



# 74HC9114; 74HCT9114

Nine wide Schmitt trigger buffer; open drain outputs;  
inverting

Rev. 5 — 5 August 2024

Product data sheet

## 1. General description

The 74HC9114; 74HCT9114 is a 9-bit inverter with Schmitt trigger inputs and open drain outputs. This device features reduced input threshold levels to allow interfacing to TTL logic levels. Inputs also 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

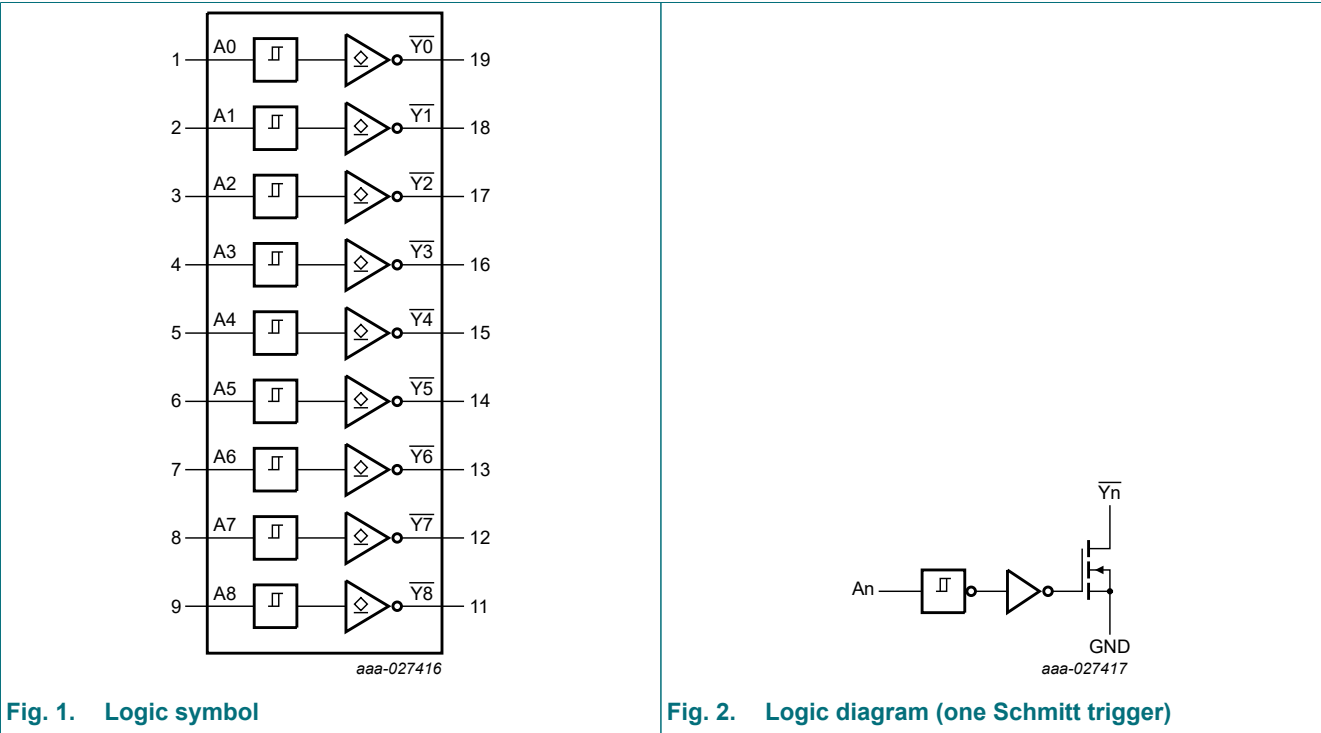
- Wide operating voltage 2.0 V to 6.0 V
- CMOS low power dissipation
- High noise immunity
- Unlimited input rise and fall times
- Latch-up performance exceeds 100 mA per JESD 78 Class II Level B
- Complies with JEDEC standards:
  - JESD8C (2.7 V to 3.6 V)
  - JESD7A (2.0 V to 6.0 V)
- ESD protection:
  - HBM: ANSI/ESDA/JEDEC JS-001 class 2 exceeds 2000 V
  - CDM: ANSI/ESDA/JEDEC JS-002 class C3 exceeds 1000 V
- Specified from -40 °C to +85 °C and from -40 °C to +125 °C

