

74HC7540; 74HCT7540

Octal Schmitt trigger buffer/line driver; 3-state; inverting

Rev. 6 — 4 August 2021

Product data sheet

1. General description

The 74HC7540; 74HCT7540 is an 8-bit inverting buffer/line driver with Schmitt-trigger inputs and 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. This enables the use of current limiting resistors to interface inputs to voltages in excess of V_{CC} . Schmitt trigger inputs transform slowly changing input signals into sharply defined jitter-free output signals.

2. Features and benefits

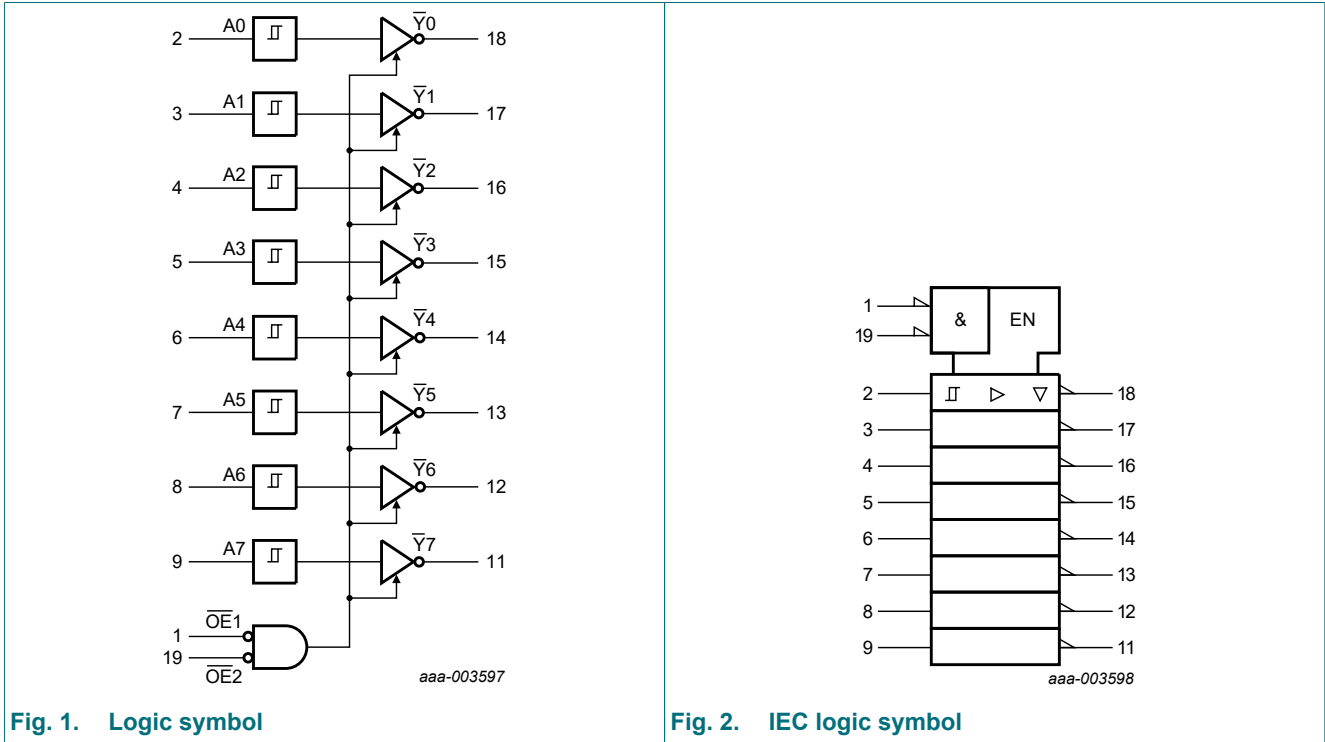
- Wide supply voltage range from 2.0 to 6.0 V
- CMOS low power dissipation
- High noise immunity
- Unlimited input rise and fall times
- Latch-up performance exceeds 100 mA per JESD 78 Class II Level B
- Inverting outputs
- Input levels:
 - For 74HC7540: CMOS level
 - For 74HCT7540: TTL level
- Complies with JEDEC standards
 - JESD8C (2.7 V to 3.6 V)
 - JESD7A (2.0 V to 6.0 V)
- ESD protection:
 - HBM JESD22-A114F exceeds 2000 V
 - MM JESD22-A115-A exceeds 200 V
- Multiple package options
- Specified from -40 °C to +85 °C and from -40 °C to +125 °C

