DATA SHEET

74ALVT16841

2.5V/3.3V ALVT 20-bit bus interface latch (3-State)

Product specification
Supersedes data of 1996 Aug 28
IC23 Data Handbook

1998 Feb 13

Philips
Semiconductors

PHILIPS

2.5V/3.3V 20-bit bus interface latch (3-State) 74ALVT16841

FEATURES

- High speed parallel latches
- 5V I/O Compatible
- Live insertion/extraction permitted
- Extra data width for wide address/data paths or buses carrying parity
- Power-up 3-State
- Power-up reset
- Ideal where high speed, light loading, or increased fan-in are required with MOS microprocessors
- Output capability: +64mA/–32mA
- Latch-up protection exceeds 500mA per Jedec Std 17
- Bus-hold data inputs eliminate the need for external pull-up resistors to hold unused inputs
- ESD protection exceeds 2000V per MIL STD 883 Method 3015 and 200V per Machine Model

DESCRIPTION

The 74ALVT16841 Bus interface latch is designed to provide extra data width for wider data/address paths of buses carrying parity. It is designed for V_{CC} operation at 2.5V or 3.3V with I/O compatibility to 5V.

The 74ALVT16841 consists of two sets of ten D-type latches with 3-State outputs. The flip-flops appear transparent to the data when Latch Enable (nLE) is High. This allows asynchronous operation, as the output transition follows the data in transition. On the nLE High-to-Low transition, the data that meets the setup and hold time is latched.

Data appears on the bus when the Output Enable ($n\overline{OE}$) is Low. When $n\overline{OE}$ is High the output is in the High-impedance state.

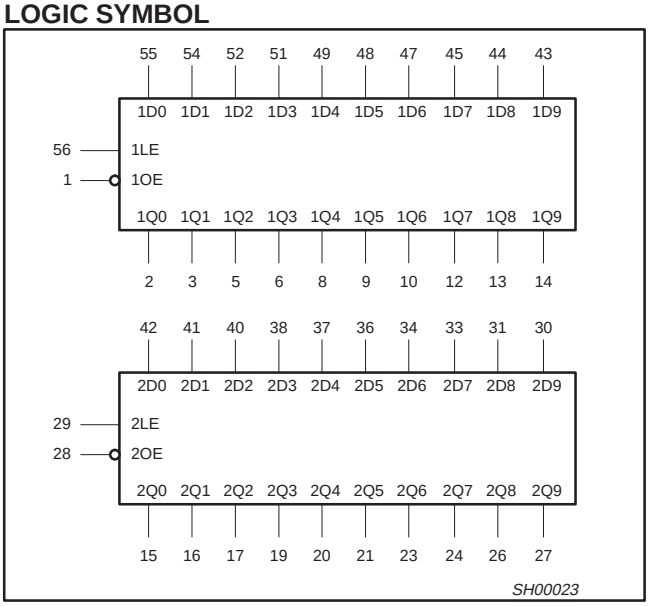
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS T_{amb} = 25°C	TYPICAL		UNIT
			2.5V	3.3V	
t_{PLH} t_{PHL}	Propagation delay nDx to nQx	C_L = 50pF	1.8 2.1	1.5 1.7	ns
C_{IN}	Input capacitance DIR, $\overline{OE}$	V_I = 0V or V_{CC}	3	3	pF
C_{Out}	Output pin capacitance	$V_{I/O}$ = 0V or V_{CC}	9	9	pF
I_{CCZ}	Total supply current	Outputs disabled	40	70	µA

