

PMEM4030NS

NPN transistor/Schottky rectifier module

Rev. 02 — 8 July 2005

Product data sheet

1. Product profile

1.1 General description

Combination of a NPN transistor with low V_{CEsat} and high current capability and a planar Schottky barrier rectifier with an integrated guard ring for stress protection in a SOT96-1 (SO8/MS-012) small plastic package. PNP complement: PMEM4030PS.

1.2 Features

- 1 W total power dissipation
- High current capability up to 2 A
- Reduces Printed-Circuit Board (PCB) area required
- Reduces pick and place costs
- Small plastic Surface Mounted Device (SMD) package
- Transistor
 - ◆ Low collector-emitter saturation voltage
- Diode
 - ◆ High-speed switching
 - ◆ Low forward voltage
 - ◆ Guard ring protected

1.3 Applications

- DC-to-DC converters
- Inductive load drivers
- General-purpose load drivers

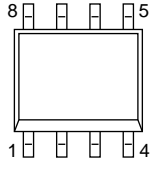
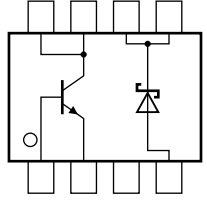
1.4 Quick reference data

Table 1: Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
NPN transistor						
V_{CEO}	collector-emitter voltage	open base	-	-	50	V
I_C	collector current (DC)	continuous	-	-	2	A
Schottky barrier rectifier						
V_R	reverse voltage		-	-	40	V
I_F	forward current		-	-	1	A

2. Pinning information

Table 2: Pinning

Pin	Description	Simplified outline	Symbol
1	base		
2	emitter		
3	not connected		
4	anode		
5	cathode		
6	cathode		
7	collector		
8	collector		

006aaa405

3. Ordering information

Table 3: Ordering information

Type number	Package		
	Name	Description	Version
PMEM4030NS	SO8	plastic small outline package; 8 leads; body width 3.9 mm	SOT96-1

4. Marking

Table 4: Marking codes

Type number	Marking code
PMEM4030NS	P4030NS

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	-	50	V	
V_{CEO}	collector-emitter voltage	open base	-	50	V	
V_{EBO}	emitter-base voltage	open collector	-	5	V	
I_C	collector current (DC)	continuous	-	2	A	
I_{CRM}	repetitive peak collector current	$t_p \leq 100$ ms; $\delta \leq 0.25$	-	3	A	
I_{CM}	peak collector current		-	5	A	
I_B	base current (DC)	continuous	-	0.5	A	
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	[1]	-	550	mW
			[2]	-	1	W
T_j	junction temperature		-	150	°C	
T_{amb}	ambient temperature		-65	+150	°C	
Schottky barrier rectifier						
V_R	reverse voltage		-	40	V	
I_F	forward current		-	1	A	
I_{FRM}	repetitive peak forward current	$t_p \leq 1$ ms; $\delta \leq 0.25$	-	3.5	A	
I_{FSM}	non-repetitive peak forward current	$t = 8.3$ μ s; half sine wave; JEDEC method	-	10	A	
I_{RSM}	non-repetitive peak reverse current	$t_p \leq 100$ μ s	-	0.5	A	
T_j	junction temperature		-	125	°C	
T_{amb}	ambient temperature		-65	+125	°C	
Combined device						
T_{stg}	storage temperature		-65	+150	°C	

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

[2] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 1 cm².

