

# DATA SHEET

# NEC

## NPN SILICON RF TWIN TRANSISTOR

# μPA828TD

### NPN SILICON RF TRANSISTOR (WITH 2 ELEMENTS) IN A 6-PIN LEAD-LESS MINIMOLD (M16, 1208 PKG)

#### FEATURES

- Built-in low phase distortion transistor suited for OSC applications  
 $f_T = 9.0 \text{ GHz TYP.}$ ,  $|S_{21e}|^2 = 7.5 \text{ dB TYP. @ } V_{CE} = 1 \text{ V, } I_c = 10 \text{ mA, } f = 2 \text{ GHz}$   
 $NF = 1.3 \text{ dB TYP. @ } V_{CE} = 1 \text{ V, } I_c = 3 \text{ mA, } f = 2 \text{ GHz}$
- Built-in 2 transistors ( $2 \times 2SC5436$ )
- 6-pin lead-less minimold (M16, 1208 PKG)

#### BUILT-IN TRANSISTORS

	Q1, Q2
3-pin thin-type ultra super minimold part No.	2SC5436

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#### ORDERING INFORMATION

Part Number	Order Number	Package	Quantity	Supplying Form
μPA828TD	μPA828TD-A	6-pin lead-less minimold (M16, 1208 PKG) (Pb-Free)	50 pcs (Non reel)	<ul style="list-style-type: none"> <li>8 mm wide embossed taping</li> <li>Pin 1 (Q1 Collector), Pin 6 (Q1 Base) face the perforation side of the tape</li> </ul>
μPA828TD-T3	μPA828TD-T3-A		10 kpcs/reel	

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

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

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**ABSOLUTE MAXIMUM RATINGS (T<sub>A</sub> = +25°C)**

Parameter	Symbol	Ratings	Unit
Collector to Base Voltage	V <sub>CBO</sub>	5.0	V
Collector to Emitter Voltage	V <sub>CEO</sub>	3.0	V
Emitter to Base Voltage	V <sub>EBO</sub>	2	V
Collector Current	I <sub>C</sub>	30	mA
Total Power Dissipation	P <sub>tot</sub> <sup>Note</sup>	90 in 1 element	mW
		180 in 2 elements	
Junction Temperature	T <sub>j</sub>	150	°C
Storage Temperature	T <sub>stg</sub>	-65 to +150	°C

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

**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> = 20 mA	70	–	140	–
<b>RF Characteristics</b>						
Gain Bandwidth Product (1)	f <sub>T</sub>	V <sub>CE</sub> = 1 V, I <sub>C</sub> = 10 mA, f = 2 GHz	7.0	9.0	–	GHz
Gain Bandwidth Product (2)	f <sub>T</sub>	V <sub>CE</sub> = 2 V, I <sub>C</sub> = 20 mA, f = 2 GHz	9.0	11.0	–	GHz
Insertion Power Gain (1)	S <sub>21e</sub>   <sup>2</sup>	V <sub>CE</sub> = 1 V, I <sub>C</sub> = 10 mA, f = 2 GHz	6.0	7.5	–	dB
Insertion Power Gain (2)	S <sub>21e</sub>   <sup>2</sup>	V <sub>CE</sub> = 2 V, I <sub>C</sub> = 20 mA, f = 2 GHz	7.0	8.5	–	dB
Noise Figure (1)	NF	V <sub>CE</sub> = 1 V, I <sub>C</sub> = 3 mA, f = 2 GHz, Z <sub>S</sub> = Z <sub>opt</sub>	–	1.3	2.0	dB
Noise Figure (2)	NF	V <sub>CE</sub> = 2 V, I <sub>C</sub> = 3 mA, f = 2 GHz, Z <sub>S</sub> = Z <sub>opt</sub>	–	1.3	2.0	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	–	0.4	0.8	pF
h <sub>FE</sub> Ratio	h <sub>FE1</sub> /h <sub>FE2</sub>	V <sub>CE</sub> = 2 V, I <sub>C</sub> = 20 mA, h <sub>FE1</sub> : Smaller value of Q1 and Q2, h <sub>FE2</sub> : Larger value of Q1 and Q2	0.85	–	–	–

