

# UN2211/2212/2213/2214/2215/2216/2217/2218/2219/2210/ 221D/221E/221F/221K/221L/221M/221N/221T/221V/221Z

## Silicon NPN epitaxial planer transistor

For digital circuits

### Features

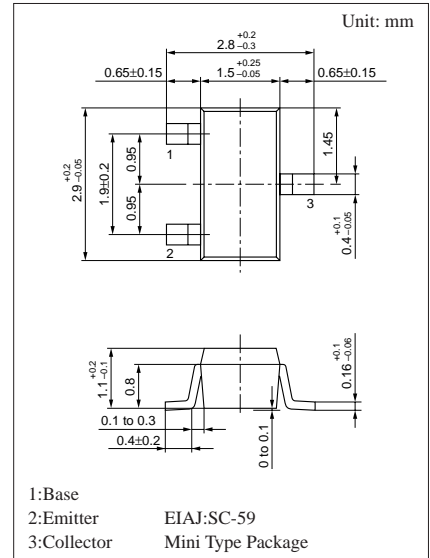
- Costs can be reduced through downsizing of the equipment and reduction of the number of parts.
- Mini type package, allowing downsizing of the equipment and automatic insertion through tape packing and magazine packing.

### Resistance by Part Number

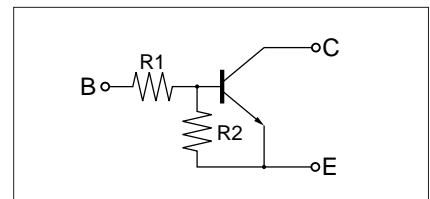
|          | Marking Symbol | (R <sub>1</sub> ) | (R <sub>2</sub> ) |
|----------|----------------|-------------------|-------------------|
| • UN2211 | 8A             | 10kΩ              | 10kΩ              |
| • UN2212 | 8B             | 22kΩ              | 22kΩ              |
| • UN2213 | 8C             | 47kΩ              | 47kΩ              |
| • UN2214 | 8D             | 10kΩ              | 47kΩ              |
| • UN2215 | 8E             | 10kΩ              | —                 |
| • UN2216 | 8F             | 4.7kΩ             | —                 |
| • UN2217 | 8H             | 22kΩ              | —                 |
| • UN2218 | 8I             | 0.51kΩ            | 5.1kΩ             |
| • UN2219 | 8K             | 1kΩ               | 10kΩ              |
| • UN2210 | 8L             | 47kΩ              | —                 |
| • UN221D | 8M             | 47kΩ              | 10kΩ              |
| • UN221E | 8N             | 47kΩ              | 22kΩ              |
| • UN221F | 8O             | 4.7kΩ             | 10kΩ              |
| • UN221K | 8P             | 10kΩ              | 4.7kΩ             |
| • UN221L | 8Q             | 4.7kΩ             | 4.7kΩ             |
| • UN221M | EL             | 2.2kΩ             | 47kΩ              |
| • UN221N | EX             | 4.7kΩ             | 47kΩ              |
| • UN221T | EZ             | 22kΩ              | 47kΩ              |
| • UN221V | FD             | 2.2kΩ             | 2.2kΩ             |
| • UN221Z | FF             | 4.7kΩ             | 22kΩ              |

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

| Parameter                    | Symbol           | Ratings     | Unit |
|------------------------------|------------------|-------------|------|
| Collector to base voltage    | V <sub>CBO</sub> | 50          | V    |
| Collector to emitter voltage | 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



UN2211/2212/2213/2214/2215/2216/2217/2218/2219/2210/  
**Transistors with built-in Resistor 221D/221E/221F/221K/221L/221M/221N/221T/221V/221Z**

**Electrical Characteristics** (T<sub>a</sub>=25°C)

| Parameter                               |                                      | Symbol               | Conditions  | min   | typ   | max    | Unit |      |
|---|--------------------------------------|----------------------|---|---|---|--------|------|------|
| Collector cutoff current                |                                      | I <sub>CBO</sub>     | V <sub>CB</sub> = 50V, I <sub>E</sub> = 0                         |   |   | 0.1    | μA   |      |
|   |                                      | I <sub>CEO</sub>     | V <sub>CE</sub> = 50V, I <sub>B</sub> = 0                         |   |   | 0.5    | μA   |      |
| Emitter cutoff current                  | UN2211                               | I <sub>EBO</sub>     | V <sub>EB</sub> = 6V, I <sub>C</sub> = 0                          |   |   | 0.5    | mA   |      |
|   | UN2212/2214/221E/221D/221M/221N/221T |                      |   |   |   | 0.2    |      |      |
|   | UN2213                               |                      |   |   |   | 0.1    |      |      |
|   | UN2215/2216/2217/2210                |                      |   |   |   | 0.01   |      |      |
|   | UN221F/221K                          |                      |   |   |   | 1.0    |      |      |
|   | UN2219                               |                      |   |   |   | 1.5    |      |      |
|   | UN2218/221L/221V                     |                      |   |   |   | 2.0    |      |      |
|   | UN221Z                               |                      |   |   |   | 0.4    |      |      |
| Collector to base voltage               |                                      | V <sub>CBO</sub>     | I <sub>C</sub> = 10μA, I <sub>E</sub> = 0                         | 50  |   |        | V    |      |
| Collector to emitter voltage            |                                      | V <sub>CEO</sub>     | I <sub>C</sub> = 2mA, I <sub>B</sub> = 0                          | 50  |   |        | V    |      |
| Forward current transfer ratio          | UN2211                               | h <sub>FE</sub>      | V <sub>CE</sub> = 10V, I <sub>C</sub> = 5mA                       | 35  |   |        | —    |      |
|   | UN2212/221E                          |                      |   | 60  |   |        |      |      |
|   | UN2213/2214/221M                     |                      |   | 80  |   |        |      |      |
|   | UN2215*/2216*/2217*/2210*            |                      |   | 160   |   | 460    |      |      |
|   | UN221F/221D/2219                     |                      |   | 30  |   |        |      |      |
|   | UN2218/221K/221L                     |                      |   | 20  |   |        |      |      |
|   | UN221N/221T                          |                      |   | 80  |   | 400    |      |      |
|   | UN221V                               |                      |   | 60  |   | 200    |      |      |
| Collector to emitter saturation voltage |                                      | V <sub>CE(sat)</sub> | I <sub>C</sub> = 10mA, I <sub>B</sub> = 0.3mA                     |   |   | 0.25   | V    |      |
|   |                                      |                      |   | UN221V  | I <sub>C</sub> = 10mA, I <sub>B</sub> = 1.5mA |        |      | 0.04 |
| Output voltage high level               |                                      | V <sub>OH</sub>      | V <sub>CC</sub> = 5V, V <sub>B</sub> = 0.5V, R <sub>L</sub> = 1kΩ | 4.9   |   |        | V    |      |
| Output voltage low level                |                                      | V <sub>OL</sub>      | V <sub>CC</sub> = 5V, V <sub>B</sub> = 2.5V, R <sub>L</sub> = 1kΩ |   |   | 0.2    | V    |      |
|   |                                      |                      | UN2213/221K   | V <sub>CC</sub> = 5V, V <sub>B</sub> = 3.5V, R <sub>L</sub> = 1kΩ |   |        |      | 0.2  |
|   |                                      |                      | UN221D  | V <sub>CC</sub> = 5V, V <sub>B</sub> = 10V, R <sub>L</sub> = 1kΩ  |   |        |      | 0.2  |
|   |                                      |                      | UN221E  | V <sub>CC</sub> = 5V, V <sub>B</sub> = 6V, R <sub>L</sub> = 1kΩ   |   |        |      | 0.2  |
| Transition frequency                    |                                      | f <sub>T</sub>       | V <sub>CB</sub> = 10V, I <sub>E</sub> = -2mA, f = 200MHz          |   | 150   |        | MHz  |      |
| Input resistance                        | UN2211/2214/2215/221K                | R <sub>I</sub>       |   | (-30%)  |   | (±30%) | kΩ   |      |
|   | UN2212/2217/221T                     |                      |   |   |   |        |      | 10   |
|   | UN2213/221D/221E/2210                |                      |   |   |   |        |      | 22   |
|   | UN2216/221F/221L/221N/221Z           |                      |   |   |   |        |      | 47   |
|   | UN2218                               |                      |   |   |   |        |      | 4.7  |
|   | UN2219                               |                      |   |   |   |        |      | 0.51 |
|   | UN221M/221V                          |                      |   |   |   |        |      | 1    |
|   | 2.2                                  |                      |   |   |   |        |      |      |

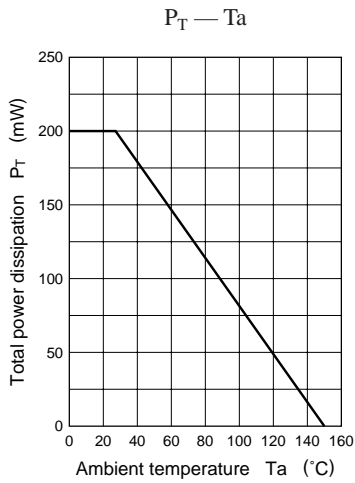
\* h<sub>FE</sub> rank classification (UN2215/2216/2217/2210)

| Rank            | Q          | R          | S          |
|-----------------|------------|------------|------------|
| h <sub>FE</sub> | 160 to 260 | 210 to 340 | 290 to 460 |

