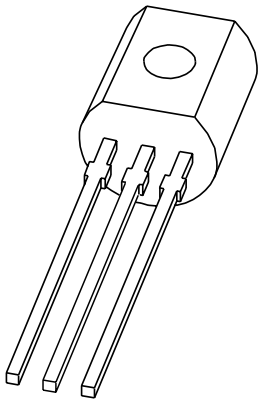
# DATA SHEET



# PSS9013 series
## 20 V NPN general purpose transistors

Product specification
Supersedes data of 2003 May 15

2004 Aug 10

Philips Semiconductors

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# 20 V NPN general purpose transistors PSS9013 series

## FEATURES

- High power dissipation: 710 mW
- Low collector capacitance
- Low collector-emitter saturation voltage
- High current capability.

## APPLICATIONS

- General purpose switching and amplification.

## DESCRIPTION

NPN general purpose transistor in a SOT54 (TO-92) leaded plastic package. PNP complement: PSS9012 series.

## MARKING

| TYPE NUMBER | MARKING CODE |
|---|---|
| PSS9013G | S9013G |
| PSS9013H | S9013H |

## QUICK REFERENCE DATA

| SYMBOL | PARAMETER | MAX. | UNIT |
|---|---|---|---|
| $V_{CEO}$ | collector-emitter voltage | 20 | V |
| $I_C$ | collector current (DC) | 500 | mA |
| $I_{CM}$ | peak collector current | 1 | A |

## PINNING

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

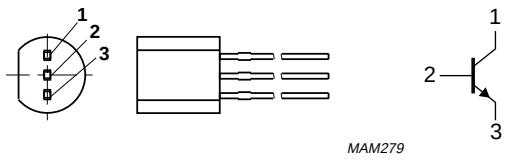



Fig.1 Simplified outline (SOT54; TO-92) and symbol.

## LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 60134).

| SYMBOL | PARAMETER | CONDITIONS | MIN. | MAX. | UNIT |
|---|---|---|---|---|---|
| $V_{CBO}$ | collector-base voltage | open emitter | – | 40 | V |
| $V_{CEO}$ | collector-emitter voltage | open base | – | 20 | V |
| $V_{EBO}$ | emitter-base voltage | open collector | – | 5 | V |
| $I_C$ | collector current (DC) | | – | 500 | mA |
| $I_{CM}$ | peak collector current | | – | 1 | A |
| $I_{BM}$ | peak base current | | – | 100 | mA |
| $P_{tot}$ | total power dissipation | $T_{amb} \leq 25$ °C; note 1 | – | 710 | mW |
| $T_{stg}$ | storage temperature | | –65 | +150 | °C |
| $T_j$ | junction temperature | | – | 150 | °C |
| $T_{amb}$ | operating ambient temperature | | –65 | +150 | °C |

**Note**

1. Device mounted on a FR4 printed-circuit board, single-sided copper, tinplated and standard footprint.

### THERMAL CHARACTERISTICS

| SYMBOL | PARAMETER | CONDITIONS | VALUE | UNIT |
|---|---|---|---|---|
| $R_{th\ j\text{-}a}$ | thermal resistance from junction to ambient | in free air; note 1 | 175 | K/W |

