**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 http://www.nxp.com, http://www.philips.com/ or http://www.semiconductors.philips.com/, use **http://www.nexperia.com**

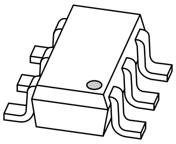
Instead of sales.addresses@www.nxp.com or sales.addresses@www.semiconductors.philips.com, use **salesaddresses@nexperia.com** (email)

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



# PBSS4420D

## 20 V, 4 A NPN low $V_{CEsat}$ (BISS) transistor

Rev. 02 — 24 September 2008 Product data sheet

# 1. Product profile

## 1.1 General description

NPN low $V_{CEsat}$ Breakthrough in Small Signal (BISS) transistor in a small SOT457 (SC-74) Surface-Mounted Device (SMD) plastic package.

PNP complement: PBSS5420D.

## 1.2 Features

- Very low collector-emitter saturation resistance
- Ultra low collector-emitter saturation voltage
- 4 A continuous collector current
- Up to 15 A peak current
- High efficiency due to less heat generation

## 1.3 Applications

- Power management functions
- Charging circuits
- DC-to-DC conversion
- MOSFET gate driving
- Power switches (e.g. motors, fans)
- Thin Film Transistor (TFT) backlight inverter

## 1.4 Quick reference data

**Table 1. Quick reference data**

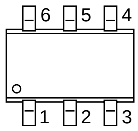
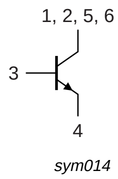
| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $V_{CEO}$ | collector-emitter voltage | open base | | - | - | 20 | V |
| $I_C$ | collector current | | [1] | - | - | 4 | A |
| $I_{CM}$ | peak collector current | single pulse; $t_p \leq 1$ ms | | - | - | 15 | A |
| $R_{CEsat}$ | collector-emitter saturation resistance | $I_C = 4$ A; $I_B = 400$ mA | [2] | - | 50 | 70 | mΩ |

[1] Device mounted on a ceramic Printed-Circuit Board (PCB), $Al_2O_3$, standard footprint.

[2] Pulse test: $t_p \leq 300$ μs; $\delta \leq 0.02$.

## 2. Pinning information

**Table 2. Pinning**

| Pin | Description | Simplified outline | Graphic symbol |
|---|---|---|---|
| 1 | collector |   |   |
| 2 | collector | | |
| 3 | base | | |
| 4 | emitter | | |
| 5 | collector | | |
| 6 | collector | | |

## 3. Ordering information

**Table 3. Ordering information**

| Type number | Package | | |
|---|---|---|---|
| | Name | Description | Version |
| PBSS4420D | SC-74 | plastic surface-mounted package (TSOP6); 6 leads | SOT457 |

## 4. Marking

**Table 4. Marking codes**

| Type number | Marking code |
|---|---|
| PBSS4420D | D4 |

## 5. Limiting values

**Table 5. 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 | | [1] | - | 4 | A |
| $I_{CM}$ | peak collector current | single pulse; $t_p \leq 1$ ms | | - | 15 | A |
| $I_B$ | base current | | | - | 0.8 | A |
| $I_{BM}$ | peak base current | single pulse; $t_p \leq 1$ ms | | - | 2 | A |
| $P_{tot}$ | total power dissipation | $T_{amb} \leq 25$ °C | [2] | - | 360 | mW |
| | | | [3] | - | 600 | mW |
| | | | [4] | - | 750 | mW |
| | | | [1] | - | 1.1 | W |
| | | | [2][5] | - | 2.5 | W |


© NXP B.V. 2008. All rights reserved.

**Table 5. Limiting values** *...continued*

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

| Symbol | Parameter | Conditions | Min | Max | Unit |
|---|---|---|---|---|---|
| $T_j$ | junction temperature | | - | 150 | °C |
| $T_{amb}$ | ambient temperature | | –65 | +150 | °C |
| $T_{stg}$ | storage temperature | | –65 | +150 | °C |

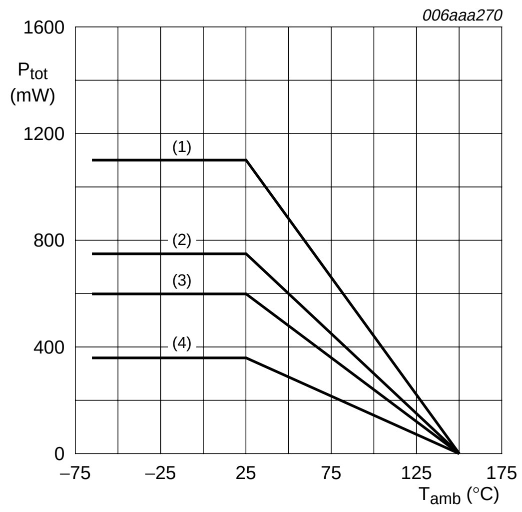
[1] Device mounted on a ceramic PCB, $Al_2O_3$, standard footprint.

