74ABT544

Octal latched transceiver with dual enable; inverting; 3-state

Rev. 04 — 15 January 2009 Product data sheet

1. General description

The 74ABT544 high performance BiCMOS device combines low static and dynamic power dissipation with high speed and high output drive.

The 74ABT544 octal latched transceiver contains two sets of D-type latches for temporary storage of data flowing in either direction. Separate latch enable ($\overline{LEAB}$, $\overline{LEBA}$) and output enable ($\overline{OEAB}$, $\overline{OEBA}$) inputs are provided for each register to permit independent control of data transfer in either direction. The outputs are guaranteed to sink 64 mA.

2. Features

- Combines 74ABT640 and 74ABT373 type functions in one device
- 8-bit octal transceiver with D-type latch
- Back-to-back registers for storage
- Separate controls for data flow in each direction
- 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
74ABT544D	–40 °C to +85 °C	SO24	plastic small outline package; 24 leads; body width 7.5 mm	SOT137-1
74ABT544DB	–40 °C to +85 °C	SSOP24	plastic shrink small outline package; 24 leads; body width 5.3 mm	SOT340-1
74ABT544PW	–40 °C to +85 °C	TSSOP24	plastic thin shrink small outline package; 24 leads; body width 4.4 mm	SOT355-1

4. Functional diagram

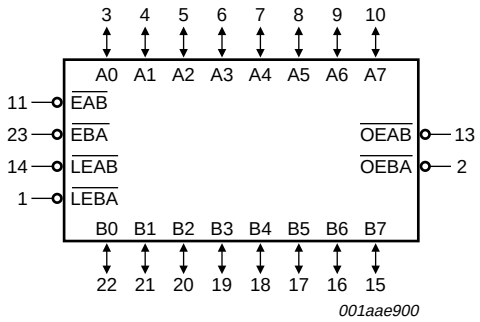


Fig 1. Logic symbol

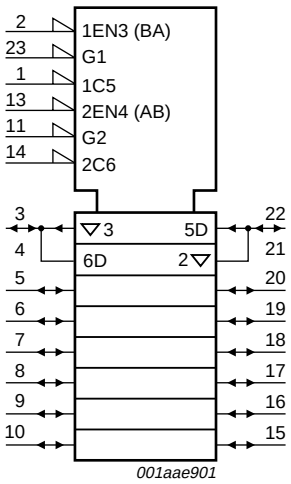


Fig 2. IEC logic symbol

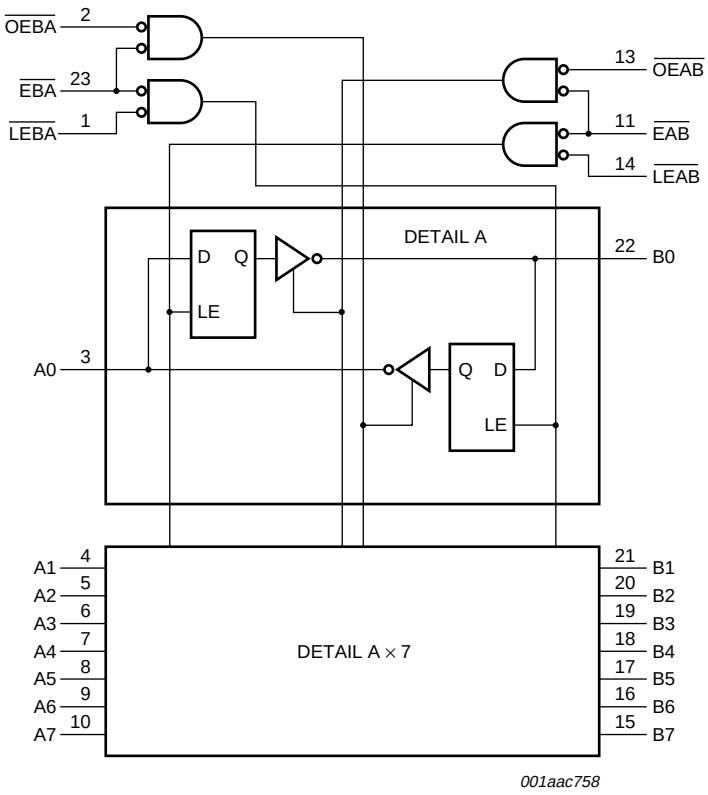


Fig 3. Logic diagram

5. Pinning information

5.1 Pinning

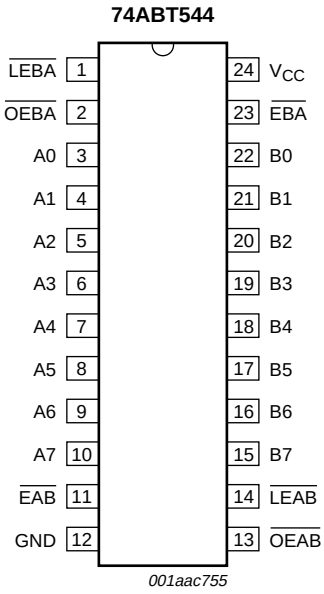


Fig 4. Pin configuration

5.2 Pin description

Table 2. Pin description

Symbol	Pin	Description
$\overline{LEBA}$	1	B-to-A latch enable input (active LOW)
$\overline{OEBA}$	2	B-to-A output enable input (active LOW)
A0 to A7	3, 4, 5, 6, 7, 8, 9, 10	data input or output
$\overline{EAB}$	11	A-to-B enable input (active LOW)
GND	12	ground (0 V)
$\overline{OEAB}$	13	A-to-B output enable input (active LOW)
$\overline{LEAB}$	14	A-to-B latch enable input (active LOW)
