

# DATA SHEET

**BFT92W**

PNP 4 GHz wideband transistor

Product specification

May 1994



# PNP 4 GHz wideband transistor

# BFT92W

### FEATURES

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

### APPLICATION

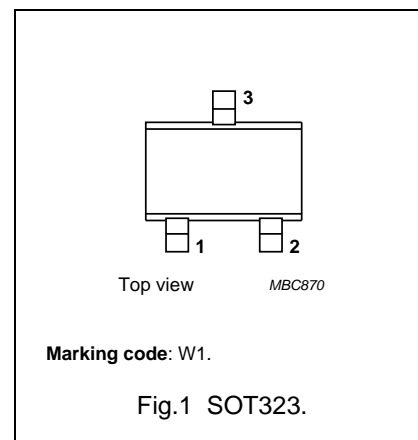
It is intended as a general purpose transistor for wideband applications up to 2 GHz.

### 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          | $I_C = -15\text{ mA}$ ; $V_{CE} = -10\text{ V}$ ; $f = 500\text{ MHz}$  | –    | 4    | –    | GHz              |
| $G_{UM}$  | maximum unilateral power gain | $I_C = -15\text{ mA}$ ; $V_{CE} = -10\text{ V}$ ; $f = 500\text{ MHz}$ ; $T_{amb} = 25\text{ }^\circ\text{C}$ | –    | 17   | –    | dB               |
