

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

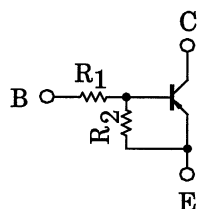
## RN2414, RN2415, RN2416, RN2417, RN2418

Switching, Inverter Circuit, Interface Circuit  
and Driver Circuit Applications

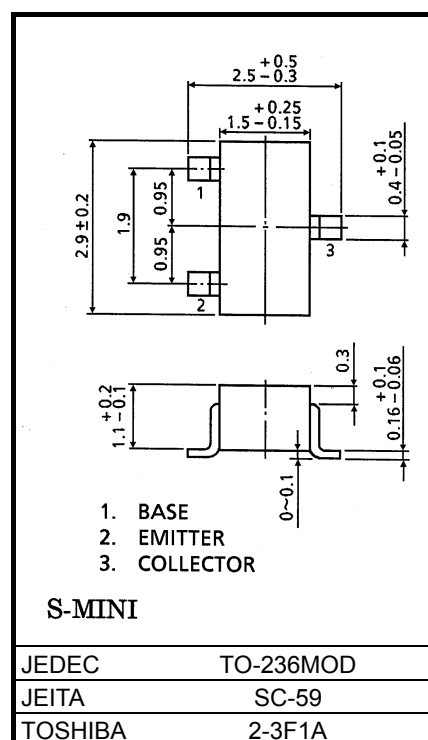
Unit: mm

- With built-in bias resistors
- Simplified circuit design
- Reduce a quantity of parts and manufacturing process
- Complementary to RN1414 to RN1418

### Equivalent Circuit and Bias Resistor Values



| Type No. | R <sub>1</sub> (kΩ) | R <sub>2</sub> (kΩ) |
|----------|---------------------|---------------------|
| RN2414   | 1                   | 10                  |
| RN2415   | 2.2                 | 10                  |
| RN2416   | 4.7                 | 10                  |
| RN2417   | 10                  | 4.7                 |
| RN2418   | 47                  | 10                  |



Weight: 0.012g (typ.)

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

| Characteristic              |                | Symbol           | Rating     | Unit |
|-----------------------------|----------------|------------------|------------|------|
| Collector-base voltage      | RN2414 to 2418 | V <sub>CBO</sub> | -50        | V    |
| Collector-emitter voltage   |                | V <sub>CEO</sub> | -50        | V    |
| Emitter-base voltage        | RN2414         | V <sub>EBO</sub> | -5         | V    |
|                             | RN2415         |                  | -6         |      |
|                             | RN2416         |                  | -7         |      |
|                             | RN2417         |                  | -15        |      |
|                             | RN2418         |                  | -25        |      |
| Collector current           | RN2414 to 2418 | I <sub>C</sub>   | -100       | mA   |
| Collector power dissipation |                | P <sub>C</sub>   | 200        | mW   |
| Junction temperature        |                | T <sub>j</sub>   | 150        | °C   |
| Storage temperature range   |                | T <sub>stg</sub> | -55 to 150 | °C   |