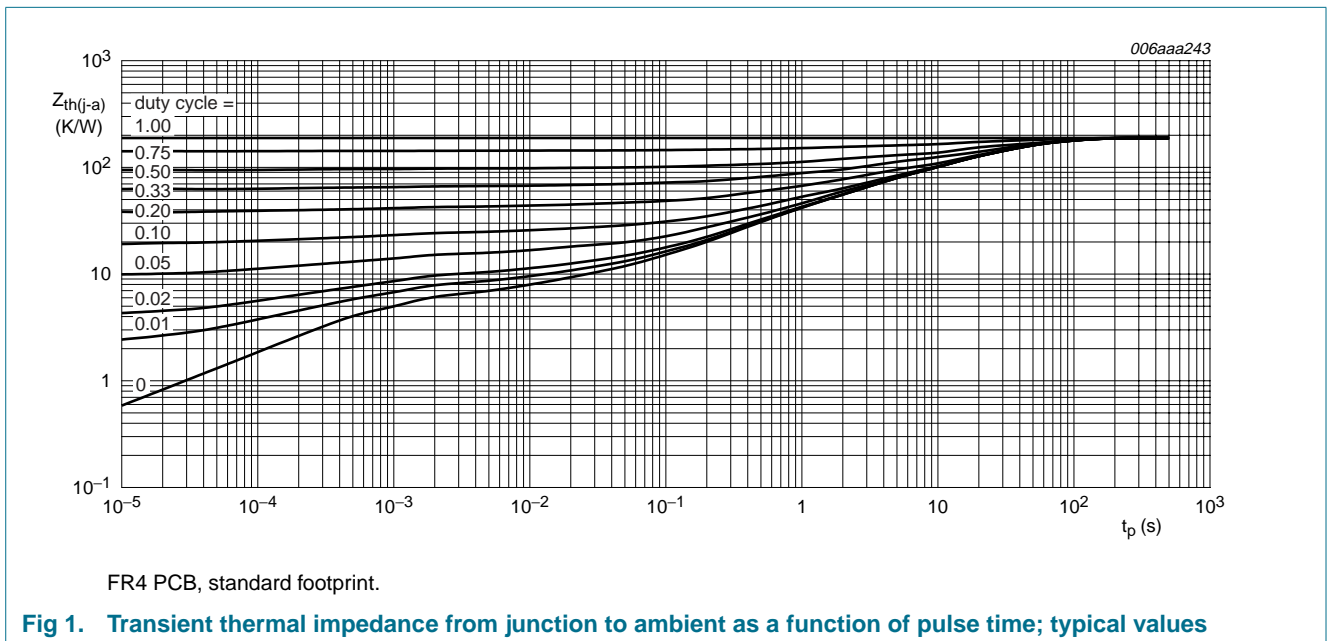
6. Thermal characteristics

Table 6: Thermal characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	-	225	K/W
			[2]	-	-	125	K/W

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

[2] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 1 cm².