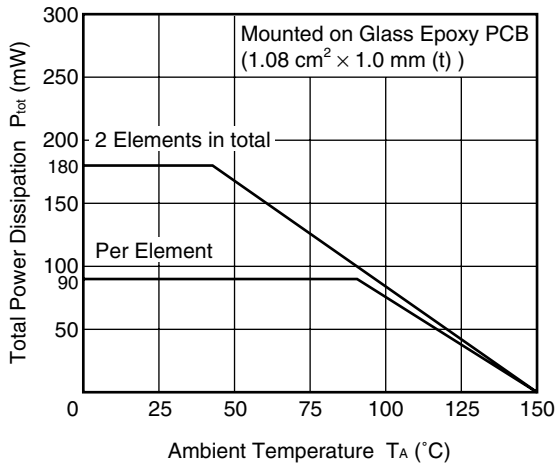
- Notes 1.** Pulse measurement: PW ≤ 350 μs, Duty Cycle ≤ 2%  
**2.** Collector to base capacitance when the emitter grounded.

**h<sub>FE</sub> CLASSIFICATION**

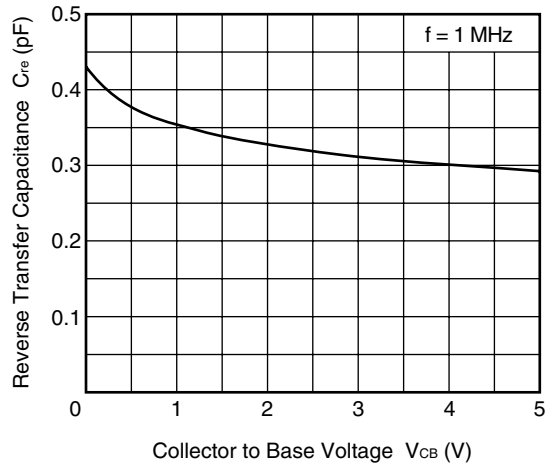
Rank	FB
Marking	kL
h <sub>FE</sub> Value	70 to 140

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

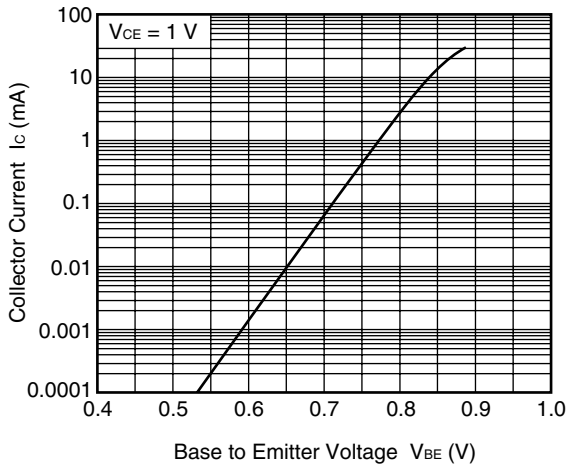
**TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE**



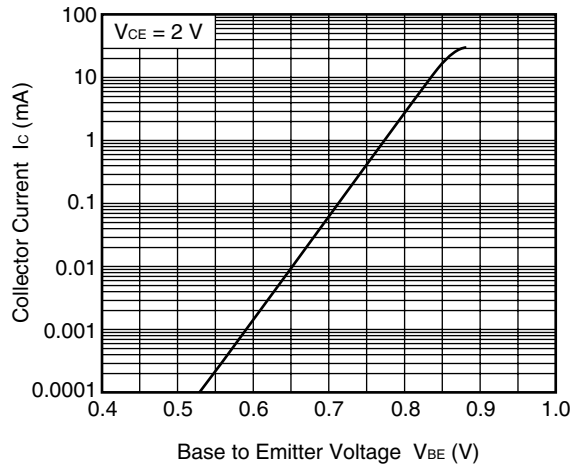
**REVERSE TRANSFER CAPACITANCE vs. COLLECTOR TO BASE VOLTAGE**



