SILICON EPITAXIAL PLANAR OVERLAY TRANSISTORS

The **2N3553** is an n-p-n overlay transistor in a TO-39 metal envelope with the collector connected to the case.
The **2N3375** and the **2N3632** are n-p-n overlay transistors in TO-60 metal envelopes with the electrodes insulated from the studs.
The **2N3553** and the **2N3375** are intended for v.h.f./u.h.f. and the **2N3632** for v.h.f. transmitting applications.

QUICK REFERENCE DATA

			2N3553	2N3375	2N3632	
Collector-emitter voltage $-V_{BE}$ = 1,5 V	V_{CEX}	max.	65	65	65	V
Collector-emitter voltage (open base)	V_{CEO}	max.	40	40	40	V
Collector current (peak value)	I_{CM}	max.	1,0	1,5	3,0	A
Total power dissipation up to T_{mb} = 25 °C	P_{tot}	max.	7	11,6	23	W
Junction temperature	T_j	max.	200	200	200	°C
Transition frequency						
I_C = 125 mA; V_{CE} = 28 V	f_T	typ.	500	500	–	MHz
I_C = 250 mA; V_{CE} = 28 V	f_T	typ.	–	–	400	MHz

R.F. performance at V_{CE} = 28 V

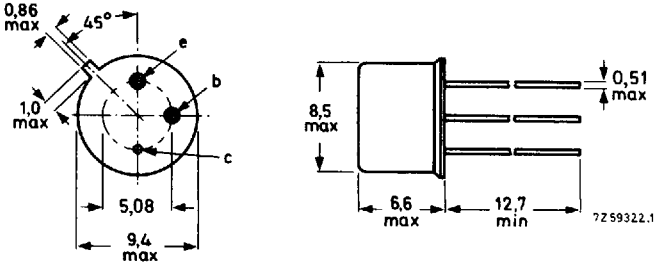
type number	f (MHz)	P_o (W)	P_i (W)	η (%)
2N3553	175	2,5	< 0,25	> 50
2N3375	100	7,5	< 1	> 65
2N3375	400	> 3	1	> 40
2N3632	175	> 13,5	3,5	> 70

MECHANICAL DATA

Dimensions in mm

Fig.1a TO-39/1; collector connected to case.

2N3553



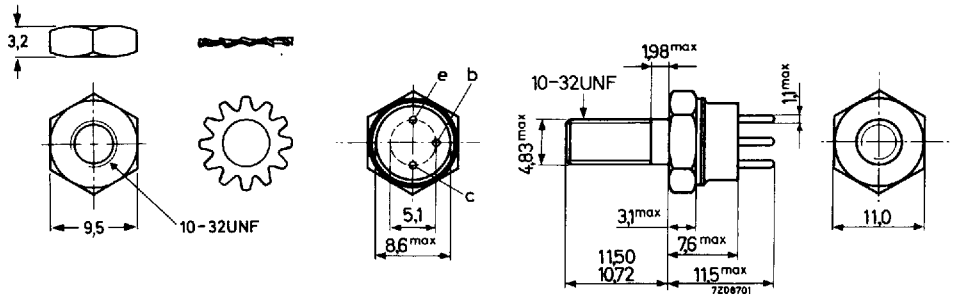
Maximum lead diameter is guaranteed only for 12,7 mm.

Accessories: 56245 (distance disc).

MECHANICAL DATA (continued) Dimensions in mm

Fig. 1b TO-60 (**2N3375** and **2N3632**).

The top pins should not be bent.



Torque on nut: min. 0,8 Nm (8 kg cm)
max. 1,7 Nm (17 kg cm)

Diameter of clearance hole in heatsink: 4,8 mm to 5,2 mm.

PRODUCT SAFETY **This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.**

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	V_{CBO}	max.		65	V
Collector-emitter voltage					
$I_C \leqslant 200$ mA; $-V_{BE} = 1,5$ V	V_{CEX}	max.		65	V
(open base); $I_C \leqslant 200$ mA	V_{CEO}	max.		40	V
Emitter-base voltage (open collector)	V_{EBO}	max.		4	V

			2N3553	2N3375	2N3632	
Collector current						
d.c.	I_C	max.	0,35	0,5	1	A
peak value	I_{CM}	max.	1,0	1,5	3	A
Total power dissipation						
up to $T_{mb} = 25$ °C	P_{tot}	max.	7	11,6	23	W
Storage temperature	T_{stg}			−65 to +200		°C
Junction temperature	T_j	max.		200		°C

THERMAL RESISTANCE

			2N3553	2N3375	2N3632	
From junction to mounting base	$R_{th\ j\text{-}mb}$	=	25	15	7.5	K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=		0.6	0.6	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current			2N3553	2N3375	2N3632	
I_B = 0; V_{CE} = 30 V	I_{CEO}	<	100	100	250	μA
Breakdown voltages						
I_E = 0; I_C = 250 μA	$V_{(BR)CBO}$	>	65	65	65	V
I_C up to 200 mA; $-V_{BE}$ = 1.5 V; R_B = 33 Ω [1]	$V_{(BR)CEX}$	>	65	65	65	V
I_B = 0 [1]	$V_{(BR)CEO}$	>	40	40	40	V
I_C = 0; I_E = 250 μA	$V_{(BR)EBO}$	>	4	4	4	V
Base-emitter voltage						
I_C = 250 mA; V_{CE} = 5 V	V_{BE}	<	1.5			V
I_C = 500 mA; V_{CE} = 5 V	V_{BE}	<		1.5		V
I_C = 1000 mA; V_{CE} = 5 V	V_{BE}	<			1.5	V
Saturation voltage						
I_C = 250 mA; I_B = 50 mA	V_{CEsat}	<	1.0			V
I_C = 500 mA; I_B = 100 mA	V_{CEsat}	<		1.0		V
I_C = 1000 mA; I_B = 200 mA	V_{CEsat}	<			1.0	V

