

1. General Description

The 74HC541 and 74HCT541 are octal non-inverting buffer/line drivers with 3-state outputs. The device features two output enables ($\overline{OE}1$ and $\overline{OE}2$). A HIGH on $\overline{OE}n$ causes the outputs to assume a high-impedance OFF-state. Inputs include clamp diodes that enable the use of current limiting resistors to interface inputs to voltages in excess of V_{CC} .

2. Features and Benefits

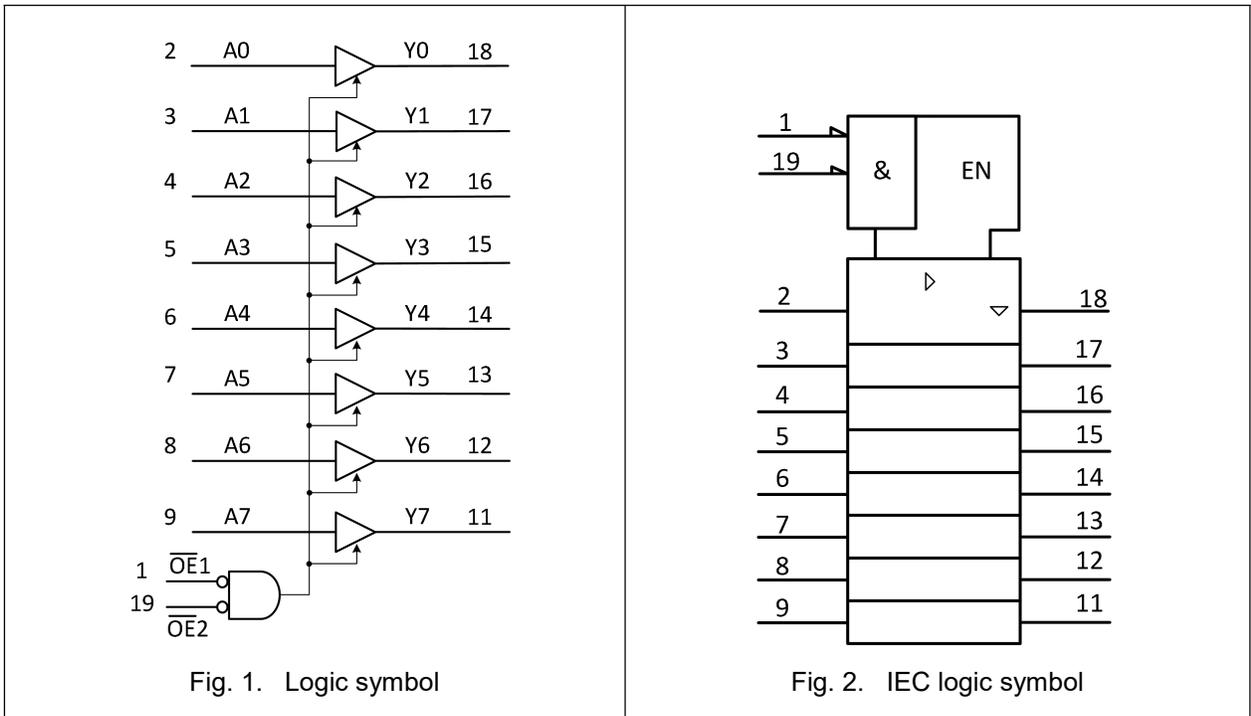
- Wide supply voltage range from 2.0 V to 6.0 V
- High noise immunity
- CMOS low power dissipation
- Latch-up performance exceeds 250 mA
- Complies with JEDEC standards:
 - JESD8C (2.7 V to 3.6 V)
 - JESD7A (2.0 V to 6.0 V)
- Input levels:
 - For 74HC541: CMOS level
 - For 74HCT541: TTL level
- ESD protection:
 - HBM ANSI/ESDA/JEDEC JS-001 Class 3A exceeds 6000 V
 - CDM ANSI/ESDA/JEDEC JS-002 Class C3 exceeds 2000 V
- Multiple package options

3. Ordering Information

Table 1. Ordering information

Type number	Package		Quantity
	Name	Description	
74HC541D	SOP-20L	plastic small outline package; 20 leads; body width 7.5 mm	2000
74HCT541D			
74HC541PW	TSSOP-20L	plastic thin shrink small outline package; 20 leads; body width 4.4 mm	2500
74HCT541PW			

