## 74AHC1G17; 74AHCT1G17

# Single Schmitt trigger buffer Rev. 2 — 5 October 2016

**Product data sheet** 

#### **General description** 1.

The 74AHC1G17 and 74AHCT1G17 are single buffers with Schmitt-trigger inputs. Inputs are overvoltage tolerant. This feature allows the use of these devices as translators in mixed voltage environments.

The AHC device has CMOS input switching levels and supply voltage range 2 V to 5.5 V.

The AHCT device has TTL input switching levels and supply voltage range 4.5 V to 5.5 V.

#### **Features and benefits** 2.

- Symmetrical output impedance
- High noise immunity
- ESD protection:
  - HBM JESD22-A114E: exceeds 2000 V
  - ♦ MM JESD22-A115-A: exceeds 200 V
  - CDM JESD22-C101C: exceeds 1000 V
- Low power dissipation
- Balanced propagation delays
- Specified from -40 °C to +125 °C

## **Applications**

- Wave and pulse shapers
- Astable multivibrators
- Monostable multivibrators



## 4. Ordering information

Table 1. Ordering information

Type number	Package	Package									
	Temperature range	Name	Description	Version							
74AHC1G17GW	-40 °C to +125 °C	TSSOP5	plastic thin shrink small outline package;	SOT353-1							
74AHCT1G17GW			5 leads; body width 1.25 mm								
74AHC1G17GV	-40 °C to +125 °C	SC-74A	plastic surface-mounted package; 5 leads	SOT753							
74AHCT1G17GV											

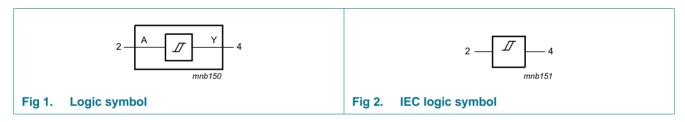
## 5. Marking

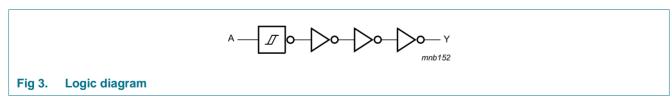
#### Table 2. Marking codes

Type number	Marking code <sup>[1]</sup>
74AHC1G17GW	AJ
74AHCT1G17GW	Cl
74AHC1G17GV	A17
74AHCT1G17GV	C17

<sup>[1]</sup> The pin 1 indicator is located on the lower left corner of the device, below the marking code.

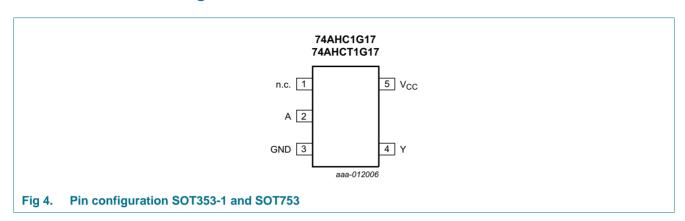
## 6. Functional diagram





## 7. Pinning information

#### 7.1 Pinning



#### 7.2 Pin description

Table 3. Pin description

Symbol	Pin	Description		
n.c.	1	not connected		
A	2	data input		
GND	3	ground (0 V)		
Υ	4	data output		
V <sub>CC</sub>	5	supply voltage		

## 8. Functional description

#### Table 4. Function table

 $H = HIGH \ voltage \ level; \ L = LOW \ voltage \ level$ 

Input	Output
A	Υ
L	L
Н	Н

## 9. Limiting values

#### Table 5. Limiting values

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

Symbol	Parameter	Conditions	Min	Max	Unit
V <sub>CC</sub>	supply voltage		-0.5	+7.0	V
VI	input voltage		-0.5	+7.0	V
I <sub>IK</sub>	input clamping current	V <sub>I</sub> < -0.5 V	-20	-	mA
I <sub>OK</sub>	output clamping current	$V_O < -0.5 \text{ V or } V_O > V_{CC} + 0.5 \text{ V}$	-	±20	mA
I <sub>O</sub>	output current	$-0.5 \text{ V} < \text{V}_{\text{O}} < \text{V}_{\text{CC}} + 0.5 \text{ V}$	-	±25	mA
I <sub>CC</sub>	supply current		-	75	mA
I <sub>GND</sub>	ground current		<b>−75</b>	-	mA
T <sub>stg</sub>	storage temperature		<b>−65</b>	+150	°C
P <sub>tot</sub>	total power dissipation	$T_{amb} = -40  ^{\circ}\text{C} \text{ to } +125  ^{\circ}\text{C}$	-	250	mW

