



# PBSS5160DS

60 V, 1 A PNP/PNP low V<sub>CEsat</sub> transistor

6 November 2023

Product data sheet

## 1. General description

PNP/PNP low V<sub>CEsat</sub> transistor pair in a small SOT457 (SC-74) Surface-Mounted Device (SMD) plastic package.

NPN complement: PBSS4160DS

## 2. Features and benefits

- Low collector-emitter saturation voltage V<sub>CEsat</sub>
- High collector current capability I<sub>C</sub> and I<sub>CM</sub>
- High collector current gain (h<sub>FE</sub>) at high I<sub>C</sub>
- High efficiency due to less heat generation
- Smaller required Printed-Circuit Board (PCB) area than for conventional transistors
- AEC-Q101 qualified

## 3. Applications

- Dual low power switches (e.g. motors, fans)
- Automotive applications

## 4. Quick reference data

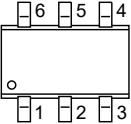
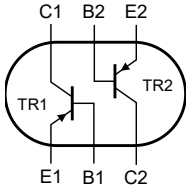
Table 1. Quick reference data

| Symbol             | Parameter                               | Conditions                                                                                                           |     | Min | Typ | Max | Unit |
|--------------------|-----------------------------------------|----------------------------------------------------------------------------------------------------------------------|-----|-----|-----|-----|------|
| Per transistor     |                                         |                                                                                                                      |     |     |     |     |      |
| V <sub>CEO</sub>   | collector-emitter voltage               | open base                                                                                                            |     | -   | -   | -60 | V    |
| I <sub>C</sub>     | collector current                       |                                                                                                                      | [1] | -   | -   | -1  | A    |
| I <sub>CM</sub>    | peak collector current                  | single pulse; t <sub>p</sub> ≤ 1 ms                                                                                  |     | -   | -   | -2  | A    |
| R <sub>CEsat</sub> | collector-emitter saturation resistance | I <sub>C</sub> = -1 A; I <sub>B</sub> = -100 mA; pulsed; t <sub>p</sub> ≤ 300 μs; δ ≤ 0.02; T <sub>amb</sub> = 25 °C |     | -   | 250 | 330 | mΩ   |

[1] Device mounted on a ceramic PCB, Al<sub>2</sub>O<sub>3</sub>, standard footprint.

5. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description   | Simplified outline                                                                                  | Graphic symbol                                                                                |
|-----|--------|---------------|-----------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|
| 1   | E1     | emitter TR1   | <br>TSOP6 (SOT457) | <br>sym138 |
| 2   | B1     | base TR1      |                                                                                                     |                                                                                               |
| 3   | C2     | collector TR2 |                                                                                                     |                                                                                               |
| 4   | E2     | emitter TR2   |                                                                                                     |                                                                                               |
| 5   | B2     | base TR2      |                                                                                                     |                                                                                               |
| 6   | C1     | collector TR1 |                                                                                                     |                                                                                               |

6. Ordering information

Table 3. Ordering information

| Type number                | Package |                                                          |                        |
|----------------------------|---------|----------------------------------------------------------|------------------------|
|                            | Name    | Description                                              | Version                |
| <a href="#">PBSS5160DS</a> | TSOP6   | plastic, surface-mounted package (SC-74; TSOP6); 6 leads | <a href="#">SOT457</a> |

7. Marking

Table 4. Marking codes

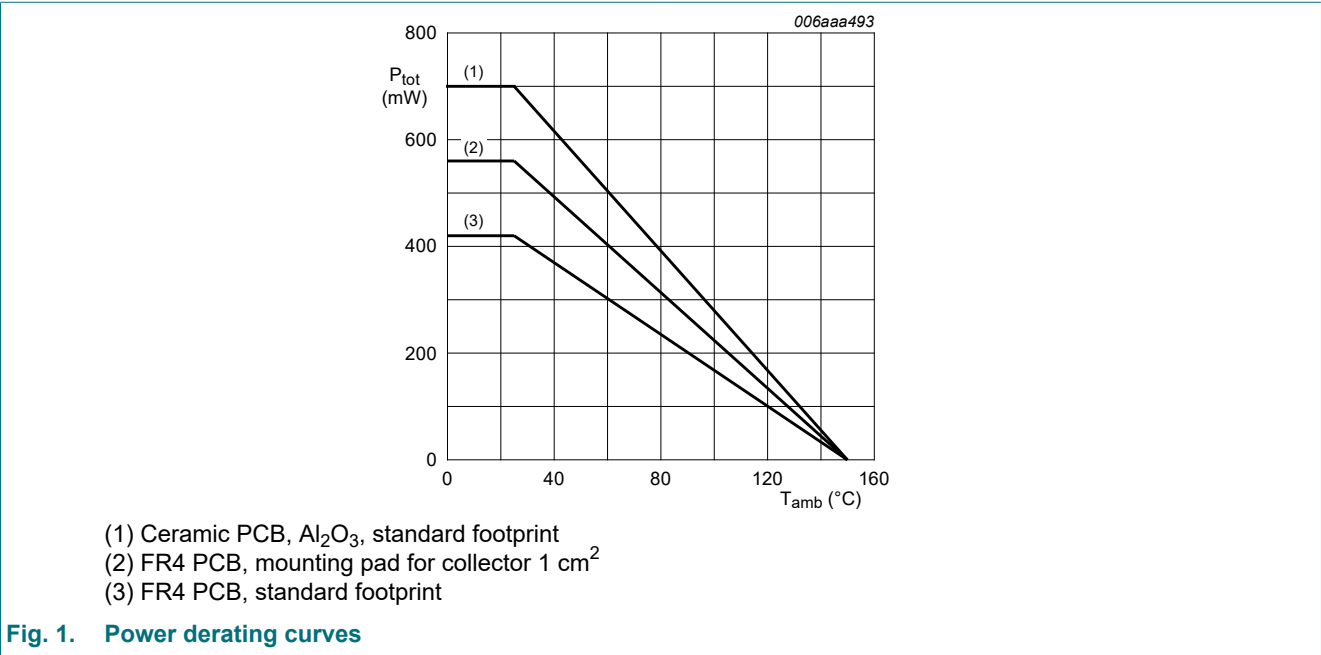
| Type number | Marking code |
|-------------|--------------|
| PBSS5160DS  | A5           |

