



# 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 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 = 14.0 dB TYP. @  $V_{CE} = 3$  V,  $I_c = 20$  mA,  $f = 5.8$  GHz
- SiGe HBT technology (UHS3) adopted:  $f_{max} = 110$  GHz
- Flat-lead 4-pin thin-type super minimold (M05, 2012 PKG)

#### ★ 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) <sup>Note</sup>	50 pcs (Non reel)	• 8 mm wide embossed taping • Pin 3 (Collector), Pin 4 (Emitter) face the perforation side of the tape
NESG3031M05-T1	NESG3031M05-T1-A		3 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 ( $T_A = +25^\circ\text{C}$ )

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)**

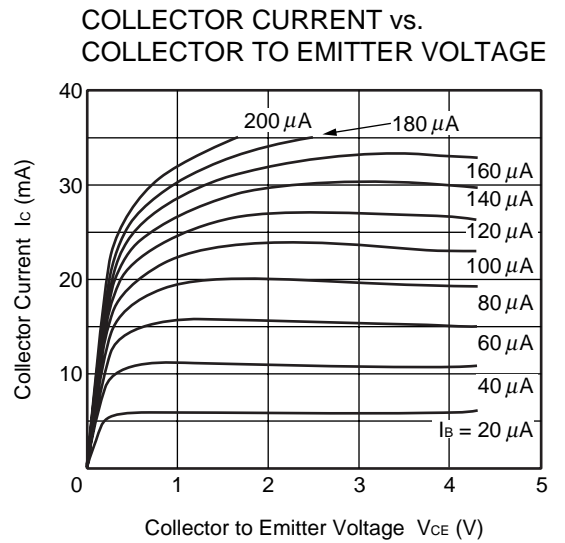
