74HC574; 74HCT574

Octal D-type flip-flop; positive edge-trigger; 3-state

Rev. 5 — 25 April 2012 Product data sheet

1. General description

The 74HC574; 74HCT574 is a high-speed Si-gate CMOS device and is pin compatible with Low-power Schottky TTL. It is specified in compliance with JEDEC standard no. 7A.

The 74HC574; 74HCT574 are octal D-type flip-flops featuring separate D-type inputs for each flip-flop and 3-state outputs for bus-oriented applications. A clock (CP) and an output enable ($\overline{OE}$) input are common to all flip-flops. The 8 flip-flops will store the state of their individual D-inputs that meet the set-up and hold times requirements on the LOW-to-HIGH CP transition. When $\overline{OE}$ is LOW the contents of the 8 flip-flops are available at the outputs. When $\overline{OE}$ is HIGH, the outputs go to the high-impedance OFF-state. Operation of the $\overline{OE}$ input does not affect the state of the flip-flops.

The 74HC574; 74HCT574 is functionally identical to:

- 74HC564: but has non-inverting outputs
- 74HC374; 74HCT374: but has a different pin arrangement

2. Features and benefits

- 3-state non-inverting outputs for bus oriented applications
- 8-bit positive, edge-triggered register
- Common 3-state output enable input
- ESD protection:
  - HBM JESD22-A114F exceeds 2 000 V
  - MM JESD22-A115-A exceeds 200 V
- 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
74HC574N	–40 °C to +125 °C	DIP20	plastic dual in-line package; 20 leads (300 mil)	SOT146-1
74HCT574N				
74HC574D	–40 °C to +125 °C	SO20	plastic small outline package; 20 leads; body width 7.5 mm	SOT163-1
74HCT574D				

Table 1. Ordering information *…continued*

Type number	Package			
	Temperature range	Name	Description	Version
74HC574DB	–40 °C to +125 °C	SSOP20	plastic shrink small outline package; 20 leads; body width 5.3 mm	SOT339-1
74HCT574DB				
74HC574PW	–40 °C to +125 °C	TSSOP20	plastic thin shrink small outline package; 20 leads; body width 4.4 mm	SOT360-1
74HCT574PW				

4. Functional diagram

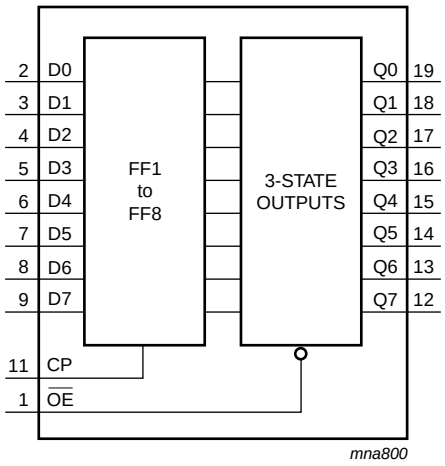


Fig 1. Functional diagram

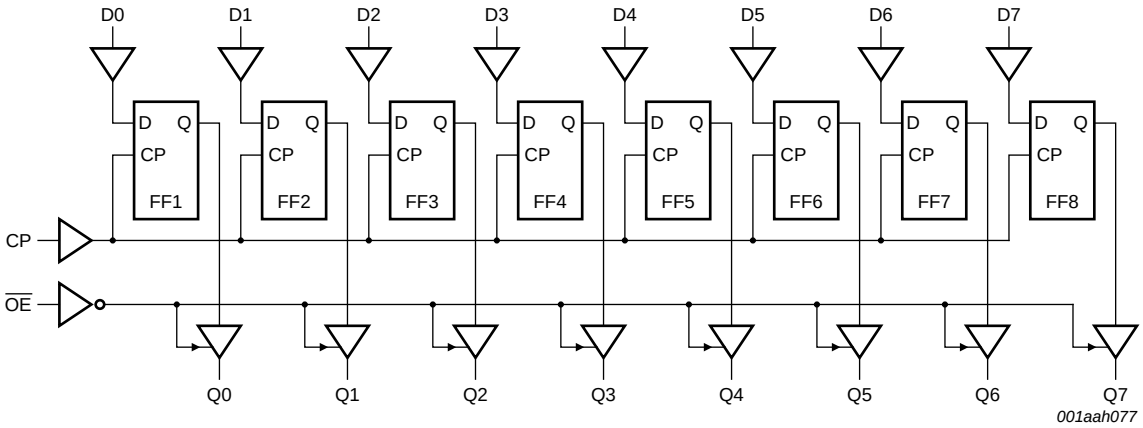


Fig 2. Logic diagram

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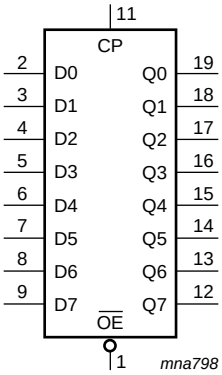


