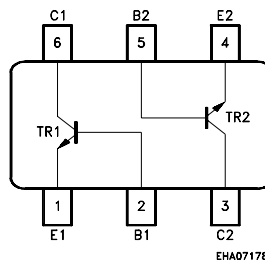
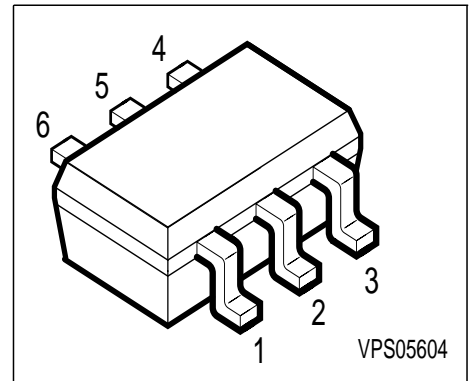


### NPN Silicon Switching Transistor Array

- High DC current gain: 0.1mA to 100mA
- Low collector-emitter saturation voltage
- Two ( galvanic) internal isolated Transistors with high matching in one package
- Complementary type: SMBT 3906S (PNP)



| Type       | Marking | Ordering Code | Pin Configuration |           |           | Package |
|------------|---------|---------------|-------------------|-----------|-----------|---------|
| SMBT 3904S | s1A     | Q62702-A1201  | 1/4=E1/E2         | 2/5=B1/B2 | 3/6=C2/C1 | SOT-363 |

### Maximum Ratings

| Parameter                                      | Symbol    | Value       | Unit |
|--|-----------|-------------|------|
| Collector-emitter voltage                      | $V_{CEO}$ | 40          | V    |
| Collector-base voltage                         | $V_{CBO}$ | 60          |      |
| Emitter-base voltage                           | $V_{EBO}$ | 6           |      |
| DC collector current                           | $I_C$     | 200         | mA   |
| Total power dissipation, $T_S = 115\text{ °C}$ | $P_{tot}$ | 250         | mW   |
| Junction temperature                           | $T_j$     | 150         | °C   |
| Storage temperature                            | $T_{stg}$ | - 65...+150 |      |

### Thermal Resistance

|                                |            |            |     |
|--------------------------------|------------|------------|-----|
| Junction ambient <sup>1)</sup> | $R_{thJA}$ | $\leq 275$ | K/W |
| Junction - soldering point     | $R_{thJS}$ | $\leq 140$ |     |

1) Package mounted on pcb 40mm x 40mm x 1.5mm / 0.5cm<sup>2</sup> Cu

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

| Parameter   | Symbol        | Values                      |                       |                         | Unit |
|---|---------------|-----------------------------|-----------------------|-------------------------|------|
|   |               | min.                        | typ.                  | max.                    |      |
| <b>DC Characteristics</b>   |               |                             |                       |                         |      |
| Collector-emitter breakdown voltage<br>$I_C = 1 \text{ mA}, I_B = 0$  | $V_{(BR)CEO}$ | 40                          | -                     | -                       | V    |
| Collector-base breakdown voltage<br>$I_C = 10 \mu\text{A}, I_B = 0$   | $V_{(BR)CBO}$ | 60                          | -                     | -                       |      |
| Emitter-base breakdown voltage<br>$I_E = 10 \mu\text{A}, I_C = 0$   | $V_{(BR)EBO}$ | 6                           | -                     | -                       |      |
| Collector cutoff current<br>$V_{CB} = 30 \text{ V}, I_E = 0$  | $I_{CBO}$     | -                           | -                     | 50                      | nA   |
| DC current gain 1)<br>$I_C = 100 \mu\text{A}, V_{CE} = 1 \text{ V}$<br>$I_C = 1 \text{ mA}, V_{CE} = 1 \text{ V}$<br>$I_C = 10 \text{ mA}, V_{CE} = 1 \text{ V}$<br>$I_C = 50 \text{ mA}, V_{CE} = 1 \text{ V}$<br>$I_C = 100 \text{ mA}, V_{CE} = 1 \text{ V}$ | $h_{FE}$      | 40<br>70<br>100<br>60<br>30 | -<br>-<br>-<br>-<br>- | -<br>-<br>300<br>-<br>- | -    |
| Collector-emitter saturation voltage1)<br>$I_C = 10 \text{ mA}, I_B = 1 \text{ mA}$<br>$I_C = 50 \text{ mA}, I_B = 5 \text{ mA}$  | $V_{CEsat}$   | -<br>-                      | -<br>-                | 0.2<br>0.3              | V    |
| Base-emitter saturation voltage 1)<br>$I_C = 10 \text{ mA}, I_B = 1 \text{ mA}$<br>$I_C = 50 \text{ mA}, I_B = 5 \text{ mA}$  | $V_{BEsat}$   | 0.65<br>-                   | -<br>-                | 0.85<br>0.95            |      |

