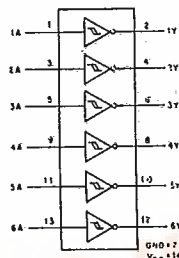


# CD54/74HC14

## CD54/74HCT14

File Number 1781

### High-Speed CMOS Logic



### Hex Inverting Schmitt Trigger

#### Type Features:

- Unlimited input rise and fall times
- Exceptionally high noise immunity

#### FUNCTIONAL DIAGRAM AND TERMINAL ASSIGNMENT

The RCA-CD54/74HC14 and CD54/74HCT14 each contain 6 Inverting Schmitt Triggers in one package.

The CD54HC14 and CD54HCT14 are supplied in 14-lead ceramic dual-in-line packages (F suffix). The CD74HC14 and CD74HCT14 are supplied in 14-lead dual-in-line plastic packages (E suffix) and in 14-lead dual-in-line surface mount plastic packages (M suffix). Both devices are also available in chip form (H suffix).



LOGIC DIAGRAM

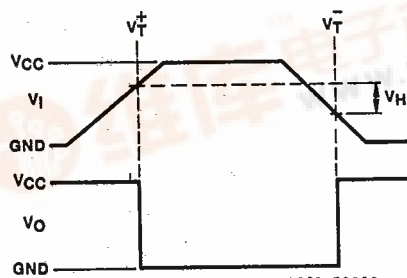
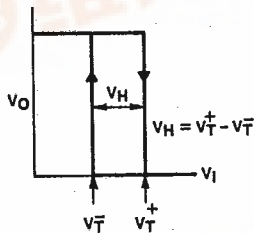


Fig. 1 - Hysteresis definition, characteristic, and test setup.

#### Family Features:

- Fanout (Over Temperature Range):  
Standard Outputs - 10 LSTTL Loads  
Bus Driver Outputs - 15 LSTTL Loads
- Wide Operating Temperature Range:  
CD74HC/HCT: -40 to +85°C
- Balanced Propagation Delay and Transition Times
- Significant Power Reduction Compared to LSTTL Logic ICs
- Alternate Source is Philips/Signetics
- CD54HC/CD74HC Types:  
2 to 6 V Operation  
High Noise Immunity:  
 $N_{IL} = 37\%$ ,  $N_{IH} = 51\%$  of  $V_{CC}$  @  $V_{CC} = 5V$
- CD54HCT/CD74HCT Types:  
4.5 to 5.5 V Operation  
Direct LSTTL Input Logic Compatibility  
 $N_{IL} = 18\%$ ,  $N_{IH} = 67\%$  of  $V_{CC}$  @  $V_{CC} = 4.5V$   
CMOS Input Compatibility  
 $I_1 \leq 1 \mu A$  @  $V_{OL}$ ,  $V_{OH}$

#### TRUTH TABLE

| INPUT | OUTPUT |
|-------|--------|
| A     | Y      |
| L     | H      |
| H     | L      |

H = High Level  
L = Low Level

HARRIS SEMICONDUCTOR 27E D 4302271 0017484 6 HAS

T-51-21 Technical Data

CD54/74HC14  
CD54/74HCT14

MAXIMUM RATINGS, Absolute-Maximum Values:

DC SUPPLY-VOLTAGE, ( $V_{CC}$ ):  
(Voltages referenced to ground) ..... -0.5 to +7 V

DC INPUT DIODE CURRENT,  $I_{IK}$  (FOR  $V_i < -0.5$  V OR  $V_i > V_{CC} + 0.5$  V) .....  $\pm 20$  mA

DC OUTPUT DIODE CURRENT,  $I_{OK}$  (FOR  $V_o < -0.5$  V OR  $V_o > V_{CC} + 0.5$  V) .....  $\pm 20$  mA

DC DRAIN CURRENT, PER OUTPUT ( $I_o$ ) (FOR  $-0.5$  V  $< V_o < V_{CC} + 0.5$  V) .....  $\pm 25$  mA

DC  $V_{CC}$  OR GROUND CURRENT ( $I_{CC}$ ) .....  $\pm 50$  mA

POWER DISSIPATION PER PACKAGE ( $P_D$ ):