<sup>[1]</sup> The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

## 10. Recommended operating conditions

Table 6. Recommended operating conditions

Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	74	74AHC1G17			AHCT1G	17	Unit
			Min	Тур	Max	Min	Тур	Max	
V <sub>CC</sub>	supply voltage		2.0	5.0	5.5	4.5	5.0	5.5	V
VI	input voltage		0	-	5.5	0	-	5.5	V
Vo	output voltage		0	-	V <sub>CC</sub>	0	-	V <sub>CC</sub>	V
T <sub>amb</sub>	ambient temperature		-40	+25	+125	-40	+25	+125	°C

<sup>[2]</sup> For TSSOP5 and SC-74A packages: above 87.5 °C the value of Ptot derates linearly with 4.0 mW/K.

## 11. Static characteristics

Table 7. Static characteristics

Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions		25 °C		-40 °C	to +85 °C	-40 °C t	o +125 °C	Unit
			Min	Тур	Max	Min	Max	Min	Max	Ī
74AHC1	G17					•				
V <sub>OH</sub>	HIGH-level	$V_I = V_{T+}$ or $V_{T-}$								
	output voltage	$I_O = -50 \mu A; V_{CC} = 2.0 V$	1.9	2.0	-	1.9	-	1.9	-	V
		$I_O = -50 \mu A; V_{CC} = 3.0 V$	2.9	3.0	-	2.9	-	2.9	-	V
		$I_O = -50 \mu A; V_{CC} = 4.5 V$	4.4	4.5	-	4.4	-	4.4	-	V
		$I_{O} = -4.0 \text{ mA}; V_{CC} = 3.0 \text{ V}$	2.58	-	-	2.48	-	2.40	-	V
		$I_{O} = -8.0 \text{ mA}; V_{CC} = 4.5 \text{ V}$	3.94	-	-	3.8	-	3.70	-	V
$V_{OL}$	LOW-level	$V_I = V_{T+}$ or $V_{T-}$								
	output voltage	$I_O = 50 \mu A; V_{CC} = 2.0 V$	-	0	0.1	-	0.1	-	0.1	V
		$I_O = 50 \mu A; V_{CC} = 3.0 V$	-	0	0.1	-	0.1	-	0.1	V
		$I_O = 50 \mu A; V_{CC} = 4.5 V$	-	0	0.1	-	0.1	-	0.1	V
		$I_O = 4.0 \text{ mA}; V_{CC} = 3.0 \text{ V}$	-	-	0.36	-	0.44	-	0.55	V
		$I_O = 8.0 \text{ mA}; V_{CC} = 4.5 \text{ V}$	-	-	0.36	-	0.44	-	0.55	V
l <sub>l</sub>	input leakage current	V <sub>I</sub> = 5.5 V or GND; V <sub>CC</sub> = 0 V to 5.5 V	-	-	0.1	-	1.0	-	2.0	μΑ
I <sub>CC</sub>	supply current	$V_I = V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 5.5 \text{ V}$	-	-	1.0	-	10	-	40	μΑ
Cı	input capacitance		-	1.5	10	-	10	-	10	pF
74AHCT	1G17									
V <sub>OH</sub>	HIGH-level	$V_{I} = V_{T+} \text{ or } V_{T-}; V_{CC} = 4.5 \text{ V}$								
	output voltage	I <sub>O</sub> = -50 μA	4.4	4.5	-	4.4	-	4.4	-	V
		$I_{O} = -8.0 \text{ mA}$	3.94	-	-	3.8	-	3.70	-	V
V <sub>OL</sub>	LOW-level	$V_{I} = V_{T+} \text{ or } V_{T-}; V_{CC} = 4.5 \text{ V}$								
	output voltage	I <sub>O</sub> = 50 μA	-	0	0.1	-	0.1	-	0.1	V
		I <sub>O</sub> = 8.0 mA	-	-	0.36	-	0.44	-	0.55	V
l <sub>l</sub>	input leakage current	V <sub>I</sub> = 5.5 V or GND; V <sub>CC</sub> = 0 V to 5.5 V	-	-	0.1	-	1.0	-	2.0	μΑ
I <sub>CC</sub>	supply current	$V_I = V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 5.5 \text{ V}$	-	-	1.0	-	10	-	40	μΑ
Δl <sub>CC</sub>	additional supply current	per input pin; $V_I = 3.4 \text{ V}$ ; other inputs at $V_{CC}$ or GND; $I_O = 0 \text{ A}$ ; $V_{CC} = 5.5 \text{ V}$	-	-	1.35	-	1.5	-	1.5	mA
Cı	input capacitance		-	1.5	10	-	10	-	10	pF