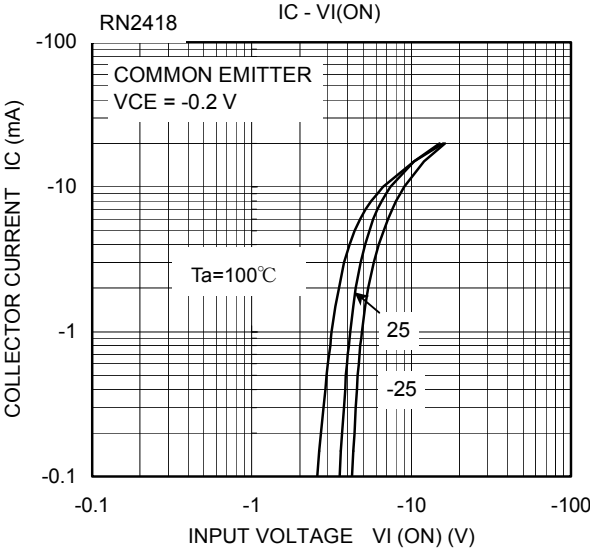
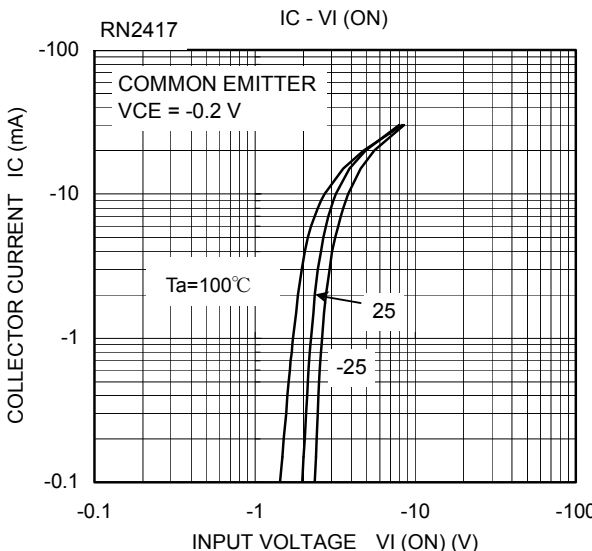
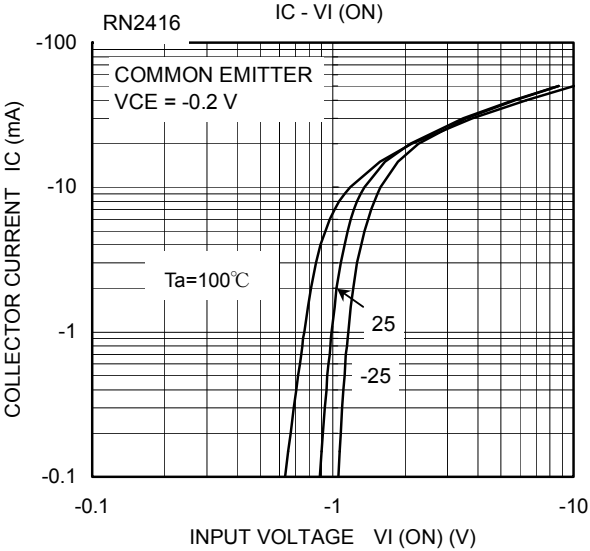
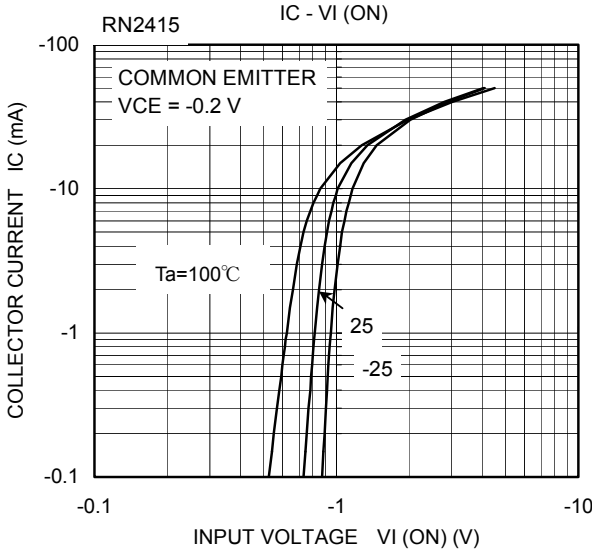
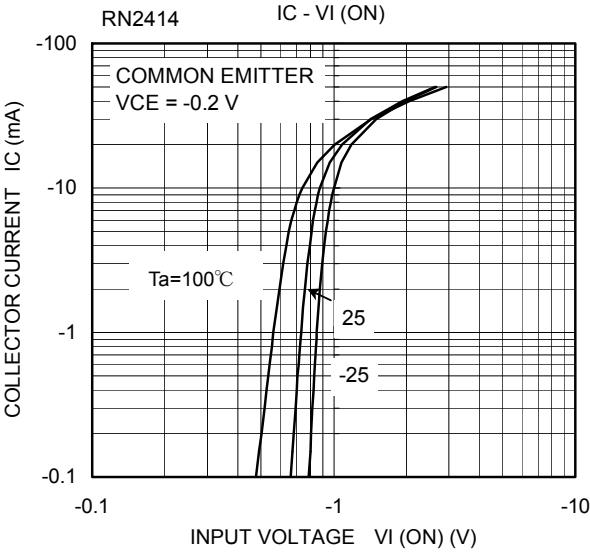
Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.)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

