

## High-Speed CMOS Logic Analog Multiplexers/Demultiplexers with Latch

### Features

- Wide Analog Input Voltage Range . . . . .  $\pm 5V$  (Max)
- Low "On" Resistance
  - $V_{CC} - V_{EE} = 4.5V$  . . . . .  $70\Omega$  (Typ)
  - $V_{CC} - V_{EE} = 9V$  . . . . .  $40\Omega$  (Typ)
- Low Crosstalk Between Switches
- Fast Switching and Propagation Speeds
- "Break-Before-Make" Switching
- Wide Operating Temperature Range . . .  $-55^{\circ}C$  to  $125^{\circ}C$
- HC Types
  - 2V to 6V Operation, Control; 0V to 10V Switch
  - High Noise Immunity:  $N_{IL} = 30\%$ ,  $N_{IH} = 30\%$  of  $V_{CC}$  at  $V_{CC} = 5V$
- HCT Types
  - 4.5V to 5.5V Operation, Control; 0V to 10V Switch
  - 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 'HC4351, CD74HCT4351, and CD74HC4352 are digitally controlled analog switches which utilize silicon-gate

CMOS technology to achieve operating speeds similar to LSTTL with the low power consumption of standard CMOS integrated circuits.

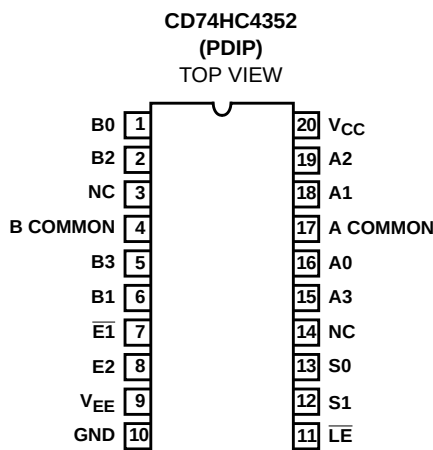
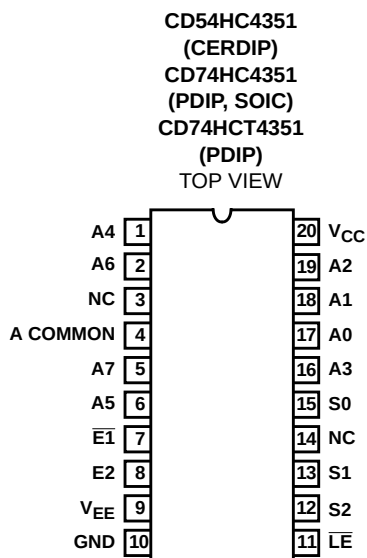
These analog multiplexers/demultiplexers are, in essence, the HC/HCT4015 and HC4052 preceded by address latches that are controlled by an active low Latch Enable input ( $\overline{LE}$ ). Two Enable inputs, one active low ( $\overline{E1}$ ), and the other active high (E2) are provided allowing enabling with either input voltage level.

### Ordering Information

| PART NUMBER   | TEMP. RANGE<br>( $^{\circ}C$ ) | PACKAGE      |
|---------------|--------------------------------|--------------|
| CD54HC4351F3A | -55 to 125                     | 20 Ld CERDIP |
| CD74HC4351E   | -55 to 125                     | 20 Ld PDIP   |
| CD74HC4351M   | -55 to 125                     | 20 Ld SOIC   |
| CD74HC4351M96 | -55 to 125                     | 20 Ld SOIC   |
| CD74HCT4351E  | -55 to 125                     | 20 Ld PDIP   |
| CD74HC4352E   | -55 to 125                     | 20 Ld PDIP   |

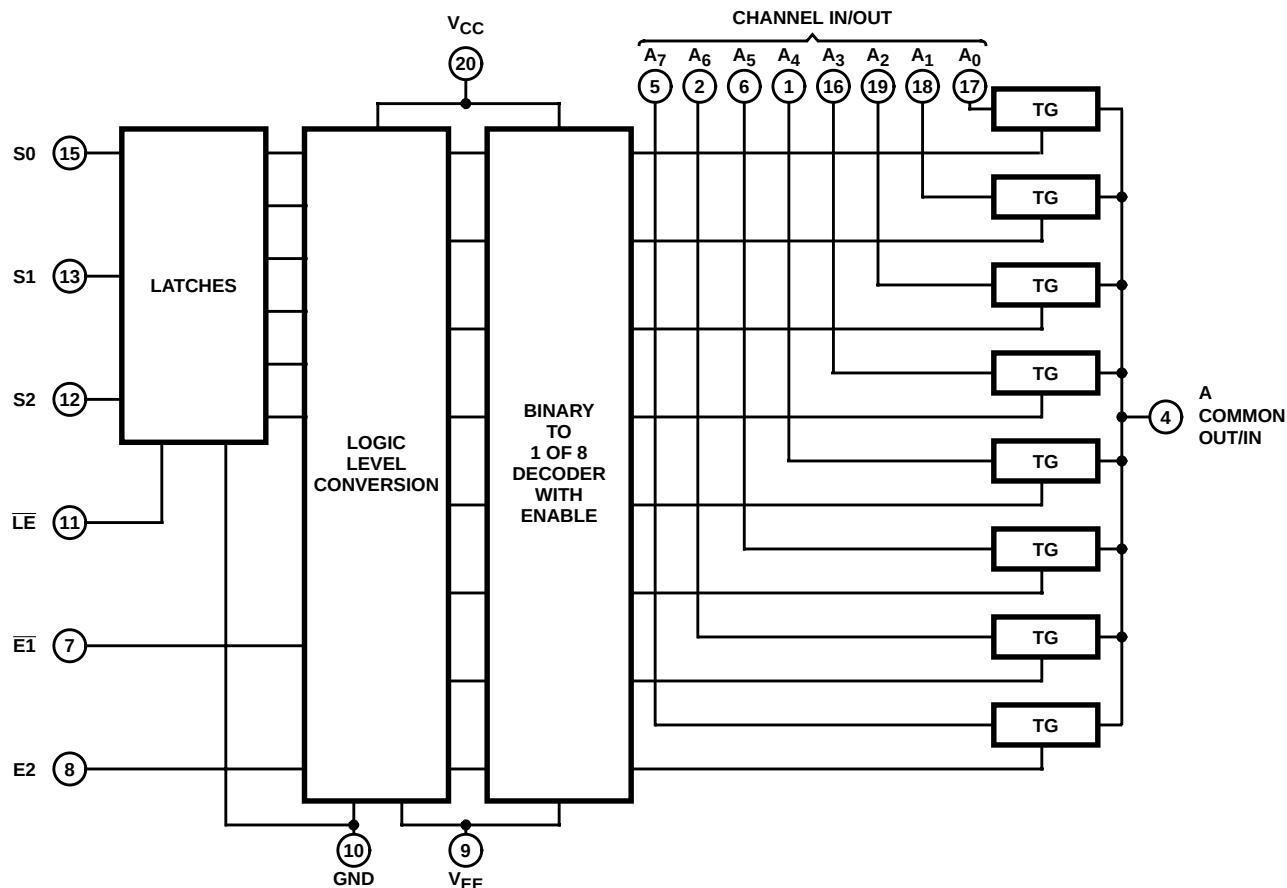
NOTE: When ordering, use the entire part number. The suffix 96 denotes tape and reel.

### Pinouts



# Functional Diagram

'HC4351, CD74HCT4351



TRUTH TABLE  
'HC4351, CD74HCT4351

| INPUT STATES    |    |    |    |    | (NOTE 1)<br>"ON"<br>SWITCHES<br>$\overline{LE} = H$ |
|-----------------|----|----|----|----|-----------------------------------------------------|
| $\overline{E1}$ | E2 | S2 | S1 | S0 |                                                     |
| L               | H  | L  | L  | L  | A <sub>0</sub>                                      |
| L               | H  | L  | L  | H  | A <sub>1</sub>                                      |
| L               | H  | L  | H  | L  | A <sub>2</sub>                                      |
| L               | H  | L  | H  | H  | A <sub>3</sub>                                      |
| L               | H  | H  | L  | L  | A <sub>4</sub>                                      |
| L               | H  | H  | L  | H  | A <sub>5</sub>                                      |
| L               | H  | H  | H  | L  | A <sub>6</sub>                                      |
| L               | H  | H  | H  | H  | A <sub>7</sub>                                      |
| H               | L  | X  | X  | X  | None                                                |

H = High Voltage Level, L = Low Voltage Level, X = Don't Care

NOTE:

