To our customers,

Old Company Name in Catalogs and Other Documents

On April 1st, 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 1st, 2010
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (http://www.renesas.com)

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RENESAS

DATA SHEET

NPN SILICON GERMANIUM RF TRANSISTOR
NESG3033M14

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. @ V_{CE} = 2 V, I_C = 6 mA, f = 2.0 GHz
- Maximum stable power gain: MSG = 20.5 dB TYP. @ V_{CE} = 2 V, I_C = 15 mA, f = 2.0 GHz
- SiGe HBT technology (UHS3) adopted: f_{max} = 110 GHz
- This product is improvement of ESD of NESG3032M14.
- 4-pin lead-less minimold (M14, 1208 PKG)

ORDERING INFORMATION

Part Number	Order Number	Package	Quantity	Supplying Form
NESG3033M14	NESG3033M14-A	4-pin lead-less minimold (M14, 1208 PKG) (Pb-Free) Note	50 pcs (Non reel)	• 8 mm wide embossed taping • Pin 1 (Collector), Pin 4 (Emitter) face the perforation side of the tape
NESG3033M14-T3	NESG3033M14-T3-A		10 kpcs/reel	

Note With regards to terminal solder (the solder contains lead) plated products (conventionally plated), contact your nearby sales office.

Remark To order evaluation samples, 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} Note 1	5.0	V
Collector to Emitter Voltage	V_{CEO}	4.3	V
Base Current	I_B Note 1	12	mA
Collector Current	I_C	35	mA
Total Power Dissipation	P_{tot} Note 2	150	mW
Junction Temperature	T_j	150	°C
Storage Temperature	T_{stg}	−65 to +150	°C

Notes 1. V_{CBO} and I_B are limited by the permissible current of the protection element.
2. Mounted on 1.08 $cm^2 \times$ 1.0 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.
Not all products and/or types are available in every country. Please check with an NEC Electronics sales representative for availability and additional information.

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Date Published May 2007 NS
Printed in Japan

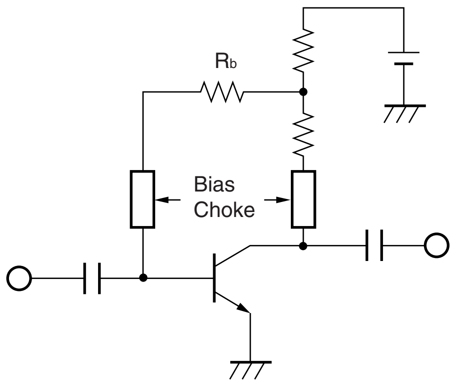
The mark <R> shows major revised points.

The revised points can be easily searched by copying an "<R>" in the PDF file and specifying it in the "Find what:" field.

RECOMMENDED OPERATING RANGE (T_A = +25°C)

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Input Power	P_{in}	–	–	0	dBm
Base Feedback Resister	R_b	–	–	100	kΩ

Remark When the voltage return bias circuit like the figure below is used, a current increase is seen because the ESD protection element is turned on when recommended range of motion in the above table is exceeded. However, there is no influence of reliability, including deterioration.



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 = 6 mA	220	300	380	–
RF Characteristics						
Insertion Power Gain	$\|S_{21e}\|^2$	V_{CE} = 2 V, I_C = 15 mA, f = 2.0 GHz	15.0	17.5	–	dB
Noise Figure	NF	V_{CE} = 2 V, I_C = 6 mA, f = 2.0 GHz, $Z_S = Z_{Sopt}$, $Z_L = Z_{Lopt}$	–	0.60	0.85	dB
Associated Gain	G_a	V_{CE} = 2 V, I_C = 6 mA, f = 2.0 GHz, $Z_S = Z_{Sopt}$, $Z_L = Z_{Lopt}$	–	17.5	–	dB
Reverse Transfer Capacitance	C_{re} Note 2	V_{CB} = 2 V, I_E = 0 mA, f = 1 MHz	–	0.15	0.25	pF
Maximum Stable Power Gain	MSG Note 3	V_{CE} = 2 V, I_C = 15 mA, f = 2.0 GHz	17.5	20.5	–	dB
Gain 1 dB Compression Output Power	$P_{O\ (1\ dB)}$	V_{CE} = 3 V, $I_{C\ (set)}$ = 20 mA, f = 2.0 GHz, $Z_S = Z_{Sopt}$, $Z_L = Z_{Lopt}$	–	12.5	–	dBm
3rd Order Intermodulation Distortion Output Intercept Point	OIP_3	V_{CE} = 3 V, $I_{C\ (set)}$ = 20 mA, f = 2.0 GHz, $Z_S = Z_{Sopt}$, $Z_L = Z_{Lopt}$	–	24.0	–	dBm

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

2. Collector to base capacitance when the emitter grounded

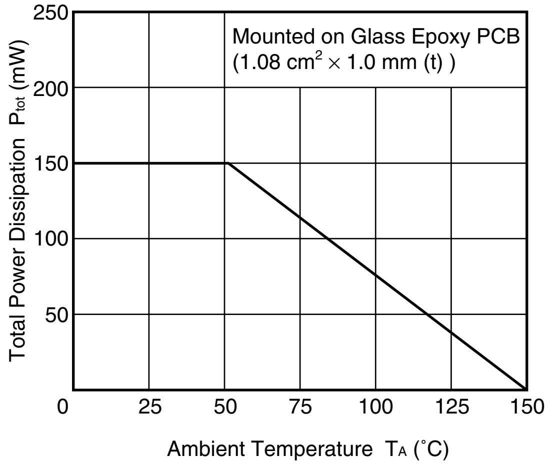
3. $MSG = \left|\frac{S_{21}}{S_{12}}\right|$

