

# DATA SHEET

## **74LVC543A**

Octal D-type registered transceiver  
(3-State)

Product specification  
Supersedes data of 1998 Jul 31  
IC24 Data Handbook

2000 Jun 21

## Octal D-type registered transceiver (3-State)

## 74LVC543A

## FEATURES

- 5-volt tolerant inputs/outputs, for interfacing with 5-volt logic
- Supply voltage range of 1.2 V to 3.6 V
- Complies with JEDEC standard no. 8–1A
- CMOS low power consumption
- Direct interface with TTL levels
- 8-bit octal transceiver with D-type latch
- Back-to-back registers for storage
- Separate controls for data flow in each direction
- 3-State non-inverting outputs for bus oriented applications
- High impedance when  $V_{CC} = 0$  V

## DESCRIPTION

The 74LVC543A is a high-performance, low-power, low-voltage, Si-gate CMOS device and superior to most advanced CMOS compatible TTL families.

The 74LVC543A is an octal registered transceiver containing two sets of D-type latches for temporary storage of the data flow in either direction. Separate latch enable ( $\overline{LE}_{AB}$ ,  $\overline{LE}_{BA}$ ) and output enable ( $\overline{OE}_{AB}$ ,  $\overline{OE}_{BA}$ ) inputs are provided for each register to permit independent control of inputting and outputting in either direction of the data flow.

The 74LVC543A contains eight D-type latches, with separate inputs and controls for each set. For data flow from A to B, for example, the A-to-B enable ( $\overline{E}_{AB}$ ) input must be LOW in order to enter data from  $A_0$ - $A_7$  or take data from  $B_0$ - $B_7$ , as indicated in the function table. With  $\overline{E}_{AB}$  LOW, a LOW signal on the A-to-B latch enable ( $\overline{LE}_{AB}$ ) input makes the A-to-B latches transparent; a subsequent LOW-to-HIGH transition of the  $\overline{LE}_{AB}$  signal puts the A data into the latches where it is stored and the B outputs no longer change with the A inputs. With  $\overline{E}_{AB}$  and  $\overline{OE}_{AB}$  both low, the 3-state B output buffers are active and display the data present at the outputs of the A latches

## QUICK REFERENCE DATA

GND = 0V;  $T_{amb} = 25^\circ\text{C}$ ;  $T_r = T_f \leq 2.5\text{ns}$

SYMBOL	PARAMETER	CONDITIONS	TYPICAL	UNIT
$t_{PHL}/t_{PLH}$	Propagation delay $A_n$ to $B_n$	$C_L = 50$ pF $V_{CC} = 3.3$ V	3.3	ns
$C_i$	input capacitance		5.0	pF
$C_{I/O}$	input/output capacitance		10.0	pF
$C_{PD}$	power dissipation capacitance per latch	$V_{CC} = 3.3$ V	27	pF

## NOTES:

1.  $C_{PD}$  is used to determine the dynamic power dissipation ( $P_D$  in  $\mu\text{W}$ )  
 $P_D = C_{PD} \times V_{CC}^2 \times f_i + \sum (C_L \times V_{CC}^2 \times f_o)$  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;  
 $\sum (C_L \times V_{CC}^2 \times f_o)$  = sum of the outputs
2. The condition is  $V_I = \text{GND to } V_{CC}$

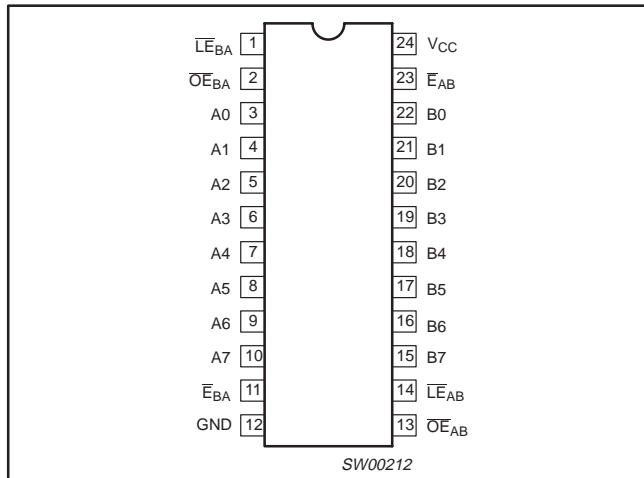
## ORDERING INFORMATION

PACKAGES	TEMPERATURE RANGE	OUTSIDE NORTH AMERICA	NORTH AMERICA	PKG DWG. #
24-Pin Plastic Small Outline (SO)	-40°C to +85°C	74LVC543A D	74LVC543A D	SOT137-1
24-Pin Plastic Shrink Small Outline (SSOP) Type II	-40°C to +85°C	74LVC543A DB	74LVC543A DB	SOT340-1
24-Pin Plastic Thin Shrink Small Outline (TSSOP) Type I	-40°C to +85°C	74LVC543A PW	7LVC543APW DH	SOT355-1

