PNP Germanium Transistors

SIEMENS AKTIENGESELLSCHAF C 04035 D
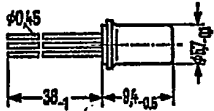
AC 151
AC 151 r

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[1]) is provided for fixing on the chassis; it has to be ordered separately.
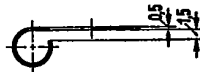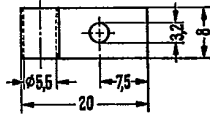
Type	Ordering code
AC 151 IV	Q60103-X151-D
AC 151 rIV	Q60103-X151-D1
AC 151 V	Q60103-X151-E
AC 151 rV	Q60103-X151-E1
AC 151 VI	Q60103-X151-F
AC 151 rVI	Q60103-X151-F1
AC 151 VII	Q60103-X151-G
Heat sink	Q62901-B1

Approx. weight 1 g
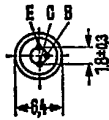
Dimensions in mm

Approx. weight 2 g

Maximum ratings

		AC 151 AC 151 r	
Collector-emitter voltage	$-V_{CEO}$	24	V
Collector-emitter voltage ($V_{BE} \geq 0.2$ V)	$-V_{CEV}$	32	V
Collector-base voltage	$-V_{CBO}$	32	V
Emitter-base voltage	$-V_{EBO}$	10	V
Collector current	$-I_C$	200	mA
Base current	$-I_B$	40	mA
Junction temperature	T_j	90	°C
Storage temperature range	T_{stg}	−55 to +75	°C
Total power dissipation	P_{tot}	900	mW

Thermal resistance

Junction to ambient air	R_{thJA}	≤ 300	K/W
Junction to case	R_{thJC}	≤ 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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AC 151
AC 151 r

Static characteristics (T_{amb} = 25 °C)[3]		AC 151 AC 151 r	
Collector-emitter saturation voltage ($-I_C$ = 200 mA; h_{FE} = 20)	$-V_{CEsat}$[1]	0.13 (<0.22)	V
Collector-emitter saturation voltage	$-V_{CEsat}$	0.25 (<0.4)[2]	V
Collector cutoff current (V_{CBO} = 10 V)	$-I_{CBO}$	<10	µA
Collector cutoff current (V_{CBO} = 32 V)	$-I_{CBO}$	6 (<25)	µA
Collector cutoff current ($-V_{CEV}$ = 32 V); ($V_{BE}\geq0.2$ V)	$-I_{CEV}$	6 (<25)	µA
Emitter cutoff current ($-V_{EBO}$ = 10 V)	$-I_{EBO}$	4 (<25)	µA

Dynamic characteristics (T_{amb} = 25 °C)		AC 151	AC 151r	
Cutoff frequency ($-I_C$ = 1 mA; $-V_{CE}$ = 5 V)	f_{hfe}	15	15	kHz
Transition frequency	f_T	1.5	1.5	MHz
Base intrinsic resistance	$r_{bb'}$	75	75	Ω
Collector-junction capacitance	$C_{b'e}$	27	27	pF
Noise figure ($-I_C$ = 0.5 mA; $-V_{CE}$ = 5 V; f = 200 Hz; R_g = 500 Ω; f = 1 kHz)	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.
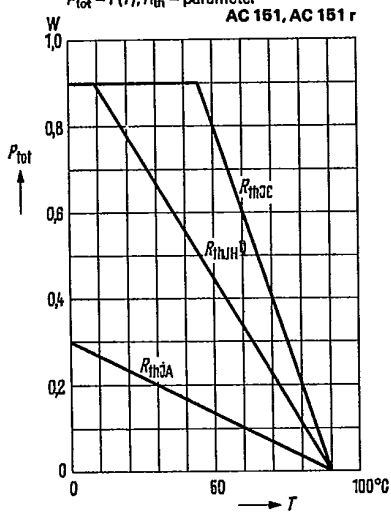
Operating point: ($-I_C$ = 2 mA; $-V_{CE}$ = 1 V; f = 1 kHz)

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)	kΩ
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)	µS

