

2PB709BRL; 2PB709BSL

50 V, 200 mA PNP general-purpose transistors

Rev. 1 — 28 June 2010

Product data sheet

1. Product profile

1.1 General description

PNP general-purpose transistors in a small SOT23 (TO-236AB) Surface-Mounted Device (SMD) plastic package.

Table 1. Product overview

Type number	Package		NPN complement
	NXP	JEDEC	
2PB709BRL	SOT23	TO-236AB	2PD601BRL
2PB709BSL			2PD601BSL

1.2 Features and benefits

- Collector current $I_C \leq -200$ mA
- Two current gain selections
- AEC-Q101 qualified
- Small SMD plastic package

1.3 Applications

- General-purpose switching and amplification

1.4 Quick reference data

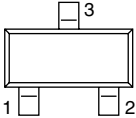
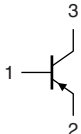
Table 2. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{CEO}	collector-emitter voltage	open base	-	-	-50	V
I_C	collector current		-	-	-200	mA
h_{FE}	DC current gain	$V_{CE} = -10$ V; $I_C = -2$ mA	210	-	460	
	h_{FE} group R		210	-	340	
	h_{FE} group S		290	-	460	



2. Pinning information

Table 3. Pinning

Pin	Description	Simplified outline	Graphic symbol
1	base		
2	emitter		
3	collector		

sym013

3. Ordering information

Table 4. Ordering information

Type number	Package		
	Name	Description	Version
2PB709BRL	-	plastic surface-mounted package; 3 leads	SOT23
2PB709BSL			

4. Marking

Table 5. Marking codes

Type number	Marking code ^[1]
2PB709BRL	MN*
2PB709BSL	MP*

[1] * = -: made in Hong Kong
 * = p: made in Hong Kong
 * = t: made in Malaysia
 * = W: made in China

5. Limiting values

Table 6. Limiting values

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

Symbol	Parameter	Conditions	Min	Max	Unit
V_{CBO}	collector-base voltage	open emitter	-	-60	V
V_{CEO}	collector-emitter voltage	open base	-	-50	V
V_{EBO}	emitter-base voltage	open collector	-	-6	V
I_C	collector current		-	-200	mA
I_{CM}	peak collector current	single pulse; $t_p \leq 1$ ms	-	-250	mA
I_{BM}	peak base current	single pulse; $t_p \leq 1$ ms	-	-200	mA

Table 6. Limiting values ...continued

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

Symbol	Parameter	Conditions	Min	Max	Unit
P_{tot}	total power dissipation	$T_{amb} \leq 25\text{ °C}$	[1] -	250	mW
T_j	junction temperature		-	150	°C
T_{amb}	ambient temperature		-55	+150	°C
T_{stg}	storage temperature		-65	+150	°C

[1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated and standard footprint.

