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

# RN2901/02/03/04/05/06

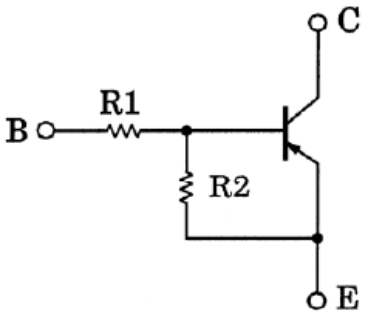
## 1. Applications

- 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) Toshiba offers transistors with a wide range of resistance to accommodate various circuit designs.
(5) Complementary to RN1901 to RN1906

## 3. Equivalent Circuit

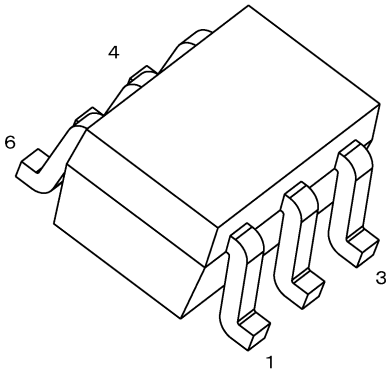



## 4. Bias Resistor Values

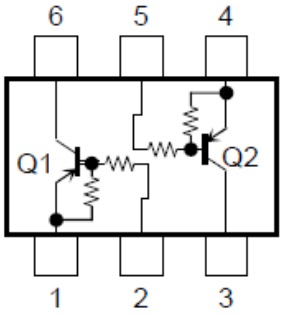
| Part No. | R1 (kΩ) | R2 (kΩ) |
|---|---|---|
| RN2901 | 4.7 | 4.7 |
| RN2902 | 10 | 10 |
| RN2903 | 22 | 22 |
| RN2904 | 47 | 47 |
| RN2905 | 2.2 | 47 |
| RN2906 | 4.7 | 47 |

Start of commercial production
1990-12

## 5. Packaging and Pin Assignment




US6




1: Emitter1
2: Base1
3: Collector2
4: Emitter2
5: Base2
6: Collector1

## 6. Orderable part number

| Orderable part number | | AEC-Q101 | | Note | |
|---|---|---|---|---|---|
| RN2901 | RN2901,LF | — | | General Use | |
| | RN2901,LXGF | YES | (Note 1) | Unintended Use | (Note 1) |
| | RN2901,LXHF | YES | | Automotive Use | |
| RN2902 | RN2902,LF | — | | General Use | |
| | RN2902,LXGF | YES | (Note 1) | Unintended Use | (Note 1) |
| | RN2902,LXHF | YES | | Automotive Use | |
| RN2903 | RN2903,LF | — | | General Use | |
| | RN2903,LXGF | YES | (Note 1) | Unintended Use | (Note 1) |
| | RN2903,LXHF | YES | | Automotive Use | |
| RN2904 | RN2904,LF | — | | General Use | |
| | RN2904,LXGF | YES | (Note 1) | Unintended Use | (Note 1) |
| | RN2904,LXHF | YES | | Automotive Use | |
| RN2905 | RN2905,LF | — | | General Use | |
| | RN2905,LXGF | YES | (Note 1) | Unintended Use | (Note 1) |
| | RN2905,LXHF | YES | | Automotive Use | |
| RN2906 | RN2906,LF | — | | General Use | |
| | RN2906,LXGF | YES | (Note 1) | Unintended Use | (Note 1) |
| | RN2906,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 °C) (Q1, Q2 Common)

| Characteristics | | Symbol | Rating | Unit |
|---|---|---|---|---|
| Collector-base voltage | RN2901～RN2906 | $V_{CBO}$ | -50 | V |
| Collector-emitter voltage | | $V_{CEO}$ | -50 | |
| Emitter-base voltage | RN2901～RN2904 | $V_{EBO}$ | -10 | |
| | RN2905,RN2906 | | -5 | |
| Collector current | RN2901～RN2906 | $I_C$ | -100 | mA |
| Collector power dissipation (Note 1) | | $P_C$ | 200 | 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 °C) (Q1, Q2 Common)

