

74ALVCH16952

16-bit registered transceiver; 3-state

Rev. 3 — 9 January 2018

Product data sheet

1 General description

The 74ALVCH16952 consists of two sections, each containing a dual octal non-inverting registered transceiver. Two 8-bit back to back registers store data flowing in both directions between two bidirectional buses. Data applied to the inputs is entered and stored on the rising edge of the clock ($\overline{nCPAB}$ and $\overline{nCPBA}$) provided that the clock enable ($\overline{nCEAB}$ and $\overline{nCEBA}$) is LOW. The data is then present at the output buffers, but is only accessible when the output enable input ($\overline{nOEAB}$ and $\overline{nOEBA}$) is LOW. Data flow from A inputs to B outputs is the same as for B inputs to A outputs.

2 Features and benefits

- CMOS low-power consumption
- Multibyte flow-through pinout architecture
- Low inductance, multiple center power and ground pins for minimum noise and ground bounce
- Direct interface with TTL levels
- Output drive capability 50 Ω transmission lines at 85 °C
- Complies with JEDEC standard JESD8-B

3 Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
74ALVCH16952DGG	-40 °C to +85 °C	TSSOP56	plastic thin shrink small outline package; 56 leads; body width 6.1 mm	SOT364-1

4 Functional diagram

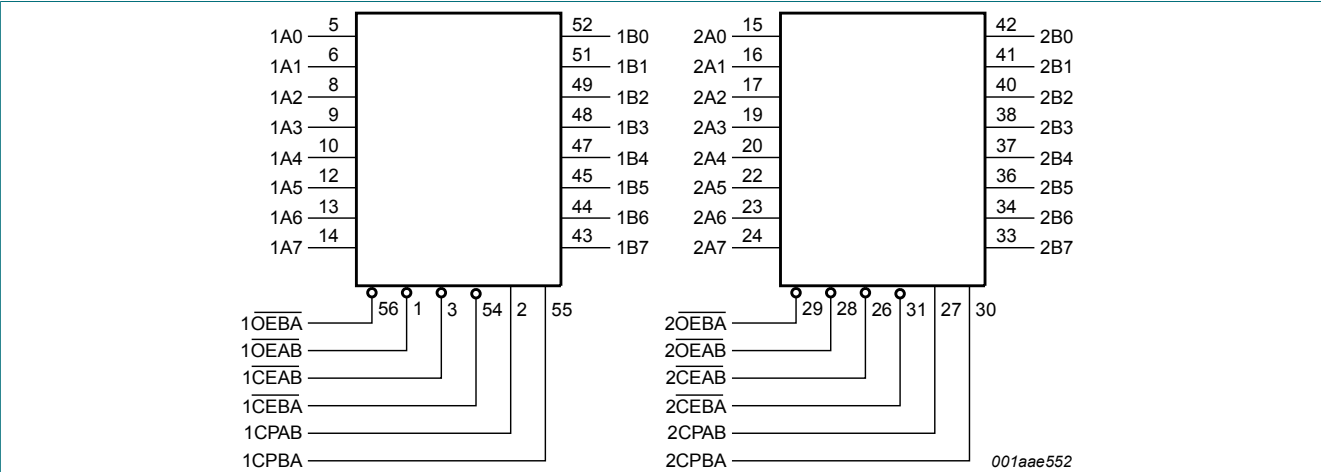


Figure 1. Logic symbol

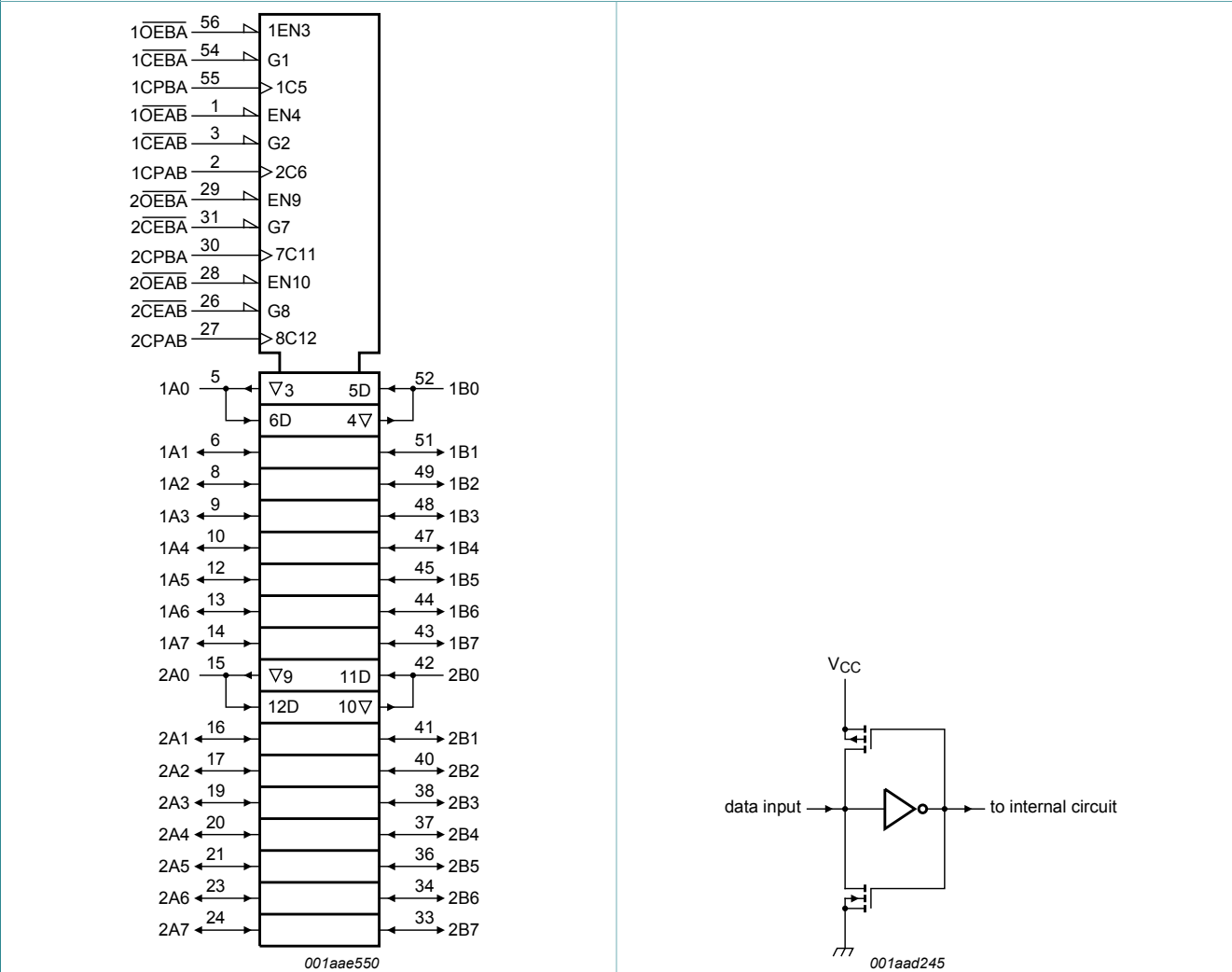
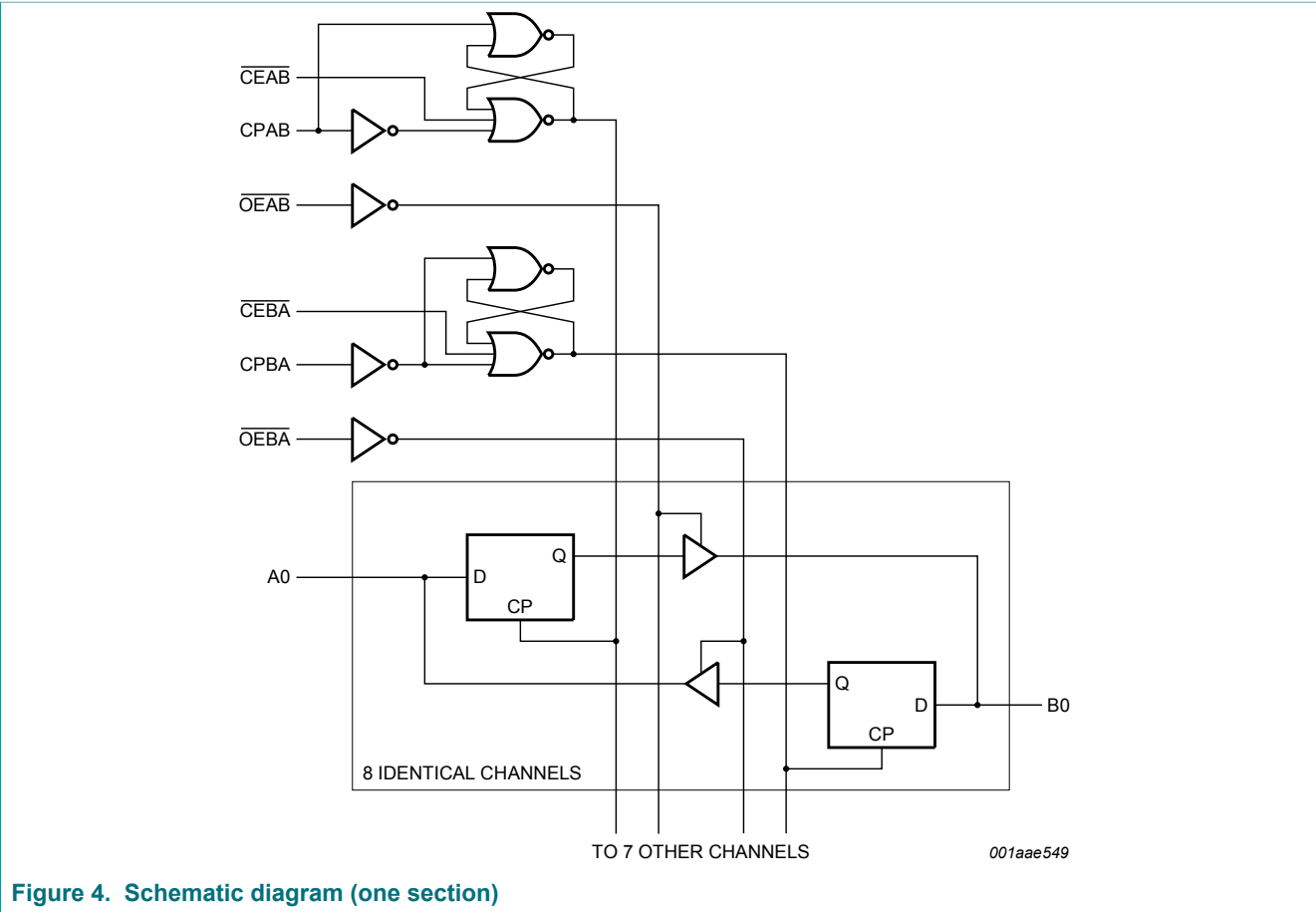