Fig 3. Logic symbol

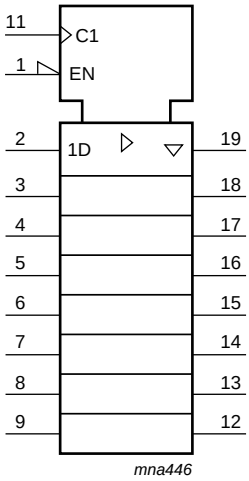


Fig 4. IEC logic symbol

5. Pinning information

5.1 Pinning

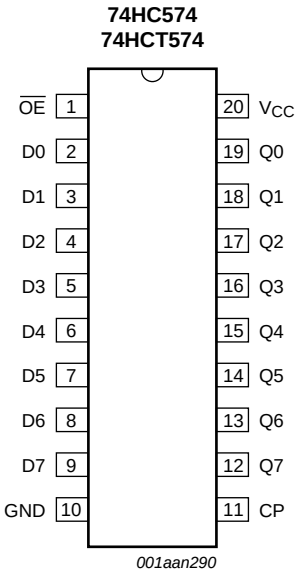


Fig 5. Pin configuration DIP20 and SO20

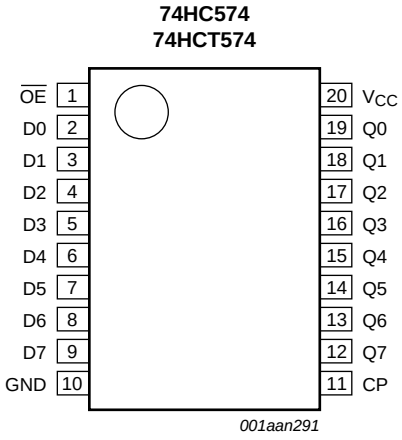


Fig 6. Pin configuration SSOP20 and TSSOP20

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5.2 Pin description

Table 2. Pin description

Symbol	Pin	Description
$\overline{OE}$	1	3-state output enable input (active LOW)
D[0:7]	2, 3, 4, 5, 6, 7, 8, 9	data input
GND	10	ground (0 V)
CP	11	clock input (LOW-to-HIGH, edge triggered)
Q[0:7]	19, 18, 17, 16, 15, 14, 13, 12	3-state flip-flop output
V_{CC}	20	supply voltage

6. Functional description

Table 3. Function table[1]

Operating mode	Input			Internal flip-flop	Output
	$\overline{OE}$	CP	Dn		Qn
Load and read register	L	↑	l	L	L
	L	↑	h	H	H
Load register and disable output	H	↑	l	L	Z
	H	↑	h	H	Z

[1] H = HIGH voltage level;
h = HIGH voltage level one setup time prior to the HIGH-to-LOW CP transition;
L = LOW voltage level;
l = LOW voltage level one setup time prior to the HIGH-to-LOW CP transition;
Z = high-impedance OFF-state;
↑ = LOW-to-HIGH clock transition.

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	$V_I < –0.5$ V or $V_I > V_{CC} + 0.5$ V		-	±20	mA
I_{OK}	output clamping current	$V_O < –0.5$ V or $V_O > V_{CC} + 0.5$ V		-	±20	mA
I_O	output current	$V_O = –0.5$ V to $(V_{CC} + 0.5$ 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	DIP20 package	[1]	-	750	mW
		SO20, SSOP20 and TSSOP20 packages	[2]	-	500	mW

[1] For DIP20 package: P_{tot} derates linearly with 12 mW/K above 70 °C.

[2] For SO20: P_{tot} derates linearly with 8 mW/K above 70 °C.
For SSOP20 and TSSOP20 packages: P_{tot} derates linearly with 5.5 mW/K above 60 °C.

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8. Recommended operating conditions

Table 5. Recommended operating conditions

Voltages are referenced to GND (ground = 0 V)

Symbol	Parameter	Conditions	74HC574			74HCT574			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
$\Delta t/\Delta V$	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).

Symbol	Parameter	Conditions	25 °C			–40 °C to +85 °C		–40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
74HC574										
V_{IH}	HIGH-level input voltage	V_{CC} = 2.0 V	1.5	1.2	-	1.5	-	1.5	-	V
		V_{CC} = 4.5 V	3.15	2.4	-	3.15	-	3.15	-	V
		V_{CC} = 6.0 V	4.2	3.2	-	4.2	-	4.2	-	V
V_{IL}	LOW-level input voltage	V_{CC} = 2.0 V	-	0.8	0.5	-	0.5	-	0.5	V
		V_{CC} = 4.5 V	-	2.1	1.35	-	1.35	-	1.35	V
		V_{CC} = 6.0 V	-	2.8	1.8	-	1.8	-	1.8	V
V_{OH}	HIGH-level output voltage	V_I = V_{IH} or V_{IL}								
		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 output voltage	V_I = V_{IH} or V_{IL}								
		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 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_{IH} or V_{IL}; V_O = V_{CC} or GND; V_{CC} = 6.0 V	-	-	±0.5	-	±5.0	-	±10.0	µA

