

# 74HC158

## Quad 2-input multiplexer; inverting

Rev. 4 — 23 December 2015

Product data sheet

## 1. General description

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The 74HC158 is a high-speed Si-gate CMOS device and is pin compatible with low power Schottky TTL (LSTTL). The 74HC158 is specified in compliance with JEDEC standard no. 7A.

The 74HC158 is a quad 2-input multiplexer which select 4 bits of data from two sources and are controlled by a common data select input (S). The four outputs present the selected data in the inverted form. The enable input ( $\bar{E}$ ) is active LOW.

When  $\bar{E}$  is HIGH, all the outputs ( $1\bar{Y}$  to  $4\bar{Y}$ ) are forced HIGH 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 74HC158. The state of S determines the particular register from which the data comes. It can also be used as a 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 74HC158 is the 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 for the output are:

$$1\bar{Y} = \bar{E} \cdot (1I1 \cdot S + 1I0 \cdot \bar{S})$$

$$2\bar{Y} = \bar{E} \cdot (2I1 \cdot S + 2I0 \cdot \bar{S})$$

$$3\bar{Y} = \bar{E} \cdot (3I1 \cdot S + 3I0 \cdot \bar{S})$$

$$4\bar{Y} = \bar{E} \cdot (4I1 \cdot S + 4I0 \cdot \bar{S})$$

The 74HC158 is identical to the 74HC157 but has inverting outputs.

## 2. Features and benefits

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- Low-power dissipation
- Inverting data path
- Complies with JEDEC standard no. 7A
- ESD protection:
  - ◆ HBM JESD22-A114F exceeds 2 000 V
  - ◆ MM JESD22-A115-A exceeds 200 V
- Multiple package options
- Specified from  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$  and  $-40^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$

### 3. Ordering information

Table 1. Ordering information

Type number	Package			Version
	Temperature range	Name	Description	
74HC158D	-40 °C to +125 °C	SO16	plastic small outline package; 16 leads; body width 3.9 mm	SOT109-1

