

Bipolar Transistors Silicon PNP/NPN Epitaxial Type (PCT Process)(Bias Resistor built-in Transistor)

RN4904FE

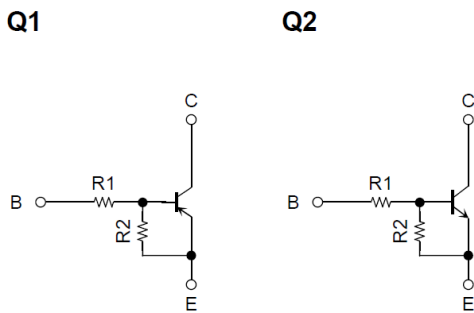
1. Applications

- Switching
- Inverter Circuits
- Interfacing
- Driver Circuits

2. Features

- (1) AEC-Q101 qualified (Please see the orderable part number list)
- (2) Small package (Dual type)
- (3) The integrated bias resistor reduces the number of external parts required, making it possible to reduce system size and assembly time.

3. Equivalent Circuit

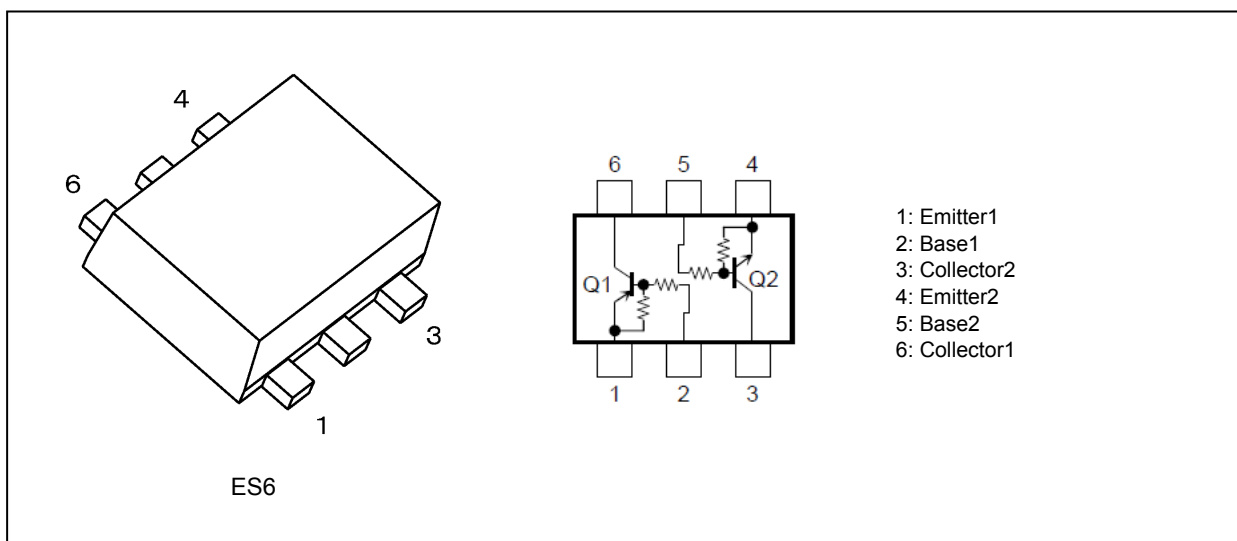


R1: 47 kΩ

R2: 47 kΩ

(Q1, Q2 common)

4. Packaging and Pin Assignment



Start of commercial production

2000-05

5. Orderable part number

| Orderable part number | AEC-Q101 | Note |
|-----------------------|--------------|-------------------------|
| RN4904FE,LF | — | General Use |
| RN4904FE,LXGF | YES (Note 1) | Unintended Use (Note 1) |
| RN4904FE,LXHF | YES | Automotive Use |

Note 1: For more information, please contact our sales or use the inquiry form on our website.

