

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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Not recommended  
for new design

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NPN SILICON GERMANIUM RF TRANSISTOR  
**NESG3031M14**

NPN SiGe RF TRANSISTOR FOR  
 LOW NOISE, HIGH-GAIN AMPLIFICATION  
 4-PIN LEAD-LESS MINIMOLD (M14, 1208 PKG)

**FEATURES**

- The device is an ideal choice for low noise, high-gain amplification  
 NF = 0.6 dB TYP.,  $G_a = 16.0$  dB TYP. @  $V_{CE} = 2$  V,  $I_c = 6$  mA,  $f = 2.4$  GHz  
 NF = 0.95 dB TYP.,  $G_a = 10.0$  dB TYP. @  $V_{CE} = 2$  V,  $I_c = 6$  mA,  $f = 5.2$  GHz  
 NF = 1.1 dB TYP.,  $G_a = 9.5$  dB TYP. @  $V_{CE} = 2$  V,  $I_c = 6$  mA,  $f = 5.8$  GHz
- Maximum stable power gain: MSG = 15.0 dB TYP. @  $V_{CE} = 3$  V,  $I_c = 20$  mA,  $f = 5.8$  GHz
- SiGe HBT technology (UHS3) adopted:  $f_{max} = 110$  GHz
- 4-pin lead-less minimold (M14, 1208 PKG)

<R> **ORDERING INFORMATION**

Part Number	Order Number	Package	Quantity	Supplying Form
NESG3031M14	NESG3031M14-A	4-pin lead-less minimold (M14, 1208 PKG) (Pb-Free)	50 pcs (Non reel)	• 8 mm wide embossed taping • Pin 1 (Collector), Pin 4 (Emitter) face the perforation side of the tape
NESG3031M14-T3	NESG3031M14-T3-A		10 kpcs/reel	

**Remark** To order evaluation samples, contact your nearby sales office.  
 Unit sample quantity is 50 pcs.

**ABSOLUTE MAXIMUM RATINGS (T<sub>A</sub> = +25°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	$P_{tot}^{Note}$	150	mW
Junction Temperature	$T_j$	150	°C
Storage Temperature	$T_{stg}$	-65 to +150	°C

