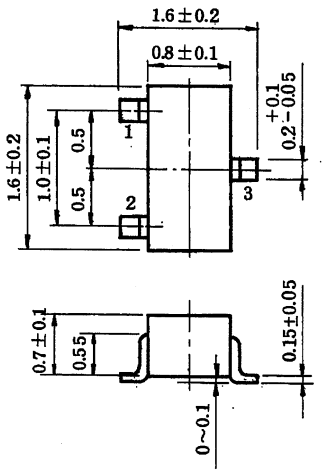
TOSHIBA Transistor Silicon PNP Epitaxial Type (PCT Process) (Bias Resistor built-in Transistor)

# RN2101, RN2102, RN2103
# RN2104, RN2105, RN2106

Switching, Inverter Circuit, Interface Circuit
and Driver Circuit Applications

- Built-in bias resistors
- Simplified circuit design
- Fewer parts and simplified manufacturing process
- Complementary to RN1101 to RN1106

Unit: mm



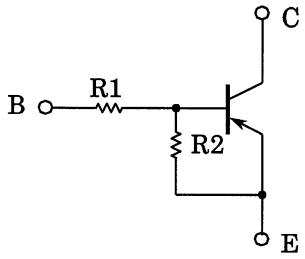

1. BASE
2. EMITTER
3. COLLECTOR

SSM

| | |
|---|---|
| JEDEC | — |
| JEITA | — |
| TOSHIBA | 2-2H1A |

Weight: 2.4 mg (typ.)

## Equivalent Circuit and Bias Resistor Values




| Type No. | R1 (kΩ) | R2 (kΩ) |
|---|---|---|
| RN2101 | 4.7 | 4.7 |
| RN2102 | 10 | 10 |
| RN2103 | 22 | 22 |
| RN2104 | 47 | 47 |
| RN2105 | 2.2 | 47 |
| RN2106 | 4.7 | 47 |

## Absolute Maximum Ratings (Ta = 25°C)

| Characteristic | | Symbol | Rating | Unit |
|---|---|---|---|---|
| Collector-base voltage | RN2101 to 2106 | $V_{CBO}$ | −50 | V |
| Collector-emitter voltage | | $V_{CEO}$ | −50 | V |
| Emitter-base voltage | RN2101 to 2104 | $V_{EBO}$ | −10 | V |
| | RN2105, 2106 | | −5 | |
| Collector current | RN2101 to 2106 | $I_C$ | −100 | mA |
| Collector power dissipation | | $P_C$ | 100 | mW |
| Junction temperature | | $T_j$ | 150 | °C |
| Storage temperature range | | $T_{stg}$ | −55 to 150 | °C |

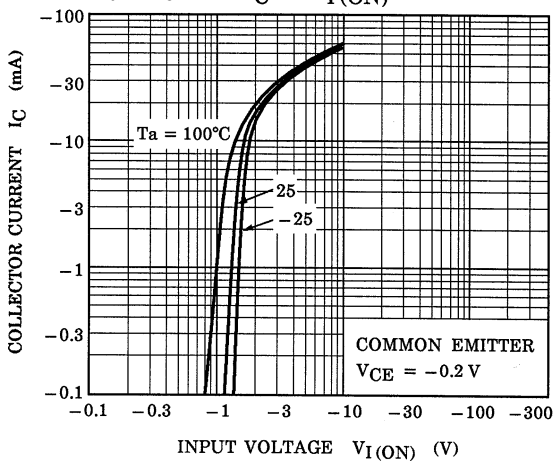
Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) 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).

