DATA SHEET

74ABT16952
16-bit registered transceiver (3-State)

Product specification
Replaces 74ABT16952/74ABTH16952 dated 1998 Feb 25

2002 Apr 03

Philips
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16-bit registered transceiver (3-State) 74ABT16952

FEATURES

- Two 8-bit registered transceivers
- Live insertion/extraction permitted
- Power-up 3-State
- Power-up reset
- Multiple V_{CC} and GND pins minimize switching noise
- Independent registers for A and B buses
- Output capability: +64 mA/–32 mA
- Latch-up protection exceeds 500 mA per Jedec Std 17
- ESD protection exceeds 2000 V per MIL STD 883 Method 3015 and 200 V per Machine Model
- Bus-hold data inputs eliminate the need for external pull-up resistors to hold unused inputs

DESCRIPTION

The 74ABT16952 high-performance BiCMOS device combines low static and dynamic power dissipation with high speed and high output drive.

The 74ABT16952 is a dual octal registered transceiver. Two 8-bit registers store data flowing in both directions between two bidirectional buses. Data applied to the inputs is entered and stored on the rising edge of the Clock (nCPXX) provided that the Clock Enable (n$\overline{\text{CEXX}}$) is LOW. The data is then present at the 3-State output buffers, but is only accessible when the Output Enable (n$\overline{\text{OEXX}}$) is LOW. Data flow from A inputs to B outputs is the same as for B inputs to A outputs.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS T_{amb} = 25 °C; GND = 0 V	TYPICAL	UNIT
t_{PLH} t_{PHL}	Propagation delay nCPBA to nAx or nCPAB to nBx	C_L = 50 pF; V_{CC} = 5 V	2.8 2.3	ns
C_{IN}	Input capacitance	V_I = 0 V or V_{CC}	4	pF
$C_{I/O}$	I/O capacitance	V_O = 0 V or V_{CC}; 3-State	7	pF
I_{CCZ}	Quiescent supply current	Outputs disabled; V_{CC} = 5.5 V	500	µA
I_{CCL}		Outputs LOW; V_{CC} = 5.5 V	8	mA

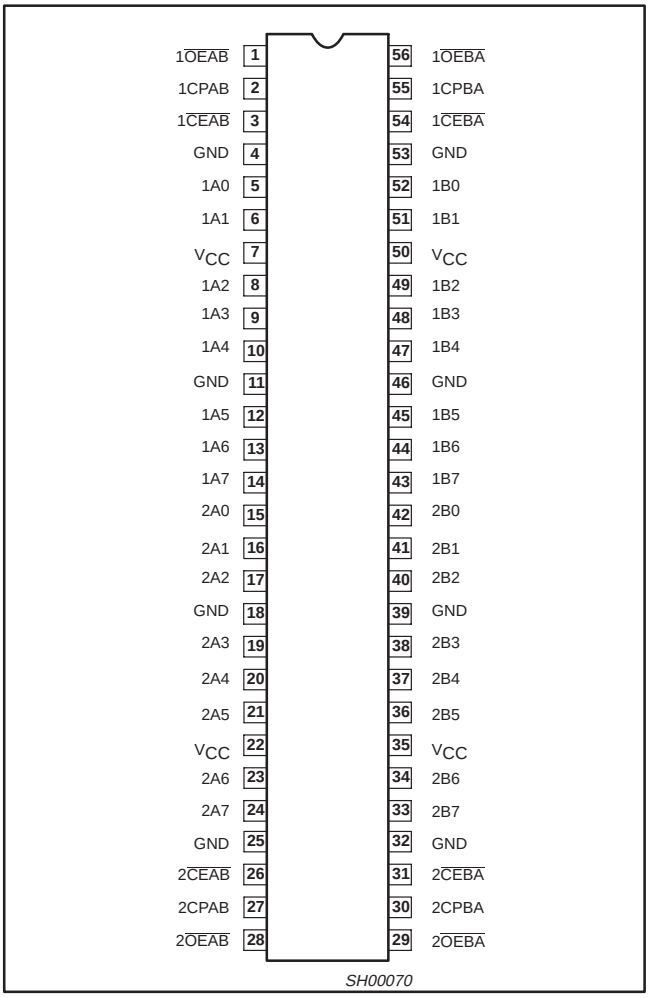
ORDERING INFORMATION

PACKAGES	TEMPERATURE RANGE	ORDER CODE	DWG NUMBER
56-Pin Plastic SSOP Type III	–40 °C to +85 °C	74ABT16952DL	SOT371-1
56-Pin Plastic TSSOP Type II	–40 °C to +85 °C	74ABT16952DGG	SOT364-1

