

# UNR221x Series (UN221x Series)

## Silicon NPN epitaxial planar transistor

For digital circuits

### ■ Features

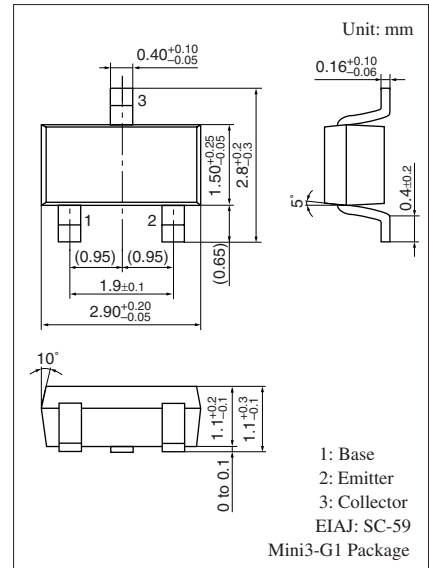
- Costs can be reduced through downsizing of the equipment and reduction of the number of parts.
- Mini type package allowing easy automatic insertion through tape packing and magazine packing

### ■ Resistance by Part Number

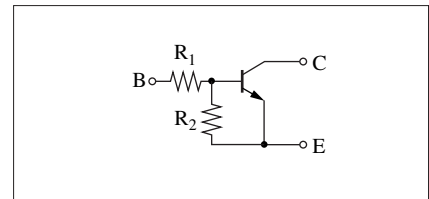
|                    | Marking Symbol (R <sub>1</sub> ) | (R <sub>2</sub> ) |
|--------------------|----------------------------------|-------------------|
| • UNR2210 (UN2210) | 8L                               | 47 kΩ —           |
| • UNR2211 (UN2211) | 8A                               | 10 kΩ 10 kΩ       |
| • UNR2212 (UN2212) | 8B                               | 22 kΩ 22 kΩ       |
| • UNR2213 (UN2213) | 8C                               | 47 kΩ 47 kΩ       |
| • UNR2214 (UN2214) | 8D                               | 10 kΩ 47 kΩ       |
| • UNR2215 (UN2215) | 8E                               | 10 kΩ —           |
| • UNR2216 (UN2216) | 8F                               | 4.7 kΩ —          |
| • UNR2217 (UN2217) | 8H                               | 22 kΩ —           |
| • UNR2218 (UN2218) | 8I                               | 0.51 kΩ 5.1 kΩ    |
| • UNR2219 (UN2219) | 8K                               | 1 kΩ 10 kΩ        |
| • UNR221D (UN221D) | 8M                               | 47 kΩ 10 kΩ       |
| • UNR221E (UN221E) | 8N                               | 47 kΩ 22 kΩ       |
| • UNR221F (UN221F) | 8O                               | 4.7 kΩ 10 kΩ      |
| • UNR221K (UN221K) | 8P                               | 10 kΩ 4.7 kΩ      |
| • UNR221L (UN221L) | 8Q                               | 4.7 kΩ 4.7 kΩ     |
| • UNR221M (UN221M) | EL                               | 2.2 kΩ 47 kΩ      |
| • UNR221N (UN221N) | EX                               | 4.7 kΩ 47 kΩ      |
| • UNR221T (UN221T) | EZ                               | 22 kΩ 47 kΩ       |
| • UNR221V (UN221V) | FD                               | 2.2 kΩ 2.2 kΩ     |
| • UNR221Z (UN221Z) | FF                               | 4.7 kΩ 22 kΩ      |

### ■ Absolute Maximum Ratings T<sub>a</sub> = 25°C

| Parameter                             | Symbol           | Rating      | Unit |
|---------------------------------------|------------------|-------------|------|
| Collector-base voltage (Emitter open) | V <sub>CBO</sub> | 50          | V    |
| Collector-emitter voltage (Base open) | V <sub>CEO</sub> | 50          | V    |
| Collector current                     | I <sub>C</sub>   | 100         | mA   |
| Total power dissipation               | P <sub>T</sub>   | 200         | mW   |
| Junction temperature                  | T <sub>j</sub>   | 150         | °C   |
| Storage temperature                   | T <sub>stg</sub> | -55 to +150 | °C   |



### Internal Connection



Note) The part numbers in the parenthesis show conventional part number.

■ Electrical Characteristics  $T_a = 25^\circ\text{C} \pm 3^\circ\text{C}$

| Parameter                                    | Symbol                                    | Conditions   | Min   | Typ  | Max  | Unit          |
|--|---|--|---|------|------|---------------|
| Collector-base voltage (Emitter open)        | $V_{CBO}$                                 | $I_C = 10 \mu\text{A}, I_E = 0$                                      | 50  |      |      | V             |
| Collector-emitter voltage (Base open)        | $V_{CEO}$                                 | $I_C = 2 \text{ mA}, I_B = 0$  | 50  |      |      | V             |
| Collector-base cutoff current (Emitter open) | $I_{CBO}$                                 | $V_{CB} = 50 \text{ V}, I_E = 0$                                     |   |      | 0.1  | $\mu\text{A}$ |
| Collector-emitter cutoff current (Base open) | $I_{CEO}$                                 | $V_{CE} = 50 \text{ V}, I_B = 0$                                     |   |      | 0.5  | $\mu\text{A}$ |
| Emitter-base cutoff current (Collector open) | UNR2210/2215/2216/2217                    | $I_{EBO}$  | $V_{EB} = -6 \text{ V}, I_C = 0$            |      | 0.01 | mA            |
|  | UNR2213                                   |  |   |      | 0.1  |               |
|  | UNR2212/2214/221D/<br>221E/221M/221N/221T |  |   |      | 0.2  |               |
|  | UNR221Z                                   |  |   |      | 0.4  |               |
|  | UNR2211                                   |  |   |      | 0.5  |               |
|  | UNR221F/221K                              |  |   |      | 1.0  |               |
|  | UNR2219                                   |  |   |      | 1.5  |               |
|  | UNR2218/221L/221V                         |  |   |      | 2.0  |               |
| Forward current transfer ratio               | UNR221V                                   | $h_{FE}$   | $V_{CE} = 10 \text{ V}, I_C = 5 \text{ mA}$ | 6    | 20   | —             |
|  | UNR2218/221K/221L                         |  |   | 20   |      |               |
|  | UNR2219/221D/221F                         |  |   | 30   |      |               |
|  | UNR2211                                   |  |   | 35   |      |               |
|  | UNR2212/221E                              |  |   | 60   |      |               |
|  | UNR221Z                                   |  |   | 60   | 200  |               |
|  | UNR2213/2214/221M                         |  |   | 80   |      |               |
|  | UNR221N/221T                              |  |   | 80   | 400  |               |
| UNR2210*/2215*/2216*/2217*                   | 160                                       | 460  |   |      |      |               |
| Collector-emitter saturation voltage         | $V_{CE(sat)}$                             | $I_C = 10 \text{ mA}, I_B = 0.3 \text{ mA}$                          |   |      | 0.25 | V             |
|  |   | $I_C = 10 \text{ mA}, I_B = 1.5 \text{ mA}$                          |   |      |      |               |
| Output voltage high-level                    | $V_{OH}$                                  | $V_{CC} = 5 \text{ V}, V_B = 0.5 \text{ V}, R_L = 1 \text{ k}\Omega$ | 4.9   |      |      | V             |
| Output voltage low-level                     | $V_{OL}$                                  | $V_{CC} = 5 \text{ V}, V_B = 2.5 \text{ V}, R_L = 1 \text{ k}\Omega$ |   |      | 0.2  | V             |
|  |   | $V_{CC} = 5 \text{ V}, V_B = 3.5 \text{ V}, R_L = 1 \text{ k}\Omega$ |   |      |      |               |
|  |   | $V_{CC} = 5 \text{ V}, V_B = 10 \text{ V}, R_L = 1 \text{ k}\Omega$  |   |      |      |               |
|  |   | $V_{CC} = 5 \text{ V}, V_B = 6 \text{ V}, R_L = 1 \text{ k}\Omega$   |   |      |      |               |
| Transition frequency                         | $f_T$                                     | $V_{CB} = 10 \text{ V}, I_E = -2 \text{ mA}, f = 200 \text{ MHz}$    |   | 150  |      | MHz           |
| Input resistance                             | $R_i$                                     |  | -30%  | 0.51 | +30% | k $\Omega$    |
|  |   |  |   | 1.0  |      |               |
|  |   |  |   | 2.2  |      |               |
|  |   |  |   | 4.7  |      |               |
|  |   |  |   | 10   |      |               |
|  |   |  |   | 22   |      |               |
|  |   |  |   | 47   |      |               |

Note) 1. Measuring methods are based on JAPANESE INDUSTRIAL STANDARD JIS C 7030 measuring methods for transistors.

