DATA SHEET

74ALVCH16952
16-bit registered transceiver (3-State)

Preliminary specification
Supersedes data of 1994 Jul
IC24 Data Handbook

1998 Sep 01

Philips
Semiconductors

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16-bit registered transceiver (3-State) 74ALVCH16952

FEATURES

- Complies with JEDEC standard no. 8-1A
- CMOS low power consumption
- MULTIBYTE™ flow-through pin-out architecture
- Low inductance, multiple center power and ground pins for minimum noise and ground bounce
- Direct interface with TTL levels
- Output drive capability 50Ω transmission lines @ 85°C

DESCRIPTION

The 74ALVCH16952 consists of two sections, each containing a dual octal non-inverting registered transceiver. Two 8-bit back to back registers store data flowing in both directions between two bi-directional busses. Data applied to the inputs is entered and stored on the rising edge of the clock (CP_{XX}, where X is AB or BA) provided that the clock enable ($\overline{CE}_{XX}$) is LOW. The data is then present at the 3-State output buffers, but is only accessible when the output enable input ($\overline{OE}_{XX}$) is LOW. Data flow from A inputs to B outputs is the same as for B inputs to A outputs.

QUICK REFERENCE DATA

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

SYMBOL	PARAMETER	CONDITIONS	TYPICAL	UNIT
t_{PHL}/t_{PLH}	Propagation delay CPnn, to An, Bn	V_{CC} = 3.3V, C_L = 50pF V_{CC} = 2.5V, C_L = 30pF	3.2	ns
f_{MAX}	Maximum clock frequency		350	MHz
C_I	Input capacitance		3.0	pF
C_{PD}	Power dissipation capacitance per buffer	V_I = GND to V_{CC}[1]	30	pF

NOTES:

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 capacity 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
56-Pin Plastic TSSOP Type II	–40°C to +85°C	74ALVCH16952 DGG	ACH16952 DGG	SOT364-1

FUNCTION TABLE for register An or Bn

INPUTS			INTERNAL Q	OPERATING MODE
An or Bn	CP_{XX}	$\overline{CE}_{XX}$		
X	X	H	NC	Hold data
L	↑	L	L	Load data
H	↑	L	H	Load data

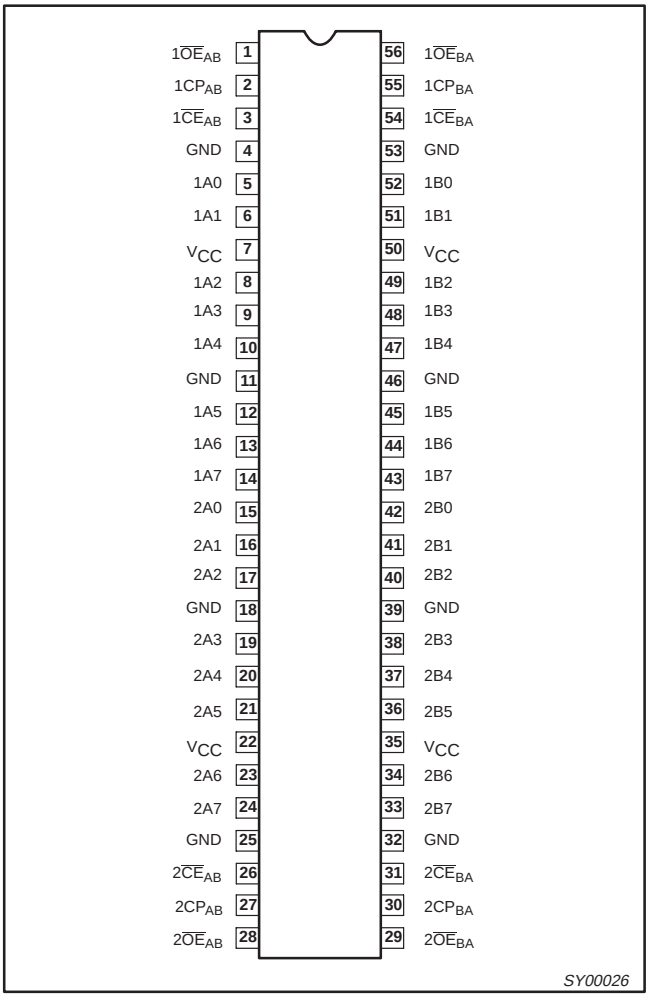
H = HIGH voltage level
L = LOW voltage level
↑ = LOW-to-HIGH transition

