



# NPN SILICON GERMANIUM RF TRANSISTOR

## NESG3031M05

### NPN SiGe RF TRANSISTOR FOR LOW NOISE, HIGH-GAIN AMPLIFICATION FLAT-LEAD 4-PIN THIN-TYPE SUPER MINIMOLD (M05, 2012 PKG)

#### FEATURES

- The device is an ideal choice for low noise, high-gain amplification  
 $NF = 0.6 \text{ dB TYP.}$ ,  $G_a = 16.0 \text{ dB TYP.}$  @  $V_{CE} = 2 \text{ V}$ ,  $I_c = 6 \text{ mA}$ ,  $f = 2.4 \text{ GHz}$   
 $NF = 0.95 \text{ dB TYP.}$ ,  $G_a = 10.0 \text{ dB TYP.}$  @  $V_{CE} = 2 \text{ V}$ ,  $I_c = 6 \text{ mA}$ ,  $f = 5.2 \text{ GHz}$   
 $NF = 1.1 \text{ dB TYP.}$ ,  $G_a = 9.5 \text{ dB TYP.}$  @  $V_{CE} = 2 \text{ V}$ ,  $I_c = 6 \text{ mA}$ ,  $f = 5.8 \text{ GHz}$
- Maximum stable power gain:  $MSG = 14.0 \text{ dB TYP.}$  @  $V_{CE} = 3 \text{ V}$ ,  $I_c = 20 \text{ mA}$ ,  $f = 5.8 \text{ GHz}$
- SiGe HBT technology (UHS3) adopted:  $f_{max} = 110 \text{ GHz}$
- Flat-lead 4-pin thin-type super minimold (M05, 2012 PKG)

#### <R> ORDERING INFORMATION

Part Number	Order Number	Package	Quantity	Supplying Form
NESG3031M05	NESG3031M05-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>
NESG3031M05-T1	NESG3031M05-T1-A		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	$V_{CBO}$	12.0	V
Collector to Emitter Voltage	$V_{CEO}$	4.3	V
Emitter to Base Voltage	$V_{EBO}$	1.5	V
Collector Current	$I_c$	35	mA
Total Power Dissipation	$P_{tot}$ <sup>Note</sup>	150	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 PWB

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

The information in this document is subject to change without notice. Before using this document, please confirm that this is the latest version.

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

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
<b>DC Characteristics</b>						
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> = 6 mA	220	300	380	–
<b>RF Characteristics</b>						
Insertion Power Gain	S <sub>21e</sub>   <sup>2</sup>	V <sub>CE</sub> = 3 V, I <sub>C</sub> = 20 mA, f = 5.8 GHz	6.0	8.5	–	dB
Noise Figure (1)	NF	V <sub>CE</sub> = 2 V, I <sub>C</sub> = 6 mA, f = 2.4 GHz, Z <sub>S</sub> = Z <sub>Sopt</sub> , Z <sub>L</sub> = Z <sub>Lopt</sub>	–	0.6	–	dB
Noise Figure (2)	NF	V <sub>CE</sub> = 2 V, I <sub>C</sub> = 6 mA, f = 5.2 GHz, Z <sub>S</sub> = Z <sub>Sopt</sub> , Z <sub>L</sub> = Z <sub>Lopt</sub>	–	0.95	–	dB
Noise Figure (3)	NF	V <sub>CE</sub> = 2 V, I <sub>C</sub> = 6 mA, f = 5.8 GHz, Z <sub>S</sub> = Z <sub>Sopt</sub> , Z <sub>L</sub> = Z <sub>Lopt</sub>	–	1.1	1.5	dB
Associated Gain (1)	G <sub>a</sub>	V <sub>CE</sub> = 2 V, I <sub>C</sub> = 6 mA, f = 2.4 GHz, Z <sub>S</sub> = Z <sub>Sopt</sub> , Z <sub>L</sub> = Z <sub>Lopt</sub>	–	16.0	–	dB
Associated Gain (2)	G <sub>a</sub>	V <sub>CE</sub> = 2 V, I <sub>C</sub> = 6 mA, f = 5.2 GHz, Z <sub>S</sub> = Z <sub>Sopt</sub> , Z <sub>L</sub> = Z <sub>Lopt</sub>	–	10.0	–	dB
Associated Gain (3)	G <sub>a</sub>	V <sub>CE</sub> = 2 V, I <sub>C</sub> = 6 mA, f = 5.8 GHz, Z <sub>S</sub> = Z <sub>Sopt</sub> , Z <sub>L</sub> = Z <sub>Lopt</sub>	7.5	9.5	–	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	–	0.15	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 = 5.8 GHz	11.0	14.0	–	dB
Gain 1 dB Compression Output Power	P <sub>O(1dB)</sub>	V <sub>CE</sub> = 3 V, I <sub>C(set)</sub> = 20 mA, f = 5.8 GHz, Z <sub>S</sub> = Z <sub>Sopt</sub> , Z <sub>L</sub> = Z <sub>Lopt</sub>	–	13.0	–	dBm
Output 3rd Order Intercept Point	OIP <sub>3</sub>	V <sub>CE</sub> = 3 V, I <sub>C(set)</sub> = 20 mA, f = 5.8 GHz, Z <sub>S</sub> = Z <sub>Sopt</sub> , Z <sub>L</sub> = Z <sub>Lopt</sub>	–	18.0	–	dBm