2. \*: Rank classification

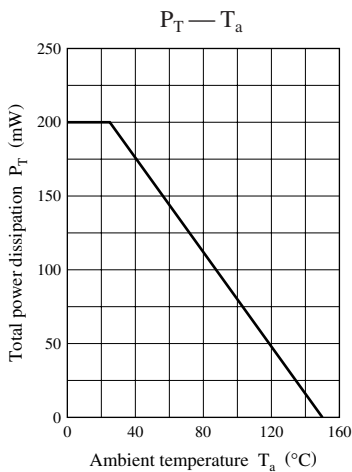
| Rank     | Q          | R          | S          | No-rank    |
|----------|------------|------------|------------|------------|
| $h_{FE}$ | 160 to 260 | 210 to 340 | 290 to 460 | 160 to 460 |

## ■ Electrical Characteristics (continued) $T_a = 25^\circ\text{C} \pm 3^\circ\text{C}$

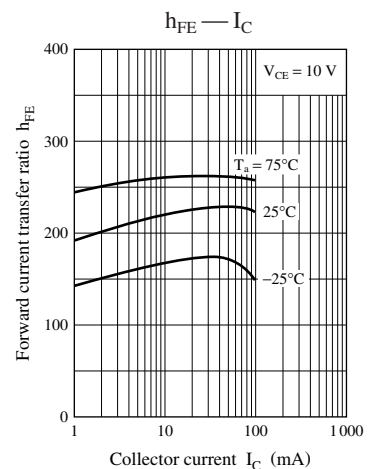
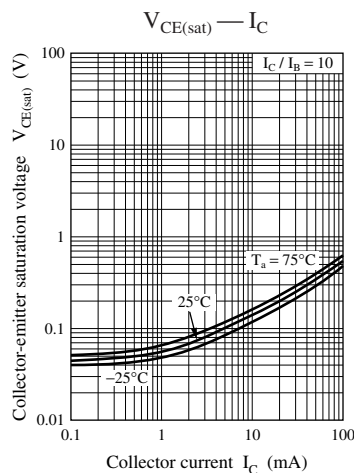
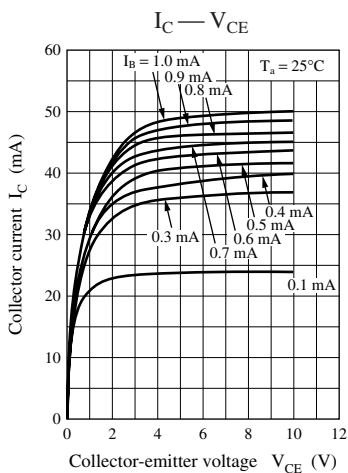
| Parameter        |                        | Symbol    | Conditions | Min  | Typ   | Max  | Unit |
|------------------|------------------------|-----------|------------|------|-------|------|------|
| Resistance ratio | UNR221M                | $R_1/R_2$ |            |      | 0.047 |      | —    |
|                  | UNR221N                |           |            |      | 0.1   |      |      |
|                  | UNR2218/2219           |           |            | 0.08 | 0.10  | 0.12 |      |
|                  | UNR221Z                |           |            |      | 0.21  |      |      |
|                  | UNR2214                |           |            | 0.17 | 0.21  | 0.25 |      |
|                  | UNR221T                |           |            |      | 0.47  |      |      |
|                  | UNR221F                |           |            | 0.37 | 0.47  | 0.57 |      |
|                  | UNR221V                |           |            |      | 1.0   |      |      |
|                  | UNR2211/2212/2213/221L |           |            | 0.8  | 1.0   | 1.2  |      |
|                  | UNR221K                |           |            | 1.70 | 2.13  | 2.60 |      |
|                  | UNR221E                |           |            | 1.70 | 2.14  | 2.60 |      |
|                  | UNR221D                |           |            | 3.7  | 4.7   | 5.7  |      |

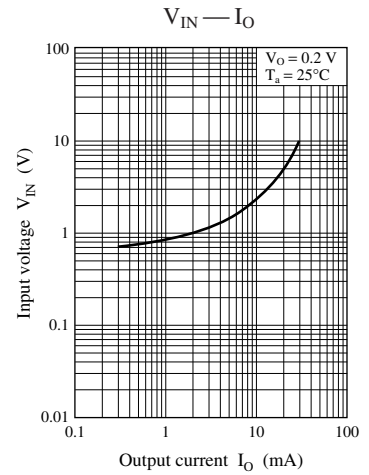
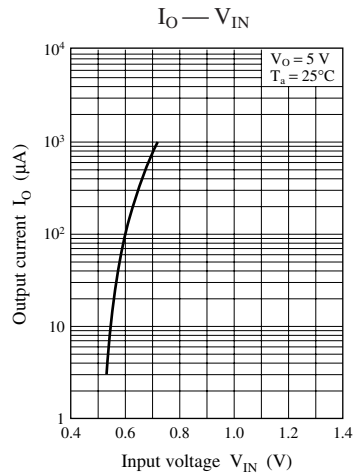
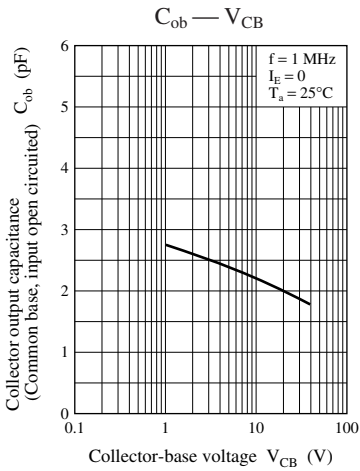
Note) Measuring methods are based on JAPANESE INDUSTRIAL STANDARD JIS C 7030 measuring methods for transistors.

### Common characteristics chart

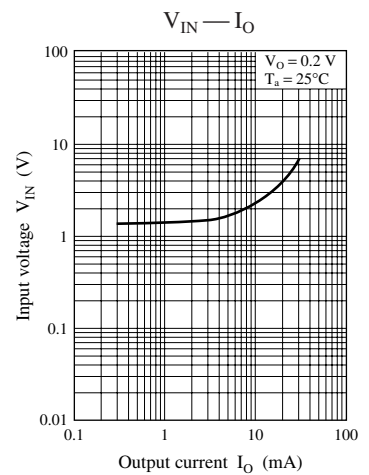
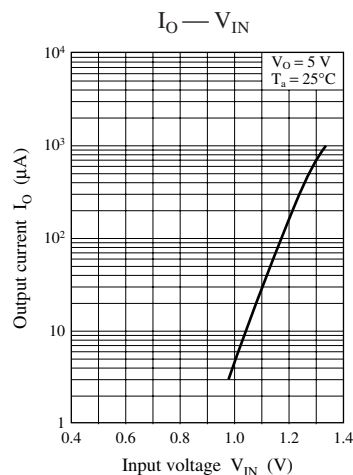
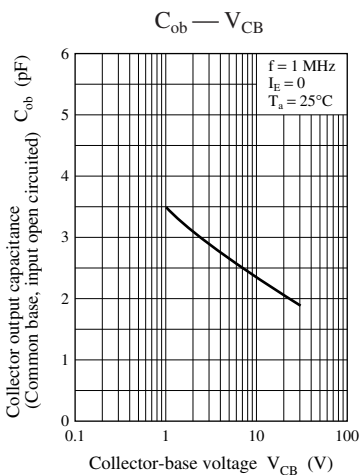
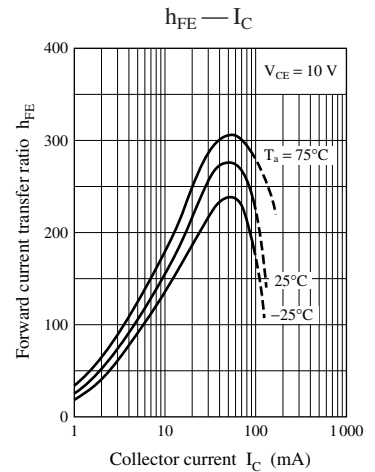
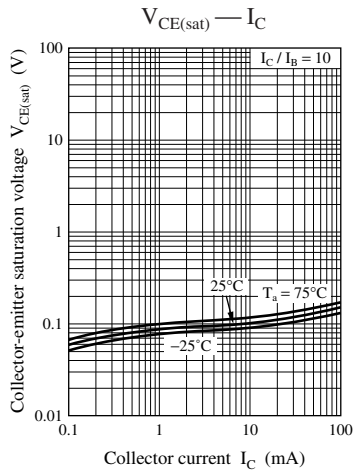
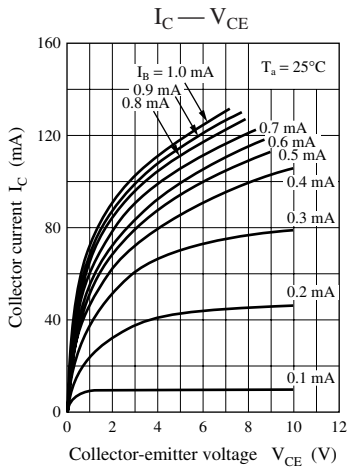


### Characteristics charts of UNR2210

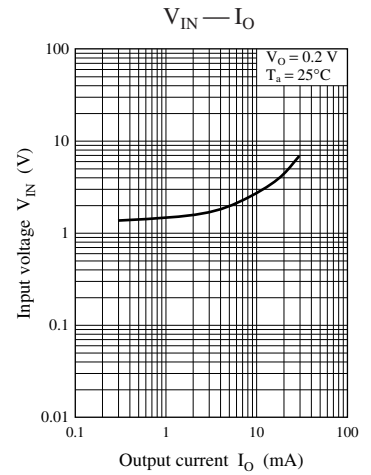
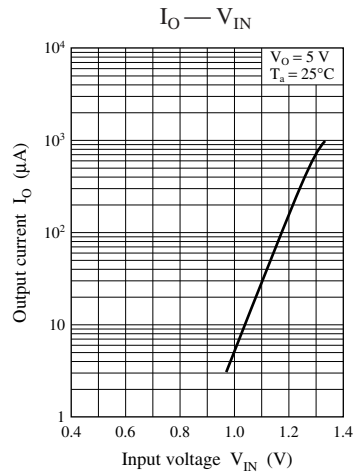
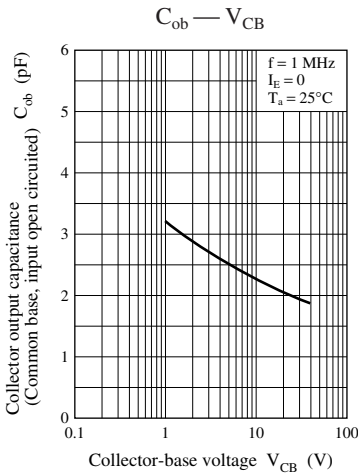
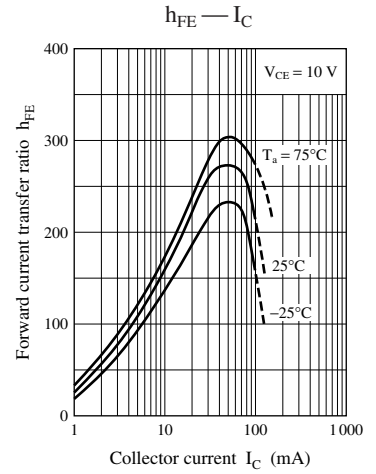
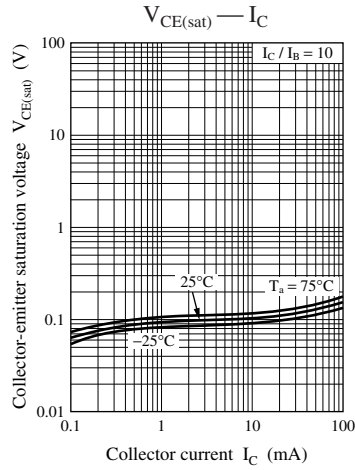
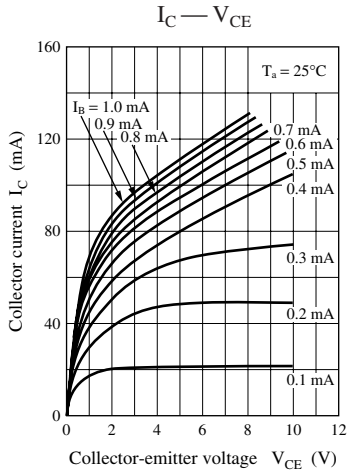