1) The transistor is overloaded to such a degree that the DC current gain decreases to h_{FE} = 20.
2) ($-I_C$ = 200 mA for the characteristic which, at a constant base current, intersects the operating point, where $-I_C$ = 200 mA; $-V_{CE}$ = 0.5 V)
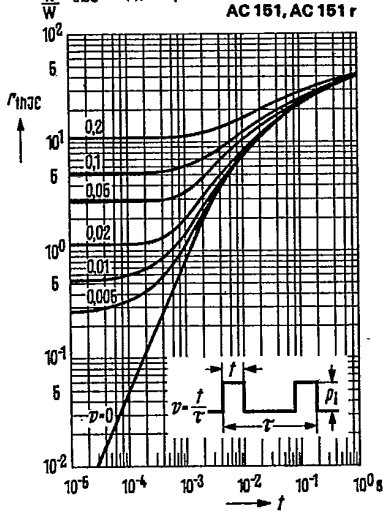3) See also next page

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AC 151
AC 151 r

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^2 x 2 mm

Permissible pulse load
$\frac{K}{W}$ $r_{thJC} = f(t)$; v = parameter
AC 151, AC 151 r

DC current gain $h_{FE} = f(I_C)$
$-V_{CE} = 0.5$ V; T_{amb} = parameter
(common emitter configuration)
AC 151, AC 151 r

Static characteristics ($T_{amb} = 25\,°C$)
$-V_{CE} = 0.5$ V

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

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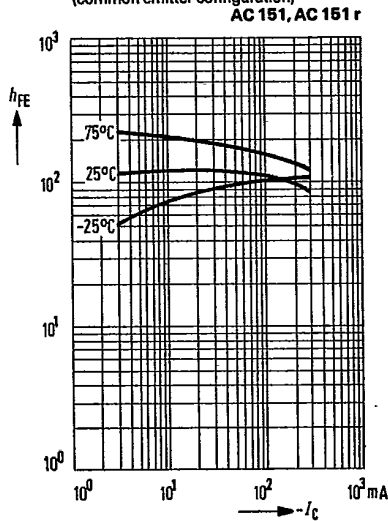
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Collector current $I_C = f(V_{BE})$
$-V_{CE} = 0.5$ V; T_{amb} = parameter
(common emitter configuration)

AC 151, AC 151 r

mA

$-I_C$

$= V_{CE} = 0.5$ V

— Average values
--- Scattering limit at $T_{amb} = 25°C$

75°C
25°C
−25°C

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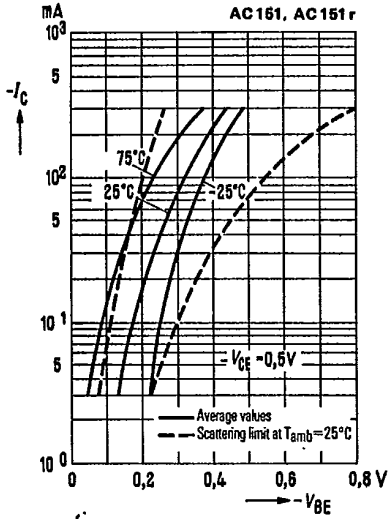
Output characteristics
$I_C = f(V_{CE})$; I_B = parameter
(common emitter configuration)

AC 151, AC 151 r

mA
250

$-I_C$

5
4,5
4
3,5
3
2,5
2
1,5
1
$-I_B = 0.5$ mA

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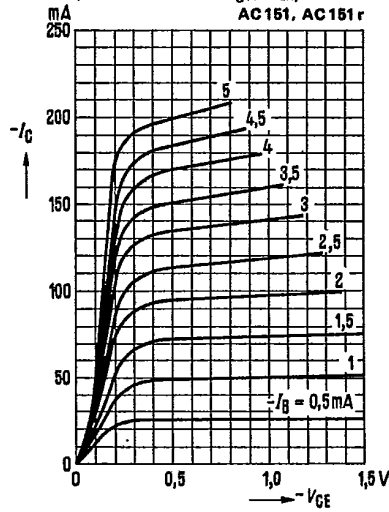
Input characteristics $I_B = f(V_{BE})$
$-V_{CE} = 0.5$ V; T_{amb} = parameter
(common emitter configuration)