6. Q1 Absolute Maximum Ratings (Note) (Unless otherwise specified, $T_a = 25\text{ }^\circ\text{C}$)

| Characteristics | Symbol | Rating | Unit |
|---------------------------|-----------|--------|------|
| Collector-base voltage | V_{CBO} | -50 | V |
| Collector-emitter voltage | V_{CEO} | -50 | |
| Emitter-base voltage | V_{EBO} | -10 | |
| Collector current | I_C | -100 | mA |

7. Q2 Absolute Maximum Ratings (Note) (Unless otherwise specified, $T_a = 25\text{ }^\circ\text{C}$)

| Characteristics | Symbol | Rating | Unit |
|---------------------------|-----------|--------|------|
| Collector-base voltage | V_{CBO} | 50 | V |
| Collector-emitter voltage | V_{CEO} | 50 | |
| Emitter-base voltage | V_{EBO} | 10 | |
| Collector current | I_C | 100 | mA |

8. Q1, Q2 Common Absolute Maximum Ratings (Note) (Unless otherwise specified, $T_a = 25\text{ }^\circ\text{C}$)

| Characteristics | Symbol | Rating | Unit |
|--------------------------------------|-----------|------------|------------------|
| Collector power dissipation (Note 1) | P_C | 100 | mW |
| Junction temperature | T_j | 150 | $^\circ\text{C}$ |
| Storage temperature | T_{stg} | -55 to 150 | |

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

9. Q1 Electrical Characteristics (Unless otherwise specified, $T_a = 25\text{ }^\circ\text{C}$)

| Characteristics | Symbol | Test Condition | Min | Typ. | Max | Unit |
|--------------------------------------|---------------|--|--------|------|-------|------|
| Collector cut-off current | I_{CBO} | $V_{CB} = -50\text{ V}, I_E = 0\text{ mA}$ | — | — | -100 | nA |
| Collector cut-off current | I_{CEO} | $V_{CE} = -50\text{ V}, I_B = 0\text{ mA}$ | — | — | -500 | |
| Emitter cut-off current | I_{EBO} | $V_{EB} = -10\text{ V}, I_C = 0\text{ mA}$ | -0.082 | — | -0.15 | mA |
| DC current gain | h_{FE} | $V_{CE} = -5\text{ V}, I_C = -10\text{ mA}$ | 80 | — | — | — |
| 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) | $V_{I(ON)}$ | $V_{CE} = -0.2\text{ V}, I_C = -5\text{ mA}$ | -1.5 | — | -5.0 | |
| Input voltage (off) | $V_{I(off)}$ | $V_{CE} = -5\text{ V}, I_C = -0.1\text{ mA}$ | -1.0 | — | -1.5 | |
| Transition frequency | f_T | $V_{CE} = -10\text{ V}, I_C = -5\text{ mA}$ | — | 200 | — | |
| Collector output capacitance | C_{ob} | $V_{CB} = -10\text{ V}, I_E = 0\text{ mA}, f = 1\text{ MHz}$ | — | 3 | 6 | pF |

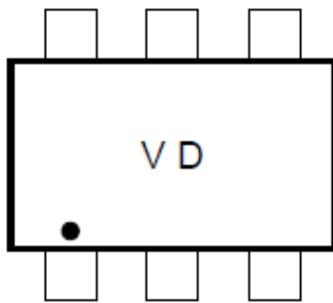
10. Q2 Electrical Characteristics (Unless otherwise specified, $T_a = 25\text{ }^\circ\text{C}$)

| Characteristics | Symbol | Test Condition | Min | Typ. | Max | Unit |
|--------------------------------------|---------------|---|-------|------|------|------|
| Collector cut-off current | I_{CBO} | $V_{CB} = 50\text{ V}, I_E = 0\text{ mA}$ | — | — | 100 | nA |
| Collector cut-off current | I_{CEO} | $V_{CE} = 50\text{ V}, I_B = 0\text{ mA}$ | — | — | 500 | |
| Emitter cut-off current | I_{EBO} | $V_{EB} = 10\text{ V}, I_C = 0\text{ mA}$ | 0.082 | — | 0.15 | mA |
| DC current gain | h_{FE} | $V_{CE} = 5\text{ V}, I_C = 10\text{ mA}$ | 80 | — | — | — |
| 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) | $V_{I(ON)}$ | $V_{CE} = 0.2\text{ V}, I_C = 5\text{ mA}$ | 1.5 | — | 5.0 | |
| Input voltage (off) | $V_{I(off)}$ | $V_{CE} = 5\text{ V}, I_C = 0.1\text{ mA}$ | 1.0 | — | 1.5 | |
| Transition frequency | f_T | $V_{CE} = 10\text{ V}, I_C = 5\text{ mA}$ | — | 250 | — | MHz |
| Collector output capacitance | C_{ob} | $V_{CB} = 10\text{ V}, I_E = 0\text{ mA}, f = 1\text{ MHz}$ | — | 3 | 6 | pF |

