

## 8-Line to 1-Line Data Selector/Multiplexer/Register With 3-State Outputs

SCHS277D - November 1997 - Revised May 2003

### Features

- HC/HCT354
  - Transparent Data and Select Latches
- Buffered Inputs
- Three-State Complementary Outputs
- Bus Line Driving Capability
- Typical Propagation Delay:  $V_{CC} = 5V$ ,  $C_L = 15pF$ ,  $T_A = 25^\circ C$ 
  - Data to Output = 18ns
- Fanout (Over Temperature Range)
  - Standard Outputs . . . . . 10 LSTTL Loads
  - Bus Driver Outputs . . . . . 15 LSTTL Loads
- Wide Operating Temperature Range . . .  $-55^\circ C$  to  $125^\circ C$
- 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 CD54HC354, CD74HC354, and CD74HCT354 are data selectors/multiplexers that select one of eight sources. In both types, the data select bits  $S_0$ ,  $S_1$  and  $S_2$  are stored in transparent latches that are enabled by a low latch enable input,  $\overline{LE}$ .

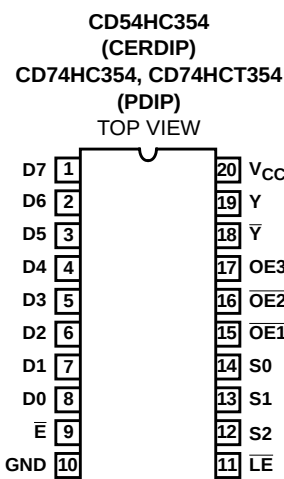
In the HC/HCT354 the data enable input,  $\overline{E}$ , controls transparent latches that pass data to the outputs when  $\overline{E}$  is high and latches in new data when  $\overline{E}$  is low.

In both types the three-state outputs are controlled by three output-enable inputs  $OE1$ ,  $OE2$ , and  $OE3$ .

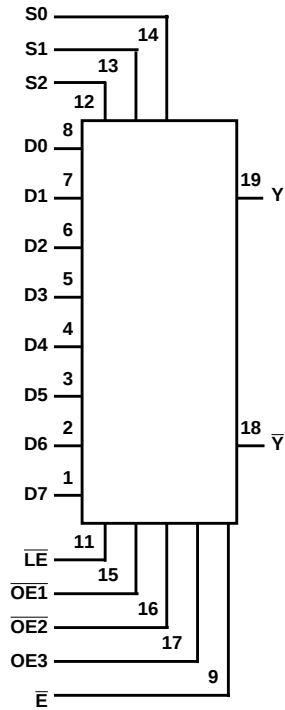
### Ordering Information

| PART NUMBER  | TEMP. RANGE (°C) | PACKAGE      |
|--------------|------------------|--------------|
| CD54HC354F3A | -55 TO 125       | 20 Ld CERDIP |
| CD74HC354E   | -55 to 125       | 20 Ld PDIP   |
| CD74HCT354E  | -55 to 125       | 20 Ld PDIP   |

### Pinout



# Functional Diagram



TRUTH TABLE

| INPUTS           |    |    |                |                  |                  |     | OUTPUTS           |                 |
|------------------|----|----|----------------|------------------|------------------|-----|-------------------|-----------------|
| SELECT (NOTE 1 ) |    |    | ENABLE DATA    | OUTPUT ENABLES   |                  |     |                   |                 |
| S2               | S1 | S0 | $\overline{E}$ | $\overline{OE1}$ | $\overline{OE2}$ | OE3 | $\overline{Y}$    | Y               |
| X                | X  | X  | X              | H                | X                | X   | Z                 | Z               |
| X                | X  | X  | X              | X                | H                | X   | Z                 | Z               |
| X                | X  | X  | X              | X                | X                | L   | Z                 | Z               |
| L                | L  | L  | L              | L                | L                | H   | $\overline{D0}$   | D0              |
| L                | L  | L  | H              | L                | L                | H   | $\overline{D0_n}$ | D0 <sub>n</sub> |
| L                | L  | H  | L              | L                | L                | H   | $\overline{D1}$   | D1              |
| L                | L  | H  | H              | L                | L                | H   | $\overline{D1_n}$ | D1 <sub>n</sub> |
| L                | H  | L  | L              | L                | L                | H   | $\overline{D2}$   | D2              |
| L                | H  | L  | H              | L                | L                | H   | $\overline{D2_n}$ | D2 <sub>n</sub> |
| L                | H  | H  | L              | L                | L                | H   | $\overline{D3}$   | D3              |
| L                | H  | H  | H              | L                | L                | H   | $\overline{D3_n}$ | D3 <sub>n</sub> |
| H                | L  | L  | L              | L                | L                | H   | $\overline{D4}$   | D4              |
| H                | L  | L  | H              | L                | L                | H   | $\overline{D4_n}$ | D4 <sub>n</sub> |
| H                | L  | H  | L              | L                | L                | H   | $\overline{D5}$   | D5              |
| H                | L  | H  | H              | L                | L                | H   | $\overline{D5_n}$ | D5 <sub>n</sub> |
| H                | H  | L  | L              | L                | L                | H   | $\overline{D6}$   | D6              |
| H                | H  | L  | H              | L                | L                | H   | $\overline{D6_n}$ | D6 <sub>n</sub> |

