

74ALVCH16600

18-bit universal bus transceiver; 3-state

Rev. 3 — 15 January 2018

Product data sheet

1 General description

The 74ALVCH16600 is an 18-bit universal transceiver featuring non-inverting 3-state bus compatible outputs in both send and receive directions. Data flow in each direction is controlled by output enable (\overline{OEAB} and \overline{OEBA}), latch enable (LEAB and LEBA), and clock (\overline{CPAB} and \overline{CPBA}) inputs. For A-to-B data flow, the device operates in the transparent mode when LEAB is HIGH. When LEAB is LOW, the A data is latched if \overline{CPAB} is held at a HIGH or LOW logic level. If LEAB is LOW, the A-bus data is stored in the flip-flop on the HIGH-to-LOW transition of \overline{CPAB} . When \overline{OEAB} is LOW, the outputs are active. When \overline{OEAB} is HIGH, the outputs are in the high-impedance state. The HIGH clock can be controlled with the clock-enable inputs (\overline{CEBA} and \overline{CEAB}).

Data flow for B-to-A is similar to that of A-to-B, but uses \overline{OEBA} , LEBA and \overline{CPBA} .

To ensure the high impedance state during power up or power down, \overline{OEBA} and \overline{OEAB} should be tied to V_{CC} through a pullup resistor; the minimum value of the resistor is determined by the current-sinking/current-sourcing capability of the driver.

Active bus hold circuitry is provided to hold unused or floating data inputs at a valid logic level.

2 Features and benefits

- CMOS low power consumption
- MultiByte flow-through standard pin-out architecture
- Low inductance multiple V_{CC} and GND pins for minimum noise and ground bounce
- Direct interface with TTL levels (2.7 V to 3.6 V)
- Bus hold on data inputs
- Output drive capability 50 Ω transmission lines at 85 °C
- Current drive ± 24 mA at 3.0 V
- Complies with JEDEC standards:
 - JESD8-5 (2.3 V to 2.7 V)
 - JESD8B/JESD36 (2.7 V to 3.6 V)
- ESD protection:
 - HBM ANSI/ESDA/JEDEC JS-001 exceeds 2000 V
 - CDM JESD22-C101E exceeds 1000 V

3 Ordering information

Table 1. Ordering information

Type number	Package			Version
	Temperature range	Name	Description	
74ALVCH16600DGG	-40 °C to +85 °C	TSSOP56	plastic thin shrink small outline package; 56 leads; body width 6.1 mm	SOT364-1

