

# UNR221x Series (UN221x Series)

## Silicon NPN epitaxial planar transistor

For digital circuits

### ■ Features

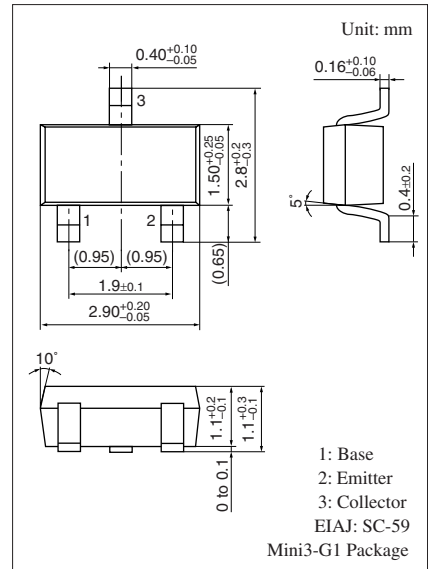
- Costs can be reduced through downsizing of the equipment and reduction of the number of parts.
- Mini type package allowing easy automatic insertion through tape packing and magazine packing

### ■ Resistance by Part Number

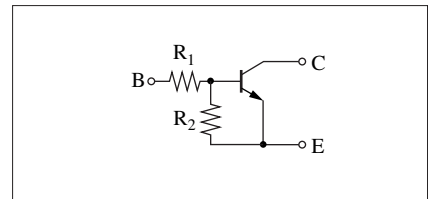
|                    | Marking Symbol (R <sub>1</sub> ) | (R <sub>2</sub> ) |
|--------------------|----------------------------------|-------------------|
| • UNR2210 (UN2210) | 8L                               | 47 kΩ —           |
| • UNR2211 (UN2211) | 8A                               | 10 kΩ 10 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

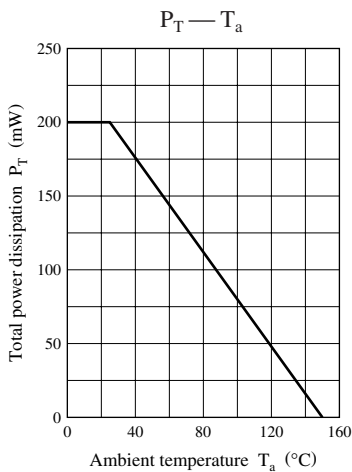
| Rank     | Q          | R          | S          | No-rank    |
|----------|------------|------------|------------|------------|
| $h_{FE}$ | 160 to 260 | 210 to 340 | 290 to 460 | 160 to 460 |

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

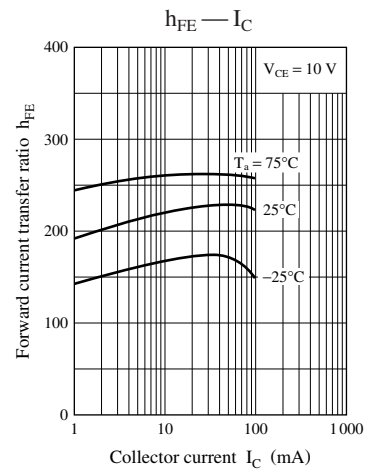
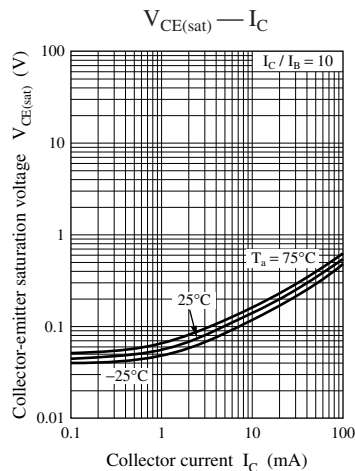
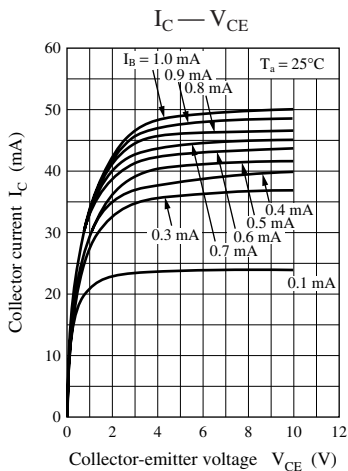
| Parameter        |                        | Symbol    | Conditions | Min  | Typ   | Max  | Unit |
|------------------|------------------------|-----------|------------|------|-------|------|------|
| Resistance ratio | UNR221M                | $R_1/R_2$ |            |      | 0.047 |      | —    |
|                  | 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  |      |

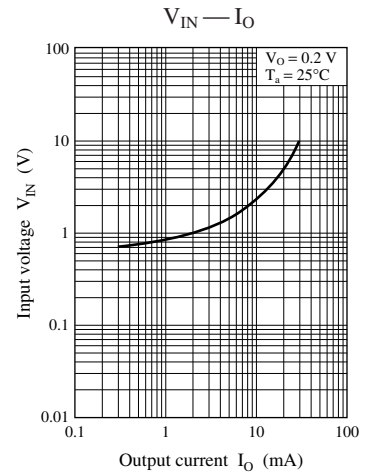
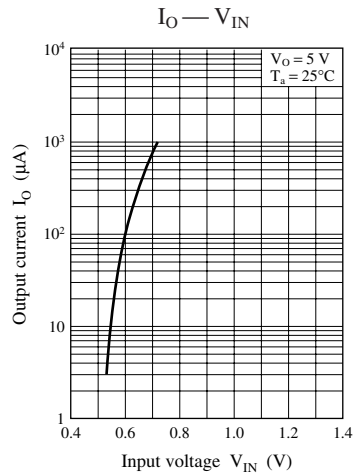
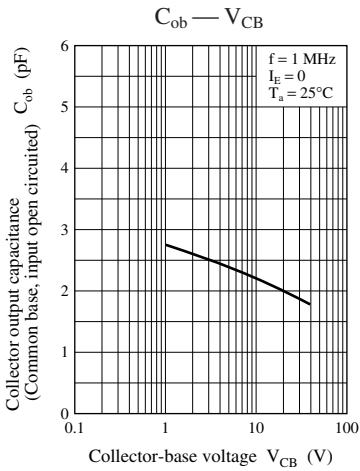
Note) Measuring methods are based on JAPANESE INDUSTRIAL STANDARD JIS C 7030 measuring methods for transistors.

Common characteristics chart

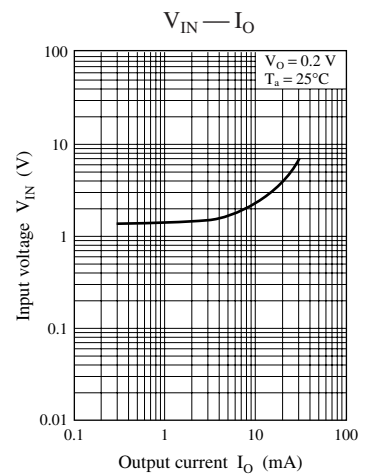
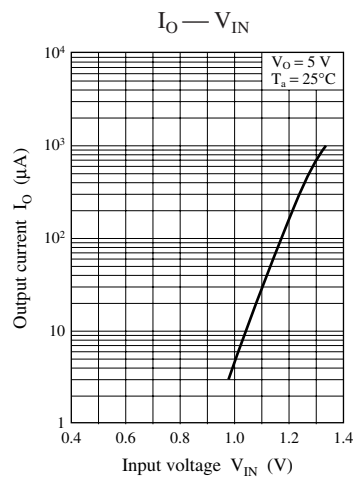
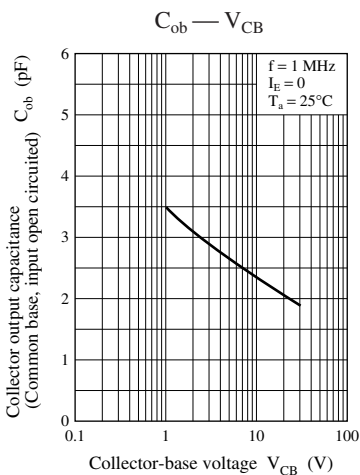
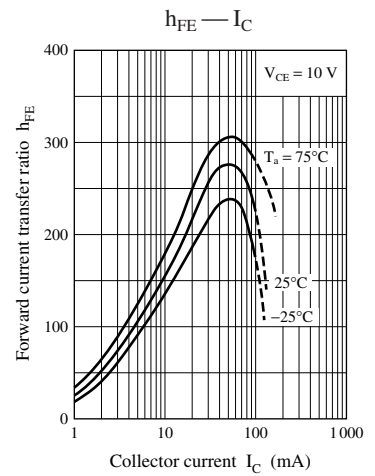
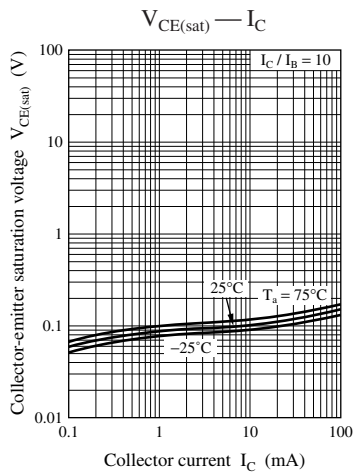
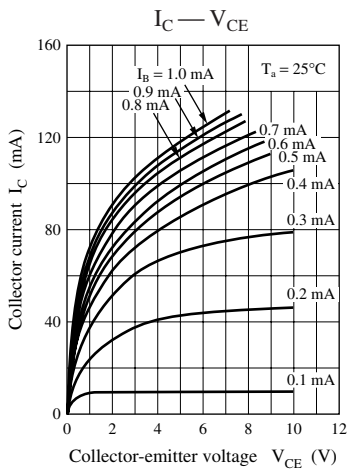


