

TOSHIBA Transistor Silicon PNP Epitaxial Type (PCT Process)

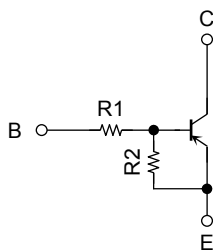
## RN2401, RN2402, RN2403, RN2404, RN2405, RN2406

Unit: mm

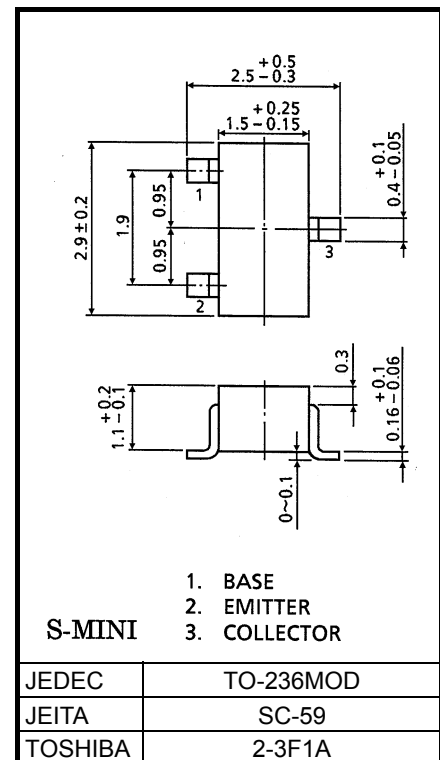
Switching, Inverter Circuit, Interface Circuit  
and Driver Circuit Applications

- With built-in bias resistors
- Simplified circuit design
- Reduce a quantity of parts and manufacturing process
- Complementary to RN1401~1406

### Equivalent Circuit Bias Resistor Values



| Type No. | R1 (kΩ) | R2 (kΩ) |
|----------|---------|---------|
| RN2401   | 4.7     | 4.7     |
| RN2402   | 10      | 10      |
| RN2403   | 22      | 22      |
| RN2404   | 47      | 47      |
| RN2405   | 2.2     | 47      |
| RN2406   | 4.7     | 47      |



Weight: 12mg (typ.)

