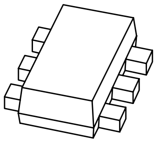


# PBSS5160V

## 60 V, 1 A PNP low $V_{CEsat}$ (BISS) transistor

Rev. 03 — 14 December 2009 Product data sheet

## 1. Product profile

### 1.1 General description

PNP low $V_{CEsat}$ Breakthrough in Small Signals (BISS) transistor in a SOT666 plastic package.

NPN complement: PBSS4160V.

### 1.2 Features

- Low collector-emitter saturation voltage $V_{CEsat}$
- High collector current capability $I_C$ and $I_{CM}$
- High efficiency leading to less heat generation
- Reduces printed-circuit board area required
- Cost effective replacement for medium power transistors BCP52 and BCX52

### 1.3 Applications

- Major application segments
    - Automotive
    - Telecom infrastructure
    - Industrial
- Power management
    - DC-to-DC conversion
    - Supply line switching
- Peripheral driver
    - Driver in low supply voltage applications (e.g. lamps and LEDs)
    - Inductive load driver (e.g. relays, buzzers and motors)

### 1.4 Quick reference data

**Table 1. Quick reference data**

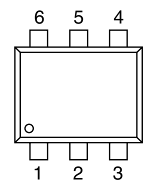
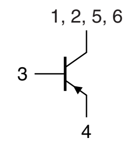
| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{CEO}$ | collector-emitter voltage | open base | - | - | –60 | V |
| $I_C$ | collector current (DC) | [1] | - | - | –1 | A |
| $I_{CM}$ | peak collector current | | - | - | –2 | A |
| $R_{CEsat}$ | equivalent on-resistance | $I_C$ = –1 A; $I_B$ = –100 mA | - | 220 | 330 | mΩ |

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

founded by Philips

## 2. Pinning information

**Table 2. Pinning**

| Pin | Description | Simplified outline | Symbol |
|---|---|---|---|
| 1, 2, 5, 6 | collector |  | <br>sym030 |
| 3 | base | | |
| 4 | emitter | | |

## 3. Ordering information

**Table 3. Ordering information**

| Type number | Package | | |
|---|---|---|---|
| | Name | Description | Version |
| PBSS5160V | - | plastic surface mounted package; 6 leads | SOT666 |

