# 74ALVCH16843

# 18-bit bus-interface D-type latch; 3-State Rev. 3 — 20 November 2017

**Product data sheet** 

## **General description**

The 74ALVCH16843 has two 9-bit D-type latch featuring separate D-type inputs for each latch and 3-State outputs for bus oriented applications. The two sections of each register are controlled independently by the latch enable (nLE), clear (nCLR), preset (nPRE) and output enable (nOE) control gates.

When  $n\overline{OE}$  is LOW, the data in the registers appear at the outputs. When  $n\overline{OE}$  is HIGH, the outputs are in the high impedance OFF state. Operation of the nOE input does not affect the state of the flip-flops.

The 74ALVCH16843 has active bus hold circuitry which is provided to hold unused or floating data inputs at a valid logic level. This feature eliminates the need for external pull-up or pull-down resistors.

#### **Features and benefits**

- Wide supply voltage range of 1.2V to 3.6V
- CMOS low power consumption
- · Direct interface with TTL levels
- Current drive ±24 mA at V<sub>CC</sub> = 3.0 V.
- MULTIBYTE flow-through standard pin-out architecture
- ullet Low inductance multiple  $V_{CC}$  and GND pins for minimize noise and ground bounce
- · All data inputs have bushold
- Output drive capability 50 Ω transmission lines at 85 °C
- 3-state non-inverting outputs for bus oriented applications
- 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

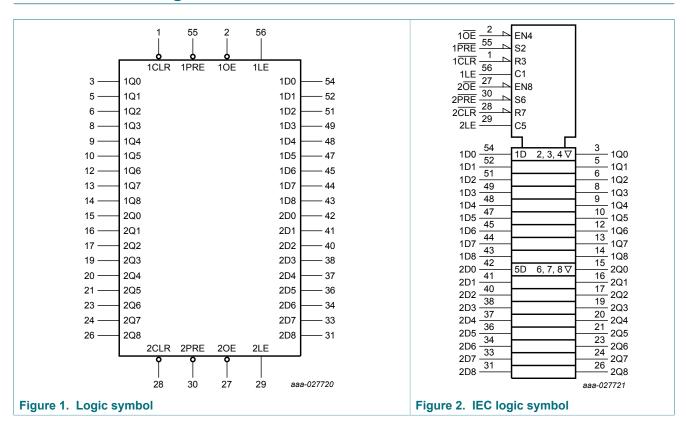
## **Ordering information**

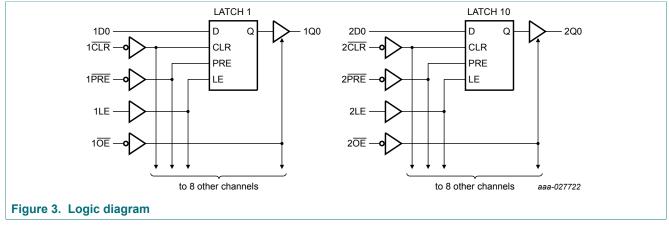
#### **Table 1. Ordering information**

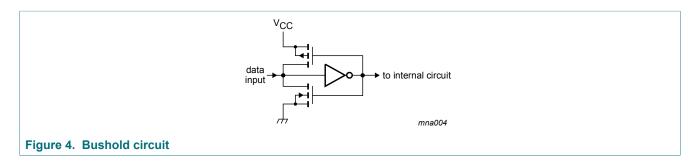
Type number	Package						
	Temperature range	Name	Description	Version			
74ALVCH16843DGG	-40 °C to +85 °C	TSSOP56	plastic thin shrink small outline package; 56 leads; body width 6.1 mm	SOT364-1			



