

# DATA SHEET

**BFT92W**

**PNP 4 GHz wideband transistor**

Product specification  
File under Discrete Semiconductors, SC14

May 1994

**Philips Semiconductors**



**PHILIPS**

## PNP 4 GHz wideband transistor

## BFT92W

## FEATURES

- High power gain
- Gold metallization ensures excellent reliability
- SOT323 (S-mini) package.

## APPLICATION

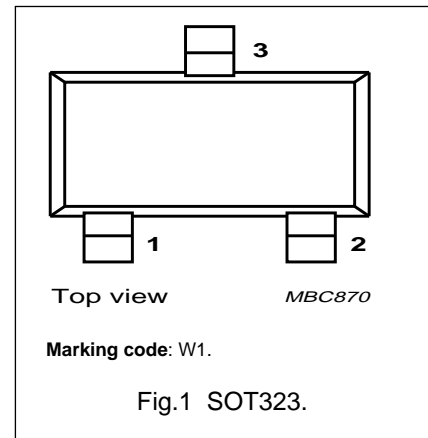
It is intended as a general purpose transistor for wideband applications up to 2 GHz.

## DESCRIPTION

Silicon PNP transistor in a plastic, SOT323 (S-mini) package. The BFT92W uses the same crystal as the SOT23 version, BFT92.

## PINNING

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



## QUICK REFERENCE DATA

| SYMBOL    | PARAMETER                     | CONDITIONS   | MIN. | TYP. | MAX. | UNIT             |
|-----------|-------------------------------|--|------|------|------|------------------|
| $V_{CBO}$ | collector-base voltage        | open emitter   | –    | –    | –20  | V                |
| $V_{CEO}$ | collector-emitter voltage     | open base  | –    | –    | –15  | V                |
| $I_C$     | collector current (DC)        |  | –    | –    | –35  | mA               |
| $P_{tot}$ | total power dissipation       | up to $T_s = 93\text{ }^\circ\text{C}$ ; note 1  | –    | –    | 300  | mW               |
| $h_{FE}$  | DC current gain               | $I_C = -15\text{ mA}$ ; $V_{CE} = -10\text{ V}$  | 20   | 50   | –    |                  |
| $C_{re}$  | feedback capacitance          | $I_C = 0$ ; $V_{CB} = -10\text{ V}$ ; $f = 1\text{ MHz}$   | –    | 0.5  | –    | pF               |
| $f_T$     | transition frequency          | $I_C = -15\text{ mA}$ ; $V_{CE} = -10\text{ V}$ ;<br>$f = 500\text{ MHz}$  | –    | 4    | –    | GHz              |
| $G_{UM}$  | maximum unilateral power gain | $I_C = -15\text{ mA}$ ; $V_{CE} = -10\text{ V}$ ;<br>$f = 500\text{ MHz}$ ; $T_{amb} = 25\text{ }^\circ\text{C}$ | –    | 17   | –    | dB               |
| F         | noise figure                  | $I_C = -5\text{ mA}$ ; $V_{CE} = -10\text{ V}$ ;<br>$f = 500\text{ MHz}$   | –    | 2.5  | –    | dB               |
| $T_j$     | junction temperature          |  | –    | –    | 150  | $^\circ\text{C}$ |

## Note

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

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**LIMITING VALUES**

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

| SYMBOL           | PARAMETER                 | CONDITIONS                           | MIN. | MAX. | UNIT |
|------------------|---------------------------|--------------------------------------|------|------|------|
| V <sub>CBO</sub> | collector-base voltage    | open emitter                         | –    | –20  | V    |
| V <sub>CEO</sub> | collector-emitter voltage | open base                            | –    | –15  | V    |
| V <sub>EBO</sub> | emitter-base voltage      | open collector                       | –    | –2   | V    |
| I <sub>C</sub>   | collector current (DC)    |                                      | –    | –25  | mA   |
| P <sub>tot</sub> | total power dissipation   | up to T <sub>s</sub> = 93 °C; note 1 | –    | 300  | mW   |
| T <sub>stg</sub> | storage temperature       |                                      | –65  | +150 | °C   |
| T <sub>j</sub>   | junction temperature      |                                      | –    | 150  | °C   |

**THERMAL CHARACTERISTICS**

| SYMBOL              | PARAMETER   | CONDITIONS                           | VALUE | UNIT |
|---------------------|---|--------------------------------------|-------|------|
| R <sub>th j-s</sub> | thermal resistance from junction to soldering point | up to T <sub>s</sub> = 93 °C; note 1 | 190   | K/W  |

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

1. T<sub>s</sub> is the temperature at the soldering point of the collector pin.

**CHARACTERISTICS**

T<sub>j</sub> = 25 °C (unless otherwise specified).

