

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

RN2307/08/09

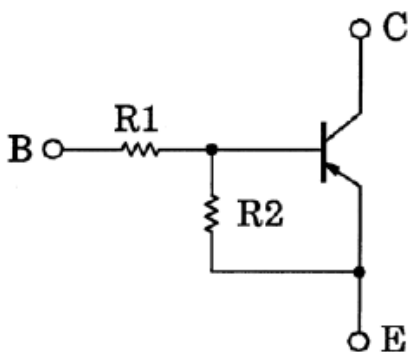
1. Applications

- Switching
- Inverter Circuits
- Interfacing
- Driver Circuits

2. Features

- (1) AEC-Q101 qualified (Please see the orderable part number list)
- (2) The integrated bias resistor reduces the number of external parts required, making it possible to reduce system size and assembly time.
- (3) Toshiba offers transistors with a wide range of resistance to accommodate various circuit designs.
- (4) Complementary to RN1307 to RN1309

3. Equivalent Circuit

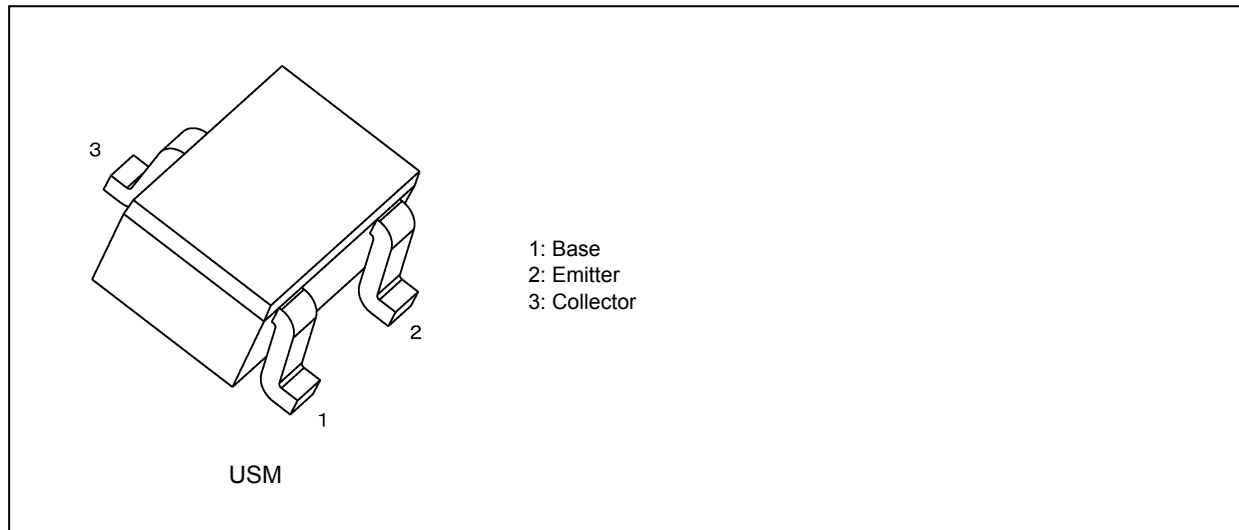


4. Bias Resistor Values

| Part No. | R1 (kΩ) | R2 (kΩ) |
|----------|---------|---------|
| RN2307 | 10 | 47 |
| RN2308 | 22 | 47 |
| RN2309 | 47 | 22 |

Start of commercial production
1988-04

5. Packaging and Pin Assignment



6. Orderable part number

| Orderable part number | | AEC-Q101 | Note | Note |
|-----------------------|-------------|----------|----------|-------------------------|
| RN2307 | RN2307,LF | — | | General Use |
| | RN2307,LXGF | YES | (Note 1) | Unintended Use (Note 1) |
| | RN2307,LXHF | YES | | Automotive Use |
| RN2308 | RN2308,LF | — | | General Use |
| | RN2308,LXGF | YES | (Note 1) | Unintended Use (Note 1) |
| | RN2308,LXHF | YES | | Automotive Use |
| RN2309 | RN2309,LF | — | | General Use |
| | RN2309,LXGF | YES | (Note 1) | Unintended Use (Note 1) |
| | RN2309,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, $T_a = 25\text{ }^\circ\text{C}$)

| Characteristics | | Symbol | Rating | Unit |
|-----------------------------|--------|-----------|------------|------------------|
| Collector-base voltage | | V_{CBO} | -50 | V |
| Collector-emitter voltage | | V_{CEO} | -50 | V |
| Emitter-base voltage | RN2307 | V_{EBO} | -6 | V |
| | RN2308 | | -7 | |
| | RN2309 | | -15 | |
| Collector current | | I_C | -100 | mA |
| Collector power dissipation | | 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).

