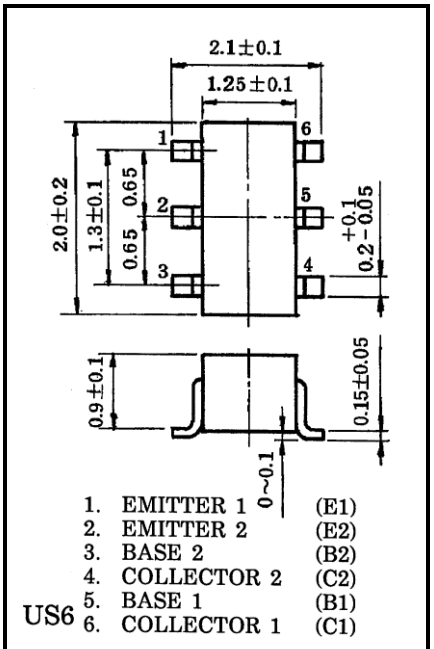
TOSHIBA Transistor Silicon NPN Epitaxial Type (PCT Process) (Bias Resistor built-in Transistor)

# RN1967, RN1968, RN1969

Switching, Inverter Circuit, Interface Circuit and Driver Circuit

- Including two devices in US6 (ultra super mini type with 6 leads).
- With built-in bias resistors.
- Simplify circuit design
- Reduce a quantity of parts and manufacturing process and miniaturize equipment.
- Various resistance values are available to suit various circuit designs.
- Complementary to RN2967 to RN2969

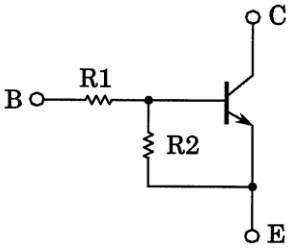
Unit: mm




| | |
|---|---|
| JEDEC | — |
| JEITA | — |
| TOSHIBA | 2-2J1B |

Weight: 6.8 mg (typ.)

## Equivalent Circuit and Bias Resistor Values

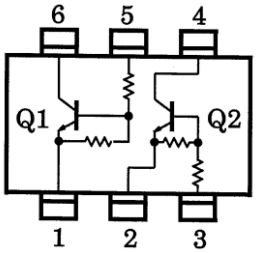



| Type No. | R1 (kΩ) | R2 (kΩ) |
|---|---|---|
| RN1967 | 10 | 47 |
| RN1968 | 22 | 47 |
| RN1969 | 47 | 22 |

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

| Characteristic | | Symbol | Rating | Unit |
|---|---|---|---|---|
| Collector-base voltage | RN1967 to 1969 | $V_{CBO}$ | 50 | V |
| Collector-emitter voltage | RN1967 to 1969 | $V_{CEO}$ | 50 | V |
| Emitter-base voltage | RN1967 | $V_{EBO}$ | 6 | V |
| | RN1968 | | 7 | |
| | RN1969 | | 15 | |
| Collector current | RN1967 to 1969 | $I_C$ | 100 | mA |
| Collector power dissipation | RN1967 to 1969 | $P_C$* | 200 | mW |
| Junction temperature | RN1967 to 1969 | $T_j$ | 150 | °C |
| Storage temperature range | RN1967 to 1969 | $T_{stg}$ | −55 to150 | °C |