1. When  $\overline{LE}$  is low S0-S2 data are latched and switches cannot change state.

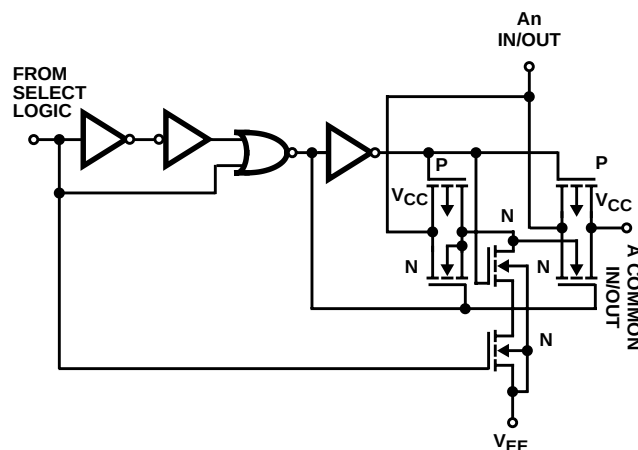
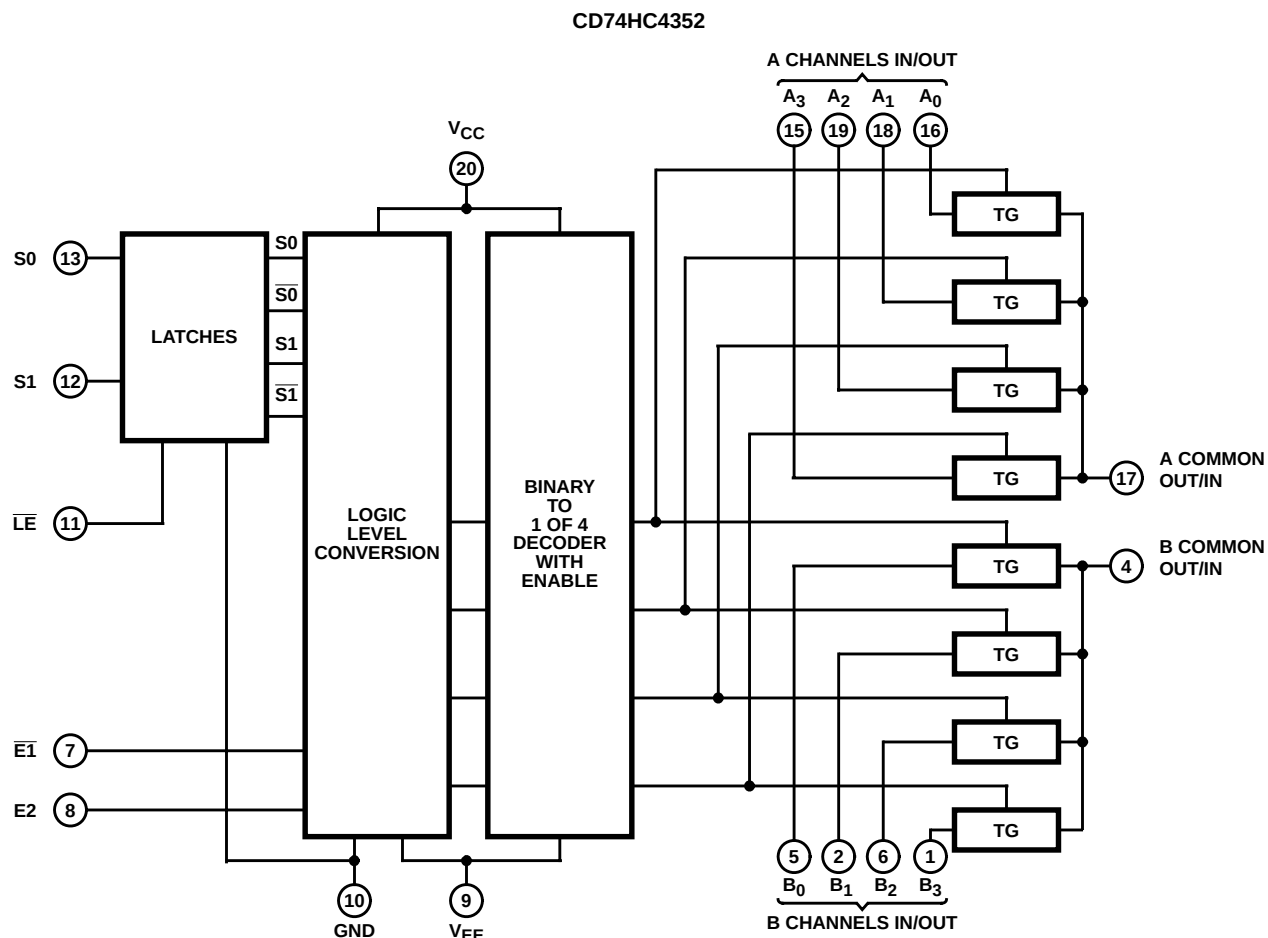


FIGURE 1. DETAIL OF ONE HC/HCT4351 SWITCH

# Functional Diagram



TRUTH TABLE  
CD74HC4352

| INPUT STATES    |    |    |    | (NOTE 2)<br>"ON"<br>SWITCHES<br>$\overline{LE} = H$ |
|-----------------|----|----|----|-----------------------------------------------------|
| $\overline{E1}$ | E2 | S1 | S0 |                                                     |
| L               | H  | L  | L  | A <sub>0</sub> , B <sub>0</sub>                     |
| L               | H  | L  | H  | A <sub>1</sub> , B <sub>1</sub>                     |
| L               | H  | H  | L  | A <sub>2</sub> , B <sub>2</sub>                     |
| L               | H  | H  | H  | A <sub>3</sub> , B <sub>3</sub>                     |
| H               | L  | X  | X  | None                                                |

H = High Voltage Level, L = Low Voltage Level, X = Don't Care

NOTE:

- When Latch Enable is "Low" channel-select data is latched and switches cannot change state.

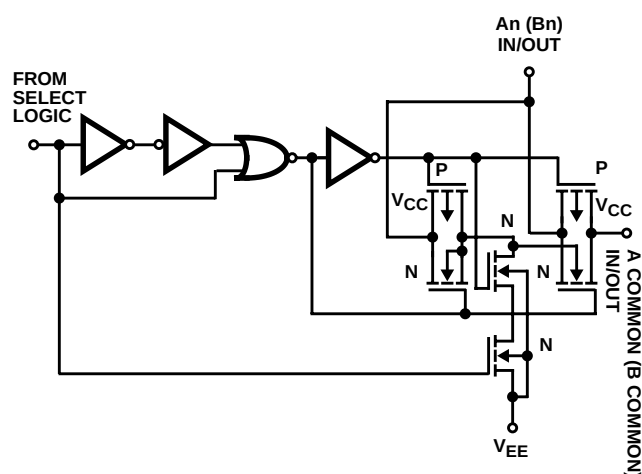


FIGURE 2. DETAIL OF ONE CD74HC4352 SWITCH

## Absolute Maximum Ratings

|                                                        |                |
|--------------------------------------------------------|----------------|
| DC Supply Voltage, $V_{CC}$                            | -0.5V to 7V    |
| DC Supply Voltage, $V_{CC} - V_{EE}$                   | -0.5V to 10.5V |
| DC Supply Voltage, $V_{EE}$                            | 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 Switch Diode Current, $I_{OK}$                      |                |
| For $V_I < V_{EE} - 0.5V$ or $V_I < V_{CC} + 0.5V$     | $\pm 25mA$     |
| DC Switch Current, $I_{OK}$ (Note 3)                   |                |
| For $V_I > V_{EE} - 0.5V$ or $V_I < V_{CC} + 0.5V$     | $\pm 20mA$     |
| DC Output Diode Current, $I_{OK}$                      |                |
| For $V_O < -0.5V$ or $V_O > V_{CC} + 0.5V$             | $\pm 20mA$     |
| DC Output Source or Sink Current per Output Pin, $I_O$ |                |
| For $V_O > -0.5V$ or $V_O < V_{CC} + 0.5V$             | $\pm 25mA$     |
| DC $V_{CC}$ or Ground Current, $I_{CC}$                | $\pm 50mA$     |

## Operating Conditions

|                                         |                 |
|-----------------------------------------|-----------------|
| Temperature Range, $T_A$                | -55°C to 125°C  |
| Supply Voltage Range, $V_{CC}$          |                 |
| HC Types                                | .2V to 6V       |
| HCT Types                               | .4.5V to 5.5V   |
| Supply Voltage Range, $V_{CC} - V_{EE}$ |                 |
| HC, HCT Types (Figure 3)                | .2V to 10V      |
| Supply Voltage Range, $V_{EE}$          |                 |
| HC, HCT Types (Figure 4)                | 0V to -6V       |
| DC Input or Output Voltage, $V_I$       | GND to $V_{CC}$ |
| Analog Switch I/O Voltage, $V_{IS}$     | $V_{EE}$ (Min)  |
|                                         | $V_{CC}$ (Max)  |
| Input Rise and Fall Time, $t_r, t_f$    |                 |
| 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.

## NOTES:

- In certain applications, the external load-resistor current may include both  $V_{CC}$  and signal-line components. To avoid drawing  $V_{CC}$  current when switch current flows into the transmission gate inputs, the voltage drop across the bidirectional switch must not exceed 0.6V (calculated from  $R_{ON}$  values shown in the DC Electrical Specifications table). No  $V_{CC}$  current will flow through  $R_L$  if the switch current flows into terminal 3 on the 'HC4351 and CD74HCT4351; terminals 3 and 13 on the CD74HC4352.
- The package thermal impedance is calculated in accordance with JESD 51-7.

## Thermal Information

|                                          |                      |
|------------------------------------------|----------------------|
| Thermal Resistance (Typical, Note 4)     | $\theta_{JA}$ (°C/W) |
| E (PDIP) Package                         | 69                   |
| M (SOIC) Package                         | 58                   |
| Maximum Junction Temperature             | 150°C                |
| Maximum Storage Temperature Range        | -65°C to 150°C       |
| Maximum Lead Temperature (Soldering 10s) | 300°C                |
| (SOIC - Lead Tips Only)                  |                      |

## Recommended Operating Area as a Function of Supply Voltage

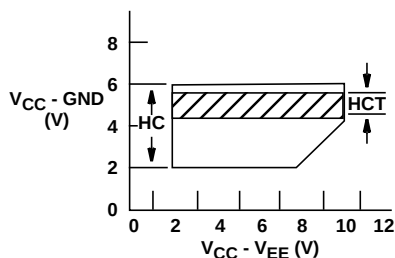


FIGURE 3.

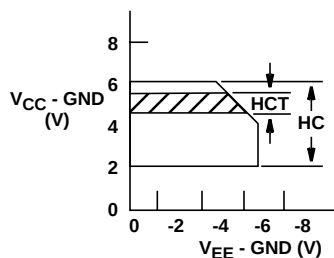


FIGURE 4.