# Octal D-type registered transceiver (3-State)

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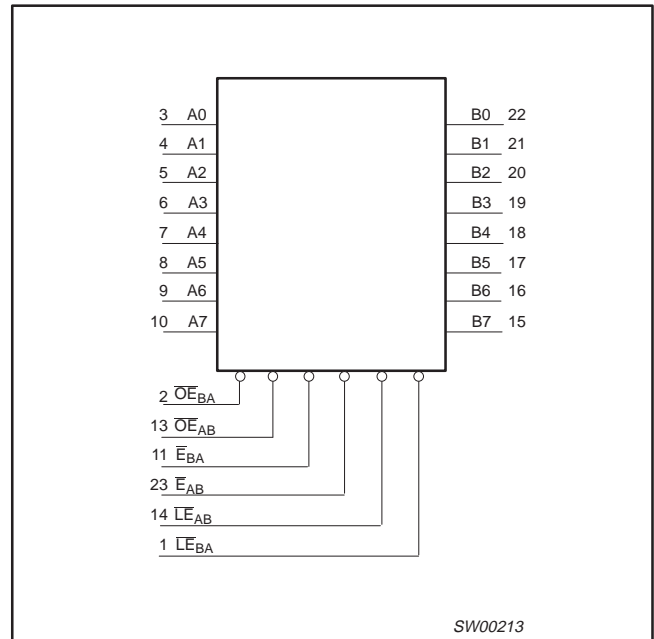
### PIN CONFIGURATION



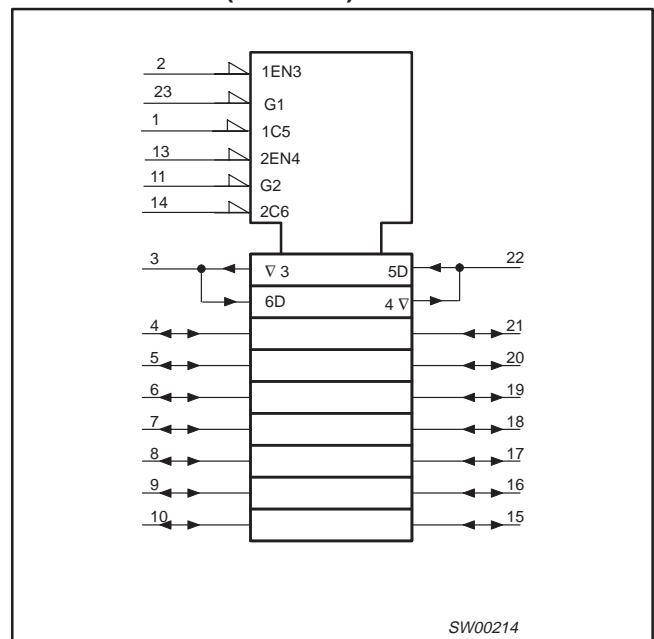
### PIN DESCRIPTION

PIN NUMBER	SYMBOL	FUNCTION
1	$\overline{LE}_{BA}$	'B' to 'A' latch enable input (active LOW)
2	$\overline{OE}_{BA}$	'B' to 'A' output enable input (active LOW)
3,4,5,6, 7, 8, 9 10	A <sub>0</sub> to A <sub>7</sub>	'A' data inputs/outputs
11	$\overline{E}_{BA}$	'B' to 'A' enable input (active LOW)
12	GND	ground (0V)
22, 21, 20, 19, 18, 17, 16, 15	B <sub>0</sub> to B <sub>7</sub>	'B' data inputs/outputs
13	$\overline{OE}_{AB}$	'A' to 'B' output enable input (active LOW)
14	$\overline{LE}_{AB}$	'A' to 'B' latch enable input (active LOW)
23	$\overline{E}_{AB}$	'A' to 'B' enable input (active LOW)
24	V <sub>CC</sub>	positive supply voltage