[2] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.

[3] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 1 $cm^2$.

[4] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 6 $cm^2$.

[5] Operated under pulsed conditions: Duty cycle $\delta \leq 10$ % and pulse width $t_p \leq 10$ ms.




(1) Ceramic PCB, $Al_2O_3$, standard footprint

(2) FR4 PCB, mounting pad for collector 6 $cm^2$

(3) FR4 PCB, mounting pad for collector 1 $cm^2$

(4) FR4 PCB, standard footprint

**Fig 1. Power derating curves**


© NXP B.V. 2008. All rights reserved.

## 6. Thermal characteristics

**Table 6. Thermal characteristics**

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | in free air | [1] | - | - | 350 | K/W |
| | | | [2] | - | - | 208 | K/W |
| | | | [3] | - | - | 160 | K/W |
| | | | [4] | - | - | 113 | K/W |
| | | | [1][5] | - | - | 50 | K/W |
| $R_{th(j-sp)}$ | thermal resistance from junction to solder point | | | - | - | 45 | K/W |

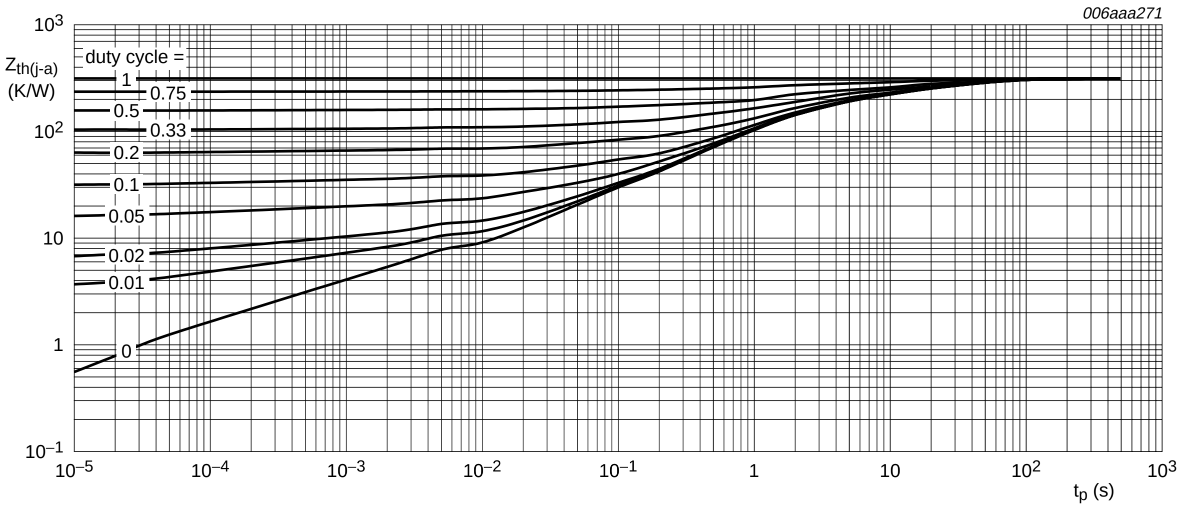
[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.

[2] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 1 $cm^2$.

[3] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 6 $cm^2$.

[4] Device mounted on a ceramic PCB, $Al_2O_3$, standard footprint.

[5] Operated under pulsed conditions: Duty cycle $\delta \leq 10$ % and pulse width $t_p \leq 10$ ms.