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

| Characteristics | | Symbol | Test Condition | Min | Typ. | Max | Unit |
|--------------------------------------|-------------------|---------------|--|--------|-------|--------|------------|
| Collector cut-off current | RN2307~ RN2309 | 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 | RN2307 | I_{EBO} | $V_{EB} = -6\text{ V}, I_C = 0\text{ mA}$ | -0.081 | — | -0.15 | mA |
| | RN2308 | | | -0.078 | — | -0.145 | |
| | RN2309 | | | -0.167 | — | -0.311 | |
| DC current gain | RN2307 | h_{FE} | $V_{CE} = -5\text{ V}, I_C = -10\text{ mA}$ | 80 | — | — | — |
| | RN2308 | | | 80 | — | — | |
| | RN2309 | | | 70 | — | — | |
| Collector-emitter saturation voltage | RN2307~ RN2309 | $V_{CE(sat)}$ | $I_C = -5\text{ mA}, I_B = -0.25\text{ mA}$ | — | -0.1 | -0.3 | V |
| Input voltage (ON) | RN2307 | $V_{I(ON)}$ | $V_{CE} = -0.2\text{ V}, I_C = -5\text{ mA}$ | -0.7 | — | -1.8 | V |
| | RN2308 | | | -1.0 | — | -2.6 | |
| | RN2309 | | | -2.2 | — | -5.8 | |
| Input voltage (OFF) | RN2307 | $V_{I(OFF)}$ | $V_{CE} = -5\text{ V}, I_C = -0.1\text{ mA}$ | -0.5 | — | -1.0 | V |
| | RN2308 | | | -0.6 | — | -1.16 | |
| | RN2309 | | | -1.5 | — | -2.6 | |
| Transition frequency | RN2307~ RN2309 | f_T | $V_{CE} = -10\text{ V}, I_C = -5\text{ mA}$ | — | 200 | — | MHz |
| Collector output capacitance | RN2307~ RN2309 | C_{ob} | $V_{CB} = -10\text{ V}, I_E = 0\text{ mA}, f = 1\text{ MHz}$ | — | 3 | 6 | pF |
| Input resistance | RN2307 | R_1 | - | 7 | 10 | 13 | k Ω |
| | RN2308 | | | 15.4 | 22 | 28.6 | |
| | RN2309 | | | 32.9 | 47 | 61.1 | |
| Resistor ratio | RN2307 | R1/R2 | - | 0.191 | 0.213 | 0.232 | — |
| | RN2308 | | | 0.421 | 0.468 | 0.515 | |
| | RN2309 | | | 1.92 | 2.14 | 2.35 | |