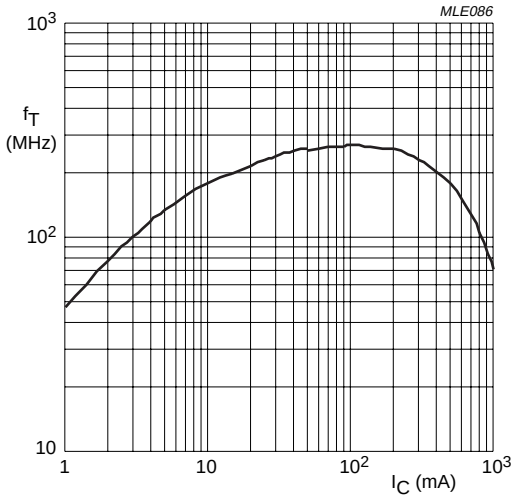
**Note**

1. Device mounted on a FR4 printed-circuit board, single-sided copper, tinplated and standard footprint.

### CHARACTERISTICS

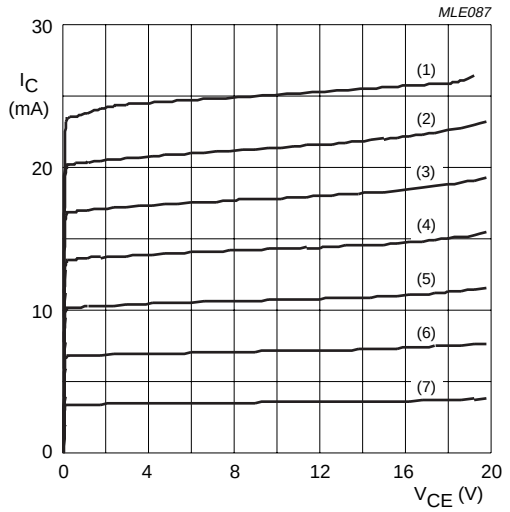
$T_{amb}$ = 25 °C unless otherwise specified.

| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| $I_{CBO}$ | collector-base cut-off current | $V_{CB}$ = 35 V; $I_E$ = 0 | – | – | 100 | nA |
| | | $V_{CB}$ = 35 V; $I_E$ = 0; $T_j$ = 150 °C | – | – | 50 | µA |
| $I_{EBO}$ | emitter-base cut-off current | $V_{EB}$ = 5 V; $I_C$ = 0 | – | – | 100 | nA |
| $h_{FE}$ | DC current gain | $V_{CE}$ = 1 V; $I_C$ = 500 mA | 40 | – | – | |
| $h_{FE}$ | DC current gain | $V_{CE}$ = 1 V; $I_C$ = 50 mA | | | | |
| | PSS9013G | | 112 | – | 166 | |
| | PSS9013H | | 144 | – | 202 | |
| $V_{CEsat}$ | collector-emitter saturation voltage | $I_C$ = 100 mA; $I_B$ = 10 mA | – | 60 | 250 | mV |
| | | $I_C$ = 500 mA; $I_B$ = 50 mA | – | 250 | 600 | mV |
| $V_{BEsat}$ | base-emitter saturation voltage | $I_C$ = 500 mA; $I_B$ = 50 mA | – | 1 | 1.2 | V |
| $V_{BEon}$ | base-emitter turn on voltage | $V_{CE}$ = 1 V; $I_C$ = 100mA | – | 760 | 1000 | mV |
| $C_c$ | collector capacitance | $V_{CB}$ = 6 V; $I_E$ = $I_e$ = 0; f = 1 MHz | – | 5 | – | pF |




$V_{CE}$ = 6 V.

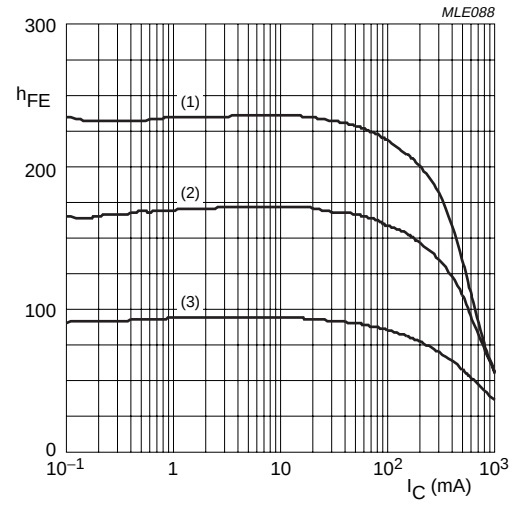
Fig.2 Transition frequency as a function of collector current; typical values.




$T_{amb}$ = 25 °C.