4 Functional diagram

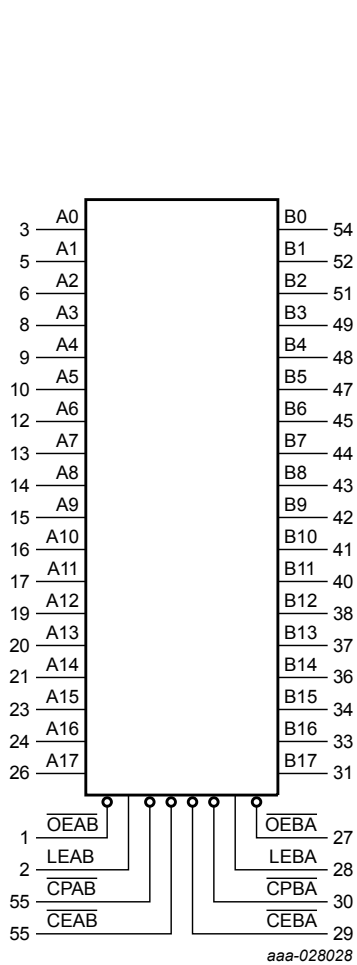


Figure 1. Logic symbol

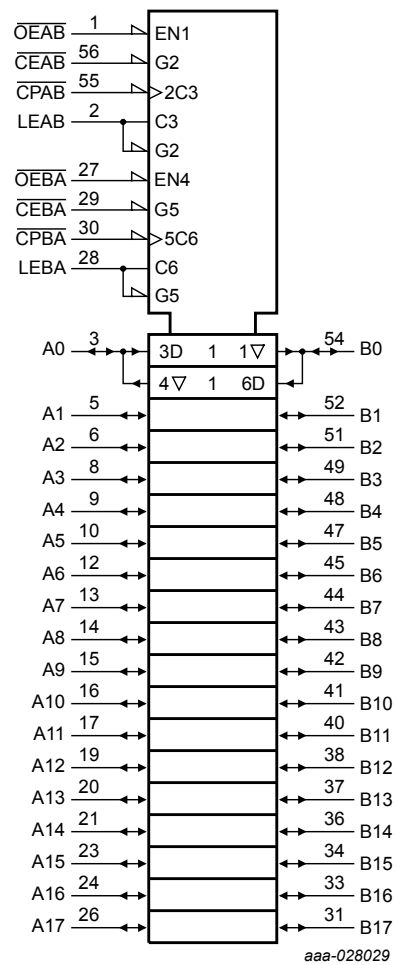


