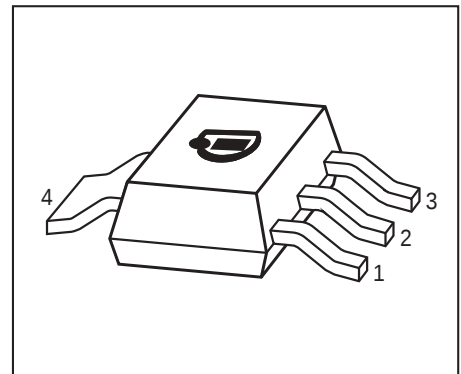


## NPN Silicon Darlington Transistors

- High collector current
- Low collector-emitter saturation voltage
- Complementary types: BSP60 - BSP52 (PNP)
- Pb-free (RoHS compliant) package<sup>1)</sup>
- Qualified according AEC Q101



| Type  | Marking | Pin Configuration |     |     |     |   |   | Package |
|-------|---------|-------------------|-----|-----|-----|---|---|---------|
| BSP50 | BSP50   | 1=B               | 2=C | 3=E | 4=C | - | - | SOT223  |
| BSP51 | BSP51   | 1=B               | 2=C | 3=E | 4=C | - | - | SOT223  |
| BSP52 | BSP52   | 1=B               | 2=C | 3=E | 4=C | - | - | SOT223  |

### Maximum Ratings

| Parameter                                            | Symbol    | Value       | Unit |
|------------------------------------------------------|-----------|-------------|------|
| Collector-emitter voltage                            | $V_{CEO}$ |             | V    |
| BSP50                                                |           | 45          |      |
| BSP51                                                |           | 60          |      |
| BSP52                                                |           | 80          |      |
| Collector-base voltage                               | $V_{CBO}$ |             |      |
| BSP50                                                |           | 60          |      |
| BSP51                                                |           | 80          |      |
| BSP52                                                |           | 90          |      |
| Emitter-base voltage                                 | $V_{EBO}$ | 5           |      |
| Collector current                                    | $I_C$     | 1           | A    |
| Peak collector current                               | $I_{CM}$  | 2           |      |
| Base current                                         | $I_B$     | 100         | mA   |
| Total power dissipation-<br>$T_S \leq 124\text{ °C}$ | $P_{tot}$ | 1.5         | W    |
| Junction temperature                                 | $T_j$     | 150         | °C   |
| Storage temperature                                  | $T_{stg}$ | -65 ... 150 |      |

<sup>1</sup>Pb-containing package may be available upon special request

**Thermal Resistance**

| Parameter                                | Symbol     | Value     | Unit |
|------------------------------------------|------------|-----------|------|
| Junction - soldering point <sup>1)</sup> | $R_{thJS}$ | $\leq 17$ | K/W  |

**Electrical Characteristics** at  $T_A = 25^\circ\text{C}$ , unless otherwise specified

| Parameter | Symbol | Values |      |      | Unit |
|-----------|--------|--------|------|------|------|
|           |        | min.   | typ. | max. |      |