## 4. Marking

**Table 4. Marking codes**

| Type number | Marking code |
|---|---|
| PBSS5160V | 51 |

## 5. Limiting values

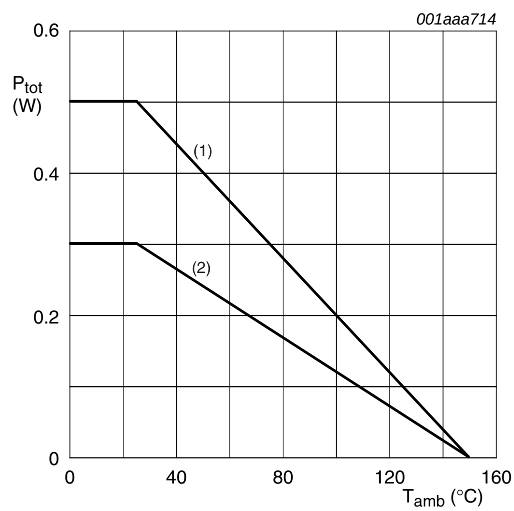
**Table 5. Limiting values**

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

| Symbol | Parameter | Conditions | | Min | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{CBO}$ | collector-base voltage | open emitter | | - | –80 | V |
| $V_{CEO}$ | collector-emitter voltage | open base | | - | –60 | V |
| $V_{EBO}$ | emitter-base voltage | open collector | | - | –5 | V |
| $I_C$ | collector current (DC) | | [1] | - | –0.9 | A |
| | | | [2] | - | –1 | A |
| $I_{CM}$ | peak collector current | t = 1 ms or limited by $T_{j(max)}$ | | - | –2 | A |
| $I_B$ | base current (DC) | | | - | –300 | mA |
| $I_{BM}$ | peak base current | $t_p \leq 300\ \mu s$; $\delta \leq 0.02$ | | - | –1 | A |
| $P_{tot}$ | total power dissipation | $T_{amb} \leq 25\ °C$ | [1] | - | 300 | mW |
| | | | [2] | - | 500 | mW |
| $T_j$ | junction temperature | | | - | 150 | °C |
| $T_{amb}$ | ambient temperature | | | –65 | +150 | °C |
| $T_{stg}$ | storage temperature | | | –65 | +150 | °C |

