

# DATA SHEET

**74ALVCH16841**

20-bit bus interface D-type latch (3-State)

Product specification

1998 Jul 27

IC24 Data Handbook

## 20-bit bus interface D-type latch (3-State)

74ALVCH16841

## FEATURES

- Wide supply voltage range of 1.2V to 3.6V
- Complies with JEDEC standard no. 8-1A
- Wide supply voltage range of 1.2V to 3.6V
- CMOS low power consumption
- Direct interface with TTL levels
- MULTIBYTE™ flow-through standard pin-out architecture
- Low inductance multiple V<sub>CC</sub> and GND pins for minimum noise and ground bounce
- Current drive ±24 mA at 3.0 V
- All inputs have bus hold circuitry
- Output drive capability 50Ω transmission lines @ 85°C
- 3-State non-inverting outputs for bus oriented applications

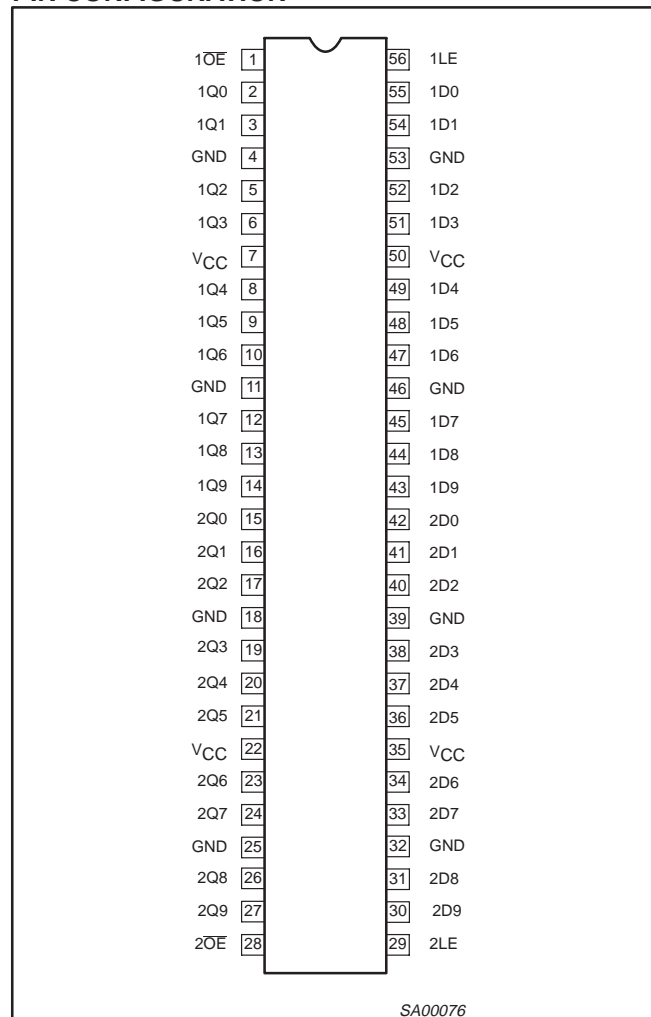
## DESCRIPTION

The 74ALVCH16841 has two 10-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) and output enable (nOE) control gates.

When nOE is LOW, the data in the registers appears at the outputs. When nOE is High the outputs are in High-impedance OFF state. Operation of the nOE input does not affect the state of the flip-flops.

The 74ALVCH16841 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.

## PIN CONFIGURATION



## QUICK REFERENCE DATA

GND = 0V; T<sub>amb</sub> = 25°C; t<sub>r</sub> = t<sub>f</sub> ≤ 2.5ns

SYMBOL	PARAMETER	CONDITIONS	TYPICAL	UNIT	
t <sub>PHL</sub> /t <sub>PLH</sub>	Propagation delay nD <sub>n</sub> to nQ <sub>n</sub>	V <sub>CC</sub> = 2.5V, C <sub>L</sub> = 30pF V <sub>CC</sub> = 3.3V, C <sub>L</sub> = 50pF	2.5 2.4	ns	
t <sub>PHL</sub> /t <sub>PLH</sub>	Propagation delay nLE to nQ <sub>n</sub>	V <sub>CC</sub> = 2.5V, C <sub>L</sub> = 30pF V <sub>CC</sub> = 3.3V, C <sub>L</sub> = 50pF	2.5 2.4	ns	
C <sub>I</sub>	Input capacitance		5.0	pF	
C <sub>PD</sub>	Power dissipation capacitance per buffer	V <sub>I</sub> = GND to V <sub>CC</sub> <sup>1</sup>	Outputs enabled	19	pF
			Outputs disabled	3	