**DC Characteristics**

|                                                                                                                                                                                                    |               |                |             |             |               |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|----------------|-------------|-------------|---------------|
| Collector-emitter breakdown voltage<br>$I_C = 10\text{ mA}$ , $I_B = 0$ , BSP50<br>$I_C = 10\text{ mA}$ , $I_B = 0$ , BSP51<br>$I_C = 10\text{ mA}$ , $I_B = 0$ , BSP52                            | $V_{(BR)CEO}$ | 45<br>60<br>80 | -<br>-<br>- | -<br>-<br>- | V             |
| Collector-base breakdown voltage<br>$I_C = 100\text{ }\mu\text{A}$ , $I_E = 0$ , BSP50<br>$I_C = 100\text{ }\mu\text{A}$ , $I_E = 0$ , BSP51<br>$I_C = 100\text{ }\mu\text{A}$ , $I_E = 0$ , BSP52 | $V_{(BR)CBO}$ | 60<br>80<br>90 | -<br>-<br>- | -<br>-<br>- |               |
| Emitter-base breakdown voltage<br>$I_E = 100\text{ }\mu\text{A}$ , $I_C = 0$                                                                                                                       | $V_{(BR)EBO}$ | 5              | -           | -           |               |
| Collector-emitter cutoff current<br>$V_{CE} = V_{CE0max}$ , $V_{BE} = 0$                                                                                                                           | $I_{CES}$     | -              | -           | 10          | $\mu\text{A}$ |
| Emitter-base cutoff current<br>$V_{EB} = 4\text{ V}$ , $I_C = 0$                                                                                                                                   | $I_{EBO}$     | -              | -           | 10          | $\mu\text{A}$ |
| DC current gain <sup>2)</sup><br>$I_C = 150\text{ mA}$ , $V_{CE} = 10\text{ V}$<br>$I_C = 500\text{ mA}$ , $V_{CE} = 10\text{ V}$                                                                  | $h_{FE}$      | 1000<br>2000   | -<br>-      | -<br>-      | -             |
| Collector-emitter saturation voltage <sup>2)</sup><br>$I_C = 500\text{ mA}$ , $I_B = 0.5\text{ mA}$<br>$I_C = 1\text{ A}$ , $I_B = 1\text{ mA}$                                                    | $V_{CEsat}$   | -<br>-         | -<br>-      | 1.3<br>1.8  | V             |
| Base emitter saturation voltage <sup>2)</sup><br>$I_C = 500\text{ mA}$ , $I_B = 0.5\text{ mA}$<br>$I_C = 1\text{ mA}$ , $I_B = 1\text{ A}$                                                         | $V_{BEsat}$   | -<br>-         | -<br>-      | 1.9<br>2.2  |               |

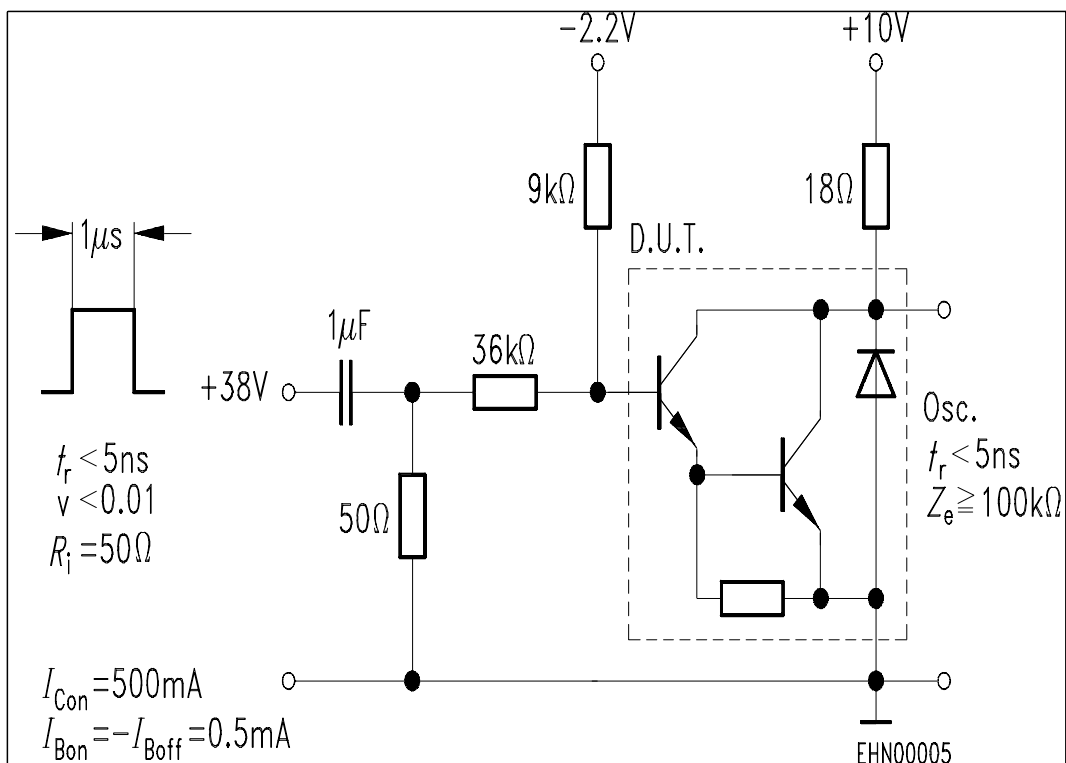
<sup>1)</sup>For calculation of  $R_{thJA}$  please refer to Application Note Thermal Resistance

