

MM74HCT14 Hex Inverting Schmitt Trigger

General Description

The MM74HCT14 utilizes advanced silicon-gate CMOS technology to achieve the low power dissipation and high noise immunity of standard CMOS, as well as the capability to drive 10 LS-TTL loads.

The 74HCT logic family is functionally and pinout compatible with the standard 74LS logic family. All inputs are protected from damage due to static discharge by internal diode clamps to V_{CC} and ground.

Features

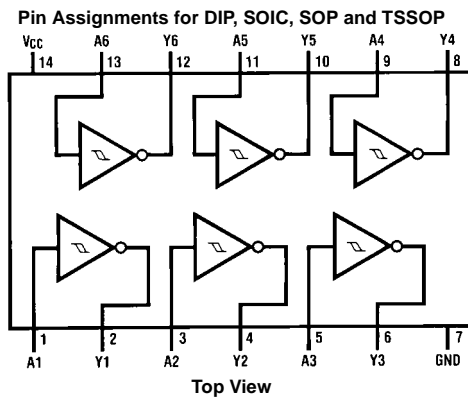
- Typical propagation delay: 13 ns
- Wide power supply range: 2–6V
- Low quiescent current: 10 μ A maximum
- Low input current: 1 μ A maximum
- Fanout of 10 LS-TTL loads
- Typical hysteresis voltage: 0.9V at $V_{CC} = 4.5V$
- TTL, LS pin-out and input threshold compatible

Ordering Codes:

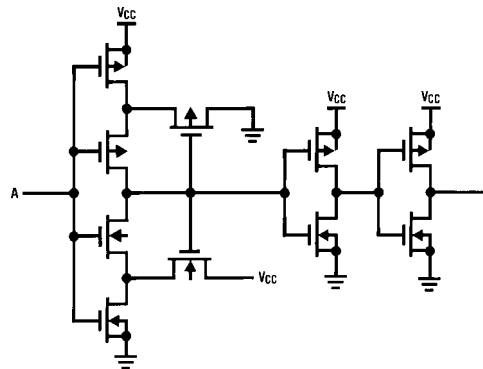
| Order Number | Package Number | Package Description |
|--------------|----------------|--|
| MM74HCT14M | M14A | 14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-120, 0.150" Narrow |
| MM74HCT14SJ | M14D | 14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide |
| MM74HCT14MTC | MTC14 | 14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide |
| MM74HCT14N | N14A | 14-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide |

Devices also available in Tape and Reel. Specify by appending the suffix letter "X" to the ordering code.

Connection Diagram



Schematic Diagram



Absolute Maximum Ratings (Note 1)

(Note 2)

| | |
|--|-------------------------|
| Supply Voltage (V_{CC}) | -0.5 to +7.0V |
| DC Input Voltage (V_{IN}) | -1.5 to $V_{CC} + 1.5V$ |
| DC Output Voltage (V_{OUT}) | -0.5 to $V_{CC} + 0.5V$ |
| Clamp Diode Current (I_{IK}, I_{OK}) | ± 20 mA |
| DC Output Current, per pin (I_{OUT}) | ± 25 mA |
| DC V_{CC} or GND Current, per pin (I_{CC}) | ± 50 mA |
| Storage Temperature Range (T_{STG}) | -65°C to +150°C |
| Lead Temperature (T_L) | |
| (Soldering 10 seconds) | 260°C |

Recommended Operating Conditions

| | Min | Max | Units |
|---|-----|----------|-------|
| Supply Voltage (V_{CC}) | 2 | 6 | V |
| DC Input or Output Voltage (V_{IN}, V_{OUT}) | 0 | V_{CC} | V |
| Operating Temperature Range (T_A) | -40 | +85 | °C |