4. Function Diagram



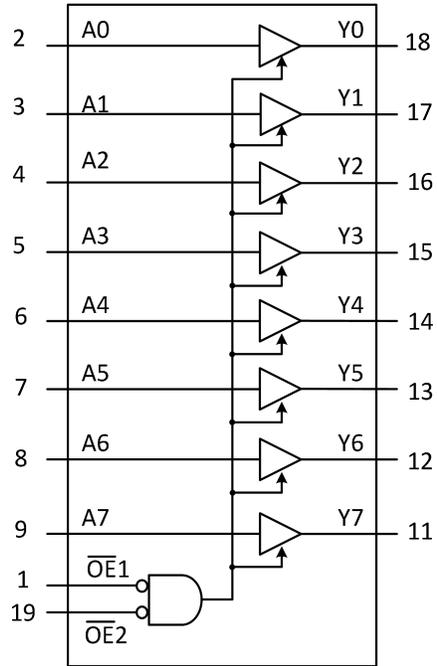


Fig. 3. Functional diagram

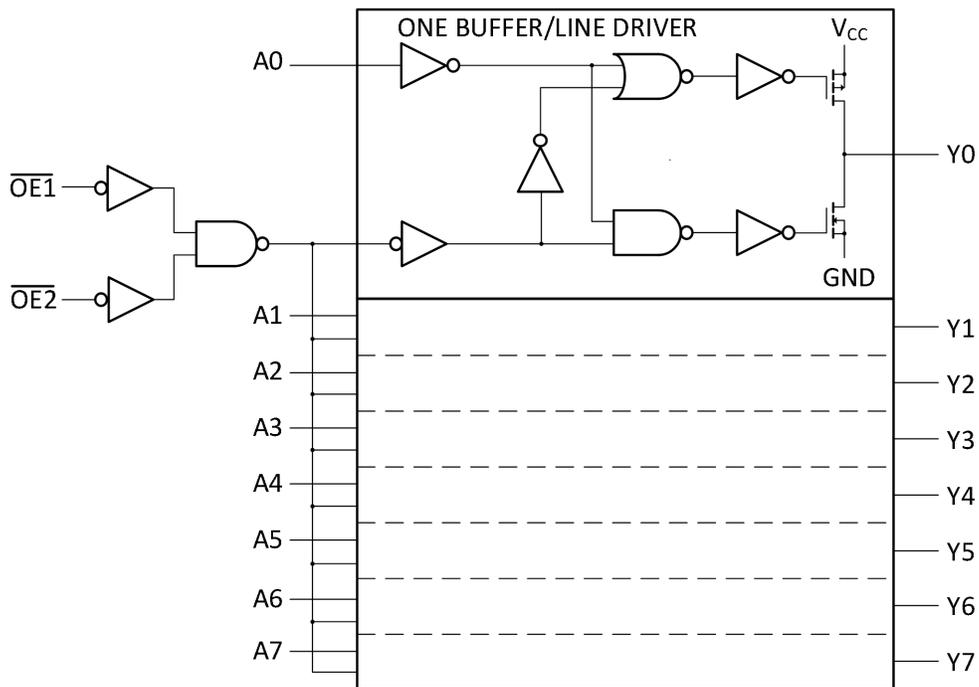
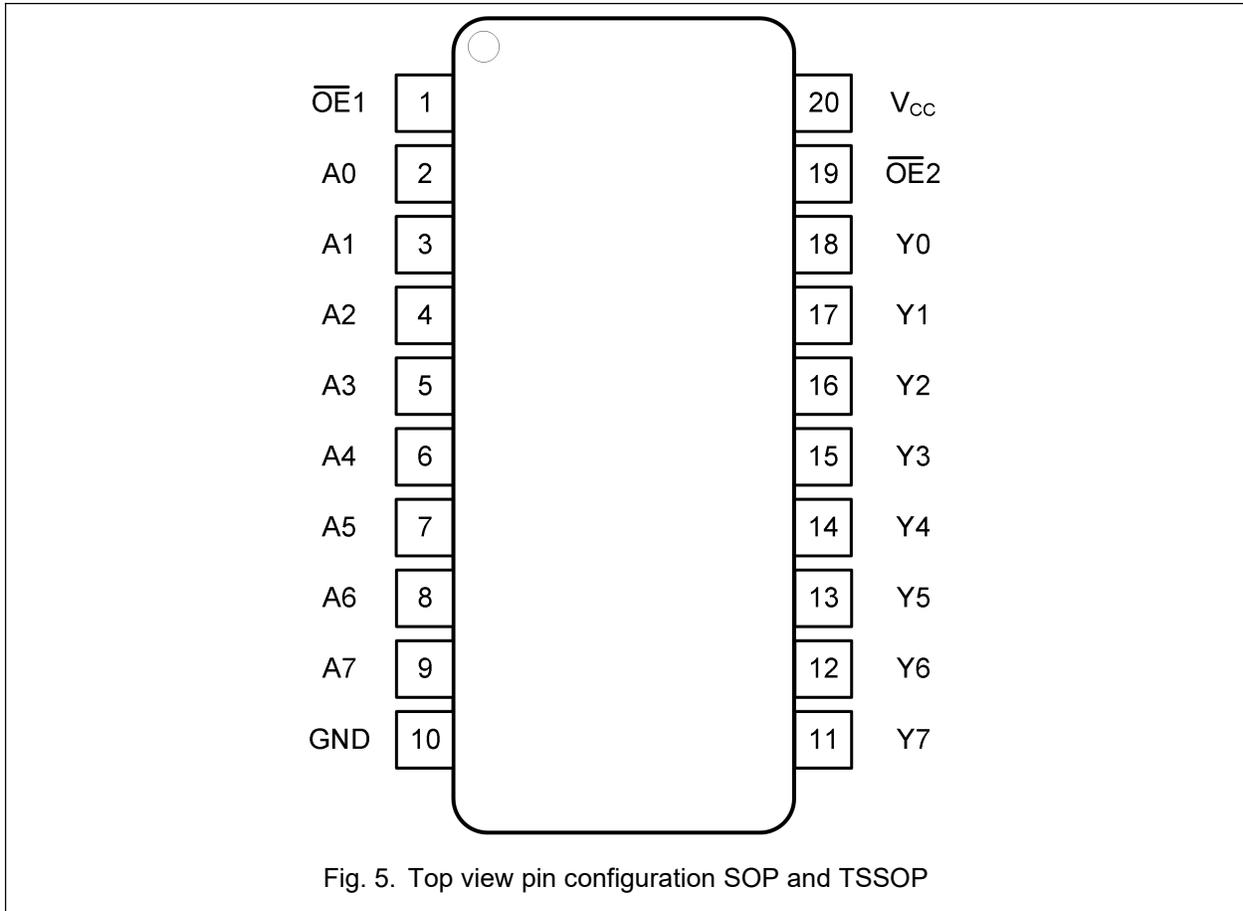