| F         | noise figure                  | $I_C = -5\text{ mA}$ ; $V_{CE} = -10\text{ V}$ ; $f = 500\text{ MHz}$   | –    | 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>CB0</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).

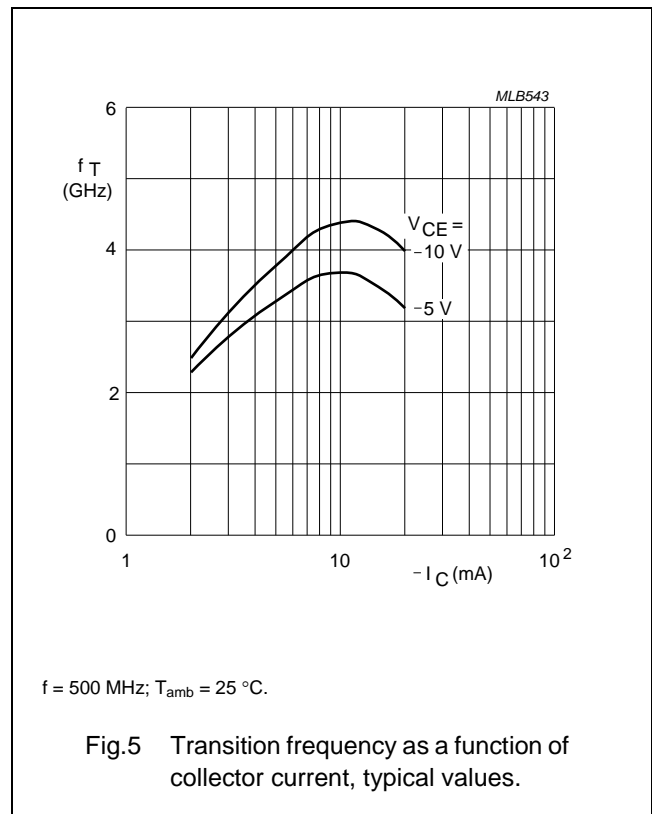
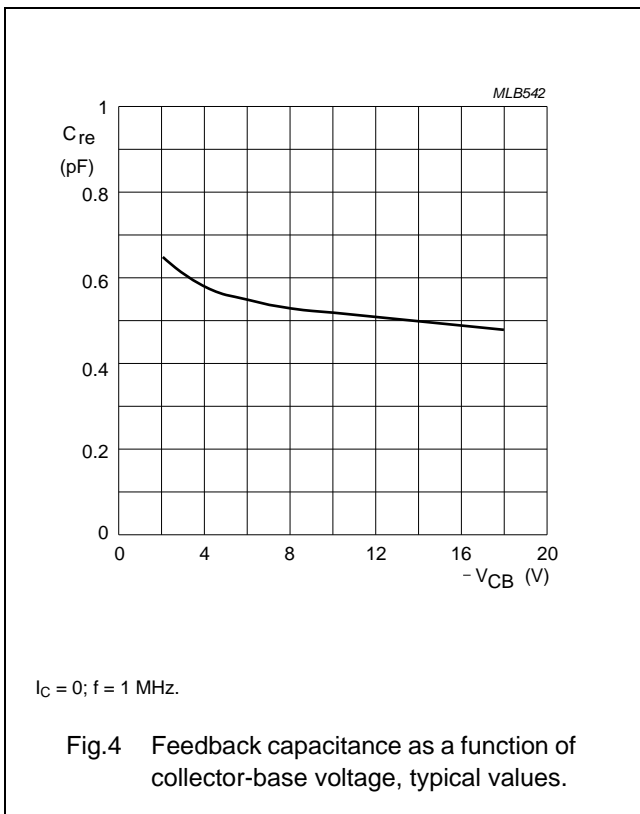
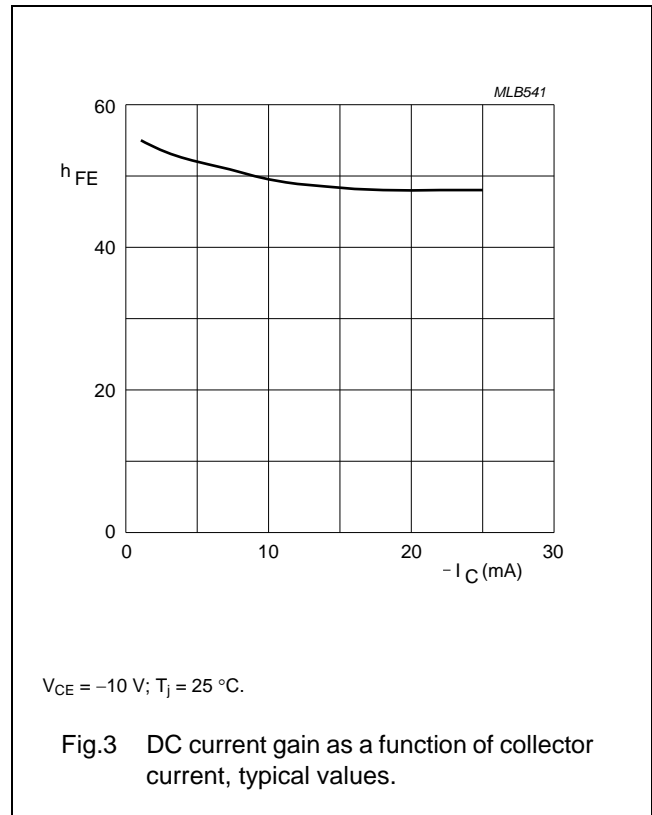
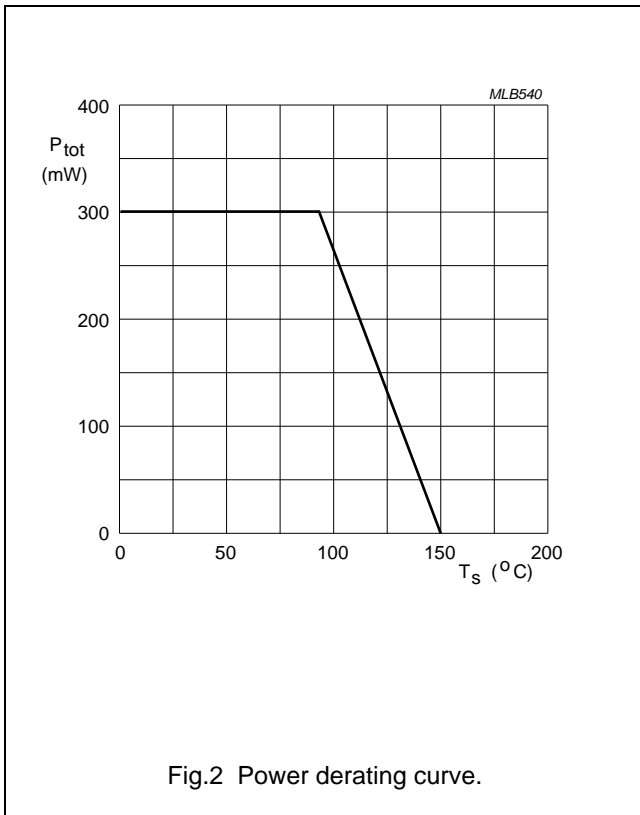
| SYMBOL           | PARAMETER                                | CONDITIONS  | MIN. | TYP. | MAX. | UNIT |
|------------------|--|---|------|------|------|------|
| I <sub>CBO</sub> | collector cut-off current                | I <sub>E</sub> = 0; V <sub>CB</sub> = –10 V   | –    | –    | –50  | nA   |
| 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.

