

# PMD5001K

## MOSFET driver

Rev. 01 — 3 November 2006 Product data sheet

## 1. Product profile

### 1.1 General description

PNP transistor and high-speed switching diode to protect the base-emitter junction in reverse direction in a SOT346 (SC-59A/TO-236) small Surface-Mounted Device (SMD) plastic package.

### 1.2 Features

- General-purpose transistor and high-speed switching diode as driver
- High-speed switching diode to protect the base-emitter junction
- Application-optimized pinout
- Internal connections to minimize layout effort
- Space-saving solution
- Reduces component count

### 1.3 Applications

- Power MOSFET driver

### 1.4 Quick reference data

Table 1. Quick reference data

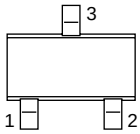
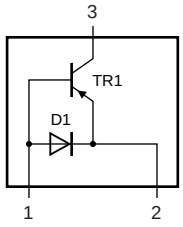
| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| **PNP transistor** | | | | | | | |
| $V_{CEO}$ | collector-emitter voltage | open base | | - | - | –40 | V |
| $I_C$ | collector current | | | - | - | –0.1 | A |
| $I_{CM}$ | peak collector current | single pulse; $t_p \leq 1$ ms | | - | - | –0.2 | A |
| **Diode** | | | | | | | |
| $I_F$ | forward current | | | - | - | 0.2 | A |
| $V_F$ | forward voltage | $I_F$ = 200 mA | [1] | - | - | 1.1 | V |

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

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## 2. Pinning information

Table 2. Pinning

| Pin | Description | Simplified outline | Symbol |
|---|---|---|---|
| 1 | base TR1, anode D1 |  |  |
| 2 | emitter TR1, cathode D1 | | |
| 3 | collector TR1 | | |





006aaa656

## 3. Ordering information

Table 3. Ordering information

| Type number | Package | | |
|---|---|---|---|
| | Name | Description | Version |
| PMD5001K | SC-59A | plastic surface-mounted package; 3 leads | SOT346 |

## 4. Marking

Table 4. Marking codes

| Type number | Marking code |
|---|---|
| PMD5001K | D4 |



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# 5. Limiting values

**Table 5. Limiting values**

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

| Symbol | Parameter | Conditions | | Min | Max | Unit |
|---|---|---|---|---|---|---|
| **PNP transistor** | | | | | | |
| $V_{CBO}$ | collector-base voltage | open emitter | | - | –40 | V |
| $V_{CEO}$ | collector-emitter voltage | open base | | - | –40 | V |
| $I_C$ | collector current | | | - | –0.1 | A |
| $I_{CM}$ | peak collector current | single pulse; $t_p \leq 1$ ms | | - | –0.2 | A |
| $I_B$ | base current | | | - | –0.1 | A |
| $I_{BM}$ | peak base current | single pulse; $t_p \leq 1$ ms | | - | –0.2 | A |
| $P_{tot}$ | total power dissipation | $T_{amb} \leq 25$ °C | [1] | - | 230 | mW |
| | | | [2] | - | 300 | mW |
| | | | [3] | - | 375 | mW |
| **Diode** | | | | | | |
| $I_F$ | forward current | | | - | 0.2 | A |
| $I_{FRM}$ | repetitive peak forward current | $t_p \leq 1$ ms; $\delta = 0.25$ | | - | 0.6 | A |
| $I_{FSM}$ | non-repetitive peak forward current | square wave | | | | |
| | | $t_p \leq 1$ µs | | - | 9 | A |
| | | $t_p \leq 100$ µs | | - | 3 | A |
| | | $t_p \leq 10$ ms | | - | 1.7 | A |
| **Device** | | | | | | |
| $T_j$ | junction temperature | | | - | 150 | °C |
| $T_{amb}$ | ambient temperature | | | –65 | +150 | °C |
| $T_{stg}$ | storage temperature | | | –65 | +150 | °C |

