

TOSHIBA Transistor Silicon NPN · PNP Epitaxial Type
(PCT Process) (Bias Resistor Built-in Transistor)

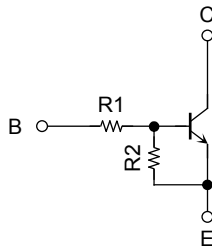
RN4989FE

Switching, Inverter Circuit, Interface Circuit and Driver Circuit Applications

- Two devices are incorporated into an Extreme-Super-Mini (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

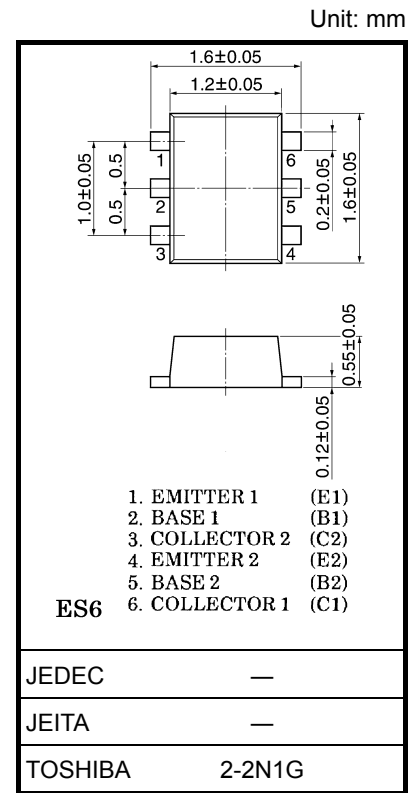
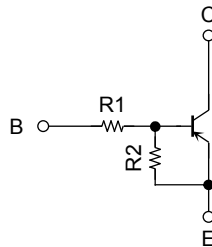


R1: 47 kΩ

R2: 22 kΩ

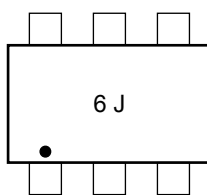
(Q1, Q2 common)

Q2

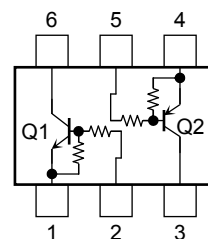


Weight: 0.003 g (typ.)

Marking



Equivalent Circuit (top view)



Start of commercial production
2000-05

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

| Characteristics | Symbol | Rating | Unit |
|---------------------------|------------------|--------|------|
| Collector-base voltage | V _{CB0} | 50 | V |
| Collector-emitter voltage | V _{CEO} | 50 | V |
| Emitter-base voltage | V _{EBO} | 15 | V |
| Collector current | I _C | 100 | mA |

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

| Characteristics | Symbol | Rating | Unit |
|---------------------------|------------------|--------|------|
| Collector-base voltage | V _{CB0} | -50 | V |
| Collector-emitter voltage | V _{CEO} | -50 | V |
| Emitter-base voltage | V _{EBO} | -15 | V |
| Collector current | I _C | -100 | mA |

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

| Characteristics | Symbol | Rating | Unit |
|-----------------------------|-------------------------|------------|------|
| Collector power dissipation | P _C (Note 1) | 100 | mW |
| Junction temperature | T _j | 150 | °C |
| Storage temperature range | T _{stg} | -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).

Note 1: Total rating

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

| Characteristics | Symbol | Test Condition | Min | Typ. | Max | Unit |
|--------------------------------------|---------------|---------------------------------------------------|-------|------|-------|------|
| Collector cut-off current | I_{CBO} | $V_{CB} = 50\text{ V}, I_E = 0$ | — | — | 100 | nA |
| | I_{CEO} | $V_{CE} = 50\text{ V}, I_B = 0$ | — | — | 500 | |
| Emitter cut-off current | I_{EBO} | $V_{EB} = 15\text{ V}, I_C = 0$ | 0.167 | — | 0.311 | mA |
| DC current gain | h_{FE} | $V_{CE} = 5\text{ V}, I_C = 10\text{ mA}$ | 70 | — | — | |
| Collector-emitter saturation voltage | $V_{CE(sat)}$ | $I_C = 5\text{ mA}, I_B = 0.25\text{ mA}$ | — | 0.1 | 0.3 | V |
| Input voltage (ON) | $V_I(ON)$ | $V_{CE} = 0.2\text{ V}, I_C = 5\text{ mA}$ | 2.2 | — | 5.8 | V |
| Input voltage (OFF) | $V_I(OFF)$ | $V_{CE} = 5\text{ V}, I_C = 0.1\text{ mA}$ | 1.5 | — | 2.6 | V |
| Transition frequency | f_T | $V_{CE} = 10\text{ V}, I_C = 5\text{ mA}$ | — | 250 | — | MHz |
| Collector output capacitance | C_{ob} | $V_{CB} = 10\text{ V}, I_E = 0, f = 1\text{ MHz}$ | — | 3 | 6 | pF |