3. Ordering information

Table 1. Ordering information

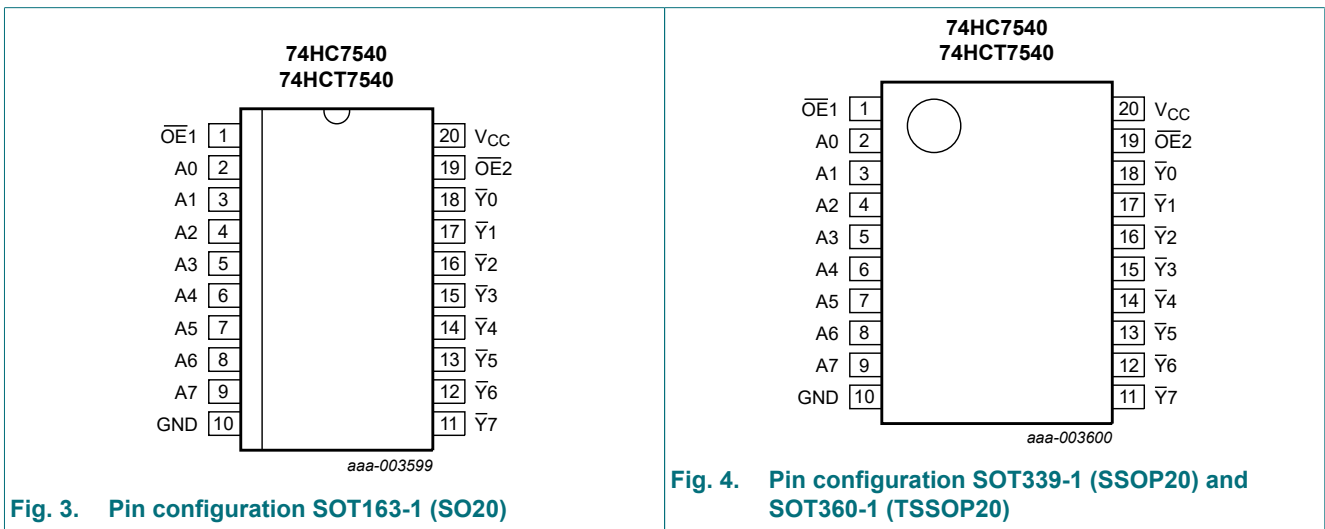
Type number	Package			
	Temperature range	Name	Description	Version
74HC7540D	-40 °C to +125 °C	SO20	plastic small outline package; 20 leads; body width 7.5 mm	SOT163-1
74HCT7540D				
74HC7540DB	-40 °C to +125 °C	SSOP20	plastic shrink small outline package; 20 leads; body width 5.3 mm	SOT339-1
74HC7540PW	-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
$\overline{OE}1$	1	output enable input (active LOW)
A0, A1, A2, A3, A4, A5, A6, A7	2, 3, 4, 5, 6, 7, 8, 9	data input
GND	10	ground (0 V)
$\overline{Y}0, \overline{Y}1, \overline{Y}2, \overline{Y}3, \overline{Y}4, \overline{Y}5, \overline{Y}6, \overline{Y}7$	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. Functional 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	Y_n
L	L	L	H
L	L	H	L
X	H	X	Z
H	X	X	Z

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	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	$-0.5 \text{ V} < V_O < V_{CC} + 0.5 \text{ V}$	-	± 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	[2]	-	500	mW

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

[2] For SOT163-1 (SO20) package: P_{tot} derates linearly with 12.3 mW/K above 109 °C.

For SOT339-1 (SSOP20) package: P_{tot} derates linearly with 10.0 mW/K above 100 °C.