## 4 Functional diagram

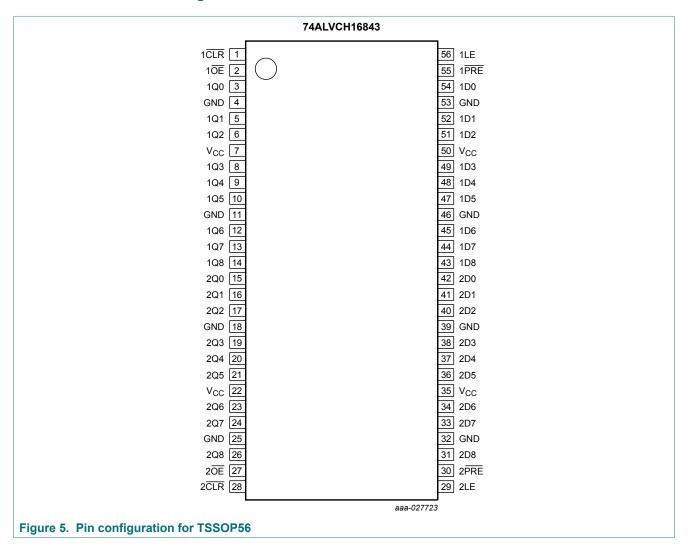






# 5 Pinning information

#### 5.1 Pinning



## 5.2 Pin description

Table 2. Pin description

Symbol	Pin	Description
1D0, 1D1, 1D2, 1D3, 1D4, 1D5, 1D6, 1D7, 1D8	54, 52, 51, 49, 48, 47, 45, 44, 43	data inputs
1Q0, 1Q1, 1Q2, 1Q3, 1Q4, 1Q5, 1Q6, 1Q7, 1Q8	3, 5, 6, 8, 9, 10, 12, 13, 14	data outputs
2D0, 2D1, 2D2, 2D3, 2D4, 2D5, 2D6, 2D7, 2D8	42, 41, 40, 38, 37, 36, 34, 33, 31	data inputs
2Q0, 2Q1, 2Q2, 2Q3, 2Q4, 2Q5, 2Q6, 2Q7, 2Q8	15, 16, 17, 19, 20, 21, 23, 24, 26	data outputs
10E, 20E	2, 27	output enable inputs (active LOW)
1PRE, 2PRE	55, 30	preset inputs (active LOW)
1CLR, 2CLR	1, 28	clear inputs (active LOW)
1LE, 2LE	56, 29	latch enable inputs (active HIGH)
GND	4, 11, 18, 25, 32, 39, 46, 53	ground (0 V)
V <sub>CC</sub>	7, 22, 35, 50	supply voltage

# 6 Functional description

Table 3. Function selection [1]

Inputs	Output				
nPRE	nCLR	nOE	nLE	nDn	nQn
L	X	L	X	X	Н
Н	L	L	X	X	L
Н	Н	L	Н	L	L
Н	Н	L	Н	Н	Н
Н	Н	L	L	X	NC
Χ	X	Н	X	X	Z

<sup>[1]</sup> H = HIGH voltage level;

L = LOW voltage level;

X = don't care;

NC = no change;

Z = high-impedance OFF-state.

# **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 <sub>CC</sub>	supply voltage		-0.5	+4.6	V
VI	input voltage	For control pins [1]	-0.5	+4.6	٧
		For data inputs [1]	-0.5	V <sub>CC</sub> + 0.5	V
Vo	output voltage	[1]	-0.5	V <sub>CC</sub> + 0.5	V
I <sub>IK</sub>	input clamping current	V <sub>I</sub> < 0 V	-50	-	mA
I <sub>OK</sub>	output clamping current	$V_O > V_{CC}$ or $V_O < 0$ V	-	±50	mA
Io	output current	$V_O = 0 V \text{ to } V_{CC}$	-	±50	mA
I <sub>CC</sub>	supply current		-	100	mA
$I_{GND}$	ground current		-100	-	mA
T <sub>stg</sub>	storage temperature		-65	+150	°C
P <sub>tot</sub>	total power dissipation	$T_{amb}$ = -40 °C to +85 °C [2]	-	600	mW

The input and output voltage ratings may be exceeded if the input and output current ratings are observed.
 Above 55 °C the value of Ptot derates linearly with 8 mW/K.

# **Recommended operating conditions**

Table 5. Recommended operating conditions

Symbol	Parameter	Conditions	Min	Max	Unit
V <sub>CC</sub>	supply voltage	maximum speed performance			
		C <sub>L</sub> = 30 pF	2.3	2.7	V
		C <sub>L</sub> = 50 pF	3.0	3.6	V
VI	input voltage		0	V <sub>CC</sub>	V
Vo	output voltage		0	V <sub>CC</sub>	V
T <sub>amb</sub>	ambient temperature	in free air	-40	+85	°C
Δt/ΔV	input transition rise and fall rate	V <sub>CC</sub> = 2.3 V to 3.0 V	-	20	ns/V
		V <sub>CC</sub> = 3.0 V to 3.6 V	-	10	ns/V