Note 1: Absolute Maximum Ratings are those values beyond which damage to the device may occur.**Note 2:** Unless otherwise specified all voltages are referenced to ground.**DC Electrical Characteristics** (Note 3)

| Symbol | Parameter | Conditions | V_{CC} | $T_A = 25^\circ\text{C}$ | | $T_A = -40$ to 85°C | | Units |
|----------|--------------------------------------|---|----------|--------------------------|-------------------|-----------------------------------|---------------|-------|
| | | | | Typ | Guaranteed Limits | | | |
| V_{T+} | Positive Going Threshold Voltage | Minimum | 4.5V | 1.5 | 1.2 | 1.2 | V | |
| | | | 5.5V | 1.7 | 1.4 | 1.4 | V | |
| | | Maximum | 4.5V | 1.5 | 1.9 | 1.9 | V | |
| | | | 5.5V | 1.7 | 2.1 | 2.1 | V | |
| V_{T-} | Negative Going Threshold Voltage | Minimum | 4.5V | 0.9 | 0.5 | 0.5 | V | |
| | | | 5.5V | 1.0 | 0.6 | 0.6 | V | |
| | | Maximum | 4.5V | 0.9 | 1.2 | 1.2 | V | |
| | | | 5.5V | 1.0 | 1.4 | 1.4 | V | |
| V_H | Hysteresis Voltage | Minimum | 4.5V | 0.6 | 0.4 | 0.4 | V | |
| | | | 5.5V | 0.7 | 0.4 | 0.4 | V | |
| | | Maximum | 4.5V | 0.6 | 1.4 | 1.4 | V | |
| | | | 5.5V | 0.7 | 1.5 | 1.5 | V | |
| V_{OH} | Minimum HIGH Level Output Voltage | $V_{IN} = V_{IL}$ $ I_{OUT} = 20 \mu\text{A}$ $ I_{OUT} = 4.0 \text{ mA}, V_{CC} = 4.5V$ $ I_{OUT} = 4.8 \text{ mA}, V_{CC} = 5.5V$ | | V_{CC} | $V_{CC} - 0.1$ | $V_{CC} - 0.1$ | V | |
| | | | | 4.2 | 3.98 | 3.84 | V | |
| | | | | 5.2 | 4.98 | 4.98 | V | |
| | | | | | | | | |
| V_{OL} | Maximum LOW Level Voltage | $V_{IN} = V_{IH}$ $ I_{OUT} = 20 \mu\text{A}$ $ I_{OUT} = 4.0 \text{ mA}, V_{CC} = 4.5V$ $ I_{OUT} = 4.8 \text{ mA}, V_{CC} = 5.5V$ | | 0 | 0.1 | 0.1 | V | |
| | | | | 0.2 | 0.26 | 0.33 | V | |
| | | | | 0.2 | 0.26 | 0.33 | V | |
| | | | | | | | | |
| I_{IN} | Maximum Input Current | $V_{IN} = V_{CC}$ or GND V_{IH} or V_{IL} | | | ± 0.1 | ± 1.0 | μA | |
| I_{CC} | Maximum Quiescent Supply Current | $V_{IN} = V_{CC}$ or GND $I_{OUT} = 0 \mu\text{A}$ | 5.5V | | 1.0 | 10 | μA | |
| | | $V_{IN} = 2.4V$ or 0.5V (Note 3) | 5.5V | | 2.4 | 2.4 | mA | |

Note 3: For a power supply of $5V \pm 10\%$ the worst case output voltages (V_{OH} , and V_{OL}) occur for HC at 4.5V. Thus the 4.5V values should be used when designing with this supply. Worst case V_{IH} and V_{IL} occur at $V_{CC} = 5.5V$ and 4.5V respectively. (The V_{IH} value at 5.5V is 3.85V.) The worst case leakage current (I_{IN} , I_{CC} , and I_{OZ}) occur for CMOS at the higher voltage and so the 6.0V values should be used.

