

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

RN1901FE/02FE/03FE/04FE/05FE/06FE

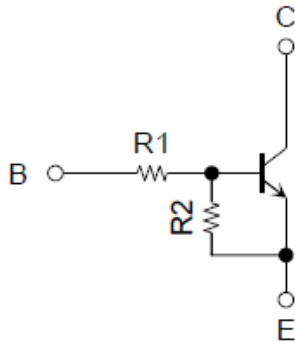
1. Applications

- 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.
- (4) Complementary to RN2901FE to RN2906FE

3. Equivalent Circuit



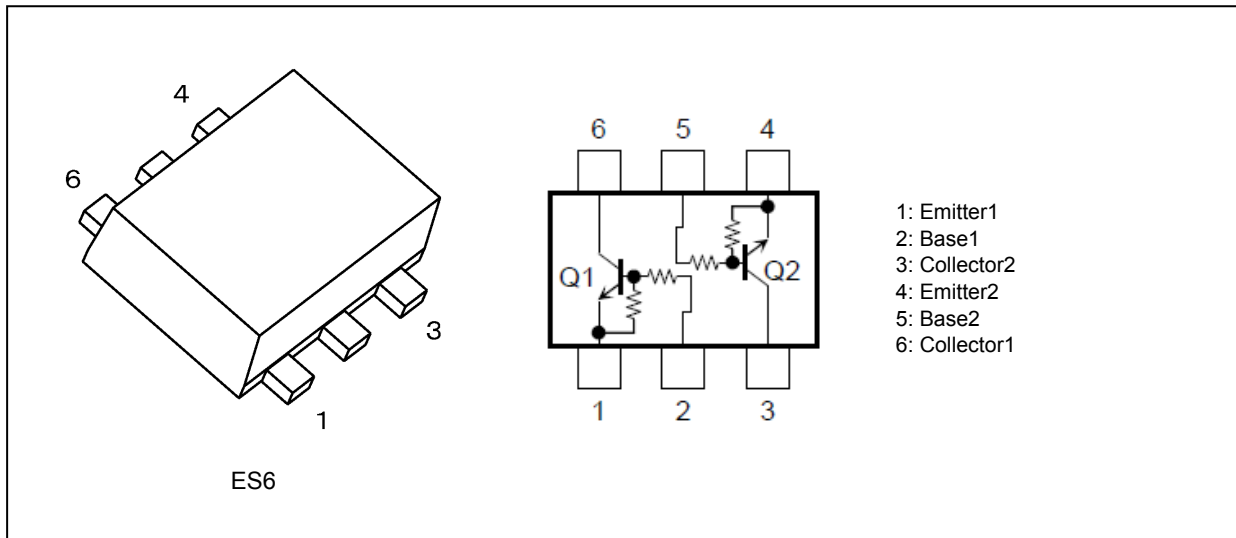
4. Bias Resistor Values

| Part No. | R1 (kΩ) | R2 (kΩ) |
|----------|---------|---------|
| RN1901FE | 4.7 | 4.7 |
| RN1902FE | 10 | 10 |
| RN1903FE | 22 | 22 |
| RN1904FE | 47 | 47 |
| RN1905FE | 2.2 | 47 |
| RN1906FE | 4.7 | 47 |

Start of commercial production

2000-05

5. Packaging and Pin Assignment



6. Orderable part number

| Orderable part number | | AEC-Q101 | Note |
|-----------------------|---------------|--------------|-------------------------|
| RN1901FE | RN1901FE,LF | — | General Use |
| | RN1901FE,LXGF | YES (Note 1) | Unintended Use (Note 1) |
| | RN1901FE,LXHF | YES | Automotive Use |
| RN1902FE | RN1902FE,LF | — | General Use |
| | RN1902FE,LXGF | YES (Note 1) | Unintended Use (Note 1) |
| | RN1902FE,LXHF | YES | Automotive Use |
| RN1903FE | RN1903FE,LF | — | General Use |
| | RN1903FE,LXGF | YES (Note 1) | Unintended Use (Note 1) |
| | RN1903FE,LXHF | YES | Automotive Use |
| RN1904FE | RN1904FE,LF | — | General Use |
| | RN1904FE,LXGF | YES (Note 1) | Unintended Use (Note 1) |
| | RN1904FE,LXHF | YES | Automotive Use |
| RN1905FE | RN1905FE,LF | — | General Use |
| | RN1905FE,LXGF | YES (Note 1) | Unintended Use (Note 1) |
| | RN1905FE,LXHF | YES | Automotive Use |
| RN1906FE | RN1906FE,LF | — | General Use |
| | RN1906FE,LXGF | YES (Note 1) | Unintended Use (Note 1) |
| | RN1906FE,LXHF | YES | Automotive Use |

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

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

| Characteristics | | Symbol | Rating | Unit |
|--------------------------------------|-------------------|-----------|------------|------|
| Collector-base voltage | RN1901FE~RN1906FE | V_{CBO} | 50 | V |
| Collector-emitter voltage | | V_{CEO} | 50 | |
| Emitter-base voltage | RN1901FE~RN1904FE | V_{EBO} | 10 | |
| | RN1905FE,RN1906FE | | 5 | |
| Collector current | RN1901FE~RN1906FE | I_C | 100 | mA |
| Collector power dissipation (Note 1) | | P_C | 100 | mW |
| Junction temperature | | T_j | 150 | °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

