

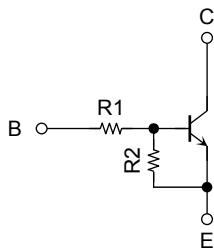
TOSHIBA Transistor Silicon NPN Epitaxial Type (PCT Process) (Bias Resistor Built-in Transistor)

# RN1707JE, RN1708JE, RN1709JE

Switching, Inverter Circuit, Interface Circuit and Driver Circuit Applications

- 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 to use in various circuit designs.
- Complementary to RN2707JE to RN2709JE

## Equivalent Circuit and Bias Resistor Values



| Type No. | R1 (kΩ) | R2 (kΩ) |
|----------|---------|---------|
| RN1707JE | 10      | 47      |
| RN1708JE | 22      | 47      |
| RN1709JE | 47      | 22      |

Unit: mm

1.BASE1 (B1)  
2.EMITTER (E)  
3.BASE2 (B2)  
4.COLLECTOR2 (C2)  
5.COLLECTOR1 (C1)

ESV

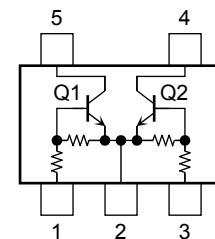
|         |        |
|---------|--------|
| JEDEC   | —      |
| JEITA   | —      |
| TOSHIBA | 2-2P1D |

Weight:3mg (typ.)

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

| Characteristics             |                    | Symbol         | Rating     | Unit |
|-----------------------------|--------------------|----------------|------------|------|
| Collector-base voltage      | RN1707JE to 1709JE | $V_{CBO}$      | 50         | V    |
| Collector-emitter voltage   |                    | $V_{CEO}$      | 50         | V    |
| Emitter-base voltage        | RN1707JE           | $V_{EBO}$      | 6          | V    |
|                             | RN1708JE           |                | 7          |      |
|                             | RN1709JE           |                | 15         |      |
| Collector current           | RN1707JE to 1709JE | $I_C$          | 100        | mA   |
| Collector power dissipation |                    | $P_C$ (Note 1) | 100        | mW   |
| Junction temperature        |                    | $T_j$          | 150        | °C   |
| Storage temperature range   |                    | $T_{stg}$      | -55 to 150 | °C   |

## Equivalent Circuit (top view)



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).

