

# 74HC257; 74HCT257

Quad 2-input multiplexer; 3-state

Rev. 7 — 2 February 2016

Product data sheet

## 1. General description

The 74HC257; 74HCT257 is a quad 2-input multiplexer with 3-state outputs. Inputs include clamp diodes. This enables the use of current limiting resistors to interface inputs to voltages in excess of  $V_{CC}$ .

## 2. Features and benefits

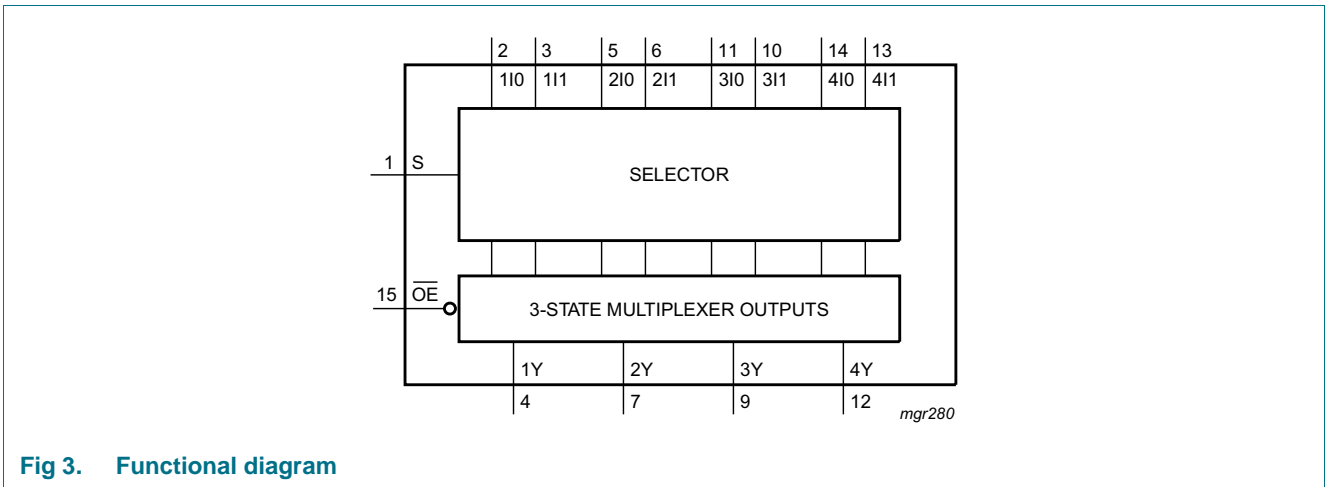
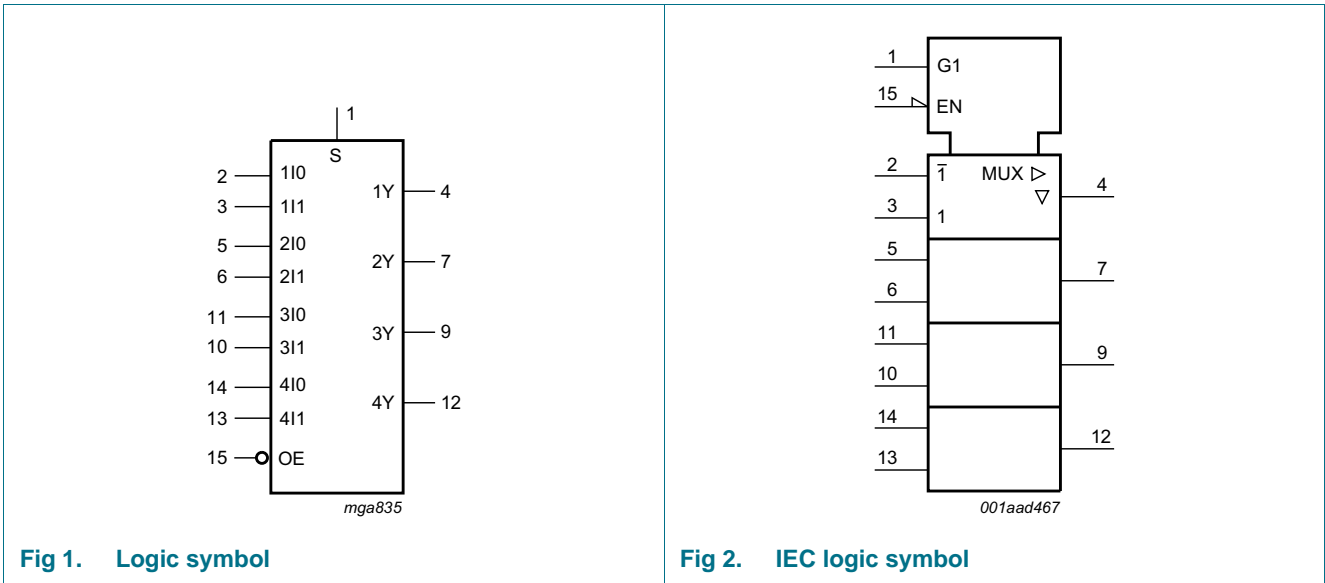
- Non-inverting data path
- 3-state outputs interface directly with system bus
- Complies with JEDEC standard no. 7A
- Input levels:
  - ◆ For 74HC257: CMOS level
  - ◆ For 74HCT257: TTL level
- ESD protection:
  - ◆ HBM JESD22-A114F exceeds 2000 V
  - ◆ MM JESD22-A115-A exceeds 200 V
- Multiple package options
- Specified from  $-40\text{ }^{\circ}\text{C}$  to  $+85\text{ }^{\circ}\text{C}$  and from  $-40\text{ }^{\circ}\text{C}$  to  $+125\text{ }^{\circ}\text{C}$

