74ABT646A

Octal bus transceiver/register; 3-state

Rev. 03 — 15 March 2010 Product data sheet

1. General description

The 74ABT646A high-performance BiCMOS device combines low static and dynamic power dissipation with high speed and high output drive.

The 74ABT646A transceiver/register consists of bus transceiver circuits with 3-state outputs, D-type flip-flops, and control circuitry arranged for multiplexed transmission of data directly from the input bus or the internal registers. Data on the A bus or B bus will be clocked into the registers as the appropriate clock pin (CPAB or CPBA) goes HIGH. Output Enable ($\overline{OE}$) and Direction (DIR) pins are provided to control the transceiver function. In the transceiver mode, data present at the high-impedance port may be stored in either the A or B register or both.

The Select (SAB, SBA) pins determine whether data is stored or transferred through the device in real-time. The DIR pin determines which bus receives data when $\overline{OE}$ is active (LOW). In isolation mode ($\overline{OE}$ = HIGH), data from bus A may be stored in the B register and/or data from bus B may be stored in the A register. When an output function is disabled, the input function is still enabled and may be used to store and transmit data. Only one of the two buses, A or B, may be driven at a time. The examples in Figure 5 “Real time bus transfer and storage” on page 6 demonstrate the four fundamental bus management functions that can be performed with the 74ABT646A.

2. Features and benefits

- Combines 74ABT245 and 74ABT373A type functions in one device
- Independent registers for A and B buses
- Multiplexed real-time and stored data
- Live insertion and extraction permitted
- Output capability: +64 mA to –32 mA
- Power-up 3-state
- Power-up reset
- Latch-up protection exceeds 500 mA per JESD78B class II level A
- ESD protection:
  - HBM JESD22-A114F exceeds 2000 V
  - MM JESD22-A115-A exceeds 200 V

3. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
74ABT646AD	–40 °C to +85 °C	SO24	plastic small outline package; 24 leads; body width 7.5 mm	SOT137-1
74ABT646ADB	–40 °C to +85 °C	SSOP24	plastic shrink small outline package; 24 leads; body width 5.3 mm	SOT340-1
74ABT646APW	–40 °C to +85 °C	TSSOP24	plastic thin shrink small outline package; 24 leads; body width 4.4 mm	SOT355-1

