〈SMALL-SIGNAL TRANSISTOR〉

# 2SC5169

**DUAL TRANSISTOR**
**FOR LOW NOISE DIFFERENTIAL AMPLIFY APPLICATION**
**SILICON NPN EPITAXIAL TYPE**

## DESCRIPTION

2SC5169 is a silicon NPN epitaxial type transistor. It is designed for low noise differential amplify application.

## FEATURE

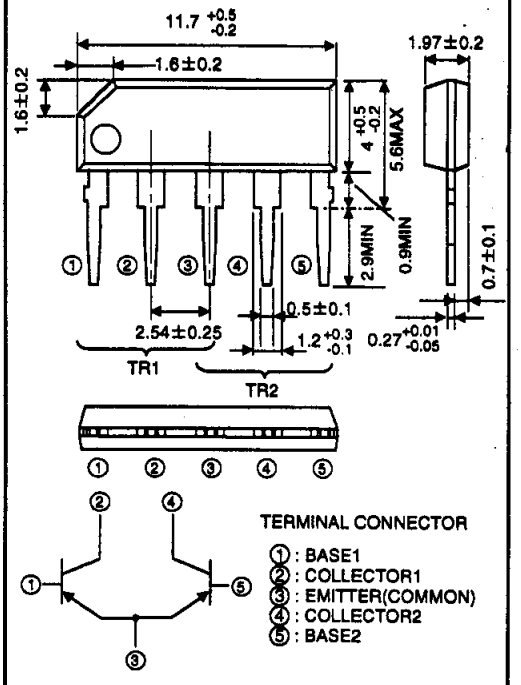
- ●High $V_{CEO}$ $V_{CEO}$=100V
- ●Low noise NF=0.5dB typ NV=100mV typ
- ●High $h_{FE}$ $h_{FE}$=250 to 1200
- ●Good two elements characteristics
  - $h_{FE1}/h_{FE2}$=0.98 typ
  - $|V_{BE1}-V_{BE2}|$=1mV typ

## APPLICATION

For low noise differential amplify application.

## OUTLINE DRAWING

Unit:mm




TERMINAL CONNECTOR

- ①: BASE1
- ②: COLLECTOR1
- ③: EMITTER(COMMON)
- ④: COLLECTOR2
- ⑤: BASE2

Note)
The dimension without tolerance represent central value.

## MAXIMUM RATINGS (Ta=25℃)

| Symbol | Parameter | Ratings | Unit |
|---|---|---|---|
| $V_{CBO}$ | Collector to Base voltage | 100 | V |
| $V_{EBO}$ | Emitter to Base voltage | 5 | V |
| $V_{CEO}$ | Collector to Emitter voltage | 100 | V |
| $I_C$ | Collector current | 50 | mA |
| $P_C$ | Collector dissipation(Ta=25℃) | 200 | mW/unit |
| $P_T$ | Total dissipation(Ta=25℃) | 400 | mW |
| $T_j$ | Junction temperature | +125 | ℃ |
| $T_{stg}$ | Storage temperature | -55 to +125 | ℃ |

## ELECTRICAL CHARACTERISTICS (Ta=25℃)

| Symbol | Parameter | | Test conditions | Limits | | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | Min | Typ | Max | |
| $V_{(BR)CEO}$ | C to E break down voltage | | $I_C$=100μA,$R_{BE}$=∞ | 100 | | | V |
| $I_{CBO}$ | Collector cut off current | | $V_{CB}$=70V,$I_E$=0 | | | 0.1 | μA |
| $I_{EBO}$ | Emitter cut off current | | $V_{EB}$=2V,$I_C$=0 | | | 0.1 | μA |
| $I_{CER}$ | Collector cut off current | | $V_{CE}$=100V,$R_{BE}$=100kΩ | | | 10 | μA |
| $h_{FE}$ * | DC forward current gain | | $V_{CE}$=6V,$I_C$=1mA | 250 | | 1200 | — |
| $V_{CE(sat)}$ | C to E saturation voltage | | $I_C$=10mA,$I_B$=1mA | | | 0.6 | V |
| $\|V_{BE1}-V_{BE2}\|$ | B-E voltage differential | | $V_{CE}$=6V,$I_C$=1mA | | 1 | 10 | mV |
| $h_{FE1}/h_{FE2}$ | DC forward current gain ratio | | $V_{CE}$=6V,$I_C$=1mA | 0.8 | 0.98 | 1.0 | — |
| $f_T$ | Gain band width product | | $V_{CE}$=6V,$I_E$=-1mA | | 150 | | MHz |
| $C_{ob}$ | Collector output capacitance | | $V_{CB}$=6V,$I_E$=0,f=1MHz | | 1.8 | | pF |
| NF | Noise figure | | $V_{CE}$=6V,$I_E$=-0.1mA,f=1kHz,$R_G$=10kΩ | | 0.5 | | dB |
| NV | Low frequency broadband noise voltage | effective value | $V_{CE}$=10V,$I_E$=-1mA,$R_G$=100kΩ,Gv=80dB, | | 100 | | mV |
| $NV_M$ | | peaked value | (Refer to test circuit) | | 0.5 | | V |

