

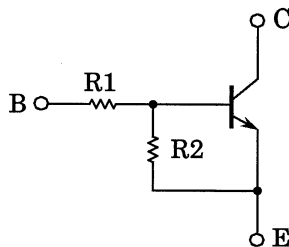
TOSHIBA Transistor Silicon NPN Epitaxial Type (PCT Process) (Bias Resistor built-in Transistor)

## RN1967, RN1968, RN1969

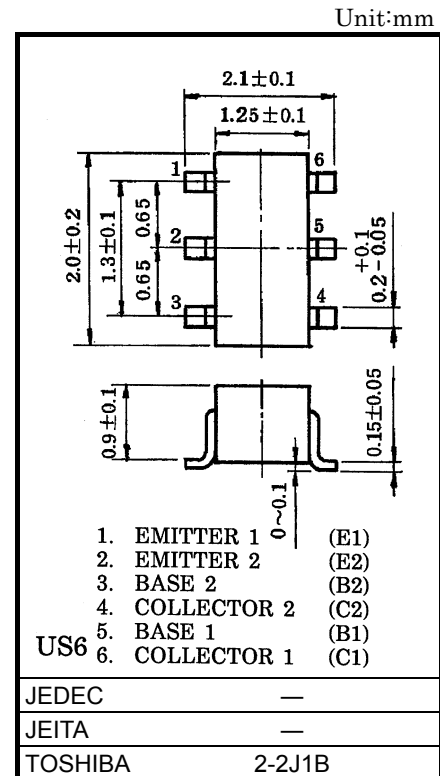
Switching, Inverter Circuit, Interface Circuit  
and Driver Circuit Applications

- Including two devices in US6 (ultra super mini type 6 leads)
- With built-in bias resistors
- Simplify circuit design
- Reduce a quantity of parts and manufacturing process
- Complementary to RN2967 to RN2969

### Equivalent Circuit and Bias Resistor Values



| Type No. | R1 (kΩ) | R2 (kΩ) |
|----------|---------|---------|
| RN1967   | 10      | 47      |
| RN1968   | 22      | 47      |
| RN1969   | 47      | 22      |



Weight: 6.8 mg (typ.)

### Absolute Maximum Ratings (Ta = 25°C) (Q1, Q2 Common)

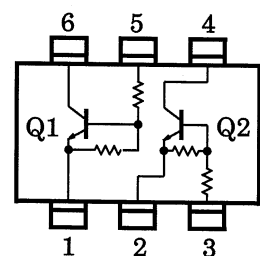
| Characteristic              |                | Symbol           | Rating    | Unit |
|-----------------------------|----------------|------------------|-----------|------|
| Collector-base voltage      | RN1967 to 1969 | V <sub>CBO</sub> | 50        | V    |
| Collector-emitter voltage   | RN1967 to 1969 | V <sub>CEO</sub> | 50        | V    |
| Emitter-base voltage        | RN1967         | V <sub>EBO</sub> | 6         | V    |
|                             | RN1968         |                  | 7         |      |
|                             | RN1969         |                  | 15        |      |
| Collector current           | RN1967 to 1969 | I <sub>C</sub>   | 100       | mA   |
| Collector power dissipation | RN1967 to 1969 | P <sub>C</sub> * | 200       | mW   |
| Junction temperature        | RN1967 to 1969 | T <sub>j</sub>   | 150       | °C   |
| Storage temperature range   | RN1967 to 1969 | T <sub>stg</sub> | −55 to150 | °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.).

