

Important notice

Dear Customer,

On 7 February 2017 the former NXP Standard Product business became a new company with the tradename **Nexperia**. Nexperia is an industry leading supplier of Discrete, Logic and PowerMOS semiconductors with its focus on the automotive, industrial, computing, consumer and wearable application markets

In data sheets and application notes which still contain NXP or Philips Semiconductors references, use the references to Nexperia, as shown below.

Instead of <http://www.nxp.com>, <http://www.philips.com/> or <http://www.semiconductors.philips.com/>, use <http://www.nexperia.com>

Instead of sales.addresses@www.nxp.com or sales.addresses@www.semiconductors.philips.com, use salesaddresses@nexperia.com (email)

Replace the copyright notice at the bottom of each page or elsewhere in the document, depending on the version, as shown below:

- © NXP N.V. (year). All rights reserved or © Koninklijke Philips Electronics N.V. (year). All rights reserved

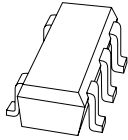
Should be replaced with:

- © **Nexperia B.V. (year). All rights reserved.**

If you have any questions related to the data sheet, please contact our nearest sales office via e-mail or telephone (details via salesaddresses@nexperia.com). Thank you for your cooperation and understanding,

Kind regards,

Team Nexperia



PSS12021SAY

Constant current source in SOT353 package

Rev. 03 — 27 August 2009

Product data sheet

1. Product profile

1.1 General description

Resistor-equipped PNP transistor with two diodes on one chip in a SOT353 (SC-88A) plastic package. Stabilized output current of between 15 μA and 50 mA by connection of an external resistor between pins 4 and 5.

1.2 Features

- One chip integrated constant current source
- Output current setting by use of an external resistor
- Very small package
- Reduces component count and board space

1.3 Applications

- Automotive applications
- Generic constant current source
- Constant current LED driver
- Active bias control for audio amplifiers

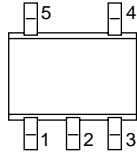
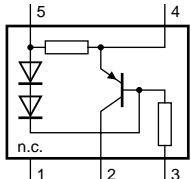
1.4 Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I_{out}	output current		0.015	-	50	mA
V_{S}	supply voltage		-	-	75	V

2. Pinning information

Table 2. Pinning

Pin	Symbol	Description	Simplified outline	Symbol
1	n.c.	not connected		 <p style="text-align: right;"><i>sym049</i></p>
2	IOUT	output current		
3	GND	ground		
4	REXT	external resistor		
5	VS	supply voltage		

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PSSI2021SAY	SC-88A	plastic surface mounted package; 5 leads	SOT353

4. Marking

Table 4. Marking codes

Type number	Marking code ^[1]
PSSI2021SAY	S1*

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

5. Limiting values

Table 5. Limiting values

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

Symbol	Parameter	Conditions	Min	Max	Unit
I_{out}	stabilized output current	see Figure 2	0.015	50	mA
V_S	supply voltage		-	75	V
V_{out}	output voltage	$V_S = 75\text{ V}$	-	73	V
V_R	reverse voltage		[1] -	0.5	V
P_{tot}	total power dissipation	$T_{amb} \leq 25\text{ °C}$	[2] -	335	mW
T_{stg}	storage temperature		-65	+150	°C
T_j	junction temperature		-	150	°C
T_{amb}	ambient temperature		-65	+150	°C

[1] Between all terminals

[2] Device mounted on a FR4 printed-circuit board, single-sided copper, tin-plated, standard footprint

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] -	-	370	K/W

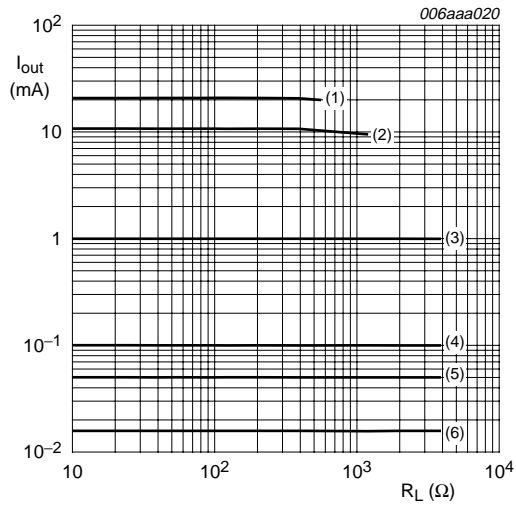
[1] Device mounted on a FR4 printed-circuit board, single-sided copper, tin-plated, standard footprint