# CD54HC354, CD74HC354, CD74HCT354

TRUTH TABLE (Continued)

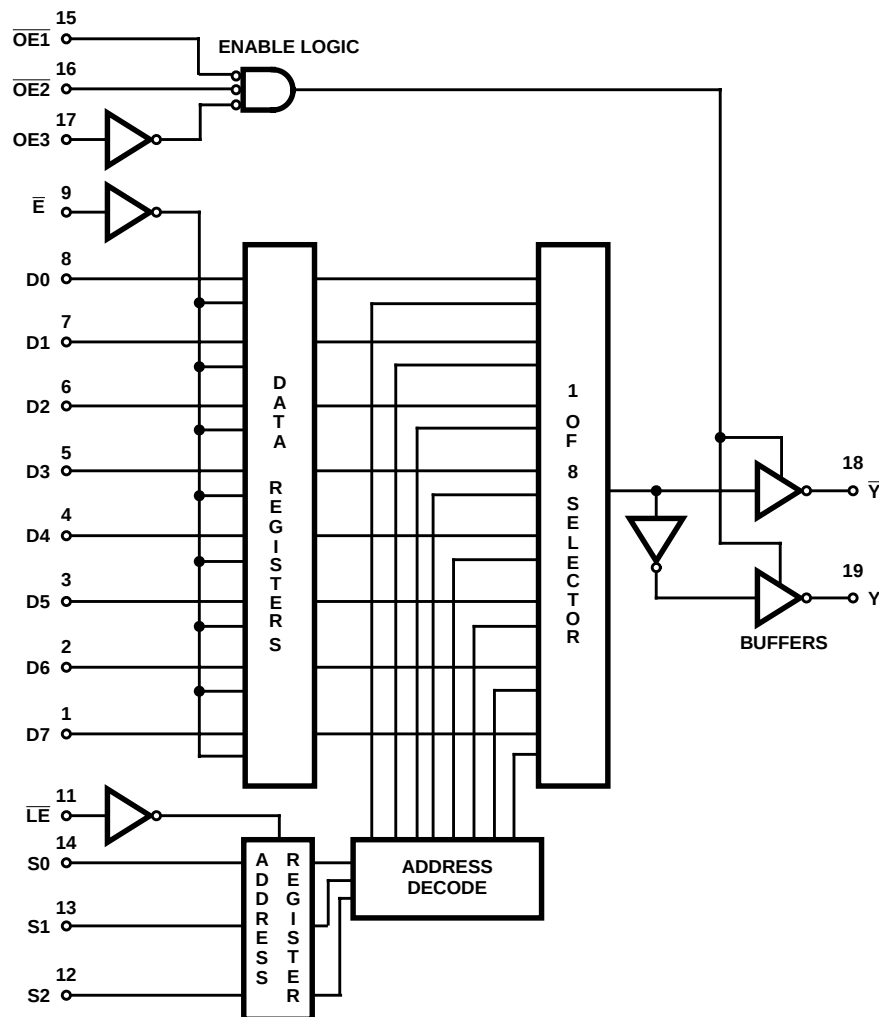
| INPUTS          |    |    |                |                  |                  |     | OUTPUTS           |                 |
|-----------------|----|----|----------------|------------------|------------------|-----|-------------------|-----------------|
| SELECT (NOTE 1) |    |    | ENABLE DATA    | OUTPUT ENABLES   |                  |     |                   |                 |
| S2              | S1 | S0 | $\overline{E}$ | $\overline{OE1}$ | $\overline{OE2}$ | OE3 | $\overline{Y}$    | Y               |
| H               | H  | H  | L              | L                | L                | H   | $\overline{D7}$   | D7              |
| H               | H  | H  | H              | L                | L                | H   | $\overline{D7_n}$ | D7 <sub>n</sub> |

H = High Voltage Level (Steady State); L = Low Voltage Level (Steady State); X = Don't Care; Z = High Impedance State (Off State); D0<sub>n</sub>...D7<sub>n</sub> = the level of steady-state inputs D0 through D7, respectively, before the most recent low-to-high transition of data control.

NOTE:

