

# 74ABT2240

Octal inverting buffer with 30  $\Omega$  series termination resistors;  
3-state

Rev. 04 — 17 January 2005

Product data sheet

## 1. General description

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The 74ABT2240 high performance BiCMOS device combines low static and dynamic power dissipation with high speed.

The 74ABT2240 device is an octal inverting buffer that is ideal for driving bus lines. The device features two output enable inputs ( $1\overline{OE}$  and  $2\overline{OE}$ ), each controlling four of the 3-state outputs.

The 74ABT2240 is designed with 30  $\Omega$  series resistance in both the HIGH and LOW states of the output. This design reduces line noise in applications such as memory address drivers, clock drivers and bus receivers/transmitters.

The 74ABT2240 is the same as the 74ABT240. The part number has been changed to reflect industry standards.

## 2. Features

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- Octal bus interface
- 3-state buffers
- Live insertion and extraction permitted
- Outputs include series resistance of 30  $\Omega$ , making external termination resistors unnecessary
- Output capability: +12 mA and –32 mA
- Latch-up protection:
  - ◆ JESD78: exceeds 500 mA
- ESD protection:
  - ◆ MIL STD 883 method 3015: exceeds 2000 V
  - ◆ Machine model: exceeds 200 V
- Power-up 3-state
- Same part as 74ABT240

**PHILIPS**

### 3. Quick reference data

**Table 1: Quick reference data**

$GND = 0\text{ V}$ ;  $T_{amb} = 25\text{ }^\circ\text{C}$ .

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$t_{PLH}$	propagation delay nAn to n $\bar{Y}$ n	$C_L = 50\text{ pF}$ ; $V_{CC} = 5\text{ V}$	-	2.8	-	ns
$t_{PHL}$	propagation delay nAn to n $\bar{Y}$ n	$C_L = 50\text{ pF}$ ; $V_{CC} = 5\text{ V}$	-	4.3	-	ns
$C_I$	input capacitance	$V_I = 0\text{ V}$ or $V_{CC}$	-	3	-	pF
$C_O$	output capacitance	outputs disabled; $V_O = 0\text{ V}$ or $V_{CC}$	-	7	-	pF
$I_{CC}$	quiescent supply current	outputs 3-state; $V_{CC} = 5\text{ V}$	-	50	-	$\mu\text{A}$

### 4. Ordering information

**Table 2: Ordering information**

Type number	Package			
	Temperature range	Name	Description	Version
74ABT2240N	-40 $^\circ\text{C}$ to +85 $^\circ\text{C}$	DIP20	plastic dual in-line package; 20 leads (300 mil)	SOT146-1
74ABT2240D	-40 $^\circ\text{C}$ to +85 $^\circ\text{C}$	S020	plastic small outline package; 20 leads; body width 7.5 mm	SOT163-1
74ABT2240PW	-40 $^\circ\text{C}$ to +85 $^\circ\text{C}$	TSSOP20	plastic thin shrink small outline package; 20 leads; body width 4.4 mm	SOT360-1

