

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

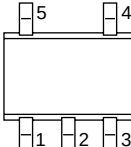
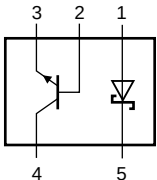
Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
NPN transistor						
V_{CEO}	collector-emitter voltage	open base	-	-	15	V
I_C	collector current (DC)	continuous	[1]	-	0.5	A
Schottky barrier rectifier						
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 ^[1]
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
NPN transistor					
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; $T_s \leq 55^\circ\text{C}$ [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_{tot}	total power dissipation	$T_{\text{amb}} \leq 25\text{ °C}$ [1]	-	200	mW
		$T_{\text{amb}} \leq 25\text{ °C}$ [2]	-	250	mW
		$T_s \leq 55\text{ °C}$ [3]	-	800	mW
T_j	junction temperature		-	150	°C
Schottky barrier rectifier					
V_R	continuous reverse voltage		-	20	V
I_F	continuous forward current		-	0.5	A
I_{FSM}	non-repetitive peak forward current	$t = 8.3\text{ ms}$; square wave	-	5	A
P_{tot}	total power dissipation	$T_{\text{amb}} \leq 25\text{ °C}$ [1]	-	100	mW
		$T_{\text{amb}} \leq 25\text{ °C}$ [2]	-	200	mW
		$T_s \leq 55\text{ °C}$ [3]	-	800	mW
T_j	junction temperature		[2]	125	°C
Combined device					
P_{tot}	total power dissipation	$T_{\text{amb}} \leq 25\text{ °C}$ [2]	-	300	mW
T_{stg}	storage temperature		-65	+150	°C
T_{amb}	operating ambient temperature		[2] -65	+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, 1cm² 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
Single device					
R _{th(j-s)}	thermal resistance from junction to solder point	in free air	[2]	120	K/W
R _{th(j-a)}	thermal resistance from junction to ambient	in free air	[3]	395	K/W
			[4]	495	K/W
Combined device					
R _{th(j-a)}	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_R are a significant part of the total power losses. Nomograms for determining the reverse power losses P_R and $I_{F(AV)}$ 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, 1cm² 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.

