

# PMD9050D

## MOSFET driver

Rev. 01 — 27 November 2006

Product data sheet

## 1. Product profile

### 1.1 General description

NPN transistor and high-speed switching diode supplemented by an NPN/PNP transistor pair connected as a silicon-controlled switch in a SOT457 (SC-74) small Surface-Mounted Device (SMD) plastic package.

### 1.2 Features

- General-purpose transistor and high-speed switching diode as driver
- Silicon-controlled switch to bypass the driver transistor
- Application-optimized pinout
- Internal connections to minimize layout effort
- Space-saving solution
- Reduces component count

### 1.3 Applications

- MOSFET driver with silicon-controlled switch

### 1.4 Quick reference data

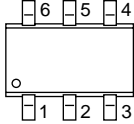
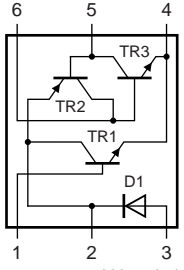
Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Per transistor; for the PNP transistor with negative polarity</b>						
$V_{CEO}$	collector-emitter voltage	open base	-	-	45	V
$I_C$	collector current		-	-	0.1	A
$I_{CM}$	peak collector current	single pulse; $t_p \leq 1$ 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
$V_R$	reverse voltage		-	-	60	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	IN	input		
2	OUT	output		
3	RC	collector resistor		
4	GND	ground		
5	ON	output enable		
6	OFF	output disable		

*006aaa654*

## 3. Ordering information

**Table 3. Ordering information**

Type number	Package		
	Name	Description	Version
PMD9050D	SC-74	plastic surface-mounted package (TSOP6); 6 leads	SOT457