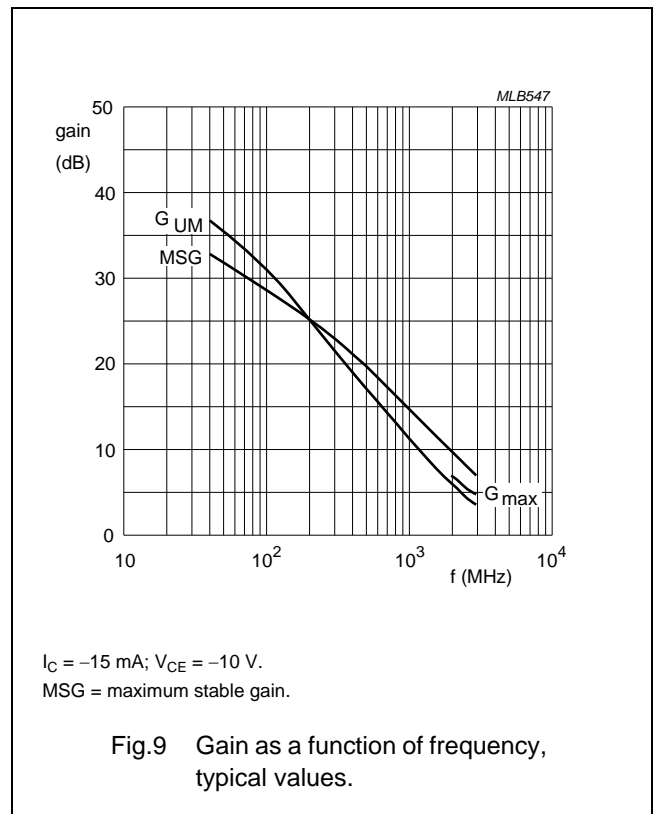
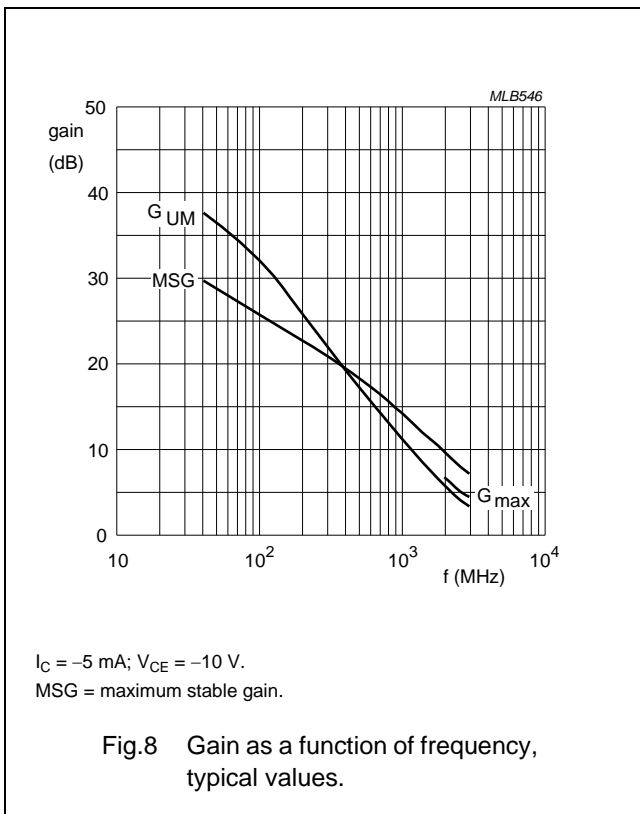
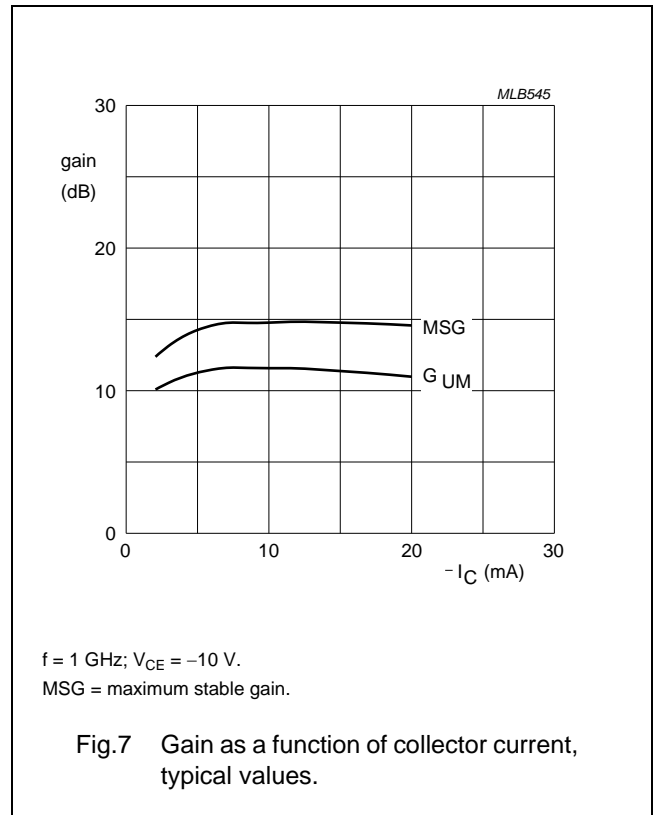
