

# UNR221x Series (UN221x Series)

## Silicon NPN epitaxial planar type

For digital circuits

### ■ Features

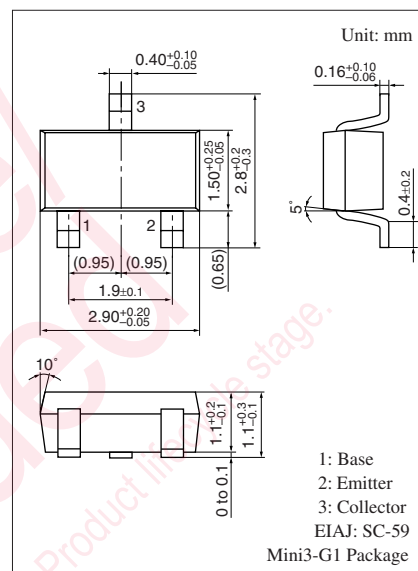
- Costs can be reduced through downsizing of the equipment and reduction of the number of parts.
- Mini type package allowing easy automatic insertion through tape packing and magazine packing

### ■ Resistance by Part Number

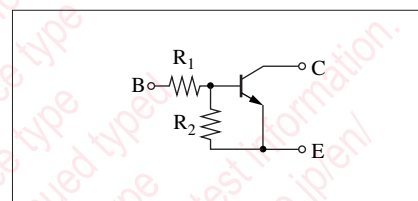
|                    |    | Marking Symbol (R <sub>1</sub> ) | (R <sub>2</sub> ) |
|--------------------|----|----------------------------------|-------------------|
| • UNR2210 (UN2210) | 8L | 47 kΩ                            | —                 |
| • UNR2211 (UN2211) | 8A | 10 kΩ                            | 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 <sub>CBO</sub>     | I <sub>C</sub> = 10 μA, I <sub>E</sub> = 0                           | 50   |      |      | V    |
| Collector-emitter voltage (Base open)              |                                           | V <sub>CEO</sub>     | I <sub>C</sub> = 2 mA, I <sub>B</sub> = 0                            | 50   |      |      | V    |
| Collector-base cutoff current (Emitter open)       |                                           | I <sub>CBO</sub>     | V <sub>CB</sub> = 50 V, I <sub>E</sub> = 0                           |      |      | 0.1  | μA   |
| Collector-emitter cutoff current (Base open)       |                                           | I <sub>CEO</sub>     | V <sub>CE</sub> = 50 V, I <sub>B</sub> = 0                           |      |      | 0.5  | μA   |
| Emitter-base<br>cutoff current<br>(Collector open) | UNR2210/2215/2216/2217                    | I <sub>EBO</sub>     | V <sub>EB</sub> = −6 V, I <sub>C</sub> = 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<br>transfer ratio                  | UNR221V                                   | h <sub>FE</sub>      | V <sub>CE</sub> = 10 V, I <sub>C</sub> = 5 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 <sub>CE(sat)</sub> | I <sub>C</sub> = 10 mA, I <sub>B</sub> = 0.3 mA                      |      |      | 0.25 | V    |
| UNR221V                                            |                                           |                      | I <sub>C</sub> = 10 mA, I <sub>B</sub> = 1.5 mA                      |      |      |      |      |
| Output voltage high-level                          |                                           | V <sub>OH</sub>      | V <sub>CC</sub> = 5 V, V <sub>B</sub> = 0.5 V, R <sub>L</sub> = 1 kΩ | 4.9  |      |      | V    |
| Output voltage low-level                           |                                           | V <sub>OL</sub>      | V <sub>CC</sub> = 5 V, V <sub>B</sub> = 2.5 V, R <sub>L</sub> = 1 kΩ |      |      | 0.2  | V    |
| UNR2213/221K                                       |                                           |                      | V <sub>CC</sub> = 5 V, V <sub>B</sub> = 3.5 V, R <sub>L</sub> = 1 kΩ |      |      |      |      |
| UNR221D                                            |                                           |                      | V <sub>CC</sub> = 5 V, V <sub>B</sub> = 10 V, R <sub>L</sub> = 1 kΩ  |      |      |      |      |
| UNR221E                                            |                                           |                      | V <sub>CC</sub> = 5 V, V <sub>B</sub> = 6 V, R <sub>L</sub> = 1 kΩ   |      |      |      |      |
| Transition frequency                               |                                           | f <sub>T</sub>       | V <sub>CB</sub> = 10 V, I <sub>E</sub> = −2 mA, f = 200 MHz          |      | 150  |      | MHz  |
| Input resistance                                   | UNR2218                                   | R <sub>I</sub>       |                                                                      | −30% | 0.51 | +30% | kΩ   |
|                                                    | UNR2219                                   |                      |                                                                      |      | 1.0  |      |      |
|                                                    | UNR221M/211V                              |                      |                                                                      |      | 2.2  |      |      |
|                                                    | UNR2216/221F/221L/<br>221N/221Z           |                      |                                                                      |      | 4.7  |      |      |
|                                                    | UNR2211/2214/2215/221K                    |                      |                                                                      |      | 10   |      |      |
|                                                    | UNR2212/2217/221T                         |                      |                                                                      |      | 22   |      |      |
|                                                    | UNR2210/2213/221D/221E                    |                      |                                                                      |      | 47   |      |      |

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

2. \*: Rank classification

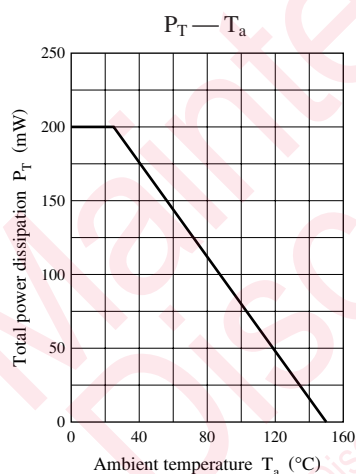
| Rank            | Q          | R          | S          | No-rank    |
|-----------------|------------|------------|------------|------------|
| $h_{\text{FE}}$ | 160 to 260 | 210 to 340 | 290 to 460 | 160 to 460 |

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

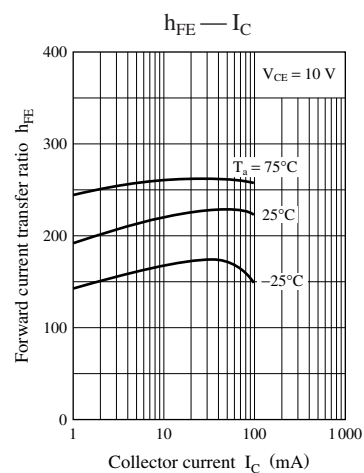
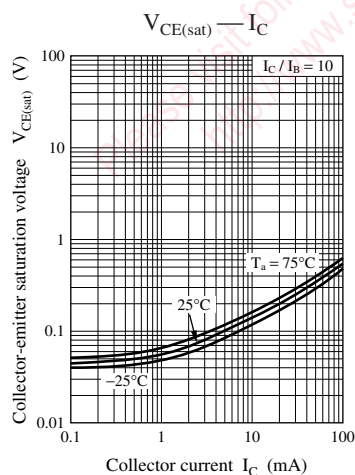
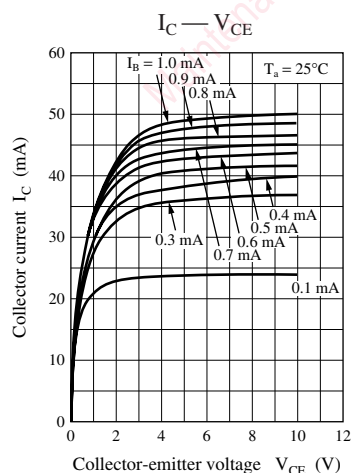
| Parameter        | Symbol                 | Conditions | Min  | Typ   | Max  | Unit |
|------------------|------------------------|------------|------|-------|------|------|
| Resistance ratio | UNR221M                | $R_1/R_2$  |      | 0.047 |      | —    |
|                  | UNR221N                |            |      | 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  |      |

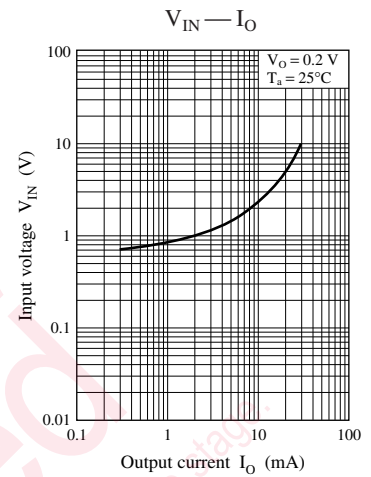
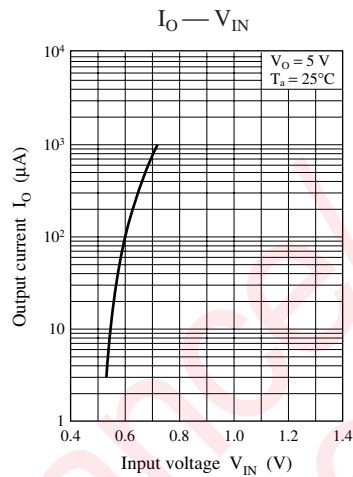
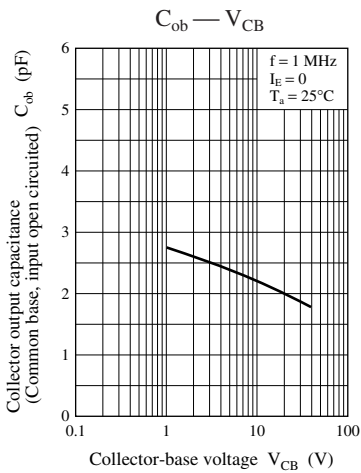
Note) Measuring methods are based on JAPANESE INDUSTRIAL STANDARD JIS C 7030 measuring methods for transistors.

