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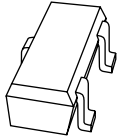
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# PMD4002K

## MOSFET driver

Rev. 01 — 3 November 2006

Product data sheet

## 1. Product profile

### 1.1 General description

NPN switching 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

- Switching 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

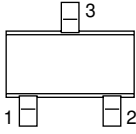
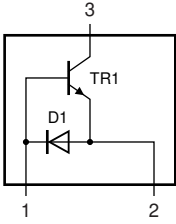
Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>NPN transistor</b>						
$V_{CE0}$	collector-emitter voltage	open base	-	-	40	V
$I_C$	collector current		-	-	0.6	A
$I_{CM}$	peak collector current	single pulse; $t_p \leq 1$ ms	-	-	1	A
<b>Diode</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	Description	Simplified outline	Symbol
1	base TR1, cathode D1		
2	emitter TR1, anode D1		
3	collector TR1		

006aaa655

## 3. Ordering information

**Table 3. Ordering information**

Type number	Package		
	Name	Description	Version
PMD4002K	SC-59A	plastic surface-mounted package; 3 leads	SOT346

## 4. Marking

**Table 4. Marking codes**

Type number	Marking code
PMD4002K	D2

## 5. Limiting values

**Table 5. Limiting values**

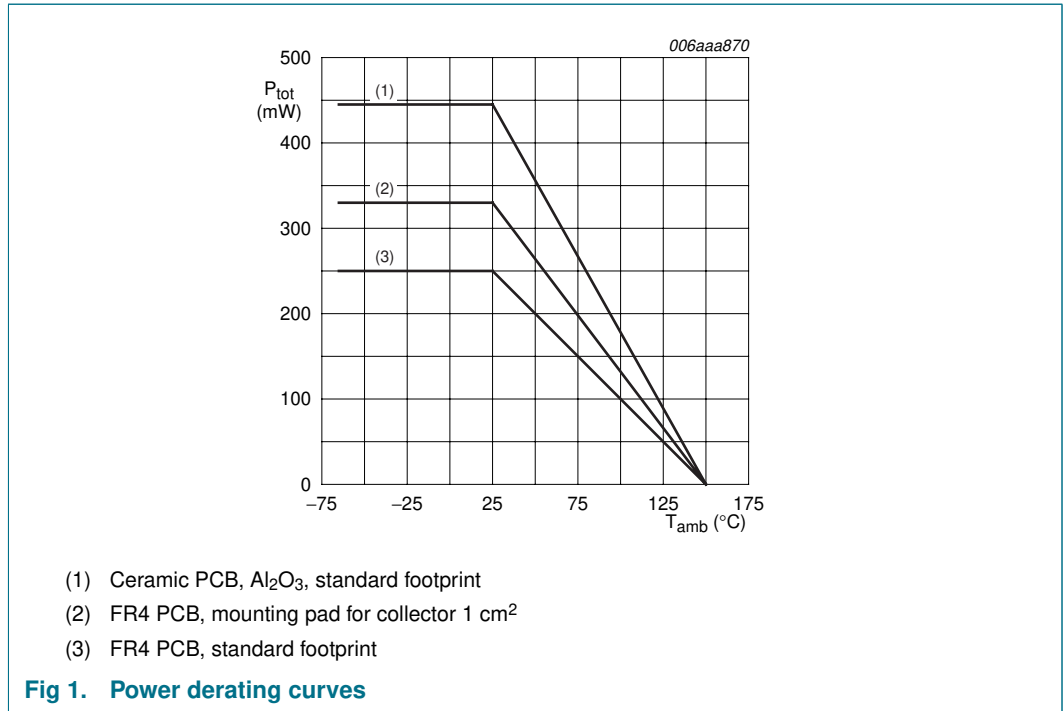
*In accordance with the Absolute Maximum Rating System (IEC 60134).*

