

TOSHIBA Transistor Silicon PNP Epitaxial Type (PCT process)

# 2SA970

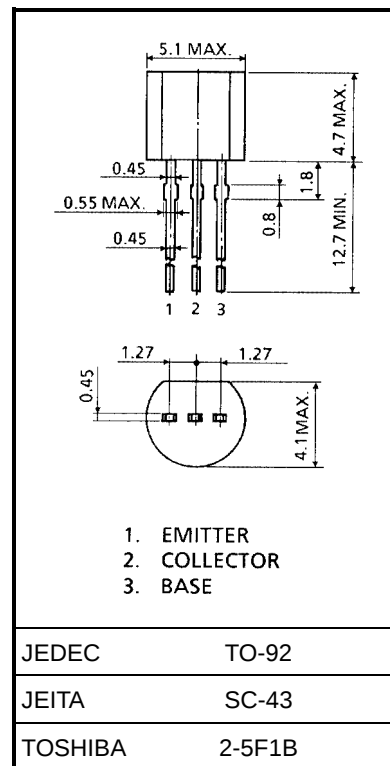
## Low Noise Audio Amplifier Applications

Unit: mm

- Low noise:  $NF = 3\text{dB}$  (typ.)  $R_G = 100\ \Omega$ ,  $V_{CE} = -6\text{ V}$ ,  $I_C = -100\ \mu\text{A}$ ,  
 $f = 1\text{ kHz}$   
 $: NF = 0.5\text{dB}$  (typ.)  $R_G = 1\text{ k}\Omega$ ,  $V_{CE} = -6\text{ V}$ ,  $I_C = -100\ \mu\text{A}$ ,  
 $f = 1\text{ kHz}$
- High DC current gain:  $h_{FE} = 200\sim 700$
- High breakdown voltage:  $V_{CEO} = -120\text{ V}$
- Low pulse noise. Low  $1/f$  noise

## Maximum Ratings ( $T_a = 25^\circ\text{C}$ )

| Characteristics             | Symbol    | Rating  | Unit             |
|-----------------------------|-----------|---------|------------------|
| Collector-base voltage      | $V_{CBO}$ | -120    | V                |
| Collector-emitter voltage   | $V_{CEO}$ | -120    | V                |
| Emitter-base voltage        | $V_{EBO}$ | -5      | V                |
| Collector current           | $I_C$     | -100    | mA               |
| Base current                | $I_B$     | -20     | mA               |
| Collector power dissipation | $P_C$     | 300     | mW               |
| Junction temperature        | $T_j$     | 125     | $^\circ\text{C}$ |
| Storage temperature range   | $T_{stg}$ | -55~125 | $^\circ\text{C}$ |

