Important notice

Dear Customer,

On 7 February 2017 the former NXP Standard Product business became a new company with the tradename Nexperia. Nexperia is an industry leading supplier of Discrete, Logic and PowerMOS semiconductors with its focus on the automotive, industrial, computing, consumer and wearable application markets.

In data sheets and application notes which still contain NXP or Philips Semiconductors references, use the references to Nexperia, as shown below.


Instead of sales.addresses@www.nxp.com or sales.addresses@www.semiconductors.philips.com, use salesaddresses@nexperia.com (email)

Replace the copyright notice at the bottom of each page or elsewhere in the document, depending on the version, as shown below:
- © NXP N.V. (year). All rights reserved or © Koninklijke Philips Electronics N.V. (year). All rights reserved.
Should be replaced with:
- © Nexperia B.V. (year). All rights reserved.

If you have any questions related to the data sheet, please contact our nearest sales office via e-mail or telephone (details via salesaddresses@nexperia.com). Thank you for your cooperation and understanding,

Kind regards,

Team Nexperia
PBSS4350X
50 V, 3 A
NPN low $V_{CE_{Sat}}$ (BISS) transistor

Product specification
Supersedes data of 2003 Nov 21
Philips Semiconductors

50 V, 3 A
NPN low $V_{CEsat}$ (BISS) transistor

PBSS4350X

FEATURES
- SOT89 (SC-62) package
- Low collector-emitter saturation voltage $V_{CEsat}$
- High collector current capability: $I_C$ and $I_{CM}$
- Higher efficiency leading to less heat generation
- Reduced printed-circuit board requirements.

APPLICATIONS
- Power management
  - DC/DC converters
  - Supply line switching
  - Battery charger
  - LCD backlighting.
- Peripheral drivers
  - Driver in low supply voltage applications (e.g. lamps and LEDs).
  - Inductive load driver (e.g. relays, buzzers and motors).

DESCRIPTION
NPN low $V_{CEsat}$ transistor in a SOT89 plastic package.
PNP complement: PBSS5350X.

MARKING

<table>
<thead>
<tr>
<th>TYPE NUMBER</th>
<th>MARKING CODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>PBSS4350X</td>
<td>S43</td>
</tr>
</tbody>
</table>

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>PARAMETER</th>
<th>MAX.</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{CEO}$</td>
<td>collector-emitter voltage</td>
<td>50</td>
<td>V</td>
</tr>
<tr>
<td>$I_C$</td>
<td>collector current (DC)</td>
<td>3</td>
<td>A</td>
</tr>
<tr>
<td>$I_{CM}$</td>
<td>peak collector current</td>
<td>5</td>
<td>A</td>
</tr>
<tr>
<td>$R_{CEsat}$</td>
<td>equivalent on-resistance</td>
<td>130</td>
<td>mΩ</td>
</tr>
</tbody>
</table>

PINNING

<table>
<thead>
<tr>
<th>PIN</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>emitter</td>
</tr>
<tr>
<td>2</td>
<td>collector</td>
</tr>
<tr>
<td>3</td>
<td>base</td>
</tr>
</tbody>
</table>

Fig. 1 Simplified outline (SOT89) and symbol.
50 V, 3 A
NPN low \(V_{CE\text{sat}}\) (BISS) transistor

**Philips Semiconductors Product specification**

**PBSS4350X**

**ORDERING INFORMATION**

<table>
<thead>
<tr>
<th>TYPE NUMBER</th>
<th>PACKAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>PBSS4350X</td>
<td>SC-62 plastic surface mounted package; collector pad for good heat transfer; 3 leads</td>
</tr>
</tbody>
</table>

