

TOSHIBA Transistor Silicon NPN Epitaxial Type (PCT Process) (Bias Resistor Built-in Transistor)

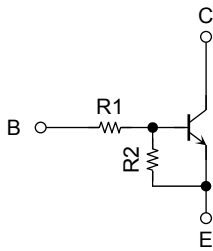
## RN1701JE, RN1702JE, RN1703JE RN1704JE, RN1705JE, RN1706JE

Switching, Inverter Circuit, Interface Circuit and Driver Circuit Applications

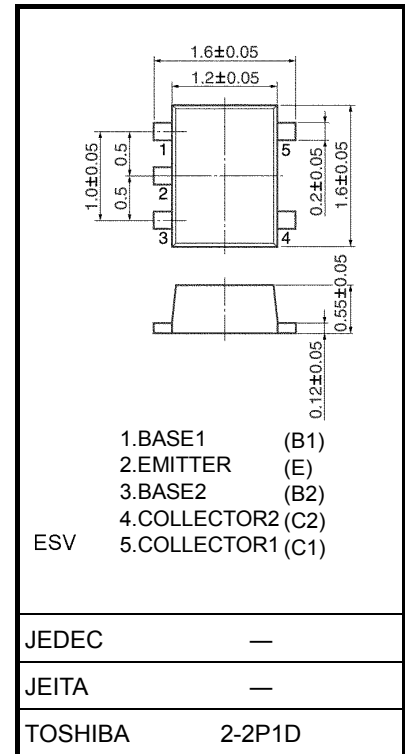
Unit: mm

- Two devices are incorporated into an Extreme-Super-Mini (5 pin) package.
- Incorporating a bias resistor into a transistor reduces parts count. Reducing the parts count enables the manufacture of ever more compact equipment and lowers assembly cost.
- A wide range of resistor values is available for use in various circuit designs.
- Complementary to RN2701JE to RN2706JE

### Equivalent Circuit and Bias Resistor Values



| Type No. | R1 (kΩ) | R2 (kΩ) |
|----------|---------|---------|
| RN1701JE | 4.7     | 4.7     |
| RN1702JE | 10      | 10      |
| RN1703JE | 22      | 22      |
| RN1704JE | 47      | 47      |
| RN1705JE | 2.2     | 47      |
| RN1706JE | 4.7     | 47      |



Weight: 0.003 g (typ.)

### Absolute Maximum Ratings (Ta = 25°C) (Q1, Q2 common)

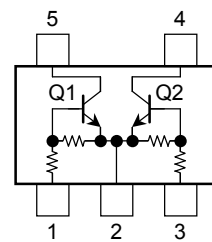
| Characteristics             |                    | Symbol                  | Rating     | Unit |
|-----------------------------|--------------------|-------------------------|------------|------|
| Collector-base voltage      | RN1701JE to 1706JE | V <sub>CBO</sub>        | 50         | V    |
| Collector-emitter voltage   |                    | V <sub>CEO</sub>        | 50         | V    |
| Emitter-base voltage        | RN1701JE to 1704JE | V <sub>EBO</sub>        | 10         | V    |
|                             | RN1705JE RN1706JE  |                         | 5          |      |
| Collector current           | RN1701JE to 1706JE | I <sub>C</sub>          | 100        | mA   |
| Collector power dissipation |                    | P <sub>C</sub> (Note 1) | 100        | mW   |
| Junction temperature        |                    | T <sub>j</sub>          | 150        | °C   |
| Storage temperature range   |                    | T <sub>stg</sub>        | -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).