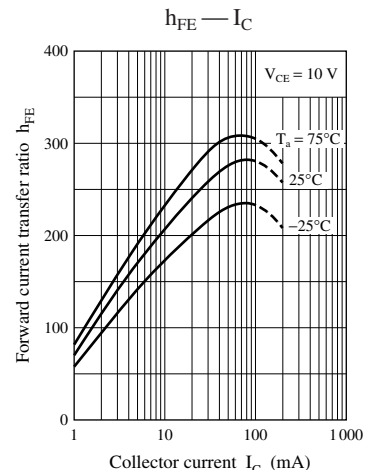
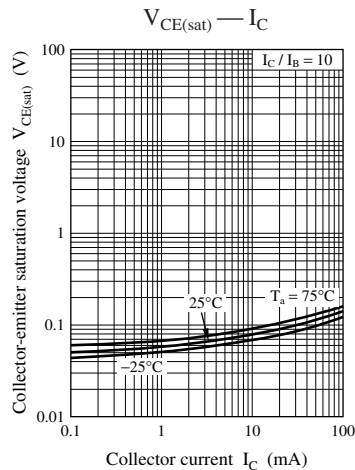
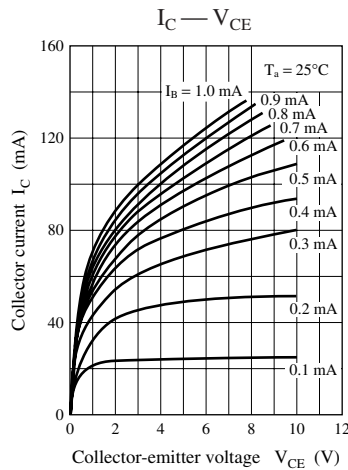
Characteristics charts of UNR2211

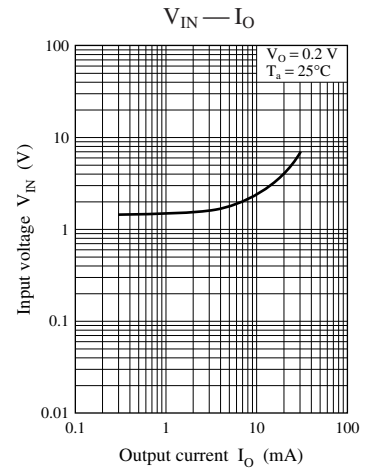
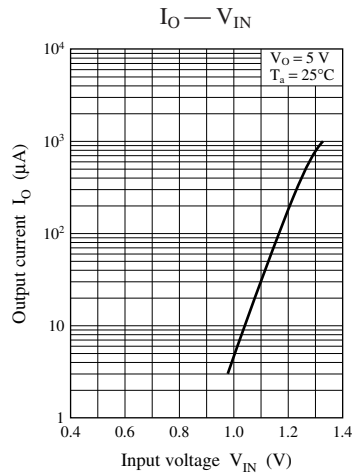
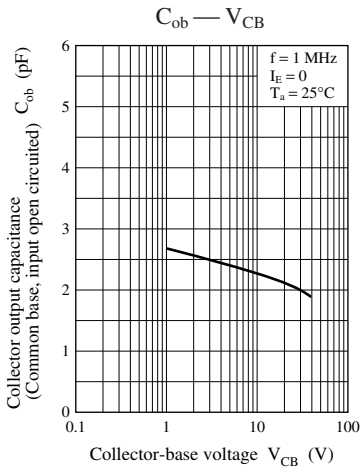


Characteristics charts of UNR2212

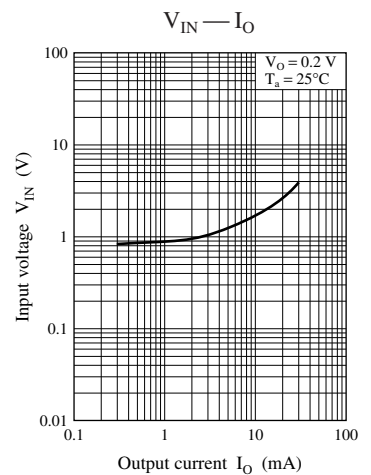
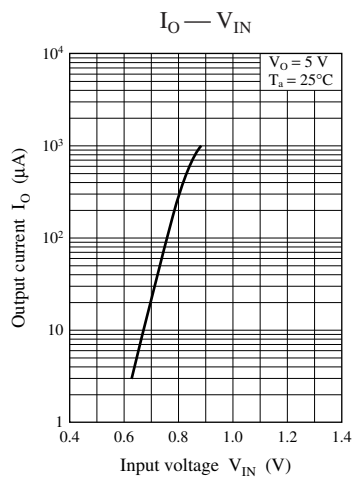
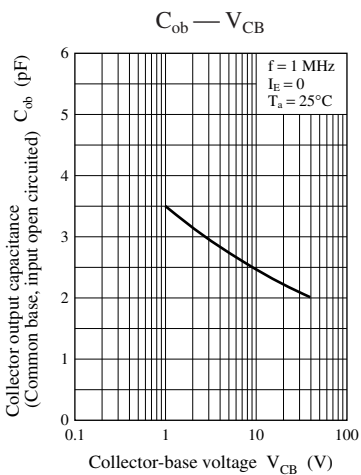
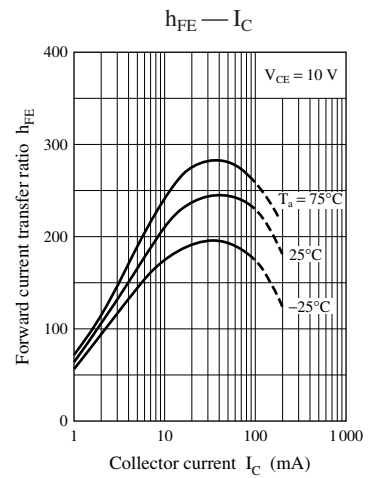
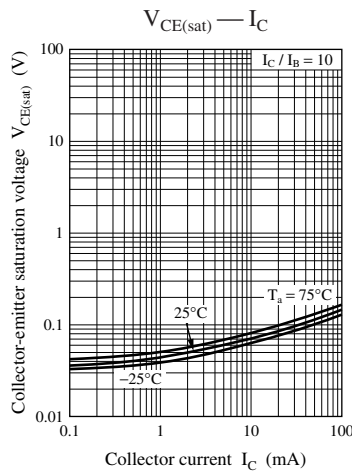
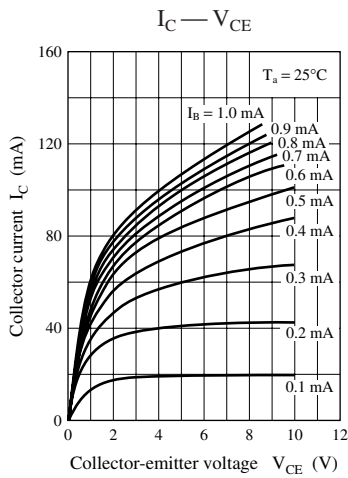