## 3. Ordering information

Table 1. Ordering information

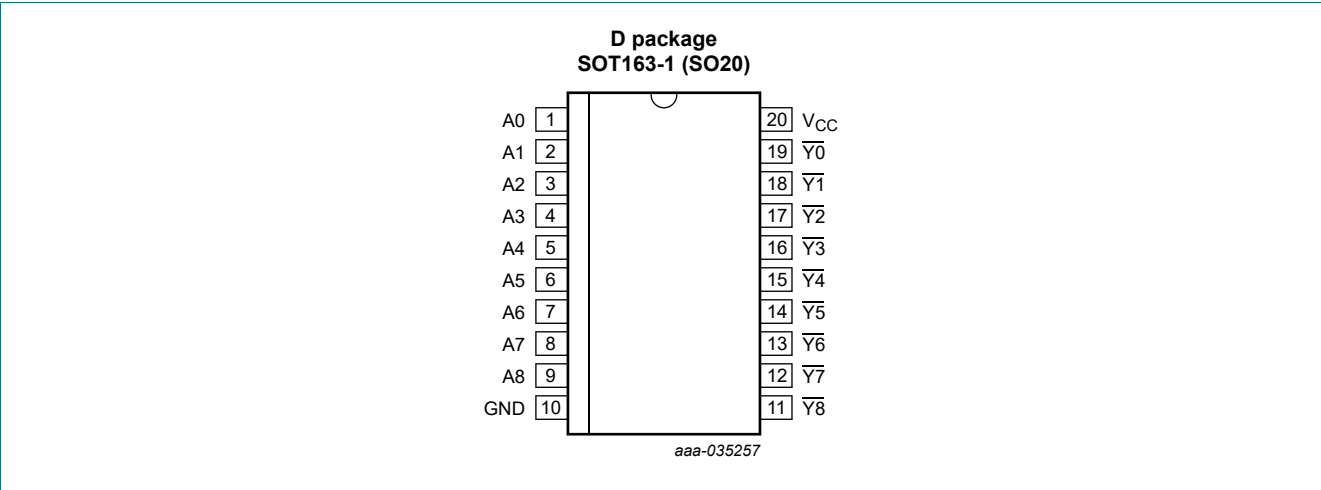
Type number	Package			
	Temperature range	Name	Description	Version
<a href="#">74HC9114D</a> <a href="#">74HCT9114D</a>	-40 °C to +125 °C	SO20	plastic small outline package; 20 leads; body width 7.5 mm	<a href="#">SOT163-1</a>

4. Functional diagram



5. Pinning information

5.1. Pinning



5.2. Pin description

Table 2. Pin description

Symbol	Pin	Description
A0, A1, A2, A3, A4, A5, A6, A7, A8	1, 2, 3, 4, 5, 6, 7, 8, 9	data input
GND	10	ground (0 V)
Y0, Y1, Y2, Y3, Y4, Y5, Y6, Y7, Y8	19, 18, 17, 16, 15, 14, 13, 12, 11	data output
V <sub>CC</sub>	20	supply voltage

6. Functional description

Table 3. Function table

H = HIGH voltage level; L = LOW voltage level; Z = high-impedance OFF-state.