For  $T_A = -40$  to  $+60^\circ\text{C}$  (PACKAGE TYPE E) ..... 500 mW

For  $T_A = +60$  to  $+85^\circ\text{C}$  (PACKAGE TYPE E) ..... Derate Linearly at 8 mW/ $^\circ\text{C}$  to 300 mW

For  $T_A = -55$  to  $+100^\circ\text{C}$  (PACKAGE TYPE F, H) ..... 500 mW

For  $T_A = +100$  to  $+125^\circ\text{C}$  (PACKAGE TYPE F, H) ..... Derate Linearly at 8 mW/ $^\circ\text{C}$  to 300 mW

For  $T_A = -40$  to  $+70^\circ\text{C}$  (PACKAGE TYPE M) ..... 400 mW

For  $T_A = +70$  to  $+125^\circ\text{C}$  (PACKAGE TYPE M) ..... Derate Linearly at 6 mW/ $^\circ\text{C}$  to 70 mW

OPERATING-TEMPERATURE RANGE ( $T_A$ ):

PACKAGE TYPE F, H .....  $-55$  to  $+125^\circ\text{C}$

PACKAGE TYPE E, M .....  $-40$  to  $+85^\circ\text{C}$

STORAGE TEMPERATURE ( $T_{stg}$ ) .....  $-65$  to  $+150^\circ\text{C}$

LEAD TEMPERATURE (DURING SOLDERING):

At distance  $1/16 \pm 1/32$  in. ( $1.59 \pm 0.79$  mm) from case for 10 s max. ....  $+265^\circ\text{C}$

Unit inserted into a PC Board (min. thickness  $1/16$  in., 1.59 mm) with solder contacting lead tips only .....  $+300^\circ\text{C}$

RECOMMENDED OPERATING CONDITIONS:

For maximum reliability, nominal operating conditions should be selected so that operation is always within the following ranges:

| CHARACTERISTIC                                                                | LIMITS |           | UNITS            |
|-------------------------------------------------------------------------------|--------|-----------|------------------|
|                                                                               | MIN.   | MAX.      |                  |
| Supply-Voltage Range (For $T_A$ = Full Package-Temperature Range) $V_{CC}$ .* |        |           |                  |
| CD54/74HC Types                                                               | 2      | 6         | V                |
| CD54/74HCT Types                                                              | 4.5    | 5.5       | V                |
| DC Input or Output Voltage $V_i$ , $V_o$                                      | 0      | $V_{CC}$  | V                |
| Operating Temperature $T_A$ :                                                 |        |           |                  |
| CD74 Types                                                                    | $-40$  | $+85$     | $^\circ\text{C}$ |
| CD54 Types                                                                    | $-55$  | $+125$    | $^\circ\text{C}$ |
| Input Rise and Fall Times $t_r$ , $t_f$                                       |        |           |                  |
| at 2 V                                                                        | 0      | Unlimited | ns               |
| at 4.5 V                                                                      | 0      | Unlimited | ns               |
| at 6 V                                                                        | 0      | Unlimited | ns               |

\*Unless otherwise specified, all voltages are referenced to Ground.