Common characteristics chart

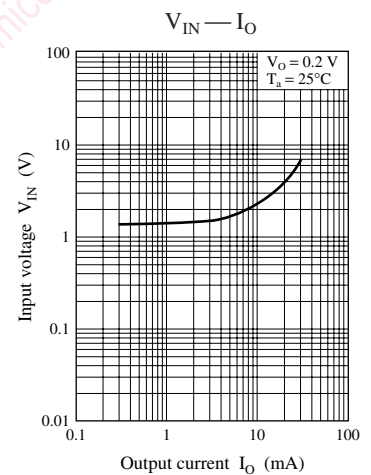
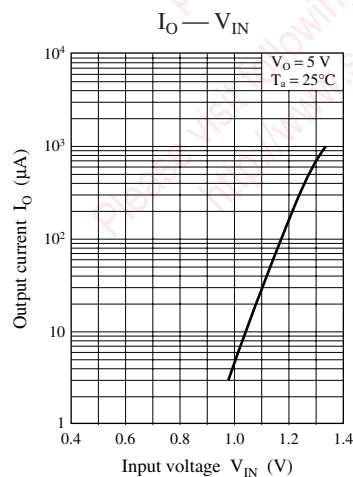
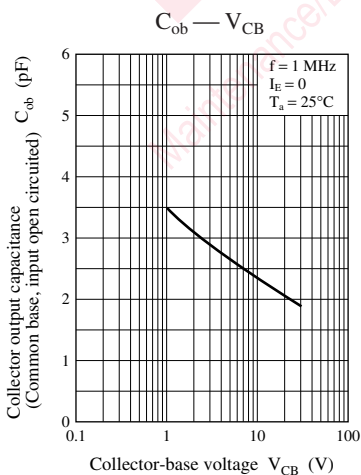
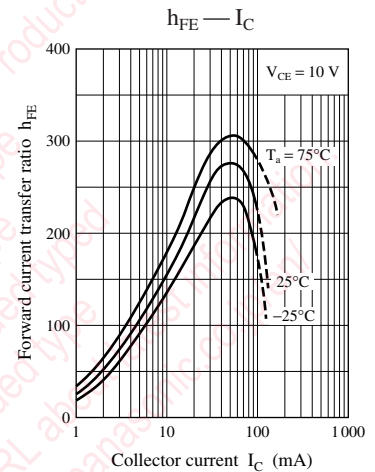
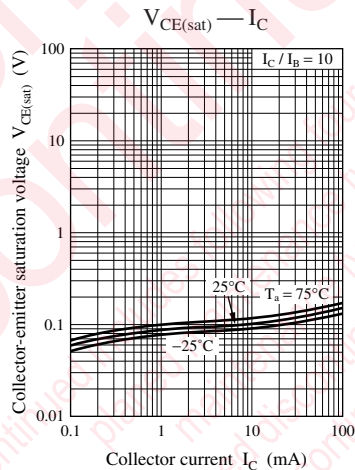
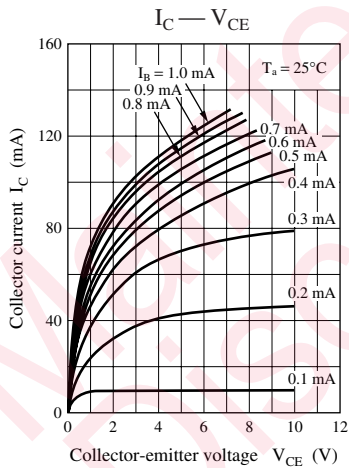


Characteristics charts of UNR2210

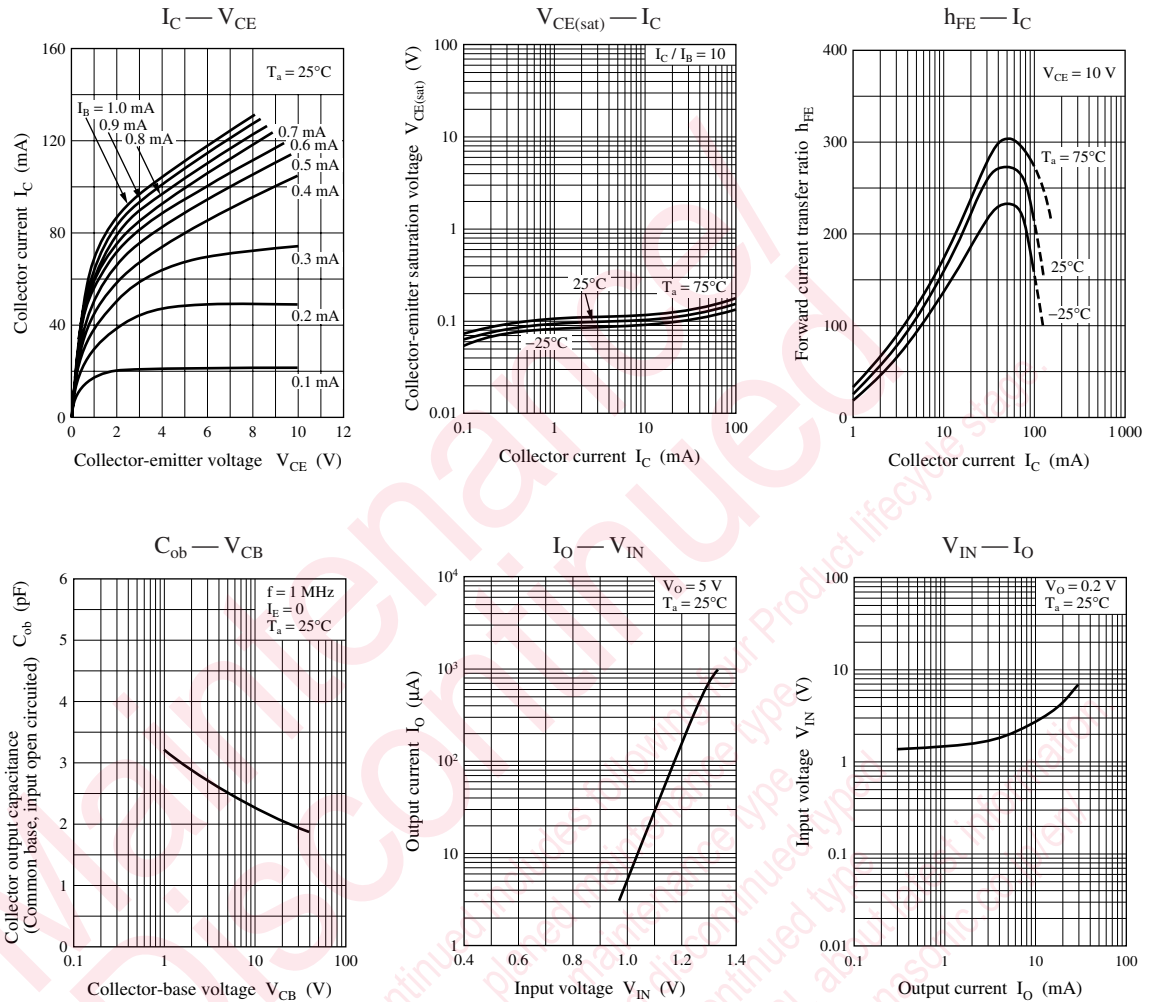




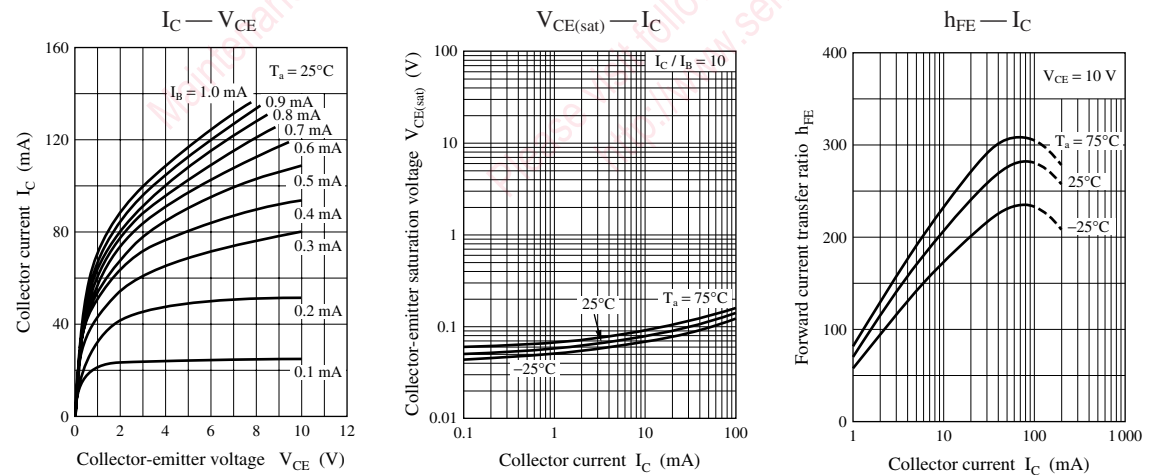
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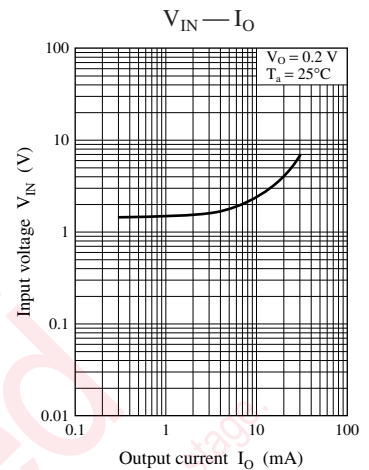
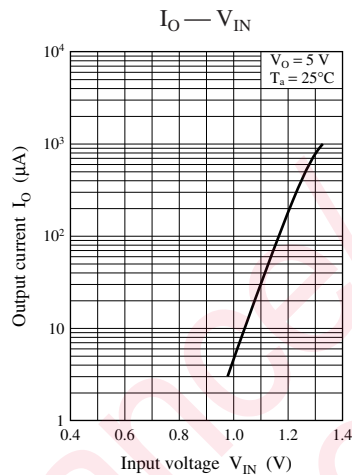
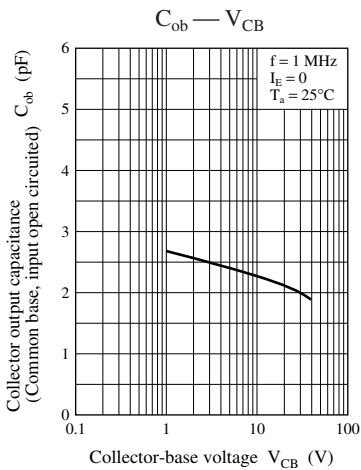