#### 11.1 Transfer characteristics

Table 8. Transfer characteristics

At recommended operating conditions; voltages are referenced to GND (ground = 0 V). See Figure 7 and Figure 8.

Symbol	Parameter	Conditions		25 °C		-40 °C 1	to +85 °C	-40 °C t	o +125 °C	Unit
			Min	Тур	Max	Min	Max	Min	Max	
74AHC1	G17									
$V_{T+}$	positive-going	V <sub>CC</sub> = 3.0 V	-	-	2.2	-	2.2	-	2.2	V
	threshold voltage	V <sub>CC</sub> = 4.5 V	-	-	3.15	-	3.15	-	3.15	V
	voltage	$V_{CC} = 5.5 \text{ V}$	-	-	3.85	-	3.85	-	3.85	V
$V_{T-}$	negative-going	$V_{CC} = 3.0 \text{ V}$	0.9	-	-	0.9	-	0.9	-	V
	threshold	V <sub>CC</sub> = 4.5 V	1.35	-	-	1.35	-	1.35	-	V
	voltage	V <sub>CC</sub> = 5.5 V	1.65	-	-	1.65	-	1.65	-	V
$V_{H}$	hysteresis voltage	$V_{CC} = 3.0 \text{ V}$	0.3	-	1.2	0.3	1.2	0.25	1.2	V
		V <sub>CC</sub> = 4.5 V	0.4	-	1.4	0.4	1.4	0.35	1.4	V
		V <sub>CC</sub> = 5.5 V	0.5	-	1.6	0.5	1.6	0.45	1.6	V
74AHCT	1G17									
$V_{T+}$	positive-going	$V_{CC} = 4.5 \text{ V}$	-	-	2.0	-	2.0	-	2.0	V
	threshold voltage	V <sub>CC</sub> = 5.5 V	-	-	2.0	-	2.0	-	2.0	V
$V_{T-}$	negative-going	$V_{CC} = 4.5 \text{ V}$	0.5	-	-	0.5	-	0.5	-	V
	threshold voltage	V <sub>CC</sub> = 5.5 V	0.6	-	-	0.6	-	0.6	-	V
V <sub>H</sub>	hysteresis	V <sub>CC</sub> = 4.5 V	0.4	-	1.4	0.4	1.4	0.35	1.4	V
	voltage	V <sub>CC</sub> = 5.5 V	0.4	-	1.6	0.4	1.6	0.35	1.6	V

## 12. Dynamic characteristics

#### Table 9. Dynamic characteristics

GND = 0 V;  $t_r = t_f \le 3.0$  ns. For waveform, see <u>Figure 5</u>. For test circuit, see <u>Figure 6</u>.