Fig. 4. Logic diagram

5. Pinning Information

5.1. Pinning



5.2. Pin description

Table 2. Pin description

Symbol	Pin	Description
$\overline{OE}1$	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
$\overline{OE}2$	19	Output enable input (active LOW)
V_{CC}	20	Supply voltage

6. Functional Description

Table 3. Function table

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

Control		Input		Output
$\overline{OE}1$	$\overline{OE}2$	An		Yn
L	L	L		L
L	L	H		H
X	H	X		Z
H	X	X		Z

7. Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

Table 4. Absolute Maximum Ratings

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

Symbol	Parameter	Conditions	Min	Max	Unit
V_{CC}	supply voltage		-0.5	7.0	V
I_{IK}	input clamping current	$V_I < -0.5\text{ V}$ or $V_I > V_{CC} + 0.5\text{ V}$ [1]		± 20	mA
I_{OK}	output clamping current	$V_O < -0.5\text{ V}$ or $V_O > V_{CC} + 0.5\text{ V}$ [1]		± 20	mA
I_O	output current	$V_O = -0.5\text{ V}$ to $(V_{CC} + 0.5\text{ V})$		± 25	mA
I_{CC}	supply current			50	mA
I_{GND}	ground current		-50		mA
P_{tot}	total power dissipation			500	mW
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.

8. Recommended Operating Conditions

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications. EnergyMath does not recommend exceeding them or designing to Absolute Maximum Ratings.

Table 5. Recommended Operating Conditions

Symbol	Parameter	Conditions	74HC541			74HCT541			Unit
			Min	Typ	Max	Min	Typ	Max	
V _{CC}	supply voltage		2.0	5.0	6.0	4.5	5.0	5.5	V
V _I	input voltage		0		V _{CC}	0		V _{CC}	V
V _O	output voltage		0		V _{CC}	0		V _{CC}	V
T _{amb}	ambient temperature		-40		125	-40		125	°C
Δt/ΔV	input transition rise and fall rate	V _{CC} = 2.0 V			625				ns/V
		V _{CC} = 4.5 V		1.67	139		1.67	139	ns/V
		V _{CC} = 6.0 V			83				ns/V

9. Static Characteristics

Table 6. Static characteristics

At recommended operating conditions. Voltages are referenced to GND (ground = 0 V). Typical values measured at $T_{amb} = 25^{\circ}\text{C}$ (unless otherwise noted).

