

# PMD9010D

## MOSFET driver

Rev. 01 — 20 November 2006

Product data sheet

## 1. Product profile

### 1.1 General description

Two NPN transistors and high-speed switching diode connected in totem pole configuration in a small SOT457 (SC-74) Surface-Mounted Device (SMD) plastic package.

### 1.2 Features

- Two general-purpose transistors and one high-speed switching diode as driver
- Totem pole configuration
- Application-optimized pinout
- Internal connections to minimize layout effort
- Space-saving solution
- Reduces component count

### 1.3 Applications

- MOSFET driver

### 1.4 Quick reference data

Table 1. Quick reference data

| Symbol                | Parameter                 | Conditions                       | Min | Typ | Max  | Unit |
|-----------------------|---------------------------|----------------------------------|-----|-----|------|------|
| <b>Per transistor</b> |                           |                                  |     |     |      |      |
| $V_{CE0}$             | collector-emitter voltage | open base                        | -   | -   | 45   | V    |
| $I_C$                 | collector current         |                                  | -   | -   | 0.1  | A    |
| $I_{CM}$              | peak collector current    | single pulse;<br>$t_p \leq 1$ ms | -   | -   | 0.2  | A    |
| <b>Diode (D1)</b>     |                           |                                  |     |     |      |      |
| $I_F$                 | forward current           |                                  | -   | -   | -0.2 | A    |
| $V_F$                 | forward voltage           | $I_F = -200$ mA                  | [1] | -   | -1.1 | V    |

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

## 2. Pinning information

**Table 2. Pinning**

| Pin | Symbol | Description        | Simplified outline | Symbol |
|-----|--------|--------------------|--------------------|--------|
| 1   | OUT    | output             |                    |        |
| 2   | GND    | ground             |                    |        |
| 3   | IN     | input              |                    |        |
| 4   | RC     | collector resistor |                    |        |
| 5   | RC     | collector resistor |                    |        |
| 6   | VCC    | supply voltage     |                    |        |

006aaa657

## 3. Ordering information

**Table 3. Ordering information**

| Type number | Package |  |         |
|-------------|---------|--|---------|
|             | Name    | Description                                      | Version |
| PMD9010D    | SC-74   | plastic surface-mounted package (TSOP6); 6 leads | SOT457  |

## 4. Marking

**Table 4. Marking codes**

| Type number | Marking code |
|-------------|--------------|
| PMD9010D    | AA           |

## 5. Limiting values

**Table 5. Limiting values**

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

| Symbol                    | Parameter                 | Conditions                       | Min | Max | Unit |
|---------------------------|---------------------------|----------------------------------|-----|-----|------|
| <b>Transistor 1 (TR1)</b> |                           |                                  |     |     |      |
| $V_{CBO}$                 | collector-base voltage    | open emitter                     | -   | 50  | V    |
| $V_{CEO}$                 | collector-emitter voltage | open base                        | -   | 45  | V    |
| $V_{EBO}$                 | emitter-base voltage      | open collector                   | -   | 5   | V    |
| $I_C$                     | collector current         |                                  | -   | 0.1 | A    |
| $I_{CM}$                  | peak collector current    | single pulse;<br>$t_p \leq 1$ ms | -   | 0.2 | A    |

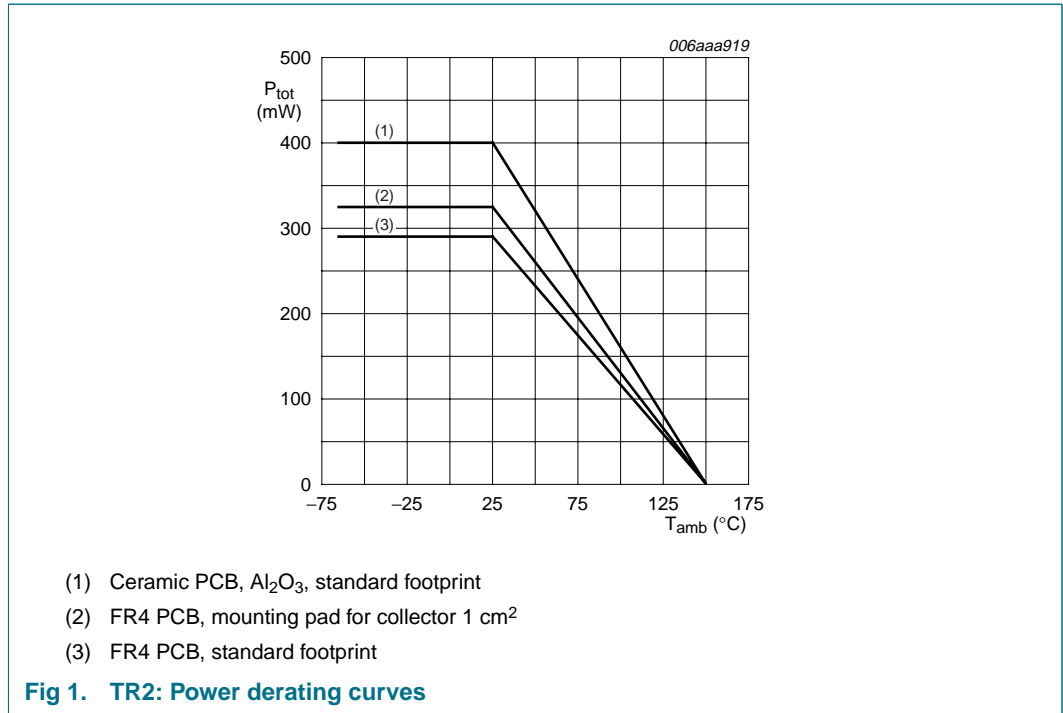
**Table 5. Limiting values ...continued**  
*In accordance with the Absolute Maximum Rating System (IEC 60134).*

