1. General description

The 74LV541A is an 8-bit buffer/line driver with 3-state outputs. The device features two output enables ($\overline{OE1}$ and $\overline{OE2}$). A HIGH on \overline{OEn} causes the associated outputs to assume a high-impedance OFF-state.

Inputs are overvoltage tolerant. This feature allows the use of these devices as translators in mixed voltage environments.

Schmitt-trigger action at all inputs makes the circuit tolerant of slower input rise and fall times.

This device is fully specified for partial power down applications using I_{OFF} . The I_{OFF} circuitry disables the output, preventing the potentially damaging backflow current through the device when it is powered down.

2. Features and benefits

- Wide supply voltage range from 2.0 V to 5.5 V
- Maximum t_{pd} of 6 ns at 5 V
- Typical V_{OL(p)} < 0.8 V at V_{CC} = 3.3 V, T_{amb} = 25 °C
- Typical V_{OH(v)} > 2.3 V at V_{CC} = 3.3 V, T_{amb} = 25 °C
- Supports mixed-mode voltage operation on all ports
- I_{OFF} circuitry provides partial Power-down mode operation
- Latch-up performance exceeds 250 mA per JESD 78 Class II
- ESD protection:
 - HBM ANSI/ESDA/JEDEC JS-001 Class 2 exceeds 3kV
 - MM JESD22-A115-A exceeds 200 V
 - CDM JESD22-C101E exceeds 2kV
- Specified from –40 °C to +85 °C and from –40 °C to +125 °C

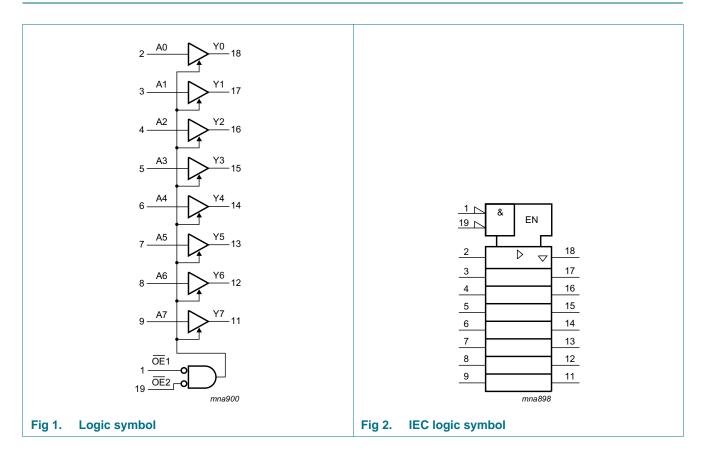
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3. Ordering information

Table 1. Ordering information

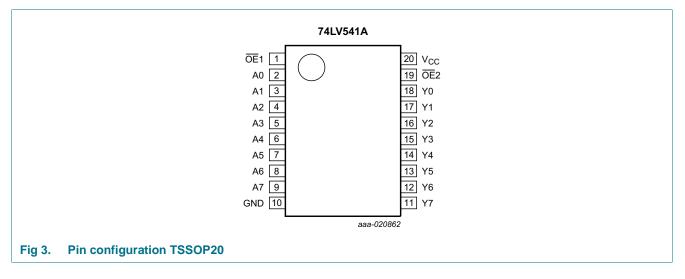
Type number	Package	Package							
	Temperature range	Name	Description	Version					
74LV541APW	–40 °C to +125 °C	TSSOP20	plastic thin shrink small outline package; 20 leads; body width 4.4 mm	SOT360-1					

4. Functional diagram



5. Pinning information

5.1 Pinning



5.2 Pin description

Table 2. Pin description

Symbol	Pin	Description
OE1	1	output enable input (active LOW)
A0 to A7	2, 3, 4, 5, 6, 7, 8, 9	data input
GND	10	ground (0 V)
Y0 to Y7	18, 17, 16, 15, 14, 13, 12, 11	data output
OE2	19	output enable input (active LOW)
V _{CC}	20	supply voltage

6. Functional description

Table 3. Functional table ^[1]								
Control		Input	Output					
OE1	OE2	An	Yn					
L	L	L	L					
L	L	Н	Н					
Х	Н	Х	Z					
Н	Х	Х	Z					

[1] H = HIGH voltage level; L = LOW voltage level; X = don't care; Z = high-impedance OFF-state.

