

# DATA SHEET

## **BFG10W/X** UHF power transistor

Product specification  
File under Discrete Semiconductors, SC14

1995 Sep 22

# UHF power transistor

# BFG10W/X

### FEATURES

- High efficiency
- Small size discrete power amplifier
- 900 MHz and 1.9 GHz operating areas
- Gold metallization ensures excellent reliability.

### APPLICATIONS

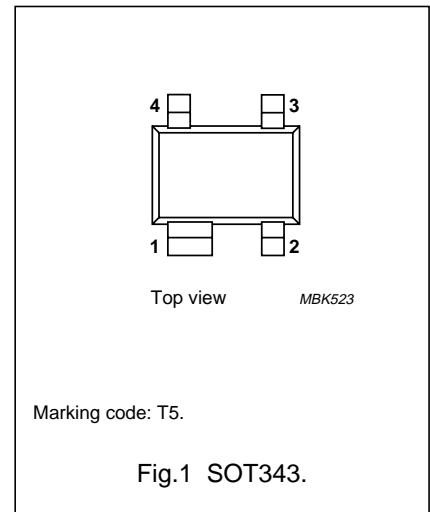
- Common emitter class-AB operation in hand-held radio equipment up to 1.9 GHz.

### 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     |



### QUICK REFERENCE DATA

RF performance at  $T_{amb} = 25\text{ }^{\circ}\text{C}$  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 : 2; $t_p = 10\text{ ms}$  | 1.9     | 3.6          | 200        | $\geq 5$    | $\geq 50$    |
| Pulsed, class-AB, duty cycle: < 1 : 8; $t_p = 4.6\text{ ms}$ | 0.9     | 6            | 650        | $\geq 10$   | $\geq 50$    |
|  | 0.9     | 6            | 360        | $\geq 12.5$ | $\geq 50$    |

### 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 $T_s = 102\text{ }^{\circ}\text{C}$ ; note 1 | –    | 400  | mW                 |
| $T_{stg}$   | storage temperature       |  | –65  | +150 | $^{\circ}\text{C}$ |
| $T_j$       | junction temperature      |  | –    | 175  | $^{\circ}\text{C}$ |

### THERMAL CHARACTERISTICS

| SYMBOL        | PARAMETER   | CONDITIONS  | VALUE | UNIT |
|---------------|---|---|-------|------|
| $R_{th\ j-s}$ | thermal resistance from junction to soldering point | up to $T_s = 102\text{ }^{\circ}\text{C}$ ; note 1; $P_{tot} = 400\text{ mW}$ | 180   | K/W  |

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

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

UHF power transistor

BFG10W/X

**CHARACTERISTICS**

$T_j = 25\text{ }^\circ\text{C}$  (unless otherwise specified).