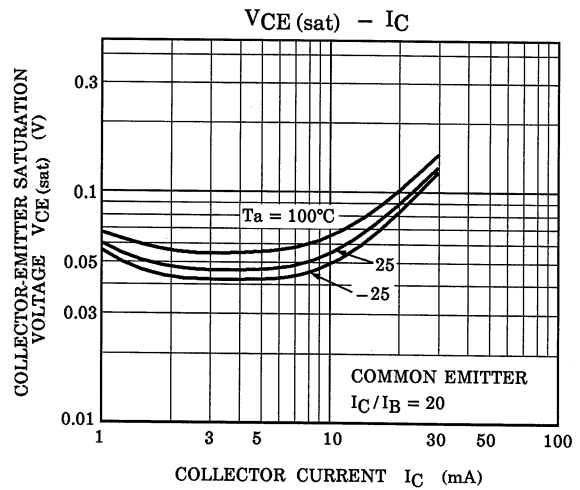
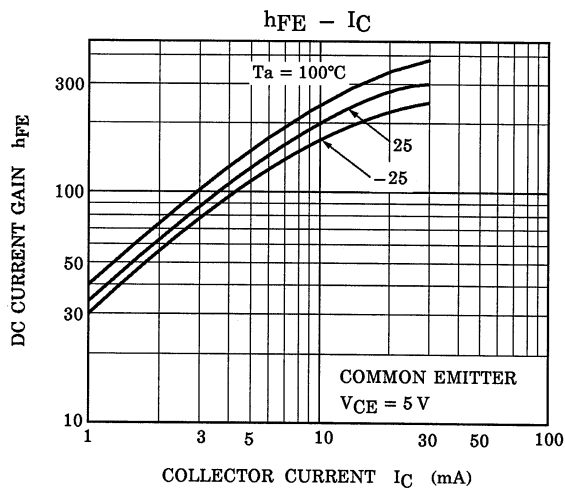
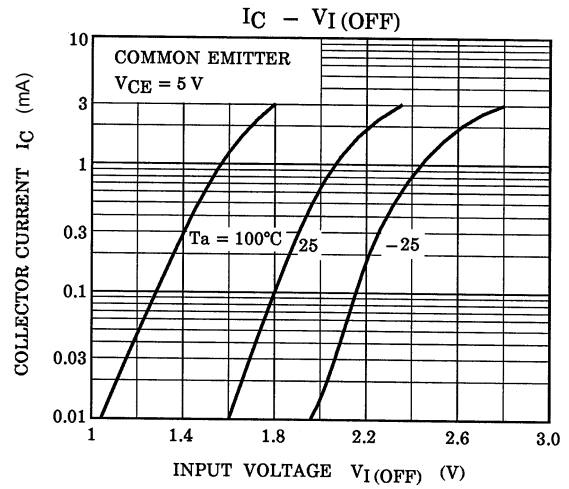
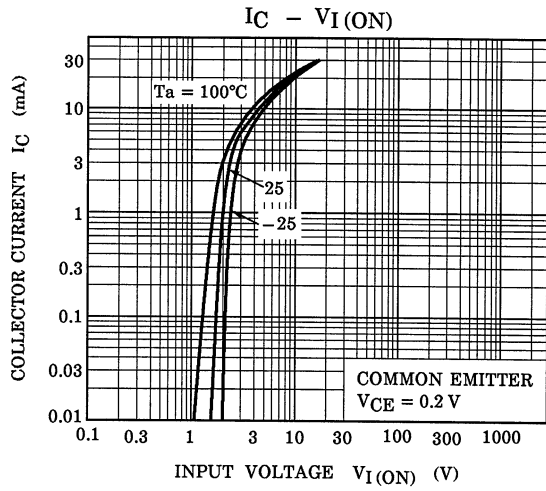
Electrical Characteristics (Ta = 25°C) (Q2)

| Characteristics | Symbol | Test Condition | Min | Typ. | Max | Unit |
|--------------------------------------|---------------|----------------------------------------------------|--------|------|--------|------|
| Collector cut-off current | 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 | I_{EBO} | $V_{EB} = -15\text{ V}, I_C = 0$ | -0.167 | — | -0.311 | mA |
| DC current gain | h_{FE} | $V_{CE} = -5\text{ V}, I_C = -10\text{ mA}$ | 70 | — | — | |
| Collector-emitter saturation voltage | $V_{CE(sat)}$ | $I_C = -5\text{ mA}, I_B = -0.25\text{ mA}$ | — | -0.1 | -0.3 | V |
| Input voltage (ON) | $V_I(ON)$ | $V_{CE} = -0.2\text{ V}, I_C = -5\text{ mA}$ | -2.2 | — | -5.8 | V |
| Input voltage (OFF) | $V_I(OFF)$ | $V_{CE} = -5\text{ V}, I_C = -0.1\text{ mA}$ | -1.5 | — | -2.6 | V |
| Transition frequency | f_T | $V_{CE} = -10\text{ V}, I_C = -5\text{ mA}$ | — | 200 | — | MHz |
| Collector output capacitance | C_{ob} | $V_{CB} = -10\text{ V}, I_E = 0, f = 1\text{ MHz}$ | — | 3 | 6 | pF |

