

# PMEM1505NG

NPN transistor/Schottky rectifier module

Rev. 02 — 31 August 2009

Product data sheet

## 1. Product profile

### 1.1 General description

Combination of an 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 SOT353 (SC-88A) small plastic package. PNP complement: PMEM1505PG

### 1.2 Features

- 300 mW total power dissipation
- Current capability up to 0.5 A
- Reduces printed-circuit board area required
- Reduces pick and place costs
- Small plastic SMD package
- Transistor
  - ◆ Low collector-emitter saturation voltage.
- Diode
  - ◆ Ultra high-speed switching
  - ◆ Very low forward voltage
  - ◆ Guard ring protected

### 1.3 Applications

- DC-to-DC converters
- General purpose load drivers
- MOSFET drivers
- Inductive load drivers
- Reverse polarity protection circuits

### 1.4 Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>NPN transistor</b>						
$V_{CEO}$	collector-emitter voltage	open base	-	-	15	V
$I_C$	collector current (DC)	continuous	[1]	-	0.5	A
<b>Schottky barrier rectifier</b>						
$V_R$	continuous reverse voltage		-	-	20	V
$I_F$	continuous forward current		-	-	0.5	A

[1] Mounted on a FR4 printed-circuit board, single-sided copper, tin-plated, standard footprint for SOT353.

## 2. Pinning information

**Table 2. Discrete pinning**

Pin	Description	Simplified outline	Symbol
1	anode		
5	cathode		
4	collector		
2	base		
3	emitter		

*sym023*

## 3. Ordering information

**Table 3. Ordering information**

Type number	Package		
	Name	Description	Version
PMEM1505NG	-	plastic surface mounted package; 5 leads	SOT353

## 4. Marking

**Table 4. Marking**

Type number	Marking code <sup>[1]</sup>
PMEM1505NG	L7*

- [1] \* = p: made in Hong Kong  
 \* = t: made in Malaysia  
 \* = W: made in China

## 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	-	15	V
$V_{CEO}$	collector-emitter voltage	open base	-	15	V
$V_{EBO}$	emitter-base voltage	open collector	-	6	V
$I_C$	collector current (DC)	continuous	[1]	0.5	A
		continuous	[2]	0.6	A
		continuous; $T_s \leq 55\text{ °C}$	[3]	1	A
$I_{CM}$	peak collector current		-	1	A
$I_{BM}$	peak base current		-	100	mA

**Table 5. Limiting values ...continued**  
*In accordance with the Absolute Maximum Rating System (IEC 60134).*

Symbol	Parameter	Conditions	Min	Max	Unit
P <sub>tot</sub>	total power dissipation	T <sub>amb</sub> ≤ 25 °C [1]	-	200	mW
		T <sub>amb</sub> ≤ 25 °C [2]	-	250	mW
		T <sub>s</sub> ≤ 55 °C [3]	-	800	mW
T <sub>j</sub>	junction temperature		-	150	°C
<b>Schottky barrier rectifier</b>					
V <sub>R</sub>	continuous reverse voltage		-	20	V
I <sub>F</sub>	continuous forward current		-	0.5	A
I <sub>FSM</sub>	non-repetitive peak forward current	t = 8.3 ms; square wave	-	5	A
P <sub>tot</sub>	total power dissipation	T <sub>amb</sub> ≤ 25 °C [1]	-	100	mW
		T <sub>amb</sub> ≤ 25 °C [2]	-	200	mW
		T <sub>s</sub> ≤ 55 °C [3]	-	800	mW
T <sub>j</sub>	junction temperature		[2]	125	°C
<b>Combined device</b>					
P <sub>tot</sub>	total power dissipation	T <sub>amb</sub> ≤ 25 °C [2]	-	300	mW
T <sub>stg</sub>	storage temperature		-65	+150	°C
T <sub>amb</sub>	operating ambient temperature		[2]	+125	°C

- [1] Mounted on a FR4 printed-circuit board, single-sided copper, tin-plated, standard footprint for SOT353.
- [2] Device mounted on a printed-circuit board, single-sided copper, tin-plated, 1 cm<sup>2</sup> mounting pad for both collector and cathode.
- [3] Solder point of collector or cathode tab.