7. Characteristics

Table 7. Characteristics

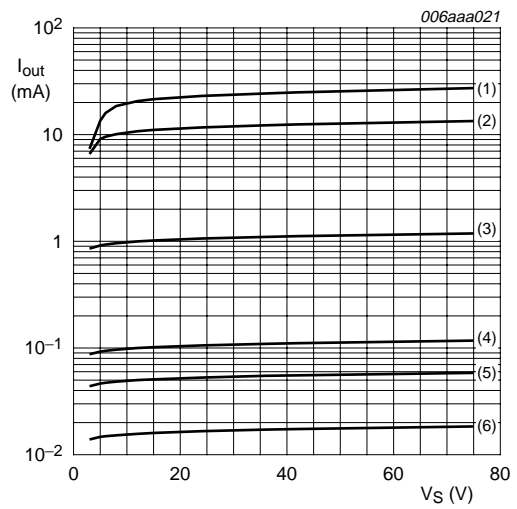
$T_{amb} = 25\text{ °C}$ unless otherwise specified

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I_{out}	stabilized output current	$V_S = 12\text{ V}$; $R_{ext} = \text{open}$; $V_{out} = 0\text{ V}$ to 10 V ; see Figure 2	10	15	20	μA
I_S	supply current	$V_S = 12\text{ V}$; $I_{out} = 15\text{ }\mu\text{A}$; $V_{out} = 0\text{ V}$ to 10 V ; see Figure 4	-	240	370	μA
		$V_S = 75\text{ V}$; $I_{out} = 15\text{ }\mu\text{A}$; $V_{out} = 0\text{ V}$; see Figure 4	-	1.5	2.2	mA
$\Delta I_{out} / (I_{out} \times \Delta T_{amb})$	output current change over ambient temperature	$V_S = 12\text{ V}$; $V_{out} = 1\text{ V}$; $T_{amb} = -55\text{ °C}$ to 150 °C	-	0.15	-	%/K
$\Delta I_{out} / I_{out}$	load stability of stabilized output current	$V_S = 12\text{ V}$; $V_{out} = 1\text{ V}$ to 10 V	-	0.5	-	%
R_{int}	internal resistor value		-	48	-	k Ω



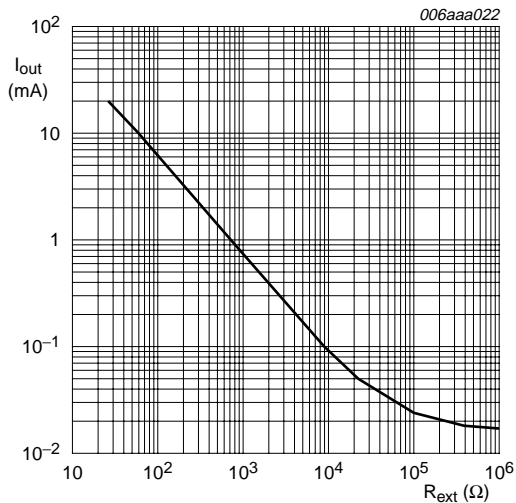
- $V_S = 12\text{ V}$
- (1) $I_{out} = 20\text{ mA}$
 - (2) $I_{out} = 10\text{ mA}$
 - (3) $I_{out} = 1\text{ mA}$
 - (4) $I_{out} = 100\text{ }\mu\text{A}$
 - (5) $I_{out} = 50\text{ }\mu\text{A}$
 - (6) $I_{out} = 15\text{ }\mu\text{A}$