4. Functional diagram

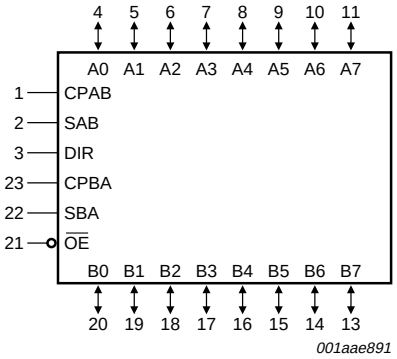


Fig 1. Logic symbol

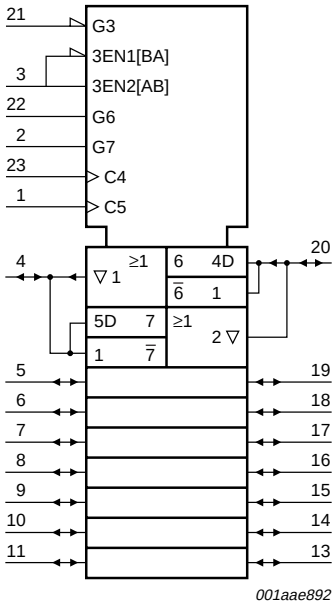


Fig 2. IEC logic symbol

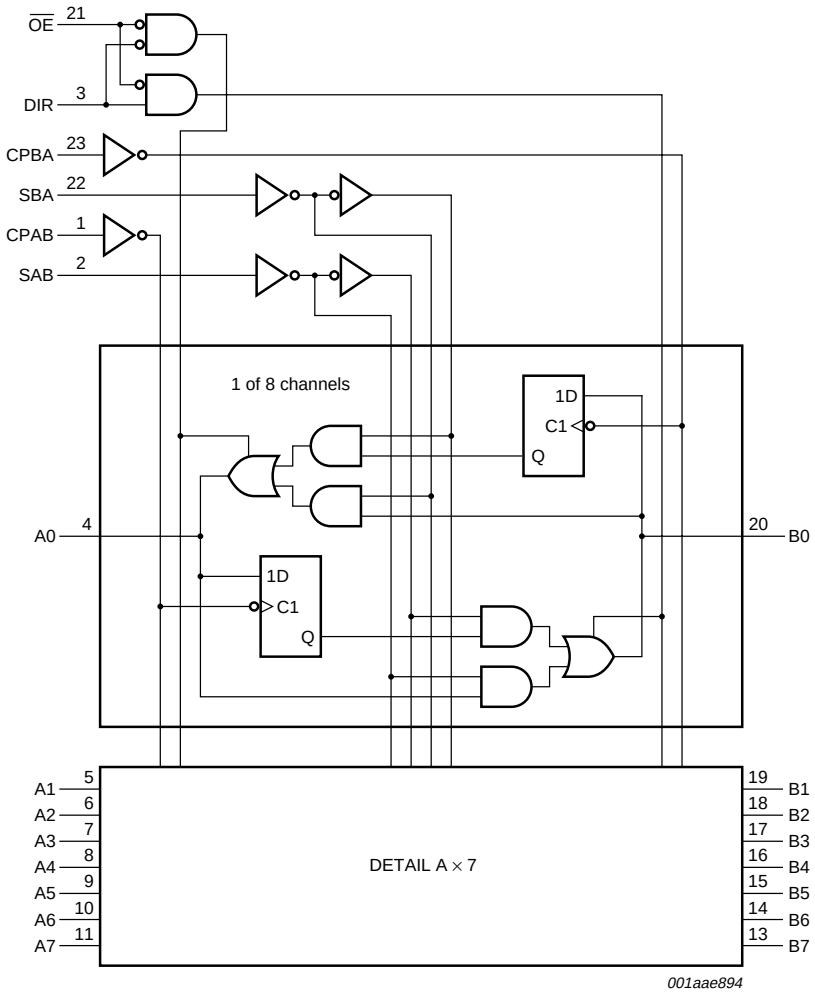


Fig 3. Logic diagram

5. Pinning information

5.1 Pinning

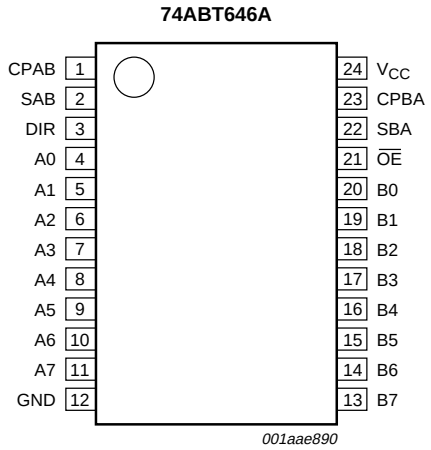


Fig 4. Pin configuration

5.2 Pin description

Table 2. Pin description

Symbol	Pin	Description
CPAB	1	A to B clock input
SAB	2	A to B select input
DIR	3	direction control input
A0, A1, A2, A3, A4, A5, A6, A7	4, 5, 6, 7, 8, 9, 10, 11	data input/output (A side)
GND	12	ground (0 V)
B0, B1, B2, B3, B4, B5, B6, B7	20, 19, 18, 17, 16, 15, 14, 13	data input/output (B side)
$\overline{OE}$	21	output enable input (active LOW)
SBA	22	B to A select input
CPBA	23	B to A clock input
V_{CC}	24	positive supply voltage

6. Functional description

Table 3. Function table[1]

Inputs						Data I/O		Operating mode
$\overline{OE}$	DIR	CPAB	CPBA	SAB	SBA	An	Bn	
X	X	↑	X	X	X	input	unspecified output[2]	store A, B unspecified
X	X	X	↑	X	X	unspecified output[2]	input	store B, A unspecified
H	X	↑	↑	X	X	input	input	store A and B data
H	X	H or L	H or L	X	X	input	input	isolation, hold storage
L	L	X	X	X	L	output	input	real time B data to A bus
L	L	X	H or L	X	H	output	input	stored B data to A bus
L	H	X	X	L	X	input	output	real time A data to B bus
L	H	H or L	X	H	X	input	output	stored A data to B bus

[1] H = HIGH voltage level;
L = LOW voltage level;
X = don't care;
↑ = LOW-to-HIGH clock transition;

[2] The data output function may be enabled or disabled by various signals at the $\overline{OE}$ input. Data input functions are always enabled, i.e. data at the bus pins will be stored on every LOW-to-HIGH transition of the clock.