PIN DESCRIPTION

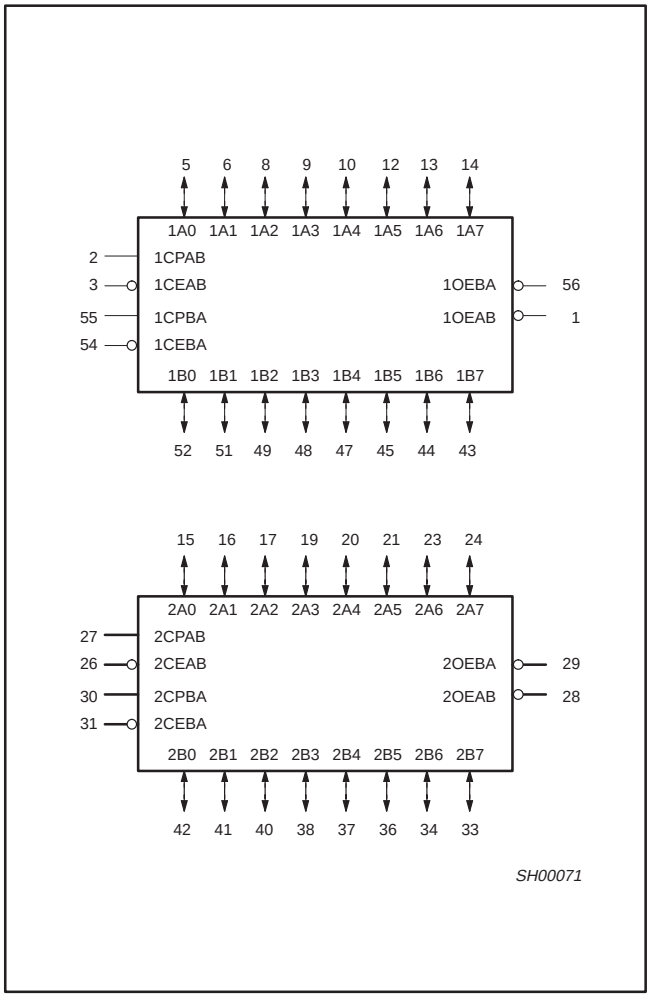
PIN NUMBER	SYMBOL	NAME AND FUNCTION
2, 55 18, 22	1CPAB / 1CPBA 2CPAB / 2CPBA	Clock input A-to-B / Clock input B-to-A
3, 54, 26, 31	1$\overline{\text{CEAB}}$ / 1$\overline{\text{CEBA}}$ 2$\overline{\text{CEAB}}$ / 2$\overline{\text{CEBA}}$	Clock enable input A-to-B / Clock enable input B-to-A
52, 51, 49, 48, 47, 45, 44, 43 42, 41, 40, 38, 37, 36, 34, 33	1A0 – 1A7 2A0 – 2A7	Data inputs/outputs (A side)
1, 56 8, 29	1B0 – 1B7 2B0 – 2B7	Data inputs/outputs (B side)
4, 11, 18, 25, 32, 39, 45, 53	1$\overline{\text{OEAB}}$ / 1$\overline{\text{OEBA}}$ 2$\overline{\text{OEAB}}$ / 2$\overline{\text{OEBA}}$	Output enable inputs
4, 17, 30, 43	GND	Ground (0 V)
7, 22, 35, 50	V_{CC}	Positive supply voltage