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

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




(1) FR4 PCB; 1 $cm^2$ collector mounting pad

(2) FR4 PCB; standard footprint

**Fig 1. Power derating curves**

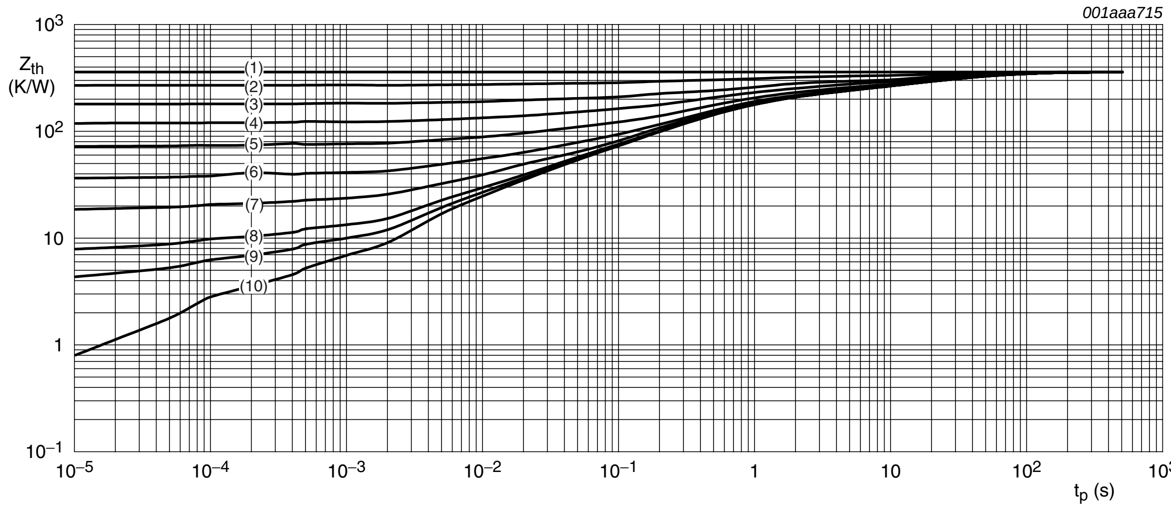
## 6. Thermal characteristics

**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] | - | - | 415 | K/W |
| | | | [2] | - | - | 250 | K/W |

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

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




Mounted on FR4 PCB; standard footprint

(1) $\delta = 1$

(2) $\delta = 0.75$

(3) $\delta = 0.5$

(4) $\delta = 0.33$

(5) $\delta = 0.2$

(6) $\delta = 0.1$

(7) $\delta = 0.05$

(8) $\delta = 0.02$

(9) $\delta = 0.01$

(10) $\delta = 0$

**Fig 2. Transient thermal impedance as a function of pulse time; typical values**

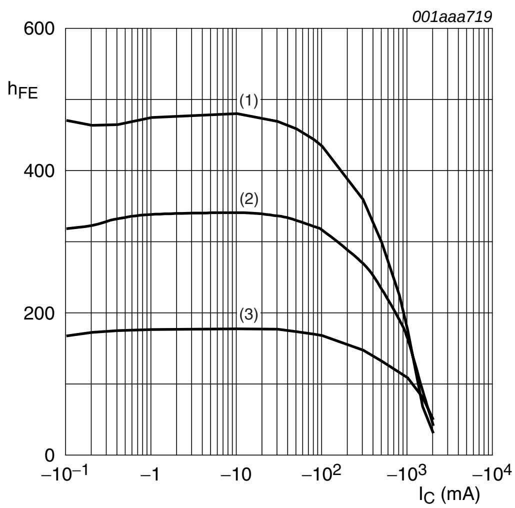
# 7. Characteristics

**Table 7. Characteristics**

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

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $I_{CBO}$ | collector-base cut-off current | $V_{CB}$ = –60 V; $I_E$ = 0 A | | - | - | –100 | nA |
| | | $V_{CB}$ = –60 V; $I_E$ = 0 A; $T_j$ = 150 °C | | - | - | –50 | μA |
| $I_{CES}$ | collector-emitter cut-off current | $V_{CE}$ = –60 V; $V_{BE}$ = 0 V | | - | - | –100 | nA |
| $I_{EBO}$ | emitter-base cut-off current | $V_{EB}$ = –5 V; $I_C$ = 0 A | | - | - | –100 | nA |
| $h_{FE}$ | DC current gain | $V_{CE}$ = –5 V; $I_C$ = –1 mA | | 200 | 350 | - | |
| | | $V_{CE}$ = –5 V; $I_C$ = –500 mA | [1] | 150 | 250 | - | |
| | | $V_{CE}$ = –5 V; $I_C$ = –1 A | [1] | 100 | 160 | - | |
| $V_{CEsat}$ | collector-emitter saturation voltage | $I_C$ = –100 mA; $I_B$ = –1 mA | | - | –110 | –160 | mV |
| | | $I_C$ = –500 mA; $I_B$ = –50 mA | | - | –120 | –175 | mV |
| | | $I_C$ = –1 A; $I_B$ = –100 mA | [1] | - | –220 | –330 | mV |
| $V_{BEsat}$ | base-emitter saturation voltage | $I_C$ = –1 A; $I_B$ = –50 mA | | - | –0.95 | –1.1 | V |
| $R_{CEsat}$ | equivalent on-resistance | $I_C$ = –1 A; $I_B$ = –100 mA | [1] | - | 220 | 330 | mΩ |
| $V_{BEon}$ | base-emitter turn-on voltage | $I_C$ = –1 A; $V_{CE}$ = –5 V | | - | –0.82 | –0.9 | V |
| $t_d$ | delay time | $V_{CC}$ = –10 V; $I_C$ = –0.5 A; $I_{Bon}$ = –0.025 A; $I_{Boff}$ = 0.025 A | | - | 11 | - | ns |
| $t_r$ | rise time | | | - | 30 | - | ns |
| $t_{on}$ | turn-on time | | | - | 41 | - | ns |
| $t_s$ | storage time | | | - | 205 | - | ns |
| $t_f$ | fall time | | | - | 55 | - | ns |
| $t_{off}$ | turn-off time | | | - | 260 | - | ns |
| $f_T$ | transition frequency | $I_C$ = –50 mA; $V_{CE}$ = –10 V; f = 100 MHz | | 150 | 220 | - | MHz |
| $C_c$ | collector capacitance | $I_E = i_e$ = 0 A; $V_{CB}$ = –10 V; f = 1 MHz | | - | 9 | 15 | pF |