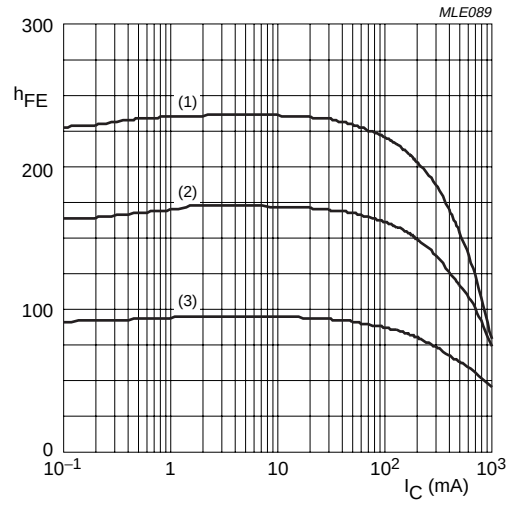
(1) $I_B$ = 140 μA.
(2) $I_B$ = 120 μA.
(3) $I_B$ = 100 μA.
(4) $I_B$ = 80 μA.
(5) $I_B$ = 60 μA.
(6) $I_B$ = 40 μA.
(7) $I_B$ = 20 μA.

Fig.3 Collector current as a function of collector-emitter voltage; typical values.



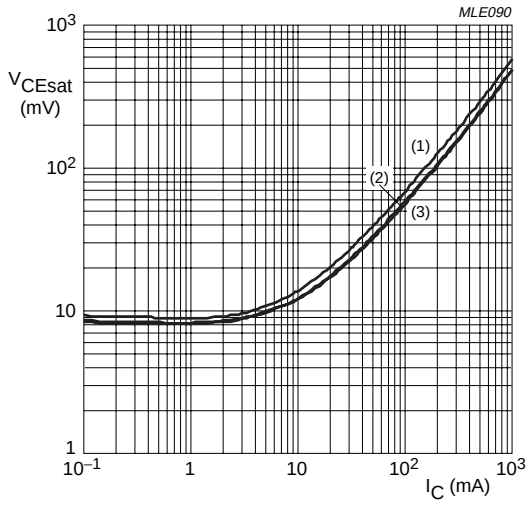

$V_{CE}$ = 1 V.
(1) $T_{amb}$ = 100 °C.
(2) $T_{amb}$ = 25 °C.
(3) $T_{amb}$ = –55 °C.

Fig.4 DC current gain as a function of collector current; typical values.



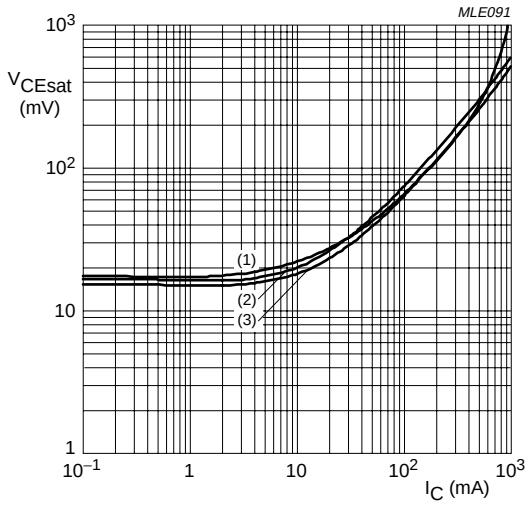

$V_{CE}$ = 2 V.
(1) $T_{amb}$ = 100 °C.
(2) $T_{amb}$ = 25 °C.
(3) $T_{amb}$ = –55 °C.

Fig.5 DC current gain as a function of collector current; typical values.