### 4. Functional diagram

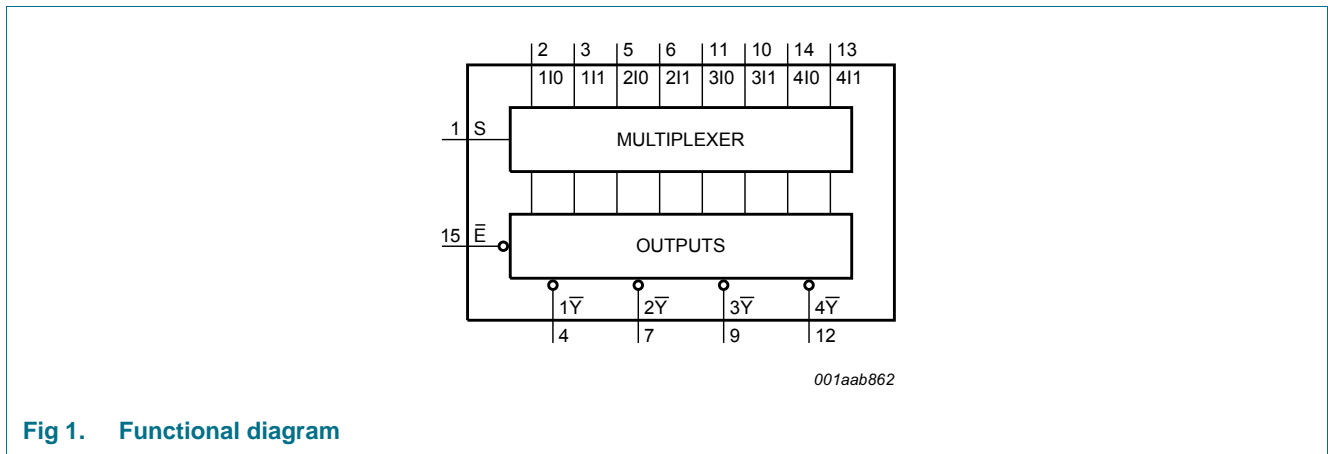


Fig 1. Functional diagram

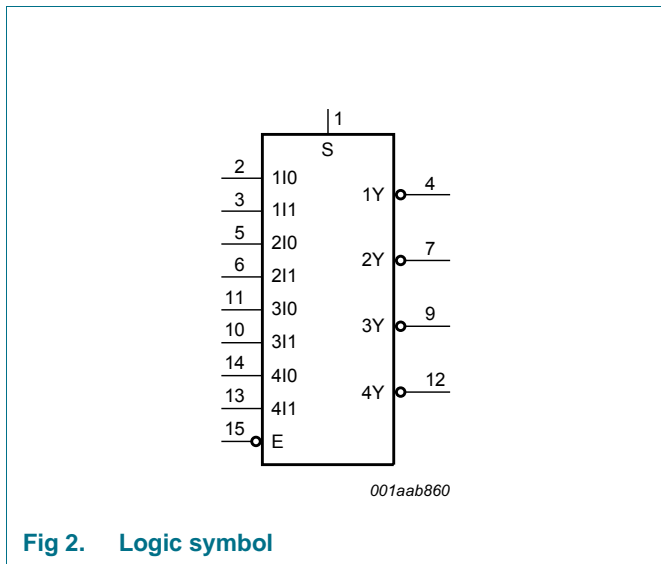


Fig 2. Logic symbol

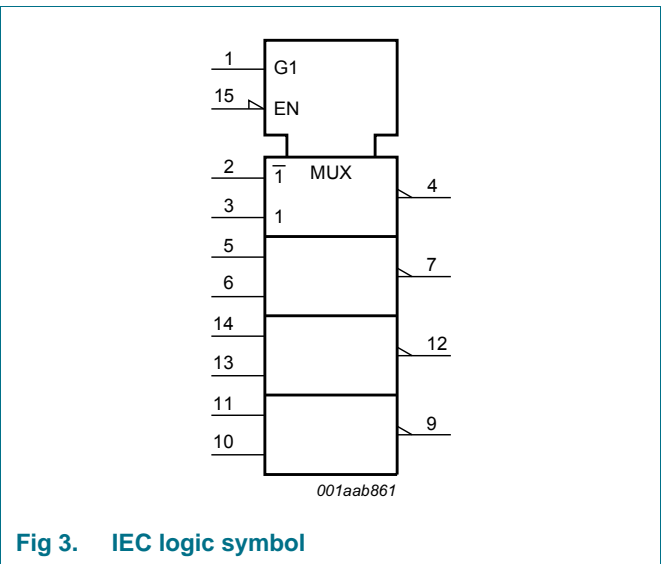


Fig 3. IEC logic symbol

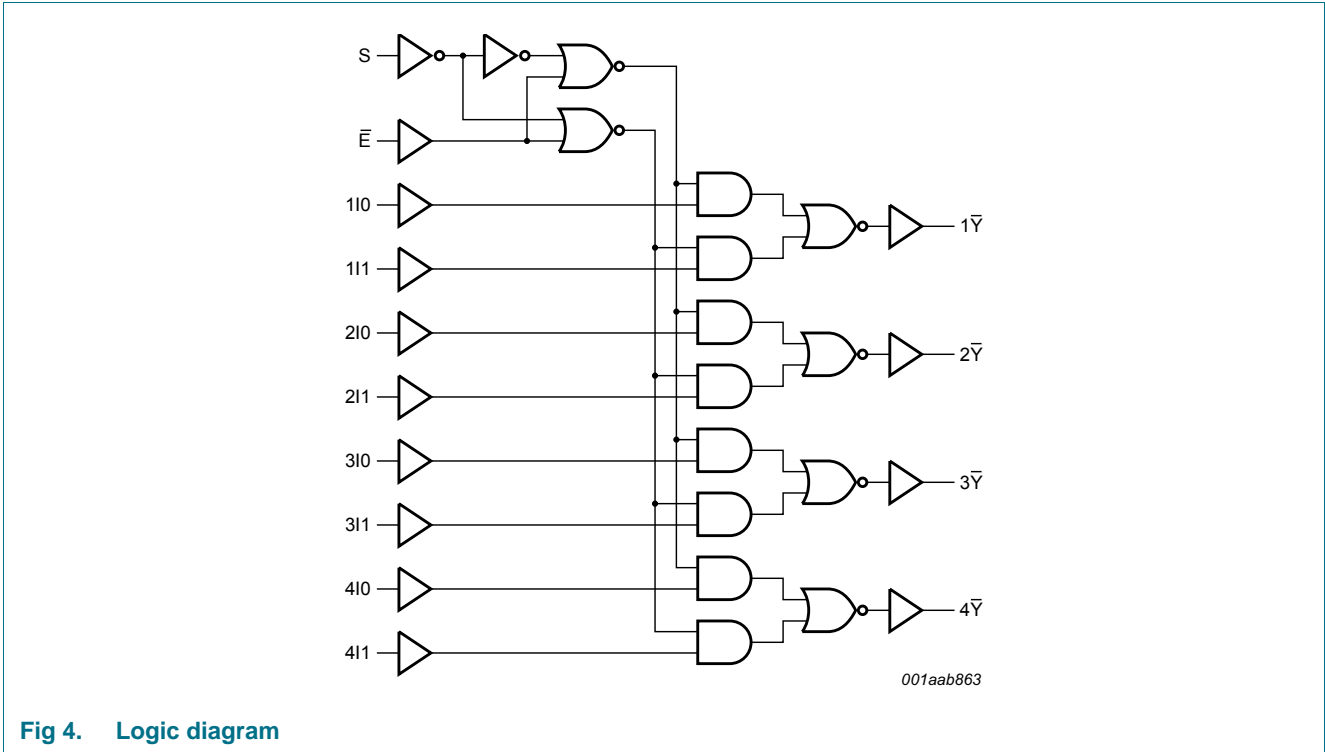


Fig 4. Logic diagram

## 5. Pinning information

### 5.1 Pinning

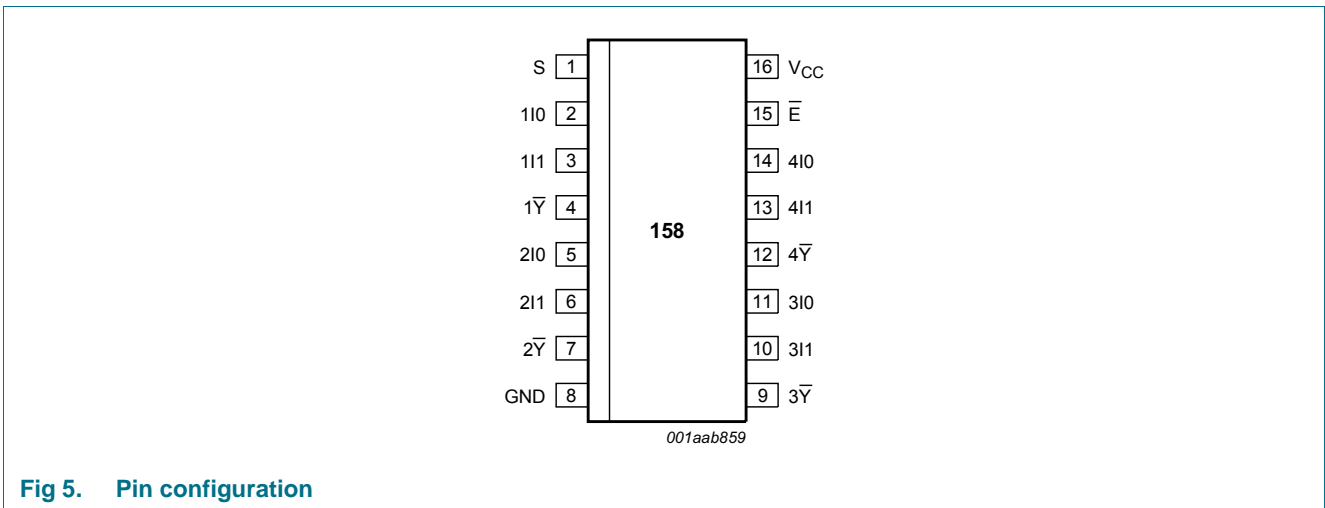


Fig 5. Pin configuration

## 5.2 Pin description

Table 2. Pin description

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

## 6. Functional description

### 6.1 Function table

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

Control		Input		Output
$\bar{E}$	S	nI0	nI1	n $\bar{Y}$
H	X	X	X	H
L	L	L	X	H
		H	X	L
	H	X	L	H
		X	H	L

- [1] H = HIGH voltage level;  
L = LOW voltage level;  
X = don't care.

