74HC574; 74HCT574

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

Rev. 9 — 20 October 2022 Product data sheet

1. General description

The 74HC574; 74HCT574 is an 8-bit positive-edge triggered D-type flip-flop with 3-state outputs. The device features a clock (CP) and output enable ($\overline{OE}$) inputs. The flip-flops will store the state of their individual D-inputs that meet the set-up and hold time requirements on the LOW-to-HIGH clock (CP) transition. A HIGH on $\overline{OE}$ causes the outputs to assume a high-impedance OFF-state. Operation of the $\overline{OE}$ input does not affect the state of the flip-flops. Inputs include clamp diodes. This enables 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
- CMOS low power dissipation
- High noise immunity
- Latch-up performance exceeds 100 mA per JESD 78 Class II Level B
- Complies with JEDEC standards:
  - JESD8C (2.7 V to 3.6 V)
  - JESD7A (2.0 V to 6.0 V)
- Input levels:
  - For 74HC574: CMOS level
  - For 74HCT574: TTL level
- 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 kV
  - 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
74HC574D 74HCT574D	-40 °C to +125 °C	SO20	plastic small outline package; 20 leads; body width 7.5 mm	SOT163-1
74HC574PW 74HCT574PW	-40 °C to +125 °C	TSSOP20	plastic thin shrink small outline package; 20 leads; body width 4.4 mm	SOT360-1
74HC574BQ	-40 °C to +125 °C	DHVQFN20	plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 20 terminals; body 2.5 × 4.5 × 0.85 mm	SOT764-1