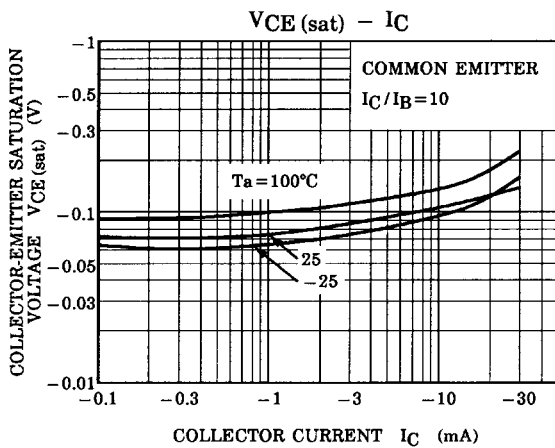
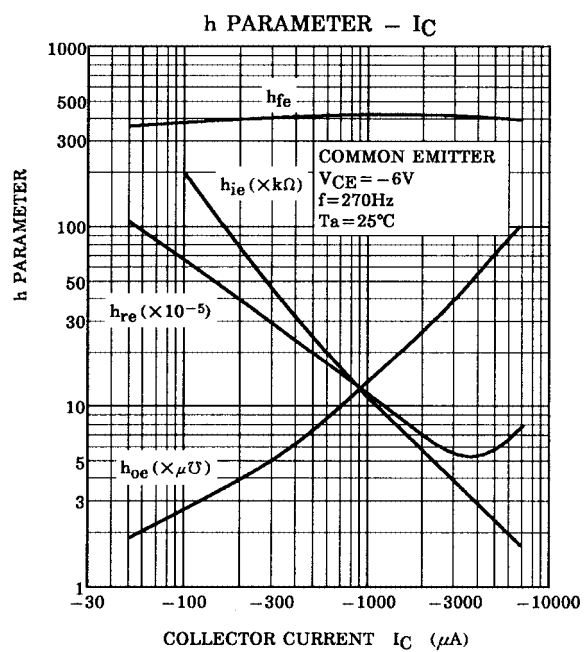
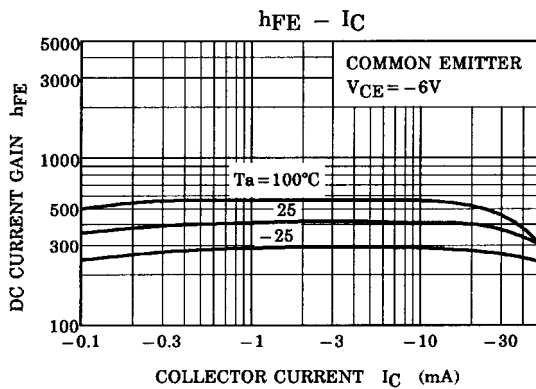
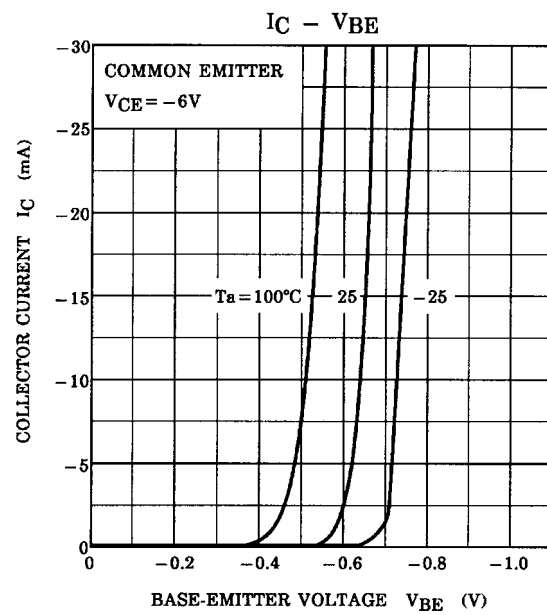
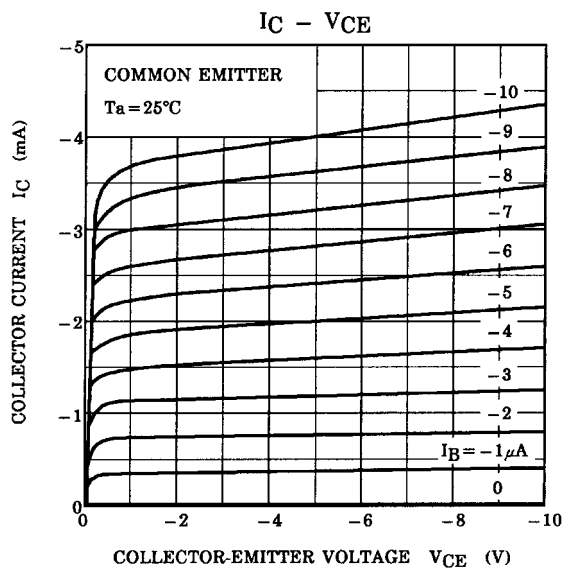