**LIMITING VALUES**

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

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>PARAMETER</th>
<th>CONDITIONS</th>
<th>MIN.</th>
<th>MAX.</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>(V_{CBO})</td>
<td>collector-base voltage</td>
<td>open emitter</td>
<td>–</td>
<td>50</td>
<td>V</td>
</tr>
<tr>
<td>(V_{CEO})</td>
<td>collector-emitter voltage</td>
<td>open base</td>
<td>–</td>
<td>50</td>
<td>V</td>
</tr>
<tr>
<td>(V_{EBO})</td>
<td>emitter-base voltage</td>
<td>open collector</td>
<td>–</td>
<td>5</td>
<td>V</td>
</tr>
<tr>
<td>(I_C)</td>
<td>collector current (DC)</td>
<td>note 4</td>
<td>–</td>
<td>3</td>
<td>A</td>
</tr>
<tr>
<td>(I_{CM})</td>
<td>peak collector current</td>
<td>limited by (T_{j\text{(max)}})</td>
<td>–</td>
<td>5</td>
<td>A</td>
</tr>
<tr>
<td>(I_B)</td>
<td>base current (DC)</td>
<td>–</td>
<td>0.5</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>(P_{tot})</td>
<td>total power dissipation</td>
<td>(T_{amb} \leq 25 , ^\circ\text{C})</td>
<td>–</td>
<td>550</td>
<td>mW</td>
</tr>
<tr>
<td></td>
<td></td>
<td>note 1</td>
<td>–</td>
<td>1</td>
<td>W</td>
</tr>
<tr>
<td></td>
<td></td>
<td>note 2</td>
<td>–</td>
<td>1.4</td>
<td>W</td>
</tr>
<tr>
<td></td>
<td></td>
<td>note 3</td>
<td>–</td>
<td>1.6</td>
<td>W</td>
</tr>
<tr>
<td></td>
<td></td>
<td>note 4</td>
<td>–</td>
<td>1.6</td>
<td>W</td>
</tr>
<tr>
<td>(T_{stg})</td>
<td>storage temperature</td>
<td>–</td>
<td>−65</td>
<td>+150</td>
<td>°C</td>
</tr>
<tr>
<td>(T_J)</td>
<td>junction temperature</td>
<td>–</td>
<td>150</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>(T_{amb})</td>
<td>ambient temperature</td>
<td>–</td>
<td>−65</td>
<td>+150</td>
<td>°C</td>
</tr>
</tbody>
</table>

**Notes**

1. Device mounted on a FR4 printed-circuit board; single-sided copper; tin-plated; standard footprint.
2. Device mounted on a FR4 printed-circuit board; single-sided copper; tin-plated; mounting pad for collector 1 cm².
3. Device mounted on a FR4 printed-circuit board; single-sided copper; tin-plated; mounting pad for collector 6 cm².
4. Device mounted on a ceramic printed-circuit board 7 cm², single-sided copper, tin-plated.
50 V, 3 A
NPN low $V_{CE_{sat}}$ (BISS) transistor

Fig. 2  Power derating curves.

(1) Ceramic PCB; 7 cm$^2$ mounting pad for collector.
(2) FR4 PCB; 6 cm$^2$ copper mounting pad for collector.
(3) FR4 PCB; 1 cm$^2$ copper mounting pad for collector.
(4) Standard footprint.
Philips Semiconductors

50 V, 3 A
NPN low $V_{\text{CEsat}}$ (BISS) transistor

PBSS4350X

THERMAL CHARACTERISTICS

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>PARAMETER</th>
<th>CONDITIONS</th>
<th>VALUE</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>$R_{\text{th(j-a)}}$</td>
<td>thermal resistance from junction to ambient</td>
<td>in free air</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>note 1</td>
<td>225</td>
<td>K/W</td>
</tr>
<tr>
<td></td>
<td></td>
<td>note 2</td>
<td>125</td>
<td>K/W</td>
</tr>
<tr>
<td></td>
<td></td>
<td>note 3</td>
<td>90</td>
<td>K/W</td>
</tr>
<tr>
<td></td>
<td></td>
<td>note 4</td>
<td>80</td>
<td>K/W</td>
</tr>
<tr>
<td>$R_{\text{th(j-s)}}$</td>
<td>thermal resistance from junction to soldering point</td>
<td>16</td>
<td>K/W</td>
<td></td>
</tr>
</tbody>
</table>

Notes

1. Device mounted on a FR4 printed-circuit board; single-sided copper; tin-plated; standard footprint.
2. Device mounted on a FR4 printed-circuit board; single-sided copper; tin-plated; mounting pad for collector 1 cm$^2$.
3. Device mounted on a FR4 printed-circuit board; single-sided copper; tin-plated; mounting pad for collector 6 cm$^2$.
4. Device mounted on a ceramic printed-circuit board 7 cm$^2$, single-sided copper, tin-plated.

Fig. 3 Transient thermal impedance as a function of pulse time; typical values.
50 V, 3 A
NPN low $V_{CEsat}$ (BISS) transistor

**PBSS4350X**

**Fig. 4** Transient thermal impedance as a function of pulse time; typical values.

1. $\delta = 1.0$
2. $\delta = 0.75$
3. $\delta = 0.50$
4. $\delta = 0.33$
5. $\delta = 0.20$
6. $\delta = 0.10$
7. $\delta = 0.05$
8. $\delta = 0.02$
9. $\delta = 0.01$
10. $\delta = 0.00$

Mounted on FR4 printed-circuit board; mounting pad for collector 1 cm$^2$.