### LOGIC SYMBOL



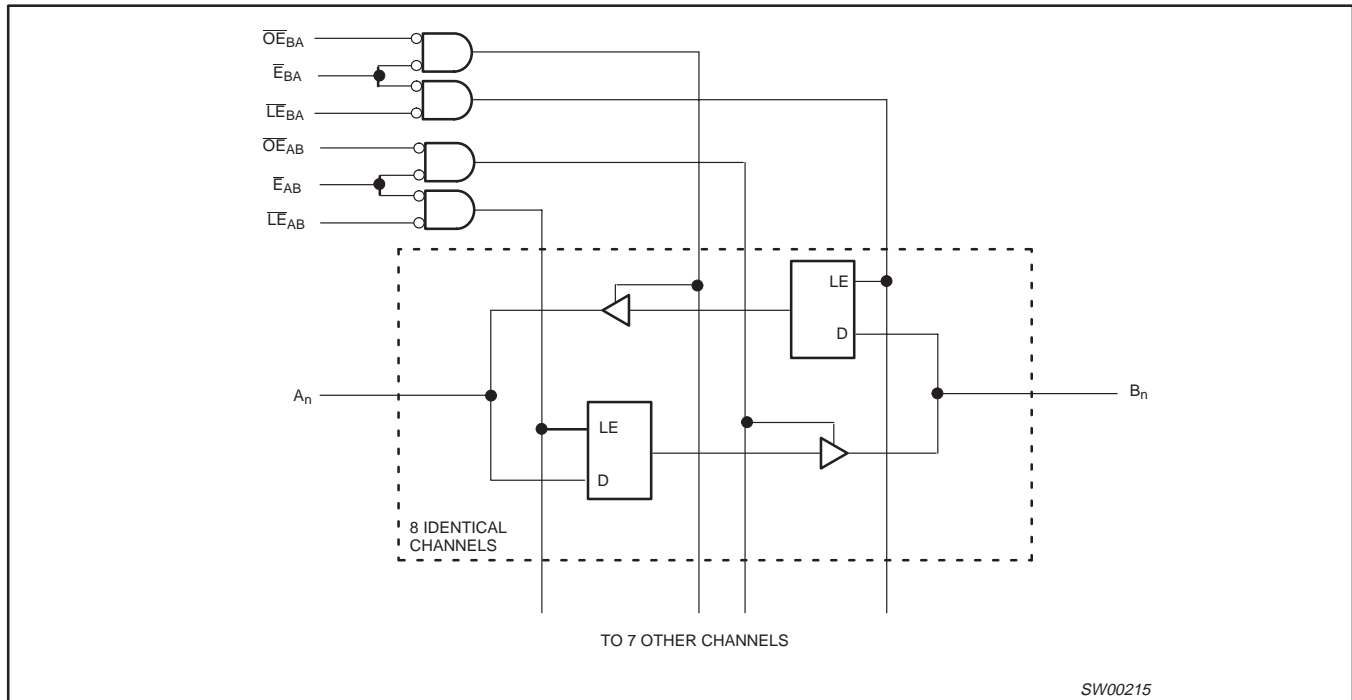
### LOGIC SYMBOL (IEEE/IEC)



# Octal D-type registered transceiver (3-State)

74LVC543A

## LOGIC DIAGRAM



## FUNCTION TABLE

OPERATING MODES	INPUTS				OUTPUTS
	$\overline{OE}_{XX}$	$\overline{E}_{XX}$	$\overline{LE}_{XX}$	DATA	
Disabled	H	X	X	X	Z
Disabled	X	H	X	X	Z
Disabled + Latch	L	↑	L	h	Z
	L	↑	L	l	Z
Latch + Display	L	L	↑	h	H
	L	L	↑	l	L
Transparent	L	L	L	H	H
	L	L	L	L	L
Hold (do nothing)	L	L	H	X	NC

### NOTES:

- XX = AB for A-to-B direction, BA for B-to-A direction
- H = High voltage level
- L = Low voltage level
- h = High state must be present one setup time before the Low-to-High transition of  $\overline{LE}_{AB}$ ,  $\overline{LE}_{BA}$ ,  $\overline{E}_{AB}$ ,  $\overline{E}_{BA}$
- l = Low state must be present one setup time before the Low-to-High transition of  $\overline{LE}_{AB}$ ,  $\overline{LE}_{BA}$ ,  $\overline{E}_{AB}$ ,  $\overline{E}_{BA}$
- X = Don't care
- ↑ = Low-to-High level transition
- NC = No change
- Z = High impedance OFF state

## Octal D-type registered transceiver (3-State)

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## RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	CONDITIONS	LIMITS		UNIT
			MIN	MAX	
$V_{CC}$	DC supply voltage (for max. speed performance)		2.7	3.6	V
$V_{CC}$	DC supply voltage (for low-voltage applications)		1.2	3.6	V
$V_I$	DC Input voltage range		0	5.5	V
$V_{I/O}$	DC Output voltage range; output HIGH or LOW state		0	$V_{CC}$	V
	DC input voltage range; output 3-State		0	5.5	V
$T_{amb}$	Operating ambient temperature range in free-air		-40	+85	°C
$t_r, t_f$	Input rise and fall times	$V_{CC} = 1.2$ to $2.7$ V	0	20	ns/V
		$V_{CC} = 2.7$ to $3.6$ V	0	10	

