

DATA SHEET

NEC

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)	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.

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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

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

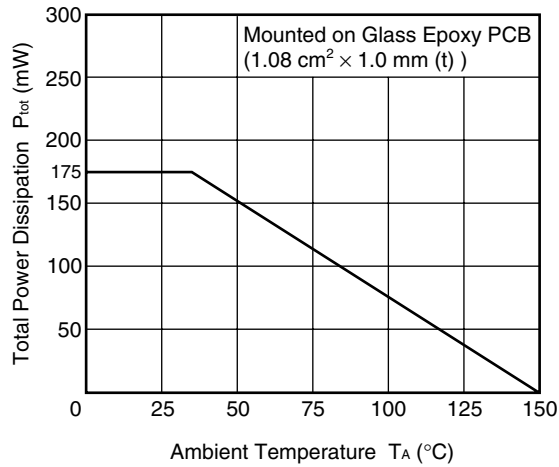
h_{FE} CLASSIFICATION

<R>

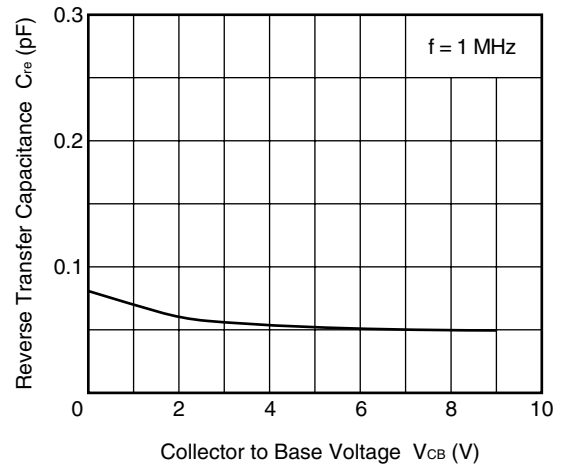
Rank	FB/YFB
Marking	zE
h _{FE} Value	130 to 260

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

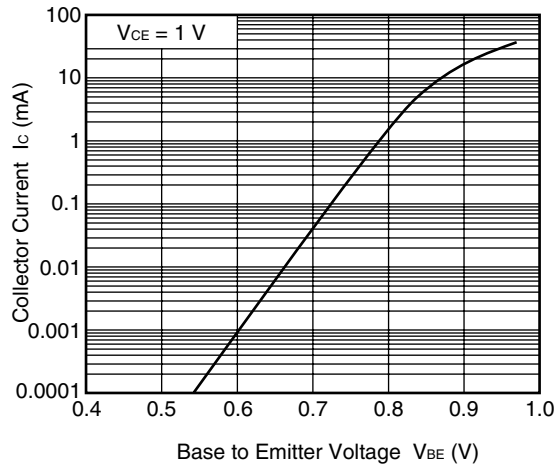
**TOTAL POWER DISSIPATION
vs. AMBIENT TEMPERATURE**



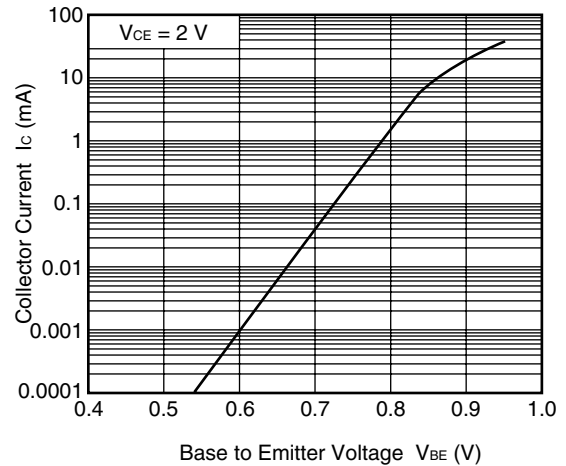
**REVERSE TRANSFER CAPACITANCE
vs. COLLECTOR TO BASE VOLTAGE**



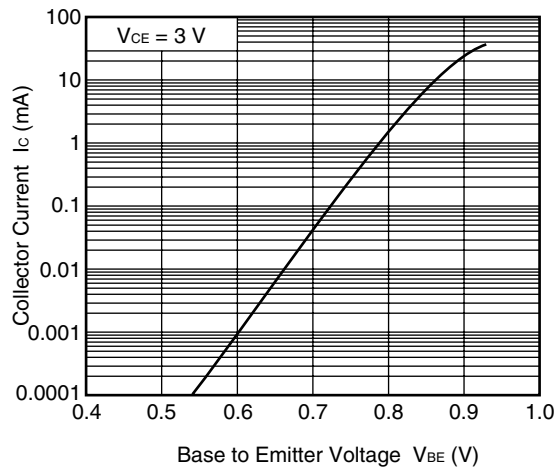
**COLLECTOR CURRENT vs.
BASE TO EMITTER VOLTAGE**