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

| Characteristics | Symbol | Test Condition | Min | Typ. | Max | Unit | |
|--------------------------------------|-----------------------|--|---|--------|--------|--------|------------|
| Collector cut-off current | RN1901FE~ RN1906FE | I_{CBO} | $V_{CB} = 50\text{ V}, I_E = 0\text{ mA}$ | — | — | 100 | nA |
| | | I_{CEO} | $V_{CE} = 50\text{ V}, I_B = 0\text{ mA}$ | — | — | 500 | |
| Emitter cut-off current | RN1901FE | I_{EBO} | $V_{EB} = 10\text{ V}, I_C = 0\text{ mA}$ | 0.82 | — | 1.52 | mA |
| | RN1902FE | | | 0.38 | — | 0.71 | |
| | RN1903FE | | | 0.17 | — | 0.33 | |
| | RN1904FE | | | 0.082 | — | 0.15 | |
| | RN1905FE | $V_{EB} = 5\text{ V}, I_C = 0\text{ mA}$ | 0.078 | — | 0.145 | | |
| | RN1906FE | | 0.074 | — | 0.138 | | |
| DC current gain | RN1901FE | h_{FE} | $V_{CE} = 5\text{ V}, I_C = 10\text{ mA}$ | 30 | — | — | — |
| | RN1902FE | | | 50 | — | — | |
| | RN1903FE | | | 70 | — | — | |
| | RN1904FE | | | 80 | — | — | |
| | RN1905FE | | | 80 | — | — | |
| | RN1906FE | | | 80 | — | — | |
| Collector-emitter saturation voltage | RN1901FE~ RN1906FE | $V_{CE(sat)}$ | $I_C = 5\text{ mA}, I_B = 0.25\text{ mA}$ | — | 0.1 | 0.3 | V |
| Input voltage (ON) | RN1901FE | $V_{I(ON)}$ | $V_{CE} = 0.2\text{ V}, I_C = 5\text{ mA}$ | 1.1 | — | 2.0 | — |
| | RN1902FE | | | 1.2 | — | 2.4 | |
| | RN1903FE | | | 1.3 | — | 3.0 | |
| | RN1904FE | | | 1.5 | — | 5.0 | |
| | RN1905FE | | | 0.6 | — | 1.1 | |
| | RN1906FE | | | 0.7 | — | 1.3 | |
| Input voltage (OFF) | RN1901FE~ RN1904FE | $V_{I(OFF)}$ | $V_{CE} = 5\text{ V}, I_C = 0.1\text{ mA}$ | 1.0 | — | 1.5 | — |
| | RN1905FE, RN1906FE | | | 0.5 | — | 0.8 | |
| Transition frequency | RN1901FE~ RN1906FE | f_T | $V_{CE} = 10\text{ V}, I_C = 5\text{ mA}$ | — | 250 | — | MHz |
| Collector output capacitance | RN1901FE~ RN1906FE | C_{ob} | $V_{CB} = 10\text{ V}, I_E = 0\text{ mA}, f = 1\text{ MHz}$ | — | 3 | 6 | pF |
| Input resistance | RN1901FE | R_1 | - | 3.29 | 4.7 | 6.11 | k Ω |
| | RN1902FE | | | 7 | 10 | 13 | |
| | RN1903FE | | | 15.4 | 22 | 28.6 | |
| | RN1904FE | | | 32.9 | 47 | 61.1 | |
| | RN1905FE | | | 1.54 | 2.2 | 2.86 | |
| | RN1906FE | | | 3.29 | 4.7 | 6.11 | |
| Resistor ratio | RN1901FE~ RN1904FE | R1/R2 | - | 0.9 | 1.0 | 1.1 | — |
| | RN1905FE | | | 0.0421 | 0.0468 | 0.0515 | |
| | RN1906FE | | | 0.09 | 0.1 | 0.11 | |