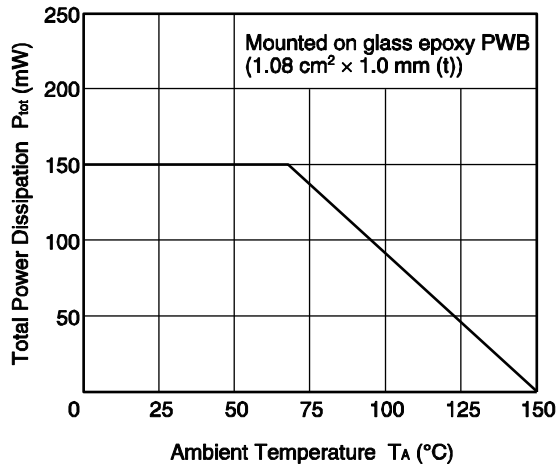
- Notes**
1. Pulse measurement: PW ≤ 350 μs, Duty Cycle ≤ 2%
  2. Collector to base capacitance when the emitter grounded
  3.  $MSG = \left| \frac{S_{21}}{S_{12}} \right|$

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

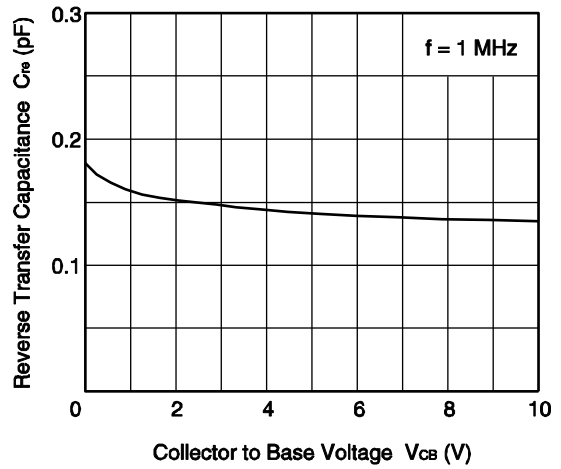
Rank	FB
Marking	T1K
h <sub>FE</sub> Value	220 to 380

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

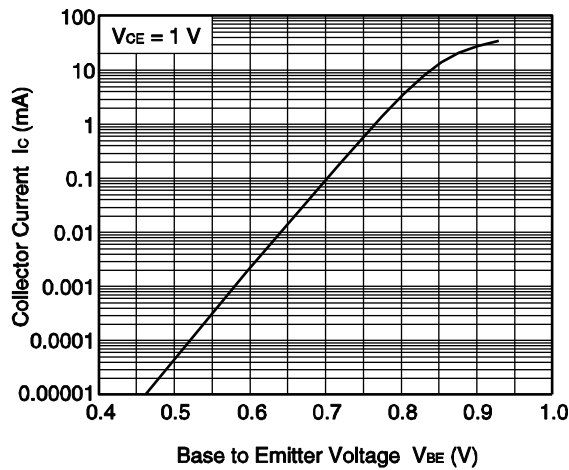
TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE



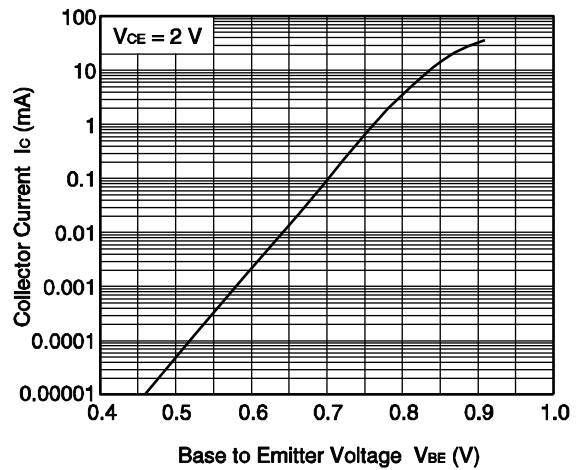
REVERSE TRANSFER CAPACITANCE vs. COLLECTOR TO BASE VOLTAGE



