

TOSHIBA Transistor Silicon NPN Epitaxial Type (PCT process) (Bias Resistor built-in Transistor)

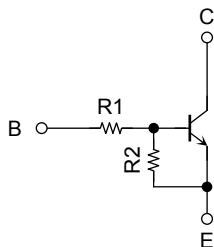
## RN1961FE, RN1962FE, RN1963FE RN1964FE, RN1965FE, RN1966FE

Switching, Inverter Circuit, Interface Circuit and  
Driver Circuit Applications

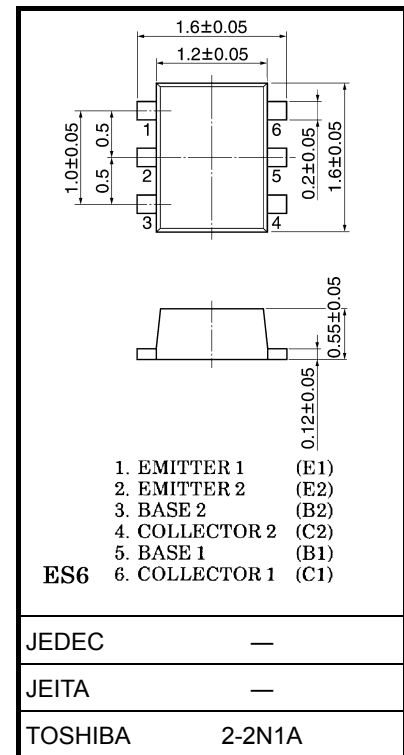
Unit: mm

- Two devices are incorporated into an Extreme-Super-Mini (6 pin) package.
- Incorporating a bias resistor into a transistor reduces parts count. Reducing the parts count enable the manufacture of ever more compact equipment and save assembly cost.
- Complementary to RN2961FE to RN2966FE

### Equivalent Circuit and Bias Resistor Values



| Type No. | R1 (kΩ) | R2 (kΩ) |
|----------|---------|---------|
| RN1961FE | 4.7     | 4.7     |
| RN1962FE | 10      | 10      |
| RN1963FE | 22      | 22      |
| RN1964FE | 47      | 47      |
| RN1965FE | 2.2     | 47      |
| RN1966FE | 4.7     | 47      |



Weight: 3mg (typ.)

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

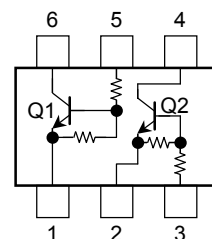
| Characteristics             | Symbol                               | Rating     | Unit |
|-----------------------------|--------------------------------------|------------|------|
| Collector-base voltage      | RN1961FE to 1966FE<br>$V_{CBO}$      | 50         | V    |
| Collector-emitter voltage   | $V_{CEO}$                            | 50         | V    |
| Emitter-base voltage        | RN1961FE to 1964FE<br>$V_{EBO}$      | 10         | V    |
|                             | RN1965FE, 1966FE                     | 5          | V    |
| Collector current           | $I_C$                                | 100        | mA   |
| Collector power dissipation | RN1961FE to 1966FE<br>$P_C$ (Note 1) | 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.).