Symbol	Parameter	Conditions			25 °C		-40 °C	to +85 °C	-40 °C t	o +125 °C	Unit
				Min	Тур	Max	Min	Max	Min	Max	1
74AHC1	G17										
t <sub>pd</sub>	propagation	A to Y	<u>[1]</u>								
	delay	V <sub>CC</sub> = 3.0 V to 3.6 V	[2]								
		C <sub>L</sub> = 15 pF		-	4.2	12.8	1.0	15.0	1.0	16.5	ns
		C <sub>L</sub> = 50 pF		-	6.0	16.3	1.0	18.5	1.0	20.5	ns
		V <sub>CC</sub> = 4.5 V to 5.5 V	[3]								
		C <sub>L</sub> = 15 pF		-	3.2	8.6	1.0	10.0	1.0	11.0	ns
		C <sub>L</sub> = 50 pF		-	4.6	10.6	1.0	12.0	1.0	13.5	ns
C <sub>PD</sub>	power dissipation capacitance	per buffer; [4] $C_L = 50 \text{ pF}; f = 1 \text{ MHz};$ $V_I = \text{GND to } V_{CC}$		-	12	-	-	-	-	-	pF
74AHCT	1G17					1				1	-
t <sub>pd</sub>	propagation delay	A to Y V <sub>CC</sub> = 4.5 V to 5.5 V	[1][3]								
		C <sub>L</sub> = 15 pF		-	4.1	7.0	1.0	8.0	1.0	9.0	ns
		C <sub>L</sub> = 50 pF		-	5.9	8.5	1.0	10.0	1.0	11.0	ns
C <sub>PD</sub>	power dissipation capacitance	per buffer; V <sub>I</sub> = GND to V <sub>CC</sub>	<u>[4]</u>	-	13	-	-	-	-	-	pF

- [1]  $t_{pd}$  is the same as  $t_{PLH}$  and  $t_{PHL}$ .
- [2] Typical values are measured at  $V_{CC} = 3.3 \text{ V}$ .
- [3] Typical values are measured at  $V_{CC} = 5.0 \text{ V}$ .
- [4]  $C_{PD}$  is used to determine the dynamic power dissipation  $P_D$  ( $\mu W$ ).

 $P_D = C_{PD} \times V_{CC}^2 \times f_i + \sum (C_L \times V_{CC}^2 \times f_o)$  where:

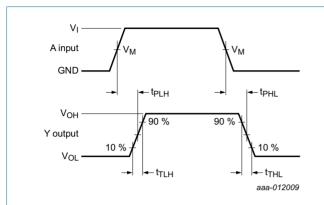
 $f_i$  = input frequency in MHz;

f<sub>o</sub> = output frequency in MHz;

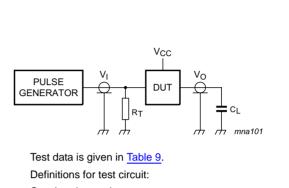
C<sub>L</sub> = output load capacitance in pF;

V<sub>CC</sub> = supply voltage in Volts.

#### 13. Waveforms



The test data is given in Table 10



 $C_L$  = Load capacitance.

 $R_T = \mbox{Termination}$  resistance should be equal to output impedance  $Z_o$  of the pulse generator.

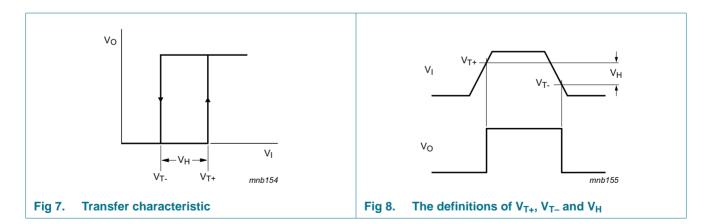
Fig 6. Test circuit for measuring switching times

Fig 5. The input (A) to output (Y) propagation delays

Table 10. Test data

Type number	Input		Output
	VI	V <sub>M</sub>	V <sub>M</sub>
74AHC1G17	GND to V <sub>CC</sub>	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$
74AHCT1G17	GND to 3.0 V	1.5 V	$0.5 \times V_{CC}$

