

### Features

- 'HC161, 'HCT161 4-Bit Binary Counter, Asynchronous Reset
- 'HC163, 'HCT163 4-Bit Binary Counter, Synchronous Reset
- Synchronous Counting and Loading
- Two Count Enable Inputs for n-Bit Cascading
- Look-Ahead Carry for High-Speed Counting
- Fanout (Over Temperature Range)
  - Standard Outputs . . . . . 10 LSTTL Loads
  - Bus Driver Outputs . . . . . 15 LSTTL Loads
- Wide Operating Temperature Range . . -55°C to 125°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  $V_{CC} = 5V$
- HCT Types
  - 4.5V to 5.5V Operation
  - Direct LSTTL Input Logic Compatibility,  $V_{IL} = 0.8V$  (Max),  $V_{IH} = 2V$  (Min)
  - CMOS Input Compatibility,  $I_I \leq 1\mu A$  at  $V_{OL}$ ,  $V_{OH}$

### Description

The 'HC161, 'HCT161, 'HC163, and 'HCT163 are presettable synchronous counters that feature look-ahead carry logic for use in high-speed counting applications. The 'HC161 and 'HCT161 are asynchronous reset decade and binary counters, respectively; the 'HC163 and 'HCT163 devices are decade and binary counters, respectively, that are reset synchronously with the clock. Counting and parallel presetting are both accomplished synchronously with the negative-to-positive transition of the clock.

A low level on the synchronous parallel enable input, SPE, disables counting operation and allows data at the P0 to P3 inputs to be loaded into the counter (provided that the setup and hold requirements for SPE are met).

All counters are reset with a low level on the Master Reset input, MR. In the 'HC163 and 'HCT163 counters (synchronous reset types), the requirements for setup and hold time with respect to the clock must be met.

Two count enables, PE and TE, in each counter are provided for n-bit cascading. In all counters reset action occurs regardless of the level of the  $\overline{SPE}$ , PE and TE inputs (and the clock input, CP, in the 'HC161 and 'HCT161 types).

If a decade counter is preset to an illegal state or assumes an illegal state when power is applied, it will return to the normal sequence in one count as shown in state diagram.

The look-ahead carry feature simplifies serial cascading of the counters. Both count enable inputs (PE and TE) must be high to count. The TE input is gated with the Q outputs of all four stages so that at the maximum count the terminal count (TC) output goes high for one clock period. This TC pulse is used to enable the next cascaded stage.

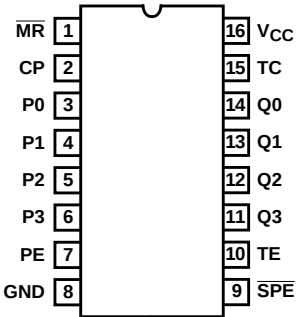
### Ordering Information

| PART NUMBER   | TEMP. RANGE (°C) | PACKAGE      |
|---------------|------------------|--------------|
| CD54HC161F3A  | -55 to 125       | 16 Ld CERDIP |
| CD54HC163F3A  | -55 to 125       | 16 Ld CERDIP |
| CD54HCT163F3A | -55 to 125       | 16 Ld CERDIP |
| CD74HC161E    | -55 to 125       | 16 Ld PDIP   |
| CD74HC161M    | -55 to 125       | 16 Ld SOIC   |
| CD74HC161MT   | -55 to 125       | 16 Ld SOIC   |
| CD74HC161M96  | -55 to 125       | 16 Ld SOIC   |
| CD74HC163E    | -55 to 125       | 16 Ld PDIP   |
| CD74HC163M    | -55 to 125       | 16 Ld SOIC   |
| CD74HC163MT   | -55 to 125       | 16 Ld SOIC   |
| CD74HC163M96  | -55 to 125       | 16 Ld SOIC   |
| CD74HCT161E   | -55 to 125       | 16 Ld PDIP   |
| CD74HCT161M   | -55 to 125       | 16 Ld SOIC   |
| CD74HCT161MT  | -55 to 125       | 16 Ld SOIC   |
| CD74HCT161M96 | -55 to 125       | 16 Ld SOIC   |
| CD74HCT163E   | -55 to 125       | 16 Ld PDIP   |
| CD74HCT163M   | -55 to 125       | 16 Ld SOIC   |
| CD74HCT163MT  | -55 to 125       | 16 Ld SOIC   |
| CD74HCT163M96 | -55 to 125       | 16 Ld SOIC   |

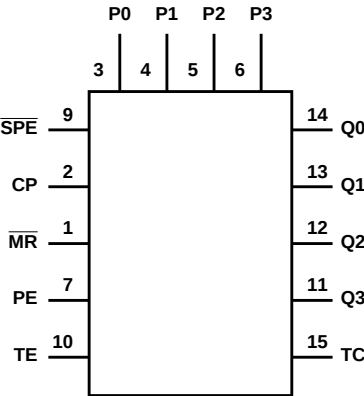
NOTE: When ordering, use the entire part number. The suffix 96 denotes tape and reel. The suffix T denotes a small-quantity reel of 250.

**Pinout**

CD54HC161, CD54HCT161, CD54HC163, CD54HCT163  
(CERDIP)  
CD74HC161, CD74HCT161, CD74HC163, CD74HCT163  
(PDIP, SOIC)  
TOP VIEW



**Functional Diagram**



**CD54/74HC161, CD54/74HCT161, CD54/74HC163, CD54/74HCT163**

**MODE SELECT - FUNCTION TABLE FOR 'HC161 AND 'HCT161**

| OPERATING MODE | INPUTS          |    |            |            |                  |       | OUTPUTS |          |
|----------------|-----------------|----|------------|------------|------------------|-------|---------|----------|
|                | $\overline{MR}$ | CP | PE         | TE         | $\overline{SPE}$ | $P_n$ | $Q_n$   | TC       |
| Reset (Clear)  | L               | X  | X          | X          | X                | X     | L       | L        |
| Parallel Load  | H               | ↑  | X          | X          | l                | l     | L       | L        |
|                | H               | ↑  | X          | X          | l                | h     | H       | (Note 1) |
| Count          | H               | ↑  | h          | h          | h (Note 3)       | X     | Count   | (Note 1) |
| Inhibit        | H               | X  | l (Note 2) | X          | h (Note 3)       | X     | $q_n$   | (Note 1) |
|                | H               | X  | X          | l (Note 2) | h (Note 3)       | X     | $q_n$   | L        |