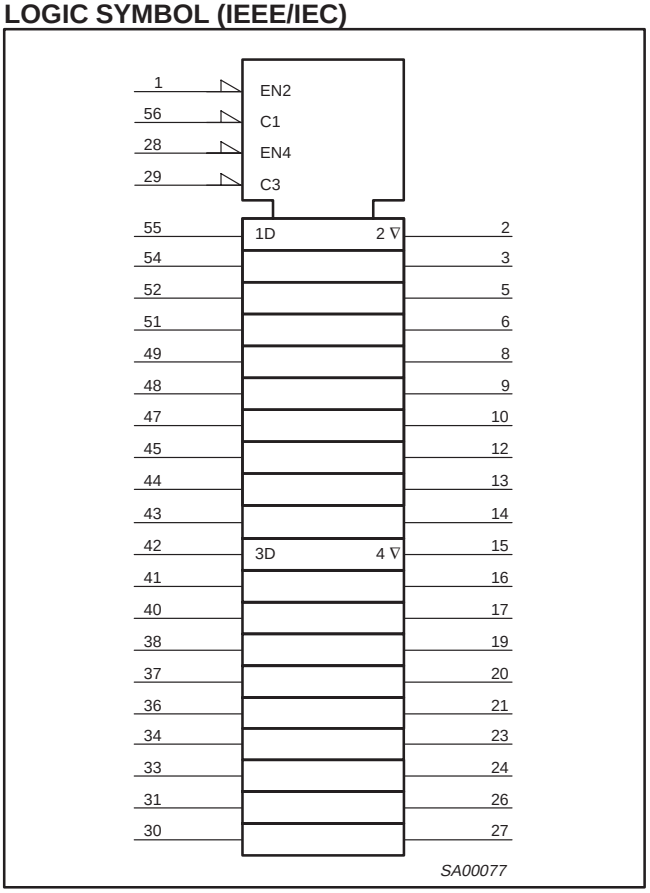
ORDERING INFORMATION

PACKAGES	TEMPERATURE RANGE	OUTSIDE NORTH AMERICA	NORTH AMERICA	DWG NUMBER
56-Pin Plastic SSOP Type III	–40°C to +85°C	74ALVT16841 DL	AV16841 DL	SOT371-1
56-Pin Plastic TSSOP Type II	–40°C to +85°C	74ALVT16841 DGG	AV16841 DGG	SOT364-1

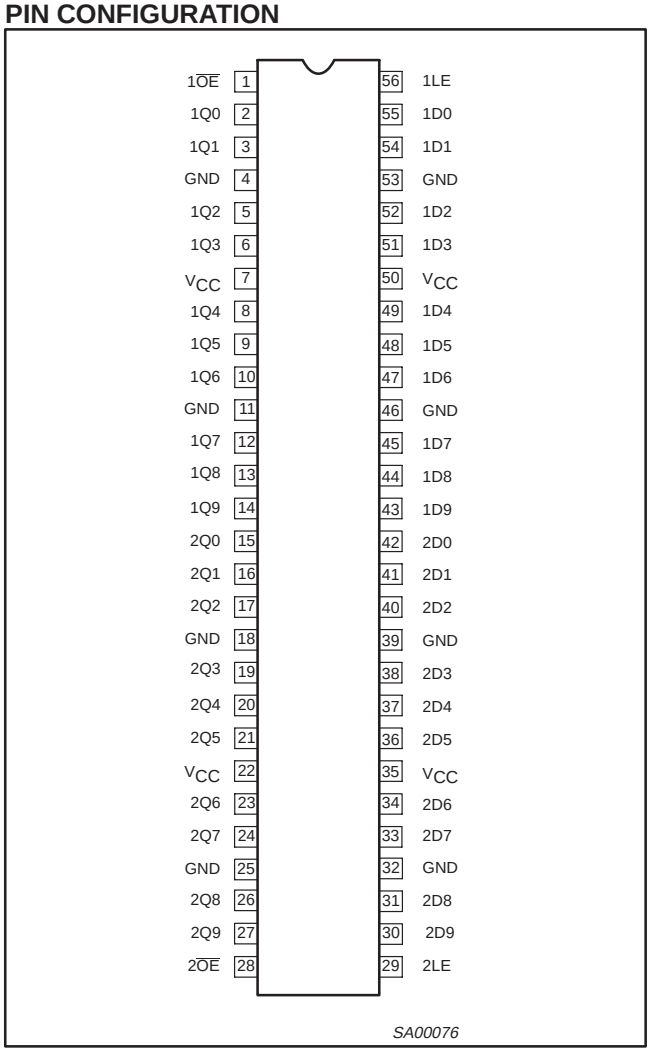
LOGIC SYMBOL



LOGIC SYMBOL (IEEE/IEC)



PIN CONFIGURATION



PIN DESCRIPTION

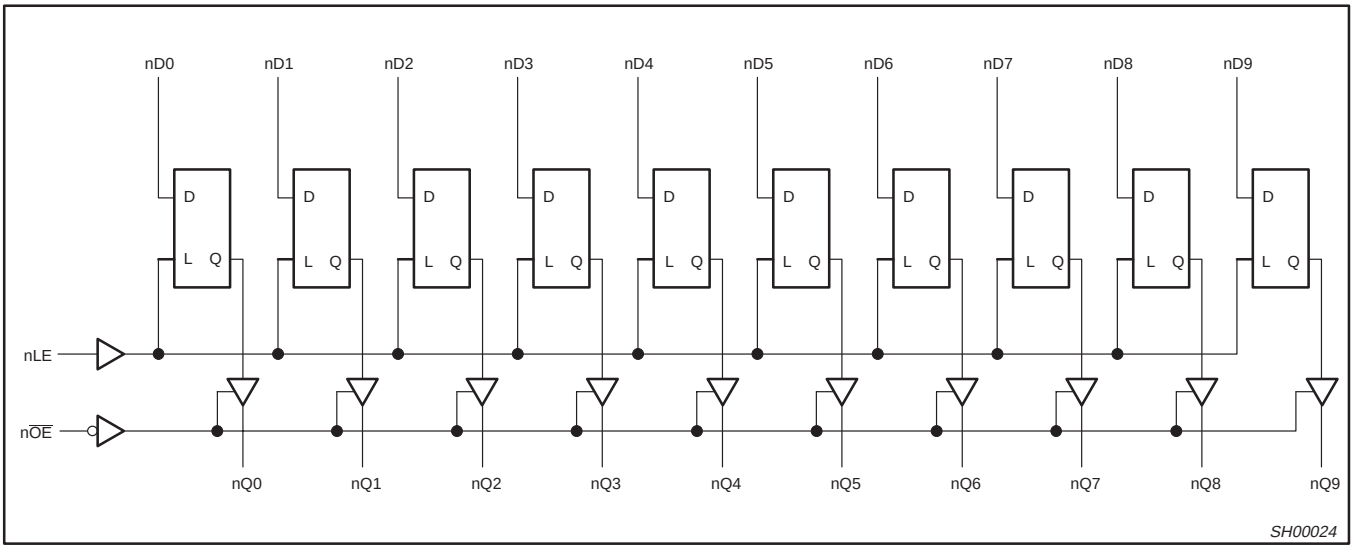
PIN NUMBER	SYMBOL	FUNCTION
55, 54, 52, 51, 49, 48, 47, 45, 44, 43 42, 41, 40, 38, 37, 36, 34, 33, 31, 30	1D0 – 1D9 2D0 – 2D9	Data inputs
2, 3, 5, 6, 8, 9, 10, 12, 13, 14 15, 16, 17, 19, 20, 21, 23, 24, 26, 27	1Q0 – 1Q9 2Q0 – 2Q9	Data outputs
1, 28	$1\overline{OE}$, $2\overline{OE}$	Output enable inputs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