AC Electrical Characteristics

$V_{CC} = 5V$, $T_A = 25^\circ C$, $C_L = 15 pF$, $t_r = t_f = 6 ns$

| Symbol | Parameter | Conditions | Typ | Guaranteed Limit | Units |
|-----------------------|---------------------------|------------|-----|------------------|-------|
| t_{PHL} , t_{PLH} | Maximum Propagation Delay | | 10 | 18 | ns |

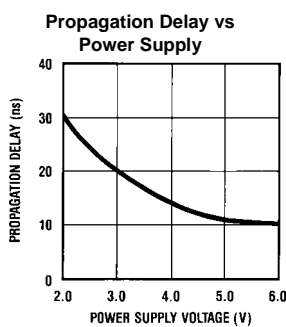
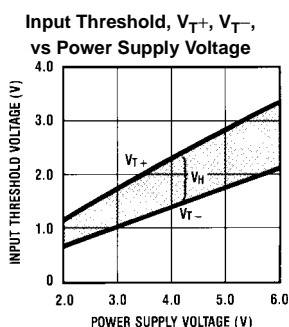
AC Electrical Characteristics

$V_{CC} = 5V \pm 10\%$, $C_L = 50 pF$, $t_r = t_f = 6 ns$ (unless otherwise specified)

| Symbol | Parameter | Conditions | $T_A = 25^\circ$ | | $T_A = -40 \text{ to } 85^\circ C$ | | Units |
|-----------------------|--|------------|------------------|-------------------|------------------------------------|-------------------|-------|
| | | | Typ | Guaranteed Limits | Typ | Guaranteed Limits | |
| t_{PHL} , t_{PLH} | Maximum Propagation Delay | | | 20 | 25 | | ns |
| t_{TLH} , t_{THL} | Maximum Output Rise and Fall Time | | 9 | 15 | 19 | | ns |
| C_{PD} | Power Dissipation Capacitance (Note 4) | (per gate) | | 25 | | | pF |
| C_{IN} | Maximum Input Capacitance | | 5 | 10 | 10 | | pF |

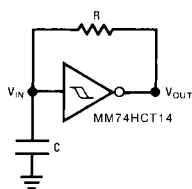
Note 4: C_{PD} determines the no load dynamic power consumption, $P_D = C_{PD} V_{CC}^2 f + I_{CC} V_{CC}$, and the no load dynamic current consumption, $I_S = C_{PD} V_{CC} f + I_{CC}$.

Typical Performance Characteristics



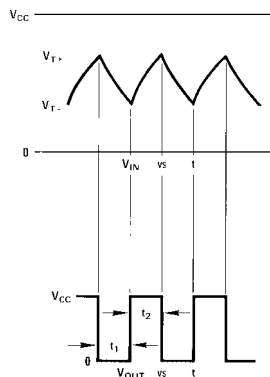
Typical Applications

Low Power Oscillator



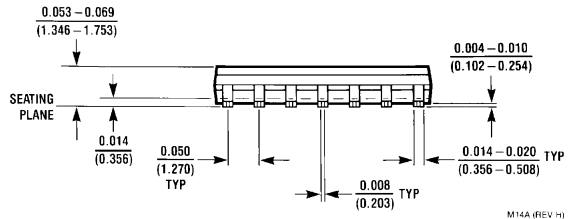
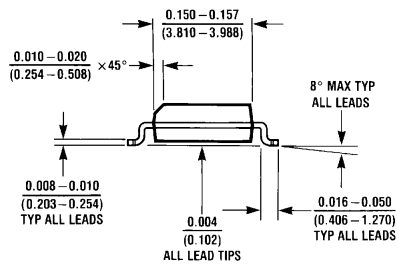
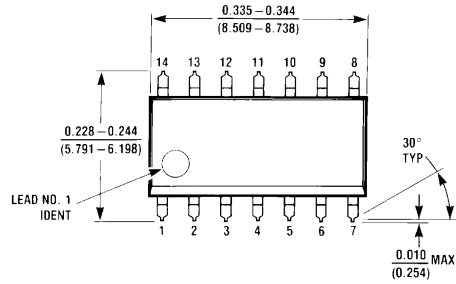
$$t_2 \approx RC \ln \frac{V_{CC} - V_{T-}}{V_{CC} - V_{T+}}$$

$$f \approx \frac{1}{RC \ln \frac{V_{T+}(V_{CC} - V_{T-})}{V_{T-}(V_{CC} - V_{T+})}}$$