FUNCTION TABLE for output enable

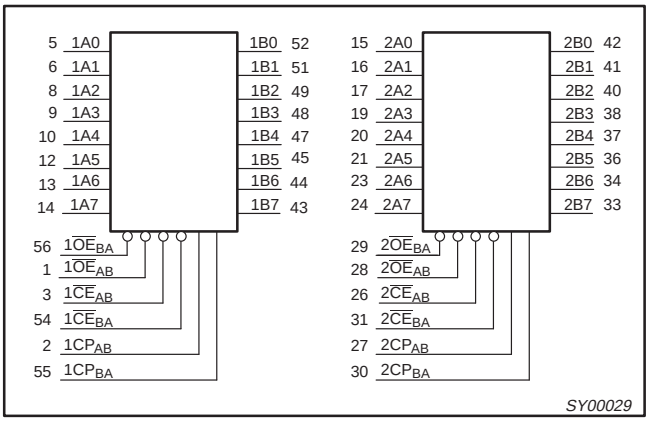
INPUTS	INTERNAL Q	An or Bn OUTPUTS	OPERATING MODE
$\overline{OE}_{nn}$			
H	X	Z	Disable outputs
L	L	L	Enable outputs
L	H	H	Enable outputs

NC = no change
X = don't care
Z = high impedance OFF-state

PIN CONFIGURATION



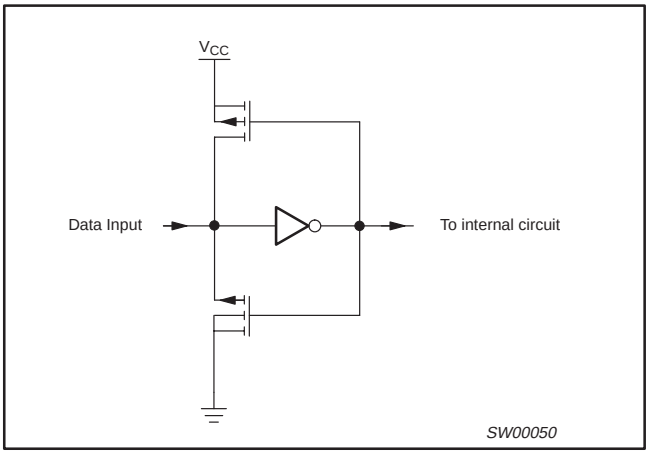
LOGIC SYMBOL



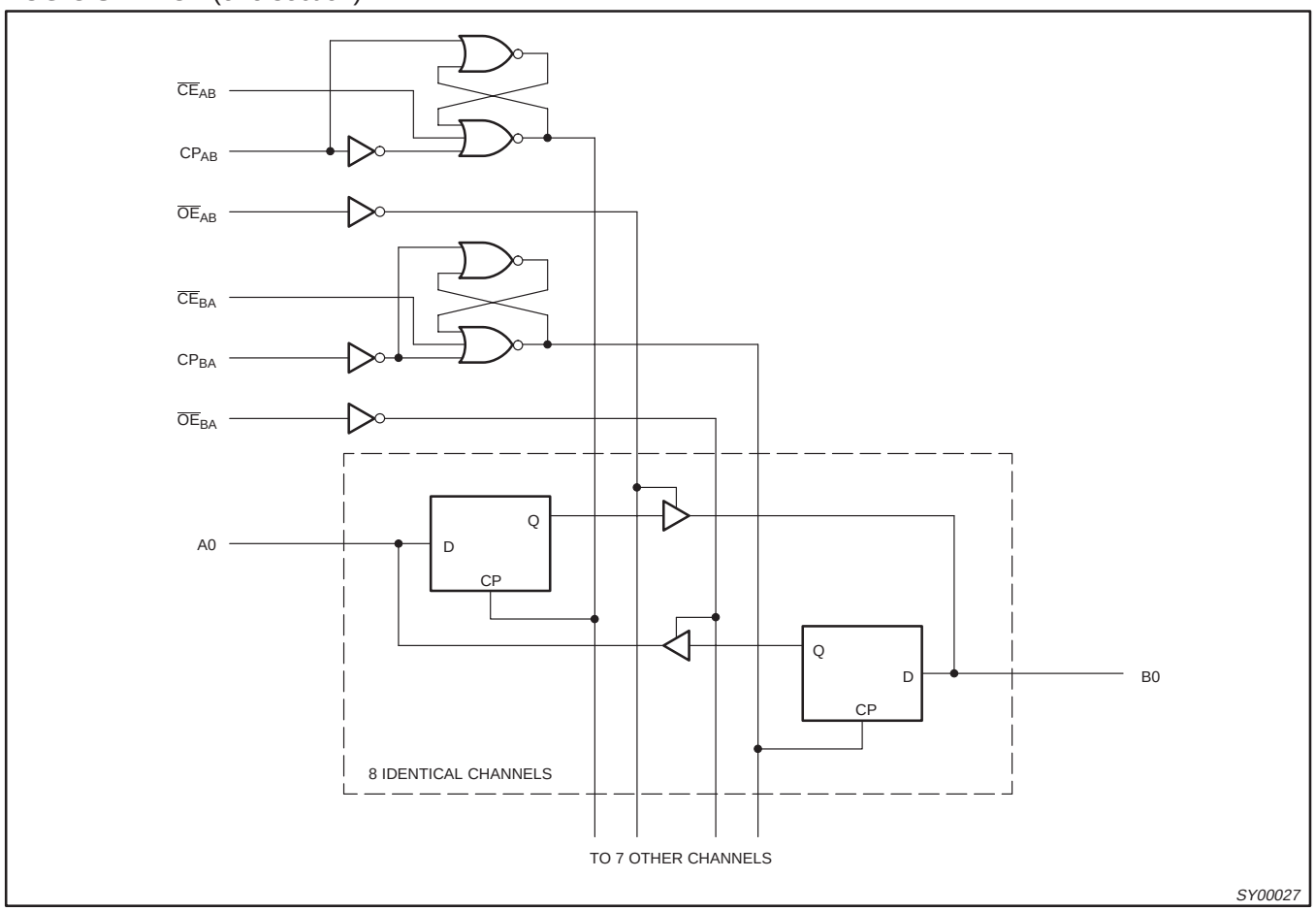
PIN DESCRIPTION

PIN NUMBER	SYMBOL	NAME AND FUNCTION
1, 28	n$\overline{OE}_{AB}$	Output enable A-to-B
2, 27	nCP_{AB}	Clock input A-to-B
3, 26	n$\overline{CE}_{AB}$	A-to-B enable
5, 6, 8, 9, 10, 12, 13, 14	1A0 to 1A7	Data inputs/outputs
4, 11, 18, 25, 32, 39, 46, 53	GND	Ground (0V)
7, 22, 35, 50	V_{CC}	Positive supply voltage
15, 16, 17, 19, 20, 21, 23, 24	2B0 to 2B7	Data inputs/outputs
29, 56	n$\overline{OE}_{BA}$	Output enable B-to-A
30, 55	nCP_{BA}	Clock input B-to-A
31, 54	n$\overline{CE}_{BA}$	B-to-A enable
42, 41, 40, 38, 37, 36, 34, 33	2B0 to 2B7	Data inputs/outputs
52, 51, 49, 48, 47, 45, 44, 43	1B0 to 1B7	Data inputs/outputs

