

October 1997 - Revised August 2003

## High-Speed CMOS Logic 8-Bit Serial-In/Parallel-Out Shift Register

### Features

- Buffered Inputs
- Asynchronous Master Reset
- Typical  $f_{MAX} = 60\text{MHz}$  at  $V_{CC} = 5\text{V}$ ,  $C_L = 15\text{pF}$ ,  $T_A = 25^\circ\text{C}$
- Fanout (Over Temperature Range)
  - Standard Outputs . . . . . 10 LSTTL Loads
  - Bus Driver Outputs . . . . . 15 LSTTL Loads
- Wide Operating Temperature Range . . .  $-55^\circ\text{C}$  to  $125^\circ\text{C}$
- Balanced Propagation Delay and Transition Times
- Significant Power Reduction Compared to LSTTL Logic ICs
- HC Types
  - 2V to 6V Operation
  - High Noise Immunity:  $N_{IL} = 30\%$ ,  $N_{IH} = 30\%$  of  $V_{CC}$  at  $V_{CC} = 5\text{V}$
- HCT Types
  - 4.5V to 5.5V Operation
  - Direct LSTTL Input Logic Compatibility,  $V_{IL} = 0.8\text{V}$  (Max),  $V_{IH} = 2\text{V}$  (Min)
  - CMOS Input Compatibility,  $I_I \leq 1\mu\text{A}$  at  $V_{OL}$ ,  $V_{OH}$

### Description

The 'HC164 and 'HCT164 are 8-bit serial-in parallel-out shift registers with asynchronous reset. Data is shifted on the positive edge of Clock (CP). A LOW on the Master Reset (MR) pin resets the shift register and all outputs go to the LOW state regardless of the input conditions. Two Serial Data inputs (DS1 and DS2) are provided, either one can be used as a Data Enable control.

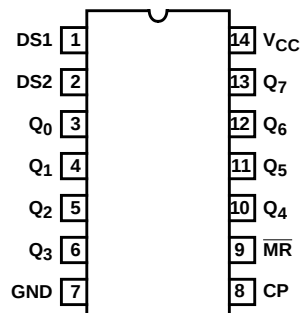
### Ordering Information

| PART NUMBER   | TEMP. RANGE<br>( $^\circ\text{C}$ ) | PACKAGE      |
|---------------|-------------------------------------|--------------|
| CD54HC164F3A  | -55 to 125                          | 14 Ld CERDIP |
| CD54HCT164F3A | -55 to 125                          | 14 Ld CERDIP |
| CD74HC164E    | -55 to 125                          | 14 Ld PDIP   |
| CD74HC164M    | -55 to 125                          | 14 Ld SOIC   |
| CD74HC164MT   | -55 to 125                          | 14 Ld SOIC   |
| CD74HC164M96  | -55 to 125                          | 14 Ld SOIC   |
| CD74HCT164E   | -55 to 125                          | 14 Ld PDIP   |
| CD74HCT164M   | -55 to 125                          | 14 Ld SOIC   |
| CD74HCT164MT  | -55 to 125                          | 14 Ld SOIC   |
| CD74HCT164M96 | -55 to 125                          | 14 Ld SOIC   |

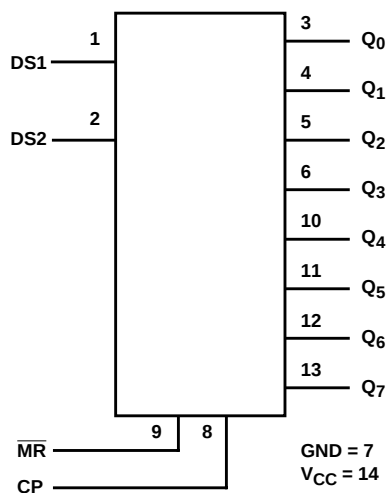
NOTE: When ordering, use the entire part number. The suffix 96 denotes tape and reel. The suffix T denotes a small-quantity reel of 250.