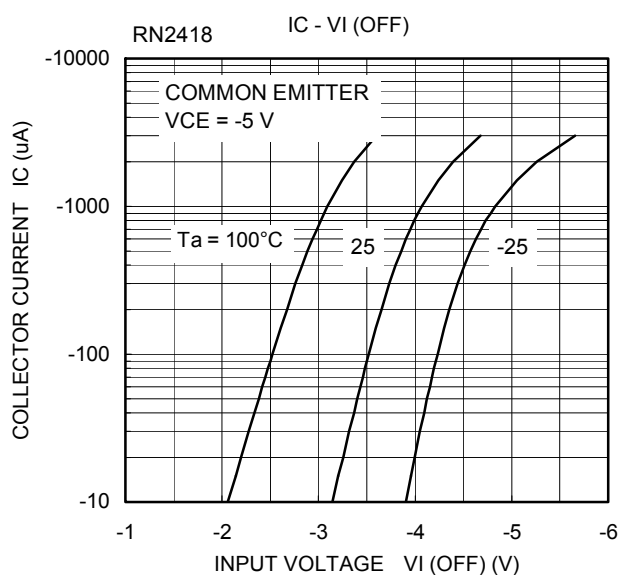
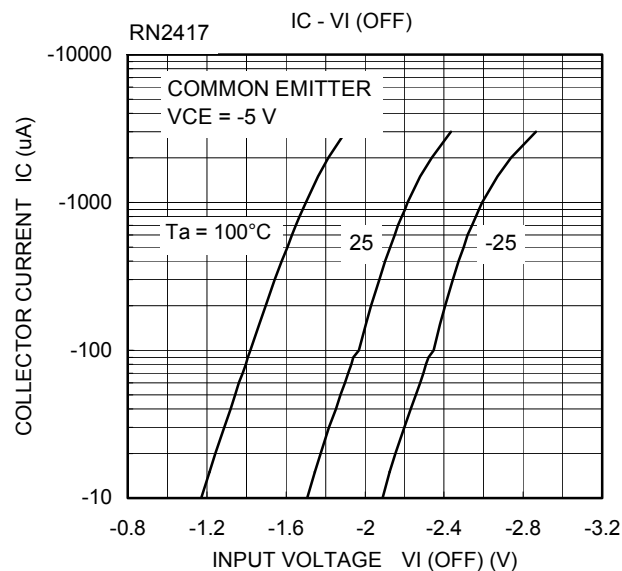
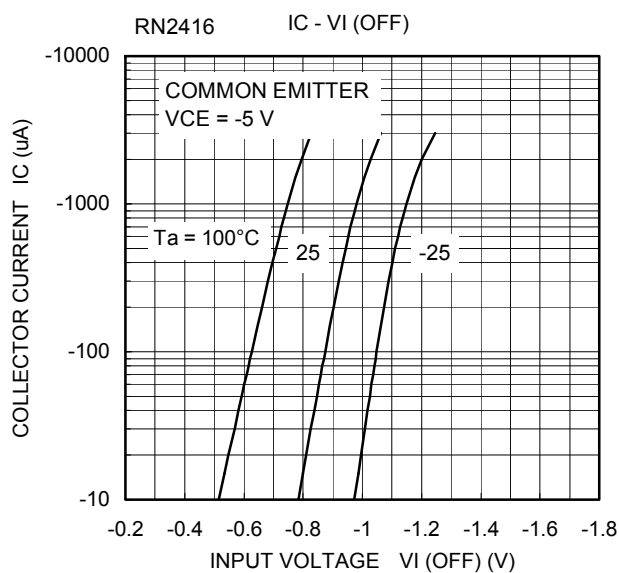