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



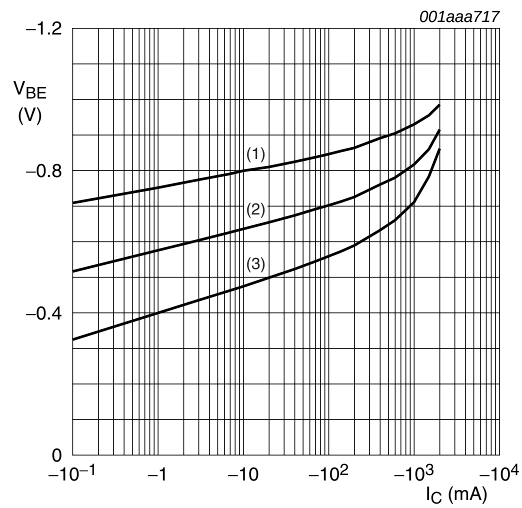

$V_{CE} = -5$ V

(1) $T_{amb} = 100$ °C

(2) $T_{amb} = 25$ °C

(3) $T_{amb} = -55$ °C

**Fig 3. DC current gain as a function of collector current; typical values**



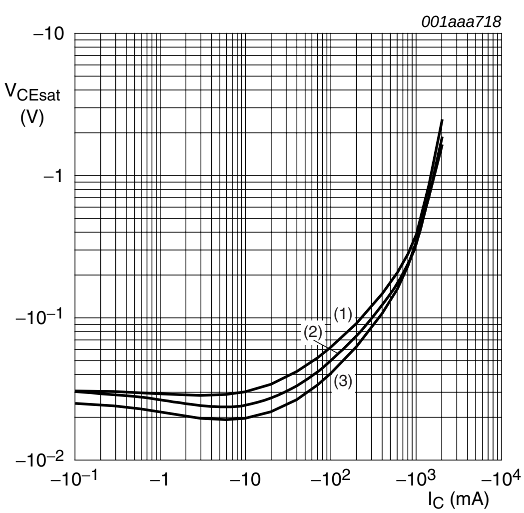

$V_{CE} = -5$ V

(1) $T_{amb} = -55$ °C

(2) $T_{amb} = 25$ °C

(3) $T_{amb} = 100$ °C

**Fig 4. Base-emitter voltage as a function of collector current; typical values**



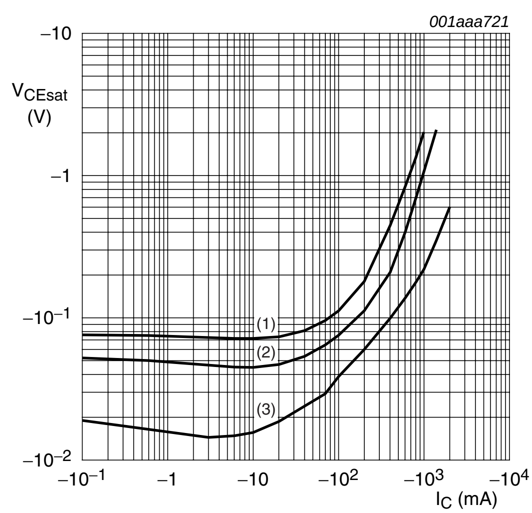

$I_C/I_B = 20$

(1) $T_{amb} = 100$ °C

(2) $T_{amb} = 25$ °C