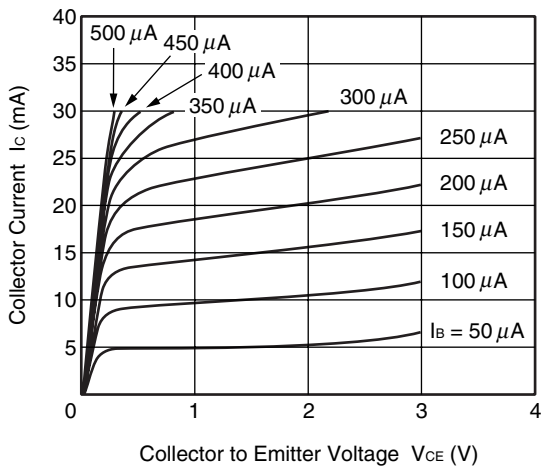
**COLLECTOR CURRENT vs. BASE TO EMITTER VOLTAGE**



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

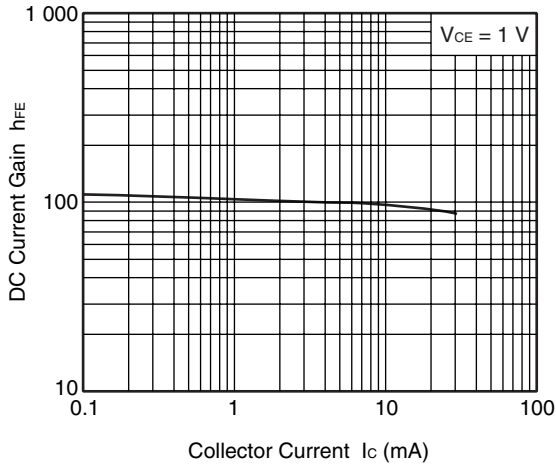


**COLLECTOR CURRENT vs. COLLECTOR TO EMITTER VOLTAGE**

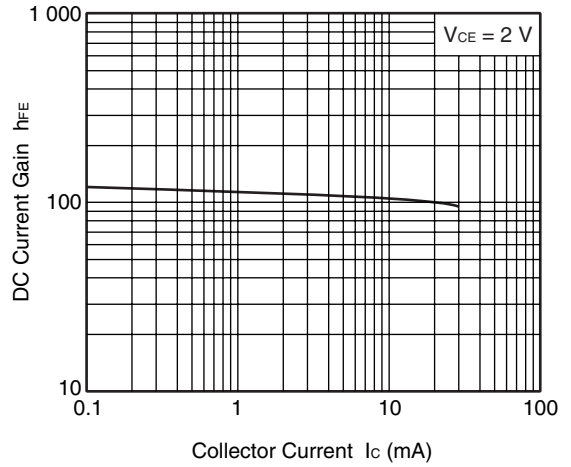


**Remark** The graphs indicate nominal characteristics.

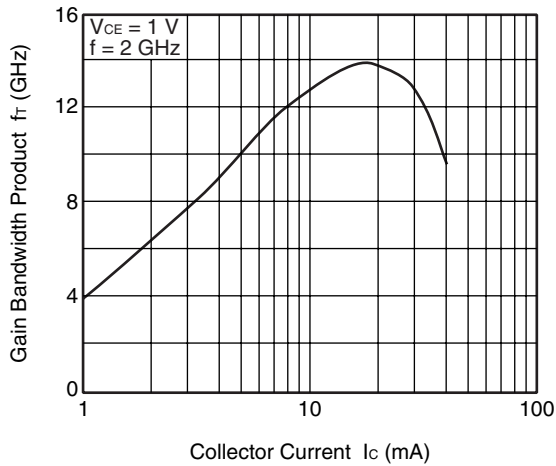