9. Marking

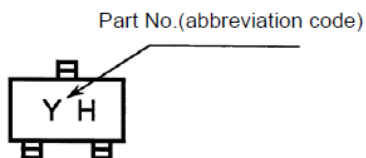


Fig. 9.1 Marking RN2307

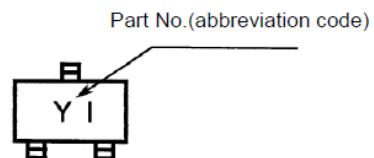


Fig. 9.2 Marking RN2308

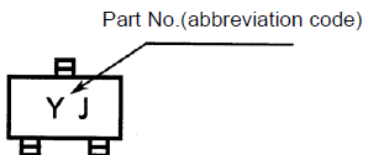


Fig. 9.3 Marking RN2309

10. Characteristics Curves (Note)

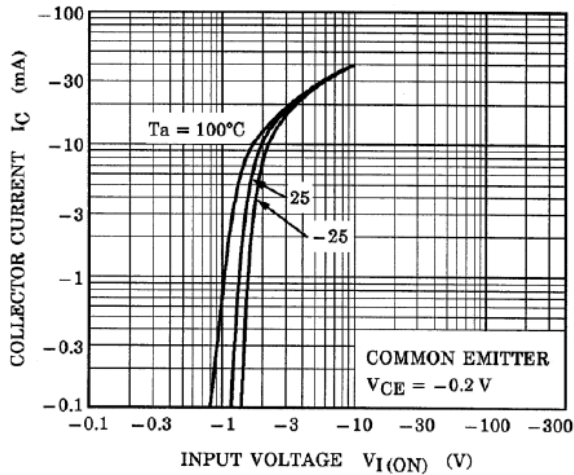


Fig. 10.1 RN2307 I_C - $V_{I(ON)}$

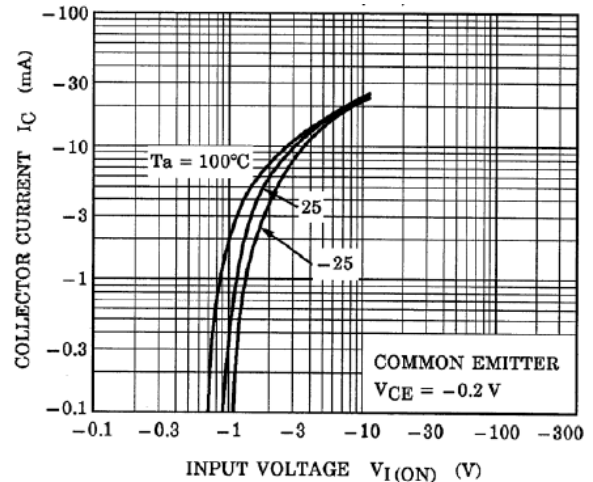


Fig. 10.2 RN2308 I_C - $V_{I(ON)}$

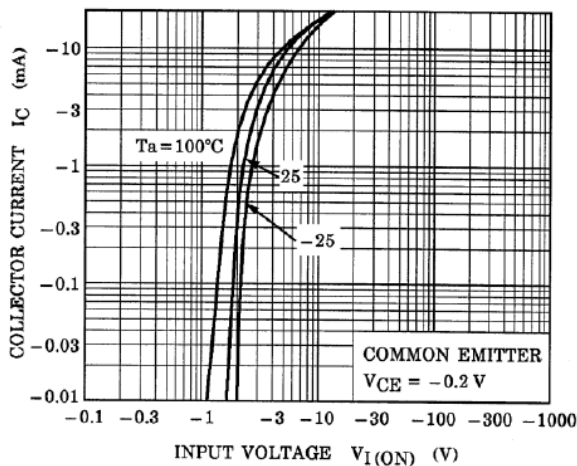