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

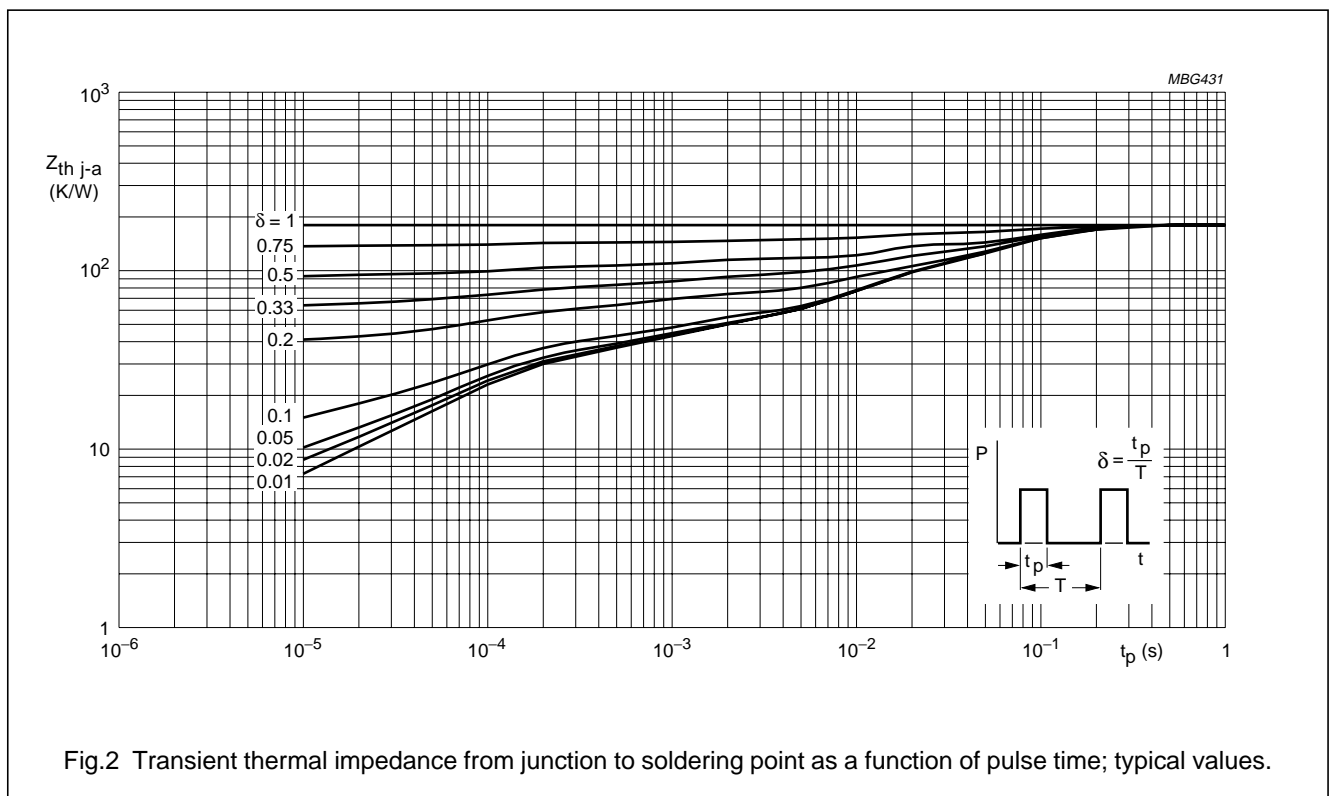
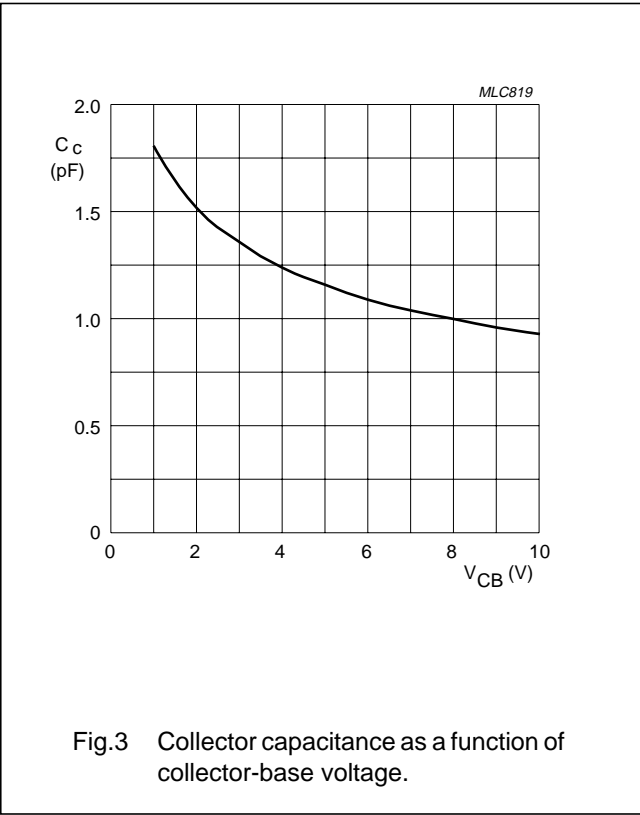


Fig.2 Transient thermal impedance from junction to soldering point as a function of pulse time; typical values.