## 4. Marking

**Table 4. Marking codes**

Type number	Marking code
PMD9050D	9G

## 5. Limiting values

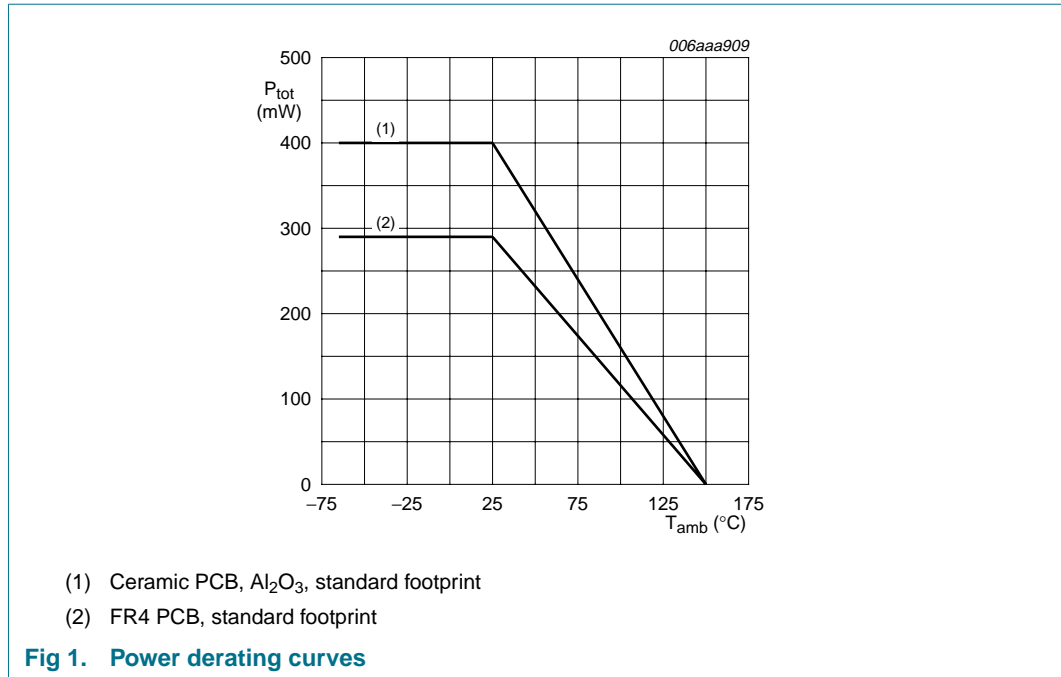
**Table 5. Limiting values**

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

Symbol	Parameter	Conditions	Min	Max	Unit	
<b>Per transistor; for the PNP transistor with negative polarity</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; $t_p \leq 1$ 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	
<b>Diode (D1)</b>						
$V_{RRM}$	repetitive peak reverse voltage		-	60	V	
$V_R$	reverse voltage		-	60	V	
$I_F$	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>						
$P_{tot}$	total power dissipation	$T_{amb} \leq 25$ °C	[1]	-	290	mW
			[2]	-	400	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 an FR4 PCB, single-sided copper, tin-plated and standard footprint.