8. Limiting values

Table 5. Limiting values  
In accordance with the Absolute Maximum Rating System (IEC 60134).

| Symbol           | Parameter                 | Conditions                          |     | Min | Max   | Unit |
|------------------|---------------------------|-------------------------------------|-----|-----|-------|------|
| Per transistor   |                           |                                     |     |     |       |      |
| V <sub>CBO</sub> | collector-base voltage    | open emitter                        |     | -   | -80   | V    |
| V <sub>CEO</sub> | collector-emitter voltage | open base                           |     | -   | -60   | V    |
| V <sub>EBO</sub> | emitter-base voltage      | open collector                      |     | -   | -5    | V    |
| I <sub>C</sub>   | collector current         |                                     | [1] | -   | -0.77 | A    |
|                  |                           |                                     | [2] | -   | -0.9  | A    |
|                  |                           |                                     | [3] | -   | -1    | A    |
| I <sub>CM</sub>  | peak collector current    | single pulse; t <sub>p</sub> ≤ 1 ms |     | -   | -2    | A    |
| I <sub>B</sub>   | base current              |                                     |     | -   | -300  | mA   |
| I <sub>BM</sub>  | peak base current         | single pulse; t <sub>p</sub> ≤ 1 ms |     | -   | -1    | A    |
| P <sub>tot</sub> | total power dissipation   | T <sub>amb</sub> ≤ 25 °C            | [1] | -   | 290   | mW   |
|                  |                           |                                     | [2] | -   | 370   | mW   |
|                  |                           |                                     | [3] | -   | 450   | mW   |
| Per device       |                           |                                     |     |     |       |      |
| P <sub>tot</sub> | total power dissipation   | T <sub>amb</sub> ≤ 25 °C            | [1] | -   | 420   | mW   |
|                  |                           |                                     | [2] | -   | 560   | mW   |
|                  |                           |                                     | [3] | -   | 700   | mW   |
| T <sub>j</sub>   | junction temperature      |                                     |     | -   | 150   | °C   |
| T <sub>amb</sub> | ambient temperature       |                                     |     | -65 | 150   | °C   |
| T <sub>stg</sub> | storage temperature       |                                     |     | -65 | 150   | °C   |

- [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<sup>2</sup>.  
[3] Device mounted on a ceramic PCB, Al<sub>2</sub>O<sub>3</sub>, standard footprint.



9. Thermal characteristics

Table 6. Thermal characteristics

| Symbol         | Parameter                                        | Conditions  |     | Min | Typ | Max | Unit |
|----------------|--------------------------------------------------|-------------|-----|-----|-----|-----|------|
| Per transistor |                                                  |             |     |     |     |     |      |
| $R_{th(j-a)}$  | thermal resistance from junction to ambient      | in free air | [1] | -   | -   | 431 | K/W  |
|                |                                                  |             | [2] | -   | -   | 338 | K/W  |
|                |                                                  |             | [3] | -   | -   | 278 | K/W  |
| $R_{th(j-sp)}$ | thermal resistance from junction to solder point |             |     | -   | -   | 105 | K/W  |
| Per device     |                                                  |             |     |     |     |     |      |
| $R_{th(j-a)}$  | thermal resistance from junction to ambient      | in free air | [1] | -   | -   | 298 | K/W  |
|                |                                                  |             | [2] | -   | -   | 223 | K/W  |
|                |                                                  |             | [3] | -   | -   | 179 | 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<sup>2</sup>.  
[3] Device mounted on a ceramic PCB, Al<sub>2</sub>O<sub>3</sub>, standard footprint.