**MODE SELECT - FUNCTION TABLE FOR 'HC163 AND 'HCT163**

| OPERATING MODE | INPUTS          |    |            |            |                  |       | OUTPUTS |          |
|----------------|-----------------|----|------------|------------|------------------|-------|---------|----------|
|                | $\overline{MR}$ | CP | PE         | TE         | $\overline{SPE}$ | $P_n$ | $Q_n$   | TC       |
| Reset (Clear)  | l               | ↑  | X          | X          | X                | X     | L       | L        |
| Parallel Load  | h (Note 3)      | ↑  | X          | X          | l                | l     | L       | L        |
|                | h (Note 3)      | ↑  | X          | X          | l                | h     | H       | (Note 1) |
| Count          | h (Note 3)      | ↑  | h          | h          | h (Note 3)       | X     | Count   | (Note 1) |
| Inhibit        | h (Note 3)      | X  | l (Note 2) | X          | h (Note 3)       | X     | $q_n$   | (Note 1) |
|                | h (Note 3)      | X  | X          | l (Note 2) | h (Note 3)       | X     | $q_n$   | L        |

H = High voltage level steady state; L = Low voltage level steady state; h = High voltage level one setup time prior to the Low-to-High clock transition; l = Low voltage level one setup time prior to the Low-to-High clock transition; X = Don't Care; q = Lower case letters indicate the state of the referenced output prior to the Low-to-High clock transition; ↑ = Low-to-High clock transition.

**NOTES:**

1. The TC output is High when TE is High and the counter is at Terminal Count (HHHH for HC/HCT161 and 'HC/HCT163).
2. The High-to-Low transition of PE or TE on the 'HC/HCT161 and the 'HC/HCT163 should only occur while CP is HIGH for conventional operation.
3. The Low-to-High transition of  $\overline{SPE}$  on the 'HC/HCT161 and  $\overline{SPE}$  or  $\overline{MR}$  on the 'HC/HCT163 should only occur while CP is HIGH for conventional operation.

# CD54/74HC161, CD54/74HCT161, CD54/74HC163, CD54/74HCT163

## 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 Drain Current, per Output,  $I_O$   
 For  $-0.5V < V_O < V_{CC} + 0.5V$  .....  $\pm 25mA$   
 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,  $I_{CC}$  .....  $\pm 50mA$

## Thermal Information

Thermal Resistance (Typical, Note 4)  $\theta_{JA}$  ( $^{\circ}C/W$ )  
 E (PDIP) Package ..... 67  
 M (SOIC) Package ..... 73  
 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:

- 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 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     |
| High Level Output Voltage<br>TTL Loads  | V <sub>OH</sub> | V <sub>IH</sub> or V <sub>IL</sub> | -                   | -                   | -    | -   | -    | -             | -    | -              | -    | V     |
|                                         |                 |                                    | -4                  | 4.5                 | 3.98 | -   | -    | 3.84          | -    | 3.7            | -    | V     |
|                                         |                 |                                    | -5.2                | 6                   | 5.48 | -   | -    | 5.34          | -    | 5.2            | -    | V     |
| Low Level Output Voltage<br>CMOS Loads  | V <sub>OL</sub> | V <sub>IH</sub> or 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     |
| Low Level Output Voltage<br>TTL Loads   | V <sub>OL</sub> | V <sub>IH</sub> or V <sub>IL</sub> | -                   | -                   | -    | -   | -    | -             | -    | -              | -    | V     |
|                                         |                 |                                    | 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>  | V <sub>CC</sub> or GND             | -                   | 6                   | -    | -   | ±0.1 | -             | ±1   | -              | ±1   | μA    |

**CD54/74HC161, CD54/74HCT161, CD54/74HC163, CD54/74HCT163**

**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 |       |
| Quiescent Device Current                                       | I <sub>CC</sub>           | V <sub>CC</sub> or GND             | 0                   | 6                   | -    | -   | 8    | -             | 80   | -              | 160 | μA    |
| <b>HCT TYPES</b>                                               |                           |                                    |                     |                     |      |     |      |               |      |                |     |       |
| 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> and 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 5) | V <sub>CC</sub> -2.1               | -                   | 4.5 to 5.5          | -    | 100 | 360  | -             | 450  | -              | 490 | μA    |

NOTE:

5. 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 |
|---------|------------|
| P0 - P3 | 0.25       |
| PE      | 0.65       |
| CP      | 1.05       |
| MR      | 0.8        |
| SPE     | 0.5        |
| TE      | 1.05       |