Input	Output
A <sub>n</sub>	Y <sub>n</sub>
L	Z
H	L

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 <sub>CC</sub>	supply voltage		-0.5	+7.0	V
I <sub>IK</sub>	input clamping current	V <sub>I</sub> < -0.5 V or V <sub>I</sub> > V <sub>CC</sub> + 0.5 V [1]	-	±20	mA
I <sub>OK</sub>	output clamping current	V <sub>O</sub> < -0.5 V or V <sub>O</sub> > V <sub>CC</sub> + 0.5 V [1]	-	±20	mA
I <sub>O</sub>	output current	-0.5 V < V <sub>O</sub> < V <sub>CC</sub> + 0.5 V [1]	-	±25	mA
I <sub>CC</sub>	supply current		-	50	mA
I <sub>GND</sub>	ground current		-50	-	mA
T <sub>stg</sub>	storage temperature		-65	+150	°C
P <sub>tot</sub>	total power dissipation	T <sub>amb</sub> = -40 °C to +125 °C [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<sub>tot</sub> derates linearly with 12.3 mW/K above 109 °C.

8. Recommended operating conditions

Table 5. Recommended operating conditions

Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	74HC9114			74HCT9114			Unit
			Min	Typ	Max	Min	Typ	Max	
V <sub>CC</sub>	supply voltage		2.0	5.0	6.0	4.5	5.0	5.5	V
V <sub>I</sub>	input voltage		0	-	V <sub>CC</sub>	0	-	V <sub>CC</sub>	V
V <sub>O</sub>	output voltage		0	-	V <sub>CC</sub>	0	-	V <sub>CC</sub>	V
T <sub>amb</sub>	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	
74HC9114										
V <sub>OH</sub>	HIGH-level output voltage	V <sub>I</sub> = V <sub>T+</sub> or V <sub>T-</sub>								
		I <sub>O</sub> = -20 µA; V <sub>CC</sub> = 2.0 V	1.9	2.0	-	1.9	-	1.9	-	V
		I <sub>O</sub> = -20 µA; V <sub>CC</sub> = 4.5 V	4.4	4.5	-	4.4	-	4.4	-	V
		I <sub>O</sub> = -20 µA; V <sub>CC</sub> = 6.0 V	5.9	6.0	-	5.9	-	5.9	-	V
		I <sub>O</sub> = -4.0 mA; V <sub>CC</sub> = 4.5 V	3.98	4.32	-	3.84	-	3.7	-	V
		I <sub>O</sub> = -5.2 mA; V <sub>CC</sub> = 6.0 V	5.48	5.81	-	5.34	-	5.2	-	V
V <sub>OL</sub>	LOW-level output voltage	V <sub>I</sub> = V <sub>T+</sub> or V <sub>T-</sub>								
		I <sub>O</sub> = 20 µA; V <sub>CC</sub> = 2.0 V	-	0	0.1	-	0.1	-	0.1	V
		I <sub>O</sub> = 20 µA; V <sub>CC</sub> = 4.5 V	-	0	0.1	-	0.1	-	0.1	V
		I <sub>O</sub> = 20 µA; V <sub>CC</sub> = 6.0 V	-	0	0.1	-	0.1	-	0.1	V
		I <sub>O</sub> = 4.0 mA; V <sub>CC</sub> = 4.5 V	-	0.15	0.26	-	0.33	-	0.4	V
		I <sub>O</sub> = 5.2 mA; V <sub>CC</sub> = 6.0 V	-	0.16	0.26	-	0.33	-	0.4	V
I <sub>I</sub>	input leakage current	V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 6.0 V	-	-	±0.1	-	±1.0	-	±1.0	µA
I <sub>CC</sub>	supply current	V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 6.0 V	-	-	8.0	-	80	-	160	µA
C <sub>I</sub>	input capacitance		-	3.5	-	-	-	-	-	pF
74HCT9114										
V <sub>OH</sub>	HIGH-level output voltage	V <sub>I</sub> = V <sub>T+</sub> or V <sub>T-</sub> ; V <sub>CC</sub> = 4.5 V								
		I <sub>O</sub> = -20 µA	4.4	4.5	-	4.4	-	4.4	-	V
		I <sub>O</sub> = -4.0 mA	3.98	4.32	-	3.84	-	3.7	-	V
V <sub>OL</sub>	LOW-level output voltage	V <sub>I</sub> = V <sub>T+</sub> or V <sub>T-</sub> ; V <sub>CC</sub> = 4.5 V								
		I <sub>O</sub> = 20 µA;	-	0	0.1	-	0.1	-	0.1	V
		I <sub>O</sub> = 4.0 mA;	-	0.15	0.26	-	0.33	-	0.4	V
I <sub>I</sub>	input leakage current	V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 5.5 V	-	-	±0.1	-	±1.0	-	±1.0	µA
I <sub>CC</sub>	supply current	V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 5.5 V	-	-	8.0	-	80	-	160	µA
ΔI <sub>CC</sub>	additional supply current	per An input pin; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 4.5 V to 5.5 V; V <sub>I</sub> = V <sub>CC</sub> - 2.1 V; other inputs at V <sub>CC</sub> or GND	-	30	108	-	135	-	147	µA
C <sub>I</sub>	input capacitance		-	3.5	-	-	-	-	-	pF

