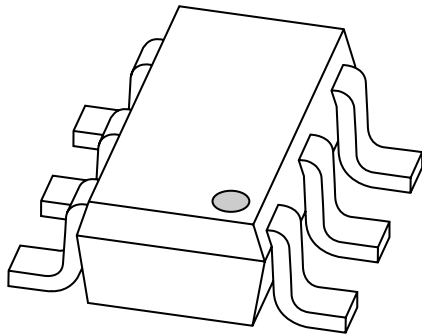


DATA SHEET



PMEM4020ND

NPN transistor/Schottky-diode
module

Product data sheet

2003 Nov 10

NPN transistor/Schottky-diode module

PMEM4020ND

FEATURES

- 600 mW total power dissipation
- High current capability
- Reduces required PCB area
- Reduced 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.

APPLICATIONS

- DC-to-DC converters
- Inductive load drivers
- MOSFET drivers.

DESCRIPTION

Combination of an NPN transistor with low V_{CEsat} and high current capability and a planar Schottky barrier diode with an integrated guard ring for stress protection in a SOT457 (SC-74) small plastic package.
PNP complement: PMEM4020PD.

ORDERING INFORMATION

TYPE NUMBER	PACKAGE		
	NAME	DESCRIPTION	VERSION
PMEM4020ND	–	plastic surface mounted package; 6 leads	SOT457

PINNING

PIN	DESCRIPTION
1	emitter
2	not connected
3	cathode
4	anode
5	base
6	collector

The figure shows two representations of the PMEM4020ND module. On the left is a simplified outline of the SOT457 package, a rectangular component with six leads. The leads are numbered: 1 (emitter) at the bottom left, 2 (not connected) at the bottom center, 3 (cathode) at the bottom right, 4 (anode) at the top right, 5 (base) at the top center, and 6 (collector) at the top left. On the right is the schematic symbol for the module, which combines an NPN transistor symbol and a Schottky diode symbol. The transistor's emitter is connected to lead 1, its base to lead 5, and its collector to lead 6. The Schottky diode's cathode is connected to lead 3 and its anode to lead 4. The symbol is labeled 'MGU865'.

Marking code: B6.

Fig.1 Simplified outline (SOT457) and symbol.

NPN transistor/Schottky-diode module

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LIMITING VALUES

In accordance with the Absolute Maximum 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
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)	note 1	–	0.95	A
		note 2	–	1.30	A
		note 3	–	1.65	A
		$T_s \leq 55\text{ °C}$; note 4	–	2.0	A
I_{CM}	peak collector current		–	3	A
I_{BM}	peak base current		–	1	A
P_{tot}	total power dissipation	$T_{amb} \leq 25\text{ °C}$; note 1	–	295	mW
		$T_{amb} \leq 25\text{ °C}$; note 2	–	400	mW
		$T_{amb} \leq 25\text{ °C}$; note 3	–	500	mW
		$T_s \leq 55\text{ °C}$; note 4	–	1000	mW
T_j	junction temperature		–	150	°C
Schottky barrier diode					
V_R	continuous reverse voltage		–	20	V
I_F	continuous forward current		–	1	A
I_{FSM}	non-repetitive peak forward current	$t = 8.3\text{ ms}$ square wave	–	5	A
P_{tot}	total power dissipation	$T_{amb} \leq 25\text{ °C}$; note 1	–	295	mW
		$T_{amb} \leq 25\text{ °C}$; note 2	–	400	mW
		$T_{amb} \leq 25\text{ °C}$; note 3	–	500	mW
		$T_s \leq 55\text{ °C}$; note 4	–	1000	mW
T_j	junction temperature	note 2	–	150	°C
Combined device					
P_{tot}	total power dissipation	$T_{amb} = 25\text{ °C}$; note 2	–	600	mW
T_{stg}	storage temperature		–65	+150	°C
T_{amb}	operating ambient temperature	note 2	–65	+150	°C

Notes

1. Device mounted on a FR4 printed-circuit board; single-sided copper; tinplated; standard footprint for SOT457.
2. Device mounted on a FR4 printed-circuit board; single-sided copper; tinplated; mounting pads for collector and cathode both 1 cm^2 .
3. Device mounted on a ceramic printed-circuit board, single-sided copper; tinplated; standard footprint.
4. Solder point of collector or cathode tab.