FUNCTION TABLE

INPUTS			OUTPUTS	OPERATING MODE
$n\overline{OE}$	nLE	nDx	nQ0 – nQ9	
L L	H H	L H	L H	Transparent
L L	↓ ↓	l h	L H	Latched
H	X	X	Z	High impedance
L	L	X	NC	Hold

H = High voltage level
h = High voltage level one set-up time prior to the High-to-Low LE transition
L = Low voltage level
l = Low voltage level one set-up time prior to the High-to-Low LE transition
↓ = High-to-Low LE transition
NC = No change
X = Don't care
Z = High impedance "off" state

LOGIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS[1, 2]

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[3]		–1.2 to +7.0	V
I_{OK}	DC output diode current	$V_O < 0$	–50	mA
V_{OUT}	DC output voltage[3]	Output in Off or High state	–0.5 to +7.0	V
I_{OUT}	DC output current	Output in Low state	128	mA
		Output in High state	–64	
T_{stg}	Storage temperature range		–65 to 150	°C

NOTES:
1. Stresses beyond those listed may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
2. The performance capability of a high-performance integrated circuit in conjunction with its thermal environment can create junction temperatures which are detrimental to reliability. The maximum junction temperature of this integrated circuit should not exceed 150°C.
3. The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	2.5V RANGE LIMITS		3.3V RANGE LIMITS		UNIT
		MIN	MAX	MIN	MAX	
V_{CC}	DC supply voltage	2.3	2.7	3.0	3.6	V
V_I	Input voltage	0	5.5	0	5.5	V
V_{IH}	High-level input voltage	1.7		2.0		V
V_{IL}	Input voltage		0.7		0.8	V
I_{OH}	High-level output current		–8		–32	mA
I_{OL}	Low-level output current		8		32	mA
	Low-level output current; current duty cycle ≤ 50%; f ≥ 1kHz		24		64	
$\Delta t/\Delta v$	Input transition rise or fall rate; Outputs enabled		10		10	ns/V
T_{amb}	Operating free-air temperature range	–40	+85	–40	+85	°C

DC ELECTRICAL CHARACTERISTICS (3.3V ±0.3V RANGE)

