



Silizium-NPN-Epitaxial-Planar-Schalttransistoren
Silicon NPN Epitaxial Planar Switching Transistors

Anwendungen: HF-Verstärker und Schalter

Applications: RF amplifiers and switches

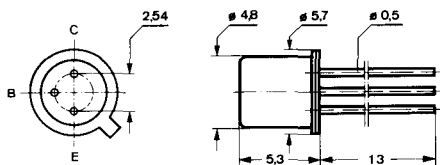
Besondere Merkmale:

- Hohe Sperrspannung
- Hohe Stromverstärkung
- Verlustleistung 1,8 W

Features:

- High reverse current
- High current gain
- Power dissipation 1.8 W

Abmessungen in mm
Dimensions in mm



Kollektor mit Gehäuse verbunden
 Collector connected with case

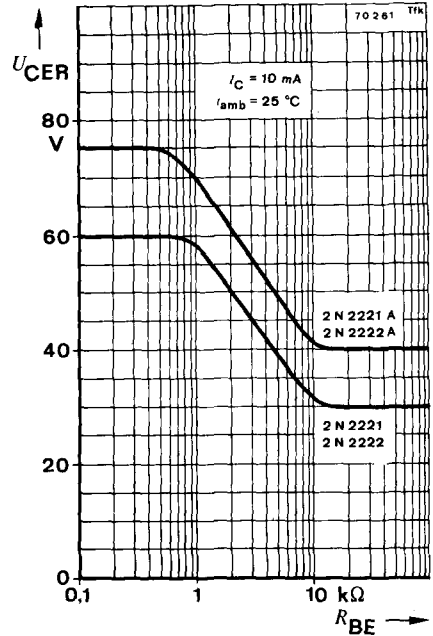
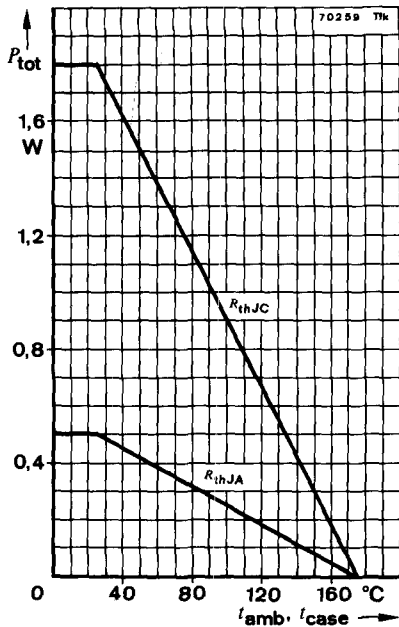
Normgehäuse
 Case
 18 A 3 DIN 41876
 JEDEC TO 18
 Gewicht · Weight
 max. 0,5 g

Absolute Grenzdaten

Absolute maximum ratings

| | | 2 N 2221 2 N 2222 | 2 N 2221 A 2 N 2222 A | |
|--|-----------|----------------------|--------------------------|------------|
| Kollektor-Basis-Sperrspannung Collector-base voltage | U_{CBO} | 60 | 75 | V |
| Kollektor-Emitter-Sperrspannung Collector-emitter voltage | U_{CEO} | 30 | 40 | V |
| Emitter-Basis-Sperrspannung Emitter-base voltage | U_{EBO} | 5 | 6 | V |
| Kollektorstrom Collector current | I_C | 800 | | mA |
| Gesamtverlustleistung Total power dissipation | | | | |
| $t_{amb} \leq 25^\circ C$ | P_{tot} | 500 | | mW |
| $t_{amb} \leq 45^\circ C$ | P_{tot} | 430 | | mW |
| $t_{case} \leq 25^\circ C$ | P_{tot} | 1,8 | | W |
| $t_{case} \leq 45^\circ C$ | P_{tot} | 1,55 | | W |
| Sperrschichttemperatur Junction temperature | t_j | 175 | | $^\circ C$ |
| Lagerungstemperaturbereich Storage temperature range | t_{stg} | -65 ... +200 | | $^\circ C$ |