### Pinout

CD54HC164, CD54HCT164  
(CERDIP)  
CD74HC164, CD74HCT164  
(PDIP, SOIC)  
TOP VIEW



## Functional Diagram



TRUTH TABLE

| OPERATING MODE | INPUTS                 |    |     |     | OUTPUTS        |                                 |
|----------------|------------------------|----|-----|-----|----------------|---------------------------------|
|                | $\overline{\text{MR}}$ | CP | DS1 | DS2 | Q <sub>0</sub> | Q <sub>1</sub> - Q <sub>7</sub> |
| RESET (CLEAR)  | L                      | X  | X   | X   | L              | L - L                           |
| Shift          | H                      | ↑  | L   | L   | L              | q <sub>0</sub> - q <sub>6</sub> |
|                | H                      | ↑  | L   | h   | L              | q <sub>0</sub> - q <sub>6</sub> |
|                | H                      | ↑  | h   | L   | L              | q <sub>0</sub> - q <sub>6</sub> |
|                | H                      | ↑  | h   | h   | H              | q <sub>0</sub> - q <sub>6</sub> |

H= High Voltage Level.

h= High Voltage Level One Set-up Time Prior To The Low-to-high Clock Transition.

L= Low Voltage Level One Set-up Time Prior To The Low-to-high Clock Transition.

L= Low Voltage Level.

X= Don't Care.

↑= Transition from Low to High Level.

q<sub>n</sub>= Lower Case Letters Indicate The State Of the Reference Input Clock Transition.

# CD54HC164, CD74HC164, CD54HCT164, CD74HCT164

## Absolute Maximum Ratings

|                                                        |             |
|--------------------------------------------------------|-------------|
| DC Supply Voltage, $V_{CC}$                            | -0.5V to 7V |
| DC Input Diode Current, $I_{IK}$                       |             |
| For $V_I < -0.5V$ or $V_I > V_{CC} + 0.5V$             | $\pm 20mA$  |
| DC Output Diode Current, $I_{OK}$                      |             |
| For $V_O < -0.5V$ or $V_O > V_{CC} + 0.5V$             | $\pm 20mA$  |
| DC Output Source or Sink Current per Output Pin, $I_O$ |             |
| For $V_O > -0.5V$ or $V_O < V_{CC} + 0.5V$             | $\pm 25mA$  |
| DC $V_{CC}$ or Ground Current, $I_{CC}$ or $I_{GND}$   | $\pm 50mA$  |

## Thermal Information

|                                          |                                    |
|------------------------------------------|------------------------------------|
| Thermal Resistance (Typical, Note 1)     | $\theta_{JA}$ ( $^{\circ}C/W$ )    |
| E (PDIP) Package                         | 80                                 |
| M (SOIC) Package                         | 86                                 |
| Maximum Junction Temperature             | 150 $^{\circ}C$                    |
| Maximum Storage Temperature Range        | -65 $^{\circ}C$ to 150 $^{\circ}C$ |
| Maximum Lead Temperature (Soldering 10s) | 300 $^{\circ}C$                    |
| (SOIC - Lead Tips Only)                  |                                    |

## Operating Conditions

|                                           |                                    |
|-------------------------------------------|------------------------------------|
| Temperature Range ( $T_A$ )               | -55 $^{\circ}C$ to 125 $^{\circ}C$ |
| Supply Voltage Range, $V_{CC}$            |                                    |
| HC Types                                  | .2V to 6V                          |
| HCT Types                                 | 4.5V to 5.5V                       |
| DC Input or Output Voltage, $V_I$ , $V_O$ | 0V to $V_{CC}$                     |
| Input Rise and Fall Time                  |                                    |
| 2V                                        | 1000ns (Max)                       |
| 4.5V                                      | 500ns (Max)                        |
| 6V                                        | 400ns (Max)                        |