\*: Total rating

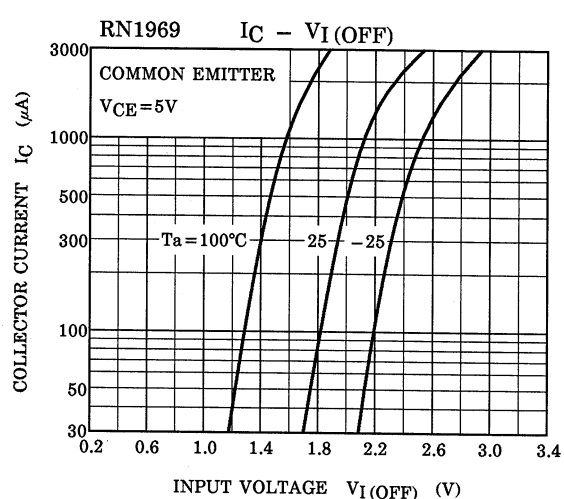
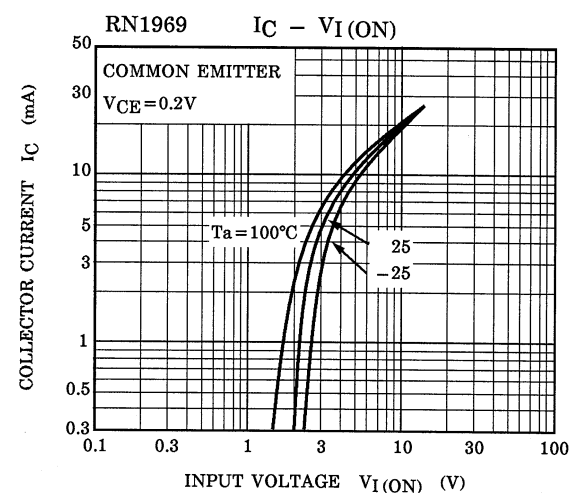
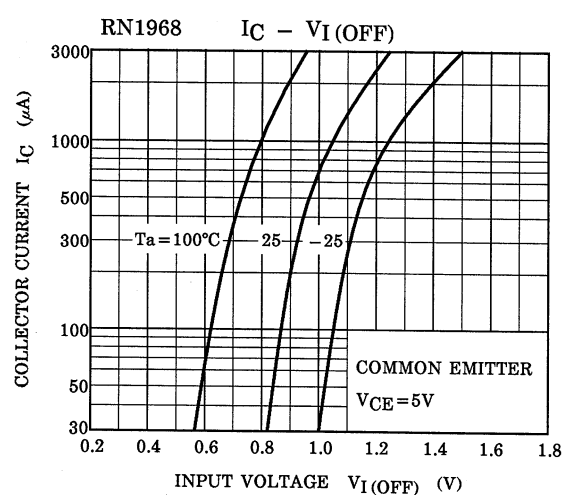
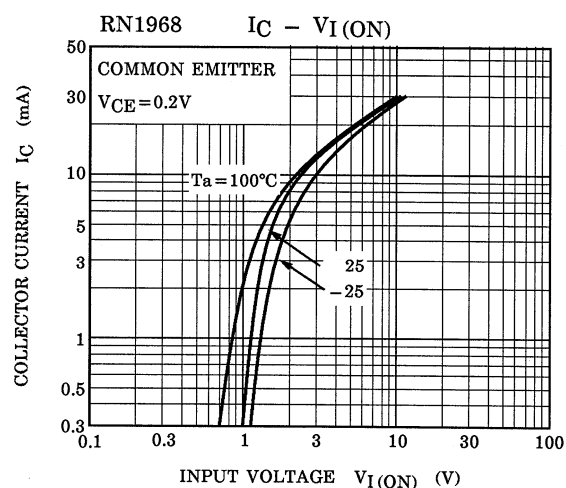
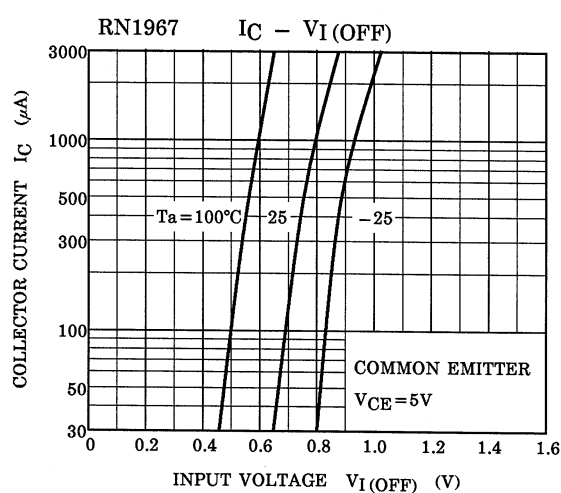
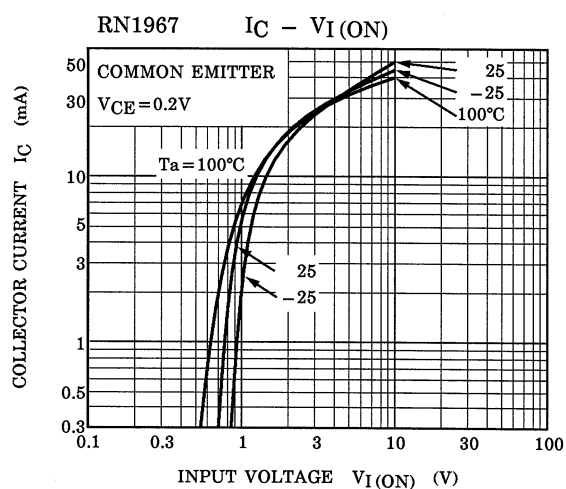
### Equivalent Circuit (Top View)