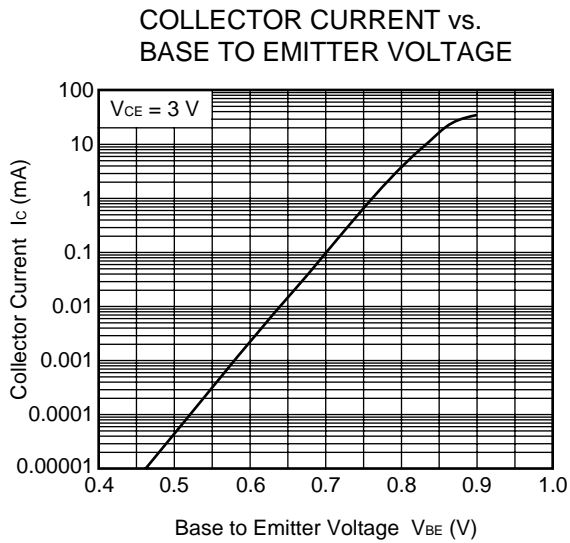
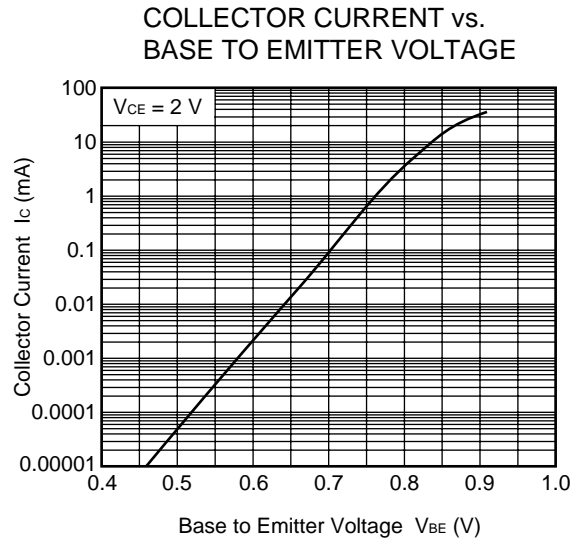
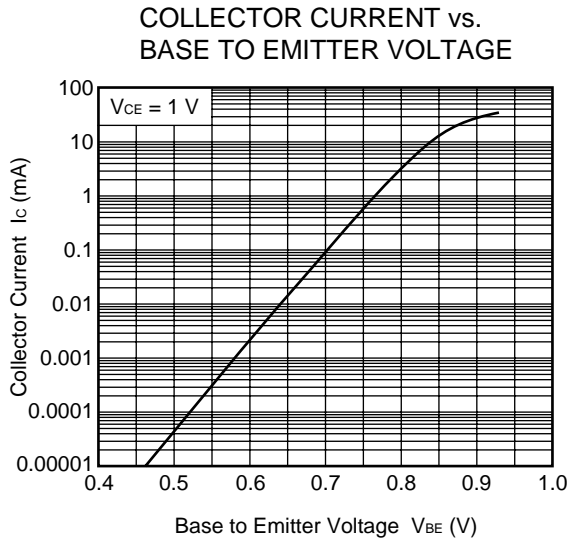
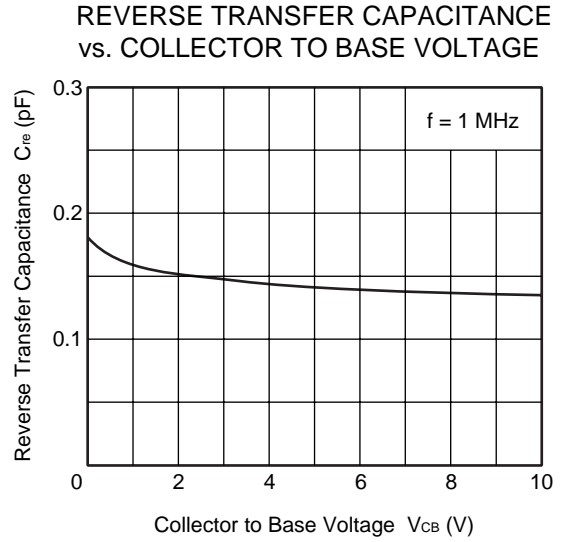
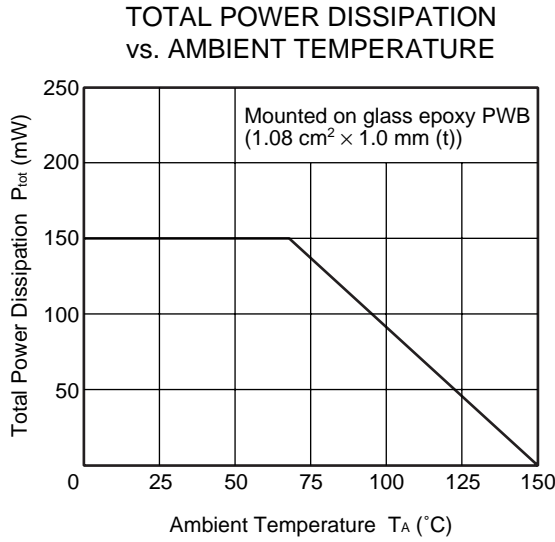
Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
<b>DC Characteristics</b>						
Collector Cut-off Current	I <sub>CBO</sub>	V <sub>CB</sub> = 5 V, I <sub>E</sub> = 0 mA	–	–	100	nA
Emitter Cut-off Current	I <sub>EBO</sub>	V <sub>EB</sub> = 1 V, I <sub>C</sub> = 0 mA	–	–	100	nA
DC Current Gain	h <sub>FE</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(1 dB)</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
3rd Order Intermodulation Distortion Output 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**

