



74ALVCH16952

16-bit registered transceiver; 3-state

Rev. 4 — 10 July 2024

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 (nCPAB and nCPBA) provided that the clock enable (nCEAB and nCEBA) is LOW. The data is then present at the output buffers, but is only accessible when the output enable input (nOEAB and 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

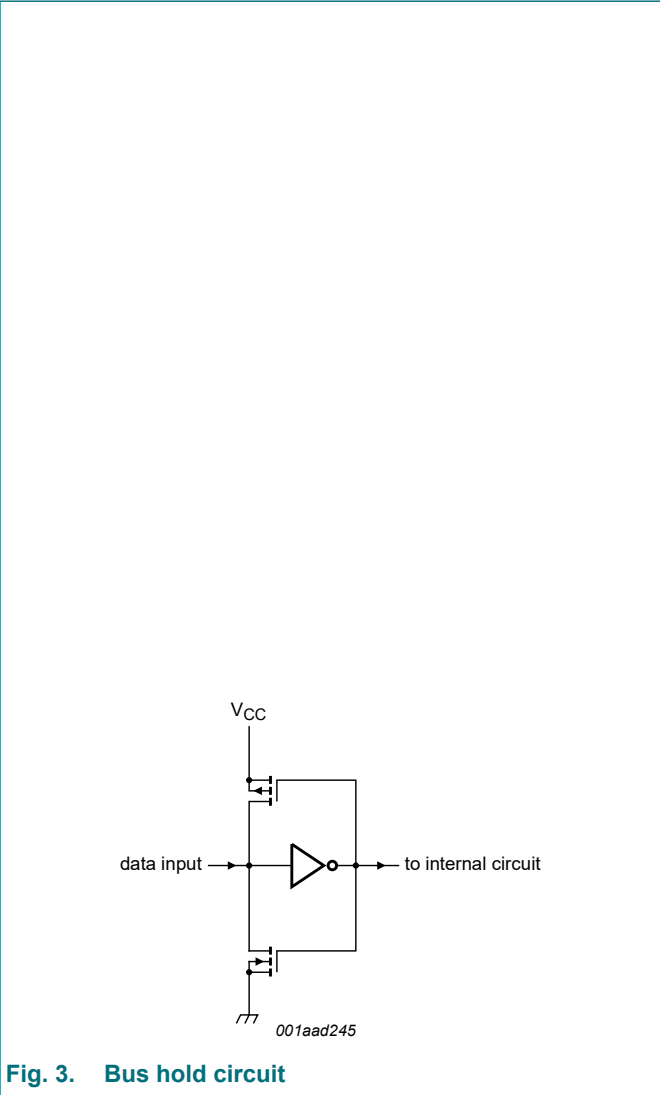
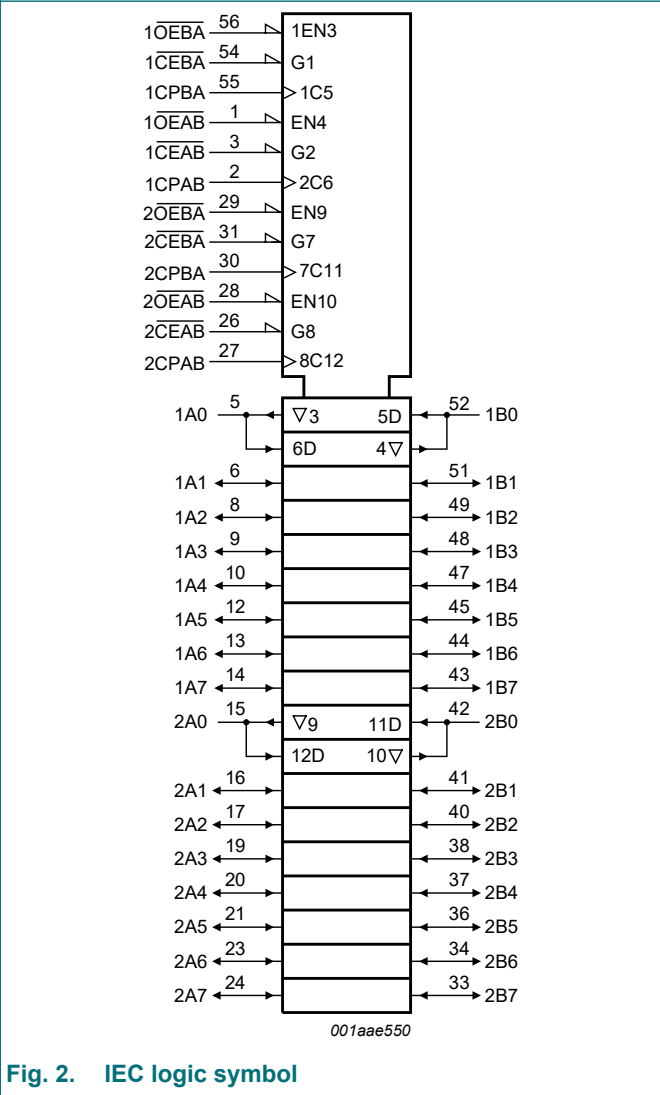
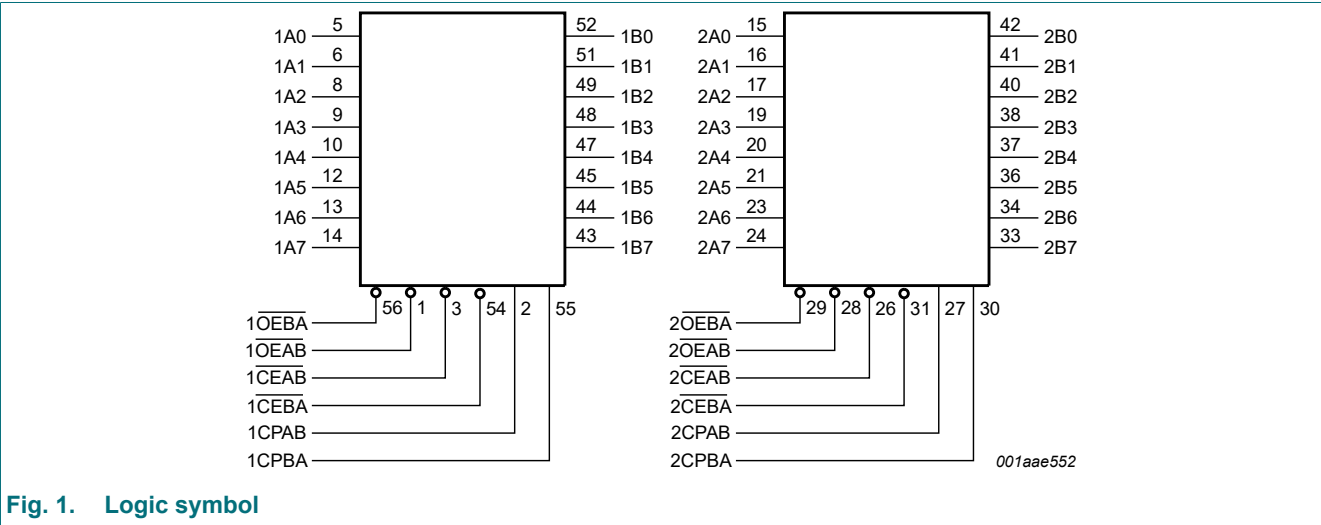
- CMOS low-power consumption
- MULTIBYTE™ flow-through pinout architecture
- Low inductance, multiple center power and ground pins for minimum noise and ground bounce
- Direct interface with TTL levels
- Output drive capability 50 Ω transmission lines at 85 °C
- Complies with JEDEC standard JESD8-B
- ESD protection:
 - HBM: ANSI/ESDA/JEDEC JS-001 class 2 exceeds 2000 V
 - CDM: ANSI/ESDA/JEDEC JS-002 class C3 exceeds 1000 V
- Specified from -40 °C to +85 °C