## 9 Static characteristics

Table 6. Static characteristics

At recommended operating conditions; voltages are referenced to GND (ground = 0 V). T<sub>amb</sub> = -40 °C to +85 °C

Symbol	Parameter	Conditions	Min	Typ <sup>[1]</sup>	Max	Unit
V <sub>IH</sub>	HIGH-level	V <sub>CC</sub> = 2.3 V to 2.7 V	1.7	1.2	-	V
	input voltage	V <sub>CC</sub> = 2.7 V to 3.6 V	2.0	1.5	-	V
V <sub>IL</sub>	LOW-level	V <sub>CC</sub> = 2.3 V to 2.7 V	-	1.2	0.7	V
	input voltage	V <sub>CC</sub> = 2.7 V to 3.6 V	-	1.5	0.8	V
V <sub>OH</sub>	HIGH-level	$V_{I} = V_{IH}$ or $V_{IL}$				
	output voltage	$I_{O}$ = -100 $\mu$ A; $V_{CC}$ = 2.3 V to 3.6 V	V <sub>CC</sub> - 0.2	V <sub>CC</sub>	-	V
		$I_{O}$ = -6 mA; $V_{CC}$ = 2.3 V	V <sub>CC</sub> - 0.3	V <sub>CC</sub> - 0.08	-	V
		$I_{O}$ = -12 mA; $V_{CC}$ = 2.3 V	V <sub>CC</sub> - 0.6	V <sub>CC</sub> - 0.26	-	V
		$I_{O}$ = -12 mA; $V_{CC}$ = 2.7 V	V <sub>CC</sub> - 0.5	V <sub>CC</sub> - 0.14	-	V
		$I_{O}$ = -12 mA; $V_{CC}$ = 3.0 V	V <sub>CC</sub> - 0.6	V <sub>CC</sub> - 0.09	-	V
		$I_{O}$ = -24 mA; $V_{CC}$ = 3.0 V	V <sub>CC</sub> - 1.0	V <sub>CC</sub> - 0.28	-	V
$V_{OL}$	LOW-level	$V_I = V_{IH}$ or $V_{IL}$				
	output voltage	$I_{O}$ = 100 $\mu$ A; $V_{CC}$ = 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 <sub>I</sub>	input leakage current	$V_{CC}$ = 2.3 V to 3.6 V; $V_I$ = $V_{CC}$ or GND	-	0.1	5	μΑ
I <sub>OZ</sub>	OFF-state output current	$V_{CC}$ = 2.3 V to 3.6 V; $V_I$ = $V_{IH}$ or $V_{IL}$ ; $V_O$ = $V_{CC}$ or GND	-	0.1	10	μA
I <sub>CC</sub>	supply current	$V_{CC}$ = 2.3 V to 3.6 V; $V_{I}$ = $V_{CC}$ or GND; $I_{O}$ = 0 A	-	0.2	40	μΑ
$\Delta I_{CC}$	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	μΑ
I <sub>BHL</sub>	bus hold LOW	V <sub>CC</sub> = 2.3 V; V <sub>I</sub> = 0.7 V	45	-	-	μΑ
	current	V <sub>CC</sub> = 3.0 V; V <sub>I</sub> = 0.8 V	75	150	-	μΑ
I <sub>BHH</sub>	bus hold HIGH	V <sub>CC</sub> = 2.3 V; V <sub>I</sub> = 1.7 V	-45	-	-	μΑ
	current	V <sub>CC</sub> = 3.0 V; V <sub>I</sub> = 2.0 V	-75	-175	-	μΑ
I <sub>BHLO</sub>	bus hold LOW overdrive current	V <sub>CC</sub> = 3.6 V	500	-	-	μΑ
Івнно	bus hold HIGH overdrive current	V <sub>CC</sub> = 3.6 V	-500	-	-	μΑ
Cı	input capacitance		-	5.0	-	pF

<sup>[1]</sup> All typical values are measured at  $T_{amb}$  = 25 °C.