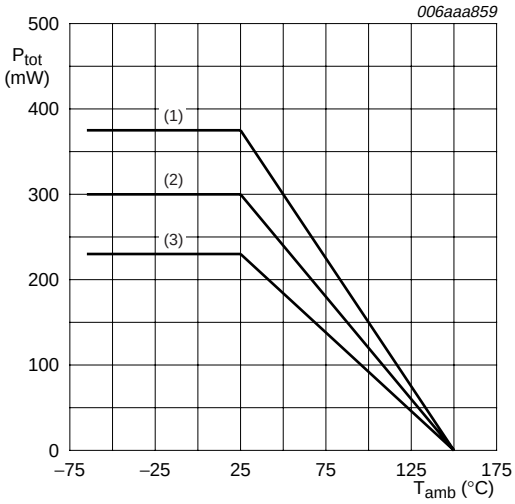
[1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated and standard footprint.

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

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



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

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

(3) FR4 PCB, standard footprint

**Fig 1. Power derating curves**

## 6. Thermal characteristics

**Table 6. Thermal characteristics**

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| **PNP transistor** | | | | | | | |
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | in free air | [1] | - | - | 540 | K/W |
| | | | [2] | - | - | 415 | K/W |
| | | | [3] | - | - | 330 | K/W |

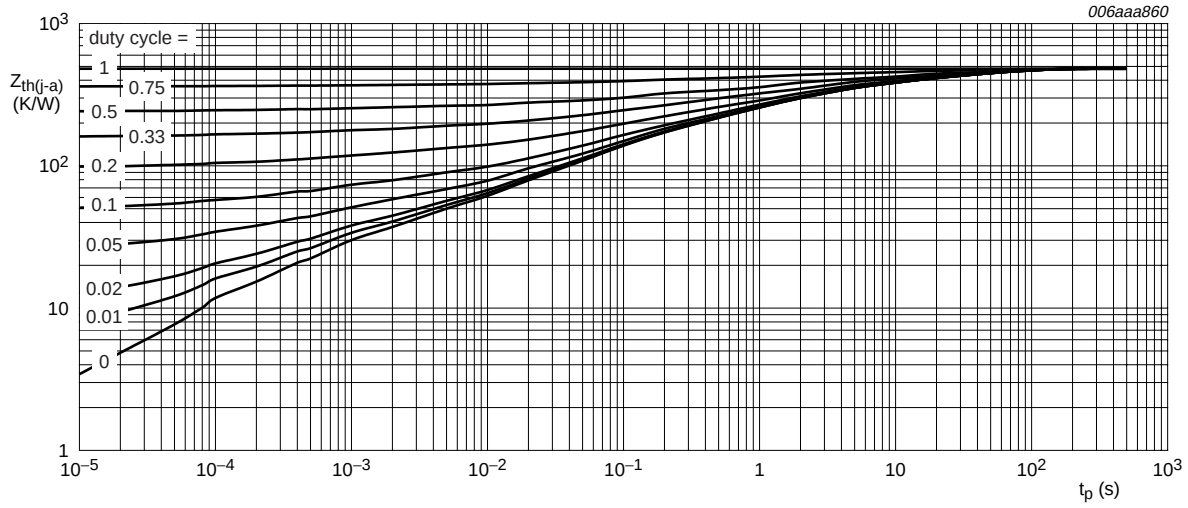
[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.