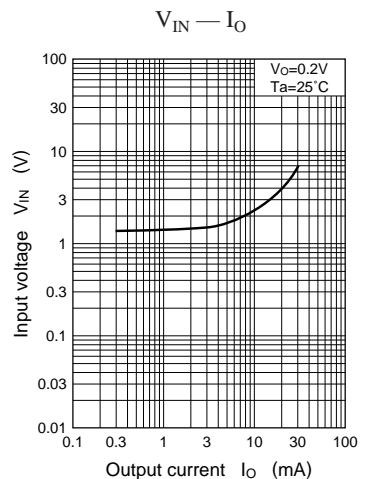
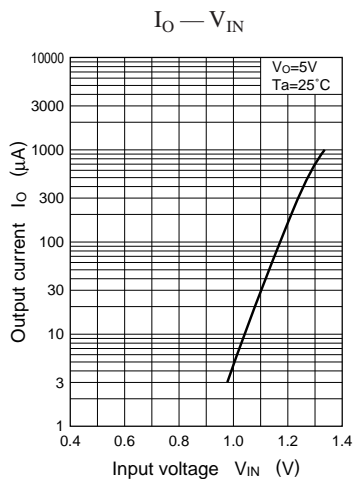
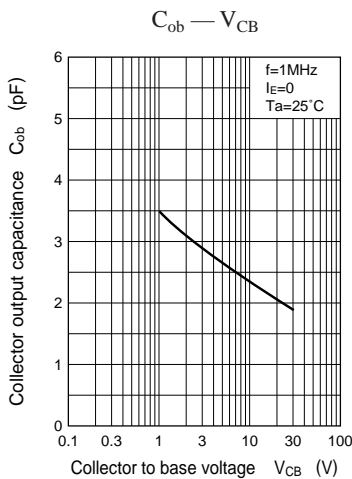
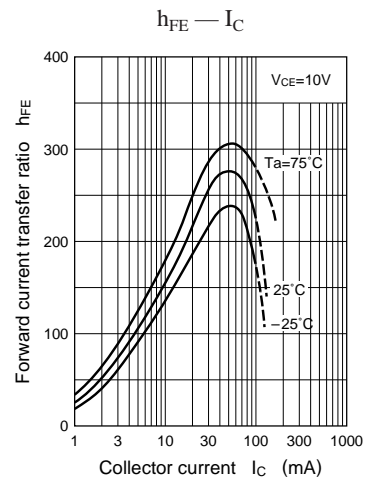
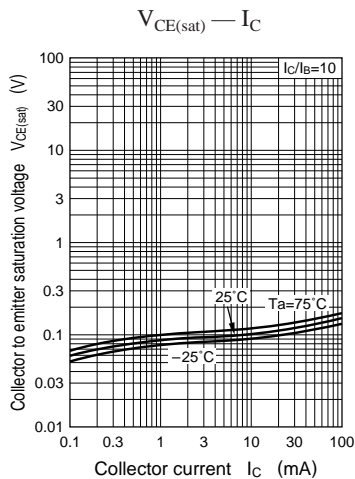
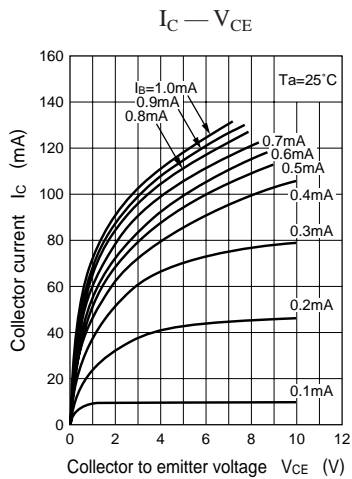
■ Electrical Characteristics (continued) (Ta=25°C)

| Parameter                |                       | Symbol                         | Conditions | min  | typ   | max  | Unit |
|--------------------------|-----------------------|--------------------------------|------------|------|-------|------|------|
| Resis-<br>tance<br>ratio | UN2211/2212/2213/221L | R <sub>1</sub> /R <sub>2</sub> |            | 0.8  | 1.0   | 1.2  |      |
|                          | UN2214                |                                |            | 0.17 | 0.21  | 0.25 |      |
|                          | UN2218/2219           |                                |            | 0.08 | 0.1   | 0.12 |      |
|                          | UN221D                |                                |            |      | 4.7   |      |      |
|                          | UN221E                |                                |            |      | 2.14  |      |      |
|                          | UN221F/221T           |                                |            |      | 0.47  |      |      |
|                          | UN221K                |                                |            |      | 2.13  |      |      |
|                          | UN221M                |                                |            |      | 0.047 |      |      |
|                          | UN211N                |                                |            |      | 0.1   |      |      |
|                          | UN211V                |                                |            |      | 1.0   |      |      |
|                          | UN211Z                |                                |            |      | 0.21  |      |      |

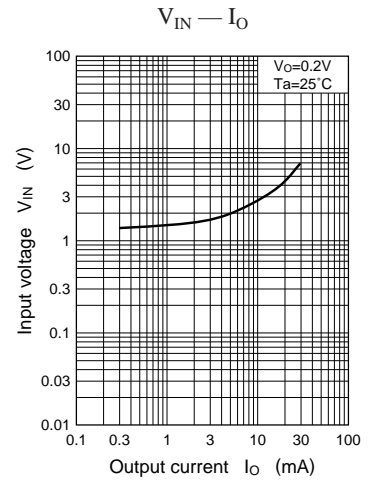
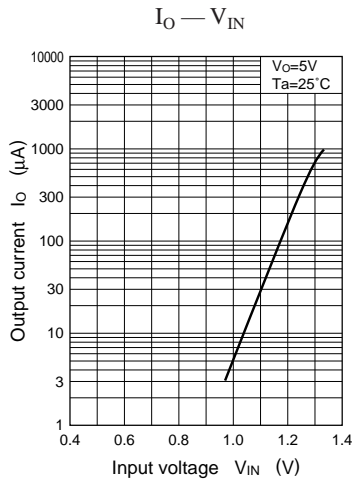
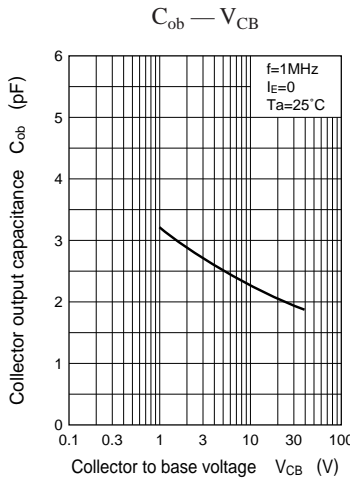
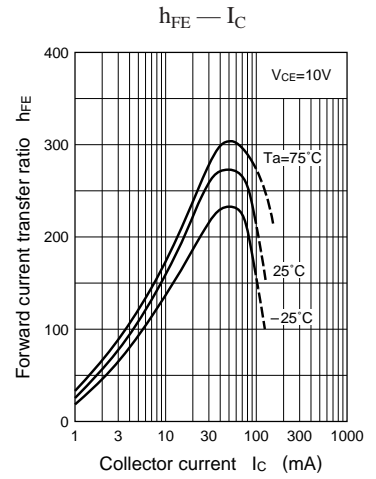
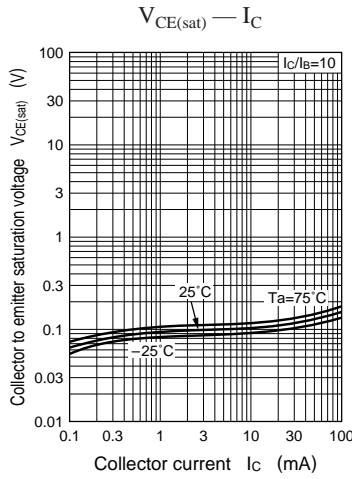
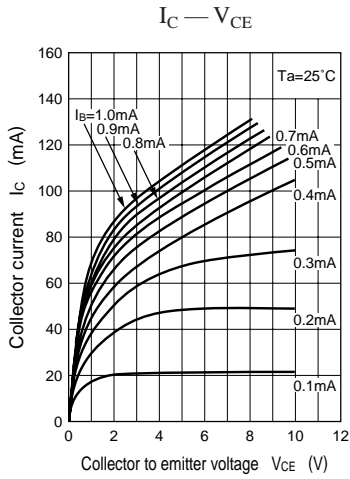
Common characteristics chart



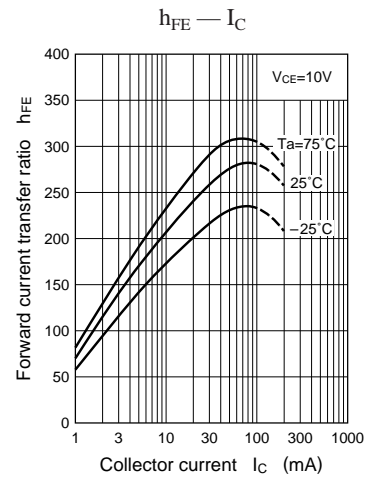
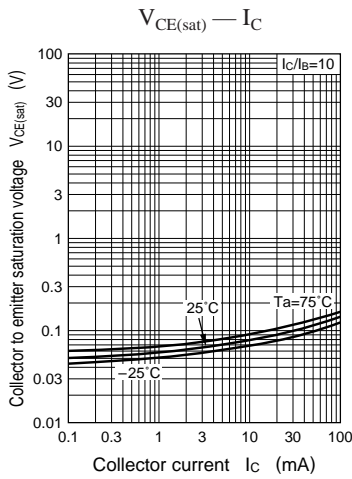
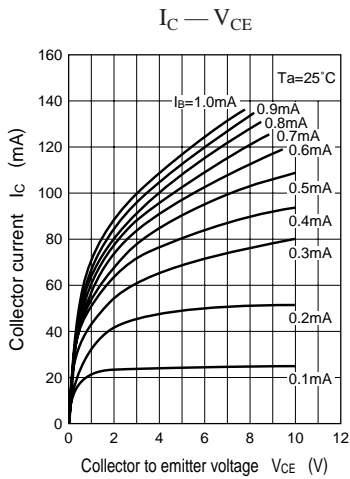
Characteristics charts of UN2211