**CD54HC4351, CD74HC4351, CD74HCT4351, CD74HC4352**

**DC Electrical Specifications**

| PARAMETER                                              | SYMBOL           | TEST CONDITIONS                       |                                                                                                                                                                                                                                                                                                                          |                     |                     | 25°C |     |      | -40°C TO 85°C |      | -55°C TO 125°C |      | UNITS |
|--------------------------------------------------------|------------------|---------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|---------------------|------|-----|------|---------------|------|----------------|------|-------|
|                                                        |                  | V <sub>I</sub> (V)                    | V <sub>IS</sub> (V)                                                                                                                                                                                                                                                                                                      | V <sub>EE</sub> (V) | V <sub>CC</sub> (V) | 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     |
| “ON” Resistance<br>I <sub>O</sub> = 1mA<br>Figure 9    | R <sub>ON</sub>  | V <sub>IH</sub> or<br>V <sub>IL</sub> | V <sub>CC</sub> or V <sub>EE</sub>                                                                                                                                                                                                                                                                                       | 0                   | 4.5                 | -    | 70  | 160  | -             | 200  | -              | 240  | Ω     |
|                                                        |                  |                                       |                                                                                                                                                                                                                                                                                                                          | 0                   | 6                   | -    | 60  | 140  | -             | 175  | -              | 210  | Ω     |
|                                                        |                  |                                       |                                                                                                                                                                                                                                                                                                                          | -4.5                | 4.5                 | -    | 40  | 120  | -             | 150  | -              | 180  | Ω     |
|                                                        |                  |                                       | V <sub>CC</sub> to V <sub>EE</sub>                                                                                                                                                                                                                                                                                       | 0                   | 4.5                 | -    | 90  | 180  | -             | 225  | -              | 270  | Ω     |
|                                                        |                  |                                       |                                                                                                                                                                                                                                                                                                                          | 0                   | 6                   | -    | 80  | 160  | -             | 200  | -              | 240  | Ω     |
|                                                        |                  |                                       |                                                                                                                                                                                                                                                                                                                          | -4.5                | 4.5                 | -    | 45  | 130  | -             | 162  | -              | 195  | Ω     |
| Maximum “ON”<br>Resistance Between<br>Any Two Channels | ΔR <sub>ON</sub> | -                                     | -                                                                                                                                                                                                                                                                                                                        | 0                   | 4.5                 | -    | 10  | -    | -             | -    | -              | -    | Ω     |
|                                                        |                  |                                       |                                                                                                                                                                                                                                                                                                                          | 0                   | 6                   | -    | 8.5 | -    | -             | -    | -              | -    | Ω     |
|                                                        |                  |                                       |                                                                                                                                                                                                                                                                                                                          | -4.5                | 4.5                 | -    | 5   | -    | -             | -    | -              | -    | Ω     |
| Switch On/Off<br>Leakage Current<br>4 Channels (4352)  | I <sub>IZ</sub>  | V <sub>IH</sub> or<br>V <sub>IL</sub> | For Switch<br>OFF:<br>When<br>V <sub>IS</sub> = V <sub>CC</sub><br>V <sub>OS</sub> = V <sub>EE</sub> ;<br>When<br>V <sub>IS</sub> = V <sub>EE</sub> ,<br>V <sub>OS</sub> = V <sub>CC</sub><br>For Switch<br>ON:<br>All<br>Applicable<br>Combina-<br>tions of V <sub>IS</sub><br>and V <sub>OS</sub><br>Voltage<br>Levels | 0                   | 6                   | -    | -   | ±0.1 | -             | ±1   | -              | ±1   | μA    |
|                                                        |                  |                                       |                                                                                                                                                                                                                                                                                                                          | -5                  | 5                   | -    | -   | ±0.2 | -             | ±2   | -              | ±2   | μA    |
| Switch On/Off<br>Leakage Current<br>8 Channels (4351)  |                  |                                       |                                                                                                                                                                                                                                                                                                                          | 0                   | 6                   | -    | -   | ±0.2 | -             | ±2   | -              | ±2   | μA    |
|                                                        |                  |                                       |                                                                                                                                                                                                                                                                                                                          | -5                  | 5                   | -    | -   | ±0.4 | -             | ±4   | -              | ±4   | μA    |
| Control Input Leakage<br>Current                       | I <sub>IL</sub>  | V <sub>CC</sub> or<br>GND             | -                                                                                                                                                                                                                                                                                                                        | 0                   | 6                   | -    | -   | ±0.1 | -             | ±1   | -              | ±1   | μA    |
| Quiescent Device<br>Current<br>I <sub>O</sub> = 0      | I <sub>CC</sub>  | V <sub>CC</sub> or<br>GND             | When<br>V <sub>IS</sub> = V <sub>EE</sub> ,<br>V <sub>OS</sub> = V <sub>CC</sub> ,<br>When<br>V <sub>IS</sub> = V <sub>CC</sub> ,<br>V <sub>OS</sub> = V <sub>EE</sub>                                                                                                                                                   | 0                   | 6                   | -    | -   | 8    | -             | 80   | -              | 160  | μA    |
|                                                        |                  |                                       |                                                                                                                                                                                                                                                                                                                          | -5                  | 5                   | -    | -   | 16   | -             | 160  | -              | 320  | μA    |

**CD54HC4351, CD74HC4351, CD74HCT4351, CD74HC4352**

**DC Electrical Specifications (Continued)**

| PARAMETER                                                      | SYMBOL                    | TEST CONDITIONS                             |                                                                                                                                                                                                                                                                                                |                     |                     | 25°C |      |      | -40°C TO 85°C |     | -55°C TO 125°C |     | UNITS |
|----------------------------------------------------------------|---------------------------|---------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|---------------------|------|------|------|---------------|-----|----------------|-----|-------|
|                                                                |                           | V <sub>I</sub> (V)                          | V <sub>IS</sub> (V)                                                                                                                                                                                                                                                                            | V <sub>EE</sub> (V) | V <sub>CC</sub> (V) | MIN  | TYP  | MAX  | MIN           | MAX | MIN            | MAX |       |
| HCT TYPES                                                      |                           |                                             |                                                                                                                                                                                                                                                                                                |                     |                     |      |      |      |               |     |                |     |       |
| High Level Input Voltage                                       | V <sub>IH</sub>           | -                                           | -                                                                                                                                                                                                                                                                                              | -                   | 4.5 to 5.5          | 2    | -    | -    | 2             | -   | 2              | -   | V     |
| Low Level Input Voltage                                        | V <sub>IL</sub>           | -                                           | -                                                                                                                                                                                                                                                                                              | -                   | 4.5 to 5.5          | -    | -    | 0.8  | -             | 0.8 | -              | 0.8 | V     |
| “ON” Resistance<br>I <sub>O</sub> = 1mA<br>Figure 9            | R <sub>ON</sub>           | V <sub>IH</sub> or V <sub>IL</sub>          | V <sub>CC</sub> or V <sub>EE</sub>                                                                                                                                                                                                                                                             | 0                   | 4.5                 | -    | 70   | 160  | -             | 200 | -              | 240 | Ω     |
|                                                                |                           |                                             |                                                                                                                                                                                                                                                                                                | -4.5                | 4.5                 | -    | 40   | 120  | -             | 150 | -              | 180 | Ω     |
|                                                                |                           |                                             | V <sub>CC</sub> to V <sub>EE</sub>                                                                                                                                                                                                                                                             | 0                   | 4.5                 | -    | 90   | 180  | -             | 225 | -              | 270 | Ω     |
|                                                                |                           |                                             |                                                                                                                                                                                                                                                                                                | -4.5                | 4.5                 | -    | 45   | 130  | -             | 162 | -              | 195 | Ω     |
| Maximum “ON” Resistance Between Any Two Channels               | ΔR <sub>ON</sub>          | -                                           | -                                                                                                                                                                                                                                                                                              | 0                   | 4.5                 | -    | 10   | -    | -             | -   | -              | -   | Ω     |
|                                                                |                           |                                             |                                                                                                                                                                                                                                                                                                | -4.5                | 4.5                 | -    | 5    | -    | -             | -   | -              | -   | Ω     |
| Switch On/Off Leakage Current 4 Channels (4352)                | I <sub>IZ</sub>           | V <sub>IH</sub> or V <sub>IL</sub>          | For Switch OFF:<br>When<br>V <sub>IS</sub> = V <sub>CC</sub><br>V <sub>OS</sub> = V <sub>EE</sub> ;<br>When<br>V <sub>IS</sub> = V <sub>EE</sub> ,<br>V <sub>OS</sub> = V <sub>CC</sub><br>For Switch ON:<br>All Applicable Combinations of V <sub>IS</sub> and V <sub>OS</sub> Voltage Levels | 0                   | 6                   | -    | -    | ±0.1 | -             | ±1  | -              | ±1  | μA    |
| -5                                                             |                           |                                             |                                                                                                                                                                                                                                                                                                | 5                   | -                   | -    | ±0.2 | -    | ±2            | -   | ±2             | μA  |       |
| Switch On/Off Leakage Current 8 Channels (4351)                |                           |                                             |                                                                                                                                                                                                                                                                                                | 0                   | 6                   | -    | -    | ±0.2 | -             | ±2  | -              | ±2  | μA    |
|                                                                |                           |                                             |                                                                                                                                                                                                                                                                                                | -5                  | 5                   | -    | -    | ±0.4 | -             | ±4  | -              | ±4  | μA    |
| Control Input Leakage Current                                  | I <sub>I</sub>            | V <sub>CC</sub> or GND                      | -                                                                                                                                                                                                                                                                                              | 0                   | 5.5                 | -    | -    | ±0.1 | -             | ±1  | -              | ±1  | μA    |
| Quiescent Device Current<br>I <sub>O</sub> = 0                 | I <sub>CC</sub>           | Any Voltage Between V <sub>CC</sub> and GND | When V <sub>IS</sub> = V <sub>EE</sub> ,<br>V <sub>OS</sub> = V <sub>CC</sub> ,<br>When V <sub>IS</sub> = V <sub>CC</sub> ,<br>V <sub>OS</sub> = V <sub>EE</sub>                                                                                                                               | 0                   | 5.5                 | -    | -    | 8    | -             | 80  | -              | 160 | μA    |
|                                                                |                           |                                             |                                                                                                                                                                                                                                                                                                | -4.5                | 5.5                 | -    | -    | 16   | -             | 160 | -              | 320 | 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**

| TYPE         | INPUT                    | UNIT LOADS |
|--------------|--------------------------|------------|
| All          | $\overline{E}1, E2, S_n$ | 0.5        |
| (4351, 4352) | $\overline{LE}$          | 1.5        |