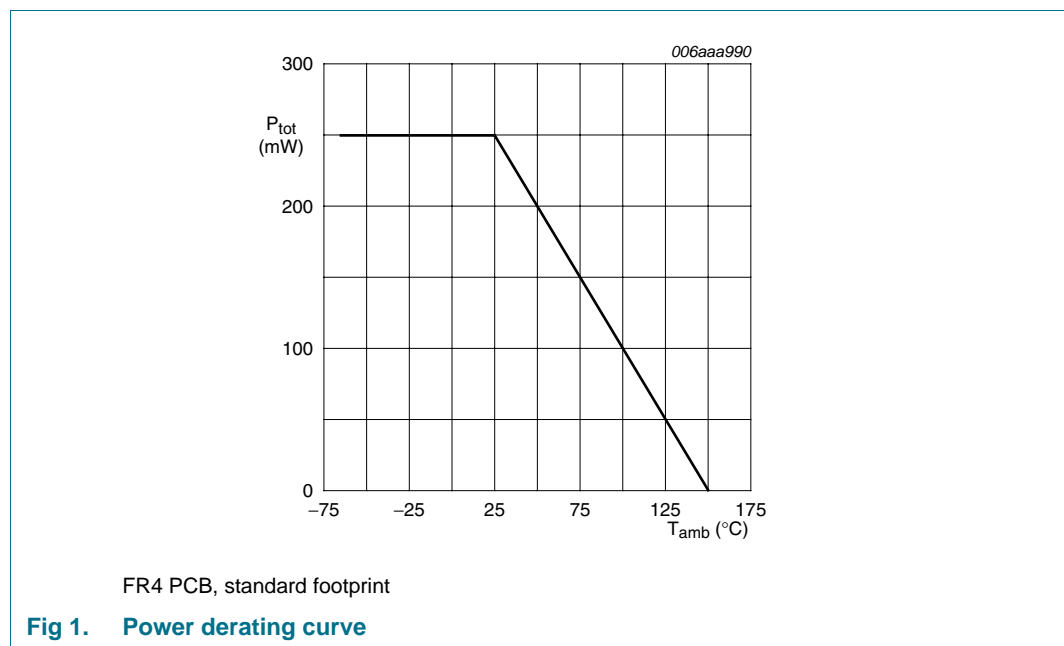


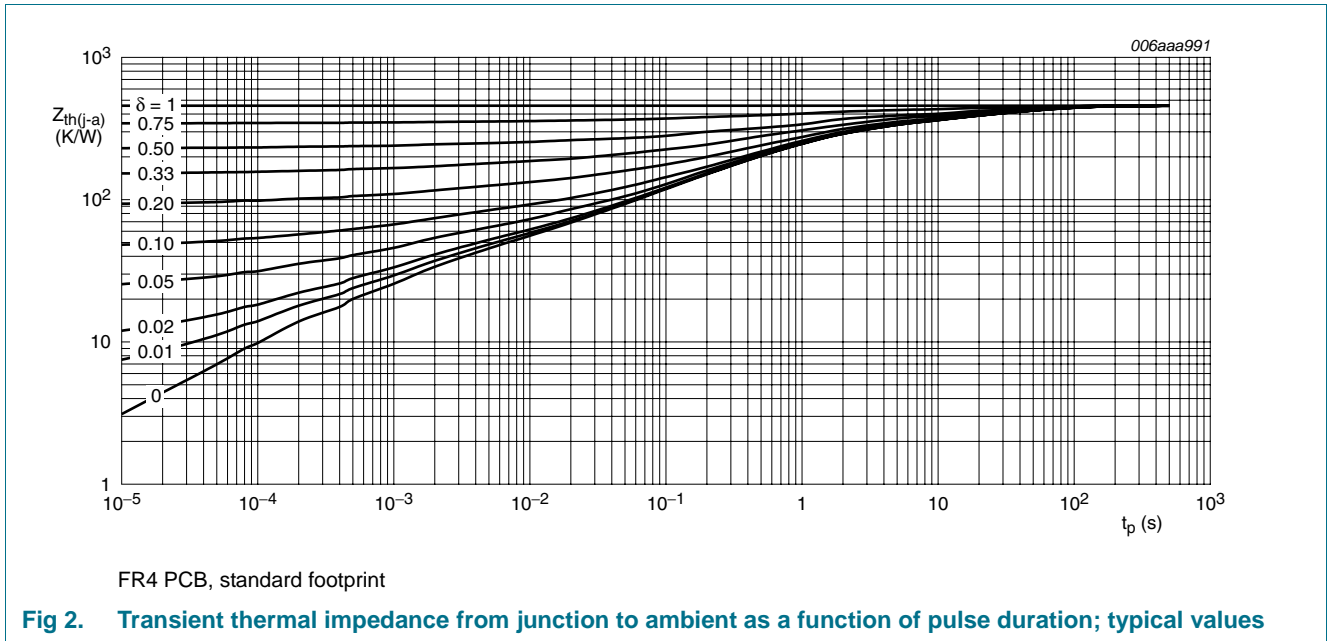
Fig 1. Power derating curve

6. Thermal characteristics

Table 7. Thermal characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1] -	-	500	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point		-	-	140	K/W

[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.



