

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

# RN1314/15/16/17/18

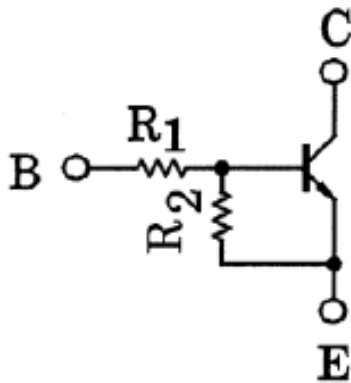
## 1. Applications

- 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 RN2314 to RN2318

## 3. Equivalent Circuit

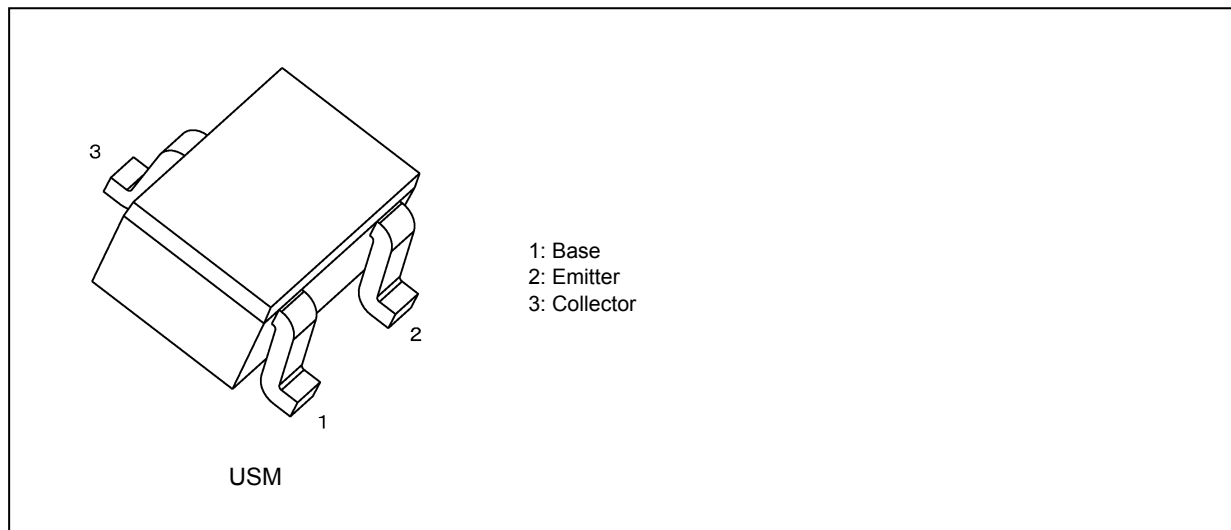


## 4. Bias Resistor Values

| Part No. | R1 (k $\Omega$ ) | R2 (k $\Omega$ ) |
|----------|------------------|------------------|
| RN1314   | 1                | 10               |
| RN1315   | 2.2              | 10               |
| RN1316   | 4.7              | 10               |
| RN1317   | 10               | 4.7              |
| RN1318   | 47               | 10               |