## 6. Thermal characteristics

**Table 6. Thermal characteristics[1]**

Symbol	Parameter	Conditions	Typ	Unit
<b>Single device</b>				
R <sub>th(j-s)</sub>	thermal resistance from junction to solder point	in free air	[2] 120	K/W
R <sub>th(j-a)</sub>	thermal resistance from junction to ambient	in free air	[3] 395	K/W
			[4] 495	K/W
<b>Combined device</b>				
R <sub>th(j-a)</sub>	thermal resistance from junction to ambient	in free air	[5] 410	K/W

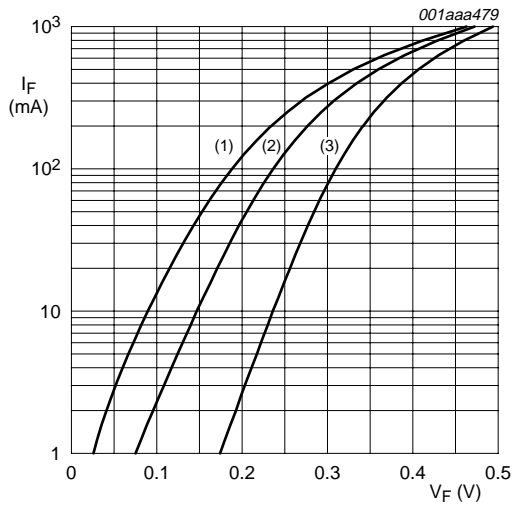
- [1] For Schottky barrier rectifiers thermal run-away has to be considered, as in some applications the reverse power losses P<sub>R</sub> are a significant part of the total power losses. Nomograms for determining the reverse power losses P<sub>R</sub> and I<sub>F(AV)</sub> rating will be available on request.
- [2] Solder point of collector or cathode tab.
- [3] Device mounted on a printed-circuit board, single-sided copper, tin-plated, 1 cm<sup>2</sup> mounting pad for both collector and cathode.
- [4] Mounted on a FR4 printed-circuit board, single-sided copper, tin-plated, standard footprint for SOT353.
- [5] Mounted on a ceramic printed-circuit board, single-sided copper, tin-plated, standard footprint.