Start of commercial production
1990-12

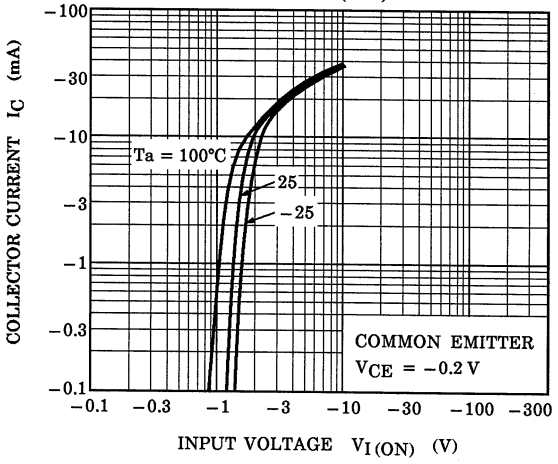
## Electrical Characteristics (Ta = 25°C)

| Characteristic | | Symbol | Test Circuit | Test Condition | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|---|---|
| Collector cut-off current | RN2101 to 2106 | $I_{CBO}$ | — | $V_{CB}$ = −50 V, $I_E$ = 0 | — | — | −100 | nA |
| | | $I_{CEO}$ | | $V_{CE}$ = −50 V, $I_B$ = 0 | — | — | −500 | |
| Emitter cut-off current | RN2101 | $I_{EBO}$ | — | $V_{EB}$ = −10 V, $I_C$ = 0 | −0.82 | — | −1.52 | mA |
| | RN2102 | | | | −0.38 | — | −0.71 | |
| | RN2103 | | | | −0.17 | — | −0.33 | |
| | RN2104 | | | | −0.082 | — | −0.15 | |
| | RN2105 | | | $V_{EB}$ = −5 V, $I_C$ = 0 | −0.078 | — | −0.145 | |
| | RN2106 | | | | −0.074 | — | −0.138 | |
| DC current gain | RN2101 | $h_{FE}$ | — | $V_{CE}$ = −5 V, $I_C$ = −10 mA | 30 | — | — | — |
| | RN2102 | | | | 50 | — | — | |
| | RN2103 | | | | 70 | — | — | |
| | RN2104 | | | | 80 | — | — | |
| | RN2105 | | | | 80 | — | — | |
| | RN2106 | | | | 80 | — | — | |
| Collector-emitter saturation voltage | RN2101 to 2106 | $V_{CE\ (sat)}$ | — | $I_C$ = −5 mA, $I_B$ = −0.25 mA | — | −0.1 | −0.3 | V |
| Input voltage (ON) | RN2101 | $V_{I\ (ON)}$ | — | $V_{CE}$ = −0.2 V, $I_C$ = −5 mA | −1.1 | — | −2.0 | V |
| | RN2102 | | | | −1.2 | — | −2.4 | |
| | RN2103 | | | | −1.3 | — | −3.0 | |
| | RN2104 | | | | −1.5 | — | −5.0 | |
| | RN2105 | | | | −0.6 | — | −1.1 | |
| | RN2106 | | | | −0.7 | — | −1.3 | |
| Input voltage (OFF) | RN2101 to 2104 | $V_{I\ (OFF)}$ | — | $V_{CE}$ = −5 V, $I_C$ = −0.1 mA | −1.0 | — | −1.5 | V |
| | RN2105, 2106 | | | | −0.5 | — | −0.8 | |
| Transition frequency | RN2101 to 2106 | $f_T$ | — | $V_{CE}$ = −10 V, $I_C$ = −5 mA | — | 200 | — | MHz |
| Collector Output capacitance | RN2101 to 2106 | $C_{ob}$ | — | $V_{CB}$ = −10 V, $I_E$ = 0, f = 1 MHz | — | 3 | 6 | pF |
| Input resistor | RN2101 | R1 | — | — | 3.29 | 4.7 | 6.11 | kΩ |
| | RN2102 | | | | 7 | 10 | 13 | |
| | RN2103 | | | | 15.4 | 22 | 28.6 | |
| | RN2104 | | | | 32.9 | 47 | 61.1 | |
| | RN2105 | | | | 1.54 | 2.2 | 2.86 | |
| | RN2106 | | | | 3.29 | 4.7 | 6.11 | |
| Resistor ratio | RN2101 to 2104 | R1/R2 | — | — | 0.9 | 1.0 | 1.1 | — |
| | RN2105 | | | | 0.0421 | 0.0468 | 0.0515 | |
| | RN2106 | | | | 0.09 | 0.1 | 0.11 | |