## 3. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
74HC257D	$-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$	SO16	plastic small outline package; 16 leads; body width 3.9 mm	SOT109-1
74HCT257D				
74HC257DB	$-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$	SSOP16	plastic shrink small outline package; 16 leads; body width 5.3 mm	SOT338-1
74HCT257DB				
74HC257PW	$-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$	TSSOP16	plastic thin shrink small outline package; 16 leads; body width 4.4 mm	SOT403-1
74HCT257PW				

## 4. Functional diagram



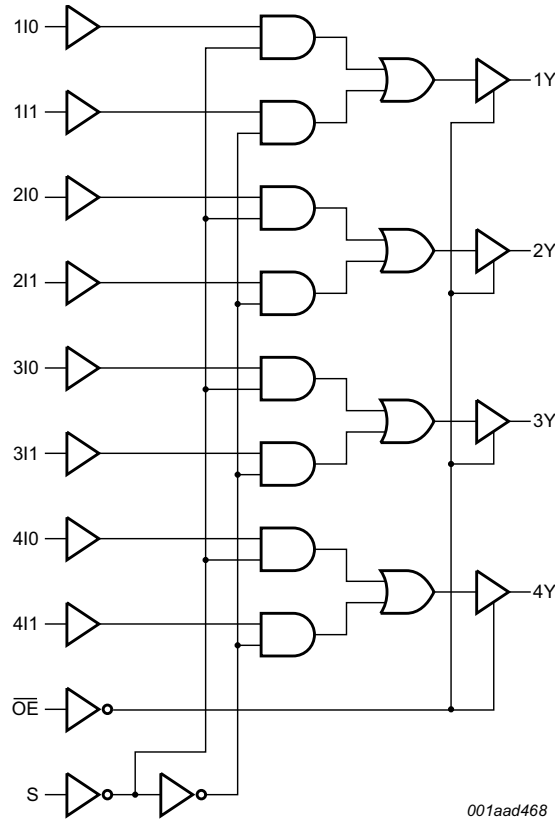


Fig 4. Logic diagram

## 5. Pinning information

### 5.1 Pinning

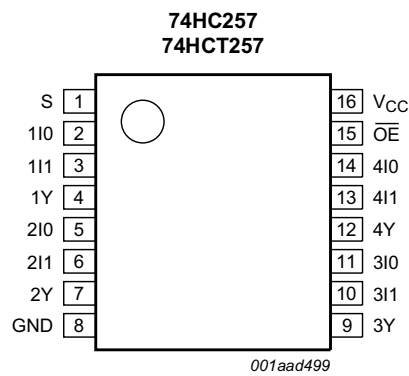


Fig 5. Pin configuration SO16, SSOP16 and TSSOP16

## 5.2 Pin description

Table 2. Pin description

Symbol	Pin	Description
S	1	common data select input
1I0 to 4I0	2, 5, 11, 14	data input from source 0
1I1 to 4I1	3, 6, 10, 13	data input from source 1
1Y to 4Y	4, 7, 9, 12	3-state multiplexer output
GND	8	ground (0 V)
$\overline{\text{OE}}$	15	3-state output enable input (active LOW)
V <sub>CC</sub>	16	supply voltage

## 6. Functional description

### 6.1 Function table

Table 3. Function table<sup>[1]</sup>

Control		Input		Output
OE	S	nI0	nI1	nY
H	X	X	X	Z
L	H	X	L	L
L	H	X	H	H
L	L	L	X	L
L	L	H	X	H

[1] H = HIGH voltage level; L = LOW voltage level; X = don't care; Z = high-impedance OFF-state.

## 7. Limiting values

Table 4. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134). Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	Min	Max	Unit
V <sub>CC</sub>	supply voltage		-0.5	+7	V
I <sub>IK</sub>	input clamping current	V <sub>I</sub> < -0.5 V or V <sub>I</sub> > V <sub>CC</sub> + 0.5 V <a href="#">[1]</a>	-	±20	mA
I <sub>OK</sub>	output clamping current	V <sub>O</sub> < -0.5 V or V <sub>O</sub> > V <sub>CC</sub> + 0.5 V <a href="#">[1]</a>	-	±20	mA
I <sub>O</sub>	output current	V <sub>O</sub> = -0.5 V to V <sub>CC</sub> + 0.5 V	-	±35	mA
I <sub>CC</sub>	supply current		-	+70	mA
I <sub>GND</sub>	ground current		-70	-	mA
T <sub>stg</sub>	storage temperature		-65	+150	°C
P <sub>tot</sub>	total power dissipation	SO16 package <a href="#">[2]</a>	-	500	mW
		SSOP16 package <a href="#">[3]</a>	-	500	mW
		TSSOP16 package <a href="#">[3]</a>	-	500	mW

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

[2] For SO16 packages: above 70 °C, P<sub>tot</sub> derates linearly with 8 mW/K.

