

# RN2307/08/09

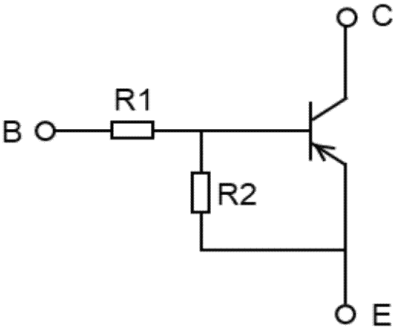
## 1. Applications

- 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

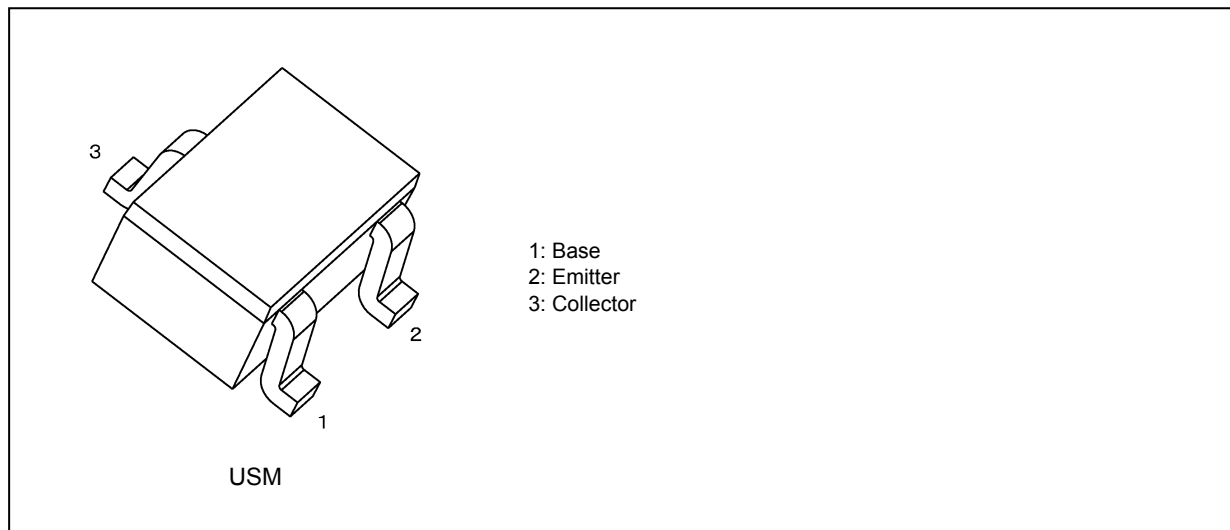


## 4. Bias Resistor Values

| 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                    |
|-----------------------|-------------|--------------|-------------------------|
| 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      | RN2307 to RN2309 | $V_{CBO}$ | -50        | V                  |
| Collector-emitter voltage   |                  | $V_{CEO}$ | -50        |                    |
| Emitter-base voltage        | RN2307           | $V_{EBO}$ | -6         |                    |
|                             | RN2308           |           | -7         |                    |
|                             | RN2309           |           | -15        |                    |
| Collector current           | RN2307 to RN2309 | $I_C$     | -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 to 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           |               | $V_{EB} = -7\text{ V}, I_C = 0\text{ mA}$                    | -0.078 | —     | -0.145 |            |
|                                      | RN2309           |               | $V_{EB} = -15\text{ V}, I_C = 0\text{ mA}$                   | -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 to 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 to RN2309 | $f_T$         | $V_{CE} = -10\text{ V}, I_C = -5\text{ mA}$                  | —      | 200   | —      | MHz        |
| Collector output capacitance         | RN2307 to 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 $\Omega$ |
|                                      | 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