Fig 1. Output current as a function of load resistance; typical values



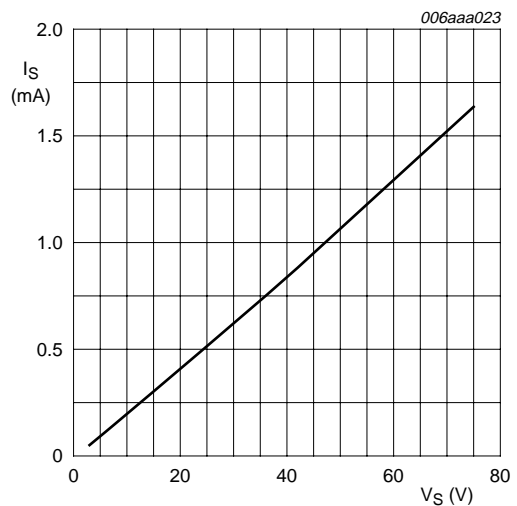
- (1) $I_{out} = 20\text{ mA}$
- (2) $I_{out} = 10\text{ mA}$
- (3) $I_{out} = 1\text{ mA}$
- (4) $I_{out} = 100\text{ }\mu\text{A}$
- (5) $I_{out} = 50\text{ }\mu\text{A}$
- (6) $I_{out} = 15\text{ }\mu\text{A}$

Fig 2. Output current as a function of supply voltage; typical values



$V_S = 12\text{ V}; R_L = 100\text{ }\Omega$

Fig 3. Output current as a function of external resistance; typical values



$R_{ext} = \infty; R_L = 100\text{ }\Omega$

Fig 4. Supply current as a function of supply voltage; typical values

8. Application information

External resistor calculation

The output current can be set by connecting an external resistor between VS (pin 5) and REXT (pin 4).

I_{out} then calculates to:
$$I_{out} = \frac{0.617}{R_{ext}} + 15 \mu A$$

Without an external resistor the output current will be typically 15 μA .

Typical output currents versus supply voltage V_S

The applied supply voltage determines the output current. [Table 8](#) gives typical I_{out} values at specified supply voltages, assuming that the working output current is 70% of the maximum possible output current.

Table 8. Typical output currents at specified supply voltages

V_S (V)	I_{out} (mA)
5	6
12	18
24	38
36	60

8.1 Typical application circuits

LED driver

Figure 5 shows a typical application circuit for an LED driver. The constant current ensures a constant LED brightness.

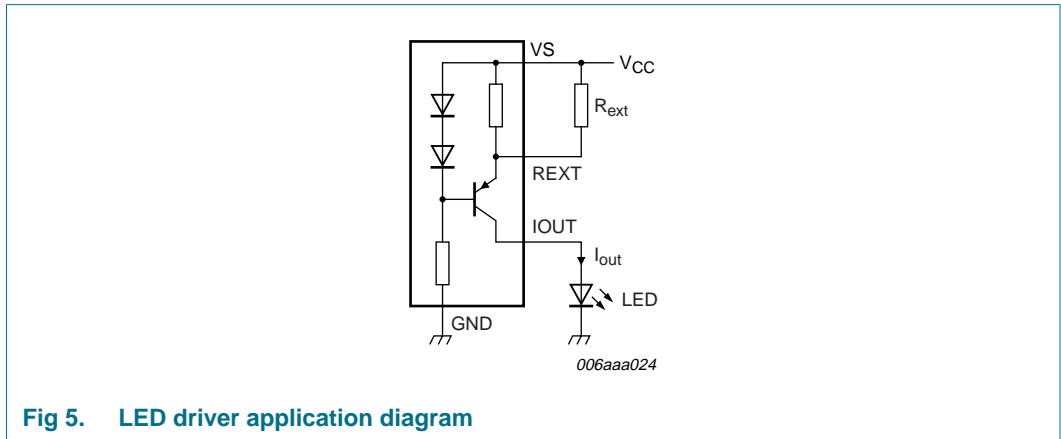


Fig 5. LED driver application diagram

Switching the current ON/OFF

The output can be switched ON and OFF by connecting a resistor-equipped transistor (RET, e.g. PDTC124XU) as shown in Figure 6.