PIN CONFIGURATION



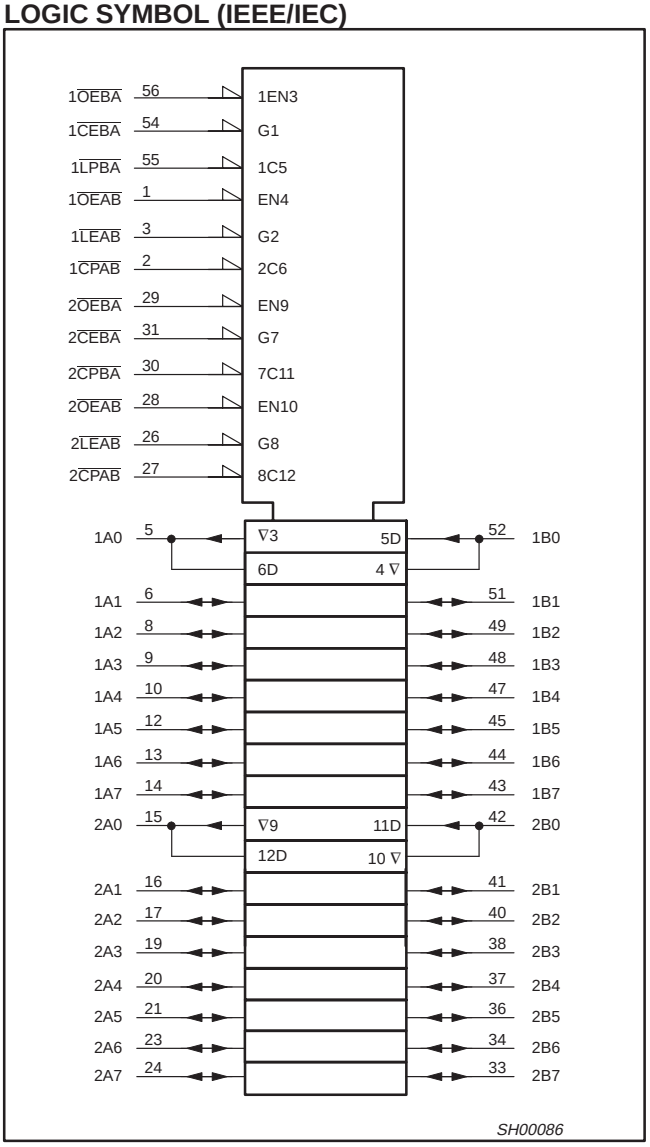
SH00070

LOGIC SYMBOL



SH00071

LOGIC SYMBOL (IEEE/IEC)



FUNCTION TABLE for Register nAx or nBx

INPUTS			INTERNAL Q	OPERATING MODE
nAx or nBx	nCPXX	$\overline{nCEXX}$		
X	X	H	NC	Hold data
L H	↑ ↑	L L	L H	Load data

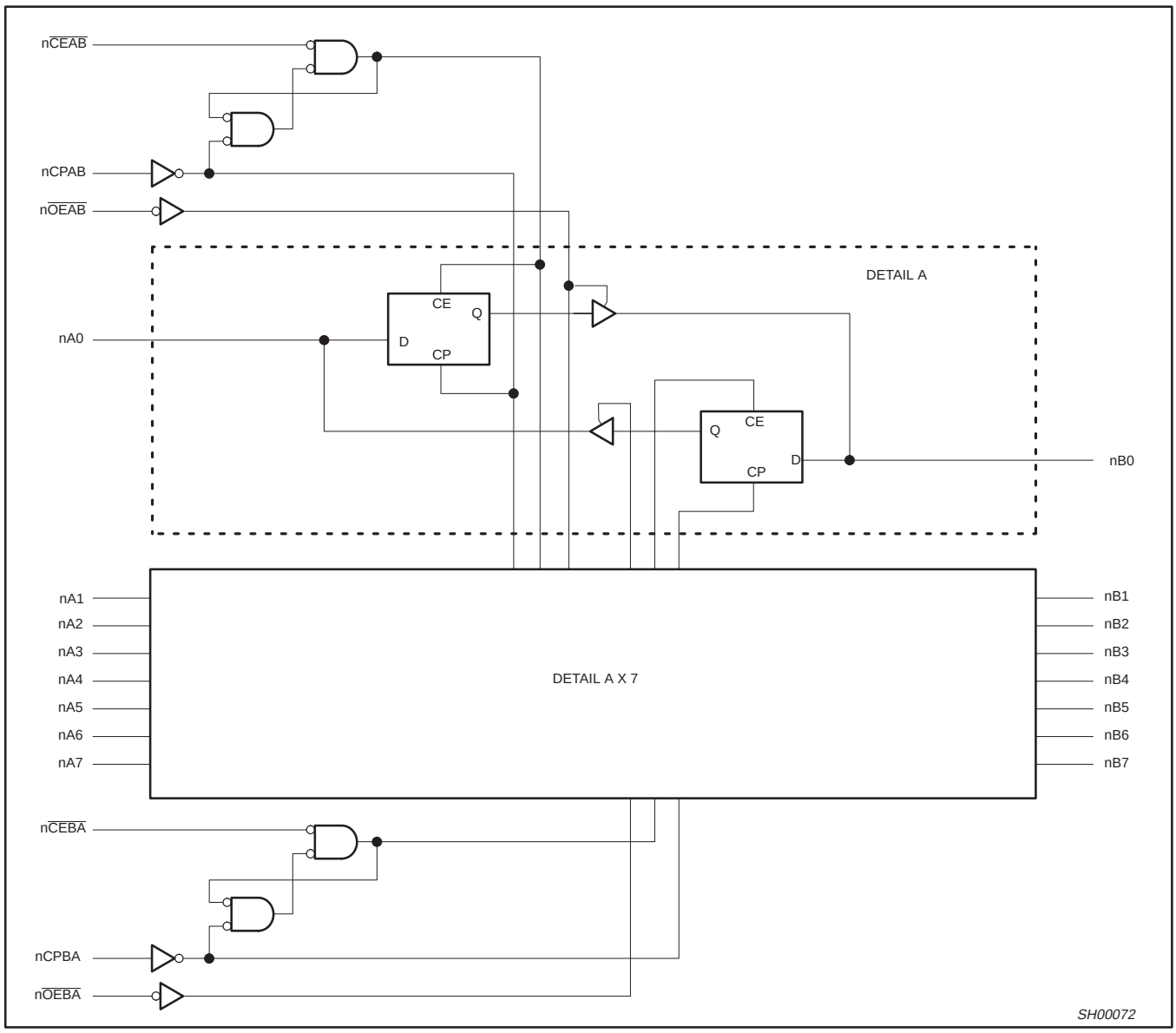
H = HIGH voltage level
L = LOW voltage level
↑ = LOW-to-HIGH transition
X = Don't care
XX = AB or BA
NC = No change