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	
74HC541								
V_{IH}	HIGH-level input voltage	$V_{CC} = 2.0\text{ V}$	1.5			1.5		V
		$V_{CC} = 4.5\text{ V}$	3.15			3.15		V
		$V_{CC} = 6.0\text{ V}$	4.2			4.2		V
V_{IL}	LOW-level input voltage	$V_{CC} = 2.0\text{ V}$			0.5		0.5	V
		$V_{CC} = 4.5\text{ V}$			1.35		1.35	V
		$V_{CC} = 6.0\text{ V}$			1.8		1.8	V
V_{OH}	HIGH-level output voltage	$V_I = V_{IH}$ or V_{IL}						
		$I_O = -20\text{ }\mu\text{A}$; $V_{CC} = 2.0\text{ V}$	1.9			1.9		V
		$I_O = -20\text{ }\mu\text{A}$; $V_{CC} = 4.5\text{ V}$	4.4			4.4		V
		$I_O = -20\text{ }\mu\text{A}$; $V_{CC} = 6.0\text{ V}$	5.9			5.9		V
		$I_O = -6.0\text{ mA}$; $V_{CC} = 4.5\text{ V}$	3.84			3.7		V
		$I_O = -7.8\text{ mA}$; $V_{CC} = 6.0\text{ V}$	5.34			5.2		V
V_{OL}	LOW-level output voltage	$V_I = V_{IH}$ or V_{IL}						
		$I_O = 20\text{ }\mu\text{A}$; $V_{CC} = 2.0\text{ V}$			0.1		0.1	V
		$I_O = 20\text{ }\mu\text{A}$; $V_{CC} = 4.5\text{ V}$			0.1		0.1	V
		$I_O = 20\text{ }\mu\text{A}$; $V_{CC} = 6.0\text{ V}$			0.1		0.1	V
		$I_O = 6.0\text{ mA}$; $V_{CC} = 4.5\text{ V}$			0.33		0.4	V
		$I_O = 7.8\text{ mA}$; $V_{CC} = 6.0\text{ V}$			0.33		0.4	V
I_I	input leakage current	$V_I = V_{CC}$ or GND ; $V_{CC} = 6.0\text{ V}$			± 1		± 1	μA
I_{OZ}	OFF-state output current	$V_I = V_{IH}$ or V_{IL} ; $V_{CC} = 6.0\text{ V}$; $V_O = V_{CC}$ or GND			± 5		± 10	μA
I_{CC}	supply current	$V_I = V_{CC}$ or GND ; $I_O = 0\text{ A}$; $V_{CC} = 6.0\text{ V}$			20		40	μA
C_i	input capacitance	$\overline{\text{OE}}1, \overline{\text{OE}}2$ input		4.0				pF
		An input		7.7				pF

74HC541; 74HCT541

Octal buffer/line driver; 3-state

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	
74HCT541								
V_{IH}	HIGH-level input voltage	$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$	2.1			2.1		V
V_{IL}	LOW-level input voltage	$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$			0.8		0.8	V
V_{OH}	HIGH-level output voltage	$V_I = V_{IH} \text{ or } V_{IL}; V_{CC} = 4.5 \text{ V}$						
		$I_O = -20 \mu\text{A};$	4.4			4.4		V
		$I_O = -6.0 \text{ mA};$	3.84			3.7		V
V_{OL}	LOW-level output voltage	$V_I = V_{IH} \text{ or } V_{IL}; V_{CC} = 4.5 \text{ V}$						
		$I_O = 20 \mu\text{A};$			0.1		0.1	V
		$I_O = 6.0 \text{ mA};$			0.33		0.4	V
I_I	input leakage current	$V_I = V_{CC} \text{ or } \text{GND}; V_{CC} = 5.5 \text{ V}$			± 1		± 1	μA
I_{OZ}	OFF-state output current	$V_I = V_{IH} \text{ or } V_{IL}; V_{CC} = 5.5 \text{ V}; V_O = V_{CC} \text{ or } \text{GND}$			± 5		± 10	μA
I_{CC}	supply current	$V_I = V_{CC} \text{ or } \text{GND}; I_O = 0 \text{ A}; V_{CC} = 5.5 \text{ V}$			20		40	μA
ΔI_{CC}	additional supply current	per pin ; $V_I = V_{CC} - 2.1 \text{ V}; I_O = 0 \text{ A};$ other inputs at V_{CC} or $\text{GND}; V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$			315		343	mA
C_I	input capacitance	$\overline{OE}1, \overline{OE}2$ input		4.0				pF
		An input		7.7				pF

10. Dynamic Characteristics

Table 7. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V); for test circuit see Fig. 8. Typical values measured at $T_{amb} = 25^{\circ}\text{C}$ (unless otherwise noted).