**Equivalent Circuit (Top View)**




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

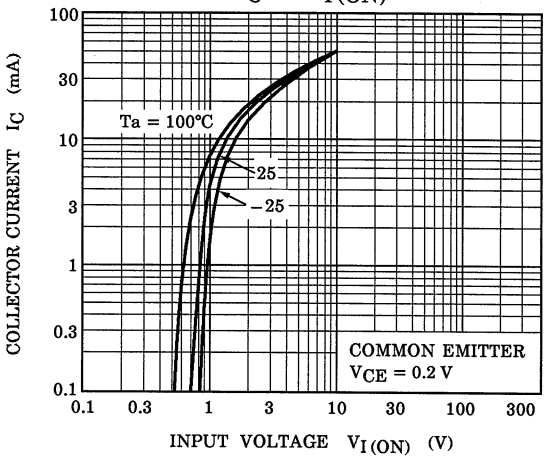
Start of commercial production
1992-01

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

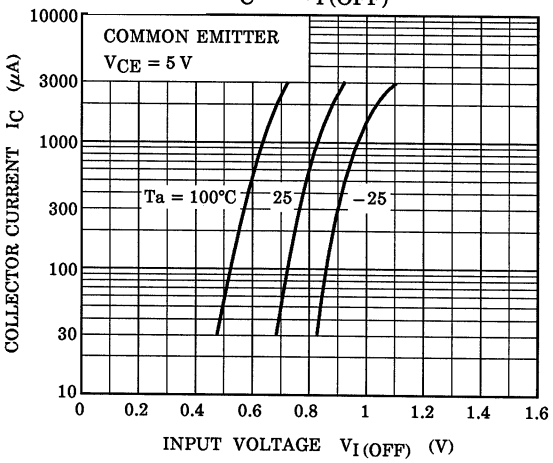
| Characteristic | | Symbol | Test Condition | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|---|
| Collector cut-off current | RN1967 to 1969 | $I_{CBO}$ | $V_{CB}$ = 50 V, $I_E$ = 0 mA | — | — | 100 | nA |
| | | $I_{CEO}$ | $V_{CE}$ = 50 V, $I_B$ = 0 mA | — | — | 500 | nA |
| Emitter cut-off current | RN1967 | $I_{EBO}$ | $V_{EB}$ = 6 V, $I_C$ = 0 mA | 0.081 | — | 0.15 | mA |
| | RN1968 | | $V_{EB}$ = 7 V, $I_C$ = 0 mA | 0.078 | — | 0.145 | |
| | RN1969 | | $V_{EB}$ = 15 V, $I_C$ = 0 mA | 0.167 | — | 0.311 | |
| DC current gain | RN1967 | $h_{FE}$ | $V_{CE}$ = 5 V, $I_C$ = 10 mA | 80 | — | — | — |
| | RN1968 | | | 80 | — | — | |
| | RN1969 | | | 70 | — | — | |
| Collector-emitter saturation voltage | RN1967 to 1969 | $V_{CE\ (sat)}$ | $I_C$ = 5 mA, $I_B$ = 0.25 mA | — | 0.1 | 0.3 | V |
| Input voltage (ON) | RN1967 | $V_{I\ (ON)}$ | $V_{CE}$ = 0.2 V, $I_C$ = 5 mA | 0.7 | — | 1.8 | V |
| | RN1968 | | | 1.0 | — | 2.6 | |
| | RN1969 | | | 2.2 | — | 5.8 | |
| Input voltage (OFF) | RN1967 | $V_{I\ (OFF)}$ | $V_{CE}$ = 5 V, $I_C$ = 0.1 mA | 0.5 | — | 1.0 | V |
| | RN1968 | | | 0.6 | — | 1.16 | |
| | RN1969 | | | 1.5 | — | 2.6 | |
| Transition frequency | RN1967 to 1969 | $f_T$ | $V_{CE}$ = 10 V, $I_C$ = 5 mA | — | 250 | — | MHz |
| Collector output capacitance | RN1967 to 1969 | $C_{ob}$ | $V_{CB}$ = 10 V, $I_E$ = 0 mA<br>f = 1 MHz | — | 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 | |