CAUTION: Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

### NOTE:

1. The package thermal impedance is calculated in accordance with JESD 51-7.

## DC Electrical Specifications

| PARAMETER                               | SYMBOL          | TEST CONDITIONS                       |                     | V <sub>CC</sub> (V) | 25°C |      |      | -40°C TO 85°C |      | -55°C TO 125°C |      | UNITS |
|-----------------------------------------|-----------------|---------------------------------------|---------------------|---------------------|------|------|------|---------------|------|----------------|------|-------|
|                                         |                 | V <sub>I</sub> (V)                    | I <sub>O</sub> (mA) |                     | MIN  | TYP  | MAX  | MIN           | MAX  | MIN            | MAX  |       |
| HC TYPES                                |                 |                                       |                     |                     |      |      |      |               |      |                |      |       |
| High Level Input Voltage                | V <sub>IH</sub> | -                                     | -                   | 2                   | 1.5  | -    | -    | 1.5           | -    | 1.5            | -    | V     |
|                                         |                 |                                       |                     | 4.5                 | 3.15 | -    | -    | 3.15          | -    | 3.15           | -    | V     |
|                                         |                 |                                       |                     | 6                   | 4.2  | -    | -    | 4.2           | -    | 4.2            | -    | V     |
| Low Level Input Voltage                 | V <sub>IL</sub> | -                                     | -                   | 2                   | -    | -    | 0.5  | -             | 0.5  | -              | 0.5  | V     |
|                                         |                 |                                       |                     | 4.5                 | -    | -    | 1.35 | -             | 1.35 | -              | 1.35 | V     |
|                                         |                 |                                       |                     | 6                   | -    | -    | 1.8  | -             | 1.8  | -              | 1.8  | V     |
| High Level Output Voltage<br>CMOS Loads | V <sub>OH</sub> | V <sub>IH</sub> or<br>V <sub>IL</sub> | -0.02               | 2                   | 1.9  | -    | -    | 1.9           | -    | 1.9            | -    | V     |
|                                         |                 |                                       | -0.02               | 4.5                 | 4.4  | -    | -    | 4.4           | -    | 4.4            | -    | V     |
|                                         |                 |                                       | -0.02               | 6                   | 5.9  | -    | -    | 5.9           | -    | 5.9            | -    | V     |
| -4                                      |                 |                                       | 4.5                 | 3.98                | -    | -    | 3.84 | -             | 3.7  | -              | V    |       |
| -5.2                                    |                 |                                       | 6                   | 5.48                | -    | -    | 5.34 | -             | 5.2  | -              | V    |       |
| High Level Output Voltage<br>TTL Loads  |                 |                                       |                     |                     |      |      |      |               |      |                |      |       |
| Low Level Output Voltage<br>CMOS Loads  | V <sub>OL</sub> | V <sub>IH</sub> or<br>V <sub>IL</sub> | 0.02                | 2                   | -    | -    | 0.1  | -             | 0.1  | -              | 0.1  | V     |
|                                         |                 |                                       | 0.02                | 4.5                 | -    | -    | 0.1  | -             | 0.1  | -              | 0.1  | V     |
|                                         |                 |                                       | 0.02                | 6                   | -    | -    | 0.1  | -             | 0.1  | -              | 0.1  | V     |
| 4                                       |                 |                                       | 4.5                 | -                   | -    | 0.26 | -    | 0.33          | -    | 0.4            | V    |       |
| 5.2                                     |                 |                                       | 6                   | -                   | -    | 0.26 | -    | 0.33          | -    | 0.4            | V    |       |
| Low Level Output Voltage<br>TTL Loads   |                 |                                       |                     |                     |      |      |      |               |      |                |      |       |
| Input Leakage Current                   | I <sub>I</sub>  | V <sub>CC</sub> or<br>GND             | -                   | 6                   | -    | -    | ±0.1 | -             | ±1   | -              | ±1   | μA    |
| Quiescent Device Current                | I <sub>CC</sub> | V <sub>CC</sub> or<br>GND             | 0                   | 6                   | -    | -    | 8    | -             | 80   | -              | 160  | μA    |