5. Functional diagram

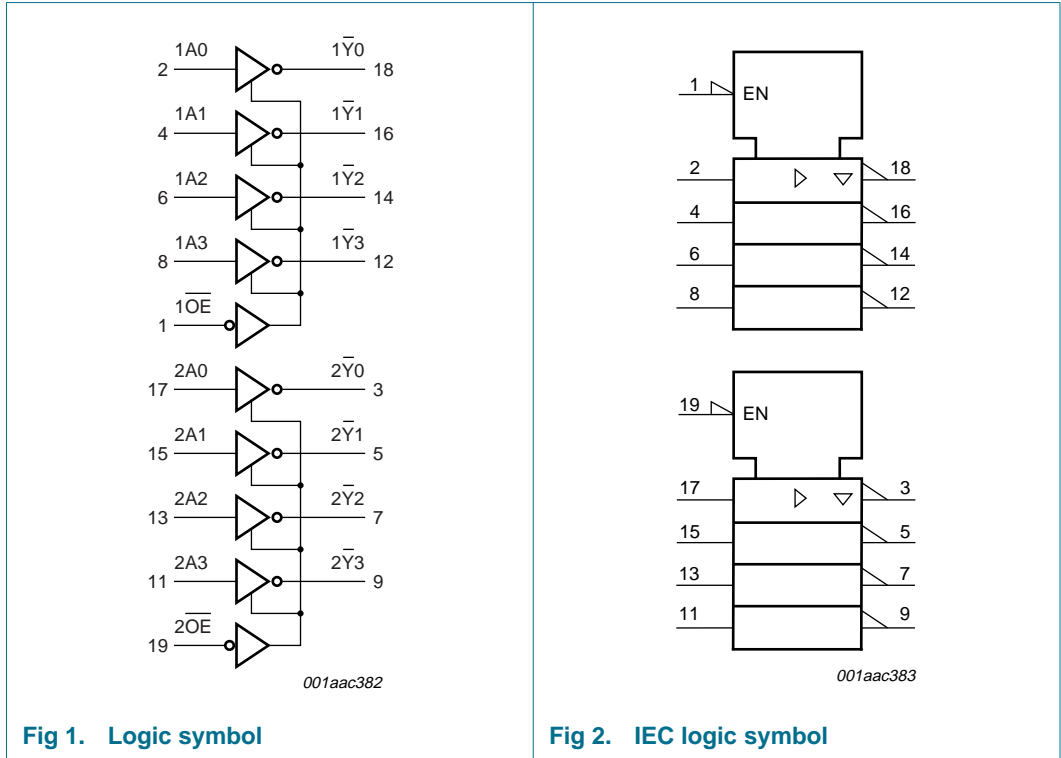


Fig 1. Logic symbol

Fig 2. IEC logic symbol

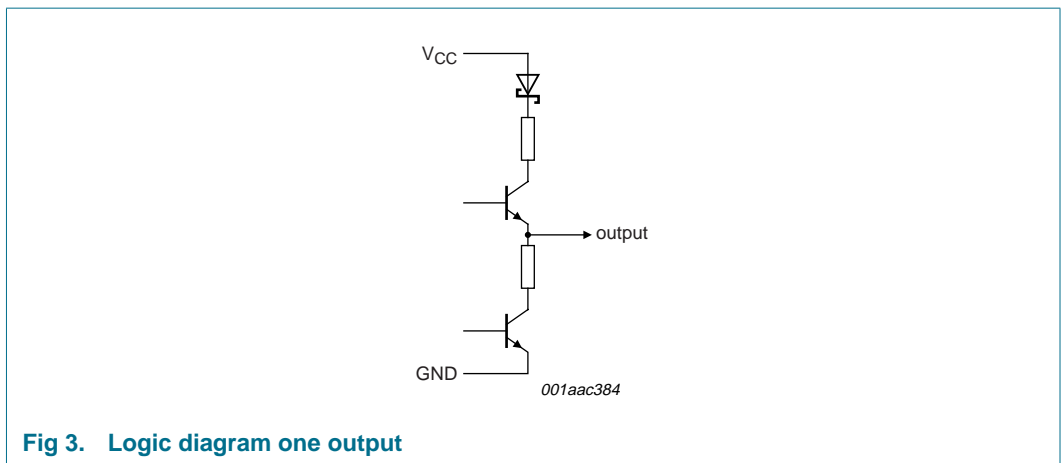
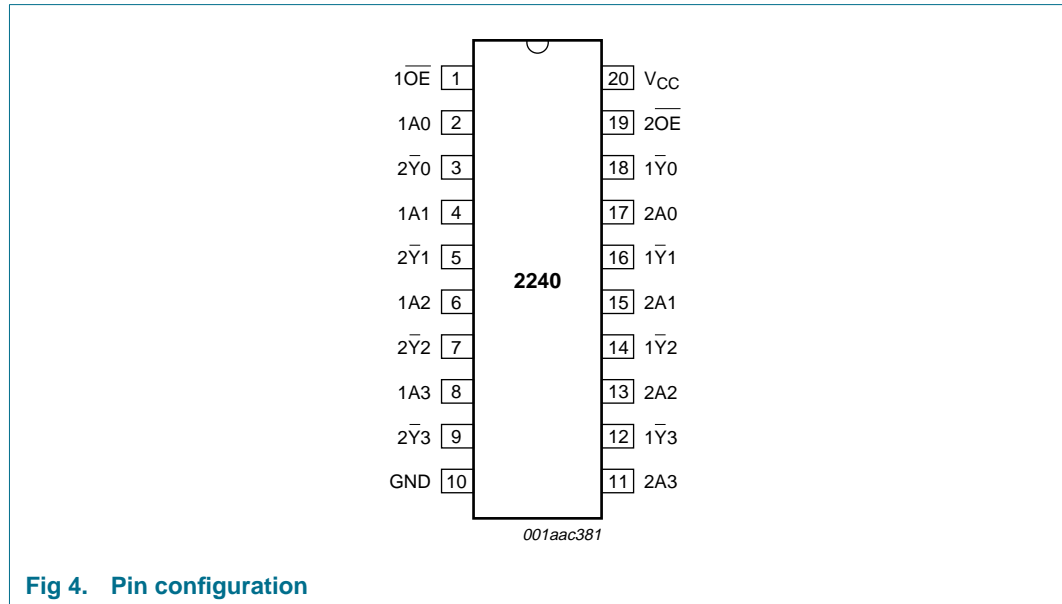


Fig 3. Logic diagram one output

## 6. Pinning information

### 6.1 Pinning



### 6.2 Pin description

**Table 3: Pin description**

Symbol	Pin	Description
1OE	1	outputs 1 enable control input
1A0	2	data input
2Y0	3	data output
1A1	4	data input
2Y1	5	data output
1A2	6	data input
2Y2	7	data output
1A3	8	data input
2Y3	9	data output
GND	10	ground (0 V)
2A3	11	data input
1Y3	12	data output
2A2	13	data input
1Y2	14	data output
2A1	15	data input
1Y1	16	data output
2A0	17	data input

Table 3: Pin description ...continued

Symbol	Pin	Description
$1\bar{Y}0$	18	data output
$2\bar{OE}$	19	outputs 2 enable control input
$V_{CC}$	20	supply voltage

## 7. Functional description

### 7.1 Function table

Table 4: Function table [1]

