

TOSHIBA Transistor Silicon NPN Epitaxial Type (PCT Process)

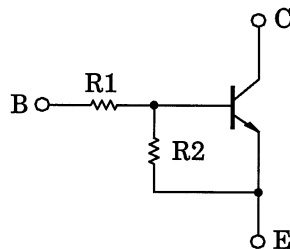
## RN1301,RN1302,RN1303 RN1304,RN1305,RN1306

Switching, Inverter Circuit, Interface Circuit  
and Driver Circuit Applications

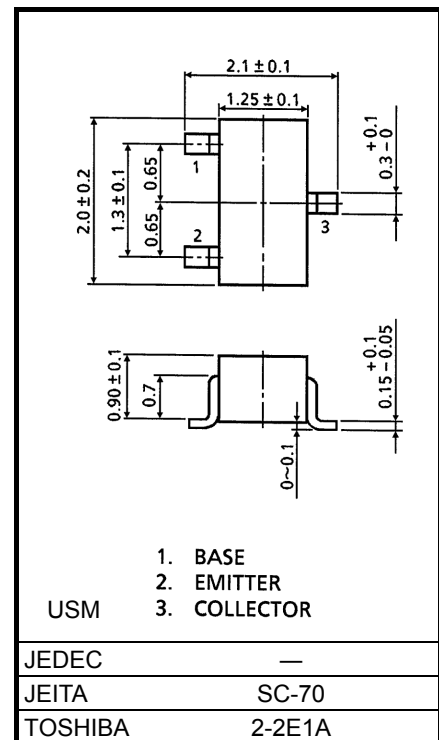
Unit: mm

- With built-in bias resistors.
- Simplify circuit design
- Reduce a quantity of parts and manufacturing process
- Complementary to RN2301 to RN2306

### Equivalent Circuit and Bias Resistor Values



| Type No. | R1 (kΩ) | R2 (kΩ) |
|----------|---------|---------|
| RN1301   | 4.7     | 4.7     |
| RN1302   | 10      | 10      |
| RN1303   | 22      | 22      |
| RN1304   | 47      | 47      |
| RN1305   | 2.2     | 47      |
| RN1306   | 4.7     | 47      |



Weight: 6 mg (typ.)