| Symbol                    | Parameter                           | Conditions                          | Min | Max  | Unit |    |
|---------------------------|-------------------------------------|-------------------------------------|-----|------|------|----|
| <b>Transistor 2 (TR2)</b> |                                     |                                     |     |      |      |    |
| $V_{CBO}$                 | collector-base voltage              | open emitter                        | -   | 50   | V    |    |
| $V_{CEO}$                 | collector-emitter voltage           | open base                           | -   | 45   | V    |    |
| $I_C$                     | collector current                   |                                     | -   | 0.1  | A    |    |
| $I_{CM}$                  | peak collector current              | single pulse;<br>$t_p \leq 1$ ms    | -   | 0.2  | A    |    |
| $I_{BM}$                  | peak base current                   | single pulse;<br>$t_p \leq 1$ ms    | -   | 0.2  | A    |    |
| $P_{tot}$                 | total power dissipation             | $T_{amb} \leq 25$ °C                | [1] | -    | 290  | mW |
|                           |                                     |                                     | [2] | -    | 325  | mW |
|                           |                                     |                                     | [3] | -    | 400  | mW |
| <b>Diode (D1)</b>         |                                     |                                     |     |      |      |    |
| $I_F$                     | forward current                     |                                     | -   | -0.2 | A    |    |
| $I_{FRM}$                 | repetitive peak forward current     | $t_p \leq 1$ ms; $\delta \leq 0.25$ | -   | -0.6 | A    |    |
| $I_{FSM}$                 | non-repetitive peak forward current | square wave                         |     |      |      |    |
|                           |                                     | $t_p = 1$ $\mu$ s                   | -   | -9   | A    |    |
|                           |                                     | $t_p = 100$ $\mu$ s                 | -   | -3   | A    |    |
|                           |                                     | $t_p = 10$ ms                       | -   | -1.7 | A    |    |
| <b>Device</b>             |                                     |                                     |     |      |      |    |
| $T_j$                     | junction temperature                |                                     | -   | 150  | °C   |    |
| $T_{amb}$                 | ambient temperature                 |                                     | -65 | +150 | °C   |    |
| $T_{stg}$                 | storage temperature                 |                                     | -65 | +150 | °C   |    |

[1] Device mounted on an FR4 Printed-Circuit Board (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.



## 6. Thermal characteristics

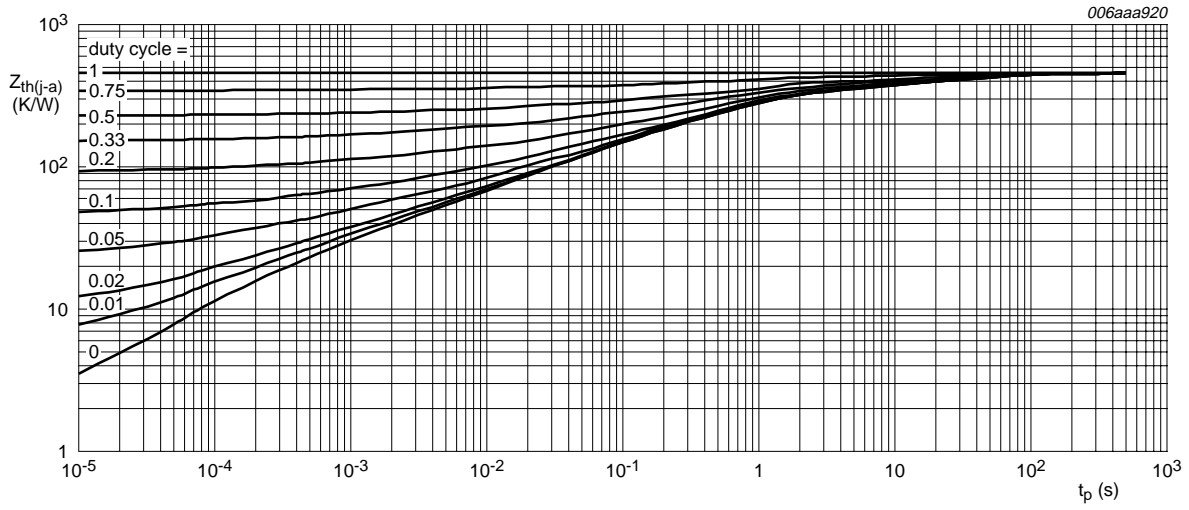
**Table 6. Thermal characteristics**

| Symbol                    | Parameter                                   | Conditions  | Min | Typ | Max | Unit |     |
|---------------------------|---|-------------|-----|-----|-----|------|-----|
| <b>Transistor 2 (TR2)</b> |   |             |     |     |     |      |     |
| R <sub>th(j-a)</sub>      | thermal resistance from junction to ambient | in free air | [1] | -   | -   | 430  | K/W |
|                           |   |             | [2] | -   | -   | 385  | K/W |
|                           |   |             | [3] | -   | -   | 312  | K/W |

