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

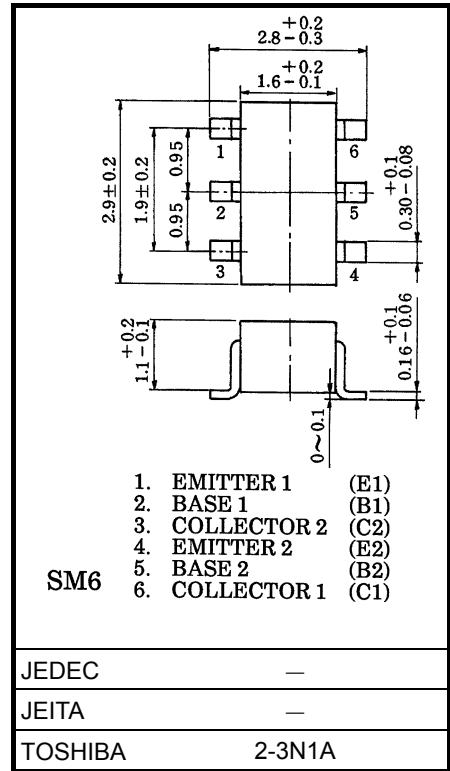
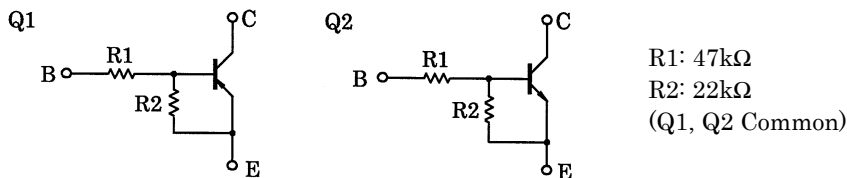
# RN4609

Switching, Inverter Circuit, Interface Circuit  
and Driver Circuit Applications

Unit: mm

- Including two devices in SM6 (super mini type with 6 leads)
- With built-in bias resistors
- Simplify circuit design
- Reduce a quantity of parts and manufacturing process

## Equivalent Circuit and Bias Resistor Values



Weight: 15 mg (typ.)

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

| Characteristic            | Symbol           | Rating | Unit |
|---------------------------|------------------|--------|------|
| Collector-base voltage    | V <sub>CBO</sub> | -50    | V    |
| Collector-emitter voltage | V <sub>CEO</sub> | -50    | V    |
| Emitter-base voltage      | V <sub>EBO</sub> | -15    | V    |
| Collector current         | I <sub>C</sub>   | -100   | mA   |

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

| Characteristic            | Symbol           | Rating | Unit |
|---------------------------|------------------|--------|------|
| Collector-base voltage    | V <sub>CBO</sub> | 50     | V    |
| Collector-emitter voltage | V <sub>CEO</sub> | 50     | V    |
| Emitter-base voltage      | V <sub>EBO</sub> | 15     | V    |
| Collector current         | I <sub>C</sub>   | 100    | mA   |

Start of commercial production  
1988-11

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

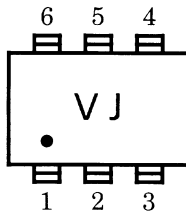
| Characteristic              | Symbol    | Rating     | Unit |
|-----------------------------|-----------|------------|------|
| Collector power dissipation | $P_C$ *   | 300        | mW   |
| Junction temperature        | $T_j$     | 150        | °C   |
| Storage temperature range   | $T_{stg}$ | -55 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.

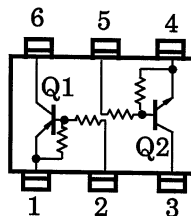
Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