B0 to B7	22, 21, 20, 19, 18, 17, 16, 15	data input or output
$\overline{EBA}$	23	B-to-A enable input (active LOW)
V_{CC}	24	positive supply voltage

6. Functional description

6.1 Function table

Table 3. Function selection[1]

Input				Output	Status
$\overline{OEXX}$	$\overline{EXX}$	$\overline{LEXX}$	An or Bn	Bn or An	
H	X	X	X	Z	disabled
X	H	X	X	Z	
L	↑	L	h	Z	disabled + latch
			l	Z	
L	L	↑	h	L	latch + display
			l	H	
L	L	L	H	L	transparent
			L	H	
L	L	H	X	NC	hold

[1] H = HIGH voltage level;
h = HIGH voltage level one set-up time prior to the LOW-to-HIGH clock transition of $\overline{LEXX}$ or $\overline{EXX}$ (XX = AB or BA);
L = LOW voltage level;
l = LOW voltage level one set-up time prior to the LOW-to-HIGH clock transition of $\overline{LEXX}$ or $\overline{EXX}$ (XX = AB or BA);
↑ = LOW-to-HIGH clock transition of $\overline{LEXX}$ or $\overline{EXX}$ (XX = AB or BA);
NC = no change;
X = don't care;
Z = high-impedance OFF-state.

6.2 Description

The 74ABT544 contains two sets of eight D-type latches, with separate control pins for each set.

Using data flow from A-to-B as an example, when the A-to-B enable ($\overline{EAB}$) input, the A-to-B latch enable ($\overline{LEAB}$) input and the A-to-B output enable ($\overline{OEAB}$) input are all LOW, the A-to-B path is transparent.

A subsequent LOW-to-HIGH transition of the $\overline{LEAB}$ signal puts the A data into the latches where it is stored and the B outputs no longer change with the A inputs. With $\overline{EAB}$ and $\overline{OEAB}$ both LOW, the 3-state B output buffers are active and display the data present at the outputs of the A latches.

Control of data flow from B-to-A is similar, but using the $\overline{EBA}$, $\overline{LEBA}$, and $\overline{OEBA}$ inputs.

7. Limiting values

Table 4. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134).
Voltages are referenced to GND (ground = 0 V).

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

Voltages are referenced to GND (ground = 0 V).