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

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

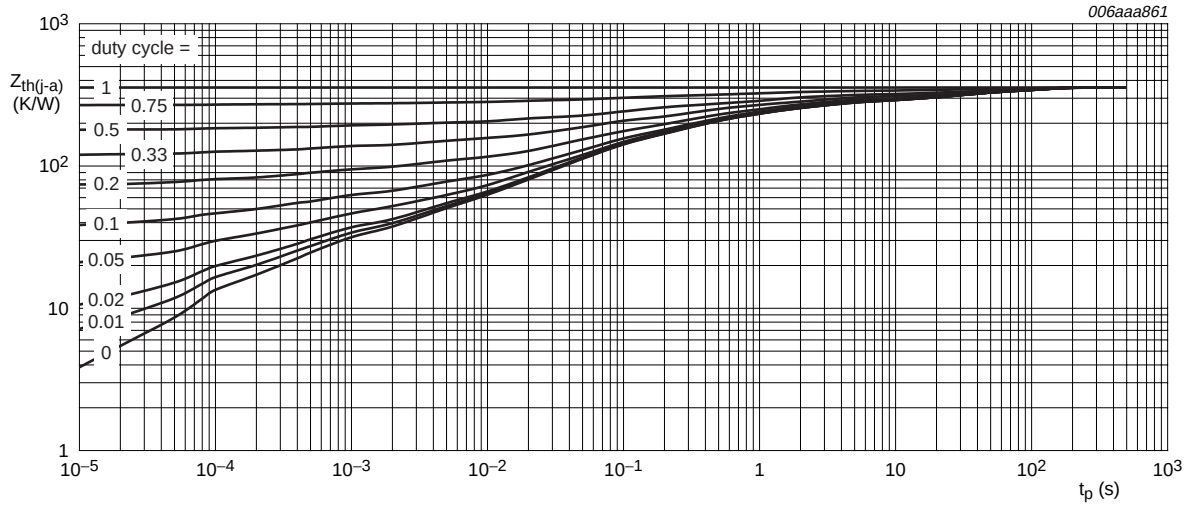


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FR4 PCB, standard footprint

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

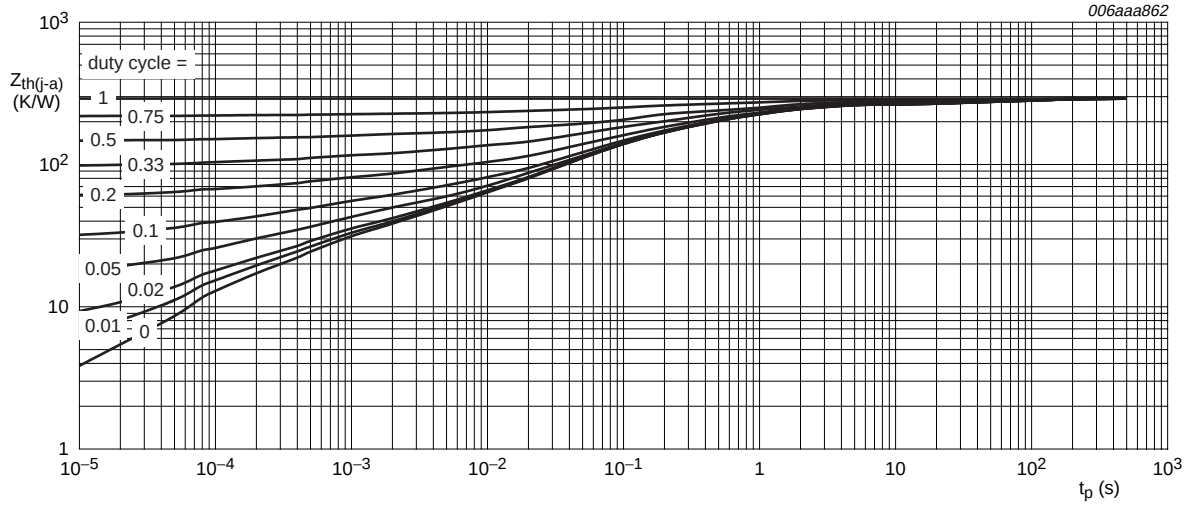



FR4 PCB, mounting pad for collector 1 $cm^2$

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



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Ceramic PCB, $Al_2O_3$, standard footprint