**Note** Mounted on 1.08 cm<sup>2</sup> × 1.0 mm (t) glass epoxy PWB

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

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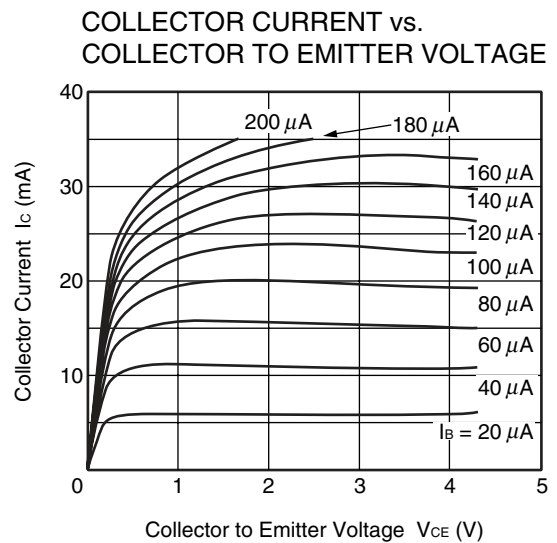
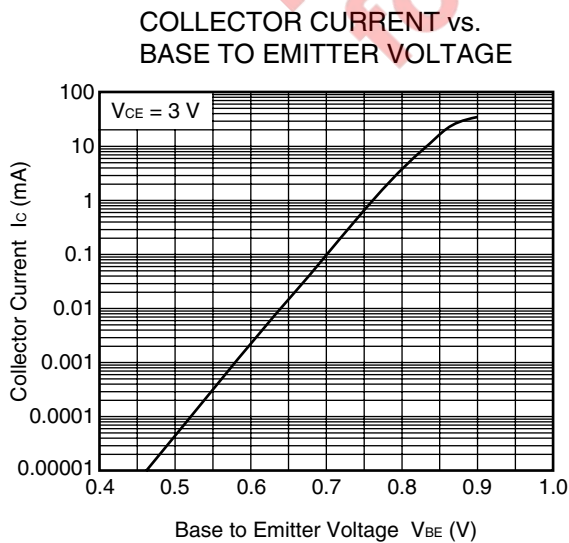
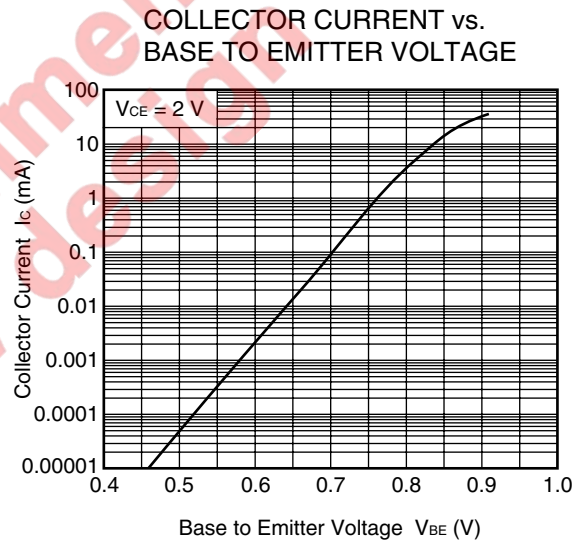
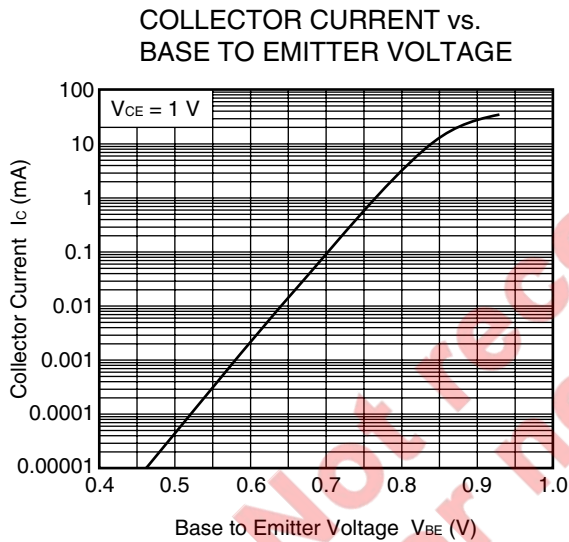
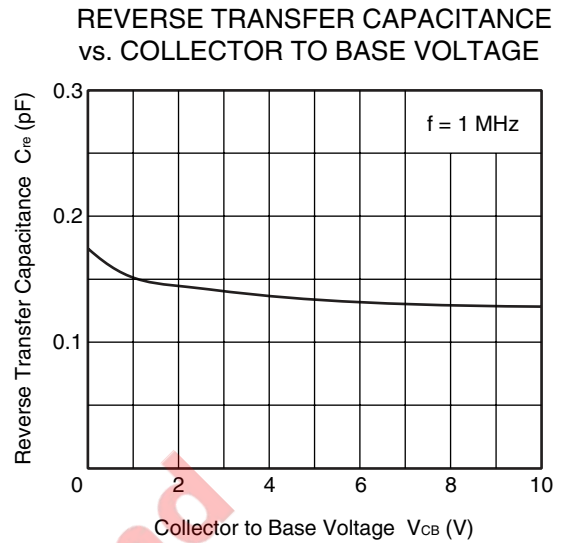
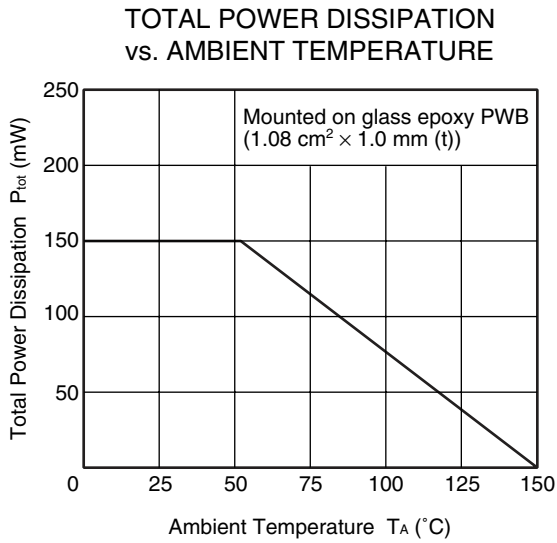
Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
<b>DC Characteristics</b>						
Collector Cut-off Current	I <sub>CBO</sub>	V <sub>CB</sub> = 5 V, I <sub>E</sub> = 0 mA	–	–	100	nA
Emitter Cut-off Current	I <sub>EBO</sub>	V <sub>EB</sub> = 1 V, I <sub>C</sub> = 0 mA	–	–	100	nA
DC Current Gain	h <sub>FE</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	6.5	9.0	–	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	12.0	15.0	–	dB
Gain 1 dB Compression Output Power	P <sub>O</sub> (1 dB)	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**