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	3.2	-	2.5	-	V
		V_{CC} = 5.0 V; I_{OH} = –3 mA	3.0	3.7	-	3.0	-	V
		V_{CC} = 4.5 V; I_{OH} = –32 mA	2.0	2.3	-	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

Table 6. Static characteristics *…continued*

Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions		25 °C			–40 °C to +85 °C		Unit
				Min	Typ	Max	Min	Max	
$V_{OL(pu)}$	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
		An, Bn		-	±5.0	±100	-	±100	µA
I_{OFF}	power-off leakage current	V_{CC} = 0 V; V_I or $V_O \leq$ 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}; $\overline{OEAB}$, $\overline{OEBA}$ don't care	[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	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]	–180	–65	–50	–180	–50	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 pin at 3.4 V, other inputs at V_{CC} or GND	[4]	-	0.3	1.5	-	1.5	mA
C_I	input capacitance	V_I = 0 V or V_{CC}		-	4	-	-	-	pF
$C_{I/O}$	input/output capacitance	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. From V_{CC} = 2.1 V to V_{CC} = 5 V ± 10 %, a transition time of up to 100 ms 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.

10. Dynamic characteristics

Table 7. Dynamic characteristics

GND = 0 V; for test circuit, see Figure 10.

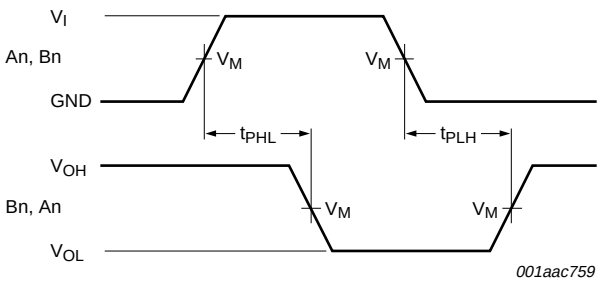
Symbol	Parameter	Conditions	25 °C; V_{CC} = 5.0 V			–40 °C to +85 °C; V_{CC} = 5.0 V ± 0.5 V		Unit
			Min	Typ	Max	Min	Max	
t_{PLH}	LOW to HIGH propagation delay	An to Bn or Bn to An; see Figure 5	1.7	3.0	3.8	1.7	4.7	ns
		$\overline{LEBA}$ to An or $\overline{LEAB}$ to Bn; see Figure 6	2.1	3.5	4.2	2.1	5.2	ns

Table 7. Dynamic characteristics *...continued*

GND = 0 V; for test circuit, see Figure 10.

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	
t_{PHL}	HIGH to LOW propagation delay	An to Bn or Bn to An; see Figure 5	2.4	3.6	4.5	2.4	5.2	ns
		$\overline{LEBA}$ to An or $\overline{LEAB}$ to Bn; see Figure 6	3.0	4.4	5.3	3.0	6.2	ns
t_{PZH}	OFF-state to HIGH propagation delay	$\overline{OEBA}$ to An, $\overline{OEAB}$ to Bn; see Figure 7	1.8	3.0	3.9	1.8	4.7	ns
		$\overline{EBA}$ to An, $\overline{EAB}$ to Bn; see Figure 7	1.9	3.4	4.1	1.9	5.0	ns
t_{PZL}	OFF-state to LOW propagation delay	$\overline{OEBA}$ to An, $\overline{OEAB}$ to Bn; see Figure 8	2.9	4.2	5.2	2.9	6.1	ns
		$\overline{EBA}$ to An, $\overline{EAB}$ to Bn; see Figure 8	3.1	4.6	5.5	3.1	6.5	ns
t_{PHZ}	HIGH to OFF-state propagation delay	$\overline{OEBA}$ to An, $\overline{OEAB}$ to Bn; see Figure 7	2.0	3.3	4.3	2.0	4.9	ns
		$\overline{EBA}$ to An, $\overline{EAB}$ to Bn; see Figure 7	2.1	3.4	4.5	2.1	5.2	ns
t_{PLZ}	LOW to OFF-state propagation delay	$\overline{OEBA}$ to An, $\overline{OEAB}$ to Bn; see Figure 8	2.0	2.8	5.8	2.0	6.3	ns
		$\overline{EBA}$ to An, $\overline{EAB}$ to Bn; see Figure 8	2.0	3.0	6.2	2.0	6.7	ns
$t_{su(H)}$	set-up time HIGH	An to $\overline{LEAB}$, Bn to $\overline{LEBA}$; see Figure 9	3.0	1.5	-	3.0	-	ns
		An to $\overline{EAB}$, Bn to $\overline{EBA}$; see Figure 9	3.0	1.5	-	3.0	-	ns
$t_{su(L)}$	set-up time LOW	An to $\overline{LEAB}$, Bn to $\overline{LEBA}$; see Figure 9	3.0	0.6	-	3.0	-	ns
		An to $\overline{EAB}$, Bn to $\overline{EBA}$; see Figure 9	3.0	0.6	-	3.0	-	ns
$t_{h(H)}$	hold time HIGH	$\overline{LEAB}$ to An, $\overline{LEBA}$ to Bn; see Figure 9	+0.5	–0.3	-	0.5	-	ns
		$\overline{EAB}$ to An, $\overline{EBA}$ to Bn; see Figure 9	+0.5	–0.2	-	0.5	-	ns
$t_{h(L)}$	hold time LOW	$\overline{LEAB}$ to An, $\overline{LEBA}$ to Bn; see Figure 9	+0.5	–1.3	-	0.5	-	ns
		$\overline{EAB}$ to An, $\overline{EBA}$ to Bn; see Figure 9	+0.5	–1.3	-	0.5	-	ns
t_{WL}	pulse width LOW	latch enable; see Figure 9	3.5	1.8	-	3.5	-	ns