[1]) Pulsed through an inductor of 25 mH; δ = 0.5; f = 50 Hz

CHARACTERISTICS (continued)

T_j = 25 °C unless otherwise specified

			2N3553	2N3375	2N3632	
D.C. current gain						
I_C = 125 mA; V_{CE} = 5 V	h_{FE}	>	15	15		
		<	200	200		
I_C = 250 mA; V_{CE} = 5 V	h_{FE}	>	10	10	10	
		<	100	100	150	
I_C = 1000 mA; V_{CE} = 5 V	h_{FE}	>			5	
		<			110	
Collector capacitance at f = 1 MHz						
$I_E = I_e$ = 0; V_{CB} = 28 V	C_c	<	10	10	20	pF
Collector-case capacitance		<		6	6	pF
Transition frequency						
I_C = 125 mA; V_{CE} = 28 V	f_T	typ.	500	500		MHz
I_C = 250 mA; V_{CE} = 28 V	f_T	typ.			400	MHz
Real part of input impedance at f = 200 MHz						
I_C = 125 mA; V_{CE} = 28 V	$Re(h_{ie})$	<	20	20		Ω
I_C = 250 mA; V_{CE} = 28 V	$Re(h_{ie})$	<			20	Ω

R.F. performance at V_{CE} = 28 V

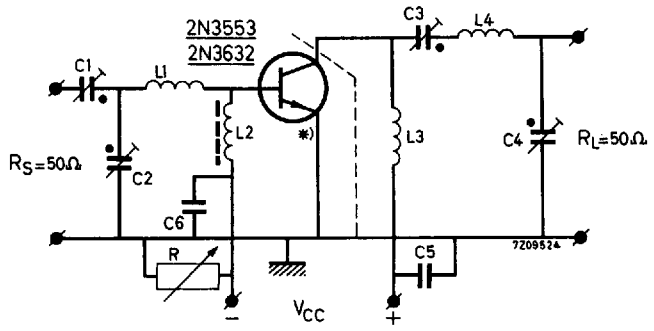
	f (MHz)	P_o (W)	P_i (W)	I_C (mA)	η %	Test circuit
2N3553	175	2.5	< 0.25	< 180	> 50	I
2N3375	100	7.5	< 1	< 410	> 65	II
2N3375	400	> 3	1	270	> 40	III
2N3632	175	> 13.5	3.5	690	> 70	I

NOTE

The transistors can withstand an output V.S.W.R. of 3 : 1 varied through all phases under conditions mentioned in the table above.

CHARACTERISTICS (continued)

Test circuit I (with the 2N3553 or the 2N3632 at f = 175 MHz)



*) The length of the external emitter wire of the 2N3553 is 1.6 mm.
The emitter of the 2N3632 should be connected to the case as short as possible.

Components

C1 = C2 = C3 = C4 = 4 to 29 pF air trimmer

C5 = 10 nF polyester

C6 = 100 pF ceramic

L1 = 1 turn Cu wire (1.0 mm); int. diam. 10 mm; leads 2 x 10 mm

L2 = Ferroxcube choke coil. Z (at f = 175 MHz) = 550 Ω ± 20%
(code number 4312 020 **36640**)

L3 = 15 turns closely wound enamelled Cu wire (0.7 mm); int. diam. 4 mm

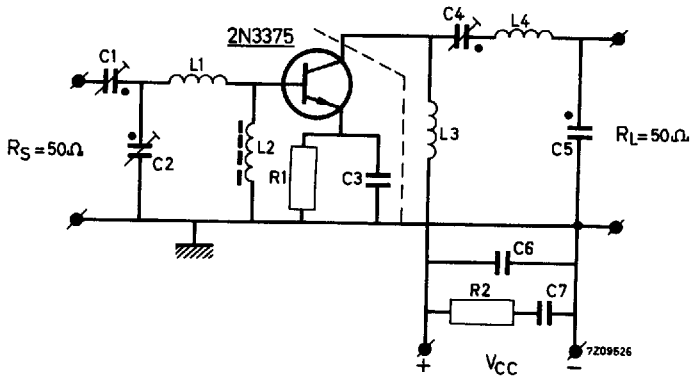
L4 = 3 turns closely wound enamelled Cu wire (1.5 mm); int. diam. 12 mm; leads 2 x 20 mm

R = 0 for the 2N3553

R = 0 to 2 Ω for the 2N3632

CHARACTERISTICS (continued)

Test circuit II (with the 2N3375 at f = 100 MHz)



Components

C1 = C2 =	3.5 to 61.5 pF	air trimmer
C3 =	10 nF	polyester
C4 = C5 =	4 to 29 pF	air trimmer
C6 =	330 pF	ceramic
C7 =	10 nF	polyester

L1 = 2 turns closely wound enamelled Cu wire (1.5 mm); int. diam. 10 mm; leads 2 x 10 mm

L2 = Ferroxcube choke coil. Z (at f = 100 MHz) = 700 Ω ± 20%
(code number 4312 020 **36640**)

L3 = 23 turns closely wound enamelled Cu wire (0.7 mm); int. diam. 6 mm

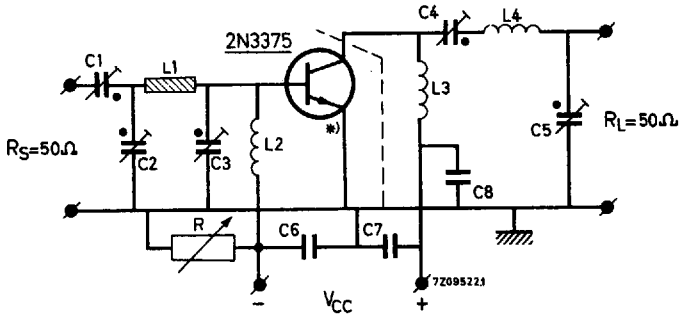
L4 = 5 turns closely wound enamelled Cu wire (1.5 mm); int. diam. 12 mm; leads 2 x 10 mm

R1 = 1.35 Ω carbon

R2 = 10 Ω carbon

CHARACTERISTICS (continued)

Test circuit III (with the 2N3375 at f = 400 MHz)



*) The emitter should be connected to the case as short as possible.