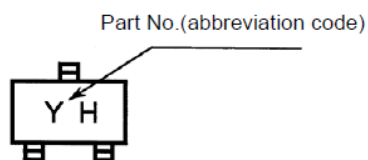


Fig. 9.1 Marking RN2307

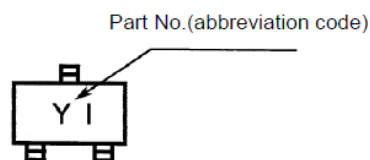


Fig. 9.2 Marking RN2308

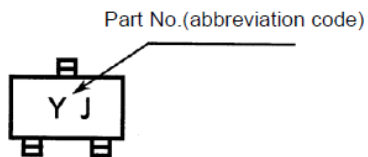


Fig. 9.3 Marking RN2309

10. Characteristics Curves (Note)

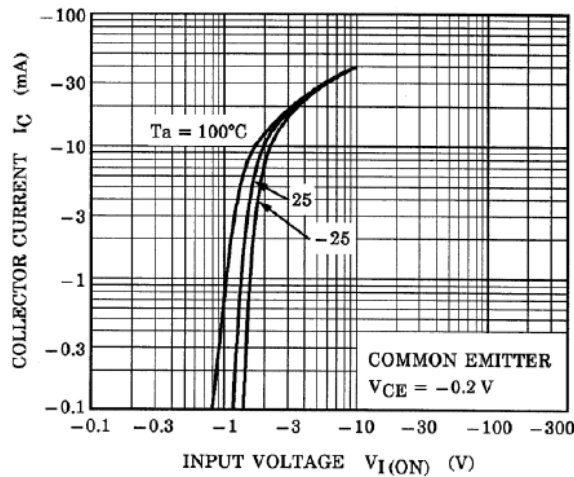


Fig. 10.1 RN2307  $I_C$ - $V_{I(ON)}$

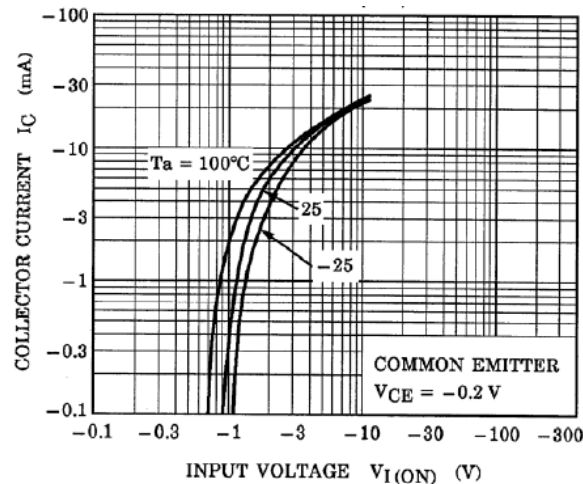