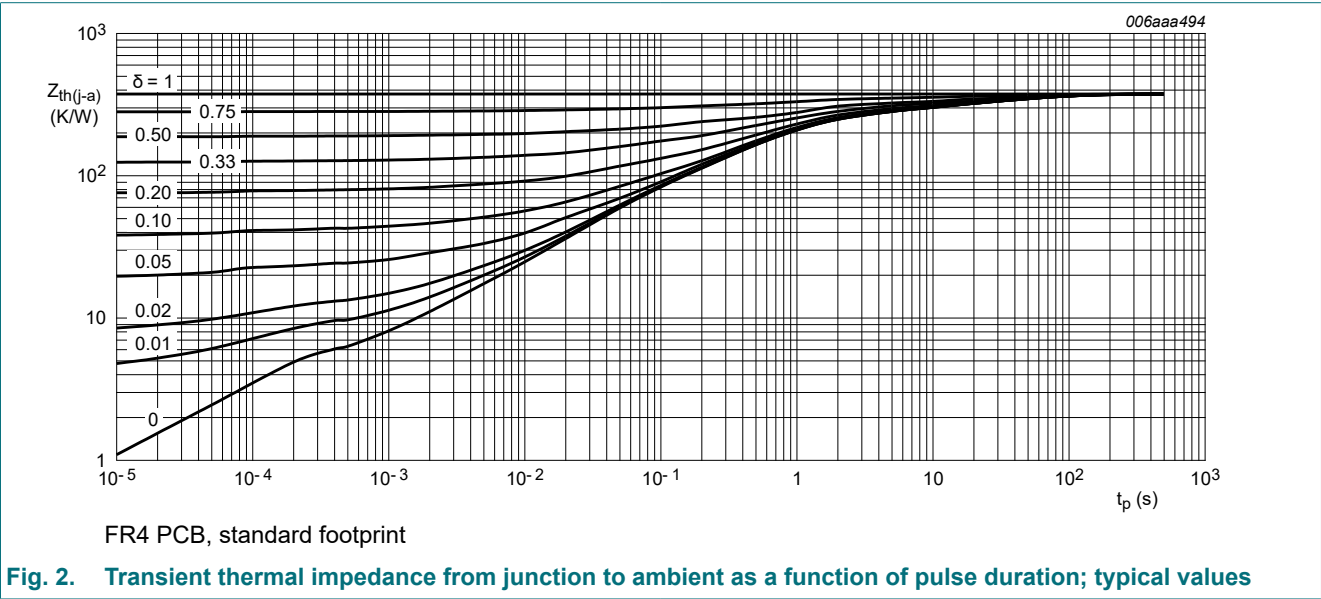


Fig. 2. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

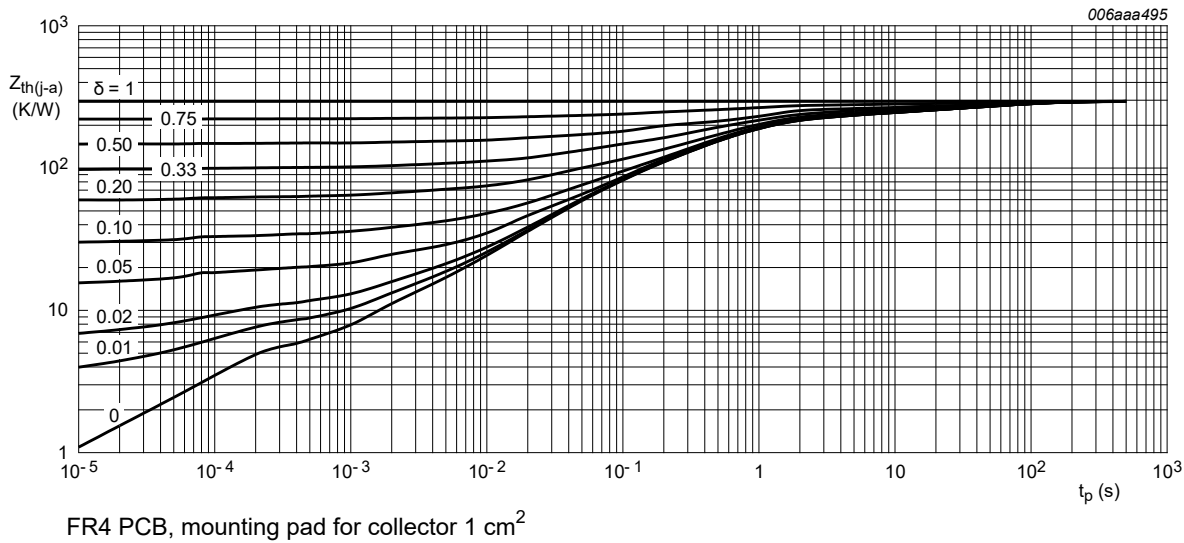


Fig. 3. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

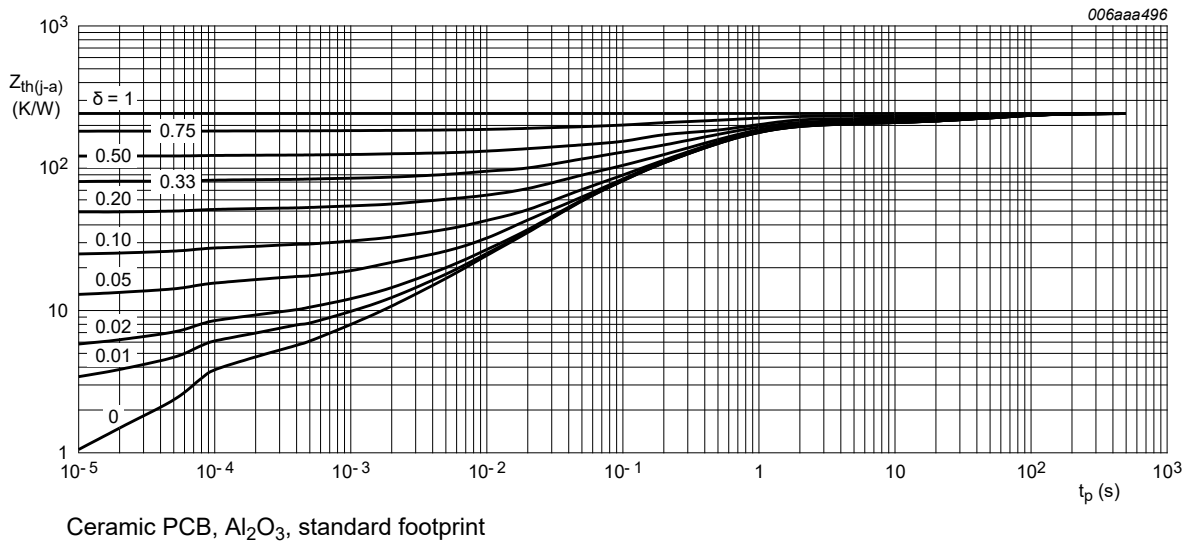


Fig. 4. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

## 10. Characteristics

Table 7. Characteristics

| Symbol                | Parameter                               | Conditions                                                                                                            |  | Min | Typ   | Max  | Unit |
|-----------------------|-----------------------------------------|-----------------------------------------------------------------------------------------------------------------------|--|-----|-------|------|------|
| <b>Per transistor</b> |                                         |                                                                                                                       |  |     |       |      |      |
| I <sub>CBO</sub>      | collector-base cut-off current          | V <sub>CB</sub> = -60 V; I <sub>E</sub> = 0 A; T <sub>amb</sub> = 25 °C                                               |  | -   | -     | -100 | nA   |
|                       |                                         | V <sub>CB</sub> = -60 V; I <sub>E</sub> = 0 A; T <sub>j</sub> = 150 °C                                                |  | -   | -     | -50  | μA   |
| I <sub>EBO</sub>      | emitter-base cut-off current            | V <sub>EB</sub> = -5 V; I <sub>C</sub> = 0 A; T <sub>amb</sub> = 25 °C                                                |  | -   | -     | -100 | nA   |
| I <sub>CES</sub>      | collector-emitter cut-off current       | V <sub>CE</sub> = -60 V; V <sub>BE</sub> = 0 V; T <sub>amb</sub> = 25 °C                                              |  | -   | -     | -100 | nA   |
| h <sub>FE</sub>       | DC current gain                         | V <sub>CE</sub> = -5 V; I <sub>C</sub> = -1 mA; T <sub>amb</sub> = 25 °C                                              |  | 200 | 350   | -    |      |
|                       |                                         | V <sub>CE</sub> = -5 V; I <sub>C</sub> = -500 mA; pulsed; t <sub>p</sub> ≤ 300 μs; δ ≤ 0.02; T <sub>amb</sub> = 25 °C |  | 150 | 250   | -    |      |
|                       |                                         | V <sub>CE</sub> = -5 V; I <sub>C</sub> = -1 A; pulsed; t <sub>p</sub> ≤ 300 μs; δ ≤ 0.02; T <sub>amb</sub> = 25 °C    |  | 100 | 160   | -    |      |
| V <sub>CEsat</sub>    | collector-emitter saturation voltage    | I <sub>C</sub> = -100 mA; I <sub>B</sub> = -1 mA; T <sub>amb</sub> = 25 °C                                            |  | -   | -110  | -165 | mV   |
