U.H.F./V.H.F. POWER TRANSISTOR

N-P-N silicon transistor for use in class-B and C operated mobile, industrial and military transmitters with a supply voltage of 13,8 V.

It has a capstan envelope with a moulded cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

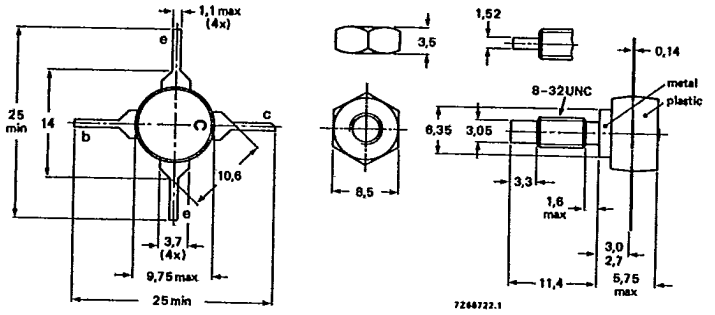
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit.

mode of operation	V_{CE} V	f MHz	P_S W	P_L W	I_C A	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mS
c.w.	13,8	470	< 2,0	7,0	< 0,78	> 5,4	> 65	–	–
c.w.	13,8	470	typ. 2,0	7,8	typ. 0,81	typ. 5,9	typ. 70	2,4 + j6,7	60 – j20
c.w.	12,5	470	< 2,2	7,0	< 0,86	> 5,0	> 65	–	–
c.w.	12,5	175	typ. 0,4	7,2	typ. 0,87	typ.12,6	typ. 66	–	–

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-48/3.



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. 4,2 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.

When locking is required an adhesive is preferred instead of a lock washer.

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) peak value	V_{CBOM}	max.	36	V
Collector-emitter voltage (R_{BE} = 0) peak value	V_{CESM}	max.	36	V
Collector-emitter voltage (open base)	V_{CEO}	max.	18	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Collector current (average)	$I_{C(AV)}$	max.	1.0	A
Collector current (peak value) f > 1 MHz	I_{CM}	max.	4.0	A
Total power dissipation up to T_h = 70 °C f > 10 MHz	P_{tot}	max.	10	W
Storage temperature	T_{stg}	−65 to +150		°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	7.0	K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0.6	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Breakdown voltages				
Collector-base voltage open emitter, I_C = 10 mA	$V_{(BR)CBO}$	>	36	V
Collector-emitter voltage V_{BE} = 0; I_C = 10 mA	$V_{(BR)CES}$	>	36	V
Collector-emitter voltage open base, I_C = 25 mA	$V_{(BR)CEO}$	>	18	V
Emitter-base voltage open collector, I_E = 1.0 mA	$V_{(BR)EBO}$	>	4	V
Collector-emitter saturation voltage				
I_C = 500 mA; I_B = 100 mA	V_{CEsat}	typ.	0.2	V
D.C. current gain				
I_C = 500 mA; V_{CE} = 5 V	h_{FE}	> typ.	10 40	
Transition frequency				
I_C = 500 mA; V_{CE} = 5 V; f = 500 MHz	f_T	typ.	1300	MHz
Collector capacitance at f = 1 MHz				
$I_E = I_e$ = 0; V_{CB} = 10 V	C_c	typ. <	14 20	pF pF
Emitter capacitance at f = 1 MHz				
$I_C = I_c$ = 0; V_{EB} = 0	C_e	typ.	65	pF
Feedback capacitance at f = 1 MHz				
I_C = 50 mA; V_{CE} = 10 V	C_{re}	typ.	10.5	pF
Collector-stud capacitance	C_{cs}	typ.	2	pF

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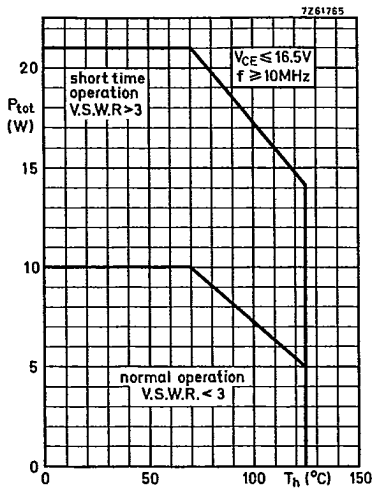
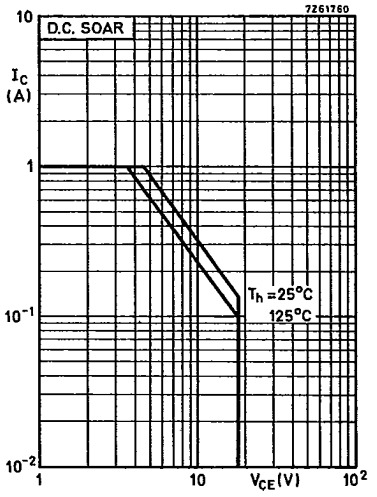
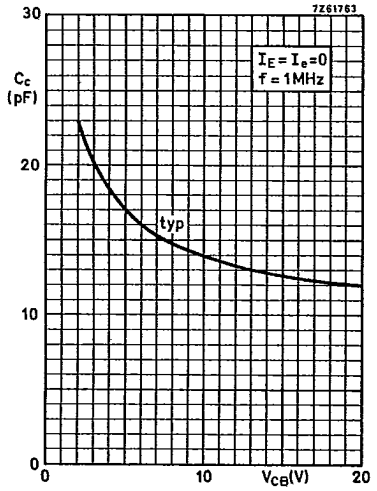