Fig. 10.2 RN2308  $I_C$ - $V_{I(ON)}$

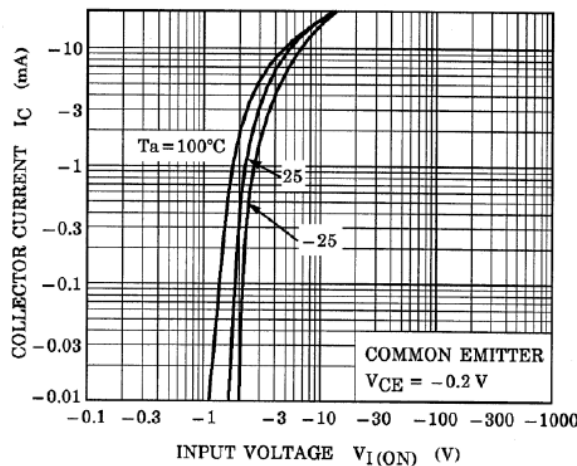


Fig. 10.3 RN2309  $I_C$ - $V_{I(ON)}$

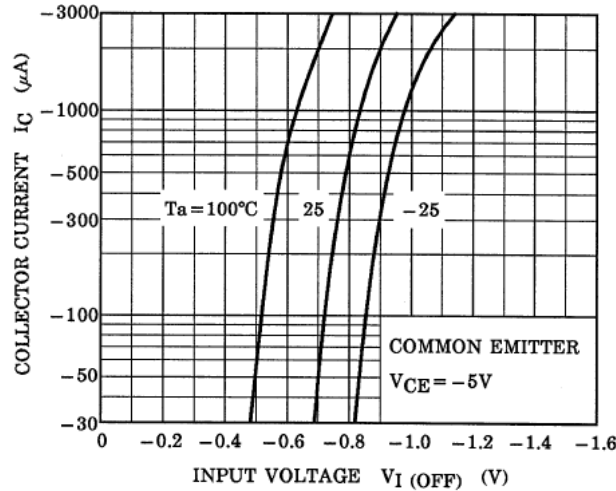


Fig. 10.4 RN2307  $I_C$ - $V_{I(OFF)}$

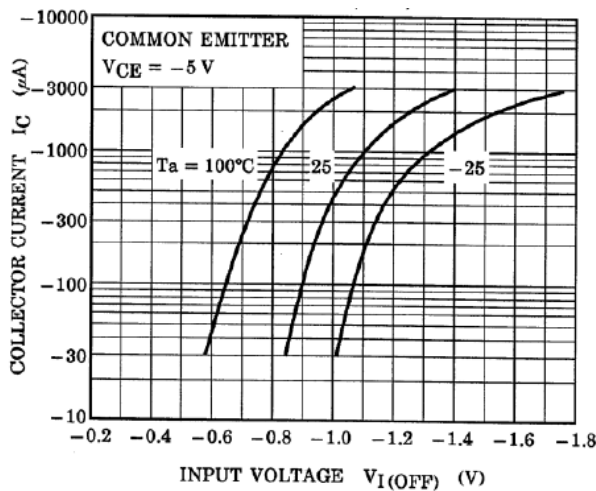


Fig. 10.5 RN2308  $I_C$ - $V_{I(OFF)}$

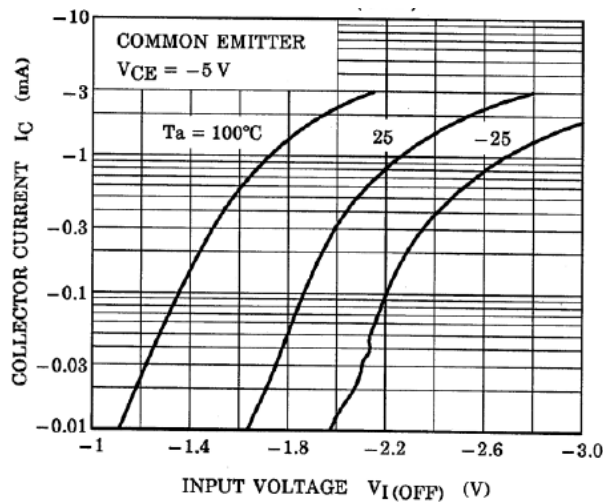


Fig. 10.6 RN2309  $I_C$ - $V_{I(OFF)}$