11. Q1, Q2 Common Electrical Characteristics (Unless otherwise specified, $T_a = 25\text{ }^\circ\text{C}$)

| Characteristics | Symbol | Test Condition | Min | Typ. | Max | Unit |
|------------------|--------|----------------|------|------|------|------------|
| Input resistance | R_1 | - | 32.9 | 47 | 61.1 | k Ω |
| Resistor ratio | R1/R2 | - | 0.9 | 1.0 | 1.1 | — |

12. Marking



13. Characteristics Curves (Note)

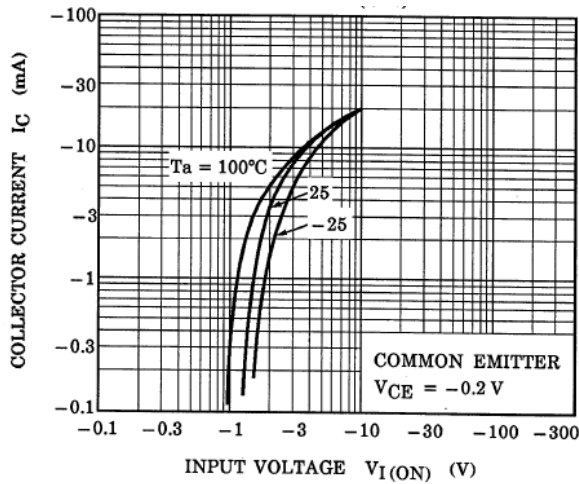


Fig. 13.1 Q1 I_C - $V_{I(ON)}$

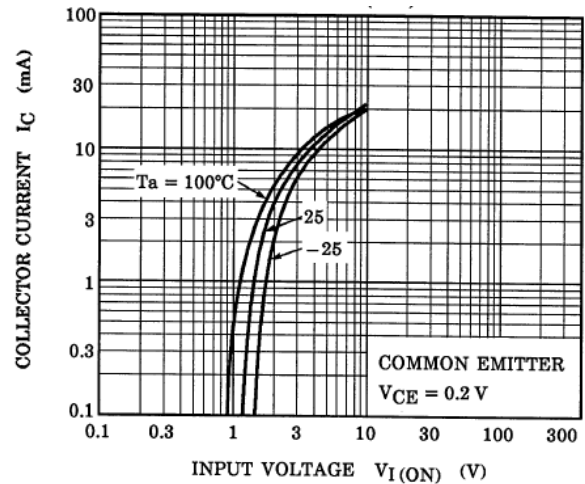


Fig. 13.2 Q2 I_C - $V_{I(ON)}$

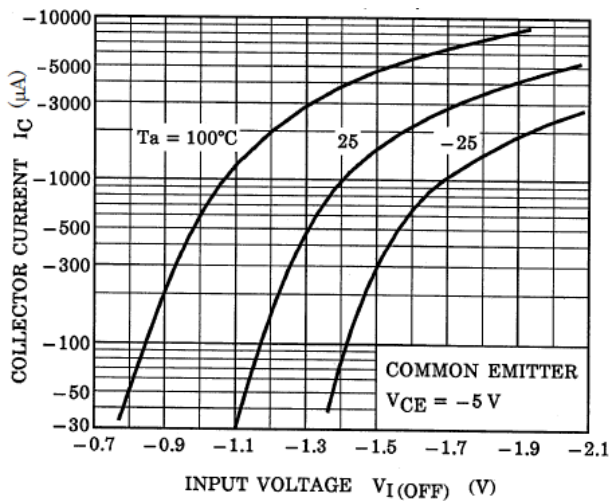


Fig. 13.3 Q1 I_C - $V_{I(OFF)}$

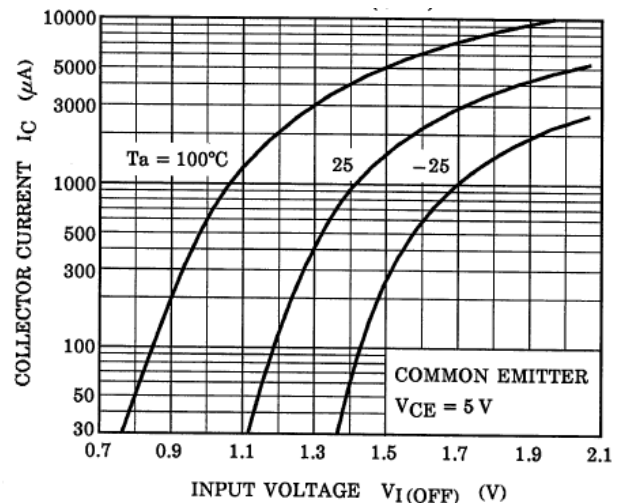


Fig. 13.4 Q2 I_C - $V_{I(OFF)}$

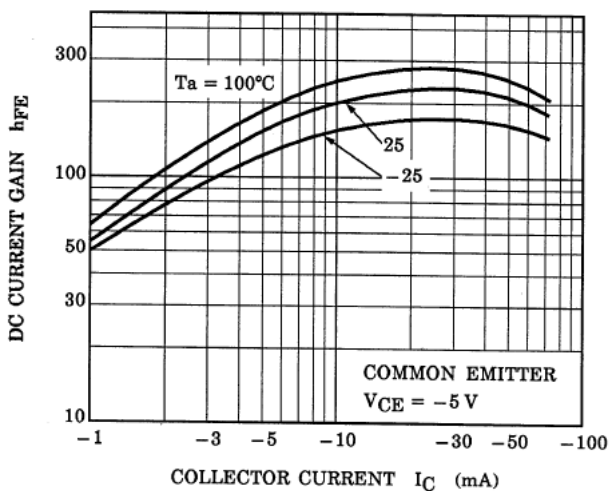


Fig. 13.5 Q1 h_{FE} - I_C

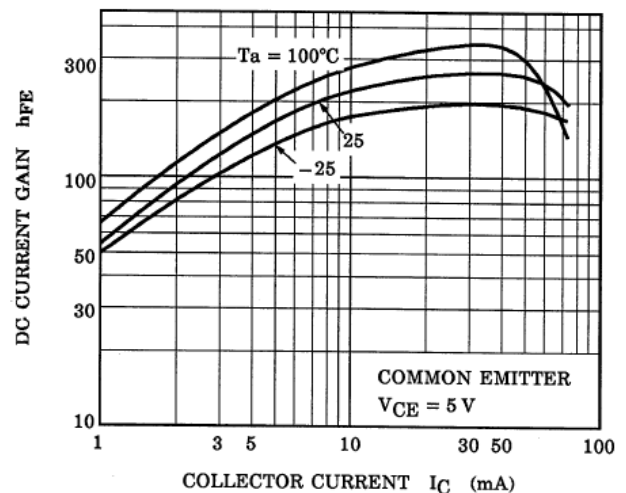


Fig. 13.6 Q2 h_{FE} - I_C