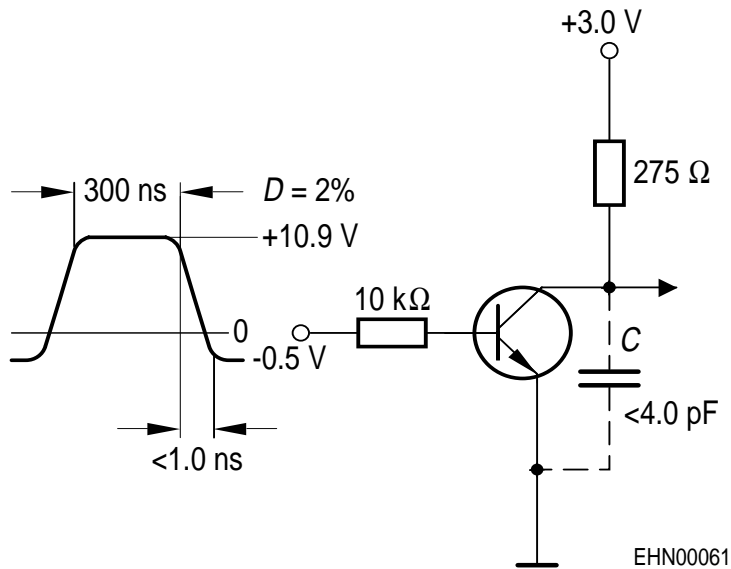
1) Pulse test:  $t < 300 \mu\text{s}$ ;  $D < 2\%$

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

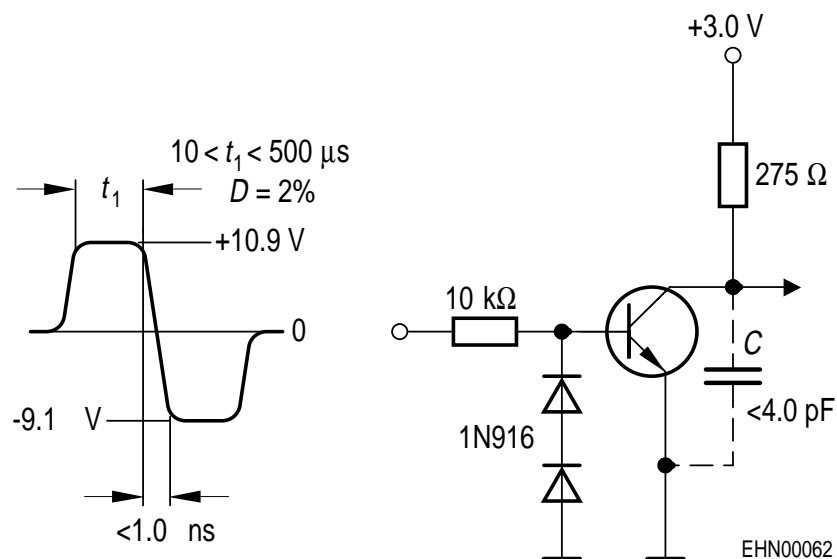
| Parameter   | Symbol    | Values |      |      | Unit          |
|---|-----------|--------|------|------|---------------|
|   |           | min.   | typ. | max. |               |
| <b>AC Characteristics</b>   |           |        |      |      |               |
| Transition frequency<br>$I_C = 10 \text{ mA}, V_{CE} = 20 \text{ V}, f = 100 \text{ MHz}$   | $f_T$     | 300    | -    | -    | MHz           |
| Collector-base capacitance<br>$V_{CB} = 5 \text{ V}, f = 1 \text{ MHz}$   | $C_{cb}$  | -      | -    | 4    | pF            |
| Emitter-base capacitance<br>$V_{EB} = 0.5 \text{ V}, f = 1 \text{ MHz}$   | $C_{eb}$  | -      | -    | 8    |               |
| Short-circuit input impedance<br>$I_C = 1 \text{ mA}, V_{CE} = 10 \text{ V}, f = 1 \text{ kHz}$   | $h_{11e}$ | 1      | -    | 10   | k $\Omega$    |
| Open-circuit reverse voltage transfer ratio<br>$I_C = 1 \text{ mA}, V_{CE} = 10 \text{ V}, f = 1 \text{ kHz}$                             | $h_{12e}$ | 0.5    | -    | 8    | $10^{-4}$     |
| Short-circuit forward current transfer ratio<br>$I_C = 1 \text{ mA}, V_{CE} = 10 \text{ V}, f = 1 \text{ kHz}$                            | $h_{21e}$ | 100    | -    | 400  | -             |
| Open-circuit output admittance<br>$I_C = 1 \text{ mA}, V_{CE} = 10 \text{ V}, f = 1 \text{ kHz}$  | $h_{22e}$ | 1      | -    | 40   | $\mu\text{s}$ |
| Noise figure<br>$I_C = 100 \mu\text{A}, V_{CE} = 5 \text{ V}, R_S = 1 \text{ k}\Omega,$<br>$f = 1 \text{ kHz}, \Delta f = 200 \text{ Hz}$ | $F$       | -      | -    | 5    | dB            |
| Delay time<br>$V_{CC} = 3 \text{ V}, I_C = 10 \text{ mA}, I_{B1} = 1 \text{ mA},$<br>$V_{BE(\text{off})} = 0.5 \text{ V}$                 | $t_d$     | -      | -    | 35   | ns            |
| Rise time<br>$V_{CC} = 3 \text{ V}, I_C = 10 \text{ mA}, I_{B1} = 1 \text{ mA},$<br>$V_{BE(\text{off})} = 0.5 \text{ V}$                  | $t_r$     | -      | -    | 35   |               |
| Storage time<br>$V_{CC} = 3 \text{ V}, I_C = 10 \text{ mA}, I_{B1}=I_{B2} = 1\text{mA}$   | $t_{stg}$ | -      | -    | 200  |               |
| Fall time<br>$V_{CC} = 3 \text{ V}, I_C = 10 \text{ mA}, I_{B1}=I_{B2} = 1\text{mA}$  | $t_f$     | -      | -    | 50   |               |