Note 1: Total rating

### Equivalent Circuit (top view)

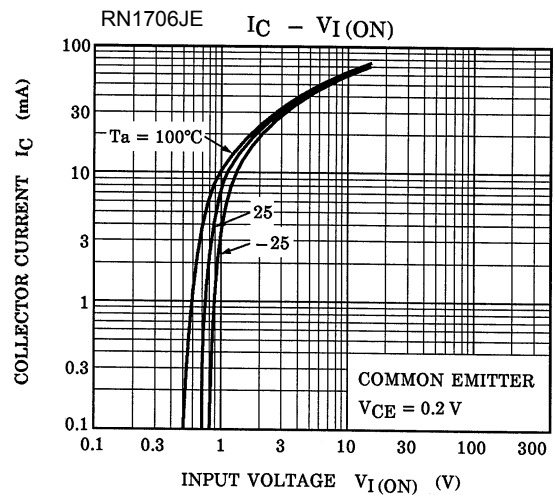
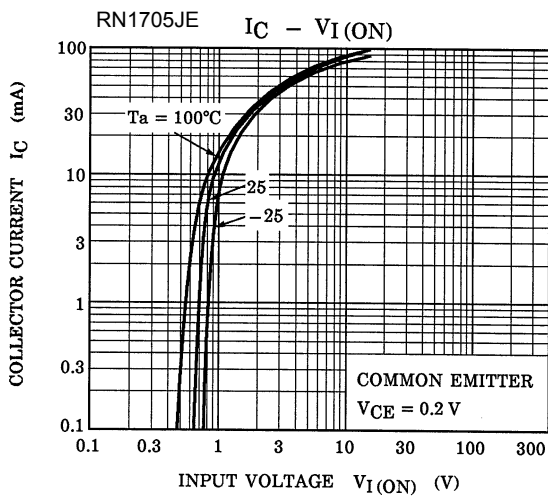
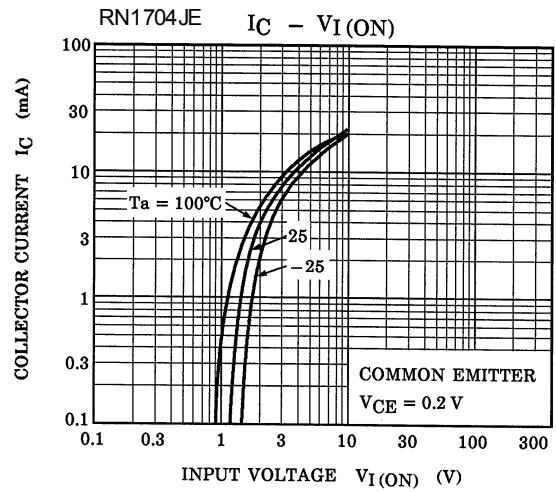
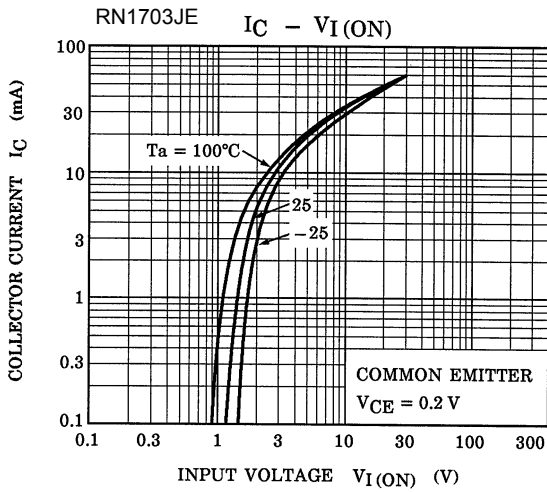
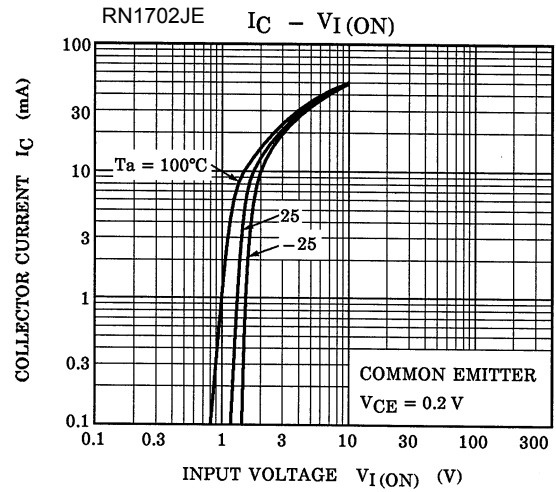
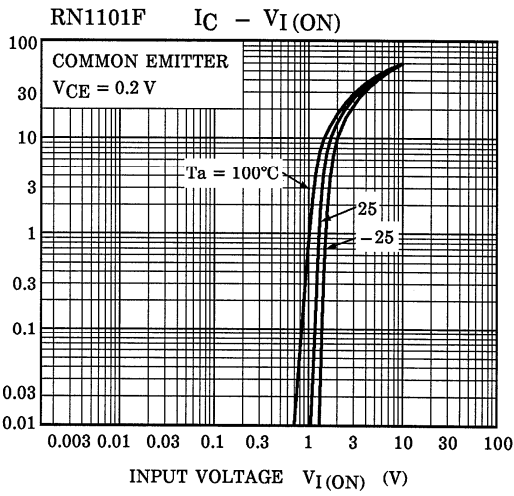