SYMBOL	PARAMETER	TEST CONDITIONS		LIMITS			UNIT
				Temp = -40°C to +85°C			
				MIN	TYP[1]	MAX	
V_{IK}	Input clamp voltage	V_{CC} = 3.0V; I_{IK} = –18mA			–0.85	–1.2	V
V_{OH}	High-level output voltage	V_{CC} = 3.0 to 3.6V; I_{OH} = –100µA		V_{CC}–0.2	V_{CC}		V
		V_{CC} = 3.0V; I_{OH} = –32mA		2.0	2.3		
V_{OL}	Low–level output voltage	V_{CC} = 3.0V; I_{OL} = 100µA			0.07	0.2	V
		V_{CC} = 3.0V; I_{OL} = 16mA			0.25	0.4	
		V_{CC} = 3.0V; I_{OL} = 32mA			0.3	0.5	
		V_{CC} = 3.0V; I_{OL} = 64mA			0.4	0.55	
V_{RST}	Power-up output low voltage[6]	V_{CC} = 3.6V; I_O = 1mA; V_I = V_{CC} or GND				0.55	V
I_I	Input leakage current	V_{CC} = 3.6V; V_I = V_{CC} or GND	Control pins		0.1	±1	µA
		V_{CC} = 0 or 3.6V; V_I = 5.5V			0.1	10	
		V_{CC} = 3.6V; V_I = V_{CC}	Data pins[4]		0.5	1	
		V_{CC} = 3.6V; V_I = 0V			0.1	-5	
I_{OFF}	Off current	V_{CC} = 0V; V_I or V_O = 0 to 4.5V			0.1	±100	µA
I_{HOLD}	Bus Hold current Data inputs[7]	V_{CC} = 3V; V_I = 0.8V		75	130		µA
		V_{CC} = 3V; V_I = 2.0V		–75	–140		
		V_{CC} = 0V to 3.6V; V_{CC} = 3.6V		±500			
I_{EX}	Current into an output in the High state when V_O > V_{CC}	V_O = 5.5V; V_{CC} = 3.0V			10	125	µA
$I_{PU/PD}$	Power up/down 3-State output current[3]	V_{CC} ≤ 1.2V; V_O = 0.5V to V_{CC}; V_I = GND or V_{CC} $\overline{OE}$ = Don't care			1	±100	µA
I_{OZH}	3-State output High current	V_{CC} = 3.6V; V_O = 3.0V; V_I = V_{IL} or V_{IH}			0.5	5	µA
I_{OZL}	3-State output Low current	V_{CC} = 3.6V; V_O = 0.5V; V_I = V_{IL} or V_{IH}			0.5	–5	µA
I_{CCH}	Quiescent supply current	V_{CC} = 3.6V; Outputs High, V_I = GND or V_{CC}, I_O = 0			0.07	0.1	mA
I_{CCL}		V_{CC} = 3.6V; Outputs Low, V_I = GND or V_{CC}, I_O = 0			3.2	7	
I_{CCZ}		V_{CC} = 3.6V; Outputs Disabled; V_I = GND or V_{CC}, I_O = 0[5]			0.07	0.1	
ΔI_{CC}	Additional supply current per input pin[2]	V_{CC} = 3V to 3.6V; One input at V_{CC}–0.6V, Other inputs at V_{CC} or GND			0.04	0.4	mA

NOTES:
1. All typical values are at V_{CC} = 3.3V and T_{amb} = 25°C.
2. This is the increase in supply current for each input at the specified voltage level other than V_{CC} or GND
3. This parameter is valid for any V_{CC} between 0V and 1.2V with a transition time of up to 10msec. From V_{CC} = 1.2V to V_{CC} = 3.3V ± 0.3V a transition time of 100µsec is permitted. This parameter is valid for T_{amb} = 25°C only.
4. Unused pins at V_{CC} or GND.
5. I_{CCZ} is measured with outputs pulled up to V_{CC} or pulled down to ground.
6. For valid test results, data must not be loaded into the flip-flops (or latches) after applying power.
7. This is the bus hold overdrive current required to force the input to the opposite logic state.

AC CHARACTERISTICS (3.3V ±0.3V RANGE)

GND = 0V; $t_R = t_F$ = 2.5ns; C_L = 50pF; R_L = 500Ω; T_{amb} = –40°C to +85°C.

SYMBOL	PARAMETER	WAVEFORM	LIMITS			UNIT
			T_{amb} = -40 to +85°C V_{CC} = +3.3V ±0.3V			
			MIN	TYP	MAX	
t_{PLH} t_{PHL}	Propagation delay nDx to nQx	2	0.5 0.5	1.5 1.7	2.5 2.7	ns
t_{PLH} t_{PHL}	Propagation delay nLE to nQx	1	1.0 1.5	2.1 3.4	3.2 5.5	ns
t_{PZH} t_{PZL}	Output enable time to High and Low level	4 5	1.0 0.5	2.3 1.3	3.6 2.3	ns
t_{PHZ} t_{PLZ}	Output disable time from High and Low level	4 5	1.5 1.5	3.2 2.8	4.9 4.3	ns

NOTE:
1. All typical values are at V_{CC} = 3.3V and T_{amb} = 25°C.

AC SETUP REQUIREMENTS (3.3V ±0.3V RANGE)

GND = 0V, $t_R = t_F$ = 2.5ns, C_L = 50pF, R_L = 500Ω

SYMBOL	PARAMETER	WAVEFORM	LIMITS		UNIT
			T_{amb} = -40 to +85°C V_{CC} = +3.3V ±0.3V		
			Min	Typ	
t_s(H) t_s(L)	Setup time, High or Low nDx to nLE	3	1.0 1.0	0 0	ns
t_h(H) t_h(L)	Hold time, High or Low nDx to nLE	3	1.2 1.2	0.1 0.3	ns
t_w(H)	nLE pulse width High	1	1.5		ns

DC ELECTRICAL CHARACTERISTICS (2.5V ±0.2V RANGE)