Note 1: Total rating

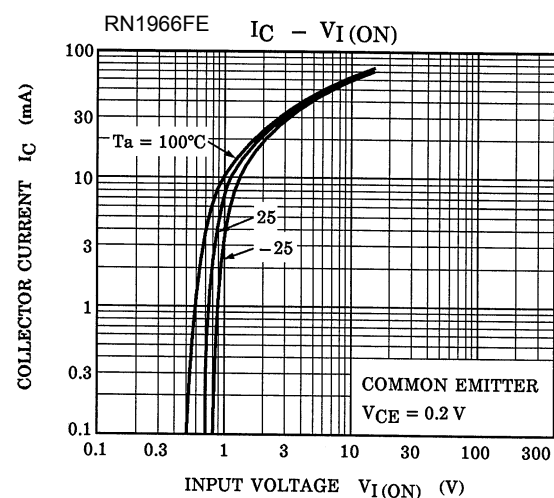
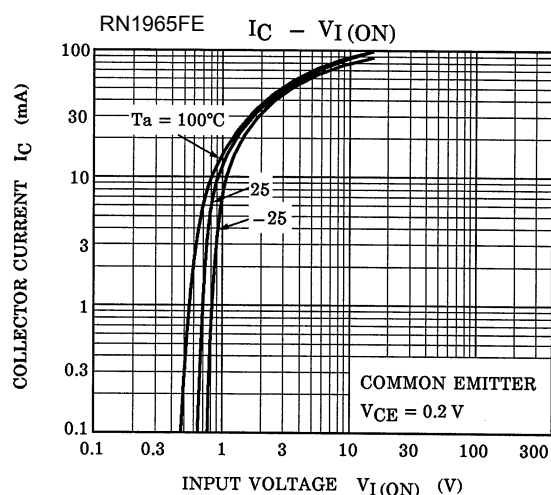
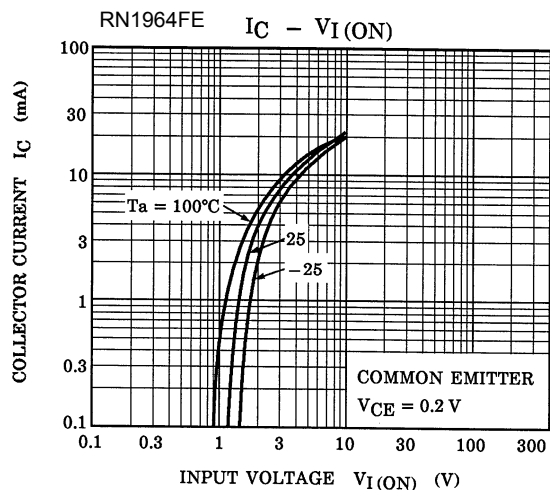
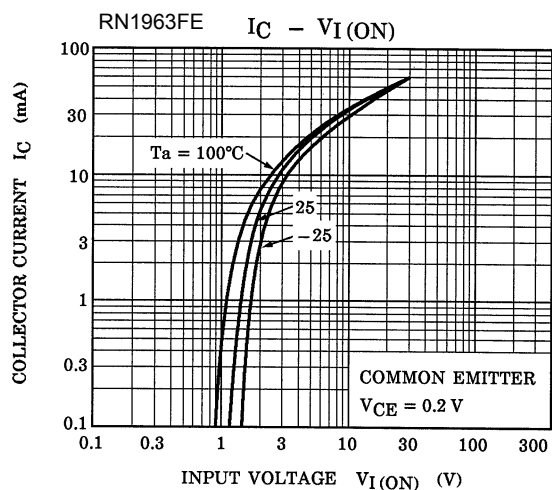
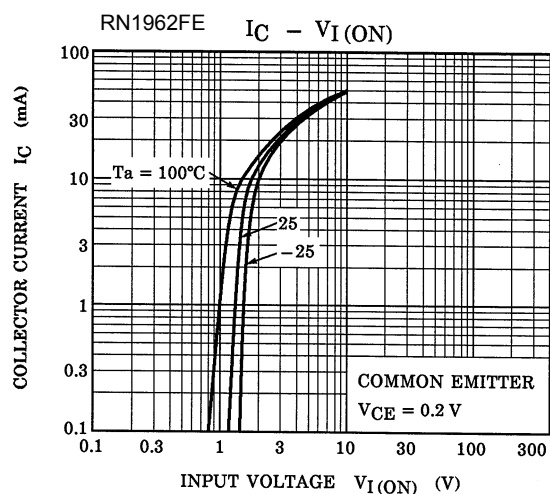
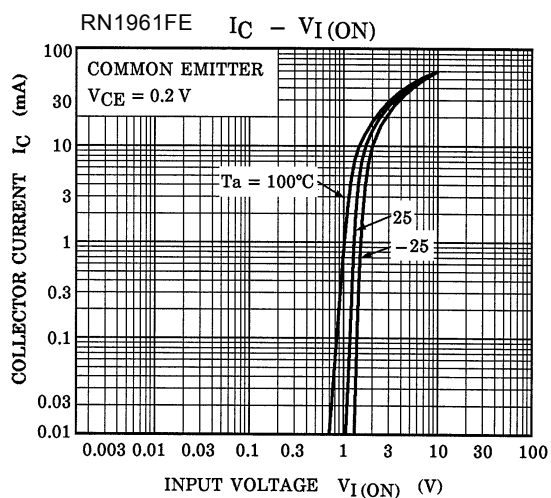
### Equivalent Circuit (top view)



