

# 74AHC157; 74AHCT157

## Quad 2-input multiplexer

Rev. 3 — 10 September 2020

Product data sheet

## 1. General description

The 74AHC/AHCT157 are high-speed Si-gate CMOS devices and are pin compatible with Low Power Schottky TTL (LSTTL). They are specified in compliance with JEDEC standard no. 7A.

The 74AHC/AHCT157 are quad 2-input multiplexer which select 4 bits of data from two sources under the control of a common data select input (S). The enable input ( $\bar{E}$ ) is active LOW. When  $\bar{E}$  is HIGH, all of the outputs (1Y to 4Y) are forced LOW regardless of all other input conditions.

Moving the data from two groups of registers to four common output buses is a common use of the 74AHC/AHCT157. The state of the common data select input (S) determines the particular register from which the data comes. It can also be used as function generator. The device is useful for implementing highly irregular logic by generating any four of the 16 different functions of two variables with one variable common. The 74AHC/AHCT157 is logic implementation of a 4-pole, 2-position switch, where the position of the switch is determined by the logic levels applied to S.

The logic equations are:

- $1Y = \bar{E} \times (1I1 \times S + 1I0 \times \bar{S})$
- $2Y = \bar{E} \times (2I1 \times S + 2I0 \times \bar{S})$
- $3Y = \bar{E} \times (3I1 \times S + 3I0 \times \bar{S})$
- $4Y = \bar{E} \times (4I1 \times S + 4I0 \times \bar{S})$

## 2. Features

- Balanced propagation delays
- All inputs have a Schmitt-trigger action
- Inputs accept voltages higher than  $V_{CC}$
- Multiple input enable for easy expansion
- Ideal for memory chip select decoding
- For 74AHC157 only: operates with CMOS input levels
- For 74AHCT157 only: operates with TTL input levels
- ESD protection:
  - HBM JESD22-A114E exceeds 2000 V
  - MM JESD22-A115-A exceeds 200 V
  - CDM JESD22-C101C exceeds 1000 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			Version
	Temperature range	Name	Description	
74AHC157D	-40 °C to +125 °C	SO16	plastic small outline package; 16 leads; body width 3.9 mm	SOT109-1
74AHCT157D				
74AHC157PW	-40 °C to +125 °C	TSSOP16	plastic thin shrink small outline package; 16 leads; body width 4.4 mm	SOT403-1
74AHCT157PW				
74AHC157BQ	-40 °C to +125 °C	DHVQFN16	plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 16 terminals; body 2.5 × 3.5 × 0.85 mm	SOT763-1
74AHCT157BQ				