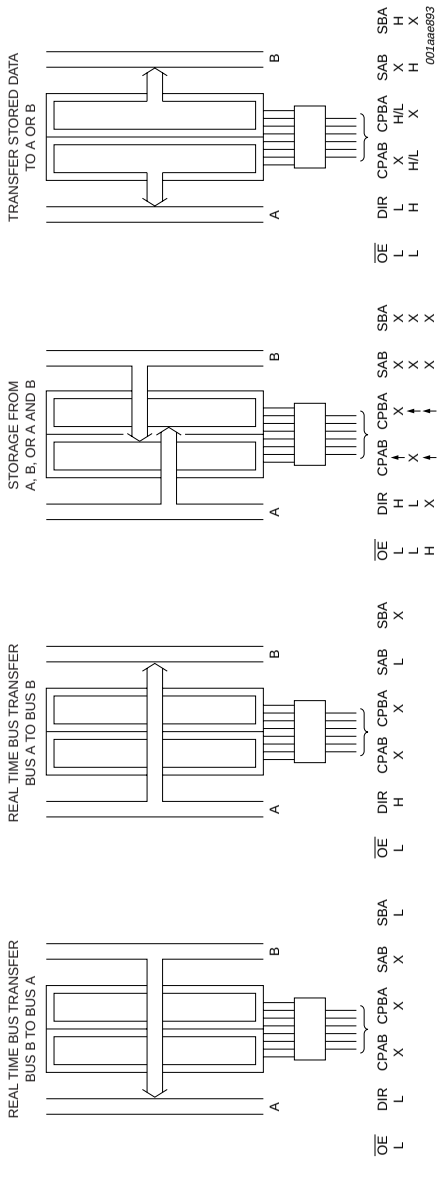


Fig 5. Real time bus transfer and storage

7. Limiting values

Table 4. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions		Min	Max	Unit
V_{CC}	supply voltage			–0.5	+7.0	V
V_I	input voltage		[1]	–1.2	+7.0	V
V_O	output voltage	output in OFF-state or HIGH-state	[1]	–0.5	+5.5	V
I_{IK}	input clamping current	$V_I < 0$ V		–18	-	mA
I_{OK}	output clamping current	$V_O < 0$ V		–50	-	mA
I_O	output current	output in LOW-state		-	128	mA
T_j	junction temperature		[2]	-	150	°C
T_{stg}	storage temperature			–65	+150	°C

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

[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.

8. Recommended operating conditions

Table 5. Recommended operating conditions

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{CC}	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 and fall rate		0	-	10	ns/V
T_{amb}	ambient temperature	in free air	–40	-	+85	°C

9. Static characteristics

Table 6. Static characteristics

Symbol	Parameter	Conditions		25 °C			–40 °C to 85 °C		Unit
				Min	Typ	Max	Min	Max	
V_{IK}	input clamping voltage	V_{CC} = 4.5 V; I_{IK} = –18 mA		–1.2	–0.9	-	–1.2	-	V
V_{OH}	HIGH-level output voltage	V_I = V_{IL} or V_{IH}							
		V_{CC} = 4.5 V; I_{OH} = –3 mA		2.5	3.0	-	2.5	-	V
		V_{CC} = 5.0 V; I_{OH} = –3 mA		3.0	3.5	-	3.0	-	V
		V_{CC} = 4.5 V; I_{OH} = –32 mA		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}		-	0.3	0.55	-	0.55	V
$V_{OL(pu)}$	power-up LOW-level output voltage	V_{CC} = 5.5 V; I_O = 1 mA; V_I = GND or V_{CC}	[1]	-	0.13	0.55	-	0.55	V
I_I	input leakage current	V_{CC} = 5.5 V; V_I = GND or 5.5 V							
		control pins		-	±0.01	±1.0	-	±1.0	µA
		data pins		-	±5	±100	-	±100	µA
I_{OFF}	power-off leakage current	V_{CC} = 0 V; V_I or V_O ≤ 4.5 V		-	±5.0	±100	-	±100	µA
$I_{O(pu/pd)}$	power-up/power-down output current	V_{CC} = 2.1 V; V_O = 0.5 V; V_I = GND or V_{CC}; $\overline{OE}$ HIGH	[2]	-	±5.0	±50	-	±50	µA
I_{OZ}	OFF-state output current	V_{CC} = 5.5 V; V_I = V_{IL} or V_{IH}							
		V_O = 2.7 V		-	5.0	50	-	50	µA
		V_O = 0.5 V		-	–5.0	–50	-	–50	µA
I_{LO}	output leakage current	V_{CC} = 5.5 V; HIGH-state; V_O = 5.5 V; V_{CC} = 5.5 V; V_I = GND or V_{CC}		-	5.0	50	-	50	µA
I_O	output current	V_{CC} = 5.5 V; V_O = 2.5 V	[3][5]	–180	–65	–40	–180	–40	mA
I_{CC}	supply current	V_{CC} = 5.5 V; V_I = GND or V_{CC}							
		outputs HIGH-state		-	110	250	-	250	µA
		outputs LOW-state		-	20	30	-	30	mA
		outputs disabled		-	110	250	-	250	µA
ΔI_{CC}	additional supply current	per input pin; V_{CC} = 5.5 V; one input at 3.4 V; other inputs at V_{CC} or GND	[4]	-	0.6	1.5	-	1.5	mA
C_I	input capacitance	control pins; V_I = 0 V or V_{CC}		-	4	-	-	-	pF
$C_{I/O}$	input/output capacitance	I/O pins; outputs disabled; V_O = 0 V or V_{CC}		-	7	-	-	-	pF