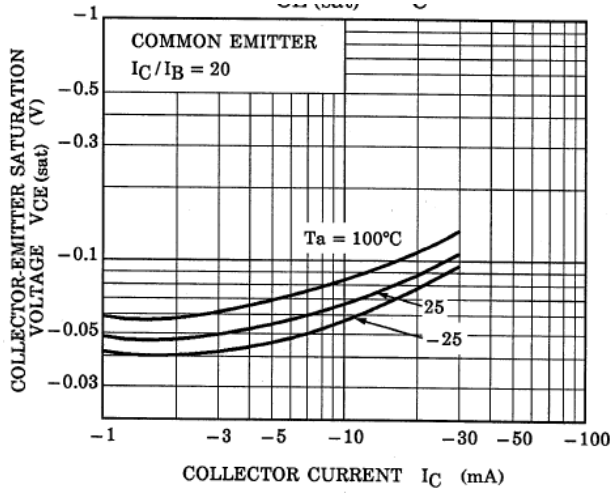


Fig. 13.7 Q1 $V_{CE(sat)}-I_C$

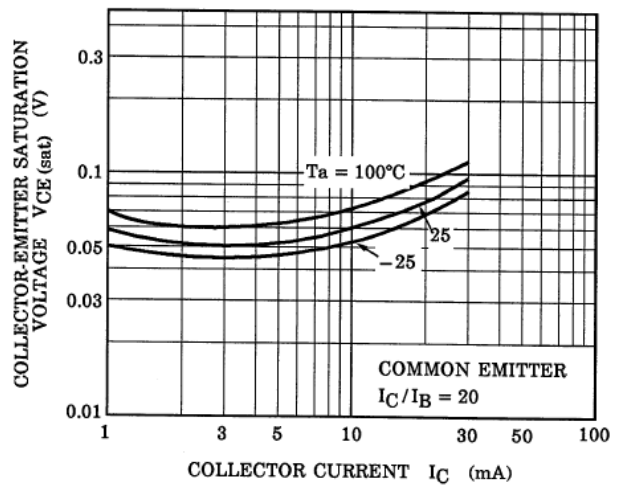
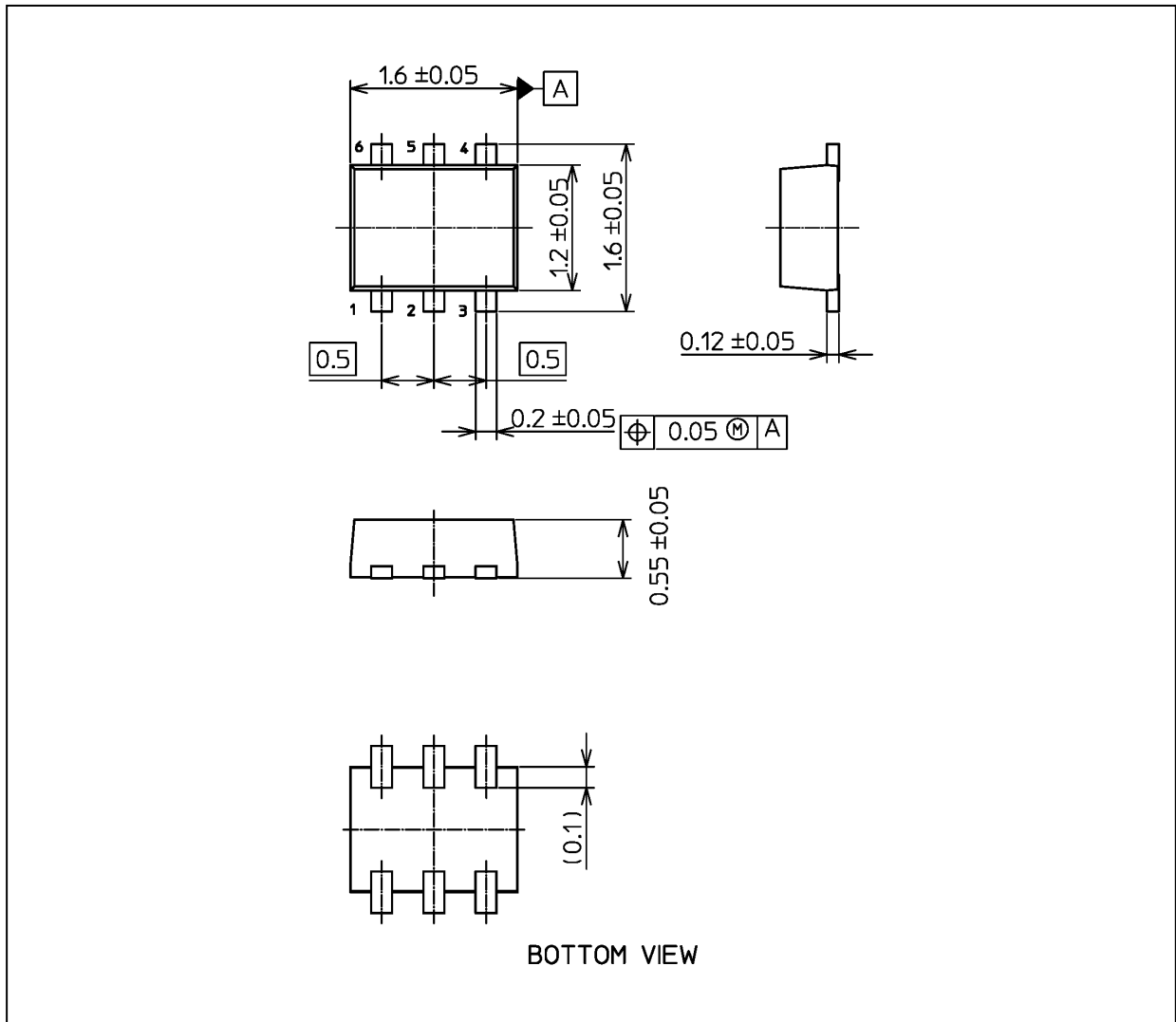


Fig. 13.8 Q2 $V_{CE(sat)}-I_C$

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

Package Dimensions

Unit: mm



Weight: 3.0 mg (typ.)

| Package Name(s) |
|-----------------|
| TOSHIBA: 1-2X1S |
| Nickname: ES6 |

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