9. Marking

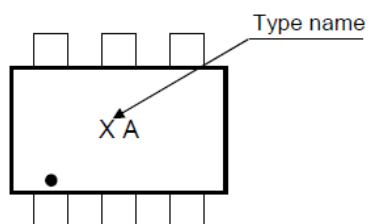


Fig. 9.1 Marking RN1901FE

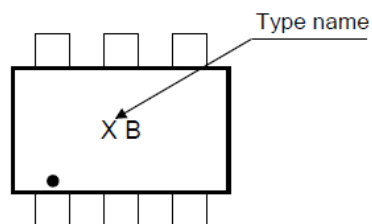


Fig. 9.2 Marking RN1902FE

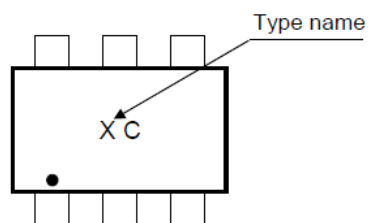


Fig. 9.3 Marking RN1903FE

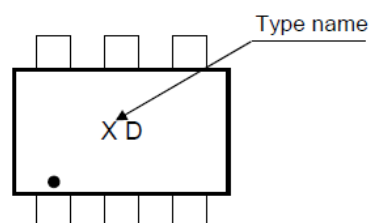


Fig. 9.4 Marking RN1904FE

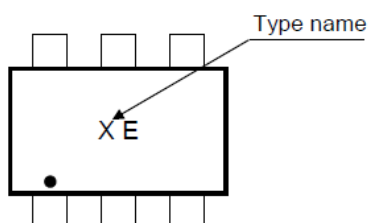


Fig. 9.5 Marking RN1905FE

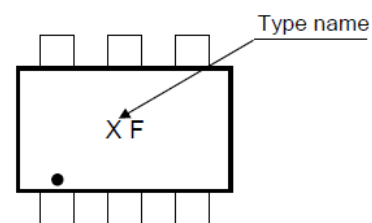


Fig. 9.6 Marking RN1906FE