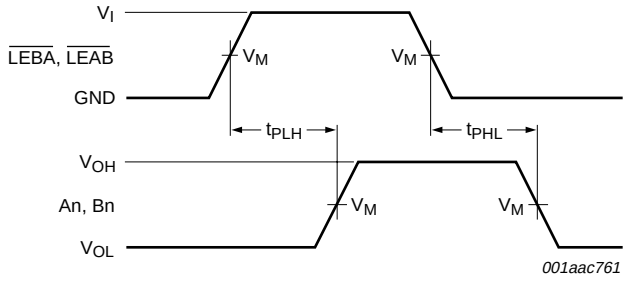
11. Waveforms



V_M = 1.5 V

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

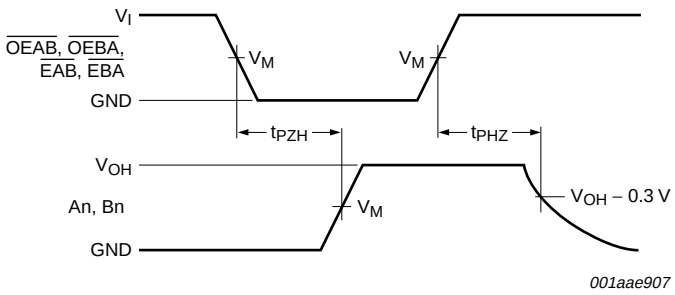
Fig 5. Propagation delay input (An, Bn) to output (Bn, An)



V_M = 1.5 V

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

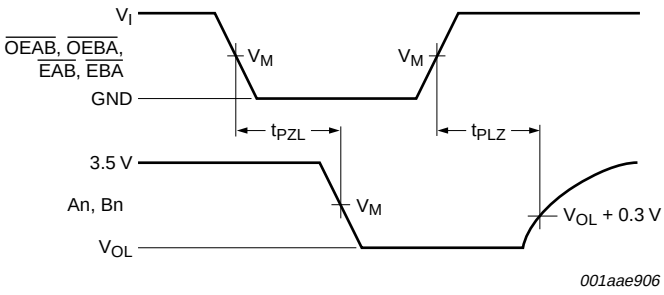
Fig 6. Propagation delay latch enable ($\overline{LEAB}$, $\overline{LEBA}$) to output (An, Bn)



V_M = 1.5 V

V_{OH} is a typical voltage output level that occurs with the output load.