## NOTES:

1. C<sub>PD</sub> is used to determine the dynamic power dissipation (P<sub>D</sub> in μW):  

$$P_D = C_{PD} \times V_{CC}^2 \times f_i + \sum (C_L \times V_{CC}^2 \times f_o)$$
 where: f<sub>i</sub> = input frequency in MHz; C<sub>L</sub> = output load capacitance in pF;  
 f<sub>o</sub> = output frequency in MHz; V<sub>CC</sub> = supply voltage in V; Σ (C<sub>L</sub> × V<sub>CC</sub><sup>2</sup> × f<sub>o</sub>) = sum of outputs.

## ORDERING INFORMATION

PACKAGES	TEMPERATURE RANGE	OUTSIDE NORTH AMERICA	NORTH AMERICA	DWG NUMBER
56-Pin Plastic TSSOP Type II	-40°C to +85°C	74ALVCH16841 DGG	ACH16841 DGG	SOT364-1

# 20-bit bus interface D-type latch (3-State)

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## PIN DESCRIPTION

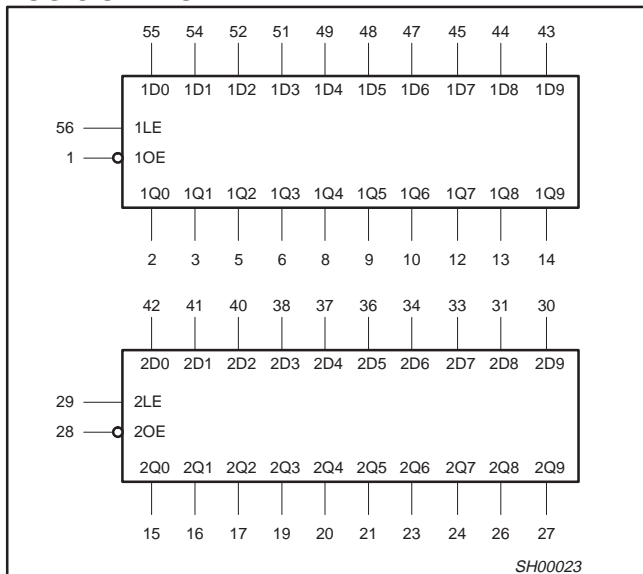
PIN NUMBER	SYMBOL	FUNCTION
1	1 $\overline{OE}$	Output enable inputs (active-LOW)
56	1LE	Latch enable inputs (active HIGH)
55, 54, 52, 51, 49, 48, 47, 45, 44, 43	1D0 – 1D9	Data inputs
2, 3, 5, 6, 8, 9, 10, 12, 13, 14	1Q0 – 1Q9	Data outputs
4, 11, 18, 25, 32, 39, 46, 53	GND	Ground (0V)
7, 22, 35, 50	V <sub>CC</sub>	Positive supply voltage
28	2 $\overline{OE}$	Output enable inputs (active-LOW)
29	2LE	Latch enable inputs (active HIGH)
42, 41, 40, 38, 37, 36, 34, 33, 31, 30	2D0 – 2D9	Data inputs
15, 16, 17, 19, 20, 21, 23, 24, 26, 27	2Q0 – 2Q9	Data outputs