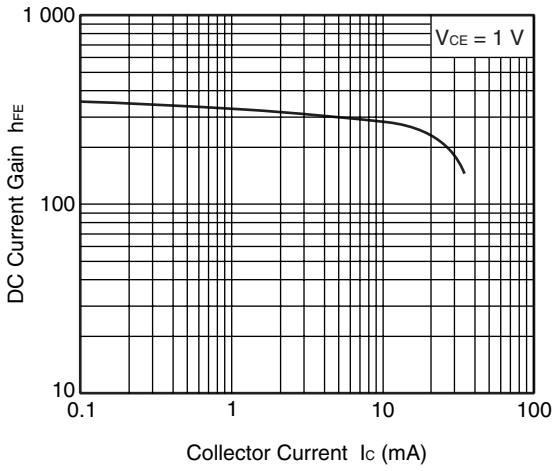
Rank	FB
Marking	zJ
h <sub>FE</sub> Value	220 to 380

**TYPICAL CHARACTERISTICS (T<sub>A</sub> = +25°C, unless otherwise specified)**

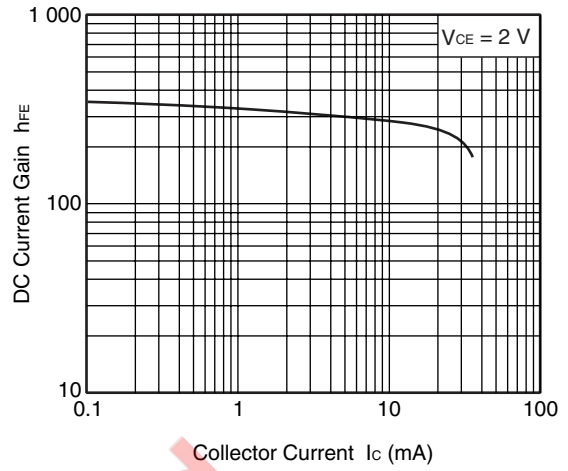


**Remark** The graphs indicate nominal characteristics.

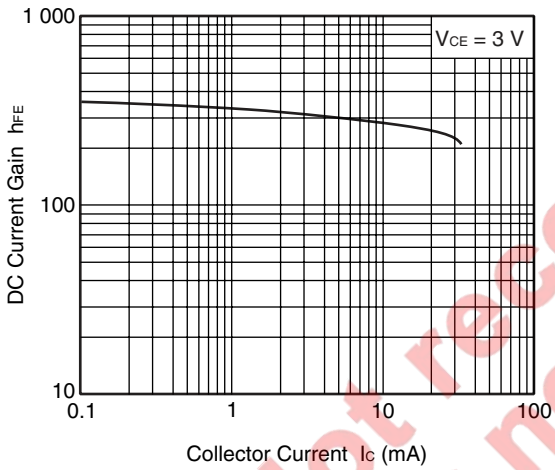
DC CURRENT GAIN vs. COLLECTOR CURRENT



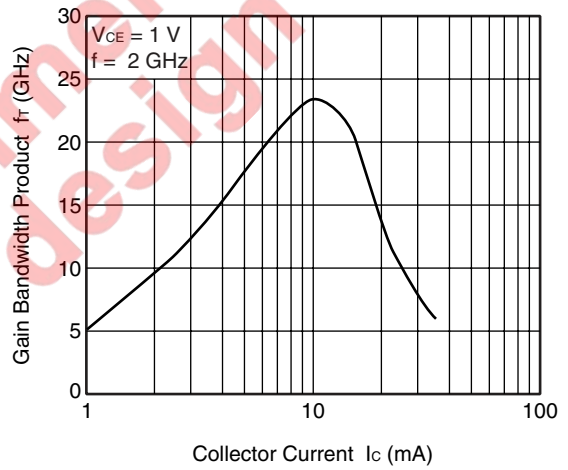
DC CURRENT GAIN vs. COLLECTOR CURRENT



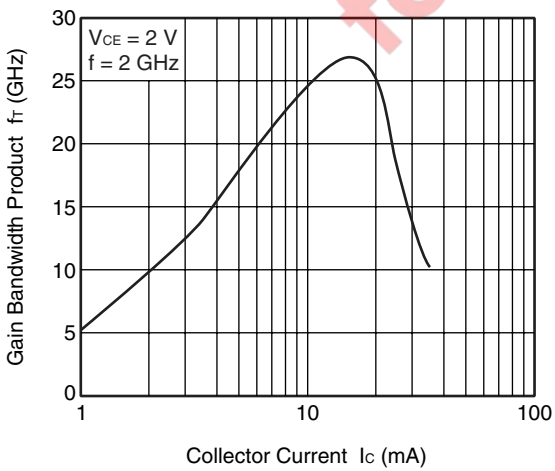
DC CURRENT GAIN vs. COLLECTOR CURRENT



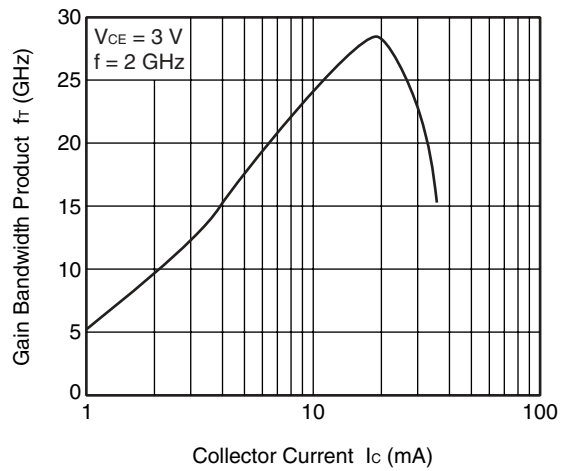
GAIN BANDWIDTH PRODUCT vs. COLLECTOR CURRENT