Components

C1 = C2 =	0.7 to 6.7 pF	ceramic trimmer
C3 =	0.5 to 3.5 pF	ceramic trimmer
C4 = C5 =	3 to 19 pF	air trimmer
C6 = C7 =	15 pF	ceramic
C8 =	4700 pF	ceramic

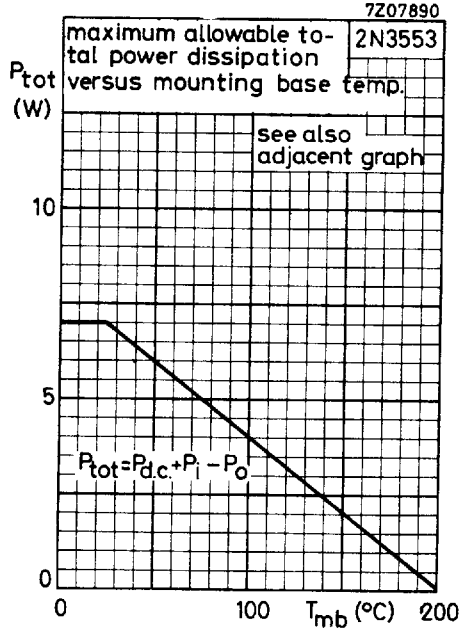
L1 = 20 mm straight Cu wire; diam. 1.5 mm; spaced 8 mm from chassis

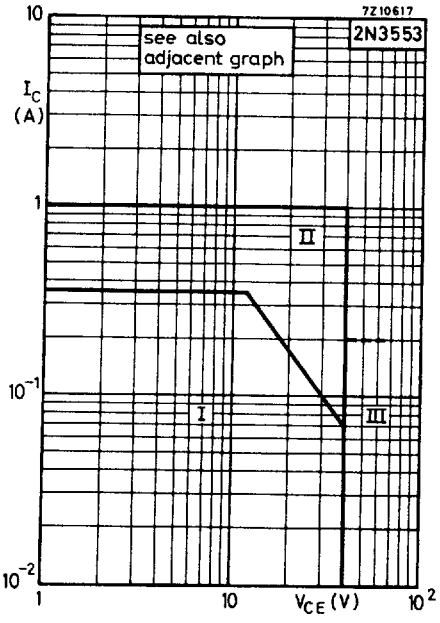
L2 = 17 turns closely wound enamelled Cu wire (0.5 mm); int. diam. 3 mm

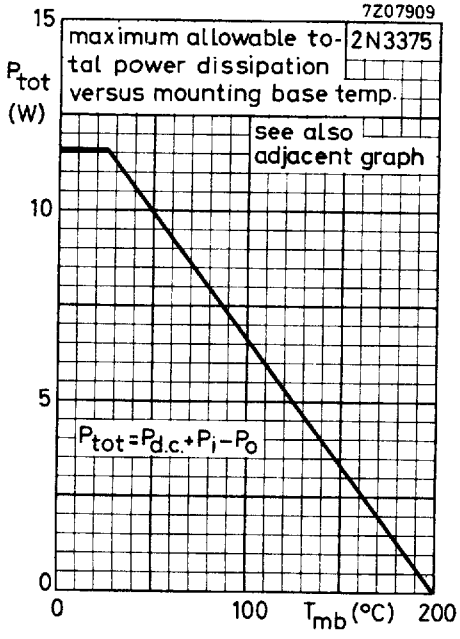
L3 = 7 turns closely wound enamelled Cu wire (0.5 mm); int. diam. 3 mm

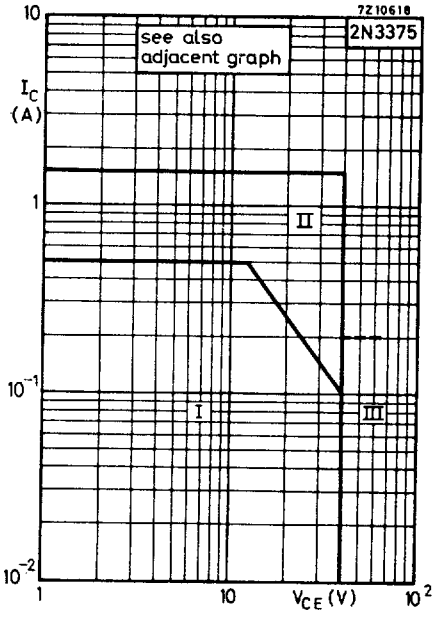
L4 = 1 turn Cu wire (1.5 mm); int. diam. 10 mm; leads 2 x 5 mm