SYMBOL	PARAMETER	TEST CONDITIONS		LIMITS			UNIT
				Temp = -40°C to +85°C			
				MIN	TYP[1]	MAX	
V_{IK}	Input clamp voltage	V_{CC} = 2.3V; I_{IK} = –18mA			–0.85	–1.2	V
V_{OH}	High-level output voltage	V_{CC} = 2.3 to 3.6V; I_{OH} = –100µA		V_{CC}–0.2	V_{CC}		V
		V_{CC} = 2.3V; I_{OH} = –8mA		1.8	2.1		
V_{OL}	Low-level output voltage	V_{CC} = 2.3V; I_{OL} = 100µA			0.07	0.2	V
		V_{CC} = 2.3V; I_{OL} = 24mA			0.3	0.5	
		V_{CC} = 2.3V; I_{OL} = 8mA				0.4	
V_{RST}	Power-up output low voltage[7]	V_{CC} = 2.7V; I_O = 1mA; V_I = V_{CC} or GND				0.55	V
I_I	Input leakage current	V_{CC} = 2.7V; V_I = V_{CC} or GND	Control pins		0.1	±1	µA
		V_{CC} = 0 or 2.7V; V_I = 5.5V			0.1	10	
		V_{CC} = 2.7V; V_I = V_{CC}	Data pins[4]		0.1	1	
		V_{CC} = 2.7V; V_I = 0			0.1	-5	
I_{OFF}	Off current	V_{CC} = 0V; V_I or V_O = 0 to 4.5V			0.1	±100	µA
I_{HOLD}	Bus Hold current Data inputs[6]	V_{CC} = 2.3V; V_I = 0.7V			90		µA
		V_{CC} = 2.3V; V_I = 1.7V			–10		
I_{EX}	Current into an output in the High state when V_O > V_{CC}	V_O = 5.5V; V_{CC} = 2.3V			10	125	µA
$I_{PU/PD}$	Power up/down 3-State output current[3]	V_{CC} ≤ 1.2V; V_O = 0.5V to V_{CC}; V_I = GND or V_{CC}; OE/$\overline{OE}$ = Don't care			1	±100	µA
I_{OZH}	3-State output High current	V_{CC} = 2.7V; V_O = 2.3V; V_I = V_{IL} or V_{IH}			0.5	5	µA
I_{OZL}	3-State output Low current	V_{CC} = 2.7V; V_O = 0.5V; V_I = V_{IL} or V_{IH}			0.5	–5	µA
I_{CCH}	Quiescent supply current	V_{CC} = 2.7V; Outputs High, V_I = GND or V_{CC}, I_O = 0			0.04	0.1	mA
I_{CCL}		V_{CC} = 2.7V; Outputs Low, V_I = GND or V_{CC}, I_O = 0			2.3	4.5	
I_{CCZ}		V_{CC} = 2.7V; Outputs Disabled; V_I = GND or V_{CC}, I_O = 0[5]			0.04	0.1	
ΔI_{CC}	Additional supply current per input pin[2]	V_{CC} = 2.3V to 2.7V; One input at V_{CC}–0.6V, Other inputs at V_{CC} or GND			0.04	0.4	mA

NOTES:
1. All typical values are at V_{CC} = 2.5V and T_{amb} = 25°C.
2. This is the increase in supply current for each input at the specified voltage level other than V_{CC} or GND
3. This parameter is valid for any V_{CC} between 0V and 1.2V with a transition time of up to 10msec. From V_{CC} = 1.2V to V_{CC} = 2.5V ± 0.2V a transition time of 100µsec is permitted. This parameter is valid for T_{amb} = 25°C only.
4. Unused pins at V_{CC} or GND.
5. I_{CCZ} is measured with outputs pulled up to V_{CC} or pulled down to ground.
6. Not guaranteed.
7. For valid test results, data must not be loaded into the flip-flops (or latches) after applying power.

AC CHARACTERISTICS (2.5V ±0.2V RANGE)

GND = 0V; $t_R = t_F$ = 2.5ns; C_L = 50pF; R_L = 500Ω; T_{amb} = –40°C to +85°C.

SYMBOL	PARAMETER	WAVEFORM	LIMITS			UNIT
			T_{amb} = -40 to +85°C V_{CC} = +2.5V ±0.2V			
			MIN	TYP	MAX	
t_{PLH} t_{PHL}	Propagation delay nDx to nQx	2	0.5 0.5	1.8 2.1	3.0 3.6	ns
t_{PLH} t_{PHL}	Propagation delay nLE to nQx	1	1.0 2.0	2.7 4.2	4.3 6.5	ns
t_{PZH} t_{PZL}	Output enable time to High and Low level	4 5	1.5 0.5	3.0 1.8	4.0 3.2	ns
t_{PHZ} t_{PLZ}	Output disable time from High and Low level	4 5	1.5 1.0	3.1 2.4	4.5 3.8	ns

NOTE:

1. All typical values are at V_{CC} = 3.3V and T_{amb} = 25°C.

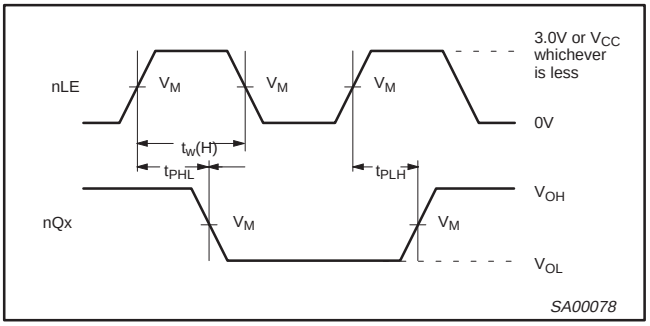
AC SETUP REQUIREMENTS (2.5V ±0.2V RANGE)