Symbol	Parameter	Conditions	Min	Max	Unit	
<b>NPN transistor</b>						
$V_{CBO}$	collector-base voltage	open emitter	-	40	V	
$V_{CEO}$	collector-emitter voltage	open base	-	40	V	
$I_C$	collector current		-	0.6	A	
$I_{CM}$	peak collector current	single pulse; $t_p \leq 1$ ms	-	1	A	
$I_B$	base current		-	0.2	A	
$I_{BM}$	peak base current	single pulse; $t_p \leq 1$ ms	-	0.3	A	
$P_{tot}$	total power dissipation	$T_{amb} \leq 25$ °C	[1]	-	250	mW
			[2]	-	330	mW
			[3]	-	445	mW
<b>Diode</b>						
$I_F$	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				
		$t_p \leq 1$ $\mu$ s	-	-9	A	
		$t_p \leq 100$ $\mu$ s	-	-3	A	
		$t_p \leq 10$ 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.

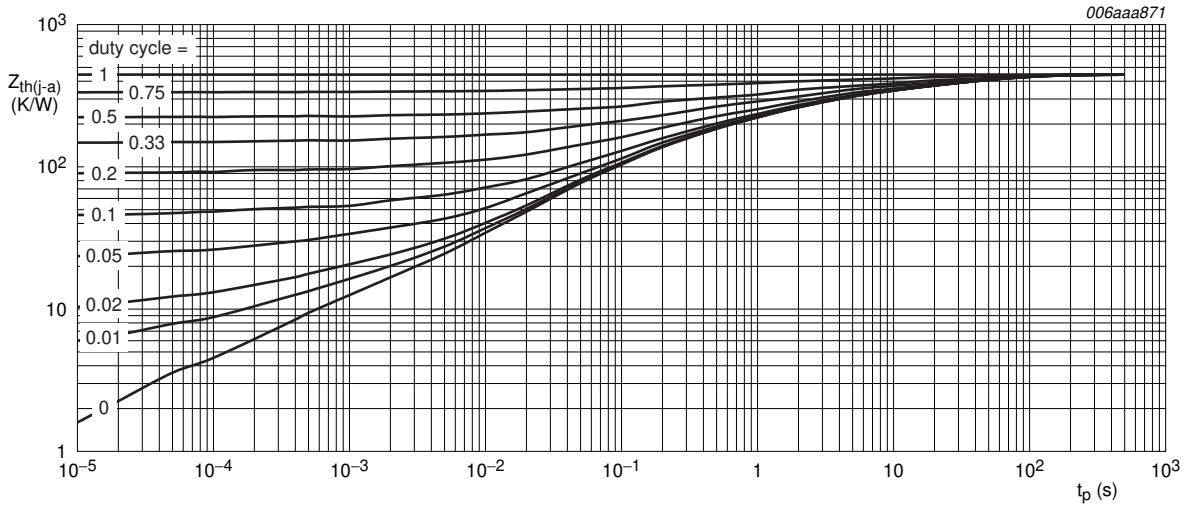


## 6. Thermal characteristics

**Table 6. Thermal characteristics**

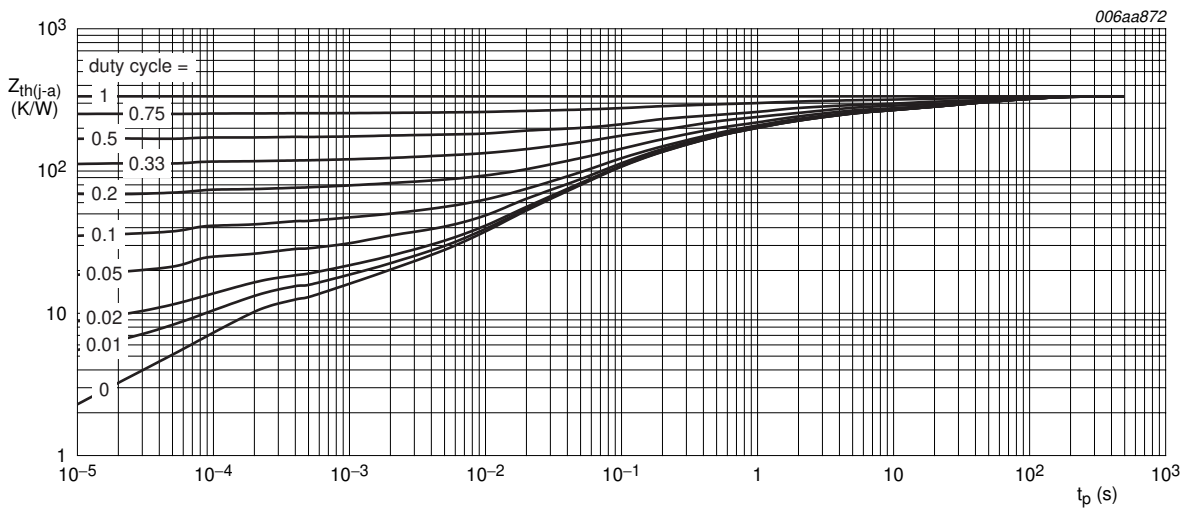
Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
<b>NPN transistor</b>							
R <sub>th(j-a)</sub>	thermal resistance from junction to ambient	in free air	[1]	-	-	500	K/W
			[2]	-	-	375	K/W
			[3]	-	-	280	K/W

- [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.



