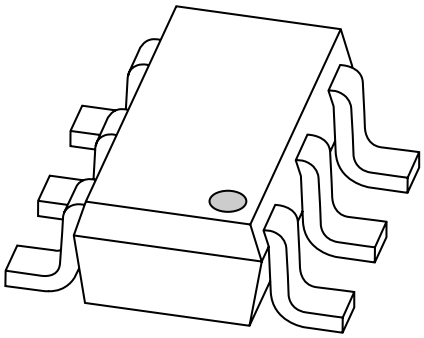
DATA SHEET



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

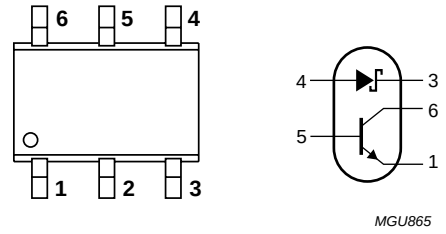
- DC-to-DC converters
- Inductive load drivers
- MOSFET drivers.

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.

PINNING

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



Marking code: B6.

Fig.1 Simplified outline (SOT457) and symbol.

ORDERING INFORMATION

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

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
		$T_s \leq 55$ °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	$T_{amb} \leq 25$ °C; note 1	–	295	mW
		$T_{amb} \leq 25$ °C; note 2	–	400	mW
		$T_{amb} \leq 25$ °C; note 3	–	500	mW
		$T_s \leq 55$ °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 ms square wave	–	5	A
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	295	mW
		$T_{amb} \leq 25$ °C; note 2	–	400	mW
		$T_{amb} \leq 25$ °C; note 3	–	500	mW
		$T_s \leq 55$ °C; note 4	–	1000	mW
T_j	junction temperature	note 2	–	150	°C
Combined device					
P_{tot}	total power dissipation	$T_{amb} = 25$ °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.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
Single device				
$R_{th\ j\text{-}s}$	thermal resistance from junction to solder point	in free air; notes 1 and 2	95	K/W
$R_{th\ j\text{-}a}$	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				
$R_{th\ j\text{-}a}$	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 cm^2/each.
5. Device mounted on a FR4 printed-circuit board; single-sided copper; tinplated; standard footprint for SOT457.

ELECTRICAL CHARACTERISTICS

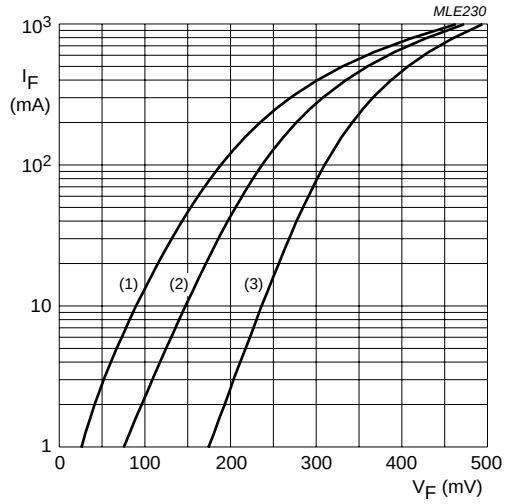
T_{amb} = 25 °C unless otherwise specified.

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

Note

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

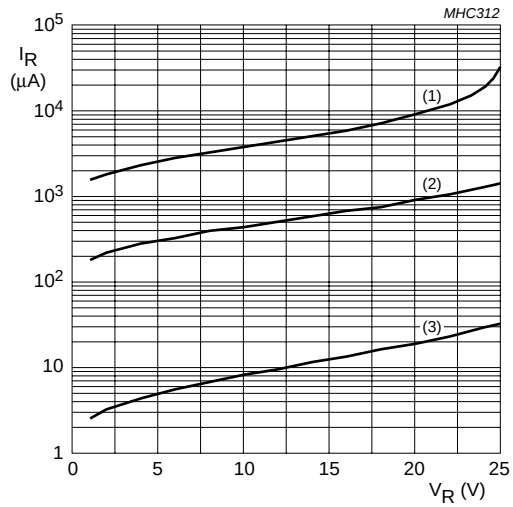
GRAPHICAL DATA



Schottky barrier diode.