10. Characteristics Curves (Note)(Q1, Q2 Common)

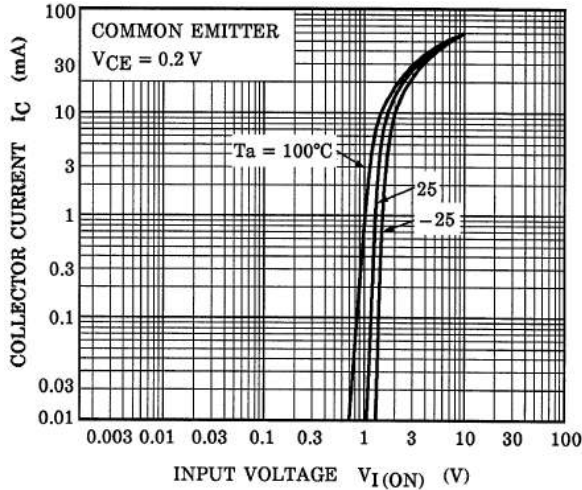


Fig. 10.1 RN1901FE I_C - $V_{I(ON)}$

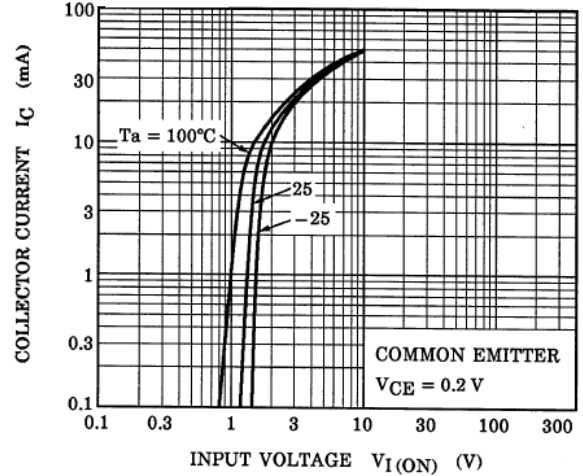


Fig. 10.2 RN1902FE I_C - $V_{I(ON)}$

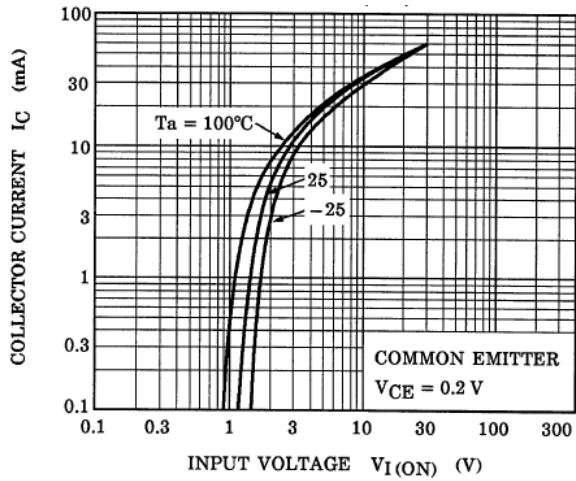


Fig. 10.3 RN1903FE I_C - $V_{I(ON)}$

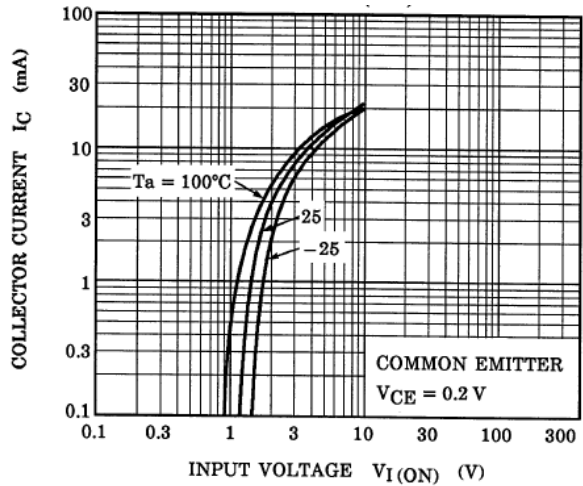


Fig. 10.4 RN1904FE I_C - $V_{I(ON)}$

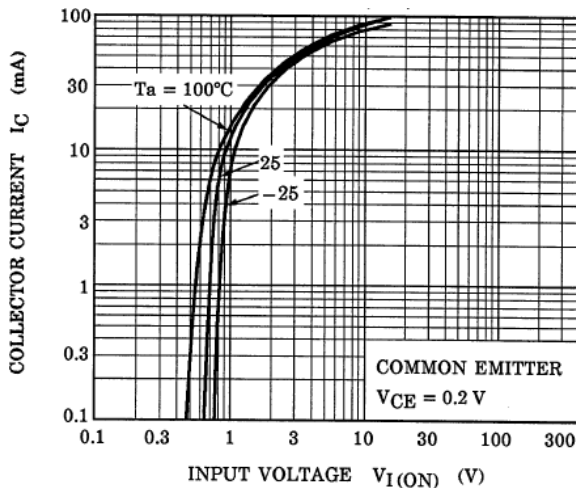


