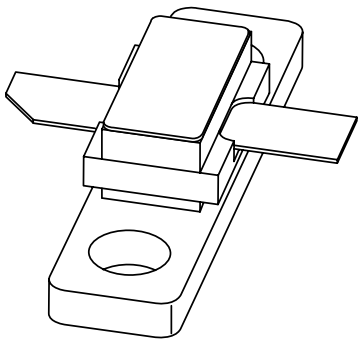
# DATA SHEET



# BLS2731-10
## Microwave power transistor

Product specification
Supersedes data of 1998 Mar 06

1998 Nov 25

Philips
Semiconductors

PHILIPS

# Microwave power transistor BLS2731-10

## FEATURES

- Suitable for short and medium pulse applications
- Internal input and output matching networks for an easy circuit design
- Emitter ballasting resistors improve ruggedness
- Gold metallization ensures excellent reliability
- Interdigitated emitter-base structure provides high emitter efficiency
- Multicell geometry improves power sharing and reduces thermal resistance.

## APPLICATIONS

- Common base class-C pulsed power amplifier for radar applications in the 2.7 to 3.1 GHz band.

## DESCRIPTION

NPN silicon planar epitaxial microwave power transistor in a 2-lead rectangular flange package with a ceramic cap (SOT445C) with the common base connected to the flange.

## PINNING - SOT445C

| PIN | DESCRIPTION |
|---|---|
| 1 | collector |
| 2 | emitter |
| 3 | base; connected to flange |

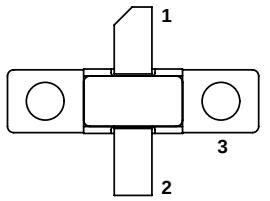



Fig.1 Simplified outline.

## QUICK REFERENCE DATA

RF performance at $T_h$ = 25 °C in a common base class-C test circuit.

| MODE OF OPERATION | f (GHz) | $V_{CB}$ (V) | $P_L$ (W) | $G_p$ (dB) | $\eta_C$ (%) |
|---|---|---|---|---|---|
| Pulsed class-C | 2.7 to 3.1 | 40 | 12.5 | typ. 10 | typ. 45 |

| WARNING |
|---|
| Product and environmental safety - toxic materials |
| This product contains beryllium oxide. The product is entirely safe provided that the BeO disc is not damaged. All persons who handle, use or dispose of this product should be aware of its nature and of the necessary safety precautions. After use, dispose of as chemical or special waste according to the regulations applying at the location of the user. It must never be thrown out with the general or domestic waste. |

## LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

| SYMBOL | PARAMETER | CONDITIONS | MIN. | MAX. | UNIT |
|---|---|---|---|---|---|
| $V_{CBO}$ | collector-base voltage | open emitter | – | 75 | V |
| $V_{CES}$ | collector-emitter voltage | $R_{BE}$ = 0 | – | 75 | V |
| $V_{EBO}$ | emitter-base voltage | open collector | – | 2 | V |
| $I_{CM}$ | peak collector current | $t_p \leq 100$ μs; $\delta \leq 10\%$ | – | 1.5 | A |
| $P_{tot}$ | total power dissipation | $t_p$ = 100 μs; $\delta$ = 10%; $T_{mb}$ = 25 °C | – | 145 | W |
| $T_{stg}$ | storage temperature | | –65 | +200 | °C |
| $T_j$ | operating junction temperature | | – | 200 | °C |
| $T_{sld}$ | soldering temperature | up to 0.2 mm from ceramic cap; t ≤ 10 s | – | 235 | °C |

## THERMAL CHARACTERISTICS

| SYMBOL | PARAMETER | CONDITIONS | VALUE | UNIT |
|---|---|---|---|---|
| $Z_{th\ j\text{-}h}$ | thermal impedance from junction to heatsink | $t_p$ = 100 μs; $\delta$ = 10%; note 1 | 1.2 | K/W |