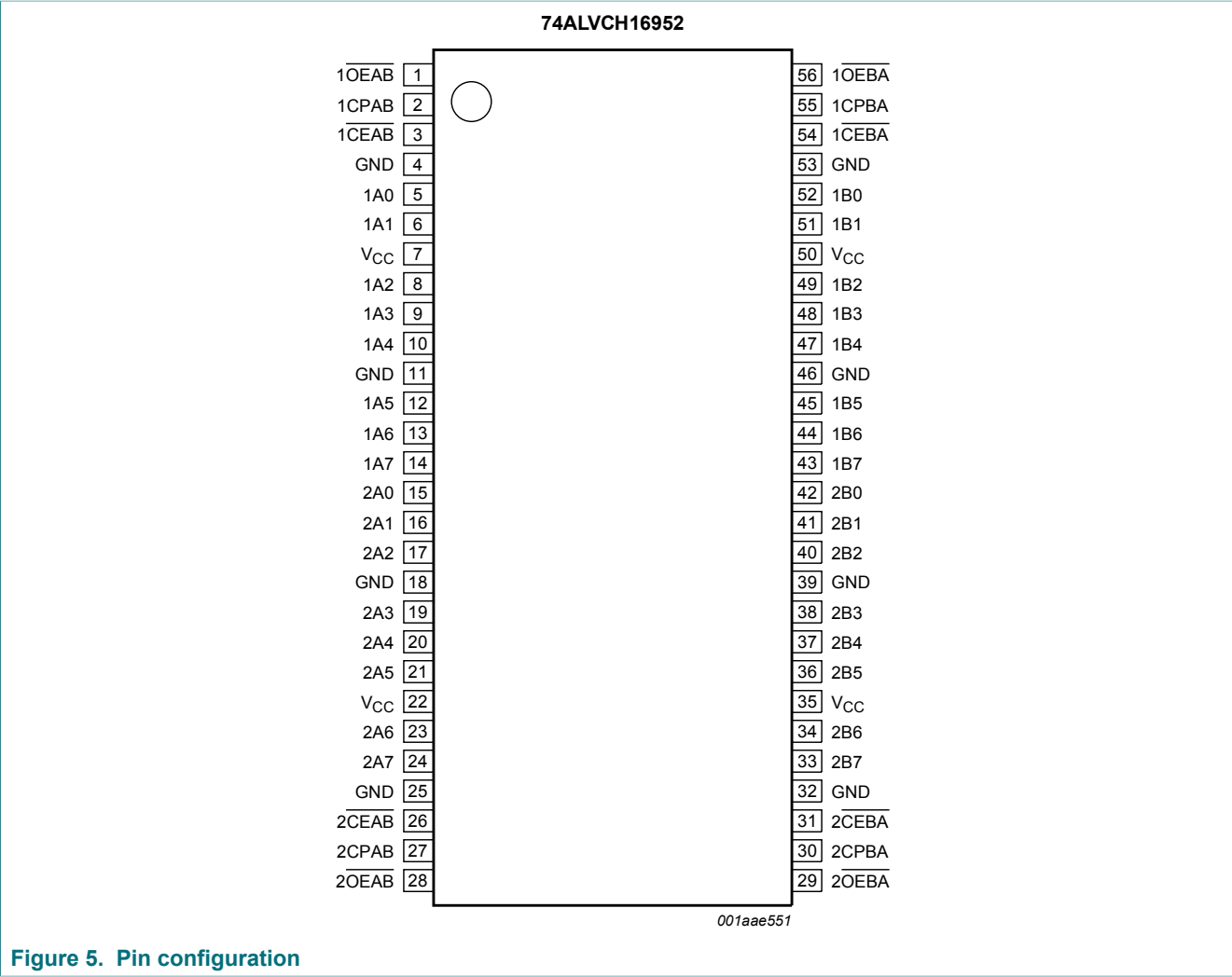
Figure 2. IEC logic symbol

Figure 3. Bus hold circuit



5 Pinning information

5.1 Pinning



5.2 Pin description

Table 2. Pin description

Symbol	Pin	Description
1A0, 1A1, 1A2, 1A3, 1A4, 1A5, 1A6, 1A7	5, 6, 8, 9, 10, 12, 13, 14	data inputs or outputs
1B0, 1B1, 1B2, 1B3, 1B4, 1B5, 1B6, 1B7	52, 51, 49, 48, 47, 45, 44, 43	data inputs or outputs
2A0, 2A1, 2A2, 2A3, 2A4, 2A5, 2A6, 2A7	15, 16, 17, 19, 20, 21, 23, 24	data inputs or outputs
2B0, 2B1, 2B2, 2B3, 2B4, 2B5, 2B6, 2B7	42, 41, 40, 38, 37, 36, 34, 33	data inputs or outputs
1 $\overline{\text{OEAB}}$, 1 $\overline{\text{OEBA}}$, 2 $\overline{\text{OEAB}}$, 2 $\overline{\text{OEBA}}$	1, 56, 28, 29	output enable input (active LOW)
1 $\overline{\text{CEAB}}$, 1 $\overline{\text{CEBA}}$, 2 $\overline{\text{CEAB}}$, 2 $\overline{\text{CEBA}}$	3, 54, 26, 31	clock enable input (active LOW)
1CPAB, 1CPBA, 2CPAB, 2CPBA	2, 55, 27, 30	clock pulse input (LOW-to-HIGH, edge-triggered)
GND	4, 11, 18, 25, 32, 39, 46, 53	ground (0 V)
V _{CC}	7, 22, 35, 50	supply voltage

6 Functional description

Table 3. Function table ^[1]

Operating mode	Control			Input	Internal	Output
A to B, B to A	n $\overline{\text{OEAB}}$, n $\overline{\text{OEBA}}$	n $\overline{\text{CEAB}}$, n $\overline{\text{CEBA}}$	nCPAB, nCPBA	nAn, nBn	nQn	nBn, nAn
Hold	L	H	X	X	NC	NC
Load and output enable	L	L	$\uparrow$	L	L	L
				H	H	H