Characteristics charts of UNR2213

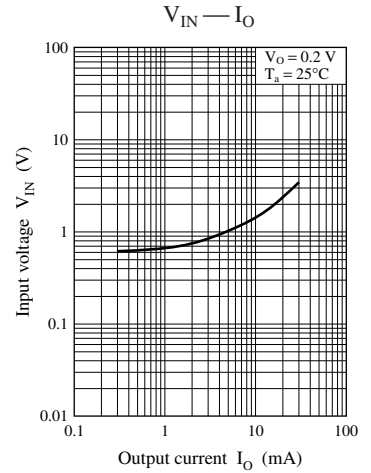
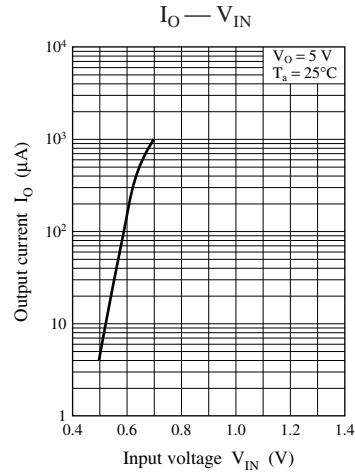
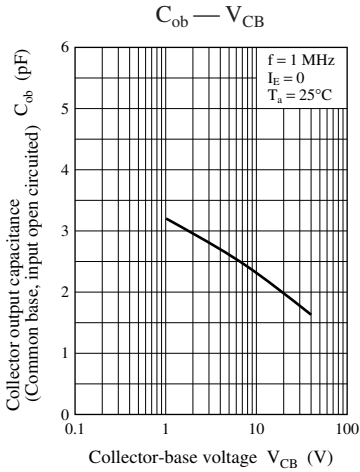
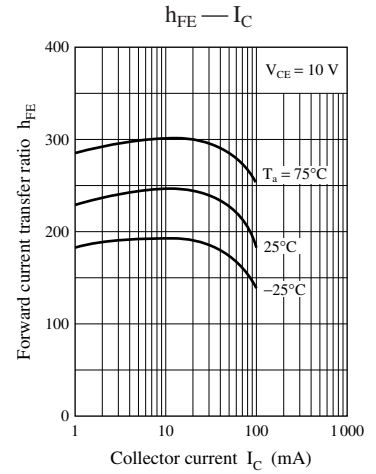
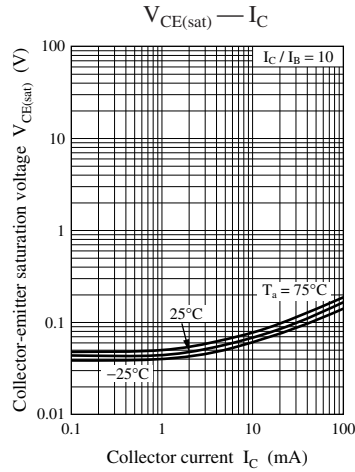
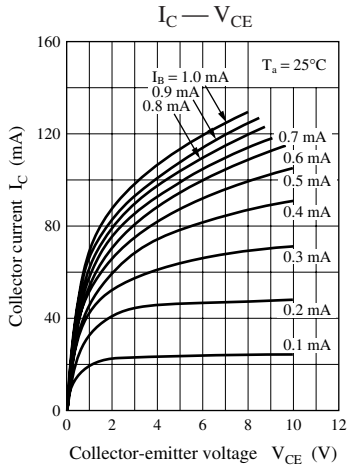




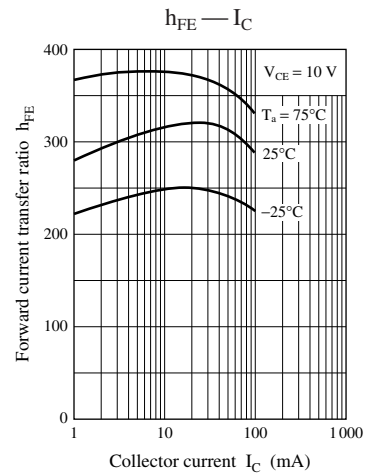
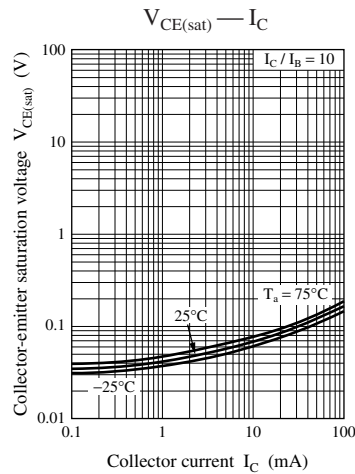
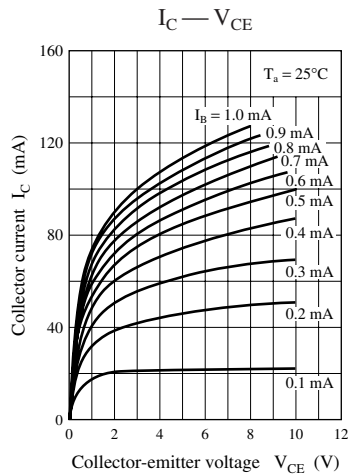
Characteristics charts of UNR2214

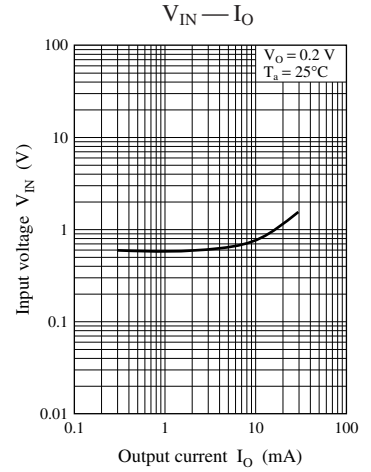
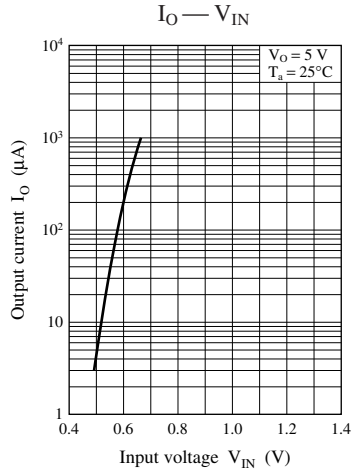
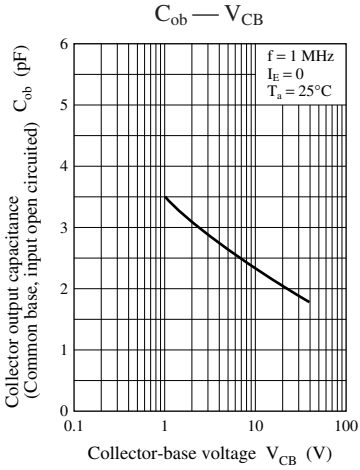


Characteristics charts of UNR2215

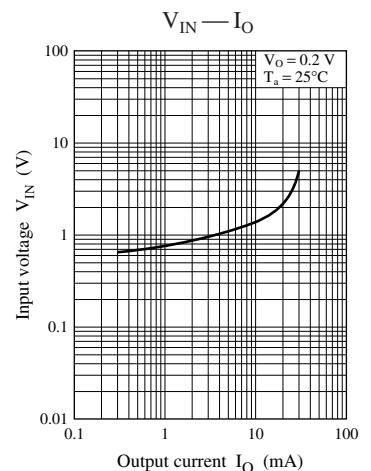
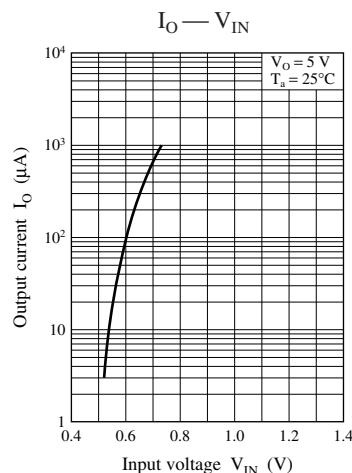
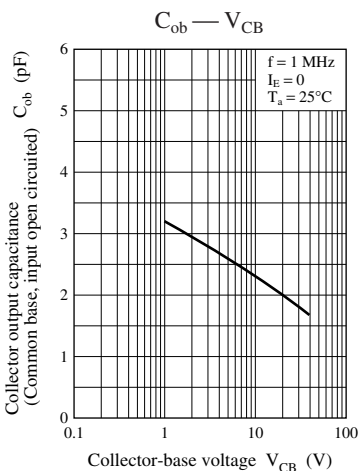
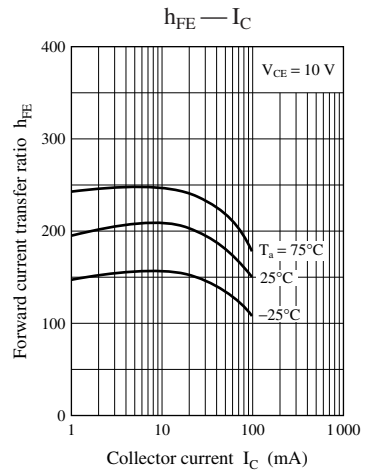
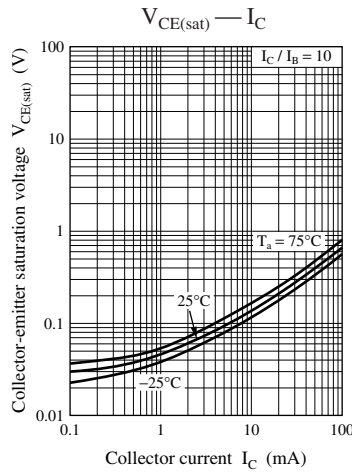
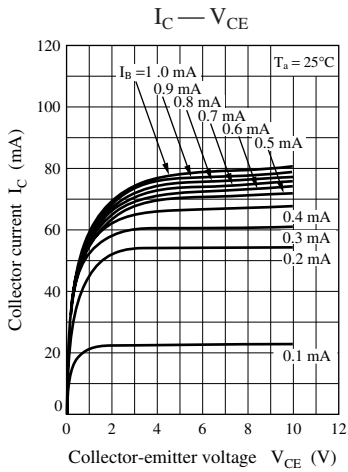