<sup>2)</sup>Pulse test:  $t < 300\mu\text{s}$ ;  $D < 2\%$

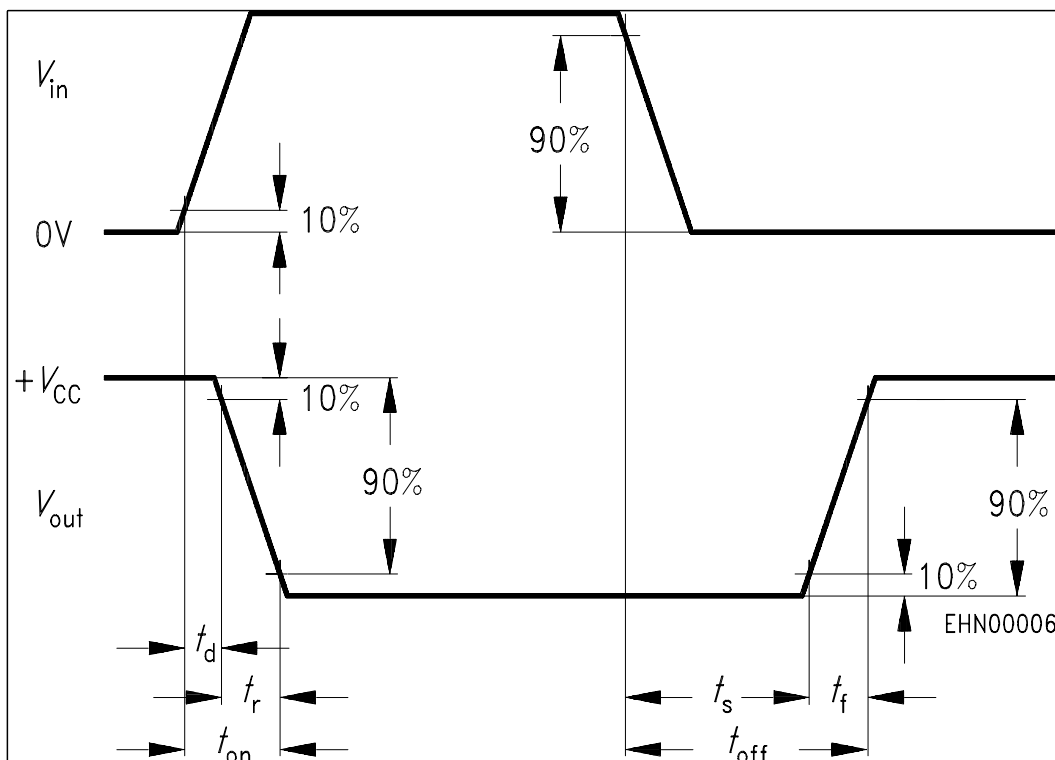
**Electrical Characteristics** at  $T_A = 25^\circ\text{C}$ , unless otherwise specified

| Parameter                                                                                    | Symbol      | Values |      |      | Unit |
|----------------------------------------------------------------------------------------------|-------------|--------|------|------|------|
|                                                                                              |             | min.   | typ. | max. |      |
| AC Characteristics                                                                           |             |        |      |      |      |
| Transition frequency<br>$I_C = 100\text{ mA}$ , $V_{CE} = 5\text{ V}$ , $f = 100\text{ MHz}$ | $f_T$       | -      | 200  | -    | MHz  |
| Tum-on time<br>$I_C = 500\text{ mA}$ , $I_{B1} = I_{B2} = 0.5\text{ mA}$                     | $t_{(on)}$  | -      | 400  | -    | ns   |
| Tum-off time<br>$I_C = 500\text{ mA}$ , $I_{B1} = I_{B2} = 0.5\text{ mA}$                    | $t_{(off)}$ | -      | 1500 | -    |      |

