

# 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

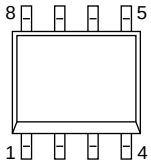
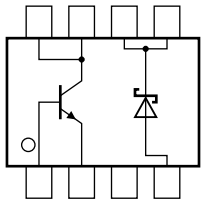
**Table 1: Quick reference data**

| 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 |

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## 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 |



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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 | | - | 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 µs; half sine wave; JEDEC method | | - | 10 | A |
| $I_{RSM}$ | non-repetitive peak reverse current | $t_p \leq 100$ µs | | - | 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 $cm^2$.



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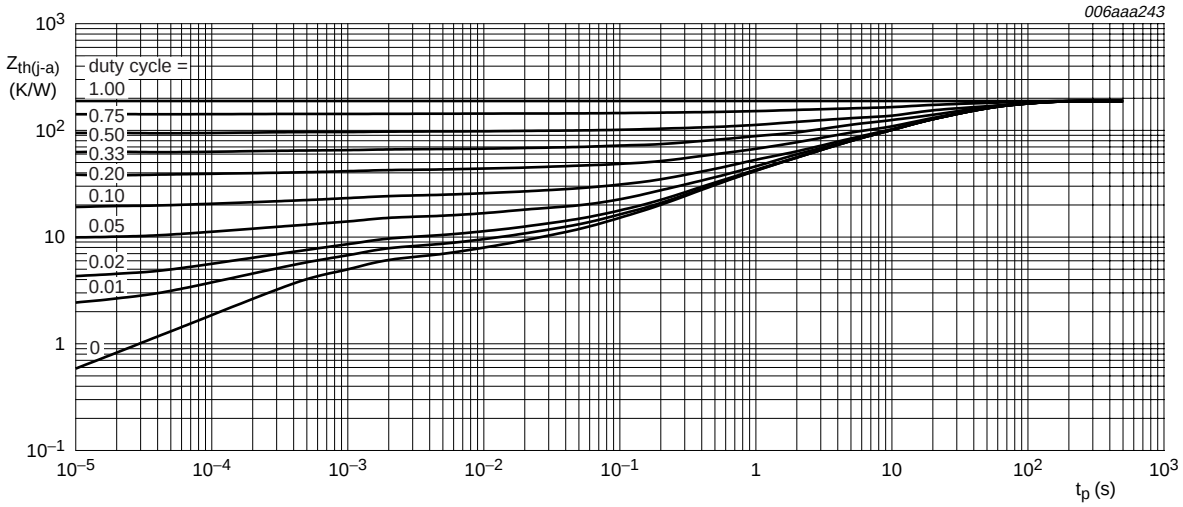
## 6. Thermal characteristics

**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 $cm^2$.




FR4 PCB, standard footprint.

**Fig 1. Transient thermal impedance from junction to ambient as a function of pulse time; typical values**


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## 7. Characteristics

**Table 7: Characteristics**

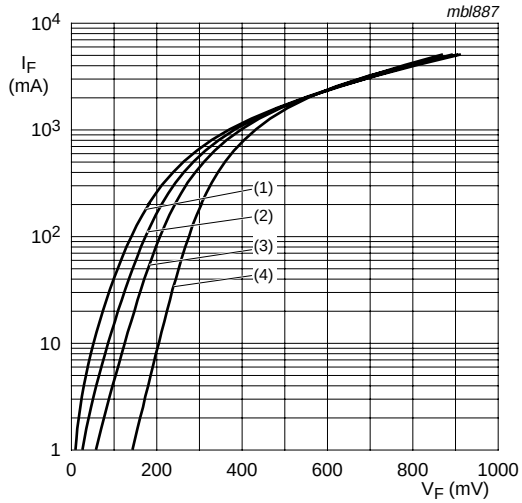
*$T_{amb}$ = 25 °C unless otherwise specified.*

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

[1] Pulse test: $t_p \leq 300$ µs; $\delta \leq 0.02$.