Start of commercial production  
2000-06

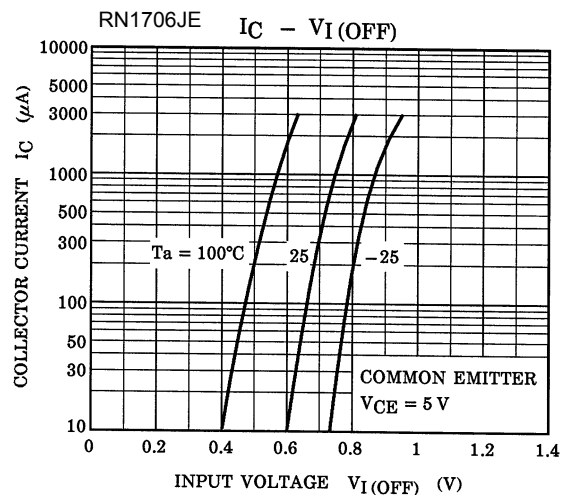
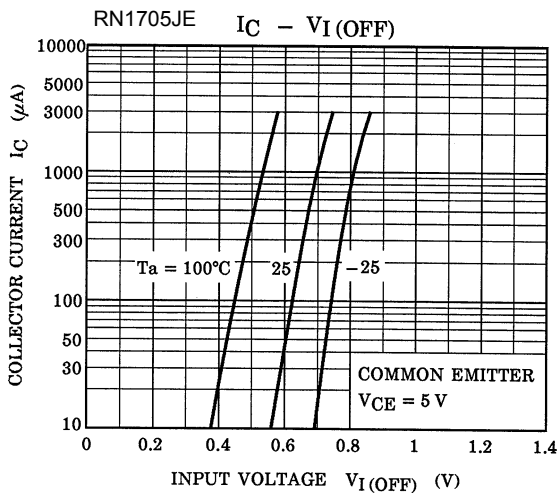
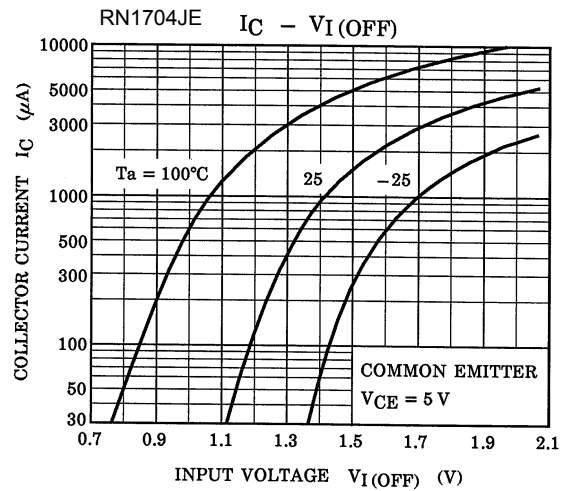
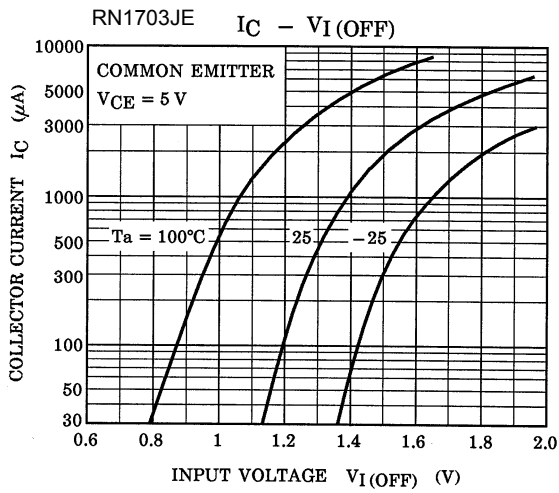
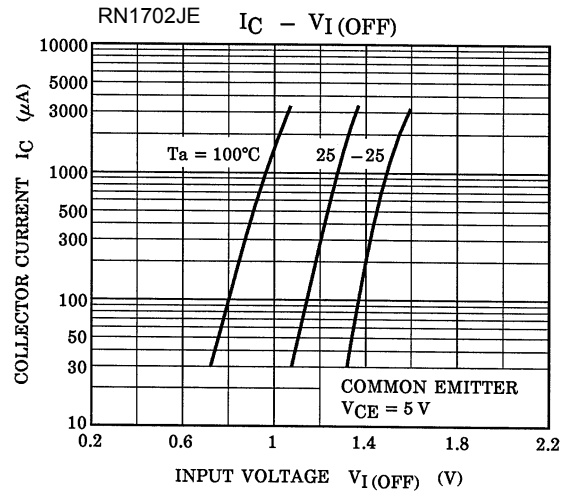
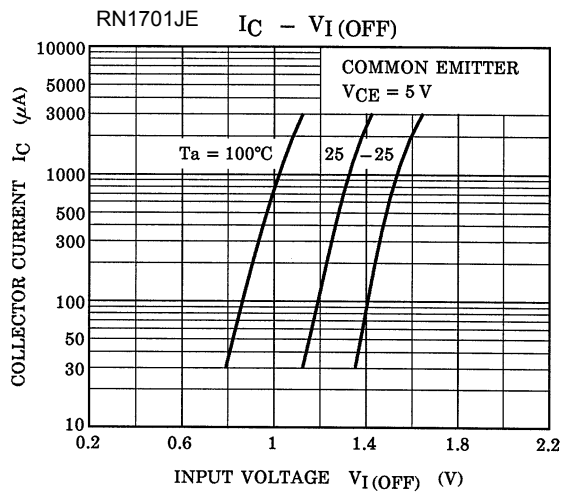
## Electrical Characteristics (Ta = 25°C) (Q1, Q2 common)

