

## PNP Germanium Transistors

SIEMENS AKTIENGESELLSCHAFT

C 04035

D

AC 151  
AC 151 r

T-29-11

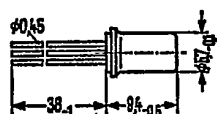
for AF input and driver stages of medium performance

AC 151 and AC 151 r are alloyed germanium PNP transistors in 1A 3 DIN 41871 case (similar to TO-1).

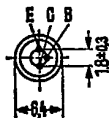
The leads of these transistors are electrically insulated from the case. The collector terminal is marked by a red dot at the rim of the case. A fixing part (heat sink<sup>1)</sup>) is provided for fixing on the chassis; it has to be ordered separately.

Not for new design

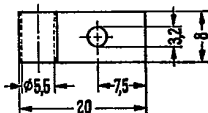
| Type       | Ordering code  |
|------------|----------------|
| AC 151 IV  | Q60103-X151-D  |
| AC 151 rIV | Q60103-X151-D1 |
| AC 151 V   | Q60103-X151-E  |
| AC 151 rV  | Q60103-X151-E1 |
| AC 151 VI  | Q60103-X151-F  |
| AC 151 rVI | Q60103-X151-F1 |
| AC 151 VII | Q60103-X151-G  |
| Heat sink  | Q62901-B1      |



Approx. weight 1 g



Dimensions in mm



Approx. weight 2 g

## Maximum ratings

|                                                     | AC 151<br>AC 151 r |    |
|-----------------------------------------------------|--------------------|----|
| Collector-emitter voltage                           | 24                 | V  |
| Collector-emitter voltage<br>( $V_{BE} \geq 0.2$ V) | 32                 | V  |
| Collector-base voltage                              | 32                 | V  |
| Emitter-base voltage                                | 10                 | V  |
| Collector current                                   | 200                | mA |
| Base current                                        | 40                 | mA |
| Junction temperature                                | 90                 | °C |
| Storage temperature range                           | -55 to +75         | °C |
| Total power dissipation                             | 900                | mW |

## Thermal resistance

|                         |            |            |     |
|-------------------------|------------|------------|-----|
| Junction to ambient air | $R_{thJA}$ | $\leq 300$ | K/W |
| Junction to case        | $R_{thJC}$ | $\leq 50$  | K/W |

1) Thermal resistance between transistor case and heat sink below the fixing screw at careful mounting:  $R_{th} \leq 10$  K/W

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**Static characteristics** ( $T_{\text{amb}} = 25^\circ\text{C}$ )<sup>3)</sup>

Collector-emitter saturation voltage

( $-I_C = 200\text{ mA}$ ;  $h_{FE} = 20$ )

Collector-emitter saturation voltage

Collector cutoff current ( $V_{CBO} = 10\text{ V}$ )Collector cutoff current ( $V_{CBO} = 32\text{ V}$ )Collector cutoff current ( $-V_{CEV} = 32\text{ V}$ ;( $V_{BE} \geq 0.2\text{ V}$ )Emitter cutoff current ( $-V_{EBO} = 10\text{ V}$ )

|                            | AC 151<br>AC 151 r        |               |
|----------------------------|---------------------------|---------------|
| $-V_{CEsat}$ <sup>1)</sup> | 0.13 (<0.22)              | V             |
| $-V_{CEsat}$               | 0.25 (<0.4) <sup>2)</sup> | V             |
| $-I_{CBO}$                 | <10                       | $\mu\text{A}$ |
| $-I_{CBO}$                 | 6 (<25)                   | $\mu\text{A}$ |
| $-I_{CEV}$                 | 6 (<25)                   | $\mu\text{A}$ |
| $-I_{EBO}$                 | 4 (<25)                   | $\mu\text{A}$ |

**Dynamic characteristics** ( $T_{\text{amb}} = 25^\circ\text{C}$ )

Cutoff frequency

( $-I_C = 1\text{ mA}$ ;  $-V_{CE} = 5\text{ V}$ )