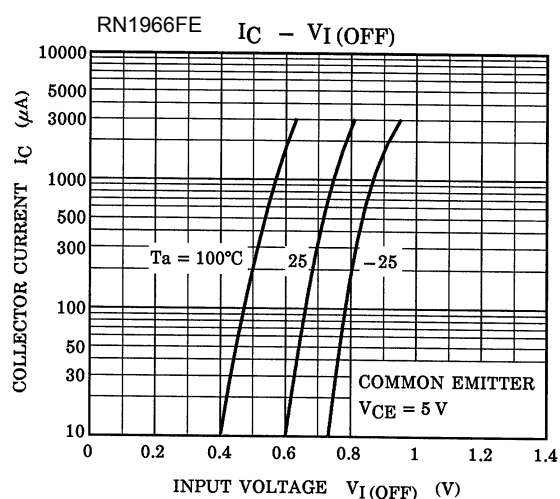
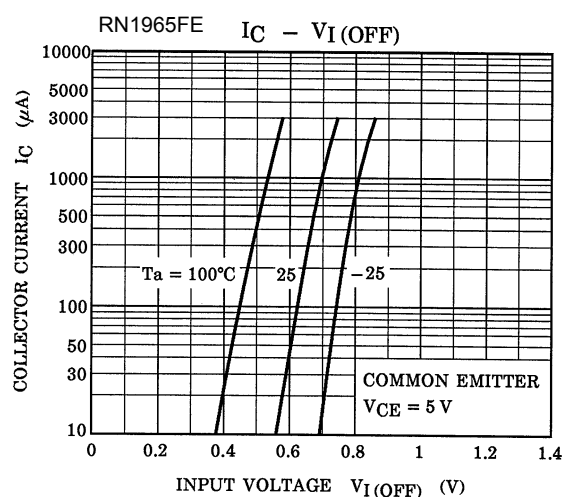
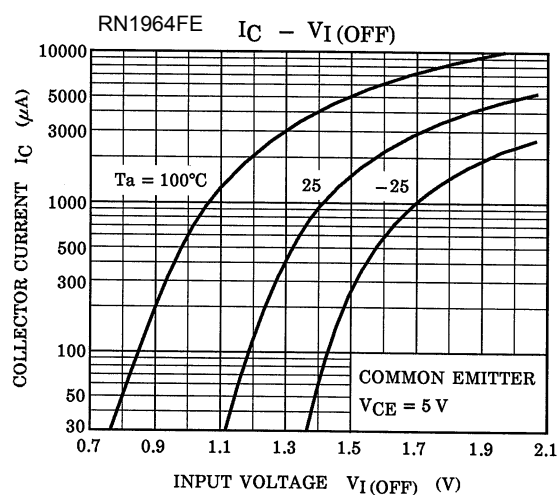
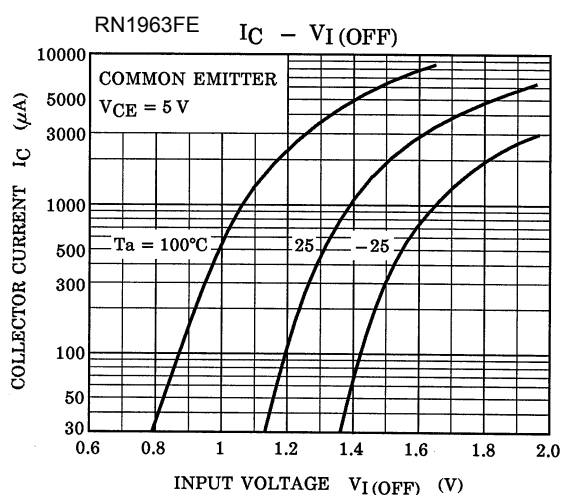
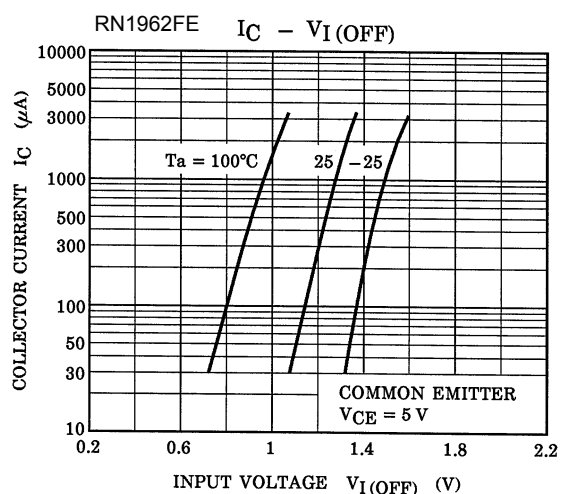
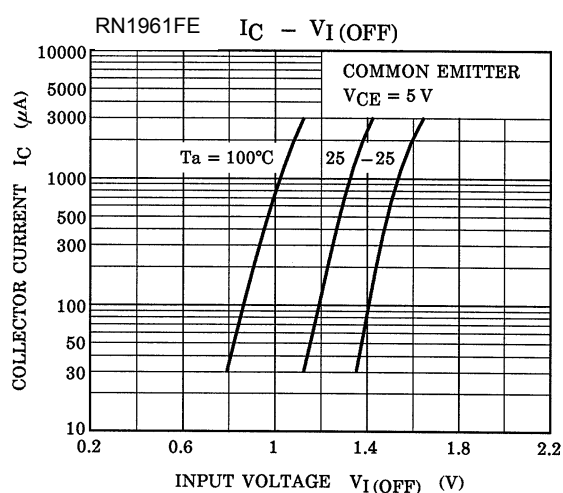
**Electrical Characteristics (Ta = 25°C) (Q1, Q2 common)**