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	
74HC541								
t_{pd}	propagation delay	An to Yn; see Fig. 6 [1]						
		$V_{CC} = 2.0\text{ V}$			35		40	ns
		$V_{CC} = 4.5\text{ V}$			20		25	ns
		$V_{CC} = 6.0\text{ V}$			15		20	ns
t_{en}	enable time	\overline{OEn} to Yn; see Fig. 7 [2]						
		$V_{CC} = 2.0\text{ V}$			35		40	ns
		$V_{CC} = 4.5\text{ V}$			20		25	ns
		$V_{CC} = 6.0\text{ V}$			15		20	ns
t_{dis}	disable time	\overline{OEn} to Yn; see Fig. 7 [3]						
		$V_{CC} = 2.0\text{ V}$			35		40	ns
		$V_{CC} = 4.5\text{ V}$			20		25	ns
		$V_{CC} = 6.0\text{ V}$			15		20	ns
t_t	transition time	see Fig. 6 [4]						
		$V_{CC} = 2.0\text{ V}$			9		11	ns
		$V_{CC} = 4.5\text{ V}$			6		8	ns
		$V_{CC} = 6.0\text{ V}$			4		5	ns
C_{PD}	power dissipation capacitance	$f = 1\text{ MHz}$; $V_I = \text{GND to } V_{CC}$ [5]		18				pF

74HC541; 74HCT541

Octal buffer/line driver; 3-state

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	
74HCT541								
t_{pd}	propagation delay	An to Yn; $V_{CC} = 4.5 \text{ V}$; see Fig. 6 [1]			20		25	ns
t_{en}	enable time	\overline{OEn} to Yn; $V_{CC} = 4.5 \text{ V}$; see Fig. 7 [2]			20		25	ns
t_{dis}	disable time	\overline{OEn} to Yn; $V_{CC} = 4.5 \text{ V}$; see Fig. 7 [3]			20		25	ns
t_t	transition time	$V_{CC} = 4.5 \text{ V}$; see Fig. 6 [4]			6		8	ns
C_{PD}	power dissipation capacitance	$f = 1 \text{ MHz}$; $V_i = \text{GND to } (V_{CC} - 1.5 \text{ V})$ [5]		18				pF

[1] t_{pd} is the same as t_{PHL} and t_{PLH} .

[2] t_{en} is the same as t_{PZH} and t_{PZL} .

[3] t_{dis} is the same as t_{PLZ} and t_{PHZ} .

[4] t_t is the same as t_{THL} and t_{TLH} .

[5] C_{PD} is used to determine the dynamic power dissipation (P_D in μW).

$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \Sigma(C_L \times V_{CC}^2 \times f_o)$ where:

f_i = input frequency in MHz;

f_o = output frequency in MHz;

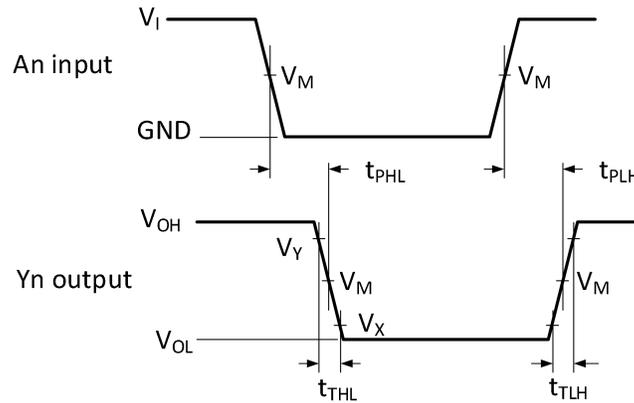
C_L = output load capacitance in pF;

V_{CC} = supply voltage in V;

N = number of inputs switching;

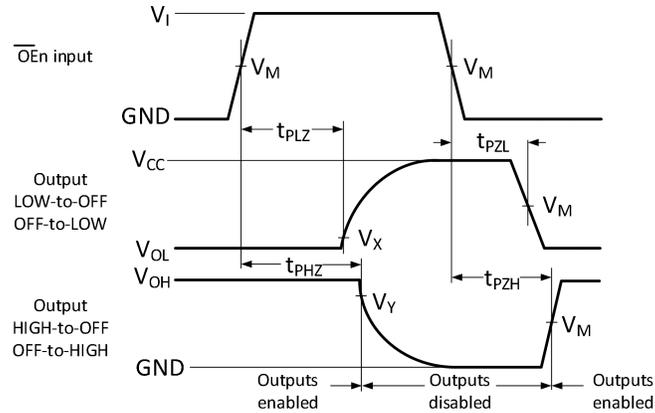
$\Sigma(C_L \times V_{CC}^2 \times f_o)$ = sum of outputs.