Characteristics charts of UNR2216



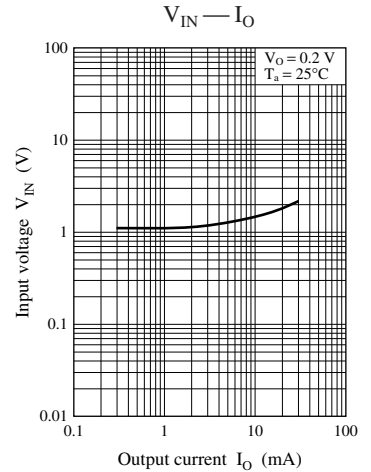
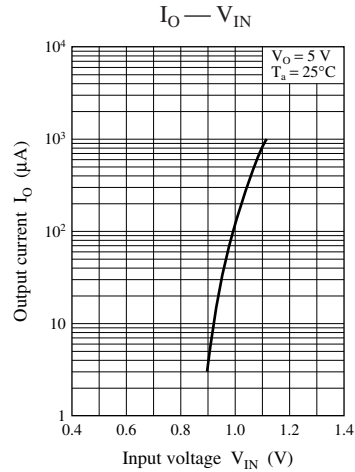
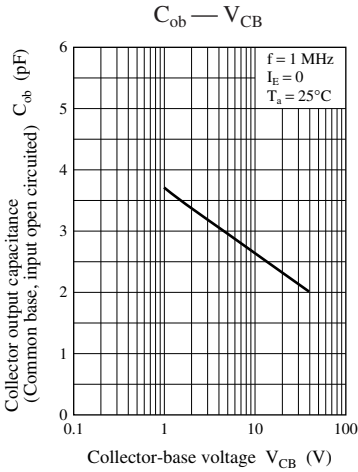
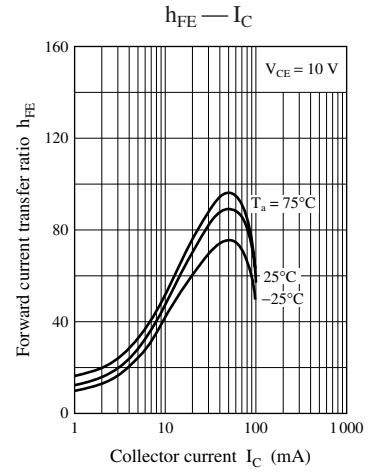
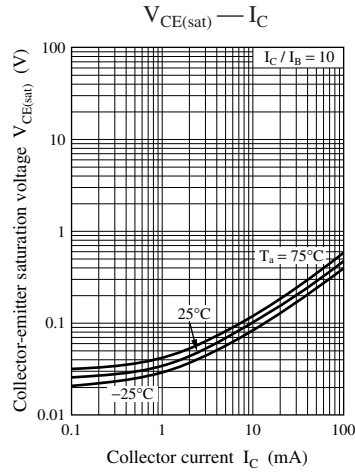
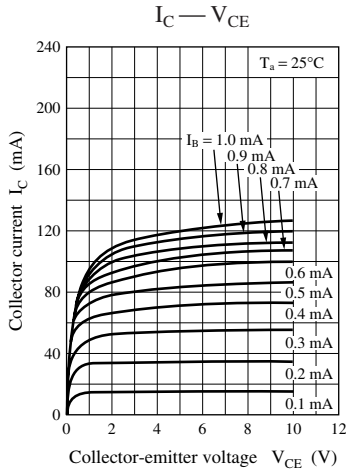


Characteristics charts of UNR2217

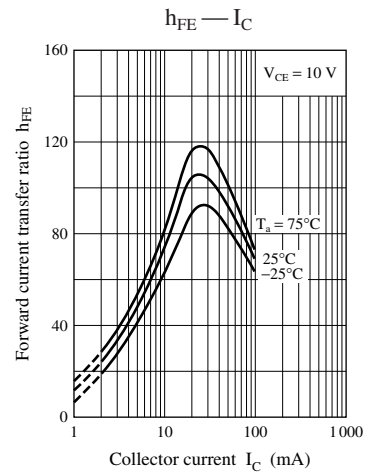
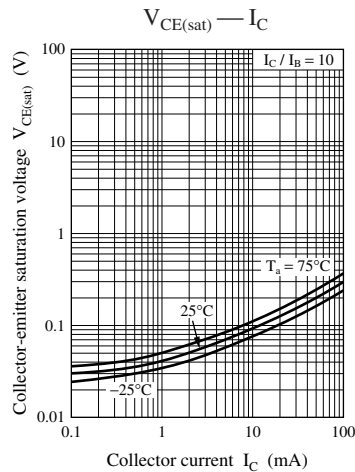
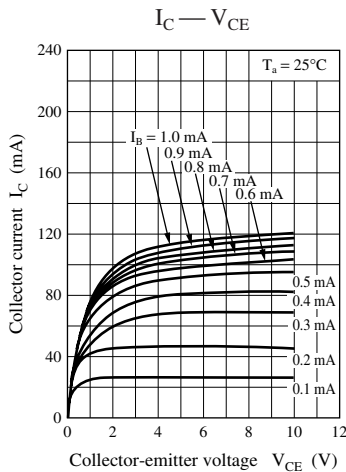


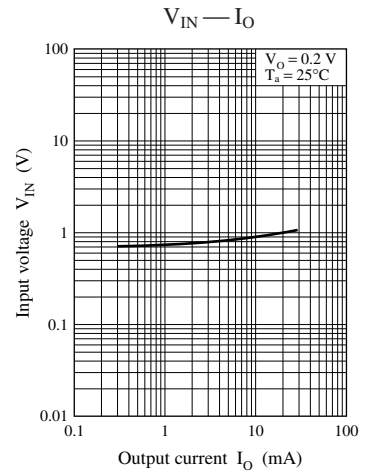
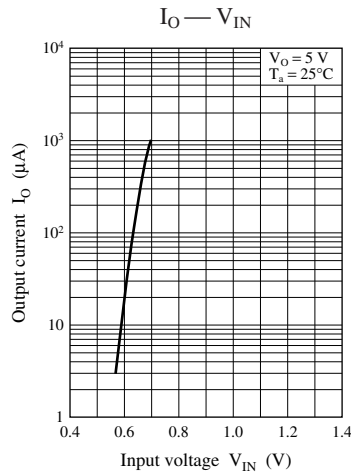
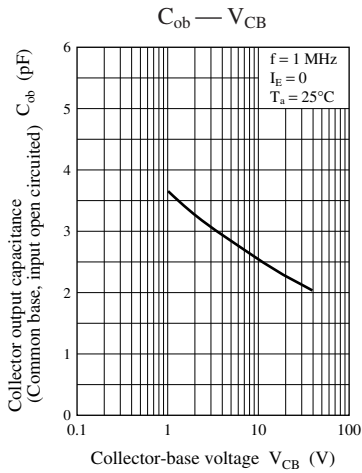


Characteristics charts of UNR2218

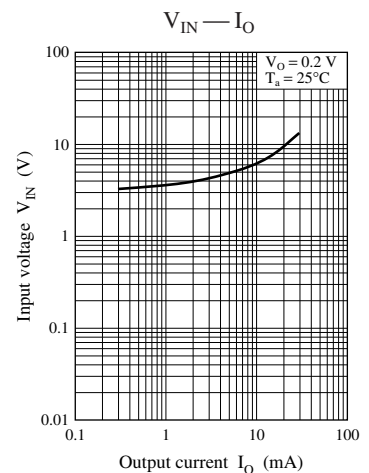
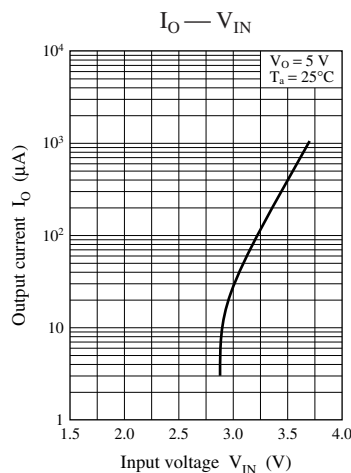
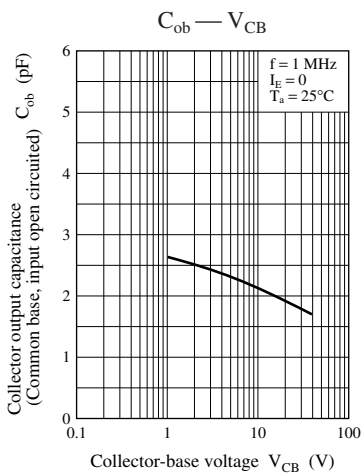
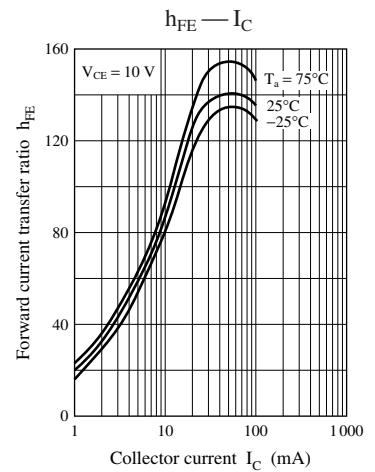
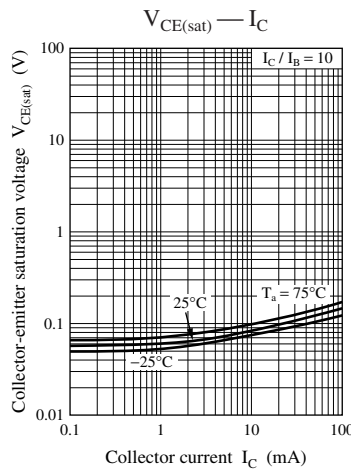
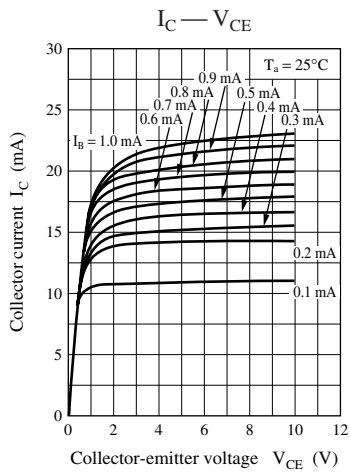