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**Schottky barrier rectifier**

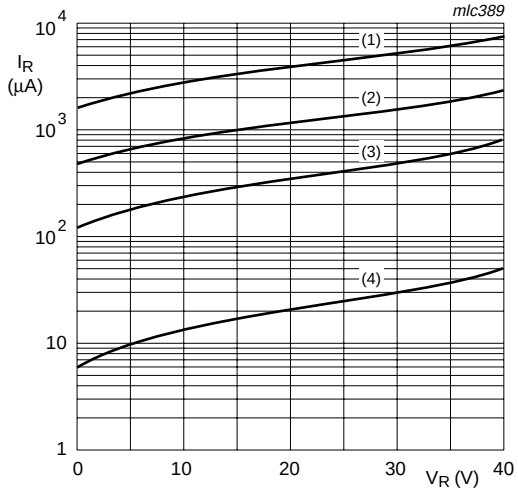
(1) $T_{amb}$ = 125 °C

(2) $T_{amb}$ = 100 °C

(3) $T_{amb}$ = 75 °C

(4) $T_{amb}$ = 25 °C

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




**Schottky barrier rectifier**

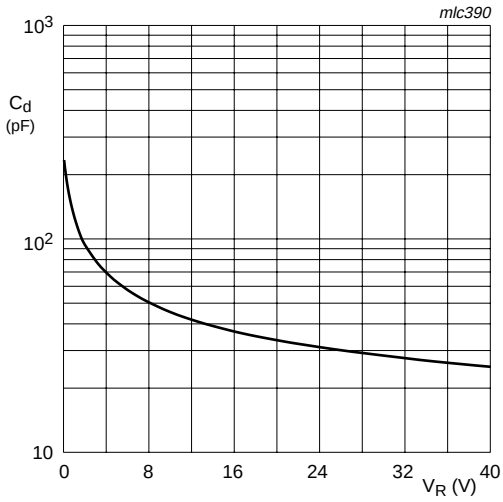
(1) $T_{amb}$ = 125 °C

(2) $T_{amb}$ = 100 °C

(3) $T_{amb}$ = 75 °C

(4) $T_{amb}$ = 25 °C

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



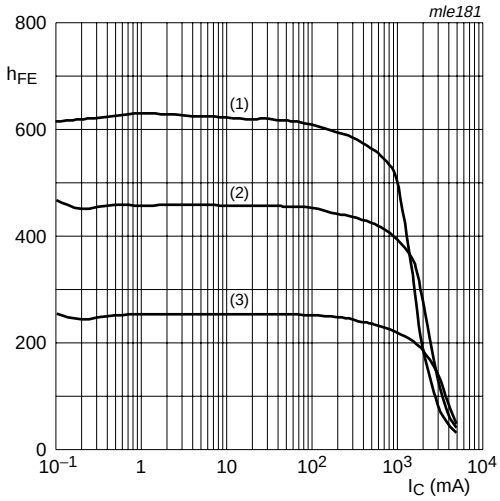

**Schottky barrier rectifier**

f = 1 MHz

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



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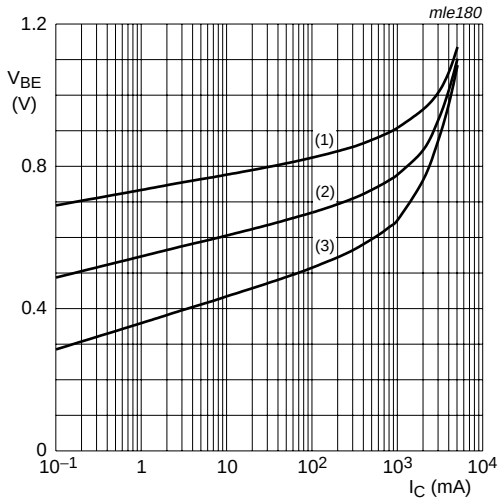