## 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
$V_{CC}$	supply voltage		-0.5	+7	V
$I_{IK}$	input clamping current	$V_I < -0.5\text{ V}$ or $V_I > V_{CC} + 0.5\text{ V}$	-	$\pm 20$	mA
$I_{OK}$	output clamping current	$V_O < -0.5\text{ V}$ or $V_O > V_{CC} + 0.5\text{ V}$	-	$\pm 20$	mA
$I_O$	output current	$V_O = -0.5\text{ V}$ to $V_{CC} + 0.5\text{ V}$	-	$\pm 25$	mA
$I_{CC}$	supply current		-	+50	mA
$I_{GND}$	ground current		-50	-	mA
$T_{stg}$	storage temperature		-65	+150	°C
$P_{tot}$	total power dissipation	$T_{amb} = -40\text{ °C}$ to $+125\text{ °C}$			
		SO16 package <a href="#">[1]</a>	-	500	mW

[1] Above 70 °C:  $P_{tot}$  derates linearly with 8 mW/K.

## 8. Recommended operating conditions

**Table 5. Recommended operating conditions**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{CC}$	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
$T_{amb}$	ambient temperature		-40	-	+125	°C
$\Delta t/\Delta V$	input transition rise and fall rate	$V_{CC} = 2.0\text{ V}$	-	-	625	ns/V
		$V_{CC} = 4.5\text{ V}$	-	1.67	139	ns/V
		$V_{CC} = 6.0\text{ V}$	-	-	83	ns/V

## 9. Static characteristics

**Table 6. 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>IH</sub>	HIGH-level input voltage	V <sub>CC</sub> = 2.0 V	1.5	1.2	-	V
		V <sub>CC</sub> = 4.5 V	3.15	2.4	-	V
		V <sub>CC</sub> = 6.0 V	4.2	3.2	-	V
V <sub>IL</sub>	LOW-level input voltage	V <sub>CC</sub> = 2.0 V	-	0.8	0.5	V
		V <sub>CC</sub> = 4.5 V	-	2.1	1.35	V
		V <sub>CC</sub> = 6.0 V	-	2.8	1.8	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> = -20 μA; V <sub>CC</sub> = 2.0 V	1.9	2.0	-	V
		I <sub>O</sub> = -20 μA; V <sub>CC</sub> = 4.5 V	4.4	4.5	-	V
		I <sub>O</sub> = -20 μA; V <sub>CC</sub> = 6.0 V	5.9	6.0	-	V
		I <sub>O</sub> = -4 mA; V <sub>CC</sub> = 4.5 V	3.98	4.32	-	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> = 20 μA; V <sub>CC</sub> = 2.0 V	-	0	0.1	V
		I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 4.5 V	-	0	0.1	V
		I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 6.0 V	-	0	0.1	V
		I <sub>O</sub> = 4 mA; V <sub>CC</sub> = 4.5 V	-	0.15	0.26	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	μA
		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	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	μA
C <sub>I</sub>	input capacitance		-	3.5	-	pF
<b>T<sub>amb</sub> = -40 °C to +85 °C</b>						
V <sub>IH</sub>	HIGH-level input voltage	V <sub>CC</sub> = 2.0 V	1.5	-	-	V
		V <sub>CC</sub> = 4.5 V	3.15	-	-	V
		V <sub>CC</sub> = 6.0 V	4.2	-	-	V
V <sub>IL</sub>	LOW-level input voltage	V <sub>CC</sub> = 2.0 V	-	-	0.5	V
		V <sub>CC</sub> = 4.5 V	-	-	1.35	V
		V <sub>CC</sub> = 6.0 V	-	-	1.8	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> = -20 μA; V <sub>CC</sub> = 2.0 V	1.9	-	-	V
		I <sub>O</sub> = -20 μA; V <sub>CC</sub> = 4.5 V	4.4	-	-	V
		I <sub>O</sub> = -20 μA; V <sub>CC</sub> = 6.0 V	5.9	-	-	V
		I <sub>O</sub> = -4 mA; V <sub>CC</sub> = 4.5 V	3.84	-	-	V
I <sub>O</sub>	LOW-level output voltage	I <sub>O</sub> = -5.2 mA; V <sub>CC</sub> = 6.0 V	5.34	-	-	V

