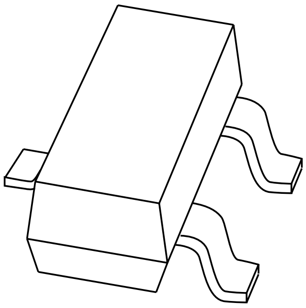
# DATA SHEET



# PBSS4320T
## 20 V low $V_{CEsat}$ NPN transistor

Product specification

2002 Aug 08

Philips Semiconductors

PHILIPS

# 20 V low $V_{CEsat}$ NPN transistor PBSS4320T

## FEATURES

- Low collector-emitter saturation voltage $V_{CEsat}$ and corresponding low $R_{CEsat}$
- High collector current capability
- High collector current gain
- Improved efficiency due to reduced heat generation.

## APPLICATIONS

- Power management applications
- Low and medium power DC/DC convertors
- Supply line switching
- Battery chargers
- Linear voltage regulation with low voltage drop-out (LDO).

## DESCRIPTION

NPN low $V_{CEsat}$ transistor in a SOT23 plastic package. PNP complement: PBSS5320T.

## MARKING

| TYPE NUMBER | MARKING CODE(1) |
|---|---|
| PBSS4320T | ZG∗ |

**Note**

1. ∗ = p: Made in Hong Kong.
   ∗ = t: Made in Malaysia.
   ∗ = w: Made in China.

## QUICK REFERENCE DATA

| SYMBOL | PARAMETER | MAX. | UNIT |
|---|---|---|---|
| $V_{CEO}$ | collector-emitter voltage | 20 | V |
| $I_C$ | collector current (DC) | 2 | A |
| $I_{CRP}$ | repetitive peak collector current | 3 | A |
| $R_{CEsat}$ | equivalent on-resistance | 105 | mΩ |

## PINNING

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

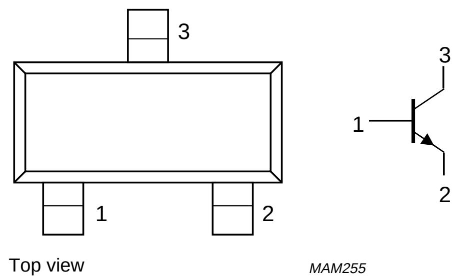



Fig.1 Simplified outline (SOT23) and symbol.

## LIMITING VALUES

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

| SYMBOL | PARAMETER | CONDITIONS | MIN. | MAX. | UNIT |
|---|---|---|---|---|---|
| $V_{CBO}$ | collector-base voltage | open emitter | – | 20 | V |
| $V_{CEO}$ | collector-emitter voltage | open base | – | 20 | V |
| $V_{EBO}$ | emitter-base voltage | open collector | – | 5 | V |
| $I_C$ | collector current (DC) | | – | 2 | A |
| $I_{CRP}$ | repetitive peak collector current | note 1 | – | 3 | A |
| $I_{CM}$ | peak collector current | single peak | – | 5 | A |
| $I_B$ | base current (DC) | | – | 0.5 | A |
| $P_{tot}$ | total power dissipation | $T_{amb} \leq 25$ °C; note 2 | – | 300 | mW |
| | | $T_{amb} \leq 25$ °C; note 3 | – | 480 | mW |
| | | $T_{amb} \leq 25$ °C; note 4 | – | 540 | mW |
| | | $T_{amb} \leq 25$ °C; notes 1 and 2 | – | 1.2 | W |
| $T_{stg}$ | storage temperature | | –65 | +150 | °C |
| $T_j$ | junction temperature | | – | 150 | °C |
| $T_{amb}$ | operating ambient temperature | | –65 | +150 | °C |

**Notes**

1. Operated under pulsed conditions: pulse width $t_p \leq 100$ ms; duty cycle $\delta \leq 0.25$.
2. Device mounted on a printed-circuit board; single sided copper; tinplated; standard footprint.
3. Device mounted on a printed-circuit board; single sided copper; tinplated; mounting pad for collector 1 $cm^2$.
4. Device mounted on a printed-circuit board; single sided copper; tinplated; mounting pad for collector 6 $cm^2$.