Characteristics charts of UNR2212

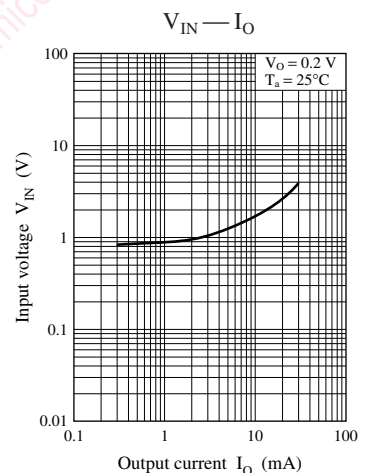
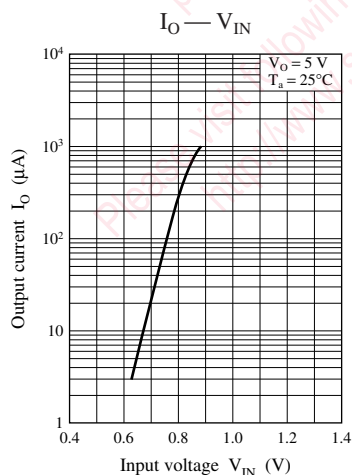
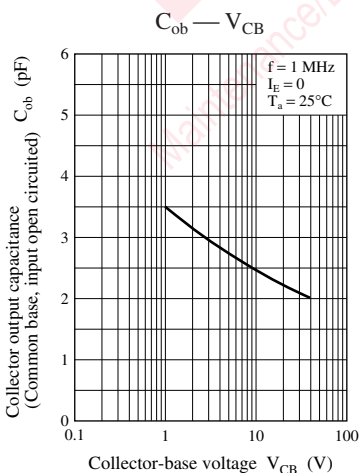
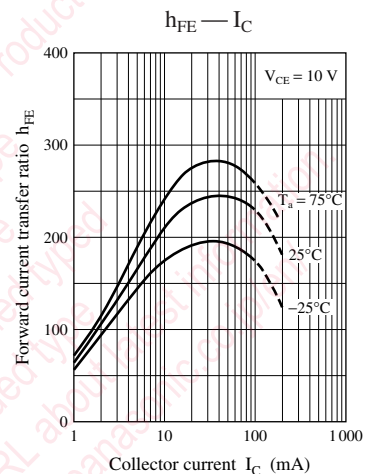
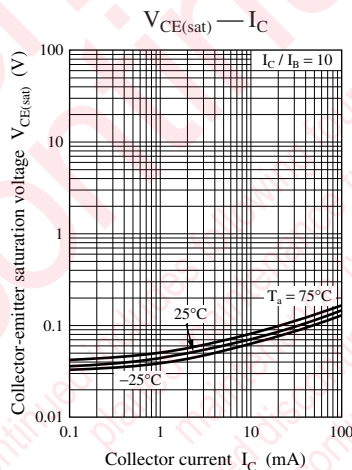
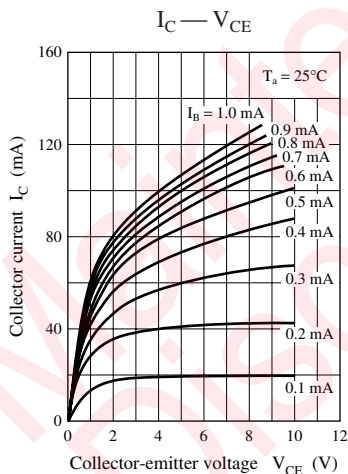


Characteristics charts of UNR2213

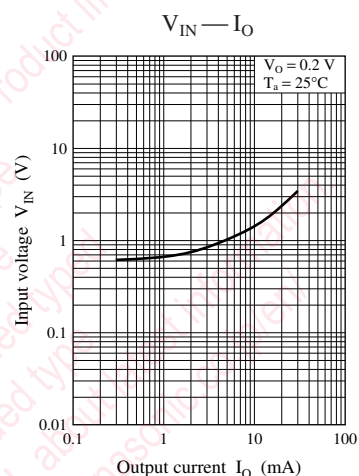
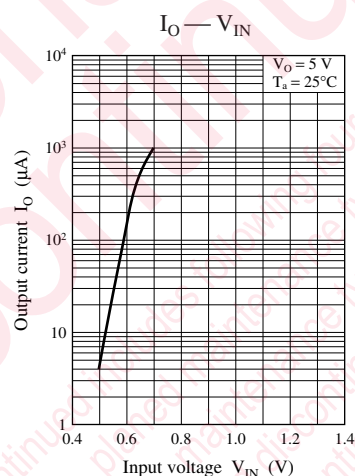
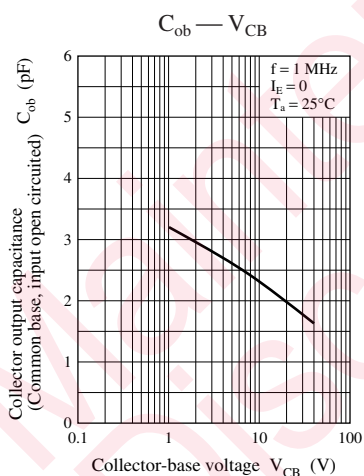
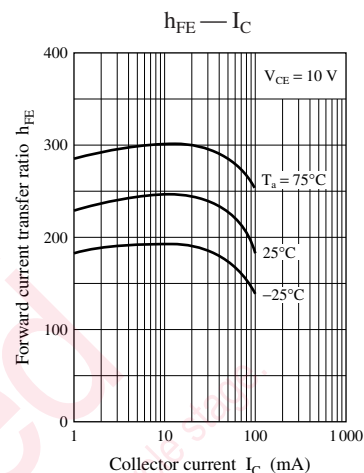
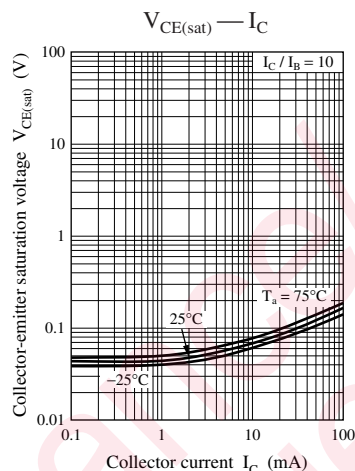
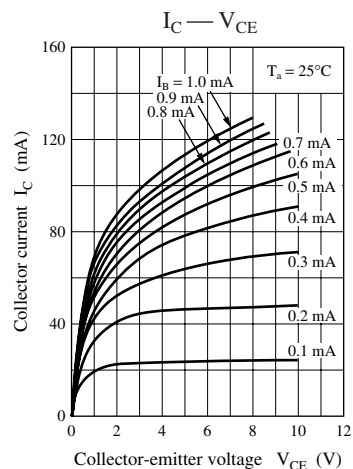