DC CURRENT GAIN vs. COLLECTOR CURRENT



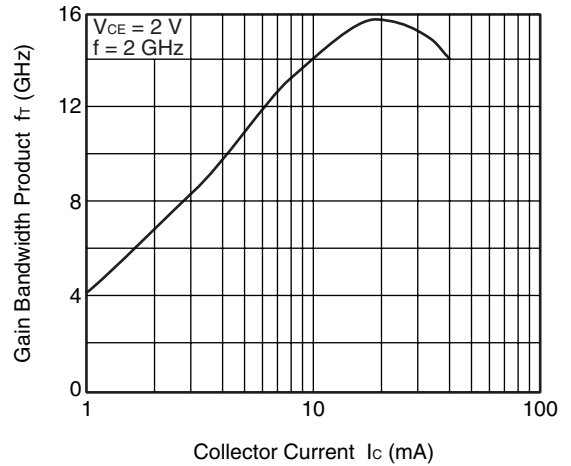
DC CURRENT GAIN vs. COLLECTOR CURRENT



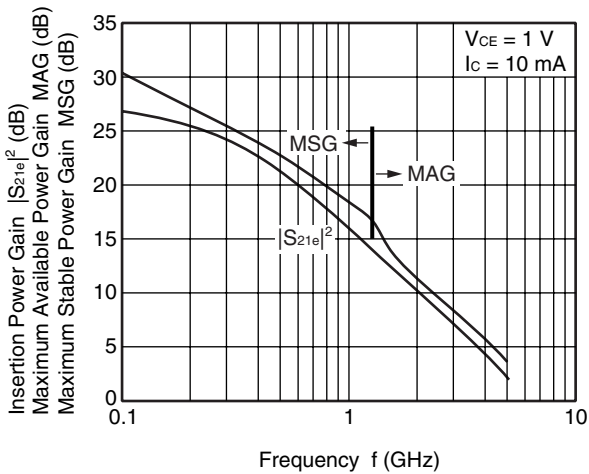
GAIN BANDWIDTH PRODUCT vs. COLLECTOR CURRENT



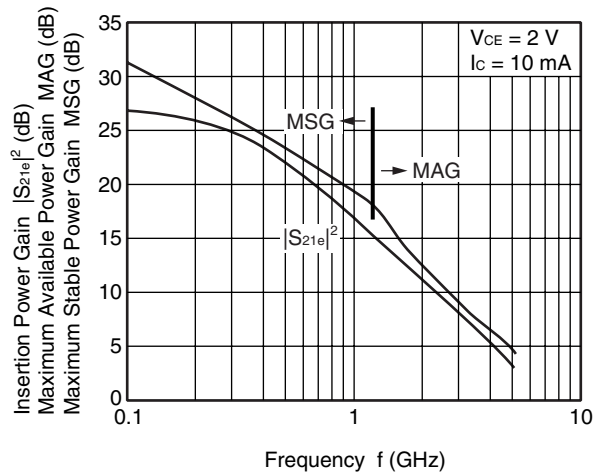
GAIN BANDWIDTH PRODUCT vs. COLLECTOR CURRENT