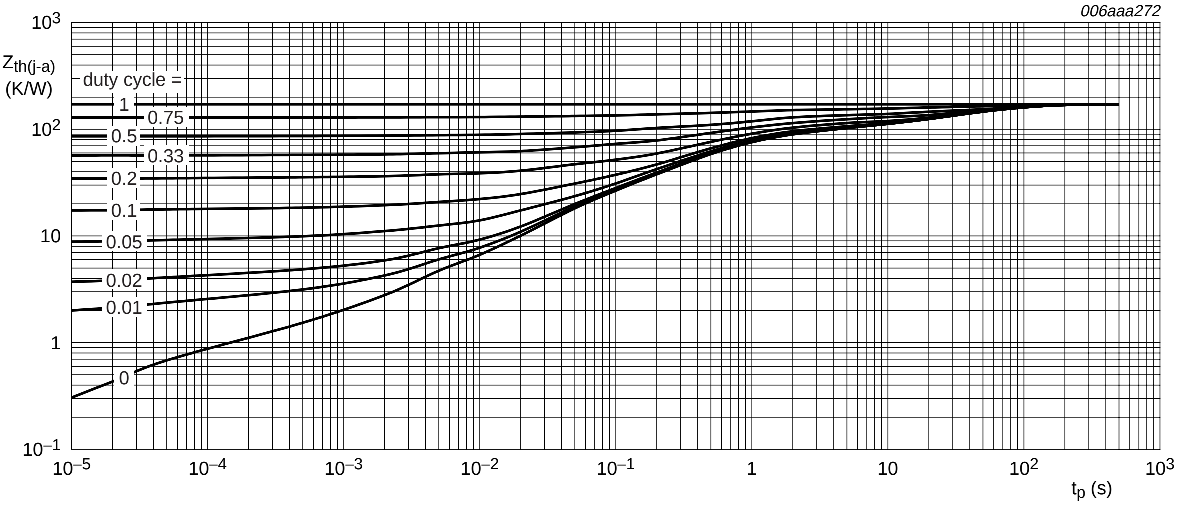



FR4 PCB, standard footprint

**Fig 2. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values**

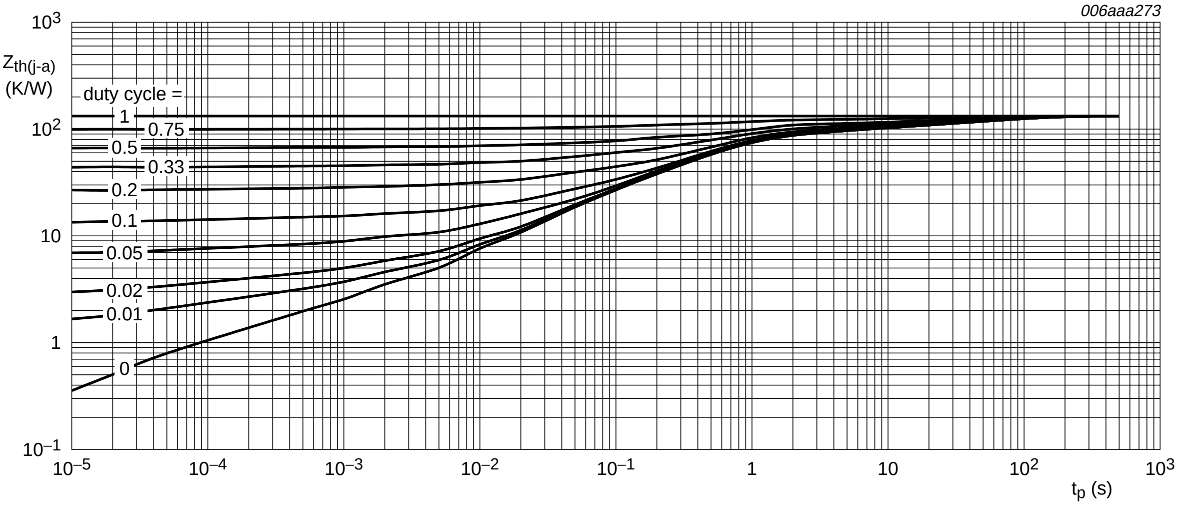


© NXP B.V. 2008. All rights reserved.




FR4 PCB, mounting pad for collector 1 cm²

**Fig 3. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values**




FR4 PCB, mounting pad for collector 6 cm²

**Fig 4. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values**


© NXP B.V. 2008. All rights reserved.