GAIN BANDWIDTH PRODUCT vs. COLLECTOR CURRENT

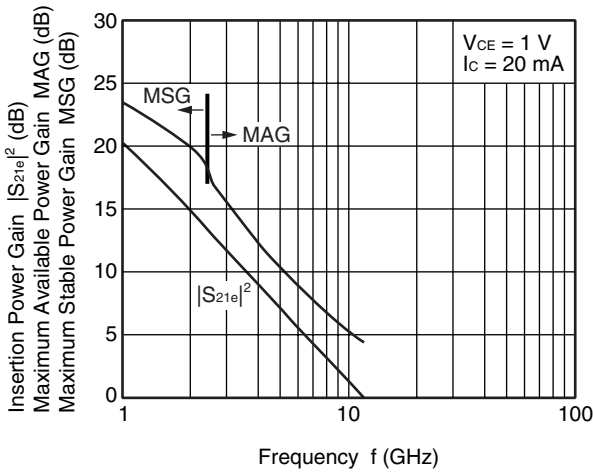


GAIN BANDWIDTH PRODUCT vs. COLLECTOR CURRENT

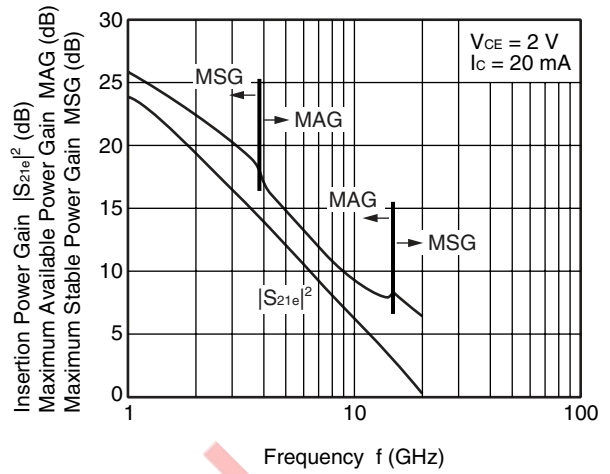


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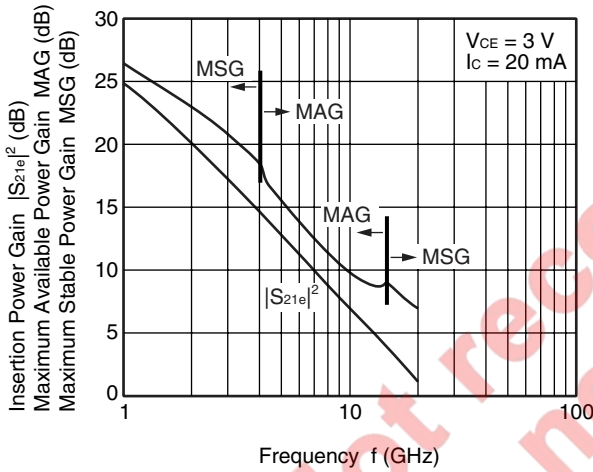
INSERTION POWER GAIN, MAG, MSG vs. FREQUENCY



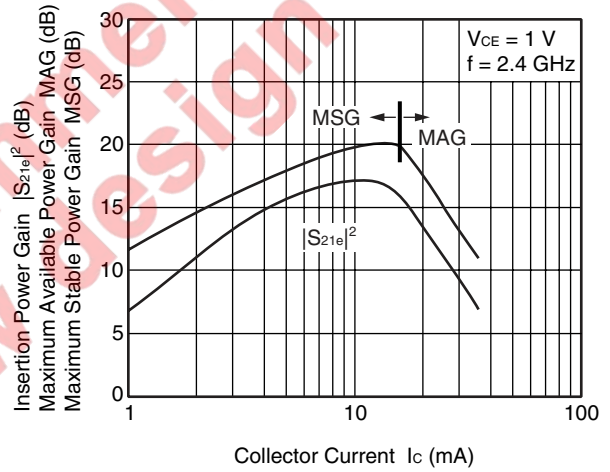
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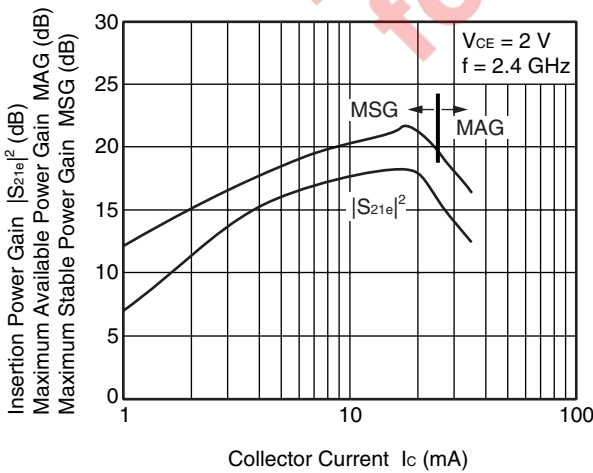
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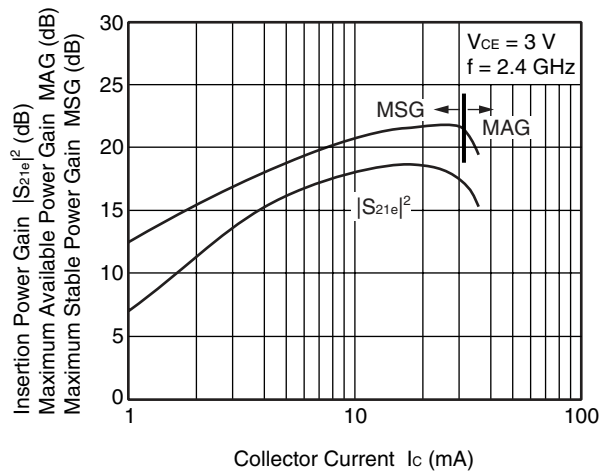
INSERTION POWER GAIN, MAG, MSG vs. COLLECTOR CURRENT