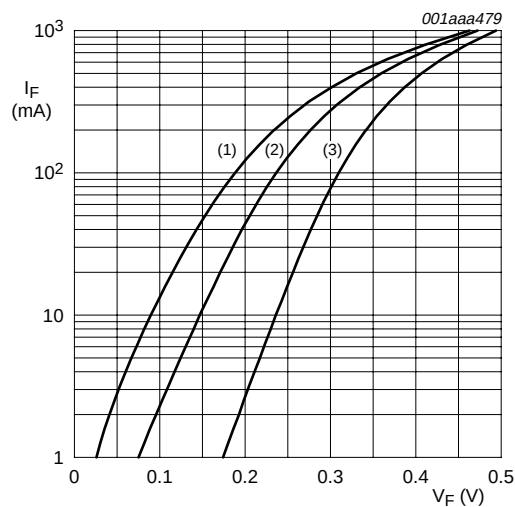
7. Characteristics

Table 7. Characteristics

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
NPN transistor						
I_{CBO}	collector-base cut-off current	$V_{CB} = 15\text{ V}; I_E = 0\text{ A}$	-	-	100	nA
		$V_{CB} = 15\text{ V}; I_E = 0\text{ A}; T_j = 150\text{ }^{\circ}\text{C}$	-	-	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	$V_{CE} = 2\text{ V}; I_C = 10\text{ mA}$	200	-	-	
		$V_{CE} = 2\text{ V}; I_C = 100\text{ mA}$	150	-	-	
		$V_{CE} = 2\text{ V}; I_C = 500\text{ mA}$	90	-	-	
V_{CEsat}	collector-emitter saturation voltage	$I_C = 10\text{ mA}; I_B = 0.5\text{ mA}$	-	-	25	mV
		$I_C = 200\text{ mA}; I_B = 10\text{ mA}$	-	-	150	mV
		$I_C = 500\text{ mA}; I_B = 50\text{ mA}$	-	-	250	mV
R_{CEsat}	equivalent on-resistance	$I_C = 500\text{ mA}; I_B = 50\text{ mA}$	[1]	300	< 500	$\text{m}\Omega$
V_{BEsat}	base-emitter saturation voltage	$I_C = 500\text{ mA}; I_B = 50\text{ mA}$	[1]	-	1.1	V
V_{BEon}	base-emitter turn-on voltage	$V_{CE} = 2\text{ V}; I_C = 100\text{ mA}$	[1]	-	0.9	V
f_T	transition frequency	$V_{CE} = 5\text{ V}; I_C = 100\text{ mA}; f = 100\text{ MHz}$	250	420	-	MHz
C_c	collector capacitance	$V_{CB} = 10\text{ V}; I_E = I_e = 0\text{ A}; f = 1\text{ MHz}$	-	4.4	6	pF
Schottky barrier rectifier						
V_F	continuous forward voltage	see Figure 1				
		$I_F = 10\text{ mA}$	[1]	240	270	mV
		$I_F = 100\text{ mA}$	[1]	300	350	mV
		$I_F = 500\text{ mA}$	[1]	400	460	mV
I_R	reverse current	$I_F = 1000\text{ mA}$	[1]	480	550	mV
		see Figure 2				
		$V_R = 5\text{ V}$	[1]	5	10	μA
		$V_R = 8\text{ V}$	[1]	7	20	μA
C_d	diode capacitance	$V_R = 15\text{ V}$	[1]	10	50	μA
		$V_R = 5\text{ V}; f = 1\text{ MHz};$ see Figure 3	-	19	25	pF

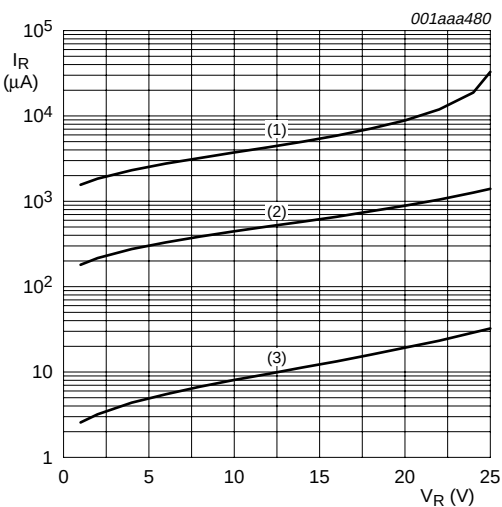
[1] Pulse test: $t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02$



Schottky barrier rectifier

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

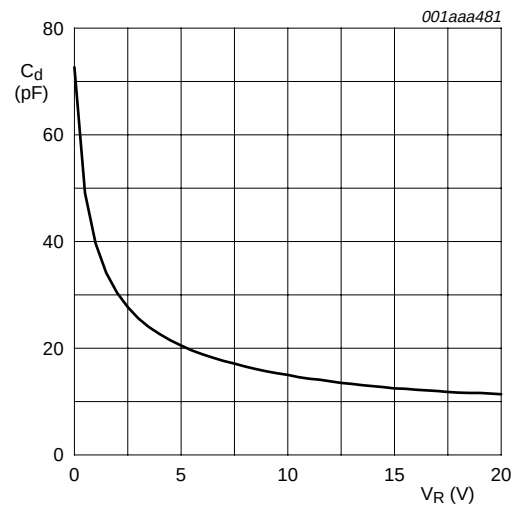
Fig 1. Forward current as a function of forward voltage; typical values



Schottky barrier rectifier

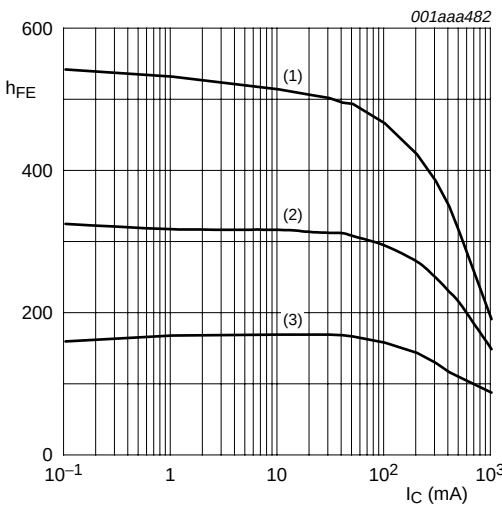
- (1) $T_{amb} = 125^\circ\text{C}$
- (2) $T_{amb} = 85^\circ\text{C}$
- (3) $T_{amb} = 25^\circ\text{C}$