### Absolute Maximum Ratings (Ta = 25°C)

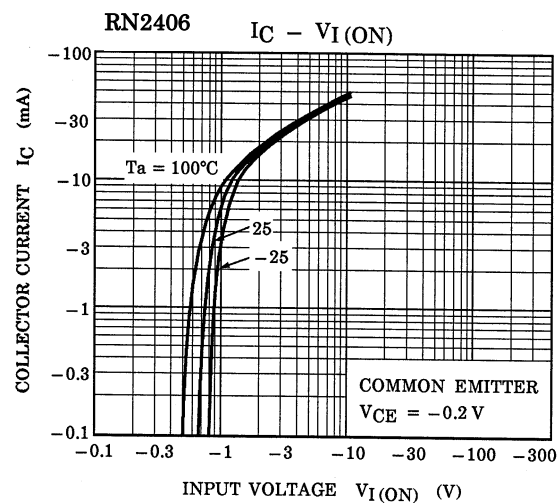
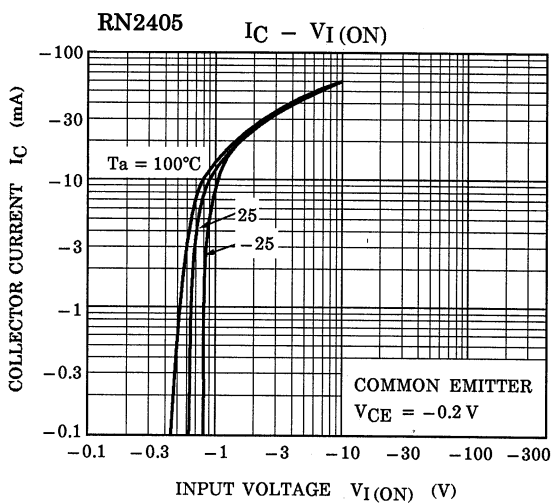
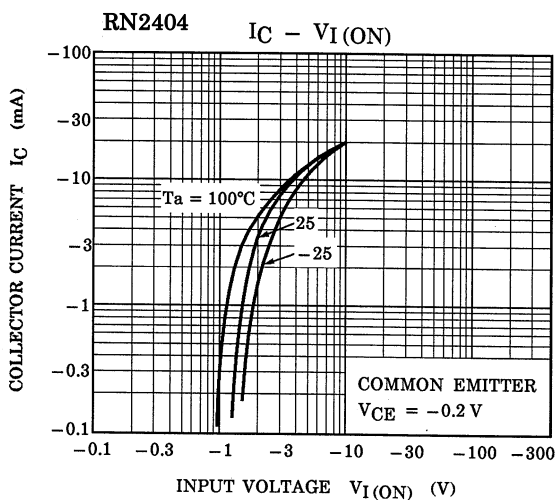
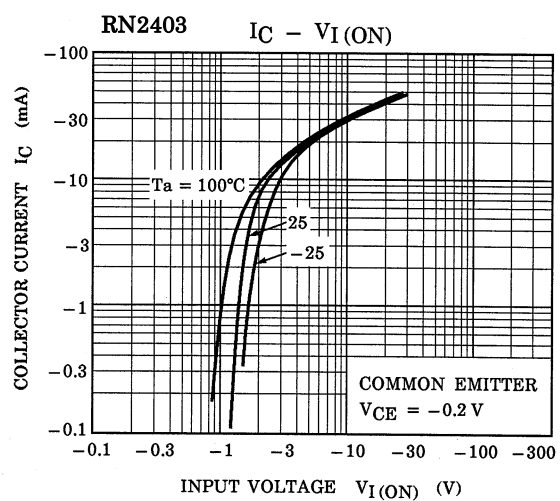
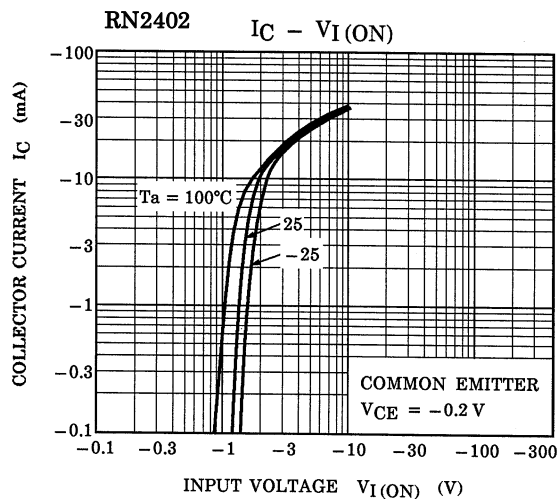
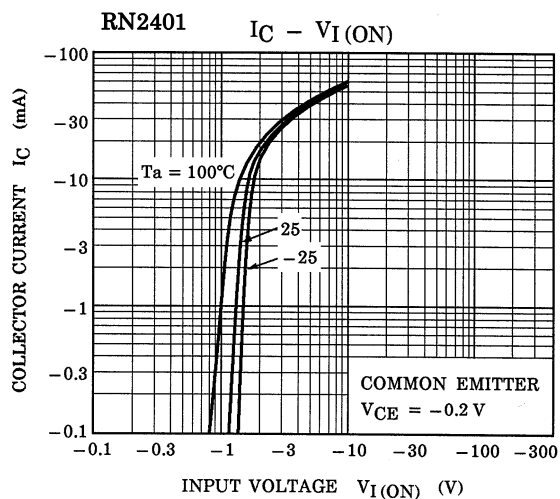
| Characteristic              |              | Symbol           | Rating     | Unit |
|-----------------------------|--------------|------------------|------------|------|
| Collector-base voltage      | RN2401~2406  | V <sub>CBO</sub> | −50        | V    |
| Collector-emitter voltage   |              | V <sub>CEO</sub> | −50        | V    |
| Emitter-base voltage        | RN2401~2404  | V <sub>EBO</sub> | −10        | V    |
|                             | RN2405, 2406 |                  | −5         | V    |
| Collector current           | RN2401~2406  | I <sub>C</sub>   | −100       | mA   |
| Collector power dissipation |              | P <sub>C</sub>   | 200        | mW   |
| Junction temperature        |              | T <sub>j</sub>   | 150        | °C   |
| Storage temperature range   |              | T <sub>stg</sub> | −55 to 150 | °C   |