* : It shows $h_{FE}$ (element 1) classification in right table.

| Item | F | G | H |
|---|---|---|---|
| $h_{FE}$ | 250 to 500 | 400 to 800 | 600 to 1200 |

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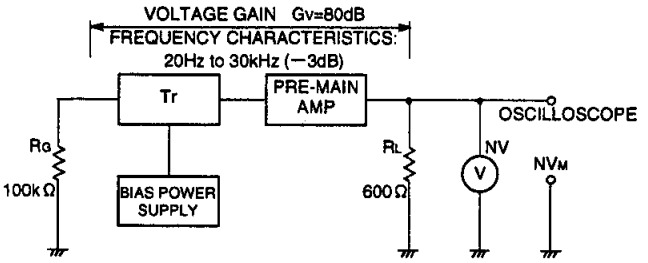
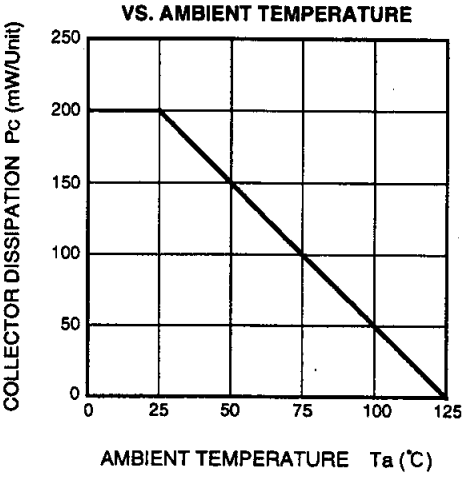
## TYPICAL CHARACTERISTICS

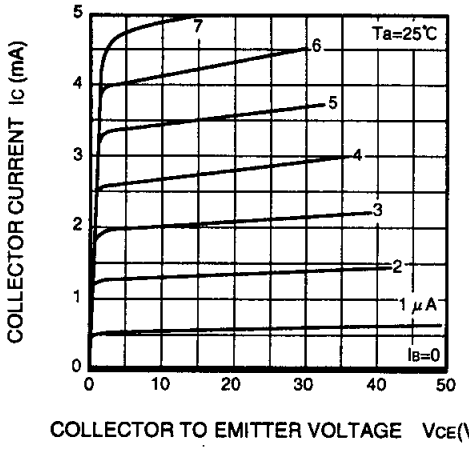
### LOW FREQUENCY WIDE BAND NOISE VOLTAGE TEST CIRCUIT