Start of commercial production  
2002-11

### 5. Packaging and Pin Assignment



### 6. Orderable part number

| Orderable part number |                 | AEC-Q101 | Note     | Note                    |
|-----------------------|-----------------|----------|----------|-------------------------|
| RN1314                | RN1314,LF       | —        |          | General Use             |
|                       | RN1314,LXGF     | YES      | (Note 1) | Unintended Use (Note 1) |
|                       | —               | YES      |          | Automotive Use          |
| RN1315                | RN1315,LF       | —        |          | General Use             |
|                       | RN1315,LXGF     | YES      | (Note 1) | Unintended Use (Note 1) |
|                       | RN1315,LXHF     | YES      |          | Automotive Use          |
| RN1316                | RN1316,LF       | —        |          | General Use             |
|                       | RN1316,LXGF     | YES      | (Note 1) | Unintended Use (Note 1) |
|                       | RN1316,LXHF     | YES      |          | Automotive Use          |
| RN1317                | RN1317(TE85L,F) | —        |          | General Use             |
|                       | —               | YES      | (Note 1) | Unintended Use (Note 1) |
|                       | —               | YES      |          | Automotive Use          |
| RN1318                | RN1318(TE85L,F) | —        |          | General Use             |
|                       | —               | YES      | (Note 1) | Unintended Use (Note 1) |
|                       | —               | 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      | RN1314~RN1318 | $V_{CBO}$ | 50         | V                |
| Collector-emitter voltage   |               | $V_{CEO}$ | 50         |                  |
| Emitter-base voltage        | RN1314        | $V_{EBO}$ | 5          | V                |
|                             | RN1315        |           | 6          |                  |
|                             | RN1316        |           | 7          |                  |
|                             | RN1317        |           | 15         |                  |
|                             | RN1318        |           | 25         |                  |
| Collector current           | RN1314~RN1318 | $I_C$     | 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            | RN1314~<br>RN1318          | $I_{CBO}$     | $V_{CB} = 50\text{ V}, I_E = 0\text{ mA}$                   | —    | —    | 100  | nA         |
|                                      |                            | $I_{CEO}$     | $V_{CE} = 50\text{ V}, I_B = 0\text{ mA}$                   | —    | —    | 500  |            |
| Emitter cut-off current              | RN1314                     | $I_{EBO}$     | $V_{EB} = 5\text{ V}, I_C = 0\text{ mA}$                    | 0.35 | —    | 0.65 | mA         |
|                                      | RN1315                     |               | $V_{EB} = 6\text{ V}, I_C = 0\text{ mA}$                    | 0.37 | —    | 0.71 |            |
|                                      | RN1316                     |               | $V_{EB} = 7\text{ V}, I_C = 0\text{ mA}$                    | 0.36 | —    | 0.68 |            |
|                                      | RN1317                     |               | $V_{EB} = 15\text{ V}, I_C = 0\text{ mA}$                   | 0.78 | —    | 1.46 |            |
|                                      | RN1318                     |               | $V_{EB} = 25\text{ V}, I_C = 0\text{ mA}$                   | 0.33 | —    | 0.63 |            |
| DC current gain                      | RN1314 - RN1316,<br>RN1318 | $h_{FE}$      | $V_{CE} = 5\text{ V}, I_C = 10\text{ mA}$                   | 50   | —    | —    | —          |
|                                      | RN1317                     |               |   | 30   | —    | —    |            |
| Collector-emitter saturation voltage | RN1314~<br>RN1318          | $V_{CE(sat)}$ | $I_C = 5\text{ mA}, I_B = 0.25\text{ mA}$                   | —    | 0.1  | 0.3  | V          |
| Input voltage (ON)                   | RN1314                     | $V_{I(ON)}$   | $V_{CE} = 0.2\text{ V}, I_C = 5\text{ mA}$                  | 0.6  | —    | 2.0  | V          |
|                                      | RN1315                     |               |   | 0.7  | —    | 2.5  |            |
|                                      | RN1316                     |               |   | 0.8  | —    | 2.5  |            |
|                                      | RN1317                     |               |   | 1.5  | —    | 3.5  |            |
|                                      | RN1318                     |               |   | 2.5  | —    | 10.0 |            |
| Input voltage (OFF)                  | RN1314                     | $V_{I(OFF)}$  | $V_{CE} = 5\text{ V}, I_C = 0.1\text{ mA}$                  | 0.3  | —    | 0.9  | V          |
|                                      | RN1315                     |               |   | 0.3  | —    | 1.0  |            |
|                                      | RN1316                     |               |   | 0.3  | —    | 1.1  |            |
|                                      | RN1317                     |               |   | 0.3  | —    | 2.3  |            |
|                                      | RN1318                     |               |   | 0.5  | —    | 5.7  |            |
| Transition frequency                 | RN1314~<br>RN1318          | $f_T$         | $V_{CE} = 10\text{ V}, I_C = 5\text{ mA}$                   | —    | 250  | —    | MHz        |
| Collector output capacitance         | RN1314~<br>RN1318          | $C_{ob}$      | $V_{CB} = 10\text{ V}, I_E = 0\text{ mA}, f = 1\text{ MHz}$ | —    | 3.0  | 6.0  | pF         |
| Input resistance                     | RN1314                     | $R_1$         | -   | 0.7  | 1.0  | 1.3  | k $\Omega$ |
|                                      | RN1315                     |               |   | 1.54 | 2.2  | 2.86 |            |
|                                      | RN1316                     |               |   | 3.29 | 4.7  | 6.11 |            |
|                                      | RN1317                     |               |   | 7.0  | 10.0 | 13.0 |            |
|                                      | RN1318                     |               |   | 32.9 | 47.0 | 61.1 |            |
| Resistor ratio                       | RN1314                     | R1/R2         | -   | —    | 0.1  | —    | —          |
|                                      | RN1315                     |               |   | —    | 0.22 | —    |            |
|                                      | RN1316                     |               |   | —    | 0.47 | —    |            |
|                                      | RN1317                     |               |   | —    | 2.13 | —    |            |
|                                      | RN1318                     |               |   | —    | 4.7  | —    |            |