UHF power transistor

BFG10W/X



UHF power transistor

BFG10W/X

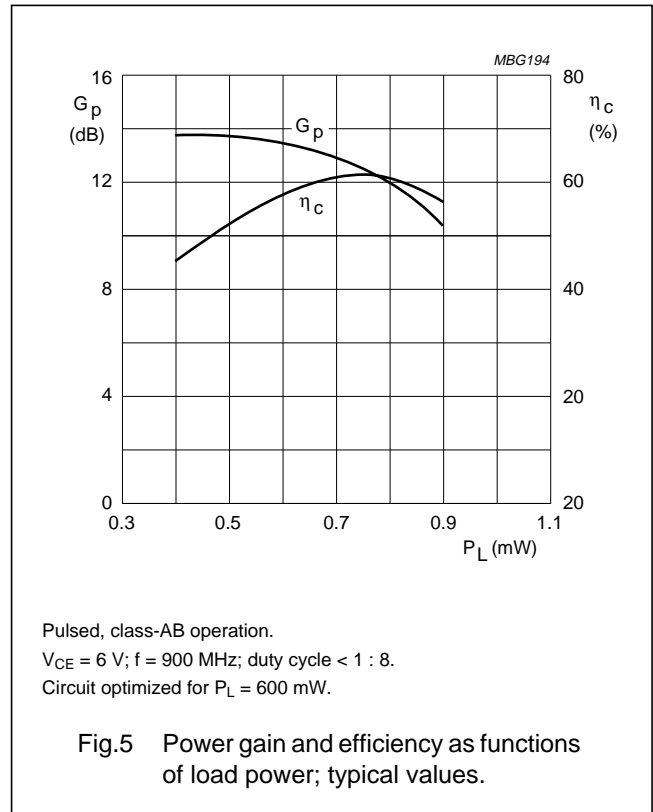
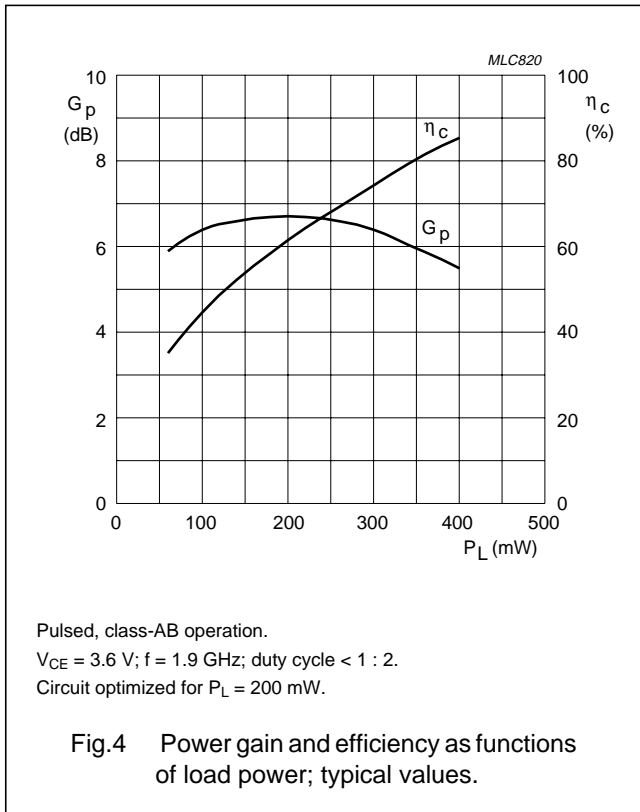
APPLICATION INFORMATION

RF performance at  $T_{amb} = 25\text{ }^{\circ}\text{C}$  in a common-emitter test circuit.

| MODE OF OPERATION   | f (GHz) | V <sub>CE</sub> (V) | P <sub>L</sub> (mW) | G <sub>p</sub> (dB) | η <sub>c</sub> (%) |
|---|---------|---------------------|---------------------|---------------------|--------------------|
| Pulsed, class-AB, duty cycle: < 1 : 2; t <sub>p</sub> = 10 ms | 1.9     | 3.6                 | 200                 | ≥5; typ. 7          | ≥50; typ. 60       |
| Pulsed, class-AB, duty cycle: < 1 : 8; t <sub>p</sub> = 5 ms  | 0.9     | 6                   | 650                 | ≥10                 | ≥50                |
|   | 0.9     | 6                   | 360                 | ≥12.5               | ≥50                |

Ruggedness in class-AB operation

The BFG10W/X is capable of withstanding a load mismatch corresponding to VSWR = 6 : 1 through all phases under pulsed conditions up to a supply voltage of 8.6 V under the conditions: 900 MHz; 650 mW; t<sub>p</sub> = 4.6 ms; duty cycle of 1 : 8 and up to a supply voltage of 5.5 V under the conditions: 1.9 GHz; 200 mW; t<sub>p</sub> = 10 ms; duty cycle of 1 : 2.