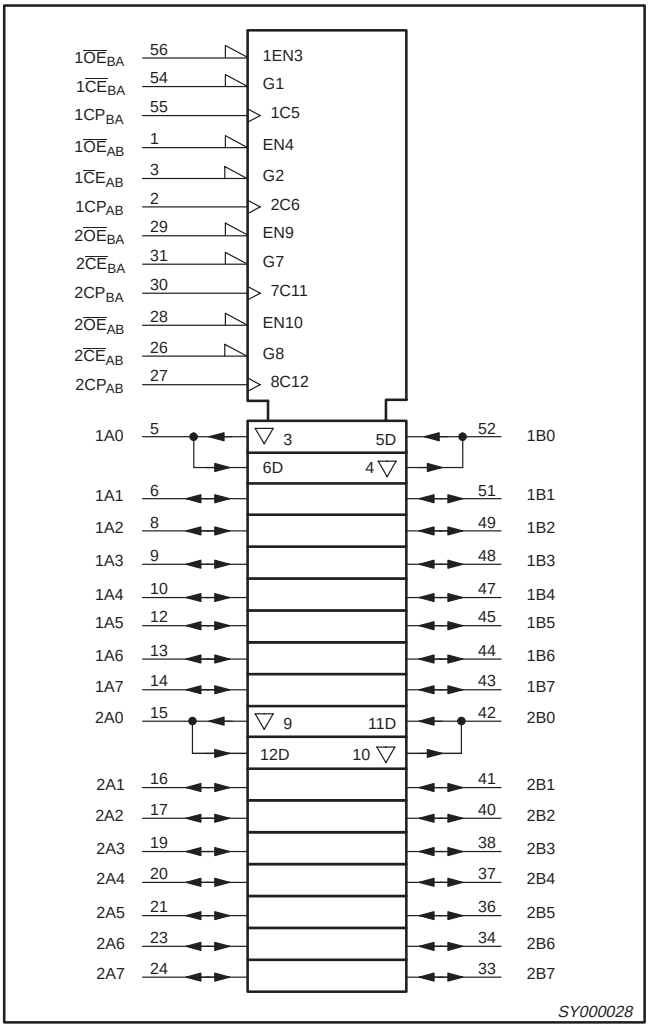
BUSHOLD CIRCUIT



LOGIC SYMBOL (one section)



LOGIC SYMBOL (IEEE/IEC)



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		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 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[1]	–0.5 to +4.6	V
		For data inputs[1]	–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 above +55°C derate linearly with 11.3 mW/K above +55°C derate linearly with 8 mW/K	 850 600	mW

NOTE:
1. 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} = 2.3 to 2.7V	1.7	1.2		V
		V_{CC} = 2.7 to 3.6V	2.0	1.5		
V_{IL}	LOW level Input voltage	V_{CC} = 2.3 to 2.7V		1.2	0.7	V
		V_{CC} = 2.7 to 3.6V		1.5	0.8	
V_{OH}	HIGH level output voltage	V_{CC} = 2.3 to 3.6V; V_I = V_{IH} or V_{IL}; I_O = –100µA	V_{CC} – 0.2	V_{CC}		V
		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} – 0.6	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 = –12mA	V_{CC} – 0.6	V_{CC} – 0.09		
		V_{CC} = 3.0V; V_I = V_{IH} or V_{IL}; I_O = –24mA	V_{CC} – 1.0	V_{CC} – 0.28		
V_{OL}	LOW level output voltage	V_{CC} = 2.3 to 3.6V; V_I = V_{IH} or V_{IL}; I_O = 100µA		GND	0.20	V
		V_{CC} = 2.3V; V_I = V_{IH} or V_{IL}; I_O = 6mA		0.07	0.40	V
		V_{CC} = 2.3V; V_I = V_{IH} or V_{IL}; I_O = 12mA		0.15	0.70	V
		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	V_{CC} = 2.3 to 3.6V; V_I = V_{CC} or GND		0.1	5	µA
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} = 2.3 to 3.6V; V_I = V_{CC} or GND; I_O = 0		0.2	40	µA
ΔI_{CC}	Additional quiescent supply current	V_{CC} = 2.3V to 3.6V; V_I = V_{CC} – 0.6V; I_O = 0		150	750	µA
I_{BHL}	Bus hold LOW sustaining current	V_{CC} = 2.3V; V_I = 0.7V[2]	45	–		µA
		V_{CC} = 3.0V; V_I = 0.8V[2]	75	150		
I_{BHH}	Bus hold HIGH sustaining current	V_{CC} = 2.3V; V_I = 1.7V[2]	–45			µA
		V_{CC} = 3.0V; V_I = 2.0V[2]	–75	–175		
I_{BHLO}	Bus hold LOW overdrive current	V_{CC} = 3.6V[2]	500			µA
I_{BHHO}	Bus hold HIGH overdrive current	V_{CC} = 3.6V[2]	–500			µA