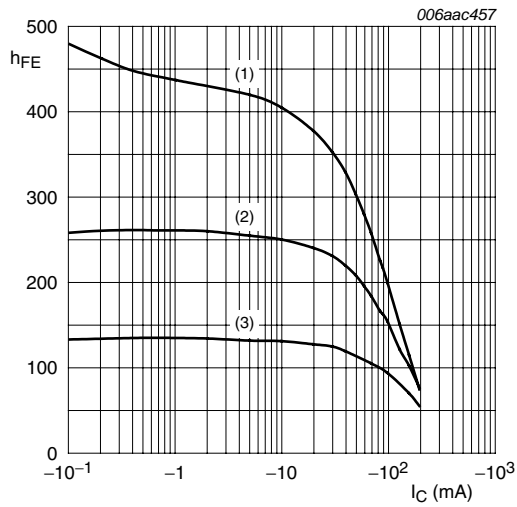
7. Characteristics

Table 8. Characteristics

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

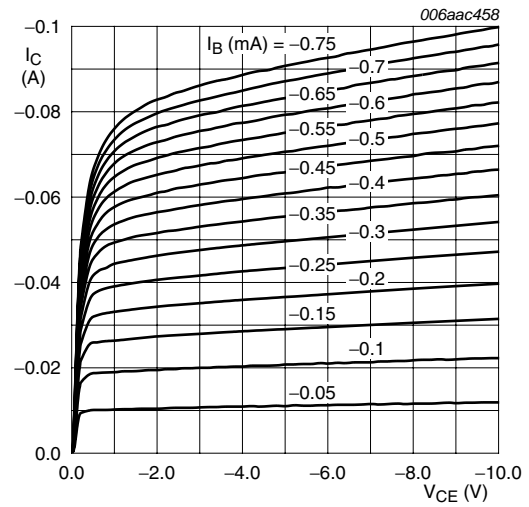
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I_{CBO}	collector-base cut-off current	$V_{CB} = -60\text{ V}; I_E = 0\text{ A}$	-	-	-10	nA
		$V_{CB} = -60\text{ V}; I_E = 0\text{ A}; T_j = 150\text{ °C}$	-	-	-5	μA
I_{EBO}	emitter-base cut-off current	$V_{EB} = -5\text{ V}; I_C = 0\text{ A}$	-	-	-10	nA
h_{FE}	DC current gain	$V_{CE} = -10\text{ V}; I_C = -2\text{ mA}$	210	-	460	
	h_{FE} group R		210	-	340	
	h_{FE} group S		290	-	460	
V_{CEsat}	collector-emitter saturation voltage	$I_C = -100\text{ mA}; I_B = -10\text{ mA}$	[1]	-	-250	mV
f_T	transition frequency	$V_{CE} = -6\text{ V}; I_C = -10\text{ mA}; f = 100\text{ MHz}$	100	200	-	MHz
C_C	collector capacitance	$V_{CB} = -10\text{ V}; I_E = I_e = 0\text{ A}; f = 1\text{ MHz}$	-	-	3	pF

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



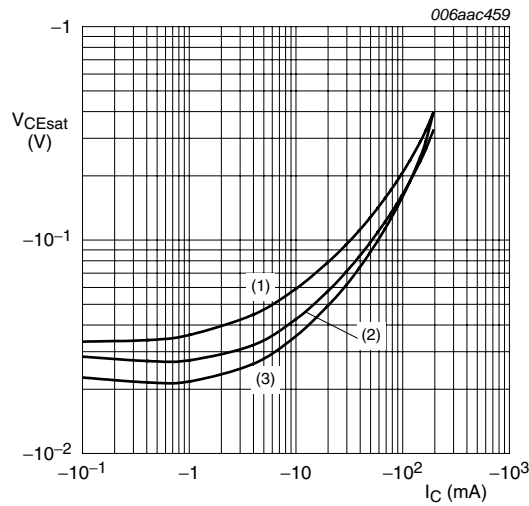
$V_{CE} = -10 \text{ V}$
 (1) $T_{amb} = 150 \text{ }^\circ\text{C}$
 (2) $T_{amb} = 25 \text{ }^\circ\text{C}$
 (3) $T_{amb} = -55 \text{ }^\circ\text{C}$

