

TOSHIBA Transistor Silicon NPN Epitaxial Type (PCT Process)

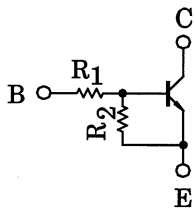
## RN1414, RN1415, RN1416, RN1417, RN1418

Switching, Inverter Circuit, Interface Circuit and Driver Circuit Applications

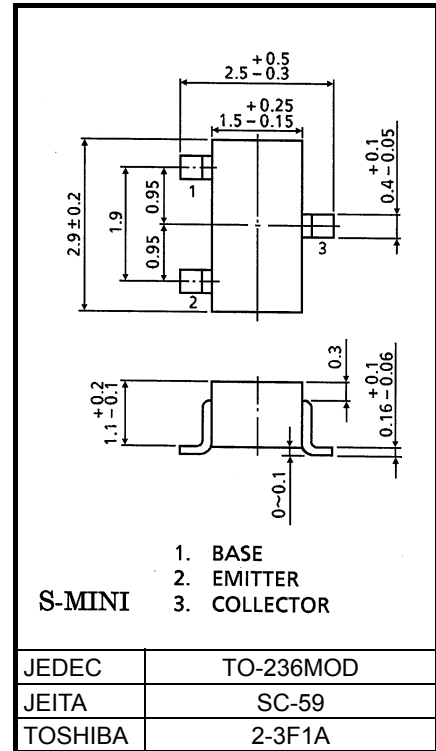
Unit: mm

- With built-in bias resistors
- Simplified circuit design
- Reduced number of parts and simplified manufacturing process
- Complementary to RN2414 to RN2418

### Equivalent Circuit and Bias Resistor Values



| Type No. | R1 (kΩ) | R2 (kΩ) |
|----------|---------|---------|
| RN1414   | 1       | 10      |
| RN1415   | 2.2     | 10      |
| RN1416   | 4.7     | 10      |
| RN1417   | 10      | 4.7     |
| RN1418   | 47      | 10      |



Weight: 0.012g (typ.)

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

| Characteristic              | Symbol    | Rating     | Unit |
|-----------------------------|-----------|------------|------|
| Collector-base voltage      | $V_{CBO}$ | 50         | V    |
| Collector-emitter voltage   | $V_{CEO}$ | 50         | V    |
| Emitter-base voltage        | $V_{EBO}$ | 5          | V    |
|                             |           | 6          |      |
|                             |           | 7          |      |
|                             |           | 15         |      |
|                             |           | 25         |      |
| Collector current           | $I_C$     | 100        | mA   |
| Collector power dissipation | $P_C$     | 200        | mW   |
| Junction temperature        | $T_j$     | 150        | °C   |
| Storage temperature range   | $T_{stg}$ | -55 to 150 | °C   |