| Characteristics | | Symbol | Test Condition | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|---|
| Collector cut-off current | RN2901～RN2906 | $I_{CBO}$ | $V_{CB}$ = -50 V, $I_E$ = 0 mA | — | — | -100 | nA |
| | | $I_{CEO}$ | $V_{CE}$ = -50 V, $I_B$ = 0 mA | — | — | -500 | |
| Emitter cut-off current | RN2901 | $I_{EBO}$ | $V_{EB}$ = -10 V, $I_C$ = 0 mA | -0.82 | — | -1.52 | mA |
| | RN2902 | | | -0.38 | — | -0.71 | |
| | RN2903 | | | -0.17 | — | -0.33 | |
| | RN2904 | | | -0.082 | — | -0.15 | |
| | RN2905 | | $V_{EB}$ = -5 V, $I_C$ = 0 mA | -0.078 | — | -0.145 | |
| | RN2906 | | | -0.074 | — | -0.138 | |
| DC current gain | RN2901 | $h_{FE}$ | $V_{CE}$ = -5 V, $I_C$ = -10 mA | 30 | — | — | — |
| | RN2902 | | | 50 | — | — | |
| | RN2903 | | | 70 | — | — | |
| | RN2904 | | | 80 | — | — | |
| | RN2905 | | | 80 | — | — | |
| | RN2906 | | | 80 | — | — | |
| Collector-emitter saturation voltage | RN2901～RN2906 | $V_{CE(sat)}$ | $I_C$ = -5 mA, $I_B$ = -0.25 mA | — | -0.1 | -0.3 | V |
| Input voltage (ON) | RN2901 | $V_{I(ON)}$ | $V_{CE}$ = -0.2 V, $I_C$ = -5 mA | -1.1 | — | -2.0 | |
| | RN2902 | | | -1.2 | — | -2.4 | |
| | RN2903 | | | -1.3 | — | -3.0 | |
| | RN2904 | | | -1.5 | — | -5.0 | |
| | RN2905 | | | -0.6 | — | -1.1 | |
| | RN2906 | | | -0.7 | — | -1.3 | |
| Input voltage (OFF) | RN2901～RN2904 | $V_{I(OFF)}$ | $V_{CE}$ = -5 V, $I_C$ = -0.1 mA | -1.0 | — | -1.5 | |
| | RN2905, RN2906 | | | -0.5 | — | -0.8 | |
| Transition frequency | RN2901～RN2906 | $f_T$ | $V_{CE}$ = -10 V, $I_C$ = -5 mA | — | 200 | — | MHz |
| Collector output capacitance | | $C_{ob}$ | $V_{CB}$ = -10 V, $I_E$ = 0 mA, f = 1 MHz | — | 3 | 6 | pF |
| Input resistance | RN2901 | $R_1$ | - | 3.29 | 4.7 | 6.11 | kΩ |
| | RN2902 | | | 7 | 10 | 13 | |
| | RN2903 | | | 15.4 | 22 | 28.6 | |
| | RN2904 | | | 32.9 | 47 | 61.1 | |
| | RN2905 | | | 1.54 | 2.2 | 2.86 | |
| | RN2906 | | | 3.29 | 4.7 | 6.11 | |
| Resistor ratio | RN2901～RN2904 | R1/R2 | - | 0.9 | 1.0 | 1.1 | — |
| | RN2905 | | | 0.0421 | 0.0468 | 0.0515 | |
| | RN2906 | | | 0.09 | 0.1 | 0.11 | |

