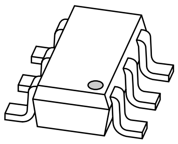


PMEM4020AND

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 SOT457 (SC-74) small plastic package. PNP complement: PMEM4020APD

1.2 Features

- 600 mW total power dissipation
- High current capability up to 2 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
- Inductive load drivers
- General purpose load drivers
- Reverse polarity protection circuits
- MOSFET 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	-	-	40	V
I_C	collector current (DC)	continuous; $T_s \leq 55$ °C [1]	-	-	2	A

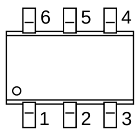
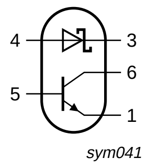
Table 1. Quick reference data *…continued*

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Schottky barrier rectifier						
V_R	continuous reverse voltage		-	-	40	V
I_F	continuous forward current		-	-	1	A

[1] Soldering point of collector or cathode tab.

2. Pinning information

Table 2. Discrete pinning

Pin	Description	Simplified outline	Symbol
1	emitter		
2	not connected		
3	cathode		
4	anode		
5	base		
6	collector		

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PMEM4020AND	SC-74	plastic surface mounted package; 6 leads	SOT457

4. Marking

Table 4. Marking

Type number	Marking code
PMEM4020AND	D2

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	-	40	V
V_{CEO}	collector-emitter voltage	open base	-	40	V
V_{EBO}	emitter-base voltage	open collector	-	5	V

Table 5. Limiting values *…continued*

In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions		Min	Max	Unit
I_C	collector current (DC)	continuous	[1]	-	0.95	A
		continuous	[2]	-	1.30	A
		continuous	[3]	-	1.65	A
		continuous; $T_s \leq 55$ °C	[4]	-	2	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	[1]	-	295	mW
		$T_{amb} \leq 25$ °C	[2]	-	400	mW
		$T_{amb} \leq 25$ °C	[3]	-	500	mW
		$T_s \leq 55$ °C	[4]	-	1000	mW
T_j	junction temperature			-	150	°C
Schottky barrier rectifier						
V_R	continuous reverse voltage			-	40	V
I_F	continuous forward voltage			-	1	A
I_{FRM}	repetitive peak forward current	$t_p \leq 1$ms; $\delta \leq 0.5$		-	3.5	A
I_{FSM}	non-repetitive peak forward current	t = 8 ms; square wave		-	10	A
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	[1]	-	295	mW
		$T_{amb} \leq 25$ °C	[2]	-	400	mW
		$T_{amb} \leq 25$ °C	[3]	-	500	mW
		$T_s \leq 55$ °C	[4]	-	1000	mW
T_j	junction temperature		[2]	-	150	°C
Combined device						
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	[2]	-	600	mW
T_{stg}	storage temperature			–65	+150	°C
T_{amb}	ambient temperature		[2]	–65	+150	°C

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

[2] Device mounted on a printed-circuit board, single-sided copper, tin-plated, 1cm^2 mounting pad for both collector and cathode.

[3] Mounted on a ceramic printed-circuit board, single-sided copper, tin-plated, standard footprint.

[4] Soldering point of collector or cathode tab.

6. Thermal characteristics

Table 6. Thermal characteristics[1]

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Single device							
$R_{th(j-s)}$	thermal resistance from junction to soldering point	in free air	[2]	-	-	95	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[3]	-	-	250	K/W
			[4]	-	-	315	K/W
			[5]	-	-	425	K/W
Combined device							
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[3]	-	-	208	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] Soldering point of collector or cathode tab.

[3] Mounted on a ceramic printed-circuit board, single-sided copper, tin-plated, standard footprint.

[4] Device mounted on a printed-circuit board, single-sided copper, tin-plated, 1cm^2 mounting pad for both collector and cathode tab.