Characteristics charts of UNR2210

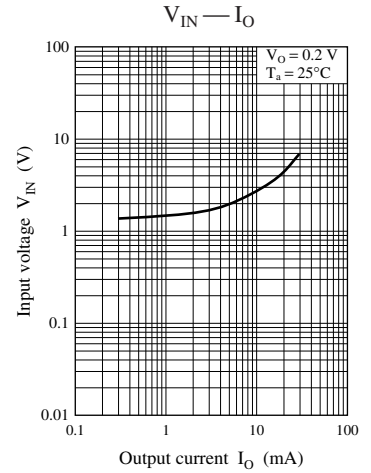
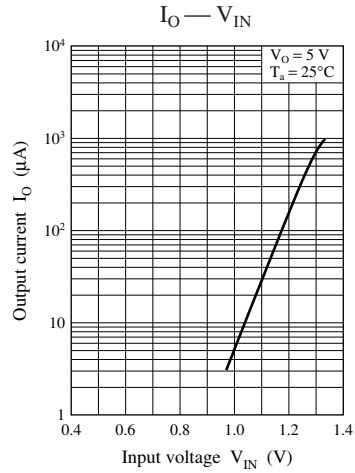
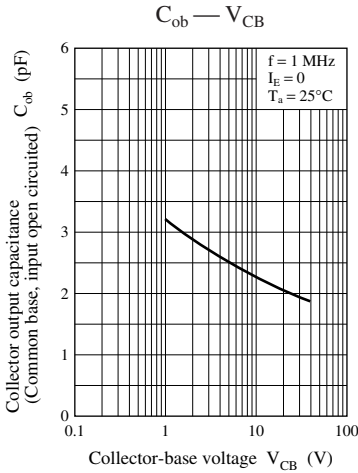
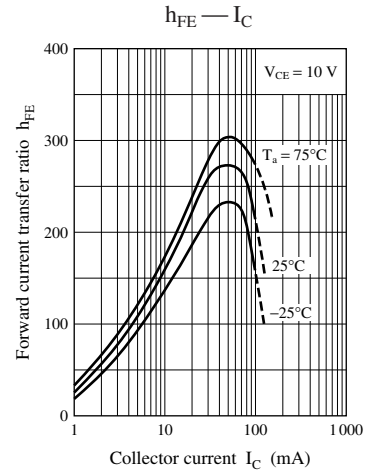
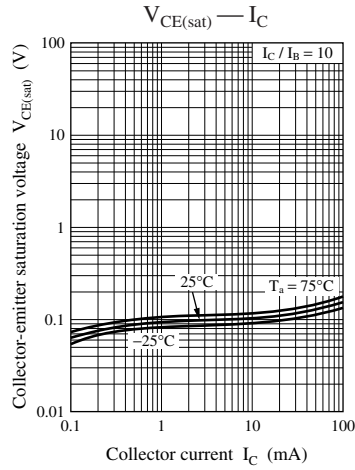
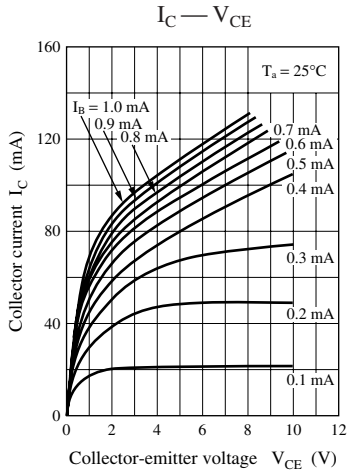




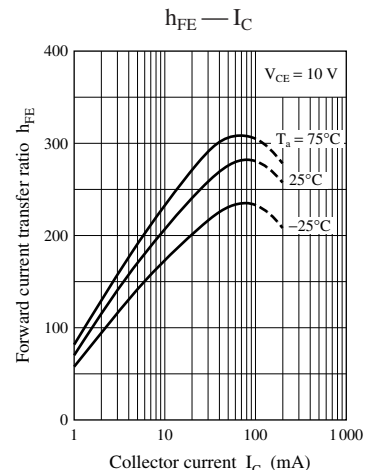
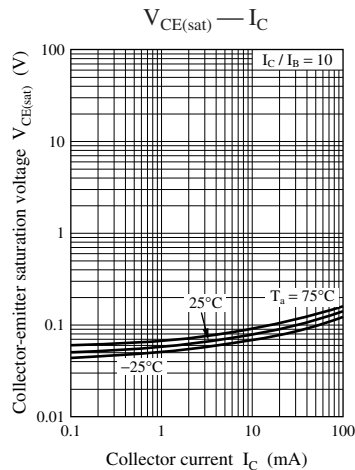
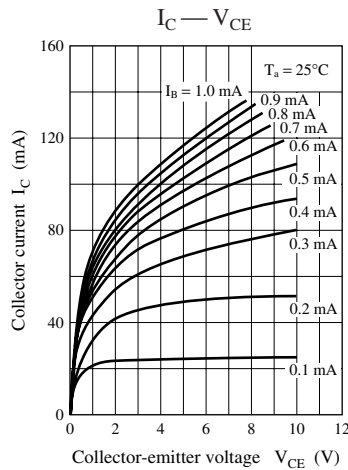
Characteristics charts of UNR2211

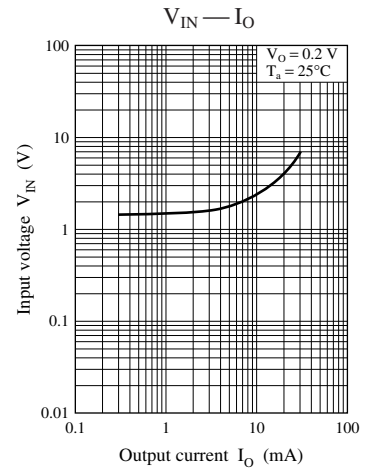
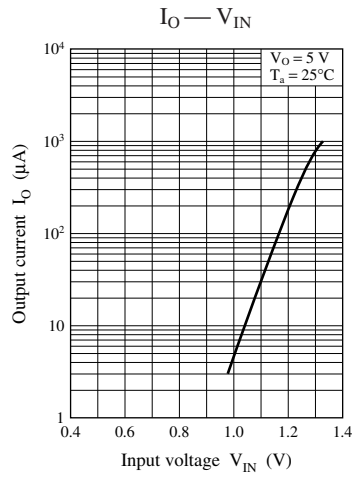
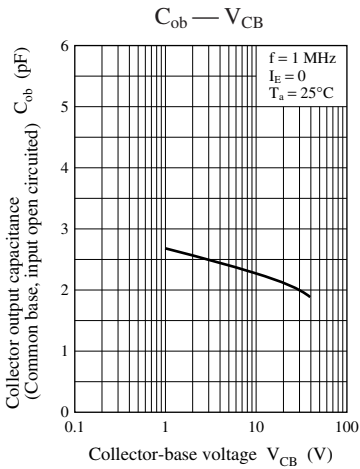