**CD54HC164, CD74HC164, CD54HCT164, CD74HCT164**

**DC Electrical Specifications (Continued)**

| PARAMETER                                                      | SYMBOL                    | TEST CONDITIONS                    |                     | V <sub>CC</sub> (V) | 25°C |     |      | -40°C TO 85°C |      | -55°C TO 125°C |     | UNITS |
|----------------------------------------------------------------|---------------------------|------------------------------------|---------------------|---------------------|------|-----|------|---------------|------|----------------|-----|-------|
|                                                                |                           | V <sub>I</sub> (V)                 | I <sub>O</sub> (mA) |                     | MIN  | TYP | MAX  | MIN           | MAX  | MIN            | MAX |       |
| HCT TYPES                                                      |                           |                                    |                     |                     |      |     |      |               |      |                |     |       |
| High Level Input Voltage                                       | V <sub>IH</sub>           | -                                  | -                   | 4.5 to 5.5          | 2    | -   | -    | 2             | -    | 2              | -   | V     |
| Low Level Input Voltage                                        | V <sub>IL</sub>           | -                                  | -                   | 4.5 to 5.5          | -    | -   | 0.8  | -             | 0.8  | -              | 0.8 | V     |
| High Level Output Voltage<br>CMOS Loads                        | V <sub>OH</sub>           | V <sub>IH</sub> or V <sub>IL</sub> | -0.02               | 4.5                 | 4.4  | -   | -    | 4.4           | -    | 4.4            | -   | V     |
| High Level Output Voltage<br>TTL Loads                         |                           |                                    | -4                  | 4.5                 | 3.98 | -   | -    | 3.84          | -    | 3.7            | -   | V     |
| Low Level Output Voltage<br>CMOS Loads                         | V <sub>OL</sub>           | V <sub>IH</sub> or V <sub>IL</sub> | 0.02                | 4.5                 | -    | -   | 0.1  | -             | 0.1  | -              | 0.1 | V     |
| Low Level Output Voltage<br>TTL Loads                          |                           |                                    | 4                   | 4.5                 | -    | -   | 0.26 | -             | 0.33 | -              | 0.4 | V     |
| Input Leakage Current                                          | I <sub>I</sub>            | V <sub>CC</sub> to GND             | 0                   | 5.5                 | -    | -   | ±0.1 | -             | ±1   | -              | ±1  | μA    |
| Quiescent Device Current                                       | I <sub>CC</sub>           | V <sub>CC</sub> or GND             | 0                   | 5.5                 | -    | -   | 8    | -             | 80   | -              | 160 | μA    |
| Additional Quiescent Device Current Per Input Pin: 1 Unit Load | ΔI <sub>CC</sub> (Note 2) | V <sub>CC</sub> -2.1               | -                   | 4.5 to 5.5          | -    | 100 | 360  | -             | 450  | -              | 490 | μA    |

NOTE:

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

**HCT Input Loading Table**

| INPUT                | UNIT LOADS |
|----------------------|------------|
| Date Shift-In (1, 2) | 0.3        |
| MR                   | 0.9        |
| Clock                | 0.7        |

NOTE: Unit Load is ΔI<sub>CC</sub> limit specified in DC Electrical Specifications table, e.g. 360μA max at 25°C.

**Prerequisite For Switching Function**

| PARAMETER               | SYMBOL           | V <sub>CC</sub> (V) | 25°C |     | -40°C TO 85°C |     | -55°C TO 125°C |     | UNITS |
|-------------------------|------------------|---------------------|------|-----|---------------|-----|----------------|-----|-------|
|                         |                  |                     | MIN  | MAX | MIN           | MAX | MIN            | MAX |       |
| HC TYPES                |                  |                     |      |     |               |     |                |     |       |
| Maximum Clock Frequency | f <sub>MAX</sub> | 2                   | 6    | -   | 5             | -   | 4              | -   | MHz   |
|                         |                  | 4.5                 | 30   | -   | 24            | -   | 20             | -   | MHz   |
|                         |                  | 6                   | 35   | -   | 28            | -   | 24             | -   | MHz   |
| MR Pulse Width          | t <sub>w</sub>   | 2                   | 60   | -   | 75            | -   | 90             | -   | ns    |
|                         |                  | 4.5                 | 12   | -   | 15            | -   | 18             | -   | ns    |
|                         |                  | 6                   | 10   | -   | 13            | -   | 15             | -   | ns    |