10.1. Waveforms and test circuit



Measurement points are given in Table 8.
 V_{OL} and V_{OH} are typical output voltage levels that occur with the output load.

Fig. 6. Input to output propagation delays

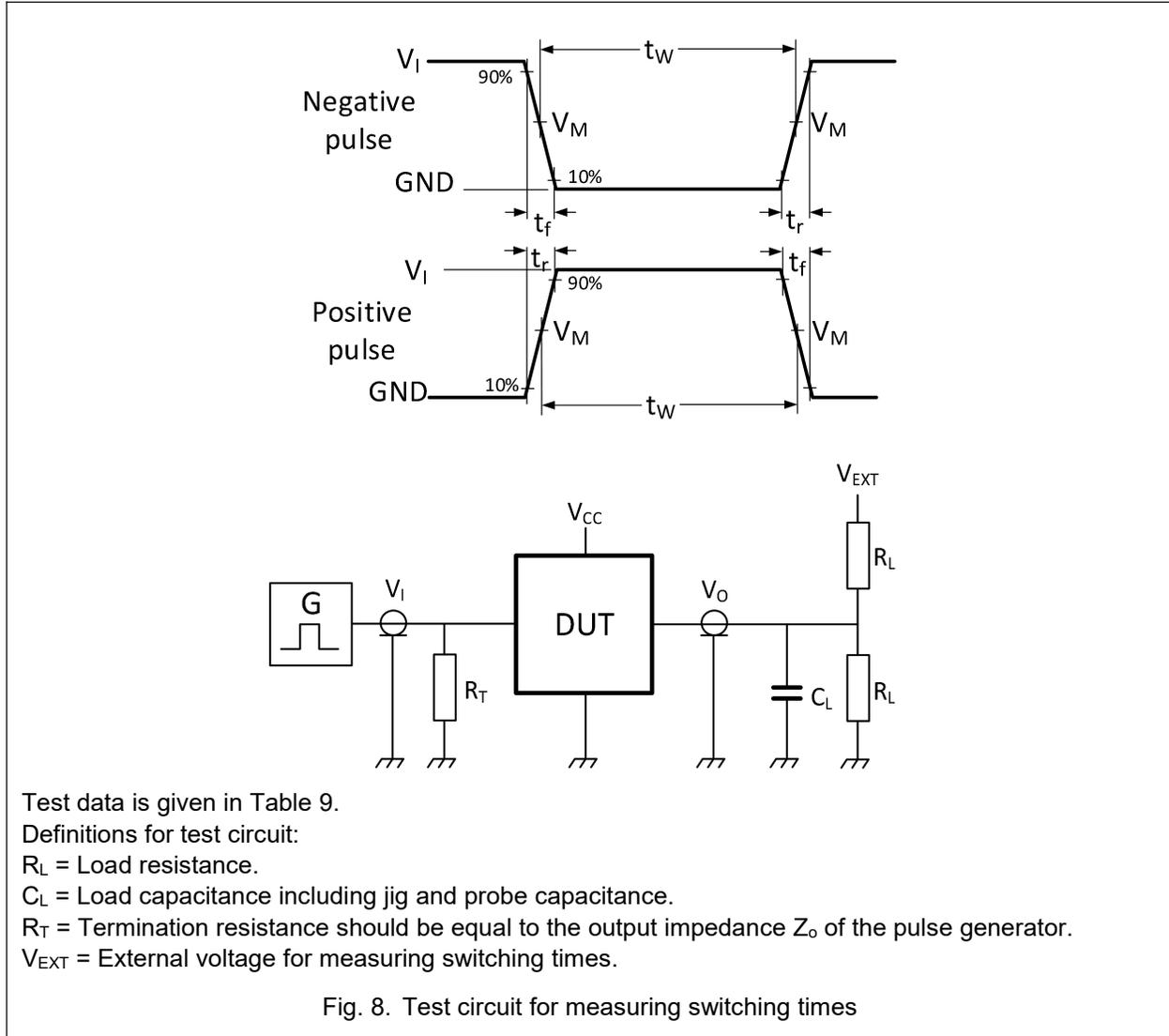


Measurement points are given in Table 8.
 V_{OL} and V_{OH} are typical output voltage levels that occur with the output load.