Characteristics charts of UNR2212

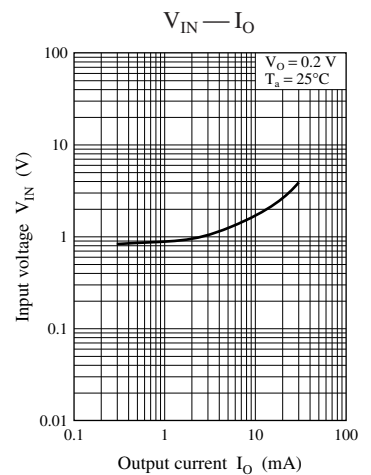
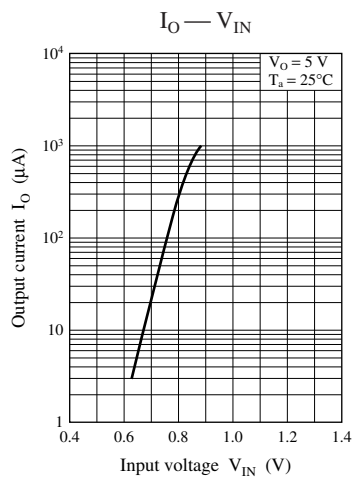
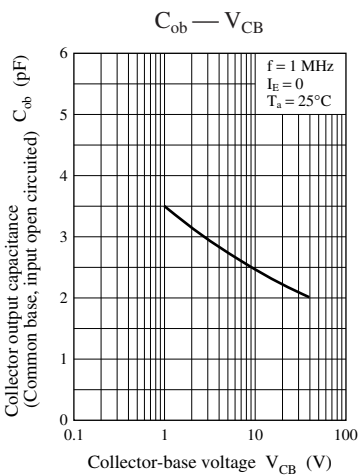
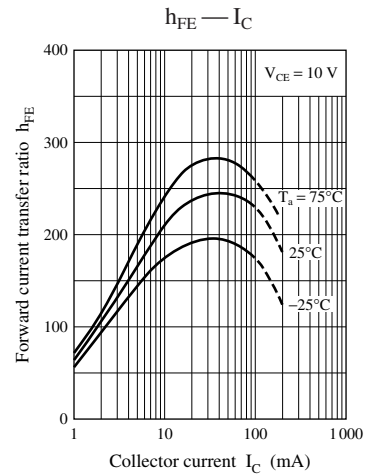
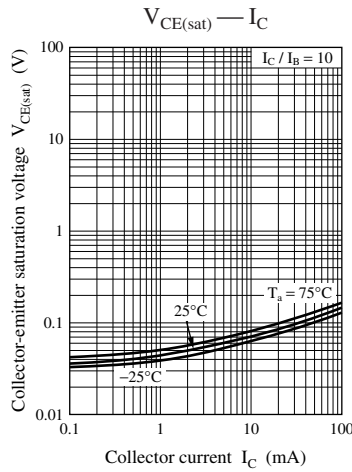
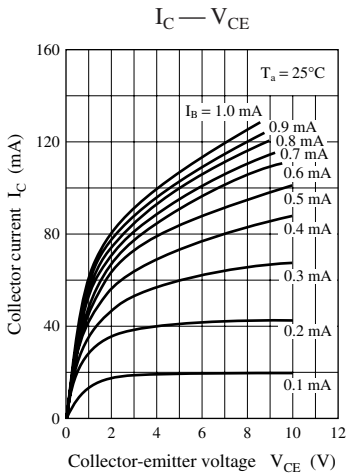


Characteristics charts of UNR2213

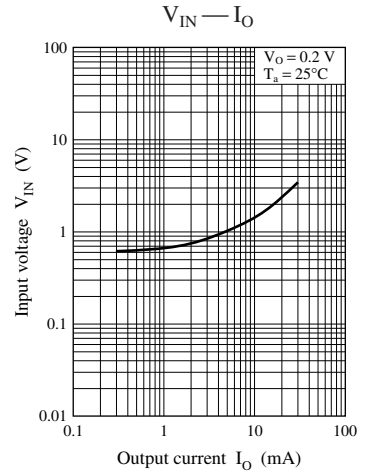
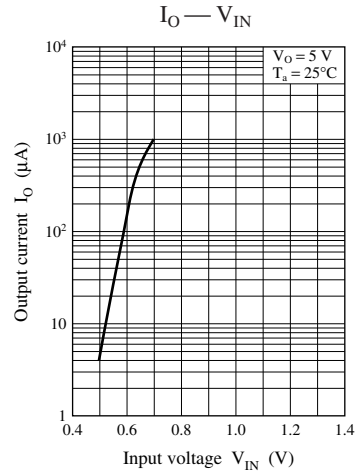
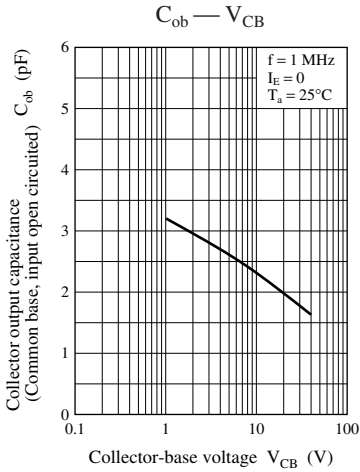
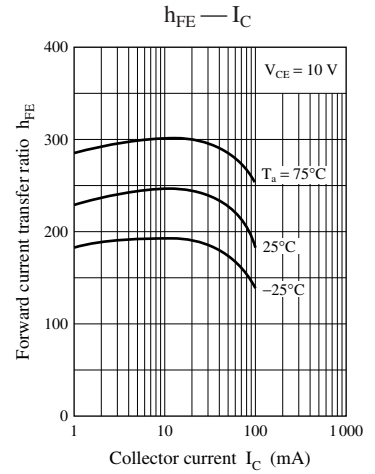
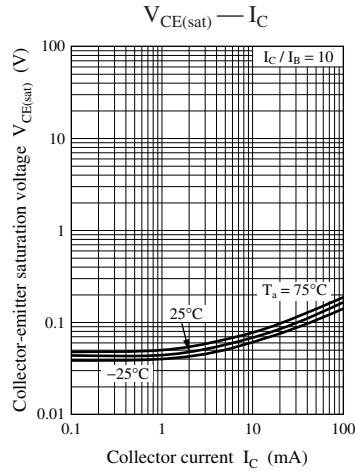
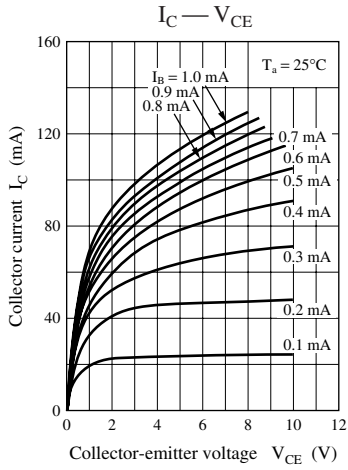




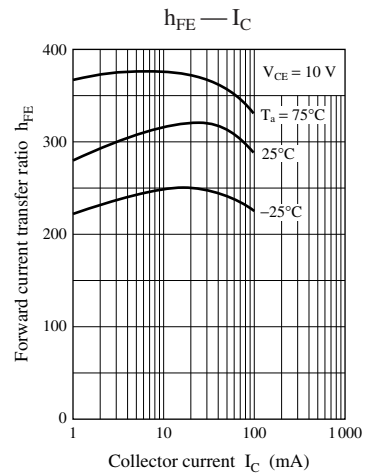
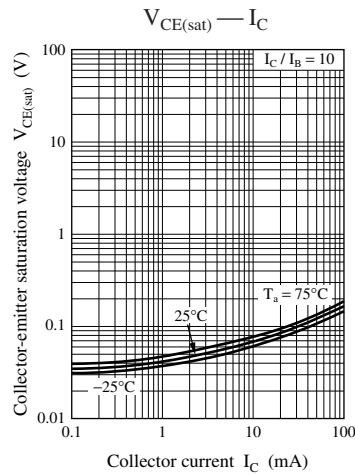
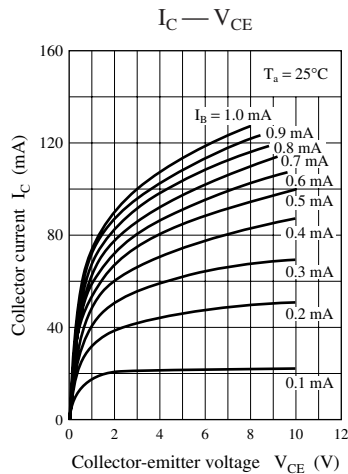
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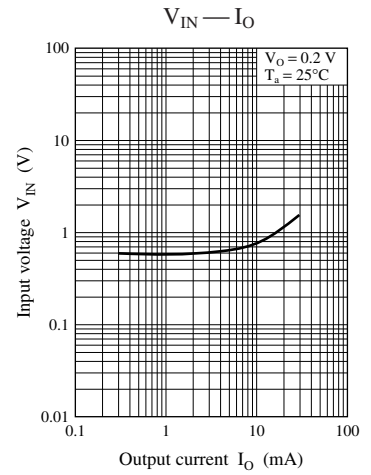
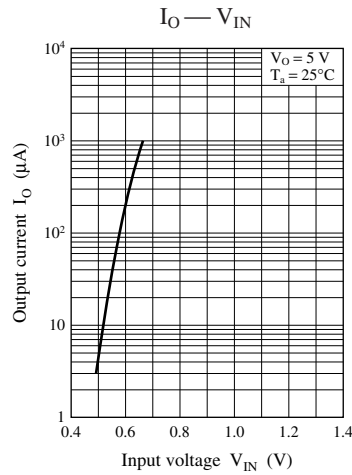
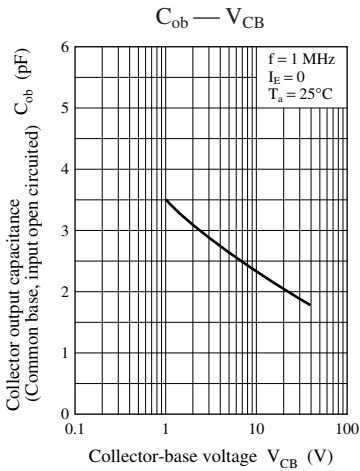