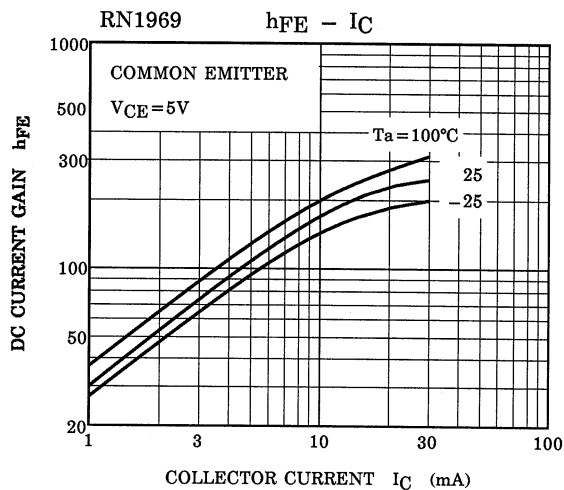
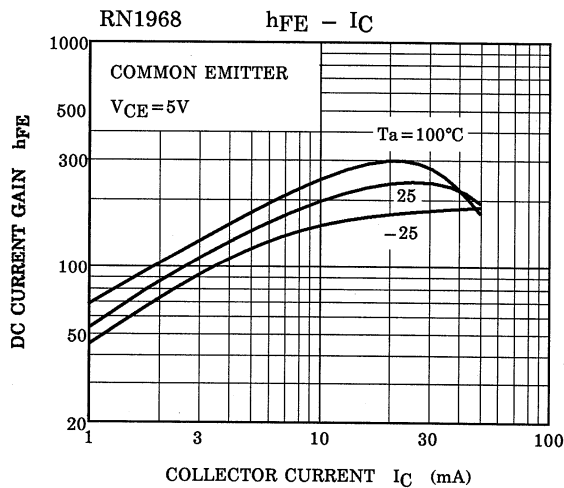
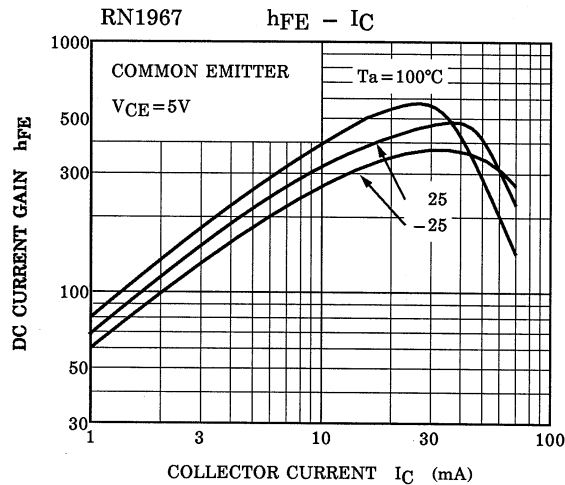
**Electrical Characteristics (Ta = 25°C) (Q1, Q2 Common)**