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

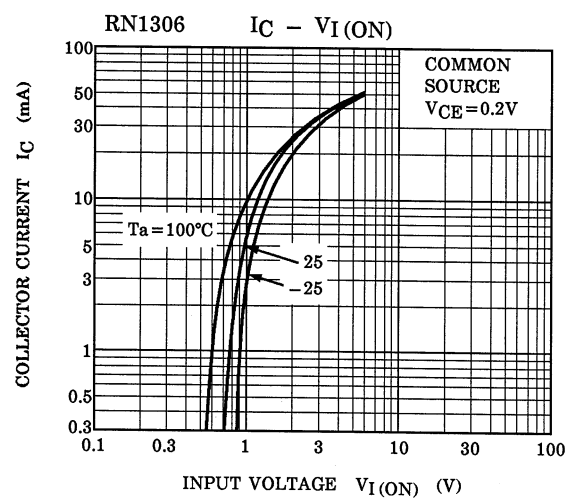
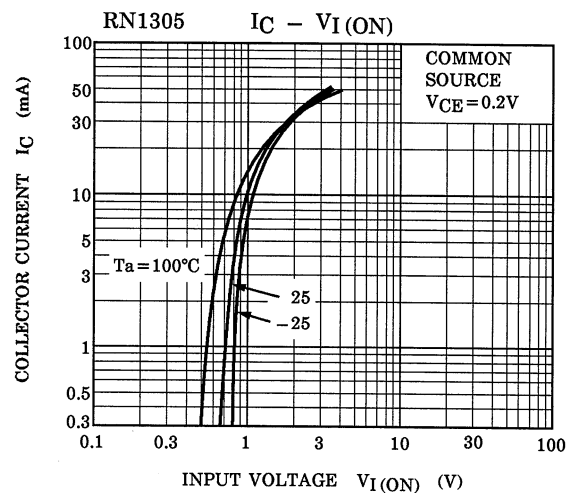
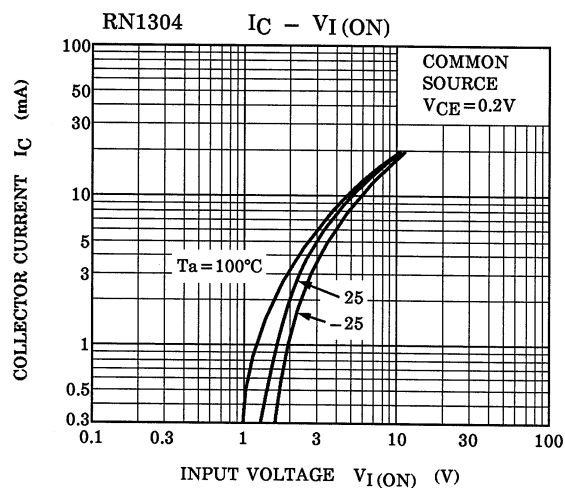
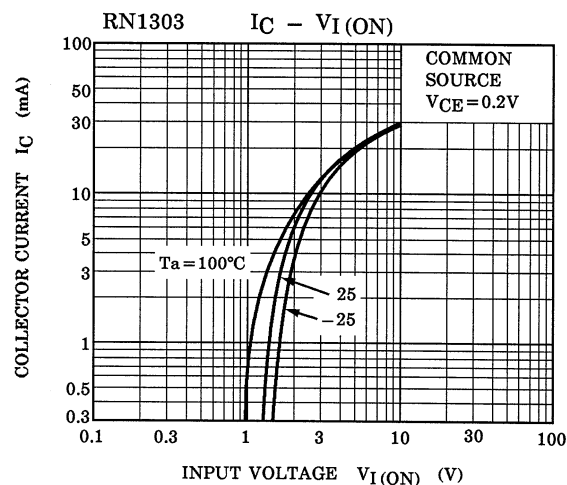
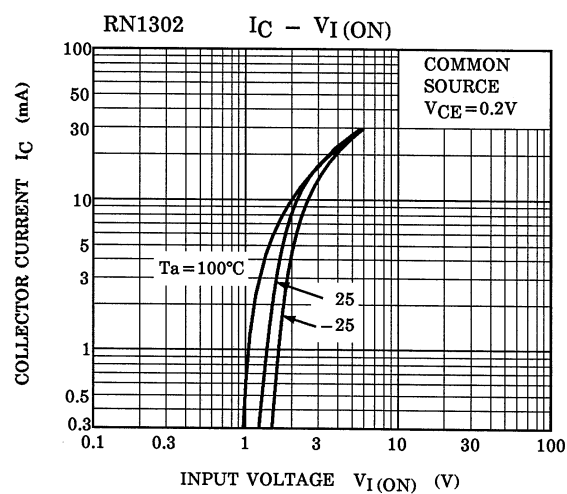
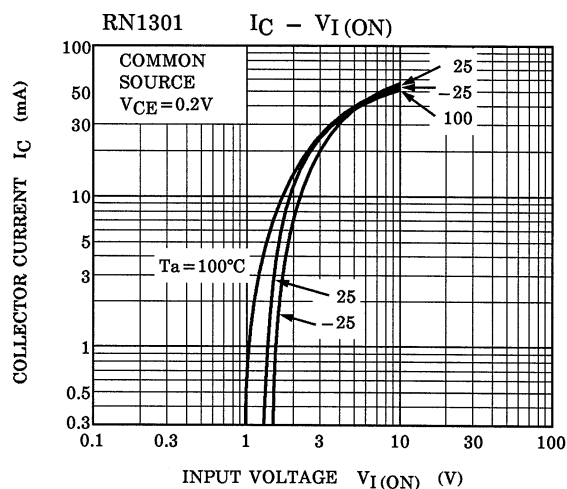
| Characteristic              | Symbol           | Rating     | Unit |
|-----------------------------|------------------|------------|------|
| Collector-base voltage      | V <sub>CBO</sub> | 50         | V    |
| Collector-emitter voltage   | V <sub>CEO</sub> | 50         | V    |
| Emitter-base voltage        | V <sub>EBO</sub> | 10         | V    |
|                             |                  | 5          | V    |
| Collector current           | I <sub>C</sub>   | 100        | mA   |
| Collector power dissipation | P <sub>C</sub>   | 100        | mW   |
| Junction temperature        | T <sub>j</sub>   | 150        | °C   |
| Storage temperature range   | T <sub>stg</sub> | −55 to 150 | °C   |