### 4. Functional diagram

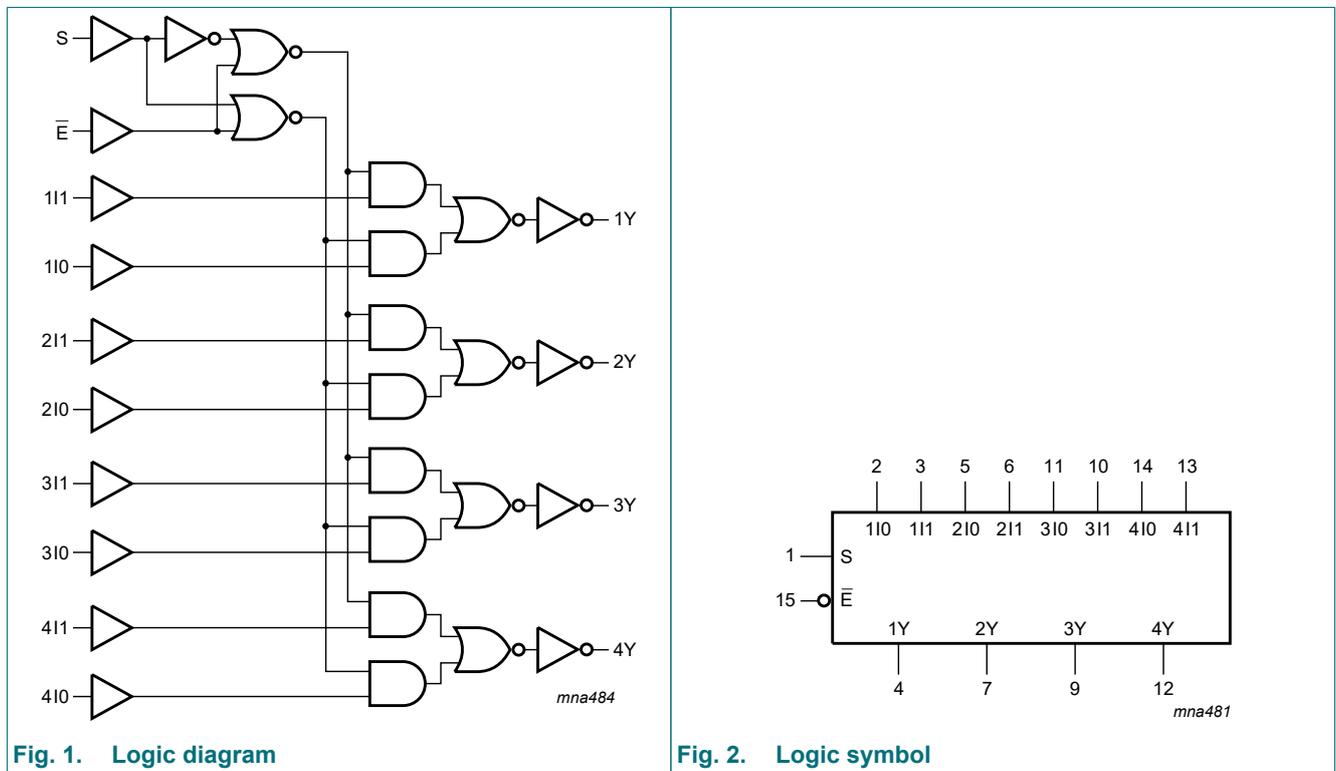


Fig. 1. Logic diagram

Fig. 2. Logic symbol

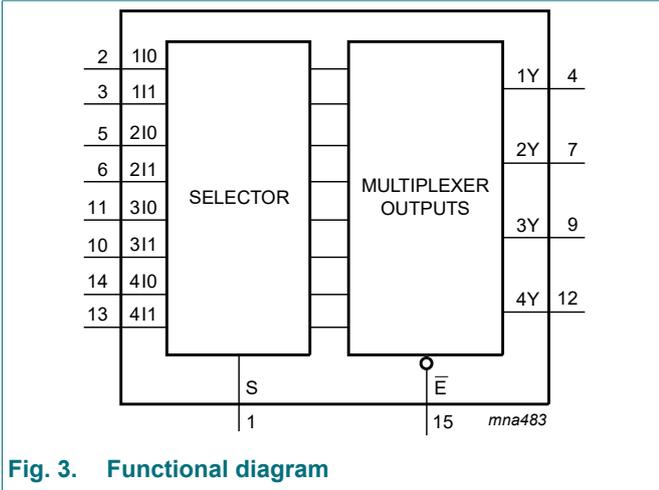


Fig. 3. Functional diagram

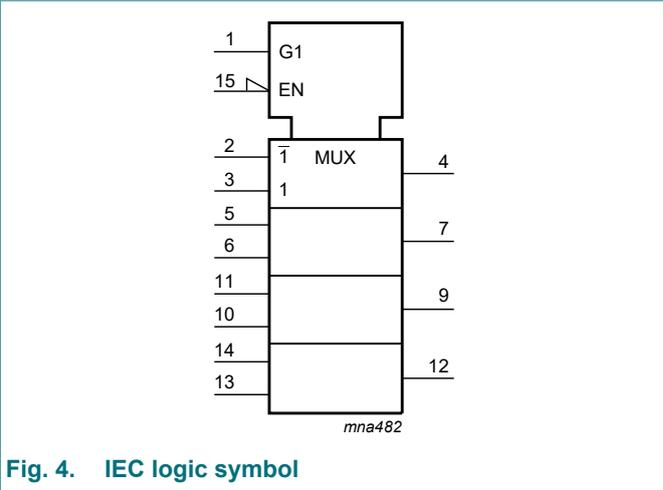


Fig. 4. IEC logic symbol

## 5. Pinning information

### 5.1. Pinning

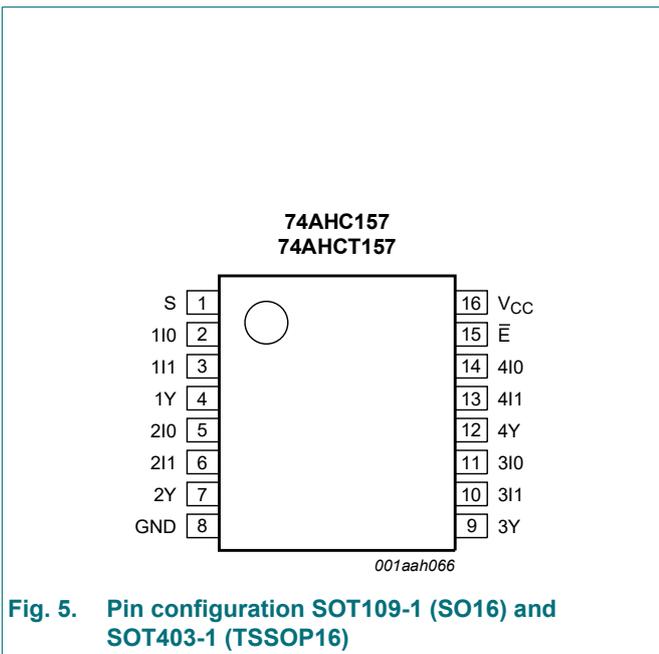


Fig. 5. Pin configuration SOT109-1 (SO16) and SOT403-1 (TSSOP16)