10. Dynamic characteristics

Table 7. Dynamic characteristics

GND = 0 V; C<sub>L</sub> = 50 pF; for test circuit see Fig. 4.

Symbol	Parameter	Conditions	+25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
74HC9114										
t <sub>pd</sub>	propagation delay	An to $\overline{Yn}$ ; see <a href="#">Fig. 3</a> [1]								
		V <sub>CC</sub> = 2.0 V	-	36	110	-	140	-	165	ns
		V <sub>CC</sub> = 4.5 V	-	13	22	-	28	-	33	ns
		V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 15 pF	-	12	-	-	-	-	-	ns
		V <sub>CC</sub> = 6.0 V	-	10	19	-	24	-	28	ns
t <sub>THL</sub>	HIGH to LOW output transition time	$\overline{Yn}$ ; see <a href="#">Fig. 3</a>								
		V <sub>CC</sub> = 2.0 V	-	19	75	-	95	-	110	ns
		V <sub>CC</sub> = 4.5 V	-	7	15	-	19	-	22	ns
		V <sub>CC</sub> = 6.0 V	-	6	13	-	16	-	19	ns
C <sub>PD</sub>	power dissipation capacitance	per buffer; V <sub>I</sub> = GND to V <sub>CC</sub> [2]	-	5	-	-	-	-	-	pF
74HCT9114										
t <sub>pd</sub>	propagation delay	An to $\overline{Yn}$ ; see <a href="#">Fig. 3</a> [1]								
		V <sub>CC</sub> = 4.5 V	-	17	31	-	39	-	47	ns
		V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 15 pF	-	13	-	-	-	-	-	ns
t <sub>THL</sub>	HIGH to LOW output transition time	$\overline{Yn}$ ; V <sub>CC</sub> = 4.5 V; see <a href="#">Fig. 3</a>	-	7	15	-	19	-	22	ns
C <sub>PD</sub>	power dissipation capacitance	per buffer; V <sub>I</sub> = GND to V <sub>CC</sub> - 1.5 V [2]	-	5	-	-	-	-	-	pF

[1] t<sub>pd</sub> is the same as t<sub>PLZ</sub> and t<sub>PZL</sub>.

[2] C<sub>PD</sub> is used to determine the dynamic power dissipation (P<sub>D</sub> in μW):  
P<sub>D</sub> = C<sub>PD</sub> × V<sub>CC</sub><sup>2</sup> × f<sub>i</sub> × N + Σ (C<sub>L</sub> × V<sub>CC</sub><sup>2</sup> × f<sub>o</sub>) where:  
f<sub>i</sub> = input frequency in MHz;  
f<sub>o</sub> = output frequency in MHz;  
C<sub>L</sub> = output load capacitance in pF;  
V<sub>CC</sub> = supply voltage in V;  
N = number of inputs switching;  
Σ (C<sub>L</sub> × V<sub>CC</sub><sup>2</sup> × f<sub>o</sub>) = sum of outputs.