UHF power transistor

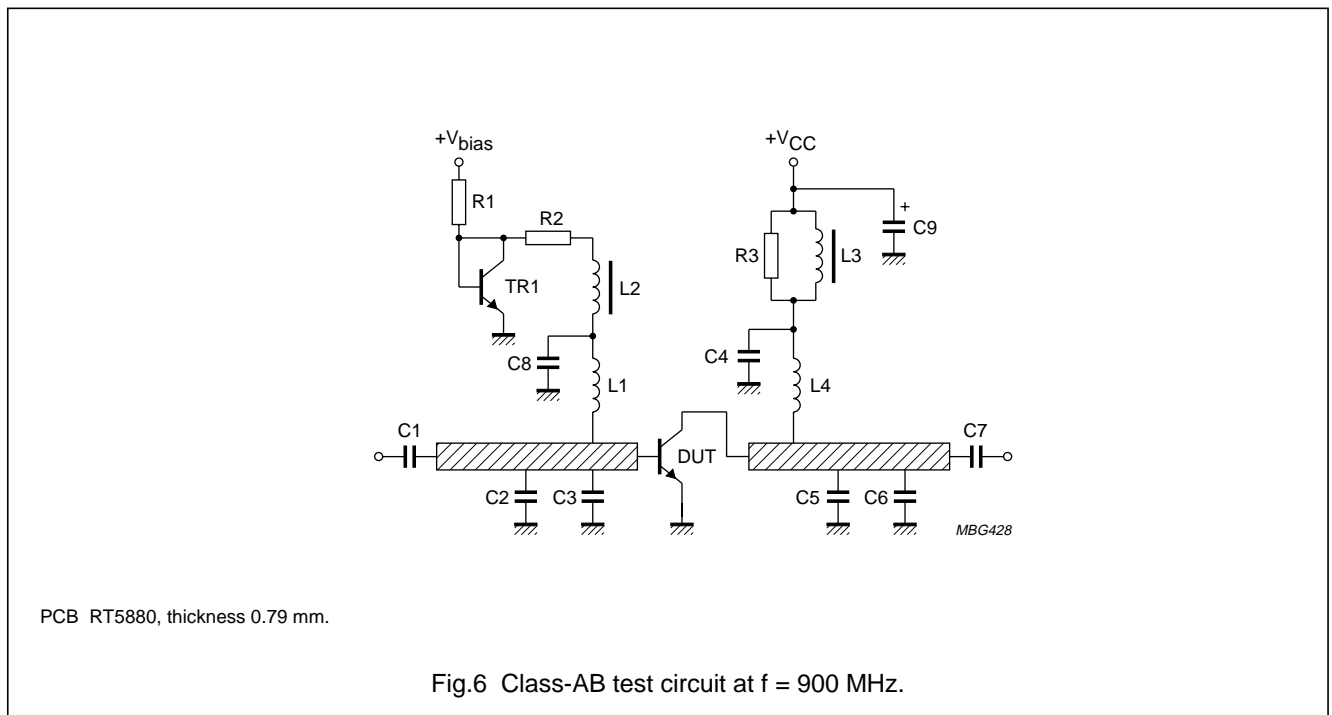
BFG10W/X

List of components (see Fig.6)