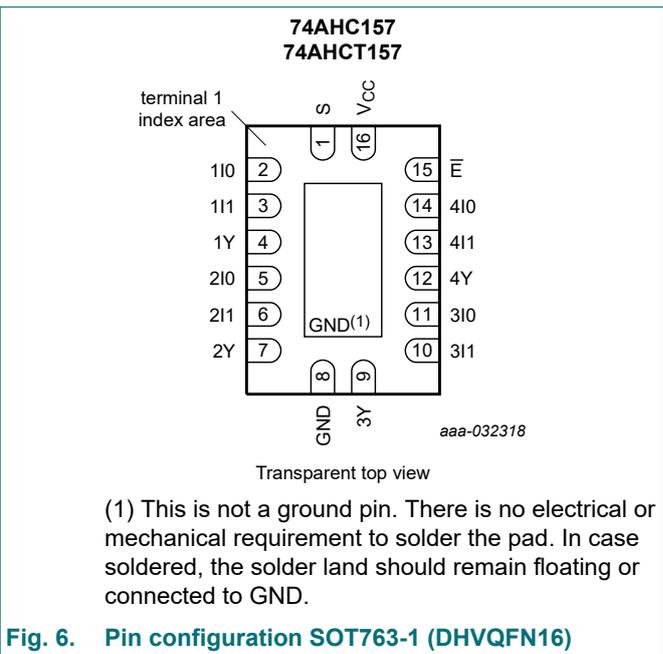


Fig. 6. Pin configuration SOT763-1 (DHVQFN16)

## 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 inputs from source 0
1I1 to 4I1	3, 6, 10, 13	data inputs from source 1
1Y to 4Y	4, 7, 9, 12	multiplexer outputs
GND	8	ground (0 V)
$\bar{E}$	15	enable input (active LOW)
V <sub>CC</sub>	16	supply voltage

## 6. Functional description

Table 3. Function table

H = HIGH voltage level; L = LOW voltage level; X = don't care.

Input				Output
$\bar{E}$	S	nI0	nI1	nY
H	X	X	X	L
L	L	L	X	L
L	L	H	X	H
L	H	X	L	L
L	H	X	H	H

## 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	+7.0	V
V <sub>I</sub>	input voltage		-0.5	+7.0	V
I <sub>IK</sub>	input clamping current	V <sub>I</sub> < -0.5 V [1]	-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 [1]	-	±20	mA
I <sub>O</sub>	output current	V <sub>O</sub> = -0.5 V to (V <sub>CC</sub> + 0.5 V)	-	±25	mA
I <sub>CC</sub>	supply current		-	75	mA
I <sub>GND</sub>	ground current		-75	-	mA
T <sub>stg</sub>	storage temperature		-65	+150	°C
P <sub>tot</sub>	total power dissipation	T <sub>amb</sub> = -40 °C to +125 °C [2]	-	500	mW

- [1] The input and output voltage ratings may be exceeded if the input and output current ratings are observed.  
 [2] For SOT109-1 (SO16) package: P<sub>tot</sub> derates linearly with 12.4 mW/K above 110 °C.  
 For SOT403-1 (TSSOP16) package: P<sub>tot</sub> derates linearly with 8.5 mW/K above 91 °C.  
 For SOT763-1 (DHVQFN16) package: P<sub>tot</sub> derates linearly with 11.2 mW/K above 106 °C.

## 8. Recommended operating conditions

**Table 5. Recommended operating conditions**

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

Symbol	Parameter	Conditions	74AHC157			74AHCT157			Unit
			Min	Typ	Max	Min	Typ	Max	
V <sub>CC</sub>	supply voltage		2.0	5.0	5.5	4.5	5.0	5.5	V
V <sub>I</sub>	input voltage		0	-	5.5	0	-	5.5	V
V <sub>O</sub>	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
Δt/ΔV	input transition rise and fall rate	V <sub>CC</sub> = 3.3 V ± 0.3 V	-	-	100	-	-	-	ns/V
		V <sub>CC</sub> = 5.0 V ± 0.5 V	-	-	20	-	-	20	ns/V

## 9. Static characteristics

**Table 6. Static characteristics**

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>74AHC157</b>										
V <sub>IH</sub>	HIGH-level input voltage	V <sub>CC</sub> = 2.0 V	1.5	-	-	1.5	-	1.5	-	V
		V <sub>CC</sub> = 3.0 V	2.1	-	-	2.1	-	2.1	-	V
		V <sub>CC</sub> = 5.5 V	3.85	-	-	3.85	-	3.85	-	V
V <sub>IL</sub>	LOW-level input voltage	V <sub>CC</sub> = 2.0 V	-	-	0.5	-	0.5	-	0.5	V
		V <sub>CC</sub> = 3.0 V	-	-	0.9	-	0.9	-	0.9	V
		V <sub>CC</sub> = 5.5 V	-	-	1.65	-	1.65	-	1.65	V
V <sub>OH</sub>	HIGH-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>								
		I <sub>O</sub> = -50 μA; V <sub>CC</sub> = 2.0 V	1.9	2.0	-	1.9	-	1.9	-	V
		I <sub>O</sub> = -50 μA; V <sub>CC</sub> = 3.0 V	2.9	3.0	-	2.9	-	2.9	-	V
		I <sub>O</sub> = -50 μA; V <sub>CC</sub> = 4.5 V	4.4	4.5	-	4.4	-	4.4	-	V
		I <sub>O</sub> = -4.0 mA; V <sub>CC</sub> = 3.0 V	2.58	-	-	2.48	-	2.40	-	V
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> = 50 μA; V <sub>CC</sub> = 2.0 V	-	0	0.1	-	0.1	-	0.1	V
		I <sub>O</sub> = 50 μA; V <sub>CC</sub> = 3.0 V	-	0	0.1	-	0.1	-	0.1	V
		I <sub>O</sub> = 50 μA; V <sub>CC</sub> = 4.5 V	-	0	0.1	-	0.1	-	0.1	V
		I <sub>O</sub> = 4.0 mA; V <sub>CC</sub> = 3.0 V	-	-	0.36	-	0.44	-	0.55	V
I <sub>I</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	μA
		V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 5.5 V	-	-	4.0	-	40	-	80	μA
C <sub>I</sub>	input capacitance		-	3.0	10	-	10	-	10	pF
C <sub>O</sub>	output capacitance		-	4.0	-	-	-	-	-	pF