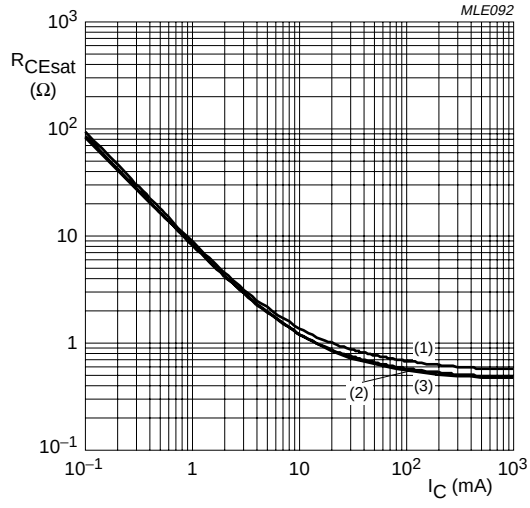

$I_C/I_B$ = 10.
(1) $T_{amb}$ = 100 °C.
(2) $T_{amb}$ = 25 °C.
(3) $T_{amb}$ = –55 °C.

Fig.6 Collector-emitter saturation voltage as a function of collector current; typical values.



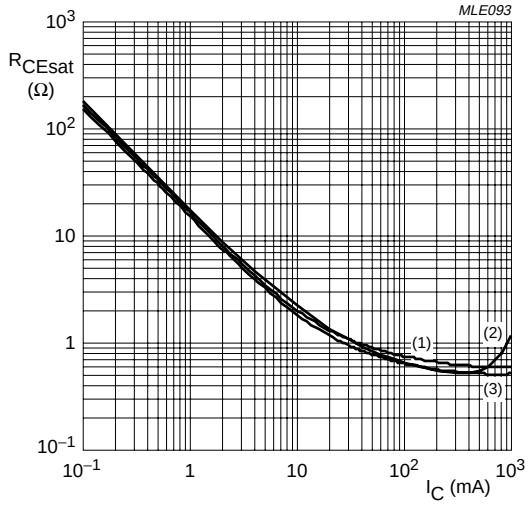

$I_C/I_B$ = 20.
(1) $T_{amb}$ = 100 °C.
(2) $T_{amb}$ = 25 °C.
(3) $T_{amb}$ = –55 °C.

Fig.7 Collector-emitter saturation voltage as a function of collector current; typical values.



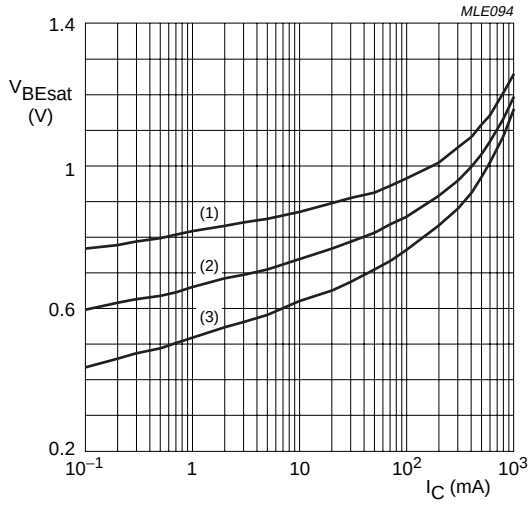

$I_C/I_B$ = 10.
(1) $T_{amb}$ = 100 °C.
(2) $T_{amb}$ = 25 °C.
(3) $T_{amb}$ = –55 °C.

Fig.8 Collector-emitter equivalent on-resistance as a function of collector current; typical values.



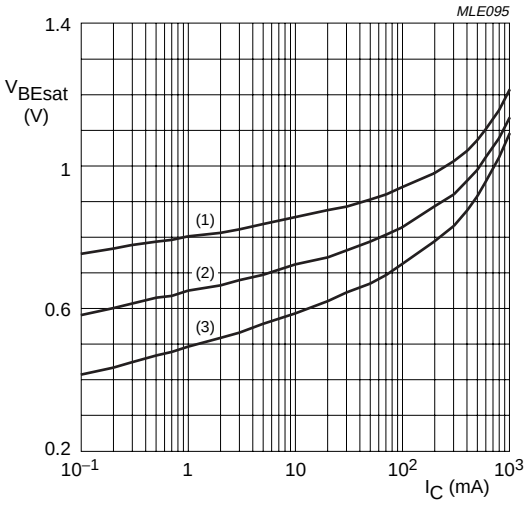

$I_C/I_B$ = 20.
(1) $T_{amb}$ = 100 °C.
(2) $T_{amb}$ = 25 °C.
(3) $T_{amb}$ = –55 °C.

