

COMPONENTI
ELETTRONICI E MATERIALI
PHILIPS

DATI TECNICI

sezione ELCOMA - Rep. Microelettronica

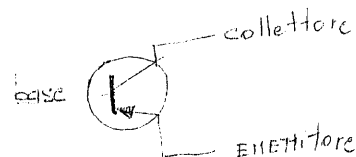
S1 a

**TRANSISTORI AL GERMANIO E
AL SILICIO PER RADIO E TV**

PHILIPS S.p.A. - Sez. ELCOMA - Piazza IV Novembre, 3 - MILANO - Tel. 69.94

P.M.P = tensione negativa di collettore

M.P.M = tensione positiva di collettore



S1 a

**TRANSISTORI AL GERMANIO E
AL SILICIO PER RADIO E TV**

PHILIPS S.p.A. - Sez. ELCOMA - Piazza IV Novembre, 3 - MILANO - Tel. 69.94

Letter symbol	Definition	
y_{ob}, y_{oe}	Output admittance	} Input short circuited to a.c.
g_{ob}, g_{oe}	Output conductance	
C_{ob}, C_{oe}	Output capacitance	
$\varphi_{ob}, \varphi_{oe}$	Phase angle of output admittance	
y_{rb}, y_{re}	Feedback admittance	} Input short circuited to a.c.
g_{rb}, g_{re}	Feedback conductance	
C_{rb}, C_{re}	Feedback capacitance	
$\varphi_{rb}, \varphi_{re}$	Phase angle of feedback admittance	

TRANSISTORI AL GERMANIO
PER BASSA FREQUENZA E
IMPIEGHI GENERALI

GERMANIUM ALLOY TRANSISTOR

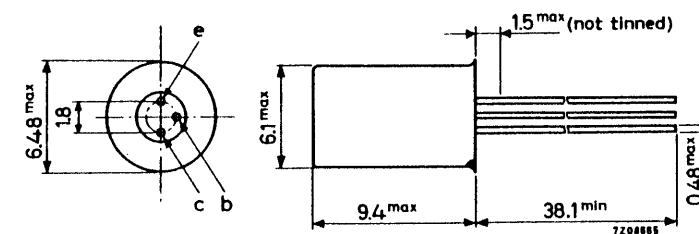
P-N-P transistor in a TO-1 metal envelope intended for use in pre-amplifier or driver stages.

QUICK REFERENCE DATA		
Collector-base voltage (open emitter)	$-V_{CBO}$	max. 32 V
Collector-emitter voltage (open base)	$-V_{CEO}$	max. 12 V
Collector current (d. c.)	$-I_C$	max. 100 mA
Total power dissipation up to $T_{amb} = 45^\circ\text{C}$ with cooling fin No. 56227 on a heatsink of at least 12.5 cm^2	P_{tot}	max. 500 mW
Junction temperature	T_j	max. 90°C
D. C. current gain at $T_{amb} = 25^\circ\text{C}$ $-I_C = 2\text{ mA}$; $-V_{CE} = 5\text{ V}$	h_{FE}	> 50 typ. 100
Small signal current gain at $T_{amb} = 25^\circ\text{C}$ $I_E = 2\text{ mA}$; $-V_{CB} = 5\text{ V}$; $f = 1\text{ kHz}$	h_{fe}	typ. 125 80 to 170
Transition frequency $-I_C = 10\text{ mA}$; $-V_{CE} = 2\text{ V}$	f_T	typ. 1.7 MHz

MECHANICAL DATA

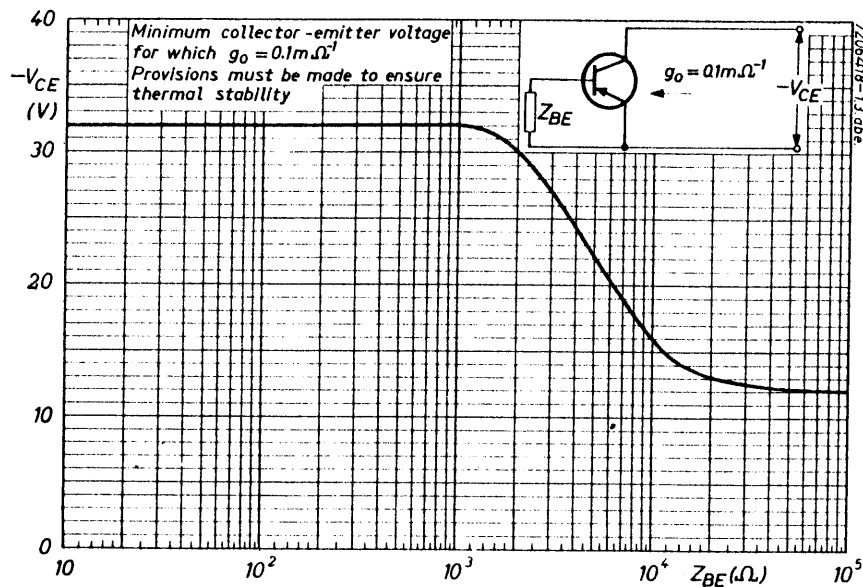
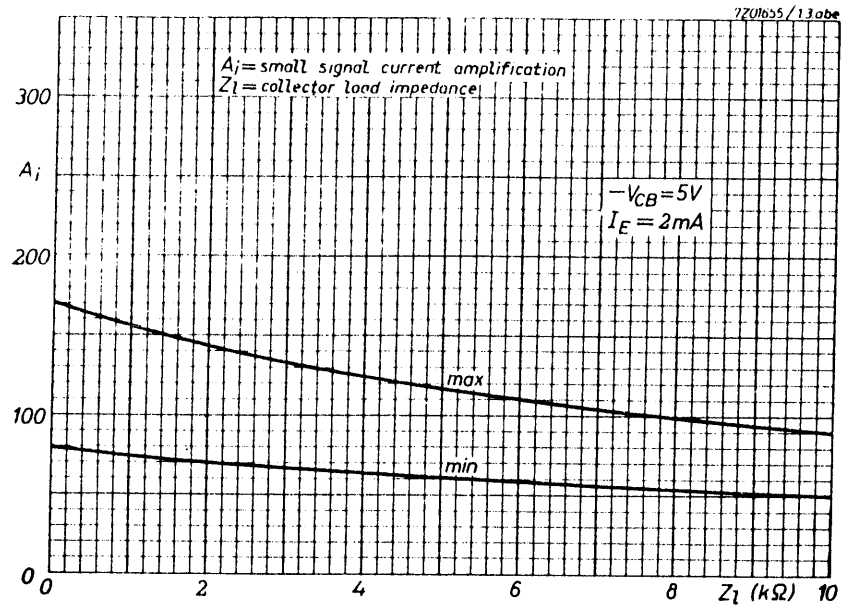
Dimensions in mm