| Characteristics                      |                    | Symbol        | Test Condition                                      | Min    | Typ.   | Max    | Unit       |
|--------------------------------------|--------------------|---------------|-----------------------------------------------------|--------|--------|--------|------------|
| Collector cut-off current            | RN1961FE to 1966FE | $I_{CBO}$     | $V_{CB} = 50 \text{ V}, I_E = 0$                    | —      | —      | 100    | nA         |
|                                      |                    | $I_{CEO}$     | $V_{CE} = 50 \text{ V}, I_B = 0$                    | —      | —      | 500    |            |
| Emitter cut-off current              | RN1961FE           | $I_{EBO}$     | $V_{EB} = 10 \text{ V}, I_C = 0$                    | 0.82   | —      | 1.52   | mA         |
|                                      | RN1962FE           |               |                                                     | 0.38   | —      | 0.71   |            |
|                                      | RN1963FE           |               |                                                     | 0.17   | —      | 0.33   |            |
|                                      | RN1964FE           |               |                                                     | 0.082  | —      | 0.15   |            |
|                                      | RN1965FE           | $I_{EBO}$     | $V_{EB} = 5 \text{ V}, I_C = 0$                     | 0.078  | —      | 0.145  |            |
|                                      | RN1966FE           |               |                                                     | 0.074  | —      | 0.138  |            |
| DC current gain                      | RN1961FE           | $h_{FE}$      | $V_{CE} = 5 \text{ V}, I_C = 10 \text{ mA}$         | 30     | —      | —      | —          |
|                                      | RN1962FE           |               |                                                     | 50     | —      | —      |            |
|                                      | RN1963FE           |               |                                                     | 70     | —      | —      |            |
|                                      | RN1964FE           |               |                                                     | 80     | —      | —      |            |
|                                      | RN1965FE           |               |                                                     | 80     | —      | —      |            |
|                                      | RN1966FE           |               |                                                     | 80     | —      | —      |            |
| Collector-emitter saturation voltage | RN1961FE to 1966FE | $V_{CE(sat)}$ | $I_C = 5 \text{ mA}, I_B = 0.25 \text{ mA}$         | —      | 0.1    | 0.3    | V          |
| Input voltage (ON)                   | RN1961FE           | $V_{I(ON)}$   | $V_{CE} = 0.2 \text{ V}, I_C = 5 \text{ mA}$        | 1.1    | —      | 2.0    | V          |
|                                      | RN1962FE           |               |                                                     | 1.2    | —      | 2.4    |            |
|                                      | RN1963FE           |               |                                                     | 1.3    | —      | 3.0    |            |
|                                      | RN1964FE           |               |                                                     | 1.5    | —      | 5.0    |            |
|                                      | RN1965FE           |               |                                                     | 0.6    | —      | 1.1    |            |
|                                      | RN1966FE           |               |                                                     | 0.7    | —      | 1.3    |            |
| Input voltage (OFF)                  | RN1961FE to 1964FE | $V_{I(OFF)}$  | $V_{CE} = 5 \text{ V}, I_C = 0.1 \text{ mA}$        | 1.0    | —      | 1.5    | V          |
|                                      | RN1965FE, 1966FE   |               |                                                     | 0.5    | —      | 0.8    |            |
| Transition frequency                 | RN1961FE to 1966FE | $f_T$         | $V_{CE} = 10 \text{ V}, I_C = 5 \text{ mA}$         | —      | 250    | —      | MHz        |
| Collector output capacitance         | RN1961FE to 1966FE | $C_{ob}$      | $V_{CB} = 10 \text{ V}, I_E = 0, f = 1 \text{ MHz}$ | —      | 3      | 6      | pF         |
| Input resistor                       | RN1961FE           | R1            | —                                                   | 3.29   | 4.7    | 6.11   | k $\Omega$ |
|                                      | RN1962FE           |               |                                                     | 7      | 10     | 13     |            |
|                                      | RN1963FE           |               |                                                     | 15.4   | 22     | 28.6   |            |
|                                      | RN1964FE           |               |                                                     | 32.9   | 47     | 61.1   |            |
|                                      | RN1965FE           |               |                                                     | 1.54   | 2.2    | 2.86   |            |
|                                      | RN1966FE           |               |                                                     | 3.29   | 4.7    | 6.11   |            |
| Resistor ratio                       | RN1961FE to 1964FE | R1/R2         | —                                                   | 0.9    | 1.0    | 1.1    | —          |
|                                      | RN1965FE           |               |                                                     | 0.0421 | 0.0468 | 0.0515 |            |
|                                      | RN1966FE           |               |                                                     | 0.09   | 0.1    | 0.11   |            |