## 9. Marking

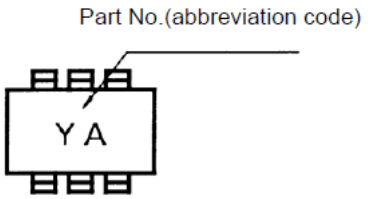



Fig. 9.1 Mraking RN2901

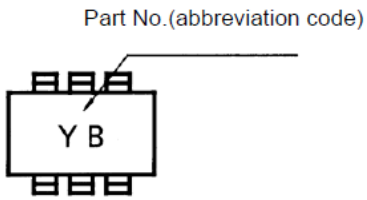



Fig. 9.2 Mraking RN2902

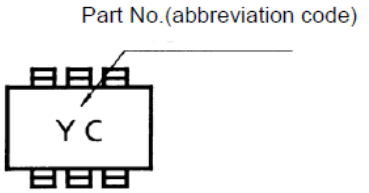



Fig. 9.3 Mraking RN2903

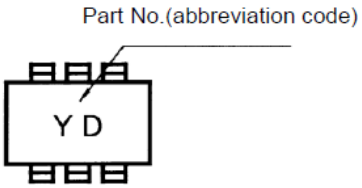



Fig. 9.4 Mraking RN2904

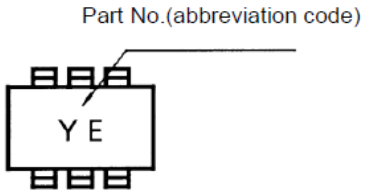



Fig. 9.5 Mraking RN2905

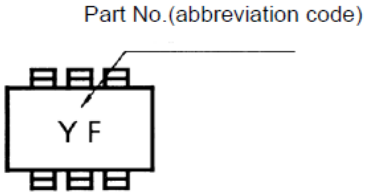



Fig. 9.6 Mraking RN2906