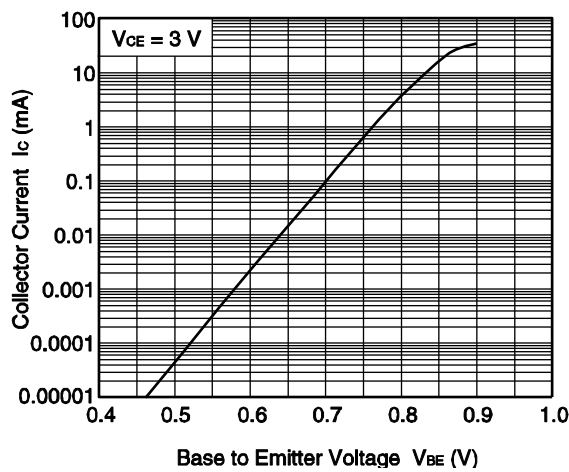
COLLECTOR CURRENT vs. BASE TO EMITTER VOLTAGE



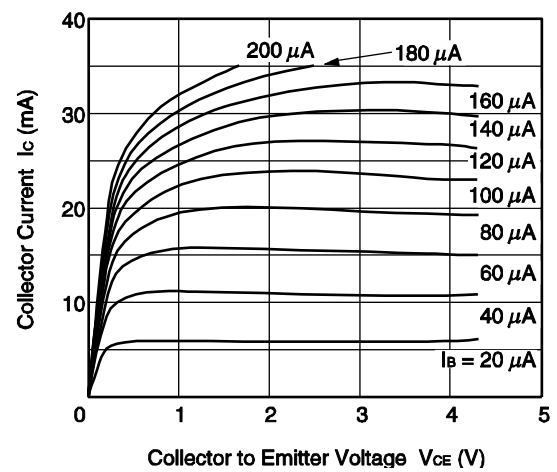
COLLECTOR CURRENT vs. BASE TO EMITTER VOLTAGE



COLLECTOR CURRENT vs. BASE TO EMITTER VOLTAGE

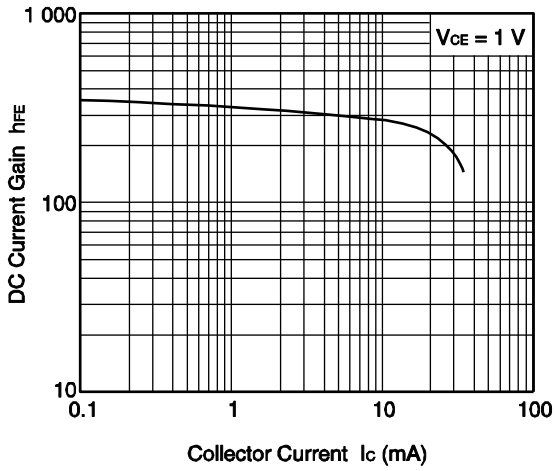


COLLECTOR CURRENT vs. COLLECTOR TO EMITTER VOLTAGE

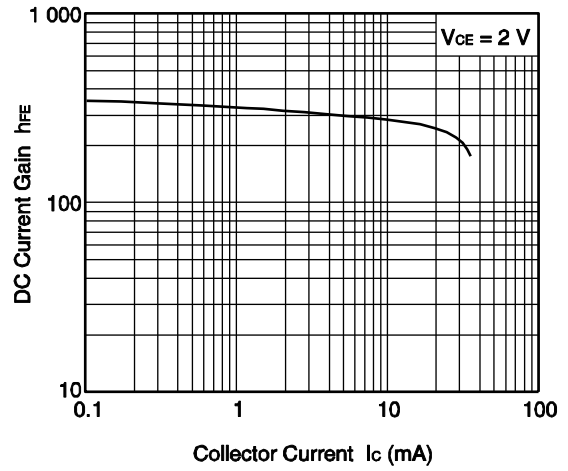


Remark The graphs indicate nominal characteristics.