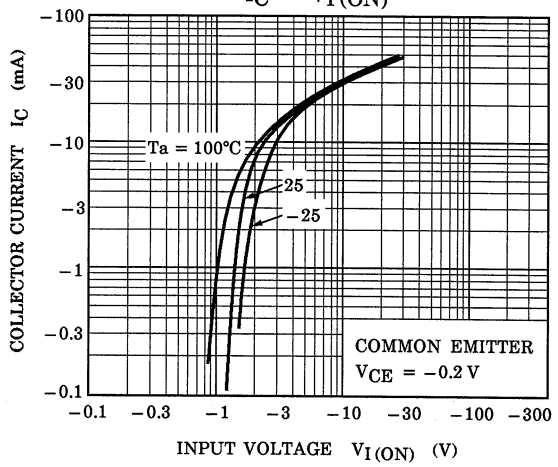
RN2101 $I_C - V_{I(ON)}$




RN2102 $I_C - V_{I(ON)}$




RN2103 $I_C - V_{I(ON)}$

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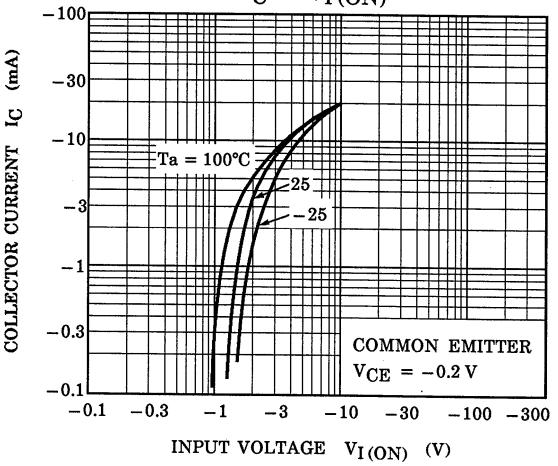
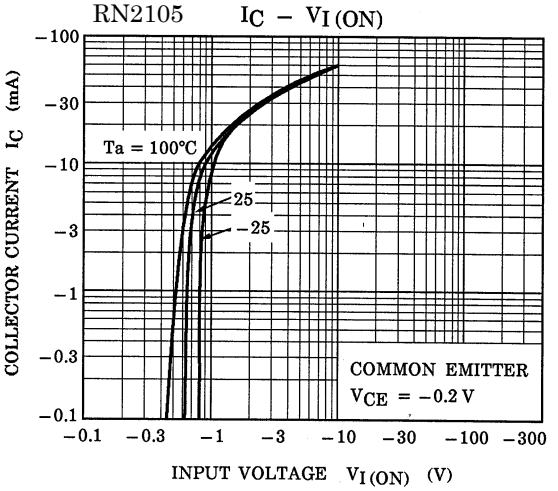
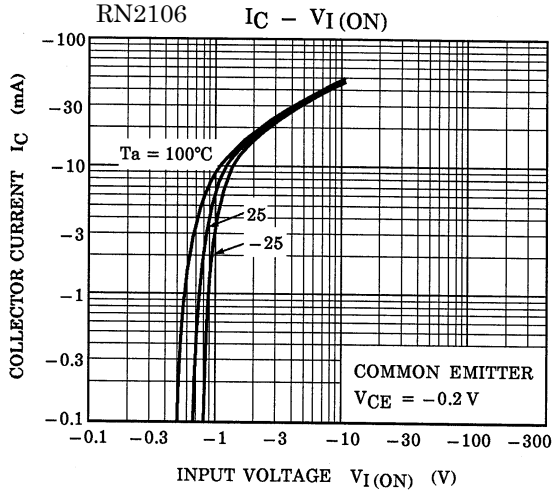