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



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# 7. Characteristics

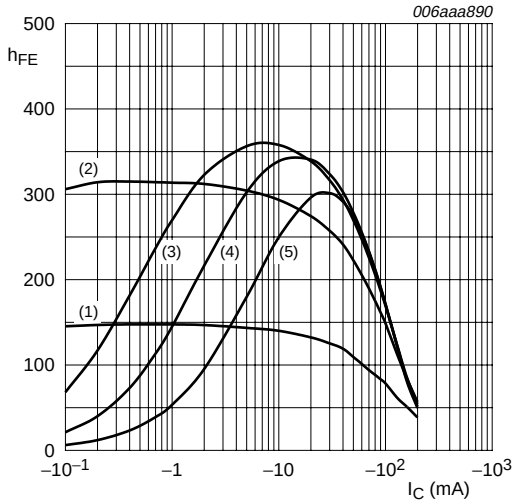
Table 7. Characteristics

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| **PNP transistor** | | | | | | | |
| $I_{CBO}$ | collector-base cut-off current | $V_{CB}$ = –40 V; $I_E$ = 0 A | | - | - | –15 | nA |
| | | $V_{CB}$ = –40 V; $I_E$ = 0 A; $T_j$ = 150 °C | | - | - | –5 | µA |
| $h_{FE}$ | DC current gain | $V_{CE}$ = –5 V; $I_C$ = –1 mA | | 200 | 290 | 450 | |
| | | $V_{CE}$ = –5 V; $I_C$ = –100 mA | | 95 | 150 | - | |
| | | $V_{CE}$ = –5 V; $I_C$ = –200 mA | | 24 | 55 | - | |
| $V_{CEsat}$ | collector-emitter saturation voltage | $I_C$ = –10 mA; $I_B$ = –0.5 mA | | - | –90 | –250 | mV |
| | | $I_C$ = –100 mA; $I_B$ = –5 mA | | - | –200 | –400 | mV |
| | | $I_C$ = –200 mA; $I_B$ = –20 mA | | - | –350 | –500 | mV |
| $V_{BEsat}$ | base-emitter saturation voltage | $I_C$ = –10 mA; $I_B$ = –0.5 mA | | - | –0.7 | - | V |
| | | $I_C$ = –100 mA; $I_B$ = –5 mA | | - | –0.85 | - | V |
| | | $I_C$ = –200 mA; $I_B$ = –20 mA | | - | –1 | –1.2 | V |
| $V_{BE}$ | base-emitter voltage | $V_{CE}$ = –5 V; $I_C$ = –2 mA | | - | –650 | - | mV |
| **Diode** | | | | | | | |
| $V_F$ | forward voltage | $I_F$ = 200 mA | [1] | - | - | 1.1 | V |
| **Device** | | | | | | | |
| $t_d$ | delay time | $I_C$ = –0.05 A; $I_B$ = –2.5 mA | | - | 8 | - | ns |
| $t_r$ | rise time | | | - | 56 | - | ns |
| $t_{on}$ | turn-on time | | | - | 64 | - | ns |
| $t_s$ | storage time | | | - | 588 | - | ns |
| $t_f$ | fall time | | | - | 216 | - | ns |
| $t_{off}$ | turn-off time | | | - | 804 | - | ns |
| **Device with optional capacitor C1** | | | | | | | |
| $t_d$ | delay time | $I_C$ = –0.05 A; $I_B$ = –2.5 mA; C1 = 1 nF | | - | 4 | - | ns |
| $t_r$ | rise time | | | - | 6 | - | ns |
| $t_{on}$ | turn-on time | | | - | 10 | - | ns |
| $t_s$ | storage time | | | - | 108 | - | ns |
| $t_f$ | fall time | | | - | 57 | - | ns |
| $t_{off}$ | turn-off time | | | - | 165 | - | ns |