4. Functional diagram

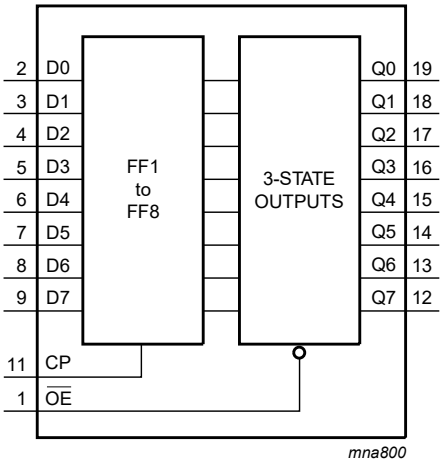


Fig. 1. Functional diagram

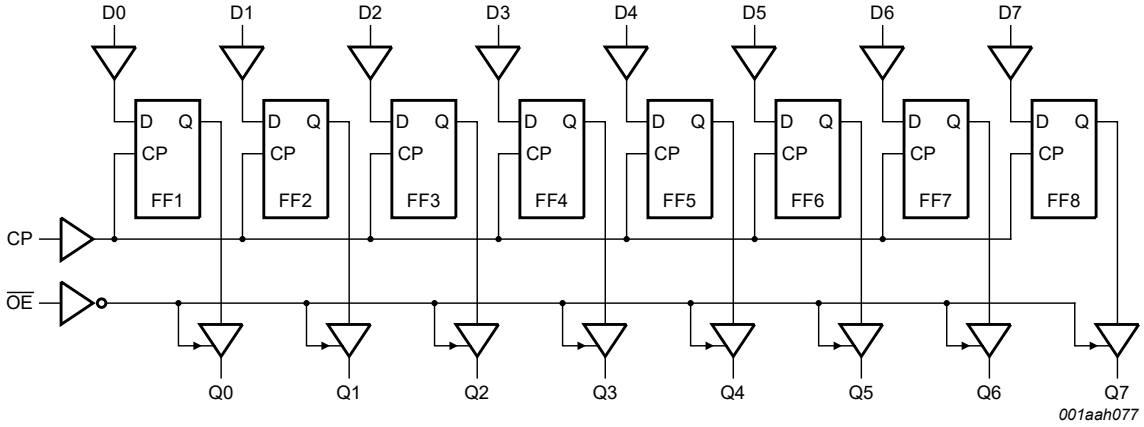


Fig. 2. Logic diagram

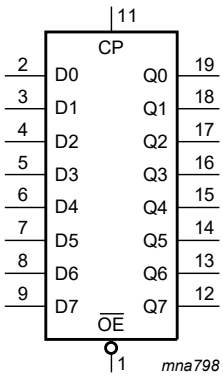


Fig. 3. Logic symbol

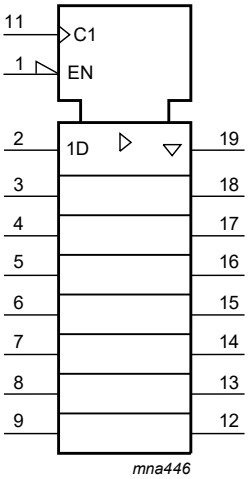
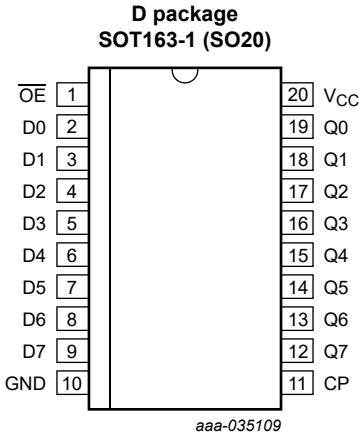
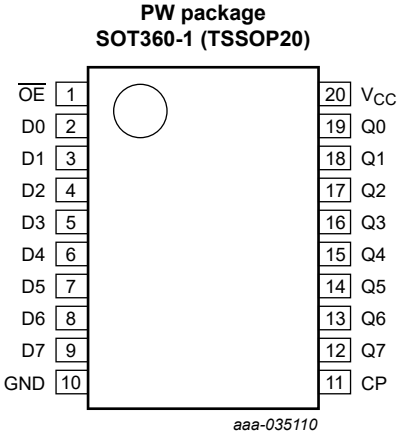


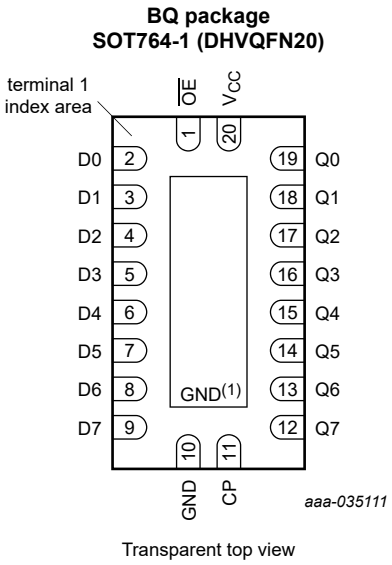
Fig. 4. IEC logic symbol

5. Pinning information

5.1. Pinning







(1) This is not a ground pin. There is no electrical or mechanical requirement to solder the pad. In case soldered, the solder land should remain floating or connected to GND.

5.2. Pin description

Table 2. Pin description

Symbol	Pin	Description
$\overline{OE}$	1	3-state output enable input (active LOW)
D0, D1, D2, D3, D4, D5, D6, D7	2, 3, 4, 5, 6, 7, 8, 9	data inputs
GND	10	ground (0 V)
CP	11	clock input (LOW-to-HIGH, edge triggered)
Q0, Q1, Q2, Q3, Q4, Q5, Q6, Q7	19, 18, 17, 16, 15, 14, 13, 12	3-state flip-flop outputs
V_{CC}	20	supply voltage

6. Functional description

Table 3. Function table

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.

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

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	[1]	-	500	mW

[1] For SOT163-1 (SO20) package: P_{tot} derates linearly with 12.3 mW/K above 109 °C.
For SOT360-1 (TSSOP20) package: P_{tot} derates linearly with 10.0 mW/K above 100 °C.
For SOT764-1 (DHVQFN20) package: P_{tot} derates linearly with 12.9 mW/K above 111 °C.

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
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).

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_{CC} = 6.0 V; V_O = V_{CC} or GND	-	-	±0.5	-	±5.0	-	±10.0	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

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
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	-	-	±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

10. Dynamic characteristics

Table 7. Dynamic characteristics

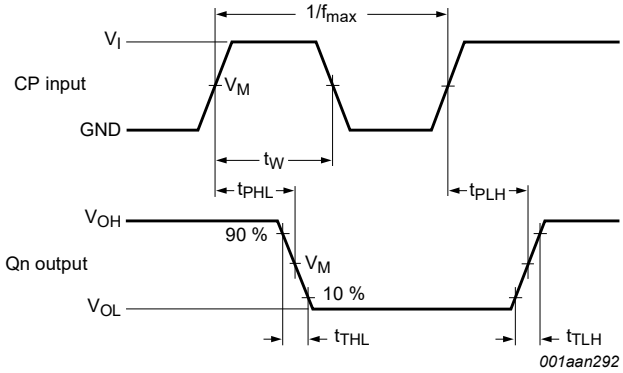
Voltages are referenced to GND (ground = 0 V); C_L = 50 pF unless otherwise specified; for test circuit see Fig. 8.