**Fig. 5** Transient thermal impedance as a function of pulse time; typical values.

1. $\delta = 1.0$
2. $\delta = 0.75$
3. $\delta = 0.50$
4. $\delta = 0.33$
5. $\delta = 0.20$
6. $\delta = 0.10$
7. $\delta = 0.05$
8. $\delta = 0.02$
9. $\delta = 0.01$
10. $\delta = 0.00$

Mounted on FR4 printed-circuit board; mounting pad for collector 6 cm$^2$. 
CHARACTERISTICS

$T_{\text{amb}} = 25 \, ^\circ\text{C}$ unless otherwise specified.

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>PARAMETER</th>
<th>CONDITIONS</th>
<th>MIN.</th>
<th>TYP.</th>
<th>MAX.</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>$I_{\text{CBO}}$</td>
<td>collector-base cut-off current</td>
<td>$V_{\text{CB}} = 50 , \text{V}; I_{\text{E}} = 0 , \text{A}$</td>
<td>–</td>
<td>–</td>
<td>100</td>
<td>nA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$V_{\text{CB}} = 50 , \text{V}; I_{\text{E}} = 0 , \text{A}; T_{j} = 150 , ^\circ\text{C}$</td>
<td>–</td>
<td>–</td>
<td>50</td>
<td>$\mu\text{A}$</td>
</tr>
<tr>
<td>$I_{\text{CES}}$</td>
<td>collector-emitter cut-off current</td>
<td>$V_{\text{CE}} = 50 , \text{V}; V_{\text{BE}} = 0 , \text{V}$</td>
<td>–</td>
<td>–</td>
<td>100</td>
<td>nA</td>
</tr>
<tr>
<td>$I_{\text{EBO}}$</td>
<td>emitter-base cut-off current</td>
<td>$V_{\text{EB}} = 5 , \text{V}; I_{\text{C}} = 0 , \text{A}$</td>
<td>–</td>
<td>–</td>
<td>100</td>
<td>nA</td>
</tr>
<tr>
<td>$h_{\text{FE}}$</td>
<td>DC current gain</td>
<td>$V_{\text{CE}} = 2 , \text{V}$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$I_{\text{C}} = 0.1 , \text{A}$</td>
<td>300</td>
<td>–</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$I_{\text{C}} = 0.5 , \text{A}$</td>
<td>300</td>
<td>–</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$I_{\text{C}} = 1 , \text{A}; \text{note} , 1$</td>
<td>300</td>
<td>–</td>
<td>700</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$I_{\text{C}} = 2 , \text{A}; \text{note} , 1$</td>
<td>200</td>
<td>–</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$I_{\text{C}} = 3 , \text{A}; \text{note} , 1$</td>
<td>100</td>
<td>–</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>$V_{\text{CESat}}$</td>
<td>collector-emitter saturation voltage</td>
<td>$I_{\text{C}} = 0.5 , \text{A}; I_{\text{B}} = 50 , \text{mA}$</td>
<td>–</td>
<td>–</td>
<td>80</td>
<td>mV</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$I_{\text{C}} = 1 , \text{A}; I_{\text{B}} = 50 , \text{mA}$</td>
<td>–</td>
<td>–</td>
<td>160</td>
<td>mV</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$I_{\text{C}} = 2 , \text{A}; I_{\text{B}} = 100 , \text{mA}$</td>
<td>–</td>
<td>–</td>
<td>280</td>
<td>mV</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$I_{\text{C}} = 2 , \text{A}; I_{\text{B}} = 200 , \text{mA}; \text{note} , 1$</td>
<td>–</td>
<td>–</td>
<td>260</td>
<td>mV</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$I_{\text{C}} = 3 , \text{A}; I_{\text{B}} = 300 , \text{mA}; \text{note} , 1$</td>
<td>–</td>
<td>–</td>
<td>370</td>
<td>mV</td>
</tr>
<tr>
<td>$R_{\text{CESat}}$</td>
<td>equivalent on-resistance</td>
<td>$I_{\text{C}} = 2 , \text{A}; I_{\text{B}} = 200 , \text{mA}; \text{note} , 1$</td>
<td>–</td>
<td>100</td>
<td></td>
<td>mΩ</td>
</tr>
<tr>
<td>$V_{\text{BEsat}}$</td>
<td>base-emitter saturation voltage</td>
<td>$I_{\text{C}} = 2 , \text{A}; I_{\text{B}} = 100 , \text{mA}$</td>
<td>–</td>
<td>–</td>
<td>1.1</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$I_{\text{C}} = 3 , \text{A}; I_{\text{B}} = 300 , \text{mA}; \text{note} , 1$</td>
<td>–</td>
<td>–</td>
<td>1.2</td>
<td>V</td>
</tr>
<tr>
<td>$V_{\text{BEon}}$</td>
<td>base-emitter turn-on voltage</td>
<td>$V_{\text{CE}} = 2 , \text{V}; I_{\text{C}} = 1 , \text{A}$</td>
<td>1.1</td>
<td>–</td>
<td>–</td>
<td>V</td>
</tr>
<tr>
<td>$f_{\text{t}}$</td>
<td>transition frequency</td>
<td>$I_{\text{C}} = 100 , \text{mA}; V_{\text{CE}} = 5 , \text{V}; f = 100 , \text{MHz}$</td>
<td>100</td>
<td>–</td>
<td>–</td>
<td>MHz</td>
</tr>
<tr>
<td>$C_{\text{c}}$</td>
<td>collector capacitance</td>
<td>$V_{\text{CB}} = 10 , \text{V}; I_{\text{E}} = i_{e} = 0 , \text{A}; f = 1 , \text{MHz}$</td>
<td>–</td>
<td>–</td>
<td>25</td>
<td>pF</td>
</tr>
</tbody>
</table>

