

TOSHIBA Transistor Silicon NPN · PNP Epitaxial Type  
(PCT process) (Bias Resistor built-in Transistor)

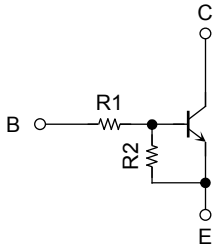
# RN4988FS

Switching, Inverter Circuit, Interface Circuit and  
Driver Circuit Applications

- Two devices are incorporated into a fine pitch Small Mold (6-pin) package.
- Incorporating a bias resistor into a transistor reduces parts count. Reducing the parts count enables the manufacture of ever more compact equipment and lowers assembly cost.

## Equivalent Circuit and Bias Resistor Values

**Q1**

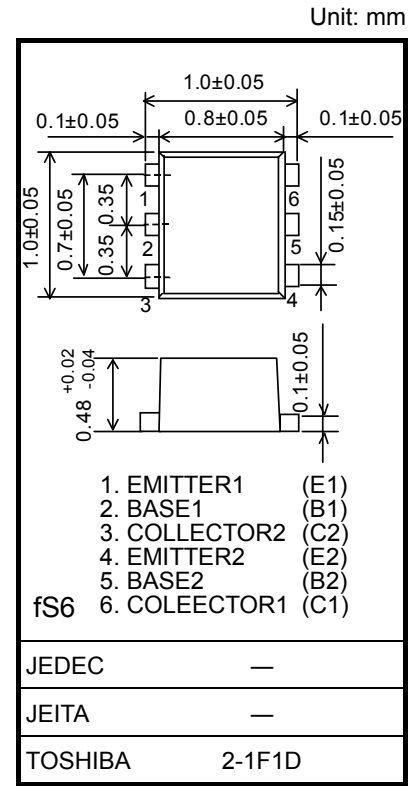
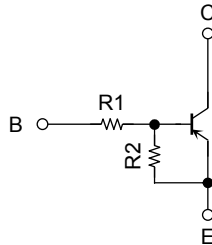


R1: 22 kΩ

R2: 47 kΩ

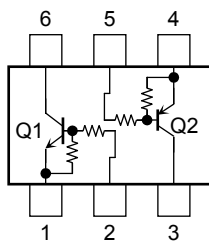
(Q1, Q2 common)

**Q2**

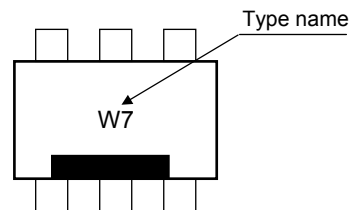


Weight:0.001g (typ.)

## Equivalent Circuit (top view)



## Marking



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

| Characteristics           | Symbol           | Rating | Unit |
|---------------------------|------------------|--------|------|
| Collector-base voltage    | V <sub>CB0</sub> | 20     | V    |
| Collector-emitter voltage | V <sub>CEO</sub> | 20     | V    |
| Emitter-base voltage      | V <sub>EBO</sub> | 7      | V    |
| Collector current         | I <sub>C</sub>   | 50     | mA   |

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

| Characteristics           | Symbol           | Rating | Unit |
|---------------------------|------------------|--------|------|
| Collector-base voltage    | V <sub>CB0</sub> | -20    | V    |
| Collector-emitter voltage | V <sub>CEO</sub> | -20    | V    |
| Emitter-base voltage      | V <sub>EBO</sub> | -7     | V    |
| Collector current         | I <sub>C</sub>   | -50    | mA   |

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

| Characteristics             | Symbol                  | Rating  | Unit |
|-----------------------------|-------------------------|---------|------|
| Collector power dissipation | P <sub>C</sub> (Note 1) | 50      | mW   |
| Junction temperature        | T <sub>j</sub>          | 150     | °C   |
| Storage temperature range   | T <sub>stg</sub>        | -55~150 | °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).