## THERMAL CHARACTERISTICS

| SYMBOL | PARAMETER | CONDITIONS | VALUE | UNIT |
|---|---|---|---|---|
| $R_{th\ j\text{-}a}$ | thermal resistance from junction to ambient | in free air; note 1 | 417 | K/W |
| | | in free air; note 2 | 260 | K/W |
| | | in free air; note 3 | 230 | K/W |
| | | in free air; notes 1 and 4 | 104 | K/W |

**Notes**

1. Device mounted on a printed-circuit board; single sided copper; tinplated; standard footprint.
2. Device mounted on a printed-circuit board; single sided copper; tinplated; mounting pad for collector 1 $cm^2$.
3. Device mounted on a printed-circuit board; single sided copper; tinplated; mounting pad for collector 6 $cm^2$.
4. Operated under pulsed conditions: pulse width $t_p \leq 100$ ms; duty cycle $\delta \leq 0.25$.

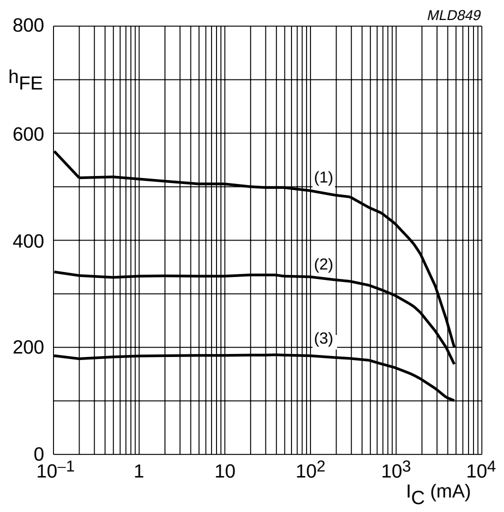
## CHARACTERISTICS

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

| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| $I_{CBO}$ | collector-base cut-off current | $V_{CB}$ = 20 V; $I_E$ = 0 | – | – | 100 | nA |
| | | $V_{CB}$ = 20 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 | $V_{CE}$ = 2 V; $I_C$ = 100 mA | 220 | – | – | |
| | | $V_{CE}$ = 2 V; $I_C$ = 500 mA | 220 | – | – | |
| | | $V_{CE}$ = 2 V; $I_C$ = 1 A; note 1 | 220 | – | – | |
| | | $V_{CE}$ = 2 V; $I_C$ = 2 A; note 1 | 200 | – | – | |
| | | $V_{CE}$ = 2 V; $I_C$ = 3 A; note 1 | 150 | – | – | |
| $V_{CEsat}$ | collector-emitter saturation voltage | $I_C$ = 500 mA; $I_B$ = 50 mA | – | – | 70 | mV |
| | | $I_C$ = 1 A; $I_B$ = 50 mA | – | – | 120 | mV |
| | | $I_C$ = 2 A; $I_B$ = 40 mA; note 1 | – | – | 230 | mV |
| | | $I_C$ = 2 A; $I_B$ = 200 mA; note 1 | – | – | 210 | mV |
| | | $I_C$ = 3 A; $I_B$ = 300 mA; note 1 | – | – | 310 | mV |
| $R_{CEsat}$ | equivalent on-resistance | $I_C$ = 2 A; $I_B$ = 200 mA; note 1 | – | 80 | 105 | mΩ |
| $V_{BEsat}$ | base-emitter saturation voltage | $I_C$ = 2 A; $I_B$ = 40 mA; note 1 | – | – | 1.1 | V |
| | | $I_C$ = 3 A; $I_B$ = 300 mA; note 1 | – | – | 1.2 | V |
| $V_{BEon}$ | base-emitter turn-on voltage | $V_{CE}$ = 2 V; $I_C$ = 1 A; note 1 | 1.2 | – | – | V |
| $f_T$ | transition frequency | $I_C$ = 100 mA; $V_{CE}$ = 5 V; f = 100 MHz | 100 | – | – | MHz |
| $C_c$ | collector capacitance | $V_{CB}$ = 10 V; $I_E$ = $I_e$ = 0; f = 1 MHz | – | – | 35 | pF |