2 N 2221 · 2 N 2221 A · 2 N 2222 · 2 N 2222 A



Wärmewiderstände Thermal resistances

Sperrschicht-Umgebung
Junction ambient

R_{thJA}

300 °C/W

Sperrschicht-Gehäuse
Junction case

R_{thJC}

84 °C/W

Statische Kenngrößen DC characteristics

$t_{amb} = 25\text{ °C}$, falls nicht anders angegeben
unless otherwise specified

Kollektorreststrom
Collector cut-off current

2 N 2221, 2 N 2222

$U_{CB} = 50\text{ V}$

$I_{CBO}^*)$

10 nA

$U_{CB} = 50\text{ V}, t_{amb} = 150\text{ °C}$

$I_{CBO}^{**})$

10 μA

2 N 2221 A, 2 N 2222 A

$U_{CB} = 60\text{ V}$

$I_{CBO}^*)$

10 nA

$U_{CB} = 60\text{ V}, t_{amb} = 150\text{ °C}$

$I_{CBO}^{**})$

10 μA

$U_{CE} = 60\text{ V}, U_{EB} = 3\text{ V}$

I_{CEV}

10 nA

*) AQL = 0,65%, **) AQL = 2,5%

2 N 2221 · 2 N 2221 A · 2 N 2222 · 2 N 2222 A

| | Min. | Typ. | Max. | |
|--|----------------------|------|------|----|
| Emitterreststrom <i>Emitter cut-off current</i> $U_{EB} = 3 \text{ V}$ | | | | |
| | I_{EBO} | | 10 | nA |
| Kollektor-Basis-Durchbruchspannung <i>Collector-base breakdown voltage</i> $I_C = 10 \mu\text{A}$ | | | | |
| 2 N 2221, 2 N 2222 | $U_{(BR)CBO}^{*)}$ | 60 | | V |
| 2 N 2221 A, 2 N 2222 A | $U_{(BR)CBO}^{*)}$ | 75 | | V |
| Kollektor-Emitter-Durchbruchspannung <i>Collector-emitter breakdown voltage</i> $I_C = 10 \text{ mA}$ | | | | |
| 2 N 2221, 2 N 2222 | $U_{(BR)CEO}^{*)1)}$ | 30 | | V |
| 2 N 2221 A, 2 N 2222 A | $U_{(BR)CEO}^{*)1)}$ | 40 | | V |
| Emitter-Basis-Durchbruchspannung <i>Emitter-base breakdown voltage</i> $I_E = 10 \mu\text{A}$ | | | | |
| 2 N 2221, 2 N 2222 | $U_{(BR)EBO}^{*)}$ | 5 | | V |
| 2 N 2221 A, 2 N 2222 A | $U_{(BR)EBO}^{*)}$ | 6 | | V |
| Kollektor-Sättigungsspannung <i>Collector saturation voltage</i> $I_C = 150 \text{ mA}, I_B = 15 \text{ mA}$ | | | | |
| 2 N 2221, 2 N 2222 | $U_{CEsat}^{1)}$ | | 400 | mV |
| 2 N 2221 A, 2 N 2222 A | $U_{CEsat}^{1)}$ | | 300 | mV |
| $I_C = 500 \text{ mA}, I_B = 50 \text{ mA}$ | | | | |
| 2 N 2221, 2 N 2222 | $U_{CEsat}^{*)1)}$ | | 1,6 | V |
| 2 N 2221 A, 2 N 2222 A | $U_{CEsat}^{*)1)}$ | | 1,0 | V |
| Basis-Sättigungsspannung <i>Base saturation voltage</i> $I_C = 150 \text{ mA}, I_B = 15 \text{ mA}$ | | | | |
| 2 N 2221, 2 N 2222 | $U_{BEsat}^{1)}$ | | 1,3 | V |
| 2 N 2221 A, 2 N 2222 A | $U_{BEsat}^{1)}$ | | 1,2 | V |
| $I_C = 500 \text{ mA}, I_B = 50 \text{ mA}$ | | | | |
| 2 N 2221, 2 N 2222 | $U_{BEsat}^{*)1)}$ | | 2,6 | V |
| 2 N 2221 A, 2 N 2222 A | $U_{BEsat}^{*)1)}$ | | 2,0 | V |