Characteristics charts of UNR2215

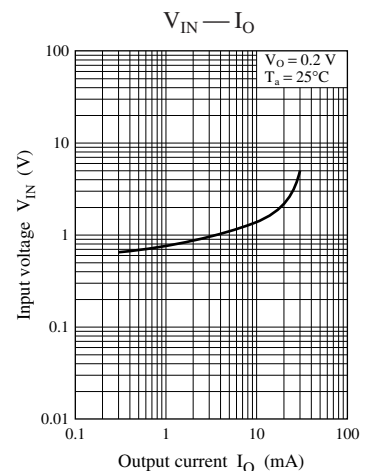
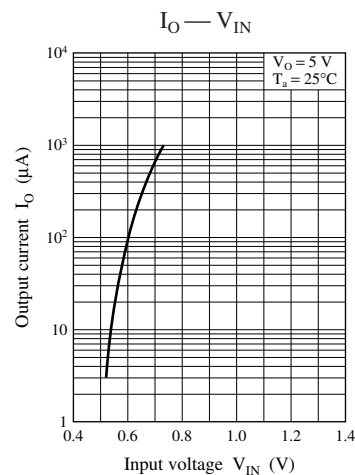
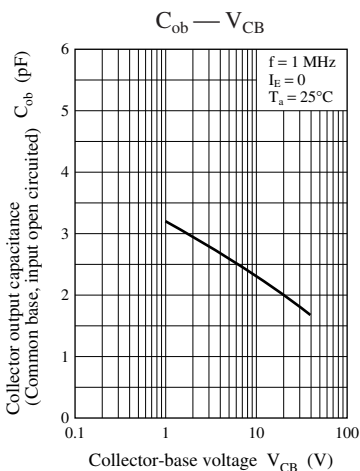
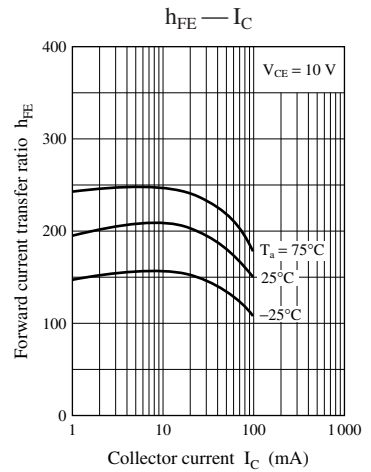
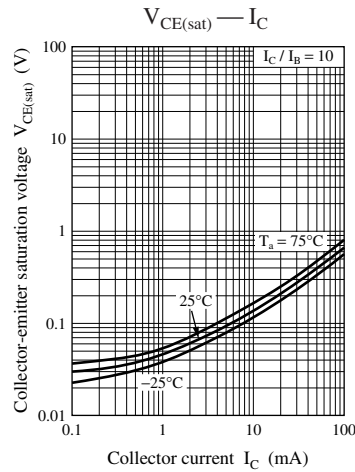
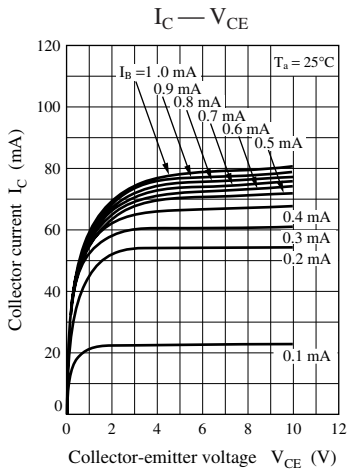


Characteristics charts of UNR2216



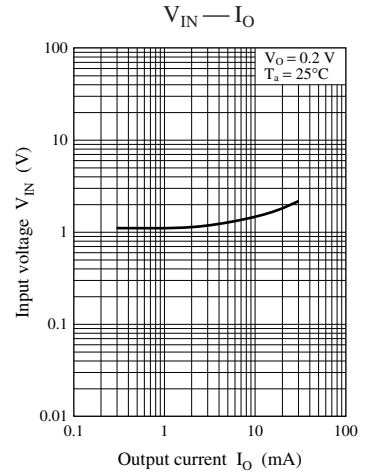
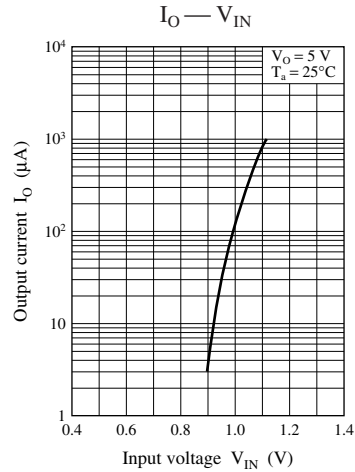
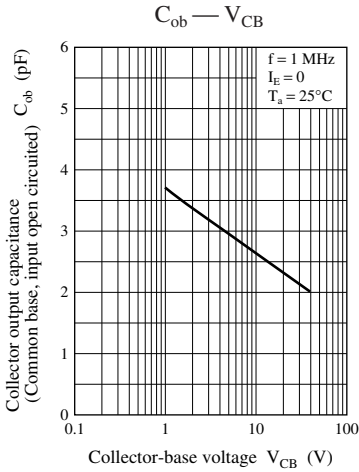
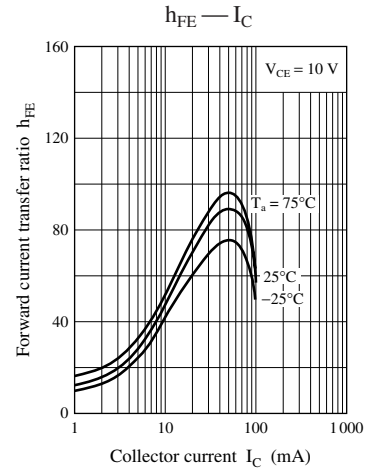
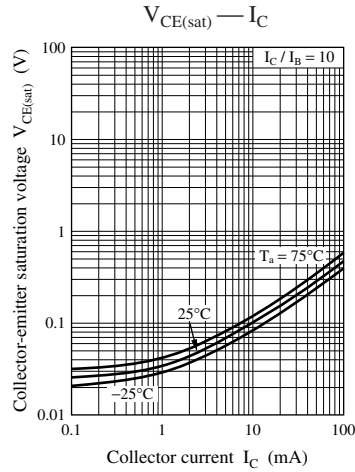
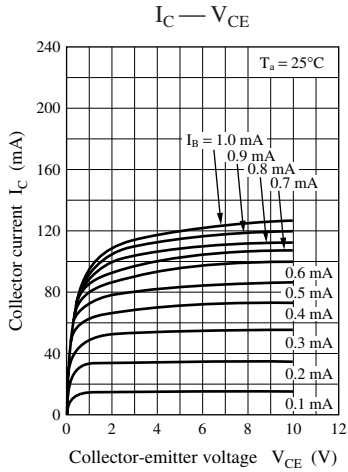


Characteristics charts of UNR2217

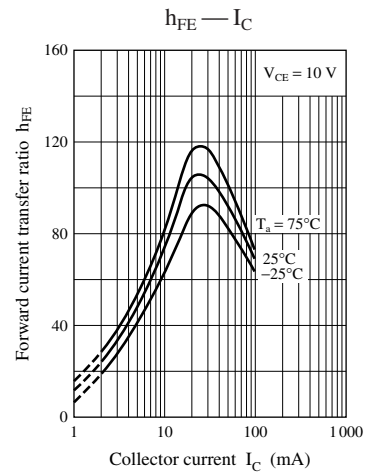
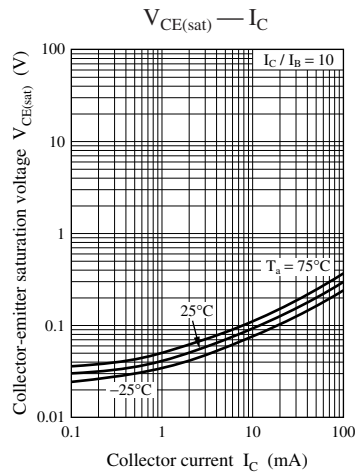
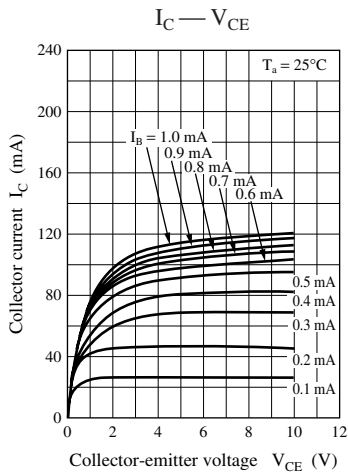