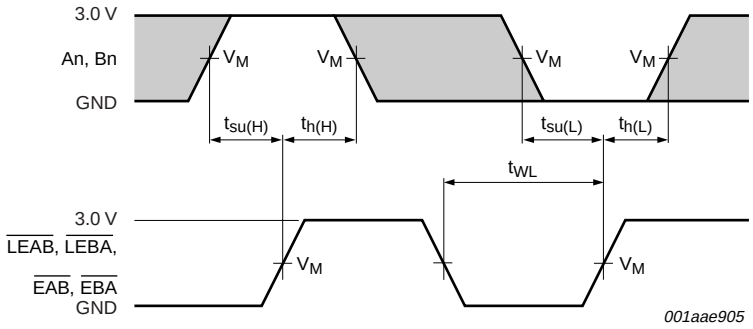
Fig 7. Propagation delay 3-state output enable to HIGH-level and output disable from HIGH-level



V_M = 1.5 V

V_{OL} is a typical voltage output level that occurs with the output load.

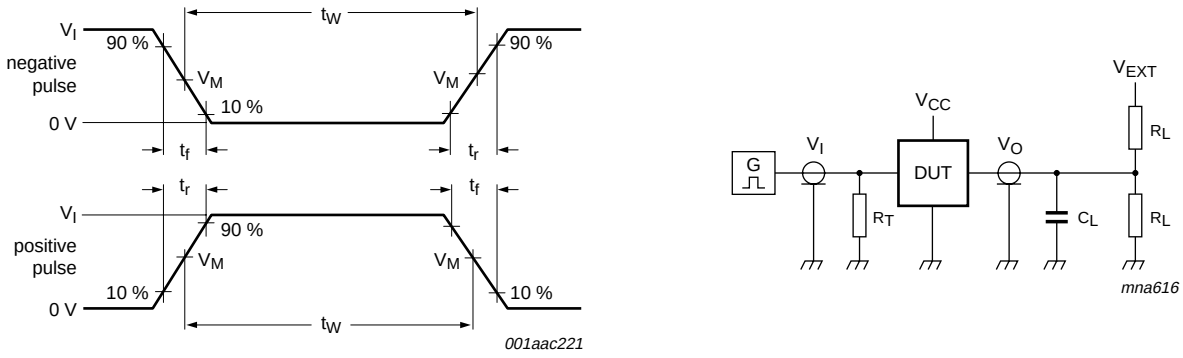
Fig 8. Propagation delay 3-state output enable to LOW-level and output disable from LOW-level



V_M = 1.5 V

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

Fig 9. Data set-up and hold times and latch enable pulse width



a. Input pulse definition

b. Test circuit

Test data is given in Table 8.

Definitions test circuit:

R_L = Load resistor.

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.

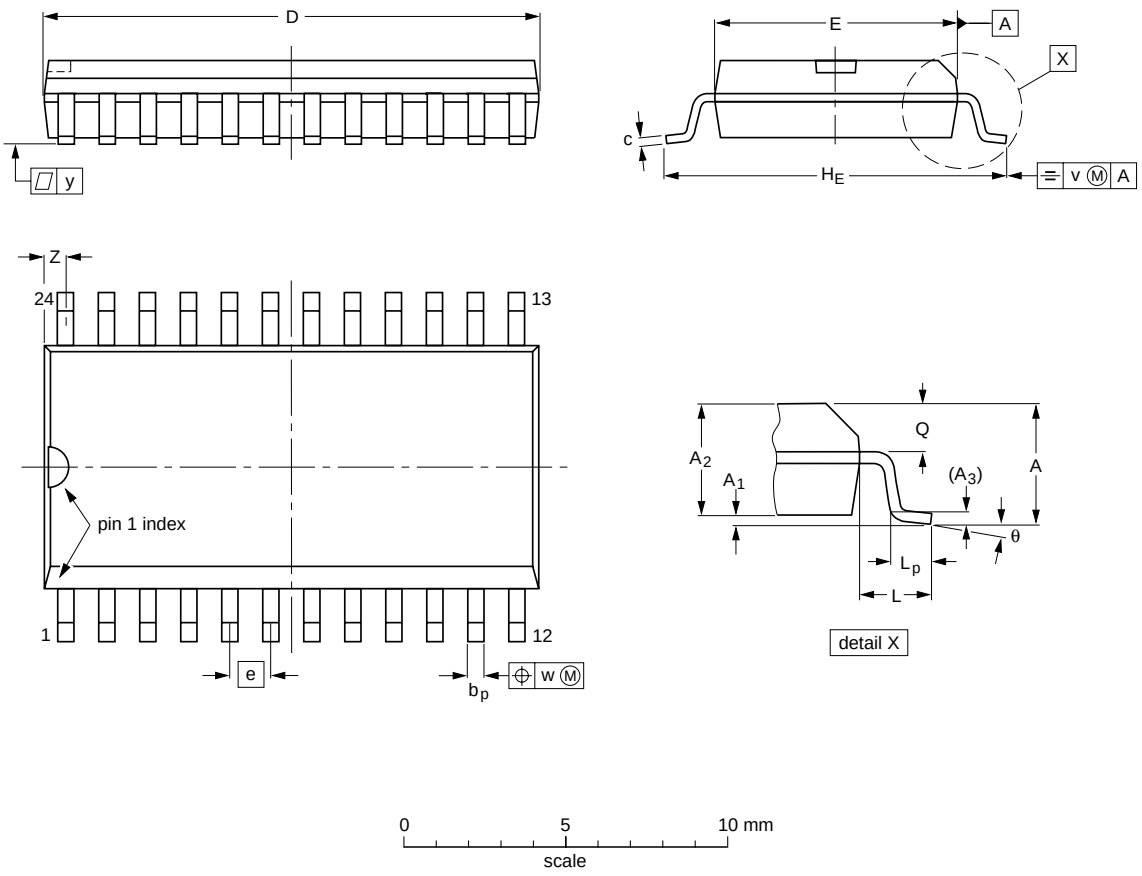
Fig 10. Load circuitry for switching times