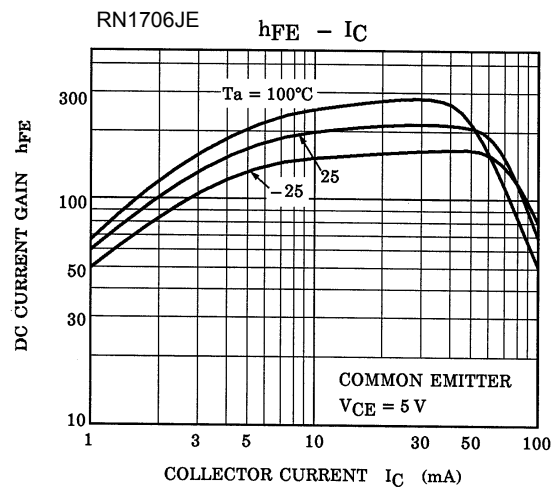
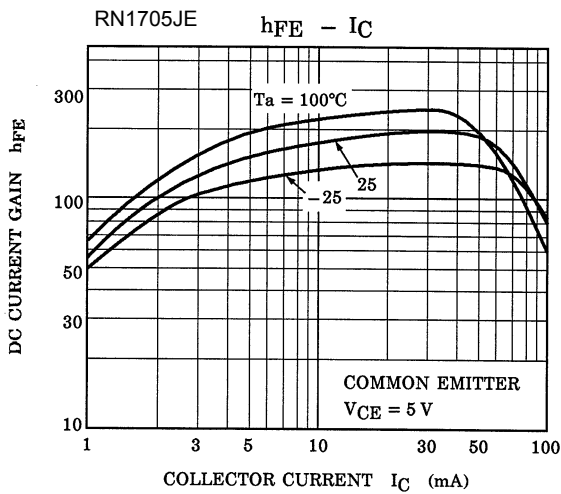
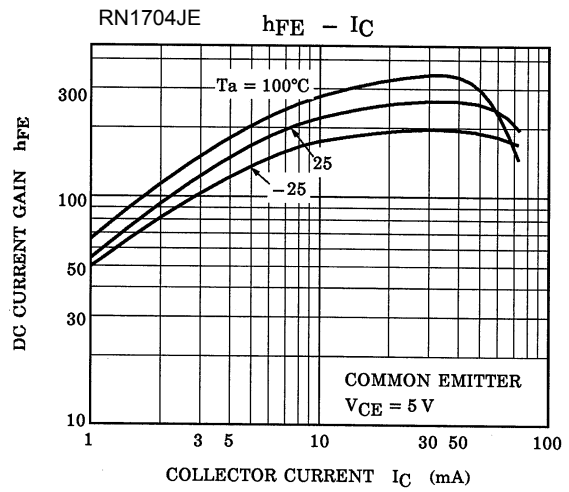
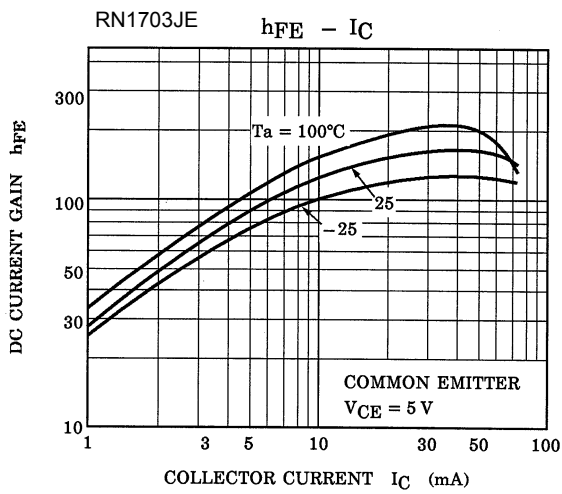
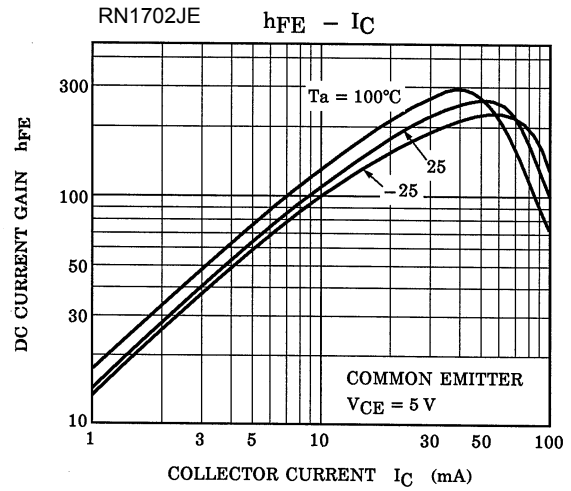
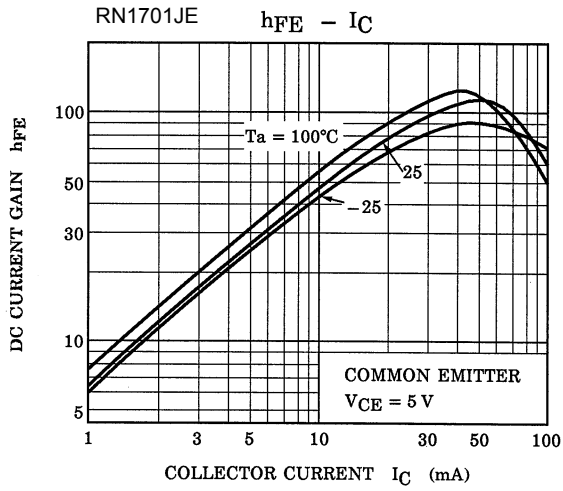
| Characteristics                      |                      | Symbol                         | Test Condition                                    | Min    | Typ.   | Max    | Unit       |
|--------------------------------------|----------------------|--------------------------------|---|--------|--------|--------|------------|
| Collector cut-off current            | RN1701JE to RN1706JE | $I_{CBO}$                      | $V_{CB} = 50\text{ V}, I_E = 0$                   | —      | —      | 100    | nA         |
|                                      |                      | $I_{CEO}$                      | $V_{CE} = 50\text{ V}, I_B = 0$                   | —      | —      | 500    |            |
| Emitter cut-off current              | RN1701JE             | $I_{EBO}$                      | $V_{EB} = 10\text{ V}, I_C = 0$                   | 0.82   | —      | 1.52   | mA         |
|                                      | RN1702JE             |                                |   | 0.38   | —      | 0.71   |            |
|                                      | RN1703JE             |                                |   | 0.17   | —      | 0.33   |            |
|                                      | RN1704JE             |                                |   | 0.082  | —      | 0.15   |            |
|                                      | RN1705JE             | $V_{EB} = 5\text{ V}, I_C = 0$ | 0.078   | —      | 0.145  |        |            |
|                                      | RN1706JE             |                                | 0.074   | —      | 0.138  |        |            |
