

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
 $NF = 0.9 \text{ dB TYP.}, G_a = 18.0 \text{ dB TYP. @ } V_{CE} = 2 \text{ V}, I_C = 3 \text{ mA}, f = 2 \text{ GHz}$
 $NF = 1.3 \text{ dB TYP.}, G_a = 10.0 \text{ dB TYP. @ } V_{CE} = 2 \text{ V}, I_C = 3 \text{ mA}, f = 5.2 \text{ GHz}$
- Maximum stable power gain: $MSG = 22.5 \text{ dB TYP. @ } V_{CE} = 3 \text{ V}, I_C = 10 \text{ mA}, f = 2 \text{ GHz}$
- 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)	<ul style="list-style-type: none"> 8 mm wide embossed taping 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 ($T_A = +25^\circ\text{C}$)

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	35	mA
Total Power Dissipation	P_{tot}^{Note}	175	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.

The information in this document is subject to change without notice. Before using this document, please confirm that this is the latest version.
Not all products and/or types are available in every country. Please check with an NEC Electronics sales representative for availability and additional information.

ELECTRICAL CHARACTERISTICS (T_A = +25°C)

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
DC Characteristics						
Collector Cut-off Current	I _{CB0}	V _{CB} = 5 V, I _E = 0 mA	–	–	100	nA
Emitter Cut-off Current	I _{EB0}	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. $MSG = \left| \frac{S_{21}}{S_{12}} \right|$

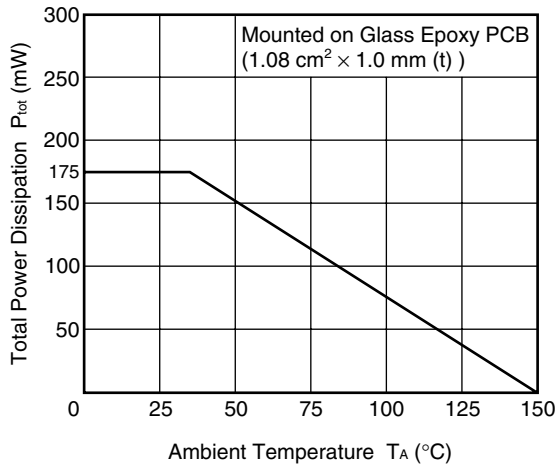
h_{FE} CLASSIFICATION

<R>

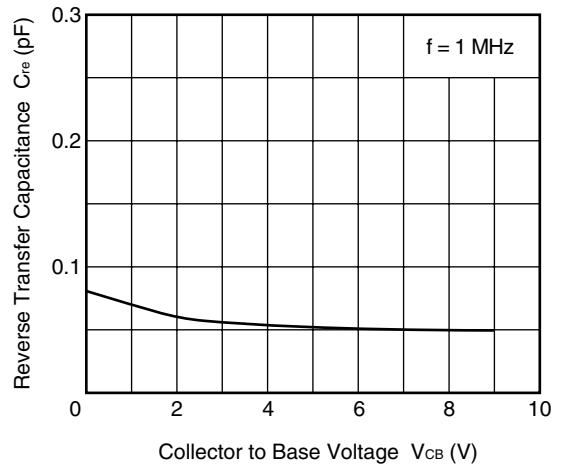
Rank	FB/YFB
Marking	zE
h _{FE} Value	130 to 260

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

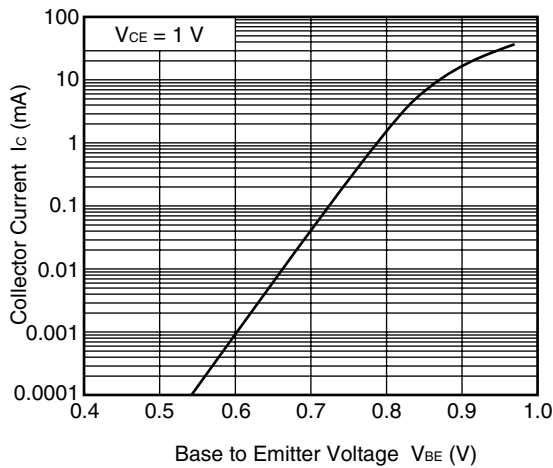
TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE



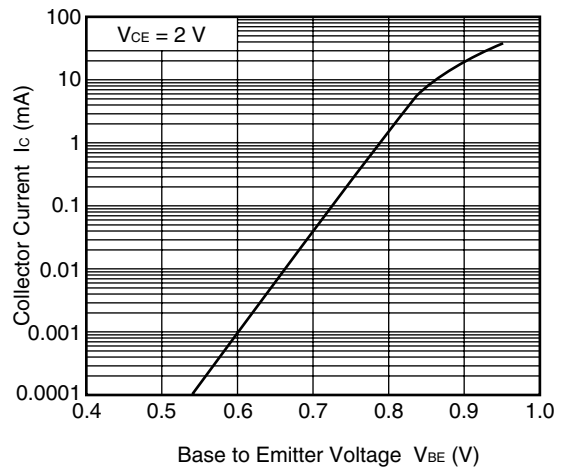
REVERSE TRANSFER CAPACITANCE vs. COLLECTOR TO BASE VOLTAGE