Note 1: Total rating

## Electrical Characteristics (Ta = 25°C) (Q1)

| Characteristics                      | Symbol        | Test Condition                                    | Min   | Typ. | Max   | Unit |
|--------------------------------------|---------------|---|-------|------|-------|------|
| Collector cut-off current            | $I_{CBO}$     | $V_{CB} = 20\text{ V}, I_E = 0$                   | —     | —    | 100   | nA   |
|                                      | $I_{CEO}$     | $V_{CE} = 20\text{ V}, I_B = 0$                   | —     | —    | 500   |      |
| Emitter cut-off current              | $I_{EBO}$     | $V_{EB} = 7\text{ V}, I_C = 0$                    | 0.085 | —    | 0.126 | mA   |
| DC current gain                      | $h_{FE}$      | $V_{CE} = 5\text{ V}, I_C = 10\text{ mA}$         | 120   | —    | —     |      |
| Collector-emitter saturation voltage | $V_{CE(sat)}$ | $I_C = 5\text{ mA}, I_B = 0.25\text{ mA}$         | —     | —    | 0.15  | V    |
| Input voltage (ON)                   | $V_I(ON)$     | $V_{CE} = 0.2\text{ V}, I_C = 5\text{ mA}$        | 0.8   | —    | 2.2   | V    |
| Input voltage (OFF)                  | $V_I(OFF)$    | $V_{CE} = 5\text{ V}, I_C = 0.1\text{ mA}$        | 0.6   | —    | 1.1   | V    |
| Collector output capacitance         | $C_{ob}$      | $V_{CB} = 10\text{ V}, I_E = 0, f = 1\text{ MHz}$ | —     | 1.2  | —     | pF   |

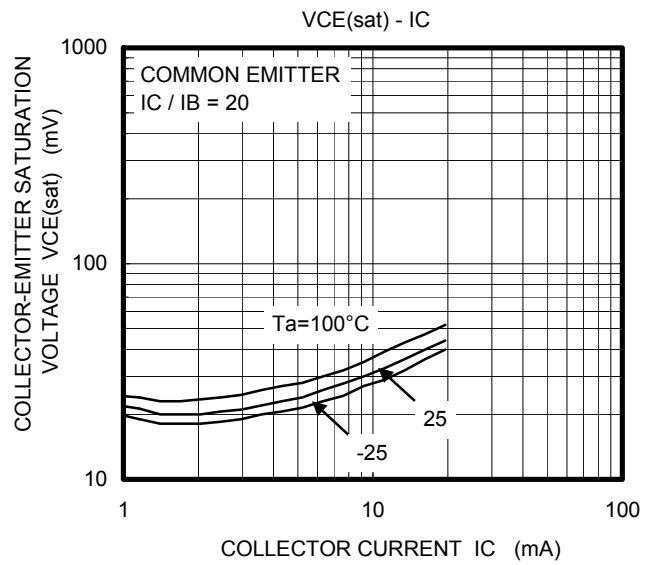
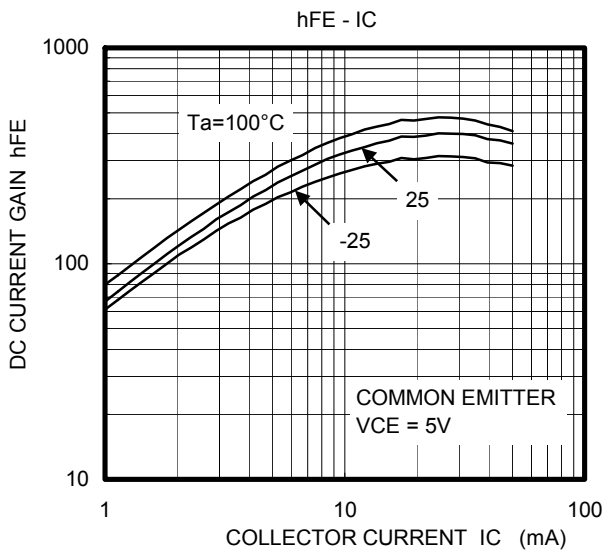
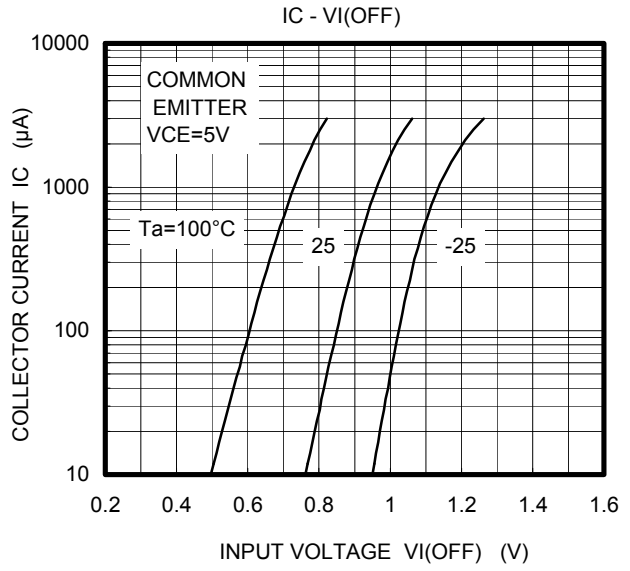
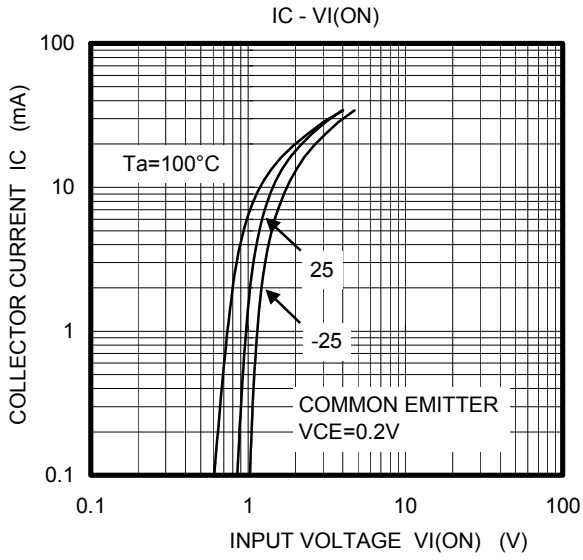
## Electrical Characteristics (Ta = 25°C) (Q2)

