

# UHF wideband transistor

# PBR941

### FEATURES

- Small size
- Low noise
- Low distortion
- High gain
- Gold metallization ensures excellent reliability.

### APPLICATIONS

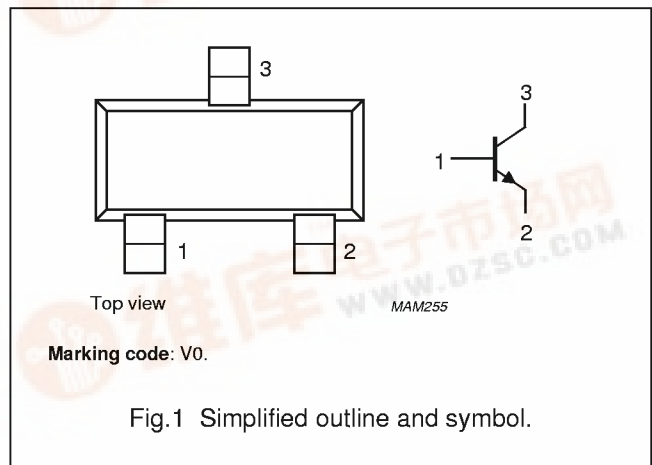
- Communication and instrumentation systems.

### DESCRIPTION

Silicon NPN transistor in a surface mount 3-pin SOT23 package. The transistor is primarily intended for wideband applications in the GHz-range in the RF front end of analog and digital cellular telephones, cordless phones, radar detectors, pagers and satellite TV-tuners.

### PINNING - SOT23

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



### QUICK REFERENCE DATA

| SYMBOL        | PARAMETER   | CONDITIONS   | TYP. | MAX. | UNIT |
|---------------|---|--|------|------|------|
| $C_{re}$      | feedback capacitance                                | $I_C = 0$ ; $V_{CB} = 6$ V; $f = 1$ MHz                                  | 0.3  | —    | pF   |
| $f_T$         | transition frequency                                | $I_C = 15$ mA; $V_{CE} = 6$ V; $f_m = 1$ GHz                             | 8    | —    | GHz  |
| $G_{UM}$      | maximum unilateral power gain                       | $I_C = 15$ mA; $V_{CE} = 6$ V; $f = 1$ GHz;<br>$T_{amb} = 25$ °C         | 15   | —    | dB   |
| F             | noise figure  | $\Gamma_S = \Gamma_{opt}$ ; $I_C = 5$ mA; $V_{CE} = 6$ V;<br>$f = 1$ GHz | 1.4  | —    | dB   |
| $P_{tot}$     | total power dissipation                             | $T_s = 60$ °C; note 1  | —    | 360  | mW   |
| $R_{th\ j-s}$ | thermal resistance from junction to soldering point | $P_{tot} = 360$ mW   | —    | 320  | K/W  |

### 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                      | –    | 10   | V    |
| V <sub>EBO</sub>   | emitter-base voltage      | open collector                 | –    | 1.5  | V    |
| I <sub>C</sub>     | collector current (DC)    |                                | –    | 50   | mA   |
| I <sub>C(AV)</sub> | average collector current |                                | –    | 50   | mA   |
| P <sub>tot</sub>   | total power dissipation   | T <sub>s</sub> = 60 °C; note 1 | –    | 360  | mW   |
| T <sub>stg</sub>   | storage temperature       |                                | –65  | +150 | °C   |
| T <sub>j</sub>     | junction temperature      |                                | –    | 175  | °C   |

**Note**

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

**THERMAL CHARACTERISTICS**

| SYMBOL              | PARAMETER   | CONDITIONS  | VALUE | UNIT |
|---------------------|---|---|-------|------|
| R <sub>th j-s</sub> | thermal resistance from junction to soldering point; note 1 | P <sub>tot</sub> = 360 mW; T <sub>s</sub> = 60 °C; note 1 | 320   | K/W  |

**Note**

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

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**CHARACTERISTICS**

$T_j = 25\text{ °C}$ ; unless otherwise specified.