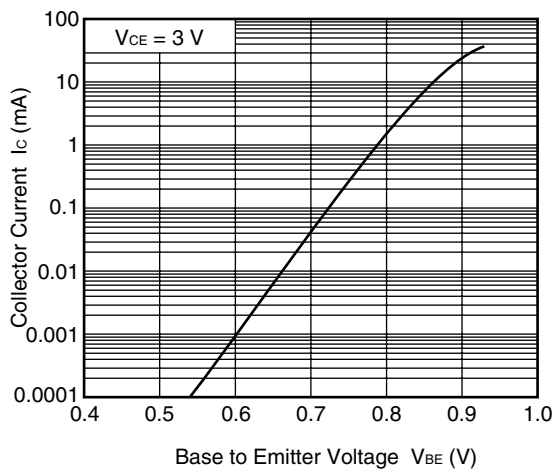
COLLECTOR CURRENT vs. BASE TO EMITTER VOLTAGE



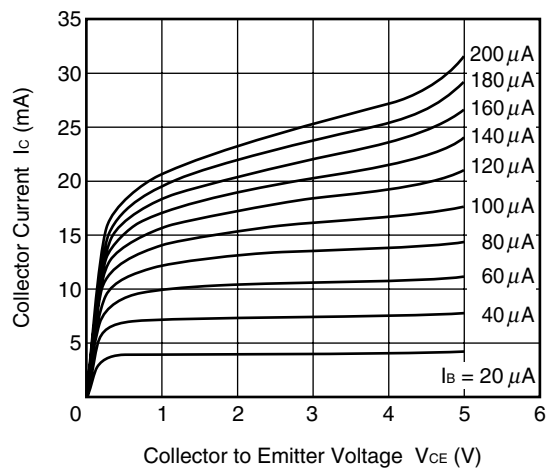
COLLECTOR CURRENT vs. BASE TO EMITTER VOLTAGE



COLLECTOR CURRENT vs. BASE TO EMITTER VOLTAGE

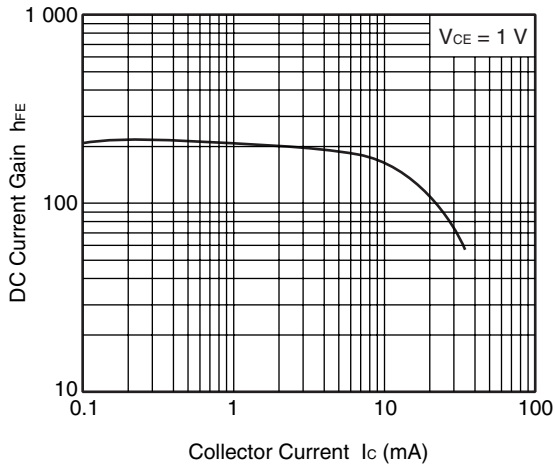


COLLECTOR CURRENT vs. COLLECTOR TO EMITTER VOLTAGE

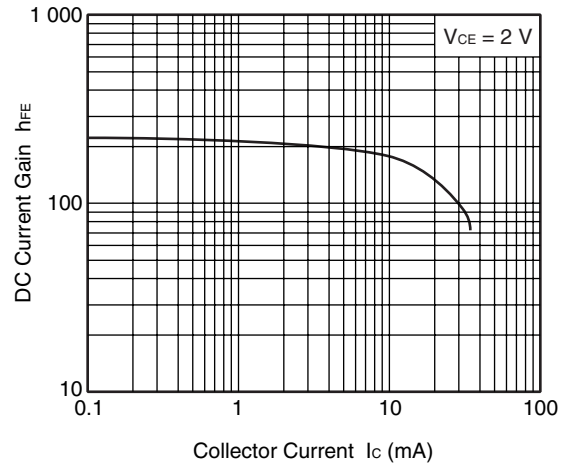


Remark The graphs indicate nominal characteristics.