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
VI	input voltage		<u>[1]</u>	-0.5	+7.0	V
Vo	output voltage	active mode	[2][3]	-0.5	V _{CC} + 0.5	V
		power-down or 3-state mode	[2]	-0.5	+7.0	V
I _{IK}	input clamping current	V ₁ < 0 V		-20	-	mA
Ι _{ΟΚ}	output clamping current	V _O < 0 V		-50	-	mA
lo	output current	$V_{O} = 0 V$ to V_{CC}		-	±35	mA
I _{CC}	supply current			-	70	mA
I _{GND}	ground current			-70	-	mA
T _{stg}	storage temperature			-65	+150	°C
P _{tot}	total power dissipation	$T_{amb} = -40 \text{ °C to } +125 \text{ °C}$	<u>[4]</u>	-	500	mW

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

[2] The output voltage ratings may be exceeded if the output current ratings are observed.

[3] This value is limited to 7.0 V maximum.

[4] For TSSOP20 package: above 100 °C the value of P_{tot} derates linearly with 10 mW/K.

Recommended operating conditions 8.

Recommended operating conditions Table 5.

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

Symbol	Parameter	Conditions	Min	Max	Unit
V _{CC}	supply voltage		2.0	5.5	V
VI	input voltage		0	5.5	V
Vo	output voltage	active mode	0	V _{CC}	V
.0		power-down or 3-state mode	0	5.5	V
T _{amb}	ambient temperature		-40	+125	°C
Δt/ΔV	input transition rise and fall rate	$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$	-	200	ns/V
		$V_{CC} = 3.0 \text{ V} \text{ to } 3.6 \text{ V}$	-	100	ns/V
		$V_{CC} = 4.5 V \text{ to } 5.5 V$	-	20	ns/V

Static characteristics 9.

Table 6. **Static characteristics**

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

Symbol	Parameter	Conditions	:	25 °C		–40 °C to	o +85 °C	-40 °C 1 °(Unit
			Min	Тур	Max	Min	Max	Min	Max	
V _{IH}	HIGH-level	$V_{CC} = 2 V$	1.5	-	-	1.5	-	1.5	-	V
	input voltage	V_{CC} = 2.3 V to 2.7 V	0.7V _{CC}	-	-	$0.7V_{CC}$	-	$0.7V_{CC}$	-	V
		$V_{CC} = 3.0 \text{ V} \text{ to } 3.6 \text{ V}$	$0.7V_{CC}$	-	-	$0.7V_{CC}$	-	$0.7V_{CC}$	-	V
		V_{CC} = 4.5 V to 5.5 V	$0.7V_{CC}$	-	-	$0.7V_{CC}$	-	$0.7V_{CC}$	-	V
V _{IL}	LOW-level	$V_{CC} = 2 V$	-	-	0.5	-	0.5	-	0.5	V
	input voltage	V_{CC} = 2.3 V to 2.7 V	-	-	$0.3V_{CC}$	-	$0.3V_{CC}$	-	$0.3V_{CC}$	V
		$V_{CC} = 3.0 \text{ V} \text{ to } 3.6 \text{ V}$	-	-	$0.3V_{CC}$	-	$0.3V_{CC}$	-	$0.3V_{CC}$	V
		V_{CC} = 4.5 V to 5.5 V	-	-	$0.3V_{CC}$	-	$0.3V_{CC}$	-	$0.3V_{CC}$	V
V _{OH}	HIGH-level output voltage	$V_{I} = V_{IH} \text{ or } V_{IL}$								V
		$\label{eq:V_CC} \begin{array}{l} V_{CC} = 2.0 \text{ V to } 5.5 \text{ V;} \\ I_O = -50 \ \mu\text{A} \end{array}$	V _{CC} -0.1	-	-	V _{CC} -0.1	-	V _{CC} -0.1	-	V
		$V_{CC} = 2.3 \text{ V}; \text{ I}_{O} = -2 \text{ mA}$	2	-	-	2	-	2	-	V
		$V_{CC} = 3.0 \text{ V}; \text{ I}_{O} = -8 \text{ mA}$	2.58	-	-	2.48	-	2.48	-	V
		$V_{CC} = 4.5 V;$ $I_{O} = -16 mA$	3.94	-	-	3.8	-	3.8	-	V
V _{OL}	LOW-level	$V_{I} = V_{IH} \text{ or } V_{IL}$								
	output voltage	$\label{eq:V_CC} \begin{array}{l} V_{CC} = 2.0 \text{ V to } 5.5 \text{ V}; \\ I_O = 50 \ \mu\text{A} \end{array}$	-	-	0.1	-	0.1	-	0.1	V
		$V_{CC} = 2.3 \text{ V}; I_{O} = 2 \text{ mA}$	-	-	0.4	-	0.4	-	0.4	V
		$V_{CC} = 3.0 \text{ V}; I_{O} = 8 \text{ mA}$	-	-	0.36	-	0.44	-	0.44	V
		$V_{CC} = 4.5 \text{ V}; I_{O} = 16 \text{ mA}$	-	-	0.44	-	0.55	-	0.55	V
I _{OZ}	OFF-state output current	$\label{eq:V_CC} \begin{array}{l} V_{CC} = 5.5 \ V; \\ V_{I} = V_{IH} \ \text{or} \ V_{IL}; \\ V_{O} = GND \ \text{to} \ 5.5 \ V \end{array}$	-	-	±0.25	-	±2.5	-	±2.5	μΑ