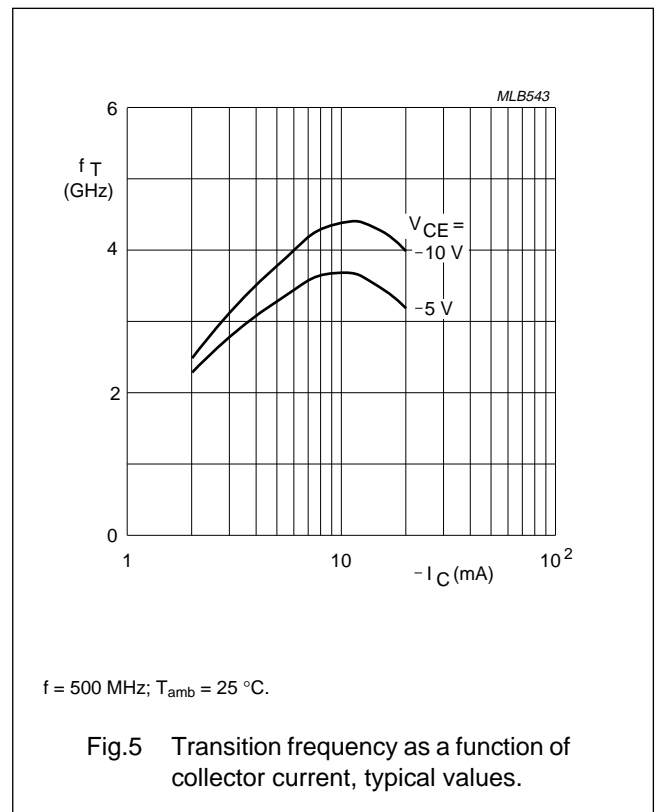
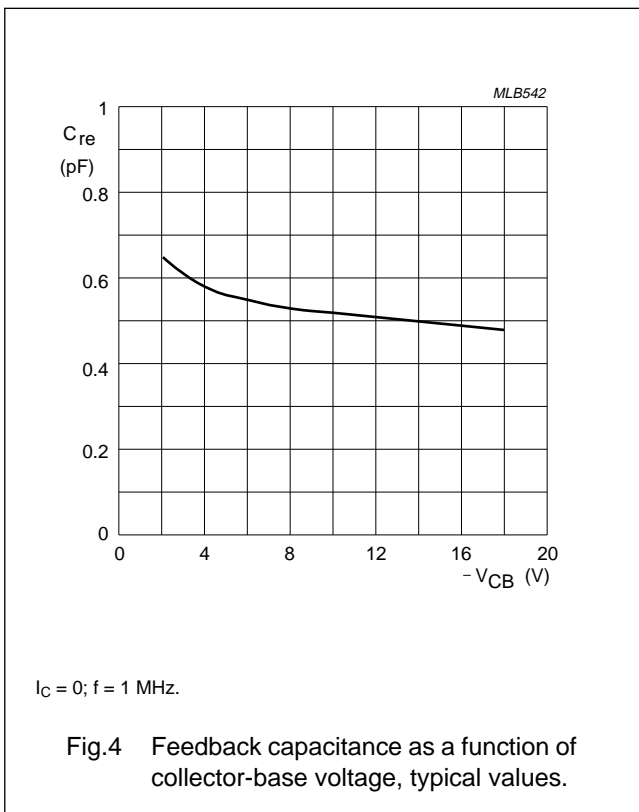
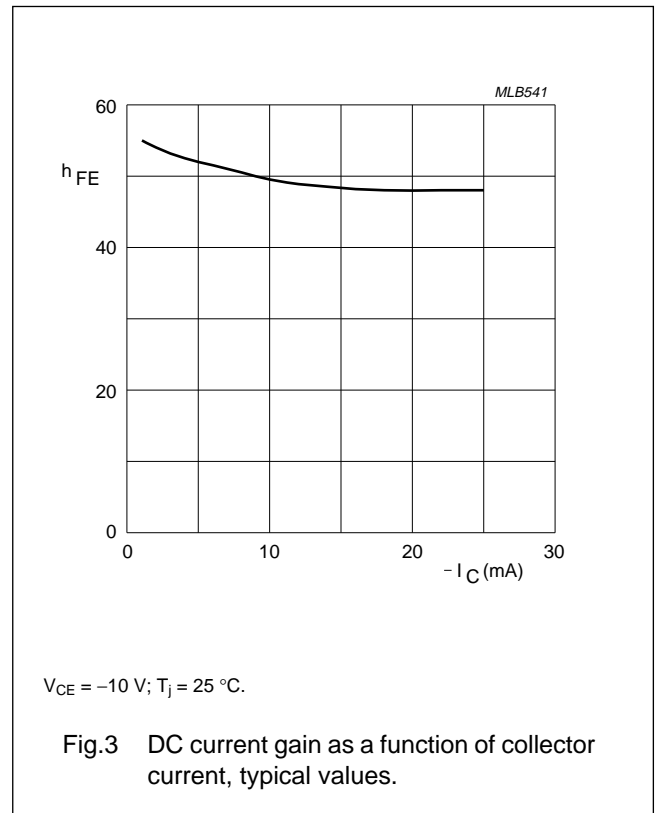
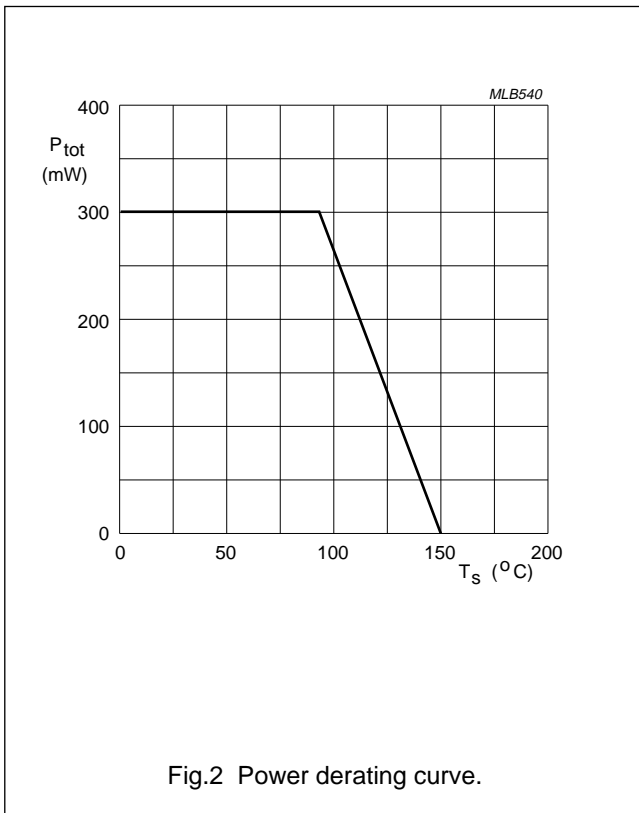
| SYMBOL           | PARAMETER                                | CONDITIONS  | MIN. | TYP. | MAX. | UNIT |
|------------------|--|---|------|------|------|------|
| I <sub>CBO</sub> | collector cut-off current                | I <sub>E</sub> = 0; V <sub>CB</sub> = –10 V   | –    | –    | –50  | nA   |
| h <sub>FE</sub>  | DC current gain                          | I <sub>C</sub> = –15 mA; V <sub>CE</sub> = –10 V  | 20   | 50   | –    |      |
| f <sub>T</sub>   | transition frequency                     | I <sub>C</sub> = –15 mA; V <sub>CE</sub> = –10 V;<br>f = 500 MHz; T <sub>amb</sub> = 25 °C          | –    | 4    | –    | GHz  |
| C <sub>c</sub>   | collector capacitance                    | I <sub>E</sub> = i <sub>e</sub> = 0; V <sub>CB</sub> = –10 V;<br>f = 1 MHz                          | –    | 0.65 | –    | pF   |
| C <sub>e</sub>   | emitter capacitance                      | I <sub>C</sub> = i <sub>c</sub> = 0; V <sub>EB</sub> = –0.5 V;<br>f = 1 MHz                         | –    | 0.75 | –    | pF   |
| C <sub>re</sub>  | feedback capacitance                     | I <sub>C</sub> = 0; V <sub>CB</sub> = –10 V;<br>f = 1 MHz   | –    | 0.5  | –    | pF   |
| G <sub>UM</sub>  | maximum unilateral power gain;<br>note 1 | I <sub>C</sub> = –15 mA; V <sub>CE</sub> = –10 V;<br>f = 500 MHz; T <sub>amb</sub> = 25 °C          | –    | 17   | –    | dB   |
|                  |  | I <sub>C</sub> = –15 mA; V <sub>CE</sub> = –10 V;<br>f = 1 GHz; T <sub>amb</sub> = 25 °C            | –    | 11   | –    | dB   |
| F                | noise figure                             | Γ <sub>s</sub> = Γ <sub>opt</sub> ; I <sub>C</sub> = –5 mA;<br>V <sub>CE</sub> = –10 V; f = 500 MHz | –    | 2.5  | –    | dB   |
|                  |  | Γ <sub>s</sub> = Γ <sub>opt</sub> ; I <sub>C</sub> = –5 mA;<br>V <sub>CE</sub> = –10 V; f = 1 GHz   | –    | 3    | –    | dB   |