10.1. Waveforms and test circuit

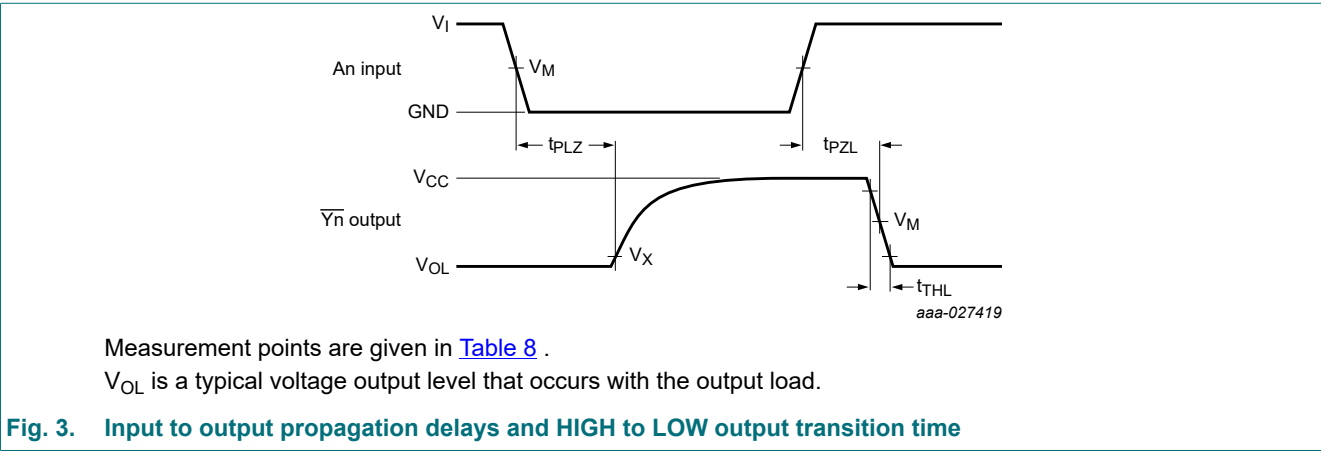


Table 8. Measurement points

Type	Input	Output	
	$V_M$	$V_M$	$V_X$
74HC9114	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$	$0.1 \times V_{CC}$
74HCT9114	1.3 V	1.3 V	$0.1 \times V_{CC}$