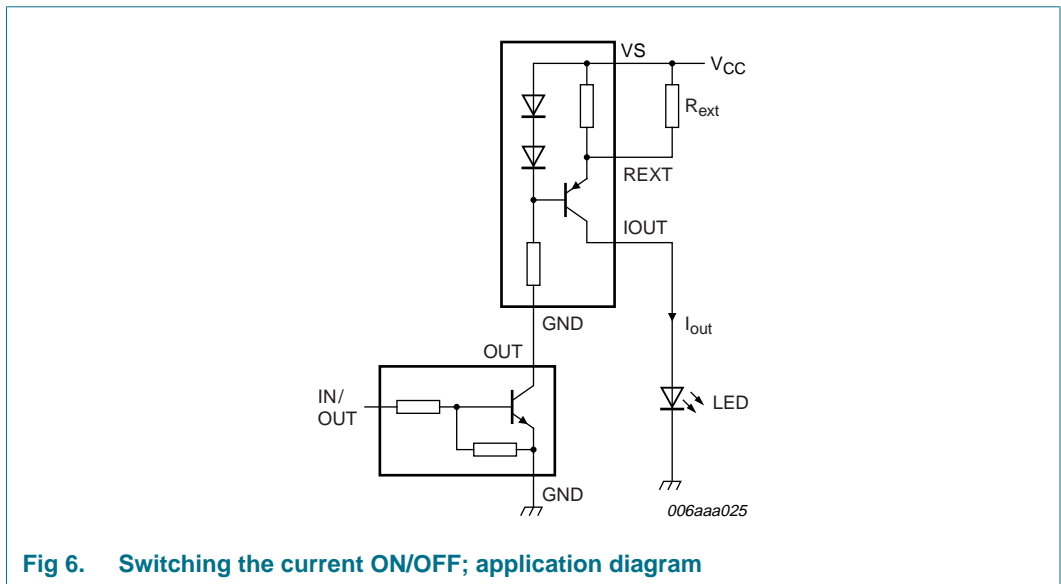


Fig 6. Switching the current ON/OFF; application diagram

Voltage reference

The PSSI2021SAY supplies a constant current to the Zener diode regardless of supply voltage variation, resulting in a constant reference voltage (see [Figure 7](#)).

