



74ALVCH16601

18-bit universal bus transceiver; 3-state

Rev. 4 — 5 July 2024

Product data sheet

1. General description

The 74ALVCH16601 is an 18-bit universal transceiver with bus hold inputs and 3-state outputs. Data flow in each direction is controlled by output enable ($\overline{OEAB}$ and $\overline{OEBA}$), latch enable (LEAB and LEBA), clock enable ($\overline{CEAB}$ and $\overline{CEBA}$) and clock (CPAB and 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 CPAB is held at a HIGH or LOW logic level. If LEAB and $\overline{CEAB}$ are LOW, the A-bus data is stored in the latch/flip-flop on the LOW-to-HIGH transition of CPAB. When OEAB is HIGH, the outputs are active. When OEAB is LOW, the outputs are in the high-impedance state. Data flow for B-to-A is similar to that of A-to-B but uses $\overline{OEBA}$, LEBA, $\overline{CEBA}$ and CPBA. This device is fully specified for partial power down applications using I_{OFF} . The I_{OFF} circuitry disables the output, preventing the potentially damaging backflow current through the device when it is powered down.

2. Features and benefits

- Wide supply voltage range from 1.65 V to 3.6 V
- CMOS low power dissipation
- 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
- Bus hold on data inputs
- Output drive capability 50 Ω transmission lines at 85 °C
- Current drive ± 24 mA at 3.0 V
- Latch-up performance exceeds 100 mA per JESD 78 Class II Level B
- Complies with JEDEC standards:
 - JESD8-7 (1.65 V to 1.95 V)
 - JESD8-5 (2.3 V to 2.7 V)
 - JESD8C (2.7 V to 3.6 V)
- 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
74ALVCH16601DGG	-40 °C to +85 °C	TSSOP56	plastic thin shrink small outline package; 56 leads; body width 6.1 mm	SOT364-1