INSERTION POWER GAIN, MAG, MSG vs. FREQUENCY

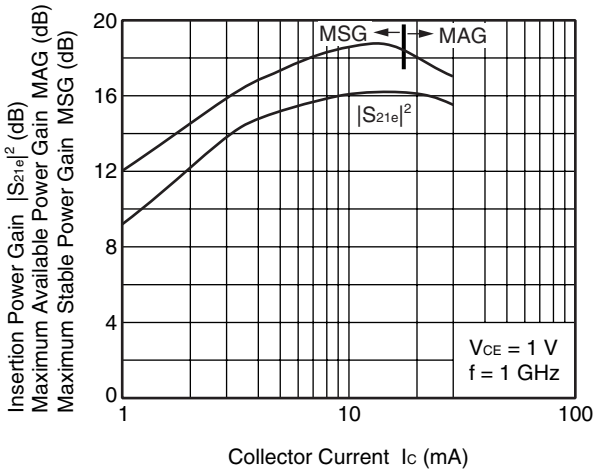


INSERTION POWER GAIN, MAG, MSG vs. FREQUENCY

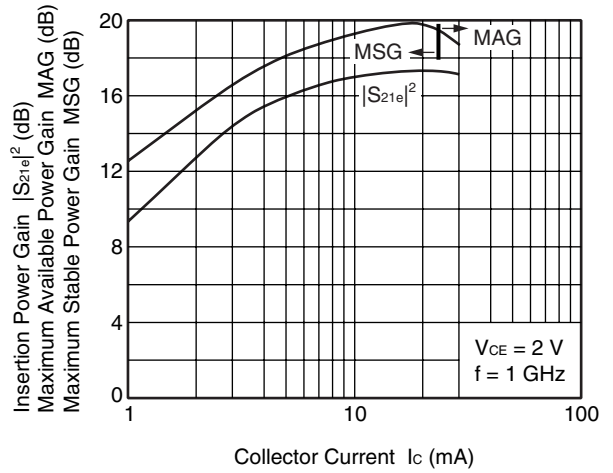


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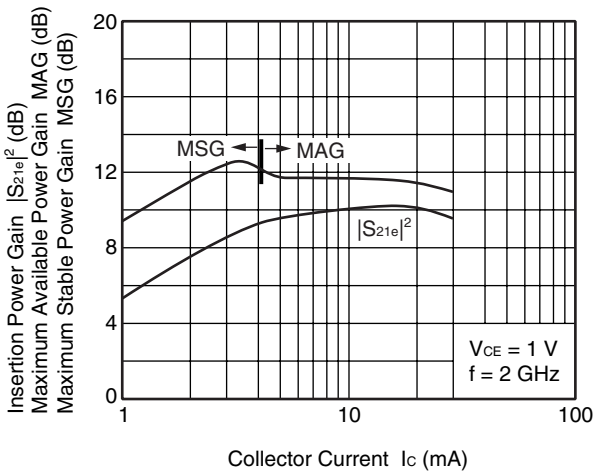
INSERTION POWER GAIN, MAG, MSG  
vs. COLLECTOR CURRENT



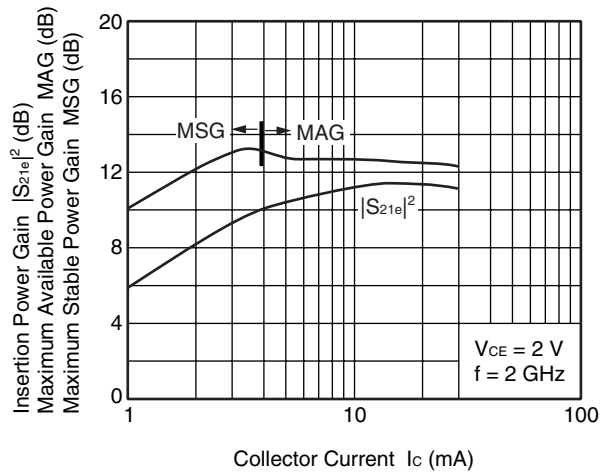
INSERTION POWER GAIN, MAG, MSG  
vs. COLLECTOR CURRENT



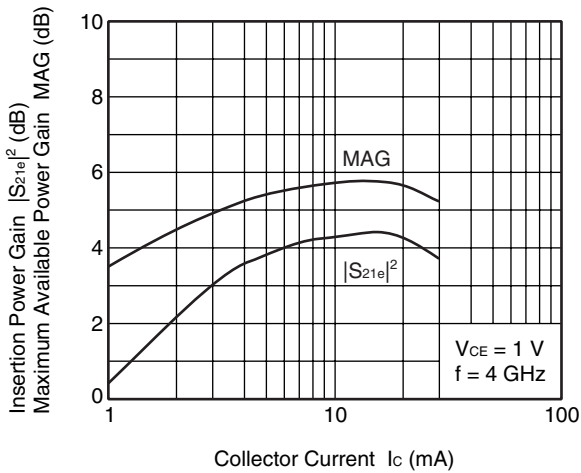
INSERTION POWER GAIN, MAG, MSG  
vs. COLLECTOR CURRENT



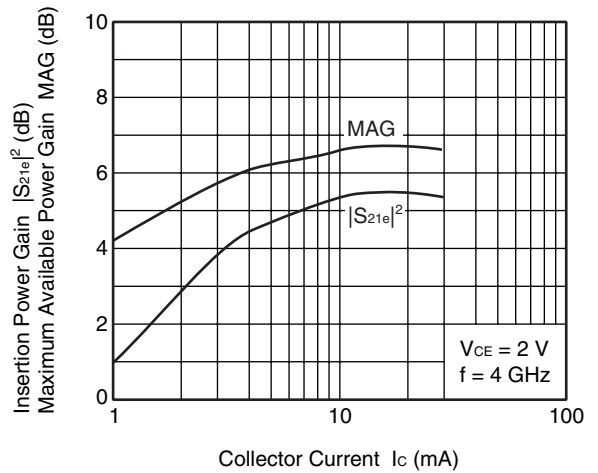
INSERTION POWER GAIN, MAG, MSG  
vs. COLLECTOR CURRENT