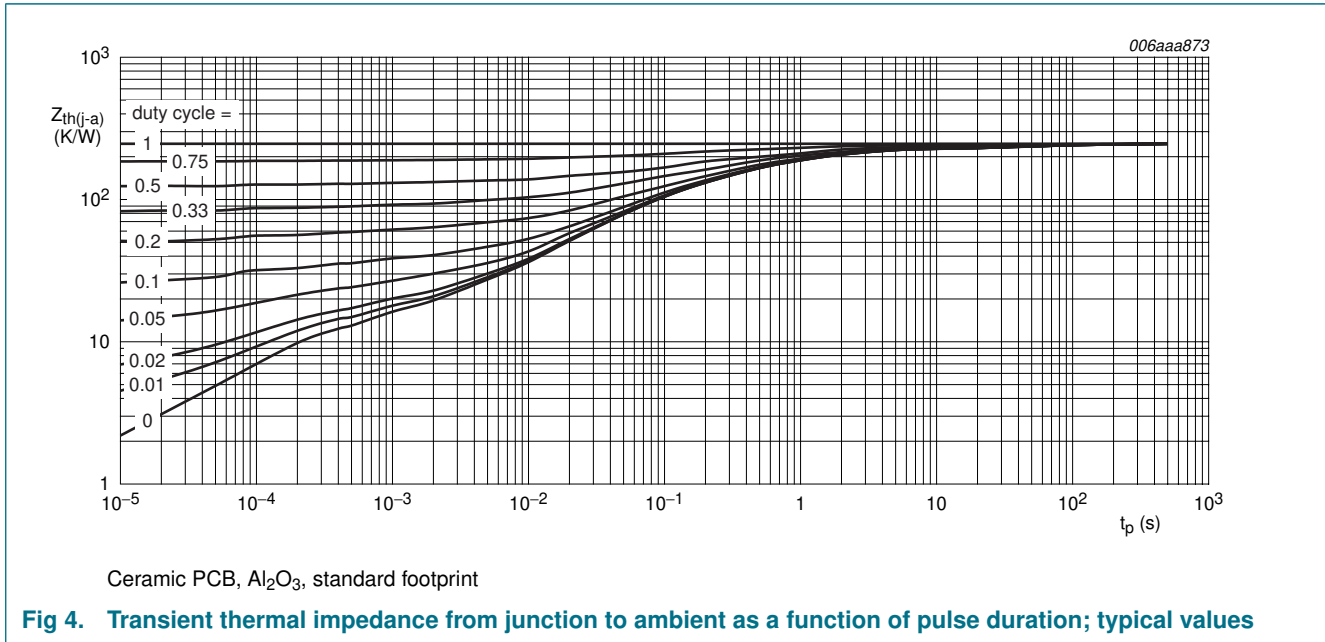
FR4 PCB, standard footprint

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



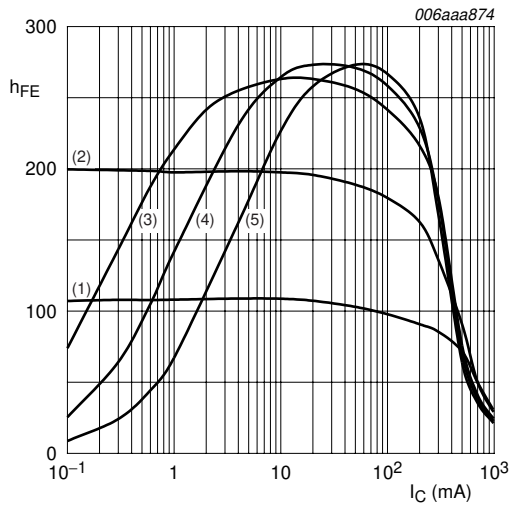
## 7. Characteristics

**Table 7. Characteristics**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>NPN transistor</b>						
$I_{CBO}$	collector-base cut-off current	$V_{CB} = 40\text{ V}; I_E = 0\text{ A}$	-	-	10	nA
		$V_{CB} = 40\text{ V}; I_E = 0\text{ A}; T_j = 150\text{ °C}$	-	-	10	$\mu\text{A}$
$h_{FE}$	DC current gain	$V_{CE} = 5\text{ V}; I_C = 1\text{ mA}$	100	210	-	
		$V_{CE} = 5\text{ V}; I_C = 200\text{ mA}$	100	170	300	
		$V_{CE} = 5\text{ V}; I_C = 500\text{ mA}$	[1]	50	100	-
$V_{CEsat}$	collector-emitter saturation voltage	$I_C = 200\text{ mA}; I_B = 20\text{ mA}$	-	150	250	mV
		$I_C = 500\text{ mA}; I_B = 50\text{ mA}$	[1]	-	300	500
$V_{BEsat}$	base-emitter saturation voltage	$I_C = 200\text{ mA}; I_B = 20\text{ mA}$	-	0.86	1	V