[1] For valid test results, data must not be loaded into the flip-flops (or latches) after applying the power.

[2] This parameter is valid for any V_{CC} between 0 V and 2.1 V with a transition time of up to 10 ms. For V_{CC} = 2.1 V to V_{CC} = 5 V ± 10 %, a transition time of up to 100 µs is permitted.

[3] Not more than one output should be tested at a time, and the duration of the test should not exceed one second.

[4] This is the increase in supply current for each input at 3.4 V.

[5] This data sheet limit may vary among suppliers.

10. Dynamic characteristics

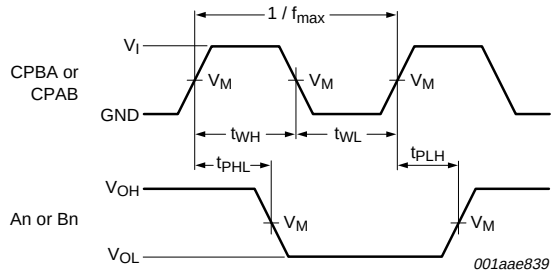
Table 7. Dynamic characteristics

GND = 0 V; for test circuit, see Figure 11.

Symbol	Parameter	Conditions	25 °C; V_{CC} = 5.0 V			−40 °C to +85 °C; V_{CC} = 5.0 V ± 0.5 V		Unit
			Min	Typ	Max	Min	Max	
f_{max}	maximum frequency	see Figure 6	125	350	-	125	-	MHz
t_{PLH}	LOW to HIGH propagation delay	CPAB to Bn or CPBA to An; see Figure 6	2.2	3.9	5.1	2.2	5.6	ns
		An to Bn or Bn to An; see Figure 7	1.5	3.2	4.3	1.5	4.8	ns
		SAB to Bn or SBA to An; see Figure 7	1.5	3.8	5.1	1.5	6.5	ns
t_{PHL}	HIGH to LOW propagation delay	CPAB to Bn or CPBA to An; see Figure 6	1.7	4.4	5.2[1]	1.7	5.6	ns
		An to Bn or Bn to An; see Figure 7	1.5	3.7	4.6	1.5	5.4	ns
		SAB to Bn or SBA to An; see Figure 7	1.5	4.4	5.3[1]	1.5	5.9	ns
t_{PZH}	OFF-state to HIGH propagation delay	$\overline{OE}$ to An or Bn; see Figure 8	1.5	3.5	5.3	1.5	6.3	ns
		DIR to An or Bn; see Figure 8	1.5	3.9	5.7	1.2	6.7	ns
t_{PZL}	OFF-state to LOW propagation delay	$\overline{OE}$ to An or Bn; see Figure 9	3.0	4.5	7.4	3.0	8.8	ns
		DIR to An or Bn; see Figure 9	2.5	4.7	9.0	2.5	9.5	ns
t_{PHZ}	HIGH to OFF-state propagation delay	$\overline{OE}$ to An or Bn; see Figure 8	1.5	4.0	4.8[1]	1.5	5.3[1]	ns
		DIR to An or Bn; see Figure 8	1.5	4.0	5.0	1.5	5.7	ns
t_{PLZ}	LOW to OFF-state propagation delay	$\overline{OE}$ to An or Bn; see Figure 9	1.5	3.3	4.0	1.5	4.5	ns
		DIR to An or Bn; see Figure 9	1.5	3.5	4.7	1.5	6.0	ns
$t_{su(H)}$	set-up time HIGH	An to CPAB, Bn to CPBA; see Figure 10	3.0	0.7	-	3.0	-	ns
$t_{su(L)}$	set-up time LOW	An to CPAB, Bn to CPBA; see Figure 10	3.0	0.7	-	3.0	-	ns
$t_{h(H)}$	hold time HIGH	An to CPAB, Bn to CPBA; see Figure 10	+0.0	−0.5	-	0.0	-	ns
$t_{h(L)}$	hold time LOW	An to CPAB, Bn to CPBA; see Figure 10	+0.0	−0.5	-	0.0	-	ns
t_{WH}	pulse width HIGH	CPAB, CPBA; see Figure 6	4.0	0.9	-	4.0	-	ns
t_{WL}	pulse width LOW	LE; see Figure 6	4.0	1.4	-	4.0	-	ns