**CD54HC164, CD74HC164, CD54HCT164, CD74HCT164**

**Prerequisite For Switching Function (Continued)**

| PARAMETER                    | SYMBOL           | V <sub>CC</sub> (V) | 25°C |     | -40°C TO 85°C |     | -55°C TO 125°C |     | UNITS |
|------------------------------|------------------|---------------------|------|-----|---------------|-----|----------------|-----|-------|
|                              |                  |                     | MIN  | MAX | MIN           | MAX | MIN            | MAX |       |
| CP Pulse Width               | t <sub>W</sub>   | 2                   | 80   | -   | 100           | -   | 120            | -   | ns    |
|                              |                  | 4.5                 | 16   | -   | 20            | -   | 24             | -   | ns    |
|                              |                  | 6                   | 14   | -   | 17            | -   | 20             | -   | ns    |
| Set-up Time                  | t <sub>SU</sub>  | 2                   | 60   | -   | 75            | -   | 90             | -   | ns    |
|                              |                  | 4.5                 | 12   | -   | 15            | -   | 18             | -   | ns    |
|                              |                  | 6                   | 10   | -   | 13            | -   | 15             | -   | ns    |
| Hold Time                    | t <sub>H</sub>   | 2                   | 4    | -   | 4             | -   | 4              | -   | ns    |
|                              |                  | 4.5                 | 4    | -   | 4             | -   | 4              | -   | ns    |
|                              |                  | 6                   | 4    | -   | 4             | -   | 4              | -   | ns    |
| MR to Clock,<br>Removal Time | t <sub>REM</sub> | 2                   | 80   | -   | 100           | -   | 120            | -   | ns    |
|                              |                  | 4.5                 | 16   | -   | 20            | -   | 24             | -   | ns    |
|                              |                  | 6                   | 14   | -   | 17            | -   | 20             | -   | ns    |
| HCT TYPES                    |                  |                     |      |     |               |     |                |     |       |
| Maximum Clock Frequency      | f <sub>MAX</sub> | 4.5                 | 27   | -   | 22            | -   | 18             | -   | MHz   |
| MR Pulse Width               | t <sub>W</sub>   | 6                   | 18   | -   | 23            | -   | 27             | -   | ns    |
| CP Pulse Width               | t <sub>W</sub>   | 4.5                 | 18   | -   | 23            | -   | 27             | -   | ns    |
| Set-up Time                  | t <sub>SU</sub>  | 6                   | 12   | -   | 15            | -   | 18             | -   | ns    |
| Hold Time                    | t <sub>H</sub>   | 4.5                 | 4    | -   | 4             | -   | 4              | -   | ns    |
| MR to Clock,<br>Removal Time | t <sub>REM</sub> | 6                   | 16   | -   | 20            | -   | 24             | -   | ns    |

**Switching Specifications** Input t<sub>r</sub>, t<sub>f</sub> = 6ns

| PARAMETER                                  | SYMBOL                              | TEST<br>CONDITIONS    | V <sub>CC</sub> (V) | 25°C |     | -40°C TO 85°C | -55°C TO 125°C | UNITS |
|--------------------------------------------|-------------------------------------|-----------------------|---------------------|------|-----|---------------|----------------|-------|
|                                            |                                     |                       |                     | TYP  | MAX | MAX           | MAX            |       |
| HC TYPES                                   |                                     |                       |                     |      |     |               |                |       |
| Propagation Delay,<br>CP to Q <sub>n</sub> | t <sub>PLH</sub> , t <sub>PHL</sub> | C <sub>L</sub> = 50pF | 2                   | -    | 170 | 212           | 255            | ns    |
|                                            |                                     |                       | 4.5                 | -    | 34  | 43            | 51             | ns    |
|                                            |                                     | C <sub>L</sub> = 15pF | 5                   | 14   | -   | -             | -              | ns    |
|                                            |                                     | C <sub>L</sub> = 50pF | 6                   | -    | 29  | 36            | 43             | ns    |
| $\overline{\text{MR}}$ to Q <sub>n</sub>   | t <sub>PLH</sub> , t <sub>PHL</sub> | C <sub>L</sub> = 50pF | 2                   | -    | 140 | 175           | 210            | ns    |
|                                            |                                     |                       | 4.5                 | -    | 28  | 35            | 42             | ns    |
|                                            |                                     | C <sub>L</sub> = 15pF | 5                   | 11   | -   | -             | -              | ns    |
|                                            |                                     | C <sub>L</sub> = 50pF | 6                   | -    | 24  | 30            | 36             | ns    |
| Output Transition Times                    | t <sub>TLH</sub> , t <sub>THL</sub> | C <sub>L</sub> = 50pF | 2                   | -    | 75  | -             | 110            | ns    |
|                                            |                                     |                       | 4.5                 | -    | 15  | -             | 22             | ns    |
|                                            |                                     |                       | 6                   | -    | 13  | -             | 19             | ns    |
| Maximum Clock Frequency                    | f <sub>MAX</sub>                    | C <sub>L</sub> = 15pF | 5                   | 60   | -   | -             | -              | MHz   |
| Input Capacitance                          | C <sub>IN</sub>                     | -                     | -                   | -    | 10  | 10            | 10             | pF    |

