# DATA SHEET

# BFG10W/X
## UHF power transistor

Preliminary specification
File under Discrete Semiconductors, SC14

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Philips
Semiconductors

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# UHF power transistor BFG10W/X

## FEATURES

- To be supplied.

## APPLICATIONS

- Common emitter class-AB operation in hand-held radio equipment up to 1.9 GHz.

## DESCRIPTION

NPN silicon planar epitaxial transistor encapsulated in a plastic, 4-pin dual-emitter SOT343 package.

## PINNING

| PIN | DESCRIPTION |
|---|---|
| 1 | collector |
| 2 | emitter |
| 3 | base |
| 4 | emitter |

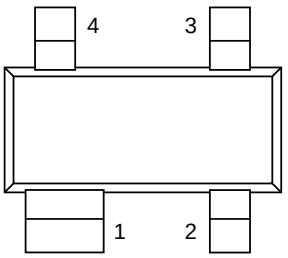



Fig.1 SOT343.

## QUICK REFERENCE DATA

RF performance at $T_{amb}$ = 25 °C in a common-emitter test circuit.

| MODE OF OPERATION | f (GHz) | $V_{CE}$ (V) | $P_L$ (mW) | $G_p$ (dB) | $\eta_c$ (%) |
|---|---|---|---|---|---|
| Pulsed, class-AB, duty cycle: < 1 : 8 | 1.9 | 3.6 | 200 | ≥5 | ≥50 |
| | 0.9 | 6 | 650 | ≥10 | ≥50 |
| | 1.8 | 6 | 650 | ≥5 | ≥50 |

## 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 | – | 20 | V |
| $V_{CEO}$ | collector-emitter voltage | open base | – | 10 | V |
| $V_{EBO}$ | emitter-base voltage | open collector | – | 2.5 | V |
| $I_C$ | collector current (DC) | | – | 250 | mA |
| $I_{C(AV)}$ | average collector current | | – | 250 | mA |
| $P_{tot}$ | total power dissipation | up to $T_s$ = 85 °C; note 1 | – | 400 | mW |
| $T_{stg}$ | storage temperature | | –65 | +150 | °C |
| $T_j$ | junction temperature | | – | 175 | °C |

## THERMAL CHARACTERISTICS

| SYMBOL | PARAMETER | CONDITIONS | VALUE | UNIT |
|---|---|---|---|---|
| $R_{th\ j\text{-}s}$ | thermal resistance from junction to soldering point | up to $T_s$ = 85 °C; note 1; $P_{tot}$ = 400 mW | 210 | K/W |

**Note to the Limiting values and Thermal characteristics**

1. $T_s$ is the temperature at the soldering point of the collector pin.

## CHARACTERISTICS

$T_j$ = 25 °C (unless otherwise specified).

| SYMBOL | PARAMETER | CONDITIONS | MIN. | MAX. | UNIT |
|---|---|---|---|---|---|
| $V_{(BR)CBO}$ | collector-base breakdown voltage | open emitter; $I_C$ = 0.1 mA | 20 | – | V |
| $V_{(BR)CEO}$ | collector-emitter breakdown voltage | open base; $I_C$ = 5 mA | 10 | – | V |
| $V_{(BR)EBO}$ | emitter-base breakdown voltage | open collector; $I_E$ = 0.1 mA | 2.5 | – | V |
| $I_{CES}$ | collector cut-off current | $V_{CE}$ = 6 V; $V_{BE}$ = 0 | – | 100 | μA |
| $h_{FE}$ | DC current gain | $I_C$ = 50 mA; $V_{CE}$ = 5 V | 25 | – | |
| $C_c$ | collector capacitance | $I_E = i_e$ = 0; $V_{CB}$ = 6 V; f = 1 MHz | – | 3 | pF |
| $C_{re}$ | feedback capacitance | $I_C$ = 0; $V_{CE}$ = 6 V; f = 1 MHz | – | 2 | pF |

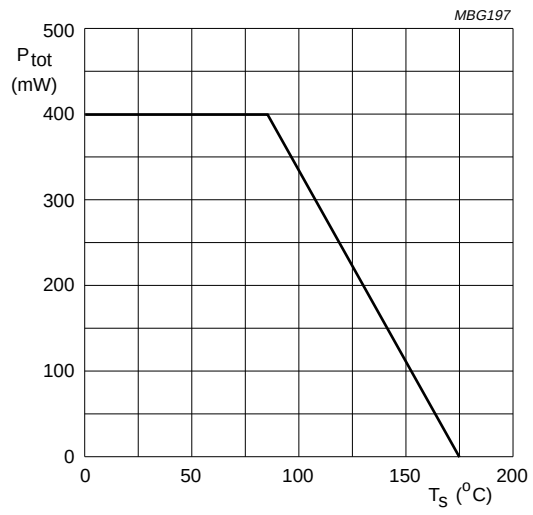



Fig.2 Power derating curve.