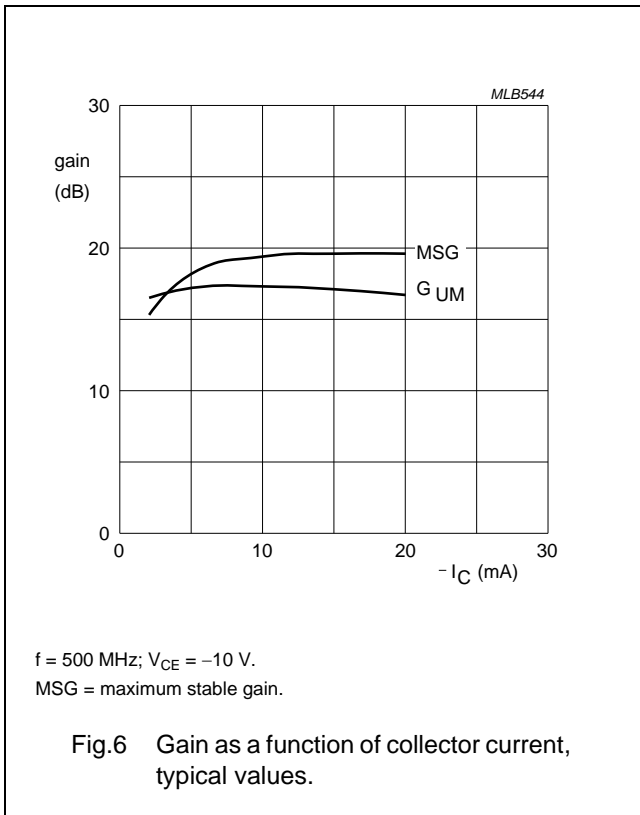
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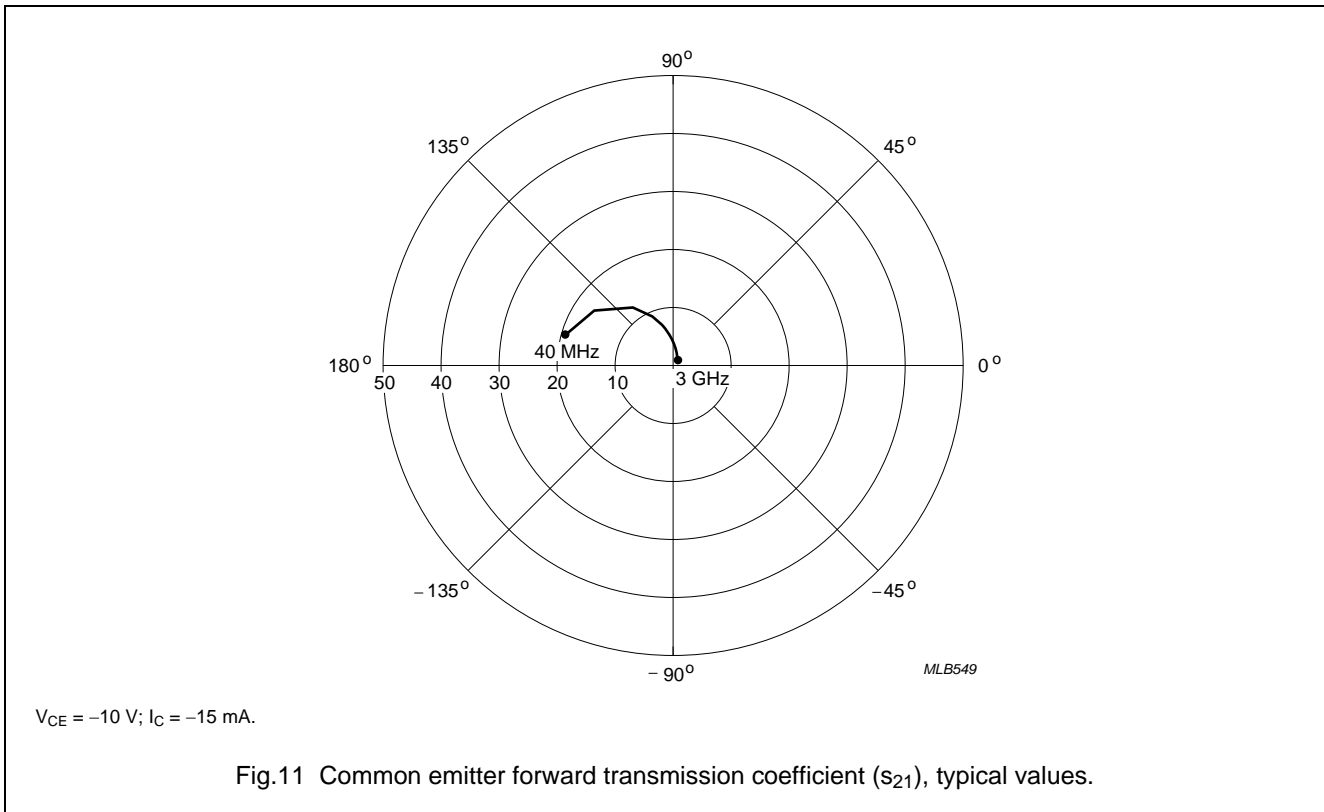
