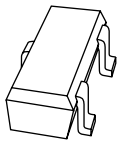

PMD4002K

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
NPN transistor							
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
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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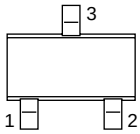
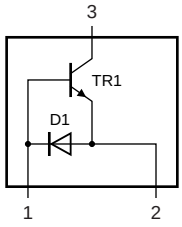
2. Pinning information

Table 2. Pinning

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

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

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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
NPN transistor						
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
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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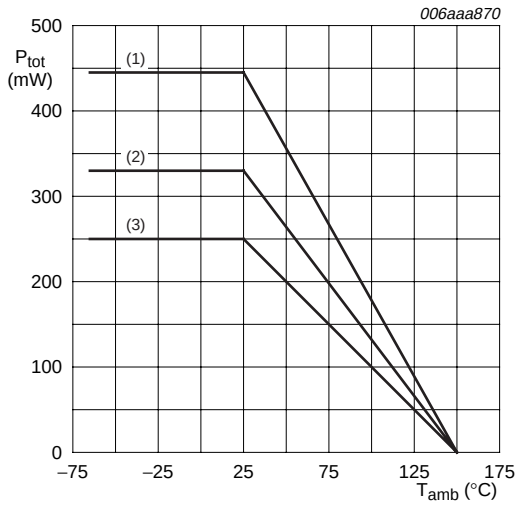

(1) Ceramic PCB, Al_2O_3, standard footprint

(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
NPN transistor							
$R_{th(j-a)}$	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^2.

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

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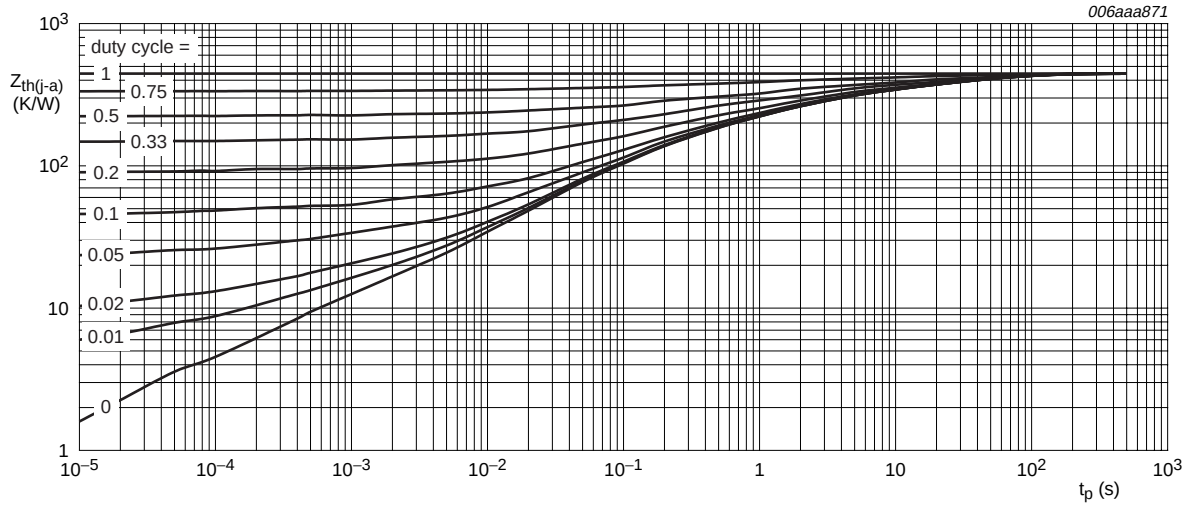
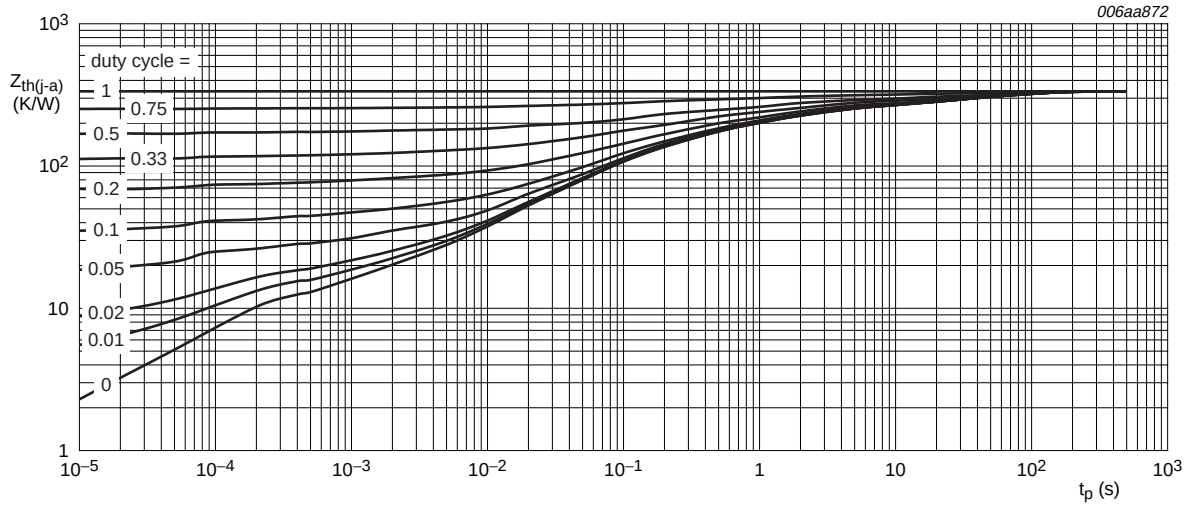