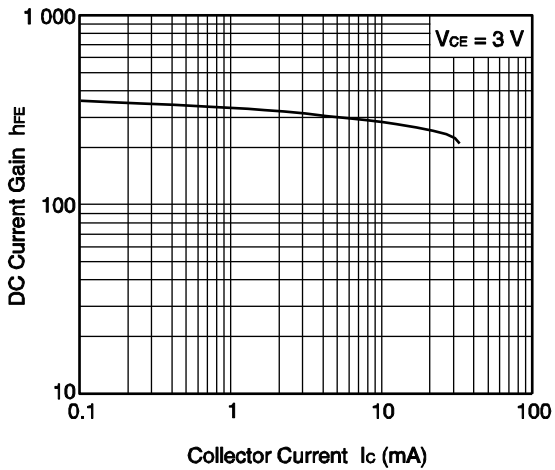
DC CURRENT GAIN vs. COLLECTOR CURRENT



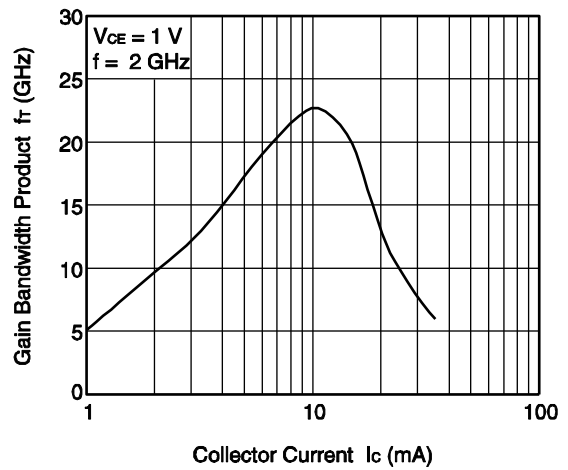
DC CURRENT GAIN vs. COLLECTOR CURRENT



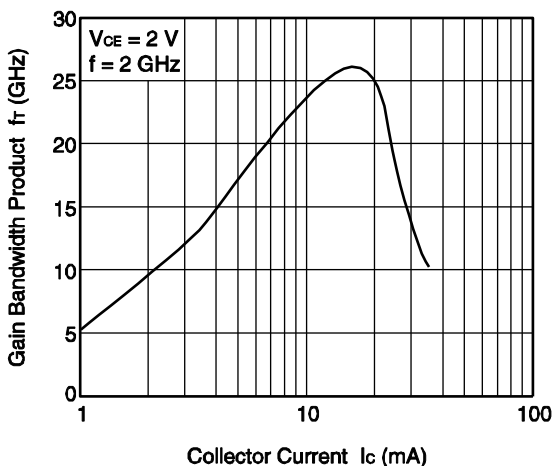
DC CURRENT GAIN vs. COLLECTOR CURRENT



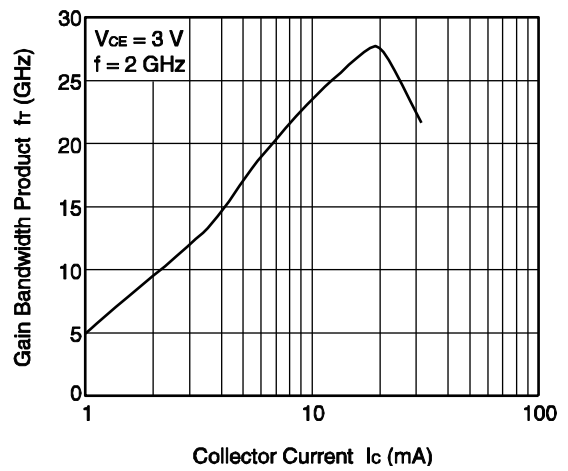
GAIN BANDWIDTH PRODUCT vs. COLLECTOR CURRENT