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

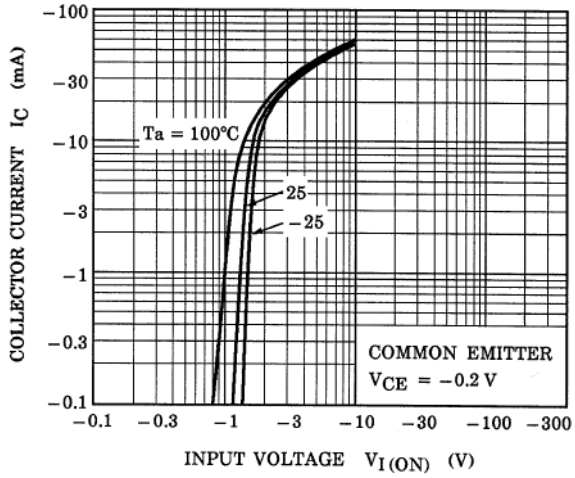



Fig. 10.1 RN2901 $I_C$-$V_{I(ON)}$

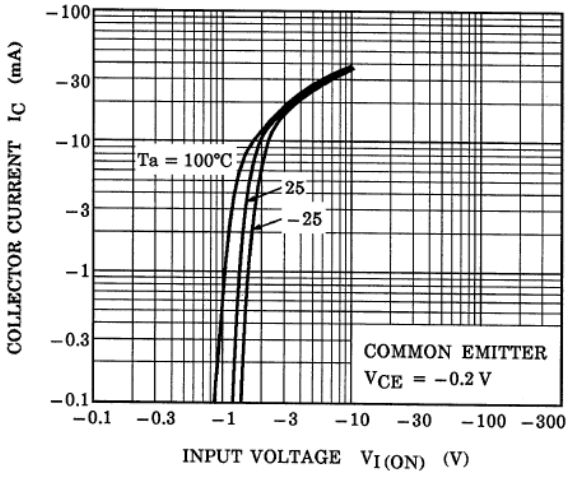



Fig. 10.2 RN2902 $I_C$-$V_{I(ON)}$

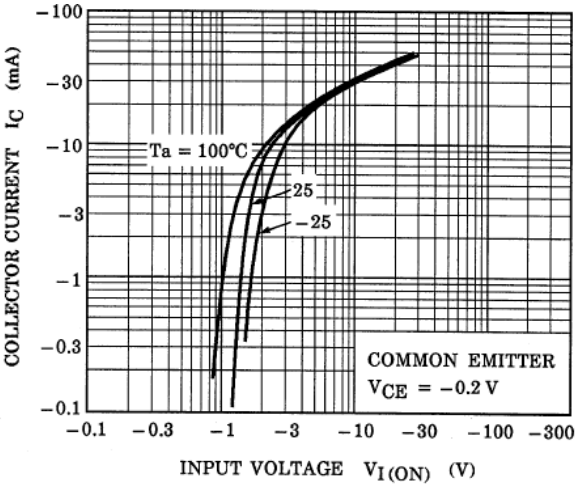



Fig. 10.3 RN2903 $I_C$-$V_{I(ON)}$

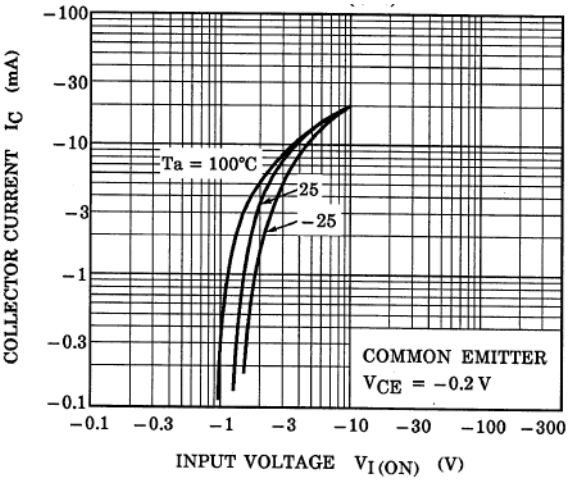



Fig. 10.4 RN2904 $I_C$-$V_{I(ON)}$

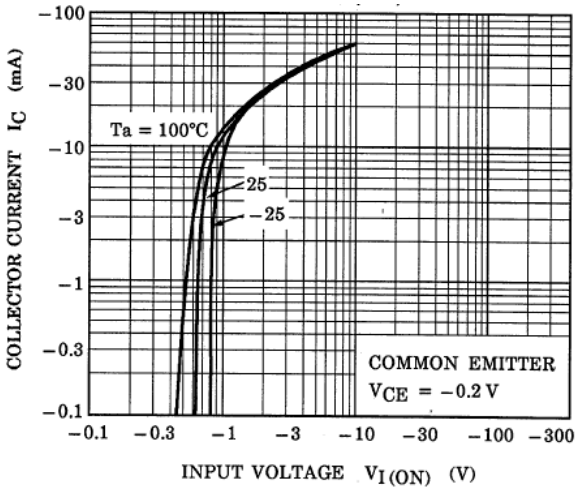



Fig. 10.5 RN2905 $I_C$-$V_{I(ON)}$