### 9. Marking

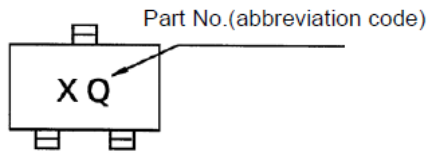


Fig. 9.1 Marking RN1314

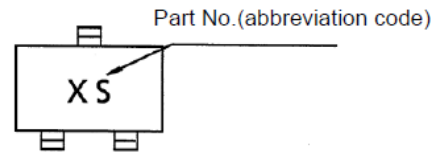


Fig. 9.2 Marking RN1315

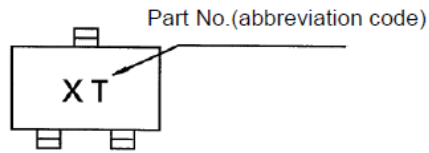


Fig. 9.3 Marking RN1316

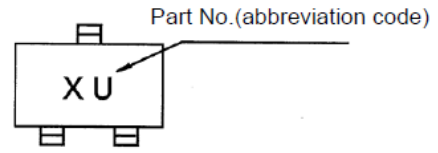


Fig. 9.4 Marking RN1317

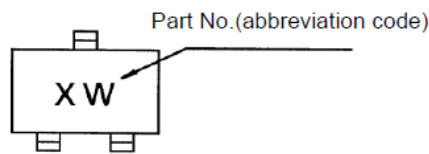


Fig. 9.5 Marking RN1318