GAIN BANDWIDTH PRODUCT vs. COLLECTOR CURRENT

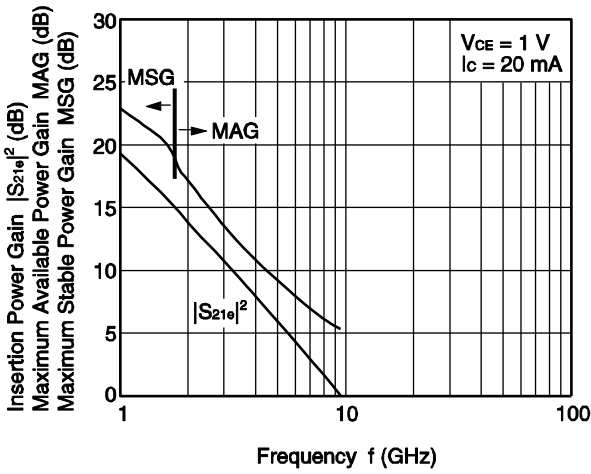


GAIN BANDWIDTH PRODUCT vs. COLLECTOR CURRENT

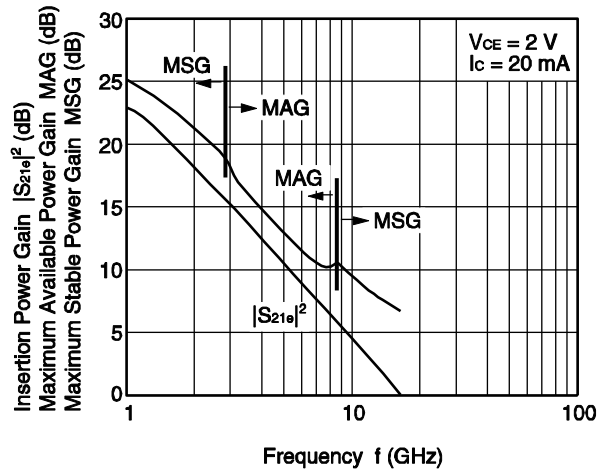


**Remark** The graphs indicate nominal characteristics.

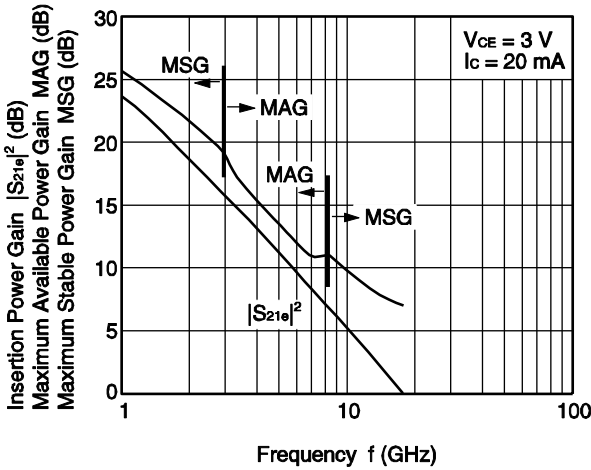
INSERTION POWER GAIN, MAG, MSG vs. FREQUENCY



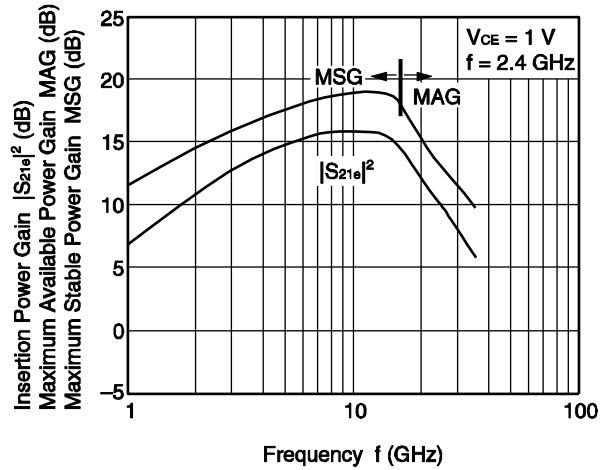
INSERTION POWER GAIN, MAG, MSG vs. FREQUENCY



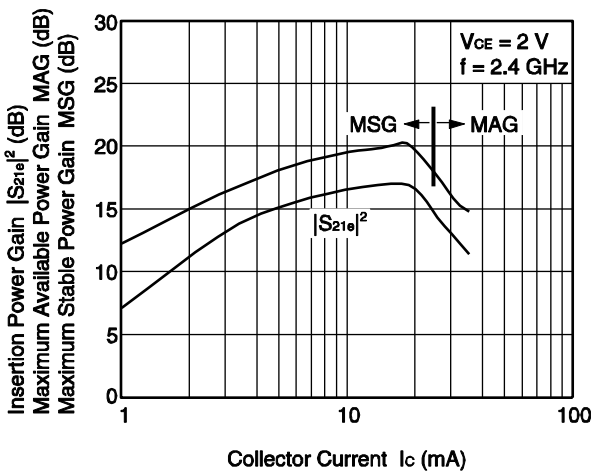
INSERTION POWER GAIN, MAG, MSG vs. FREQUENCY