h_{FE} CLASSIFICATION

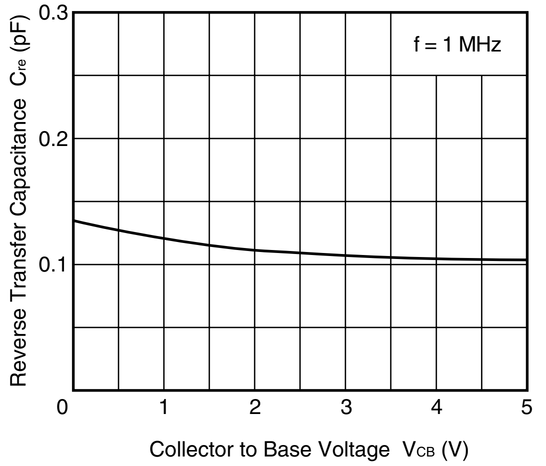
Rank	FB
Marking	zL
h_{FE} Value	220 to 380

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

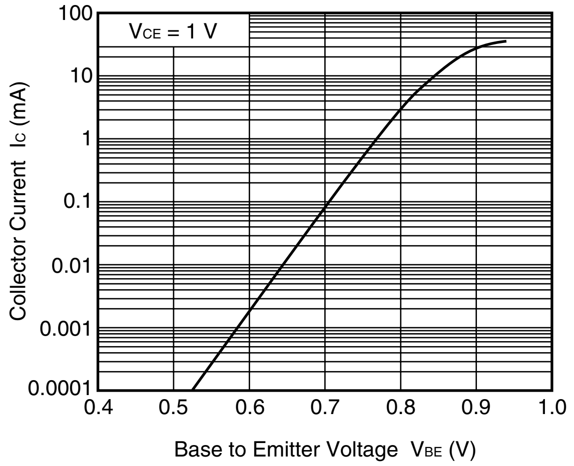
TOTAL POWER DISSIPATION
vs. AMBIENT TEMPERATURE



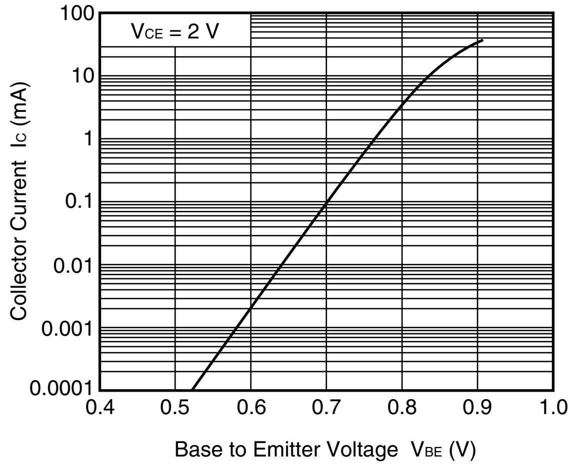
REVERSE TRANSFER CAPACITANCE
vs. COLLECTOR TO BASE VOLTAGE



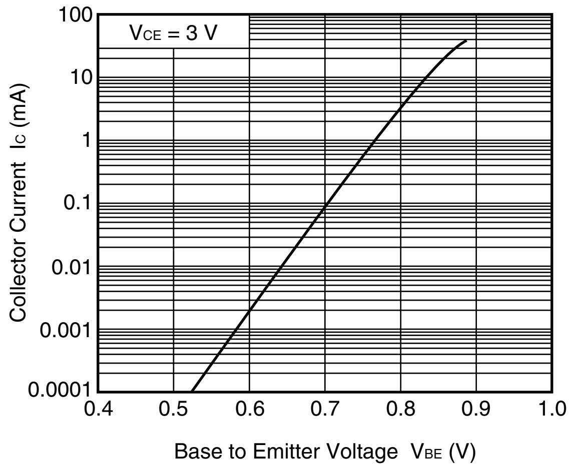
COLLECTOR CURRENT vs.
BASE TO EMITTER VOLTAGE



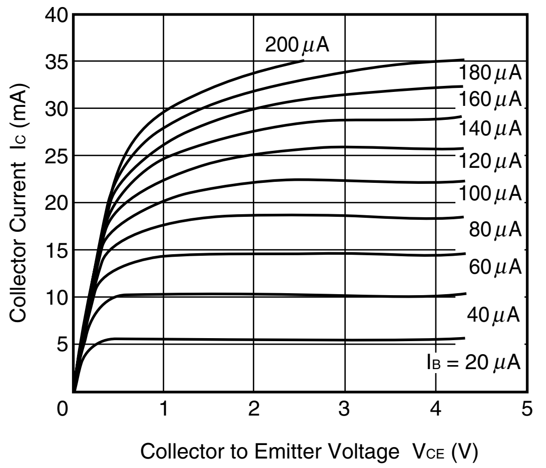
COLLECTOR CURRENT vs.
BASE TO EMITTER VOLTAGE