[1] This data sheet limit may vary among suppliers.

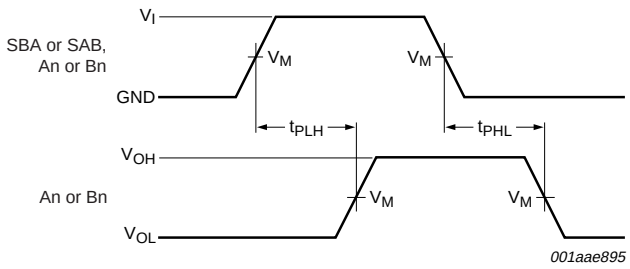
11. Waveforms



V_M = 1.5 V

V_{OL} and V_{OH} are typical voltage output levels that occur with the output load.

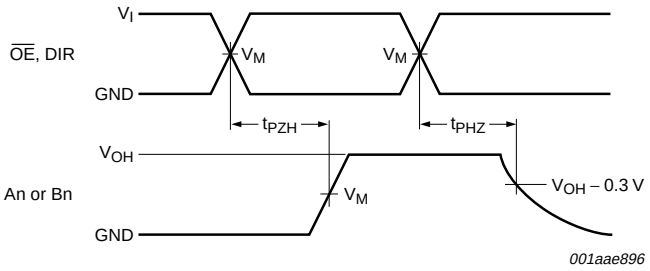
Fig 6. Propagation delay clock input to output and clock pulse width, maximum clock frequency



V_M = 1.5 V

V_{OL} and V_{OH} are typical voltage output levels that occur with the output load.

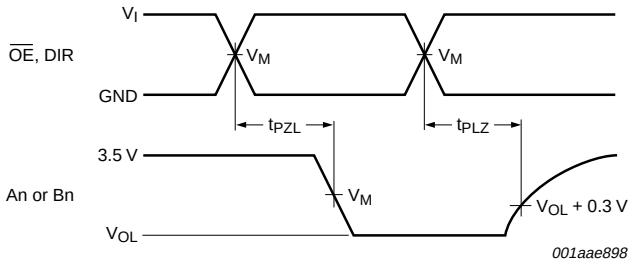
Fig 7. Propagation delay, SAB to Bn or SBA to An, An to Bn or Bn to An



V_M = 1.5 V

V_{OL} and V_{OH} are typical voltage output levels that occur with the output load.

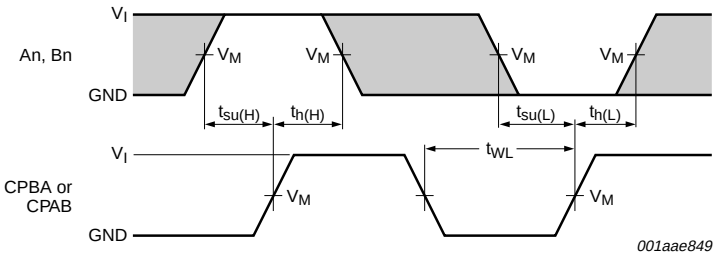
Fig 8. 3-state output enable time to HIGH-level and output disable time from HIGH-level



V_M = 1.5 V

V_{OL} and V_{OH} are typical voltage output levels that occur with the output load.