GND = 0V, $t_R = t_F$ = 2.5ns, C_L = 50pF, R_L = 500Ω

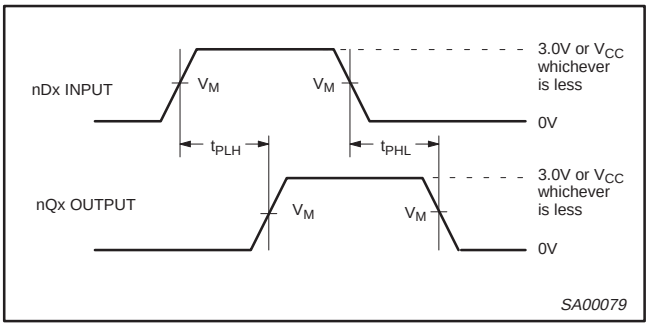
SYMBOL	PARAMETER	WAVEFORM	LIMITS		UNIT
			T_{amb} = -40 to +85°C V_{CC} = +2.5V ±0.2V		
			Min	Typ	
t_s(H) t_s(L)	Setup time, High or Low nDx to nLE	3	0.5 1.5	0 0.2	ns
t_h(H) t_h(L)	Hold time, High or Low nDx to nLE	3	1.8 2.0	0 0.8	ns
t_w(H)	nLE pulse width High	1	1.5		ns

AC WAVEFORMS

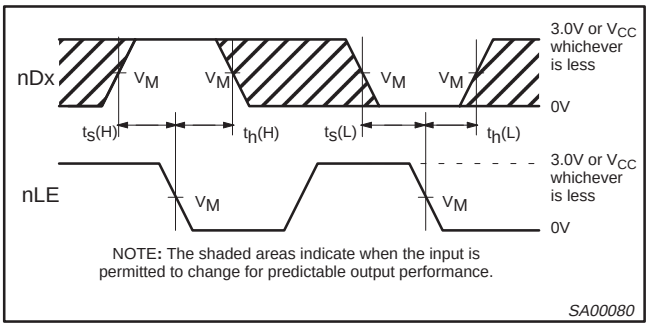
V_M = 1.5V at $V_{CC} \geq$ 3.0V; $V_M = V_{CC}/2$ at $V_{CC} \leq$ 2.7V
$V_X = V_{OL}$ + 0.3V at $V_{CC} \geq$ 3.0V; $V_X = V_{OL}$ + 0.15V at $V_{CC} \leq$ 2.7V
$V_Y = V_{OH}$ – 0.3V at $V_{CC} \geq$ 3.0V; $V_Y = V_{OH}$ – 0.15V at $V_{CC} \leq$ 2.7V



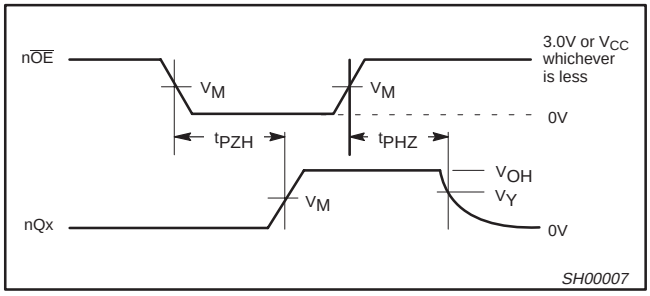
Waveform 1. Propagation Delay, Latch Enable Input to Output, and Enable Pulse Width



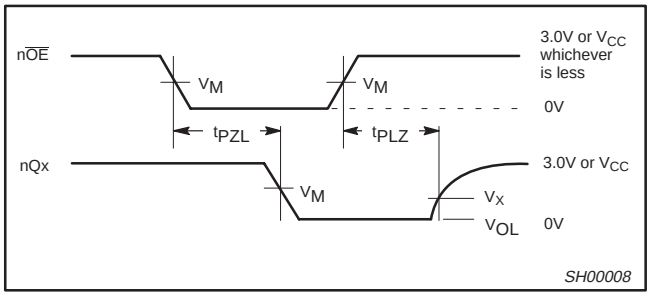
Waveform 2. Propagation Delay for Data to Outputs