|                       |                                         | I <sub>C</sub> = -500 mA; I <sub>B</sub> = -50 mA; T <sub>amb</sub> = 25 °C                                           |  | -   | -120  | -175 | mV   |
|                       |                                         | I <sub>C</sub> = -1 A; I <sub>B</sub> = -100 mA; pulsed; t <sub>p</sub> ≤ 300 μs; δ ≤ 0.02; T <sub>amb</sub> = 25 °C  |  | -   | -250  | -330 | mV   |
| R <sub>CEsat</sub>    | collector-emitter saturation resistance |                                                                                                                       |  | -   | 250   | 330  | mΩ   |
| V <sub>BEsat</sub>    | base-emitter saturation voltage         | I <sub>C</sub> = -1 A; I <sub>B</sub> = -50 mA; pulsed; t <sub>p</sub> ≤ 300 μs; δ ≤ 0.02; T <sub>amb</sub> = 25 °C   |  | -   | -0.95 | -1.1 | V    |
| V <sub>BEon</sub>     | base-emitter turn-on voltage            | V <sub>CE</sub> = -5 V; I <sub>C</sub> = -1 A; pulsed; t <sub>p</sub> ≤ 300 μs; δ ≤ 0.02; T <sub>amb</sub> = 25 °C    |  | -   | -0.82 | -0.9 | V    |
| t <sub>d</sub>        | delay time                              | I <sub>C</sub> = -0.5 A; I <sub>Bon</sub> = -25 mA; I <sub>Boff</sub> = 25 mA; T <sub>amb</sub> = 25 °C               |  | -   | 11    | -    | ns   |
| t <sub>r</sub>        | rise time                               |                                                                                                                       |  | -   | 30    | -    | ns   |
| t <sub>on</sub>       | turn-on time                            |                                                                                                                       |  | -   | 41    | -    | ns   |
| t <sub>s</sub>        | storage time                            |                                                                                                                       |  | -   | 205   | -    | ns   |
| t <sub>f</sub>        | fall time                               |                                                                                                                       |  | -   | 55    | -    | ns   |
| t <sub>off</sub>      | turn-off time                           |                                                                                                                       |  | -   | 260   | -    | ns   |
| f <sub>T</sub>        | transition frequency                    | V <sub>CE</sub> = -10 V; I <sub>C</sub> = -50 mA; f = 100 MHz; T <sub>amb</sub> = 25 °C                               |  | 150 | 185   | -    | MHz  |
| C <sub>c</sub>        | collector capacitance                   | V <sub>CB</sub> = -10 V; I <sub>E</sub> = 0 A; i <sub>e</sub> = 0 A; f = 1 MHz; T <sub>amb</sub> = 25 °C              |  | -   | 9     | 15   | pF   |