[3] For SSOP16 and TSSOP16 packages: above 60 °C, P<sub>tot</sub> derates linearly with 5.5 mW/K.

## 8. Recommended operating conditions

**Table 5. Recommended operating conditions**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>74HC257</b>						
$V_{CC}$	supply voltage		2.0	5.0	6.0	V
$V_I$	input voltage		0	-	$V_{CC}$	V
$V_O$	output voltage		0	-	$V_{CC}$	V
$\Delta t/\Delta V$	input transition rise and fall rates	$V_{CC} = 2.0\text{ V}$	-	-	625	ns
		$V_{CC} = 4.5\text{ V}$	-	1.67	139	ns
		$V_{CC} = 6.0\text{ V}$	-	-	83	ns
$T_{amb}$	ambient temperature		-40	-	+125	°C
<b>74HCT257</b>						
$V_{CC}$	supply voltage		4.5	5.0	5.5	V
$V_I$	input voltage		0	-	$V_{CC}$	V
$V_O$	output voltage		0	-	$V_{CC}$	V
$\Delta t/\Delta V$	input transition rise and fall rates	$V_{CC} = 4.5\text{ V}$	-	1.67	139	ns
$T_{amb}$	ambient temperature		-40	-	+125	°C

## 9. Static characteristics

**Table 6. Static characteristics**

At recommended operating conditions; voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
<b>74HC257</b>										
$V_{IH}$	HIGH-level input voltage	$V_{CC} = 2.0\text{ V}$	1.5	1.2	-	1.5	-	1.5	-	V
		$V_{CC} = 4.5\text{ V}$	3.15	2.4	-	3.15	-	3.15	-	V
		$V_{CC} = 6.0\text{ V}$	4.2	3.2	-	4.2	-	4.2	-	V
$V_{IL}$	LOW-level input voltage	$V_{CC} = 2.0\text{ V}$	-	0.8	0.5	-	0.5	-	0.5	V
		$V_{CC} = 4.5\text{ V}$	-	2.1	1.35	-	1.35	-	1.35	V
		$V_{CC} = 6.0\text{ V}$	-	2.8	1.8	-	1.8	-	1.8	V
$V_{OH}$	HIGH-level output voltage	$V_I = V_{IH}$ or $V_{IL}$								
		$I_O = -20\text{ }\mu\text{A}$ ; $V_{CC} = 2.0\text{ V}$	1.9	2.0	-	1.9	-	1.9	-	V
		$I_O = -20\text{ }\mu\text{A}$ ; $V_{CC} = 4.5\text{ V}$	4.4	4.5	-	4.4	-	4.4	-	V
		$I_O = -20\text{ }\mu\text{A}$ ; $V_{CC} = 6.0\text{ V}$	5.9	6.0	-	5.9	-	5.9	-	V
		$I_O = -6.0\text{ mA}$ ; $V_{CC} = 4.5\text{ V}$	3.98	4.32	-	3.84	-	3.7	-	V
		$I_O = -7.8\text{ mA}$ ; $V_{CC} = 6.0\text{ V}$	5.48	5.81	-	5.34	-	5.2	-	V