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



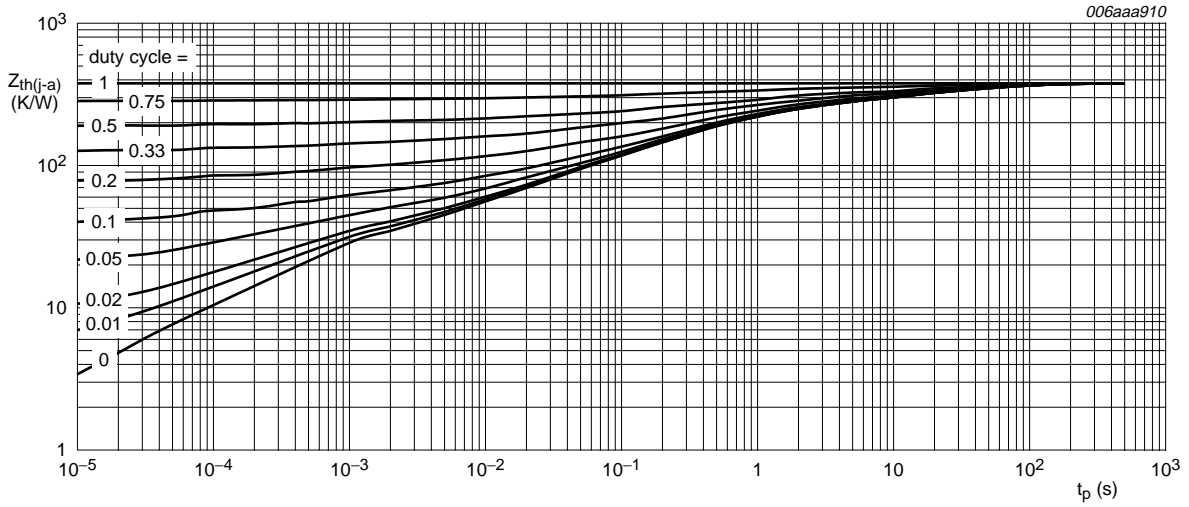
## 6. Thermal characteristics

**Table 6. Thermal characteristics**

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

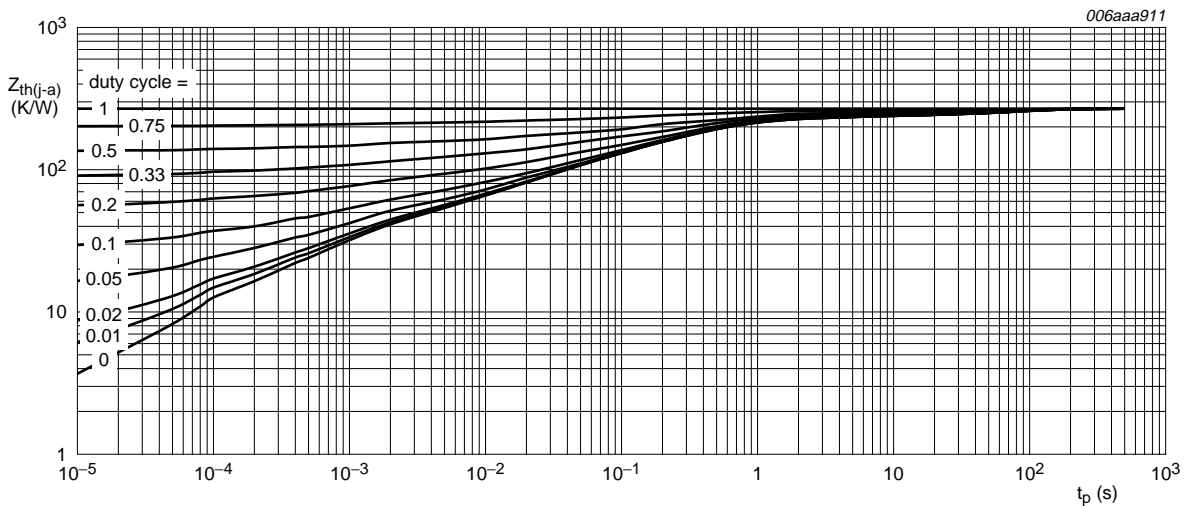
[1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated and standard footprint.

[2] 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



Ceramic PCB, Al<sub>2</sub>O<sub>3</sub>, standard footprint

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

## 7. Characteristics

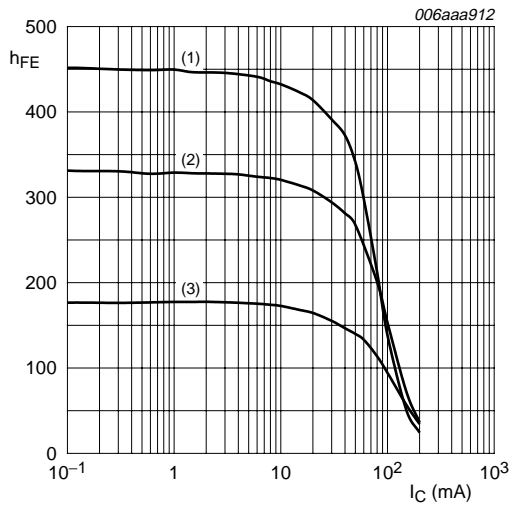
**Table 7. Characteristics**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Per transistor; for the PNP transistor with negative polarity</b>						
$I_{CBO}$	collector-base cut-off current	$V_{CB} = 30\text{ V}; I_E = 0\text{ A}$	-	-	50	nA
		$V_{CB} = 30\text{ V}; I_E = 0\text{ A}; T_j = 150\text{ °C}$	-	-	10	$\mu\text{A}$
$I_{EBO}$	emitter-base cut-off current	$V_{EB} = 5\text{ V}; I_C = 0\text{ A}$	-	-	100	nA
$h_{FE}$	DC current gain					
	TR1 and TR3 (NPN)	$V_{CE} = 5\text{ V}; I_C = 1\text{ mA}$	200	320	450	
		$V_{CE} = 5\text{ V}; I_C = 100\text{ mA}$	95	165	-	
		$V_{CE} = 5\text{ V}; I_C = 200\text{ mA}$	24	40	-	
	TR2 (PNP)	$V_{CE} = 5\text{ V}; I_C = 1\text{ mA}$	200	270	450	
		$V_{CE} = 5\text{ V}; I_C = 100\text{ mA}$	95	120	-	
		$V_{CE} = 5\text{ V}; I_C = 200\text{ mA}$	24	45	-	
$V_{CEsat}$	collector-emitter saturation voltage	$I_C = 10\text{ mA}; I_B = 0.5\text{ mA}$	-	70	200	mV
		$I_C = 100\text{ mA}; I_B = 5\text{ mA}$	-	200	400	mV
		$I_C = 200\text{ mA}; I_B = 20\text{ mA}$	-	350	500	mV
$V_{BEsat}$	base-emitter saturation voltage	$I_C = 10\text{ mA}; I_B = 0.5\text{ mA}$	-	0.74	-	V
		$I_C = 100\text{ mA}; I_B = 5\text{ mA}$	-	0.91	-	V
		$I_C = 200\text{ mA}; I_B = 20\text{ mA}$	-	1	1.2	V
$V_{BE}$	base-emitter voltage	$V_{CE} = 5\text{ V}; I_C = 2\text{ mA}$	-	660	-	mV
<b>Diode (D1)</b>						
$V_F$	forward voltage	$I_F = 200\text{ mA}$	[1]	-	1.1	V
$I_R$	reverse current	$V_R = 60\text{ V}$	-	-	100	nA
		$V_R = 60\text{ V}; T_j = 150\text{ °C}$	-	-	100	$\mu\text{A}$
$t_{rr}$	reverse recovery time		[2]	-	6	ns
$V_{FR}$	forward recovery voltage		[3]	-	2	V
<b>Transistor 1 (TR1)</b>						
$t_d$	delay time	$I_C = 0.05\text{ A}; I_{B(on)} = 2.5\text{ mA}; I_{B(off)} = -2.5\text{ mA}$	-	12	-	ns
$t_r$	rise time		-	78	-	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:  $t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02$ .