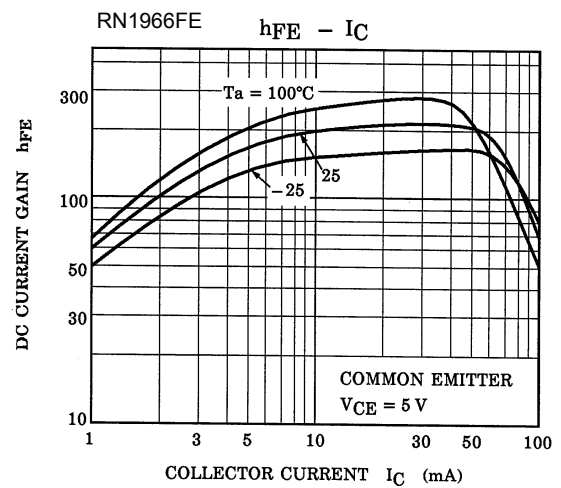
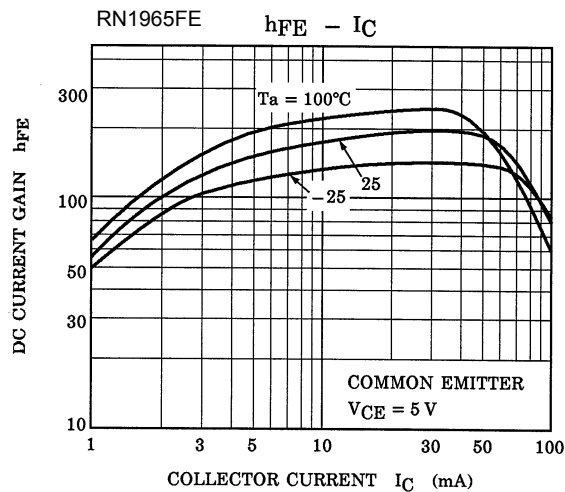
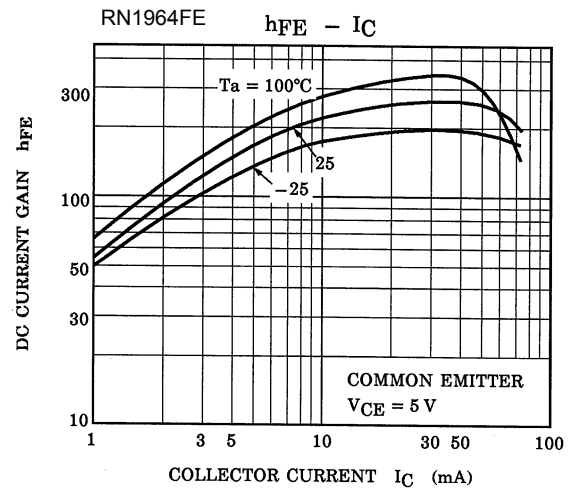
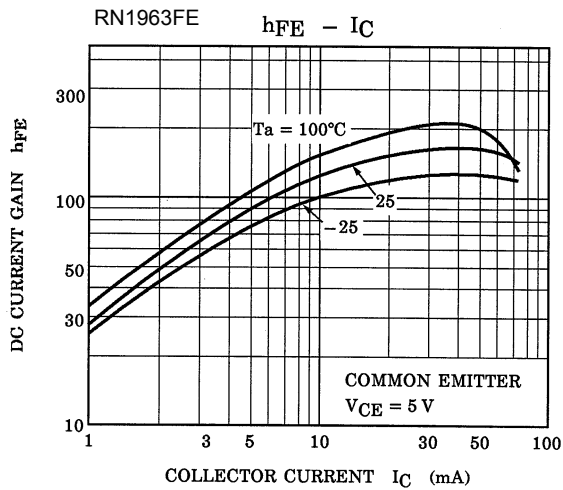
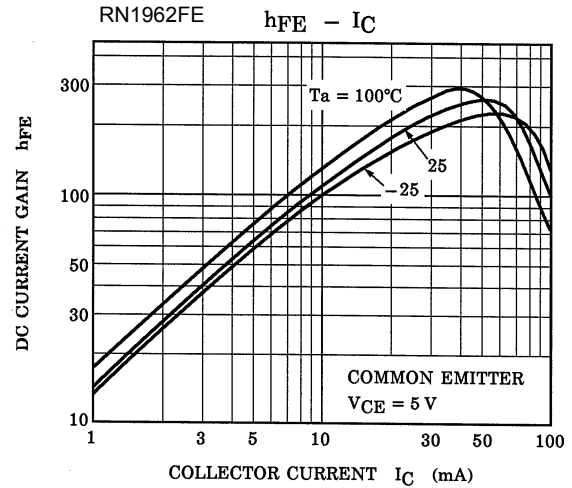
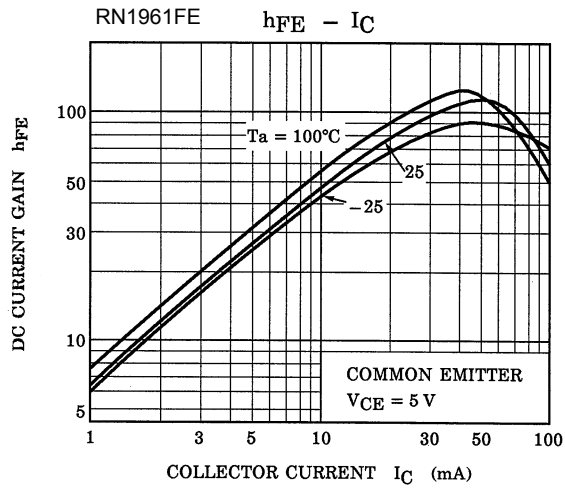
## Q1, Q2 Common