**Table 6. Static characteristics ...continued**

At recommended operating conditions; voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
V <sub>OL</sub>	LOW-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>								
		I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 2.0 V	-	0	0.1	-	0.1	-	0.1	V
		I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 4.5 V	-	0	0.1	-	0.1	-	0.1	V
		I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 6.0 V	-	0	0.1	-	0.1	-	0.1	V
		I <sub>O</sub> = 6.0 mA; V <sub>CC</sub> = 4.5 V	-	0.15	0.26	-	0.33	-	0.4	V
		I <sub>O</sub> = 7.8 mA; V <sub>CC</sub> = 6.0 V	-	0.16	0.26	-	0.33	-	0.4	V
I <sub>I</sub>	input leakage current	V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 6.0 V	-	-	±0.1	-	±1.0	-	±1.0	μA
I <sub>OZ</sub>	OFF-state output current	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; V <sub>O</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 6.0 V	-	-	±0.5	-	±5.0	-	±10.0	μA
I <sub>CC</sub>	supply current	V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 6.0 V	-	-	8.0	-	80	-	160	μA
C <sub>i</sub>	input capacitance		-	3.5	-	-	-	-	-	pF
<b>74HCT257</b>										
V <sub>IH</sub>	HIGH-level input voltage	V <sub>CC</sub> = 4.5 V to 5.5 V	2.0	1.6	-	2.0	-	2.0	-	V
V <sub>IL</sub>	LOW-level input voltage	V <sub>CC</sub> = 4.5 V to 5.5 V	-	1.2	0.8	-	0.8	-	0.8	V
V <sub>OH</sub>	HIGH-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; V <sub>CC</sub> = 4.5 V								
		I <sub>O</sub> = -20 μA	4.4	4.5	-	4.4	-	4.4	-	V
		I <sub>O</sub> = -6 mA	3.98	4.32	-	3.84	-	3.7	-	V
V <sub>OL</sub>	LOW-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; V <sub>CC</sub> = 4.5 V								
		I <sub>O</sub> = 20 μA	-	0	0.1	-	0.33	-	0.4	V
		I <sub>O</sub> = 6.0 mA	-	0.15	0.26	-	0.33	-	0.4	V
I <sub>I</sub>	input leakage current	V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 5.5 V	-	-	±0.1	-	±1.0	-	±1.0	μA
I <sub>OZ</sub>	OFF-state output current	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; V <sub>O</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 5.5 V	-	-	±0.5	-	±5.0	-	±10	μA
I <sub>CC</sub>	supply current	V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 5.5 V	-	-	8.0	-	80	-	160	μA
ΔI <sub>CC</sub>	additional supply current	V <sub>I</sub> = V <sub>CC</sub> - 2.1 V; other inputs at V <sub>CC</sub> or GND; V <sub>CC</sub> = 4.5 V to 5.5 V; I <sub>O</sub> = 0 A								
		per input pin; nI0, nI1 inputs	-	40	144	-	180	-	196	μA
		per input pin; $\overline{\text{OE}}$ input	-	135	486	-	608	-	662	μA
		per input pin; S input	-	70	252	-	315	-	343	μA
C <sub>i</sub>	input capacitance		-	3.5	-	-	-	-	-	pF

## 10. Dynamic characteristics

**Table 7. Dynamic characteristics**

Voltages are referenced to GND (ground = 0 V); For test circuit see [Figure 8](#).

Symbol	Parameter	Conditions	25 °C		-40 °C to +85 °C	-40 °C to +125 °C	Unit
			Typ	Max	Max	Max	
<b>74HC257</b>							
$t_{pd}$	propagation delay	nI0 to nY or nI1 to nY; see <a href="#">Figure 6</a> <sup>[1]</sup>					
		$V_{CC} = 2.0\text{ V}$	36	110	140	165	ns
		$V_{CC} = 4.5\text{ V}$	13	22	28	33	ns
		$V_{CC} = 5.0\text{ V}; C_L = 15\text{ pF}$	11	-	-	-	ns
		$V_{CC} = 6.0\text{ V}$	10	19	24	28	ns
		S to nY; see <a href="#">Figure 6</a>					
		$V_{CC} = 2.0\text{ V}$	47	150	190	225	ns
		$V_{CC} = 4.5\text{ V}$	17	30	38	45	ns
$t_{en}$	enable time	$\overline{OE}$ to nY; see <a href="#">Figure 7</a> <sup>[2]</sup>					
		$V_{CC} = 2.0\text{ V}$	33	150	190	225	ns
		$V_{CC} = 4.5\text{ V}$	12	30	38	45	ns
		$V_{CC} = 6.0\text{ V}$	10	26	33	38	ns
$t_{dis}$	disable time	$\overline{OE}$ to nY; see <a href="#">Figure 7</a> <sup>[3]</sup>					
		$V_{CC} = 2.0\text{ V}$	41	150	190	225	ns
		$V_{CC} = 4.5\text{ V}$	15	30	38	45	ns
		$V_{CC} = 6.0\text{ V}$	12	26	33	38	ns
$t_t$	transition time	see <a href="#">Figure 6</a> <sup>[4]</sup>					
		$V_{CC} = 2.0\text{ V}$	14	60	75	90	ns
		$V_{CC} = 4.5\text{ V}$	5	12	15	18	ns
		$V_{CC} = 6.0\text{ V}$	4	10	13	15	ns
$C_{PD}$	power dissipation capacitance	per multiplexer; $V_I = \text{GND to } V_{CC}$ <sup>[5]</sup>	45	-	-	-	pF
<b>74HCT257</b>							
$t_{pd}$	propagation delay	nI0 to nY or nI1 to nY; see <a href="#">Figure 6</a> <sup>[1]</sup>					
		$V_{CC} = 4.5\text{ V}$	16	30	38	45	ns
		$V_{CC} = 5.0\text{ V}; C_L = 15\text{ pF}$	13	-	-	-	ns
		S to nY; see <a href="#">Figure 6</a>					
		$V_{CC} = 4.5\text{ V}$	20	35	44	53	ns
$t_{en}$	enable time	$\overline{OE}$ to nY; $V_{CC} = 4.5\text{ V}$ ; see <a href="#">Figure 7</a> <sup>[2]</sup>	15	30	38	45	ns
		$V_{CC} = 5.0\text{ V}; C_L = 15\text{ pF}$	17	-	-	-	ns
$t_{dis}$	disable time	$\overline{OE}$ to nY; $V_{CC} = 4.5\text{ V}$ ; see <a href="#">Figure 7</a> <sup>[3]</sup>	16	30	38	45	ns
$t_t$	transition time	$V_{CC} = 4.5\text{ V}$ ; see <a href="#">Figure 6</a> <sup>[4]</sup>	5	12	15	18	ns