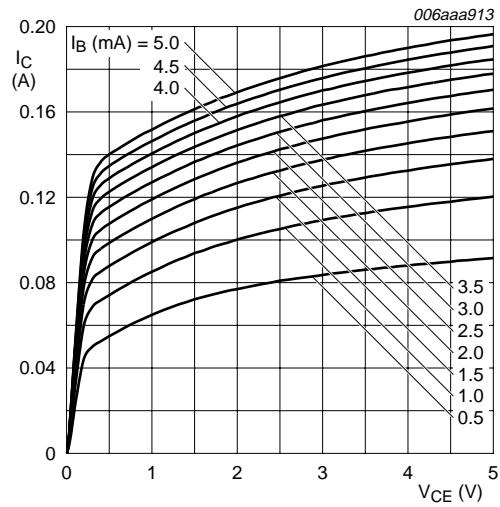
[2] When switched from  $I_F = 400\text{ mA}$  to  $I_R = 400\text{ mA}; R_L = 100\text{ }\Omega$ ; measured at  $I_R = 40\text{ mA}$ .

[3] When switched from  $I_F = 400\text{ mA}; t_r = 30\text{ ns}$ .



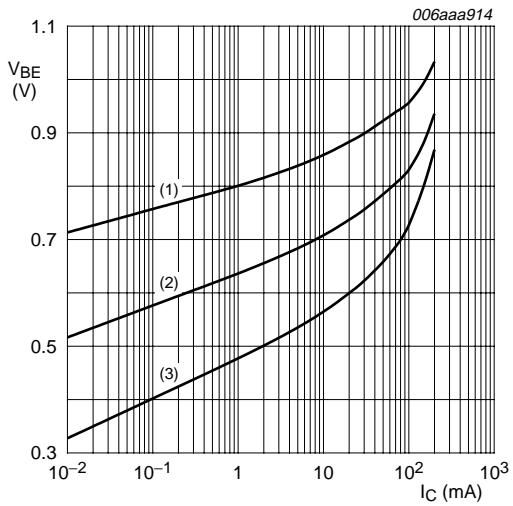
$V_{CE} = 5\text{ V}$   
 (1)  $T_{amb} = 100\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = -55\text{ °C}$