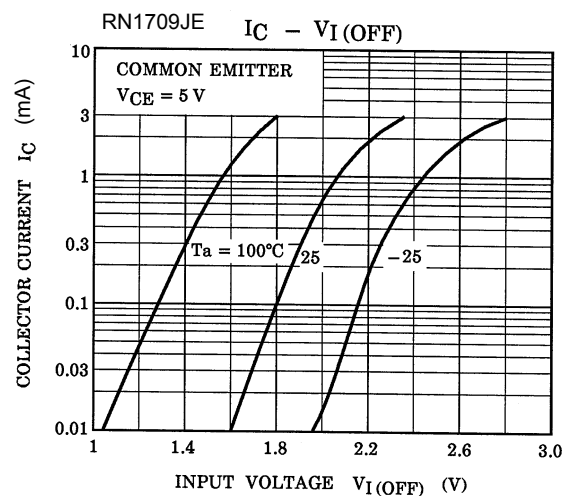
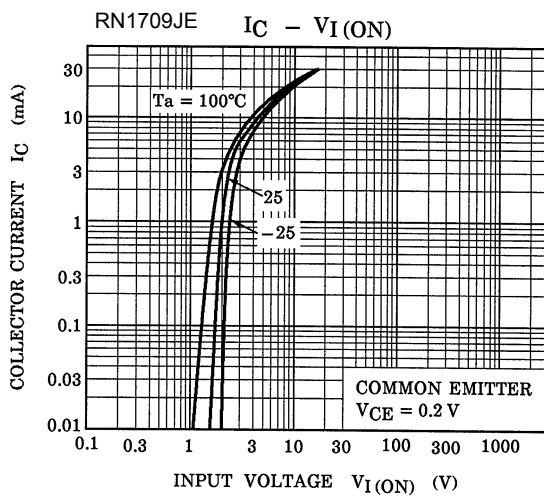
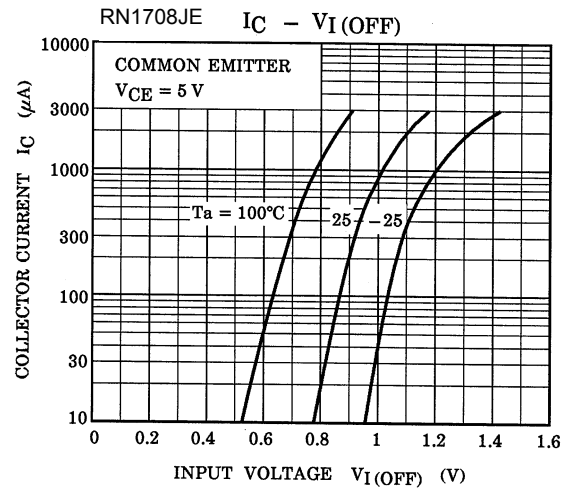
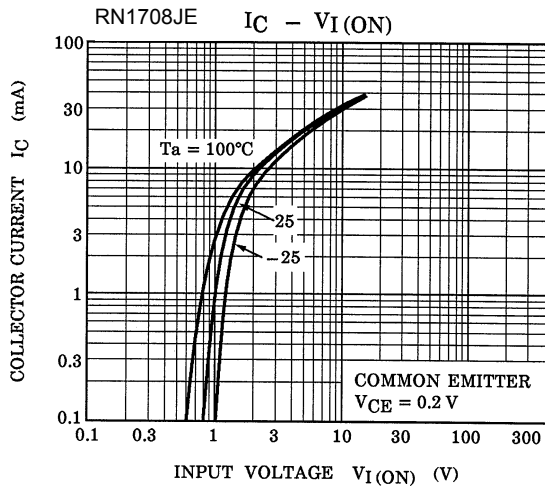
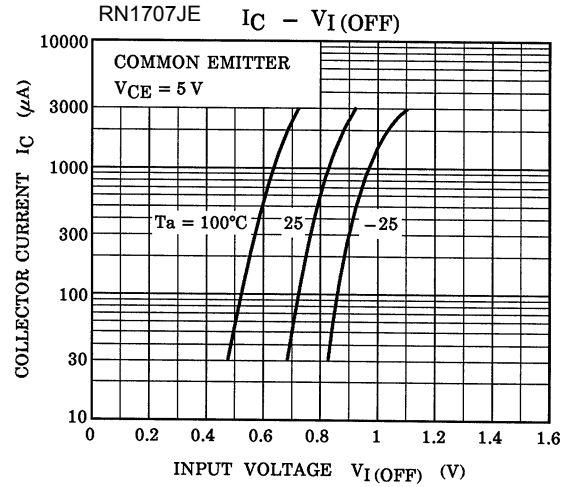
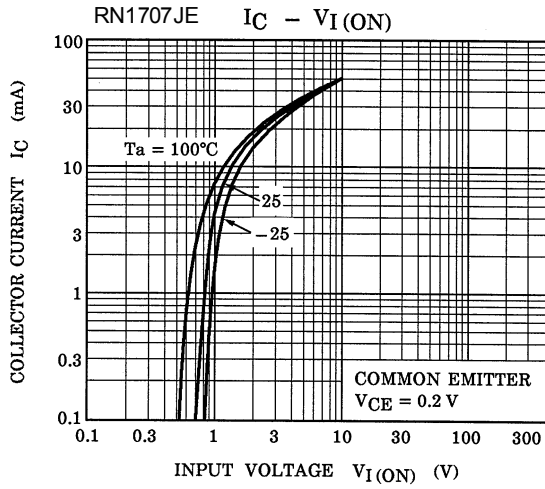
Note 1: Total rating

