# Power Transistor

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## Description:

Switch mode Series NPN Power Transistors are designed for use in high-voltage, high-speed, power switching in inductive circuits, they are particularly suited for 115 and 220V switch mode applications such as switching regulator's, inverters, DC-DC converters, Motor controls, solenoid/relay drivers and deflection circuits.

## Features:

- Collector-Emitter Sustaining Voltage - $V_{CEO(sus)}$ = 400V
- Collector-Emitter Saturation Voltage - $V_{CE(sat)}$ = 1V (Max.) at $I_C$ = 4A, $I_B$ = 1A
- Switching Time- $t_f$ = 0.9µs (Max.) at $I_C$ = 2A

## Maximum Ratings

| Characteristic | Symbol | Rating | Unit |
|---|---|---|---|
| Collector-Emitter Voltage | $V_{CEO}$ | 400 | V |
| Collector-Emitter Voltage | $V_{CEV}$ | 700 | |
| Emitter-Base Voltage | $V_{EBO}$ | 9 | |
| Collector Current-Continuous         -Peak | $I_C$ <br> $I_{CM}$ | 4 <br> 8 | A |
| Base Current | $I_B$ | 2 | |
| Total Power Dissipation at $T_C$ = 25°C <br> Derate above 25°C | $P_D$ | 75 <br> 0.6 | W <br> W/°C |
| Operating and Storage Junction Temperature Range | $T_J$, $T_{STG}$ | -65 to +150 | °C |

## Thermal Characteristics

| Characteristic | Symbol | Max. | Unit |
|---|---|---|---|
| Thermal Resistance Junction to Case | $R_{\theta jc}$ | 1.67 | °C/W |

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## Electrical Characteristics (T$_C$ = 25°C unless otherwise noted)

| Characteristic | Symbol | Min. | Max. | Unit |
|---|---|---|---|---|
| **Off Characteristics** | | | | |
| Collector-Emitter Sustaining Voltage<br>I$_C$ = 10mA, I$_B$ = 0 | V$_{CEO (sus)}$ | 400 | - | V |
| Collector Cut off Current<br>V$_{CE}$ = Rated Value, V$_{BE(off)}$ = 1.5V<br>V$_{CE}$ = Rated Value, V$_{BE(off)}$ = 1.5V, T$_C$ = 100°C | I$_{CEV}$ | - | 1<br>5 | mA |
| Emitter Cut off Current<br>V$_{EB}$ = 9V, I$_C$ = 0 | I$_{EBO}$ | - | 1 | |
| **On Characteristics (1)** | | | | |
| DC Current Gain<br>I$_C$ = 1A, V$_{CE}$ = 5V<br>I$_C$ = 2A, V$_{CE}$ = 5V | hFE | 10<br>8 | 60<br>40 | - |
| Collector-Emitter Saturation Voltage<br>I$_C$ = 1A, I$_B$ = 200mA<br>I$_C$ = 2A, I$_B$ = 500mA<br>I$_C$ = 4A, I$_B$ = 1A | V$_{CE (sat)}$ | - | 0.5<br>0.6<br>1 | V |
| Base-Emitter Saturation Voltage<br>I$_C$ = 1A, I$_B$ = 200mA<br>I$_C$ = 2A, I$_B$ = 500mA | V$_{BE (sat)}$ | - | 1.2<br>1.6 | |
| **Dynamic Characteristics** | | | | |
| Current Gain-Bandwidth Product<br>I$_C$ = 500mA, V$_{CE}$ = 10V, f = 1MHz | f$_T$ | 4 | - | MHz |

**Switching Characteristics**

| | | | | | |
|---|---|---|---|---|---|
| Delay Time | V$_{CC}$ = 125V, I$_C$ = 2A<br>I$_{B1}$ = -I$_{B2}$ = 0.4A<br>tp = 25µs<br>Duty Cycle ≤1% | t$_d$ | - | 0.1 | µs |
| Rise Time | | t$_r$ | - | 0.7 | |
| Storage Time | | t$_s$ | - | 4 | |
| Fall Time | | t$_f$ | - | 0.9 | |