Octal buffer/line driver; 3-state

Table 6.Static characteristics ... continuedVoltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	25 °C		–40 °C to +85 °C		–40 ℃ to +125 ℃		Unit	
			Min	Тур	Max	Min	Max	Min	Max	
I _{OFF}	power-off leakage current	V_1 or V_0 = GND to 5.5 V; V_{CC} = 0 V	-	-	0.5	-	5	-	5	μA
I	input leakage current	$V_I = V_{CC}$ or GND; $V_{CC} = 0 V$ to 5.5 V	-	-	±0.1	-	±1	-	±1	μA
I _{CC}	supply current	$\label{eq:VI} \begin{array}{l} V_{I} = V_{CC} \text{ or } GND; \ I_{O} = 0 \ A; \\ V_{CC} = 5.5 \ V \end{array}$	-	-	2	-	20	-	20	μA

10. Dynamic characteristics

Table 7. Dynamic characteristics

GND = 0 V. For test circuit see <u>Figure 6</u>.

Symbol	Parameter	Conditions			25 °C		_40 °C	to +85 °C	–40 °C t	o +125 °C	Unit
				Min	Typ <mark>[1]</mark>	Max	Min	Max	Min	Мах	-
t _{pd}	propagation	An to Yn; see Figure 4	[2]								
	delay	$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$									
		C _L = 15 pF		-	4.9	11.3	1	13.5	1	13.5	ns
		C _L = 50 pF		-	6.8	15.9	1	18.5	1	18.5	ns
		$V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$									
		C _L = 15 pF		-	3.7	7	1	8.5	1	8.5	ns
		C _L = 50 pF		-	5.2	10.5	1	12	1	12	ns
		$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$									
		C _L = 15 pF		-	2.9	5	1	6	1	6	ns
		C _L = 50 pF		-	4.1	7	1	8	1	8	ns
t _{en}	enable time	OEn to Yn; see Figure 5	[2]								
		$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$									
		C _L = 15 pF		-	6.1	16.6	1	19.5	1	19.5	ns
		C _L = 50 pF		-	8.1	20.7	1	24	1	24	ns
		$V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$									
		C _L = 15 pF		-	4.5	10.5	1	12.5	1	12.5	ns
		C _L = 50 pF		-	6.2	14	1	16	1	16	ns
		$V_{CC} = 4.5 \text{ V} \text{ to } 5.5 \text{ V}$									
		C _L = 15 pF		-	3.4	7.2	1	8.5	1	8.5	ns
		C _L = 50 pF		-	4.7	9.2	1	10.5	1	10.5	ns

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Octal buffer/line driver; 3-state