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

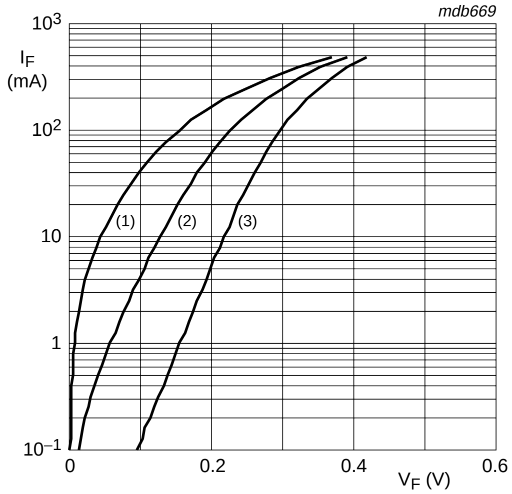
7. Characteristics

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} = 40 V; I_E = 0 A		-	-	100	nA
		V_{CB} = 40 V; I_E = 0 A; T_j = 150 °C		-	-	50	µA
I_{CEO}	collector-emitter cut-off current	V_{CE} = 30 V; I_B = 0 A		-	-	100	nA
I_{EBO}	emitter-base cut-off current	V_{EB} = 5 V; I_C = 0 A		-	-	100	nA
h_{FE}	DC current gain	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	[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
R_{CEsat}	equivalent on-resistance	I_C = 1 A; I_B = 100 mA	[1]	-	150	190	mΩ
V_{BEsat}	base-emitter saturation voltage	I_C = 1 A; I_B = 100 mA	[1]	-	-	1.2	V
V_{BEon}	base-emitter turn-on voltage	V_{CE} = 5 V; I_C = 1 A	[1]	-	-	1.1	V
f_T	transition frequency	V_{CE} = 10 V; I_C = 50 mA; f = 100 MHz		150	-	-	MHz
C_c	collector capacitance	V_{CB} = 10 V; I_E = i_e = 0 A; f = 1 MHz		-	-	10	pF
Schottky barrier rectifier							
V_F	continuous forward voltage	see Figure 1					
		I_F = 0.1 mA	[1]	-	95	130	mV
		I_F = 1 mA	[1]	-	155	210	mV
		I_F = 10 mA	[1]	-	220	270	mV
		I_F = 100 mA	[1]	-	295	350	mV
		I_F = 1000 mA	[1]	-	540	640	mV
I_R	reverse current	see Figure 2					
		V_R = 10 V	[1]	-	7	20	µA
		V_R = 40 V	[1]	-	30	100	µA
C_d	diode capacitance	V_R = 1 V; f = 1 MHz; see Figure 3		-	43	48	pF

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



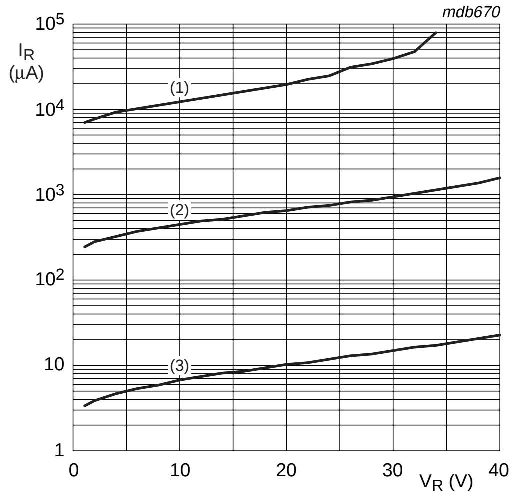
Schottky barrier rectifier

(1) T_{amb} = 150 °C

(2) T_{amb} = 85 °C

(3) T_{amb} = 25 °C

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



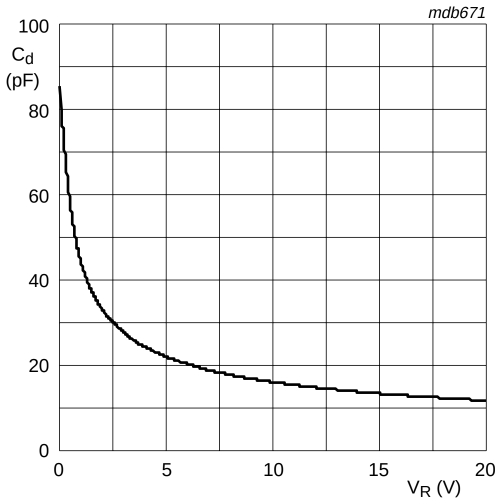
Schottky barrier rectifier

(1) T_{amb} = 150 °C

(2) T_{amb} = 85 °C

(3) T_{amb} = 25 °C

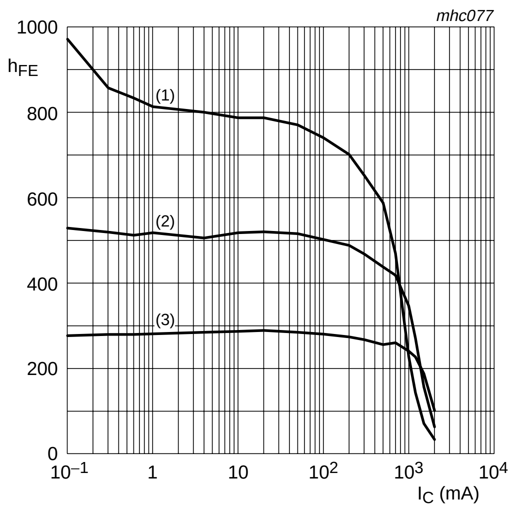
Fig 2. Reverse current as a function of reverse voltage; typical values