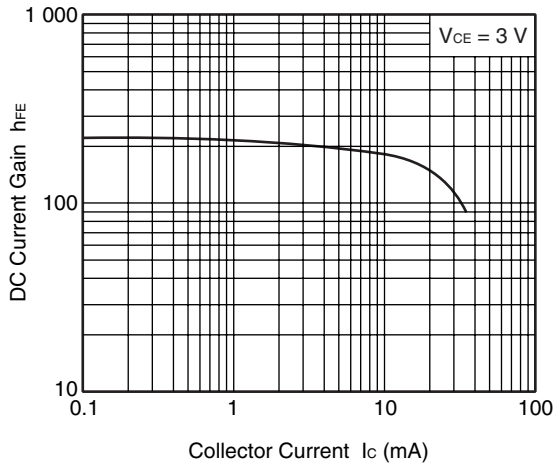
DC CURRENT GAIN vs.
COLLECTOR CURRENT



DC CURRENT GAIN vs.
COLLECTOR CURRENT

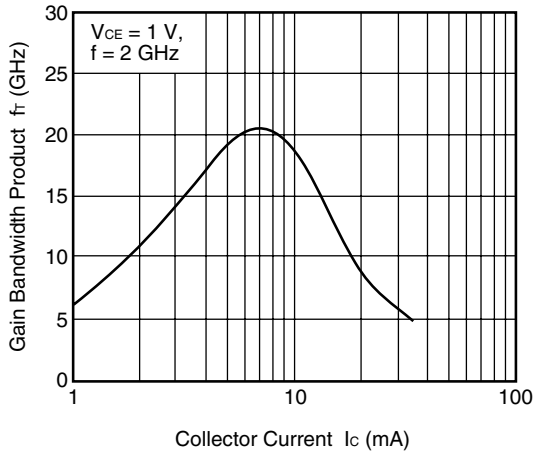


DC CURRENT GAIN vs.
COLLECTOR CURRENT

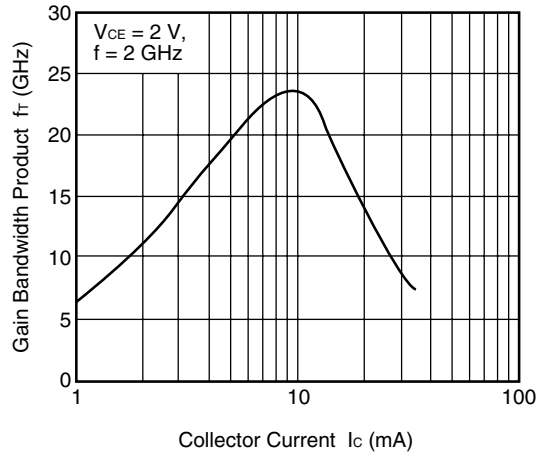


Remark The graphs indicate nominal characteristics.

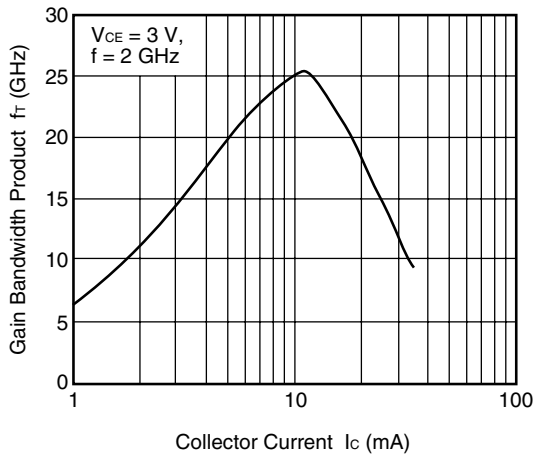
GAIN BANDWIDTH PRODUCT vs. COLLECTOR CURRENT



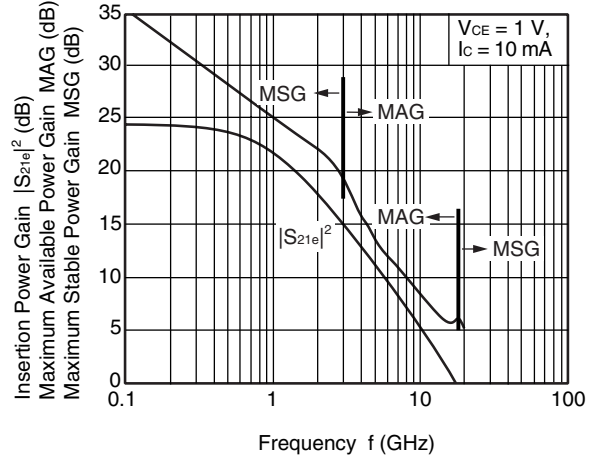
GAIN BANDWIDTH PRODUCT vs. COLLECTOR CURRENT



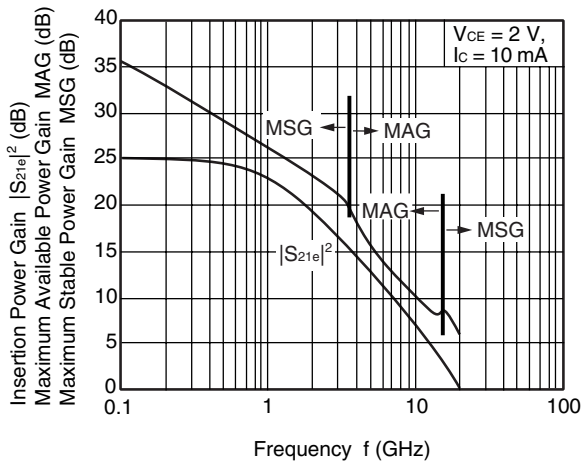
GAIN BANDWIDTH PRODUCT vs. COLLECTOR CURRENT



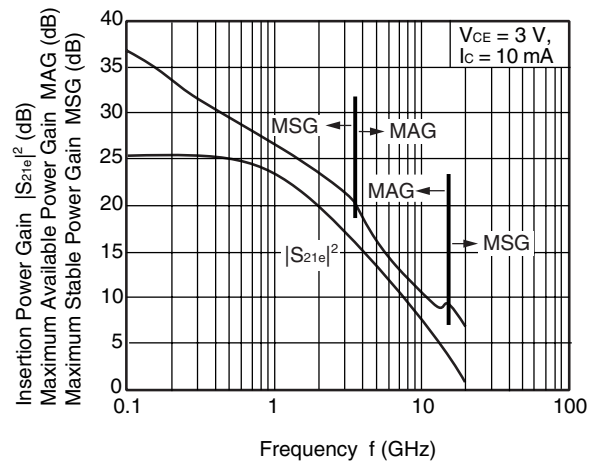
INSERTION POWER GAIN, MAG, MSG vs. FREQUENCY