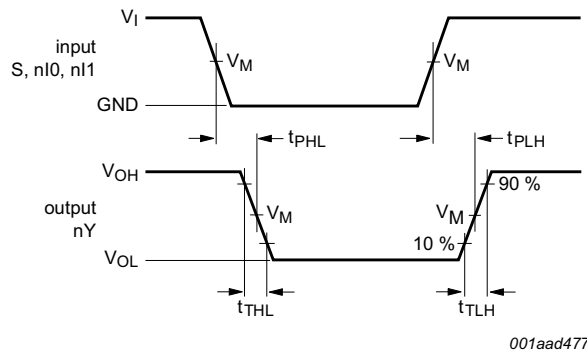
**Table 7. Dynamic characteristics ...continued**

Voltages are referenced to GND (ground = 0 V); For test circuit see [Figure 8](#).

Symbol	Parameter	Conditions	25 °C		-40 °C to +85 °C	-40 °C to +125 °C	Unit
			Typ	Max	Max	Max	
C <sub>PD</sub>	power dissipation capacitance	per multiplexer; V <sub>I</sub> = GND to V <sub>CC</sub> - 1.5 V <a href="#">[5]</a>	45	-	-	-	pF

- [1] t<sub>pd</sub> is the same as t<sub>PHL</sub>, t<sub>PLH</sub>.
- [2] t<sub>en</sub> is the same as t<sub>PZH</sub>, t<sub>PZL</sub>.
- [3] t<sub>dis</sub> is the same as t<sub>PHZ</sub>, t<sub>PLZ</sub>.
- [4] t<sub>t</sub> is the same as t<sub>THL</sub>, t<sub>TLH</sub>.
- [5] C<sub>PD</sub> is used to determine the dynamic power dissipation (P<sub>D</sub> in μW).  
 $P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \sum(C_L \times V_{CC}^2 \times f_o)$  where:  
 f<sub>i</sub> = 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 V;  
 N = number of inputs switching;  
 $\sum(C_L \times V_{CC}^2 \times f_o)$  = sum of outputs.

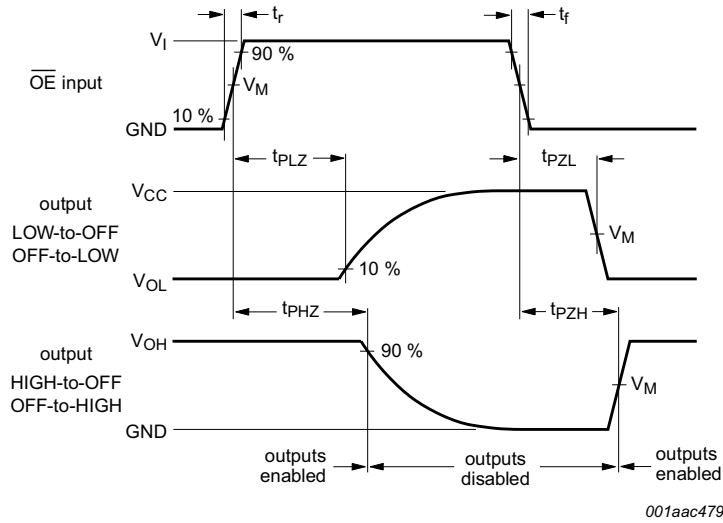
## 11. Waveforms



Measurement points are given in [Table 8](#).

V<sub>OL</sub> and V<sub>OH</sub> are typical voltage output levels that occur with the output load.

**Fig 6. Propagation delays input (S, nI0, nI1) to output (nY) and output (nY) transition times**

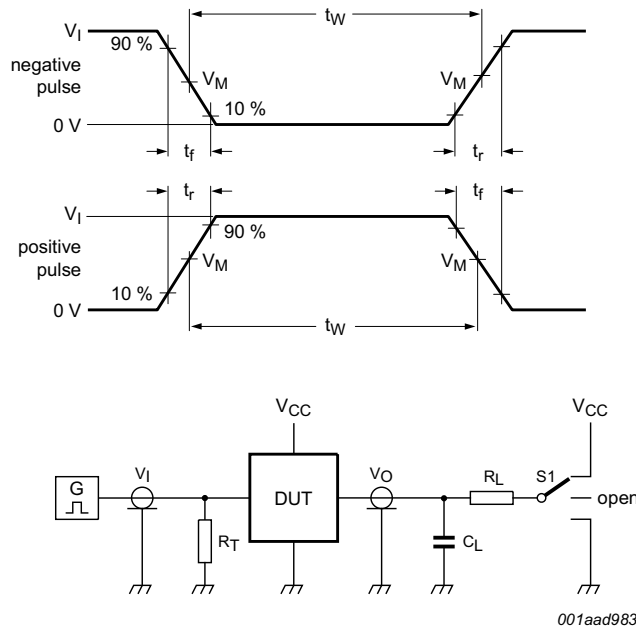


Measurement points are given in [Table 8](#).  
 $V_{OL}$  and  $V_{OH}$  are typical voltage output levels that occur with the output load.