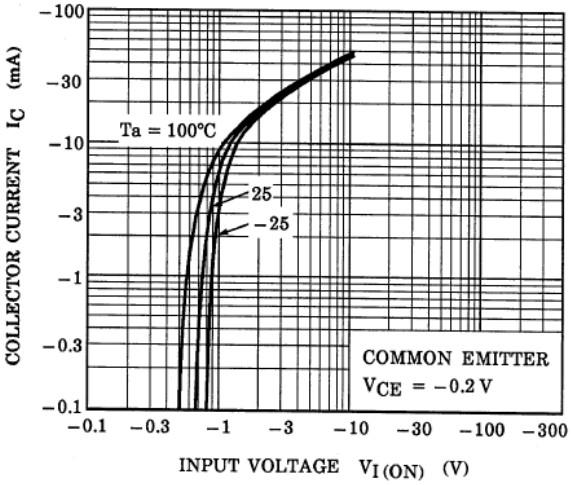



Fig. 10.6 RN2906 $I_C$-$V_{I(ON)}$

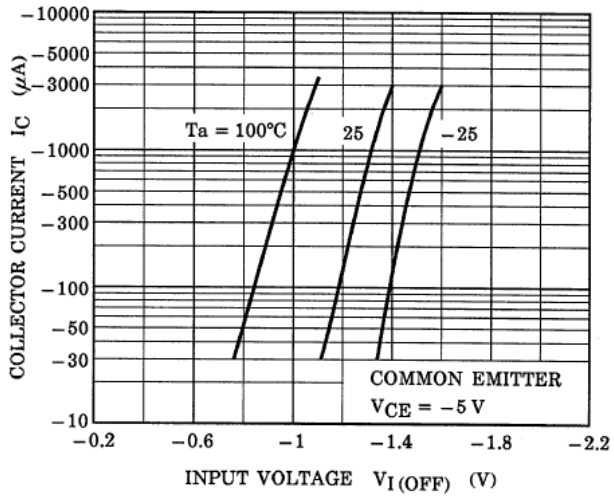



Fig. 10.7 RN2901 $I_C$-$V_{I(OFF)}$

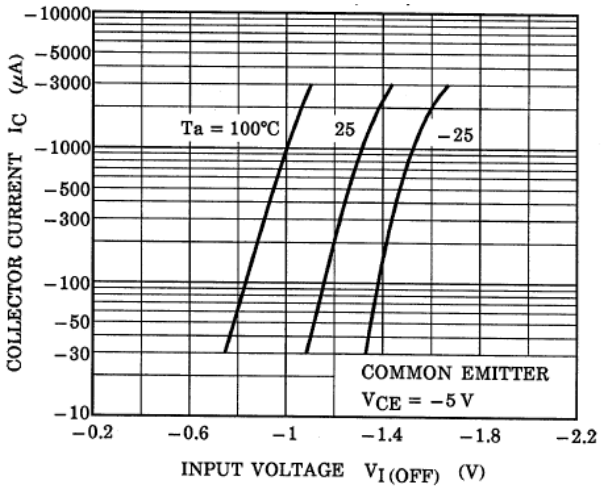



Fig. 10.8 RN2902 $I_C$-$V_{I(OFF)}$

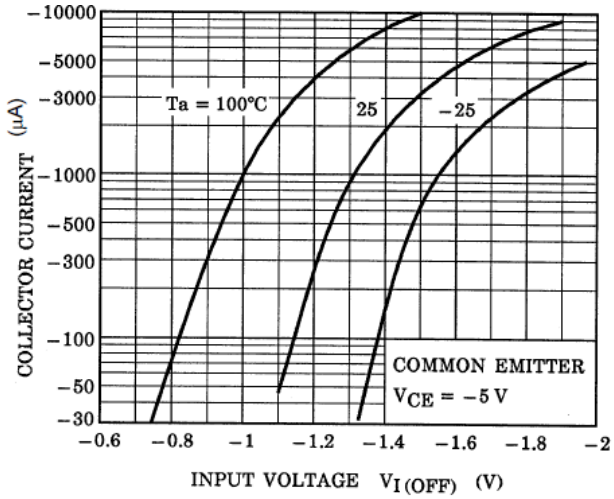



Fig. 10.9 RN2903 $I_C$-$V_{I(OFF)}$

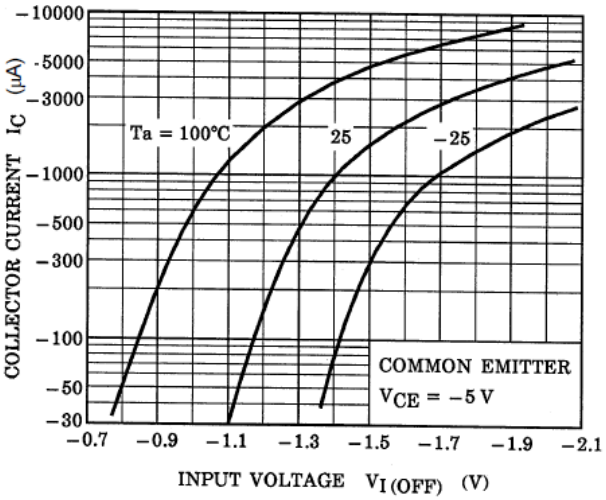



Fig. 10.10 RN2904 $I_C$-$V_{I(OFF)}$

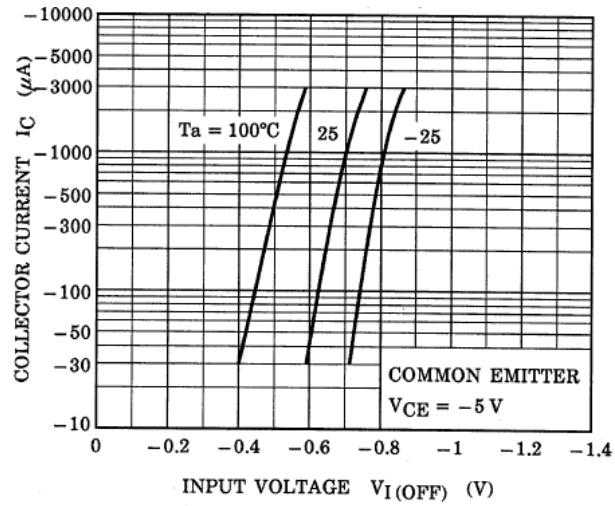



