# UHF POWER TRANSISTOR

NPN silicon planar epitaxial transistor primarily intended for use in radio transmitters in the 470 MHz communications band.

**Features**

- Multi-base structure and emitter ballasting resistors for an optimum temperature profile
- Gold metallization ensures excellent reliability
- Internal matching to achieve an optimum wideband capability and high power gain

The BLU60/28 has a 6-lead flange envelope with a ceramic cap (SOT119). All leads are isolated from the flange.

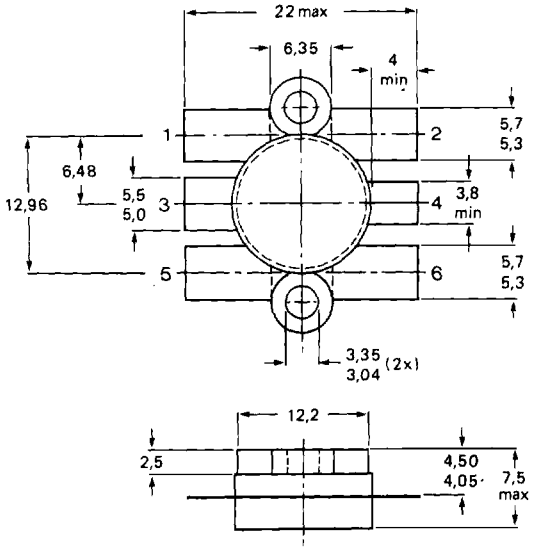
## QUICK REFERENCE DATA

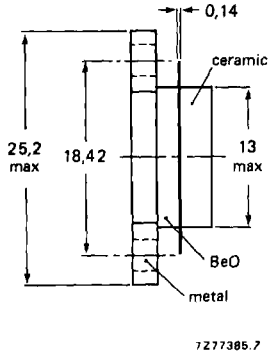
RF performance at $T_h$ = 25 °C in a common-emitter class-B circuit

| Mode of operation | f MHz | $V_{CE}$ V | $P_L$ W | $G_P$ dB | $\eta_C$ % |
|---|---|---|---|---|---|
| CW class-B | 470 | 28 | 60 | > 7 | > 55 |
| CW class-B | 470 | 24 | 50 | typ. 7 | typ. 60 |

## MECHANICAL DATA

Dimensions in mm




**Lead reference**

1 = emitter
2 = emitter
3 = base
4 = collector
5 = emitter
6 = emitter

Torque on screw: min. 0.6 Nm (6 kg cm)
max. 0.75 Nm (7.5 kg cm)
Recommended screw: cheese-head 4-40 UNC/2A

Heatsink compound must be applied sparingly, and evenly distributed.

Fig.1 SOT119.

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

## RATINGS

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

| | | | |
|---|---|---|---|
| Collector-emitter voltage (peak value), $V_{BE} = 0$ | $V_{CESM}$ | max. | 60 V |
| open base | $V_{CEO}$ | max. | 32 V |
| Emitter-base voltage (open collector) | $V_{EBO}$ | max. | 3.5 V |
| Collector current | | | |
| DC or average | $I_C$, $I_{C(AV)}$ | max. | 8.0 A |
| peak value; $f > 1$ MHz | $I_{CM}$ | max. | 24 A |
| RF power dissipation | | | |
| $f > 1$ MHz; $T_{mb} = 25\ ^oC$ | $P_{rf}$ | max. | 110 W |
| Storage temperature range | $T_{stg}$ | | −65 to + 150 °C |
| Operating junction temperature | $T_j$ | max. | 200 °C |

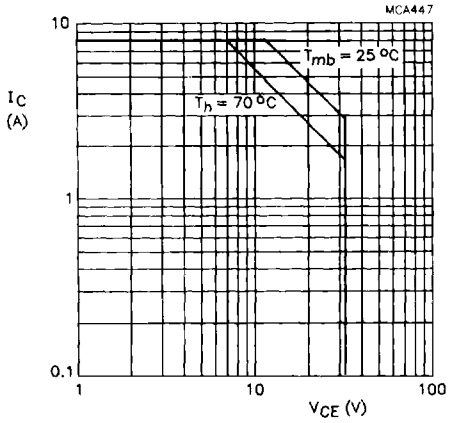
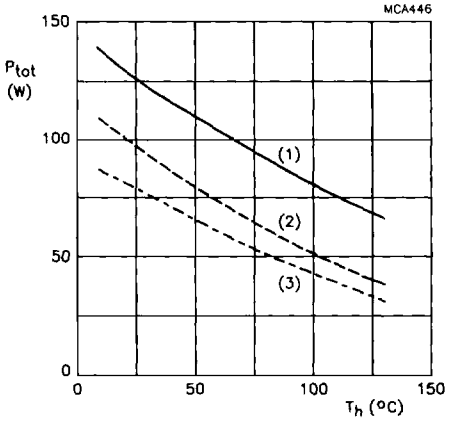



Fig.2 DC SOAR.