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Table 6. Static characteristics *…continued*

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	
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
74HCT574										
V_{IH}	HIGH-level input voltage	$V_{CC} = 4.5$ V to 5.5 V	2.0	1.6	-	2.0	-	2.0	-	V
V_{IL}	LOW-level input voltage	$V_{CC} = 4.5$ V to 5.5 V	-	1.2	0.8	-	0.8	-	0.8	V
V_{OH}	HIGH-level output voltage	$V_I = V_{IH}$ or V_{IL}; $V_{CC} = 4.5$ V								
		$I_O = –20$ µA	4.4	4.5	-	4.4	-	4.4	-	V
		$I_O = –6$ mA	3.98	4.32	-	3.84	-	3.7	-	V
V_{OL}	LOW-level output voltage	$V_I = V_{IH}$ or V_{IL}; $V_{CC} = 4.5$ V								
		$I_O = 20$ µA	-	0	0.1	-	0.1	-	0.1	V
		$I_O = 6.0$ mA	-	0.16	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	$V_I = V_{IH}$ or V_{IL}; $V_{CC} = 5.5$ V; $V_O = V_{CC}$ or GND per input pin; other inputs at V_{CC} or GND; $I_O = 0$ A	-	-	±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	$V_I = V_{CC} – 2.1$ V; other inputs at V_{CC} or GND; $V_{CC} = 4.5$ V to 5.5 V; $I_O = 0$ A								
		per input pin; Dn inputs	-	50	180	-	225	-	245	µA
		per input pin; $\overline{OE}$ input	-	125	450	-	563	-	613	µA
		per input pin; CP input	-	150	540	-	675	-	735	µA
C_I	input capacitance		-	3.5	-					pF

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10. Dynamic characteristics

Table 7. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V); C_L = 50 pF unless otherwise specified; for test circuit see Figure 10.

Symbol	Parameter	Conditions		25 °C			–40 °C to +85 °C		–40 °C to +125 °C		Unit
				Min	Typ	Max	Min	Max	Min	Max	
For type 74HC574											
t_{pd}	propagation delay	CP to Qn; see Figure 7	[1]								
		V_{CC} = 2.0 V		-	47	150	-	190	-	225	ns
		V_{CC} = 4.5 V		-	17	30	-	35	-	45	ns
		V_{CC} = 5 V; C_L = 15 pF		-	14	-	-	-	-	-	ns
		V_{CC} = 6.0 V		-	14	26	-	33	-	38	ns
t_{en}	enable time	$\overline{OE}$ to Qn; see Figure 9	[2]								
		V_{CC} = 2.0 V		-	44	140	-	175	-	210	ns
		V_{CC} = 4.5 V		-	16	28	-	35	-	42	ns
		V_{CC} = 6.0 V		-	13	24	-	30	-	36	ns
t_{dis}	disable time	$\overline{OE}$ to Qn; see Figure 9	[3]								
		V_{CC} = 2.0 V		-	39	125	-	155	-	190	ns
		V_{CC} = 4.5 V		-	14	25	-	31	-	38	ns
		V_{CC} = 6.0 V		-	11	21	-	26	-	32	ns
t_t	transition time	Qn; see Figure 7	[4]								
		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
t_W	pulse width	CP HIGH or LOW; see Figure 8									
		V_{CC} = 2.0 V		80	14	-	100	-	120	-	ns
		V_{CC} = 4.5 V		16	5	-	20	-	24	-	ns
		V_{CC} = 6.0 V		14	4	-	17	-	20	-	ns
t_{su}	set-up time	Dn to CP; see Figure 8									
		V_{CC} = 2.0 V		60	6	-	75	-	90	-	ns
		V_{CC} = 4.5 V		12	2	-	15	-	18	-	ns
		V_{CC} = 6.0 V		10	2	-	13	-	15	-	ns
t_h	hold time	Dn to CP; see Figure 8									
		V_{CC} = 2.0 V		5	0	-	5	-	5	-	ns
		V_{CC} = 4.5 V		5	0	-	5	-	5	-	ns
		V_{CC} = 6.0 V		5	0	-	5	-	5	-	ns
f_{max}	maximum frequency	CP; see Figure 7									
		V_{CC} = 2.0 V		6.0	37	-	4.8	-	4.0	-	MHz
		V_{CC} = 4.5 V		30	112	-	24	-	20	-	MHz
		V_{CC} = 5 V; C_L = 15 pF		-	123	-	-	-	-	-	MHz
		V_{CC} = 6.0 V		35	133	-	28	-	24	-	MHz

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Table 7. Dynamic characteristics *...continued*

Voltages are referenced to GND (ground = 0 V); C_L = 50 pF unless otherwise specified; for test circuit see Figure 10.