# CD54HC164, CD74HC164, CD54HCT164, CD74HCT164

## Switching Specifications Input $t_r, t_f = 6\text{ns}$ (Continued)

| PARAMETER                                  | SYMBOL             | TEST CONDITIONS     | $V_{CC}$ (V) | 25°C |     | -40°C TO 85°C | -55°C TO 125°C | UNITS |
|--------------------------------------------|--------------------|---------------------|--------------|------|-----|---------------|----------------|-------|
|                                            |                    |                     |              | TYP  | MAX | MAX           | MAX            |       |
| Power Dissipation Capacitance (Notes 3, 4) | $C_{PD}$           | -                   | 5            | 47   | -   | -             | -              | pF    |
| <b>HCT TYPES</b>                           |                    |                     |              |      |     |               |                |       |
| Propagation Delay, CP to $Q_n$             | $t_{PLH}, t_{PHL}$ | $C_L = 50\text{pF}$ | 4.5          | -    | 36  | 45            | 54             | ns    |
|                                            |                    | $C_L = 15\text{pF}$ | 5            | 15   | -   | -             | -              | ns    |
| $\overline{MR}$ to $Q_n$                   | $t_{PLH}, t_{PHL}$ | $C_L = 50\text{pF}$ | 4.5          | -    | 38  | 46            | 57             | ns    |
|                                            |                    | $C_L = 15\text{pF}$ | 5            | 16   | -   | -             | -              | ns    |
| Output Transition Times                    | $t_{TLH}, t_{THL}$ | $C_L = 50\text{pF}$ | 4.5          | -    | 15  | 19            | 22             | ns    |
| Input Capacitance                          | $C_{IN}$           | -                   | -            | -    | -   | -             | -              | pF    |
| Maximum Clock Frequency                    | $f_{MAX}$          | $C_L = 15\text{pF}$ | -            | 54   | -   | -             | -              | MHz   |
| Power Dissipation Capacitance (Notes 3, 4) | $C_{PD}$           | -                   | 5            | 49   | 10  | 10            | 10             | pF    |

### NOTES:

- $C_{PD}$  is used to determine the dynamic power consumption, per device.
- $P_D = V_{CC}^2 f_i + \sum (C_L V_{CC}^2 + f_O)$  where  $f_i$  = Input Frequency,  $f_O$  = Output Frequency,  $C_L$  = Output Load Capacitance,  $V_{CC}$  = Supply Voltage.