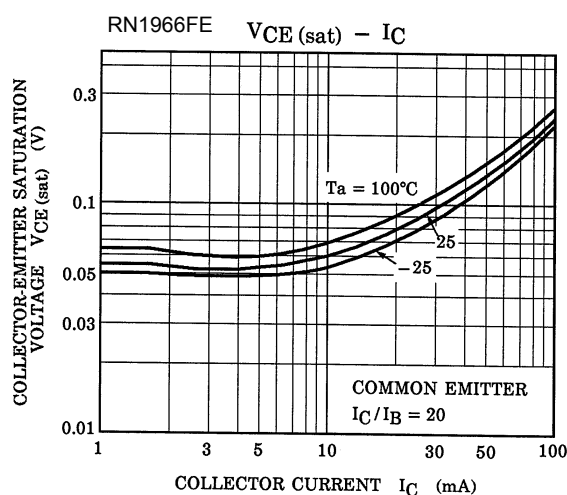
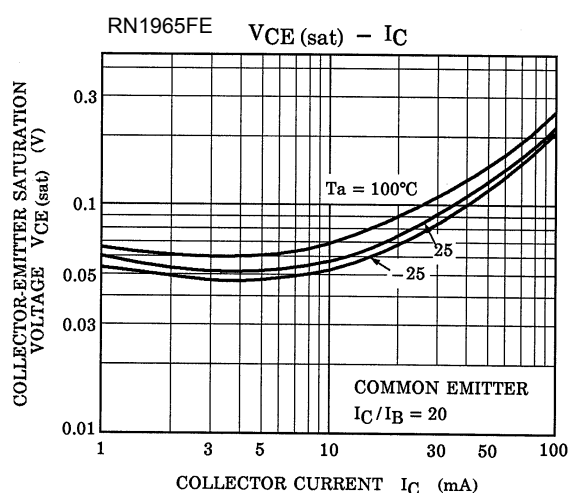
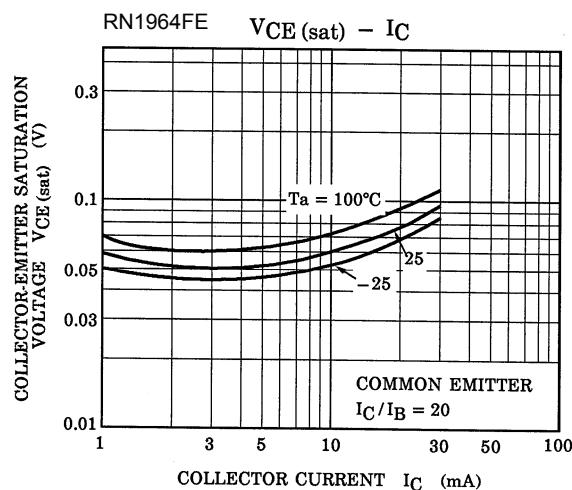
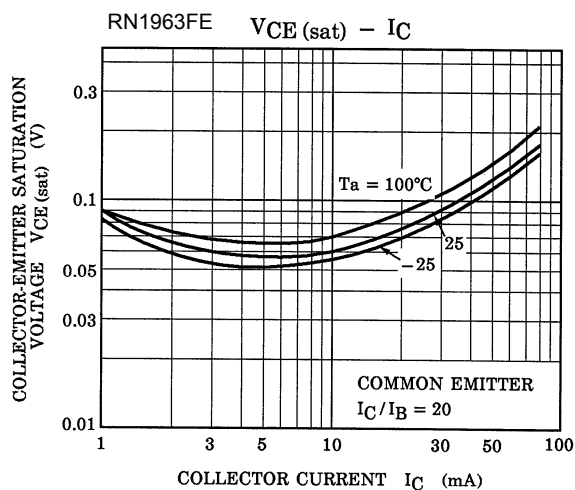
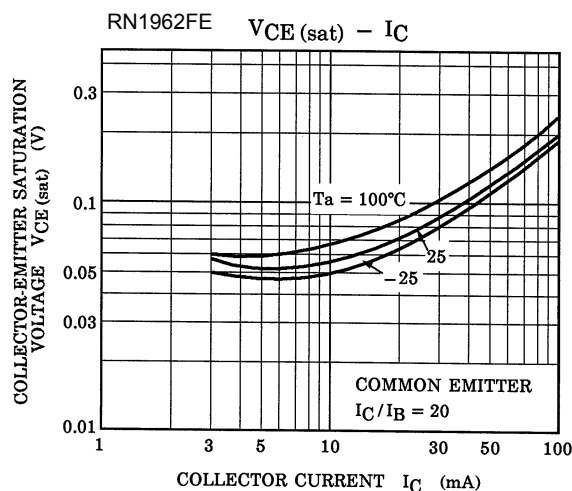
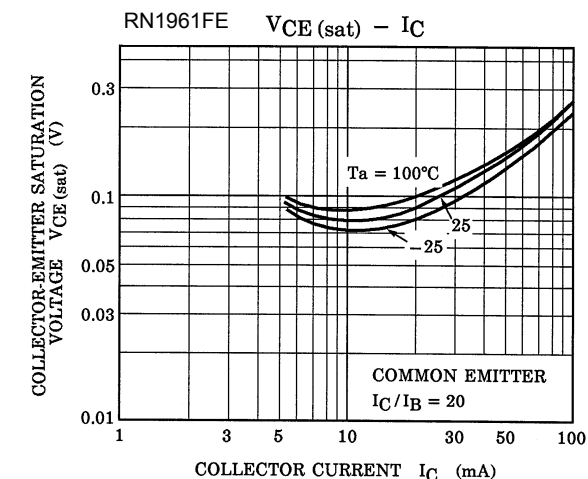