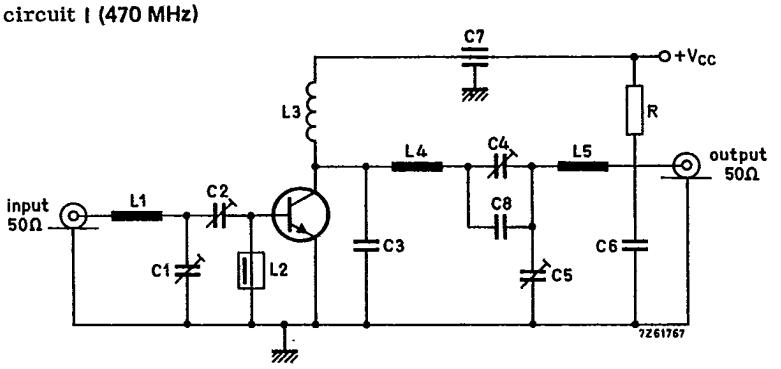
APPLICATION INFORMATION

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

T_h up to 25 °C

f (MHz)	V_{CC} (V)	P_S (W)	P_L (W)	I_C (A)	G_p (dB)	η (%)	$\bar{z}_i$ (Ω)	$\bar{Y}_L$ (mS)
470	13.8	< 2.0	7.0	< 0.78	> 5.4	> 65	–	–
470	13.8	typ. 2.0	7.8	typ. 0.81	typ. 5.9	typ. 70	2.4+j6.7	60 – j20
470	12.5	< 2.2	7.0	< 0.86	> 5.0	> 65	–	–
175	12.5	typ. 0.4	7.2	typ. 0.87	typ. 12.6	typ. 66	–	–

Test circuit I (470 MHz)



C1 = C2 = C4 = C5 = 1.8 to 18 pF film dielectric trimmer
C3 = 6.8 pF ceramic capacitor
C6 = 0.1 µF polyester capacitor
C7 = 4 nF feed-through capacitor
C8 = 10 pF ceramic capacitor

L1 = L4 = L5 = 20 mm straight Cu wire (1.2 mm); height above print 12 mm
L2 = 0.47 µH choke
L3 = 1 turn Cu wire (1.7 mm); int. diam. 10 mm; max. lead length 5 mm

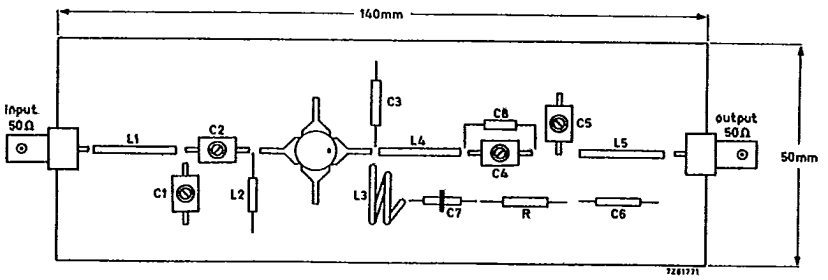
R = 10 Ω carbon

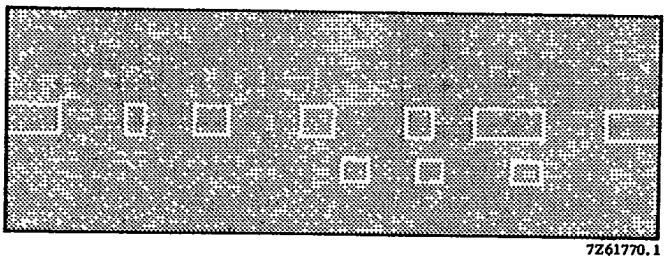
At P_L = 7.0 W and V_{CC} = 12.5 V the output power at heatsink temperatures between 25 °C and 90 °C relative to that at 25 °C is diminished by typ. 10 mW/K