Load and output disable	H	L	$\uparrow$	L	L	Z
				H	H	Z

[1] H = HIGH voltage level;
 L = LOW voltage level;
 $\uparrow$ = LOW-to-HIGH clock transition;
 X = don't care;
 Z = high impedance OFF-state;
 NC = no change.

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	+4.6	V
V_I	input voltage	control pins ^[1]	-0.5	+4.6	V
		data inputs ^[1]	-0.5	$V_{CC} + 0.5$	V
V_O	output voltage	^[1]	-0.5	$V_{CC} + 0.5$	V
I_{IK}	input clamping current	$V_I < 0$ V	-	-50	mA
I_{OK}	output clamping current	$V_O > V_{CC}$ or $V_O < 0$ V	-	±50	mA
I_O	output current	$V_O = 0$ V to V_{CC}	-	±50	mA
I_{CC}	supply current		-	100	mA
I_{GND}	ground current		-100	-	mA
T_{stg}	storage temperature		-65	+150	°C
P_{tot}	total power dissipation	$T_{amb} = -40$ °C to +125 °C ^[2]	-	600	mW

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

[2] For TSSOP56 package: P_{tot} derates linearly with 8 mW/K above 55 °C.

8 Recommended operating conditions

Table 5. Recommended operating conditions

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{CC}	supply voltage	maximum speed performance				
		$C_L = 30$ pF	2.3	-	2.7	V
		$C_L = 50$ pF	3.0	-	3.6	V
V_I	input voltage		0	-	V_{CC}	V
V_O	output voltage		0	-	V_{CC}	V
T_{amb}	ambient temperature	operating in free-air	-40	-	+85	°C
$\Delta t/\Delta V$	input transition rise and fall rate	$V_{CC} = 2.3$ V to 3.0 V	0	-	20	ns/V
		$V_{CC} = 3.0$ V to 3.6 V	0	-	10	ns/V