**Note**

1. Equivalent thermal impedance under pulsed microwave operating conditions.

## CHARACTERISTICS

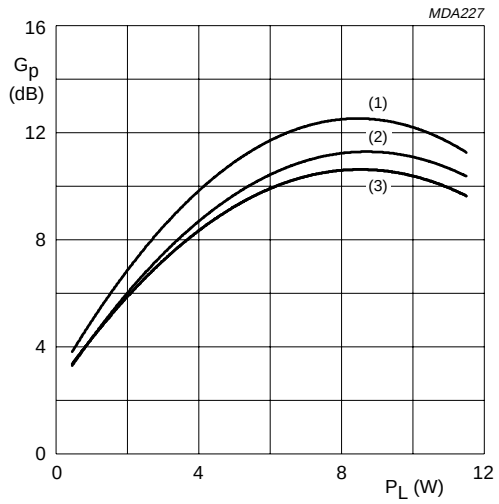
$T_j$ = 25 °C unless otherwise specified.

| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| $V_{(BR)CBO}$ | collector-base breakdown voltage | $I_C$ = 2.5 mA; open emitter | 75 | – | – | V |
| $V_{(BR)CES}$ | collector-emitter breakdown voltage | $I_C$ = 2.5 mA; $V_{BE}$ = 0 | 75 | – | – | V |
| $I_{CBO}$ | collector leakage current | $V_{CB}$ = 40 V; $I_E$ = 0 | – | – | 0.3 | mA |
| $I_{CES}$ | collector leakage current | $V_{CE}$ = 40 V; $V_{BE}$ = 0 | – | – | 0.5 | mA |
| $I_{EBO}$ | emitter leakage current | $V_{EB}$ = 1.5 V; $I_C$ = 0 | – | – | 0.1 | mA |
| $h_{FE}$ | DC current gain | $V_{CE}$ = 5 V; $I_C$ = 0.25 A | 40 | – | – | |
| $C_c$ | collector capacitance (die only) | $V_{CE}$ = 1 V; $I_E = i_e$ = 0; f = 1 MHz | – | 10 | – | pF |

**APPLICATION INFORMATION**

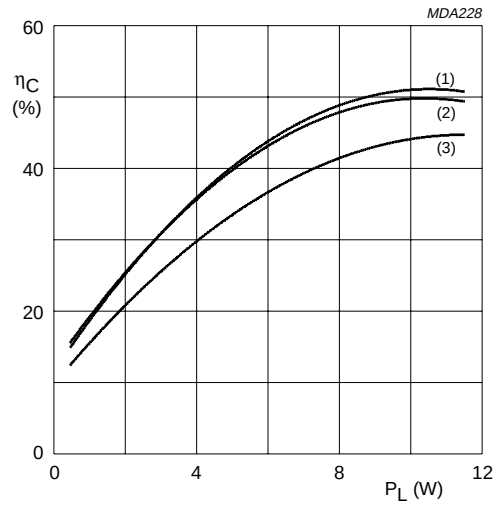
RF performance at $T_h$ = 25 °C in a common-base test circuit.

| MODE OF OPERATION | f (GHz) | $V_{CE}$ (V) | $P_L$ (W) | $G_p$ (dB) | $\eta_C$ (%) |
|---|---|---|---|---|---|
| Class-C; $t_p$ = 100 μs; δ = 10% | 2.7 to 3.1 | 40 | ≥10<br>typ. 12.5 | ≥9<br>typ. 10 | ≥35<br>typ. 45 |



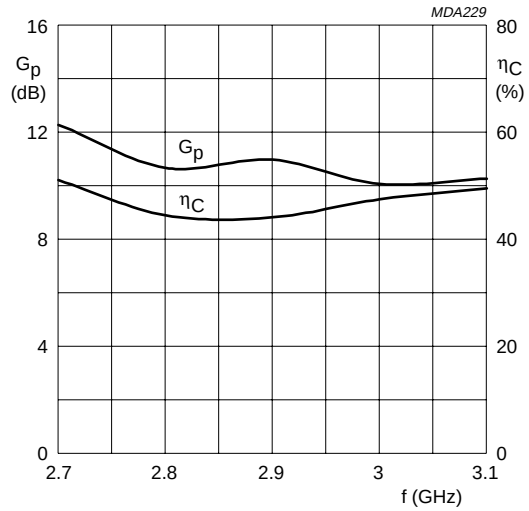

$V_{CB}$ = 40 V; class-C; $t_p$ = 100 μs; δ = 10%.
(1) f = 2.7 GHz.
(2) f = 2.9 GHz.
(3) f = 3.1 GHz.

