74HC9114; 74HCT9114

Nine wide Schmitt trigger buffer; open drain outputs; inverting

Product data sheet

1 **General description**

The 74HC9114; 74HCT9114 is a 9-bit inverter with Schmitt trigger inputs and open drain outputs. 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.

Features and benefits

- Wide operating voltage 2.0 V to 6.0 V
- Schmitt trigger action on all data inputs
- Low-power dissipation
- Complies with JEDEC standard no. 7A
- · ESD protection:
 - HBM JESD22-A114F exceeds 2000 V
 - MM JESD22-A115-A exceeds 200 V
- Specified from -40 °C to +85 °C and from -40 °C to +125 °C

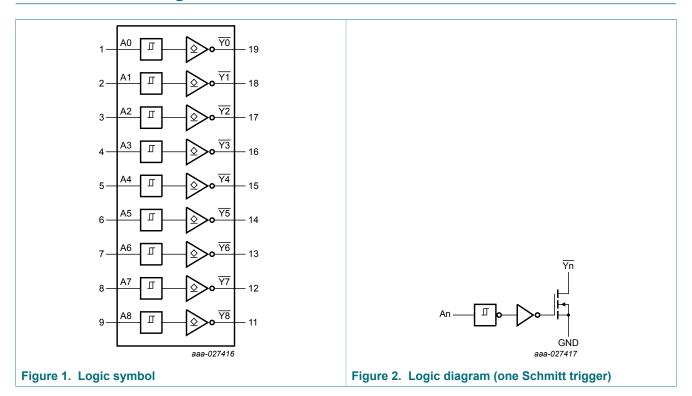
Ordering information

Table 1. Ordering information

| Type number | Package | | | | | | | |
|-------------|-------------------|------|--|----------|--|--|--|--|
| | Temperature range | Name | Description | Version | | | | |
| 74HC9114D | -40 °C to +125 °C | | plastic small outline package; 20 leads; | SOT163-1 | | | | |
| 74HCT9114D | | | body width 7.5 mm | | | | | |

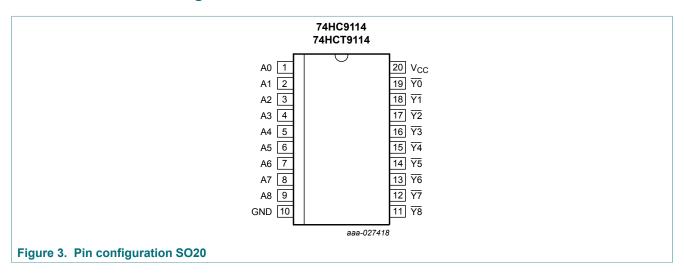


4 Functional diagram



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) |
| <u>Y0, Y1, Y2, Y3, Y4, Y5, Y6, Y7, Y8</u> | 19, 18, 17, 16, 15, 14, 13, 12, 11 | data output |
| Vcc | 20 | supply voltage |

6 Functional description

Table 3. Function table [1]

| Input | Output |
|-------|--------|
| An | Yn |
| L | Z |
| Н | L |

^[1] H = HIGH voltage level; L = LOW voltage level; Z = high-impedance OFF-state.

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 | +7.0 | V |
| I _{IK} | input clamping current | $V_{I} < -0.5 \text{ V or } V_{I} > V_{CC} + 0.5 \text{ V}$ | [1] | - | ±20 | mA |
| lok | output clamping current | V_O < -0.5 V or V_O > V_{CC} + 0.5 V | [1] | - | ±20 | mA |
| Io | output current | $-0.5 \text{ V} < \text{V}_{\text{O}} < \text{V}_{\text{CC}} + 0.5 \text{ V}$ | [1] | - | ±25 | mA |
| I _{CC} | supply current | | | - | 50 | mA |
| I _{GND} | ground current | | | -50 | - | mA |
| T _{stg} | storage temperature | | | -65 | +150 | °C |
| P _{tot} | total power dissipation | T _{amb} = -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] Above 70 °C the value of Ptot derates linearly with 8 mW/K.