**Note**

1. G<sub>UM</sub> is the maximum unilateral power gain, assuming s<sub>12</sub> is zero.  $G_{UM} = 10 \log \frac{|s_{21}|^2}{(1 - |s_{11}|^2)(1 - |s_{22}|^2)}$  dB.

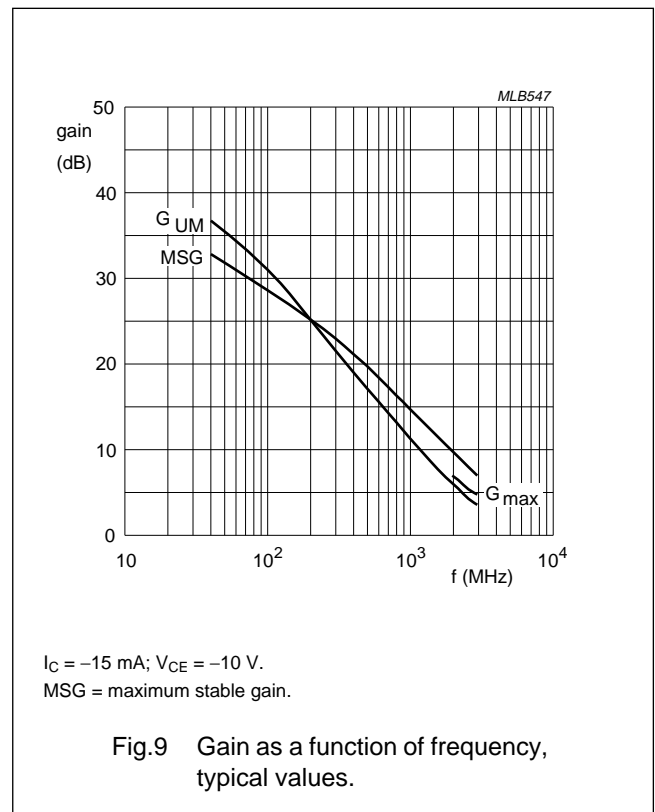
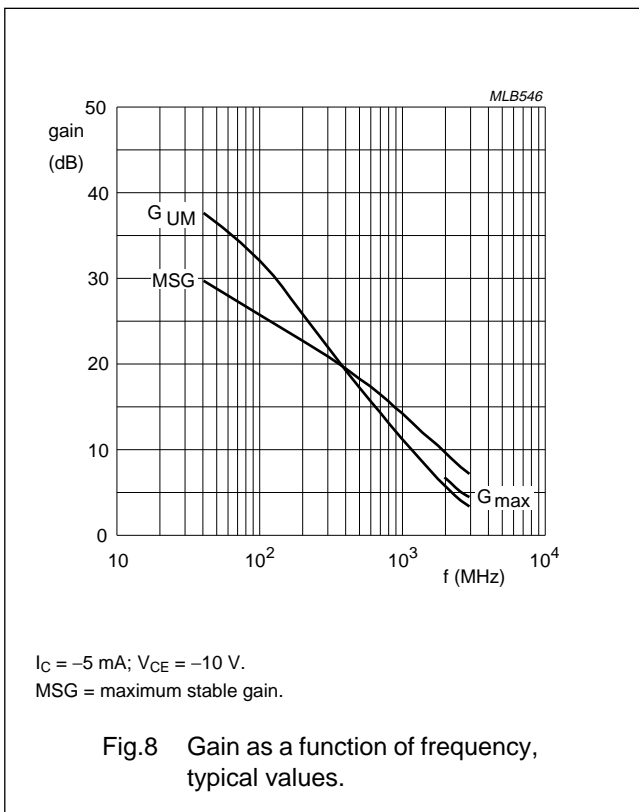