Fig.9 Collector-emitter equivalent on-resistance as a function of collector current; typical values.



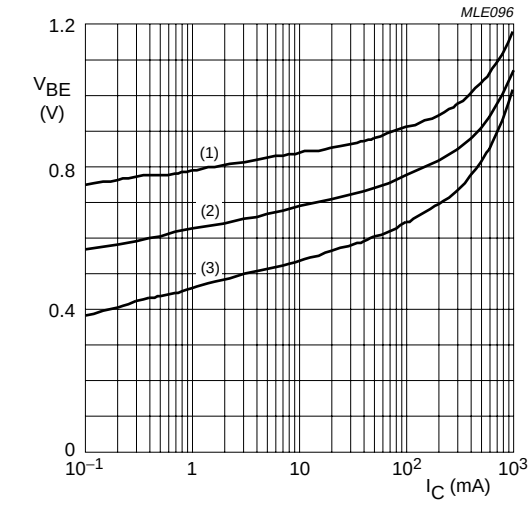

$I_C/I_B$ = 10.
(1) $T_{amb}$ = –55 °C.
(2) $T_{amb}$ = 25 °C.
(3) $T_{amb}$ = 100 °C.

Fig.10 Base-emitter saturation voltage as a function of collector current; typical values.



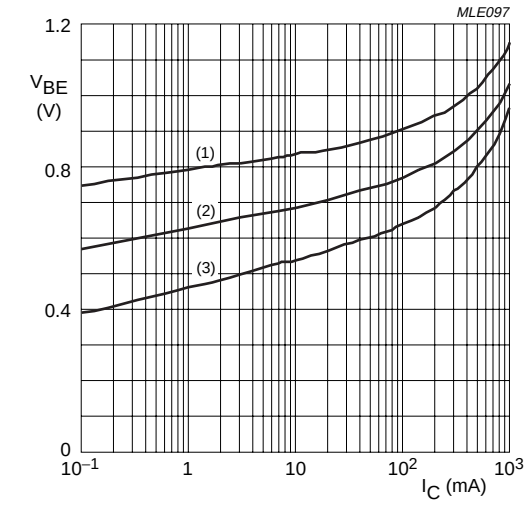

$I_C/I_B$ = 20.
(1) $T_{amb}$ = –55 °C.
(2) $T_{amb}$ = 25 °C.
(3) $T_{amb}$ = 100 °C.

Fig.11 Base-emitter saturation voltage as a function of collector current; typical values.




$V_{CE}$ = 1 V.
(1) $T_{amb}$ = –55 °C.
(2) $T_{amb}$ = 25 °C.
(3) $T_{amb}$ = 100 °C.

Fig.12 Base-emitter voltage as a function of collector current; typical values.