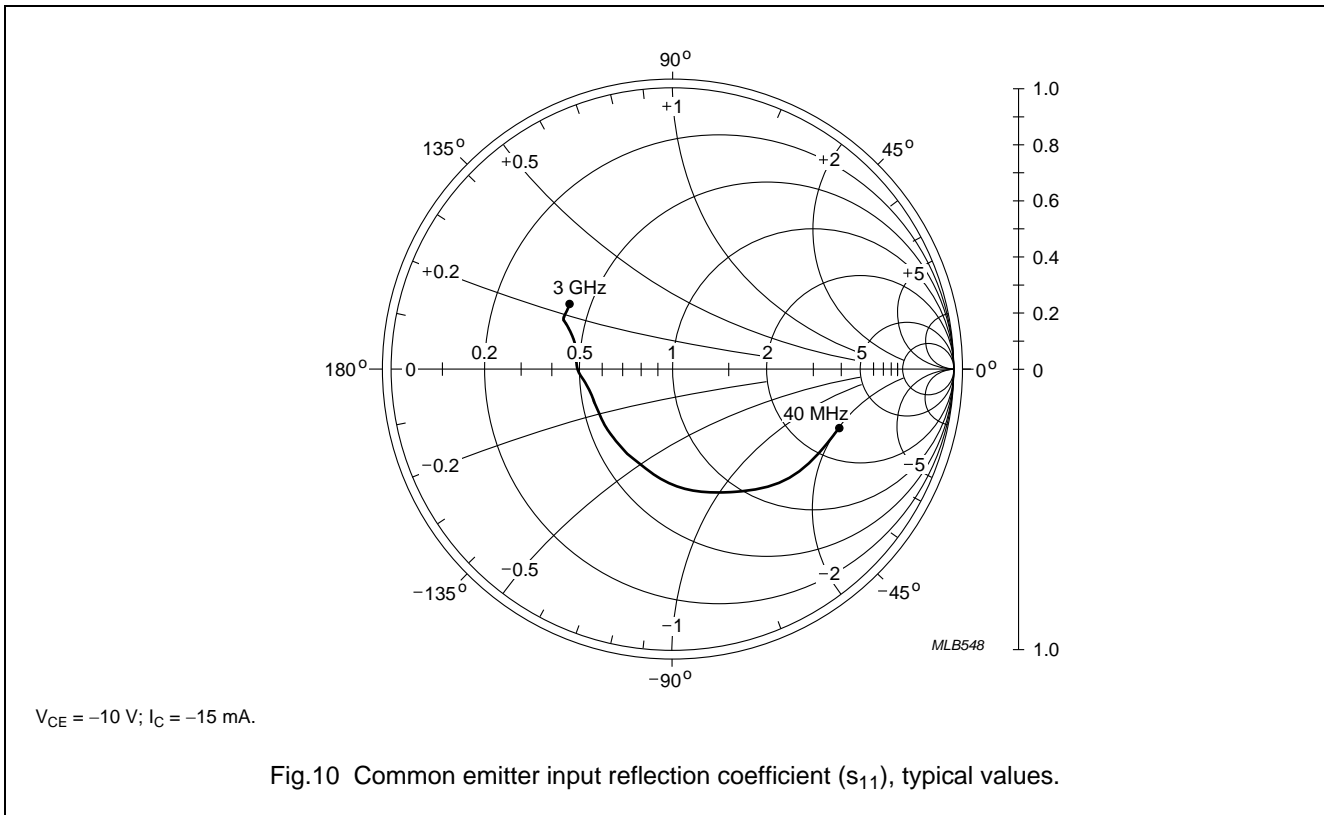
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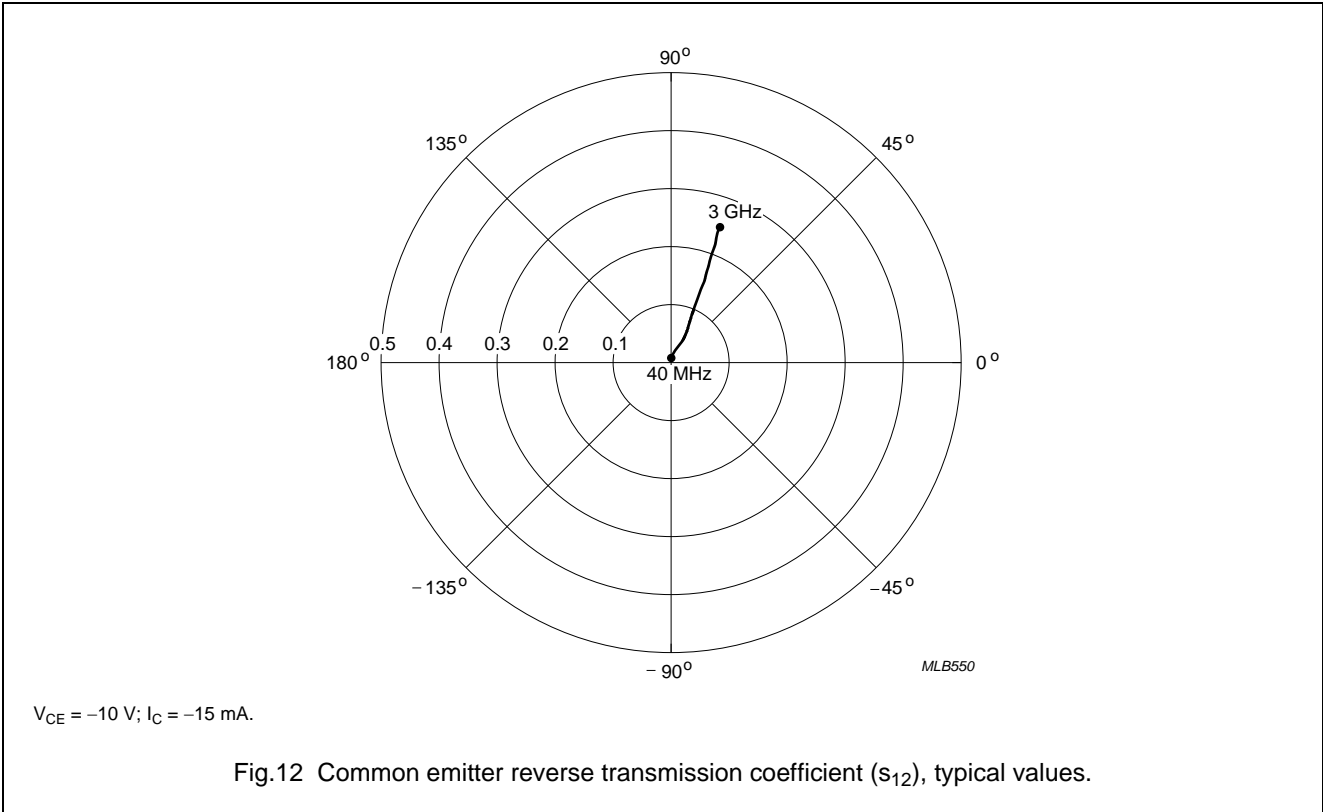