Fig. 10.11 RN2905 $I_C$-$V_{I(OFF)}$

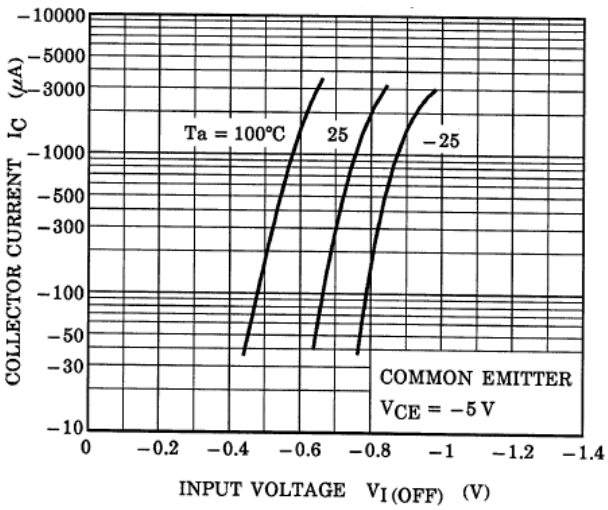



Fig. 10.12 RN2906 $I_C$-$V_{I(OFF)}$

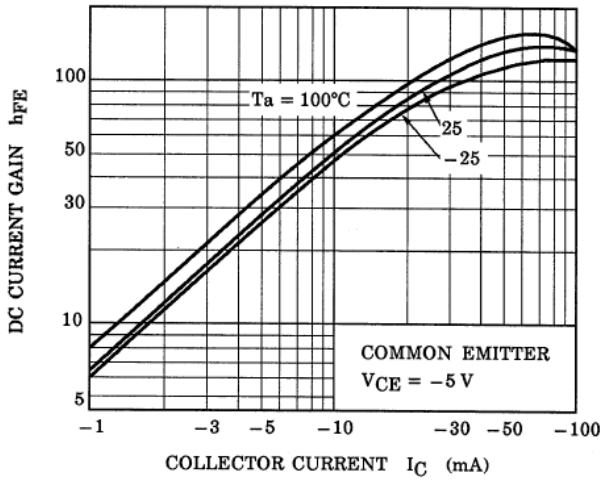



Fig. 10.13 RN2901 $h_{FE}$-$I_C$

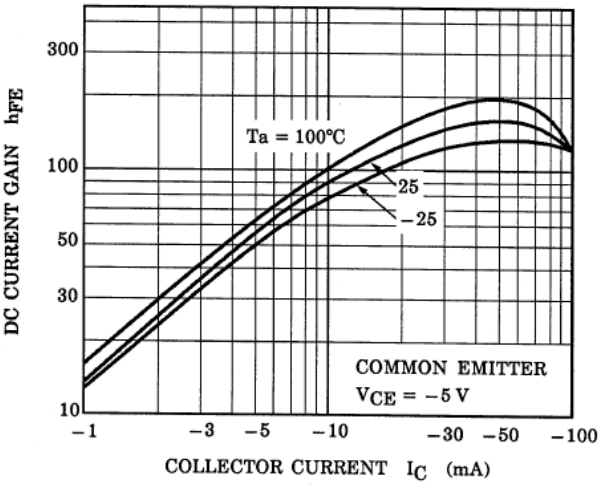



Fig. 10.14 RN2902 $h_{FE}$-$I_C$

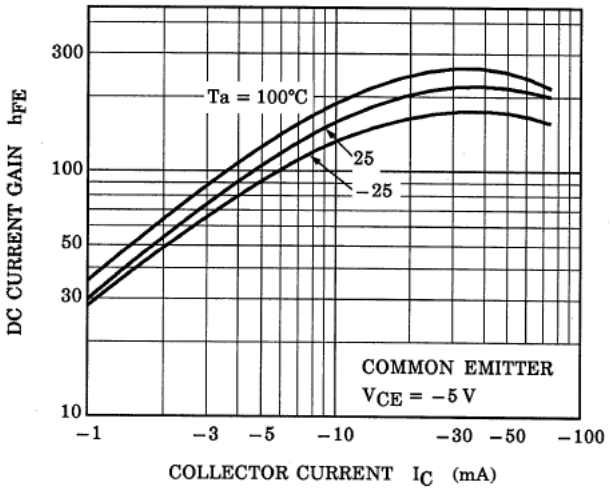



Fig. 10.15 RN2903 $h_{FE}$-$I_C$

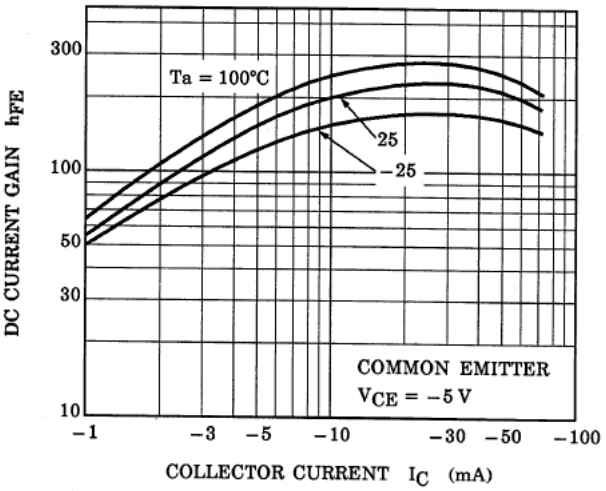



Fig. 10.16 RN2904 $h_{FE}$-$I_C$

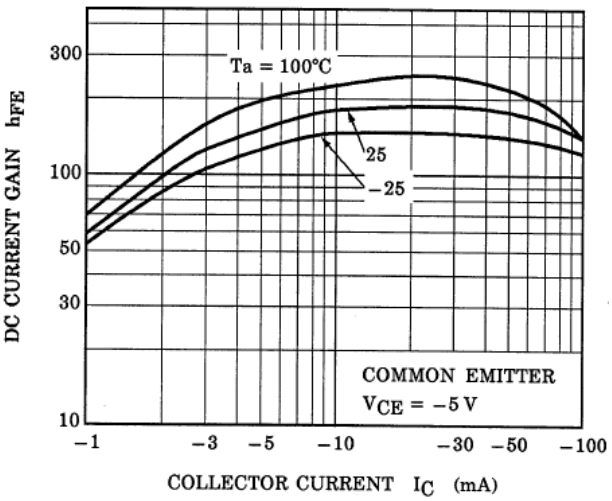