Control input	Input	Output
$n\bar{OE}$	$nA_n$	$n\bar{Y}_n$
L	L	H
L	H	L
H	X	Z

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

## 8. Limiting values

**Table 5: Limiting values**

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

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{CC}$	supply voltage		-0.5	+7.0	V
$V_I$	input voltage		[1] -1.2	+7.0	V
$V_O$	output voltage	output in OFF-state or HIGH-state	[1] -0.5	+5.5	V
$I_{IK}$	input diode current	$V_I < 0$ V	-18	-	mA
$I_{OK}$	output diode current	$V_O < 0$ V	-50	-	mA
$I_O$	output current	output in LOW-state	-	128	mA
$T_j$	junction temperature		[2] -	150	$^{\circ}$ C
$T_{stg}$	storage temperature		-65	+150	$^{\circ}$ C

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

[2] The performance capability of a high-performance integrated circuit in conjunction with its thermal environment can create junction temperatures which are detrimental to reliability. The maximum junction temperature of this integrated circuit should not exceed 150  $^{\circ}$ C.

## 9. Recommended operating conditions

**Table 6: Recommended operating conditions**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{CC}$	supply voltage		4.5	-	5.5	V
$V_I$	input voltage		0	-	$V_{CC}$	V
$V_{IH}$	HIGH-level input voltage		2.0	-	-	V
$V_{IL}$	LOW-level input voltage		-	-	0.8	V
$I_{OH}$	HIGH-level output current		-	-	-32	mA
$I_{OL}$	LOW-level output current		-	-	12	mA
$\Delta t/\Delta V$	input transition rise or fall rate		0	-	10	ns/V
$T_{amb}$	ambient temperature	in free air	-40	-	+85	$^{\circ}$ C

## 10. Static characteristics

**Table 7: Static characteristics**

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit		
<b>T<sub>amb</sub> = 25 °C</b>								
V <sub>IK</sub>	input diode voltage	V <sub>CC</sub> = 4.5 V; I <sub>IK</sub> = -18 mA	-	-0.9	-1.2	V		
V <sub>OH</sub>	HIGH-level output voltage	V <sub>CC</sub> = 4.5 V; V <sub>I</sub> = V <sub>IL</sub> or V <sub>IH</sub>						
		I <sub>OH</sub> = -3 mA	2.5	2.9	-	V		
		I <sub>OH</sub> = -32 mA	2.0	2.4	-	V		
		V <sub>CC</sub> = 5.0 V; V <sub>I</sub> = V <sub>IL</sub> or V <sub>IH</sub>						
		I <sub>OH</sub> = -3 mA	3.0	3.4	-	V		
V <sub>OL</sub>	LOW-level output voltage	V <sub>CC</sub> = 4.5 V; V <sub>I</sub> = V <sub>IL</sub> or V <sub>IH</sub>						
		I <sub>OL</sub> = 5 mA	-	0.32	0.55	V		
		I <sub>OL</sub> = 12 mA	-	-	0.8	V		
I <sub>LI</sub>	input leakage current	V <sub>CC</sub> = 5.5 V; V <sub>I</sub> = GND or 5.5 V	-	±0.01	±1.0	μA		
I <sub>OFF</sub>	power-off leakage current	V <sub>CC</sub> = 0 V; V <sub>O</sub> or V <sub>I</sub> 4.5 V	-	±5.0	±100	μA		
I <sub>PU</sub> , I <sub>PD</sub>	power-up or power-down down 3-state output current	V <sub>CC</sub> = 2.1 V; V <sub>O</sub> = 0.5 V; V <sub>I</sub> = GND or V <sub>CC</sub> ; V <sub>nOE</sub> = don't care	[1]	±5.0	±50	μA		
I <sub>OZ</sub>	3-state output current	V <sub>CC</sub> = 5.5 V; V <sub>I</sub> = V <sub>IL</sub> or V <sub>IH</sub>						
		output HIGH-state at V <sub>O</sub> = 2.7 V	-	0.01	50	μA		
		output LOW-state at V <sub>O</sub> = 0.5 V	-	-0.01	-50	μA		
I <sub>CEX</sub>	output HIGH-state leakage current	V <sub>CC</sub> = 5.5 V; V <sub>O</sub> = 5.5 V; V <sub>I</sub> = GND or V <sub>CC</sub>	-	5.0	50	μA		
I <sub>O</sub>	output current	V <sub>CC</sub> = 5.5 V; V <sub>O</sub> = 2.5 V	[2]	-50	-100	-180	mA	
I <sub>CC</sub>	quiescent supply current	V <sub>CC</sub> = 5.5 V; V <sub>I</sub> = GND or V <sub>CC</sub>						
		outputs HIGH-state	-	50	250	μA		
		outputs LOW-state	-	24	30	mA		
		outputs 3-state	-	50	250	μA		
ΔI <sub>CC</sub>	additional supply current	per data input pin	one data input at 3.4 V and other inputs at V <sub>CC</sub> or GND; V <sub>CC</sub> = 5.5 V	[3]				
					-	0.5	1.5	mA
					-	0.5	1.5	mA
		per enable input pin	one enable input at 3.4 V and other inputs at V <sub>CC</sub> or GND; V <sub>CC</sub> = 5.5 V	[3]				
					-	0.5	1.5	mA
C <sub>I</sub>	input capacitance	V <sub>I</sub> = 0 V or V <sub>CC</sub>	-	3	-	pF		
C <sub>O</sub>	output capacitance	outputs disabled; V <sub>O</sub> = 0 V or V <sub>CC</sub>	-	7	-	pF		