Figure 2. IEC logic symbol

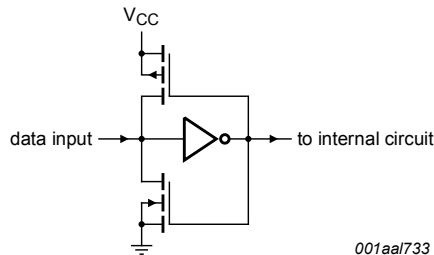
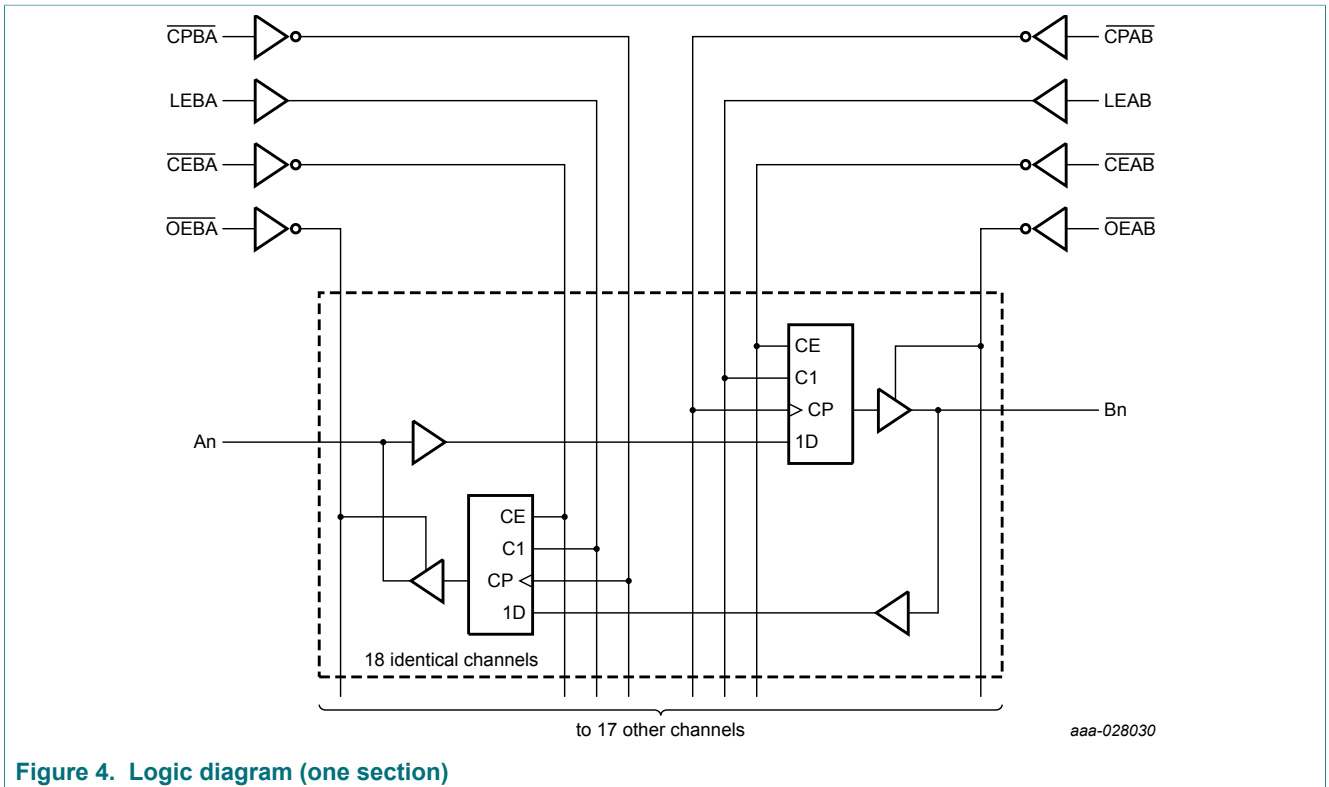