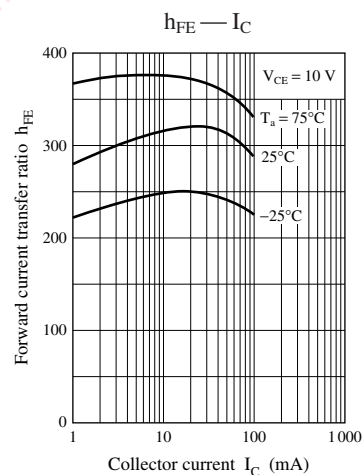
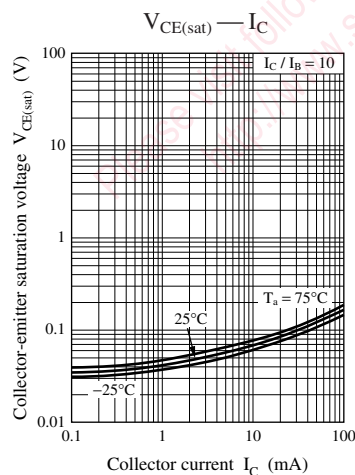
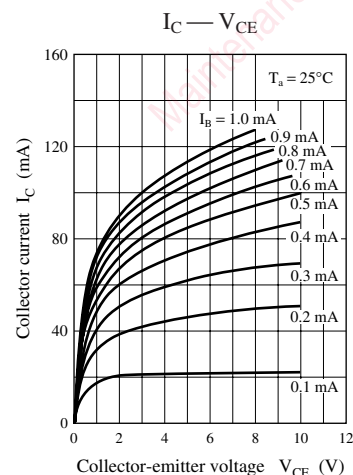
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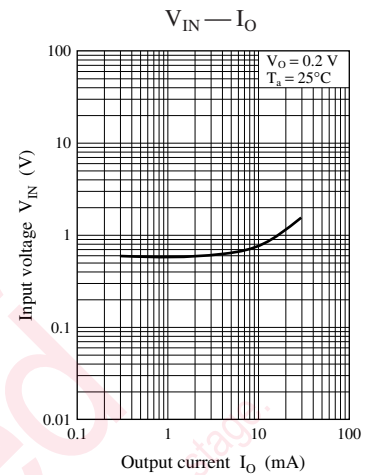
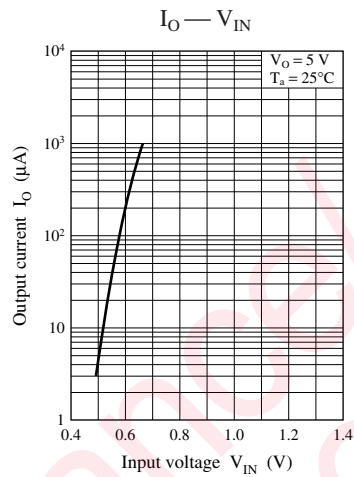
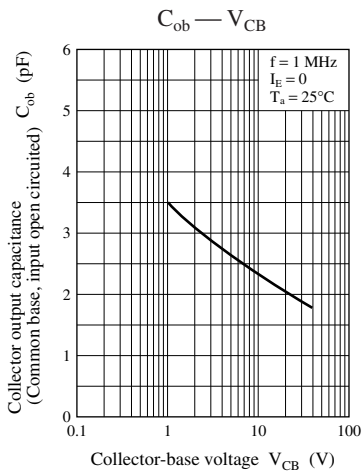


Characteristics charts of UNR2215

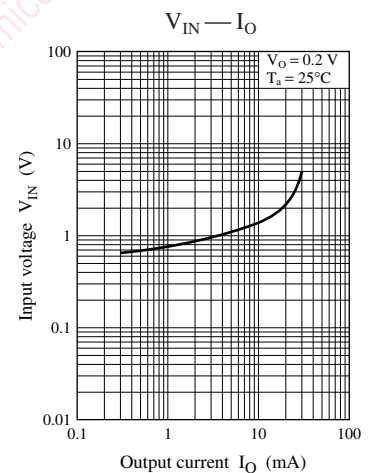
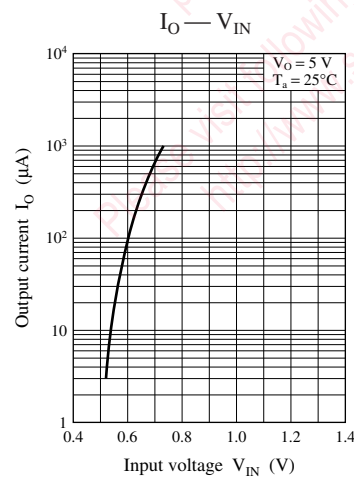
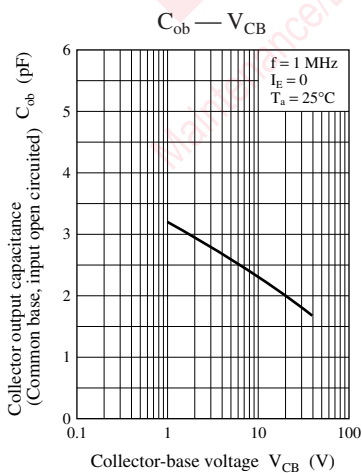
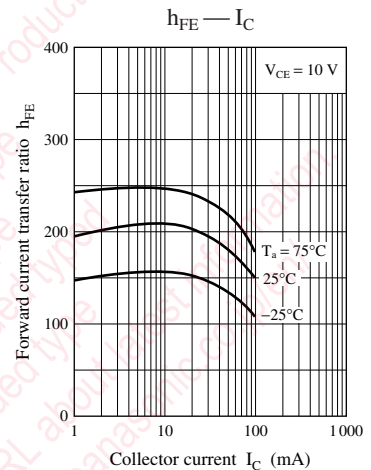
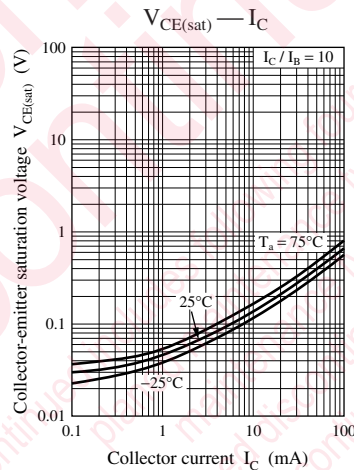
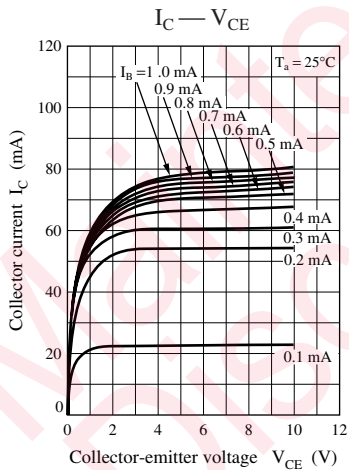


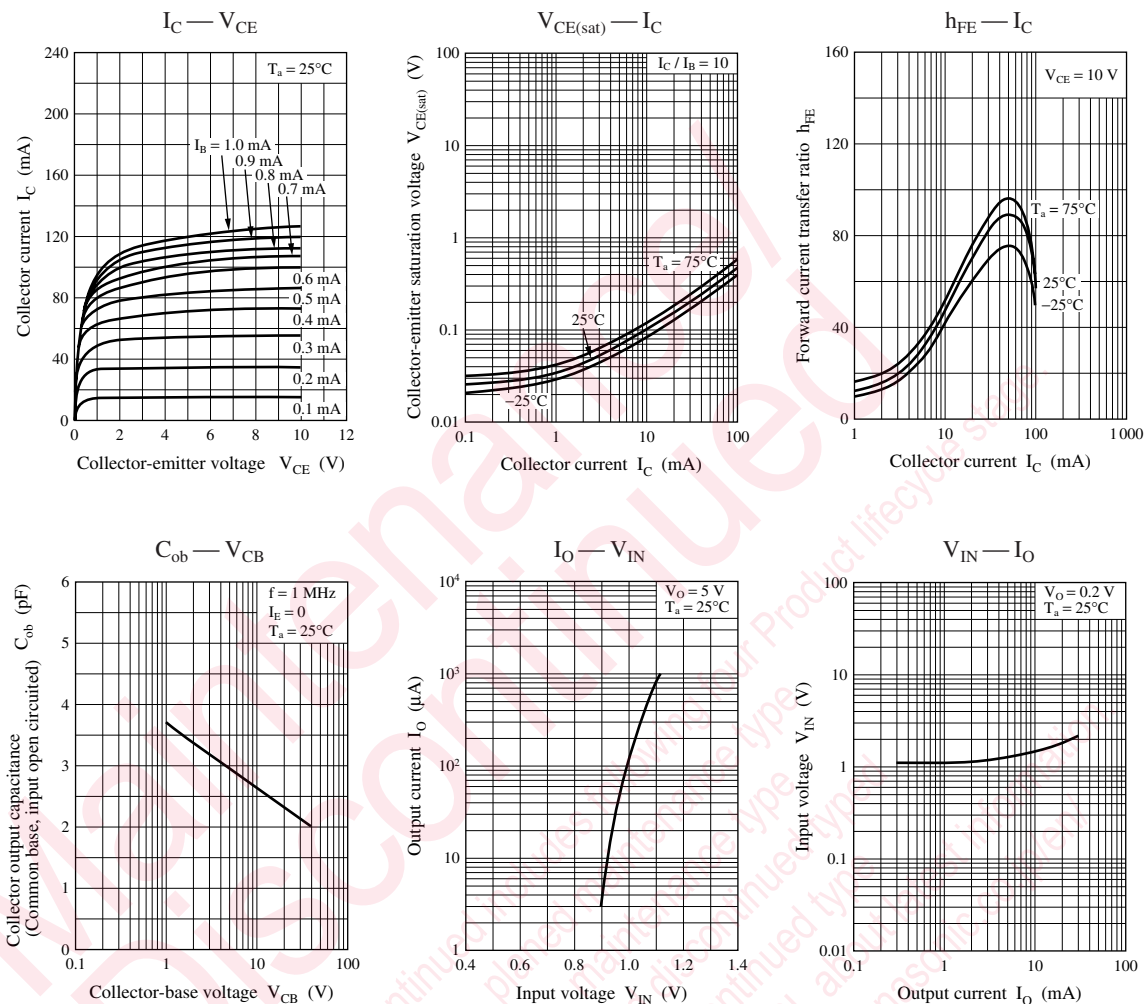
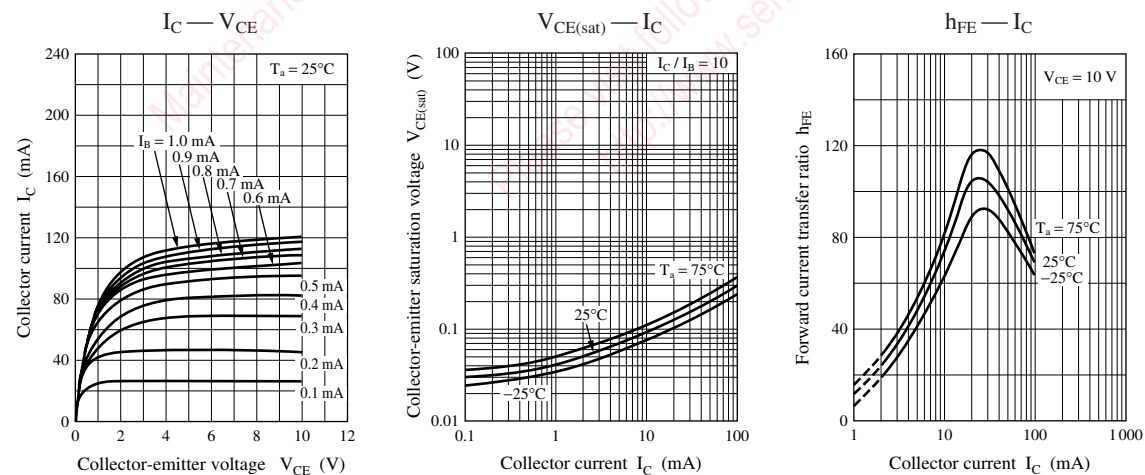
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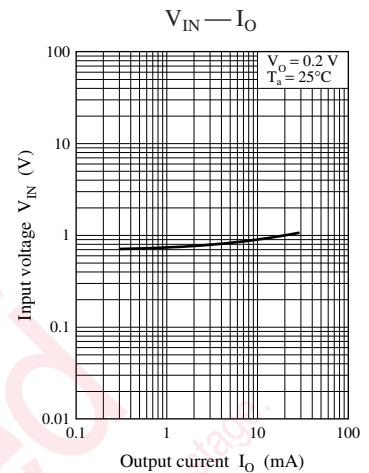
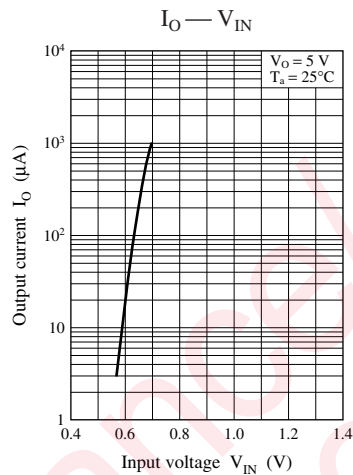
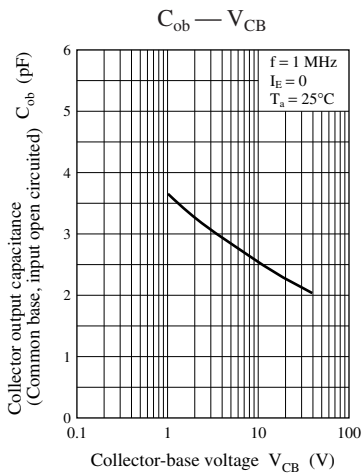