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

**CD54/74HC161, CD54/74HCT161, CD54/74HC163, CD54/74HCT163**

**Prerequisite For Switching Specifications**

| PARAMETER                                  | SYMBOL            | TEST CONDITIONS | V <sub>CC</sub> (V) | 25°C |     |     | -40°C TO 85°C |     | -55°C TO 125°C |     | UNITS |
|--------------------------------------------|-------------------|-----------------|---------------------|------|-----|-----|---------------|-----|----------------|-----|-------|
|                                            |                   |                 |                     | MIN  | TYP | MAX | MIN           | MAX | MIN            | MAX |       |
| HC TYPES                                   |                   |                 |                     |      |     |     |               |     |                |     |       |
| Maximum CP Frequency (Note 6)              | f <sub>MAX</sub>  | -               | 2                   | 6    | -   | -   | 5             | -   | 4              | -   | MHz   |
|                                            |                   |                 | 4.5                 | 30   | -   | -   | 24            | -   | 20             | -   | MHz   |
|                                            |                   |                 | 6                   | 35   | -   | -   | 28            | -   | 24             | -   | MHz   |
| CP Width (Low)                             | t <sub>W(L)</sub> | -               | 2                   | 80   | -   | -   | 100           | -   | 120            | -   | ns    |
|                                            |                   |                 | 4.5                 | 16   | -   | -   | 20            | -   | 24             | -   | ns    |
|                                            |                   |                 | 6                   | 14   | -   | -   | 17            | -   | 20             | -   | ns    |
| MR Pulse Width (161)                       | t <sub>W</sub>    | -               | 2                   | 100  | -   | -   | 125           | -   | 150            | -   | ns    |
|                                            |                   |                 | 4.5                 | 20   | -   | -   | 25            | -   | 30             | -   | ns    |
|                                            |                   |                 | 6                   | 17   | -   | -   | 21            | -   | 26             | -   | ns    |
| Setup Time, Pn to CP                       | t <sub>SU</sub>   | -               | 2                   | 60   | -   | -   | 75            | -   | 90             | -   | ns    |
|                                            |                   |                 | 4.5                 | 12   | -   | -   | 15            | -   | 18             | -   | ns    |
|                                            |                   |                 | 6                   | 10   | -   | -   | 13            | -   | 15             | -   | ns    |
| Setup Time, PE or TE to CP                 | t <sub>SU</sub>   | -               | 2                   | 50   | -   | -   | 65            | -   | 75             | -   | ns    |
|                                            |                   |                 | 4.5                 | 10   | -   | -   | 13            | -   | 15             | -   | ns    |
|                                            |                   |                 | 6                   | 9    | -   | -   | 11            | -   | 13             | -   | ns    |
| Setup Time, $\overline{SPE}$ to CP         | t <sub>SU</sub>   | -               | 2                   | 60   | -   | -   | 75            | -   | 90             | -   | ns    |
|                                            |                   |                 | 4.5                 | 12   | -   | -   | 15            | -   | 18             | -   | ns    |
|                                            |                   |                 | 6                   | 10   | -   | -   | 13            | -   | 15             | -   | ns    |
| Setup Time, $\overline{MR}$ to CP (163)    | t <sub>SU</sub>   | -               | 2                   | 65   | -   | -   | 80            | -   | 100            | -   | ns    |
|                                            |                   |                 | 4.5                 | 13   | -   | -   | 16            | -   | 20             | -   | ns    |
|                                            |                   |                 | 6                   | 11   | -   | -   | 14            | -   | 17             | -   | ns    |
| Hold Time, PN to CP                        | t <sub>H</sub>    | -               | 2                   | 3    | -   | -   | 3             | -   | 3              | -   | ns    |
|                                            |                   |                 | 4.5                 | 3    | -   | -   | 3             | -   | 3              | -   | ns    |
|                                            |                   |                 | 6                   | 3    | -   | -   | 3             | -   | 3              | -   | ns    |
| Hold Time, TE or PE to CP                  | t <sub>H</sub>    | -               | 2                   | 0    | -   | -   | 0             | -   | 0              | -   | ns    |
|                                            |                   |                 | 4.5                 | 0    | -   | -   | 0             | -   | 0              | -   | ns    |
|                                            |                   |                 | 6                   | 0    | -   | -   | 0             | -   | 0              | -   | ns    |
| Hold Time, $\overline{SPE}$ to CP          | t <sub>H</sub>    | -               | 2                   | 0    | -   | -   | 0             | -   | 0              | -   | ns    |
|                                            |                   |                 | 4.5                 | 0    | -   | -   | 0             | -   | 0              | -   | ns    |
|                                            |                   |                 | 6                   | 0    | -   | -   | 0             | -   | 0              | -   | ns    |
| Recovery Time, $\overline{MR}$ to CP (161) | t <sub>REC</sub>  | -               | 2                   | 75   | -   | -   | 95            | -   | 110            | -   | ns    |
|                                            |                   |                 | 4.5                 | 15   | -   | -   | 19            | -   | 22             | -   | ns    |
|                                            |                   |                 | 6                   | 13   | -   | -   | 16            | -   | 19             | -   | ns    |

**CD54/74HC161, CD54/74HCT161, CD54/74HC163, CD54/74HCT163**

**Prerequisite For Switching Specifications (Continued)**

| PARAMETER                                         | SYMBOL            | TEST CONDITIONS | V <sub>CC</sub> (V) | 25°C |     |     | -40°C TO 85°C |     | -55°C TO 125°C |     | UNITS |
|---------------------------------------------------|-------------------|-----------------|---------------------|------|-----|-----|---------------|-----|----------------|-----|-------|
|                                                   |                   |                 |                     | MIN  | TYP | MAX | MIN           | MAX | MIN            | MAX |       |
| HCT TYPES                                         |                   |                 |                     |      |     |     |               |     |                |     |       |
| Maximum CP Frequency                              | f <sub>MAX</sub>  | -               | 4.5                 | 30   | -   | -   | 24            | -   | 20             | -   | MHz   |
| CP Width (Low) (Note 6)                           | t <sub>W(L)</sub> | -               | 4.5                 | 16   | -   | -   | 20            | -   | 24             | -   | ns    |
| $\overline{\text{MR}}$ Pulse Width (161)          | t <sub>W</sub>    | -               | 4.5                 | 20   | -   | -   | 25            | -   | 30             | -   | ns    |
| Setup Time, Pn to CP                              | t <sub>SU</sub>   | -               | 4.5                 | 10   | -   | -   | 13            | -   | 15             | -   | ns    |
| Setup Time, PE or TE to CP                        | t <sub>SU</sub>   | -               | 4.5                 | 13   | -   | -   | 16            | -   | 20             | -   | ns    |
| Setup Time, $\overline{\text{SPE}}$ to CP         | t <sub>SU</sub>   | -               | 4.5                 | 12   | -   | -   | 15            | -   | 18             | -   | ns    |
| Setup Time, $\overline{\text{MR}}$ to CP (163)    | t <sub>SU</sub>   | -               | 4.5                 | 13   | -   | -   | 16            | -   | 20             | -   | ns    |
| Hold Time, PN to CP                               | t <sub>H</sub>    | -               | 4.5                 | 5    | -   | -   | 5             | -   | 5              | -   | ns    |
| Hold Time, TE or PE to CP                         | t <sub>H</sub>    | -               | 4.5                 | 3    | -   | -   | 3             | -   | 3              | -   | ns    |
| Hold Time, $\overline{\text{SPE}}$ to CP          | t <sub>H</sub>    | -               | 4.5                 | 3    | -   | -   | 3             | -   | 3              | -   | ns    |
| Recovery Time, $\overline{\text{MR}}$ to CP (161) | t <sub>REC</sub>  | -               | 4.5                 | 15   | -   | -   | 19            | -   | 22             | -   | ns    |