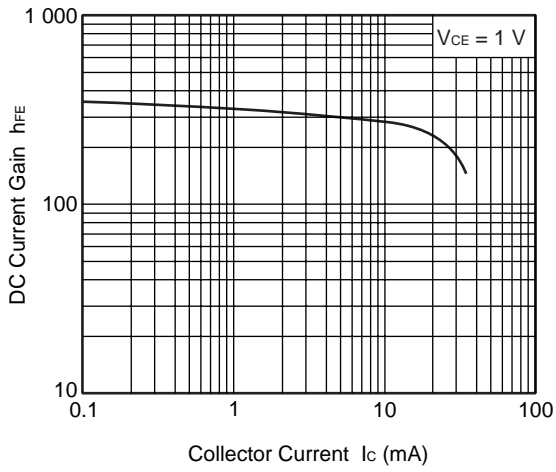
Rank	FB
Marking	T1K
h <sub>FE</sub> Value	220 to 380

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

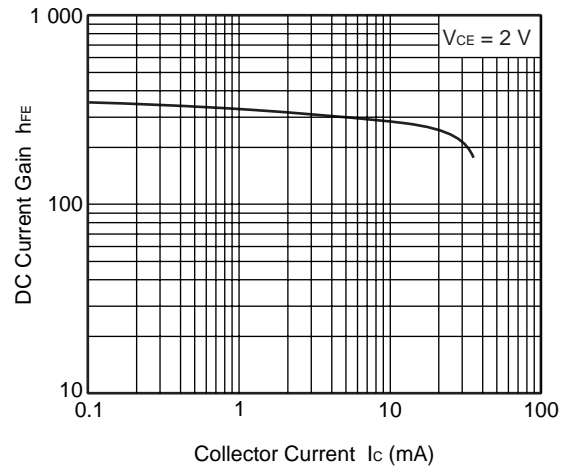


**Remark** The graphs indicate nominal characteristics.

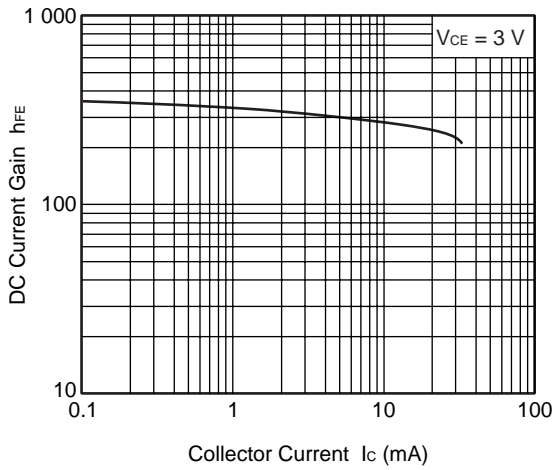
DC CURRENT GAIN vs. COLLECTOR CURRENT



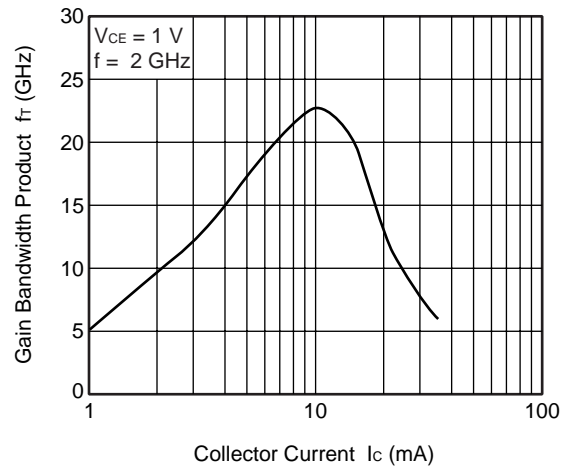
DC CURRENT GAIN vs. COLLECTOR CURRENT



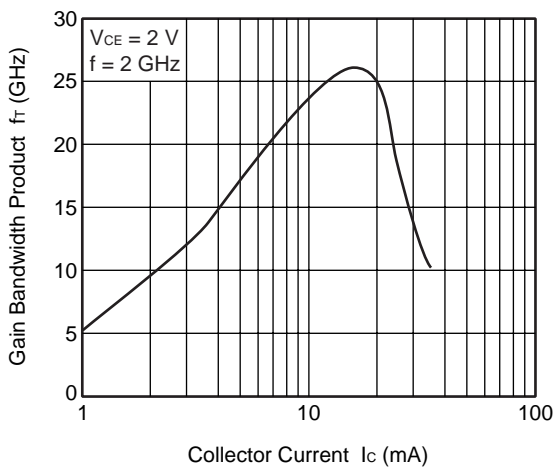