Fig.12 Common emitter reverse transmission coefficient ( $s_{12}$ ), typical values.

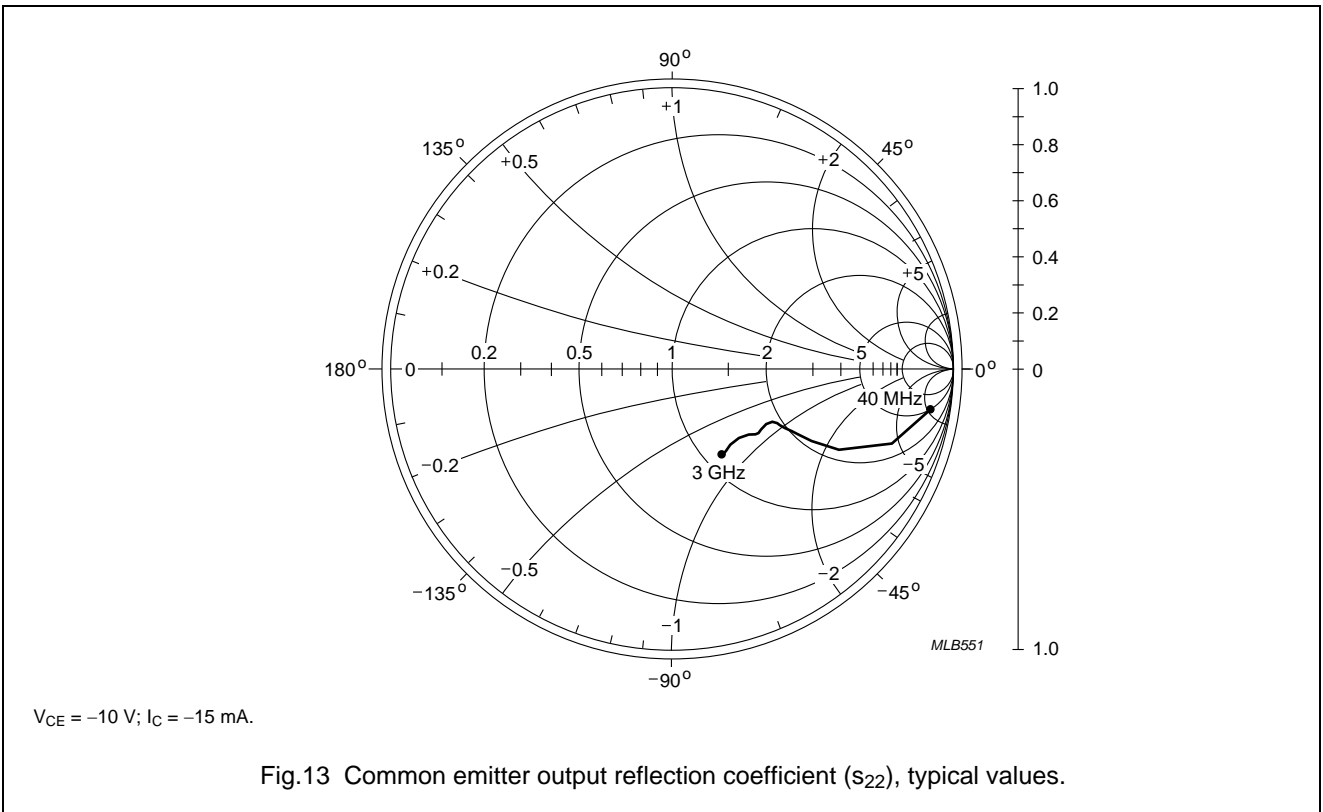
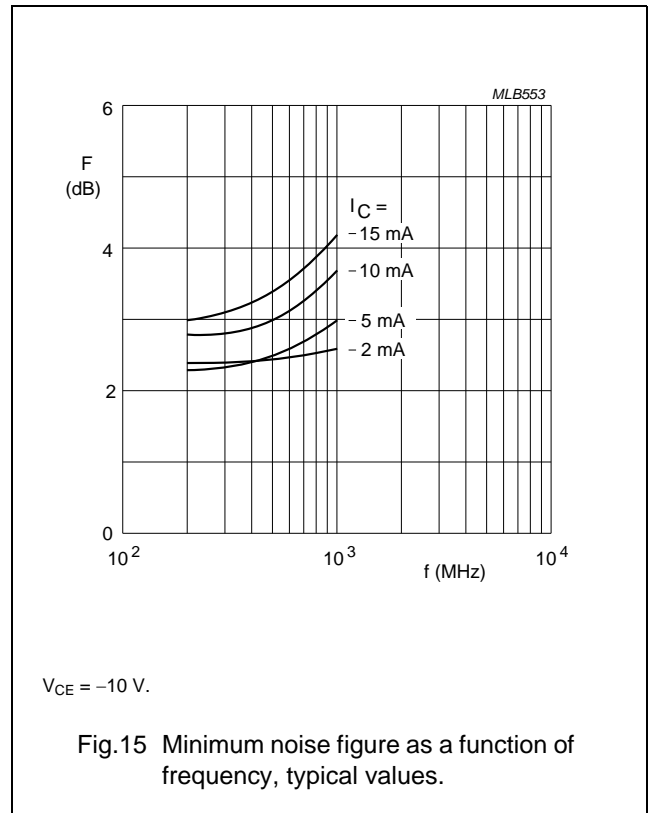
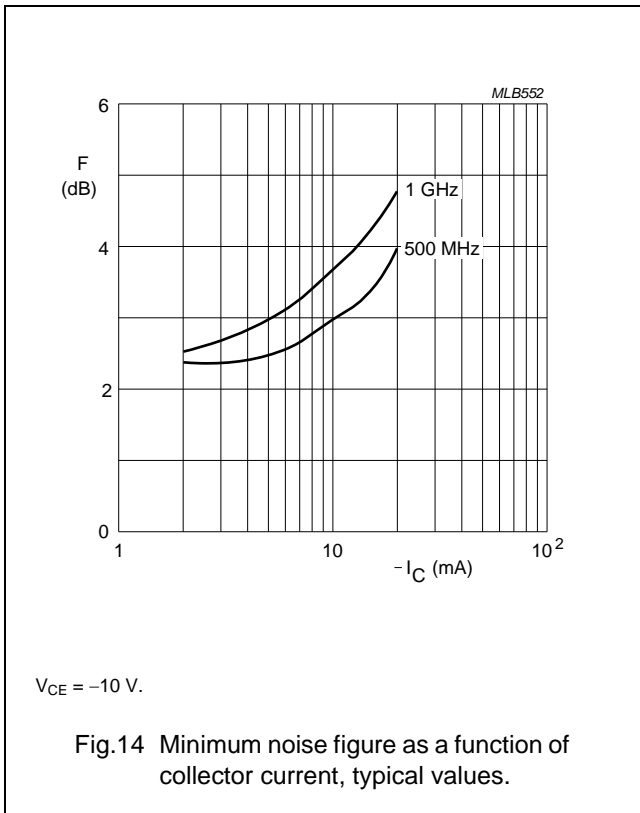