| COMPONENT  | DESCRIPTION                          | VALUE              | DIMENSIONS    | CATALOGUE No.  |
|------------|--------------------------------------|--------------------|---------------|----------------|
| TR1        | bias transistor, BC548 or equivalent | note 1             |               |                |
| C1, C4, C7 | capacitor; notes 2 and 3             | 120 pF             |               |                |
| C2         | capacitor; note 2                    | 6.8 pF             |               |                |
| C3         | capacitor; note 2                    | 0.5 pF             |               |                |
| C5         | capacitor; note 2                    | 1.2 pF             |               |                |
| C6         | capacitor; note 2                    | 1.9 pF             |               |                |
| C8         | Philips multilayer capacitor         | 1 nF, 10 V         |               |                |
| C9         | Philips capacitor                    | 1500 $\mu$ F, 10 V |               | 2222 032 14152 |
| L1         | 6 turns enamelled 0.7 mm copper wire |                    | length 3.5 mm |                |
| L4         | 2 turns enamelled 0.7 mm copper wire |                    | length 3 mm   |                |
| L2, L3     | RF choke, Philips                    |                    |               | 4312 020 36690 |
| R1         | metal film resistor                  | 275 $\Omega$       |               |                |
| R2         | metal film resistor                  | 100 $\Omega$       |               |                |
| R3         | metal film resistor                  | 10 $\Omega$        |               |                |

Notes

1.  $V_{BE}$  at 1 mA must be 0.65 V.
2. American Technical Ceramics type 100A or capacitor of same quality.
3. Resonant at 1900 MHz.