1. This column shows the input address setup with  $\overline{LE}$  low.

## Block Diagram



# Logic Diagram

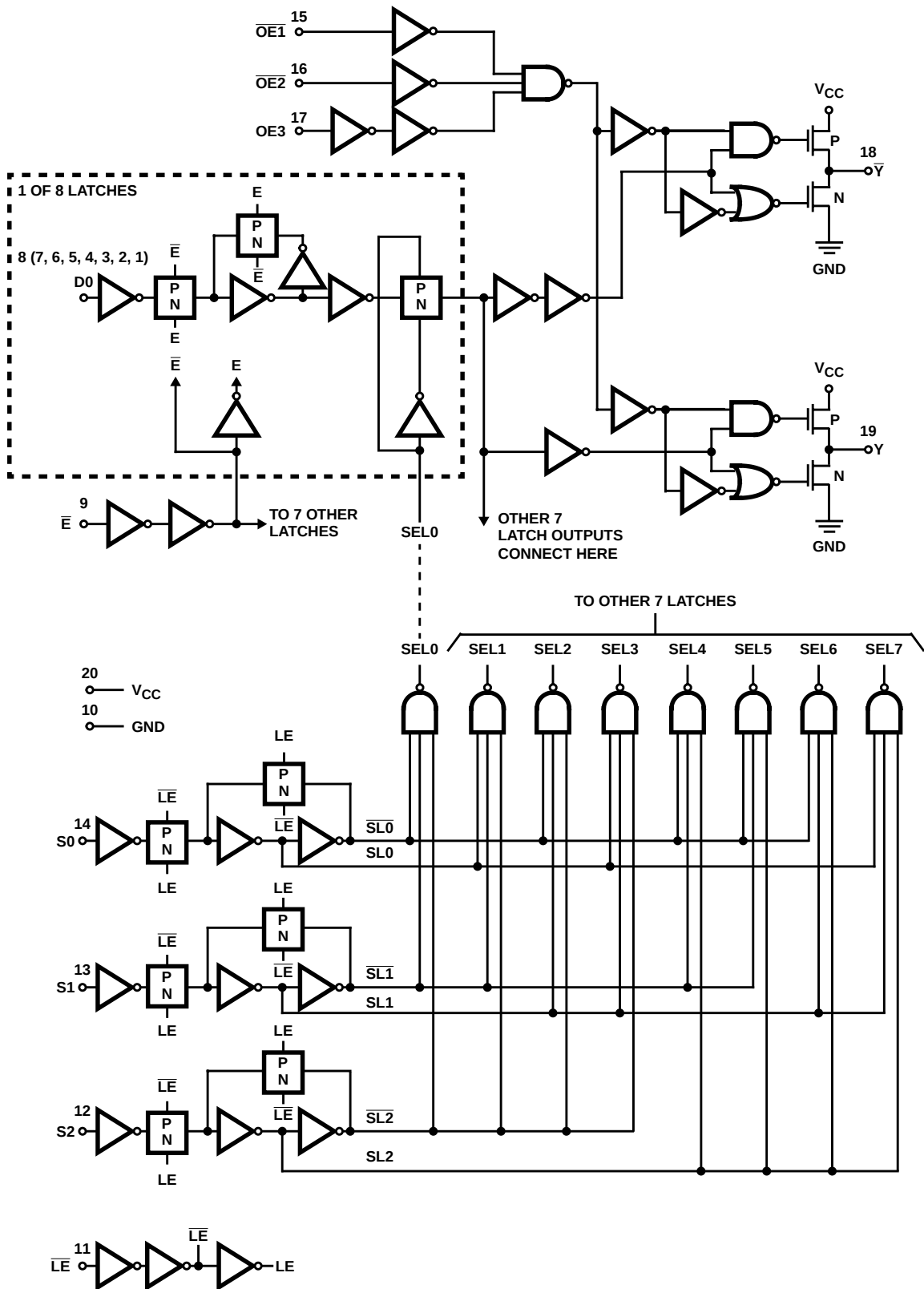


FIGURE 1. HC/HCT354 LOGIC DIAGRAM

# CD54HC354, CD74HC354, CD74HCT354

## 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  $-0.5V < V_O < V_{CC} + 0.5V$  .....  $\pm 35mA$   
 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 2)  $\theta_{JA}$  ( $^{\circ}C/W$ )  
     E (PDIP) Package ..... 69  
 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<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     |
| High Level Output Voltage<br>TTL Loads<br>(Bus Driver) |                 |                                       | -6                  | 4.5                 | 3.98 | -   | -    | 3.84          | -    | 3.7            | -    | V     |
|                                                        |                 |                                       | -7.8                | 6                   | 5.48 | -   | -    | 5.34          | -    | 5.2            | -    | V     |
| 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     |
| Low Level Output Voltage<br>TTL Loads<br>(Bus Driver)  |                 |                                       | 6                   | 4.5                 | -    | -   | 0.26 | -             | 0.33 | -              | 0.4  | V     |
|                                                        |                 |                                       | 7.8                 | 6                   | -    | -   | 0.26 | -             | 0.33 | -              | 0.4  | V     |
| Input Leakage Current                                  | I <sub>I</sub>  | V <sub>CC</sub> or<br>GND             | -                   | 6                   | -    | -   | ±0.1 | -             | ±1   | -              | ±1   | μA    |