#### 13.1 Transfer characteristic waveforms



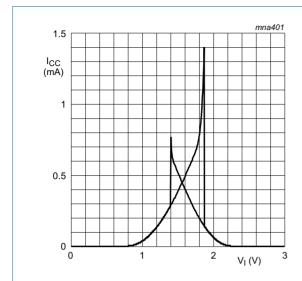


Fig 9. Typical 74AHC1G17 transfer characteristics;  $V_{CC} = 3.0 \text{ V}$ 

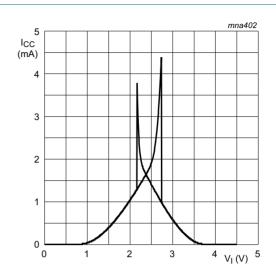


Fig 10. Typical 74AHC1G17 transfer characteristics;  $V_{CC} = 4.5 \text{ V}$ 

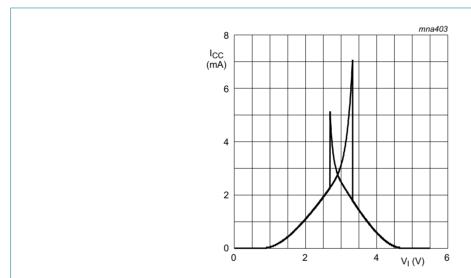
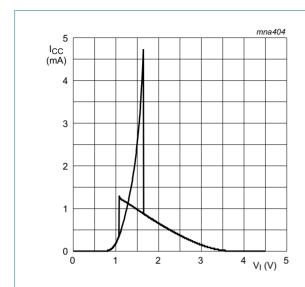


Fig 11. Typical 74AHC1G17 transfer characteristics; V<sub>CC</sub> = 5.5 V





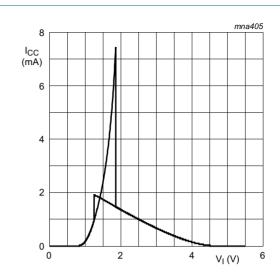


Fig 13. Typical 74AHCT1G17 transfer characteristics;  $V_{CC} = 5.5 \text{ V}$ 

## 14. Application information

The slow input rise and fall times cause additional power dissipation, which can be calculated using the following formula:

 $P_{add} = f_i \times (t_r \times \Delta I_{CC(AV)} + t_f \times \Delta I_{CC(AV)}) \times V_{CC}$  where:

 $P_{add}$  = additional power dissipation ( $\mu W$ );

 $f_i = input frequency (MHz);$ 

 $t_r$  = input rise time (ns); 10 % to 90 %;

 $t_f$  = input fall time (ns); 90 % to 10 %;

 $\Delta I_{CC(AV)}$  = average additional supply current ( $\mu A$ ).

Average additional  $I_{CC}$  differs with positive or negative input transitions, as shown in Figure 14 and Figure 15.

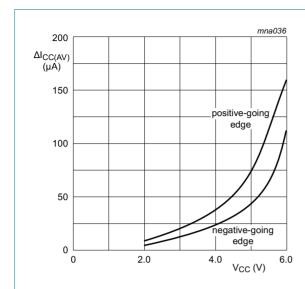


Fig 14. Average additional  $I_{CC}$  for 74AHC1G17 Schmitt trigger devices; linear change of  $V_I$  between  $0.1V_{CC}$  to  $0.9V_{CC}$ 

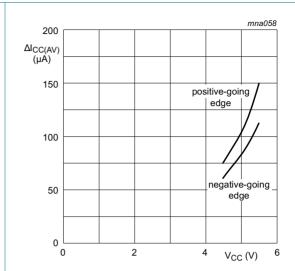
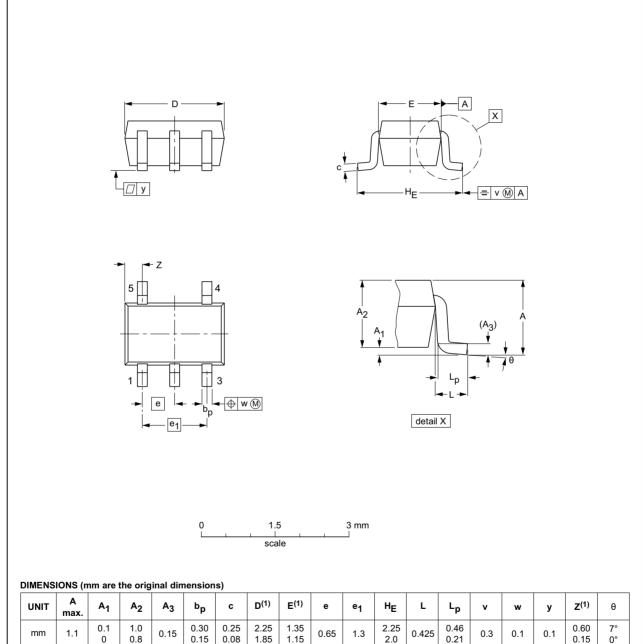