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

**CD54HC4351, CD74HC4351, CD74HCT4351, CD74HC4352**

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

| PARAMETER                                                                                        | SYMBOL                              | TEST CONDITIONS       | V <sub>EE</sub><br>(V) | V <sub>CC</sub><br>(V) | 25°C |     |     | -40°C TO 85°C |     | -55°C TO 125°C |     | UNITS |
|--------------------------------------------------------------------------------------------------|-------------------------------------|-----------------------|------------------------|------------------------|------|-----|-----|---------------|-----|----------------|-----|-------|
|                                                                                                  |                                     |                       |                        |                        | MIN  | TYP | MAX | MIN           | MAX | MIN            | MAX |       |
| HC TYPES                                                                                         |                                     |                       |                        |                        |      |     |     |               |     |                |     |       |
| Propagation Delay,<br>Switch In to Switch Out                                                    | t <sub>PLH</sub> , t <sub>PHL</sub> | C <sub>L</sub> = 50pF | 0                      | 2                      | -    | -   | 35  | -             | 45  | -              | 55  | ns    |
|                                                                                                  |                                     |                       | 0                      | 4.5                    | -    | -   | 7   | -             | 9   | -              | 11  | ns    |
|                                                                                                  |                                     |                       | 0                      | 6                      | -    | -   | 6   | -             | 8   | -              | 9   | ns    |
|                                                                                                  |                                     |                       | -4.5                   | 4.5                    | -    | -   | 5   | -             | 7   | -              | 8   | ns    |
| Maximum Switch Turn "ON"<br>Delay 4351<br>E <sub>1</sub> , E2, L <sub>E</sub> to V <sub>OS</sub> | t <sub>PZH</sub> , t <sub>PZL</sub> | C <sub>L</sub> = 50pF | 0                      | 2                      | -    | -   | 300 | -             | 375 | -              | 450 | ns    |
|                                                                                                  |                                     |                       | 0                      | 4.5                    | -    | -   | 60  | -             | 75  | -              | 90  | ns    |
|                                                                                                  |                                     |                       | 0                      | 6                      | -    | -   | 51  | -             | 64  | -              | 77  | ns    |
|                                                                                                  |                                     |                       | -4.5                   | 4.5                    | -    | -   | 55  | -             | 69  | -              | 83  | ns    |
|                                                                                                  |                                     | C <sub>L</sub> = 15pF | -                      | 5                      | -    | 27  | -   | -             | -   | -              | -   | ns    |
| Maximum Switch Turn "ON"<br>Delay 4352<br>E <sub>1</sub> , E2, L <sub>E</sub> to V <sub>OS</sub> | t <sub>PZH</sub> , t <sub>PZL</sub> | C <sub>L</sub> = 50pF | 0                      | 2                      | -    | -   | 350 | -             | 440 | -              | 525 | ns    |
|                                                                                                  |                                     |                       | 0                      | 4.5                    | -    | -   | 70  | -             | 88  | -              | 105 | ns    |
|                                                                                                  |                                     |                       | 0                      | 6                      | -    | -   | 60  | -             | 75  | -              | 90  | ns    |
|                                                                                                  |                                     |                       | -4.5                   | 4.5                    | -    | -   | 60  | -             | 75  | -              | 90  | ns    |
|                                                                                                  |                                     | C <sub>L</sub> = 15pF | -                      | 5                      | -    | 35  | -   | -             | -   | -              | -   | ns    |
| Maximum Switch Turn "ON"<br>Delay 4351<br>S <sub>n</sub> to V <sub>OS</sub>                      | t <sub>PZH</sub> , t <sub>PZL</sub> | C <sub>L</sub> = 50pF | 0                      | 2                      | -    | -   | 300 | -             | 375 | -              | 450 | ns    |
|                                                                                                  |                                     |                       | 0                      | 4.5                    | -    | -   | 60  | -             | 75  | -              | 90  | ns    |
|                                                                                                  |                                     |                       | 0                      | 6                      | -    | -   | 51  | -             | 64  | -              | 77  | ns    |
|                                                                                                  |                                     |                       | -4.5                   | 4.5                    | -    | -   | 50  | -             | 63  | -              | 75  | ns    |
|                                                                                                  |                                     | C <sub>L</sub> = 15pF | -                      | 5                      | -    | 27  | -   | -             | -   | -              | -   | ns    |
| Maximum Switch Turn "ON"<br>Delay 4352<br>S <sub>n</sub> to V <sub>OS</sub>                      | t <sub>PZH</sub> , t <sub>PZL</sub> | C <sub>L</sub> = 50pF | 0                      | 2                      | -    | -   | 375 | -             | 470 | -              | 565 | ns    |
|                                                                                                  |                                     |                       | 0                      | 4.5                    | -    | -   | 75  | -             | 94  | -              | 113 | ns    |
|                                                                                                  |                                     |                       | 0                      | 6                      | -    | -   | 64  | -             | 80  | -              | 96  | ns    |
|                                                                                                  |                                     |                       | -4.5                   | 4.5                    | -    | -   | 55  | -             | 69  | -              | 83  | ns    |
|                                                                                                  |                                     | C <sub>L</sub> = 15pF | -                      | 5                      | -    | 35  | -   | -             | -   | -              | -   | ns    |
| Maximum Switch Turn "OFF"<br>Delay 4351<br>E <sub>1</sub> to V <sub>OS</sub>                     | t <sub>PHZ</sub> , t <sub>PLZ</sub> | C <sub>L</sub> = 50pF | 0                      | 2                      | -    | -   | 250 | -             | 315 | -              | 375 | ns    |
|                                                                                                  |                                     |                       | 0                      | 4.5                    | -    | -   | 50  | -             | 63  | -              | 75  | ns    |
|                                                                                                  |                                     |                       | 0                      | 6                      | -    | -   | 43  | -             | 54  | -              | 64  | ns    |
|                                                                                                  |                                     |                       | -4.5                   | 4.5                    | -    | -   | 40  | -             | 50  | -              | 60  | ns    |
|                                                                                                  |                                     | C <sub>L</sub> = 15pF | -                      | 5                      | -    | 21  | -   | -             | -   | -              | -   | ns    |

**CD54HC4351, CD74HC4351, CD74HCT4351, CD74HC4352**

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

| PARAMETER                                                         | SYMBOL             | TEST CONDITIONS     | $V_{EE}$<br>(V) | $V_{CC}$<br>(V) | 25°C |     |     | -40°C TO<br>85°C |     | -55°C TO<br>125°C |     | UNITS |
|-------------------------------------------------------------------|--------------------|---------------------|-----------------|-----------------|------|-----|-----|------------------|-----|-------------------|-----|-------|
|                                                                   |                    |                     |                 |                 | MIN  | TYP | MAX | MIN              | MAX | MIN               | MAX |       |
| Maximum Switch Turn "OFF"<br>Delay 4351<br>E2 to $V_{OS}$         | $t_{PHZ}, t_{PLZ}$ | $C_L = 50\text{pF}$ | 0               | 2               | -    | -   | 250 | -                | 315 | -                 | 375 | ns    |
|                                                                   |                    |                     | 0               | 4.5             | -    | -   | 50  | -                | 63  | -                 | 75  | ns    |
|                                                                   |                    |                     | 0               | 6               | -    | -   | 43  | -                | 54  | -                 | 64  | ns    |
|                                                                   |                    |                     | -4.5            | 4.5             | -    | -   | 40  | -                | 50  | -                 | 60  | ns    |
|                                                                   |                    | $C_L = 15\text{pF}$ | -               | 5               | -    | 21  | -   | -                | -   | -                 | -   | ns    |
| Maximum Switch Turn "OFF"<br>Delay 4351<br>LE to $V_{OS}$         | $t_{PHZ}, t_{PLZ}$ | $C_L = 50\text{pF}$ | 0               | 2               | -    | -   | 275 | -                | 345 | -                 | 415 | ns    |
|                                                                   |                    |                     | 0               | 4.5             | -    | -   | 55  | -                | 69  | -                 | 83  | ns    |
|                                                                   |                    |                     | 0               | 6               | -    | -   | 47  | -                | 59  | -                 | 71  | ns    |
|                                                                   |                    |                     | -4.5            | 4.5             | -    | -   | 45  | -                | 56  | -                 | 68  | ns    |
| Maximum Switch Turn "OFF"<br>Delay 4351<br>Sn to $V_{OS}$         | $t_{PHZ}, t_{PLZ}$ | $C_L = 50\text{pF}$ | 0               | 2               | -    | -   | 275 | -                | 345 | -                 | 415 | ns    |
|                                                                   |                    |                     | 0               | 4.5             | -    | -   | 55  | -                | 69  | -                 | 83  | ns    |
|                                                                   |                    |                     | 0               | 6               | -    | -   | 47  | -                | 59  | -                 | 71  | ns    |
|                                                                   |                    |                     | -4.5            | 4.5             | -    | -   | 48  | -                | 60  | -                 | 71  | ns    |
|                                                                   |                    | $C_L = 15\text{pF}$ | -               | 5               | -    | 21  | -   | -                | -   | -                 | -   | ns    |
| Maximum Switch Turn "OFF"<br>Delay 4352<br>E1, E2, LE to $V_{OS}$ | $t_{PHZ}, t_{PLZ}$ | $C_L = 50\text{pF}$ | 0               | 2               | -    | -   | 275 | -                | 345 | -                 | 415 | ns    |
|                                                                   |                    |                     | 0               | 4.5             | -    | -   | 55  | -                | 69  | -                 | 83  | ns    |
|                                                                   |                    |                     | 0               | 6               | -    | -   | 47  | -                | 59  | -                 | 71  | ns    |
|                                                                   |                    |                     | -4.5            | 4.5             | -    | -   | 50  | -                | 63  | -                 | 75  | ns    |
|                                                                   |                    | $C_L = 15\text{pF}$ | -               | 5               | -    | 21  | -   | -                | -   | -                 | -   | ns    |
| Setup Time 4351<br>Sn to $\overline{LE}$                          | $t_{SU}$           | $C_L = 50\text{pF}$ | 0               | 2               | -    | -   | 60  | -                | 75  | -                 | 90  | ns    |
|                                                                   |                    |                     | 0               | 4.5             | -    | -   | 12  | -                | 15  | -                 | 18  | ns    |
|                                                                   |                    |                     | 0               | 6               | -    | -   | 10  | -                | 13  | -                 | 15  | ns    |
|                                                                   |                    |                     | -4.5            | 4.5             | -    | -   | 18  | -                | 23  | -                 | 27  | ns    |
| Hold Time 4351 and 4352<br>Sn to $\overline{LE}$                  | $t_H$              | $C_L = 50\text{pF}$ | 0               | 2               | 5    | -   | -   | 5                | -   | 5                 | -   | ns    |
|                                                                   |                    |                     | 0               | 4.5             | 5    | -   | -   | 5                | -   | 5                 | -   | ns    |
|                                                                   |                    |                     | 0               | 6               | 5    | -   | -   | 5                | -   | 5                 | -   | ns    |
|                                                                   |                    |                     | -4.5            | 4.5             | 5    | -   | -   | 5                | -   | 5                 | -   | ns    |
| Pulse Width 4351 and 4352<br>$\overline{LE}$                      | $t_W$              | $C_L = 50\text{pF}$ | 0               | 2               | 100  | -   | -   | 125              | -   | 150               | -   | ns    |
|                                                                   |                    |                     | 0               | 4.5             | 20   | -   | -   | 25               | -   | 30                | -   | ns    |
|                                                                   |                    |                     | 0               | 6               | 17   | -   | -   | 21               | -   | 26                | -   | ns    |
|                                                                   |                    |                     | -4.5            | 4.5             | 25   | -   | -   | 31               | -   | 38                | -   | ns    |
| Input (Control) Capacitance                                       | $C_I$              | -                   | -               | -               | -    | -   | 10  | -                | 10  | -                 | 10  | pF    |
| Power Dissipation Capacitance<br>(Notes 6, 7) 4351                | $C_{PD}$           | -                   | -               | 5               | -    | 50  | -   | -                | -   | -                 | -   | pF    |