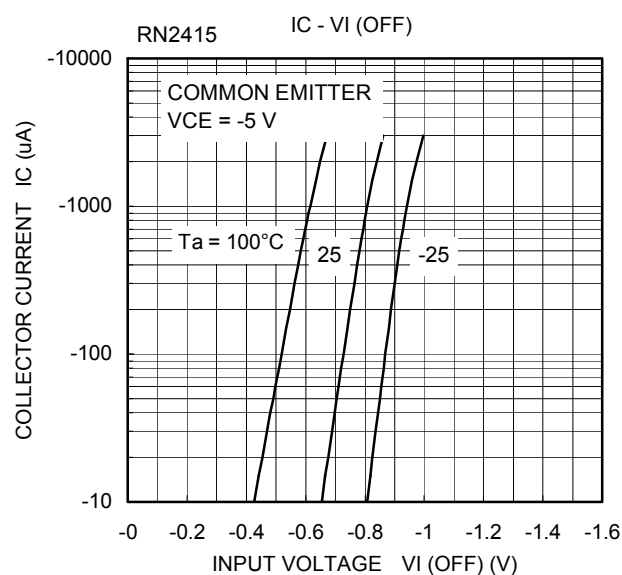
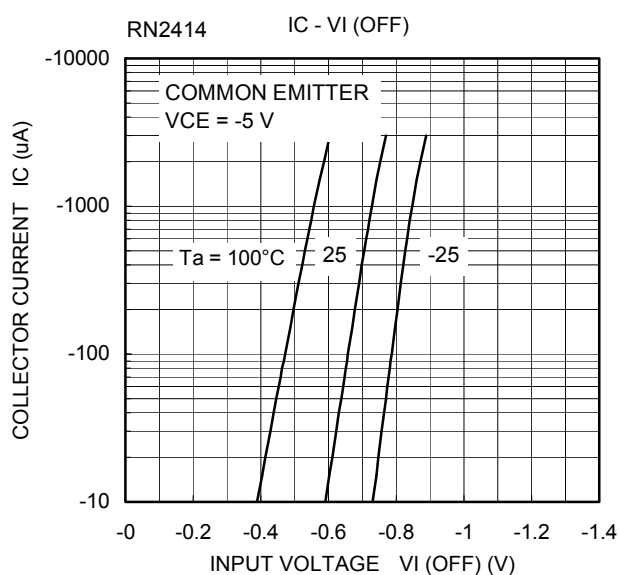
Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