Note

1. Pulse test: $t_{p} \leq 300 \, \mu\text{s}; \delta \leq 0.02$. 
50 V, 3 A
NPN low $V_{CE\text{sat}}$ (BISS) transistor

**Philips Semiconductors**

**Product specification**

**PBSS4350X**

---

**Fig. 6** DC current gain as a function of collector current; typical values.

$V_{CE} = 2 \, \text{V}$.

1. $T_{\text{amb}} = 100 \, ^{\circ} \text{C}$.
2. $T_{\text{amb}} = 25 \, ^{\circ} \text{C}$.
3. $T_{\text{amb}} = -55 \, ^{\circ} \text{C}$.

---

**Fig. 7** Base-emitter voltage as a function of collector current; typical values.

$V_{CE} = 2 \, \text{V}$.

1. $T_{\text{amb}} = -55 \, ^{\circ} \text{C}$.
2. $T_{\text{amb}} = 25 \, ^{\circ} \text{C}$.
3. $T_{\text{amb}} = 100 \, ^{\circ} \text{C}$.

---

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

$I_C / I_B = 20$.

1. $T_{\text{amb}} = 100 \, ^{\circ} \text{C}$.
2. $T_{\text{amb}} = 25 \, ^{\circ} \text{C}$.
3. $T_{\text{amb}} = -55 \, ^{\circ} \text{C}$.

---

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

$T_{\text{amb}} = 25 \, ^{\circ} \text{C}$.

1. $I_C / I_B = 100$.
2. $I_C / I_B = 50$.
3. $I_C / I_B = 10$. 
**Philips Semiconductors Product specification**

**50 V, 3 A**

**NPN low V_{CEsat} (BISS) transistor**

**PBSS4350X**

---

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

- $I_C/I_B = 20$.
- (1) $T_{amb} = -55 \, ^\circ C$.
- (2) $T_{amb} = 25 \, ^\circ C$.
- (3) $T_{amb} = 100 \, ^\circ C$.

---

**Fig. 11** Equivalent on-resistance as a function of collector current; typical values.

- $I_C/I_B = 20$.
- (1) $T_{amb} = 150 \, ^\circ C$.
- (2) $T_{amb} = 25 \, ^\circ C$.
- (3) $T_{amb} = -55 \, ^\circ C$.

---

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

- $T_{amb} = 25 \, ^\circ C$.
- (1) $I_B = 2600 \, \mu A$.
- (2) $I_B = 2340 \, \mu A$.
- (3) $I_B = 2080 \, \mu A$.
- (4) $I_B = 1820 \, \mu A$.
- (5) $I_B = 1560 \, \mu A$.
- (6) $I_B = 1300 \, \mu A$.
- (7) $I_B = 1040 \, \mu A$.
- (8) $I_B = 780 \, \mu A$.