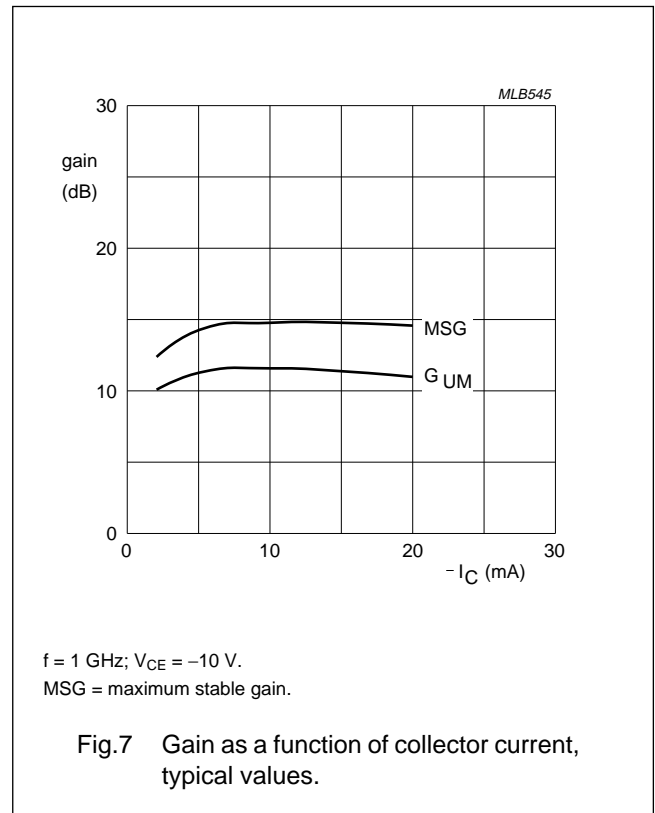
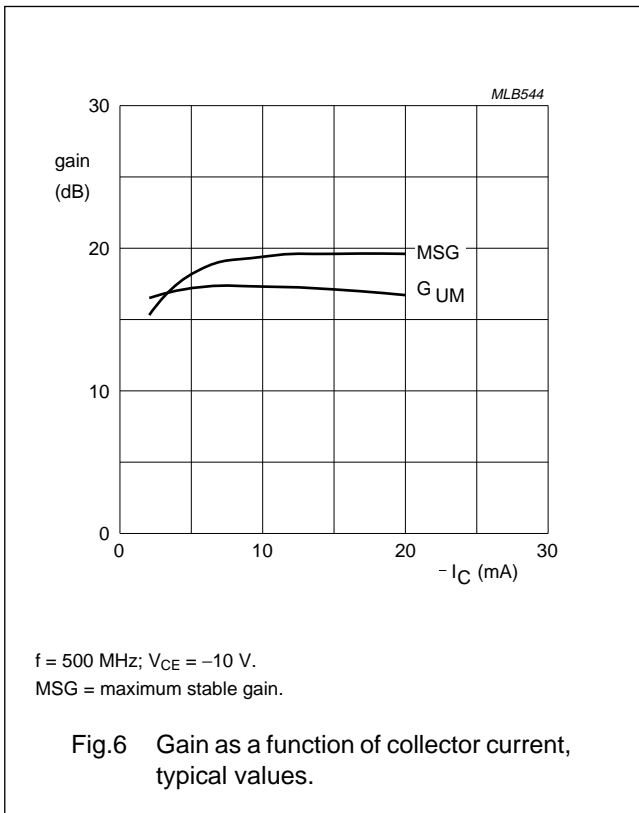
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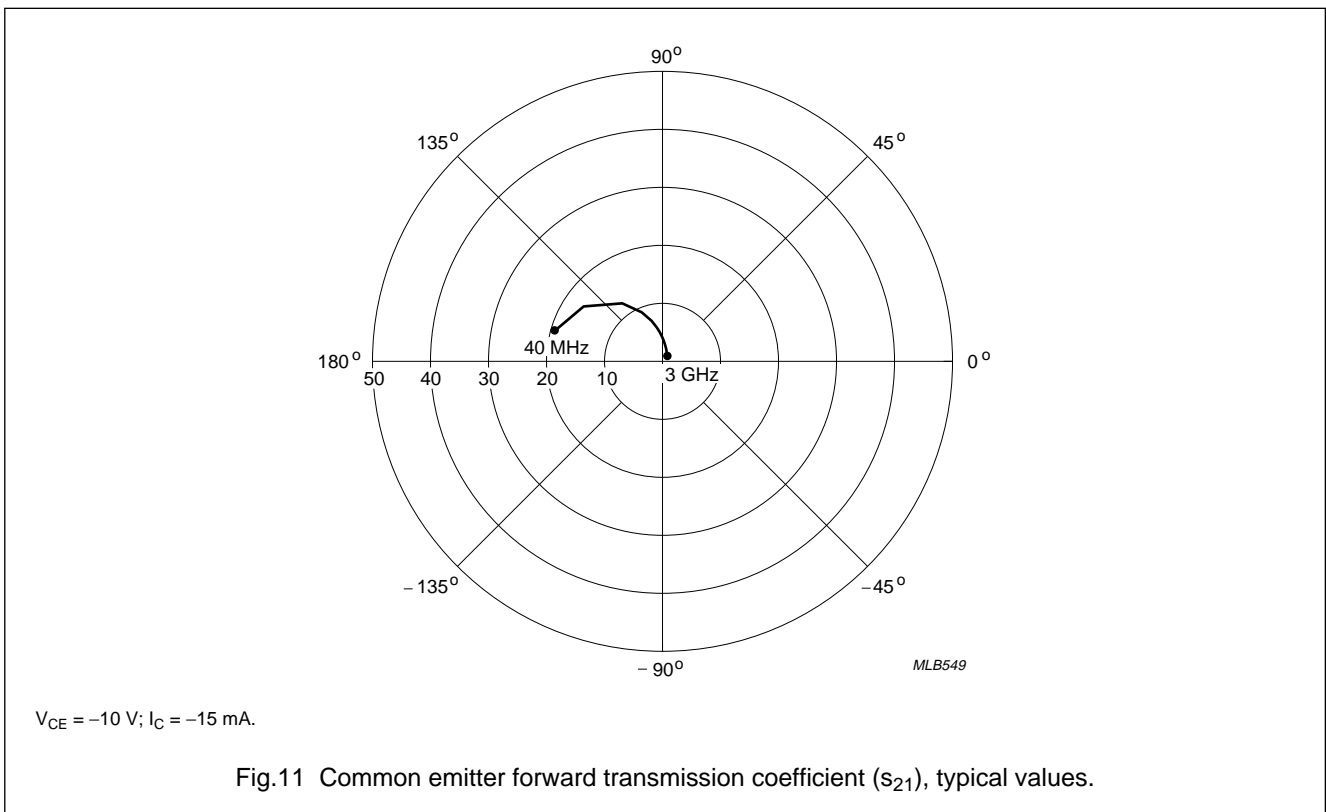
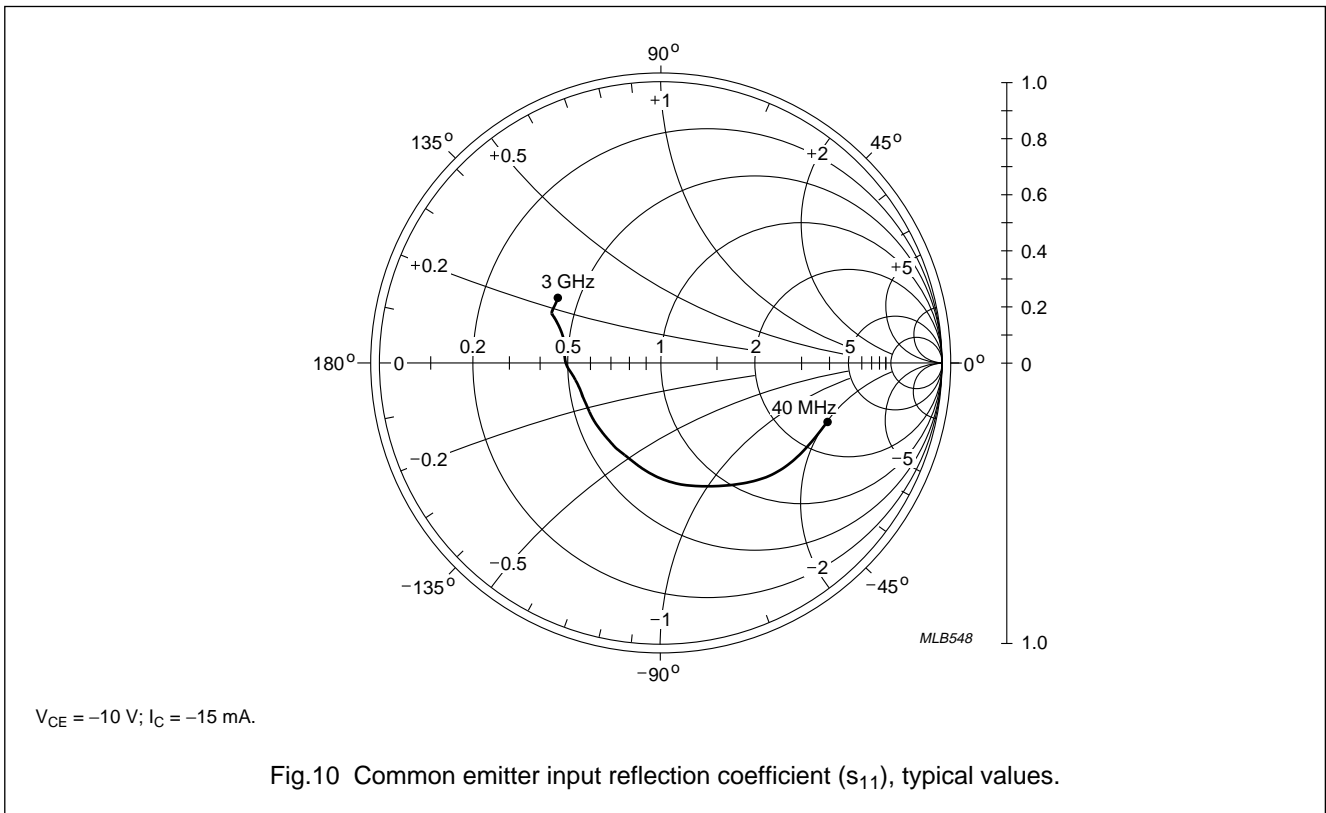