## Test Circuits and Waveforms

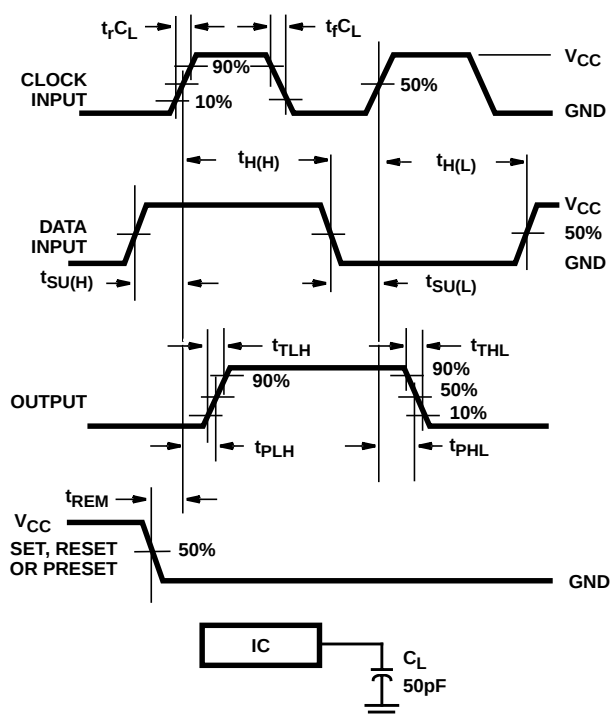


FIGURE 1. HC SETUP TIMES, HOLD TIMES, REMOVAL TIME, AND PROPAGATION DELAY TIMES FOR EDGE TRIGGERED SEQUENTIAL LOGIC CIRCUITS

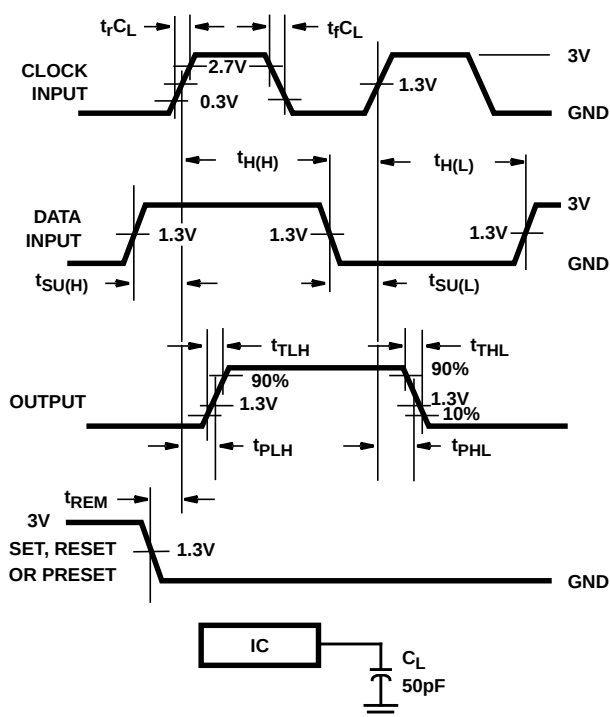


FIGURE 2. HCT SETUP TIMES, HOLD TIMES, REMOVAL TIME, AND PROPAGATION DELAY TIMES FOR EDGE TRIGGERED SEQUENTIAL LOGIC CIRCUITS

**PACKAGING INFORMATION**

| Orderable Device | Status <sup>(1)</sup> | Package Type | Package Drawing | Pins | Package Qty | Eco Plan <sup>(2)</sup> | Lead/Ball Finish | MSL Peak Temp <sup>(3)</sup>               |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|--------------------------------------------|
| 5962-8970401CA   | ACTIVE                | CDIP         | J               | 14   | 1           | None                    | Call TI          | Level-NC-NC-NC                             |
| CD54HC164F       | ACTIVE                | CDIP         | J               | 14   | 1           | None                    | Call TI          | Level-NC-NC-NC                             |
| CD54HC164F3A     | ACTIVE                | CDIP         | J               | 14   | 1           | None                    | Call TI          | Level-NC-NC-NC                             |
| CD54HCT164F3A    | ACTIVE                | CDIP         | J               | 14   | 1           | None                    | Call TI          | Level-NC-NC-NC                             |
| CD74HC164E       | ACTIVE                | PDIP         | N               | 14   | 25          | Pb-Free (RoHS)          | CU NIPDAU        | Level-NC-NC-NC                             |
| CD74HC164M       | ACTIVE                | SOIC         | D               | 14   | 50          | Pb-Free (RoHS)          | CU NIPDAU        | Level-2-260C-1 YEAR/<br>Level-1-235C-UNLIM |
| CD74HC164M96     | ACTIVE                | SOIC         | D               | 14   | 2500        | Pb-Free (RoHS)          | CU NIPDAU        | Level-2-260C-1 YEAR/<br>Level-1-235C-UNLIM |
| CD74HC164MT      | ACTIVE                | SOIC         | D               | 14   | 250         | Pb-Free (RoHS)          | CU NIPDAU        | Level-2-260C-1 YEAR/<br>Level-1-235C-UNLIM |
| CD74HCT164E      | ACTIVE                | PDIP         | N               | 14   | 25          | Pb-Free (RoHS)          | CU NIPDAU        | Level-NC-NC-NC                             |
| CD74HCT164M      | ACTIVE                | SOIC         | D               | 14   | 50          | Pb-Free (RoHS)          | CU NIPDAU        | Level-2-260C-1 YEAR/<br>Level-1-235C-UNLIM |
| CD74HCT164M96    | ACTIVE                | SOIC         | D               | 14   | 2500        | Pb-Free (RoHS)          | CU NIPDAU        | Level-2-260C-1 YEAR/<br>Level-1-235C-UNLIM |
| CD74HCT164MT     | ACTIVE                | SOIC         | D               | 14   | 250         | Pb-Free (RoHS)          | CU NIPDAU        | Level-2-260C-1 YEAR/<br>Level-1-235C-UNLIM |