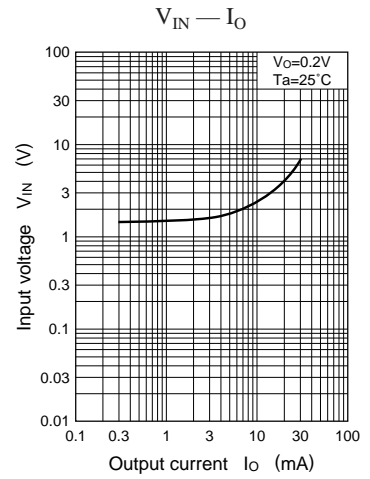
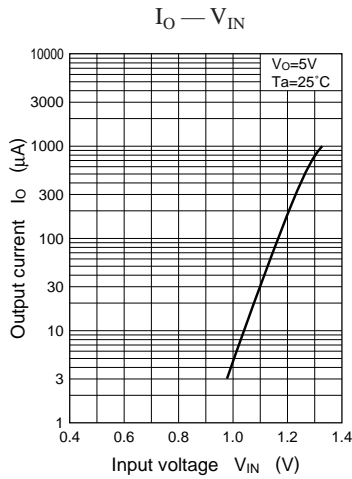
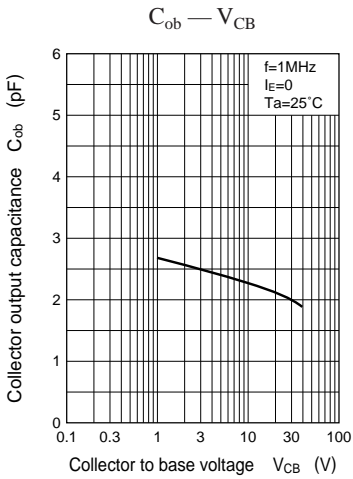


Characteristics charts of UN2212

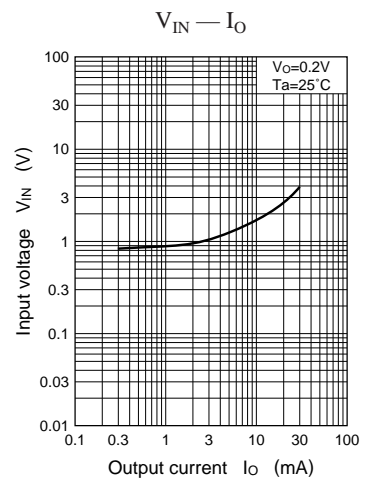
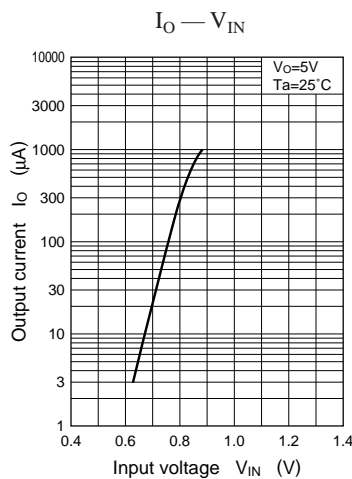
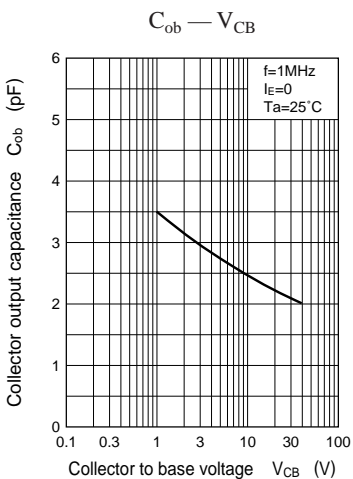
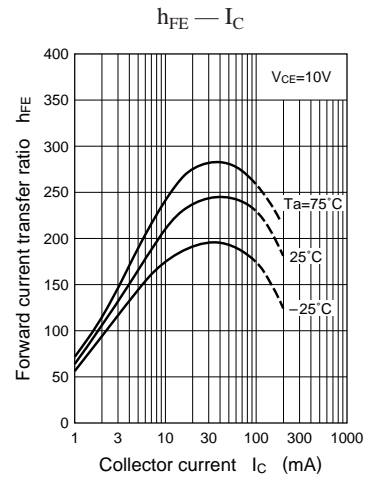
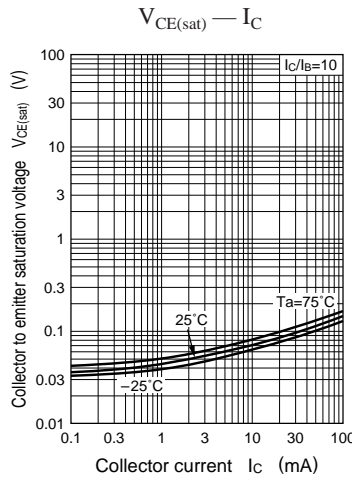
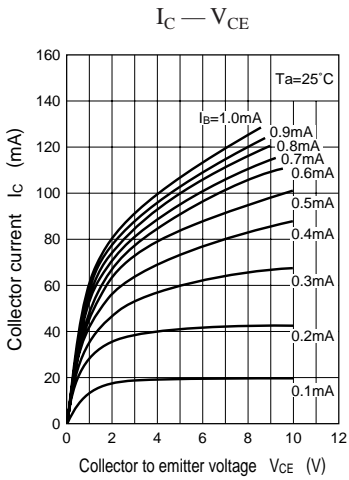


Characteristics charts of UN2213

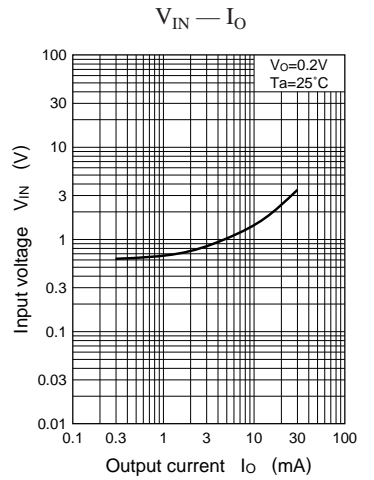
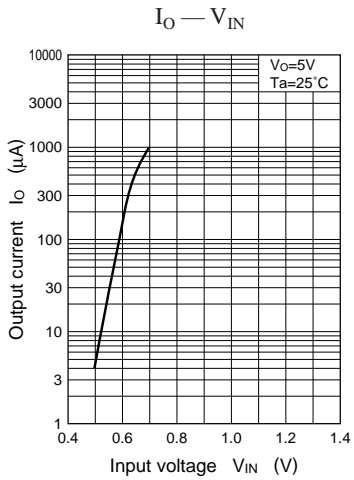
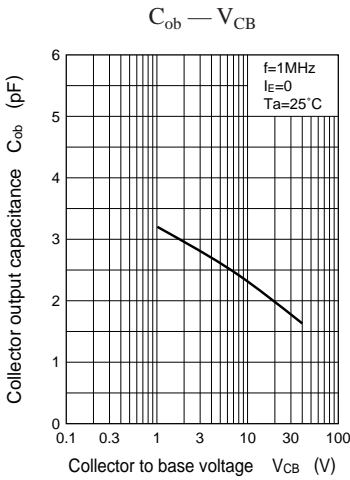
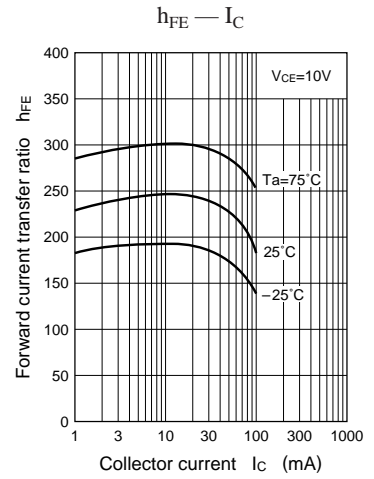
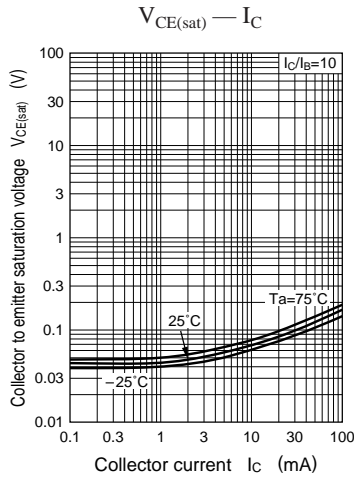
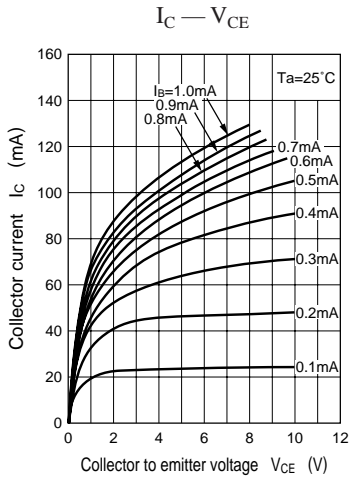




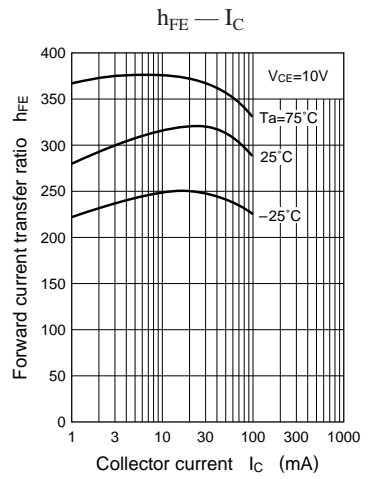
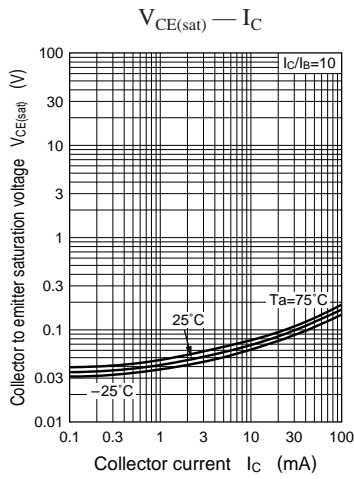
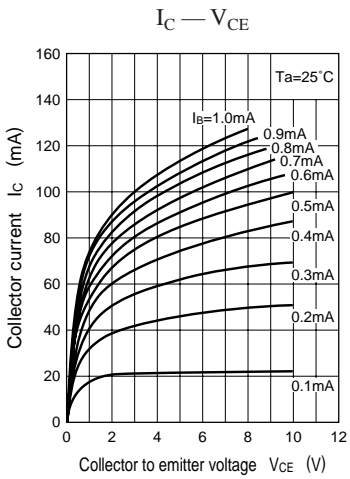
Characteristics charts of UN2214