(1) T_{amb} = 125 °C.
(2) T_{amb} = 85 °C.
(3) T_{amb} = 25 °C.

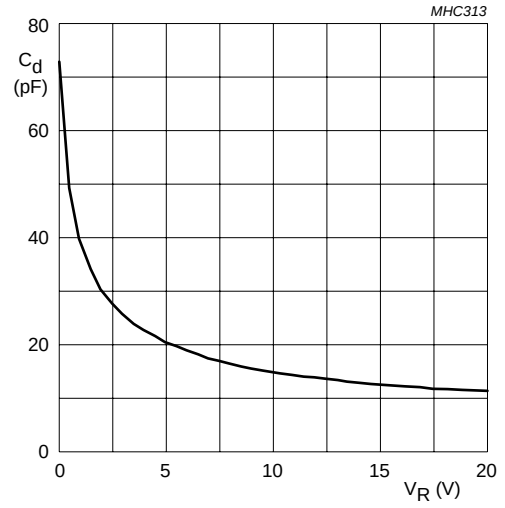
Fig.2 Forward current as a function of forward voltage; typical values.



Schottky barrier diode.

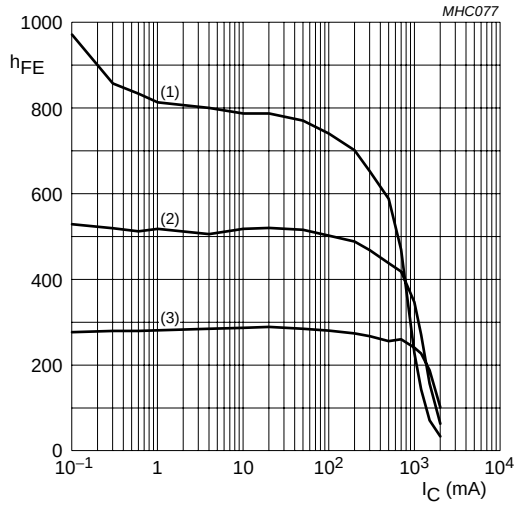
(1) T_{amb} = 125 °C.
(2) T_{amb} = 85 °C.
(3) T_{amb} = 25 °C.

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



Schottky barrier diode; f = 1 MHz; T_{amb} = 25 °C.

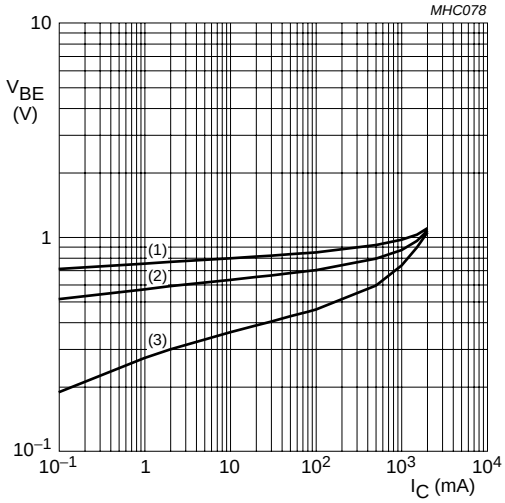
Fig.4 Diode capacitance as a function of reverse voltage; typical values.



NPN transistor; V_{CE} = 5 V.

(1) T_{amb} = 150 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = –55 °C.

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



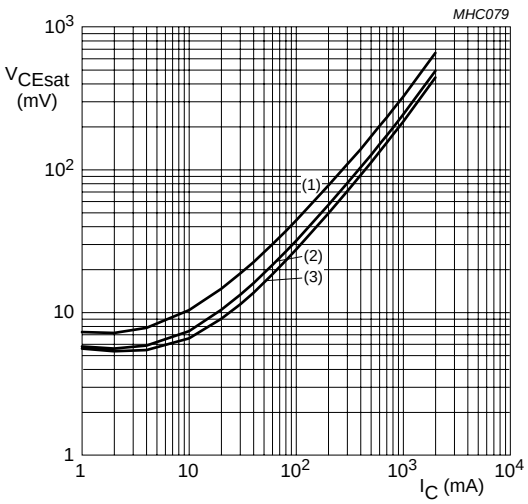
NPN transistor; V_{CE} = 5 V.