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	

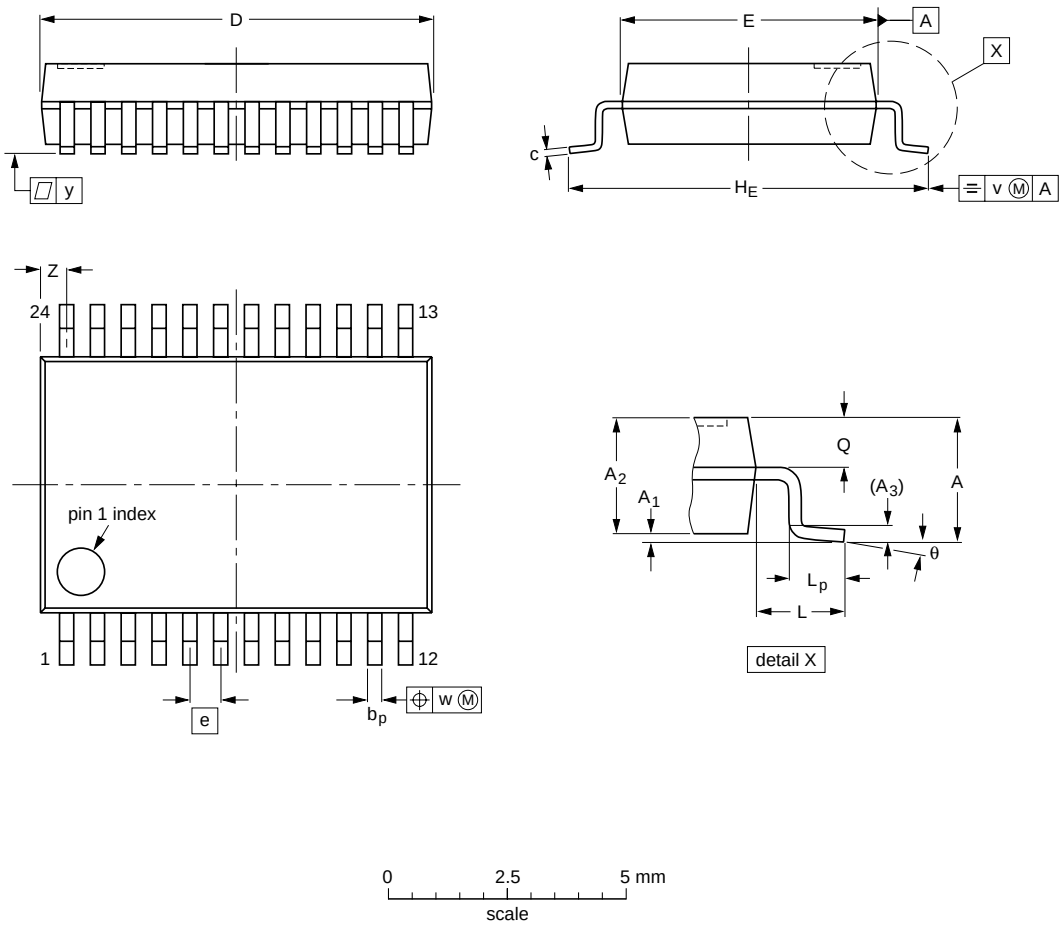
Note

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 11. 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