INSERTION POWER GAIN, MAG, MSG vs. FREQUENCY

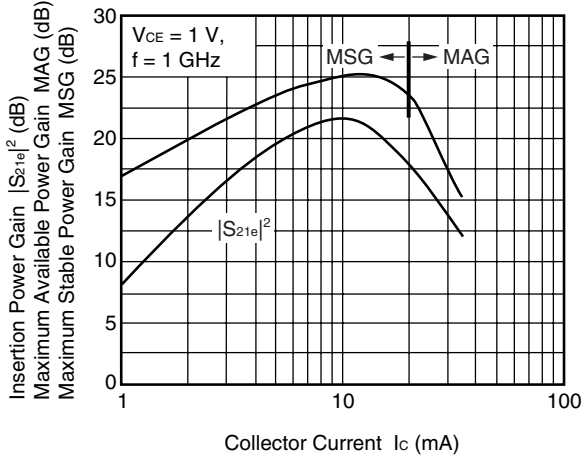


INSERTION POWER GAIN, MAG, MSG vs. FREQUENCY

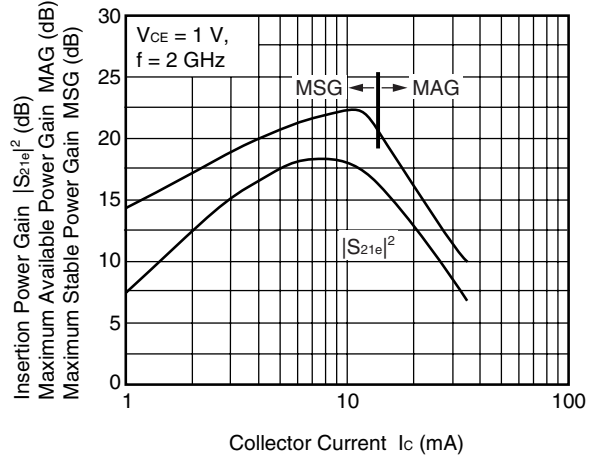


Remark The graphs indicate nominal characteristics.

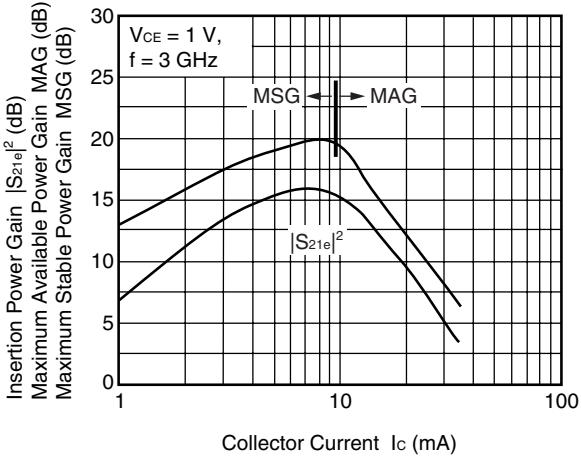
INSERTION POWER GAIN, MAG, MSG vs. COLLECTOR CURRENT



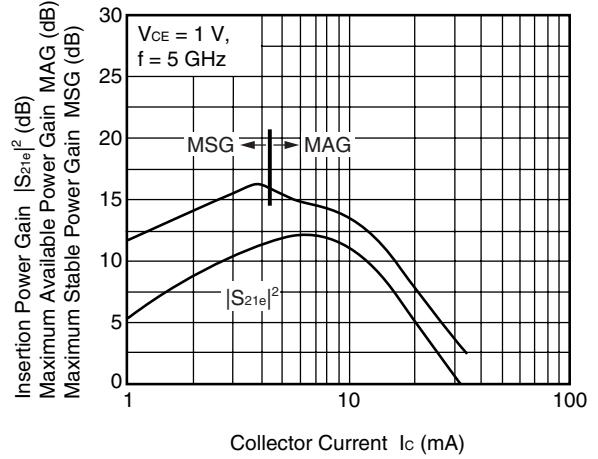
INSERTION POWER GAIN, MAG, MSG vs. COLLECTOR CURRENT



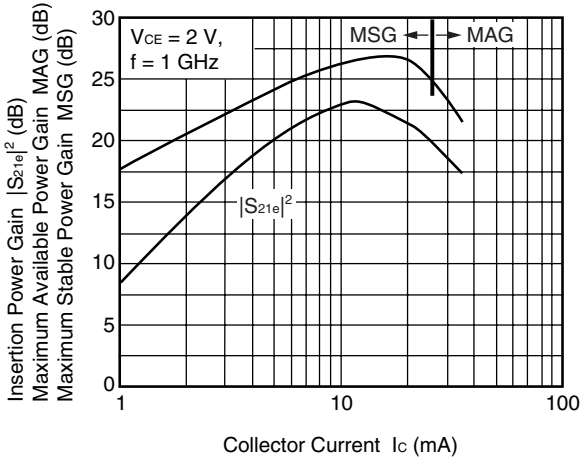
INSERTION POWER GAIN, MAG, MSG vs. COLLECTOR CURRENT



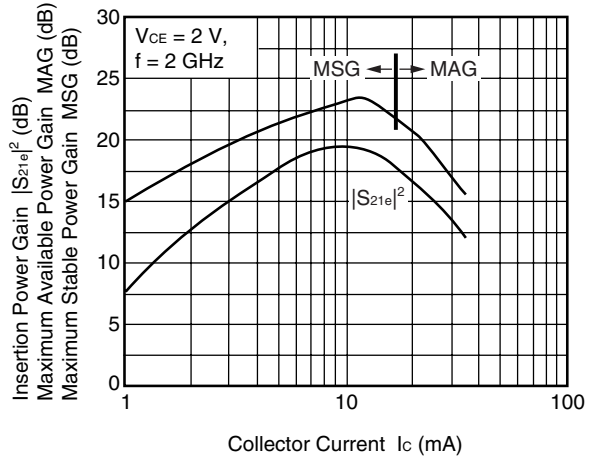
INSERTION POWER GAIN, MAG, MSG vs. COLLECTOR CURRENT