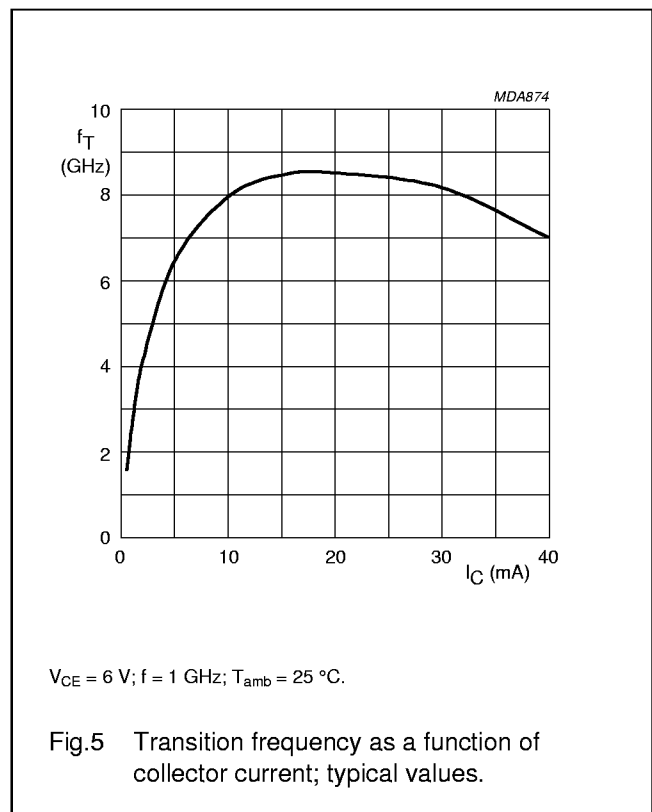
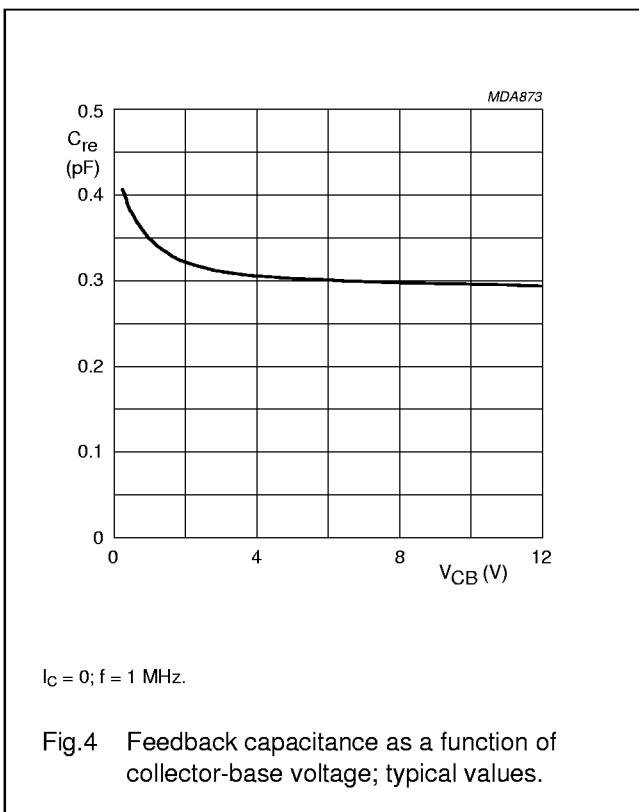
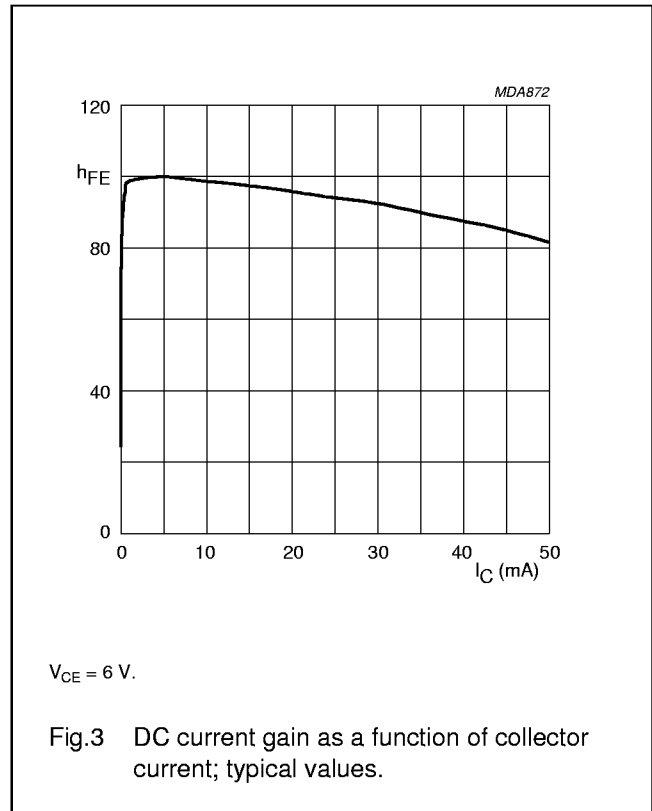
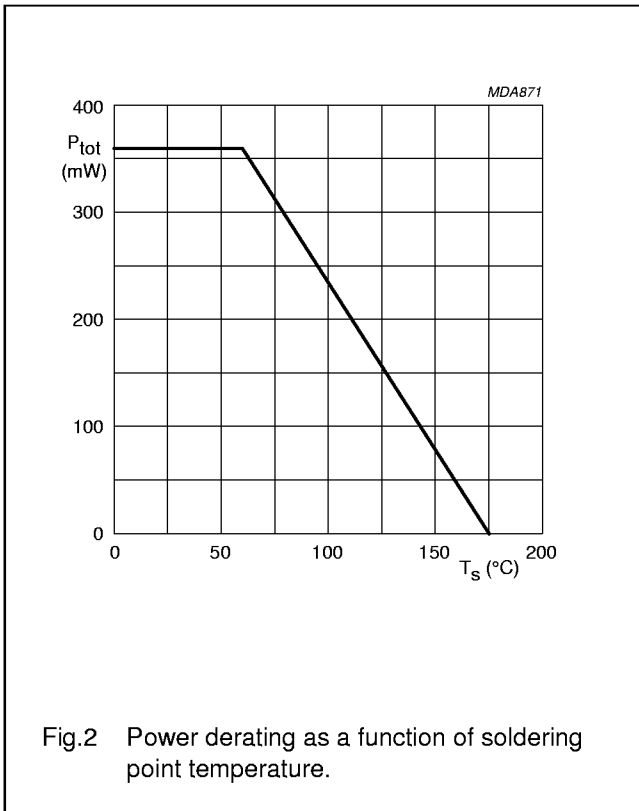
| SYMBOL                    | PARAMETER                                | CONDITIONS  | MIN. | TYP. | MAX. | UNIT |
|---------------------------|--|---|------|------|------|------|
| <b>DC characteristics</b> |  |   |      |      |      |      |
| $V_{(BR)CBO}$             | collector-base breakdown voltage         | $I_C = 100\ \mu\text{A}; I_E = 0$   | 20   | –    | –    | V    |
| $V_{(BR)CEO}$             | collector-emitter breakdown voltage      | $I_C = 100\ \mu\text{A}; I_B = 0$   | 10   | –    | –    | V    |
| $V_{(BR)EBO}$             | emitter-base breakdown voltage           | $I_E = 10\ \mu\text{A}; I_C = 0$  | 1.5  | –    | –    | V    |
| $I_{CBO}$                 | collector-base leakage current           | $V_{CB} = 10\ \text{V}; I_E = 0$  | –    | –    | 100  | nA   |
| $I_{EBO}$                 | emitter-base leakage current             | $V_{EB} = 1\ \text{V}; I_C = 0$   | –    | –    | 100  | nA   |
| $h_{FE}$                  | DC current gain                          | $I_C = 5\ \text{mA}; V_{CE} = 6\ \text{V}$  | 50   | 100  | 200  |      |
|                           |  | $I_C = 15\ \text{mA}; V_{CE} = 6\ \text{V}$   | –    | 100  | –    |      |
| <b>AC characteristics</b> |  |   |      |      |      |      |
| $C_{re}$                  | feedback capacitance                     | $I_C = 0; V_{CB} = 6\ \text{V}; f = 1\ \text{MHz}$  | –    | 0.3  | –    | pF   |
| $f_T$                     | transition frequency                     | $I_C = 15\ \text{mA}; V_{CE} = 6\ \text{V}; f = 1\ \text{GHz}$                              | –    | 8    | –    | GHz  |
| $G_{UM}$                  | maximum unilateral power gain;<br>note 1 | $I_C = 15\ \text{mA}; V_{CE} = 6\ \text{V};$<br>$T_{amb} = 25\text{ °C}; f = 1\ \text{GHz}$ | –    | 15   | –    | dB   |
|                           |  | $I_C = 15\ \text{mA}; V_{CE} = 6\ \text{V};$<br>$T_{amb} = 25\text{ °C}; f = 2\ \text{GHz}$ | –    | 9.5  | –    | dB   |
| F                         | noise figure                             | $\Gamma_S = \Gamma_{opt}; I_C = 5\ \text{mA}; V_{CE} = 6\ \text{V};$<br>$f = 1\ \text{GHz}$ | –    | 1.4  | –    | dB   |
|                           |  | $\Gamma_S = \Gamma_{opt}; I_C = 5\ \text{mA}; V_{CE} = 6\ \text{V};$<br>$f = 2\ \text{GHz}$ | –    | 2    | –    | dB   |