(1) Short-time operation during mismatch.
(2) Continuous RF operation ($f > 1$ MHz).
(3) Continuous DC operation.

Fig.3 Power/temperature derating curves.

## THERMAL RESISTANCE

RF dissipation = 110 W; $T_{mb} = 25\ ^oC$

| | | | |
|---|---|---|---|
| From junction to mounting base | $R_{th\ j\text{-}mb}$ | max. | 1.55 K/W |
| From mounting base to heatsink | $R_{th\ mb\text{-}h}$ | max. | 0.2 K/W |

## CHARACTERISTICS

$T_j$ = 25 °C unless otherwise specified

| | | | |
|---|---|---|---|
| Collector-emitter breakdown voltage | | | |
| $V_{BE}$ = 0; $I_C$ = 30 mA | $V_{(BR)CES}$ | min. | 60 V |
| open base; $I_C$ = 200 mA | $V_{(BR)CEO}$ | min. | 32 V |
| Emitter-base breakdown voltage | | | |
| open collector; $I_E$ = 20 mA | $V_{(BR)EBO}$ | min. | 3.5 V |
| Collector cut-off current | | | |
| $V_{BE}$ = 0; $V_{CE}$ = 32 V | $I_{CES}$ | max. | 10 mA |
| DC current gain | | | |
| $I_C$ = 3.2 A; $V_{CE}$ = 25 V | $h_{FE}$ | 20 to 120 | |
| | | typ. | 75 |
| Collector capacitance at f = 1 MHz | | | |
| $I_E = I_e$ = 0; $V_{CB}$ = 28 V | $C_c$ | typ. | 90 pF |
| Feedback capacitance at f = 1 MHz | | | |
| $I_C$ = 0; $V_{CE}$ = 28 V | $C_{re}$ | typ. | 55 pF |
| Collector-flange capacitance | $C_{cf}$ | typ. | 3.0 pF |

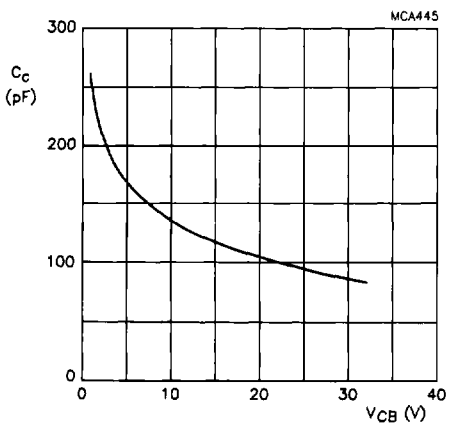
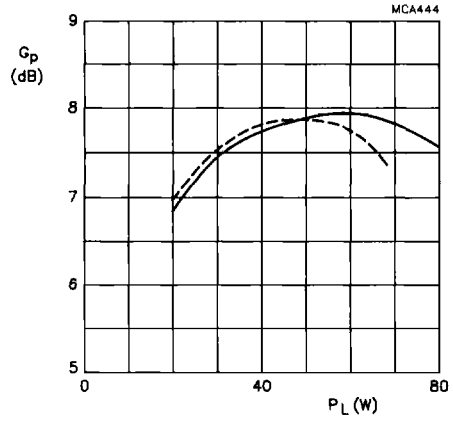



Fig.4 Collector capacitance as a function of base-collector voltage; $I_E = I_e$ = 0; f = 1 MHz; typical values.

## APPLICATION INFORMATION

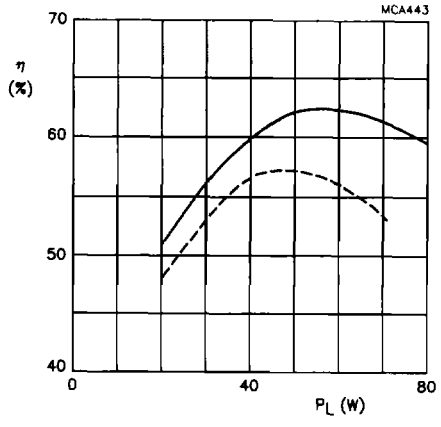
RF performance at $T_h$ = 25 °C in a class-B test circuit

| Mode of operation | f MHz | $V_{CE}$ V | $P_L$ W | $G_P$ dB | $\eta_C$ % |
|---|---|---|---|---|---|
| CW class-B | 470 | 28 | 60 | > 7 | > 55 |
| CW class-B | 470 | 24 | 50 | typ. 7 | typ. 60 |



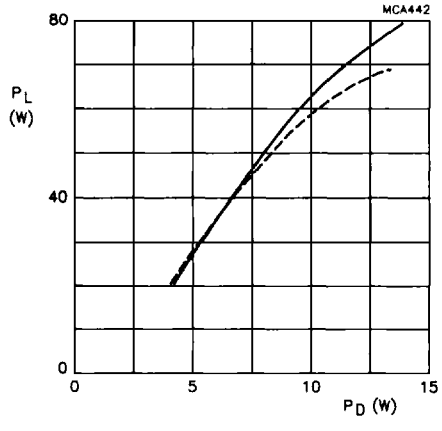

——— $T_h$ = 25 °C
– – – $T_h$ = 70 °C

Fig.5 Power gain as a function of load power; typical values.




