U.H.F. TRANSMITTING TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for transmitting applications in class A, B or C with a supply voltage up to 28 V.
The transistor is resistance stabilized and is tested under severe load mismatch conditions. It has a 1/4" capstan envelope with a moulded cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

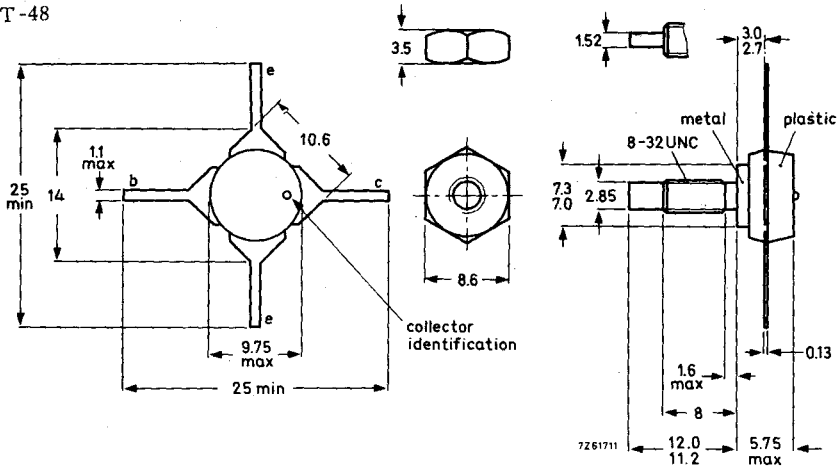
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter clas B circuit.

Mode of operation	V_{CC} (V)	f (MHz)	P_S (mW)	P_L (W)	I_C (mA)	G_p (dB)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
c.w.	24	470	typ. 50	0,85	typ. 67	typ. 12,3	typ. 53	–	–
c.w.	28	470	< 80	1,0	< 71	> 11,0	> 50	–	–
c.w.	28	470	typ. 80	1,45	typ. 86	typ. 12,6	typ. 60	2,5 + j0,2	3,4 – j16
c.w.	28	1000	typ. 400	1,4	typ. 100	typ. 5,4	typ. 50	–	–

MECHANICAL DATA

Dimensions in mm

SOT-48



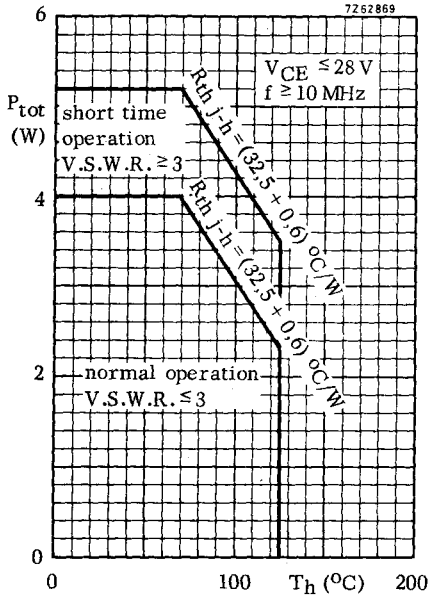
When locking is required an adhesive instead of a lock washer is preferred.
Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)
Diameter of clearance hole in heatsink: max. 4,17 mm
Mounting hole to have no burrs at either end
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

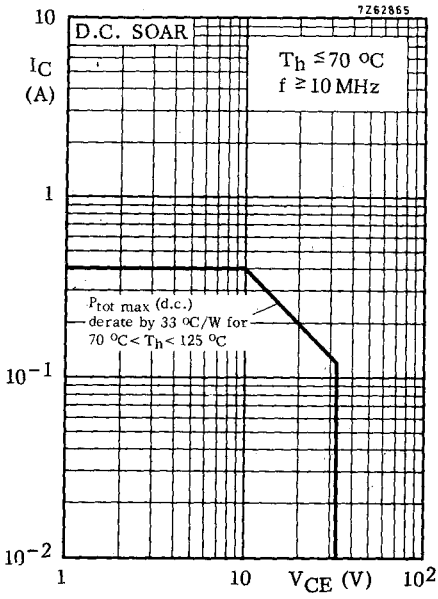
RATINGS Limiting values in accordance with the Absolute Maximum System (IEC134)