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

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
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	-	-	0.1	V
		I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 4.5 V	-	-	0.1	V
		I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 6.0 V	-	-	0.1	V
		I <sub>O</sub> = 4 mA; V <sub>CC</sub> = 4.5 V	-	-	0.33	V
		I <sub>O</sub> = 5.2 mA; V <sub>CC</sub> = 6.0 V	-	-	0.33	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	-	-	±1.0	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	-	-	80	μA
<b>T<sub>amb</sub> = -40 °C to +125 °C</b>						
V <sub>IH</sub>	HIGH-level input voltage	V <sub>CC</sub> = 2.0 V	1.5	-	-	V
		V <sub>CC</sub> = 4.5 V	3.15	-	-	V
		V <sub>CC</sub> = 6.0 V	4.2	-	-	V
V <sub>IL</sub>	LOW-level input voltage	V <sub>CC</sub> = 2.0 V	-	-	0.5	V
		V <sub>CC</sub> = 4.5 V	-	-	1.35	V
		V <sub>CC</sub> = 6.0 V	-	-	1.8	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> = -20 μA; V <sub>CC</sub> = 2.0 V	1.9	-	-	V
		I <sub>O</sub> = -20 μA; V <sub>CC</sub> = 4.5 V	4.4	-	-	V
		I <sub>O</sub> = -20 μA; V <sub>CC</sub> = 6.0 V	5.9	-	-	V
		I <sub>O</sub> = -4 mA; V <sub>CC</sub> = 4.5 V	3.7	-	-	V
		I <sub>O</sub> = -5.2 mA; V <sub>CC</sub> = 6.0 V	5.2	-	-	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> = 20 μA; V <sub>CC</sub> = 2.0 V	-	-	0.1	V
		I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 4.5 V	-	-	0.1	V
		I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 6.0 V	-	-	0.1	V
		I <sub>O</sub> = 4 mA; V <sub>CC</sub> = 4.5 V	-	-	0.4	V
		I <sub>O</sub> = 5.2 mA; V <sub>CC</sub> = 6.0 V	-	-	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	-	-	±1.0	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	-	-	160	μA

## 10. Dynamic characteristics

**Table 7. Dynamic characteristics**

$GND = 0\text{ V}$ ;  $t_r = t_f = 6\text{ ns}$ ;  $C_L = 50\text{ pF}$ ; for test circuit see [Figure 8](#).