### Test circuit

#### Delay and rise time

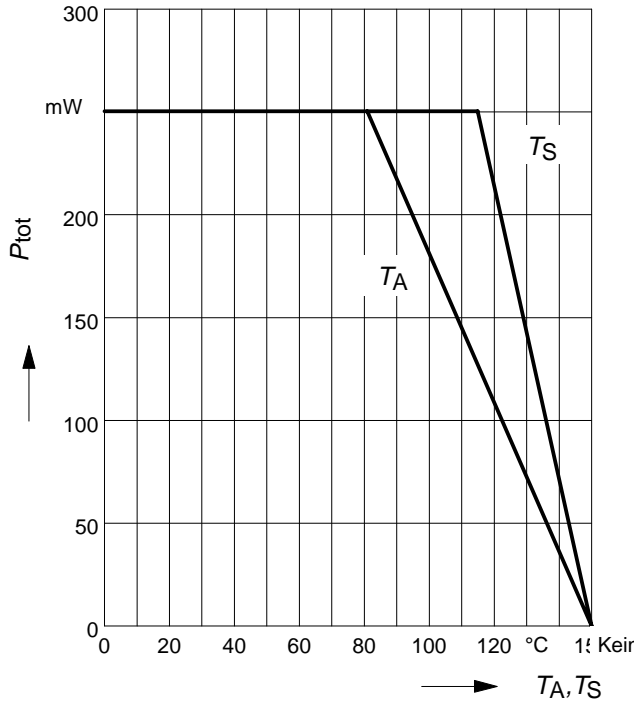


#### Storage time and fall time

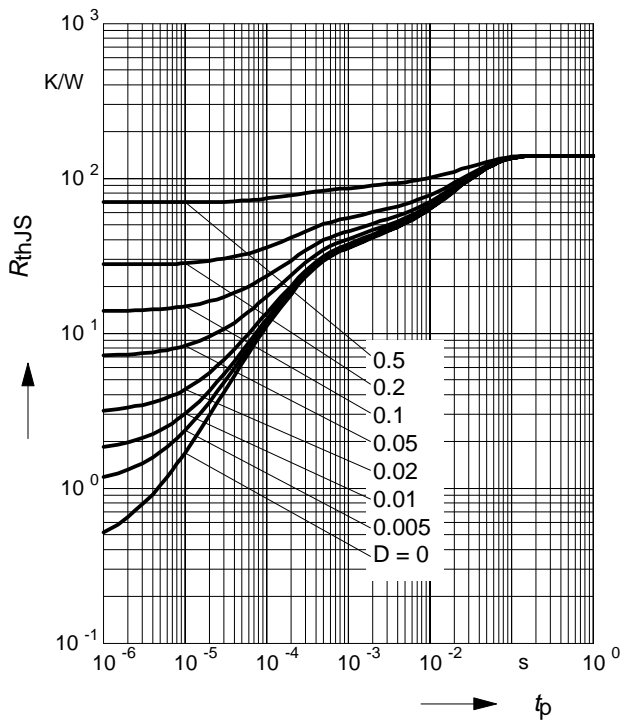


### Total power dissipation $P_{tot} = f(T_A^*; T_S)$

\* Package mounted on epoxy

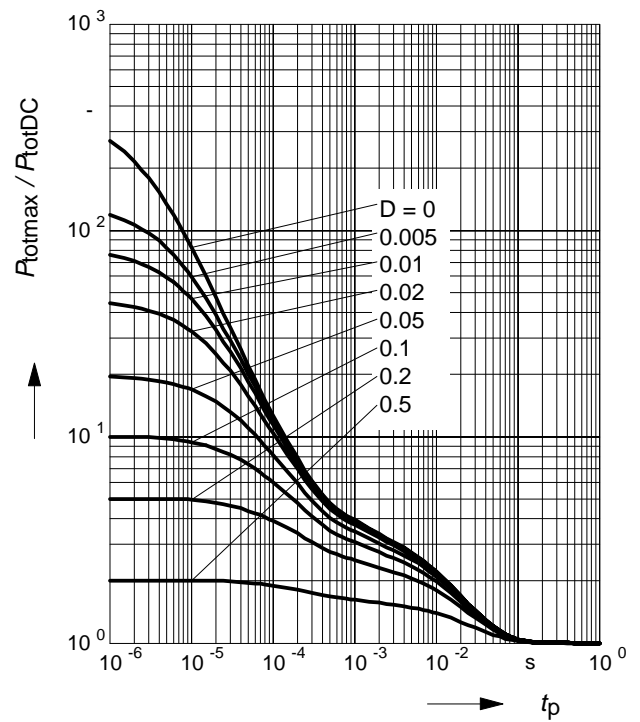