**Table 7: Static characteristics ...continued**

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
<b>T<sub>amb</sub> = -40 °C to +85 °C</b>							
V <sub>IK</sub>	input diode voltage	V <sub>CC</sub> = 4.5 V; I <sub>IK</sub> = -18 mA	-	-	-1.2	V	
V <sub>OH</sub>	HIGH-level output voltage	V <sub>CC</sub> = 4.5 V; V <sub>I</sub> = V <sub>IL</sub> or V <sub>IH</sub>					
		I <sub>OH</sub> = -3 mA	2.5	-	-	V	
		I <sub>OH</sub> = -32 mA	2.0	-	-	V	
		V <sub>CC</sub> = 5.0 V; V <sub>I</sub> = V <sub>IL</sub> or V <sub>IH</sub>					
V <sub>OL</sub>	LOW-level output voltage	V <sub>CC</sub> = 4.5 V; V <sub>I</sub> = V <sub>IL</sub> or V <sub>IH</sub>					
		I <sub>OL</sub> = 5 mA	-	-	0.55	V	
		I <sub>OL</sub> = 12 mA	-	-	0.8	V	
I <sub>LI</sub>	input leakage current	V <sub>CC</sub> = 5.5 V; V <sub>I</sub> = GND or 5.5 V	-	-	±1.0	μA	
I <sub>OFF</sub>	power-off leakage current	V <sub>CC</sub> = 0.0 V; V <sub>O</sub> or V <sub>I</sub> ≤ 4.5 V	-	-	±100	μA	
I <sub>PU</sub> , I <sub>PD</sub>	power-up or power-down down 3-state output current	V <sub>CC</sub> = 2.1 V; V <sub>O</sub> = 0.5 V; V <sub>I</sub> = GND or V <sub>CC</sub> ; V <sub>nOE</sub> = don't care	[1]	-	±50	μA	
I <sub>OZ</sub>	3-state output current	V <sub>CC</sub> = 5.5 V; V <sub>I</sub> = V <sub>IL</sub> or V <sub>IH</sub>					
		output HIGH-state at V <sub>O</sub> = 2.7 V	-	-	50	μA	
		output LOW-state at V <sub>O</sub> = 0.5 V	-	-	-50	μA	
I <sub>CEx</sub>	output HIGH-state leakage current	V <sub>CC</sub> = 5.5 V; V <sub>O</sub> = 5.5 V; V <sub>I</sub> = GND or V <sub>CC</sub>	-	-	50	μA	
I <sub>O</sub>	output current	V <sub>CC</sub> = 5.5 V; V <sub>O</sub> = 2.5 V	[2]	-50	-	-180	mA
I <sub>CC</sub>	quiescent supply current	V <sub>CC</sub> = 5.5 V; V <sub>I</sub> = GND or V <sub>CC</sub>					
		outputs HIGH-state	-	-	250	μA	
		outputs LOW-state	-	-	30	mA	
		outputs 3-state	-	-	250	μA	
ΔI <sub>CC</sub>	additional supply current per data input pin	one data input at 3.4 V and other inputs at V <sub>CC</sub> or GND; V <sub>CC</sub> = 5.5 V	[3]				
		outputs enabled	-	-	1.5	mA	
		outputs 3-state	-	-	1.5	mA	
	per enable input pin	one enable input at 3.4 V and other inputs at V <sub>CC</sub> or GND; V <sub>CC</sub> = 5.5 V	[3]				
		outputs 3-state	-	-	1.5	mA	

[1] This parameter is valid for any V<sub>CC</sub> between 0 V and 2.1 V, with a transition time of up to 10 ms. From V<sub>CC</sub> = 2.1 V to V<sub>CC</sub> = 5 V ± 10 % a transition time of up to 100 μs is permitted.

[2] Not more than one output should be tested at a time, and the duration of the test should not exceed one second.

[3] This is the increase in supply current for each input at 3.4 V.



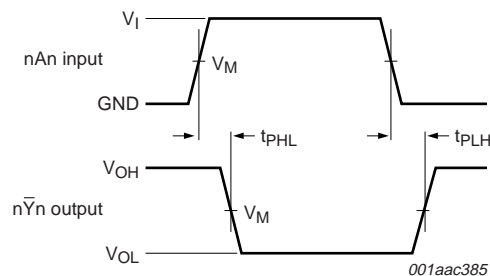
## 11. Dynamic characteristics

**Table 8: Dynamic characteristics**

$GND = 0\text{ V}$ ;  $t_r = t_f = 2.5\text{ ns}$ ;  $C_L = 50\text{ pF}$ ,  $R_L = 500\text{ }\Omega$ ; for test circuit see [Figure 7](#).