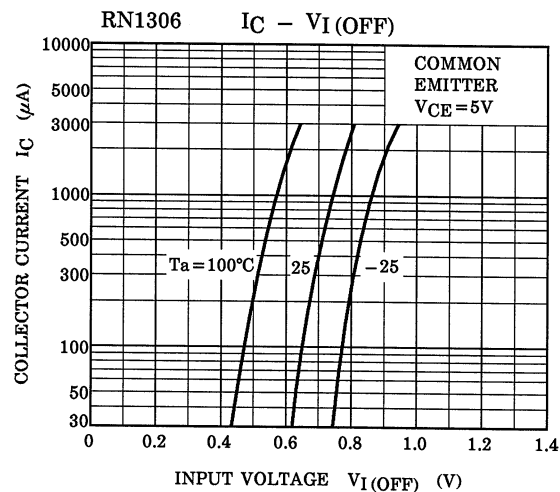
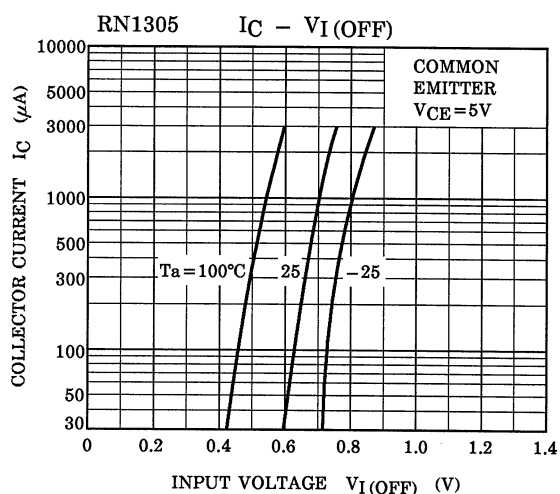
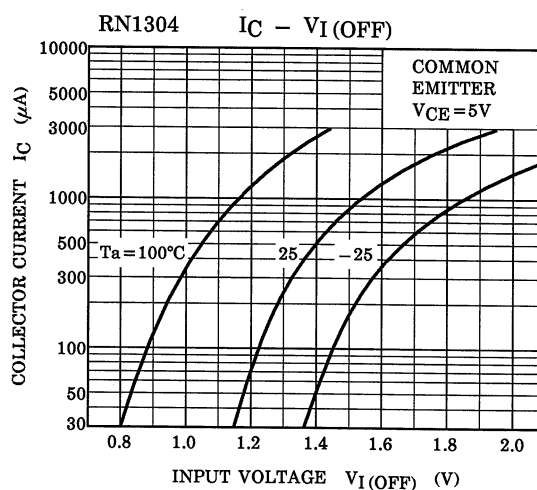
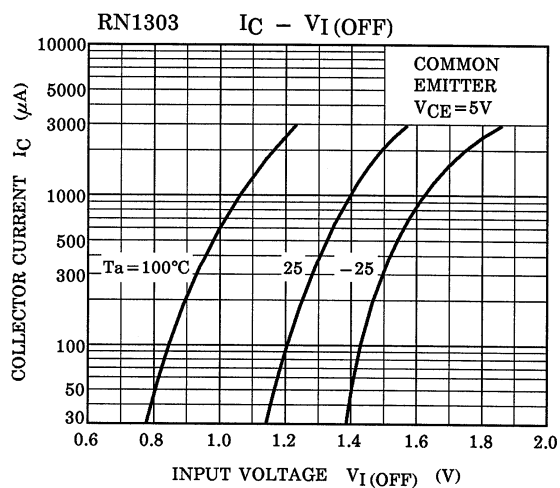
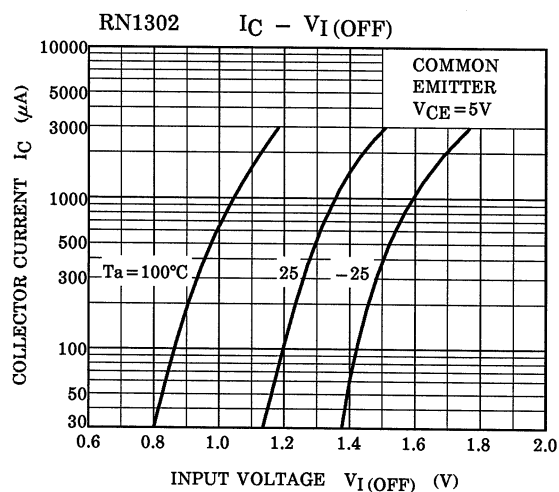
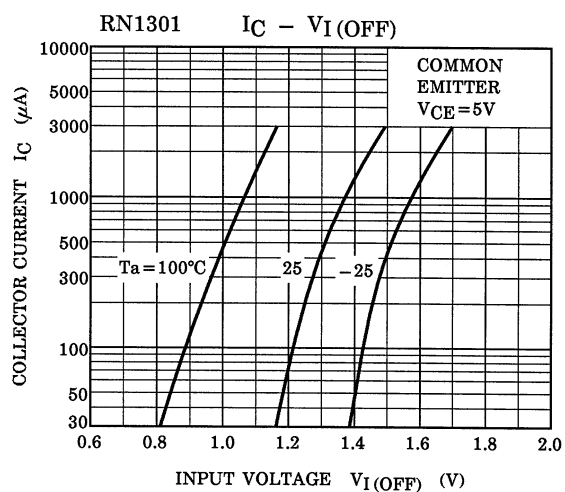
Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.)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

