DATA SHEET

74ALVCH16373

2.5V/3.3V 16-bit D-type transparent latch (3-State)

Product specification
Supersedes data of 1998 Jun 29
IC24 Data Handbook

1999 Sep 20

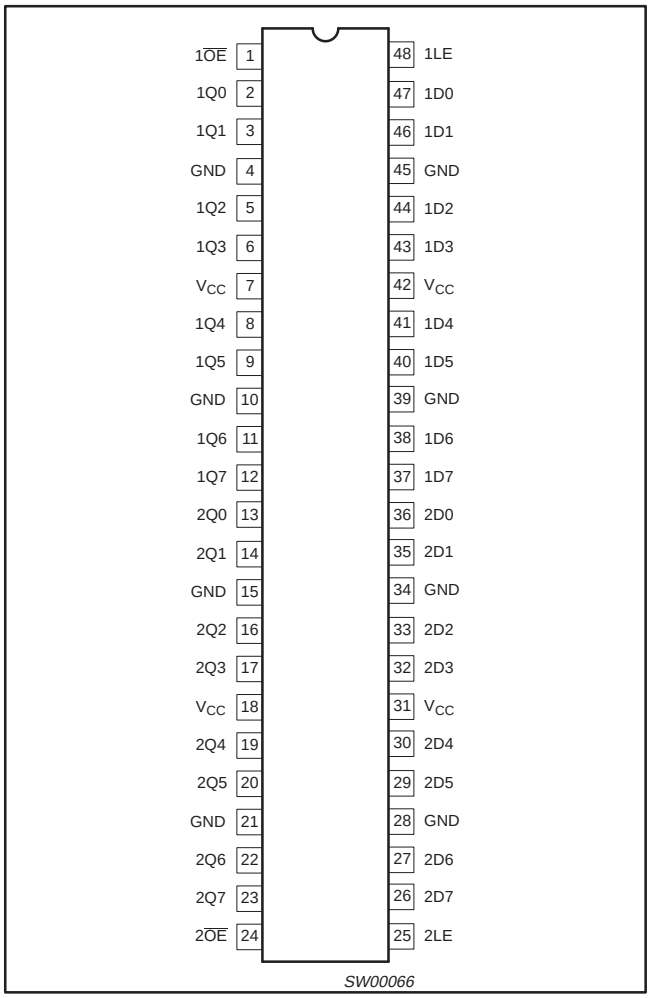
Philips
Semiconductors

16-bit D-type transparent latch (3-State) 74ALVCH16373

FEATURES

- Wide supply voltage range of 1.2V to 3.6V
- Complies with JEDEC standard no. 8-1A
- CMOS low power consumption
- MULTIBYTE™ flow-through standard pin-out architecture
- Low inductance multiple V_{CC} and ground pins for minimum noise and ground bounce
- Direct interface with TTL levels
- All data inputs have bus hold
- Output drive capability 50Ω transmission lines @ 85°C
- Current drive ±24 mA at 3.0 V

PIN CONFIGURATION



SW00066

DESCRIPTION

The 74ALVCH16373 is a 16-bit D-type transparent latch featuring separate D-type inputs for each latch and 3-State outputs for bus oriented applications. Incorporates bus hold data inputs which eliminate the need for external pull-up or pull-down resistors to hold unused inputs. One latch enable (LE) input and one output enable ($\overline{OE}$) are provided per 8-bit section.

The 74ALVCH16373 consists of 2 sections of eight D-type transparent latches with 3-State true outputs. When LE is HIGH, data at the Dn inputs enter the latches. In this condition the latches are transparent, i.e., a latch output will change each time its corresponding D-input changes.

When LE is LOW the latches store the information that was present at the D-inputs a set-up time preceding the HIGH-to-LOW transition of LE. When $\overline{OE}$ is LOW, the contents of the eight latches are available at the outputs. When $\overline{OE}$ is HIGH, the outputs go to the high impedance OFF-state. Operation of the $\overline{OE}$ input does not affect the state of the latches.

QUICK REFERENCE DATA

GND = 0V; T_{amb} = 25°C; $t_r = t_f \leq 2.5$ns

SYMBOL	PARAMETER	CONDITIONS		TYPICAL	UNIT
t_{PHL}/t_{PLH}	Propagation delay Dn to Qn	V_{CC} = 2.5V, C_L = 30pF		2.1	ns
		V_{CC} = 3.3V, C_L = 50pF		2.1	
	Propagation delay LE to Qn	V_{CC} = 2.5V, C_L = 30pF		2.2	
		V_{CC} = 3.3V, C_L = 50pF		2.2	
C_I	Input capacitance			5.0	pF
C_{PD}	Power dissipation capacitance per latch	V_I = GND to V_{CC}[1]	Outputs enabled	16	pF
			Outputs disabled	10	

NOTE:

1. C_{PD} is used to determine the dynamic power dissipation (P_D in μW):
   $P_D = C_{PD} \times V_{CC}^2 \times f_i + \Sigma (C_L \times V_{CC}^2 \times f_o)$ where: f_i = input frequency in MHz; C_L = output load capacitance in pF; f_o = output frequency in MHz; V_{CC} = supply voltage in V; $\Sigma (C_L \times V_{CC}^2 \times f_o)$ = sum of outputs.