DC CURRENT GAIN vs. COLLECTOR CURRENT



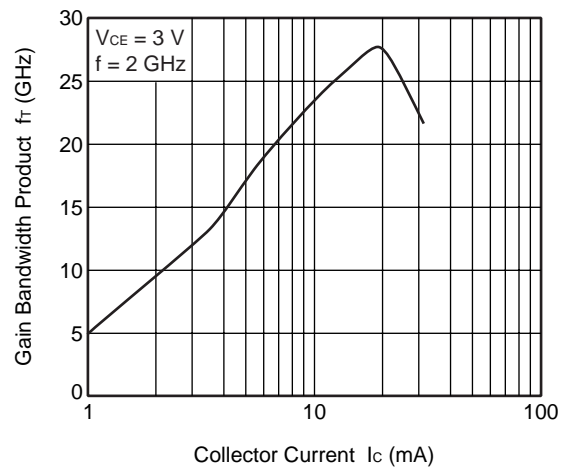
GAIN BANDWIDTH PRODUCT vs. COLLECTOR CURRENT



GAIN BANDWIDTH PRODUCT vs. COLLECTOR CURRENT

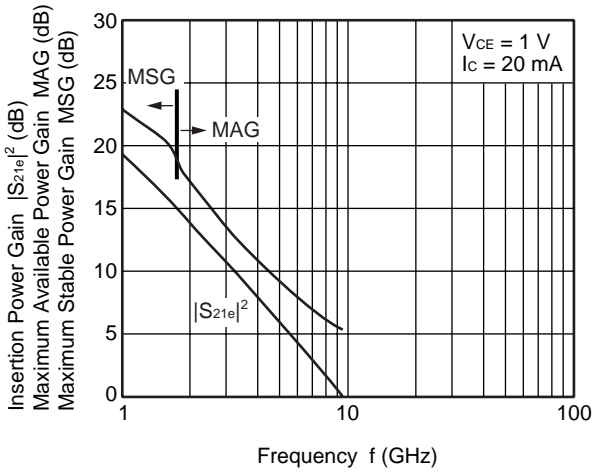


GAIN BANDWIDTH PRODUCT vs. COLLECTOR CURRENT

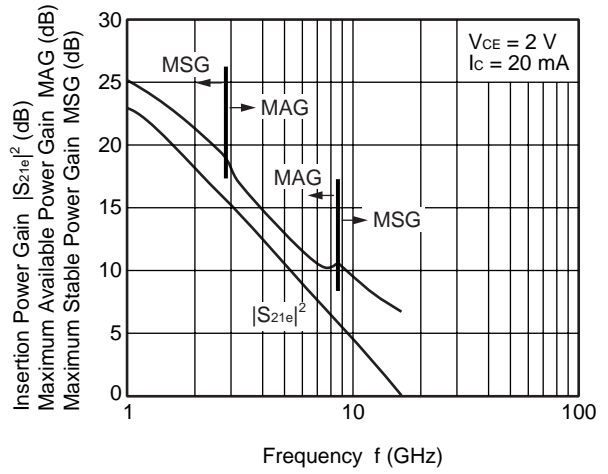


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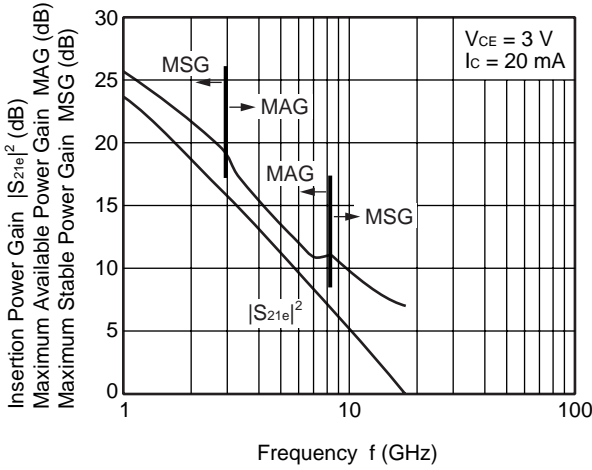
INSERTION POWER GAIN, MAG, MSG vs. FREQUENCY