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b><math>T_{amb} = 25\text{ }^\circ\text{C}</math></b>						
$t_{PLH}$	propagation delay nAn to $\overline{nYn}$	$V_{CC} = 5\text{ V}$ ; see <a href="#">Figure 5</a>	1.0	2.8	4.0	ns
$t_{PHL}$	propagation delay nAn to $\overline{nYn}$	$V_{CC} = 5\text{ V}$ ; see <a href="#">Figure 5</a>	3.0	4.3	5.8	ns
$t_{PZH}$	output enable time to HIGH-level	$V_{CC} = 5\text{ V}$ ; see <a href="#">Figure 6</a>	1.5	3.4	4.7	ns
$t_{PZL}$	output enable time to LOW-level	$V_{CC} = 5\text{ V}$ ; see <a href="#">Figure 6</a>	3.5	5.5	7.6	ns
$t_{PHZ}$	output disable time from HIGH-level	$V_{CC} = 5\text{ V}$ ; see <a href="#">Figure 6</a>	1.9	4.1	5.0	ns
$t_{PLZ}$	output disable time from LOW-level	$V_{CC} = 5\text{ V}$ ; see <a href="#">Figure 6</a>	2.5	3.4	5.8	ns
<b><math>T_{amb} = -40\text{ }^\circ\text{C to } +85\text{ }^\circ\text{C}</math></b>						
$t_{PLH}$	propagation delay nAn to $\overline{nYn}$	$V_{CC} = 5\text{ V} \pm 0.5\text{ V}$ ; see <a href="#">Figure 5</a>	1.0	-	4.9	ns
$t_{PHL}$	propagation delay nAn to $\overline{nYn}$	$V_{CC} = 5\text{ V} \pm 0.5\text{ V}$ ; see <a href="#">Figure 5</a>	3.0	-	6.0	ns
$t_{PZH}$	output enable time to HIGH-level	$V_{CC} = 5\text{ V} \pm 0.5\text{ V}$ ; see <a href="#">Figure 6</a>	1.5	-	5.8	ns
$t_{PZL}$	output enable time to LOW-level	$V_{CC} = 5\text{ V} \pm 0.5\text{ V}$ ; see <a href="#">Figure 6</a>	3.5	-	8.4	ns
$t_{PHZ}$	output disable time from HIGH-level	$V_{CC} = 5\text{ V} \pm 0.5\text{ V}$ ; see <a href="#">Figure 6</a>	1.9	-	5.6	ns
$t_{PLZ}$	output disable time from LOW-level	$V_{CC} = 5\text{ V} \pm 0.5\text{ V}$ ; see <a href="#">Figure 6</a>	2.5	-	6.4	ns

## 12. Waveforms



$V_M = 1.5\text{ V}$ .

$V_{OL}$  and  $V_{OH}$  are typical voltage output drop that occur with the output load.

**Fig 5. Propagation delays of input (nAn) to output ( $\overline{nYn}$ )**

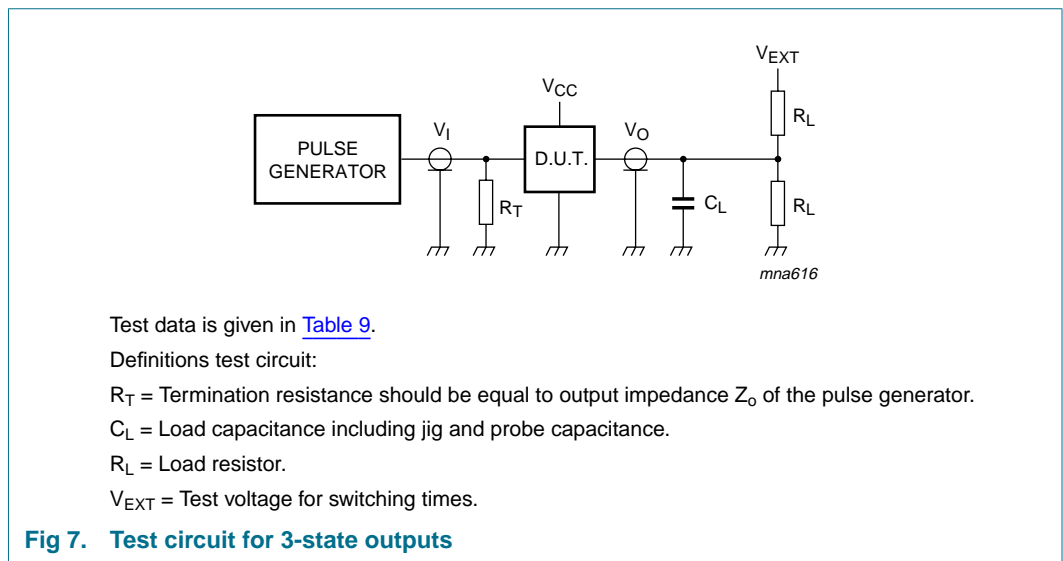
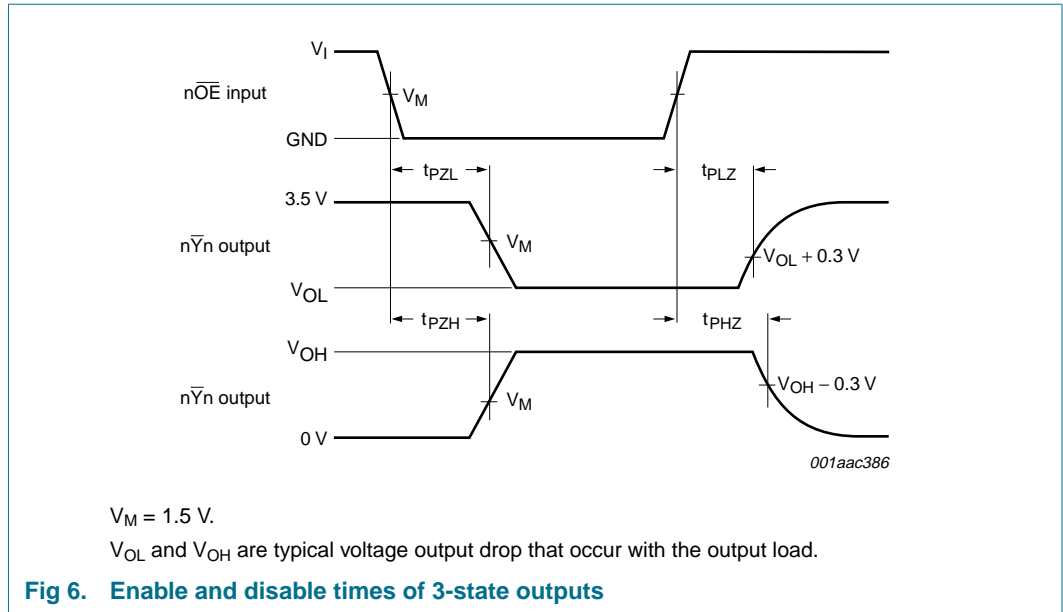