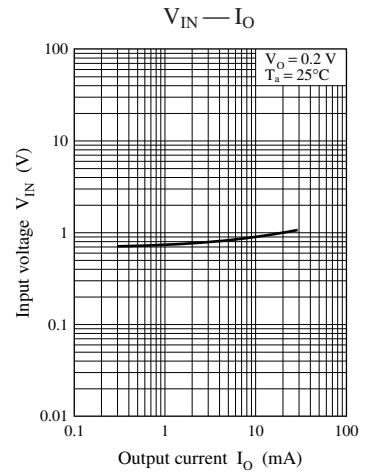
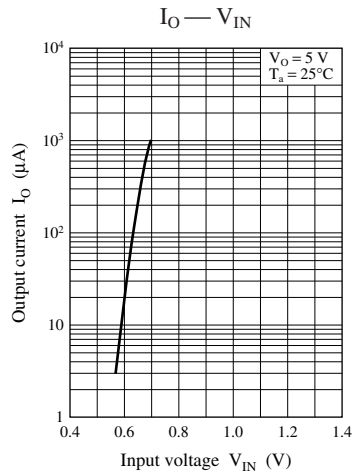
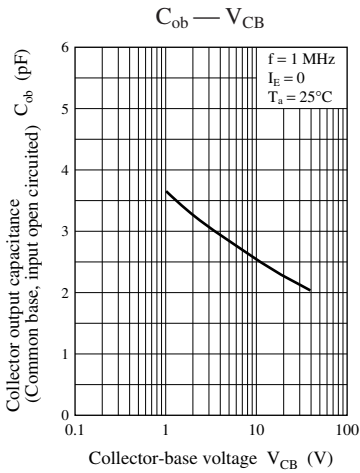


Characteristics charts of UNR2218

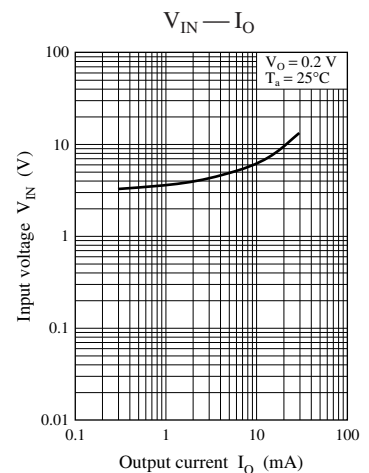
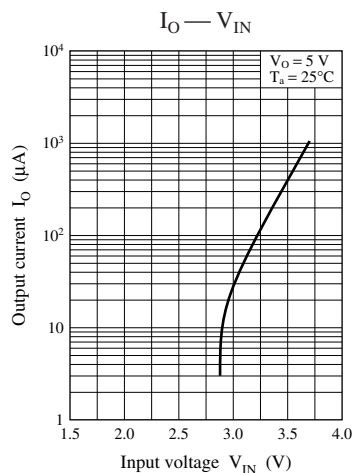
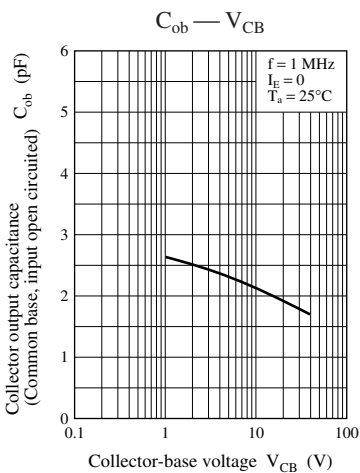
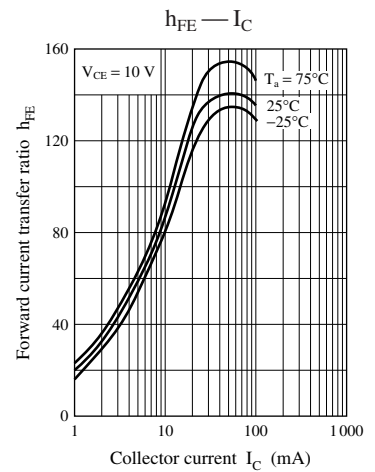
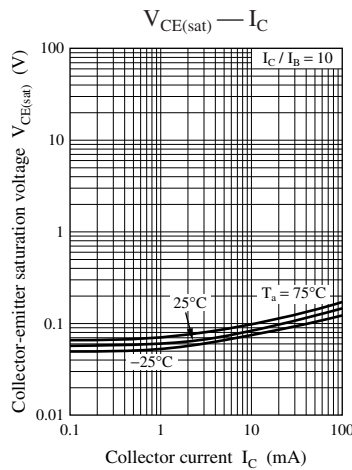
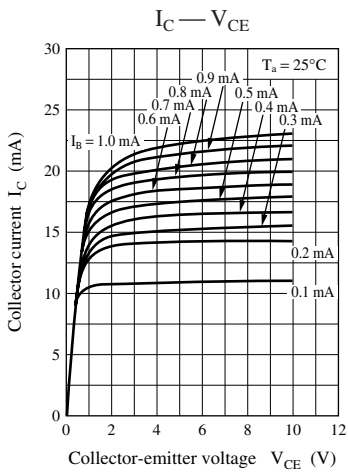


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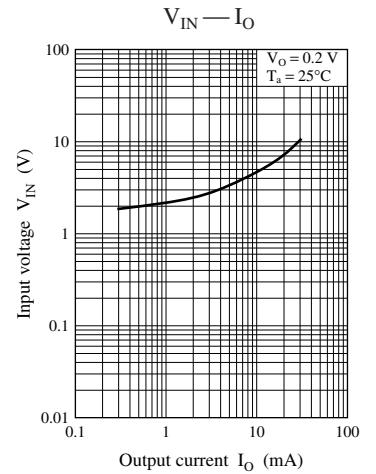
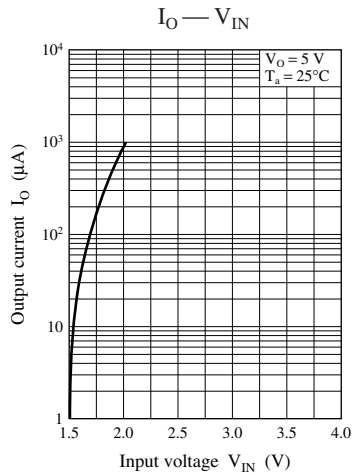
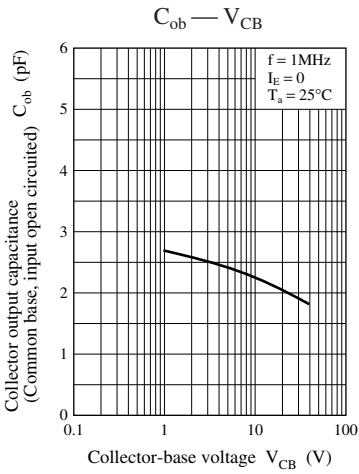
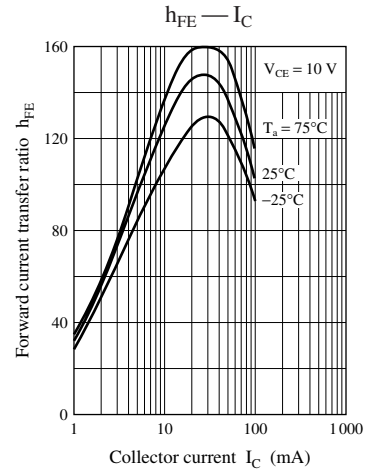
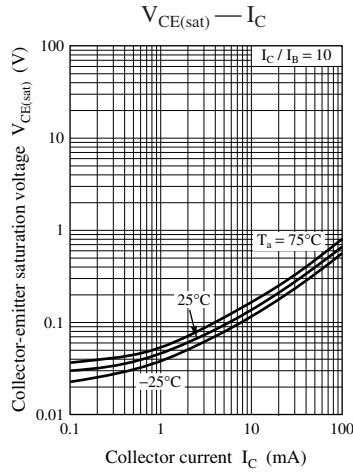
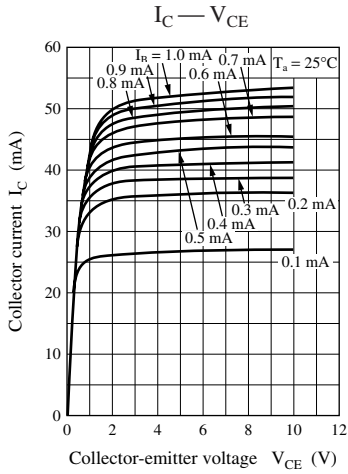