# 7. Characteristics

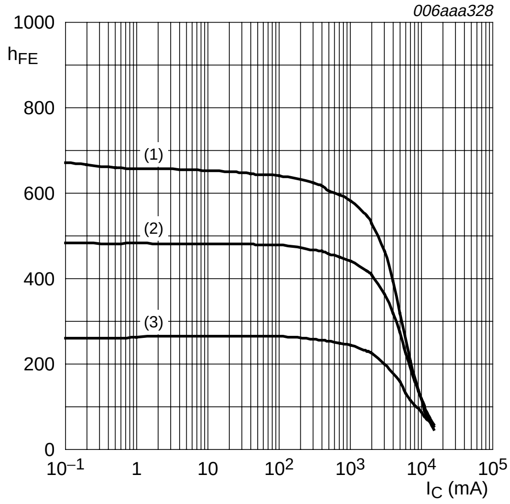
**Table 7. Characteristics**

*$T_{amb}$ = 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 A | - | - | 0.1 | µA |
| | | $V_{CB}$ = 20 V; $I_E$ = 0 A; $T_j$ = 150 °C | - | - | 50 | µA |
| $I_{CES}$ | collector-emitter cut-off current | $V_{CE}$ = 20 V; $V_{BE}$ = 0 V | - | - | 0.1 | µA |
| $I_{EBO}$ | emitter-base cut-off current | $V_{EB}$ = 5 V; $I_C$ = 0 A | - | - | 0.1 | µA |
| $h_{FE}$ | DC current gain | $V_{CE}$ = 2 V; $I_C$ = 0.5 A | 300 | 450 | - | |
| | | $V_{CE}$ = 2 V; $I_C$ = 1 A [1] | 300 | 430 | - | |
| | | $V_{CE}$ = 2 V; $I_C$ = 2 A [1] | 250 | 400 | - | |
| | | $V_{CE}$ = 2 V; $I_C$ = 4 A [1] | 200 | 310 | - | |
| | | $V_{CE}$ = 2 V; $I_C$ = 6 A [1] | 100 | 230 | - | |
| $V_{CEsat}$ | collector-emitter saturation voltage | $I_C$ = 0.5 A; $I_B$ = 50 mA | - | 30 | 50 | mV |
| | | $I_C$ = 1 A; $I_B$ = 50 mA | - | 60 | 90 | mV |
| | | $I_C$ = 2 A; $I_B$ = 200 mA | - | 110 | 150 | mV |
| | | $I_C$ = 4 A; $I_B$ = 400 mA [1] | - | 200 | 280 | mV |
| | | $I_C$ = 6 A; $I_B$ = 600 mA [1] | - | 300 | 420 | mV |
| $R_{CEsat}$ | collector-emitter saturation resistance | $I_C$ = 4 A; $I_B$ = 400 mA [1] | - | 50 | 70 | mΩ |
| $V_{BEsat}$ | base-emitter saturation voltage | $I_C$ = 0.5 A; $I_B$ = 50 mA | - | 0.79 | 0.85 | V |
| | | $I_C$ = 1 A; $I_B$ = 50 mA | - | 0.81 | 0.9 | V |
| | | $I_C$ = 1 A; $I_B$ = 100 mA [1] | - | 0.83 | 1 | V |
| | | $I_C$ = 4 A; $I_B$ = 400 mA [1] | - | 1.0 | 1.1 | V |
| $V_{BEon}$ | base-emitter turn-on voltage | $V_{CE}$ = 2 V; $I_C$ = 2 A | - | 0.79 | 1 | V |
| $t_d$ | delay time | $V_{CC}$ = 12.5 V; $I_C$ = 3 A; $I_{Bon}$ = 0.15 A; $I_{Boff}$ = −0.15 A | - | 12 | - | ns |
| $t_r$ | rise time | | - | 36 | - | ns |
| $t_{on}$ | turn-on time | | - | 48 | - | ns |
| $t_s$ | storage time | | - | 230 | - | ns |
| $t_f$ | fall time | | - | 50 | - | ns |
| $t_{off}$ | turn-off time | | - | 280 | - | ns |
| $f_T$ | transition frequency | $V_{CE}$ = 10 V; $I_C$ = 0.1 A; f = 100 MHz | - | 100 | - | MHz |
| $C_c$ | collector capacitance | $V_{CB}$ = 10 V; $I_E$ = $i_e$ = 0 A; f = 1 MHz | - | 60 | - | pF |

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


© NXP B.V. 2008. All rights reserved.