For SOT360-1 (TSSOP20) package: P_{tot} derates linearly with 10.0 mW/K above 100 °C.

8. Recommended operating conditions

Table 5. Recommended operating conditions

Voltages are referenced to GND (ground = 0 V)

Symbol	Parameter	Conditions	74HC7540			74HCT7540			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	+25	+125	-40	+25	+125	°C

9. Static characteristics

Table 6. Static characteristics

At recommended operating conditions; voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
74HC7540										
V_{OH}	HIGH-level output voltage	$V_I = V_{T+}$ or V_{T-}								
		$I_O = -20 \mu A$; $V_{CC} = 2.0 V$	1.9	2.0	-	1.9	-	1.9	-	V
		$I_O = -20 \mu A$; $V_{CC} = 4.5 V$	4.4	4.5	-	4.4	-	4.4	-	V
		$I_O = -20 \mu A$; $V_{CC} = 6.0 V$	5.9	6.0	-	5.9	-	5.9	-	V
		$I_O = -6.0 mA$; $V_{CC} = 4.5 V$	3.98	4.32	-	3.84	-	3.7	-	V
	$I_O = -7.8 mA$; $V_{CC} = 6.0 V$	5.48	5.81	-	5.34	-	5.2	-	V	
V_{OL}	LOW-level output voltage	$V_I = V_{T+}$ or V_{T-}								
		$I_O = 20 \mu A$; $V_{CC} = 2.0 V$	-	0	0.1	-	0.1	-	0.1	V
		$I_O = 20 \mu A$; $V_{CC} = 4.5 V$	-	0	0.1	-	0.1	-	0.1	V
		$I_O = 20 \mu A$; $V_{CC} = 6.0 V$	-	0	0.1	-	0.1	-	0.1	V
		$I_O = 6.0 mA$; $V_{CC} = 4.5 V$	-	0.15	0.26	-	0.33	-	0.4	V
	$I_O = 7.8 mA$; $V_{CC} = 6.0 V$	-	0.16	0.26	-	0.33	-	0.4	V	
I_I	input leakage current	$V_I = V_{CC}$ or GND; $V_{CC} = 6.0 V$	-	-	± 0.1	-	± 1.0	-	± 1.0	μA
I_{OZ}	OFF-state output current	$V_I = V_{T+}$ or V_{T-} ; $V_{CC} = 6.0 V$; $V_O = V_{CC}$ or GND	-	-	± 0.5	-	± 5.0	-	± 10	μA
I_{CC}	supply current	$V_I = V_{CC}$ or GND; $I_O = 0 A$; $V_{CC} = 6.0 V$	-	-	8.0	-	80	-	160	μA
C_I	input capacitance		-	3.5	-	-	-	-	-	pF

Octal Schmitt trigger buffer/line driver; 3-state; inverting

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
74HCT7540										
V _{OH}	HIGH-level output voltage	V _I = V _{T+} or V _{T-} ; V _{CC} = 4.5 V								
		I _O = -20 µA	4.4	4.5	-	4.4	-	4.4	-	V
		I _O = -6.0 mA	3.98	4.32	-	3.84	-	3.7	-	V
V _{OL}	LOW-level output voltage	V _I = V _{T+} or V _{T-} ; V _{CC} = 4.5 V								
		I _O = 20 µA;	-	0	0.1	-	0.1	-	0.1	V
		I _O = 6.0 mA;	-	0.15	0.26	-	0.33	-	0.4	V
I _I	input leakage current	V _I = V _{CC} or GND; V _{CC} = 5.5 V	-	-	±0.1	-	±1.0	-	±1.0	µA
I _{OZ}	OFF-state output current	V _I = V _{T+} or V _{T-} ; V _{CC} = 5.5 V; V _O = V _{CC} or GND	-	-	±0.5	-	±5.0	-	±10	µA
I _{CC}	supply current	V _I = V _{CC} or GND; I _O = 0 A; V _{CC} = 5.5 V	-	-	8.0	-	80	-	160	µA
ΔI _{CC}	additional supply current	per input pin; I _O = 0 A; V _I = V _{CC} - 2.1 V; other inputs at V _{CC} or GND; V _{CC} = 4.5 V to 5.5 V								
		An input	-	20	72	-	90	-	98	µA
		$\overline{\text{OEn}}$ input	-	130	468	-	585	-	637	µA
C _I	input capacitance		-	3.5	-	-	-	-	-	pF

10. Dynamic characteristics

Table 7. Dynamic characteristics

$GND = 0\text{ V}$; $C_L = 50\text{ pF}$; for test circuit see Fig. 7.