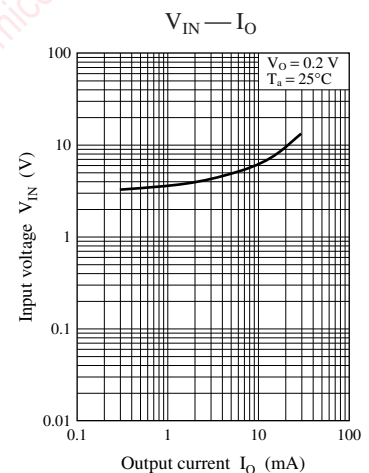
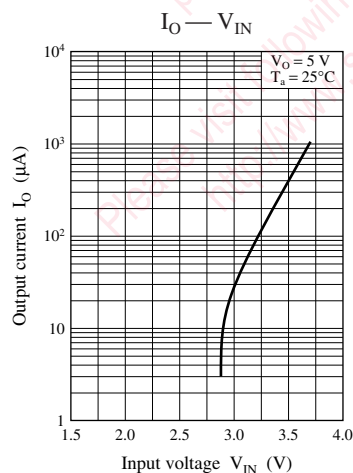
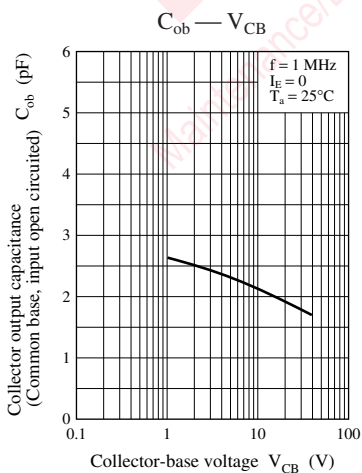
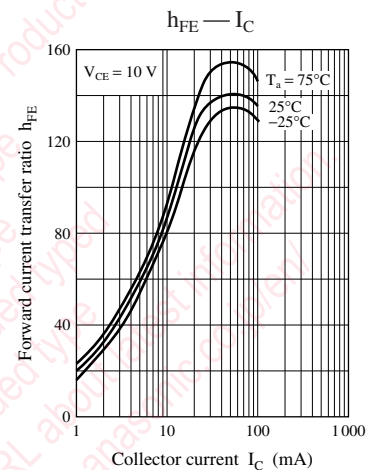
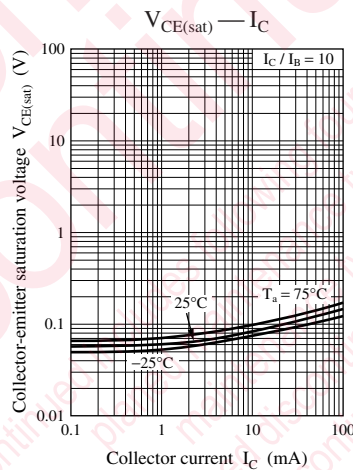
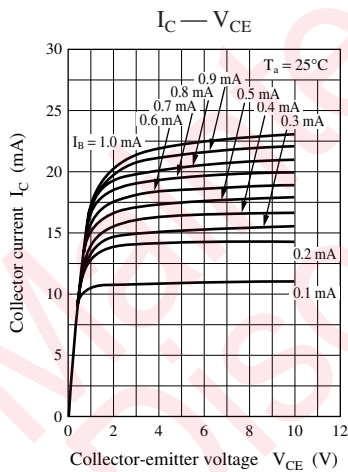
Characteristics charts of UNR2217



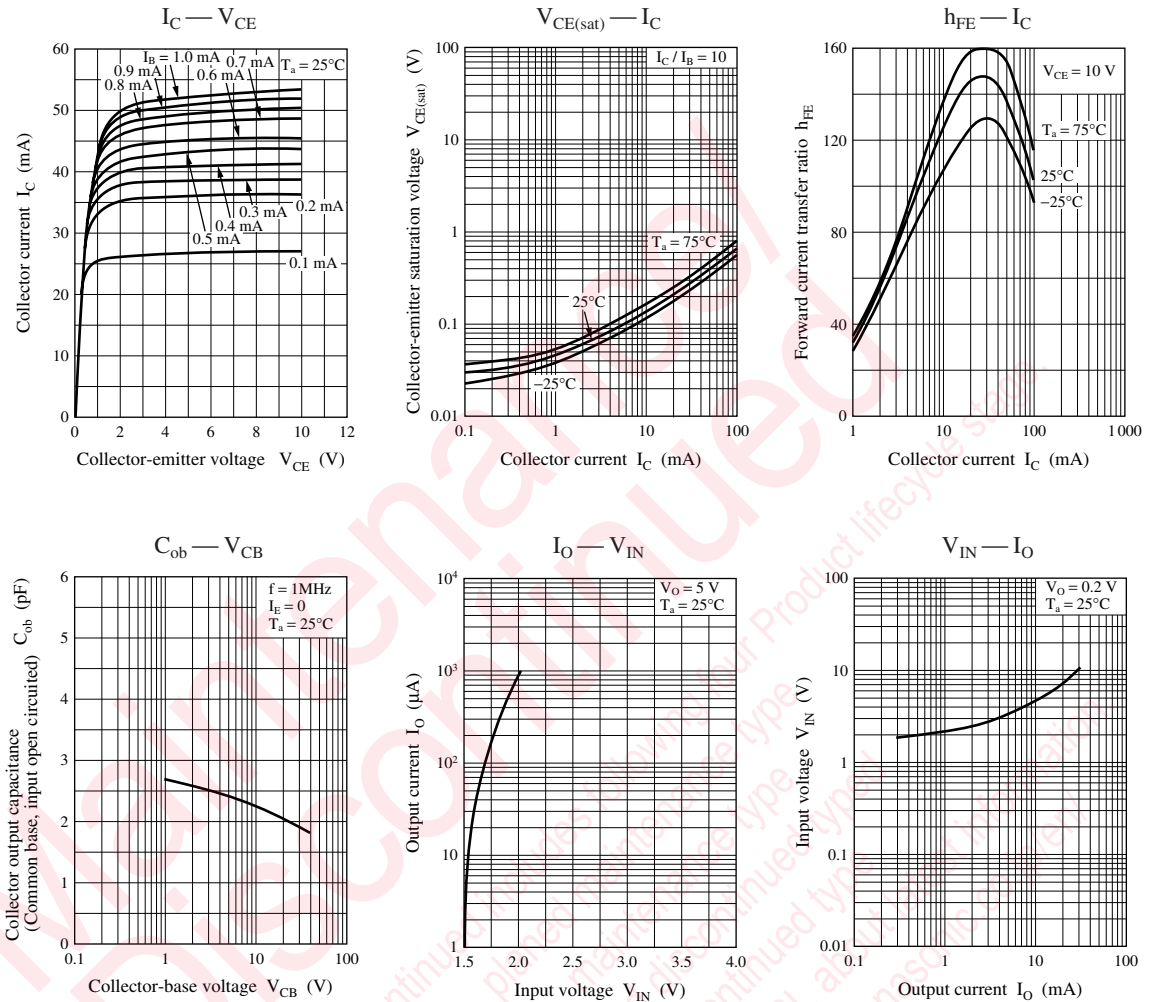
**Characteristics charts of UNR2218****Characteristics charts of UNR2219**