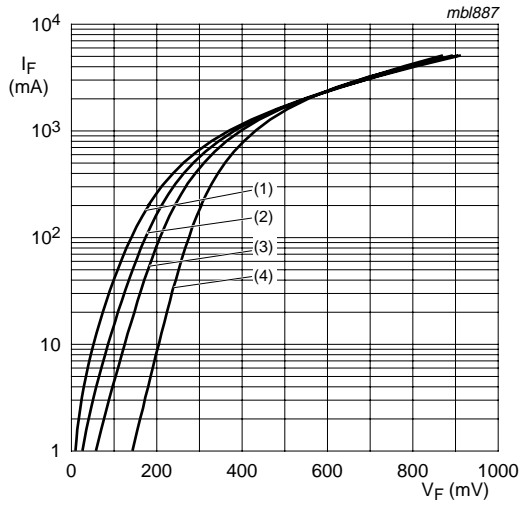
7. Characteristics

Table 7: Characteristics

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
NPN transistor						
I_{CBO}	collector-base cut-off current	$V_{CB} = 50\text{ V}; I_E = 0\text{ A}$	-	-	100	nA
		$V_{CB} = 50\text{ V}; I_E = 0\text{ A}; T_j = 150^\circ\text{C}$	-	-	50	μA
I_{EBO}	emitter-base cut-off current	$V_{EB} = 5\text{ V}; I_C = 0\text{ A}$	-	-	100	nA
h_{FE}	DC current gain	$V_{CE} = 2\text{ V}; I_C = 100\text{ mA}$	200	-	-	
		$V_{CE} = 2\text{ V}; I_C = 500\text{ mA}$	200	-	-	
		$V_{CE} = 2\text{ V}; I_C = 1\text{ A}$	[1] 200	-	450	
		$V_{CE} = 2\text{ V}; I_C = 2\text{ A}$	[1] 130	-	-	
		$V_{CE} = 2\text{ V}; I_C = 3\text{ A}$	[1] 80	-	-	
V_{CEsat}	collector-emitter saturation voltage	$I_C = 500\text{ mA}; I_B = 50\text{ mA}$	-	-	80	mV
		$I_C = 1\text{ A}; I_B = 50\text{ mA}$	-	-	160	mV
		$I_C = 2\text{ A}; I_B = 100\text{ mA}$	[1] -	-	280	mV
		$I_C = 2\text{ A}; I_B = 200\text{ mA}$	[1] -	-	260	mV
		$I_C = 3\text{ A}; I_B = 300\text{ mA}$	[1] -	-	370	mV
R_{CEsat}	collector-emitter saturation resistance	$I_C = 2\text{ A}; I_B = 200\text{ mA}$	[1] -	100	130	$\text{m}\Omega$
V_{BEsat}	base-emitter saturation voltage	$I_C = 2\text{ A}; I_B = 100\text{ mA}$	[1] -	-	1.1	V
		$I_C = 3\text{ A}; I_B = 300\text{ mA}$	[1] -	-	1.2	V
V_{BEon}	base-emitter turn-on voltage	$V_{CE} = 2\text{ V}; I_C = 1\text{ A}$	[1] 1.1	-	-	V
f_T	transition frequency	$V_{CE} = 5\text{ V}; I_C = 100\text{ mA}; f = 100\text{ MHz}$	100	-	-	MHz
C_c	collector capacitance	$V_{CB} = 10\text{ V}; I_E = I_e = 0\text{ A}; f = 1\text{ MHz}$	-	-	25	pF
Schottky barrier rectifier						
V_F	forward voltage	$I_F = 100\text{ mA}$	[1] -	280	330	mV
		$I_F = 1\text{ A}$	[1] -	460	500	mV
I_R	reverse current	$V_R = 10\text{ V}$	[1] -	15	40	μA
		$V_R = 40\text{ V}$	[1] -	60	300	μA
C_d	diode capacitance	$V_R = 4\text{ V}; f = 1\text{ MHz};$	-	65	80	pF

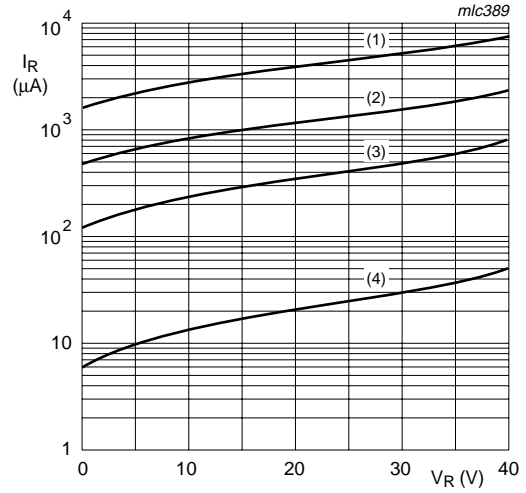
[1] Pulse test: $t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02$.



Schottky barrier rectifier

- (1) $T_{amb} = 125\text{ °C}$
- (2) $T_{amb} = 100\text{ °C}$
- (3) $T_{amb} = 75\text{ °C}$
- (4) $T_{amb} = 25\text{ °C}$

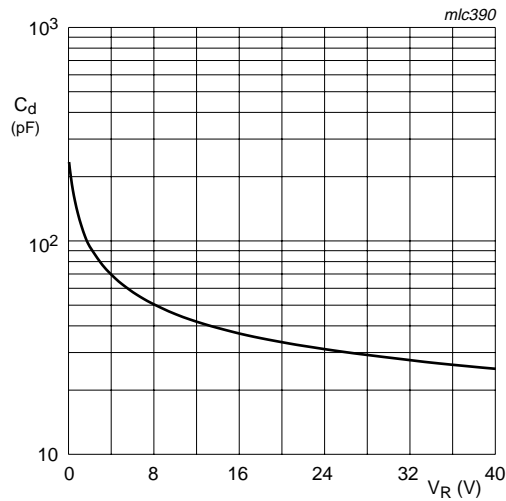
Fig 2. Forward current as a function of forward voltage; typical values