### 10. Characteristics Curves (Note)

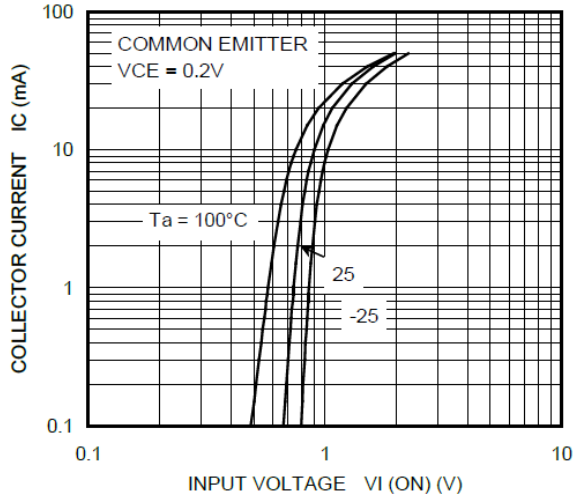


Fig. 10.1 RN1314  $I_C$ - $V_{I(ON)}$

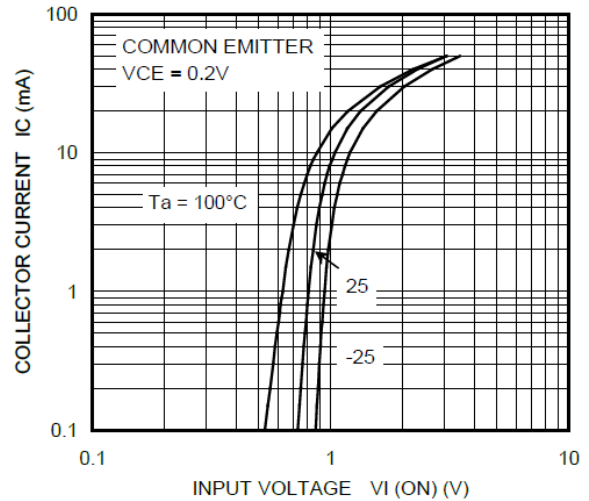


Fig. 10.2 RN1315  $I_C$ - $V_{I(ON)}$

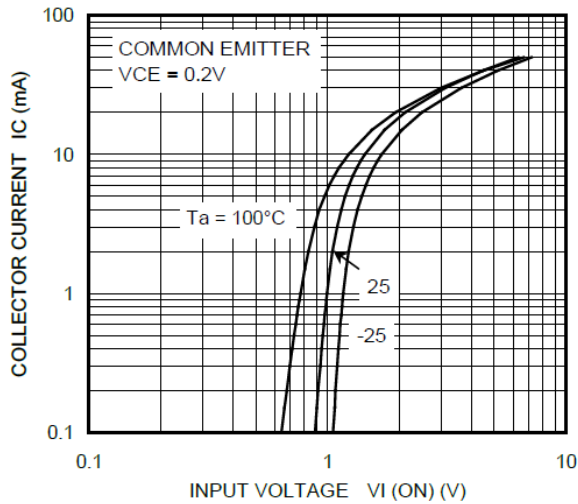


Fig. 10.3 RN1316  $I_C$ - $V_{I(ON)}$

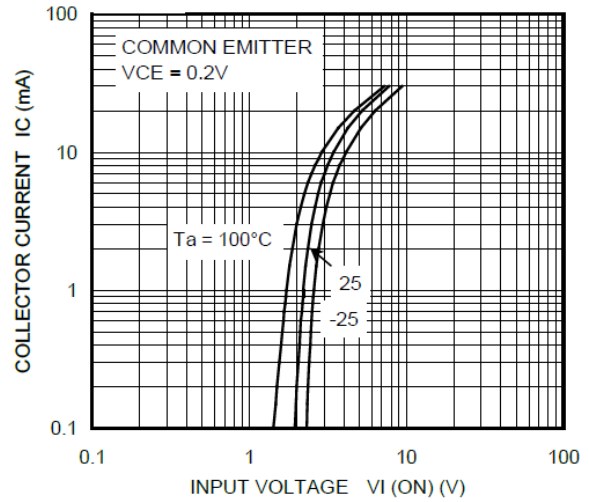


Fig. 10.4 RN1317  $I_C$ - $V_{I(ON)}$

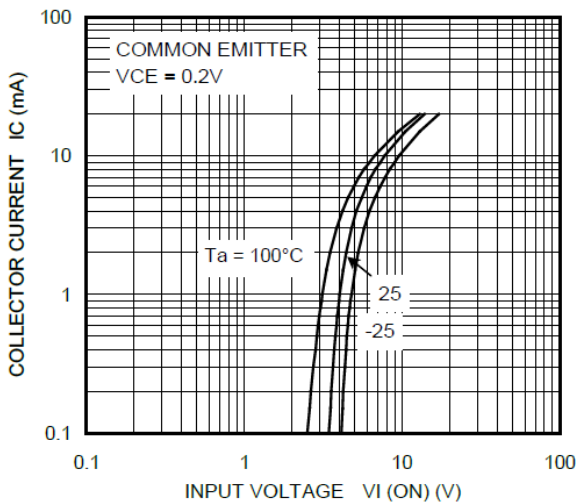