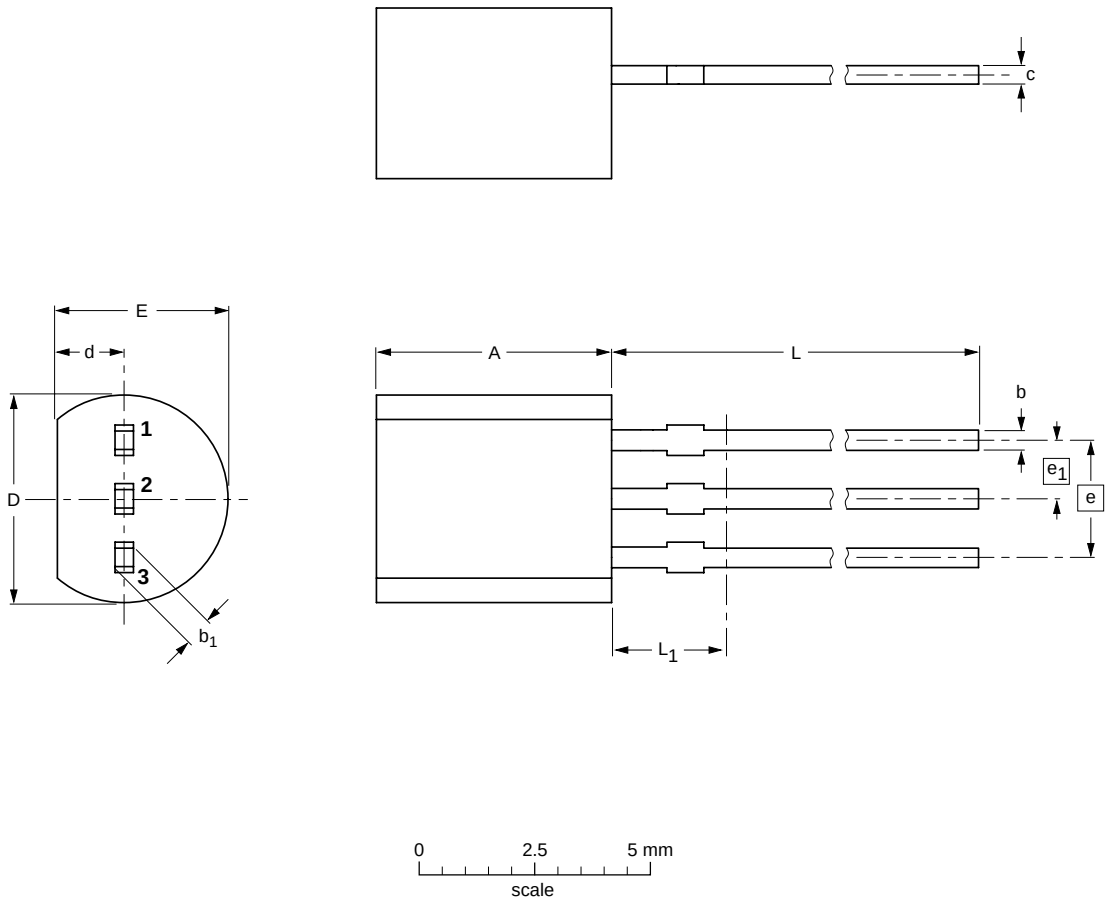



$V_{CE}$ = 2 V.
(1) $T_{amb}$ = –55 °C.
(2) $T_{amb}$ = 25 °C.
(3) $T_{amb}$ = 100 °C.

Fig.13 Base-emitter voltage as a function of collector current; typical values.

## PACKAGE OUTLINE

**Plastic single-ended leaded (through hole) package; 3 leads** **SOT54**




**DIMENSIONS (mm are the original dimensions)**

| UNIT | A | b | $b_1$ | c | D | d | E | e | $e_1$ | L | $L_1$ (1) max. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 5.2<br>5.0 | 0.48<br>0.40 | 0.66<br>0.55 | 0.45<br>0.38 | 4.8<br>4.4 | 1.7<br>1.4 | 4.2<br>3.6 | 2.54 | 1.27 | 14.5<br>12.7 | 2.5 |

**Note**

1. Terminal dimensions within this zone are uncontrolled to allow for flow of plastic and terminal irregularities.

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT54 | | TO-92 | SC-43A | | | ~~97-02-28~~<br>04-06-28 |

**DATA SHEET STATUS**

| LEVEL | DATA SHEET STATUS(1) | PRODUCT STATUS(2)(3) | DEFINITION |
|---|---|---|---|
| I | Objective data | Development | This data sheet contains data from the objective specification for product development. Philips Semiconductors reserves the right to change the specification in any manner without notice. |
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