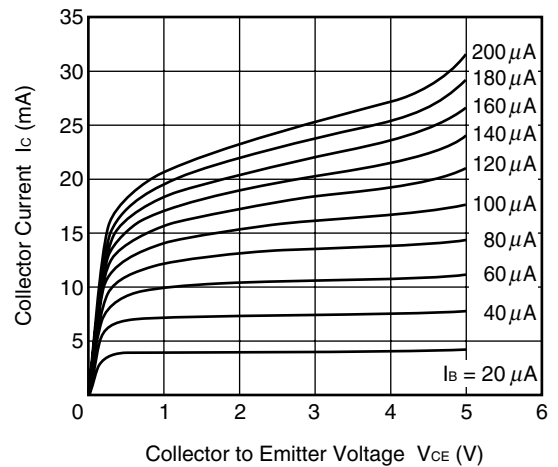
**COLLECTOR CURRENT vs.
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**COLLECTOR CURRENT vs.
BASE TO EMITTER VOLTAGE**

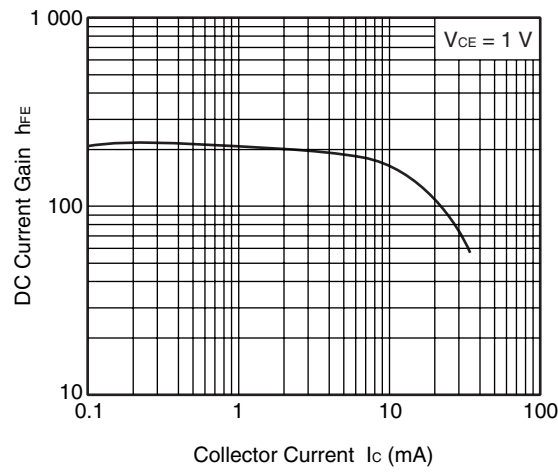


**COLLECTOR CURRENT vs.
COLLECTOR TO EMITTER VOLTAGE**

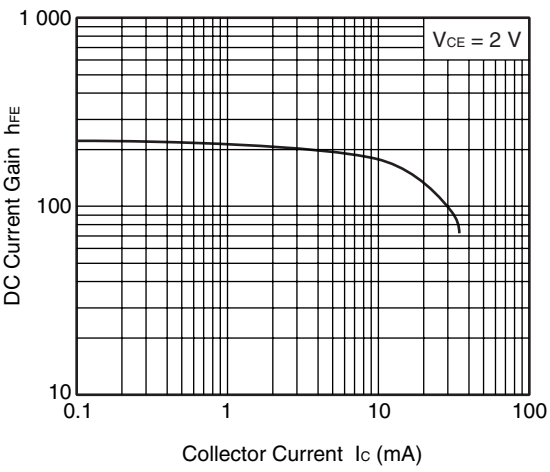


Remark The graphs indicate nominal characteristics.