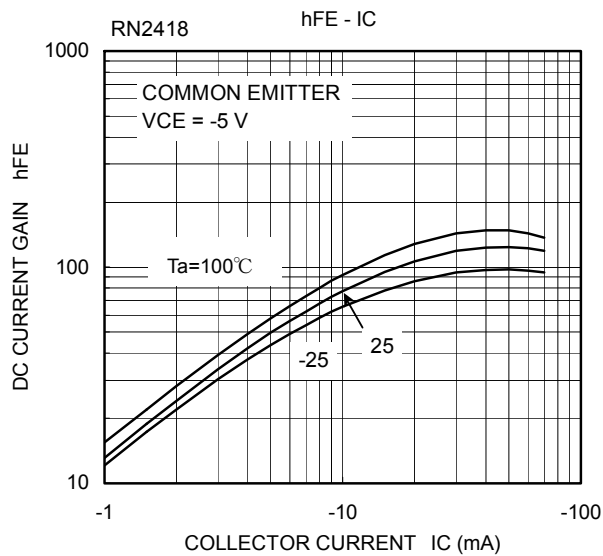
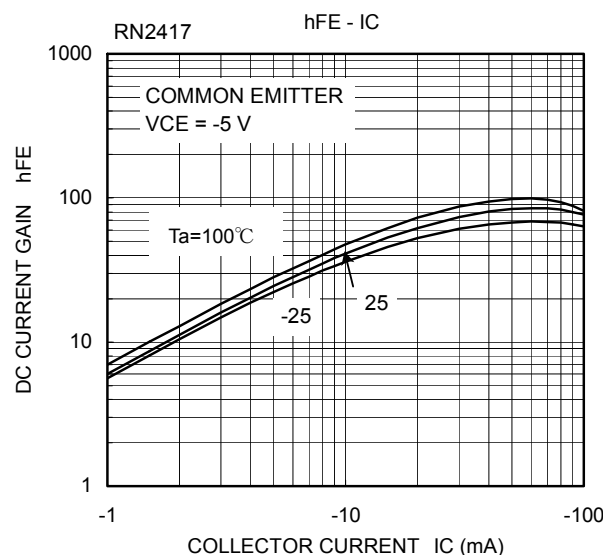
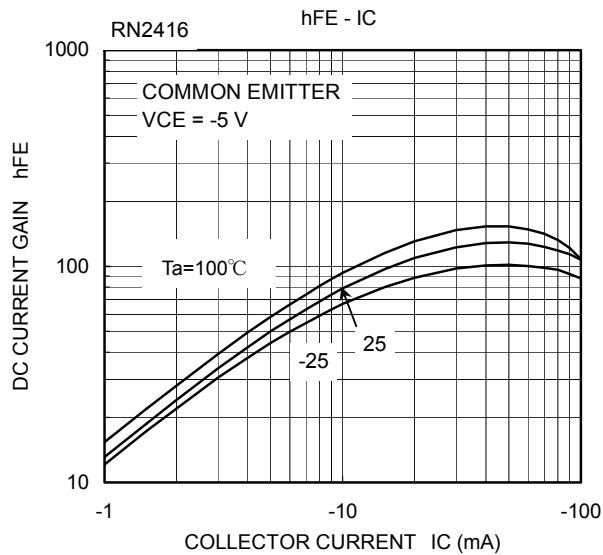
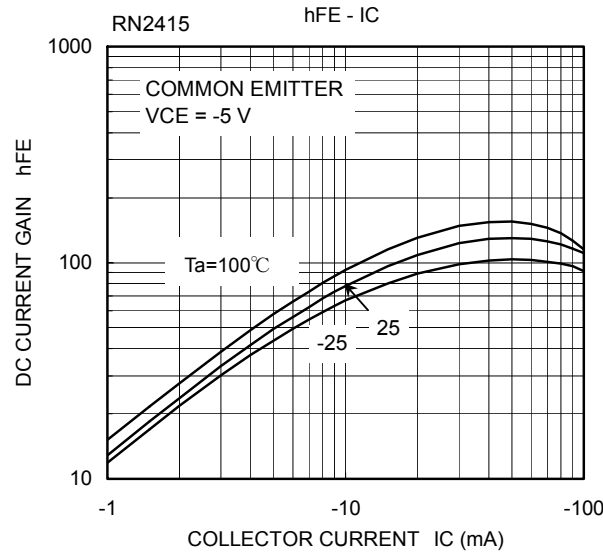
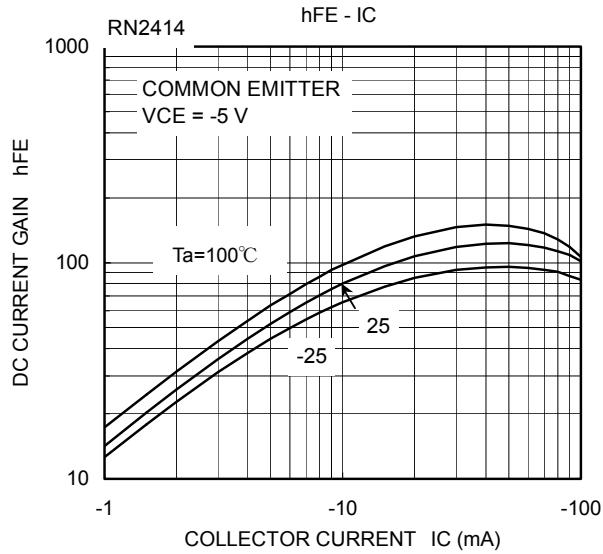
Start of commercial production  
1994-08