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THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
Single device				
R _{th j-s}	thermal resistance from junction to solder point	in free air; notes 1 and 2	95	K/W
R _{th j-a}	thermal resistance from junction to ambient	in free air; notes 1 and 3	250	K/W
		in free air; notes 1 and 4	315	K/W
		in free air; notes 1 and 5	425	K/W
Combined device				
R _{th j-a}	thermal resistance from junction to ambient	in free air; notes 1 and 3	208	K/W

Notes

1. For Schottky barrier diodes 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 determination of 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 ceramic printed-circuit board; single-sided copper; tinplated; standard footprint.
4. Device mounted on a FR4 printed-circuit board, single-sided copper; tinplated; mounting pad for collector and cathode 1 cm²/each.
5. Device mounted on a FR4 printed-circuit board; single-sided copper; tinplated; standard footprint for SOT457.

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ELECTRICAL 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	$V_{CB} = 40\text{ V}; I_E = 0$	–	–	100	nA
		$V_{CB} = 40\text{ V}; I_E = 0; T_{amb} = 150\text{ }^{\circ}\text{C}$	–	–	50	μA
I_{CEO}	collector-emitter cut-off current	$V_{CE} = 30\text{ V}; I_B = 0$	–	–	100	nA
I_{EBO}	emitter-base cut-off current	$V_{EB} = 5\text{ V}; I_C = 0$	–	–	100	nA
h_{FE}	current gain (DC)	$V_{CE} = 5\text{ V}; I_C = 1\text{ mA}$	300	–	–	
		$V_{CE} = 5\text{ V}; I_C = 500\text{ mA}$	300	–	900	
		$V_{CE} = 5\text{ V}; I_C = 1\text{ A}$	200	–	–	
		$V_{CE} = 5\text{ V}; I_C = 2\text{ A}; \text{note 1}$	75	–	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = 100\text{ mA}; I_B = 1\text{ mA}$	–	–	75	mV
		$I_C = 500\text{ mA}; I_B = 50\text{ mA}$	–	–	100	mV
		$I_C = 1\text{ A}; I_B = 100\text{ mA}$	–	–	190	mV
		$I_C = 2\text{ A}; I_B = 200\text{ mA}$	–	–	400	mV
V_{BEsat}	base-emitter saturation voltage	$I_C = 1\text{ A}; I_B = 100\text{ mA}$	–	–	1.2	V
R_{CEsat}	equivalent on-resistance	$I_C = 1\text{ A}; I_B = 100\text{ mA}; \text{note 1}$	–	150	190	$\text{m}\Omega$
V_{BEon}	base-emitter turn-on voltage	$V_{CE} = 5\text{ V}; I_C = 1\text{ A}$	–	–	1.1	V
f_T	transition frequency	$I_C = 50\text{ mA}; V_{CE} = 10\text{ V};$ $f = 100\text{ MHz}$	150	–	–	MHz
C_c	collector capacitance	$V_{CB} = 10\text{ V}; I_E = 0; i_e = 0;$ $f = 1\text{ MHz}$	–	–	10	pF
Schottky barrier diode						
V_F	continuous forward voltage	see Fig.2; note 1				
		$I_F = 10\text{ mA}$	–	240	270	mV
		$I_F = 100\text{ mA}$	–	300	350	mV
		$I_F = 1000\text{ mA}$	–	480	550	mV
I_R	reverse current	see Fig.3; note 1				
		$V_R = 5\text{ V}$	–	5	10	μA
		$V_R = 8\text{ V}$	–	7	20	μA
		$V_R = 15\text{ V}$	–	10	50	μA
C_d	diode capacitance	$V_R = 5\text{ V}; f = 1\text{ MHz}; \text{see Fig.4}$	–	19	25	pF