Waveform 3. Data Setup and Hold Times

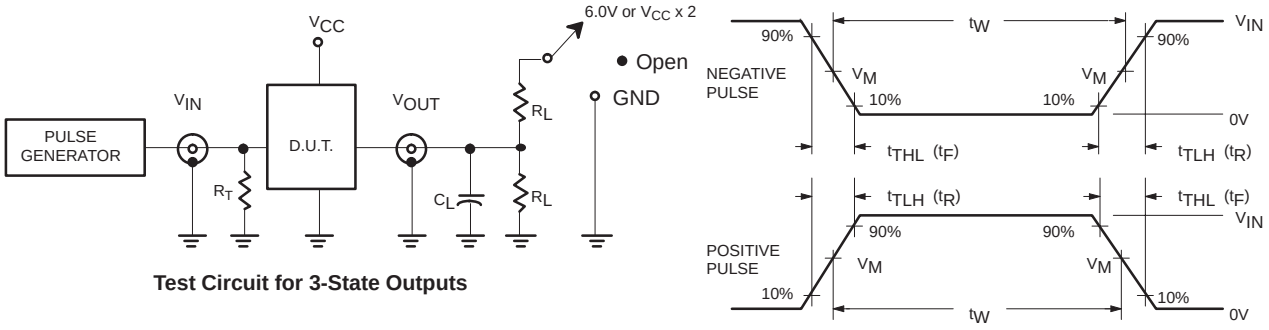


Waveform 4. 3-State Output Enable Time to High Level and Output Disable Time from High Level



Waveform 5. 3-State Output Enable Time to Low Level and Output Disable Time from Low Level

TEST CIRCUIT AND WAVEFORM



Test Circuit for 3-State Outputs

SWITCH POSITION

TEST	SWITCH
t_{PLZ}/t_{PZL}	6V or $V_{CC\ x\ 2}$
t_{PLH}/t_{PHL}	Open
t_{PHZ}/t_{PZH}	GND

DEFINITIONS

R_L = Load resistor; see AC CHARACTERISTICS for value.

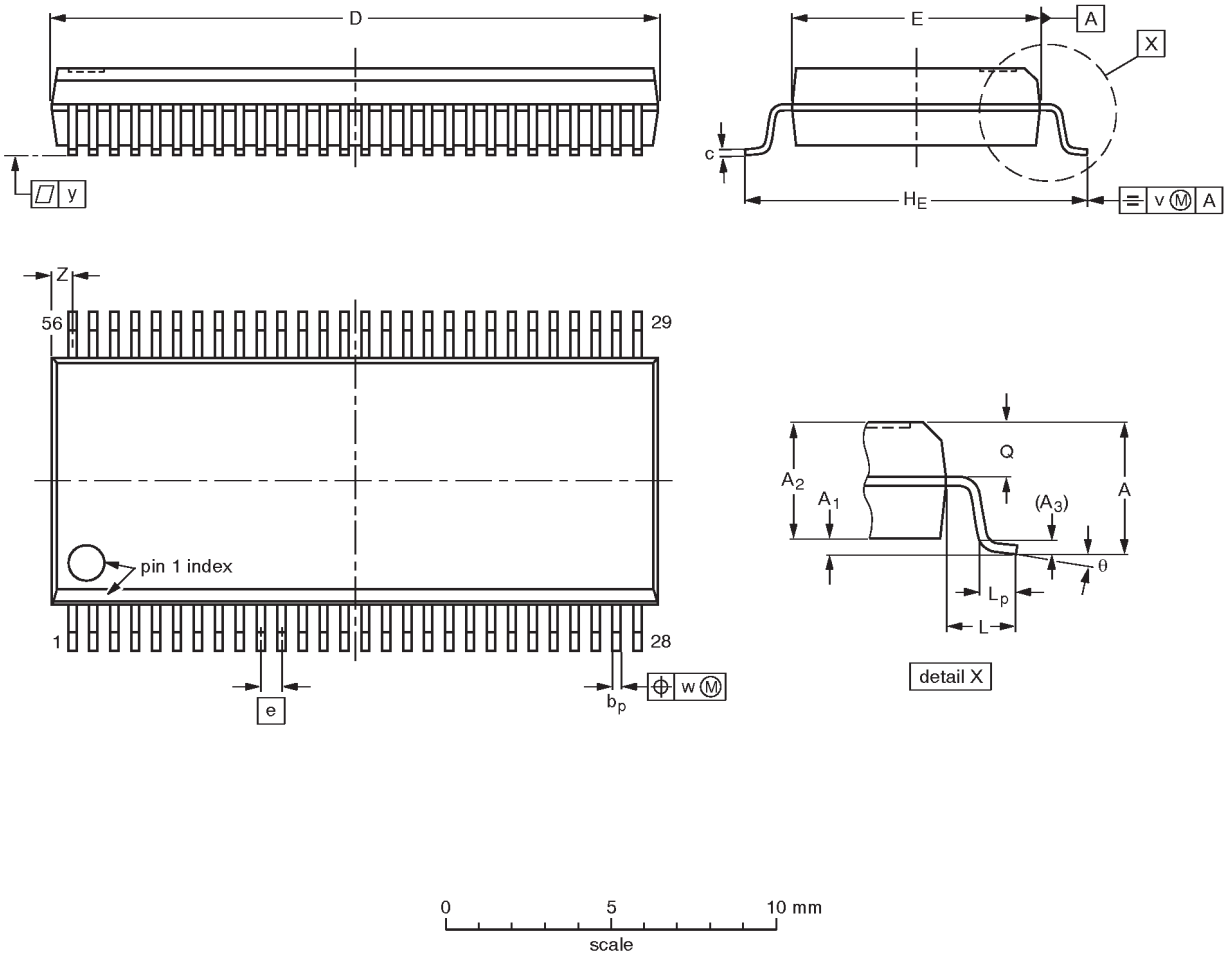
C_L = Load capacitance includes jig and probe capacitance: See AC CHARACTERISTICS for value.