**NPN transistor;** $V_{CE}$ = 2 V

(1) $T_{amb}$ = 100 °C

(2) $T_{amb}$ = 25 °C

(3) $T_{amb}$ = –55 °C

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



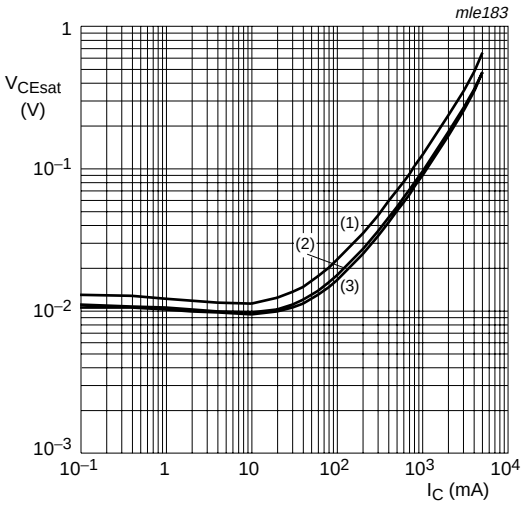

**NPN transistor;** $V_{CE}$ = 2 V

(1) $T_{amb}$ = –55 °C

(2) $T_{amb}$ = 25 °C

(3) $T_{amb}$ = 100 °C

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



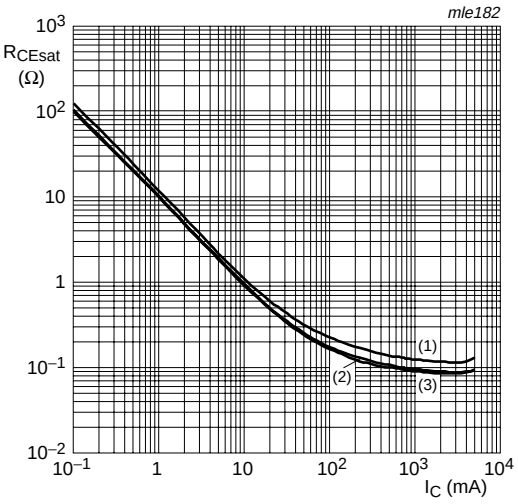

**NPN transistor;** $I_C/I_B$ = 20

(1) $T_{amb}$ = 100 °C

(2) $T_{amb}$ = 25 °C

(3) $T_{amb}$ = –55 °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 °C

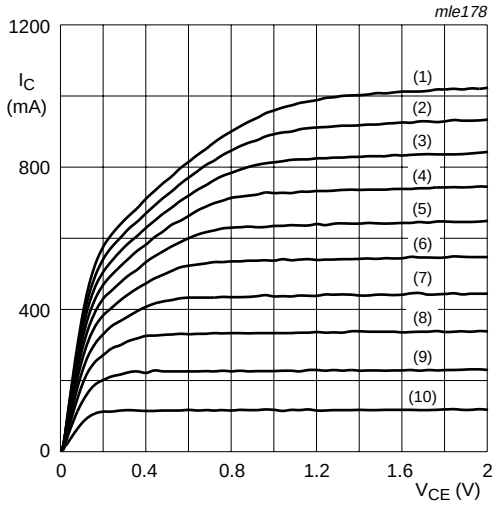
(2) $T_{amb}$ = 25 °C

(3) $T_{amb}$ = –55 °C

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



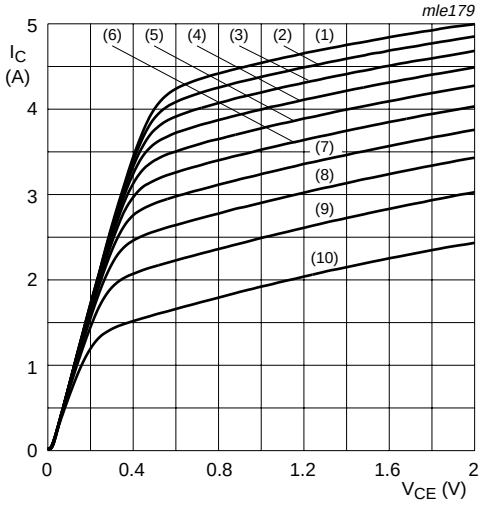
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$T_{amb}$ = 25 °C