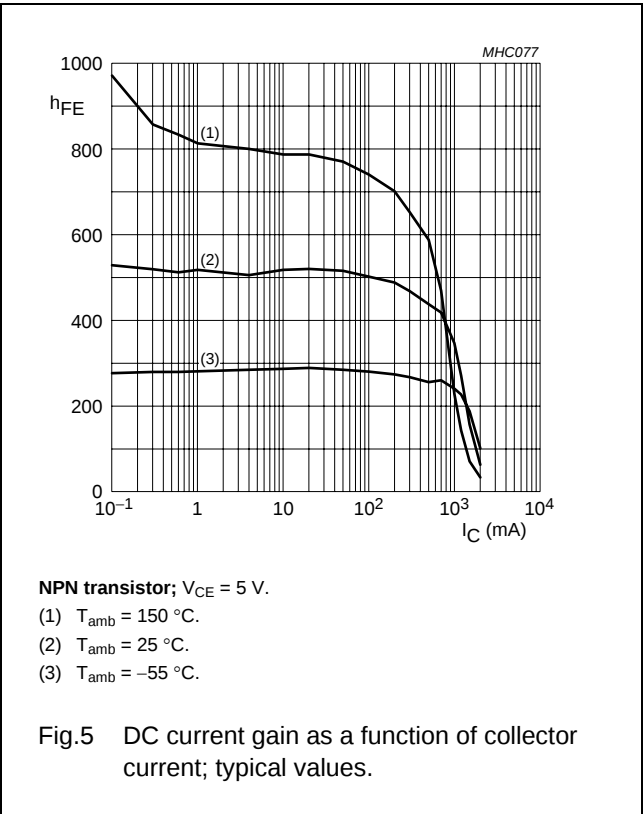
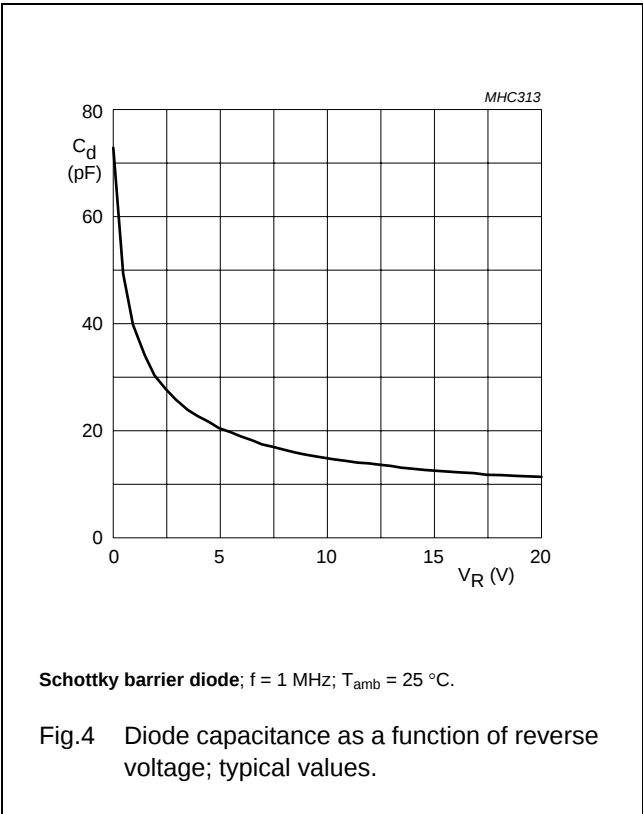