TO-1



The coloured dot indicates the collector

Accessories available: 56200, 56208, 56209, 56210, 56226, 56227



GERMANIUM ALLOY TRANSISTOR

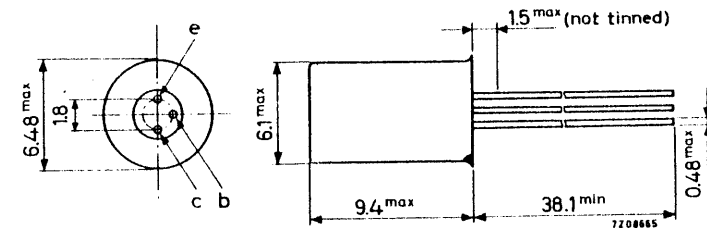
P-N-P transistor in a TO-1 metal envelope intended for use in pre-amplifier or driver stages.

QUICK REFERENCE DATA		
Collector-base voltage (open emitter)	$-V_{CBO}$	max. 32 V
Collector-emitter voltage (open base)	$-V_{CEO}$	max. 12 V
Collector current (d. c.)	$-I_C$	max. 100 mA
Total power dissipation up to $T_{amb} = 45^\circ C$ with cooling fin No. 56227 on a heatsink of at least 12.5 cm^2	P_{tot}	max. 500 mW
Junction temperature	T_j	max. $90^\circ C$
D. C. current gain at $T_{amb} = 25^\circ C$ $-I_C = 2\text{ mA}; -V_{CE} = 5\text{ V}$	h_{FE}	> 65 typ. 140
Small signal current gain at $T_{amb} = 25^\circ C$ $I_E = 2\text{ mA}; -V_{CB} = 5\text{ V}; f = 1\text{ kHz}$	h_{fe}	typ. 180 130 to 300
Transition frequency $-I_C = 10\text{ mA}; -V_{CE} = 2\text{ V}$	f_T	typ. 2.3 MHz

MECHANICAL DATA

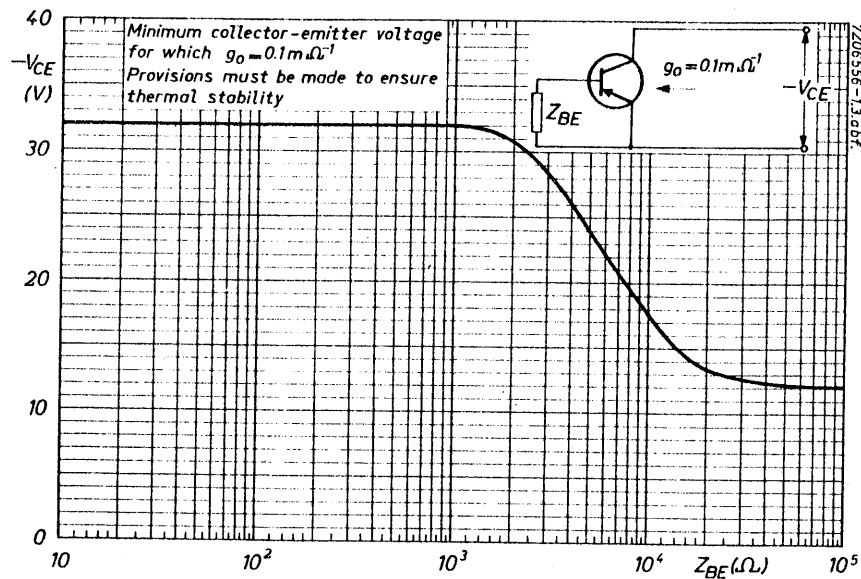
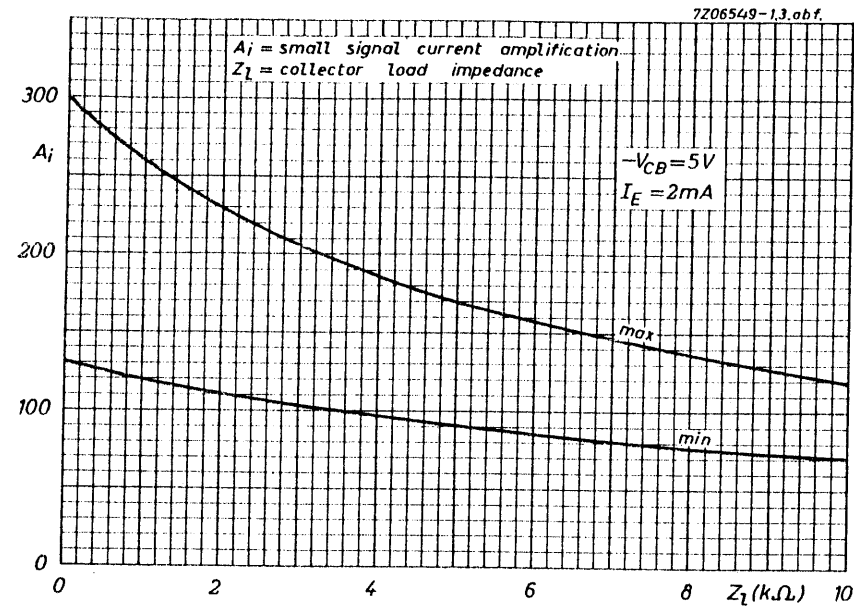
Dimensions in mm