Fig. 10.5 RN1318  $I_C$ - $V_{I(ON)}$

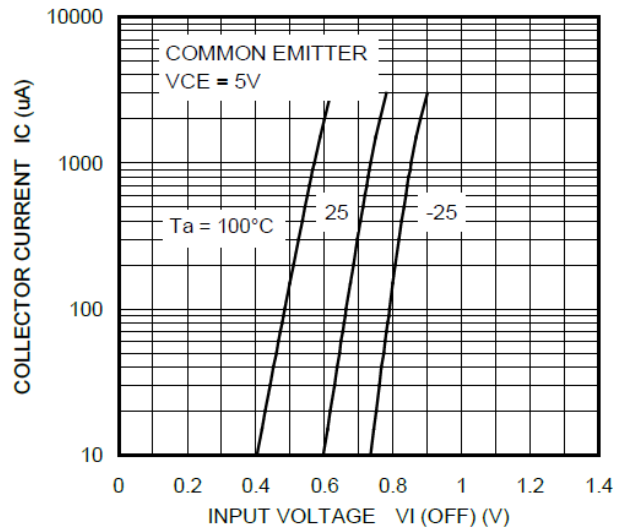


Fig. 10.6 RN1314  $I_C$ - $V_{I(OFF)}$

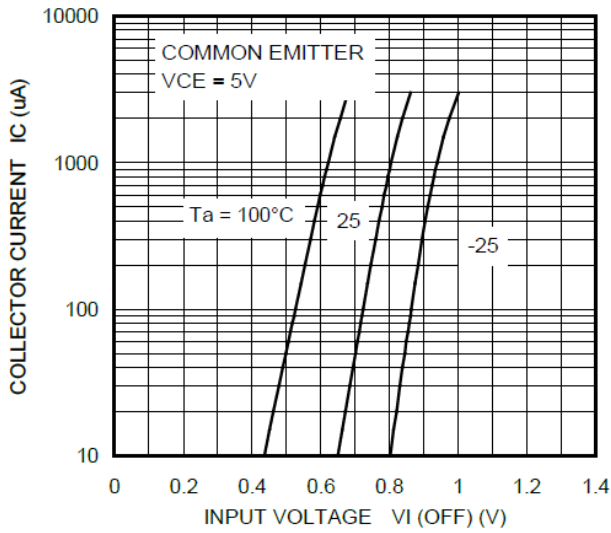


Fig. 10.7 RN1315  $I_C$ - $V_{I(OFF)}$

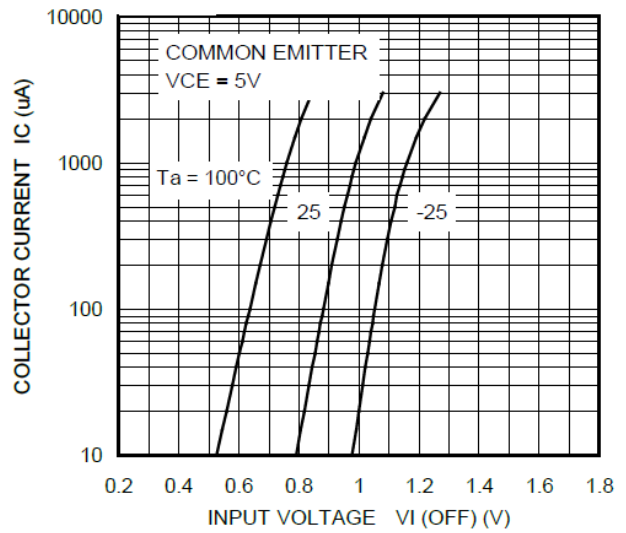


Fig. 10.8 RN1316  $I_C$ - $V_{I(OFF)}$

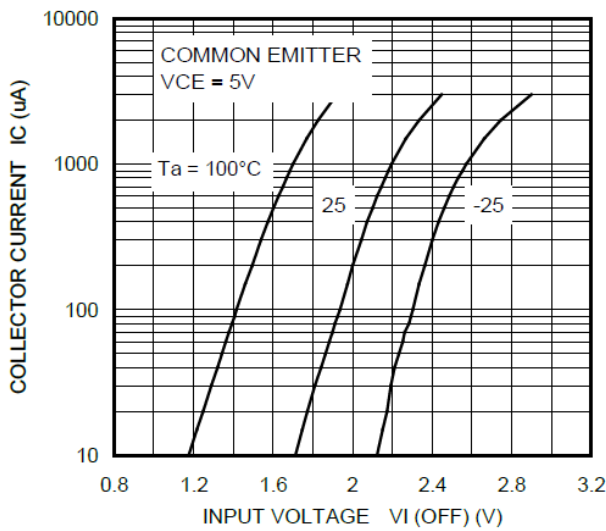


Fig. 10.9 RN1317  $I_C$ - $V_{I(OFF)}$