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

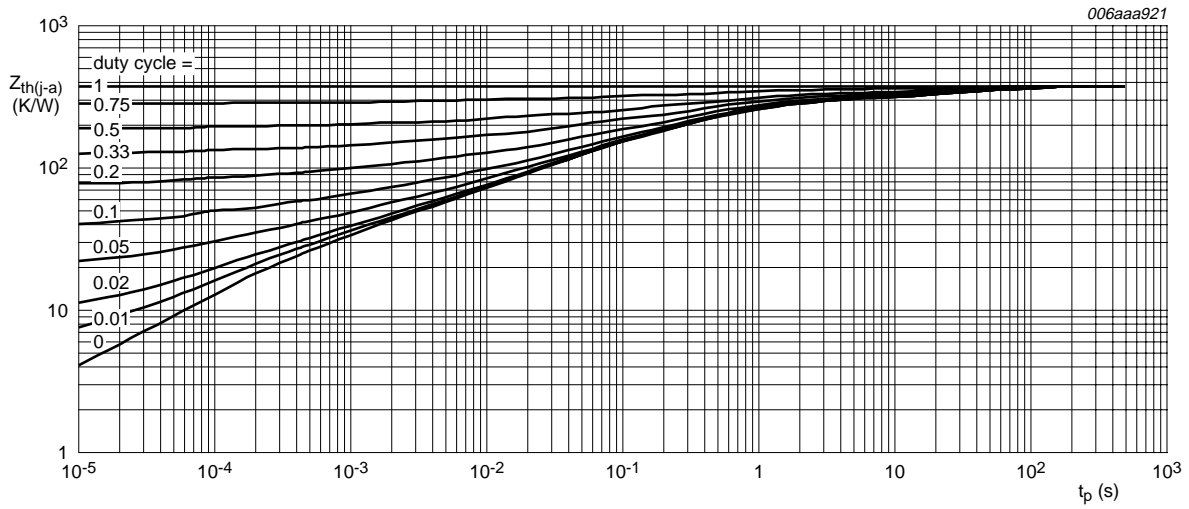
[2] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 1 cm<sup>2</sup>.

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



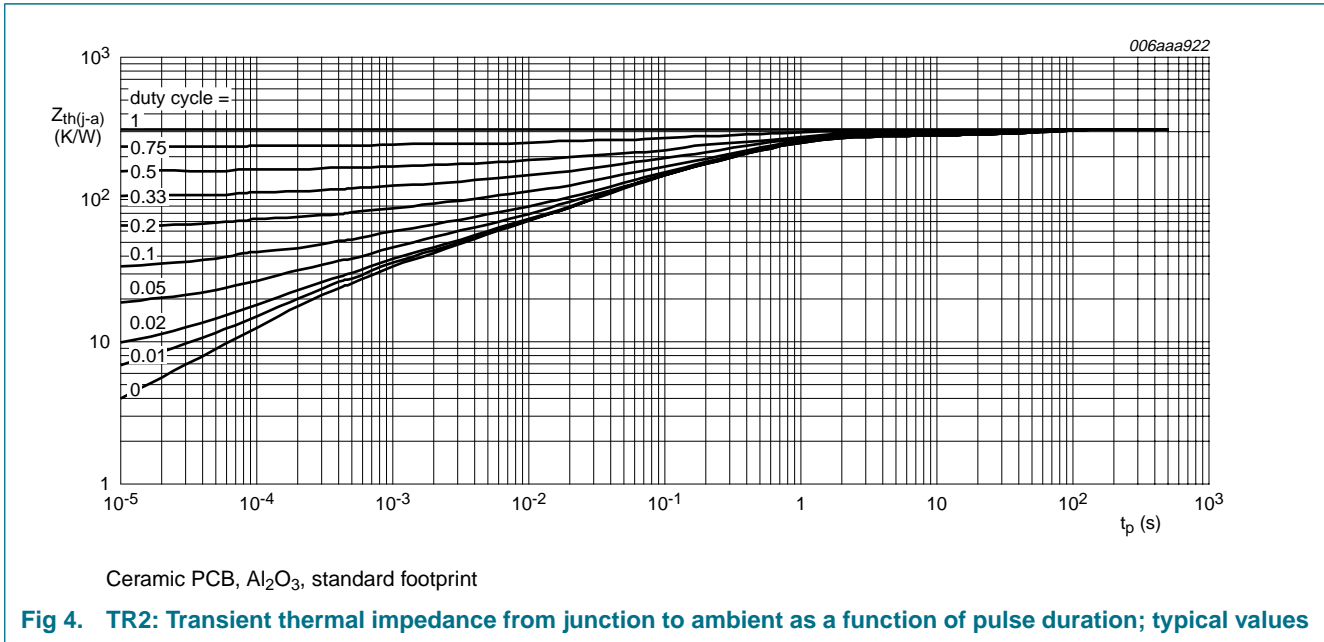
FR4 PCB, standard footprint

Fig 2. TR2: Transient thermal impedance from junction to ambient as a function of pulse duration; typical values



FR4 PCB, mounting pad for collector 1 cm<sup>2</sup>

Fig 3. TR2: Transient thermal impedance from junction to ambient as a function of pulse duration; typical values