Fig. 7. 3-state enable and disable times

Table 8. Measurement points

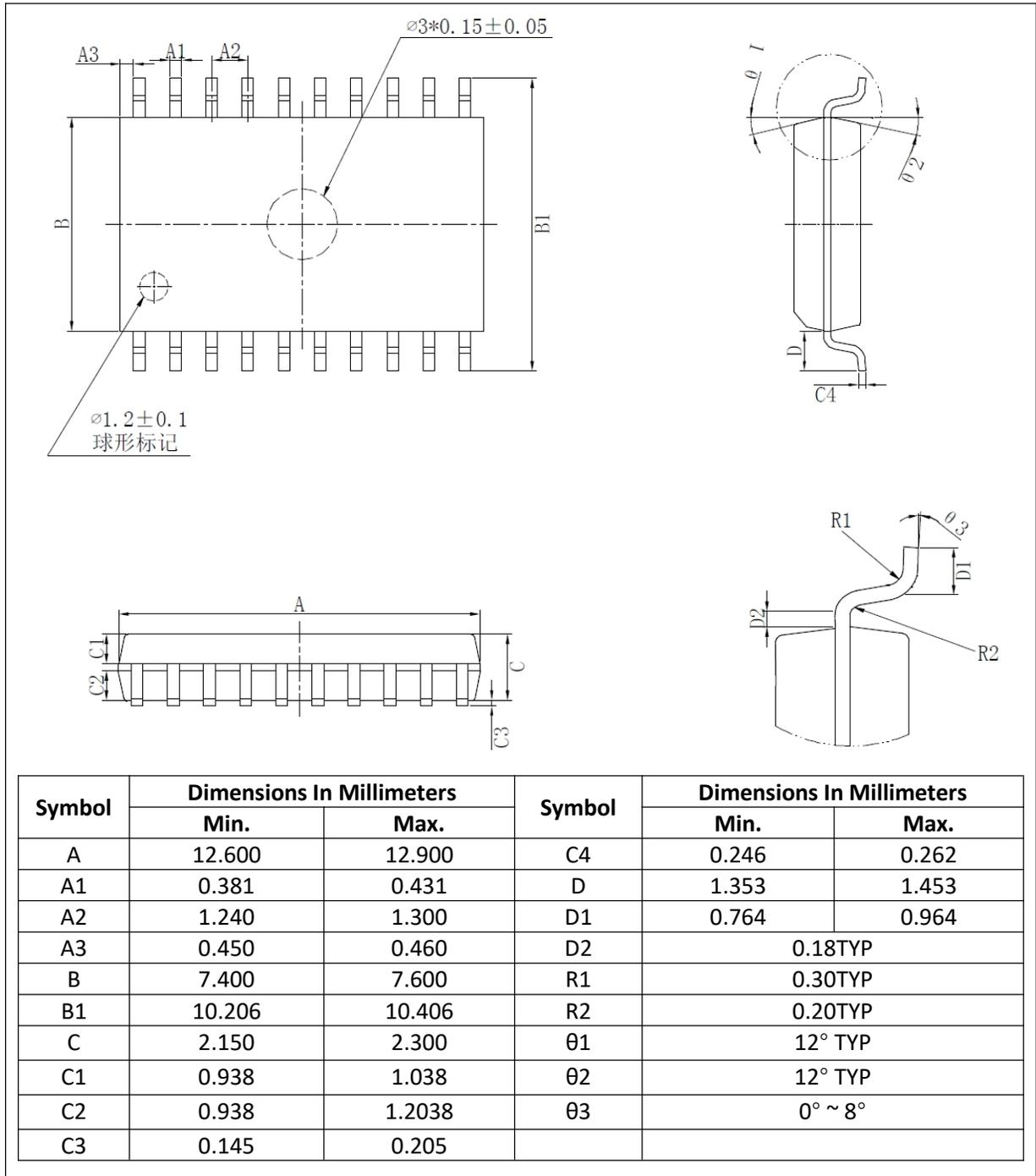
Type	Input	Output		
	V_M	V_M	V_X	V_Y
74HC541	$0.5V_{CC}$	$0.5V_{CC}$	$0.1V_{CC}$	$0.9V_{CC}$
74HCT541	1.3 V	1.3 V	$0.1V_{CC}$	$0.9V_{CC}$