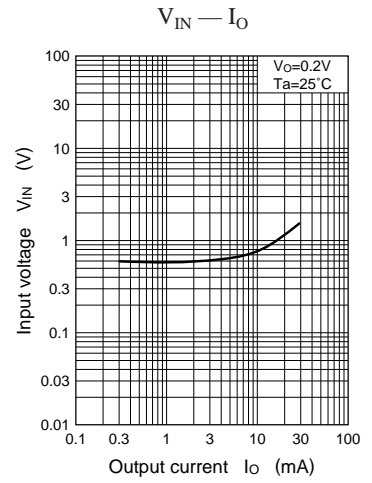
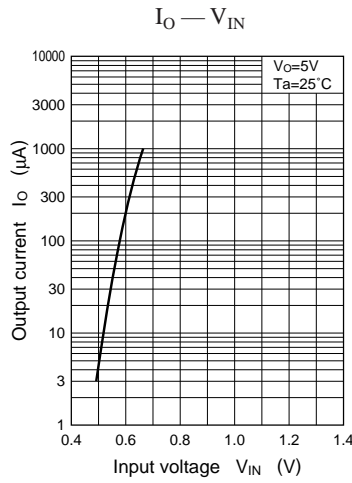
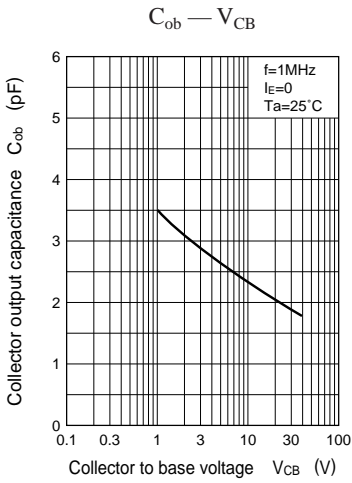


Characteristics charts of UN2215

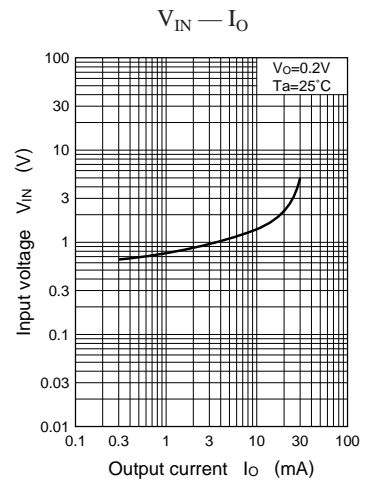
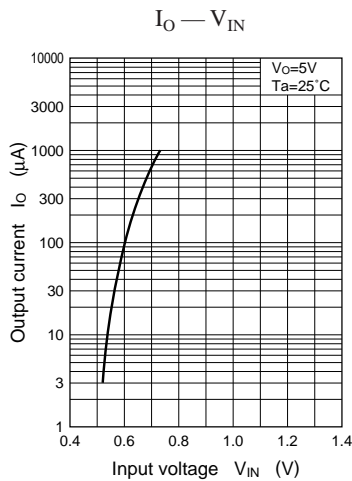
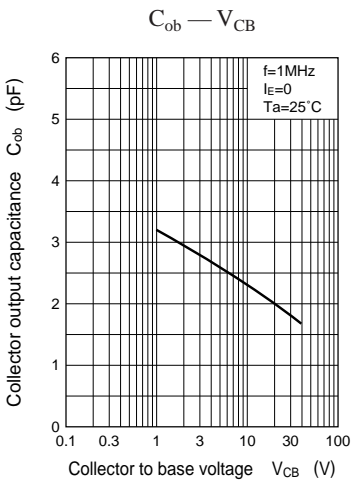
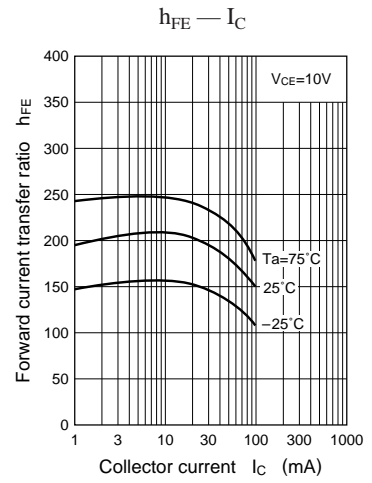
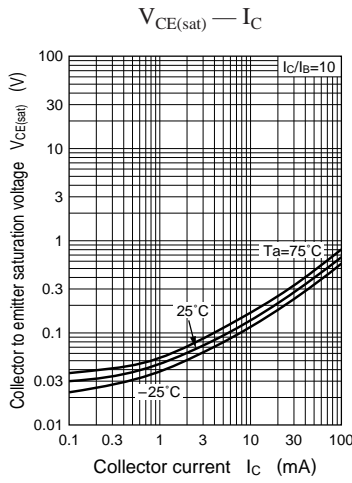
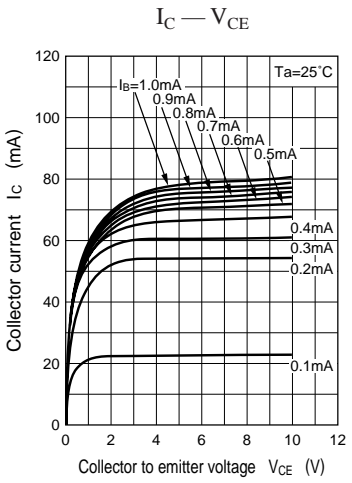


Characteristics charts of UN2216



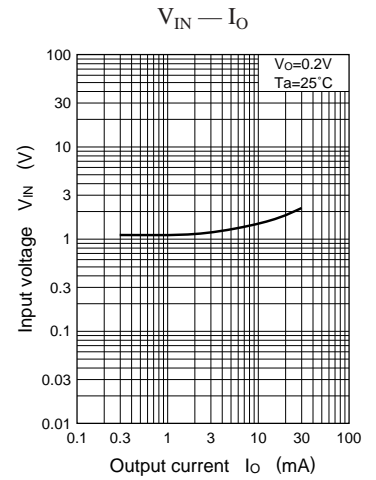
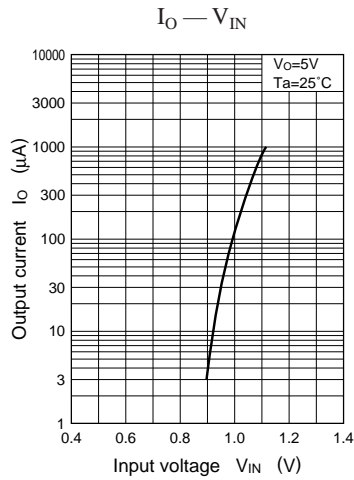
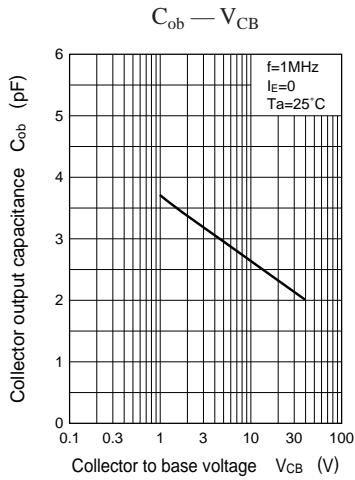
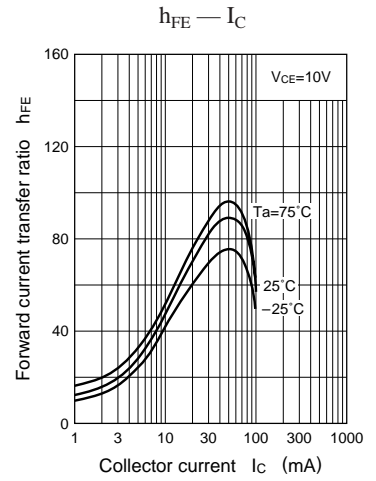
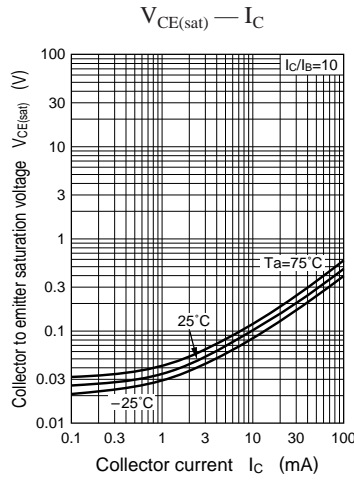
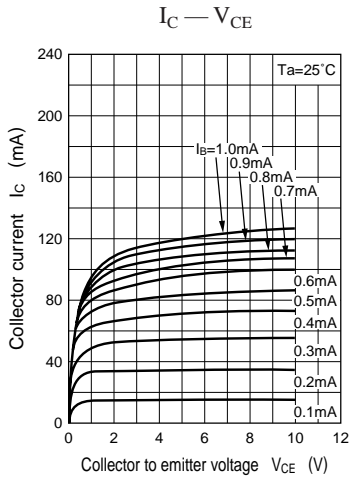


Characteristics charts of UN2217

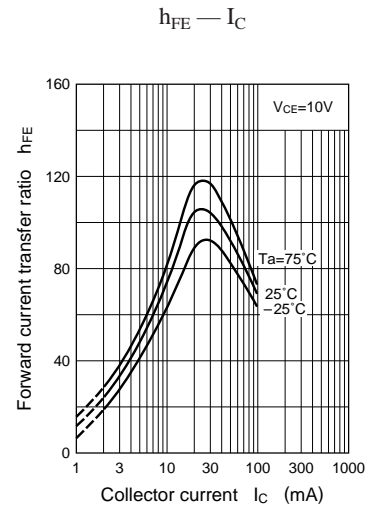
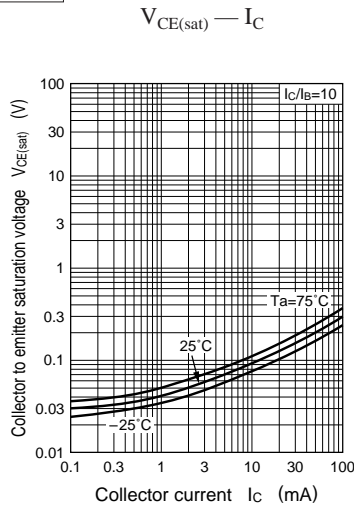
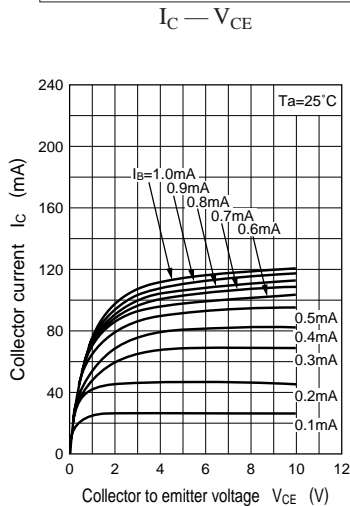