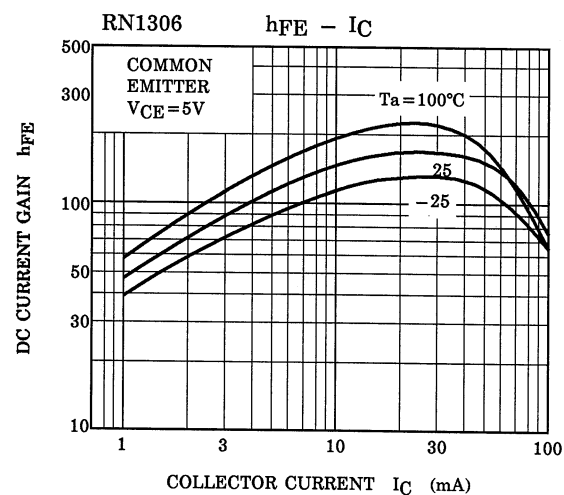
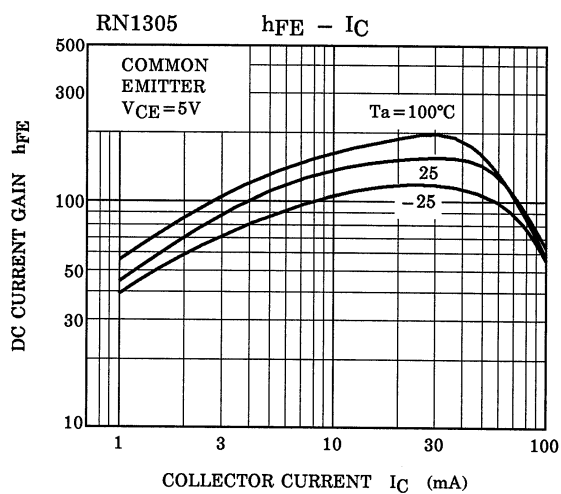
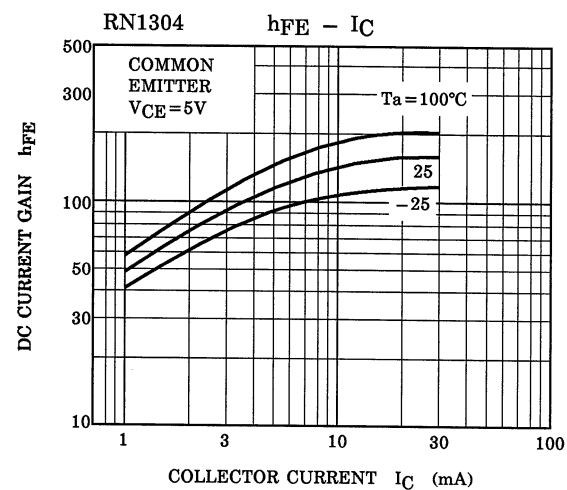
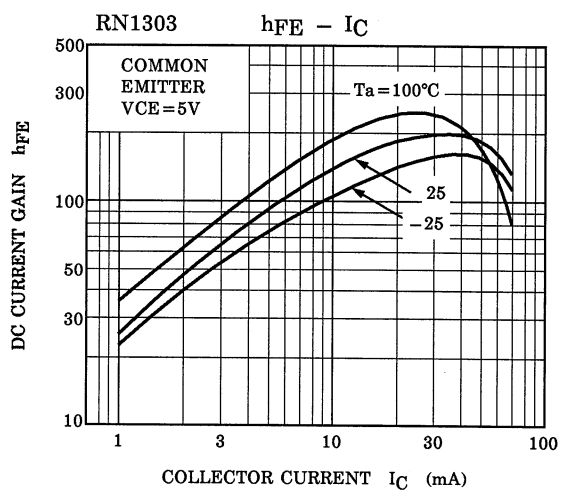
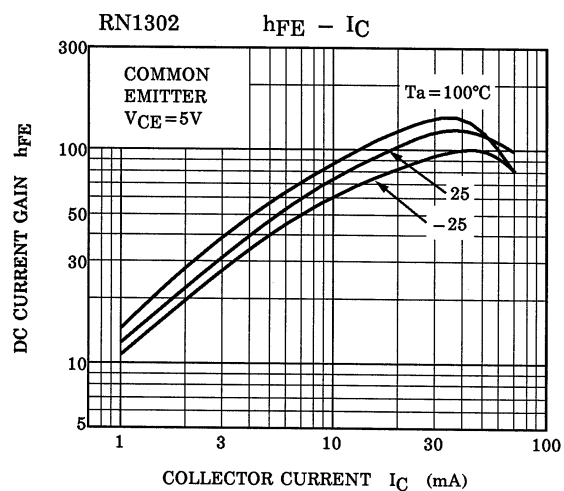
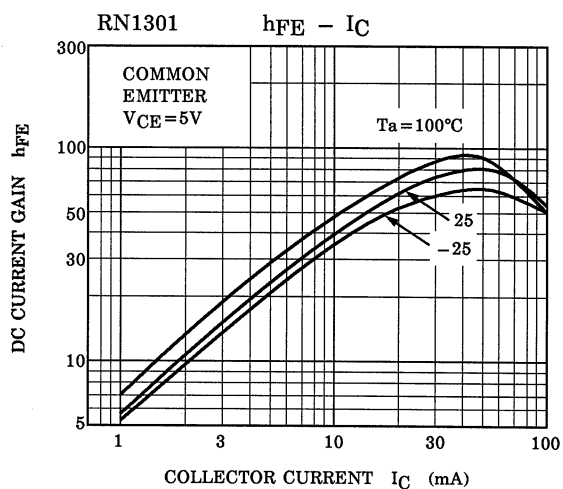
Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