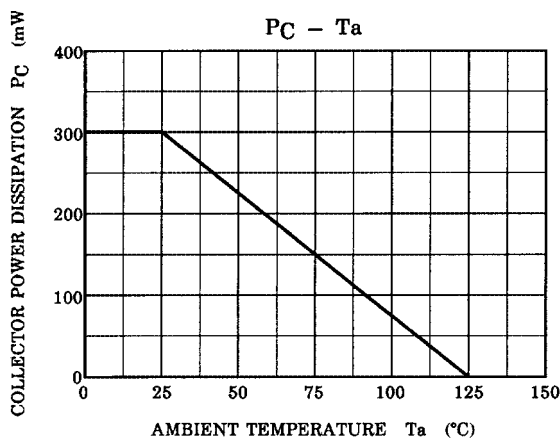
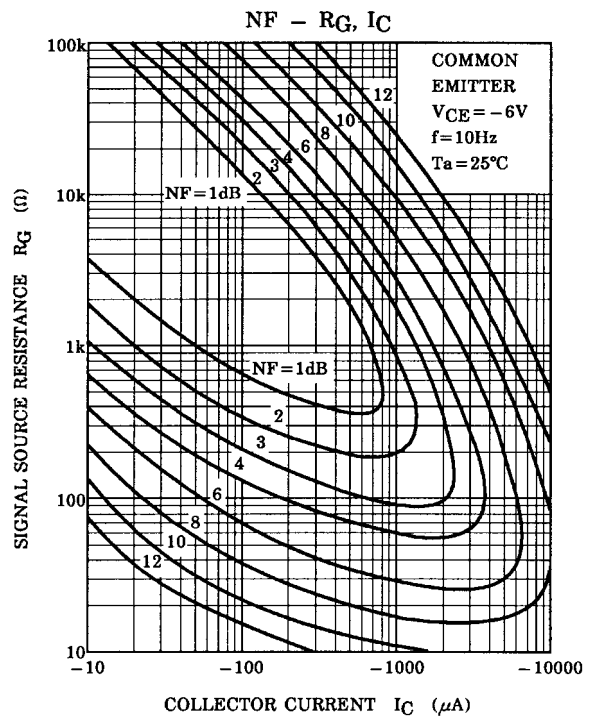
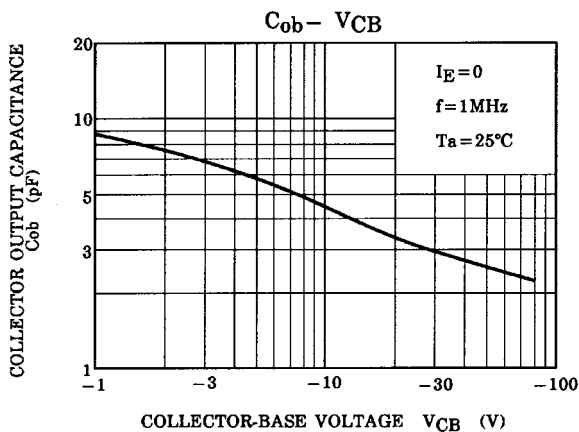
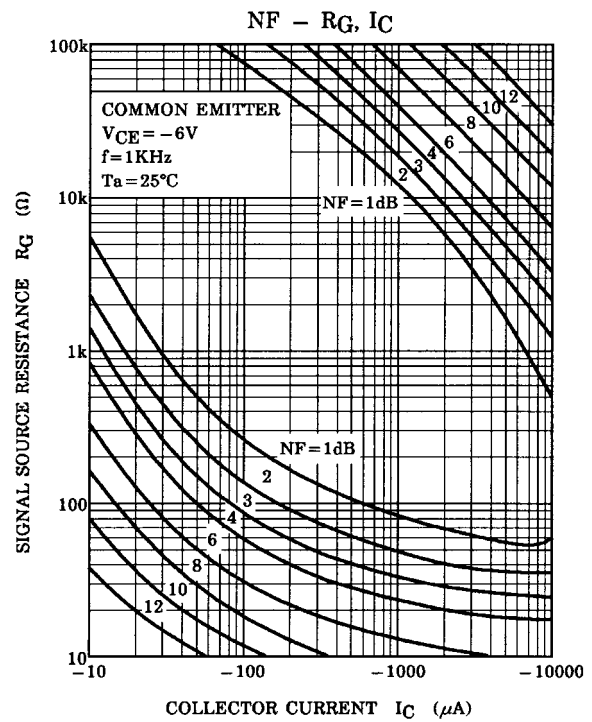
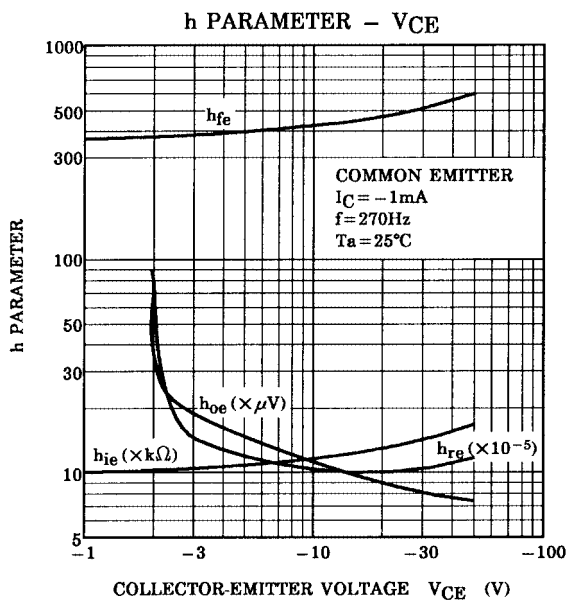
Weight: 0.21 g (typ.)