**Note**

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

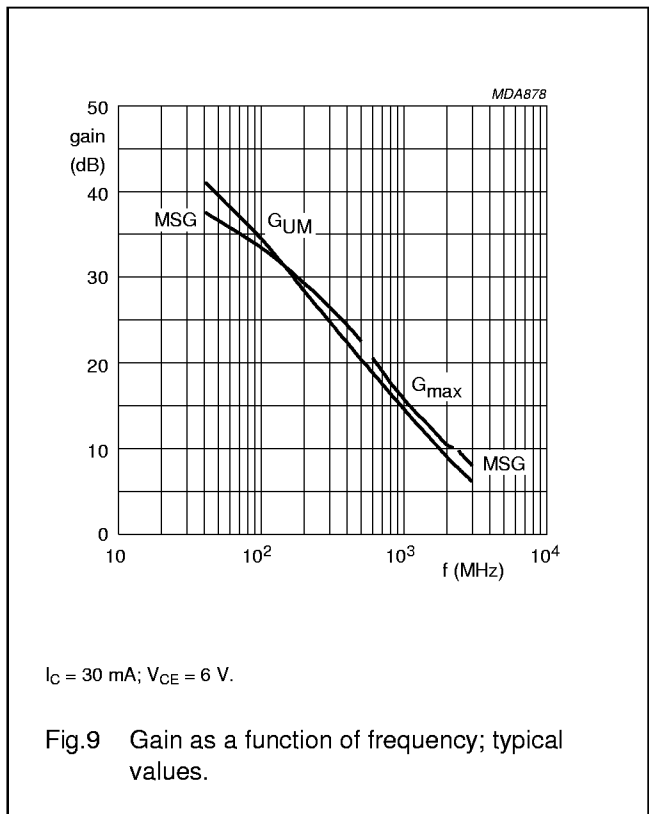
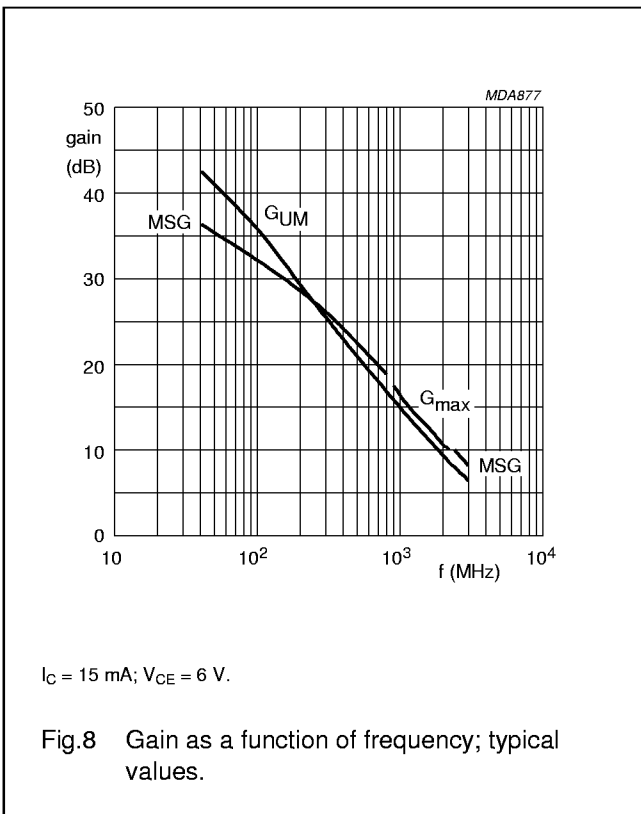
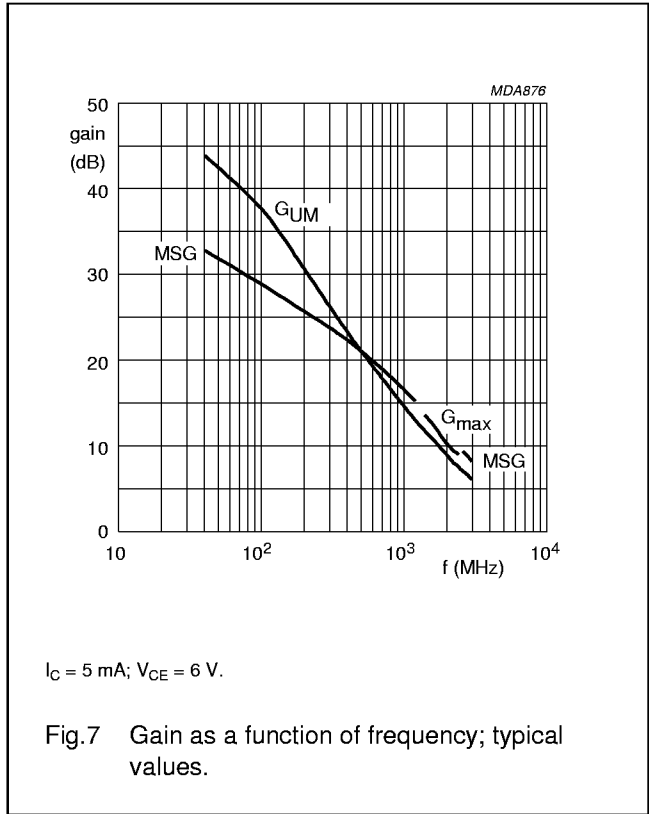
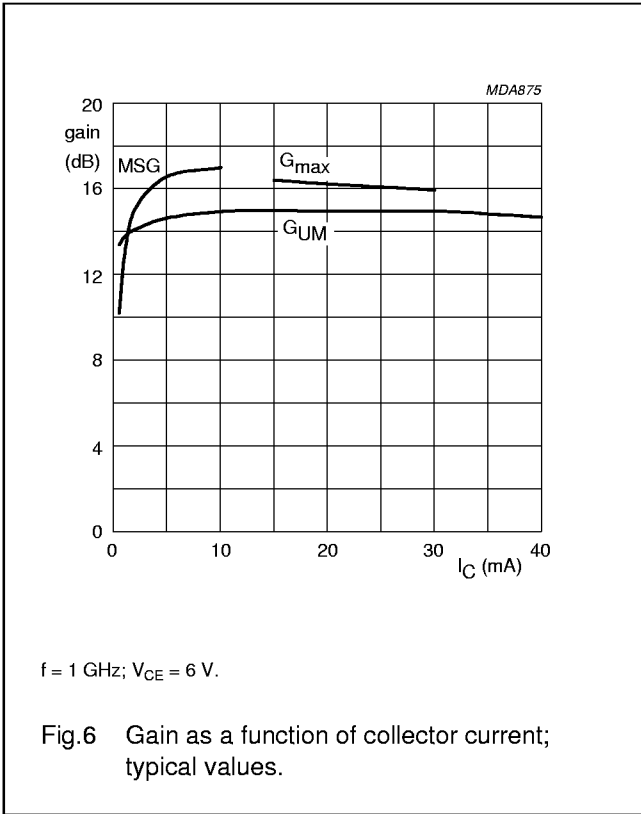
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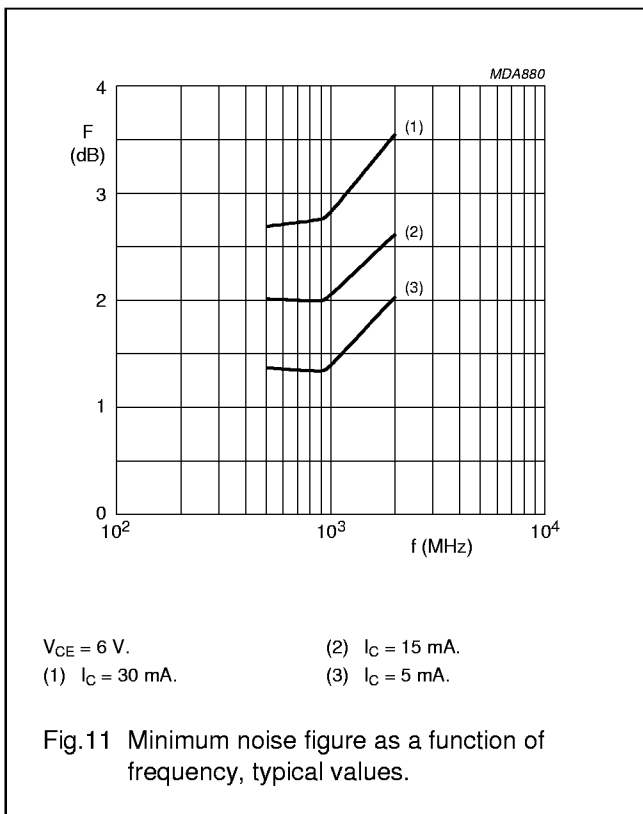
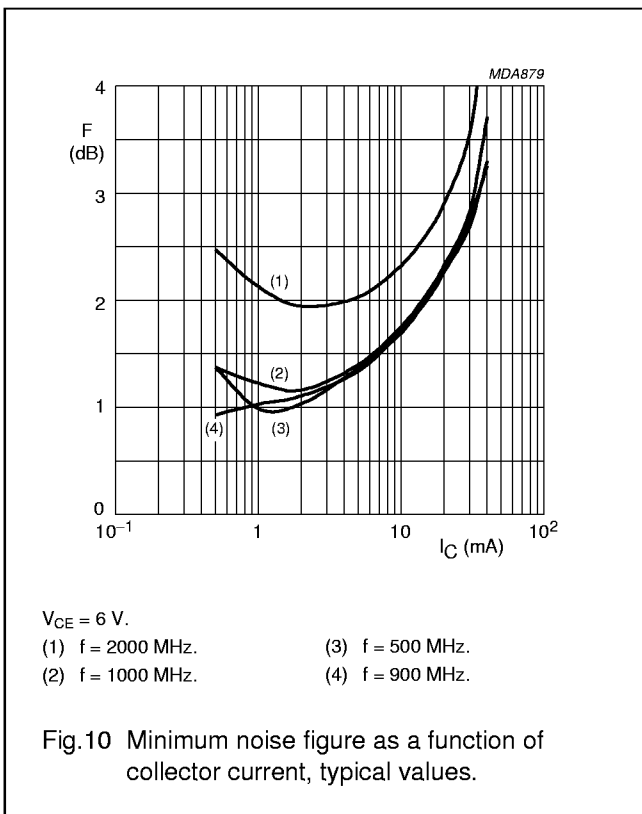
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APPLICATION INFORMATION