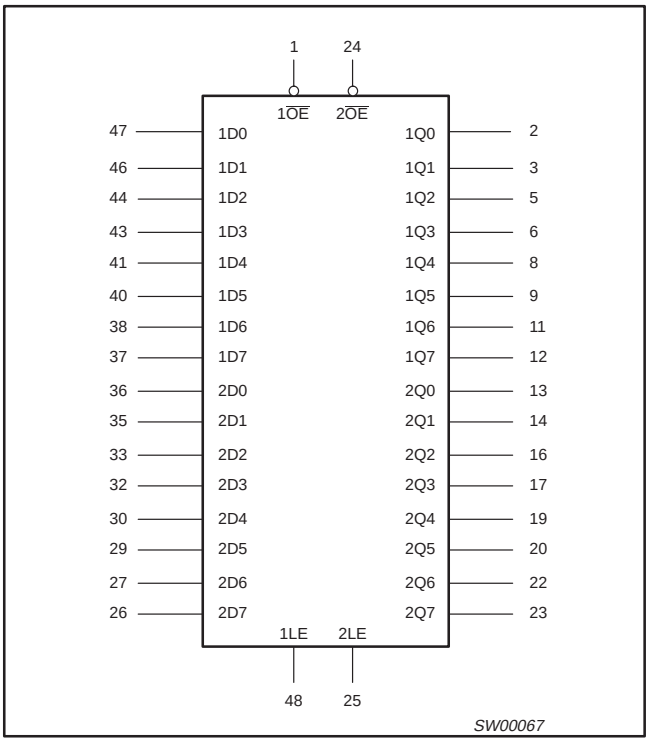
ORDERING INFORMATION

PACKAGES	TEMPERATURE RANGE	OUTSIDE NORTH AMERICA	NORTH AMERICA	DWG NUMBER
48-Pin Plastic SSOP Type III	–40°C to +85°C	74ALVCH16373 DL	ACH16373 DL	SOT370-1
48-Pin Plastic TSSOP Type II	–40°C to +85°C	74ALVCH16373 DGG	ACH16373 DGG	SOT362-1

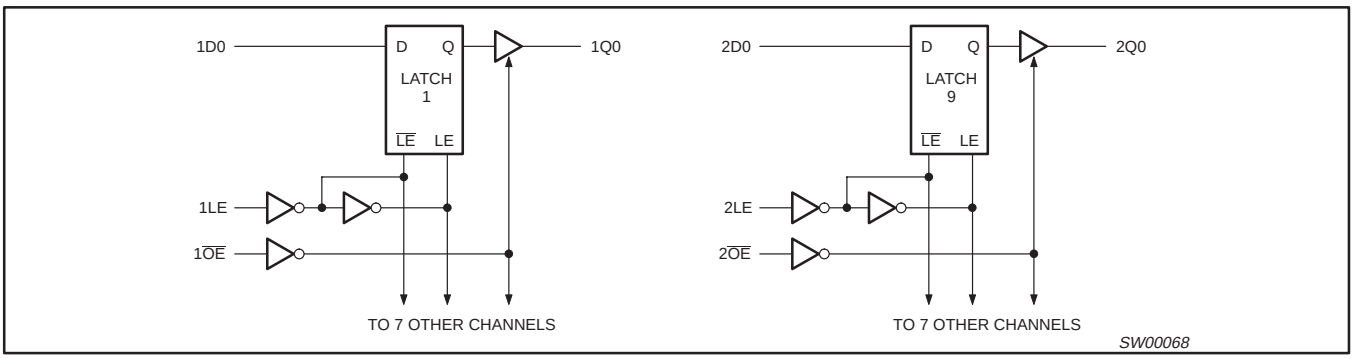
PIN DESCRIPTION

PIN NUMBER	SYMBOL	NAME AND FUNCTION
1	$1\overline{OE}$	Output enable input (active LOW)
2, 3, 5, 6, 8, 9, 11, 12	1Q0 to 1Q7	Data inputs/outputs
4, 10, 15, 21, 28, 34, 39, 45	GND	Ground (0V)
7, 18, 31, 42	V_{CC}	Positive supply voltage
13, 14, 16, 17, 19, 20, 22, 23	2Q0 to 2Q7	Data inputs/outputs
24	$2\overline{OE}$	Output enable input (active LOW)
25	2LE	Latch enable input (active HIGH)
36, 35, 33, 32, 30, 29, 27, 26	2D0 to 2D7	Data inputs
47, 46, 44, 43, 41, 40, 38, 37	1D0 to 1D7	Data inputs
48	1LE	Latch enable input (active HIGH)