Voltages				
Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	65	V
Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max.	65	V
Collector-emitter voltage (open base)	V_{CEO}	max.	33	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4,0	V
Currents				
Collector current (d.c.)	I_C	max.	400	mA
Collector current (peak value); f ≥ 10 MHz	I_{CM}	max.	800	mA
Power dissipation				
Total power dissipation up to T_h = 70 °C f ≥ 10 MHz (see also page 3)	P_{tot}	max.	4,0	W
Temperatures				
Storage temperature	T_{stg}	−65 to +150		°C
Operating junction temperature	T_j	max.	200	°C

THERMAL RESISTANCE

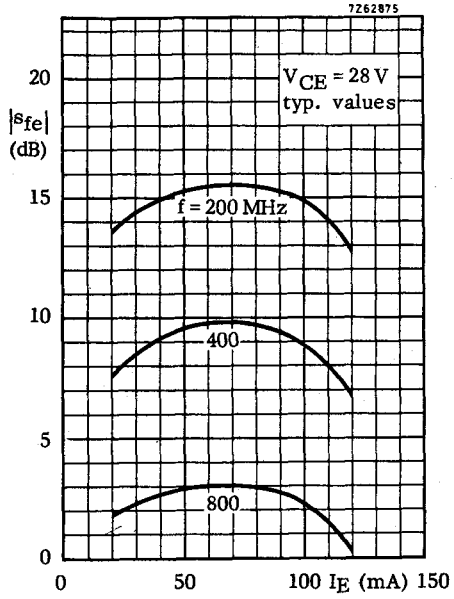
From junction to mounting base	$R_{th\ j\text{-}mb}$	=	32,5	°C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,6	°C/W

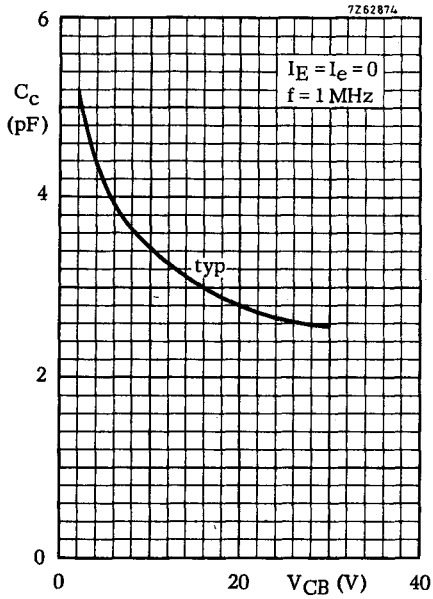

7Z62869
6
4
2
0
P_{tot} (W)
$V_{CE} \leq 28$ V
f ≥ 10 MHz
short time operation
V.S.W.R. ≥ 3
$R_{th\ j\text{-}h} = (32.5 + 0.6)$ °C/W
$R_{th\ j\text{-}h} = (32.5 + 0.6)$ °C/W
normal operation
V.S.W.R. ≤ 3
0
100
T_h (°C)
200