8 Recommended operating conditions

Table 5. Recommended operating conditions

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

| Symbol | Parameter | Conditions | 74HC9114 | | | 7 | Unit | | |
|------------------|---------------------|------------|----------|-----|-----------------|-----|------|-----------------|----|
| | | | Min | Тур | Max | 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 | T _{ar} | _{nb} = 25 | °C | T _{amb} = -40 °C to +85 °C | | T _{amb} = -40 °C to +125 °C | | Unit |
|-----------------|---|---|-----------------|--------------------|------|--|------|---|------|------|
| | | | Min | Тур | Max | Min | Max | Min | Max | |
| 74HC911 | 4 | | | | | | | | 1 | |
| V _{OH} | HIGH-level | $V_I = V_{T+}$ or V_{T-} | | | | | | | | |
| | output voltage | I_{O} = -20 μ A; 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 μ A; V_{CC} = 6.0 V | 5.9 | 6.0 | - | 5.9 | - | 5.9 | - | V | |
| | | I_{O} = -4.0 mA; V_{CC} = 4.5 V | 3.98 | 4.32 | - | 3.84 | - | 3.7 | - | V |
| | | I_{O} = -5.2 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 μ A; V_{CC} = 6.0 V | - | 0 | 0.1 | - | 0.1 | - | 0.1 | V |
| | | I_{O} = 4.0 mA; V_{CC} = 4.5 V | - | 0.15 | 0.26 | - | 0.33 | - | 0.4 | V |
| | | $I_O = 5.2 \text{ mA}; V_{CC} = 6.0 \text{ V}$ | - | 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 _{CC} | supply current | $V_I = V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 6.0 \text{ V}$ | - | - | 8.0 | - | 80 | - | 160 | μΑ |
| Cı | input capacitance | | - | 3.5 | - | - | - | - | - | pF |

| Symbol | Parameter | Conditions | T _{ar} | T _{amb} = 25 °C | | | T _{amb} = -40 °C to +85 °C | | T _{amb} = -40 °C to +125 °C | |
|------------------|---------------------------|--|-----------------|--------------------------|------|------|--|-----|---|----|
| | | | Min | Тур | Max | Min | Max | Min | Max | (|
| 74HCT91 | 114 | | | <u> </u> | ' | ' | · | | 1 | |
| V _{OH} | HIGH-level | $V_{I} = V_{T+} \text{ or } V_{T-}; V_{CC} = 4.5 \text{ V}$ | | | | | | | | |
| | output voltage | I _O = -20 μA | 4.4 | 4.5 | - | 4.4 | - | 4.4 | - | V |
| | | I _O = -4.0 mA | 3.98 | 4.32 | - | 3.84 | - | 3.7 | - | V |
| V _{OL} | LOW-level output voltage | $V_{I} = V_{T+} \text{ or } V_{T-}; V_{CC} = 4.5 \text{ V}$ | | | | | | | | |
| | | I _O = 20 μA; | - | 0 | 0.1 | - | 0.1 | - | 0.1 | V |
| | | I _O = 4.0 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 |
| 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 An input pin; $I_O = 0$ A; $V_{CC} = 4.5$ V to 5.5 V; $V_I = V_{CC} - 2.1$ V; other inputs at V_{CC} or GND | - | 30 | 108 | - | 135 | - | 147 | μA |
| Cı | input capacitance | | - | 3.5 | - | - | - | - | - | pF |

10 Dynamic characteristics

Table 7. Dynamic characteristics

 $GND = 0 \ V; \ C_L = 50 \ pF;$ for test circuit see Figure 5.

| Symbol | Parameter | Conditions | Ta | _{mb} = 25 | °C | T _{amb} = -40 ° | C to +125 °C | Unit |
|------------------|-----------------------------------|---|-----|--------------------|-----|--------------------------|-----------------|------|
| | | | Min | Тур | Max | Max (85 °C) | Max (125 °C) | |
| 74HC911 | 4 | | | | | | | , |
| t _{pd} | t _{pd} propagation delay | An to $\overline{\text{Yn}}$; see Figure 4 | | | | | | |
| | | V _{CC} = 2.0 V | - | 36 | 110 | 140 | 165 | ns |
| | V _{CC} = 4.5 V | - | 13 | 22 | 28 | 33 | ns | |
| | | V _{CC} = 5.0 V; C _L = 15 pF | - | 12 | - | - | - | ns |
| | | V _{CC} = 6.0 V | - | 10 | 19 | 24 | 28 | ns |
| t _{THL} | HIGH to LOW | Yn; see Figure 4 | | | | | | |
| | output transition time | V _{CC} = 2.0 V | - | 19 | 75 | 95 | 110 | ns |
| | | V _{CC} = 4.5 V | - | 7 | 15 | 19 | 22 | ns |
| | | V _{CC} = 6.0 V | - | 6 | 13 | 16 | 19 | ns |
| C _{PD} | power dissipation capacitance | per buffer; V _I = GND to V _{CC} [2] | - | 5 | - | - | - | pF |

| Symbol | Parameter | Conditions | Ta | _{mb} = 25 | °C | T _{amb} = -40 ° | T_{amb} = -40 °C to +125 °C | | |
|------------------|------------------------------------|---|-----|--------------------|-----|--------------------------|-------------------------------|----|--|
| | | | Min | Тур | Max | Max (85 °C) | Max (125 °C) | | |
| 74HCT91 | 14 | | | ' | ' | ' | | | |
| t _{pd} | propagation delay | An to Yn; see Figure 4 |] | | | | | | |
| | | V _{CC} = 4.5 V | - | 17 | 31 | 39 | 47 | ns | |
| | | $V_{CC} = 5.0 \text{ V}; C_L = 15 \text{ pF}$ | - | 13 | - | - | - | ns | |
| t _{THL} | HIGH to LOW output transition time | Yn; V _{CC} = 4.5 V; see Figure 4 | - | 7 | 15 | 19 | 22 | ns | |
| C _{PD} | power dissipation capacitance | per buffer; [2] V _I = GND to V _{CC} - 1.5 V | _ | 5 | - | - | - | pF | |