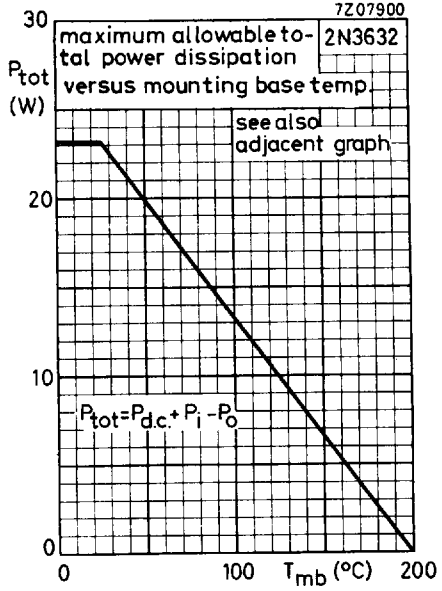
R = 0 to 5 Ω

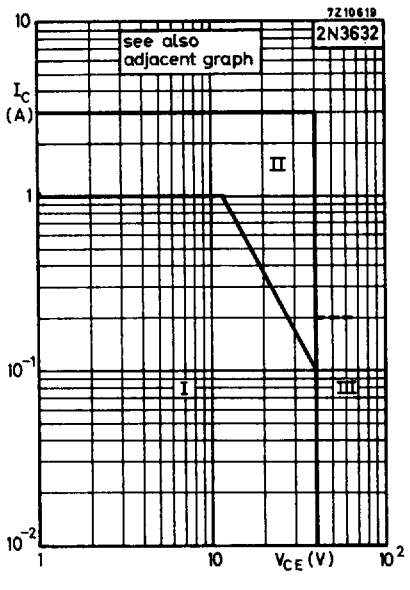

7Z07890
maximum allowable total power dissipation versus mounting base temp.
2N3553
see also adjacent graph
P_{tot} (W)
10
5
0
$P_{tot}=P_{d.c.}+P_i-P_o$
0
100
T_{mb} (°C)
200


7Z10617
see also adjacent graph
2N3553
I_C (A)
10
1
10^{-1}
10^{-2}
I
II
III
1
10
V_{CE} (V)
10^2


7Z07909
maximum allowable total power dissipation versus mounting base temp.
2N3375
see also adjacent graph
P_{tot} (W)
15
10
5
0
$P_{tot}=P_{d.c.}+P_i-P_o$
0
100
T_{mb} (°C)
200


7Z10618
see also adjacent graph
2N3375
I_C (A)
10
1
10^{-1}
10^{-2}
I
II
III
1
10
V_{CE} (V)
10^2

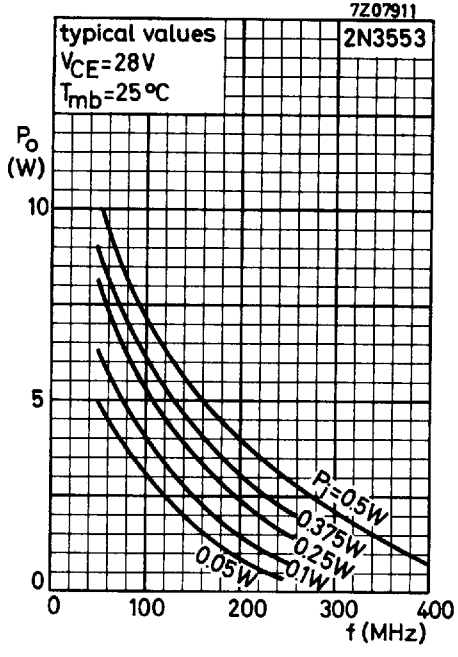


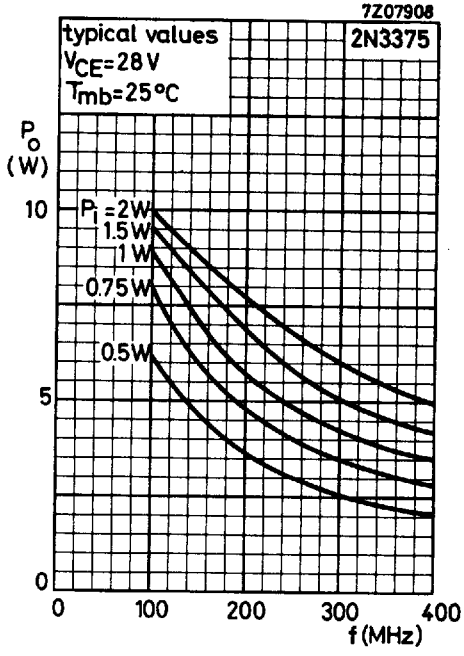


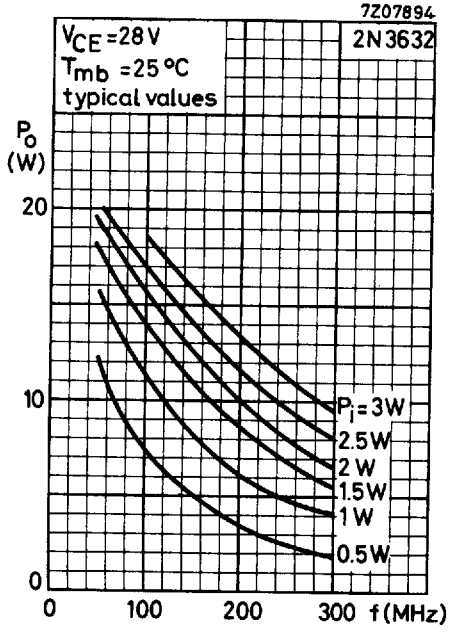
I Region of permissible operation under all base-emitter conditions and at all frequencies, including d.c.