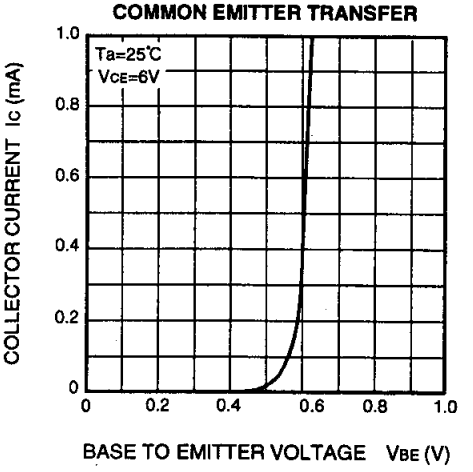

### COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



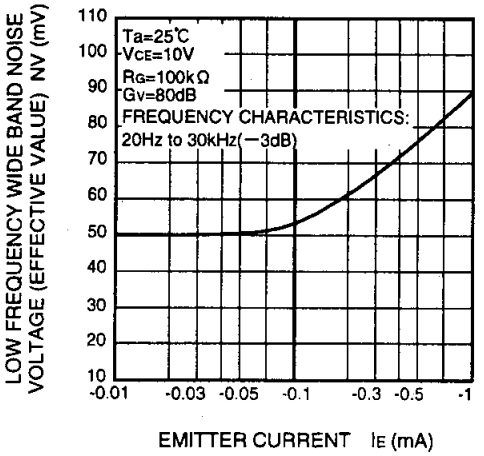

### COMMON EMITTER OUTPUT



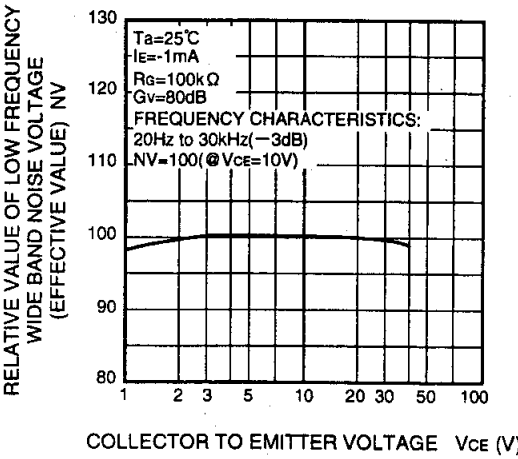

### COMMON EMITTER TRANSFER




### LOW FREQUENCY WIDE BAND NOISE VOLTAGE (EFFECTIVE VALUE) VS. EMITTER CURRENT




### LOW FREQUENCY WIDE BAND NOISE VOLTAGE (EFFECTIVE) VS. COLLECTOR TO EMITTER VOLTAGE



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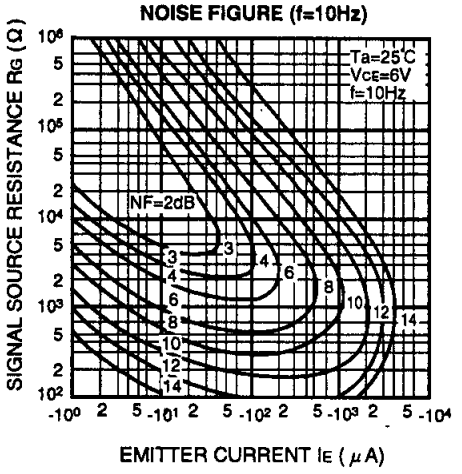
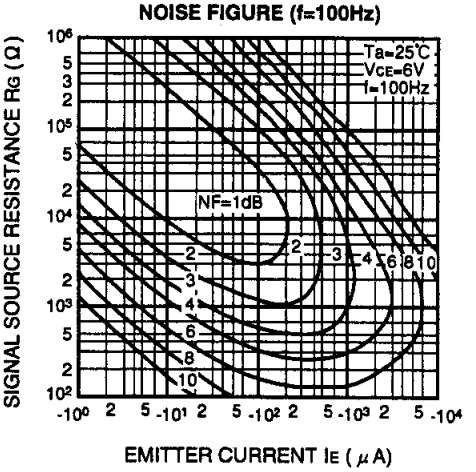
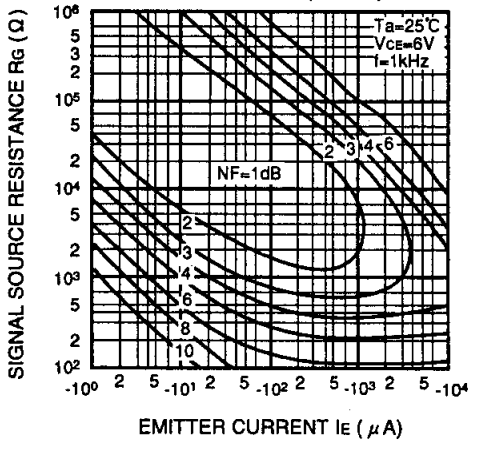
**NOISE FIGURE (f=10Hz)**