TO-1



The coloured dot indicates the collector

Accessories available: 56200, 56208, 56209, 56210, 56226, 56227



GERMANIUM ALLOY TRANSISTOR

N-P-N transistor in a TO-1 metal envelope intended for use together with the p-n-p transistors AC128 or AC132 as matched pair in class B output or driver stages with complementary symmetry.

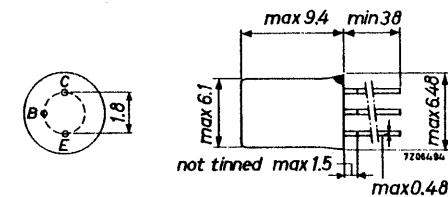
QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max. 32 V
Collector-emitter voltage (open base)	V_{CEO}	max. 12 V
Collector current (d.c.)	I_C	max. 500 mA
Total power dissipation up to $T_{amb} = 45^\circ C$ with cooling fin on a heatsink of at least 12.5 cm^2	P_{tot}	max. 340 mW
Junction temperature (incidentally)	T_j	max. 100 °C
D.C. current gain at $T_{amb} = 25^\circ C$	h_{FE}	typ. 100
$I_C = 20\text{ mA}; V_{CB} = 0$		
Transition frequency	f_T	typ. 2.5 MHz
$I_C = 10\text{ mA}; V_{CB} = 2\text{ V}$		

MECHANICAL DATA

Dimensions in mm

TO-1



The blue dot indicates the collector

Accessories see page 4

723 1116

GERMANIUM ALLOY TRANSISTOR

P-N-P transistor in a TO-1 metal envelope intended for use in class A or class B output stages with battery voltages up to 14 V and an output power of up to 4 W. Type 2-AC128 consists of 2 transistors AC128 selected for operation in a low distortion class B amplifier.

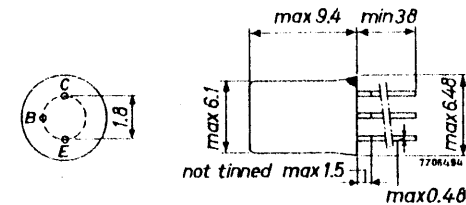
QUICK REFERENCE DATA

Collector-base voltage (open emitter)	$-V_{CB0}$	max. 32 V
Collector-emitter voltage (open base)	$-V_{CE0}$	max. 16 V
Collector current (d.c.)	$-I_C$	max. 1 A
Total power dissipation up to $T_{amb} = 25^\circ C$ with cooling fin on a heatsink of at least 12.5 cm^2	P_{tot}	max. 1 W
Junction temperature (incidentally)	T_j	max. 100 $^\circ C$
D.C. current gain at $T_{amb} = 25^\circ C$ $-I_C = 50\text{ mA}; V_{CB} = 0$	h_{FE}	typ. 90 55 to 175
Transition frequency $-I_C = 10\text{ mA}; -V_{CE} = 2\text{ V}$	f_T	typ. 1.5 MHz

MECHANICAL DATA

Dimensions in mm

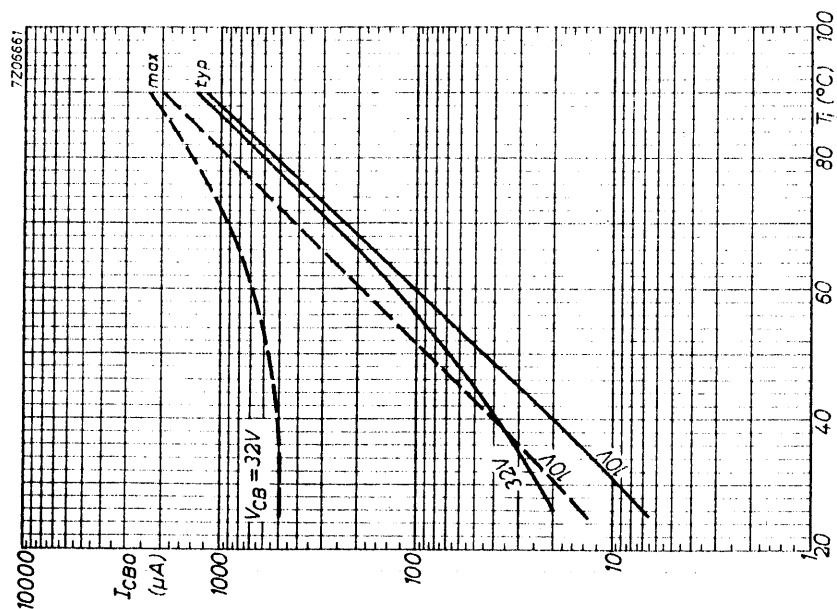
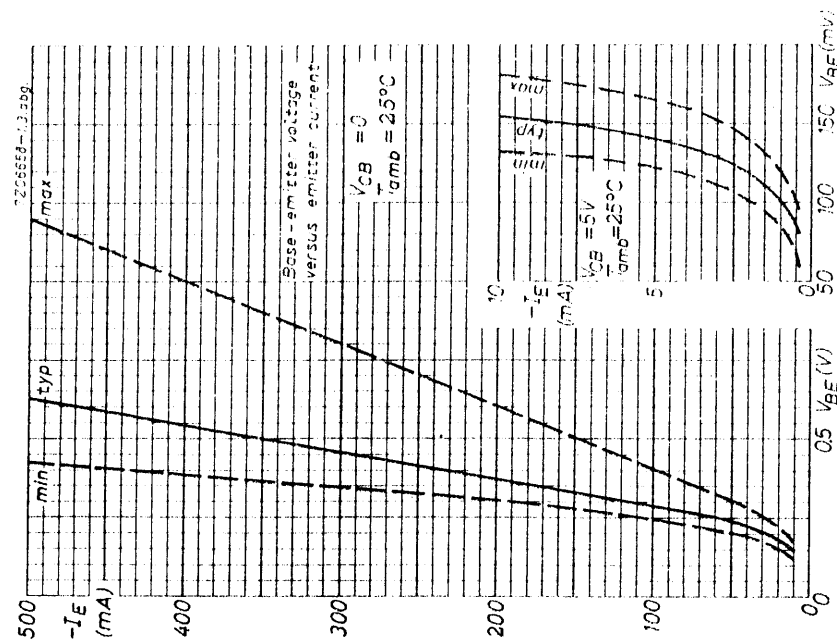
TO-1