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
<b>74AHCT157</b>										
V <sub>IH</sub>	HIGH-level input voltage	V <sub>CC</sub> = 4.5 V to 5.5 V	2.0	-	-	2.0	-	2.0	-	V
V <sub>IL</sub>	LOW-level input voltage	V <sub>CC</sub> = 4.5 V to 5.5 V	-	-	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> = -50 µA	4.4	4.5	-	4.4	-	4.4	-	V
		I <sub>O</sub> = -8.0 mA	3.94	-	-	3.8	-	3.70	-	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> = 50 µA	-	0	0.1	-	0.1	-	0.1	V
		I <sub>O</sub> = 8.0 mA	-	-	0.36	-	0.44	-	0.55	V
I <sub>I</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	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	-	-	4.0	-	40	-	80	µA
ΔI <sub>CC</sub>	additional supply current	per input pin; V <sub>I</sub> = V <sub>CC</sub> - 2.1 V; I <sub>O</sub> = 0 A; other pins at V <sub>CC</sub> or GND; V <sub>CC</sub> = 4.5 V to 5.5 V	-	-	1.35	-	1.5	-	1.5	mA
C <sub>I</sub>	input capacitance		-	3	10	-	10	-	10	pF
C <sub>O</sub>	output capacitance		-	4.0	-	-	-	-	-	pF

## 10. Dynamic characteristics

**Table 7. Dynamic characteristics**
*GND = 0 V; For test circuit see Fig. 9.*

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ[1]	Max	Min	Max	Min	Max	
<b>74AHC157</b>										
$t_{pd}$	propagation delay	nI0, nI1 to nY; see Fig. 7 [2]								
		$V_{CC} = 3.0\text{ V to }3.6\text{ V}$								
		$C_L = 15\text{ pF}$	-	4.4	9.7	1.0	11.5	1.0	12.5	ns
		$C_L = 50\text{ pF}$	-	6.3	13.2	1.0	15.0	1.0	16.5	ns
		$V_{CC} = 4.5\text{ V to }5.5\text{ V}$								
		$C_L = 15\text{ pF}$	-	3.2	6.4	1.0	7.5	1.0	8.0	ns
		$C_L = 50\text{ pF}$	-	4.6	8.4	1.0	9.5	1.0	10.5	ns
		S to nY; see Fig. 7 [2]								
		$V_{CC} = 3.0\text{ V to }3.6\text{ V}$								
		$C_L = 15\text{ pF}$	-	4.8	13.6	1.0	16.0	1.0	17.0	ns
		$C_L = 50\text{ pF}$	-	6.8	17.1	1.0	19.5	1.0	21.5	ns
		$V_{CC} = 4.5\text{ V to }5.5\text{ V}$								
		$C_L = 15\text{ pF}$	-	3.6	8.6	1.0	10.0	1.0	11.0	ns
		$C_L = 50\text{ pF}$	-	5.2	10.6	1.0	12.0	1.0	13.5	ns
		$\bar{E}$ to nY; see Fig. 8 [2]								
		$V_{CC} = 3.0\text{ V to }3.6\text{ V}$								
		$C_L = 15\text{ pF}$	-	5.9	13.2	1.0	15.5	1.0	16.5	ns
		$C_L = 50\text{ pF}$	-	8.4	16.7	1.0	19.0	1.0	21.0	ns
$V_{CC} = 4.5\text{ V to }5.5\text{ V}$										
$C_L = 15\text{ pF}$	-	4.2	8.1	1.0	9.5	1.0	10.5	ns		
$C_L = 50\text{ pF}$	-	6.0	10.1	1.0	11.5	1.0	13.0	ns		
$C_{PD}$	power dissipation capacitance	$C_L = 50\text{ pF}; f_i = 1\text{ MHz}; V_i = \text{GND to }V_{CC}$ [3]								
		4 outputs switching via S	-	31	-	-	-	-	-	pF
		1 output switching via I	-	13	-	-	-	-	-	pF