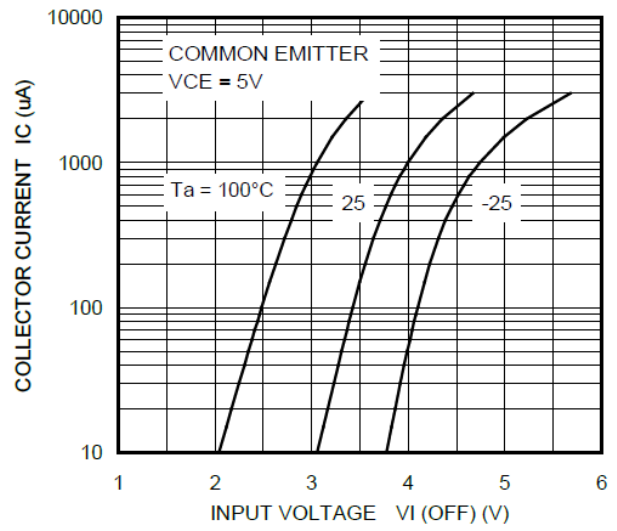


Fig. 10.10 RN1318  $I_C$ - $V_{I(OFF)}$

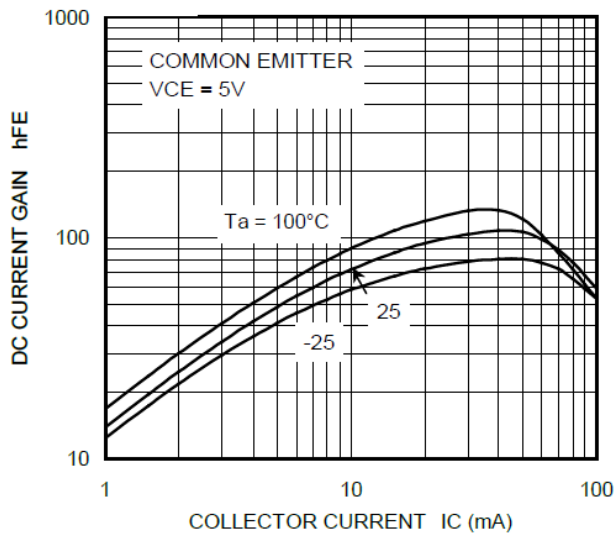


Fig. 10.11 RN1314  $h_{FE}$ - $I_C$

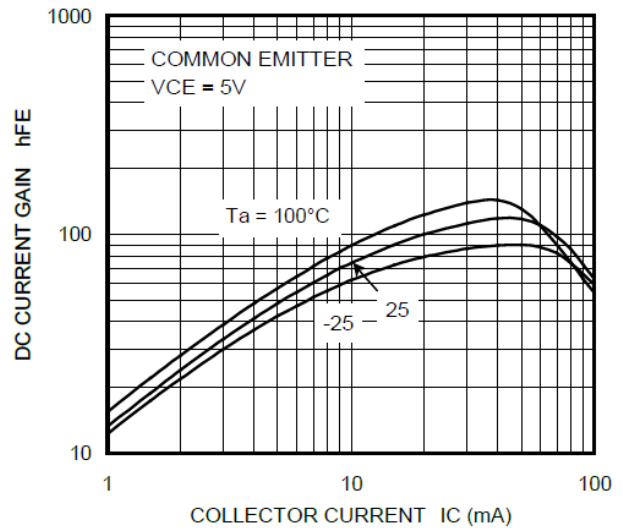


Fig. 10.12 RN1315  $h_{FE}$ - $I_C$

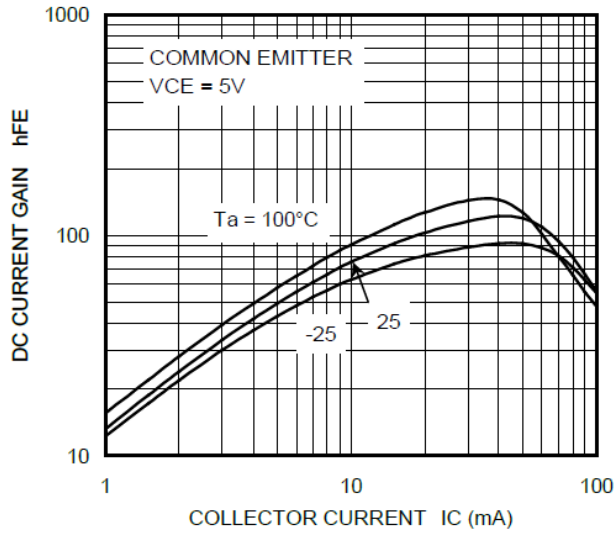


Fig. 10.13 RN1316  $h_{FE}-I_C$

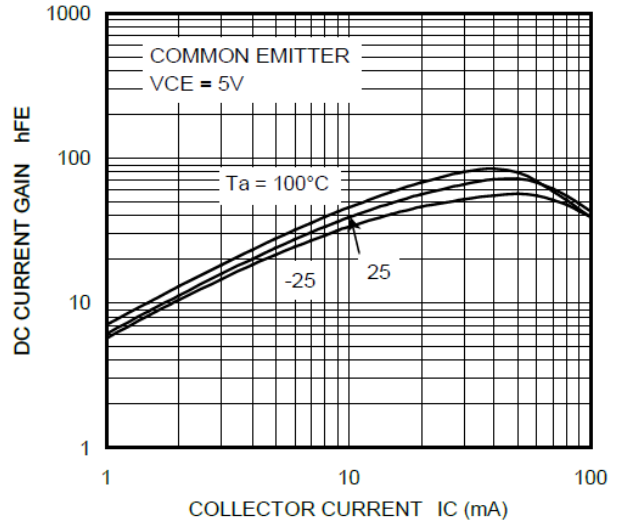