Symbol	Parameter	Conditions	Min	Typ	Max	Unit		
<b><math>T_{\text{amb}} = 25\text{ °C}</math></b>								
$t_{\text{pd}}$	propagation delay	$nI0, nI1$ to $n\bar{Y}$ ; see <a href="#">Figure 6</a> <sup>[1]</sup>						
		$V_{\text{CC}} = 2.0\text{ V}$	-	41	125	ns		
		$V_{\text{CC}} = 4.5\text{ V}$	-	15	25	ns		
		$V_{\text{CC}} = 6.0\text{ V}$	-	12	21	ns		
		$V_{\text{CC}} = 5.0\text{ V}$ ; $C_L = 15\text{ pF}$	-	12	-	ns		
		$\bar{E}$ to $n\bar{Y}$ ; see <a href="#">Figure 7</a> <sup>[1]</sup>						
		$V_{\text{CC}} = 2.0\text{ V}$	-	47	145	ns		
		$V_{\text{CC}} = 4.5\text{ V}$	-	17	29	ns		
		$V_{\text{CC}} = 6.0\text{ V}$	-	14	25	ns		
		$V_{\text{CC}} = 5.0\text{ V}$ ; $C_L = 15\text{ pF}$	-	14	-	ns		
		$S$ to $n\bar{Y}$ ; see <a href="#">Figure 6</a> <sup>[1]</sup>						
		$V_{\text{CC}} = 2.0\text{ V}$	-	47	145	ns		
		$V_{\text{CC}} = 4.5\text{ V}$	-	17	29	ns		
		$V_{\text{CC}} = 6.0\text{ V}$	-	14	25	ns		
$V_{\text{CC}} = 5.0\text{ V}$ ; $C_L = 15\text{ pF}$	-	14	-	ns				
$t_t$	transition time	see <a href="#">Figure 6</a> and <a href="#">7</a> <sup>[2]</sup>						
		$V_{\text{CC}} = 2.0\text{ V}$	-	19	75	ns		
		$V_{\text{CC}} = 4.5\text{ V}$	-	7	15	ns		
		$V_{\text{CC}} = 6.0\text{ V}$	-	6	13	ns		
$C_{\text{PD}}$	power dissipation capacitance	per multiplexer; $V_I = GND$ to $V_{\text{CC}}$ <sup>[3]</sup>	-	40	-	pF		
<b><math>T_{\text{amb}} = -40\text{ °C to }+85\text{ °C}</math></b>								
$t_{\text{pd}}$	propagation delay	$nI0, nI1$ to $n\bar{Y}$ ; see <a href="#">Figure 6</a> <sup>[1]</sup>						
		$V_{\text{CC}} = 2.0\text{ V}$	-	-	155	ns		
		$V_{\text{CC}} = 4.5\text{ V}$	-	-	31	ns		
		$V_{\text{CC}} = 6.0\text{ V}$	-	-	26	ns		
		$\bar{E}$ to $n\bar{Y}$ ; see <a href="#">Figure 7</a> <sup>[1]</sup>						
		$V_{\text{CC}} = 2.0\text{ V}$	-	-	180	ns		
		$V_{\text{CC}} = 4.5\text{ V}$	-	-	36	ns		
		$V_{\text{CC}} = 6.0\text{ V}$	-	-	31	ns		
		$S$ to $n\bar{Y}$ ; see <a href="#">Figure 6</a> <sup>[1]</sup>						
		$V_{\text{CC}} = 2.0\text{ V}$	-	-	180	ns		
		$V_{\text{CC}} = 4.5\text{ V}$	-	-	36	ns		
		$V_{\text{CC}} = 6.0\text{ V}$	-	-	31	ns		
		$t_t$	transition time	see <a href="#">Figure 6</a> and <a href="#">7</a> <sup>[2]</sup>				
				$V_{\text{CC}} = 2.0\text{ V}$	-	-	95	ns
$V_{\text{CC}} = 4.5\text{ V}$	-			-	19	ns		
$V_{\text{CC}} = 6.0\text{ V}$	-			-	16	ns		



**Table 7. Dynamic characteristics ...continued**  
*GND = 0 V;  $t_r = t_f = 6$  ns;  $C_L = 50$  pF; for test circuit see [Figure 8](#).*

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>T<sub>amb</sub> = -40 °C to +125 °C</b>						
t <sub>pd</sub>	propagation delay	nI0, nI1 to n $\bar{Y}$ ; see <a href="#">Figure 6</a> [1]				
		V <sub>CC</sub> = 2.0 V	-	-	190	ns
		V <sub>CC</sub> = 4.5 V	-	-	38	ns
		V <sub>CC</sub> = 6.0 V	-	-	32	ns
		$\bar{E}$ to n $\bar{Y}$ ; see <a href="#">Figure 7</a> [1]				
		V <sub>CC</sub> = 2.0 V	-	-	220	ns
		V <sub>CC</sub> = 4.5 V	-	-	44	ns
		V <sub>CC</sub> = 6.0 V	-	-	38	ns
		S to n $\bar{Y}$ ; see <a href="#">Figure 6</a> [1]				
		V <sub>CC</sub> = 2.0 V	-	-	220	ns
		V <sub>CC</sub> = 4.5 V	-	-	44	ns
		V <sub>CC</sub> = 6.0 V	-	-	38	ns
t <sub>t</sub>	transition time	see <a href="#">Figure 6</a> and <a href="#">7</a> [2]				
		V <sub>CC</sub> = 2.0 V	-	-	110	ns
		V <sub>CC</sub> = 4.5 V	-	-	22	ns
		V <sub>CC</sub> = 6.0 V	-	-	19	ns

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

[2] t<sub>t</sub> is the same as t<sub>THL</sub> and t<sub>TLH</sub>.