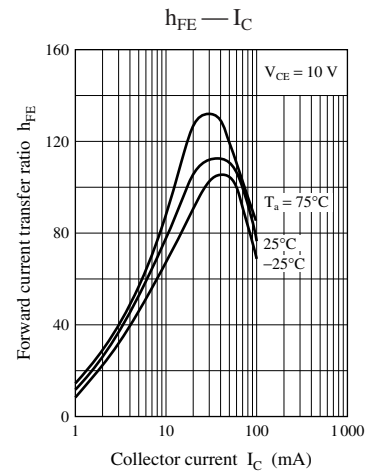
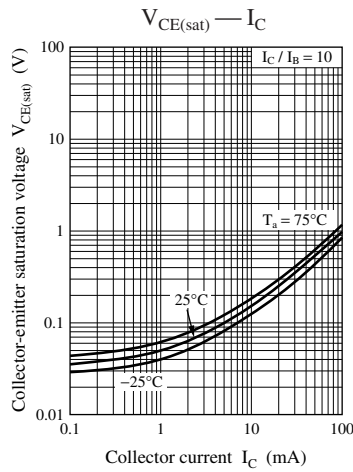
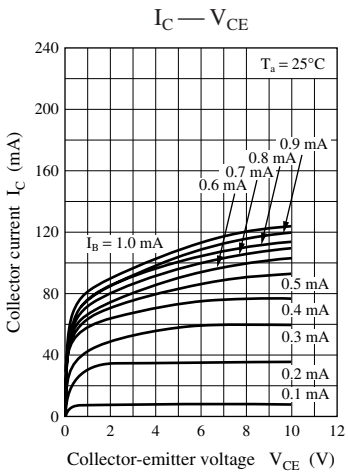
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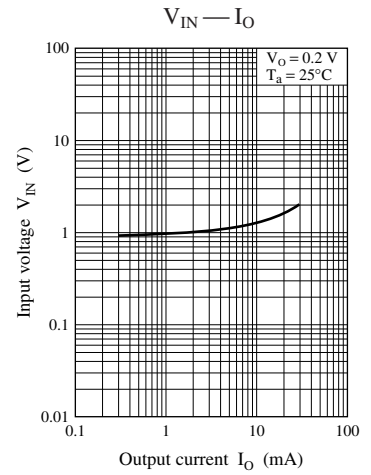
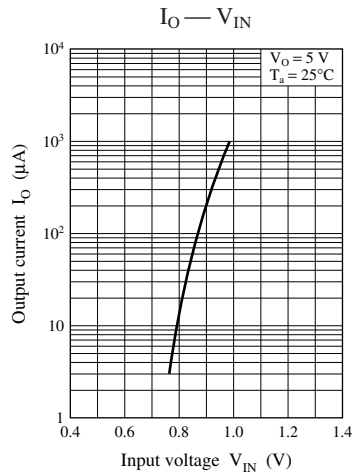
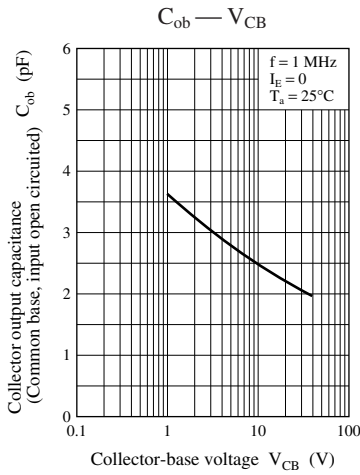


Characteristics charts of UNR221E

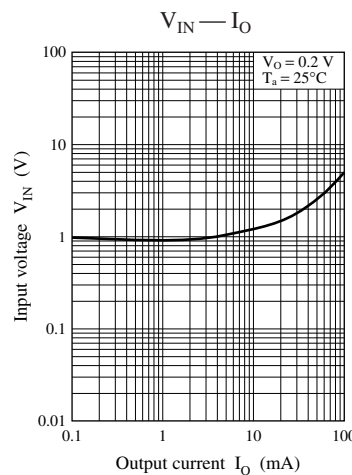
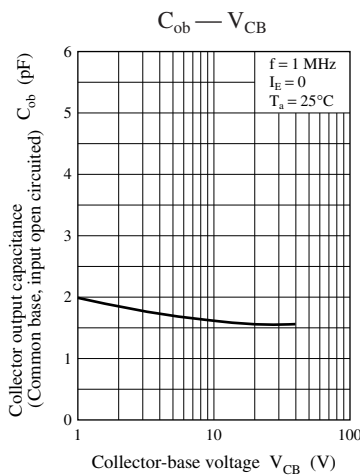
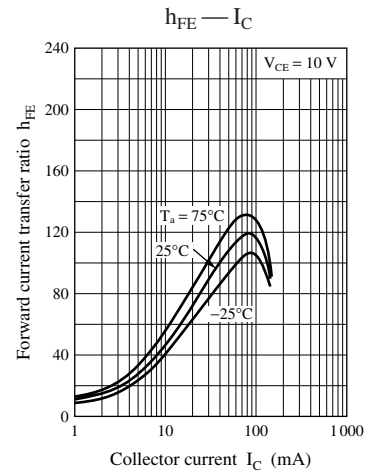
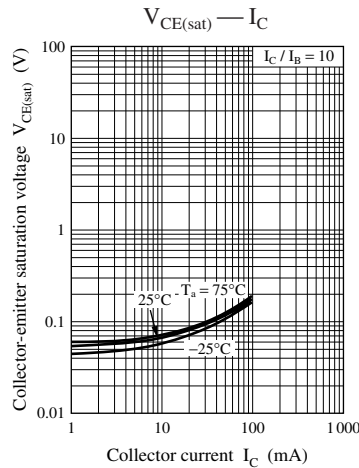
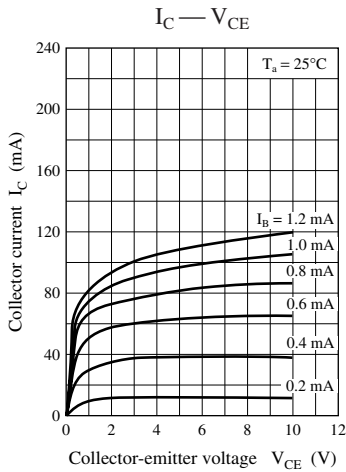


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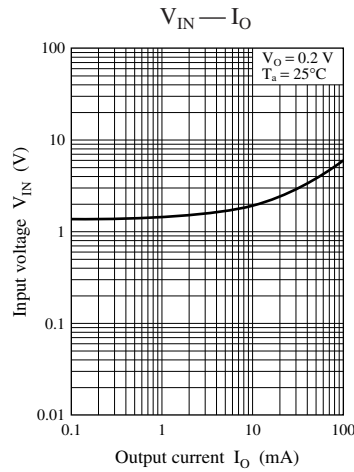
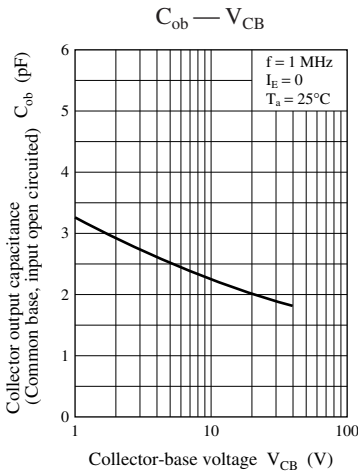
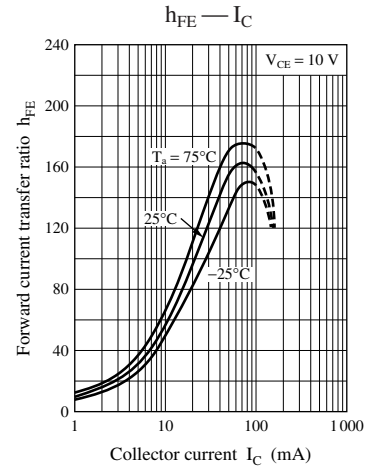
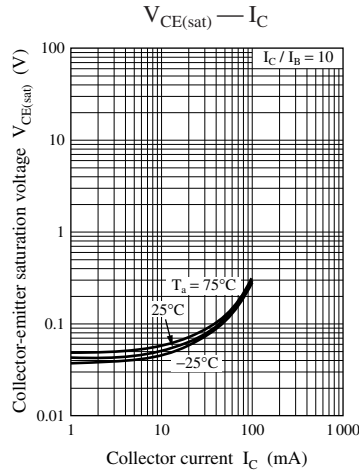
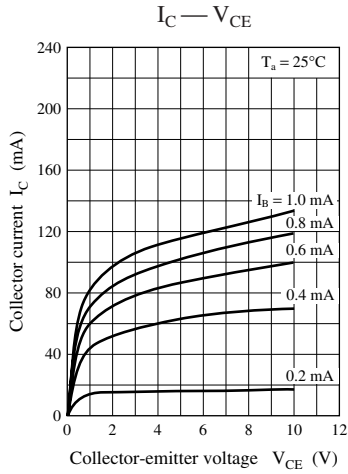