**Fig 7. 3-state output enable and disable times**

**Table 8. Measurement points**

Type	Input	Output
	$V_M$	$V_M$
74HC257	$0.5V_{CC}$	$0.5V_{CC}$
74HCT257	1.3 V	1.3 V



Measurement points are given in [Table 8](#) and test data is given in [Table 9](#).

Definitions test circuit:

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

$C_L$  = Load capacitance including jig and probe capacitance.

$R_L$  = Load resistance.

**Fig 8. Test circuit for measuring switching times**

**Table 9. Test data**

Type	Input		Load		Switch position		
	$V_I$	$t_r, t_f$	$C_L$	$R_L$	$t_{PHL}, t_{PLH}$	$t_{PZH}, t_{PHZ}$	$t_{PZL}, t_{PLZ}$
74HC257	$V_{CC}$	6 ns	50 pF	1 k $\Omega$	open	GND	$V_{CC}$
74HCT257	3 V	6 ns	50 pF	1 k $\Omega$	open	GND	$V_{CC}$

12. Package outline

SO16: plastic small outline package; 16 leads; body width 3.9 mm

SOT109-1

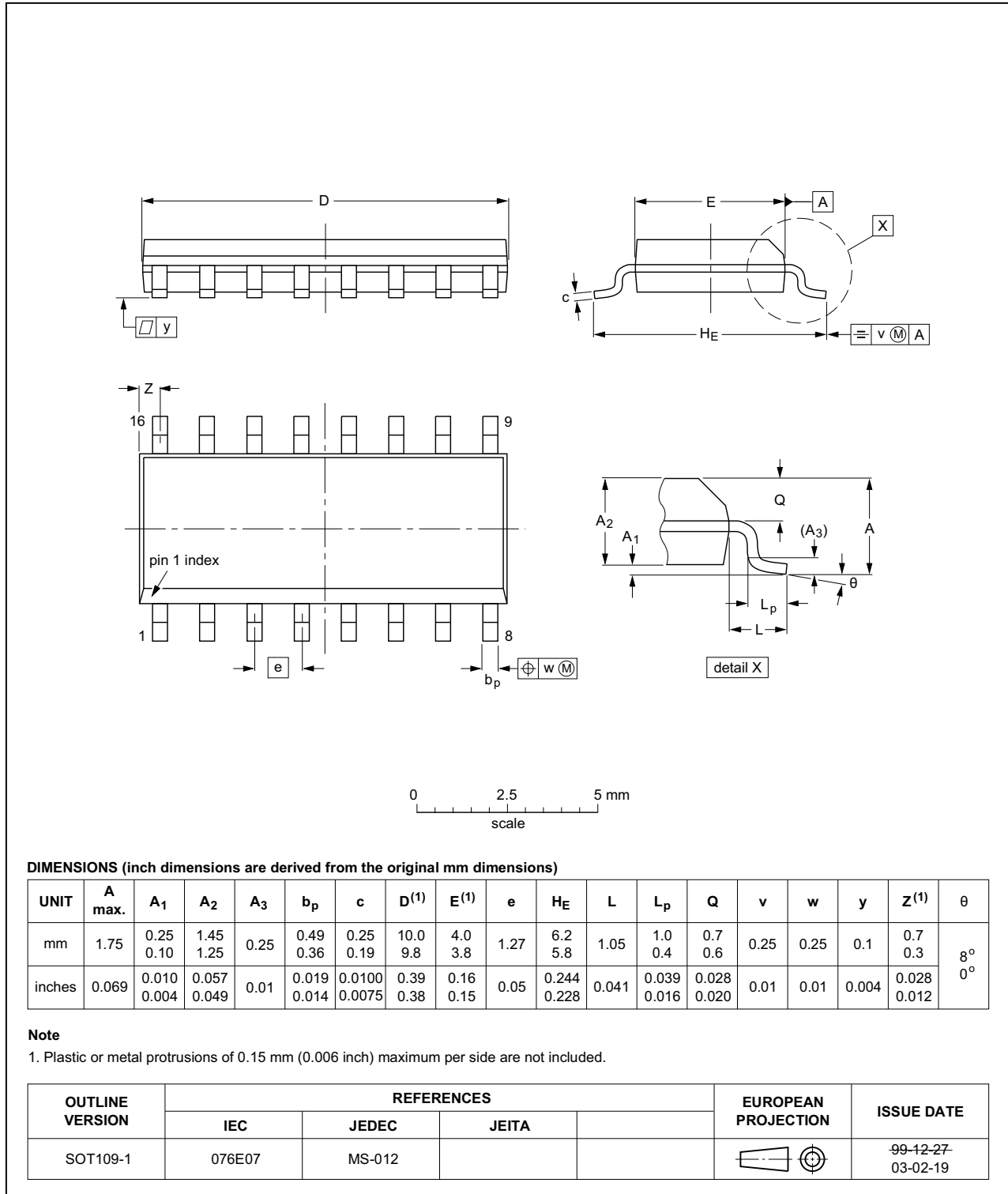


Fig 9. Package outline SOT109-1 (SO16)