Table 9. Test data

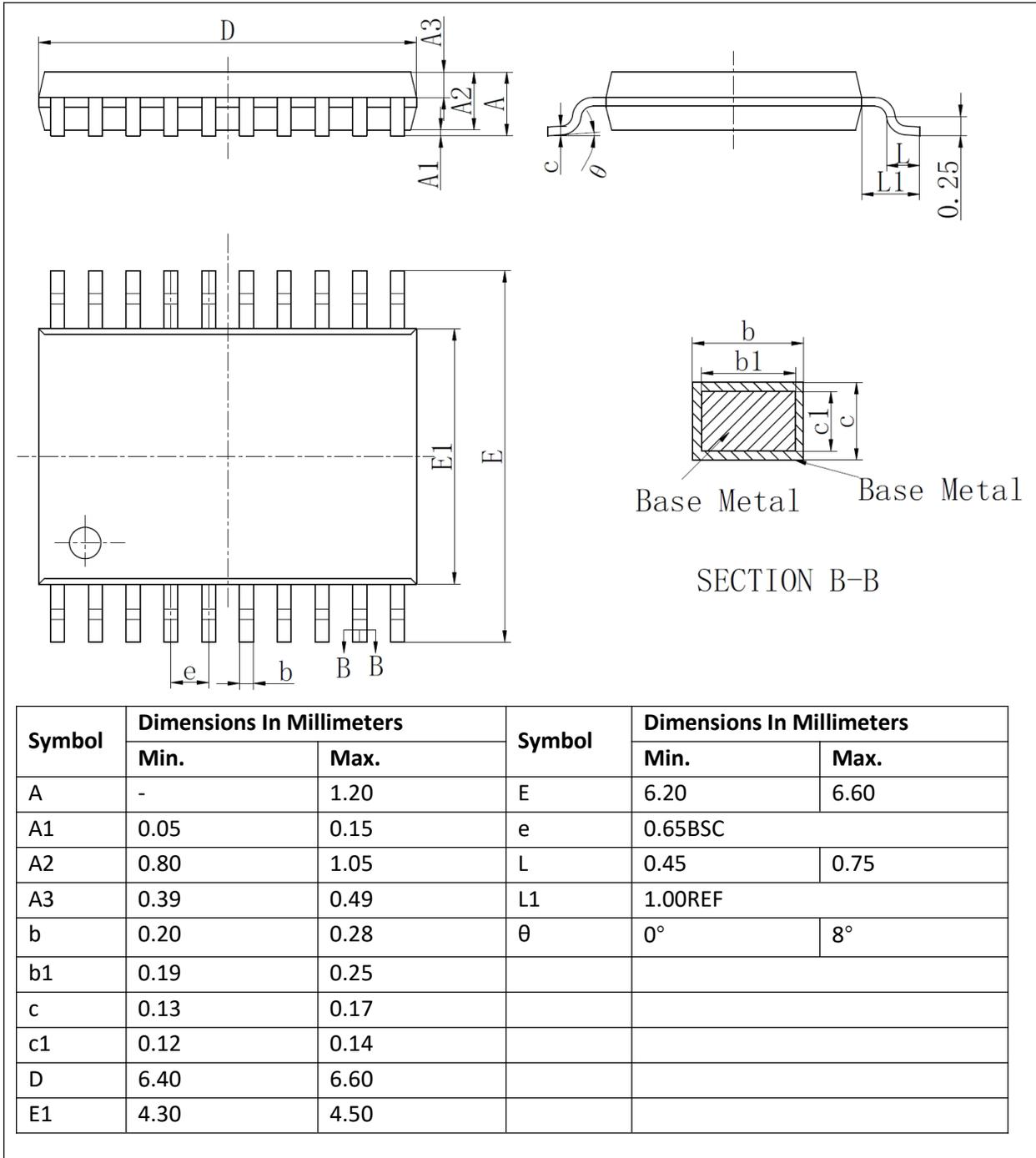
Type	Input		Load		V_{EXT}		
	V_I	$t_r = t_f$	C_L	R_L	t_{PLH}, t_{PHL}	t_{PZH}, t_{PHZ}	t_{PZL}, t_{PLZ}
74HC541	V_{CC}	≤ 2.5 ns	50 pF	500 Ω	open	GND	$2V_{CC}$
74HCT541	3 V	≤ 2.5 ns	50 pF	500 Ω	open	GND	$2V_{CC}$

11. Package Outline

SOP-20L



TSSOP-20L



12. Abbreviations

Table 10. Abbreviations

Acronym	Description
CMOS	Complementary Metal-Oxide Semiconductor
DUT	Device Under Test
ESD	ElectroStatic Discharge
HBM	Human Body Model
CDM	Charged Device Model
TTL	Transistor-Transistor Logic

13. Revision History

Table 11. Revision history

Document ID	Release Date	Data sheet status	Change notice	Supersedes
74HC_HCT541 Rev. 1.0	Aug 08, 2024	Product datasheet		