Fig.2 Power gain as a function of load power; typical values.



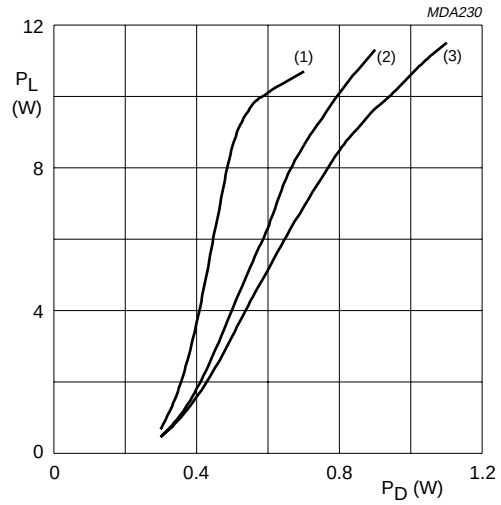

$V_{CB}$ = 40 V; class-C; $t_p$ = 100 μs; δ = 10%.
(1) f = 2.7 GHz.
(2) f = 3.1 GHz.
(3) f = 2.9 GHz.

Fig.3 Collector efficiency as a function of load power; typical values.



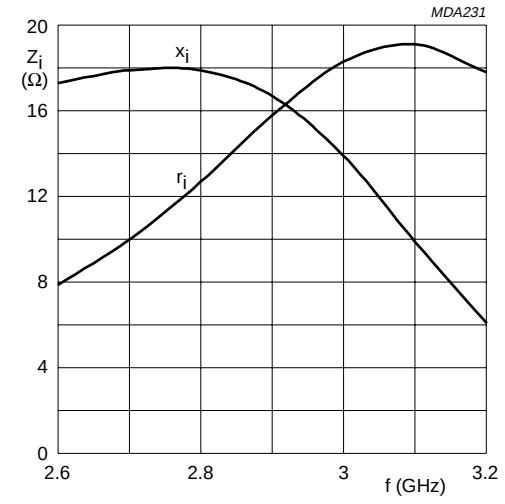

$V_{CB}$ = 40 V; class-C; $t_p$ = 100 μs; δ = 10%.

Fig.4 Power gain and efficiency as functions of frequency; typical values.



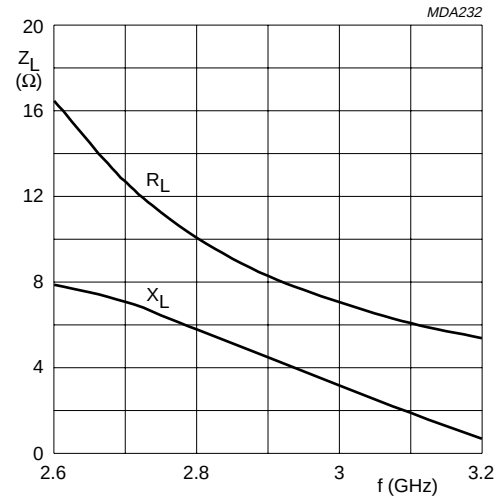

$V_{CB}$ = 40 V; class-C; $t_p$ = 100 μs; δ = 10%.
(1) f = 2.7 GHz.
(2) f = 2.9 GHz.
(3) f = 3.1 GHz.

Fig.5 Load power as a function of drive power; typical values.