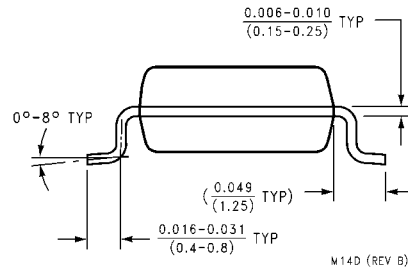
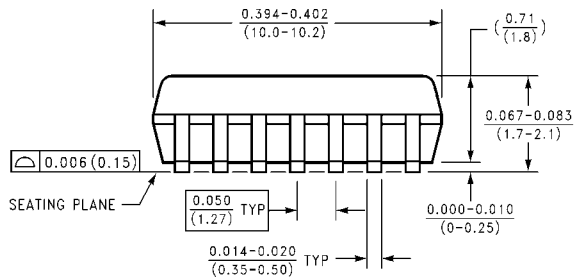
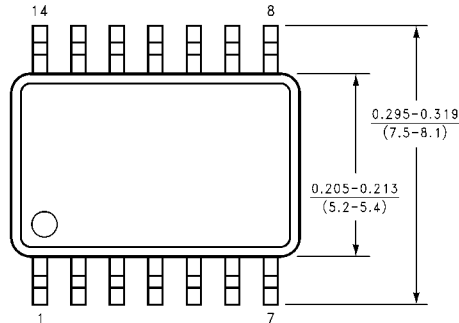
Note: The equations assume $t_1 + t_2 \gg t_{pd0} + t_{pd1}$

Physical Dimensions inches (millimeters) unless otherwise noted



M14A (REV H)

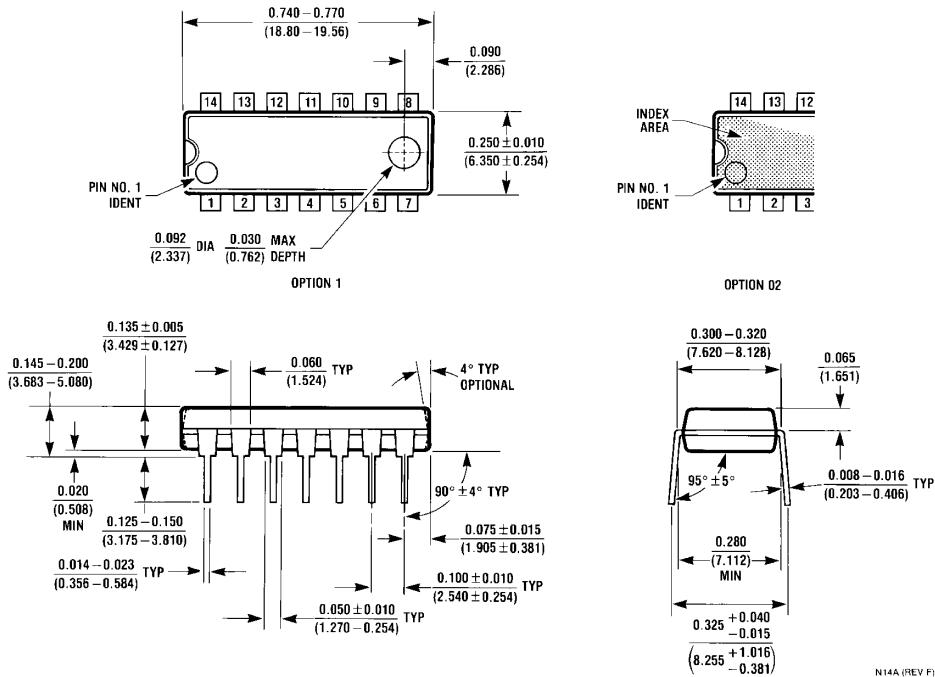
14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-120, 0.150" Narrow Package Number M14A



M14D (REV B)

14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide Package Number M14D

Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



14-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide Package Number N14A

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