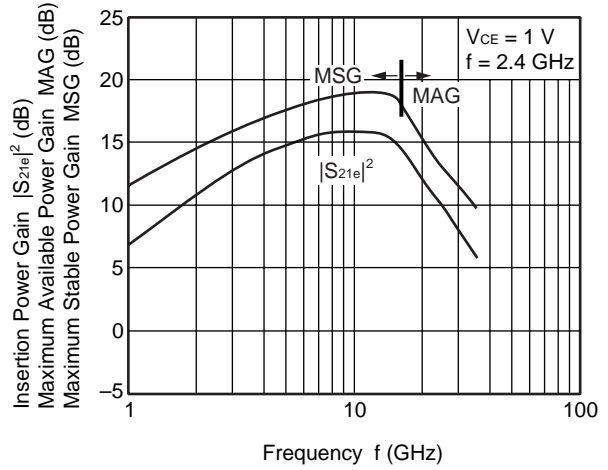
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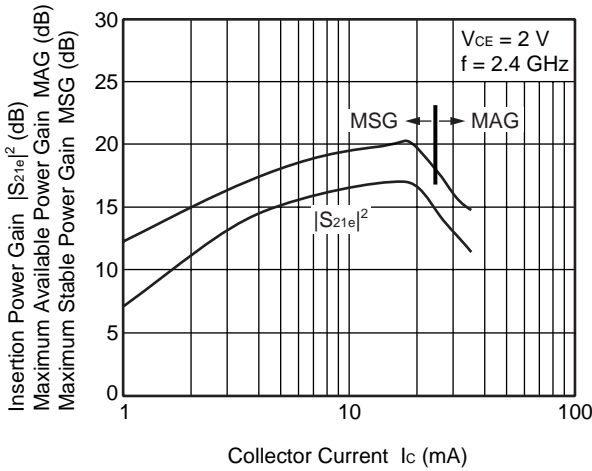
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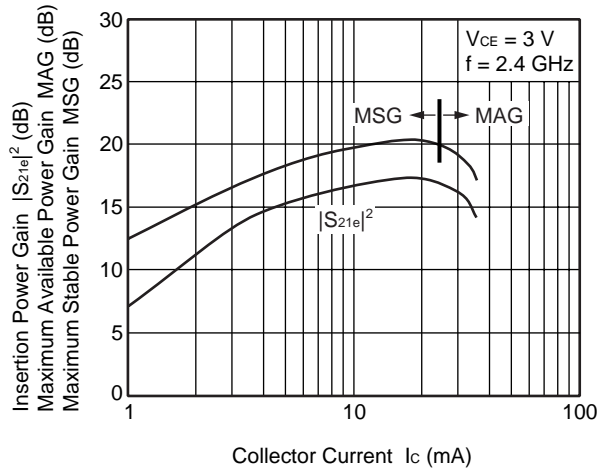
INSERTION POWER GAIN, MAG, MSG vs. FREQUENCY