Fig 15. Average additional  $I_{CC}$  for 74AHCT1G17 Schmitt trigger devices; linear change of  $V_{I}$  between 0.1 $V_{CC}$  to 0.9 $V_{CC}$ 

## 15. Package outline

TSSOP5: plastic thin shrink small outline package; 5 leads; body width 1.25 mm

SOT353-1



UNIT	A max.	A <sub>1</sub>	A <sub>2</sub>	А3	bp	С	D <sup>(1)</sup>	E <sup>(1)</sup>	е	e <sub>1</sub>	HE	L	Lp	v	w	у	Z <sup>(1)</sup>	θ
mm	1.1	0.1 0	1.0 0.8	0.15	0.30 0.15	0.25 0.08	2.25 1.85	1.35 1.15	0.65	1.3	2.25 2.0	0.425	0.46 0.21	0.3	0.1	0.1	0.60 0.15	7° 0°

#### Note

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.

(	OUTLINE		REFER	EUROPEAN	ISSUE DATE		
	VERSION	IEC	JEDEC	JEITA		PROJECTION	ISSUE DATE
	SOT353-1		MO-203	SC-88A			<del>-00-09-01</del> 03-02-19

Fig 16. Package outline SOT353-1 (TSSOP5)

#### Plastic surface-mounted package; 5 leads

**SOT753** 

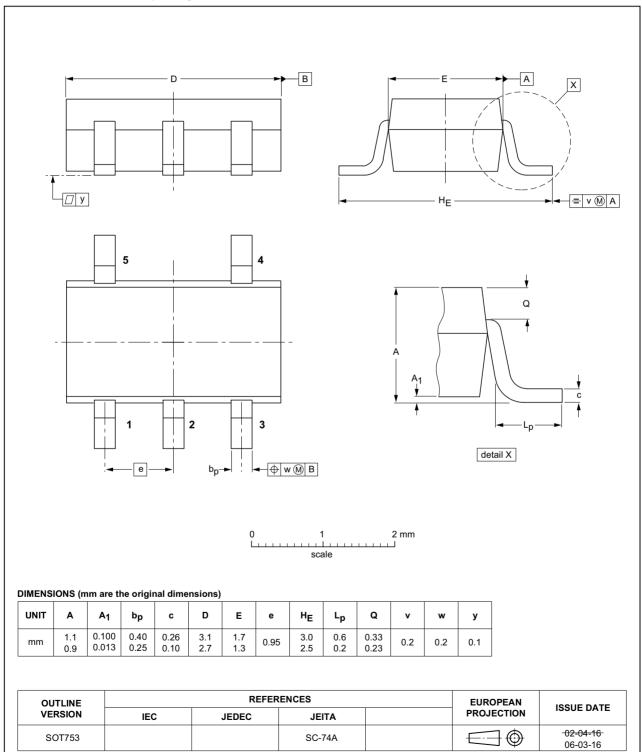


Fig 17. Package outline SOT753 (SC-74A)

## 16. Abbreviations

#### Table 11. Abbreviations

Acronym	Description
CDM	Charged Device Model
CMOS	Complementary Metal-Oxide Semiconductor
DUT	Device Under Test
ESD	ElectroStatic Discharge
HBM	Human Body Model
MM	Machine Model
TTL	Transistor-Transistor Logic

## 17. Revision history

#### Table 12. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74AHC_AHCT1G17 v.2	20161005	Product data sheet	-	74AHC_AHCT1G17 v.1
Modifications:	<ul> <li>Type numbers 74AHC1G17GF, 74AHC1G17GM, 74AHCT1G17GF and 74AHCT1G17GM removed.</li> </ul>			
74AHC_AHCT1G17 v.1	20140318	Product data sheet	-	-

## 18. Legal information

#### 18.1 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.nexperia.com.

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