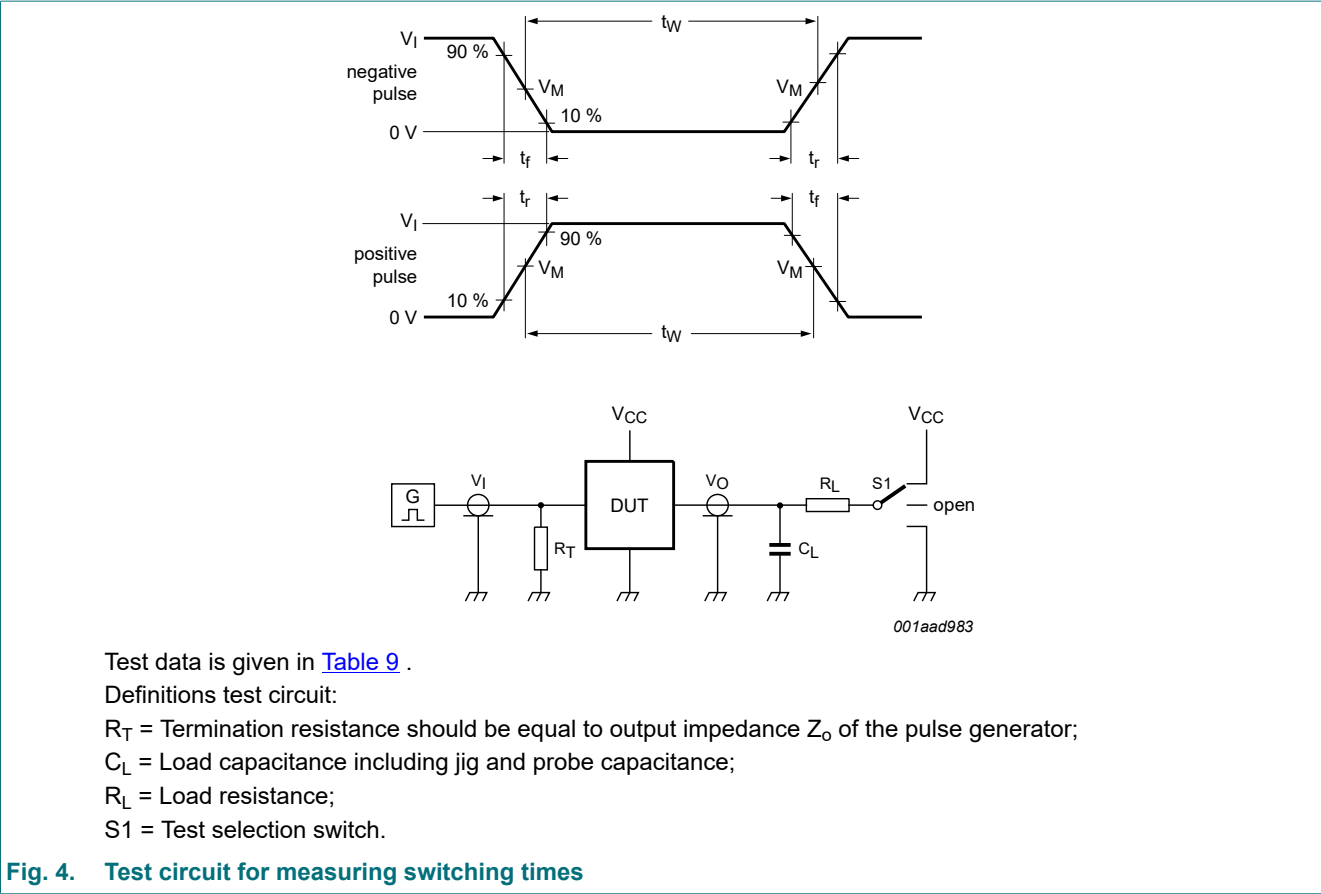


Table 9. Test data

Type	Input		Load		S1 position	
	$V_I$	$t_r, t_f$	$C_L$	$R_L$	$t_{PHL}, t_{PLH}$	$t_{PZL}, t_{PLZ}$
74HC9114	$V_{CC}$	6 ns	15 pF, 50 pF	1 k $\Omega$	open	$V_{CC}$
74HCT9114	3 V	6 ns	15 pF, 50 pF	1 k $\Omega$	open	$V_{CC}$

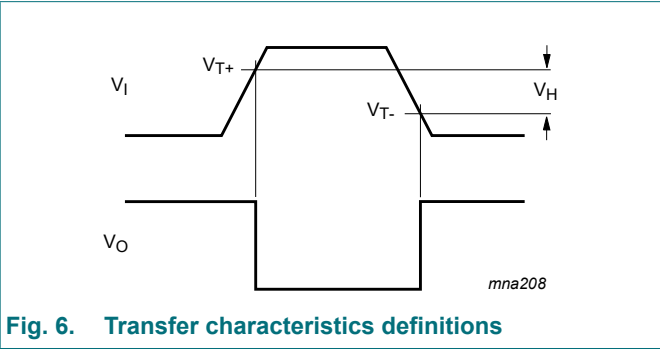
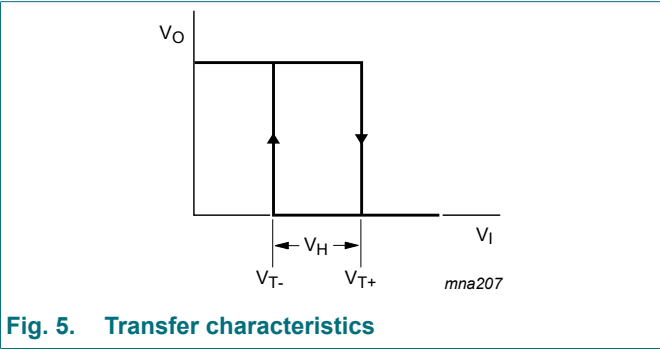
11. Transfer characteristics

Table 10. Transfer characteristics

At recommended operating conditions; voltages are referenced to GND (ground = 0 V); see Fig. 5 and Fig. 6.