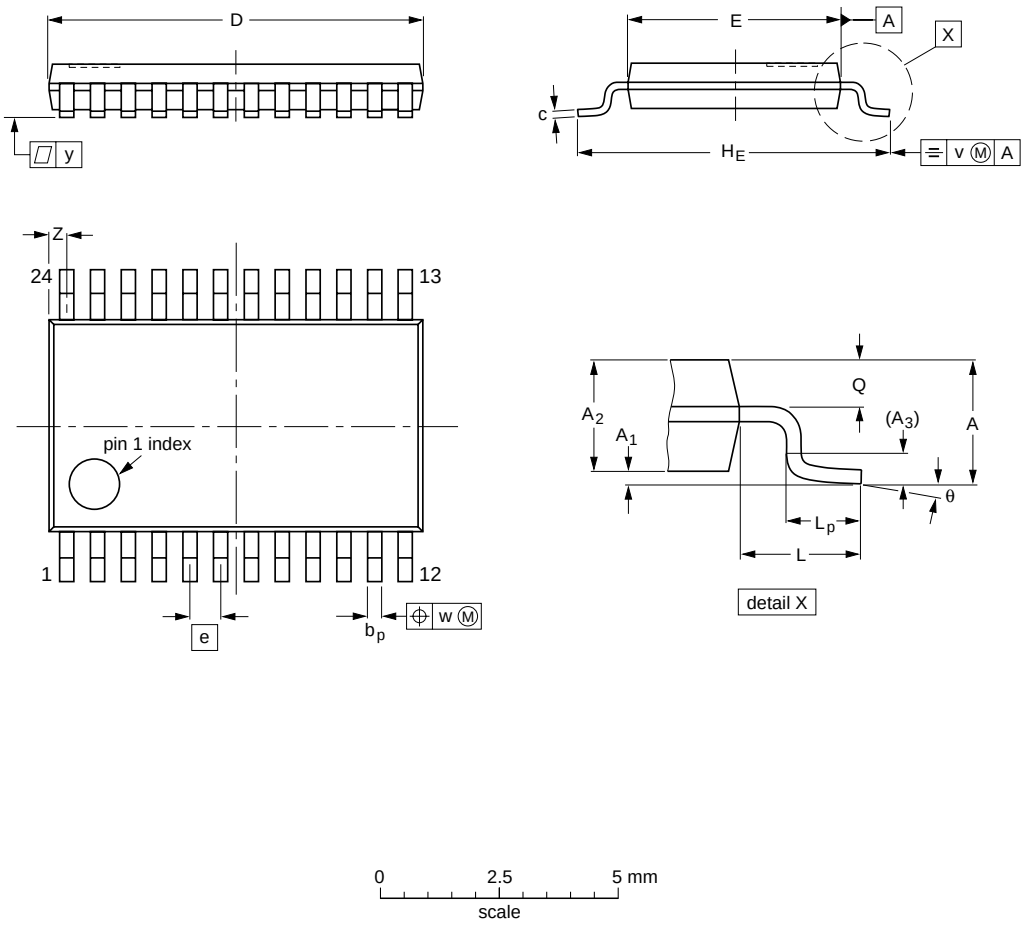
Note

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 12. 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 13. 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
74ABT544_4	20100115	Product data sheet	-	74ABT544_3 (9397 750 14756)
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.			
74ABT544_3 (9397 750 14756)	20050420	Product specification	-	74ABT544_2 (9397 750 10752)
74ABT544_2 (9397 750 10752)	20021118	Product specification	-	74ABT544
74ABT544	19930701	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.

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17. Contents

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