**Fig 4. TR1 (NPN): DC current gain as a function of collector current; typical values**



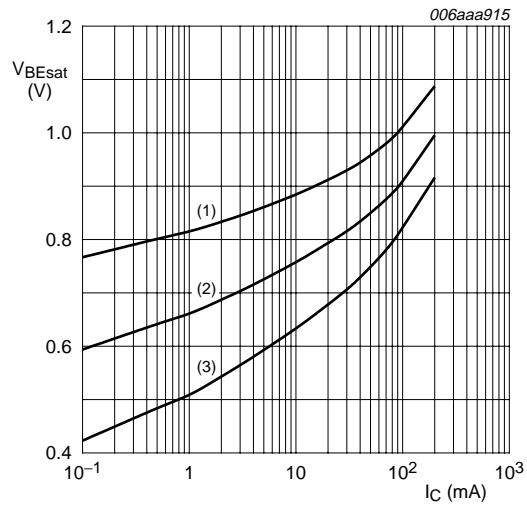
$T_{amb} = 25\text{ °C}$

**Fig 5. TR1 (NPN): Collector current as a function of collector-emitter voltage; typical values**



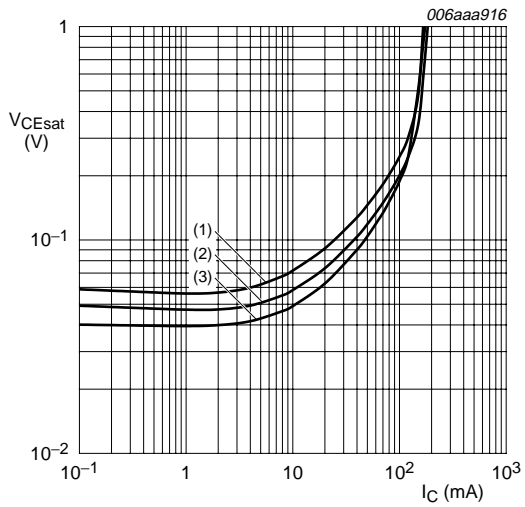
$V_{CE} = 5\text{ V}$   
 (1)  $T_{amb} = -55\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = 100\text{ °C}$

**Fig 6. TR1 (NPN): Base-emitter voltage as a function of collector current; typical values**



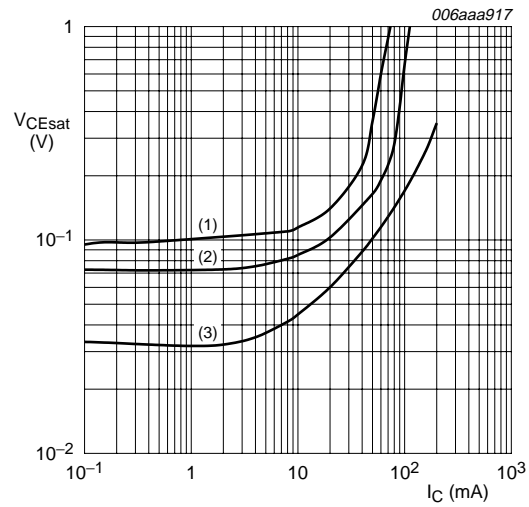
$I_C/I_B = 20$   
 (1)  $T_{amb} = -55\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = 100\text{ °C}$

**Fig 7. TR1 (NPN): 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)  $T_{amb} = -55\text{ }^\circ\text{C}$

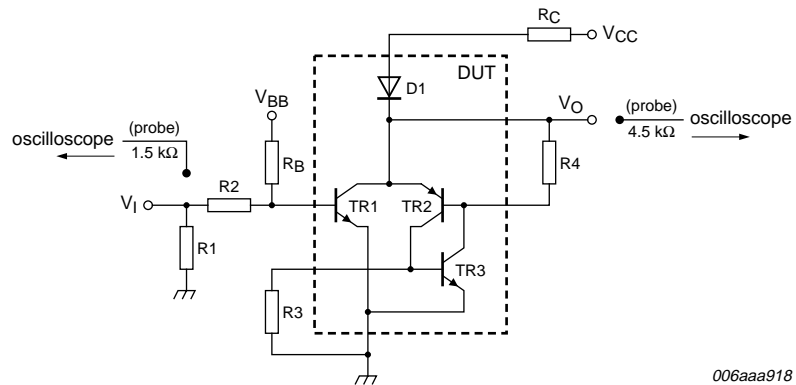
**Fig 8. TR1 (NPN): Collector-emitter saturation voltage as a function of collector current; typical values**