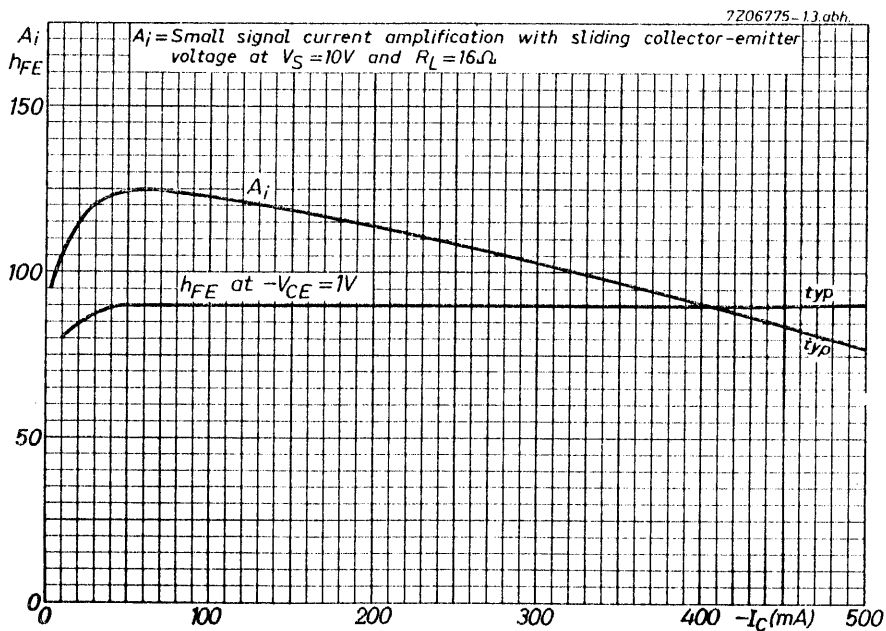
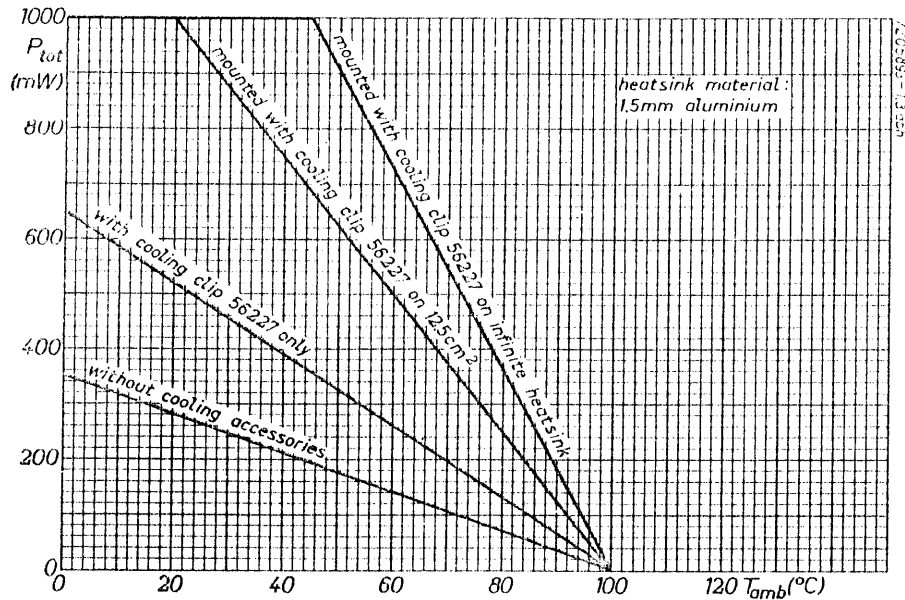


The red dot indicates the collector

Accessories see page 4.

7Z3 0870





SYMMETRICAL GERMANIUM TRANSISTOR

N-P-N transistor in a TO-1 metal envelope. The AC130 is primarily intended for use in horizontal deflection synchronization circuits.

RATINGS Limiting values according to the Absolute Maximum System as defined in IEC publication 134.