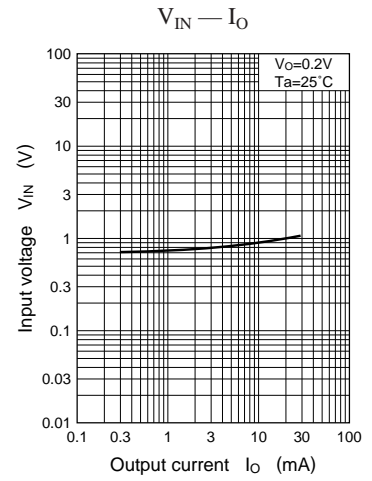
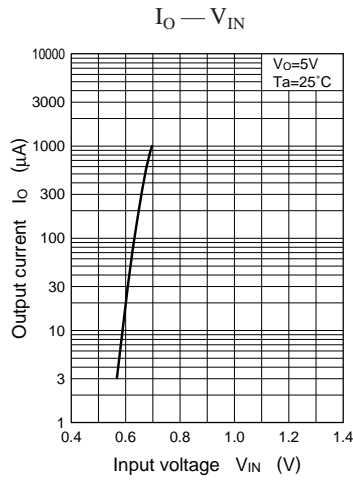
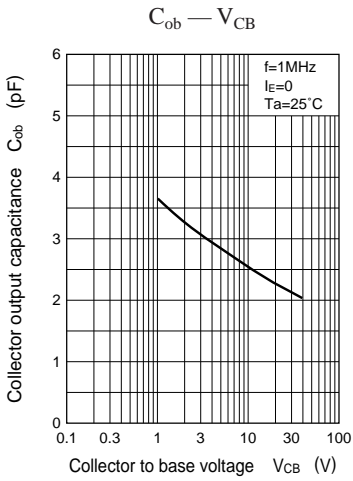


Characteristics charts of UN2218

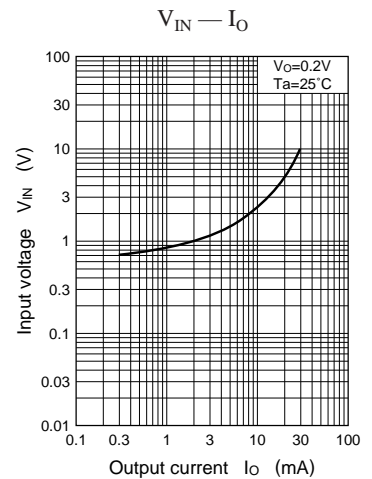
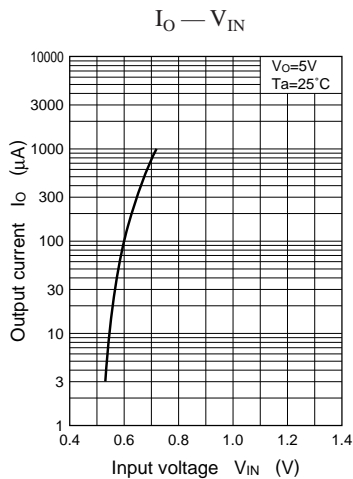
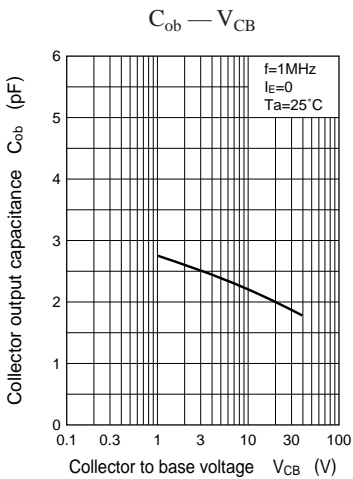
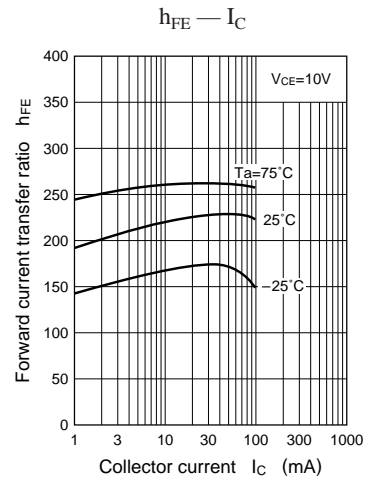
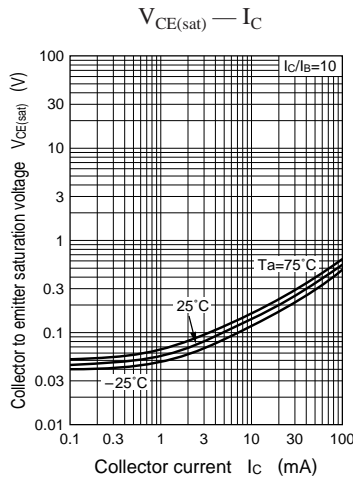
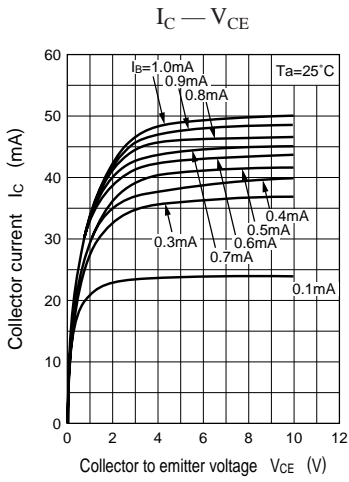