COLLECTOR CURRENT vs.
BASE TO EMITTER VOLTAGE

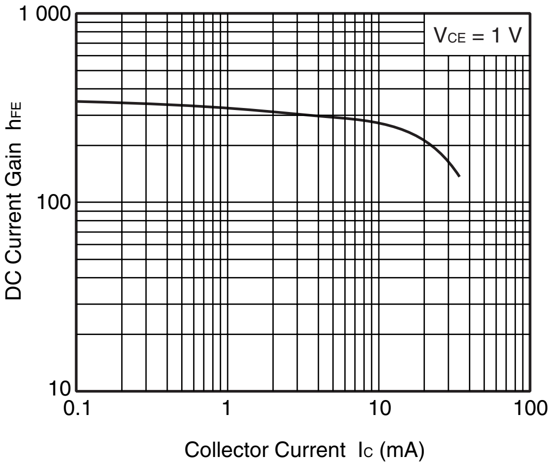


COLLECTOR CURRENT vs.
COLLECTOR TO EMITTER VOLTAGE

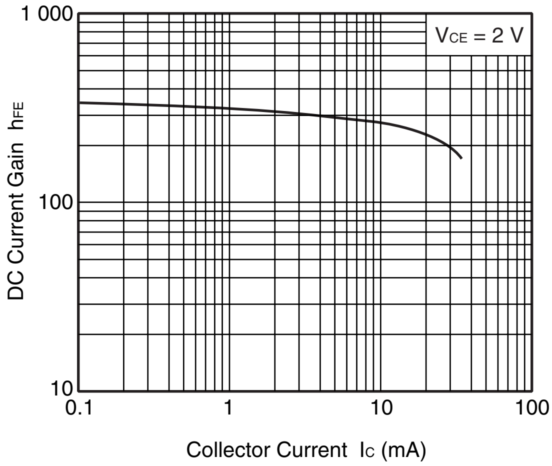


Remark The graphs indicate nominal characteristics.

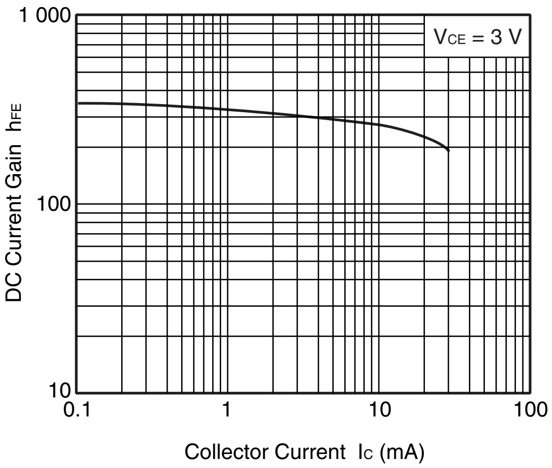
DC CURRENT GAIN vs.
COLLECTOR CURRENT



DC CURRENT GAIN vs.
COLLECTOR CURRENT

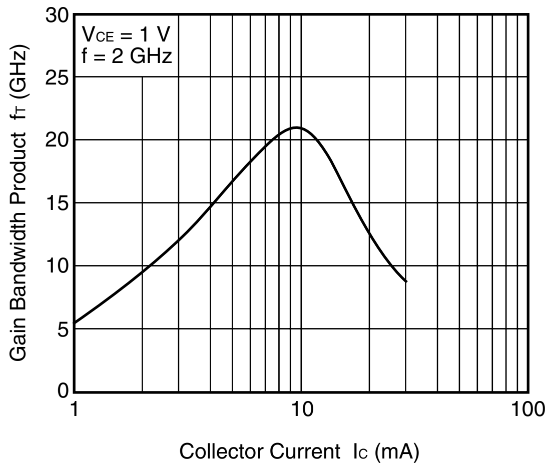


DC CURRENT GAIN vs.
COLLECTOR CURRENT

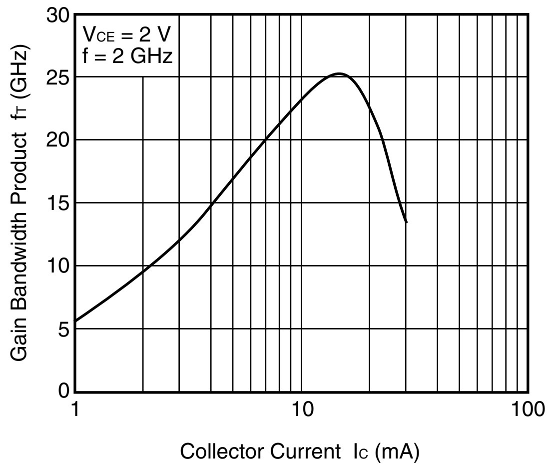


Remark The graphs indicate nominal characteristics.

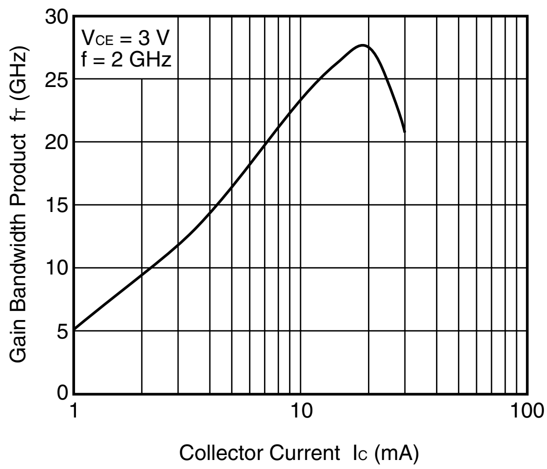
GAIN BANDWIDTH PRODUCT vs. COLLECTOR CURRENT



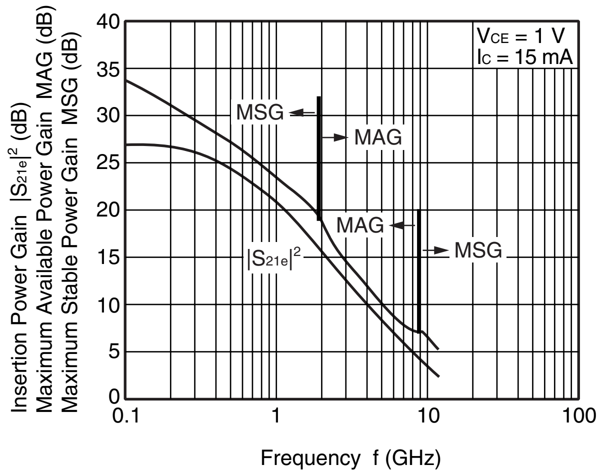
GAIN BANDWIDTH PRODUCT vs. COLLECTOR CURRENT