ABSOLUTE MAXIMUM RATINGS<sup>1</sup>

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 +6.5	V
$I_{IK}$	DC input diode current	$V_I < 0$	-50	mA
$V_I$	DC input voltage	Note 2	-0.5 to +6.5	V
$I_{OK}$	DC output diode current	$V_O > V_{CC}$ or $V_O < 0$	±50	mA
$V_{I/O}$	DC output voltage; output HIGH or LOW state	Note 2	-0.5 to $V_{CC} + 0.5$	V
	DC input voltage; output 3-State	Note 2	-0.5 to 6.5	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 mini-pack (SO) - plastic shrink mini-pack (SSOP and TSSOP)	above +70°C derate linearly with 8 mW/K	500	mW
		above +60°C derate linearly with 5.5 mW/K	500	

## NOTES:

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

## Octal D-type registered transceiver (3-State)

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**DC ELECTRICAL CHARACTERISTICS**

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

SYMBOL	PARAMETER	TEST CONDITIONS	LIMITS			UNIT	
			Temp = -40°C to +85°C				
			MIN	TYP <sup>1</sup>	MAX		
V <sub>IH</sub>	HIGH level Input voltage	V <sub>CC</sub> = 1.2 V	V <sub>CC</sub>			V	
		V <sub>CC</sub> = 2.7 to 3.6 V	2.0				
V <sub>IL</sub>	LOW level Input voltage	V <sub>CC</sub> = 1.2 V			GND	V	
		V <sub>CC</sub> = 2.7 to 3.6 V			0.8		
V <sub>OH</sub>	HIGH level output voltage	V <sub>CC</sub> = 2.7 V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = -12 mA	V <sub>CC</sub> - 0.5			V	
		V <sub>CC</sub> = 3.0 V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = -100 μA	V <sub>CC</sub> - 0.2	V <sub>CC</sub>			
		V <sub>CC</sub> = 3.0 V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = -18 mA	V <sub>CC</sub> - 0.6				
		V <sub>CC</sub> = 3.0 V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = -24 mA	V <sub>CC</sub> - 0.8				
V <sub>OL</sub>	LOW level output voltage	V <sub>CC</sub> = 2.7 V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = 12 mA			0.40	V	
		V <sub>CC</sub> = 3.0 V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = 100 μA		GND	0.20		
		V <sub>CC</sub> = 3.0 V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = 24 mA			0.55		
I <sub>I</sub>	Input leakage current	V <sub>CC</sub> = 3.6 V; V <sub>I</sub> = 5.5 V or GND	Not for I/O pins		±0.1	±5	μA
I <sub>IHZ</sub> /I <sub>ILZ</sub>	Input current for common I/O pins	V <sub>CC</sub> = 3.6 V; V <sub>I</sub> = 5.5 V or GND			±0.1	±15	μA
I <sub>OZ</sub>	3-State output OFF-state current	V <sub>CC</sub> = 3.6 V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; V <sub>O</sub> = 5.5 V or GND			0.1	±10	μA
I <sub>off</sub>	Power off leakage supply	V <sub>CC</sub> = 0.0 V; V <sub>I</sub> or V <sub>O</sub> = 5.5 V			0.1	±10	μA
I <sub>CC</sub>	Quiescent supply current	V <sub>CC</sub> = 3.6 V; V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0			0.1	10	μA
ΔI <sub>CC</sub>	Additional quiescent supply current per input pin	V <sub>CC</sub> = 2.7 V to 3.6 V; V <sub>I</sub> = V <sub>CC</sub> - 0.6 V; I <sub>O</sub> = 0			5	500	μA

**NOTE:**1. All typical values are at V<sub>CC</sub> = 3.3 V and T<sub>amb</sub> = 25°C.**AC CHARACTERISTICS**GND = 0 V; t<sub>r</sub> = t<sub>f</sub> = 2.5 ns; C<sub>L</sub> = 50 pF