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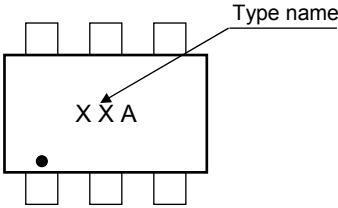
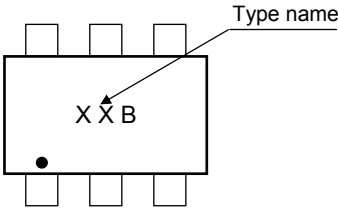
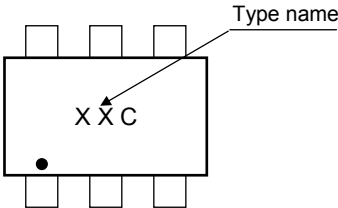
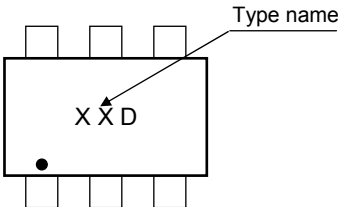
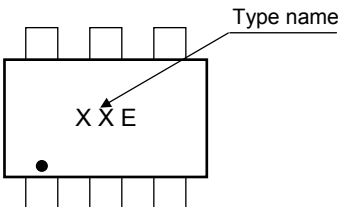
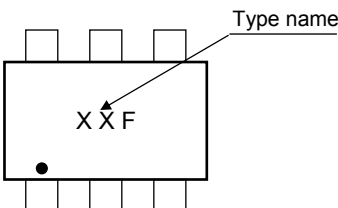
## Q1,Q2 Common