Figure 3. Bus hold circuit



5 Pinning information

5.1 Pinning

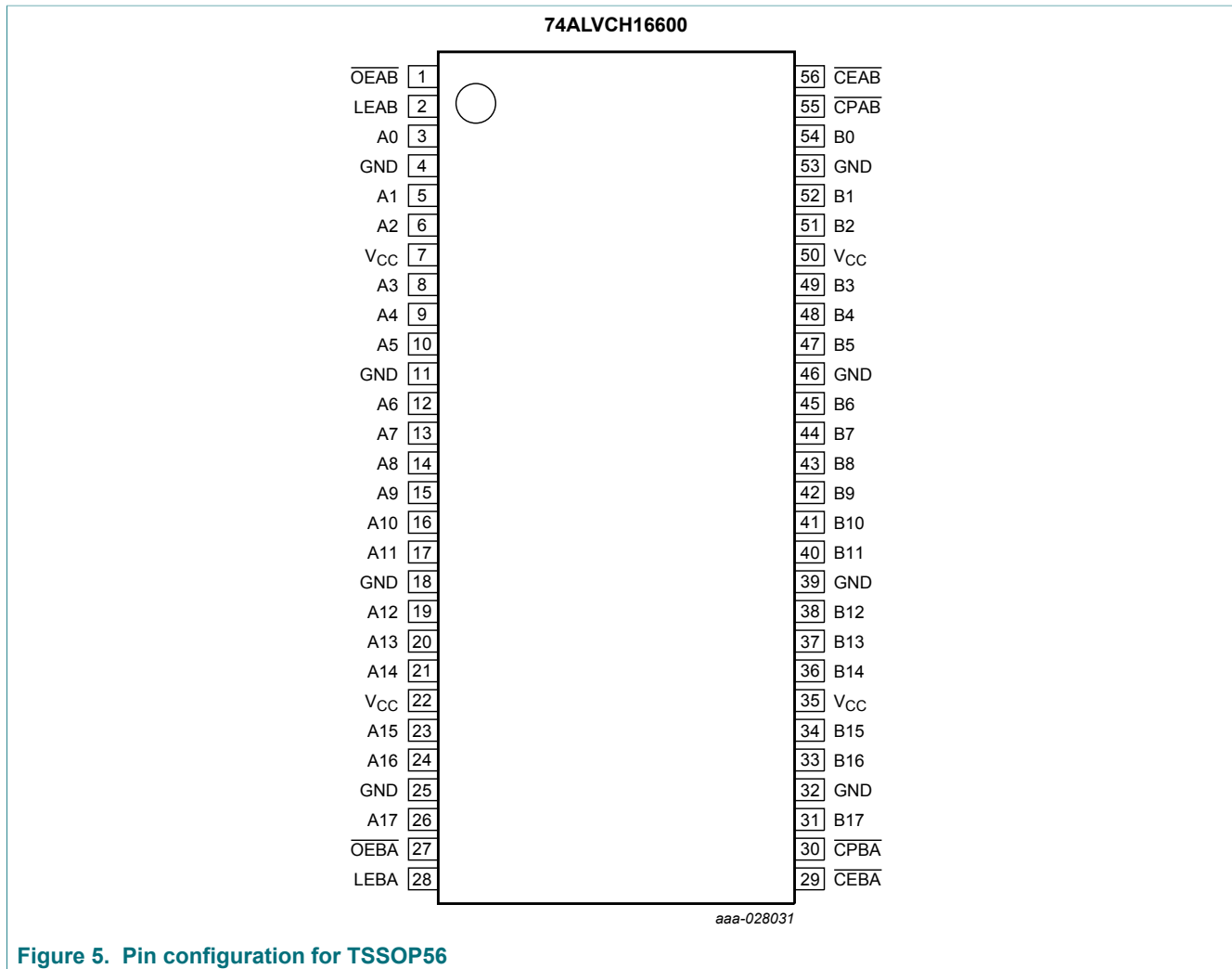


Figure 5. Pin configuration for TSSOP56

5.2 Pin description

Table 2. Pin description

Symbol	Pin	Description
A0, A1, A2, A3, A4, A5, A6, A7, A8, A9, A10, A11, A12, A13, A14, A15, A16, A17	3, 5, 6, 8, 9, 10, 12, 13, 14, 15, 16, 17, 19, 20, 21, 23, 24, 26	data inputs/outputs
B0, B1, B2, B3, B4, B5, B6, B7, B8, B9, B10, B11, B12, B13, B14, B15, B16, B17	54, 52, 51, 49, 48, 47, 45, 44, 43, 42, 41, 40, 38, 37, 36, 34, 33, 31	data outputs/inputs
\overline{OEAB} , \overline{OEBA}	1, 27	A to B / B to A output enable input (active LOW)
LEAB, LEBA	2, 28	A to B / B to A latch enable inputs (active HIGH)
\overline{CPBA} , \overline{CPAB}	30, 55	B to A / A to B clock inputs (active LOW)
\overline{CEBA} , \overline{CEAB}	29, 56	B to A / A to B clock enable inputs (active LOW)
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 selection ^[1] ^[2]

Operating mode	Inputs					Outputs
	\overline{CEAB}	\overline{OEAB}	LEAB	\overline{CPAB}	An	Bn
Disabled	X	H	X	X	X	Z
Transparent	X	L	H	X	H	H
	X	L	H	X	L	L
Hold	H	L	L	X	X	NC
Clock data & Display	L	L	L	↓	h	H
	L	L	L	↓	l	L
Hold data & Display	L	L	L	H	X	NC
	L	L	L	L	X	NC

[1] A-to-B data flow is shown; B-to-A flow is similar but uses \overline{CEBA} , \overline{OEBA} , LEBA, and \overline{CPBA} .

[2] H = HIGH voltage level;

h = HIGH voltage level one set-up time prior to the enable or clock transition;

L = LOW voltage level;

l = LOW voltage level one set-up time prior to the enable or clock transition;

X = don't care;

NC = no change

↓ = HIGH-to-LOW enable or clock transition;

Z = high-impedance OFF-state.

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	data inputs [1]	-0.5	$V_{CC} + 0.5$	V
		control inputs [1]	-0.5	+4.6	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 [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 packages: above 55 °C derate linearly with 8 mW/K.