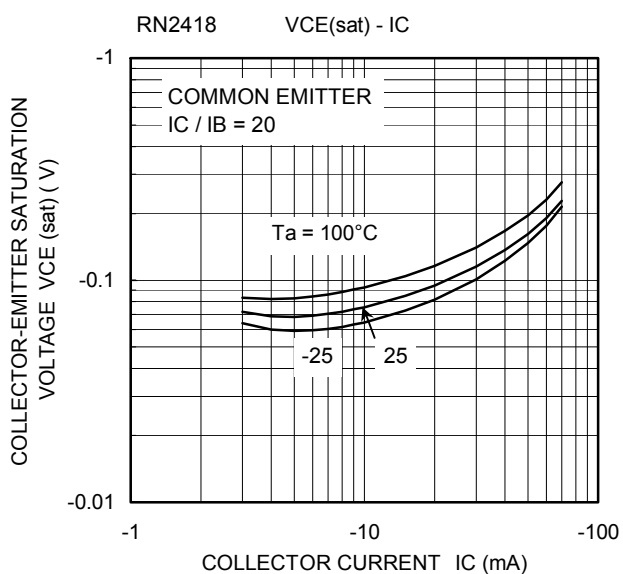
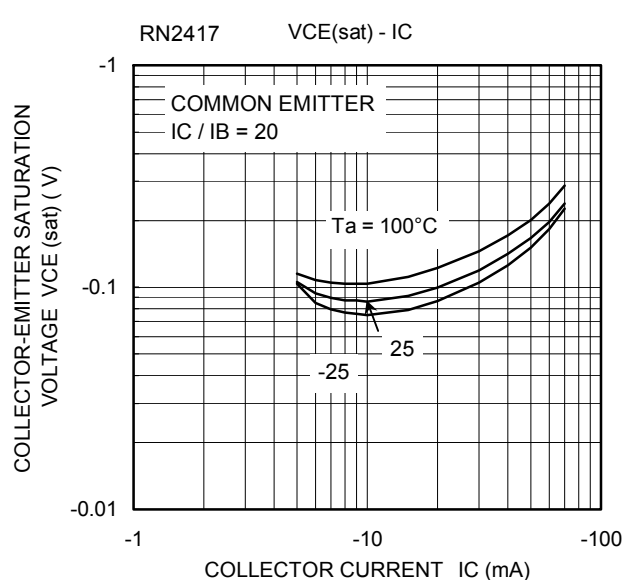
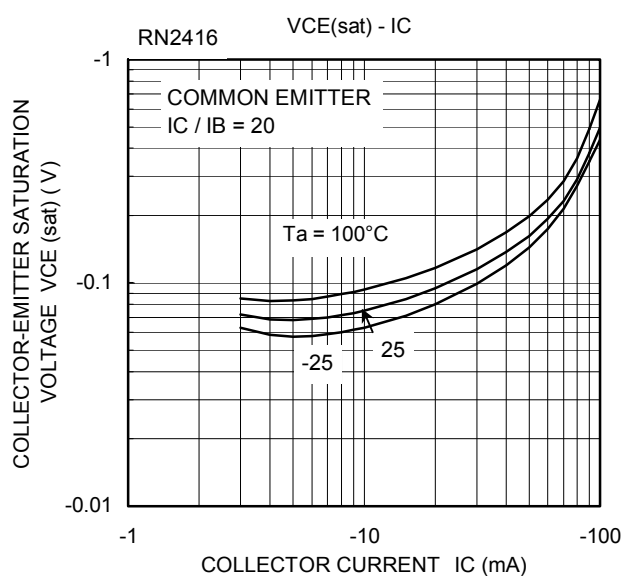