4. Functional diagram

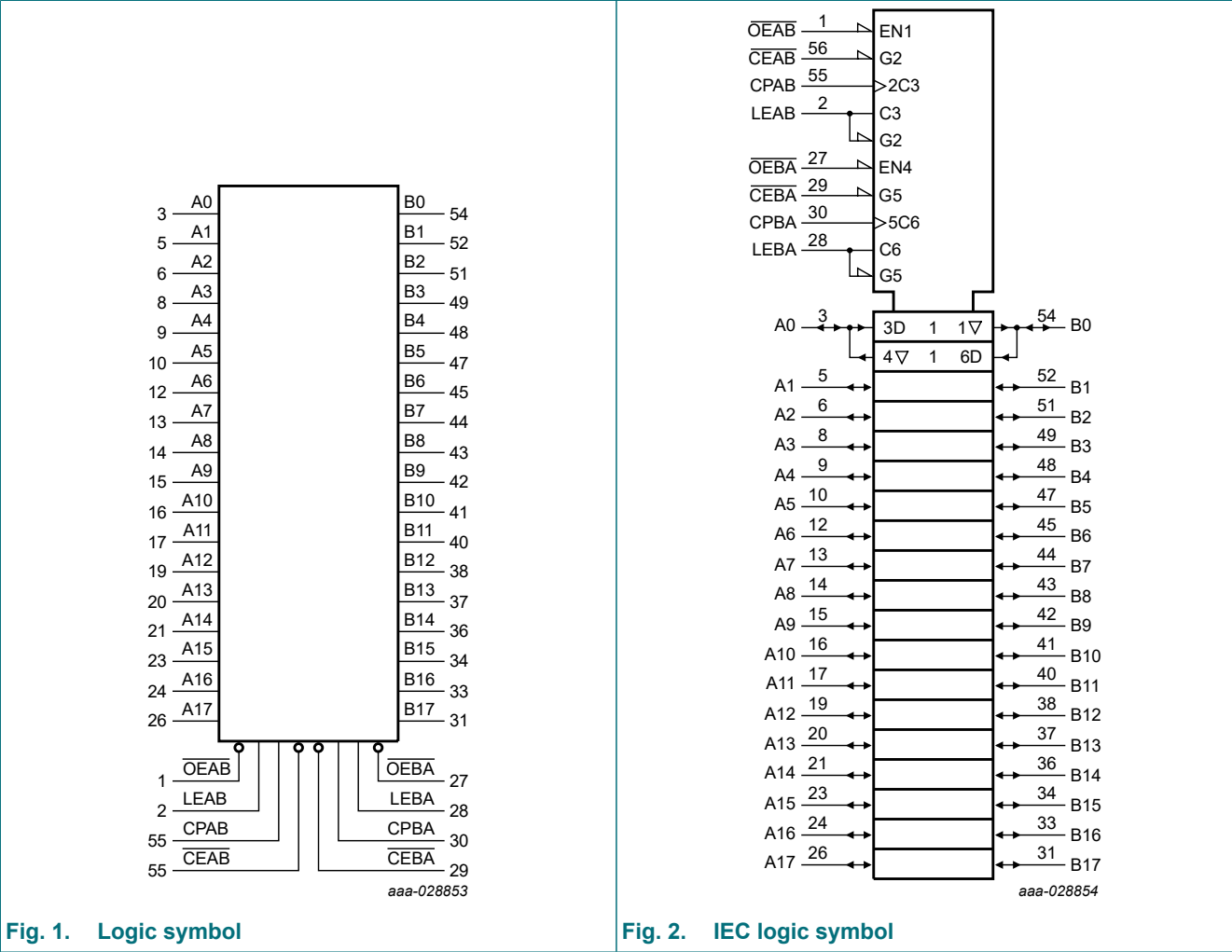


Fig. 1. Logic symbol

Fig. 2. IEC logic symbol