INSERTION POWER GAIN, MAG, MSG vs. COLLECTOR CURRENT

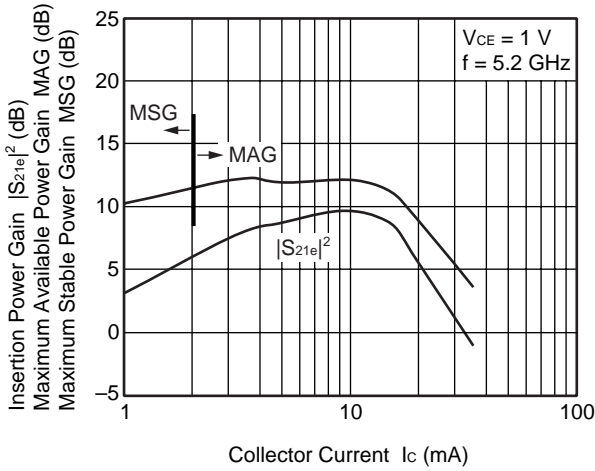


INSERTION POWER GAIN, MAG, MSG vs. COLLECTOR CURRENT

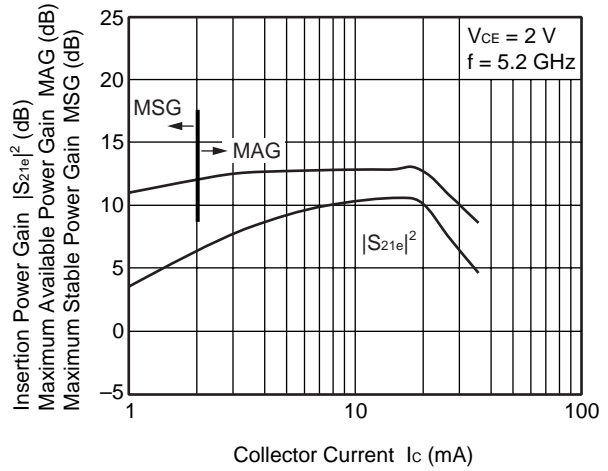


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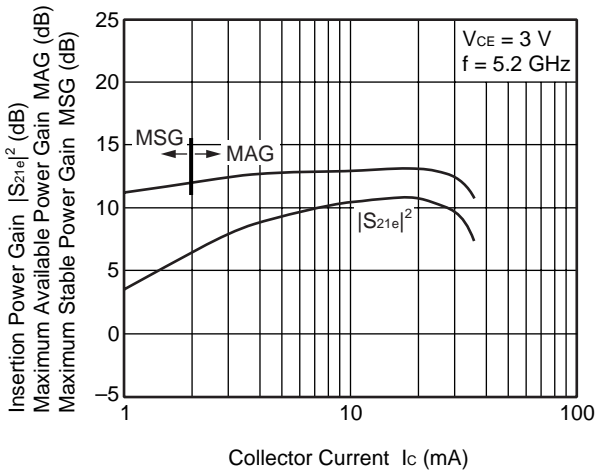
INSERTION POWER GAIN, MAG, MSG  
vs. COLLECTOR CURRENT



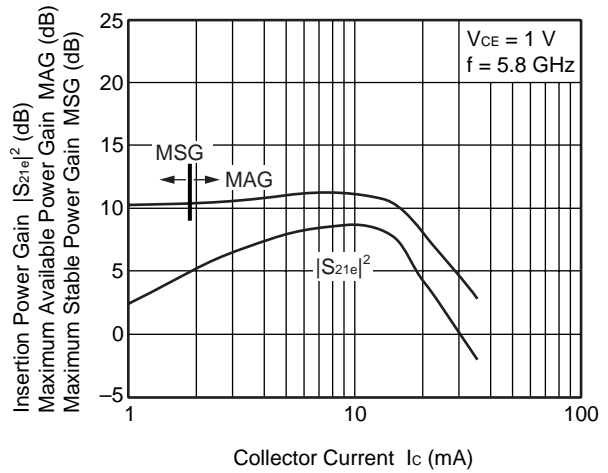
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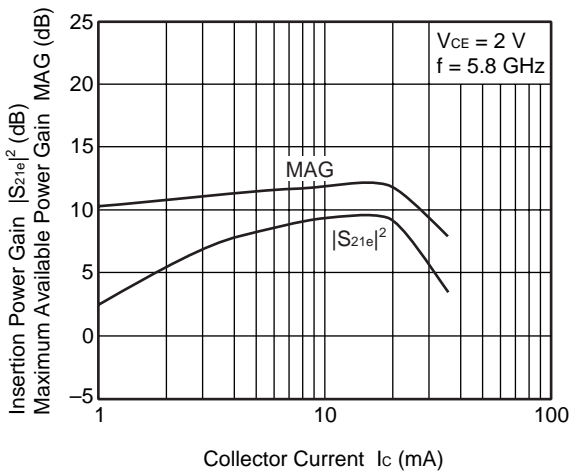
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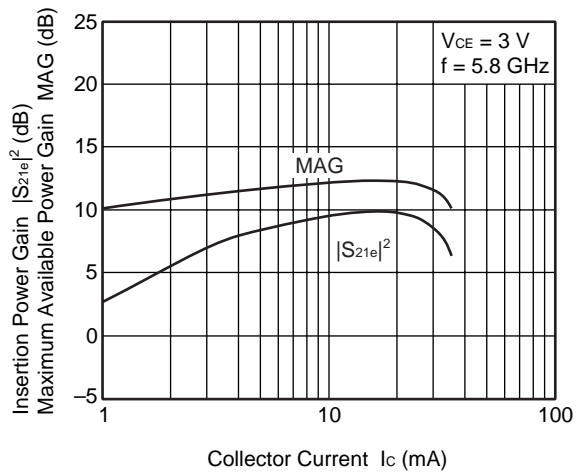
INSERTION POWER GAIN, MAG, MSG  
vs. COLLECTOR CURRENT