UHF power transistor

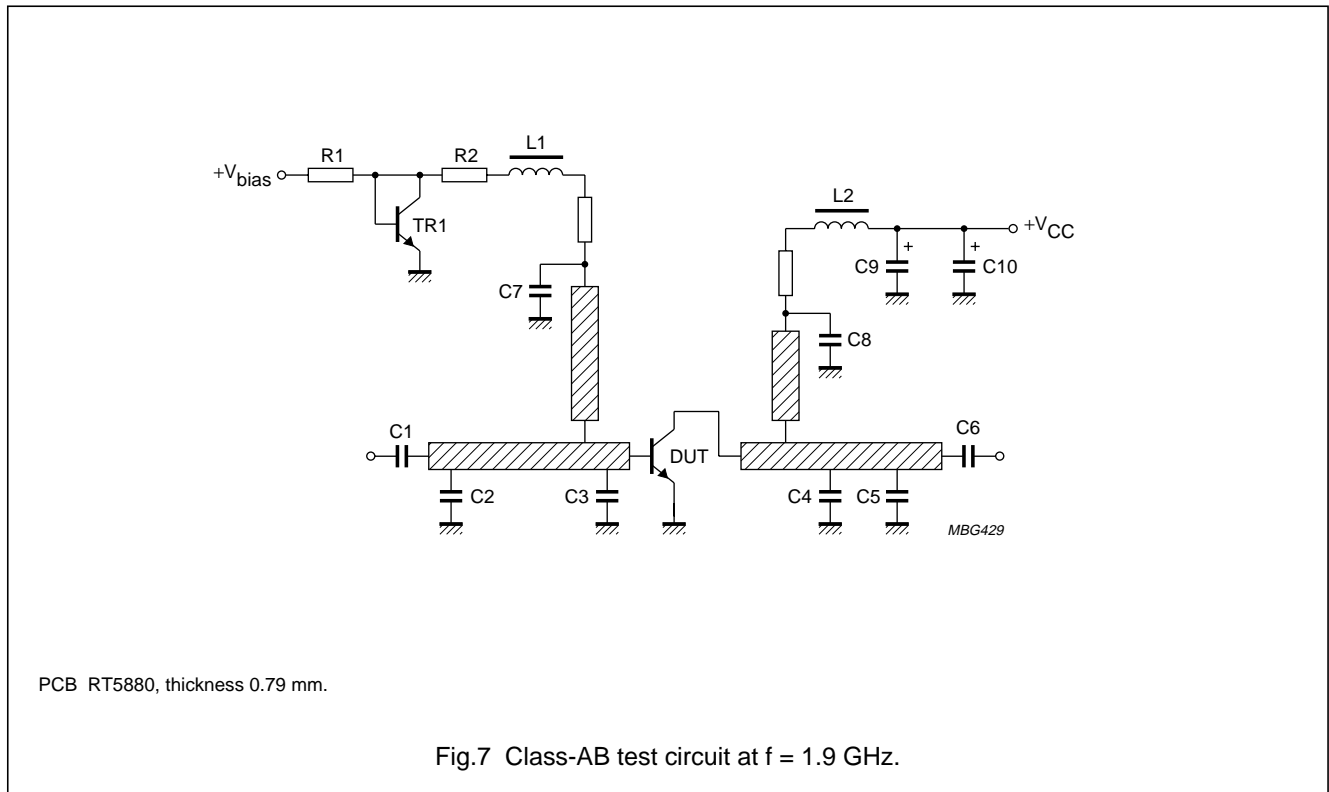
BFG10W/X

List of components (see Fig.7)

| COMPONENT      | DESCRIPTION                          | VALUE              | DIMENSIONS | CATALOGUE No.  |
|----------------|--------------------------------------|--------------------|------------|----------------|
| TR1            | bias transistor, BC548 or equivalent | note 1             |            |                |
| C1, C6, C7, C8 | capacitor; notes 2 and 3             | 24 pF              |            |                |
| C2             | capacitor; note 2                    | 0.4 pF             |            |                |
| C3             | capacitor; note 2                    | 2.4 pF             |            |                |
| C4             | capacitor; note 2                    | 0.5 pF             |            |                |
| C5             | capacitor; note 2                    | 1.2 pF             |            |                |
| C9, C10        | Philips capacitor                    | 1500 $\mu$ F, 10 V |            | 2222 032 14152 |
| L1, L2         | RF choke, Philips                    |                    |            | 4330 030 36301 |
| R1, R2         | metal film resistor                  | 75 $\Omega$        |            |                |
| R3, R4         | metal film resistor                  | 10 $\Omega$        |            |                |

Notes

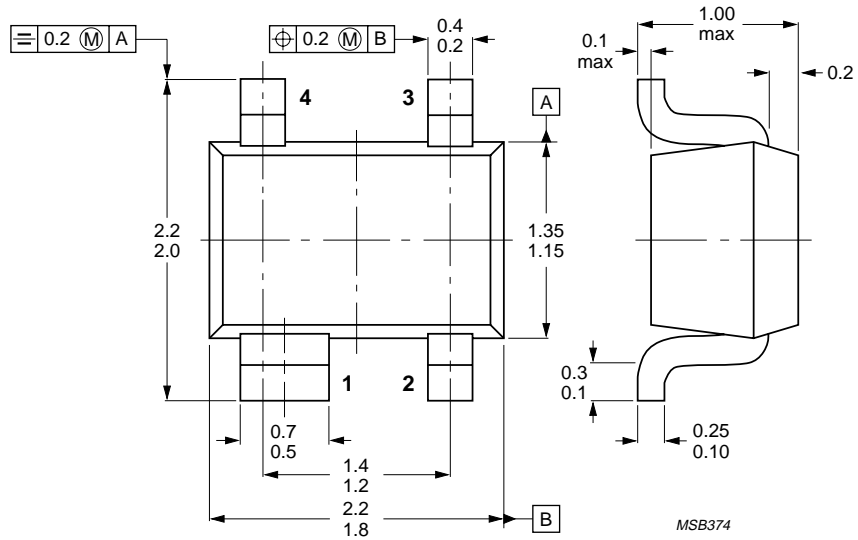
1.  $V_{BE}$  at 1 mA must be 0.65 V.
2. American Technical Ceramics type 100A or capacitor of same quality.
3. Resonant at 1900 MHz.



UHF power transistor

BFG10W/X

PACKAGE OUTLINE



Dimensions in mm.

Fig.8 SOT343.



## UHF power transistor

BFG10W/X

**DEFINITIONS**

| <b>Data Sheet Status</b>  |   |
|---|---|
| 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.                                |
| <b>Limiting values</b>  |   |
| 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. |   |
| <b>Application information</b>  |   |
| Where application information is given, it is advisory and does not form part of the specification.   |   |

**LIFE SUPPORT APPLICATIONS**

These products are not designed for use in life support appliances, devices, or systems where malfunction of these products can reasonably be expected to result in personal injury. Philips customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Philips for any damages resulting from such improper use or sale.