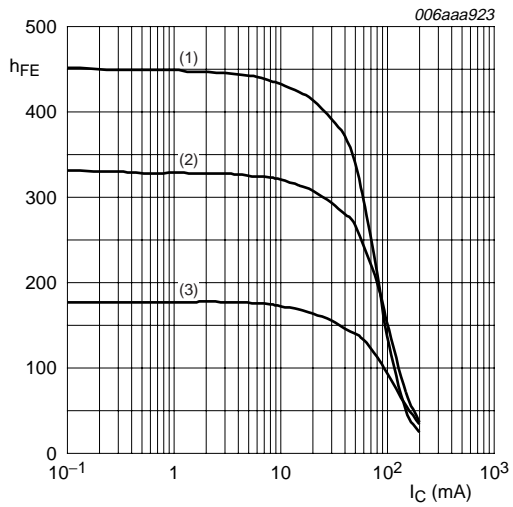
## 7. Characteristics

**Table 7. Characteristics**

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

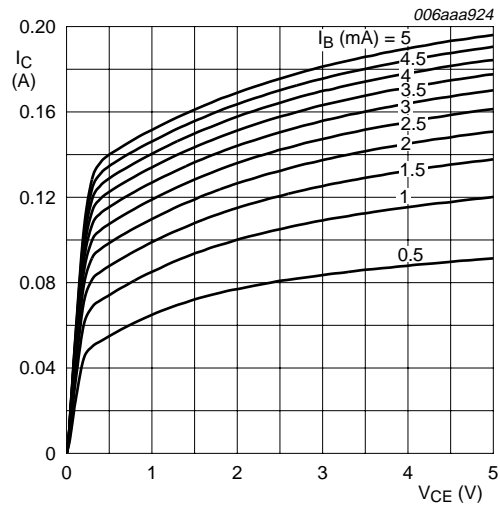
| Symbol                    | Parameter                            | Conditions  | Min | Typ  | Max  | Unit          |
|---------------------------|--------------------------------------|---|-----|------|------|---------------|
| <b>Transistor 1 (TR1)</b> |                                      |   |     |      |      |               |
| $I_{CBO}$                 | collector-base cut-off current       | $V_{CB} = 30\text{ V}; I_E = 0\text{ A}$                                    | -   | -    | 100  | nA            |
| $I_{CEO}$                 | collector-emitter cut-off current    | $V_{CE} = 30\text{ V}; I_B = 0\text{ A}; T_j = 150\text{ }^{\circ}\text{C}$ | -   | -    | 50   | $\mu\text{A}$ |
| $I_{EBO}$                 | emitter-base cut-off current         | $V_{EB} = 5\text{ V}; I_C = 0\text{ A}$                                     | -   | -    | 0.1  | mA            |
| $h_{FE}$                  | DC current gain                      | $V_{CE} = 5\text{ V}; I_C = 1\text{ mA}$                                    | 200 | 290  | 450  |               |
| $V_{CEsat}$               | collector-emitter saturation voltage | $I_C = 10\text{ mA}; I_B = 0.5\text{ mA}$                                   | -   | 60   | 200  | mV            |
| $V_{BEsat}$               | base-emitter saturation voltage      | $I_C = 10\text{ mA}; I_B = 0.5\text{ mA}$                                   | -   | 0.7  | -    | V             |
| $V_{BE}$                  | base-emitter voltage                 | $V_{CE} = 5\text{ V}; I_C = 2\text{ mA}$                                    | -   | 660  | -    | mV            |
| <b>Transistor 2 (TR2)</b> |                                      |   |     |      |      |               |
| $I_{CBO}$                 | collector-base cut-off current       | $V_{CB} = 30\text{ V}; I_E = 0\text{ A}$                                    | -   | -    | 15   | nA            |
|                           |                                      | $V_{CB} = 30\text{ V}; I_E = 0\text{ A}; T_j = 150\text{ }^{\circ}\text{C}$ | -   | -    | 5    | $\mu\text{A}$ |
| $V_{CEsat}$               | collector-emitter saturation voltage | $I_C = 10\text{ mA}; I_B = 0.5\text{ mA}$                                   | -   | 60   | 200  | mV            |
|                           |                                      | $I_C = 100\text{ mA}; I_B = 5\text{ mA}$                                    | -   | 200  | 400  | mV            |
|                           |                                      | $I_C = 200\text{ mA}; I_B = 20\text{ mA}$                                   | -   | 340  | 500  | mV            |
| $V_{BEsat}$               | base-emitter saturation voltage      | $I_C = 10\text{ mA}; I_B = 0.5\text{ mA}$                                   | -   | 0.7  | -    | V             |
|                           |                                      | $I_C = 100\text{ mA}; I_B = 5\text{ mA}$                                    | -   | 0.9  | -    | V             |
| $V_{BE}$                  | base-emitter voltage                 | $V_{CE} = 5\text{ V}; I_C = 2\text{ mA}$                                    | 610 | 660  | 710  | mV            |
|                           |                                      | $V_{CE} = 5\text{ V}; I_C = 10\text{ mA}$                                   | -   | -    | 770  | mV            |
| <b>Diode (D1)</b>         |                                      |   |     |      |      |               |
| $V_F$                     | forward voltage                      | $I_F = -200\text{ mA}$  | [1] | -    | -1.1 | V             |
| <b>TR2 and D1</b>         |                                      |   |     |      |      |               |
| $h_{FE}$                  | DC current gain                      | $V_{CE} = 5\text{ V}; I_C = 1\text{ mA}$                                    | 200 | 290  | 450  |               |
|                           |                                      | $V_{CE} = 5\text{ V}; I_C = 100\text{ mA}$                                  | 95  | 140  | -    |               |
|                           |                                      | $V_{CE} = 5\text{ V}; I_C = 200\text{ mA}$                                  | 24  | 35   | -    |               |
| <b>Device</b>             |                                      |   |     |      |      |               |
| $t_d$                     | delay time                           | $I_C = 0.05\text{ A}; I_B = 2.5\text{ mA}$                                  | -   | 13   | -    | ns            |
| $t_r$                     | rise time                            |   | -   | 77   | -    | ns            |
| $t_{on}$                  | turn-on time                         |   | -   | 90   | -    | ns            |
| $t_s$                     | storage time                         |   | -   | 853  | -    | ns            |
| $t_f$                     | fall time                            |   | -   | 205  | -    | ns            |
| $t_{off}$                 | turn-off time                        |   | -   | 1058 | -    | ns            |

[1] Pulse test:  $t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02$ .