FUNCTION TABLE for Output Enable

INPUTS	INTERNAL Q	nAx or nBx OUTPUTS	OPERATING MODE
$\overline{nOEXX}$			
H	X	Z	Disable outputs
L L	L H	L H	Enable outputs

H = HIGH voltage level
L = LOW voltage level
X = Don't care
XX = AB or BA
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 +7.0	V
I_{IK}	DC input diode current	$V_I < 0$	–18	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 +5.5	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	LIMITS		UNIT
		MIN	MAX	
V_{CC}	DC supply voltage	4.5	5.5	V
V_I	Input voltage	0	V_{CC}	V
V_{IH}	HIGH-level input voltage	2.0	–	V
V_{IL}	LOW-level Input voltage	–	0.8	V
I_{OH}	HIGH-level output current	–	–32	mA
I_{OL}	LOW-level output current	–	64	mA
$\Delta t/\Delta v$	Input transition rise or fall rate	0	10	ns/V
T_{amb}	Operating free-air temperature range	–40	+85	°C

DC ELECTRICAL CHARACTERISTICS

SYMBOL	PARAMETER	TEST CONDITIONS	LIMITS					UNIT
			T_{amb} = +25 °C			T_{amb} = –40 °C to +85 °C		
			MIN	TYP	MAX	MIN	MAX	
V_{IK}	Input clamp voltage	V_{CC} = 4.5 V; I_{IK} = –18 mA		–0.9	–1.2		–1.2	V
V_{OH}	HIGH-level output voltage	V_{CC} = 4.5 V; I_{OH} = –3 mA; V_I = V_{IL} or V_{IH}	2.5	2.9		2.5		V
		V_{CC} = 5.0 V; I_{OH} = –3 mA; V_I = V_{IL} or V_{IH}	3.0	3.4		3.0		V
		V_{CC} = 4.5 V; I_{OH} = –32 mA; V_I = V_{IL} or V_{IH}	2.0	2.4		2.0		V
V_{OL}	LOW-level output voltage	V_{CC} = 4.5 V; I_{OL} = 64 mA; V_I = V_{IL} or V_{IH}		0.42	0.55		0.55	V
V_{RST}	Power-up output low voltage[3]	V_{CC} = 5.5 V; I_{OL} = 1 mA; V_I = GND or V_{CC}		0.13	0.55		0.55	V
I_I	Input leakage current; Control pins	V_{CC} = 5.5 V; V_I = GND or 5.5 V		±0.01	±1.0		±1.0	µA
I_{OFF}	Power-off leakage current	V_{CC} = 0 V; V_O or $V_I \leq$ 4.5 V		±5.0	±100		±100	µA
$I_{PU/PD}$	Power-up/down 3-State output current[4]	V_{CC} = 2.1 V; V_O = 0.0 V; V_I = GND or V_{CC}; $V_{\overline{OE}}$ = Don't care		±5.0	±50		±50	µA
$I_{IH} + I_{OZH}$	3-State output HIGH current	V_{CC} = 5.5 V; V_O = 5.5 V; V_I = V_{IL} or V_{IH}		5.0	50		50	µA
$I_{IL} + I_{OZL}$	3-State output LOW current	V_{CC} = 5.5 V; V_O = 0.0 V; V_I = V_{IL} or V_{IH}		–5.0	–50		–50	µA
I_{CEX}	Output HIGH leakage current	V_{CC} = 5.5 V; V_O = 5.5 V; V_I = GND or V_{cc}		5.0	50		50	µA
I_O	Output current[1]	V_{CC} = 5.5 V; V_O = 2.5 V	–50	–70	–180	–50	–180	mA
I_{CCH}	Quiescent supply current	V_{CC} = 5.5 V; Outputs HIGH, V_I = GND or V_{CC}		0.5	1.5		1.5	mA
I_{CCL}		V_{CC} = 5.5 V; Outputs LOW, V_I = GND or V_{CC}		8	19		19	mA
I_{CCZ}		V_{CC} = 5.5 V; Outputs 3-State; V_I = GND or V_{CC}		0.5	1.5		1.5	mA
ΔI_{CC}	Additional supply current per input pin[2]	V_{CC} = 5.5 V; one input at 3.4 V, other inputs at V_{CC} or GND		5	100		100	µA