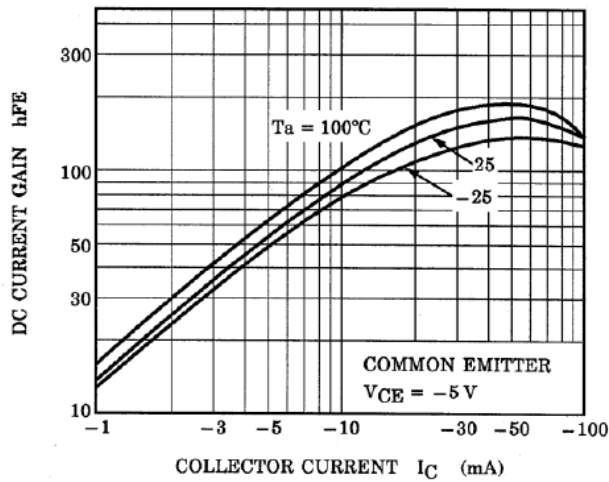


Fig. 10.7 RN2307  $h_{FE}$ - $I_C$

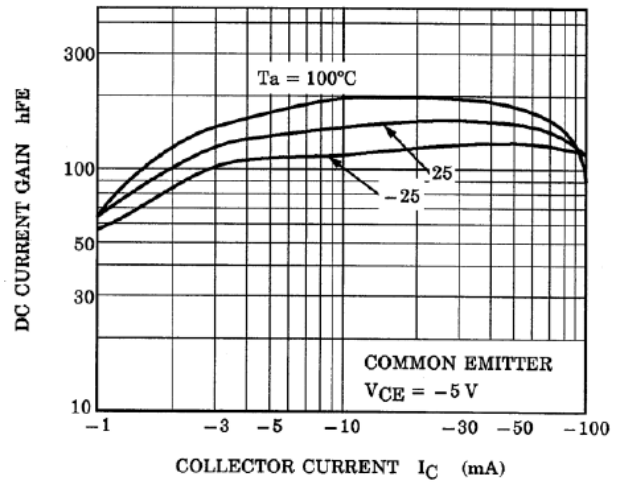


Fig. 10.8 RN2308  $h_{FE}$ - $I_C$

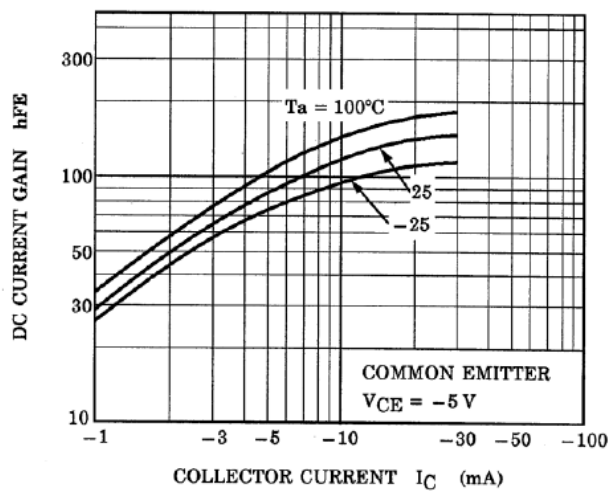


Fig. 10.9 RN2309  $h_{FE}$ - $I_C$

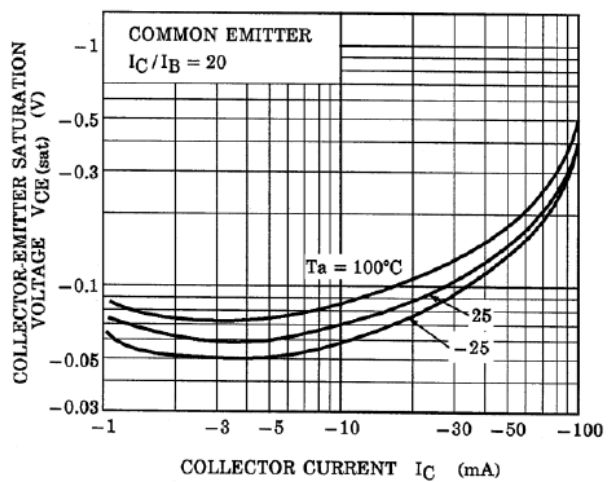


Fig. 10.10 RN2307  $V_{CE(sat)}$ - $I_C$

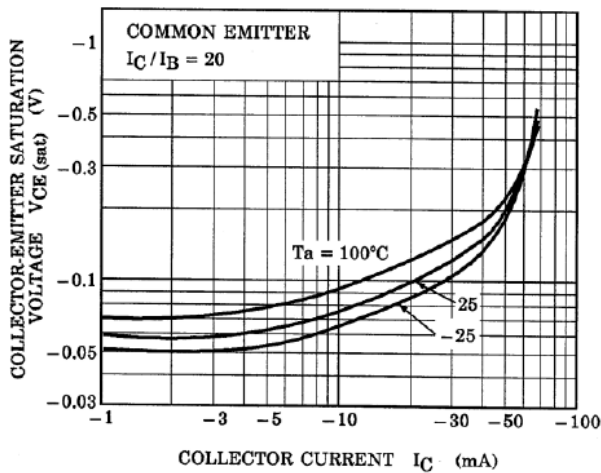


