



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 nOEB \bar{A}) is LOW. Data flow from A inputs to B outputs is the same as for B inputs to A outputs.

2. Features and benefits

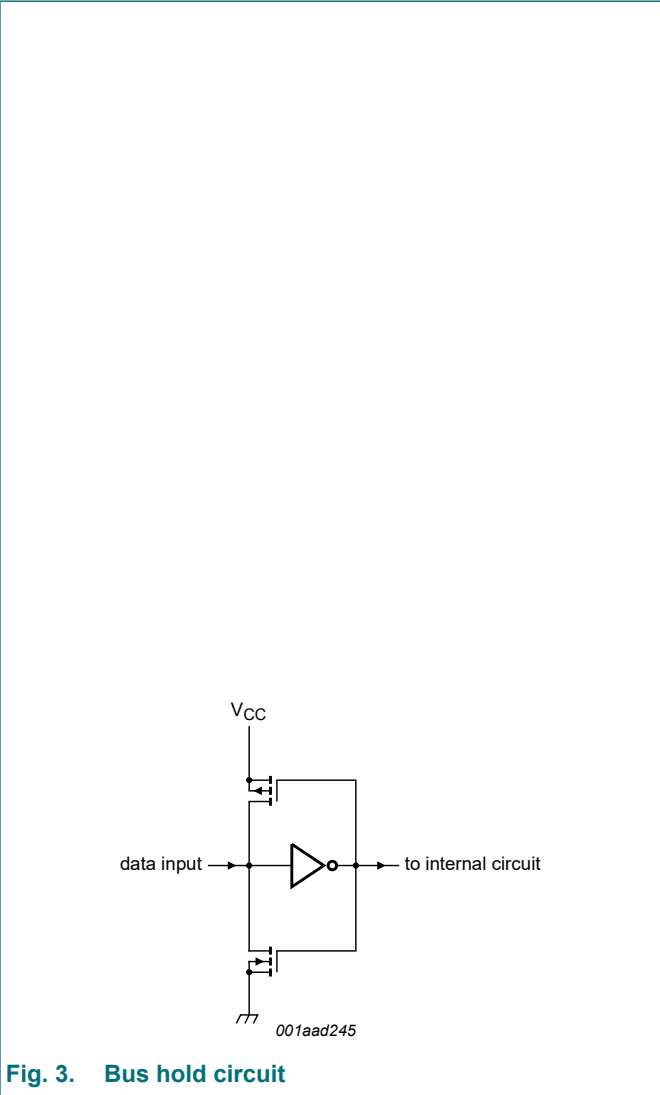
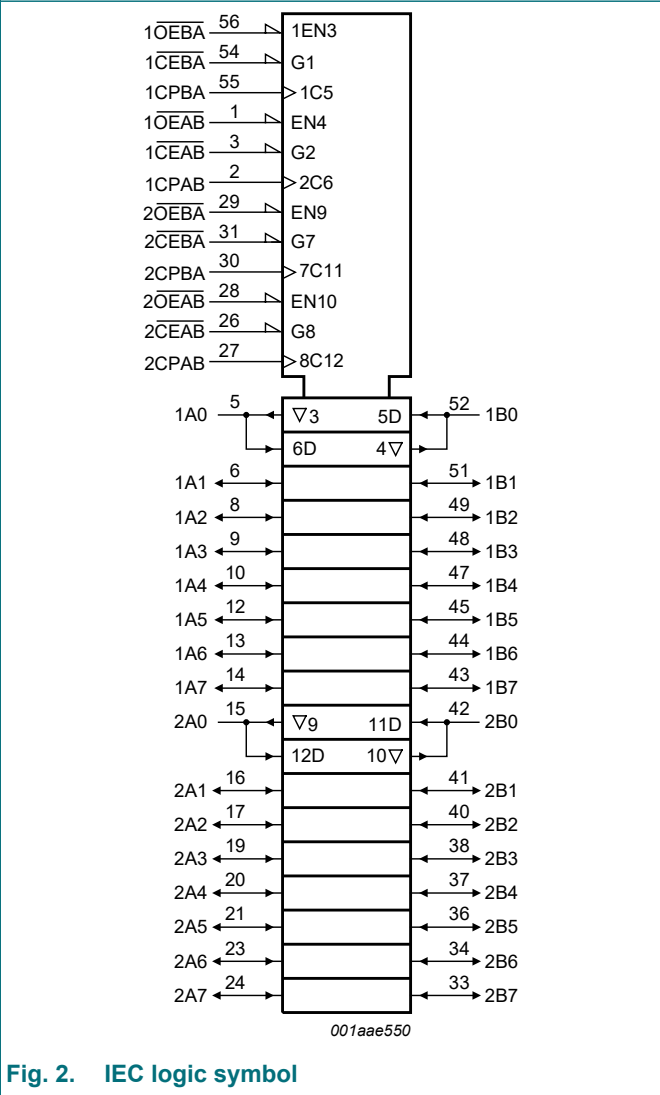
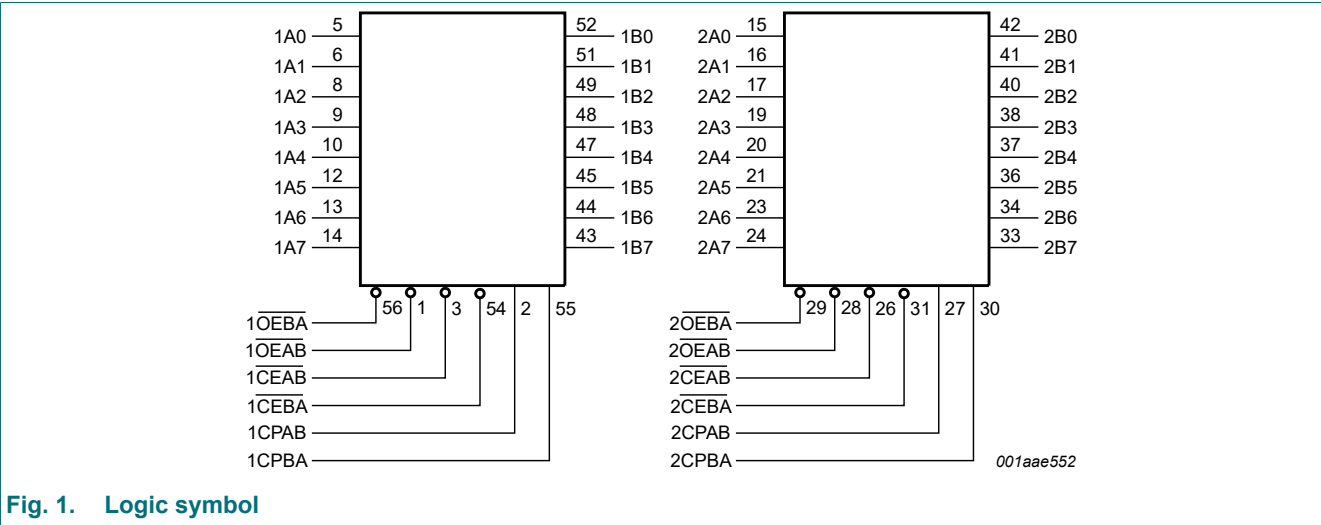
- CMOS low-power consumption
- MULTIBYTE™ flow-through pinout architecture
- Low inductance, multiple center power and ground pins for minimum noise and ground bounce
- Direct interface with TTL levels
- Output drive capability 50 Ω transmission lines at 85 °C
- Complies with JEDEC standard JESD8-B
-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