(3) $T_{amb} = -55$ °C

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



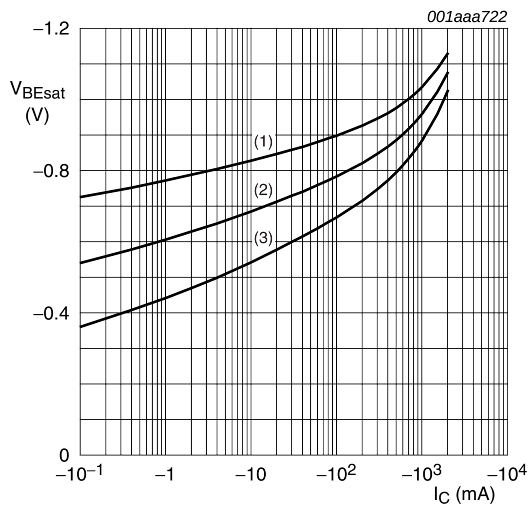

$T_{amb} = 25$ °C

(1) $I_C/I_B = 100$

(2) $I_C/I_B = 50$

(3) $I_C/I_B = 10$

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



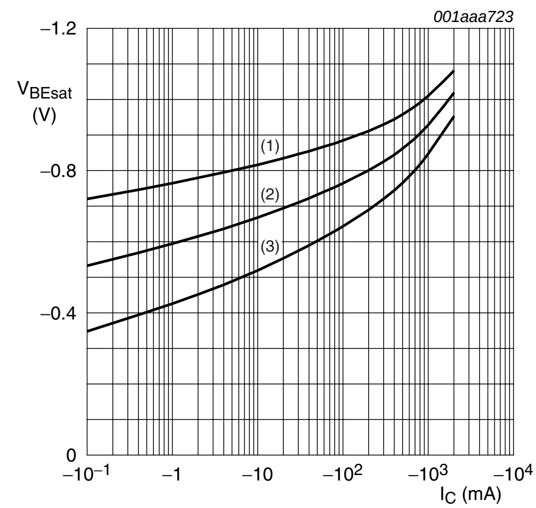

$I_C/I_B = 10$

(1) $T_{amb} = -55$ °C

(2) $T_{amb} = 25$ °C

(3) $T_{amb} = 100$ °C

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



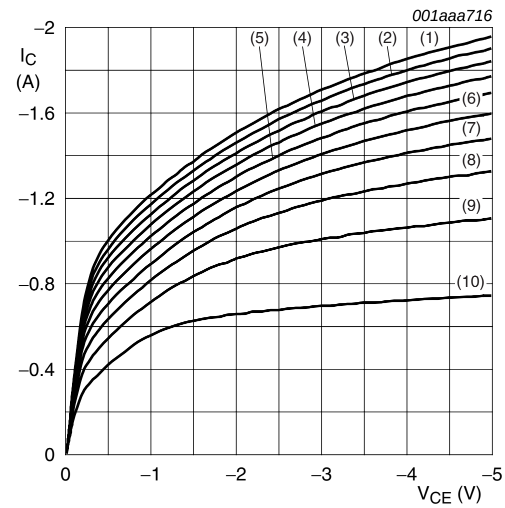

$I_C/I_B = 20$

(1) $T_{amb} = -55$ °C

(2) $T_{amb} = 25$ °C

(3) $T_{amb} = 100$ °C