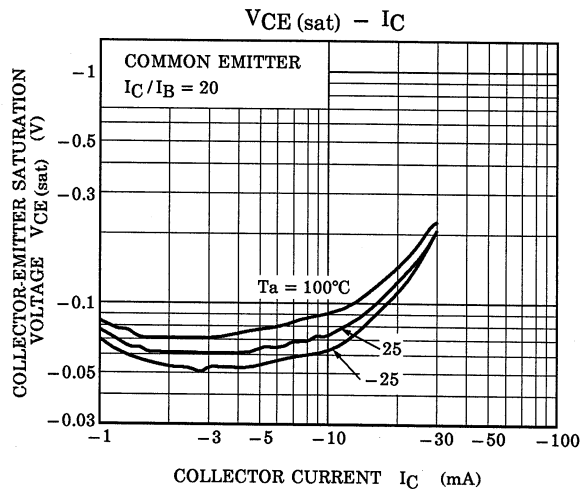
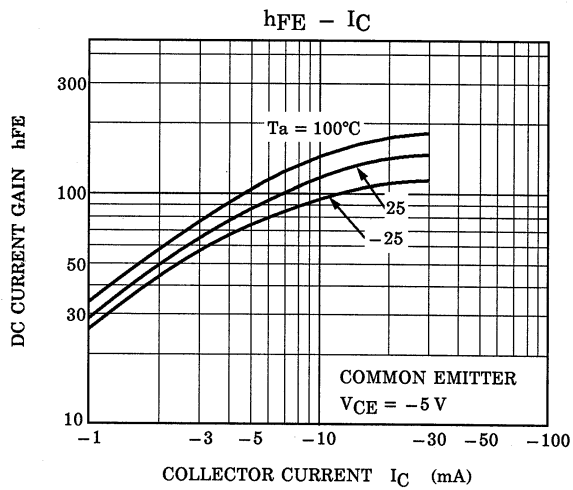
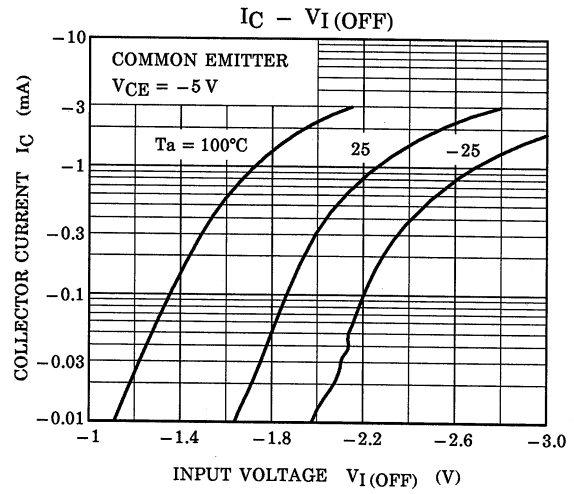
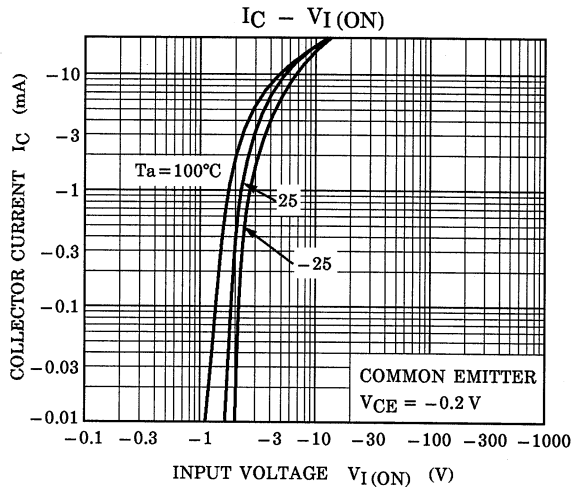
Electrical Characteristics (Ta = 25°C) (Q1, Q2 common)

| Characteristics | Symbol | Test Condition | Min | Typ. | Max | Unit |
|-----------------|--------|----------------|------|------|------|------------|
| Input resistor | R1 | — | 32.9 | 47 | 61.1 | k Ω |
| Resistor ratio | R1/R2 | — | 1.92 | 2.14 | 2.35 | |

Q1



Q2



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