Characteristics charts of UN2219

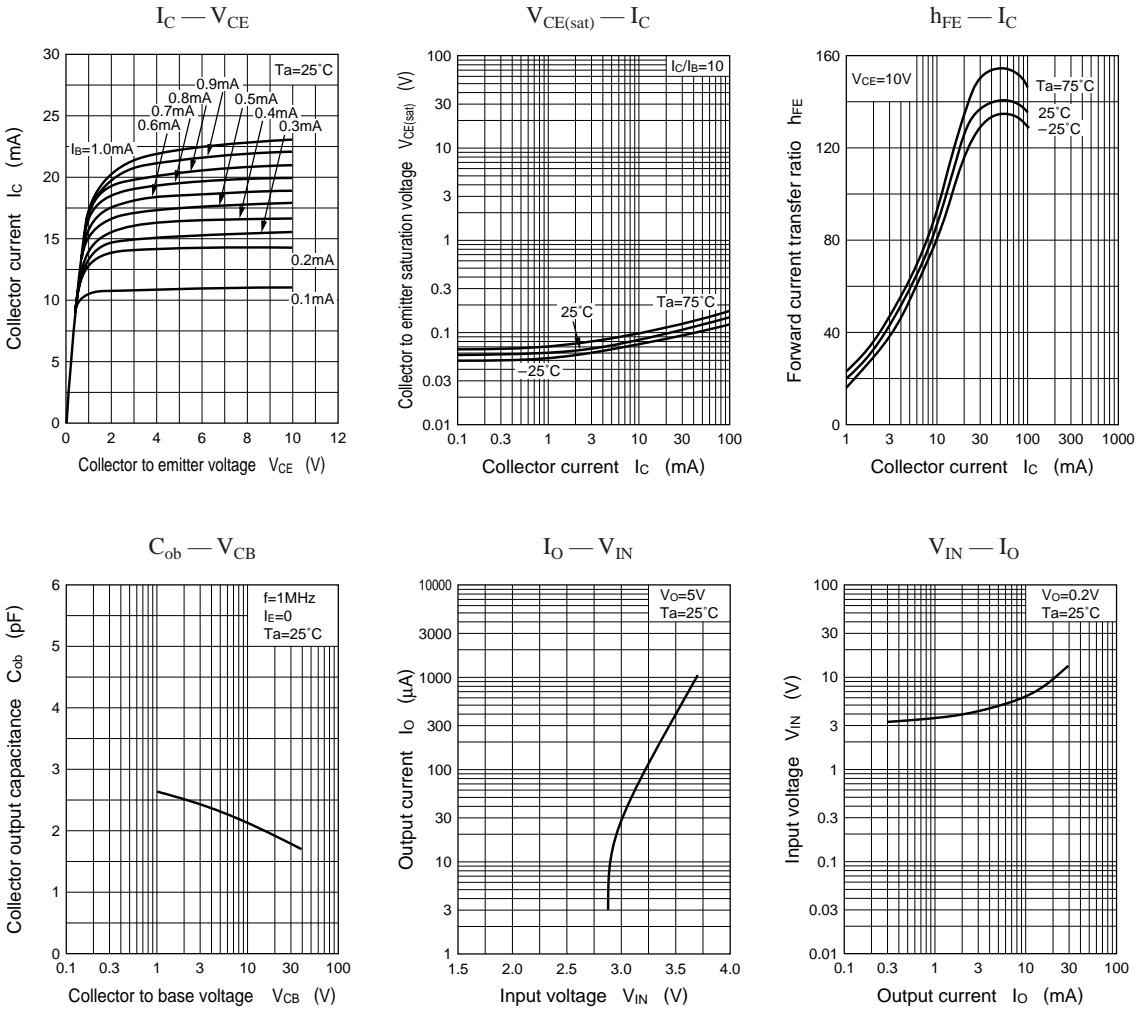




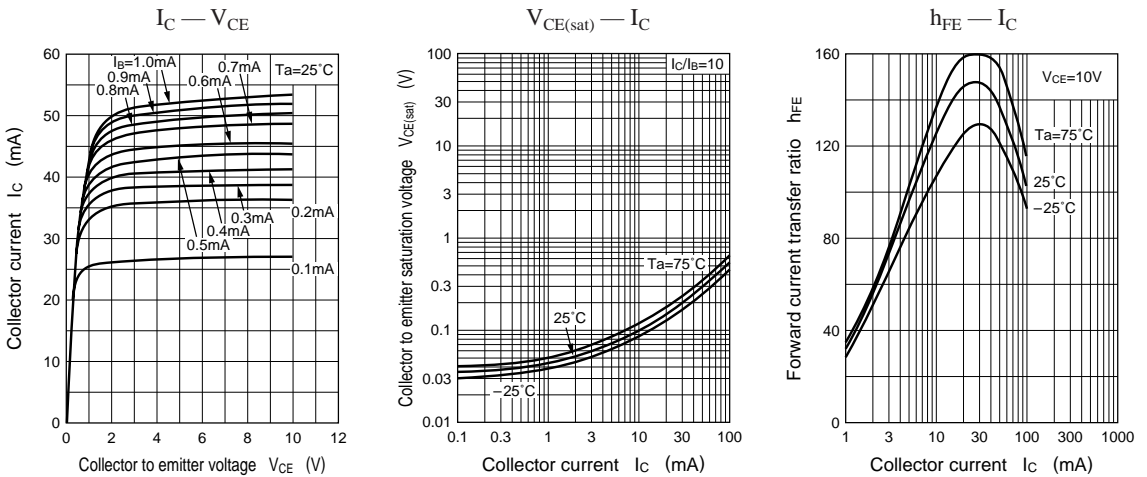
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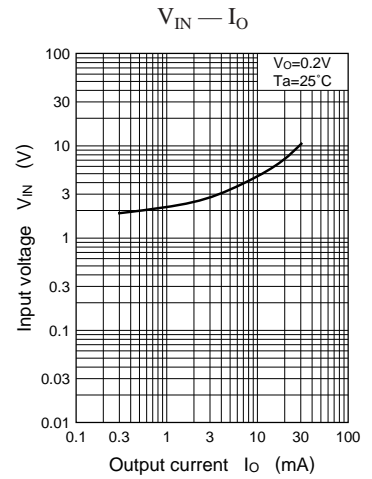
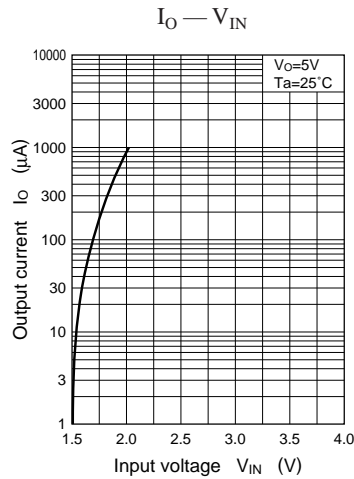
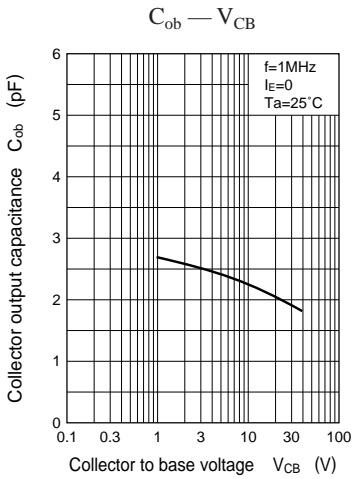


Characteristics charts of UN221D

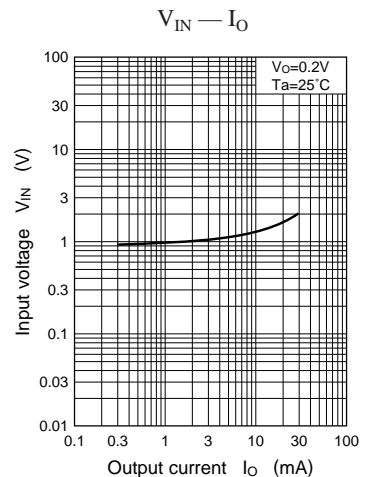
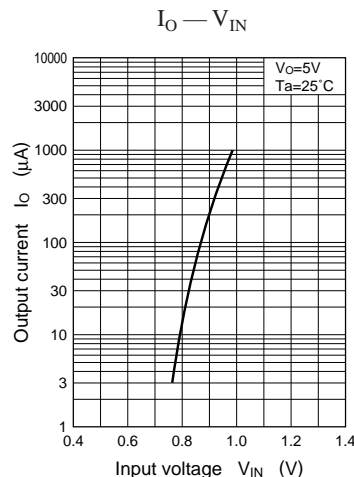
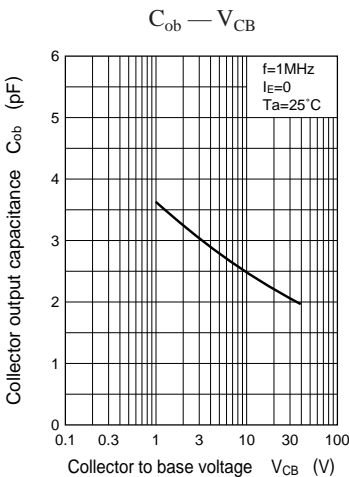
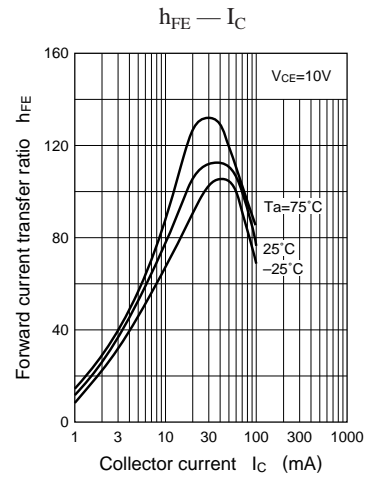
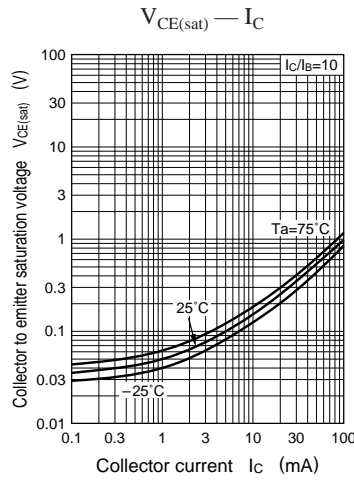
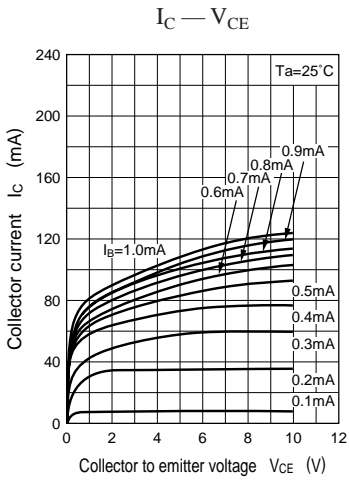


Characteristics charts of UN221E

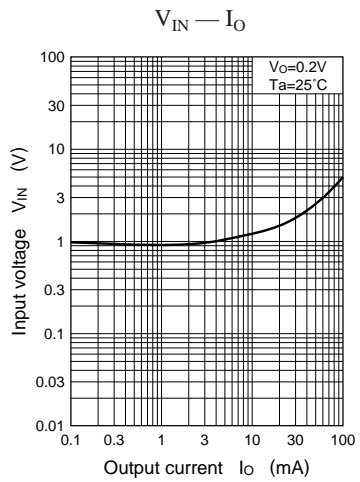
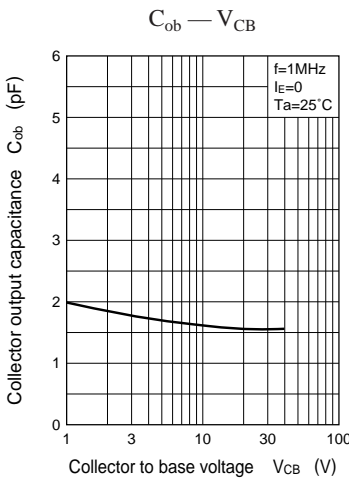
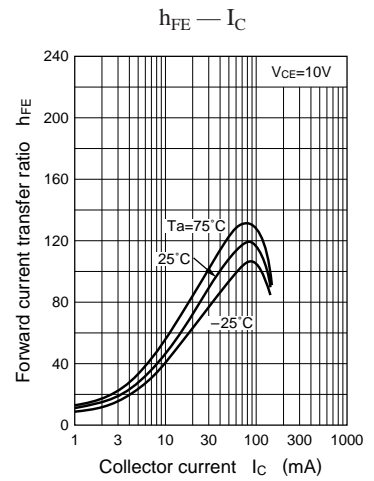
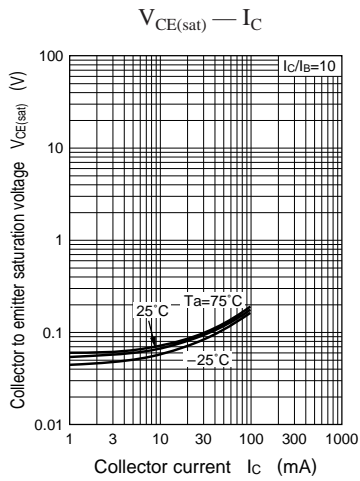
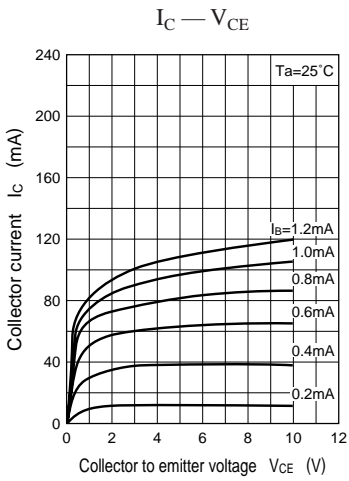