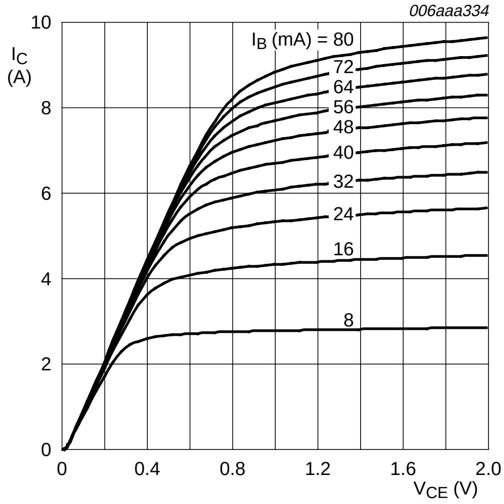

$V_{CE}$ = 2 V

(1) $T_{amb}$ = 100 °C

(2) $T_{amb}$ = 25 °C

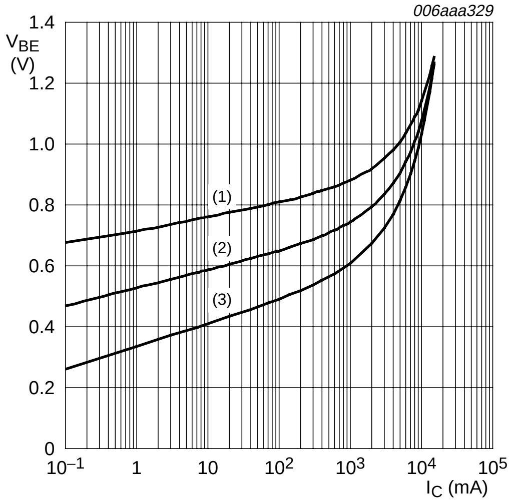
(3) $T_{amb}$ = −55 °C

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




$T_{amb}$ = 25 °C

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



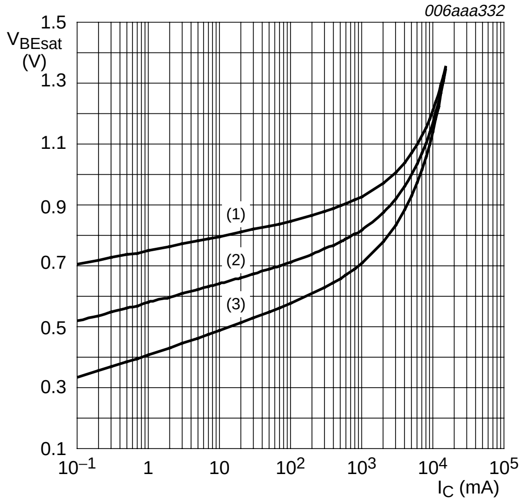

$V_{CE}$ = 2 V

(1) $T_{amb}$ = −55 °C

(2) $T_{amb}$ = 25 °C

(3) $T_{amb}$ = 100 °C

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




$I_C/I_B$ = 20

(1) $T_{amb}$ = −55 °C

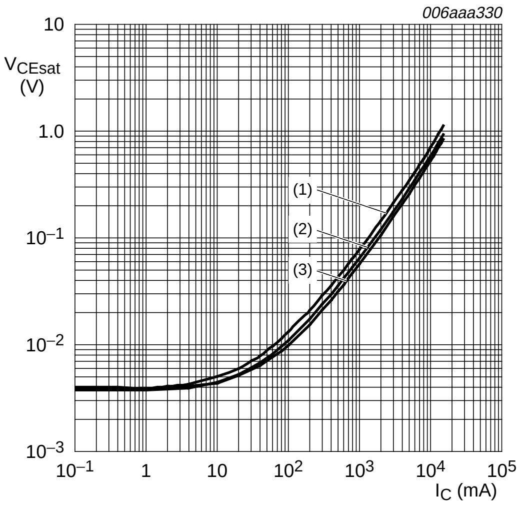
(2) $T_{amb}$ = 25 °C

(3) $T_{amb}$ = 100 °C

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



© NXP B.V. 2008. All rights reserved.



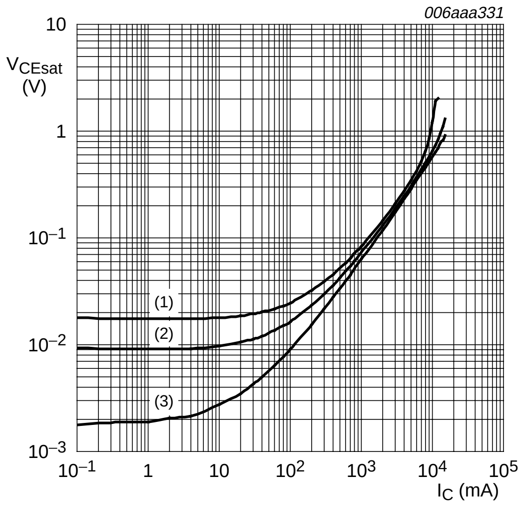

$I_C/I_B = 20$

(1) $T_{amb} = 100\ °C$

(2) $T_{amb} = 25\ °C$

(3) $T_{amb} = -55\ °C$

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



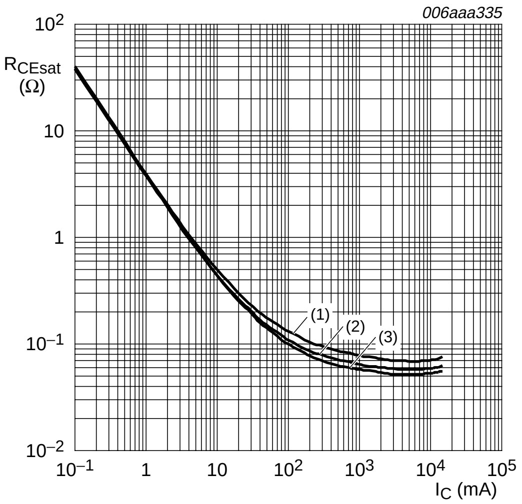

$T_{amb} = 25\ °C$

(1) $I_C/I_B = 100$

(2) $I_C/I_B = 50$

(3) $I_C/I_B = 10$

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



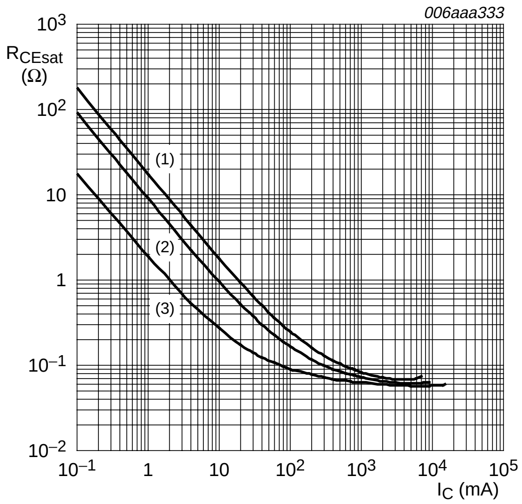

$I_C/I_B = 20$

(1) $T_{amb} = 100\ °C$

(2) $T_{amb} = 25\ °C$

(3) $T_{amb} = -55\ °C$

**Fig 11. Collector-emitter saturation resistance as a function of collector current; typical values**




$T_{amb} = 25\ °C$

(1) $I_C/I_B = 100$

(2) $I_C/I_B = 50$

(3) $I_C/I_B = 10$

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



© NXP B.V. 2008. All rights reserved.