INSERTION POWER GAIN, MAG, MSG vs. COLLECTOR CURRENT



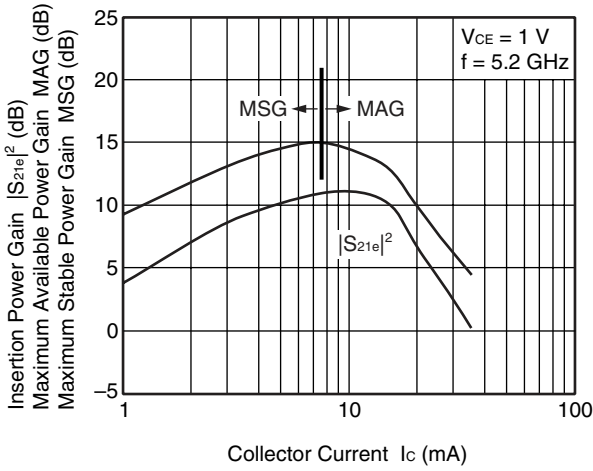
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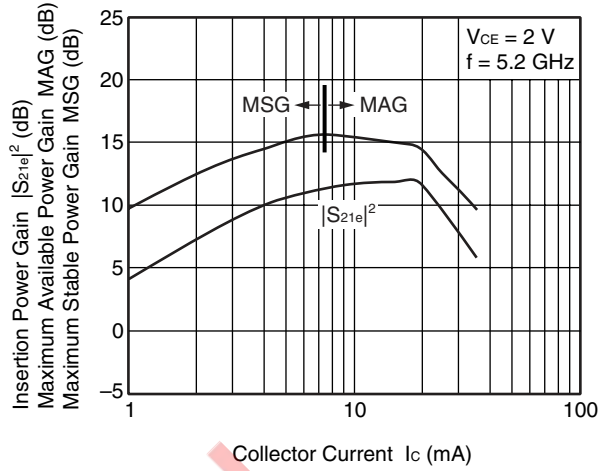
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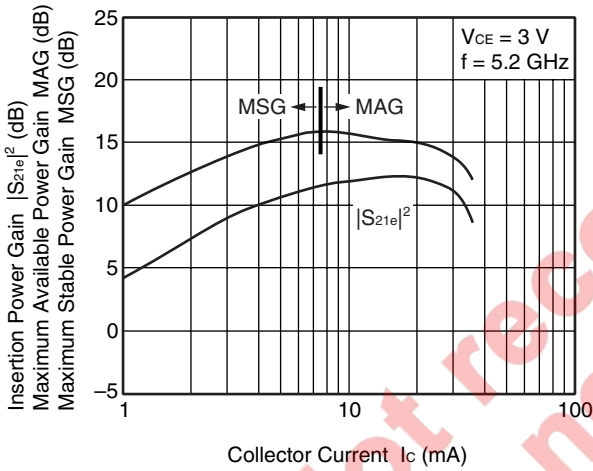
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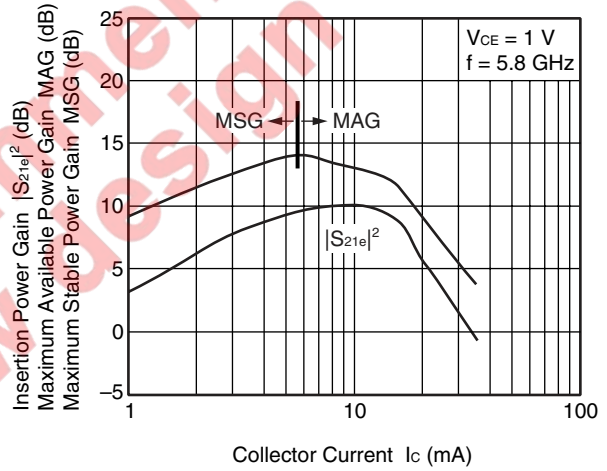
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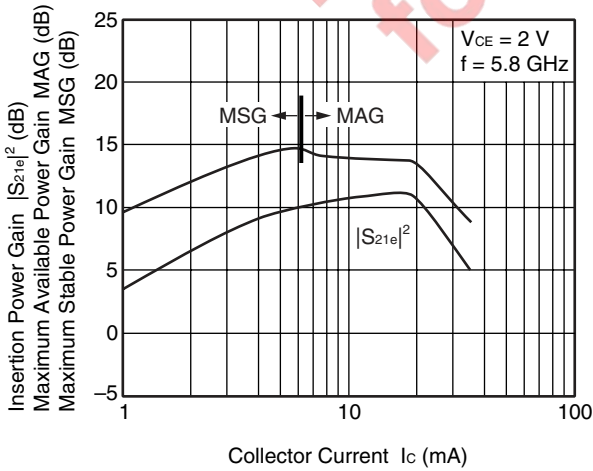
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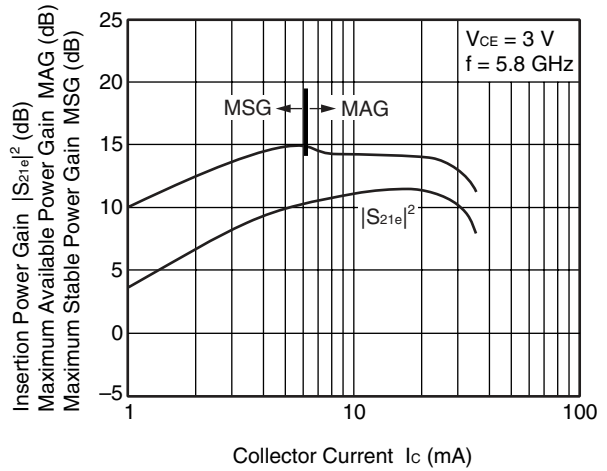
INSERTION POWER GAIN, MAG, MSG vs. COLLECTOR CURRENT