## 7. Characteristics

**Table 7. Characteristics**
*T<sub>amb</sub> = 25 °C unless otherwise specified*

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
<b>NPN transistor</b>							
I <sub>CBO</sub>	collector-base cut-off current	V <sub>CB</sub> = 15 V; I <sub>E</sub> = 0 A	-	-	100	nA	
		V <sub>CB</sub> = 15 V; I <sub>E</sub> = 0 A; T <sub>j</sub> = 150 °C	-	-	50	μA	
I <sub>EBO</sub>	emitter-base cut-off current	V <sub>EB</sub> = 5 V; I <sub>C</sub> = 0 A	-	-	100	nA	
h <sub>FE</sub>	DC current gain	V <sub>CE</sub> = 2 V; I <sub>C</sub> = 10 mA	200	-	-		
		V <sub>CE</sub> = 2 V; I <sub>C</sub> = 100 mA	150	-	-		
		V <sub>CE</sub> = 2 V; I <sub>C</sub> = 500 mA	90	-	-		
V <sub>CEsat</sub>	collector-emitter saturation voltage	I <sub>C</sub> = 10 mA; I <sub>B</sub> = 0.5 mA	-	-	25	mV	
		I <sub>C</sub> = 200 mA; I <sub>B</sub> = 10 mA	-	-	150	mV	
		I <sub>C</sub> = 500 mA; I <sub>B</sub> = 50 mA	-	-	250	mV	
R <sub>CEsat</sub>	equivalent on-resistance	I <sub>C</sub> = 500 mA; I <sub>B</sub> = 50 mA	[1]	-	300	< 500 mΩ	
V <sub>BEsat</sub>	base-emitter saturation voltage	I <sub>C</sub> = 500 mA; I <sub>B</sub> = 50 mA	[1]	-	-	1.1 V	
V <sub>BEon</sub>	base-emitter turn-on voltage	V <sub>CE</sub> = 2 V; I <sub>C</sub> = 100 mA	[1]	-	-	0.9 V	
f <sub>T</sub>	transition frequency	V <sub>CE</sub> = 5 V; I <sub>C</sub> = 100 mA; f = 100 MHz	250	420	-	MHz	
C <sub>c</sub>	collector capacitance	V <sub>CB</sub> = 10 V; I <sub>E</sub> = I <sub>e</sub> = 0 A; f = 1 MHz	-	4.4	6	pF	
<b>Schottky barrier rectifier</b>							
V <sub>F</sub>	continuous forward voltage	see <a href="#">Figure 1</a>					
		I <sub>F</sub> = 10 mA	[1]	-	240	270	mV
		I <sub>F</sub> = 100 mA	[1]	-	300	350	mV
		I <sub>F</sub> = 500 mA	[1]	-	400	460	mV
I <sub>R</sub>	reverse current	see <a href="#">Figure 2</a>					
		V <sub>R</sub> = 5 V	[1]	-	5	10	μA
		V <sub>R</sub> = 8 V	[1]	-	7	20	μA
		V <sub>R</sub> = 15 V	[1]	-	10	50	μA
C <sub>d</sub>	diode capacitance	V <sub>R</sub> = 5 V; f = 1 MHz; see <a href="#">Figure 3</a>	-	19	25	pF	

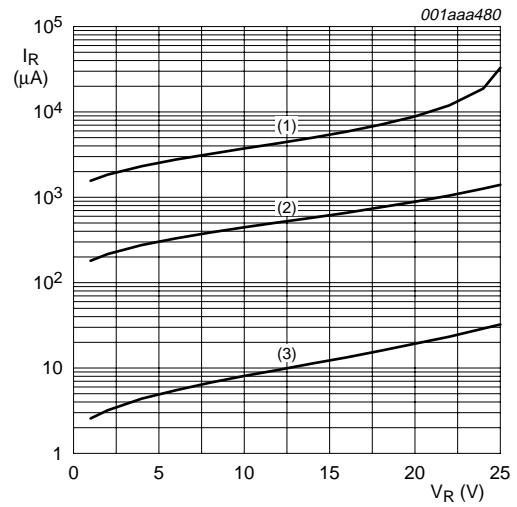
[1] Pulse test: t<sub>p</sub> ≤ 300 μs; δ ≤ 0.02



Schottky barrier rectifier

- (1)  $T_{amb} = 125\text{ °C}$
- (2)  $T_{amb} = 85\text{ °C}$
- (3)  $T_{amb} = 25\text{ °C}$

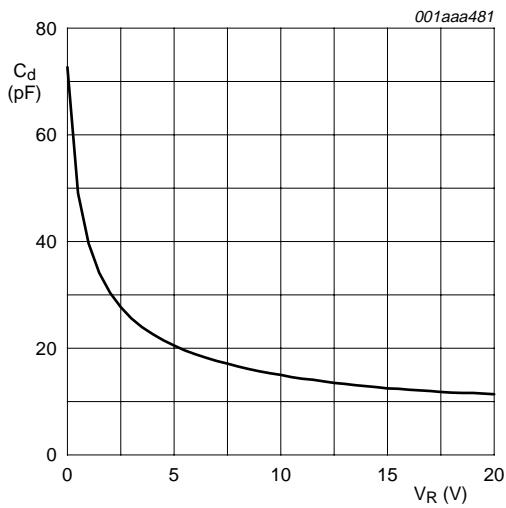
Fig 1. Forward current as a function of forward voltage; typical values