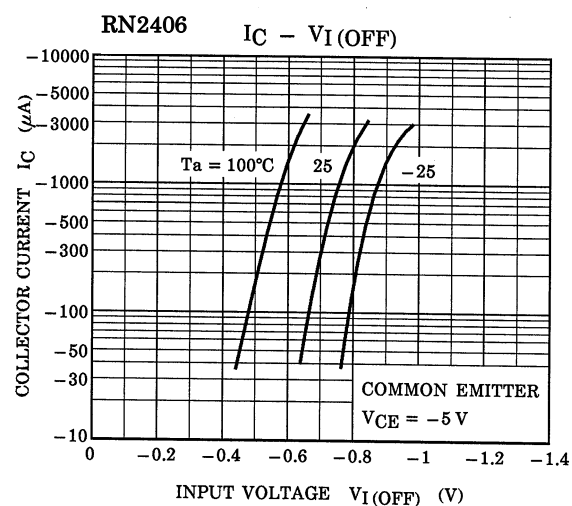
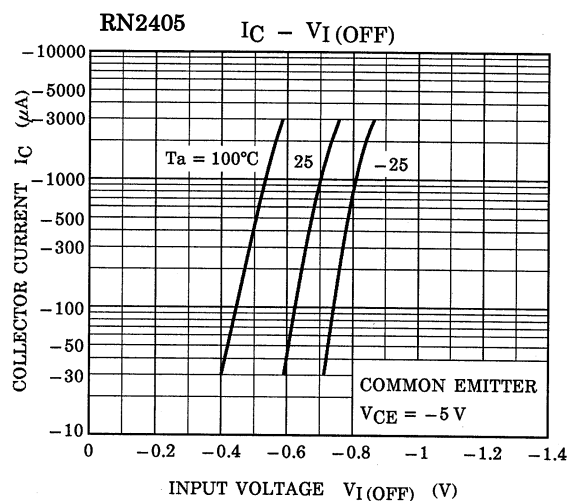
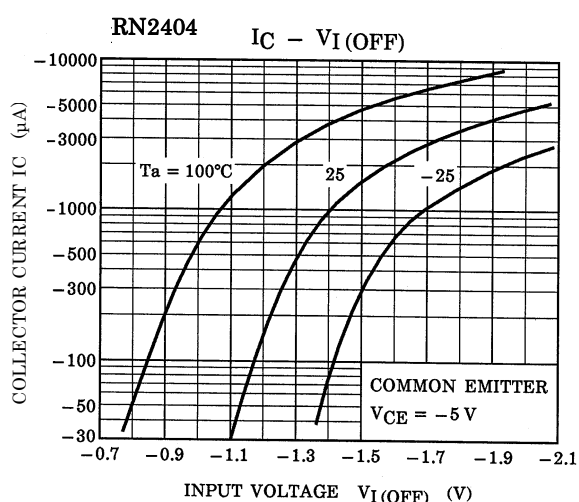
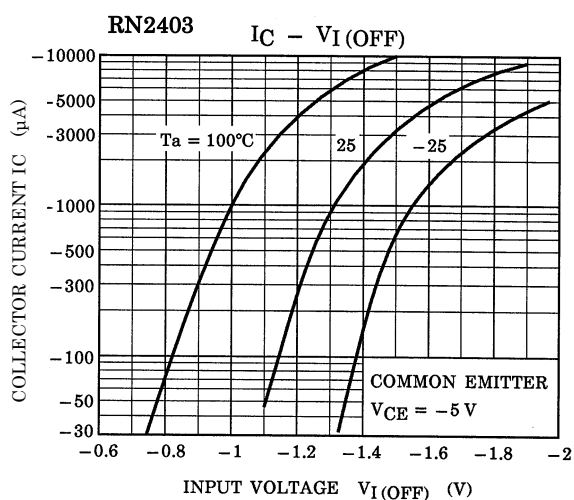
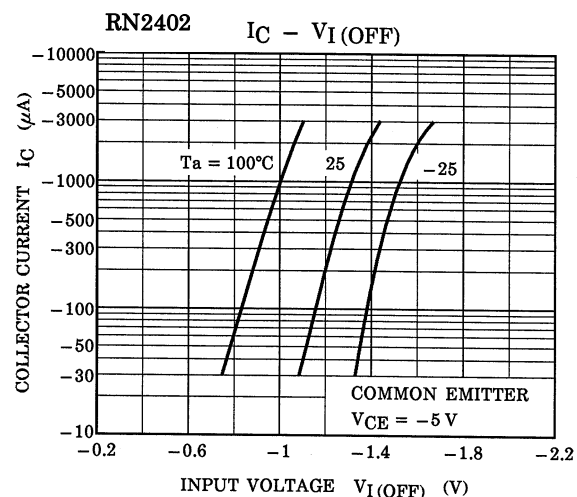
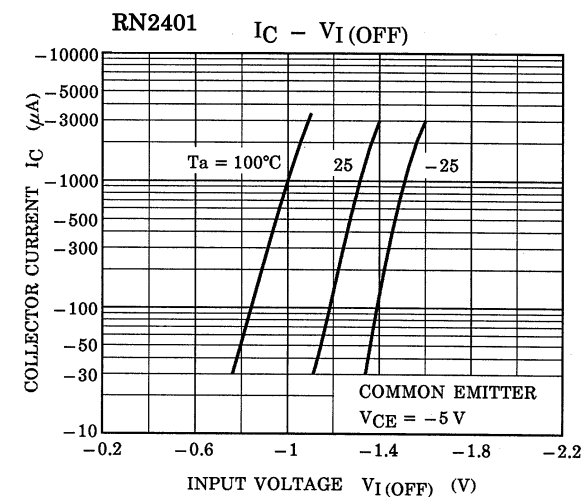
Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings.