Fig.13 Common emitter output reflection coefficient ( $s_{22}$ ), typical values.

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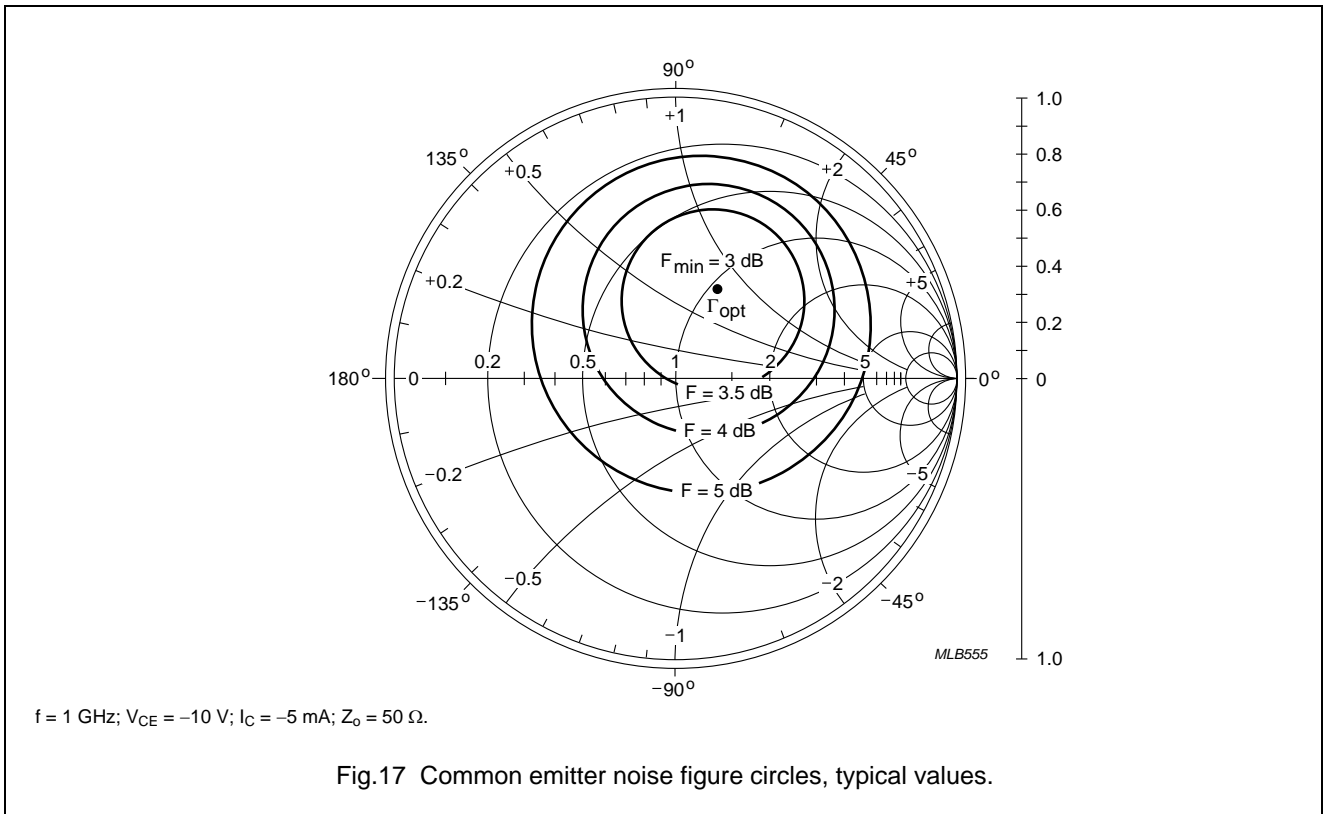
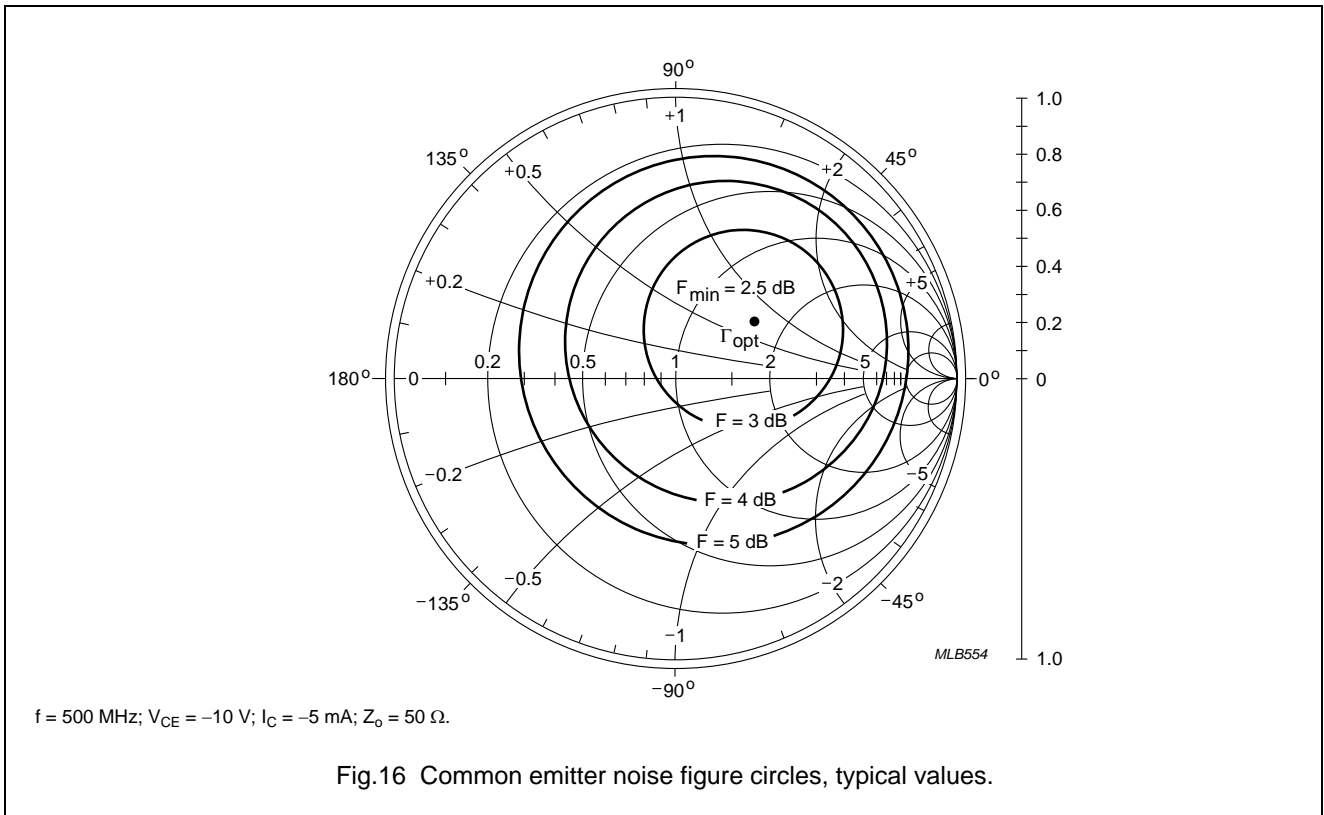
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SPICE parameters for the BFT92W crystal