SYMBOL	PARAMETER	WAVEFORM	LIMITS						UNIT
			V <sub>CC</sub> = 3.3 V ± 0.3 V			V <sub>CC</sub> = 2.7 V		V <sub>CC</sub> = 1.2 V	
			MIN	TYP <sup>1</sup>	MAX	MIN	MAX	TYP	
t <sub>PHL</sub> t <sub>PLH</sub>	Propagation delay A <sub>n</sub> to B <sub>n</sub> , B <sub>n</sub> to A <sub>n</sub>	1, 5	1.5	3.3	7	1.5	8	13.0	ns
t <sub>PHL</sub> t <sub>PLH</sub>	Propagation delay LE <sub>BA</sub> to A <sub>n</sub> , LE <sub>AB</sub> to B <sub>n</sub>	2, 5	1.5	4.1	8.5	1.5	9.5	16.0	ns
t <sub>PZH</sub> t <sub>PZL</sub>	3-State output enable time OE <sub>BA</sub> to A <sub>n</sub> , OE <sub>AB</sub> to B <sub>n</sub>	3, 5	1.5	4.2	7.7	1.5	9.2	15.0	ns
t <sub>PHZ</sub> t <sub>PLZ</sub>	3-State output disable time OE <sub>BA</sub> to A <sub>n</sub> , OE <sub>AB</sub> to B <sub>n</sub>	3, 5	1.5	3.4	7.0	1.5	7.5	8.0	ns
t <sub>PZH</sub> t <sub>PZL</sub>	3-State output enable time E <sub>BA</sub> to A <sub>n</sub> , E <sub>AB</sub> to B <sub>n</sub>	3, 5	1.5	4.4	8.0	1.5	9.3	15.0	ns
t <sub>PHZ</sub> t <sub>PLZ</sub>	3-State output disable time E <sub>BA</sub> to A <sub>n</sub> , E <sub>AB</sub> to B <sub>n</sub>	3, 5	1.5	3.6	7.0	1.5	7.5	8.0	ns
t <sub>W</sub>	LE <sub>XX</sub> pulse width LOW	2	3.0	0.9	–	3.0	–	4.0	ns
t <sub>su</sub>	Set-up time A <sub>n</sub> /B <sub>n</sub> to LE <sub>XX</sub> , A <sub>n</sub> /B <sub>n</sub> to E <sub>XX</sub>	4	1.5	-0.5	–	1.5	–	-1.5	ns
t <sub>h</sub>	Hold time A <sub>n</sub> /B <sub>n</sub> to LE <sub>XX</sub> , A <sub>n</sub> /B <sub>n</sub> to E <sub>XX</sub>	4	1.5	0.6	–	1.5	–	2.0	ns

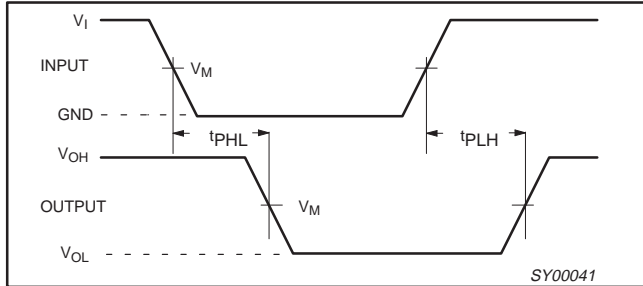
**NOTE:**1. These typical values are at V<sub>CC</sub> = 3.3 V and T<sub>amb</sub> = 25°C.

# Octal D-type registered transceiver (3-State)

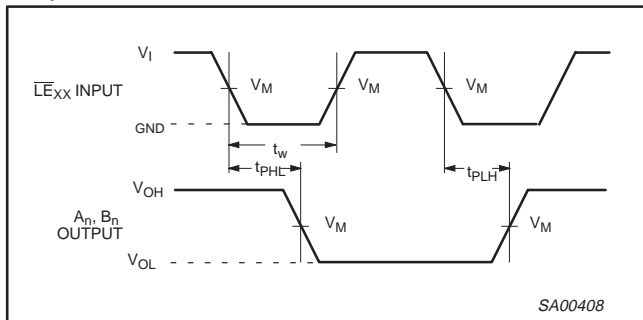
# 74LVC543A

## AC WAVEFORMS

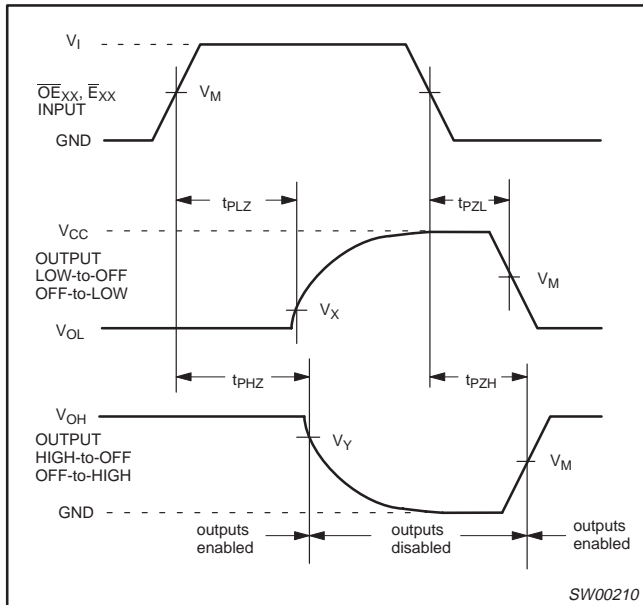
$V_M = 1.5\text{ V}$  at  $V_{CC} \geq 2.7\text{ V}$ ;  $V_M = 0.5 V_{CC}$  at  $V_{CC} < 2.7\text{ V}$ .  
 $V_{OL}$  and  $V_{OH}$  are the typical output voltage drop that occur with the output load.  
 $V_X = V_{OL} + 0.3\text{ V}$  at  $V_{CC} \geq 2.7\text{ V}$ ;  $V_X = V_{OL} + 0.1 V_{CC}$  at  $V_{CC} < 2.7\text{ V}$   
 $V_Y = V_{OH} - 0.3\text{ V}$  at  $V_{CC} \geq 2.7\text{ V}$ ;  $V_Y = V_{OH} - 0.1 V_{CC}$  at  $V_{CC} < 2.7\text{ V}$