Fig. 10.5 RN1905FE I_C - $V_{I(ON)}$

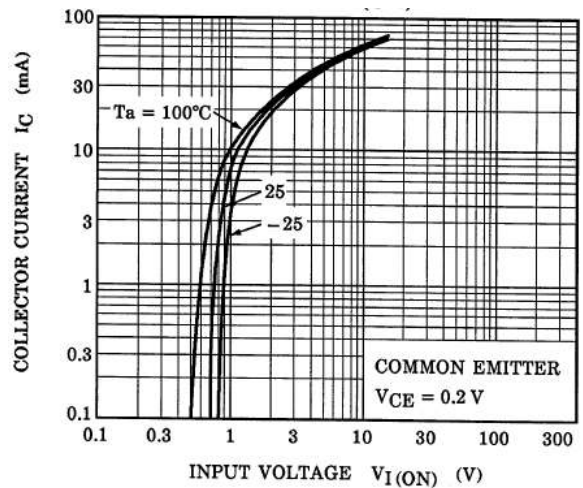


Fig. 10.6 RN1906FE I_C - $V_{I(ON)}$

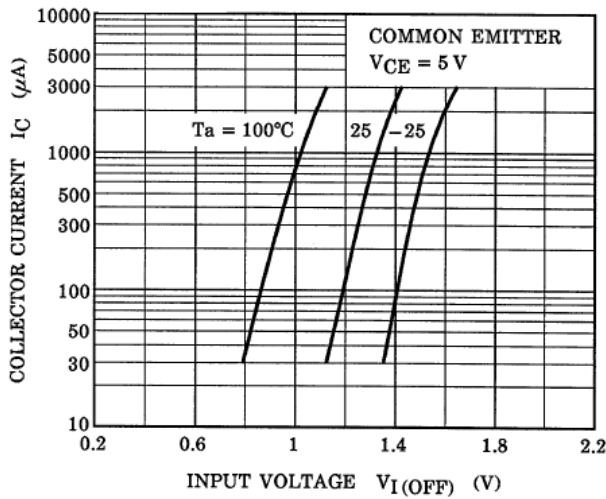


Fig. 10.7 RN1901FE I_C-V_{I(OFF)}

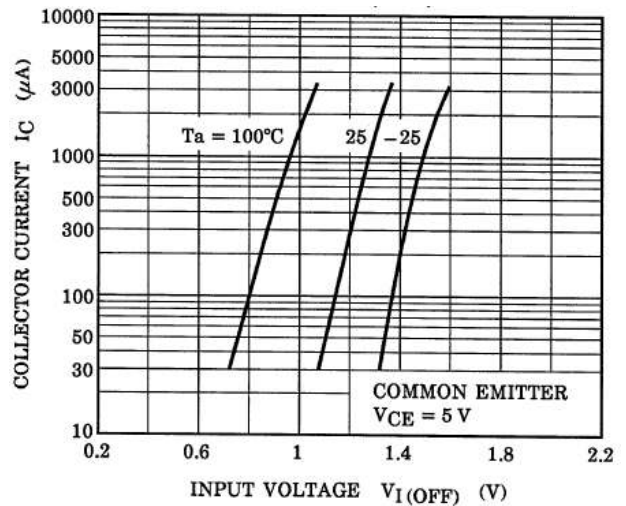


Fig. 10.8 RN1902FE I_C-V_{I(OFF)}

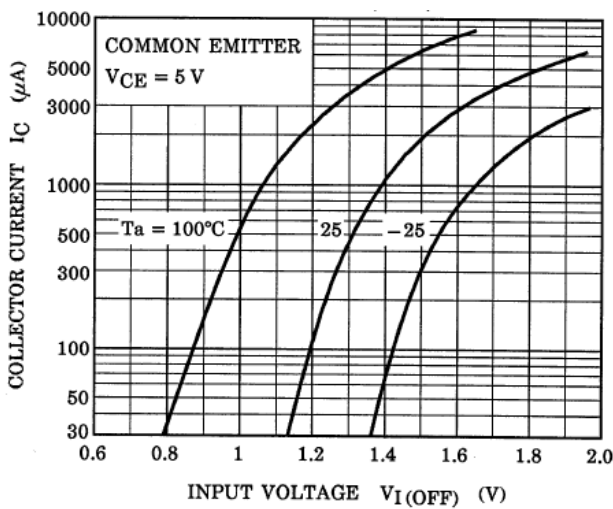


Fig. 10.9 RN1903FE I_C-V_{I(OFF)}

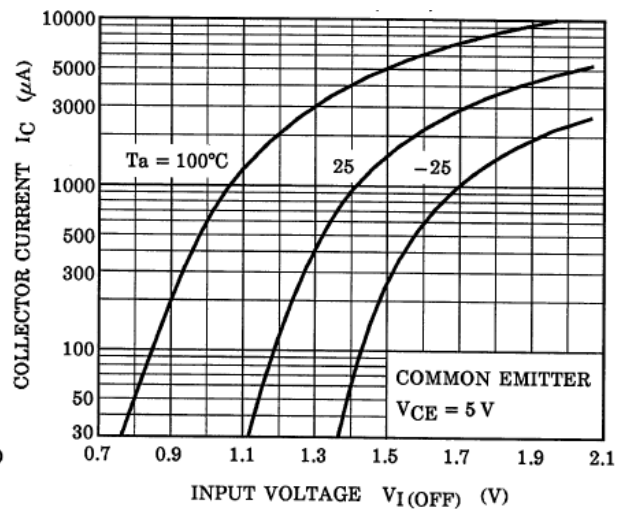


Fig. 10.10 RN1904FE I_C-V_{I(OFF)}