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



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$V_{CE}$ = −5 V

(1) $T_{amb}$ = −55 °C

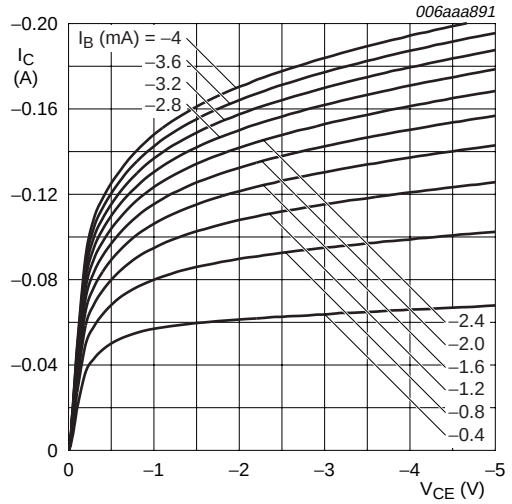
(2) $T_{amb}$ = 25 °C

(3) $T_{amb}$ = 100 °C

(4) $T_{amb}$ = 125 °C

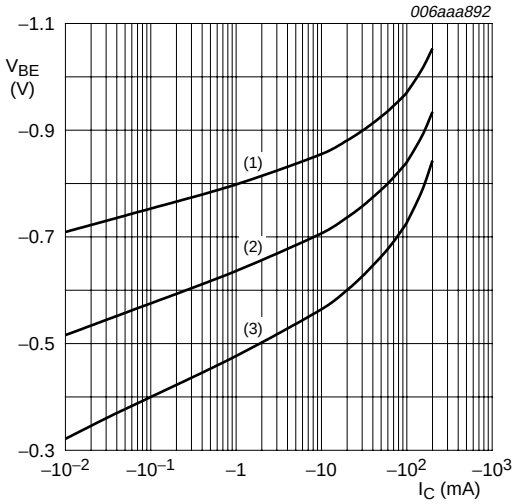
(5) $T_{amb}$ = 150 °C

**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**



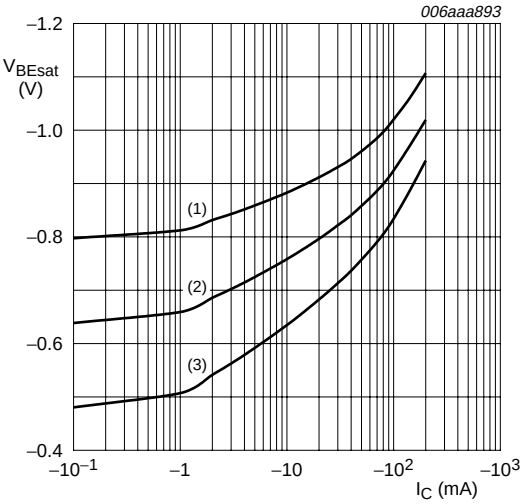

$V_{CE}$ = −5 V

(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

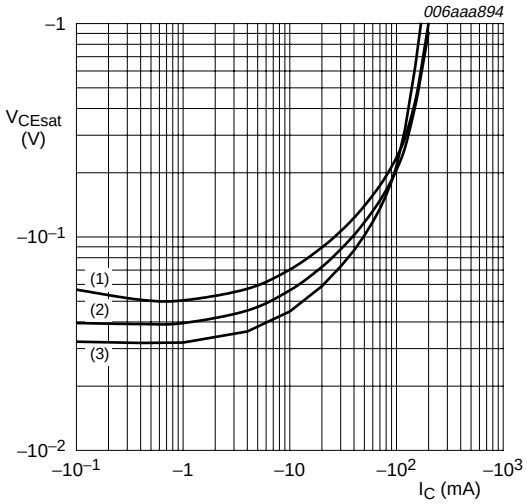
(2) $T_{amb}$ = 25 °C

(3) $T_{amb}$ = 100 °C

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



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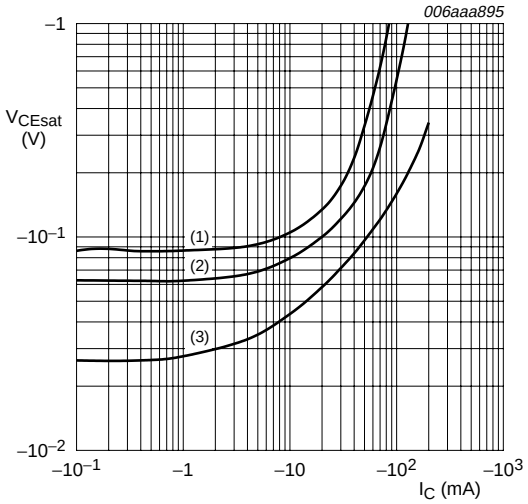