AC 151, AC 151 r

mA

$-I_B$

75°C
−25°C
25°C

$-V_{CE} = 0.5$ V

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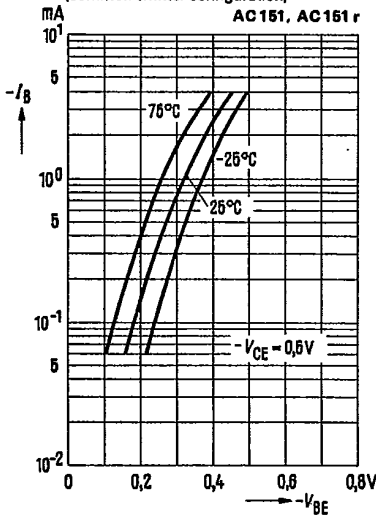
Output characteristics
$I_C = f(V_{CE})$; V_{BE} = parameter
(common emitter configuration)

AC 151, AC 151 r

mA
400

$-I_C$
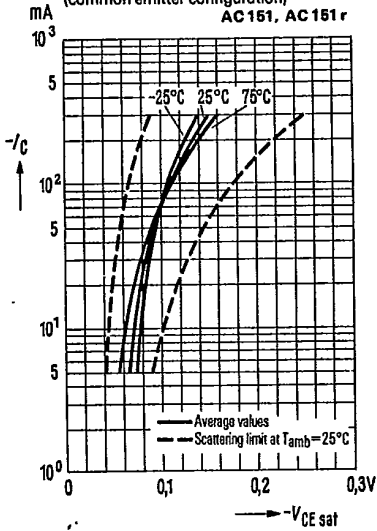
450
400
350
300
250
$-V_{BE} = 200$ mV

$-V_{CE}$

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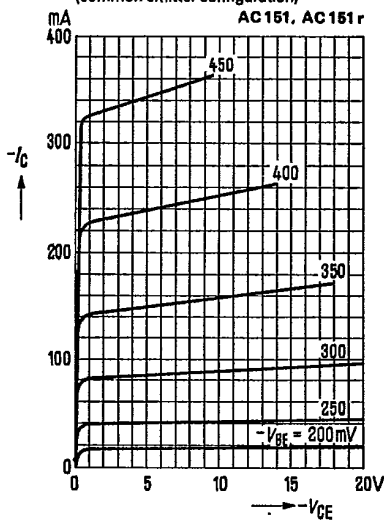
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Collector-emitter saturation voltage
$V_{CEsat} = f(I_C); h_{FE} = 20$
(common emitter configuration)

AC 151, AC 151 r

mA
$-I_C$

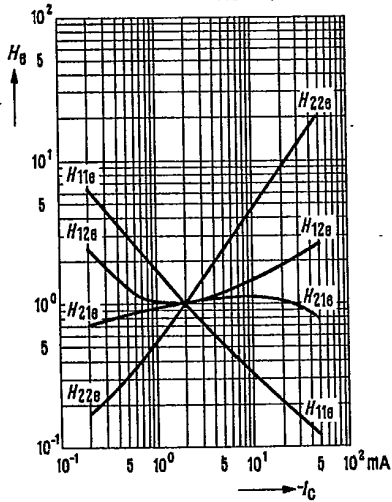— Average values
- - - Scattering limit at $T_{amb} = 25°C$

$-V_{CE\,sat}$

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

μA
$-I_{CBO}$

AC 151, AC 151 r

— Average value
- - - Scattering limit

T_{amb}

h-parameter versus collector current
$$H_e = \frac{h_e(I_C)}{h_e(I_C = -2\,mA)} = f(I_C)$$
$-V_{CE} = 1\,V; f = 1\,kHz$