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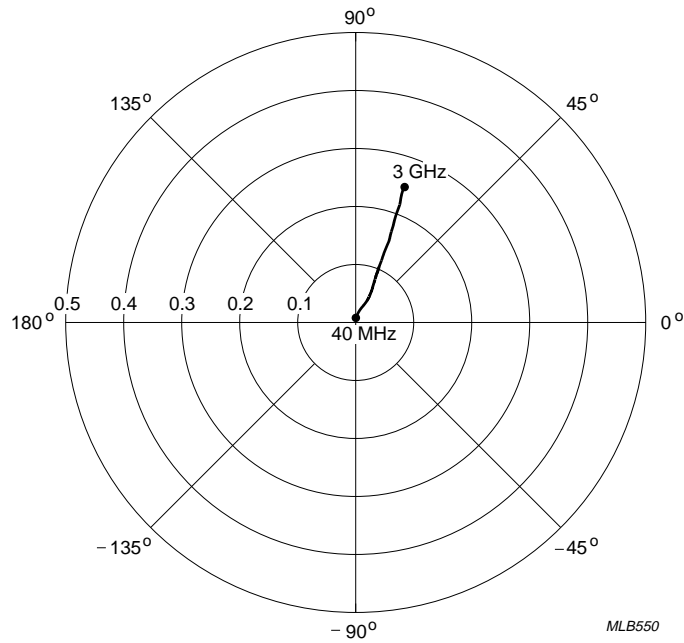
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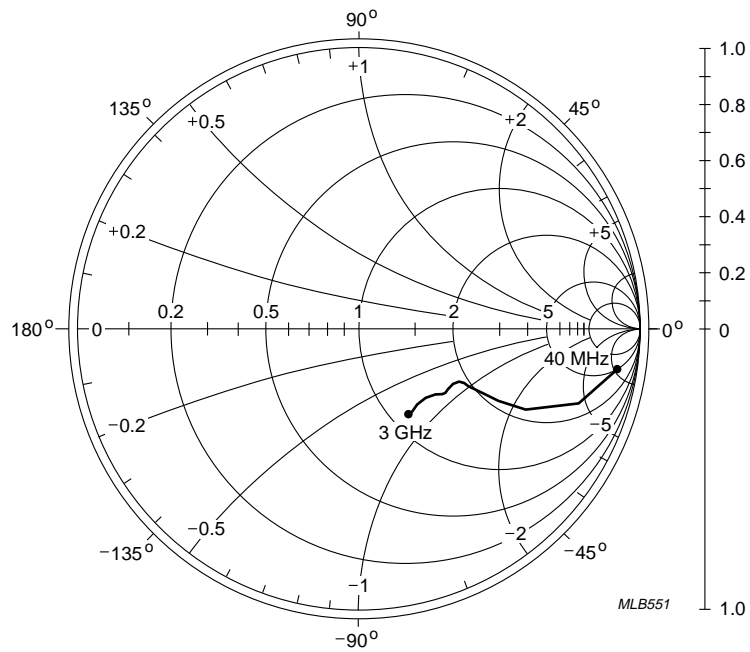
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MLB550