---

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

- $T_{amb} = 25 \, ^\circ C$.
- (1) $I_B = 120 \, mA$.
- (2) $I_B = 108 \, mA$.
- (3) $I_B = 96 \, mA$.
- (4) $I_B = 84 \, mA$.
- (5) $I_B = 72 \, mA$.
- (6) $I_B = 60 \, mA$.
- (7) $I_B = 48 \, mA$.
- (8) $I_B = 36 \, mA$. 

---
50 V, 3 A
NPN low $V_{CE_{Sat}}$ (BISS) transistor

PBSS4350X

PACKAGE OUTLINE

Plastic surface mounted package; collector pad for good heat transfer; 3 leads

SOT89

DIMENSIONS (mm are the original dimensions)

<table>
<thead>
<tr>
<th>UNIT</th>
<th>A</th>
<th>$b_{p1}$</th>
<th>$b_{p2}$</th>
<th>$b_{p3}$</th>
<th>c</th>
<th>D</th>
<th>E</th>
<th>e</th>
<th>$e_1$</th>
<th>$H_E$</th>
<th>$L_p$</th>
<th>w</th>
</tr>
</thead>
<tbody>
<tr>
<td>mm</td>
<td>1.6</td>
<td>0.48</td>
<td>0.35</td>
<td>0.53</td>
<td>1.8</td>
<td>0.44</td>
<td>4.6</td>
<td>2.6</td>
<td>3.0</td>
<td>1.5</td>
<td>4.25</td>
<td>1.2</td>
</tr>
<tr>
<td></td>
<td>1.4</td>
<td></td>
<td>0.40</td>
<td>0.40</td>
<td>1.4</td>
<td>0.23</td>
<td>4.4</td>
<td>2.4</td>
<td>2.4</td>
<td>3.75</td>
<td>1.2</td>
<td>0.8</td>
</tr>
</tbody>
</table>

OUTLINE

SOT89

REFERENCES

IEC  TO-243  JEITA  SC-62

EUROPEAN PROJECTION

ISSUE DATE

-99-00+93
04-08-03
Philips Semiconductors Product specification

50 V, 3 A
NPN low \(V_{C\text{Sat}}\) (BISS) transistor

PBSS4350X

DATA SHEET STATUS

<table>
<thead>
<tr>
<th>LEVEL</th>
<th>DATA SHEET STATUS(^{(1)})</th>
<th>PRODUCT STATUS(^{(2)(3)})</th>
<th>DEFINITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Objective data Development</td>
<td>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.</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>Preliminary data Qualification</td>
<td>This data sheet contains data from the preliminary specification. Supplementary data will be published at a later date. Philips Semiconductors reserves the right to change the specification without notice, in order to improve the design and supply the best possible product.</td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>Product data Production</td>
<td>This data sheet contains data from the product specification. Philips Semiconductors reserves the right to make changes at any time in order to improve the design, manufacturing and supply. Relevant changes will be communicated via a Customer Product/Process Change Notification (CPCN).</td>
<td></td>
</tr>
</tbody>
</table>

Notes
1. Please consult the most recently issued data sheet before initiating or completing a design.
2. The product status of the device(s) described in this data sheet may have changed since this data sheet was published. The latest information is available on the Internet at URL http://www.semiconductors.philips.com.
3. For data sheets describing multiple type numbers, the highest-level product status determines the data sheet status.

DEFINITIONS

Short-form specification — The data in a short-form specification is extracted from a full data sheet with the same type number and title. For detailed information see the relevant data sheet or data handbook.

Limiting values definition — Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 60134). 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.

Application information — Applications that are described herein for any of these products are for illustrative purposes only. Philips Semiconductors make no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

DISCLAIMERS

Life support applications — These products are not designed for use in life support appliances, devices, or systems where malfunction of these products can reasonably be expected to result in personal injury. Philips Semiconductors customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Philips Semiconductors for any damages resulting from such application.

Right to make changes — Philips Semiconductors reserves the right to make changes in the products - including circuits, standard cells, and/or software - described or contained herein in order to improve design and/or performance. When the product is in full production (status 'Production'), relevant changes will be communicated via a Customer Product/Process Change Notification (CPCN). Philips Semiconductors assumes no responsibility or liability for the use of any of these products, conveys no licence or title under any patent, copyright, or mask work right to these products, and makes no representations or warranties that these products are free from patent, copyright, or mask work right infringement, unless otherwise specified.