SSOP16: plastic shrink small outline package; 16 leads; body width 5.3 mm

SOT338-1

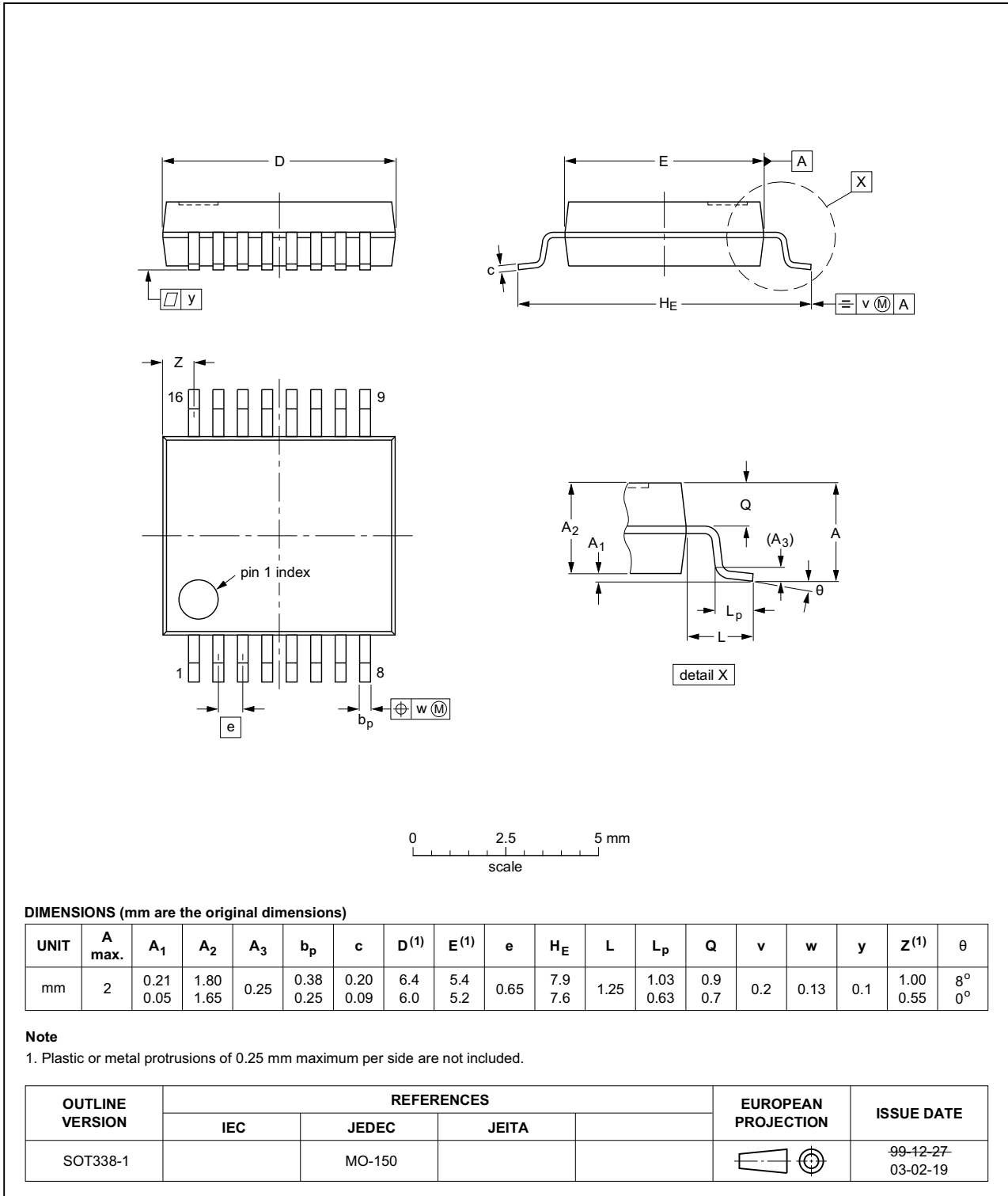


Fig 10. Package outline SOT338-1 (SSOP16)