[1] t_{pd} is the same as t_{PLZ} and t_{PZL} . [2] 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;

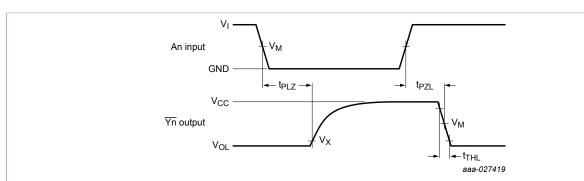
C_L = output load capacitance in pF;

V_{CC} = supply voltage in V;

N = number of inputs switching;

 $\sum (C_L \times V_{CC}^2 \times f_0) = \text{sum of outputs.}$

10.1 Waveforms and test circuit



Measurement points are given in Table 8.

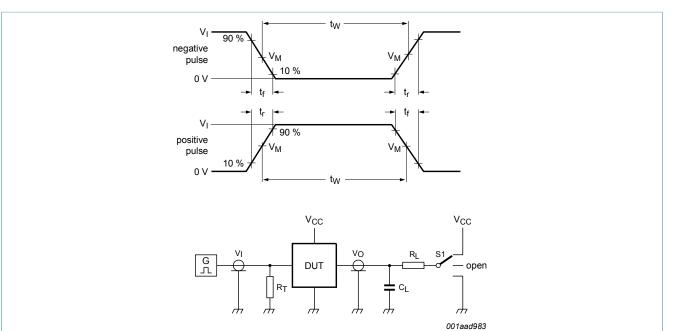
V_{OL} is a typical voltage output level that occurs with the output load.

Figure 4. Input to output propagation delays and HIGH to LOW output transition time

Table 8. Measurement points

| Туре | Input | Output | | | | | |
|-----------|--------------------|--------------------|--------------------|--|--|--|--|
| | V _M | V _M | V_X | | | | |
| 74HC9114 | 0.5V _{CC} | 0.5V _{CC} | 0.1V _{CC} | | | | |
| 74HCT9114 | 1.3 V | 1.3 V | 0.1V _{CC} | | | | |

74HC_HCT9114



Test data is given in Table 9.

Definitions test circuit:

 R_T = Termination resistance should be equal to output impedance Z_0 of the pulse generator

 C_L = Load capacitance including jig and probe capacitance

R_L = Load resistance

S1 = Test selection switch

Figure 5. 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 _{PZL} , t _{PLZ} |
| 74HC9114 | V _{CC} | 6 ns | 15 pF, 50 pF | 1 kΩ | open | V _{CC} |
| 74HCT9114 | 3 V | 6 ns | 15 pF, 50 pF | 1 kΩ | open | V _{CC} |

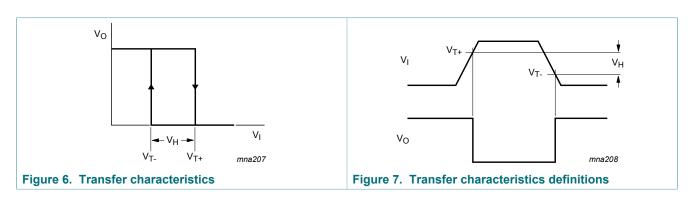
10.2 Transfer characteristics

Table 10. Transfer characteristics

At recommended operating conditions; voltages are referenced to GND (ground = 0 V); see Figure 6 and Figure 7.