INSERTION POWER GAIN, MAG, MSG vs. COLLECTOR CURRENT



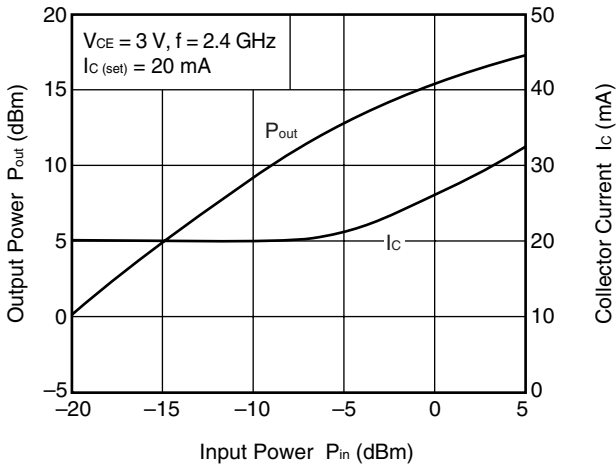
INSERTION POWER GAIN, MAG, MSG vs. COLLECTOR CURRENT



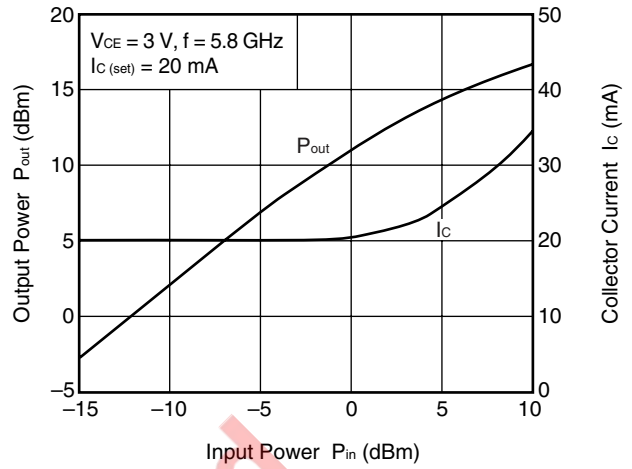
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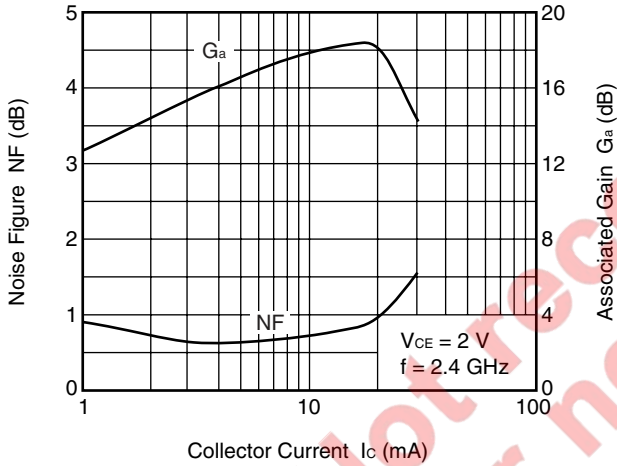
OUTPUT POWER, COLLECTOR CURRENT vs. INPUT POWER