[3] C<sub>PD</sub> is used to determine the dynamic power dissipation (P<sub>D</sub> in  $\mu$ W).

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

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

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

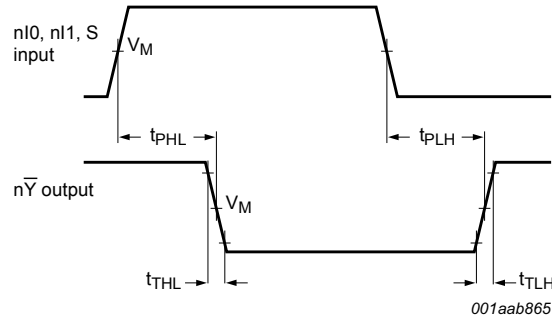
C<sub>L</sub> = output load capacitance in pF;

V<sub>CC</sub> = supply voltage in V;

N = number of inputs switching;

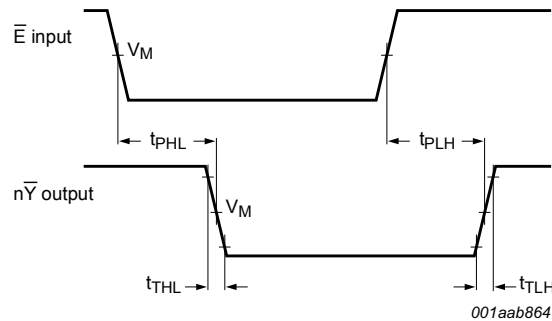
$\sum(C_L \times V_{CC}^2 \times f_o)$  = sum of outputs.

11. Waveforms



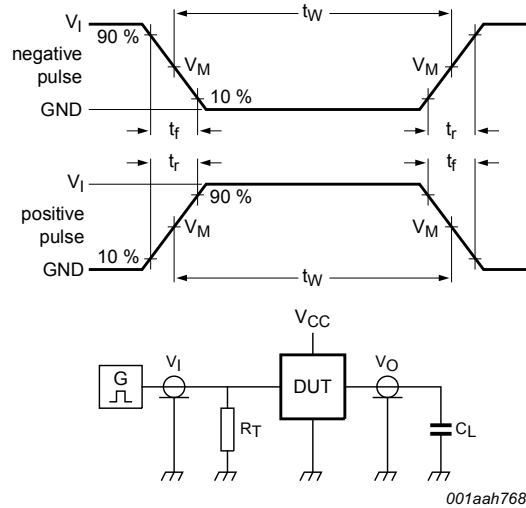
$V_M = 0.5V_{CC}$ .

**Fig 6.** Waveforms showing the data input (nI0, nI1) to output (nY-bar) propagation delays and the output transition times



$V_M = 0.5V_{CC}$ .

**Fig 7.** Waveforms showing the enable input (E-bar) to output (nY-bar) propagation delays and the output transition times



001aah768

Test data is given in [Table 8](#).

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 8. Test circuit for measuring switching times**

**Table 8. Test data**

Type	Input		Load	Test
	$V_I$	$t_r, t_f$	$C_L$	
74HC158	$V_{CC}$	6.0 ns	15 pF, 50 pF	$t_{PLH}, t_{PHL}$

