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

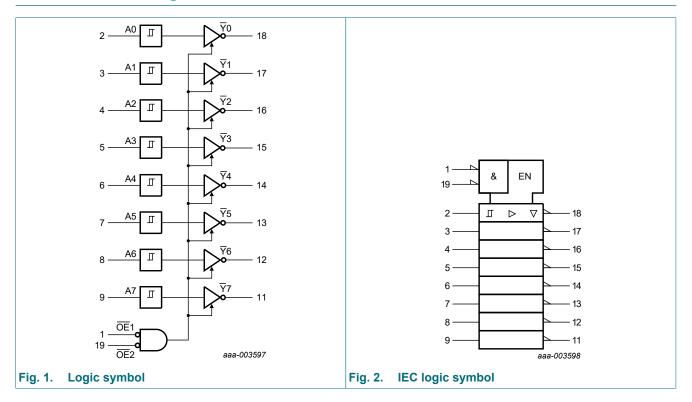
3. Ordering information

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;	SOT163-1
74HCT7540D			body width 7.5 mm	
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

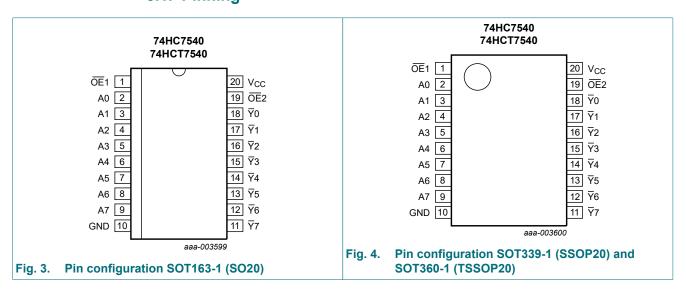


4. Functional diagram



5. Pinning information

5.1. Pinning



5.2. Pin description

Table 2. Pin description

Symbol	Pin	Description
ŌE1	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)
70, 71, 72, 73, 74, 75, 76, 77	18, 17, 16, 15, 14, 13, 12, 11	data output
ŌE2	19	output enable input (active LOW)
V _{CC}	20	supply voltage

6. Functional description

Table 3. Functional table

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

Control		Input	Output
OE1	OE2	An	Ϋ́n
L	L	L	Н
L	L	Н	L
X	Н	X	Z
Н	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
Io	output current	-0.5 V < V _O < V _{CC} + 0.5 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.

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

^[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.

8. Recommended operating conditions

Table 5. Recommended operating conditions

Voltages are referenced to GND (ground = 0 V)

Symbol	Parameter	Conditions	7	4HC754	0	7-	Unit		
			Min	Min Typ I		Min	Тур	Max	
V _{CC}	supply voltage		2.0	5.0	6.0	4.5	5.0	5.5	V
VI	input voltage		0	-	V _{CC}	0	-	V _{CC}	V
Vo	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 t	o +85 °C	-40 °C to	+125 °C	Unit
			Min	Тур	Max	Min	Max	Min	Max	
74HC75	40							,		•
V _{OH}	HIGH-level	$V_I = V_{T+}$ or V_{T-}								
	output voltage	I _O = -20 μA; V _{CC} = 2.0 V	1.9	2.0	-	1.9	-	1.9	-	V
		I _O = -20 μA; V _{CC} = 4.5 V	4.4	4.5	-	4.4	-	4.4	-	V
		I _O = -20 μA; 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		$V_I = V_{T+}$ or V_{T-}								
	output voltage	I _O = 20 μA; V _{CC} = 2.0 V	-	0	0.1	-	0.1	-	0.1	V
		I _O = 20 μA; V _{CC} = 4.5 V	-	0	0.1	-	0.1	-	0.1	V
		I _O = 20 μA; V _{CC} = 6.0 V	-	0	0.1	-	0.1	-	0.1	V
		$I_O = 6.0 \text{ mA}; V_{CC} = 4.5 \text{ V}$	-	0.15	0.26	-	0.33	-	0.4	V
		$I_O = 7.8 \text{ mA}; V_{CC} = 6.0 \text{ V}$	-	0.16	0.26	-	0.33	-	0.4	V
l _l	input leakage current	$V_I = V_{CC}$ or GND; $V_{CC} = 6.0 \text{ V}$	-	-	±0.1	-	±1.0	-	±1.0	μΑ
I _{OZ}	OFF-state output current	$V_I = V_{T+} \text{ or } V_{T-}; V_{CC} = 6.0 \text{ V}; $ $V_O = V_{CC} \text{ or GND}$	-	-	±0.5	-	±5.0	-	±10	μΑ
I _{CC}	supply current	$V_I = V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 6.0 \text{ V}$	-	-	8.0	-	80	-	160	μΑ
C _I	input capacitance		-	3.5	-	-	-	-	-	pF