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H_e

H_{22e}
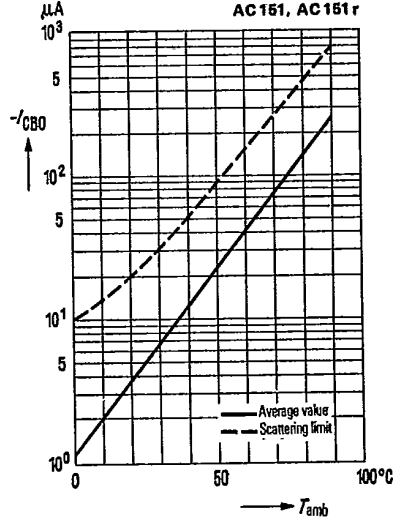H_{11e}
H_{12e}
H_{12e}
H_{21e}
H_{21e}
H_{22e}
H_{11e}

$-I_C$

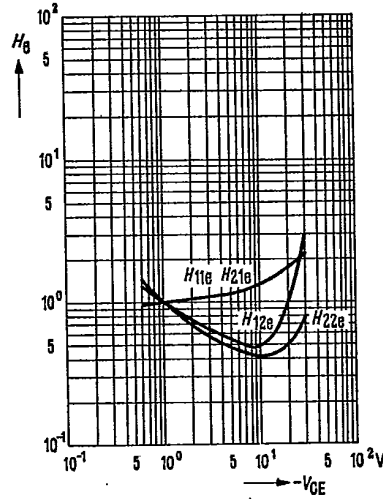**h-parameter versus collector-emitter voltage**
$$H_e = \frac{h_e(V_{CE})}{h_e(V_{CE} = -1\,V)} = f(V_{CE})$$
$-I_C = 2\,mA; f = 1\,kHz$
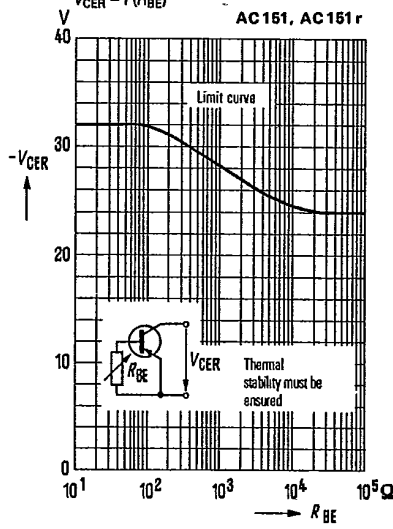
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H_e

H_{11e} H_{21e}
H_{12e} H_{22e}

$-V_{CE}$

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25C D ■■ 8235605 0004040 2 ■■SIEG
04040   D

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AC 151
AC 151 r

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

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

AC 151, AC 151 r

Limit curve

Thermal stability must be ensured
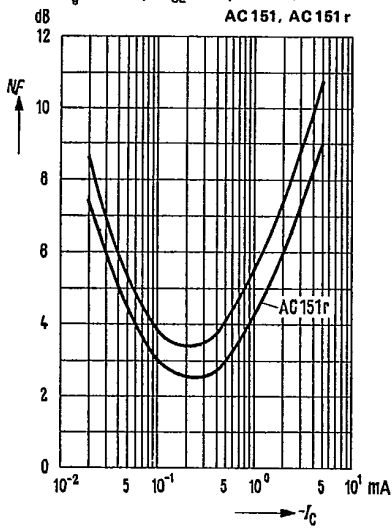
Noise figure versus collector-emitter
voltage $NF = f(V_{CE})$
$R_g = 500\,\Omega; f = 1\,kHz; -I_C = 0.5\,mA$

AC 151 r
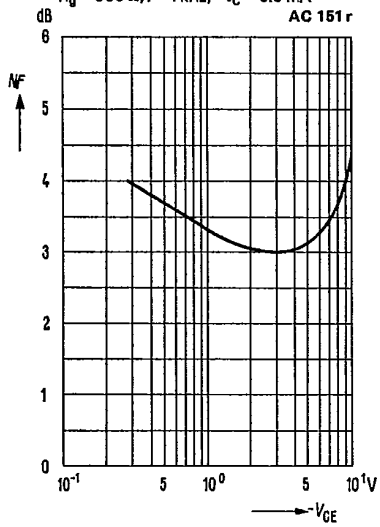
Noise figure versus internal resistance
of generator $NF = f(R_g)$:
$f = 1\,kHz; -I_C = 0.5\,mA; -V_{CE} = 5\,V$

AC 151 r

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