9 Static characteristics

Table 6. Static characteristics

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

Symbol	Parameter	Conditions	T _{amb} = -40 °C to +85 °C			Unit
			Min	Typ ^[1]	Max	
V _{IH}	HIGH-level input voltage	V _{CC} = 2.3 V to 2.7 V	1.7	1.2	-	V
		V _{CC} = 2.7 V to 3.6 V	2.0	1.5	-	V
V _{IL}	LOW-level input voltage	V _{CC} = 2.3 V to 2.7 V	-	1.2	0.7	V
		V _{CC} = 2.7 V to 3.6 V	-	1.5	0.8	V
V _{OH}	HIGH-level output voltage	V _I = V _{IH} or V _{IL}				
		V _{CC} = 2.3 V to 3.6 V; I _O = -100 µA	V _{CC} - 0.2	V _{CC}	-	V
		V _{CC} = 2.3 V; I _O = -6 mA	V _{CC} - 0.3	V _{CC} - 0.08	-	V
		V _{CC} = 2.3 V; I _O = -12 mA	V _{CC} - 0.6	V _{CC} - 0.26	-	V
		V _{CC} = 2.7 V; I _O = -12 mA	V _{CC} - 0.5	V _{CC} - 0.14	-	V
		V _{CC} = 3.0 V; I _O = -12 mA	V _{CC} - 0.6	V _{CC} - 0.09	-	V
		V _{CC} = 3.0 V; I _O = -24 mA	V _{CC} - 1.0	V _{CC} - 0.28	-	V
V _{OL}	LOW-level output voltage	V _I = V _{IH} or V _{IL}				
		V _{CC} = 2.3 V to 3.6 V; I _O = 100 µA	-	GND	0.20	V
		V _{CC} = 2.3 V; I _O = 6 mA	-	0.07	0.40	V
		V _{CC} = 2.3 V; I _O = 12 mA	-	0.15	0.70	V
		V _{CC} = 2.7 V; I _O = 12 mA	-	0.14	0.40	V
		V _{CC} = 3.0 V; I _O = 24 mA	-	0.27	0.55	V
I _I	input leakage current	V _{CC} = 2.3 V to 3.6 V; V _I = V _{CC} or GND	-	0.1	5	µA
I _{OZ}	OFF-state output current	V _{CC} = 2.7 V to 3.6 V; V _I = V _{IH} or V _{IL} ; V _O = V _{CC} or GND	-	0.1	10	µA
I _{CC}	supply current	V _{CC} = 2.3 V to 3.6 V; V _I = V _{CC} or GND; I _O = 0 A	-	0.2	40	µA
ΔI _{CC}	additional supply current	V _{CC} = 2.3 V to 3.6 V; V _I = V _{CC} - 0.6 V; I _O = 0 A	-	150	750	µA
I _{BHL}	bus hold LOW sustaining current	V _{CC} = 2.3 V; V _I = 0.7 V	45	-	-	µA
		V _{CC} = 3.0 V; V _I = 0.8 V	75	150	-	µA
I _{BHH}	bus hold HIGH sustaining current	V _{CC} = 2.3 V; V _I = 1.7 V	-45	-	-	µA
		V _{CC} = 3.0 V; V _I = 2.0 V	-75	-175	-	µA
I _{BHLO}	bus hold LOW overdrive current	V _{CC} = 3.6 V	500	-	-	µA
I _{BHHO}	bus hold HIGH overdrive current	V _{CC} = 3.6 V	-500	-	-	µA
C _i	input capacitance		-	3.0	-	pF

[1] Typical values are measured at T_{amb} = 25 °C

Typical values for V_{CC} = 2.3 V to 2.7 V are measured at V_{CC} = 2.5 V

Typical values for V_{CC} = 3.0 V to 3.6 V are measured at V_{CC} = 3.3 V

10 Dynamic characteristics

Table 7. Dynamic characteristics

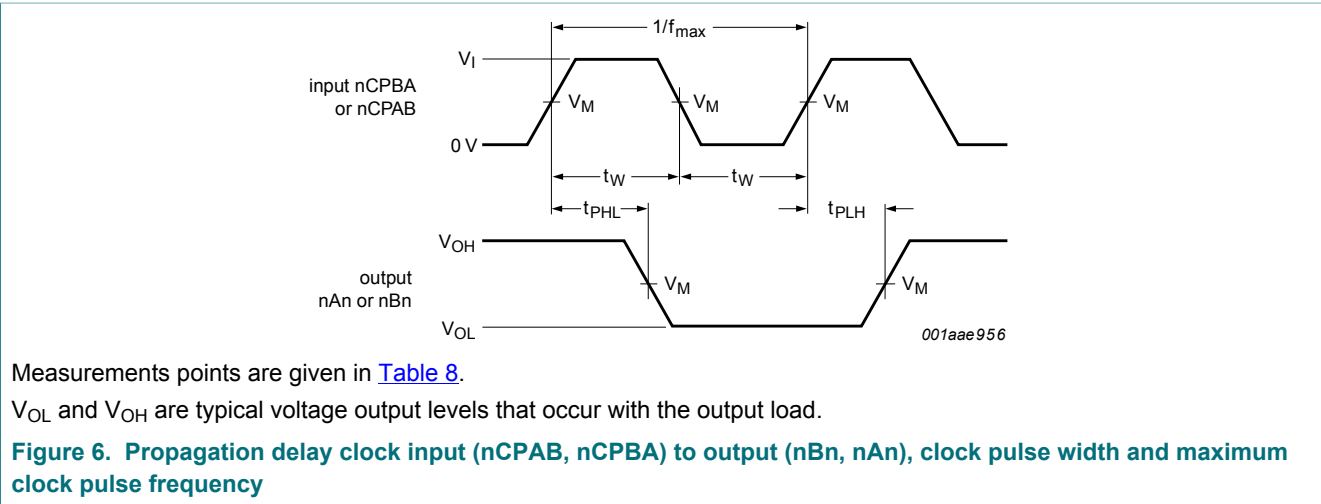
Voltages are referenced to GND (ground = 0 V). $T_{amb} = -40\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$; For test circuit, see [Figure 9](#).