Collector-base voltage (open emitter)	V_{CBO}	max.	20 V
Collector-emitter voltage (open base)	V_{CEO}	max.	10 V
Collector-emitter voltage with $R_{BE} \leq 10 \text{ k}\Omega$	V_{CER}	max.	15 V
Collector current (d.c.)	I_C	max.	100 mA
Total power dissipation up to $T_{amb} = 25^\circ\text{C}$	P_{tot}	max.	145 mW
Junction temperature	T_j	max.	90 °C

THERMAL RESISTANCE

From junction to ambient in free air $R_{th \text{ j-a}} = 0.45 \text{ }^\circ\text{C/mW}$

CHARACTERISTICS

Saturation voltages

$I_C = 10 \text{ mA}; I_B = 1 \text{ mA}$

$T_j = 25 \text{ }^\circ\text{C}$ unless otherwise specified

V_{CEsat}	typ.	15 mV
V_{BEsat}	typ.	245 mV

D.C. current gain

$I_C = 10 \text{ mA}; V_{CE} = 1 \text{ V}$

h_{FE}	>	25
	typ.	65

Ratio between h_{FE} and h_{FC} for each individual transistor

$\frac{h_{FE}}{h_{FC}}$	typ.	1
		0.5 to 2

Transition frequency

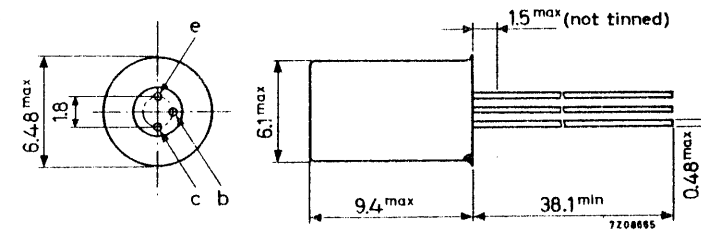
$I_C = 10 \text{ mA}; V_{CE} = 1 \text{ V}$

f_T	>	2 MHz
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MECHANICAL DATA

TO-1

Dimensions in mm



The coloured dot indicates the collector.

Because of its very good symmetrical properties the collector and emitter can be connected interchangeably.

GERMANIUM ALLOY TRANSISTOR

P-N-P transistor in a TO-1 metal envelope intended for use together with the n-p-n transistor AC127 as matched pair AC127/AC132 in class B output stages with complementary symmetry.

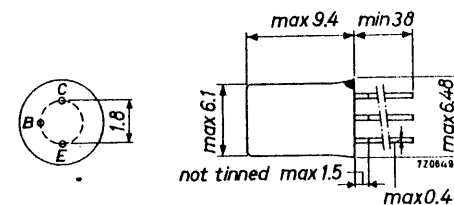
Type 2-AC132 consists of 2 transistors AC132 selected for operation in class B output stages.

QUICK REFERENCE DATA		
Collector-base voltage (open emitter)	$-V_{CBO}$	max. 32 V
Collector-emitter voltage (open base)	$-V_{CEO}$	max. 12 V
Collector current (d.c.)	$-I_C$	max. 200 mA
Total power dissipation up to $T_{amb} = 45^\circ\text{C}$ with cooling fin on a heatsink of at least 12.5 cm ²	P_{tot}	max. 500 mW
Junction temperature	T_j	max. 90 °C
D.C. current gain at $T_{amb} = 25^\circ\text{C}$ $-I_C = 20\text{ mA}; V_{CB} = 0$	h_{FE}	typ. 135
Transition frequency $-I_C = 10\text{ mA}; -V_{CE} = 2\text{ V}$	f_T	typ. 2.0 MHz

MECHANICAL DATA

Dimensions in mm

TO-1

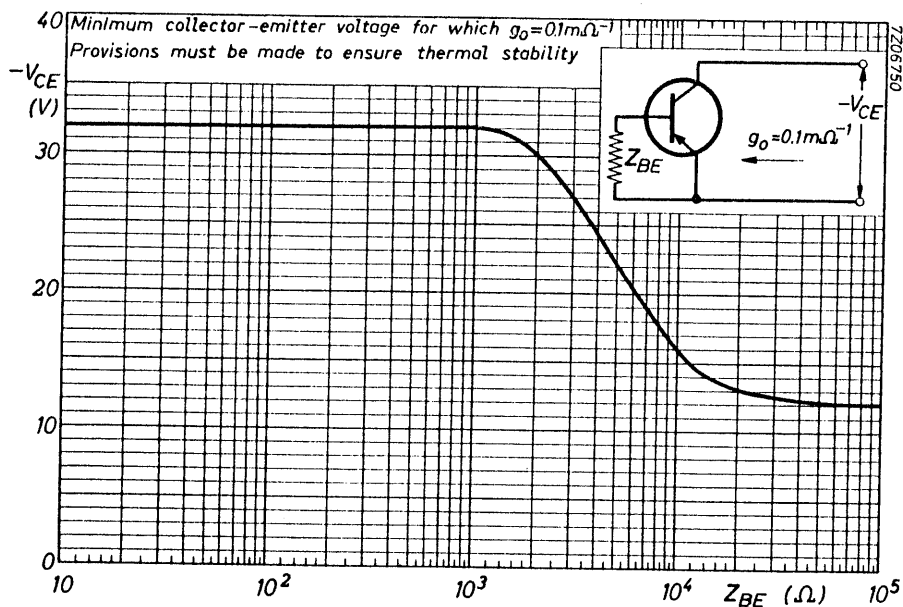


The red dot indicates the collector

Accessories see page 4.

7Z3 0875

GERMANIUM ALLOYED MEDIUM POWER TRANSISTORS



The AC187 is a n-p-n audio transistor in a TO-1 metal envelope.

The AC187 is primarily intended for use together with the p-n-p medium power transistor AC188 as matched pair AC187/AC188 to about 3 W complementary symmetry class B output stages.