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

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

SYMBOL	PARAMETER	WAVEFORM	LIMITS			UNIT
			V_{CC} = 2.5V ± 0.2V			
			MIN	TYP	MAX	
t_{PLH}/t_{PHL}	Propagation delay nCP_{AB} to nBn, nCP_{BA} to nAn	3	1.0		4.1	ns
t_{PZH}/t_{PZL}	3-State output enable time $n\overline{OE}$ to nAn, nBn	4	1.0		5.4	ns
t_{PHZ}/t_{PLZ}	3-State output disable time $n\overline{OE}$ to nAn, nBn	4	1.0		5.3	ns
t_W	Pulse width HIGH or LOW nCP_{AB}, nCP_{BA}	3	3.3			ns
t_{SU}	Set up time An or Bn before CP_{AB}	3	1.7			ns
	Set up time CE_{AB} or CE_{BA} before CP_{AB}	3	1.2			
t_h	Hold time An or Bn after CP_{AB}	3	0.6			ns
	Hold time An or Bn after CP_{AB}	3	1.1			
F_{max}	Maximum clock pulse frequency	3	150			MHz

NOTE:
1. All typical values are at V_{CC} = 2.5V and T_{amb} = 25°C.

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

GND = 0V; $t_r = t_f$ = 2.5ns; 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 nCP_{AB} to nBn, nCP_{BA} to nAn	1, 4	1.0		3.9	1.0		4.6	ns
t_{PZH}/t_{PZL}	3-State output enable time $n\overline{OE}$ to nAn, nBn	2, 4	1.0		4.4	1.0		5.3	ns
t_{PHZ}/t_{PLZ}	3-State output disable time $n\overline{OE}$ to nAn, nBn	2, 4	1.1		4	1.4		4.4	ns
t_W	Pulse width HIGH or LOW nCP_{AB}, nCP_{BA}	3, 4	3.3			3.3			ns
t_{SU}	Set up time An or Bn before CP_{AB}	3, 4	1.5			1.9			ns
	Set up time CE_{AB} or CE_{BA} before CP_{AB}	3, 4	1			1			
t_h	Hold time An or Bn after CP_{AB}	3, 4	0.8			0.6			ns
	Hold time An or Bn after CP_{AB}	3, 4	1.1			0.9			
F_{max}	Maximum clock pulse frequency	1, 4	150			150			MHz