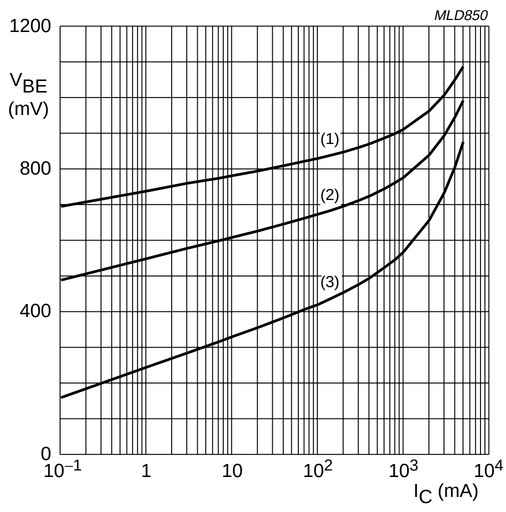
**Note**

1. Pulse test: $t_p \leq 300$ μs; $\delta \leq 0.02$.



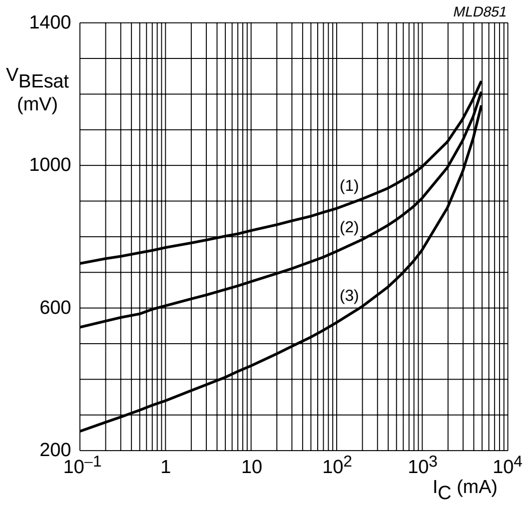

$V_{CE}$ = 2 V.
(1) $T_{amb}$ = 150 °C.
(2) $T_{amb}$ = 25 °C.
(3) $T_{amb}$ = –55 °C.

Fig.2 DC current gain as a function of collector current; typical values.



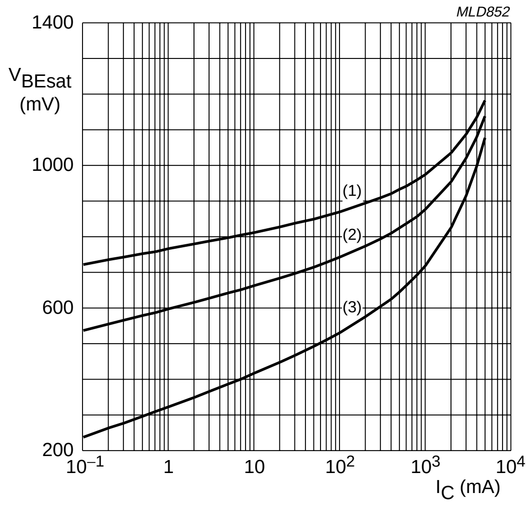

$V_{CE}$ = 2 V.
(1) $T_{amb}$ = –55 °C.
(2) $T_{amb}$ = 25 °C.
(3) $T_{amb}$ = 150 °C.

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



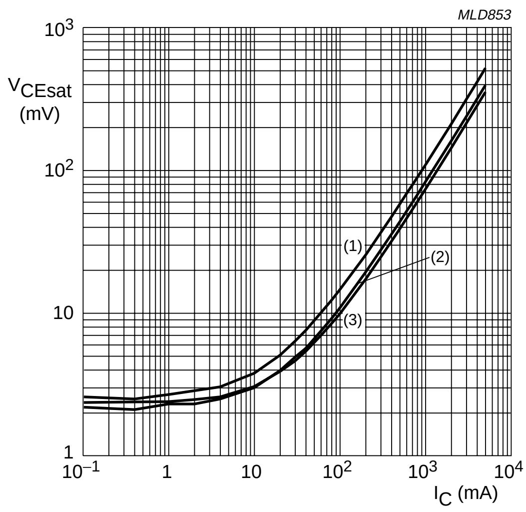

$I_C/I_B$ = 10.
(1) $T_{amb}$ = –55 °C.
(2) $T_{amb}$ = 25 °C.
(3) $T_{amb}$ = 150 °C.

Fig.4 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) $T_{amb}$ = 150 °C.