Fig. 10.11 RN2308  $V_{CE(sat)}$ - $I_C$

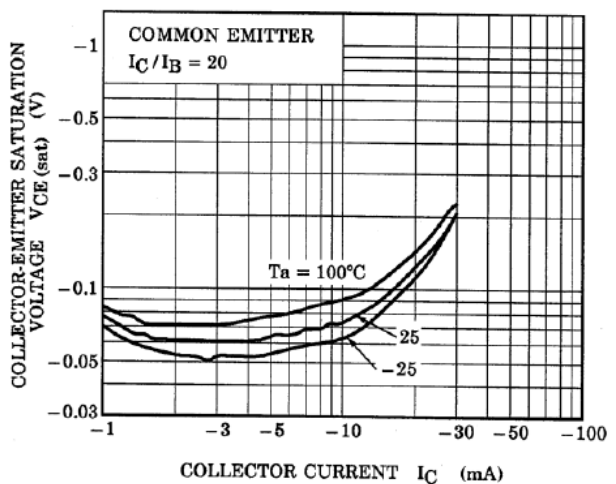
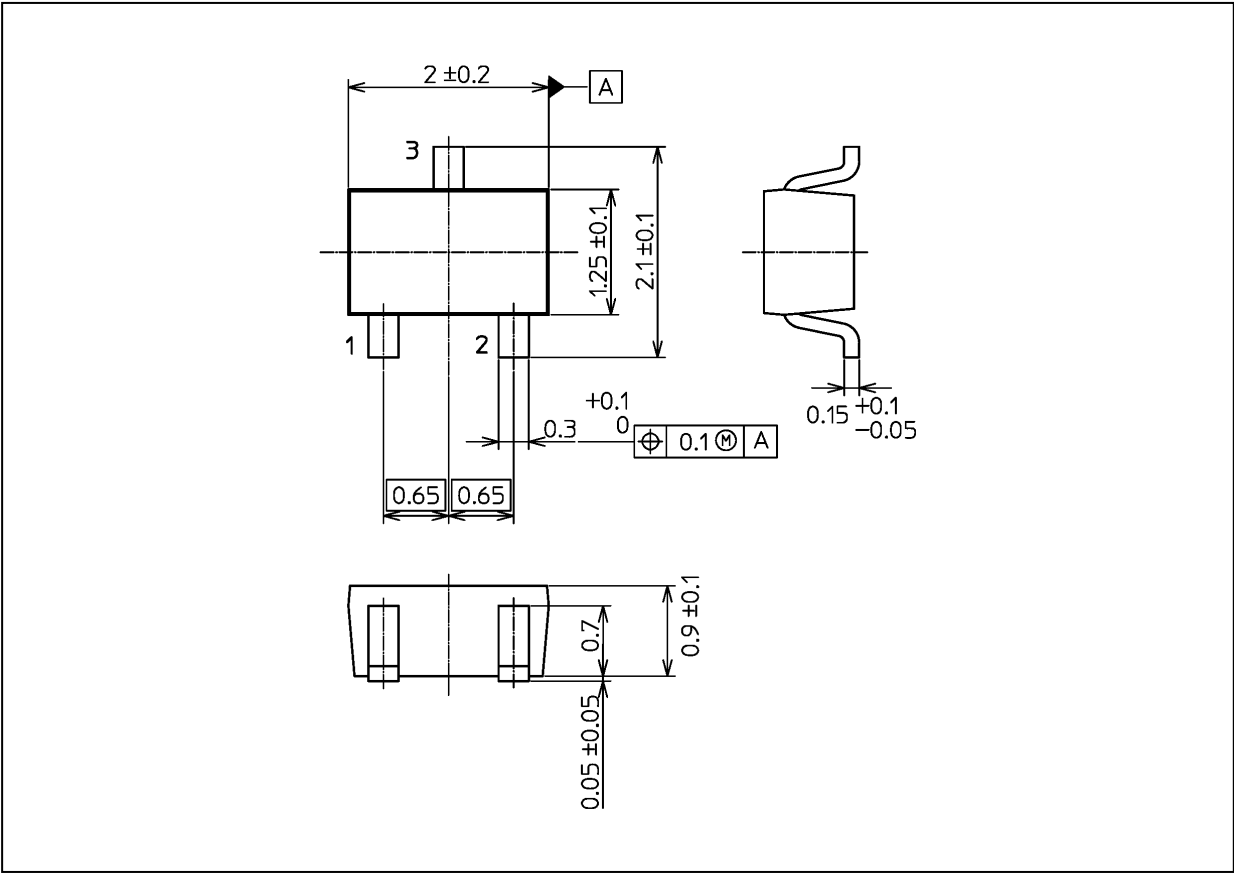


Fig. 10.12 RN2309  $V_{CE(sat)}$ - $I_C$

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

Package Dimensions

Unit: mm



Weight: 6.0 mg (typ.)

| Package Name(s) |
|-----------------|
| Nickname: USM   |

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