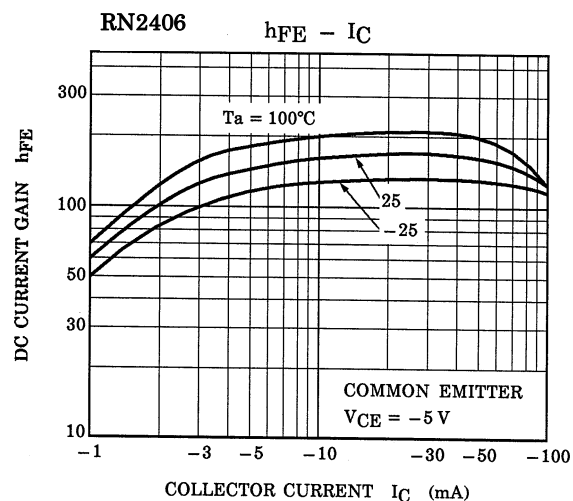
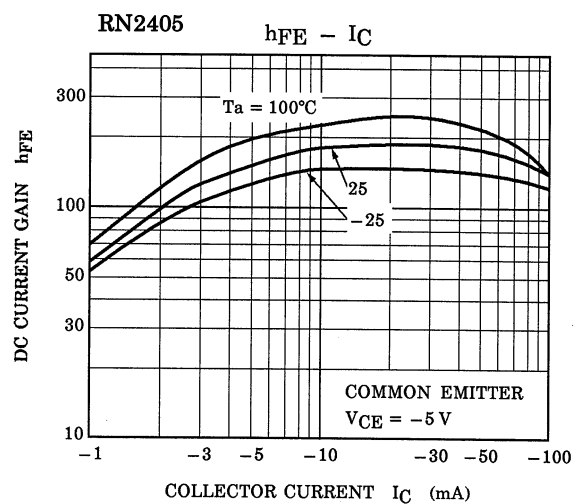
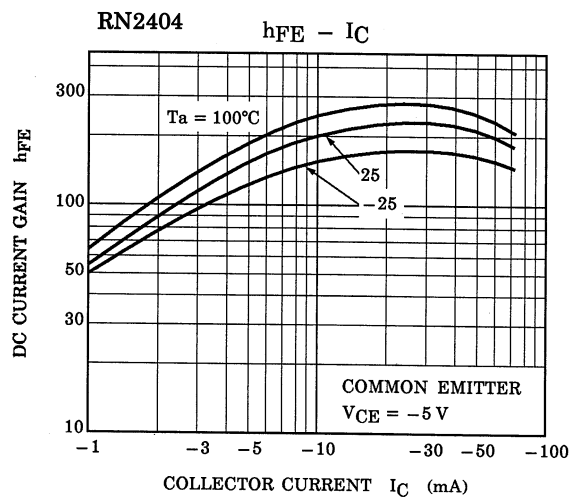
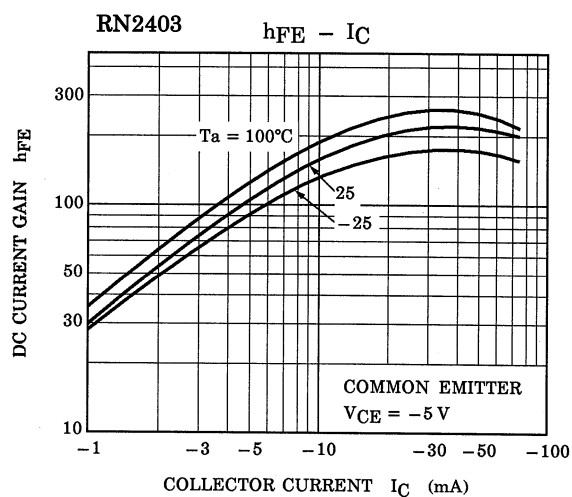
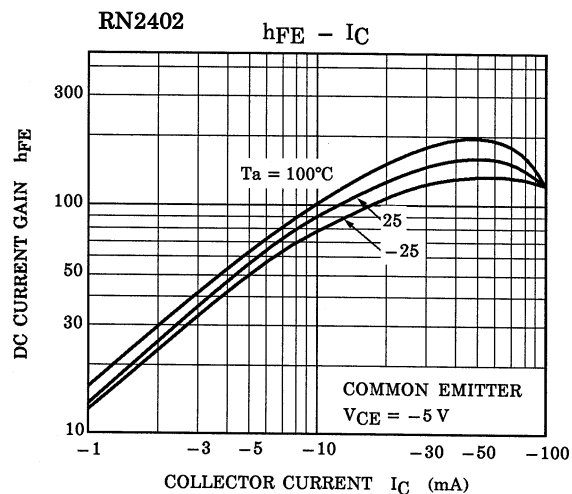
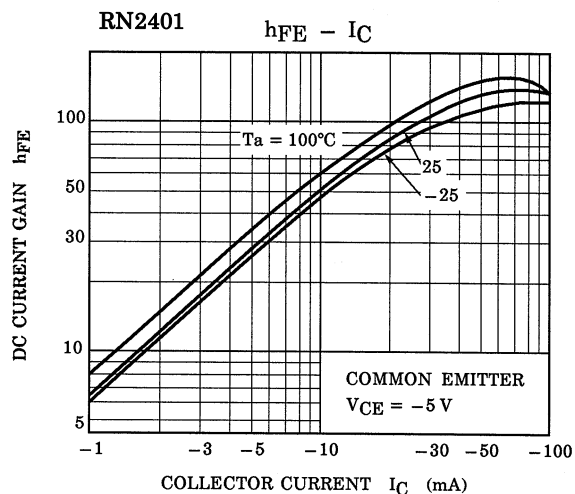
Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