R_T = Termination resistance should be equal to Z_{OUT} of pulse generators.

FAMILY	INPUT PULSE REQUIREMENTS				
	Amplitude	Rep. Rate	t_W	t_R	t_F
74ALVT16	3.0V or V_{CC} whichever is less	≤ 10MHz	500ns	≤ 2.5ns	≤ 2.5ns

SW00025

SSOP56: plastic shrink small outline package; 56 leads; body width 7.5 mm **SOT371-1**



DIMENSIONS (mm are the original dimensions)

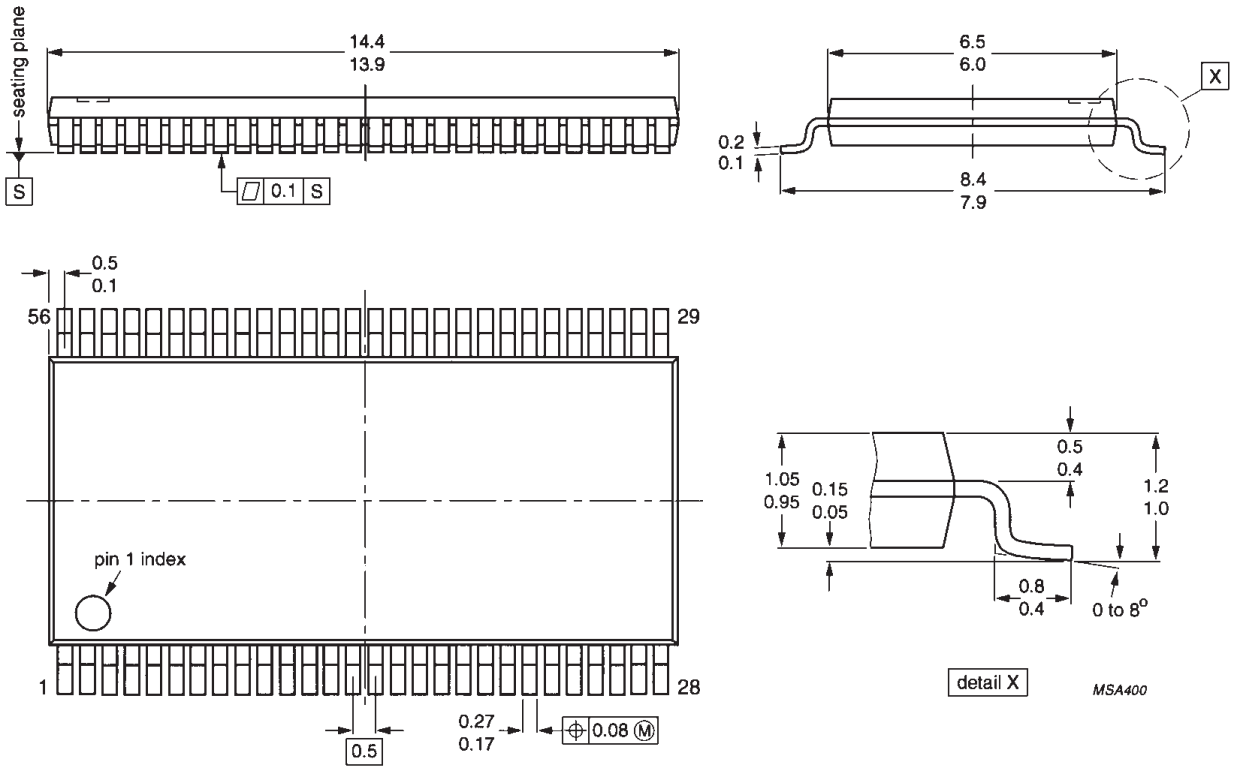
UNIT	A max.	A_1	A_2	A_3	b_p	c	D (1)	E (1)	e	H_E	L	L_p	Q	v	w	y	Z (1)	θ
mm	2.8	0.4 0.2	2.35 2.20	0.25	0.3 0.2	0.22 0.13	18.55 18.30	7.6 7.4	0.635	10.4 10.1	1.4	1.0 0.6	1.2 1.0	0.25	0.18	0.1	0.85 0.40	8° 0°

Note

1. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT371-1		MO-118AB				~~93-11-02~~ 95-02-04

TSSOP56: plastic thin shrink small outline package; 56 leads; body width 6.1mm **SOT364-1**



Dimensions in mm.

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 chages at any time without notice in order to improve design and supply the best possible product.
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Philips Semiconductors
811 East Arques Avenue
P.O. Box 3409
Sunnyvale, California 94088–3409
Telephone 800-234-7381

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