FR4 PCB, standard footprint

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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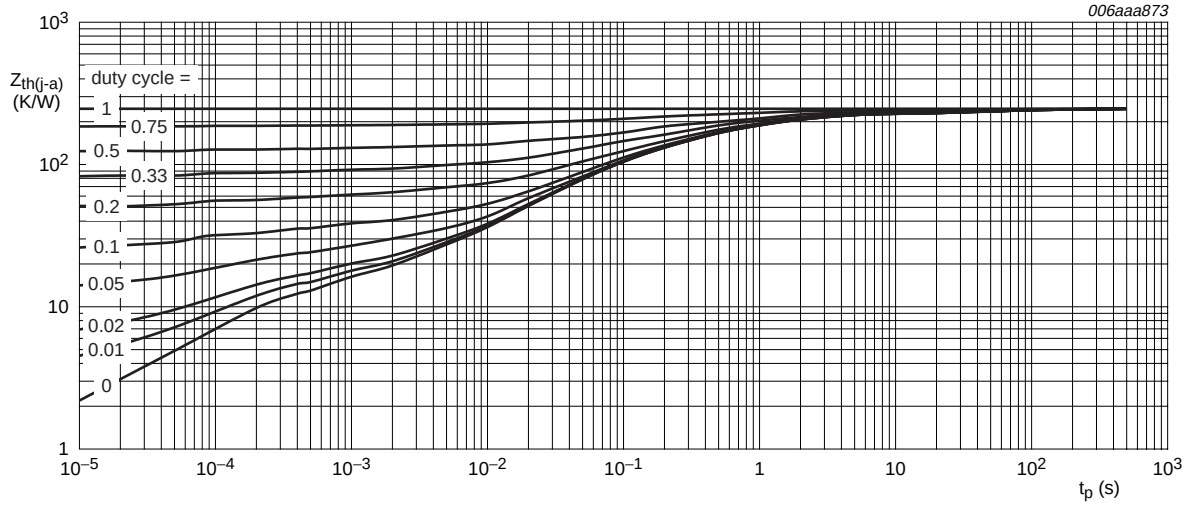