NOTE:

6. Applies to non-cascaded operation only. With cascaded counters clock to terminal count propagation delays, count enables (PE or TE)-to-clock setup times, and count enables (PE or TE)-to-clock hold times determine maximum clock frequency. For example with these HC devices:

$$f_{\text{MAX}} (\text{CP}) = \frac{1}{\text{CP-to-TC prop. delay} + \text{TE-to-CP setup} + \text{TE-to-CP Hold}} = \frac{1}{37 + 10 + 0} \approx 21\text{MHz}(\text{min})$$

**Switching Specifications** C<sub>L</sub> = 50pF, 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<br>85°C |     | -55°C TO<br>125°C |     | UNITS |
|-------------------------------|-------------------------------------|-----------------------|---------------------|------|-----|-----|------------------|-----|-------------------|-----|-------|
|                               |                                     |                       |                     | MIN  | TYP | MAX | MIN              | MAX | MIN               | MAX |       |
| HC TYPES                      |                                     |                       |                     |      |     |     |                  |     |                   |     |       |
| Propagation Delay<br>CP to TC | t <sub>PHL</sub> , t <sub>PLH</sub> | C <sub>L</sub> = 50pF | 2                   | -    | -   | 185 | -                | 230 | -                 | 280 | ns    |
|                               |                                     |                       | 4.5                 | -    | -   | 37  | -                | 46  | -                 | 56  | ns    |
|                               |                                     | C <sub>L</sub> = 15pF | 5                   | -    | 15  | -   | -                | -   | -                 | -   | ns    |
|                               |                                     | C <sub>L</sub> = 50pF | 6                   | -    | -   | 31  | -                | 39  | -                 | 48  | ns    |
| CP to Qn                      | t <sub>PHL</sub> , t <sub>PLH</sub> | C <sub>L</sub> = 50pF | 2                   | -    | -   | 185 | -                | 230 | -                 | 280 | ns    |
|                               |                                     |                       | 4.5                 | -    | -   | 37  | -                | 46  | -                 | 56  | ns    |
|                               |                                     | C <sub>L</sub> = 15pF | 5                   | -    | 15  | -   | -                | -   | -                 | -   | ns    |
|                               |                                     | C <sub>L</sub> = 50pF | 6                   | -    | -   | 31  | -                | 39  | -                 | 48  | ns    |
| TE to TC                      | t <sub>PHL</sub> , t <sub>PLH</sub> | C <sub>L</sub> = 50pF | 2                   | -    | -   | 120 | -                | 150 | -                 | 180 | ns    |
|                               |                                     |                       | 4.5                 | -    | -   | 24  | -                | 30  | -                 | 36  | ns    |
|                               |                                     | C <sub>L</sub> = 15pF | 5                   | -    | 9   | -   | -                | -   | -                 | -   | ns    |
|                               |                                     | C <sub>L</sub> = 50pF | 6                   | -    | -   | 20  | -                | 26  | -                 | 31  | ns    |

**CD54/74HC161, CD54/74HCT161, CD54/74HC163, CD54/74HCT163**

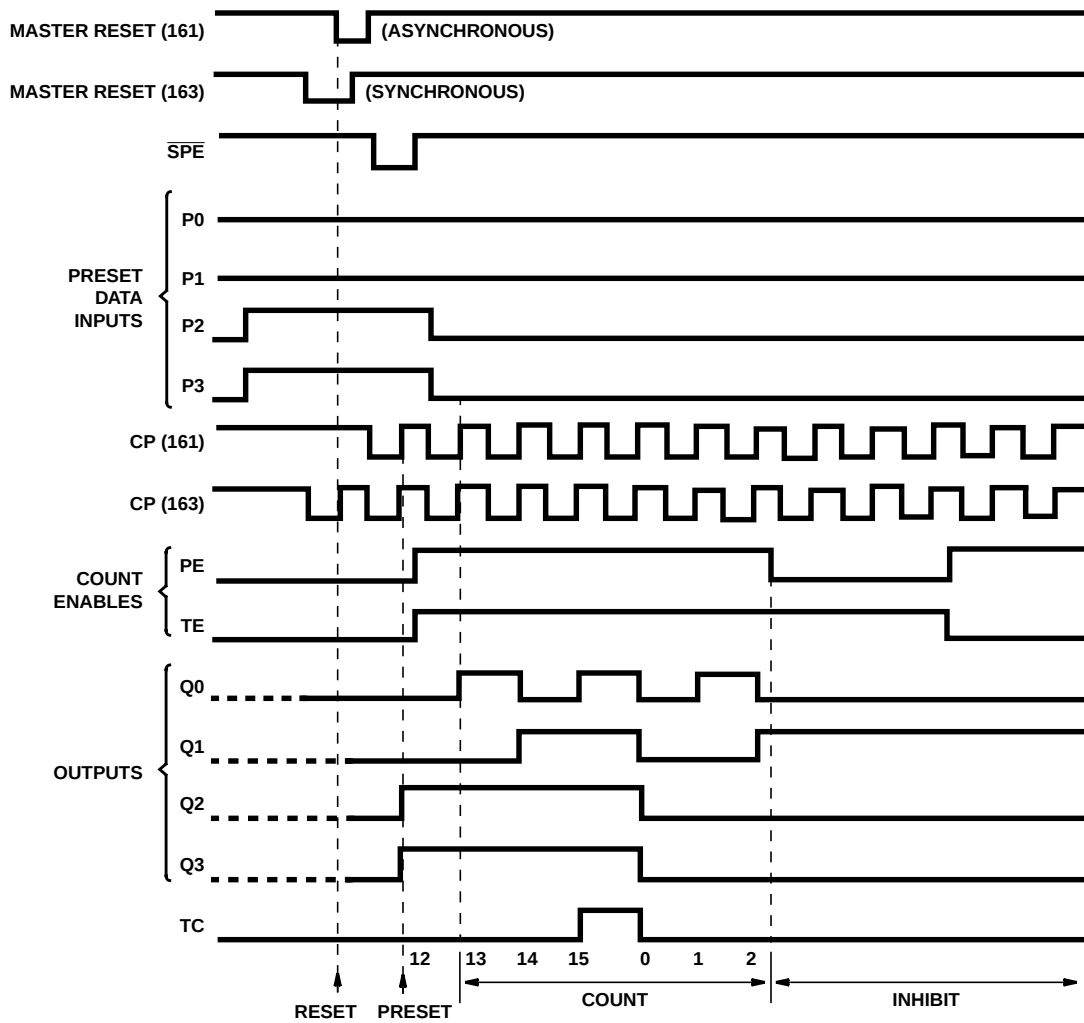
**Switching Specifications**  $C_L = 50\text{pF}$ , Input  $t_r$ ,  $t_f = 6\text{ns}$  (Continued)