LOGIC SYMBOL



LOGIC DIAGRAM

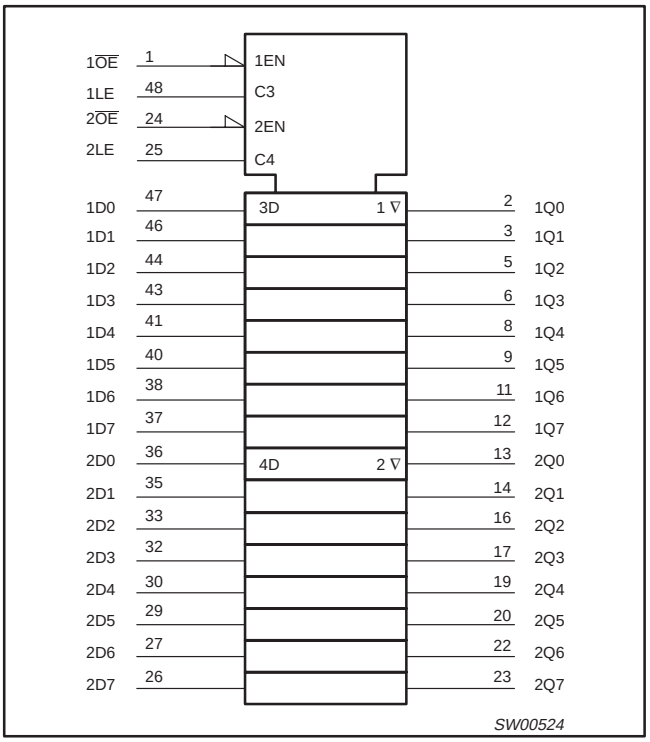


FUNCTION TABLE (per section of eight bits)

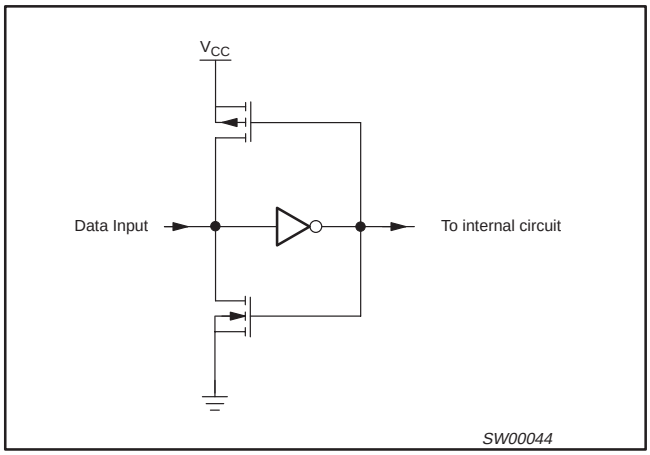
OPERATING MODES	INPUTS			INTERNAL LATCHES	OUTPUTS
	$n\overline{OE}$	nLE	nDn		nQn
Enable and read register (transparent mode)	L L	H H	L H	L H	L H
Latch and read register (hold mode)	L L	L L	l h	L H	L H
Latch register and disable outputs	H H	L L	l h	L H	Z Z

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
X = don't care
Z = high impedance OFF-state

LOGIC SYMBOL (IEEE/IEC)



BUS HOLD CIRCUIT



RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	CONDITIONS	LIMITS		UNIT
			MIN	MAX	
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	For data input pins	0	V_{CC}	V
		For control pins	0	5.5	
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 V_{CC} = 3.0 to 3.6V	0 0	20 10	ns/V

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[2]	–0.5 to +4.6	V
		For data inputs[2]	–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 2	–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 above +55°C derate linearly with 11.3 mW/K above +55°C derate linearly with 8 mW/K	 850 600	mW