NOTES:
1. Not more than one output should be tested at a time, and the duration of the test should not exceed one second.
2. This is the increase in supply current for each input at 3.4 V.
3. For valid test results, data must not be loaded into the flip-flops (or latches) after applying the power.
4. This parameter is valid for any V_{CC} between 0 V and 2.1 V with a transition time of up to 10 msec. From V_{CC} = 2.1 V to V_{CC} = 5 V ± 10% a transition time of up to 100 µsec is permitted.
5. Unused pins at V_{CC} or GND.

AC CHARACTERISTICS

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

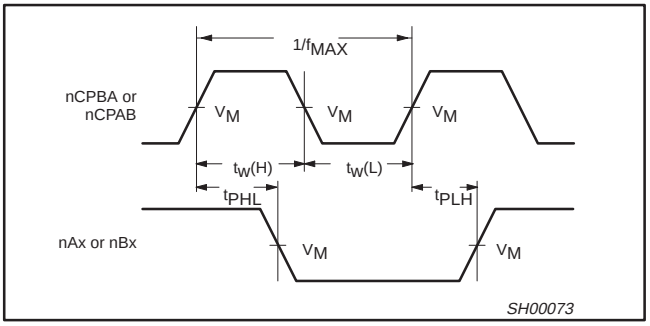
SYMBOL	PARAMETER	WAVEFORM	LIMITS					UNIT
			T_{amb} = +25 °C V_{CC} = +5.0 V			T_{amb} = –40 °C to +85 °C V_{CC} = +5.0 V ±0.5 V		
			MIN	TYP	MAX	MIN	MAX	
f_{MAX}	Maximum clock frequency	1	150			150		MHz
t_{PLH} t_{PHL}	Propagation delay nCPBA to nAx, nCPAB to nBx	1	1.0 1.0	2.8 2.3	3.9 3.9	1.0 1.0	4.3 4.3	ns
t_{PZH} t_{PZL}	Output enable time n$\overline{OEBA}$ to nAx, n$\overline{OEAB}$ to nBx	3 4	1.0 1.0	2.5 2.2	3.8 3.8	1.0 1.0	4.6 4.6	ns
t_{PHZ} t_{PLZ}	Output disable time n$\overline{OEBA}$ to nAx, n$\overline{OEAB}$ to nBx	3 4	1.7 1.3	3.4 2.6	4.4 3.9	1.7 1.3	5.2 4.2	ns

AC SET-UP REQUIREMENTS

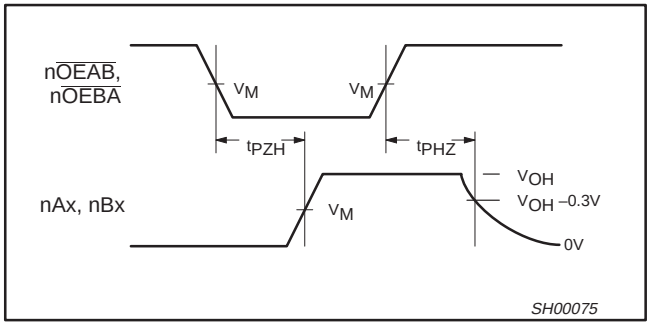
SYMBOL	PARAMETER	WAVEFORM	LIMITS			UNIT
			T_{amb} = +25 °C V_{CC} = +5.0 V		T_{amb} = –40 °C to +85 °C V_{CC} = +5.0 V ±0.5 V	
			MIN	TYP	MIN	
$t_S(H)$ $t_s(L)$	Set-up time nAx to nCPAB or nBx to nCPBA	2	1.2 1.5	0.9 1.2	1.2 1.5	ns
$t_h(H)$ $t_h(L)$	Hold time nAx to nCPAB or nBx to nCPBA	2	0.0 0.0	–1.2 –0.9	0.0 0.0	ns
$t_s(H)$ $t_s(L)$	Set-up time n$\overline{CEAB}$ to nCPAB, n$\overline{CEBA}$ to nCPBA	2	1.2 1.6	0.9 1.1	1.2 1.6	ns
$t_h(H)$ $t_h(L)$	Hold time n$\overline{CEAB}$ to nCPAB, n$\overline{CEBA}$ to nCPBA	2	0.0 0.0	–1.1 –0.9	0.0 0.0	ns
$t_w(H)$ $t_w(L)$	nCPAB or nCPBA pulse width, HIGH or LOW	1	3.3 2.5	2.6 1.0	3.3 2.5	ns