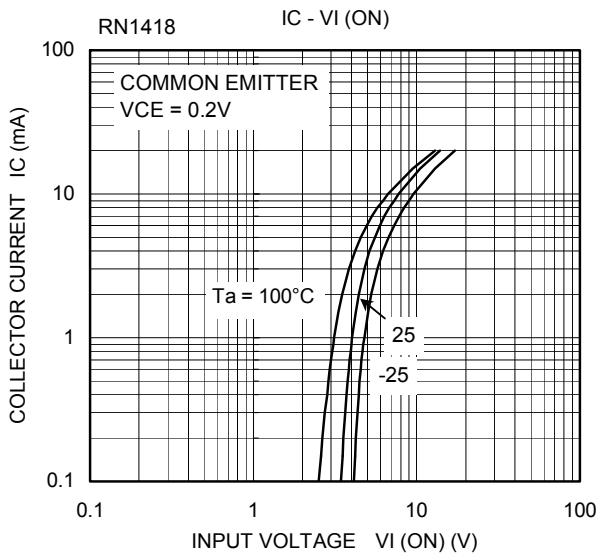
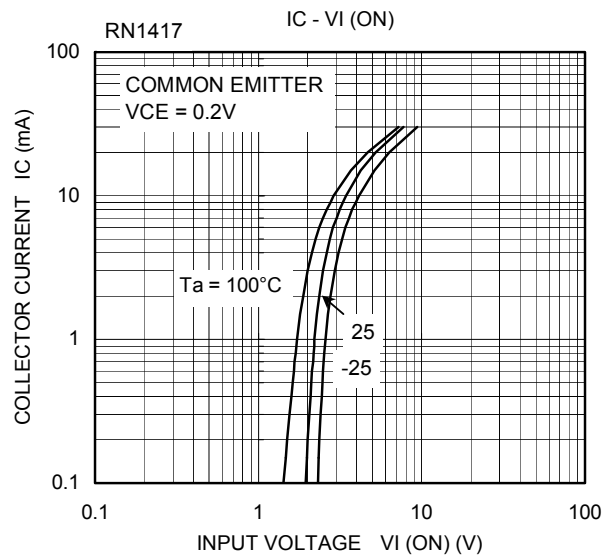
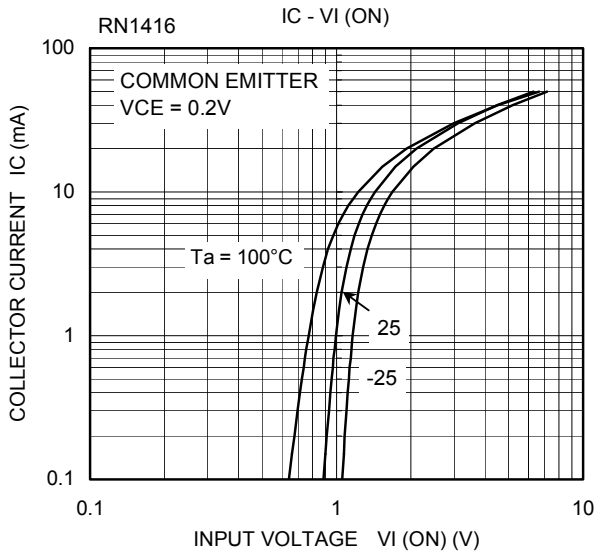
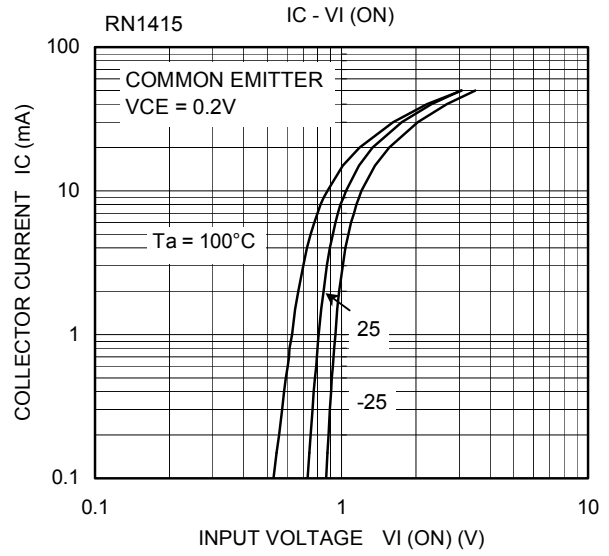
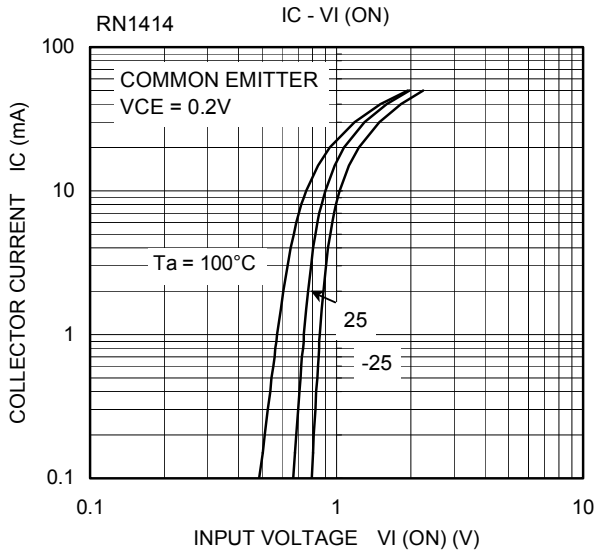
Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.)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