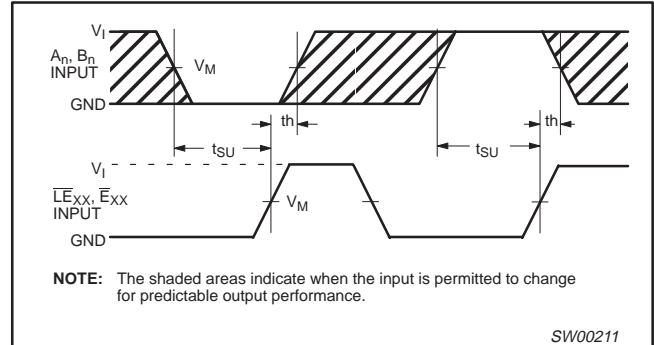
**Waveform 1. Input ( $A_n, B_n$ ) to output ( $B_n, A_n$ ) propagation delays.**



**Waveform 2. Latch enable input ( $\overline{LE}_{XX}$ ) pulse width and the latch enable input to output ( $A_n, B_n$ ) propagation delays.**

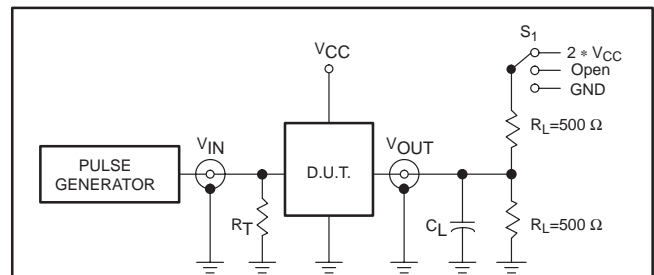


**Waveform 3. 3-State enable and disable times**



**Waveform 4. Data setup and hold times for the ( $A_n, B_n$ ) input to the  $\overline{LE}_{XX}$  and  $\overline{EXX}$  inputs.**