**CD54HC4351, CD74HC4351, CD74HCT4351, CD74HC4352**

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

| PARAMETER                                                                                | SYMBOL             | TEST CONDITIONS     | $V_{EE}$<br>(V) | $V_{CC}$<br>(V) | 25°C |     |     | -40°C TO<br>85°C |     | -55°C TO<br>125°C |     | UNITS |
|------------------------------------------------------------------------------------------|--------------------|---------------------|-----------------|-----------------|------|-----|-----|------------------|-----|-------------------|-----|-------|
|                                                                                          |                    |                     |                 |                 | MIN  | TYP | MAX | MIN              | MAX | MIN               | MAX |       |
| Power Dissipation Capacitance<br>(Notes 6, 7) 4352                                       | $C_{PD}$           | -                   | -               | 5               | -    | 74  | -   | -                | -   | -                 | -   | pF    |
| <b>HCT TYPES</b>                                                                         |                    |                     |                 |                 |      |     |     |                  |     |                   |     |       |
| Propagation Delay,<br>Switch In to Switch Out                                            | $t_{PLH}, t_{PHL}$ | $C_L = 50\text{pF}$ | 0               | 4.5             | -    | -   | 7   | -                | 9   | -                 | 11  | ns    |
|                                                                                          |                    |                     | -4.5            | 4.5             | -    | -   | 5   | -                | 7   | -                 | 8   | ns    |
| Maximum Switch Turn "ON"<br>Delay 4351<br>$\overline{E1}, E2, \overline{LE}$ to $V_{OS}$ | $t_{PZH}, t_{PZL}$ | $C_L = 50\text{pF}$ | 0               | 4.5             | -    | -   | 75  | -                | 94  | -                 | 113 | ns    |
|                                                                                          |                    |                     | -4.5            | 4.5             | -    | -   | 60  | -                | 75  | -                 | 90  | ns    |
|                                                                                          |                    | $C_L = 15\text{pF}$ | -               | 5               | -    | 35  | -   | -                | -   | -                 | -   | ns    |
| Maximum Switch Turn "ON"<br>Delay 4351<br>$S_n$ to $V_{OS}$                              | $t_{PZH}, t_{PZL}$ | $C_L = 50\text{pF}$ | 0               | 4.5             | -    | -   | 75  | -                | 94  | -                 | 113 | ns    |
|                                                                                          |                    |                     | -4.5            | 4.5             | -    | -   | 60  | -                | 75  | -                 | 90  | ns    |
|                                                                                          |                    | $C_L = 15\text{pF}$ | -               | 5               | -    | 35  | -   | -                | -   | -                 | -   | ns    |
| Maximum Switch Turn "OFF"<br>Delay 4351<br>$\overline{E1}$ to $V_{OS}$                   | $t_{PHZ}, t_{PLZ}$ | $C_L = 50\text{pF}$ | 0               | 4.5             | -    | -   | 55  | -                | 69  | -                 | 83  | ns    |
|                                                                                          |                    |                     | -4.5            | 4.5             | -    | -   | 40  | -                | 50  | -                 | 60  | ns    |
|                                                                                          |                    | $C_L = 15\text{pF}$ | -               | 5               | -    | 23  | -   | -                | -   | -                 | -   | ns    |
| Maximum Switch Turn "OFF"<br>Delay 4351<br>$E2$ to $V_{OS}$                              | $t_{PHZ}, t_{PLZ}$ | $C_L = 50\text{pF}$ | 0               | 4.5             | -    | -   | 60  | -                | 75  | -                 | 90  | ns    |
|                                                                                          |                    |                     | -4.5            | 4.5             | -    | -   | 50  | -                | 63  | -                 | 75  | ns    |
|                                                                                          |                    | $C_L = 15\text{pF}$ | -               | 5               | -    | 23  | -   | -                | -   | -                 | -   | ns    |
| Maximum Switch Turn "OFF"<br>Delay 4351<br>$\overline{LE}$ to $V_{OS}$                   | $t_{PHZ}, t_{PLZ}$ | $C_L = 50\text{pF}$ | 0               | 4.5             | -    | -   | 60  | -                | 75  | -                 | 90  | ns    |
|                                                                                          |                    |                     | -4.5            | 4.5             | -    | -   | 55  | -                | 69  | -                 | 83  | ns    |
| Maximum Switch Turn "OFF"<br>Delay 4351<br>$S_n$ to $V_{OS}$                             | $t_{PHZ}, t_{PLZ}$ | $C_L = 50\text{pF}$ | 0               | 4.5             | -    | -   | 65  | -                | 81  | -                 | 98  | ns    |
|                                                                                          |                    |                     | -4.5            | 4.5             | -    | -   | 55  | -                | 69  | -                 | 83  | ns    |
|                                                                                          |                    | $C_L = 15\text{pF}$ | -               | 5               | -    | 23  | -   | -                | -   | -                 | -   | ns    |
| Setup Time 4351<br>$S_n$ to $\overline{LE}$                                              |                    | $C_L = 50\text{pF}$ | 0               | 4.5             | -    | -   | 12  | -                | 15  | -                 | 18  | ns    |
|                                                                                          |                    |                     | -4.5            | 4.5             | -    | -   | 14  | -                | 18  | -                 | 21  | ns    |
| Hold Time 4351 and 4352<br>$S_n$ to $\overline{LE}$                                      |                    | $C_L = 50\text{pF}$ | 0               | 4.5             | 5    | -   | -   | 5                | -   | 5                 | -   | ns    |
|                                                                                          |                    |                     | -4.5            | 4.5             | 5    | -   | -   | 5                | -   | 5                 | -   | ns    |
| Pulse Width 4351<br>$\overline{LE}$                                                      | $t_W$              | $C_L = 50\text{pF}$ | 0               | 4.5             | 25   | -   | -   | 31               | -   | 28                | -   | ns    |
|                                                                                          |                    |                     | -4.5            | 4.5             | 25   | -   | -   | 31               | -   | 38                | -   | ns    |
| Input (Control) Capacitance                                                              | $C_I$              | -                   | -               | -               | -    | -   | 10  | -                | 10  | -                 | 10  | pF    |
| Power Dissipation Capacitance<br>(Notes 6, 7) 4351                                       | $C_{PD}$           | -                   | -               | 5               | -    | 52  | -   | -                | -   | -                 | -   | pF    |

**NOTES:**

6.  $C_{PD}$  is used to determine the dynamic power consumption, per package.

7.  $P_D = C_{PD} V_{CC}^2 f_i + \sum (C_L + C_S) V_{CC}^2 f_o$  where  $f_i$  = input frequency,  $f_o$  = output frequency,  $C_L$  = output load capacitance,  $C_S$  = switch capacitance,  $V_{CC}$  = supply voltage.