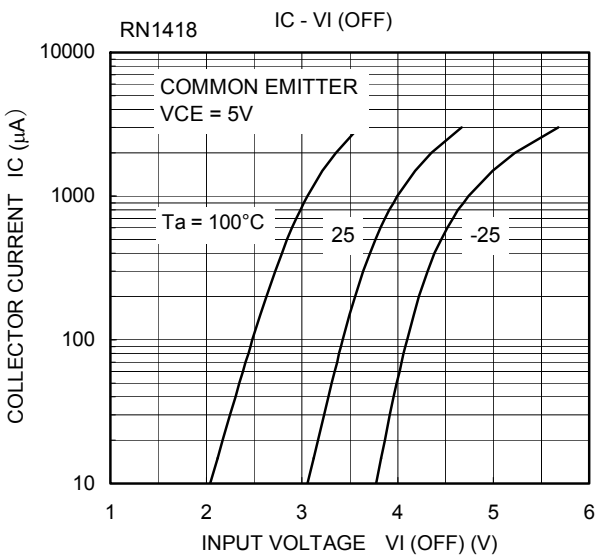
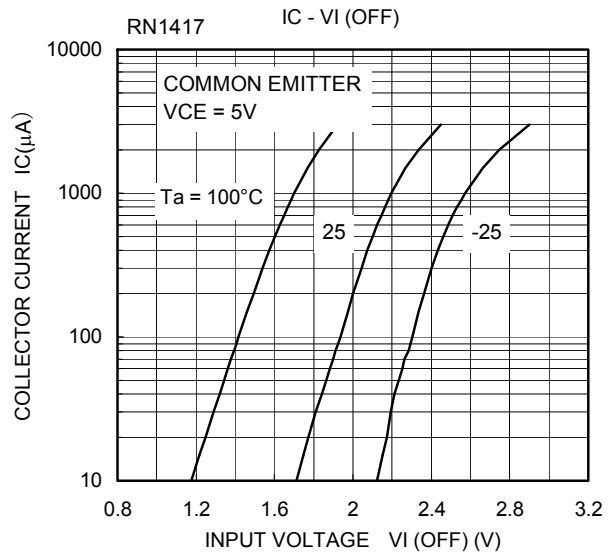
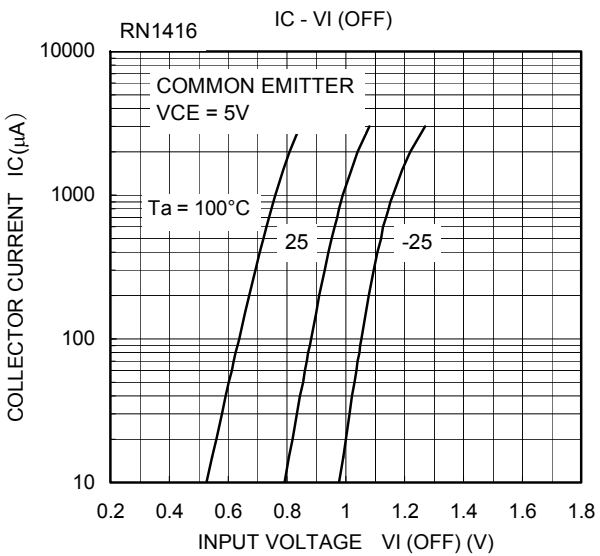
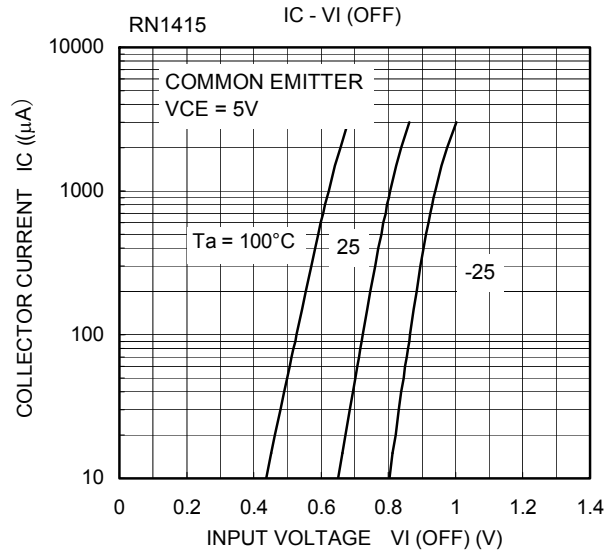
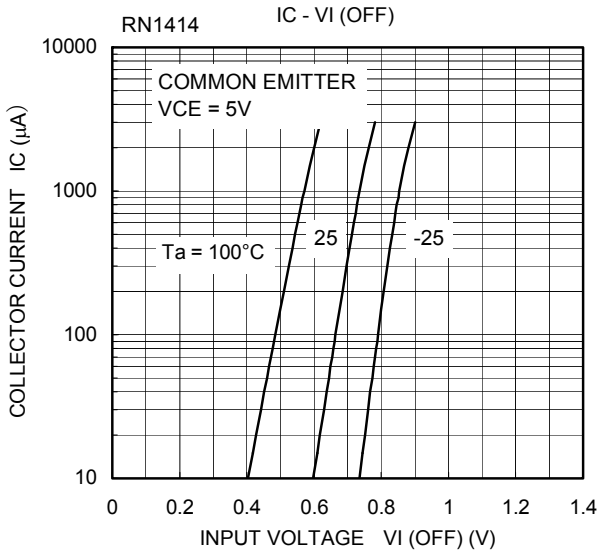
Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