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
74HC7540										
t_{pd}	propagation delay	An to \bar{Y}_n ; see Fig. 5 [1]								
		$V_{CC} = 2.0\text{ V}$	-	39	120	-	150	-	180	ns
		$V_{CC} = 4.5\text{ V}$	-	14	24	-	30	-	36	ns
		$V_{CC} = 5.0\text{ V}$; $C_L = 15\text{ pF}$	-	11	-	-	-	-	-	ns
		$V_{CC} = 6.0\text{ V}$	-	11	20	-	26	-	31	ns
t_{en}	enable time	$\overline{O}E_n$ to \bar{Y}_n ; see Fig. 6 [1]								
		$V_{CC} = 2.0\text{ V}$	-	41	150	-	190	-	225	ns
		$V_{CC} = 4.5\text{ V}$	-	15	30	-	38	-	45	ns
		$V_{CC} = 6.0\text{ V}$	-	12	26	-	33	-	38	ns
t_{dis}	disable time	$\overline{O}E_n$ to \bar{Y}_n ; see Fig. 6 [1]								
		$V_{CC} = 2.0\text{ V}$	-	52	150	-	190	-	225	ns
		$V_{CC} = 4.5\text{ V}$	-	19	30	-	38	-	45	ns
		$V_{CC} = 6.0\text{ V}$	-	15	26	-	33	-	38	ns
t_t	transition time	see Fig. 5 [2]								
		$V_{CC} = 2.0\text{ V}$	-	14	60	-	75	-	90	ns
		$V_{CC} = 4.5\text{ V}$	-	5	12	-	15	-	18	ns
		$V_{CC} = 6.0\text{ V}$	-	4	10	-	13	-	15	ns
C_{PD}	power dissipation capacitance	per package; $V_I = GND$ to V_{CC} [3]	-	29	-	-	-	-	-	pF
74HCT7540										
t_{pd}	propagation delay	An to \bar{Y}_n ; see Fig. 5 [1]								
		$V_{CC} = 4.5\text{ V}$	-	19	32	-	40	-	48	ns
		$V_{CC} = 5.0\text{ V}$; $C_L = 15\text{ pF}$	-	16	-	-	-	-	-	ns
t_{en}	enable time	$\overline{O}E_n$ to \bar{Y}_n ; see Fig. 6 [1]								
		$V_{CC} = 4.5\text{ V}$	-	19	32	-	40	-	48	ns
t_{dis}	disable time	$\overline{O}E_n$ to \bar{Y}_n ; see Fig. 6 [1]								
		$V_{CC} = 4.5\text{ V}$	-	20	32	-	40	-	48	ns
t_t	transition time	$V_{CC} = 4.5\text{ V}$; see Fig. 5 [2]	-	5	12	-	15	-	18	ns
C_{PD}	power dissipation capacitance	per package; $V_I = GND$ to $V_{CC} - 1.5\text{ V}$ [3]	-	31	-	-	-	-	-	pF

[1] t_{pd} is the same as t_{PLH} and t_{PHL} ; t_{en} is the same as t_{PZL} and t_{PZH} ; t_{dis} is the same as t_{PLZ} and t_{PHZ} .