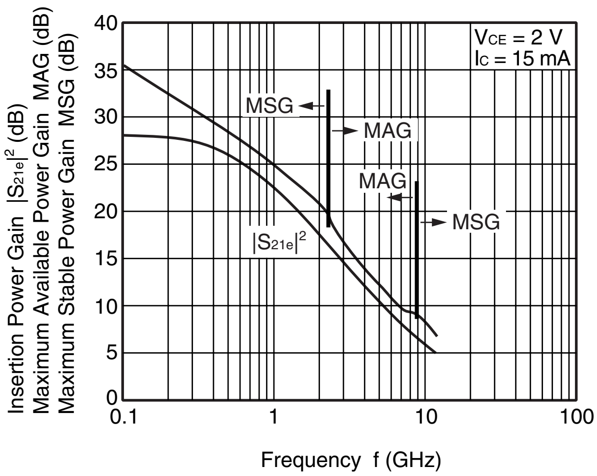
GAIN BANDWIDTH PRODUCT vs. COLLECTOR CURRENT



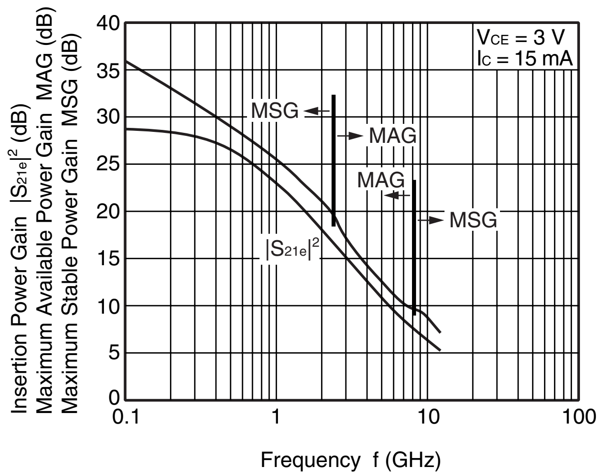
INSERTION POWER GAIN, MAG, MSG vs. FREQUENCY



INSERTION POWER GAIN, MAG, MSG vs. FREQUENCY



INSERTION POWER GAIN, MAG, MSG vs. FREQUENCY



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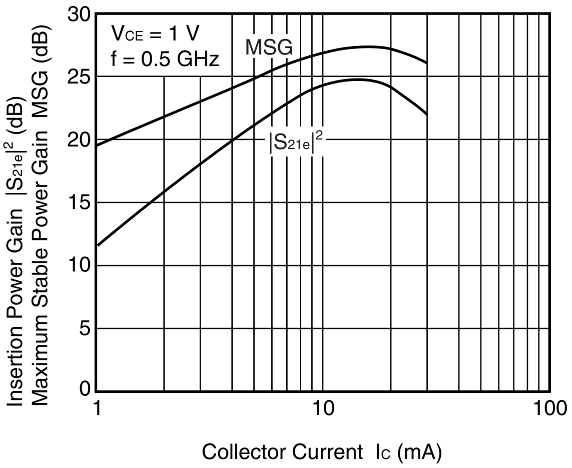
INSERTION POWER GAIN, MSG vs. COLLECTOR CURRENT



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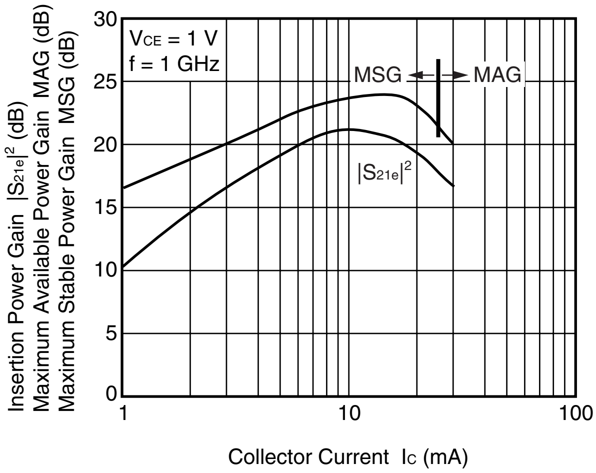

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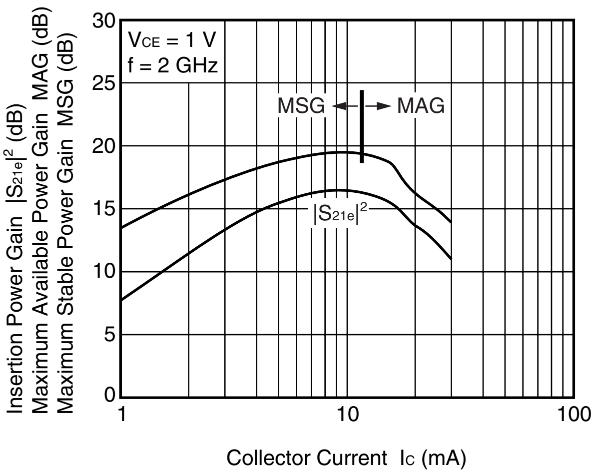
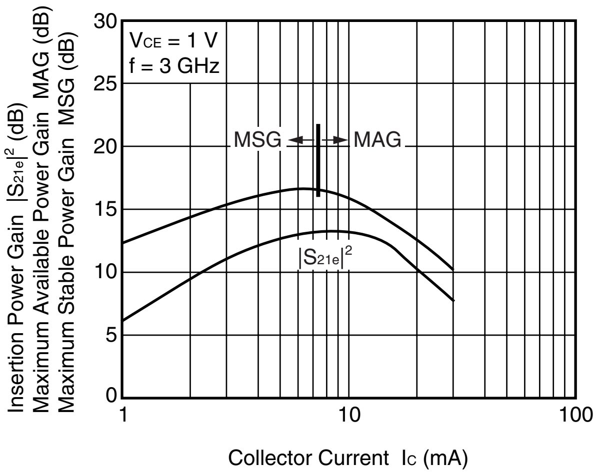