| PARAMETER                                  | SYMBOL             | TEST CONDITIONS     | $V_{CC}$ (V) | 25°C |     |     | -40°C TO 85°C |     | -55°C TO 125°C |     | UNITS |
|--------------------------------------------|--------------------|---------------------|--------------|------|-----|-----|---------------|-----|----------------|-----|-------|
|                                            |                    |                     |              | MIN  | TYP | MAX | MIN           | MAX | MIN            | MAX |       |
| $\overline{MR}$ to Qn (161)                | $t_{PHL}$          | $C_L = 50\text{pF}$ | 2            | -    | -   | 210 | -             | 265 | -              | 315 | ns    |
|                                            |                    |                     | 4.5          | -    | -   | 42  | -             | 53  | -              | 63  | ns    |
|                                            |                    | $C_L = 15\text{pF}$ | 5            | -    | 18  | -   | -             | -   | -              | -   | ns    |
|                                            |                    | $C_L = 50\text{pF}$ | 6            | -    | -   | 36  | -             | 45  | -              | 54  | ns    |
| $\overline{MR}$ to TC (161)                | $t_{PHL}$          | $C_L = 50\text{pF}$ | 2            | -    | -   | 210 | -             | 265 | -              | 315 | ns    |
|                                            |                    |                     | 4.5          | -    | -   | 42  | -             | 53  | -              | 63  | ns    |
|                                            |                    | $C_L = 50\text{pF}$ | 6            | -    | -   | 36  | -             | 45  | -              | 54  | ns    |
| Output Transition Time                     | $t_{THL}, t_{TLH}$ | $C_L = 50\text{pF}$ | 2            | -    | -   | 75  | -             | 95  | -              | 110 | ns    |
|                                            |                    |                     | 4.5          | -    | -   | 15  | -             | 19  | -              | 22  | ns    |
|                                            |                    |                     | 6            | -    | -   | 13  | -             | 16  | -              | 19  | ns    |
| Power Dissipation Capacitance (Notes 7, 8) | $C_{PD}$           | -                   | 5            | -    | 60  | -   | -             | -   | -              | -   | pF    |
| Input Capacitance                          | $C_{IN}$           | $C_L = 50\text{pF}$ | -            | 10   | -   | 10  | -             | 10  | -              | 10  | pF    |
| <b>HCT TYPES</b>                           |                    |                     |              |      |     |     |               |     |                |     |       |
| Propagation Delay<br>CP to TC              | $t_{PHL}, t_{PLH}$ | $C_L = 50\text{pF}$ | 4.5          | -    | -   | 42  | -             | 53  | -              | 63  | ns    |
|                                            |                    | $C_L = 15\text{pF}$ | 5            | -    | 18  | -   | -             | -   | -              | -   | ns    |
| CP to Qn                                   | $t_{PHL}, t_{PLH}$ | $C_L = 50\text{pF}$ | 4.5          | -    | -   | 39  | -             | 49  | -              | 59  | ns    |
|                                            |                    | $C_L = 15\text{pF}$ | 5            | -    | 16  | -   | -             | -   | -              | -   | ns    |
| TE to TC                                   | $t_{PHL}, t_{PLH}$ | $C_L = 50\text{pF}$ | 4.5          | -    | -   | 32  | -             | 40  | -              | 48  | ns    |
|                                            |                    | $C_L = 15\text{pF}$ | 5            | -    | 13  | -   | -             | -   | -              | -   | ns    |
| $\overline{MR}$ to Qn (161)                | $t_{PHL}$          | $C_L = 50\text{pF}$ | 4.5          | -    | -   | 50  | -             | 63  | -              | 75  | ns    |
|                                            |                    | $C_L = 15\text{pF}$ | 5            | -    | 21  | -   | -             | -   | -              | -   | ns    |
| $\overline{MR}$ to TC (161)                | $t_{PHL}$          | $C_L = 50\text{pF}$ | 4.5          | -    | -   | 50  | -             | 63  | -              | 75  | ns    |
| Output Transition Time                     | $t_{THL}, t_{TLH}$ | $C_L = 50\text{pF}$ | 4.5          | -    | -   | 15  | -             | 19  | -              | 22  | ns    |
| Power Dissipation Capacitance (Notes 7, 8) | $C_{PD}$           | -                   | 5            | -    | 63  | -   | -             | -   | -              | -   | pF    |
| Input Capacitance                          | $C_{IN}$           | $C_L = 50\text{pF}$ | -            | 10   | -   | 10  | -             | 10  | -              | 10  | pF    |

**NOTES:**

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

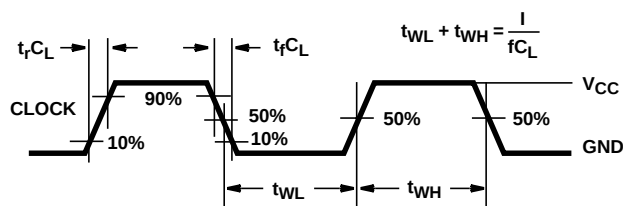
## Timing Diagram



Sequence illustrated on waveforms:

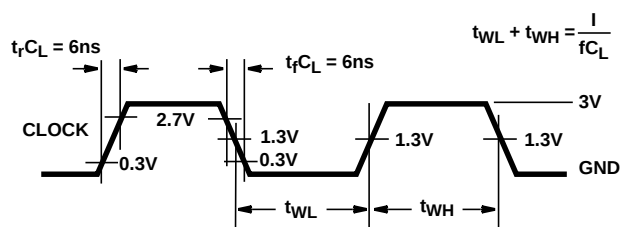
1. Reset outputs to zero.
2. Preset to binary twelve.
3. Count to thirteen, fourteen, fifteen, zero, one, and two.
4. Inhibit.