$V_{CE} = -10\text{ V}; I_C = -15\text{ mA}$ .

Fig.12 Common emitter reverse transmission coefficient ( $s_{12}$ ), typical values.



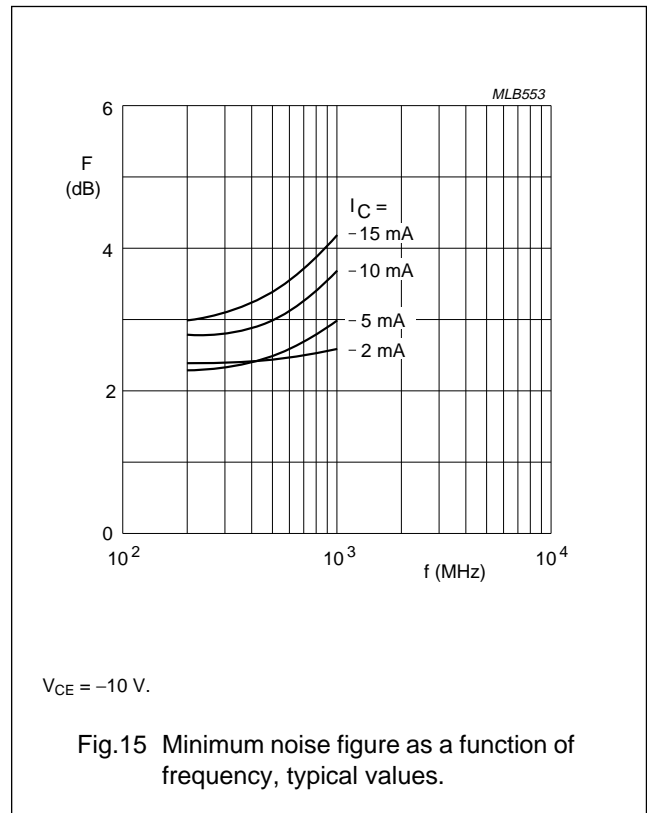
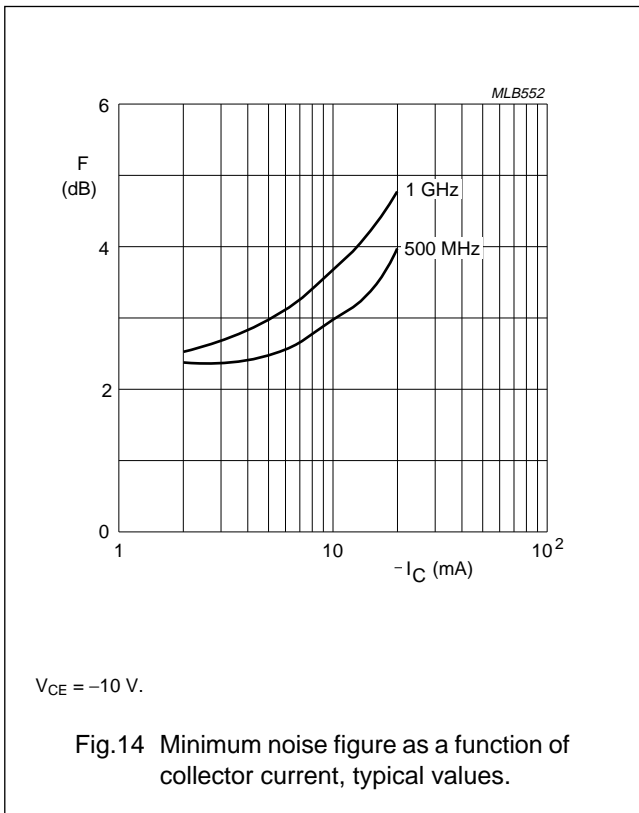
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$V_{CE} = -10\text{ V}; I_C = -15\text{ mA}$ .

Fig.13 Common emitter output reflection coefficient ( $s_{22}$ ), typical values.