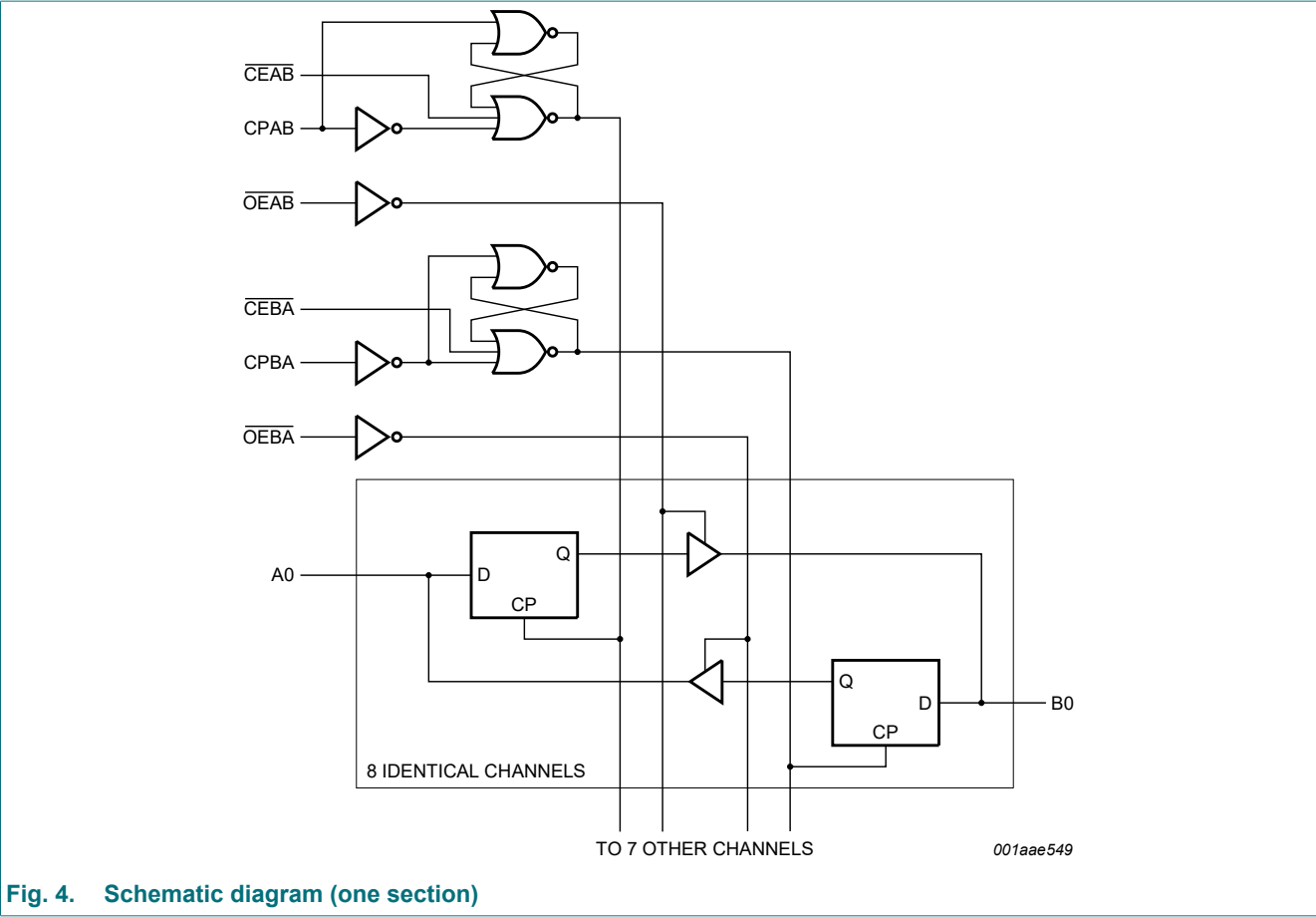
3. Ordering information

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

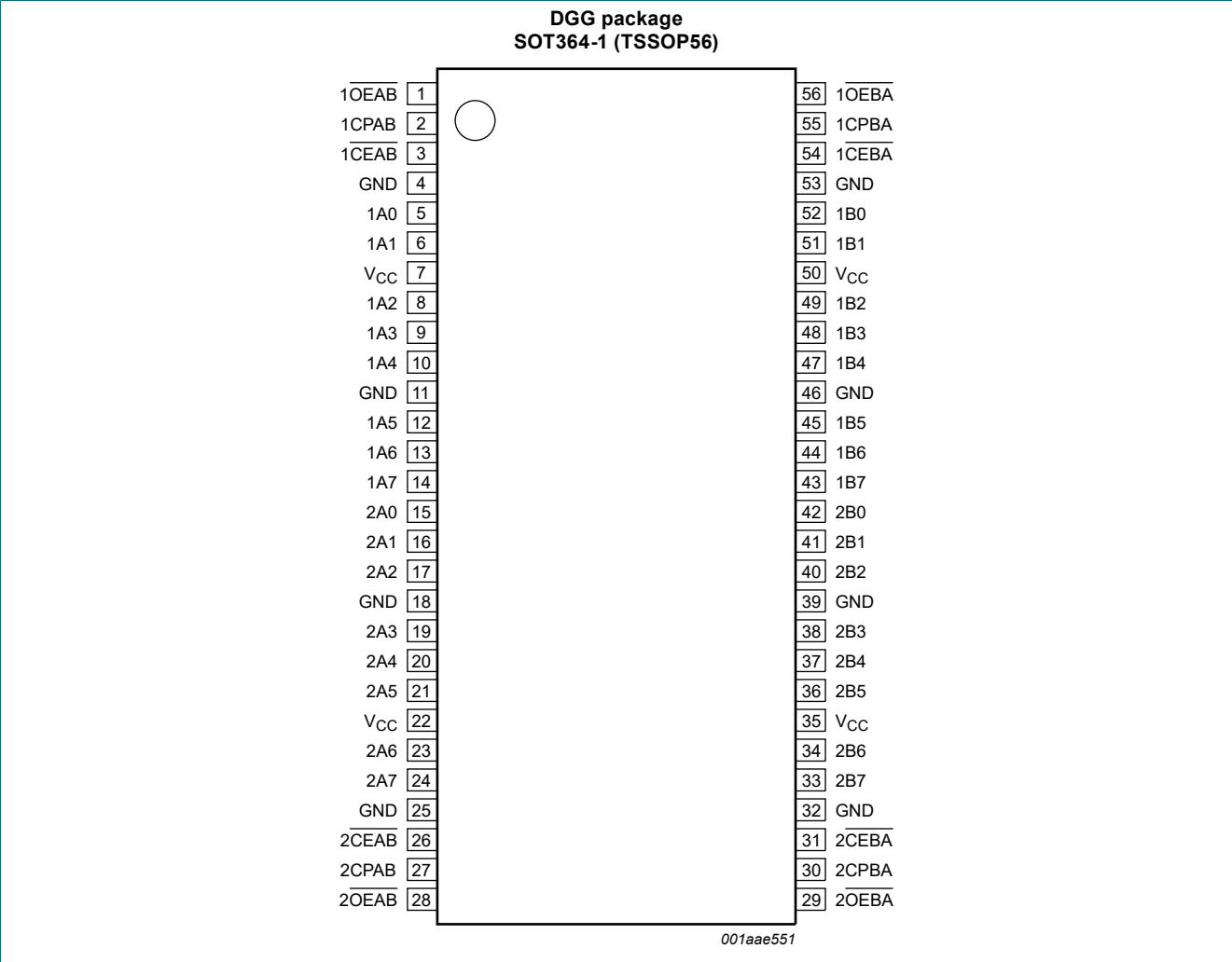
4. Functional diagram





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
1OEAB, 1OEBA, 2OEAB, 2OEBA	1, 56, 28, 29	output enable input (active LOW)
1CEAB, 1CEBA, 2CEAB, 2CEBA	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

H = HIGH voltage level; L = LOW voltage level; ↑ = LOW-to-HIGH clock transition;
X = don't care; Z = high impedance OFF-state; NC = no change.