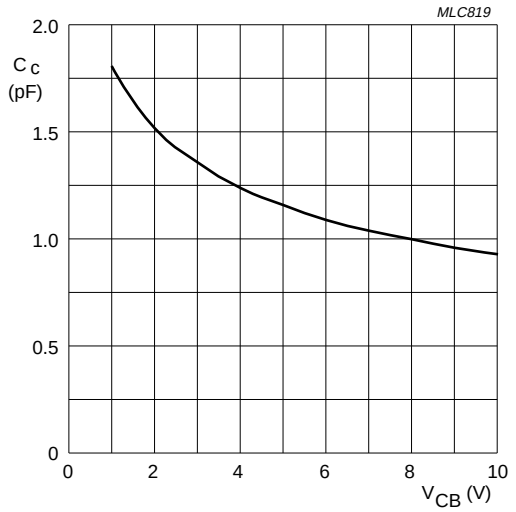



Fig.3 Collector capacitance as a function of collector-base voltage.

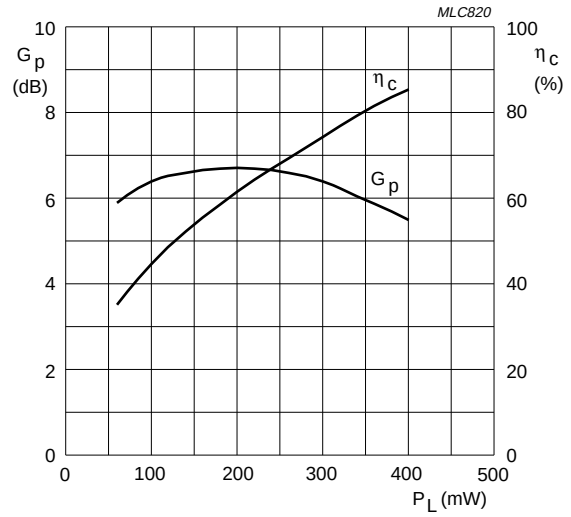
## APPLICATION INFORMATION

RF performance at $T_{amb}$ = 25 °C in a common-emitter test circuit.

| MODE OF OPERATION | f (GHz) | $V_{CE}$ (V) | $P_L$ (mW) | $G_p$ (dB) | $\eta_c$ (%) |
|---|---|---|---|---|---|
| Pulsed, class-AB, duty cycle: < 1 : 8 | 1.9 | 3.6 | 200 | ≥5; typ. 7 | ≥50; typ. 60 |
| | 0.9 | 6 | 650 | ≥10 | ≥50 |
| | 1.8 | 6 | 650 | ≥5 | ≥50 |

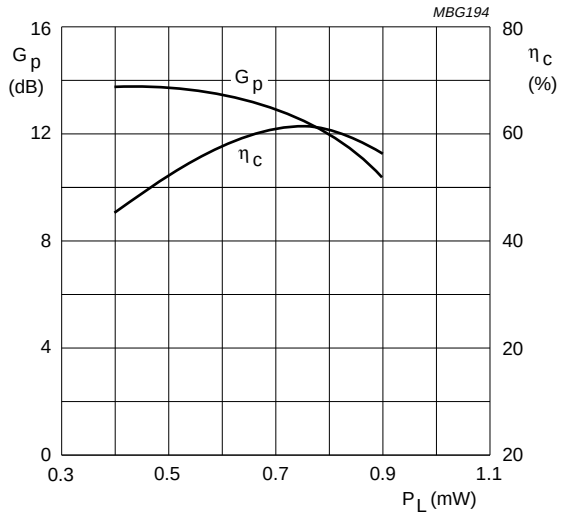
### Ruggedness in class-AB operation

The BFG10W/X is capable of withstanding a load mismatch corresponding to VSWR = 6 : 1 through all phases, at rated output power under pulsed conditions up to a supply voltage of 8.6 V, $t_p$ = 4.6 ms and a duty cycle of 1 : 8.




Pulsed, class-AB operation.
$V_{CE}$ = 3.6 V; f = 1.9 GHz; duty cycle < 1 : 8.
Circuit optimized for $P_L$ = 200 mW.

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




Pulsed, class-AB operation.
$V_{CE}$ = 6 V; f = 900 MHz; duty cycle < 1 : 8.
Circuit optimized for $P_L$ = 600 mW.

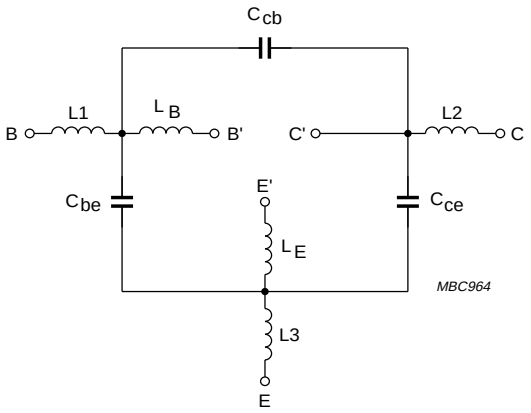
Fig.5 Power gain and efficiency as functions of load power; typical values.