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

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[1]	MAX	
V_{IH}	HIGH level Input voltage	V_{CC} = 1.2V	V_{CC}			V
		V_{CC} = 1.8V	0.7*V_{CC}	0.9		
		V_{CC} = 2.3 to 2.7V	1.7	1.2		
		V_{CC} = 2.7 to 3.6V	2.0	1.5		
V_{IL}	LOW level Input voltage	V_{CC} = 1.2V			GND	V
		V_{CC} = 1.8V		0.9	0.2*V_{CC}	
		V_{CC} = 2.3 to 2.7V		1.2	0.7	
		V_{CC} = 2.7 to 3.6V		1.5	0.8	
V_{OH}	HIGH level output voltage	V_{CC} = 1.8 to 3.6V; V_I = V_{IH} or V_{IL}; I_O = –100µA	V_{CC} – 0.2	V_{CC}		V
		V_{CC} = 1.8V; V_I = V_{IH} or V_{IL}; I_O = –6mA	V_{CC} – 0.4	V_{CC} – 0.10		
		V_{CC} = 2.3V; V_I = V_{IH} or V_{IL}; I_O = –6mA	V_{CC} – 0.3	V_{CC} – 0.08		
		V_{CC} = 2.3V; V_I = V_{IH} or V_{IL}; I_O = –12mA	V_{CC} – 0.5	V_{CC} – 0.17		
		V_{CC} = 2.3V; V_I = V_{IH} or V_{IL}; I_O = –18mA	V_{CC} – 0.6	V_{CC} – 0.26		
		V_{CC} = 2.7V; V_I = V_{IH} or V_{IL}; I_O = –12mA	V_{CC} – 0.5	V_{CC} – 0.14		
		V_{CC} = 3.0V; V_I = V_{IH} or V_{IL}; I_O = –24mA	V_{CC} – 1.0	V_{CC} – 0.28		

DC ELECTRICAL CHARACTERISTICS (Continued)

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

V_{OL}	LOW level output voltage	V_{CC} = 1.8 to 3.6V; $V_I = V_{IH}$ or V_{IL}; I_O = 100µA		GND	0.20	V
		V_{CC} = 1.8V; $V_I = V_{IH}$ or V_{IL}; I_O = 6mA		0.09	0.30	
		V_{CC} = 2.3V; $V_I = V_{IH}$ or V_{IL}; I_O = 6mA		0.07	0.20	
		V_{CC} = 2.3V; $V_I = V_{IH}$ or V_{IL}; I_O = 12mA		0.15	0.40	
		V_{CC} = 2.3V; $V_I = V_{IH}$ or V_{IL}; I_O = 12mA		0.23	0.60	
		V_{CC} = 2.7V; $V_I = V_{IH}$ or V_{IL}; I_O = 12mA		0.14	0.40	
		V_{CC} = 3.0V; $V_I = V_{IH}$ or V_{IL}; I_O = 24mA		0.27	0.55	
I_I	Input leakage current per control pin	V_{CC} = 1.8 to 3.6V; V_I = 5.5V or GND		0.1	5	µA
	Input leakage current per data pin	V_{CC} = 1.8 to 3.6V; $V_I = V_{CC}$ or GND		0.1	5	
I_{IHZ}/I_{ILZ}	Input current for common I/O pins	V_{CC} = 1.8 to 2.7V; $V_I = V_{CC}$ or GND		0.1	10	µA
		V_{CC} = 3.6V; $V_I = V_{CC}$ or GND		0.1	15	
I_{OZ}	3-State output OFF-state current	V_{CC} = 2.7 to 3.6V; $V_I = V_{IH}$ or V_{IL}; $V_O = V_{CC}$ or GND		0.1	10	µA
I_{CC}	Quiescent supply current	V_{CC} = 1.8 to 2.7V; $V_I = V_{CC}$ or GND; I_O = 0		0.2	40	µA
		V_{CC} = 2.7 to 3.6V; $V_I = V_{CC}$ or GND; I_O = 0		0.2	40	
ΔI_{CC}	Additional quiescent supply current given per control pin	V_{CC} = 2.7V to 3.6V; $V_I = V_{CC}$ – 0.6V; I_O = 0		150	750	µA
	Additional quiescent supply current given per data I/O pin	V_{CC} = 2.7V to 3.6V; $V_I = V_{CC}$ – 0.6V; I_O = 0		150	750	
I_{BHL}[2]	Bus hold LOW sustaining current	V_{CC} = 2.3V; V_I = 0.7V	45	–		µA
		V_{CC} = 3.0V; V_I = 0.8V	75	150		
I_{BHH}[2]	Bus hold HIGH sustaining current	V_{CC} = 2.3V; V_I = 1.7V	–45			µA
		V_{CC} = 3.0V; V_I = 2.0V	–75	–175		
I_{BHLO}[2]	Bus hold LOW overdrive current	V_{CC} = 2.7V	300			µA
		V_{CC} = 3.6V	450			
I_{BHHO}[2]	Bus hold HIGH overdrive current	V_{CC} = 2.7V	–300			µA
		V_{CC} = 3.6V	–450			

NOTES:
1. All typical values are at T_{amb} = 25°C.
2. Valid for data inputs of bus hold parts.