Symbol	Parameter	Conditions		25 °C		–40 °C	to +85 °C	-40 °C t	to +125 °C	Unit
			Min	Typ[1]	Max	Min	Мах	Min	Max	
t _{dis}	disable time	OEn to Yn; see Figure 5								
		V_{CC} = 2.3 V to 2.7 V								
		C _L = 15 pF	-	6.5	13.1	1	15	1	15	ns
		C _L = 50 pF	-	11.0	17.9	1	20	1	20	ns
		$V_{CC} = 3.0 \text{ V} \text{ to } 3.6 \text{ V}$								
		C _L = 15 pF	-	5.2	11	1	12	1	12	ns
		C _L = 50 pF	-	8.5	15.4	1	17.5	1	17.5	ns
		$V_{CC} = 4.5 \text{ V} \text{ to } 5.5 \text{ V}$								
		C _L = 15 pF	-	4.2	7.5	1	8	1	8	ns
		C _L = 50 pF	-	6.3	8.8	1	10	1	10	ns
t _{sk(o)}	skew	C _L = 50 pF								
		V_{CC} = 2.3 V to 2.7 V	-	-	2	-	2	-	2	ns
		$V_{CC} = 3.0 \text{ V} \text{ to } 3.6 \text{ V}$	-	-	1.5	-	1.5	-	1.5	ns
		$V_{CC} = 4.5 \text{ V} \text{ to } 5.5 \text{ V}$	-	-	1	-	1	-	1	ns
CI	input capacitance	$V_1 = V_{CC} \text{ or GND};$ $V_{CC} = 3.3 \text{ V}$	-	2	6	-	6	-	6	pF
Co	output capacitance	$V_{O} = V_{CC}$ or GND; $V_{CC} = 3.3 \text{ V}$	-	5	-	-	-	-	-	pF
C _{PD}	power dissipation capacitance	per buffer; [3] $C_L = 50 \text{ pF}; f = 10 \text{ MHz};$ $V_I = \text{GND to } V_{\text{CC}}$								
		V _{CC} = 3.3 V	-	9	-	-	-	-	-	pF
		V _{CC} = 5.0 V	-	11	-	-	-	-	-	pF

Table 7.Dynamic characteristics ... continuedGND = 0 V. For test circuit see Figure 6.

[1] Typical values are measured at T_{amb} = 25 °C and V_{CC} = 2.5 V, 3.3 V, and 5 V respectively, unless otherwise specified.

[3] C_{PD} is used to determine the dynamic power dissipation P_D (μ W).

 $P_{D} = C_{PD} \times V_{CC}^{2} \times f_{i} + \sum (C_{L} \times V_{CC}^{2} \times f_{o}) \text{ where:}$

 f_i = input frequency in MHz; f_o = output frequency in MHz;

 C_L = output load capacitance in pF;

 V_{CC} = supply voltage in Volts.

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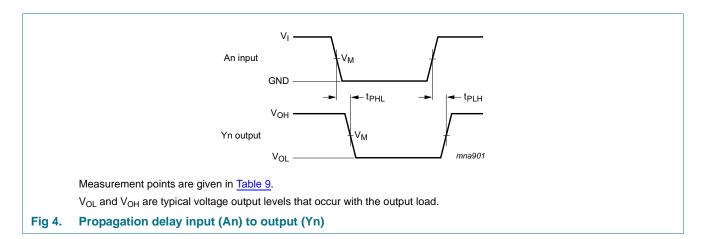
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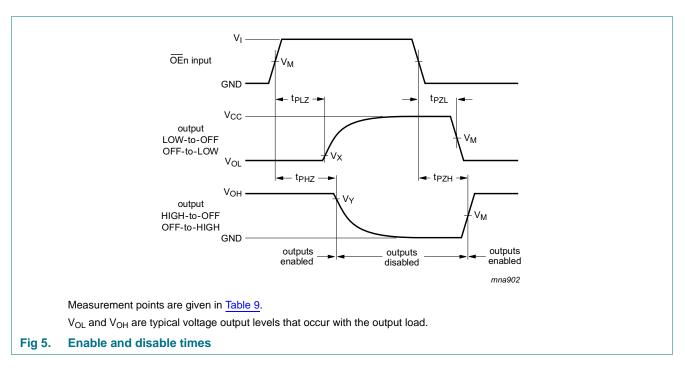
Table 8.Noise characteristics

GND = 0 V. For test circuit see Figure 6.