## FUNCTION TABLE

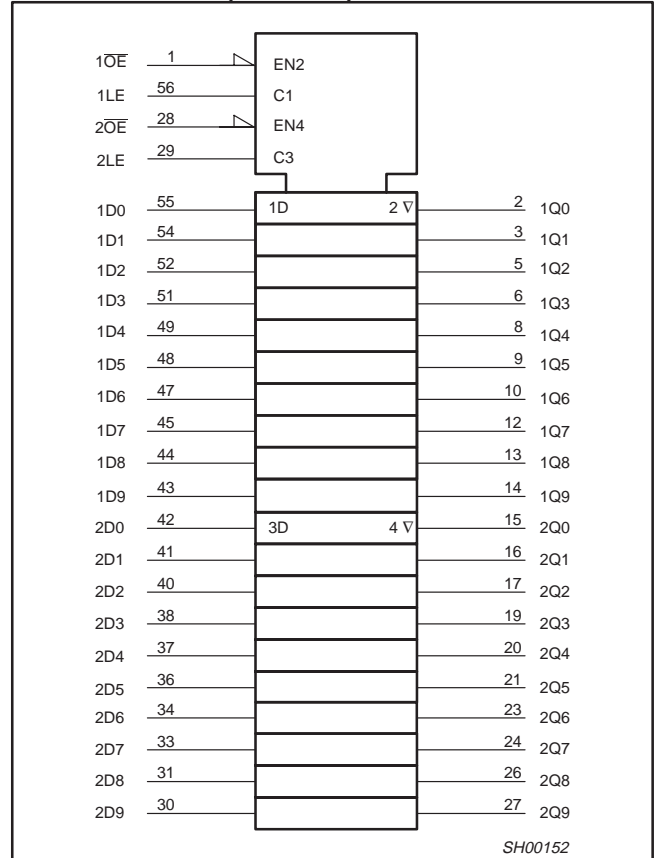
INPUTS			OUTPUT
n $\overline{OE}$	LE	D <sub>x</sub>	Q
L	H	L	L
L	H	H	H
L	L	X	Q <sub>0</sub>
H	X	X	Z

H = High voltage level  
 L = Low voltage level  
 X = Don't care  
 Z = High impedance "off" state

## LOGIC SYMBOL

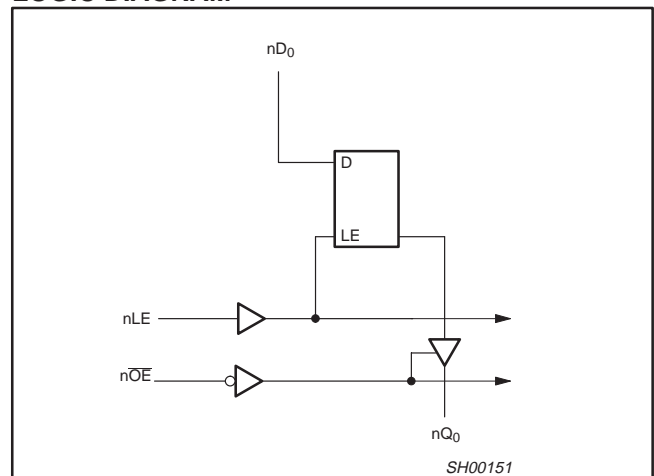


## LOGIC SYMBOL (IEEE/IEC)



SH00152

## LOGIC DIAGRAM

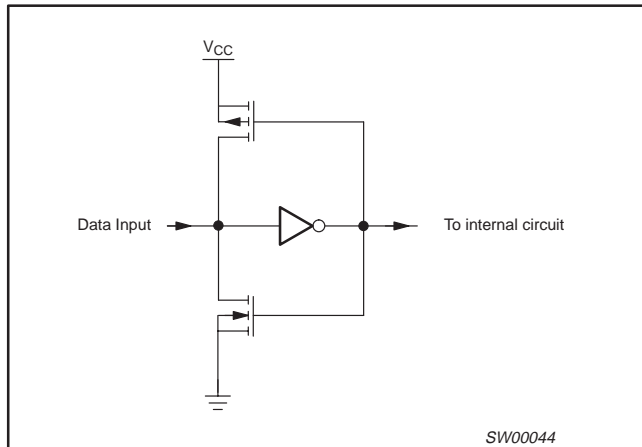


SH00151

# 20-bit bus interface D-type latch (3-State)

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## BUS HOLD CIRCUIT



## RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	CONDITIONS	MIN	MAX	UNIT
$V_{CC}$	DC supply voltage 2.5V range (for max. speed performance @ 30 pF output load)		2.3	2.7	V
	DC supply voltage 3.3V range (for max. speed performance @ 50 pF output load)		3.0	3.6	
$V_I$	DC Input voltage range		0	$V_{CC}$	V
$V_O$	DC output voltage range		0	$V_{CC}$	V
$T_{amb}$	Operating free-air temperature range		-40	+85	°C
$t_r, t_f$	Input rise and fall times	$V_{CC} = 2.3$ to $3.0V$	0	20	ns/V
		$V_{CC} = 3.0$ to $3.6V$	0	10	