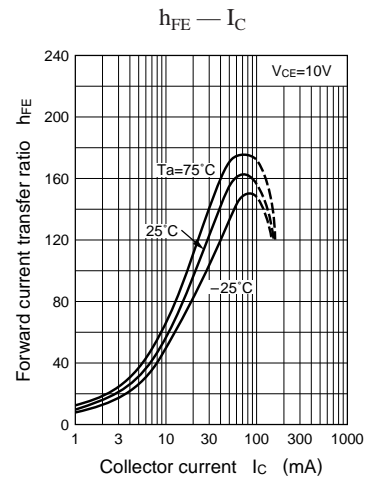
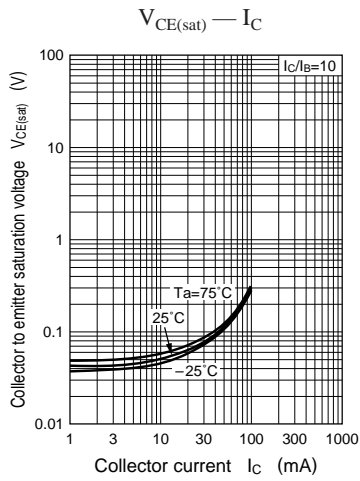
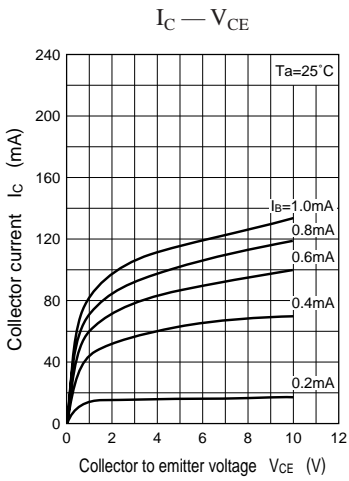
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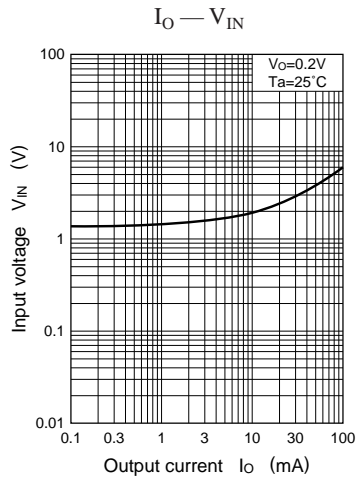
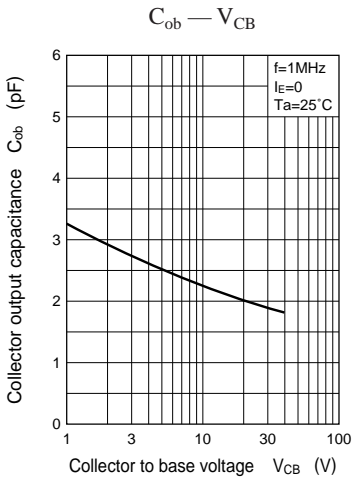


Characteristics charts of UN221K

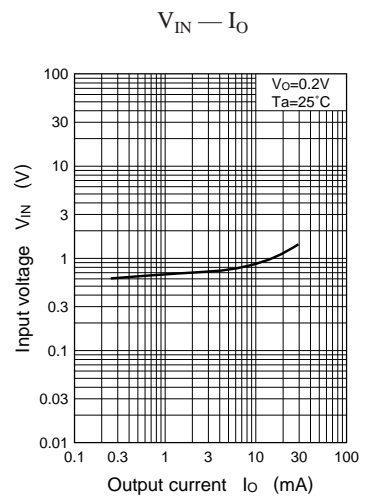
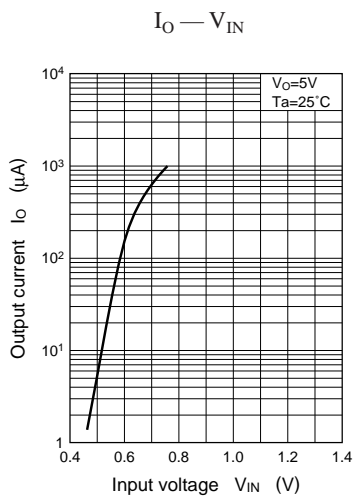
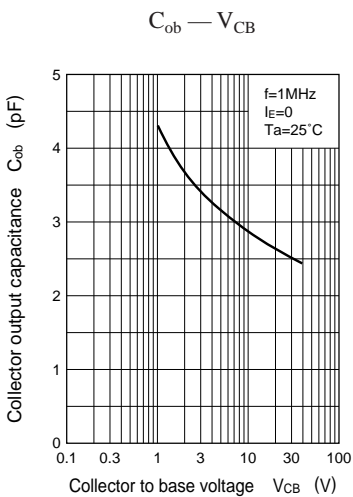
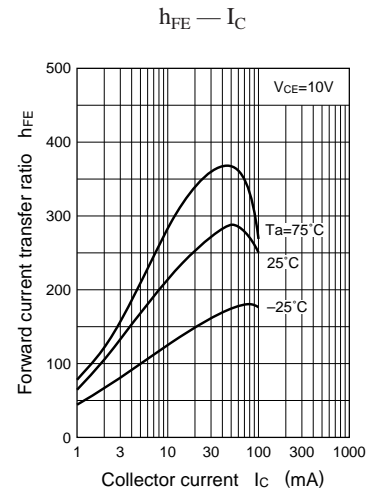
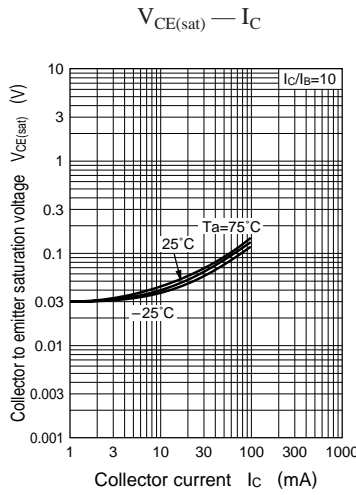
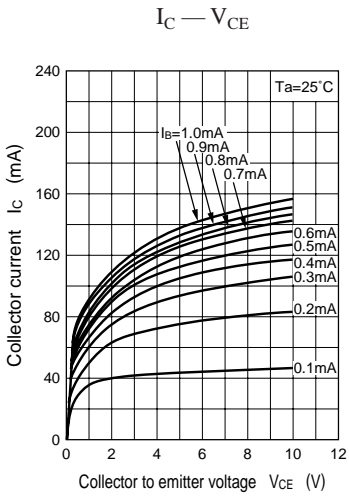


Characteristics charts of UN221L

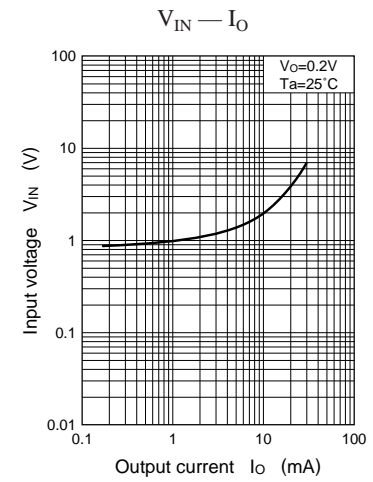
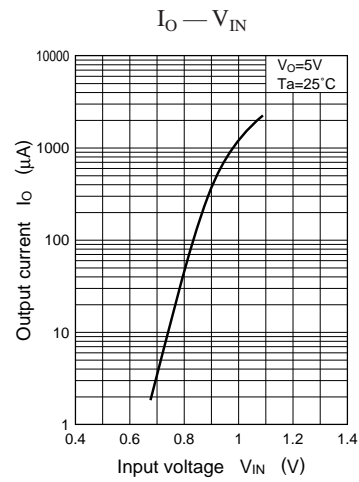
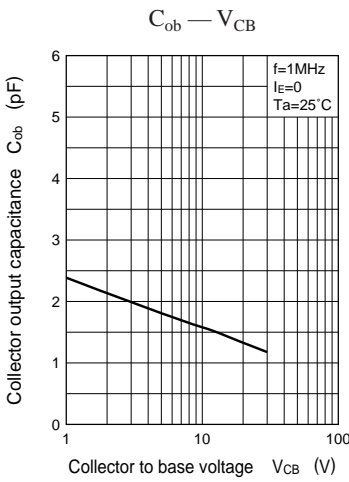
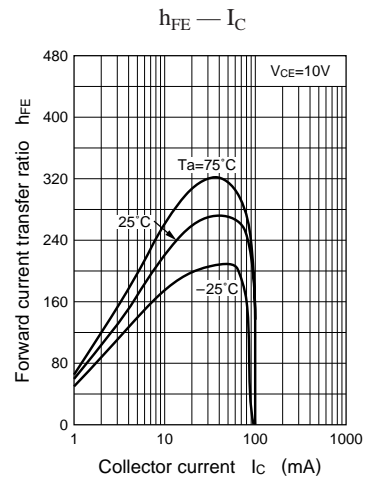
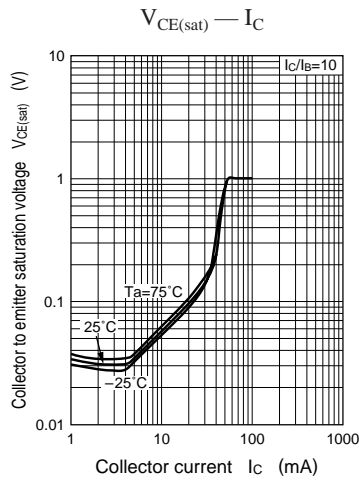
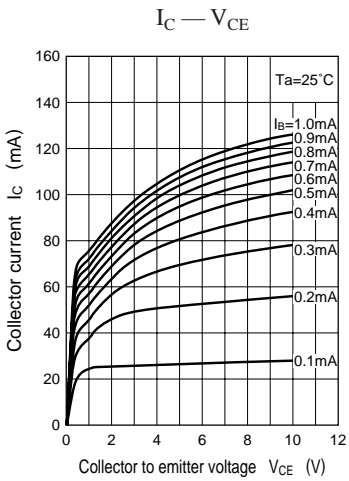