AC CHARACTERISTICS FOR V_{CC} = 2.3V TO 2.7V RANGE AND V_{CC} < 2.3V

GND = 0V; $t_r = t_f \leq 2.0$ns; C_L = 30pF

SYMBOL	PARAMETER	WAVEFORM	LIMITS							UNIT
			V_{CC} = 2.3 to 2.7V			V_{CC} = 1.8V			V_{CC} = 1.2V	
			MIN	TYP[1, 2]	MAX	MIN	TYP1	MAX	TYP	
t_{PHL}/t_{PLH}	Propagation delay nDn to nYn	1, 5	1.0	2.1	3.9	1.5	3.2	5.7	8.8	ns
t_{PHL}/t_{PLH}	Propagation delay nLE to nYn	2, 5	1.0	2.2	3.9	1.5	3.4	5.9	7.4	ns
t_{PZH}/t_{PZL}	3-State output enable time $n\overline{OE}$ to nYn	4, 5	1.0	2.6	5.2	1.5	4.0	7.3	8.9	ns
t_{PHZ}/t_{PLZ}	3-State output disable time $n\overline{OE}$ to nYn	4, 5	1.0	2.2	4.1	1.5	3.2	5.6	8.9	ns
t_W	nLE pulse width HIGH	2	3.0	1.0	–	3.5	1.0	–	–	ns
t_{SU}	Set-up time nDn to nLE	3	1.0	–0.1	–	1.0	–0.1	–	–	ns
t_h	Hold time nDn to nLE	3	1.5	0.2	–	1.2	0.1	–	–	ns

NOTES:

1. All typical values are measured at T_{amb} = 25°C.
2. Typical value is measured at V_{CC} = 2.5V.

AC CHARACTERISTICS FOR V_{CC} = 3.0V TO 3.6V RANGE AND V_{CC} = 2.7V

GND = 0V; $t_r = t_f \leq 2.5$ns; C_L = 50pF

SYMBOL	PARAMETER	WAVEFORM	LIMITS						UNIT
			V_{CC} = 3.3V ±0.3V			V_{CC} = 2.7V			
			MIN	TYP[1, 2]	MAX	MIN	TYP[1]	MAX	
t_{PHL}/t_{PLH}	Propagation delay nDn to nYn	1, 5	1.0	2.1	3.3	1.0	2.3	3.7	ns
t_{PHL}/t_{PLH}	Propagation delay nLE to nYn	2, 5	1.0	2.2	3.2	1.0	2.2	3.5	ns
t_{PZH}/t_{PZL}	3-State output enable time $n\overline{OE}$ to nYn	4, 5	1.0	2.3	4.2	1.0	2.9	4.9	ns
t_{PHZ}/t_{PLZ}	3-State output disable time $n\overline{OE}$ to nYn	4, 5	1.0	2.8	4.1	1.0	3.1	4.7	ns
t_W	nLE pulse width HIGH	2	2.5	1.0	–	3.0	1.0	–	ns
t_{SU}	Set-up time nDn to nLE	3	1.0	0.0	–	1.0	–0.1	–	ns
t_h	Hold time nDn to nLE	3	1.2	0.2	–	1.5	0.4	–	ns

NOTES:

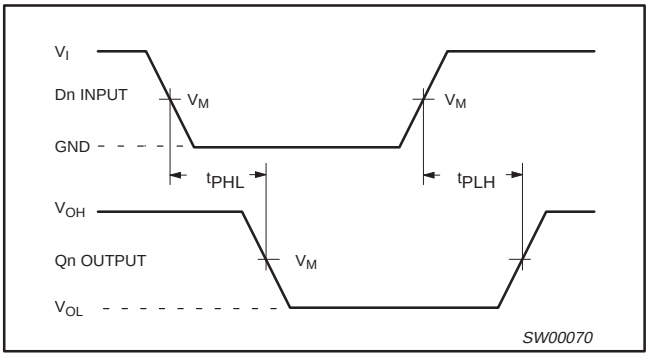
1. All typical values are measured at T_{amb} = 25°C.
2. Typical value is measured at V_{CC} = 3.3V.