*) AQL = 0,65%, ¹⁾ $\frac{t_p}{T} = 0,01, t_p = 0,3 \text{ ms}$

2 N 2221 · 2 N 2221 A · 2 N 2222 · 2 N 2222 A

| | | Min. | Typ. | Max. |
|--|---|-----------------|------|------|
| Kollektor-Basis-Gleichstromverhältnis DC forward current transfer ratio | | | | |
| $U_{CE} = 10 \text{ V}, I_C = 0,1 \text{ mA}$ | | | | |
| | 2 N 2221, 2 N 2221 A | h_{FE} | 20 | |
| | 2 N 2222, 2 N 2222 A | h_{FE} | 35 | |
| $U_{CE} = 10 \text{ V}, I_C = 1 \text{ mA}$ | | | | |
| | 2 N 2221, 2 N 2221 A | h_{FE} | 25 | |
| | 2 N 2222, 2 N 2222 A | h_{FE} | 50 | |
| $U_{CE} = 10 \text{ V}, I_C = 10 \text{ mA}$ | | | | |
| | 2 N 2221, 2 N 2221 A | h_{FE} | 35 | |
| | 2 N 2222, 2 N 2222 A | h_{FE} | 75 | |
| $U_{CE} = 10 \text{ V}, I_C = 10 \text{ mA}, t_{amb} = -55^\circ\text{C}$ | | | | |
| | 2 N 2221 A | $h_{FE}^{**})$ | 15 | |
| | 2 N 2222 A | $h_{FE}^{**})$ | 35 | |
| $U_{CE} = 10 \text{ V}, I_C = 150 \text{ mA}$ | | | | |
| | 2 N 2221, 2 N 2221 A | $h_{FE}^{*)1})$ | 40 | 120 |
| | 2 N 2222, 2 N 2222 A | $h_{FE}^{*)1})$ | 100 | 300 |
| $U_{CE} = 10 \text{ V}, I_C = 500 \text{ mA}$ | | | | |
| | 2 N 2221 | $h_{FE}^{1})$ | 20 | |
| | 2 N 2221 A | $h_{FE}^{1})$ | 25 | |
| | 2 N 2222 | $h_{FE}^{1})$ | 30 | |
| | 2 N 2222 A | $h_{FE}^{1})$ | 40 | |
| $U_{CE} = 1 \text{ V}, I_C = 150 \text{ mA}$ | | | | |
| | 2 N 2221, 2 N 2221 A | $h_{FE}^{1})$ | 20 | |
| | 2 N 2222, 2 N 2222 A | $h_{FE}^{1})$ | 50 | |
| Dynamische Kenngrößen AC characteristics | | | | |
| $t_{amb} = 25^\circ\text{C}$ | | | | |
| Transitfrequenz Gain bandwidth product | | | | |
| $U_{CE} = 20 \text{ V}, I_C = 20 \text{ mA}, f = 100 \text{ MHz}$ | | | | |
| | 2 N 2221, 2 N 2221 A, 2 N 2222 | f_T | 250 | MHz |
| | 2 N 2222 A | f_T | 300 | MHz |
| Kollektor-Basis-Kapazität Collector-base capacitance | | | | |
| | $U_{CB} = 10 \text{ V}, f = 1 \text{ MHz}$ | C_{CBO} | 8 | pF |
| Emitter-Basis-Kapazität Emitter-base capacitance | | | | |
| | $U_{EB} = 0,5 \text{ V}, f = 1 \text{ MHz}$ | | | |
| | 2 N 2221, 2 N 2222 | C_{EBO} | 30 | pF |
| | 2 N 2221 A, 2 N 2222 A | C_{EBO} | 25 | pF |
| Rauschmaß Noise figure | | | | |
| | $U_{CE} = 10 \text{ V}, I_C = 100 \mu\text{A}, R_G = 1 \text{ k}\Omega,$ $f = 1 \text{ kHz}$ | | | |
| | 2 N 2222 A | F | 4 | dB |