Table 9: Test data

Input		Load		$V_{EXT}$		
$V_I$	$t_r, t_f$	$C_L$	$R_L$	$t_{PHZ}, t_{PZH}$	$t_{PLZ}, t_{PZL}$	$t_{PLH}, t_{PHL}$
3 V	2.5 ns	50 pF	500 Ω	open	7 V	open

13. Package outline

DIP20: plastic dual in-line package; 20 leads (300 mil)

SOT146-1

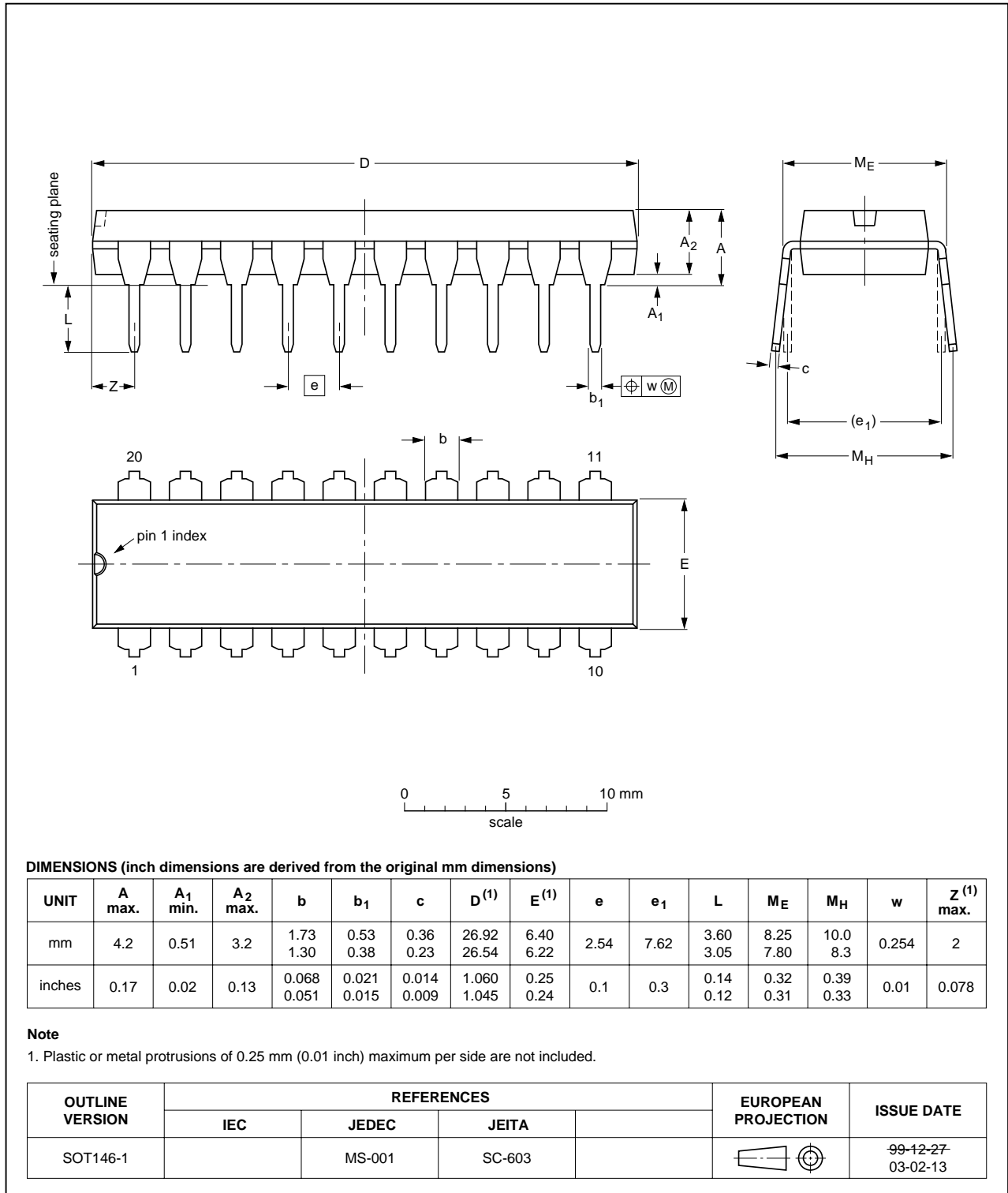


Fig 8. Package outline SOT146-1 (DIP20)