Symbol	Parameter	Conditions		25 °C			–40 °C to +85 °C		–40 °C to +125 °C		Unit
				Min	Typ	Max	Min	Max	Min	Max	
C_{PD}	power dissipation capacitance	C_L = 50 pF; f = 1 MHz; V_I = GND to V_{CC}	[5]	-	22	-	-	-	-	-	pF
For type 74HCT574											
t_{pd}	propagation delay	CP to Qn; see Figure 7	[1]								
		V_{CC} = 4.5 V		-	18	33	-	41	-	50	ns
		V_{CC} = 5 V; C_L = 15 pF		-	15	-	-	-	-	-	ns
t_{en}	enable time	$\overline{OE}$ to Qn; see Figure 9	[2]								
		V_{CC} = 4.5 V		-	19	33	-	41	-	50	ns
t_{dis}	disable time	$\overline{OE}$ to Qn; see Figure 9	[3]								
		V_{CC} = 4.5 V		-	16	28	-	35	-	42	ns
t_t	transition time	Qn; see Figure 7	[4]								
		V_{CC} = 4.5 V		-	5	12	-	15	-	18	ns
t_W	pulse width	CP HIGH or LOW; see Figure 8									
		V_{CC} = 4.5 V		16	7	-	20	-	24	-	ns
t_{su}	set-up time	Dn to CP; see Figure 8									
		V_{CC} = 4.5 V		12	3	-	15	-	18	-	ns
t_h	hold time	Dn to CP; see Figure 8									
		V_{CC} = 4.5 V		5	–1	-	5	-	5	-	ns
f_{max}	maximum frequency	CP; see Figure 7									
		V_{CC} = 4.5 V		30	69	-	24	-	20	-	MHz
		V_{CC} = 5 V; C_L = 15 pF		-	76	-	-	-	-	-	MHz
C_{PD}	power dissipation capacitance	C_L = 50 pF; f = 1 MHz; V_I = GND to V_{CC}	[5]	-	25	-	-	-	-	-	pF

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

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

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

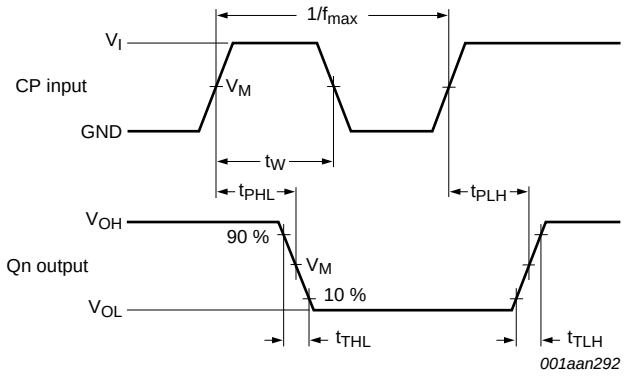
[4] t_t is the same as t_{THL} and t_{TLH}.

[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.

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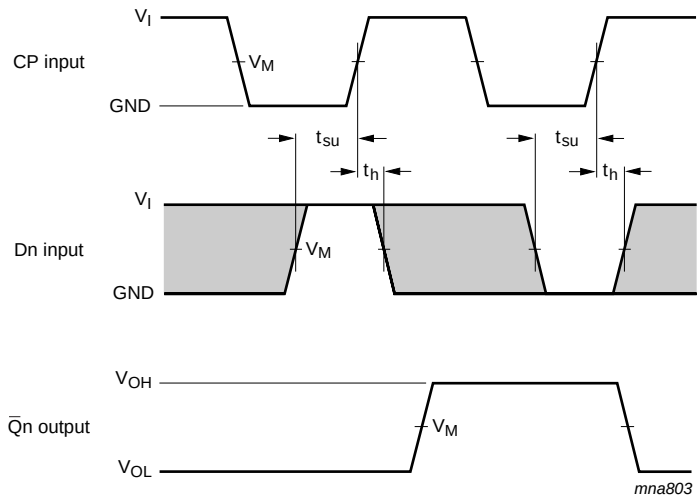
11. Waveforms



Measurement points are given in Table 8.