Fig 3. 2PB709BRL: DC current gain as a function of collector current; typical values



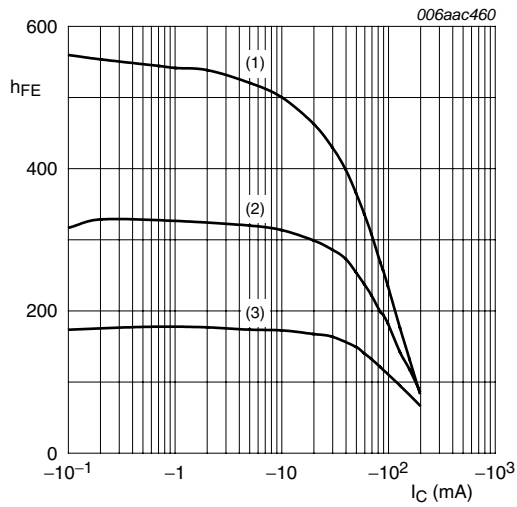
$T_{amb} = 25 \text{ }^\circ\text{C}$

Fig 4. 2PB709BRL: Collector current as a function of collector-emitter voltage; typical values



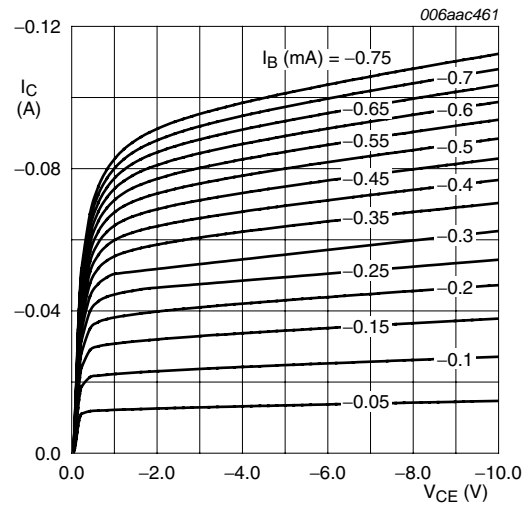
$I_C/I_B = 10$
 (1) $T_{amb} = 150 \text{ }^\circ\text{C}$
 (2) $T_{amb} = 25 \text{ }^\circ\text{C}$
 (3) $T_{amb} = -55 \text{ }^\circ\text{C}$

Fig 5. 2PB709BRL: Collector-emitter saturation voltage as a function of collector current; typical values



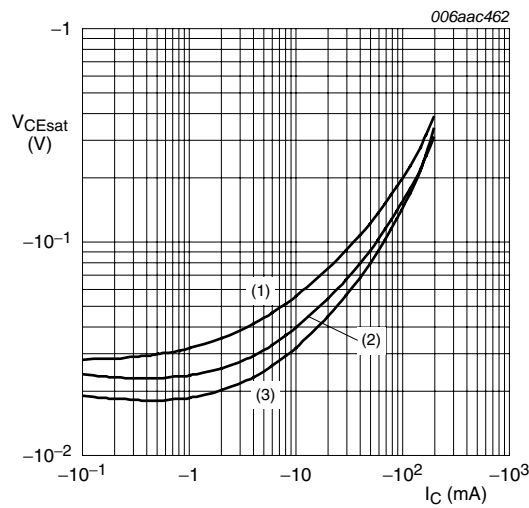
$V_{CE} = -10\text{ V}$
 (1) $T_{amb} = 150\text{ }^{\circ}\text{C}$
 (2) $T_{amb} = 25\text{ }^{\circ}\text{C}$
 (3) $T_{amb} = -55\text{ }^{\circ}\text{C}$