$I_C/I_B$ = 20

(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

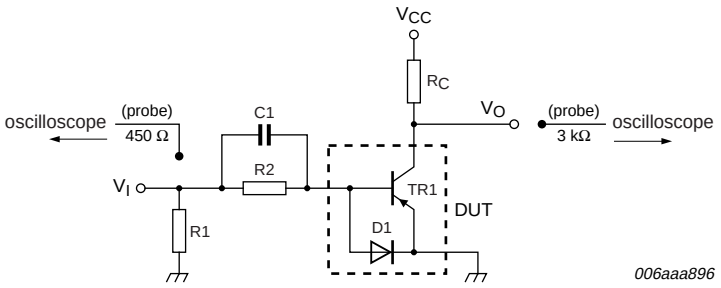
(1) $I_C/I_B$ = 100

(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**

## 8. Test information




$I_C$ = −0.05 A; $I_B$ = −2.5 mA; R1 = 50 Ω; R2 = 3 kΩ; $R_C$ = 180 Ω; C1 = 1 nF

**Fig 11. Test circuit for switching times**



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## 9. Package outline

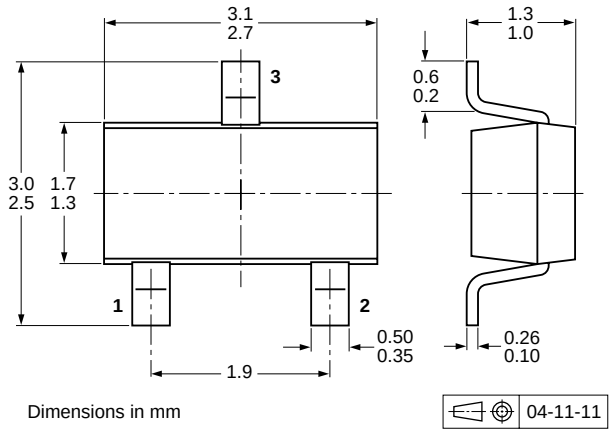



**Fig 12. Package outline SOT346 (SC-59A/TO-236)**

## 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 |
| PMD5001K | SOT346 | 4 mm pitch, 8 mm tape and reel | -115 | -135 |

[1] For further information and the availability of packing methods, see Section 15.