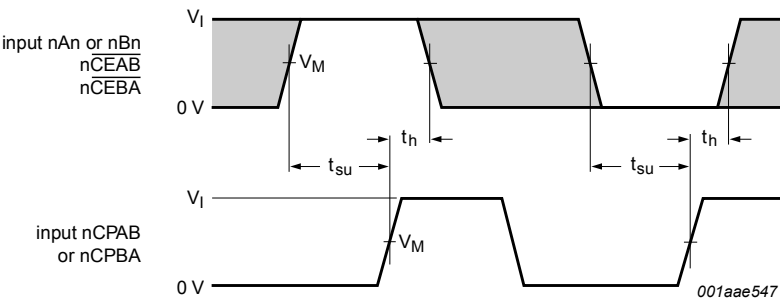
Symbol	Parameter	Conditions	Min	Typ ^[1]	Max	Unit
t_{pd}	propagation delay	nCPBA to nAn; nCPAB to nBn; see Figure 6 ^[2]				
		$V_{CC} = 2.3\text{ V to }2.7\text{ V}$	1.0	3.2	4.1	ns
		$V_{CC} = 2.7\text{ V}$	1.0	-	4.6	ns
		$V_{CC} = 3.0\text{ V to }3.6\text{ V}$	1.0	3.2	3.9	ns
t_{en}	enable time	nOEBA to nAn; nOEAB to nBn; see Figure 8 ^[3]				
		$V_{CC} = 2.3\text{ V to }2.7\text{ V}$	1.0	-	5.4	ns
		$V_{CC} = 2.7\text{ V}$	1.0	-	5.3	ns
		$V_{CC} = 3.0\text{ V to }3.6\text{ V}$	1.0	-	4.4	ns
t_{dis}	disable time	nOEBA to nAn; nOEAB to nBn; see Figure 8 ^[4]				
		$V_{CC} = 2.3\text{ V to }2.7\text{ V}$	1.0	-	5.3	ns
		$V_{CC} = 2.7\text{ V}$	1.4	-	4.4	ns
		$V_{CC} = 3.0\text{ V to }3.6\text{ V}$	1.1	-	4.0	ns
t_w	pulse width	nCPAB; nCPBA; HIGH or LOW; see Figure 6				
		$V_{CC} = 2.3\text{ V to }2.7\text{ V}$	3.3	-	-	ns
		$V_{CC} = 2.7\text{ V}$	3.3	-	-	ns
		$V_{CC} = 3.0\text{ V to }3.6\text{ V}$	3.3	-	-	ns
t_{su}	set-up time	nAn to nCPAB or nBn to nCPBA; see Figure 7				
		$V_{CC} = 2.3\text{ V to }2.7\text{ V}$	1.7	-	-	ns
		$V_{CC} = 2.7\text{ V}$	1.9	-	-	ns
		$V_{CC} = 3.0\text{ V to }3.6\text{ V}$	1.5	-	-	ns
		nCEAB to nCPAB or nCEBA to nCPBA; see Figure 7				
		$V_{CC} = 2.3\text{ V to }2.7\text{ V}$	1.2	-	-	ns
		$V_{CC} = 2.7\text{ V}$	1.0	-	-	ns
		$V_{CC} = 3.0\text{ V to }3.6\text{ V}$	1.0	-	-	ns
t_h	hold time	nAn to nCPAB or nBn to nCPBA; see Figure 7				
		$V_{CC} = 2.3\text{ V to }2.7\text{ V}$	0.6	-	-	ns
		$V_{CC} = 2.7\text{ V}$	0.6	-	-	ns
		$V_{CC} = 3.0\text{ V to }3.6\text{ V}$	0.8	-	-	ns
		nCEAB to nCPAB or nCEBA to nCPBA; see Figure 7				
		$V_{CC} = 2.3\text{ V to }2.7\text{ V}$	1.1	-	-	ns
		$V_{CC} = 2.7\text{ V}$	0.9	-	-	ns
		$V_{CC} = 3.0\text{ V to }3.6\text{ V}$	1.1	-	-	ns

Symbol	Parameter	Conditions	Min	Typ ^[1]	Max	Unit
f _{max}	maximum frequency	CP; see Figure 6				
		V _{CC} = 2.3 V to 2.7 V	150	350	-	MHz
		V _{CC} = 2.7 V	150	350	-	MHz
		V _{CC} = 3.0 V to 3.6 V	150	350	-	MHz
C _{PD}	power dissipation capacitance	per driver; V _I = GND to V _{CC} ^[5]	-	30	-	pF

- [1] Typical values are measured at T_{amb} = 25 °C
Typical values for V_{CC} = 2.3 V to 2.7 V are measured at V_{CC} = 2.5 V
Typical values for V_{CC} = 3.0 V to 3.6 V are measured at V_{CC} = 3.3 V
- [2] t_{pd} is the same as t_{PHL} and t_{PLH}.
- [3] t_{en} is the same as t_{pZH} and t_{pZL}.
- [4] t_{dis} is the same as t_{pHZ} and t_{pLZ}.
- [5] C_{PD} is used to determine the dynamic power dissipation (P_D 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_i = input frequency in MHz;
f_o = output frequency in MHz;
C_L = output load capacitance in pF;
V_{CC} = supply voltage in V;
N = number of inputs switching;
Σ(C_L × V_{CC}² × f_o) = sum of outputs.