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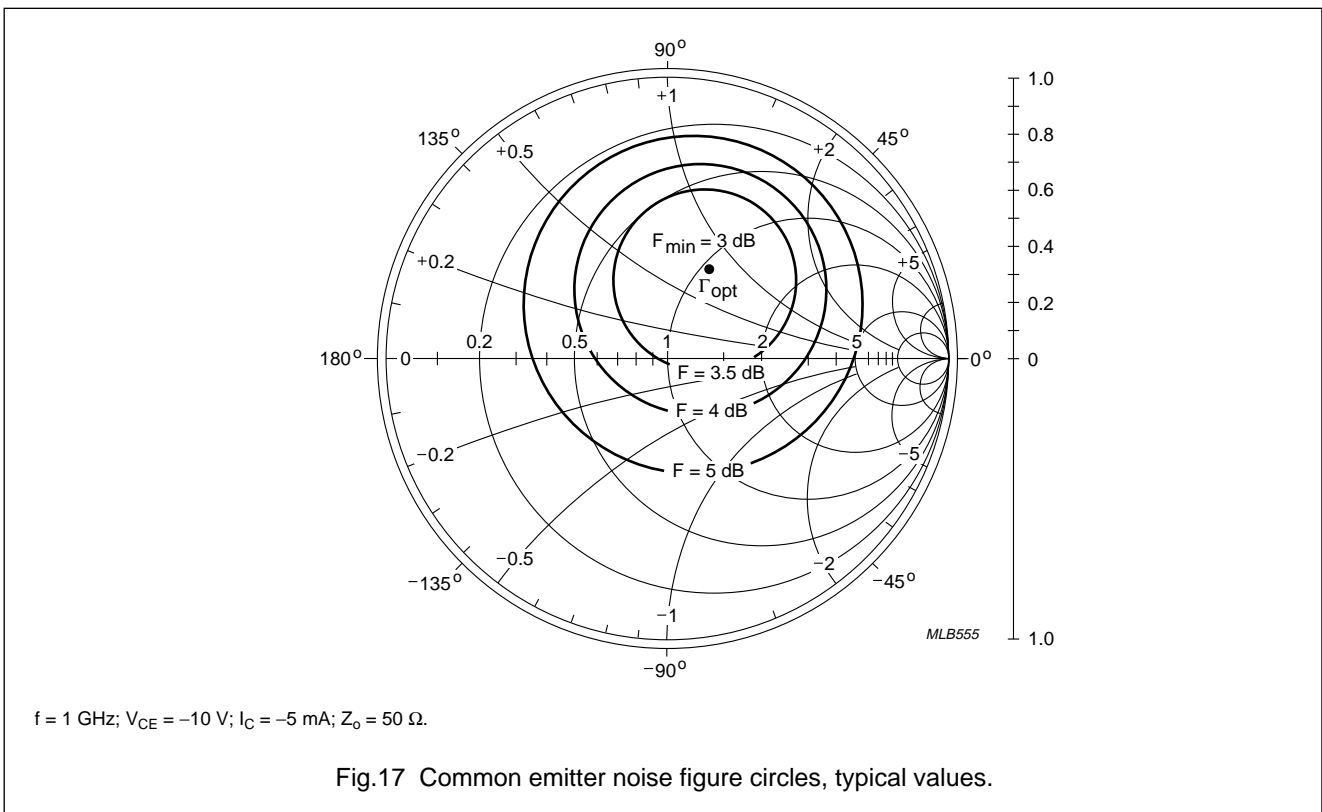
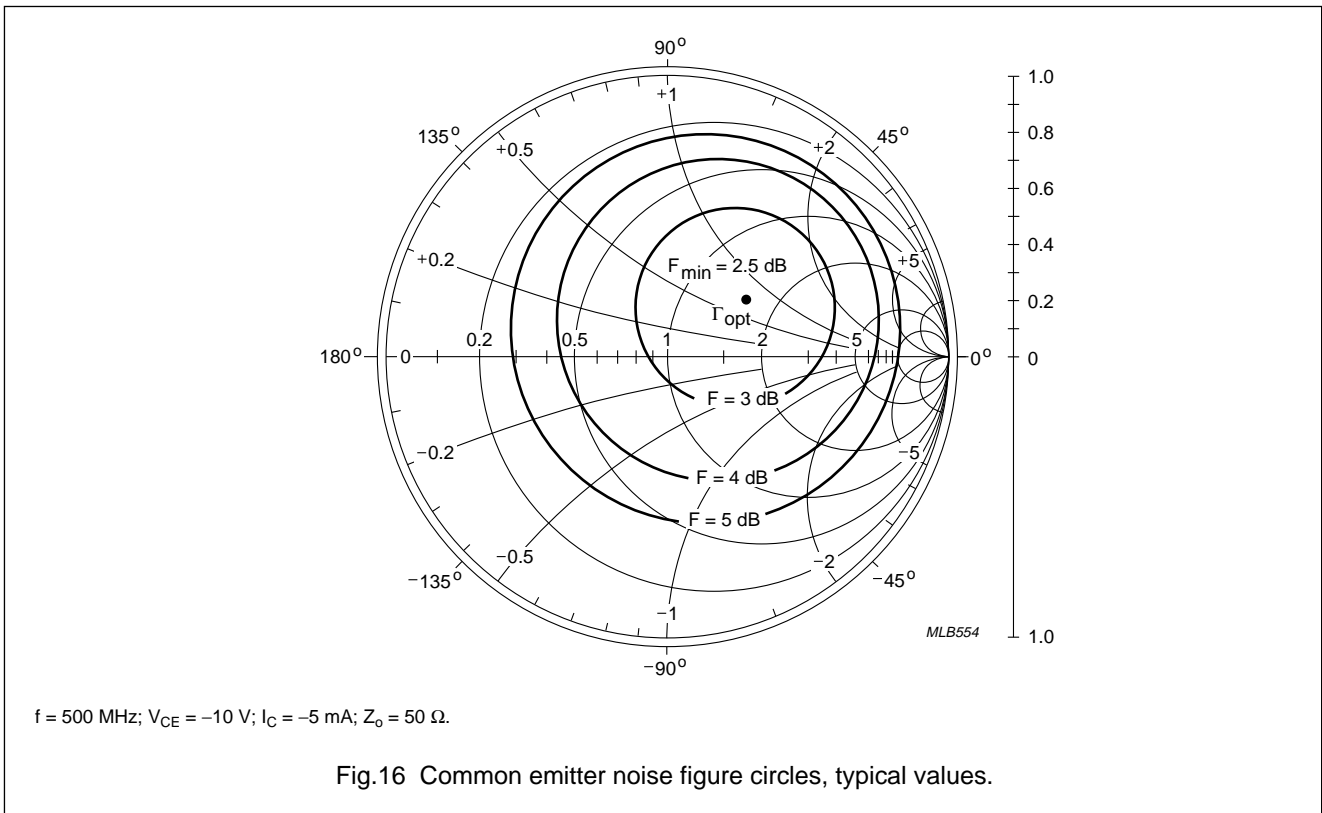
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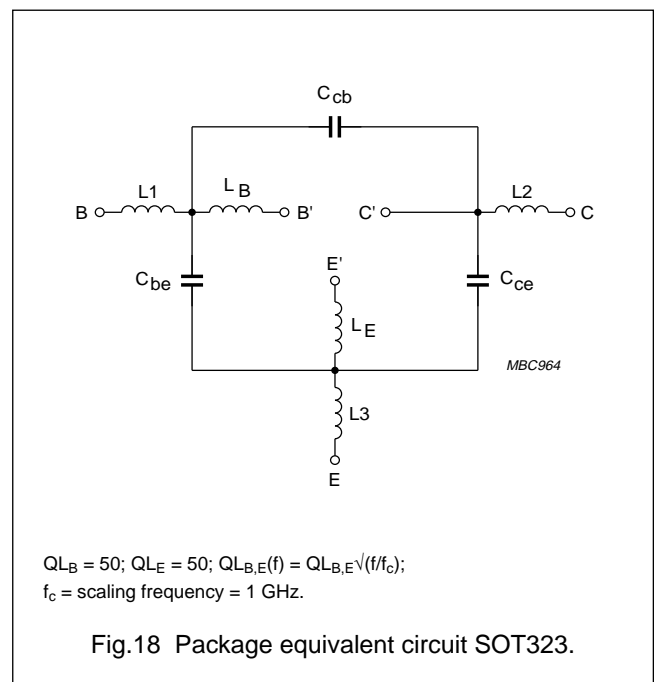
SPICE parameters for the BFT92W crystal