Start of commercial production  
2000-06

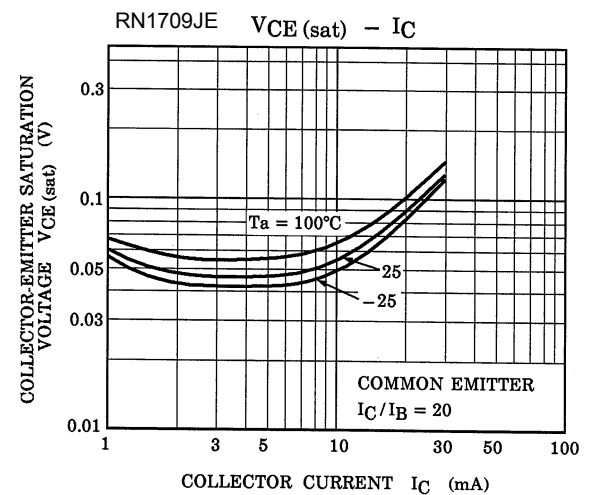
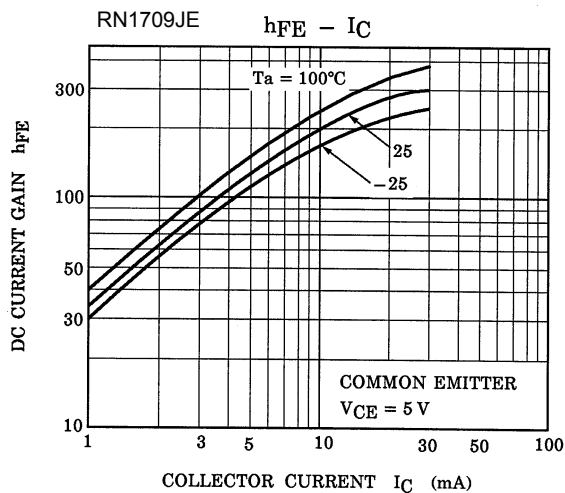
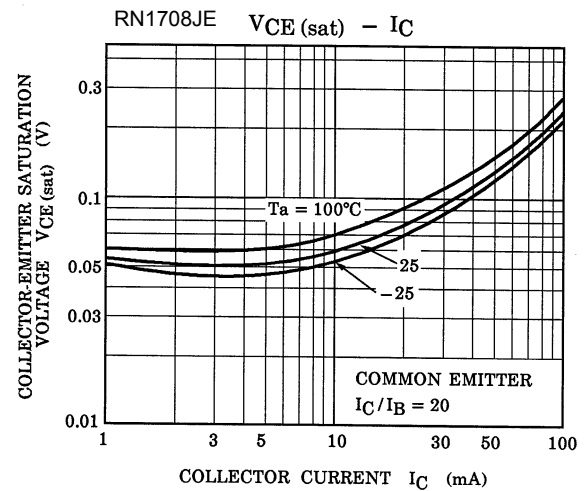
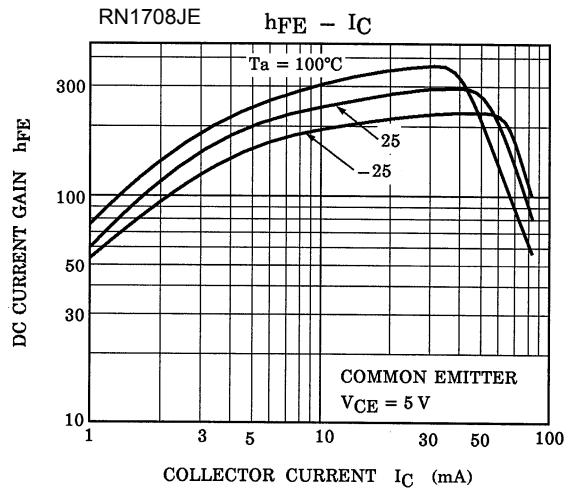
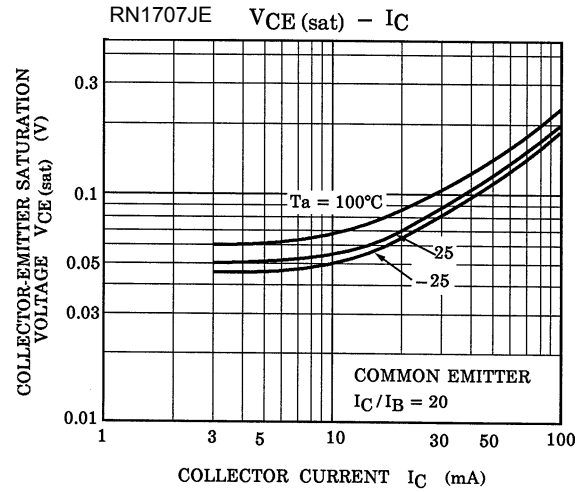
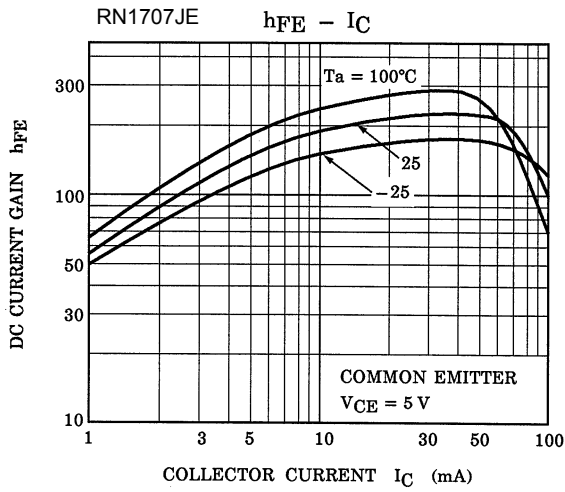
## Electrical Characteristics (Ta = 25°C) (Q1, Q2 common)