The AC187/01 is electrically equivalent to the AC187, constructed integrally with a heat conducting block, which gives better heat transfer.

The thermal resistance from junction to heatsink shows an improvement ($\approx 10^\circ\text{C/W}$) as compared with that obtained with the AC187 when using heat conducting clip 56227.

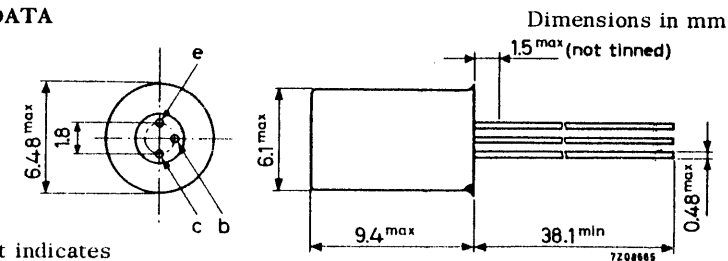
The AC187/01 is also available as matched pair with the AC188/01.

QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max. 25 V
Collector-emitter voltage (open base)	V_{CEO}	max. 15 V
Collector current (peak value)	I_{CM}	max. 2 A
Total power dissipation up to $T_{amb} = 46^\circ\text{C}$	P_{tot}	max. 0.8 W
Junction temperature	T_j	max. 90°C
D.C. current gain at $T_j = 25^\circ\text{C}$ $I_C = 300 \text{ mA}; V_{CE} = 1 \text{ V}$	h_{FE}	100 to 500
Cut-off frequency $I_C = 10 \text{ mA}; V_{CE} = 2 \text{ V}$	f_{hfe}	typ. 20 kHz

MECHANICAL DATA

AC187
TO-1



The coloured dot indicates the collector

Accessories available: 56200; 56208; 56209; 56210; 56226; 56227

GERMANIUM ALLOYED MEDIUM POWER TRANSISTORS

The AC188 is a p-n-p audio transistor in a TO-1 metal envelope.

The AC188 is primarily intended for use together with the n-p-n medium power transistor AC187 as matched pair AC187/AC188 to about 3 W complementary symmetry class B output stages.

The AC188/01 is electrically equivalent to the AC188, constructed integrally with a heat conducting block, which gives better heat transfer.

The thermal resistance from junction to heatsink shows an improvement (≈ 10 °C/W) as compared with that obtained with the AC188 when using heat conducting clip 56227.

The AC188/01 is also available as matched pair with the AC187/01.

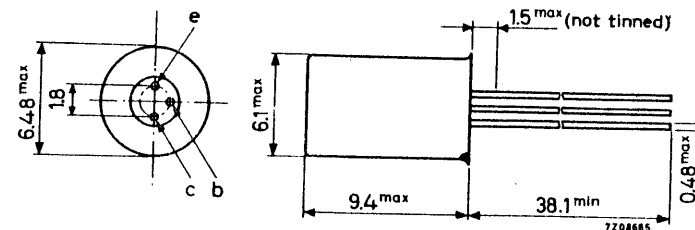
QUICK REFERENCE DATA

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	25 V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	15 V
Collector current (peak value)	$-I_{CM}$	max.	2 A
Total power dissipation up to $T_{amb} = 46$ °C	P_{tot}	max.	0.8 W
Junction temperature	T_j	max.	90 °C
D.C. current gain at $T_j = 25$ °C	h_{FE}		100 to 500
$-I_C = 300$ mA; $-V_{CE} = 1$ V			
Cut-off frequency	f_{hfe}	typ.	10 kHz
$-I_C = 10$ mA; $-V_{CE} = 2$ V			

MECHANICAL DATA

AC188

TO-1



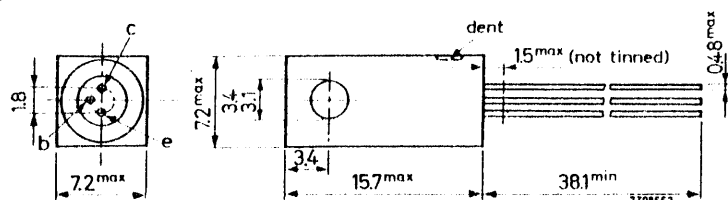
The coloured dot indicates the collector

Accessories available: 56200; 56208; 56209; 56210; 56226; 56227

MECHANICAL DATA (continued)

Dimensions in mm

AC188/01



The dent indicates the collector

RATINGS (Limiting values) ¹⁾

Voltages

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	25 V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	15 V
Collector-emitter voltage $-I_C \leq 600 \text{ mA}; R_{BE} \leq 1 \Omega$	$-V_{CER}$	max.	18 V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	10 V

Currents

Collector current (d.c. or average over any 50 ms period)	$-I_C$	max.	1 A
Collector current (peak value)	$-I_{CM}$	max.	2 A

Power dissipation

Total power dissipation up to $T_{amb} = 46 \text{ }^\circ\text{C}$ ²⁾	P_{tot}	max.	0.8 W
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Temperatures

Storage temperature	T_{stg}	-55 to +75	$^\circ\text{C}$
Junction temperature	T_j	max.	90 $^\circ\text{C}$

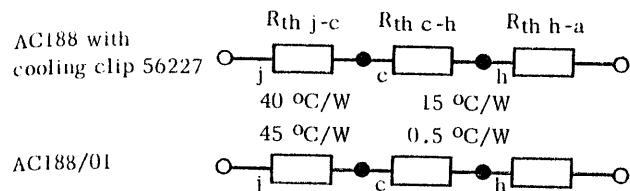
1) Limiting values according to the Absolute Maximum System as defined in IEC publication 134.