		$I_C = 500\text{ mA}; I_B = 50\text{ mA}$	[1]	-	0.95	1.1
$V_{BE}$	base-emitter voltage	$V_{CE} = 5\text{ V}; I_C = 300\text{ mA}$	-	830	-	mV
<b>Diode</b>						
$V_F$	forward voltage	$I_F = -200\text{ mA}$	[1]	-	-1.1	V
<b>Device</b>						
$t_d$	delay time	$I_C = 0.15\text{ A}; I_B = 5\text{ mA}$	-	6	-	ns
$t_r$	rise time		-	21	-	ns
$t_{on}$	turn-on time		-	27	-	ns
$t_s$	storage time		-	484	-	ns
$t_f$	fall time		-	120	-	ns
$t_{off}$	turn-off time		-	604	-	ns
<b>Device with optional capacitor C1</b>						
$t_d$	delay time	$I_C = 0.15\text{ A}; I_B = 5\text{ mA}; C1 = 1\text{ nF}$	-	3	-	ns
$t_r$	rise time		-	1	-	ns
$t_{on}$	turn-on time		-	4	-	ns
$t_s$	storage time		-	23	-	ns
$t_f$	fall time		-	41	-	ns
$t_{off}$	turn-off time		-	64	-	ns

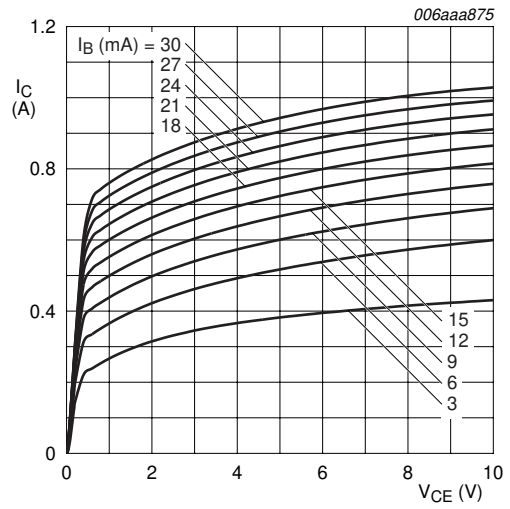
[1] Pulse test:  $t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02$ .