| DC current gain                      | RN1701JE             | $h_{FE}$                       | $V_{CE} = 5\text{ V}, I_C = 10\text{ mA}$         | 30     | —      | —      |            |
|                                      | RN1702JE             |                                |   | 50     | —      | —      |            |
|                                      | RN1703JE             |                                |   | 70     | —      | —      |            |
|                                      | RN1704JE             |                                |   | 80     | —      | —      |            |
|                                      | RN1705JE             |                                |   | 80     | —      | —      |            |
|                                      | RN1706JE             |                                |   | 80     | —      | —      |            |
| Collector-emitter saturation voltage | RN1701JE to RN1706JE | $V_{CE(sat)}$                  | $I_C = 5\text{ mA}, I_B = 0.25\text{ mA}$         | —      | 0.1    | 0.3    | V          |
| Input voltage (ON)                   | RN1701JE             | $V_{I(ON)}$                    | $V_{CE} = 0.2\text{ V}, I_C = 5\text{ mA}$        | 1.1    | —      | 2.0    | V          |
|                                      | RN1702JE             |                                |   | 1.2    | —      | 2.4    |            |
|                                      | RN1703JE             |                                |   | 1.3    | —      | 3.0    |            |
|                                      | RN1704JE             |                                |   | 1.5    | —      | 5.0    |            |
|                                      | RN1705JE             |                                |   | 0.6    | —      | 1.1    |            |
|                                      | RN1706JE             |                                |   | 0.7    | —      | 1.3    |            |