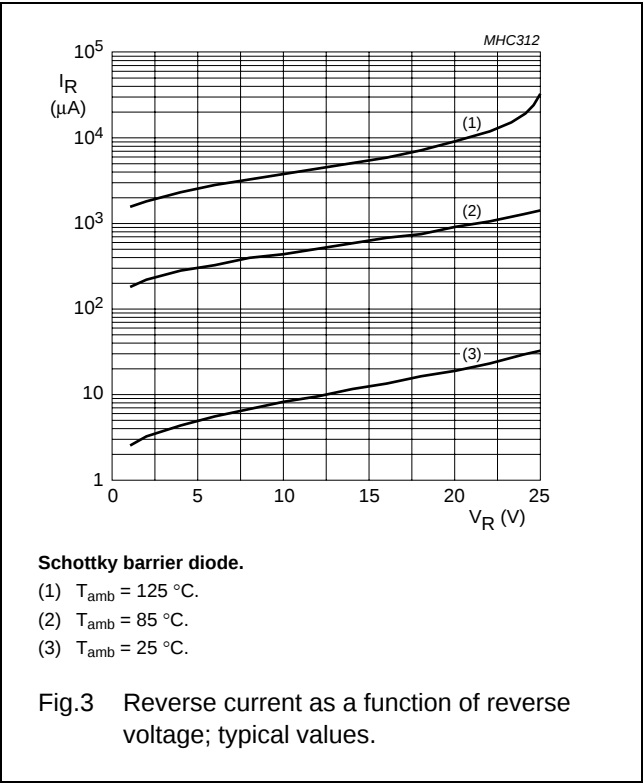
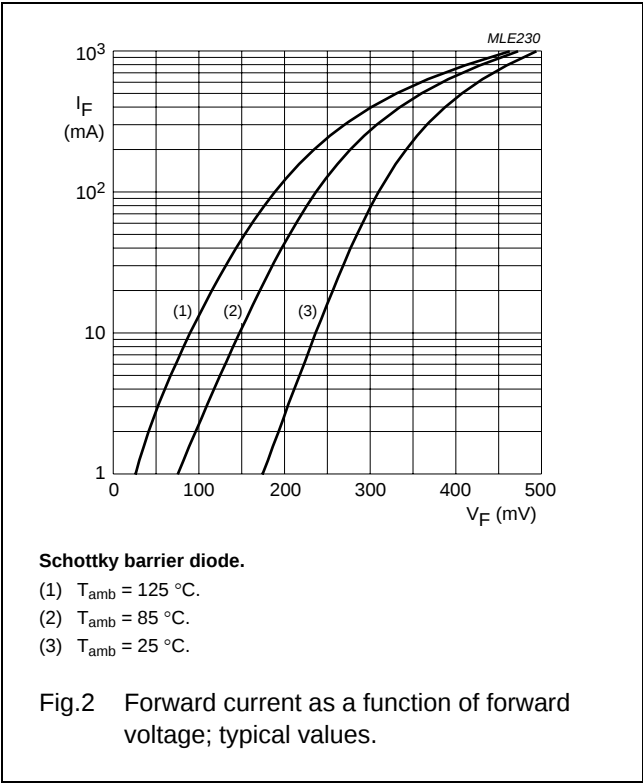
Note