Fig.5 Base-emitter saturation voltage as a function of collector current; typical values.



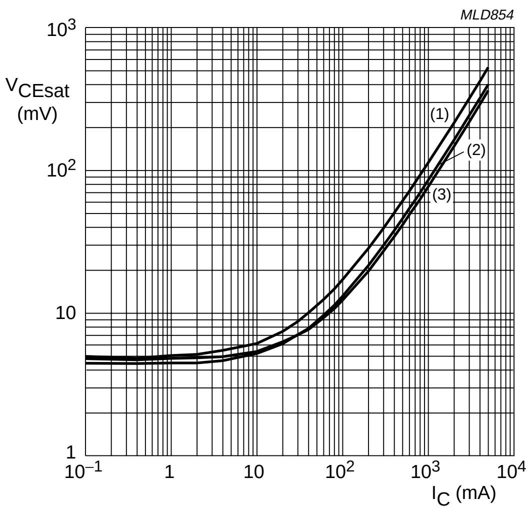

$I_C/I_B$ = 10.

(1) $T_{amb}$ = 150 °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.



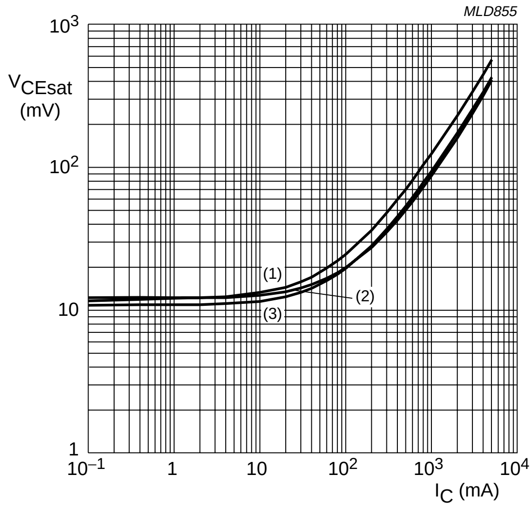

$I_C/I_B$ = 20.

(1) $T_{amb}$ = 150 °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.



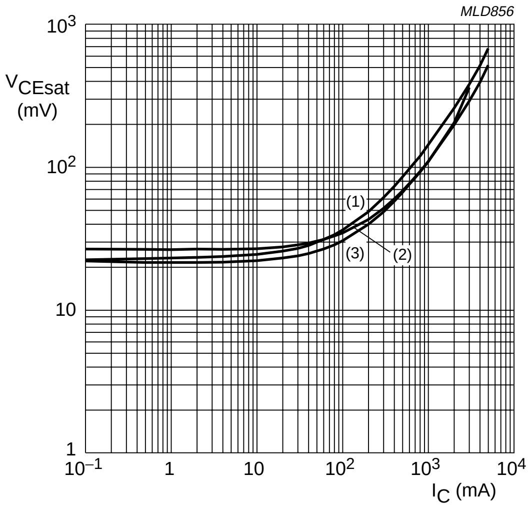

$I_C/I_B$ = 50.

(1) $T_{amb}$ = 150 °C.

(2) $T_{amb}$ = 25 °C.

(3) $T_{amb}$ = −55 °C.

Fig.8 Collector-emitter saturation voltage as a function of collector current; typical values.



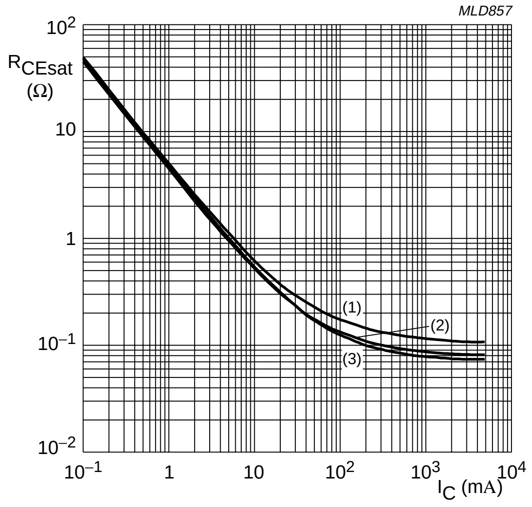

$I_C/I_B$ = 100.