Schottky barrier rectifier

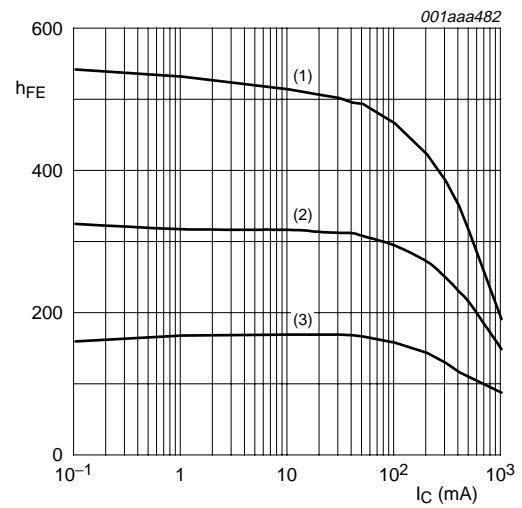
- (1)  $T_{amb} = 125\text{ °C}$
- (2)  $T_{amb} = 85\text{ °C}$
- (3)  $T_{amb} = 25\text{ °C}$

Fig 2. Reverse current as a function of reverse voltage; typical values



Schottky barrier rectifier;  $f = 1\text{ MHz}$ ;  $T_{amb} = 25\text{ °C}$

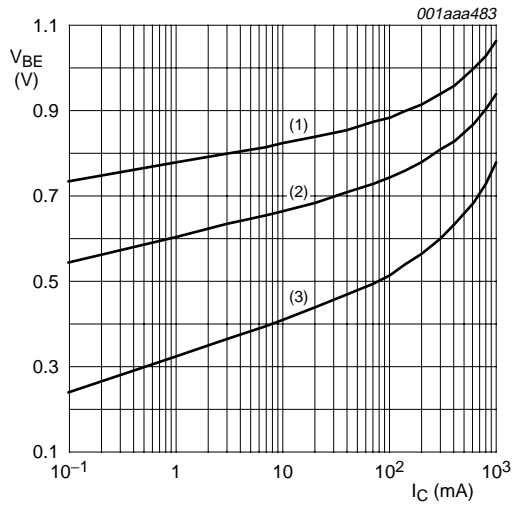
Fig 3. Diode capacitance as a function of reverse voltage; typical values



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

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

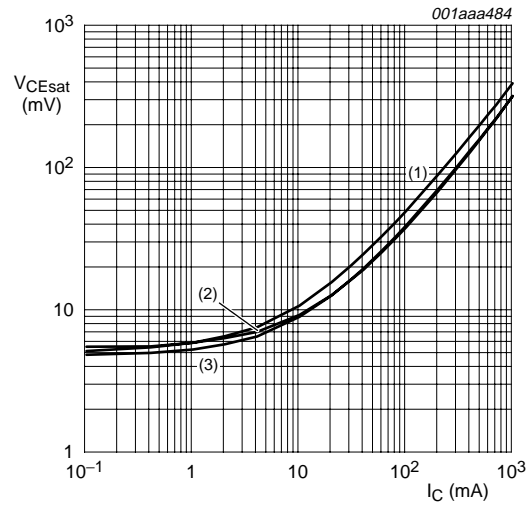
Fig 4. DC current gain as a function of collector current; typical values



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

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

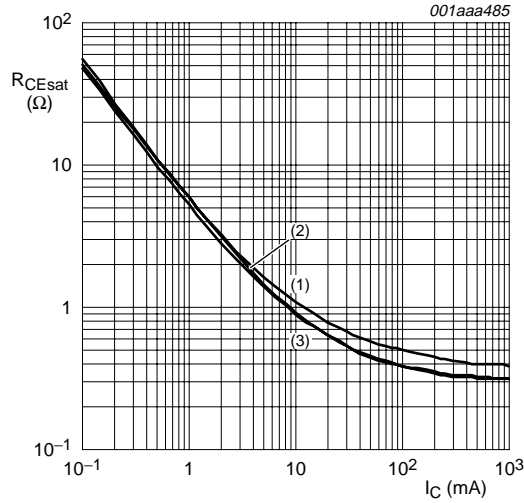
Fig 5. Base-emitter voltage as a function of collector current; typical values