Fig. 10.17 RN2905 $h_{FE}$-$I_C$

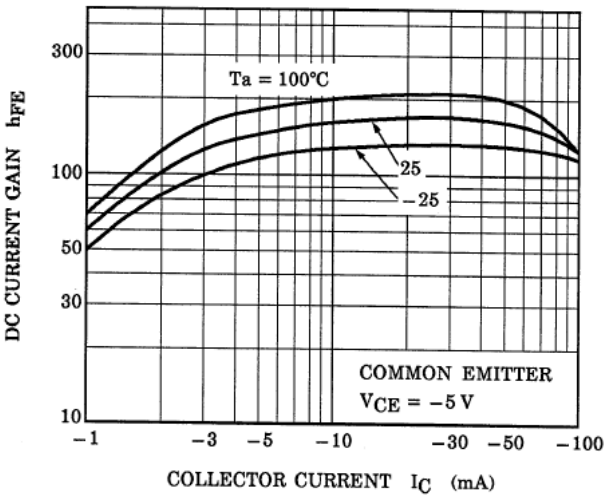



Fig. 10.18 RN2906 $h_{FE}$-$I_C$

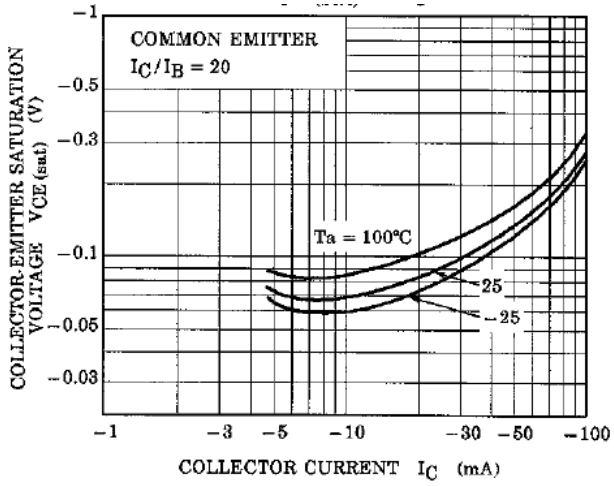



Fig. 10.19 RN2901 $V_{CE(sat)}$-$I_C$

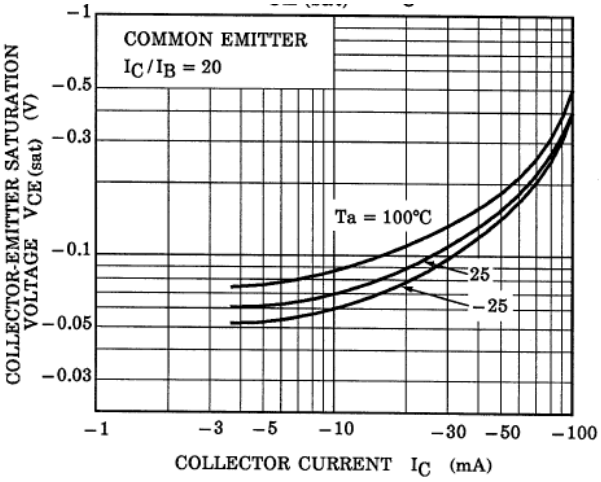



Fig. 10.20 RN2902 $V_{CE(sat)}$-$I_C$

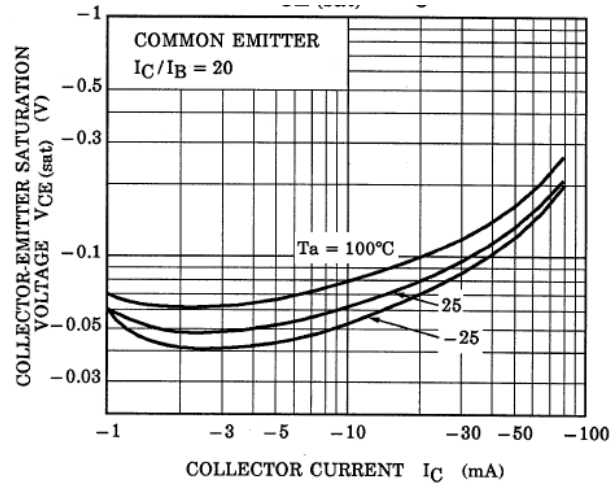



Fig. 10.21 RN2903 $V_{CE(sat)}$-$I_C$

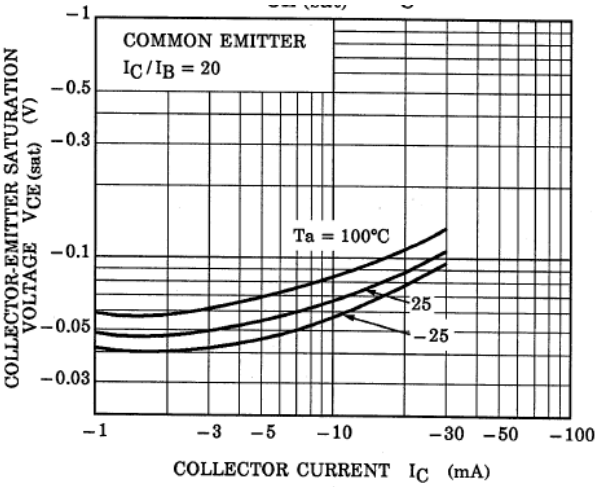



Fig. 10.22 RN2904 $V_{CE(sat)}$-$I_C$