AC WAVEFORMS

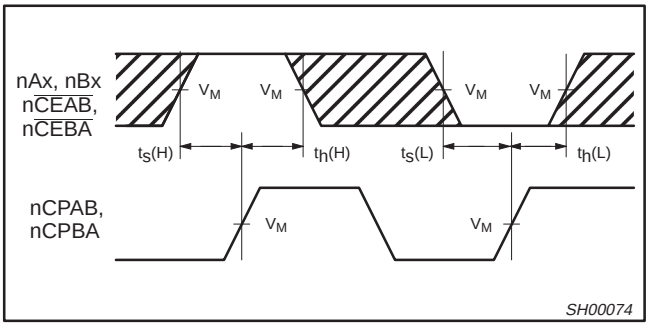
V_M = 1.5 V, V_{IN} = GND to 3.0 V



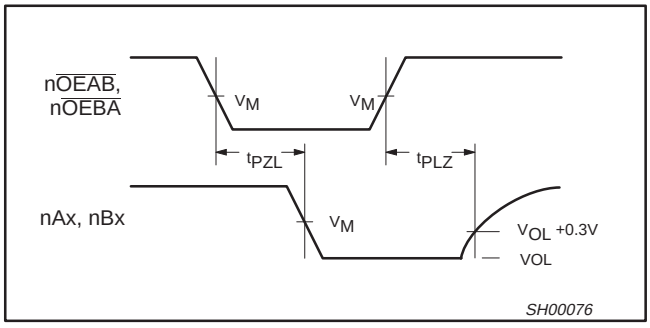
Waveform 1. Propagation Delay, Clock Input to Output, Clock Pulse Width, and Maximum Clock Frequency



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

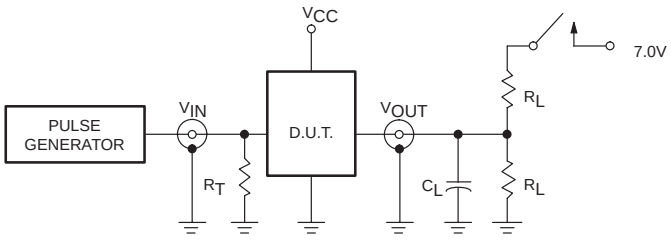


Waveform 2. Data Set-up and Hold Times

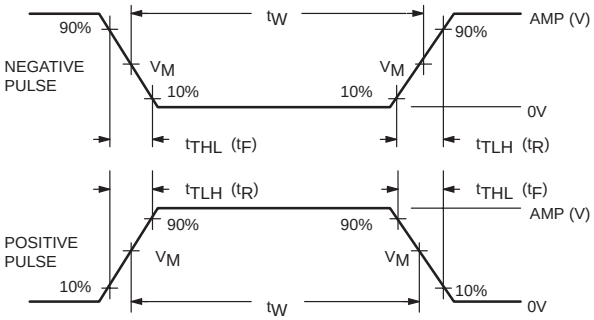


Waveform 4. 3-State Output Enable Time to Low Level and Output Disable Time from Low Level

TEST CIRCUIT AND WAVEFORMS



Test Circuit for 3-State Outputs



V_M = 1.5V
Input Pulse Definition

SWITCH POSITION

TEST	SWITCH
t_{PLZ}	closed
t_{PZL}	closed
All other	open

DEFINITIONS

R_L = Load resistor; see AC CHARACTERISTICS for value.