8 Recommended operating conditions

Table 5. Recommended operating conditions

Symbol	Parameter	Conditions	Min	Max	Unit
V_{CC}	supply voltage	$V_{CC} = 2.5$ V: for maximum speed performance at $C_L = 30$ pF	2.3	2.7	V
		$V_{CC} = 3.3$ V: for maximum speed performance at $C_L = 50$ 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	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. $T_{amb} = -40\text{ °C}$ to $+85\text{ °C}$; Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	Min	Typ ^[1]	Max	Unit
V _{IH}	HIGH-level input voltage	V _{CC} = 2.3 to 2.7 V	1.7	1.2	-	V
		V _{CC} = 2.7 to 3.6 V	2.0	1.5	-	V
V _{IL}	LOW-level input voltage	V _{CC} = 2.3 to 2.7 V	-	1.2	0.7	V
		V _{CC} = 2.7 to 3.6 V	-	1.5	0.8	V
V _{OH}	HIGH-level output voltage	V _I = V _{IH} or V _{IL}				
		I _O = -100 μA; V _{CC} = 2.3 V to 3.6 V	V _{CC} - 0.2	V _{CC}	-	V
		I _O = -6 mA; V _{CC} = 2.3 V	V _{CC} - 0.3	V _{CC} - 0.08	-	V
		I _O = -12 mA; V _{CC} = 2.3 V	V _{CC} - 0.6	V _{CC} - 0.26	-	V
		I _O = -12 mA; V _{CC} = 2.7 V	V _{CC} - 0.5	V _{CC} - 0.14	-	V
		I _O = -12 mA; V _{CC} = 3.0 V	V _{CC} - 0.6	V _{CC} - 0.09	-	V
V _{OL}	LOW-level output voltage	V _I = V _{IH} or V _{IL}				
		I _O = 100 μA; V _{CC} = 2.3 V to 3.6 V	-	GND	0.20	V
		I _O = 6 mA; V _{CC} = 2.3 V	-	0.07	0.40	V
		I _O = 12 mA; V _{CC} = 2.3 V	-	0.15	0.70	V
		I _O = 12 mA; V _{CC} = 2.7 V	-	0.14	0.40	V
		I _O = 24 mA; V _{CC} = 3.0 V	-	0.27	0.55	V
I _I	input leakage current	V _I = V _{CC} or GND; V _{CC} = 2.3 V to 3.6 V	-	0.1	5	μA
I _{BHL}	bus hold LOW 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 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
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 to 3.6 V; V _I = V _{CC} or GND; I _O = 0 A	-	0.2	40	μA
ΔI _{CC}	additional supply current	V _I = V _{CC} - 0.6 V; I _O = 0 A; V _{CC} = 2.3 V to 3.6 V	-	150	750	μA
C _I	input capacitance		-	4.0	-	pF
C _{I/O}	input/output capacitance		-	8.0	-	pF

[1] All typical values are measured at $T_{amb} = 25\text{ °C}$.

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 10](#).

Symbol	Parameter	Conditions	Min	Typ ^[1]	Max	Unit
t_{pd}	propagation delay	An to Bn; Bn to An; Figure 6 ^[2]				
		$V_{CC} = 2.3\text{ V to }2.7\text{ V}$	1.0	3.1	5.2	ns
		$V_{CC} = 2.7\text{ V}$	-	3.1	4.7	ns
		$V_{CC} = 3.0\text{ V to }3.6\text{ V}$	1.0	2.8	4.2	ns
		LEAB to Bn; LEBA to An; Figure 7 ^[2]				
		$V_{CC} = 2.3\text{ V to }2.7\text{ V}$	1.0	3.6	6.2	ns
		$V_{CC} = 2.7\text{ V}$	-	3.4	5.5	ns
		$V_{CC} = 3.0\text{ V to }3.6\text{ V}$	1.0	3.1	4.9	ns
		\overline{CPAB} to Bn; \overline{CPBA} to An; Figure 7 ^[2]				
		$V_{CC} = 2.3\text{ V to }2.7\text{ V}$	1.0	3.8	7.3	ns
		$V_{CC} = 2.7\text{ V}$	-	3.8	6.8	ns
		$V_{CC} = 3.0\text{ V to }3.6\text{ V}$	1.3	2.9	5.7	ns
t_{en}	enable time	\overline{OEAB} to Bn; \overline{OEBA} to An; Figure 8 ^[2]				
		$V_{CC} = 2.3\text{ V to }2.7\text{ V}$	1.0	3.1	6.5	ns
		$V_{CC} = 2.7\text{ V}$	-	3.3	6.3	ns
		$V_{CC} = 3.0\text{ V to }3.6\text{ V}$	1.1	2.8	5.2	ns
t_{dis}	disable time	\overline{OEAB} to Bn; \overline{OEBA} to An; Figure 8 ^[2]				
		$V_{CC} = 2.3\text{ V to }2.7\text{ V}$	1.0	2.8	5.1	ns
		$V_{CC} = 2.7\text{ V}$	-	3.3	4.7	ns
		$V_{CC} = 3.0\text{ V to }3.6\text{ V}$	1.2	3.2	4.4	ns
t_w	pulse width	LEAB HIGH; LEBA HIGH; Figure 7				
		$V_{CC} = 2.3\text{ V to }2.7\text{ V}$	3.3	1.6	-	ns
		$V_{CC} = 2.7\text{ V}$	3.3	1.0	-	ns
		$V_{CC} = 3.0\text{ V to }3.6\text{ V}$	3.3	1.0	-	ns
		\overline{CPAB} HIGH or LOW; \overline{CPBA} HIGH or LOW; Figure 7				
		$V_{CC} = 2.3\text{ V to }2.7\text{ V}$	3.3	2.0	-	ns
		$V_{CC} = 2.7\text{ V}$	3.3	1.4	-	ns
		$V_{CC} = 3.0\text{ V to }3.6\text{ V}$	3.3	1.1	-	ns