*) AQL = 0,65%, **) AQL = 2,5%, $^{1}) \frac{t_p}{T} = 0,01, t_p = 0,3 \text{ ms}$

2 N 2221 · 2 N 2221 A · 2 N 2222 · 2 N 2222 A

Vierpol Kenngrößen Two port characteristics

Min. Typ. Max.

$t_{amb} = 25^{\circ}\text{C}$

Emitterschaltung 2 N 2221 A, 2 N 2222 A Common emitter configuration

$U_{CE} = 10\text{ V}, I_C = 1\text{ mA}, f = 1\text{ kHz}$

| | | | |
|---|-------------------|-------------------|---------------|
| Kurzschluß-Eingangswiderstand <i>Short circuit input resistance</i> | h_{ie} | 2,2 | k Ω |
| Leerlauf-Spannungsrückwirkung <i>Open circuit reverse voltage transfer ratio</i> | h_{re} | $3 \cdot 10^{-4}$ | |
| Leerlauf-Ausgangsleitwert <i>Open circuit output conductance</i> | h_{oe} | 9 | μS |
| Kurzschluß-Stromverstärkung <i>Short circuit forward current transfer ratio</i> | | | |
| | 2 N 2221 A | h_{fe} | 30 |
| | 2 N 2222 A | h_{fe} | 50 |
| | 2 N 2221 A | h_{fe} | 50 |
| | 2 N 2222 A | h_{fe} | 75 |

| | | | |
|---|-------------------|----------|----|
| $U_{CE} = 10\text{ V}, I_C = 10\text{ mA},$ | | | |
| | 2 N 2221 A | h_{fe} | 30 |
| | 2 N 2222 A | h_{fe} | 50 |
| | 2 N 2221 A | h_{fe} | 50 |
| | 2 N 2222 A | h_{fe} | 75 |

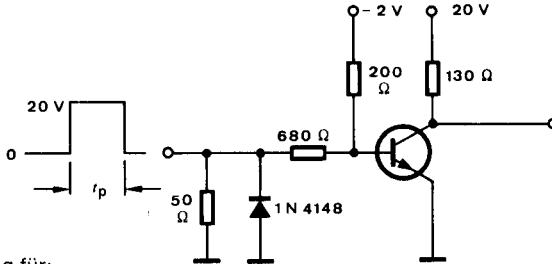
Schaltzeiten Switching characteristics

$I_C = 150\text{ mA}, I_{B1} = -I_{B2} = 15\text{ mA}, t_{amb} = 25^{\circ}\text{C}$

| | | | |
|---------------------------------------|----------------|-----|----|
| Einschaltzeit <i>Turn-on time</i> | | | |
| $R_L = 200\ \Omega$ | $t_{on}^{2)}$ | 25 | ns |
| Ausschaltzeit <i>Turn-off time</i> | | | |
| $R_L = 40\ \Omega$ | $t_{off}^{2)}$ | 150 | ns |

$R_G = 50\ \Omega$
 $t_f = t_r < 15\text{ ns}$
 $\frac{t_p}{T} = 0,01$
 $t_p = 0,2\ \mu\text{s}$