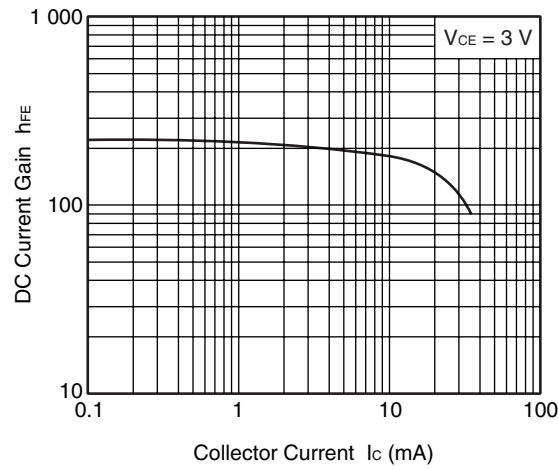
DC CURRENT GAIN vs.
COLLECTOR CURRENT



DC CURRENT GAIN vs.
COLLECTOR CURRENT

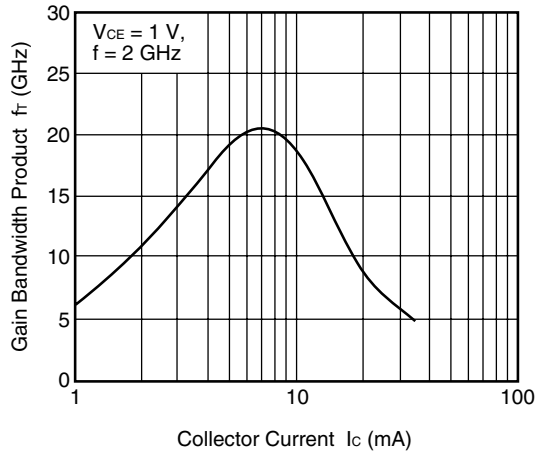


DC CURRENT GAIN vs.
COLLECTOR CURRENT

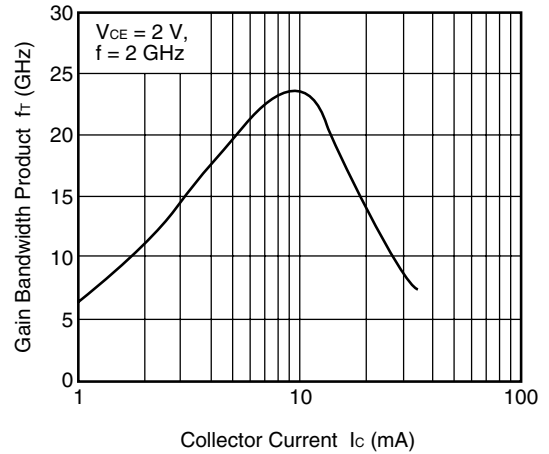


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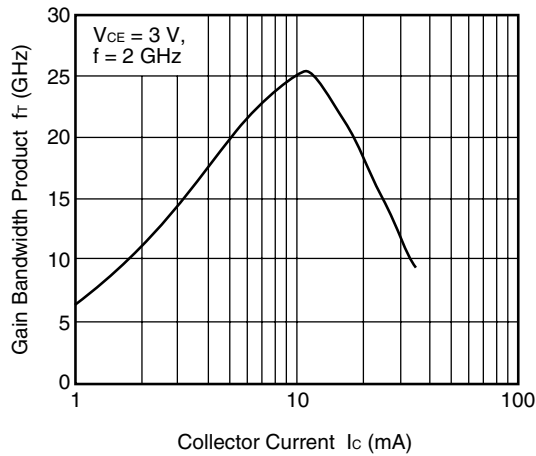
GAIN BANDWIDTH PRODUCT
vs. COLLECTOR CURRENT



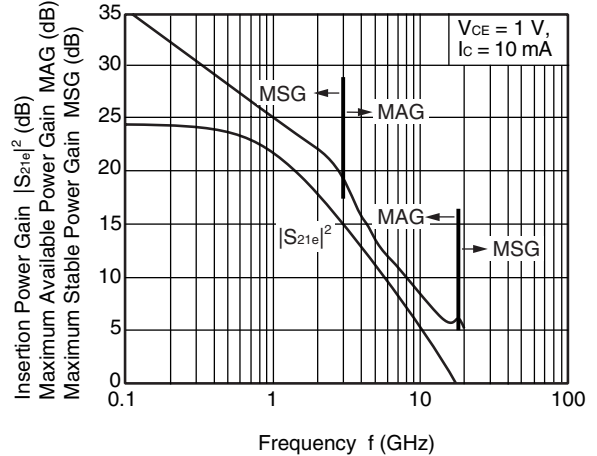
GAIN BANDWIDTH PRODUCT
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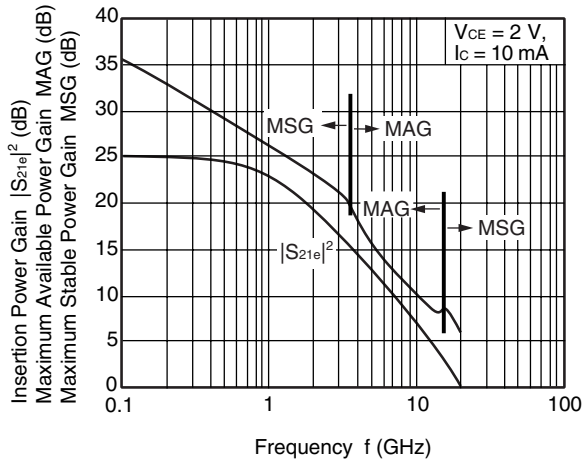
GAIN BANDWIDTH PRODUCT
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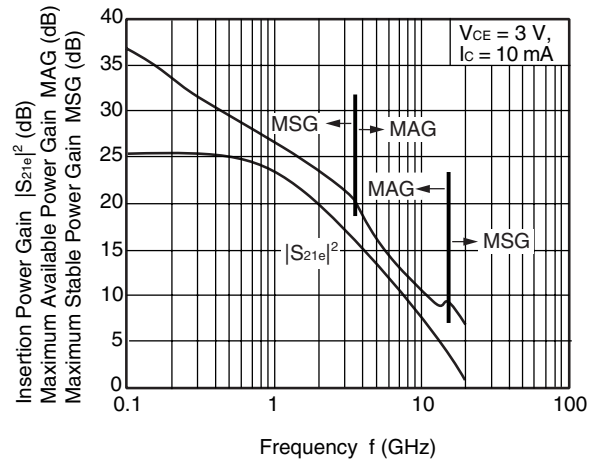
INSERTION POWER GAIN,
MAG, MSG vs. FREQUENCY