Symbol	Parameter	Conditions	Min	Typ ^[1]	Max	Unit
t _{su}	set-up time	An to \overline{CPAB} ; Bn to \overline{CPBA} ; Figure 9				
		V _{CC} = 2.3 V to 2.7 V	1.3	-0.1	-	ns
		V _{CC} = 2.7 V	1.3	-0.4	-	ns
		V _{CC} = 3.0 V to 3.6 V	1.2	-0.1	-	ns
		An to LEAB; Bn to LEBA; Figure 9				
		V _{CC} = 2.3 V to 2.7 V	1.2	0.1	-	ns
		V _{CC} = 2.7 V	1.1	-0.2	-	ns
		V _{CC} = 3.0 V to 3.6 V	1.1	0.3	-	ns
		CEAB to \overline{CPAB} ; CEBA to \overline{CPBA} ; Figure 9				
		V _{CC} = 2.3 V to 2.7 V	0.7	-0.4	-	ns
		V _{CC} = 2.7 V	0.7	-0.7	-	ns
		V _{CC} = 3.0 V to 3.6 V	0.8	-0.2	-	ns
t _h	hold time	An to \overline{CPAB} ; Bn to \overline{CPBA} ; Figure 9				
		V _{CC} = 2.3 V to 2.7 V	1.5	0.6	-	ns
		V _{CC} = 2.7 V	1.8	0.4	-	ns
		V _{CC} = 3.0 V to 3.6 V	1.5	0.4	-	ns
		An to LEAB; Bn to LEBA; Figure 9				
		V _{CC} = 2.3 V to 2.7 V	1.2	0.6	-	ns
		V _{CC} = 2.7 V	1.6	0.1	-	ns
		V _{CC} = 3.0 V to 3.6 V	1.3	0.1	-	ns
		CEAB to \overline{CPAB} ; CEBA to \overline{CPBA} ; Figure 9				
		V _{CC} = 2.3 V to 2.7 V	1.4	2.0	-	ns
		V _{CC} = 2.7 V	1.7	0.6	-	ns
		V _{CC} = 3.0 V to 3.6 V	1.4	0.4	-	ns
f _{max}	maximum frequency	\overline{CPAB} , \overline{CPBA} ; Figure 7				
		V _{CC} = 2.3 V to 2.7 V	150	335	-	MHz
		V _{CC} = 2.7 V	150	350	-	MHz
		V _{CC} = 3.0 V to 3.6 V	150	362	-	MHz
C _{PD}	power dissipation capacitance	per latch; V _I = GND to V _{CC} ^[3]				
		output enabled	-	21	-	pF
		output disabled	-	3	-	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;

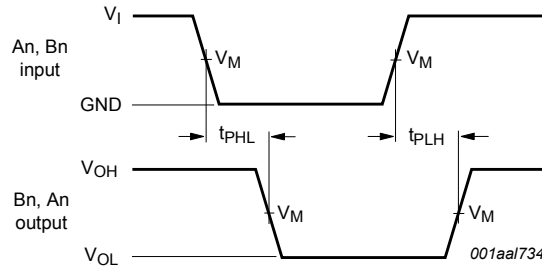
C_L = output load capacitance in pF;

V_{CC} = supply voltage in V;

N = number of inputs switching;