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

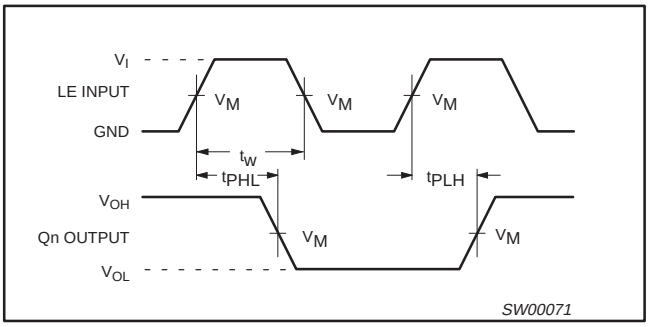
$V_M = 0.5\ V_{CC}$
$V_X = V_{OL} + 0.15V$
$V_Y = V_{OH} – 0.15V$
V_{OL} and V_{OH} are the typical output voltage drop that occur with the output load.
$V_I = V_{CC}$

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

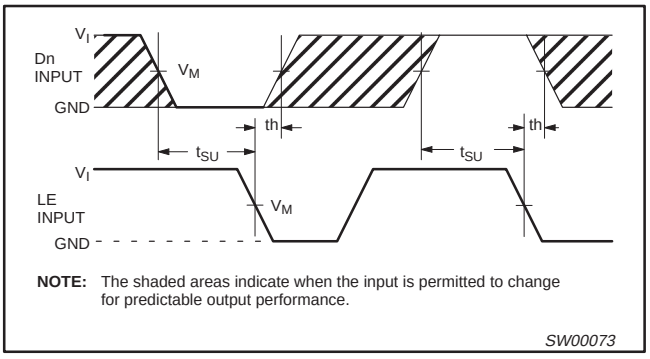
$V_M = 1.5\ V$
$V_X = V_{OL} + 0.3V$
$V_Y = V_{OH} – 0.3V$
V_{OL} and V_{OH} are the typical output voltage drop that occur with the output load.
$V_I = 2.7V$



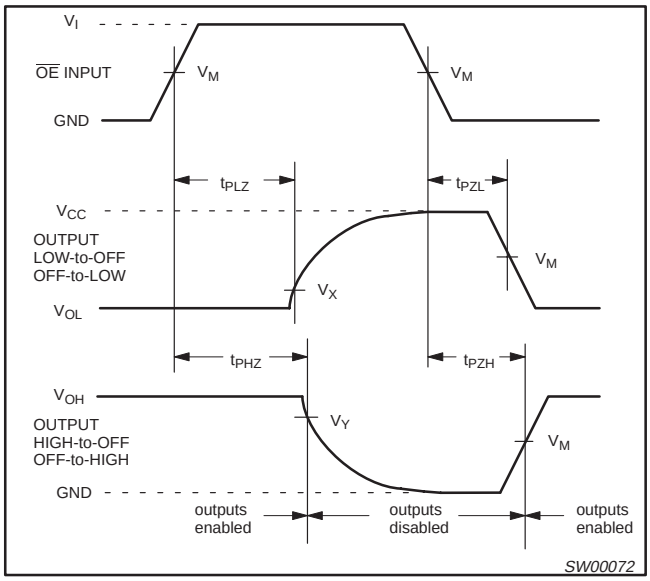
Waveform 1. Input (Dn) to output (Qn) propagation delays



Waveform 2. Latch enable input (LE) pulse width, the latch enable input to output (Qn) propagation delays