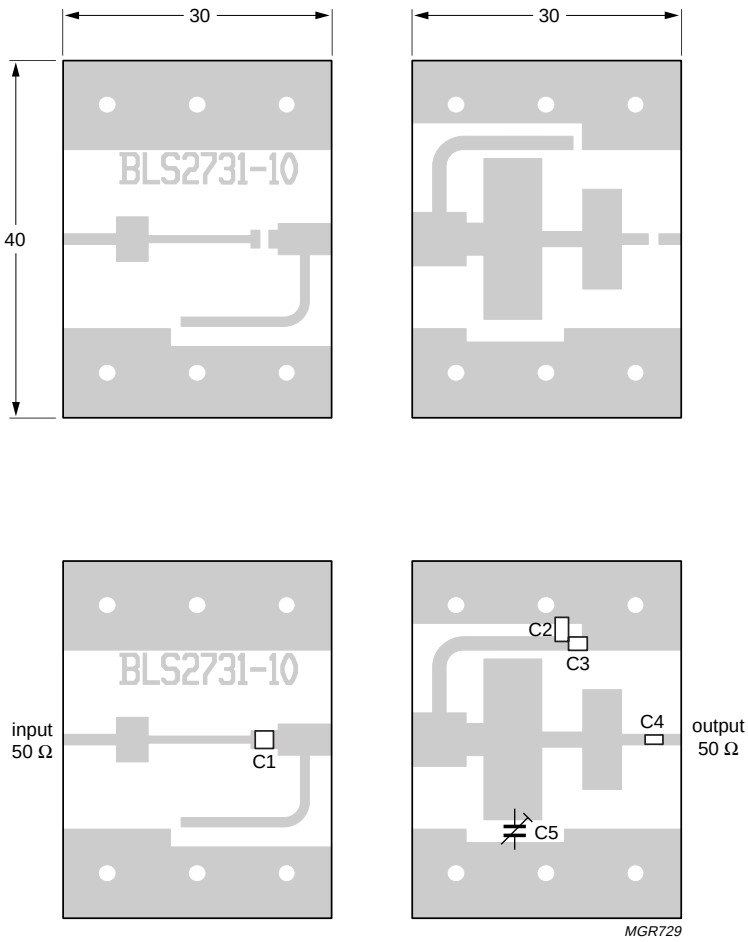

$V_{CB}$ = 40 V; class-C; $P_L$ = 10 W.

Fig.6 Input impedance as function of frequency (series components); typical values.




$V_{CB}$ = 40 V; class-C; $P_L$ = 10 W.

Fig.7 Load impedance as function of frequency (series components); typical values.




Dimensions in mm.

The components are located on one side of the copper-clad printed circuit board, the other side is unetched and serves as a ground plane. Earth connections from the component side to the ground plane are made by through metallization.

The striplines are on double-clad printed-circuit board with Duroid dielectric ($\varepsilon_r$ = 2.2); thickness = 0.38 mm.

Fig.8 Component layout for 2.7 to 3.1 GHz class-C test circuit.