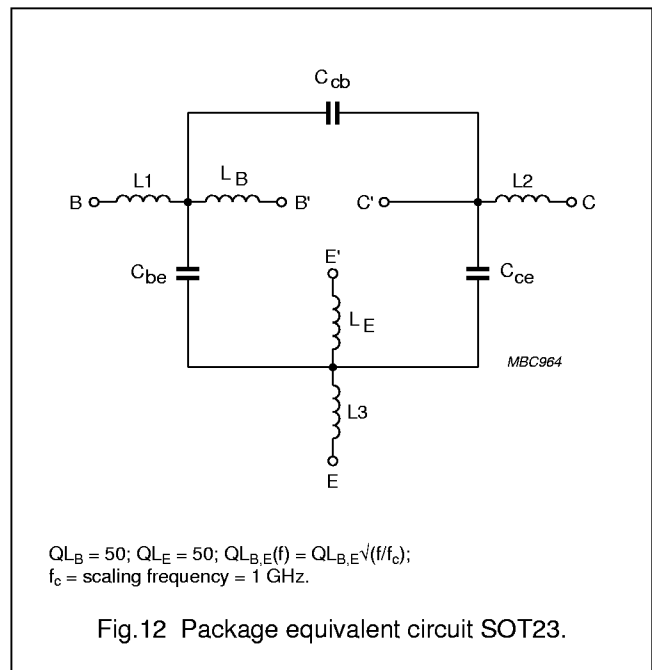
SPICE parameters for the PBR941 die

| SEQUENCE No.      | PARAMETER | VALUE | UNIT |
|-------------------|-----------|-------|------|
| 1                 | IS        | 0.466 | fA   |
| 2                 | BF        | 150.4 | –    |
| 3                 | NF        | 1.000 | –    |
| 4                 | VAF       | 53.06 | V    |
| 5                 | IKF       | 180.0 | mA   |
| 6                 | ISE       | 57.30 | fA   |
| 7                 | NE        | 2.000 | –    |
| 8                 | BR        | 27.68 | –    |
| 9                 | NR        | 1.000 | –    |
| 10                | VAR       | 1.976 | V    |
| 11                | IKR       | 9.943 | mA   |
| 12                | ISC       | 1.420 | aA   |
| 13                | NC        | 1.000 | –    |
| 14                | RB        | 12.14 | Ω    |
| 15                | IRB       | 0.000 | μA   |
| 16                | RBM       | 4.957 | Ω    |
| 17                | RE        | 0.597 | Ω    |
| 18                | RC        | 1.988 | 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       | 0.568 | pF   |
| 23                | VJE       | 600.0 | mV   |
| 24                | MJE       | 0.412 | –    |
| 25                | TF        | 2.037 | ps   |
| 26                | XTF       | 30.90 | –    |