| SEQUENCE No.      | PARAMETER | VALUE | UNIT |
|-------------------|-----------|-------|------|
| 1                 | IS        | 437.5 | aA   |
| 2                 | BF        | 33.58 | –    |
| 3                 | NF        | 1.009 | –    |
| 4                 | VAF       | 23.39 | V    |
| 5                 | IKF       | 99.53 | mA   |
| 6                 | ISE       | 87.05 | fA   |
| 7                 | NE        | 1.943 | –    |
| 8                 | BR        | 4.947 | –    |
| 9                 | NR        | 1.002 | –    |
| 10                | VAR       | 3.903 | V    |
| 11                | IKR       | 5.281 | mA   |
| 12                | ISC       | 35.88 | fA   |
| 13                | NC        | 1.393 | –    |
| 14                | RB        | 5.000 | Ω    |
| 15                | IRB       | 1.000 | μA   |
| 16                | RBM       | 5.000 | Ω    |
| 17                | RE        | 1.000 | Ω    |
| 18                | RC        | 10.00 | Ω    |
| 19 <sup>(1)</sup> | XTB       | 0.000 | –    |
| 20 <sup>(1)</sup> | EG        | 1.110 | eV   |
| 21 <sup>(1)</sup> | XTI       | 3.000 | –    |
| 22                | CJE       | 746.6 | fF   |
| 23                | VJE       | 600.0 | mV   |
| 24                | MJE       | 0.357 | –    |
| 25                | TF        | 17.49 | ps   |
| 26                | XTF       | 1.354 | –    |
| 27                | VTF       | 155.6 | mV   |
| 28                | ITF       | 1.000 | mA   |
| 29                | PTF       | 45.00 | deg  |
| 30                | CJC       | 937.1 | fF   |
| 31                | VJC       | 396.4 | mV   |
| 32                | MJC       | 0.200 | –    |
| 33                | XCJC      | 0.106 | –    |
| 34                | TR        | 8.422 | ns   |
| 35 <sup>(1)</sup> | CJS       | 0.000 | F    |

| SEQUENCE No.      | PARAMETER | VALUE | UNIT |
|-------------------|-----------|-------|------|
| 36 <sup>(1)</sup> | VJS       | 750.0 | mV   |
| 37 <sup>(1)</sup> | MJS       | 0.000 | –    |
| 38                | FC        | 0.768 | –    |

Note

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



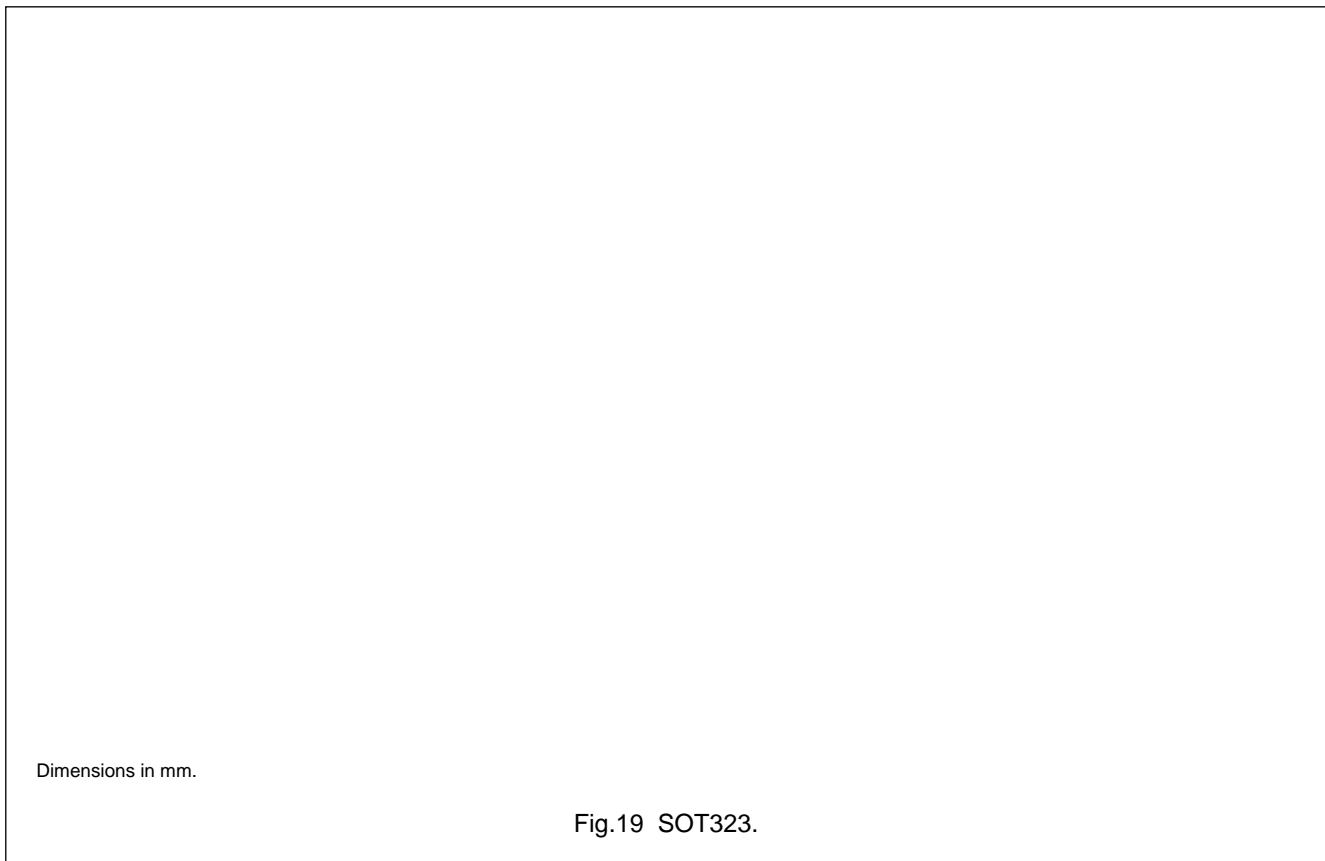
List of components (see Fig.18)

| DESIGNATION | VALUE | UNIT |
|-------------|-------|------|
| $C_{be}$    | 2     | fF   |
| $C_{cb}$    | 100   | fF   |
| $C_{ce}$    | 100   | fF   |
| L1          | 0.34  | nH   |
| L2          | 0.10  | nH   |
| L3          | 0.34  | nH   |
| $L_B$       | 0.60  | nH   |
| $L_E$       | 0.60  | nH   |

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**PACKAGE OUTLINE**



**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.   |   |

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Printed in The Netherlands

123065/1500/01/pp12

Document order number:

Date of release: May 1994

9397 731 20011

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