### Switching time test circuit

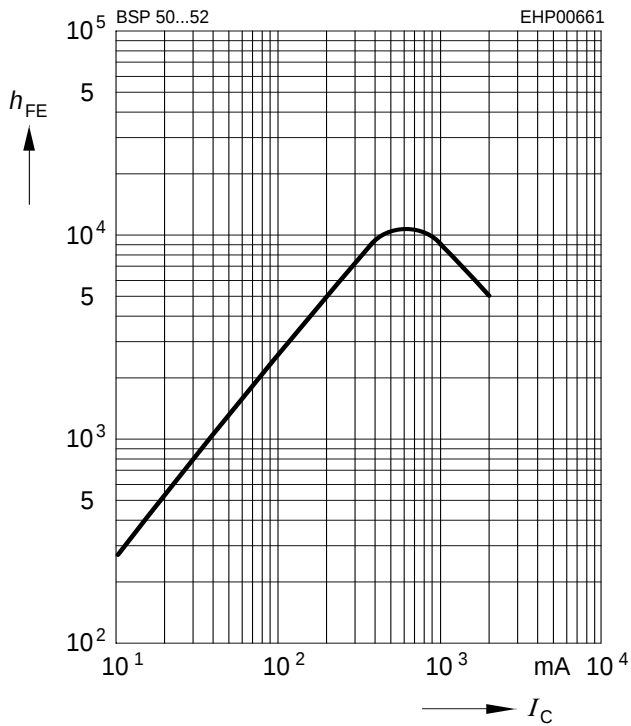


## Switching time waveform



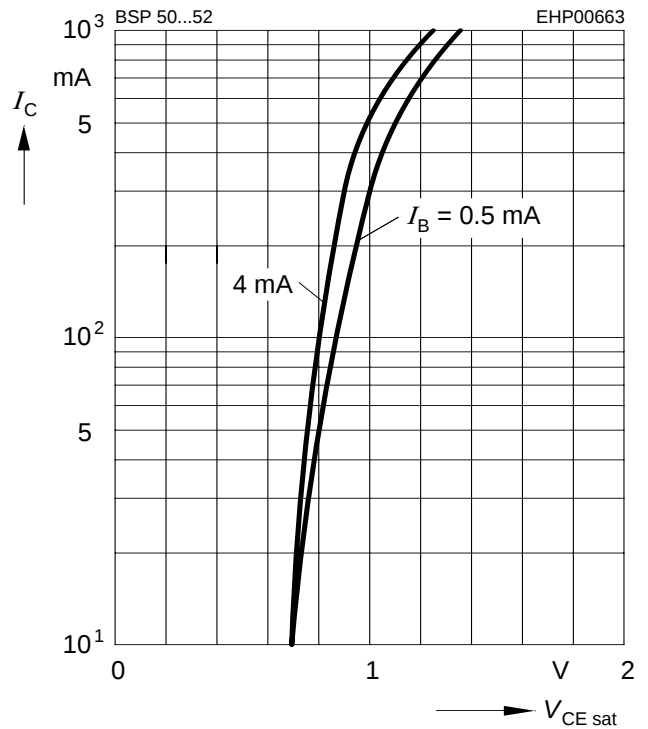
### DC current gain $h_{FE} = f(I_C)$

$V_{CE} = 10 \text{ V}$



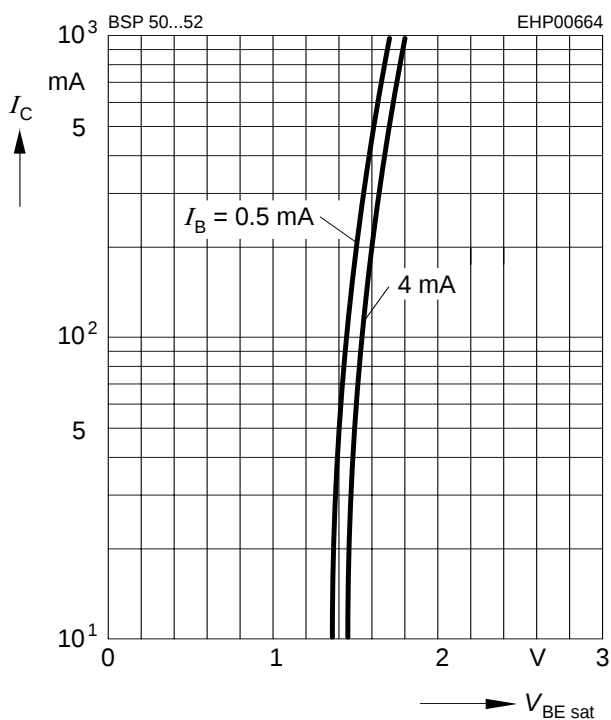
### Collector-emitter saturation voltage