(1) $I_B$ = 2600 µA
(2) $I_B$ = 2340 µA
(3) $I_B$ = 2080 µA
(4) $I_B$ = 1820 µA
(5) $I_B$ = 1560 µA
(6) $I_B$ = 1300 µA
(7) $I_B$ = 1040 µA
(8) $I_B$ = 780 µA
(9) $I_B$ = 520 µA
(10) $I_B$ = 260 µA

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

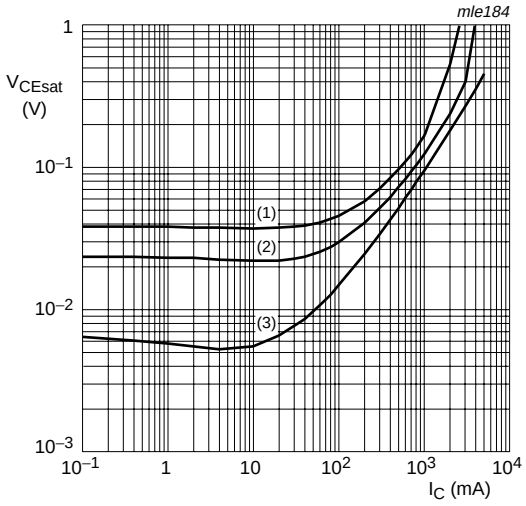



$T_{amb}$ = 25 °C

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

**Fig 10. Collector current as a function of collector-emitter voltage; typical values**


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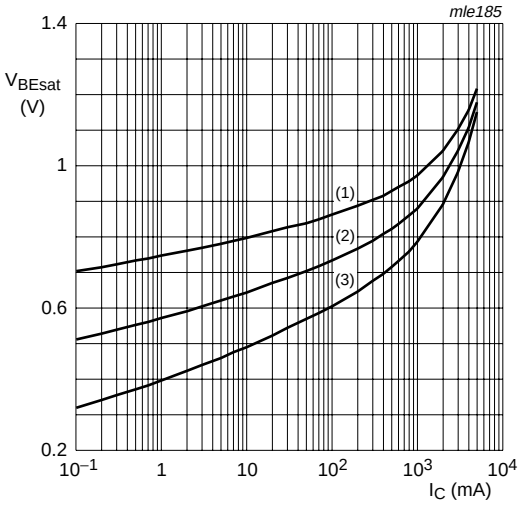