INSERTION POWER GAIN,
MAG, MSG vs. FREQUENCY

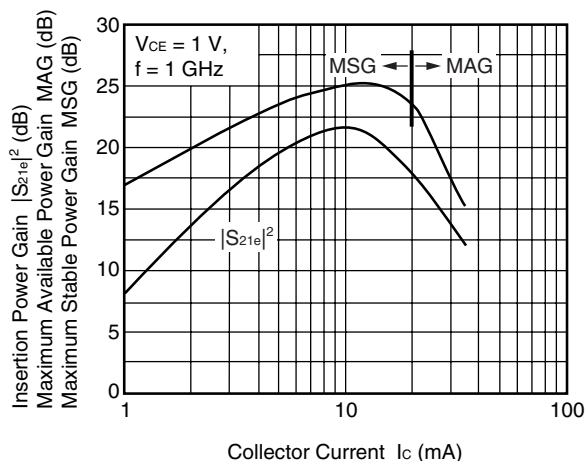


INSERTION POWER GAIN,
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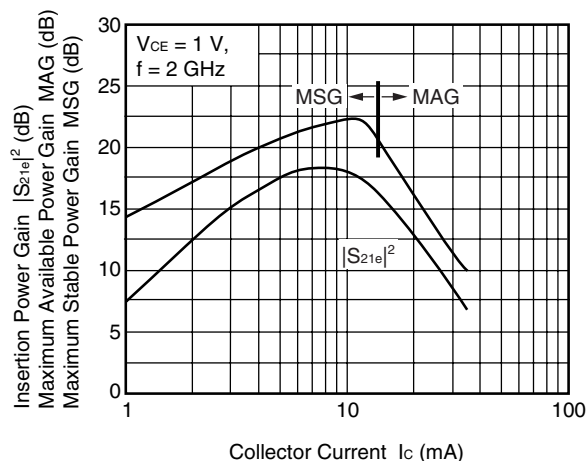


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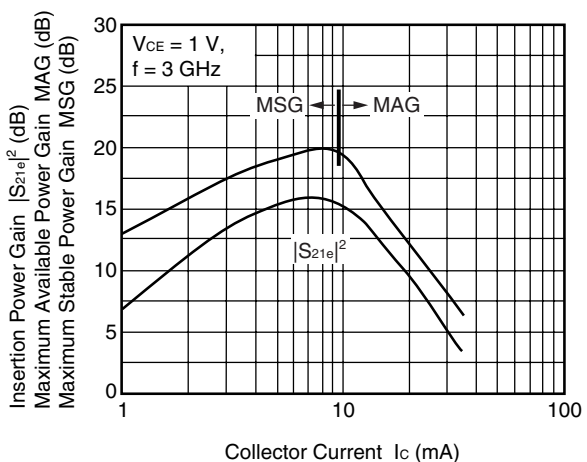
INSERTION POWER GAIN, MAG, MSG
vs. COLLECTOR CURRENT



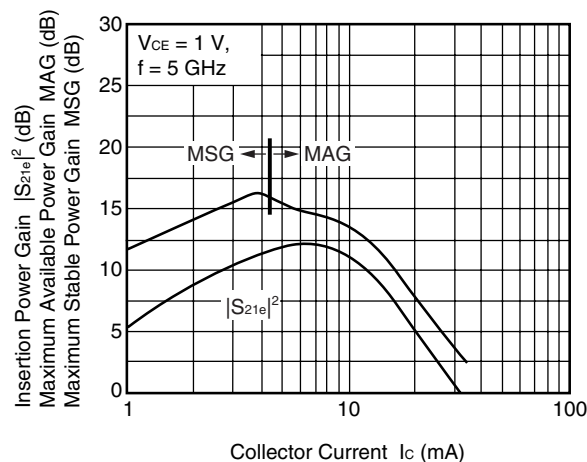
INSERTION POWER GAIN, MAG, MSG
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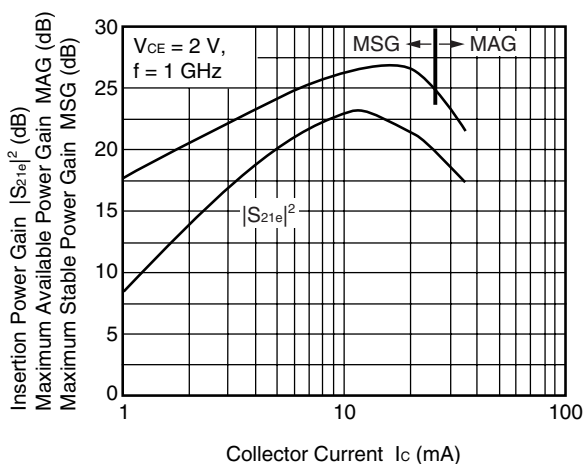
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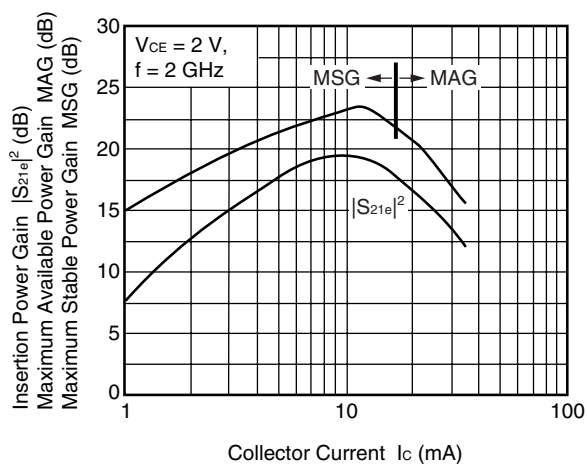
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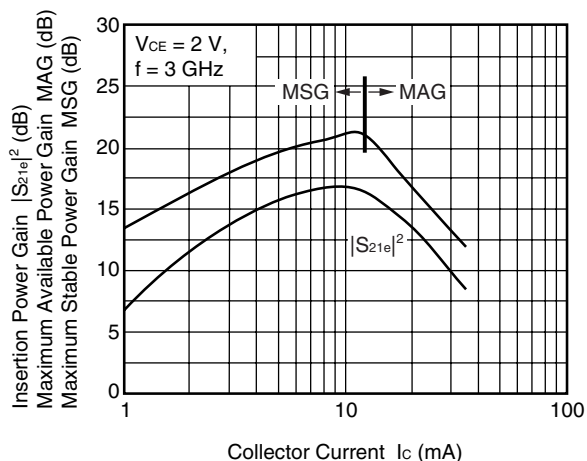