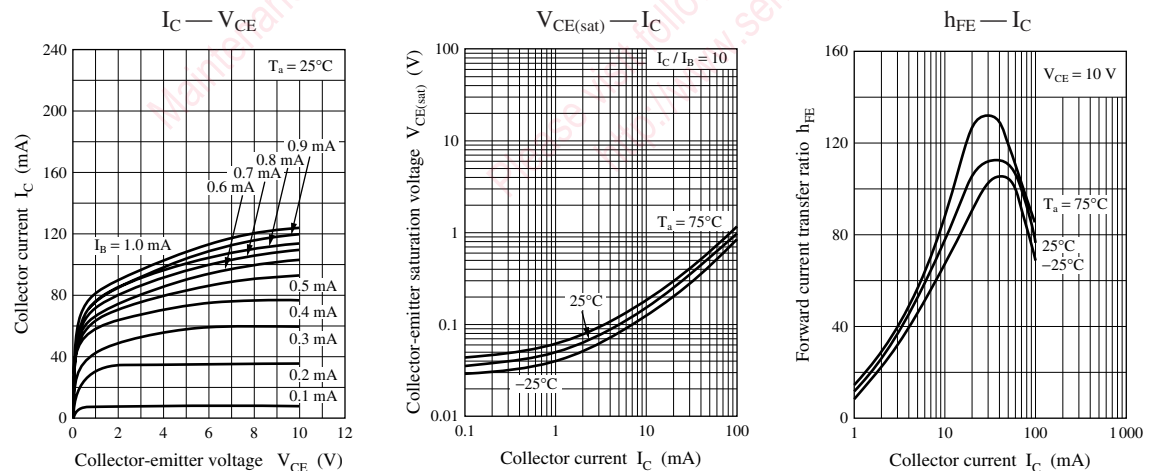
## Characteristics charts of UNR221D

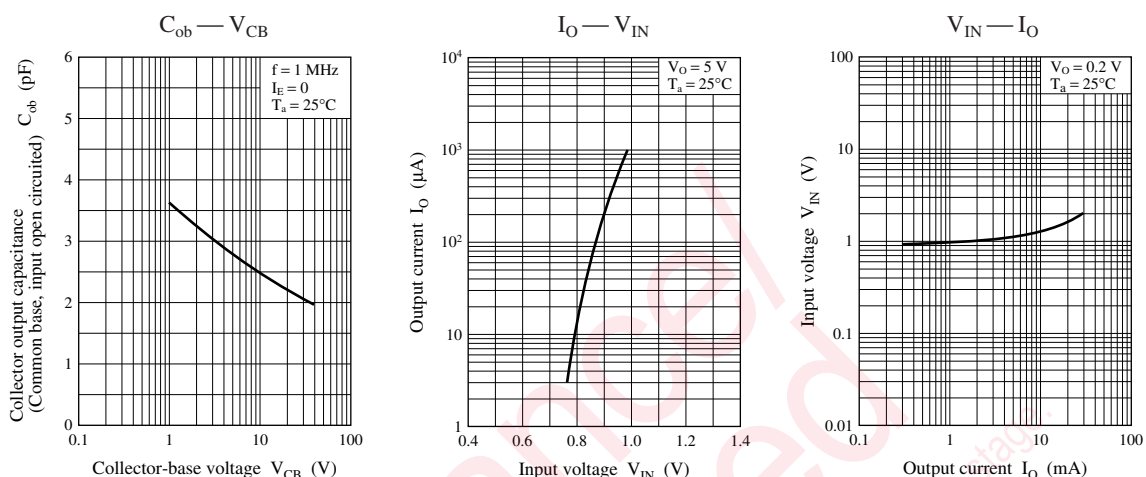


Characteristics charts of UNR221E

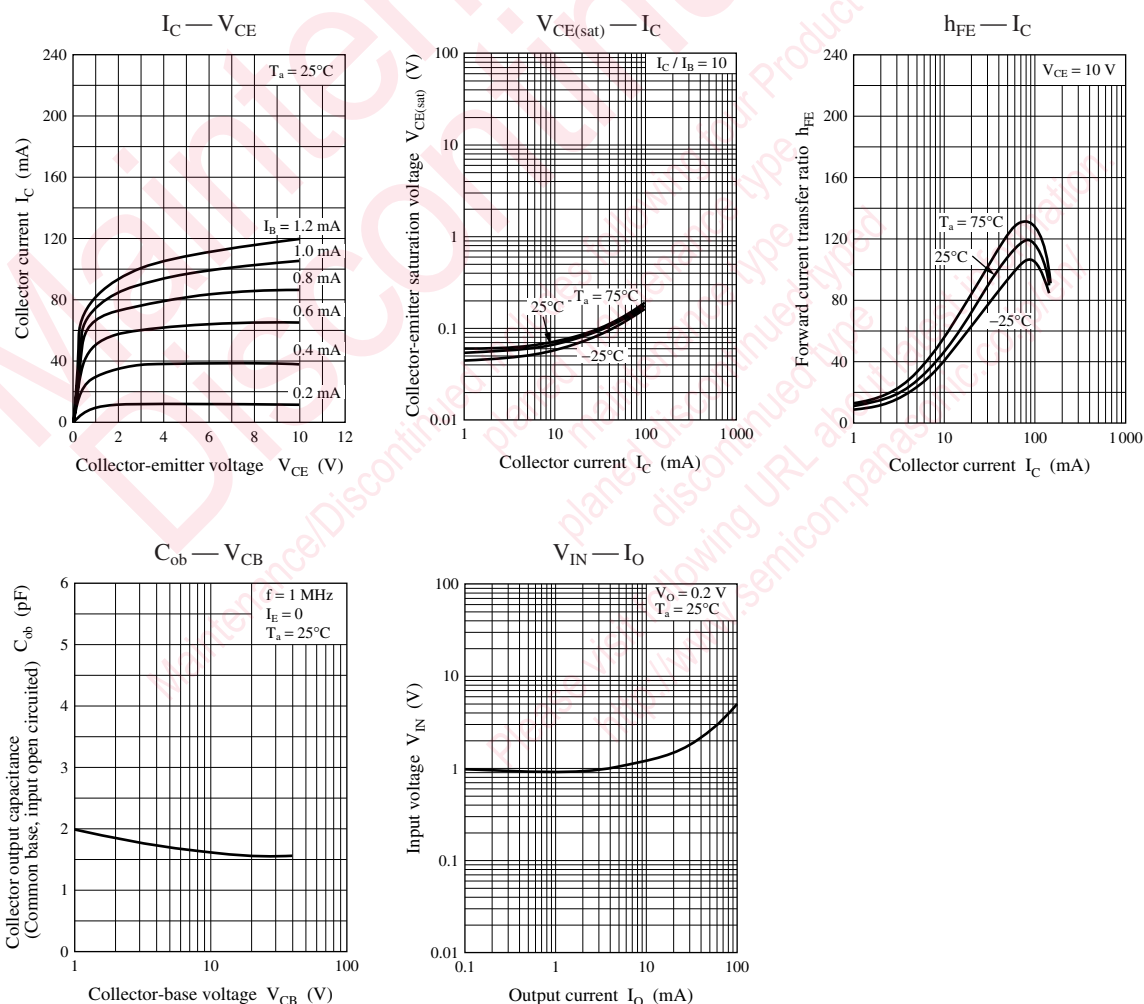


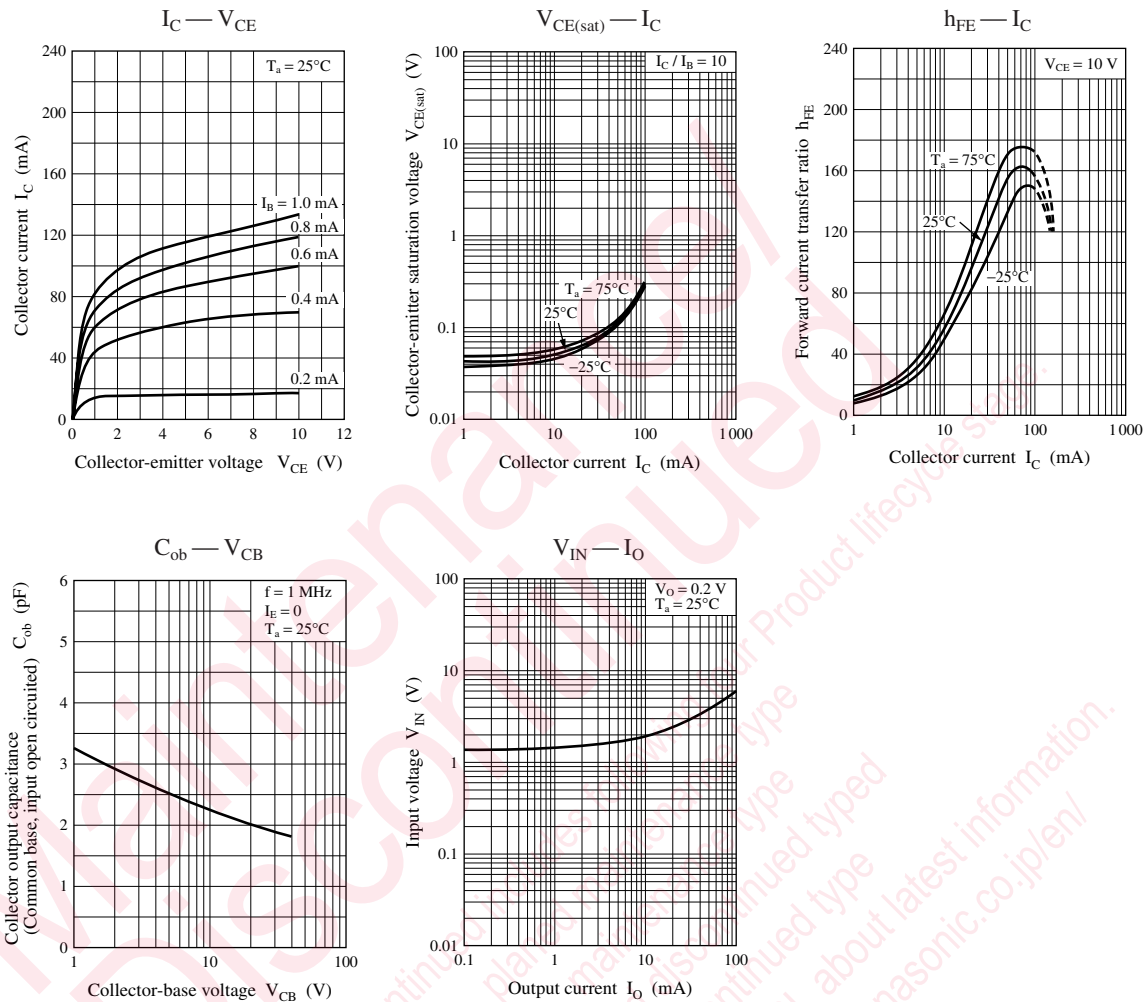
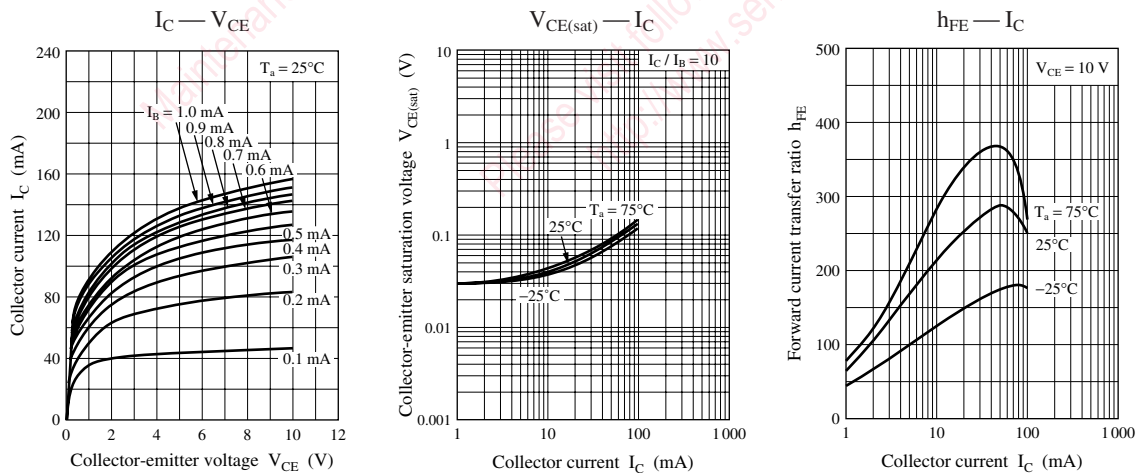
Characteristics charts of UNR221F

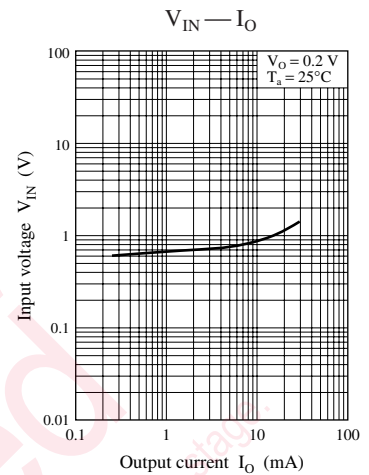