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

NPN transistor/Schottky-diode module

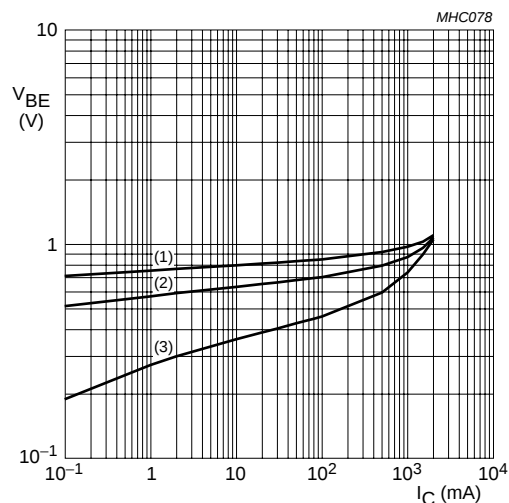
PMEM4020ND

GRAPHICAL DATA



NPN transistor/Schottky-diode module

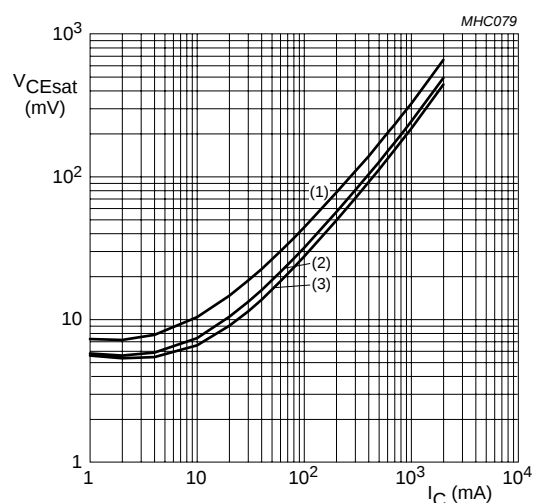
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NPN transistor; $V_{CE} = 5 \text{ V}$.

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

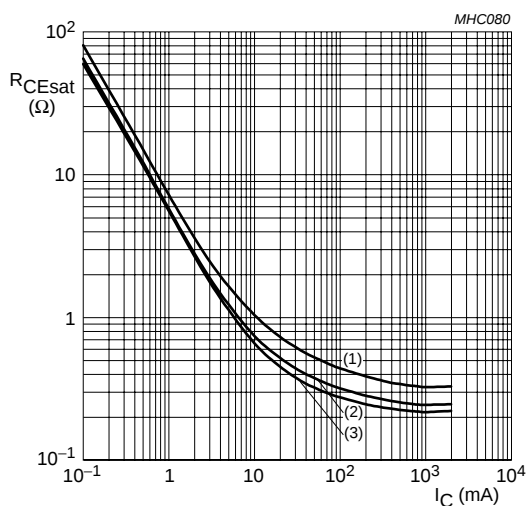
Fig.6 Base-emitter voltage as a function of collector current; typical values.



NPN transistor; $I_C/I_B = 10$.

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

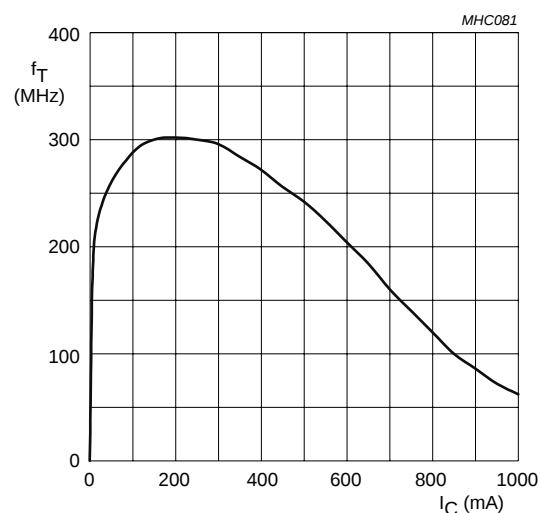
Fig.7 Collector-emitter saturation voltage as a function of collector current; typical values.



NPN transistor; $I_C/I_B = 10$.

- (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.8 Equivalent on-resistance as a function of collector current; typical values.



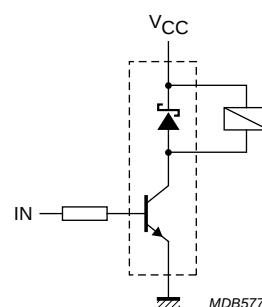
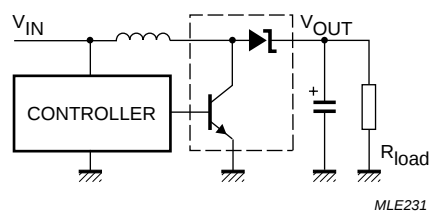
NPN transistor; $V_{CE} = 10 \text{ V}$.

Fig.9 Transition frequency as a function of collector current.