## Electrical Characteristics ( $T_a = 25^\circ\text{C}$ )

| Characteristics                      | Symbol             | Test Condition                                                                                      | Min  | Typ. | Max  | Unit          |
|--------------------------------------|--------------------|-----------------------------------------------------------------------------------------------------|------|------|------|---------------|
| Collector cut-off current            | $I_{CBO}$          | $V_{CB} = -120\text{ V}$ , $I_E = 0$                                                                | —    | —    | -0.1 | $\mu\text{A}$ |
| Emitter cut-off current              | $I_{EBO}$          | $V_{EB} = -5\text{ V}$ , $I_C = 0$                                                                  | —    | —    | -0.1 | $\mu\text{A}$ |
| Collector-emitter breakdown voltage  | $V_{(BR)CEO}$      | $I_C = -1\text{ mA}$ , $I_B = 0$                                                                    | -120 | —    | —    | V             |
| DC current gain                      | $h_{FE}$<br>(Note) | $V_{CE} = -6\text{ V}$ , $I_C = -2\text{ mA}$                                                       | 200  | —    | 700  |               |
| Collector-emitter saturation voltage | $V_{CE(sat)}$      | $I_C = -10\text{ mA}$ , $I_B = -1\text{ mA}$                                                        | —    | —    | -0.3 | V             |
| Base-emitter voltage                 | $V_{BE}$           | $V_{CE} = -6\text{ V}$ , $I_C = -2\text{ mA}$                                                       | —    | 0.65 | —    | V             |
| Transition frequency                 | $f_T$              | $V_{CE} = -6\text{ V}$ , $I_C = -1\text{ mA}$                                                       | —    | 100  | —    | MHz           |
| Collector output capacitance         | $C_{ob}$           | $V_{CB} = -10\text{ V}$ , $I_E = 0$ , $f = 1\text{ MHz}$                                            | —    | 4.0  | —    | pF            |
| Noise figure                         | NF                 | $V_{CE} = -6\text{ V}$ , $I_C = -0.1\text{ mA}$ , $f = 10\text{ Hz}$ ,<br>$R_G = 10\text{ k}\Omega$ | —    | —    | 6    | dB            |
|                                      |                    | $V_{CE} = -6\text{ V}$ , $I_C = -0.1\text{ mA}$ , $f = 1\text{ kHz}$ ,<br>$R_G = 10\text{ k}\Omega$ | —    | —    | 2    |               |
|                                      |                    | $V_{CE} = -6\text{ V}$ , $I_C = -0.1\text{ mA}$ , $f = 1\text{ kHz}$ ,<br>$R_G = 100\ \Omega$       | —    | 3    | —    |               |

Note:  $h_{FE}$  classification GR: 200~400, BL: 350~700





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