| Characteristic                       |                | Symbol        | Test Circuit | Test Condition                        | Min   | Typ.  | Max   | Unit |
|--------------------------------------|----------------|---------------|--------------|---------------------------------------|-------|-------|-------|------|
| Collector cut-off current            | RN1967 to 1969 | $I_{CBO}$     | —            | $V_{CB} = 50V, I_E = 0$               | —     | —     | 100   | nA   |
|                                      |                | $I_{CEO}$     | —            | $V_{CE} = 50V, I_B = 0$               | —     | —     | 500   | nA   |
| Emitter cut-off current              | RN1967         | $I_{EBO}$     | —            | $V_{EB} = 6V, I_C = 0$                | 0.081 | —     | 0.15  | mA   |
|                                      | RN1968         |               | —            | $V_{EB} = 7V, I_C = 0$                | 0.078 | —     | 0.145 |      |
|                                      | RN1969         |               | —            | $V_{EB} = 15V, I_C = 0$               | 0.167 | —     | 0.311 |      |
| DC current gain                      | RN1967         | $h_{FE}$      | —            | $V_{CE} = 5V, I_C = 10mA$             | 80    | —     | —     | —    |
|                                      | RN1968         |               | —            |                                       | 80    | —     | —     |      |
|                                      | RN1969         |               | —            |                                       | 70    | —     | —     |      |
| Collector-emitter saturation voltage | RN1967 to 1969 | $V_{CE(sat)}$ | —            | $I_C = 5mA, I_B = 0.25mA$             | —     | 0.1   | 0.3   | V    |
| Input voltage (ON)                   | RN1967         | $V_{I(ON)}$   | —            | $V_{CE} = 0.2V, I_C = 5mA$            | 0.7   | —     | 1.8   | V    |
|                                      | RN1968         |               | —            |                                       | 1.0   | —     | 2.6   |      |
|                                      | RN1969         |               | —            |                                       | 2.2   | —     | 5.8   |      |
| Input voltage (OFF)                  | RN1967         | $V_{I(OFF)}$  | —            | $V_{CE} = 5V, I_C = 0.1mA$            | 0.5   | —     | 1.0   | V    |
|                                      | RN1968         |               | —            |                                       | 0.6   | —     | 1.16  |      |
|                                      | RN1969         |               | —            |                                       | 1.5   | —     | 2.6   |      |
| Transition frequency                 | RN1967 to 1969 | $f_T$         | —            | $V_{CE} = 10V, I_C = 5mA$             | —     | 250   | —     | MHz  |
| Collector output capacitance         | RN1967 to 1969 | $C_{ob}$      | —            | $V_{CB} = 10V, I_E = 0$<br>$f = 1MHz$ | —     | 3     | 6     | pF   |
| Input resistor                       | RN1967         | R1            | —            | —                                     | 7     | 10    | 13    | kΩ   |
|                                      | RN1968         |               | —            |                                       | 15.4  | 22    | 28.6  |      |
|                                      | RN1969         |               | —            |                                       | 32.9  | 47    | 61.1  |      |
| Resistor ratio                       | RN1967         | R1/R2         | —            | —                                     | 0.191 | 0.213 | 0.232 | —    |
|                                      | RN1968         |               | —            |                                       | 0.421 | 0.468 | 0.515 |      |
|                                      | RN1969         |               | —            |                                       | 1.92  | 2.14  | 2.35  |      |

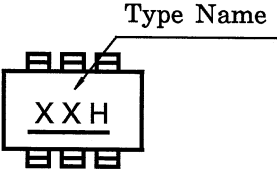
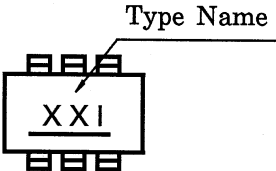
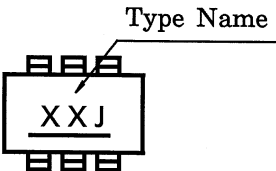
(Q1, Q2 Common)



(Q1, Q2 Common)



**Marking**

| Type Name | Marking                                                                           |
|-----------|-----------------------------------------------------------------------------------|
| RN1967    |  |
| RN1968    |  |
| RN1969    |  |

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