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ[1]	Max	Min	Max	Min	Max	
<b>74AHCT157</b>										
t <sub>pd</sub>	propagation delay	nI0, nI1 to nY; see Fig. 7 [2]								
		V <sub>CC</sub> = 4.5 V to 5.5 V								
		C <sub>L</sub> = 15 pF	-	3.2	6.4	1.0	7.5	1.0	8.0	ns
		C <sub>L</sub> = 50 pF	-	4.6	8.7	1.0	9.8	1.0	11.0	ns
		S to nY; see Fig. 7								
		V <sub>CC</sub> = 4.5 V to 5.5 V								
		C <sub>L</sub> = 15 pF	-	3.7	8.6	1.0	10.0	1.0	11.0	ns
		C <sub>L</sub> = 50 pF	-	5.2	10.4	1.0	12.0	1.0	13.0	ns
		$\bar{E}$ to nY; see Fig. 8 [2]								
		V <sub>CC</sub> = 4.5 V to 5.5 V								
C <sub>PD</sub>	power dissipation capacitance	C <sub>L</sub> = 50 pF; f <sub>i</sub> = 1 MHz; V <sub>I</sub> = GND to V <sub>CC</sub> [3]								
		4 outputs switching via S	-	41	-	-	-	-	-	pF
		1 output switching via I	-	16	-	-	-	-	-	pF

[1] Typical values are measured at nominal supply voltage (V<sub>CC</sub> = 3.3 V and V<sub>CC</sub> = 5.0 V).

[2] t<sub>pd</sub> is the same as t<sub>PLH</sub> and t<sub>PHL</sub>.

[3] C<sub>PD</sub> is used to determine the dynamic power dissipation P<sub>D</sub> (μW).

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

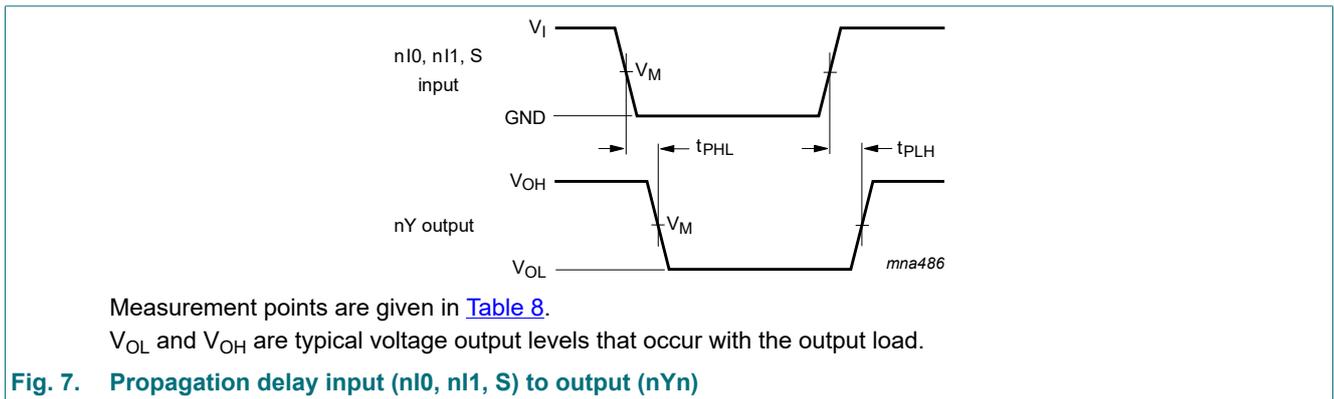
f<sub>i</sub> = input frequency in MHz;

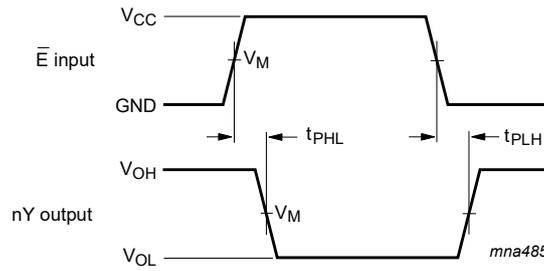
f<sub>o</sub> = output frequency in MHz;

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

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

### 10.1. Waveforms and test circuit





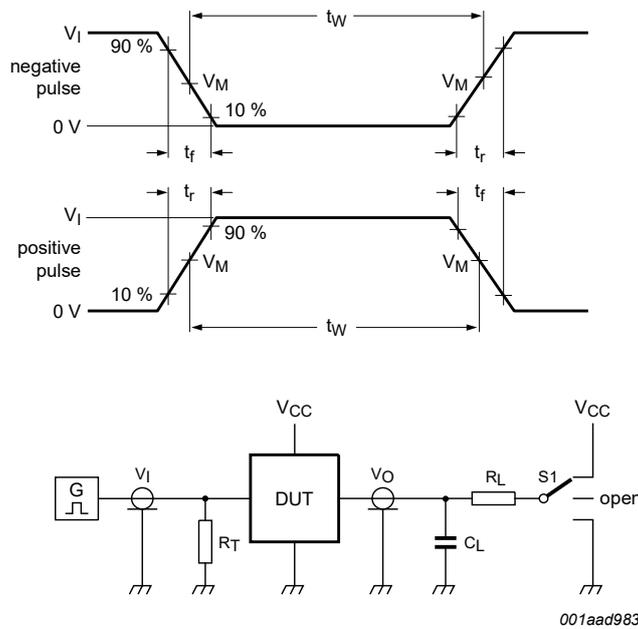
Measurement points are given in [Table 8](#).