# CD54/74HC14

## CD54/74HCT14

### STATIC ELECTRICAL CHARACTERISTICS

| CHARACTERISTIC                                                                  | CD74HC14/CD54HC14                  |                          |                      |                 |      |               |      |                |      | CD74HCT14/CD54HCT14                         |                        |                   |      |               |      |                |     |     | UNITS |
|---------------------------------------------------------------------------------|------------------------------------|--------------------------|----------------------|-----------------|------|---------------|------|----------------|------|---------------------------------------------|------------------------|-------------------|------|---------------|------|----------------|-----|-----|-------|
|                                                                                 | TEST CONDITIONS                    |                          |                      | 74HC/54HC TYPES |      | 74HC TYPE     |      | 54HC TYPE      |      | TEST CONDITIONS                             |                        | 74HCT/54HCT TYPES |      | 74HCT TYPE    |      | 54HCT TYPE     |     |     |       |
|                                                                                 | V <sub>I</sub><br>V                | I <sub>O</sub><br>mA     | V <sub>CC</sub><br>V | +25°C           |      | -40/<br>+85°C |      | -55/<br>+125°C |      | V <sub>I</sub><br>V                         | V <sub>CC</sub><br>V   | +25°C             |      | -40/<br>+85°C |      | -55/<br>+125°C |     |     |       |
|                                                                                 |                                    |                          |                      | Min             | Max  | Min           | Max  | Min            | Max  |                                             |                        | Min               | Max  | Min           | Max  | Min            | Max |     |       |
| Input Switch Points                                                             | V <sub>I+</sub>                    |                          | 2                    | 0.7             | 1.5  | 0.7           | 1.5  | 0.7            | 1.5  |                                             |                        | —                 | —    | —             | —    | —              | —   | V   |       |
|                                                                                 |                                    |                          | 4.5                  | 1.7             | 3.15 | 1.7           | 3.15 | 1.7            | 3.15 |                                             | 4.5                    | 1.2               | 1.9  | 1.2           | 1.9  | 1.2            | 1.9 | V   |       |
|                                                                                 |                                    |                          | 6                    | 2.1             | 4.2  | 2.1           | 4.2  | 2.1            | 4.2  |                                             | 5.5                    | 1.4               | 2.1  | 1.4           | 2.1  | 1.4            | 2.1 | V   |       |
|                                                                                 | V <sub>I-</sub>                    |                          | 2                    | 0.3             | 1    | 0.3           | 1    | 0.3            | 1    |                                             |                        | —                 | —    | —             | —    | —              | —   | V   |       |
|                                                                                 |                                    |                          | 4.5                  | 0.9             | 2.2  | 0.9           | 2.2  | 0.9            | 2.2  |                                             | 4.5                    | 0.5               | 1.2  | 0.5           | 1.2  | 0.5            | 1.2 | V   |       |
|                                                                                 |                                    |                          | 6                    | 1.2             | 3    | 1.2           | 3    | 1.2            | 3    |                                             | 5.5                    | 0.6               | 1.4  | 0.6           | 1.4  | 0.6            | 1.4 | V   |       |
|                                                                                 | V <sub>HI</sub>                    |                          | 2                    | 0.2             | 1    | 0.2           | 1    | 0.2            | 1    |                                             |                        | —                 | —    | —             | —    | —              | —   | V   |       |
|                                                                                 |                                    |                          | 4.5                  | 0.4             | 1.4  | 0.4           | 1.4  | 0.4            | 1.4  |                                             | 4.5                    | 0.4               | 1.4  | 0.4           | 1.4  | 0.4            | 1.4 | V   |       |
|                                                                                 |                                    |                          | 6                    | 0.6             | 1.6  | 0.6           | 1.6  | 0.6            | 1.6  |                                             | 5.5                    | 0.4               | 1.5  | 0.4           | 1.5  | 0.4            | 1.5 | V   |       |
| High-Level Output Voltage                                                       | V <sub>OH</sub>                    | V <sub>I-</sub> or -0.02 | 2                    | 1.9             | —    | 1.9           | —    | 1.9            | —    | V <sub>I-</sub> or V <sub>I+</sub>          |                        | —                 | —    | —             | —    | —              | —   | V   |       |