$I_C = f(V_{CEsat}), I_B = \text{Parameter}$



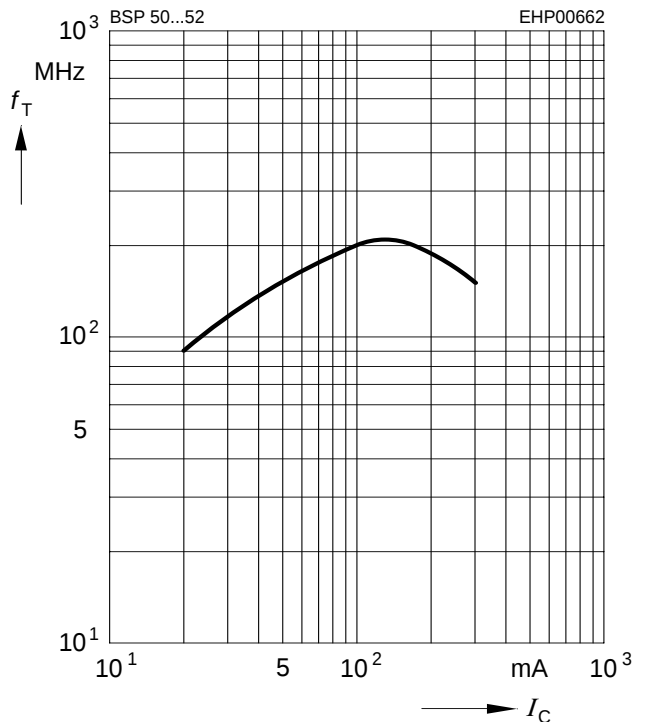
### Base-emitter saturation voltage

$I_C = f(V_{BEsat}), I_B = \text{Parameter}$



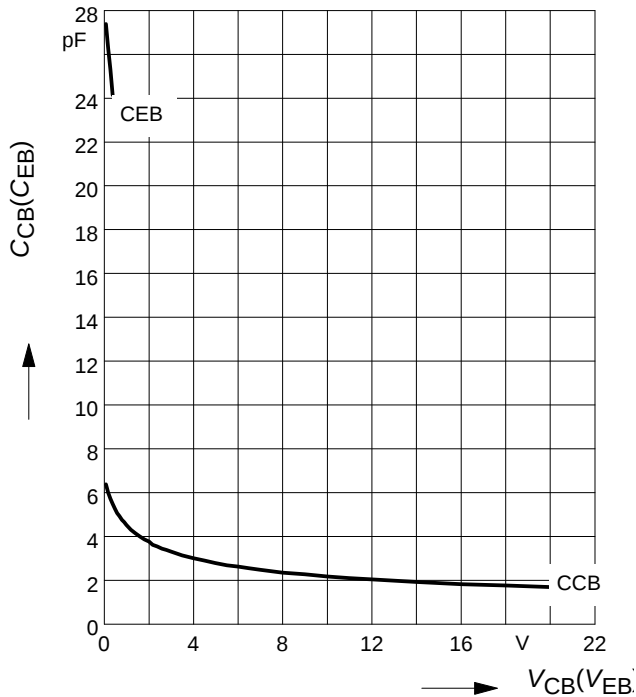
### Transition frequency $f_T = f(I_C)$

$V_{CE} = 5 \text{ V}, f = 100 \text{ MHz}$

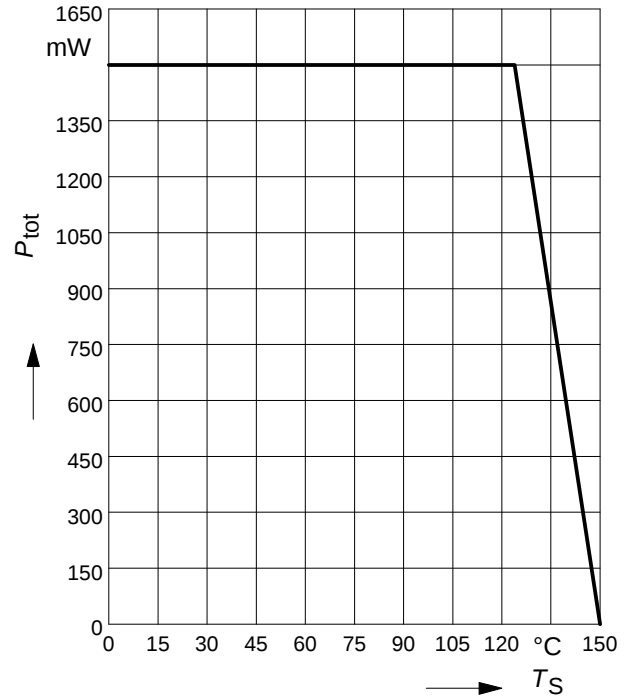


Collector-base capacitance  $C_{cb} = f(V_{CB})$