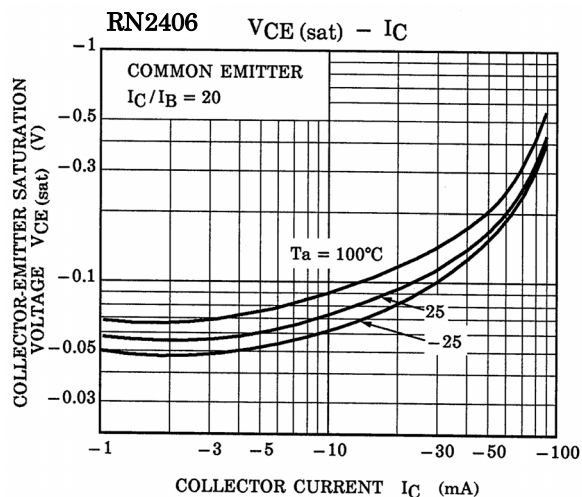
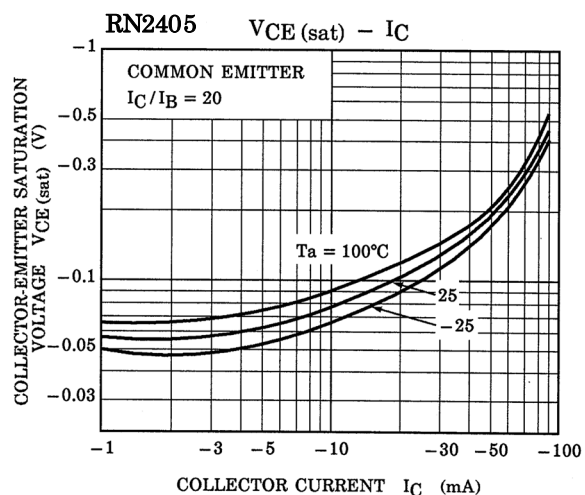
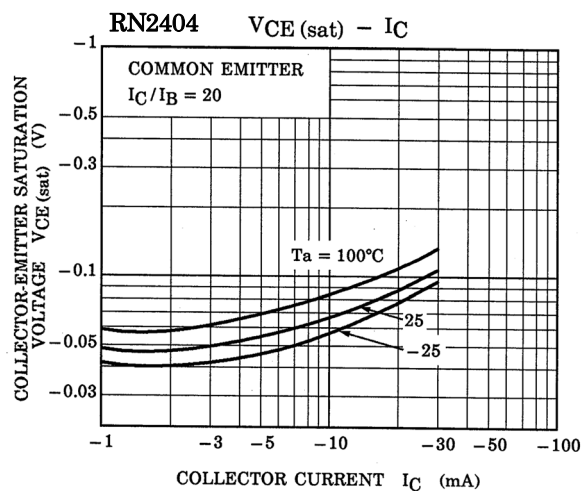
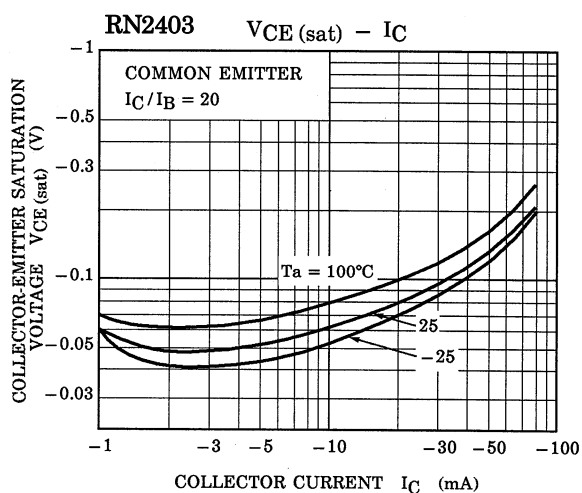
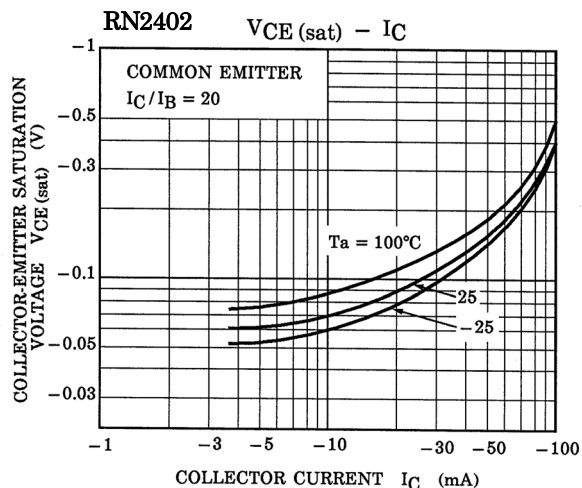
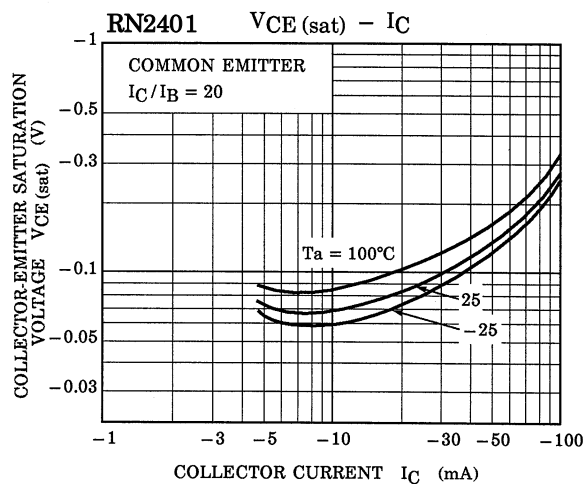
## Electrical Characteristics (Ta = 25°C)