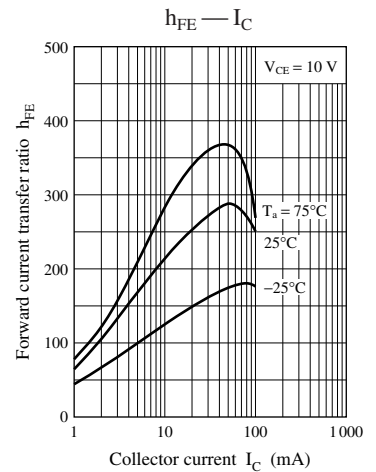
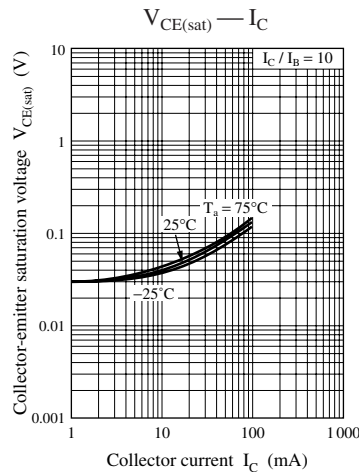
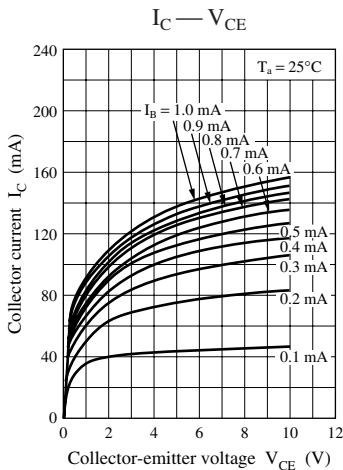
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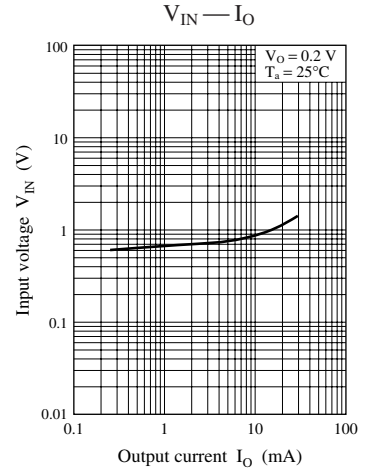
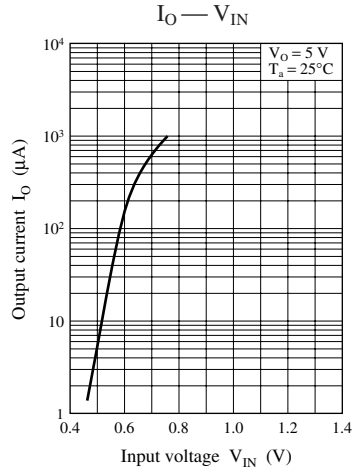
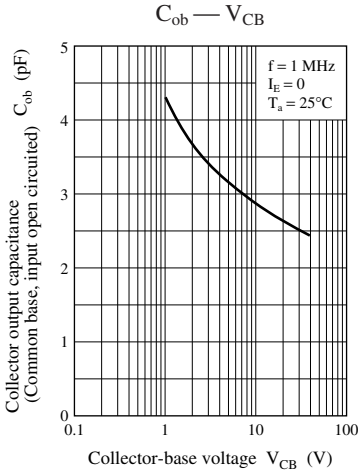


Characteristics charts of UNR221L

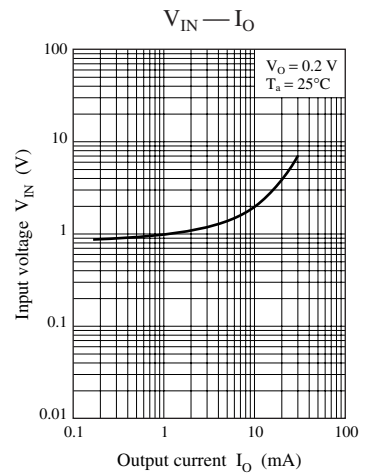
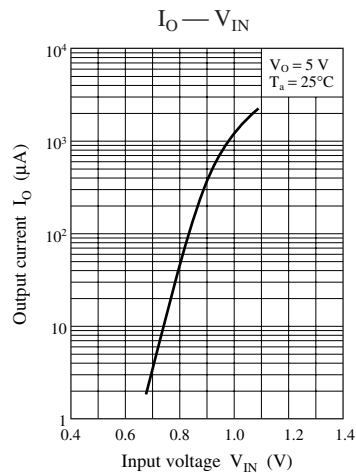
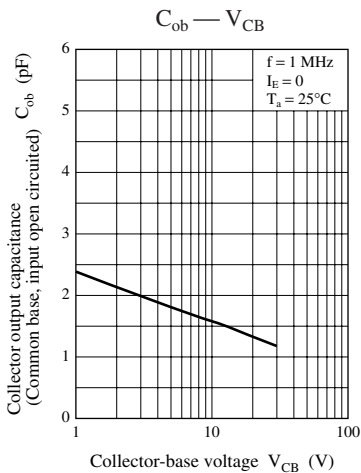
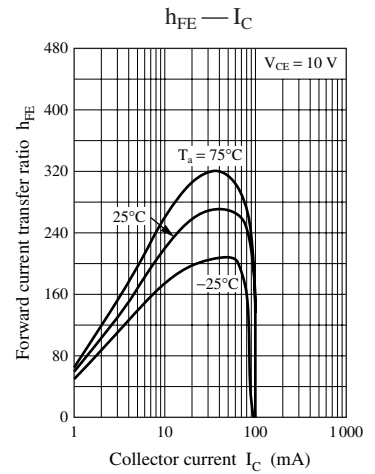
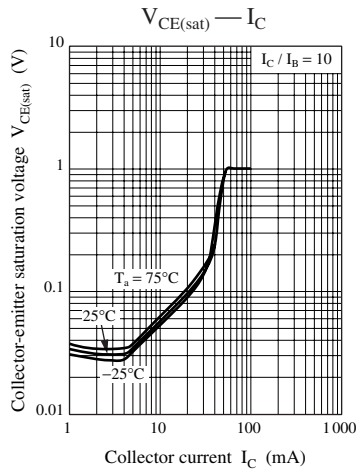
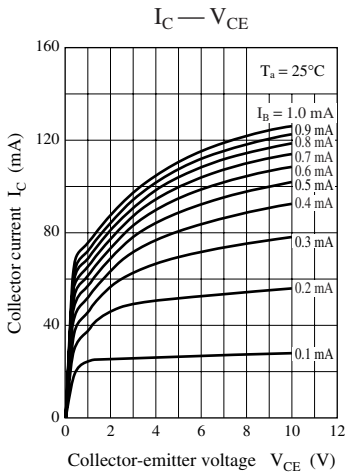