Emitter-base capacitance  $C_{eb} = f(V_{EB})$

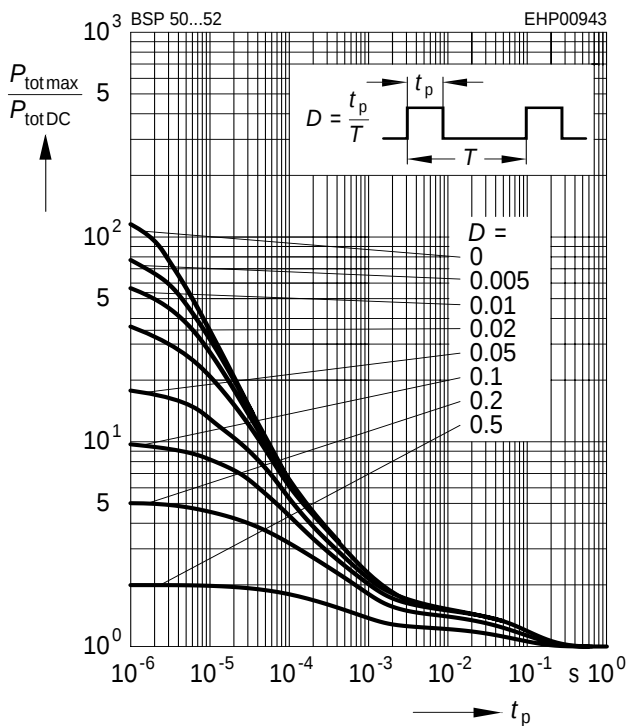


Total power dissipation  $P_{tot} = f(T_S)$



Permissible Pulse Load

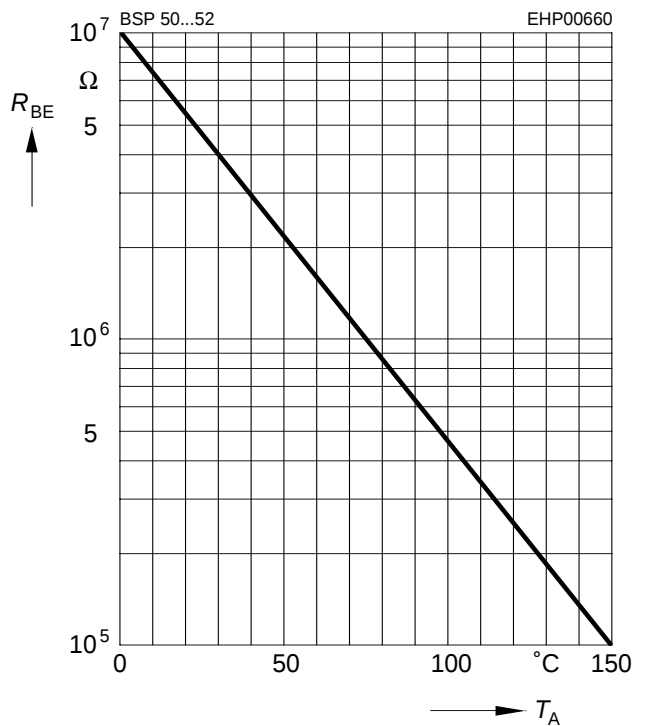
$P_{totmax}/P_{totDC} = f(t_p)$



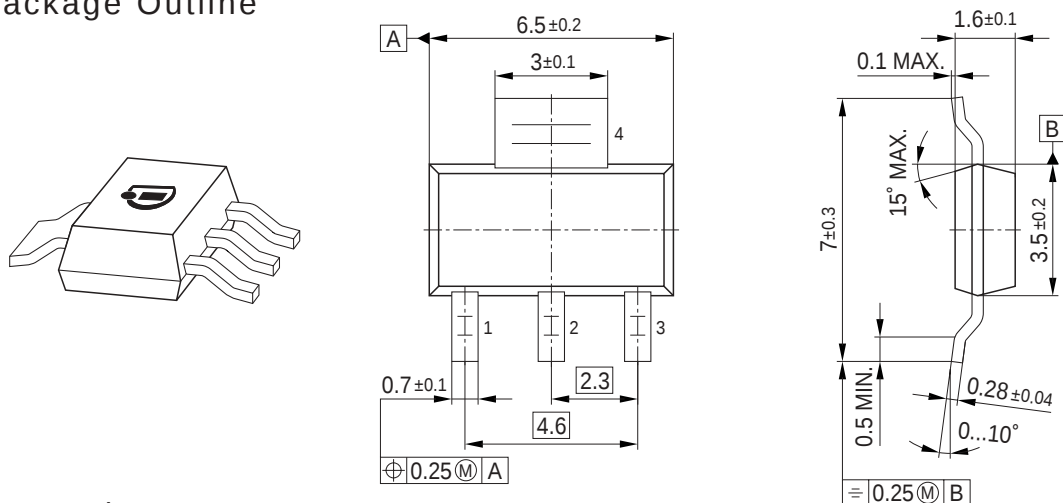
External resistance  $R_{BE} = f(T_A)^{**}$

$V_{CB} = V_{CEmax}$

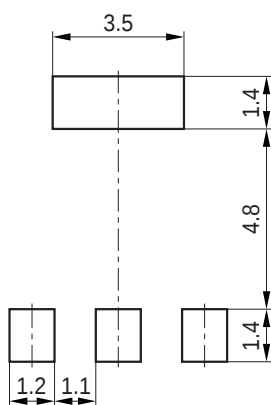