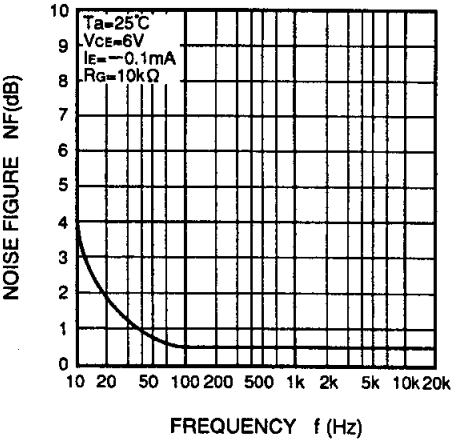

**NOISE FIGURE (f=100Hz)**



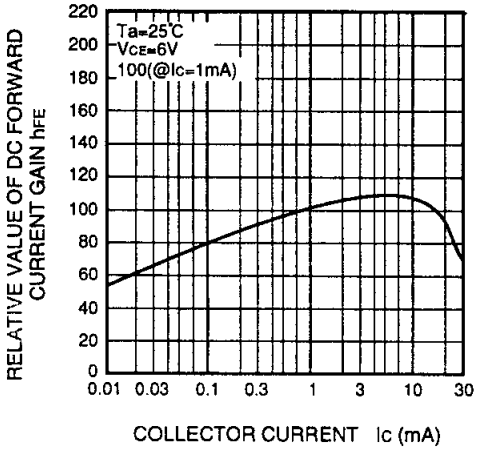

**NOISE FIGURE (f=1kHz)**



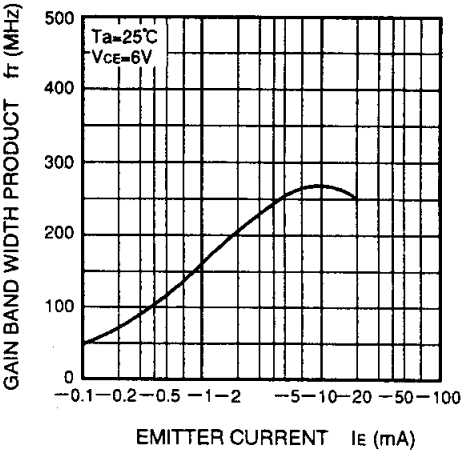

**NOISE FIGURE VS.FREQUENCY**




**DC FORWARD CURRENT GAIN VS. COLLECTOR CURRENT**




**GAIN BAND WIDTH PRODUCT VS. EMITTER CURRENT**



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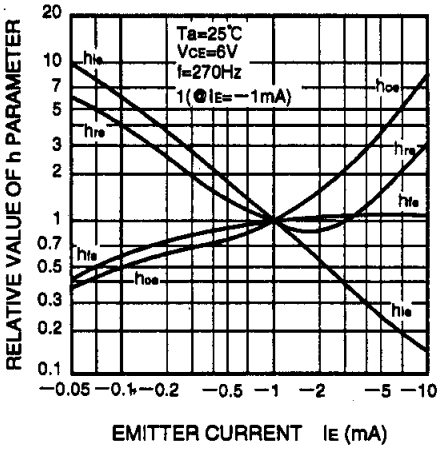
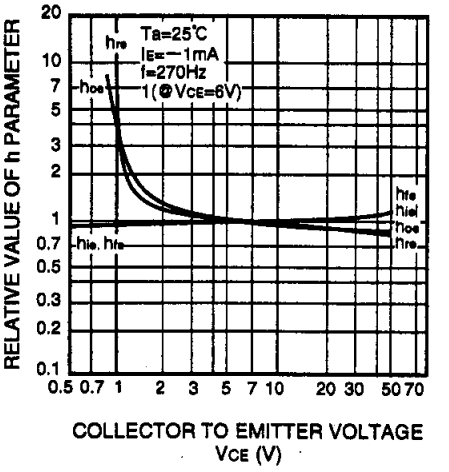
**h PARAMETER VS. EMITTER CURRENT**




**h PARAMETER VS. COLLECTOR TO EMITTER VOLTAGE**




**COMMON EMITTER h PARAMETER** (TYPICAL VALUE)

| Symbol | Parameter | Test conditions | Limits | Unit |
|---|---|---|---|---|
| hie | Closed loop small signal input impedance | Ta=25℃<br>VCE=6V<br>IE=-1mA<br>f=270Hz | 18 | kΩ |
| hre | Open loop small signal reverse voltage amplification factor | | 0.08 | $\times 10^{-3}$ |
| hfe | Closed loop small signal forward current amplification factor | | 600 | — |
| hoe | Open loop small signal output admittance | | 10 | μS |

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