(1) $T_{amb}$ = 150 °C.

(2) $T_{amb}$ = 25 °C.

(3) $T_{amb}$ = −55 °C.

Fig.9 Collector-emitter saturation voltage as a function of collector current; typical values.




$I_C/I_B = 20$.

(1) $T_{amb} = 150$ °C.

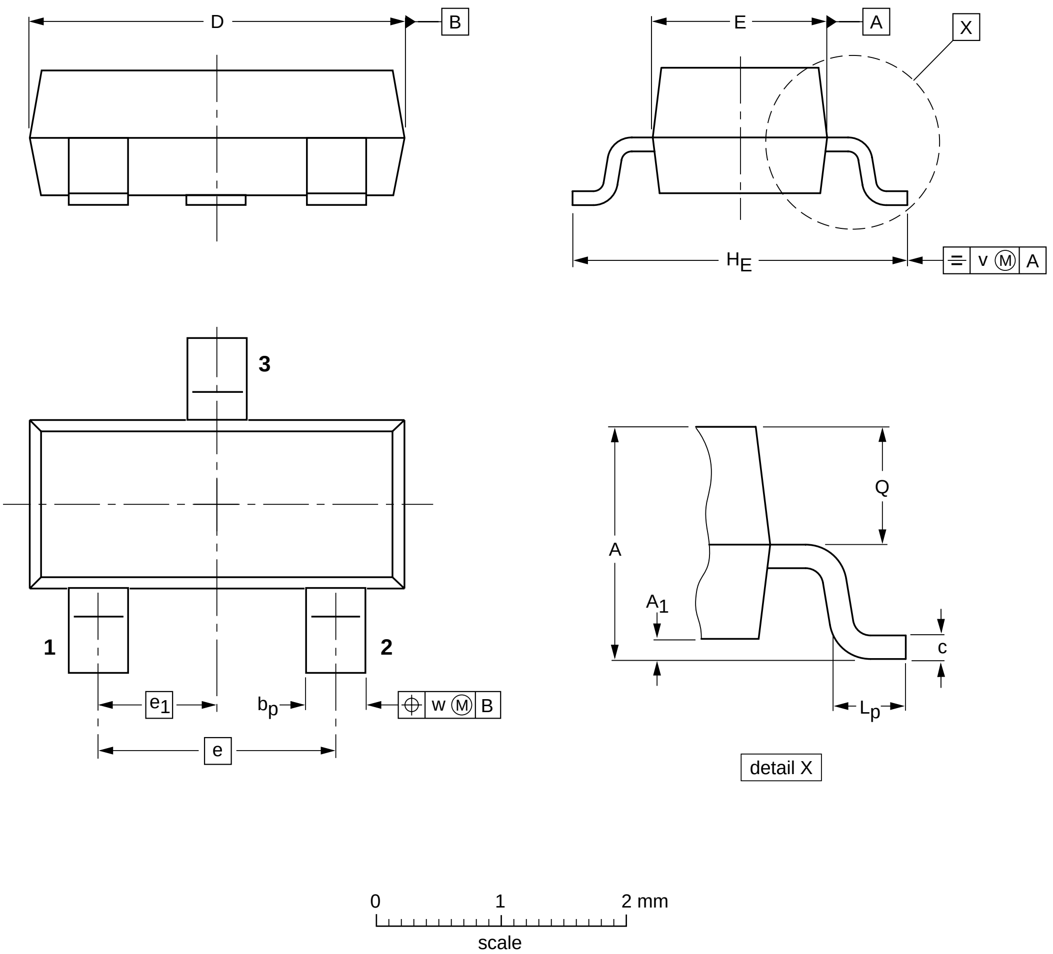
(2) $T_{amb} = 25$ °C.

(3) $T_{amb} = -55$ °C.

Fig.10 Equivalent on-resistance as a function of collector current; typical values.

## PACKAGE OUTLINE

**Plastic surface mounted package; 3 leads** **SOT23**




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

| UNIT | A | $A_1$ max. | $b_p$ | c | D | E | e | $e_1$ | $H_E$ | $L_p$ | 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 VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | EIAJ | | | |
| SOT23 | | TO-236AB | | | | ~~97-02-28~~<br>99-09-13 |

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**NOTES**

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