## Test Circuits and Waveforms



NOTE: Outputs should be switching from 10%  $V_{CC}$  to 90%  $V_{CC}$  in accordance with device truth table. For  $f_{MAX}$ , input duty cycle = 50%.

FIGURE 1. HC CLOCK PULSE RISE AND FALL TIMES AND PULSE WIDTH



NOTE: Outputs should be switching from 10%  $V_{CC}$  to 90%  $V_{CC}$  in accordance with device truth table. For  $f_{MAX}$ , input duty cycle = 50%.

FIGURE 2. HCT CLOCK PULSE RISE AND FALL TIMES AND PULSE WIDTH

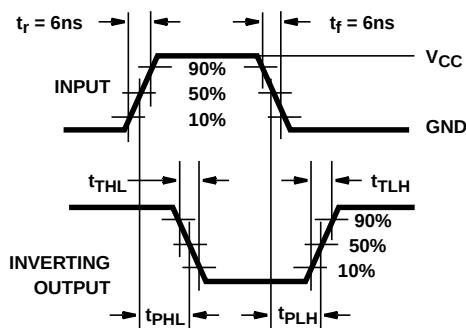


FIGURE 3. HC TRANSITION TIMES AND PROPAGATION DELAY TIMES, COMBINATION LOGIC

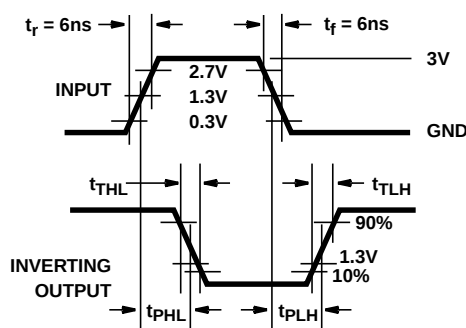


FIGURE 4. HCT TRANSITION TIMES AND PROPAGATION DELAY TIMES, COMBINATION LOGIC

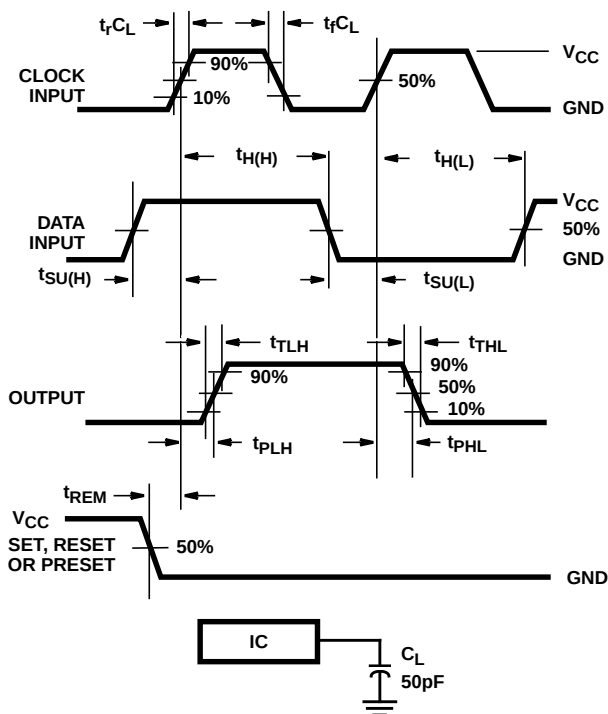


FIGURE 5. HC SETUP TIMES, HOLD TIMES, REMOVAL TIME, AND PROPAGATION DELAY TIMES FOR EDGE TRIGGERED SEQUENTIAL LOGIC CIRCUITS

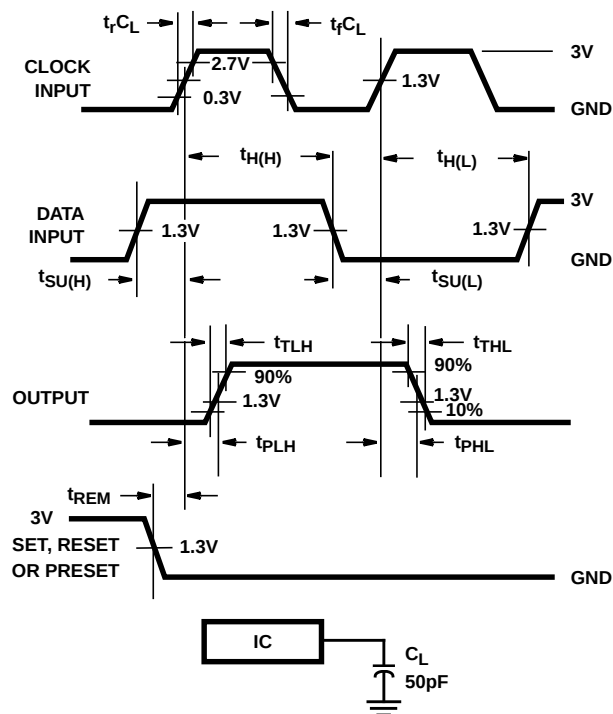


FIGURE 6. HCT SETUP TIMES, HOLD TIMES, REMOVAL TIME, AND PROPAGATION DELAY TIMES FOR EDGE TRIGGERED SEQUENTIAL LOGIC CIRCUITS