## ABSOLUTE MAXIMUM RATINGS

In accordance with the Absolute Maximum Rating System (IEC 134)  
 Voltages are referenced to GND (ground = 0V)

SYMBOL	PARAMETER	CONDITIONS	RATING	UNIT
$V_{CC}$	DC supply voltage		-0.5 to +4.6	V
$I_{IK}$	DC input diode current	$V_I < 0$	-50	mA
$V_I$	DC input voltage	For control pins <sup>1</sup>	-0.5 to +4.6	V
		For data inputs <sup>1</sup>	-0.5 to $V_{CC} + 0.5$	
$I_{OK}$	DC output diode current	$V_O > V_{CC}$ or $V_O < 0$	± 50	mA
$V_O$	DC output voltage	Note 1	-0.5 to $V_{CC} + 0.5$	V
$I_O$	DC output source or sink current	$V_O = 0$ to $V_{CC}$	± 50	mA
$I_{GND}, I_{CC}$	DC $V_{CC}$ or GND current		± 100	mA
$T_{stg}$	Storage temperature range		-65 to +150	°C
$P_{TOT}$	Power dissipation per package -plastic medium-shrink (SSOP) -plastic thin-medium-shrink (TSSOP)	For temperature range: -40 to +125 °C	850	mW
		above +55°C derate linearly with 11.3 mW/K above +55°C derate linearly with 8 mW/K	600	

**NOTE:**

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

## 20-bit bus interface D-type latch (3-State)

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**DC ELECTRICAL CHARACTERISTICS**

Over recommended operating conditions. Voltage are referenced to GND (ground = 0 V).

SYMBOL	PARAMETER	TEST CONDITIONS	LIMITS			UNIT
			Temp = -40°C to +85°C			
			MIN	TYP <sup>1</sup>	MAX	
V <sub>IH</sub>	HIGH level Input voltage	V <sub>CC</sub> = 2.3 to 2.7V	1.7	1.2		V
		V <sub>CC</sub> = 2.7 to 3.6V	2.0	1.5		
V <sub>IL</sub>	LOW level Input voltage	V <sub>CC</sub> = 2.3 to 2.7V		1.2	0.7	V
		V <sub>CC</sub> = 2.7 to 3.6V		1.5	0.8	
V <sub>OH</sub>	HIGH level output voltage	V <sub>CC</sub> = 2.3 to 3.6V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = -100μA	V <sub>CC</sub> - 0.2	V <sub>CC</sub>		V
		V <sub>CC</sub> = 2.3V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = -6mA	V <sub>CC</sub> - 0.3	V <sub>CC</sub> - 0.08		
		V <sub>CC</sub> = 2.3V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = -12mA	V <sub>CC</sub> - 0.6	V <sub>CC</sub> - 0.26		
		V <sub>CC</sub> = 2.7V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = -12mA	V <sub>CC</sub> - 0.5	V <sub>CC</sub> - 0.14		
		V <sub>CC</sub> = 3.0V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = -12mA	V <sub>CC</sub> - 0.6	V <sub>CC</sub> - 0.09		
		V <sub>CC</sub> = 3.0V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = -24mA	V <sub>CC</sub> - 1.0	V <sub>CC</sub> - 0.28		
V <sub>OL</sub>	LOW level output voltage	V <sub>CC</sub> = 2.3 to 3.6V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = 100μA		GND	0.20	V
		V <sub>CC</sub> = 2.3V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = 6mA		0.07	0.40	V
		V <sub>CC</sub> = 2.3V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = 12mA		0.15	0.70	V
		V <sub>CC</sub> = 2.7V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = 12mA		0.14	0.40	
		V <sub>CC</sub> = 3.0V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = 24mA		0.27	0.55	
I <sub>I</sub>	Input leakage current	V <sub>CC</sub> = 2.3 to 3.6V; V <sub>I</sub> = V <sub>CC</sub> or GND		0.1	5	μA
I <sub>OZ</sub>	3-State output OFF-state current	V <sub>CC</sub> = 2.3 to 3.6V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; V <sub>O</sub> = V <sub>CC</sub> or GND		0.1	10	μA
I <sub>CC</sub>	Quiescent supply current	V <sub>CC</sub> = 2.3 to 3.6V; V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0		0.2	40	μA
ΔI <sub>CC</sub>	Additional quiescent supply current	V <sub>CC</sub> = 2.3V to 3.6V; V <sub>I</sub> = V <sub>CC</sub> - 0.6V; I <sub>O</sub> = 0		150	750	μA
I <sub>BHL</sub> <sup>2</sup>	Bus hold LOW sustaining current	V <sub>CC</sub> = 2.3V; V <sub>I</sub> = 0.7V	45	-		μA
		V <sub>CC</sub> = 3.0V; V <sub>I</sub> = 0.8V	75	150		
I <sub>BHH</sub> <sup>2</sup>	Bus hold HIGH sustaining current	V <sub>CC</sub> = 2.3V; V <sub>I</sub> = 1.7V	-45			μA
		V <sub>CC</sub> = 3.0V; V <sub>I</sub> = 2.0V	-75	-175		
I <sub>BHLO</sub> <sup>2</sup>	Bus hold LOW overdrive current	V <sub>CC</sub> = 3.6V	500			μA
I <sub>BHHO</sub> <sup>2</sup>	Bus hold HIGH overdrive current	V <sub>CC</sub> = 3.6V	-500			μA