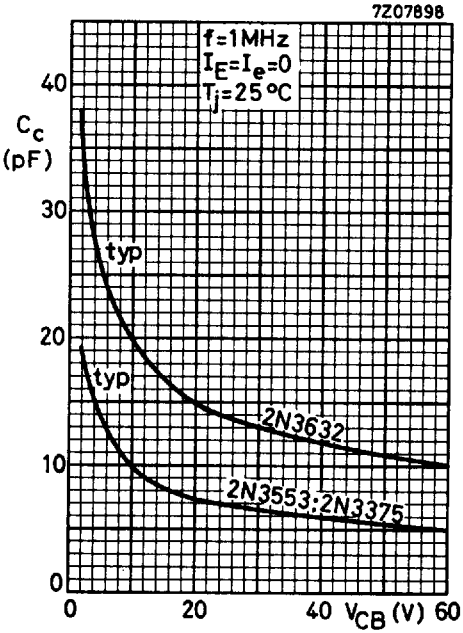
II Additional region of operation at $f \geq 1$ MHz.
Care must be taken to reduce the d.c. adjustment to region I before removing the a.c. signal. This may be achieved by an appropriate bias in class A, B or C.

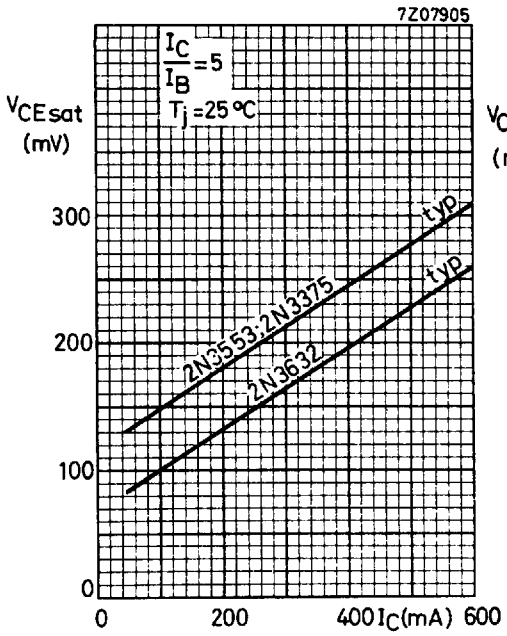
III Operating during switching off in this region is allowed, provided the transistor is cut-off with $-V_{BB} \leq 1.5$ V and $R_{BE} \geq 33\ \Omega$, $I_C \leq 200$ mA and the transient energy does not exceed 0.5 mWs.

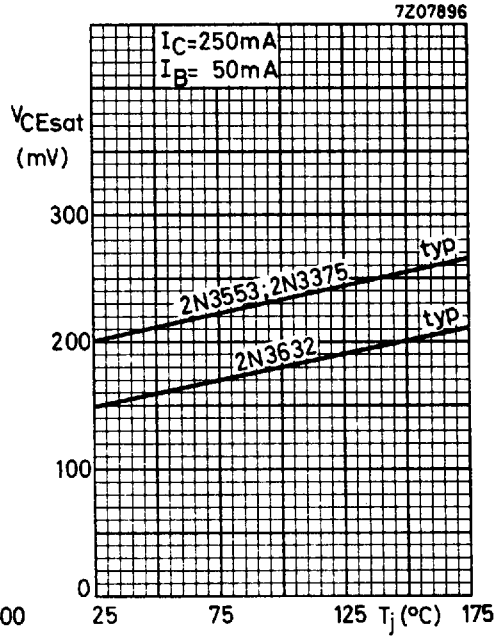

7Z07911
typical values
V_{CE}=28V
T_{mb}=25°C
2N3553
P_o (W)
10
5
0
0
100
200
300
400
f (MHz)
P_i=0.5W
0.375W
0.25W
0.1W
0.05W

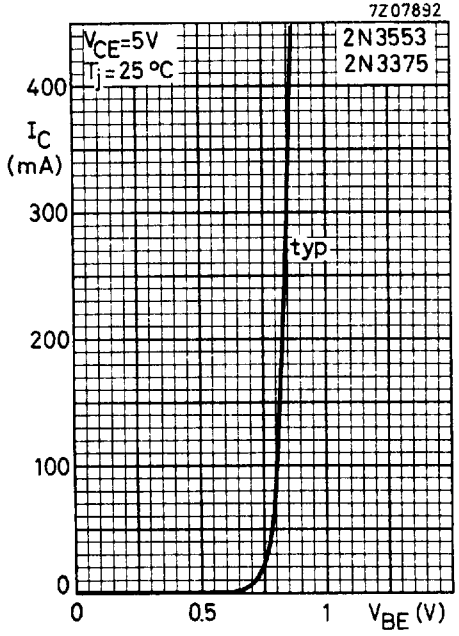

7Z07908
typical values
V_{CE}=28V
T_{mb}=25°C
2N3375
P_o (W)
10
5
0
0
100
200
300
400
f (MHz)
P_i=2W
1.5W
1W
0.75W
0.5W

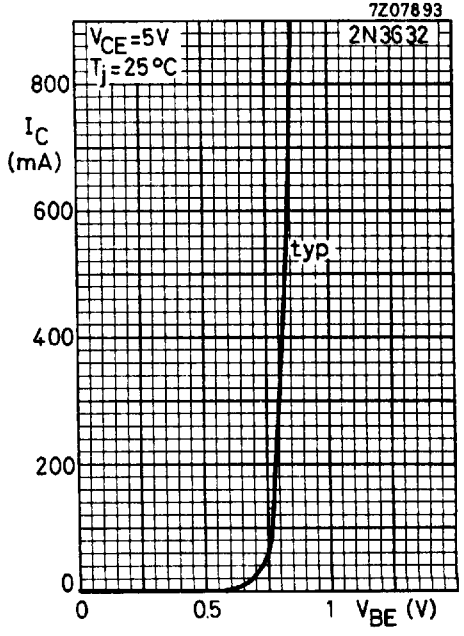

7Z07894
V_{CE}=28V
T_{mb}=25°C
typical values
2N3632
P_o (W)
20
10
0
0
100
200
300
f (MHz)
P_i=3W
2.5W
2W
1.5W
1W
0.5W