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

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

## 8. Test information

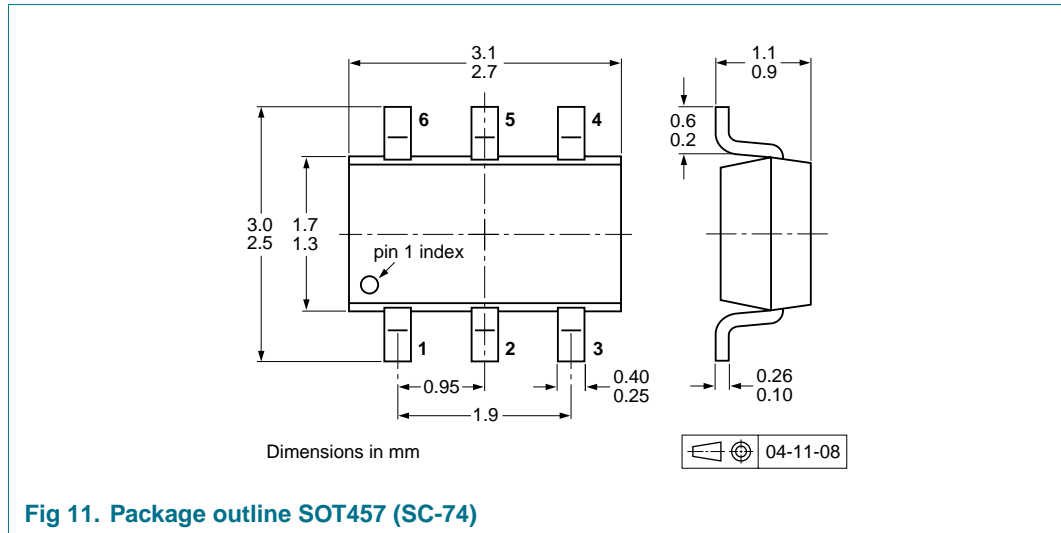


$I_C = 0.05\text{ A}$ ;  $I_{B(on)} = 2.5\text{ mA}$ ;  $I_{B(off)} = -2.5\text{ mA}$ ;  $R_1 = 50\text{ }\Omega$ ;  $R_2 = 1\text{ k}\Omega$ ;  $R_3 = 1\text{ k}\Omega$ ;  $R_4 = 1\text{ k}\Omega$ ;  $R_B = 1.5\text{ k}\Omega$ ;  $R_C = 150\text{ }\Omega$