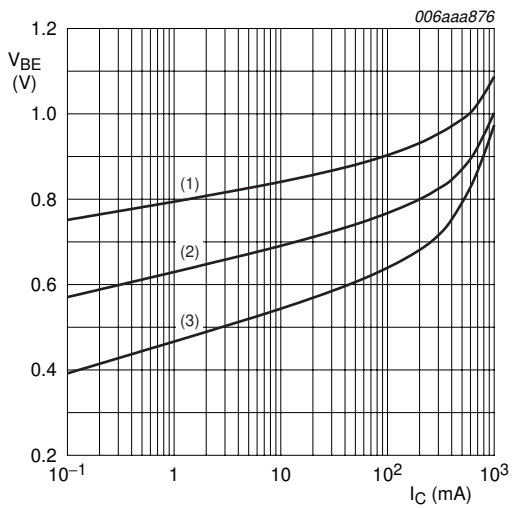
$V_{CE} = 5\text{ V}$   
 (1)  $T_{amb} = -55^\circ\text{C}$   
 (2)  $T_{amb} = 25^\circ\text{C}$   
 (3)  $T_{amb} = 100^\circ\text{C}$   
 (4)  $T_{amb} = 125^\circ\text{C}$   
 (5)  $T_{amb} = 150^\circ\text{C}$

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



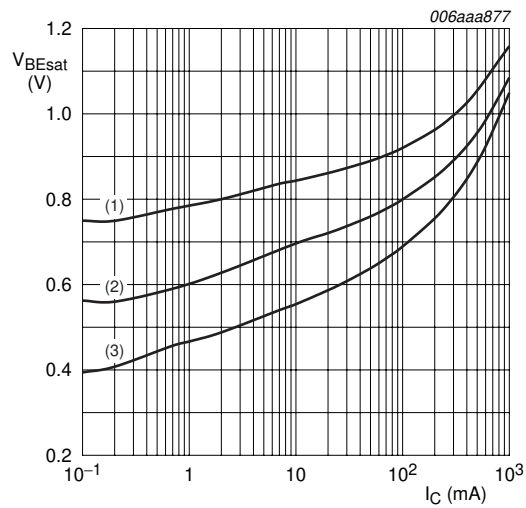
$T_{amb} = 25^\circ\text{C}$

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



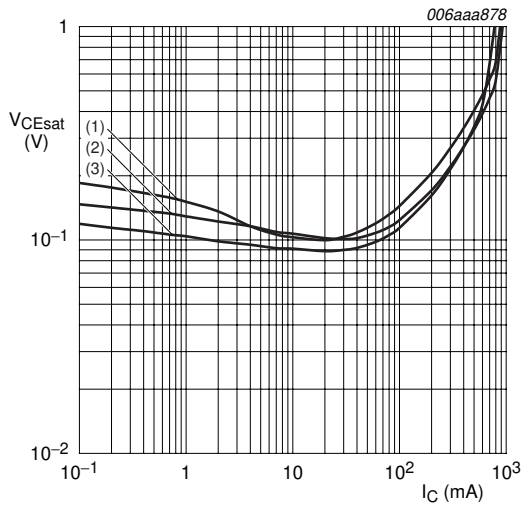
$V_{CE} = 5\text{ V}$   
 (1)  $T_{amb} = -55^\circ\text{C}$   
 (2)  $T_{amb} = 25^\circ\text{C}$   
 (3)  $T_{amb} = 100^\circ\text{C}$