(1) T_{amb} = –55 °C.

(2) T_{amb} = 25 °C.

(3) T_{amb} = 150 °C.

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



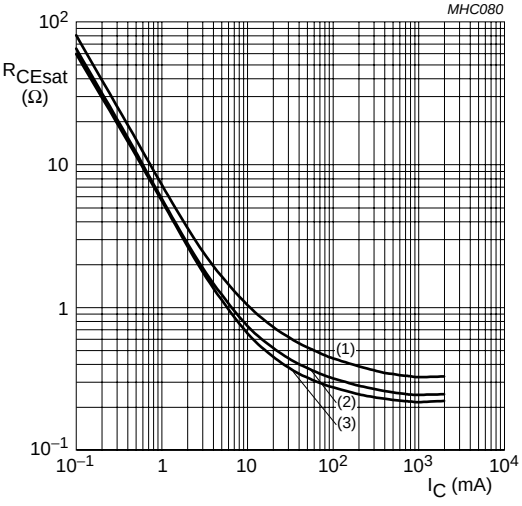
NPN transistor; I_C/I_B = 10.

(1) T_{amb} = 150 °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.



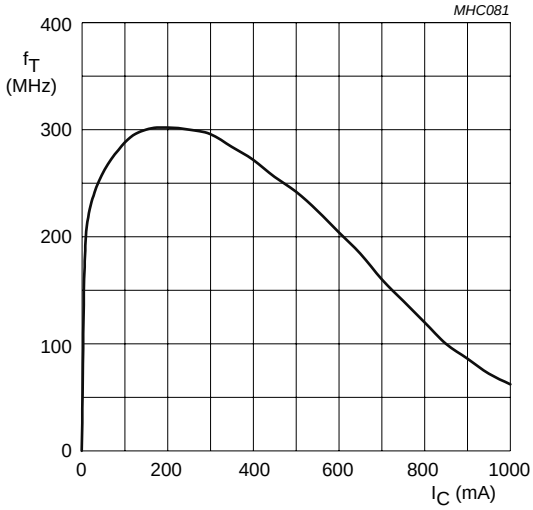
NPN transistor; I_C/I_B = 10.

(1) T_{amb} = 150 °C.

(2) T_{amb} = 25 °C.

(3) T_{amb} = –55 °C.

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



NPN transistor; V_{CE} = 10 V.

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

APPLICATION INFORMATION

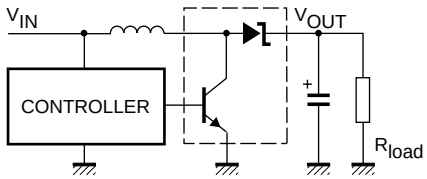


Fig.10 DC-to-DC converter.