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

Fig 7. Propagation delay input (CP) to output (Qn), output transition time, clock input (CP) pulse width and the maximum frequency (CP)



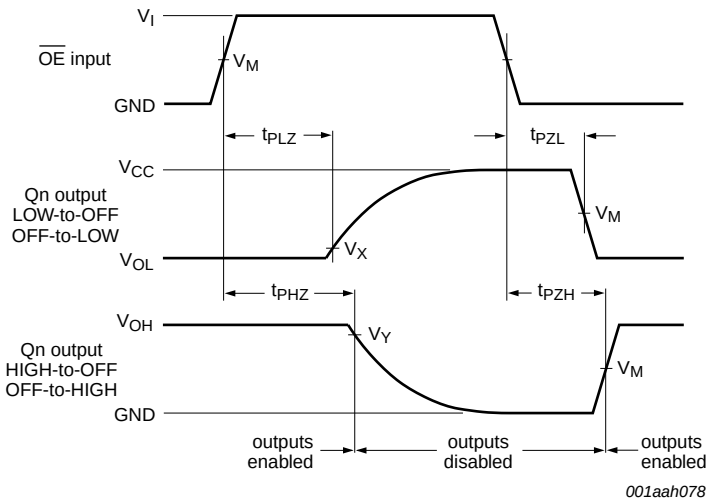
Measurement points are given in Table 8.

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

Fig 8. The data input (D) to clock input (CP) set-up times and clock input (CP) to data input (D) hold times

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Measurement points are given in Table 8.

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

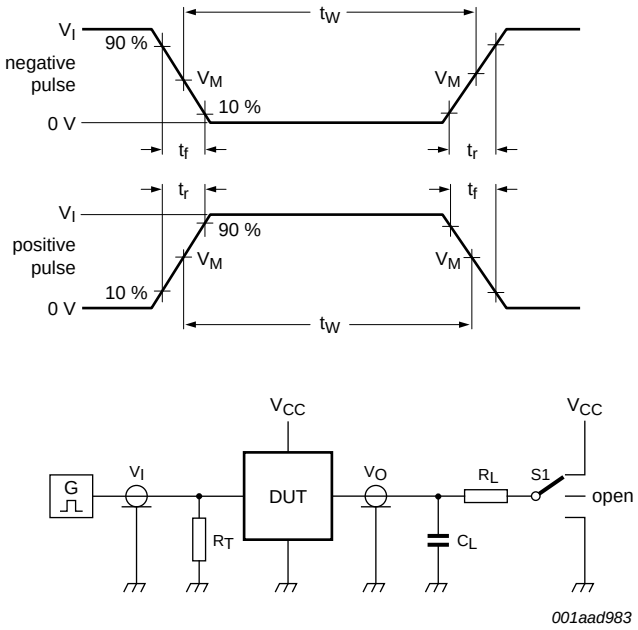
Fig 9. Enable and disable times

Table 8. Measurement points

Type	Input	Output		
	V_M	V_M	V_X	V_Y
74HC574	$0.5V_{CC}$	$0.5V_{CC}$	$0.1V_{CC}$	$0.9V_{CC}$
74HCT574	1.3 V	1.3 V	$0.1V_{CC}$	$0.9V_{CC}$

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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 10. Test circuit for measuring switching times

Table 9. Test data

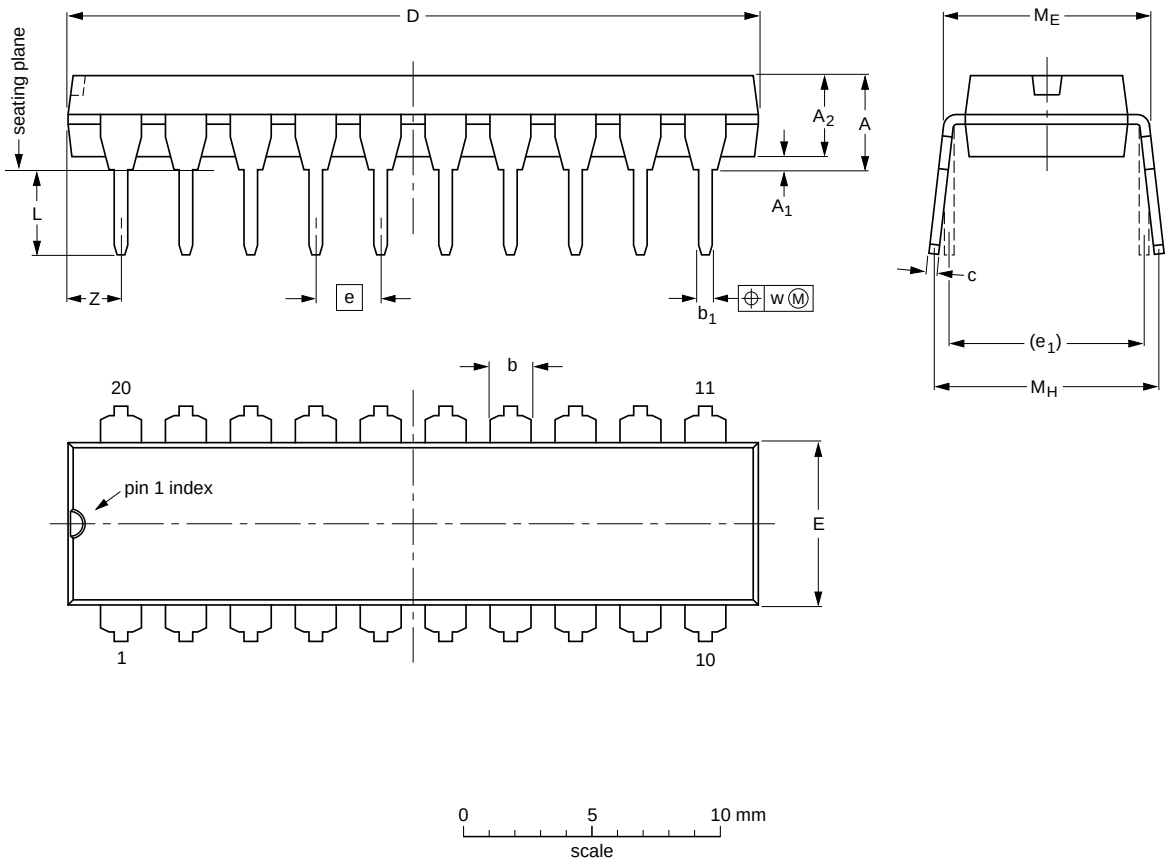
Type	Input		Load		S1 position		
	V_I	t_r, t_f	C_L	R_L	t_{PHL}, t_{PLH}	t_{PZH}, t_{PHZ}	t_{PZL}, t_{PLZ}
74HC574	V_{CC}	6 ns	15 pF, 50 pF	1 kΩ	open	GND	V_{CC}
74HCT574	3 V	6 ns	15 pF, 50 pF	1 kΩ	open	GND	V_{CC}