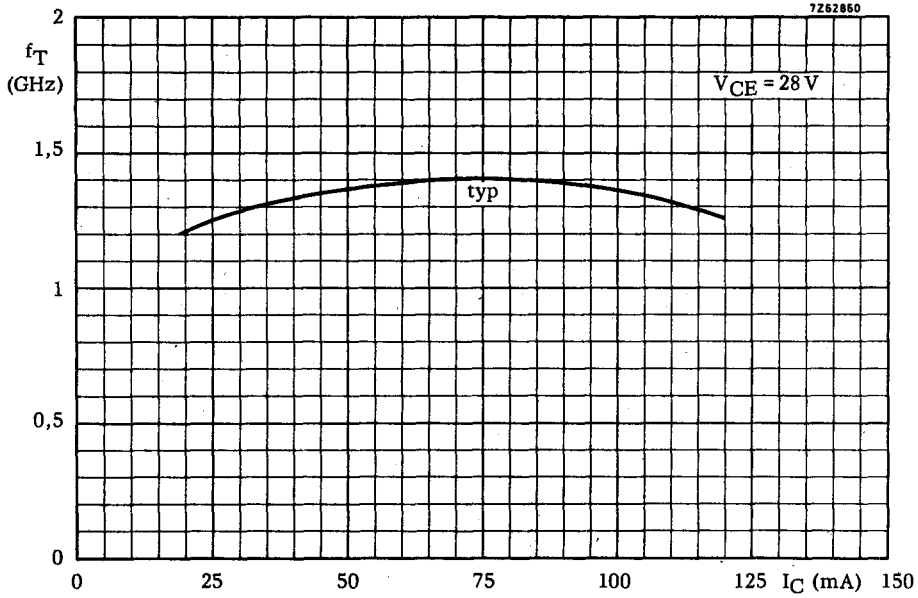

7Z62865
10
1
10^{-1}
10^{-2}
I_C (A)
D.C. SOAR
$T_h \leq 70$ °C
f ≥ 10 MHz
P_{tot} max (d.c.)
derate by 33 °C/W for
70 °C < T_h < 125 °C
1
10
V_{CE} (V)
10^2

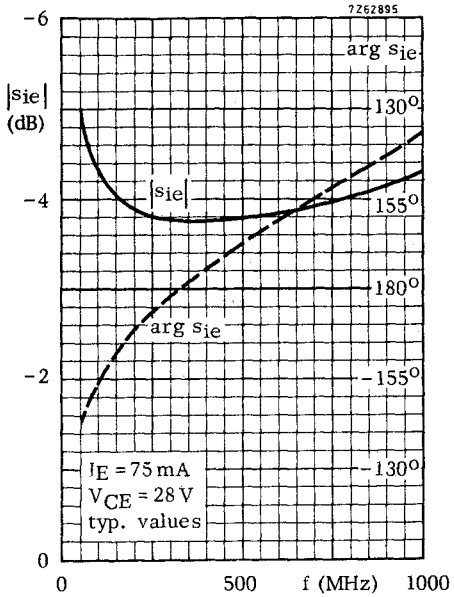
CHARACTERISTICS $T_j = 25\,^{o}C$ unless otherwise specified

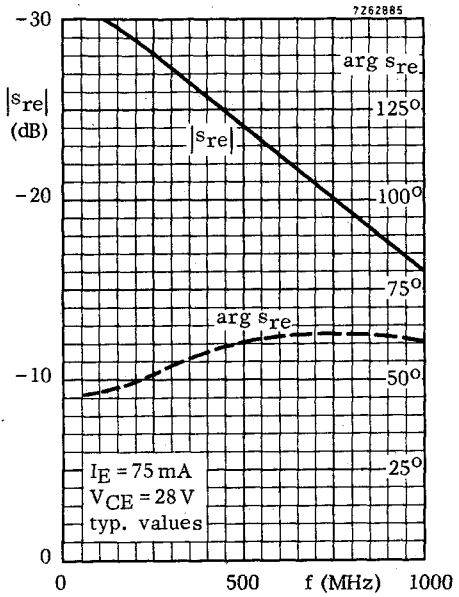
Breakdown voltages				
Collector-base voltage open emitter, $I_C = 10$ mA	$V_{(BR)CBO}$	>	65	V
Collector-emitter voltage $V_{BE} = 0$, $I_C = 10$ mA	$V_{(BR)CES}$	>	65	V
Collector-emitter voltage open base, $I_C = 25$ mA	$V_{(BR)CEO}$	>	33	V
Emitter-base voltage open collector, $I_E = 1{,}0$ mA	$V_{(BR)EBO}$	>	4,0	V
D.C. current gain				
$I_C = 100$ mA; $V_{CE} = 5{,}0$ V	h_{FE}	>	10	
		typ.	35	
Transition frequency				
$I_C = 50$ mA; $V_{CE} = 5{,}0$ V	f_T	typ.	1,2	GHz
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; $V_{CB} = 10$ V	C_c	typ.	3,5	pF
Emitter capacitance at f = 1 MHz				
$I_C = I_c = 0$; $V_{EB} = 0$	C_e	typ.	11	pF
Feedback capacitance at f = 1 MHz				
$I_C = 5$ mA; $V_{CE} = 10$ V	C_{re}	typ.	2,5	pF
Collector-stud capacitance	C_{cs}	typ.	2,0	pF