INSERTION POWER GAIN, MAG, MSG vs. COLLECTOR CURRENT

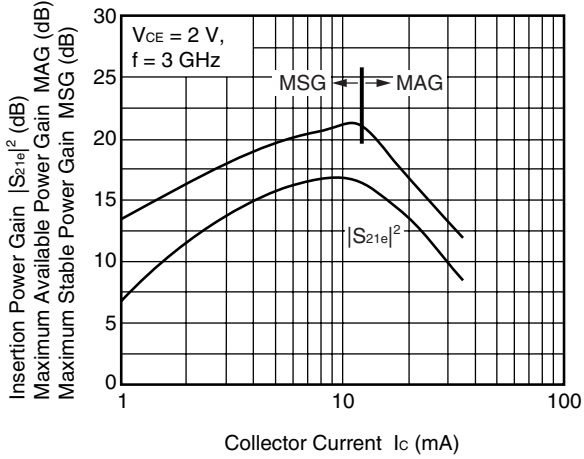


INSERTION POWER GAIN, MAG, MSG vs. COLLECTOR CURRENT

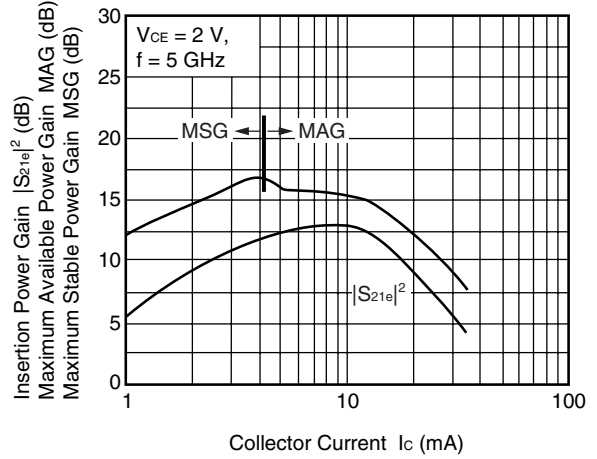


Remark The graphs indicate nominal characteristics.

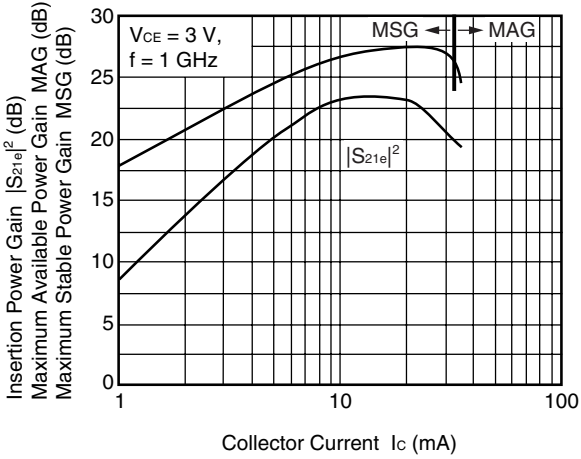
INSERTION POWER GAIN, MAG, MSG
vs. COLLECTOR CURRENT



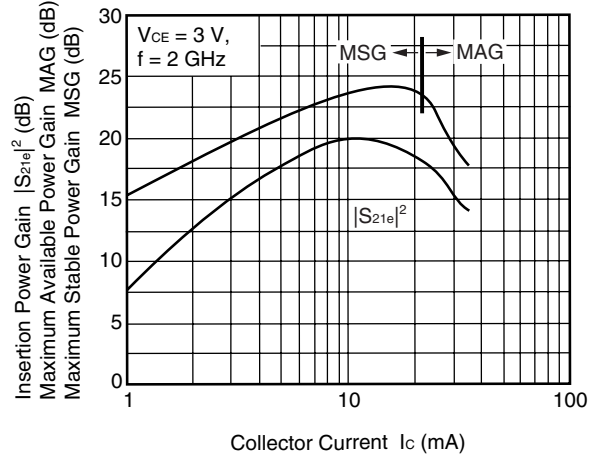
INSERTION POWER GAIN, MAG, MSG
vs. COLLECTOR CURRENT



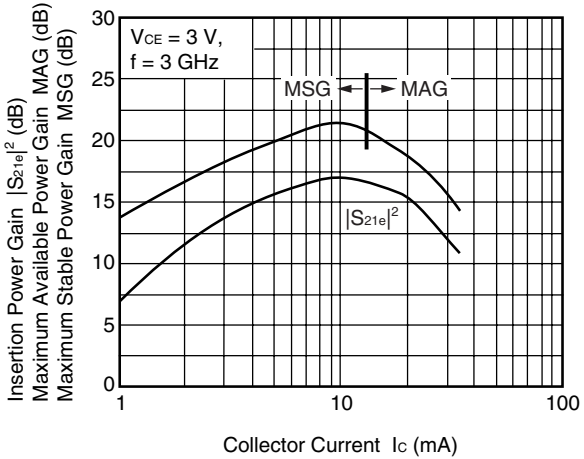
INSERTION POWER GAIN, MAG, MSG
vs. COLLECTOR CURRENT