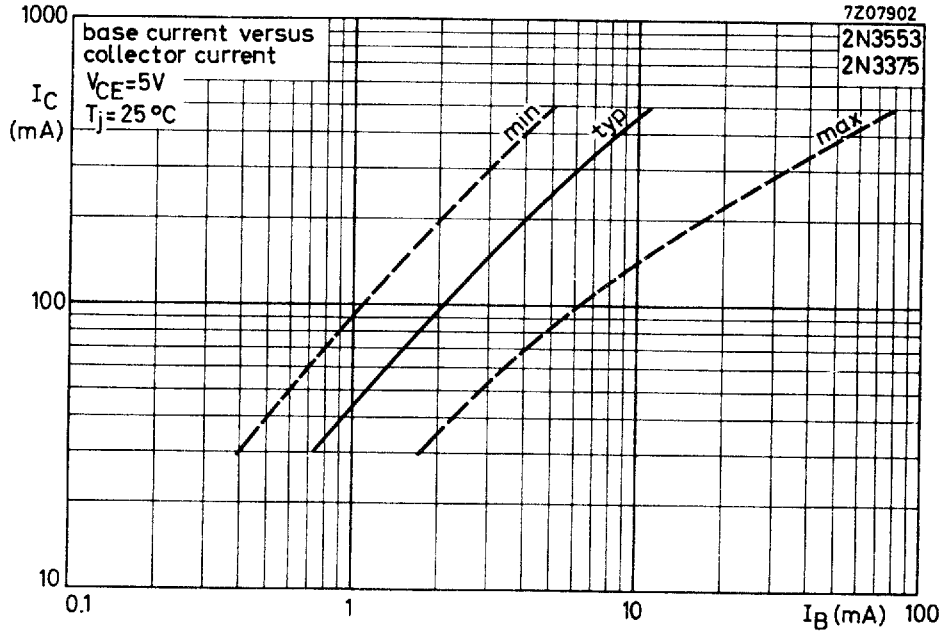

7Z07898
f=1MHz
I_E=I_e=0
T_j=25°C
C_c (pF)
40
30
20
10
0
0
20
40
V_{CB} (V)
60
typ
typ
2N3632
2N3553;2N3375

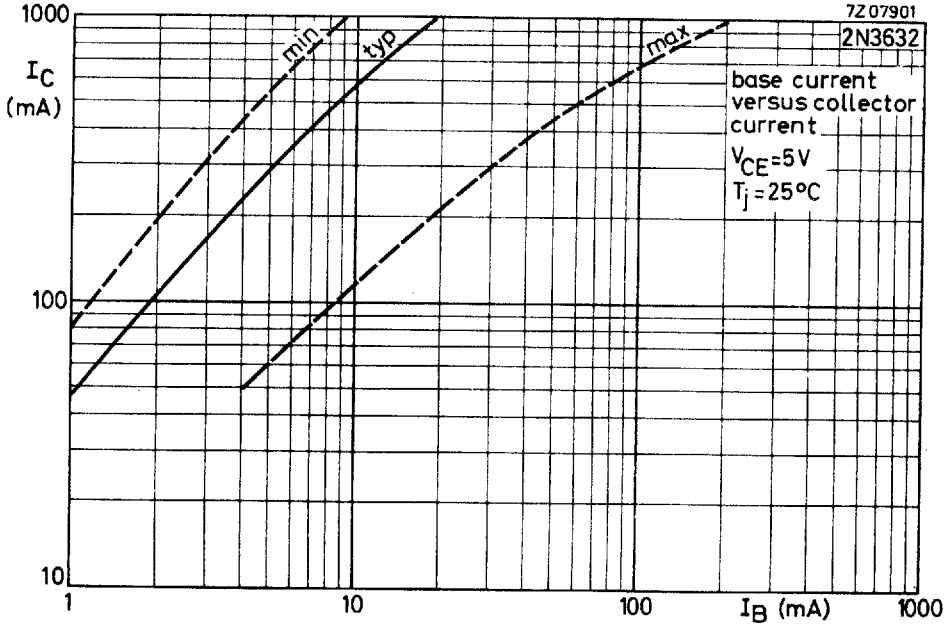

7Z07905
$\frac{I_C}{I_B}$=5
T_j=25 °C
V_{CEsat} (mV)
300
200
100
0
typ
typ
2N3553;2N3375
2N3632
0
200
400
I_C(mA)
600

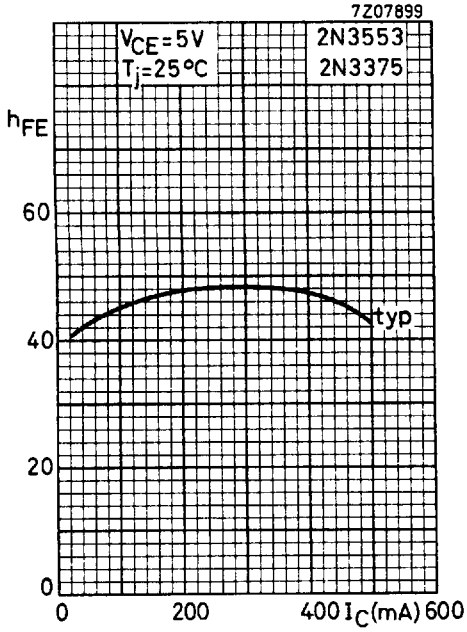

7Z07896
I_C=250mA
I_B= 50mA
V_{CEsat} (mV)
300
200
100
0
typ
2N3553;2N3375
typ
2N3632
25
75
125
T_j (°C)
175