## 8. Test information

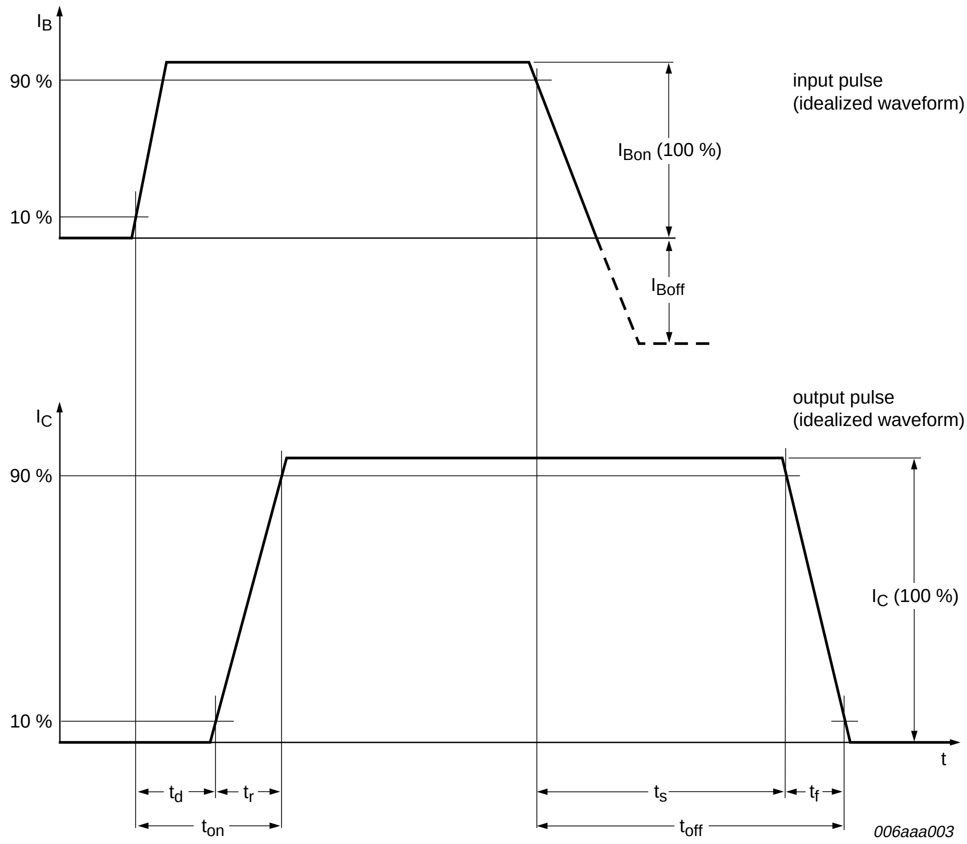
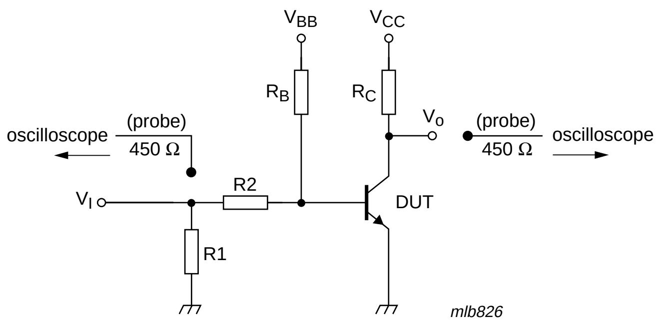



**Fig 13. BISS transistor switching time definition**




$V_{CC}$ = 12.5 V; $I_C$ = 3 A; $I_{Bon}$ = 0.15 A; $I_{Boff}$ = –0.15 A

**Fig 14. Test circuit for switching times**



© NXP B.V. 2008. All rights reserved.

## 9. Package outline

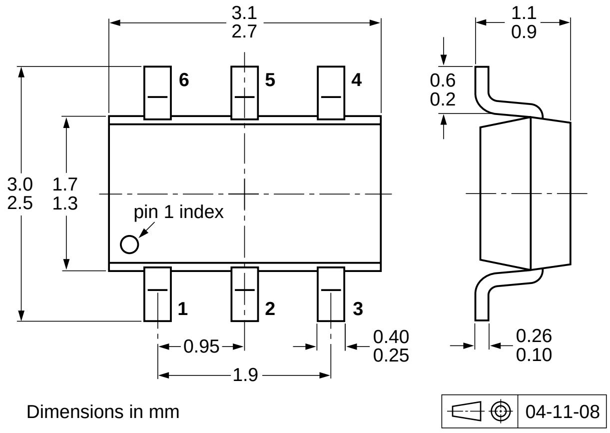



**Fig 15. Package outline SOT457 (SC-74)**

## 10. Packing information

**Table 8. Packing methods**

*The indicated -xxx are the last three digits of the 12NC ordering code.*[1]

| Type number | Package | Description | | Packing quantity | |
|---|---|---|---|---|---|
| | | | | 3000 | 10000 |
| PBSS4420D | SOT457 | 4 mm pitch, 8 mm tape and reel; T1 | [2] | -115 | -135 |
| | | 4 mm pitch, 8 mm tape and reel; T2 | [3] | -125 | -165 |

[1] For further information and the availability of packing methods, see Section 14.