# 10 Dynamic characteristics

#### **Table 7. Dynamic characteristics**

At recommended operating conditions; voltages are referenced to GND (ground = 0 V); for test circuit see Figure 11;  $T_{amb}$  = -40 °C to +85 °C

Symbol	Parameter	Conditions	Min	Typ <sup>[1]</sup>	Max	Unit
t <sub>pd</sub>	propagation delay	nDn to nQn; see Figure 6				
		V <sub>CC</sub> = 2.3 V to 2.7 V	1.0	2.2	4.3	ns
		V <sub>CC</sub> = 2.7 V	1.0	2.3	4.0	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	1.0	2.1	3.5	ns
		nLE to nQn; see Figure 7				
		V <sub>CC</sub> = 2.3 V to 2.7 V	1.0	2.3	4.6	ns
		V <sub>CC</sub> = 2.7 V	1.0	2.1	3.9	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	1.0	2.0	3.5	ns
		nPRE to nQn; see Figure 6				
		V <sub>CC</sub> = 2.3 V to 2.7 V	1.0	2.5	4.8	ns
		V <sub>CC</sub> = 2.7 V	1.0	2.6	4.5	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	1.0	2.2	3.8	ns
		nCLR to nQn; see Figure 6				
		V <sub>CC</sub> = 2.3 V to 2.7 V	1.0	2.5	4.8	ns
		V <sub>CC</sub> = 2.7 V	1.0	2.5	4.3	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	1.0	2.3	3.9	ns
t <sub>en</sub>	enable time	nOE to nQn; see Figure 10				
		V <sub>CC</sub> = 2.3 V to 2.7 V	1.0	2.8	5.8	ns
		V <sub>CC</sub> = 2.7 V	1.0	3.0	5.3	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	1.0	2.5	4.4	ns
t <sub>dis</sub>	disable time	nOE to nQn; see Figure 10 [4]				
		V <sub>CC</sub> = 2.3 V to 2.7 V	1.1	2.2	4.3	ns
		V <sub>CC</sub> = 2.7 V	1.3	2.8	4.4	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	1.3	2.6	4.0	ns
t <sub>su</sub>	set-up time	nDn to nLE; see Figure 8				
		V <sub>CC</sub> = 2.3 V to 2.7 V	0.5	-0.1	-	ns
		V <sub>CC</sub> = 2.7 V	0.5	-0.3	-	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	0.5	0.0	-	ns
t <sub>h</sub>	hold time	nDn to nLE; see Figure 8				
		V <sub>CC</sub> = 2.3 V to 2.7 V	0.9	0.5	-	ns
		V <sub>CC</sub> = 2.7 V	0.9	0.5	-	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	0.9	0.5	-	ns

Symbol	Parameter	Conditions	Min	Typ <sup>[1]</sup>	Max	Unit
t <sub>W</sub>	pulse width	nLE HIGH; see Figure 7				
		V <sub>CC</sub> = 2.3 V to 2.7 V	1.5	0.5	-	ns
		V <sub>CC</sub> = 2.7 V	1.5	0.5	-	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	1.5	0.5	-	ns
		nPRE LOW; see Figure 9				
		V <sub>CC</sub> = 2.3 V to 2.7 V	1.5	0.5	-	ns
		V <sub>CC</sub> = 2.7 V	1.5	0.6	-	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	1.5	0.5	-	ns
		nCLR LOW; see Figure 9				
		V <sub>CC</sub> = 2.3 V to 2.7 V	1.5	0.5	-	ns
		V <sub>CC</sub> = 2.7 V	1.5	0.5	-	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	1.5	0.5	-	ns
t <sub>rec</sub>	recovery time	nPRE to nLE; see Figure 9				
		V <sub>CC</sub> = 2.3 V to 2.7 V	0.5	1.1	-	ns
		V <sub>CC</sub> = 2.7 V	0.8	-0.2	-	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	1.0	0.4	-	ns
		nCLR to nLE; see Figure 9				
		V <sub>CC</sub> = 2.3 V to 2.7 V	0.5	1.0	-	ns
		V <sub>CC</sub> = 2.7 V	0.6	-0.4	-	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	8.0	0.2	-	ns
C <sub>PD</sub>	power dissipation	per latch; V <sub>I</sub> = GND to V <sub>CC</sub> [5]				
	capacitance	transparent mode; outputs enabled	-	17	-	pF
		transparent mode; outputs disabled	-	3	-	pF
		clocked mode; outputs enabled	-	19	-	pF
		clocked mode; outputs disabled	-	9	-	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  $V_{CC} = 2.3 \text{ V}$  to 2.7 V are measured at  $V_{CC} = 2.3 \text{ V}$ . Typical values for  $V_{CC} = 3.0 \text{ V}$  to 3.6 V are measured at  $V_{CC} = 3.3 \text{ V}$ . [2]  $t_{pd}$  is the same as  $t_{PLH}$  and  $t_{PHL}$ . [3]  $t_{en}$  is the same as  $t_{PLL}$  and  $t_{PHL}$ . [4]  $t_{dis}$  is the same as  $t_{PLL}$  and  $t_{PHL}$ . [5]  $C_{PD}$  is used to determine the dynamic power dissipation ( $P_D$  in  $\mu$ W).