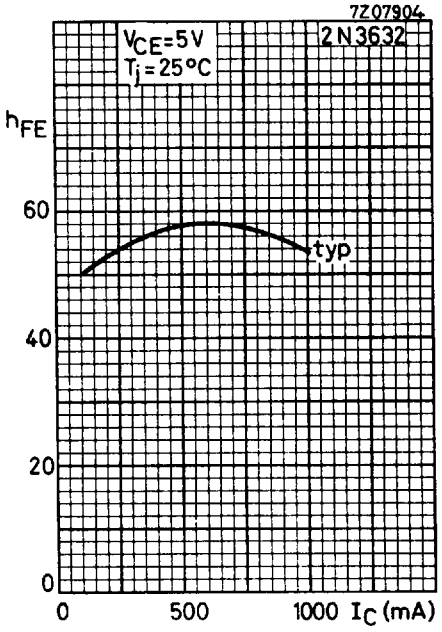

7Z07892
V_{CE}=5V
T_j=25 °C
2N3553
2N3375
400
I_C (mA)
300
200
100
0
typ
0
0.5
1
V_{BE} (V)

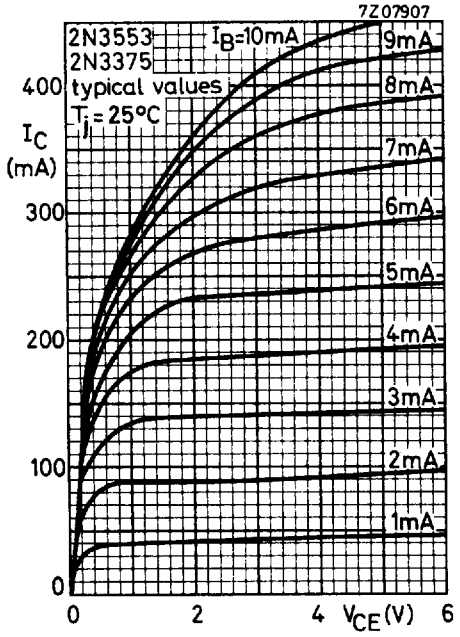

7Z07893
V_{CE}=5V
T_j=25 °C
2N3632
800
I_C (mA)
600
400
200
0
typ
0
0.5
1
V_{BE} (V)

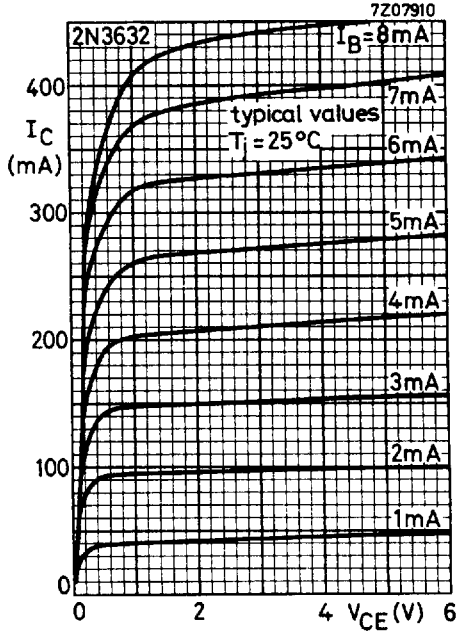

7Z07902
2N3553
2N3375
base current versus collector current
V_{CE}=5V
T_j=25 °C
I_C (mA)
1000
100
10
0.1
1
10
I_B (mA)
100
min
typ
max

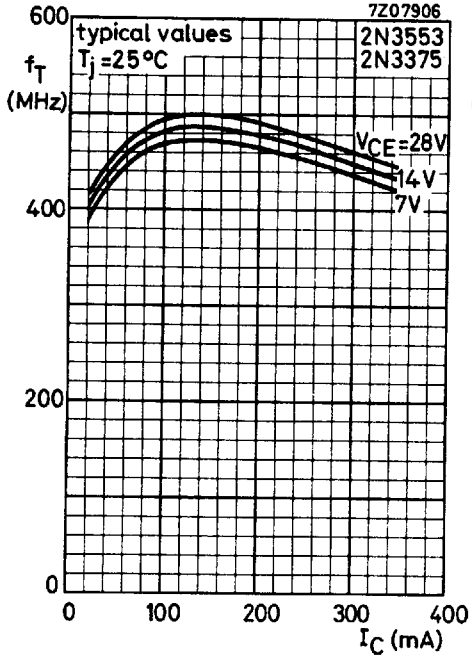

7Z07901
2N3632
base current versus collector current
V_{CE}=5V
T_j=25°C
I_C (mA)
1000
100
10
1
10
100
I_B (mA)
1000
min
typ
max

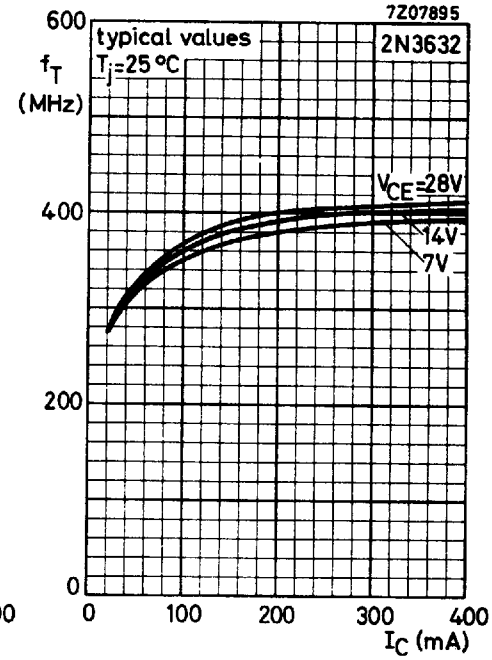

7Z07899
V_{CE}=5V
T_j=25°C
2N3553
2N3375
h_{FE}
60
40
20
0
typ
0
200
400 I_C(mA) 600