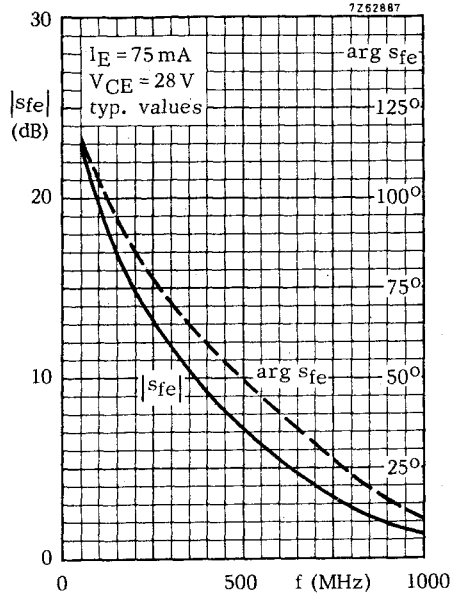

7Z62875
20
|sfe|
(dB)
15
10
5
0
VCE = 28 V
typ. values
f = 200 MHz
400
800
0
50
100 IE (mA) 150

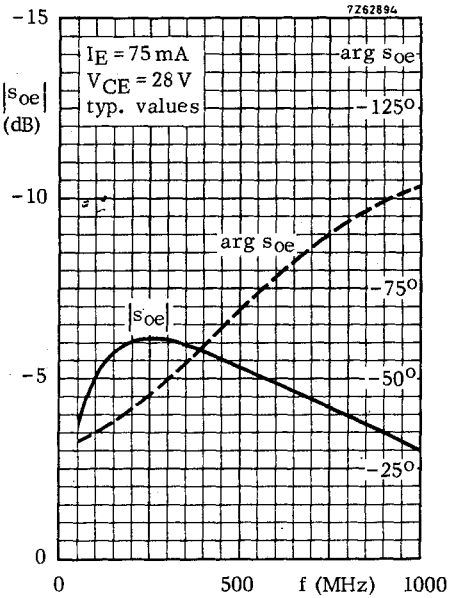

7Z62874
6
Cc
(pF)
4
2
0
IE = Ie = 0
f = 1 MHz
typ
0
20
VCB (V)
40


7Z62850
2
fT
(GHz)
1,5
1
0,5
0
VCE = 28 V
typ
0
25
50
75
100
125 IC (mA)
150


7Z62895
arg s_{ie}
130°
155°
180°
-155°
-130°
$|s_{ie}|$
(dB)
$|s_{ie}|$
arg s_{ie}
I_E = 75 mA
V_{CE} = 28 V
typ. values
-6
-4
-2
0
0
500
f (MHz)
1000


7Z62885
arg s_{re}
125°
100°
75°
50°
25°
$|s_{re}|$
(dB)
$|s_{re}|$
arg s_{re}
I_E = 75 mA
V_{CE} = 28 V
typ. values
-30
-20
-10
0
0
500
f (MHz)
1000


7Z62887
I_E = 75 mA
V_{CE} = 28 V
typ. values
arg s_{fe}
125°
100°
75°
50°
25°
$|s_{fe}|$
(dB)
$|s_{fe}|$
arg s_{fe}
30
20
10
0
0
500
f (MHz)
1000


7Z62894
I_E = 75 mA
V_{CE} = 28 V
typ. values
arg s_{oe}
-125°
-75°
-50°
-25°
$|s_{oe}|$
(dB)
$|s_{oe}|$
arg s_{oe}
-15
-10
-5
0
0
500
f (MHz)
1000