**Fig 10. Test circuit for switching times per TR1**



## 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>

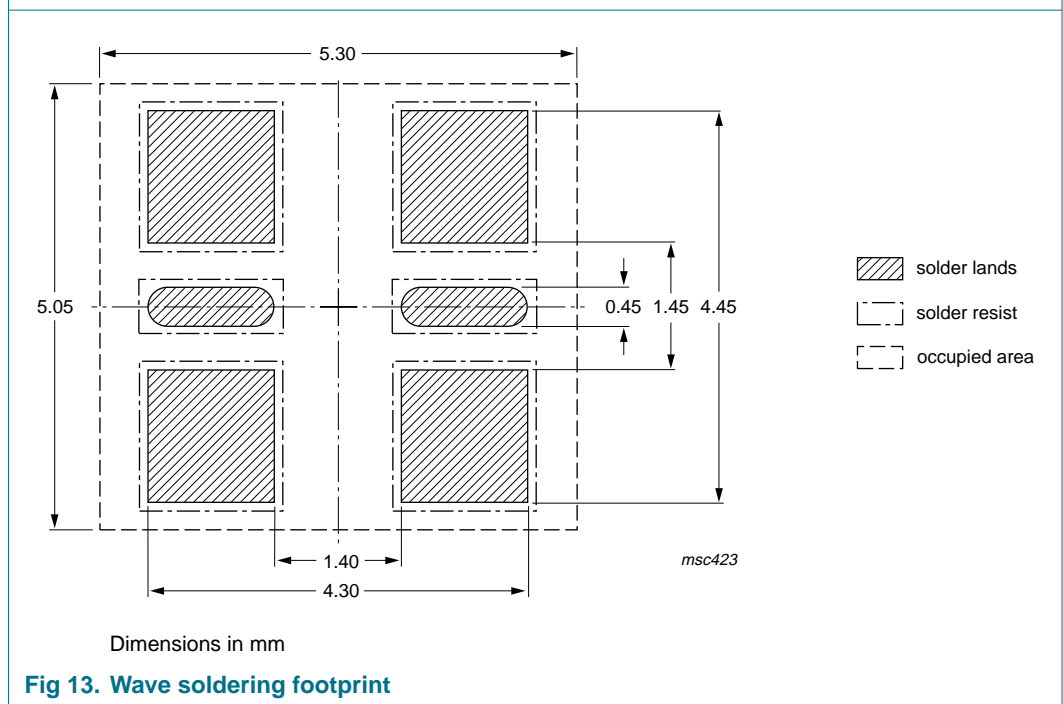
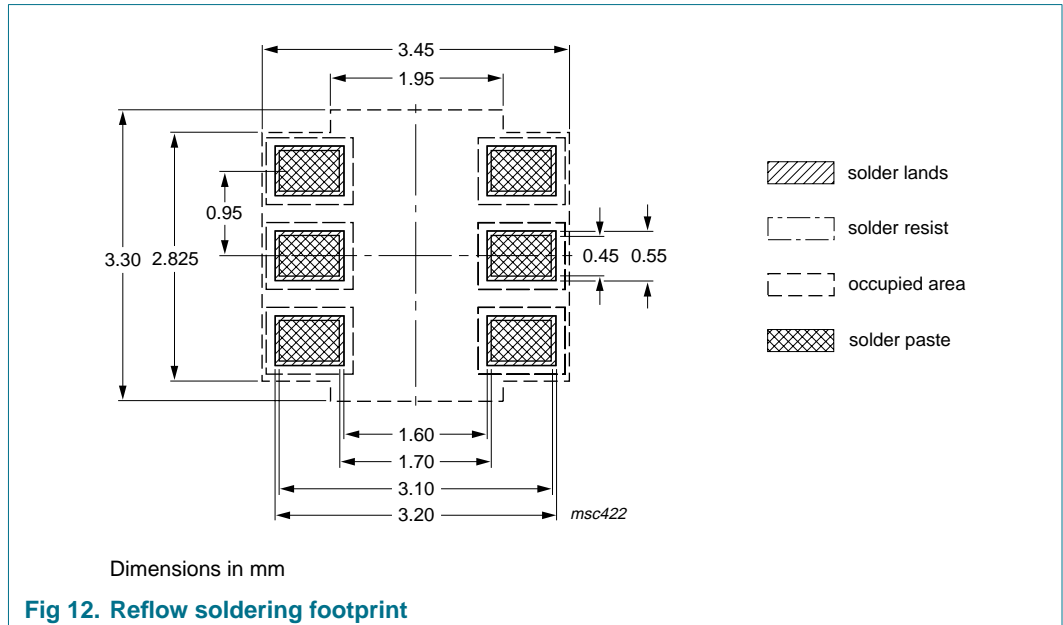
Type number	Package	Description	Packing quantity	
			3000	10000
PMD9050D	SOT457	4 mm pitch, 8 mm tape and reel; T1	[2] -115	-135
		4 mm pitch, 8 mm tape and reel; T2	[3] -125	-165

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

[2] T1: normal taping

[3] T2: reverse taping

### 11. Soldering



## 12. Revision history

Table 9. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PMD9050D_1	20061127	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.

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[2] The term 'short data sheet' is explained in section "Definitions".

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