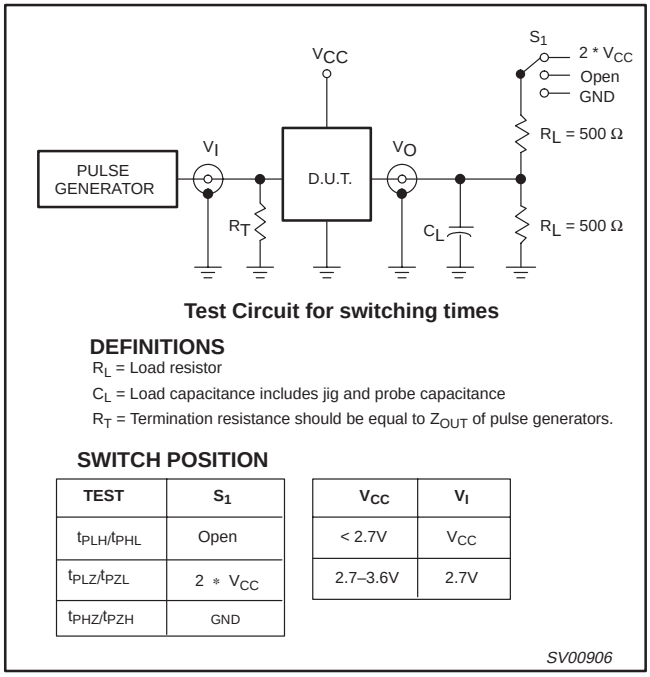


Waveform 3. Data set-up and hold times for the Dn input to the LE input



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

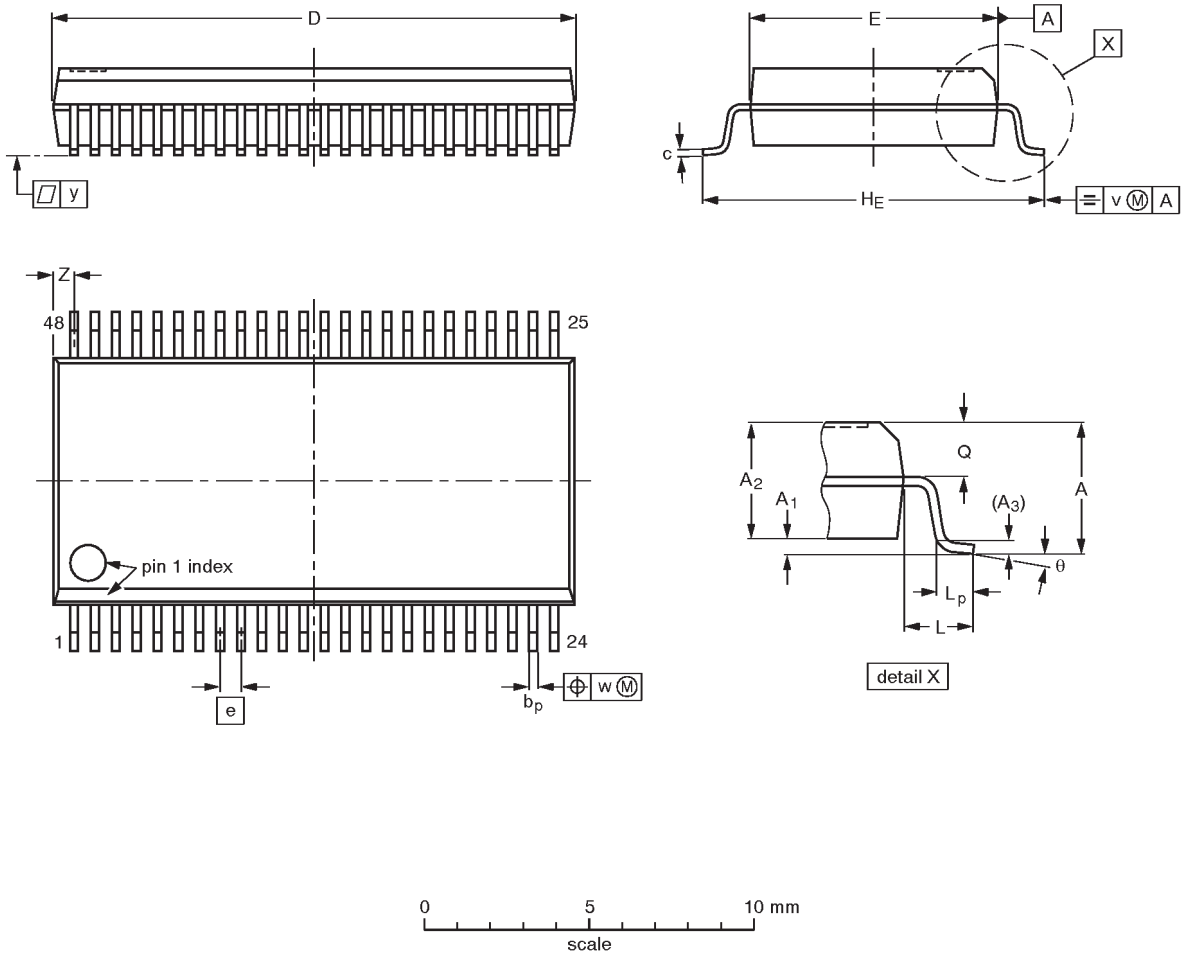
TEST	S_1
t_{PLH}/t_{PHL}	Open
t_{PLZ}/t_{PZL}	2 * V_{CC}
t_{PHZ}/t_{PZH}	GND

V_{CC}	V_I
< 2.7V	V_{CC}
2.7–3.6V	2.7V

SV00906

Waveform 5. Load circuitry for switching times

SSOP48: plastic shrink small outline package; 48 leads; body width 7.5 mm **SOT370-1**



DIMENSIONS (mm are the original dimensions)