**NOTES:**

1. All typical values are at T<sub>amb</sub> = 25°C.
2. Valid for data inputs of bus hold parts.

## 20-bit bus interface D-type latch (3-State)

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**AC CHARACTERISTICS FOR  $V_{CC} = 2.3V$  TO  $2.7V$  RANGE**GND = 0V;  $t_r = t_f \leq 2.0ns$ ;  $C_L = 30pF$ 

SYMBOL	PARAMETER	WAVEFORM	LIMITS			UNIT
			$V_{CC} = 2.3$ to $2.7V$			
			MIN	TYP <sup>1</sup>	MAX	
$t_{PLH}/t_{PHL}$	Propagation delay nD <sub>n</sub> to nQ <sub>n</sub>	1, 5	1.0	2.5	5.0	ns
$t_{PLH}/t_{PHL}$	Propagation delay nLE to nQ <sub>n</sub>	2, 5	1.0	2.5	5.6	ns
$t_{PZH}/t_{PZL}$	3-State output enable time nOE <sub>n</sub> to nQ <sub>n</sub>	4, 5	1.0	2.7	6.2	ns
$t_{PHZ}/t_{PLZ}$	3-State output disable time nOE <sub>n</sub> to nQ <sub>n</sub>	4, 5	1.1	2.2	5.3	ns
$t_W$	nLE pulse width HIGH	2, 5	3.3	1.5	–	ns
$t_{SU}$	Set up time nD <sub>n</sub> to nLE	3, 5	1.3	0.1	–	ns
$T_h$	Hold time nD <sub>n</sub> to nLE	3, 5	1.4	0.3	–	ns

**NOTE:**1. All typical values are at  $V_{CC} = 3.3V$  and  $T_{amb} = 25^\circ C$ .**AC CHARACTERISTICS FOR  $V_{CC} = 3.0V$  TO  $3.6V$  RANGE AND  $V_{CC} = 2.7V$** GND = 0V;  $t_r = t_f \leq 2.5ns$ ;  $C_L = 50pF$ 

SYMBOL	PARAMETER	WAVEFORM	LIMITS			LIMITS			UNIT
			$V_{CC} = 3.3 \pm 0.3V$			$V_{CC} = 2.7V$			
			MIN	TYP <sup>1, 2</sup>	MAX	MIN	TYP <sup>1</sup>	MAX	
$t_{PLH}/t_{PHL}$	Propagation delay nD <sub>n</sub> to nQ <sub>n</sub>	1, 5	1.0	2.4	3.9	1.0	2.6	4.7	ns
$t_{PLH}/t_{PHL}$	Propagation delay nLE to nQ <sub>n</sub>	2, 5	1.0	2.4	4.3	1.0	2.6	5.1	ns
$t_{PZH}/t_{PZL}$	3-State output enable time nOE <sub>n</sub> to nQ <sub>n</sub>	4, 5	1.0	2.3	4.9	1.0	3.1	6.0	ns
$t_{PHZ}/t_{PLZ}$	3-State output disable time nOE <sub>n</sub> to nQ <sub>n</sub>	4, 5	1.3	2.9	4.1	1.3	3.1	4.3	ns
$t_W$	nLE pulse width HIGH	2, 5	3.3	1.5	–	3.3	1.5	–	ns
$t_{SU}$	Set up time nD <sub>n</sub> to nLE	3, 5	1.0	0.6	–	1.1	0.1	–	ns
$t_h$	Hold time nD <sub>n</sub> to nLE	3, 5	1.4	0.2	–	1.7	0.2	–	ns