Operating mode	Control			Input	Internal	Output
A to B, B to A	nOEAB, nOEBA	nCEAB, nCEBA	nCPAB, nCPBA	nAn, nBn	nQn	nBn, nAn
Hold	L	H	X	X	NC	NC
Load and output enable	L	L	↑	L	L	L
				H	H	H
Load and output disable	H	L	↑	L	L	Z
				H	H	Z

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 +85 °C	-	500	mW

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

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
Δt/ΔV	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	-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

Symbol	Parameter	Conditions	-40 °C to +85 °C			Unit
			Min	Typ [1]	Max	
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

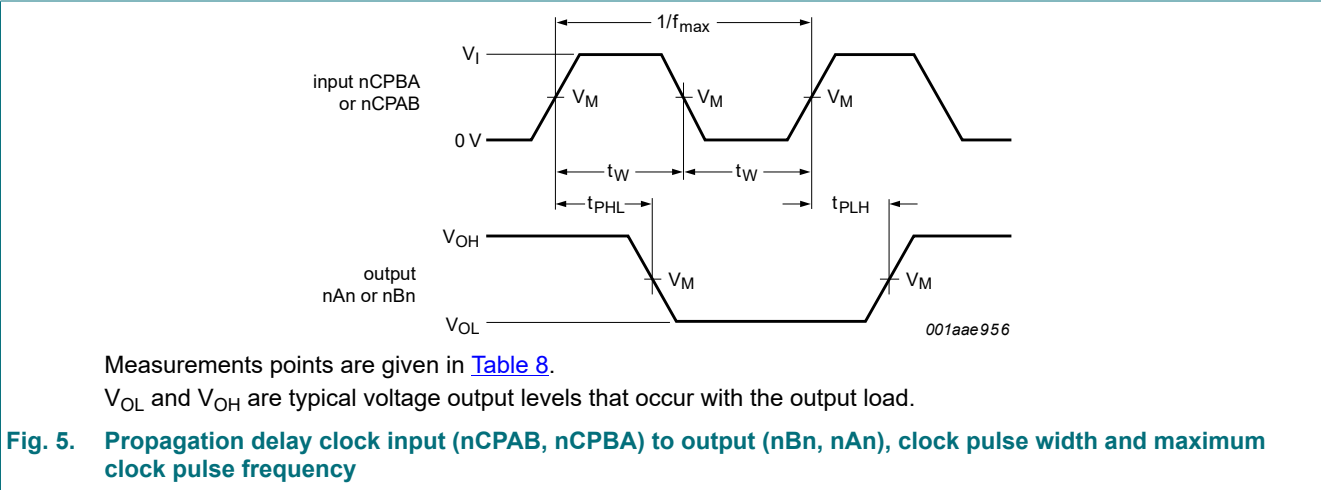
Voltages are referenced to GND (ground = 0 V). For test circuit, see Fig. 8.