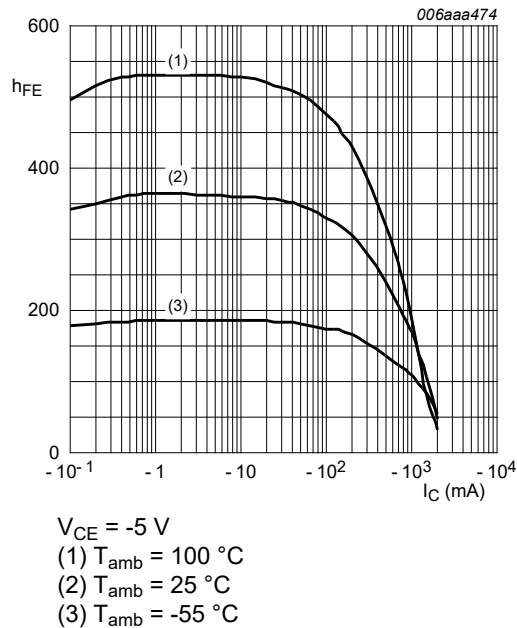


Fig. 5. DC current gain as a function of collector current; typical values

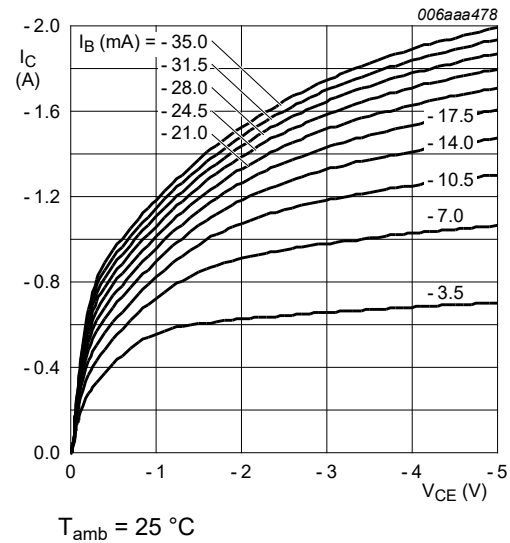


Fig. 6. Collector current as a function of collector-emitter voltage; typical values

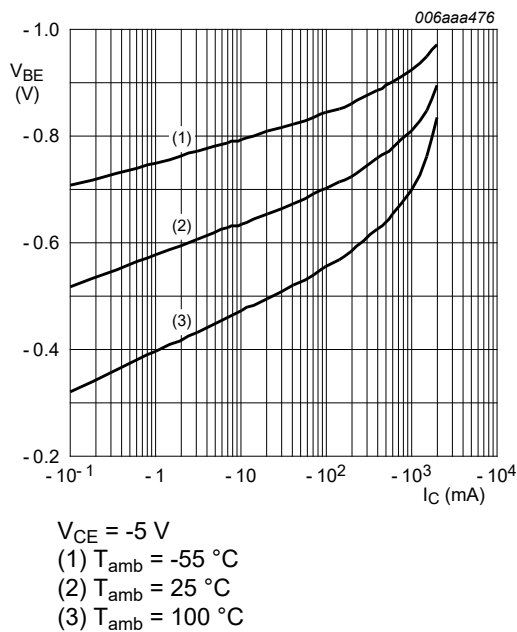


Fig. 7. Base-emitter voltage as a function of collector current; typical values

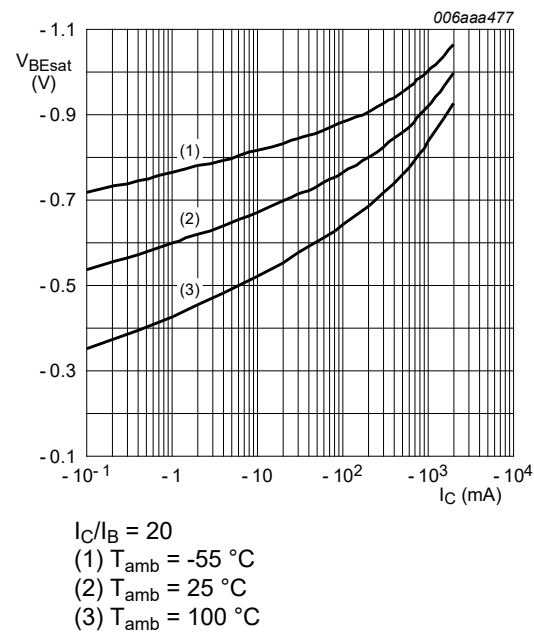


Fig. 8. Base-emitter saturation voltage as a function of collector current; typical values