| 27                | VTF       | 3.148 | V    |
| 28                | ITF       | 131.8 | mA   |
| 29                | PTF       | 0.000 | deg  |
| 30                | CJC       | 205.8 | fF   |
| 31                | VJC       | 296.2 | mV   |
| 32                | MJC       | 0.118 | –    |
| 33                | XCJC      | 0.104 | –    |
| 34                | TR        | 0.000 | ps   |
| 35 <sup>(1)</sup> | CJS       | 0.000 | F    |
| 36 <sup>(1)</sup> | VJS       | 700.0 | mV   |
| 37 <sup>(1)</sup> | MJS       | 0.000 | –    |
| 38                | FC        | 0.943 | –    |

| SEQUENCE No.      | PARAMETER        | VALUE                 | UNIT |
|-------------------|------------------|-----------------------|------|
| 39 <sup>(2)</sup> | C <sub>bpb</sub> | 83.00                 | fF   |
| 40 <sup>(2)</sup> | C <sub>bpe</sub> | 84.00                 | fF   |
| 41                | AF               | 1.000                 | –    |
| 42                | KF               | 4 x 10 <sup>-16</sup> | –    |

Notes

1. These parameters have not been extracted, the default values are shown.
2. C<sub>bpb</sub>, C<sub>bpe</sub>; base-bondpad and emitter-bondpad capacitance to collector.

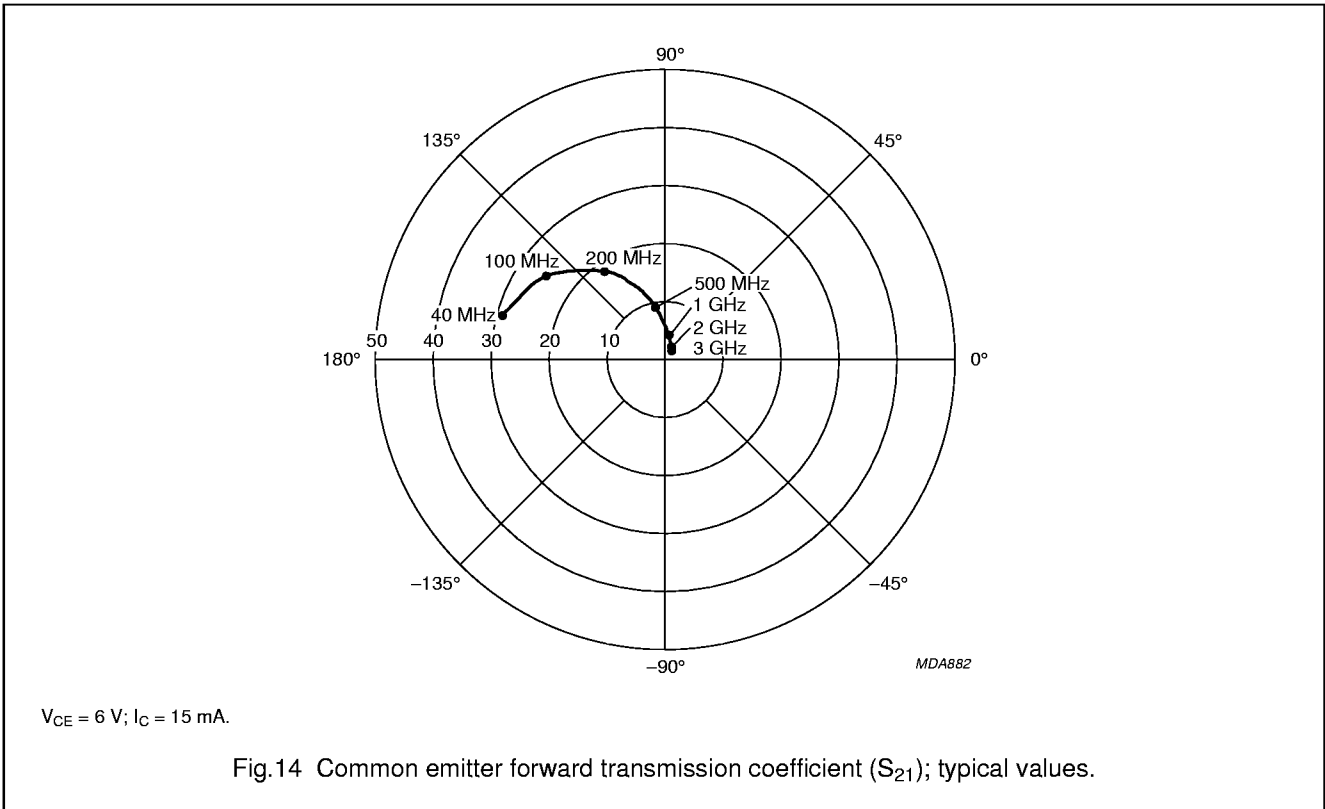
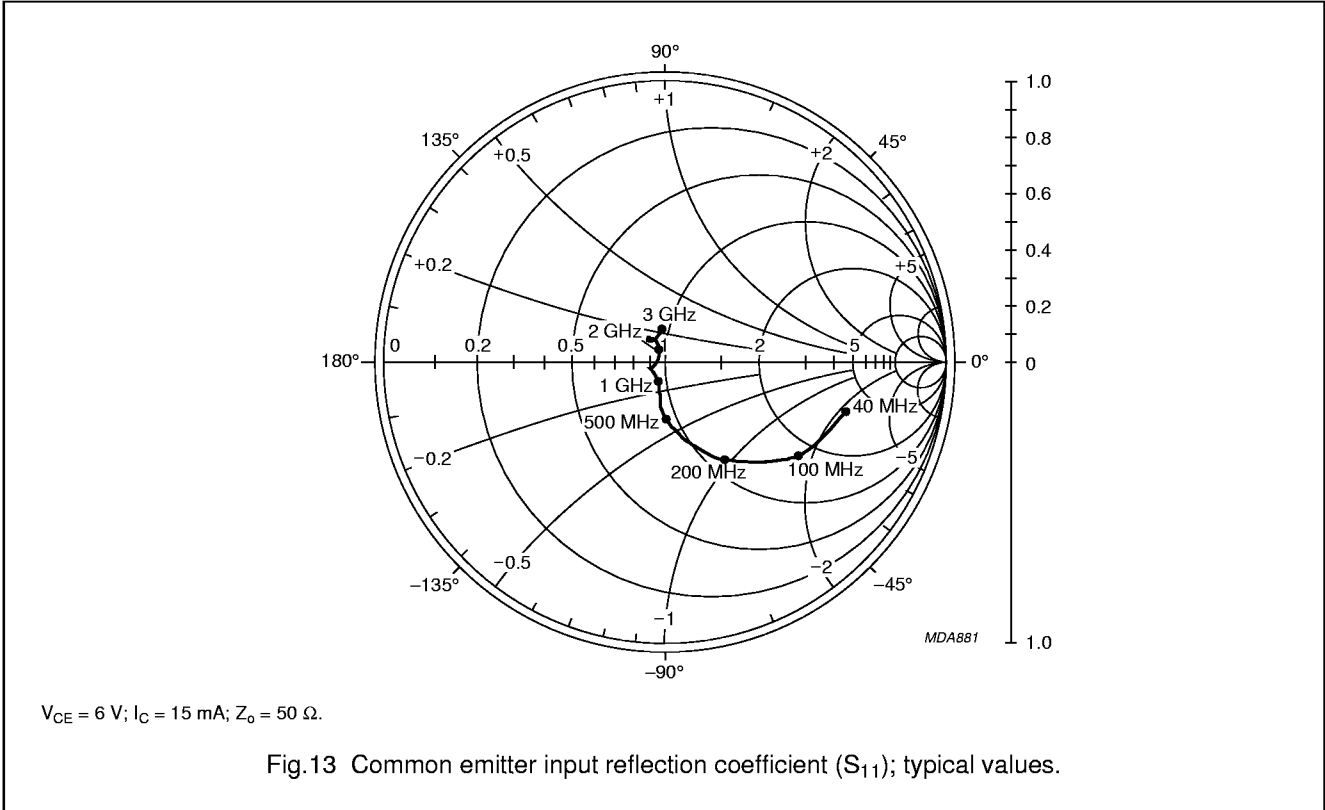