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12. Package outline

DIP20: plastic dual in-line package; 20 leads (300 mil) **SOT146-1**



DIMENSIONS (inch dimensions are derived from the original mm dimensions)

UNIT	A max.	A_1 min.	A_2 max.	b	b_1	c	D (1)	E (1)	e	e_1	L	M_E	M_H	w	Z (1) max.
mm	4.2	0.51	3.2	1.73 1.30	0.53 0.38	0.36 0.23	26.92 26.54	6.40 6.22	2.54	7.62	3.60 3.05	8.25 7.80	10.0 8.3	0.254	2
inches	0.17	0.02	0.13	0.068 0.051	0.021 0.015	0.014 0.009	1.060 1.045	0.25 0.24	0.1	0.3	0.14 0.12	0.32 0.31	0.39 0.33	0.01	0.078

Note

1. Plastic or metal protrusions of 0.25 mm (0.01 inch) maximum per side are not included.

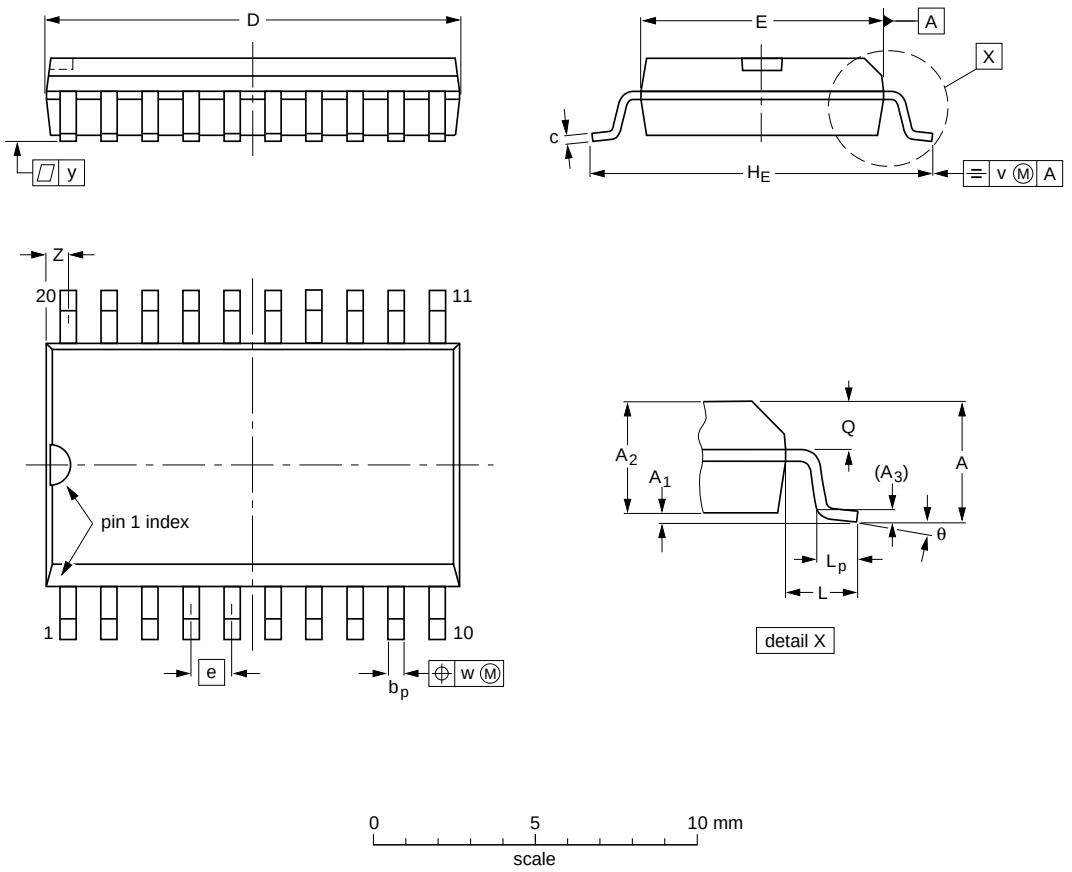
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT146-1		MS-001	SC-603			~~99-12-27~~ 03-02-13