SO20: plastic small outline package; 20 leads; body width 7.5 mm

SOT163-1

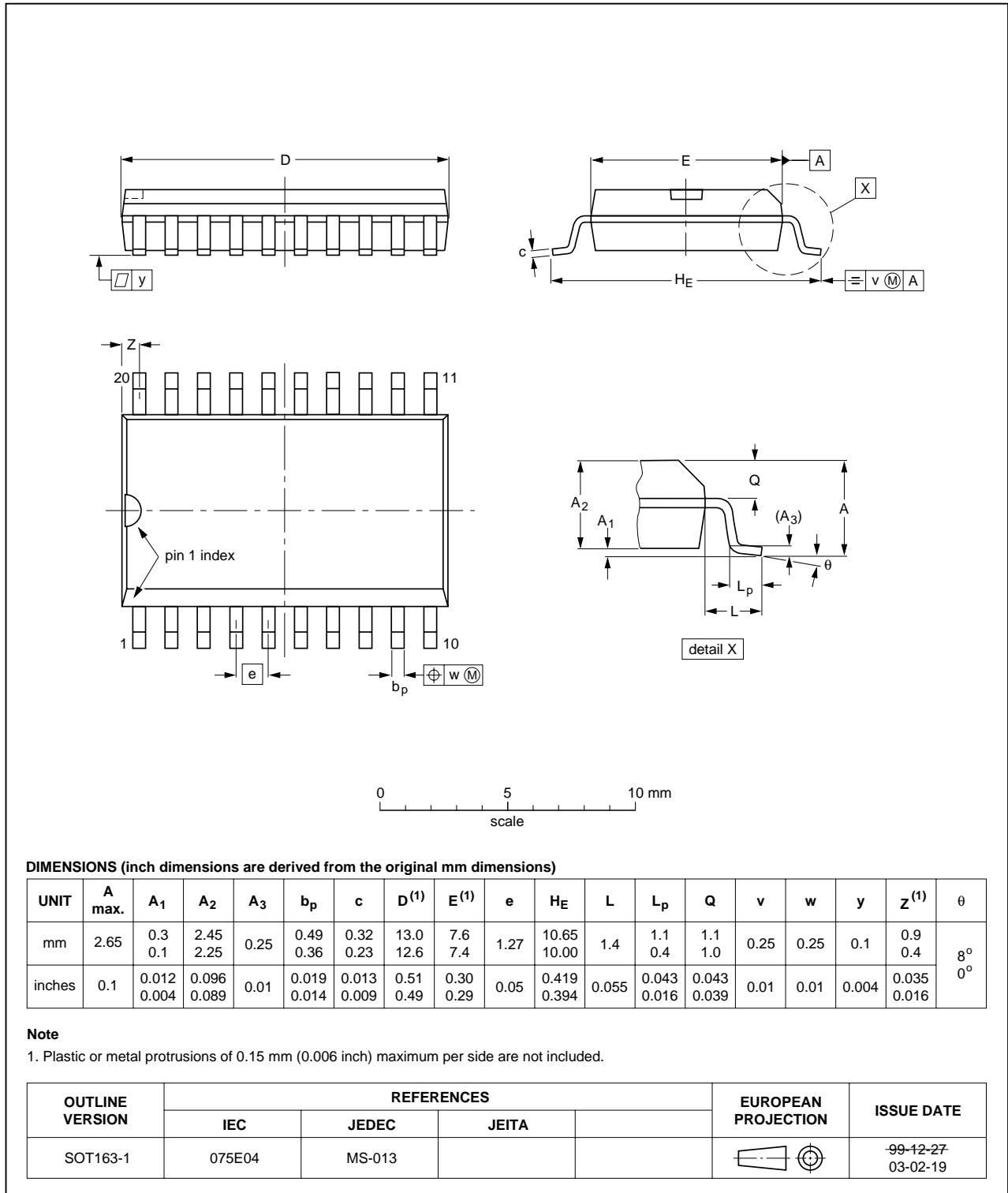


Fig 9. Package outline SOT163-1 (SO20)