 $P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \sum (C_L \times V_{CC}^2 \times f_o)$  where:

f<sub>i</sub> = input frequency in MHz;

f<sub>o</sub> = output frequency in MHz;

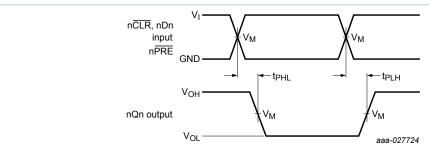
C<sub>L</sub> = output load capacitance in pF;

V<sub>CC</sub> = supply voltage in Volts;

N = total load switching outputs;

 $\sum (C_L \times V_{CC}^2 \times f_0) = \text{sum of outputs.}$ 

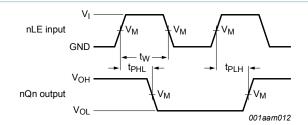
## 10.1 Waveforms and test circuit



Measurement points are given in Table 8.

V<sub>OL</sub> and V<sub>OH</sub> are typical output levels that occur with the output load.

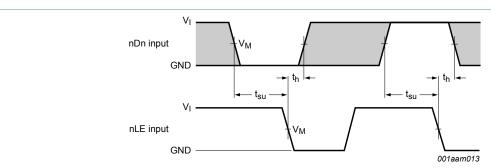
Figure 6. Data input (nDn) to output (nQn), clear input (nCLR) to output (nQn) and preset input (nPRE) to output (nQn) propagation delay



Measurement points are given in <u>Table 8</u>.

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

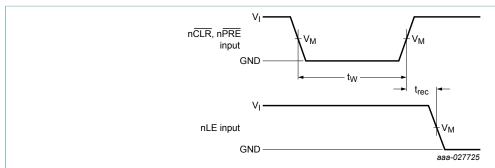
Figure 7. Latch enable input (nLE) to data output (nQn) propagation delay and pulse width (nLE)



Measurement points are given in Table 8.

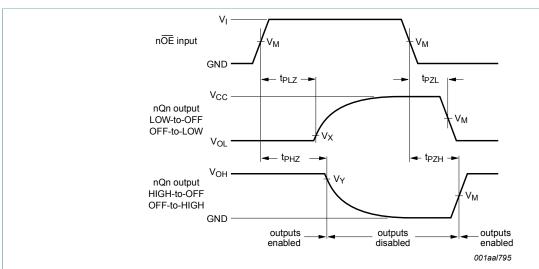
The shaded areas indicate when the input is permitted to change for predictable output performance.

Figure 8. Data setup and hold times for input (nDn) to input (nLE)



Measurement points are given in Table 8.

Figure 9. Clear (nCLR) and preset (nPRE) pulse width, the clear (nCLR) and preset (nPRE) to latch (nLE) recovery time



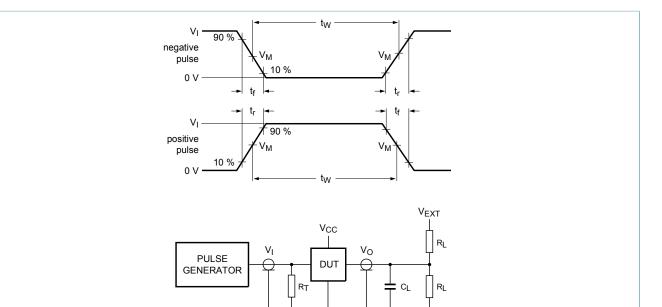
Measurement points are given in Table 8.