# CD54HC354, CD74HC354, CD74HCT354

## DC Electrical Specifications (Continued)

| PARAMETER                                                      | SYMBOL                      | TEST CONDITIONS      |                       | $V_{CC}$ (V) | 25°C |     |           | -40°C TO 85°C |           | -55°C TO 125°C |          | UNITS   |
|----------------------------------------------------------------|-----------------------------|----------------------|-----------------------|--------------|------|-----|-----------|---------------|-----------|----------------|----------|---------|
|                                                                |                             | $V_I$ (V)            | $I_O$ (mA)            |              | MIN  | TYP | MAX       | MIN           | MAX       | MIN            | MAX      |         |
| Quiescent Device Current                                       | $I_{CC}$                    | $V_{CC}$ or GND      | 0                     | 6            | -    | -   | 8         | -             | 80        | -              | 160      | $\mu A$ |
| Three-State Leakage Current                                    | $I_{OZ}$                    | $V_{IL}$ or $V_{IH}$ | $V_O = V_{CC}$ or GND | 6            | -    | -   | $\pm 0.5$ | -             | $\pm 5.0$ | -              | $\pm 10$ | $\mu A$ |
| <b>HCT TYPES</b>                                               |                             |                      |                       |              |      |     |           |               |           |                |          |         |
| High Level Input Voltage                                       | $V_{IH}$                    | -                    | -                     | 4.5 to 5.5   | 2    | -   | -         | 2             | -         | 2              | -        | V       |
| Low Level Input Voltage                                        | $V_{IL}$                    | -                    | -                     | 4.5 to 5.5   | -    | -   | 0.8       | -             | 0.8       | -              | 0.8      | V       |
| High Level Output Voltage<br>CMOS Loads                        | $V_{OH}$                    | $V_{IH}$ or $V_{IL}$ | -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                         | $V_{OL}$                    | $V_{IH}$ or $V_{IL}$ | 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                                          | $I_I$                       | $V_{CC}$ to GND      | -                     | 5.5          | -    | -   | $\pm 0.1$ | -             | $\pm 1$   | -              | $\pm 1$  | $\mu A$ |
| Quiescent Device Current                                       | $I_{CC}$                    | $V_{CC}$ or GND      | 0                     | 5.5          | -    | -   | 8         | -             | 80        | -              | 160      | $\mu A$ |
| Additional Quiescent Device Current Per Input Pin: 1 Unit Load | $\Delta I_{CC}$<br>(Note 3) | $V_{CC}$ -2.1        | -                     | 4.5 to 5.5   | -    | 100 | 360       | -             | 450       | -              | 490      | $\mu A$ |
| Three-State Leakage Current                                    | $I_{OZ}$                    | $V_{IL}$ or $V_{IH}$ | $V_O = V_{CC}$ or GND | 5.5          | -    | -   | $\pm 0.5$ | -             | $\pm 5.0$ | -              | $\pm 10$ | $\mu A$ |

NOTE:

- For dual-supply systems theoretical worst case ( $V_I = 2.4V$ ,  $V_{CC} = 5.5V$ ) specification is 1.8mA.

## HCT Input Loading Table

| INPUT                               | UNIT LOADS |
|-------------------------------------|------------|
| D0-D7                               | 0.50       |
| S0, S1, S3                          | 0.70       |
| $\overline{OE}1$ , $\overline{OE}2$ | 0.80       |
| $\overline{OE}3$                    | 0.25       |
| $\overline{LE}$                     | 0.25       |
| $\overline{E}$                      | 0.60       |

NOTE: Unit Load is  $\Delta I_{CC}$  limit specified in DC Electrical Specifications table, e.g., 360 $\mu A$  max at 25°C.

# CD54HC354, CD74HC354, CD74HCT354

## 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                                    |                    |                 |                     |      |     |     |               |     |                |     |       |
| $\overline{E}$ Pulse Width                  | $t_{PLH}, t_{PHL}$ | -               | 2                   | 80   | -   | -   | 100           | -   | 120            | -   | ns    |
|                                             |                    |                 | 4.5                 | 16   | -   | -   | 20            | -   | 24             | -   | ns    |
|                                             |                    |                 | 6                   | 14   | -   | -   | 17            | -   | 20             | -   | ns    |
| $\overline{LE}$ Pulse Width                 | $t_{PLH}, t_{PHL}$ | -               | 2                   | 80   | -   | -   | 100           | -   | 120            | -   | ns    |
|                                             |                    |                 | 4.5                 | 16   | -   | -   | 20            | -   | 24             | -   | ns    |
|                                             |                    |                 | 6                   | 14   | -   | -   | 17            | -   | 20             | -   | ns    |
| Set-up Times Dn $\rightarrow \overline{E}$  | $t_{SU}$           | -               | 2                   | 50   | -   | -   | 65            | -   | 75             | -   | ns    |
|                                             |                    |                 | 4.5                 | 10   | -   | -   | 13            | -   | 15             | -   | ns    |
|                                             |                    |                 | 6                   | 9    | -   | -   | 11            | -   | 13             | -   | ns    |
| Set-up Times Sn $\rightarrow \overline{LE}$ | $t_{SU}$           | -               | 2                   | 50   | -   | -   | 65            | -   | 75             | -   | ns    |
|                                             |                    |                 | 4.5                 | 10   | -   | -   | 13            | -   | 15             | -   | ns    |
|                                             |                    |                 | 6                   | 9    | -   | -   | 11            | -   | 13             | -   | ns    |
| Hold Times Dn $\rightarrow \overline{E}$    | $t_H$              | -               | 2                   | 45   | -   | -   | 55            | -   | 70             | -   | ns    |
|                                             |                    |                 | 4.5                 | 9    | -   | -   | 11            | -   | 14             | -   | ns    |
|                                             |                    |                 | 6                   | 8    | -   | -   | 9             | -   | 12             | -   | ns    |
| Hold Times Sn $\rightarrow \overline{LE}$   | $t_H$              | -               | 2                   | 45   | -   | -   | 55            | -   | 70             | -   | ns    |
|                                             |                    |                 | 4.5                 | 9    | -   | -   | 11            | -   | 14             | -   | ns    |
|                                             |                    |                 | 6                   | 8    | -   | -   | 9             | -   | 12             | -   | ns    |
| HCT TYPES                                   |                    |                 |                     |      |     |     |               |     |                |     |       |
| $\overline{E}$ Pulse Width                  | $t_{PLH}, t_{PHL}$ | -               | 4.5                 | 16   | -   | -   | 20            | -   | 24             | -   | ns    |
| $\overline{LE}$ Pulse Width                 | $t_{PLH}, t_{PHL}$ | -               | 4.5                 | 16   | -   | -   | 20            | -   | 24             | -   | ns    |
| Set-up Times Dn $\rightarrow \overline{E}$  | $t_{SU}$           | -               | 4.5                 | 10   | -   | -   | 13            | -   | 15             | -   | ns    |
| Set-up Times Sn $\rightarrow \overline{LE}$ | $t_{SU}$           | -               | 4.5                 | 10   | -   | -   | 13            | -   | 15             | -   | ns    |
| Hold Times Dn $\rightarrow \overline{E}$    | $t_H$              | -               | 4.5                 | 9    | -   | -   | 11            | -   | 14             | -   | ns    |
| Hold Times Sn $\rightarrow \overline{LE}$   | $t_H$              | -               | 4.5                 | 9    | -   | -   | 11            | -   | 14             | -   | ns    |