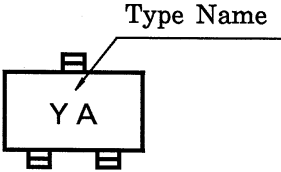
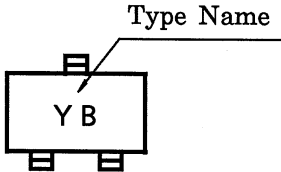
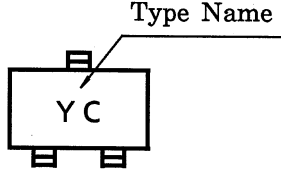
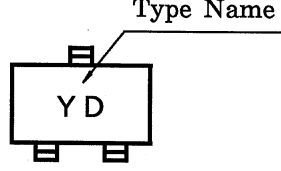
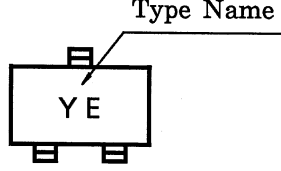
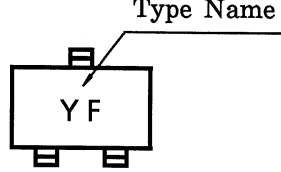
| Characteristic                       |              | Symbol            | Test Circuit | Test Condition                                         | Min    | Typ.   | Max    | Unit |
|--------------------------------------|--------------|-------------------|--------------|--------------------------------------------------------|--------|--------|--------|------|
| Collector cut-off current            | RN2401~2406  | $I_{CBO}$         | —            | $V_{CB} = -50\text{ V}, I_E = 0$                       | —      |        | -100   | nA   |
|                                      |              | $I_{CEO}$         | —            | $V_{CE} = -50\text{ V}, I_B = 0$                       | —      | —      | -500   |      |
| Emitter cut-off current              | RN2401       | $I_{EBO}$         | —            | $V_{EB} = -10\text{ V}, I_C = 0$                       | -0.82  | —      | -1.52  | mA   |
|                                      | RN2402       |                   | —            |                                                        | -0.38  | —      | -0.71  |      |
|                                      | RN2403       |                   | —            |                                                        | -0.17  | —      | -0.33  |      |
|                                      | RN2404       |                   | —            | $V_{EB} = -5\text{ V}, I_C = 0$                        | -0.082 | —      | -0.15  |      |
|                                      | RN2405       |                   | —            |                                                        | -0.078 | —      | -0.145 |      |
|                                      | RN2406       |                   | —            |                                                        | -0.074 | —      | -0.138 |      |
| DC current gain                      | RN2401       | $h_{FE}$          | —            | $V_{CE} = -5\text{ V}$<br>$I_C = -10\text{ mA}$        | 30     | —      | —      | —    |
|                                      | RN2402       |                   | —            |                                                        | 50     | —      | —      |      |
|                                      | RN2403       |                   | —            |                                                        | 70     | —      | —      |      |
|                                      | RN2404       |                   | —            |                                                        | 80     | —      | —      |      |
|                                      | RN2405       |                   | —            |                                                        | 80     | —      | —      |      |
|                                      | RN2406       |                   | —            |                                                        | 80     | —      | —      |      |
| Collector-emitter saturation voltage | RN2401~2406  | $V_{CE(sat)}$     | —            | $I_C = -5\text{ mA}$<br>$I_B = -0.25\text{ mA}$        | —      | -0.1   | -0.3   | V    |
| Input voltage (ON)                   | RN2401       | $V_I(\text{ON})$  | —            | $V_{CE} = -0.2\text{ V}$<br>$I_C = -5\text{ mA}$       | -1.1   | —      | -2.0   | V    |