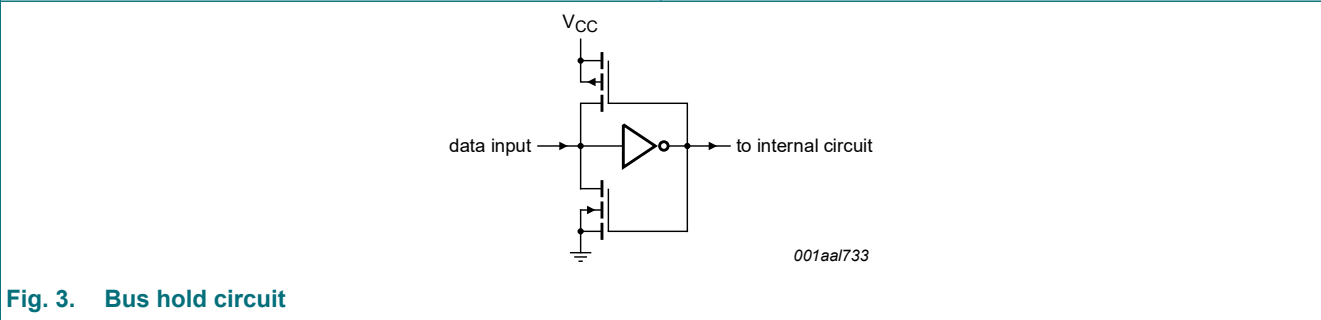
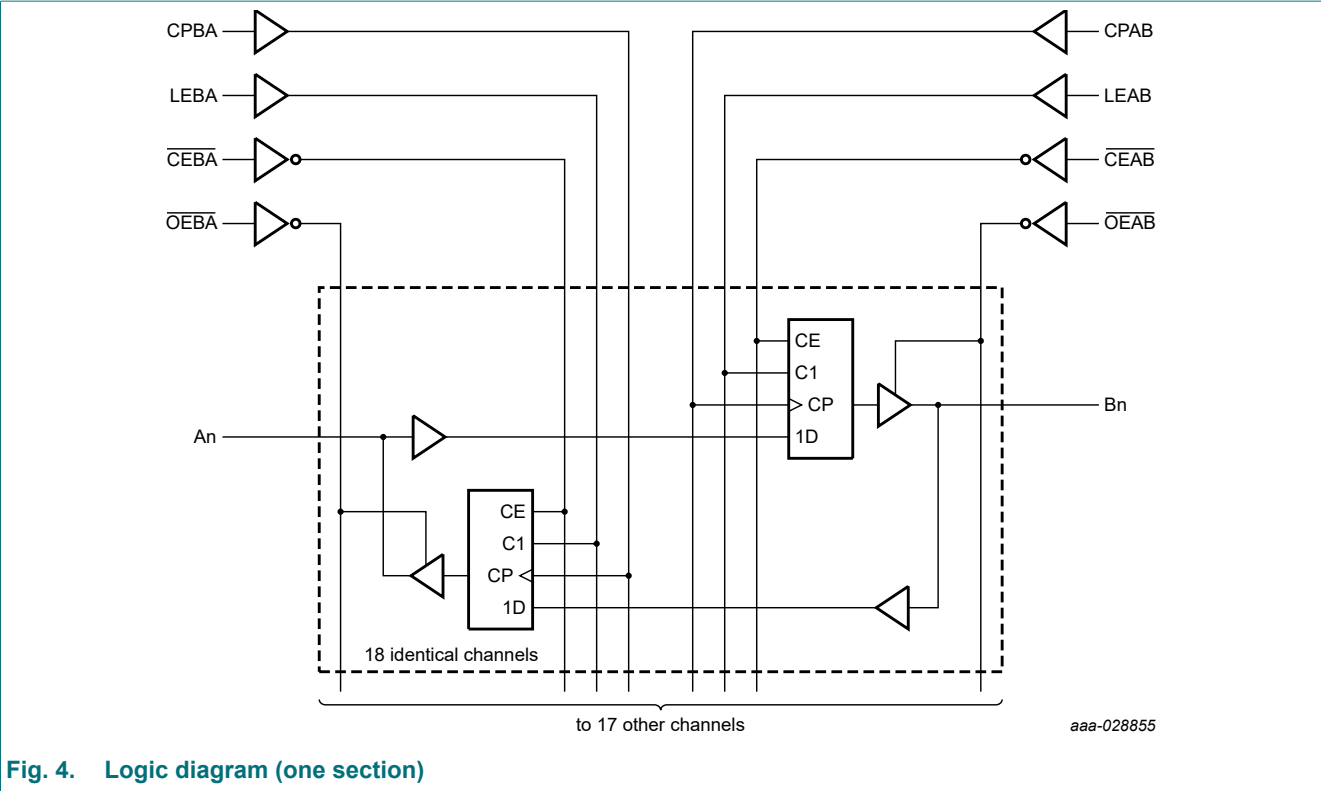
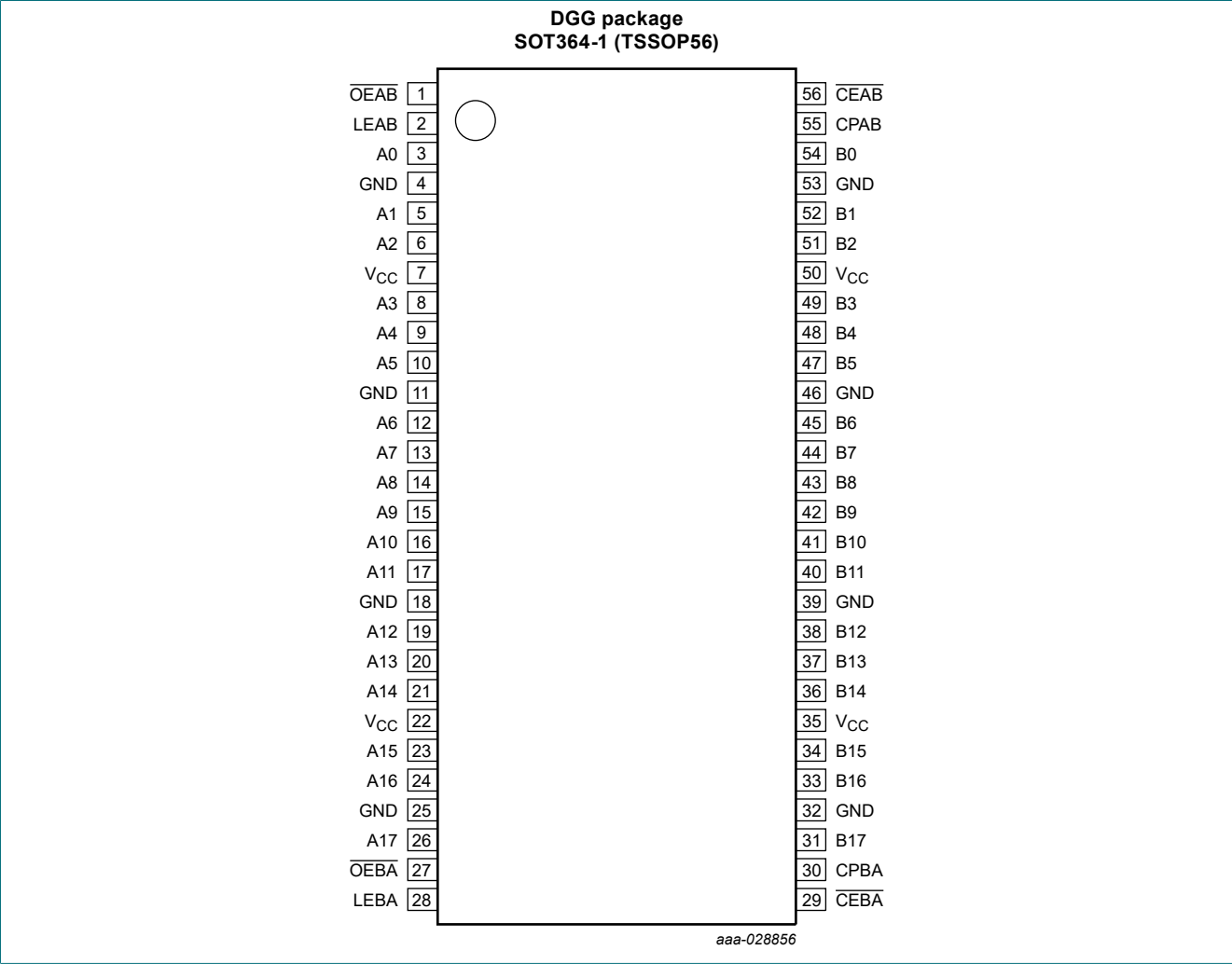