INSERTION POWER GAIN, MAG, MSG vs. COLLECTOR CURRENT



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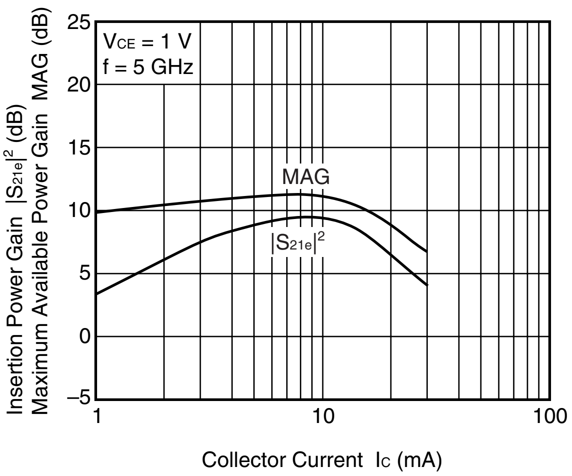
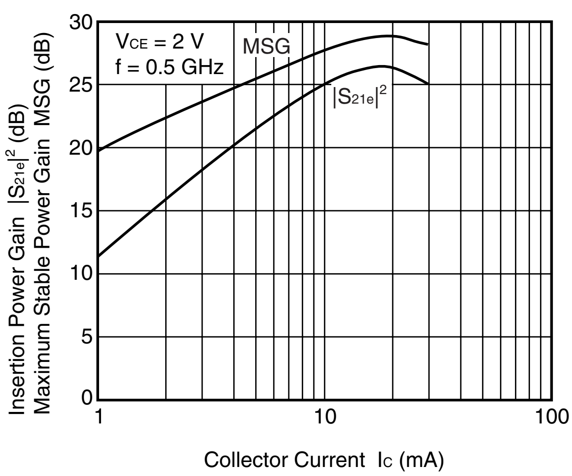


INSERTION POWER GAIN, MSG vs. COLLECTOR CURRENT



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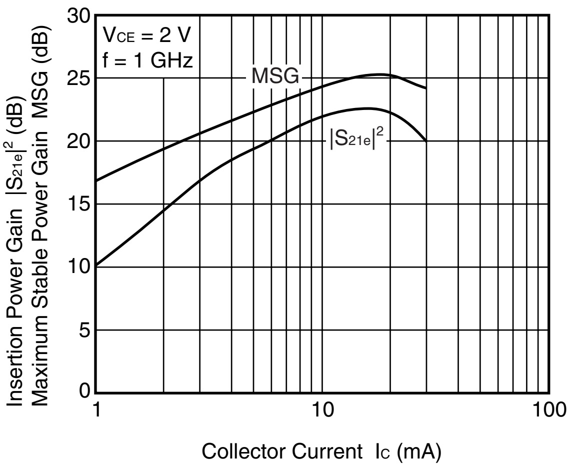
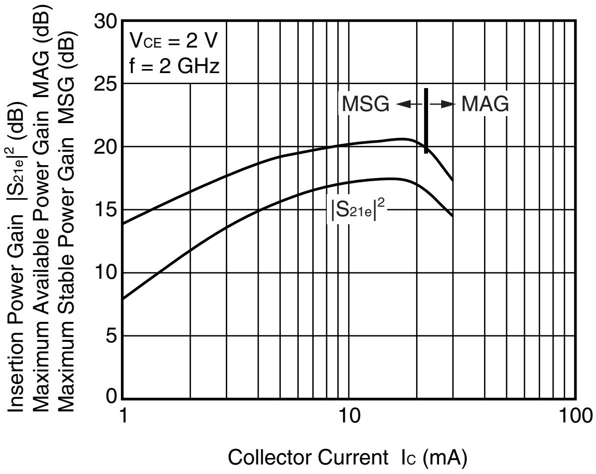
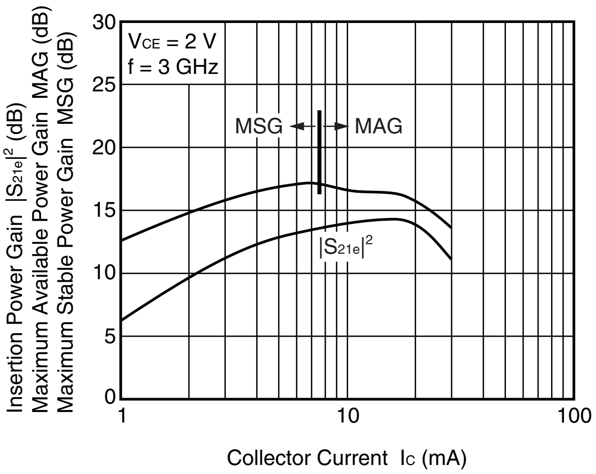