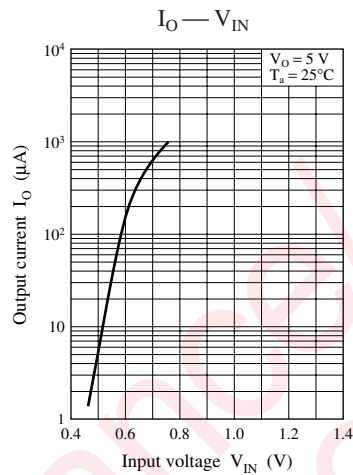
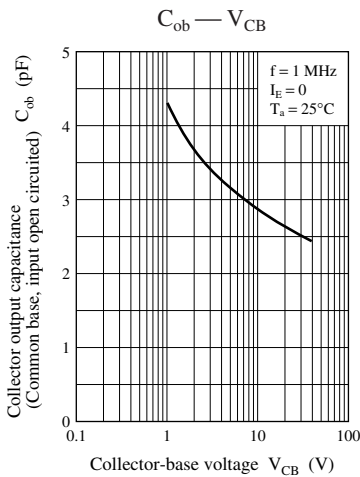




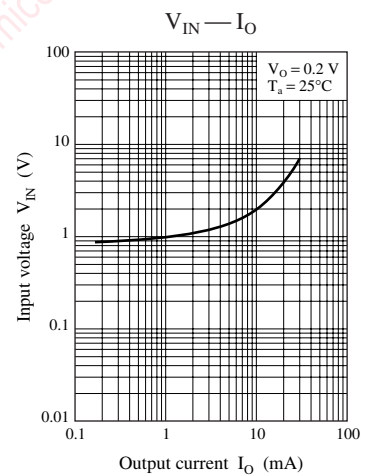
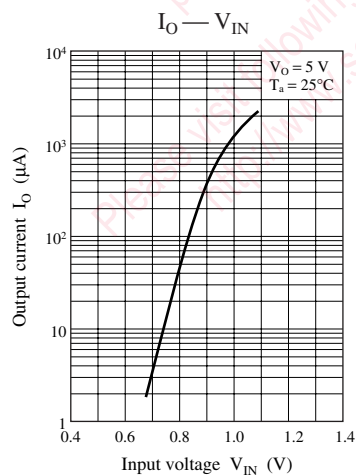
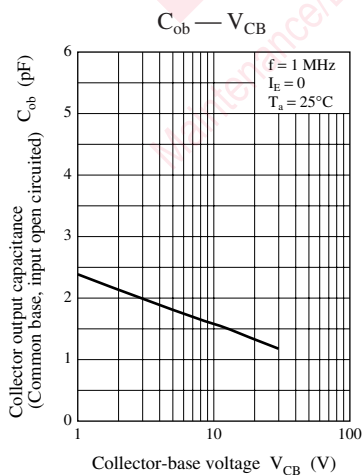
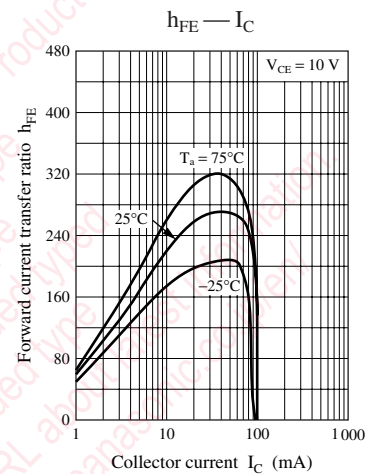
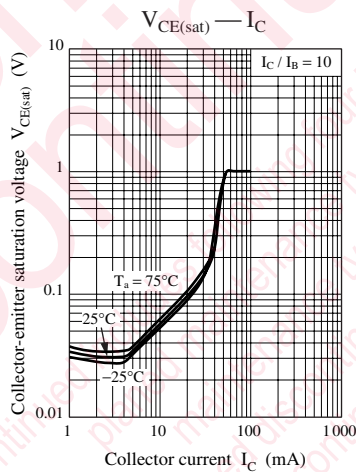
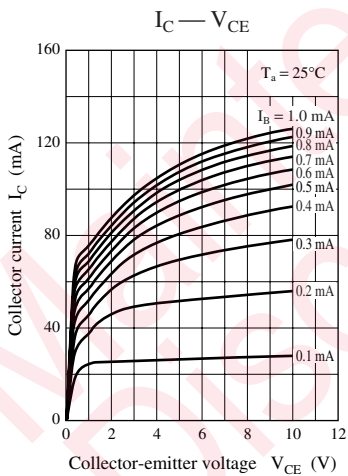
Characteristics charts of UNR221K