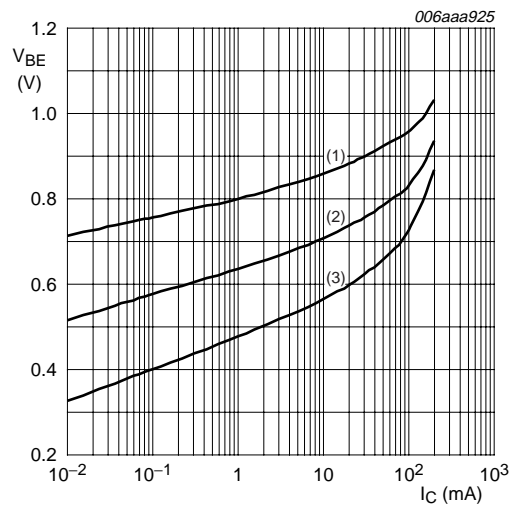
$V_{CE} = 5\text{ V}$   
 (1)  $T_{amb} = 100\text{ }^{\circ}\text{C}$   
 (2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$   
 (3)  $T_{amb} = -55\text{ }^{\circ}\text{C}$

**Fig 5. TR1: DC current gain as a function of collector current; typical values**



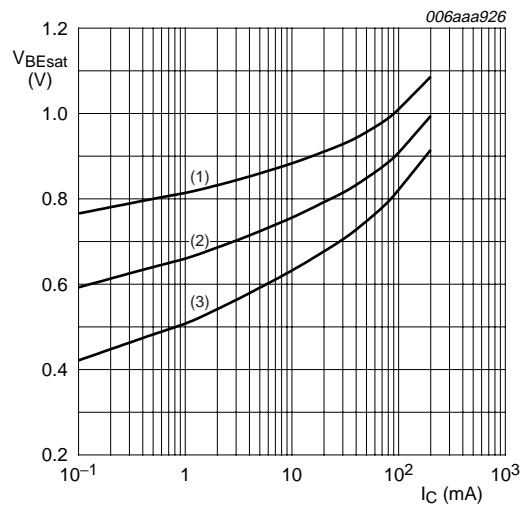
$T_{amb} = 25\text{ }^{\circ}\text{C}$

**Fig 6. TR1: Collector current as a function of collector-emitter voltage; typical values**



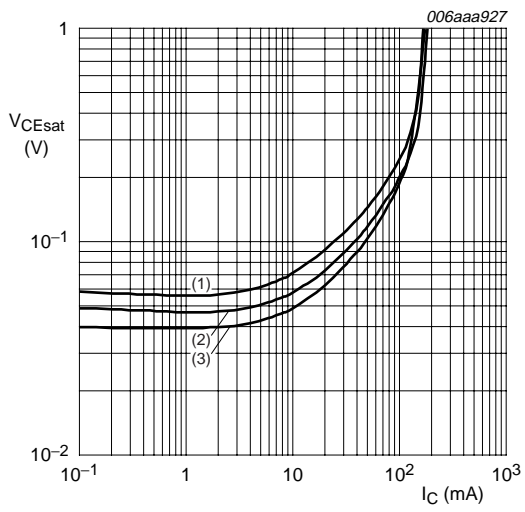
$V_{CE} = 5\text{ V}$   
 (1)  $T_{amb} = -55\text{ }^{\circ}\text{C}$   
 (2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$   
 (3)  $T_{amb} = 100\text{ }^{\circ}\text{C}$

**Fig 7. TR1: Base-emitter voltage as a function of collector current; typical values**



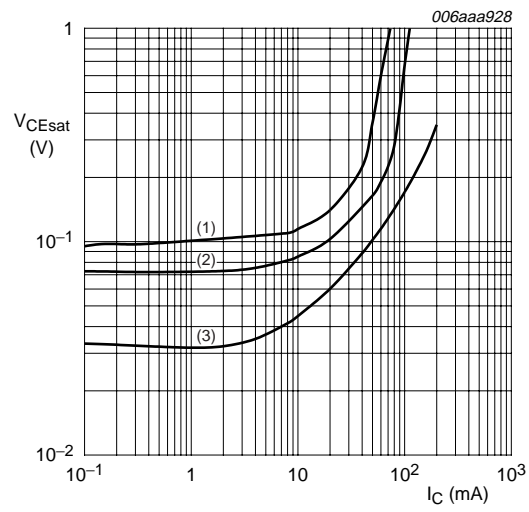
$I_C/I_B = 20$   
 (1)  $T_{amb} = -55\text{ }^{\circ}\text{C}$   
 (2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$   
 (3)  $T_{amb} = 100\text{ }^{\circ}\text{C}$

**Fig 8. TR1: Base-emitter saturation voltage as a function of collector current; typical values**



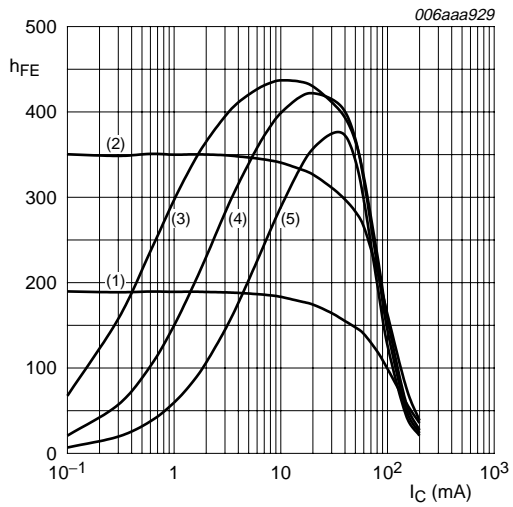
- $I_C/I_B = 20$
- (1)  $T_{amb} = 100\text{ °C}$
  - (2)  $T_{amb} = 25\text{ °C}$
  - (3)  $T_{amb} = -55\text{ °C}$