Symbol	Parameter	Conditions	T	T _{amb} = 25 °C			
			Min	Тур	Max		
V _{CC} = 3.3	V; C _L = 50 pF				-	_	
V _{OL(p)}	LOW-level output voltage (peak)		-	0.3	0.8	V	
V _{OL(v)}	LOW-level output voltage (valley)		-0.8	-0.2	-	V	
V _{OH(v)}	HIGH-level output voltage (valley)		-	2.9	-	V	
V _{IH(AC)}	AC HIGH-level input voltage		2.31	-	-	V	
V _{IL(AC)}	AC LOW-level input voltage		-	-	0.99	V	

11. Waveforms





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Table 9.

Input

Measurement points

Output

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Octal buffer/line driver; 3-state

V _M		V _M	V _X	V _Y
$0.5V_{CC}$		0.5V _{CC}	V _{OL} + 0.3 V	V _{OH} – 0.3 V
			1	
		$\begin{array}{c c} V_{I} & 90 \% \\ \hline negative \\ pulse \\ 0 V \\ \hline V_{I} \hline V_{I} \\ \hline V_{I} \\ \hline V_{I} \\ \hline V_{I} \hline V_{I} \\ \hline V_{I} \\ \hline V_{I} \\ \hline V_{I} \hline V_{I} \\ \hline V_{I} \hline V_{I} \hline V_{I} \hline V_{I} \\ \hline V_{I} \hline$		
			VO RL S1 open OU1aad983	
	Test data is given in Tabl	e 10.		
	Definitions test circuit:			
		nce should be equal to output imp		
		ncluding jig and probe capacitance)	
	R_L = Load resistor	F		
_	S1 = Test selection switc			
Fig 6.	Test circuit for meas	uring switching times		

Table 10. Test data

Input		Load		S1 position			
VI	t _r , t _f	CL	RL	t _{PHL} , t _{PLH}	t _{PZH} , t _{PHZ}	t _{PZL} , t _{PLZ}	
GND to V_{CC}	3.0 ns	15 pF, 50 pF	1 kΩ	open	GND	V _{CC}	

Octal buffer/line driver; 3-state

12. Package outline

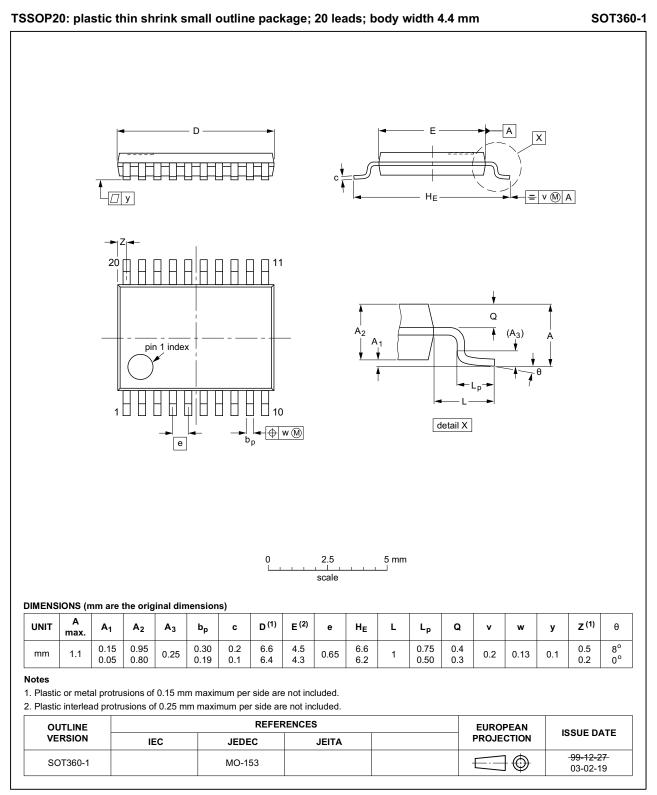


Fig 7. Package outline SOT360-1 (TSSOP20)

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13. Abbreviations

Table 11. Abbreviations		
Acronym	Description	
CDM	Charge Device Model	
DUT	Device Under Test	
ESD	ElectroStatic Discharge	
HBM	Human Body Model	
MM	Machine Model	

14. Revision history

Table 12.Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74LV541A v.2	20161101	Product data sheet	-	74LV541A v.1
Modifications:	• Type number	74LV541ABQ removed.		
74LV541A v.1	20151223	Product data sheet	-	-

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.

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