## 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

$V_{CC}$	$V_{IN}$
$< 2.7\text{ V}$	$V_{CC}$
$2.7 - 3.6\text{ V}$	$2.7\text{ V}$

### 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

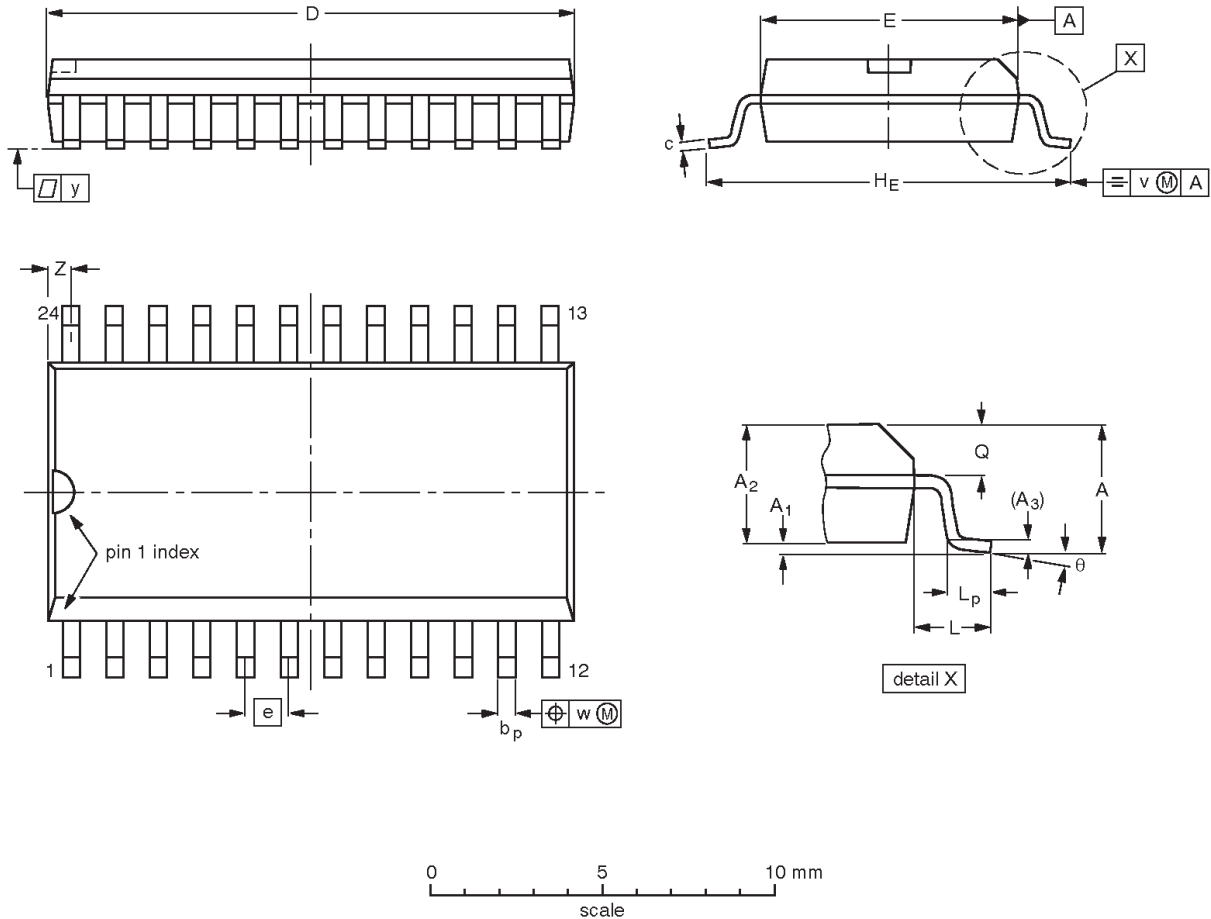
**Waveform 5. Load circuitry for switching times.**

# Octal D-type registered transceiver (3-State)

## 74LVC543A

**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 <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	b <sub>p</sub>	c	D <sup>(1)</sup>	E <sup>(1)</sup>	e	H <sub>E</sub>	L	L <sub>p</sub>	Q	v	w	y	Z <sup>(1)</sup>	$\theta$
mm	2.65	0.30 0.10	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° 0°
inches	0.10	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	0.050	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 maximum per side are not included.

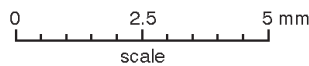
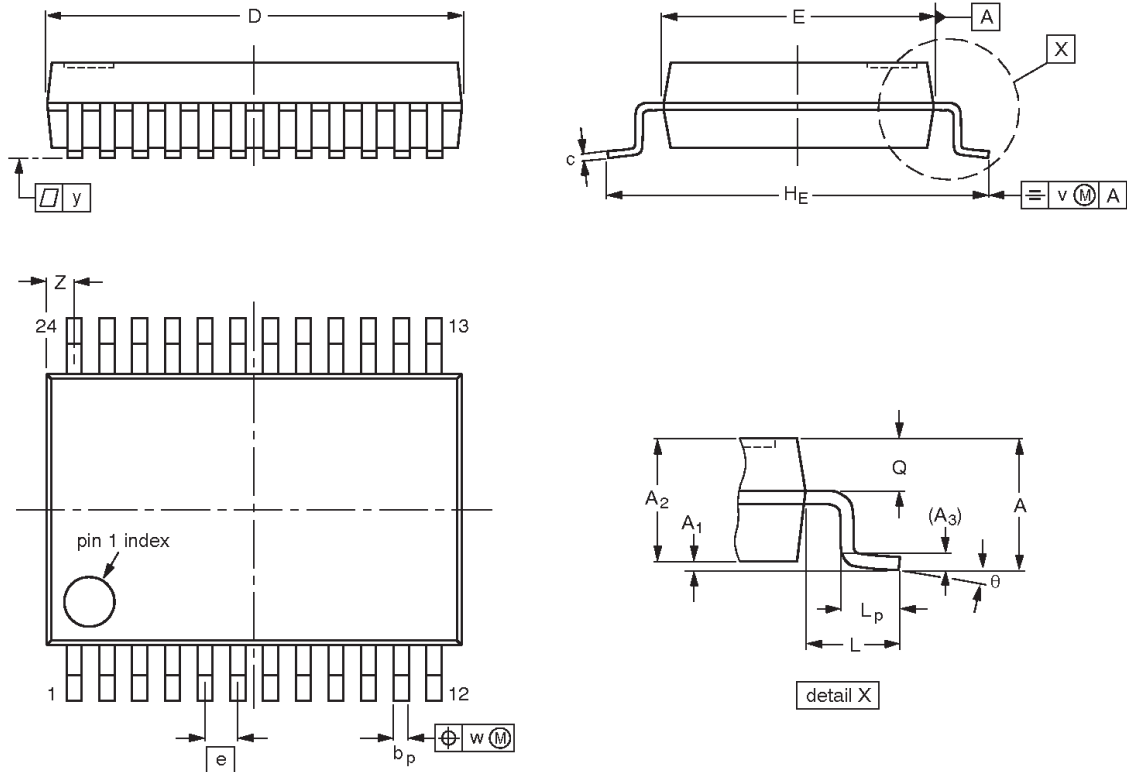
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT137-1	075E05	MS-013				-97-05-22 99-12-27