2) The allowable peak power in class B speech and musical driven amplifiers is 1.1 W

THERMAL RESISTANCE

From junction to ambient in free air

	AC188	AC188/01
without cooling clip	$R_{th j-a} = 290$	180 $^\circ\text{C/W}$
with cooling clip 56227	$R_{th j-a} = 140$	$^\circ\text{C/W}$
with cooling clip 56227 on 1.5 mm Al blackened heatsink of 12.5 cm ²	$R_{th j-a} = 80$	70.5 $^\circ\text{C/W}$
with cooling clip 56227 on infinite heatsink	$R_{th j-a} = 55$	$^\circ\text{C/W}$
From junction to case	$R_{th j-c} = 40$	45 $^\circ\text{C/W}$



CHARACTERISTICS

$T_j = 25 \text{ }^\circ\text{C}$ unless otherwise specified

Collector cut-off current

$I_E = 0; -V_{CB} = 25 \text{ V}$	$-I_{CBO}$	typ.	20 μA
		<	200 μA
$I_E = 0; -V_{CB} = 25 \text{ V}; T_j = 90 \text{ }^\circ\text{C}$	$-I_{CBO}$	<	1.4 mA
$+V_{BE} = 1.0 \text{ V}; -V_{CE} = 25 \text{ V}$	$-I_{CEX}$	<	200 μA

Emitter cut-off current

$I_C = 0; -V_{EB} = 10 \text{ V}$	$-I_{EBO}$	typ.	15 μA
		<	200 μA
$I_C = 0; -V_{EB} = 10 \text{ V}; T_j = 90 \text{ }^\circ\text{C}$	$-I_{EBO}$	typ.	0.4 mA
		<	1.4 mA

Base-emitter voltage

$-I_C = 5 \text{ mA}; -V_{CE} = 10 \text{ V}$	$-V_{BE}$	115 to 145	mV
$-I_C = 300 \text{ mA}; -V_{CE} = 1 \text{ V}$	$-V_{BE}$	<	450 mV

Emitter-base floating voltage

$I_E = 0; -V_{CB} = 25 \text{ V}; T_j = 90 \text{ }^\circ\text{C}$	$-V_{EBfl}$	<	400 mV
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GERMANIUM ALLOYED POWER TRANSISTORS

P-N-P power transistor in a metal envelope with the collector connected to the mounting base.

It is primarily intended for use as matched pair 2-AD149 in class B push-pull output stages with an output power of up to 20 W.

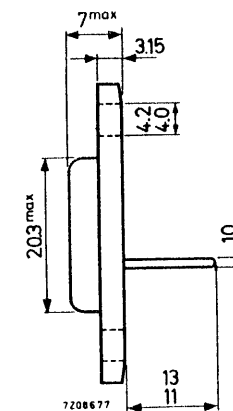
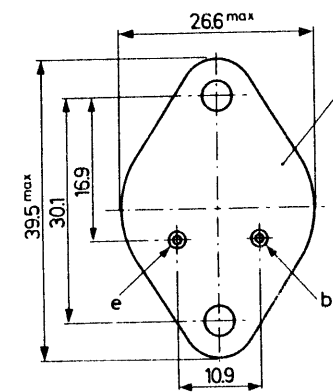
QUICK REFERENCE DATA

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	50 V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	30 V
Collector current (d.c.)	$-I_C$	max.	3.5 A
Total power dissipation up to $T_{mb} = 45^\circ\text{C}$	P_{tot}	max.	32.5 W
Junction temperature (incidentally)	T_j	max.	110 $^\circ\text{C}$
D.C. current gain at $T_j = 25^\circ\text{C}$	h_{FE}		30 to 100
$-I_C = 1\text{ A}; V_{CB} = 0\text{ V}$			
Cut-off frequency	f_{hfe}	typ.	10 kHz
$-I_C = 0.5\text{ A}; -V_{CE} = 2\text{ V}$			