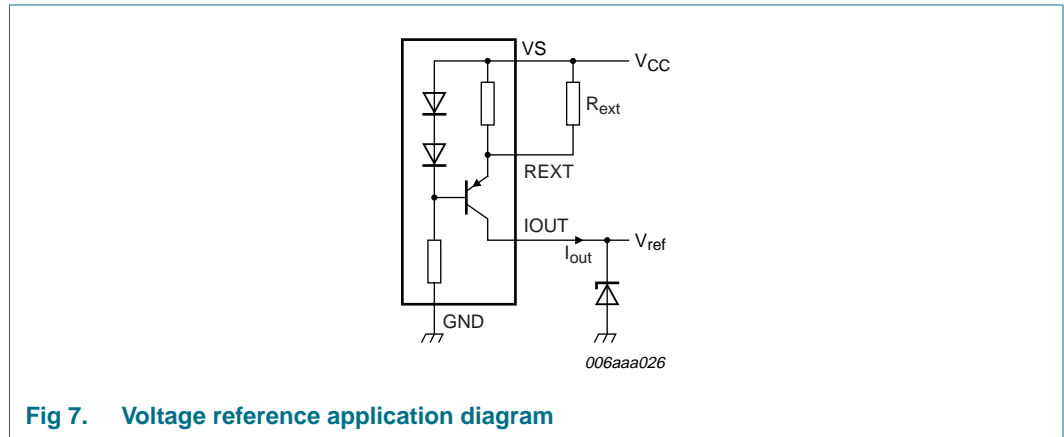


Fig 7. Voltage reference application diagram

9. Package outline

Plastic surface-mounted package; 5 leads

SOT353

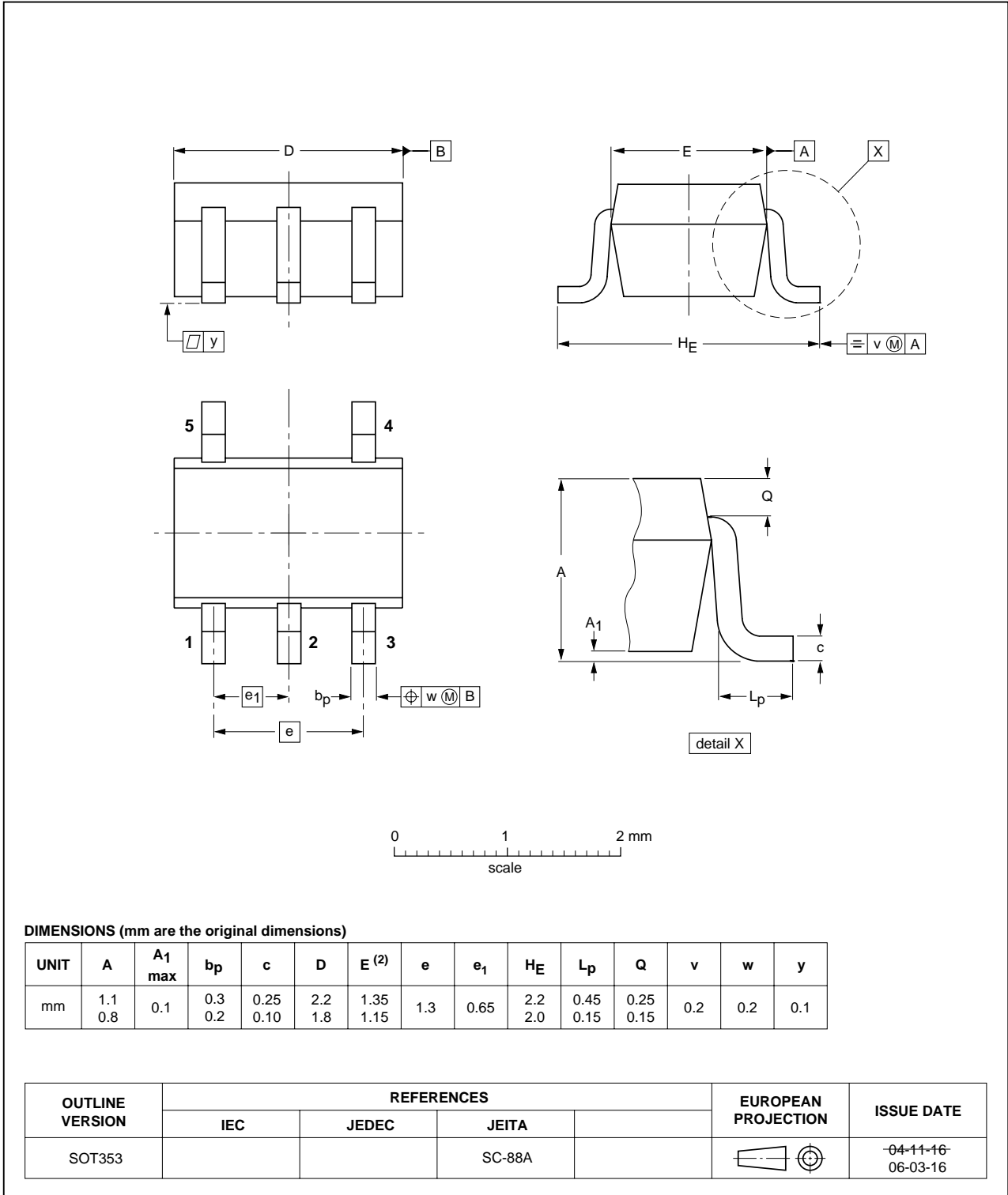


Fig 8. Package outline SOT353 (SC-88A)

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
PSSI2021SAY	SOT353	4 mm pitch, 8 mm tape and reel	-115

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

11. Revision history

Table 10. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PSSI2021SAY_3	20090827	Product data sheet	-	PSSI2021SAY_2
Modifications:		<ul style="list-style-type: none">• 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 “Pinning”: amended• Figure 8 “Package outline SOT353 (SC-88A)”: updated		
PSSI2021SAY_2	20041020	Product data sheet	-	PSSI2021SAY_1
PSSI2021SAY_1	20010507	Product specification	-	-

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

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 3

7 Characteristics 3

8 Application information 5

8.1 Typical application circuits 6

9 Package outline 8

10 Packing information 9

11 Revision history 10

12 Legal information 11

12.1 Data sheet status 11

12.2 Definitions 11

12.3 Disclaimers 11

12.4 Trademarks 11

13 Contact information 11

14 Contents 12

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