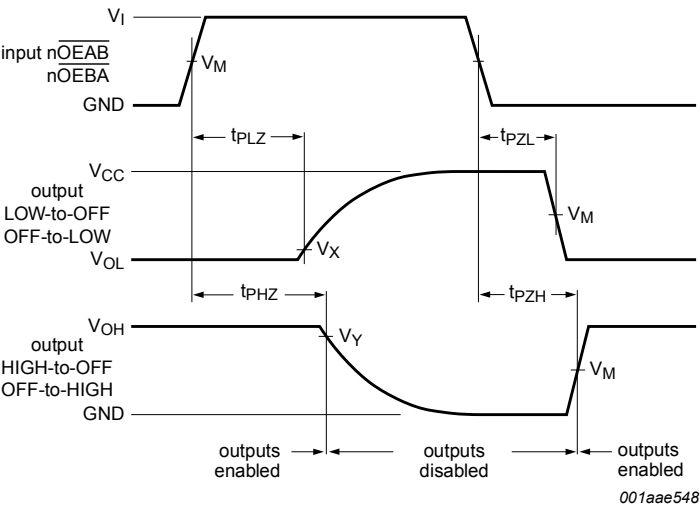
10.1 Waveforms and test circuit





Measurements points are given in [Table 8](#).
The shaded areas indicate when the input is permitted to change for predictable output performance.

Figure 7. Setup and hold times

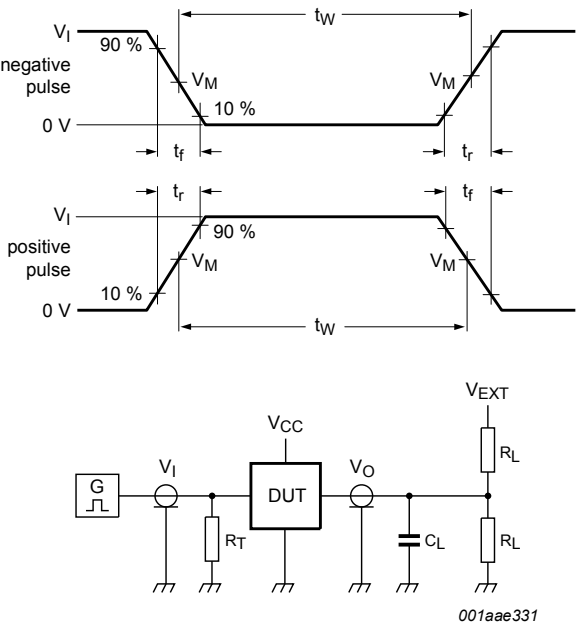


Measurements points are given in [Table 8](#).
 V_{OL} and V_{OH} are typical voltage output levels that occur with the output load.

Figure 8. 3-state enable and disable time

Table 8. Measurement points

Supply voltage	Input		Output		
V_{CC}	V_I	V_M	V_M	V_X	V_Y
2.3 V to 2.7 V	V_{CC}	0.5 V	0.5 V	$V_{OL} + 0.15 \text{ V}$	$V_{OH} - 0.15 \text{ V}$
2.7 V	2.7 V	1.5 V	1.5 V	$V_{OL} + 0.3 \text{ V}$	$V_{OH} - 0.3 \text{ V}$
3.0 V to 3.6 V	2.7 V	1.5 V	1.5 V	$V_{OL} + 0.3 \text{ V}$	$V_{OH} - 0.3 \text{ V}$



Test data is given in [Table 9](#).
Definitions for 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.
 V_{EXT} = External voltage for measuring switching times.