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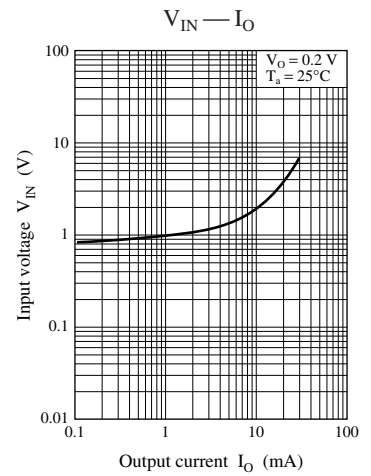
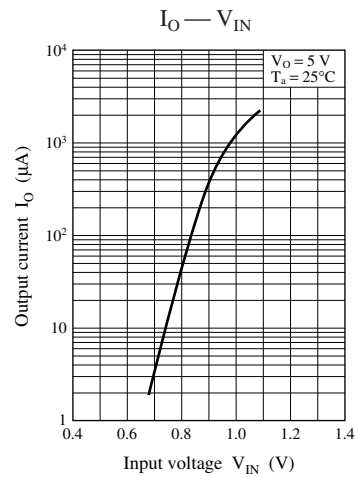
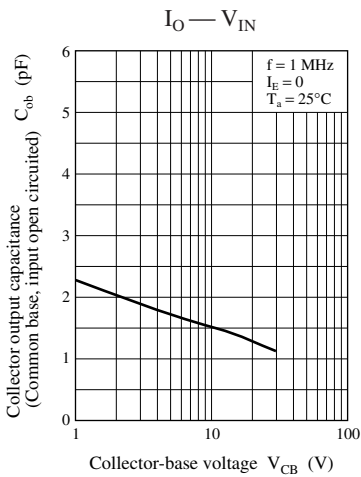
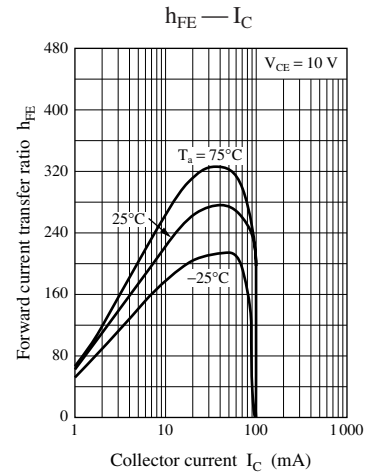
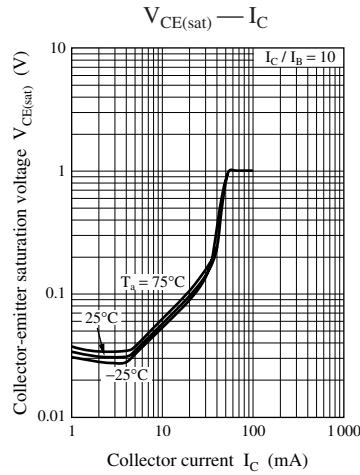
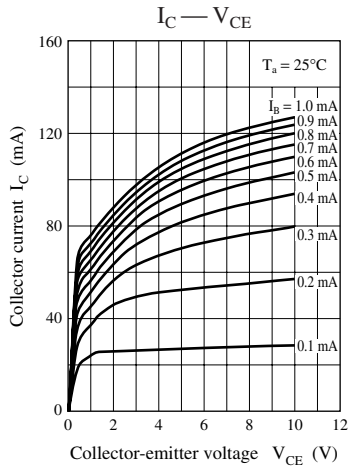




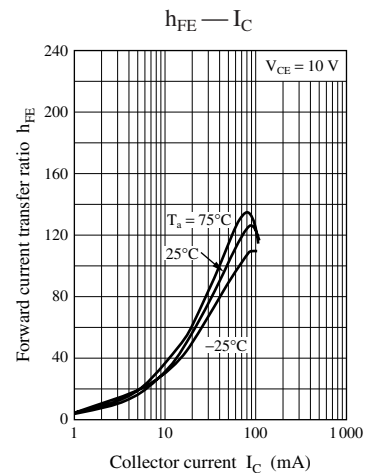
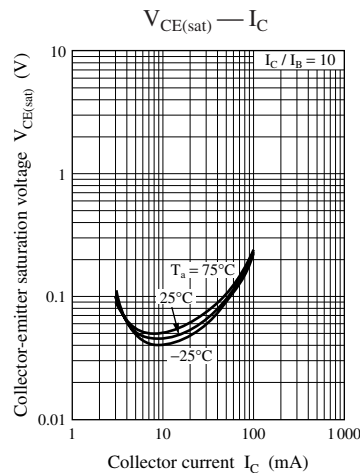
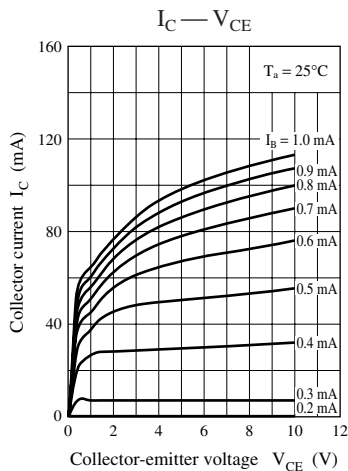
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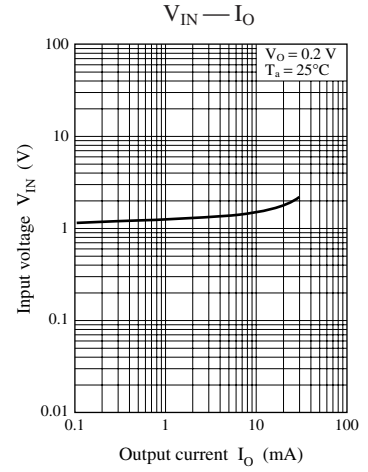
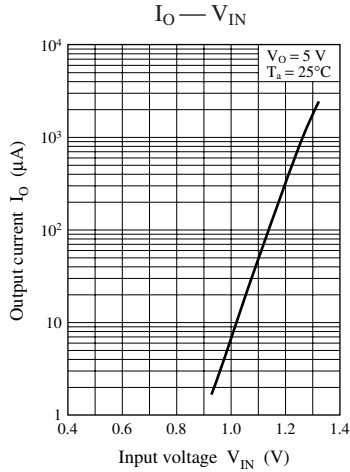
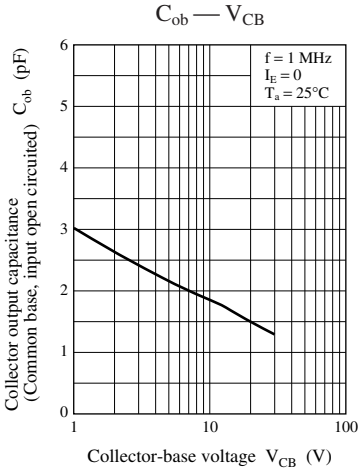


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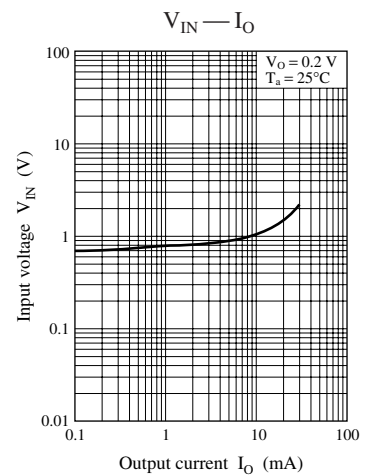
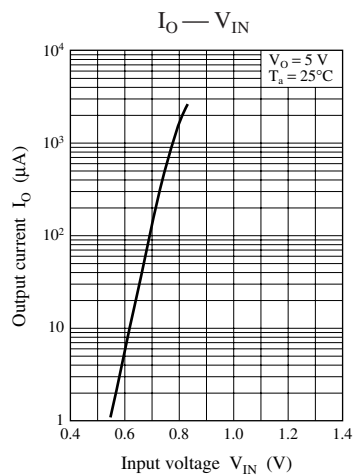
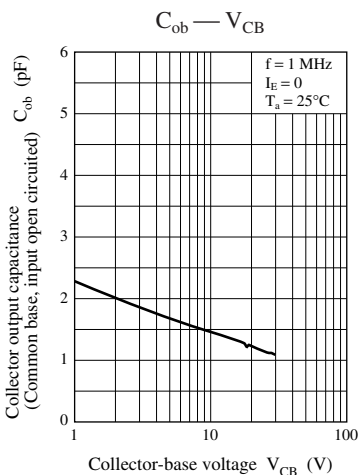
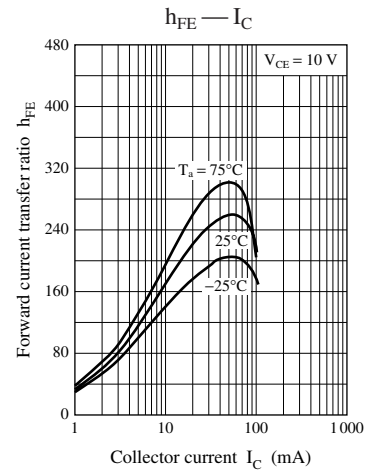
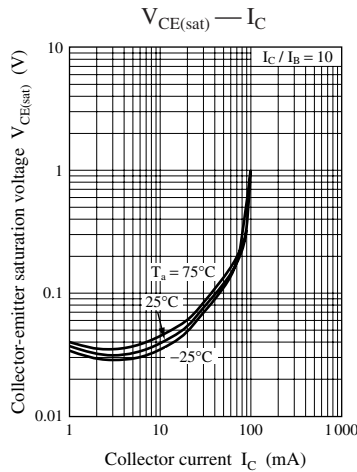
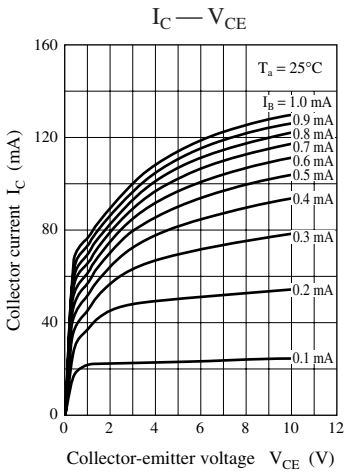


## Characteristics charts of UNR221V





Characteristics charts of UNR221Z





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