U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor, for use in class A, B and C operated mobile, industrial and military transmitters with a supply voltage of 13.5 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions with a supply over-voltage to 16.5 V. Gold metallization ensures extremely high reliability.

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

QUICK REFERENCE DATA

R.F., performance up to $T_{mb} = 25^\circ$C in an unneutralized common-emitter class-B circuit

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>$V_{CE}$ V</th>
<th>$f$ MHz</th>
<th>$PS$ W</th>
<th>$PL$ W</th>
<th>$IC$ A</th>
<th>$Gp$ dB</th>
<th>$\eta$ %</th>
<th>$\Sigma$ Ω</th>
<th>$\nabla L$ mS</th>
</tr>
</thead>
<tbody>
<tr>
<td>c.w.</td>
<td>13.5</td>
<td>470</td>
<td>&lt; 8.0</td>
<td>20</td>
<td>&lt; 2.28</td>
<td>&gt; 4</td>
<td>&gt; 85</td>
<td>1.2 $\pm$ 4.5</td>
<td>163 - 38</td>
</tr>
<tr>
<td>c.w.</td>
<td>12.5</td>
<td>470</td>
<td>&lt; 6.8</td>
<td>17</td>
<td>&lt; 2.09</td>
<td>&gt; 4</td>
<td>&gt; 85</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Fig. 1 SOT-48/2.

Dimensions in mm

Torque on nut: min. 0.76 Nm (7.5 kg cm) max. 0.96 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.

3589 D-14 August 1986 879
RATINGS  Limiting values in accordance with the Absolute Maximum System* (IEC 134)

Voltages
Collector-base voltage (open emitter) peak value
V_{CBO}  max.  36  V
Collector-emitter voltage (open base)
V_{CEO}  max.  18  V
Emitter-base voltage (open collector)
V_{EBO}  max.  4   V

Currents
Collector current (average)
I_{CAV}  max.  3.5  A
Collector current (peak value) f > 1 MHz
I_{CM}  max.  10  A

Power dissipation
Total power dissipation up to T_{j} = 25 °C
f ≥ 1 MHz
P_{TOT}  max.  50  W

Temperatures
Storage temperature
T_{STG}  -65 to +200  °C
Junction temperature
T_{J}  max.  200  °C

THERMAL RESISTANCE
From junction to mounting base
R_{TH J-MB}  =  2.9  K/W
From mounting base to heatsink
R_{TH MB-H}  =  0.6  K/W
CHARACTERISTICS

$T_J = 25 \, ^\circ C$ unless otherwise specified

Breakdown voltages

Collector-base voltage
open emitter; $I_C = 25 \, mA$

$V(BR)CEO > 36 \, V$

Collector-emitter voltage
open base; $I_C = 25 \, mA$

$V(BR)CEO > 18 \, V$

Emitter-base voltage
open collector; $I_E = 10 \, mA$

$V(BR)EBO > 4 \, V$

Transient energy

$L = 25 \, mH; f = 50 \, Hz$

open base

$V_{BE} = 1.5 \, V; R_{BB} = 33 \, \Omega$

$E_B > 3.1 \, mWs$

$E_E > 3.1 \, mWs$

D.C. current gain

$I_C = 1 \, A; V_{CE} = 5 \, V$

$h_{FE} > 10$

typ. 30

Transition frequency

$I_C = 2 \, A; V_{CE} = 10 \, V$

$f_T$ typ. 1.0 GHz

Collector capacitance at $f = 1 \, MHz$

$I_E = I_C = 0; V_{CB} = 15 \, V$

$C_C$ typ. 55 pF

$< 70$ pF

Feedback capacitance

$I_C = 100 \, mA; V_{CE} = 15 \, V$

$C_{re}$ typ. 32 pF

$C_{cs}$ typ. 2 pF
APPLICATION INFORMATION

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

\[ T_{mb} \text{ up to } 25 \degree C \]

<table>
<thead>
<tr>
<th>( f ) (MHz)</th>
<th>( V_{CE} ) (V)</th>
<th>( P_{S} ) (W)</th>
<th>( P_{L} ) (W)</th>
<th>( I_{C} ) (A)</th>
<th>( S_{P} ) (dB)</th>
<th>( \eta ) (%)</th>
<th>( Z_{L} ) (Ω)</th>
<th>( V_{L} ) (mS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>470</td>
<td>13,5</td>
<td>&lt; 8,00</td>
<td>20</td>
<td>&lt; 2,28</td>
<td>&gt; 65</td>
<td>1,2 + j4,5</td>
<td>163 - j35</td>
<td></td>
</tr>
<tr>
<td>470</td>
<td>12,5</td>
<td>&lt; 6,80</td>
<td>17</td>
<td>&lt; 2,09</td>
<td>&gt; 65</td>
<td>&lt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>175</td>
<td>12,5</td>
<td>typ. 1,35</td>
<td>17</td>
<td>typ. 2,30</td>
<td>typ. 11</td>
<td>typ. 60</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Test circuit: 470 MHz; c.w. class-B.

List of components:

- \( C1 = C2 = C7 = C8 = 2,0 \text{ to } 9,0 \text{ pF film dielectric trimmer (cat. no. } 2222 \ 809 \ 09002) \)
- \( C3 = C4 = 15 \text{ pF chip capacitor} \)
- \( C5 = 100 \text{ pF feed-through capacitor} \)
- \( C6 = 33 \text{ nF polyester capacitor} \)
- \( R1 = 1 \text{ Ω carbon resistor} \)
- \( R2 = 10 \text{ Ω carbon resistor} \)
- \( L1 = \text{strip line (41,1 mm } \times \text{ 5,0 mm)} \)
- \( L2 = 13 \text{ turns closely wound enamel Cu wire (0,5 mm); int. dia. 4,0 mm (0,32 } \mu \text{H)} \)
- \( L3 = 2 \text{ turns Cu wire (1 mm); winding pitch } 1,5 \text{ mm; int. dia. 4 mm; leads } 2 \times 5 \text{ mm} \)
- \( L4 = \text{strip line (52,7 mm } \times \text{ 5,0 mm)} \)
- \( L5 = \text{Ferroxcube choke coil. Z (at } f = 50 \text{ MHz) } = 750 \text{ Ω } \pm \text{ 20% (cat. no. } 4312 \ 020 \ 36640) \)

L1 and L4 are striplines on a double Cu-clad print plate with PTFE fibre-glass dielectric. \( (\varepsilon_{r} = 2,74) \); thickness 1,48 mm.
APPLICATION INFORMATION (continued)
Component layout and printed-circuit board for 470 MHz test circuit.

The circuit and the components are situated on one side of the PTFE fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets.
The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graph above for safe operation at supply voltages other than the nominal. The graph shows the allowable output power, under nominal conditions, as a function of the supply overvoltage ratio, with VSWR as parameter.

The graph applies to the situation in which the drive (P_D/P_Snom) increases linearly with the supply overvoltage ratio.

The horizontal line at 20 W applies at V_CCMnom = 13.5 V.

For V_CCMnom = 12.5 V, P_L should be derated to 17 W.