12. Package outline

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

SOT109-1

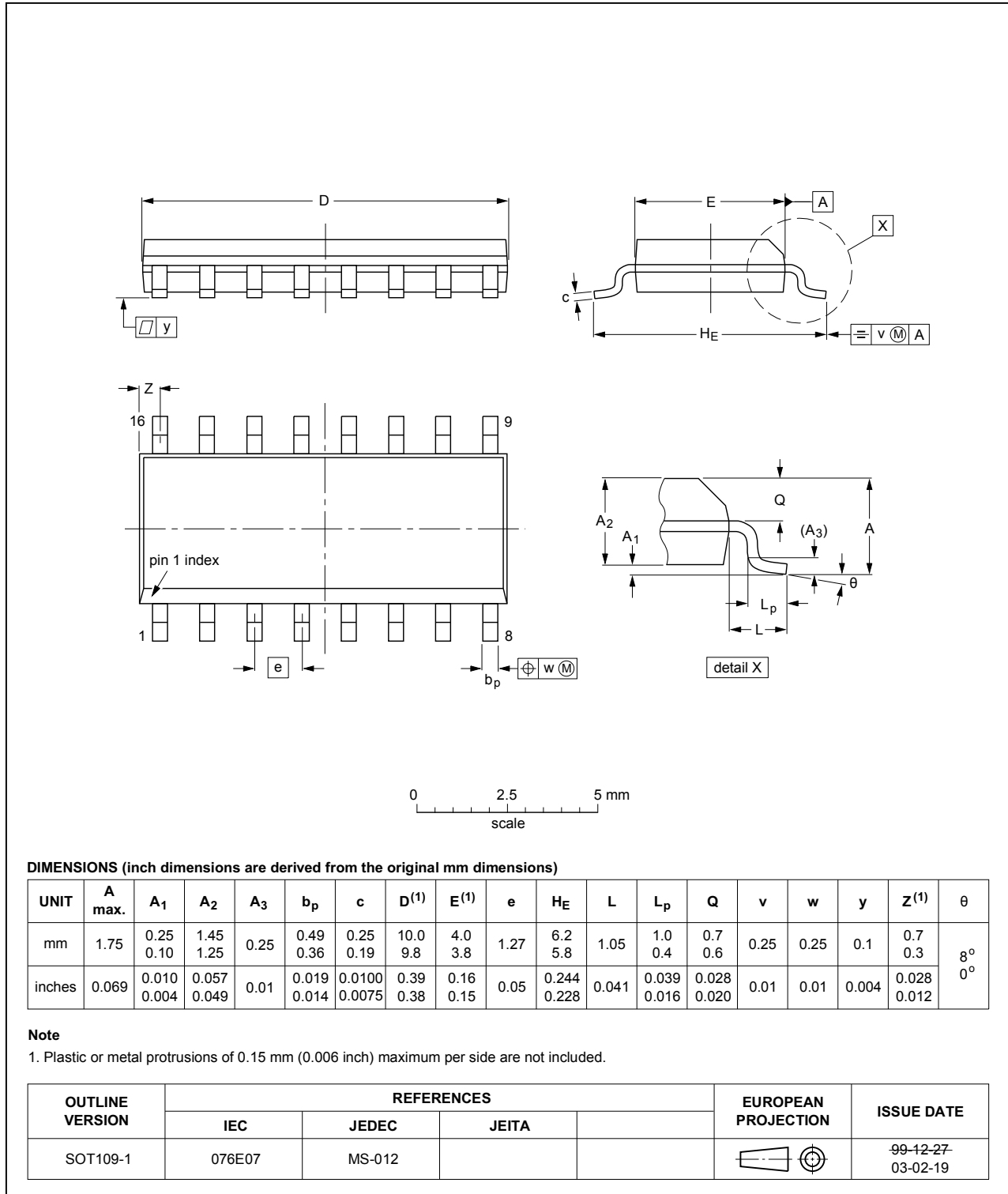


Fig 9. Package outline SOT109-1 (SO16)

## 13. Abbreviations

Table 9. Abbreviations

Acronym	Abbreviation
CMOS	Complementary Metal Oxide Semiconductor
DUT	Device Under Test
ESD	ElectroStatic Discharge
HBM	Human Body Model
LSTTL	Low-power Schottky Transistor-Transistor Logic
MM	Machine Model

## 14. Revision history

Table 10. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74HC158 v.4	20151223	Product data sheet	-	74HC158 v.3
Modifications:	<ul style="list-style-type: none"> <li>Type number 74HC158N (SOT38-4) removed.</li> </ul>			
74HC158 v.3	20041112	Product data sheet	-	74HC_HCT158_CNV v.2
Modifications:	<ul style="list-style-type: none"> <li>The format of this data sheet has been redesigned to comply with the current presentation and information standard of Philips Semiconductors.</li> <li>Removed type number 74HCT158.</li> <li>Inserted family specification.</li> </ul>			
74HC_HCT158_CNV v.2	19970827	Product specification	-	74HC_HCT158 v.1
74HC_HCT158 v.1	19901201	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".

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## 16. Contact information

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

For sales office addresses, please send an email to: [salesaddresses@nexperia.com](mailto:salesaddresses@nexperia.com)

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