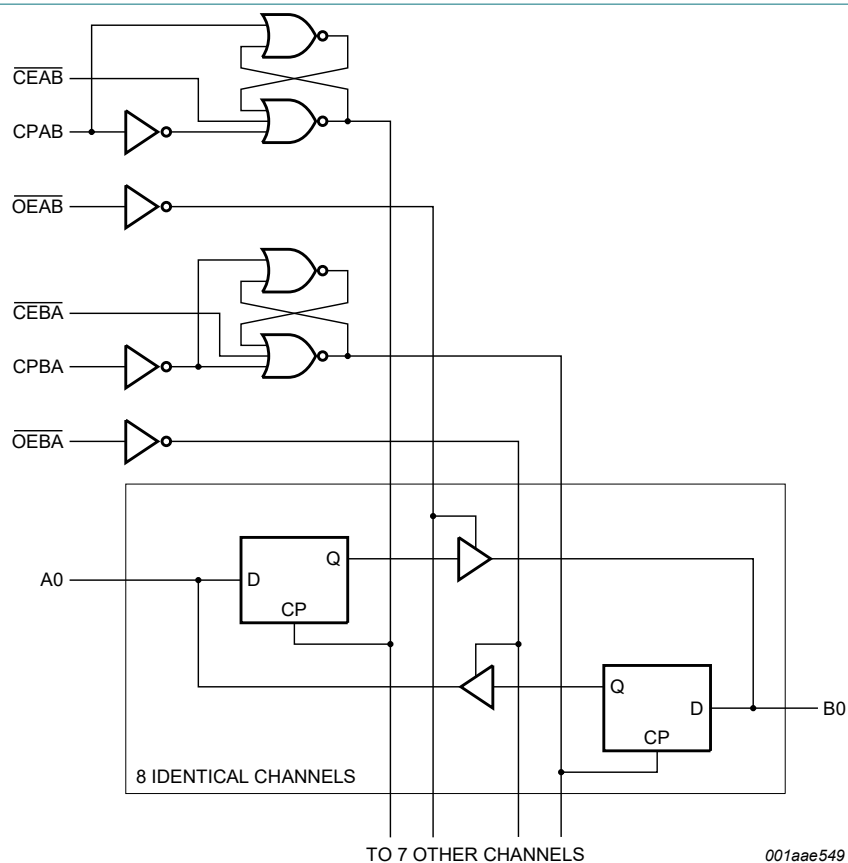
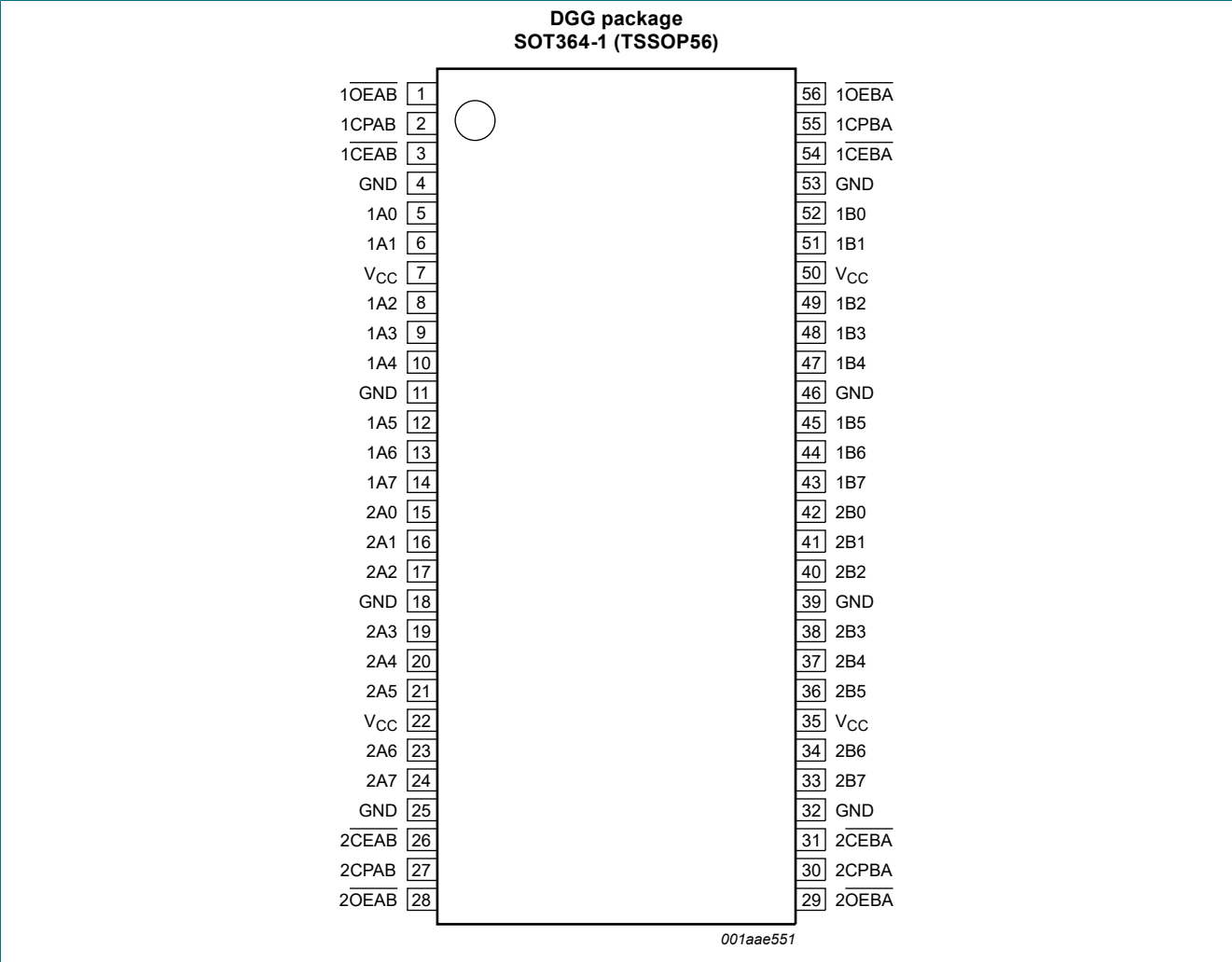