### Permissible Pulse Load $R_{thJS} = f(t_p)$



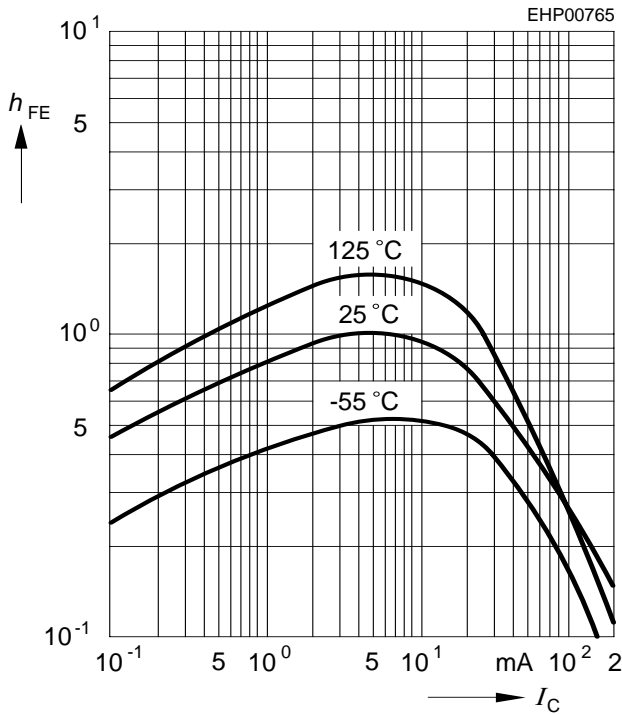
### Permissible Pulse Load

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



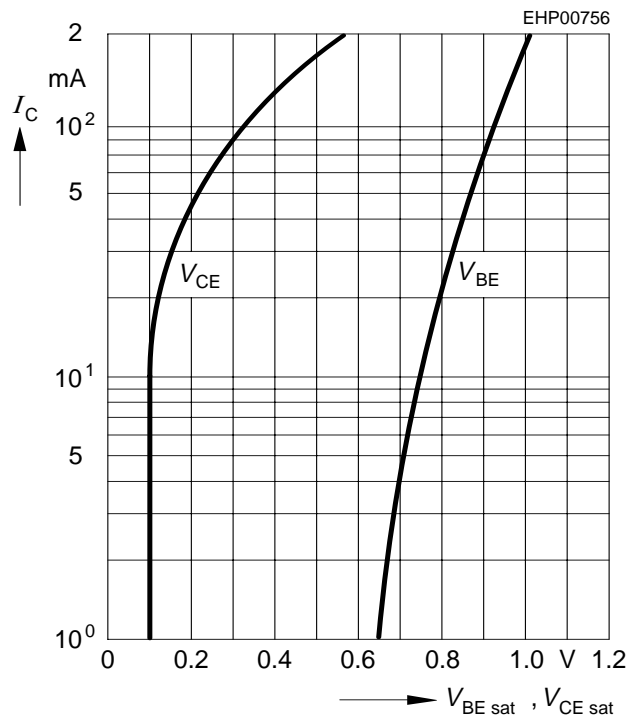
### DC current gain $h_{FE} = f(I_C)$

$V_{CE} = 10V$ , normalized