Ceramic PCB, Al_2O_3, standard footprint

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
NPN transistor							
I_{CBO}	collector-base cut-off current	V_{CB} = 40 V; I_E = 0 A		-	-	10	nA
		V_{CB} = 40 V; I_E = 0 A; T_j = 150 °C		-	-	10	µA
h_{FE}	DC current gain	V_{CE} = 5 V; I_C = 1 mA		100	210	-	
		V_{CE} = 5 V; I_C = 200 mA		100	170	300	
		V_{CE} = 5 V; I_C = 500 mA	[1]	50	100	-	
V_{CEsat}	collector-emitter saturation voltage	I_C = 200 mA; I_B = 20 mA		-	150	250	mV
		I_C = 500 mA; I_B = 50 mA	[1]	-	300	500	mV
V_{BEsat}	base-emitter saturation voltage	I_C = 200 mA; I_B = 20 mA		-	0.86	1	V
		I_C = 500 mA; I_B = 50 mA	[1]	-	0.95	1.1	V
V_{BE}	base-emitter voltage	V_{CE} = 5 V; I_C = 300 mA		-	830	-	mV
Diode							
V_F	forward voltage	I_F = –200 mA	[1]	-	-	–1.1	V
Device							
t_d	delay time	I_C = 0.15 A; I_B = 5 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
Device with optional capacitor C1							
t_d	delay time	I_C = 0.15 A; I_B = 5 mA; C1 = 1 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: $t_p \leq 300$ µs; $\delta \leq 0.02$.

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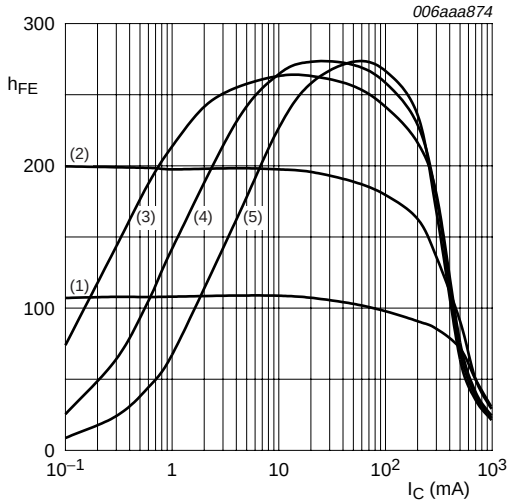