Fig 9. 3-state output enable time to LOW-level and output disable time from LOW-level

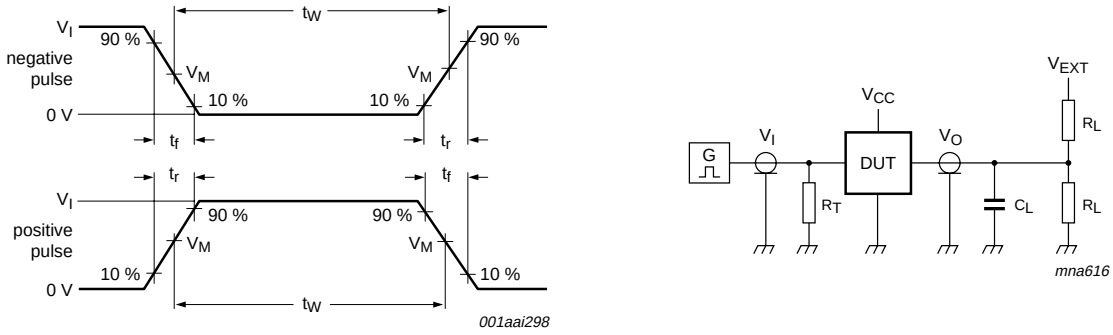


V_M = 1.5 V

V_{OL} and V_{OH} are typical voltage output levels that occur with the output load.

The shaded areas indicate when the input is permitted to change for predictable output performance.

Fig 10. Data set-up and hold times



a. Input pulse definition

b. Test circuit

Test data is given in Table 8.

R_L = Load resistance.

C_L = Load capacitance including jig and probe capacitance.

R_T = Termination resistance should be equal to output impedance Z_o of the pulse generator.

V_{EXT} = Test voltage for switching times.

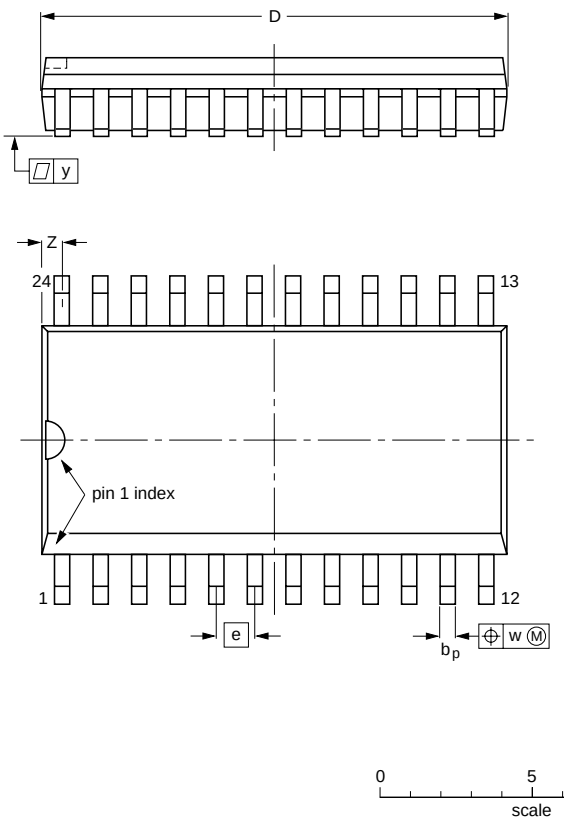
Fig 11. Load circuitry for switching times

Table 8. Test data

Input				Load		V_{EXT}		
V_I	f_I	t_W	t_r, t_f	C_L	R_L	t_{PHL}, t_{PLH}	t_{PZH}, t_{PHZ}	t_{PZL}, t_{PLZ}
3.0 V	1 MHz	500 ns	≤ 2.5 ns	50 pF	500 Ω	open	open	7.0 V

12. Package outline

SO24: plastic small outline package; 24 leads; body width 7.5 mm **SOT137-1**



DIMENSIONS (inch dimensions are derived from the original mm 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	2.65	0.3 0.1	2.45 2.25	0.25	0.49 0.36	0.32 0.23	15.6 15.2	7.6 7.4	1.27	10.65 10.00	1.4	1.1 0.4	1.1 1.0	0.25	0.25	0.1	0.9 0.4	8^o 0^o
inches	0.1	0.012 0.004	0.096 0.089	0.01	0.019 0.014	0.013 0.009	0.61 0.60	0.30 0.29	0.05	0.419 0.394	0.055	0.043 0.016	0.043 0.039	0.01	0.01	0.004	0.035 0.016	