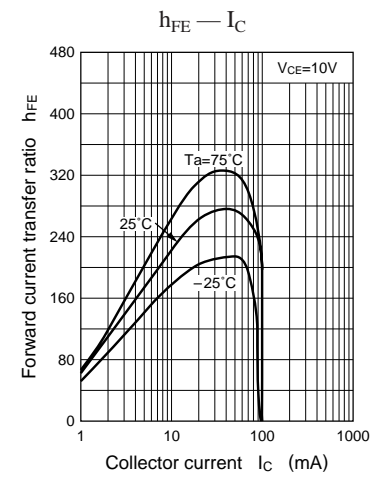
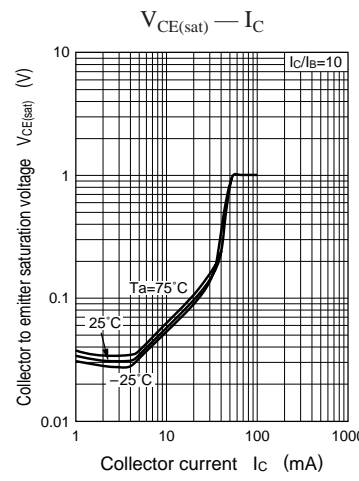
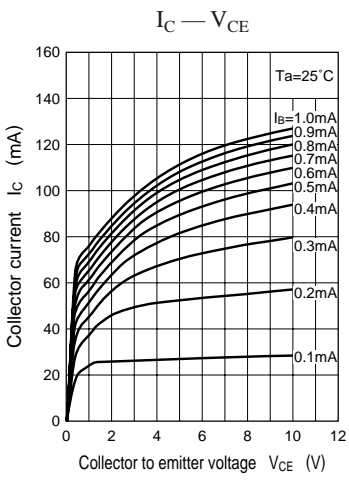
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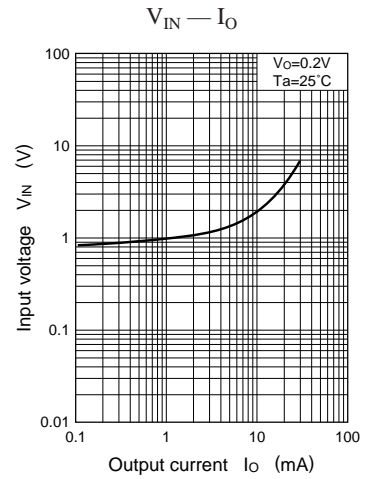
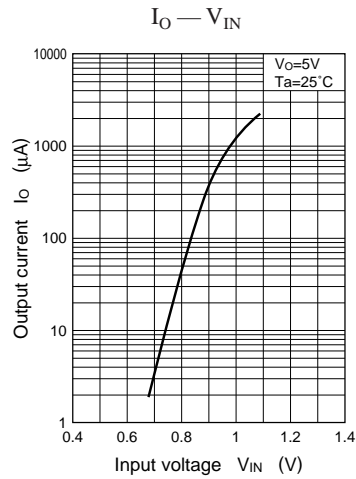
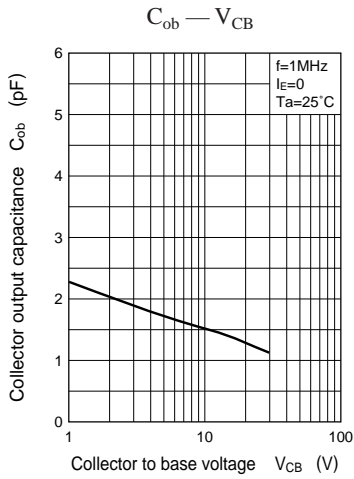


Characteristics charts of UN221N

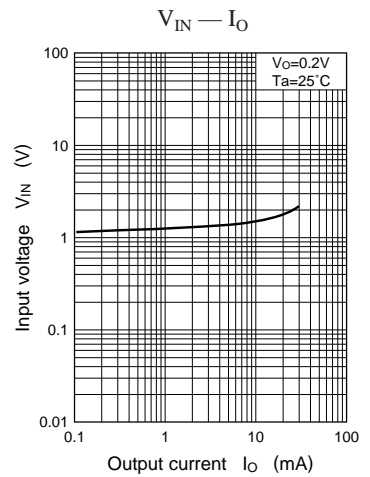
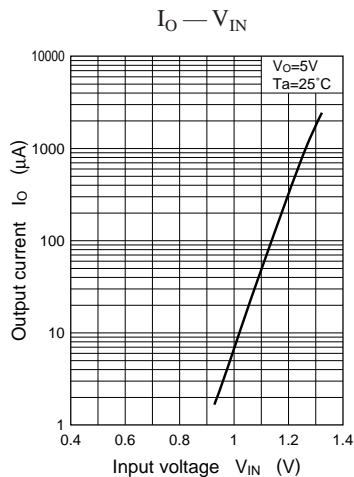
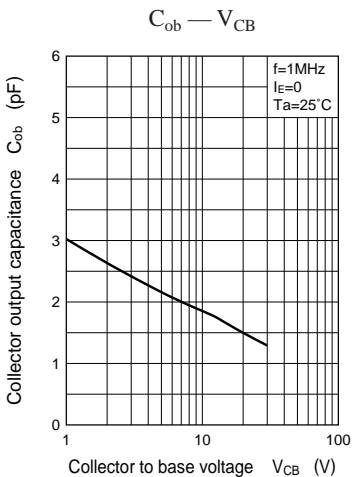
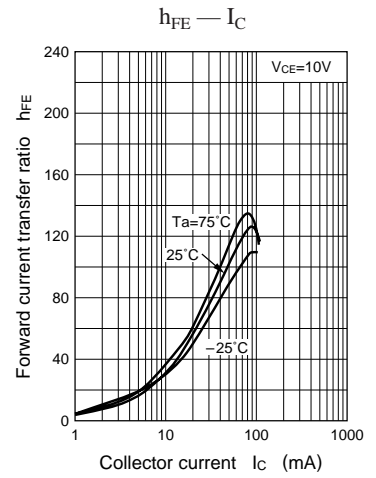
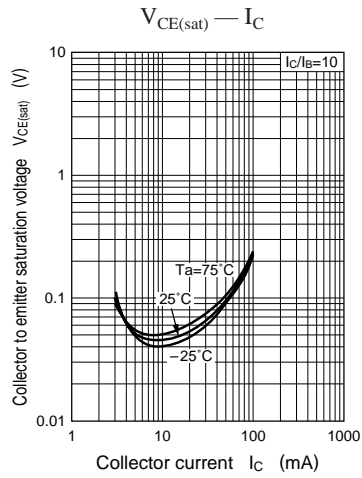
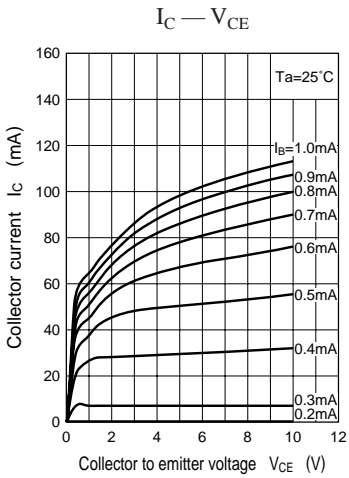


Characteristics charts of UN221T





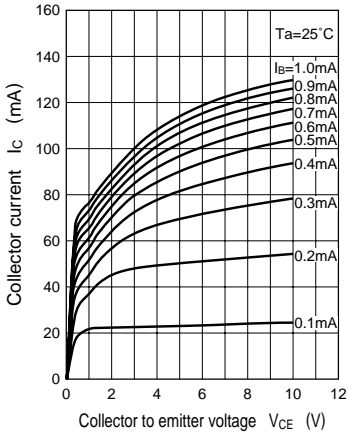
Characteristics charts of UN221V



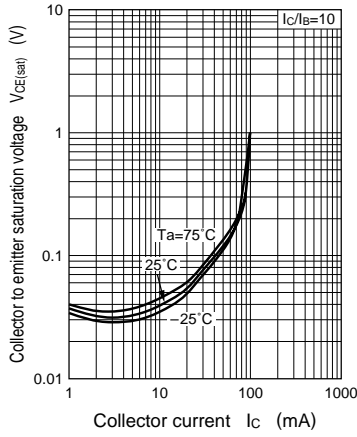


Characteristics charts of UN221Z

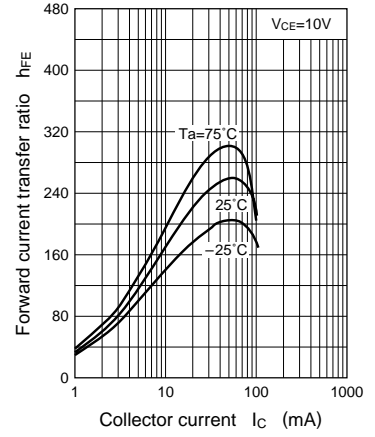
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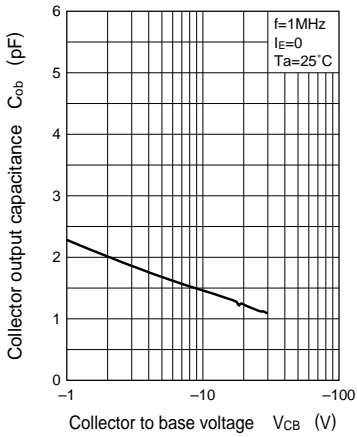
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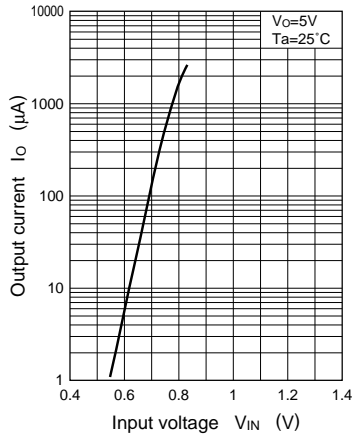
$h_{FE} - I_C$



$C_{ob} - V_{CB}$



$I_O - V_{IN}$



$V_{IN} - I_O$