<sup>(1)</sup> The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBSOLETE:** TI has discontinued the production of the device.

<sup>(2)</sup> Eco Plan - May not be currently available - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

**None:** Not yet available Lead (Pb-Free).

**Pb-Free (RoHS):** TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

**Green (RoHS & no Sb/Br):** TI defines "Green" to mean "Pb-Free" and in addition, uses package materials that do not contain halogens, including bromine (Br) or antimony (Sb) above 0.1% of total product weight.

<sup>(3)</sup> MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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J (R-GDIP-T\*\*)

14 LEADS SHOWN

# CERAMIC DUAL IN-LINE PACKAGE



| PINS **<br>DIM | 14                     | 16                     | 18                     | 20                     |
|----------------|------------------------|------------------------|------------------------|------------------------|
| A              | 0.300<br>(7,62)<br>BSC | 0.300<br>(7,62)<br>BSC | 0.300<br>(7,62)<br>BSC | 0.300<br>(7,62)<br>BSC |
| B MAX          | 0.785<br>(19,94)       | .840<br>(21,34)        | 0.960<br>(24,38)       | 1.060<br>(26,92)       |
| B MIN          | —                      | —                      | —                      | —                      |
| C MAX          | 0.300<br>(7,62)        | 0.300<br>(7,62)        | 0.310<br>(7,87)        | 0.300<br>(7,62)        |
| C MIN          | 0.245<br>(6,22)        | 0.245<br>(6,22)        | 0.220<br>(5,59)        | 0.245<br>(6,22)        |



4040083/F 03/03

- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. This package is hermetically sealed with a ceramic lid using glass frit.
  - D. Index point is provided on cap for terminal identification only on press ceramic glass frit seal only.
  - E. Falls within MIL STD 1835 GDIP1-T14, GDIP1-T16, GDIP1-T18 and GDIP1-T20.

## N (R-PDIP-T\*\*)

16 PINS SHOWN

## PLASTIC DUAL-IN-LINE PACKAGE



| PINS **             | 14               | 16               | 18               | 20               |
|---------------------|------------------|------------------|------------------|------------------|
| DIM                 |                  |                  |                  |                  |
| A MAX               | 0.775<br>(19,69) | 0.775<br>(19,69) | 0.920<br>(23,37) | 1.060<br>(26,92) |
| A MIN               | 0.745<br>(18,92) | 0.745<br>(18,92) | 0.850<br>(21,59) | 0.940<br>(23,88) |
| MS-001<br>VARIATION | AA               | BB               | AC               | AD               |



14/18 Pin Only  
20 Pin vendor option

4040049/E 12/2002

- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
  - The 20 pin end lead shoulder width is a vendor option, either half or full width.

## D (R-PDSO-G14)

## PLASTIC SMALL-OUTLINE PACKAGE



- NOTES:
- All linear dimensions are in inches (millimeters).
  - This drawing is subject to change without notice.
  - Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
  - Falls within JEDEC MS-012 variation AB.

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