Fig. 4. Schematic diagram (one section)

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

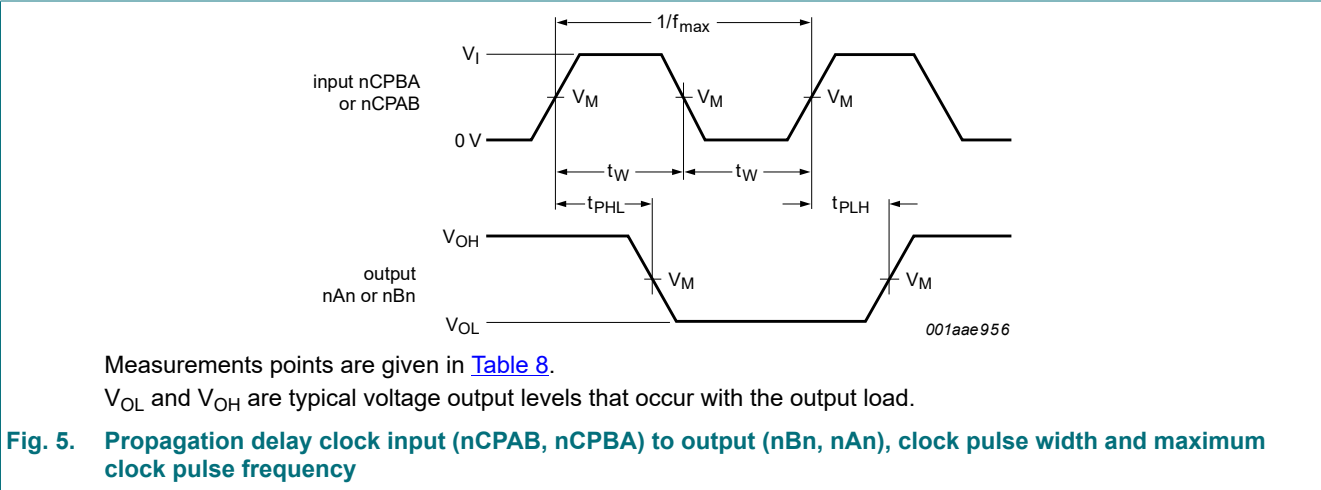
Voltages are referenced to GND (ground = 0 V). For test circuit, see Fig. 8.

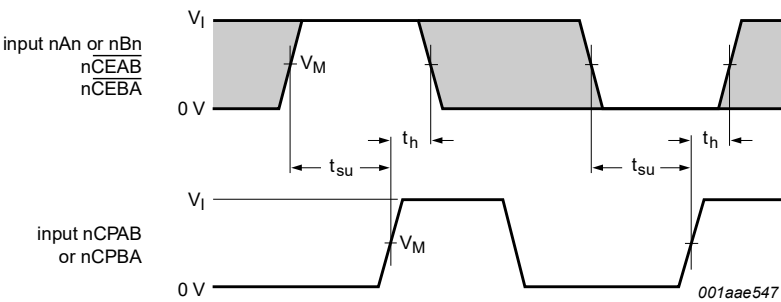
Symbol	Parameter	Conditions	-40 °C to +85 °C			Unit
			Min	Typ [1]	Max	
t _{pd}	propagation delay	nCPBA to nAn; nCPAB to nBn; see Fig. 5 [2]				
		V _{CC} = 2.3 V to 2.7 V	1.0	3.2	4.1	ns
		V _{CC} = 2.7 V	1.0	-	4.6	ns
		V _{CC} = 3.0 V to 3.6 V	1.0	3.2	3.9	ns
t _{en}	enable time	nOEBA to nAn; nOEAB to 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.