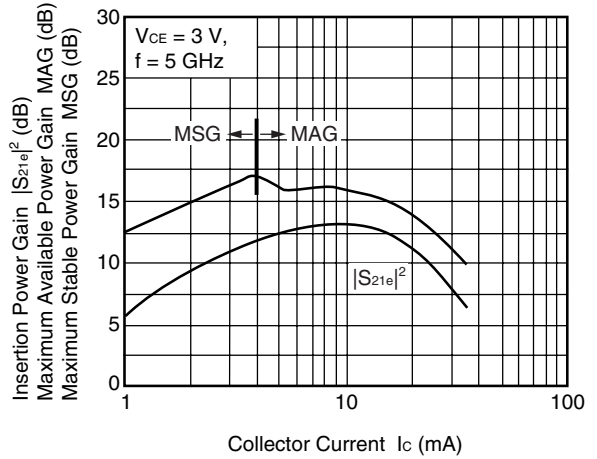
INSERTION POWER GAIN, MAG, MSG
vs. COLLECTOR CURRENT



INSERTION POWER GAIN, MAG, MSG
vs. COLLECTOR CURRENT

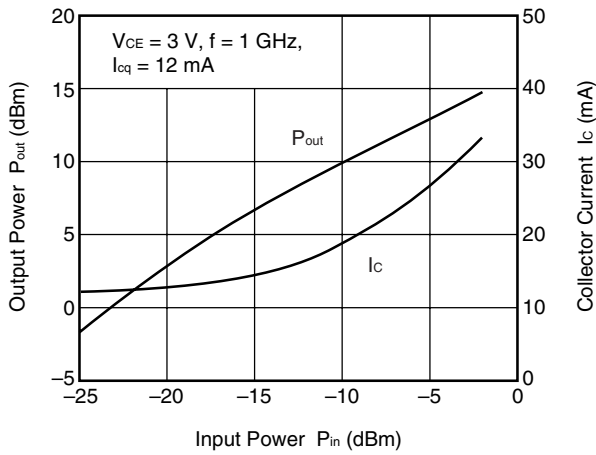


INSERTION POWER GAIN, MAG, MSG
vs. COLLECTOR CURRENT

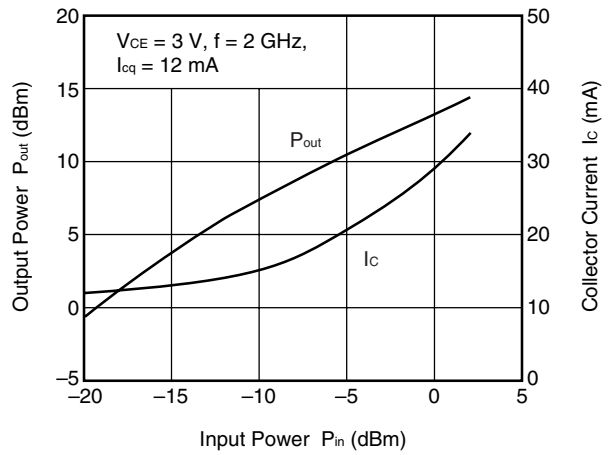


Remark The graphs indicate nominal characteristics.

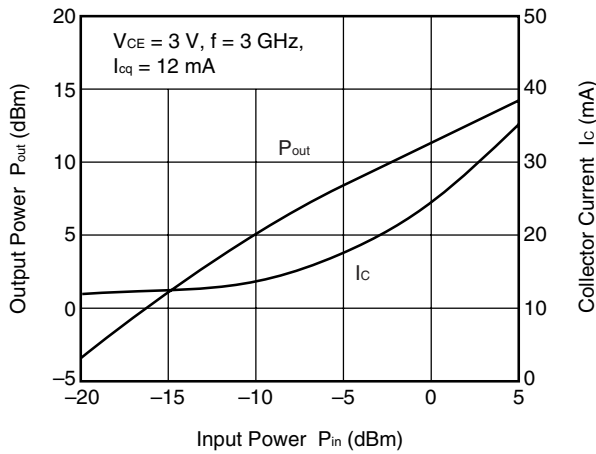
OUTPUT POWER, COLLECTOR CURRENT vs. INPUT POWER



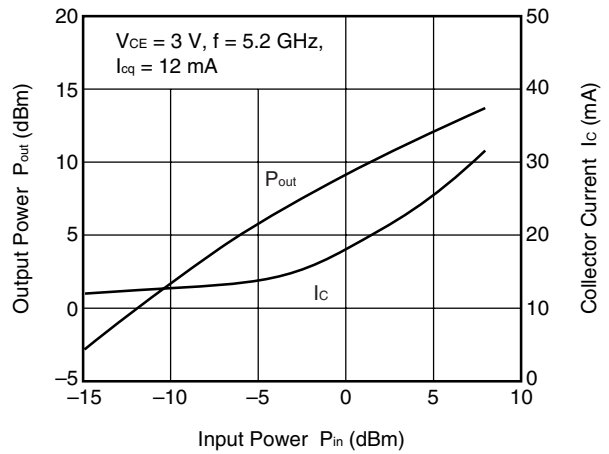
OUTPUT POWER, COLLECTOR CURRENT vs. INPUT POWER