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# 11. Soldering

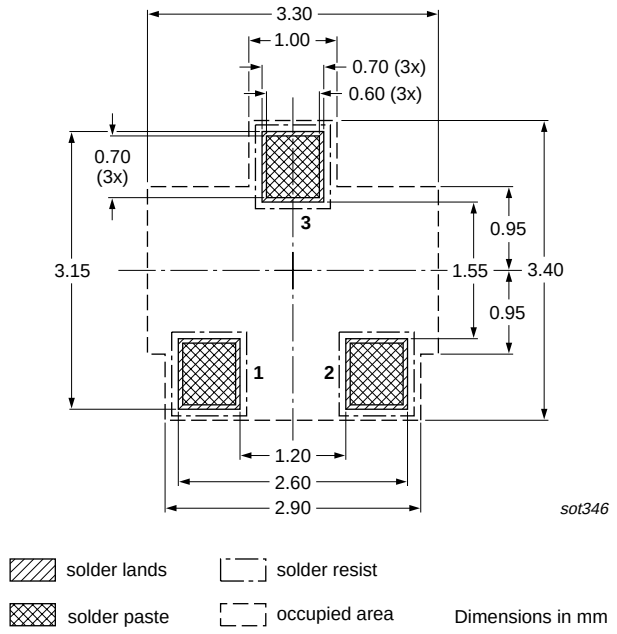



**Fig 13. Reflow soldering footprint**

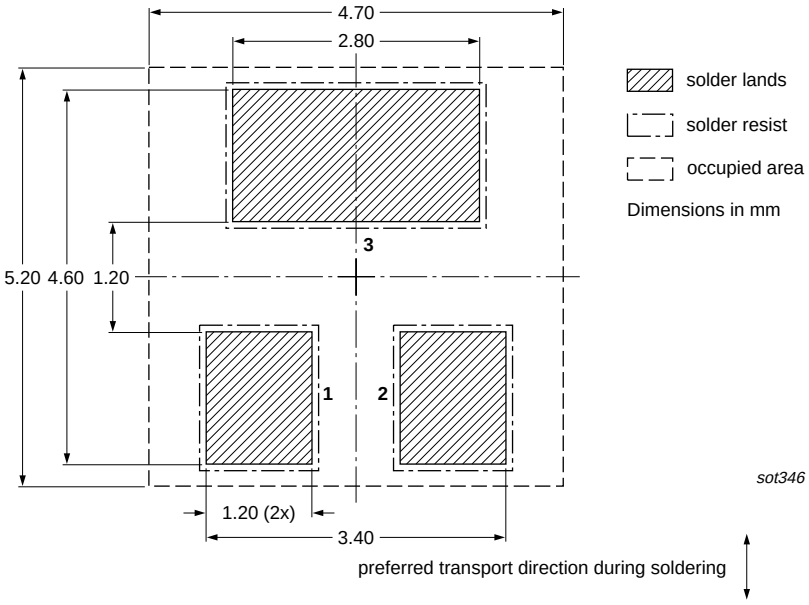
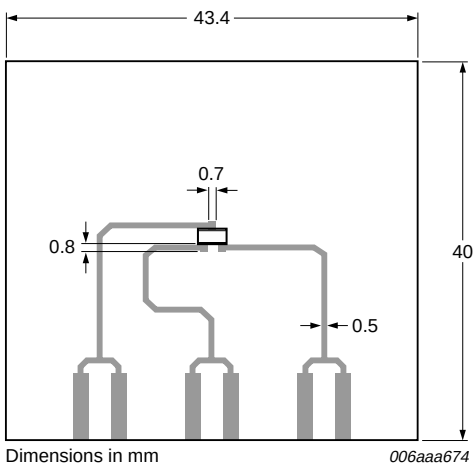



**Fig 14. Wave soldering footprint**



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## 12. Mounting

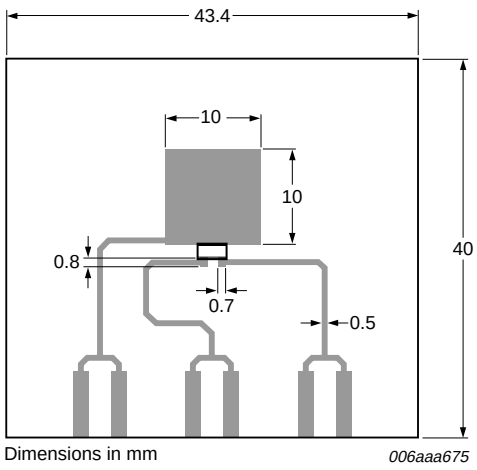



PCB thickness:

FR4 PCB = 1.6 mm

ceramic PCB = 0.635 mm

**Fig 15. FR4 PCB, standard footprint; ceramic PCB, $Al_2O_3$, standard footprint**




PCB thickness = 1.6 mm

**Fig 16. FR4 PCB, mounting pad for collector 1 $cm^2$**



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## 13. Revision history

**Table 9. Revision history**

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|---|---|---|---|---|
| PMD5001K_1 | 20061103 | Product data sheet | - | - |



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# 14. Legal information

## 14.1 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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