Characteristics charts of UNR2219

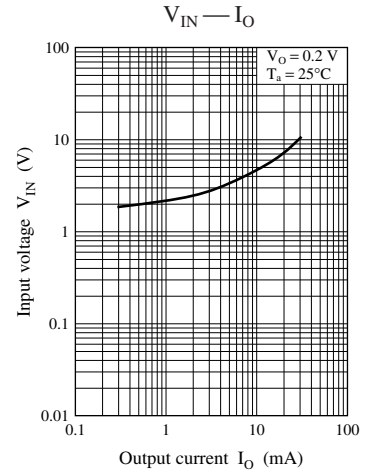
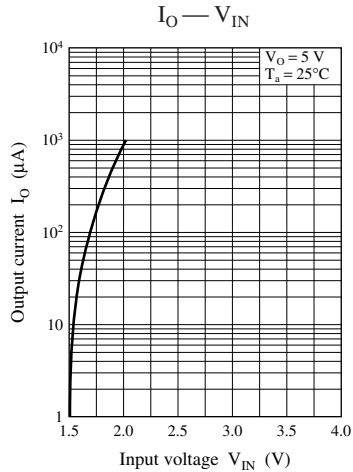
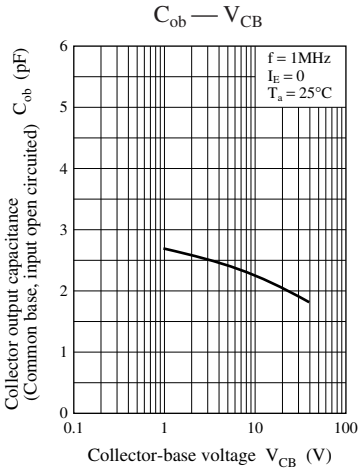
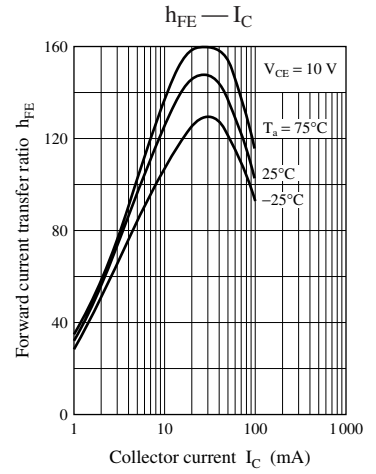
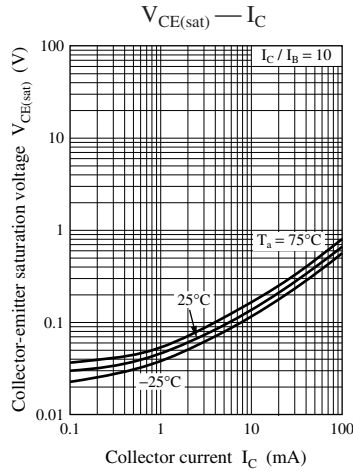
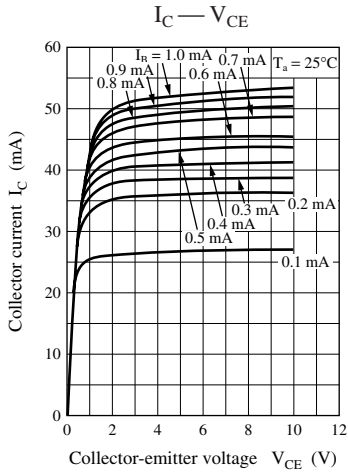




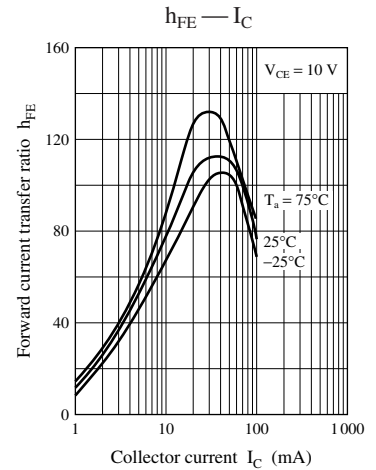
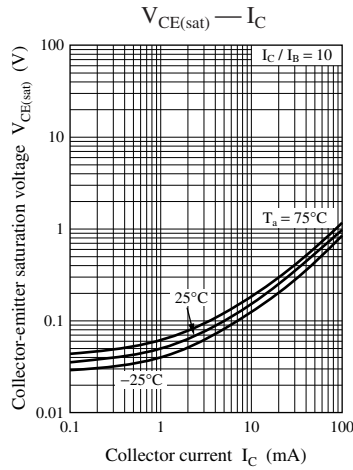
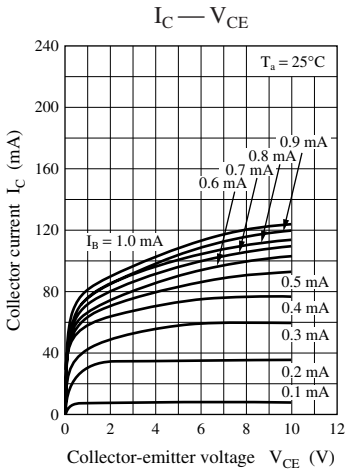
Characteristics charts of UNR221D

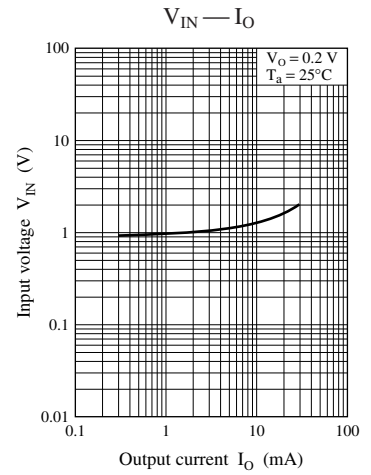
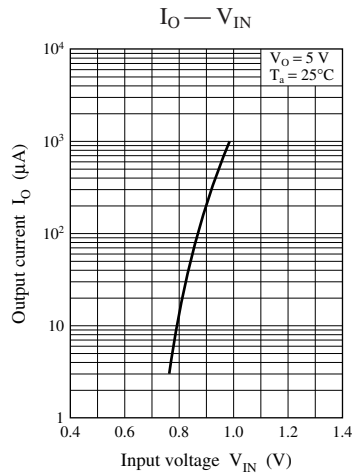
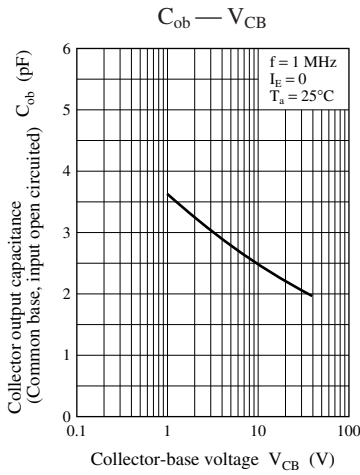


Characteristics charts of UNR221E

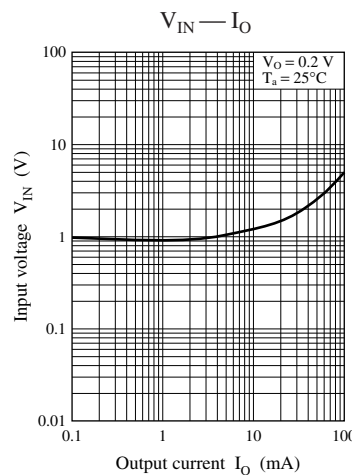
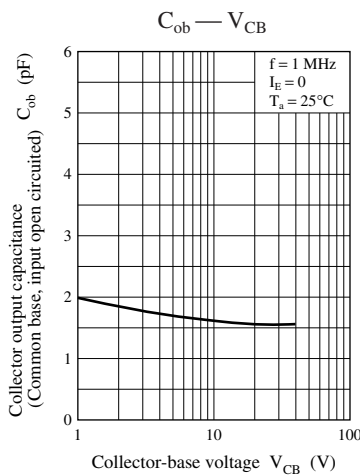
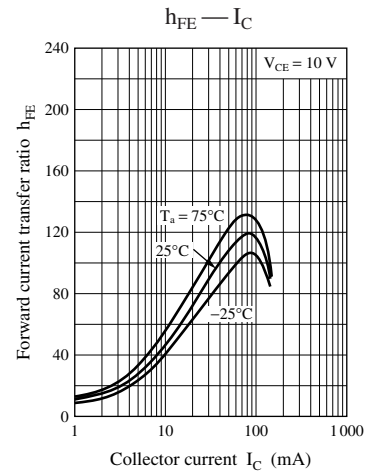
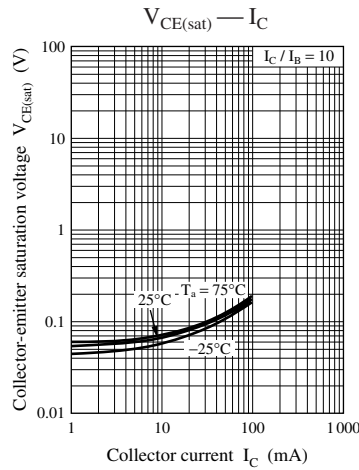
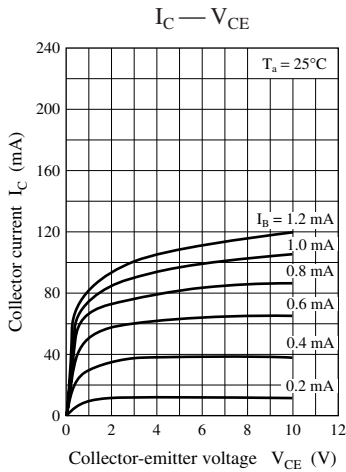