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

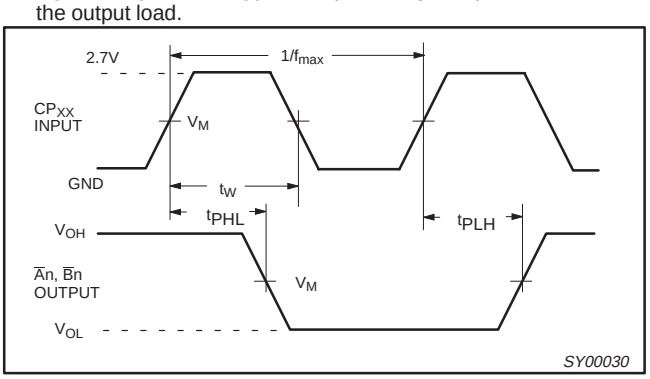
AC WAVEFORMS

V_{CC} = 2.3 TO 2.7 V RANGE

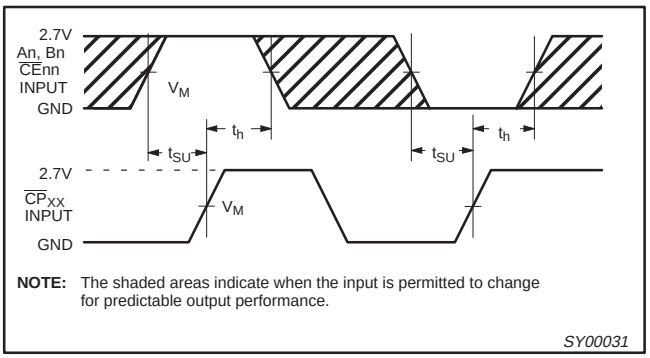
1. V_M = 0.5 V
2. $V_X = V_{OL}$ + 0.15V
3. $V_Y = V_{OH}$ – 0.15V
4. $V_I = V_{CC}$
5. V_{OL} and V_{OH} are the typical output voltage drop that occur with the output load.

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

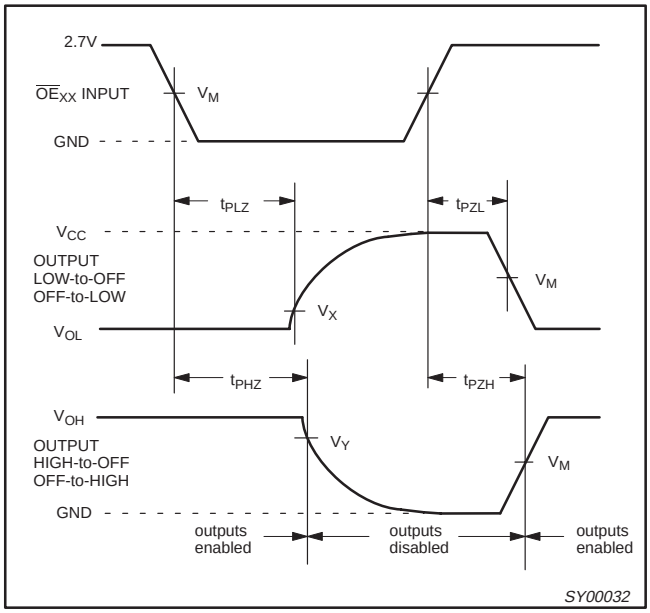
1. V_M = 1.5 V
2. $V_X = V_{OL}$ + 0.3V
3. $V_Y = V_{OH}$ – 0.3V
4. V_I = 2.7 V
5. V_{OL} and V_{OH} are the typical output voltage drop that occur with the output load.



Waveform 1. Clock input (CP_{BA}, CP_{AB}) to output ($\overline{B}n$, $\overline{A}n$) propagation delays, the clock pulse width and the maximum clock pulse frequency.

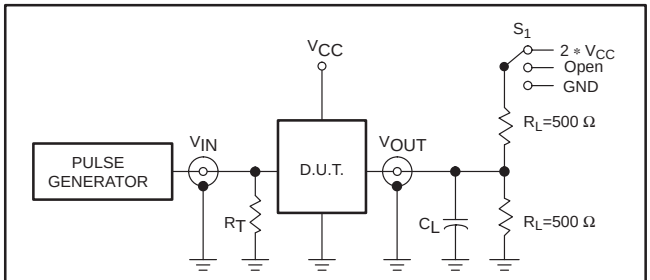


Waveform 2. Set-up and hold times for the An, Bn and $\overline{CE}_{XX}$ inputs.