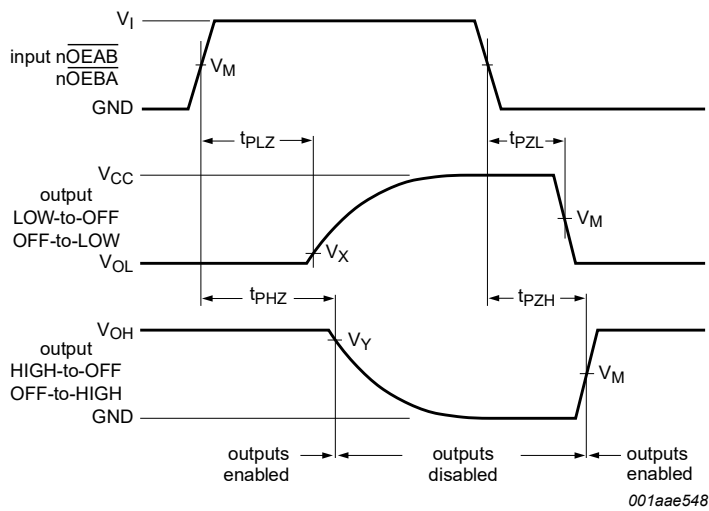
10.1. Waveforms and test circuit





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

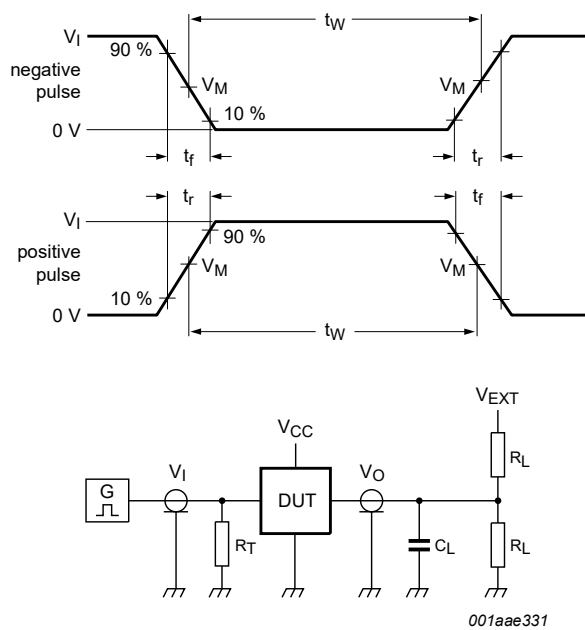


Measurements points are given in [Table 8](#).
 V_{OL} and V_{OH} are typical voltage output levels that occur with the output load.

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	$2 \times V_{CC}$	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