List of components (see Fig.12)

| DESIGNATION     | VALUE | UNIT |
|-----------------|-------|------|
| C <sub>be</sub> | 7     | fF   |
| C <sub>cb</sub> | 80    | fF   |
| C <sub>ce</sub> | 80    | fF   |
| L1              | 0.35  | nH   |
| L2              | 0.17  | nH   |
| L3              | 0.35  | nH   |
| L <sub>B</sub>  | 0.40  | nH   |
| L <sub>E</sub>  | 0.83  | nH   |

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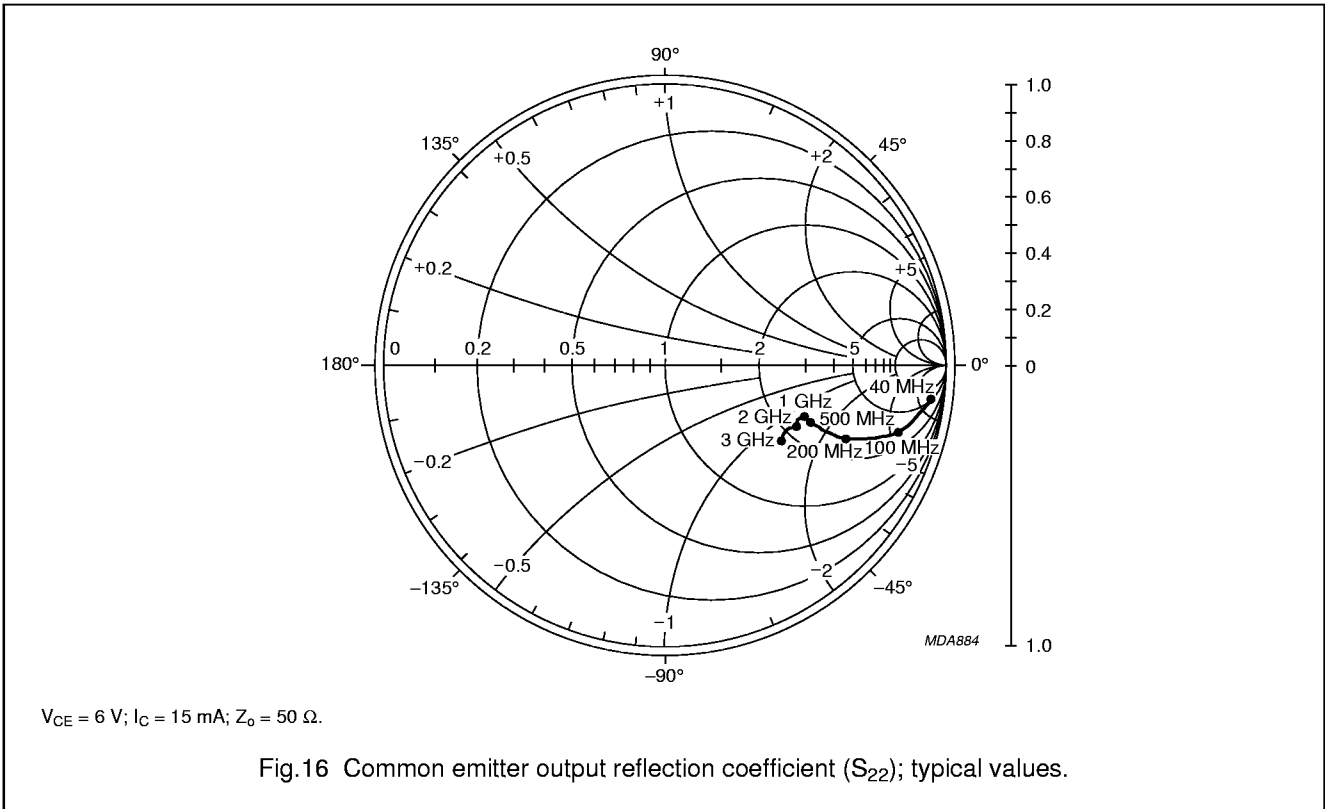
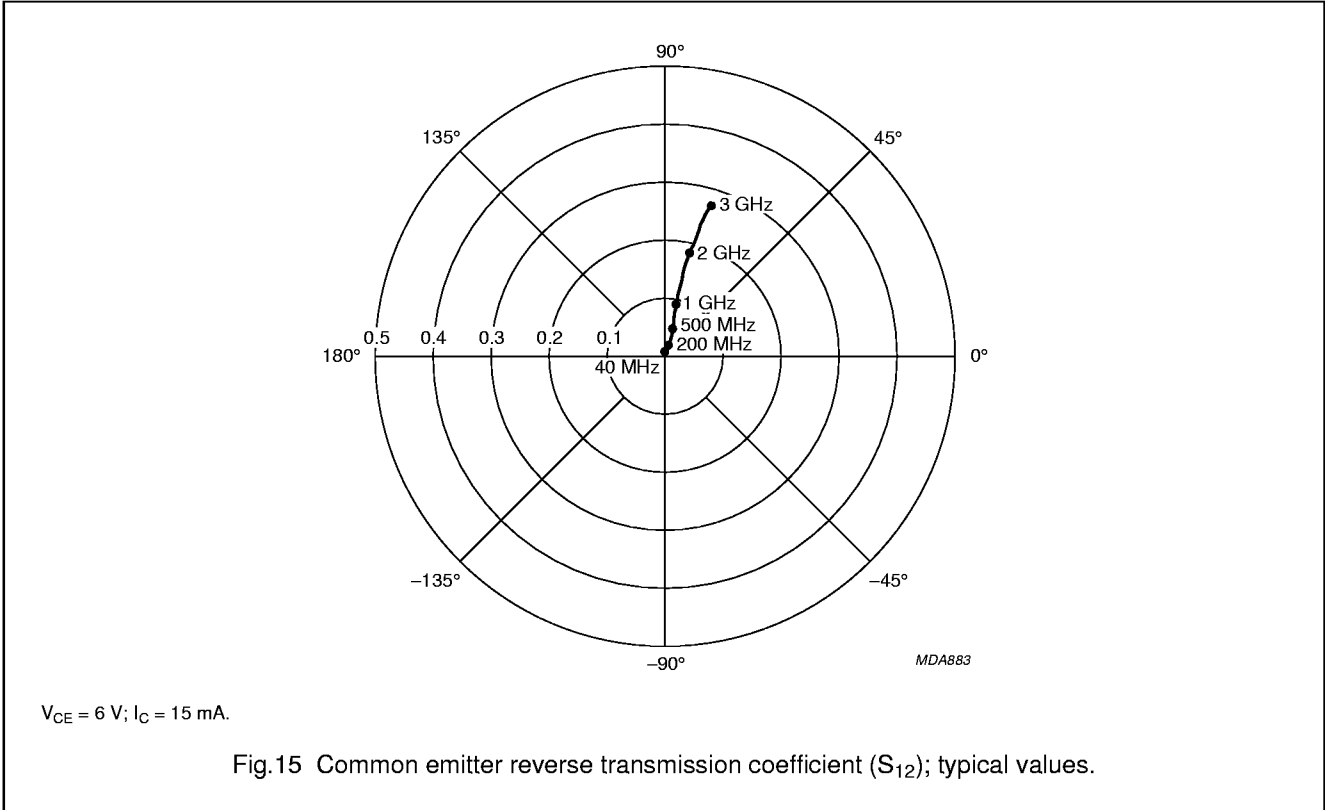