| CMOS Loads                                                                      |                                    |                          | 4.5                  | 4.4             | —    | 4.4           | —    | 4.4            | —    |                                             | 4.5                    | 4.4               | —    | 4.4           | —    | 4.4            | —   | V   |       |
|                                                                                 |                                    |                          | 6                    | 5.9             | —    | 5.9           | —    | 5.9            | —    |                                             |                        | —                 | —    | —             | —    | —              | —   | V   |       |
| TTL Loads                                                                       | V <sub>I-</sub> or V <sub>I+</sub> |                          | —                    | —               | —    | —             | —    | —              | —    | V <sub>I-</sub> or V <sub>I+</sub>          |                        | —                 | —    | —             | —    | —              | —   | V   |       |
|                                                                                 |                                    | -4                       | 4.5                  | 3.98            | —    | 3.84          | —    | 3.7            | —    |                                             | 4.5                    | 3.98              | —    | 3.84          | —    | 3.7            | —   | V   |       |
|                                                                                 |                                    | -5.2                     | 6                    | 5.48            | —    | 5.34          | —    | 5.2            | —    |                                             |                        | —                 | —    | —             | —    | —              | —   | V   |       |
| Low-Level Output Voltage                                                        | V <sub>OL</sub>                    | V <sub>I-</sub> or 0.02  | 2                    | —               | 0.1  | —             | 0.1  | —              | 0.1  | V <sub>I-</sub> or V <sub>I+</sub>          |                        | —                 | —    | —             | —    | —              | —   | V   |       |
|                                                                                 |                                    |                          | 4.5                  | —               | 0.1  | —             | 0.1  | —              | 0.1  |                                             | 4.5                    | —                 | 0.1  | —             | 0.1  | —              | 0.1 | V   |       |
| CMOS Loads                                                                      |                                    |                          | 6                    | —               | 0.1  | —             | 0.1  | —              | 0.1  |                                             |                        | —                 | —    | —             | —    | —              | —   | V   |       |
| TTL Loads                                                                       | V <sub>I-</sub> or V <sub>I+</sub> |                          | —                    | —               | —    | —             | —    | —              | —    | V <sub>I-</sub> or V <sub>I+</sub>          |                        | —                 | —    | —             | —    | —              | —   | V   |       |
|                                                                                 |                                    | 4                        | 4.5                  | —               | 0.26 | —             | 0.33 | —              | 0.4  |                                             | 4.5                    | —                 | 0.26 | —             | 0.33 | —              | 0.4 | V   |       |
|                                                                                 |                                    | 5.2                      | 6                    | —               | 0.26 | —             | 0.33 | —              | 0.4  |                                             |                        | —                 | —    | —             | —    | —              | —   | V   |       |
| Input Leakage Current                                                           | I <sub>I</sub> or Gnd              | V <sub>CC</sub>          | 6                    | —               | ±0.1 | —             | ±1   | —              | ±1   | Any Voltage Between V <sub>CC</sub> and Gnd | 5.5                    | —                 | ±0.1 | —             | ±1   | —              | ±1  | μA  |       |
| Quiescent Device Current                                                        | I <sub>CC</sub>                    | V <sub>CC</sub> or Gnd   | 0                    | 6               | —    | 2             | —    | 20             | —    | 40                                          | V <sub>CC</sub> or Gnd | 5.5               | —    | 2             | —    | 20             | —   | 40  | μA    |
| Additional Quiescent Device Current per input pin: 1 unit load ΔI <sub>CC</sub> |                                    |                          |                      |                 |      |               |      |                |      | V <sub>CC</sub> -2.1 to 5.5                 | 4.5                    | Min               | Typ  | Max           |      |                |     | μA  |       |
|                                                                                 |                                    |                          |                      |                 |      |               |      |                |      |                                             | to                     | —                 | 100  | 360           | —    | 450            | —   | 490 | μA    |