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

**Fig. 8. Propagation delay input ( $\bar{E}$ ) to output ( $nY$ )**

**Table 8. Measurement points**

Type	Input	Output
	$V_M$	$V_M$
74AHC157	$0.5V_{CC}$	$0.5V_{CC}$
74AHCT157	1.5 V	$0.5V_{CC}$



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

S1 = Test selection switch

**Fig. 9. Test circuit for measuring switching times**

**Table 9. Test data**

Type	Input		Load		S1 position		
	$V_I$	$t_r, t_f$	$C_L$	$R_L$	$t_{PHL}, t_{PLH}$	$t_{PZH}, t_{PHZ}$	$t_{PZL}, t_{PLZ}$
74AHC157	$V_{CC}$	3.0 ns	15 pF, 50 pF	1 k $\Omega$	open	GND	$V_{CC}$
74AHCT157	3.0 V	3.0 ns	15 pF, 50 pF	1 k $\Omega$	open	GND	$V_{CC}$

11. Package outline

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

SOT109-1

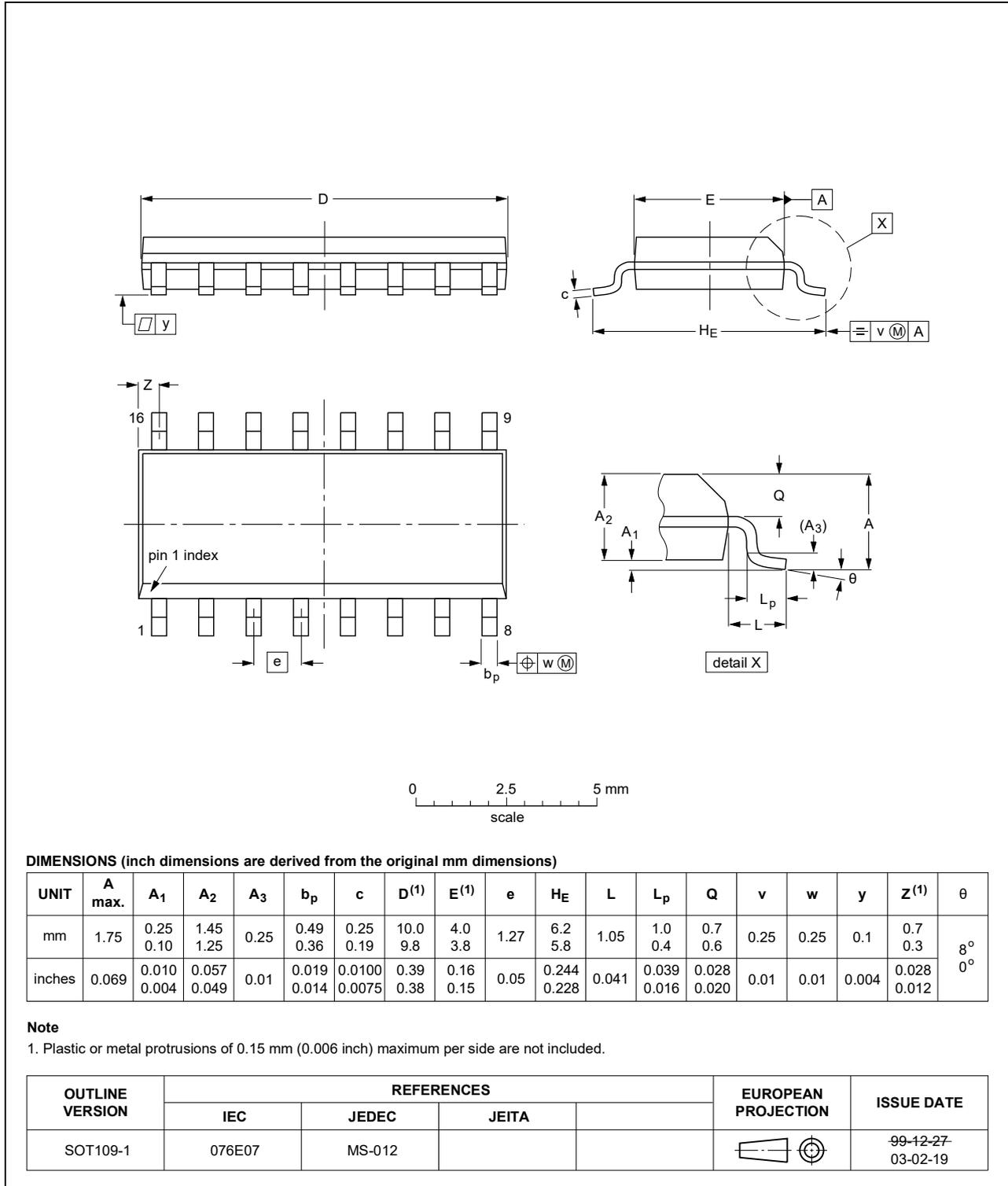


Fig. 10. Package outline SOT109-1 (SO16)