| Input voltage (OFF)                  | RN1701JE to RN1704JE | $V_{I(OFF)}$                   | $V_{CE} = 5\text{ V}, I_C = 0.1\text{ mA}$        | 1.0    | —      | 1.5    | V          |
|                                      | RN1705JE, RN1706JE   |                                |   | 0.5    | —      | 0.8    |            |
| Transition frequency                 | RN1701JE to RN1706JE | $f_T$                          | $V_{CE} = 10\text{ V}, I_C = 5\text{ mA}$         | —      | 250    | —      | MHz        |
| Collector output capacitance         | RN1701JE to RN1706JE | $C_{ob}$                       | $V_{CB} = 10\text{ V}, I_E = 0, f = 1\text{ MHz}$ | —      | 3      | 6      | pF         |
| Input resistor                       | RN1701JE             | $R_1$                          | —   | 3.29   | 4.7    | 6.11   | k $\Omega$ |
|                                      | RN1702JE             |                                |   | 7      | 10     | 13     |            |
|                                      | RN1703JE             |                                |   | 15.4   | 22     | 28.6   |            |
|                                      | RN1704JE             |                                |   | 32.9   | 47     | 61.1   |            |
|                                      | RN1705JE             |                                |   | 1.54   | 2.2    | 2.86   |            |
|                                      | RN1706JE             |                                |   | 3.29   | 4.7    | 6.11   |            |
| Resistor ratio                       | RN1701JE to RN1704JE | $R_1/R_2$                      | —   | 0.9    | 1.0    | 1.1    |            |
|                                      | RN1705JE             |                                |   | 0.0421 | 0.0468 | 0.0515 |            |
|                                      | RN1706JE             |                                |   | 0.09   | 0.1    | 0.11   |            |