Transition frequency

Base intrinsic resistance

Collector-junction capacitance

Noise figure ( $-I_C = 0.5\text{ mA}$ ;  $-V_{CE} = 5\text{ V}$ ; $f = 200\text{ Hz}$ ;  $R_g = 500\ \Omega$ ;  $f = 1\text{ kHz}$ )

|           | AC 151  | AC 151 r |          |
|-----------|---------|----------|----------|
| $f_{hfe}$ | 15      | 15       | kHz      |
| $f_T$     | 1.5     | 1.5      | MHz      |
| $r_{bb'}$ | 75      | 75       | $\Omega$ |
| $C_{b'e}$ | 27      | 27       | pF       |
| NF        | 4 (<10) | 3 (<6)   | dB       |

The transistors AC 151 and AC 151r are grouped according to the small signal current gain  $h_{fe}$  and marked by Roman numerals.

Operating point: ( $-I_C = 2\text{ mA}$ ;  $-V_{CE} = 1\text{ V}$ ;  $f = 1\text{ kHz}$ )

| $h_{fe}$ group | IV                | V                | VI               | VII              |               |
|----------------|-------------------|------------------|------------------|------------------|---------------|
| Type           | AC 151 r          | AC 151 r         | AC 151 r         | —                |               |
|                | AC 151            | AC 151           | AC 151           | AC 151           |               |
| $h_{11e}$      | 0.75 (0.4 to 1.3) | 1.2 (0.6 to 2.1) | 1.8 (1.0 to 3.2) | 2.7 (1.7 to 5.3) | k $\Omega$    |
| $h_{12e}$      | 9 (<20)           | 13 (<25)         | 16 (<28)         | 19 (<30)         | $10^{-4}$     |
| $h_{21e}$      | 45 (30 to 60)     | 75 (50 to 100)   | 110 (75 to 150)  | 170 (125 to 250) | —             |
| $h_{22e}$      | 100 (<200)        | 140 (<250)       | 160 (<280)       | 160 (<300)       | $\mu\text{S}$ |

1) The transistor is overloaded to such a degree that the DC current gain decreases to  $h_{FE} = 20$ .

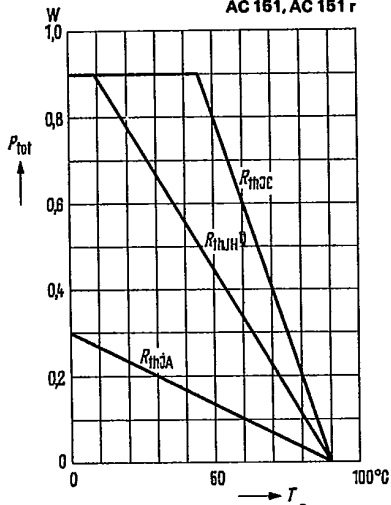
2) ( $-I_C = 200\text{ mA}$  for the characteristic which, at a constant base current, intersects the operating point, where  $-I_C = 200\text{ mA}$ ;  $-V_{CE} = 0.5\text{ V}$ )

3) See also next page

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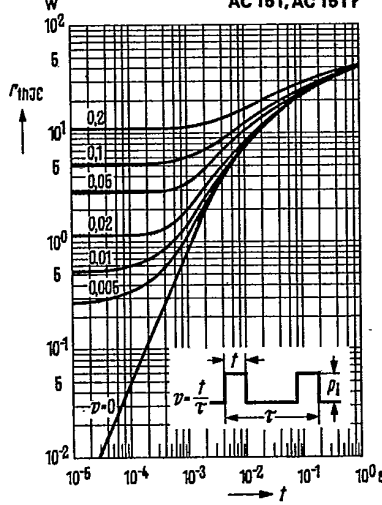
Total perm. power dissipation  
versus temperature  
 $P_{tot} = f(T)$ ;  $R_{th}$  = parameter