### Saturation voltage $I_C = f(V_{BEsat}, V_{CEsat})$

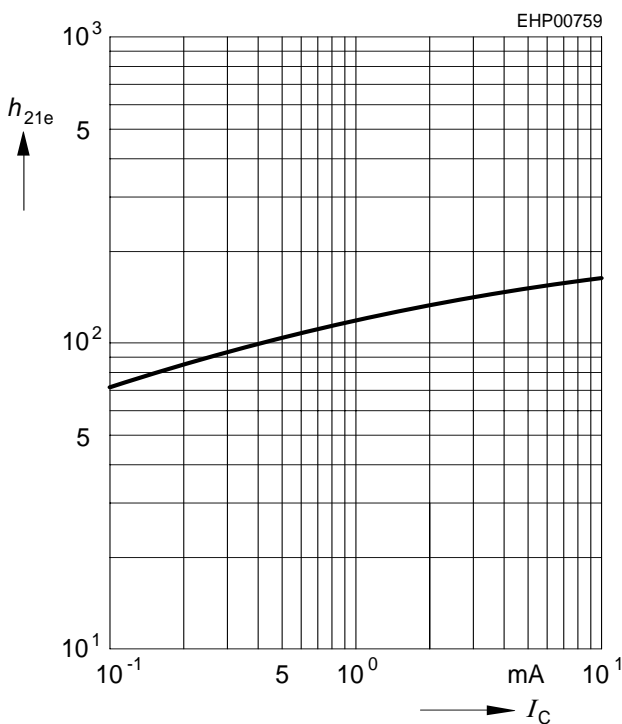
$h_{FE} = 10$



### Short-circuit forward current transfer ratio $h_{21e} = f(I_C)$

$V_{CE} = 10V$ ,  $f = 1MHz$

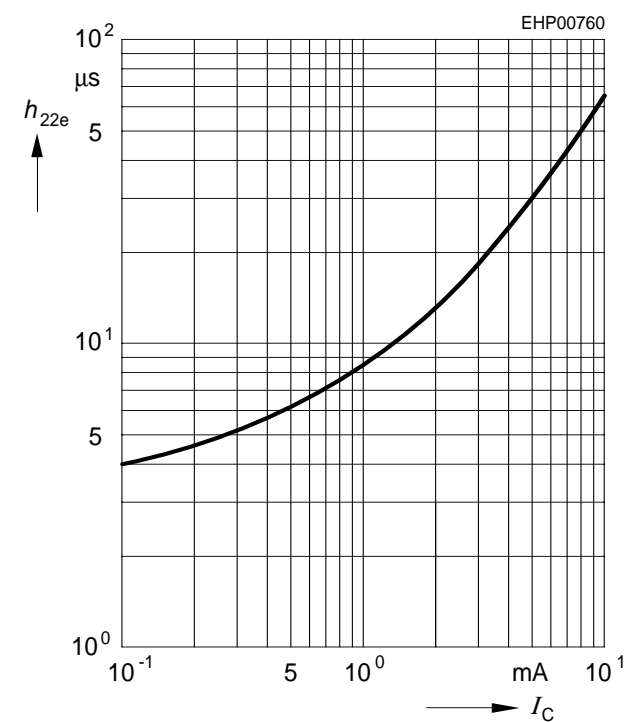
$V_{CE} = 10V$ ,  $f = 1MHz$



### Open-circuit output admittance $h_{22e} = f(I_C)$