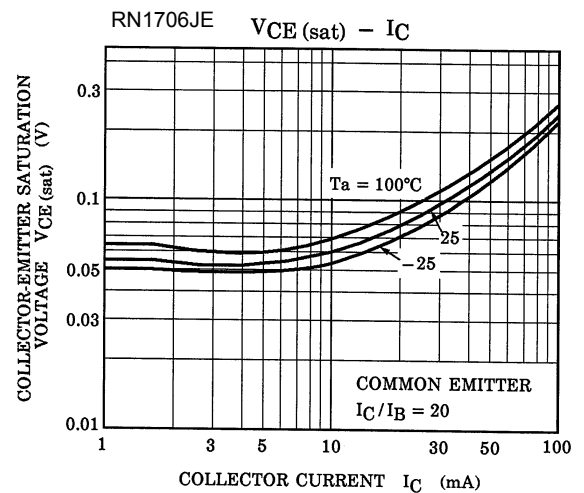
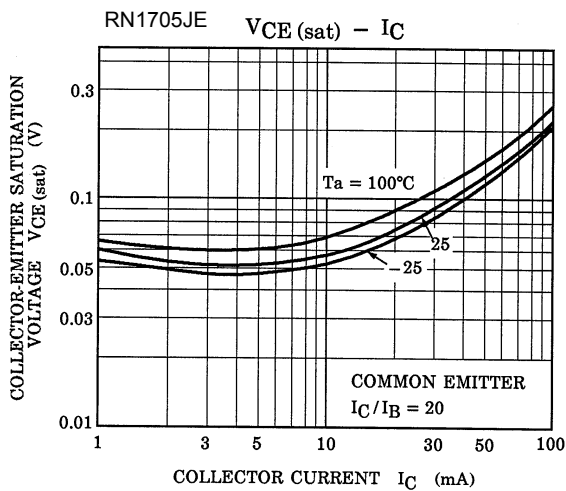
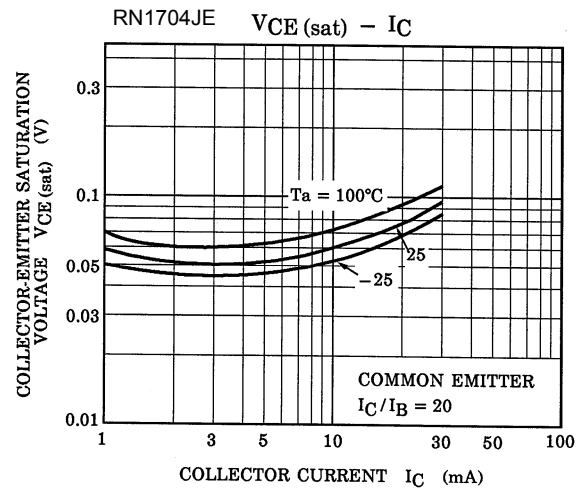
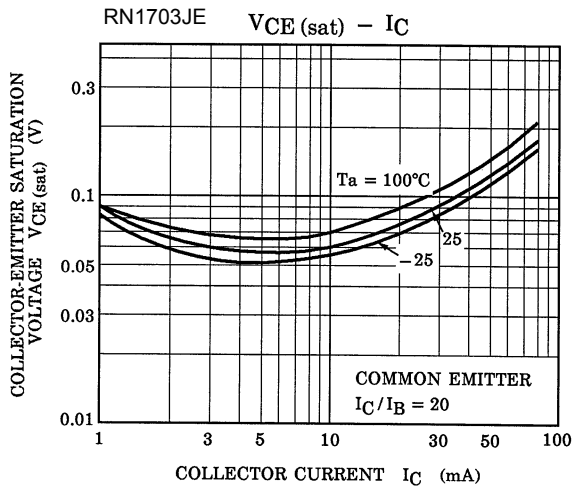
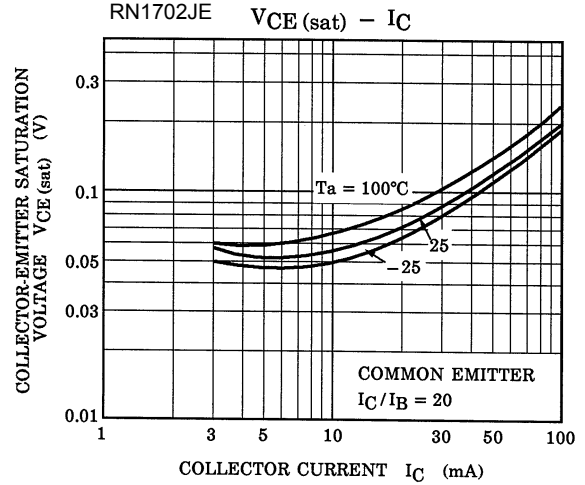
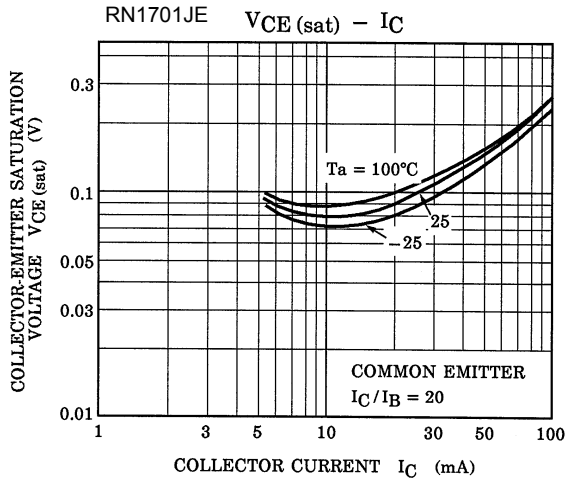
## Q1, Q2 Common