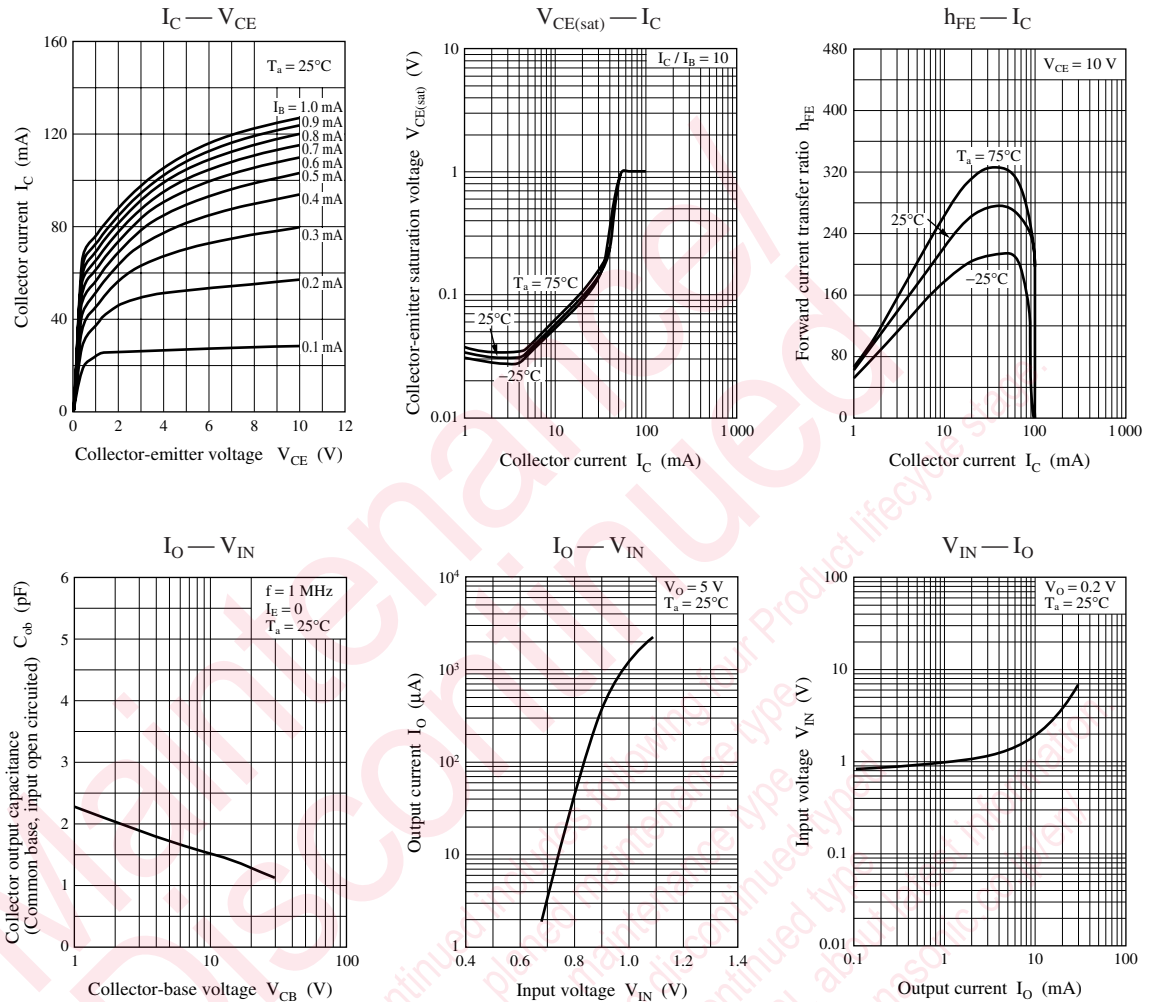
**Characteristics charts of UNR221L****Characteristics charts of UNR221M**



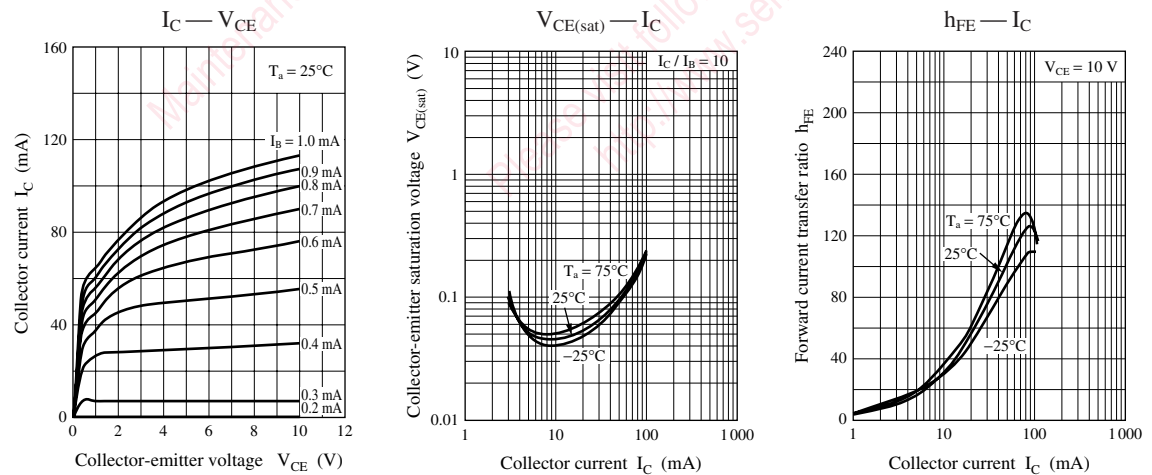
Characteristics charts of UNR221N

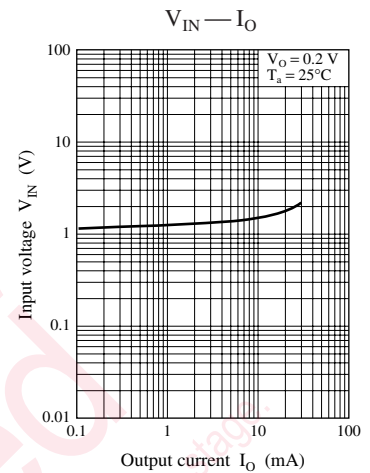
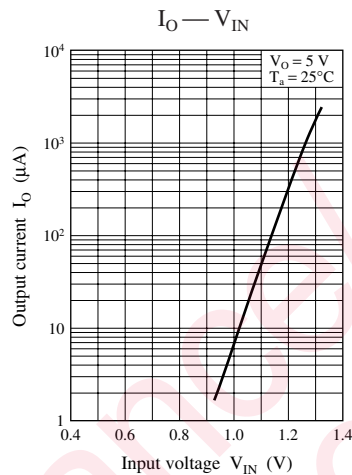
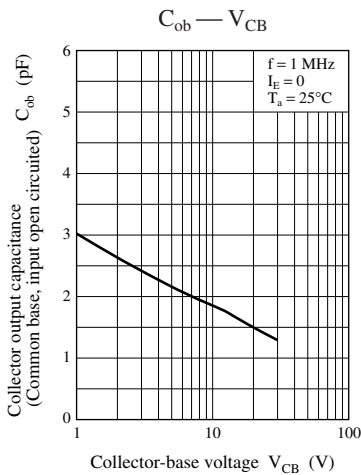


Characteristics charts of UNR221T

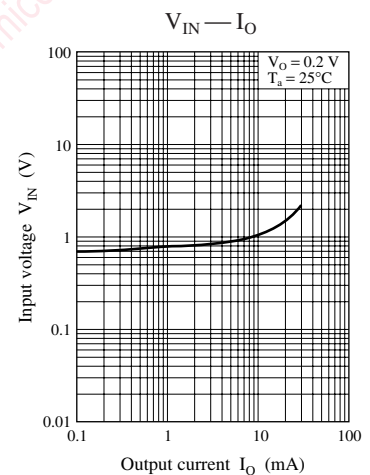
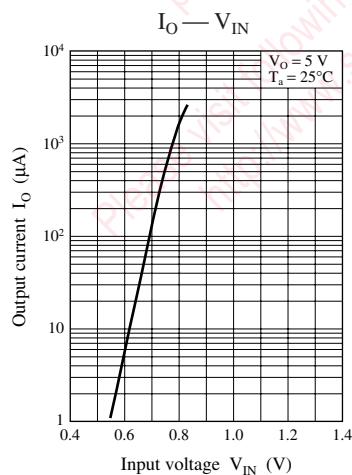
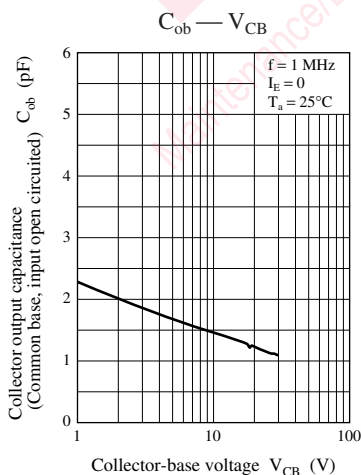
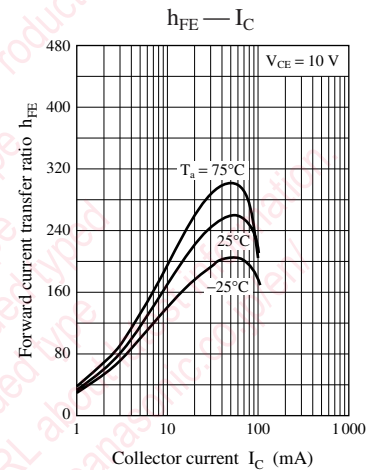
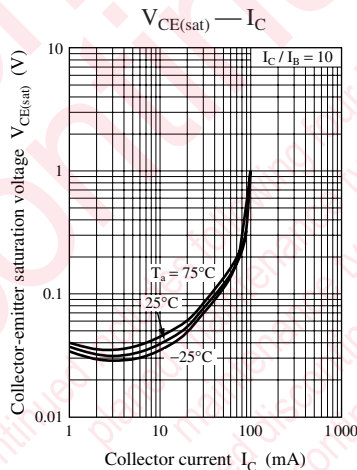
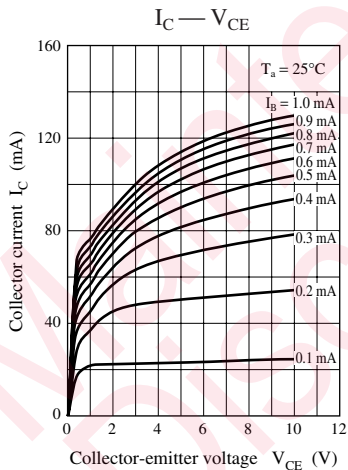


Characteristics charts of UNR221V





## Characteristics charts of UNR221Z



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