Symbol	Parameter	Conditions		25 °C		-40 °C t	o +85 °C	-40 °C to	+125 °C	Unit
			Min	Тур	Max	Min	Max	Min	Max	
74HCT7	540					·		·		
V _{OH}	HIGH-level	$V_{I} = V_{T+} \text{ or } V_{T-}; V_{CC} = 4.5 \text{ V}$								
	output voltage	Ι _Ο = -20 μΑ	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	$V_{I} = V_{T+} \text{ or } V_{T-}; V_{CC} = 4.5 \text{ V}$								
	output voltage	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; $V_{CC} = 5.5 \text{ V}$	-	-	±0.1	-	±1.0	-	±1.0	μΑ
l _{OZ}	OFF-state output current	$V_{I} = V_{T+} \text{ or } V_{T-}; V_{CC} = 5.5 \text{ V};$ $V_{O} = V_{CC} \text{ or GND}$	-	-	±0.5	-	±5.0	-	±10	μΑ
I _{CC}	supply current	$V_I = V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 5.5 \text{ V}$	-	-	8.0	-	80	-	160	μΑ
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	μΑ
		OEn input	-	130	468	-	585	-	637	μΑ
Cı	input capacitance		-	3.5	-	-	-	-	-	pF

10. Dynamic characteristics

Table 7. Dynamic characteristics

GND = 0 V; C_L = 50 pF; for test circuit see Fig. 7.

Symbol	Parameter	Conditions		25 °C		-40 °C t	o +85 °C	-40 °C to	o +125 °C	Unit
			Min	Тур	Max	Min	Max	Min	Max	1
74HC75	40						'	·		
t _{pd}	propagation	An to \overline{Y} n; see $\underline{\text{Fig. 5}}$ [1]								
	delay	V _{CC} = 2.0 V	-	39	120	-	150	-	180	ns
		V _{CC} = 4.5 V	-	14	24	-	30	-	36	ns
		V _{CC} = 5.0 V; C _L = 15 pF	-	11	-	-	-	-	-	ns
		V _{CC} = 6.0 V	-	11	20	-	26	-	31	ns
t _{en}	enable time	ŌEn to ¬n; see Fig. 6 [1]								
		V _{CC} = 2.0 V	-	41	150	-	190	-	225	ns
		V _{CC} = 4.5 V	-	15	30	-	38	-	45	ns
		V _{CC} = 6.0 V	-	12	26	-	33	-	38	ns
t _{dis}	disable time	OEn to Yn; see Fig. 6 [1]								
		V _{CC} = 2.0 V	-	52	150	-	190	-	225	ns
		V _{CC} = 4.5 V	-	19	30	-	38	-	45	ns
		V _{CC} = 6.0 V	-	15	26	-	33	-	38	ns
t _t	transition	see <u>Fig. 5</u> [2]								
	time	V _{CC} = 2.0 V	-	14	60	-	75	-	90	ns
		V _{CC} = 4.5 V	-	5	12	-	15	-	18	ns
		V _{CC} = 6.0 V	-	4	10	-	13	-	15	ns
C _{PD}	power dissipation capacitance	per package; [3] V _I = GND to V _{CC}	-	29	-	-	-	-	-	pF
74HCT7	540						I			
t _{pd}	propagation	An to \overline{Y} n; see $\underline{\text{Fig. 5}}$ [1]								
	delay	V _{CC} = 4.5 V	-	19	32	-	40	-	48	ns
		V _{CC} = 5.0 V; C _L = 15 pF	-	16	-	-	-	-	-	ns
t _{en}	enable time	OEn to ∀n; see Fig. 6 [1]								
		V _{CC} = 4.5 V	-	19	32	-	40	-	48	ns
t _{dis}	disable time	OEn to ∀n; see Fig. 6 [1]								
		V _{CC} = 4.5 V	-	20	32	-	40	-	48	ns
t _t	transition time	V _{CC} = 4.5 V; see <u>Fig. 5</u> [2]	-	5	12	-	15	-	18	ns
C _{PD}	power dissipation capacitance	per package; [3] V _I = GND to V _{CC} - 1.5 V	-	31	-	-	-	-	-	pF