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




$T_{amb}$ = 25 °C

(1) $I_B$ = −40 mA

(2) $I_B$ = −36 mA

(3) $I_B$ = −32 mA

(4) $I_B$ = −28 mA

(5) $I_B$ = −24 mA

(6) $I_B$ = −20 mA

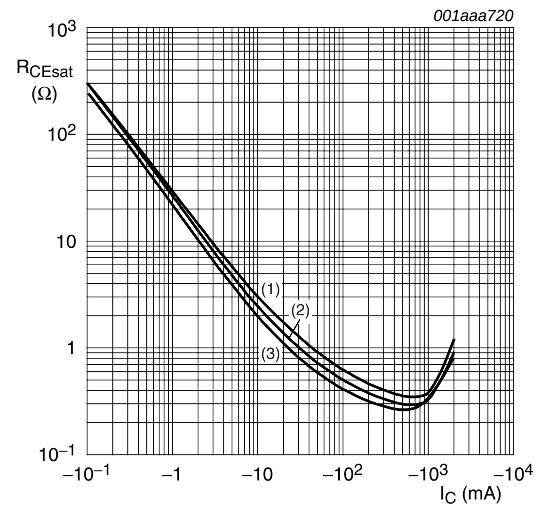
(7) $I_B$ = −16 mA

(8) $I_B$ = −12 mA

(9) $I_B$ = −8 mA

(10) $I_B$ = −4 mA

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




$I_C/I_B$ = 20

(1) $T_{amb}$ = 100 °C

(2) $T_{amb}$ = 25 °C

(3) $T_{amb}$ = −55 °C

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

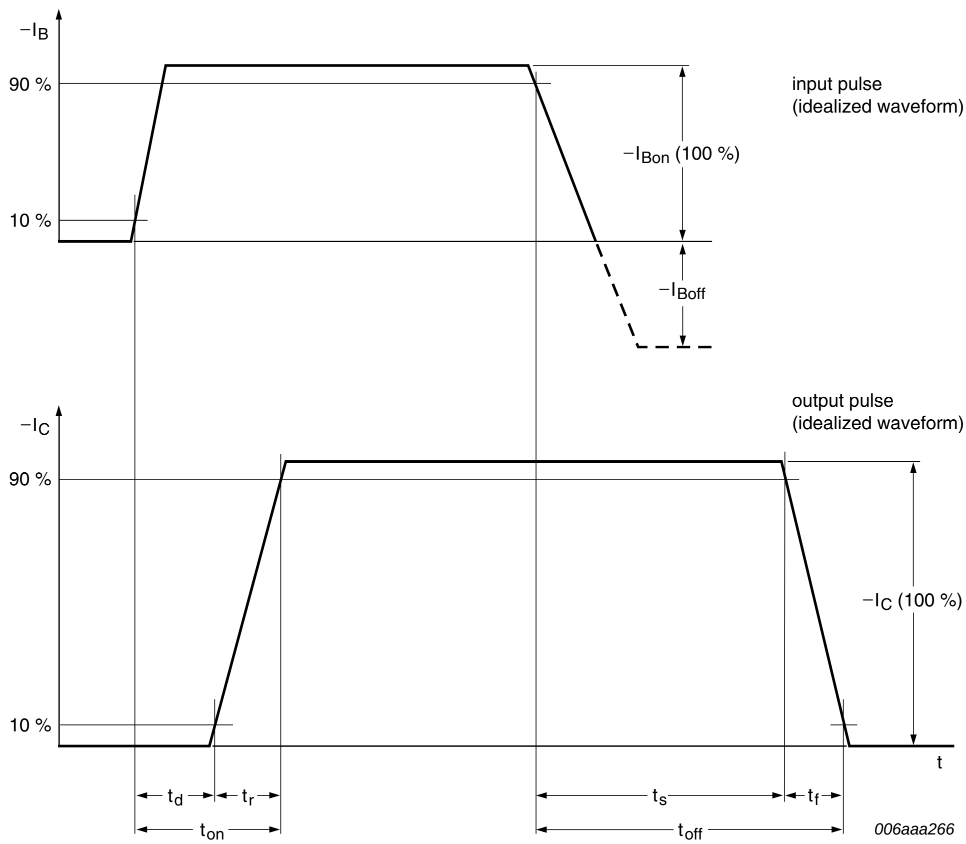
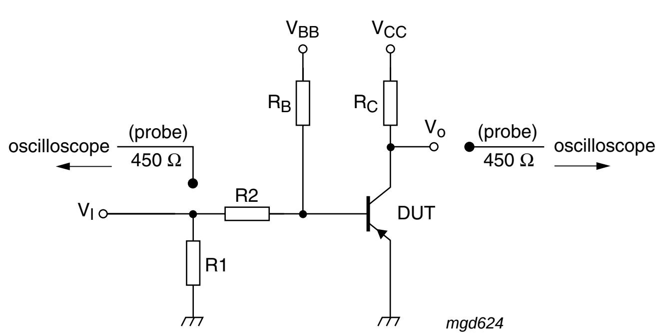