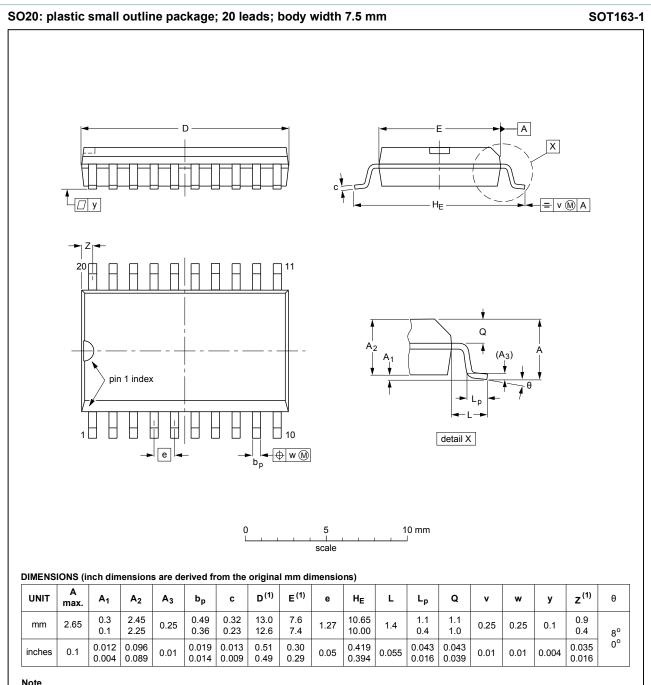
| Symbol | Parameter | Conditions | Tai | _{mb} = 25 | °C | T _{amb} = -40 °C to +85 °C | | T _{amb} = -40 °C to +125 °C | | Unit |
|-----------------|--------------------|-------------------------|----------|--------------------|------|--|------|---|------|------|
| | | | Min | Тур | Max | Min | Max | Min | Max | |
| 74HC911 | 14 | | <u> </u> | ' | ' | | | | - | |
| V _{T+} | positive-going | V _{CC} = 2.0 V | 0.70 | 1.13 | 1.50 | 0.70 | 1.50 | 0.70 | 1.50 | V |
| | threshold voltage | V _{CC} = 4.5 V | 1.75 | 2.37 | 3.15 | 1.75 | 3.15 | 1.75 | 3.15 | V |
| | | V _{CC} = 6.0 V | 2.30 | 3.11 | 4.20 | 2.30 | 4.20 | 2.30 | 4.20 | V |
| V _{T-} | | V _{CC} = 2.0 V | 0.30 | 0.70 | 1.10 | 0.30 | 1.10 | 0.30 | 1.10 | V |
| | threshold voltage | V _{CC} = 4.5 V | 1.35 | 1.80 | 2.40 | 1.35 | 2.40 | 1.35 | 2.40 | V |
| | | V _{CC} = 6.0 V | 1.8 | 2.43 | 3.30 | 1.80 | 3.30 | 1.80 | 3.30 | V |
| V _H | hysteresis voltage | V _{CC} = 2.0 V | 0.2 | 0.43 | 0.80 | 0.18 | 0.80 | 0.15 | 0.80 | V |
| | | V _{CC} = 4.5 V | 0.4 | 0.57 | 1.00 | 0.40 | 1.00 | 0.40 | 1.00 | V |
| | | V _{CC} = 6.0 V | 0.5 | 0.68 | 1.10 | 0.50 | 1.10 | 0.50 | 1.10 | V |
| 74HCT9 | 114 | | | , | | | | ' | | |
| V _{T+} | positive-going | V _{CC} = 4.5 V | 0.9 | 1.50 | 2.0 | 0.9 | 2.0 | 0.9 | 2.0 | V |
| | threshold voltage | V _{CC} = 5.5 V | 1.2 | 1.70 | 2.1 | 1.2 | 2.1 | 1.2 | 2.1 | V |
| V _{T-} | negative-going | V _{CC} = 4.5 V | 0.7 | 1.06 | 1.4 | 0.7 | 1.4 | 0.7 | 1.4 | V |
| | threshold voltage | V _{CC} = 5.5 V | 0.8 | 1.27 | 1.7 | 0.8 | 1.7 | 0.8 | 2.7 | V |
| V _H | hysteresis voltage | V _{CC} = 4.5 V | 0.2 | 0.44 | 8.0 | 0.2 | 0.8 | 0.2 | 0.8 | V |
| | | V _{CC} = 5.5 V | 0.2 | 0.44 | 0.8 | 0.2 | 0.8 | 0.2 | 0.8 | V |

10.3 Transfer characteristics waveforms



74HC HCT9114

11 Package outline



Note

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

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

Figure 8. Package outline SOT163-1 (SO20)

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12 Abbreviations

Table 11. Abbreviations

| Acronym | Description |
|---------|-------------------------|
| DUT | Device Under Test |
| ESD | ElectroStatic Discharge |
| НВМ | Human Body Model |
| MM | Machine Model |

13 Revision history

Table 12. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes | |
|------------------|---|-----------------------|---------------|------------------|--|
| 74HC_HCT9114 v.3 | 20171002 | Product data sheet | - | 74HC_HCT9114 v.2 | |
| 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. | | | | |
| 74HC_HCT9114 v.2 | 19901201 | Product specification | - | 74HC_HCT9114 v.1 | |
| 74HC_HCT9114 v.1 | 19880301 | Product specification | - | - | |

14 Legal information

14.1 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. |

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74HC9114; 74HCT9114

Nine wide Schmitt trigger buffer; open drain outputs; inverting

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