 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} . t_{t} is the same as t_{THL} and t_{TLH} . C_{PD} is used to determine the dynamic power dissipation (P_{D} in μW):

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

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

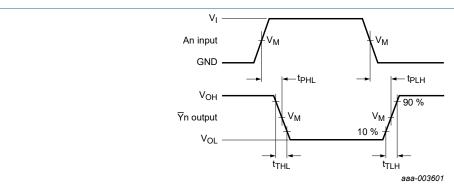
 V_{CC} = supply voltage in V; N = number of inputs switching; $\sum (C_L \times V_{CC})^2 \times f_0$ = sum of outputs.

74HC_HCT7540

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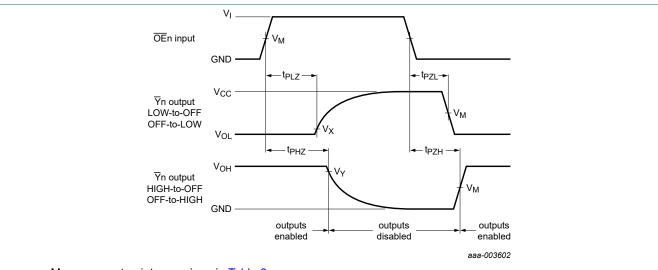
10.1. Waveforms and test circuit



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



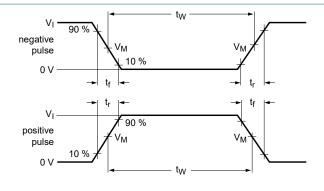
Measurement points are given in <u>Table 8</u>.

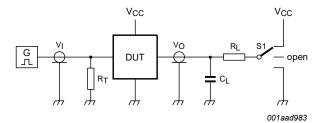
 V_{OL} and V_{OH} are typical voltage output levels that occur with the output load.

Fig. 6. 3-state enable and disable times

Table 8. Measurement points

Туре	Input	Output	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}							





Test data is given in Table 9.

Definitions test circuit:

 R_T = Termination resistance should be equal to output impedance Z_o of the pulse generator

C_L = Load capacitance including jig and probe capacitance

R_L = Load resistance

S1 = Test selection switch

Fig. 7. Test circuit for measuring switching times

Table 9. Test data

Туре	Input		Load		S1 position				
	V _I	t _r , t _f	CL	R _L	t _{PHL} , t _{PLH}	t _{PZH} , t _{PHZ}	t _{PZL} , t _{PLZ}		
74HC7540	V _{CC}	6 ns	15 pF, 50 pF	1 kΩ	open	GND	V _{CC}		
74HCT7540	3 V	6 ns	15 pF, 50 pF	1 kΩ	open	GND	V _{CC}		