## Switching Specifications Input $t_r, t_f = 6ns$

| PARAMETER                                      | SYMBOL                              | TEST 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>Dn → Y, $\bar{Y}$        | t <sub>PLH</sub> , t <sub>PHL</sub> | C <sub>L</sub> = 50pF | 2                   | -    | 210 | 265           | 315            | ns    |
|                                                |                                     |                       | 4.5                 | -    | 42  | 53            | 63             | ns    |
|                                                |                                     |                       | 6                   | -    | 36  | 45            | 54             | ns    |
|                                                |                                     | C <sub>L</sub> = 15pF | 5                   | 18   | -   | -             | -              | ns    |
| Propagation Delay,<br>$\bar{E}$ → Y, $\bar{Y}$ | t <sub>PLH</sub> , t <sub>PHL</sub> | C <sub>L</sub> = 50pF | 2                   | -    | 250 | 315           | 375            | ns    |
|                                                |                                     |                       | 4.5                 | -    | 50  | 63            | 75             | ns    |
|                                                |                                     |                       | 6                   | -    | 43  | 54            | 64             | ns    |
|                                                |                                     | C <sub>L</sub> = 15pF | 5                   | 21   | -   | -             | -              | ns    |

# CD54HC354, CD74HC354, CD74HCT354

## 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            |       |
| Propagation Delay,<br>$S_n \rightarrow Y, \bar{Y}$                  | $t_{PLH}, t_{PHL}$ | $C_L = 50\text{pF}$ | 2            | -      | 260 | 325           | 390            | ns    |
|                                                                     |                    |                     | 4.5          | -      | 52  | 65            | 78             | ns    |
|                                                                     |                    |                     | 6            | -      | 44  | 55            | 66             | ns    |
|                                                                     |                    | $C_L = 15\text{pF}$ | 5            | 22     | -   | -             | -              | ns    |
| Propagation Delay,<br>$\bar{L}\bar{E} \rightarrow Y, \bar{Y}$       | $t_{PLH}, t_{PHL}$ | $C_L = 50\text{pF}$ | 2            | -      | 290 | 365           | 435            | ns    |
|                                                                     |                    |                     | 4.5          | -      | 58  | 73            | 87             | ns    |
|                                                                     |                    |                     | 6            | -      | 49  | 62            | 74             | ns    |
|                                                                     |                    | $C_L = 15\text{pF}$ | 5            | 24     | -   | -             | -              | ns    |
| Output Disabling Time,<br>$\bar{O}\bar{E}_n \rightarrow Y, \bar{Y}$ | $t_{PLZ}, t_{PHZ}$ | $C_L = 50\text{pF}$ | 2            | -      | 155 | 195           | 235            | ns    |
|                                                                     |                    |                     | 4.5          | -      | 31  | 39            | 47             | ns    |
|                                                                     |                    |                     | 6            | -      | 26  | 33            | 40             | ns    |
|                                                                     |                    | $C_L = 15\text{pF}$ | 5            | 13     | -   | -             | -              | ns    |
| Output Disabling Time,<br>$O\bar{E}_3 \rightarrow Y, \bar{Y}$       | $t_{PLZ}, t_{PHZ}$ | $C_L = 50\text{pF}$ | 2            | -      | 155 | 195           | 235            | ns    |
|                                                                     |                    |                     | 4.5          | -      | 31  | 39            | 47             | ns    |
|                                                                     |                    |                     | 6            | -      | 26  | 33            | 40             | ns    |
|                                                                     |                    | $C_L = 15\text{pF}$ | 5            | 13     | -   | -             | -              | ns    |
| Output Enabling Time,<br>$\bar{O}\bar{E}_n \rightarrow Y, \bar{Y}$  | $t_{PZL}, t_{PZH}$ | $C_L = 50\text{pF}$ | 2            | -      | 150 | 190           | 225            | ns    |
|                                                                     |                    |                     | 4.5          | -      | 30  | 38            | 45             | ns    |
|                                                                     |                    |                     | 6            | -      | 26  | 33            | 38             | ns    |
|                                                                     |                    | $C_L = 15\text{pF}$ | 5            | 12, 13 | -   | -             | -              | ns    |
| Output Enabling Time,<br>$O\bar{E}_3 \rightarrow Y, \bar{Y}$        | $t_{PZL}, t_{PZH}$ | $C_L = 50\text{pF}$ | 2            | -      | 160 | 200           | 240            | ns    |
|                                                                     |                    |                     | 4.5          | -      | 32  | 40            | 48             | ns    |
|                                                                     |                    |                     | 6            | -      | 27  | 34            | 41             | ns    |
|                                                                     |                    | $C_L = 15\text{pF}$ | 5            | 12, 13 | -   | -             | -              | ns    |
| Output Transition Time                                              | $t_{TLH}, t_{THL}$ | $C_L = 50\text{pF}$ | 2            | -      | 60  | 75            | 90             | ns    |
|                                                                     |                    |                     | 4.5          | -      | 12  | 15            | 18             | ns    |
|                                                                     |                    |                     | 6            | -      | 10  | 13            | 15             | ns    |
| Input Capacitance                                                   | $C_I$              | -                   | -            | -      | 10  | 10            | 10             | pF    |
| Three-State Capacitance                                             | $C_O$              | -                   | -            | -      | 20  | 20            | 20             | pF    |
| Power Dissipation Capacitance<br>(Notes 4, 5)                       | $C_{PD}$           | -                   | 5            | 90     | -   | -             | -              | pF    |
| <b>HCT TYPES</b>                                                    |                    |                     |              |        |     |               |                |       |
| Propagation Delay,<br>$D_n \rightarrow Y, \bar{Y}$                  | $t_{PLH}, t_{PHL}$ | $C_L = 50\text{pF}$ | 4.5          | -      | 47  | 59            | 71             | ns    |
|                                                                     |                    | $C_L = 15\text{pF}$ | 5            | 20     | -   | -             | -              | ns    |
| Propagation Delay,<br>$\bar{E} \rightarrow Y, \bar{Y}$              | $t_{PLH}, t_{PHL}$ | $C_L = 50\text{pF}$ | 4.5          | -      | 54  | 68            | 81             | ns    |
|                                                                     |                    | $C_L = 15\text{pF}$ | 5            | 23     | -   | -             | -              | ns    |