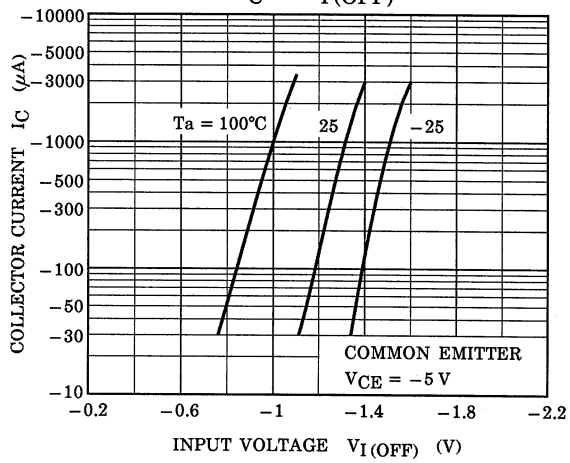

RN2105 $I_C - V_{I(ON)}$



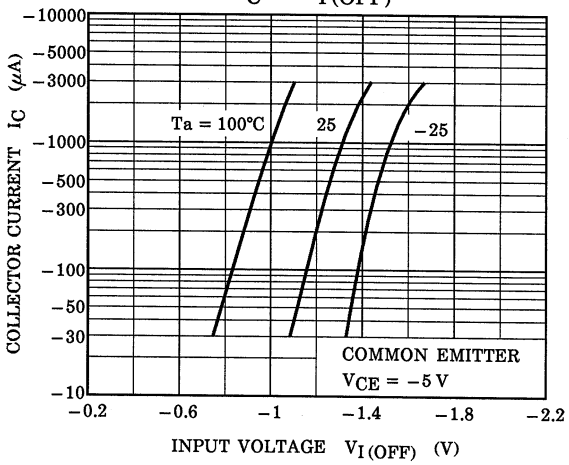

RN2106 $I_C - V_{I(ON)}$



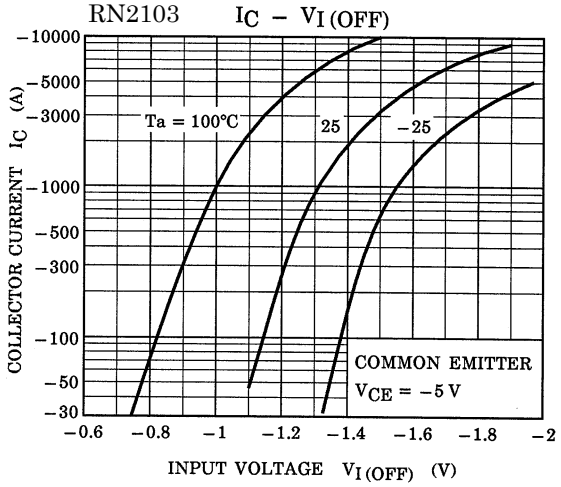
RN2101 $I_C - V_{I(OFF)}$



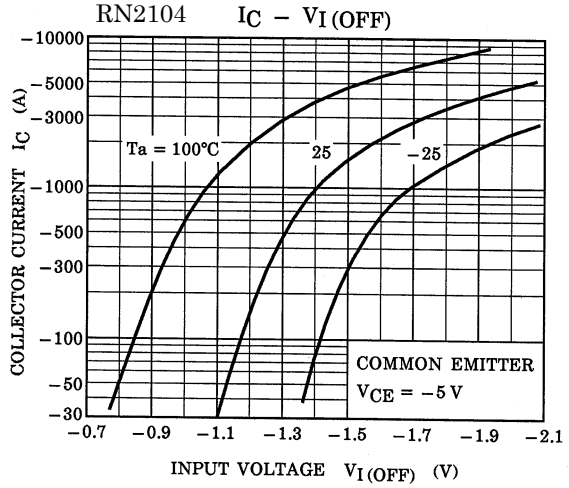

RN2102 $I_C - V_{I(OFF)}$