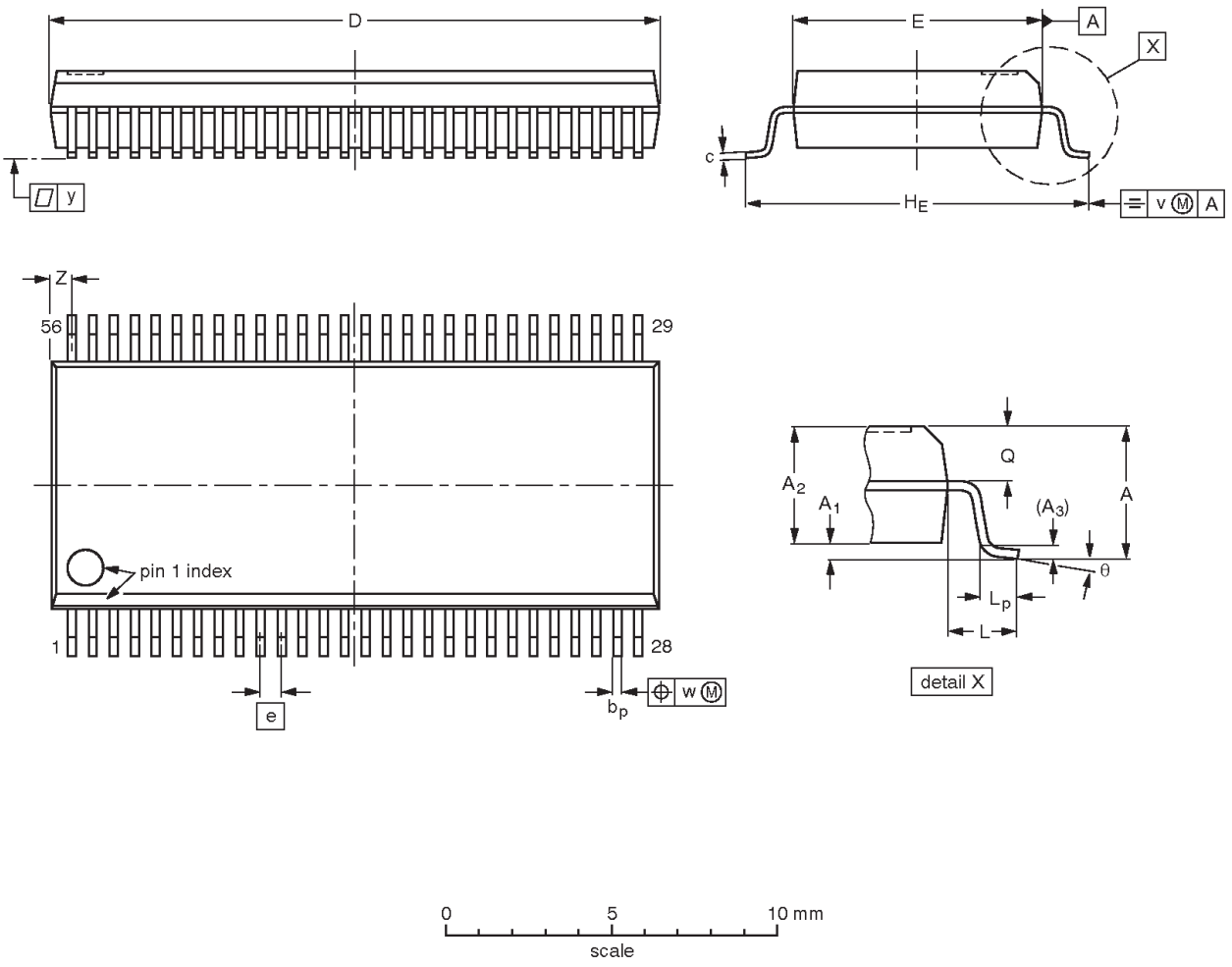
C_L = Load capacitance includes jig and probe capacitance; see AC CHARACTERISTICS for value.

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
74ABT/H16	3.0V	1MHz	500ns	2.5ns	2.5ns

SA00018

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



DIMENSIONS (mm are the original dimensions)