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



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

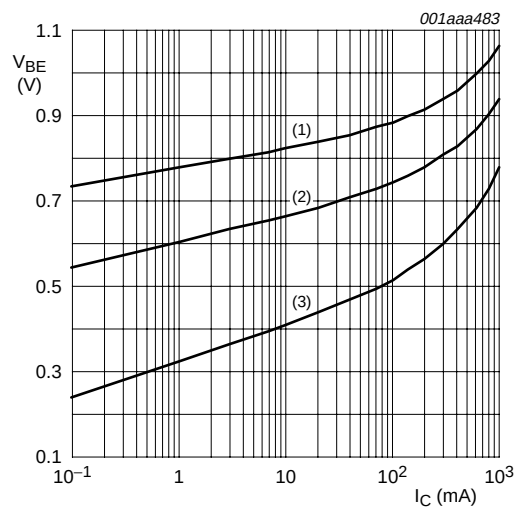
Fig 3. Diode capacitance as a function of reverse voltage; typical values



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

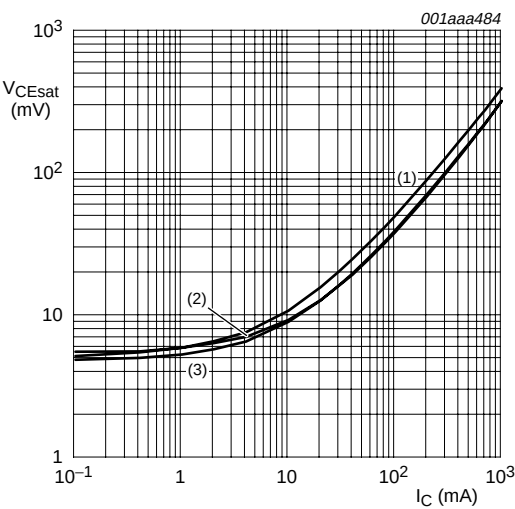
- (1) $T_{amb} = 150^\circ\text{C}$
- (2) $T_{amb} = 25^\circ\text{C}$
- (3) $T_{amb} = -55^\circ\text{C}$

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



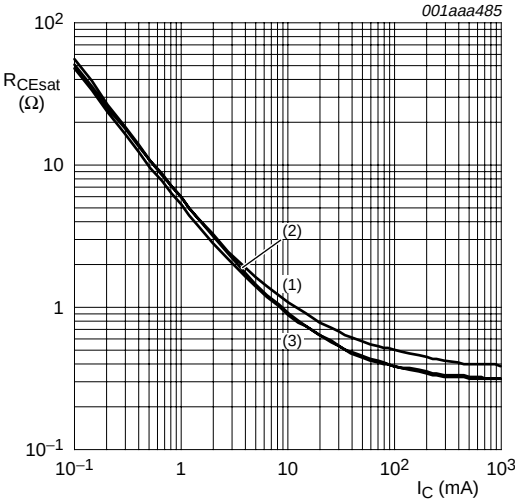
NPN transistor; $V_{CE} = 2\text{ V}$
(1) $T_{amb} = -55\text{ }^{\circ}\text{C}$
(2) $T_{amb} = 25\text{ }^{\circ}\text{C}$
(3) $T_{amb} = 150\text{ }^{\circ}\text{C}$

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



NPN transistor; $I_C/I_B = 20$
(1) $T_{amb} = 150\text{ }^{\circ}\text{C}$
(2) $T_{amb} = 25\text{ }^{\circ}\text{C}$
(3) $T_{amb} = -55\text{ }^{\circ}\text{C}$

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



NPN transistor; $I_C/I_B = 20$
(1) $T_{amb} = 150\text{ }^{\circ}\text{C}$
(2) $T_{amb} = 25\text{ }^{\circ}\text{C}$
(3) $T_{amb} = -55\text{ }^{\circ}\text{C}$

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

8. Application information

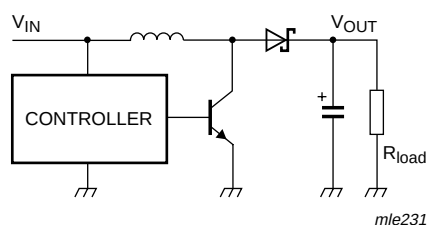


Fig 8. DC-to-DC converter

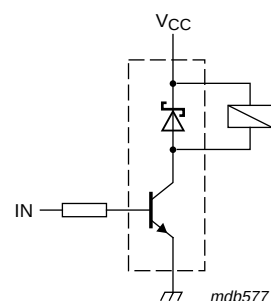


Fig 9. Inductive load driver (relays, motors and buzzers) with free-wheeling diode