**Fig 9. TR1: Collector-emitter saturation voltage as a function of collector current; typical values**



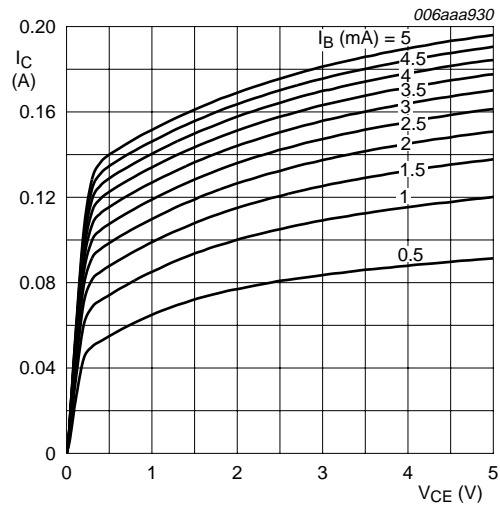
- $T_{amb} = 25\text{ °C}$
- (1)  $I_C/I_B = 100$
  - (2)  $I_C/I_B = 50$
  - (3)  $I_C/I_B = 10$

**Fig 10. TR1: Collector-emitter saturation voltage as a function of collector current; typical values**



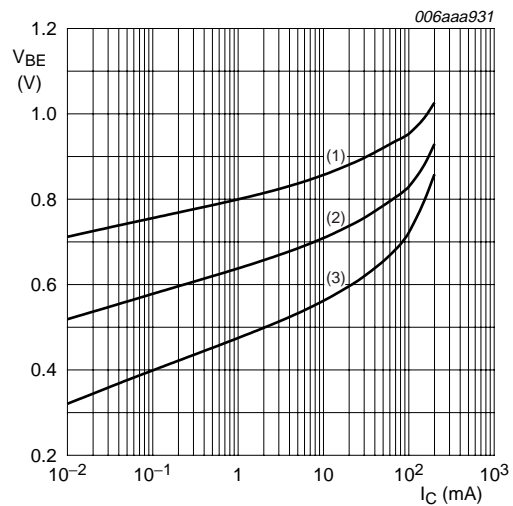
$V_{CE} = 5\text{ V}$   
 (1)  $T_{amb} = -55\text{ }^{\circ}\text{C}$   
 (2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$   
 (3)  $T_{amb} = 100\text{ }^{\circ}\text{C}$   
 (4)  $T_{amb} = 125\text{ }^{\circ}\text{C}$   
 (5)  $T_{amb} = 150\text{ }^{\circ}\text{C}$

**Fig 11. TR2 and D1: DC current gain as a function of collector current; typical values**



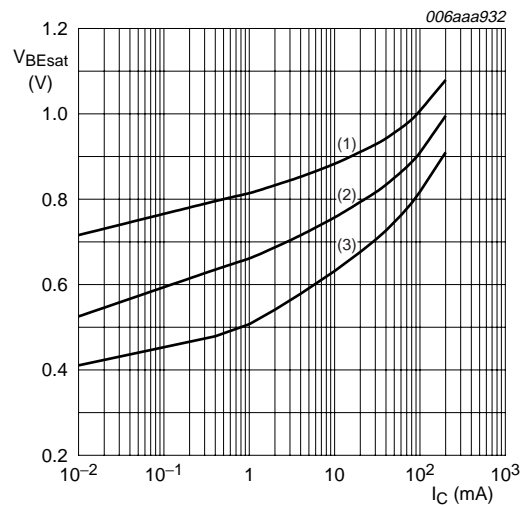
$T_{amb} = 25\text{ }^{\circ}\text{C}$

**Fig 12. TR2: Collector current as a function of collector-emitter voltage; typical values**



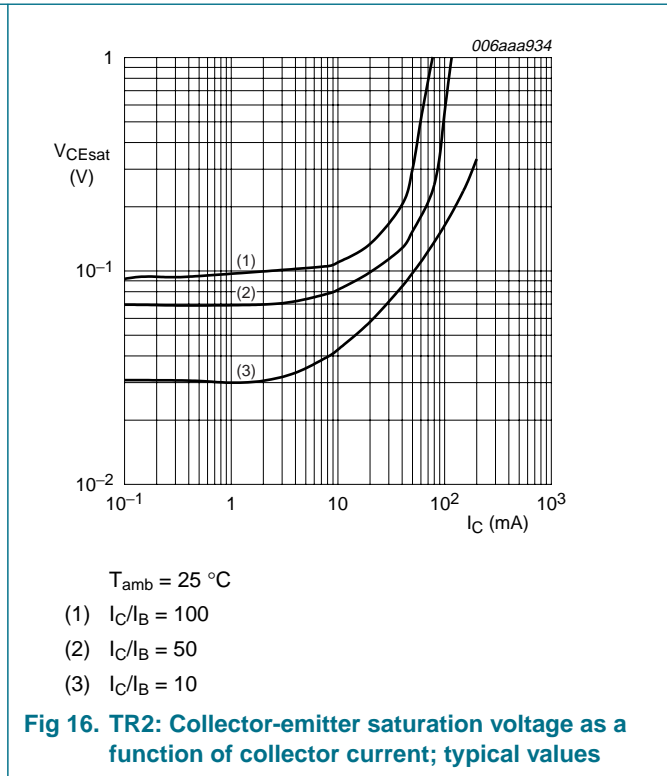
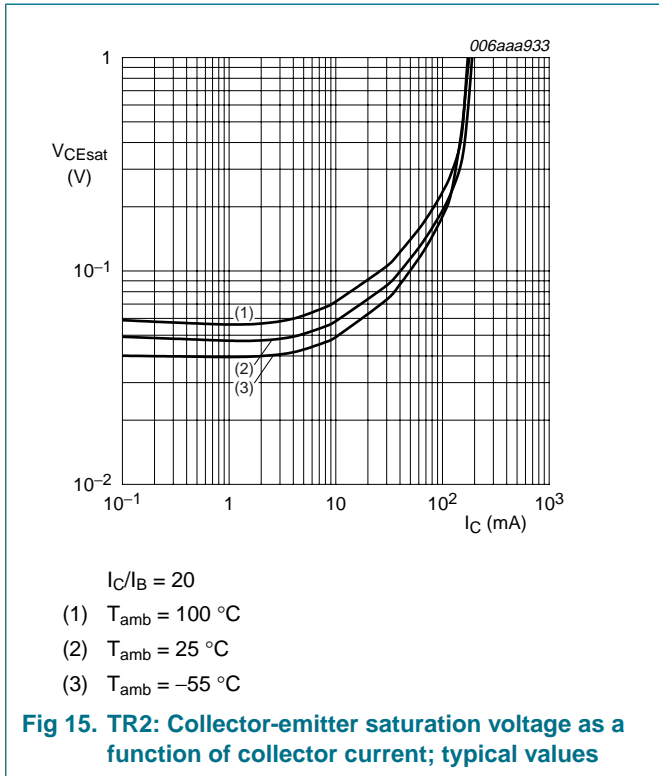
$V_{CE} = 5\text{ V}$   
 (1)  $T_{amb} = -55\text{ }^{\circ}\text{C}$   
 (2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$   
 (3)  $T_{amb} = 100\text{ }^{\circ}\text{C}$