Fig. 10.3 RN2309 I_C - $V_{I(ON)}$

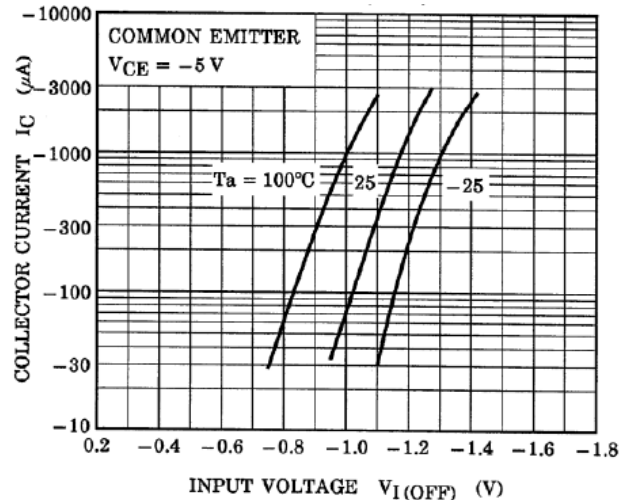


Fig. 10.4 RN2307 I_C - $V_{I(OFF)}$

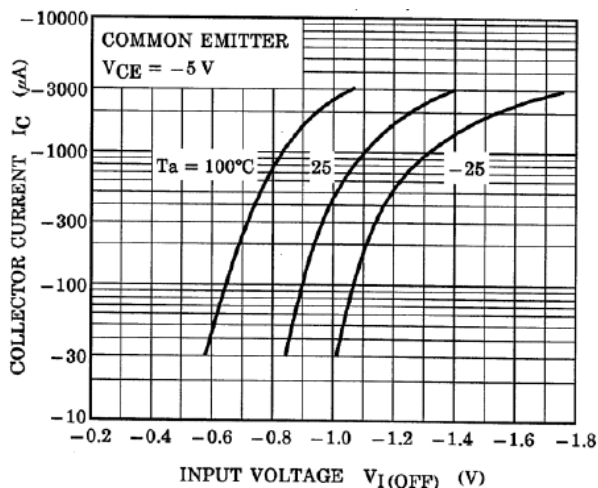


Fig. 10.5 RN2308 I_C - $V_{I(OFF)}$

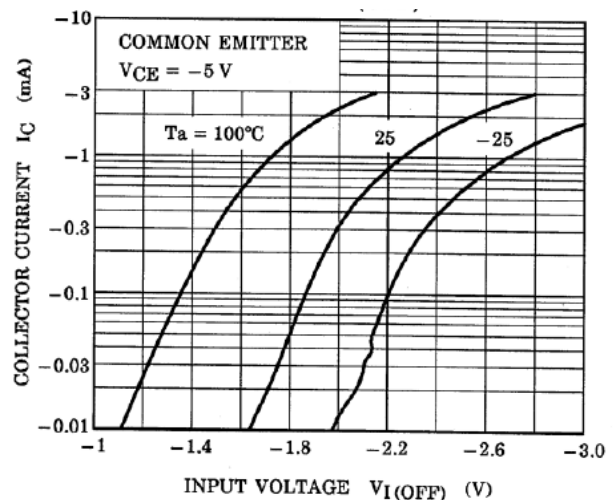


Fig. 10.6 RN2309 I_C - $V_{I(OFF)}$

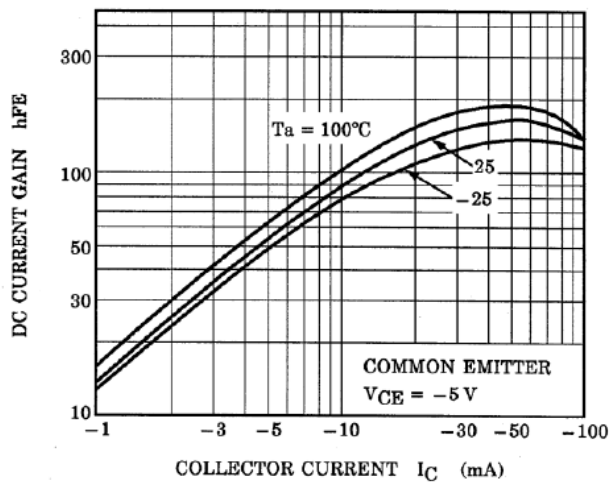


Fig. 10.7 RN2307 h_{FE} - I_C

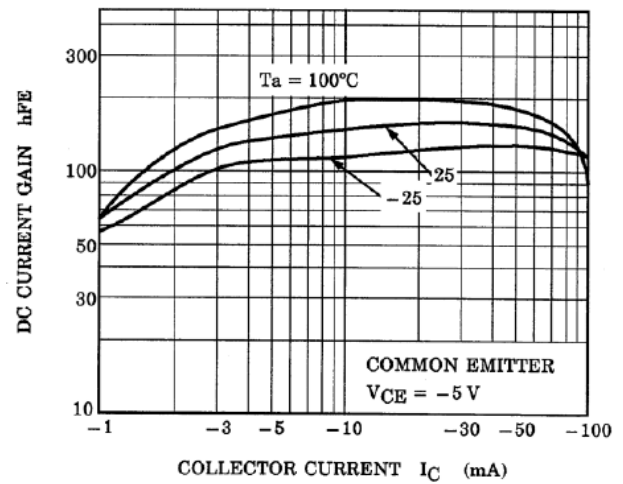


Fig. 10.8 RN2308 h_{FE} - I_C