V_{CE} = 5 V

(1) T_{amb} = –55 °C

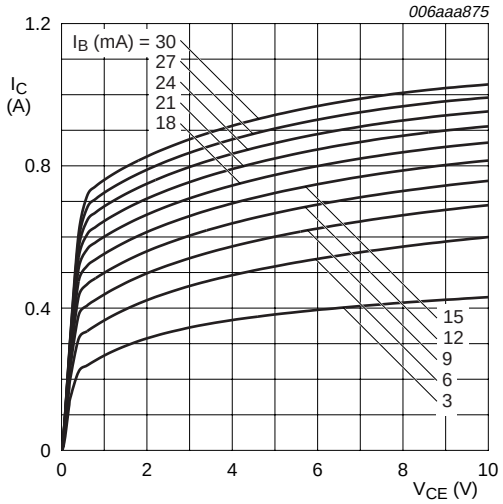
(2) T_{amb} = 25 °C

(3) T_{amb} = 100 °C

(4) T_{amb} = 125 °C

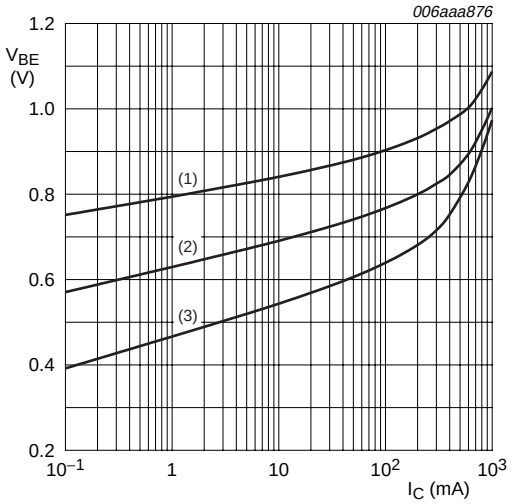
(5) T_{amb} = 150 °C

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



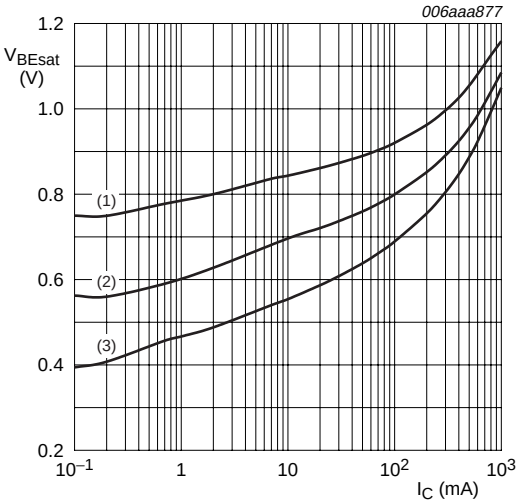
V_{CE} = 5 V

(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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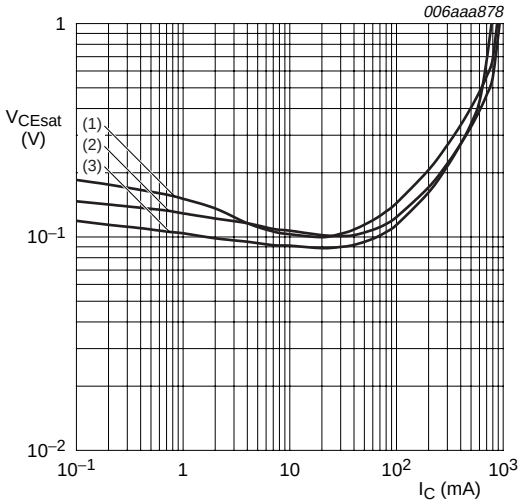


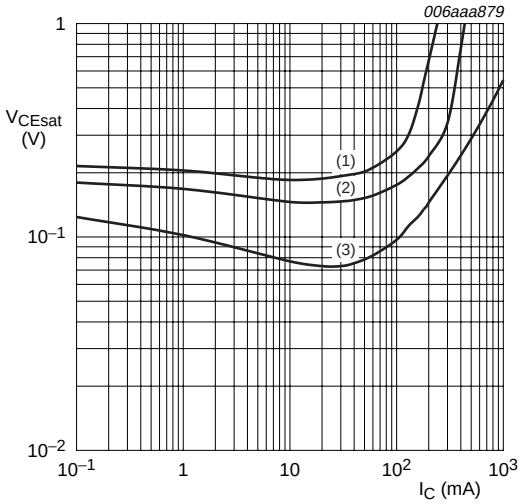
I_C/I_B = 20

(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

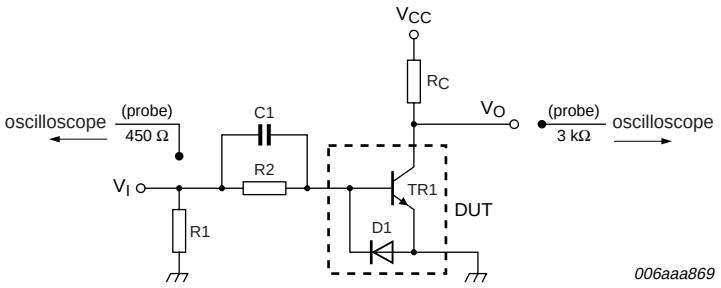
(1) I_C/I_B = 100

(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 = 0.15 A; I_B = 5 mA; R1 = 50 Ω; R2 = 1 kΩ; R_C = 68 Ω; C1 = 1 nF

Fig 11. Test circuit for switching times

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9. Package outline

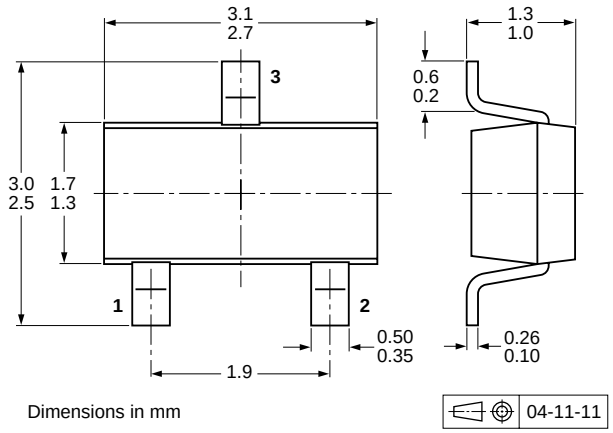

Fig 12. Package outline SOT346 (SC-59A/TO-236)

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
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.