## Characteristics Curves (Q1, Q2 Common)

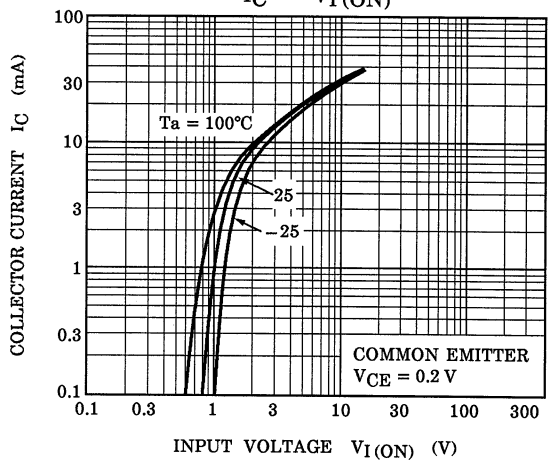
RN1967 $I_C$ – $V_{I(ON)}$



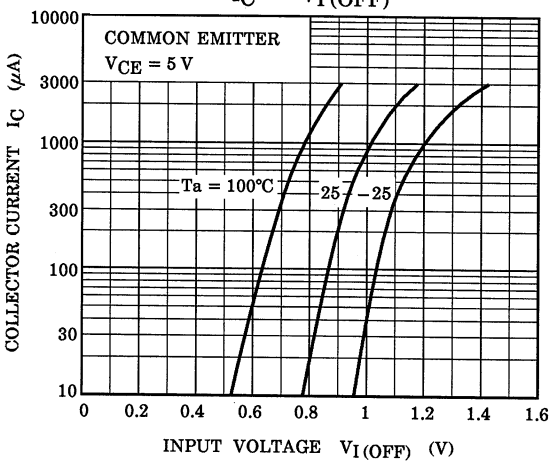

RN1967 $I_C$ – $V_{I(OFF)}$



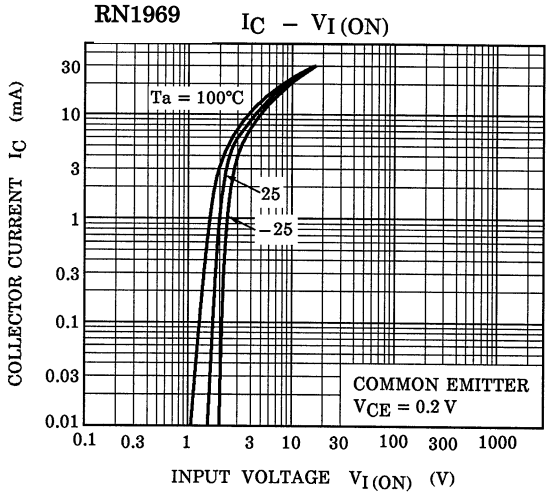

RN1968 $I_C$ – $V_{I(ON)}$



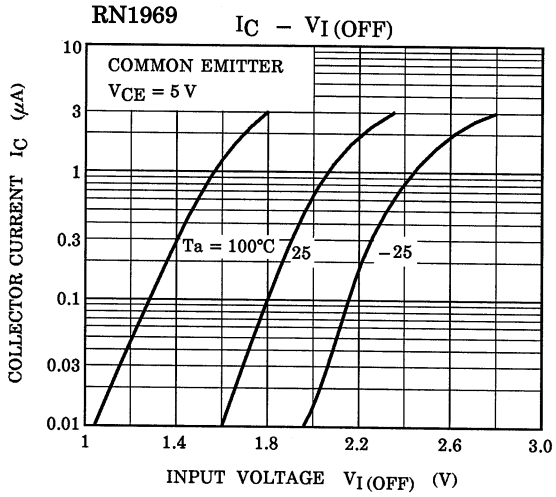

RN1968 $I_C$ – $V_{I(OFF)}$




RN1969 $I_C$ – $V_{I(ON)}$



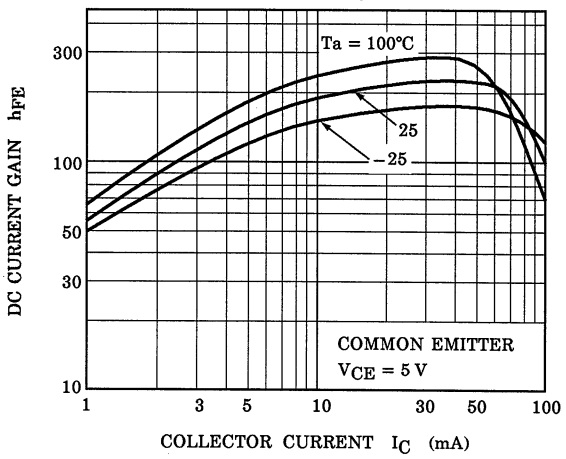

RN1969 $I_C$ – $V_{I(OFF)}$



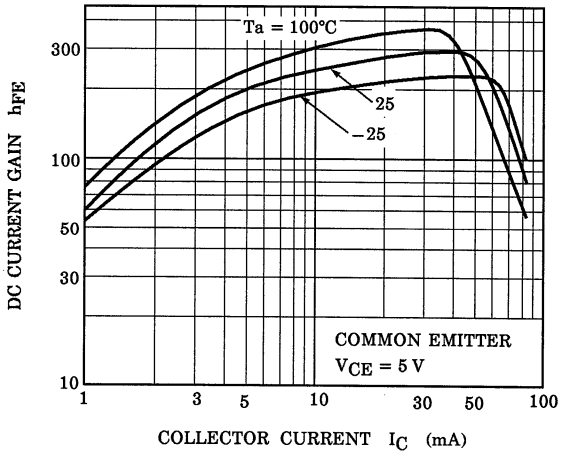

The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.

## Characteristics Curves (Q1, Q2 Common)

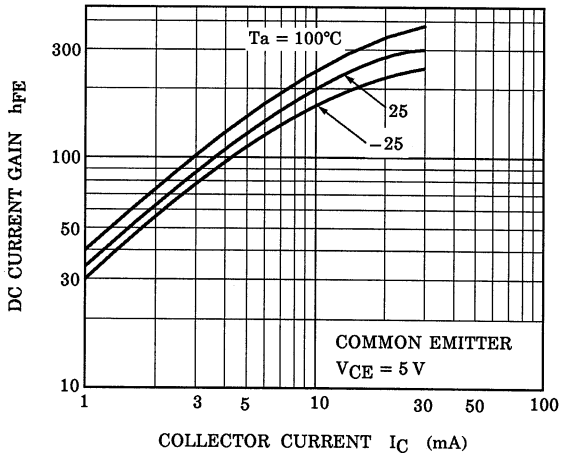
RN1967 $h_{FE}$ – $I_C$




RN1968 $h_{FE}$ – $I_C$




RN1969 $h_{FE}$ – $I_C$

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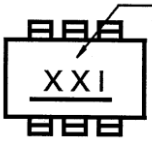
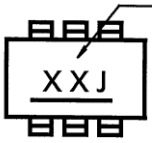
## Marking

| Part No. | Marking |
|---|---|
| RN1967 | Part No.(abbreviation code)<br>  |
| RN1968 | Part No.(abbreviation code)<br>  |
| RN1969 | Part No.(abbreviation code)<br>  |

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