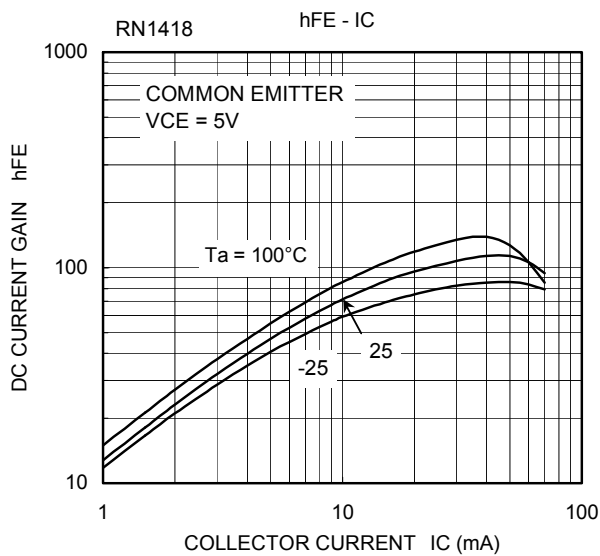
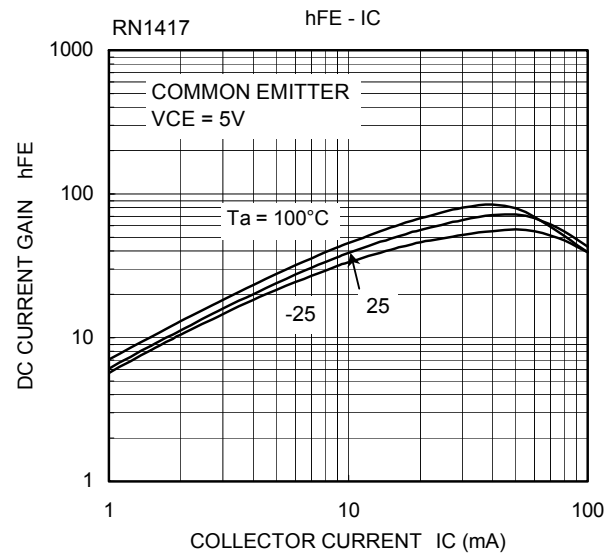
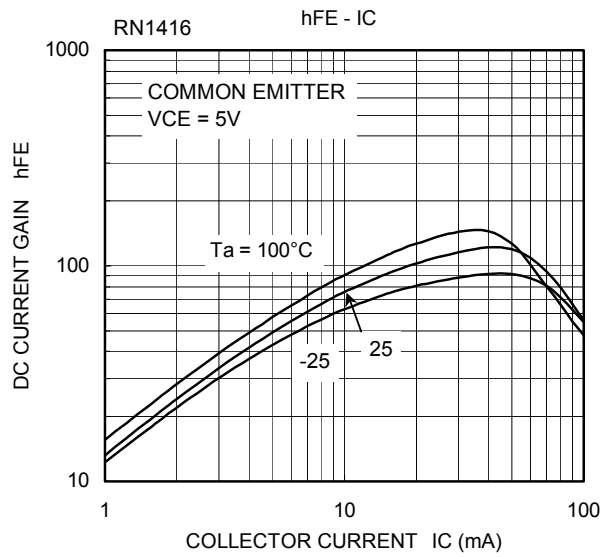
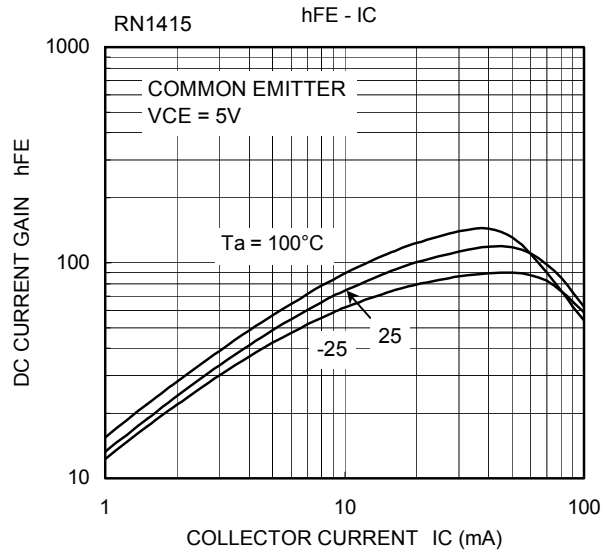
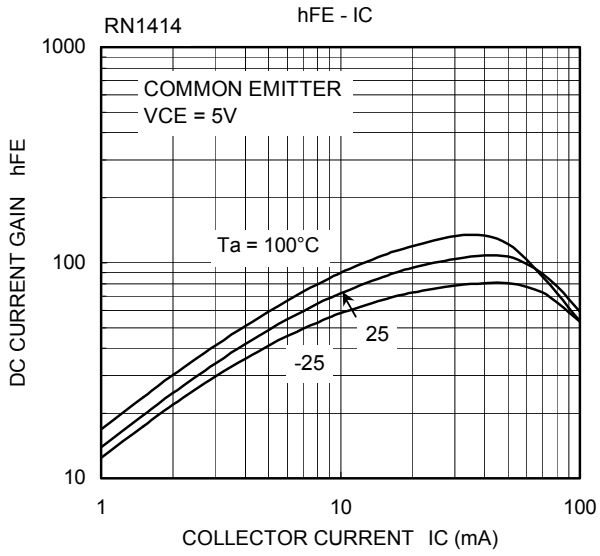
Start of commercial production  
1994-08