**Fig 11. BISS transistor switching time definition**

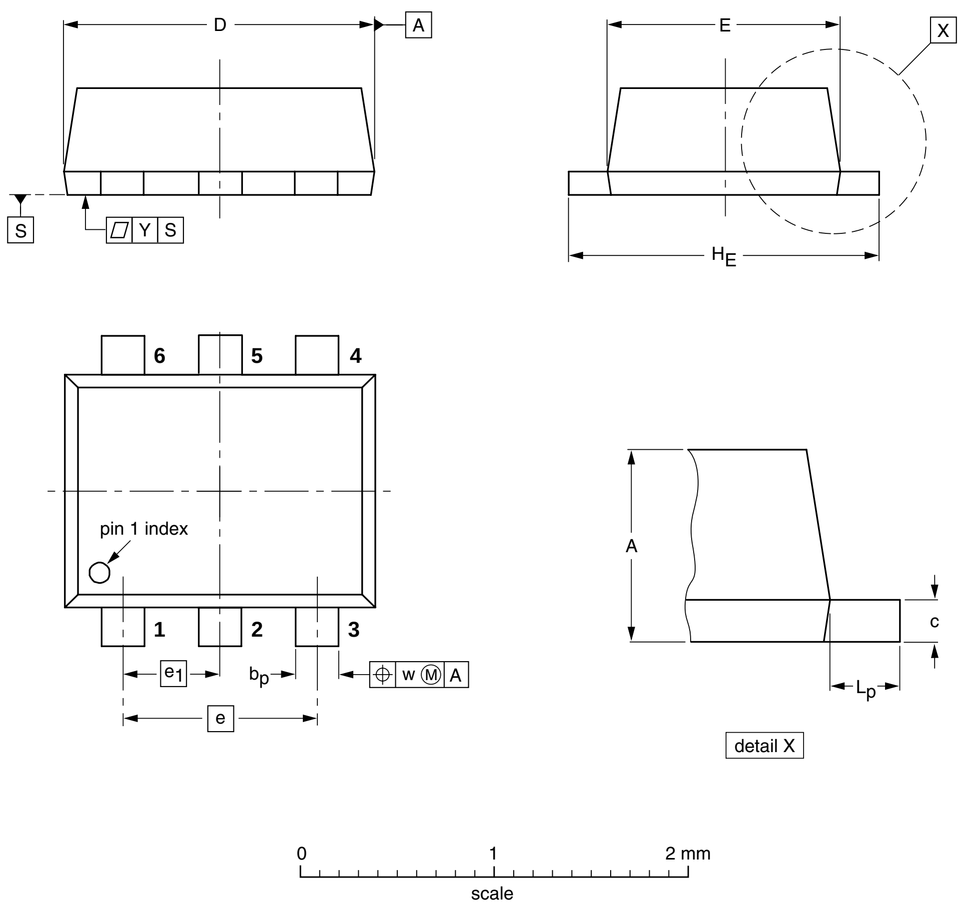



$V_{CC}$ = –10 V; $I_C$ = –0.5 A; $I_{Bon}$ = –0.025 A; $I_{Boff}$ = 0.025 A

**Fig 12. Test circuit for switching times**

## 8. Package outline

**Plastic surface-mounted package; 6 leads** **SOT666**




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

| UNIT | A | $b_p$ | c | D | E | e | $e_1$ | $H_E$ | $L_p$ | w | y |
|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 0.6<br>0.5 | 0.27<br>0.17 | 0.18<br>0.08 | 1.7<br>1.5 | 1.3<br>1.1 | 1.0 | 0.5 | 1.7<br>1.5 | 0.3<br>0.1 | 0.1 | 0.1 |

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT666 | | | | | | ~~04-11-08~~<br>06-03-16 |

**Fig 13. Package outline SOT666**

## 9. 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** |
| PBSS5160V | SOT666 | 4 mm pitch, 8 mm tape and reel | -115 |

[1] For further information and the availability of packing methods, see Section 12.

## 10. Revision history

**Table 9. Revision history**

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|---|---|---|---|---|
| PBSS5160V_3 | 20091214 | Product data sheet | - | PBSS5160V_2 |
| Modifications: | • This data sheet was changed to reflect the new company name NXP Semiconductors, including new legal definitions and disclaimers. No changes were made to the technical content.<br>• Figure 13 “Package outline SOT666”: updated | | | |
| PBSS5160V_2 | 20050404 | Product data sheet | - | PBSS5160V_1 |
| PBSS5160V_1 | 20040420 | Objective data sheet | - | - |

# 11. Legal information

## 11.1 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.

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# 13. Contents





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**Date of release: 14 December 2009**
**Document identifier: PBSS5160V_3**