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March 2015

74VHC14 Hex Schmitt Inverter

Features

- High Speed: $t_{PD} = 5.5$ ns (Typ.) at $V_{CC} = 5$ V
- Low Power Dissipation: $I_{CC} = 2$ μ A (Max.) at $T_A = 25^\circ$ C
- High Noise Immunity: $V_{NIH} = V_{NIL} = 28\%$ V_{CC} (Min.)
- Power down protection is provided on all inputs
- Low Noise: $V_{OLP} = 0.8$ V (Max.)
- Pin and Function Compatible with 74HC14

General Description

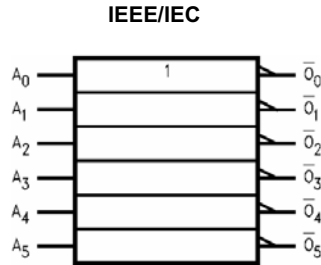
The VHC14 is an advanced high speed CMOS Hex Schmitt Inverter fabricated with silicon gate CMOS technology. It achieves the high speed operation similar to equivalent Bipolar Schottky TTL while maintaining the CMOS low power dissipation. Pin configuration and function are the same as the VHC04 but the inputs have hysteresis between the positive-going and negative-going input thresholds, which are capable of transforming slowly changing input signals into sharply defined, jitter-free output signals, thus providing greater noise margin than conventional inverters.

An input protection circuit ensures that 0 V to 7 V can be applied to the input pins without regard to the supply voltage. This device can be used to interface 5 V to 3 V systems and two supply systems such as battery back up. This circuit prevents device destruction due to mismatched supply and input voltages.

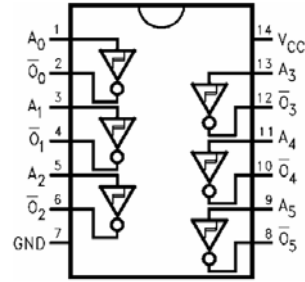
Ordering Information

| Part Number | Top Mark | Package | Packing Method |
|-------------|----------|-----------|----------------|
| 74VHC14M | 74VHC14 | SOIC 14L | Rail |
| 74VHC14MX | 74VHC14 | SOIC 14L | Tape and Reel |
| 74VHC14SJX | VHC14 | SOP 14L | Tape and Reel |
| 74VHC14MTC | V14 | TSSOP 14L | Rail |
| 74VHC14MTCX | V14 | TSSOP 14L | Tape and Reel |

Logic Symbol/s



Connection Diagram/s



Pin Descriptions

| Pin Names | Description |
|------------------|-------------|
| A_n | Inputs |
| \overline{O}_n | Outputs |

Truth Table/s

| A | O |
|---|---|
| L | H |
| H | L |

Absolute Maximum Ratings⁽¹⁾

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

| Symbol | Parameter | Value | Unit |
|-----------|---|----------------------|-------------|
| V_{CC} | Supply Voltage | -0.5 to +7.0 | V |
| V_{IN} | DC Input Voltage | -0.5 to +7.0 | V |
| V_{OUT} | DC Output Voltage | -0.5 to $V_{CC}+0.5$ | V |
| I_{IK} | Input Diode Current | -20 | mA |
| I_{OK} | Output Diode Current | ± 20 | mA |
| I_{OUT} | DC Output Current | ± 25 | mA |
| I_{CC} | DC V_{CC} / GND Current | ± 50 | mA |
| T_{STG} | Storage Temperature Range | -65 to +150 | $^{\circ}C$ |
| T_L | Lead Temperature (Soldering 10 seconds) | 260 | $^{\circ}C$ |

Note:

1. Absolute maximum ratings are values beyond which the device may be damaged or have its useful life impaired. The data book specifications should be met, without exception, to ensure that the system design is reliable over its power supply, temperature, and output/input loading variables. Fairchild does not recommend operation outside data-book specifications.