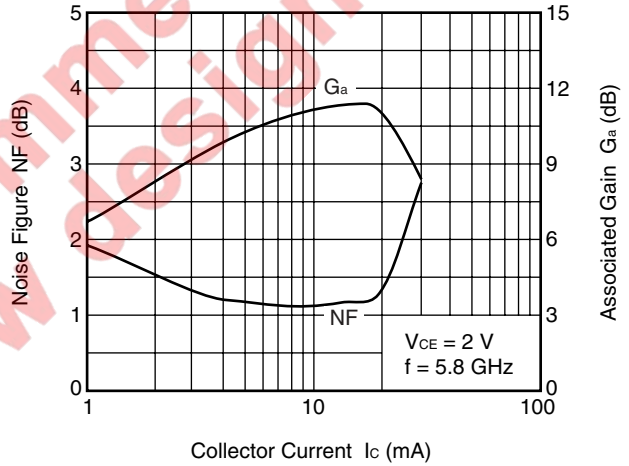
OUTPUT POWER, COLLECTOR CURRENT vs. INPUT POWER



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.

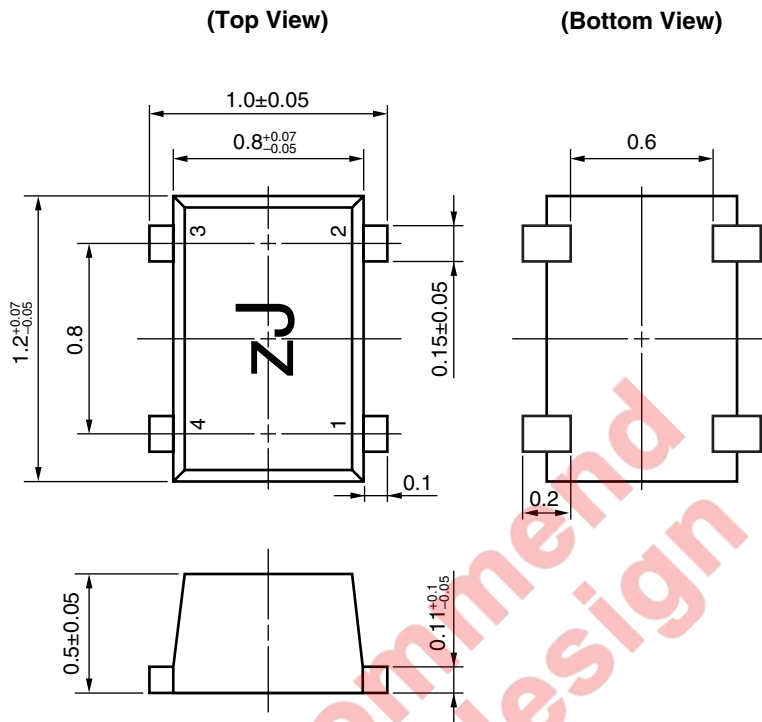
[RF and Microwave] → [Device Parameters]

URL <http://www.necel.com/microwave/en/>

**Not recommend  
for new design**

<R> PACKAGE DIMENSIONS

4-PIN LEAD-LESS MINIMOLD (M14, 1208 PKG) (UNIT: mm)



PIN CONNECTIONS

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

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