(1) Pulse Test: Pulse Width = 300µs, Duty Cycle ≤2%

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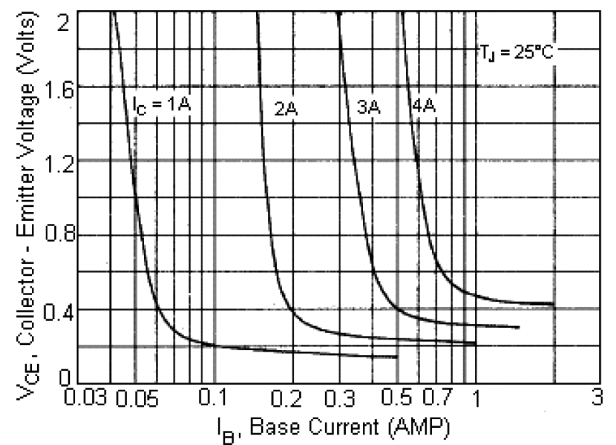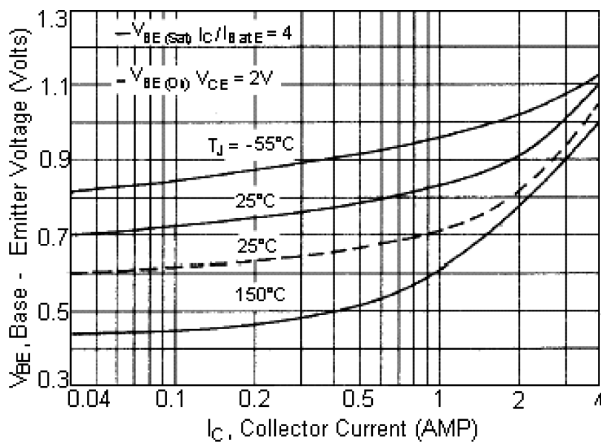
# Power Transistor