INSERTION POWER GAIN, MAG  
vs. COLLECTOR CURRENT

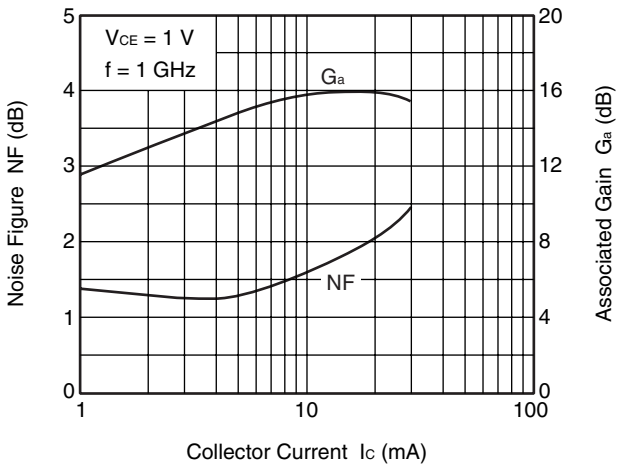


INSERTION POWER GAIN, MAG  
vs. COLLECTOR CURRENT

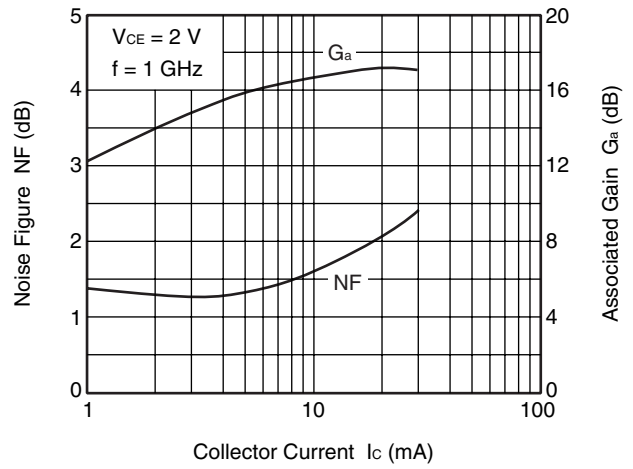


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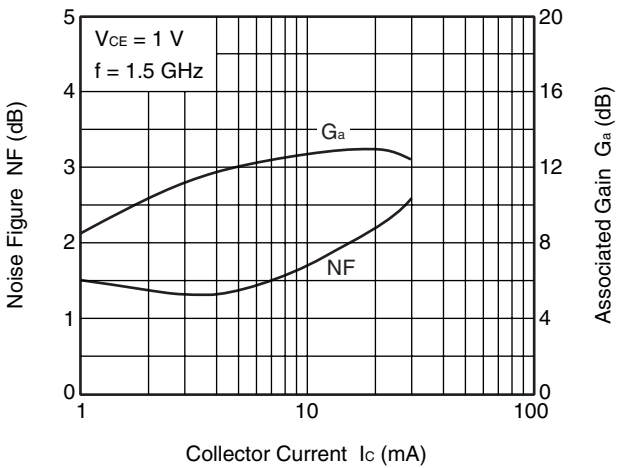
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