AC 151, AC 151 r


1) Heat sink: aluminum 12.5 cm<sup>2</sup> x 2 mm

Permissible pulse load  
 $r_{thJC} = f(t)$ ;  $v =$  parameter

AC 151, AC 151 r

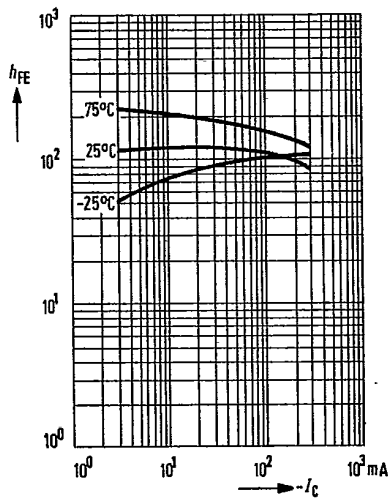


Static characteristics ( $T_{amb} = 25^\circ\text{C}$ )  
 $-V_{CE} = 0.5\text{ V}$

| Type         | AC 151, 151 r |                       |                     |  |
|--------------|---------------|-----------------------|---------------------|--|
| $-I_C$<br>mA | $-I_B$<br>mA  | $h_{FE}$<br>$I_C/I_B$ | $-V_{BE}$<br>V      |  |
| 2            | 0,043         | 47                    | 0,125<br>( $<0,2$ ) |  |
| 10           | 0,2           | 50                    | 0,18<br>( $<0,3$ )  |  |
| 50           | —             | —                     | —                   |  |
| 100          | 2,222         | 45                    | 0,32<br>( $<0,55$ ) |  |
| 200          | 5             | 40                    | 0,39<br>( $<0,7$ )  |  |

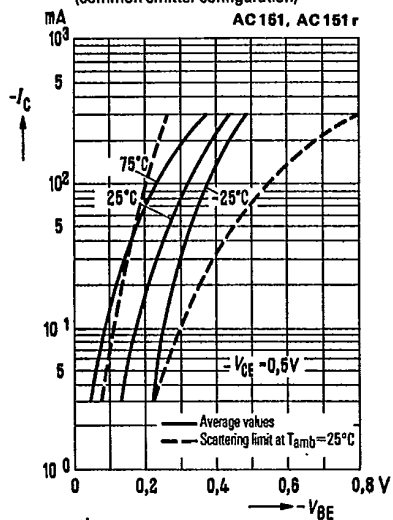
DC current gain  $h_{FE} = f(I_C)$   
 $-V_{CE} = 0.5\text{ V}$ ;  $T_{amb} =$  parameter  
(common emitter configuration)

AC 151, AC 151 r

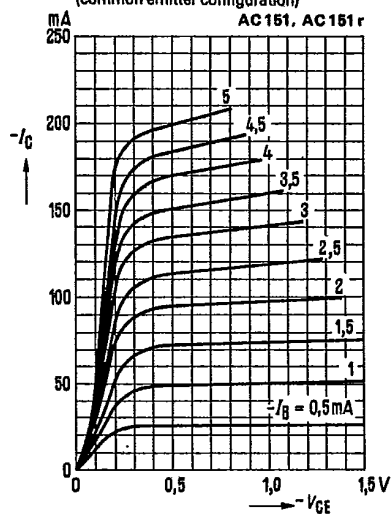


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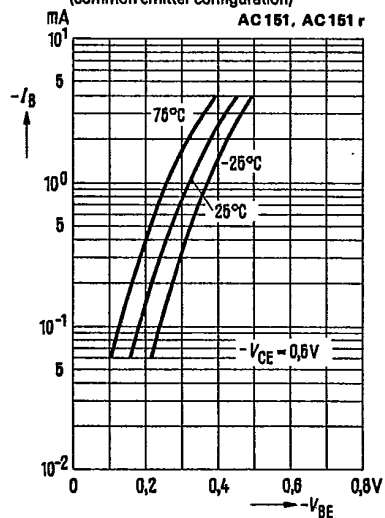
Collector current  $I_C = f(V_{BE})$   
 $-V_{CE} = 0.5 \text{ V}; T_{amb} = \text{parameter}$   
 (common emitter configuration)