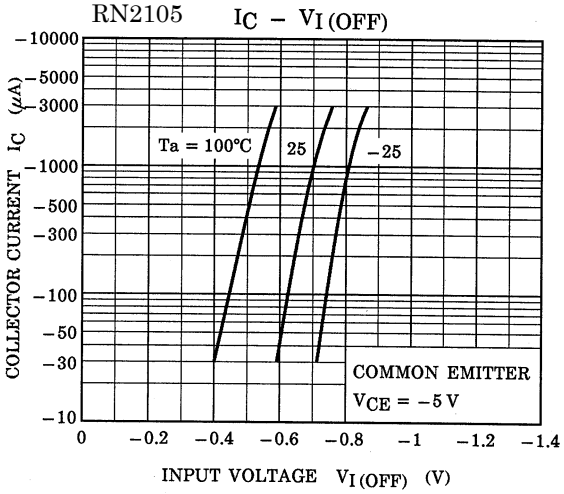

RN2103 $I_C - V_{I(OFF)}$




RN2104 $I_C - V_{I(OFF)}$




RN2105 $I_C - V_{I(OFF)}$

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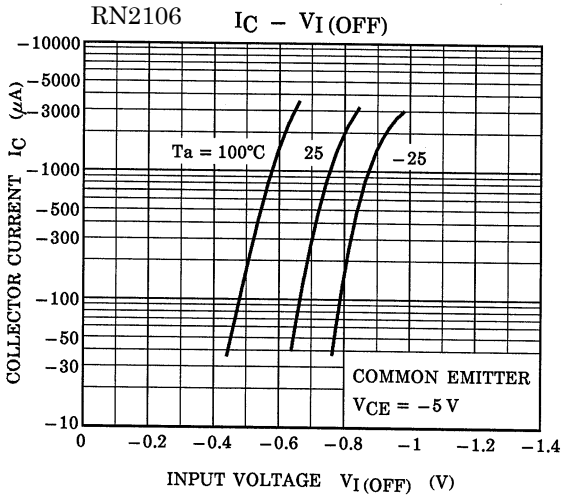
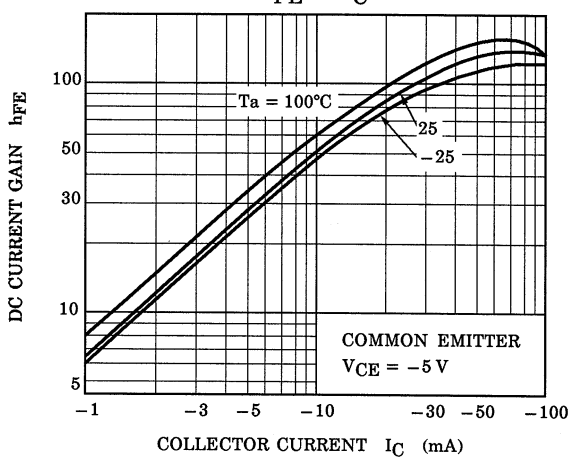
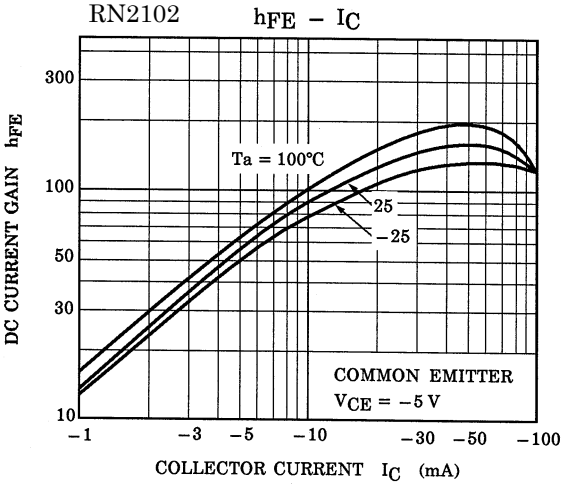