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

SOT403-1

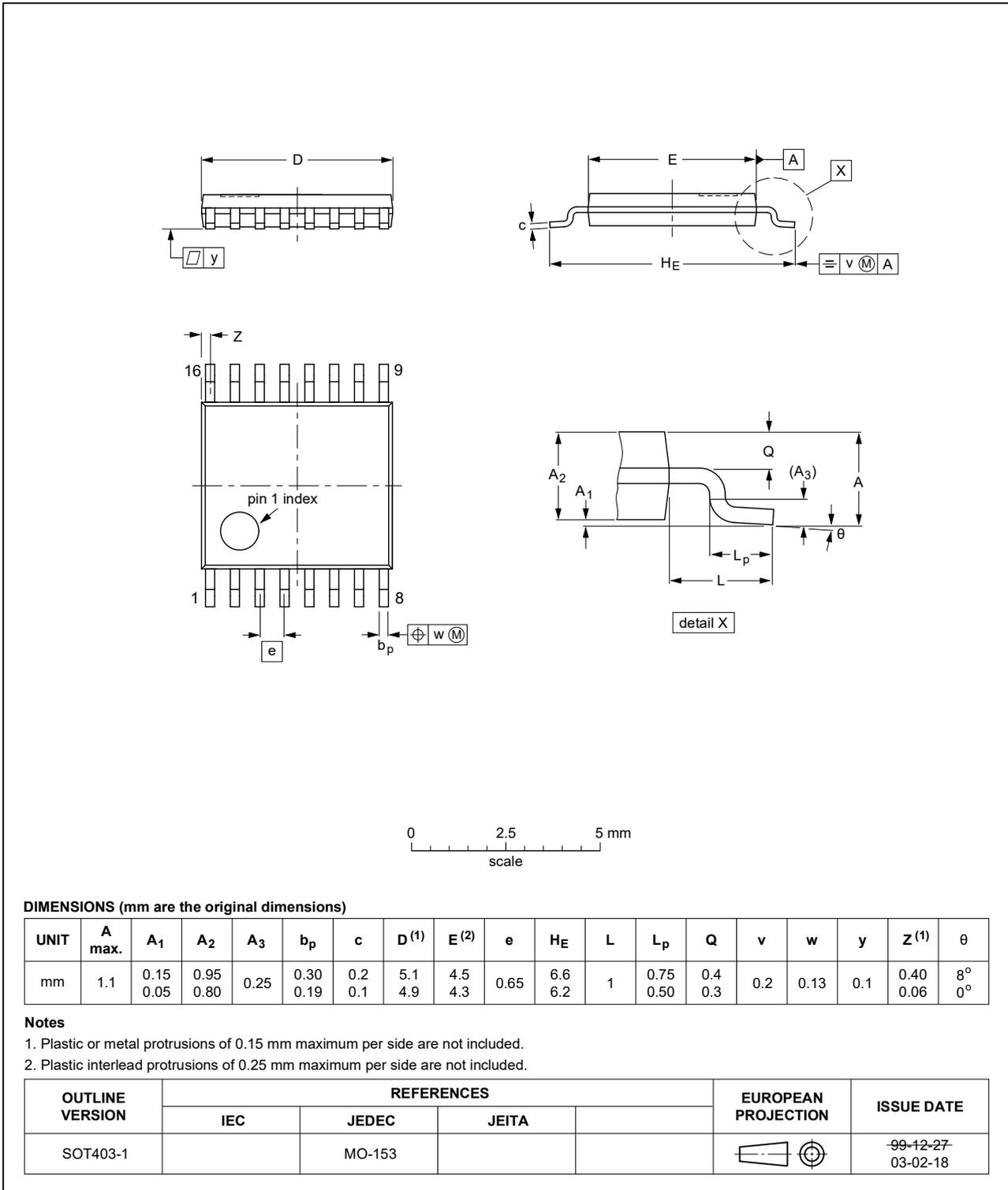


Fig. 11. Package outline SOT403-1 (TSSOP16)

DHVQFN16: plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 16 terminals; body 2.5 x 3.5 x 0.85 mm