$T_{amb}$ = 25 °C

(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 °C

(2) $T_{amb}$ = 25 °C

(3) $T_{amb}$ = 100 °C

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

## 8. Application information

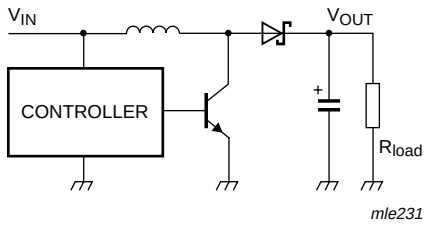



**Fig 13. DC-to-DC converter**

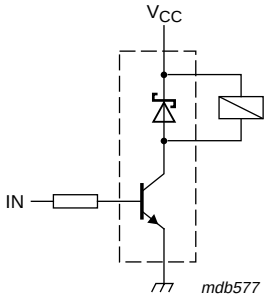


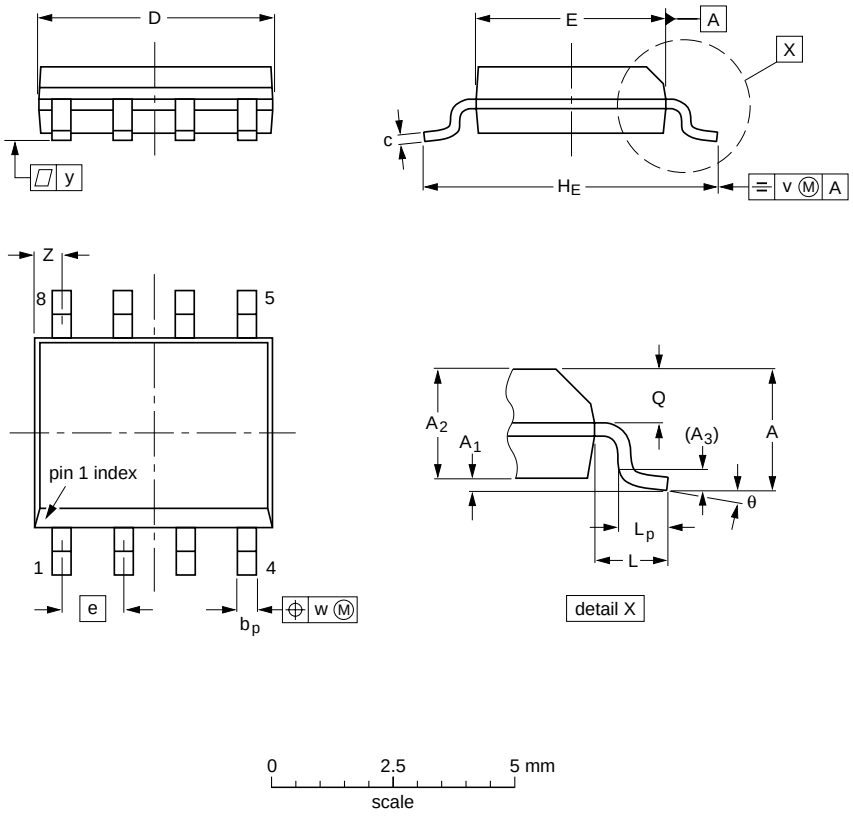

**Fig 14. Inductive load driver (relays, motors and buzzers) with free-wheeling diode**



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# 9. Package outline

**SO8: plastic small outline package; 8 leads; body width 3.9 mm** **SOT96-1**




**DIMENSIONS (inch dimensions are derived from the original mm dimensions)**

| UNIT | A max. | $A_1$ | $A_2$ | $A_3$ | $b_p$ | c | $D^{(1)}$ | $E^{(2)}$ | e | $H_E$ | L | $L_p$ | Q | v | w | y | $Z^{(1)}$ | θ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 1.75 | 0.25<br>0.10 | 1.45<br>1.25 | 0.25 | 0.49<br>0.36 | 0.25<br>0.19 | 5.0<br>4.8 | 4.0<br>3.8 | 1.27 | 6.2<br>5.8 | 1.05 | 1.0<br>0.4 | 0.7<br>0.6 | 0.25 | 0.25 | 0.1 | 0.7<br>0.3 | $8^o$<br>$0^o$ |
| inches | 0.069 | 0.010<br>0.004 | 0.057<br>0.049 | 0.01 | 0.019<br>0.014 | 0.0100<br>0.0075 | 0.20<br>0.19 | 0.16<br>0.15 | 0.05 | 0.244<br>0.228 | 0.041 | 0.039<br>0.016 | 0.028<br>0.024 | 0.01 | 0.01 | 0.004 | 0.028<br>0.012 | |

**Notes**

1. Plastic or metal protrusions of 0.15 mm (0.006 inch) maximum per side are not included.
2. Plastic or metal protrusions of 0.25 mm (0.01 inch) maximum per side are not included.

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT96-1 | 076E03 | MS-012 | | | | ~~99-12-27~~<br>03-02-18 |

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


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## 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.



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## 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: | • 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 | - |


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## 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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[1] Please consult the most recently issued data sheet before initiating or completing a design.

[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.

## 13. Definitions

**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.

**Application information —** Applications that are described herein for any of these products are for illustrative purposes only. Philips Semiconductors make no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

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For sales office addresses, send an email to: **sales.addresses@www.semiconductors.philips.com**



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## 17. 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** | **3** |
| **6** | **Thermal characteristics** | **4** |
| **7** | **Characteristics** | **5** |
| **8** | **Application information** | **9** |
| **9** | **Package outline** | **10** |
| **10** | **Packing information** | **11** |
| **11** | **Revision history** | **12** |
| **12** | **Data sheet status** | **13** |
| **13** | **Definitions** | **13** |
| **14** | **Disclaimers** | **13** |
| **15** | **Trademarks** | **13** |
| **16** | **Contact information** | **13** |


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