|                                      | RN2402       |                   | —            |                                                        | -1.2   | —      | -2.4   |      |
|                                      | RN2403       |                   | —            |                                                        | -1.3   | —      | -3.0   |      |
|                                      | RN2404       |                   | —            |                                                        | -1.5   | —      | -5.0   |      |
|                                      | RN2405       |                   | —            |                                                        | -0.6   | —      | -1.1   |      |
|                                      | RN2406       |                   | —            |                                                        | -0.7   | —      | -1.3   |      |
| Input voltage (OFF)                  | RN2401~2404  | $V_I(\text{OFF})$ | —            | $V_{CE} = -5\text{ V},$<br>$I_C = -0.1\text{ mA}$      | -1.0   | —      | -1.5   | V    |
|                                      | RN2405, 2406 |                   | —            |                                                        | -0.5   | —      | -0.8   |      |
| Transition frequency                 | RN2401~2406  | $f_T$             | —            | $V_{CE} = -10\text{ V},$<br>$I_C = -5\text{ mA}$       | —      | 200    | —      | MHz  |
| Collector output capacitance         | RN2401~2406  | $C_{ob}$          | —            | $V_{CB} = -10\text{ V}, I_E = 0$<br>$f = 1\text{ MHz}$ | —      | 3      | 6      | pF   |
| Input resistor                       | RN2401       | R1                | —            | —                                                      | 3.29   | 4.7    | 6.11   | kΩ   |
|                                      | RN2402       |                   | —            |                                                        | 7      | 10     | 13     |      |
|                                      | RN2403       |                   | —            |                                                        | 15.4   | 22     | 28.6   |      |
|                                      | RN2404       |                   | —            |                                                        | 32.9   | 47     | 61.1   |      |
|                                      | RN2405       |                   | —            |                                                        | 1.54   | 2.2    | 2.86   |      |
|                                      | RN2406       |                   | —            |                                                        | 3.29   | 4.7    | 6.11   |      |
| Resistor ratio                       | RN2401~2404  | R1/R2             | —            | —                                                      | 0.9    | 1.0    | 1.1    | —    |
|                                      | RN2405       |                   | —            |                                                        | 0.0421 | 0.0468 | 0.0515 |      |
|                                      | RN2406       |                   | —            |                                                        | 0.09   | 0.1    | 0.11   |      |









| Type Name | Marking                                                                             |
|-----------|-------------------------------------------------------------------------------------|
| RN2401    |    |
| RN2402    |    |
| RN2403    |    |
| RN2404    |   |
| RN2405    |  |
| RN2406    |  |

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