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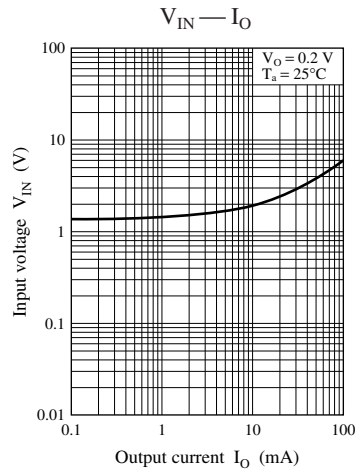
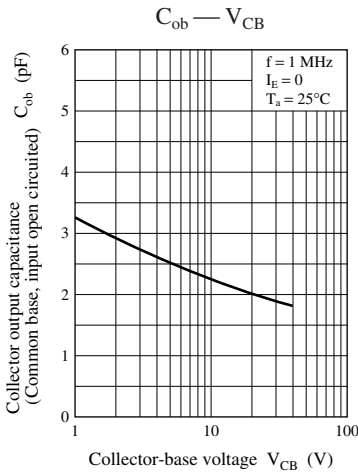
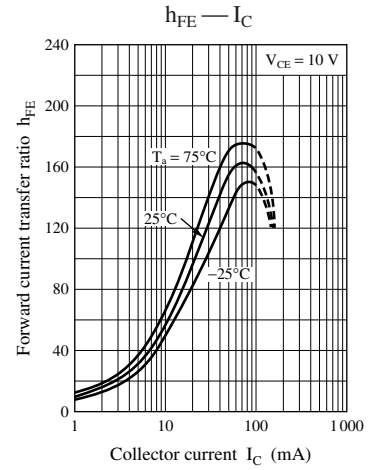
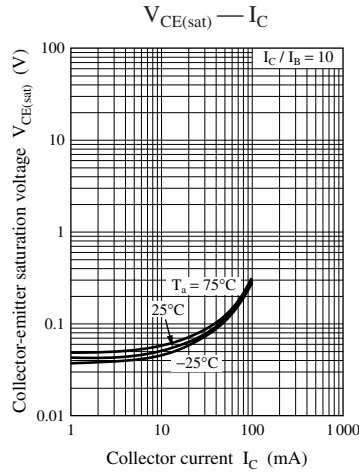
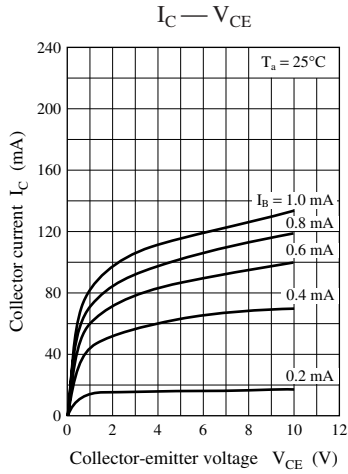




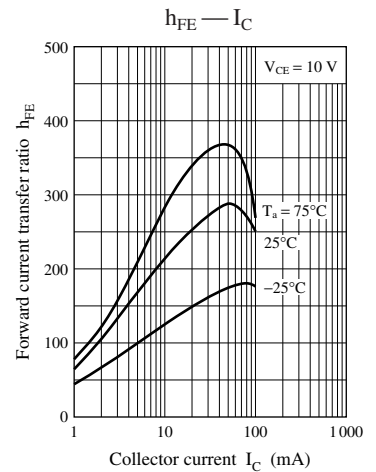
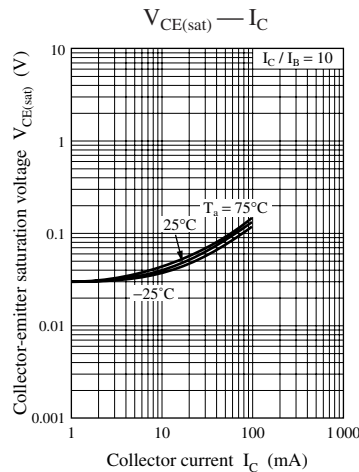
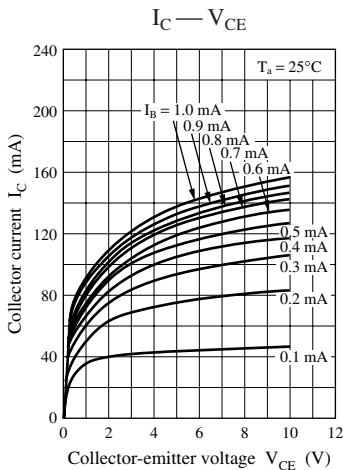
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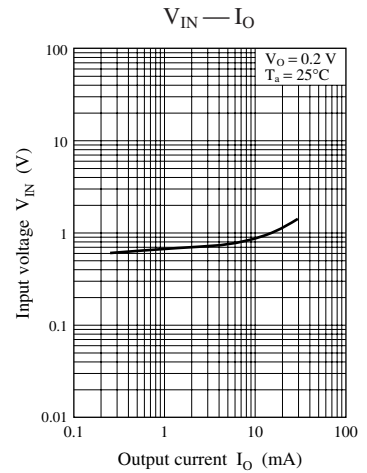
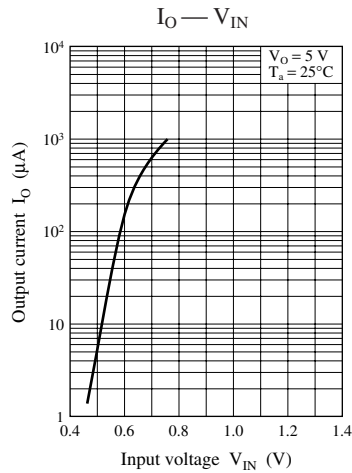
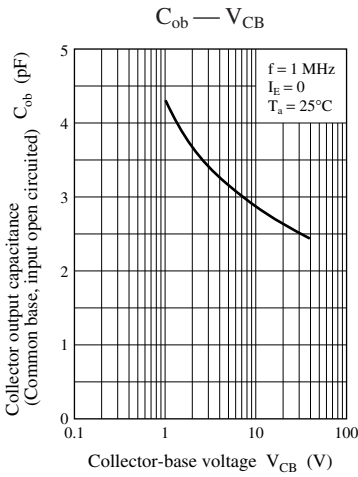


Characteristics charts of UNR221L

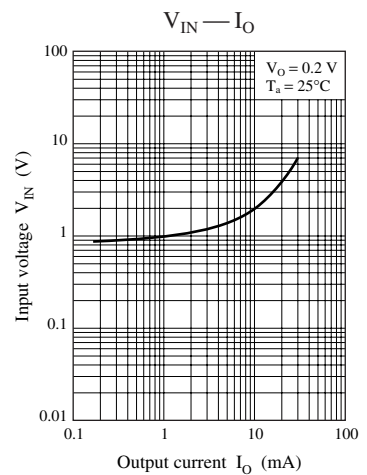
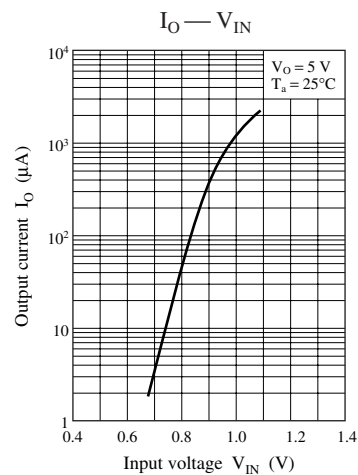
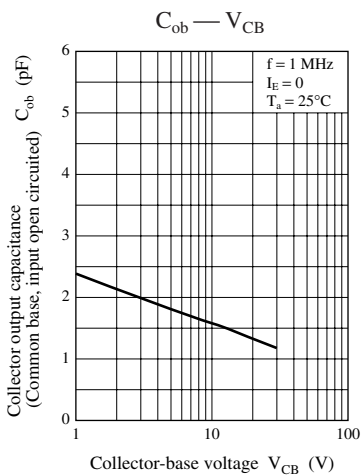
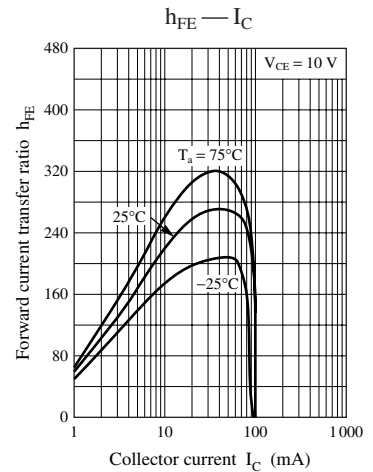
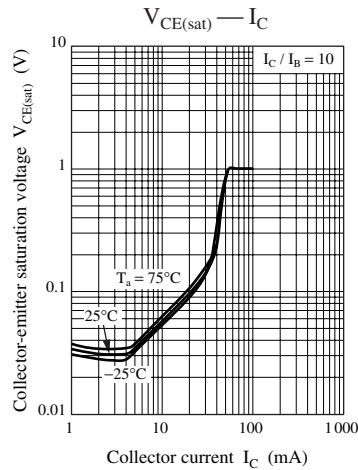
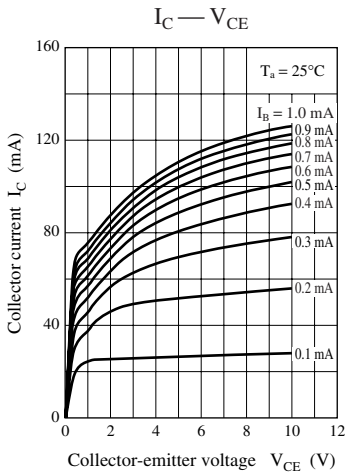