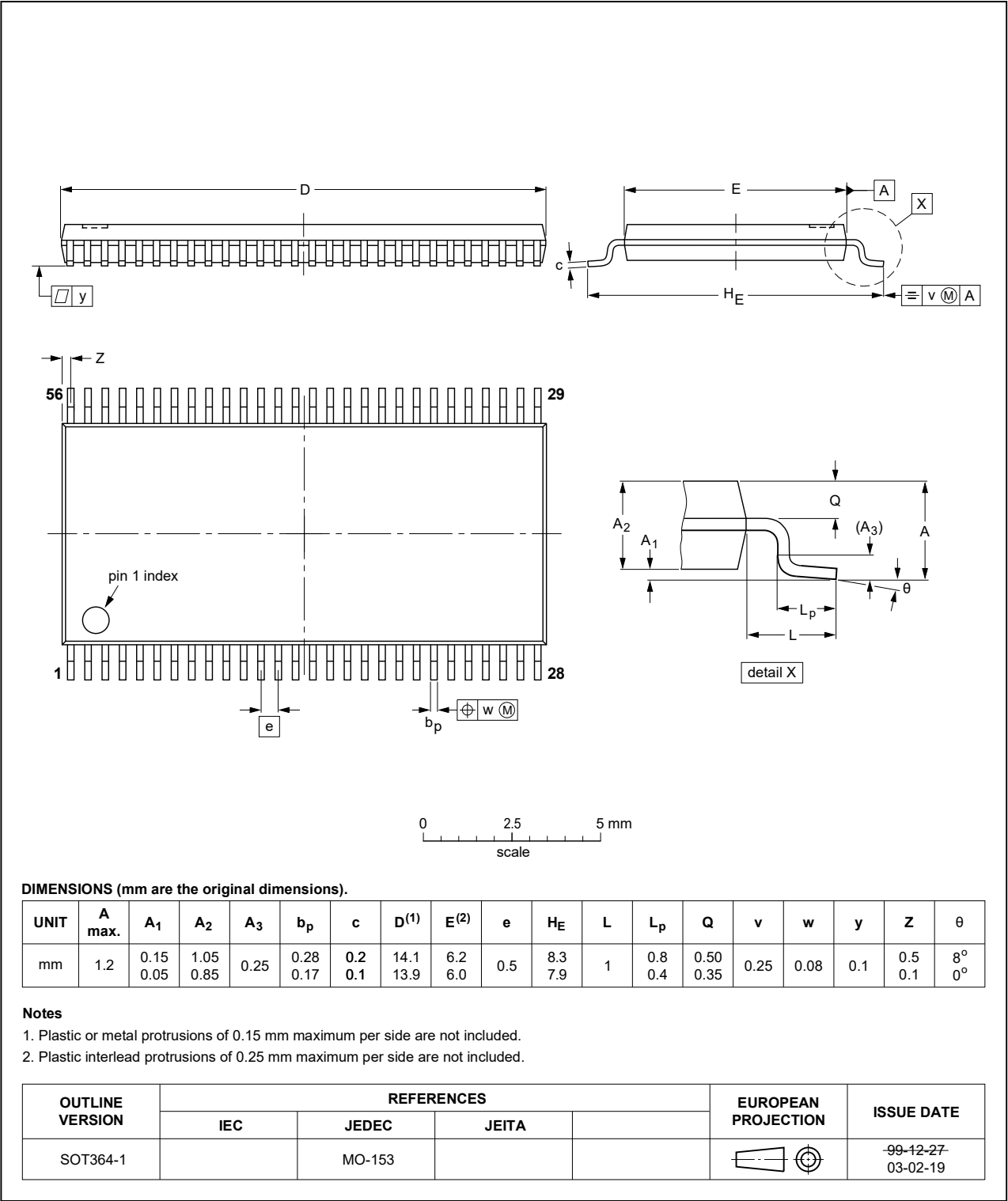


Fig. 9. Package outline SOT364-1 (TSSOP56)

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".
- [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>.

Definitions

Draft — The document is a draft version only. The content is still under internal review and subject to formal approval, which may result in modifications or additions. Nexperia does not give any representations or warranties as to the accuracy or completeness of information included herein and shall have no liability for the consequences of use of such information.

Short data sheet — A short data sheet is an extract from a full data sheet with the same product type number(s) and title. A short data sheet is intended for quick reference only and should not be relied upon to contain detailed and full information. For detailed and full information see the relevant full data sheet, which is available on request via the local Nexperia sales office. In case of any inconsistency or conflict with the short data sheet, the full data sheet shall prevail.

Product specification — The information and data provided in a Product data sheet shall define the specification of the product as agreed between Nexperia and its customer, unless Nexperia and customer have explicitly agreed otherwise in writing. In no event however, shall an agreement be valid in which the Nexperia product is deemed to offer functions and qualities beyond those described in the Product data sheet.

Disclaimers

Limited warranty and liability — Information in this document is believed to be accurate and reliable. However, Nexperia does not give any representations or warranties, expressed or implied, as to the accuracy or completeness of such information and shall have no liability for the consequences of use of such information. Nexperia takes no responsibility for the content in this document if provided by an information source outside of Nexperia.