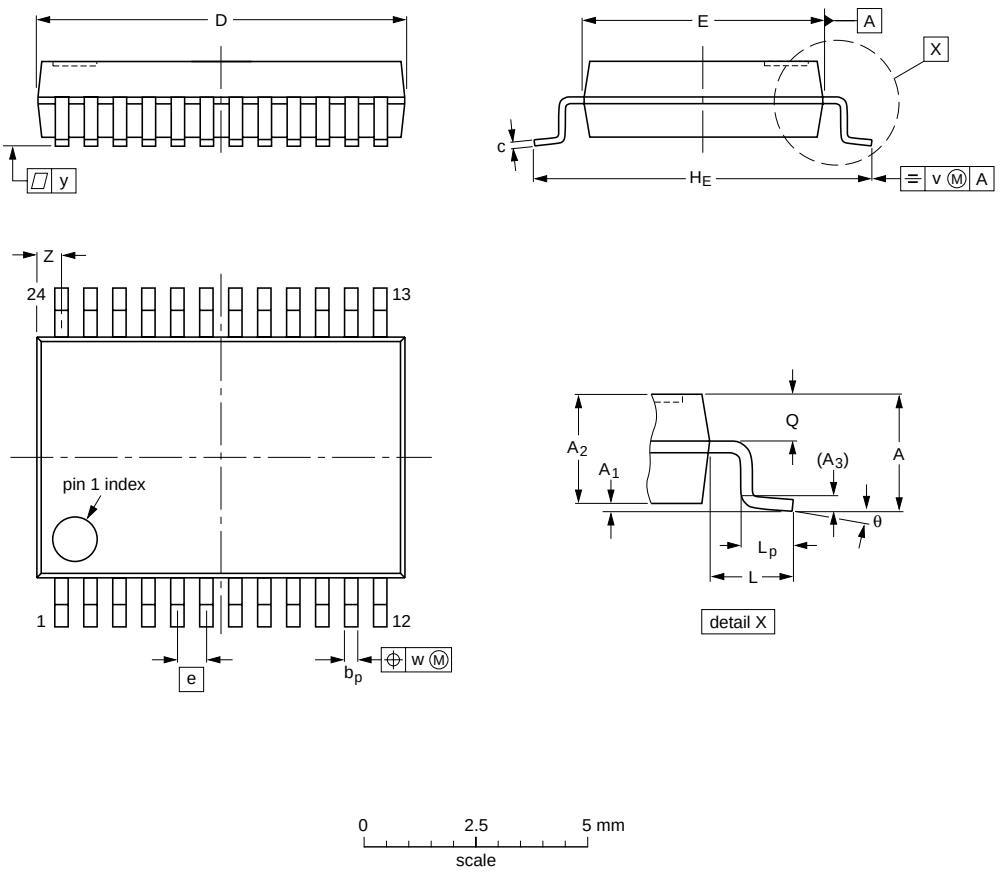
Note

1. Plastic or metal protrusions of 0.15 mm (0.006 inch) maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT137-1	075E05	MS-013				~~99-12-27~~ 03-02-19

Fig 12. Package outline SOT137-1 (SO24)

SSOP24: plastic shrink small outline package; 24 leads; body width 5.3 mm **SOT340-1**



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	0.21 0.05	1.80 1.65	0.25	0.38 0.25	0.20 0.09	8.4 8.0	5.4 5.2	0.65	7.9 7.6	1.25	1.03 0.63	0.9 0.7	0.2	0.13	0.1	0.8 0.4	8^o 0^o