——— $T_h$ = 25 °C
– – – $T_h$ = 70 °C

Fig.6 Efficiency as a function of load power; typical values.




——— $T_h$ = 25 °C
– – – $T_h$ = 70 °C

Fig.7 Load power as a function of drive power; typical values.

**Conditions for Figs 5 to 7**

Class-B operation; $V_{CE}$ = 28 V; f = 470 MHz; $R_{th\ mb\text{-}h}$ = 0.2 K/W.

**Ruggedness in class-B operation**

The BLU60/28 is capable of withstanding a load mismatch corresponding with VSWR = 50 through all phases under the following conditions: $V_{CE}$ = 28 V; f = 470 MHz; $T_h$ = 25 °C; $R_{th\ mb\text{-}h}$ = 0.2 K/W, at rated output power.

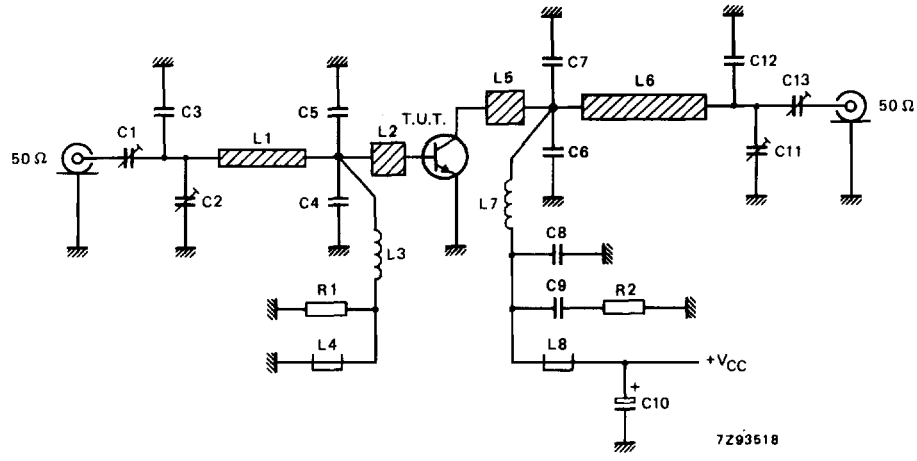



Fig.8 Class-B test circuit at f = 470 MHz.

**List of components**

C1 = C13 = 1.8 to 10 pF film dielectric trimmer (cat. no. 2222 809 05002)
C2 = C11 = 1.4 to 5.5 pF film dielectric trimmer (cat. no. 2222 809 09001)
C3 = 12 pF multilayer ceramic chip capacitor*
C4 = C5 = 8.2 pF multilayer ceramic chip capacitor**
C6 = C7 = 15 pF multilayer ceramic chip capacitor*
C8 = 110 pF multilayer ceramic chip capacitor*
C9 = 3 x 100 nF multilayer ceramic chip capacitors in parallel
C10 = 2.2 μF (35 V) electrolytic capacitor
C12 = 5.6 pF multilayer ceramic chip capacitor*

L1 = 34.6 Ω stripline (17 mm x 4 mm)
L2 = L5 = 25.3 Ω stripline (6 mm x 6 mm)
L3 = 45 nH; 4 turns, closely wound enamelled Cu-wire (0.5 mm); int. diam. 2.5 mm; leads 2 x 5 mm
L4 = L8 = Ferroxcube wideband HF choke, grade 3B (cat. no. 4312 020 36642)
L6 = 29.2 Ω stripline (25.5 mm x 5 mm)
L7 = 10 nH; 1 turn Cu-wire (1.0 mm); int. diam. 5 mm; leads 2 x 5 mm

R1 = 1 Ω ± 5% (0.4 W) metal film resistor
R2 = 10 Ω ± 5% (1.0 W) metal film resistor

Striplines are on a double Cu-clad printed-circuit board with PTFE fibre-glass dielectric; thickness 1/32 inch; ($\epsilon_r$ = 2.2).

* American Technical Ceramics capacitor type B or equivalent.
** Idem type A.