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

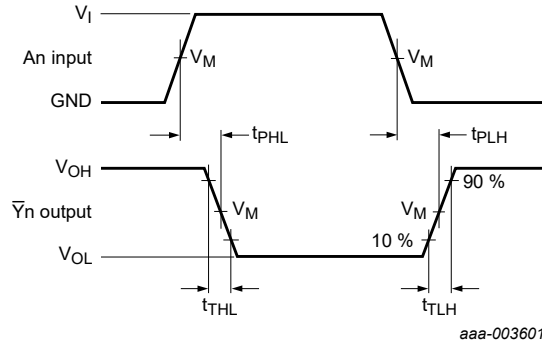
[3] C_{PD} is used to determine the dynamic power dissipation (P_D in μW):

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

f_i = input frequency in MHz; f_o = output frequency in MHz; C_L = output load capacitance in pF;

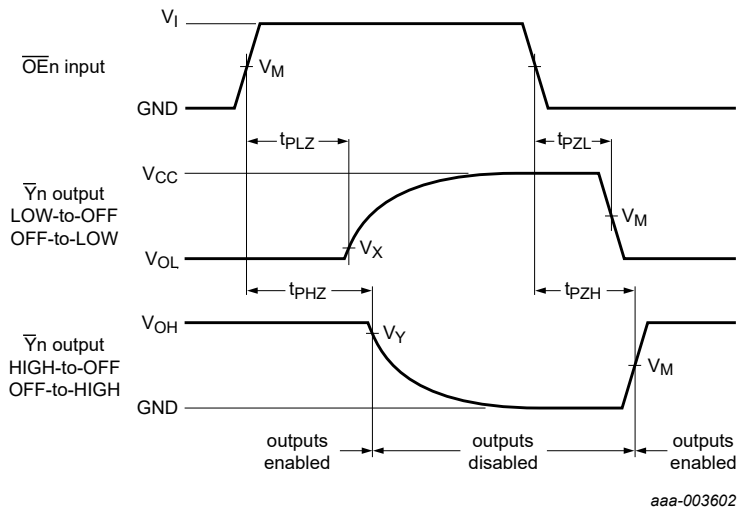
V_{CC} = supply voltage in V; N = number of inputs switching; $\sum (C_L \times V_{CC}^2 \times f_o)$ = sum of outputs.

10.1. Waveforms and test circuit



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

Fig. 5. Input to output propagation delays



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

Fig. 6. 3-state enable and disable times

Table 8. Measurement points

Type	Input	Output		
	V_M	V_M	V_X	V_Y
74HC7540	$0.5V_{CC}$	$0.5V_{CC}$	$0.1V_{CC}$	$0.9V_{CC}$
74HCT7540	1.3 V	1.3 V	$0.1V_{CC}$	$0.9V_{CC}$