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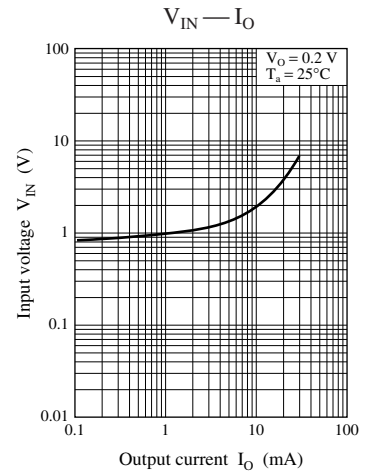
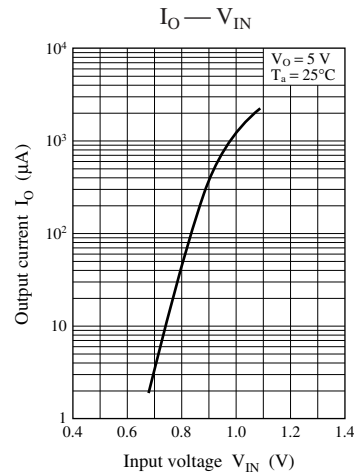
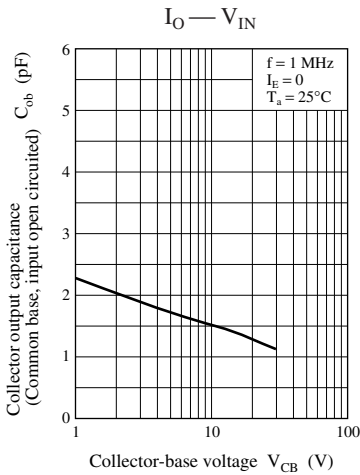
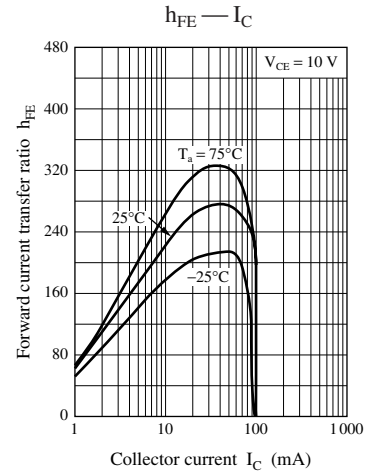
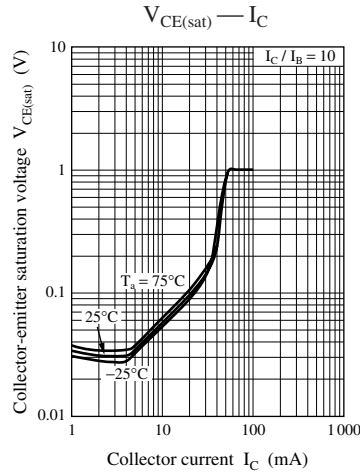
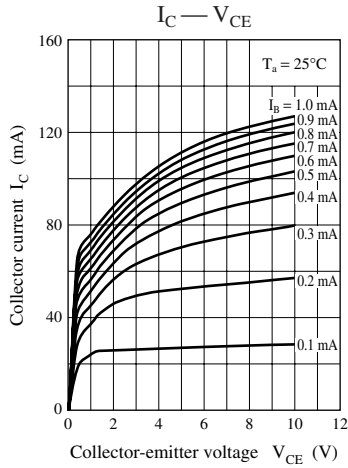




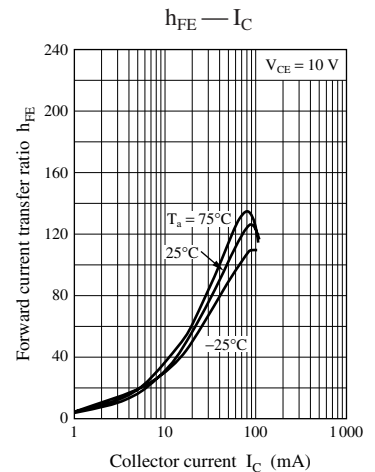
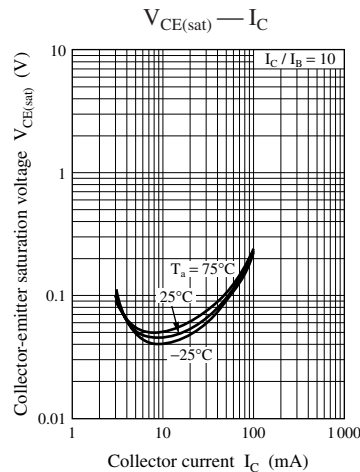
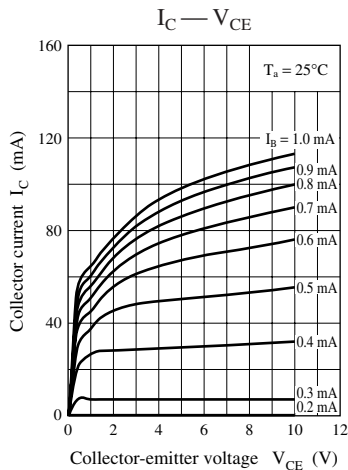
Characteristics charts of UNR221N

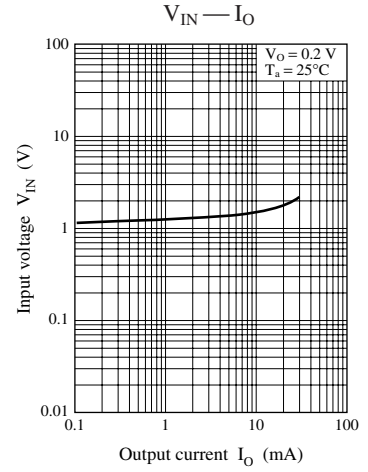
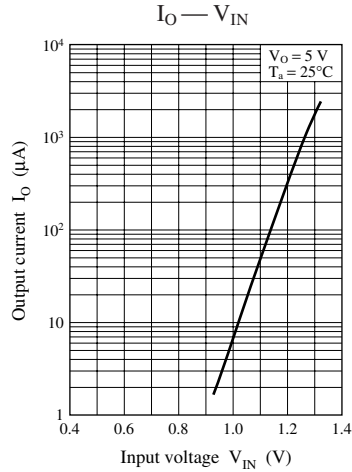
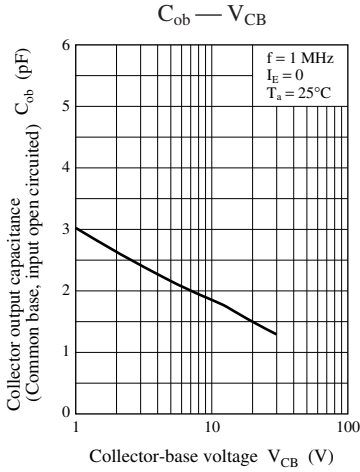


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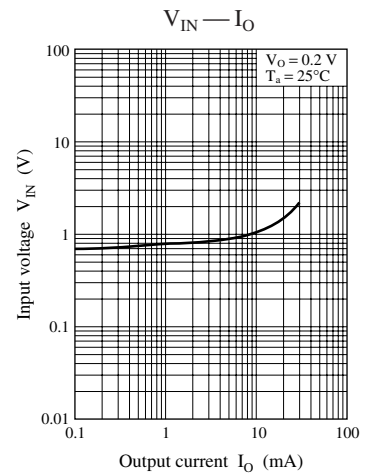
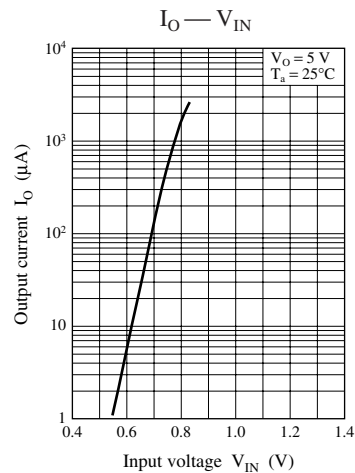
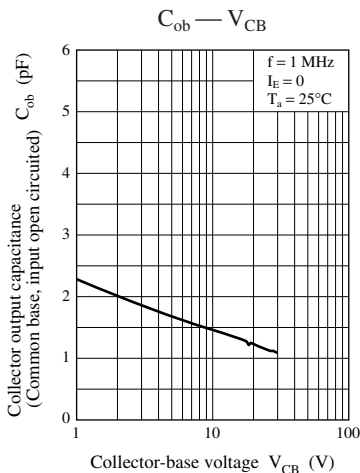
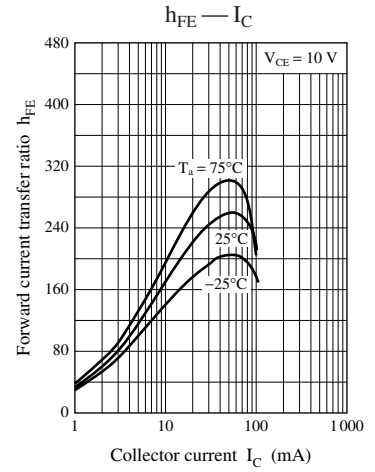
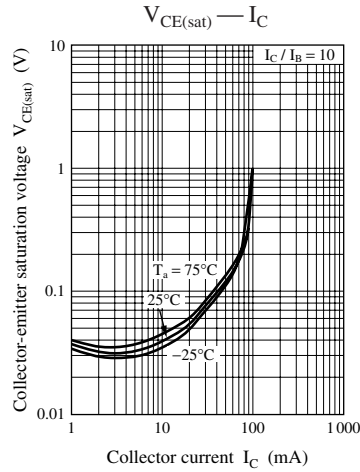
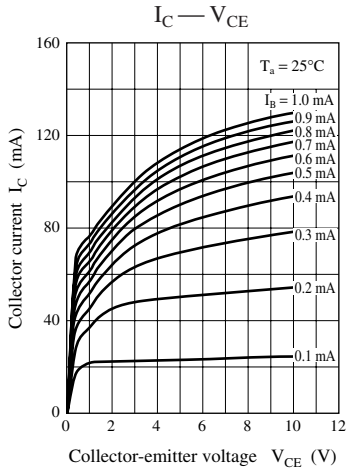


### Characteristics charts of UNR221V





Characteristics charts of UNR221Z





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