75 12 5 6

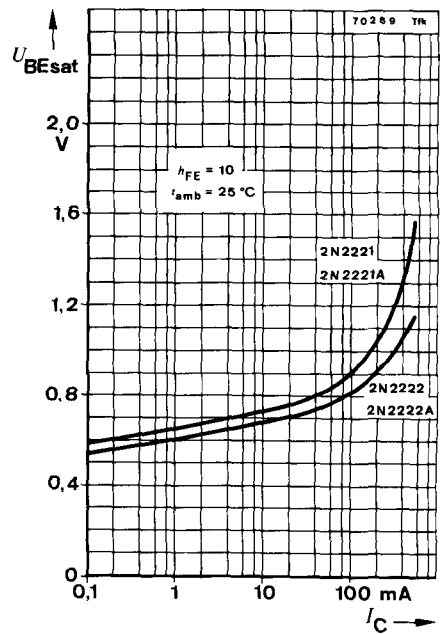
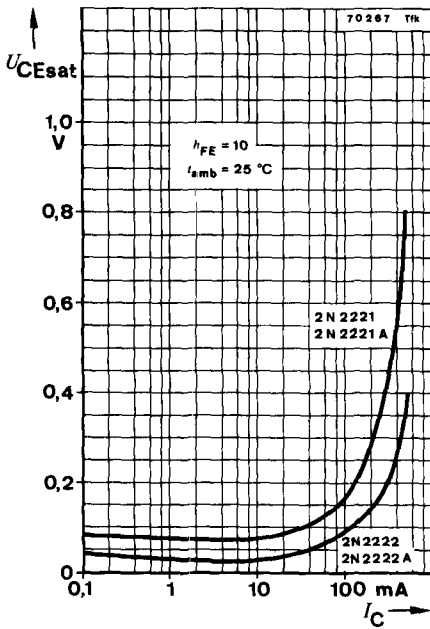
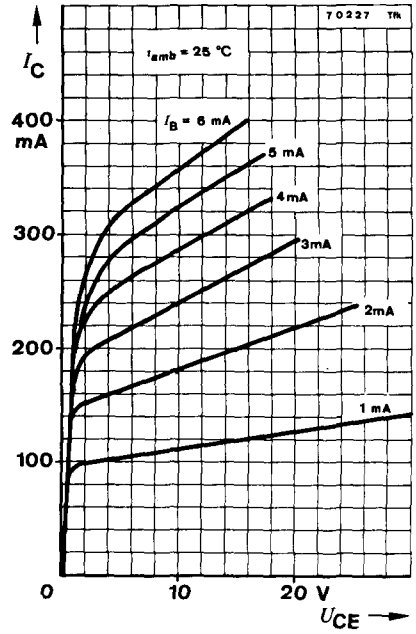
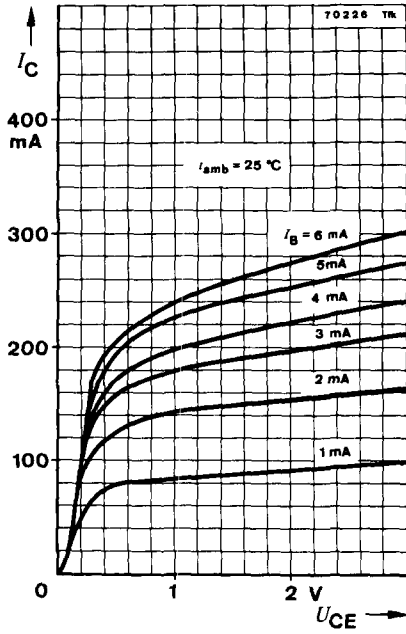


Oszilloskop:
Oscilloscope:
 $R_i \geq 100\text{ k}\Omega$

Meßschaltung für:
Test circuit for: t_{on}, t_{off}

²⁾ siehe Meßschaltung
see test circuit

2 N 2221 · 2 N 2221 A · 2 N 2222 · 2 N 2222 A



2 N 2221 · 2 N 2221 A · 2 N 2222 · 2 N 2222 A