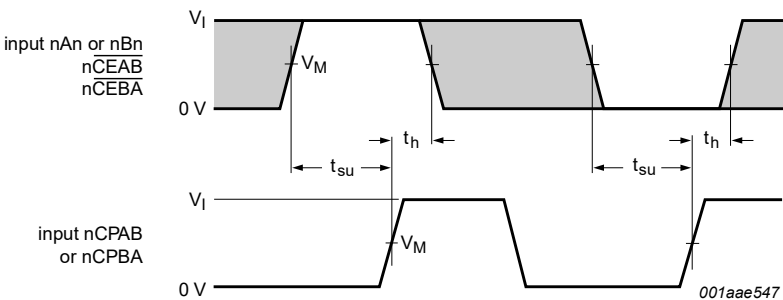
Symbol	Parameter	Conditions	-40 °C to +85 °C			Unit
			Min	Typ [1]	Max	
t _{pd}	propagation delay	nCPBA to nAn; nCPAB to nBn; see Fig. 5 [2]				
		V _{CC} = 2.3 V to 2.7 V	1.0	3.2	4.1	ns
		V _{CC} = 2.7 V	1.0	-	4.6	ns
		V _{CC} = 3.0 V to 3.6 V	1.0	3.2	3.9	ns
t _{en}	enable time	nOEBA to nAn; nOEAB to nBn; see Fig. 7 [2]				
		V _{CC} = 2.3 V to 2.7 V	1.0	-	5.4	ns
		V _{CC} = 2.7 V	1.0	-	5.3	ns
		V _{CC} = 3.0 V to 3.6 V	1.0	-	4.4	ns
t _{dis}	disable time	nOEBA to nAn; nOEAB to nBn; see Fig. 7 [2]				
		V _{CC} = 2.3 V to 2.7 V	1.0	-	5.3	ns
		V _{CC} = 2.7 V	1.4	-	4.4	ns
		V _{CC} = 3.0 V to 3.6 V	1.1	-	4.0	ns
t _w	pulse width	nCPAB; nCPBA; HIGH or LOW; see Fig. 5				
		V _{CC} = 2.3 V to 2.7 V	3.3	-	-	ns
		V _{CC} = 2.7 V	3.3	-	-	ns
		V _{CC} = 3.0 V to 3.6 V	3.3	-	-	ns
t _{su}	set-up time	nAn to nCPAB or nBn to nCPBA; see Fig. 6				
		V _{CC} = 2.3 V to 2.7 V	1.7	-	-	ns
		V _{CC} = 2.7 V	1.9	-	-	ns
		V _{CC} = 3.0 V to 3.6 V	1.5	-	-	ns
		nCEAB to nCPAB; nCEBA to nCPBA; see Fig. 6				
		V _{CC} = 2.3 V to 2.7 V	1.2	-	-	ns
		V _{CC} = 2.7 V	1.0	-	-	ns
		V _{CC} = 3.0 V to 3.6 V	1.0	-	-	ns

Symbol	Parameter	Conditions	-40 °C to +85 °C			Unit
			Min	Typ [1]	Max	
t _h	hold time	nAn to nCPAB or nBn to nCPBA; see Fig. 6				
		V _{CC} = 2.3 V to 2.7 V	0.6	-	-	ns
		V _{CC} = 2.7 V	0.6	-	-	ns
		V _{CC} = 3.0 V to 3.6 V	0.8	-	-	ns
		nCEAB to nCPAB; nCEBĀ to nCPBA; see Fig. 6				
		V _{CC} = 2.3 V to 2.7 V	1.1	-	-	ns
		V _{CC} = 2.7 V	0.9	-	-	ns
		V _{CC} = 3.0 V to 3.6 V	1.1	-	-	ns
f _{max}	maximum frequency	CP; see Fig. 5				
		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} [3]	-	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}; t_{en} is the same as t_{PZH} and t_{PZL}; t_{dis} is the same as t_{PHZ} and t_{PLZ}.
- [3] 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; $\sum (C_L \times V_{CC}^2 \times f_o)$ = sum of outputs.