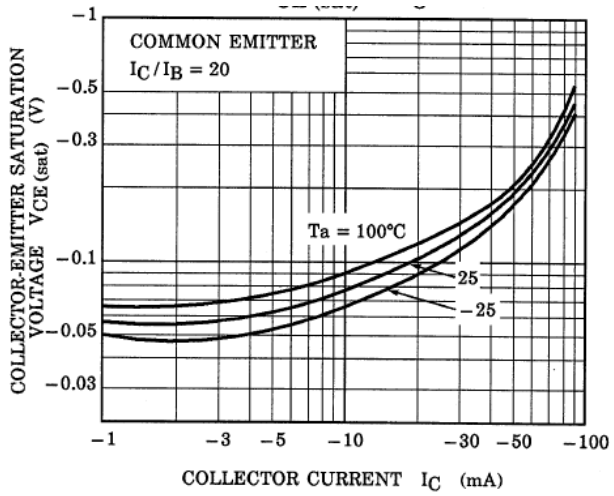



Fig. 10.23 RN2905 $V_{CE(sat)}$-$I_C$

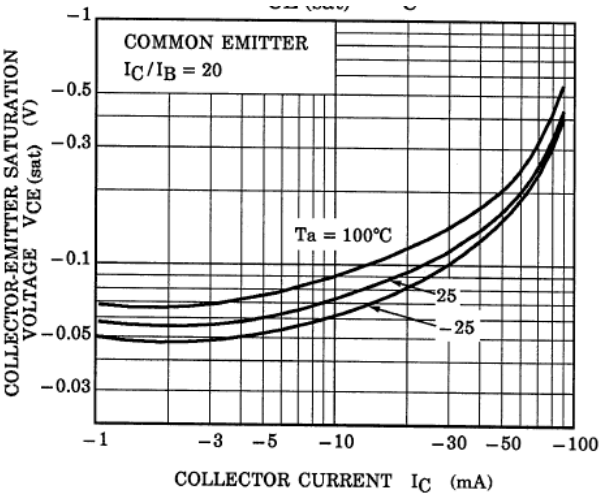
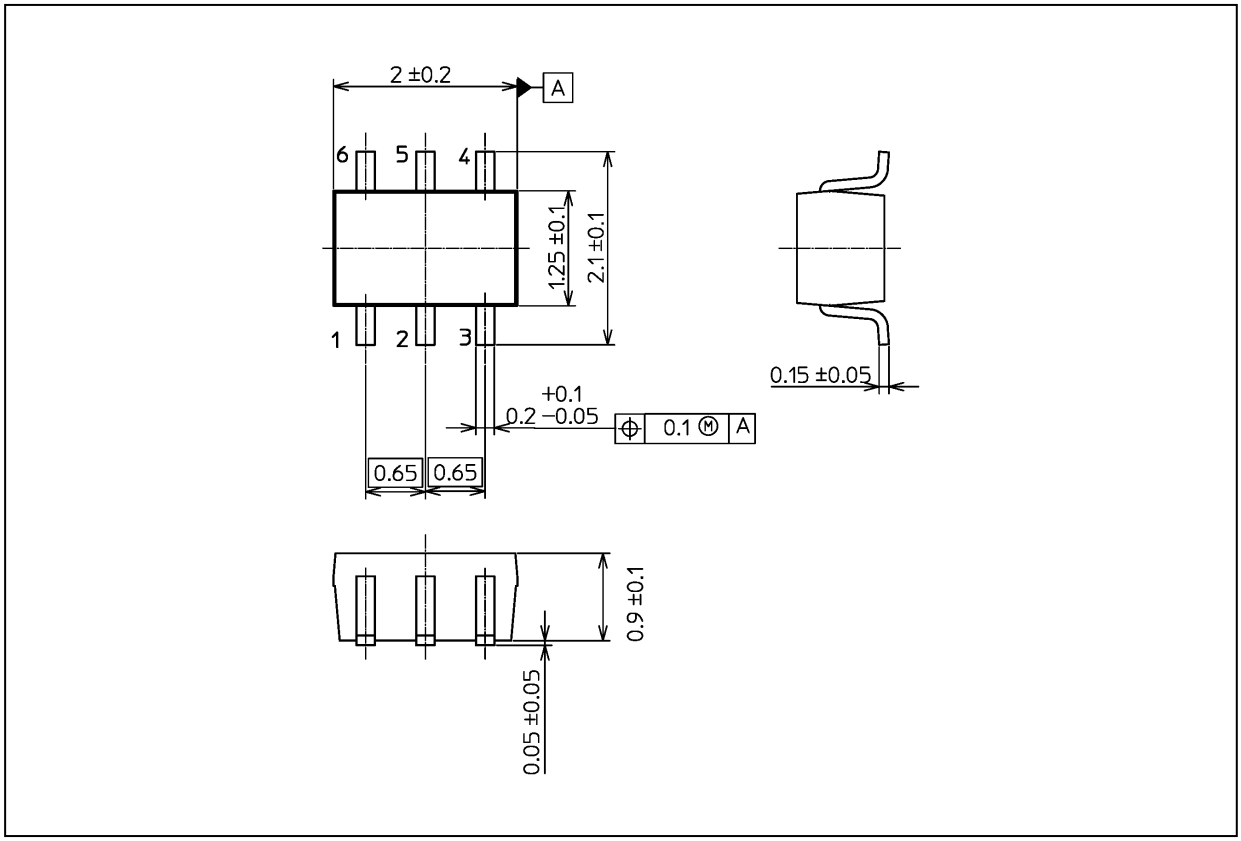



Fig. 10.24 RN1206 $V_{CE(sat)}$-$I_C$

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

## Package Dimensions

Unit: mm




Weight: 6.8 mg (typ.)

| Package Name(s) |
|---|
| TOSHIBA: 1-2T1S |
| Nickname: US6 |

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