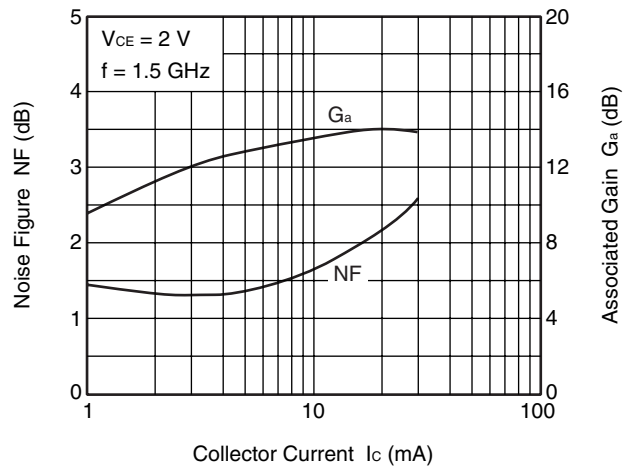
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



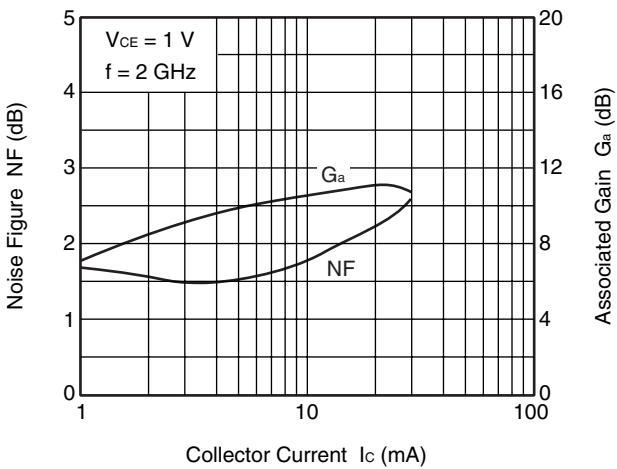
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



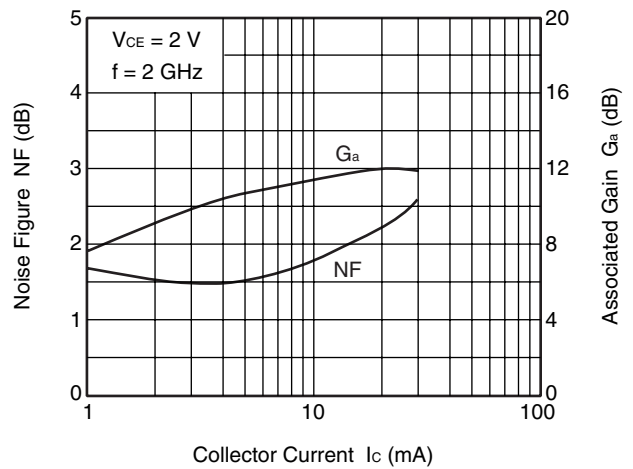
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



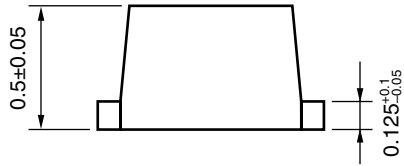
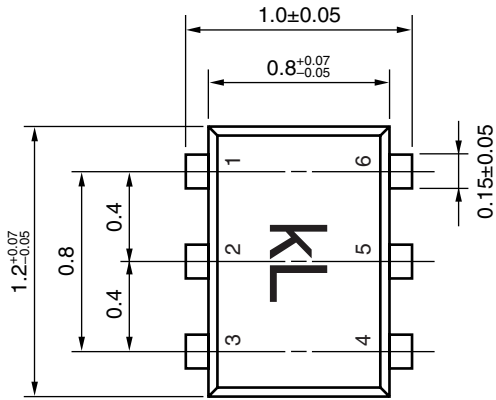
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



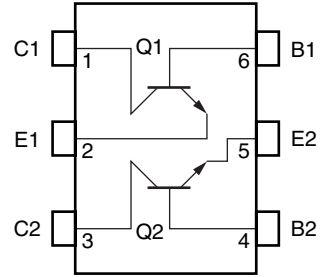
**Remark** The graphs indicate nominal characteristics.

PACKAGE DIMENSIONS

6-PIN LEAD-LESS MINIMOLD (M16, 1208 PKG) (UNIT: mm)



(Top View)



PIN CONNECTIONS

1. Collector (Q1)
2. Emitter (Q1)
3. Collector (Q2)
4. Base (Q2)
5. Emitter (Q2)
6. Base (Q1)

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