

## 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

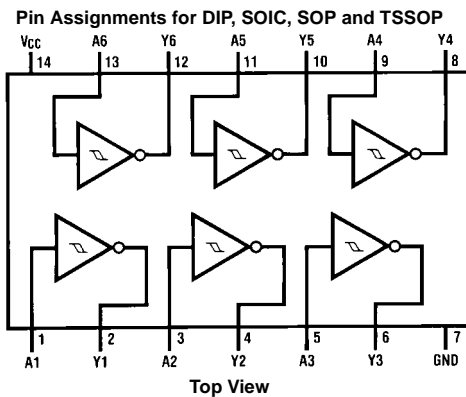
- Typical propagation delay: 13 ns
- Wide power supply range: 2–6V
- Low quiescent current: 10  $\mu$ A maximum
- Low input current: 1  $\mu$ A maximum
- Fanout of 10 LS-TTL loads
- Typical hysteresis voltage: 0.9V at  $V_{CC} = 4.5V$
- TTL, LS pin-out and input threshold compatible

### Ordering Codes:

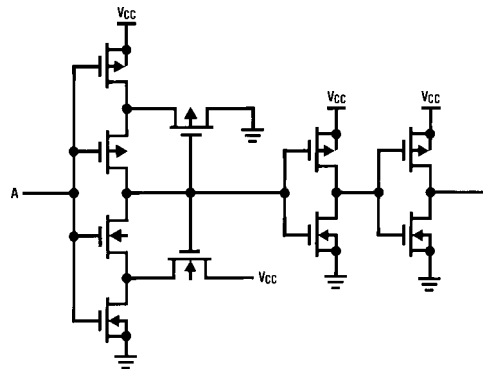
Order Number	Package Number	Package Description
MM74HCT14M	M14A	14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-120, 0.150" Narrow
MM74HCT14SJ	M14D	14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
MM74HCT14MTC	MTC14	14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 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 ( $I_{IK}, I_{OK}$ )	$\pm 20$ mA
DC Output Current, per pin ( $I_{OUT}$ )	$\pm 25$ mA
DC $V_{CC}$ or GND Current, per pin ( $I_{CC}$ )	$\pm 50$ 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 $85^\circ\text{C}$		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 $V_{IL}$			$\pm 0.1$	$\pm 1.0$	$\mu\text{A}$	
$I_{CC}$	Maximum Quiescent Supply Current	$V_{IN} = V_{CC}$ or GND $I_{OUT} = 0 \mu\text{A}$	5.5V		1.0	10	$\mu\text{A}$	
		$V_{IN} = 2.4V$ 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

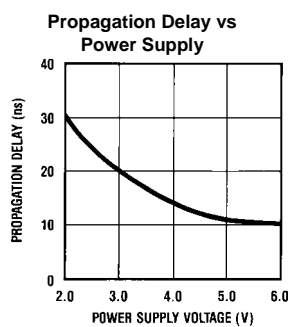
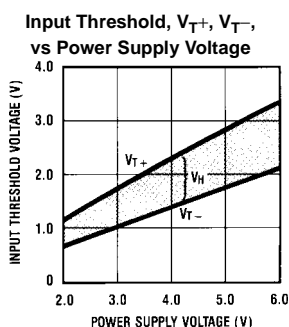
### AC Electrical Characteristics

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

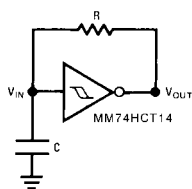
**Note 4:**  $C_{PD}$  determines the no load dynamic power consumption,  $P_D = C_{PD} V_{CC}^2 f + I_{CC} V_{CC}$ , and the no load dynamic current consumption,  $I_S = C_{PD} V_{CC} f + I_{CC}$ .