**List of components**

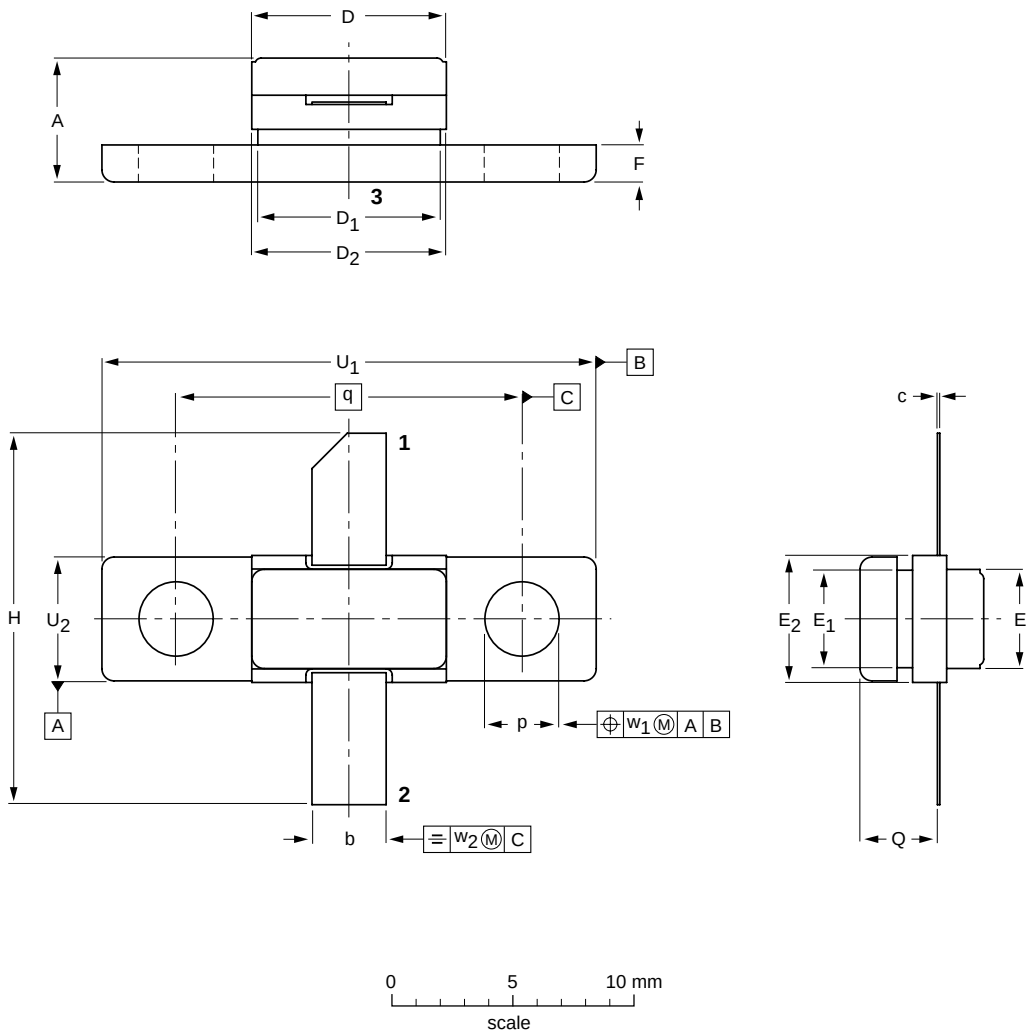
| COMPONENT | DESCRIPTION | VALUE |
|---|---|---|
| C1 | multilayer ceramic chip capacitor; note 1 | 0.7 nF |
| C2 | multilayer ceramic chip capacitor; note 2 | 1 nF |
| C3 | multilayer ceramic chip capacitor; note 1 | 10 pF |
| C4 | multilayer ceramic chip capacitor; note 3 | 150 pF |
| C5 | Tekelec trimmer type 37281SL | 0.4 to 2.5 pF |

**Notes**

1. American Technical Ceramics type 100A or capacitor of same quality.
2. American Technical Ceramics type 200A or capacitor of same quality.
3. American Technical Ceramics type 700A or capacitor of same quality.

## PACKAGE OUTLINE

**Flanged hermetic ceramic package; 2 mounting holes; 2 leads** **SOT445C**




**DIMENSIONS (mm are the original dimensions)**

| UNIT | A | b | c | D | $D_1$ | $D_2$ | E | $E_1$ | $E_2$ | F | H | p | Q | q | $U_1$ | $U_2$ | $w_1$ | $w_2$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 5.57<br>4.70 | 3.15<br>2.95 | 0.15<br>0.09 | 8.13<br>7.87 | 7.65<br>7.35 | 8.15<br>7.85 | 4.20<br>3.93 | 4.25<br>3.95 | 5.31<br>5.01 | 1.82<br>1.22 | 15.84<br>14.64 | 3.35<br>3.05 | 3.33<br>3.03 | 14.22 | 20.47<br>20.17 | 5.18<br>4.98 | 0.51 | 1.02 |

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | EIAJ | | | |
| SOT445C | | | | | | 97-05-23 |

## DEFINITIONS

| **Data Sheet Status** | |
|---|---|
| Objective specification | This data sheet contains target or goal specifications for product development. |
| Preliminary specification | This data sheet contains preliminary data; supplementary data may be published later. |
| Product specification | This data sheet contains final product specifications. |
| **Limiting values** | |
| Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability. | |
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| Where application information is given, it is advisory and does not form part of the specification. | |

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**NOTES**

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