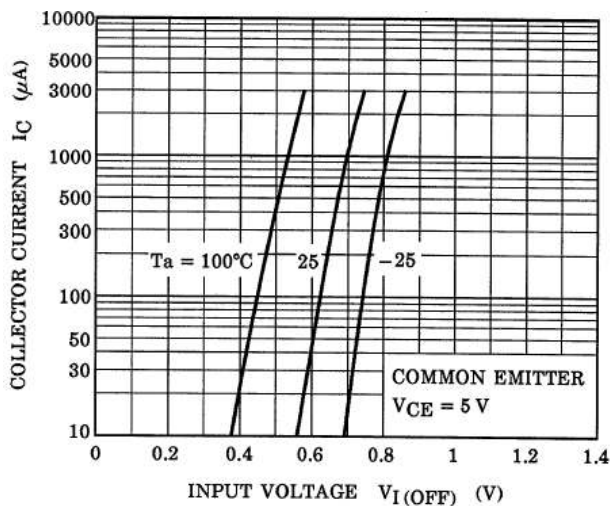


Fig. 10.11 RN1905FE I_C-V_{I(OFF)}

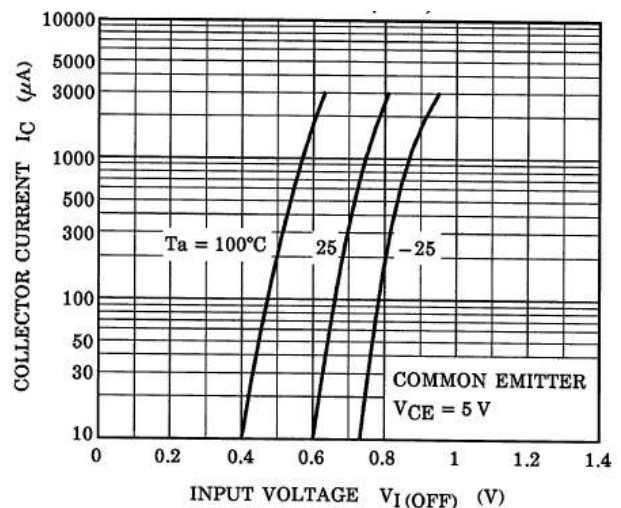


Fig. 10.12 RN1906FE I_C-V_{I(OFF)}

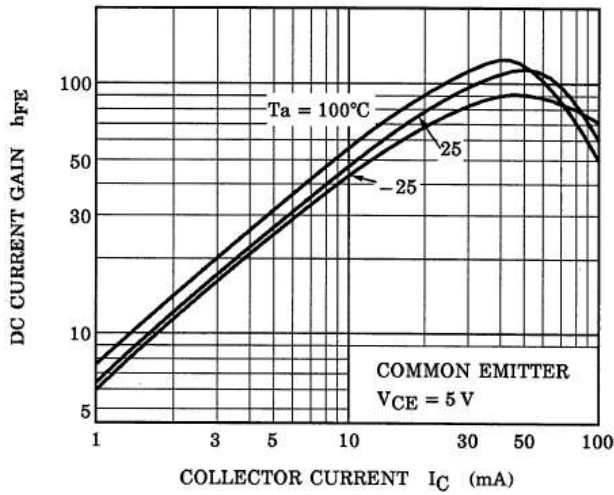


Fig. 10.13 RN1901FE $h_{FE}-I_C$

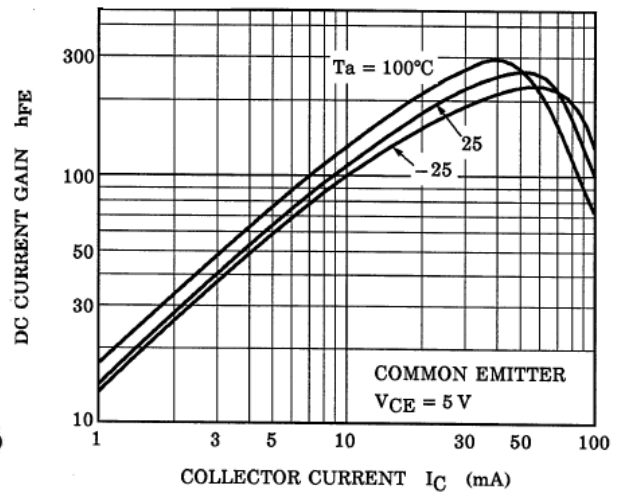


Fig. 10.14 RN1902FE $h_{FE}-I_C$

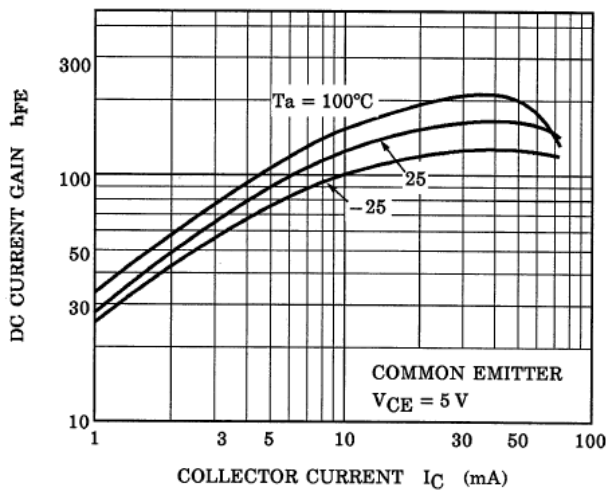


Fig. 10.15 RN1903FE $h_{FE}-I_C$

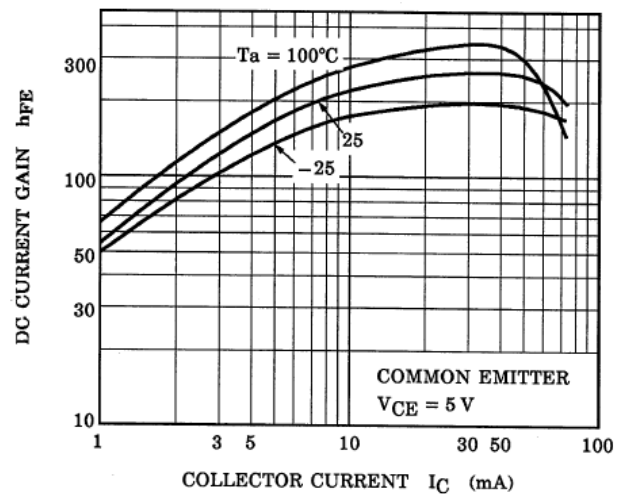