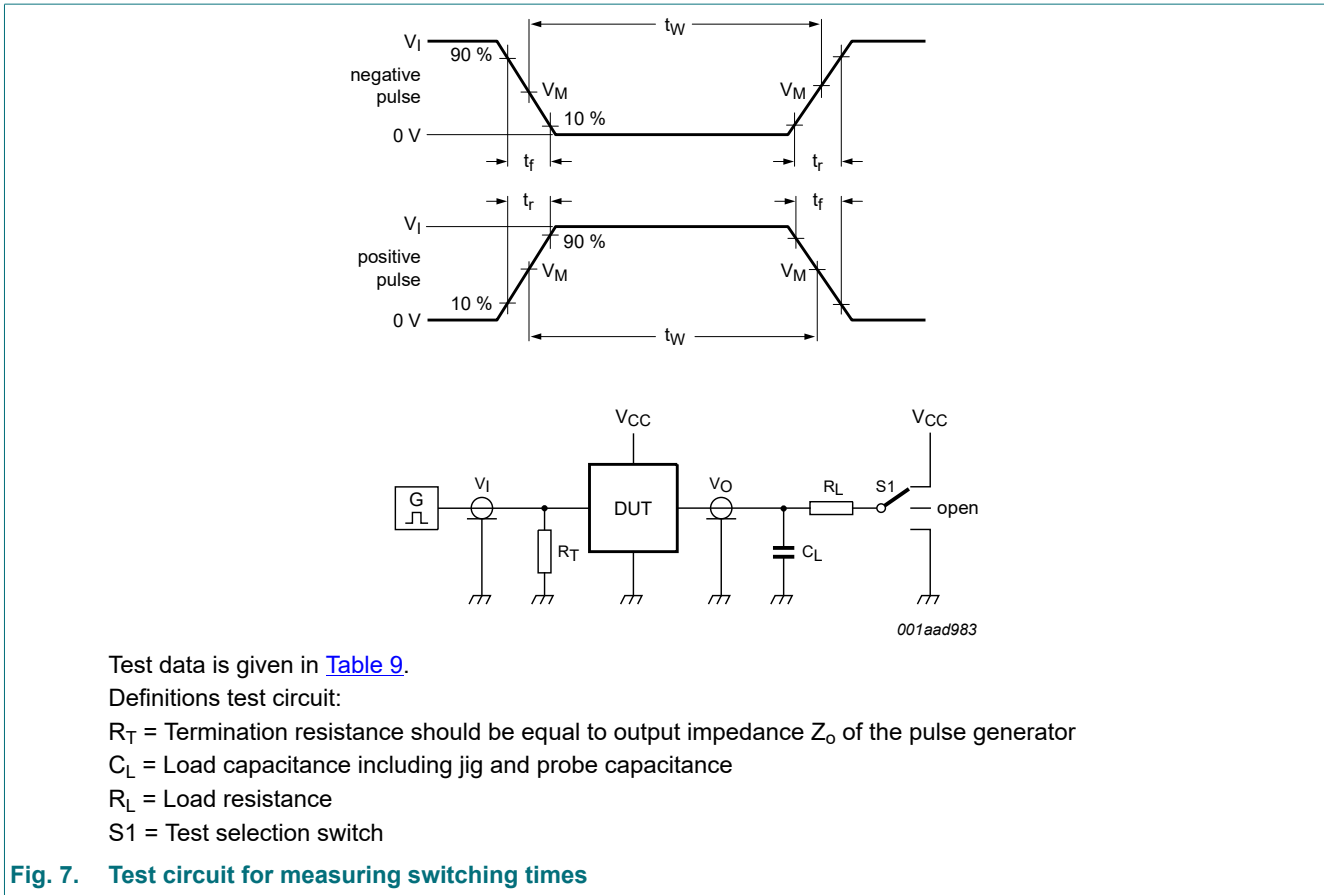


Fig. 7. Test circuit for measuring switching times

Table 9. Test data

Type	Input		Load		S1 position		
	V_I	t_r, t_f	C_L	R_L	t_{PHL}, t_{PLH}	t_{PZH}, t_{PHZ}	t_{PZL}, t_{PLZ}
74HC7540	V_{CC}	6 ns	15 pF, 50 pF	1 k Ω	open	GND	V_{CC}
74HCT7540	3 V	6 ns	15 pF, 50 pF	1 k Ω	open	GND	V_{CC}

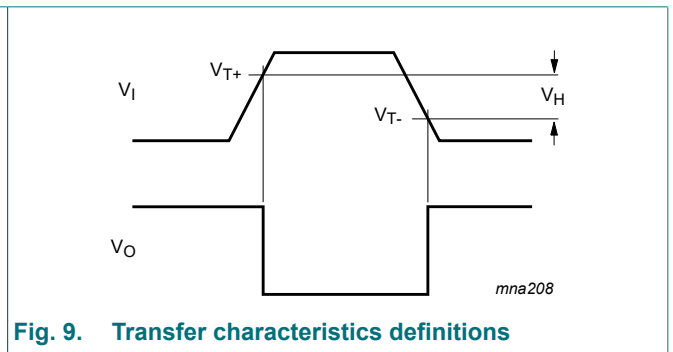
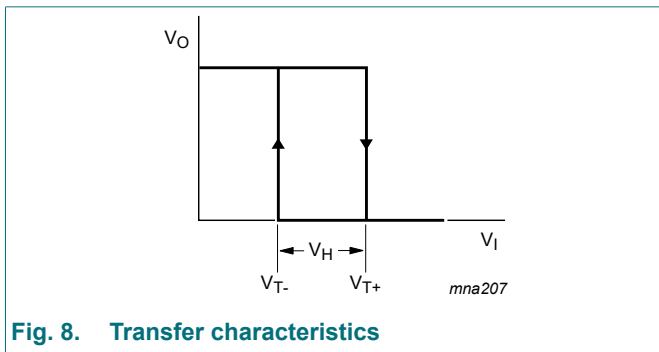
11. Transfer characteristics

Table 10. Transfer characteristics

At recommended operating conditions; voltages are referenced to GND (ground = 0 V); see Fig. 8 and Fig. 9.