SOT763-1

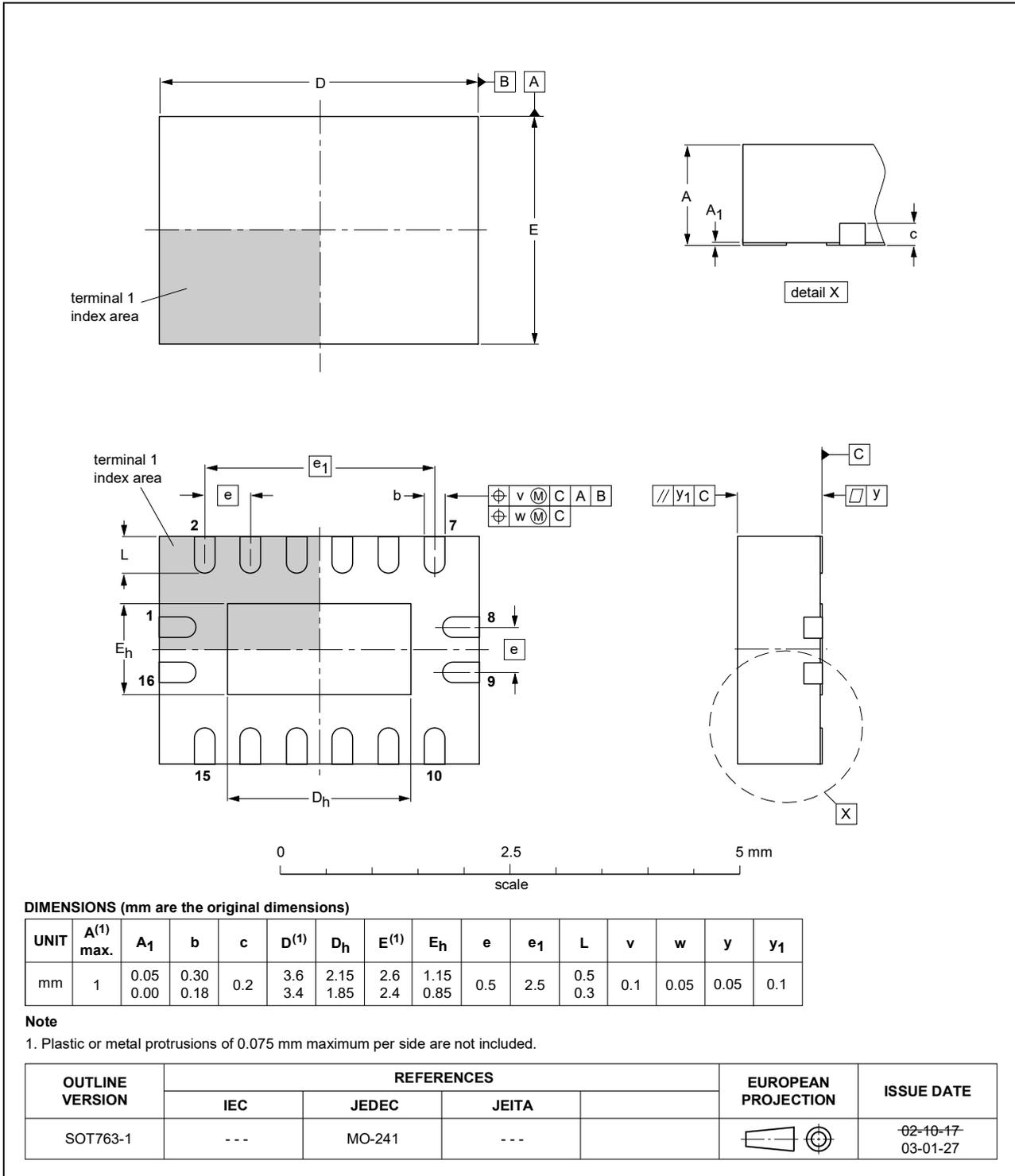


Fig. 12. Package outline SOT763-1 (DHVQFN16)

## 12. Abbreviations

Table 10. 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

## 13. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74AHC_AHCT157 v.3	20200910	Product data sheet	-	74AHC_AHCT157 v.2
Modifications:	<ul style="list-style-type: none"> <li>The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia.</li> <li>Legal texts have been adapted to the new company name where appropriate.</li> <li><a href="#">Table 4</a>: Derating values for <math>P_{tot}</math> total power dissipation have been updated.</li> </ul>			
74AHC_AHCT157 v.2	20071109	Product data sheet	-	74AHC_AHCT157 v.1
Modifications:	<ul style="list-style-type: none"> <li>The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors.</li> <li>Legal texts have been adapted to the new company name where appropriate.</li> <li><a href="#">Section 3</a>: DHVQFN16 package added.</li> <li><a href="#">Section 7</a>: derating values added for DHVQFN16 package.</li> <li><a href="#">Section 11</a>: outline drawing added for DHVQFN16 package.</li> </ul>			
74AHC_AHCT157 v.1	19990924	Product specification	-	-

## 14. Legal information

### 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 <https://www.nexperia.com>.

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## Contents

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<b>1. General description</b> .....	<b>1</b>
<b>2. Features</b> .....	<b>1</b>
<b>3. Ordering information</b> .....	<b>2</b>
<b>4. Functional diagram</b> .....	<b>2</b>
<b>5. Pinning information</b> .....	<b>3</b>
5.1. Pinning.....	3
5.2. Pin description.....	4
<b>6. Functional description</b> .....	<b>4</b>
<b>7. Limiting values</b> .....	<b>4</b>
<b>8. Recommended operating conditions</b> .....	<b>5</b>
<b>9. Static characteristics</b> .....	<b>5</b>
<b>10. Dynamic characteristics</b> .....	<b>7</b>
10.1. Waveforms and test circuit.....	8
<b>11. Package outline</b> .....	<b>10</b>
<b>12. Abbreviations</b> .....	<b>13</b>
<b>13. Revision history</b> .....	<b>13</b>
<b>14. Legal information</b> .....	<b>14</b>

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