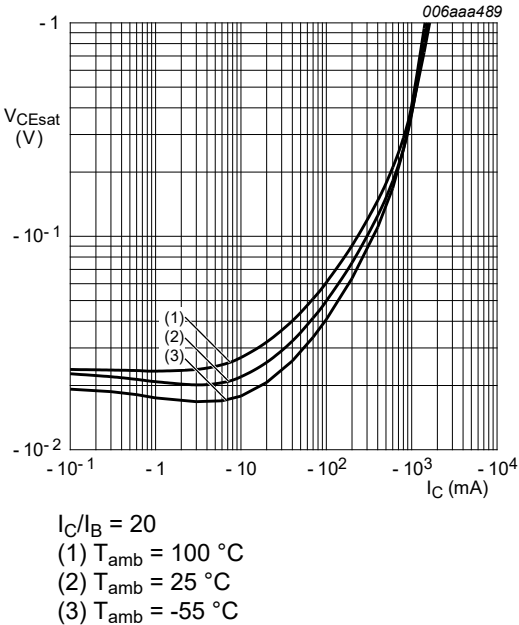


Fig. 9. Collector-emitter saturation voltage as a function of collector current; typical values

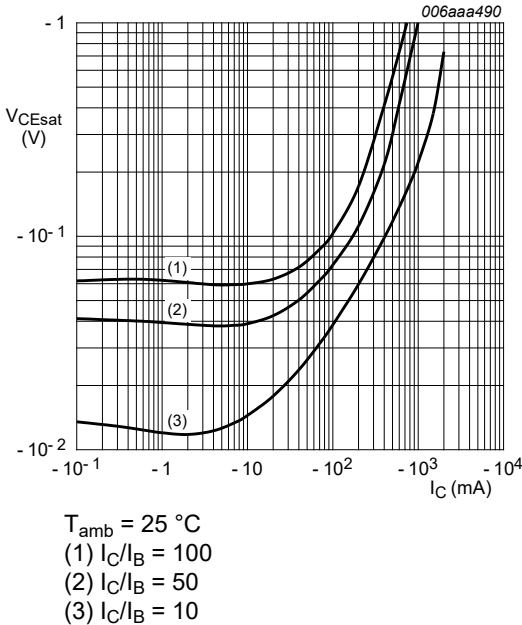


Fig. 10. Collector-emitter saturation voltage as a function of collector current; typical values

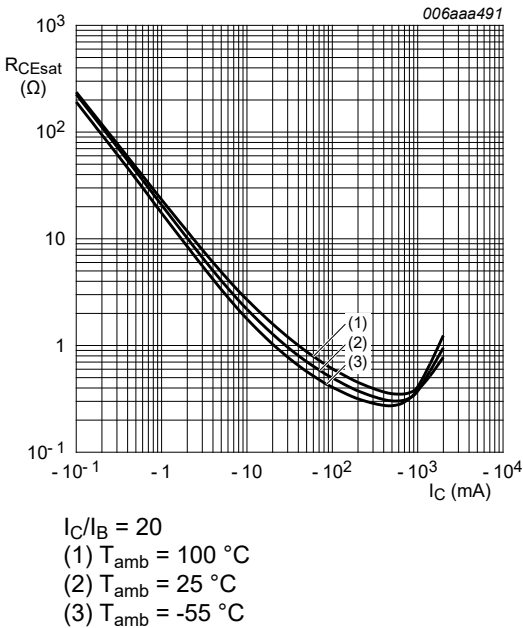


Fig. 11. Collector-emitter saturation resistance as a function of collector current; typical values

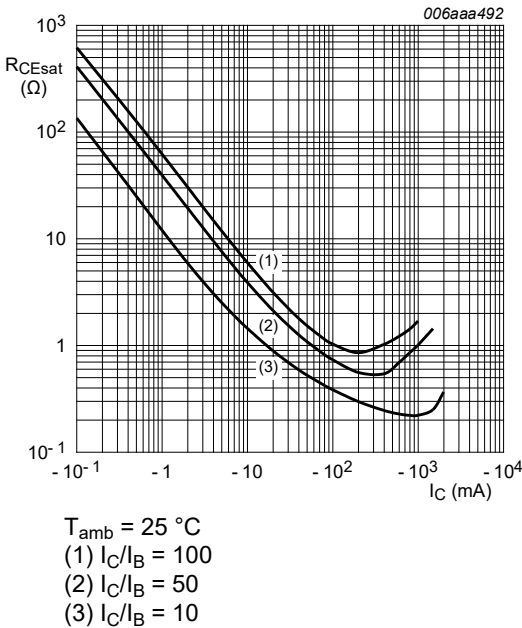


Fig. 12. Collector-emitter saturation resistance as a function of collector current; typical values