The transistor is designed to withstand full load mismatch in the test circuit under the following conditions: V_{CC} = 16.5 V; f = 470 MHz; T_h = 70 °C;
V.S.W.R. = 50 : 1 through all phases; $P_S = P_{Snom} + 20\%$
where $P_{Snom} = P_S$ for 7.0 W transistor output into 50 Ω load at V_{CC} = 13.8 V

APPLICATION INFORMATION (continued)

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





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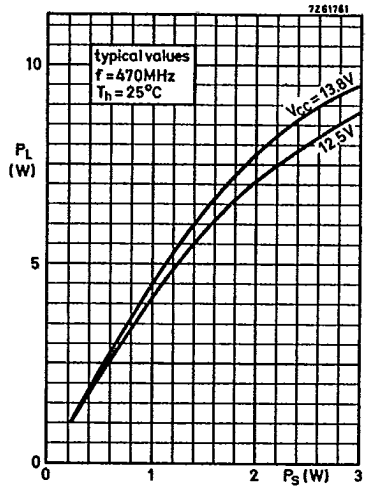
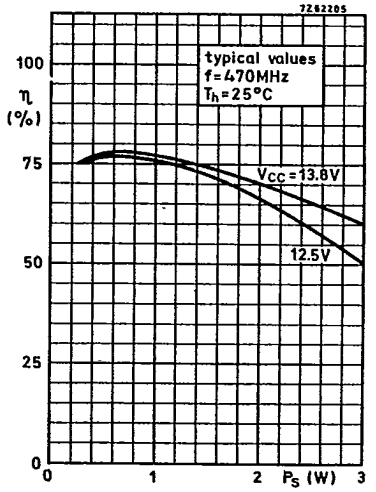
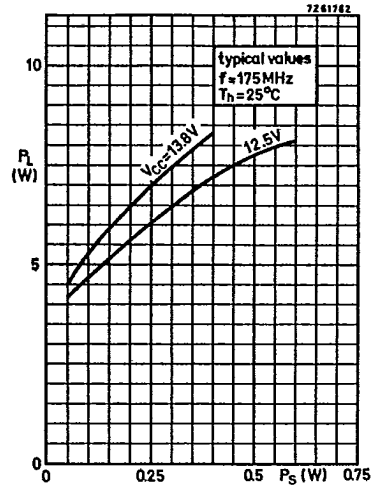
Shaded area copper

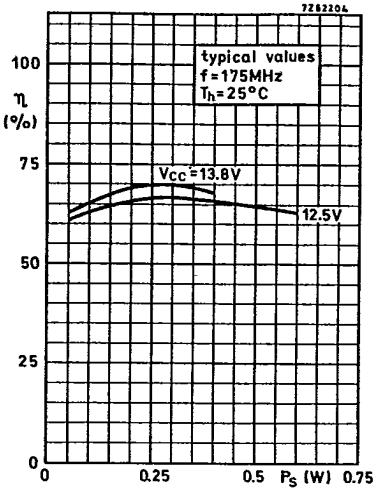
Back area completely copper clad

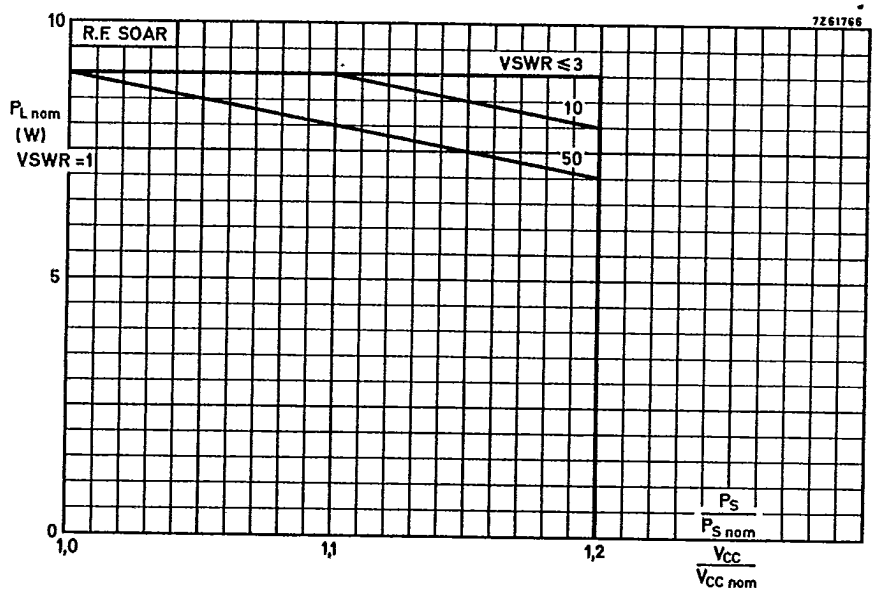
Material of printed circuit board: 1.5 mm epoxy fibre glass