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



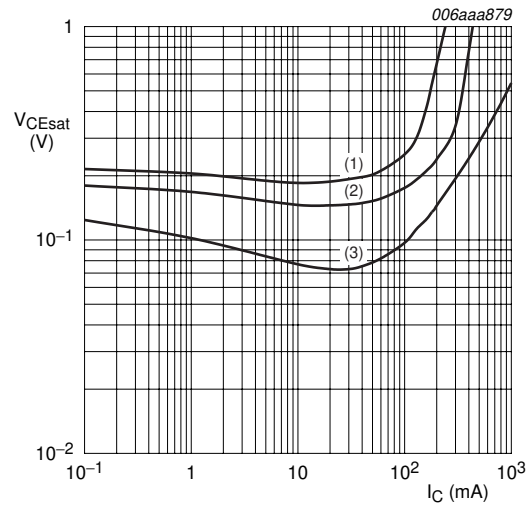
$I_C/I_B = 20$   
 (1)  $T_{amb} = -55^\circ\text{C}$   
 (2)  $T_{amb} = 25^\circ\text{C}$   
 (3)  $T_{amb} = 100^\circ\text{C}$

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



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

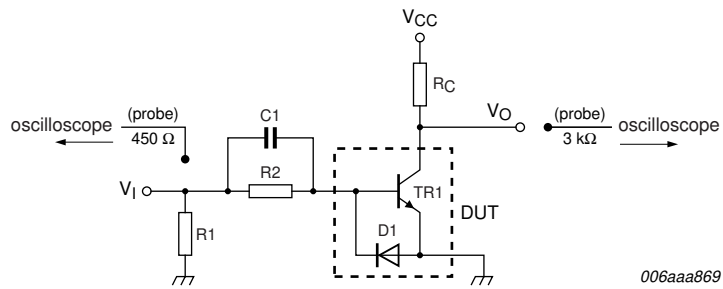
**Fig 9. Collector-emitter saturation voltage as a function of collector current; typical values**



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

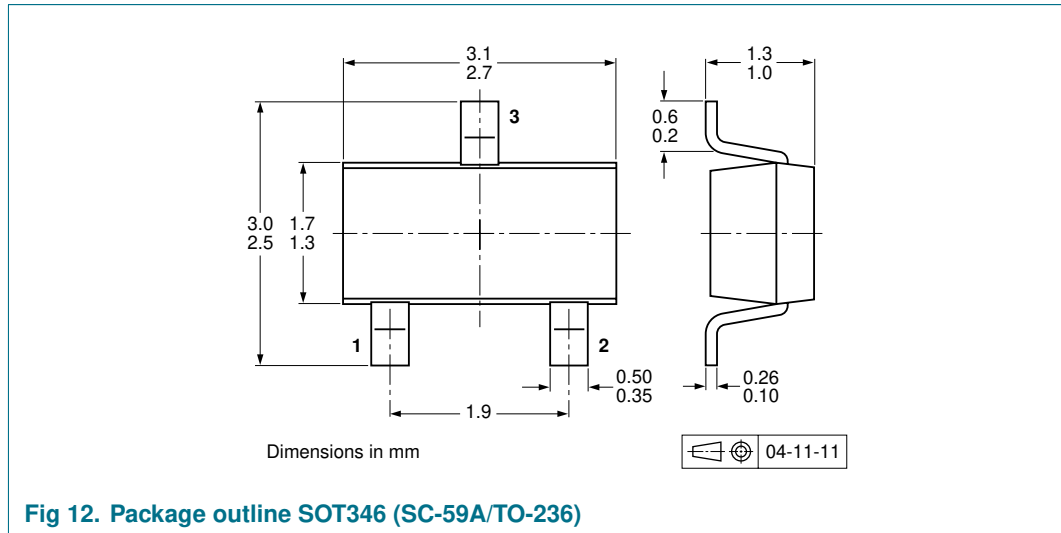
## 8. Test information



$I_C = 0.15\text{ A}; I_B = 5\text{ mA}; R_1 = 50\text{ }\Omega; R_2 = 1\text{ k}\Omega; R_C = 68\text{ }\Omega; C_1 = 1\text{ nF}$