Symbol	Parameter	Conditions	+25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
74HC9114										
V <sub>T+</sub>	positive-going threshold voltage	V <sub>CC</sub> = 2.0 V	0.70	1.13	1.50	0.70	1.50	0.70	1.50	V
		V <sub>CC</sub> = 4.5 V	1.75	2.37	3.15	1.75	3.15	1.75	3.15	V
		V <sub>CC</sub> = 6.0 V	2.30	3.11	4.20	2.30	4.20	2.30	4.20	V
V <sub>T-</sub>	negative-going threshold voltage	V <sub>CC</sub> = 2.0 V	0.30	0.70	1.10	0.30	1.10	0.30	1.10	V
		V <sub>CC</sub> = 4.5 V	1.35	1.80	2.40	1.35	2.40	1.35	2.40	V
		V <sub>CC</sub> = 6.0 V	1.8	2.43	3.30	1.80	3.30	1.80	3.30	V
V <sub>H</sub>	hysteresis voltage	V <sub>CC</sub> = 2.0 V	0.2	0.43	0.80	0.18	0.80	0.15	0.80	V
		V <sub>CC</sub> = 4.5 V	0.4	0.57	1.00	0.40	1.00	0.40	1.00	V
		V <sub>CC</sub> = 6.0 V	0.5	0.68	1.10	0.50	1.10	0.50	1.10	V
74HCT9114										
V <sub>T+</sub>	positive-going threshold voltage	V <sub>CC</sub> = 4.5 V	0.9	1.50	2.0	0.9	2.0	0.9	2.0	V
		V <sub>CC</sub> = 5.5 V	1.2	1.70	2.1	1.2	2.1	1.2	2.1	V
V <sub>T-</sub>	negative-going threshold voltage	V <sub>CC</sub> = 4.5 V	0.7	1.06	1.4	0.7	1.4	0.7	1.4	V
		V <sub>CC</sub> = 5.5 V	0.8	1.27	1.7	0.8	1.7	0.8	2.7	V
V <sub>H</sub>	hysteresis voltage	V <sub>CC</sub> = 4.5 V	0.2	0.44	0.8	0.2	0.8	0.2	0.8	V
		V <sub>CC</sub> = 5.5 V	0.2	0.44	0.8	0.2	0.8	0.2	0.8	V

11.1. Transfer characteristics waveforms





12. Package outline

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

SOT163-1



Fig. 7. Package outline SOT163-1 (SO20)

13. Abbreviations

Table 11. Abbreviations

Acronym	Description
ANSI	American National Standards Institute
CDM	Charged Device Model
CMOS	Complementary Metal Oxide Semiconductor
DUT	Device Under Test
ESD	ElectroStatic Discharge
ESDA	ElectroStatic Discharge Association
HBM	Human Body Model
JEDEC	Joint Electron Device Engineering Council

14. Revision history

Table 12. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74HC_HCT9114 v.5	20240805	Product data sheet	-	74HC_HCT9114 v.4
Modifications:	<ul style="list-style-type: none"><li><a href="#">Section 2</a>: ESD specification updated according to the latest JEDEC standard.</li></ul>			
74HC_HCT9114 v.4	20231109	Product data sheet	-	74HC_HCT9114 v.3
Modifications:	<ul style="list-style-type: none"><li><a href="#">Section 1</a> and <a href="#">Section 2</a> updated.</li><li><a href="#">Section 7</a>: Derating values for P<sub>tot</sub> total power dissipation updated.</li></ul>			
74HC_HCT9114 v.3	20171002	Product data sheet	-	74HC_HCT9114 v.2
Modifications:	<ul style="list-style-type: none"><li>The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia.</li><li>Legal texts have been adapted to the new company name where appropriate.</li></ul>			
74HC_HCT9114 v.2	19901201	Product specification	-	74HC_HCT9114 v.1
74HC_HCT9114 v.1	19880301	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".
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