9. Package outline

Plastic surface-mounted package; 5 leadsSOT353

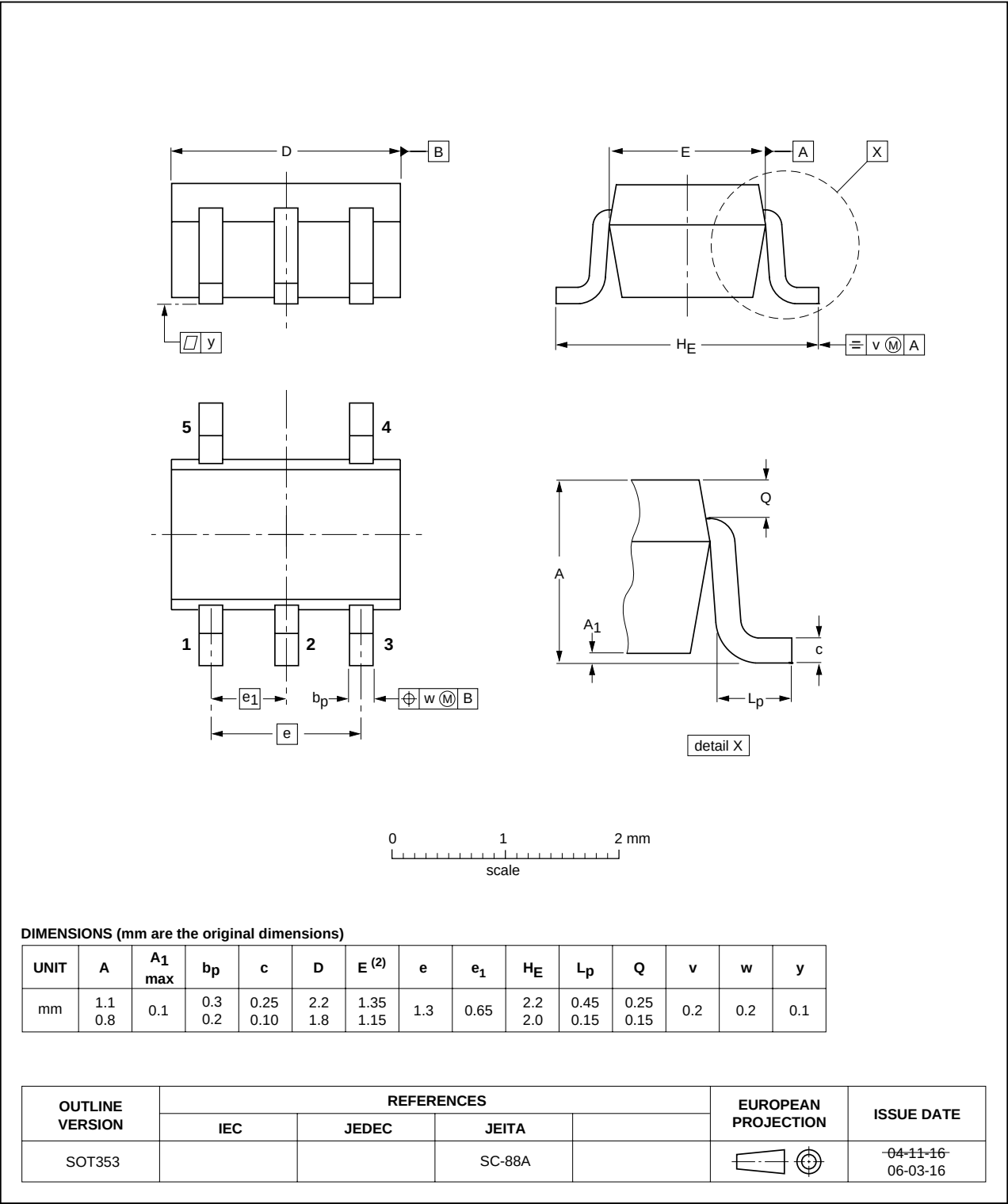


Fig 10. Package outline

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:	• 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. • Table 2 "Discrete pinning": amended • Figure 10 "Package outline": updated			
PMEM1505NG_1	20040525	Product data	-	-

11. Legal information

11.1 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.
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[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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