\*For dual-supply systems theoretical worst case (V<sub>I</sub> = 2.4 V, V<sub>CC</sub> = 5.5 V) specification is 1.8 mA.

#### HCT INPUT LOADING TABLE

| INPUT | UNIT LOADS* |
|-------|-------------|
| nA    | 0.6         |

\*Unit load is ΔI<sub>CC</sub> limit specified in Static Characteristic Chart, e.g., 360 μA max. @ 25°C.

HARRIS SEMICONDUCTOR 27E D 430227J 0017486 T HAS

T-51-21

Technical Data

# CD54/74HC14 CD54/74HCT14

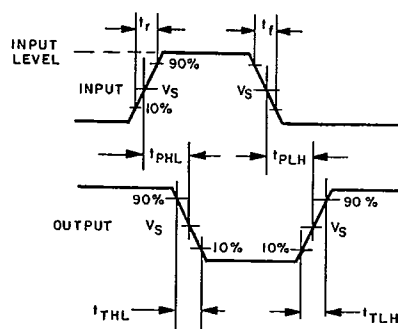
SWITCHING CHARACTERISTICS ( $V_{CC} = 5\text{ V}$ ,  $T_A = 25^\circ\text{C}$ , Input  $t_r$ ,  $t_f = 6\text{ ns}$ )

| CHARACTERISTIC                 |           | CL<br>(pF) | TYPICAL<br>HC HCT |    | UNITS |
|--------------------------------|-----------|------------|-------------------|----|-------|
| Propagation Delay,<br>A to Y   | $t_{PLH}$ | 15         | 11                | 16 | ns    |
|                                | $t_{PLH}$ |            |                   |    |       |
| Power Dissipation Capacitance* |           | —          | 20                | 20 | pF    |

\* $C_{PD}$  is used to determine the dynamic power consumption, per inverter.  
 $P_D = V_{CC}^2 f_i (C_{PD} + C_L)$  where:  $f_i$  = input frequency  
 $C_L$  = output load capacitance  
 $V_{CC}$  = supply voltage

SWITCHING CHARACTERISTICS ( $C_L = 50\text{ pF}$ , Input  $t_r$ ,  $t_f = 6\text{ ns}$ )

| CHARACTERISTIC               |                  | V <sub>CC</sub> | 25° C |      |      |      | -40° C to +85° C |      |       |      | -55° C to +125° C |      |       |      | UNITS |
|------------------------------|------------------|-----------------|-------|------|------|------|------------------|------|-------|------|-------------------|------|-------|------|-------|
|                              |                  |                 | HC    |      | HCT  |      | 74HC             |      | 74HCT |      | 54HC              |      | 54HCT |      |       |
|                              |                  |                 | Min.  | Max. | Min. | Max. | Min.             | Max. | Min.  | Max. | Min.              | Max. | Min.  | Max. |       |
| Propagation Delay,<br>A to Y | t <sub>PLH</sub> | 2               | —     | 135  | —    | —    | —                | 170  | —     | —    | —                 | 205  | —     | —    | ns    |
|                              | t <sub>PHL</sub> | 4.5             | —     | 27   | —    | 38   | —                | 34   | —     | 48   | —                 | 41   | —     | 57   |       |
|                              |                  | 6               | —     | 23   | —    | —    | —                | 29   | —     | —    | —                 | 35   | —     | —    |       |
| Output<br>Transition Time    | t <sub>TLH</sub> | 2               | —     | 75   | —    | —    | —                | 95   | —     | —    | —                 | 110  | —     | —    | ns    |
|                              | t <sub>THL</sub> | 4.5             | —     | 15   | —    | 15   | —                | 19   | —     | 19   | —                 | 22   | —     | 22   |       |
|                              |                  | 6               | —     | 13   | —    | —    | —                | 16   | —     | —    | —                 | 19   | —     | —    |       |
| Input<br>Capacitance         | C <sub>i</sub>   | —               | —     | 10   | —    | 10   | —                | 10   | —     | 10   | —                 | 10   | —     | 10   | pF    |



|             |              |          |
|-------------|--------------|----------|
|             | 54/74HC      | 54/74HCT |
| INPUT LEVEL | $V_{CC}$     | 3V       |
| $V_S$       | 50% $V_{CC}$ | 1.3V     |

92CS-36948R1

Fig. 2 - Transition times and propagation delay times.