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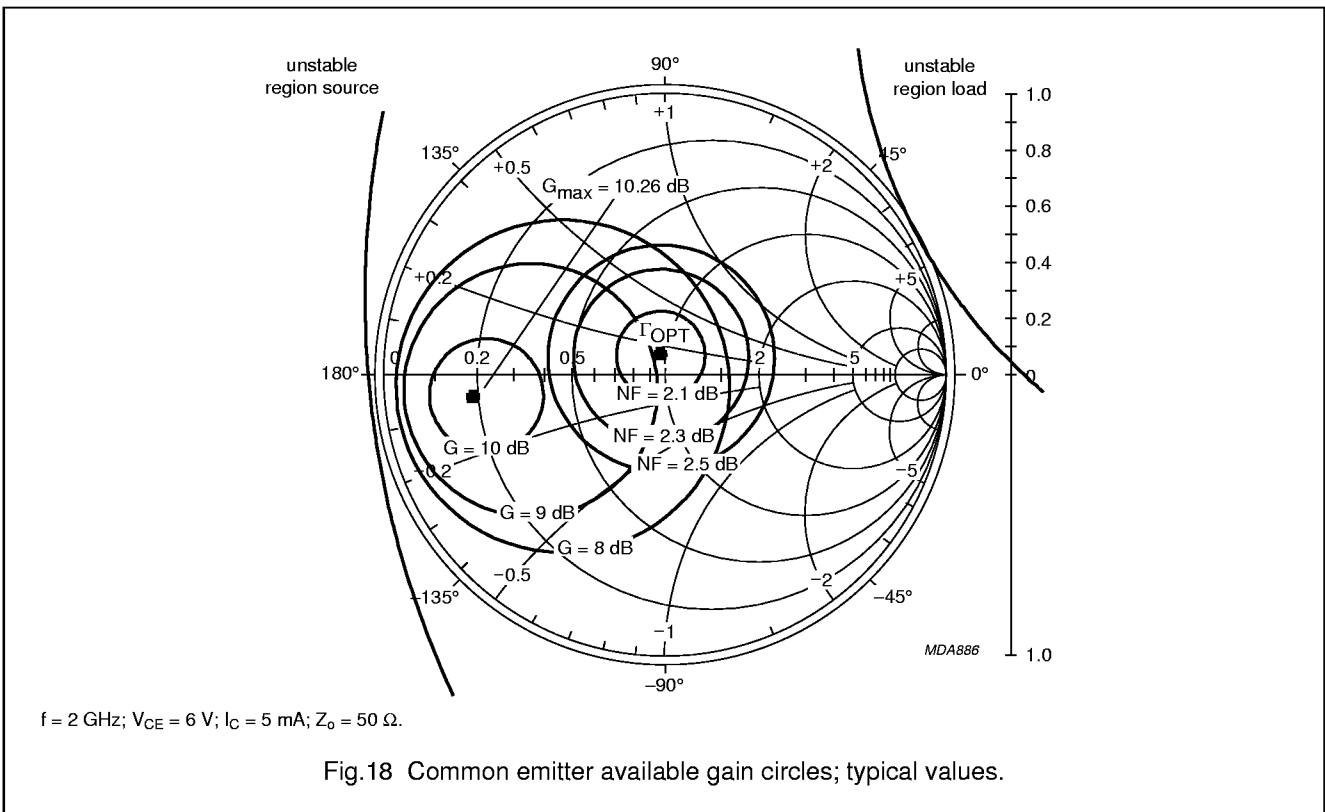
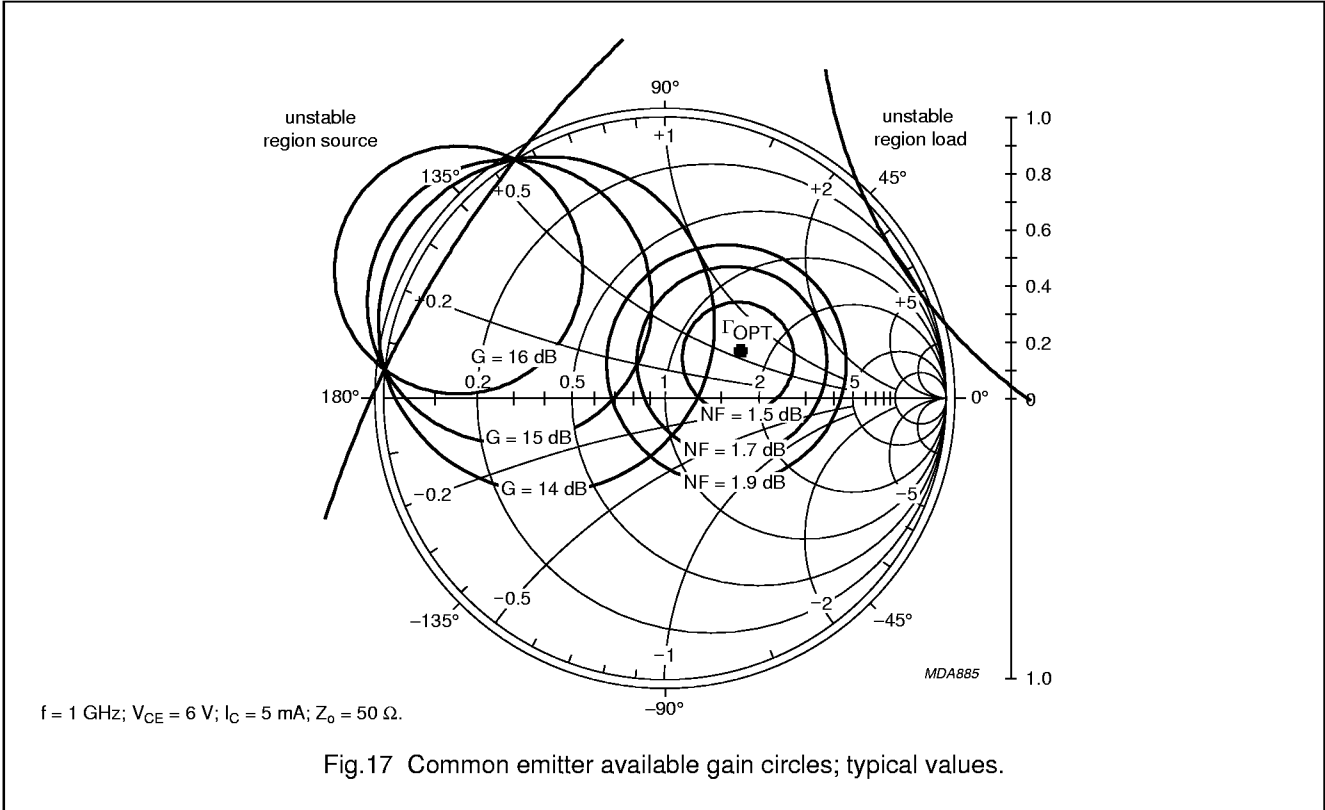
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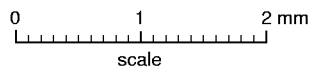
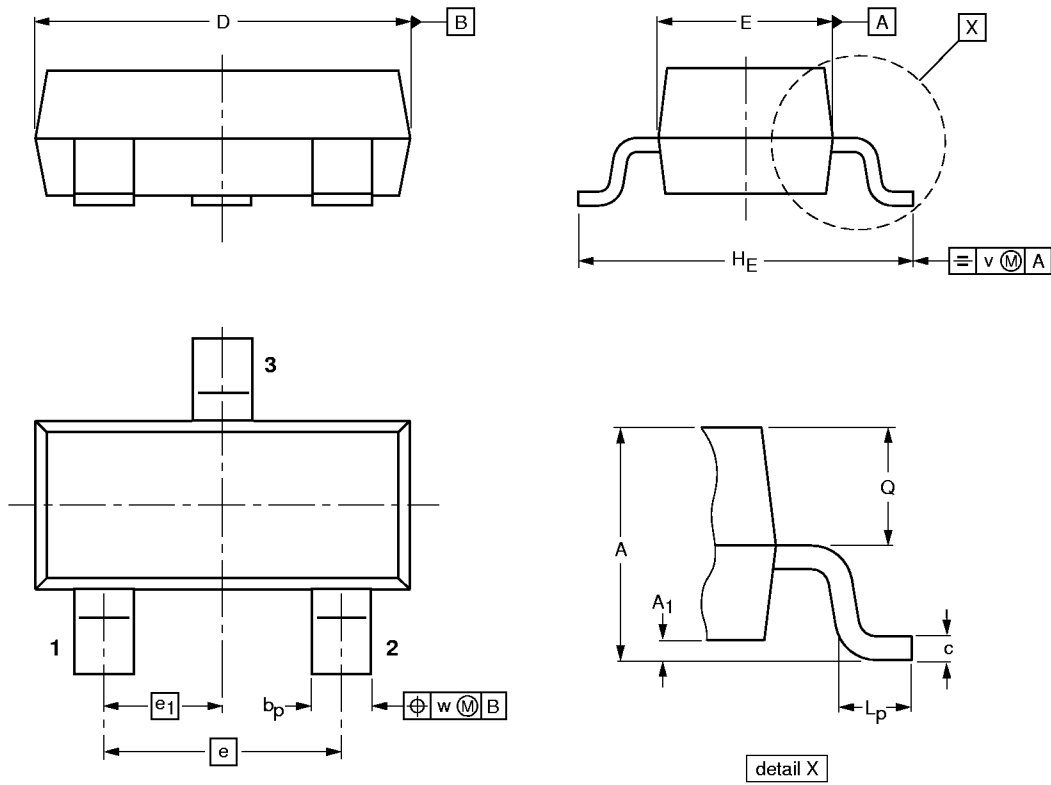
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PACKAGE OUTLINE

Plastic surface mounted package; 3 leads

SOT23



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>0.9 | 0.1                    | 0.48<br>0.38   | 0.15<br>0.09 | 3.0<br>2.8 | 1.4<br>1.2 | 1.9 | 0.95           | 2.5<br>2.1     | 0.45<br>0.15   | 0.55<br>0.45 | 0.2 | 0.1 |

| OUTLINE<br>VERSION | REFERENCES |       |      |  | EUROPEAN<br>PROJECTION | ISSUE DATE |
|--------------------|------------|-------|------|--|------------------------|------------|
|                    | IEC        | JEDEC | EIAJ |  |                        |            |
| SOT23              |            |       |      |  |                        | 97-02-28   |