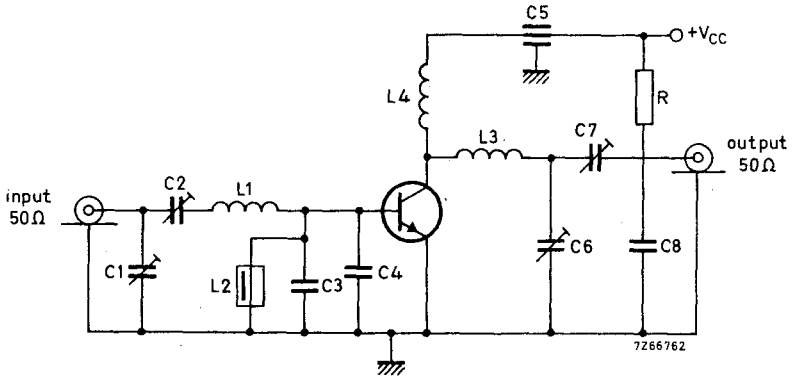
APPLICATION INFORMATION

R.F. performance in c.w. operation (Unneutralized common-emitter class B circuit)

T_h = 25 °C

V_{CC} (V)	f (MHz)	P_S (mW)	P_L (W)	I_C (mA)	G_p (dB)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
24	470	typ. 50	0,85	typ. 67	typ. 12,3	typ. 53	–	–
28	470	< 80	1,0	< 71	> 11,0	> 50	–	–
28	470	typ. 80	1,45	typ. 86	typ. 12,6	typ. 60	2,5 + j0,2	3,4 – j16 ←
28	1000	typ. 400	1,4	typ. 100	typ. 5,4	typ. 50	–	–

Test circuit for 470 MHz:



C1 = C2 = C7 = 1,8 to 18 pF film dielectric trimmer
C3 = C4 = 18 pF disc ceramic capacitor
C5 = 1 nF feed-through capacitor
C6 = 1,0 to 9,0 pF film dielectric trimmer
C8 = 0,1 µF polyester capacitor

L1 = 1 turn Cu wire (1,2 mm); int.diam.5 mm; lead length = 2 mm
L2 = 0,47 µH choke
L3 = 4 turns closely wound enamelled Cu wire (1,2 mm); int. diam. 6,5 mm; lead length = 4 mm
L4 = 5 turns closely wound enamelled Cu wire (0,5 mm); int. diam. 4 mm; lead length = 5 mm

R = 10 Ω carbon

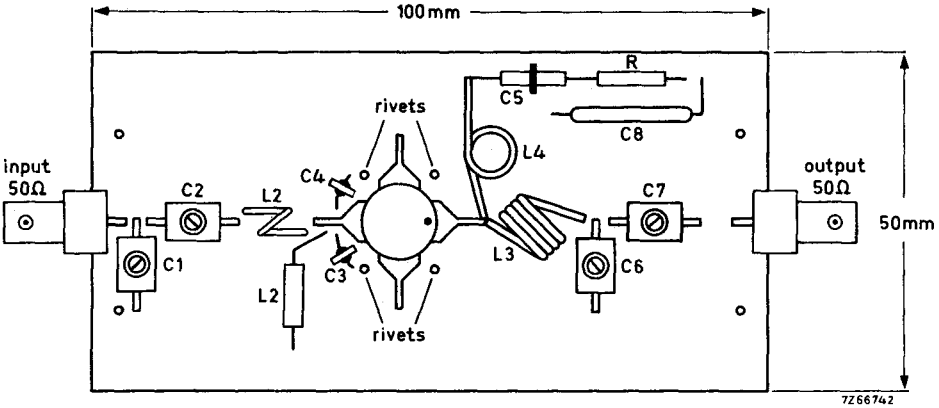
At P_L = 1,0 W and V_{CC} = 28 V, the output power at heatsink temperatures between 25 °C and 90 °C relative to that at 25 °C is diminished by typ. 2 mW/°C.