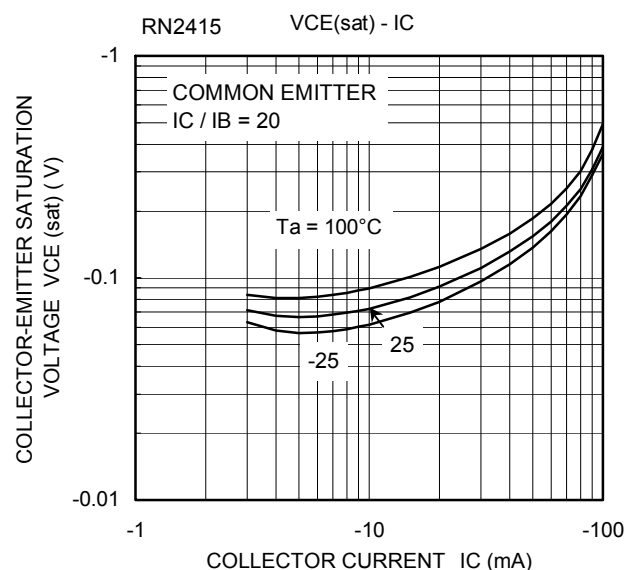
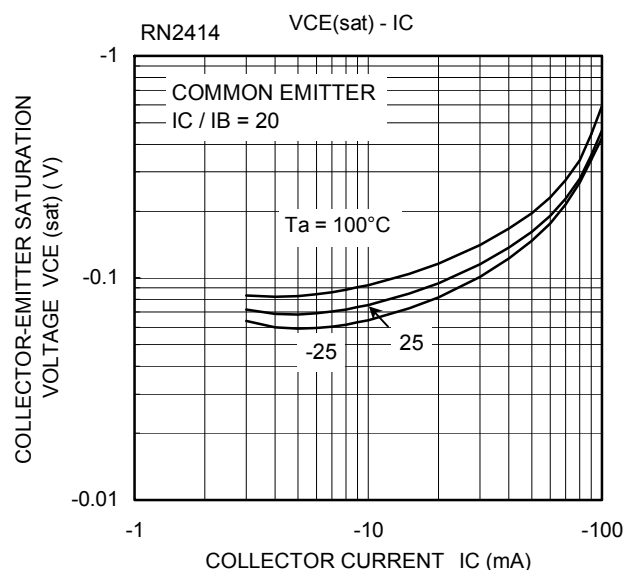
**Electrical Characteristics (Ta = 25°C)**

