

## Silicon NPN Power Transistors

## 2SC4004

## DESCRIPTION

- With TO-220Fa package
- Satisfactory linearity of forward current transfer ratio  $h_{FE}$
- Wide area of safe operation (ASO)
- High-speed switching
- High collector to base voltage  $V_{CBO}$

## APPLICATIONS

- For high breakdown voltage high-speed switching

## PINNING

| PIN | DESCRIPTION |
|-----|-------------|
| 1   | Base        |
| 2   | Collector   |
| 3   | Emitter     |

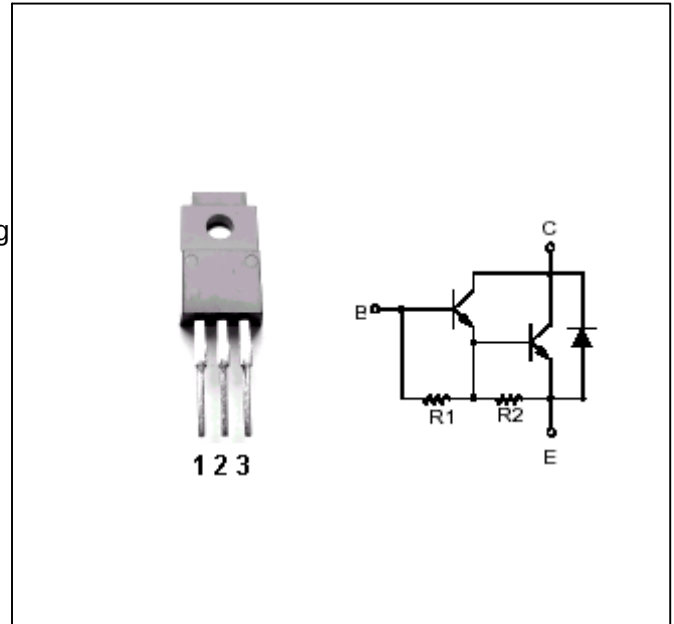


Fig.1 simplified outline (TO-220Fa) and symbol

ABSOLUTE MAXIMUM RATINGS AT  $T_c=25^\circ\text{C}$ 

| SYMBOL    | PARAMETER                   | CONDITIONS             | VALUE   | UNIT             |
|-----------|-----------------------------|------------------------|---------|------------------|
| $V_{CBO}$ | Collector-base voltage      | Open emitter           | 900     | V                |
| $V_{CEO}$ | Collector-emitter voltage   | Open base              | 900     | V                |
| $V_{CES}$ |                             |                        | 800     | V                |
| $V_{EBO}$ | Emitter-base voltage        | Open collector         | 7       | V                |
| $I_C$     | Collector current (DC)      |                        | 1       | A                |
| $I_{CM}$  | Collector current-Peak      |                        | 2       | A                |
| $I_B$     | Base current                |                        | 0.3     | A                |
| $P_C$     | Collector power dissipation | $T_c=25^\circ\text{C}$ | 30      | W                |
|           |                             | $T_a=25^\circ\text{C}$ | 2       | W                |
| $T_j$     | Junction temperature        |                        | 150     | $^\circ\text{C}$ |
| $T_{stg}$ | Storage temperature         |                        | -55~150 | $^\circ\text{C}$ |

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## CHARACTERISTICS

T<sub>j</sub>=25

°C

unless

otherwise

specified

| Symbole              | Conditions                                                                                          | min | typ | max | Unit |
|----------------------|-----------------------------------------------------------------------------------------------------|-----|-----|-----|------|
| I <sub>CBO</sub>     | V <sub>CB</sub> = 900V, I <sub>E</sub> = 0                                                          |     |     | 50  | μA   |
| I <sub>EBO</sub>     | V <sub>EB</sub> = 7V, I <sub>C</sub> = 0                                                            |     |     | 50  | μA   |
| V <sub>CEO</sub>     | I <sub>C</sub> = 1mA, I <sub>B</sub> = 0                                                            | 800 |     |     | V    |
| h <sub>FE1</sub>     | V <sub>CE</sub> = 5V, I <sub>C</sub> = 0.05A                                                        | 6   |     |     |      |
| h <sub>FE2</sub>     | V <sub>CE</sub> = 5V, I <sub>C</sub> = 0.5A                                                         | 3   |     |     |      |
| V <sub>CE(sat)</sub> | I <sub>C</sub> = 0.2A, I <sub>B</sub> = 0.04A                                                       |     |     | 1.5 | V    |
| V <sub>BE(sat)</sub> | I <sub>C</sub> = 0.2A, I <sub>B</sub> = 0.04A                                                       |     |     | 1.0 | V    |
| f <sub>T</sub>       | V <sub>CE</sub> = 10V, I <sub>C</sub> = 0.05A, f = 1MHz                                             |     | 4   |     | MHz  |
| t <sub>on</sub>      | I <sub>C</sub> = 0.2A, I <sub>B1</sub> = 0.04A, I <sub>B2</sub> = -0.04A,<br>V <sub>CC</sub> = 250V |     |     | 1.0 | μs   |
| t <sub>stg</sub>     |                                                                                                     |     |     | 3.0 | μs   |
| t <sub>f</sub>       |                                                                                                     |     |     | 1.0 | μs   |