Waveform 3. 3-State enable and disable times

TEST CIRCUIT



Test Circuit for 3-State Outputs

SWITCH POSITION

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

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

DEFINITIONS

R_L = Load resistor

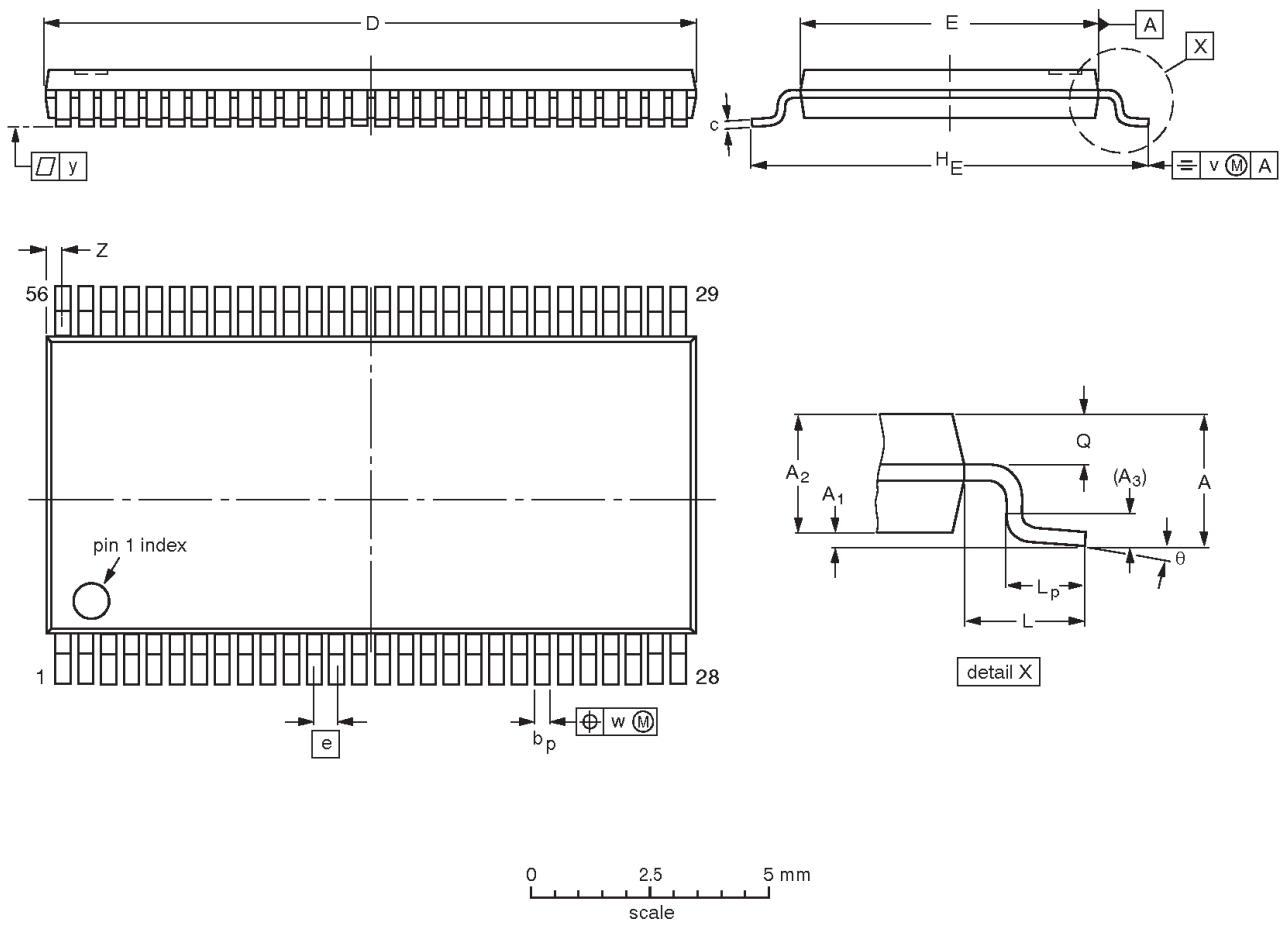
C_L = Load capacitance includes jig and probe capacitance

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

SW00047

Load circuitry for switching times

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_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-153EE					~~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.

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