Fig. 10.16 RN1904FE $h_{FE}-I_C$

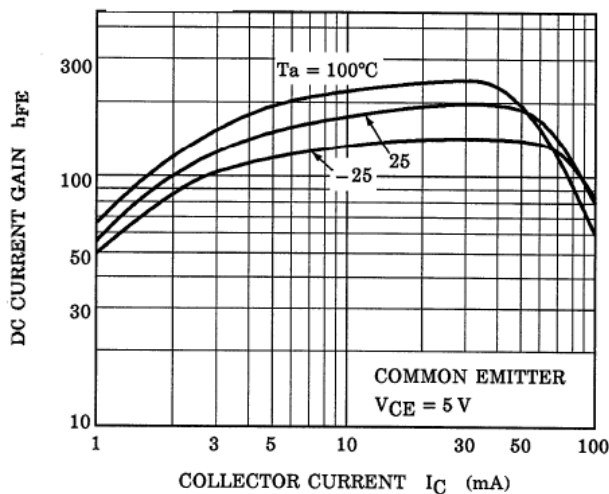


Fig. 10.17 RN1905FE $h_{FE}-I_C$

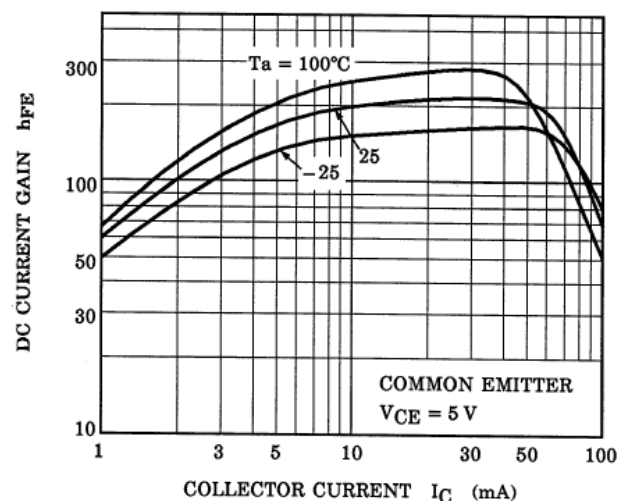


Fig. 10.18 RN1906FE $h_{FE}-I_C$

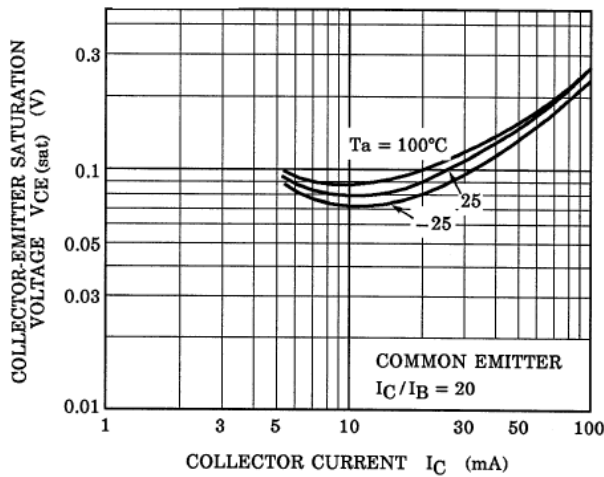


Fig. 10.19 RN1901FE $V_{CE(sat)}$ - I_C

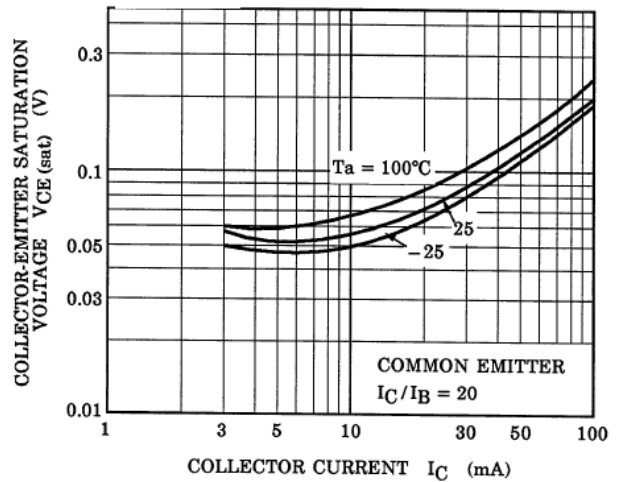


Fig. 10.20 RN1902FE $V_{CE(sat)}$ - I_C

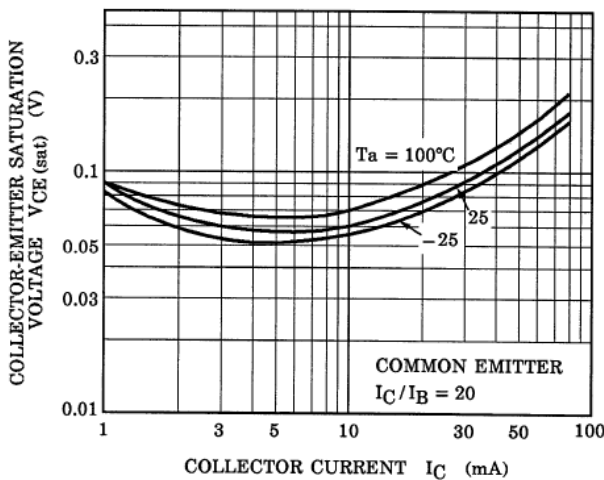