[2] T1: normal taping

[3] T2: reverse taping



© NXP B.V. 2008. All rights reserved.

## 11. Soldering

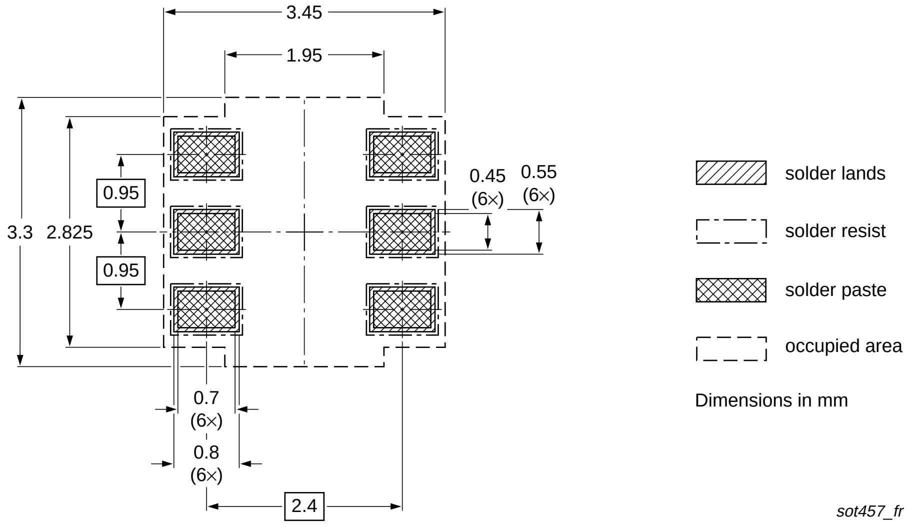



**Fig 16. Reflow soldering footprint SOT457 (SC-74)**

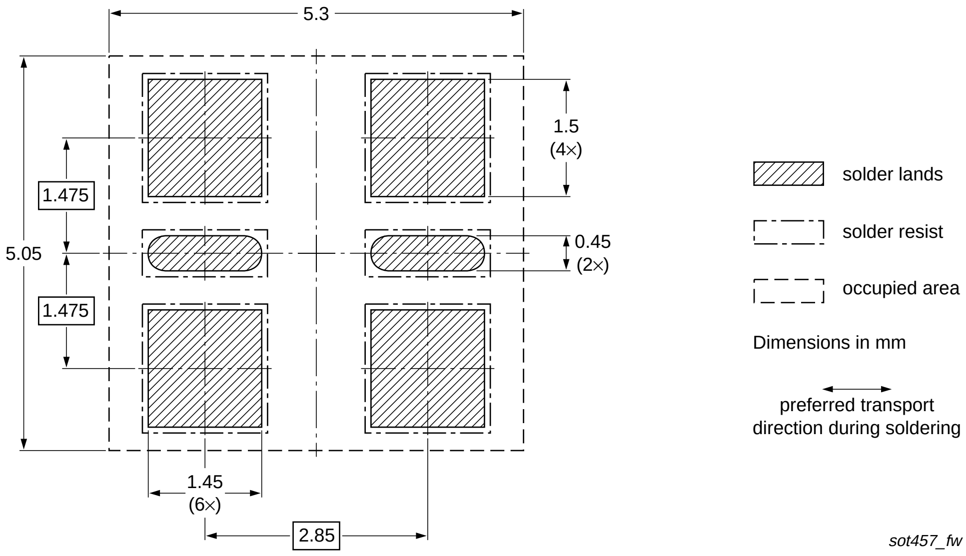



**Fig 17. Wave soldering footprint SOT457 (SC-74)**


© NXP B.V. 2008. All rights reserved.

## 12. Revision history

**Table 9. Revision history**

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|---|---|---|---|---|
| PBSS4420D_2 | 20080924 | Product data sheet | - | PBSS4420D_1 |
| Modifications: | • The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors.<br>• Legal texts have been adapted to the new company name where appropriate.<br>• Figure 7: amended<br>• Section 11 "Soldering": added<br>• Section 13 "Legal information": updated | | | |
| PBSS4420D_1 | 20050421 | Product data sheet | - | - |


© NXP B.V. 2008. All rights reserved.