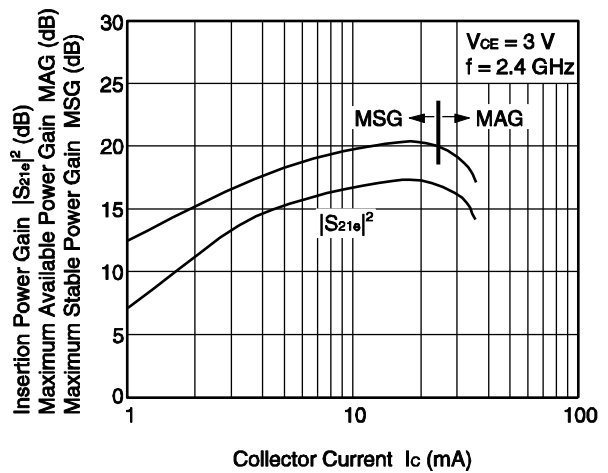
INSERTION POWER GAIN, MAG, MSG vs. FREQUENCY



INSERTION POWER GAIN, MAG, MSG vs. COLLECTOR CURRENT

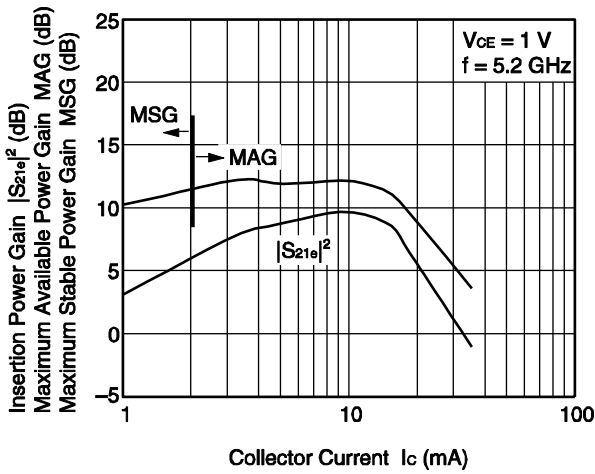


INSERTION POWER GAIN, MAG, MSG vs. COLLECTOR CURRENT

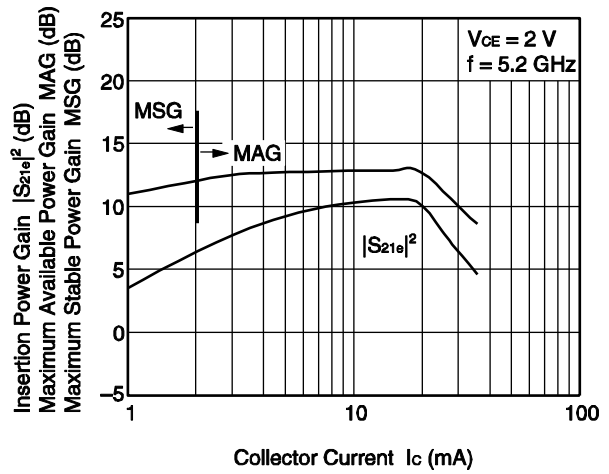


Remark The graphs indicate nominal characteristics.

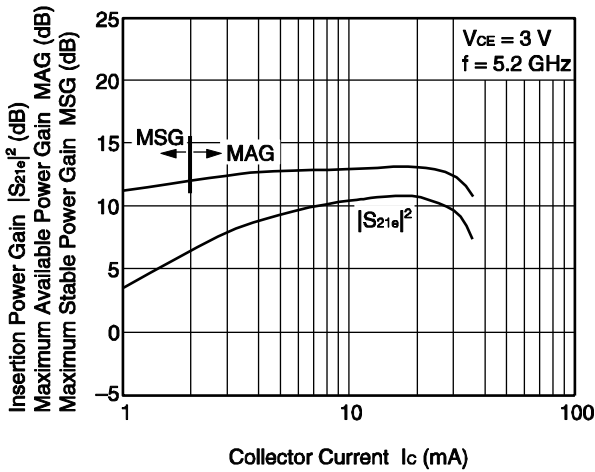
INSERTION POWER GAIN, MAG, MSG  
vs. COLLECTOR CURRENT