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

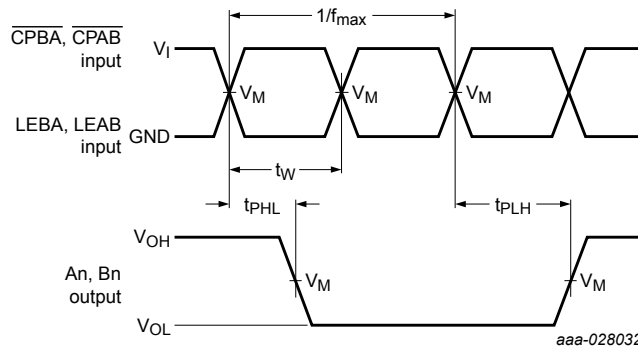
10.1 Waveforms and test circuit



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

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

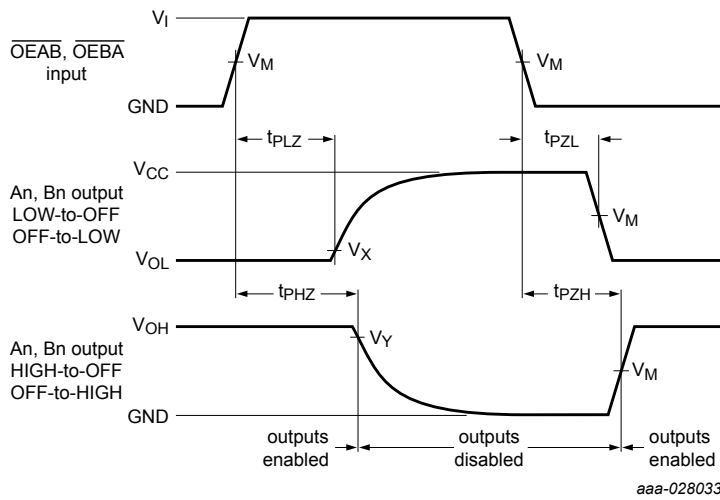
Figure 6. The input An, Bn to output Bn, An propagation delay times.



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

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

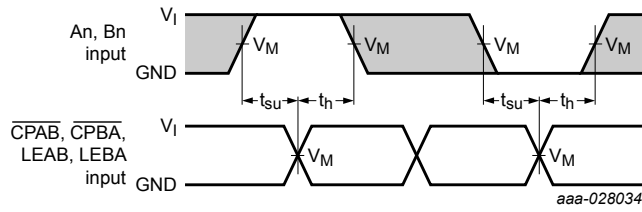
Figure 7. Latch enable input LEAB, LEBA and clock input CPAB, CPBA to output Bn, An propagation delay times; pulse width and f_{max} of CPAB and CPBA



Measurement 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 times.



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

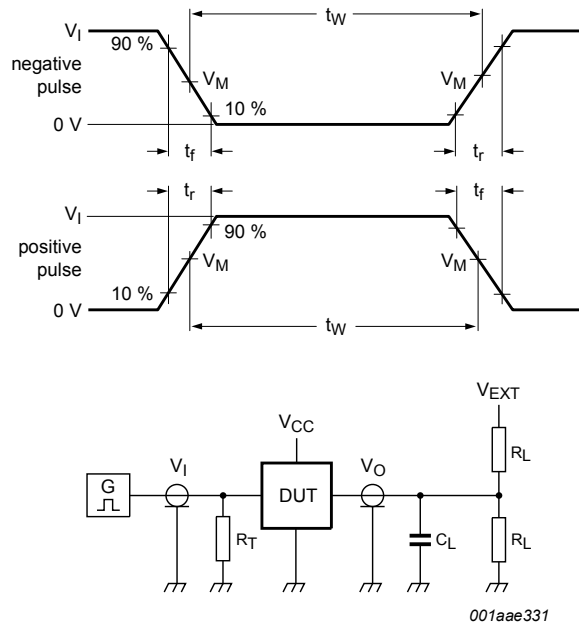
The shaded areas indicate when the input is permitted to change for predictable output performance.

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

Figure 9. Data set-up and hold times for An and Bn inputs to LEAB, LEBA, CPAB or CPBA inputs.

Table 8. Measurement points

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



Test data is given in [Table 9](#).

Definitions for test circuit:

R_L = Load resistance.

C_L = Load capacitance including jig and probe capacitance.