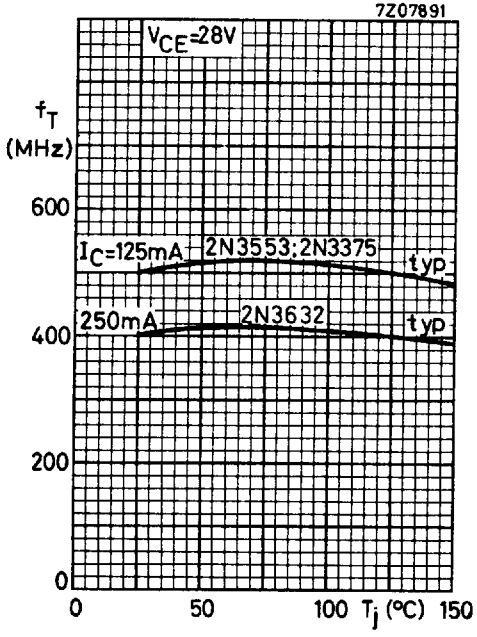

7Z07904
V_{CE}=5V
T_j=25°C
2N3632
h_{FE}
60
40
20
0
typ
0
500
1000 I_C (mA)

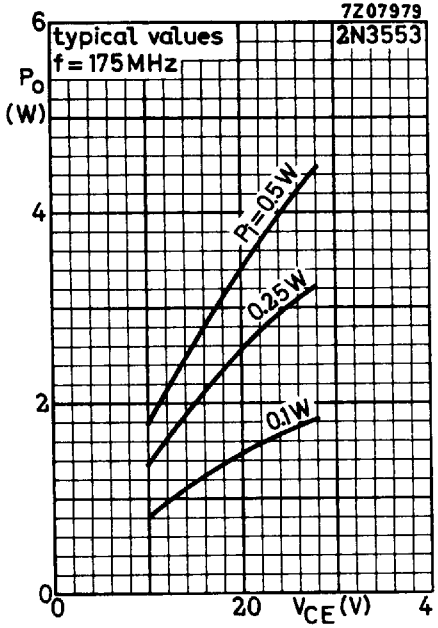

7Z07907
2N3553
2N3375
typical values
T_j=25°C
I_B=10mA
9mA
8mA
7mA
6mA
5mA
4mA
3mA
2mA
1mA
I_C (mA)
400
300
200
100
0
0
2
4 V_{CE}(V) 6

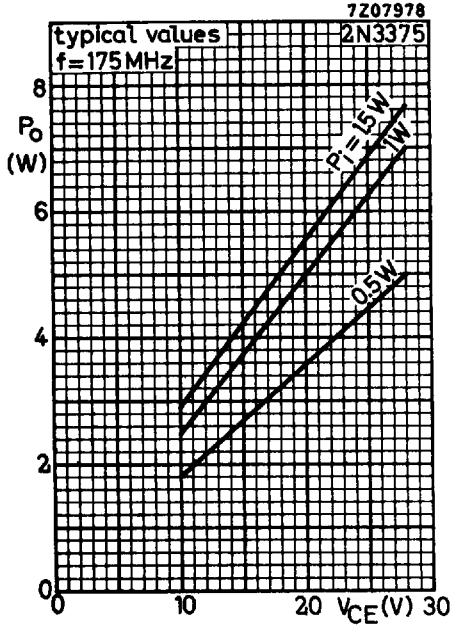

7Z07910
2N3632
typical values
T_j=25°C
I_B=8mA
7mA
6mA
5mA
4mA
3mA
2mA
1mA
I_C (mA)
400
300
200
100
0
0
2
4 V_{CE}(V) 6

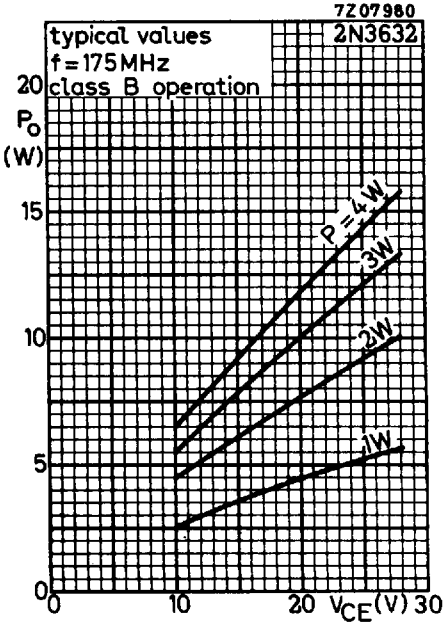

7Z07906
typical values
T_j =25 °C
2N3553
2N3375
V_{CE}=28V
14V
7V
f_T
(MHz)
600
400
200
0
0
100
200
300
400
I_C (mA)


7Z07895
typical values
T_j=25 °C
2N3632
V_{CE}=28V
14V
7V
f_T
(MHz)
600
400
200
0
0
100
200
300
400
I_C (mA)


7Z07891
V_{CE}=28V
f_T
(MHz)
600
400
200
0
I_C=125mA
2N3553;2N3375
typ.
250mA
2N3632
typ.
0
50
100
T_j (°C)
150


7Z07979
typical values
f = 175 MHz
2N3553
P_o (W)
P_i = 0.5 W
0.25 W
0.1 W
V_{CE} (V)


7Z07978
typical values
f = 175 MHz
2N3375
P_o (W)
P_i = 1.5 W
1 W
0.5 W
V_{CE} (V)


7Z07980
typical values
f = 175 MHz
class B operation
2N3632
P_o (W)
P_i = 4 W
3 W
2 W
1 W
V_{CE} (V)