**PACKAGING INFORMATION**

| Orderable part number         | Status<br>(1) | Material type<br>(2) | Package   Pins | Package qty   Carrier | RoHS<br>(3) | Lead finish/<br>Ball material<br>(4) | MSL rating/<br>Peak reflow<br>(5) | Op temp (°C) | Part marking<br>(6)       |
|-------------------------------|---------------|----------------------|----------------|-----------------------|-------------|--------------------------------------|-----------------------------------|--------------|---------------------------|
| <a href="#">CD54HC161F</a>    | Active        | Production           | CDIP (J)   16  | 25   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | CD54HC161F                |
| CD54HC161F.A                  | Active        | Production           | CDIP (J)   16  | 25   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | CD54HC161F                |
| <a href="#">CD54HC161F3A</a>  | Active        | Production           | CDIP (J)   16  | 25   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | 8407501EA<br>CD54HC161F3A |
| CD54HC161F3A.A                | Active        | Production           | CDIP (J)   16  | 25   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | 8407501EA<br>CD54HC161F3A |
| <a href="#">CD54HC163F3A</a>  | Active        | Production           | CDIP (J)   16  | 25   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | 8607601EA<br>CD54HC163F3A |
| CD54HC163F3A.A                | Active        | Production           | CDIP (J)   16  | 25   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | 8607601EA<br>CD54HC163F3A |
| <a href="#">CD54HCT163F</a>   | Active        | Production           | CDIP (J)   16  | 25   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | CD54HCT163F               |
| CD54HCT163F.A                 | Active        | Production           | CDIP (J)   16  | 25   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | CD54HCT163F               |
| <a href="#">CD54HCT163F3A</a> | Active        | Production           | CDIP (J)   16  | 25   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | CD54HCT163F3A             |
| CD54HCT163F3A.A               | Active        | Production           | CDIP (J)   16  | 25   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | CD54HCT163F3A             |
| <a href="#">CD74HC161E</a>    | Active        | Production           | PDIP (N)   16  | 25   TUBE             | Yes         | NIPDAU                               | N/A for Pkg Type                  | -55 to 125   | CD74HC161E                |
| CD74HC161E.A                  | Active        | Production           | PDIP (N)   16  | 25   TUBE             | Yes         | NIPDAU                               | N/A for Pkg Type                  | -55 to 125   | CD74HC161E                |
| <a href="#">CD74HC161M</a>    | Obsolete      | Production           | SOIC (D)   16  | -                     | -           | Call TI                              | Call TI                           | -55 to 125   | HC161M                    |
| <a href="#">CD74HC161M96</a>  | Active        | Production           | SOIC (D)   16  | 2500   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -55 to 125   | HC161M                    |
| CD74HC161M96.A                | Active        | Production           | SOIC (D)   16  | 2500   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -55 to 125   | HC161M                    |
| <a href="#">CD74HC163E</a>    | Active        | Production           | PDIP (N)   16  | 25   TUBE             | Yes         | NIPDAU                               | N/A for Pkg Type                  | -55 to 125   | CD74HC163E                |
| CD74HC163E.A                  | Active        | Production           | PDIP (N)   16  | 25   TUBE             | Yes         | NIPDAU                               | N/A for Pkg Type                  | -55 to 125   | CD74HC163E                |
| <a href="#">CD74HC163M</a>    | Obsolete      | Production           | SOIC (D)   16  | -                     | -           | Call TI                              | Call TI                           | -55 to 125   | HC163M                    |
| <a href="#">CD74HC163M96</a>  | Active        | Production           | SOIC (D)   16  | 2500   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -55 to 125   | HC163M                    |
| CD74HC163M96.A                | Active        | Production           | SOIC (D)   16  | 2500   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -55 to 125   | HC163M                    |
| <a href="#">CD74HC163MT</a>   | Obsolete      | Production           | SOIC (D)   16  | -                     | -           | Call TI                              | Call TI                           | -55 to 125   | HC163M                    |
| <a href="#">CD74HCT161E</a>   | Active        | Production           | PDIP (N)   16  | 25   TUBE             | Yes         | NIPDAU                               | N/A for Pkg Type                  | -55 to 125   | CD74HCT161E               |
| CD74HCT161E.A                 | Active        | Production           | PDIP (N)   16  | 25   TUBE             | Yes         | NIPDAU                               | N/A for Pkg Type                  | -55 to 125   | CD74HCT161E               |
| CD74HCT161EE4                 | Active        | Production           | PDIP (N)   16  | 25   TUBE             | Yes         | NIPDAU                               | N/A for Pkg Type                  | -55 to 125   | CD74HCT161E               |
| <a href="#">CD74HCT161M</a>   | Obsolete      | Production           | SOIC (D)   16  | -                     | -           | Call TI                              | Call TI                           | -55 to 125   | HCT161M                   |
| <a href="#">CD74HCT161M96</a> | Active        | Production           | SOIC (D)   16  | 2500   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -55 to 125   | HCT161M                   |

| Orderable part number         | Status<br>(1) | Material type<br>(2) | Package   Pins | Package qty   Carrier | RoHS<br>(3) | Lead finish/<br>Ball material<br>(4) | MSL rating/<br>Peak reflow<br>(5) | Op temp (°C) | Part marking<br>(6) |
|-------------------------------|---------------|----------------------|----------------|-----------------------|-------------|--------------------------------------|-----------------------------------|--------------|---------------------|
| CD74HCT161M96.A               | Active        | Production           | SOIC (D)   16  | 2500   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -55 to 125   | HCT161M             |
| <a href="#">CD74HCT163E</a>   | Active        | Production           | PDIP (N)   16  | 25   TUBE             | Yes         | NIPDAU                               | N/A for Pkg Type                  | -55 to 125   | CD74HCT163E         |
| CD74HCT163E.A                 | Active        | Production           | PDIP (N)   16  | 25   TUBE             | Yes         | NIPDAU                               | N/A for Pkg Type                  | -55 to 125   | CD74HCT163E         |
| <a href="#">CD74HCT163M</a>   | Obsolete      | Production           | SOIC (D)   16  | -                     | -           | Call TI                              | Call TI                           | -55 to 125   | HCT163M             |
| <a href="#">CD74HCT163M96</a> | Active        | Production           | SOIC (D)   16  | 2500   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -55 to 125   | HCT163M             |
| CD74HCT163M96.A               | Active        | Production           | SOIC (D)   16  | 2500   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -55 to 125   | HCT163M             |

<sup>(1)</sup> **Status:** For more details on status, see our [product life cycle](#).

<sup>(2)</sup> **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

<sup>(3)</sup> **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.