Schottky barrier rectifier;

T_{amb} = 25 °C; f = 1 MHz

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



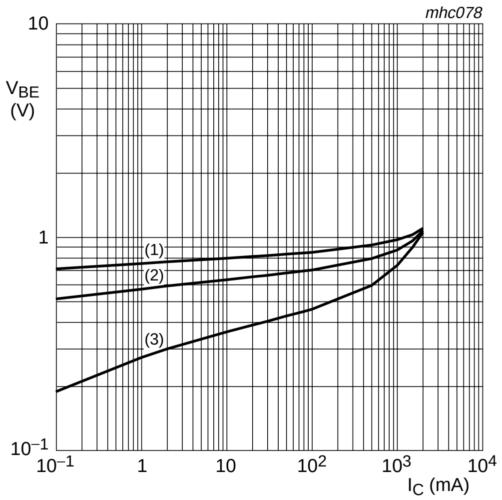
NPN transistor; V_{CE} = 5 V

(1) T_{amb} = 150 °C

(2) T_{amb} = 25 °C

(3) T_{amb} = –55 °C

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



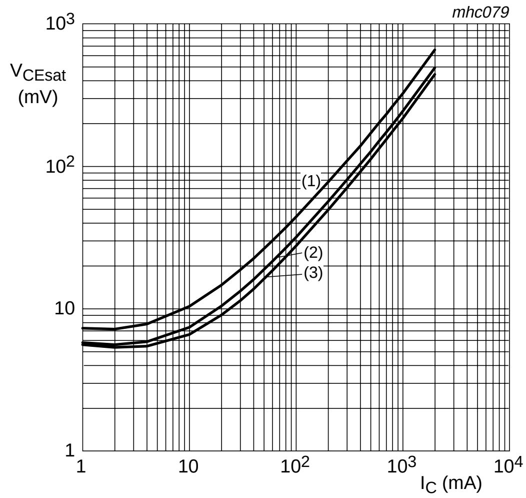
NPN transistor; V_{CE} = 5 V

(1) T_{amb} = −55 °C

(2) T_{amb} = 25 °C

(3) T_{amb} = 150 °C

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



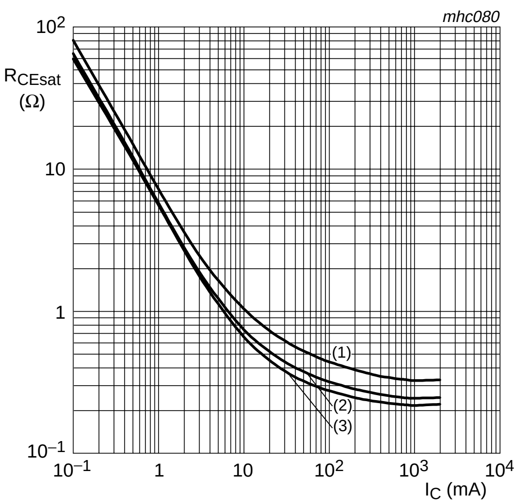
NPN transistor; I_C/I_B = 10