### Typical Performance Characteristics



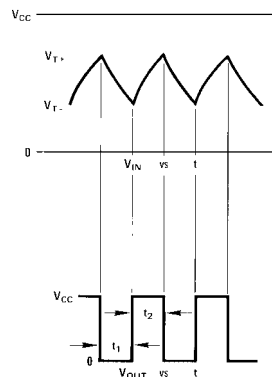
### Typical Applications

#### Low Power Oscillator



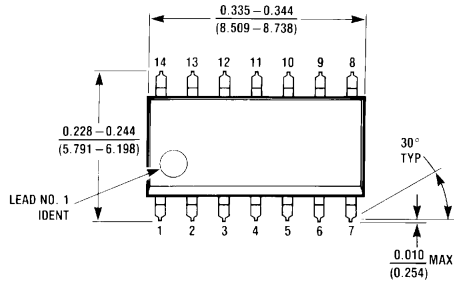
$$t_2 \approx RC \ln \frac{V_{CC} - V_{T-}}{V_{CC} - V_{T+}}$$

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

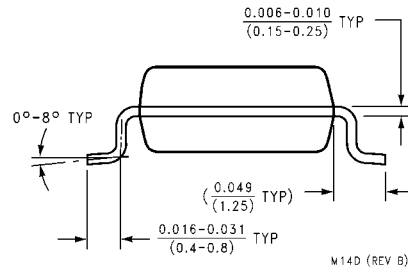
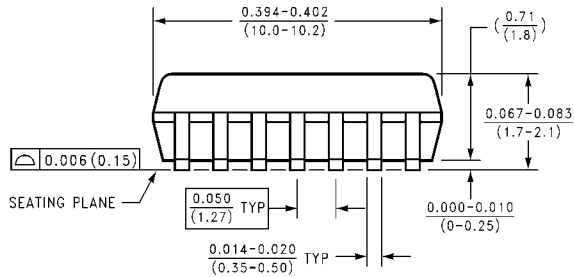
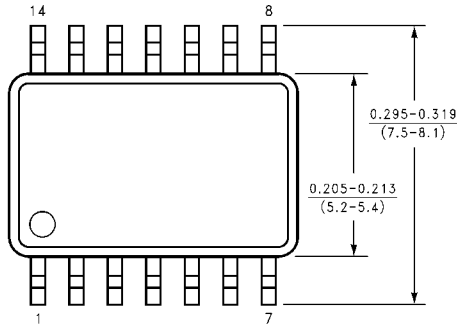


**Note:** The equations assume  $t_1 + t_2 \gg t_{pd0} + t_{pd1}$

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



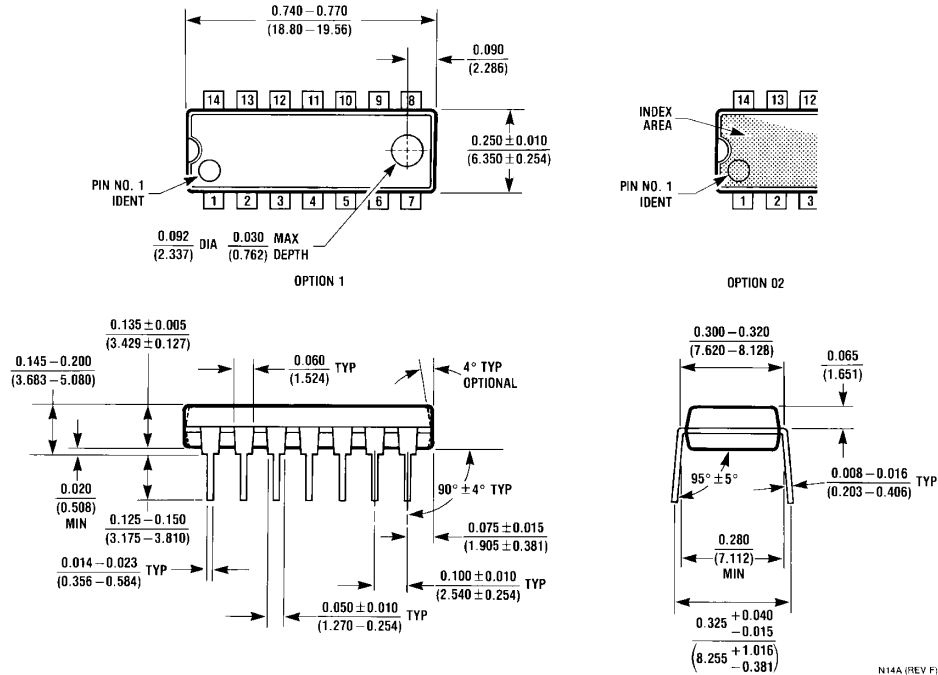
**14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-120, 0.150" Narrow Package Number M14A**



**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**

N14A (REV F)

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