**CD54HC4351, CD74HC4351, CD74HCT4351, CD74HC4352**

**Analog Channel Specifications**  $T_A = 25^\circ\text{C}$

| PARAMETER                                                  | SYMBOL    | TEST CONDITIONS                | TYPE | $V_{EE}$ (V) | $V_{CC}$ (V) | HC/HCT | UNITS |
|------------------------------------------------------------|-----------|--------------------------------|------|--------------|--------------|--------|-------|
| Switch Input Capacitance                                   | $C_I$     |                                | All  | -            | -            | 5      | pF    |
| Common Capacitance                                         | $C_{COM}$ |                                | 4351 | -            | -            | 25     | pF    |
|                                                            |           |                                | 4352 | -            | -            | 12     | pF    |
| Minimum Switch Frequency Response at -3dB<br>(Figure 6, 8) | $f_{MAX}$ | See Figure 11<br>(Notes 8, 9)  | 4351 | -            | -            | 145    | MHz   |
|                                                            |           |                                | 4352 | -2.25        | 2.25         | 165    | MHz   |
|                                                            |           |                                | 4351 | -            | -            | 180    | MHz   |
|                                                            |           |                                | 4352 | -4.5         | 4.5          | 185    | MHz   |
| Crosstalk Between Any Two Switches<br>(Note 11)            |           | See Figure 10<br>(Notes 9, 10) | 4351 | -            | -            | N/A    | dB    |
|                                                            |           |                                | 4352 | -2.25        | 2.25         | (TBE)  | dB    |
|                                                            |           |                                | 4351 | -            | -            | N/A    | dB    |
|                                                            |           |                                | 4352 | -4.5         | 4.5          | (TBE)  | dB    |
| Sine-Wave Distortion                                       |           | See Figure 12                  | All  | -2.25        | 2.25         | 0.035  | %     |
|                                                            |           |                                | All  | -4.5         | 4.5          | 0.018  | %     |
| $\bar{E}$ or S to Switch Feedthrough Noise                 |           | See Figure 13<br>(Notes 9, 10) | 4351 | -            | -            | -      | mV    |
|                                                            |           |                                | 4352 | -2.25        | 2.25         | (TBE)  | mV    |
|                                                            |           |                                | 4351 | -            | -            | -      | mV    |
|                                                            |           |                                | 4352 | -4.5         | 4.5          | (TBE)  | mV    |
| Switch "OFF" Signal Feedthrough<br>(Figure 6, 8)           |           | See Figure 14<br>(Notes 9, 10) | 4351 | -            | -            | -73    | dB    |
|                                                            |           |                                | 4352 | -2.25        | 2.25         | -65    | dB    |
|                                                            |           |                                | 4351 | -            | -            | -75    | dB    |
|                                                            |           |                                | 4352 | -4.5         | 4.5          | -67    | dB    |

NOTES:

8. Adjust input voltage to obtain 0dBm at  $V_{OS}$  for,  $f_{in} = 1\text{MHz}$ .
9.  $V_{IS}$  is centered at  $(V_{CC} - V_{EE})/2$ .
10. Adjust input for 0dBm.
11. Not applicable for 'HC4351 and CD74HCT4351.

# Typical Performance Curves

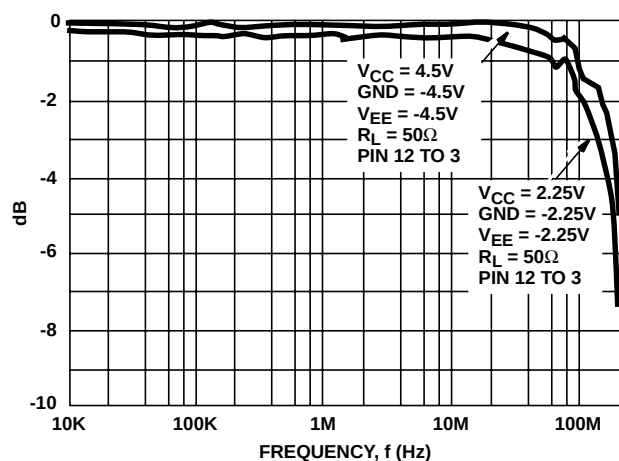


FIGURE 5. CHANNEL ON BANDWIDTH ('HC4351, CD74HCT4351)

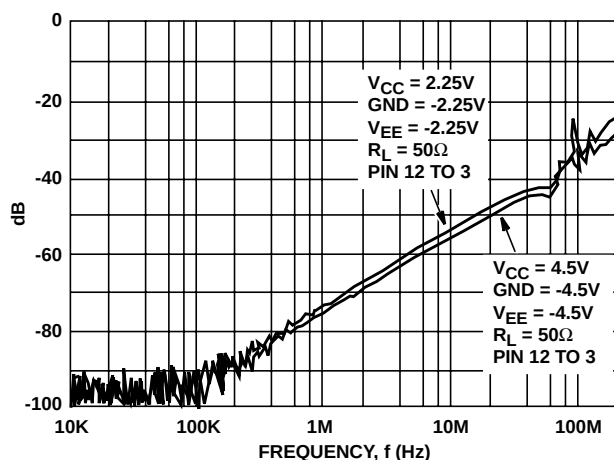


FIGURE 6. CHANNEL OFF FEEDTHROUGH ('HC4351, CD74HCT4351)

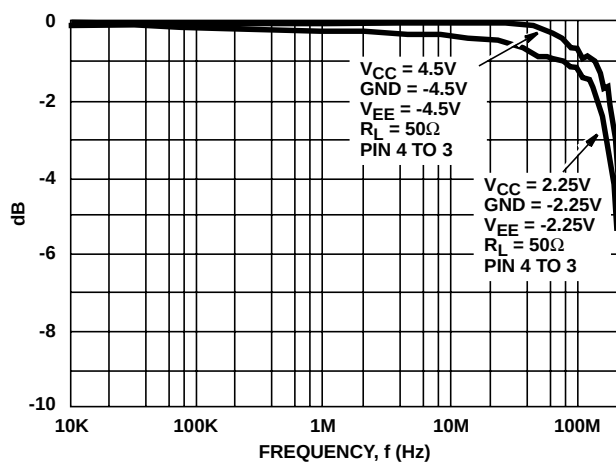


FIGURE 7. CHANNEL ON BANDWIDTH (CD74HC4352)

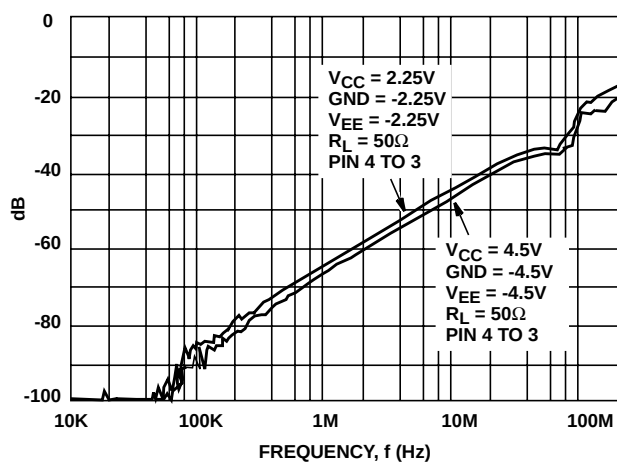


FIGURE 8. CHANNEL OFF FEEDTHROUGH (CD74HC4352)

## Typical Performance Curves (Continued)

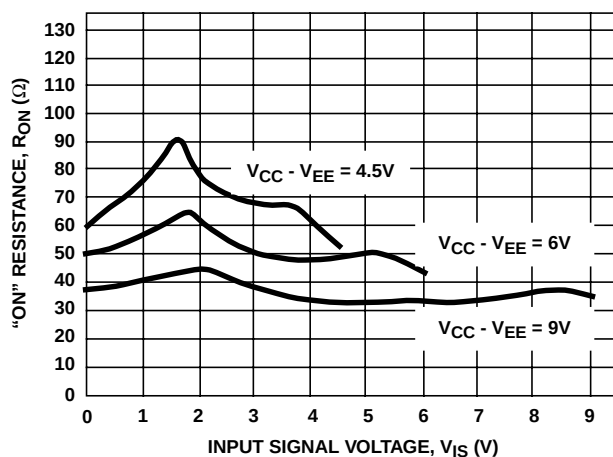


FIGURE 9. TYPICAL ON RESISTANCE vs INPUT SIGNAL VOLTAGE

## Analog Test Circuits

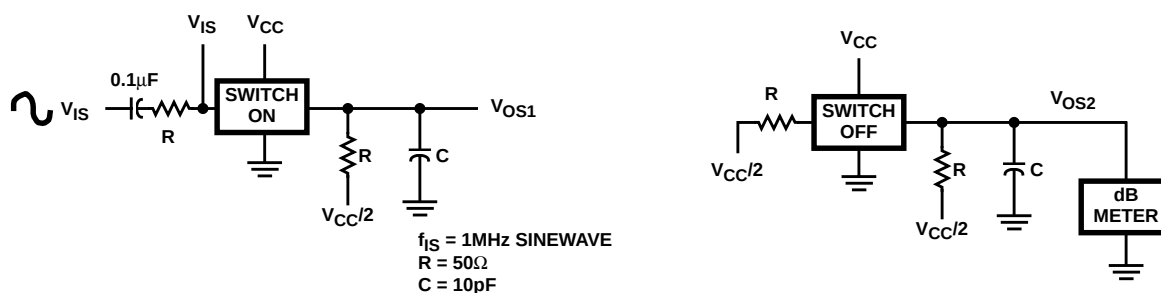


FIGURE 10. CROSSTALK BETWEEN TWO SWITCHES TEST CIRCUIT

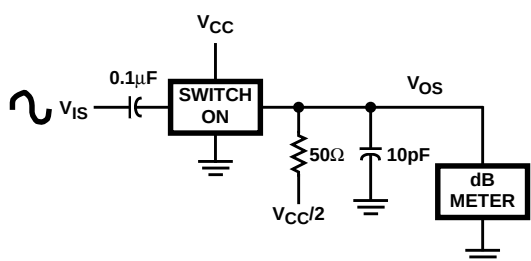


FIGURE 11. FREQUENCY RESPONSE TEST CIRCUIT

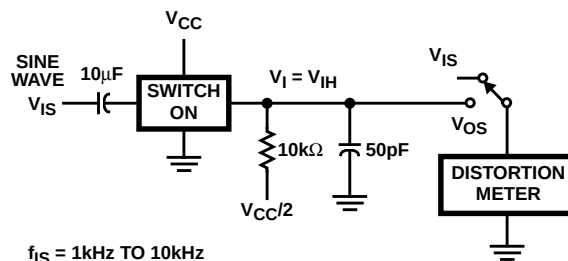


FIGURE 12. TOTAL HARMONIC DISTORTION TEST CIRCUIT

# Analog Test Circuits (Continued)

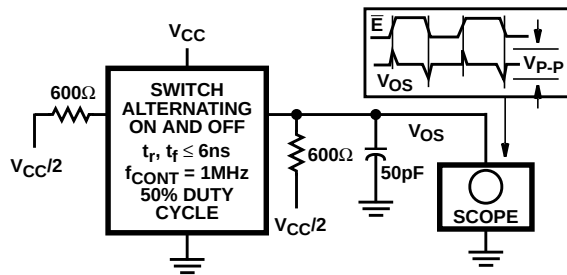


FIGURE 13. CONTROL-TO-SWITCH FEEDTHROUGH NOISE TEST CIRCUIT

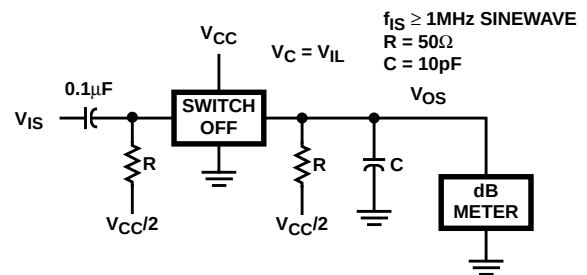
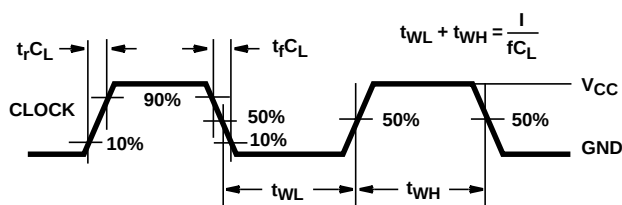