\* Total rating

## Marking



## Equivalent Circuit (Top View)



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

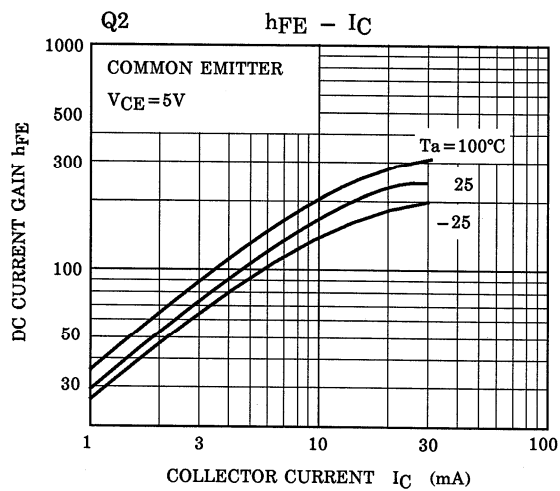
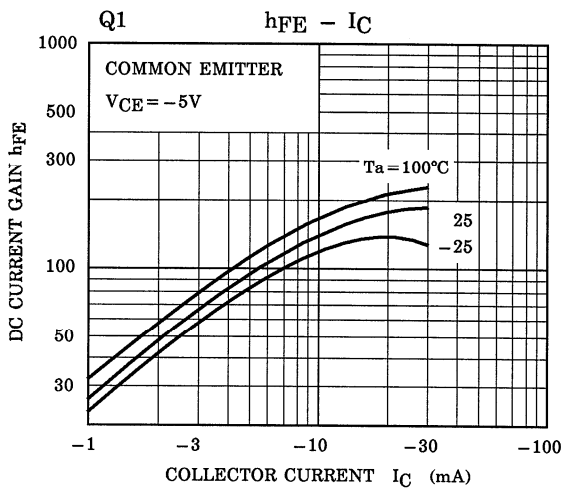
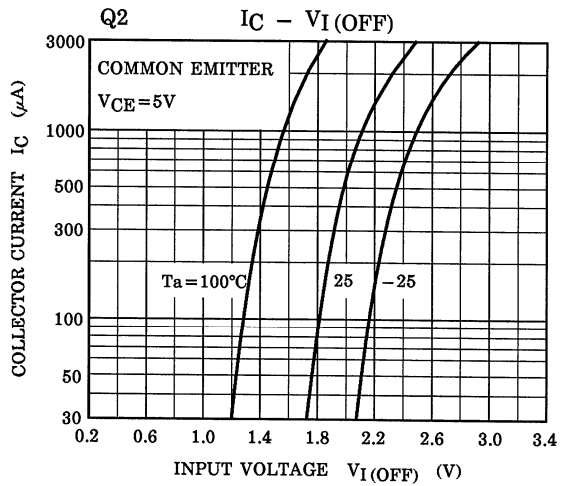
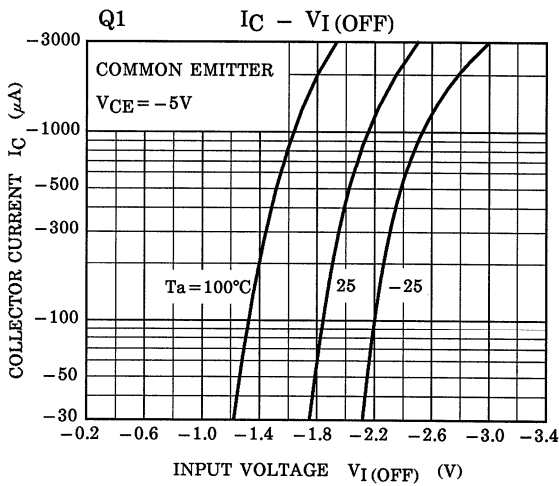
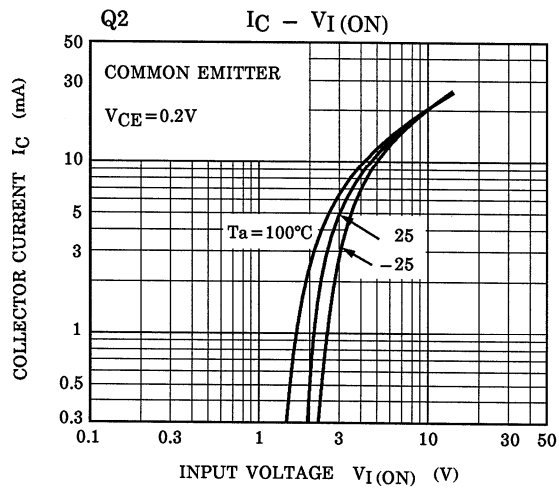
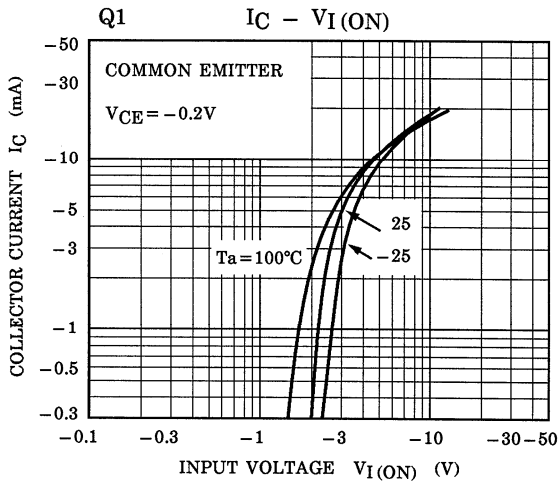
| Characteristic                       | Symbol        | Test Circuit | Test Condition                     | Min    | Typ. | Max    | Unit |
|--------------------------------------|---------------|--------------|------------------------------------|--------|------|--------|------|
| Collector cut-off current            | $I_{CBO}$     | —            | $V_{CB} = -50V, I_E = 0$           | —      | —    | -100   | nA   |
|                                      | $I_{CEO}$     | —            | $V_{CE} = -50V, I_B = 0$           | —      | —    | -500   |      |
| Emitter cut-off current              | $I_{EBO}$     | —            | $V_{EB} = -15V, I_C = 0$           | -0.167 | —    | -0.311 | mA   |
| DC current gain                      | $h_{FE}$      | —            | $V_{CE} = -5V, I_C = -10mA$        | 70     | —    | —      | —    |
| Collector-emitter saturation voltage | $V_{CE(sat)}$ | —            | $I_C = -5mA, I_B = -0.25mA$        | —      | -0.1 | -0.3   | V    |
| Input voltage (ON)                   | $V_I(ON)$     | —            | $V_{CE} = -0.2V, I_C = -5mA$       | -2.2   | —    | -5.8   | V    |
| Input voltage (OFF)                  | $V_I(OFF)$    | —            | $V_{CE} = -5V, I_C = -0.1mA$       | -1.5   | —    | -2.6   | V    |
| Transition frequency                 | $f_T$         | —            | $V_{CE} = -10V, I_C = -5mA$        | —      | 200  | —      | MHz  |
| Collector output capacitance         | $C_{ob}$      | —            | $V_{CB} = -10V, I_E = 0, f = 1MHz$ | —      | 3    | 6      | pF   |

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

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

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

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



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