# CD54HC354, CD74HC354, CD74HCT354

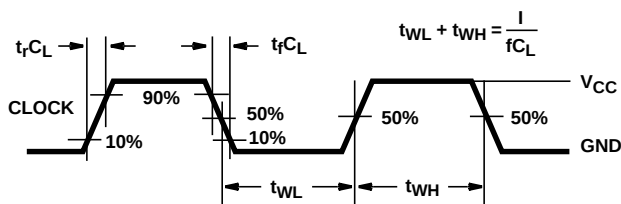
## Switching Specifications Input $t_r, t_f = 6\text{ns}$ (Continued)

| PARAMETER                                                    | SYMBOL             | TEST CONDITIONS     | $V_{CC}$ (V) | 25°C   |     | -40°C TO 85°C | -55°C TO 125°C | UNITS |
|--------------------------------------------------------------|--------------------|---------------------|--------------|--------|-----|---------------|----------------|-------|
|                                                              |                    |                     |              | TYP    | MAX | MAX           | MAX            |       |
| Propagation Delay,<br>$S_n \rightarrow Y, \bar{Y}$           | $t_{PLH}, t_{PHL}$ | $C_L = 50\text{pF}$ | 4.5          | -      | 59  | 74            | 89             | ns    |
|                                                              |                    | $C_L = 15\text{pF}$ | 5            | 25     | -   | -             | -              | ns    |
| Propagation Delay,<br>$\bar{LE} \rightarrow Y, \bar{Y}$      | $t_{PLH}, t_{PHL}$ | $C_L = 50\text{pF}$ | 4.5          | -      | 63  | 79            | 94             | ns    |
|                                                              |                    | $C_L = 15\text{pF}$ | 5            | 25     | -   | -             | -              | ns    |
| Output Disabling Time,<br>$\bar{OEn} \rightarrow Y, \bar{Y}$ | $t_{PLZ}, t_{PHZ}$ | $C_L = 50\text{pF}$ | 4.5          | -      | 33  | 41            | 50             | ns    |
|                                                              |                    | $C_L = 15\text{pF}$ | 5            | 13, 16 | -   | -             | -              | ns    |
| Output Disabling Time,<br>$OE3 \rightarrow Y, \bar{Y}$       | $t_{PLZ}, t_{PHZ}$ | $C_L = 50\text{pF}$ | 4.5          | -      | 39  | 49            | 59             | ns    |
|                                                              |                    | $C_L = 15\text{pF}$ | 5            | 13, 16 | -   | -             | -              | ns    |
| Output Enabling Time,<br>$\bar{OEn} \rightarrow Y, \bar{Y}$  | $t_{PZL}, t_{PZH}$ | $C_L = 50\text{pF}$ | 4.5          | -      | 34  | 43            | 51             | ns    |
|                                                              |                    | $C_L = 15\text{pF}$ | 5            | 14     | -   | -             | -              | ns    |
| Output Enabling Time,<br>$OE3 \rightarrow Y, \bar{Y}$        | $t_{PZL}, t_{PZH}$ | $C_L = 50\text{pF}$ | 4.5          | -      | 34  | 43            | 51             | ns    |
|                                                              |                    | $C_L = 15\text{pF}$ | 5            | 14     | -   | -             | -              | ns    |
| Output Transition Time                                       | $t_{TLH}, t_{THL}$ | $C_L = 50\text{pF}$ | 4.5          | -      | 12  | 15            | 18             | ns    |
| Input Capacitance                                            | $C_{IN}$           | -                   | -            | -      | 10  | 10            | 10             | pF    |
| Three-State Capacitance                                      | $C_O$              | -                   | -            | -      | 20  | 20            | 20             | pF    |
| Power Dissipation Capacitance<br>(Notes 4, 5)                | $C_{PD}$           | -                   | 5            | 92     | -   | -             | -              | pF    |