TSSOP16: plastic thin shrink small outline package; 16 leads; body width 4.4 mm

SOT403-1

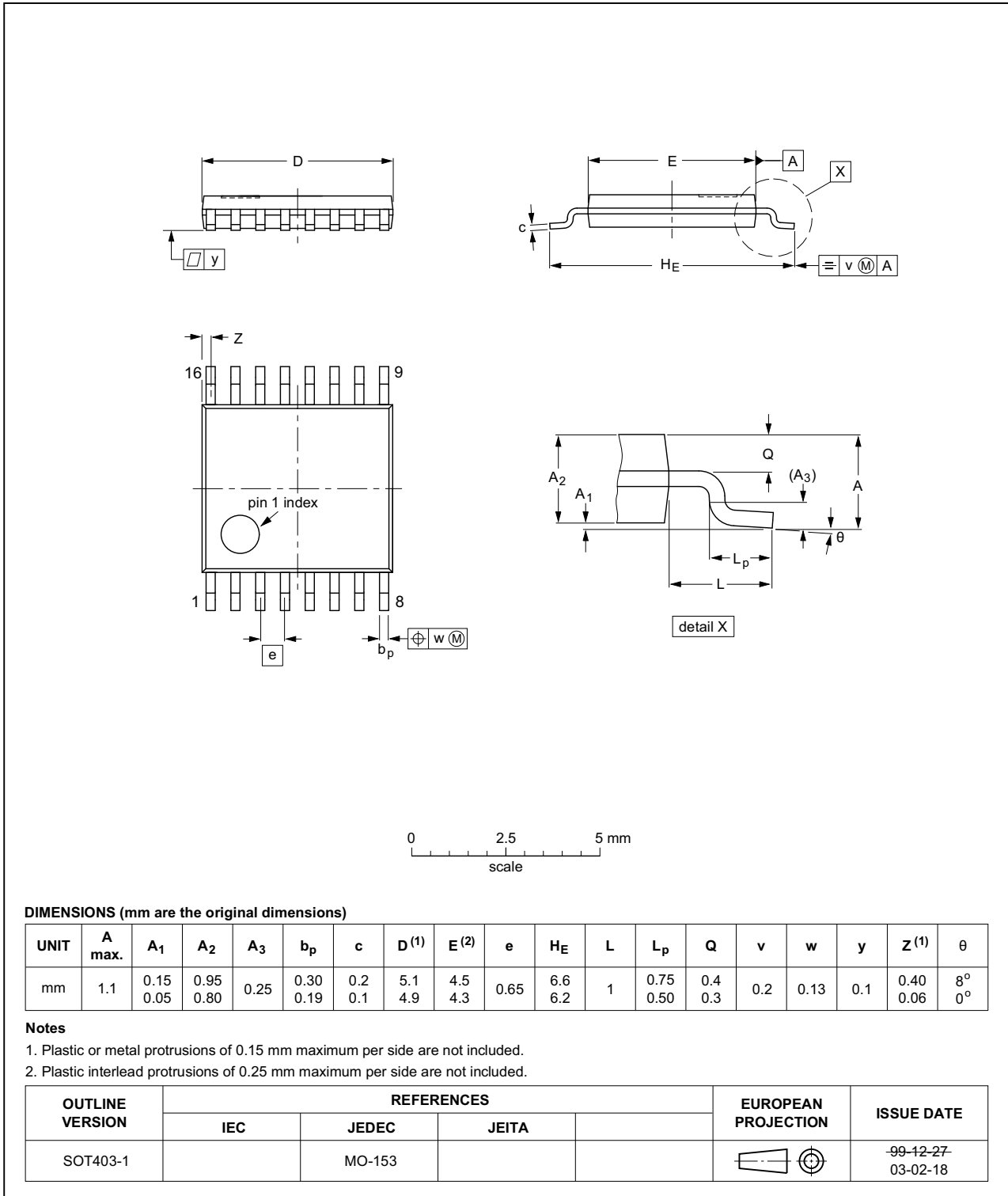


Fig 11. Package outline SOT403-1 (TSSOP16)

## 13. Abbreviations

Table 10. Abbreviations

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

## 14. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74HC_HCT257 v.7	20160202	Product data sheet	-	74HC_HCT257 v.6
Modifications:	<ul style="list-style-type: none"> <li>Type numbers 74HC257N and 74HCT257N (SOT38-4) removed.</li> </ul>			
74HC_HCT257 v.6	20150126	Product data sheet	-	74HC_HCT257 v.5
Modifications:	<ul style="list-style-type: none"> <li><a href="#">Table 7</a>: Power dissipation capacitance condition for 74HCT257 is corrected.</li> </ul>			
74HC_HCT257 v.5	20100113	Product data sheet	-	74HC_HCT257 v.4
Modifications:	<ul style="list-style-type: none"> <li><a href="#">Table 7</a>: changed <math>\overline{3OE}</math> to <math>\overline{OE}</math></li> </ul>			
74HC_HCT257 v.4	20090608	Product data sheet	-	74HC_HCT257 v.3
74HC_HCT257 v.3	20050920	Product data sheet	-	74HC_HCT257_CNV v.2
74HC_HCT257_CNV v.2	19980930	Product specification	-	-

## 15. Legal information

### 15.1 Data sheet status

Document status <sup>[1][2]</sup>	Product status <sup>[3]</sup>	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>.

### 15.2 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. Nexperia 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 Nexperia sales office. In case of any inconsistency or conflict with the short data sheet, the full data sheet shall prevail.

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## 16. Contact information

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

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