Recommended Operating Conditions⁽²⁾

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications. Fairchild does not recommend exceeding them or designing to absolute maximum ratings.

| Symbol | Parameter | Min. | Max. | Unit |
|-----------|-----------------------------|------|----------|------|
| V_{CC} | Supply Voltage | 2.0 | 5.5 | V |
| V_{IN} | Input Voltage | 0 | 5.5 | V |
| V_{OUT} | Output Voltage | 0 | V_{CC} | V |
| T_{OPR} | Operating Temperature Range | -40 | 85 | °C |

Note:

2. Unused inputs must be held HIGH or LOW. They may not float.

DC Electrical Characteristics

| Symbol | Parameter | V_{CC} | $T_A = 25^\circ\text{C}$ | | | $T_A = -40 \text{ to } 85^\circ\text{C}$ | | Unit | Conditions | |
|----------|----------------------------|----------|--------------------------|------|-----------|--|-----------|---------------|----------------------------------|----------------------------|
| | | | Min. | Typ. | Max. | Min. | Max. | | | |
| V_P | Positive Threshold Voltage | 3.0 | | | 2.20 | | 2.20 | V | | |
| | | 4.5 | | | 3.15 | | 3.15 | | | |
| | | 5.5 | | | 3.85 | | 3.85 | | | |
| V_N | Negative Threshold Voltage | 3.0 | 0.90 | | | 0.90 | | V | | |
| | | 4.5 | 1.35 | | | 1.35 | | | | |
| | | 5.5 | 1.65 | | | 1.65 | | | | |
| V_H | Hysteresis Voltage | 3.0 | 0.30 | | 1.20 | 0.30 | 1.20 | V | | |
| | | 4.5 | 0.40 | | 1.40 | 0.40 | 1.40 | | | |
| | | 5.5 | 0.50 | | 1.60 | 0.50 | 1.60 | | | |
| V_{OH} | HIGH Level Output Voltage | 2.0 | 1.9 | 2.0 | | 1.9 | | V | $V_{IN} = V_{IL}$ | $I_{OH} = -50 \mu\text{A}$ |
| | | 3.0 | 2.9 | 3.0 | | 2.9 | | | | $I_{OH} = -4 \text{ mA}$ |
| | | 4.5 | 4.4 | 4.5 | | 4.4 | | | | $I_{OH} = -8 \text{ mA}$ |
| | | 3.0 | 2.58 | | | 2.48 | | | | |
| | | 4.5 | 3.94 | | | 3.80 | | | | |
| V_{OL} | LOW Level Output Voltage | 2.0 | | 0.0 | 0.1 | | 0.1 | V | $V_{IN} = V_{IH}$ | $I_{OL} = 50 \mu\text{A}$ |
| | | 3.0 | | 0.0 | 0.1 | | 0.1 | | | |
| | | 4.5 | | 0.0 | 0.1 | | 0.1 | | | |
| | | 3.0 | | | 0.36 | | 0.44 | | | $I_{OL} = 4 \text{ mA}$ |
| | | 4.5 | | | 0.36 | | 0.44 | | | $I_{OL} = 8 \text{ mA}$ |
| I_{IN} | Input Leakage Current | 0 - 5.5 | | | ± 0.1 | | ± 1.0 | μA | $V_{IN} = 5.5 \text{ V or GND}$ | |
| I_{CC} | Quiescent Supply Current | 5.5 | | | 2.0 | | 20.0 | μA | $V_{IN} = V_{CC} \text{ or GND}$ | |

Noise Characteristics⁽²⁾

| Symbol | Parameter | V _{CC} | T _A = 25°C | | Unit | Conditions |
|------------------|--|-----------------|-----------------------|------|------|------------------------|
| | | | Typ. | Max. | | |
| V _{OLP} | Quiet Output Maximum Dynamic V _{OL} | 5.0 | 0.4 | 0.8 | V | C _L = 50 pF |
| V _{OLV} | Quiet Output Minimum Dynamic V _{OL} | 5.0 | -0.4 | 0.8 | V | C _L = 50 pF |
| V _{IHD} | Minimum HIGH Level Dynamic Input Voltage | 5.0 | | 3.5 | V | C _L = 50 pF |
| V _{ILD} | Maximum LOW Level Dynamic Input Voltage | 5.0 | | 1.5 | V | C _L = 50 pF |