## Q1,Q2 Common



Marking

| Type Name | Marking                                                                                                                                                                                                                                                                                                                                                                           |
|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| RN1961FE  |  <p>The diagram shows a rectangular component with six pins (three on each long side). Inside the rectangle, the text 'X X A' is printed. A small black dot is located at the bottom-left corner of the rectangle. An arrow points from the text 'Type name' to the second 'X' in 'X X A'.</p>   |
| RN1962FE  |  <p>The diagram shows a rectangular component with six pins (three on each long side). Inside the rectangle, the text 'X X B' is printed. A small black dot is located at the bottom-left corner of the rectangle. An arrow points from the text 'Type name' to the second 'X' in 'X X B'.</p>   |
| RN1963FE  |  <p>The diagram shows a rectangular component with six pins (three on each long side). Inside the rectangle, the text 'X X C' is printed. A small black dot is located at the bottom-left corner of the rectangle. An arrow points from the text 'Type name' to the second 'X' in 'X X C'.</p>  |
| RN1964FE  |  <p>The diagram shows a rectangular component with six pins (three on each long side). Inside the rectangle, the text 'X X D' is printed. A small black dot is located at the bottom-left corner of the rectangle. An arrow points from the text 'Type name' to the second 'X' in 'X X D'.</p> |
| RN1965FE  |  <p>The diagram shows a rectangular component with six pins (three on each long side). Inside the rectangle, the text 'X X E' is printed. A small black dot is located at the bottom-left corner of the rectangle. An arrow points from the text 'Type name' to the second 'X' in 'X X E'.</p> |
| RN1966FE  |  <p>The diagram shows a rectangular component with six pins (three on each long side). Inside the rectangle, the text 'X X F' is printed. A small black dot is located at the bottom-left corner of the rectangle. An arrow points from the text 'Type name' to the second 'X' in 'X X F'.</p> |

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