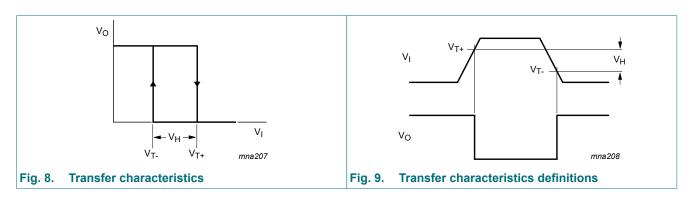
11. Transfer characteristics

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	o +85 °C	-40 °C to	+125 °C	Unit
			Min	Тур	Max	Min	Max	Min	Max	
74HC75	40						1		-	
V _{T+}	positive-going	V _{CC} = 2.0 V	-	-	1.5	-	1.5	-	1.5	V
	threshold	V _{CC} = 4.5 V	-	-	3.15	-	3.15	-	3.15	V
	threshold voltage	V _{CC} = 6.0 V	-	-	4.2	-	4.2	-	4.2	V
V _{T-}	negative-going	V _{CC} = 2.0 V	0.3	-	-	0.3	-	0.3	-	V
		V _{CC} = 4.5 V	1.35	-	-	1.35	-	1.35	-	V
	Voltage	V _{CC} = 6.0 V	1.8	-	-	1.8	-	1.8	-	V
V _H		V _{CC} = 2.0 V	0.1	0.20	-	0.1	-	0.1	-	V
	voltage	V _{CC} = 4.5 V	0.25	0.40	-	0.25	-	0.25	-	V
		V _{CC} = 6.0 V	0.3	0.5	-	0.3	-	0.3	-	V
74HCT7	540							•		
V _{T+}	positive-going	V _{CC} = 4.5 V	-	-	2.0	-	2.0	-	2.0	V
	threshold voltage	V _{CC} = 5.5 V	-	-	2.1	-	2.1	-	2.1	V
V _{T-}	negative-going	V _{CC} = 4.5 V	0.7	-	-	0.64	-	0.6	-	V
	threshold voltage	V _{CC} = 5.5 V	0.8	-	-	0.74	-	0.7	-	V
V _H	hysteresis	V _{CC} = 4.5 V	0.17	0.23	-	-	-	-	-	V
	voltage	V _{CC} = 5.5 V	0.17	0.23	-	-	-	-	-	V

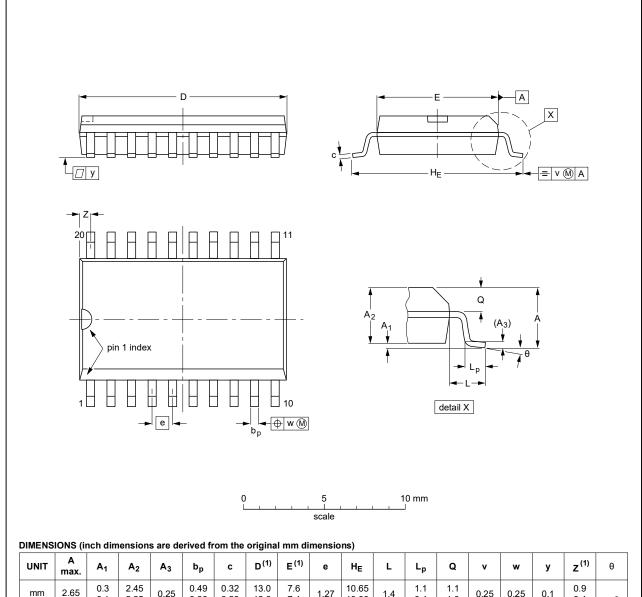
11.1. Transfer characteristics waveforms



12. Package outline

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

SOT163-1



UNIT	A max.	A ₁	A ₂	A ₃	bp	С	D ⁽¹⁾	E ⁽¹⁾	е	HE	L	Lp	Q	v	w	у	z ⁽¹⁾	θ
mm	2.65	0.3 0.1	2.45 2.25	0.25	0.49 0.36	0.32 0.23	13.0 12.6	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°
inches	0.1	0.012 0.004	0.096 0.089	0.01	0.019 0.014	0.013 0.009	0.51 0.49	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	0°

1. Plastic or metal protrusions of 0.15 mm (0.006 inch) maximum per side are not included.

OUTLINE	REFERENCES				EUROPEAN	ISSUE DATE
VERSION	IEC	JEDEC	JEITA		PROJECTION	1330E DATE
SOT163-1	075E04	MS-013				99-12-27 03-02-19