| SYMBOL             | PARAMETER                            | CONDITIONS                                            | MIN | TYP. | MAX | UNIT |
|--------------------|--------------------------------------|-------------------------------------------------------|-----|------|-----|------|
| V <sub>CEO</sub>   | Collector-emitter breakdown voltage  | I <sub>C</sub> =1mA, I <sub>B</sub> =0                | 800 |      |     | V    |
| V <sub>CEsat</sub> | Collector-emitter saturation voltage | I <sub>C</sub> =0.2A I <sub>B</sub> =0.04A            |     |      | 1.5 | V    |
| V <sub>BESat</sub> | Base-emitter saturation voltage      | I <sub>C</sub> =0.2A I <sub>B</sub> =0.04A            |     |      | 1.0 | V    |
| I <sub>CBO</sub>   | Collector cut-off current            | V <sub>CB</sub> =900V I <sub>E</sub> =0               |     |      | 50  | μA   |
| I <sub>EBO</sub>   | Emitter cut-off current              | V <sub>EB</sub> =7V; I <sub>C</sub> =0                |     |      | 50  | μA   |
| h <sub>FE-1</sub>  | DC current gain                      | I <sub>C</sub> =0.05A ; V <sub>CE</sub> =5V           | 6   |      |     |      |
| h <sub>FE-2</sub>  | DC current gain                      | I <sub>C</sub> =0.5A ; V <sub>CE</sub> =5V            | 3   |      |     |      |
| f <sub>T</sub>     | Transition frequency                 | I <sub>C</sub> =0.05A;<br>V <sub>CE</sub> =10V;f=1MHz |     | 4    |     | MHz  |

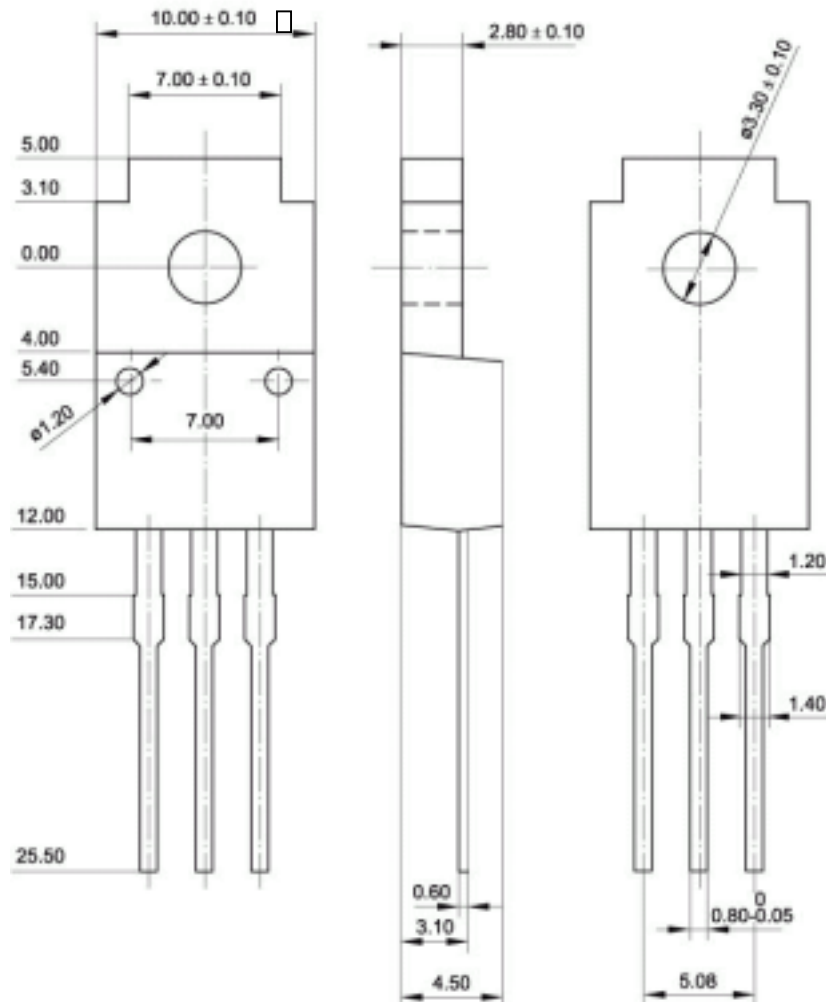
## Switching times

|                 |              |                                                                                                   |  |  |     |    |
|-----------------|--------------|---------------------------------------------------------------------------------------------------|--|--|-----|----|
| t <sub>on</sub> | Turn-on time | I <sub>C</sub> =0.2A ;I <sub>B1</sub> =0.04A<br>I <sub>B2</sub> =-0.04A;<br>V <sub>CC</sub> =250V |  |  | 1.0 | μs |
| t <sub>s</sub>  | Storage time |                                                                                                   |  |  | 3.0 | μs |
| t <sub>f</sub>  | Fall time    |                                                                                                   |  |  | 1.0 | μs |

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## PACKAGE OUTLINE

Fig.2 Outline dimensions (unindicated tolerance:  $\pm 0.15$  mm)