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
74HC574										
t_{pd}	propagation delay	CP to Qn; see Fig. 5 [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 Fig. 7 [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 Fig. 7 [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 Fig. 5 [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 Fig. 6								
		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 Fig. 6								
		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 Fig. 6								
		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 Fig. 5								
		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
C_{PD}	power dissipation capacitance	C_L = 50 pF; f = 1 MHz; V_I = GND to V_{CC} [5]	-	22	-	-	-	-	-	pF

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
74HCT574										
t_{pd}	propagation delay	CP to Qn; see Fig. 5 [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 Fig. 7 [2]								
		V_{CC} = 4.5 V	-	19	33	-	41	-	50	ns
t_{dis}	disable time	$\overline{OE}$ to Qn; see Fig. 7 [3]								
		V_{CC} = 4.5 V	-	16	28	-	35	-	42	ns
t_t	transition time	Qn; see Fig. 5 [4]								
		V_{CC} = 4.5 V	-	5	12	-	15	-	18	ns
t_W	pulse width	CP HIGH or LOW; see Fig. 6								
		V_{CC} = 4.5 V	16	7	-	20	-	24	-	ns
t_{su}	set-up time	Dn to CP; see Fig. 6								
		V_{CC} = 4.5 V	12	3	-	15	-	18	-	ns
t_h	hold time	Dn to CP; see Fig. 6								
		V_{CC} = 4.5 V	5	-1	-	5	-	5	-	ns
f_{max}	maximum frequency	CP; see Fig. 5								
		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} - 1.5 V [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.

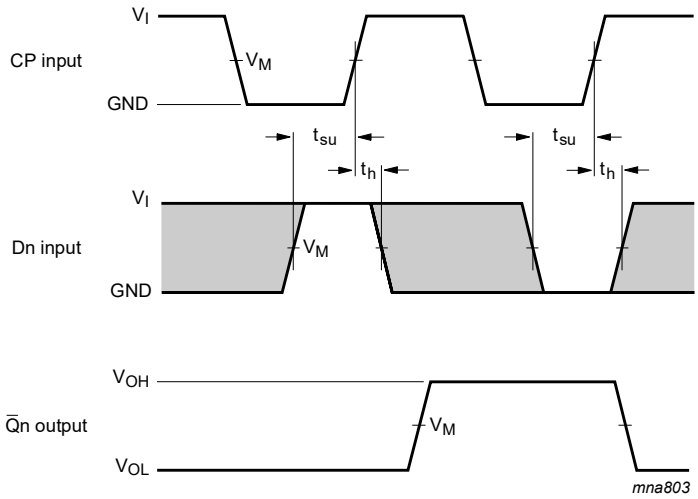
10.1. Waveforms and test circuit



Measurement points are given in Table 8.

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

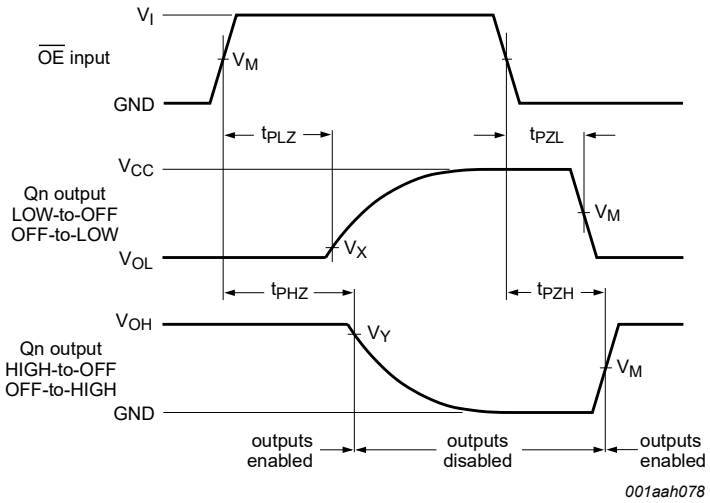
Fig. 5. Propagation delay input (CP) to output (Qn), output transition time, clock input (CP) pulse width and the maximum frequency (CP)



Measurement points are given in Table 8.