Fig. 3. Bus hold circuit



5. Pinning information

5.1. Pinning



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
OEAB, OEBA	1, 27	A to B / B to A output enable inputs (active LOW)
LEAB, LEBA	2, 28	A to B / B to A latch enable inputs (active HIGH)
CPBA, CPAB	30, 55	B to A / A to B clock inputs (active HIGH)
CEBA, 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

A-to-B data flow is shown; B-to-A flow is similar but uses $\overline{CEBA}$, $\overline{OEBA}$, LEBA, and CPBA.
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; ↑ = LOW-to-HIGH enable or clock transition; Z = high-impedance OFF-state.

Operating mode	Inputs					Outputs
	CEAB	OEAB	LEAB	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

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 (sink/source)}	output sink or source 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	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
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 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
		I _O = -24 mA; V _{CC} = 3.0 V	V _{CC} - 1.0	V _{CC} - 0.28	-	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 °C.

10. Dynamic characteristics

Table 7. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V); for test circuit, see Fig. 9.

Symbol	Parameter	Conditions	−40 °C to +85 °C			Unit
			Min	Typ [1]	Max	
t _{pd}	propagation delay	An to Bn; Bn to An; Fig. 5 [2]				
		V _{CC} = 2.3 V to 2.7 V	1.0	3.1	5.2	ns
		V _{CC} = 2.7 V	-	3.1	4.7	ns
		V _{CC} = 3.0 V to 3.6 V	1.0	2.8	4.2	ns
		LEAB to Bn; LEBA to An; Fig. 6 [2]				
		V _{CC} = 2.3 V to 2.7 V	1.0	3.6	6.2	ns
		V _{CC} = 2.7 V	-	3.4	5.4	ns
		V _{CC} = 3.0 V to 3.6 V	1.0	3.1	4.9	ns
		CPAB to Bn; CPBA to An; Fig. 6 [2]				
		V _{CC} = 2.3 V to 2.7 V	1.0	3.4	5.9	ns
		V _{CC} = 2.7 V	-	3.5	5.8	ns
		V _{CC} = 3.0 V to 3.6 V	1.3	3.1	5.0	ns
t _{en}	enable time	OEAB to Bn; OEBA to An; Fig. 7 [2]				
		V _{CC} = 2.3 V to 2.7 V	1.1	3.1	5.3	ns
		V _{CC} = 2.7 V	-	3.3	6.1	ns
		V _{CC} = 3.0 V to 3.6 V	1.1	2.8	5.2	ns
t _{dis}	disable time	OEAB to Bn; OEBA to An; Fig. 7 [2]				
		V _{CC} = 2.3 V to 2.7 V	1.4	2.8	4.9	ns
		V _{CC} = 2.7 V	-	3.3	4.8	ns
		V _{CC} = 3.0 V to 3.6 V	1.2	3.2	4.4	ns
t _{su}	set-up time	An to CPAB; Bn to CPBA; Fig. 8				
		V _{CC} = 2.3 V to 2.7 V	2.3	−0.2	-	ns
		V _{CC} = 2.7 V	2.4	0.0	-	ns
		V _{CC} = 3.0 V to 3.6 V	2.1	−0.2	-	ns
		An to LEAB; Bn to LEBA; Fig. 8				
		V _{CC} = 2.3 V to 2.7 V	1.3	0.1	-	ns
		V _{CC} = 2.7 V	1.2	−0.2	-	ns
		V _{CC} = 3.0 V to 3.6 V	1.1	0.3	-	ns
		CEAB to CPAB; CEBA to CPBA;				
		V _{CC} = 2.3 V to 2.7 V	2.0	−0.4	-	ns
		V _{CC} = 2.7 V	2.0	−0.7	-	ns
		V _{CC} = 3.0 V to 3.6 V	1.7	−0.2	-	ns