Note:

2. Parameter guaranteed by design.

AC Electrical Characteristics

| Symbol | Parameter | V _{CC} | T _A = 25°C | | | T _A = -40 to 85°C | | Unit | Conditions |
|--------------------------------------|-------------------------------|-----------------|-----------------------|------|------|------------------------------|------|------|------------------------|
| | | | Min. | Typ. | Max. | Min. | Max. | | |
| t _{PLH} t _{PHL} | Propagation Delay Time | 3.3 ± 0.3 | | 8.3 | 12.8 | 1.0 | 15.0 | ns | C _L = 15 pF |
| | | | | 10.8 | 16.3 | 1.0 | 18.5 | | C _L = 50 pF |
| | | 5.0 ± 0.5 | | 5.5 | 8.6 | 1.0 | 10.0 | | C _L = 15 pF |
| | | | | 7.0 | 10.6 | 1.0 | 12.0 | | C _L = 50 pF |
| C _{IN} | Input Capacitance | | | 4 | 10 | | 10 | pF | V _{CC} = Open |
| C _{PD} | Power Dissipation Capacitance | | | 21 | | | | pF | ⁽³⁾ |

Note:

3. C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the opening current consumption without load.

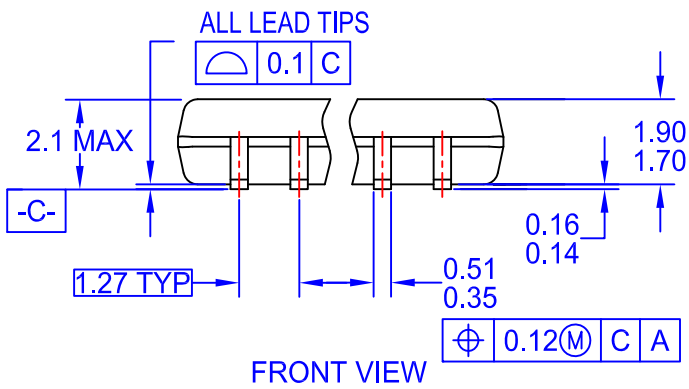
Average operating current can be obtained by the equation: I_{CC} (Opr) = C_{PD} * V_{CC} * f_{IN} + I_{CC} /6 (per Gate)



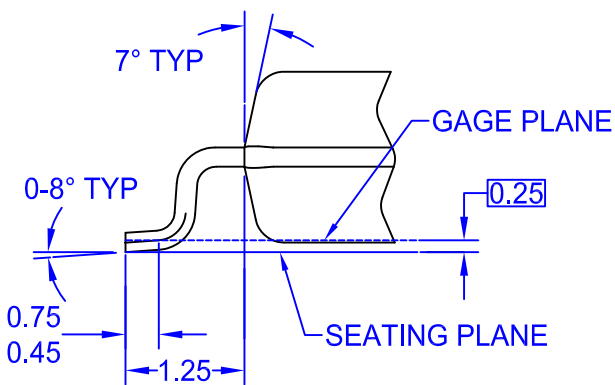
NOTES:

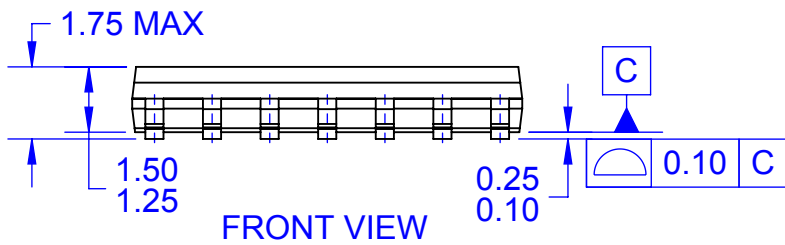
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