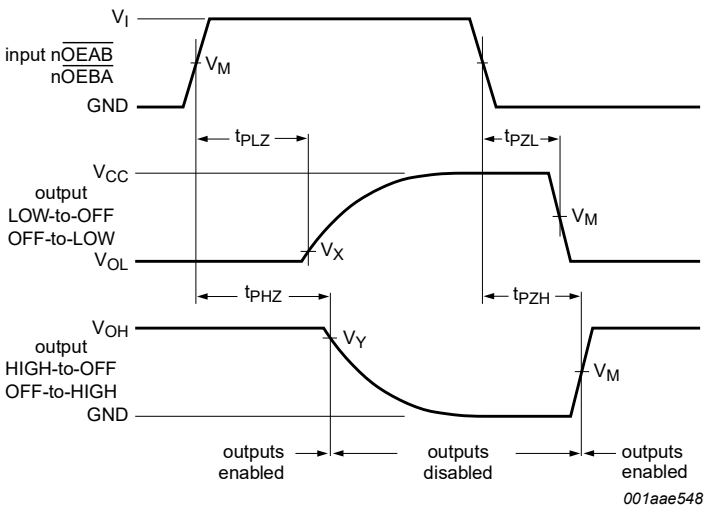
10.1. Waveforms and test circuit





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

Fig. 6. Setup and hold times

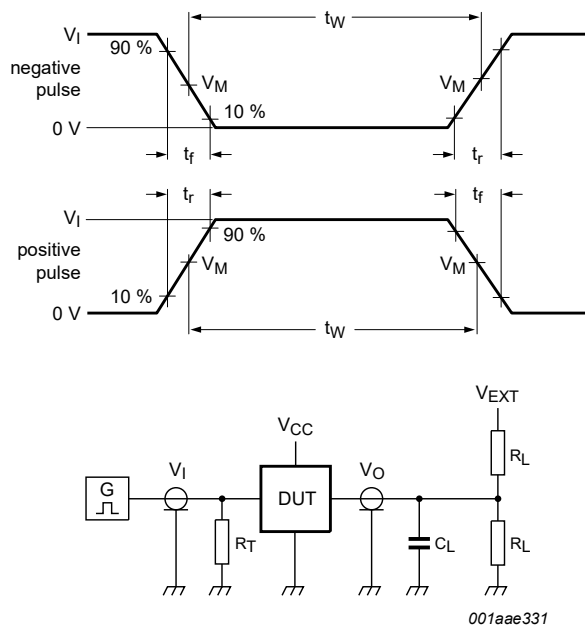


Measurements points are given in [Table 8](#).
 V_{OL} and V_{OH} are typical voltage output levels that occur with the output load.

Fig. 7. 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.

Fig. 8. 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 × V _{CC}	GND
2.7 V	2.7 V	2.5 ns	50 pF	500 Ω	open	2 × V _{CC}	GND
3.0 V to 3.6 V	2.7 V	2.5 ns	50 pF	500 Ω	open	2 × V _{CC}	GND