**APPLICATION INFORMATION** (continued)

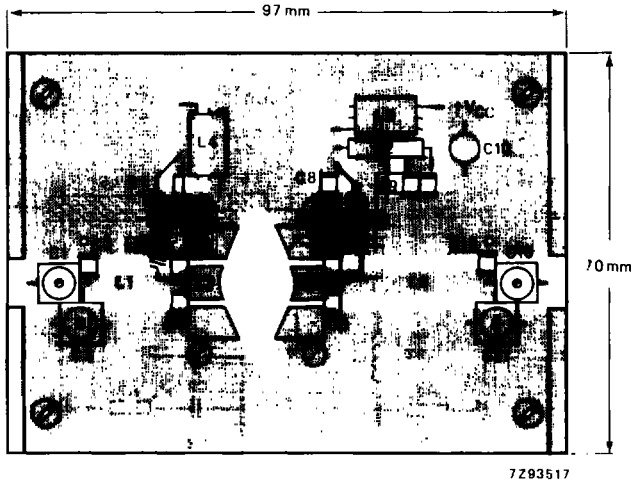



Fig.9 Component layout of 470 MHz, class-B test circuit.

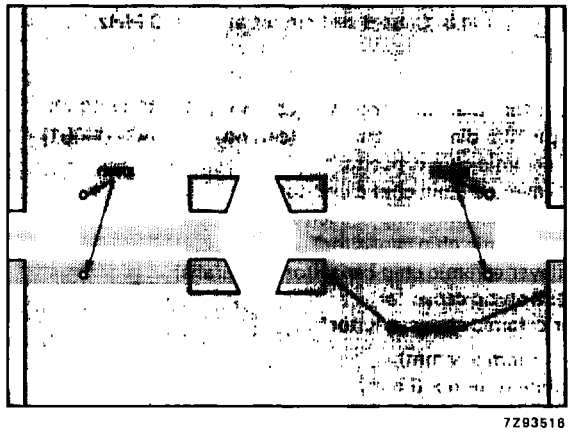



Fig.10 Printed-circuit board for 470 MHz, class-B test circuit.

**NOTE**

The circuit and the components are on one side of the PTFE fibre-glass board; the other side is fully metallized serving as groundplane. Earth connections are made by fixing screws, hollow rivets and also by copper straps under the emitter to provide a direct contact between the copper on the component side and the ground plane.

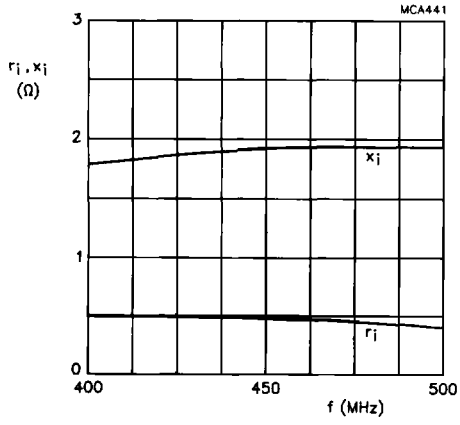



Fig.11 Input impedance as a function of frequency (series components); typical values.

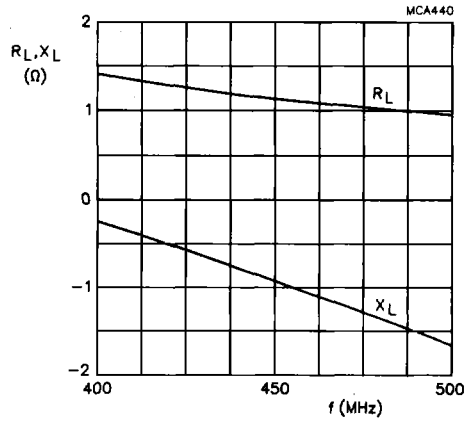



Fig.12 Load impedance as a function of frequency (series components); typical values.

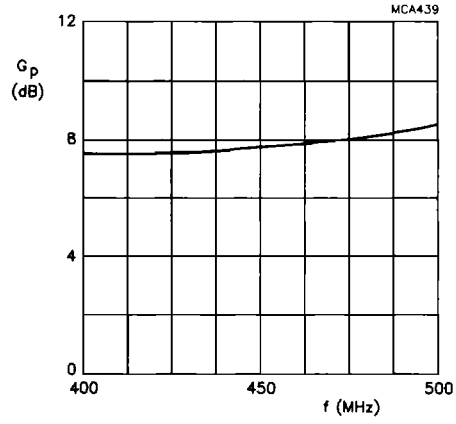



Fig.13 Gain as a function of frequency; typical values.

**Conditions for Figs 11 to 13**

Class-B operation; $V_{CE}$ = 28 V; $P_L$ = 60 W; $R_{th\ mb\text{-}h}$ = 0.2 K/W.