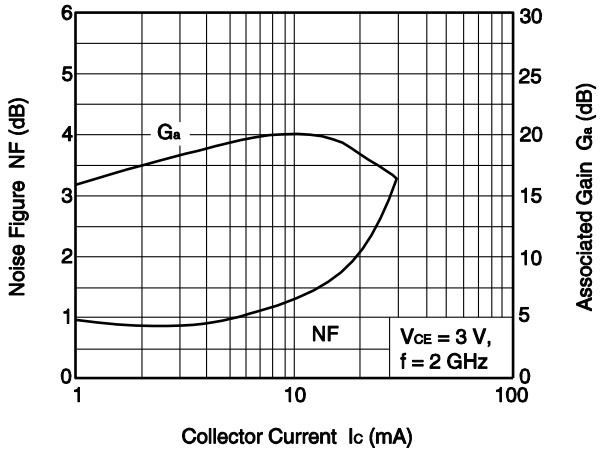


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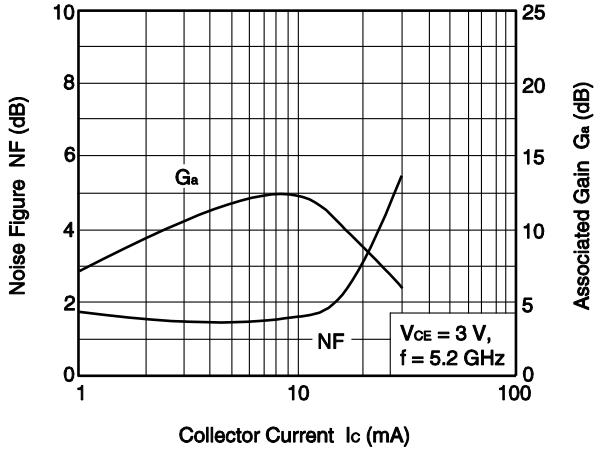


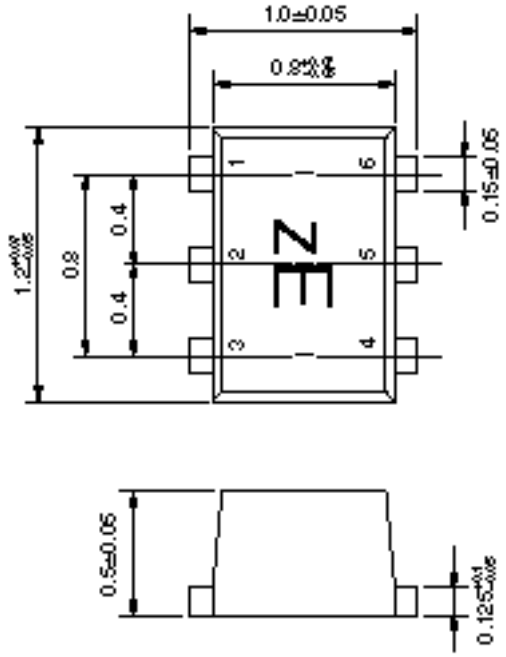

**Remark** The graphs indicate nominal characteristics.

<R> **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**

**6-PIN LEAD-LESS MINIMOLD (M16, 1208 PKG) (UNIT: mm)**




PIN CONNECTIONS

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

**Caution All four Emitter-pins should be connected to PWB in order to obtain better Electrical performance and heat sinking.**