### NOTES:

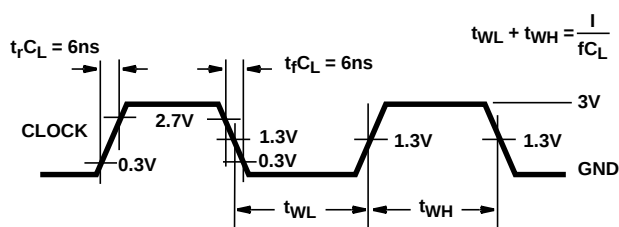
- $C_{PD}$  is used to determine the dynamic power consumption, per device.
- $P_D = V_{CC}^2 (C_{PD} + C_L) f_i$  where  $f_i$  = Input Frequency,  $C_L$  = Output Load Capacitance,  $V_{CC}$  = Supply Voltage.

## 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 2. 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 3. HCT CLOCK PULSE RISE AND FALL TIMES AND PULSE WIDTH**

Test Circuits and Waveforms (Continued)

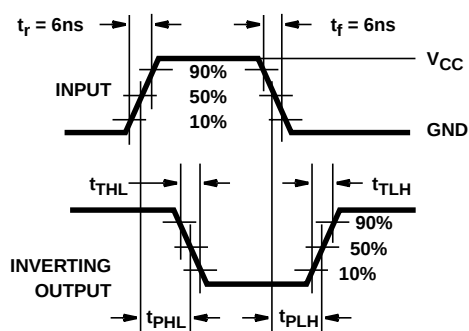


FIGURE 4. HC AND HCT TRANSITION TIMES AND PROPAGATION DELAY TIMES, COMBINATION LOGIC

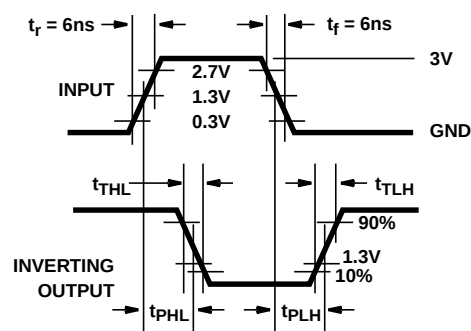


FIGURE 5. HCT TRANSITION TIMES AND PROPAGATION DELAY TIMES, COMBINATION LOGIC

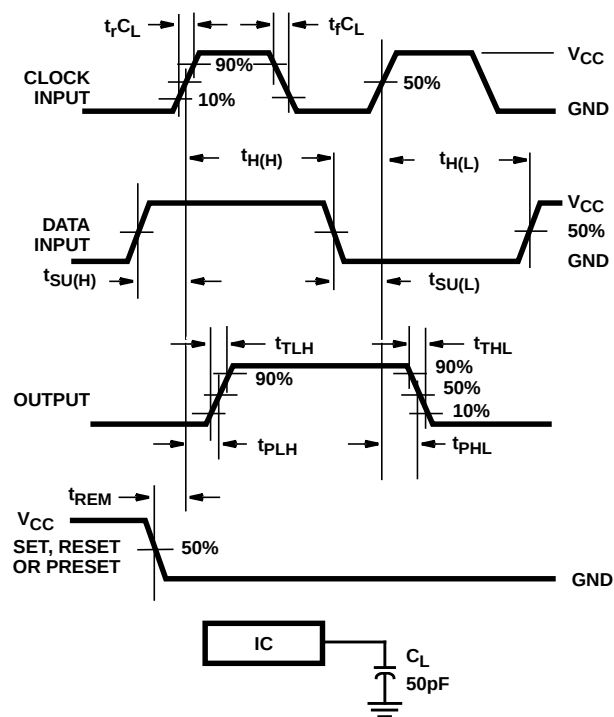


FIGURE 6. HC SETUP TIMES, HOLD TIMES, REMOVAL TIME, AND PROPAGATION DELAY TIMES FOR EDGE TRIGGERED SEQUENTIAL LOGIC CIRCUITS