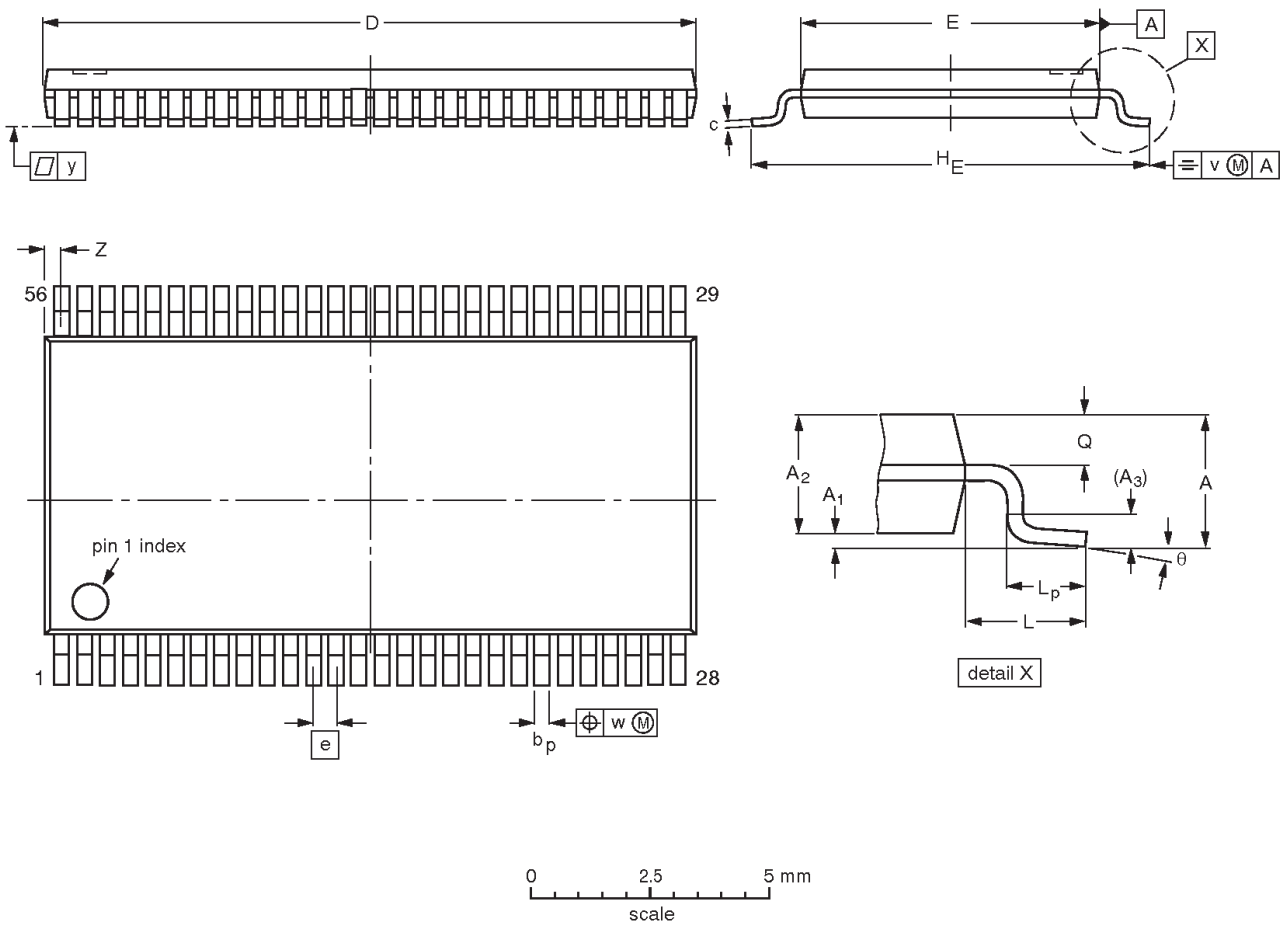
UNIT	A max.	A_1	A_2	A_3	b_p	c	$D^{(1)}$	$E^{(1)}$	e	H_E	L	L_p	Q	v	w	y	$Z^{(1)}$	θ
mm	2.8	0.4 0.2	2.35 2.20	0.25	0.3 0.2	0.22 0.13	18.55 18.30	7.6 7.4	0.635	10.4 10.1	1.4	1.0 0.6	1.2 1.0	0.25	0.18	0.1	0.85 0.40	8^o 0^o

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-118				~~95-02-04~~ 99-12-27

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



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	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^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				
SOT364-1		MO-153					~~95-02-10~~ 99-12-27

Data sheet status

Data sheet status[1]	Product status[2]	Definitions
Objective data	Development	This data sheet contains data from the objective specification for product development. Philips Semiconductors reserves the right to change the specification in any manner without notice.
Preliminary data	Qualification	This data sheet contains data from the preliminary specification. Supplementary data will be published at a later date. Philips Semiconductors reserves the right to change the specification without notice, in order to improve the design and supply the best possible product.
Product data	Production	This data sheet contains data from the product specification. Philips Semiconductors reserves the right to make changes at any time in order to improve the design, manufacturing and supply. Changes will be communicated according to the Customer Product/Process Change Notification (CPCN) procedure SNW-SQ-650A.

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

[2] The product status of the device(s) described in this data sheet may have changed since this data sheet was published. The latest information is available on the Internet at URL http://www.semiconductors.philips.com.

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Limiting values definition — Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 60134). 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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Date of release: 04-02

Document order number: 9397 750 09693

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