**NOTES:**1. All typical values are measured  $T_{amb} = 25^\circ C$ .2. Typical value is measured at  $V_{CC} = 3.3V$

# 20-bit bus interface D-type latch (3-State)

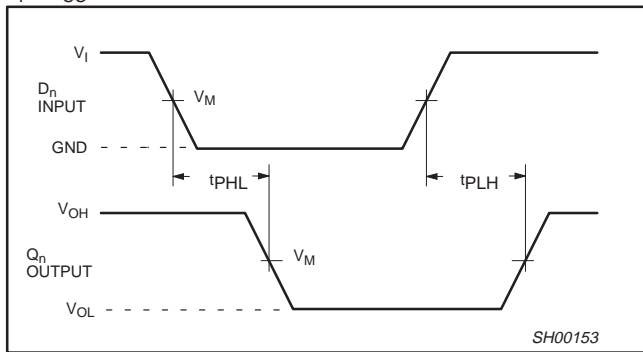
# 74ALVCH16841

## AC WAVEFORMS FOR $V_{CC} = 2.3V$ TO $2.7V$ AND $V_{CC} < 2.3V$ RANGE

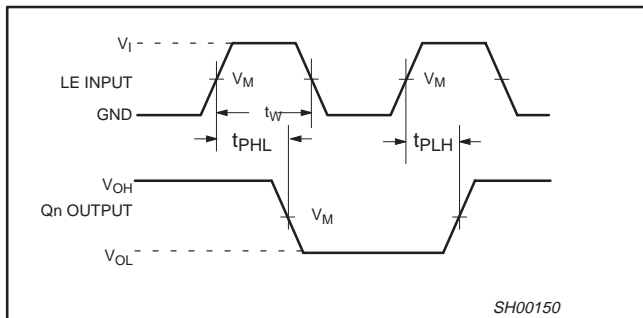
$V_M = 0.5 V_{CC}$   
 $V_X = V_{OL} + 0.15V$   
 $V_Y = V_{OH} - 0.15V$   
 $V_{OL}$  and  $V_{OH}$  are the typical output voltage drop that occur with the output load.

## AC WAVEFORMS FOR $V_{CC} = 3.0V$ TO $3.6V$ AND $V_{CC} = 2.7V$ RANGE

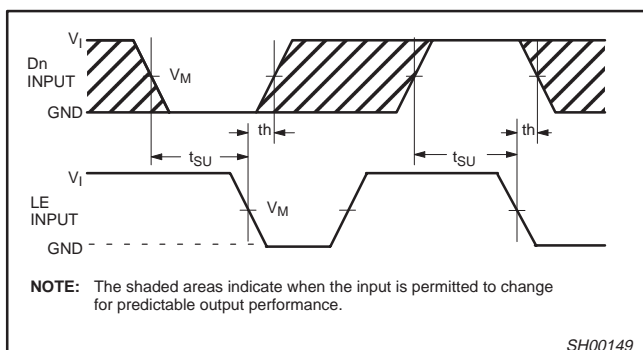
$V_M = 1.5 V$   
 $V_X = V_{OL} + 0.3V$   
 $V_Y = V_{OH} - 0.3V$   
 $V_{OL}$  and  $V_{OH}$  are the typical output voltage drop that occur with the output load.  
 $V_I = 2.7V$   
 $V_I = V_{CC}$