INSERTION POWER GAIN, MAG, MSG
vs. COLLECTOR CURRENT

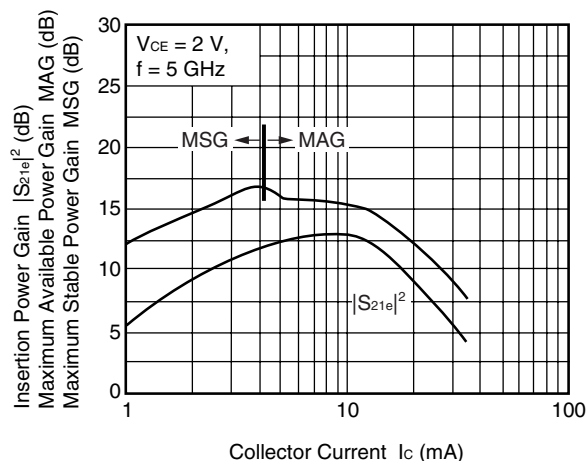


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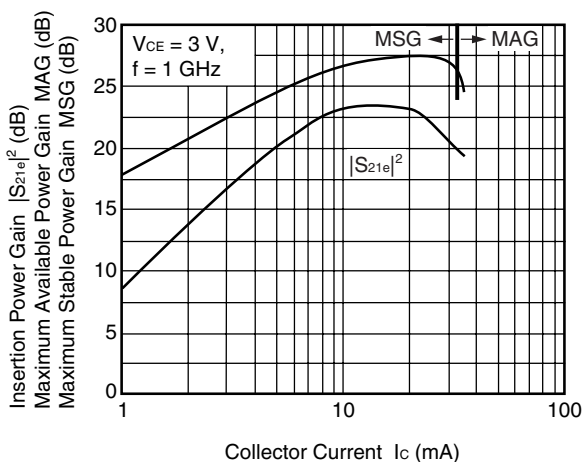
INSERTION POWER GAIN, MAG, MSG
vs. COLLECTOR CURRENT



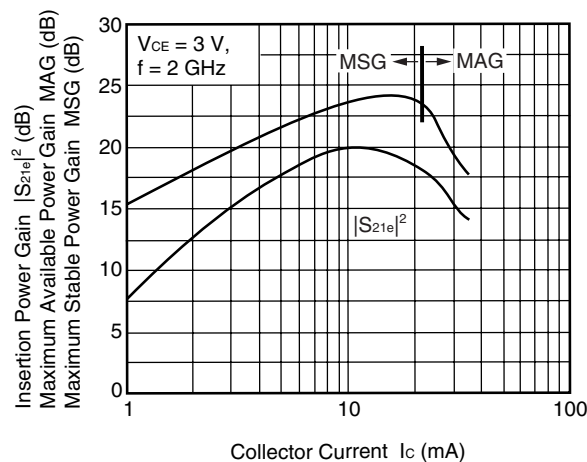
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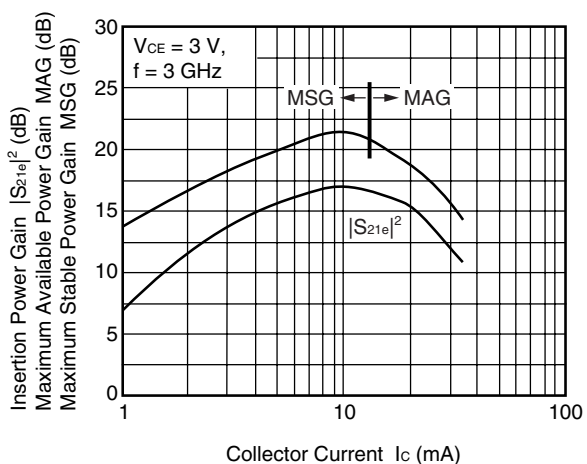
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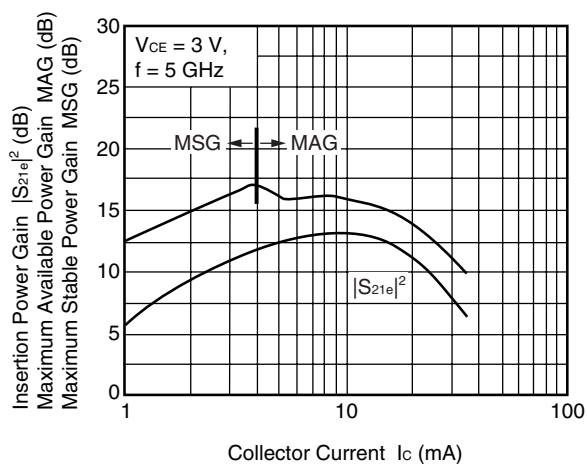
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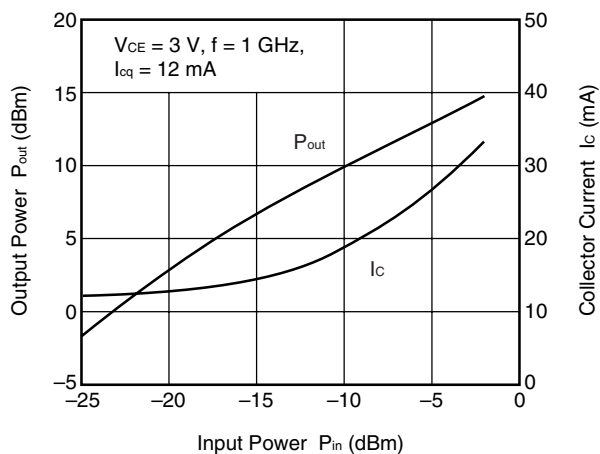