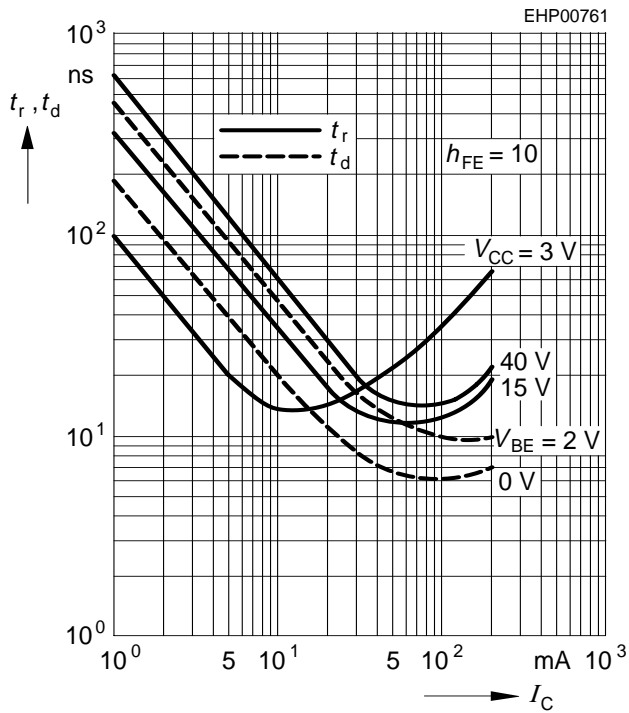
$h_{22e} = f(I_C)$

$V_{CE} = 10V$ ,  $f = 1MHz$

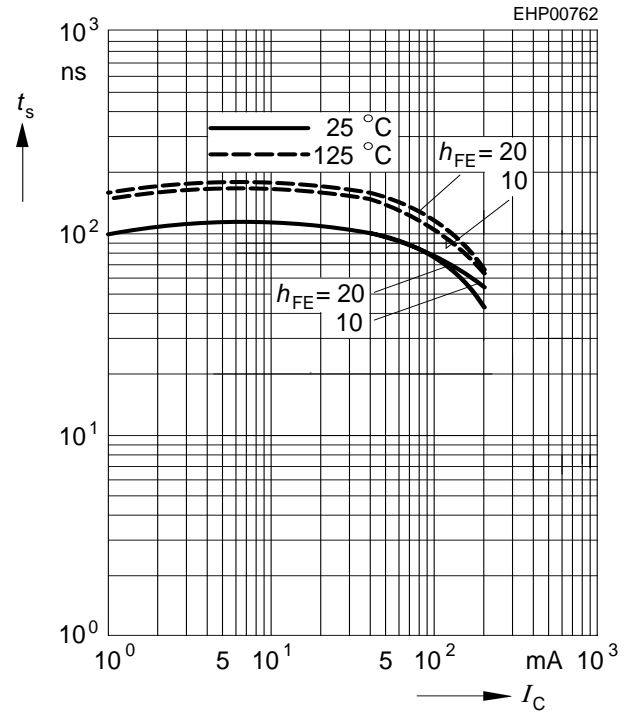


Delay time  $t_d = f(I_C)$

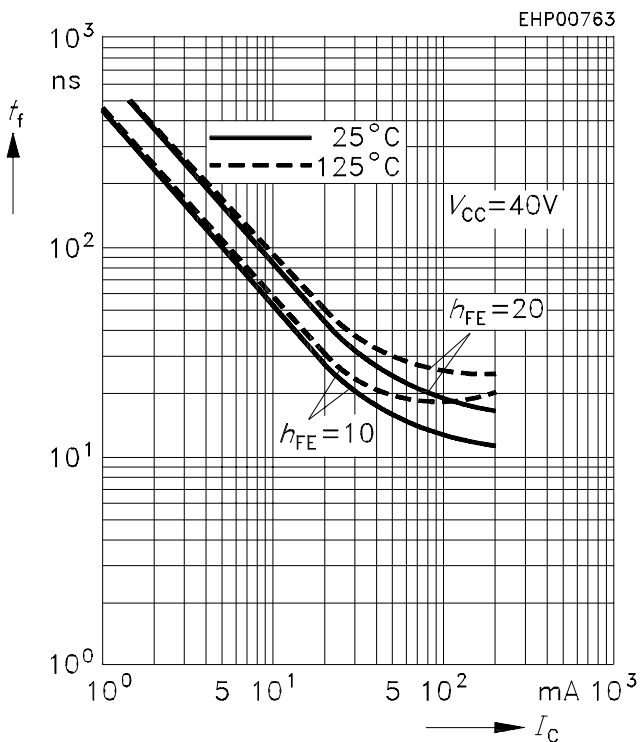
Rise time  $t_r = f(I_C)$



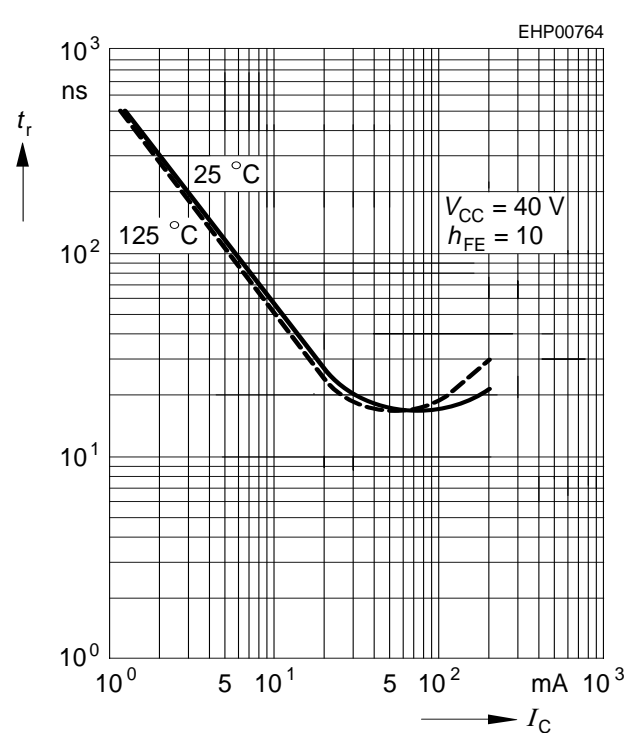
Storage time  $t_{stg} = f(I_C)$