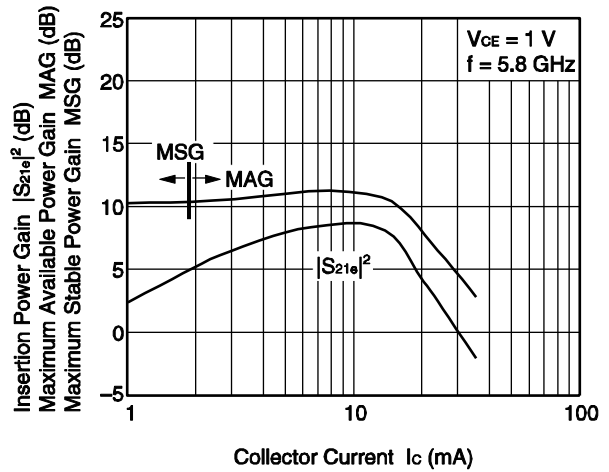
INSERTION POWER GAIN, MAG, MSG  
vs. COLLECTOR CURRENT



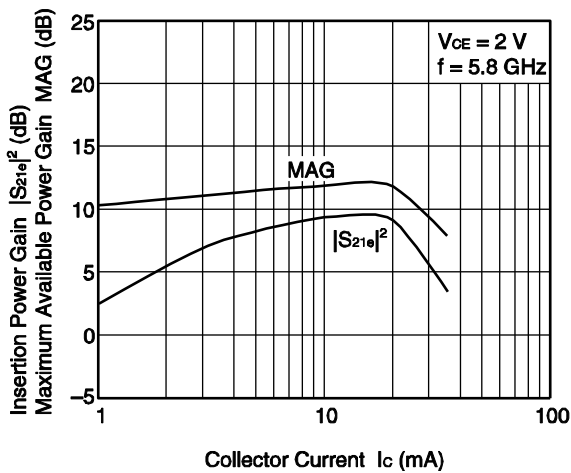
INSERTION POWER GAIN, MAG, MSG  
vs. COLLECTOR CURRENT



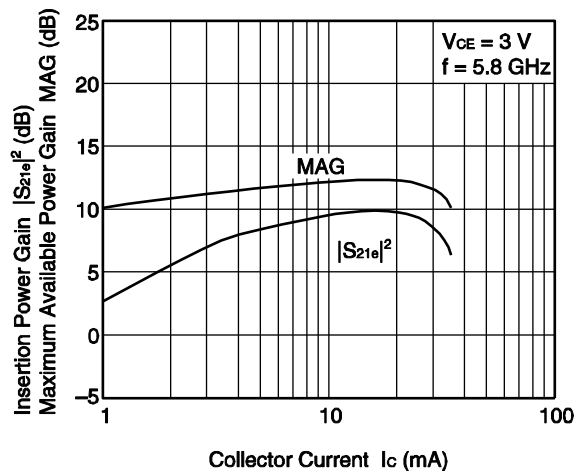
INSERTION POWER GAIN, MAG, MSG  
vs. COLLECTOR CURRENT



INSERTION POWER GAIN, MAG, MSG  
vs. COLLECTOR CURRENT

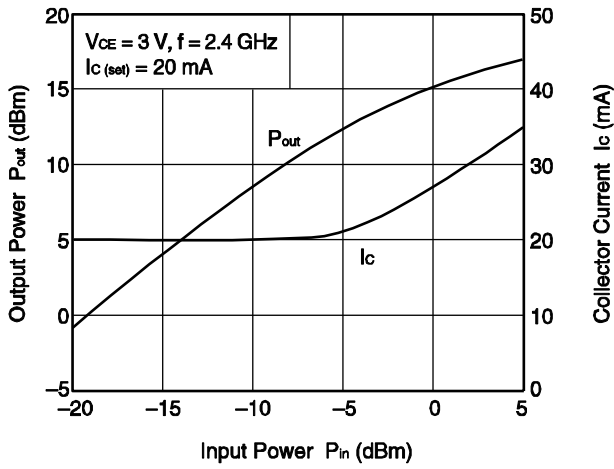


INSERTION POWER GAIN, MAG, MSG  
vs. COLLECTOR CURRENT

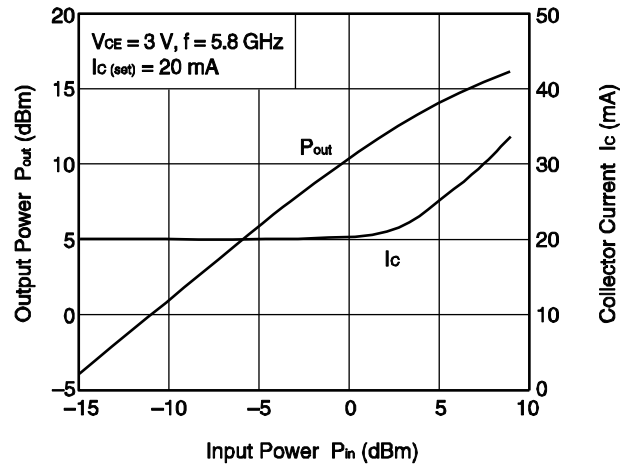


Remark The graphs indicate nominal characteristics.