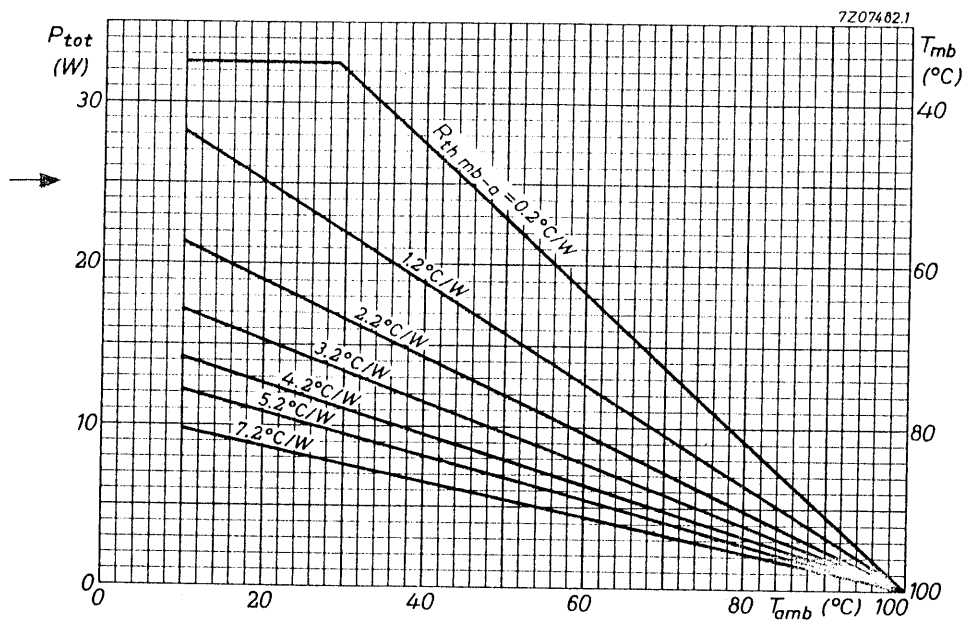
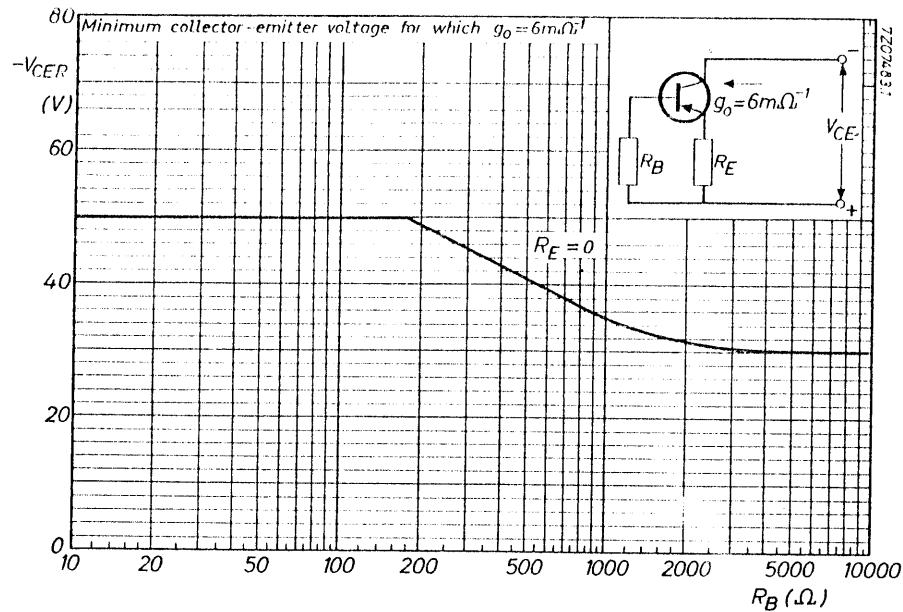
MECHANICAL DATA

Dimensions in mm

Collector connected to mounting base



Accessories available: 56201



GERMANIUM ALLOYED POWER TRANSISTOR

N-P-N power transistor in a metal envelope with the collector connected to the mounting base.

The AD161 is primarily intended for use together with the p-n-p power transistor AD162 as matched pair AD161/AD162 in 10 W complementary symmetry class B output stages of mains operated amplifiers and radio receivers.

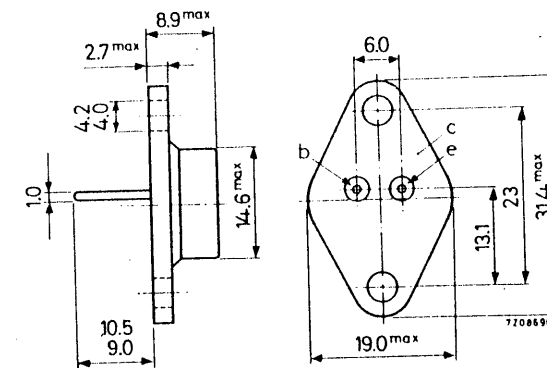
QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	32 V
Collector-emitter voltage (open base)	V_{CEO}	max.	20 V
Collector current (peak value)	I_{CM}	max.	3 A
Total power dissipation up to $T_{mb} = 75^\circ\text{C}$	P_{tot}	max.	4 W
Junction temperature (incidentally)	T_j	max.	100 $^\circ\text{C}$
D.C. current gain at $T_j = 25^\circ\text{C}$			
$I_C = 0.5 \text{ A}; V_{CE} = 1 \text{ V}$	h_{FE}		80 to 320
Cut-off frequency			
$I_C = 0.3 \text{ A}; V_{CE} = 2 \text{ V}$	f_{hfe}	typ.	35 kHz

MECHANICAL DATA

Dimensions in mm

Collector connected to mounting base



Accessories available: 56203

GERMANIUM ALLOYED POWER TRANSISTOR

P-N-P power transistor in a metal envelope with the collector connected to the mounting base.

It is primarily intended for use as matched pair 2-AD162 in class B push-pull output stages and together with the n-p-n power transistor AD161 as matched pair AD161/AD162 in 10 W complementary symmetry class B output stages of mains operated amplifiers and radio receivers.

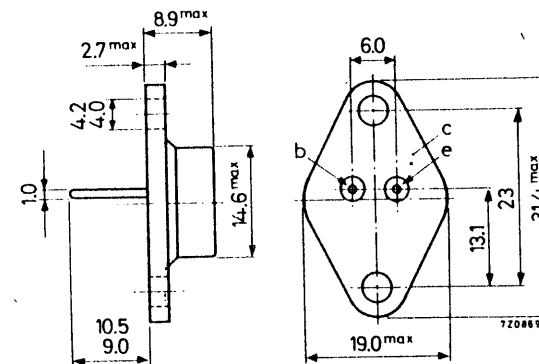
QUICK REFERENCE DATA

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	32 V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	20 V
Collector current (peak value)	$-I_{CM}$	max.	3 A
Total power dissipation up to $T_{mb} = 63^{\circ}\text{C}$	P_{tot}	max.	6 W
Junction temperature (incidentally)	T_j	max.	100 $^{\circ}\text{C}$
D.C. current gain at $T_j = 25^{\circ}\text{C}$ $-I_C = 0.5 \text{ A}; -V_{CE} = 1 \text{ V}$	h_{FE}		80 to 320
Cut-off frequency $-I_C = 0.3 \text{ A}; -V_{CE} = 2 \text{ V}$	f_{hfe}	typ.	15 kHz

MECHANICAL DATA

Dimensions in mm

Collector connected to mounting base



Accessories available: 56203