**Fig 13. TR2: Base-emitter voltage as a function of collector current; typical values**

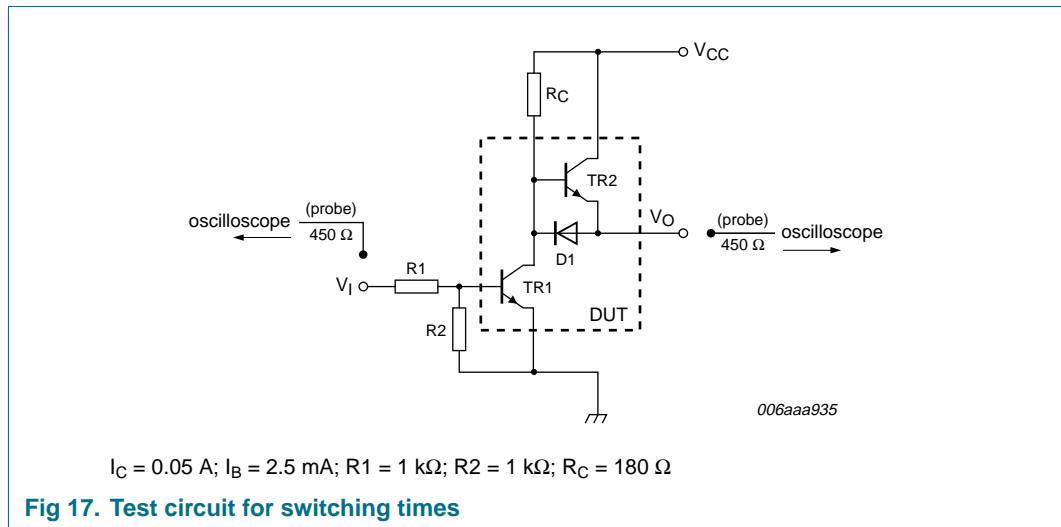


$I_C/I_B = 20$   
 (1)  $T_{amb} = -55\text{ }^{\circ}\text{C}$   
 (2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$   
 (3)  $T_{amb} = 100\text{ }^{\circ}\text{C}$

**Fig 14. TR2: Base-emitter saturation voltage as a function of collector current; typical values**



## 8. Test information



## 9. Package outline

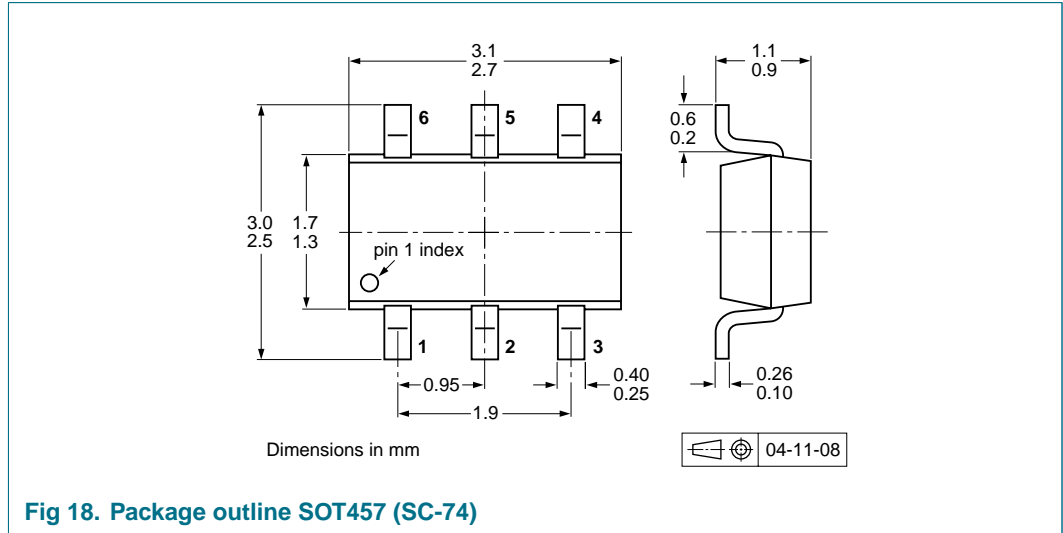


Fig 18. Package outline SOT457 (SC-74)