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

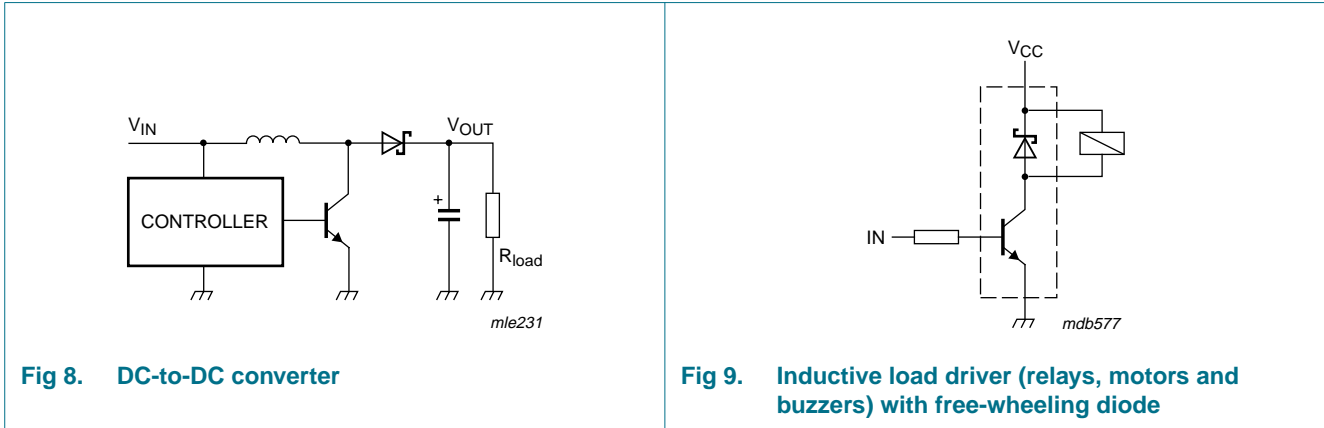


NPN transistor;  $I_C/I_B = 20$

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

Fig 7. Equivalent on-resistance as a function of collector current; typical values