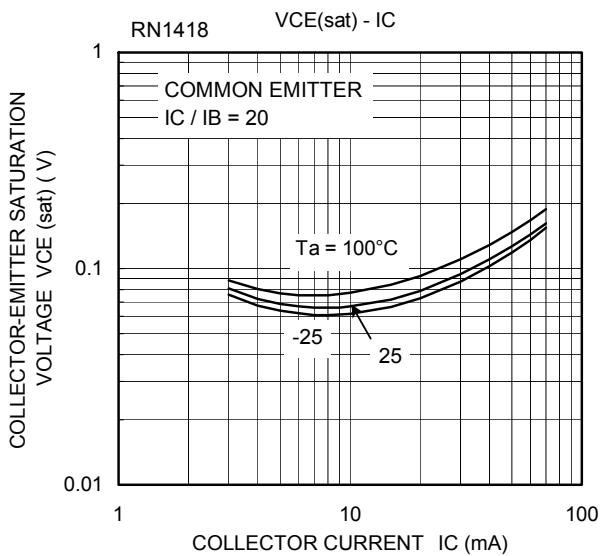
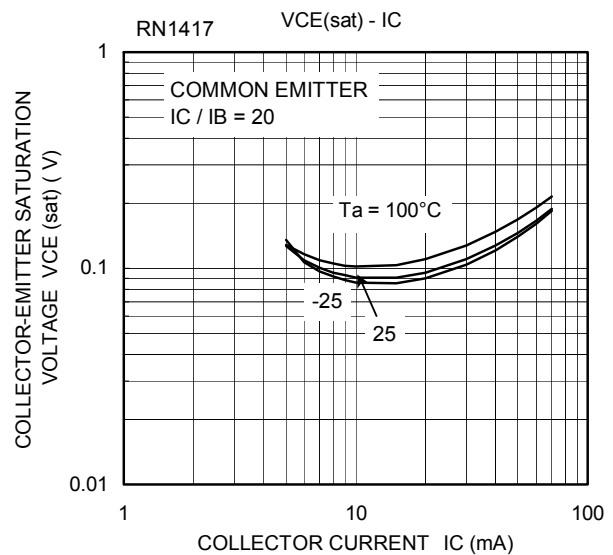
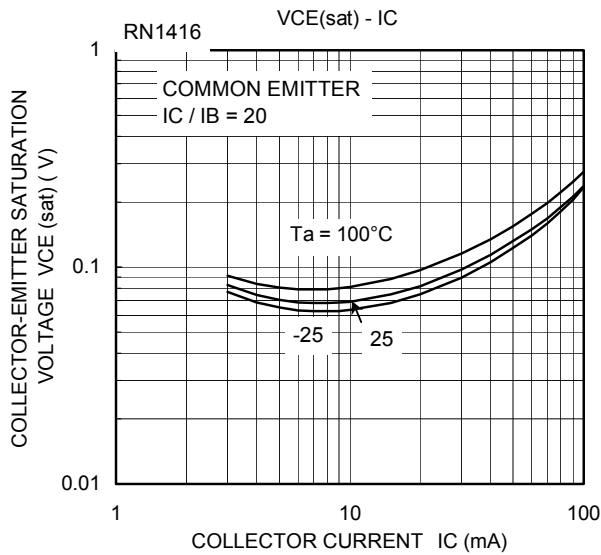