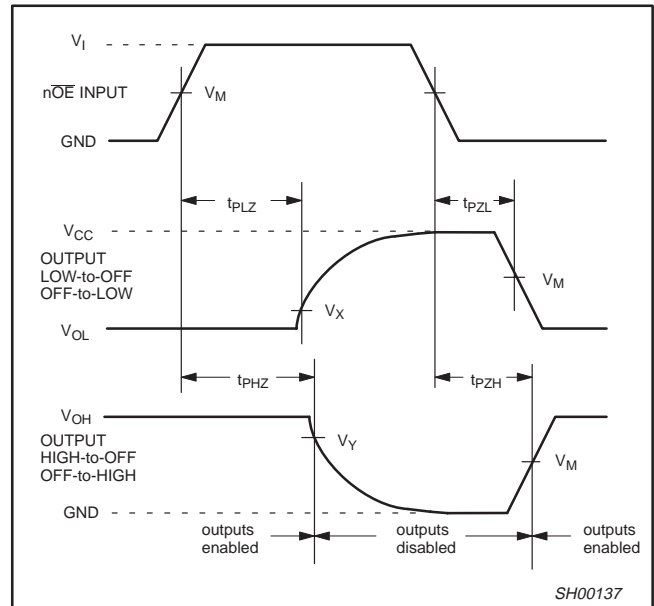
Waveform 1. The input ( $D_n$ ) to output ( $Q_n$ ) propagation delay



Waveform 2. The latch enable (LE) pulse width, the latch enable input to output ( $Q_n$ ) propagation delay

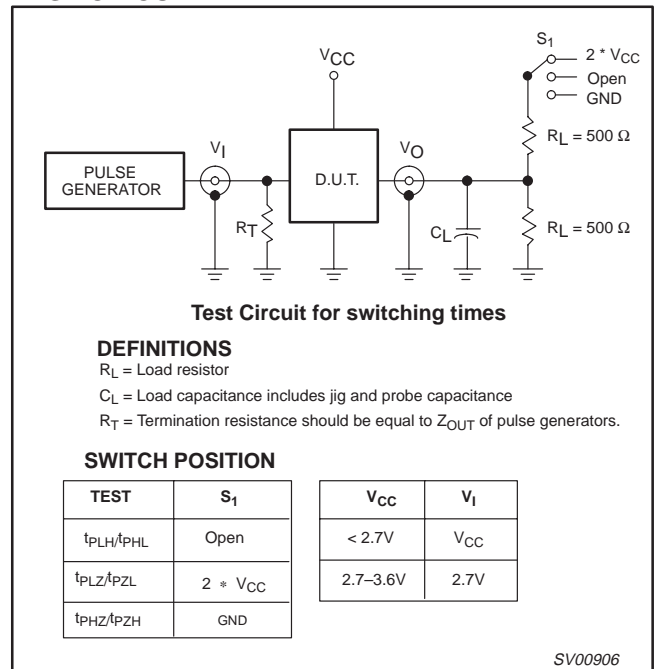


Waveform 3. The data set up and hold times for the  $D_n$  input to the LE input



Waveform 4. 3-State enable and disable times

## TEST CIRCUIT



Test Circuit for switching times

### DEFINITIONS

$R_L$  = Load resistor  
 $C_L$  = Load capacitance includes jig and probe capacitance  
 $R_T$  = Termination resistance should be equal to  $Z_{OUT}$  of pulse generators.

### SWITCH POSITION

TEST	$S_1$	$V_{CC}$	$V_I$
$t_{PLH}/t_{PHL}$	Open	< 2.7V	$V_{CC}$
$t_{PLZ}/t_{PZL}$	$2 \cdot V_{CC}$	2.7-3.6V	2.7V
$t_{PHZ}/t_{PZH}$	GND		