Fig 6. 2PB709BSL: DC current gain as a function of collector current; typical values



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

Fig 7. 2PB709BSL: Collector current as a function of collector-emitter voltage; typical values



$I_C/I_B = 10$
 (1) $T_{amb} = 150\text{ }^{\circ}\text{C}$
 (2) $T_{amb} = 25\text{ }^{\circ}\text{C}$
 (3) $T_{amb} = -55\text{ }^{\circ}\text{C}$

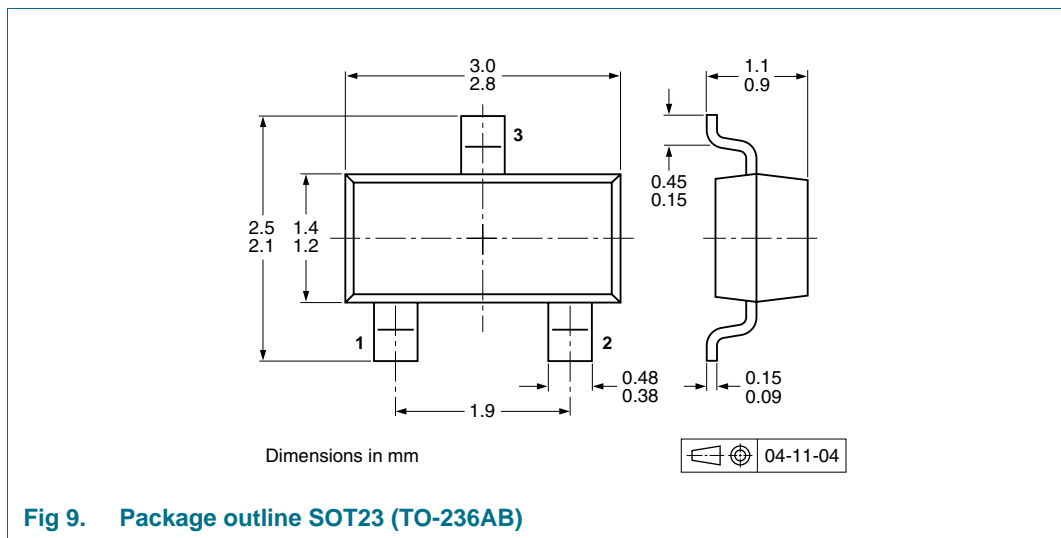
Fig 8. 2PB709BSL: Collector-emitter saturation voltage as a function of collector current; typical values

8. Test information

8.1 Quality information

This product has been qualified in accordance with the Automotive Electronics Council (AEC) standard *Q101 - Stress test qualification for discrete semiconductors*, and is suitable for use in automotive applications.