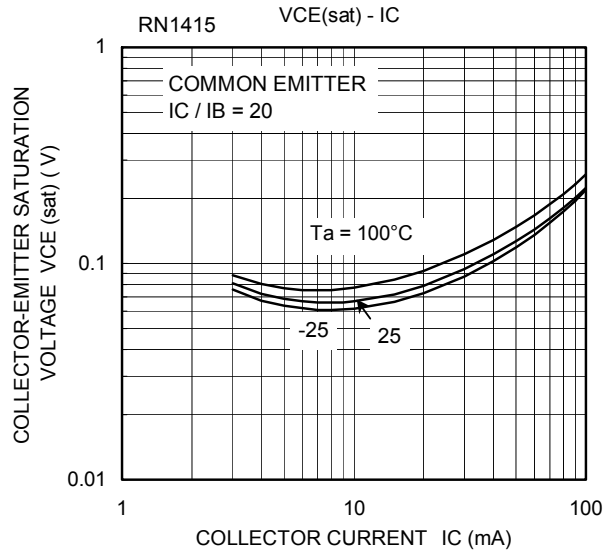
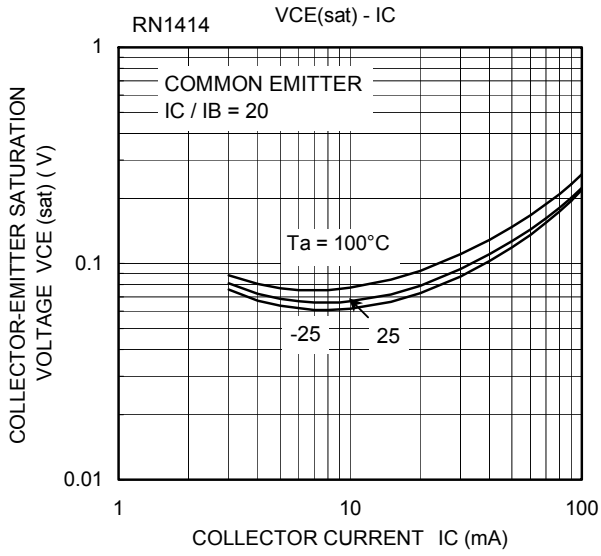
## Electrical Characteristics (Ta = 25°C)