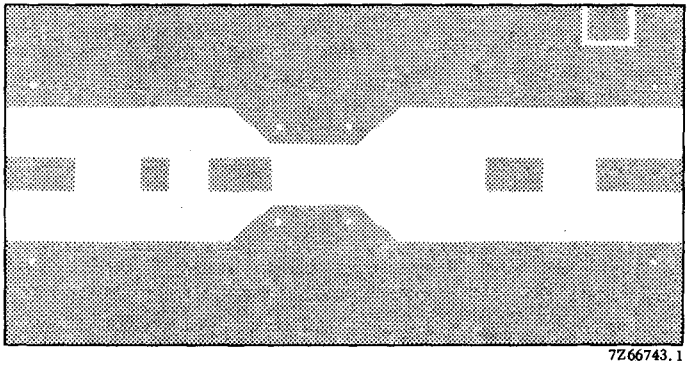
The transistor is designed to withstand full load mismatch in the test circuit under the following conditions: V_{CC} = 28 V; f = 470 MHz; T_h = 90 °C
V.S.W.R. = 50 : 1 through all phases; P_L = 1,2 W

Component lay-out for 470 MHz test circuit see page 8.

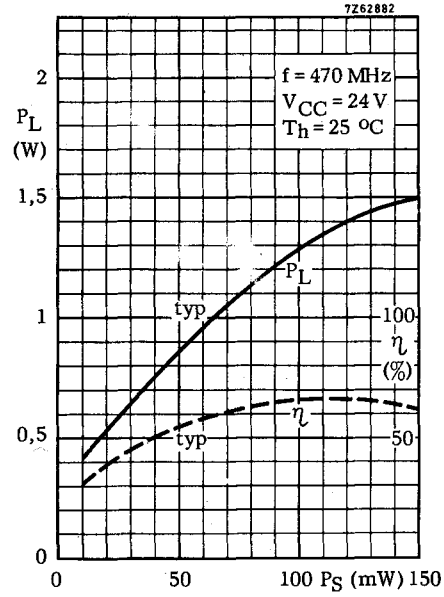
APPLICATION INFORMATION (continued)

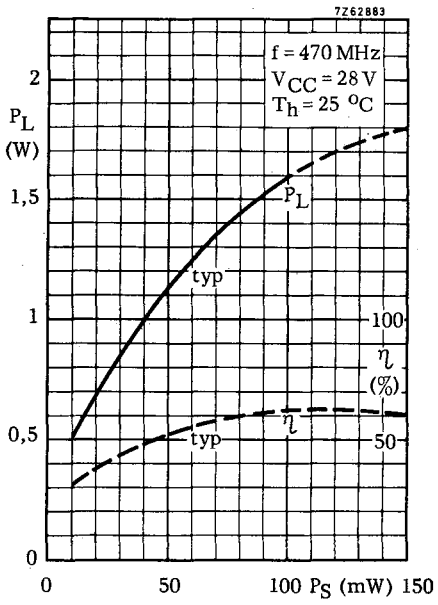
Component lay-out and printed circuit board for 470 MHz test circuit.

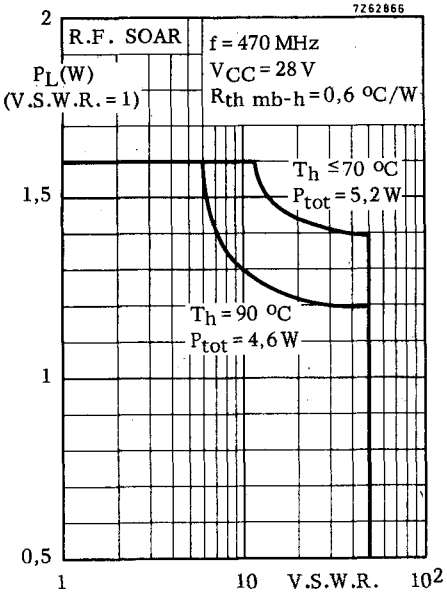




Shaded area copper
Back area completely copper clad
Material of printed circuit board: 1,5 mm epoxy fibre-glass







Indicated load power as a function of overload

The graph has been derived from an evaluation of the performance of transistors matched up to 1,6 W load power in the test amplifier on page 7 and subsequently subjected to various mismatch conditions at 28 V with V.S.W.R. up to 50 : 1 and elevated heatsink temperatures. This indicates a restriction to the load power matched under nominal conditions in the recommended test configuration.

→ **OPERATING NOTE** Below 350 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for both d.c. and r.f.