11. Test information

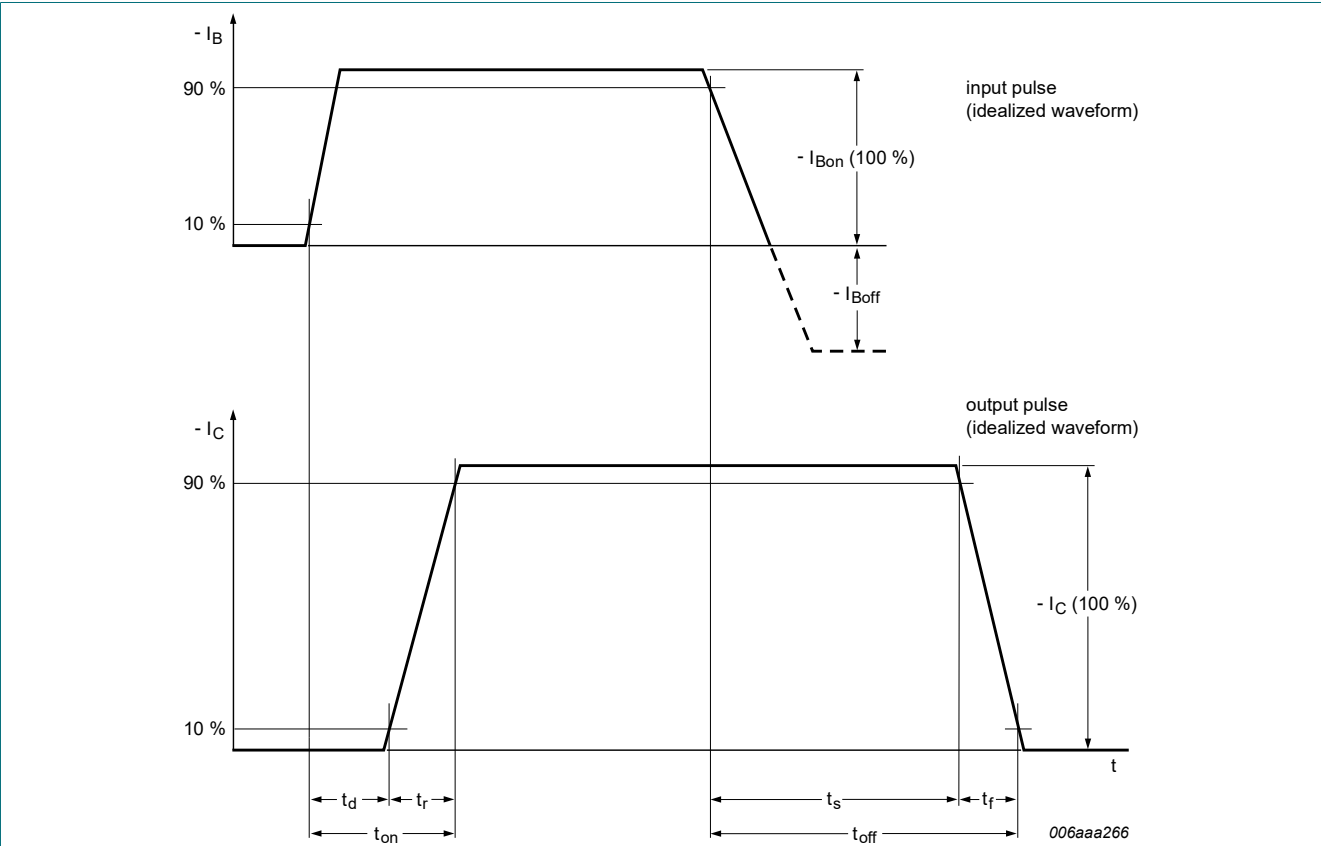
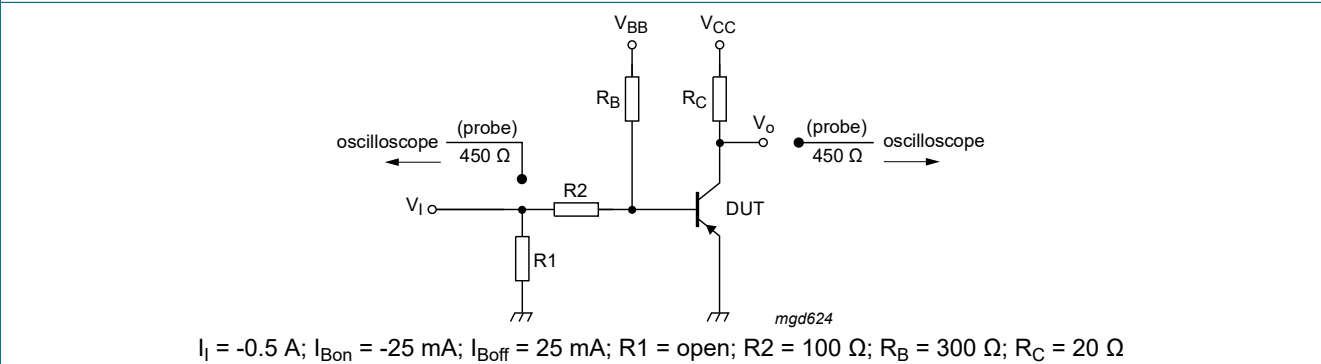