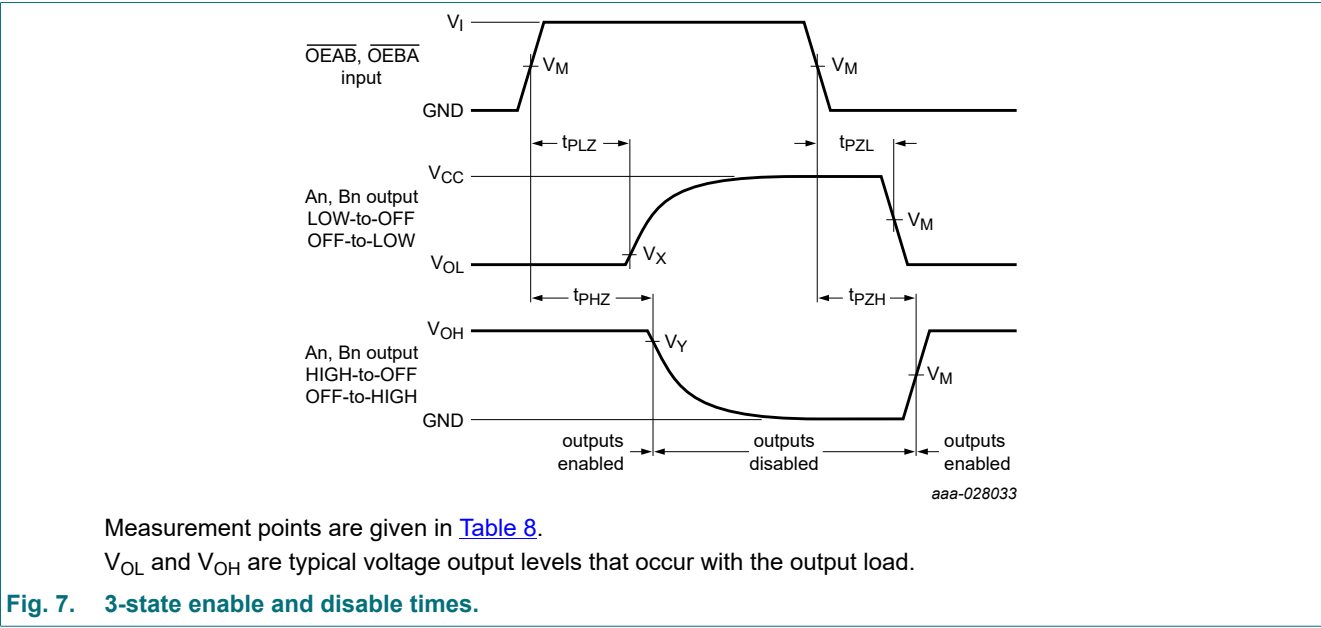
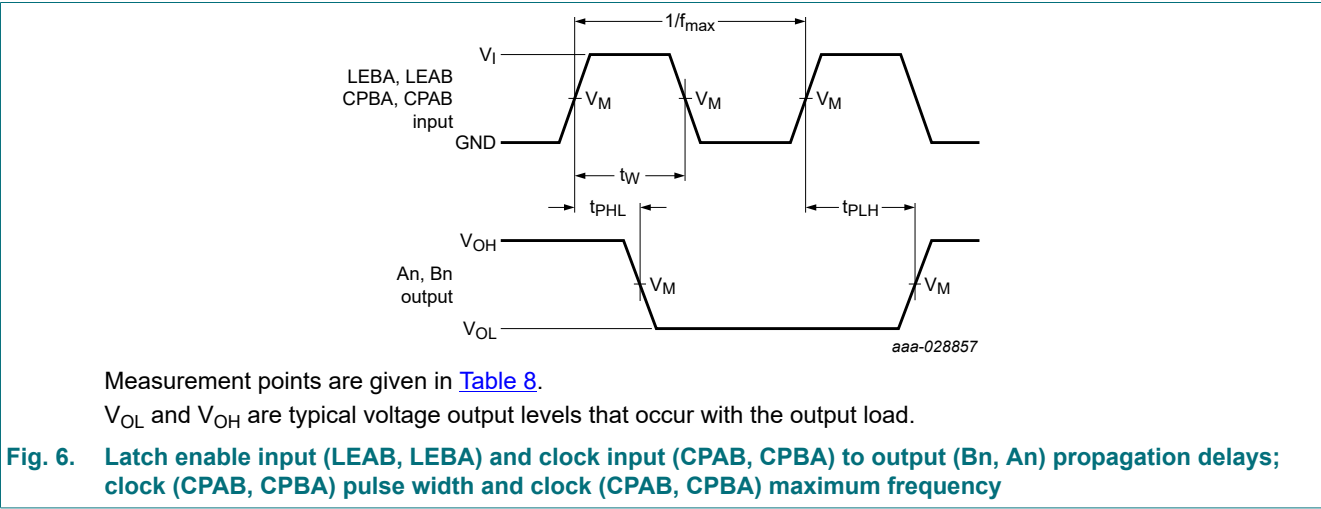
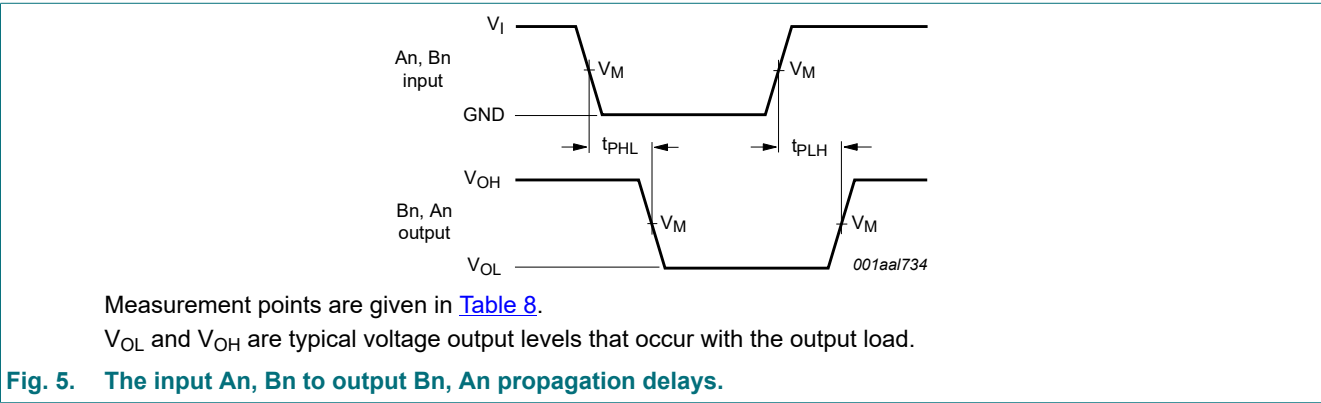
Symbol	Parameter	Conditions	−40 °C to +85 °C			Unit
			Min	Typ [1]	Max	
t _h	hold time	An to CPAB; Bn to CPBA; Fig. 8				
		V _{CC} = 2.3 V to 2.7 V	1.2	0.3	-	ns
		V _{CC} = 2.7 V	1.1	0.3	-	ns
		V _{CC} = 3.0 V to 3.6 V	1.0	−0.1	-	ns
		An to LEAB; Bn to LEBA; Fig. 8				
		V _{CC} = 2.3 V to 2.7 V	1.3	0.2	-	ns
		V _{CC} = 2.7 V	1.6	0.1	-	ns
		V _{CC} = 3.0 V to 3.6 V	1.4	0.1	-	ns
		CEAB to CPAB; CEBA to CPBA;				
		V _{CC} = 2.3 V to 2.7 V	1.1	0.4	-	ns
		V _{CC} = 2.7 V	1.2	0.6	-	ns
		V _{CC} = 3.0 V to 3.6 V	1.1	0.4	-	ns
t _w	pulse width	LEAB HIGH; LEBA HIGH; Fig. 6				
		V _{CC} = 2.3 V to 2.7 V	3.3	1.6	-	ns
		V _{CC} = 2.7 V	3.3	0.7	-	ns
		V _{CC} = 3.0 V to 3.6 V	3.3	0.9	-	ns
		CPAB HIGH or LOW; CPBA HIGH or LOW; Fig. 6				
		V _{CC} = 2.3 V to 2.7 V	3.3	2.0	-	ns
		V _{CC} = 2.7 V	3.3	1.2	-	ns
		V _{CC} = 3.0 V to 3.6 V	3.3	0.9	-	ns
f _{max}	maximum frequency	CPAB, CPBA; Fig. 6				
		V _{CC} = 2.3 V to 2.7 V	150	390	-	MHz
		V _{CC} = 2.7 V	150	333	-	MHz
		V _{CC} = 3.0 V to 3.6 V	150	340	-	MHz
C _{PD}	power dissipation capacitance	per latch; V _I = GND to V _{CC} [3]				
		outputs enabled	-	21	-	pF
		outputs 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} × V_{CC}² × f_i × N + Σ(C_L × V_{CC}² × 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