In no event shall Nexperia be liable for any indirect, incidental, punitive, special or consequential damages (including - without limitation - lost profits, lost savings, business interruption, costs related to the removal or replacement of any products or rework charges) whether or not such damages are based on tort (including negligence), warranty, breach of contract or any other legal theory.

Notwithstanding any damages that customer might incur for any reason whatsoever, Nexperia's aggregate and cumulative liability towards customer for the products described herein shall be limited in accordance with the Terms and conditions of commercial sale of Nexperia.

Right to make changes — Nexperia reserves the right to make changes to information published in this document, including without limitation specifications and product descriptions, at any time and without notice. This document supersedes and replaces all information supplied prior to the publication hereof.

Suitability for use — Nexperia products are not designed, authorized or warranted to be suitable for use in life support, life-critical or safety-critical systems or equipment, nor in applications where failure or malfunction of an Nexperia product can reasonably be expected to result in personal

injury, death or severe property or environmental damage. Nexperia and its suppliers accept no liability for inclusion and/or use of Nexperia products in such equipment or applications and therefore such inclusion and/or use is at the customer's own risk.

Quick reference data — The Quick reference data is an extract of the product data given in the Limiting values and Characteristics sections of this document, and as such is not complete, exhaustive or legally binding.

Applications — Applications that are described herein for any of these products are for illustrative purposes only. Nexperia makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

Customers are responsible for the design and operation of their applications and products using Nexperia products, and Nexperia accepts no liability for any assistance with applications or customer product design. It is customer's sole responsibility to determine whether the Nexperia product is suitable and fit for the customer's applications and products planned, as well as for the planned application and use of customer's third party customer(s). Customers should provide appropriate design and operating safeguards to minimize the risks associated with their applications and products.

Nexperia does not accept any liability related to any default, damage, costs or problem which is based on any weakness or default in the customer's applications or products, or the application or use by customer's third party customer(s). Customer is responsible for doing all necessary testing for the customer's applications and products using Nexperia products in order to avoid a default of the applications and the products or of the application or use by customer's third party customer(s). Nexperia does not accept any liability in this respect.

Limiting values — Stress above one or more limiting values (as defined in the Absolute Maximum Ratings System of IEC 60134) will cause permanent damage to the device. Limiting values are stress ratings only and (proper) operation of the device at these or any other conditions above those given in the Recommended operating conditions section (if present) or the Characteristics sections of this document is not warranted. Constant or repeated exposure to limiting values will permanently and irreversibly affect the quality and reliability of the device.

Terms and conditions of commercial sale — Nexperia products are sold subject to the general terms and conditions of commercial sale, as published at <http://www.nexperia.com/profile/terms>, unless otherwise agreed in a valid written individual agreement. In case an individual agreement is concluded only the terms and conditions of the respective agreement shall apply. Nexperia hereby expressly objects to applying the customer's general terms and conditions with regard to the purchase of Nexperia products by customer.

No offer to sell or license — Nothing in this document may be interpreted or construed as an offer to sell products that is open for acceptance or the grant, conveyance or implication of any license under any copyrights, patents or other industrial or intellectual property rights.

Export control — This document as well as the item(s) described herein may be subject to export control regulations. Export might require a prior authorization from competent authorities.

Non-automotive qualified products — Unless this data sheet expressly states that this specific Nexperia product is automotive qualified, the product is not suitable for automotive use. It is neither qualified nor tested in accordance with automotive testing or application requirements. Nexperia accepts no liability for inclusion and/or use of non-automotive qualified products in automotive equipment or applications.

In the event that customer uses the product for design-in and use in automotive applications to automotive specifications and standards, customer (a) shall use the product without Nexperia's warranty of the product for such automotive applications, use and specifications, and (b) whenever customer uses the product for automotive applications beyond Nexperia's specifications such use shall be solely at customer's own risk, and (c) customer fully indemnifies Nexperia for any liability, damages or failed product claims resulting from customer design and use of the product for automotive applications beyond Nexperia's standard warranty and Nexperia's product specifications.

Translations — A non-English (translated) version of a document is for reference only. The English version shall prevail in case of any discrepancy between the translated and English versions.

Trademarks

Notice: All referenced brands, product names, service names and trademarks are the property of their respective owners.

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

© Nexperia B.V. 2024. All rights reserved

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

For sales office addresses, please send an email to: salesaddresses@nexperia.com

Date of release: 10 July 2024