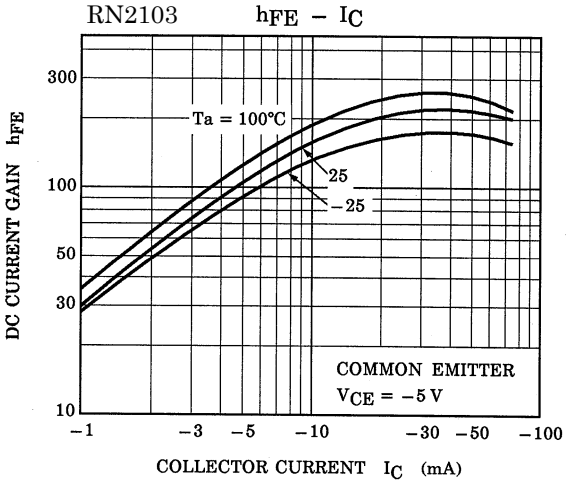
RN2101 $h_{FE}$ – $I_C$




RN2102 $h_{FE}$ – $I_C$




RN2103 $h_{FE}$ – $I_C$

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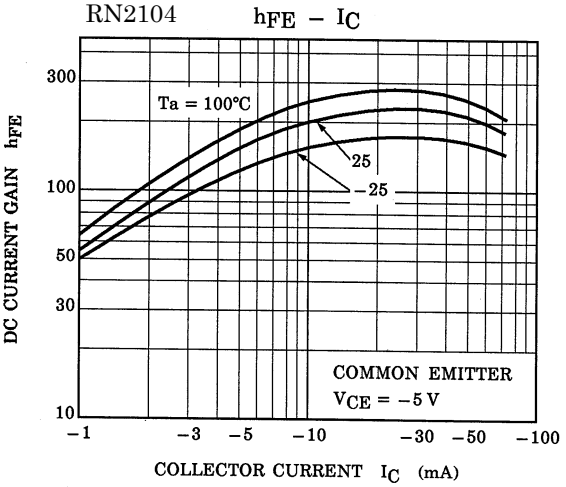
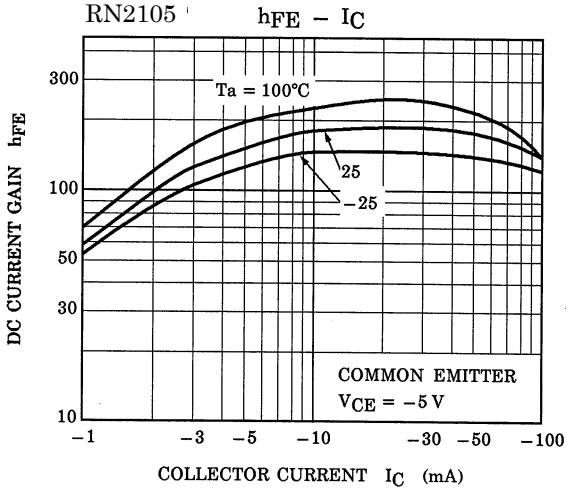
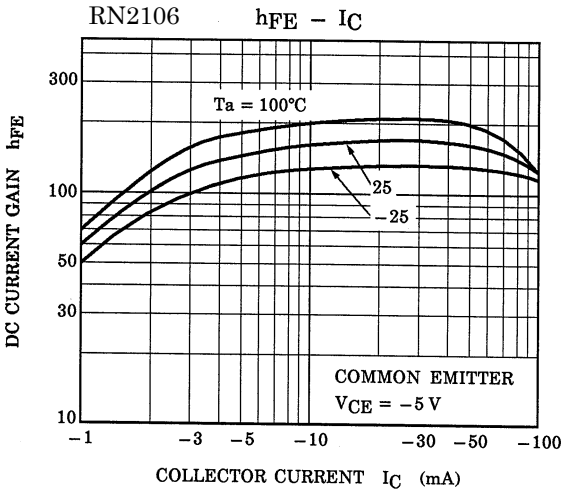