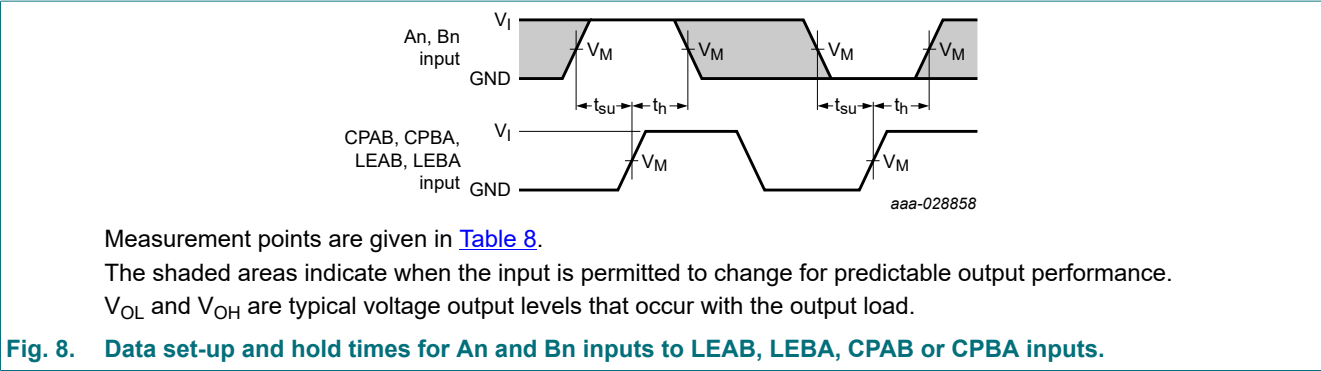


Table 8. Measurement points

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}	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$	$V_{OL} + 0.15 \text{ V}$	$V_{OH} - 0.15 \text{ V}$
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	$V_{OL} + 0.3 \text{ V}$	$V_{OH} - 0.3 \text{ V}$

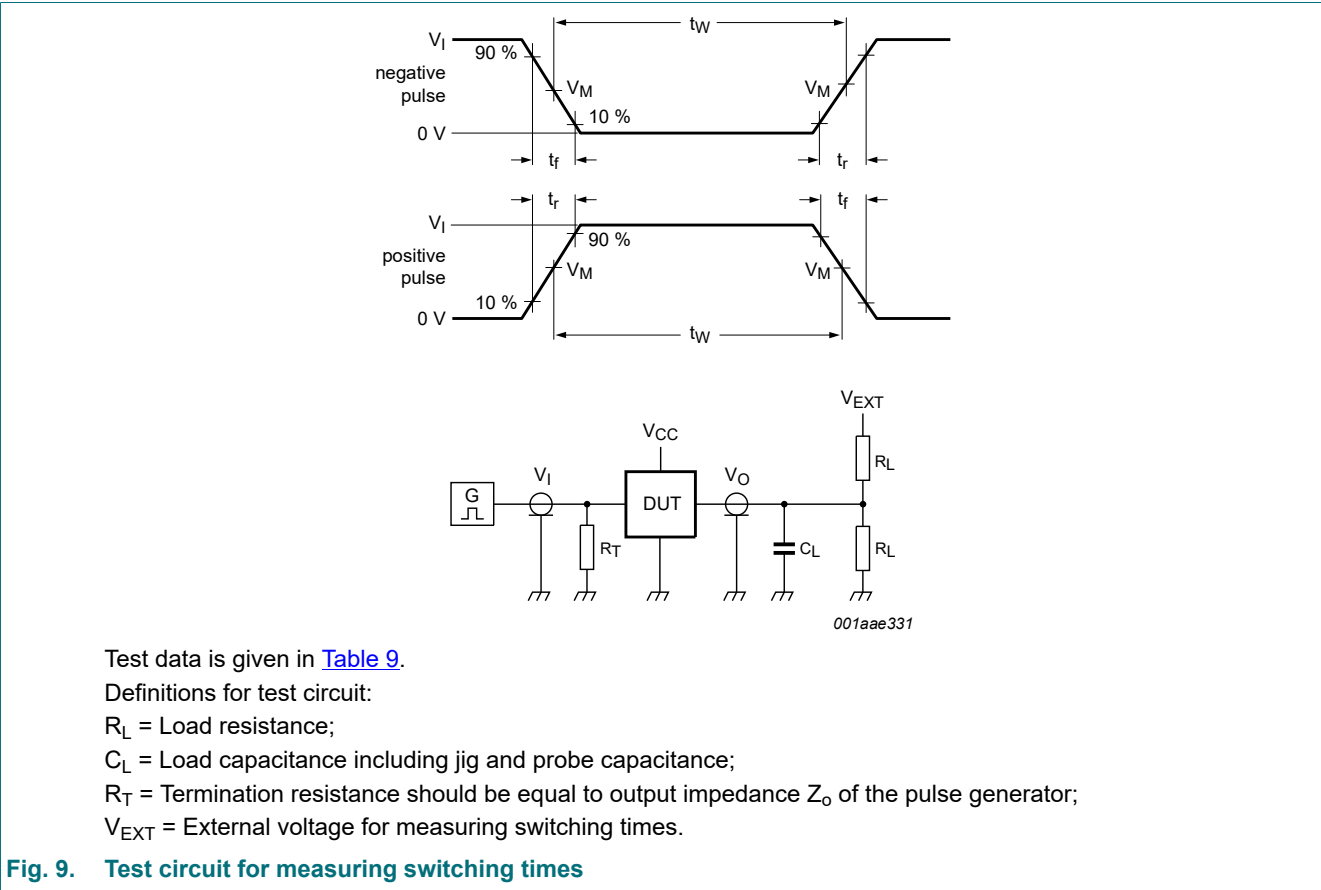


Table 9. Test data

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}	$\leq 2.0 \text{ ns}$	30 pF	500 Ω	open	$2 \times V_{CC}$	GND
2.7 V	2.7 V	$\leq 2.5 \text{ ns}$	50 pF	500 Ω	open	$2 \times V_{CC}$	GND
3.0 V to 3.6 V	2.7 V	$\leq 2.5 \text{ ns}$	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