(1) T_{amb} = 150 °C

(2) T_{amb} = 25 °C

(3) T_{amb} = −55 °C

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



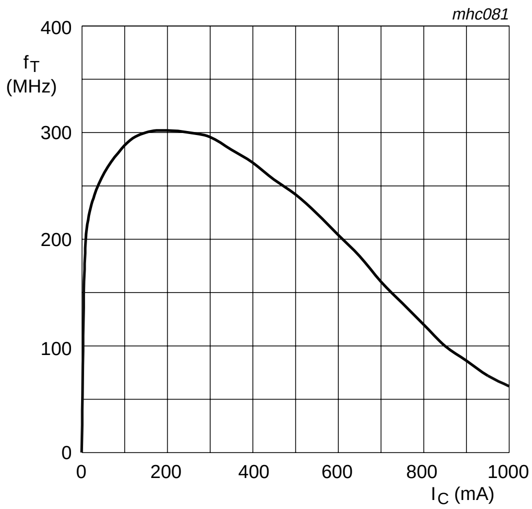
NPN transistor; I_C/I_B = 10

(1) T_{amb} = 150 °C

(2) T_{amb} = 25 °C

(3) T_{amb} = −55 °C

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



NPN transistor; V_{CE} = 10 V

Fig 8. Transition frequency as a function of collector current

8. Application information

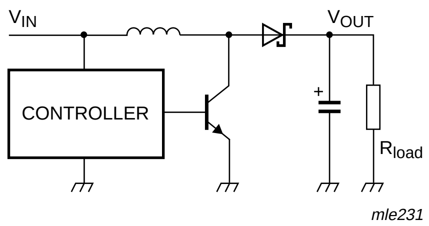


Fig 9. DC-to-DC converter

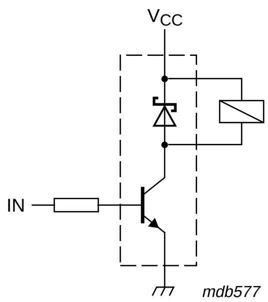
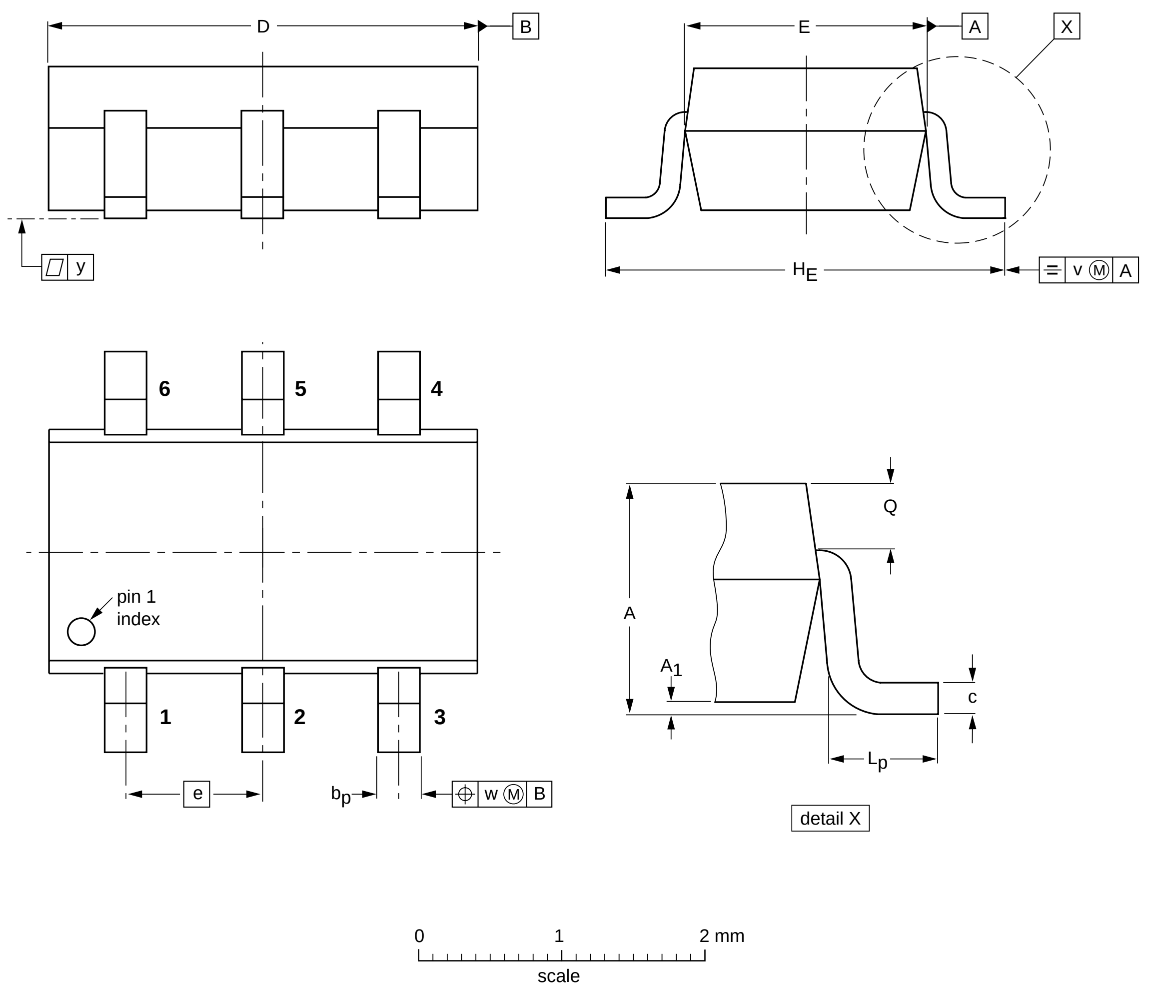