**SPICE parameters for the BFG10 crystal**

| SEQUENCE No. | PARAMETER | VALUE | UNIT |
|---|---|---|---|
| 1 | IS | 2.714 | fA |
| 2 | BF | 102.8 | – |
| 3 | NF | 0.998 | – |
| 4 | VAF | 28.12 | V |
| 5 | IKF | 60.09 | A |
| 6 | ISE | 403.2 | pA |
| 7 | NE | 2.937 | – |
| 8 | BR | 31.01 | – |
| 9 | NR | 0.999 | – |
| 10 | VAR | 2.889 | V |
| 11 | IKR | 0.284 | A |
| 12 | ISC | 1.487 | fA |
| 13 | NC | 1.100 | – |
| 14 | RB | 3.500 | Ω |
| 15 | IRB | 1.000 | μA |
| 16 | RBM | 3.500 | Ω |
| 17 | RE | 0.217 | Ω |
| 18 | RC | 0.196 | Ω |
| 19(1) | XTB | 0.000 | – |
| 20(1) | EG | 1.110 | eV |
| 21(1) | XTI | 3.000 | – |
| 22 | CJE | 5.125 | pF |
| 23 | VJE | 0.600 | V |
| 24 | MJE | 0.367 | – |
| 25 | TF | 12.07 | ps |
| 26 | XTF | 99.40 | – |
| 27 | VTF | 7.220 | V |
| 28 | ITF | 3.950 | A |
| 29 | PTF | 0.000 | deg |
| 30 | CJC | 2.327 | pF |
| 31 | VJC | 0.668 | V |
| 32 | MJC | 0.398 | – |
| 33 | XCJC | 0.160 | – |
| 34(1) | TR | 0.000 | ns |
| 35(1) | CJS | 0.000 | F |
| 36(1) | VJS | 750.0 | mV |
| 37(1) | MJS | 0.000 | – |
| 38 | FC | 0.652 | – |

**Note**

1. These parameters have not been extracted, the default values are shown.



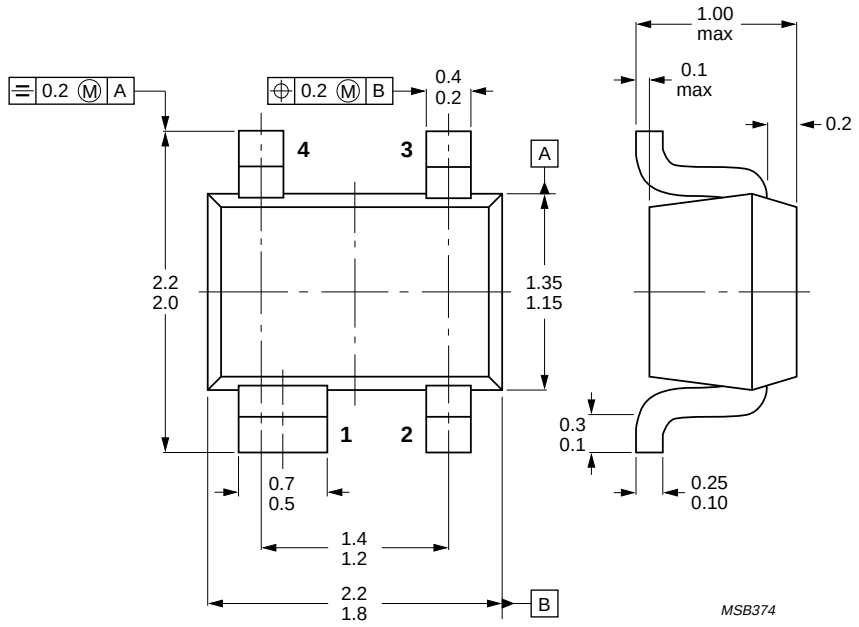

$QL_B = 50$; $QL_E = 50$; $QL_{B,E}(f) = QL_{B,E}\sqrt{(f/f_c)}$;
$f_c$ = scaling frequency = 1 GHz.

Fig.6 Package equivalent circuit SOT343.

**List of components** (see Fig.6)

| DESIGNATION | VALUE | UNIT |
|---|---|---|
| $C_{be}$ | 70 | fF |
| $C_{cb}$ | 50 | fF |
| $C_{ce}$ | 115 | fF |
| L1 | 0.34 | nH |
| L2 | 0.10 | nH |
| L3 | 0.25 | nH |
| $L_B$ | 0.40 | nH |
| $L_E$ | 0.40 | nH |

**PACKAGE OUTLINE**




Dimensions in mm.

Fig.7 SOT343.

**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. | |
| **Application information** | |
| Where application information is given, it is advisory and does not form part of the specification. | |

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