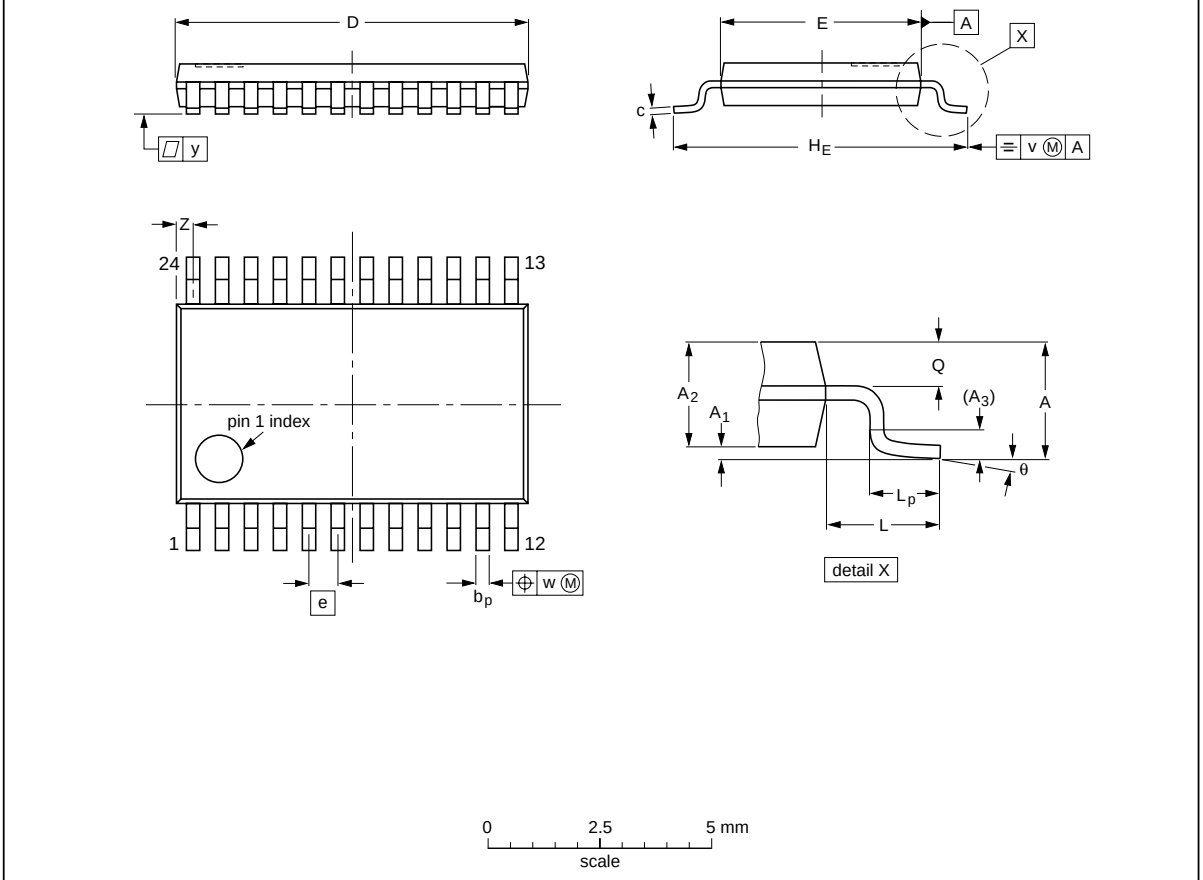
Note

1. Plastic or metal protrusions of 0.2 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT340-1		MO-150				~~99-12-27~~ 03-02-19

Fig 13. Package outline SOT340-1 (SSOP24)

TSSOP24: plastic thin shrink small outline package; 24 leads; body width 4.4 mm **SOT355-1**



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	$Z^{(1)}$	θ
mm	1.1	0.15 0.05	0.95 0.80	0.25	0.30 0.19	0.2 0.1	7.9 7.7	4.5 4.3	0.65	6.6 6.2	1	0.75 0.50	0.4 0.3	0.2	0.13	0.1	0.5 0.2	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	JEITA			
SOT355-1		MO-153				~~99-12-27~~ 03-02-19

Fig 14. Package outline SOT355-1 (TSSOP24)

13. Abbreviations

Table 9. Abbreviations

Acronym	Description
BiCMOS	Bipolar Complementary Metal-Oxide Semiconductor
DUT	Device Under Test
ESD	ElectroStatic Discharge
HBM	Human Body Model
MM	Machine Model

14. Revision history

Table 10. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74ABT646A_3	20100315	Product data sheet	-	74ABT646A_2
Modifications:	• The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors. • Legal texts have been adapted to the new company name where appropriate. • DIP 24 (SOT222-1) package removed from Section 3 “Ordering information” and Section 12 “Package outline”.			
74ABT646A_2	19980217	Product specification	-	74ABT646A_1
74ABT646A_1	19950906	Product specification	-	-

15. Legal information

15.1 Data sheet status

Document status[1][2]	Product status[3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

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

[2] The term 'short data sheet' is explained in section "Definitions".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL http://www.nxp.com.

15.2 Definitions

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17. Contents

1 General description 1
2 Features and benefits 1
3 Ordering information 2
4 Functional diagram 2
5 Pinning information 4
5.1 Pinning 4
5.2 Pin description 4
6 Functional description 5
7 Limiting values 7
8 Recommended operating conditions 7
9 Static characteristics 8
10 Dynamic characteristics 9
11 Waveforms 10
12 Package outline 13
13 Abbreviations 16
14 Revision history 16
15 Legal information 17
15.1 Data sheet status 17
15.2 Definitions 17
15.3 Disclaimers 17
15.4 Trademarks 17
16 Contact information 18
17 Contents 19

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