<sup>(4)</sup> **Lead finish/Ball material:** Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

<sup>(5)</sup> **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

<sup>(6)</sup> **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "-" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

**OTHER QUALIFIED VERSIONS OF CD54HC161, CD54HC163, CD54HCT163, CD74HC161, CD74HC163, CD74HCT163 :**

- Catalog : [CD74HC161](#), [CD74HC163](#), [CD74HCT163](#)
- Military : [CD54HC161](#), [CD54HC163](#), [CD54HCT163](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product
- Military - QML certified for Military and Defense Applications

## TAPE AND REEL INFORMATION



\*All dimensions are nominal

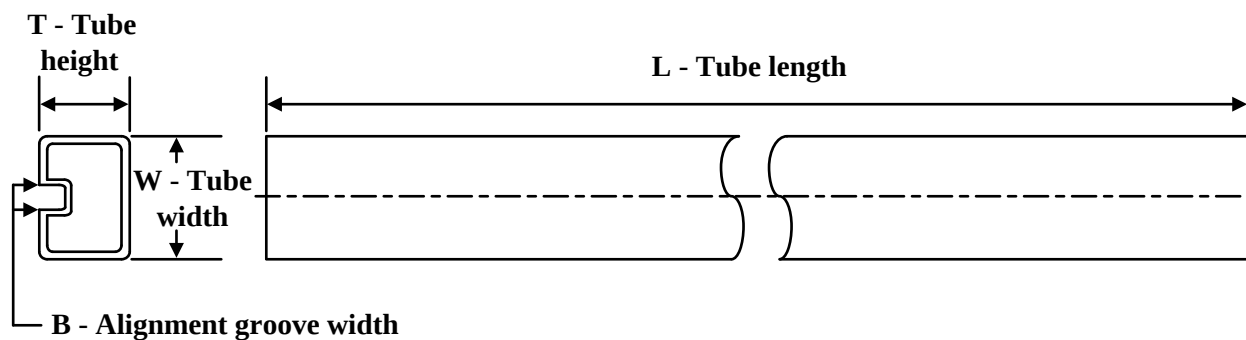
| Device        | Package Type | Package Drawing | Pins | SPQ  | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|---------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| CD74HC161M96  | SOIC         | D               | 16   | 2500 | 330.0              | 16.4               | 6.5     | 10.3    | 2.1     | 8.0     | 16.0   | Q1            |
| CD74HC163M96  | SOIC         | D               | 16   | 2500 | 330.0              | 16.4               | 6.5     | 10.3    | 2.1     | 8.0     | 16.0   | Q1            |
| CD74HCT161M96 | SOIC         | D               | 16   | 2500 | 330.0              | 16.4               | 6.5     | 10.3    | 2.1     | 8.0     | 16.0   | Q1            |
| CD74HCT163M96 | SOIC         | D               | 16   | 2500 | 330.0              | 16.4               | 6.5     | 10.3    | 2.1     | 8.0     | 16.0   | Q1            |

## TAPE AND REEL BOX DIMENSIONS



\*All dimensions are nominal

| Device        | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|---------------|--------------|-----------------|------|------|-------------|------------|-------------|
| CD74HC161M96  | SOIC         | D               | 16   | 2500 | 353.0       | 353.0      | 32.0        |
| CD74HC163M96  | SOIC         | D               | 16   | 2500 | 340.5       | 336.1      | 32.0        |
| CD74HCT161M96 | SOIC         | D               | 16   | 2500 | 353.0       | 353.0      | 32.0        |
| CD74HCT163M96 | SOIC         | D               | 16   | 2500 | 353.0       | 353.0      | 32.0        |

**TUBE**


\*All dimensions are nominal

| Device        | Package Name | Package Type | Pins | SPQ | L (mm) | W (mm) | T (μm) | B (mm) |
|---------------|--------------|--------------|------|-----|--------|--------|--------|--------|
| CD74HC161E    | N            | PDIP         | 16   | 25  | 506    | 13.97  | 11230  | 4.32   |
| CD74HC161E    | N            | PDIP         | 16   | 25  | 506    | 13.97  | 11230  | 4.32   |
| CD74HC161E.A  | N            | PDIP         | 16   | 25  | 506    | 13.97  | 11230  | 4.32   |
| CD74HC161E.A  | N            | PDIP         | 16   | 25  | 506    | 13.97  | 11230  | 4.32   |
| CD74HC163E    | N            | PDIP         | 16   | 25  | 506    | 13.97  | 11230  | 4.32   |
| CD74HC163E    | N            | PDIP         | 16   | 25  | 506    | 13.97  | 11230  | 4.32   |
| CD74HC163E.A  | N            | PDIP         | 16   | 25  | 506    | 13.97  | 11230  | 4.32   |
| CD74HC163E.A  | N            | PDIP         | 16   | 25  | 506    | 13.97  | 11230  | 4.32   |
| CD74HCT161E   | N            | PDIP         | 16   | 25  | 506    | 13.97  | 11230  | 4.32   |
| CD74HCT161E   | N            | PDIP         | 16   | 25  | 506    | 13.97  | 11230  | 4.32   |
| CD74HCT161E.A | N            | PDIP         | 16   | 25  | 506    | 13.97  | 11230  | 4.32   |
| CD74HCT161E.A | N            | PDIP         | 16   | 25  | 506    | 13.97  | 11230  | 4.32   |
| CD74HCT161EE4 | N            | PDIP         | 16   | 25  | 506    | 13.97  | 11230  | 4.32   |
| CD74HCT161EE4 | N            | PDIP         | 16   | 25  | 506    | 13.97  | 11230  | 4.32   |
| CD74HCT163E   | N            | PDIP         | 16   | 25  | 506    | 13.97  | 11230  | 4.32   |
| CD74HCT163E   | N            | PDIP         | 16   | 25  | 506    | 13.97  | 11230  | 4.32   |
| CD74HCT163E.A | N            | PDIP         | 16   | 25  | 506    | 13.97  | 11230  | 4.32   |
| CD74HCT163E.A | N            | PDIP         | 16   | 25  | 506    | 13.97  | 11230  | 4.32   |

D (R-PDSO-G16)

PLASTIC SMALL OUTLINE



4040047-6/M 06/11

- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
  - D. Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
  - E. Reference JEDEC MS-012 variation AC.

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 **<br>DIM      | 14               | 16               | 18               | 20               |
|---------------------|------------------|------------------|------------------|------------------|
| 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               |



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.

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