| Characteristics                      | Symbol        | Test Condition                                     | Min    | Typ. | Max    | Unit |
|--------------------------------------|---------------|--|--------|------|--------|------|
| Collector cut-off current            | $I_{CBO}$     | $V_{CB} = -20\text{ V}, I_E = 0$                   | —      | —    | -100   | nA   |
|                                      | $I_{CEO}$     | $V_{CE} = -20\text{ V}, I_B = 0$                   | —      | —    | -500   |      |
| Emitter cut-off current              | $I_{EBO}$     | $V_{EB} = -7\text{ V}, I_C = 0$                    | -0.085 | —    | -0.126 | mA   |
| DC current gain                      | $h_{FE}$      | $V_{CE} = -5\text{ V}, I_C = -10\text{ mA}$        | 120    | —    | —      |      |
| Collector-emitter saturation voltage | $V_{CE(sat)}$ | $I_C = -5\text{ mA}, I_B = -0.25\text{ mA}$        | —      | —    | -0.15  | V    |
| Input voltage (ON)                   | $V_I(ON)$     | $V_{CE} = -0.2\text{ V}, I_C = -5\text{ mA}$       | -0.8   | —    | -2.2   | V    |
| Input voltage (OFF)                  | $V_I(OFF)$    | $V_{CE} = -5\text{ V}, I_C = -0.1\text{ mA}$       | -0.6   | —    | -1.1   | V    |
| Collector output capacitance         | $C_{ob}$      | $V_{CB} = -10\text{ V}, I_E = 0, f = 1\text{ MHz}$ | —      | 1.2  | —      | pF   |