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

Fig. 6. The data input (D) to clock input (CP) set-up times and clock input (CP) to data input (D) hold times



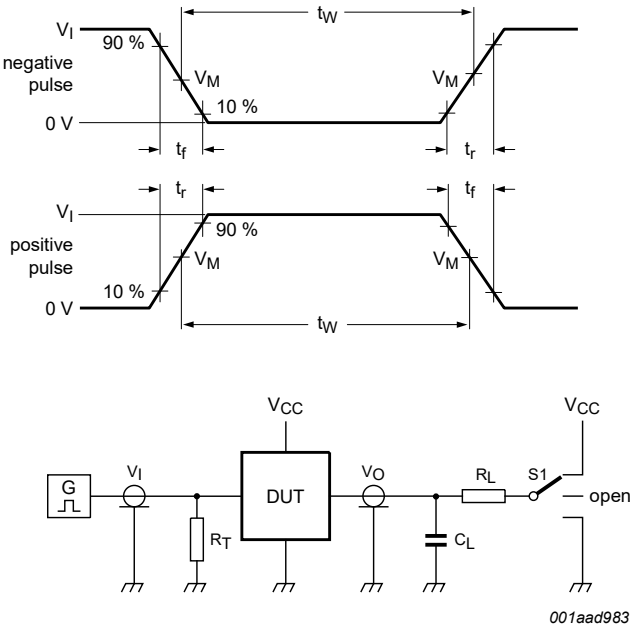
Measurement points are given in Table 8.

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

Fig. 7. Enable and disable times

Table 8. Measurement points

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

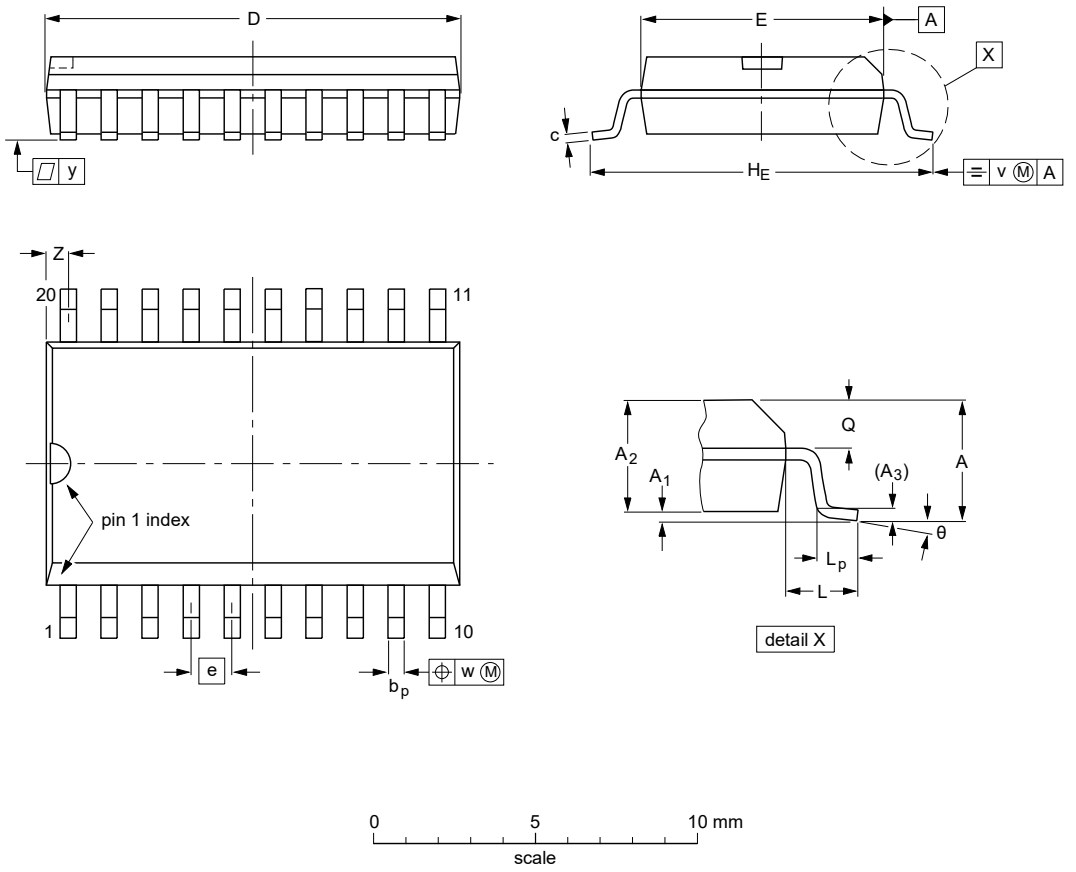
Fig. 8. Test circuit for measuring switching times