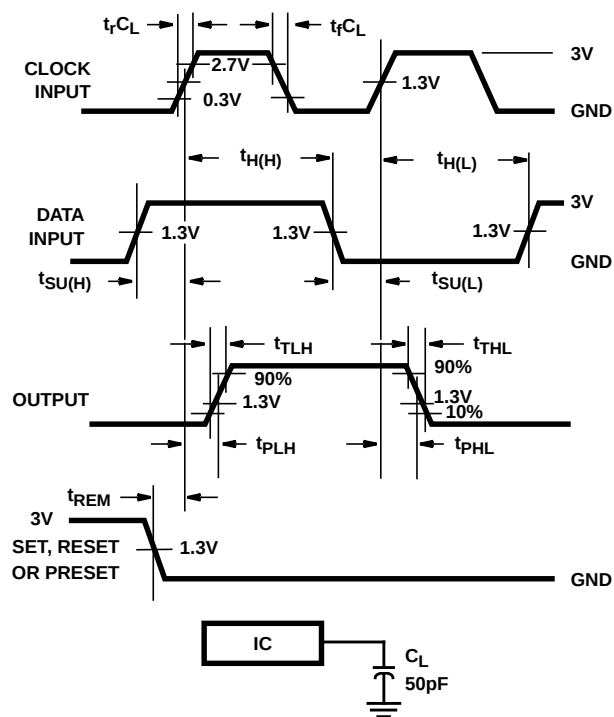


FIGURE 7. HCT SETUP TIMES, HOLD TIMES, REMOVAL TIME, AND PROPAGATION DELAY TIMES FOR EDGE TRIGGERED SEQUENTIAL LOGIC CIRCUITS

**Test Circuits and Waveforms** (Continued)

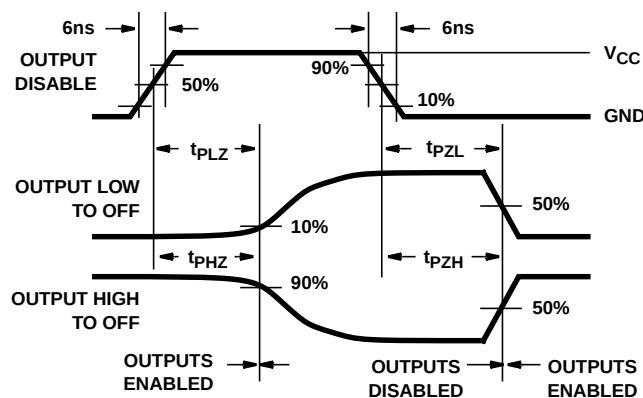


FIGURE 8. HC THREE-STATE PROPAGATION DELAY WAVEFORM

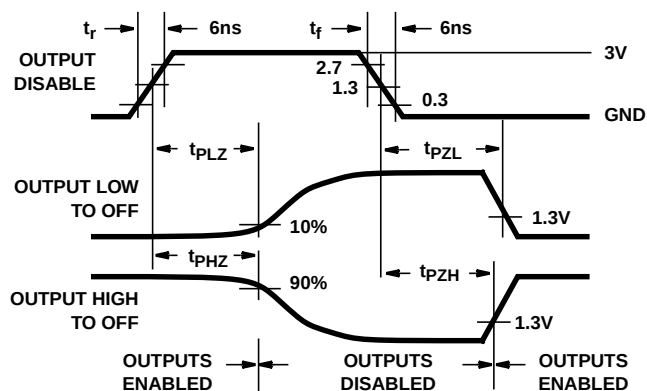
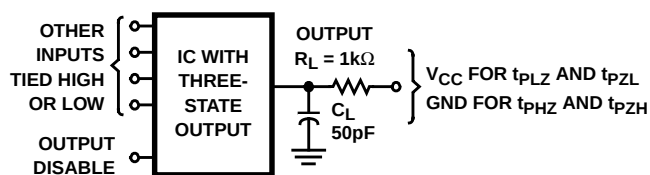


FIGURE 9. HCT THREE-STATE PROPAGATION DELAY WAVEFORM



NOTE: Open drain waveforms  $t_{PLZ}$  and  $t_{PZL}$  are the same as those for three-state shown on the left. The test circuit is Output  $R_L = 1k\Omega$  to  $V_{CC}$ ,  $C_L = 50pF$ .

FIGURE 10. HC AND HCT THREE-STATE PROPAGATION DELAY TEST CIRCUIT

**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> |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| CD54HC354F3A     | ACTIVE                | CDIP         | J               | 20   | 1           | TBD                     | A42              | N / A for Pkg Type           |
| CD74HC354E       | ACTIVE                | PDIP         | N               | 20   | 20          | Pb-Free (RoHS)          | CU NIPDAU        | N / A for Pkg Type           |
| CD74HC354EE4     | ACTIVE                | PDIP         | N               | 20   | 20          | Pb-Free (RoHS)          | CU NIPDAU        | N / A for Pkg Type           |
| CD74HCT354E      | ACTIVE                | PDIP         | N               | 20   | 20          | Pb-Free (RoHS)          | CU NIPDAU        | N / A for Pkg Type           |
| CD74HCT354EE4    | ACTIVE                | PDIP         | N               | 20   | 20          | Pb-Free (RoHS)          | CU NIPDAU        | N / A for Pkg Type           |

<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 - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

**TBD:** The Pb-Free/Green conversion plan has not been defined.

**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.

**Pb-Free (RoHS Exempt):** This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

<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:
- All linear dimensions are in inches (millimeters).
  - This drawing is subject to change without notice.
  - This package is hermetically sealed with a ceramic lid using glass frit.
  - Index point is provided on cap for terminal identification only on press ceramic glass frit seal only.
  - 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.

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