R_T = Termination resistance should be equal to output impedance Z_o of the pulse generator.

V_{EXT} = External voltage for measuring switching times.

Figure 10. Test circuit for measuring switching times

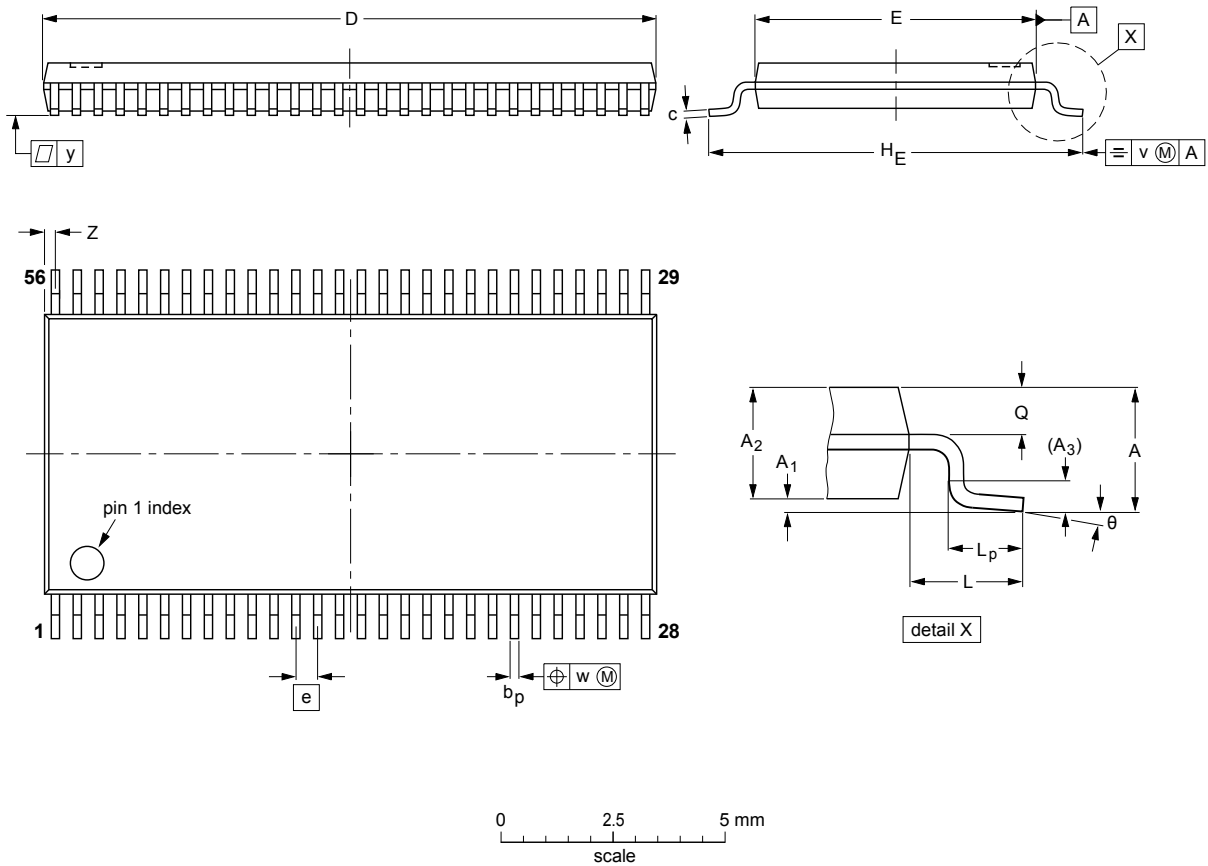
Table 9. Test data

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 11. Package outline SOT364-1 (TSSOP56)

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
TTL	Transistor-Transistor Logic

13 Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74ALVCH16600 v.3	20180115	Product data sheet	-	74ALVCH16600 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. 			
74ALVCH16600 v.2	19980924	Product specification	-	74ALVCH16600 v.1
74ALVCH16600 v.1	19980801	Product specification	-	-

14 Legal information

14.1 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 URL <http://www.nexperia.com>.

14.2 Definitions

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