**8. Application information**



9. Package outline

Plastic surface-mounted package; 5 leads

SOT353

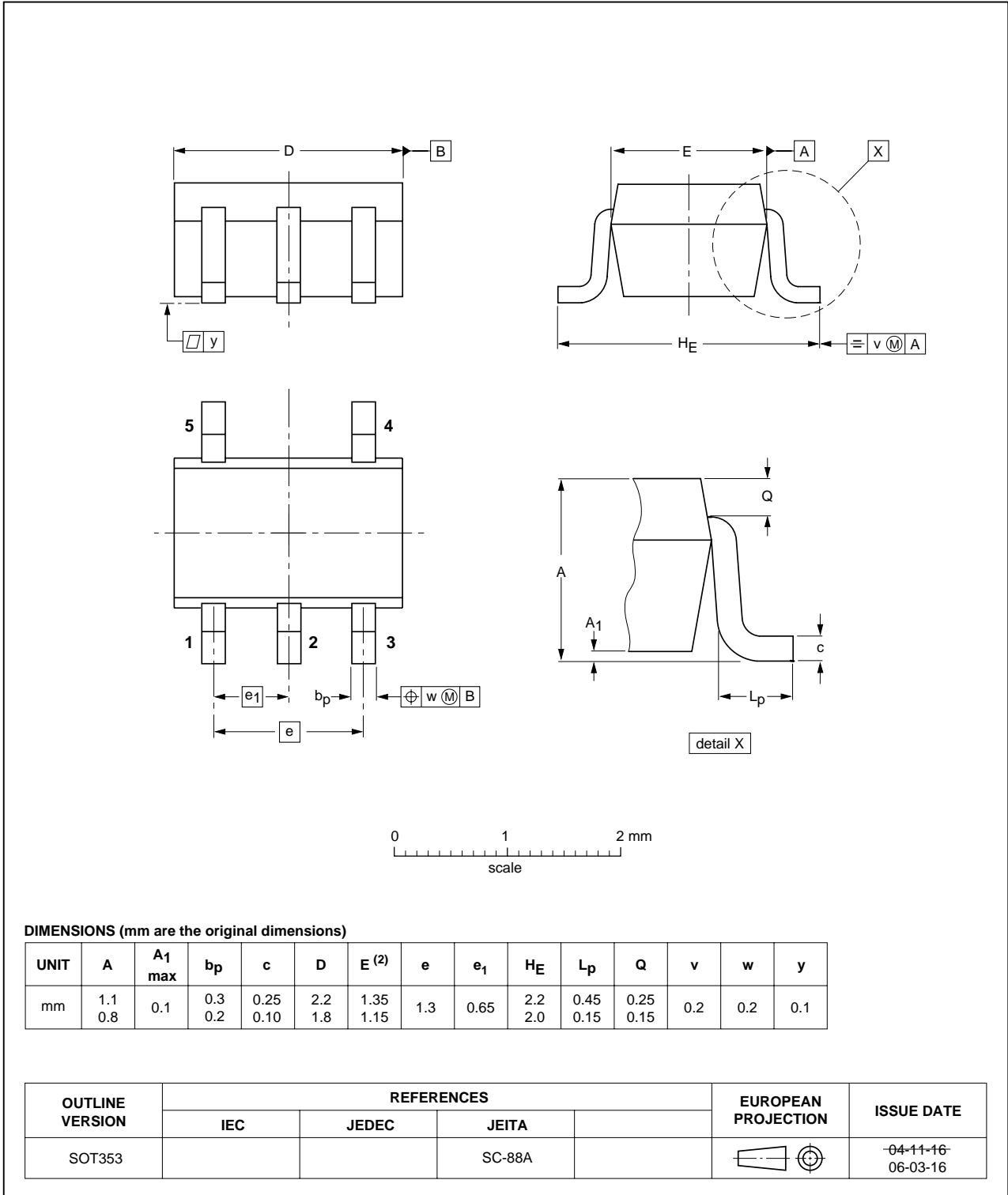


Fig 10. Package outline



## 10. Revision history

**Table 8. Revision history**

Document ID	Release date	Data sheet status	Change notice	Supersedes
PMEM1505NG_2	20090831	Product data	-	PMEM1505NG_1
Modifications:	<ul style="list-style-type: none"> <li>• This data sheet was changed to reflect the new company name NXP Semiconductors, including new legal definitions and disclaimers. No changes were made to the technical content.</li> <li>• <a href="#">Table 2 “Discrete pinning”</a>: amended</li> <li>• <a href="#">Figure 10 “Package outline”</a>: updated</li> </ul>			
PMEM1505NG_1	20040525	Product data	-	-

## 11. Legal information

### 11.1 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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**13. Contents**

**1 Product profile . . . . . 1**

1.1 General description. . . . . 1

1.2 Features . . . . . 1

1.3 Applications . . . . . 1

1.4 Quick reference data. . . . . 1

**2 Pinning information. . . . . 2**

**3 Ordering information. . . . . 2**

**4 Marking. . . . . 2**

**5 Limiting values. . . . . 2**

**6 Thermal characteristics. . . . . 3**

**7 Characteristics. . . . . 4**

**8 Application information. . . . . 7**

**9 Package outline . . . . . 8**

**10 Revision history. . . . . 9**

**11 Legal information. . . . . 10**

11.1 Data sheet status . . . . . 10

11.2 Definitions . . . . . 10

11.3 Disclaimers . . . . . 10

11.4 Trademarks . . . . . 10

**12 Contact information. . . . . 10**

**13 Contents . . . . . 11**

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