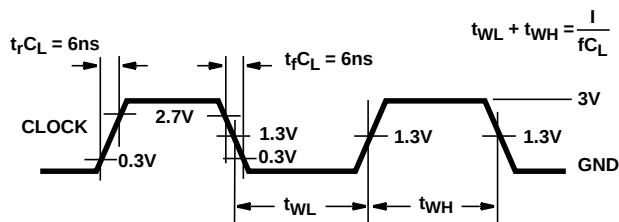
FIGURE 14. SWITCH OFF SIGNAL FEEDTHROUGH TEST CIRCUIT

## 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 15. 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 16. HCT CLOCK PULSE RISE AND FALL TIMES AND PULSE WIDTH

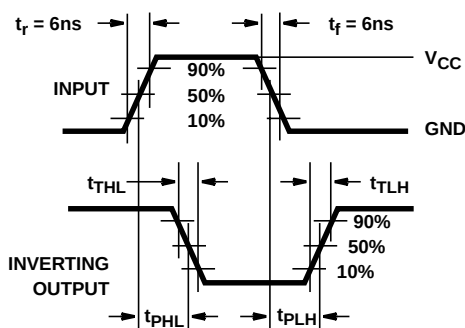


FIGURE 17. HC TRANSITION TIMES AND PROPAGATION DELAY TIMES, COMBINATION LOGIC

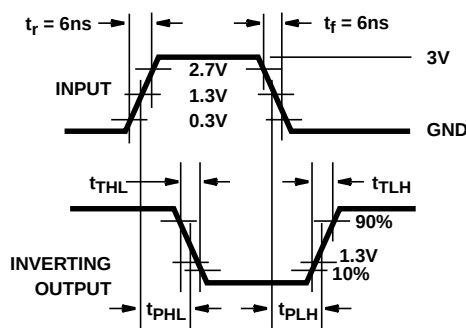


FIGURE 18. HCT TRANSITION TIMES AND PROPAGATION DELAY TIMES, COMBINATION LOGIC

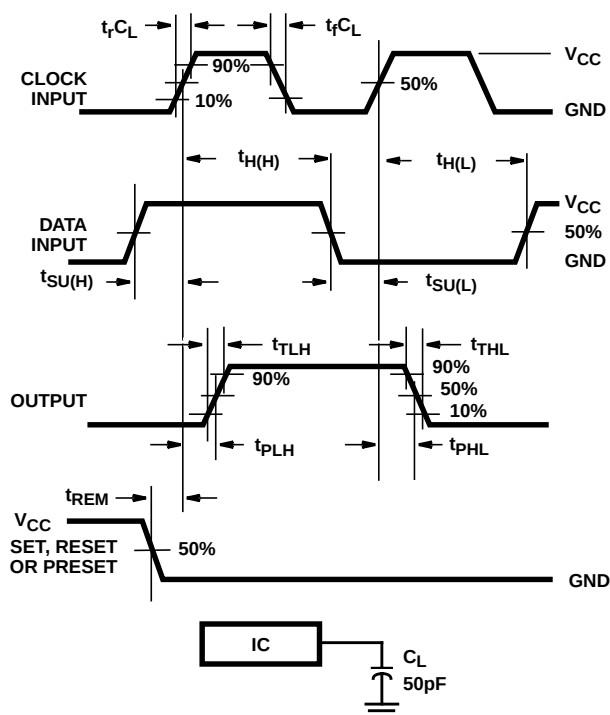


FIGURE 19. HC SETUP TIMES, HOLD TIMES, REMOVAL TIME, AND PROPAGATION DELAY TIMES FOR EDGE TRIGGERED SEQUENTIAL LOGIC CIRCUITS

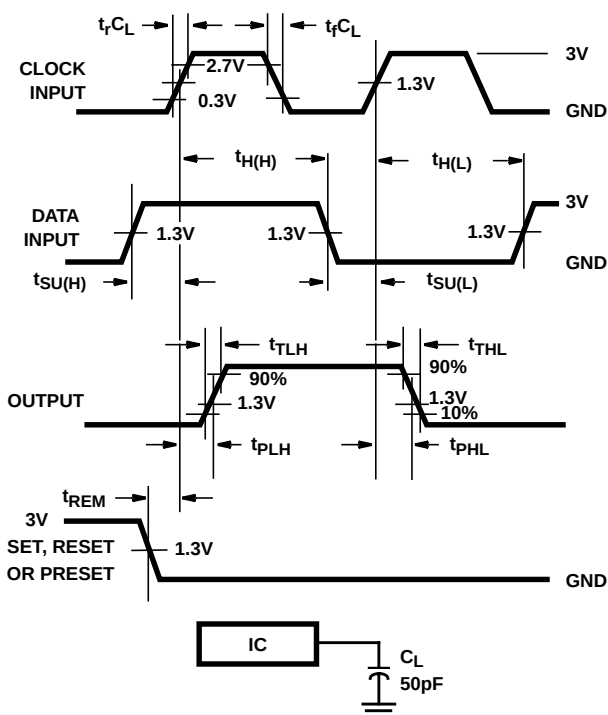


FIGURE 20. HCT SETUP TIMES, HOLD TIMES, REMOVAL TIME, AND PROPAGATION DELAY TIMES FOR EDGE TRIGGERED SEQUENTIAL LOGIC CIRCUITS

# Test Circuits and Waveforms (Continued)

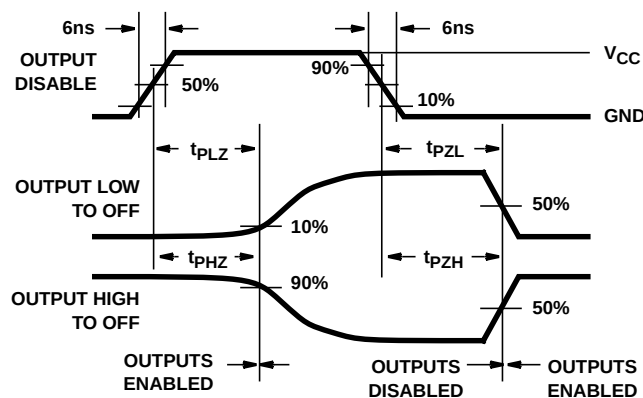


FIGURE 21. HC THREE-STATE PROPAGATION DELAY WAVEFORM

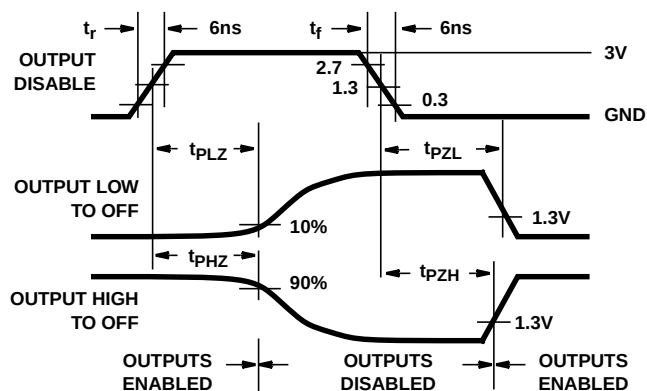
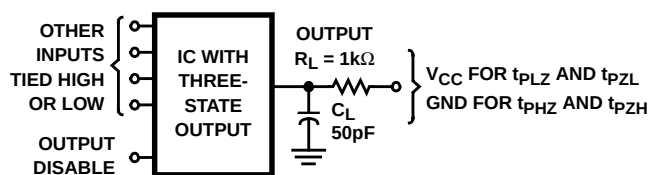


FIGURE 22. HCT THREE-STATE PROPAGATION DELAY WAVEFORM



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 23. 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> |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| CD54HC4351F3A    | ACTIVE                | CDIP         | J               | 20   | 1           | TBD                     | Call TI          | Level-NC-NC-NC               |
| CD74HC4351E      | ACTIVE                | PDIP         | N               | 20   | 20          | Pb-Free (RoHS)          | CU NIPDAU        | Level-NC-NC-NC               |
| CD74HC4351EE4    | ACTIVE                | PDIP         | N               | 20   | 20          | Pb-Free (RoHS)          | CU NIPDAU        | Level-NC-NC-NC               |
| CD74HC4351M      | ACTIVE                | SOIC         | DW              | 20   | 25          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| CD74HC4351M96    | ACTIVE                | SOIC         | DW              | 20   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| CD74HC4351M96E4  | ACTIVE                | SOIC         | DW              | 20   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| CD74HC4351ME4    | ACTIVE                | SOIC         | DW              | 20   | 25          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| CD74HC4352E      | ACTIVE                | PDIP         | N               | 20   | 20          | Pb-Free (RoHS)          | CU NIPDAU        | Level-NC-NC-NC               |
| CD74HC4352EE4    | ACTIVE                | PDIP         | N               | 20   | 20          | Pb-Free (RoHS)          | CU NIPDAU        | Level-NC-NC-NC               |
| CD74HCT4351E     | ACTIVE                | PDIP         | N               | 20   | 20          | Pb-Free (RoHS)          | CU NIPDAU        | Level-NC-NC-NC               |
| CD74HCT4351EE4   | ACTIVE                | PDIP         | N               | 20   | 20          | Pb-Free (RoHS)          | CU NIPDAU        | Level-NC-NC-NC               |

<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) 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.