Schottky barrier rectifier

- (1) $T_{amb} = 125\text{ °C}$
- (2) $T_{amb} = 100\text{ °C}$
- (3) $T_{amb} = 75\text{ °C}$
- (4) $T_{amb} = 25\text{ °C}$

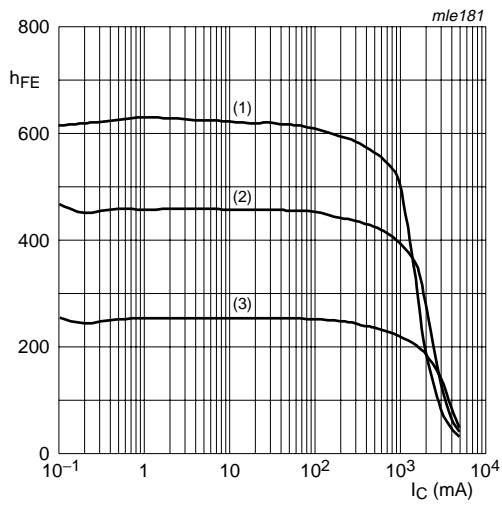
Fig 3. Reverse current as a function of reverse voltage; typical values



Schottky barrier rectifier

$f = 1\text{ MHz}$

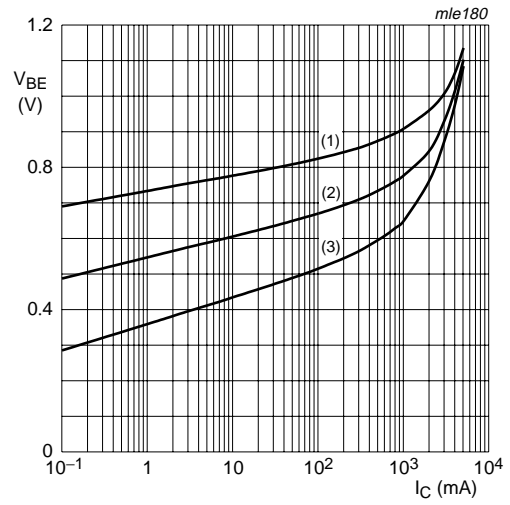
Fig 4. Diode capacitance as a function of reverse voltage; typical values



NPN transistor; $V_{CE} = 2\text{ V}$

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

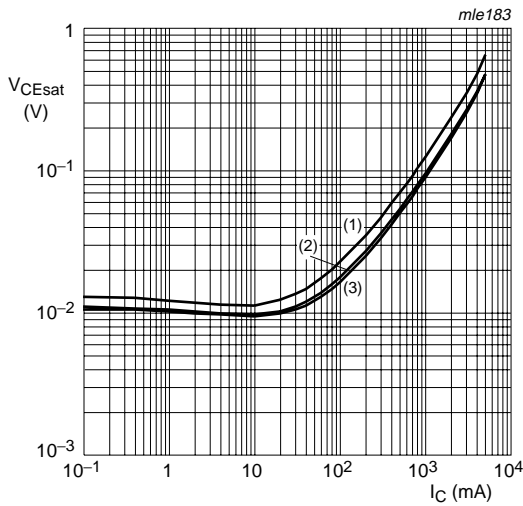
Fig 5. DC current gain as a function of collector current; typical values



NPN transistor; $V_{CE} = 2\text{ V}$

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

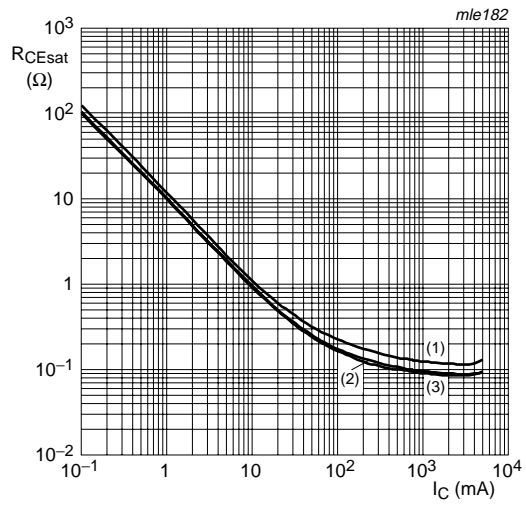
Fig 6. Base-emitter voltage as a function of collector current; typical values