Fig. 13. Transistor switching time definition



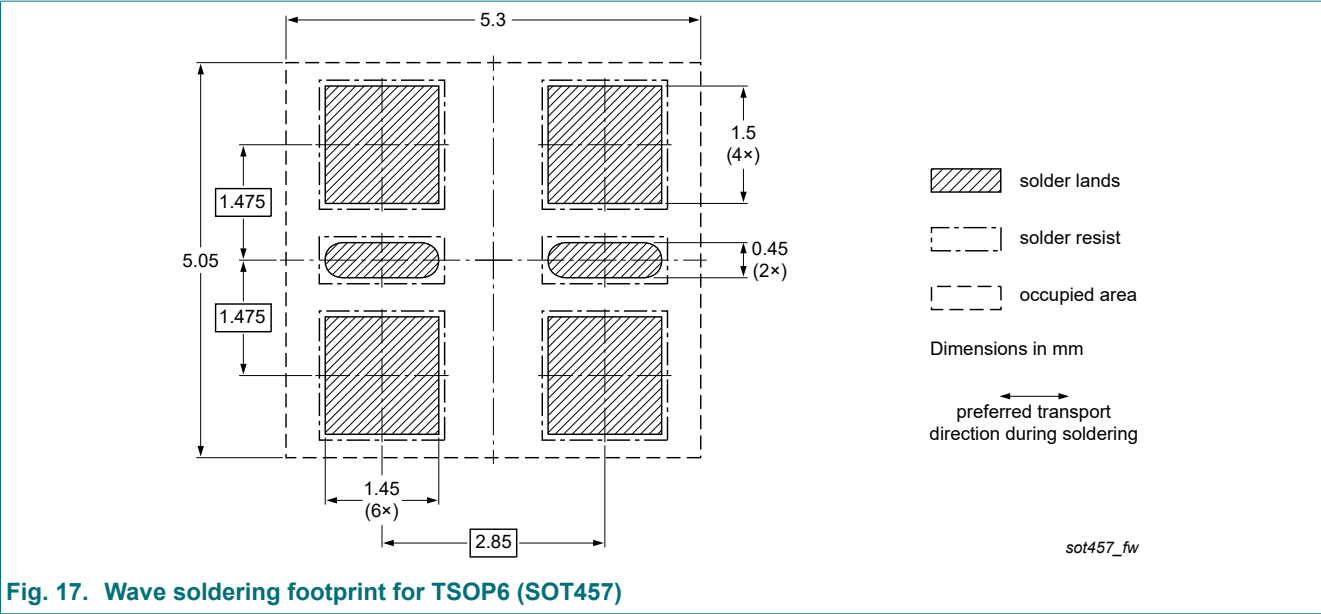
$I_I = -0.5\text{ A}$ ;  $I_{B\text{on}} = -25\text{ mA}$ ;  $I_{B\text{off}} = 25\text{ mA}$ ;  $R_1 = \text{open}$ ;  $R_2 = 100\text{ }\Omega$ ;  $R_B = 300\text{ }\Omega$ ;  $R_C = 20\text{ }\Omega$

Fig. 14. Test circuit for switching times

Quality information

This product has been qualified in accordance with the Automotive Electronics Council (AEC) standard Q101 - Stress test qualification for discrete semiconductors, and is suitable for use in automotive applications.





14. Revision history

Table 8. Revision history

| Data sheet ID  | Release date                                                                                                                                                                                                                                                                          | Data sheet status    | Change notice | Supersedes   |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|---------------|--------------|
| PBSS5160DS v.4 | 20231106                                                                                                                                                                                                                                                                              | Product data sheet   | -             | PBSS5160DS_3 |
| Modifications: | <ul style="list-style-type: none"><li>The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia.</li><li>Legal texts have been adapted to the new company name where appropriate.</li><li>Section "Packing information" removed.</li></ul> |                      |               |              |
| PBSS5160DS_3   | 20081009                                                                                                                                                                                                                                                                              | Product data sheet   | -             | PBSS5160DS_2 |
| PBSS5160DS_2   | 20050628                                                                                                                                                                                                                                                                              | Product data sheet   | -             | PBSS5160DS_1 |
| PBSS5160DS_1   | 20040716                                                                                                                                                                                                                                                                              | Objective data sheet | -             | -            |

## 15. Legal information

### 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".
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Contents

1. General description..... 1

2. Features and benefits..... 1

3. Applications..... 1

4. Quick reference data..... 1

5. Pinning information.....2

6. Ordering information.....2

7. Marking.....2

8. Limiting values..... 3

9. Thermal characteristics..... 4

10. Characteristics..... 6

11. Test information..... 9

12. Package outline..... 10

13. Soldering..... 10

14. Revision history.....12

15. Legal information.....13

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Date of release: 6 November 2023

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