**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.

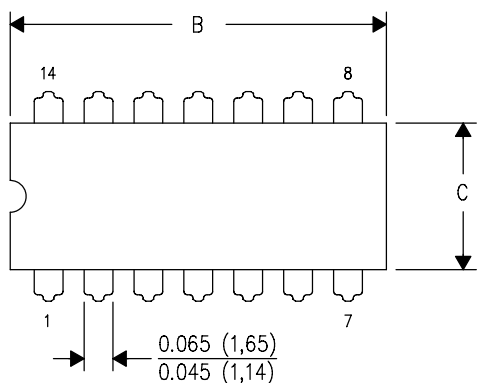
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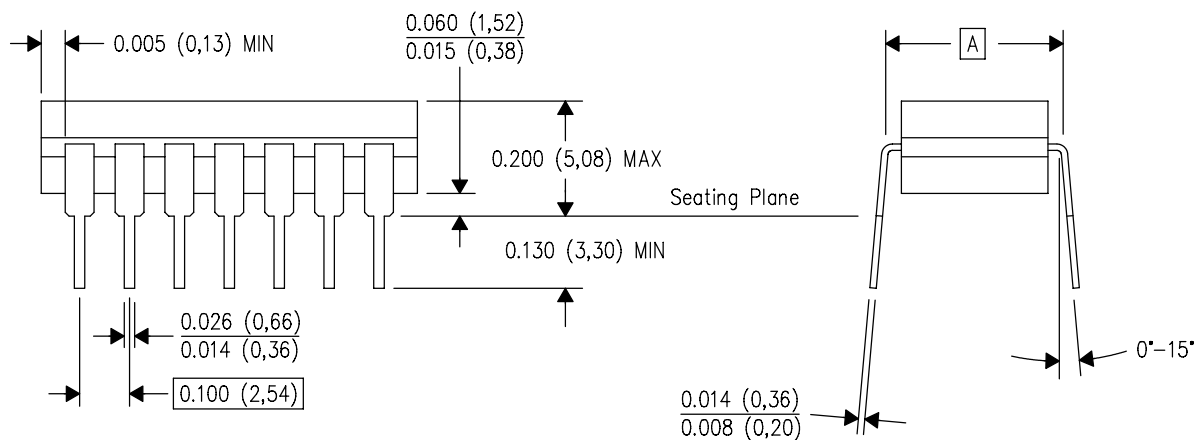
J (R-GDIP-T\*\*)

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)        |



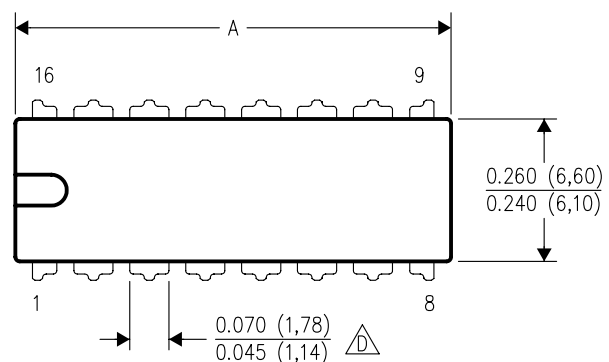
4040083/F 03/03

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

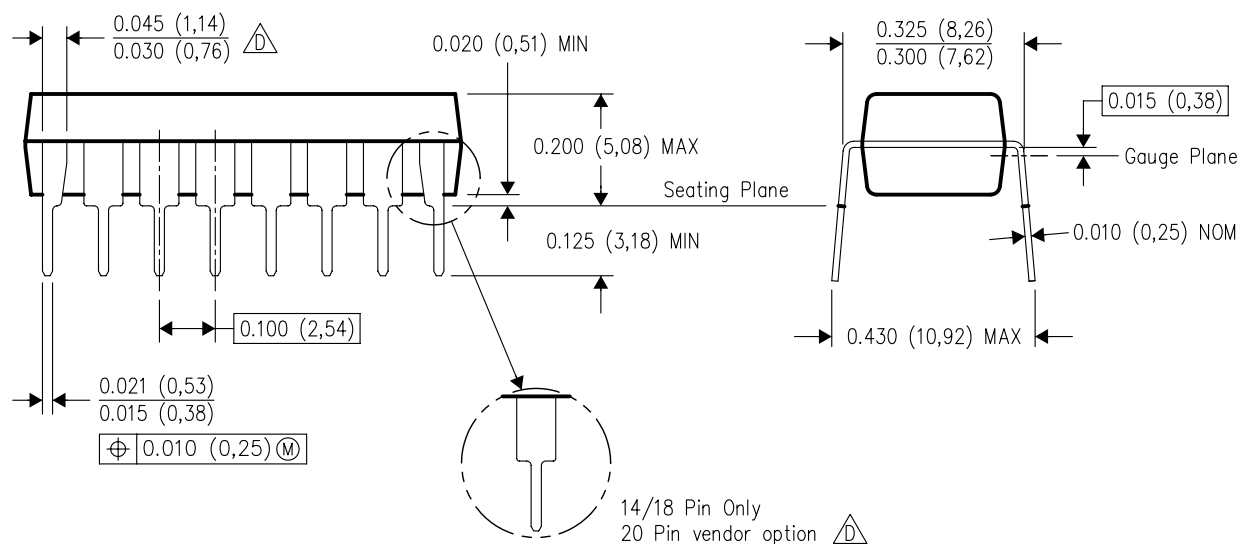
## N (R-PDIP-T\*\*)

16 PINS SHOWN

## PLASTIC DUAL-IN-LINE PACKAGE



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

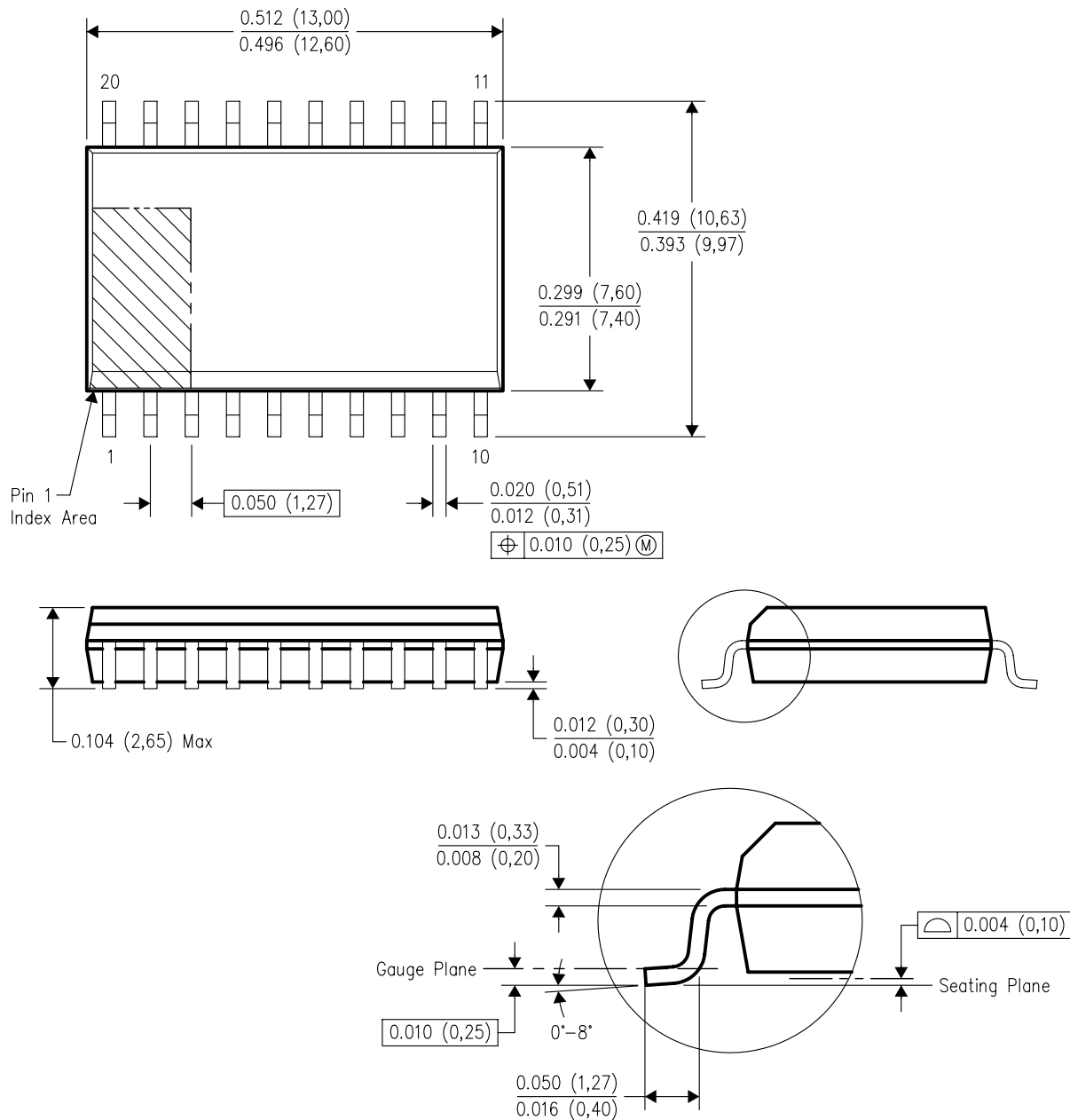


4040049/E 12/2002

- 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.

DW (R-PDSO-G20)

## PLASTIC SMALL-OUTLINE PACKAGE



4040000-4/F 06/2004

- NOTES: A. All linear dimensions are in inches (millimeters).  
B. This drawing is subject to change without notice.  
C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).  
D. Falls within JEDEC MS-013 variation AC.

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