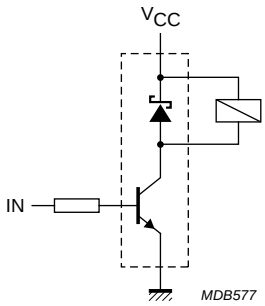
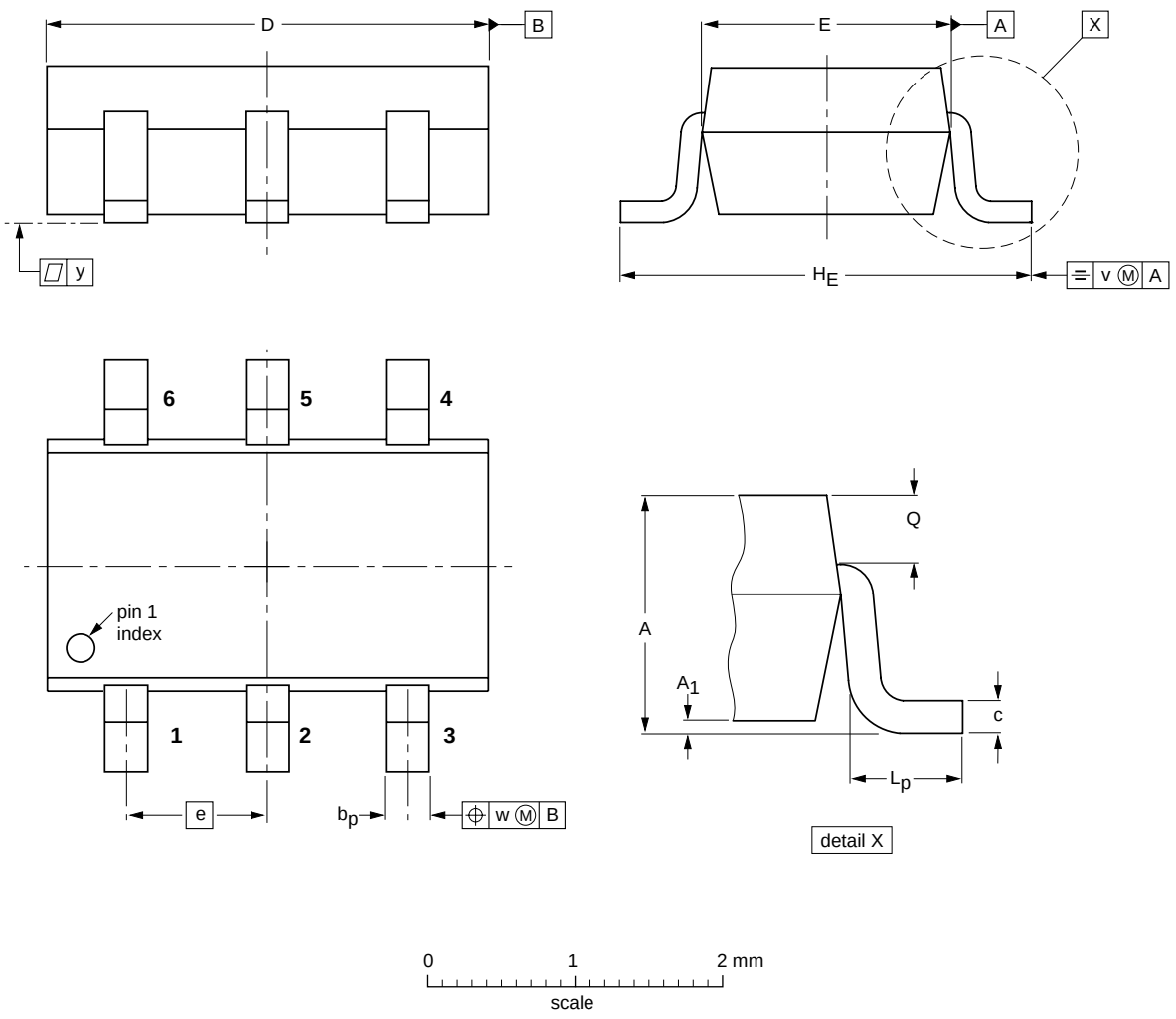


Fig.11 Inductive load driver (relays, motors, buzzers) with free-wheeling diode.

PACKAGE OUTLINE

Plastic surface mounted package; 6 leads **SOT457**



DIMENSIONS (mm are the original dimensions)

UNIT	A	A_1	b_p	c	D	E	e	H_E	L_p	Q	v	w	y
mm	1.1 0.9	0.1 0.013	0.40 0.25	0.26 0.10	3.1 2.7	1.7 1.3	0.95	3.0 2.5	0.6 0.2	0.33 0.23	0.2	0.2	0.1

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT457			SC-74			~~97-02-28~~ 01-05-04

DATA SHEET STATUS

DOCUMENT STATUS[1]	PRODUCT STATUS[2]	DEFINITION
Objective data sheet	Development	This document contains data from the objective specification for product development.
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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