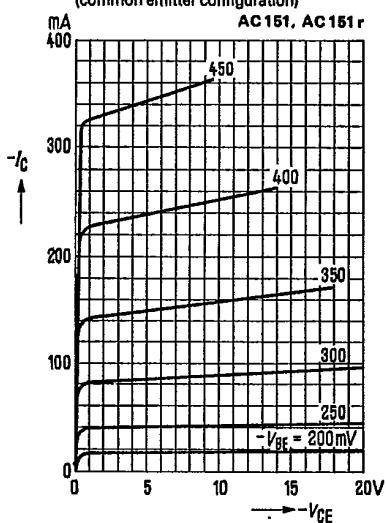
Output characteristics  
 $I_C = f(V_{CE}); I_B = \text{parameter}$   
 (common emitter configuration)



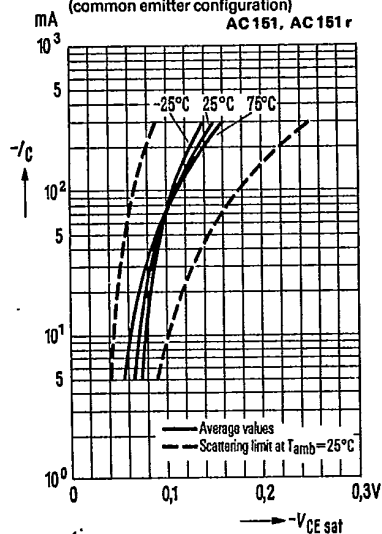
Input characteristics  $I_B = f(V_{BE})$   
 $-V_{CE} = 0.5 \text{ V}; T_{amb} = \text{parameter}$   
 (common emitter configuration)



Output characteristics  
 $I_C = f(V_{CE}); V_{BE} = \text{parameter}$   
 (common emitter configuration)



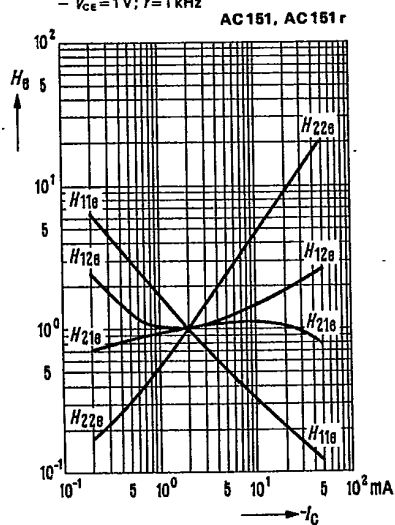
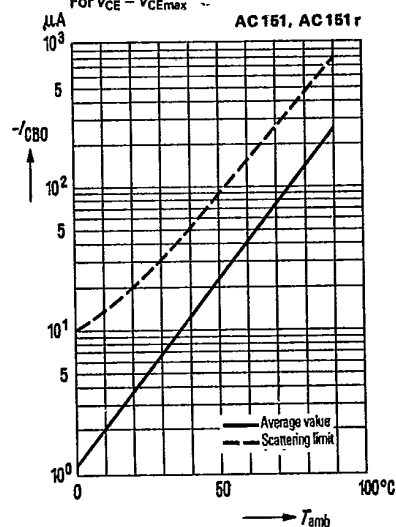
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Collector-emitter saturation voltage  
 $V_{CEsat} = f(I_C); h_{FE} = 20$   
(common emitter configuration)

h-parameter versus collector current

$$H_e = \frac{h_e(I_C)}{h_e(I_C = -2\text{ mA})} = f(I_C)$$

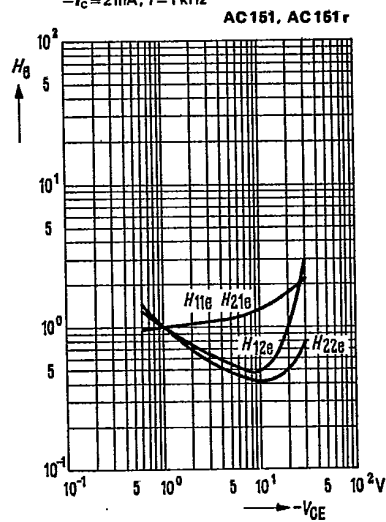
—  $V_{CE} = 1\text{ V}; f = 1\text{ kHz}$