9. Package outline



10. Packing information

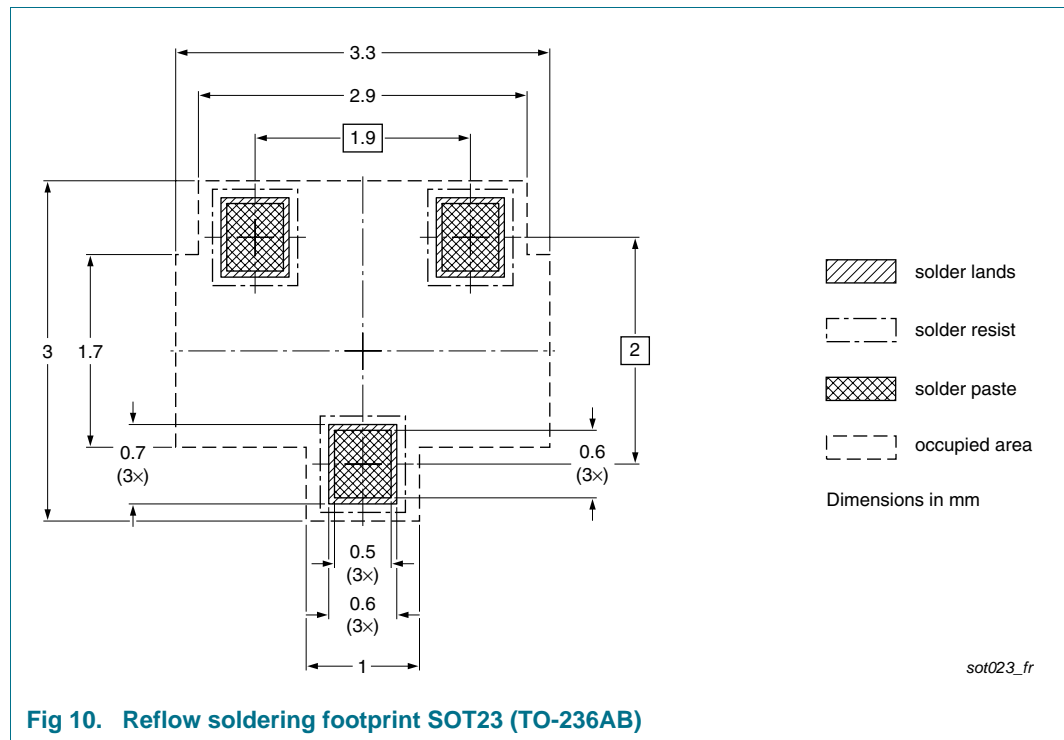
Table 9. Packing methods

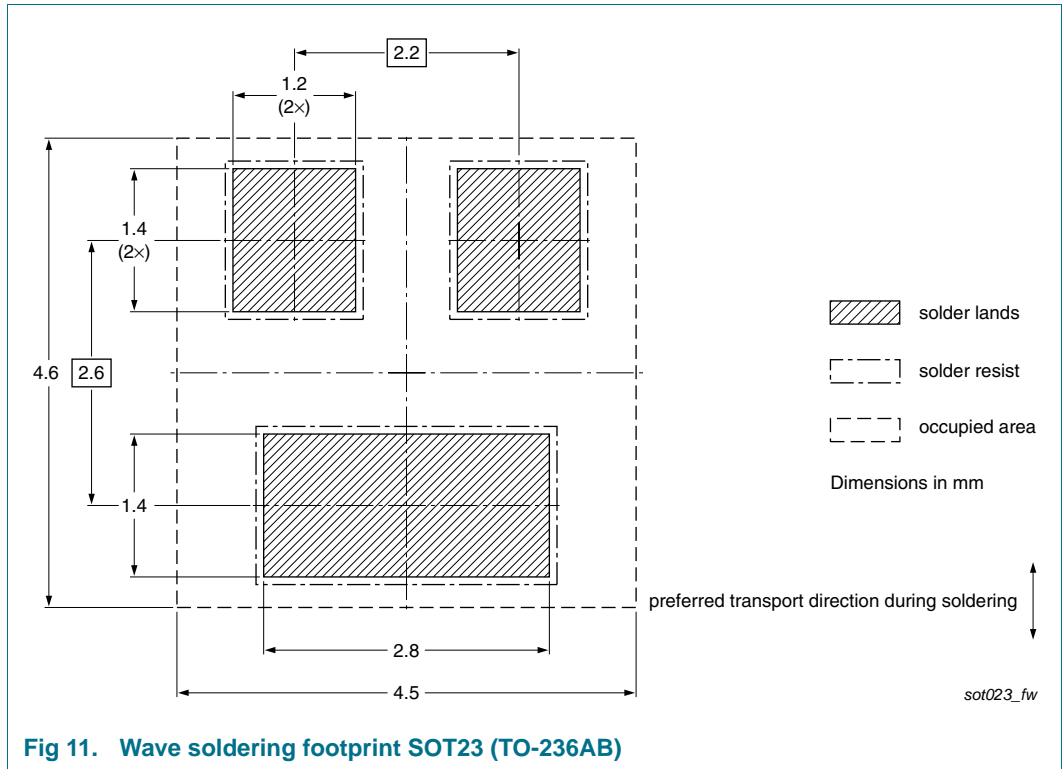
The indicated -xxx are the last three digits of the 12NC ordering code.^[1]

Type number	Package	Description	Packing quantity	
			3000	10000
2PB709BRL	SOT23	4 mm pitch, 8 mm tape and reel	-215	-235
2PB709BSL				

[1] For further information and the availability of packing methods, see [Section 14](#).