NPN transistor; $I_C/I_B = 20$

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

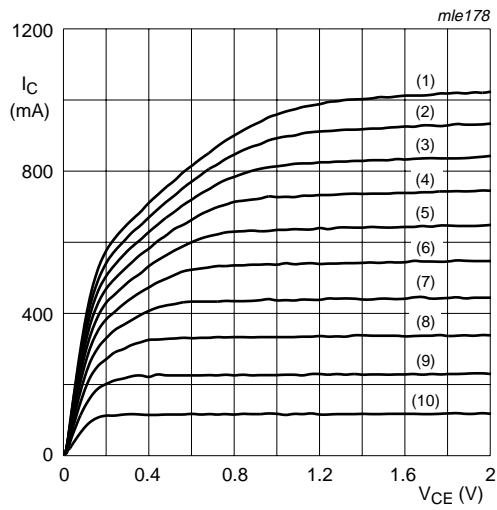
Fig 7. Collector-emitter saturation voltage as a function of collector current; typical values



NPN transistor; $I_C/I_B = 20$

- (1) $T_{amb} = 150\text{ °C}$
- (2) $T_{amb} = 25\text{ °C}$
- (3) $T_{amb} = -55\text{ °C}$

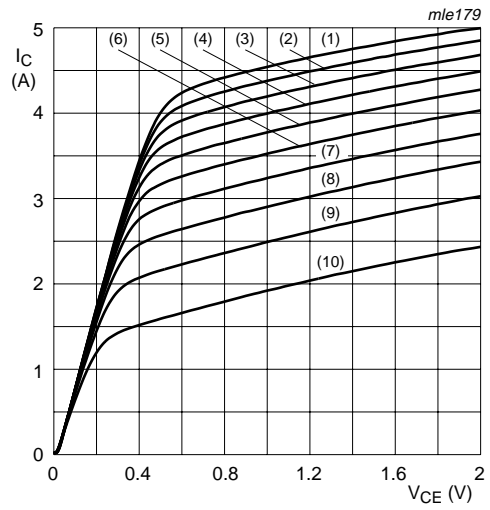
Fig 8. Collector-emitter saturation resistance as a function of collector current; typical values



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

- (1) $I_B = 2600\text{ }\mu\text{A}$
- (2) $I_B = 2340\text{ }\mu\text{A}$
- (3) $I_B = 2080\text{ }\mu\text{A}$
- (4) $I_B = 1820\text{ }\mu\text{A}$
- (5) $I_B = 1560\text{ }\mu\text{A}$
- (6) $I_B = 1300\text{ }\mu\text{A}$
- (7) $I_B = 1040\text{ }\mu\text{A}$
- (8) $I_B = 780\text{ }\mu\text{A}$
- (9) $I_B = 520\text{ }\mu\text{A}$
- (10) $I_B = 260\text{ }\mu\text{A}$

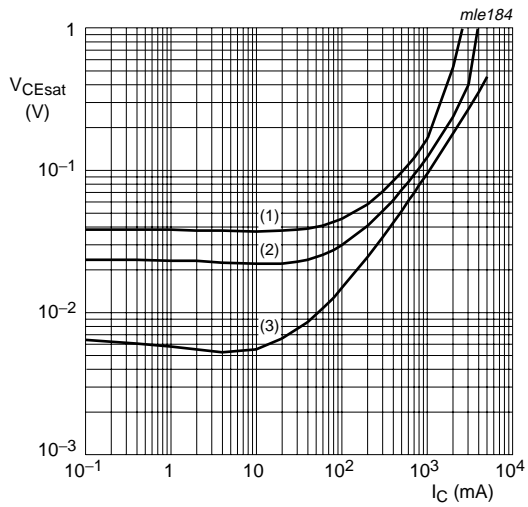
Fig 9. Collector current as a function of collector-emitter voltage; typical values