Collector cutoff current versus  
temperature  $I_{CBO} = f(T_{amb})$   
For  $V_{CE} = V_{CEmax}$ 

h-parameter versus collector-emitter voltage

$$H_e = \frac{h_e(V_{CE})}{h_e(V_{CE} = -1\text{ V})} = f(V_{CE})$$

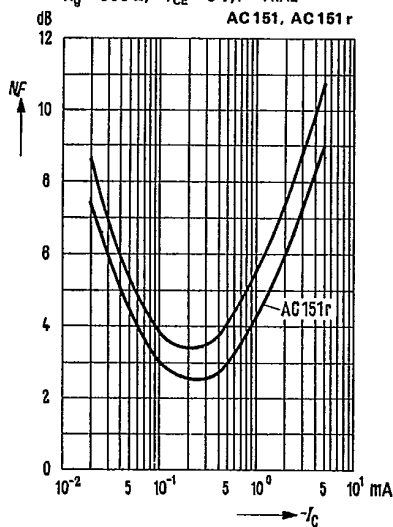
—  $I_C = 2\text{ mA}; f = 1\text{ kHz}$



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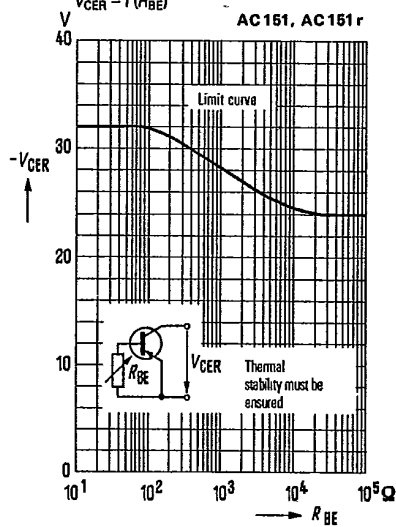
Noise figure versus  
collector current  $NF = f(I_C)$   
 $R_g = 500 \Omega$ ;  $-V_{CE} = 5 \text{ V}$ ;  $f = 1 \text{ kHz}$

AC 151, AC 151 r



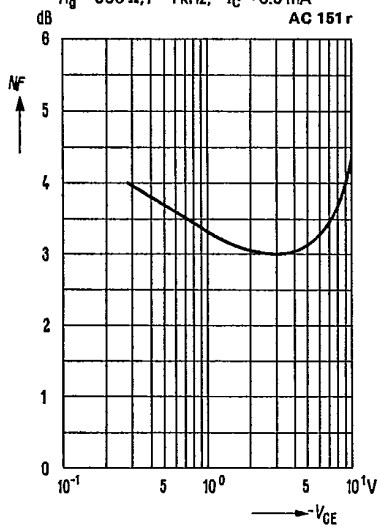
Collector-emitter voltage  
 $V_{CE} = f(R_{BE})$

AC 151, AC 151 r



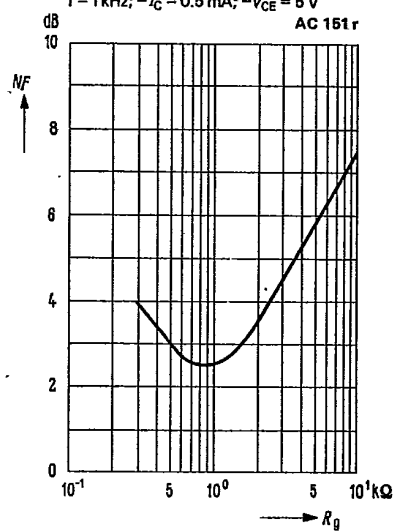
Noise figure versus collector-emitter  
voltage  $NF = f(V_{CE})$   
 $R_g = 500 \Omega$ ;  $f = 1 \text{ kHz}$ ;  $-I_C = 0.5 \text{ mA}$

AC 151 r



Noise figure versus internal resistance  
of generator  $NF = f(R_g)$   
 $f = 1 \text{ kHz}$ ;  $-I_C = 0.5 \text{ mA}$ ;  $-V_{CE} = 5 \text{ V}$

AC 151 r



1516

C-13