11. Package outline

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

SOT364-1

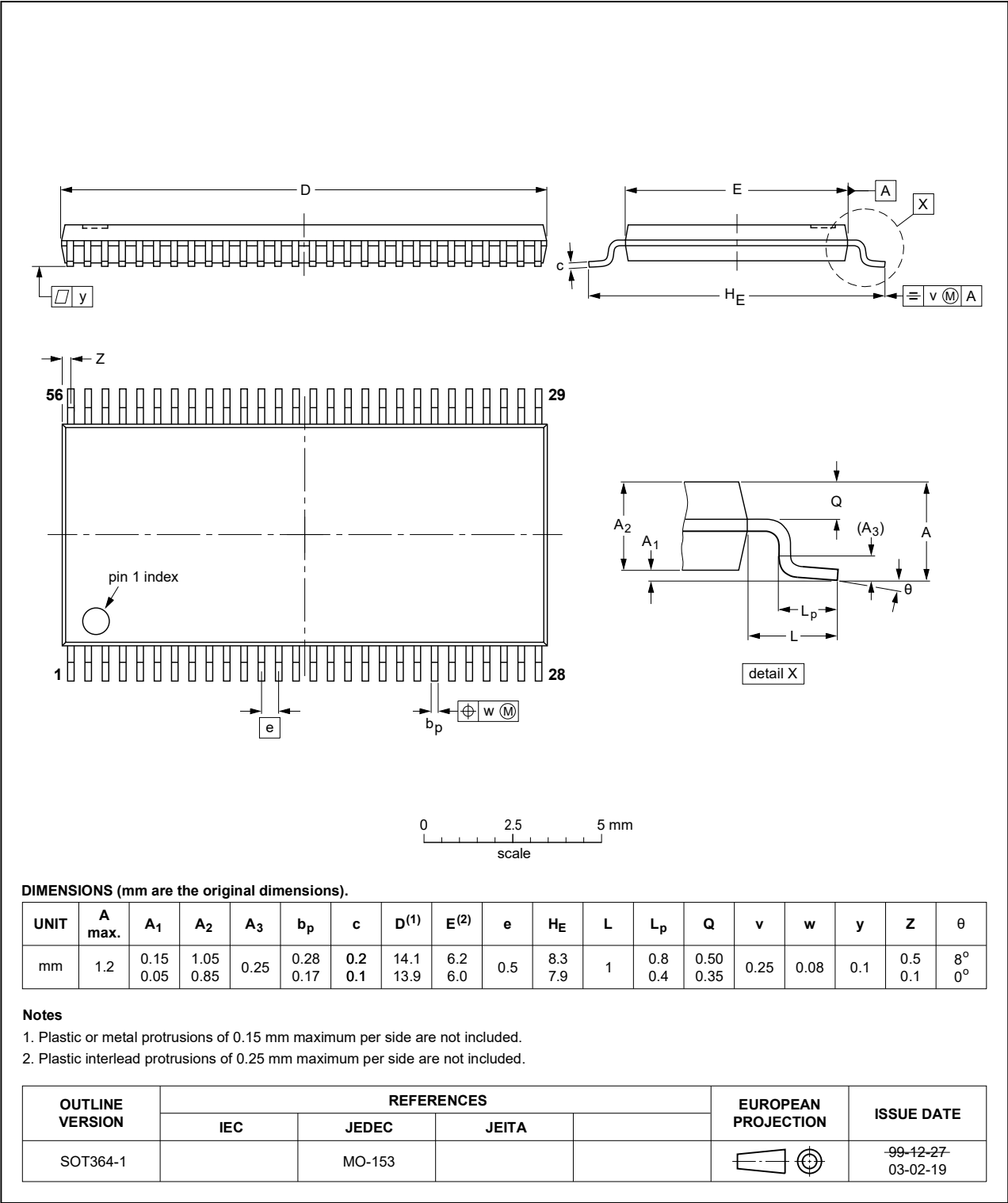


Fig. 9. Package outline SOT364-1 (TSSOP56)

12. Abbreviations

Table 10. Abbreviations

Acronym	Description
ANSI	American National Standards Institute
CDM	Charged Device Model
CMOS	Complementary Metal-Oxide Semiconductor
DUT	Device Under Test
ESD	ElectroStatic Discharge
ESDA	ElectroStatic Discharge Association
HBM	Human Body Model
JEDEC	Joint Electron Device Engineering Council
TTL	Transistor-Transistor Logic

13. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74ALVCH16952 v.4	20240710	Product data sheet	-	74ALVCH16952 v.3
Modifications:	<ul style="list-style-type: none">Section 2: ESD specification updated according to the latest JEDEC standard.Fig. 1: corrected pinnumber for 2A5.Table 4: P_{tot} total power dissipation updated.			
74ALVCH16952 v.3	20180109	Product data sheet	-	74ALVCH16952 v.2
Modifications:	<ul style="list-style-type: none">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:	<ul style="list-style-type: none">The format of this data sheet has been redesigned to comply with the new presentation and information standard of Philips SemiconductorsThe symbol of pin numbers 15, 16, 17, 19, 20, 21, 23 and 24 is rectified			
74ALVCH16952 v.1	19980901	Preliminary 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".
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Contents

1. General description..... 1

2. Features and benefits..... 1

3. Ordering information..... 1

4. Functional diagram..... 2

5. Pinning information..... 4

5.1. Pinning..... 4

5.2. Pin description..... 5

6. Functional description..... 5

7. Limiting values..... 5

8. Recommended operating conditions..... 6

9. Static characteristics..... 6

10. Dynamic characteristics..... 7

10.1. Waveforms and test circuit..... 8

11. Package outline..... 11

12. Abbreviations..... 12

13. Revision history..... 12

14. Legal information..... 13

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