INSERTION POWER GAIN, MAG, MSG  
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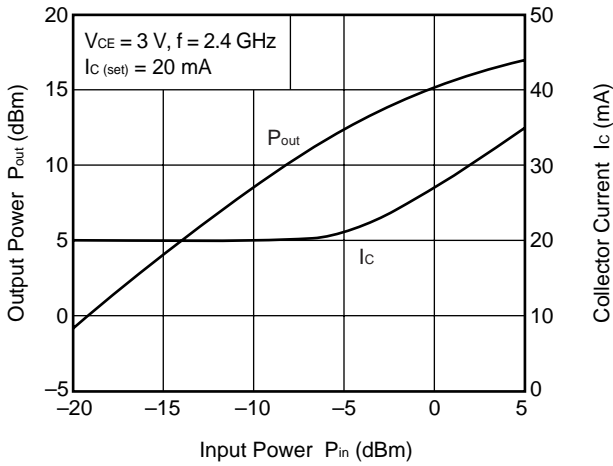


INSERTION POWER GAIN, MAG, MSG  
vs. COLLECTOR CURRENT

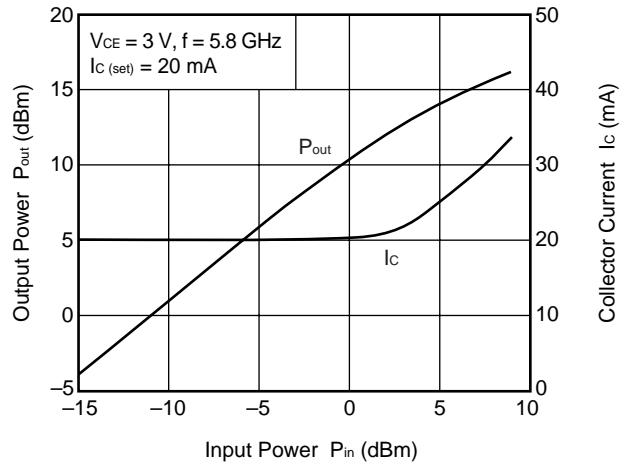


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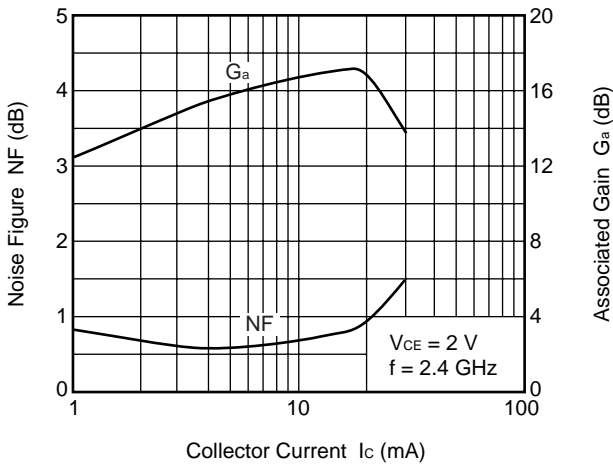
OUTPUT POWER, COLLECTOR CURRENT vs. INPUT POWER