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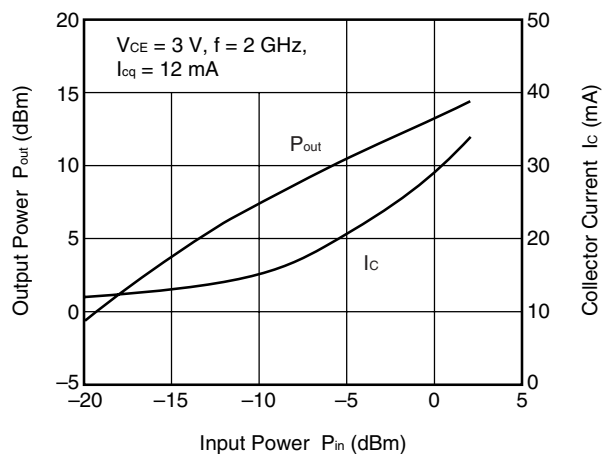


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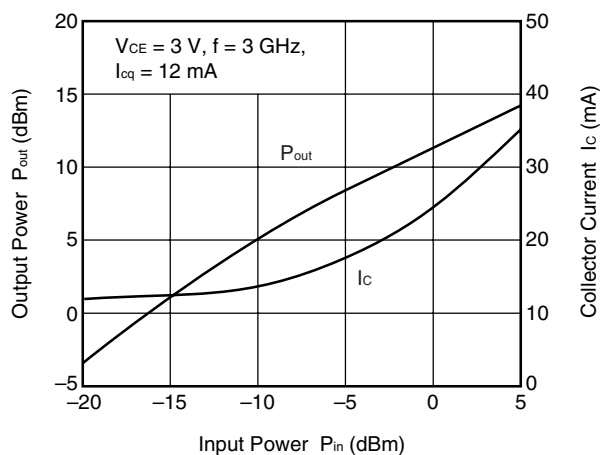
OUTPUT POWER, COLLECTOR
CURRENT vs. INPUT POWER



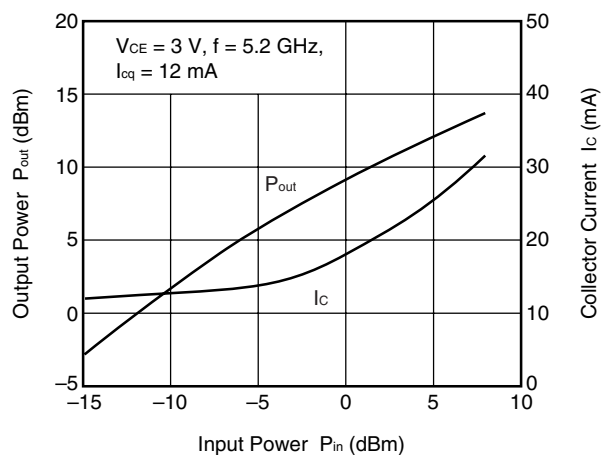
OUTPUT POWER, COLLECTOR
CURRENT vs. INPUT POWER