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11. Soldering

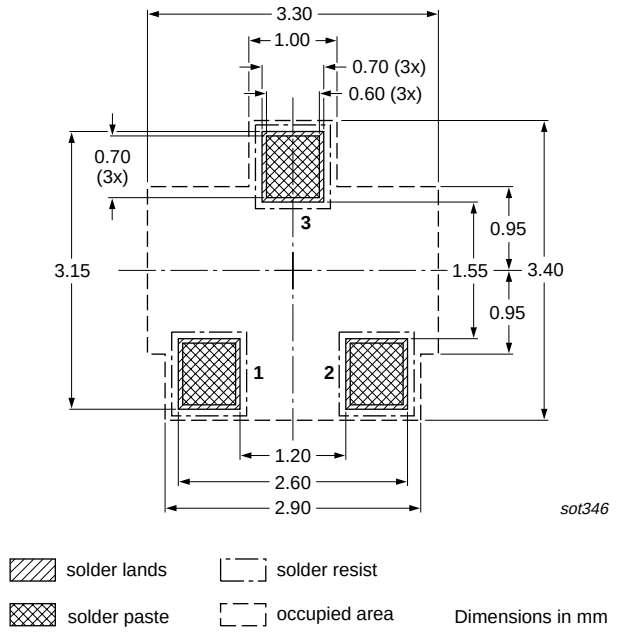

Fig 13. Reflow soldering footprint

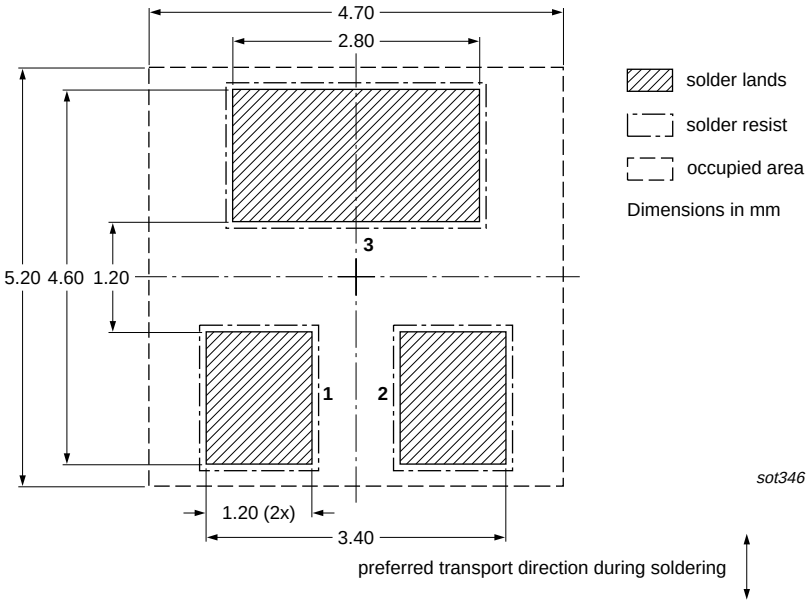

Fig 14. Wave soldering footprint

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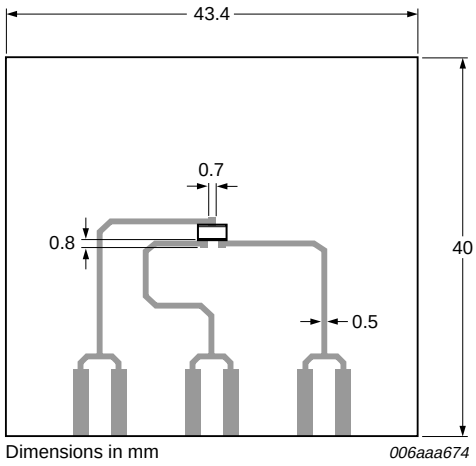
12. Mounting

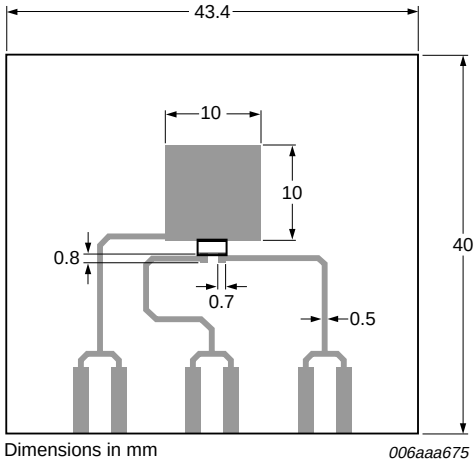


PCB thickness:

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
PMD4002K_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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