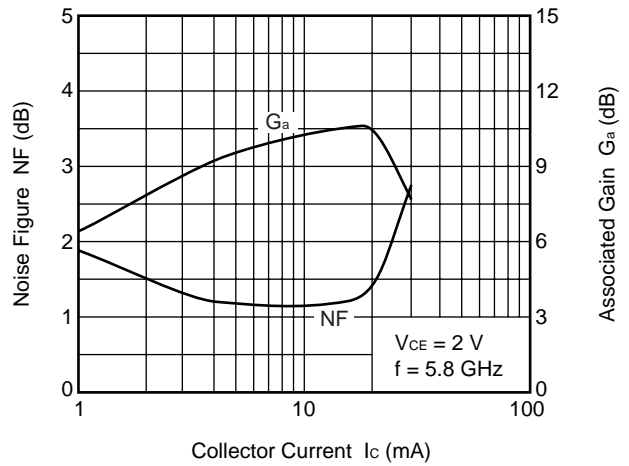
OUTPUT POWER, COLLECTOR CURRENT vs. INPUT POWER



NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



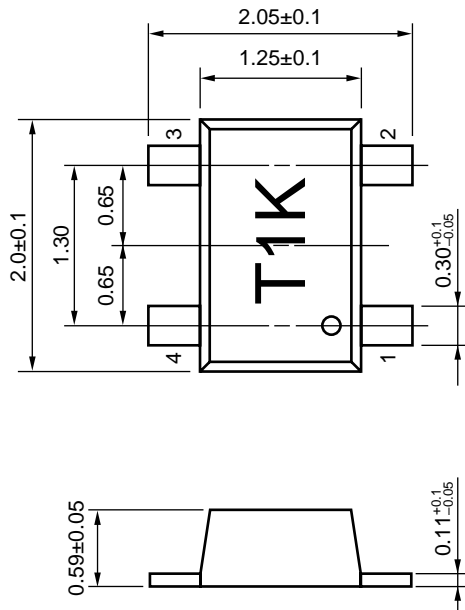
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



**Remark** The graphs indicate nominal characteristics.

**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

Subject: Compliance with EU Directives

CEL certifies, to its knowledge, that semiconductor and laser products detailed below are compliant with the requirements of European Union (EU) Directive 2002/95/EC Restriction on Use of Hazardous Substances in electrical and electronic equipment (RoHS) and the requirements of EU Directive 2003/11/EC Restriction on Penta and Octa BDE.

CEL Pb-free products have the same base part number with a suffix added. The suffix –A indicates that the device is Pb-free. The –AZ suffix is used to designate devices containing Pb which are exempted from the requirement of RoHS directive (\*). In all cases the devices have Pb-free terminals. All devices with these suffixes meet the requirements of the RoHS directive.

This status is based on CEL’s understanding of the EU Directives and knowledge of the materials that go into its products as of the date of disclosure of this information.

Restricted Substance per RoHS	Concentration Limit per RoHS (values are not yet fixed)	Concentration contained in CEL devices	
		-A	-AZ
Lead (Pb)	< 1000 PPM	Not Detected	(*)
Mercury	< 1000 PPM	Not Detected	
Cadmium	< 100 PPM	Not Detected	
Hexavalent Chromium	< 1000 PPM	Not Detected	
PBB	< 1000 PPM	Not Detected	
PBDE	< 1000 PPM	Not Detected	

If you should have any additional questions regarding our devices and compliance to environmental standards, please do not hesitate to contact your local representative.

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