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

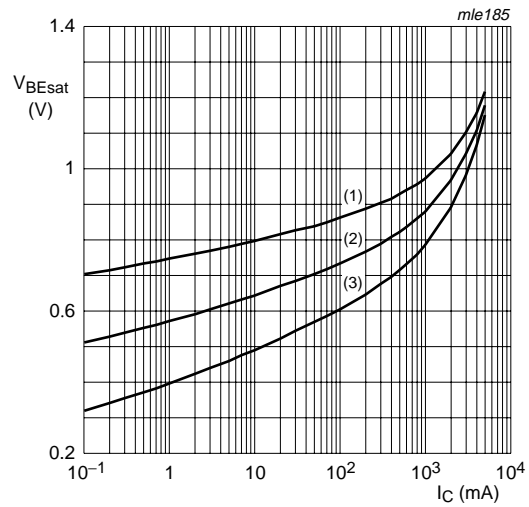
- (1) $I_B = 120\text{ mA}$
- (2) $I_B = 108\text{ mA}$
- (3) $I_B = 96\text{ mA}$
- (4) $I_B = 84\text{ mA}$
- (5) $I_B = 72\text{ mA}$
- (6) $I_B = 60\text{ mA}$
- (7) $I_B = 48\text{ mA}$
- (8) $I_B = 36\text{ mA}$
- (9) $I_B = 24\text{ mA}$
- (10) $I_B = 12\text{ mA}$

Fig 10. Collector current as a function of collector-emitter voltage; 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 11. Collector-emitter saturation 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 12. Base-emitter saturation voltage as a function of collector current; typical values

8. Application information

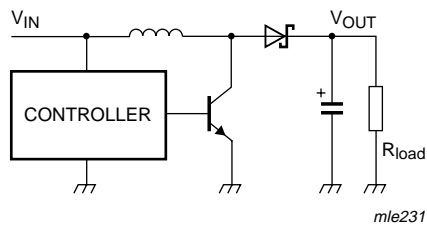


Fig 13. DC-to-DC converter

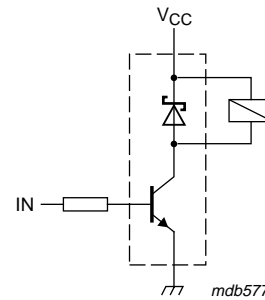


Fig 14. Inductive load driver (relays, motors and buzzers) with free-wheeling diode