# 13. Legal information

## 13.1 Data sheet status

| Document status[1][2] | Product status[3] | Definition |
|---|---|---|
| Objective [short] data sheet | Development | This document contains data from the objective specification for product development. |
| Preliminary [short] data sheet | Qualification | This document contains data from the preliminary specification. |
| Product [short] data sheet | Production | This document contains the product specification. |

[1] Please consult the most recently issued document before initiating or completing a design.

[2] The term 'short data sheet' is explained in section "Definitions".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL http://www.nxp.com.

## 13.2 Definitions

**Draft —** The document is a draft version only. The content is still under internal review and subject to formal approval, which may result in modifications or additions. NXP Semiconductors does not give any representations or warranties as to the accuracy or completeness of information included herein and shall have no liability for the consequences of use of such information.

**Short data sheet —** A short data sheet is an extract from a full data sheet with the same product type number(s) and title. A short data sheet is intended for quick reference only and should not be relied upon to contain detailed and full information. For detailed and full information see the relevant full data sheet, which is available on request via the local NXP Semiconductors sales office. In case of any inconsistency or conflict with the short data sheet, the full data sheet shall prevail.

## 13.3 Disclaimers

**General —** Information in this document is believed to be accurate and reliable. However, NXP Semiconductors does not give any representations or warranties, expressed or implied, as to the accuracy or completeness of such information and shall have no liability for the consequences of use of such information.

**Right to make changes —** NXP Semiconductors reserves the right to make changes to information published in this document, including without limitation specifications and product descriptions, at any time and without notice. This document supersedes and replaces all information supplied prior to the publication hereof.

**Suitability for use —** NXP Semiconductors products are not designed, authorized or warranted to be suitable for use in medical, military, aircraft, space or life support equipment, nor in applications where failure or malfunction of an NXP Semiconductors product can reasonably be expected to result in personal injury, death or severe property or environmental damage. NXP Semiconductors accepts no liability for inclusion and/or use of NXP Semiconductors products in such equipment or applications and therefore such inclusion and/or use is at the customer's own risk.

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

**Limiting values —** Stress above one or more limiting values (as defined in the Absolute Maximum Ratings System of IEC 60134) may cause permanent damage to the device. Limiting values are stress ratings only and operation of the device at these or any other conditions above those given in the Characteristics sections of this document is not implied. Exposure to limiting values for extended periods may affect device reliability.

**Terms and conditions of sale —** NXP Semiconductors products are sold subject to the general terms and conditions of commercial sale, as published at http://www.nxp.com/profile/terms, including those pertaining to warranty, intellectual property rights infringement and limitation of liability, unless explicitly otherwise agreed to in writing by NXP Semiconductors. In case of any inconsistency or conflict between information in this document and such terms and conditions, the latter will prevail.

**No offer to sell or license —** Nothing in this document may be interpreted or construed as an offer to sell products that is open for acceptance or the grant, conveyance or implication of any license under any copyrights, patents or other industrial or intellectual property rights.

**Quick reference data —** The Quick reference data is an extract of the product data given in the Limiting values and Characteristics sections of this document, and as such is not complete, exhaustive or legally binding.

## 13.4 Trademarks

Notice: All referenced brands, product names, service names and trademarks are the property of their respective owners.

# 14. Contact information

For more information, please visit: **http://www.nxp.com**

For sales office addresses, please send an email to: **salesaddresses@nxp.com**



© NXP B.V. 2008. All rights reserved.

## 15. Contents



Please be aware that important notices concerning this document and the product(s) described herein, have been included in section 'Legal information'.

founded by PHILIPS

© NXP B.V. 2008. All rights reserved.

For more information, please visit: http://www.nxp.com
For sales office addresses, please send an email to: salesaddresses@nxp.com

Date of release: 24 September 2008
Document identifier: PBSS4420D_2

## X-ON Electronics

Largest Supplier of Electrical and Electronic Components

***Click to view similar products for*** Bipolar Transistors - BJT ***category:***

***Click to view products by*** Nexperia ***manufacturer:***

Other Similar products are found below :

619691C MCH4017-TL-H BC546/116 BC557/116 BSW67A NTE158 NTE187A NTE195A NTE2302 NTE2330 NTE63 C4460 2SA1419T-TD-H 2SA1721-O(TE85L,F) 2SA2126-E 2SB1204S-TL-E 2SC5488A-TL-H 2SD2150T100R SP000011176 FMMTA92QTA 2N2369ADCSM 2N5769 2SC2412KT146S 2SC5490A-TL-H 2SD1816S-TL-E 2SD1816T-TL-E CMXT2207 TR CPH6501-TL-E MCH4021-TL-E US6T6TR NJL0281DG 732314D CMXT3906 TR CPH3121-TL-E CPH6021-TL-H 873787E IMZ2AT108 UMX21NTR MCH6102-TL-E NJL0302DG 2N3583 2SA1434-TB-E 2SC3143-4-TB-E 2SD1621S-TD-E NTE103 30A02MH-TL-E NSV40301MZ4T1G NTE101 NTE13 NTE15