Fall time  $t_f = f(I_C)$



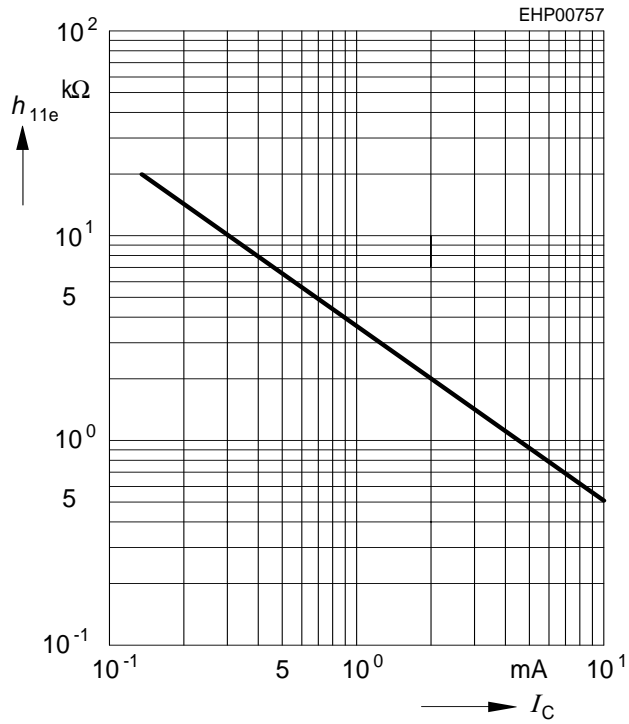
Rise time  $t_r = f(I_C)$



### Input impedance

$$h_{11e} = f(I_C)$$

$$V_{CE} = 10V, f = 1kHz$$



### Open-circuit reverse voltage transfer ratio $h_{12e} = f(I_C)$

$$h_{12e} = f(I_C)$$

$$V_{CE} = 10V, f = 1kHz$$