9. Package outline

SO8: plastic small outline package; 8 leads; body width 3.9 mm

SOT96-1

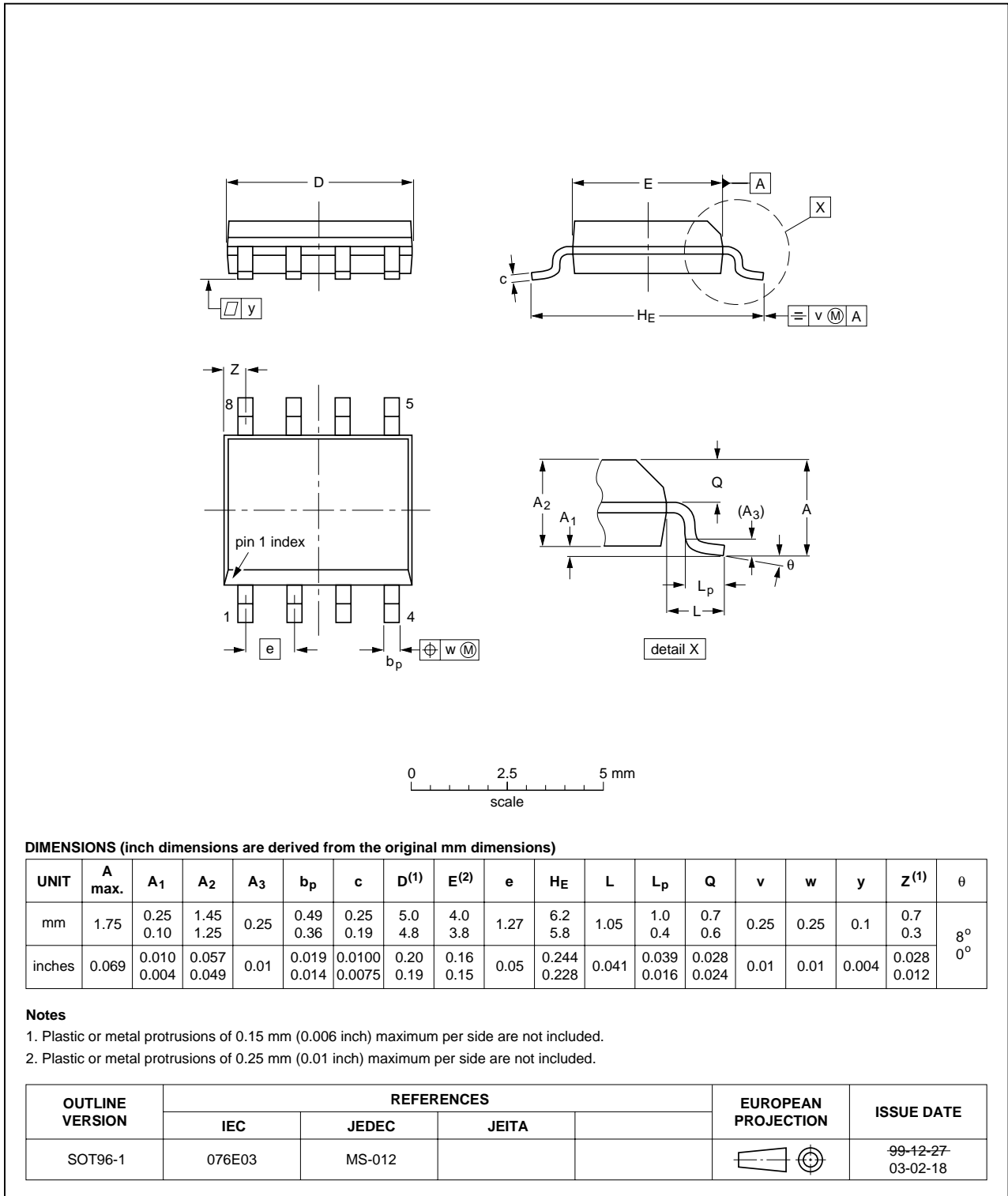


Fig 15. Package outline SOT96-1 (SO8/MS-012)

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	
			1000	2500
PMEM4030NS	SOT96-1	8 mm pitch, 12 mm tape and reel	-115	-118

[1] For further information and the availability of packing methods, see [Section 16](#).

11. Revision history

Table 9: Revision history

Document ID	Release date	Data sheet status	Change notice	Doc. number	Supersedes
PMEM4030NS_2	20050708	Product data sheet	-	-	PMEM4030NS_1
Modifications:	<ul style="list-style-type: none">• Table 5 "Limiting values": I_{CRP} repetitive pulsed collector current renamed to I_{CRM} repetitive peak collector current				
PMEM4030NS_1	20050525	Product data sheet	-	9397 750 15065	-

12. Data sheet status

Level	Data sheet status ^[1]	Product status ^{[2] [3]}	Definition
I	Objective data	Development	This data sheet contains data from the objective specification for product development. Philips Semiconductors reserves the right to change the specification in any manner without notice.
II	Preliminary data	Qualification	This data sheet contains data from the preliminary specification. Supplementary data will be published at a later date. Philips Semiconductors reserves the right to change the specification without notice, in order to improve the design and supply the best possible product.
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[2] The product status of the device(s) described in this data sheet may have changed since this data sheet was published. The latest information is available on the Internet at URL <http://www.semiconductors.philips.com>.

[3] For data sheets describing multiple type numbers, the highest-level product status determines the data sheet status.

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Short-form specification — The data in a short-form specification is extracted from a full data sheet with the same type number and title. For detailed information see the relevant data sheet or data handbook.

Limiting values definition — Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 60134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.

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