**Figure - 1 Power Derating**
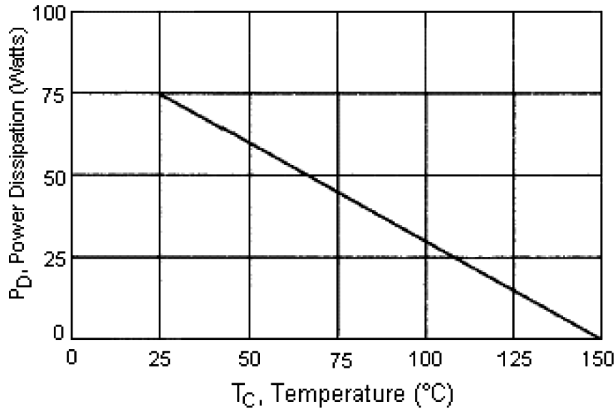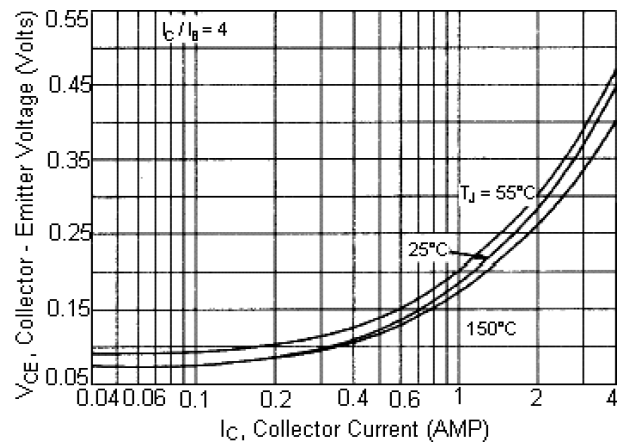


**DC Current Gain**
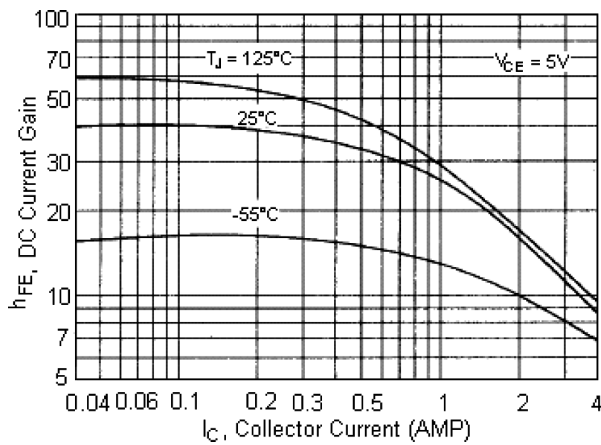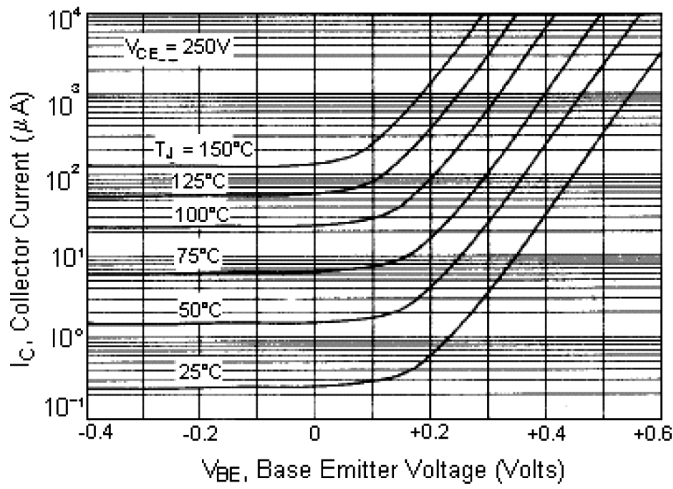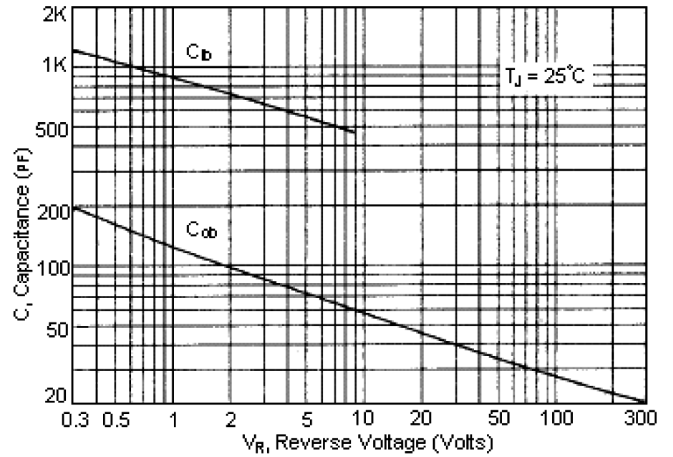


**Collector Saturation Region**



**Base-Emitter Voltage**



**Collector-Emitter Saturation Voltage**

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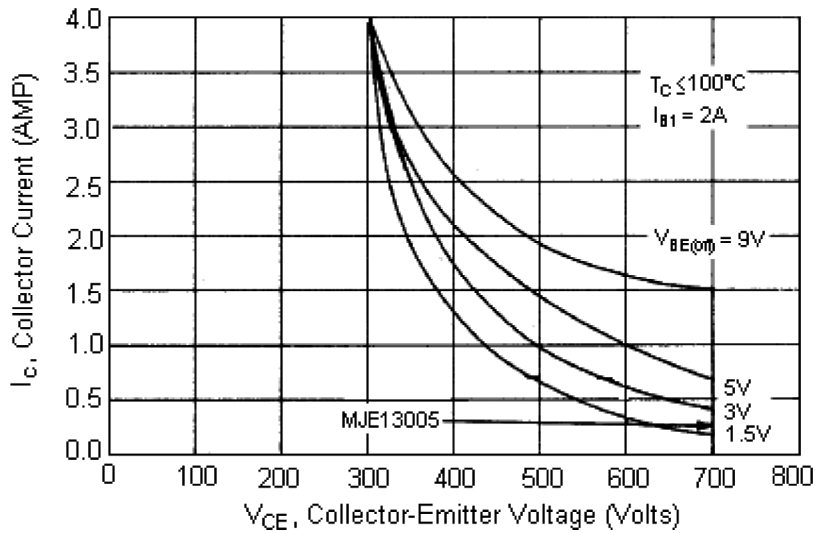# Power Transistor