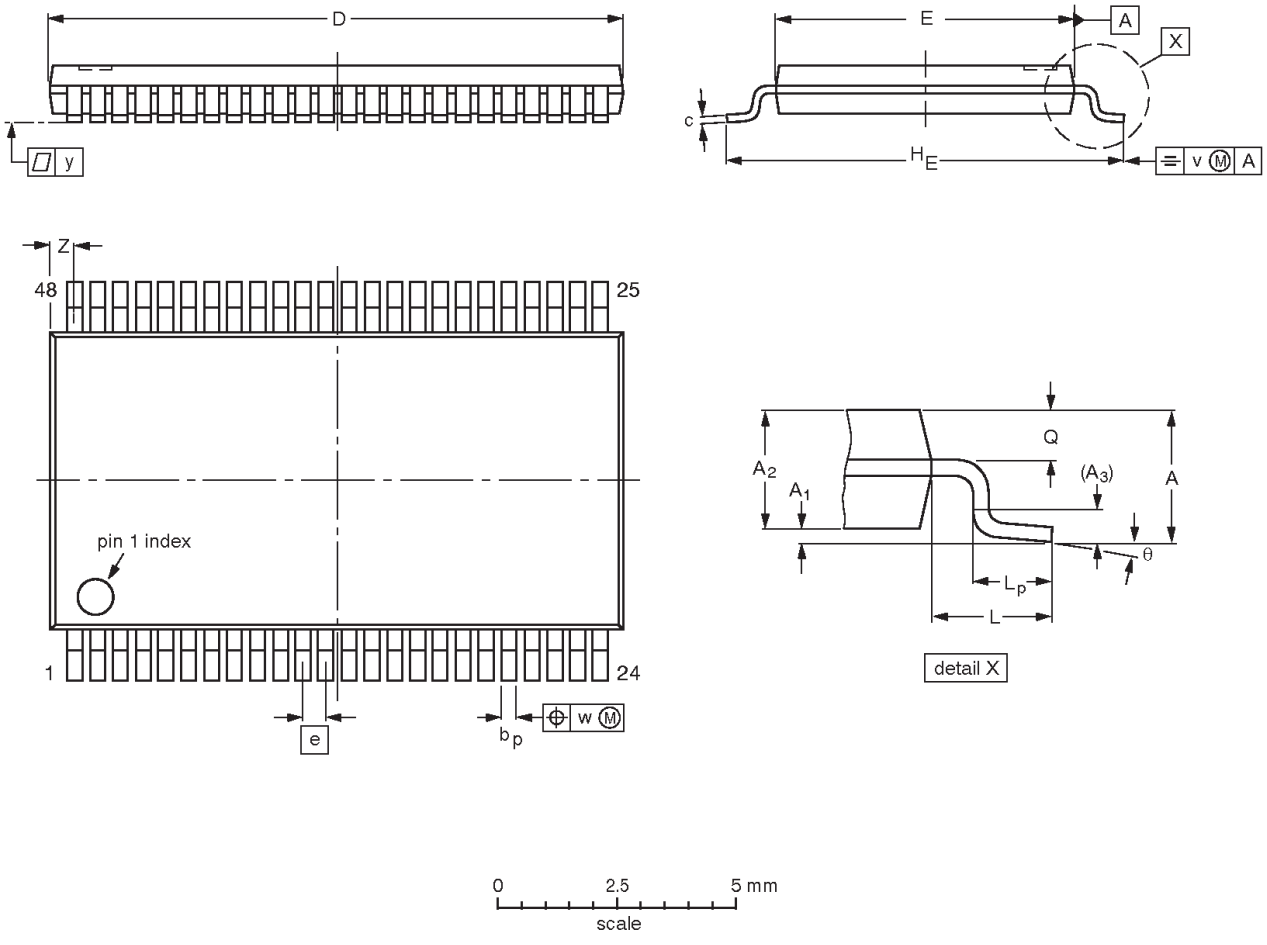
UNIT	A max.	A_1	A_2	A_3	b_p	c	D (1)	E (1)	e	H_E	L	L_p	Q	v	w	y	Z (1)	θ
mm	2.8	0.4 0.2	2.35 2.20	0.25	0.3 0.2	0.22 0.13	16.00 15.75	7.6 7.4	0.635	10.4 10.1	1.4	1.0 0.6	1.2 1.0	0.25	0.18	0.1	0.85 0.40	8° 0°

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			
SOT370-1		MO-118AA				~~93-11-02~~ 95-02-04

TSSOP48: plastic thin shrink small outline package; 48 leads; body width 6.1mm **SOT362-1**



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	12.6 12.4	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	0.8 0.4	8^o 0^o

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				
SOT362-1		MO-153ED					~~93-02-03~~ 95-02-10

NOTES

DEFINITIONS

Data Sheet Identification	Product Status	Definition
Objective Specification	Formative or in Design	This data sheet contains the design target or goal specifications for product development. Specifications may change in any manner without notice.
Preliminary Specification	Preproduction Product	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	Full 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.

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

Date of release: 10-99

Document order number: 9397-750-06515

Let's make things better.

Philips Semiconductors

PHILIPS

PHILIPS