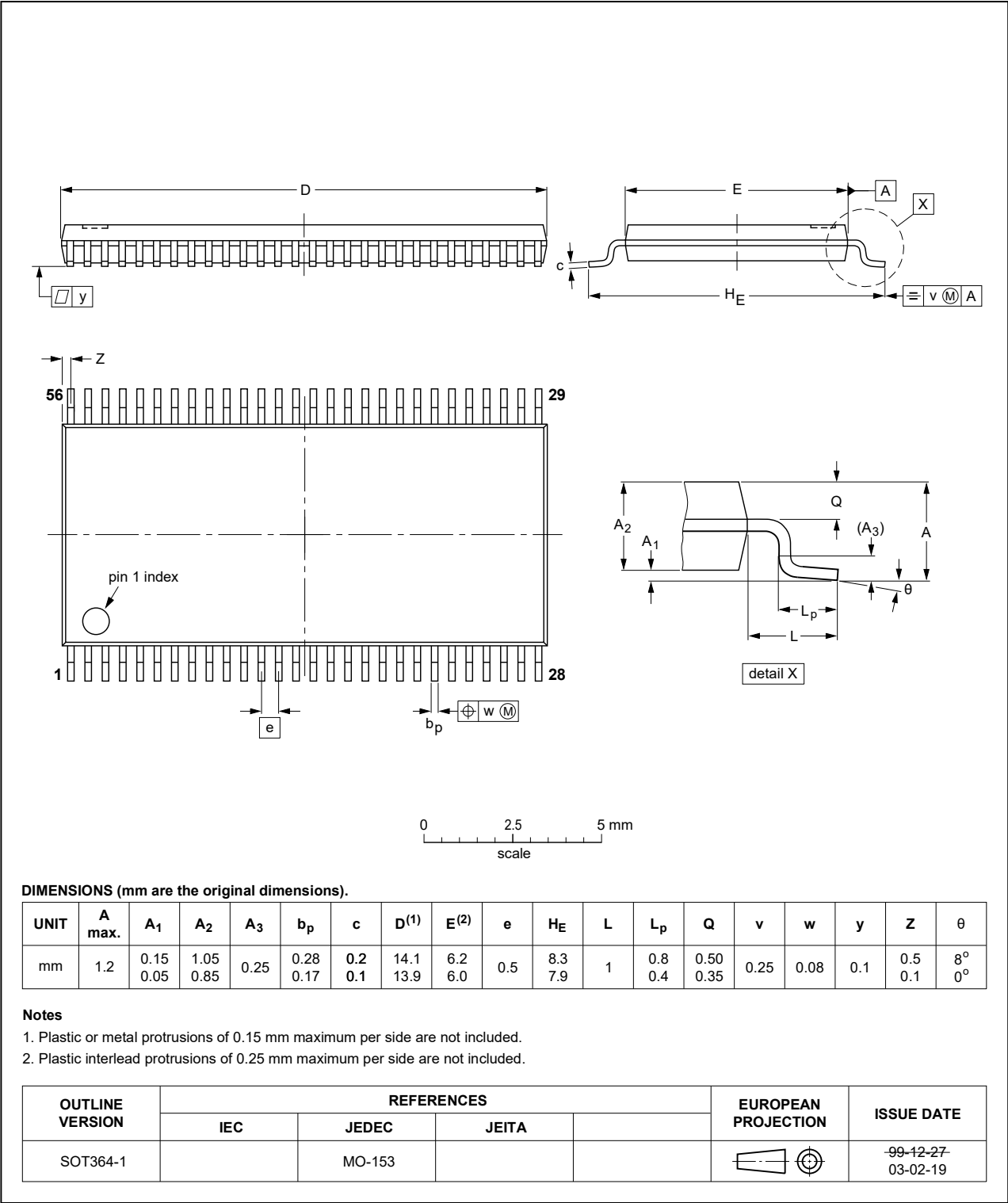


Fig. 10. Package outline SOT364-1 (TSSOP56)

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
74ALVCH16601 v.4	20240705	Product data sheet	-	74ALVCH16601 v.3
Modifications:	• Section 1 updated. • Section 2: ESD specification updated according to the latest JEDEC standard. • Table 4: P_{tot} total power dissipation updated.			
74ALVCH16601 v.3	20180813	Product data sheet	-	74ALVCH16601 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.			
74ALVCH16601 v.2	19980924	Product specification	-	74ALVCH16601 v.1
74ALVCH16601 v.1	19980831	Product 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>.

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