Fig. 10.21 RN1903FE $V_{CE(sat)}$ - I_C

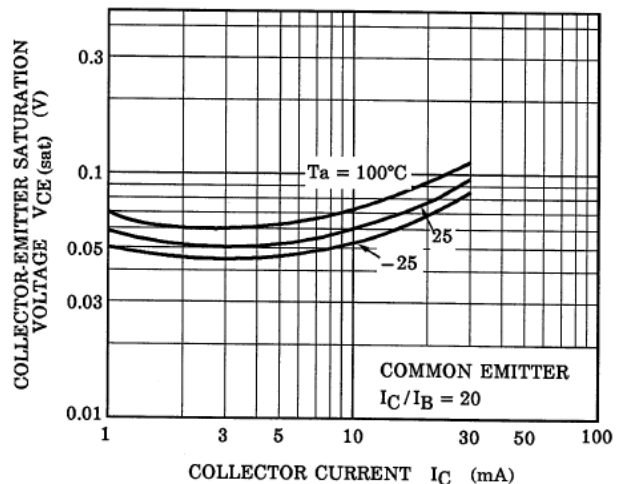


Fig. 10.22 RN1904FE $V_{CE(sat)}$ - I_C

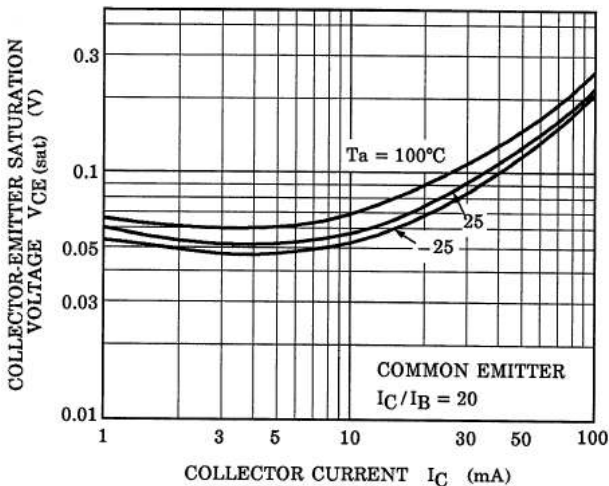


Fig. 10.23 RN1905FE $V_{CE(sat)}$ - I_C

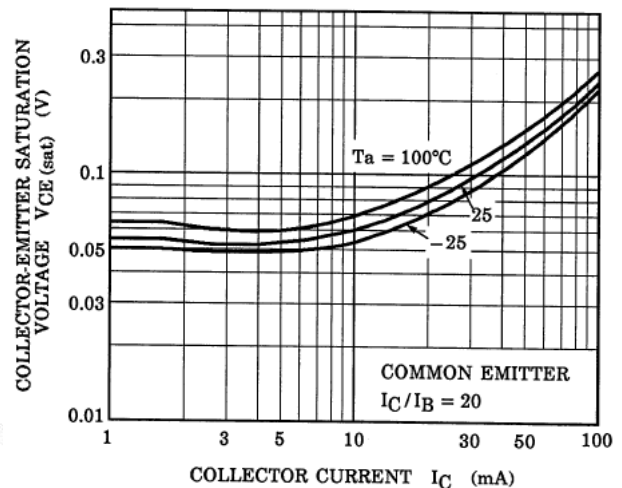
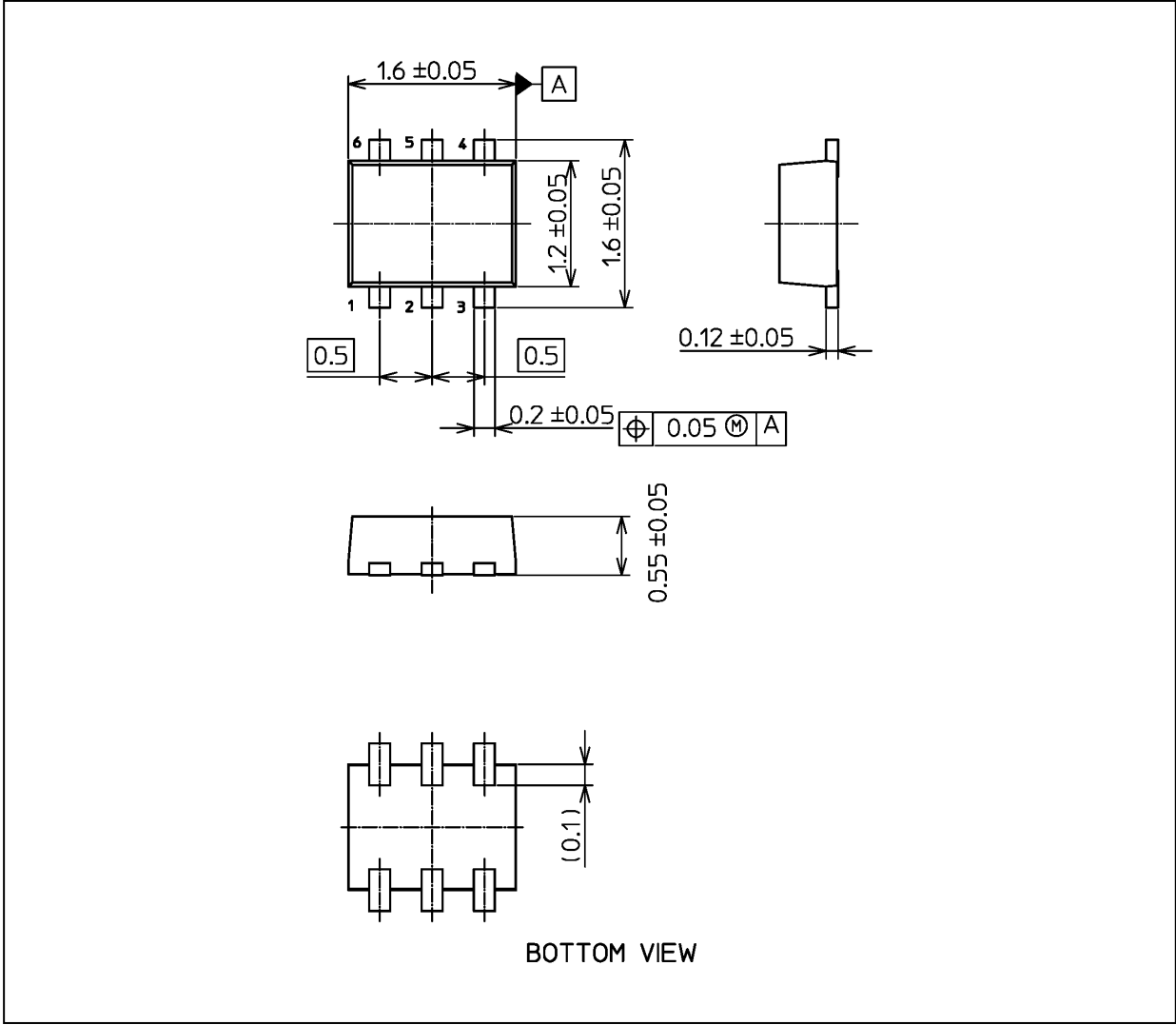


Fig. 10.24 RN1906FE $V_{CE(sat)}$ - I_C

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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