Fig. 10.14 RN1317  $h_{FE}-I_C$

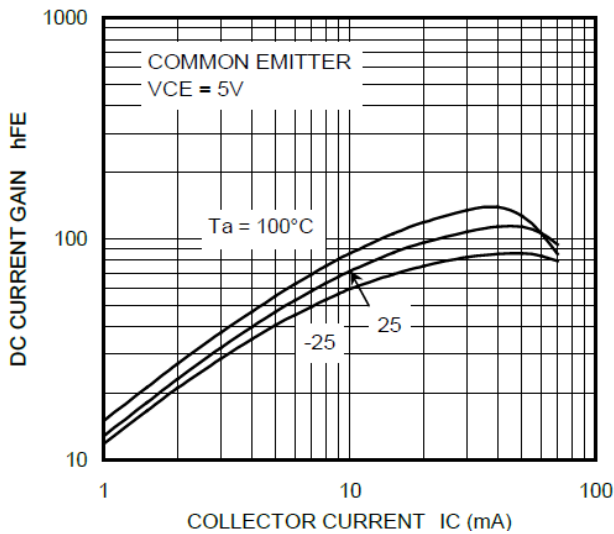


Fig. 10.15 RN1318  $h_{FE}-I_C$

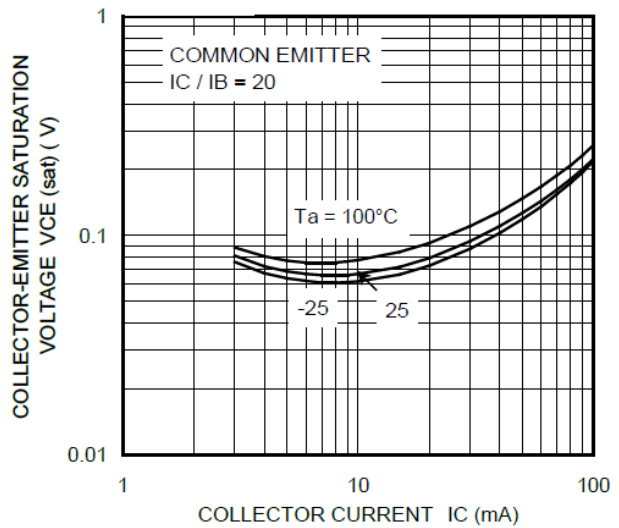


Fig. 10.16 RN1314  $V_{CE(sat)}-I_C$

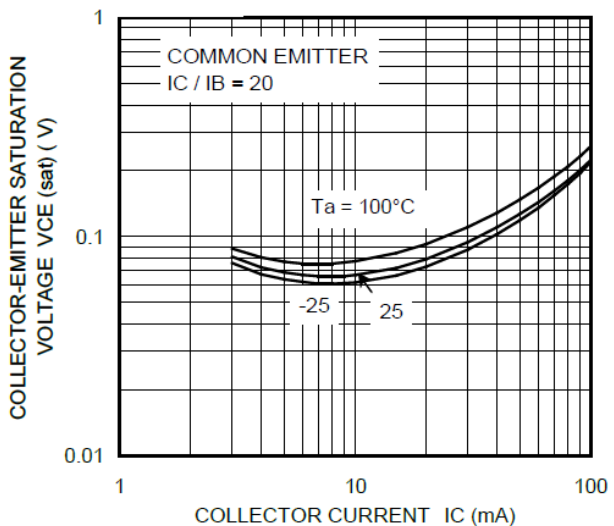


Fig. 10.17 RN1315  $V_{CE(sat)}-I_C$

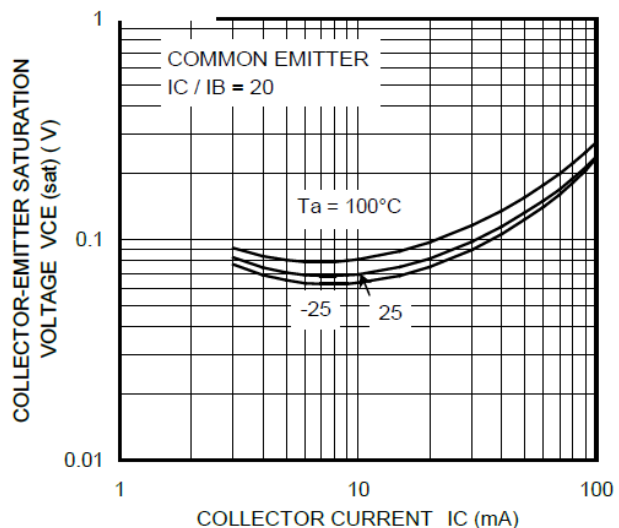


Fig. 10.18 RN1316  $V_{CE(sat)}-I_C$