## 10. Packing information

**Table 8. Packing methods**

The indicated -xxx are the last three digits of the 12NC ordering code.<sup>[1]</sup>

| Type number | Package | Description                                       | Packing quantity |       |
|-------------|---------|---|------------------|-------|
|             |         |   | 3000             | 10000 |
| PMD9010D    | SOT457  | 4 mm pitch, 8 mm tape and reel; T1 <sup>[2]</sup> | -115             | -135  |
|             |         | 4 mm pitch, 8 mm tape and reel; T2 <sup>[3]</sup> | -125             | -165  |

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

[2] T1: normal taping

[3] T2: reverse taping

11. Soldering

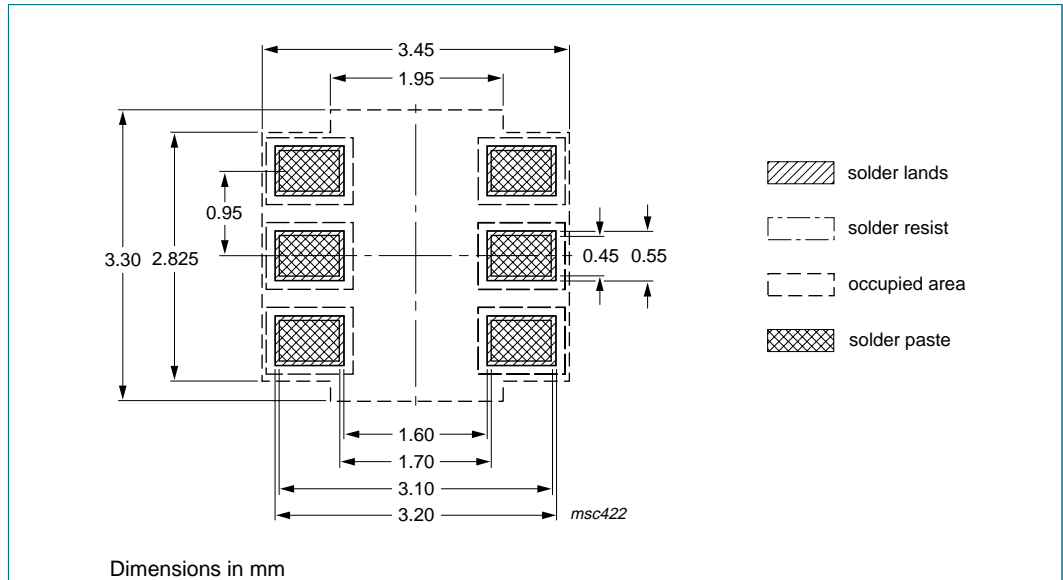


Fig 19. Reflow soldering footprint SOT457 (SC-74)

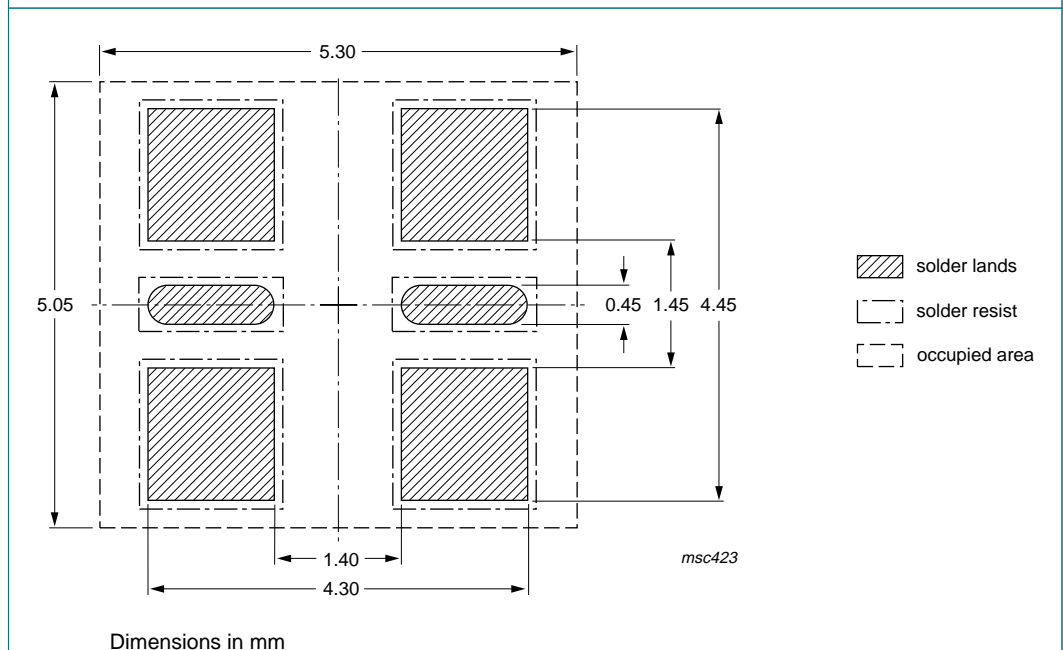


Fig 20. Wave soldering footprint SOT457 (SC-74)

## 12. Revision history

Table 9. Revision history

| Document ID | Release date | Data sheet status  | Change notice | Supersedes |
|-------------|--------------|--------------------|---------------|------------|
| PMD9010D_1  | 20061120     | Product data sheet | -             | -          |

## 13. Legal information

### 13.1 Data sheet status

| Document status <sup>[1][2]</sup> | Product status <sup>[3]</sup> | 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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