Conditions for R.F. SOAR:

f = 470 MHz

T_h = 70 °C

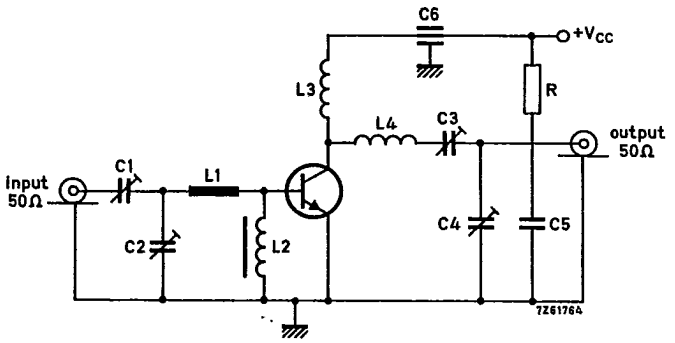
V_{CCnom} = 13,8 V

$P_{Snom} = P_S$ at $V_{CC} = V_{CCnom}$ and VSWR = 1

The transistor was developed for use with unstabilized supply voltage V_{CC}.
The above graph is based on its measured performance in test circuit I.
Supply voltage was varied from V_{CCnom} to 1,2 V_{CCnom}, and VSWR from 1 to 50.
It shows the max. permissible output power under nominal conditions in order not to exceed the max. permissible power dissipation under conditions of supply over-voltage ($V_{CC} > V_{CCnom}$) and load mismatch (VSWR > 1).
It is assumed that the drive power increases linearly with the supply voltage; i.e. $P_S/P_{Snom} = V_{CC}/V_{CCnom}$.

APPLICATION INFORMATION (continued)

Test circuit II (175 MHz)



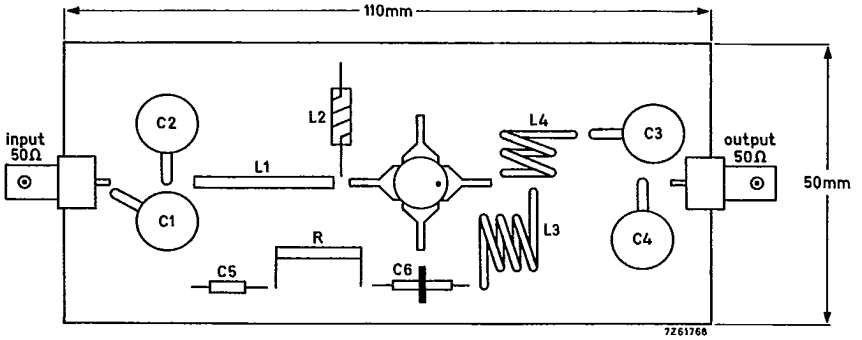
C1 = C3 = C4 = 30 pF concentric air trimmer
C2 = 60 pF concentric air trimmer
C5 = 0.25 µF polyester capacitor
C6 = 4.0 nF feed-through capacitor

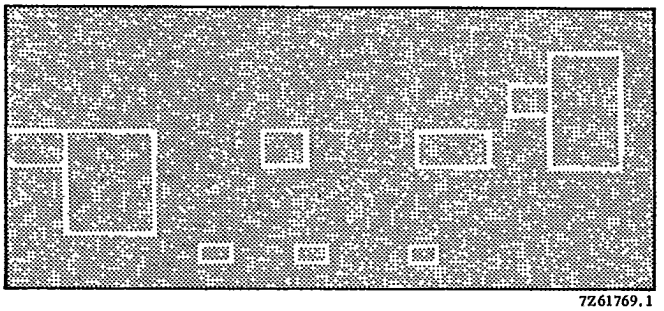
L1 = 25 mm straight Cu wire (1.2 mm); height above print 3 mm
L2 = 3 turns Cu wire (0.5 mm) on Ferrite FX1115, d = 2 mm, D = 4 mm, l = 5 mm material 3B (code number 3113 991 16740)
L3 = 5 turns closely wound Cu wire (1.2 mm); int. diam. 10 mm; lead length 5 mm
L4 = 3 turns closely wound Cu wire (1.2 mm); int. diam. 10 mm; lead length 5 mm

R = 10 Ω carbon

APPLICATION INFORMATION (continued)

Component lay-out and printed circuit board for 175 MHz test circuit





Shaded area copper
Back area not metalized
Material of printed circuit board: 1.5 mm epoxy fibre glass