| 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.

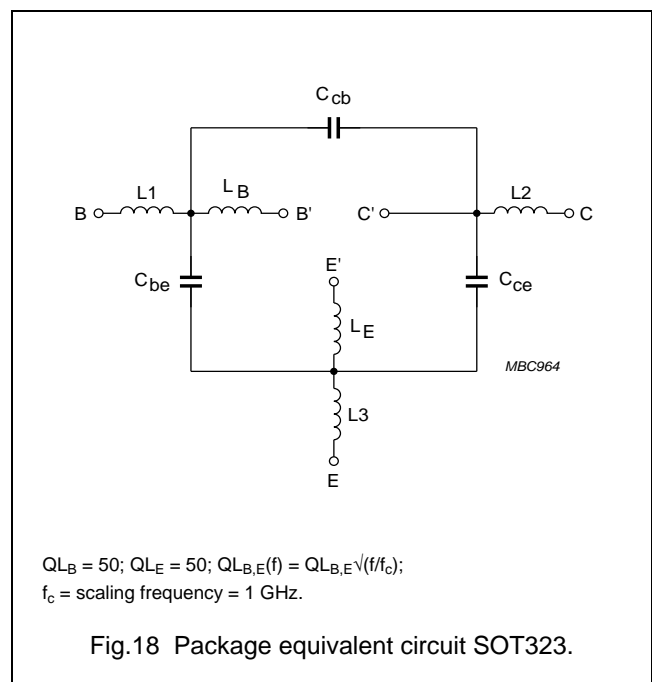


Fig.18 Package equivalent circuit SOT323.

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   |

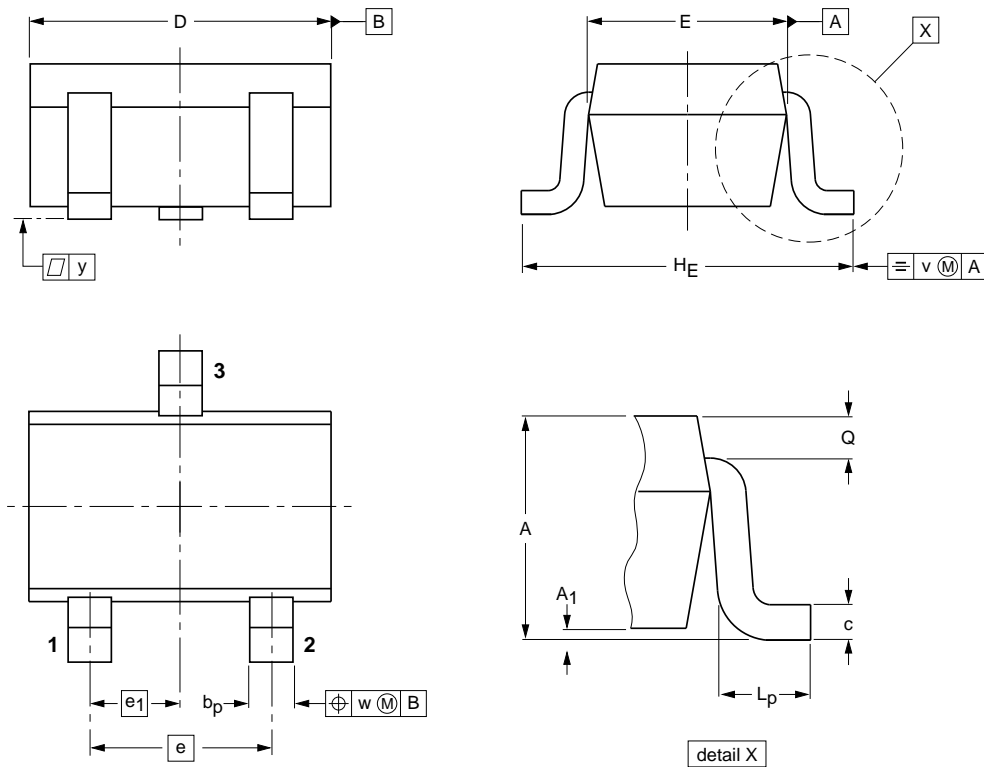
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PACKAGE OUTLINE

Plastic surface-mounted package; 3 leads

SOT323



DIMENSIONS (mm are the original dimensions)

| UNIT | A          | A <sub>1</sub><br>max | b <sub>p</sub> | c            | D          | E            | e   | e <sub>1</sub> | H <sub>E</sub> | L <sub>p</sub> | Q            | v   | w   |
|------|------------|-----------------------|----------------|--------------|------------|--------------|-----|----------------|----------------|----------------|--------------|-----|-----|
| mm   | 1.1<br>0.8 | 0.1                   | 0.4<br>0.3     | 0.25<br>0.10 | 2.2<br>1.8 | 1.35<br>1.15 | 1.3 | 0.65           | 2.2<br>2.0     | 0.45<br>0.15   | 0.23<br>0.13 | 0.2 | 0.2 |

| OUTLINE<br>VERSION | REFERENCES |       |       |  | EUROPEAN<br>PROJECTION | ISSUE DATE           |
|--------------------|------------|-------|-------|--|------------------------|----------------------|
|                    | IEC        | JEDEC | JEITA |  |                        |                      |
| SOT323             |            |       | SC-70 |  |                        | 04-11-04<br>06-03-16 |

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## DATA SHEET STATUS

| DOCUMENT STATUS <sup>(1)</sup> | PRODUCT STATUS <sup>(2)</sup> | DEFINITION  |
|--------------------------------|-------------------------------|---|
| Objective data sheet           | Development                   | This document contains data from the objective specification for product development. |
| Preliminary data sheet         | Qualification                 | This document contains data from the preliminary specification.                       |
| Product data sheet             | Production                    | This document contains the product specification.                                     |

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Printed in The Netherlands

R77/01/pp14

Date of release: May 1994