NPN transistor/Schottky-diode module

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APPLICATION INFORMATION



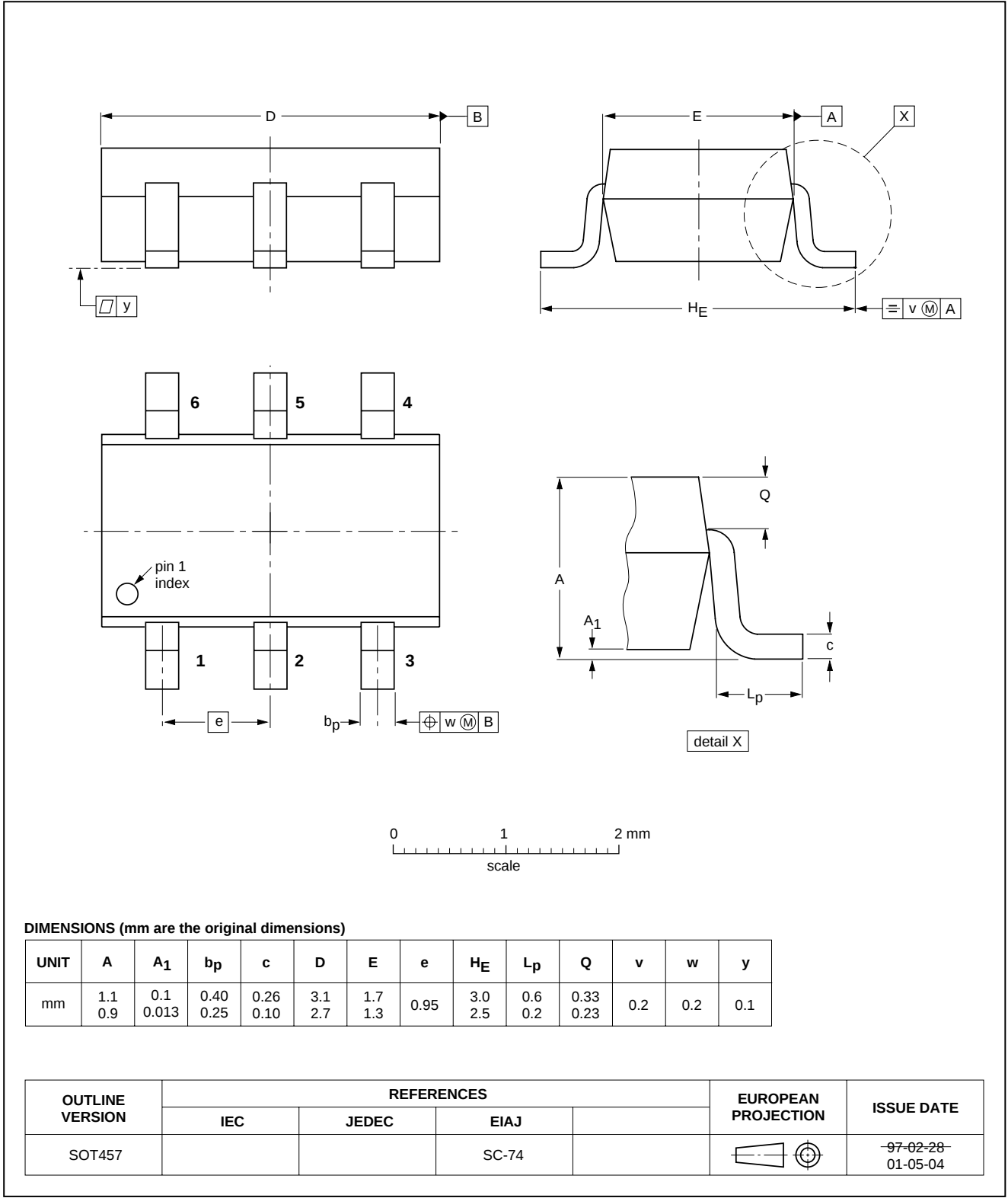
NPN transistor/Schottky-diode module

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PACKAGE OUTLINE

Plastic surface mounted package; 6 leads

SOT457



NPN transistor/Schottky-diode module

PMEM4020ND

DATA SHEET STATUS

DOCUMENT STATUS ⁽¹⁾	PRODUCT STATUS ⁽²⁾	DEFINITION
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Preliminary data sheet	Qualification	This document contains data from the preliminary specification.
Product data sheet	Production	This document contains the product specification.

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