OUTPUT POWER, COLLECTOR CURRENT vs. INPUT POWER

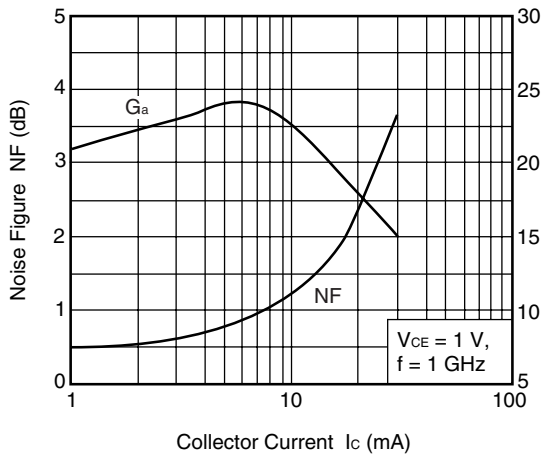


OUTPUT POWER, COLLECTOR CURRENT vs. INPUT POWER

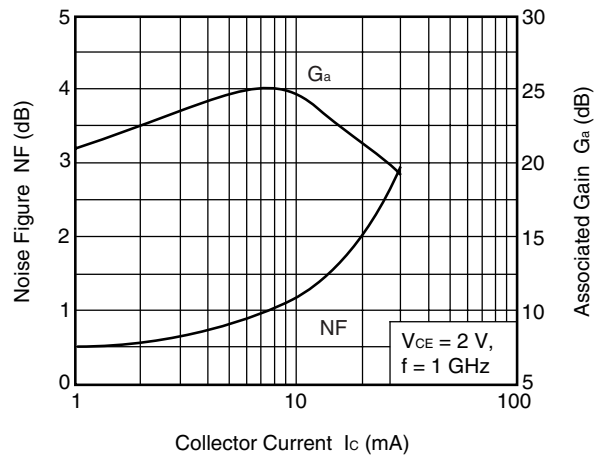


Remark The graphs indicate nominal characteristics.

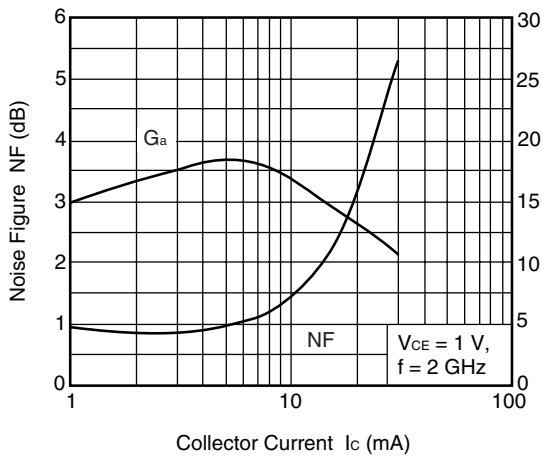
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



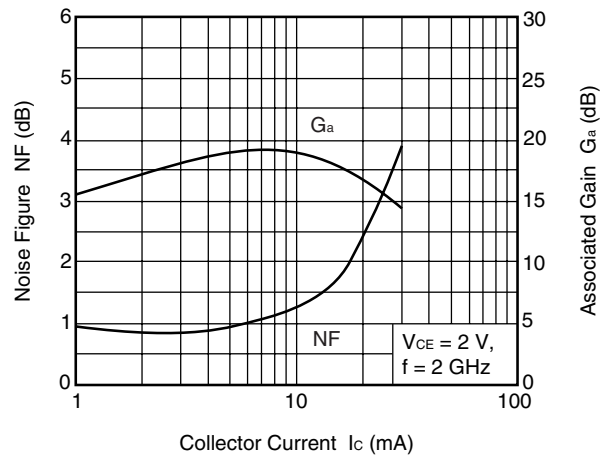
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



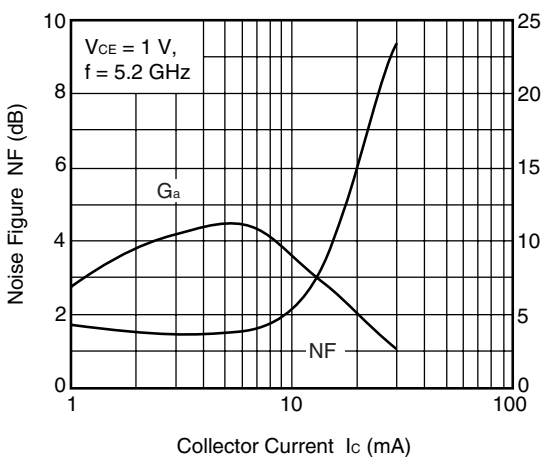
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



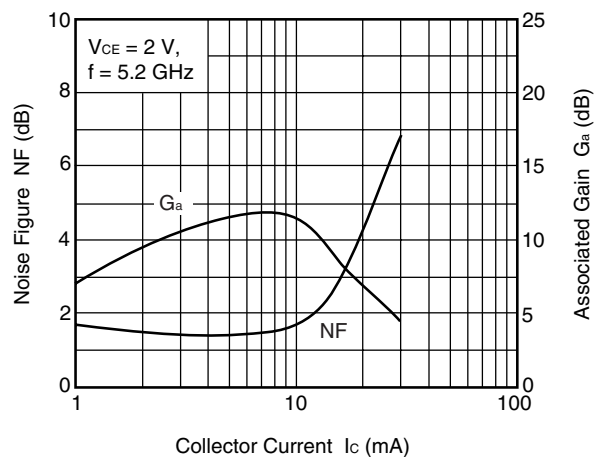
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT

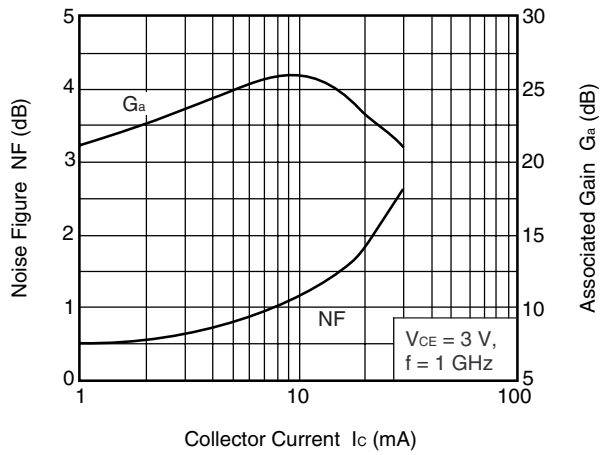


NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT

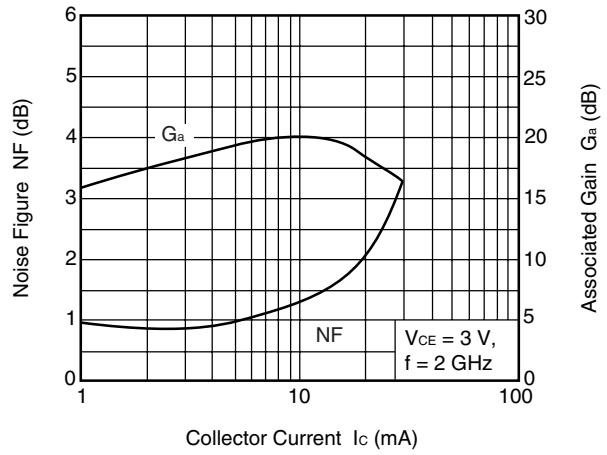


Remark The graphs indicate nominal characteristics.

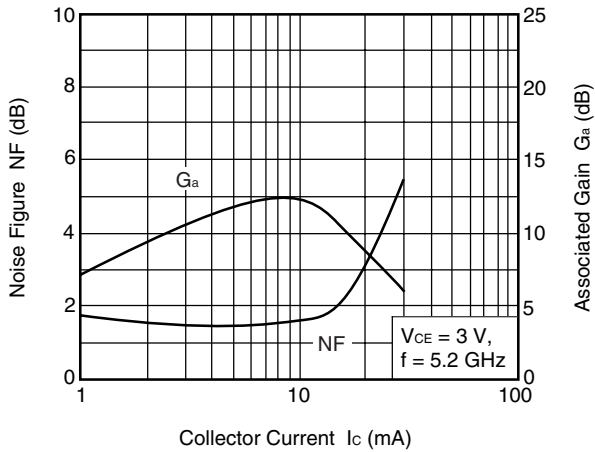
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



Remark The graphs indicate nominal characteristics.

<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/>

- **The information in this document is current as of September, 2009. The information is subject to change without notice. For actual design-in, refer to the latest publications of NEC Electronics data sheets, etc., for the most up-to-date specifications of NEC Electronics products. Not all products and/or types are available in every country. Please check with an NEC Electronics sales representative for availability and additional information.**
- No part of this document may be copied or reproduced in any form or by any means without the prior written consent of NEC Electronics. NEC Electronics assumes no responsibility for any errors that may appear in this document.
- NEC Electronics does not assume any liability for infringement of patents, copyrights or other intellectual property rights of third parties by or arising from the use of NEC Electronics products listed in this document or any other liability arising from the use of such products. No license, express, implied or otherwise, is granted under any patents, copyrights or other intellectual property rights of NEC Electronics or others.
- Descriptions of circuits, software and other related information in this document are provided for illustrative purposes in semiconductor product operation and application examples. The incorporation of these circuits, software and information in the design of a customer's equipment shall be done under the full responsibility of the customer. NEC Electronics assumes no responsibility for any losses incurred by customers or third parties arising from the use of these circuits, software and information.
- While NEC Electronics endeavors to enhance the quality and safety of NEC Electronics products, customers agree and acknowledge that the possibility of defects thereof cannot be eliminated entirely. In addition, NEC Electronics products are not taken measures to prevent radioactive rays in the product design. When customers use NEC Electronics products with their products, customers shall, on their own responsibility, incorporate sufficient safety measures such as redundancy, fire-containment and anti-failure features to their products in order to avoid risks of the damages to property (including public or social property) or injury (including death) to persons, as the result of defects of NEC Electronics products.
- NEC Electronics products are classified into the following three quality grades: "Standard", "Special" and "Specific".

The "Specific" quality grade applies only to NEC Electronics products developed based on a customer-designated "quality assurance program" for a specific application. The recommended applications of an NEC Electronics product depend on its quality grade, as indicated below. Customers must check the quality grade of each NEC Electronics product before using it in a particular application.

"Standard": Computers, office equipment, communications equipment, test and measurement equipment, audio and visual equipment, home electronic appliances, machine tools, personal electronic equipment and industrial robots.

"Special": Transportation equipment (automobiles, trains, ships, etc.), traffic control systems, anti-disaster systems, anti-crime systems, safety equipment and medical equipment (not specifically designed for life support).

"Specific": Aircraft, aerospace equipment, submersible repeaters, nuclear reactor control systems, life support systems and medical equipment for life support, etc.

The quality grade of NEC Electronics products is "Standard" unless otherwise expressly specified in NEC Electronics data sheets or data books, etc. If customers wish to use NEC Electronics products in applications not intended by NEC Electronics, they must contact an NEC Electronics sales representative in advance to determine NEC Electronics' willingness to support a given application.

(Note)

- (1) "NEC Electronics" as used in this statement means NEC Electronics Corporation and also includes its majority-owned subsidiaries.
- (2) "NEC Electronics products" means any product developed or manufactured by or for NEC Electronics (as defined above).