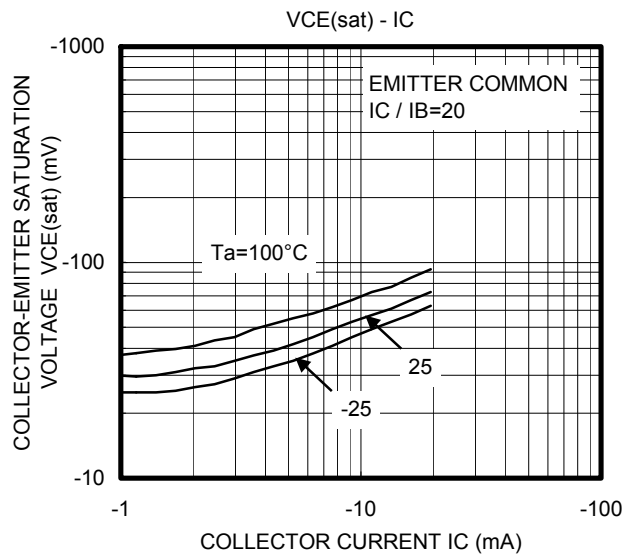
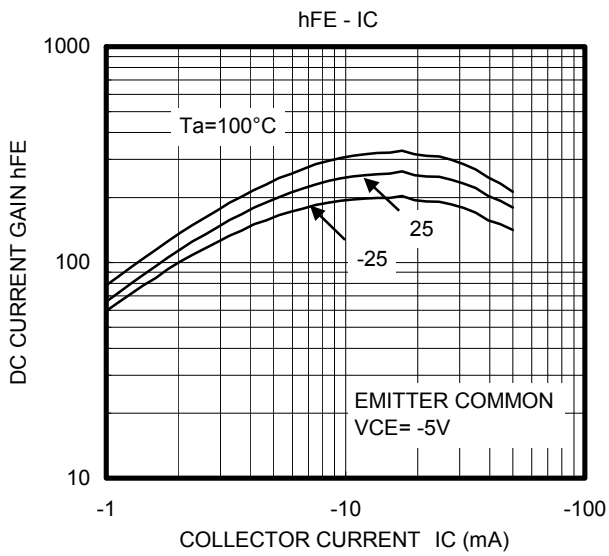
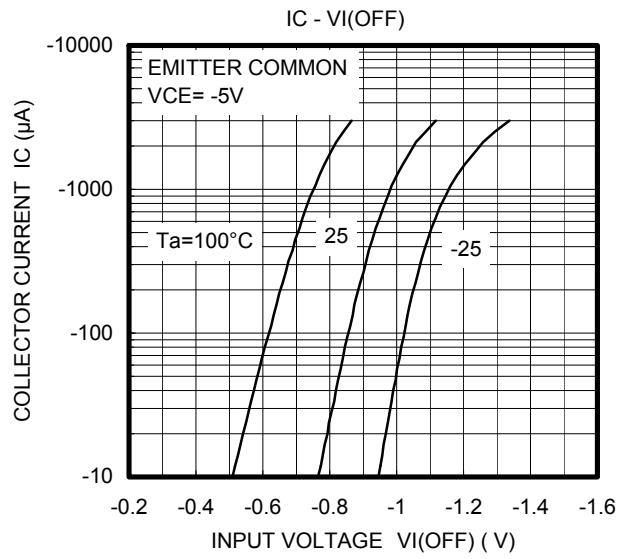
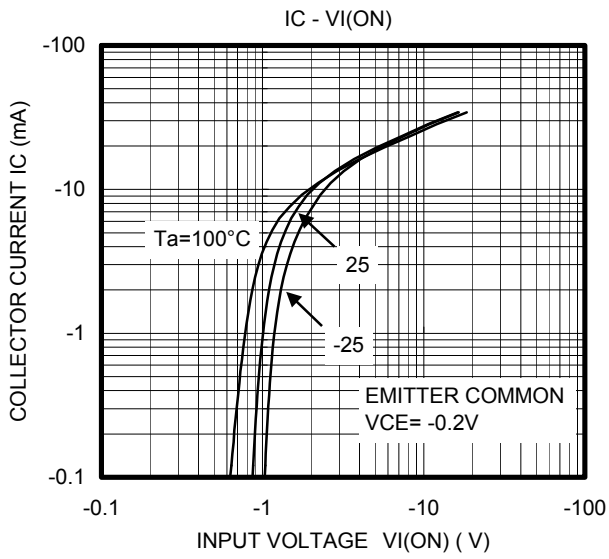
## Electrical Characteristics (Ta = 25°C) (Q1, Q2 common)

| Characteristics | Symbol | Test Condition | Min   | Typ.  | Max   | Unit       |
|-----------------|--------|----------------|-------|-------|-------|------------|
| Input resistor  | R1     | —              | 17.6  | 22    | 26.4  | k $\Omega$ |
| Resistor ratio  | R1/R2  | —              | 0.374 | 0.468 | 0.562 |            |

**Q1**



**Q2**



**Handling Precaution**

Before handling individual devices that are not yet mounted on a circuit board, make sure that the environment is protected against static electricity. Operators should wear anti-static clothing, and containers and other objects that come direct contact with devices should be made of anti-static materials.

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