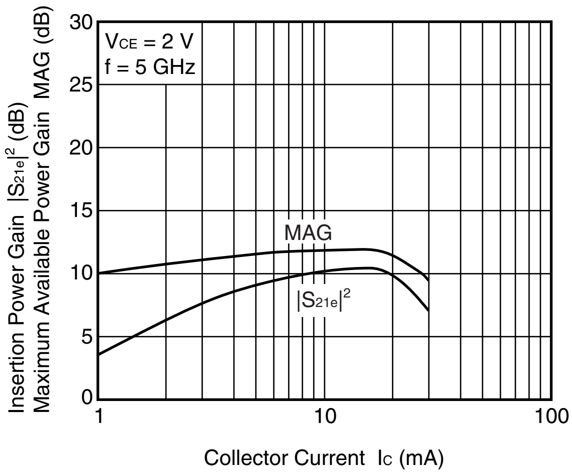
INSERTION POWER GAIN, MAG, MSG vs. COLLECTOR CURRENT



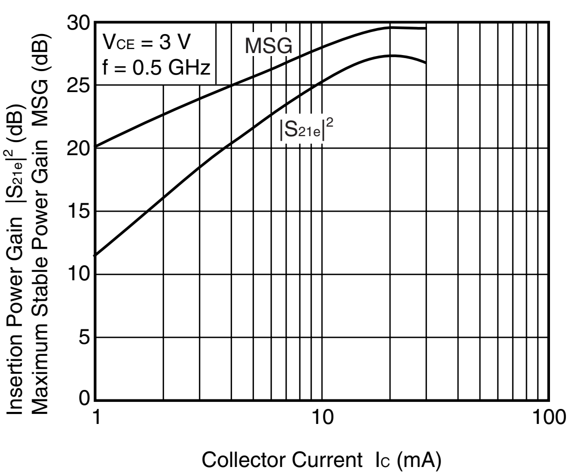
INSERTION POWER GAIN, MAG, MSG vs. COLLECTOR CURRENT



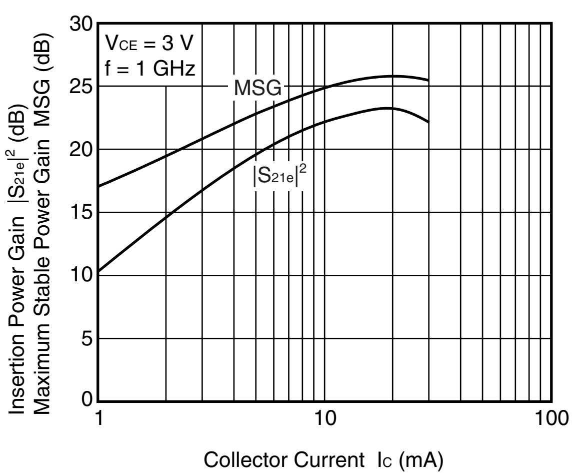
INSERTION POWER GAIN, MAG vs. COLLECTOR CURRENT



INSERTION POWER GAIN, MSG vs. COLLECTOR CURRENT

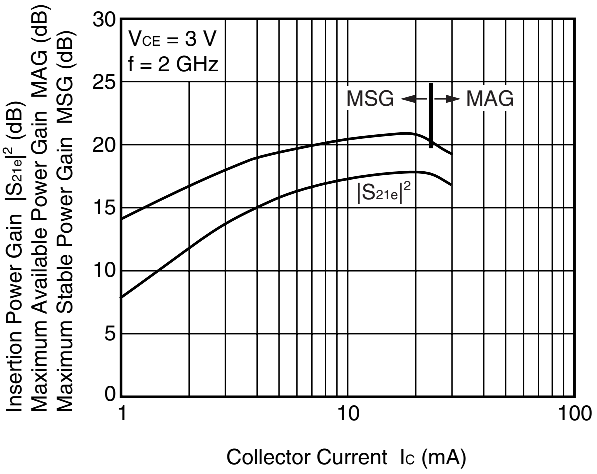


INSERTION POWER GAIN, MSG vs. COLLECTOR CURRENT

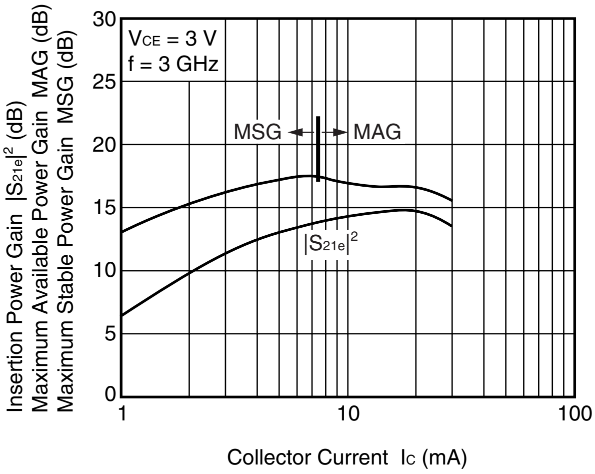


Remark The graphs indicate nominal characteristics.

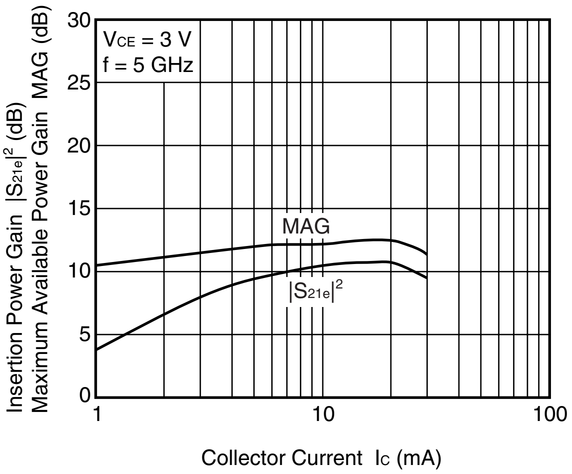
INSERTION POWER GAIN, MAG, MSG
vs. COLLECTOR CURRENT