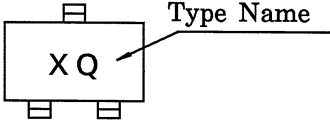
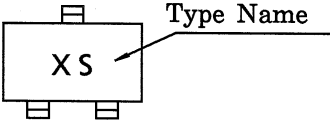
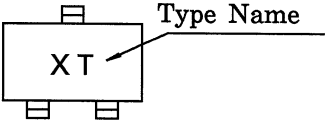
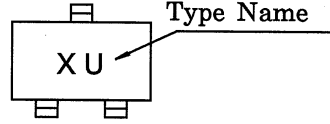
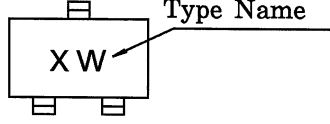
| Characteristic                       |                 | Symbol        | Test Circuit | Test Condition                    | Min  | Typ. | Max  | Unit |
|--------------------------------------|-----------------|---------------|--------------|-----------------------------------|------|------|------|------|
| Collector cut-off current            | RN1414 to 1418  | $I_{CBO}$     | —            | $V_{CB} = 50V, I_E = 0$           | —    | —    | 100  | nA   |
|                                      | RN1414 to 1418  | $I_{CEO}$     |              | $V_{CE} = 50V, I_B = 0$           | —    | —    | 500  | nA   |
| Emitter cut-off current              | RN1414          | $I_{EBO}$     | —            | $V_{EB} = 5V, I_C = 0$            | 0.35 | —    | 0.65 | mA   |
|                                      | RN1415          |               |              | $V_{EB} = 6V, I_C = 0$            | 0.37 | —    | 0.71 |      |
|                                      | RN1416          |               |              | $V_{EB} = 7V, I_C = 0$            | 0.36 | —    | 0.68 |      |
|                                      | RN1417          |               |              | $V_{EB} = 15V, I_C = 0$           | 0.78 | —    | 1.46 |      |
|                                      | RN1418          |               |              | $V_{EB} = 25V, I_C = 0$           | 0.33 | —    | 0.63 |      |
| DC current gain                      | RN1414 to 16,18 | $h_{FE}$      | —            | $V_{CE} = 5V, I_C = 10mA$         | 50   | —    | —    |      |
|                                      | RN1417          |               |              |                                   | 30   | —    | —    |      |
| Collector-emitter saturation voltage | RN1414 to 1418  | $V_{CE(sat)}$ | —            | $I_C = 5mA, I_B = 0.25mA$         | —    | 0.1  | 0.3  | V    |
| Input voltage (ON)                   | RN1414          | $V_{I(ON)}$   | —            | $V_{CE} = 0.2V, I_C = 5mA$        | 0.6  | —    | 2.0  | V    |
|                                      | RN1415          |               |              |                                   | 0.7  | —    | 2.5  |      |
|                                      | RN1416          |               |              |                                   | 0.8  | —    | 2.5  |      |
|                                      | RN1417          |               |              |                                   | 1.5  | —    | 3.5  |      |
|                                      | RN1418          |               |              |                                   | 2.5  | —    | 10.0 |      |
| Input voltage (OFF)                  | RN1414          | $V_{I(OFF)}$  | —            | $V_{CE} = 5V, I_C = 0.1mA$        | 0.3  | —    | 0.9  | V    |
|                                      | RN1415          |               |              |                                   | 0.3  | —    | 1.0  |      |
|                                      | RN1416          |               |              |                                   | 0.3  | —    | 1.1  |      |
|                                      | RN1417          |               |              |                                   | 0.3  | —    | 2.3  |      |
|                                      | RN1418          |               |              |                                   | 0.5  | —    | 5.7  |      |
| Transition frequency                 | RN1414 to 1418  | $f_T$         | —            | $V_{CE} = 10V, I_C = 5mA$         | —    | 250  | —    | MHz  |
| Collector Output capacitance         | RN1414 to 1418  | $C_{ob}$      | —            | $V_{CB} = 10V, I_E = 0, f = 1MHz$ | —    | 3.0  | 6.0  | pF   |
| Input resistor                       | RN1414          | R1            | —            | —                                 | 0.7  | 1.0  | 1.3  | kΩ   |
|                                      | RN1415          |               |              |                                   | 1.54 | 2.2  | 2.86 |      |
|                                      | RN1416          |               |              |                                   | 3.29 | 4.7  | 6.11 |      |
|                                      | RN1417          |               |              |                                   | 7.0  | 10.0 | 13.0 |      |
|                                      | RN1418          |               |              |                                   | 32.9 | 47.0 | 61.1 |      |
| Resistor ratio                       | RN1414          | R1/R2         | —            | —                                 | —    | 0.1  | —    |      |
|                                      | RN1415          |               |              |                                   | —    | 0.22 | —    |      |
|                                      | RN1416          |               |              |                                   | —    | 0.47 | —    |      |
|                                      | RN1417          |               |              |                                   | —    | 2.13 | —    |      |
|                                      | RN1418          |               |              |                                   | —    | 4.7  | —    |      |









| Type Name | Marking   |
|-----------|---|
| RN1414    |    |
| RN1415    |    |
| RN1416    |    |
| RN1417    |  |
| RN1418    |  |

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