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
74HC7540										
V_{T+}	positive-going threshold voltage	$V_{CC} = 2.0\text{ V}$	-	-	1.5	-	1.5	-	1.5	V
		$V_{CC} = 4.5\text{ V}$	-	-	3.15	-	3.15	-	3.15	V
		$V_{CC} = 6.0\text{ V}$	-	-	4.2	-	4.2	-	4.2	V
V_{T-}	negative-going threshold voltage	$V_{CC} = 2.0\text{ V}$	0.3	-	-	0.3	-	0.3	-	V
		$V_{CC} = 4.5\text{ V}$	1.35	-	-	1.35	-	1.35	-	V
		$V_{CC} = 6.0\text{ V}$	1.8	-	-	1.8	-	1.8	-	V
V_H	hysteresis voltage	$V_{CC} = 2.0\text{ V}$	0.1	0.20	-	0.1	-	0.1	-	V
		$V_{CC} = 4.5\text{ V}$	0.25	0.40	-	0.25	-	0.25	-	V
		$V_{CC} = 6.0\text{ V}$	0.3	0.5	-	0.3	-	0.3	-	V
74HCT7540										
V_{T+}	positive-going threshold voltage	$V_{CC} = 4.5\text{ V}$	-	-	2.0	-	2.0	-	2.0	V
		$V_{CC} = 5.5\text{ V}$	-	-	2.1	-	2.1	-	2.1	V
V_{T-}	negative-going threshold voltage	$V_{CC} = 4.5\text{ V}$	0.7	-	-	0.64	-	0.6	-	V
		$V_{CC} = 5.5\text{ V}$	0.8	-	-	0.74	-	0.7	-	V
V_H	hysteresis voltage	$V_{CC} = 4.5\text{ V}$	0.17	0.23	-	-	-	-	-	V
		$V_{CC} = 5.5\text{ V}$	0.17	0.23	-	-	-	-	-	V

11.1. Transfer characteristics waveforms



12. Package outline

SO20: plastic small outline package; 20 leads; body width 7.5 mm

SOT163-1



Fig. 10. Package outline SOT163-1 (SO20)