# Octal D-type registered transceiver (3-State)

## 74LVC543A

**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 <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	b <sub>p</sub>	c	D <sup>(1)</sup>	E <sup>(1)</sup>	e	H <sub>E</sub>	L	L <sub>p</sub>	Q	v	w	y	Z <sup>(1)</sup>	θ
mm	2.0	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° 0°

**Note**

1. Plastic or metal protrusions of 0.20 mm maximum per side are not included.

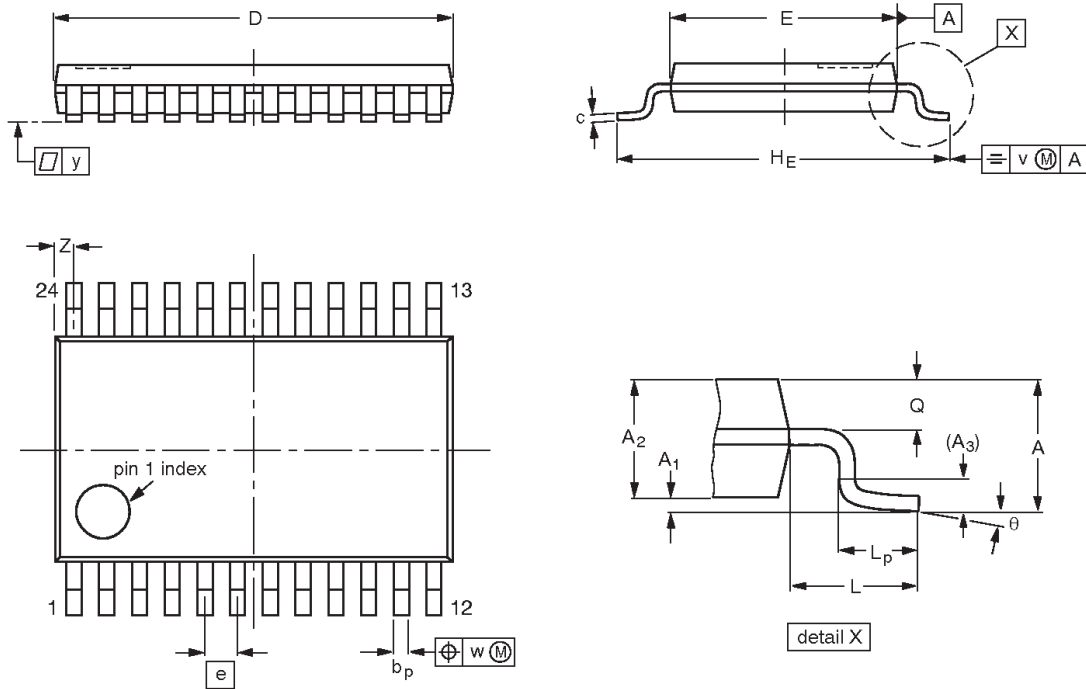
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT340-1		MO-150				95-02-04 99-12-27

Octal D-type registered transceiver (3-State)

74LVC543A

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 <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	b <sub>p</sub>	c	D <sup>(1)</sup>	E <sup>(2)</sup>	e	H <sub>E</sub>	L	L <sub>p</sub>	Q	v	w	y	Z <sup>(1)</sup>	θ
mm	1.10	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	0.75 0.50	0.4 0.3	0.2	0.13	0.1	0.5 0.2	8° 0°

**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			
SOT355-1		MO-153				95-02-04 99-12-27

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Octal D-type registered transceiver (3-State)

74LVC543A

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**NOTES**

## Octal D-type registered transceiver (3-State)

74LVC543A

## Data sheet status

Data sheet status	Product status	Definition [1]
Objective specification	Development	This data sheet contains the design target or goal specifications for product development. Specification may change in any manner without notice.
Preliminary specification	Qualification	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	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.

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

## Definitions

**Short-form specification** — The data in a short-form specification is extracted from a full data sheet with the same type number and title. For detailed information see the relevant data sheet or data handbook.

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