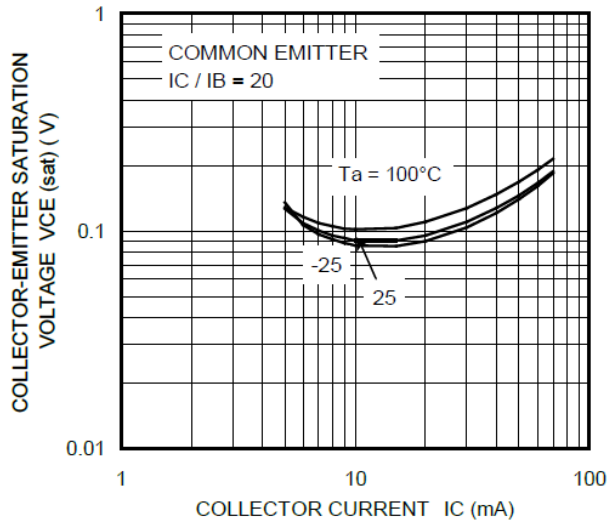


Fig. 10.19 RN1317  $V_{CE(sat)}$ - $I_C$

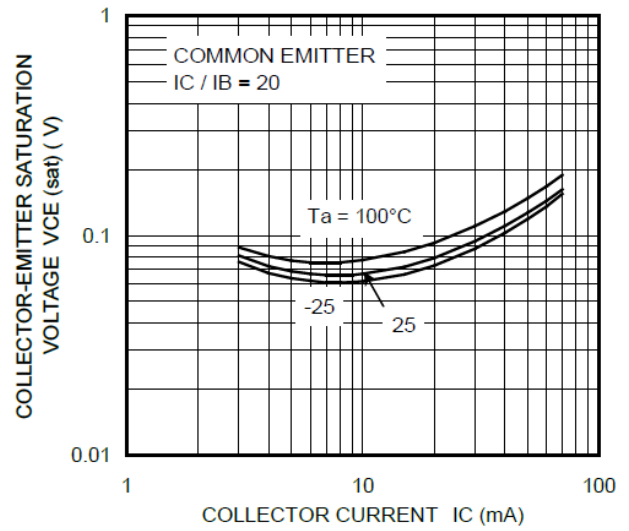
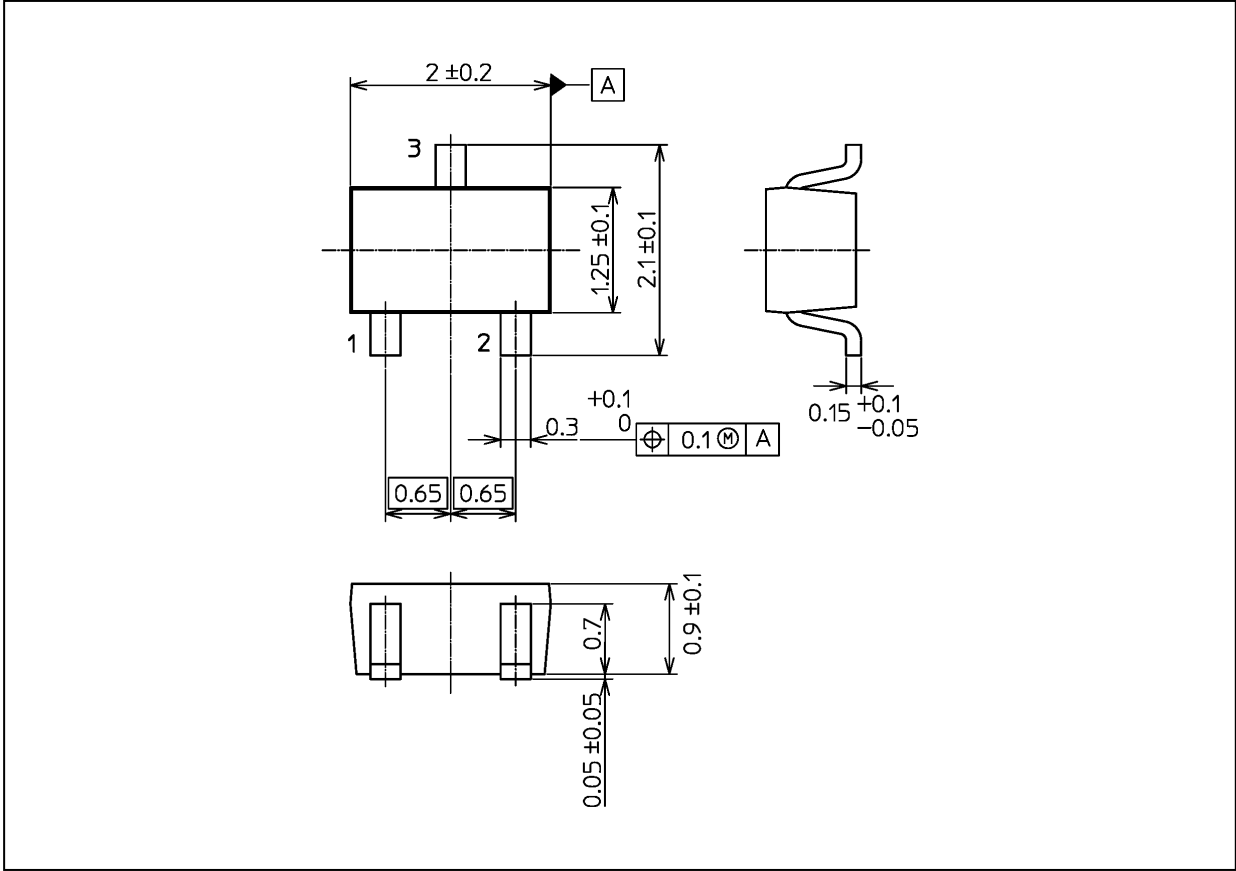


Fig. 10.20 RN1318  $V_{CE(sat)}$ - $I_C$

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) |
|-----------------|
| TOSHIBA: 2-2E1S |
| Nickname: USM   |

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