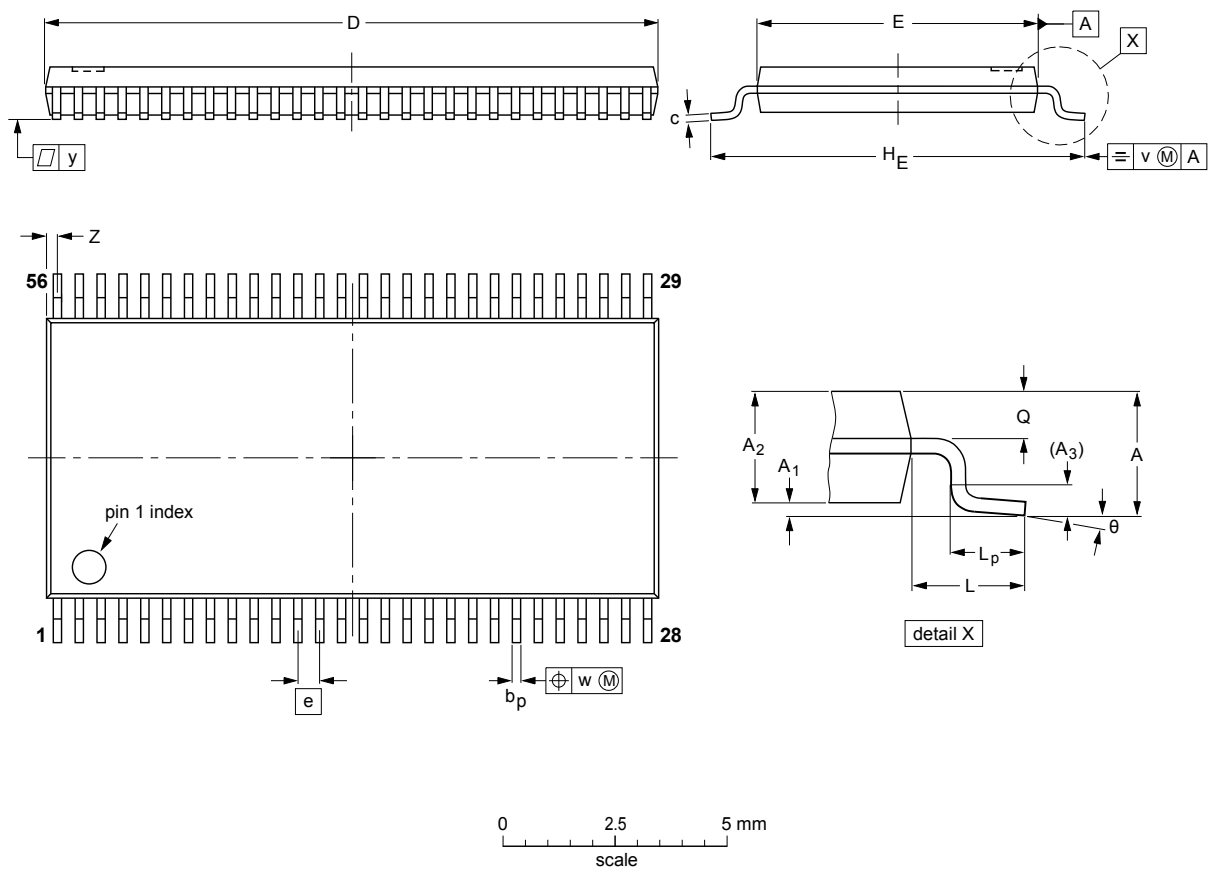
Figure 9. Test circuit for measuring switching times

Table 9. Test data

Supply voltage	Input		Load		V_{EXT}		
V_{CC}	V_I	t_r, t_f	C_L	R_L	t_{PLH}, t_{PHL}	t_{PLZ}, t_{PZL}	t_{PHZ}, t_{PZH}
2.3 V to 2.7 V	V_{CC}	≤ 2.0 ns	30 pF	500 Ω	open	$2 \times V_{CC}$	GND
2.7 V	2.7 V	2.5 ns	50 pF	500 Ω	open	$2 \times V_{CC}$	GND
3.0 V to 3.6 V	2.7 V	2.5 ns	50 pF	500 Ω	open	$2 \times V_{CC}$	GND

11 Package outline

TSSOP56: plastic thin shrink small outline package; 56 leads; body width 6.1 mm SOT364-1



DIMENSIONS (mm are the original dimensions).

UNIT	A max.	A ₁	A ₂	A ₃	b _p	c	D ⁽¹⁾	E ⁽²⁾	e	H _E	L	L _p	Q	v	w	y	Z	θ
mm	1.2	0.15 0.05	1.05 0.85	0.25	0.28 0.17	0.2 0.1	14.1 13.9	6.2 6.0	0.5	8.3 7.9	1	0.8 0.4	0.50 0.35	0.25	0.08	0.1	0.5 0.1	8° 0°

Notes

- 1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.
- 2. Plastic interlead protrusions of 0.25 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT364-1		MO-153				99-12-27 03-02-19

Figure 10. Package outline SOT364-1 (TSSOP56)

12 Abbreviations

Table 10. Abbreviations

Acronym	Description
CMOS	Complementary Metal-Oxide Semiconductor
DUT	Device Under Test
TTL	Transistor-Transistor Logic

13 Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74ALVCH16952 v.3	20180109	Product data sheet	-	74ALVCH16952 v.2
Modifications:	- The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia. - Legal texts have been adapted to the new company name where appropriate.			
74ALVCH16952 v.2	20060427	Product data sheet	-	74ALVCH16952 v.1
Modifications:	- The format of this data sheet has been redesigned to comply with the new presentation and information standard of Philips Semiconductors - The symbol of pin numbers 15, 16, 17, 19, 20, 21, 23 and 24 is rectified			
74ALVCH16952 v.1	19980901	Preliminary specification	-	-

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Please be aware that important notices concerning this document and the product(s) described herein, have been included in section 'Legal information'.