INSERTION POWER GAIN, MAG, MSG
vs. COLLECTOR CURRENT



INSERTION POWER GAIN, MAG
vs. COLLECTOR CURRENT



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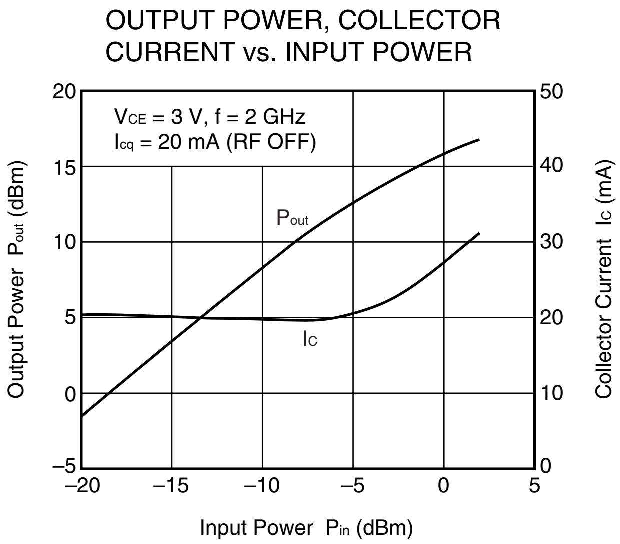
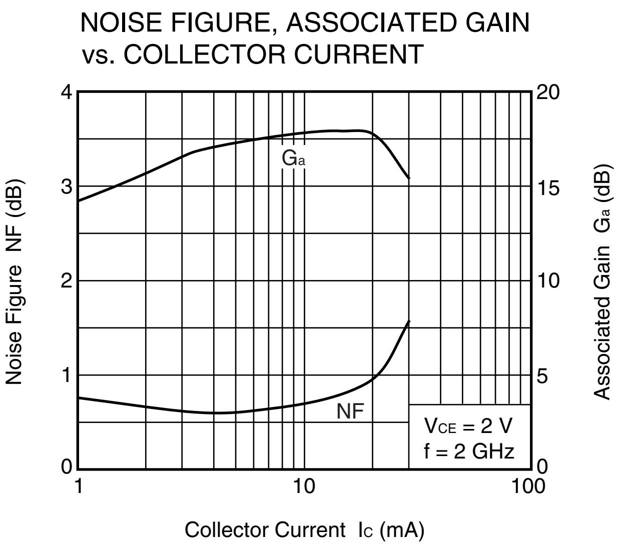


Measuring method : Measured at power matched with external sleeve tuner. (The load resistance is not inserted between the base DC power supply and Bias Tee.)



Remark The graphs indicate nominal characteristics.

<R> **S-PARAMETERS**

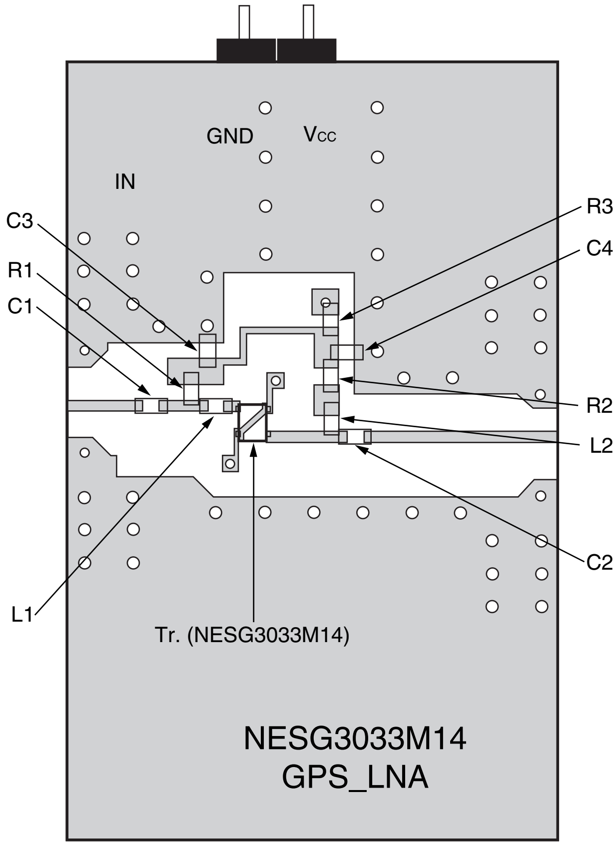
S-parameters/Noise parameters are provided on our web site in a form (S2P) that enables direct import to a microwave circuit simulator without keyboard input.

Click here to download S-parameters.

[RF and Microwave] → [Device Parameters]