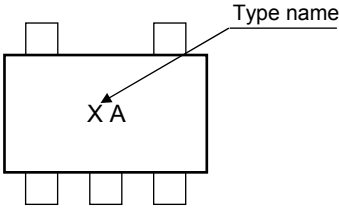
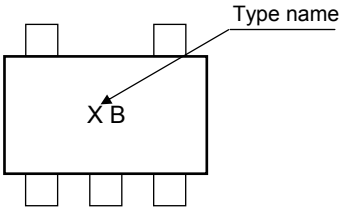
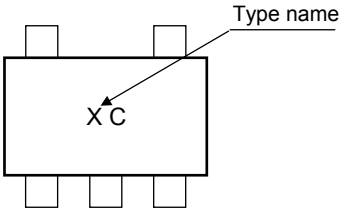
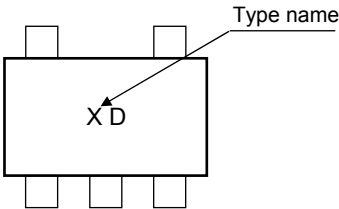
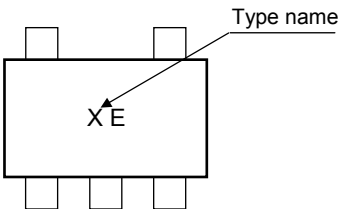
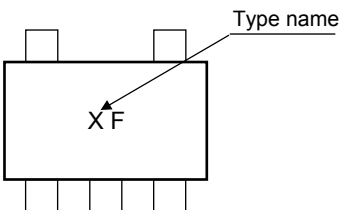


## Q1, Q2 Common







| Type Name | Marking   |
|-----------|---|
| RN1701JE  |    |
| RN1702JE  |    |
| RN1703JE  |   |
| RN1704JE  |  |
| RN1705JE  |  |
| RN1706JE  |  |

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