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

## 9. Package outline



## 10. Packing information

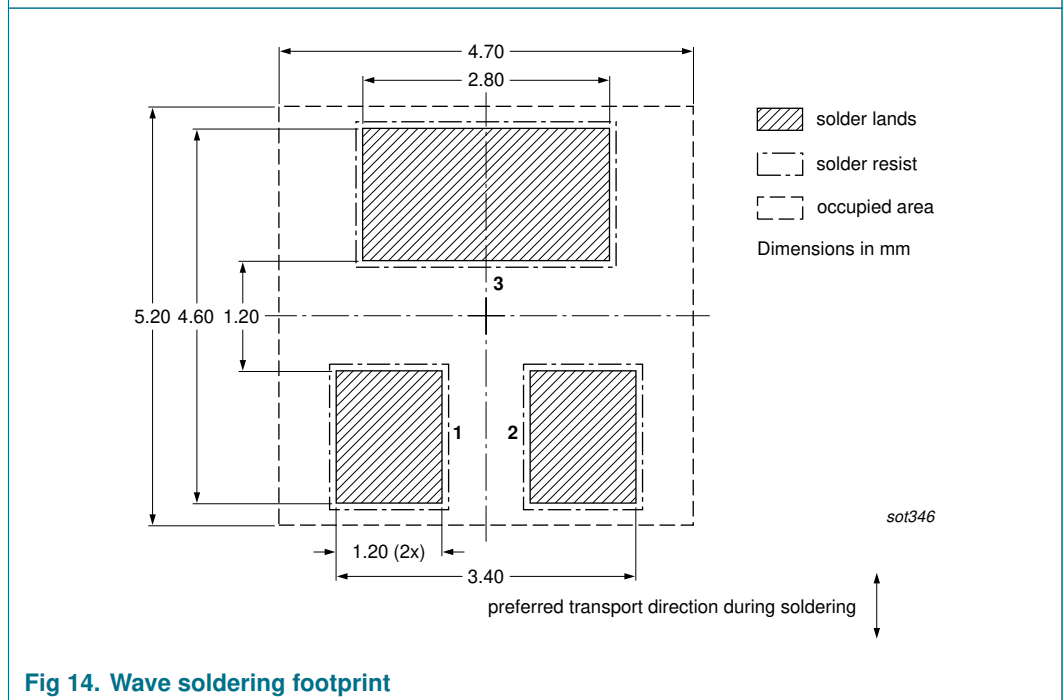
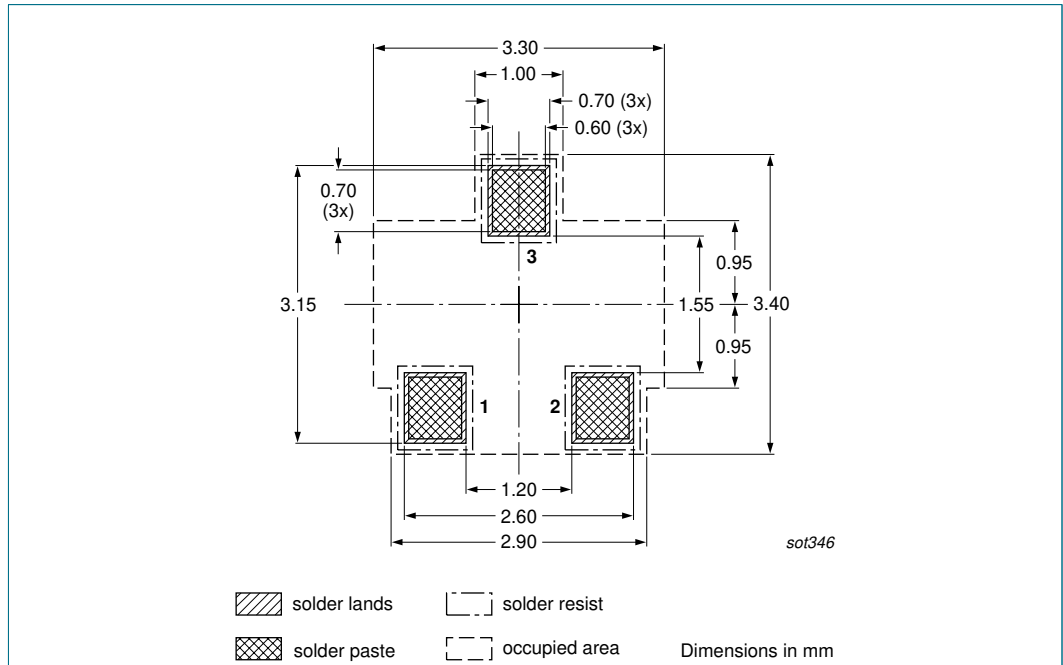
**Table 8. Packing methods**