SSOP20: plastic shrink small outline package; 20 leads; body width 5.3 mm

SOT339-1

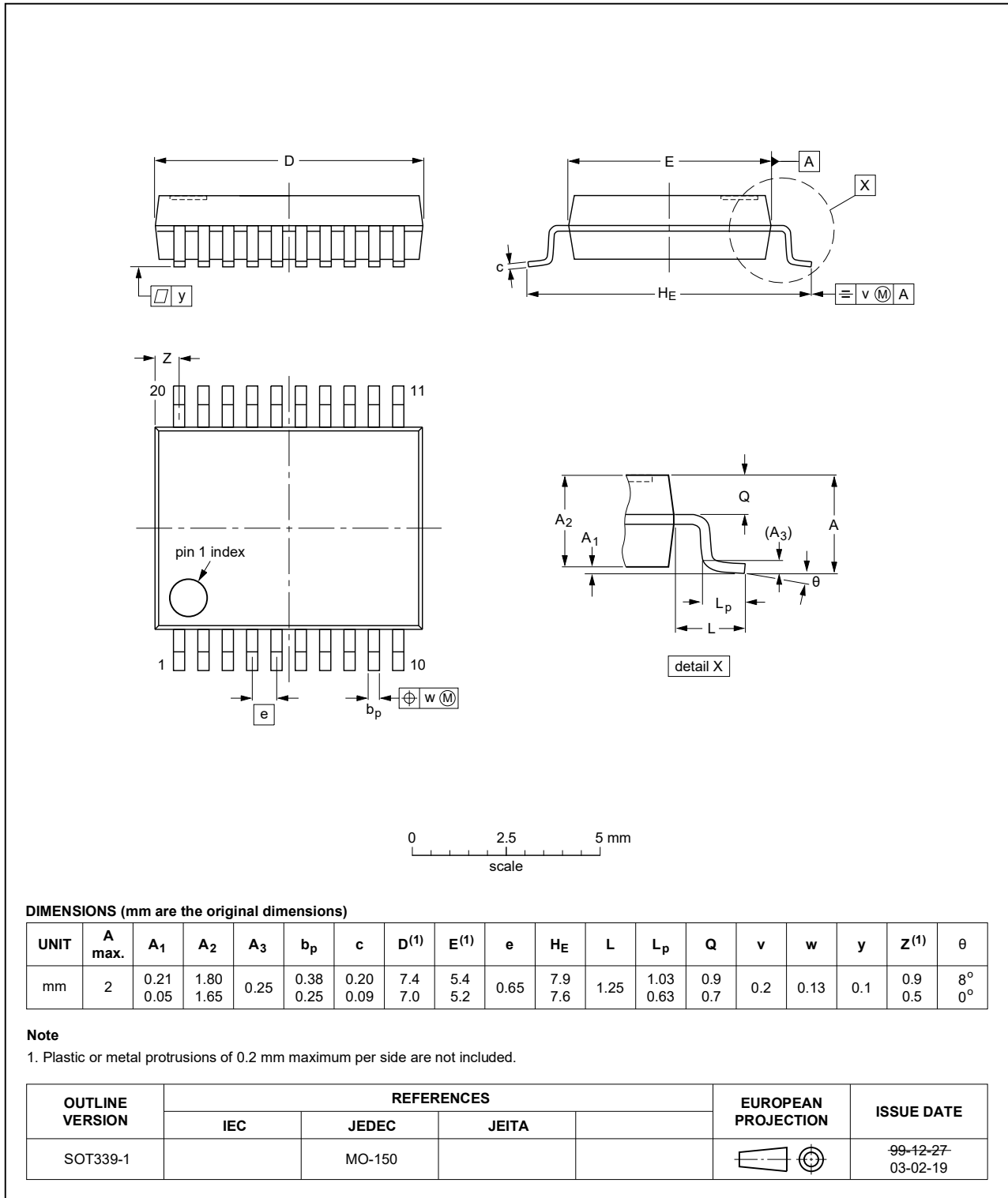


Fig. 11. Package outline SOT339-1 (SSOP20)

TSSOP20: plastic thin shrink small outline package; 20 leads; body width 4.4 mm

SOT360-1



Fig. 12. Package outline SOT360-1 (TSSOP20)

13. Abbreviations

Table 11. Abbreviations

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

14. Revision history

Table 12. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74HC_HCT7540 v.6	20210804	Product data sheet	-	74HC_HCT7540 v.5
Modifications:	<ul style="list-style-type: none"> The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia. Legal texts have been adapted to the new company name where appropriate. Type number 74HC7540PW (SOT360-1/TSSOP20) added. Section 2 updated. Table 4: Derating values for P_{tot} total power dissipation updated. 			
74HC_HCT7540 v.5	20160526	Product data sheet	-	74HC_HCT7540 v.4
Modifications:	<ul style="list-style-type: none"> Type numbers 74HC7540N and 74HCT7540N (SOT146-1) removed. Table 6: conditions for OFF-state output current have changed. 			
74HC_HCT7540 v.4	20121231	Product data sheet	-	74HC_HCT7540 v.3
Modifications:	<ul style="list-style-type: none"> Table 6: I_{OZ} added to static characteristics table. 			
74HC_HCT7540 v.3	20120827	Product data sheet	-	74HC_HCT7540_CNV v.2
Modifications:	<ul style="list-style-type: none"> 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. 			
74HC_HCT7540_CNV v.2	19970917	Product specification	-	-

15. Legal information

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 <https://www.nexperia.com>.

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