| Characteristics                      |                      | Symbol        | Test Condition                                    | Min   | Typ.  | Max   | Unit |
|--------------------------------------|----------------------|---------------|---|-------|-------|-------|------|
| Collector cut-off current            | RN1707JE to RN1709JE | $I_{CBO}$     | $V_{CB} = 50\text{ V}, I_E = 0$                   | —     | —     | 100   | nA   |
|                                      |                      | $I_{CEO}$     | $V_{CE} = 50\text{ V}, I_B = 0$                   | —     | —     | 500   |      |
| Emitter cut-off current              | RN1707JE             | $I_{EBO}$     | $V_{EB} = 6\text{ V}, I_C = 0$                    | 0.081 | —     | 0.15  | mA   |
|                                      | RN1708JE             |               | $V_{EB} = 7\text{ V}, I_C = 0$                    | 0.078 | —     | 0.145 |      |
|                                      | RN1709JE             |               | $V_{EB} = 15\text{ V}, I_C = 0$                   | 0.167 | —     | 0.311 |      |
| DC current gain                      | RN1707JE             | $h_{FE}$      | $V_{CE} = 5\text{ V}, I_C = 10\text{ mA}$         | 80    | —     | —     | —    |
|                                      | RN1708JE             |               |   | 80    | —     | —     |      |
|                                      | RN1709JE             |               |   | 70    | —     | —     |      |
| Collector-emitter saturation voltage | RN1707JE to RN1709JE | $V_{CE(sat)}$ | $I_C = 5\text{ mA}, I_B = 0.25\text{ mA}$         | —     | 0.1   | 0.3   | V    |
| Input voltage (ON)                   | RN1707JE             | $V_I(ON)$     | $V_{CE} = 0.2\text{ V}, I_C = 5\text{ mA}$        | 0.7   | —     | 1.8   | V    |
|                                      | RN1708JE             |               |   | 1.0   | —     | 2.6   |      |
|                                      | RN1709JE             |               |   | 2.2   | —     | 5.8   |      |
| Input voltage (OFF)                  | RN1707JE             | $V_I(OFF)$    | $V_{CE} = 5\text{ V}, I_C = 0.1\text{ mA}$        | 0.5   | —     | 1     | V    |
|                                      | RN1708JE             |               |   | 0.6   | —     | 1.16  |      |
|                                      | RN1709JE             |               |   | 1.5   | —     | 2.6   |      |
| Transition frequency                 | RN1707JE to RN1709JE | $f_T$         | $V_{CE} = 10\text{ V}, I_C = 5\text{ mA}$         | —     | 250   | —     | MHz  |
| Collector output capacitance         | RN1707JE to RN1709JE | $C_{ob}$      | $V_{CB} = 10\text{ V}, I_E = 0, f = 1\text{ MHz}$ | —     | 3     | 6     | pF   |
| Input resistor                       | RN1707JE             | R1            | —   | 7     | 10    | 13    | kΩ   |
|                                      | RN1708JE             |               |   | 15.4  | 22    | 28.6  |      |
|                                      | RN1709JE             |               |   | 32.9  | 47    | 61.1  |      |
| Resistor ratio                       | RN1707JE             | R1/R2         | —   | 0.191 | 0.213 | 0.232 | —    |
|                                      | RN1708JE             |               |   | 0.421 | 0.468 | 0.515 |      |
|                                      | RN1709JE             |               |   | 1.92  | 2.14  | 2.35  |      |

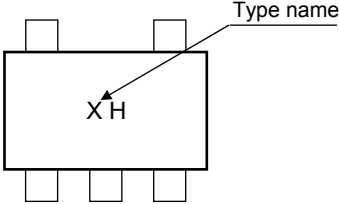
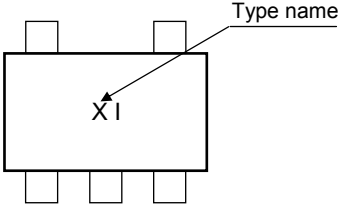
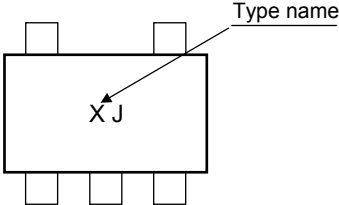
## Q1, Q2 Common



Q1, Q2 Common



**Marking**

| Type Name | Marking  |
|-----------|--|
| RN1707JE  |  A schematic diagram of a rectangular component with four pins (two on top, two on bottom). The marking 'XH' is centered on the component. An arrow points from the text 'Type name' to the 'H' in 'XH'.  |
| RN1708JE  |  A schematic diagram of a rectangular component with four pins (two on top, two on bottom). The marking 'XI' is centered on the component. An arrow points from the text 'Type name' to the 'I' in 'XI'.  |
| RN1709JE  |  A schematic diagram of a rectangular component with four pins (two on top, two on bottom). The marking 'XJ' is centered on the component. An arrow points from the text 'Type name' to the 'J' in 'XJ'. |

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