11. Soldering





12. Revision history

Table 10. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
2PB709BRL_2PB709BSL v.1	20100628	Product data sheet	-	-

13. Legal information

13.1 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>.

13.2 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.

Product specification — The information and data provided in a Product data sheet shall define the specification of the product as agreed between NXP Semiconductors and its customer, unless NXP Semiconductors and customer have explicitly agreed otherwise in writing. In no event however, shall an agreement be valid in which the NXP Semiconductors product is deemed to offer functions and qualities beyond those described in the Product data sheet.

13.3 Disclaimers

Limited warranty and liability — 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.

In no event shall NXP Semiconductors be liable for any indirect, incidental, punitive, special or consequential damages (including - without limitation - lost profits, lost savings, business interruption, costs related to the removal or replacement of any products or rework charges) whether or not such damages are based on tort (including negligence), warranty, breach of contract or any other legal theory.

Notwithstanding any damages that customer might incur for any reason whatsoever, NXP Semiconductors' aggregate and cumulative liability towards customer for the products described herein shall be limited in accordance with the *Terms and conditions of commercial sale* of NXP Semiconductors.

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 life support, life-critical or safety-critical systems or 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.

Customers are responsible for the design and operation of their applications and products using NXP Semiconductors products, and NXP Semiconductors accepts no liability for any assistance with applications or customer product design. It is customer's sole responsibility to determine whether the NXP Semiconductors product is suitable and fit for the customer's applications and products planned, as well as for the planned application and use of customer's third party customer(s). Customers should provide appropriate design and operating safeguards to minimize the risks associated with their applications and products.

NXP Semiconductors does not accept any liability related to any default, damage, costs or problem which is based on any weakness or default in the customer's applications or products, or the application or use by customer's third party customer(s). Customer is responsible for doing all necessary testing for the customer's applications and products using NXP Semiconductors products in order to avoid a default of the applications and the products or of the application or use by customer's third party customer(s). NXP does not accept any liability in this respect.

Limiting values — Stress above one or more limiting values (as defined in the Absolute Maximum Ratings System of IEC 60134) will cause permanent damage to the device. Limiting values are stress ratings only and (proper) operation of the device at these or any other conditions above those given in the Recommended operating conditions section (if present) or the Characteristics sections of this document is not warranted. Constant or repeated exposure to limiting values will permanently and irreversibly affect the quality and reliability of the device.

Terms and conditions of commercial 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>, unless otherwise agreed in a valid written individual agreement. In case an individual agreement is concluded only the terms and conditions of the respective agreement shall apply. NXP Semiconductors hereby expressly objects to applying the customer's general terms and conditions with regard to the purchase of NXP Semiconductors products by customer.

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.

13.4 Trademarks

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

14. Contact information

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

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

15. Contents

1	Product profile	1
1.1	General description	1
1.2	Features and benefits	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	2
6	Thermal characteristics	3
7	Characteristics	4
8	Test information	7
8.1	Quality information	7
9	Package outline	7
10	Packing information	8
11	Soldering	8
12	Revision history	10
13	Legal information	11
13.1	Data sheet status	11
13.2	Definitions	11
13.3	Disclaimers	11
13.4	Trademarks	12
14	Contact information	12
15	Contents	13

Please be aware that important notices concerning this document and the product(s) described herein, have been included in section 'Legal information'.

© NXP B.V. 2010.

All rights reserved.

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

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

Date of release: 28 June 2010

Document identifier: 2PB709BRL_2PB709BSL