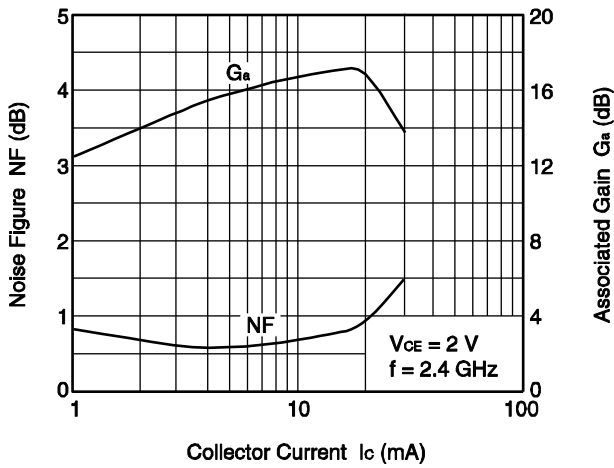
OUTPUT POWER, COLLECTOR CURRENT vs. INPUT POWER



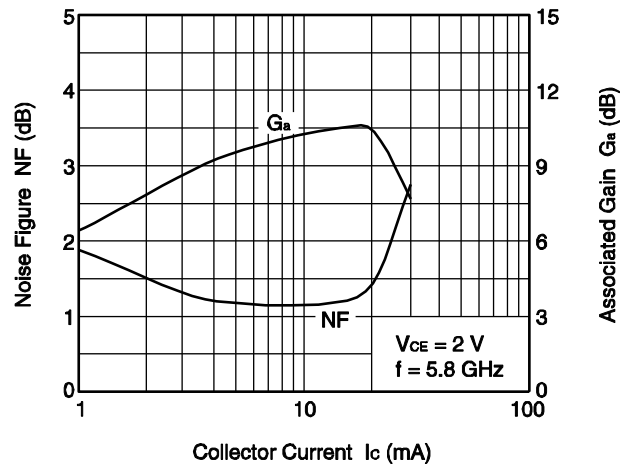
OUTPUT POWER, COLLECTOR CURRENT vs. INPUT POWER



NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



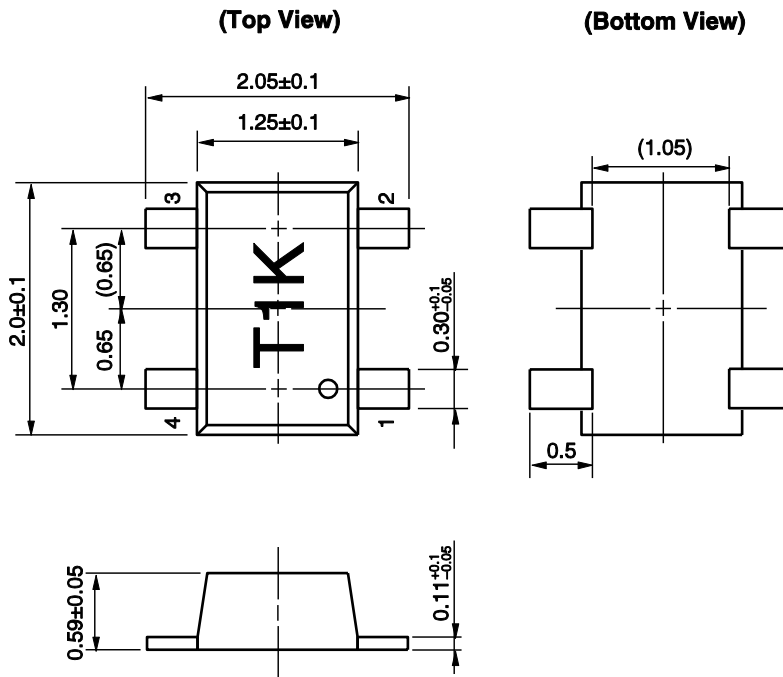
Remark The graphs indicate nominal characteristics.

- <R> **S-PARAMETERS**
- S-parameters and noise parameters are provided on our Web site in a 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/>



<R> **PACKAGE DIMENSIONS**

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



**PIN CONNECTIONS**

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

**Remark ( ) :** Reference value