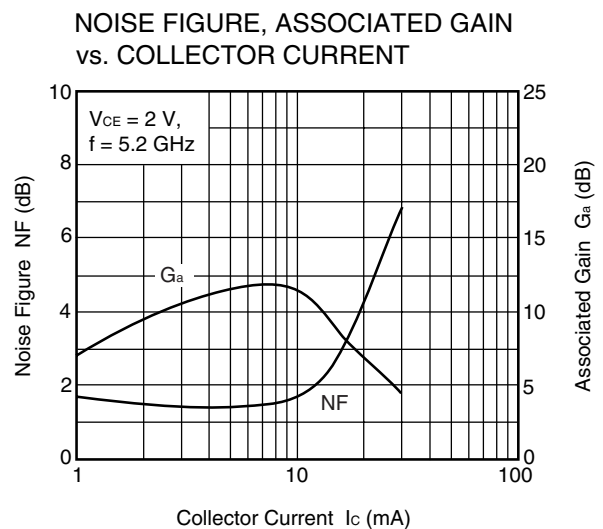
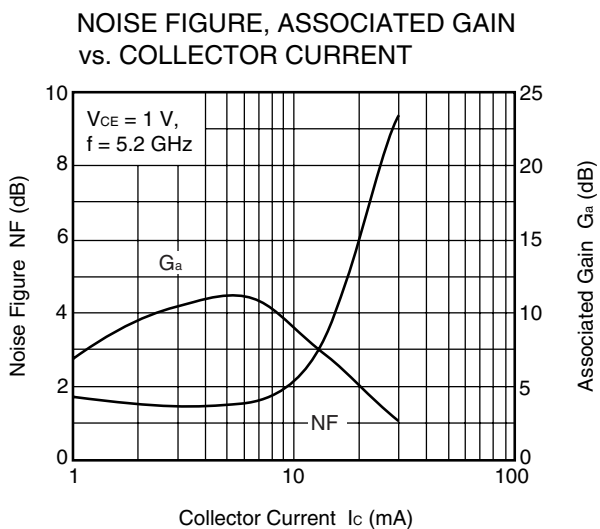
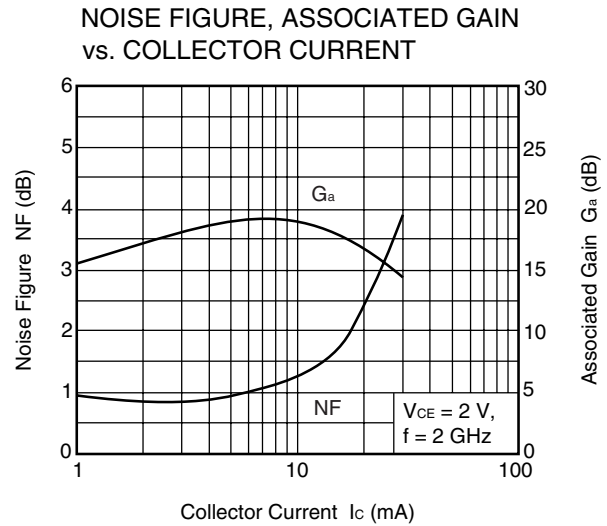
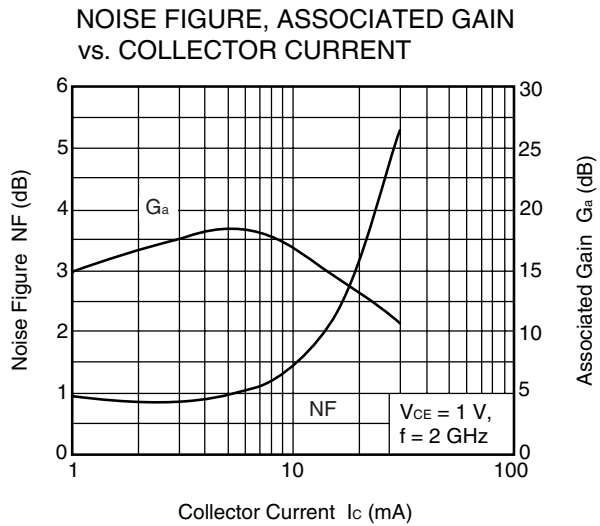
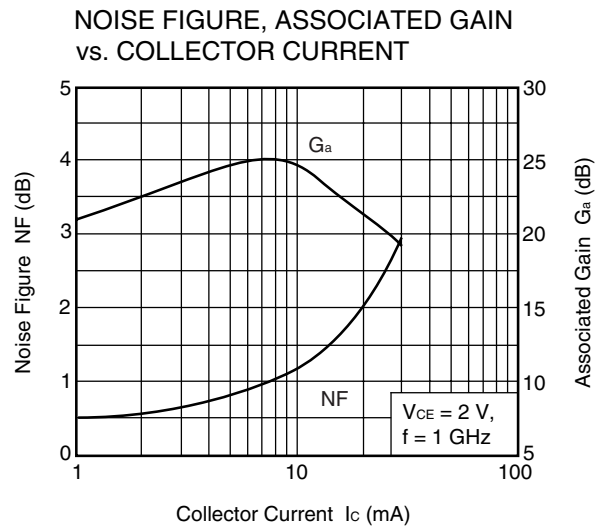
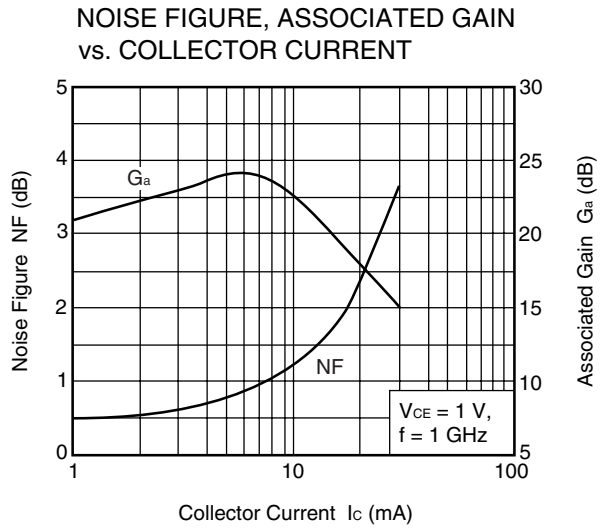
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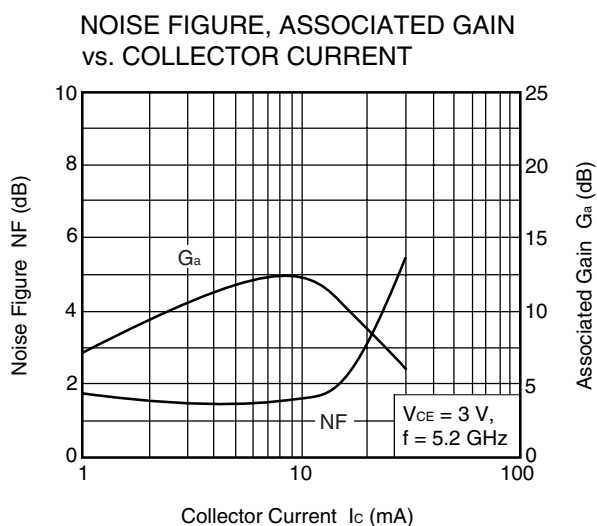
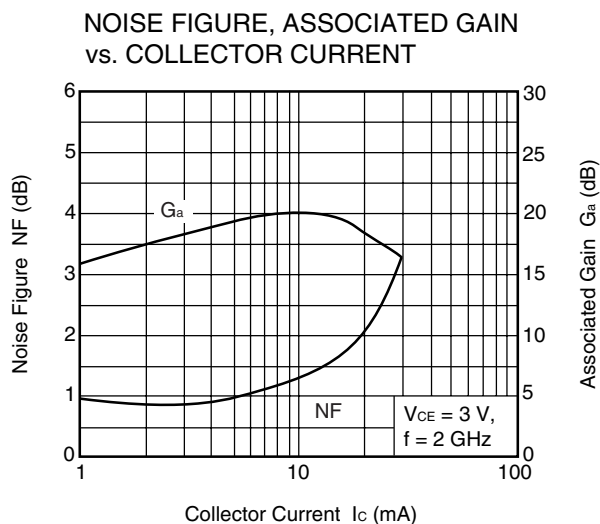
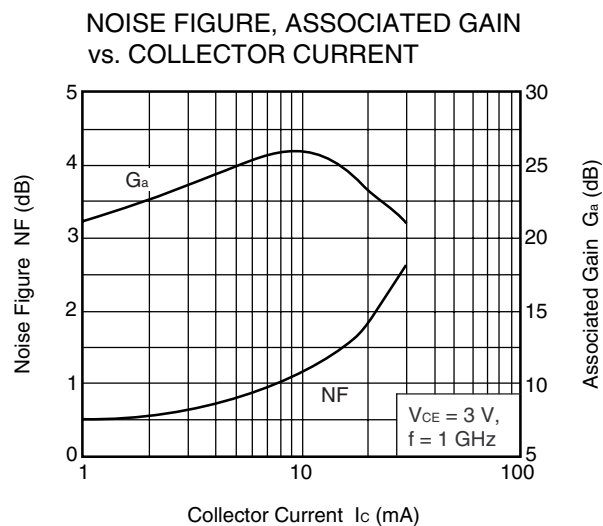
OUTPUT POWER, COLLECTOR
CURRENT vs. INPUT POWER



Remark The graphs indicate nominal characteristics.



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<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.

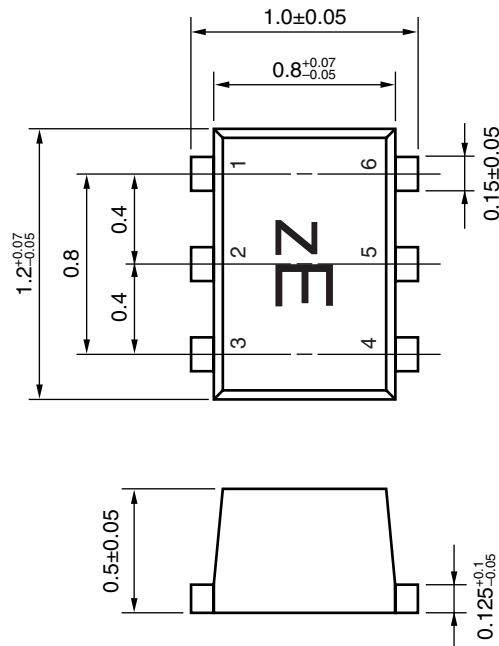
Click here to download S-parameters.

[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.

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