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

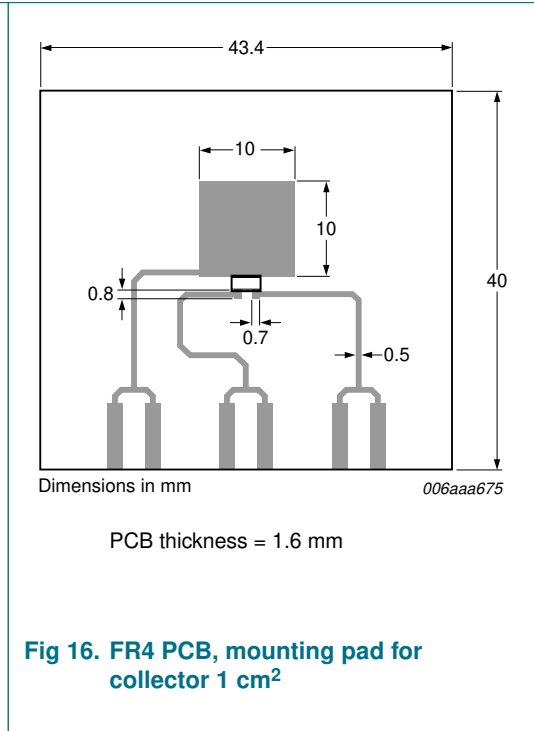
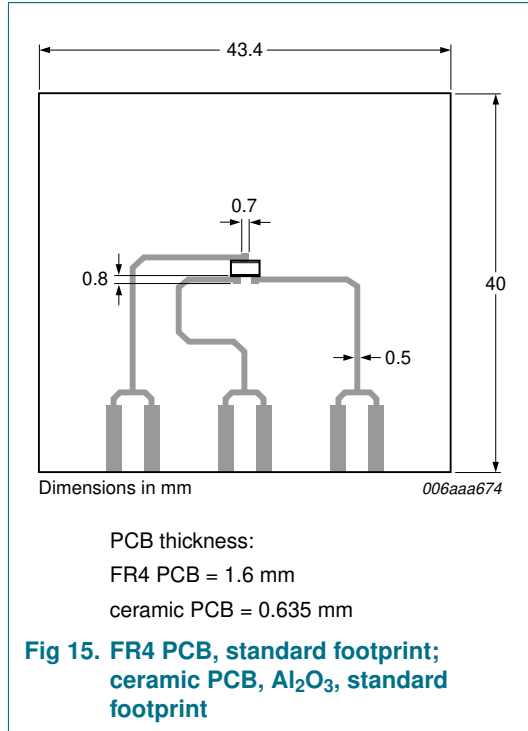
Type number	Package	Description	Packing quantity	
			3000	10000
PMD4002K	SOT346	4 mm pitch, 8 mm tape and reel	-115	-135

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

## 11. Soldering



**12. Mounting**



## 13. Revision history

**Table 9.** Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PMD4002K_1	20061103	Product data sheet	-	-

## 14. Legal information

### 14.1 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".

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