\*\*  $R_{BEmax}$  for thermal stability



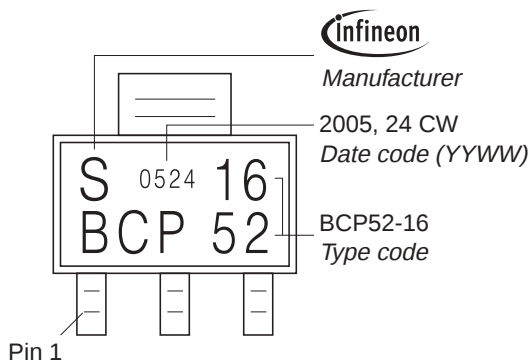
## Package Outline



## Foot Print

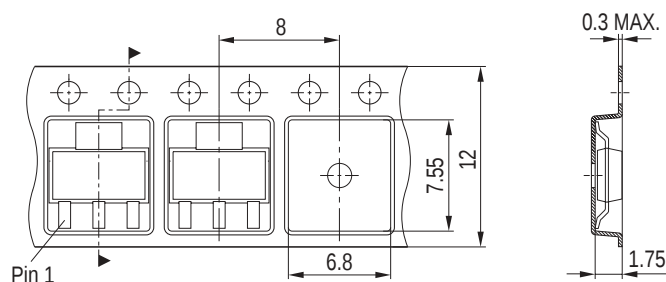


## Marking Layout (Example)



## Packing

Reel  $\varnothing 180 \text{ mm}$  = 1.000 Pieces/Reel  
 Reel  $\varnothing 330 \text{ mm}$  = 4.000 Pieces/Reel



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