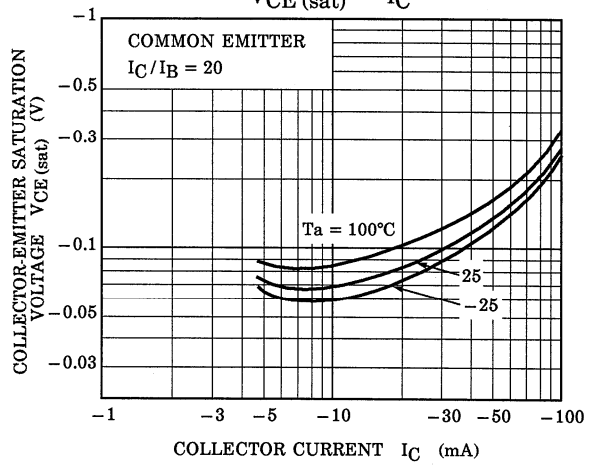

RN2105 $h_{FE}$ – $I_C$



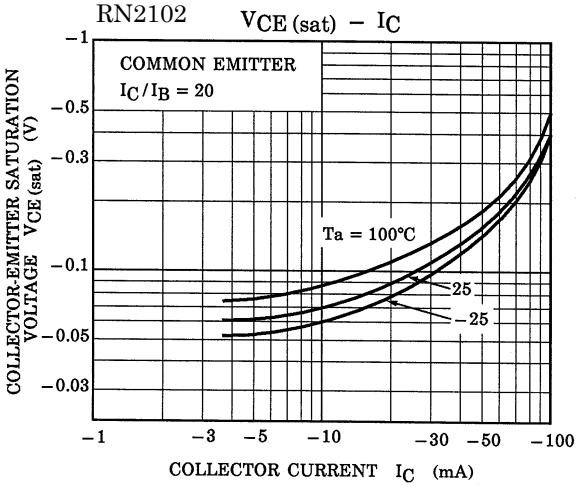

RN2106 $h_{FE}$ – $I_C$



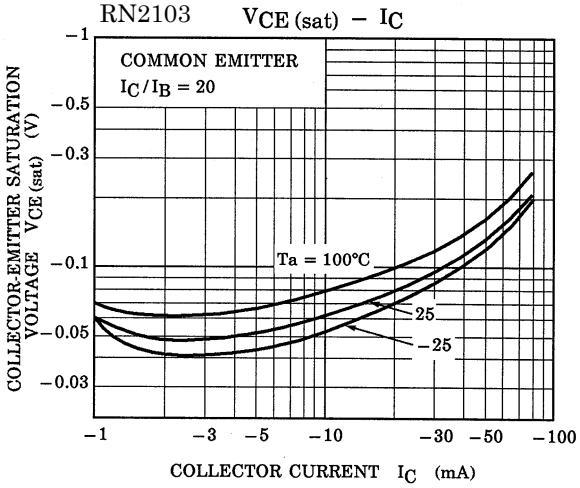
RN2101 $V_{CE\,(sat)} - I_C$



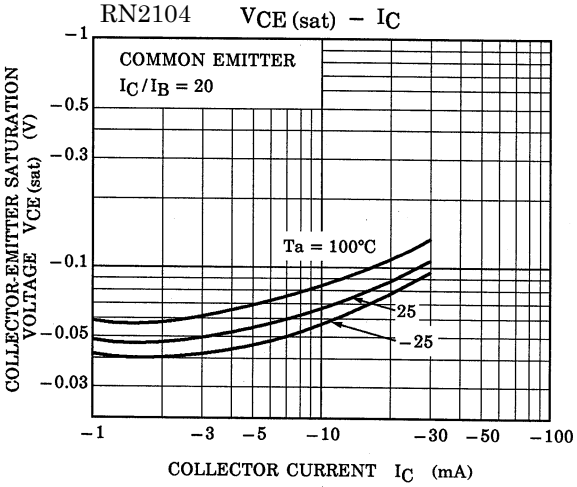

RN2102 $V_{CE\,(sat)} - I_C$




RN2103 $V_{CE\,(sat)} - I_C$




RN2104 $V_{CE\,(sat)} - I_C$

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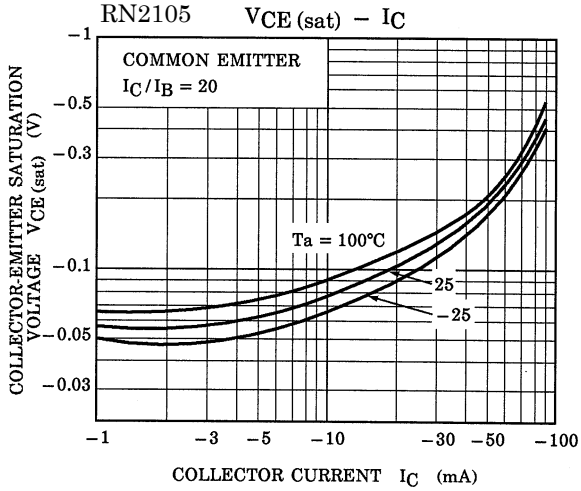
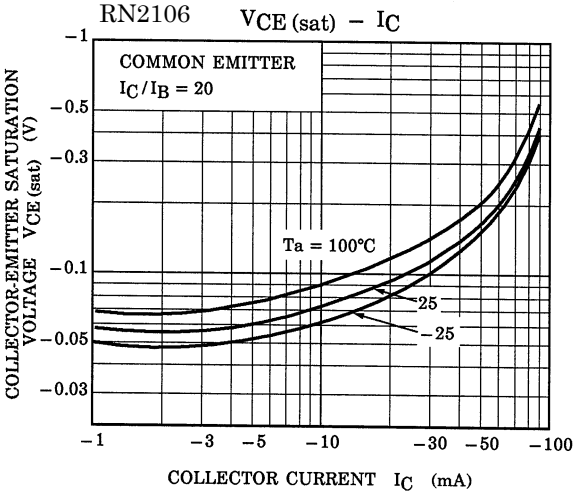



RN2106 $V_{CE\,(sat)} - I_C$



| Type Name | Marking |
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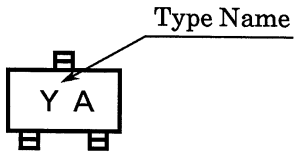
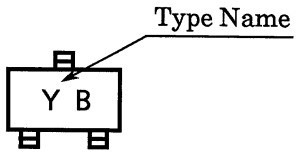
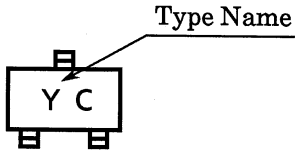
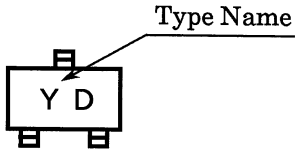
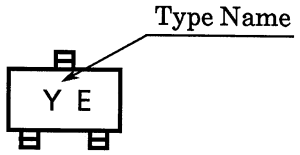
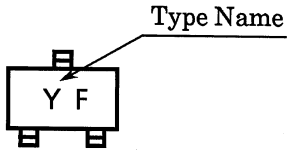
| RN2101 |   |
| RN2102 |   |
| RN2103 |   |
| RN2104 |   |
| RN2105 |   |
| RN2106 |   |

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