URL http://www.ncsd.necel.com/microwave/index.html

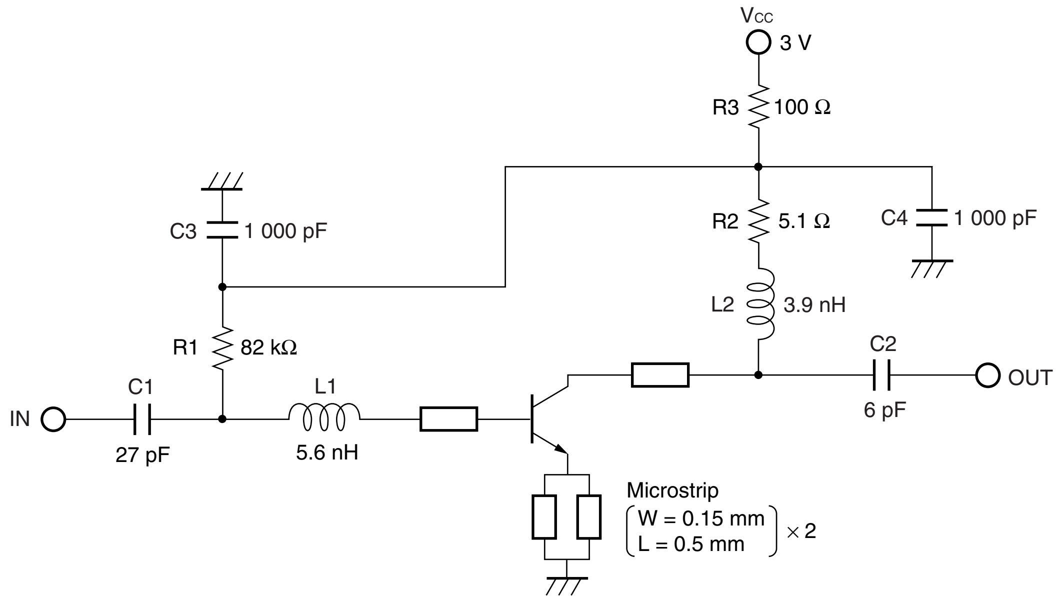
<R> EVALUATION CIRCUIT EXAMPLE (f = 1.575 GHz LNA)



Notes

1. 15 × 24 mm, t = 0.2 mm double sided copper clad glass epoxy PWB.
2. Au plated on pattern
3. ○ : Through holes

<R> EVALUATION CIRCUIT (f = 1.575 GHz LNA)



The application circuits and their parameters are for reference only and are not intended for use in actual design-ins.

<R> COMPONENT LIST

Symbol	Parts	Part Number	Maker	Value
C1	Chip Capacitor	GRM1552C1H270JZ01	Murata	27 pF
C2	Chip Capacitor	GRM1552C1H6R0JZ01	Murata	6 pF
C3, C4	Chip Capacitor	GRM155B11H102KA01	Murata	1 000 pF
L1	Chip Inductor	AML1005H5N6STS	FDK	5.6 nH
L2	Chip Inductor	AML1005H3N9STS	FDK	3.9 nH
R1	Chip Resistor	MCR01MZPJ823	ROHM	82 kΩ
R2	Chip Resistor	MCR01MZPJ5R1	ROHM	5.1 Ω
R3	Chip Resistor	MCR01MZPJ101	ROHM	100 Ω

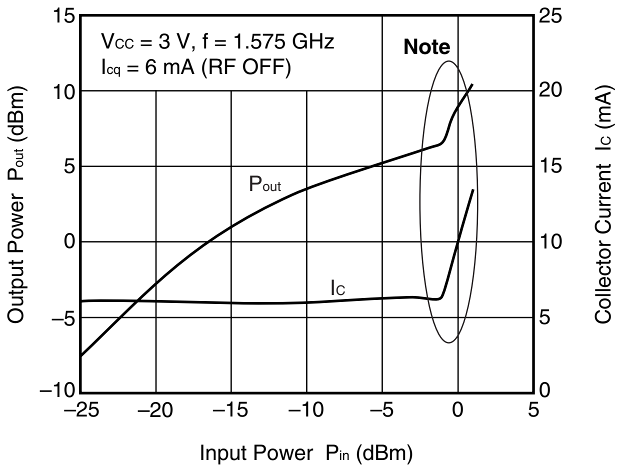
<R> **EXAMPLE OF CHARACTERISTICS FOR 1.575 GHz LNA EVALUATION BOARD**

ELECTRICAL CHARACTERISTICS (T_A = +25°C, V_{CC} = 3 V, I_C = 6.1 mA, f = 1.575 GHz)

Parameter	Symbol	Value	Unit
Noise Figure	NF	0.65	dB
Gain	G_a	17.4	dB
Input Return Loss	RL_{in}	10.1	dB
Output Return Loss	RL_{out}	14.4	dB
Gain 1 dB Compression Output Power	$P_{O (1 dB)}$	0.7	dBm

TYPICAL CHARACTERISTICS (T_A = +25°C, unless otherwise specified)

OUTPUT POWER, COLLECTOR CURRENT vs. INPUT POWER

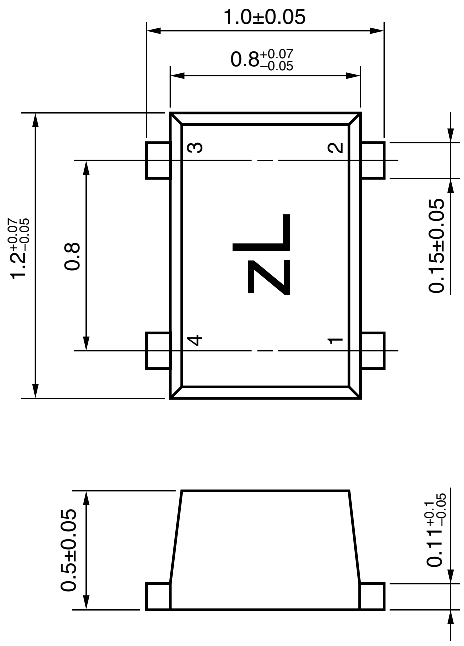


Note A current increase is seen because the ESD protection element is turned on. However, there is no influence of deterioration etc. on reliability.

Remark The graph indicates nominal characteristics.

PACKAGE DIMENSIONS

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



PIN CONNECTIONS

1. Collector
2. Emitter
3. Base
4. NC (Connected with Pin 2) Note

<R> **Note** A NC pin is Non-connection in the mold package (When NC-pin is open state, It will get an influences of floating capacitance. Therefore, we recommend connect to NC pin and Emitter pin).