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}

11. Package outline

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° 0°
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	

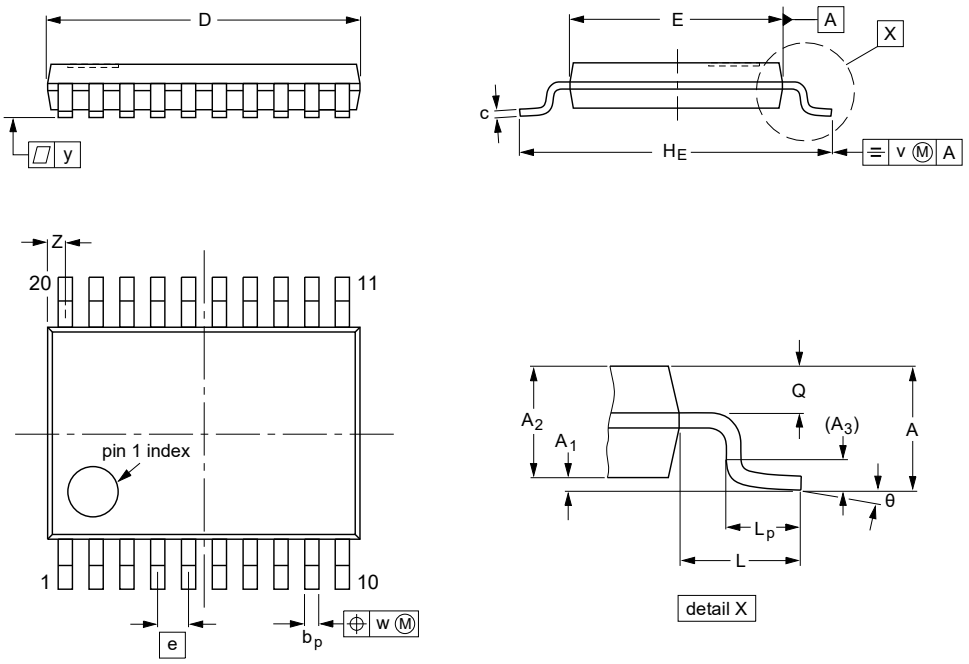
Note

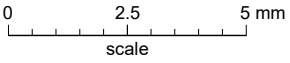
1. Plastic or metal protrusions of 0.15 mm (0.006 inch) maximum per side are not included.

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

Fig. 9. Package outline SOT163-1 (SO20)