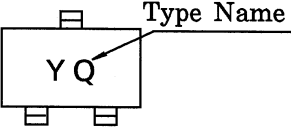
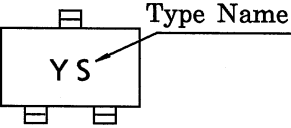
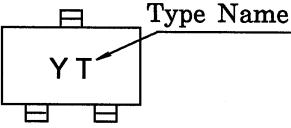
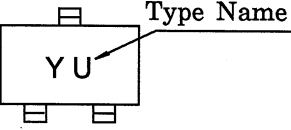
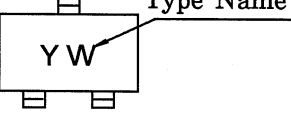
| Characteristic                       |                        | Symbol        | Test Circuit | Test Condition                                          | Min   | Typ. | Max   | Unit |
|--------------------------------------|------------------------|---------------|--------------|---------------------------------------------------------|-------|------|-------|------|
| Collector cut-off current            | RN2414 to 2418         | $I_{CBO}$     | —            | $V_{CB} = -50\text{ V}, I_E = 0$                        | —     | —    | -100  | nA   |
|                                      | RN2414 to 2418         | $I_{CEO}$     | —            | $V_{CE} = -50\text{ V}, I_B = 0$                        | —     | —    | -500  | nA   |
| Emitter cut-off current              | RN2414                 | $I_{EBO}$     | —            | $V_{EB} = -5\text{ V}, I_C = 0$                         | -0.35 | —    | -0.65 | mA   |
|                                      | RN2415                 |               | —            | $V_{EB} = -6\text{ V}, I_C = 0$                         | -0.37 | —    | -0.71 |      |
|                                      | RN2416                 |               | —            | $V_{EB} = -7\text{ V}, I_C = 0$                         | -0.36 | —    | -0.68 |      |
|                                      | RN2417                 |               | —            | $V_{EB} = -15\text{ V}, I_C = 0$                        | -0.78 | —    | -1.46 |      |
|                                      | RN2418                 |               | —            | $V_{EB} = -25\text{ V}, I_C = 0$                        | -0.33 | —    | -0.63 |      |
| DC current gain                      | RN2414 to 16<br>RN2418 | $h_{FE}$      | —            | $V_{CE} = -5\text{ V}, I_C = -10\text{ mA}$             | 50    | —    | —     | —    |
|                                      | RN2417                 |               | —            |                                                         | 30    | —    | —     |      |
| Collector-emitter saturation voltage | RN2414 to 2418         | $V_{CE(sat)}$ | —            | $I_C = -5\text{ mA}, I_B = -0.25\text{ mA}$             | —     | -0.1 | -0.3  | V    |
| Input voltage (ON)                   | RN2414                 | $V_{I(ON)}$   | —            | $V_{CE} = -0.2\text{ V}, I_C = -5\text{ mA}$            | -0.5  | —    | -2.0  | V    |
|                                      | RN2415                 |               | —            |                                                         | -0.6  | —    | -2.5  |      |
|                                      | RN2416                 |               | —            |                                                         | -0.7  | —    | -2.5  |      |
|                                      | RN2417                 |               | —            |                                                         | -1.5  | —    | -3.5  |      |
|                                      | RN2418                 |               | —            |                                                         | -2.5  | —    | -10.0 |      |
| Input voltage (OFF)                  | RN2414                 | $V_{I(OFF)}$  | —            | $V_{CE} = -5\text{ V}, I_C = -0.1\text{ mA}$            | -0.3  | —    | -0.9  | V    |
|                                      | RN2415                 |               | —            |                                                         | -0.3  | —    | -1.0  |      |
|                                      | RN2416                 |               | —            |                                                         | -0.3  | —    | -1.1  |      |
|                                      | RN2417                 |               | —            |                                                         | -0.3  | —    | -3.0  |      |
|                                      | RN2418                 |               | —            |                                                         | -0.5  | —    | -5.7  |      |
| Translation frequency                | RN2414 to 2418         | $f_T$         | —            | $V_{CE} = -10\text{ V}, I_C = -5\text{ mA}$             | —     | 200  | —     | MHz  |
| Collector output capacitance         | RN2414 to 2418         | $C_{ob}$      | —            | $V_{CB} = -10\text{ V}, I_E = 0,$<br>$f = 1\text{ MHz}$ | —     | 3.0  | 6.0   | pF   |
| Input resistor                       | RN2414                 | $R_1$         | —            | —                                                       | 0.7   | 1.0  | 1.3   | kΩ   |
|                                      | RN2415                 |               | —            |                                                         | 1.54  | 2.2  | 2.86  |      |
|                                      | RN2416                 |               | —            |                                                         | 3.29  | 4.7  | 6.11  |      |
|                                      | RN2417                 |               | —            |                                                         | 7.0   | 10.0 | 13.0  |      |
|                                      | RN2418                 |               | —            |                                                         | 32.9  | 47.0 | 61.1  |      |
| Resistor ratio                       | RN2414                 | $R_1/R_2$     | —            | —                                                       | —     | 0.1  | —     | —    |
|                                      | RN2415                 |               | —            |                                                         | —     | 0.22 | —     |      |
|                                      | RN2416                 |               | —            |                                                         | —     | 0.47 | —     |      |
|                                      | RN2417                 |               | —            |                                                         | —     | 2.13 | —     |      |
|                                      | RN2418                 |               | —            |                                                         | —     | 4.7  | —     |      |









| Type Name | Marking                                                                             |
|-----------|-------------------------------------------------------------------------------------|
| RN2414    |    |
| RN2415    |    |
| RN2416    |    |
| RN2417    |   |
| RN2418    |  |

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