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

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

SOT339-1

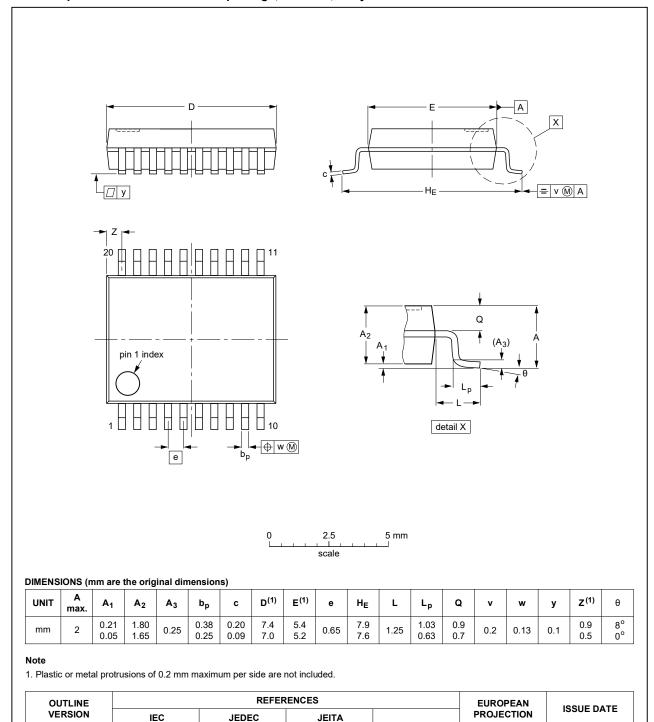


Fig. 11. Package outline SOT339-1 (SSOP20)

MO-150

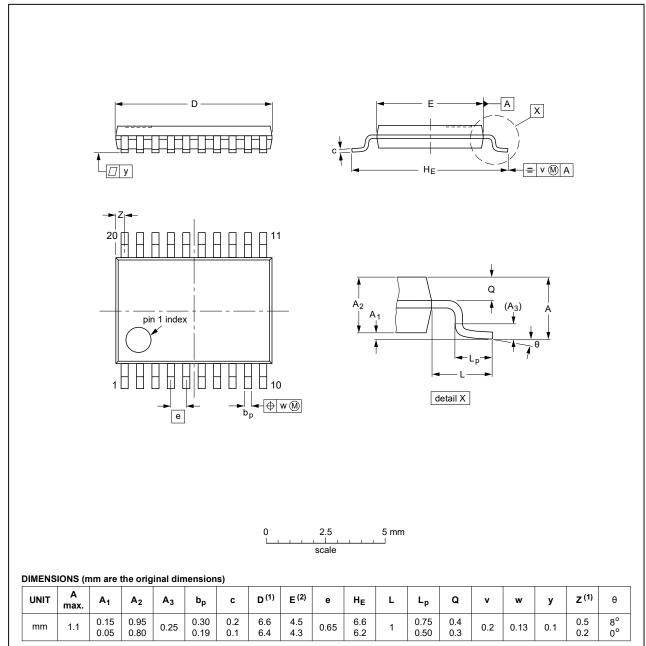
99-12-27

03-02-19

SOT339-1

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

SOT360-1



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	REFERENCES				EUROPEAN	ISSUE DATE
VERSION	IEC	JEDEC	JEITA		PROJECTION	ISSUE DATE
SOT360-1		MO-153				99-12-27 03-02-19

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
НВМ	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:	guidelines o Legal texts I Type numbe Section 2 up	 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 Ptot total power dissipation updated. 				
74HC_HCT7540 v.5	20160526	Product data sheet	-	74HC_HCT7540 v.4		
Modifications:	1 **	 Type numbers 74HC7540N and 74HCT7540N (SOT146-1) removed. <u>Table 6</u>: conditions for OFF-state output current have changed. 				
74HC_HCT7540 v.4	20121231	Product data sheet	-	74HC_HCT7540 v.3		
Modifications:	• Table 6: I _{OZ}	<u>Table 6</u> : I _{OZ} added to static characteristics table.				
74HC_HCT7540 v.3	20120827	Product data sheet	-	74HC_HCT7540_CNV v.2		
Modifications:	guidelines o	 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.

- Please consult the most recently issued document before initiating or completing a design.
- [2] The term 'short data sheet' is explained in section "Definitions".
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