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

Figure 10. 3-State enable and disable times

**Table 8. Measurement points** 

Input			Output			
V <sub>CC</sub>	Vı	V <sub>M</sub>	V <sub>M</sub>	V <sub>x</sub>	V <sub>y</sub>	
2.3 V to 2.7 V	V <sub>CC</sub>	0.5V <sub>CC</sub>	0.5V <sub>CC</sub>	V <sub>OL</sub> + 0.15 V	V <sub>OH</sub> - 0.15 V	
2.7 V	2.7 V	1.5 V	1.5 V	V <sub>OL</sub> + 0.3 V	V <sub>OH</sub> - 0.3 V	
3.0 V to 3.6 V	2.7 V	1.5 V	1.5 V	V <sub>OL</sub> + 0.3 V	V <sub>OH</sub> - 0.3 V	



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Test data is given in Table 9.

Definitions test circuit:

R<sub>L</sub> = Load resistance;

C<sub>L</sub> = Load capacitance including jig and probe capacitance;

 $R_T$  = Termination resistance should be equal to output impedance  $Z_0$  of the pulse generator;

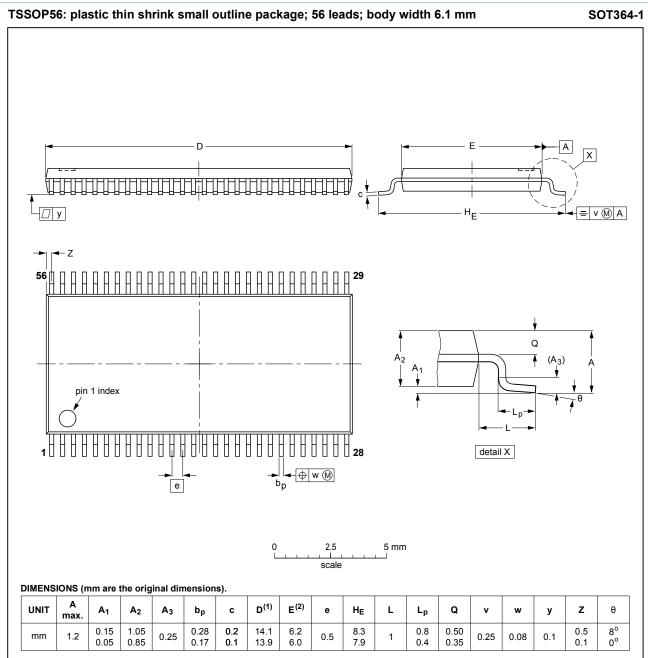
 $V_{EXT}$  = External voltage for measuring switching times.

Figure 11. Test circuit for measuring switching times

Table 9. Test data

Input			Load		V <sub>EXT</sub>		
V <sub>CC</sub>	VI	t <sub>r</sub> , t <sub>f</sub>	R <sub>L</sub>	CL	t <sub>PHZ</sub> , t <sub>PZH</sub>	t <sub>PLZ</sub> , t <sub>PZL</sub>	t <sub>PLH</sub> , t <sub>PHL</sub>
2.3 V to 2.7 V	V <sub>CC</sub>	≤ 2.0 ns	500 Ω	30 pF	GND	2 × V <sub>CC</sub>	open
2.7 V	2.7 V	≤ 2.5 ns	500 Ω	50 pF	GND	2 × V <sub>CC</sub>	open
3.0 V to 3.6 V	2.7 V	≤ 2.5 ns	500 Ω	50 pF	GND	2 × V <sub>CC</sub>	open

# 11 Package outline



#### ...

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

Figure 12. Package outline SOT364-1 (TSSOP56)

74ALVCH16843

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## 12 Abbreviations

#### Table 10. Abbreviations

Acronym	Description
CDM	Charged Device Model
CMOS	Complementary Metal-Oxide Semiconductor
DUT	Device Under Test
ESD	ElectroStatic Discharge
НВМ	Human Body Model
TTL	Transistor-Transistor Logic

# 13 Revision history

#### Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes		
74ALVCH16843 v.3	20171120	Product data sheet	-	74ALVCH16843 v.2		
Modifications:	<ul> <li>The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia.</li> <li>Legal texts have been adapted to the new company name where appropriate.</li> </ul>					
74ALVCH16843 v.2	19980804	Product specification	-	74ALVCH16843 v.2		
74ALVCH16843 v.1	19980804	Product specification	-	-		

## 14 Legal information

#### 14.1 Data sheet status

Document status <sup>[1][2]</sup>	Product status <sup>[3]</sup>	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.

- Please consult the most recently issued document before initiating or completing a design.
- The term 'short data sheet' is explained in section "Definitions". [2] [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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