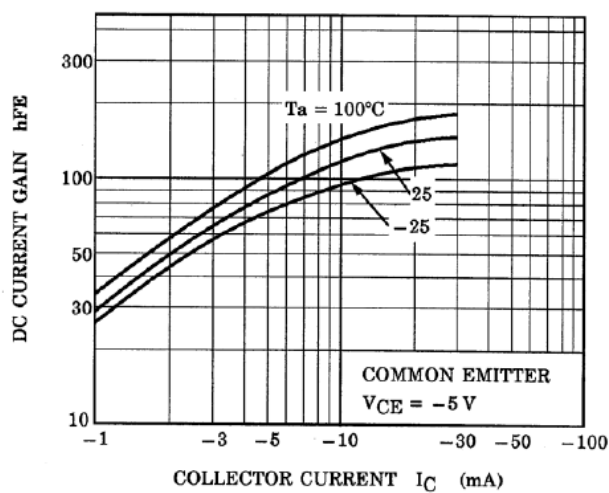


Fig. 10.9 RN2309 h_{FE} - I_C

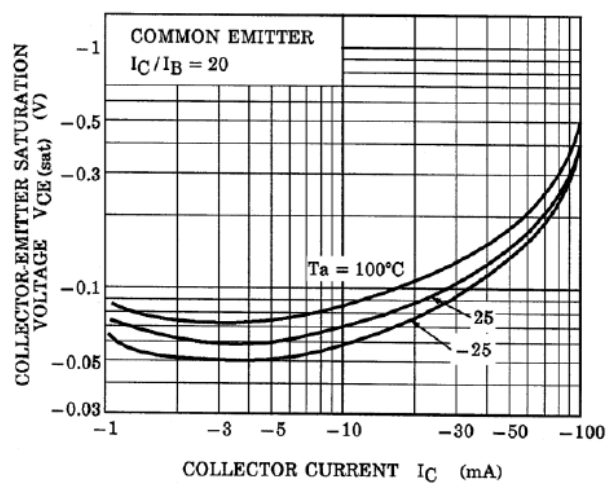


Fig. 10.10 RN2307 $V_{CE(sat)}$ - I_C

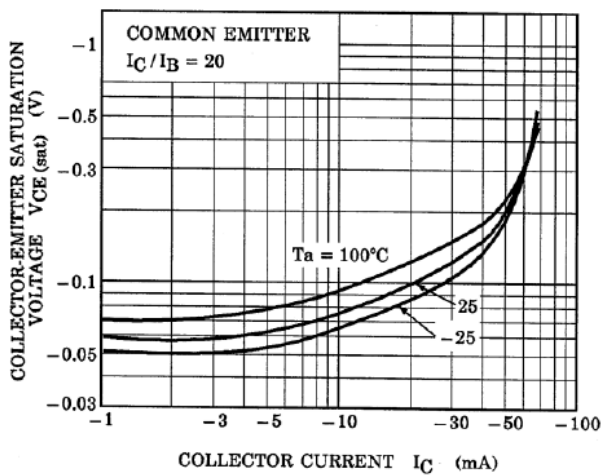


Fig. 10.11 RN2308 $V_{CE(sat)}$ - I_C

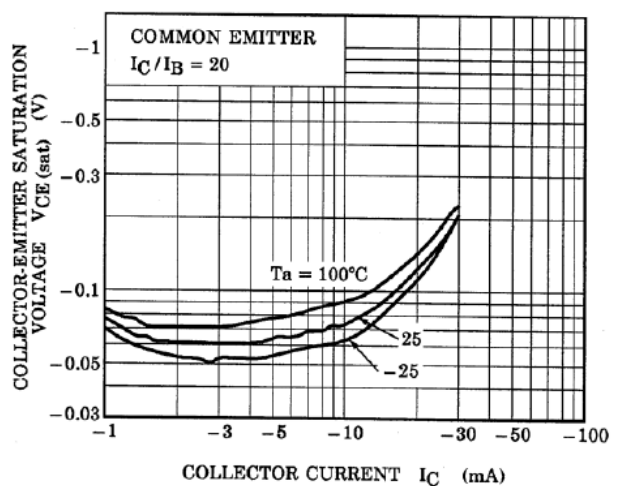


Fig. 10.12 RN2309 $V_{CE(sat)}$ - I_C

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

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