TSSOP20: plastic thin shrink small outline package; 20 leads; body width 4.4 mm

SOT360-1

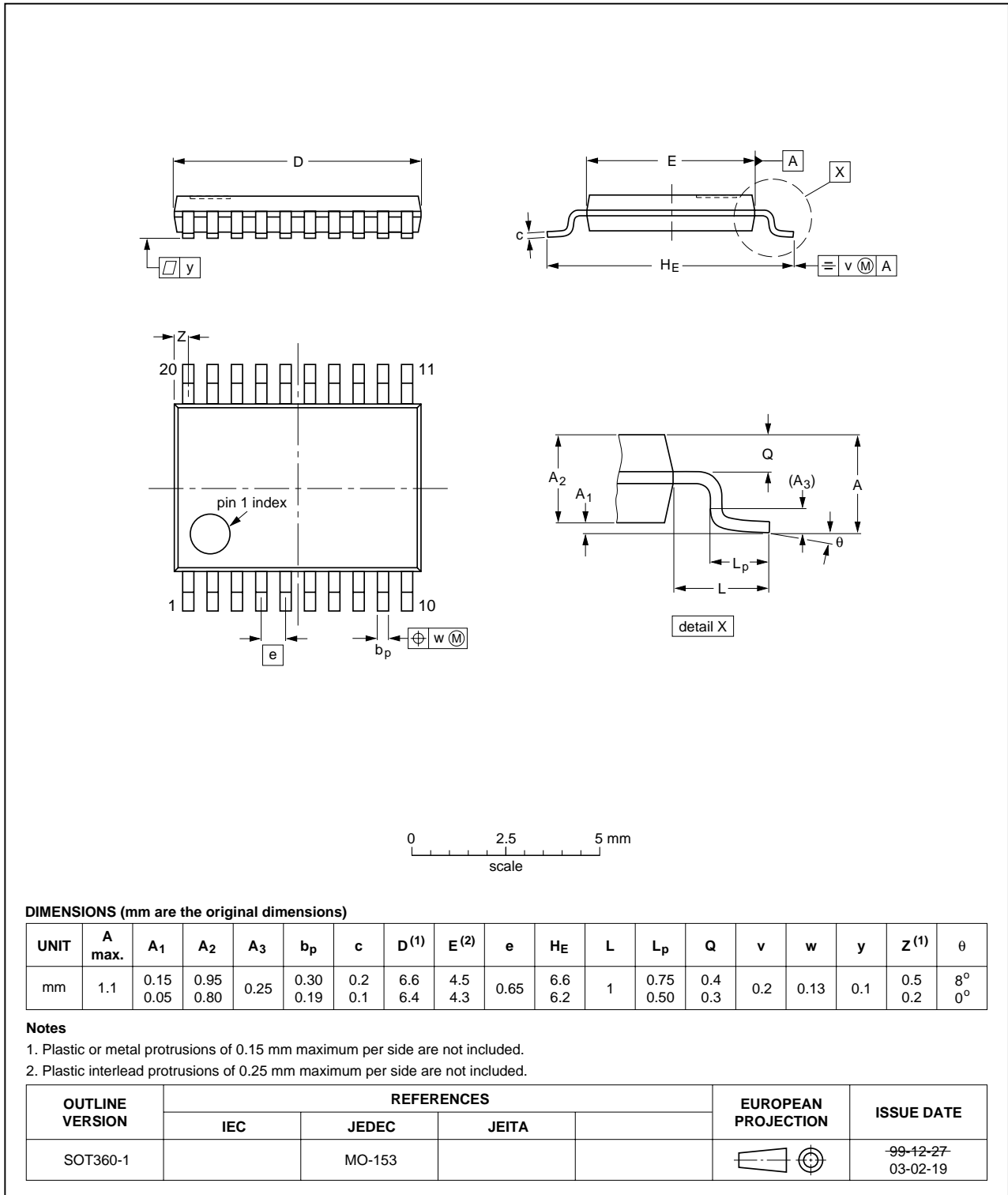


Fig 10. Package outline SOT360-1 (TSSOP20)

## 14. Revision history

Table 10: Revision history

Document ID	Release date	Data sheet status	Change notice	Doc. number	Supersedes
74ABT2240_4	20050117	Product data sheet	-	9397 750 14414	74ABT2240_3
Modifications:					
<ul style="list-style-type: none"> <li>The format of this data sheet has been redesigned to comply with the new presentation and information standard of Philips Semiconductors.</li> <li><a href="#">Section 2 "Features"</a>: modified 'JEDEC Std. 17' into 'JESD78'.</li> <li><a href="#">Table 8 "Dynamic characteristics"</a>: changed min value of <math>t_{pZL}</math> from 4.2 ns into 3.5 ns for both conditions <math>V_{CC} = 5.0</math> V at <math>T_{amb} = 25</math> °C and <math>V_{CC} = 5.0</math> V <math>\pm</math> 0.5 V at <math>T_{amb} = -40</math> °C to +85 °C.</li> </ul>					
74ABT2240_3	20030425	Product specification	ECN 853-1626 29854	9397 750 11431	74ABT2240_2
74ABT2240_2	19980116	Product specification	ECN 853-1626 18865	9397 750 03463	74ABT2240_1
74ABT2240_1	19961008	Product specification	-	-	-

## 15. Data sheet status

Level	Data sheet status <sup>[1]</sup>	Product status <sup>[2]</sup> <sup>[3]</sup>	Definition
I	Objective data	Development	This data sheet contains data from the objective specification for product development. Philips Semiconductors reserves the right to change the specification in any manner without notice.
II	Preliminary data	Qualification	This data sheet contains data from the preliminary specification. Supplementary data will be published at a later date. Philips Semiconductors reserves the right to change the specification without notice, in order to improve the design and supply the best possible product.
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[1] Please consult the most recently issued data sheet before initiating or completing a design.

[2] The product status of the device(s) described in this data sheet may have changed since this data sheet was published. The latest information is available on the Internet at URL <http://www.semiconductors.philips.com>.

[3] For data sheets describing multiple type numbers, the highest-level product status determines the data sheet status.

## 16. Definitions

**Short-form specification** — The data in a short-form specification is extracted from a full data sheet with the same type number and title. For detailed information see the relevant data sheet or data handbook.

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

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Date of release: 17 January 2005  
Document number: 9397 750 14414

Published in The Netherlands