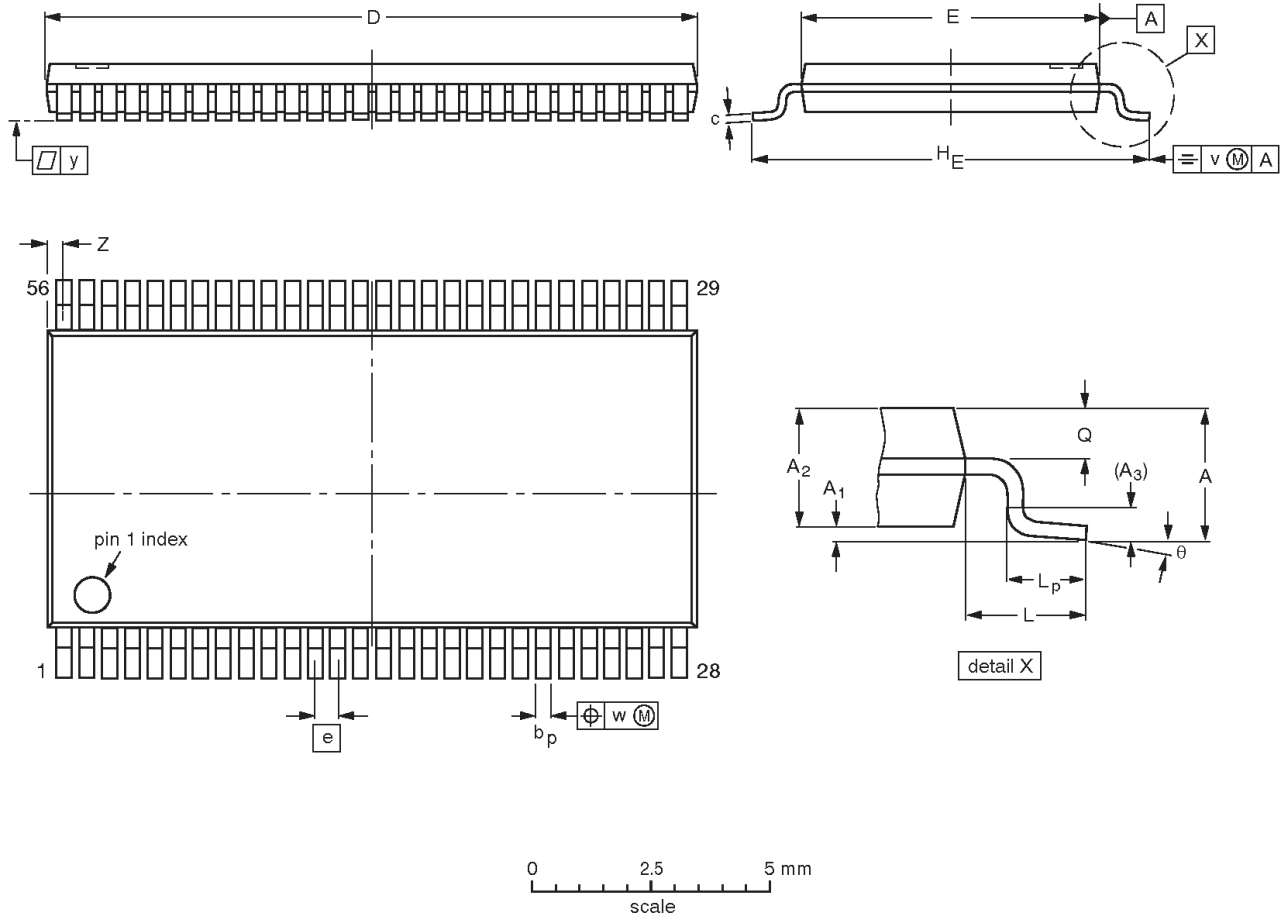
Waveform 5. Load circuitry for switching times

# 20-bit bus interface D-type latch (3-State)

# 74ALVCH16841

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

**SOT364-1**



**DIMENSIONS (mm are the original dimensions).**

UNIT	A max.	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	b <sub>p</sub>	c	D <sup>(1)</sup>	E <sup>(2)</sup>	e	H <sub>E</sub>	L	L <sub>p</sub>	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	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	EIAJ			
SOT364-1		MO-153EE				93-02-03 95-02-10



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20-bit bus interface D-type latch (3-State)

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**NOTES**

## 20-bit bus interface D-type latch (3-State)

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## Data sheet status

Data sheet status	Product status	Definition [1]
Objective specification	Development	This data sheet contains the design target or goal specifications for product development. Specification may change in any manner without notice.
Preliminary specification	Qualification	This data sheet contains preliminary data, and supplementary data will be published at a later date. Philips Semiconductors reserves the right to make changes at any time without notice in order to improve design and supply the best possible product.
Product specification	Production	This data sheet contains final specifications. Philips Semiconductors reserves the right to make changes at any time without notice in order to improve design and supply the best possible product.

[1] Please consult the most recently issued datasheet before initiating or completing a design.

## Definitions

**Short-form specification** — The data in a short-form specification is extracted from a full data sheet with the same type number and title. For detailed information see the relevant data sheet or data handbook.

**Limiting values definition** — Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.

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811 East Arques Avenue  
P.O. Box 3409  
Sunnyvale, California 94088-3409  
Telephone 800-234-7381

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