### Collector Cut-Off Region



### Capacitance



### Turn-On Time



### Turn-Off Time

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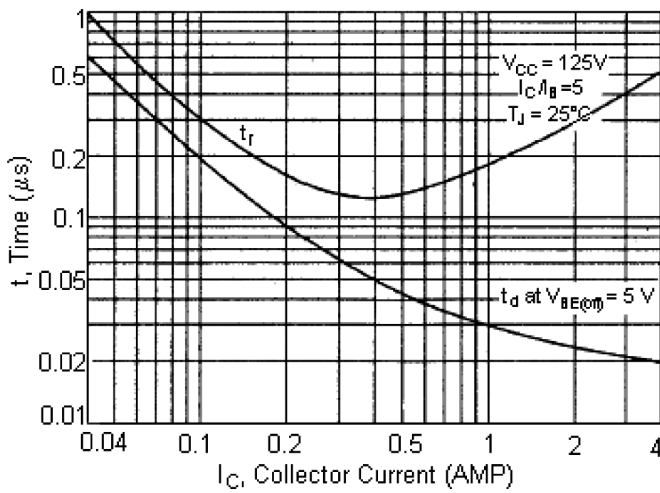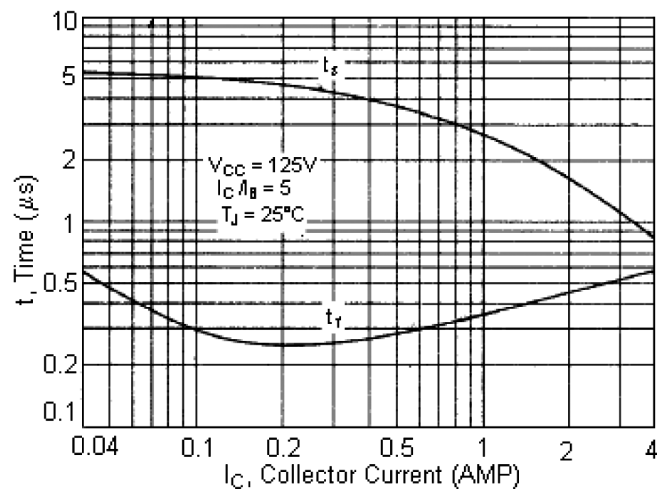
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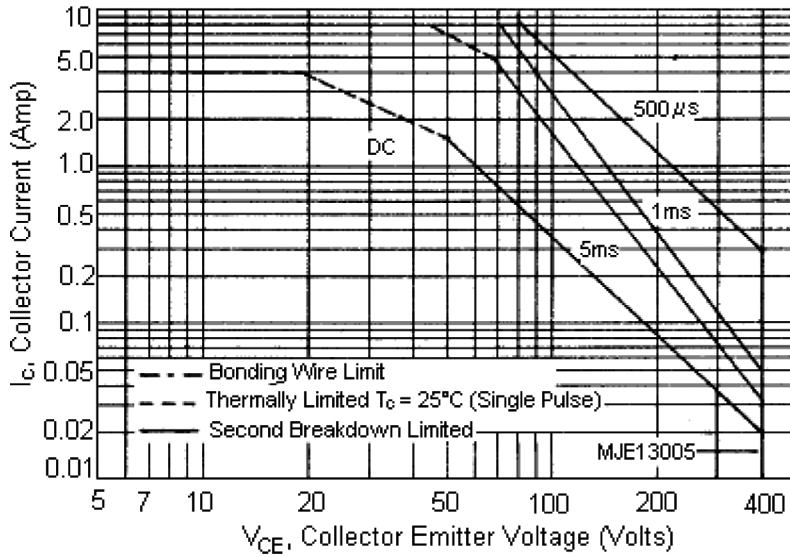


### Reverse Bias Switching Safe Operating Area

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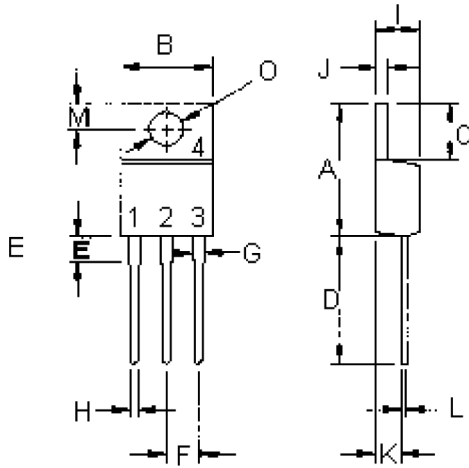
**Pin Configuration:**

1. Base
2. Collector
3. Emitter
4. Collector(Case)

| Dimensions | Min. | Max. |
|:---:|:---:|:---:|
| A | 14.68 | 15.31 |
| B | 9.78 | 10.42 |
| C | 5.01 | 6.52 |
| D | 13.06 | 14.62 |
| E | 3.57 | 4.07 |
| F | 2.42 | 3.66 |
| G | 1.12 | 1.36 |
| H | 0.72 | 0.96 |
| I | 4.22 | 4.98 |
| J | 1.14 | 1.38 |
| K | 2.2 | 2.97 |
| L | 0.33 | 0.55 |
| M | 2.48 | 2.98 |
| O | 3.7 | 3.9 |

Dimensions : Millimetres

## Part Number Table

| Description | Part Number |
|:---:|:---:|
| Transistor, NPN, TO-220 | MJE13005 |

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