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° 0°

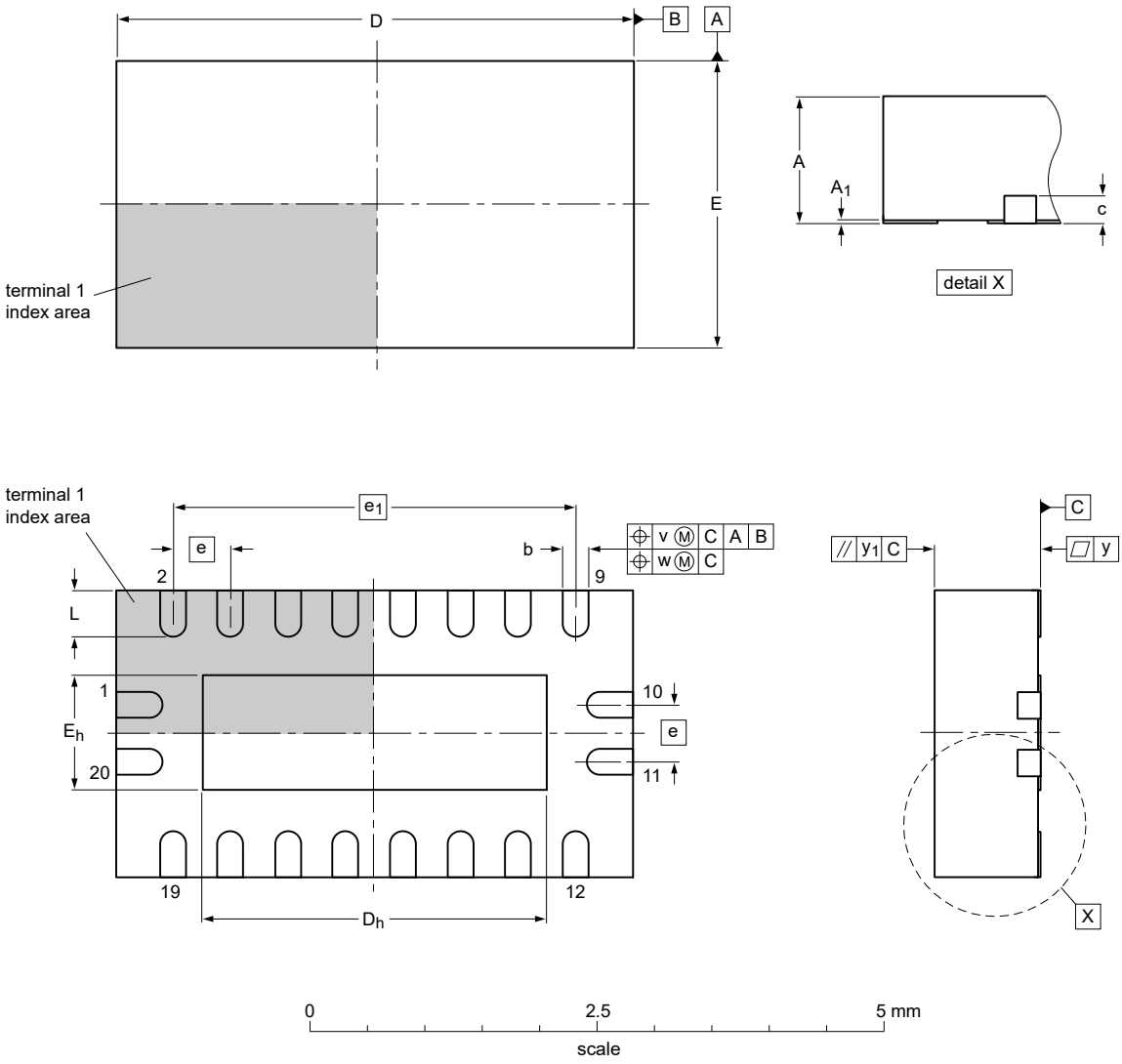
Notes

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. 10. Package outline SOT360-1 (TSSOP20)

DHVQFN20: plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 20 terminals; body 2.5 x 4.5 x 0.85 mm **SOT764-1**



Dimensions (mm are the original dimensions)

Unit		$A^{(1)}$	A_1	b	c	$D^{(1)}$	D_h	$E^{(1)}$	E_h	e	e_1	L	v	w	y	y_1
	max	1.00	0.05	0.30		4.6	3.15	2.6	1.15			0.5				
mm	nom	0.90	0.02	0.25	0.2	4.5	3.00	2.5	1.00	0.5	3.5	0.4	0.1	0.05	0.05	0.1
	min	0.80	0.00	0.18		4.4	2.85	2.4	0.85			0.3				

Note
1. Plastic or metal protrusions of 0.075 mm maximum per side are not included.

sot764-1_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT764-1	- - -	MO-241	- - -			~~03-01-27~~ 14-12-12

Fig. 11. Package outline SOT764-1 (DHVQFN20)

12. Abbreviations

Table 10. 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

13. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74HC_HCT574 v.9	20221020	Product data sheet	-	74HC_HCT574 v.8
Modifications:	• Type number 74HC574BQ (SOT764-1/DHVQFN20) added.			
74HC_HCT574 v.8	20210730	Product data sheet	-	74HC_HCT574 v.7
Modifications:	• 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 numbers 74HC574DB and 74HCT574DB (SOT339-1/SSOP20) removed. • Section 2 updated. • Section 7: Derating values for P_{tot} total power dissipation updated.			
74HC_HCT574 v.7	20160304	Product data sheet	-	74HC_HCT574 v.6
Modifications:	• Type numbers 74HC574N and 74HCT574N (SOT146-1) removed.			
74HC_HCT574 v.6	20150126	Product data sheet	-	74HC_HCT574 v.5
Modifications:	• Section 7: Power dissipation capacitance condition for 74HCT574 is corrected.			
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	-	-

14. 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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For more information, please visit: http://www.nexperia.com
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