Fig 11. Package outline SOT146-1 (DIP20)

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SO20: plastic small outline package; 20 leads; body width 7.5 mm **SOT163-1**



DIMENSIONS (inch dimensions are derived from the original mm dimensions)

UNIT	A max.	A_1	A_2	A_3	b_p	c	D (1)	E (1)	e	H_E	L	L_p	Q	v	w	y	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^o 0^o
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	

Note

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

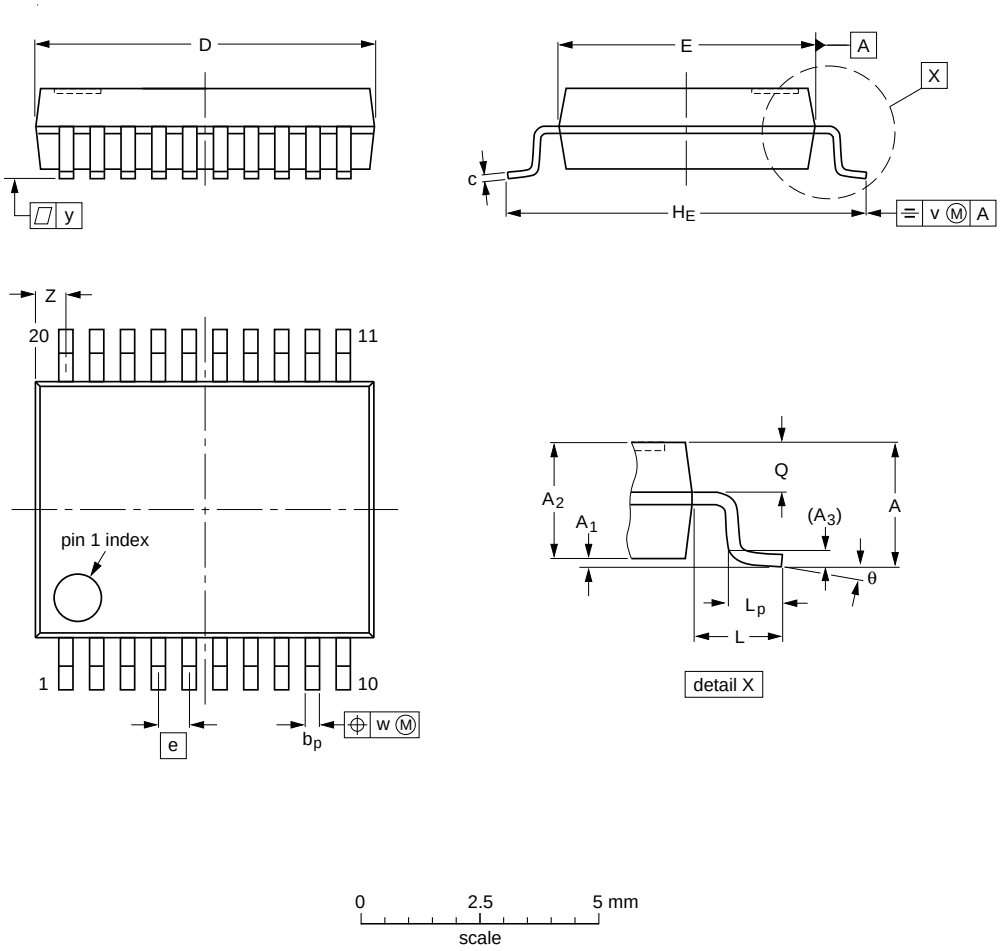
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT163-1	075E04	MS-013				~~99-12-27~~ 03-02-19

Fig 12. Package outline SOT163-1 (SO20)

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SSOP20: plastic shrink small outline package; 20 leads; body width 5.3 mm **SOT339-1**



DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A_1	A_2	A_3	b_p	c	$D^{(1)}$	$E^{(1)}$	e	H_E	L	L_p	Q	v	w	y	$Z^{(1)}$	θ
mm	2	0.21 0.05	1.80 1.65	0.25	0.38 0.25	0.20 0.09	7.4 7.0	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	0.9 0.5	8^o 0^o

Note

1. Plastic or metal protrusions of 0.2 mm maximum per side are not included.

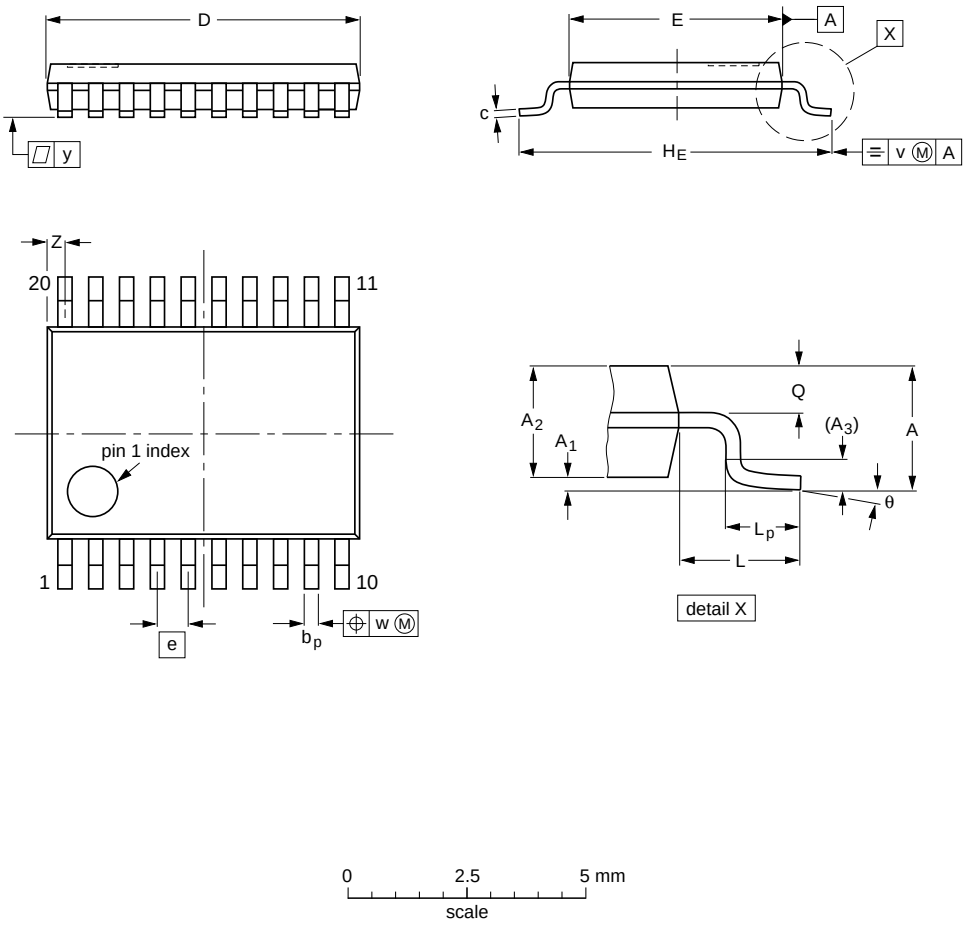
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT339-1		MO-150				~~99-12-27~~ 03-02-19

Fig 13. Package outline SOT339-1 (SSOP20)

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TSSOP20: plastic thin shrink small outline package; 20 leads; body width 4.4 mm **SOT360-1**



DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A_1	A_2	A_3	b_p	c	D (1)	E (2)	e	H_E	L	L_p	Q	v	w	y	Z (1)	θ
mm	1.1	0.15 0.05	0.95 0.80	0.25	0.30 0.19	0.2 0.1	6.6 6.4	4.5 4.3	0.65	6.6 6.2	1	0.75 0.50	0.4 0.3	0.2	0.13	0.1	0.5 0.2	8^o 0^o

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	JEITA			
SOT360-1		MO-153				~~99-12-27~~ 03-02-19

Fig 14. Package outline SOT360-1 (TSSOP20)

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13. Abbreviations

Table 10. Abbreviations

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

14. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74HC_HCT574 v.5	20120425	Product data sheet	-	74HC_HCT574 v.4
Modifications:	• V_X and V_Y measurement points added to Table 8.			
74HC_HCT574 v.4	20111219	Product data sheet	-	74HC_HCT574 v.3
Modifications:	• Legal pages updated.			
74HC_HCT574 v.3	20101215	Product data sheet	-	74HC_HCT574_CNV v.2
74HC_HCT574_CNV v.2	19970827	Product specification	-	-

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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".

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