Fig 10. Inductive load driver (relays, motors and buzzers) with free-wheeling diode

9. Package outline

Plastic surface-mounted package (TSOP6); 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

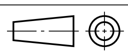
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT457			SC-74			~~05-11-07~~ 06-03-16

Fig 11. Package outline SOT457 (SC-74)

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	
			3000	10000
PMEM4020AND	SOT457	4 mm pitch, 8 mm tape and reel; T1	-115	-135
		4 mm pitch, 8 mm tape and reel; T2	-125	-165

[1] For further information and the availability of packing methods, see Section 13.

11. Revision history

Table 9. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PMEM4020AND_2	20090831	Product data sheet	-	PMEM4020AND_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 11 “Package outline SOT457 (SC-74)”: updated			
PMEM4020AND_1	20041004	Product data sheet	-	-

12. Legal information

12.1 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.
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".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL http://www.nxp.com.

12.2 Definitions

Draft — The document is a draft version only. The content is still under internal review and subject to formal approval, which may result in modifications or additions. NXP Semiconductors does not give any representations or warranties as to the accuracy or completeness of information included herein and shall have no liability for the consequences of use of such information.

Short data sheet — A short data sheet is an extract from a full data sheet with the same product type number(s) and title. A short data sheet is intended for quick reference only and should not be relied upon to contain detailed and full information. For detailed and full information see the relevant full data sheet, which is available on request via the local NXP Semiconductors sales office. In case of any inconsistency or conflict with the short data sheet, the full data sheet shall prevail.

12.3 Disclaimers

General — Information in this document is believed to be accurate and reliable. However, NXP Semiconductors does not give any representations or warranties, expressed or implied, as to the accuracy or completeness of such information and shall have no liability for the consequences of use of such information.

Right to make changes — NXP Semiconductors reserves the right to make changes to information published in this document, including without limitation specifications and product descriptions, at any time and without notice. This document supersedes and replaces all information supplied prior to the publication hereof.

Suitability for use — NXP Semiconductors products are not designed, authorized or warranted to be suitable for use in medical, military, aircraft, space or life support equipment, nor in applications where failure or malfunction of an NXP Semiconductors product can reasonably be expected to result in personal injury, death or severe property or environmental damage. NXP Semiconductors accepts no liability for inclusion and/or use of NXP Semiconductors products in such equipment or applications and therefore such inclusion and/or use is at the customer's own risk.

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

Limiting values — Stress above one or more limiting values (as defined in the Absolute Maximum Ratings System of IEC 60134) may cause permanent damage to the device. Limiting values are stress ratings only and operation of the device at these or any other conditions above those given in the Characteristics sections of this document is not implied. Exposure to limiting values for extended periods may affect device reliability.

Terms and conditions of sale — NXP Semiconductors products are sold subject to the general terms and conditions of commercial sale, as published at http://www.nxp.com/profile/terms, including those pertaining to warranty, intellectual property rights infringement and limitation of liability, unless explicitly otherwise agreed to in writing by NXP Semiconductors. In case of any inconsistency or conflict between information in this document and such terms and conditions, the latter will prevail.

No offer to sell or license — Nothing in this document may be interpreted or construed as an offer to sell products that is open for acceptance or the grant, conveyance or implication of any license under any copyrights, patents or other industrial or intellectual property rights.

Export control — This document as well as the item(s) described herein may be subject to export control regulations. Export might require a prior authorization from national authorities.

Quick reference data — The Quick reference data is an extract of the product data given in the Limiting values and Characteristics sections of this document, and as such is not complete, exhaustive or legally binding.

12.4 Trademarks

Notice: All referenced brands, product names, service names and trademarks are the property of their respective owners.

13. Contact information

For more information, please visit: **http://www.nxp.com**

For sales office addresses, please send an email to: **salesaddresses@nxp.com**

14. Contents

Date of release: 31 August 2009
Document identifier: PMEM4020AND_2