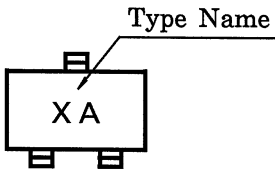
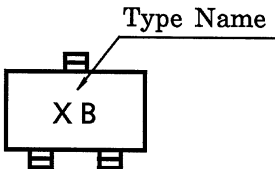
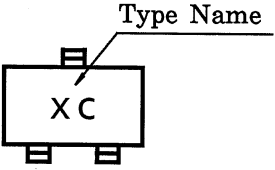
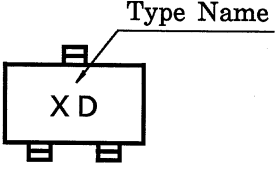
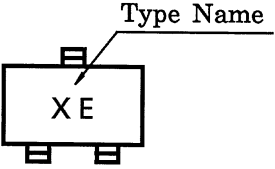
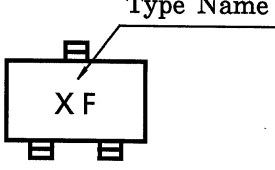
**Electrical Characteristics (Ta = 25°C)**

| Characteristic                       |                | Symbol        | Test Circuit | Test Condition                    | Min    | Typ.   | Max    | Unit |
|--------------------------------------|----------------|---------------|--------------|-----------------------------------|--------|--------|--------|------|
| Collector cut-off current            | RN1301 to 1306 | $I_{CBO}$     | —            | $V_{CB} = 50V, I_E = 0$           | —      | —      | 100    | nA   |
|                                      |                | $I_{CEO}$     | —            | $V_{CE} = 50V, I_B = 0$           | —      | —      | 500    |      |
| Emitter cut-off current              | RN1301         | $I_{EBO}$     | —            | $V_{EB} = 10V, I_C = 0$           | 0.82   | —      | 1.52   | mA   |
|                                      | RN1302         |               | —            |                                   | 0.38   | —      | 0.71   |      |
|                                      | RN1303         |               | —            |                                   | 0.17   | —      | 0.33   |      |
|                                      | RN1304         |               | —            |                                   | 0.082  | —      | 0.15   |      |
|                                      | RN1305         |               | —            | $V_{EB} = 5V, I_C = 0$            | 0.078  | —      | 0.145  |      |
|                                      | RN1306         |               | —            |                                   | 0.074  | —      | 0.138  |      |
| DC current gain                      | RN1301         | $h_{FE}$      | —            | $V_{CE} = 5V, I_C = 10mA$         | 30     | —      | —      | —    |
|                                      | RN1302         |               | —            |                                   | 50     | —      | —      |      |
|                                      | RN1303         |               | —            |                                   | 70     | —      | —      |      |
|                                      | RN1304         |               | —            |                                   | 80     | —      | —      |      |
|                                      | RN1305         |               | —            |                                   | 80     | —      | —      |      |
|                                      | RN1306         |               | —            |                                   | 80     | —      | —      |      |
| Collector-emitter saturation voltage | RN1301 to 1306 | $V_{CE(sat)}$ | —            | $I_C = 5mA, I_B = 0.25mA$         | —      | 0.1    | 0.3    | V    |
| Input voltage (ON)                   | RN1301         | $V_{I(ON)}$   | —            | $V_{CE} = 0.2V, I_C = 5mA$        | 1.1    | —      | 2.0    | V    |
|                                      | RN1302         |               | —            |                                   | 1.2    | —      | 2.4    |      |
|                                      | RN1303         |               | —            |                                   | 1.3    | —      | 3.0    |      |
|                                      | RN1304         |               | —            |                                   | 1.5    | —      | 5.0    |      |
|                                      | RN1305         |               | —            |                                   | 0.6    | —      | 1.1    |      |
|                                      | RN1306         |               | —            |                                   | 0.7    | —      | 1.3    |      |
| Input voltage (OFF)                  | RN1301 to 1304 | $V_{I(OFF)}$  | —            | $V_{CE} = 5V, I_C = 0.1mA$        | 1.0    | —      | 1.5    | V    |
|                                      | RN1305, 1306   |               | —            |                                   | 0.5    | —      | 0.8    |      |
| Transition frequency                 | RN1301 to 1306 | $f_T$         | —            | $V_{CE} = 10V, I_C = 5mA$         | —      | 250    | —      | MHz  |
| Collector output capacitance         | RN1301 to 1306 | $C_{ob}$      | —            | $V_{CB} = 10V, I_E = 0, f = 1MHz$ | —      | 3      | 6      | pF   |
| Input resistor                       | RN1301         | R1            | —            | —                                 | 3.29   | 4.7    | 6.11   | kΩ   |
|                                      | RN1302         |               | —            |                                   | 7      | 10     | 13     |      |
|                                      | RN1303         |               | —            |                                   | 15.4   | 22     | 28.6   |      |
|                                      | RN1304         |               | —            |                                   | 32.9   | 47     | 61.1   |      |
|                                      | RN1305         |               | —            |                                   | 1.54   | 2.2    | 2.86   |      |
|                                      | RN1306         |               | —            |                                   | 3.29   | 4.7    | 6.11   |      |
| Resistor ratio                       | RN1301 to 1304 | R1/R2         | —            | —                                 | 0.9    | 1.0    | 1.1    | —    |
|                                      | RN1305         |               | —            |                                   | 0.0421 | 0.0468 | 0.0515 |      |
|                                      | RN1306         |               | —            |                                   | 0.09   | 0.1    | 0.11   |      |







| Type Name | Marking                                                                             |
|-----------|-------------------------------------------------------------------------------------|
| RN1301    |    |
| RN1302    |    |
| RN1303    |    |
| RN1304    |   |
| RN1305    |  |
| RN1306    |  |

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